VIM556
VIM556RC

3U graphics controller module in CompactPCI format

User Manual

October 2015

Version 1.2

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REVISION RECORD

Revision index	Brief description of changes	Renewal date
1.0	Initial version	October 2014
1.1	Changes were made to technical specifications according to the results of tests, versions were changed, figures of VIM556 without MXM module were deleted.	December 2014
1.2	Module description in conduction cooling was added (VIM556RC).	August 2015

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NOTATIONS

Attention!
Device, sensitive to static electricity!

This sign and caption indicate that electronic boards and their components are sensitive to static electricity. This is why it is required to exercise caution when handling this device and at the time of inspections, in order to guarantee integrity and working capacity of the device.

Attention! Hot surface!

This sign and caption warn us of a danger, related to touching hot surfaces, containing within the device.

Attention!

This sign is designed to make you consider those aspects of the User Manual, which incomplete understanding or failure to follow could endanger your health or result in damages of the equipment.

Note

This sign is used to mark the parts of the text, which should be read thoroughly.

Safety requirements

This product is designed and tested for the purpose of ensuring compliance with the electric safety requirements. Its design guarantees long-term failsafe operation. Life cycle of the device can be sufficiently reduced due to improper handling during unpacking and installation. Therefore, for your own safety and in order to ensure the proper operation of the device, you should observe the below recommendations.

Attention!

All works with this device should be performed only by employees which have sufficient skills for these types of works.

BOARD HANDLING INSTRUCTIONS

Device, sensitive to static electricity!

Electronic boards and their components are sensible to static electricity. This is why you should pay special attention to handling with these devices in order to ensure their integrity and working efficiency.

- Do not leave the board without protective packaging, when it is not operated.
- When applicable, always operate the board at the workplace equipped with protection against static electricity. If it is impossible, the user should remove a static discharge before touching the device by hand or using tools. The best way to do it is to touch a metal part of system enclosure.

General Board Operation Rules

- To preserve the manufacturer's guarantee, the product must not be reworked or altered in any way. Any alterations and improvements not authorized by Fastwel Group Co. Ltd company, except those described in this Manual or obtained from the Fastwel Group Co. Ltd technical support service in the form of a set of instructions describing their performance cancel the guarantee

- This device must be only installed into and connected to systems meeting all necessary technical and climatic requirements. This relates to the operating temperatures range of the specific board design version. The temperature limitations of the batteries installed on the board should be taken into account as well.

- Please follow only the instructions of this Manual while performing all necessary installation and configuring operations.

- Keep original package to store the product in the future or to transport it in case of a guarantee event. Should it become necessary to transport or store the board, pack it in the same way it was packed upon receipt

- Take particular care during handling the product and its unpacking. Act in accordance with the instructions of the above section and Chapter 7 Transportation, unpacking and storage.

The Manufacturer's Guarantees

Guarantee Liabilities

The Manufacturer hereby guarantees conformity of VIM556 with the requirements of TU 469555.001, and VIM556RC conformity with the requirements of TU 469555.002 specifications provided the Consumer abides by the conditions of operation, transportation, storage, installation and assembly established by the accompanying documents.

The Manufacturer hereby guarantees that the products supply thereby are free from defects in workmanship and materials, provided operation and maintenance norms were observed during the currently established guarantee period. The Manufacturer's obligation under this guarantee is to repair or replace free of charge any defective electronic component being a part of a returned product.

Products that broke down through the Manufacturer's fault during the guarantee period will be repaired free of charge. Otherwise, the Consumer will be invoiced as per the current labor remuneration rates and expendable materials cost.

Liability Limitation Right

The Manufacturer shall not be liable for the damage inflicted to the Consumer's property because of the product breakdown in the process of its utilization.

Guarantee Period

The guarantee period for the products made by the manufacturer company is 36 months since the sale date (unless otherwise provided by the supply contract).
The guarantee period for the products made to special order is 60 months since the sale date (unless otherwise provided by the supply contract).

The warranty set forth above does not extend to and shall not apply to:

1.   Products, including software, which have been repaired or altered by other than Fastwel personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Fastwel.

2.   Products, which have been subject to power supply reversal, misuse, neglect, accident, or improper installation.

Returning a product for repair

1.   Apply to Fastwel company or to any of the Fastwel's official representatives for the Product Return Authorization.

2.   Attach a failure inspection report with a product to be returned in the form, accepted by customer, with a description of the failure circumstances and symptoms.

3.   Carefully package the product in the antistatic bag, in which the product had been supplied. Failure to package in antistatic material will VOID all warranties. Then package the product in a safe container for shipping.

4. The customer pays for shipping the product to Fastwel or to an official Fastwel representative or dealer.

1 Introduction

VIM556 and VIM556RC graphics controller modules are designed for the use as part of CompactPCI Serial 3U embedded computing systems and serves for output of graphics information to the display via the DisplayPort interface.

Depending on the version, the VIM556 and VIM556RC modules are equipped with high-performance graphics card of MXM 3.0 standard - NVIDIA Quadro or AMD Radeon.

Using VIM556 and VIM556RC modules, the computing system can perform high-performance multi-threaded computations and output high resolution graphics information to the several (up to 4x) displays via DisplayPort 1.2 interface with support of Multi Stream Transport and Dual Mode Display modes.

Extension of functional capabilities due to the connection of special-purpose RIO Compact PCI Serial modules is possible.

The module has the following structure of input/output channels:

- CompactPCI Serial interface;

- MXM interface;

- 4x DisplayPort interfaces on the front panel;

- 4x DisplayPort interfaces on RIO Compact PCI Serial connector.

1.1   Technical specifications

- **CompactPCI Serial:**

  - PCIe x8 GEN1 (2,5 Gb/sec) /GEN2 (5 Gb/sec);
  - re-drivers of data signals and clock frequency;
  - size: 3U/4HP.

- **MXM:**

  - support of MXM 3.0 graphics cards of Type A (82x75 mm) and Type B (82x105 mm) sizes;
  - use of 4-x DisplayPort interfaces: A, B, C, D.

- **NVIDIA Quadro K2100M:**

  - graphics controller: 665 MHz, 576 cores;
  - memory: 2 GB GDDR5, 128 bit, 48 GB/s;
  - graphics: 3840 x 2160 @ 60 Hz;
  - image processing functions: FXAA / TXAA anti-aliasing, 16K rendering, MPEG-2 HD / WMV HD, H.264, AES-128 CTR / CBC / ECB decoding;
  - API: DirectX 11.1, OpenGL 4.3, OpenCL, CUDA C/C++, DirectCompute 5.0, Java, Python, Fortran.

- **AMD Radeon E8860:**

  - graphics controller: 625 MHz, 640 cores;
  - memory: 2 GB GDDR5, 128 bit, 72 GB/s;
  - graphics: 4096 x 2160 @ 60 Hz;
  - image processing functions: GCN, AMD APP technology, AMD Eyefinity technology, AMD HD3D technology, H.264, UVD 4 for H.264, VC-1, MPEG-4, MPEG-2;

- API: DirectX 11.1, Shader Model version 5.0, OpenGL 4.2, AMD APP technology, OpenCL 1.2, DirectCompute 11.1.

- **DisplayPort:**

  - up to 4x DisplayPort 1.2 interfaces on the front panel*;
  - Support of Dual Mode Display mode*;
  - Support of Multi Stream Transport mode*;
  - ESD protection 8 kV (air) / 4 kV (contact);
  - active independent protection against supply current overload of each port.

- **Power supply:**

  - power supply voltage: +12 V ± 10%;
  - maximum current - no more than 6,6 A;
  - power consumption:
    - no more than 75 W for the version equipped with NVIDIA Quadro K2100M or AMD Radeon E8860 graphics modules.

- **Operating temperature range of VIM556:**

  - commercial version: from 0 to + 70 °C;
  - industrial version based on NVIDIA Quadro: from - 20 to + 70 °C;
  - industrial version based on AMD Radeon: from - 40 to + 70 °C.

- **Operating temperature range of VIM556RC:**

  - commercial version: from 0 to + 70 °C;
  - industrial version based on NVIDIA Quadro: from - 20 to + 80 °C;
  - industrial version based on AMD Radeon: from - 50 to + 80 °C.

- **Module weight**

  - no more than 850 g.

- **Compatibility with OS:**

  - Windows 7 Professional 32/64 ;
  - Windows Embedded Standard 7 32/64;
  - Linux Debian 7.0 32 bit;
  - Astra Linux 64 bit.

- **MTBF:**

  - no less than 250 000 hours

- **Compatibility with the PICMG/VITA standards:**

  - PICMG CPCI-S 1.0 D0.70.

