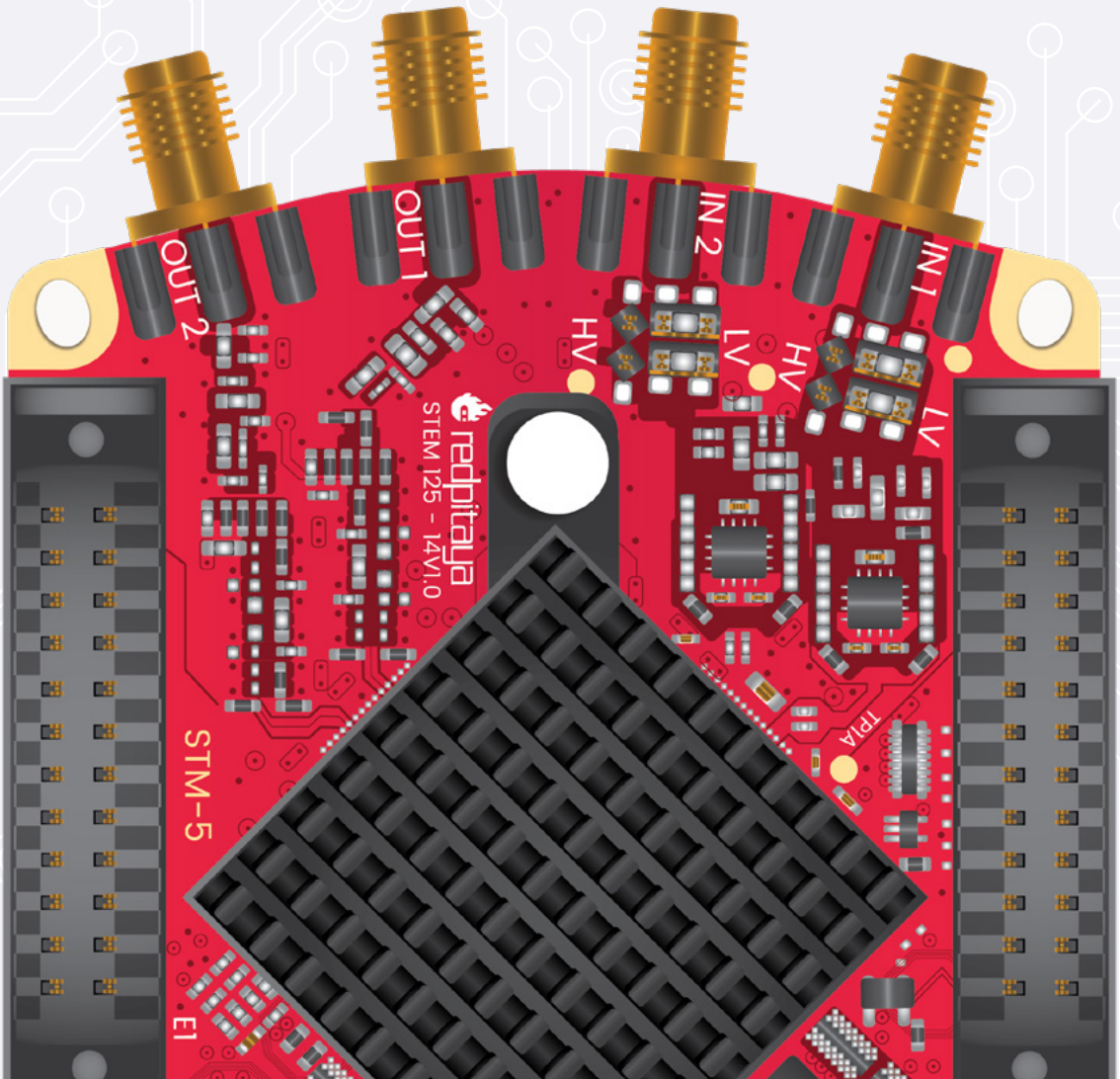
RED PITAYA

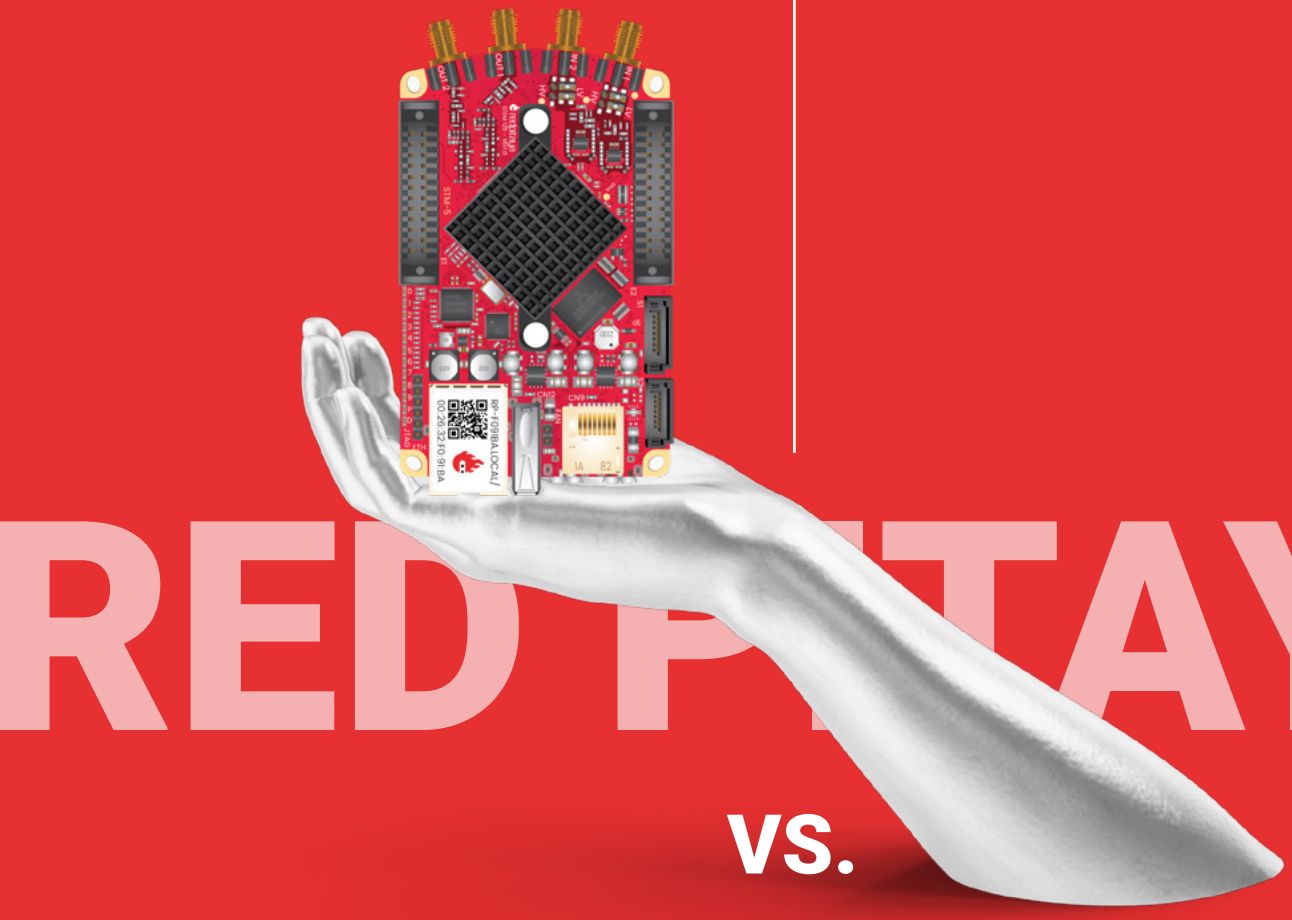
redpitaya

Swiss army knife
FOR ENGINEERS



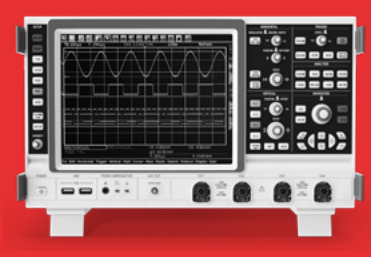
Replace your
LAB INSTRUMENTS

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



RED PITAYA

VS.



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.

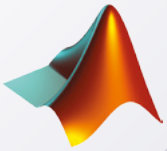
WORKS WITH

Remote control

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

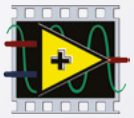
