



User Guide (EN)

PGC-1000 Grabber Card

Rev. 1.3.17

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01 About This Document

01.1 Classification of Warnings

The safety messages used here warn of dangers that can lead to personal injury or damage to property:



Indicates a dangerous, high-risk situation which, if not avoided, will lead to a fatal or serious injury.



Indicates a dangerous, medium-risk situation which, if not avoided, may lead to a fatal or serious injury.



Indicates a dangerous, low-risk situation which, if not avoided, may lead to a minor or moderate injury.

Notice

Indicates a situation which, if not avoided, can lead to material damage.

01.2 Presentation of Supporting Information



Contains additional supporting information.

02 General Safety Information

Carefully read the accompanying documentation for the product (*safety instructions* and this user guide) prior to commissioning. The plc2 Group accepts no liability for damage caused by improper handling, use other than for the intended purpose and non-compliance with safety precautions.

02.1 Requirements for Users and Obligations of the Operator

Failure to comply with the safety instructions may lead to the risk of damage to life and limb or property. The companies of the plc2 Group and its representatives accept no liability for any damage or injury caused by improper operation or improper use of the product. Only use the product if you have read and understood the information concerning safe operation and have the required qualifications and training for this product. If you have any questions about safe operation, please contact plc2: www.plc2.com.

02.1.1 General Occupational Safety

The product is only approved for the applications described in the technical documentation. When using and operating this product, all applicable regulations and laws must be observed.

02.2 Intended Use

Notice: damage to the electronics due to potential equalization

The cables' shield may be connected to the housing, the ground, or the ground for the product's power supply. If there are different ground potentials in the test setup, equalizing currents can flow between the products via the cables' shield.

Take account of different electric potentials in your test setup and take appropriate measures to prevent equalizing currents.

02.2.1 Area of Application of the Product

- The product is approved for use in the following areas: Personal computer.
- Do not operate the product in a wet or damp environment.
- Do not operate the product in potentially explosive atmospheres.

02.2.2 Requirements for the Technical Condition of the Product

The product is designed in accordance with state-of-the-art technology. Only operate the product and its accessories if they are in perfect working order. Shut down a damaged product immediately. Do not modify the product. Changes must only be implemented by PLC2.

02.2.3 Requirements for Operation

Only operate the product with the latest firmware. You can find information about updating the firmware in the Software User Guide. If the firmware update is not completed successfully, try it again. If a new firmware update is not possible and the product is not functional, send the product to the distributor.

02.2.4 Electrical Safety and Power Supply

Adhere to the connection and setting values (see chapter *Technical Data* in the Safety Advice document).

02.2.5 Power Supply

The power supply is ensured via the PC power supply unit. Make sure that the PC power supply unit can cover the maximum power requirements of the PGC-1000.

02.2.6 Approved Cables

- Only use PLC2 cables or other cables certified for the application.
- Route the cables such that they are protected against abrasion, damage, deformation and kinking.
- Do not place any objects on the cables.
- Do not use any damaged cables.
- The connector and connection must not be dirty.
- The connector and connection must be compatible.
- Correctly align the connector with the connection.
- Do not connect the connector and connection by force.

02.2.7 Requirements for the Installation Site

The product must only be removed from the ESD packaging and installed at a workplace protected against electrostatic discharge.

02.2.8 Wiring Requirements

Ensure that the cabling does not cause additional hazards (e.g. tripping hazards, strangulation, etc.).

02.2.9 Configuration Requirements

Ensure that the configuration does not result in the vehicle being moved to an unsafe state.

02.2.10 Ventilation Requirements

Ensure that there is sufficient air circulation for efficient heat exchange.

02.2.11 Transport

- Transport and store the product only in ESD packaging.
- Only transport the product individually.
- Remove all connected cables before transportation.
- Do not transport the product by the connected cables.

02.2.12 Maintenance

The product is maintenance-free.

02.2.13 Repair

If a repair is required, send the product to your distributor, or contact them directly through our website at www.plc2.com.