- **VIM556 complies with the RoHS directives.**

   * - *depending on the VBIOS version of graphics module.*

1.2   Versions

Table 1-1: Versions of VIM556

Module's versions	Specifications
VIM556-01	MXM module NVIDIA Quadro K2100M, commercial temperature range
VIM556-02	MXM module NVIDIA Quadro K2100M, industrial temperature range: - 20 … + 70 °C
VIM556-03	MXM module AMD Radeon E8860, commercial temperature range
VIM556-04	MXM module AMD Radeon E8860, industrial temperature range: - 40 … + 70 °C

** - suffix **\COATED** means that the module has a conformal coating.*

Example of number recording for ordering:

VIM556-04\COATED - VIM556 graphics controller module based on the graphics card
AMD Radeon E8860, industrial temperature range: - 40 … + 70 °C

Table 1-2: Versions of VIM556 RC

Module's versions*	Specifications
VIM556RC-01	MXM module NVIDIA Quadro K2100M, commercial temperature range
VIM556RC-02	MXM module NVIDIA Quadro K2100M, industrial temperature range: - 20 … + 80 °C
VIM556RC-03	MXM module AMD Radeon E8860, commercial temperature range
VIM556RC-04	MXM module AMD Radeon E8860, industrial temperature range: - 50 … + 80 °C

* - suffix \COATED means that the module has a conformal coating.

Example of number recording for ordering:

VIM556RC-04\COATED - VIM556RC graphics controller module based on AMD Radeon E8860
graphics card, industrial temperature range - 50 … + 80°C.

1.3   Delivery checklist

- VIM556 or VIM556RC module.
- Technical certificate.
- Package.

1.4   Packaging information

VIM556, VIM556RC module is packed in a box with overall dimensions: 350 x 260 x 70 mm.

Table 1-3: Packaging information

Weight of modules in the package, in kg, no more than	VIM556	0.9
	VIM556RC	0.9

Note

Preserve the original static protective packaging and protective packaging until the end of the warranty period.

1.5   External view and location of elements

The bellow figures can help in identifying components, understanding their mutual arrangement and functions.

1.5.1   Module's external view
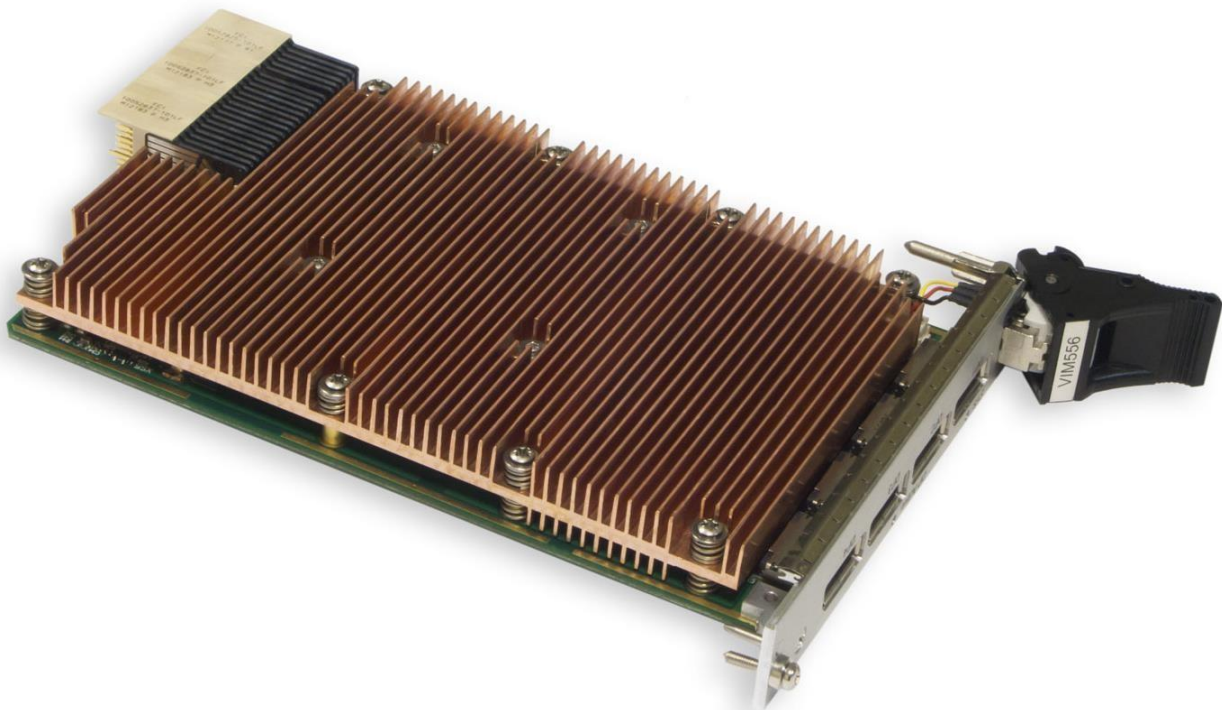
Fig. 1-1: External view of VIM556

Fig. 1-2: External view of VIM556RC

	Note
	External view of module's versions can slightly vary from the one indicated in the figures.

