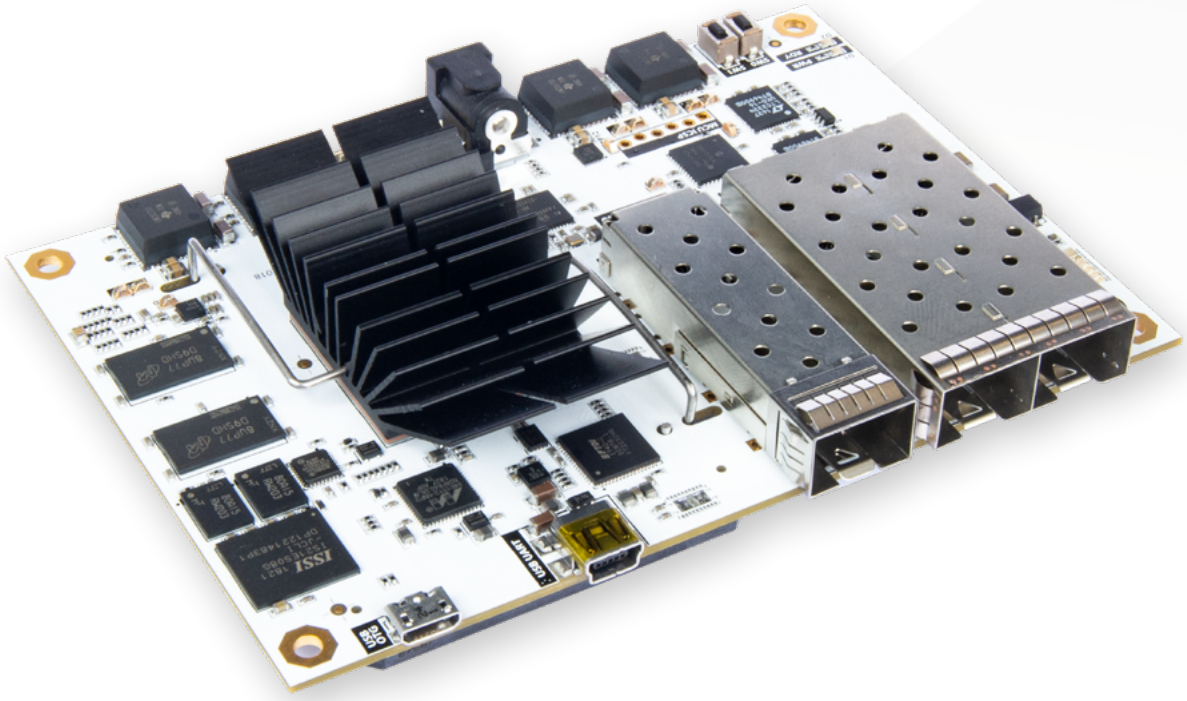
imperix

B-Board PRO

EMBEDDABLE CONTROLLER

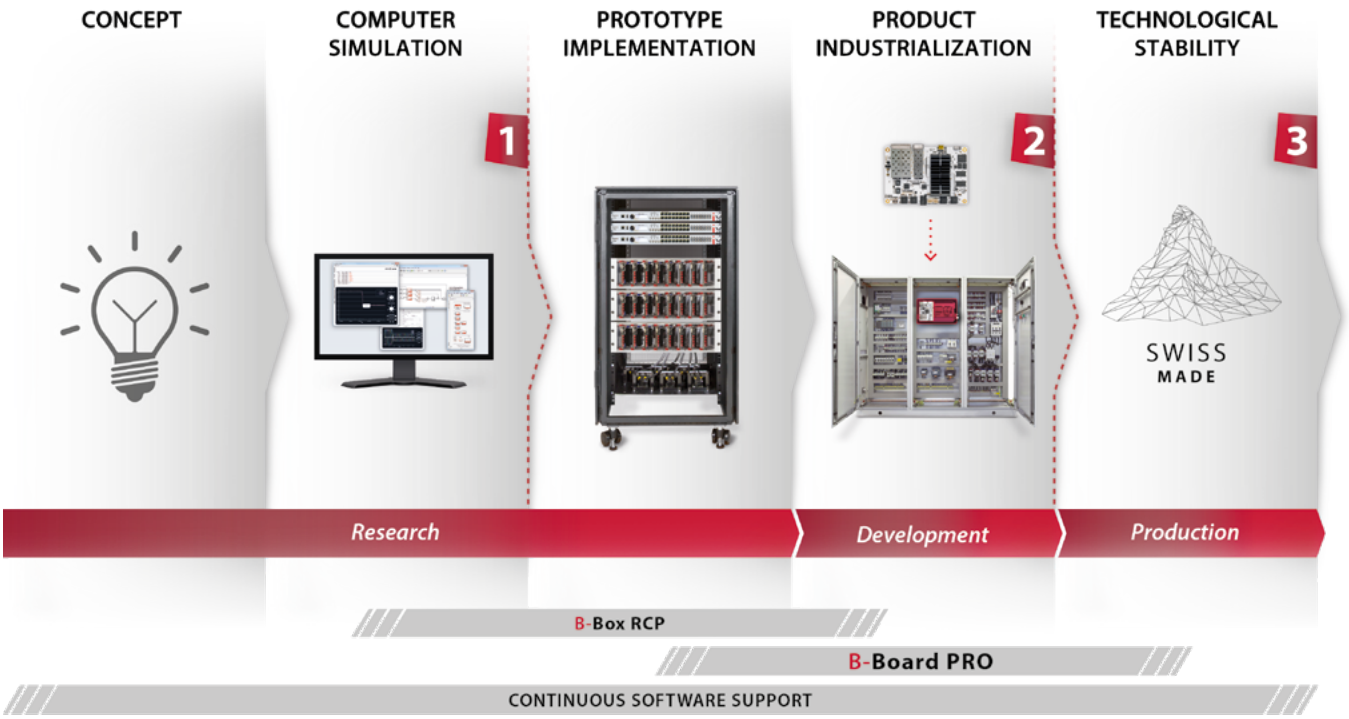
The B-Board PRO is an advanced controller designed for series-manufactured products.



