COASTIPC
coastipc.com | 866-412-6278 | info@coastipc.com

Neousys Technology Inc.

PCIe-NPL54

User Manual

Revision 1.0

Rev080825

Table of Contents

Legal Information

All Neousys Technology Inc. products shall be subject to the latest Standard Warranty Policy.

Neousys Technology Inc. may modify, update or upgrade the software, firmware or any accompanying user documentation without prior notice. Neousys Technology Inc. will provide access to these new software, firmware or documentation releases from download sections of our website or through our service partners.

Before installing any software, applications or components provided by a third party, customer should ensure that they are compatible and interoperable with Neousys Technology Inc. product by checking in advance with Neousys Technology Inc.. Customer is solely responsible for ensuring the compatibility and interoperability of the third party's products. Customer is further solely responsible for ensuring its systems, software, and data are adequately backed up as a precaution against possible failures, alternation, or loss.

For questions in regards to hardware/ software compatibility, customers should contact Neousys Technology Inc. sales representative or technical support.

To the extent permitted by applicable laws, Neousys Technology Inc. shall NOT be responsible for any interoperability or compatibility issues that may arise when (1) products, software, or options not certified and supported; (2) configurations not certified and supported are used; (3) parts intended for one system is installed in another system of different make or model.

Contact Information

Headquarters

(Taipei, Taiwan)

Neousys Technology Inc.

15F, No.868-3, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 23586, Taiwan

Tel: +886-2-2223-6182 Fax: +886-2-2223-6183 Email, Website

Americas

(Illinois, USA)

Neousys Technology America Inc.

3384 Commercial Avenue, Northbrook, IL 60062, USA

Tel: +1-847-656-3298 Email, Website

China

Neousys Technology (China) Ltd.

Room 612, Building 32, Guiping Road 680, Shanghai

Tel: +86-2161155366 Email, Website

Notices

Disclaimer This manual is intended to be used as an informative guide only and is subject to change without prior notice. It does not represent commitment from Neousys Technology Inc. Neousys Technology Inc. shall not be liable for any direct, indirect, special, incidental, or consequential damages arising from the use of the product or documentation, nor for any infringement on third party rights.

FCC Conformity	This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CE Conformity	The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

Safety Precautions

Read these instructions carefully before you install, operate, or transport the system.

- Install the system or DIN rail associated with, at a sturdy location
- Install the power socket outlet near the system where it is easily accessible
- Secure each system module(s) using its retaining screws
- Place power cords and other connection cables away from foot traffic.
- Do not place items over power cords and make sure they do not rest against data cables
- Shutdown, disconnect all cables from the system and ground yourself before touching internal modules
- Ensure that the correct power range is being used before powering the device
- Should a module fail, arrange for a replacement as soon as possible to minimize down-time
- If the system is not going to be used for a long time, disconnect it from mains (power socket) to avoid transient over-voltage

Service and Maintenance

- ONLY qualified personnel should service the system
- Shutdown the system, disconnect the power cord and all other connections before servicing the system
- When replacing/ installing additional components (expansion card, memory module, etc.), insert them as gently as possible while assuring proper connector engagement

ESD Precautions

- Handle add-on module, motherboard by their retention screws or the module's frame/ heat sink.
- Avoid touching the PCB circuit board or add-on module connector pins
- Use a grounded wrist strap and an anti-static work pad to discharge static electricity when installing or maintaining the system
- Avoid dust, debris, carpets, plastic, vinyl and styrofoam in your work area.
- Do not remove any module or component from its anti-static bag before installation

About This Manual

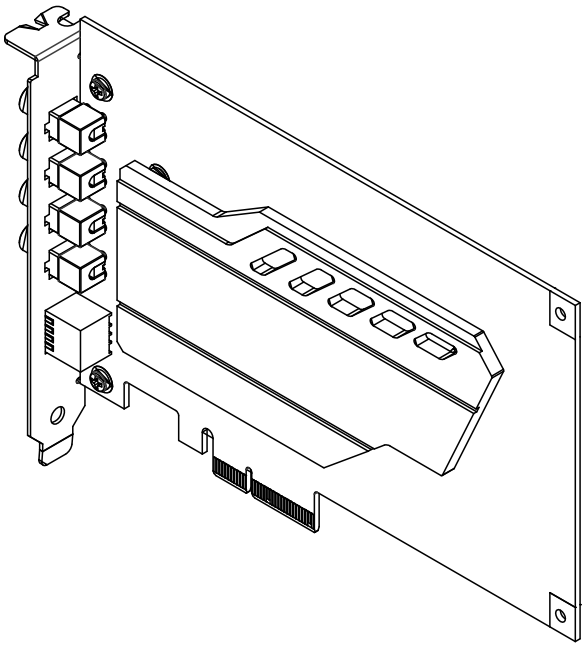
This manual introduces and describes how to setup/ install Neousys Technology PCIe-NPL54, a cost-effective, fanless, wide-temperature, 4-channel GMSL2 frame grabber designed to meet the growing demand for seamless integration of automotive GMSL2 cameras with x86 systems

Revision History

Version	Date	Description
1.0	Jul. 2025	Initial release

1 Introduction

The PCIe-NPL54 is a cost-effective, fanless, wide-temperature, 4-channel GMSL2 frame grabber designed to meet the growing demand for seamless integration of automotive GMSL2 cameras with x86 systems. As edge AI applications—such as autonomous driving, ADAS, and outdoor AMRs—increasingly rely on robust sensor inputs, the PCIe-NPL54 can deliver exceptional performance, and enable reliable camera integration in demanding environments.



