MicroLabBox

Hardware Installation and Configuration

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dSPACE

How to Contact dSPACE

Mail:	dSPACE GmbH Rathenaustraße 26 33102 Paderborn Germany
Tel.:	+49 5251 1638-0
Fax:	+49 5251 16198-0
E-mail:	info@dspace.de
Web:	http://www.dspace.com

How to Contact dSPACE Support

If you encounter a problem when using dSPACE products, contact your local dSPACE representative:

- Local dSPACE companies and distributors: http://www.dspace.com/go/locations
- For countries not listed, contact dSPACE GmbH in Paderborn, Germany.
  Tel.: +49 5251 1638-941 or e-mail: support@dspace.de

You can also use the support request form: http://www.dspace.com/go/supportrequest. If you are logged on to mydSPACE, you are automatically identified and do not need to add your contact details manually.

If possible, always provide the relevant dSPACE License ID or the serial number of the CmContainer in your support request.

Software Updates and Patches

dSPACE strongly recommends that you download and install the most recent patches for your current dSPACE installation. Visit http://www.dspace.com/go/patches for software updates and patches.

Important Notice

Contents

Data Sheet 77

About This Document

Content

This document describes how to install and configure MicroLabBox's hardware.

- Preparing MicroLabBox for downloading real-time applications
- Connecting external devices

It also gives you details on self-help, in case there are hardware-related problems, and MicroLabBox's data sheet. This document is valid for all variants of MicroLabBox.

Symbols

dSPACE user documentation uses the following symbols:

Symbol	Description
DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a hazard that, if not avoided, could result in property damage.
Note	Indicates important information that you should take into account to avoid malfunctions.
Tip	Indicates tips that can make your work easier.
	Indicates a link that refers to a definition in the glossary, which you can find at the end of the document unless stated otherwise.
	Precedes the document title in a link that refers to another document.

Naming conventions

dSPACE user documentation uses the following naming conventions:

%name% Names enclosed in percent signs refer to environment variables for file and path names.

< > Angle brackets contain wildcard characters or placeholders for variable file and path names, etc.

Special folders

Some software products use the following special folders:

Common Program Data folder A standard folder for application-specific configuration data that is used by all users.

```
%PROGRAMDATA%\dSPACE\<InstallationGUID>\<ProductName>
```

or

```
%PROGRAMDATA%\dSPACE\<ProductName>\<VersionNumber>
```

Documents folder A standard folder for user-specific documents.

```
%USERPROFILE%\Documents\dSPACE\<ProductName>\
<VersionNumber>
```

Local Program Data folder A standard folder for application-specific configuration data that is used by the current, non-roaming user.

```
%USERPROFILE%\AppData\Local\dSPACE\<InstallationGUID>\
<ProductName>
```

Accessing dSPACE Help and PDF Files

After you install and decrypt dSPACE software, the documentation for the installed products is available in dSPACE Help and as Adobe® PDF files.

dSPACE Help (local) You can open your local installation of dSPACE Help:

- On its home page via Windows Start Menu
- On specific content using context-sensitive help via **F1**

dSPACE Help (Web) You can access the Web version of dSPACE Help at www.dspace.com.

To access the Web version, you must have a *mydSPACE* account.

PDF files You can access PDF files via the icon in dSPACE Help. The PDF opens on the first page.

Safety Precautions

Introduction

To avoid risk of injury and/or damage to the dSPACE hardware, read and ensure that you comply with the following safety precautions. These precautions must be observed during all phases of system operation.

dSPACE General Safety Precautions

In addition to the safety precautions given in this document, read the dSPACE General Safety Precautions. This document describes the risks of injury and damage to the dSPACE hardware in general.

A printed document of the dSPACE General Safety Precautions is delivered together with your hardware. You can also find the document in PDF format on the dSPACE DVD.

Where to go from here

Information in this section

User Qualification and Intended Use

User qualification

Work on dSPACE hardware, and on the connected electric equipment, must be carried out only by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician, and in accordance with electrical engineering rules and regulations.

A skilled electrician is a person with sufficient technical training, comprehension, experience, and knowledge of the relevant regulations to assess the tasks assigned to them and to recognize possible dangers.

Intended use

MicroLabBox is a ready-to-use rapid control prototyping (RCP) system for a laboratory environment. It is intended for use in the research and development of mechatronic applications. MicroLabBox is neither vibration nor shock resistant and must be used in a clean and dry environment (pollution degree 2, according to IEC 664).

Using MicroLabBox for purposes other than these (such as in vehicles, or in machines as part of production machinery) is improper and noncontractual use.

Only connect external devices with voltages inside the specified ranges. For absolute maximum levels, refer to Absolute Maximum Levels on page 93.

Only MicroLabBox's power fuses are user-serviceable parts. In case of malfunction do not attempt to make any other repairs, instead contact dSPACE Support.

You are not allowed to modify or service MicroLabBox unless the required instructions are explicitly given in the user documentation or from dSPACE support in writing. Perform the instructions only if you have the required skills.

General Safety Precautions to Avoid Injury

Introduction

You must take the following safety precautions to avoid risks of injury when you work with MicroLabBox.

Do not open the housing of MicroLabBox

Opening and modifying MicroLabBox might result in electric shock due to hazardous voltages.

Never use MicroLabBox on wet locations

Using MicroLabBox on wet locations might result in electric shock due to hazardous voltages or might damage MicroLabBox.

According to IEC 61010-1 (product safety), use MicroLabBox only on dry locations and avoid condensation.

