

# VIM554 3U CPCI Audio / Video Input Module User Manual

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The product described in this manual is compliant with all related CE standards.



 Product Title:
 VIM554

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 VIM554 User Manual

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### General Board Operation Rules

- To keep the warranty, the product should not be altered or revised in any way. Any alterations or improvements not authorized by Fastwel LLC, except for those specified in this document or obtained from the technical support department of Fastwel LLC as a set of instructions for their implementation, cancel the warranty.
- This device should be installed and connected only to the systems, meeting all the necessary technical and climatic requirements. This above is also true of the operating temperature range of a particular version of the board.
- While performing all the required operations for installation and adjustment, please follow the instructions specified only in this document.
- Keep the original package for subsequent storage of the device and transportation in the warranty event. If it is necessary to transport or store the board, please pack it the same way as it was packed upon delivery.
- Exercise special care when unpacking and handling the device. Act in accordance with the instructions given in the paragraph above.



### TRANSPORTATION, UNPACKING AND STORAGE

### Transportation

The module should be transported in a separate packaging box (transport packaging) of the manufacturing facility, which consists of an individual antistatic bag and a cardboard box, in the closed transport (automobile, railway, air transportation in heated and pressurized compartments) in storage conditions 5 defined in the GOST standard 15150-69 (IEC 721-2-1 standard) or in storage conditions 3 during sea transportation.

It is possible to transport modules, packaged in individual antistatic packages, in multiple packaging (transport packaging) of the manufacturing facility.

The packaged modules should be transported in accordance with the shipping rules, operating with this particular type of transport.

During handling and transportation operations, the packaged modules should not undergo sharp pounding, falls, shocks and exposure to atmospheric precipitation. The packaged modules should be stored in a carrier vehicle in such a manner which will prevent their moving.

### Unpacking

Prior to unpacking, before transportation at subzero temperature of ambient air the modules should be kept within 6 hours under storage conditions 1 defined in the GOST standard 15150-69 (IEC 721-2-1 standard).

It is prohibited to place the packaged module close to the heat source, prior to unpacking.

While unpacking, it is required to comply with all safety precautions, which ensure its safety, as well as marketable condition of consumer packaging of the manufacturing company.

At the time of unpacking it is required to check the module that it has no external mechanical damages after transportation.



### Storage

Module storage conditions for group 1 are defined in the GOST standard 15150-69 (IEC 721-2-1 standard).



### MANUFACTURER'S WAARRANTY

### Warranty Liabilities

- The Manufacturer hereby guarantees the product conformity with the requirements of the "Modules in 3U CompactPCI Serial format" technical conditions provided that the Consumer complies with the operating, storage, transportation and installation conditions and procedures, specified by the accompanying documents.
- The Manufacturer hereby guarantees that the products supplied thereby are free from defects in workmanship and materials, provided operation and maintenance norms were observed during the currently established warranty period. The Manufacturer's obligation under this warranty 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 warranty 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.

### Warranty Period

- The warranty period for the products made by Fastwel LLC is 36 months since the sale date (unless otherwise provided by the supply contract).
- The warranty period for the custom-made products is 60 months since the sale date (unless otherwise provided by the supply contract.

### Limitation of warranty liabilities

- The above warranty liabilities shall not be applied:
- To the products (including software), which were repaired or were amended by the employees, that do not represent the manufacturer. Exceptions are the cases where the

VIM554 3U CPCI Audio / Video Input Module



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customer has made repairs or made amendments to the devices in the strict compliance with instructions, preliminary agreed and approved by the manufacturer in writing;

• To the products, broken down due to unacceptable polarity reversal (to the opposite sign) of the power supply, improper operation, transportation, storage, installation, mounting or accident.

### 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 the Manufacturer, 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



### **Notation Conventions**



This symbol draws your attention to the information related to electro static sensitivity of your product and its components. To keep product safety and operability it is necessary to handle it with care and follow the ESD safety directions.



This sign marks warnings about hot surfaces. The surface of the heatsink and some components can get very hot during operation. Take due care when handling, avoid touching hot surfaces!



Information marked by this symbol is essential for human and equipment safety. Read this information attentively, be watchful.



This symbol and title marks important information to be read attentively for your own benefit



## 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.

### High-voltage safe handling rules



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 give 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 touch a metal part of system enclosure.



## **1 INTRODUCTION**

### 1.1 Purpose

VIM554 Audio / Video Input Module (hereinafter referred to as the module) is designed for reception of analog audio and video signals, converting them into digital form and their output to the system memory of computer. Uses a high-speed I/O interface (PCI Express x4) and is aimed at a joint operation with various modifications of CPC510 CPU module.