The PCIe-NPL54 is driver-ready for selected automotive GMSL2 cameras, which are a preferred choice for edge AI applications due to their superior performance in outdoor settings. Even under dynamic lighting conditions, these cameras deliver high-quality images with 120–140 dB HDR and LED Flicker Mitigation (LFM), while the ISP on the camera side fine-tunes image settings within a single frame through auto exposure, auto gain control, and auto white balance. Automotive GMSL2 cameras also offer deployment advantages, including a compact footprint and simplified cabling—using a single coaxial cable for both power and signal—secured with FAKRA connectors for robust connectivity. Additionally, their IP67 and IP69K ratings ensure reliable operation in dusty and wet environments.

Built with advanced FPGA technology, the PCIe-NPL54 offers a cost-effective solution with minimal power consumption: under 20W while streaming from four 5MP GMSL2 cameras at 30 FPS. Its low power design enables fanless operation at temperatures up to 70°C. The card’s single-slot width and PCIe Gen2 x4 interface ensure compatibility with rugged, space-constrained edge AI platforms. Its integrated power design draws all necessary power from the PCIe connector, eliminating the need for an external 6-pin power connector and streamlining installation.

Engineered for precision and scalability, the PCIe-NPL54 features a GPS PPS input for frame synchronization across multiple PCIe-NPL54 units and LiDAR systems, ensuring accurate data alignment for sensor fusion. A GPS PPS output mirrors the input, enabling daisy-chaining of multiple units from a single GPS PPS source. Additionally, the PCIe-NPL54 features an auto

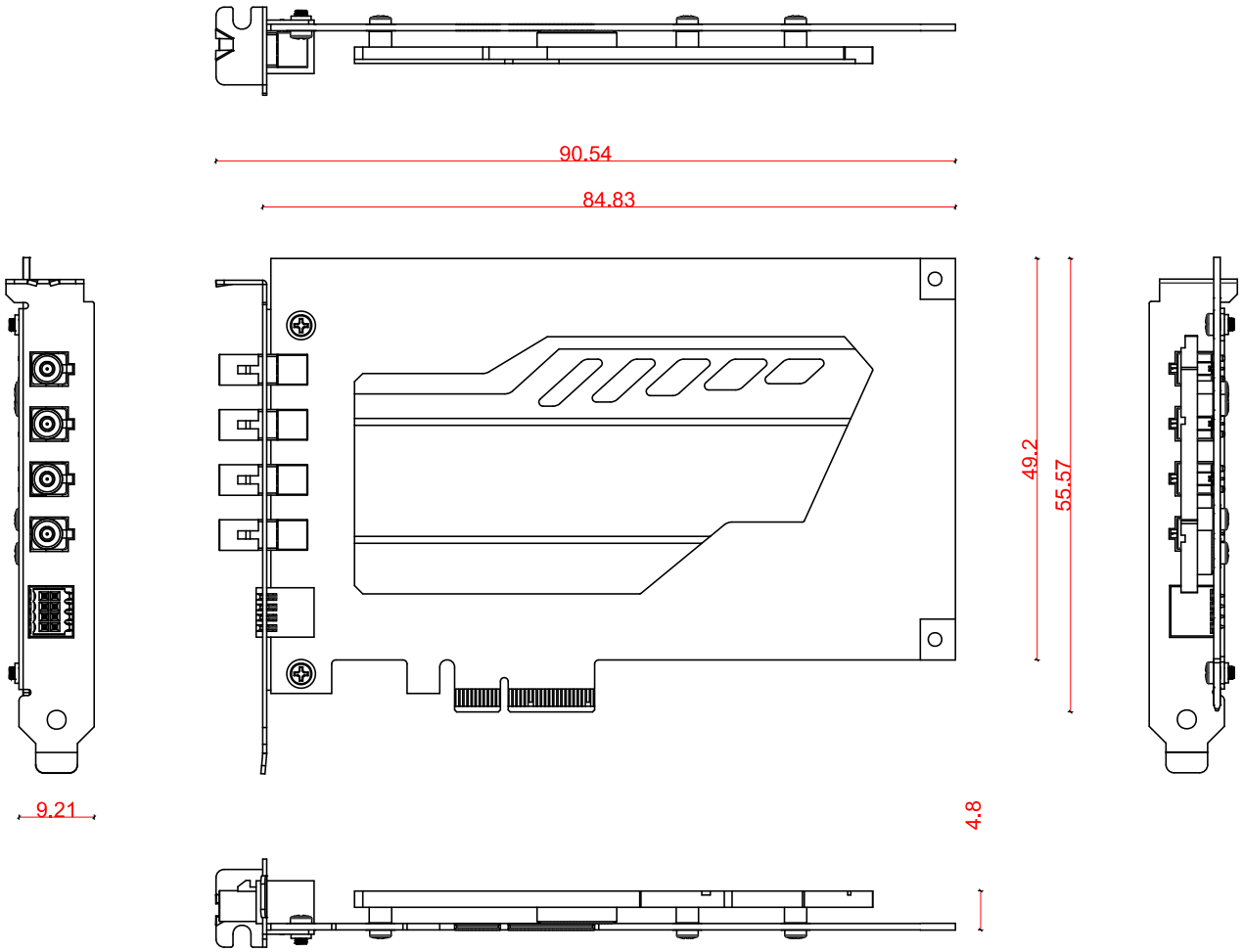
recovery mechanism that automatically restores GMSL2 camera streaming after unexpected disconnections caused by electrostatic discharge (ESD).