THE ULTIMATE CONTROLLER
FOR EMBEDDED APPLICATIONS

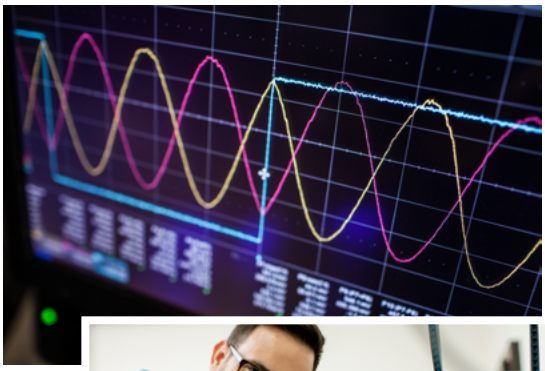
COMPREHENSIVE SOLUTIONS

Tools for the whole product life cycle!



1 FROM THE COMPUTER TO THE LAB

BRIDGE THE GAP BETWEEN THE SIMULATION AND THE REAL WORLD!



Accurate simulations are guaranteed, thanks to the perfect functional equivalence between B-Box RCP and B-Board PRO, as well as to a precise modeling of the discrete-time control during simulation.

Instant switchover between simulation and experimentation is possible in just one click. This allows to move very quickly to the lab, or even work iteratively to improve the simulation model.

Early experimentation is possible, thanks to the software-independent protections of the B-Box. This enables users to identify potential challenges early and mitigate design risks.

No controller tuning is ever needed thanks to the seamless transition between the simulation and the real world. The same also applies between B-Box RCP and B-Board PRO, which are at 100% bitfile-compatible.

2 FROM THE LAB TO THE FIELD!

MIGRATE EASILY TO B-BOARD PRO

What if you could simply take the result of your research and put it into an affordable controller, directly embeded inside your own products?

SEAMLESS TRANSITION

DEVELOPMENT PHASE

- Flexible hardware
- Rapid control validation

PRODUCTION PHASE

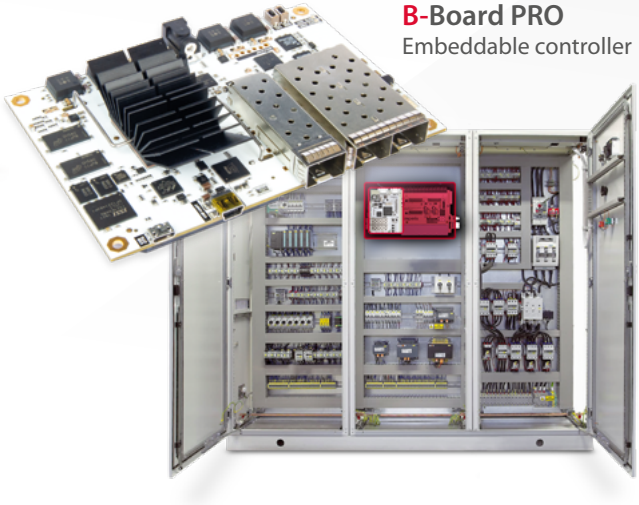
- Cost-optimized hardware
- Pre-validated control

FULL BITFILE COMPATIBILITY!

B-Box RCP
Prototyping controller

The exact compatibility between B-Box RCP and B-Board PRO allows benefiting from the increased flexibility of the rapid prototyping controller during developments, while using a lower-cost, product-embeddable variant during series production.

B-Board PRO
Embeddable controller



3 MAINTENANCE

LET US TAKE CARE OF THE MAINTENANCE OF YOUR CONTROL SOLUTION!