1.5.2   Overall and connecting dimensions, location of main components
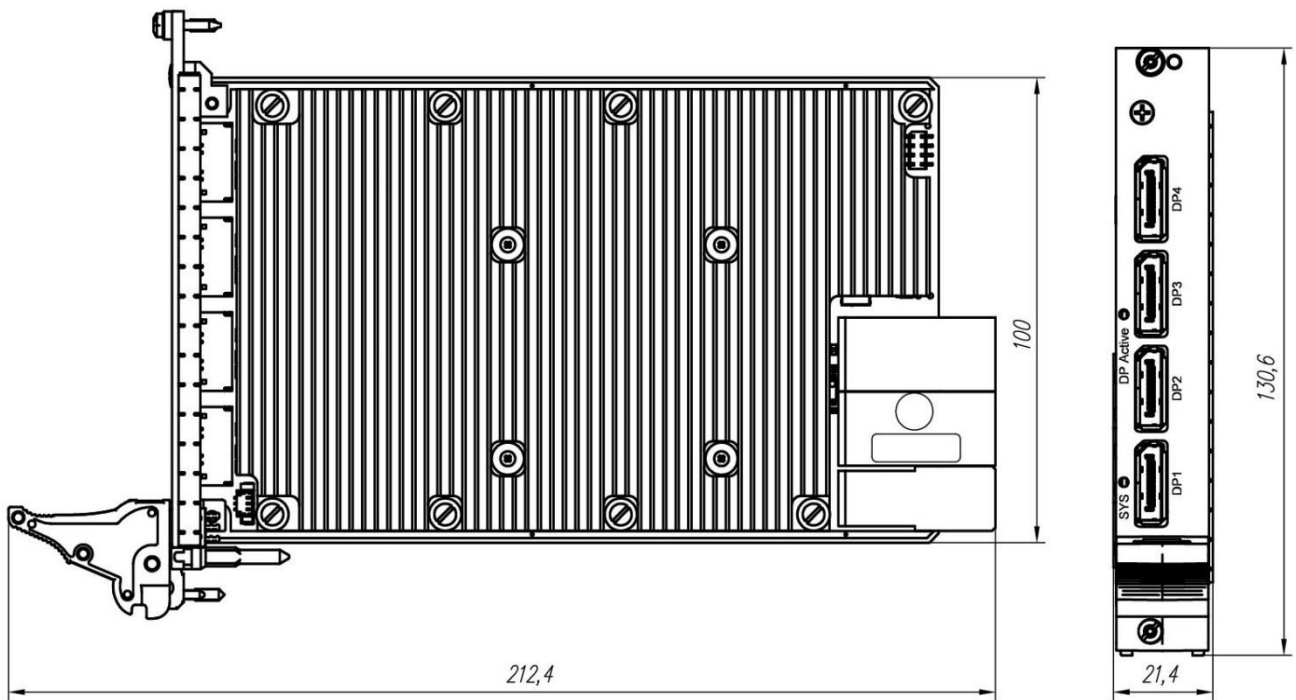
Fig. 1-3: Dimensions of VIM556
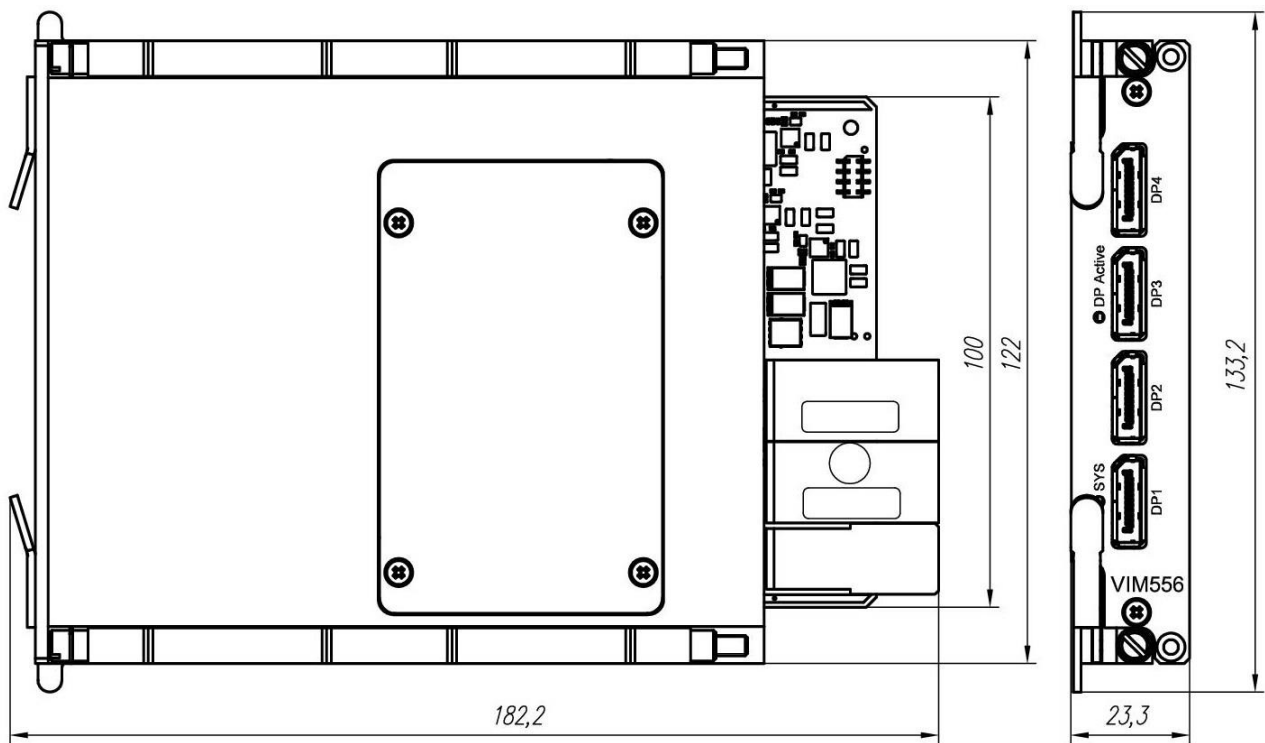
Fig. 1-4: Dimensions of VIM556RC
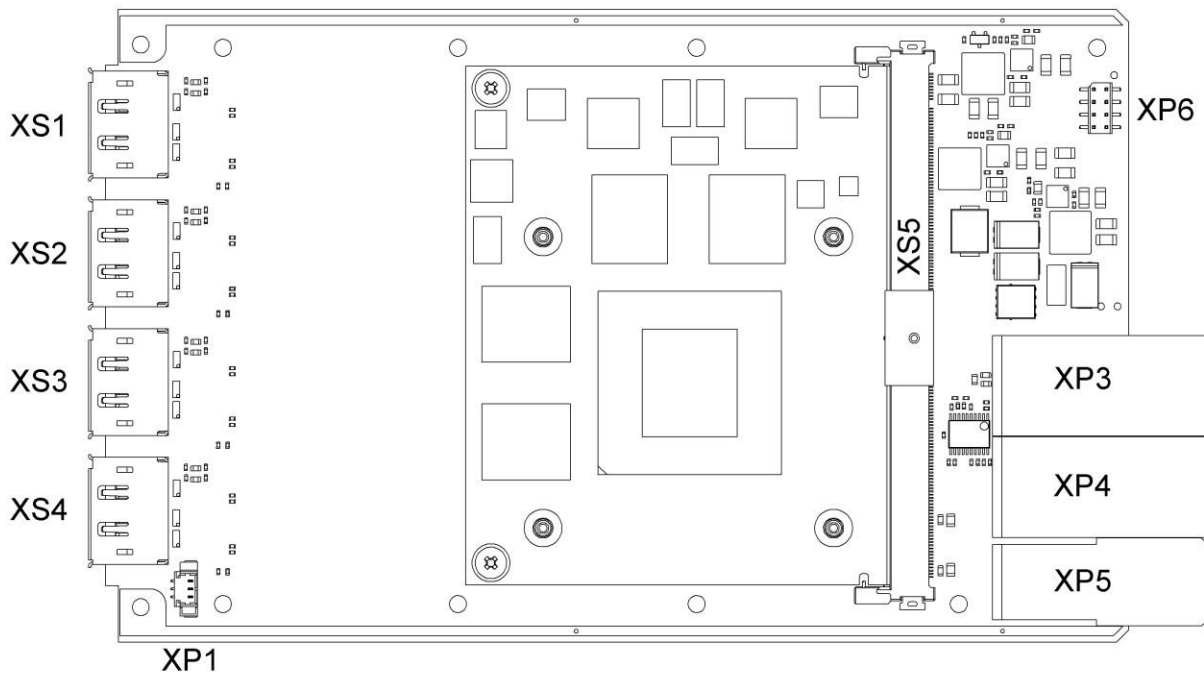
Fig. 1-5: Location of element block main components of VIM556 and VIM556RC

1.5.3   Front panel
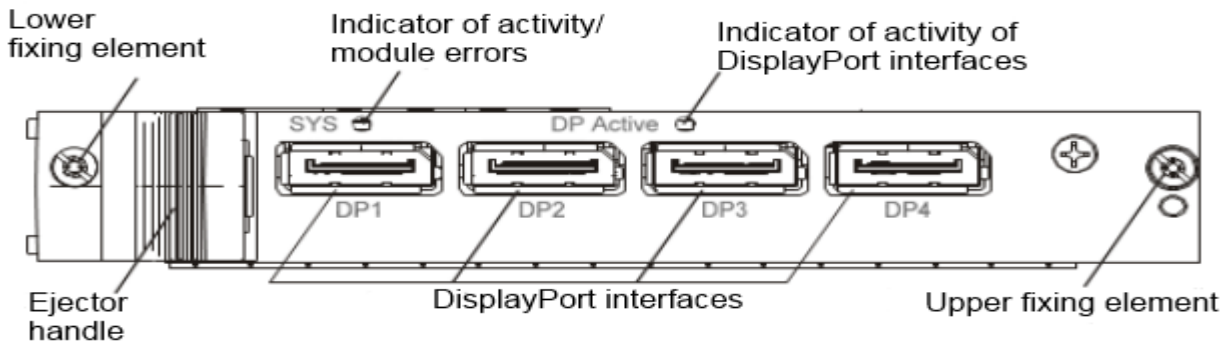
Fig. 1-6: Front panel of VIM556
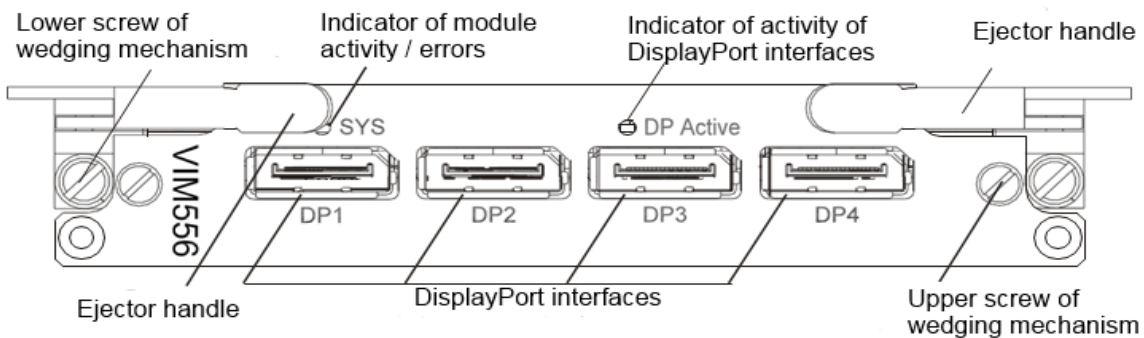
Fig. 1-7: Front panel of VIM556RC

