User's Manual

Raptor™ SQ2801

Color LCD Monitor

Important

Please read PRECAUTIONS and this User's Manual carefully to familiarize yourself with safe and effective usage procedures. Please retain this manual for future reference.

Product specification may vary with sales areas.
Confirm the specification in the manual written in language of the region of purchase.

Contents

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1 Overview

The TFT Monitor Raptor SQ2801 was developed to meet the very demanding requirements in the Air Traffic Management where system availability and reliability is crucial. Ergonomic criteria have been addressed to ensure high acceptance from the operators.

Reduced depth and lower weight compared to CRT monitors allow easy installation into workstation consoles of air traffic control rooms. Considerably lower power consumption and heat emissions are some of the other advantages over CRT based units.

The TFT technology employed in this design is based on Sharp's ASV technology and offers very sharp, undistorted image, right up to the edges. Unlike the CRT counterpart, this technology does not have problems such as convergence or effects from electro magnetic radiation.

The Raptor SQ2801 is a 28.05" TFT module with native resolution of 2,048 x 2,048 pixel. Wide viewing angle of 170° (horizontally and vertically), a contrast ratio of 1000 : 1 and maximum brightness of 210 cd/m² enable very clear and sharp pictures with color depth of 16.7 million colors. It is backward compatible with Sony's DDM[1] monitors.

The Raptor SQ2801 product has two dual link DVI-D (digital) inputs and one analog input. OSD (on screen display) allows control of various configurable parameters such as brightness, contrast and input switching. These parameters can also be controlled via RS-232 and RS-422 interfaces. Remote control software is available from Tech Source.

Key Features:

- **28.05" TFT LCD Display (square format)**
  Direct replacement for CRT monitors.
- **High Resolution of 2,048 x 2,048 Pixel**
  For input signals with a resolution up to 2,048 x 2,048 pixel; even lower resolution pictures (e.g. during installation or service) are displayed correctly.
- **Excellent Optical Characteristics**
  Brightness 210 cd/m², Contrast 1000 : 1, Viewing Angle 170° (horizontally and vertically).
- **Versatile and Flexible Implementation**
  The analog RGB interface and two dual link DVI-D interfaces enable integration into different systems
- **Automatic Frequency- and Phase Adjustment**
  The monitor adjusts itself to the applied input signal.
- **Automatic Backlight Stabilization**
  The selected brightness of the backlight unit is readjusted automatically.

1 Sony DDM is a registered trademark of Sony Corporation

1.1 Layout of this Manual

This manual was created to assist system integrators and operators during installation and operation of the LCD TFT Monitor Raptor SQ2801. The layout is intended to allow even inexperienced users to install and set-up the monitor.

The manual is divided into following chapters:

Chapter 1 Introduction

Brief description of the Raptor SQ2801

Chapter 2 Installation

The chapter discusses the installation and the various interfaces available to the monitor

Chapter 3 Operation

Operation and adjustment controls of the Raptor SQ2801

Chapter 4 Serial Communication

Transmission protocol for communication between a PC / Workstation and the monitor via a serial interface

Chapter 5 Technical Data

Display module, power supply, environment and other data

Chapter 6 Part numbers and Field Replaceable Units

Part numbers for all field replaceable units are discussed, as well as the various components of the TSI ATC visualization kit.

1.2 Warnings and Safety Notes

For information about warnings and safety notes, refer to PRECATUIONS supplied with this manual.

1.3 Packaging

NOTE To avoid permanent damage, great care should be taken to ensure that the monitor is adequately packed and transported in the correct manner. The original packaging should be retained and re-used for future transportation purposes. The original packaging has a red label with two arrows and text “hier oben” (see Fig. 1 and Fig. 2), which indicates the correct orientation of the package **(i.e. when correctly packed this label should be aligned with the top edge and front glass face of the monitor see** Fig. 1 **and** Fig. 2**.)**

Please note that **the monitor (chassis, desktop and panel mount version) must** only be transported in a **vertical position**. The red label should be at the top of the package. See Fig. 1. and Fig. 2

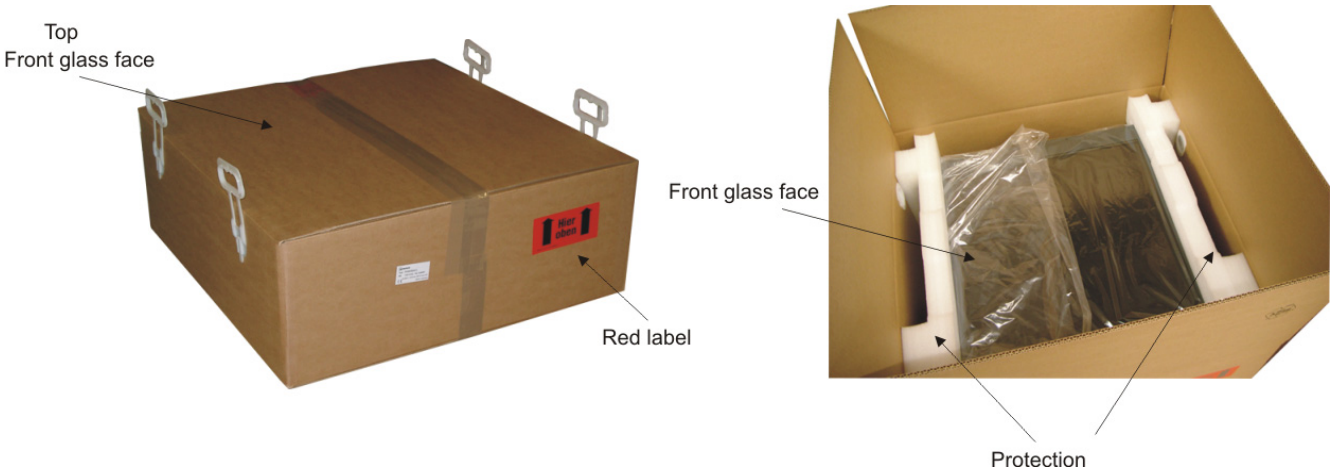


Fig. 1: Package of the chassis and panel mount monitor

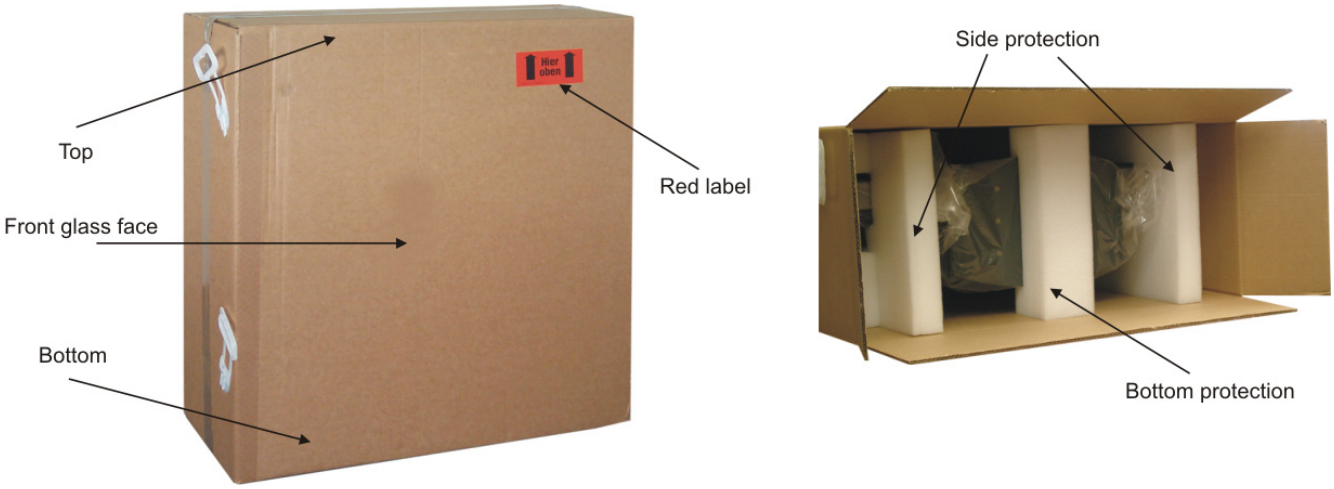


Fig. 2: Package of the desktop monitor

1.4 Instructions for Handling Components Susceptible to Electrostatic Shocks

Most of the assemblies within the LCD monitor Raptor SQ2801 contain components which can be permanently damaged or destroyed by electrostatic discharge. Such resulting damage may or may not result in total failure of the components or modules affected.

The following precautions must be strictly observed when handling such assemblies (this work should only be carried out by qualified service technicians):

- When handling electronic components, care should be taken to prevent electrostatic discharge. Such discharge may occur when handling components or modules without suitable precautions to ensure adequate grounding.
- This also applies to all (insulated) tools. They must also be discharged to earth at all times.
- When assemblies are removed or added to the system, the unit must always be switched off and unplugged from the power supply.
- Vulnerable components should always be held by their edges. Avoid touching circuit paths and contact pins.

1.5 Cleaning

Clean the monitor periodically to keep the monitor clean and extend its life.

Cabinet

Clean the cabinet with a soft cloth dampened with little mild detergent.

NOTE Never use any solvents or chemicals, such as thinner, benzene, wax, alcohol, and abrasive cleaner, which may damage the cabinet or LCD panel.

LCD Panel

- Clean the LCD panel with a soft cloth such as cotton cloth or lens cleaning paper.
- Remove persistent stains gently with a cloth dampened with little water, and then clean the LCD panel again with a dry cloth for better finishing.

TIPS Optional ScreenCleaner is recommended for cleaning the LCD panel surface.

2 General Installation

Preparation for installing the LCD monitor includes following steps:

- Removal of all packaging materials
- Checking of components for damage
- Comparison of components received with those listed on the delivery note
- Connection to the computer system and power supply
- System integration under consideration of technical and ergonomic aspects

2.1 Removal of Packaging and Checking of Component Parts

After unpacking all delivered components, they should be checked for completeness and for possible shipping damage (visual inspection). If any parts are missing or damaged, please contact your local dealer. Have your packing list number, serial number of the unit and a description of the problem available when calling.

The original packaging should be kept for future shipping of the product.

2.2 Installing the Monitor

The Raptor SQ2801 is currently offered in two versions - desktop version and chassis version. Both these version are discussed in this section.

The desktop version is a “standalone” unit that can be placed on top of a desktop console. As for the chassis version, it is easy to integrate it onto the rear of control panel or a console by using two mounting brackets.

Please note the following for safe and proper operation:

Ambient Temperature

In order for the LCD monitor to maintain an optimum operating temperature while in use, air must be allowed to circulate freely around the Raptor SQ2801 enclosure. This is especially important for the rear of the unit. Convection current must be allowed to circulate around the enclosure.

Please bear in mind that increased temperatures may result in on-screen defects and significantly reduced lifetime of the panel.

EMC – Radiation

The LCD monitor is a piece of equipment designed for integration into an industrial system. The operator of the entire plant is responsible for maintaining electromagnetic compatibility according to EMC laws.

Safety Aspects

All voltage and signal connections must adhere to legal requirements.

Ergonomics

The screen comes with anti-reflective glass. However, it should be installed/positioned properly to allow easy viewing from all sides.

Mechanical Integration

The chassis version is secured into a system by 6 bolts (M6 x 10). These bolts can be used for attaching mounting angles which allow mounting the monitor in a control panel or a console (see Fig. 4, Page 13). The dimensions in the drawings are all in mm.