Digital control electronics suffer from a shorter life cycle than their associated power stages. This may be challenging for companies that have limited resources devoted to their maintenance. The same remark also holds to the software development tools.

Relying on imperix's solutions avoids this burden and guarantees to work with up-to-date hardware and software at all times, for both protyping and embeddable solutions.

Thanks to a strict abstraction from the hardware resources and strong retro-compatibility guidelines, imperix also guarantees that any control code will still work on future equipment.

DEVICE DESCRIPTION

The B-Board PRO is a small piggy-back board meant to be assembled within a larger control system. It embeds the essential and application-independent part of a converter controller, hence without extensive signal conditioning.

SFP INTERCONNECT

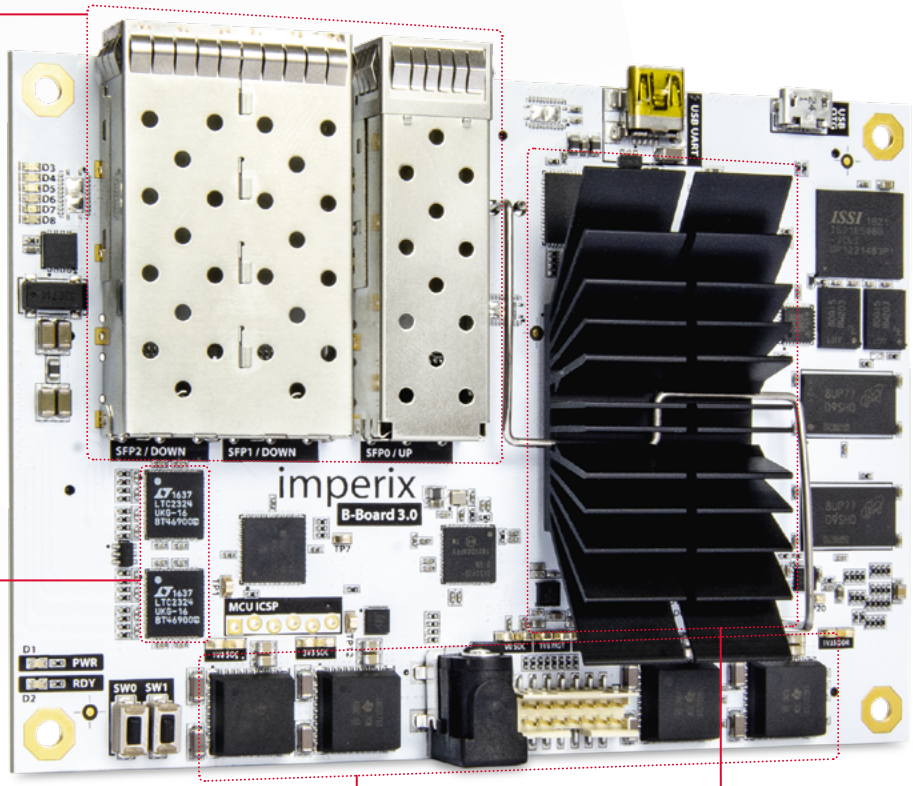
Imperix's proprietary RealSync technology provides unrivaled communication performance, including:

- High data bandwidth (5 Gbps)
- Intrinsic synchronization
- Ultra-low latency
- Up to 64 units (B-Board PRO or B-Box RCP)

ANALOG-TO-DIGITAL CONVERTERS

Data acquisition is supported by two LTC2324, offering:

- 8 full-differential channels
- Up to 2Msps operation
- 16 bits resolution
- Simultaneous sampling



FLEXIBLE POWER SUPPLY

B-Board PRO is compatible with 5-15V DC input voltages

- Single power supply
- Wide input range 5-15VDC
- Low power (15W max)

XILINX ZYNQ 7030

B-Board PRO is based on a high-performance System-on-Chip (SoC), offering:

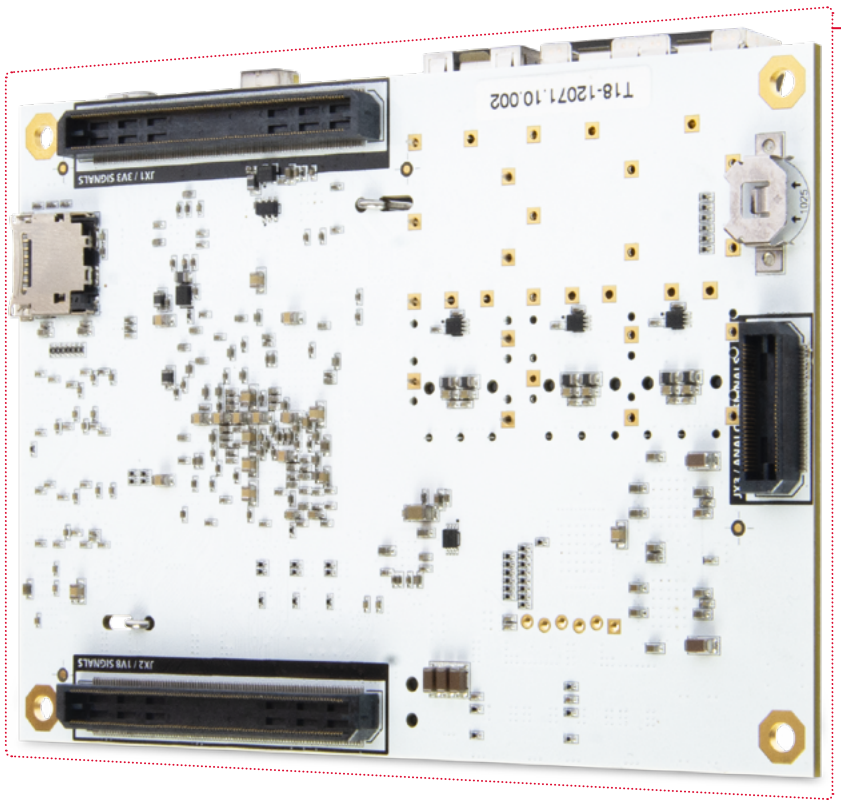
- 2x ARM Cores 1GHz
- 1GB DDR3
- 125K Kintex-grade FPGA

SMALL FORM FACTOR

Despite its high number of I/Os, the B-Board PRO measures only 86x124 mm. This is small enough to be assembled in most industrial systems. It also fits within a headroom of 22 mm only!

TAILOR-MADE KERNEL

The B-Board PRO embeds a special operating system, tailored for hard real-time applications with extremely low latency. This OS simultaneously combines a high level of safety with a very low overhead.



BOARD-TO-BOARD SIGNALS

Digital signals, including

- 16x PWM outputs (3V3)
- 16x Digital inputs (3V3)
- 16x Digital outputs (3V3)
- 36x Bidirectional user I/O straight from / to the FPGA
- 16x PWM outputs (1V8)
- 16x Fault inputs (1V8)

Communication signals, including

- 1x Gigabit Ethernet
- 1x USB 2.0 OTG
- 2x Quad SPI
- 1x JTAG output
- 1x GTX lane
- 4x Fault inputs

Analog signals, including

- 8x Full-differential inputs

BITFILE COMPATIBILITY

The B-Board PRO is guaranteed to work exactly the same way as the B-Box RCP, with the exact same control performance. In fact, the very same bitfile can be used on both devices.

PROCESSING POWER

The B-Board PRO is exactly as powerful as the B-Box RCP. Indeed, with its dual-core 1GHz processor, it features outstanding performance, especially for an embedded controller.

KEY SPECIFICATIONS

System on chip	Zynq XC7Z030-3FBG676E	
Processor	ARM Cortex A9 1 GHz 1GB DDR3	x2
FPGAs	Kintex 7 125K (user programmable)	x1
Analog inputs	16bits @ 2Msps	x8
PWM outputs	Electrical (PWM lanes 0-15, 1.8V) Electrial (PWM lanes 16-31, 3.3V)	x16 x16
User I/Os (high-speed)	Electrical (3.3V)	x36

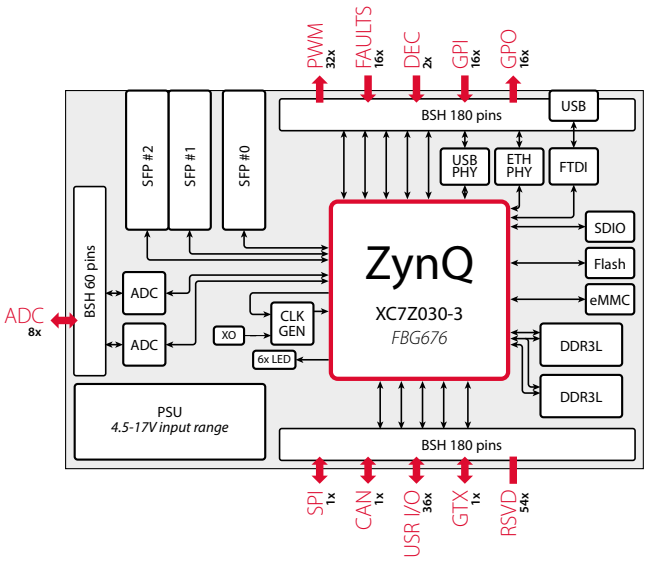
Digital outputs	Electrical (3.3V)	x16
Digital inputs	Electrical (3.3V)	x16
Fault inputs	Electrical (1.8V) Electrical interlock	x16 x1
Incremental decoder inputs	3-pins (A,B,Z) (shared with GPI inputs)	x4
Communication	Ethernet 1 Gbps SFP+ 5 Gbps USB 2.0 (computer)	x1 x3 x1

EXTENSIVE CONNECTIVITY

The B-Board PRO is ready for the most demanding requirements and has been specially designed with low- to mid-volume, complex applications in mind.

