Swiss army knife
FOR ENGINEERS
Replace your LAB INSTRUMENTS

One open-source platform that will replace bulky and expensive instruments? Meet Red Pitaya, and step on this revolutionary road!

And many more!
Great minds in different segments
TRUST RED PITAYA PRODUCTS

1. Industry
Companies in the automotive, aerospace, telecommunications and medical fields use Red Pitaya as a reliable OEM component for a variety of RF applications.

“We did some tests with the SIGNALlab 250-12. I have to say the device is surprisingly good: very low noise and high stability.”
Erik Winkelmann - Supervisor Monitoring Systems at HIGHVOLT

2. Academia
Red Pitaya helps professors teach more efficiently and effectively, and students learn with greater ease. Learning FPGA programming and the basics of electronics is now more intuitive and affordable than ever.

“Red Pitayas in the classroom will offer university students an introduction to not only a wide variety of scientific and analytical instruments, but the electronics design, DSP (digital signal processing), FPGA and basic programming logic which is at the heart of many fields today”.
Christoph Crosepet - professor at Brown University

3. Research
Red Pitaya is an essential component of many scientific research projects in the fields of physics, communication, materials and bioscience. Use Red Pitaya to speed up your experimental setup and get faster results.

“Fantastic little board that puts capabilities which were previously the reserve of well-funded labs into the hands of hobbyists, makers, classrooms and professional engineers with modest budgets.”
Andrew Back - Open-source and technical communities consulting

4. Radio amateurs & makers
Red Pitaya provides a great price/performance solution to build your own SDR transceiver or other DIY projects.

“Red Pitaya is exactly what I have been looking for: having one of the latest FPGAs combined with fast and broad AD - and DA - converters attached to that chip.”
Ulrich Hebel - Radio Communications System Engineer
Applications for your RED PITAYA

All the applications are web-based, FREE of charge and available when purchasing a board.

Oscilloscope & Signal generator

Spectrum analyzer

LCR meter

Bode analyzer

Logic analyzer

Vector network analyzer
An intuitive USER INTERFACE

Red Pitaya uses a web interface and all the software is running on the board, there’s no need to install any proprietary software to get started. All you have to do is open your web browser, connect to the board and select which application you want to run.
Remote control

Your Red Pitaya board can be controlled remotely over LAN or wireless.

Python

Control your Red Pitaya with Python – the most popular script language used by researchers working on the fast development of any engineering application that requires testing, measurement, control & signal processing.

MATLAB

Control your Red Pitaya with MATLAB – the easiest and most productive software environment for engineers and scientists. The perfect combination to speed up your research, prototyping and testing.

LabVIEW

Control your Red Pitaya with LabVIEW – software designed for the fast development of any engineering application that requires testing, measurement, or control.
For those who would like to program their own applications, we have provided C and Python APIs that enable super easy access to all Red Pitaya features, while more advanced users can also create and run their own FPGA logic.

**Jupyter Notebook / Python**

Jupyter Notebook enables you to execute Python code and control Red Pitaya hardware features, visualize data and add explanatory text or write interactive documents directly in a web browser Jupyter Notebook Python editor.

**C API**

A list of built-in C code functions (APIs) provides full control over the Red Pitaya board (signal generation and acquisition, digital I/O control, communication: I2C, SPI, UART, and others).

**FPGA**

Examples of Red Pitaya FPGA code include complete control logic over signal acquisition, generation and more, along with all image build instructions and register map documentation. The code is free and available on Github.
Explore
OUR PRODUCTS

STEMlab 125-14
STEMlab 125-14 is our most versatile and popular product, providing perfect value for money.

More variants available:
- Zynq 7020 Low Noise
- External Clock
- ISO17025
- Low Noise
- OEM
- X-Channel System

STEMlab 125-14 4-Input
The STEMlab 125-14 4-Input offers four input channels, and also improved performance.

SIGNALlab 250-12
SIGNALlab 250-12 is the most sophisticated Red Pitaya product, built for more demanding industrial applications and research.

SDRlab 122-16
SDRlab 122-16 was developed specifically for software-defined radio and more demanding RF applications.
Select the right kit FOR YOUR APPLICATION

All Red Pitaya products come in kits, with different accessories. Select the right kit for your project and start measuring!
Hardware SPECIFICATIONS

STEMlab 125-14

Daisy chain connector (SATA)
Dual core ARM cortex A9 + FPGA
Extension connector
slow analog IOs, I2C, SPI, UART, ext. clock
RF inputs
125 MSPS 14 bit
RF outputs
125 MSPS 14 bit
Power (Micro USB)
Console (Micro USB)
USB
Remote access
SD card with Linux OS
Extension connector GPIOs

SIGNALlab 250-12

Dual core ARM cortex A9 + FPGA
Extension connector
slow analog IOs, I2C, SPI, UART, ext. clock
RF inputs
250 MSPS 12 bit
Trigger input
RF outputs
250 MSPS 14 bit
Console (USB C)
Ref. clk input
Daisy chain connector (eSATA)
2x USB
Ethernet with PoE
Power jack
SD card with Linux OS
Extension connector USB, GPIOs
STEMlab 125-14 4-Input