The PCIe-NPL54 is a cutting-edge GMSL2 frame grabber designed to empower edge AI applications that rely on x86-based systems, where native MIPI interfaces are typically scarce on Intel and AMD platforms. It redefines the GMSL2 frame grabber category by combining affordability, efficiency, and advanced functionality—making it ideal for both automotive and industrial environments.

1.1 PCIe-NPL54 Specification

Interface	x4, Gen2 PCI Express
GMSL2 Camera Support	4x GMSL2 FAKRA Z connectors, supporting multiple camera configurations, including but not limited to: Configuration A: 2x 8MP + 1x 3MP @ 30 FPS Configuration B: 4x 5MP @ 30 FPS Configuration C: 4x 3MP @ 30 FPS Configuration D: 4x 2MP @ 60 FPS Configuration E: 4x 2MP @ 30 FPS
GPS PPS	1x isolated GPS PPS input 1x GPS PPS output (follows the GPS PPS input; designed for GPS PPS signal daisy-chaining)
Serial Port	1x RS-232 (connected to onboard MCU)
Dimension	167.7 mm (W) x 111 mm (H)
Weight	183 g
Storage Temperature	-40°C to 85°C
Operating Temperature	-40°C to 70°C fanless operation
Humidity	10% to 90%, non-condensing
EMC	CE/ FCC Class A, according to EN 55032 & EN 55035

1.2 Dimension



NOTE

All measurements are in millimeters (mm).

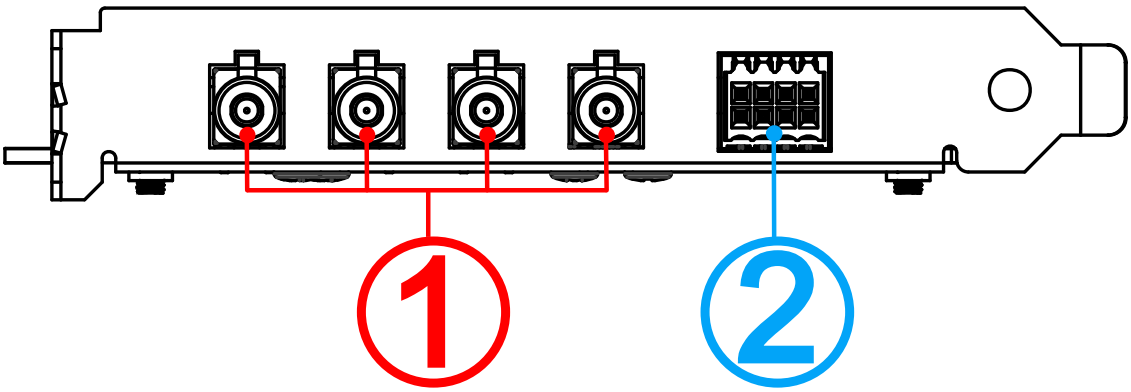
2 Setting Up Your PCIe-NPL54

2.1 Unpacking Your PCIe-NPL54

Upon receiving the PCIe-NPL54, please check immediately if the package contains all the items listed in the following table. If any item is missing or damaged, please contact your local dealer or Neousys Technology.

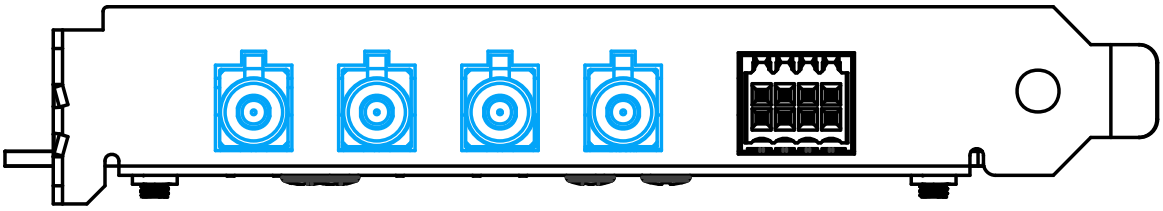
Item	Description	Qty
1	PCIe-NPL54	1
2	Push-in 8-pole (2x4) terminal block	1
3	Standoff pack (for multiple card installation)	1
4	Poron for installation inside a Cassette module	1
5	Screw pack	1