With its high number of digital I/Os, there's plenty of extension possibilities. Its application scope is hence mostly defined by the number of available analog inputs.

When needed, hierarchized or distributed control systems can also be implemented, similarly to B-Box RCP. Then, the number of usable I/O becomes practically boundless (512 analog in and 2048 PWM outputs).



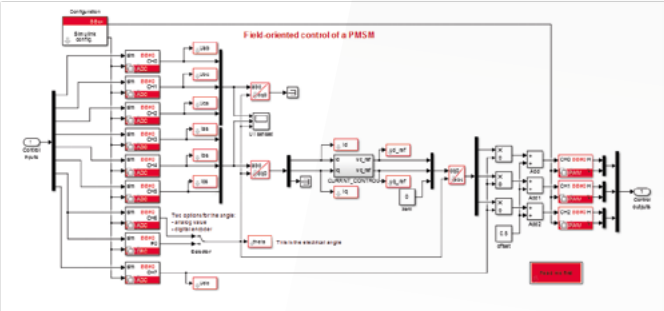
A COST-COMPETITIVE CONTROLLER, EQUIVALENT TO B-BOX RCP!

The B-Board possesses most features of the B-Box RCP, except the configurable analog front end and its own software-independent protection thresholds.

It is meant to be a cost-optimized controller for embedded systems, fully cross-compatible with its bigger and more flexible variant.

	B-Box RCP	B-Board PRO
Processor	2x ARM 1GHz	2x ARM 1GHz
FPGA	Kintex 7 125K	Kintex 7 125K
Analog to digital converters	16x	8x
C++ programming	☑	☑
Simulink programming	☑	☑
Programmable front-end	☑	☐
Hardware protections	☑	☐

FEATURES AND BENEFITS



INTEGRATED WITH SIMULINK™

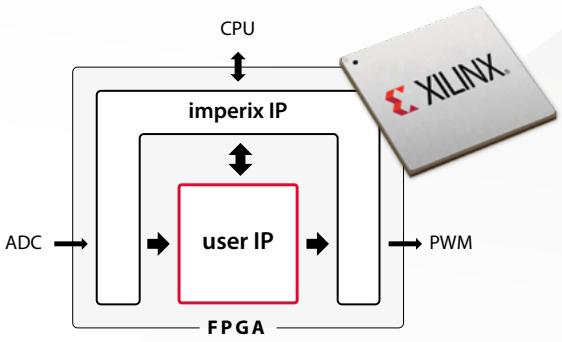
The B-Board can be programmed using either C/C++ or directly from simulation software, such as Simulink or PLECS. Thanks to a fully automated code generation toolchain, just one click is all it needs to fully program the device!

With Simulink, the provided blockset also embeds simulation models so that the system behavior can be accurately simulated and tuned before run-time. Then, everything truly works from the first test!

USER-PROGRAMMABLE FPGA

Absolutely no expertise in FPGA-based development is needed to work with the B-Board, as it operates readily with a highly flexible and highly configurable FPGA firmware.

Nevertheless, for the most advanced users who require to alter the FPGA code, the B-Board allows doing so. In this case, dedicated areas are provided, with straightforward integration with the existing DSP software kernel.



HIGH PROCESSING POWER

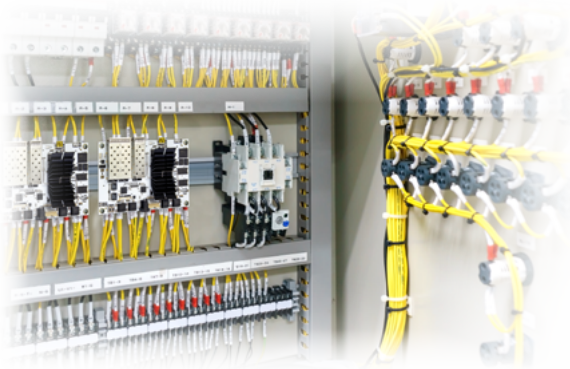
The B-Board PRO uses a dual-core processor. One core is dedicated to the execution of closed-loop control tasks (bare metal, dedicated kernel), the other one to the system supervision and monitoring (linux). Most tasks are also shifted in FPGA.

This results in the full dedication of a fast 32bits floating-point processor core to real-time control tasks, with excellent performance, ranging up to 200kHz closed-loop control frequencies.

QUICK INTEGRATION

In addition to being 100% compatible with B-Box, the B-Board PRO benefits from the same software environment and tools. It can be programmed from Simulink and PLECS, and controlled from Imperix Cockpit too!

Overall, most of the integration efforts are only those related to the mechanical aspects, as well as the signal conditioning and protection, which are often tailored to the application anyway.



