MicroLabBox

Compact power in the lab

With MicroLabBox, dSPACE introduces an entirely new system – a compact development system for laboratory use that is very powerful and versatile, despite its low system costs and small size. Over 100 channels of different I/O types and a combination of real-time processor and FPGA provide the versatility needed in research and development. This lets you implement control, test and data acquisition applications quickly, simply and cost-effectively.

The technical requirements for real-time systems in research, development and education are quite varied. Depending on the specific application, there are extremely different demands on the processing power and I/O interfaces. However, since the budget and often the available space are limited, it is not always possible to set up a large, expensive system with a superset of all the possibly required functions in the laboratory, especially when small, rather manageable projects are involved. On the other hand, it is also not a good idea to always use a different system that needs to be purchased on an ad hoc basis for a specific project. This wild "zoo" of hardware and associated software is expensive, involves inconvenient maintenance and causes problems for compatibility, updates and training. If you could wish for something, it would probably be like this: I want a system that just needs a little bit of space on my already crowded desk, a system whose versatility covers a wide range of applications and whose price is as low as possible! dSPACE grants this wish – with the new MicroLabBox.

MicroLabBox – A System Class of Its Own

Shaped by the influence of dSPACE's long years of experience, with numerous customers from academia and the industry in areas such as drive engineering, robotics, medical engineering, automation and vehicle engineering, a new system class has evolved. MicroLabBox makes several central ideas a reality: a high level of processing power and I/O in a compact case that can be placed anywhere a conventional notebook would fit. A flexible, professional system providing an extensive range of features and software that even a limited budget can afford. A system that even includes numerous features from dSPACE's already popular MicroAutoBox II and modular hardware – with everything already integrated into an all-in-one solution.

> MicroLabBox: A wide performance range with a compact design.

Closed-Loop Power

When running fast closed control loops, two decisive factors are the processor's computing power and the processor's access time to the I/O interfaces. Tests of various processors have shown that, in particular, PowerPC processors provide optimum results due to their sufficiently large cache memory in conjunction with a parallel I/O data bus. MicroLabBox is therefore equipped with the latest Freescale QorIQ P5020 PowerPC, a 2GHz dual-core processor. This enables control loop times of less than 15 µs, depending on the application. For extremely fast control loops, such as active noise and vibration suppression and underlying current controllers for E-motor controls, MicroLabBox also offers a Kintex®-7 FPGA. This can be used to offload parts of the model to the FPGA and can be programmed with the Simulink blockset called Xilinx® System Generator for DSP. These performance reserves ensure that future projects can also be implemented.

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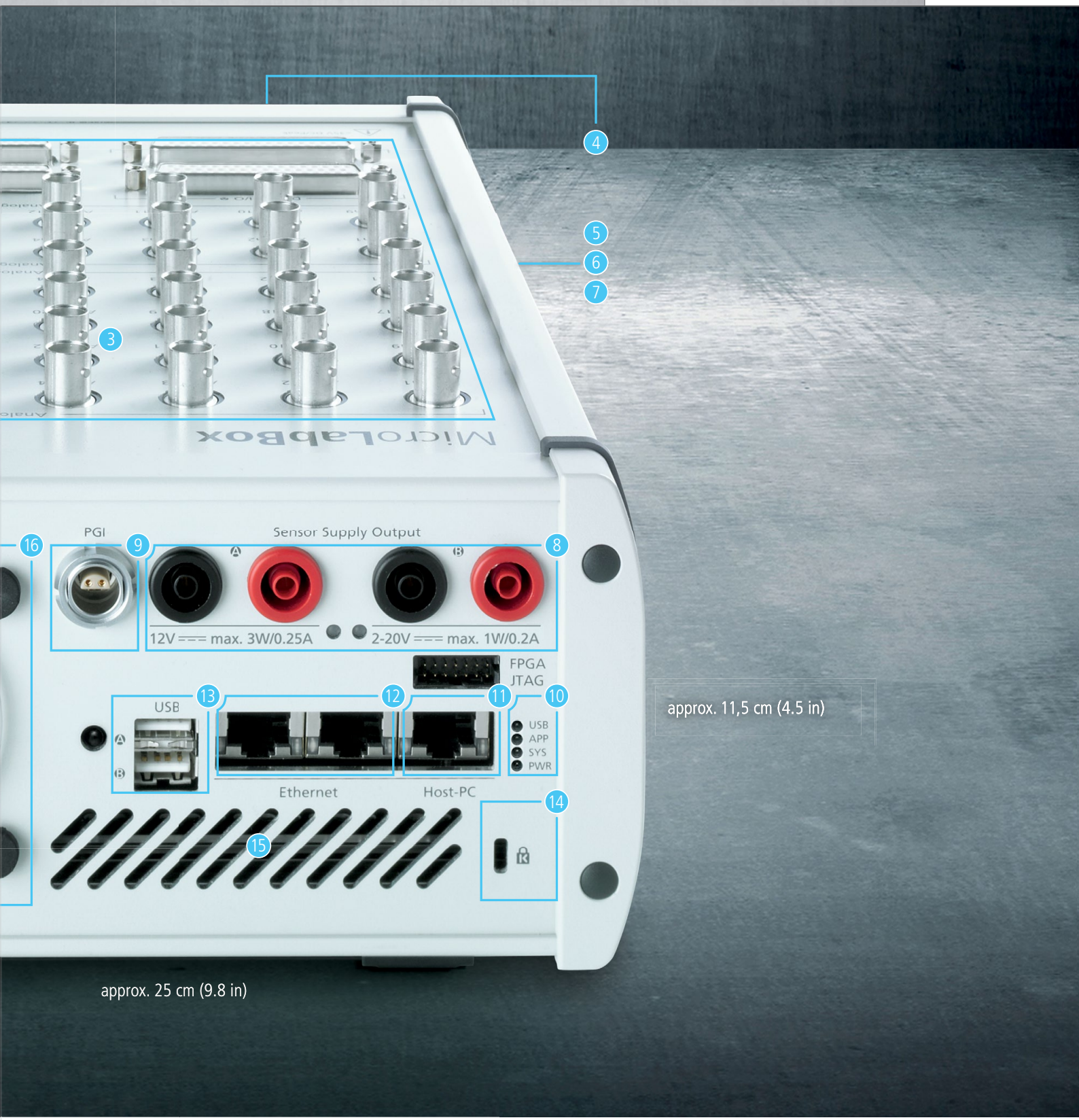
For more impressions, have a look at the MicroLabBox video.
www.dspace.com/go/dMag_20151_MLB_E