Python

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.

Programming

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.

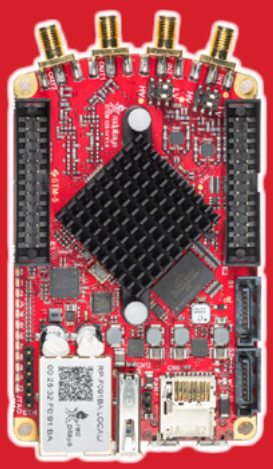
C API

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

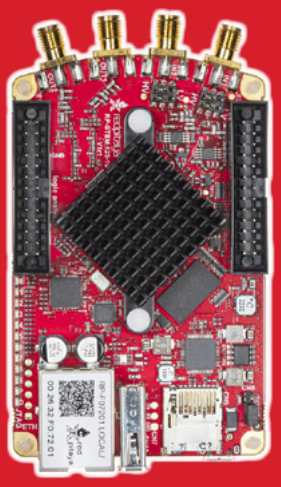


STEMlab 125-14

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



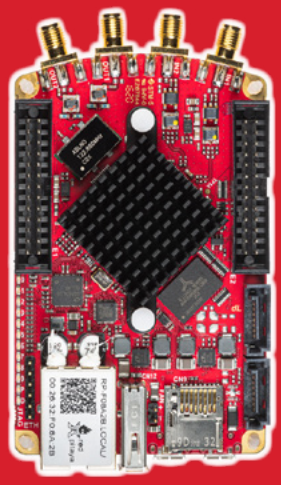
STEMlab 125-14 4-Input

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.