02.2.14 Cleaning

- Only clean the product when it is de-energized.
- Do not use compressed air to clean the fans.
- Make sure that no moisture enters the product.
- Carefully vacuum off dust particles and loose foreign bodies.

03 Product Description

This document contains hardware and software installation instructions for the PGC-1000 PCIe card in low-profile half-length format. The PGC-1000 is a high performance PCIe® card capable of transmitting up to 4 x 10 Gbit/s via QSFP+. The PGC-1000 is very well suited for recording data from high-end multi-camera systems in average PCs. Through the use of the PGC-1000, high costs for high-end multiprocessor PCs are avoided. The use of the PGC-1000 significantly reduces CPU load by pre-processing camera data on the PGC-1000's programmable hardware. The PC is provided with the pure image data via PCIe, which requires only a very low CPU load.

03.1 Features of the PGC-1000

The features of the PGC-1000 grabber card are listed below:

- UltraScale+ XCZU7EV FPGA
- 16 GB RAM DDR4 up to 2133 MT/s
- 1 Gbit/s Quad SPI flash memory for configuration
- QSFP+ interface that supports up to 4 x 10 Gbit/s
- 8-lane PCIe interface (Gen3 x8)
- Low power consumption via PCIe slot

03.2 Minimum Requirements for the PC System

Components	Requirements
Motherboard	PCIe 3.0-compliant with a slot that provides at least x8 lanes.*
Supply voltage/ power	Maximum 58 W according to PCIe specification. The PCIe 6-pin power connector is not needed and should not be connected.
Operating system	Windows 10, x86_64, version 2004 or newer. Ubuntu 20.04, x86_64, kernel 5.4 or newer.**
System memory	Minimum system requirements for the operating system used. At least 8 GB RAM.
Hard disk space	Minimum 2 GB for driver/application.
Licenses	No license is required for application development.

Table 1: minimum system requirements

* Tested motherboards:

ASUS Z390 Pro (Rev. 1.02), ASUS Prime 390-A (Rev. 1.02), MSI MPG Z590 Gaming Force (Ver. 2.1)

** Custom kernel with CMA is required

04 PGC-1000 Interfaces

The PGC-1000 grabber card is a PCIe card in low-profile half-length format, which can be installed in any CPU-based standard motherboard with at least one PCIe x8 slot.

The card provides the following interfaces:

- One PCIe x8 connector
- One QSFP+ interface
- Not for use: A PCIe 6-pin 12 V power connector.

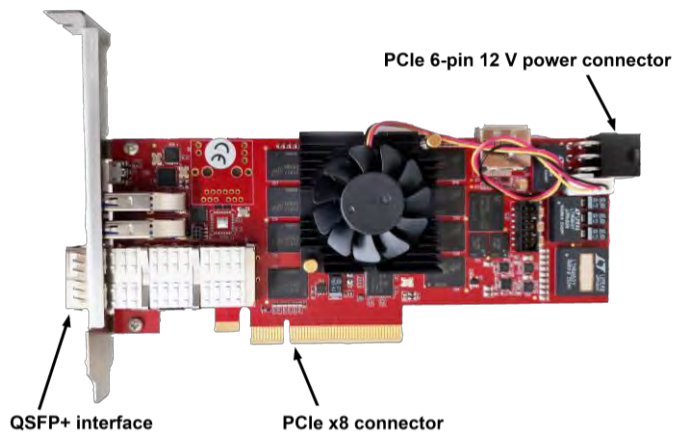


Figure 1: PGC-1000 Grabber Card

The pinout and mechanics of the PCIe power connector are shown in figure 2. It should be noted that this connector is listed only for the sake of providing a complete description. As indicated in chapter 01.2, the connector should not be connected.