Figure 1: MicroLabBox is exactly as wide as this figure: approx. 25 cm (9.8 in). The variant shown here: MicroLabBox Top Panel.

Strong Advantages
MicroLabBox combines several performance features in a single box.

① Smaller than the space needed for a notebook
② Programmable status LEDs
③ Lots of easy-to-access I/O: panel with Sub-D and BNC connectors for easy wiring
④ Pin-out information directly on the case (here: the back side)
⑤ For computation-intensive models: dual-core 2 GHz PowerPC
⑥ Kintex®-7 FPGA for fast I/O and offloading model parts
⑦ Flash memory for autonomous system booting
⑧ Sensor supply



⑨ PGI interface to the PGI1 connector (supported in the future)
⑩ System status LEDs
⑪ Gigabit Ethernet host interface
⑫ Gigabit Ethernet I/O interface to connect to Ethernet-based devices
⑬ USB connector for data logging via a mass storage device
⑭ Kensington® lock to protect against theft
⑮ Programmable buzzer
⑯ Low-noise, active cooling to enable use in ambient temperatures of up to 50 °C (122 °F)
⑰ Usable worldwide due to operating voltages of 90 ... 240 V AC, 50 ... 60 Hz, via country-specific power cables

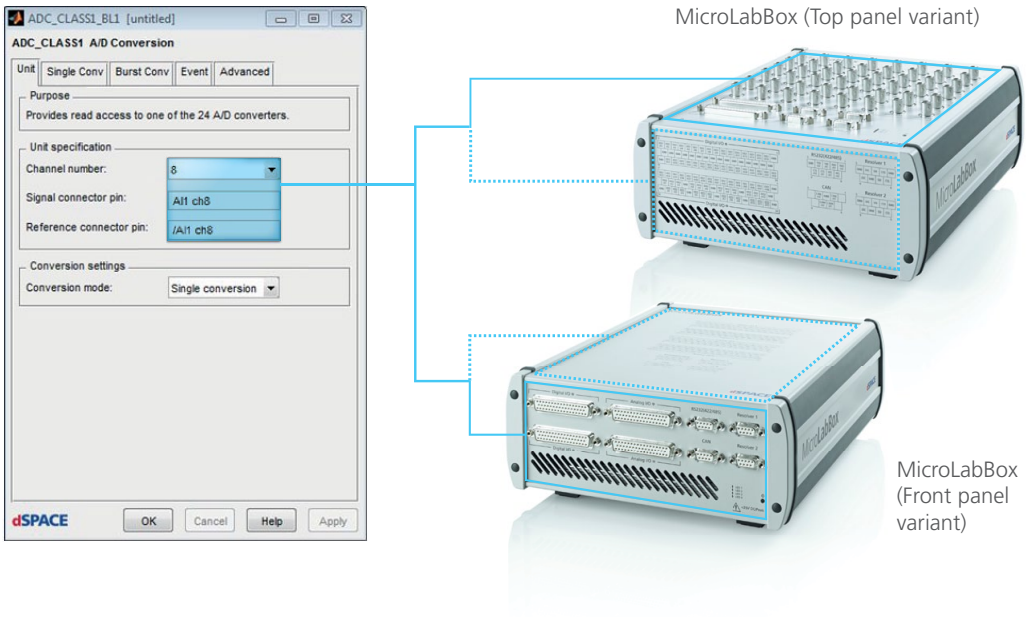


Figure 2: Intuitive connection via channel allocation in the software (Real-Time Interface; RTI), the pin-out information on the hardware, and the easily accessible, integrated connector panel. There are two MicroLabBox variants, each with a different position and selection of connectors.