In order to expand functional capabilities of VIM554 the following rear I/O modules are provided:

- RIO591:
- four serial-ports RS422/485 with galvanic insulation for control of video cameras;
- four opto-coupler inputs;
- four opto-coupler outputs;
- RIO593:
- eight serial ports RS232 with galvanic insulation for control of video cameras;
- four opto-coupler inputs;
- four opto-coupler outputs;

The opto-coupler inputs/outputs are designed for interfacing with various safety-alarm devices (contact sensors, infrared lightning control etc.).

### 1.2 Versions

Module versions and their ordering names (ordering information) are given in the table below:

Name	Reference designation	Ordering name	Note
VIM554 Audio /	VIM554	VIM554-01-R1- I <sup>1)</sup>	4 audio inputs and 4 video inputs
Video Input Module		VIM554-02-R1- I <sup>1)</sup>	8 audio inputs and 8 video inputs
		VIM554-xx <sup>2)</sup> -R1-I <sup>1)</sup>	Conformal coating
		\Coated	option
<ul> <li>Temperature range: I – industrial range from -40°C to +85°C.</li> <li>Where xx – module version (01, 02).</li> </ul>			





Heat-sink (R1 option) makes it possible to install modules into the crate with a pitch of 4HP. Forced cooling (blowing) is required.

### **1.3 Delivery checklist**

The delivery checklist for all module versions is given in the table below:

Table 1-2: Delivery checklist

Ordering name	Description
VIM554-01-R1-I	VIM554 Audio / Video Input Module
VIM554-02-R1-I	
	Cable video connector, p/n 133-8433-001
	(made by Emerson Connectivity Solutions)
	- For VIM554-01: 4 pcs.
	- For VIM554-02: 8 pcs.
	Cable audio connector E26MSG1+ (made by
	Honda Connectors)
	- For VIM554-01: 1 pcs.
	- For VIM554-02: 2 cps.
	Cable audio connector housing HDR-E26LPH
	(made by Honda Connectors)
	- For VIM554-01: 1 pcs.
	- For VIM554-02: 2 pcs.
	-
-	Packaging

### **1.4 Packaging information**

VIM554 is packaged into a box with the following overall dimensions: 350 x 260 x 70 mm.

Table 1-3: Module's packed weight		
Ordering name	Packed module's weight,	
VIM554-01-R1-I	630	
VIM554-02-R1-I	690	



Retain all original anti-static and consumer packaging at least until the warranty period is over.



## **2 SPECIFICATIONS**

### 2.1 Technical specifications

#### Form-factor:

- PICMG CPCI-S.0 R1.0 CompactPCI® Serial Specification 3U

#### System bus:

- PCI Express x4.

#### **Electric power supply:**

- Power supply voltage: +12.0 V;

- Power consumption: 0.8 A.

#### Indication:

- RGB-LEDs on module's front panel are used for diagnostics and indication of module operating modes.

#### Hardware monitor:

- Overheating protection (module shutdown).

#### Mechanical stress resistance:

- Sinusoidal vibrations for frequencies from 10 to 150 Hz:

With acceleration of no more than 2 g;

- Single shocks with duration of 11 ms:

With peak acceleration of no more than 50 g;

- Multiple shocks with duration of 6 ms:

With peak acceleration of no more than 25 g.

#### MTBF:

- No less than 100 000 hours.

#### Module's weight:

- VIM554-01-R1 — no more than 320 g;

- VIM554-02-R1— no more than 380 g.

#### **Overall dimensions:**

- No more than 130.5 mm x 213.0 mm x 20.32 mm (WxLxH).

#### **Operating temperature:**

- Industrial version: from -40°C to +85°C.

#### Humidity:

- Up to 80% without condensation.

#### Resistance to cyclic damp heat in case of conformal coating:

- At the ambient temperature of (+55±2)°C and relative humidity of (93±3)%.

#### Software compatibility:

- Windows Embedded Standard 7, 32/64 bit;

- Linux 3.2.0.



### 2.2 Audio and video path

### Video path:

- 4/8 channels;
- Video signal standard: PAL (B, D, G, H, I, M, N, 60), SECAM, NTSC (4.43 MHz, M);
- Video signal type: composite (CVBS);
- Type and wave impedance of the connector: MCX (socket), 75 Ohm;
- Input resistance: 75 Ohm;
- Video input type closed (AC-coupled);
- Standard level of input video signal: 1.2 V (double crest value);
- Protection filters against spectrum aliasing: Yes;
- Input speed via each channel: 25/30 frame/second, depending on video signal standard;
- Frame output format: up to D1;
- Video decoder: TW6869.