Provide fast access to the mains switch	Place MicroLabBox in position that gives you fast access to the mains switch on its rear side.
Ensure that the external devices cannot endanger anyone	Before you connect an external device to MicroLabBox, make sure that the I/O voltages are inside the specified ranges of MicroLabBox. The I/O signals might provide unexpected hazardous voltages. If MicroLabBox controls movable devices, use hazard-free devices or restricted test areas. Executing applications might lead to unexpected movements of movable devices.
Disconnect movable external devices before updating the firmware	Updating the firmware might cause the connected devices to move uncontrollably.
Set up a restricted test area when simulating electric faults with movable external devices	If movable devices are controlled by the dSPACE hardware, the simulation of electric faults might lead to unintended movements. In this case you should use hazard-free devices or set up a restricted test area with an emergency shutdown.
Replace the delivered power cord only with a suitable power cord	Make sure that the power cord fulfills the mains input characteristics of MicroLabBox.

General Safety Precautions to Avoid Hardware Damage

Introduction	When you work with MicroLabBox, the following situations involve the risk of hardware damage. It is strongly recommended to follow these instructions.
Connecting external devices	Before connecting external devices, make sure that: ▪ MicroLabBox is switched off. ▪ The power supplies of the connected devices (sensors, actuators, etc.) are switched off. ▪ Do not apply voltages/currents outside the specified ranges to the connector pins. ▪ Make sure that you hold cable connectors straight to connect or disconnect them. Holding them at an angle might damage the pins of the connectors or break the connector shells.

Operating MicroLabBox

MicroLabBox needs a free air flow and the operating temperature must not exceed the specified temperature.

- Before you install and operate MicroLabBox, you must always take it out of its soft bag.
- Provide sufficient space for free air flow. Especially, keep air intakes and outlets open.
- Keep MicroLabBox away from heat sources such as radiators, heat storage devices, power amplifiers, and other hardware that produces heat.
- MicroLabBox must not be exposed to direct solar irradiation.

For the specified operating temperature, refer to Absolute Maximum Levels on page 93.

For details on required clearances, refer to Clearances on page 94.

Transportation and shipment of MicroLabBox

MicroLabBox must be secured from stress due to vibration and shock.

- Always transport and store MicroLabBox inside its delivered soft bag.
- Always ship MicroLabBox inside the soft bag and with the original package from dSPACE.

Handling hardware with electrostatic sensitive devices

dSPACE hardware contains sensitive electronic devices. There is a risk of damaging the hardware or reducing its lifetime due to electrical fields or electrostatic discharge (ESD) that occur on touch. To avoid this risk, take the following precautions:

- Only qualified persons with knowledge of protective measures for electrostatic sensitive devices are allowed to unpack, install, or remove sensitive electronic devices.
- During the transport and storage of a sensitive electronic device, place it in closed ESD packaging.
- While handling a sensitive electronic device, place it on a properly grounded workstation, such as a special ESD desk or desk mat.
- You must ensure potential equalization between the environment and you, e.g., by wearing a grounded ESD wristband.
- Do not touch the board or the contacts of the connectors, even after installing the sensitive electronic device.

Electromagnetic compatibility

MicroLabBox is a CE class A device. This equipment may cause interference in a residential installation. In this case the user is encouraged to perform appropriate measures to correct the interference. For details on CE compliance, refer to Certifications on page 94.

Saftey Precautions for Disposing dSPACE Hardware

Disposing of a MicroLabBox

You must ensure that dSPACE hardware is disposed of in accordance with the applicable regional rules and regulations. You are strongly recommended to contact the regional waste management authorities to find a disposal or recycling center for the proper and environmentally sound disposal of dSPACE hardware (e-waste). Recycle or reuse dSPACE hardware wherever possible.

Battery information A lithium manganese dioxide coin cell battery is permanently installed in the MicroLabBox.

Package Contents

Introduction

Lets you check the package contents for completeness.

Where to go from here

Information in this section

MicroLabBox BNC Variant

Package contents

Contents	Description
1 x MicroLabBox	—
1 x Soft bag	To transport and store MicroLabBox.
1 x Power cord	Power cord with inlet connector for non-heating apparatus (IEC 60320-1, C13 connector).
1 x Ethernet cable	To connect MicroLabBox to your host PC.
1 x Package with male Sub-D connectors: ▪ 2 x 50-pin sub-D connectors ▪ 4 x 9-pin sub-D connectors	To set up the I/O cables for external devices.
1 x dSPACE General Safety Precautions	Printed document to prevent personal injury and damage to dSPACE hardware due to improper handling.

MicroLabBox Spring-Cage Variant

Package contents

Contents	Description
1 x MicroLabBox	—
1 x Soft bag	To transport and store MicroLabBox.
1 x Power cord	Power cord with inlet connector for non-heating apparatus (IEC 60320-1, C13 connector).
1 x Ethernet cable	To connect MicroLabBox to your host PC.
1 x Package with 2 x 9-pin male Sub-D connectors	To connect MicroLabBox to CAN and RS232/422/485.
1 x Unlocking tool	To replace defective terminal blocks.
1 x dSPACE General Safety Precautions	Printed document to prevent personal injury and damage to dSPACE hardware due to improper handling.

MicroLabBox Sub-D Variant

Package contents

Contents	Description
1 x MicroLabBox	—
1 x Soft bag	To transport and store MicroLabBox.
1 x Power cord	Power cord with inlet connector for non-heating apparatus (IEC 60320-1, C13 connector).
1 x Ethernet cable	To connect MicroLabBox to your host PC.
1 x Package with male Sub-D connectors: ▪ 4 x 50-pin sub-D connectors ▪ 4 x 9-pin sub-D connectors	To set up the I/O cables for external devices.
1 x dSPACE General Safety Precautions	Printed document to prevent personal injury and damage to dSPACE hardware due to improper handling.

Introduction to MicroLabBox

Introduction

MicroLabBox is a ready-to-use rapid control prototyping (RCP) system for laboratory environment. It can be used in research and development for mechatronic applications.