HIGH-END INTERCONNECT

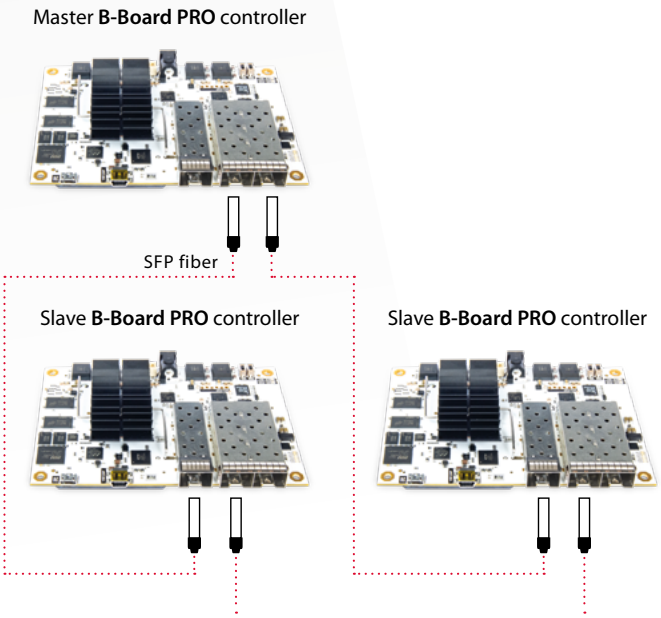
Imperix RealSync™ technology

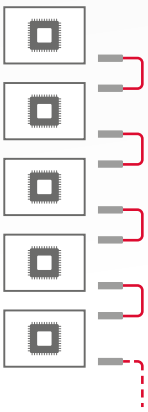
PERFECT SYNCHRONIZATION

Imperix's patent-pending RealSync™ technology guarantees an unrivaled synchronization accuracy across multiple units, down to ±2.0 ns! This is achieved through advanced clock dissemination through the optical fibers, enabling multiple B-Boxes to operate as if they were one single unit!

HIGH-SPEED COMMUNICATION

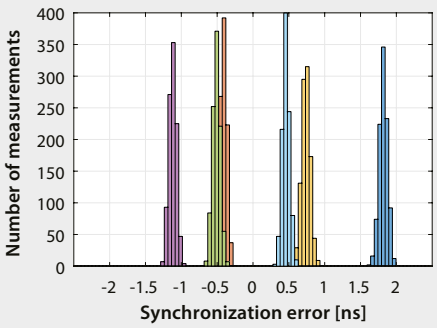
The 5 Gbps SFP optical filber links can be configured to form a tree-shaped network, achieving superior data bandwidth and lower latency over daisy-chain or ring network topologies. This guarantees sub-microsecond transfers in configurations with up to 8 controllers!



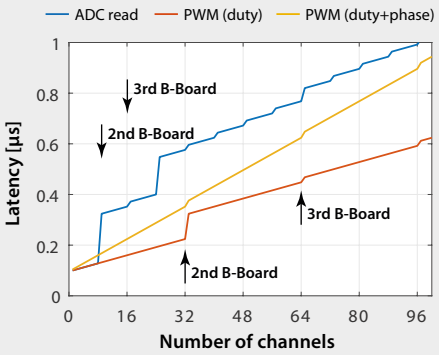


MAXIMUM I/O CAPABILITIES

Component	Single (1 unit)	Stacked (64 units)
Analog inputs	8x	512x
PWM outputs	32x	2048x
General-Purpose digital Outputs (GPO)	16x	1024x
General-Purpose digital Inputs (GPI)	16x	1024x



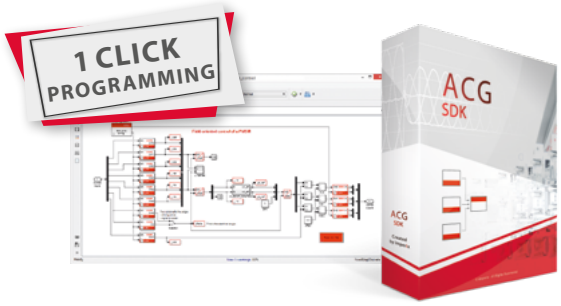
Synchronization between multiple B-Boards is achieved without the user even knowing it! The guaranteed accuracy is ±2.0 ns.



Ultra-low latency is achieved even with a high number of ADC or PWM channels. This supports closed-loop control frequencies up to 200 kHz.

PROGRAMMING

Software Development Kits (SDK)



ACG SDK

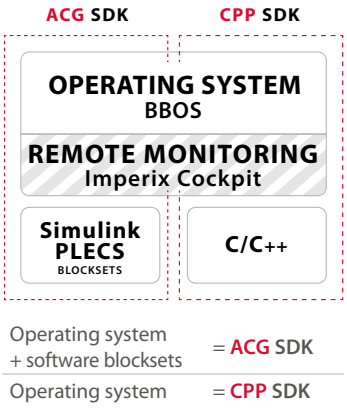
The Automated Code Generation (ACG) SDK enables engineers to program B-Box RCP and B-Board PRO controllers directly from Simulink and PLECS. The provided toolchain handles fully automated code generation, compilation and upload, in just one click.