### Audio path:

- 4/8 channels (mono);
- Type of audio sources: active microphones, amplifiers, sound cards;
- Power supply of active microphones: +12.0 V/45.0 mA;
- Bandwidth: 12 KHz (on level 3 dB);
- Input cascade type: differential;
- Input impedance no less than 47 KOhm (f=1 KHz);
- Input signal level: up to 2.0 V (root-mean-square value);
- Sampling frequency: 8/16/32/44.1/48 KHz;
- Retrieval capacity: 8/16 bit;
- Protection of input cascades against overloading: Yes;
- Audio decoder: TW6869.



Specification

## **3 MODULE STRUCTURE AND OPERATION**

The below figures will help you identify components and understand their mutual arrangement and functions.

### 3.1 Main components and module overall dimensions



Fig. 3-1: External view of VIM554 (version VIM554-01-R1)



External view of module versions can be slightly different from the one shown in Figures.

#### 3.1.1 Main elements on the front module panel

Location of main elements on the front panel of 8-channel VIM554-02-R1-x is shown in Fig. 3-2. Video outputs **VIN1...VIN8** are equipped with micro coaxial connectors (MCX) with wave impedance of 75 Ohm made by Emerson Connectivity Solutions (p/n **133-8701-801**). Their enclosures are insulated from the front panel (chassis) by plastic plugs and come in contact only with the logic analog ground of the module.

Audio 1 and Audio 2 inputs use 26-pin connectors HDR-EA26LFYPG1-SLG+ (made by Honda Connectors). Each connector is equipped with four audio channels (Audio 1- channels 5..8, Audio 2 – channels 1..4).



From this point on, numbering of audio and video channels corresponds to the description of TW6869 decoder, unless specified otherwise.



Fig. 3-2: Location of main elements on the front panel of VIM554 (version VIM554-02-R1)

Purpose of contacts, recommended cables and cable connectors are described in subsection **3.3.9 Connection of signal sources**.



**Status 1** and **Status 2** LEDs are used for indication of module operating modes (subsection 3.3.8 LEDs).

4-channel VIM554-01 modules do not have with video inputs **VIN5...8**, LED **Status 2** and audio connector **Audio 2** (in this case they lack numbering, they are only equipped with **Status** and **Audio**, see Fig. 3-6).

Ejector handle is designed for installing the module into a slot or extracting it from it. After installing into the slot, the module should be additionally fixed by upper and lower retention screws.

#### 3.1.2 Main components on the board of VIM554

Designations of LEDs and connectors on Fig. 3-3 and Fig. 3-4 correspond to those on module's diagram:

- System connector XP6 with PCI-E x4 system bus routed to it;
- -XP5 for connection of rear I/O module (RIO591/RIO593);
- Process connectors for programming microcontrollers (not shown on the diagram);
- AIB922 mezzanine (for 8-channel VIM554-02 modules);
- Heatsink (R1);
- Service LEDs HL1, HL3, HL10 и HL11;
- Front panel;
- Ejector handle.

Tricolor (RGB) LEDs **Status 1** and **Status 2** are not shown in figures, since they are placed inside the module, on the interior surface of PCBs.

For transporting luminous flux from LEDs to the front panel, polymer light guides are used.





Fig. 3-3: VIM554, top view, with mezzanine installed (for version VIM554-02-R1)



Fig. 3-4: VIM554, bottom view



### 3.1.3 Module overall dimensions



Fig. 3-5: Overall dimensions of VIM554 (side view is shown for version VIM554-01-R1)







Fig. 3-6: Overall dimensions for the front panel of VIM554 (for version VIM554-01-R1)



### 3.2 Board layout

Board layout is shown in Fig. 3-7:







The above board layout shows the following functional elements:

- 8-channel audio and TW6869 video decoder;
- PCI-E bus switch;
- XP6 system connector with system bus PCI-E x4 routed to it;
- XP5 connector for rear I/O modules (RIO591/RIO593);
- **dB** programmable attenuators (audio volume controls);
- ALC Amplifiers with AGC circuits (auto level control);
- Amp Input audio and video amplifiers;
- VIN1...8 video inputs;
- Audio 1, Audio 2 audio inputs;
- Control loop;
- AIB922 mezzanine.

The input amplifiers have integrated low-frequency filters for protection against spectrum aliasing and several operation modes.

Input audio amplifiers are equipped with differential input. AIB922 mezzanine is highlighted violet on the diagram. It is installed only in 8-channel modules (VIM554-02).

Violet arrows show the loop of control of main functional units of audio and video paths. The control loop has actuated GPIO lines of TW6869 and 8-bit ATtiny88 microcontroller. The microcontroller is used for controlling audio volume and LEDs.