Where to go from here

Information in this section

Hardware

Variants

Different connector variants of MicroLabBox are available:

- MicroLabBox BNC variant that provides BNC connectors as the main connection type on the top panel.
- MicroLabBox spring-cage variant that provides spring-cage terminal block connectors as the main connection type on the top panel.
- MicroLabBox Sub-D variant that provides Sub-D connectors as the main connection type on the front panel.

All MicroLabBox variants handle the same signals with the same electrical characteristics.

For illustrations of the variants, refer to Package Contents on page 15.

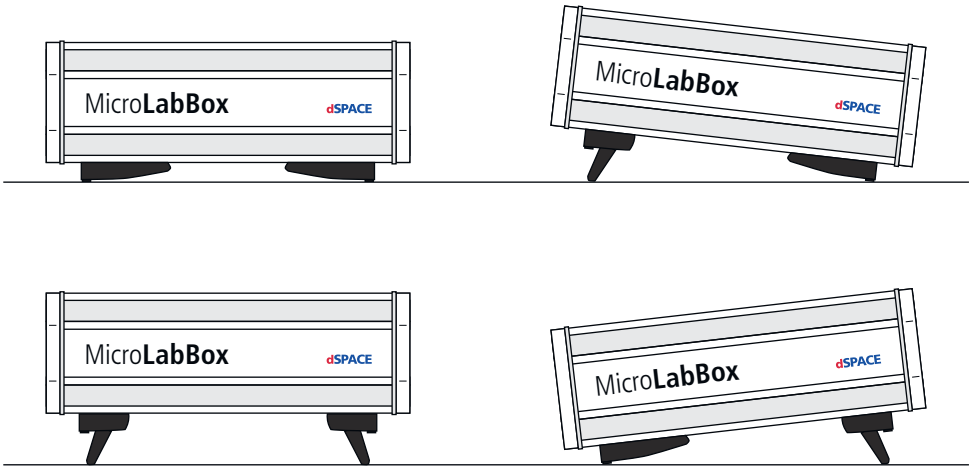
Transportation and Shipment of MicroLabBox

MicroLabBox must be secured from stress due to vibration and shock.

- Always transport and store MicroLabBox inside its soft bag.
- Always ship MicroLabBox inside the soft bag and with the original package from dSPACE.

Placement

MicroLabBox has tilt legs on the bottom that let you stand MicroLabBox up in different positions.



Use MicroLabBox in a clean and dry environment (pollution degree 2, according to IEC 664) and provide sufficient space for free air flow. Especially, keep air intakes and outlets open. For details on required clearances, refer to Clearances on page 94.

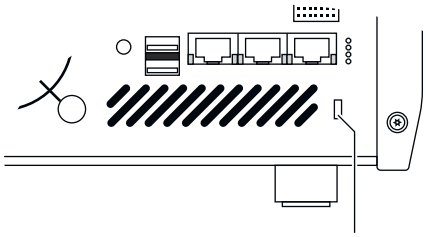
Connection to a PC or notebook

For program download, data analysis, and calibration you connect a PC or notebook via Ethernet to MicroLabBox. The connected PC or notebook is the host PC of MicroLabBox.

Beside the delivered Ethernet cable, you can use a crossover cable or a standard Ethernet cable. MicroLabBox automatically detects what type of cable is used.

Locking MicroLabBox

MicroLabBox has a slot for a Kensington lock on its rear side. You can insert a Kensington lock here to keep MicroLabBox from being stolen.



Slot for Kensington lock

Buzzer

An internal buzzer can be controlled by your application. For details, refer to Buzzer (🕮 MicroLabBox Features).

Software

Host PC software

The dSPACE software on the host PC (such as the implementation and the experiment software) lets you configure MicroLabBox, download applications to it and monitor experiments. The dSPACE software comes on DVD.

First you have to install the RCP and HIL software. For further information, refer to Basics on dSPACE Software Installation (🕮 Installing dSPACE Software). You can find the document in PDF format on the dSPACE DVD.

Firmware

To update or manage MicroLabBox's firmware, use the Firmware Manager. For details on the Firmware Manager, refer to 🕮 Firmware Manager Manual.

Web interface

MicroLabBox provides a web interface to configure the system and to manage applications. After you have established an Ethernet connection, you can do the following:

- Manage the host interface and Ethernet switch configuration
- Manage the flash applications (real-time applications stored on MicroLabBox's flash memory)
- Manage the USB applications (real-time applications stored on a USB mass storage device)
- Manage the nonvolatile data (NVDATA) file system
- Generate system status reports for dSPACE Support
- View the internal message log
- Reboot the system

For details on the web interface, refer to Using the Web Interface on page 57.

Boot behavior

MicroLabBox can automatically load and run applications from flash memory or from a USB mass storage device. Therefore you can use MicroLabBox as a stand-alone prototyping device.

For details on starting applications, refer to MicroLabBox Application Start (🕮 MicroLabBox Features).

Setting up a Connection Between the Host PC and MicroLabBox

Introduction

Before you can register and use MicroLabBox, you must establish a connection to the host PC.

Where to go from here

Information in this section

Basics on the Connection to the Host PC

Introduction

MicroLabBox must be connected via Ethernet to the host PC to download and monitor the applications. There are several connection options and requirements to establish the connection.

Default settings

By default, MicroLabBox is preconfigured as follows:

- Static IP Address: 192.168.140.7
- Network Mask: 255.255.255.0
- IP Mode: static

Requirements of the host PC

To work with MicroLabBox, the host PC must provide the following minimum system requirements:

- Software requirements: An RCP and HIL software installation.

  The software installation includes the `DsNetConfig` command-line utility to set MicroLabBox's network configuration.
- Hardware requirements: An Ethernet network interface card.

For further general software and hardware requirements for the host PC, refer to Appendix (🕮 Installing dSPACE Software).

Ethernet cable connection

MicroLabBox provides three RJ45 Ethernet connectors. An internal Ethernet switch manages the communication and with the default configuration all connectors are equivalent. Nevertheless, it is recommended to use the Host PC connector.