2 Functional description

2.1 Block diagram
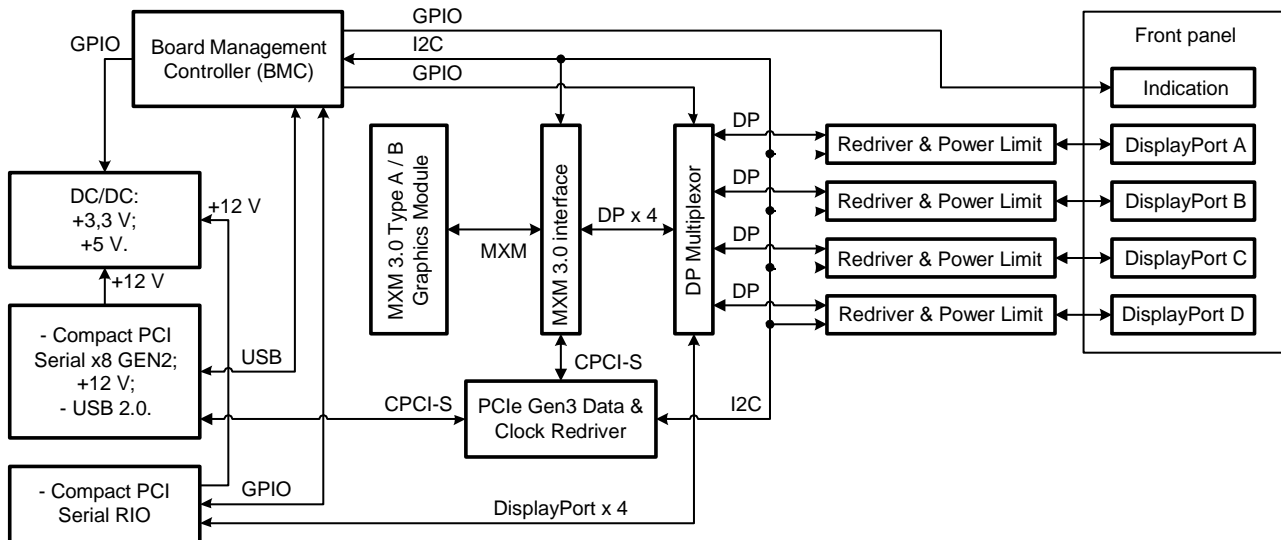
Fig. 2-1: **Block diagram of VIM556, VIM556RC**

2.2 Operating peculiarities of functional units

■ **CompactPCI Serial interface**

▪ Uses 8 GEN2 links (5 Gb/sec) for data exchange with the system. In order to improve the reliability of CompactPCI Serial interface communication within the diagram, re-drivers of data signals and clock frequency were used (PCIe Gen3 Data & Clock Re-driver).

▪ For implementing diagnostics tasks, BMC connection over USB 2.0 interface within the CompactPCI Serial is used in the module.

▪ In order to extend functionalities of the device, 4 DisplayPort interfaces, power supply and control signals are routed to the RIO CompactPCI Serial connector from BMC. Output of the image stream to RIO CompactPCI Serial is carried out by switching the DP Multiplexor into the relevant state, in accordance with the user settings.

■ **Board Management Controller (BMC):**

▪ configures module's nodes in accordance with the user settings;

▪ ensures safe removal and installation of the module on activated system;

▪ ensures a start delay according to the "geographical address" in order to reduce loads to power supply source;

▪ indicates module's activity and error states;

▪ limits the consumed current to prevent module's damage in case of malfunctions during graphics card operation;

▪ controls the start and temperature mode of the graphics card for the prevention of module's damage due to the violation of operating conditions;

▪ exercises a continuous control and diagnostics of module's nodes with the output of diagnostics information upon user's request, via the virtual COM port (USB 2.0) or by way of indicators on the front panel.

■ **DC/DC:**

- generates power supply voltages of the module nodes (+5, +3,3 V), using the input voltage of +12 V;
- operates under BMC control.

■ **MXM interface**

- Fulfills possibility of connection of high-performance graphics cards of MXM 3.0 Type A and Type B formats. The interface uses a special-purpose connector with a robust connection to the module's board, system of fastening the MXM 3.0 graphics module and cooling system, which correspond to the MXM 3.0 specification.
- Power supply parameters of MXM 3.0 graphics cards, provided by the VIM556 module, are specified in the table below.

Table 2-1: Power supply parameters of MXM 3.0 graphics cards

Parameter	Module power supply		
	+12 V ± 10%	+5 V ± 6%	+3.3 V ± 6%
Maximum consumed current, A	10	3	3.5

■ **MXM 3.0 Type A / B Graphics Module**

In VIM556 and VIM556RC versions the following graphics cards are installed: NVIDIA Quadro K2100M or AMD Radeon E8860. Their main technical specifications:

NVIDIA Quadro K2100M:

- **Form Factor:** MXM v3.1 Type A (82mm x 70mm);
- **Graphics Controller:**
  - N15P-Q3, 665MHz core clock;
  - 576 CUDA cores;
- **Bus Type:** PCI Express Gen 3 x16;
- **Memory:**
  - 2GB GDDR5;
  - 128 bit wide interface;
  - 3000 MHz;
  - 48 GB/s;
- **Maximum Resolution:** 2 x 3840x2160 @ 60 Hz digital displays;
- **Image Quality Features:**
  - Each color component can be processed at up to 32-bit floating point precision and displayed at up to 12-bit precision;
  - Advanced FXAA and TXAA antialiasing;
  - 16K Texture and Render Processing;
  - MPEG-2 HD and WMV HD video playback (1920x1080p);
  - H.264 hardware decode acceleration;
  - Nvidia Scalable Geometry Engine;
  - AES-128 CTR/CBC/ECB decryption modes supported;
  - Nvidia 3D Vision Pro;
- **Shading Architecture:** Shader Model 5.0 support;
- **Supported Graphics APIs:**
  - Full IEEE 764-2008 32-bit;

・   DirectX 11.1 Shader Model 5.0;

・   OpenGL 4.3;

・   Compute API support for NVIDIA CUDA C, CUDA C++, DirectCompute 5.0, OpenCL, Java, Python and Fortran;

AMD Radeon E8860:

▪   **Form Factor:** MXM v3.0 Type A (82mm x 70mm);

▪   **Graphics Controller:**

・   625 MHz core clock;

・   640 Shader Processing Units;

▪   **Bus Type:** PCI Express Gen 3 x16;

▪   **Memory:**

・   2 GB GDDR5;

・   128 bit wide interface;

・   1125 MHz;

・   72 Gbps;

▪   **Maximum Resolution:** 3840 x 2160 @ 60 Hz;

▪   **Image Quality Features:**

・   GCN;

・   AMD APP technology;

・   AMD Eyefinity technology;

・   AMD HD3D technology;

・   H.264;

・   UVD 4 for H.264;

・   VC-1;

・   MPEG-4, MPEG-2;

▪   **Supported Graphics APIs:**

・   DirectX 11.1;

・   Shader Model version 5.0;

・   OpenGL 4.2;

・   AMD APP technology;

・   OpenCL 1.2;

・   DirectCompute 11.1;

Below are the tables with comparative characteristics of some graphics cards manufactured by NVIDIA and AMD.

Table 2-2: NVIDIA graphics cards

Characteristics	NVIDIA Quadro			
	K5100M	**K4100M**	**K3100M**	**K2100M**
Compute kernels NVIDIA® CUDA™	1536	1152	768	576
RAM volume, GB	8	4	4	2
Memory interface, bit	256	256	256	128
Memory bandwidth, Gb/sec	115.2	102.4	102.4	48
Number of DisplayPort interfaces	4	4	4	4
Maximum power consumption, W	100	100	75	55

Table 2-3: AMD graphics cards

Characteristics	AMD Radeon			
	E6460	**E6760**	**E8860**	**HD7970M**
Compute kernels	160	480	640	1280
RAM volume, GB	0.5	1024	2048	2048
Memory interface, bit	64	128	128	256
Memory bandwidth, Gb/sec	25.6	51.2	72	153.6
Number of DisplayPort	4	4	4	4
Maximum power consumption, W	20	35	55	100

■ **DP Multiplexor**

This node ensures switching of image stream between the front panel and RIO CompactPCI Serial, in accordance with the user settings, using the relevant switch.

■ **Re-driver & Power Limit**

This node ensures buffering and enhancement of DisplayPort 1.2 interface signals to compensate for electric losses on printed circuit board and connectors. In addition, the node ensures power supply to DisplayPort interfaces of the front panel, the node monitors current consumed by each of the interfaces and deactivates them in case the limit is exceeded, in accordance with the DisplayPort v1.2 specification.

■ **DisplayPort**

DisplayPort interface corresponds to the specification of version 1.2 and supports connection of external displays. The front panel interfaces are equipped with ESD protection. Th interface supports Dual Mode, which makes it possible to connect DisplayPort interface adapters in HDMI or DVI. The interface supports the Multi Stream Transport mode, which makes it possible to connect several displays to a single connector of VIM556 via DP HUB.

■ **Indication**

Board start LED, combined with the Hot Swap indicator and LED of DisplayPort interfaces activity are routed to the module's front panel.

2.3   Module interfaces

2.3.1   CompactPCI Serial connectors

VIM556 is designed in accordance with architecture of CompactPCI Serial bus. The module uses two connectors of CompactPCI Serial interface (see Fig. 2-1). The detailed description of the interface is given in the CompactPCI Serial Specification R2.0.