In addition, the SDK contains detailed simulation models of each peripheral, so that the exact system behavior can be simulated – and hence easily anticipated – before code is generated.

C/C++ SDK

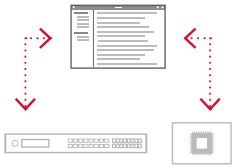
The C/C++ SDK provides a direct way to implement control techniques without requiring any simulation software. This approach also offers superior performance and flexibility over automatically-generated code.

The SDK contains extensive libraries, specifically developed to make the coding experience as simple as possible, while granting users direct access to each and every system parameter.



FEATURE	ACG SDK	CPP SDK
BBOS operating system	☑	☑
Blockset for Simulink* and PLECS	☑	☐
C/C++ coding environment	☐	☑
Imperix Cockpit software	☑	☑
Code examples	☑	☑
User-editable FPGA area	☑	☑
Multi B-Box operation (I/O extension)	☑	☑

* Requires a valid MATLAB™ license issued by MathWorks™ and the following toolboxes: Embedded Coder, MATLAB™ Coder and Simulink™ Coder.



MULTIPLE HARDWARE

The very same software can be used for programming either the B-Box RCP or the B-Board PRO. Besides, thanks to the strict equivalence between both devices, user-level control software is also guaranteed to behave identically.

OPEN FRAMEWORK

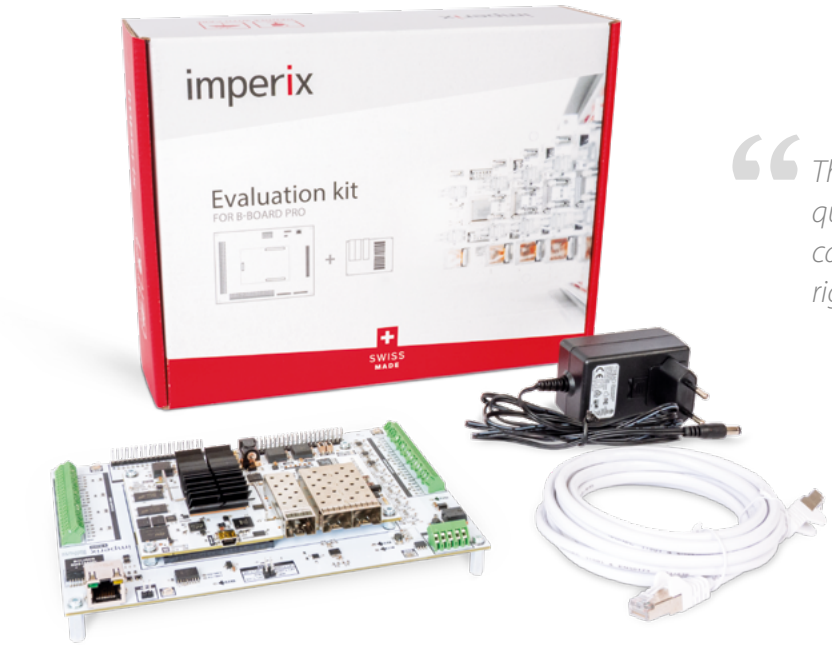
Imperix SDKs being merely a set of tools, developers remain in complete control of their control software. Everything can be edited and tuned down to the duty cycle! Furthermore, the FPGA firmware can also be modified for even more flexibility.

SOFTWARE FOR EVERYONE

Irrespectively of the level of expertise or field of use, the very same software can be used for teaching purposes, R&D activities or industrial applications. Everything is kept simple, allowing to accelerate any development.

Evaluation kit

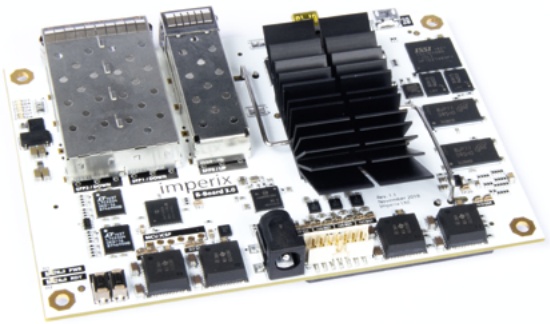
CARRIER MODULE FOR B-BOARD PRO



The Evaluation kit allows to quickly assess the tremendous capabilities of the B-Board PRO, right from the top of your desk.