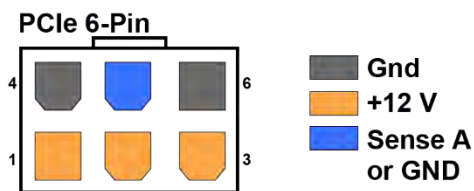


Figure 2: PCIe power connector pinout

Note

The use of the power connector is currently NOT intended for the product. The information regarding the power connector is only listed here for the sake of completeness.

04.1 QSFP+ Interface

Only use short-range QSFP+ transceivers with a maximum cable length of 30 m.

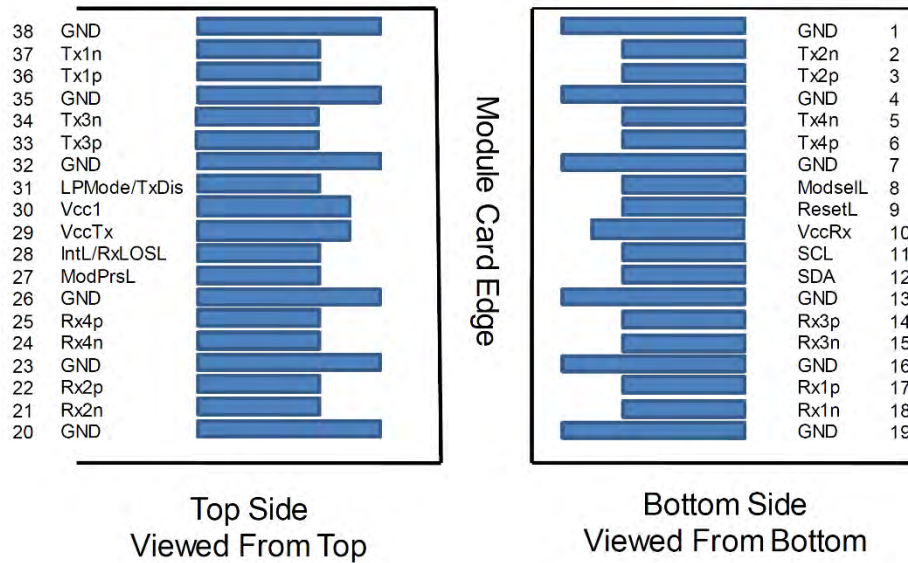


Figure 3: QSFP+ interface pin layout, copyright © 2018 SNIA

Pad	Logic	Symbol	Description	Plug Seq- uence	Note
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTL-I	ModSeL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10		VccRx	+3.3V Power Supply Receiver	2	2
11	LVCMOS-I/O	SCL	Two-wire interface clock	3	
12	LVCMOS-I/O	SDA	Two-wire interface data	3	
13		GND	Ground	1	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3	
15	CML-O	Rx3n	Receiver Inverted Data Output	3	
16		GND	Ground	1	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3	
18	CML-O	Rx1n	Receiver Inverted Data Output	3	
19		GND	Ground	1	1
20		GND	Ground	1	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3	
23		GND	Ground	1	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	
26		GND	Ground	1	1
27	LVTTL-O	ModPrsL	Module Present	3	
28	LVTTL-O	IntL/RxLOSL	Interrupt. Optionally configurable as RxLOSL via the management interface (SFF-8636).	3	
29		VccTx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTL-I	LPMoDe/TxDiS	Low Power Mode. Optionally configurable as TxDis via the management interface (SFF-8636).	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	1

Note 1: GND is the symbol for signal and supply (power) common for the module. All are common within the module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

Note 2: VccRx, Vcc1 and VccTx are applied concurrently and may be internally connected within the module in any combination. Vcc contacts in SFF-8662 and SFF-8672 each have a steady state current rating of 1 A.

Figure 4: function of the different pins of the QSFP+ interface, copyright © 2018 SNIA

05 PGC-1000 Installation Instructions

Take basic safety precautions to avoid the risk of fire, electric shock or injury.

05.1 Safety Instructions

Safety information and ESD notes

Adhere to the following instructions to ensure your personal safety and the safety of your equipment.

Notice

Always wear an ESD wrist strap or a comparable form of ESD protection when using the hardware.