OEM



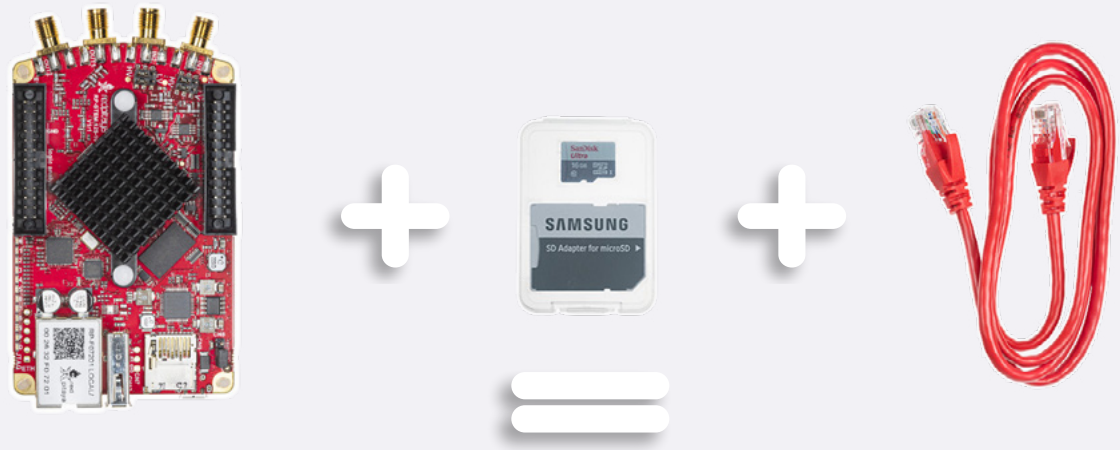
SDRlab 122-16

SDRlab 122-16 was developed specifically for software-defined radio and more demanding RF applications.

External Clock

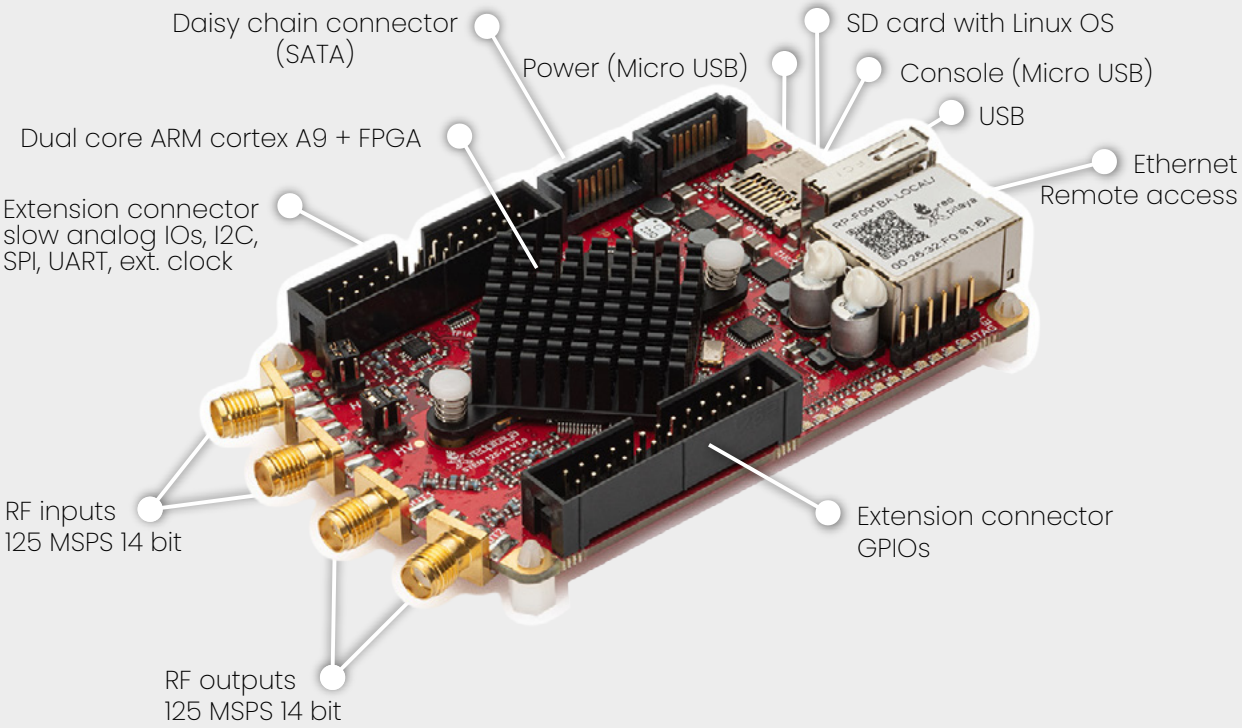
Select the right kit
FOR YOUR APPLICATION