- Daisy chain connector (SATA)
- Dual core ARM cortex A9 + FPGA
- Extension connector slow analog IOs, I2C, SPI, UART, ext. clock
- Power (Micro USB)
- SD card with Linux OS
- USB
- Console (Micro USB)
- Ethernet
- Remote access
- Extension connector GPIOs
- RF inputs 125 MSPS 14 bit

SDRlab 122-16

- Daisy chain connector (SATA)
- Dual core ARM cortex A9 + FPGA
- Extension connector slow analog IOs, I2C, SPI, UART, ext. clock
- Power (Micro USB)
- SD card with Linux OS
- USB
- Console (Micro USB)
- Ethernet
- Remote access
- Extension connector GPIOs
- RF inputs 122.88 MSPS 16 bit
- RF outputs 122.88 MSPS 14 bit
## Compare

### OUR PRODUCTS

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<td><strong>1 MΩ / 10 pF</strong></td>
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<td><strong>1 MΩ</strong></td>
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<td><strong>0.5 Vpp/-2 dBm</strong></td>
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<td><strong>+5 V, +3.3 V, -4 V</strong></td>
<td><strong>+5 V, +3.3 V, -4 V</strong></td>
<td><strong>Yes</strong></td>
<td><strong>Yes</strong></td>
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<td><strong>Yes</strong></td>
<td><strong>Yes</strong></td>
<td><strong>Yes</strong></td>
<td><strong>Through extension connector</strong></td>
<td><strong>Through extension connector</strong></td>
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<tr>
<td><strong>Through extension connector</strong></td>
<td><strong>Through extension connector</strong></td>
<td><strong>Through BNC connector</strong></td>
<td><strong>Over SATA connection (up to 500 Mbps)</strong></td>
<td><strong>Over SATA connection (up to 500 Mbps)</strong></td>
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<td><strong>Over SATA connection (up to 500 Mbps)</strong></td>
<td><strong>Over SATA connection (up to 500 Mbps)</strong></td>
<td><strong>Over SATA connection (up to 500 Mbps)</strong></td>
<td><strong>N/A</strong></td>
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<td><strong>N/A</strong></td>
<td><strong>Through SMA connector</strong></td>
<td><strong>N/A</strong></td>
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Red Pitaya's MULTI-CHANNEL SOLUTIONS

STEMlab 125-14 X-Channel System

- Designed for applications that require multi-channel RF signal acquisition and generation
- Consists of multiple STEMlab 125-14 Low Noise devices
- Open-source multi-channel streaming software available (command line tool and Qt client app)
- Clock and trigger synchronization
- SCPI server support (Python, MATLAB, LabVIEW)

Applications

- Power grid monitoring that requires multi-channel signal acquisition or generation solutions
- Readout of scientific multi-channel detectors
- Multi-channel SDR receivers
- Phased array antennas
- Nondestructive testing
- RADAR/LIDAR
- Medical and industrial imaging (MRI and ultrasound systems)
STEMlab 125-14 4-Input

- Four inputs at 125 MSPS 14 bit
- Internal/external clock selector available
- Performance improvements (less noise & crosstalk)
- Xilinx Zynq 7020 SoC

Applications

- Automotive Equipment
- Multi-channel Data Acquisition
- Base-Station IF Receivers
- Software Defined Radios
- Diversity Receivers
- Medical Imaging
- Communications
- Nondestructive Testing
- Test Equipment
- Cellular Base Stations
Red Pitaya at the core of SMU’s signal processing classes

When COVID and lockdowns struck in 2020, SMU was one of the universities that did not sit idly but went into action and organized their Digital Signal Processing classes to be run remotely using Red Pitaya. This enabled students to still have a laboratory on their desk even if they were at home and not miss a beat. When the laboratories reopened, this enabled students to each work on their own piece of equipment individually which increased their productivity.

At SMU, students are introduced to signal analysis using MATLAB®, and signal acquisition/processing using the Red Pitaya STEMlab boards. Students are additionally exposed to multiple applications of signal analysis and system design using MATLAB and the Red Pitaya STEMlab.

Dense Network of dual-mission HF radars based on Red Pitaya STEMlab and Raspberry Pi boards

Prof. Michael Hirsch and his team from Boston University are working on a dense network of dual mission HF radars based on Red Pitaya STEMlab and Raspberry Pi boards: to improve ionospheric models, for 4-D imaging of the Earth’s atmosphere/ionosphere, solar storm impact detection and quantification.
JPL was looking for a core signal acquisition module for mass spectrometer in space application. They evaluated many DAQ devices from other companies and found STEMlab 125-14 as a best option for them since it comes on a small form factor offer signal generation as well as signal acquisition, beside that it comes with CPU+FPGA and open source software them makes it possible for them to run their complete application on this board.