### 3.3 Functional units and interfaces

### 3.3.1 Input audio amplifiers

Input audio amplifiers – amplifiers with differential input and Ku=1. No adjustments are provided. Maximum level of input signal – 2.0 V (root-mean-square value). Short-term increase of this level up to 3.0 V (root-mean- square value) is accepted, however leads to signal form distortion and fast growth of nonlinear distortions, as consequence.



Inputs are protected against overload, which limits the signal at a safe level. However, a long-term operation with the level exceeding 3.0 V (root-mean-square value) can lead module damages.



#### 3.3.2 Input video amplifiers

Input video amplifiers are amplifiers with integrated filters for protection against spectra aliasing (Fc = 10 MHz on level - 3 dB).

#### 3.3.3 Programmable attenuators

The programmable attenuators are volume adjusters with digital control. Attenuation range is from 0 dB to -95 dB, control step: 1 dB. There is a Mute mode, which is activated by power up. Its activation / deactivation can also be programmed. Each audio channel has its own attenuator.

### 3.3.4 Amplifiers with AGC circuits

Amplifiers with AGC circuit represent a circuit with a variable gain ratio that supports signal level at the relevant audio input of TW6869 decoder approximately on the same level, not exceeding the maximum permissible level.

Available in each module's audio channel.



Note

Parameter of the AGC circuit are in the first place optimized for speech audio signals. When recording music pieces aliasing could occur. It is important to make sure that signal level at input of the AGC circuit would not exceed the permissible (see p.4.7).

### 3.3.5 TW6869 audio and video decoder

TW6869 audio/video decoder is module's major component. It is designed for digitizing audio and video signals and transferring them to system memory. Main features:

- Integrated transceiver of PCI-Expess x1 Gen 1.1 bus;
- 8 audio channels (mono);
- Audio samples in bits: 8/16 bits;
- Sampling rate: 8/16/32/44.1/48 KHz;
- 8 video channels (10-bit analog-digital converters);

- Supports the following video signal standards: PAL (B, D, G, H, I, M, N, 60), SECAM, NTSC (4.43 MHz, M);

- Input video signal type: composite (CVBS);
- Frame output format: up to D1;

- 39 GPIO lines used for control of input video amplifiers, volume controls, AGC circuits, LEDs and power supply to active microphones.



### 3.3.6 PCI-E bus switch

Switch of PCI-E buses is designed for ensuring an interface between CPC510 CPU module or similar device on one hand and TW6869 decoder and RIO591 I/O Module on the other hand. Upstream port x4 is routed to XP6 connector, one of the downstream ports x1 is connected with TW6869, while another one – which is x1 too, is routed to XP5 for connection of RIO591 or RIO593 rear I/O modules.

The upstream port x4 can run in the x1 mode, which makes it possible to install the module in hybrid systems in accordance with the PICMG 2.30 specification.

Switch of PCI-E buses is regarded the most thermally-loaded unit of the module. It has protection against overheating, which is triggered when the crystal is heated up to about +115°C. In this case, protection deactivates all integrated power supply sources of the module, except for the duty one, and activates the relevant indication mode (see Table 3-2, paragraph 7). This usually results in operating system hang-up.

### 3.3.7 Jumpers and process connectors

VIM554 has no jumpers, switches etc. All configurations are made via software.



#### Attention!

Connection of any devices or cables to XP3 and XP4 process connectors, closing their outputs or installation of jumpers is not allowed. All operations related to programming module components should be carried out

All operations related to programming module components should be carried ou by manufacturer only.

### 3.3.8 LEDs

At module's startup, **Status 1** LED (see Fig. 3-2, Fig. 3-6) glows with orange then it goes down. This indicates that the device is in good operating condition and is waiting for software driver to boot. After device initialization by the software driver, the both **Status 1** and **Status 2** indicators are glowing with green. This means they are ready for work.

Then Status 1 indicates the state of VIN1...4 video channels and 5..8 audio channels (Audio 1 connectors), and Status 2 – the state of VIN5...8 video channels and 1..4 audio channels (Audio 2 connector).

LEDs are located not only on the front panel – (see Fig. 3-1 and Fig. 3-2). A couple of service LEDs are located in the bottom part of the module - HL10, HL11 and a couple - in the upper part – HL1, HL3 (mezzanine). Their control is implemented by hardware and is not available for the user.



HL3 and HL11 indicate that microphones power supply is ON in any of the channels 1...4 (**Audio 2** connectors) and 5...8 (**Audio 1** connectors or just **Audio** in case of VIM554-01 version), respectively. Glowing color – orange or yellow.