2.2 Panel Side Connectivity



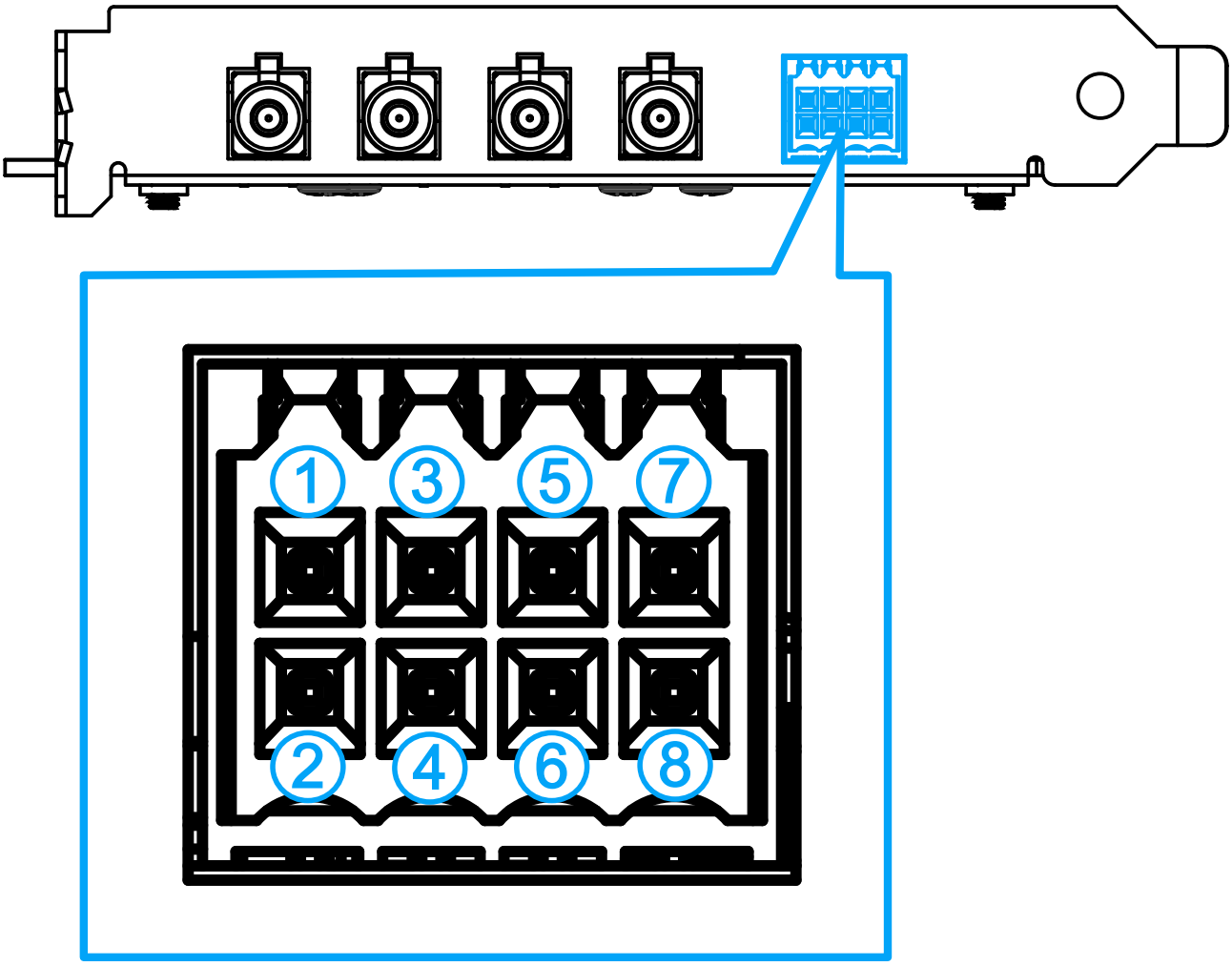
No.	Item	Description
1.	FAKRA Z connectors	There are four FAKRA Z connectors on the panel side of PCIe-NPL54 designed to connect to GMSL2 cameras.
2.	8-pin terminal block	The 8-pin terminal includes isolated signals for GPS PPS input, GPS PPS output, and a RS-232 COM port to the onboard MCU (for debugging purposes).

2.2.1 FAKRA Z Connector



Fachkreis Automobil (FAKRA) connector is a German standard for SubMiniature version B based automotive-grade connectors. There are four FAKRA Z connectors on the panel side of PCIe-NPL54 to connect to automotive GMSL2 cameras.