For details on configuring the Internal Ethernet switch, refer to Configuring the Internal Ethernet Switch on page 55.

Required system presettings

To allow communication between MicroLabBox and the host PC, the following settings have to be made:

- The network card of the host PC should be configured to use the *auto-negotiation* mode for communication between MicroLabBox and the host PC. The auto-negotiation mode is standard for Ethernet networks.
- The firewall of the host PC might have to be adjusted to guarantee that it does not block the communication between MicroLabBox and the host PC, refer to Basics on Adapting Firewall Settings on page 26.

Connection options

Depending on how you want to access MicroLabBox there are different connection options.

Peer-to-peer connection If you want to access a MicroLabBox exclusively with one host PC you can connect MicroLabBox via a peer-to-peer connection. You need no other network devices for this connection.

Network connection You can connect MicroLabBox to an Ethernet network to have a flexible access. MicroLabBox and the host PC can be members of either the same network or different networks. You can also access MicroLabBox with several host PCs.

IP mode options

Ethernet devices use IP addresses to communicate to each other in networks. These addresses can be set manually or a DHCP server sets these addresses.

Manually configured IP addresses are static IP addresses. Ethernet devices in *static mode* use static IP addresses. Ethernet devices in *DHCP mode* use the IP addresses assigned by a server.

In a peer-to-peer connection the host PC and MicroLabBox must use static IP addresses.

In a network connection you can use either a DHCP server to set the network configuration of MicroLabBox or you can use static IP addresses.

Note

In DHCP mode, MicroLabBox attempts to retrieve its network configuration from a DHCP server upon startup. If no DHCP server is found, MicroLabBox will use the static configuration provided in its network configuration. This lets you access MicroLabBox with a peer-to-peer connection and via company LAN in the laboratory without changing the network configuration.

Static mode

In static mode an Ethernet device uses a static IP address. A static IP address does not change, even if MicroLabBox is disconnected from the host PC or the network. You are responsible for ensuring that the IP address is unique within your network. A static IP address is primarily useful in peer-to-peer connections, but you can also use one in a network connection.

Tip

With the default network configuration of MicroLabBox you can establish a peer-to-peer by setting the static IP address of the host PC's Ethernet interface.

Set the host PC's network configuration as follows:

- IP address: 192.168.140.100
- Network mask: 255.255.255.0
- Network mode: Static

DHCP mode

DHCP mode is useful if MicroLabBox and the host PC are connected via a network. Depending on the DHCP server configuration, the server can define a fixed IP address or a variable IP address which might change each time MicroLabBox signs onto the network. The DHCP server not only sets the IP address but also defines the required network configurations automatically.

Related topics

Basics

Using the Web Interface 57

HowTos

How to Set Up Peer-to-Peer Connections 27

Basics on Adapting Firewall Settings

Introduction

If a firewall is installed on the host PC, it must allow communication between MicroLabBox and the host PC.

Windows Firewall

During the installation of dSPACE software, the Windows Firewall is automatically adapted to allow communication between MicroLabBox and the host PC via the Ethernet. Two different rule types are installed to allow communication for services and applications:

- Firewall rule for services (Example: dSPACE Device Access Service):

```
advfirewall firewall add rule name="DsDevAccSvc"
service=any dir=in action=allow profile=any protocol=icmpv4:0,
any description="Allow the dSPACE Device Access Service to
connect to a dSPACE system via network."
```

- Firewall rule for applications (Example: ControlDesk):

```
advfirewall firewall add rule name="dSPACE ControlDesk"
program="<RCP_HIL_InstallationPath>\ControlDesk\bin\
ControlDesk.exe"
dir=in action=allow profile=any description=
"Allow dSPACE ControlDesk to connect to a dSPACE system
via network."
```

Other firewalls

If the host PC works with a different firewall, you have to adapt that firewall manually to allow communication via Ethernet for the following service and applications:

- Service:
  - dSPACE Device Access Service (`DsDevAccSvc.exe`)
- Applications:
  - dSPACE Message Dispatch Server (`<RCP_HIL_InstallationPath>\Common\bin\DsMessageDispatchServer.exe`)

- dSPACE Network Configuration (`<RCP_HIL_InstallationPath>\MicroLabBox\Win32\DsNetConfig.exe`)
- ControlDesk (`<InstallationPath>Main\bin\ControlDesk.exe`)

Whether you can use these rule types as templates depends on the syntax of the firewall. If you can use them as templates, you have to adapt the application-specific settings of the rule for applications to the applications listed above. Since there is only one service, you do not have to adapt the rule for services.

MicroLabBox and the dSPACE software use ports dynamically for ICMP, UDP and TCP communication. The firewall must allow the communication to MicroLabBox based on the used services, applications and protocols. Ask your network administrator for a correct setting of your firewall.

Related topics

HowTos

How to Set Up Peer-to-Peer Connections..... 27

How to Set Up Peer-to-Peer Connections

Objective

To set a new static IP address for MicroLabBox with the `DsNetConfig` command-line utility.

Alternative method

An alternate method is to set the host PC's network configuration to establish a peer-to-peer connection. This is useful if MicroLabBox uses the default configuration or if you know the changed network configuration.

For an example, refer to Basics on the Connection to the Host PC on page 23.

Limitations

- MicroLabBox does not support IPv6.
- Do not use the address space 192.168.253.x. It is reserved for internal communication of MicroLabBox.

Preconditions

- You know the MAC address of MicroLabBox. The MAC address is written on the adhesive label located on the bottom of MicroLabBox.
- The new IP Address and network mask for MicroLabBox is valid:
  - The host PC and MicroLabBox must be set to the same network mask: e.g., 255.255.255.0.
  - The IP addresses of the host PC and of MicroLabBox must be set to the same subnetwork: e.g., 192.168.140.x.
  - The IP address of MicroLabBox must be unique in your network.