2.2.1 Raptor SQ2801 Dimensions (Chassis version)

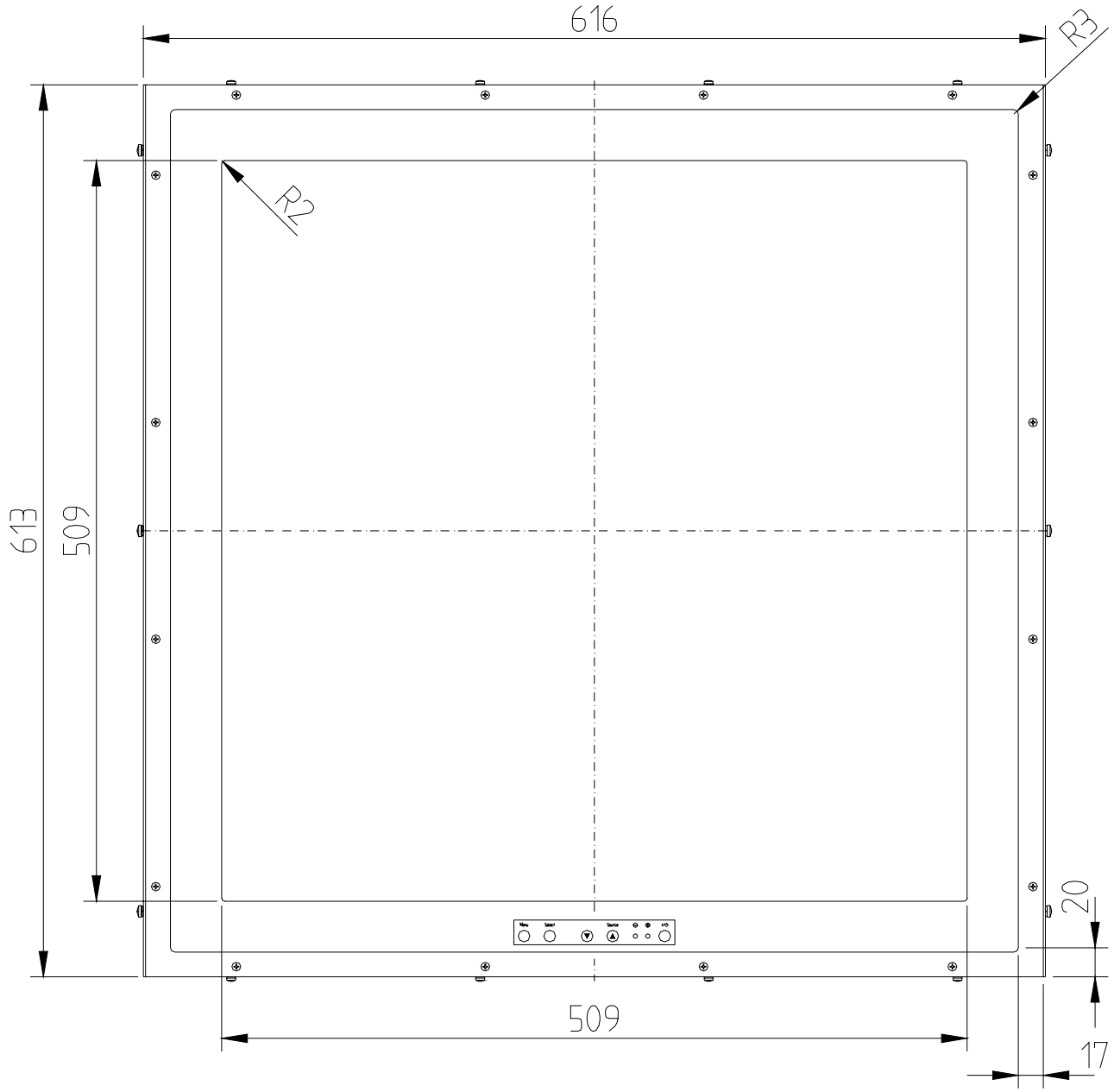


Fig. 3: Raptor SQ2801 Dimensions (Chassis version); Front View

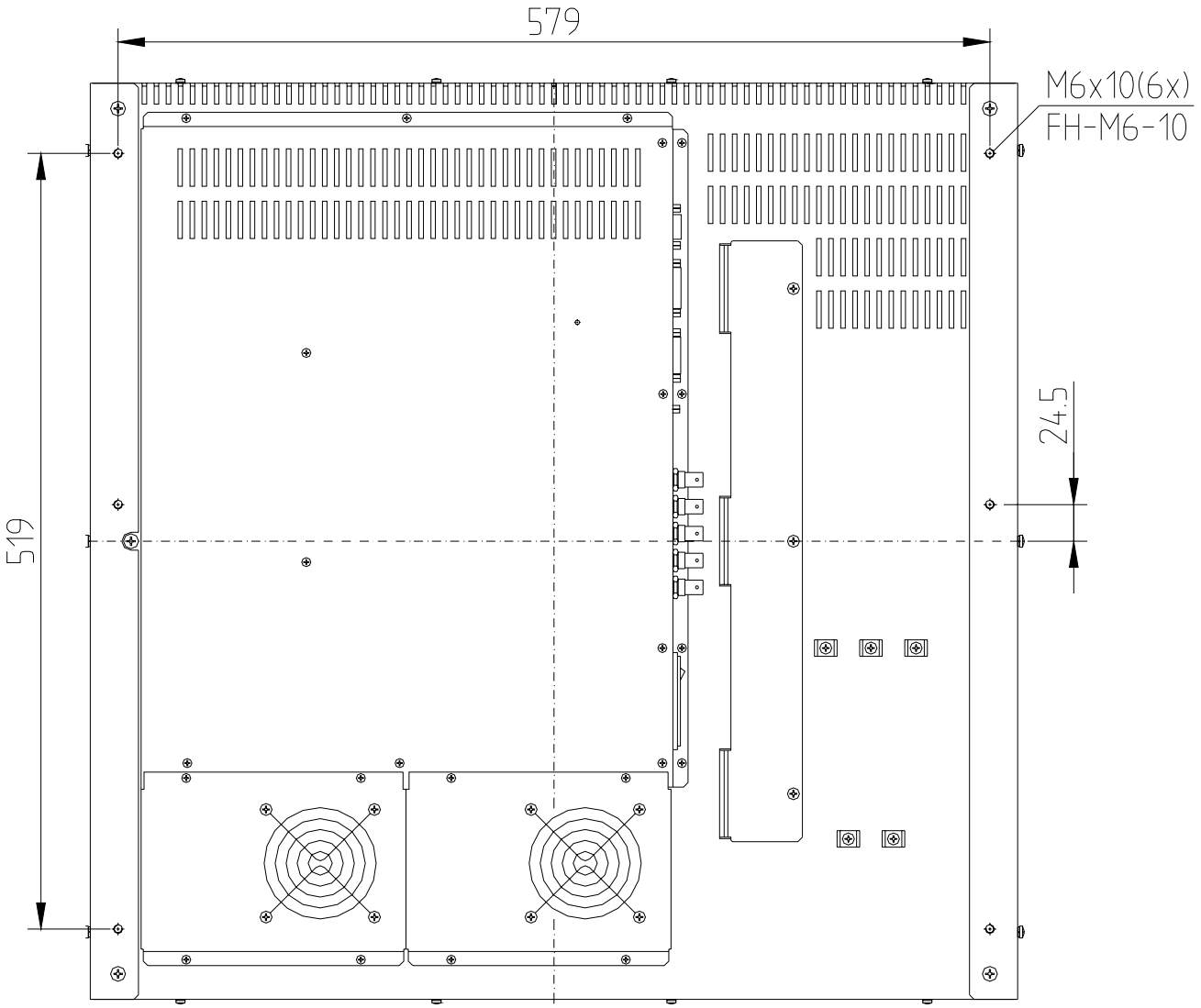


Fig. 4: Raptor SQ2801 Dimensions (Chassis version); Rear View

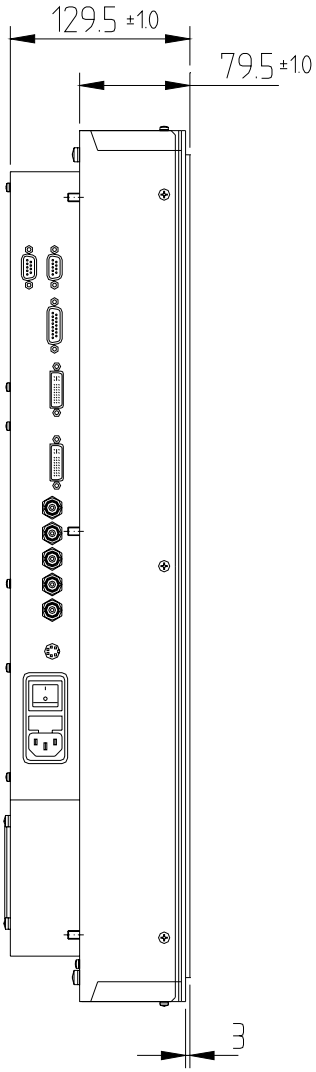


Fig. 5: Raptor SQ2801 Dimensions (Chassis version); Side View

2.2.2 Raptor SQ2801 Dimensions (Desktop version)

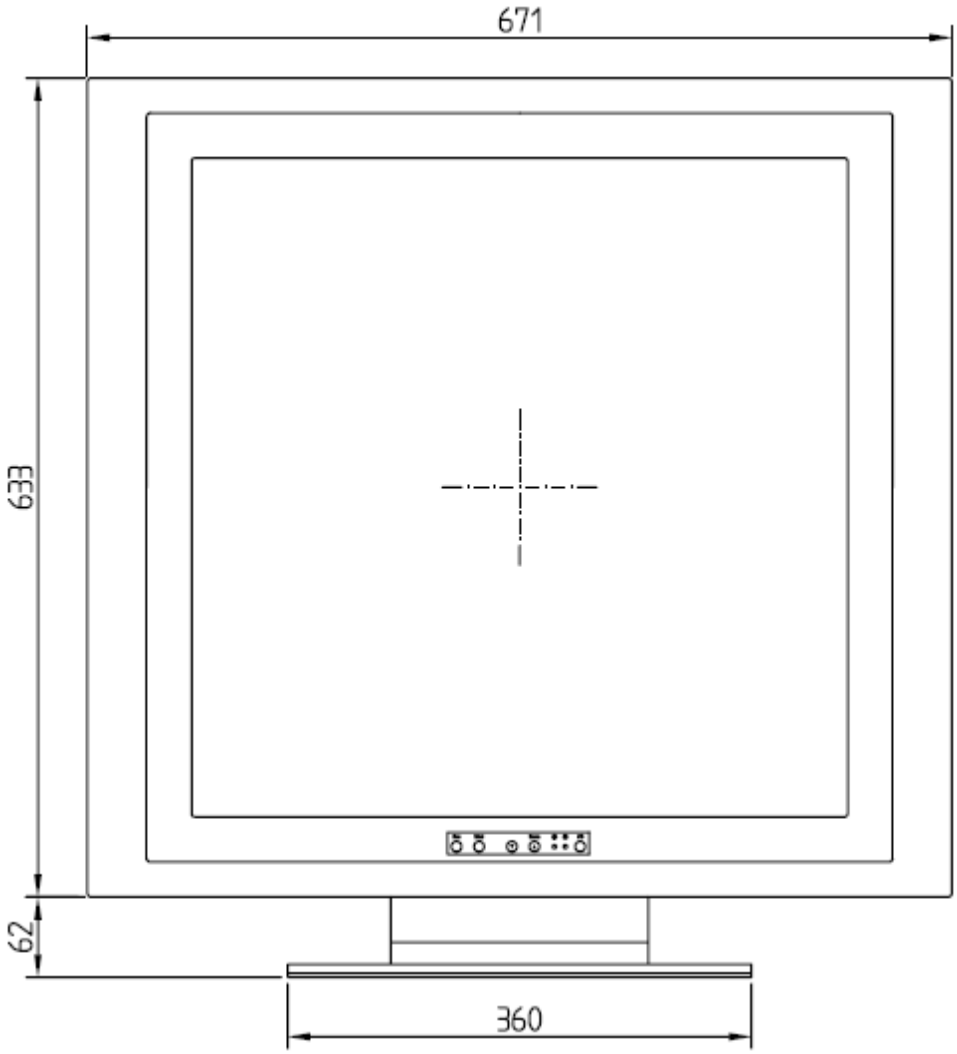


Fig. 6: Raptor SQ2801 (Desktop Version); Front View

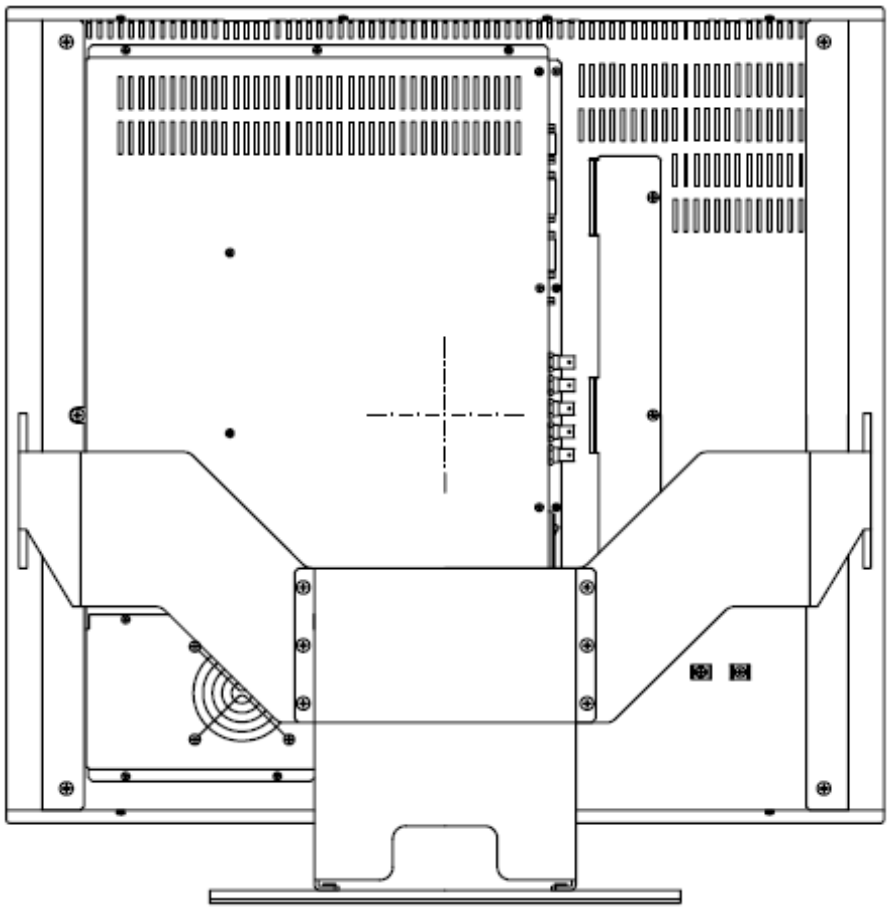


Fig. 7: Raptor SQ2801 Dimensions (Desktop version); Rear View

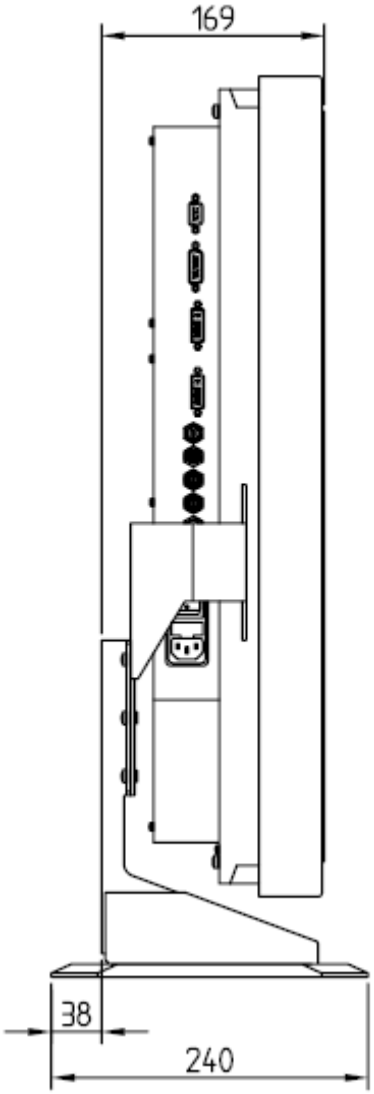


Fig. 8: Raptor SQ2801 Dimensions (Desktop); Side View

2.2.3 Raptor SQ2801 Dimensions (Panel mount version)

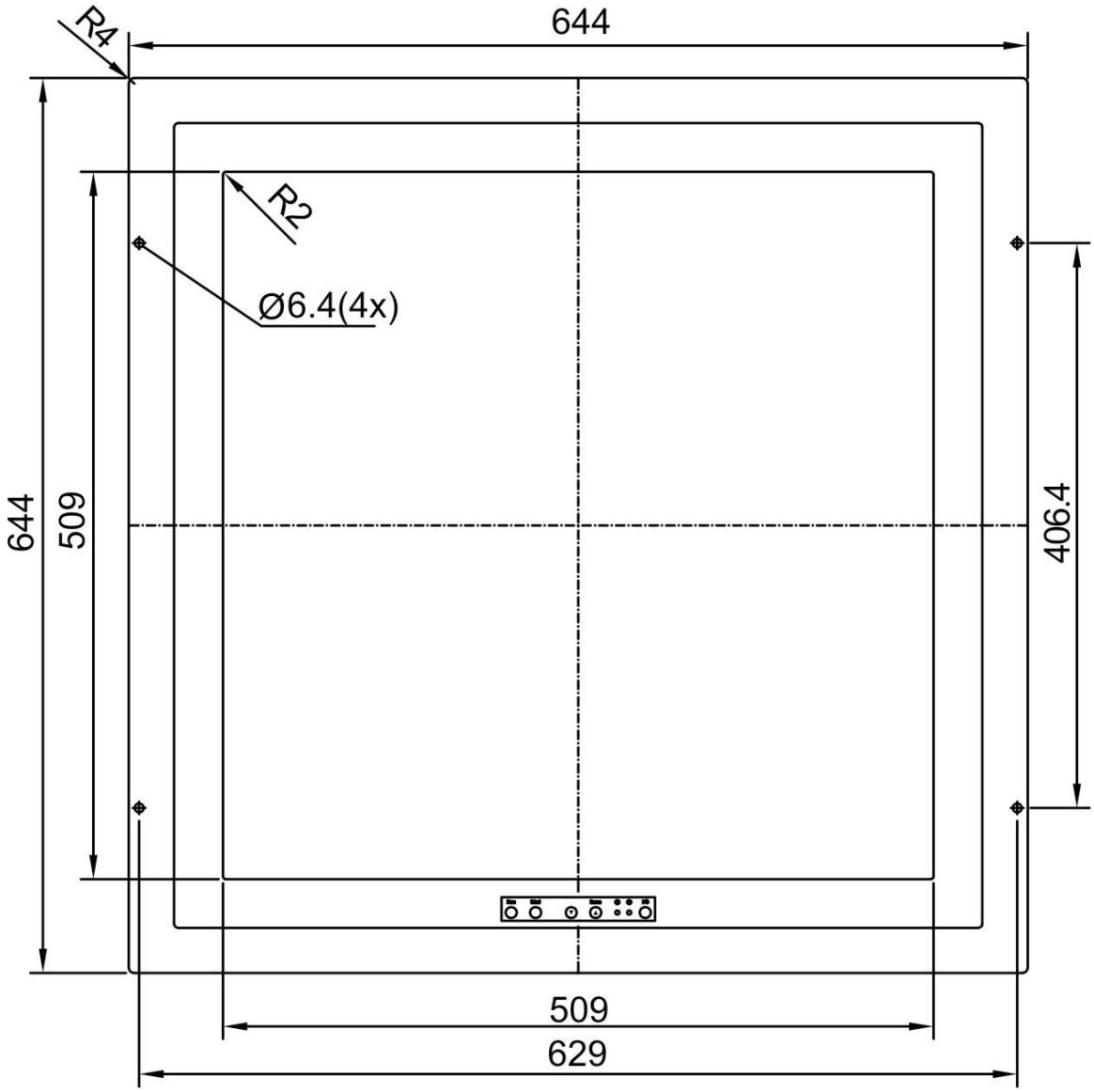


Fig. 9: Raptor SQ2801 Dimensions (Panel mount); Front View

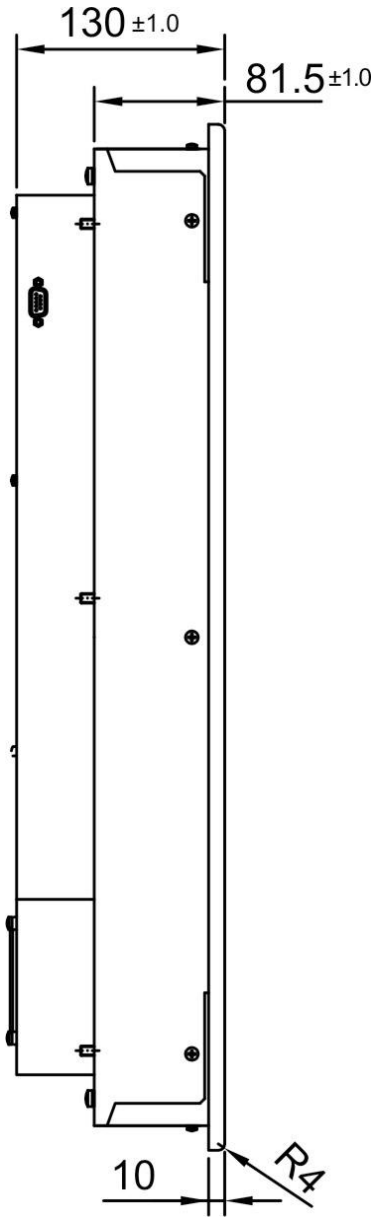


Fig. 10: Raptor SQ2801 Dimensions (Panel mount); Side View

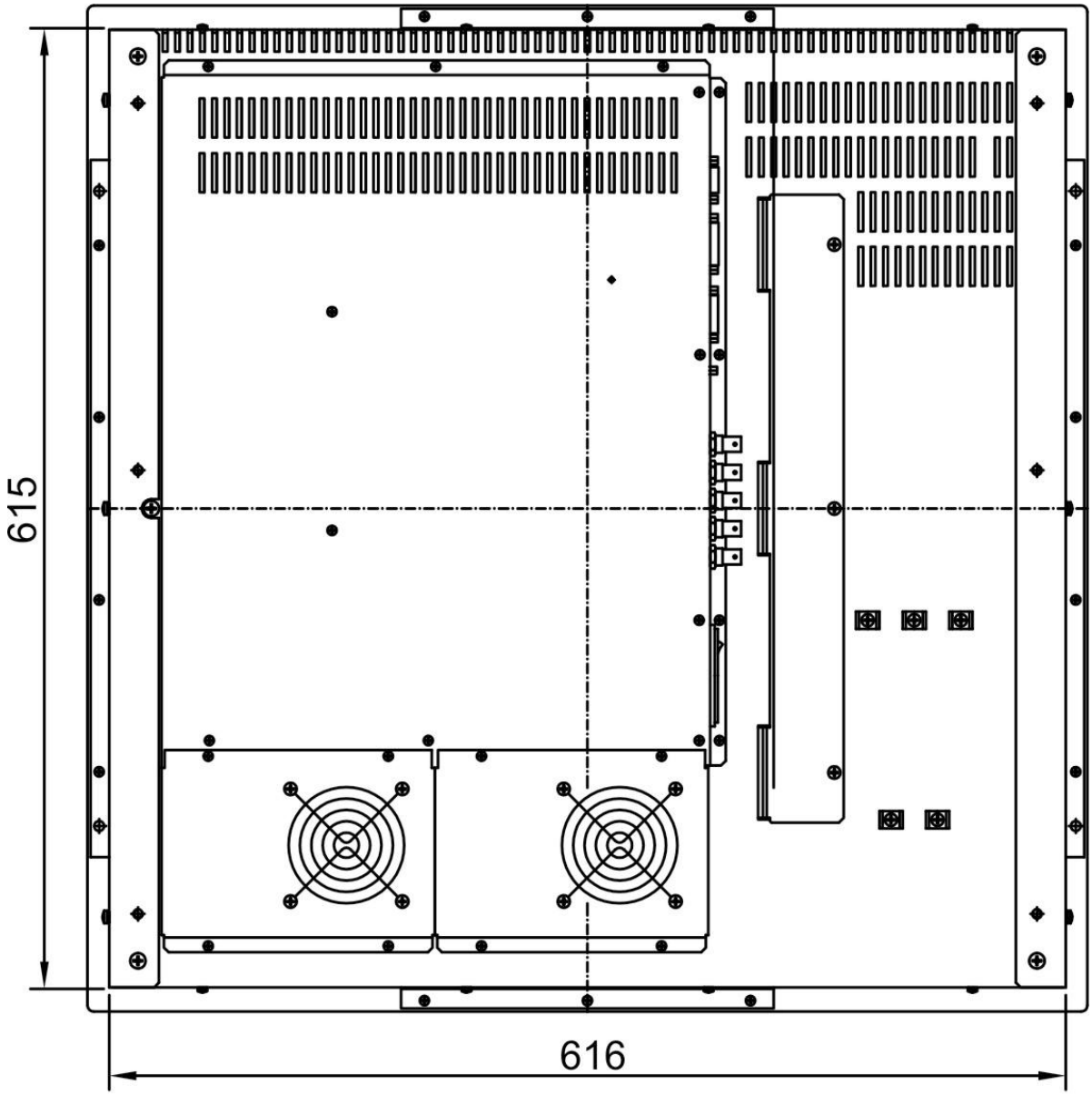


Fig. 11: Raptor SQ2801 Dimensions (Panel mount); Back View

2.3 Interfaces and Connector Assignment

The monitor has been tested and pre-adjusted at the factory. For system installation, connect the unit to the main power supply, serial interfaces and input sources. All input connectors are shown in the figure below. All connections should adhere to EMC regulations.

The Power cord is included in the package for only Chinese market.

Use cord grips to secure cables.

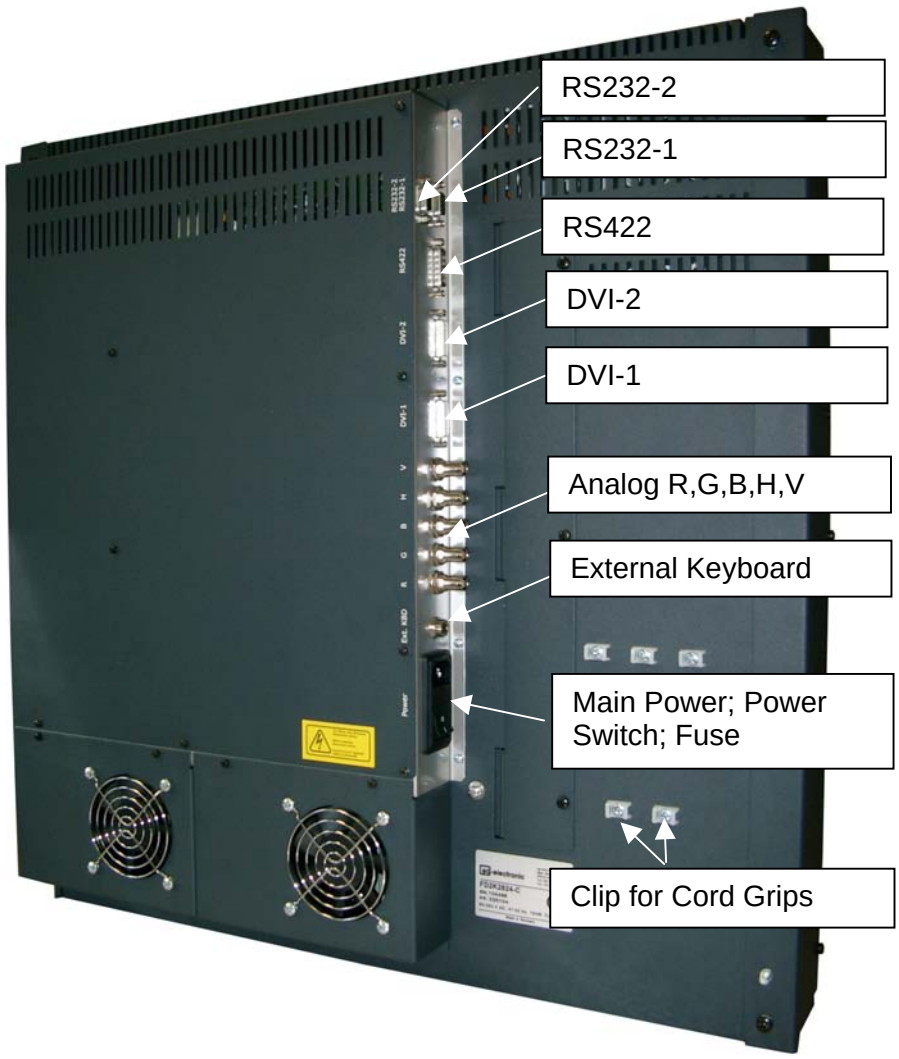


Fig. 12: Location of Interface Connectors

2.3.1 Analog RGB – Interface

The analog RGB input may be used for Sony DDM compatible configurations. However, the Raptor SQ2801 panel can also handle all common VESA timings. When using this interface, specific adjustments for phase and frequency may be necessary. These adjustments are explained in detail in section 3.3 on page 40.