CONTENT

Evaluation board	Carrier board	x1
B-Board PRO	Embeddable controller	x1
RJ45 cable		x1
Power supply	20W / 12V adapter	x1
Quick start guide		x1



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Choose your Software Development Kits (SDK)

ACG SDK

CPP SDK

PRODUCT DESCRIPTION

The evaluation kit enables research engineers to power up the B-Board and get the first signals out of it within few minutes. It notably contains an easy-to-use carrier board that gives instant access to most analog and digital signals, normally located on the bottom of the B-Board PRO.

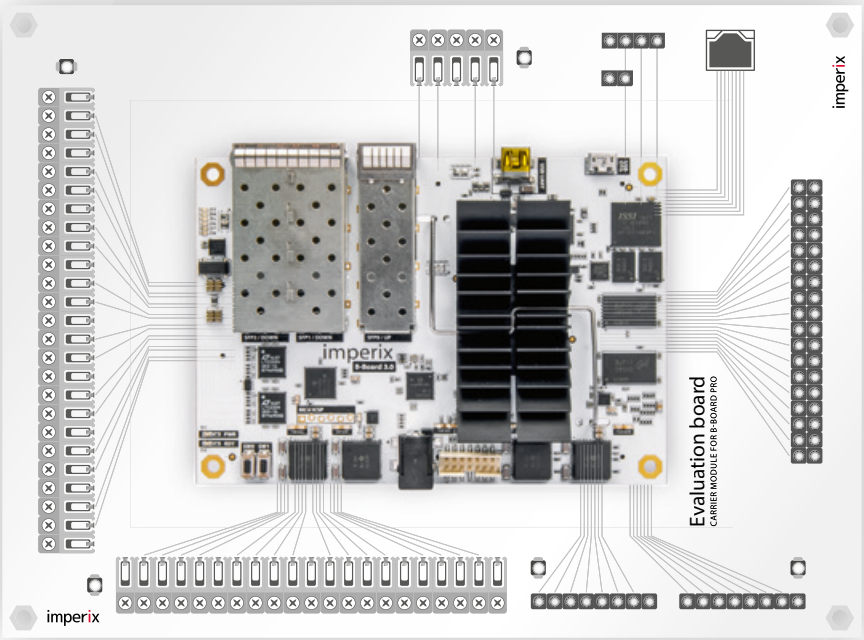
The kit also contains documentation and getting-started examples as to best support a rapid evaluation of the hardware and software capabilities, featuring the very same performance as the larger B-Box RCP system.

8x ANALOG INPUTS

4x ANALOG OUTPUTS

4x FAULT INPUTS

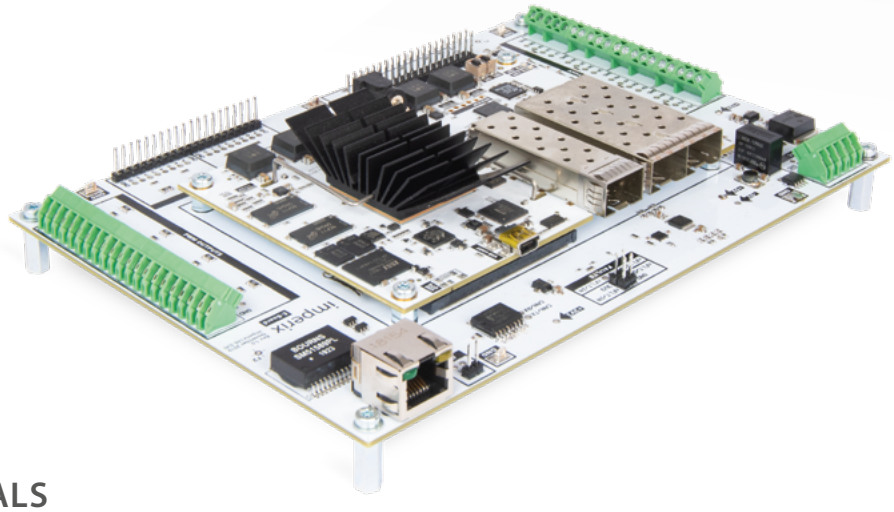
1x ETHERNET



16x PWM OUTPUTS

8x DIGITAL OUTPUTS
8x DIGITAL INPUTS

36x USER-CONFIGURABLE I/Os



CARRIER BOARD SIGNALS

x8	**Analog inputs**	Full-differential inputs,16bits	Phoenix 3.5mm (1989023)	± 5V
x4	**Analog outputs**	16bits, single-ended	Phoenix 3.5mm (1989023)	± 5V
x4	**Fault inputs**	Electrical	2.54 mm header	3.3V
x1	**Communication**	Ethernet, device programming and monitoring	RJ45 socket	
x16	**PWM outputs**	Dedicated modulators, 4 differents time bases	Phoenix 3.5mm (1989023)	3.3V
x8	**Digital outputs**		2.54 mm header	3.3V
x8	**Digital inputs**		2.54 mm header	3.3V
x36	**User configurable I/Os**	Direct to FPGA, bidirectional	2.54 mm header	3.3V

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