- The host PC is set to static mode.
- The host PC requirements and system presettings have been fulfilled. For details, refer to Basics on the Connection to the Host PC on page 23.

Method

To set up a peer-to-peer connection

1. With the delivered Ethernet cable, connect MicroLabBox directly to the host PC in a peer-to-peer connection. Using MicroLabBox's *Host PC* connector is recommended.
2. Make sure that MicroLabBox is switched on.
3. On the Start menu of Windows, select dSPACE RCP and HIL <Version> — Command Prompt for dSPACE RCP and HIL <Version>.

   A Command Prompt window opens.
4. Apply a new and valid IP address and network mask: Enter `DsNetConfig <MAC_address_of_MicroLabBox> -ip <IP_address> <network_mask>`.

   For example, `DsNetConfig 64:4d:70:00:18:3a -ip 192.168.0.3 255.255.255.0`.
5. Switch off MicroLabBox.
6. Wait a few seconds and switch MicroLabBox on.
7. In the Command Prompt window, enter `DsNetConfig -scan`.

   MicroLabBox is displayed with its MAC address, the specified IP address, the network mask (subnet mask), and the board name.

Tip

If MicroLabBox is not displayed:
- Check if the subnet masks of MicroLabBox and of the host PC are the same.
- Check if the IP address of MicroLabBox is part of the subnetwork of the host PC's Ethernet interface.
- Check if the IP address of MicroLabBox is within the valid ranges and specified correctly.

Result

You established a peer-to-peer connection between the host PC and MicroLabBox.

Next steps

Now you can register MicroLabBox and use a demo application or you can connect external devices. For the next steps, refer to Registering MicroLabBox

and Using a Demo Application on page 33 or Connecting and Disconnecting External Devices on page 35.

Related topics

Basics

Using the Web Interface 57

How to Set Up a Network Connection

Objective

To set the network configuration of MicroLabBox to the configuration of the Ethernet network with the `DsNetConfig` command-line utility.

DHCP or static mode

You can let a DHCP server set the IP address (DHCP mode) or you can set a static IP address (static mode). With the default configuration, MicroLabBox attempts to retrieve its network configuration from a DHCP server upon startup. If no DHCP server is found, MicroLabBox will use the static configuration provided in its network configuration.

In DHCP mode the network configuration of MicroLabBox might change each time MicroLabBox signs onto the network. This depends on the configuration of the DHCP server.

Limitations

- MicroLabBox does not support IPv6.
- Do not use the address space 192.168.253.x. It is reserved for internal communication of MicroLabBox.

Preconditions

- You know the MAC address of MicroLabBox. The MAC address is written on the adhesive label located on the bottom of MicroLabBox.
- The host PC requirements and system presettings have been fulfilled. For details, refer to Basics on the Connection to the Host PC on page 23.
- You know a valid IP address, the network mask, and the gateway address (if needed) to connect MicroLabBox to the network. For details, ask your network administrator.

Method

To set up a network connection

1. Connect MicroLabBox directly to the host PC. Using MicroLabBox's *Host PC* connector is recommended.
2. Make sure that MicroLabBox is switched on.

3. On the Start menu of Windows, select dSPACE RCP and HIL <version> — Command Prompt for dSPACE RCP and HIL <version>.

   A Command Prompt window opens.

4. If you want to enable MicroLabBox DHCP mode, enter the following:
   - `DsNetConfig <MAC_address_of_MicroLabBox> -dhcp`

     For example,

     `DsNetConfig 64:4d:70:00:18:3a -dhcp`.

5. If you want to set MicroLabBox to static mode, enter one of the following commands:
   - To set a static IP address without gateway, enter the new IP address and the network mask:

     ```
     DsNetConfig <MAC_address_of_MicroLabBox> -ip <IP_address>
     <subnet_mask>
     ```

     For example:

     ```
     DsNetConfig 64:4d:70:00:18:3a -ip 192.168.0.2
     255.255.255.0
     ```
   - To set a static IP address with gateway, enter the new IP address, the network mask, and the gateway address:

     ```
     DsNetConfig <MAC_address_of_MicroLabBox> -ip <IP_address>
     <subnet_mask> -gw <gateway_address>
     ```

     For example:

     ```
     DsNetConfig 64:4d:70:00:18:3a -ip 192.168.0.2
     255.255.255.0 -gw 192.168.0.1
     ```
6. Switch off MicroLabBox.
7. Disconnect the peer-to-peer connection between MicroLabBox and the host PC.
8. Connect MicroLabBox and the host PC to the Ethernet network.

Tip

To check the Ethernet configuration, type MicroLabBox's IP address in the browser's address bar of your host PC. If the browser displays the web interface, the Ethernet configuration is correct.

Result

You established a network connection between MicroLabBox and the host PC.

Next steps

Now you can register MicroLabBox and use a demo application or you can connect external devices. For the next steps, refer to Registering MicroLabBox

and Using a Demo Application on page 33 or Connecting and Disconnecting External Devices on page 35.

Related topics

Basics

Using the Web Interface 57

Registering MicroLabBox and Using a Demo Application

Introduction

Provides basic information on using MicroLabBox so that you know the first steps.

Where to go from here

Information in this section

Registering MicroLabBox..... 34
You have to register MicroLabBox before you can download applications to MicroLabBox.

Using a Demo Application..... 34
To become more familiar with MicroLabBox.

Information in other sections

MicroLabBox Application Start (🕮 MicroLabBox Features)
A real-time application can be run from the program memory, the flash memory or from a USB mass storage device.

Registering MicroLabBox

Introduction

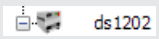
You have to register MicroLabBox before you can download applications to MicroLabBox.

Registering MicroLabBox

You register MicroLabBox with the Platform Manager. The Platform Manager is a component of several dSPACE software products, such as ControlDesk.