2.2.2 8-pin Terminal Block

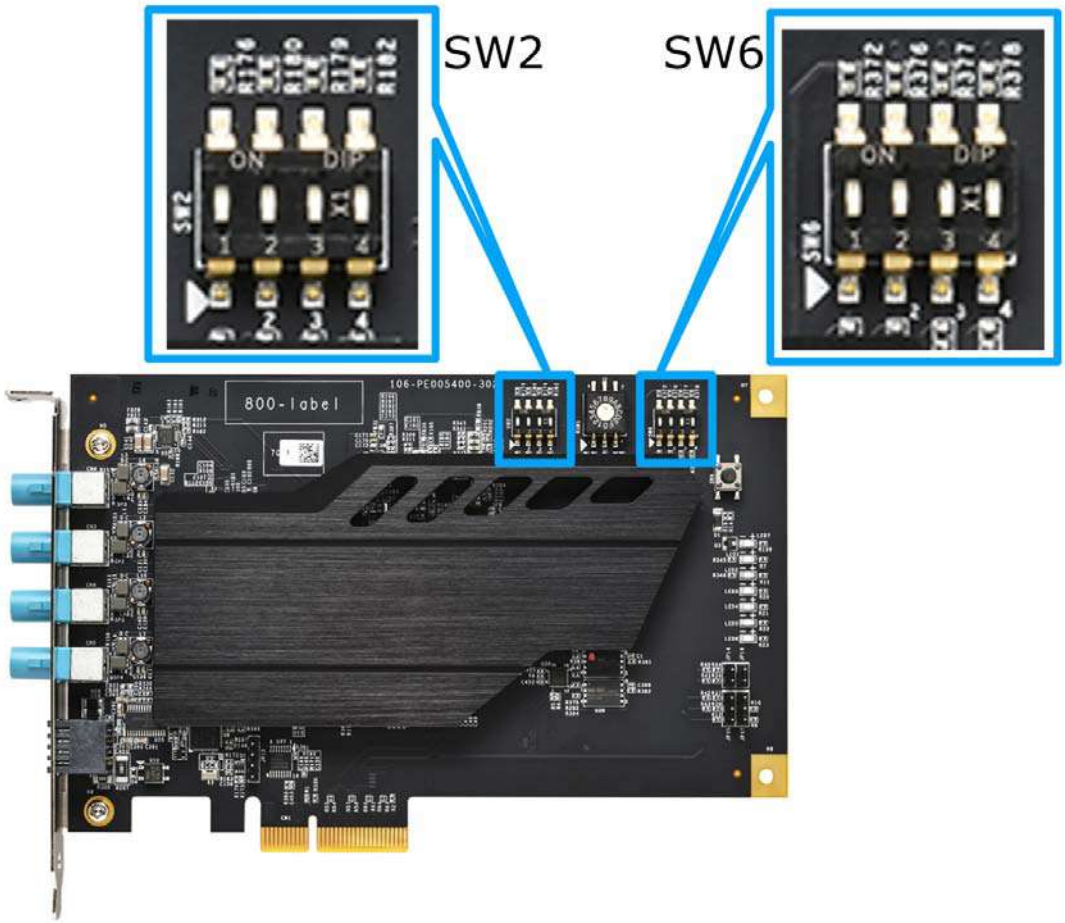


The terminal includes isolated signals for GPS PPS input, and a RS-232 COM port. For pin definitions, please refer to the following table:

Pin	Description	Pin	Description
1	MCU_TX	5	PPS_IN_H
2	MCU_RX	6	PPS_IN_L
3	GND	7	PPS_OUT_H
4	GND	8	PPS_OUT_L

2.3 SW2 and SW6 DIP Switch

The DIP switches SW2 and SW6 enable different frame sync modes, including freerun as well as 20 FPS, 30 FPS, and 60 FPS synchronization. An additional feature, phase shift, allows you to introduce a delay between frame sync signals for each camera (by default, the card is shipped with a 25% phase shift configuration).



Please note that the DIP switches (SW2 and SW6) only affect the frame sync signal generated by the onboard MCU. To properly use the camera's frame sync mode, please also ensure the firmware compatibility with CMOS characteristics of each camera.

For detailed usage of SW2 and SW6, please refer to the following tables:

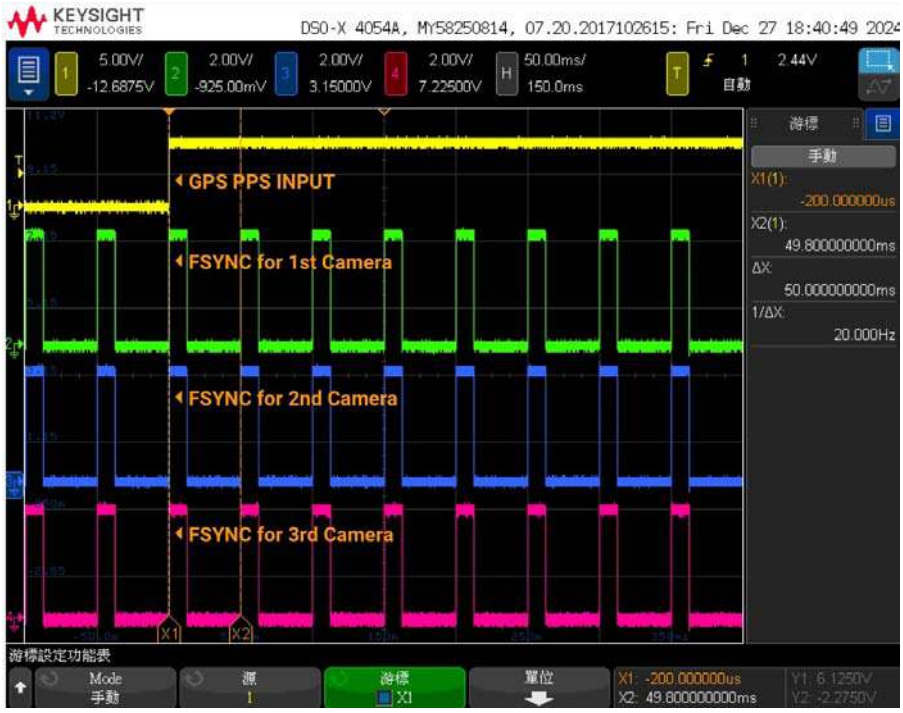
SW2 DIP Switch

Switch / Position	#1	#2	#3	#4
On	60 FPS framesync	20 FPS framesync	Framesync for each camera aligned with 25% phase shift	PPS input and frame sync: aligned
Off	Framesync depends on #2 setting	30 FPS framesync	Framesync for each camera aligned with 0% phase shift	PPS input and frame sync: not aligned

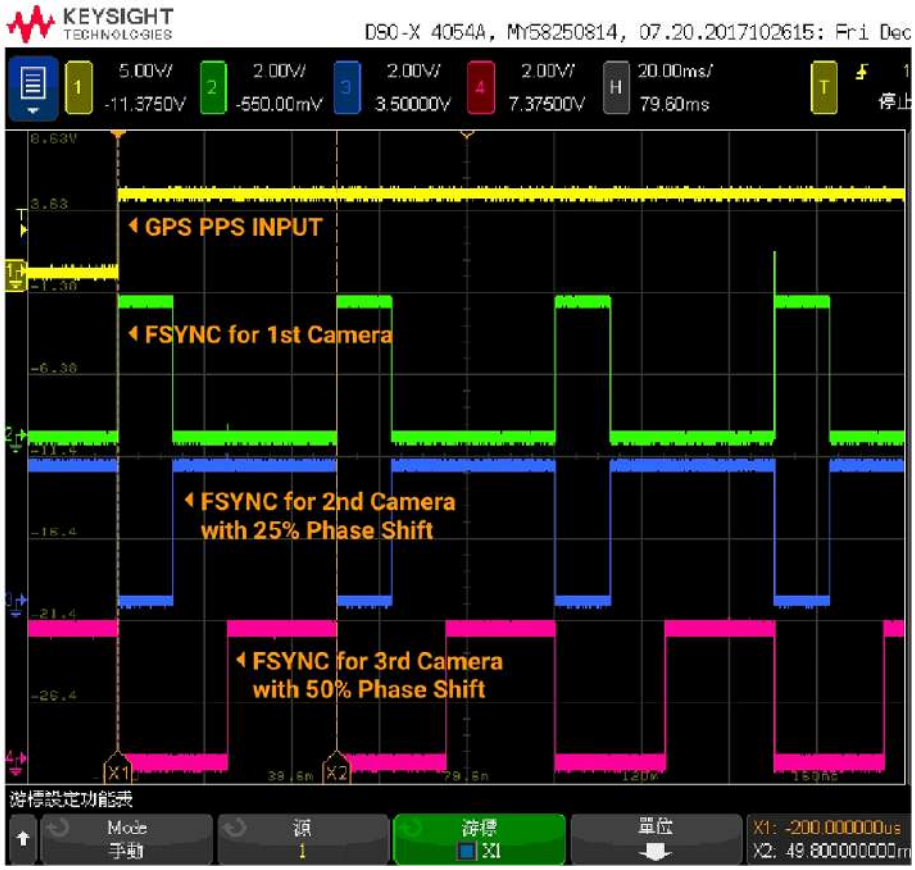
SW6 DIP Switch

Switch / Position	#1	#2	#3	#4
On	RSVD	Freerun (overrides SW2#1 and SW2#2)	RSVD	RSVD
Off	Default	Frame sync (depends on SW2#1, SW2#2)	RSVD	Default

The frame sync signal is generated by an onboard MCU, which ensures a stable synchronization frequency with minimal jitter, regardless of OS load.