HL1 and HL10 indicate that protection in microphones power supply circuits in any of the channels 1...4 (**Audio 2** connector) and 5...8 (**Audio 1** connector or just **Audio** in case of VIM554-01 version), respectively. Glowing color – hot-pink.

Indication modes available for the user (application program), are specified in the Table 3-1.

No	LED blinking rate	Color of LED glowing	Purpose of indication mode
1	Slow blinking	Green	The device is used by application software. Only video or audio channels are enabled, no loss of data.
2	Rapid blinking	Green	The device is used by application software. Video and audio channels are enabled, no loss of data.
3	Slow blinking	Orange	The device is used by application software. Only video or audio channels are enabled, loss of data.
4	Rapid blinking	Orange	The device is used by application software. Video and audio channels are enabled, loss of data.

#### Table 3-1: User indication modes (Status indicators)



Note

Such user modes are selected since they can be easy distinguishable from fault

indication.

Detection of data loss (loss or deterioration of signal parameters) is carried out by application program.

In addition to it, Status 1 indicator is used for diagnostics in case of module faults.

Emergency indication modes are specified in Table 3-2.



No	LED blinking type	Color of LED glowing	Fault source
1	Continuous blinking	Red	Installation into a peripheral slot with incorrect geographical address 1
2	Slow blinking	Red	Increased voltage of the system power supply source (+12.0 V).
3	Long-term flashing – short- term flashing <sup>2</sup>	Red	Failure of the secondary power source of PCI- E buses switch.
4	Long-term flashing – two short-term flashings <sup>2</sup>	Red	Failure of the secondary power source of TW6869 audio/video decoder.
5	Long-term flashing – four short-term flashings <sup>2</sup>	Red	Failure of the secondary power source of RIO591 or RIO593 rear I/O module.
6	Long-term flashing – five short-term flashings <sup>2</sup>	Red	Rebooting power transistor (+12.0 V).
7	Rapid blinking	Green – red	Module overheating
8	Rapid blinking	Blue - red	Incorrect attempt of module removal (pressing the ejector button at actuated system power supply).

#### Table 3-2: Modes of failure indication



1. Module is designed for installation into crate together with backplane occupying no more than 9 slots. When using crates with a large number of slots, startup and proper operation of the module is not guaranteed.

2. The LED continuously repeats the series of flashes. Structure of the series is specified in the table.

#### 3.3.9 Connection of signal sources



Switching connectors on the front panel can be performed only when the module is switched off.

For connection of video signal sources cable coaxial connectors Emerson Connectivity Solutions, p/n 133-8433-001 for RG179B/U cable or Emerson p/n 133-8445-001 – for the thicker cable Belden p/n 735A1. In any case, if video signal sources are located at great distances, it is recommended using patch panel for cables of larger diameter and lesser specific ohmic resistance.



In order to connect to the patch panel when using RG179B/U cable, its far end can be used for BNC-connector Amphenol-Connex p/n **112954** or similar one. It is recommended to use coaxial cable with copper central conductor (e.g., Alpha Wire p/n **M4243** or similar).

If video signal sources are located at a great distance or outside the facilities, it is recommended to use surge protection devices (e.g. Hakel **H30** or **H40**).

For connecting audio signal sources, cable connector **E26MSG1+** in **HDR-E26LPH** casing (made by Honda Connectors). Diameter of conductors in the cables used should not exceed 28 AWG. Diameter of the cable should be selected as low as possible, otherwise it won't fit the connector casing.

Contact	Name	Contact	Name
1	GND (chassis)	14	GND (chassis)
2	+AIN5	15	-AIN5
3	GND (signal)	16	MIC5_PWR
4	GND (chassis)	17	GND (chassis)
5	-AIN6	18	+AIN6
6	GND (signal)	19	MIC6_PWR
7	GND (chassis)	20	GND (chassis)
8	MIC7_PWR	21	GND (signal)
9	+AIN7	22	-AIN7
10	GND (chassis)	23	GND (chassis)
11	MIC8_PWR	24	GND (signal)
12	-AIN8	25	+AIN8
13	GND (chassis)	26	GND (chassis)

#### Table 3-3: Purpose of contacts of Audio 1 connector

Numbering outputs of Audio 1 and Audio 2 connectors is specified in Fig. 3-2, and their purpose – in Tables 3-3 and Table 3-4, respectively.

Table cells, related to separate channels, are highlighted in various colors.