Note

The Platform Manager shows MicroLabBox's base board name (DS1202).



For details on registering MicroLabBox with ControlDesk, refer to How to Register a Platform (🕮 ControlDesk Platform Management).

Using a Demo Application

Using a demo application

To use a demo application, refer to Quick Start for Working with a dSPACE System (🕮 DS100x, DS110x, MicroAutoBox II, MicroLabBox – Software Getting Started).

Connecting and Disconnecting External Devices

Introduction

Provides details on proper cabling and connecting external devices.

Where to go from here

Information in this section

Basics on Proper Cabling

Introduction

Proper cabling, including grounding and shielding, reduces noise, capacitive and inductive effects, and influences caused by electro-static discharge (ESD) pulses.

Tip

The advice specified here also applies to the cabling of the devices in your laboratory. It is better to eliminate the cause, than to reduce the effects.

Where to go from here

Information in this section

Definition of Different Ground Signals

Introduction

MicroLabBox uses two different ground signals: Signal ground and protective ground. To achieve the best results regarding signal quality, noise rejection, and EMC behavior, these different signals must not be mixed.

Definition of ground signals

The following definitions will help you to distinguish between the ground signals:

- *Signal ground* is the reference potential of MicroLabBox for connecting external devices.

- *Protective ground* is the reference potential for the exposed metallic parts of electric installations. It is a part of the electrical safety concept and the reference potential for shielding.

  MicroLabBox's housing and the metal shells of the connectors are connected to protective ground.

There might be a potential difference of typical ±0.6 V between the protective ground and the signal ground. The floating connection to protective ground prevents parasitic ground loops and compensating currents caused by ground loops.

Grounding Signals

General rule

Do not use a signal ground line for more than one purpose. A grounding scheme has to be evaluated based according to its AC current flow and not only on its DC behavior.

Guidelines

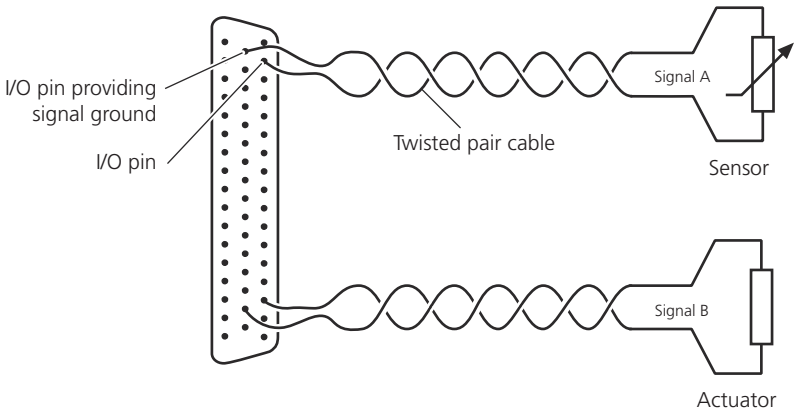
The following guidelines help you to reduce noise, capacitive, and inductive effects:

- To avoid ground loops and ground bounces, use separate signal ground lines for all connected sensors and actuators.
- Each signal should have its own signal ground line. You improve the results if you use twisted pair cables. A twisted pair cable is relatively immune to inductive coupling.
- Always use the same connector for signal line and signal ground line.

  Use signal ground connector pins exclusively for the signals that are provided by the same connector.
- If you use shielded cables for high-accuracy measurements, the shield must be connected to the housing of the sensor/actuator and to the metal shell of the I/O connector. For the shielding use large-area connections to the metal shell of the connector and avoid pigtails. Do not connect the shield to signal ground anywhere.

  For details on shielding, refer to Shielding on page 38.

The illustration below visualizes the above guidelines:



If not enough signal ground pins are available at the connector, several signal ground lines can be attached to a common signal ground pin. However, this common signal ground pin lead must be kept as short as possible to reduce ground line inductance.

If a cable contains unused leads, connect them to signal ground lines at both ends to lower the inductance of the ground path between MicroLabBox and the sensor/actuator.

Shielding

Introduction

Proper shielding reduces noise, inductive effects, and influences caused by electro-static discharge (ESD) pulses. This is recommended for high-accuracy measurement results.

Background information

A *shield* is a barrier to keep everything inside in and keep everything outside out. It is usually connected to the device enclosures at both ends to form a closed cage around all signals.

The best shield is a low-inductance conductive barrier surrounding the complete setup of the device, cable and system, keeping everything inside in and keeping everything outside out (Faraday cage). Low resistance, and most especially low inductance, are the key to a good shield against electric fields.

EMC radiation and immunity are mostly affected by the outer cable shield. Individual lead shielding has only a minor effect if a common outer shield is present. Individual shielding is only necessary to reduce crosstalk.

Cabling

For cabling you should use shielded, twisted pair cables. The inner twisted-pair leads are used for the signal line and the return line (ground line).

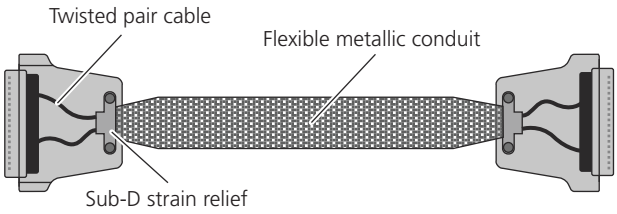
Ideally, each signal must be twisted with its signal ground line so that the effects of electromagnetic fields cancel one another.

Connecting shield to MicroLabBox

Note the following to get proper ESD protection:

- Use metal shell connectors for cabling.
- Use a flexible metallic conduit to shield the signal lines which are attached to each Sub-D connector.
- Each metallic conduit must be completely inserted in the strain relief of the respective I/O connector with surface contact (to obtain ESD protection).

The illustration below shows the above guidelines.