For connection with the analog video source, a high quality coaxial cable must be used. The three video signals (red, green and blue) require 50 ohm impedance on the coaxial cable while the synchronization signals (hsync and vsync) must have 75 ohms impedance. Signal cables of poor quality may cause distortions and shadowing in the displayed picture.

Technical data pertaining to the analog RGB interface is discussed in section 5.6 on page 54.

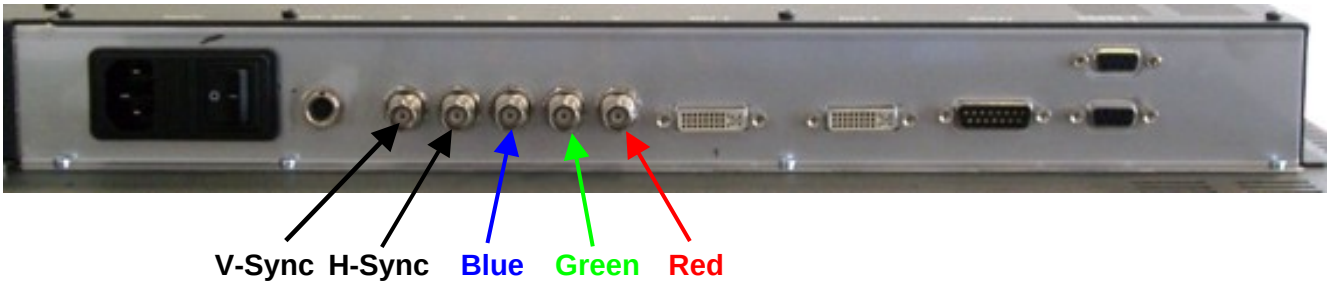


Fig. 13: Connector type: 5 x BNC socket

2.3.2 DVI-1 / DVI-2 Interface

The digital video inputs use the standard dual-link DVI interface. Dual-link DVI is necessary to support the high data rate (dot clock) as required by this high resolution of 2048 x 2048. However, the monitor also supports lower resolutions (e.g. VGA, SVGA, XGA, SXGA, UXGA, etc.) using a single link DVI cable. This feature can be useful during boot up on some machines that use a lower resolution during start-up.

The monitor provides EDID information (**E**xtended **D**isplay **I**dentification **D**ata) to the host system (workstation) via the DDC (**D**isplay **D**ata **C**hannel) protocol. This data includes, in addition to the standard VESA timing, a special timing for 2048 x 2048 @ 60 Hz that is designed to use pixel frequencies below the DVI maximum.

If the connected workstation/graphics card does not support DDC, it can be configured manually as described in section 5.7 on page 55. In addition to this specific timing, all others timing that are part of the DVI specification are displayed.

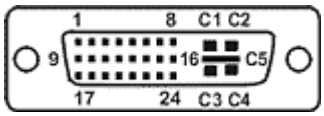
Video cables up to 5 meters in length may be used for the connection between the graphics card and the display.

Connector Assignment:

Pin	Signal
1	TMDS-Data 2 -
2	TMDS-Data 2 +
3	TMDS-Data Shield 2 (GND)
4	TMDS-Data 4 -
5	TMDS-Data 4 +
6	DDC-CLK
7	DDC-DATA
8	NC
9	TMDS-Data 1 -
10	TMDS-Data 1 +
11	TMDS-Data Shield 1 (GND)
12	TMDS-Data 3 -
13	TMDS-Data 3 +
14	+5 V Power (In)
15	GND

Pin	Signal
16	Hot Plug Detect