2.3.2   DisplayPort

The DisplayPort 1.2 interfaces on the front panel of the VIM556 module (see subparagraph 1.5.3) are designed for the connection of digital displays with the relevant interface. The interfaces support the Dual Mode, which enables to connect HDMI / DVI-D displays via a passive adapter.

The interface supports the Multi Stream Transport mode, which makes it possible to connect several displays to a single connector of VIM556 via DP HUB. DisplayPort Multi Stream Transport HUB (Sensevision) CSV-5400 or its equivalent can be used as the hub.

The detailed description of the interface is given in the VESA DisplayPort specification Standard 1.2.

Note

Functional capabilities of the VIM556 and VIM556RC modules, such as:

- mode and operating capability of the interfaces: DisplayPort / HDMI / DVI;
- maximum amount of displays simultaneously connected to the module;
- support of display Hot Swap;
- support of the Dual Mode and Multi Stream Transport mode;

depends on VBIOS version of the MXM graphics card. VBIOS of the graphics card can be updated by the user (see Section 5 of this User Manual).
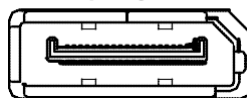
Fig. 2-2: Connector of DisplayPort interface

Table 2-4: Purpose of DisplayPort connector contacts

Contact	Purpose
1	LANE0+
2	GND
3	LANE0-
4	LANE1+
5	GND
6	LANE1-
7	LANE2+
8	GND
9	LANE2-
10	LANE3+
11	GND
12	LANE3-
13	AUX_EN#
14	CONFIG2
15	AUX+
16	GND
17	AUX-
18	HP_DETECT
19	GND
20	+3.3V

2.4   LED indicators

On the front panel of VIM556 (see Fig. 1-6) and VIM556RC (see Fig.   1-7) there are LED indicators, which are described in the table below:

Table 2-5: Designation and functions of LED indicators in VIM556 and VIM556RC modules

Designation on the front panel	Description
SYS	**Two-color red and blue. Blue:** **is on constantly** – the module can be removed; **flickering** – the module prepares for removal procedure, it should not be removed as long as the power is on; **is off** – the module can't be removed as long as the power is on **Red:** **is on constantly** – unknown hardware failure of the module (please, contact technical support); **flickering –** hardware failure. Number of flickers is determined by the error code (see Table 6-7).
ACTIVE	**Green:** **is on constantly** – activity of DisplayPort interfaces of the front panel; **flickering** - one of the DisplayPort interfaces of the front panel has current overload.

3   Installation

For proper and safe installation of VIM556 and VIM556RC modules it is required to follow the below rules, warnings and procedures.

3.1   Safety requirements

When handling the VIM556 and VIM556RC modules, follow the below safety requirements. Manufacturer shall not be liable for any damages, arising out as the result of non-compliance with these requirements.

Caution!

When handling the module be proceed with caution, since the cooling heatsink can be heated. Do not touch the hot heatsink. Use the gloves to protect your hands against burns or wait for the module to cool down.

The module should not be placed to any package until the heatsink gets cold down to the ambient temperature.

Attention!

Turn off the system power supply before installation of the module into an empty slot. Violation of this rule may pose a threat to your health and life, as well as lead to module or system damages.

If it is necessary to place the module on a table, make sure it is placed with its hetsing facing down.

Device sensitive to electrostatic discharge (ESD)!

The module contains elements sensitive to electrostatic discharge. In order to avoid module damages, observe the following precaution measures:

- ■ Before touching the module, discharge the static electricity from your clothes and tools before use.
- ■ Do not touch electronic components and connector's contacts.
- ■ If you work at the workplace equipped with antistatic protection, do not forget to use it.

3.2   Module installation procedure

Make sure that the safety requirements listed in the previous chapter, have been observed.

> **Attention!**
>
> Noncompliance with the following instructions can cause module damages and improper system operation.

Before the start of operations, make sure that the system power supply is off. In order to install the module, perform the sequence of actions, outlined in the next sections.

3.2.1   Installation of VIM556

Fig. 3-1: Installation of VIM556

- Carefully insert the module into the required slot, moving it along the guide-rails until it touches the connector of the backplane (see Fig. 3-1).

- Using the handle on the front panel, push the module into the the backplane connector. Do not apply too much force, inserting the module's connector into the backplane's connector.

■   Finish module's installation, lowering down the handle, hooking the frame of the system' enclosure and snapping the connection (see Fig. 3-1). Make sure that the module is installed flush with other system modules or stop plugs. Fasten the module by two retention screw (upper and lower ones) on the front panel.

■   Joint the required interface cables to the connectors of the module's front panel and make sure that they are fixed reliably.

The module is ready for operation.

3.2.2   Installation of VIM556 RC
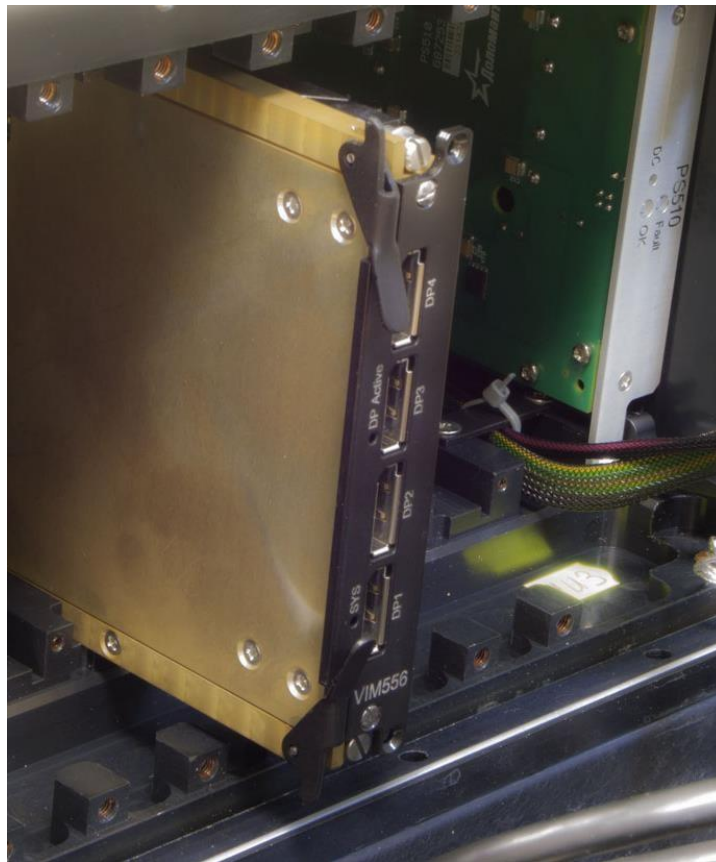
Fig. 3-2: Installation of VIM556RC

■   Loosen the wedging mechanism by unscrewing coupling screws by several rotations.

■   Carefully insert the module into the required slot, moving it along the guide-rails until it touches the connector of the backplane (see Fig. 3-2).

■   Push the module into the backplane connector by slightly pressing to the front panel. Make sure that the module is installed flush with the other modules of the system (see Fig. 3-2).

■ Fix the module using wedges, screwing the both coupling screws tight. Fix the module by two fixing screws, if necessary (upper and lower ones).

■ Joint the required interface cables to the connectors of the module's front panel and make sure that they are fixed reliably.

The module is ready for operation.

3.3 Module removal procedure

In order to remove the module from the system, the following operations are required:

■ Make sure that all safety requirements listed in chapter 3.1 have been observed.   A particular attention should be paid to the warning related to the heat-sink temperature!

Attention!

The following operations should be performed carefully in order not to damage the module or other system devices.

Before start of the work, make sure that the system power is off.   For removal of the module, follow the sequence of actions in the sections below.

3.3.1   Removal of VIM556

■ Disconnect all the interface cables from the module.

■ Unscrew the holding screws (upper and lower) on the front panel.

■ Unblock the front panel handle by pressing the button of ejector's handle and by pulling it down take the module away from the backplane connector

■ After the module has been extracted from the backplane connector, take it away from the slot along the guide-rails.

Module removal process is finished.

3.3.2   Removal of VIM556 RC

■ Disconnect all the interface cables from the module.

■ Unscrew the holding screws (upper and lower) on the front panel, if they are installed. Loose the wedging mechanism by unscrewing the both of coupling screws by several revolutions.

■ Pull on the upper and lower ejector handles, thereby removing the module from the backplane connector.

■ After the module was extracted from the backplane connector, pull it out from the slot.

Module removal process is finished.