Note

Do not connect the shield to signal ground of MicroLabBox.

Connecting shield to sensors and actuators

At the other end, the shield must be connected directly to the sensor/actuator housing. Sometimes sensors and actuators have dedicated shield pins available at their connector. The idea is to form one closed shielding cage consisting of the cable shield and sensor/actuator enclosure, which is ideally nowhere connected to signal ground. Use a large-area connection and avoid pigtails.

Avoiding Crosstalk by Proper Cabling

Background information

Crosstalk is any phenomenon in which a signal transmitted on one circuit or channel of a transmission system creates an undesired effect in another circuit or channel.

Crosstalk occurs if a signal with steep edges or high frequency runs close to a high impedance signal. The main reasons for crosstalk are capacitive and inductive coupling.

Measures to avoid crosstalk

If crosstalk becomes a problem in your application, take the following measures to reduce and possibly avoid it:

- Twist each signal line with its signal ground line.
- Never twist two signal lines.
- Keep digital and analog signal lines separated. Keep fast-changing signals far away from analog inputs.
- If you use multiconductor cables, the individual twisted pairs should be shielded.
- You should also note the advice, provided in Wiring Up External Devices on page 40.

Wiring Up External Devices

Introduction

When wiring up the different devices in your laboratory, consider that the wiring might have effects on signal quality. For example, noise and/or crosstalk can be reduced and possibly avoided if you follow the notes and tips specified here.

Notes and tips on wiring

- Use connections that are as short as possible between the different devices in your laboratory.
- Keep cabling away from noise sources.
- Separate signal lines from high-frequency, high-current, or high-voltage lines. These lines are capable of inducing currents on the signal lines if they run parallel and close to them. To reduce the magnetic coupling between lines, separate them by a reasonable distance if they run in parallel, or run the lines at right angles to each other.
- Do not route signal lines through conduits that also contain power lines.
- Protect signal lines from magnetic fields caused by devices such as monitors, electric motors, welding equipment, transformers, and so on, by running these through metal conduits.

Connecting and Disconnecting External Devices to MicroLabBox

Introduction

Basics on connecting and disconnecting external devices to achieve trouble-free operation.

Where to go from here

Information in this section

How to Connect and Disconnect External Devices

Objective

To connect and disconnect external devices safely.

Method

To connect and disconnect external devices

⚠ WARNING

Risk of electric shock due to hazardous voltages

Connecting any high-voltage devices to MicroLabBox can result in serious personal injury.

- You must ensure that all external devices and MicroLabBox are switched off.
- Do not apply voltages or currents outside the specified ranges to the connectors of MicroLabBox.

NOTICE

Damage to hardware due to disconnecting cables

Connecting and disconnecting cables without switching off the hardware might damage hardware.

- You must ensure that all external devices and MicroLabBox are switched off.

1. Switch off all external devices.
2. Switch off MicroLabBox.
3. Connect or disconnect your application's devices to/from MicroLabBox. For details on the different signals, refer to Connecting and Disconnecting External Devices to MicroLabBox on page 41.
4. Make sure that the connected devices cannot endanger anyone. If MicroLabBox controls movable devices, failures might lead to unexpected movements.
5. Switch on MicroLabBox.
6. Switch on the external devices.

Result

The external devices are connected to or disconnected from MicroLabBox.

Related topics

Basics

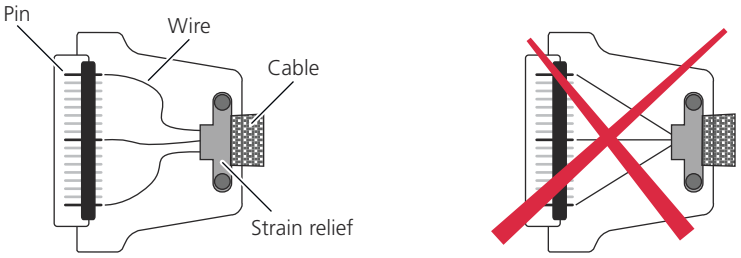
Using Sub-D Connectors

Checking connectors before first use

Before you use a crimped or soldered connector for the first time, check the following points:

- The pins are straight and not deformed.
- The contact surfaces of the male and female connectors are clean.

  Especially the contact surfaces of soldered connectors must be free from solder and flux.
- Inside the connector, the wires of the connector cable are long enough and do not stretch the connector pins.



  To easily plug the connector the pins are loosely mounted. When the connector pins are stretched, it might not be possible to connect the connector to its counterpart.
- The connector shell is mounted.

  This helps you hold the connector straight for plugging.

Plugging the connector

NOTICE

Improper plugging might deform connector pins

Using connectors with deformed connector pins might result in defective contacts and disturbed signals.

- Hold the connector shell straight and do not force the connector.
  Holding the connector at an angle might deform pins.

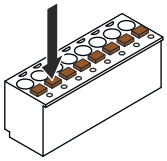
Inserting Wires into Spring-Cage Terminals and Removing Wires

Introduction

The MicroLabBox spring-cage variant provides spring-cage terminals that let you connect wires directly to MicroLabBox.

Inserting and removing the wires

To insert wires into the spring-cage terminals, push down the colored button with a 2 mm (0.08 in.) slot-head screwdriver and insert the wire. Solid and ferruled wires can also be inserted directly. To remove the wire, push down the colored button.



Connecting Analog Signals

Proper cabling

Analog signals are susceptible to interference. For details on proper cabling, refer to Basics on Proper Cabling on page 36.

General behavior of analog output signals

All analog outputs are set to high impedance until the application is started. Then the outputs follow the output voltage defined in your application. Unused outputs remain in high impedance state.

Unused connector pins or BNC connectors

Unused connector pins or BNC connectors can be left open.