Contact	Name	Contact	Name
1	GND (chassis)	14	GND (chassis)
2	+AIN1	15	-AIN1
3	GND (signal)	16	MIC1_PWR
4	GND (chassis)	17	GND (chassis)
5	-AIN2	18	+AIN2
6	GND (signal)	19	MIC2_PWR
7	GND (chassis)	20	GND (chassis)
8	MIC3_PWR	21	GND (signal)
9	+AIN3	22	-AIN3
10	GND (chassis)	23	GND (chassis)
11	MIC4_PWR	24	GND (signal)
12	-AIN4	25	+AIN4
13	GND (chassis)	26	GND (chassis)

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Note

-AINx and +AINx – are an inverting and noninverting inputs of differential audio amplifiers. x – channel number.

MICx\_PWR – power supply ports of active microphones (11.0-12.0 V).

x - channel number.

Circuit numbering of audio channels is used (corresponds to the numbering given in the TW6869 decoder description).

For connection to the remote audio signal sources it is also recommended to use patch panel or adapters. In order to transfer the signal from the patch panel to the module when microphones are supplied with power from VIM554, it is possible to use the cable 3M p/n **3644B/16 100SF** (8 twisted pairs in the collective screen, Ø5.8 mm) or the similar one.

If an external power supply source is used, we recommend using cable Tasker p/n **C202** (single twisted pair in the screen,  $\emptyset$  3.0 mm) or the similar one. In the latter, there are four of such cables per connector.

Purpose of outputs in audio connectors is that each channel has a couple of contacts, connected to the enclosure (chassis): 4-14, 7-17, 10-20 and 13-23; and a single contact, connected to circuit ground: 3, 6, 21 and 24. This makes possible using various options of cable scree grounding.

This is why it should be noted that enclosure grounding of the screen can also be done in the casing of a cable part of the audio connector.

An option of connecting a microphone with the use of individual cable (e.g. Tasker p/n **C202**) and an external power source in each channel is shown in Figure 3-8.





Fig. 3-8: Connecting microphone with external power supply source

Resistor with impedance equal to the output impedance of the microphone should be included into the blue wire breakage close to the microphone.

Multiple connections among power sources and audio signal receivers often lead to parasitic ground loops, especially when it comes to connecting cables of extended length. This results in a low-frequency background in the audio channel.



Fig. 3-9: Connecting microphone with the use of isolating transformer

These loops can be broken with the help of isolation transformers. An example of microphone connection for this case is shown on Figure 3-9.

Connecting the module to audio signal source with differential output is carried out in the same way.

In addition, there are a couple of contacts (connected to chassis), which are common for all four audio connector's channels: 1-26. They could be used for additional connection of the chassis with microphone cable screen, common for all four channels (such as 3M p/n 3644B/16 100SF). Assume that VIM554 requires connection of four microphones via the patch panel or terminal box with metal enclosure. Microphones power is supplied from the modules. The section "VIM554 - terminal box" uses the cable 3M p/n 3644B/16 100SF. This option of microphone connection is shown in the Figure 3-10. Then, after switching inside the box transferring to separate cables, they are disposed into microphones' installation sites (not shown in the figure).







Fig. 3-10: Connecting 4 microphones with the use of 3M p/n 3644B/16 100SF cable

Number of grounding contacts in audio connectors enables to use cables, which consist of 4 twisted pairs with individual screens, placed into additional common screen. In this case each screen can be grounded in two points (from the side of audio connector) in order to reduce stray inductance.

Decisions on methods of cable screen grounding are made on the case-by-case basis by developer of a system where VIM554 is applied.



#### Note

When connecting signal source to the module, the ground circuit should be carefully studied. Any "parasitic" ground loops should be avoided.

Consumption current of active microphones should not exceed 45 mA per channel otherwise an external power source has to be used. It should also be used if the power supply voltage of the used microphones deviates from the one with +12.0 V.

Power supply circuits of microphones are equipped with overload protection. No softwareaccessible protection actuation indicators are provided. Possible solution of this issue – audio stream analysis by an application program when microphone is activated.

If microphone is activated and there has been no signal, it is most likely that protection is actuated.

### 3.3.10 Module power supply

Module power is supplied from DC system power supply source with a voltage of +12 V  $\pm$  5 % (XP6 connector).

Consumption current at 50% recovery of audio and video channels does not exceed 800 mA (not including consumption of external microphones).



## **4 MODULE CONFIGURATIONS**

### 4.1 Installing the module into slot

The module is designed for installation into crates together with backplane occupying no more than 9 slots. One of them is a system slot and the rest 8 can be used for installation of peripheral modules.

When using the module make sure it is installed into peripheral slot.



While being installed into the system slot, VIM554 power should be switched off. In this case no indication modes are provided.

Some protection elements on module inputs are electrically connected to the chassis. Before operation, make sure the module is properly fixed in the crate by retention screws (see Fig. 3-2).