3.4   Installation of software

Procedure of modules drivers installation:

■ determine the used operating system (Windows, Linux) and its digit capacity (32/64);

■ determine the VIM556 and VIM556RC module versions and the type the graphics card use in it (NVIDIA or AMD);

■ start the driver installation software, which correspond to the relevant module and graphics card from DRVERS\NVIDIA or DRVERS\AMD catalog;

■ install module drivers complying with the instructions of the installation software;

■ restart the system.

4 Configuration of module's operating modes

4 Switch of module's operating modes

The boards of VIM556 and VIM556RC modules are equipped with the switches of SA1 module's operating mode (see Fig. 4-1, Fig. 4-2 and Table 4-1).
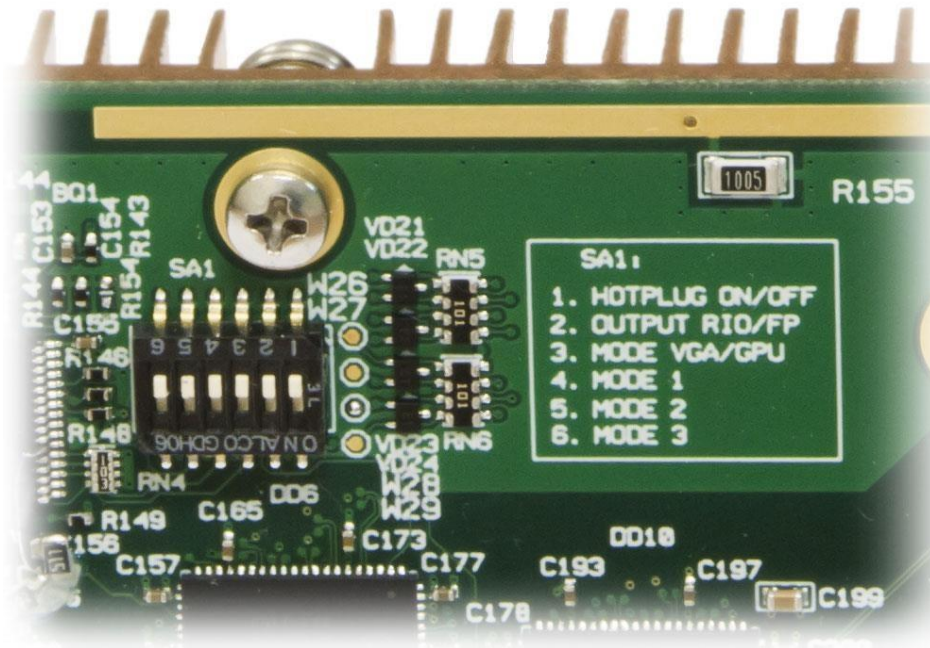
Fig. 4-1: Switch of operating modes of VIM556 (SA1)

Fig. 4-2: Switch of operating modes of VIM556RC (SA1)

Table 4-1: Switch of operating modes in VIM556 and VIM556RC

Switch number	Name	Position	Description
1	Hot plug disable	OFF	Hot swap mechanism is on. For module operation, it is mandatory to latch the ejector handle. The module is allowed to be installed and removed when the system is on.
		ON	Hot swap mechanism is switched on. Installation and removal is allowed only when the system is switched on. The mode is used in VIM556RC module.
2	Output RIO / FP	OFF	Output of image stream to the DisplayPort on the front panel of the module (Front Panel).
		ON	Output of image stream to the DisplayPort to the RIO CompactPCI Serial connector.
3	Mode VGA / GPU	OFF	Module operates as the GPU device.
		ON	Module operates as the VGA device.
4	DP "C", "D" mapping	OFF	DisplayPort interfaces of the graphics card are directly transmitted to the front panel or RIO CompactPCI Serial: C – C, D – D,
		ON	DisplayPort interfaces of the graphics card are directly transmitted to the front panel or RIO CompactPCI Serial from "E" and "F" alternative ports: C – F, D – E,
5	BMC debug mode	OFF	Used for processing tasks only
		ON	
6	Not used	-	-

4.2 Hot Swap mechanism

VIM556 makes it possible to be installed and removed from the system with the power supply on. Standard drivers from the delivery package do not support the Hot Swap mechanism. Therefor the Hot Swap mechanism can be used in emergency cases.

In order to activate the mode, the switch 1, SA1 should be in OFF position (see Table 4-1).

In order to remove the module from the powered-on system, you should perform the following:

- Disconnect all the interface cables from the module;

- Unscrew the holding screws (upper and lower) on the front panel;

- Unblock the front panel handle by pressing the ejector handle button;

- Wait for SYS indicator to be constantly illuminated with blue;

- Turn the ejector's handle down and remove the module from the backplane connector.

■   After the module has been extracted from the backplane connector, take it away from the slot along the guide-rails.

The VIM556RC module can't be installed and removed from the system with the power supply on. For system operation, the Hot Swap mechanism should be ON. For this purpose, the switch 1, SA1 should be in ON position (see Table 4-1).

4.3   Switch of image output direction

The VIM556 and VIM556RC modules enable to switch direction of image output between the front and RIO connector of PCI Express Serial interface. This mechanism can be used for image output to the display from the system back panel via RIO auxiliary modules, connected in accordance with the PCI Express Serial specification.

For selection of the required mode, use the switch 2, SA1 (see Table 4-1).

Signals of DisplayPort interfaces (A, B, C, D) are routed to the RIO PCI Express Serial (P3) connector of the module. Location of signals on the connector is shown in the Figure 2-1.

4.4 System video adapter mode

VIM556 can be used as the system video adapter. In this case, system messages (POST, BIOS messages, OS booting messages) will be transmitted to the display via one of the DisplayPort interfaces of the front panel.   For using this mode, the CPU board should be set for output of the image via an external graphics card (IGFX), connected via PCI Express. E.g. in BIOS menu of the CPC510 CPU board this is set in the way it is show in the Figure 4-3.

When using this mode, the 3 SA1 switch should be in ON position (see Table 4-1).

Note

In other CPU boards, the configuration procedure may be different.

4.5   GPU mode

In this mode, the VIM556, VIM556RC modules are used as additional graphics cards and serve for output images to additional displays or performing computational tasks.   For using this mode it is required to set the CPU board for output of the image via an integrated (into the CPU board) video adapter or other graphics card, connected via PCI Express. For setting the output via an integrated video adapter, e.g.in BIOS menu of the CPC510 CPU board it is required to set:
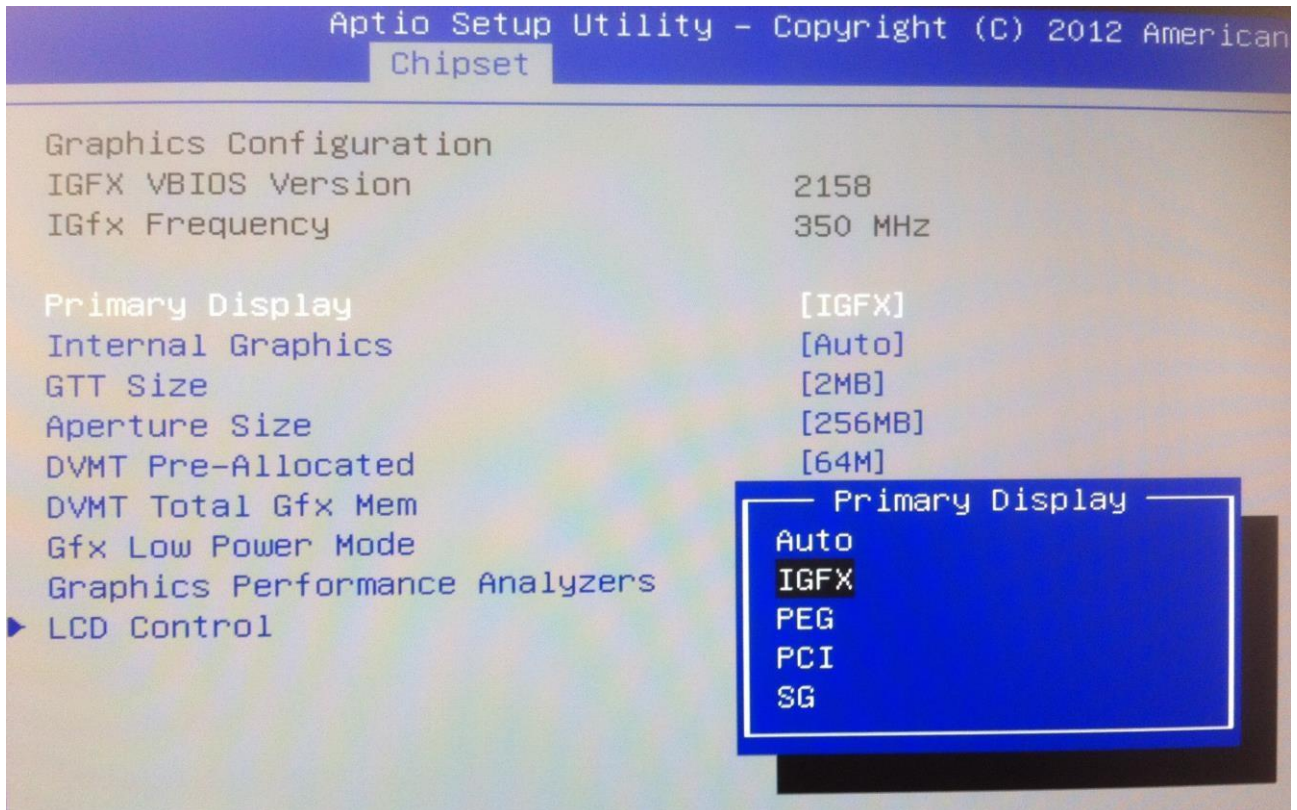
Fig. 4-3: BIOS menu of CPC510 CPU board for setting the output via the IGFX

When using this mode, the 3 SA1 switch should be in OFF position (see Table 4-1).