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

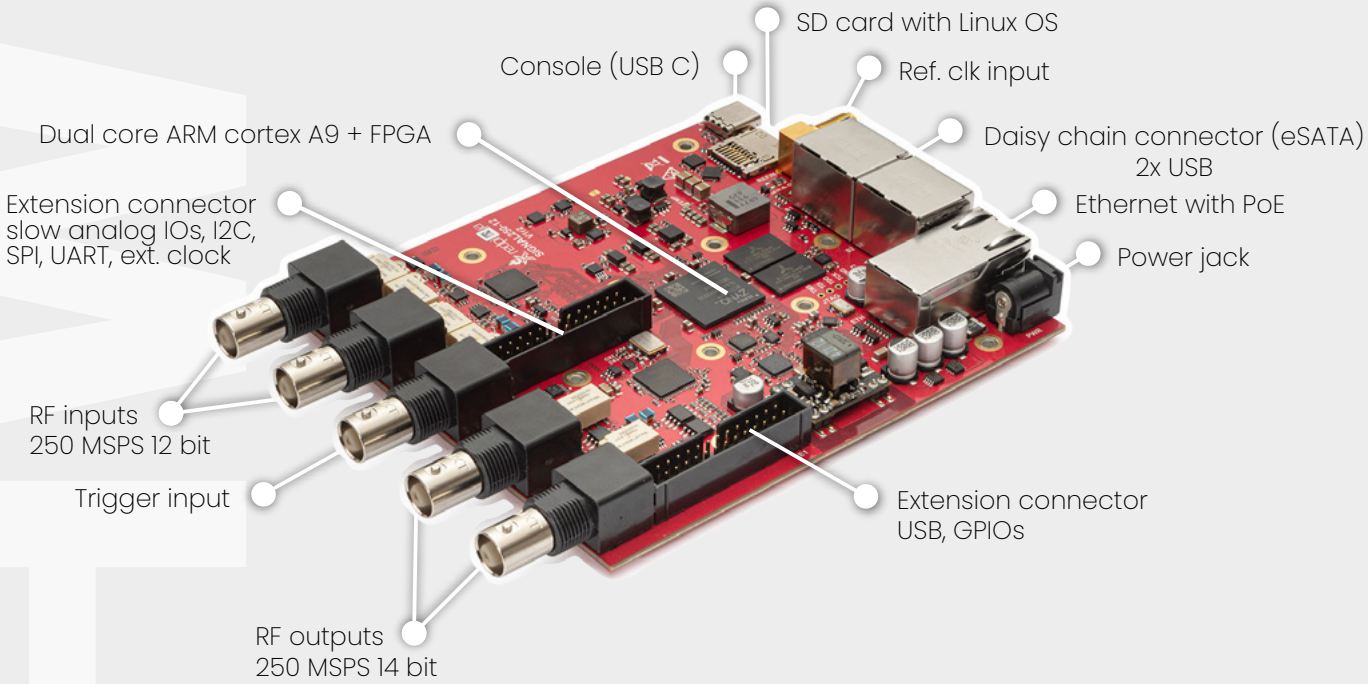


Hardware
SPECIFICATIONS

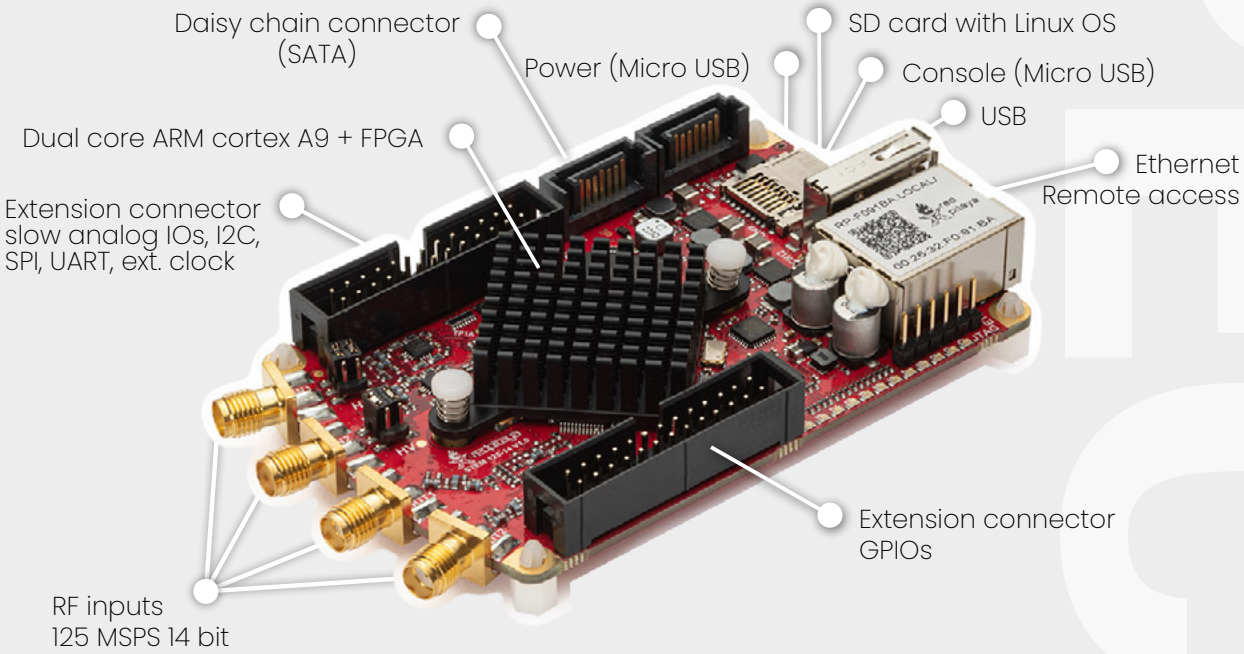
STEMlab 125-14



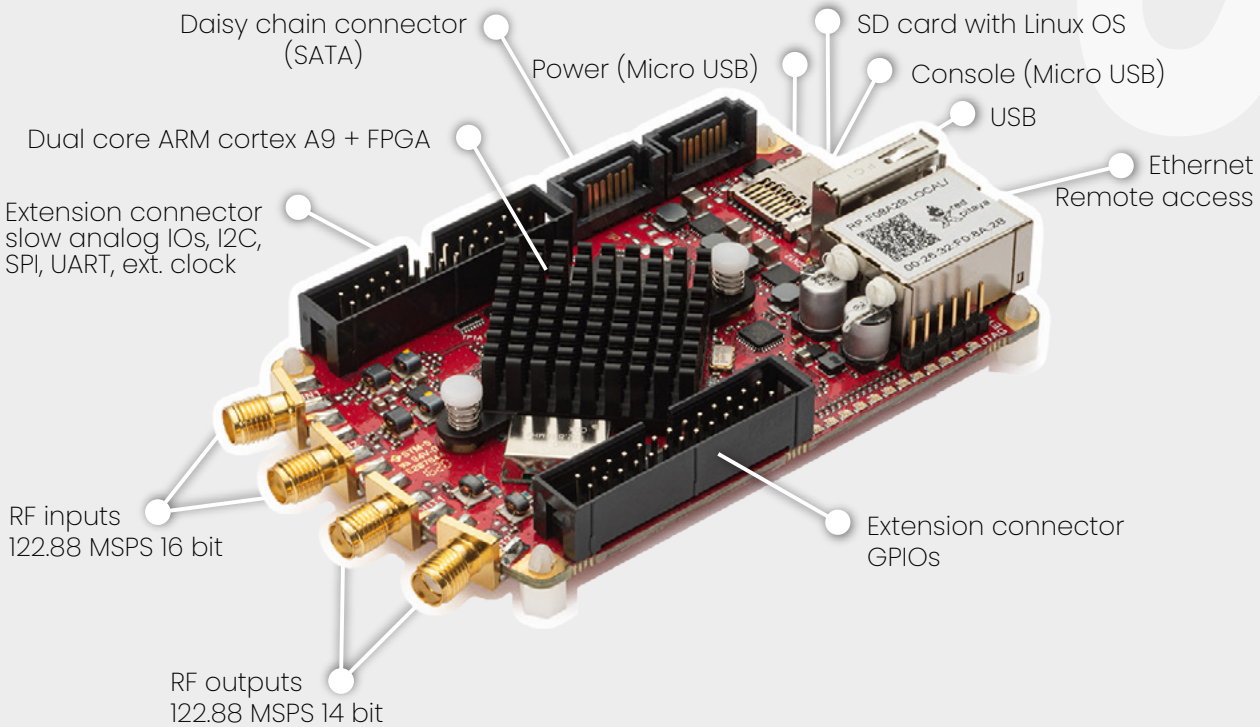
SIGNALlab 250-12



STEMlab 125-14 4-Input



SDRlab 122-16



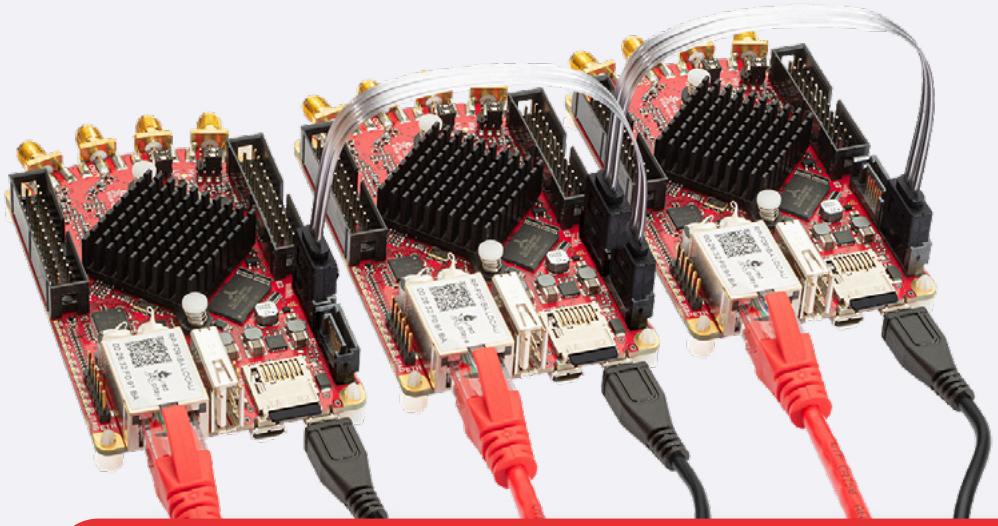
Compare
OUR PRODUCTS

	STEMlab 125-14 STEMlab 125-14 LN STEMlab 125-14 ext. clk	STEMlab 125-14 Z7020 LN
BASIC		
Processor	DUAL CORE ARM CORTEX A9	DUAL CORE ARM CORTEX A9
FPGA	FPGA Xilinx Zynq 7010 SOC	FPGA Xilinx Zynq 7020 SOC
RAM	512 MB (4 Gb)	512 MB (4 Gb)
System memory	Micro SD up to 32 GB	Micro SD up to 32 GB
Console connection	Micro USB	Micro USB
Power connector	Micro USB	Micro USB