17	TMDS-Data 0 -
18	TMDS-Data 0 +
19	TMDS-Data Shield 0 (GND)
20	TMDS-Data 5 -
21	TMDS-Data 5 +
22	TMDS-CLK Shield (GND)
23	TMDS-CLK +
24	TMDS-CLK -
C1	NC
C2	NC
C3	NC
C4	NC
C5	GND

Connector type: 29 pin DVI-I socket



2.3.3 RS232-1 Interface

This RS232 interface is used for communication with the host machine (workstation). Three different protocols are available which are described in chapter 4 on page 42.

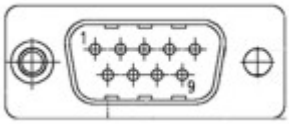
In addition, this interface is used for monitor firmware updates

NOTE Only the RS232-1 interface can be used for monitor firmware update.

Connector Assignment:

Pin	Signal
1	NC
2	TXD (Output)
3	RXD (Input)
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

Connector type: 9 pin D-Sub-socket



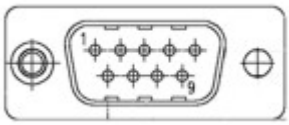
2.3.4 RS232-2 Interface

This RS232 interface is used for communication with the host machine (workstation). Three different protocols are available which are described in chapter 4 on page 42. The additional handshake signals serve to communicate with a workstation via the DDM protocol.

Connector Assignment:

Pin	Signal
1	NC
2	TXD (Output)
3	RXD (Input)
4	DSR (Input)
5	GND
6	DTR (Output)
7	NC
8	NC
9	NC

Connector type: 9 pin D-Sub-socket



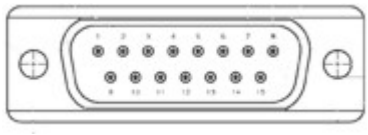
2.3.5 RS422 Interface

The RS422 interface is used for communication with the host machine (external PC, workstation). Three different protocols are available which are described in chapter 4 on page 42.

Connector Assignment:

Pin	Signal
1	GND
2	TXD+
3	RXD+
4	DSR-
5	DTR-
6	GND
7	NC
8	+5V output
9	TXD-
10	RXD-
11	DSR+
12	DTR+
13	GND
14	NC
15	+5V output

Connector type: 15 pin D-Sub-plug

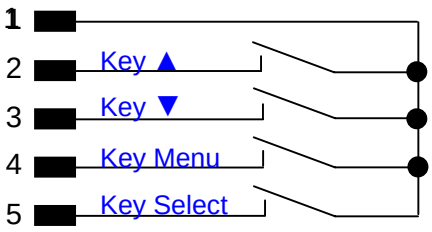


2.3.6 External OSD-Keyboard Interface

This connector is for an external passive keyboard which has exactly same functionality as the buttons on the front of the panel, used to control the OSD (on screen display) (see section 3.1, page 27).