- Wear an ESD wrist strap and make sure that the ESD wrist strap is in contact with your skin. Connect the end of the ESD wrist strap to an unpainted metal surface of the housing.
- Avoid letting your clothing come into contact with the card, as the ESD wrist strap can only protect the card from ESD damage if the card is touched with an (exposed) part of the body.
- Only touch the slot bracket or edges of the card. Avoid touching the board or the connectors on the board.
- The product must only be removed from the ESD packaging and installed at a workplace protected against electrostatic discharge.
- Connect only certified QSFP+ modules and cables and follow the safety instructions of the QSFP+ modules and cables. (see also chapter 04.1)

05.2 Installation of the PGC-1000 Grabber Card

The following procedure describes the installation of the PGC-1000 PCIe card. For more information, read the PC documentation.

- Shut down the PC and disconnect the power connector of the PC.
- Open the PC by removing the housing or part of the housing.
- Remove the slot bracket of the housing at the position where the PGC-1000 card is to be installed.
- Additionally, remove the adjacent slot bracket if necessary.
- Insert the PGC-1000 grabber card into a PCIe x8 (or higher) slot on the motherboard.
- Make sure that the PGC-1000 grabber card is inserted correctly and screw the card in tight.
- Close the PC housing.
- Connect the power connector of the PC and switch on the PC.

Please refer to the detailed description in the associated document Safety Advice, chapter *Assembly*.

05.3 Wiring

Note

Ensure that the test setup is EMC-compliant. A test setup with simultaneously shielded and unshielded components can lead to an impairment of the signal quality and is not recommended by plc2 Design GmbH.

05.4 Checking the Function of the PGC-1000

Install the drivers according to the Software User Guide and make sure that the PGC-1000 is displayed in the Windows Device Manager.

 **Note**

The product is capable of forwarding data even in the event of an error. Use the monitoring capabilities and error indicators of the product and of the transmitted data to detect erroneous data. Further instructions can be found in the software user guide.

06 Appendix

06.1 Appendix: Abbreviations

Abbreviations	Expanded Form
BD	Buffer Descriptor
DDR	Double Data Rate
ETH	Ethernet
FPGA	Field Programmable Gate Array
FW	Firmware
GigE	Gigabit Ethernet
IP	Internet Protocol
MPSoC	Multi-Processor System on Chip
NIC	Network Interface Card
PGC	PLC2 Grabber Card
QSFP+	Quad Small Form Factor Pluggable
SW	Software

Table 2: abbreviations

06.2 Appendix: References

Images	Sources
Module pad layout	QSFP+ 4X Hardware and Electrical Specification, page 14 https://www.snia.org/technology-communities/sff/specifications (as of 11/30/2022)
Pad function definition	QSFP+ 4X Hardware and Electrical Specification, page 15 https://www.snia.org/technology-communities/sff/specifications (as of 11/30/2022)

Table 3: references

07 General Data

07.1 Technical Data

07.1.1 Ambient Conditions

Operating temperature range	0 °C to +45 °C +32 °F to +113 °F
Storage temperature range (without packaging)	-40 °C to +85 °C -40 °F to +185 °F
Max. relative humidity (non-condensing)	90 %
Max. altitude	2000 m/6562 ft
Degree of contamination (IEC 60664-1, IEC 61010-1)	2
Degree of protection	IP00
Table 4: ambient conditions	

07.1.2 Mechanical Data

Dimensions (H x W x D)	185 x 123 x 24 mm 7.28 x 4.84 x 0.94 in
Weight	0.14 kg/0.31 lb
Interface	PCIe 3.0 x8
Table 5: mechanical data	

07.1.3 Electrical Data

Operating voltage range	12 V DC, 3 A max (via PCIe interface) 3.3 V DC, 11.75 A max (via PCIe interface)
Max. power consumption	58 W
Overvoltage category (IEC 60664-1)	I
Table 6: electrical data	

07.2 Product Conformity

07.2.1 European Union

The EU Directive 2011/65/EU limits the use of certain dangerous materials for electric and electronic devices (RoHS conformity).