>> **Lots of Fast I/O**

With over 100 different I/O interfaces, MicroLabBox covers a wide range of various applications. The FPGA technology enables for precise, parallel and fast I/O processing, which allows synchronous detection of analog measurements and high-precision PWM signal generation. It is also possible to offload large I/O preprocessing tasks, such as filtering and signal analysis, onto the FPGA so that the real-time processor is not under unnecessary strain (for details on the I/O interfaces, see the MicroLabBox profile on p. 39). Specially designed to easily control electric drives such as asynchronous 3-phase motors or brushless DC motors, MicroLabBox provides special interfaces such as encoder and Hall sensor inputs and, in the future, SSI, EnDat and resolver sensor inputs. To minimize the required number of additional devices, such as laboratory power supplies, MicroLabBox also has a built-in sensor supply. This permanently supplies 12 V, as well as an adjustable voltage between 2 - 20 V.

Expandability

In addition to standard I/O, MicroLabBox also has additional expansion interfaces. With CAN or Ethernet, the system can be coupled to other devices and in the future it will be possible to couple MicroLabBox with the dSPACE PGI1 (Programmable Generic Interface). The PGI1 can also be used for customer-specific expansions, in addition to the existing solutions for lithium-ion battery management or connecting an LTi inverter via the TWINSync protocol.

Easy to wire

To make wiring as easy as possible, dSPACE designed MicroLabBox so that all connectors in the lab are either ready to go, such as for BNC connectors or banana plugs, or can be configured with just a little effort, as is the case for Sub-D connectors. This is why hard-to-wire, high-density connectors and hard-to-obtain connector formats were not included. For the first time ever, MicroLabBox shows the connector pin assignment to the RTI I/O block in Simulink. This makes it easy to follow the signal chain, even without additional

High processing power and fast, comprehensive I/O are what make MicroLabBox a universal system.

documentation. MicroLabBox is available in two I/O panel variants (figure 2).

Stand-Alone Use

In many cases, MicroLabBox is used together with a host PC. In some cases, however, it might be important that MicroLabBox can be used without a host PC, like when it is installed as part of an entire autonomous system. MicroLabBox is thus equipped with a flash boot option that starts the system by connecting the power supply in a few seconds with a pre-loaded application from flash memory. To be able to capture real-time data over a long period in this kind of application, it is possible to connect a USB flash memory, which can be read out for analysis later. In addition, the operating conditions or warnings from the model can be seen directly on the MicroLabBox via programmable multistate LEDs or heard via the integrated buzzer.

Comprehensive Software

MicroLabBox is supported by a comprehensive dSPACE software package. This includes, among other things, the industry-proven products Real-Time Interface (RTI) for Simulink® for model-based I/O integration and ControlDesk® Next Generation for access to the real-time application at run time via graphical tools. In addition to these tools, dSPACE offers further software modules that complement MicroLabBox in various use cases. For users who prefer to program in C or VHDL there are APIs for manual programming.
MicroLabBox can be used for many mechatronics applications: drives, robotics, medical engineering, automotive engineering and also energy engineering.
In short: an innovation to drive further innovations. ■

MicroLabBox: Profile

Size	MicroLabBox (Top panel variant) approx. 310 x 250 x 115 mm (12.2 x 9.8 x 4.5 in) MicroLabBox (Front panel variant) approx. 310 x 250 x 110 mm (12.2 x 9.8 x 4.3 in
Processor	ProcessorPowerPC DualCore 2 GHz
FPGA	Kintex®-7-FPGA
I/O interfaces	■ Digital I/O: ■ 48 x bi-directional channels 2.5/3.3/5 V (single-ended) ■ 12 x bi-directional differential channels (RS422/485) ■ Functionality: Bit I/O, PWM I/O, SPI Master ■ Analog in: ■ 8 x 10 Msps, 14-bit channels, differential, ± 10 V ■ 24 x 1 Msps, 16-bit channels, differential, ± 10 V ■ Various trigger options ■ Analog out: ■ 16 x 1 Msps, 16-bit channels, ± 10 V ■ I/O functionality for electric motor control (for up to two electric motors): ■ 6 x encoder interfaces ■ 2 x Hall sensor interfaces (3 Hall sensors per interface) ■ Multichannel PWM ■ Block commutation PWM ■ 2 x SSI (in the future) ■ 2 x EnDat (in the future) ■ 2 x Resolver (in the future) ■ 2 x UART (RS232/422/485) can be used universally ■ 2 x CAN interfaces ■ Ethernet-I/O interface ■ Sensor supply: 1 x 12 V set, 1 x 2 ... 20 V variable ■ USB connector for data logging via mass storage devices ■ Programmable buzzer ■ Programmable status LEDs
Host interface	■ Gigabit Ethernet host interface
Temperature range	■ 0 ... 50 °C (ambient temperature)
Mains voltage	■ 90 ... 240 V AC, 50 ... 60 Hz
MicroLabBox variants (figure 2)	■ Top panel ■ Front panel
Protection against theft	■ Kensington® lock