4.6   Use of DisplayPort E, F interfaces

In accordance with the MXM 3.0 standard, the graphics card can have up to 6 DisplayPort interfaces: A, B, C, D, E, F. Their operation capability and operation mode are determined by the VBIOS (see subsection 5).

VIM556 and VIM556RC modules enable to use DisplayPort E, F interfaces for output of images to the front panel or RIO. This is implemented by multiplexing of the relevant ports of the front panel or RIO. Depending on the position of 4 switch, SA1 ports C and D of the front panel or RIO are connected to the F or E ports, accordingly (see Table 4-1).

5   VBIOS upgrade

Functional capabilities of the VIM556 and VIM556RC modules depend on VBIOS of the installed graphics card MXM 3.0. Depending on the specifics of tasks, solved by the module, user may be required to upgrade VBIOS of the graphics card. For this purpose, special utility programs are provided to the users by the graphics cards manufacturers.

Attention!

VBIOS upgrade can lead to device malfunctions.   Use only those VBIOS versions that were provided by manufacturer of VIM556 and VIM556RC modules.   Otherwise, module manufacturer will not be responsible for device operation capability.

Before proceeding to the VBIOS upgrade it is required to perform the following:

■   determine the VIM556 and VIM556RC module versions and the type the graphics card used in it (NVIDIA or AMD);

■   obtain a new version of **VBIOS** of the graphics card from the manufacturer.

5.1   Upgrade of VBIOS of NVIDIA graphics cards

In order to upgrade **VBIOS** of **NVIDIA** graphic card, **NVFLASH** utility program should be used. Depending on user requirements, **VBIOS** upgrade can be carried out using one of the following operating systems: **Linux, DOS**, **Windows**.

Upgrade procedure of **VBIOS** of the graphics card:

■   place the firmware into the catalog with **NVFLASH** program;

■   familiarize oneself with operation of the **NVFLASH** program, starting it with the parameter **«–help»**;

■   save the old **VBIOS** firmware of the graphics card, for which purpose start the **NVFLASH** program with the following parameter: **"--save reserved.rom"**, where **"reserved.rom"** - is the name of the file, where such firmware will be saved;

■   relocate file with the old firmware into a safe place;

■   unblock **EEPROM** of the graphics card, for which purpose start the **NVFLASH** program with "**--protectoff"** parameter;

■   upgrade **VBIOS** of the graphic card. In order to do so start the **NVFLASH** program with **"new.rom"** parameter, where the specified parameter is the file name with the new firmware;

■   check whether the **VBIOS** upgrade has been successful. In order to do so start the **NVFLASH** program with **"--verify new.rom"** parameter, where **"new.rom"** is the file name with the new firmware;

■   block **EEPROM** of the graphics card, in order to do so start the **NVFLASH** program with **"--protecton"** parameter;

■   turn off and turn on the system, make sure that **VIM556** or **VIM556RC** module and all its interfaces operate properly;

■   For making the VBIOS upgrade more convenient, we recommend using the following batch file: **program vbios.bat**.

5.1   Upgrade of VBIOS of AMD graphics cards

In order to upgrade **VBIOS** of **AMD** graphics card, **WINFLASH** utility program should be used. Upgrade of **VBIOS** can be performed using **Windows 32/64** OS.

■   Upgrade procedure of **VBIOS** of the graphics card: start the **ATIWinflash.exe** program;

■   press the **Load Image** button and indicate **VBIOS** file for booting (extension *.bios);

■   boot **VBIOS** to the graphics card by pressing the **Program** button;

■   wait until the end of booting, turn off, turn on the system and makes sure that **VIM556** or **VIM556RC** and all its interfaces operate properly.

6   Additional information

6.1   Power consumption

VIM556 and VIM556RC modules, independent of their versions, specifies the following power supply requirements.

Table 6-1: Requirements for power supply

Power supply voltage +12, V		Maximum consumption current, A
Min.	**Max.**	
10.8	13.2	6.65

Attention!!!

The table contains limit voltage values on power supply lines, and if they are exceeded this could lead to module damages and malfunctions. If the power supply voltages go beyond the specified boundaries, module's functionality is not guaranteed.

The backplane of the system should ensure an optimal allocation of power supply voltages among the connected devices.

Connections of power supply lines and backplane should ensure minimum losses and guarantee stability of operating characteristics.   Long feeding lines, small conductor sections and high-resistance connections should be avoided.

Installation of several VIM556, VIM556RC modules into the system is possible. While designing the power supply of your system, the total power consumption of all its components should be considered. Capacity of the power supply source should be selected with due consideration of reserve.

6.1.1   Start and average module consumption currents

During tests of the VIM556, VIM556RC module, maximum values of starting and average consumption current were measured. Average consumption current was measured in two modes:

- in system video adapter mode without additional computation load;
- In system video adapter mode, with additional computation load (**FURMARK** program was used).

Table 6-2: Maximum starting and average consumption currents

Module	Power supply voltage, V	Starting consumption current, A	Average consumption current, A	
			Without computation load	With computation load
VIM556-01, VIM556-02, VIM556RC-01, VIM556RC-02.	10.8	7.6	0.7	3.7
	13.2	7.6	0.55	2.9
VIM556-03, VIM556-04, VIM556RC-03, VIM556RC-04.	10.8	7.6	0.56	3.24
	13.2	7.6	0.46	2.72

6.2   Cable connections

VIM556 was tested together with TFT display, connected to the module via DisplayPort interface. For connection, DisplayPort Gefen cable was used: **CAB-DP-RP-15MM**.

6.3   Use of DisplayPort interfaces

Special features of VBIOS of the graphics card determine module's capabilities for support of DisplayPort interfaces (see Table 6-3).

Table 6-3: Support of DisplayPort

Module	Graphics card	VBIOS	Limitations
VIM556-01, VIM556-02, VIM556RC-01, VIM556RC-02.	NVIDIA Quadro K2100M	80.06.68.00.03	DP3 interface on the front panel (DisplayPort C) does not support the Hot Plugging of display. DP3 interface does not support output of POST and BIOS messages.
VIM556-03, VIM556-04, VIM556RC-03, VIM556RC-04.	AMD Radeon E8860	113-1E259030PC-S01	No

6.4   Use of Dual Mode Display mode

The VIM556 and VIM556RC modules support the Dual Mode Display, which enable to connect displays with DVI and HDMI interfaces to the DisplayPort interface. For this purpose use adapters, e.g.: HDMI A-DPM-HDMIF-002-W, DVI A-DPM-DVIF-002-W.

Special features of VBIOS of the graphics card determine module's capabilities for support of the Dual Mode Display (see Table 6-4)

Table 6-4: Support of Dual Mode Display

Module	Graphics card	VBIOS	Support of Dual Mode Display
VIM556-01, VIM556-02, VIM556RC-01, VIM556RC-02.	NVIDIA Quadro K2100M	80.06.68.00.03	The mode is not supported at the stage of output of POST and BIOS messages
VIM556-03, VIM556-04, VIM556RC-03, VIM556RC-04.	AMD Radeon E8860	113-1E259030PC-S01	The mode is fully supported

6.5   Use of Multi Stream Transport mode

The VIM556 and VIM556RC modules support the Multi Stream Transport mode, which makes it possible to connect several displays via HUB to a single DiaplyPort connector of the module. For this purpose HUB can be used, e.g. DisplayPort Multi Stream Transport HUB (Sensevision) CSV-5400.

Special features of VBIOS of the graphics card determine module's capabilities for support of the Multi Stream Transport mode (see Table 6-5).