Module can be removed from the crate only when the system power source is OFF. Pressing the ejector button when the power supply is ON will lead to module's shutdown and hang-up of the operating system as a consequence. In this case failure indication mode will be activated (see Table 3-2, paragraph 8).

### 4.2 Configuration sequence

Module is configured before each working session.



#### Note

During configuration it should be noted that numbering of audio and video channels in module's software is different from the one used in this User Manual.

Sequence of configuring elements of audio and video path, which are external towards TW6869, is as follows:

Availability of mezzanine is determined;

- Type of video amplifiers is determined;
- Set volume controls to mute;
- Configuring operation mode of audio amplifiers with AGC circuit (switching gain ratio of additional step to "0 dB" position);



- Turn on microphone power supply, if necessary;
- Deactivate mute mode;
- Set the required volume level in audio channels;
- Configure operation modes of input video amplifiers.

After these steps, audio and/or video input procedure can be activated. For more detailed information on VIM554 configurations, please see the documents: "VIM554 demo program. User guides" and "VIM554. Description of function library".

### 4.3 Mezzanine availability

If mezzanine is installed (valid only for VIM554-02 modules), audio channels 1...4 and video channels 5...8 become available.

### 4.4 Operating modes of input video amplifiers

The module can simultaneously use two types of amplifiers:

- ADA4430-1;
- MAX7452.

Their control methods are different.

Possible operating modes of MAX7452 are specified in Table 4-1. The amplifiers can operate both with a fixed gain ratio (Ku = 1 or 2) and with activated AGC circuit.

Table 4-1: Operating modes of MAX7452 input amplifiers (with due account for AGC)

No	Control input "AGC Disable"	Control input "GAIN Set"	Amplifier output
1	0	0	AGC activated, Vout =1Vp-p fixed
2	0	1	AGC activated, Vout=2Vp-p fixed
3	1	0	AGC deactivated, Vout=Vin
4	1	1	AGC deactivated, Vout=2Vin

If AGC circuit is activated, with any signal level at its video input, the amplifier will try to set the 1 Vp-p or 2 Vp-p level at its output, depending on the state of GAIN Set control input (at output load of 150 Ohm). At video inputs of TW6869 the signal level will be half as much, since conforming resistors at amplifier's output and at TW6869 inputs generate divider. If the AGC is off, the amplifier will simply operate with a fixed gain ratio equal to 1 or 2, depending on the state of GAIN Set control input.

By default (right after power is on), in all the channels AGC Disable =1 and GAINSet =1, meaning that the amplifiers operate with the ratio of 2 and the AGC system is ON.



When changing operating modes of MAX7452 amplifiers, loss of synchronization with the loss of some frames are possible.

As to ADA4430-1, it always operates with Ku = 2, AGC system is missing.

The only control signal is Enable input. So before starting work you should turn on the amplifier by providing this input with enable level.

When supplying power, the ADA4430-1 amplifiers are switched off by default.

### 4.5 Operating mode of audio amplifiers with AGC circuit

When operating with active microphones, The "Att +20 dB" parameters should always be equal to zero (should be off). Before starting the work, this should be done in all the audio channels.



#### Attention!

For normal operation of AGC circuit, signal level at its input should not exceed 0.1 V (rootmean-square value). Otherwise, audio inputs of TW6869 will be rebooted, signal form will be deviated and sharp increase of nonlinear distortions will be detected.

The required deterioration of input signal is ensured by volume adjusters equipped with digital control.

### 4.6 Power supply of microphones

Power supply of the microphones is off by default. The microphones should be turned on one at a time, at the interval of 50 or more ms, and can be turned off simultaneously.



When microphones are activated, the volume control should be in the Mute mode.

### 4.7 Setting the required volume level in audio channels

Volume levels, or more precisely attenuation range of input audio signal, set by these adjusters, has nothing to do with the level of digitized signal at output of TW6869. Their purpose is to limit the signal level at amplifiers input with AGC circuit (see subsections 3.3.4 and 4.5). E.g. it is required to connect active microphone with maximum signal level of 1.5 V (root-mean-square value) at the expected level of acoustic pressure. Therefore, the required attenuation Att in this audio channel will be equal to:

Att = 
$$20 \cdot \log_{10} \left( \frac{1.5}{0.1} \right) = 23.5 \, dB$$

Now let's round off to 24 dB and initialize volume controls by this value.



If the input signals level is less or equal to 0.1 V, then set 0 db.

When module power supply is turned on, the mute mode will always be activated.



Volume controls should be programmed prior to the start of the working session, since during this process there could be short-term bursts (transition processes) on their outputs.

If the volume level is too high, this could lead to overload of audio inputs of TW6869 (see paragraph 4.5).