An external keyboard allows operation of the monitor when the front side keyboard is not accessible or is absent. Cable length for this external keyboard should not exceed 7 meters.

The keys of the external keyboard pull the signal to ground (see following sketch).



Connector Assignment:

Pin	Signal
1	GND
2	Key ▲
3	Key ▼
4	Key “Menu”
5	Key “Select”

Connector Type:

Sub miniature circular connector Series 712 (Binder GmbH)

2.4 Electrical Installation

Before connecting the Raptor SQ2801 to main power, ensure that all connectors for video signals and serial interfaces are plugged in properly and securely.

After that, the monitor may be connected to main power and switched on by turning ON the main power switch on the rear of the unit (see Fig. 12, page 21).

NOTE By default, automatic source scan is disabled and the DVI-1video input interface is activated.
A different video input interface can be selected via the OSD menu (see 3.2, page 28) or the serial interfaces.

3 Operation and Adjustment

The manual operation and adjustment of the monitor is facilitated by buttons that are integrated on the front of the unit. The buttons are used for navigation and control of the OSD menu. Alternatively, all adjustments for brightness, contrast, etc. can be carried out via an external keyboard or via the serial interfaces (see chapter 4, page 42).

Fig. 14: OSD keyboard and LED

3.1 Function of OSD Keys and LED

The OSD keys have following function(s):

Source ▲	- Increment value - Navigation to the right - Invoke Quick-OSD (if no OSD is active) + Selection of signal interface + execute automatic adjustment (for analog input source)
▼	- Decrement value - Navigation to the left
Menu	- Invoke OSD menu - toggle between main- and submenu
Select	- Menu navigation, scroll down (if OSD is active) - Invoke Quick-OSD (if no OSD is active) Selection of Quick-Menu-Function (Brightness, Contrast and backlight brightness)
I/O	- Soft power - On and off function of the monitor (Stand-By mode)
LED1	Status Off: valid input signal on selected video interface Flashing: no valid input signal on selected video interface On: monitor in stand by mode
LED2	Power Off: No main power or device switched off On: Main power connected and device switched on

3.2 OSD-Menu / Quick-OSD-Menu

In addition to detailed adjustments in the **OSD-Menu,** there is another option available for adjusting frequently used functions such as brightness and contrast via direct access (remotely), the so called **Quick-OSD-Menu**. The protocols for access are discussed in Chapter 4.

All settings and adjustments of the OSD are stored in non-volatile memory.

3.2.1 Quick-OSD-Menu

Following settings / functions are available via Quick-OSD-Menu:

- Brightness
- Contrast
- Source select
- Automatic adjustment

Fig. 15: Quick-OSD-Menu

Invoke via key **< Select >**

Function	Adjustment / Value	Description
Brightness	Setting range: 0 to 100 via key (▲/▼)	Brightness adjustment
Contrast	Setting range: 0 to 100 via key (▲/▼)	Contrast adjustment

Invoke via key **<▲>**

Function	Adjustment / Value	Description
Source RGB1 Digital1,Digital2	Press <▲> key again	Selection of input source
Automatic Adjustment *(Only available if source "RGB1" is active)*	Press <▲> key again	Performs an automatic image adjustment. Adjustment of frequency, phase and image position.

3.2.2 OSD-Menu

The OSD (**O**n **S**creen **D**isplay) is a menu system which is displayed on the screen. All monitor settings and adjustments are done by operating the OSD

OSD options depend on the selected signal source (RGB or DVI). For example, functions for frequency and phase adjustment of analog signal sources are not available when the unit is displaying a DVI signal.

3.2.2.1 OSD-Menu – Picture

Fig. 16: OSD-Menu - Picture

Active Signal Source

Function	Description	RGB	DVI
Brightness	Display brightness adjustment (not backlight brightness!!!) Setting range: 0 to 100	**X**	**X**
Contrast	Contrast adjustment Setting range: 0 to 100	**X**	**X**
H-Position	Horizontal picture position Setting range: 0 to 100	**X**	
V-Position	Vertical picture position Setting range: 0 to 100	**X**	
Phase	Phase adjustment, see section 3.3.1 page 40 Setting range: 0 to 31	**X**	

Function	Description	RGB	DVI
Frequency	Frequency adjustment, see section 3.3.1 page 40 Setting range: depends on input timing / resolution	**X**	
Scaling	Scaling adjustment if input resolution is lower than 2048 x 2048 Setting range: One to One: Display signal without scaling. Fill All: The input signal is displayed full screen. Fill Aspect Ratio: The input signal is displayed in maximum size while height / width ratio is kept. Depending on the resolution, a black field may be displayed up and down or left and right.	**X**	**X**
Auto Phase Tune	Enable / disable automatic phase tune. If this function is enabled, phase adjustment is periodically checked and if necessary readjusted (see section 3.3.2 page 41). Setting range: On, Off	**X**	

(**X**): available for this input signal

3.2.2.2 OSD-Menu (Advanced)

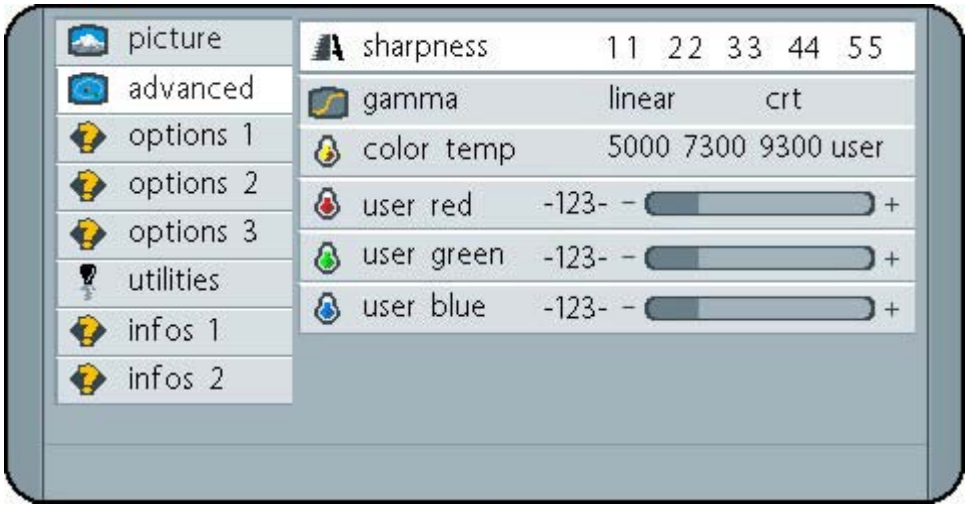


Fig. 17: OSD-Menu (advanced)

Function	Description	RGB	DVI
Sharpness	Sharpness adjustment of the picture; choose from 1 = sharp to 5 = smooth. This function is only available, if the input resolution is lower than target resolution 2048 x 2048. Setting range: 1 to 5	**X**	**X**
Gamma	Gamma – Curve selection Setting range: Linear or CRT	**X**	**X**
Color-temperature	Color temperature adjustment Choose among three predefined and one free adjustable color temperature values. Enabling “user “ adjustment causes bars for red, green and blue to appear. Range: 0 to 100 % (50 % corresponds factor 1) Setting range: 5000 K, 7300 K, 9300 K, user	**X**	**X**

(**X**): available for this input signal

3.2.2.3 OSD-Menu - Options 1

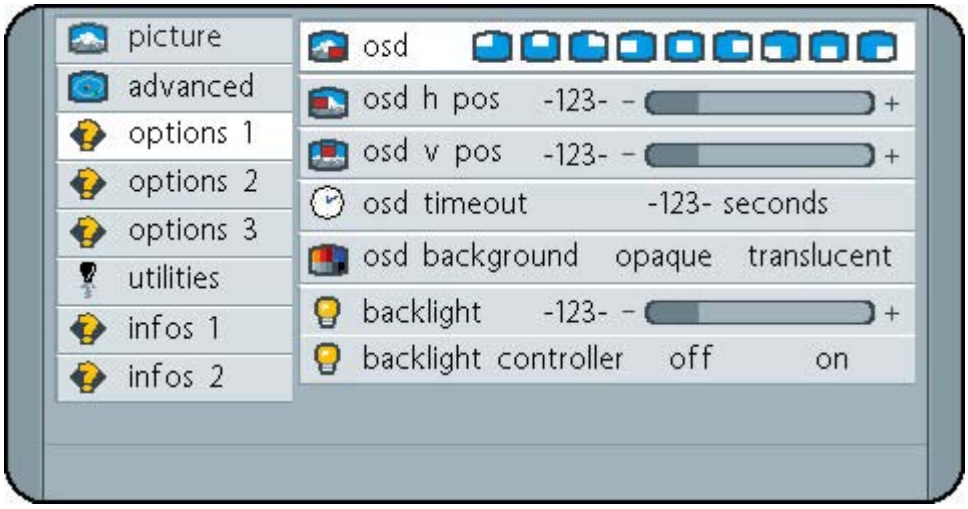


Fig. 18: OSD-Menu - Options 1

Function	Description	RGB	DVI
OSD	Choose among nine predefined OSD positions	**X**	**X**
OSD H-Pos.	Shift OSD-menu in horizontal direction Setting range: 0 to 100	**X**	**X**
OSD V-Pos.	Shift OSD-menu in vertical direction Setting range: 0 to 100	**X**	**X**
OSD Timeout	Timeout for OSD menu; OSD disappears after that time, if no key is pressed. Setting range: in steps of 5 sec. between 5 and 60 sec.	**X**	**X**
OSD Background	Choose between transparent and colored background Setting range: Opaque; translucent	**X**	**X**
Backlight	Adjust backlight brightness Setting range (backlight controller “off”): 0 to 100 % Setting range (backlight controller “on”): 30 to 150 cd/m²	**X**	**X**
Backlight Controller	Backlight control to compensate for loss of brightness due to backlight aging (see section3.4 page 41). Setting range: off; on	**X**	**X**

(**X**): available for this input signal

3.2.2.4 OSD-Menu - Options 2

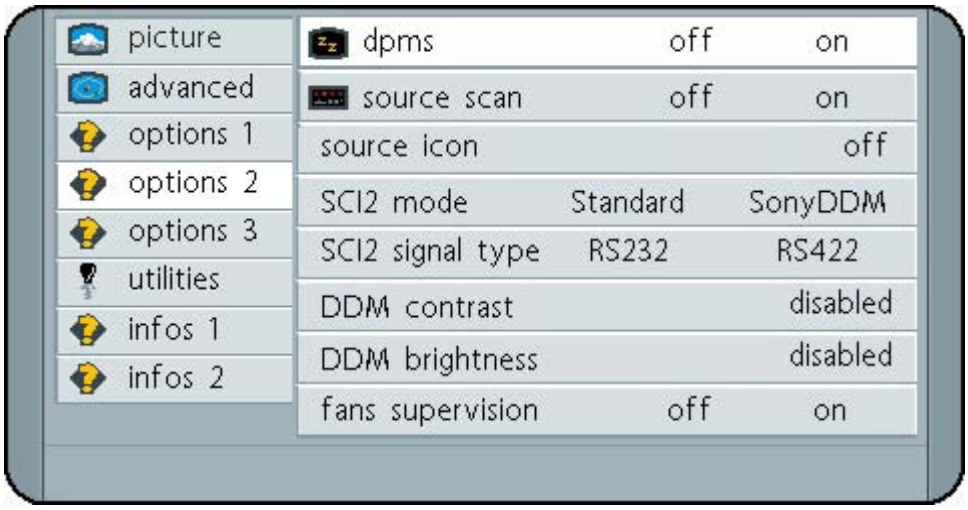
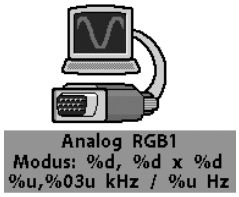