Once they made their prototype work they were very satisfied with STEMlab performance and measurements and they decided they would like to integrate it into their final product.

Red Pitaya boards used for development of digital hardware

The UK company Silicon Microgravity (SMG) – a designer and producer of advanced sensors and accelerometers with proprietary MEMS resonant technology for navigation, gravimetry survey and high-speed accelerometers, tilt sensors and gyroscopes – has provided many valuable insights arising from their applications where they need to validate digital signal processing algorithms before they are deployed in the final electronics, and where Red Pitaya boards help in the development of digital hardware by using the hardware capabilities of the units’ FPGA Zync.

SMG runs a lot of tests for their MEMS in different setups, where reprogrammable units are a major requirement to eliminate the need for redesigning or creating additional custom hardware. For this reason they use the SDRlab 122-16 and the STEMlab 125-14 Z7020 Low-Noise boards, because of their high-resolution sampling and effectiveness in terms of internal development and experimentation, specifications that are perfectly in line with the company’s requirements.
Radio amateurs

Red Pitaya for evaluation of southern hemisphere radio propagation

M. Hartje (HS Bremen), U. Walter (TU München)

The objective of this project was to gain more knowledge about the propagation of radio waves in the ionosphere at Antarctic latitudes and at frequencies between 100 kHz and 50 MHz. This was achieved by using transmitting and receiving beacon signals from about 1000 ham radio stations spread over the globe. The project was scheduled to last for at least one year with request to extend it over a full sun spot cycle of 11 years until 2030.

The project is sponsored by the two prime investigating institutions as well as by DARC (German Amateur Radio Club) and supported by several highly dedicated private persons. When starting the project in January 2018, the first objectives were to install a receiver station at the station's air chemistry laboratory SpuSo with specially designed antennas and a transmitter station with a conventional vertical antenna on the roof of the Neumayer Station III.

SDR-based ground station

A. Kleinschrodt, A. Freimann, S. Christall, M. Lankl, K. Schilling (University of Würzburg)

With the ever rising demands of small satellite missions the traditional point to point communication protocols such as AX.25 reach their limits and novel more efficient ones are needed. At the same time with the availability of low cost software defined radio systems like Red Pitaya’s STEMlab new possibilities arise, since they offer a simple way to test, develop and employ such novel protocols.

This project presents first steps for implementing and testing these protocols in a software defined radio based ground station system. The setup of a simple testbed is presented and the implementation of these protocols is described.
Quantum nanomechanical resonators, inspired by spiderwebs

The experiment has shown that ultralow dissipation in room-temperature environments can be achieved via a simulation-based optimization approach for the design of a spiderweb-shaped nanomechanical resonator, enabling high-Qm devices with smaller aspect ratios compared to previous designs, which makes it easier, cheaper and faster to manufacture them.

This can only strengthen the belief that affordable quantum technology is waiting just around the corner, and obviously, the ever more affordable and reliable Red Pitaya units will be there to help out wherever possible.

A new way to data acquisition in nuclear fusion

When thinking of nuclear fusion experiments, you don’t immediately expect to find pocket-sized components in charge of data acquisition and monitoring. And yet, the ITER Neutral Beam Test Facility, located in Padova (Italy), discovered the added value Red Pitaya STEMlab boards could bring to their SPIDER experiment.

Relatively small-sized components like Red Pitaya make it possible to embed these systems close to the sensors, which can lead to a solution that integrates several different diagnostics systems into a single unsupervised model. The innate flexibility of SoC boards, capable of embedding full OS such as GNU Linux, combined with their small size, automatically brings these components into the picture, and the Red Pitaya units are textbook examples of compact, highly flexible FPGAs.
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Volkswagen  CONSORZIO RFX  Science and Technology Facilities Council  DESY

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ROHDE & SCHWARZ  HIGH VOLT  Neel Institut  LONGPATH TECHNOLOGIES

ColdQuanta  XANADU  Fraunhofer
We are especially proud of winning the Academic Support Award at The Electronic Industry Awards 2022!
Six reasons to BUY RED PITAYA

1. Replace bulky instruments & save space
   Red Pitaya is a very powerful and precise multifunctional measurement tool that can replace a set of lab instruments and save space.

2. Offers flexibility
   Red Pitaya devices come with open-source software and can be programmed to meet your own needs, providing full control over the device and its features.

3. Uses the latest real-time signal processing technologies
   All Red Pitaya products come with Xilinx Zynq SoC that combines FPGA and CPU, providing a great combination of real-time processing and CPU flexibility.

4. Reduces your testing tool costs
   Red Pitaya products require no licenses or hidden fees, significantly reducing your testing and prototyping costs.

5. Versatility
   Red Pitaya replaces test and measurement instruments and can be controlled by LabVIEW, MATLAB, and Python, or programmed to meet your own needs.

6. Control or measure remotely
   All Red Pitaya products are IoT devices that can perform remote and distributed measurements, and provide real-time data.
Write your

THOUGHTS AND IDEAS

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