### 4.8 Indication

The front panel of the module is equipped with one (Status, VIM554-01) or two (Status 1 and Status 2, VIM554-02) LEDs. **Status 1** indicates the state of video channels **1...4** and audio channels **5...8** (connector **Audio 1**) and **Status 2** – the state of video channels **5...8** and audio channels **1...4** (connector **Audio 2**).

The suggested indication levels are specified in Table 3-1. It is possible to use the modes different from the ones suggested however in this case there is a chance that they could coincide with any fault indication mode from Table 3-2.



Note

Blue color for LEDs is inaccessible via software.

### 4.9 Number of simultaneously operating modules

Simultaneous operation up to four modules within the system is available.



Note

OS Linux does not support simultaneous recording of the sound with the sampling frequency more than 8 KHz, if the number of active channels is more than 8, regardless of the number of modules used.



## ANNEX A

Term	Meaning
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



## ANNEX B

## DISCLAIMER

This Disclaimer contains special operating conditions of Fastwel in the following areas: intellectual property, warranty policy, conditions of the order and delivery.

#### 1 INTELLECTUAL PRORETY

1.1 If any infraction, interference, improper use, illegitimate exploitation and/or violation of the industrial and/or intellectual property rights of any third party and/or property, exploitation during the use of Fastwel Embedded Module will take place – Fastwel does not guarantee to replace the materials, computer programs, procedures or equipment affected by the complaint and under no circumstances doesn't bear responsibility in any form for possible refusal in case of such a replacement.

1.2 Use of the Fastwel products as well as the objects of intellectual property containing in them, in the ways and for the purposes, not provided by the present user manual and datasheet isn't allowed without preliminary written approval of Fastwel.

1.3 Fastwel is not responsible for possible incidents and losses, related to the operation of end devices, in which the original Fastwel equipment is used.

#### 2 WARRANTY POLICY

2.1 When the detected flaws in an element can be corrected without decreasing the foreseen technical features and functionality for it, User may demand Fastwel the urgent correction of the failures in additionally agreed period and an increasing of the period of the guarantee of the element equal as the time elapsed from the formal request to repair the failures, until the receipt of the repaired element. All costs associated to the correction of failures, included those of assembly, dismantle, transport, tests, etc, if they exist, shall be prosecuted according the Warranty Policy of Fastwel.

#### 3 ORDER AND DELIVERY CONDITIONS

3.1 The general rule is that all Fastwel equipment prices are determined with due consideration of delivery under the EXW terms and conditions (Incoterms 2010). Delivery of the products under other terms and conditions should be preliminary agreed and stated in writing between the parties.

3.2 Unless otherwise expressly agreed with Fastwel, all the deliveries of Fastwel equipment will be carried out only after the official purchase order is obtained and provided that the ordered products have been prepaid in full. Other terms and conditions of cooperation should be made in writing.

3.3 Any delivery of Fastwel electronics is submitted with the right package in accordance with the current rules and standards in the Member States of the European Economic Area. The purchaser independently bears all risks regarding the compliance of package and marking of Fastwel products with legislation requirements being in effect at the place of purchased products destination (in the buyer's country). The specified condition excludes unequivocally any liability of Fastwel for possible non-compliance of package and marking of products with the requirements of legislation of the country of products destination.

3.4 In general, all components of the supply are properly protected with respect to freight, in order to avoid any damage to the supply, third parties, environmental damages or unrelated goods, as consequence of wrong packaging.

3.5 Each package unit is labeled on the exterior area with the indications of product's Part Number and Serial Number.

3.6 The support documents for the order should be made either in English or in Russian unless otherwise agreed between parties in writing.

3.7 Fastwel does not pay penalties and does not cover costs associated with delay in the delivery of the products caused by actions of the third parties, force-majeure etc. - Fastwel doesn't bear any responsibility for non-execution or inadequate execution of the obligations in a case when it is caused by actions of the third parties (for example producers or suppliers of accessories), force majeure etc.

3.8 Fastwel declares that independently and at any time without damage, it has an exclusive right to define and change functionality architecture, bill of materials of its products without any preliminary coordination and approvals of the third parties.

#### **4 OTHER CONDITIONS**

4.1 Fastwel has the obligation to respect the current Russian legislation (including, but not limited to environmental, labor, social laws) in each moment and to apply it to its embedded electronics considering all and each execution phase, that is to say, from the design until the commissioning and subsequent maintenance. In this regard Fastwel is not liable to the user or other persons in connection with possible changes of the company's rules (including, but not limited to warranty, ordering policy) caused by changes of the Russian legislation.

4.2 Unless otherwise expressly agreed in writing, Fastwel provides no training for

assembly\installation\adjustment\operation of its equipment.