Fig. 19: OSD-Menu - Options 2

Function	Description	RGB	DVI
DPMS	Display power management system If DPMS is active, the monitor shuts down when there no sync signals Setting range: off; on	**X**	**X**
Source scan	Automatic scan for input sources; scans all input interfaces for valid input signal. Setting range: off; on	**X**	**X**
Source icon	Enable or disable display of source icon. Changes to any of the following cause this icon to appear and display the actual signal source information: Signal source (e.g. RGB1 analog) Mode, resolution of input signal source, H- and V-frequency. 	**X**	**X**
SCI2-mode	Selection of communication protocol of serial interface RS232-2 and RS422 (see chapter 4 page 42). Setting range: Standard; Sony DDM	**X**	**X**
SCI2-signal type	Selection of active serial interface. Only one of the two interfaces can be active. Setting range: RS232; RS422	**X**	**X**

(**X**): available for this input signal

Function	Description	RGB	DVI
DDM contrast	DDM control function assignment to DDM protocol 0xA1 Valid functions: backlight, brightness, contrast, disabled	**X**	**X**
DDM brightness	DDM control function assignment to DDM protocol 0xA0 Valid functions: backlight, brightness, contrast, disabled	**X**	**X**
Fans supervision	**ON**: number of number of rotation will be shown in Menu Info 2 **OFF**: Status is OK in Menu Info 2 If a fan without control function is installed and status is ON; menu Info 2 shows a failure.	**X**	**X**

3.2.2.5 OSD-Menu - Options 3

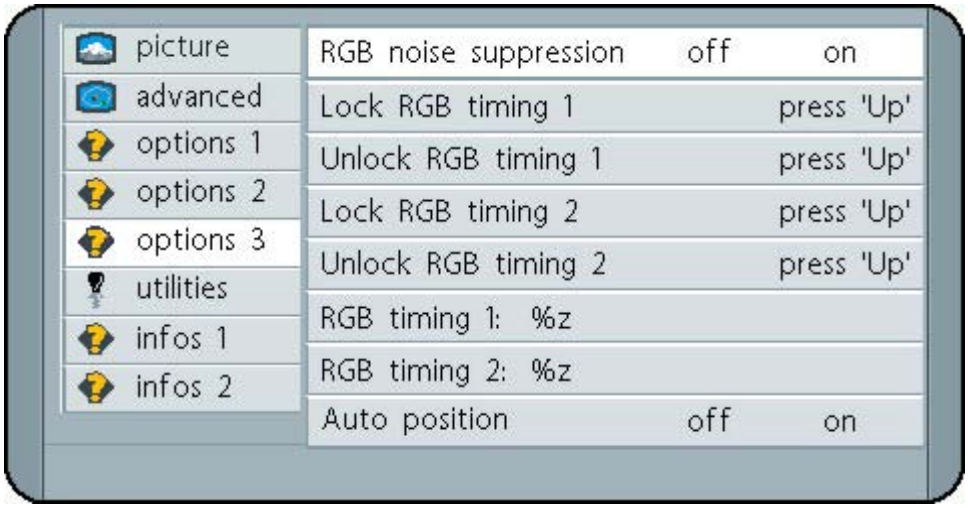


Fig. 20: OSD-Menu - Options 3

Function	Description	RGB	DVI
RGB-noise suppression	This function suppresses interference at the sync signal lines to avoid a new auto adjustment during short interference. Setting range: off; on	**X**	**X**
Lock RGB-Timing 1	The current video timing will be stored and processed with higher tolerances in H- and V- frequencies. These timings will be used despite fluctuations in H- and V- frequency resulting from a noisy video signal, which might otherwise be misinterpreted, resulting in incorrect centering or pixel resolution.	**X**	**X**
Unlock RGB-Timing 1	Settings for video timing 1 get released. Auto adjustment is enabled again.	**X**	**X**
Lock RGB-Timing 2	See lock RGB-Timing 1	**X**	**X**
Unlock RGB-Timing 2	See unlock RGB-Timing 1	**X**	**X**
RGB-Timing 1	Shows resolution and refresh rate of locked timing 1; Only available if timing 1 is locked.	**X**	**X**
RGB-Timing 2	Shows resolution and refresh rate of locked timing 2; Only available if timing 2 is locked.	**X**	**X**
Auto position	ON: the position will be automatic centered OFF: the position depends on the auto adjustment of the signal	**X**	

(**X**): available for this input signal

3.2.2.6 OSD-Menu – Utilities

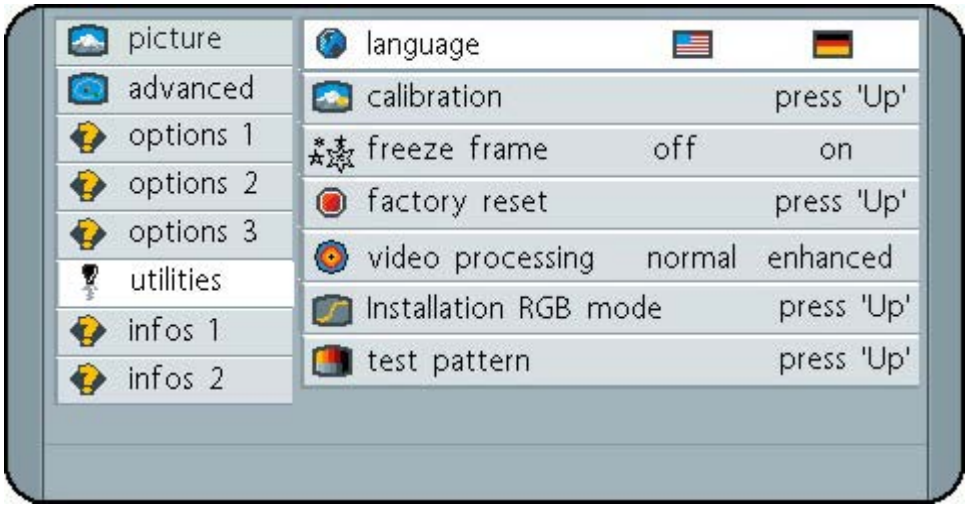


Fig. 21: OSD-Menu – Utilities

Function	Description	RGB	DVI
Language	Select language of OSD Menu Setting range: English; German	**X**	**X**
Calibration	This function allows to calibrate the A/D converter	**X**	
Freeze frame	Saves the actual image	**X**	**X**
Factory reset	Reset of all parameters (brightness, contrast, backlight brightness, etc.) to factory default values.	**X**	**X**
Installation RGB-Mode	This function allows the user to add a signal timing definition to the monitor. It will be used to process a signal that is not internally defined.	**X**	**X**
Test pattern	Displays a test pattern on the screen. Select one of 7 different test patterns by pressing <▲> key. Any other key will return to normal operation (no OSD).	**X**	**X**

(**X**): available for this input signal

3.2.2.7 OSD-Menu - Utilities / Installation RGB-Mode

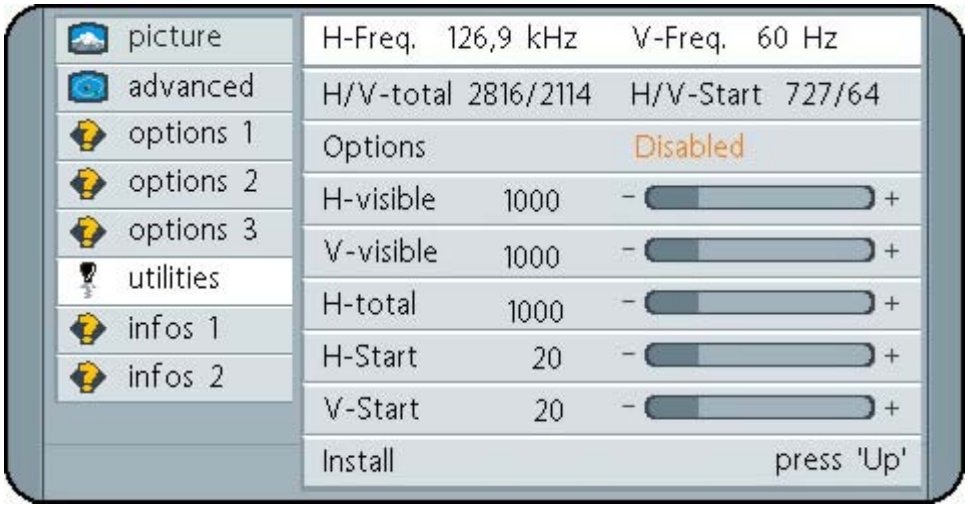


Fig. 22: OSD-Menu - Utilities / Installation RGB-Mode

Function	Description	RGB	DVI
Options	Select the RGB installation mode for those timings which are not part of the internal timing list. Disabled: use only the internal timing table. Mode1: use timing parameters and carry out complete auto adjustment (most frequently used). Mode 2: use timing parameters and carry out an auto adjustment; however without an automatic image position adjustment. Mode 3: use timing parameters and carry out an auto adjustment; however without an automatic frequency adjustment. Setting range: Disabled, Mode1, Mode2, Mode3	**X**	**X**
H-visible	Horizontal image resolution	**X**	**X**
V-visible	Vertical image resolution	**X**	**X**
H-total	Number of pixels per line (most important parameter)	**X**	**X**
H-Start	Number of pixels from H-sync start to image start	**X**	**X**
V-Start	Number of Lines from V-sync start to image start	**X**	**X**
Install	Activate installation parameters	**X**	**X**

(**X**): available for this input signal

3.2.2.8 OSD-Menu - Infos 1

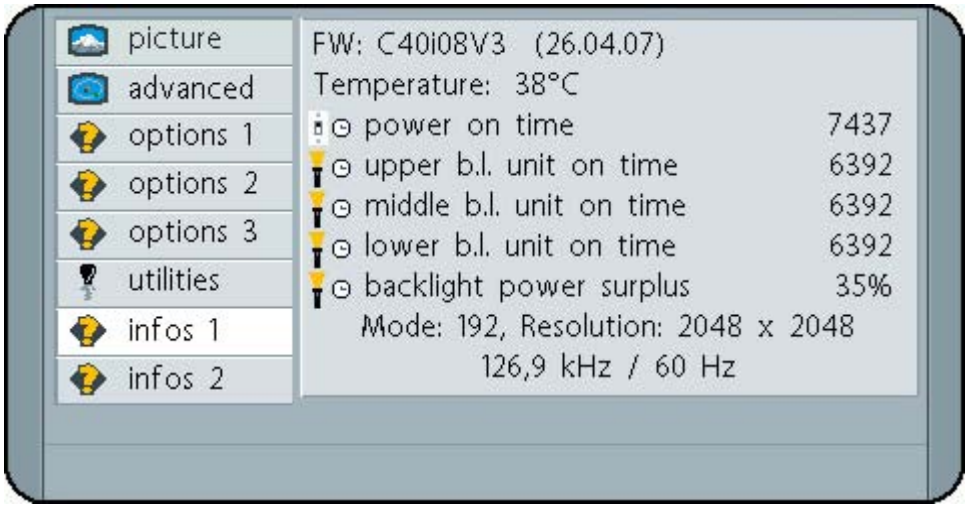


Fig. 23: OSD-Menu – Infos 1

Function	Description	RGB	DVI
FW	Shows the firmware version of the controller board	**X**	**X**
Temperature	Shows internal temperature	**X**	**X**
Power on time	Shows power-on time of the monitor (main power connected to the unit and switched on)	**X**	**X**
Upper b.l. unit on time	Shows backlight on time of upper backlight unit	**X**	**X**
Middle b.l. unit on time	Shows backlight on time of middle backlight unit	**X**	**X**
Lower b.l. unit on time	Shows backlight on time of lower backlight unit	**X**	**X**
Backlight power surplus	Shows the reserve for adjusting the backlight brightness	**X**	**X**
Mode, Resolution	Shows parameters of the current input signal	**X**	**X**