Table 6-5: Support of Multi Stream Transport mode

Module	Graphics card	VBIOS	Support of Multi Stream Transport
VIM556-01, VIM556-02, VIM556RC-01, VIM556RC-02.	NVIDIA Quadro K2100M	80.06.68.00.03	Support of up to 2 displays
VIM556-03, VIM556-04, VIM556RC-03, VIM556RC-04.	AMD Radeon E8860	113-1E259030PC-S01	Support of no less than 4 displays

6.6   Performance of graphics card

During tests of the VIM556 and VIM556RC modules, performance of various versions with the use of FurMark test was measured (see Table 6-6). Settings of Furmark v1.10.3:

- Full Screen = ON;
- Resolution = display resolution, e.g. 1920x1200;
- Anti-aliasing = 8X MSAA;
- Settings (ON):
    - Dynamic background;
    - Burn-in;
    - Xtreme burn-in;
    - Post FX.

Table 6-6: Performance of the graphics card

Module	Graphics card	Average performance of the FurMark test, FPS
VIM556-01, VIM556-02, VIM556RC-01, VIM556RC-02.	NVIDIA Quadro K2100M:	3
VIM556-03, VIM556-04, VIM556RC-03, VIM556RC-04.	AMD Radeon E8860:	4

6.7   Cooling system requirements

High power consumed by the module (up to 75 W) requires use of the forced cooling system. This should be considered at the time of system designing.

For the versions of VIM556RC, it is recommended to apply a thermal conductive paste (e.g. Arctic Silver 5) to the joint between the module's and system's enclosure in order to reduce thermal losses.

Attention!!!

Manufacturer will not be responsible for damages to VIM556, VIM556RC and other equipment, caused by the overheating. System developers and end users should strictly observe module's operating conditions.

In order to control module's temperature within the system and to assess the cooling system efficiency, **GPU-Z** and **FURMARK** utility programs can be used. Temperature of compute kernel of the **GPU** within the whole range of operating temperatures of the module should not exceed **90°C**.

6.8   Diagnostics information

Device operation could cause the conditions that lead to the impossibility of it normal performance:

- installation into system slot;
- supply by the voltage that fails to meet the requirements, imposed by the module;
- module overheating;
- mechanical or electrical damages due to module improper handling.

In most cases, non-standard functioning of the device is followed by the relevant indication. For displaying information on non-standard situations or malfunctions, SYS indicator on the front panel is used. Indicator can illuminate continuously or flicker in accordance with the fault code (see Figure 6-1).
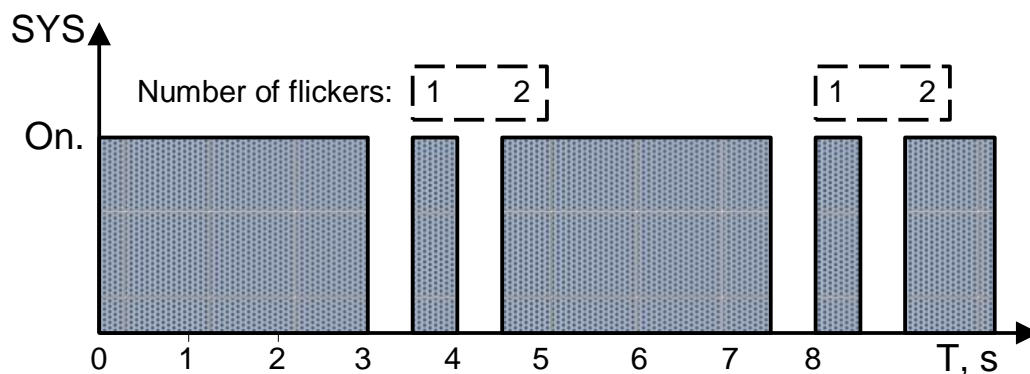

Fig. 6-1: Operation of SYS indicator (fault code 2)

SYS indicator operates in two phases:

- 3 seconds pause;
- flickering in accordance with the fault code (see Table 6-7, Fig. 6-1).

Table 6-7: Codes of faults

Designation	Fault code	Fault description
ERROR_SUPPLY_FAULT	1	Module power supply fault (voltage is lower than
ERROR_PWRSW_FAULT	2	Overload of input feed key
ERROR_DPSW_FAULT	3	Overload of one of the DsiplayPort feed keys
ERROR_DCDC_FAULT	4	DC/DC start fault
ERROR_I2C1_FAULT	5	I2C1 initialization fault
ERROR_I2C2_FAULT	6	I2C2 initialization fault
ERROR_RDV1_FAULT	7	Re-driver 1 initialization fault
ERROR_RDV2_FAULT	8	Re-driver 2 initialization fault
ERROR_PESYSEN_FAULT	9	Module installation fault (installed into the system slot)
ERROR_MXMOVT_FAULT	10	Overheating of MXM module

6.9   Compliance with safety requirements

VIM556 complies with the general safety requirements imposed for IT equipment in accordance with the GOST R IEC 60950-2002 (for equipment, connected to the power supply network with the voltage up to 600 V).

6.10   Operating conditions

6.10.1   Operating conditions of VIM556

VIM556 is resistant to the following environmental factors:

Table 6-8: External influencing factors for VIM556

Parameter		Value
Operating temperature of the environment for commercial versions: VIM556-01, VIM556-03	reduced, °C	0
	elevated, °C	+ 70
Operating temperature of the environment for industrial versions: VIM556-02	reduced, °C	- 20
	elevated, °C	+ 70
Operating temperature of the environment for industrial versions: VIM556-04	reduced, °C	- 40
	elevated, °C	+ 70
Limit temperature	reduced, °C	- 55
	elevated, °C	+ 85
Sinusoidal vibration	Amplitude (10..50 Hz), mm	0.15
	Acceleration (50..150Hz), g	2
Single mechanical shock	Peak acceleration, g	50
	Duration, ms	11
Multiple mechanical shock	Peak acceleration, g	25
	Duration, ms	6
Relative humidity (without condensation)	No more than %	80
Relative humidity (without condensation) for the versions with COATED option	No more than %	98

6.10.2   Operating conditions of VIM556 RC

VIM556RC is resistant to the following environmental factors:

Table 6-9: External influencing factors for VIM556RC

Parameter		Value
Operating temperature of the environment for commercial versions: VIM556RC-01, VIM556RC-03	reduced, °C	0
	elevated, °C	+ 70
Operating temperature of the environment for industrial versions: VIM556RC-02	reduced, °C	- 20
	elevated, °C	+ 80
Operating temperature of the environment for industrial versions: VIM556RC-04	reduced, °C	- 50
	elevated, °C	+ 80
Limit temperature	reduced, °C	- 65
	elevated, °C	+ 85
Sinusoidal vibration	Range, Hz	from 1 to 500
	Acceleration (50..150Hz), g	6
Single mechanical shock	Peak acceleration, g	75
	Duration, ms	from 1 to 5
Multiple mechanical shock	Peak acceleration, g	15
	Duration, ms	from 5 to 15
Relative humidity (without condensation)	No more than %	80
Relative humidity (without condensation) for the versions with COATED option	No more than %	98

7   Transportation, unpacking and storage

7.1   Transportation

The module must be transported in individual factory packages consisting of an individual antistatic bag and a cardboard box, in closed vehicles (in heated and airtight compartments of motor, railroad or airborne vehicles) under storage conditions 5 as per GOST 15150-69 or under storage conditions 3 during transportation by sea.

It is allowed to transport modules packed in individual antistatic bags in factory multipacks.

Packed modules must be transported pursuant to the cargo transportation rules applicable to this mode of transport.

During loading and unloading work and transportation, packed modules must not be exposed to jerks, falls, shocks and atmospheric precipitation. The stowage of packed modules in a vehicle must exclude their shifting.

7.2   Unpacking

The modules that were transported at subzero ambient temperature must be stored for 6 hours under storage conditions 1 as per GOST 15150-69 before they can be unpacked.

Placing packed modules in front of a heat source before their unpacking is forbidden.

In the process of the modules unpacking one must observe all the precautions ensuring their safety and marketable appearance of the factory packages.

Upon unpacking, the modules must be checked for external mechanical damage after transportation.

7.3   Storage

Modules storage conditions: 1 as per GOST 15150-69 (IEC721).

Annex A

Table 7-1: Terms and abbreviations

Term	Value
BIOS	Basic Input-Output System
VBIOS	Video Basic Input-Output System
EEPROM	Electrically Erasable Programmable Read-Only Memory
ESD	Electrostatically Sensitive Device Electrostatic Discharge
POST	Power On Self Test
TFT	Thin Film Transistor
GPU	Graphics processing unit
HDMI	High Definition Multimedia Interface
DVI	Digital Visual Interface
TPD	Total Power Dissipation