This product does not contain any of the prohibited substances listed in EU Directive 2011/65/EU and does not exceed the maximum authorized concentrations specified. There are currently no equivalent alternative substances for individual electronic components used in our products. We are therefore making use of exemptions 7A, 7C-I and 6C (for accessory cables) in Annex III of this Directive. plc2 Design GmbH confirms that the product corresponds to this directive that is applicable in the European Union.

07.2.2 CE Conformity

With the CE marking attached to the product or its packaging, plc2 Design GmbH confirms that the product corresponds to the applicable product-specific directives of the European Union.



Figure 5: CE label

07.2.3 UKCA Conformity

With the UKCA marking attached to the product or its packaging, plc2 Design GmbH confirms that the product meets the applicable product-specific standards and directives of Great Britain.



Figure 6: UKCA label

07.2.4 China RoHS

With the China RoHS marking attached to the product or its packaging, plc2 Design GmbH confirms that the product meets the guidelines of the "China RoHS" (Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation) applicable in the People's Republic of China.



Figure 7: China RoHS label

07.3 Product Return and Recycling

The European Union (EU) issued the Directive for Waste Electrical and Electronic Equipment - WEEE to ensure the setup of systems for collecting, treating, and recycling electronic waste in all countries of the EU. This ensures that the devices are recycled in a resource-friendly way that does not represent any risk to personal health and the environment.



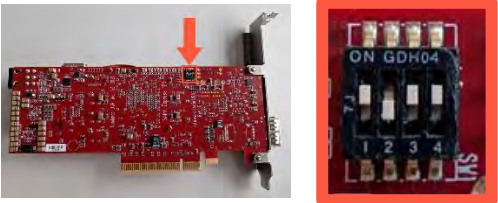
Figure 8: WEEE label

The WEEE label (see figure 8) on the product or its packaging indicates that the product must not be disposed of together with regular waste. The user is obligated to separately collect old devices and provide them to the WEEE return system for recycling. The WEEE directive applies to all plc2 Design devices, but not to external cables or batteries. *For more information on the recycling program, contact your distributor or visit our website at www.plc2.com.*

07.4 Use of Open Source Software

The product uses open source software (OSS). This software is installed in the product at the time of delivery and does not have to be installed or updated by the user. Reference must be made to the use of the software in order to fulfill OSS licensing terms. More information can be found in the *OSS Attribution* document.

08 Self-Help

Problem description	Troubleshooting questions
<p>PGC-1000 is not visible in Windows Device Manager as "PGC1K Device" or as "Ethernet Controller".</p>	<p>Set the DIP switches on the PGC-1000 PCIe card as shown in the image below.</p> 
<p>PGC-1000 is visible in Windows Device Manager as "Ethernet Controller", but not as "PGC1K Device".</p>	<p>Install the PGC-1000 driver.</p>
<p>The console window shows "Waiting for cameras" after launching the application (PGC-1000 does not receive data from the remote network node).</p>	<p>Is the QSFP+ cable correctly plugged into the QSFP+ retainer of the PGC-1000? Are the SFP connectors correctly plugged into the remote network node? Are the physical 1:1 connections and mappings established correctly (for example, is interface 1 of the PGC-1000 connected to interface 1 of the remote network node)? Is the remote network node actually sending data?</p>
<p>PGC-1000 only captures data incompletely or with limited bandwidth.</p>	<p>Was the PGC-1000 inserted into a PCIe slot with at least 8 lanes as required and not accidentally into a 4x, 2x or 1x lanes slot? Did the PGC-1000 and the PC actually broker 8 PCIe lanes?</p>
<p>Table 7: self-help troubleshooting and solutions</p>	

09 Contact Information

Headquarters:

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Technical support

Please contact the distributor or get in touch with us directly via our website www.plc2.com.

Shipment and packaging

Please contact the distributor or get in touch with us directly via our website www.plc2.com.

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