(**X**): available for this input signal

3.2.2.9 OSD-Menu - Infos 2

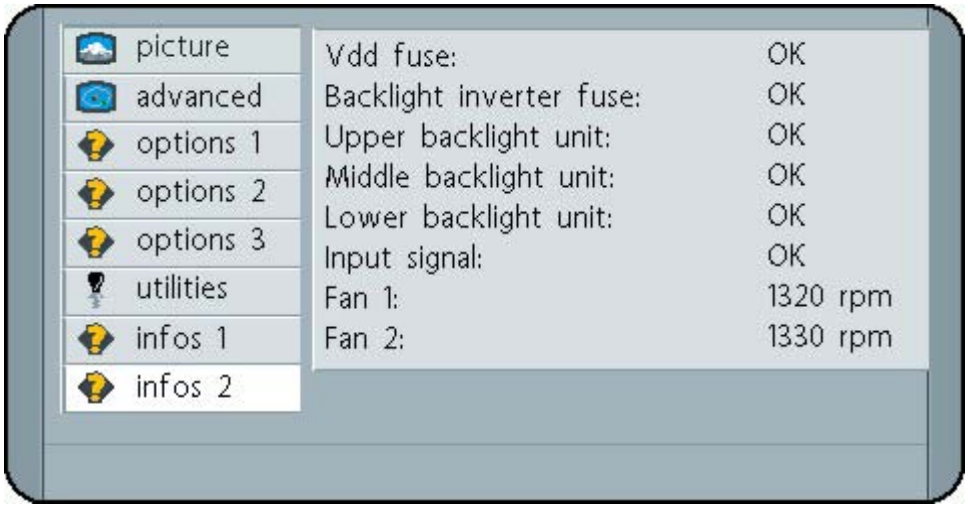


Fig. 24: OSD-Menu – Infos 2

Function	Description	RGB	DVI
Vdd-fuse	Shows status of main power fuse	**X**	**X**
Backlight inverter fuse	Shows status of backlight inverter fuse	**X**	**X**
Upper backlight unit	Shows status of upper backlight unit	**X**	**X**
Middle backlight unit	Shows status of middle backlight unit	**X**	**X**
Lower backlight unit	Shows status of lower backlight unit	**X**	**X**
Input signal	Shows if valid input signal has been detected	**X**	**X**
Fan 1	Shows the number of rotation and OK if the control function is not active.	**X**	**X**
Fan 2	Shows the number of rotation and OK if the control function is not active.	**X**	**X**

(**X**): available for this input signal

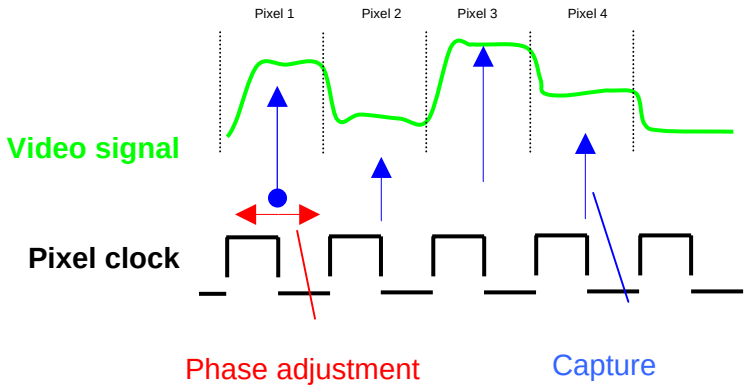
3.3 Adjustment Analog Signal Source (DDM)

There is no strict standardization for the signals coming from analog signal sources. Certain adjustments are therefore necessary, depending on the graphics adaptors and used cables. When the Raptor SQ2801 is connected to an analog signal source for the first time, an integrated “automatic adjustment” function performs this adjustment. It uses the H and V frequencies of the input signal to adjust the frequency, phase and picture position of the image. Depending on the quality of the displayed image, it may be necessary to tweak the image manually.

3.3.1 Adjustment Phase and Frequency

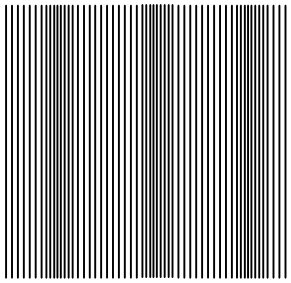
The two most important parameters of an analog signal are frequency and phase adjustments. Frequency adjustment precisely indicates the total number of pixels per line.

With phase adjustment, the capture point of a pixel is determined. See the illustration below.

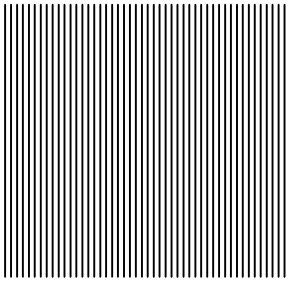


For adjustment of frequency and phase, pictures with plenty of vertical stripes (ideally alternating black and white columns) are very useful. A test pattern like this allows simple adjustment of frequency and phase.

With bad frequency adjustment from left to right, parts of the picture appear blurred. Each alteration of the frequency increases or decreases the number of blurred fields. Correct setting is achieved when the whole screen has the same appearance. The picture may appear blurry, but it should be homogeneously across the whole screen. Blurry or messy lines will be compensated for by phase adjustment.



bad frequency adjustment



correct frequency adjustment

NOTE When DDM compatible timings are used, frequency adjustment may not get modified.
Frequency has to be set to 2816. All graphic adapters which are used in air traffic control (ATC) use this setting.

3.3.2 Automatic Phase Adjustment

During normal operation, the monitor will heat up, causing marginal phasing between the pixel clock and the video signal. Enabling the automatic phase adjustment in the OSD will allow the monitor to compensate this. This function performs tests every 5 minutes for phasing in the pixel clock and readjusts itself if a deviation is detected.

NOTE For best results, the automatic phase adjustment function requires that text or lines are visible on the screen. These areas are used to evaluate the degree of phasing.

3.4 Adjustment of Backlight Brightness / Automatic Backlight Control

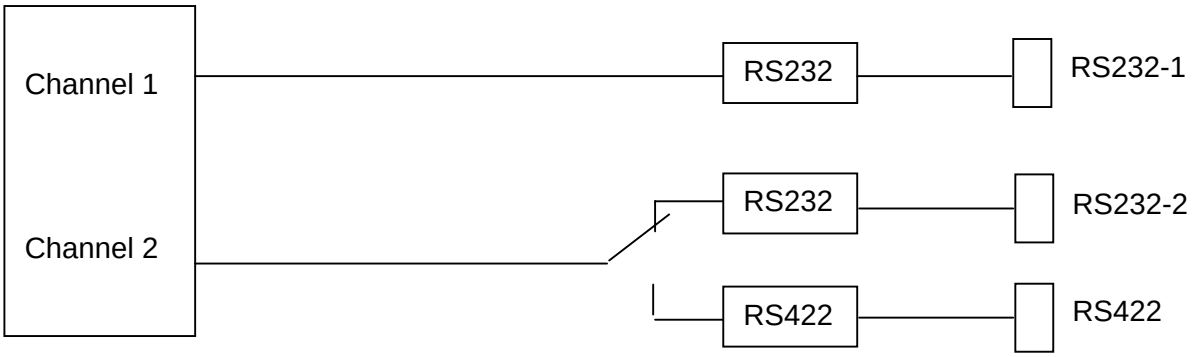
The monitor has an integrated automatic backlight control function which keeps backlight brightness constant. If this function is enabled, the backlight value of the OSD is scaled to “cd/m²”.

This mode allows the user to set the backlight brightness to a value between 30 and 150 cd/m².The TFT module’s maximum brightness is 210 cd/m² (with new backlight tubes). The difference from 150 to 210 cd/m² is used to compensate for old-age brightness leakage of the backlight tubes.

If automatic brightness control is disabled, the value can be set between 0 and 100 %.

4 Serial Communication

There are two channels for serial communication available, in which one channel can be used alternatively as RS232 or RS422 interface.



Switching between RS232-2 and RS422 is done in the OSD menu.

There are three different transmission protocols available:

Standard Protocol

This protocol supports all adjustments and controls of the monitor.

Simplified Protocol

This protocol has a simplified structure, and only allows the adjustment of brightness, contrast and backlight brightness. It can also query the monitor's system status for information such as error messages, temperature, active source and operating time.

DDM-Protocol

This protocol is used in Sony-DDM compatible systems.

The following table shows which protocols are available for each of the different interfaces:

Standard Protocol	RS232-1		
Simplified Protocol	RS232-1	RS232-2	RS-422
DDM-Protocol		RS232-2*	RS-422

* The RS232-2 interface has additional handshake signals which are needed for communication via DDM-protocol.

4.1 Standard Protocol

The standard protocol supports all adjustments and control of the monitor. This protocol uses two kinds of data packet types. Packet format called “Operation” is used for adjustments such as brightness, contrast and backlight brightness. The packet type called “key simulation” is used to operate the OSD via serial interface.

Interface Parameters

Baud-Rate	19200
Parity	None
Data-Bits	8
Stop Bits	1
Handshake	No

Protocol

Host		Monitor
Operation / Key	→	
	←	ACK(OK)
Operation(GET)	→	
	←	ACK(OK)
	←	OpPack
0x1E	→	

ACK-Message

OK	0x06
Error	0x15

4.1.1 Data Packet Structure “Operation”

Byte No	0	1	2	3	4	5	6	7	8	9	10
Data	0xBE	0xEF	0x03	0x19	0x00	CRC-L	CRC-H	***O-Type***	***Code-L***	***Code-H***	0x00

Byte No	11	12	13	14	15	16	17	18	19	20	21
Data	0x00	0x00	0x00	0x00	0x00	***Val-L***	***Val-1***	***Val-2***	***Val-H***	0x00	0x00

Byte No	22	23	24	25	26	27	28	29	30	31
Data	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00

-L = Lower Byte

-H = Higher Byte

O-Type (BYTE) : Operation

Code (WORD) : Function

Val (DWORD) : Value

O-Type

Code	Operation	Comment
0x01	SET	Set value
0x02	GET	Get value
0x03	INC	Increment value
0x04	DEC	Decrement value

Code

Code	Operation	Comment	Val Min	Val Max
0x03E8	Backlight brightness	Set backlight value	0	0xff
0x139C	Brightness	Set brightness level	0	0xff
0x13AF	Contrast	Set contrast level	0	0xff

Protocol

Host		Monitor
Operation packet	→	
	←	Char 0x1E + Operation packet

4.1.2 Data Packet Structure “Keyboard Simulation”

Byte No.	0	1	2	3	4	5	6	7	8	9	10
Data	0xBE	0xEF	0x02	0x06	0x00	CRC-L	CRC-H	***Code-L***	***Code-H***	0x00	0x00

Byte No.	11	12
Data	0x00	0x00

L = Lower Byte

H = Higher Byte

Code (WORD) : Key code

Following codes are supported:

Key code	**Function / Key**
0x0061	**+**
0x0062	**-**
0x005b	**UP**
0x0059	**DOWN**
0x005a	**LEFT**
0x0058	**RIGHT**
0x0057	**MENU**
0x005c	**MENU RIGHT**
0x005d	**MENU LEFT**
0x005f	**ESCAPE**
0x0056	**AUTOADJ.**
0x0055	**SOURCE**