Power consumption	5 V, 2 A max	5 V, 2 A max
CONNECTIVITY		
Ethernet	1 Gbit	1 Gbit
USB	USB 2.0	USB 2.0
WIFI	Requires WIFI dongle	Requires WIFI dongle
Synchronisation	Daisy chain connector (up to 500 Mbps)	Daisy chain connector (up to 500 Mbps)
RF INPUTS		
RF input channels	2	2
Sample rate	125 MS/s	125 MS/s
ADC resolution	14 bit	14 bit
Input impedance	1 MOhm/10 pF	1 MOhm/10 pF
Full scale voltage range	±1 V (LV) and ±20 V (HV)	±1 V (LV) and ±20 V (HV)
Input coupling	DC	DC
Absolute max. input voltage range	30 V	30 V
Input ESD protection	Yes	Yes
Overload protection	Protection diodes	Protection diodes
Bandwidth	DC-60 MHz	DC-60 MHz
RF OUTPUTS		
RF output channels	2	2
Sample rate	125 MS/s	125 MS/s
DAC resolution	14 bit	14 bit
Load impedance	50 Ohm	50 Ohm
Voltage range	±1 V	±1 V
Short circuit protection	Yes	Yes
Connector type	SMA	SMA
Output slew rate	2 V / 10 ns	2 V / 10 ns
Bandwidth	DC-60 MHz	DC-60 MHz
EXTENSION CONNECTOR		
Digital IOs	16	16
Analog inputs	4	4
Analog inputs voltage range	0-3,5 V	0-3,5 V
Sample rate	100 kS/s	100 kS/s
Resolution	12 bit	12 bit
Analog outputs	4	4
Analog outputs voltage range	0-1,8 V	0-1,8 V
Communication interfaces	I2C, SPI, UART	I2C, SPI, UART
Available voltages	+5 V, +3,3 V, -4 V	+5 V, +3,3 V, -4 V
External ADC clock	Yes	Yes
SYNCHRONIZATION		
Trigger input	Through extension connector	Through extension connector
Daisy chain connection	Over SATA connection (up to 500 Mbps)	Over SATA connection (up to 500 Mbps)
Ref. clock input	N/A	N/A