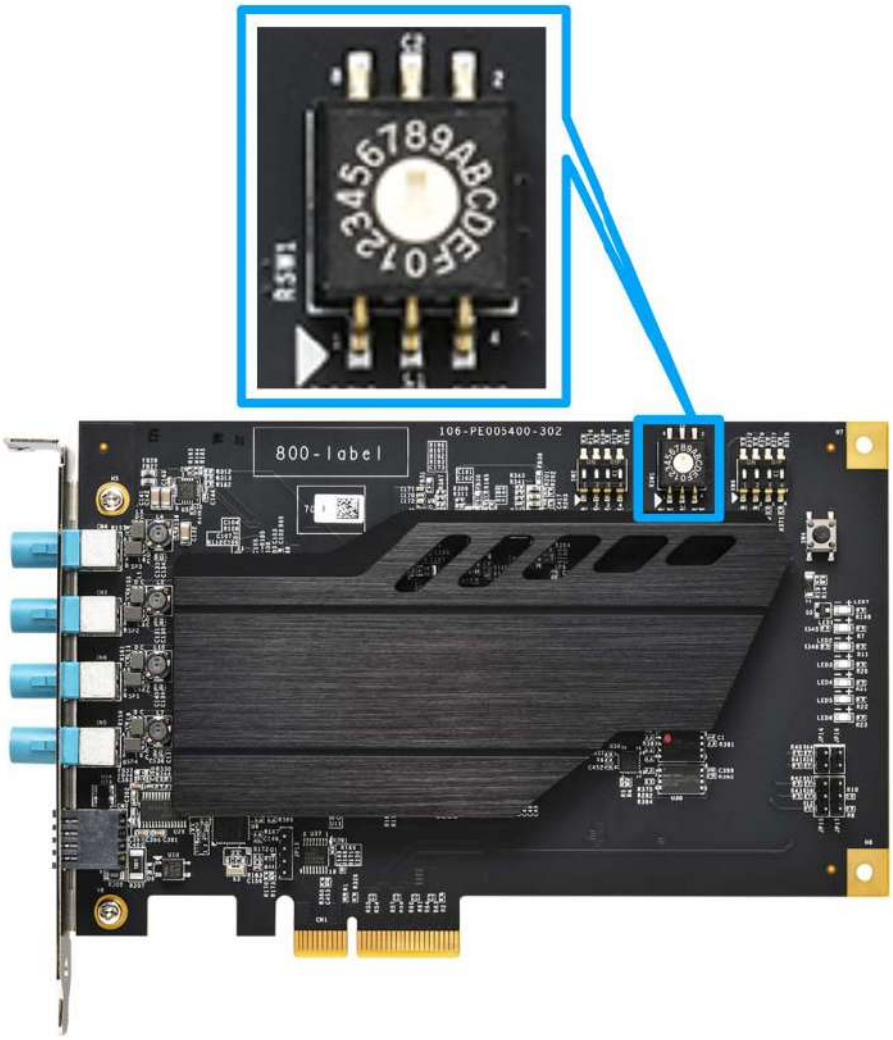


Another advanced feature is PPS alignment, which uses the GPS PPS input from the 8-pin terminal block to calibrate the rising edge of the frame sync signal with the rising edge of the GPS PPS signal.



2.4 RSW1 Rotary Switch

The RSW1 rotary switch controls the GMSL2 initialization protocol for different camera models. The following table shows the RSW1 rotary switch settings mapped to specific camera models, along with their supported frame sync modes.



Rotary position		Frame sync FPS
0	4x AC-IMX390	Fixed 30 FPS
1	4x AC-ISX031	20 FPS / 30 FPS
2	4x AC-IMX490	20 FPS / 30 FPS
3	Reserved	-
4	4x AC-AR0233 OR 4x AC-AR0233-60FPS	20 FPS / 30 FPS OR 20 FPS / 30 FPS / 60 FPS
5	4x SG3S-ISX031C-GMSL2F-Hxxx (3MP/ MAX96717/	20 FPS / 30 FPS

	No EBD)	
6	Reserved	-
7	Reserved	-
8	4x TierIV C1	20 FPS / 30 FPS
9	Reserved	-
10	Due to bandwidth limitations, rotary switch No. 10 supports either: 2x 8MP + 1x 3MP or 1x 8MP + 2x 3MP A fixed port-to-camera mapping is also defined: **Ports 0 and 1:** 8MP **Ports 2 and 3:** 3MP The 8MP camera model is **Sensing World SG8S-AR0820C-5300-G2A-Hxxx**. The 3MP camera model is **Sensing World SG3S-ISX031C-GMSL2F-Hxxx**, which uses the **MAX96717** GMSL2 serializer instead of the **MAX9295**.	20 FPS / 30 FPS
11	Reserved (for upcoming 3D camera)	-
12	Reserved	-
13	Reserved	-
14	4x STURDeCAM31	30FPS (fixed)
15	Reserved (for framesync only. No I2C mode)	-

 NOTE

Due to camera characteristics, using STURDeCAM31 with PCIe-NPL54 results in a different mapping configuration

NPL54 Freerun → e-con ISX031 *Master Mode*, 30 FPS

NPL54 60 FPS Framesync → e-con ISX031 *Master Mode*, 60 FPS

NPL54 30 FPS Framesync → e-con ISX031 *Trigger Mode*, 30 FPS

NPL54 20 FPS Framesync → e-con ISX031 *Trigger Mode*, 30 FPS

3 System Installation

Before you install PCIe-NPL54 into the host computer, it is recommended that you configure the DIP/ rotary switches to suit your application.