Protocol

Host		**Monitor**
Packet "Keyboard simulation"	→	
	←	Char 0x06

4.1.3 Calculation of CRC - Check Sum

For CRC check sum calculation set 0x00 for CRC-L and CRC-H. Check sum is calculated according to a reference table.

```
WORD CalculateCRC16(BYTE *pcData, int nCount)
{
    BYTE    cCRCHi = 0xFF;      // high byte of CRC initialised
    BYTE    cCRCLo = 0xFF;      // low byte of CRC initialised
    BYTE    cIndex;             // will index into CRC lookup table

    while (nCount--)            // step through each byte of data
    {
        cIndex = cCRCHi ^ *pcData++;            // calculate the CRC
        cCRCHi = cCRCLo ^ cCRCHiArray[cIndex];
        cCRCLo = cCRCLoArray[cIndex];
    }

    return (cCRCHi << 8) + cCRCLo;
}

static CROMDATA BYTE    cCRCHiArray[] = {
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
    0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
    0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
    0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
    0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
    0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
    0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
    0x80, 0x41, 0x00, 0xC1, 0x81, 0x40
};

static CROMDATA BYTE    cCRCLoArray[] = {
    0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06,
    0x07, 0xC7, 0x05, 0xC5, 0xC4, 0x04, 0xCC, 0x0C, 0x0D, 0xCD,
    0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09,
    0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A,
    0x1E, 0xDE, 0xDF, 0x1F, 0xDD, 0x1D, 0x1C, 0xDC, 0x14, 0xD4,
    0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3,
    0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3,
    0xF2, 0x32, 0x36, 0xF6, 0xF7, 0x37, 0xF5, 0x35, 0x34, 0xF4,
    0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A,
    0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29,
    0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E, 0x2F, 0xEF, 0x2D, 0xED,
    0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26,
```

```
    0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60,
    0x61, 0xA1, 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6, 0xA7, 0x67,
    0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,
    0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68,
    0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA, 0xBE, 0x7E,
    0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,
    0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71,
    0x70, 0xB0, 0x50, 0x90, 0x91, 0x51, 0x93, 0x53, 0x52, 0x92,
    0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54, 0x9C, 0x5C,
    0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B,
    0x99, 0x59, 0x58, 0x98, 0x88, 0x48, 0x49, 0x89, 0x4B, 0x8B,
    0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,
    0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42,
    0x43, 0x83, 0x41, 0x81, 0x80, 0x40
};
```

4.2 Simplified Protocol

The simplified protocol uses a data packet structure similar to the standard protocol, however with reduced functional range. Calculation of CRC check sum is similar to description in section 4.1.3 page 46.

Interface Parameters

Baud-Rate	19200
Parity	None
Data-Bits	8
Stop Bits	1
Handshake	No

ACK-Message

OK	0x06

Protocol

Host		**Monitor**
Control Packet	→	
	←	Data Packet or ACK (OK)

Maximum response time of the monitor is 200 ms. In case of an error in transmission, the monitor does not respond.

4.2.1 Data Packet Structure

Byte No	0	1	2	3	4	5	6	7	8	9	10
Data	0xBE	0xEF	0x10	***Len-L***	***Len-H***	CRC-L	CRC-H	***CMD***	Data 0	Data 1	Data

Byte No	11	12	13	14	15	16	17	18	19	20
Data	Data	Data	Data	Data	Data	Data	Data	Data	Data	Data

-L = Lower Byte

-H = Higher Byte

CMD (BYTE) : Command

Len-L / H (WORD) : Number of data bytes ***CMD*** + Data 0 to Data xx

CMD

Code	Command	Comment
0x01	Status	Reply of system status **Host → Monitor** Byte 03: L-Len = 0x01 Byte 04: H-Len = 0x00 **Monitor → Host** Byte 03: L-Len = 0x0E Byte 04: H-Len = 0x00 **Byte 08: Status Information Display Module** - Bit 0: VDD - fuse faulty - Bit 1: Backlight inverter – fuse faulty - Bit 2: Upper backlight unit faulty - Bit 3: Middle backlight unit faulty - Bit 4: Lower backlight unit faulty - Bit 5: No or no valid input signal from controller - Bit 6: reserved - Bit 7: reserved **Byte 09: Internal Temperature** -55°C to +125°C in complement on two **Byte 10: Active Input Source** - Bit 0..1: 0 = RGB-Analog1 1 = DVI1 2 = DVI2 3 = RGB-Analog2 - Bit 2: Input signal active **Byte 11: reserved** **Byte 12: reserved** **Byte 13: LSB Operating hour meter** **Byte 14: Second Byte Operating hour meter** **Byte 15: Third Byte Operating hour meter** **Byte 16: MSB Operating hour meter** **Byte 17: LSB Backlight- Operating hour meter** **Byte 18: Second Byte Backlight- Operating hour meter** **Byte 19: Third Byte Backlight- Operating hour meter** **Byte 20: MSB Backlight- Operating hour meter**

Code	Command	Comment
0x02	Source Switch	This command enables the host to switch signal source. **Host → Monitor** Byte 03: L-Len = 0x01 Byte 04: H-Len = 0x00 **Byte 08: Input - Source** 0 = RGB-Analog1 1 = DVI 1 2 = DVI 2 3 = RGB-Analog2 **Monitor → Host** Byte 00: ACK = 0x06 ACK is sent after the monitor has internally switched the source. CRC-Check sum for individual sources:: - AnalogRGB1: 0x2C1C - DVI1: 0xEDDC - DVI2: 0xADDD - AnalogRGB2: 0x6C1D
0x03	Backlight - Brightness	This command is used to adjust backlight brightness **Host →Monitor** Byte 03: L-Len = 0x02 Byte 04: H-Len = 0x00 **Byte 08: Value of Brightness (0 .. 255)** **Monitor →Host** Byte 00: ACK = 0x06 Value 0 to 255 corresponds 0 to 100% of adjustment range.

Code	Command	Comment
0x04	Brightness	This command is used to adjust brightness (black level). **Host → Monitor** Byte 03: L-Len = 0x02 Byte 04: H-Len = 0x00 **Byte 08: Brightness value (0 .. 255)** **Monitor → Host** Byte 00: ACK = 0x06 Value 0 to 255 corresponds 0 to 100% of adjustment range.
0x05	Contrast	This command is used to adjust contrast. **Host → Monitor** Byte 03: L-Len = 0x02 Byte 04: H-Len = 0x00 **Byte 08: Contrast value (0 .. 255)** **Monitor → Host** Byte 00: ACK = 0x06 Value 0 to 255 corresponds 0 to 100% of adjustment range.

4.3 DDM-Protocol

The DDM-Protocol and its commands have been defined for operation with Sony DDM compatible monitor. The Raptor SQ2801 only implements those commands which the monitor supports. All other commands will simply return success.

This protocol is only supported by RS232-2 or RS422 interface. For this the DDM protocol and the appropriate interface must be selected in the OSD.

NOTE Data transmission with handshake signals is only supported by RS232-2 interface (see section 2.3.4 page 24).

List of implemented commands:

Code	Command	Comment
0xA0	Operator Brightness	This command is used to set Backlight brightness.
0xA1	Operator Contrast	This command is used to set contrast.

Code	Command	Comment
0xB8	Status	Response System Status **Byte 0: Status Information Display-Module** - Bit 0: VDD-fuse faulty - Bit 1: Backlight inverter-fuse faulty - Bit 2: Upper backlight unit faulty - Bit 3: Middle backlight unit faulty - Bit 4: Lower backlight unit faulty - Bit 5: No or no valid signal from controller - Bit 6: reserved - Bit 7: reserved **Byte 1: Internal Temperature** -55°C to +125°C in complement on two **Byte 2: Active Input Source** - Bit 0..1: 0 = RGB-Analog1 1 = DVI1 2 = DVI2 3 = RGB-Analog2 - Bit 2: Input signal active **Byte 3: Reserved** **Byte 4: LSB Operating hour meter** **Byte 5: Second Byte Operating hour meter** **Byte 6: Third Byte Operating hour meter** **Byte 7: MSB Operating hour meter** **Byte 8: LSB Backlight- operating hour meter** **Byte 9: Second Byte Backlight- operating hour meter** **Byte 10: Third Byte Backlight- operating hour meter** **Byte 11: MSB Backlight- operating hour meter**

5 Technical Data

5.1 Display Module

Type	Color active TFT-LCD
Diagonal	28.05"
Display area (WxH)	503.808 x 503.808 mm²
Resolution	2048 x 2048 Pixel
Pitch	0.246 x 0.246 mm²
Colors	16.7 Million
Viewing angle typ. **horizontally** **(CR >= 10)** **vertically**	± 85° ± 85°
Contrast ratio typ.	1000 : 1
Response time **White → Black** **Black → White**	5 ms 20 ms
White Uniformity max. **(max. luminance / min. luminance)**	1,25
Backlight	3 x CCFT-Trays (Cold Cathode Fluorescent Tube)
Brightness typ. **max.** **min.**	225 cd/m² 22 cd/m²

5.2 Power Supply

Input voltage	90 - 264 V_{AC} (47 – 63 Hz)
Main power fuse	2 x 5 A delay action fuse
Power consumption typ. **at 70 cd/m²** **at 210 cd/m²** **Power consumption Stand by (no input signal)**	 approx. 110 W approx. 150 W approx. 15 W

5.3 Operating Conditions

Operating temperature	0 to +40 °C
Storage temperature	-25 to +60 °C
Humidity	max. 95 % (no condensation)

5.4 Protection

Protection	None
Front shield	antireflective

5.5 Housing

Weight	approx. 29.1 kg
Material of housing	Sheet steel
Color of housing	RAL 9005 (jet black)

5.6 Input signal RGB analog

Level (Video)	0.7 Vss RGB analog on 50 Ω
Bandwidth	500 MHz (-3dB)
Impedance	50 Ω
Synchronization	Separate Sync
Synchronization (level)	1 - 5 Vss
Impedance	75 Ω
H- Frequency	30 to 130 KHz
V- Frequency	50 to 70 Hz

5.7 Standard ATC-Timing

H-Frequency	126.84 KHz
Pixel clock	357 MHz
H-Total	2816 pixel
H-Visible	2048 pixel
V-Frequency	60 Hz
V-Total	2114 lines
V-Visible	2048 lines

5.8 Input Signal DVI-1 / DVI-2

Signal	Standard DVI 1.0
Pixel clock max.	2 x 165 MHz

5.9 Recommended DVI-Timing 2,048 x 2,048 Pixel

H-Frequency	124.8 KHz
Pixel clock	260 MHz (2 x 130 MHz)
H-Total	2080 pixel
H-Visible	2048 pixel
V-Frequency	60 Hz
V-Total	2100 lines
V-Visible	2048 lines

5.10 EU – Declaration of Conformity on EMC

Product	LCD-Monitor Raptor SQ2801		
Test guidelines	EG-guide lines	No 2004/108/EC No 2006/95/EC	
Harmonized standards used	EN 55022 Class B +A1/EN55022/A1		Interference emissions (industrial)
	EN55024:1998 +A1:2001+A2:2003		Interference resistance (industrial)
	EN 60950		Safety

6 Part Numbers and Field Replaceable Units (FRUs)

6.1 TSI ATC Visualization Kit

The Raptor SQ2801 is part of the Tech Source ATC Visualization kit (19-0206-01) and is comprised of the following components:

Part Number	Description
19-0152-01	Raptor 2500T-DL 2Kx2K Graphics Accelerator
19-0201-01	Raptor SQ2801 Display (Desktop version)
15-0231-01	Dual Link DVI cable
73-0066-01	Raptor OpenWindows software (Solaris drivers)
65-0228-01	Raptor OpenWindows manual (Raptor Graphics hardware and software installation manual)
65-0265-01	Raptor SQ2801 Reference & Maintenance manual

6.2 Raptor SQ2801 Field Replaceable components

Field maintenance of the Raptor SQ2801 unit is discussed in Maintenance Manual. The following is a list of field upgradeable components:

EIZO Part Number	Description	Reference
00L0D303A1	Upper Lamp Tray for Backlight	HW-TFTBL2802U
00L0D305A1	Middle Lamp Tray for Backlight	HW-TFTBL2802M
00L0D304A1	Lower Lamp Tray for Backlight	HW-TFTBL2802D
03V22431A1	Power Supply	NT250-12V17A-01
03V22432A1	Fan with cover	ZB-28RS10-A1
03V22433A1	Interface Controller board with two Dual Link DVI inputs	C140-0K-0110-1XX
03V22464A1	RGB daughter board	LP-C140AFE-VB01
03V22434A1	20 mm, 5 Amp, 250 V Delay Action/Slow Blow Fuse	

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