STEMlab 125-14 4-Input	SDRlab 122-16 SDRlab 122-16 ext. clk	SIGNALlab 250-12
DUAL CORE ARM CORTEX A9	DUAL CORE ARM CORTEX A9	DUAL CORE ARM CORTEX A9
FPGA Xilinx Zynq 7020 SOC	FPGA Xilinx Zynq 7020 SOC	FPGA Xilinx Zynq 7020 SOC
512 MB (4 Gb)	512 MB (4 Gb)	1 GB (8 Gb)
Micro SD up to 32 GB	Micro SD up to 32 GB	Micro SD up to 32 GB
Micro USB	Micro USB	USB-C
Micro USB	Micro USB	Power jack RJ45 (PoE version only)
5 V, 2 A max	5 V, 2 A max	24 V, 0.5 A max
1 Gbit	1 Gbit	1 Gbit
USB 2.0	USB 2.0	2x USB 2.0
requires WIFI dongle	Requires WIFI dongle	Requires WIFI dongle
Daisy chain connector (up to 500 Mbps)	Daisy chain connector (up to 500 Mbps)	Daisy chain connector (up to 500 Mbps)
4	2	2
125 MS/s	122.88 MS/s	250 MS/s
14 bit	16 bit	12 bit
1 MOhm / 10 pF	50 Ohm	1 MOhm
±1 V (LV) and ±20 V (HV)	0.5 Vpp/-2 dBm	±1 V / ±20 V (software selectable)
DC	AC	AC / DC (software selectable)
30 V	DC max 50 V (AC-coupled) 1 Vpp for RF	30 V
Yes	Yes	Yes
Protection diodes	DC voltage protection	Protection diodes
DC - 60 MHz	300 kHz - 550 MHz	DC - 60 MHz
N/A	2	2
N/A	122.88 MS/s	250 MS/s
N/A	16 bit	12 bit
N/A	50 Ohm	50 Ohm
N/A	1 Vpp/ +4 dBm	±2 V / ±10 V (Hi-Z load) (software selectable)
N/A	N/A, RF transformer & AC-coupled	Yes
N/A	SMA	BNC
N/A	N/A	10 V / 17 ns
N/A	300 kHz - 60 MHz	DC – 60 MHz
16	16	16
4	4	4
0-3,5 V	0-3,5 V	0-3,5 V
100 kS/s	100 kS/s	100 kS/s
12 bit	12 bit	12 bit
4	4	4
0-1,8 V	0-1,8 V	0-1,8 V
I2C, SPI, UART	I2C, SPI, UART	I2C, SPI, UART, USB, CAN
+5 V, +3,3 V, -4 V	+5 V, +3,3 V, -4 V	+5 V, +3,3 V, - 4 V
Yes	Yes	Yes
Through extension connector	Through extension connector	Through BNC connector
Over SATA connection (up to 500 Mbps)	Over SATA connection (up to 500 Mbps)	Over SATA connection (up to 500 Mbps)
N/A	N/A	Through SMA connector

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

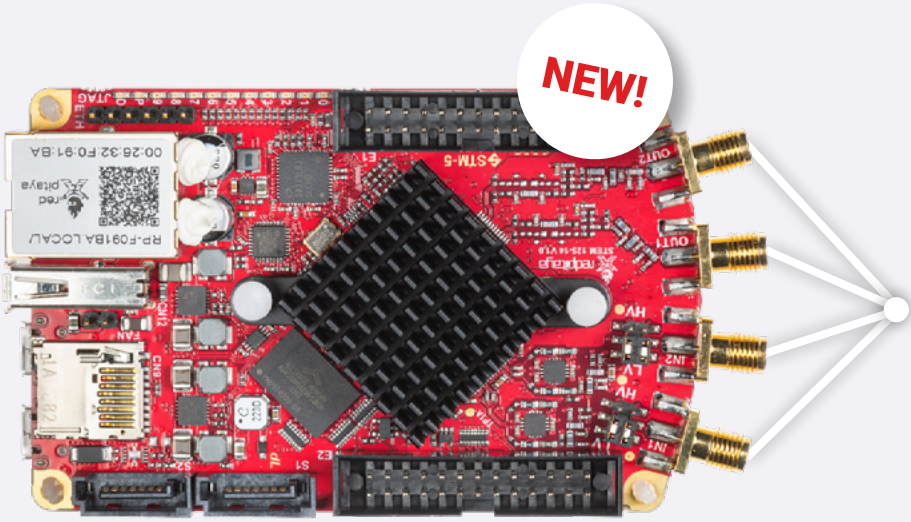
Phased array antennas

Nondestructive testing

RADAR/LIDAR

Medical and industrial imaging (MRI and ultrasound systems)

STEMlab 125-14 4-Input



4 RF inputs
125 MSPS
14 bit

- 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

Academia

Red Pitaya at the core of SMU's signal processing classes

Southern Methodist University, USA

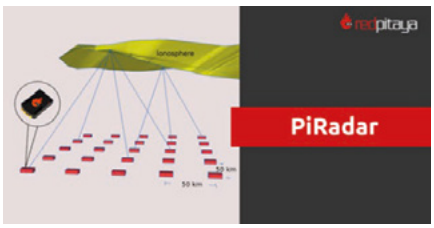
When COVID and lockdowns struck in 2020, SMU was one of the universities that did not sit idly but went into action and organized their Digital Signal Processing classes to be run remotely using Red Pitaya. This enabled students to still have a laboratory on their desk even if they were at home and not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

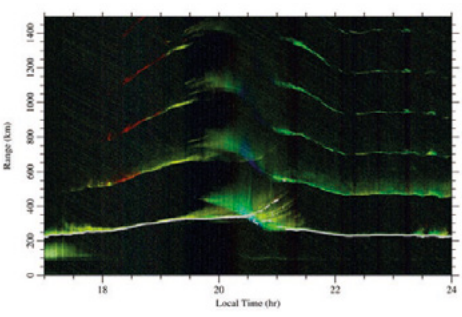
At SMU, students are introduced to signal analysis using MATLAB®, and signal acquisition/processing using the Red Pitaya STEMlab boards. Students are additionally exposed to multiple applications of signal analysis and system design using MATLAB and the Red Pitaya STEMlab.

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

Boston University, USA

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.