Once you have set up the DIP/ rotary switches, your PCIe-NPL54 is ready to be installed into the host computer system. Please refer to the following installation procedures.

Before disassembling the system enclosure and installing the card, please read the following instructions:

- **DO NOT** take the card out of the anti-static until you are ready to install it into the system.
- It is recommended that only qualified service personnel should install and service this product to avoid injury or damage to the system.
- Please observe all ESD procedures at all times to avoid damaging the equipment.
- Before disassembling your system, please make sure the system has powered off, all cables and antennae (power, video, data, etc.) are disconnected.
- Place the system on a flat and sturdy surface (remove from mounts or out of server cabinets) before proceeding with the installation/ replacement procedure.

 NOTE

Please ensure that the solder side component height of the subsequent PCIe card (on the PCIe-NPL54 fan side) must not exceed the PCIe standards of 2.67mm. It is preferrable to maintain a height below 2.3mm to avoid making contact with PCIe-NPL54's heatsink fan.

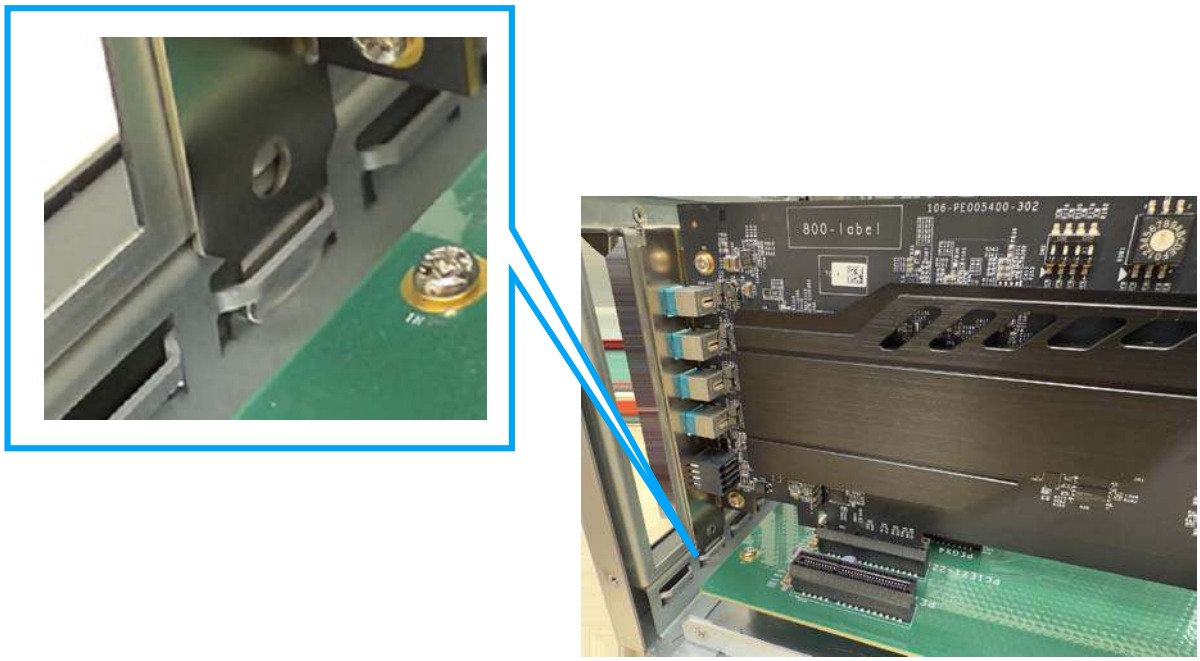
3.1 Installing PCIe-NPL54 into the Host Computer

To install the PCIe-NPL54 into the host computer, please refer to the following instructions:

1. Save and close all work in progress on the host computer.
2. Power off the system and unplug the power cable to the host computer you wish to install to.
3. Please refer to the host computer's user manual and disassemble the chassis (side panel) of the host computer you wish to install the PCIe-NPL54 into.
4. Locate the x4 PCIe slot or a spare and compatible x16/ x8 PCIe slot.
5. Align and insert PCIe-NPL54's gold finger into the PCIe slot.

Align with PCIe slot

Insert gold fingers into PCIe slot



Make sure the card's panel is properly inserted into the enclosure hinge

6. Secure the card to the chassis with a screw.

7. Please refer to the host computer’s user manual and reinstall the system’s chassis (panel) to complete the card’s installation process.

4 PCIe-NPL54 Host Configuration

The PCIe-NPL54 is Neousys' cost-effective, low-latency, FPGA-based GMSL2 frame grabber card designed for edge AI and robotic vision systems. It connects via a PCIe Gen2 x4 slot and supports multi-camera setups through GMSL2 interfaces. A companion FPGA demo and driver package simplifies initial integration. Setup involves installing the drivers, preparing the environment using the provided scripts, and launching data capture with tools such as ffplay or GStreamer, as demonstrated in the GitBook. This streamlined process enables fast deployment and reliable data streaming.

For details, please refer to this link.