Industry

Red Pitaya for space applications

Jet Propulsion Laboratory
California Institute of Technology

NASA Jet Propulsion Laboratory

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.

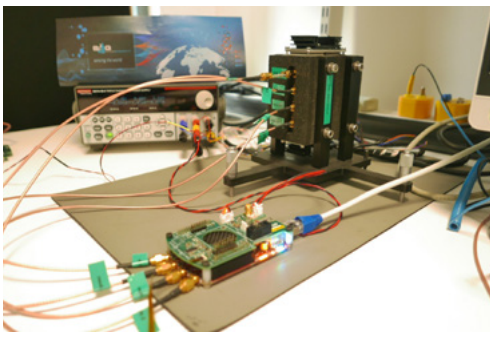
Red Pitaya boards used for development of digital hardware

SMG SILICONMICROGRAVITY

Silicon Microgravity, UK

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.

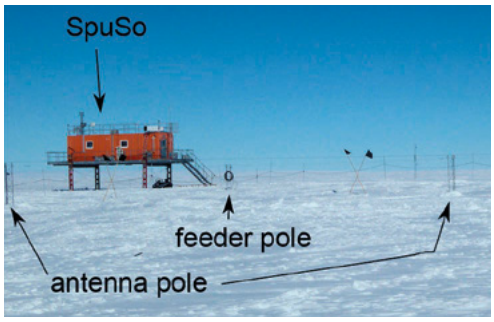


Radio amateurs

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.

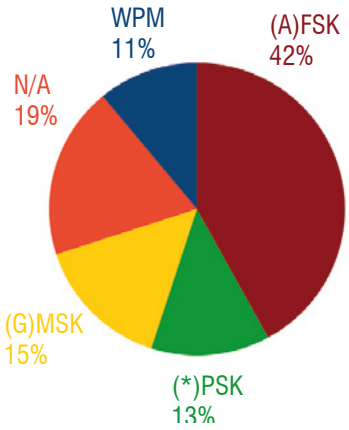


The project is sponsored by the two prime investigating institutions as well as by DARC (German Amateur Radio Club) and supported by several highly dedicated private persons. When starting the project in January 2018, the first objectives were to install a receiver station at the station's air chemistry 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 effcient 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.

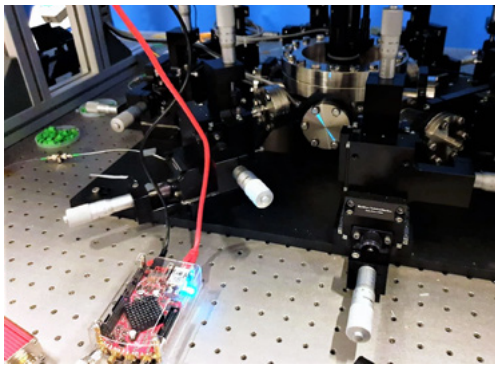
Research

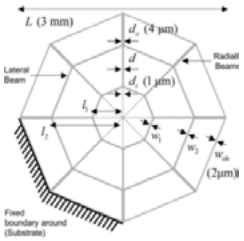
Quantum nanomechanical resonators, inspired by spiderwebs

Delft university of Technology

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.

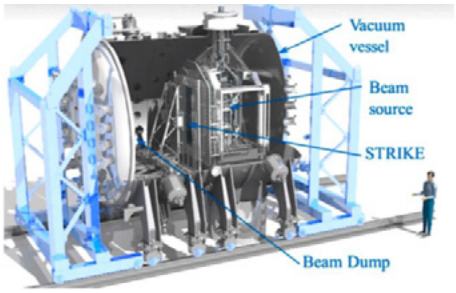


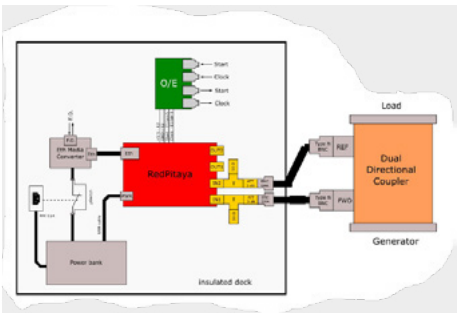


A new way to data acquisition in nuclear fusion

Consorzio RFX (Padova, Italy) &
International Atomic Energy Agency

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.





Trusted
BY


Stanford
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UKRI
Science and Technology Facilities Council
DESY
Los Alamos
NATIONAL LABORATORY
Ford
BOSCH
Swabian instruments
NASA
ONERA
THE FRENCH AEROSPACE LAB
AQT
UC San Diego
PAUL SCHERRER INSTITUT
PSI
ROHDE&SCHWARZ
HIGH VOLT
NÉEL
institut
LONGPATH
TECHNOLOGIES
ColdQuanta
XANADU
Fraunhofer

Nominations & **AWARDS**

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

Join our vibrant **COMMUNITY!**

www.redpitaya.com
sales@redpitaya.com

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