Related topics

Basics

ADC Class 1 (📖 MicroLabBox Features)
ADC Class 2 (📖 MicroLabBox Features)
Basics on Proper Cabling....36
DAC Class 1 (📖 MicroLabBox Features)
Electric Motor Control (📖 MicroLabBox Features)

References

Connector Pinouts....96
Signal Description....122

Connecting Digital Signals

General behavior of digital signals

All digital outputs are set to high impedance until the application is started. Then the outputs follow the states defined in your application. Unused outputs remain in high impedance state.

Different electrical characteristics

MicroLabBox supports single-ended (Class 1) and differential (Class 2) digital signals.

The high level of a digital Class 1 output signal is set by your application. It can be configured to 2.5 V, 3.3 V, or 5 V referenced to signal ground. Make sure that the connected external devices fit to the configured output level.

Related topics

Basics

Basics on Proper Cabling 36
Bit I/O (DIO Class 1) (MicroLabBox Features)
Bit I/O (DIO Class 2) (MicroLabBox Features)
Electric Motor Control (MicroLabBox Features)
Serial Peripheral Interface (DIO Class 1) (MicroLabBox Features)
Timing I/O (MicroLabBox Features)

References

Connector Pinouts 96
Signal Description 122

Connecting Resolvers

Verifying the excitation output voltage and frequency

MicroLabBox provides the excitation output voltage and your application sets the excitation voltage level and frequency.

Before you connect a resolver to the resolver interface, make sure that the differential excitation output voltage and its frequency match the electrical characteristics of your resolver.

For the correct values of the excitation input voltage and frequency of the resolver, refer to the data sheet of the used resolver.

For details on the pinout of the resolver interface, refer to Resolver Connectors (Sub-D) on page 114 or Resolver Connectors (Spring-Cage) on page 115.

Verifying the sine and cosine input voltage

The sine and cosine input voltage depend on the transformation ratio of the resolver and the excitation output voltage. Note that the transformation ratio is valid only at the recommended excitation frequency of the used resolver. Your application sets the sine and cosine input voltage of MicroLabBox's resolver interface.

Make sure that the configured sine and cosine input voltage characteristics of the resolver interface match the sine and cosine output voltage characteristics of your resolver.

For the correct values of the resolver's transformation ratio, refer to the data sheet of the used resolver.

For supported transformation ratios, refer to 🕮 MicroLabBox Hardware Installation and Configuration.

Related topics

Basics

Resolver Interface (🕮 MicroLabBox Features)

Connecting to Sensor Supply

Activating the supplies

When you switch on MicroLabBox, *Sensor Supply Output A* immediately provides a fixed voltage. In contrast, *Sensor Supply Output B* provides a voltage only if your application sets an output voltage level. If the application sets no output voltage level, *Sensor Supply Output B* supplies no voltage.

Related topics

Basics

Sensor Supply (🕮 MicroLabBox Features)

References

Connector Pinouts 96
Signal Description 122

Connecting CAN Devices

CAN version

MicroLabBox provides the high-speed CAN version 2.0.

Terminating the bus

A CAN network must be terminated with the line impedance to minimize signal reflection on the bus. It is recommended to terminate the beginning and the end of the bus. ISO-11898 requires that the CAN network has a nominal characteristic line impedance of 120 Ω. So each end of the bus must be terminated with a 120 Ω resistor.

- Make sure that only the ends of the bus are terminated.
- Keep the stub lengths as short as possible.

MicroLabBox provides 120 Ω terminations that can be enabled by your application.

Related topics

Basics

Basics on Proper Cabling 36
CAN Support (MicroLabBox Features)

References

Connector Pinouts 96
Signal Description 122

Connecting Ethernet Devices

Connecting host PC

Connect your host PC to the **Host PC** connector. This connector provides a host PC communication independent from MicroLabBox's internal Ethernet switch configuration. For details on the Ethernet switch configuration, refer to Configuring the Internal Ethernet Switch on page 55.

Connecting Ethernet I/O devices

Connect the Ethernet I/O devices to the **Ethernet** connector. With the default internal Ethernet switch configuration these connectors provide Ethernet I/O communication. For details on the Ethernet switch configuration, refer to Configuring the Internal Ethernet Switch on page 55.

Related topics

Basics

Configuring the Internal Ethernet Switch 55
Ethernet I/O Interface (MicroLabBox Features)

References

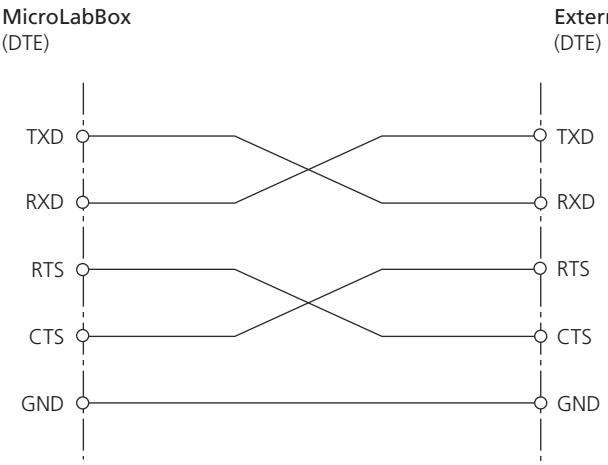
Connector Pinouts 96
Signal Description 122

Connecting RS232 Devices

Guidelines

If you want to connect two DTE devices (data terminal equipment, such as a PC), you have to cross-connect the data lines and the handshake lines of the two RS232 devices.

To do this, connect the pins of the devices as shown below. This method is known as 'null modem cabling'.



If no handshaking is required or if handshaking is done by software the handshake lines can be left unconnected.

Tip

You can use a null modem cable to communicate from one serial port to another.

Related topics

Basics

Basics on Proper Cabling..... 36
Serial Interface of MicroLabBox (📖 MicroLabBox Features)

References

Connector Pinouts..... 96
Signal Description..... 122

Connecting RS422 Devices

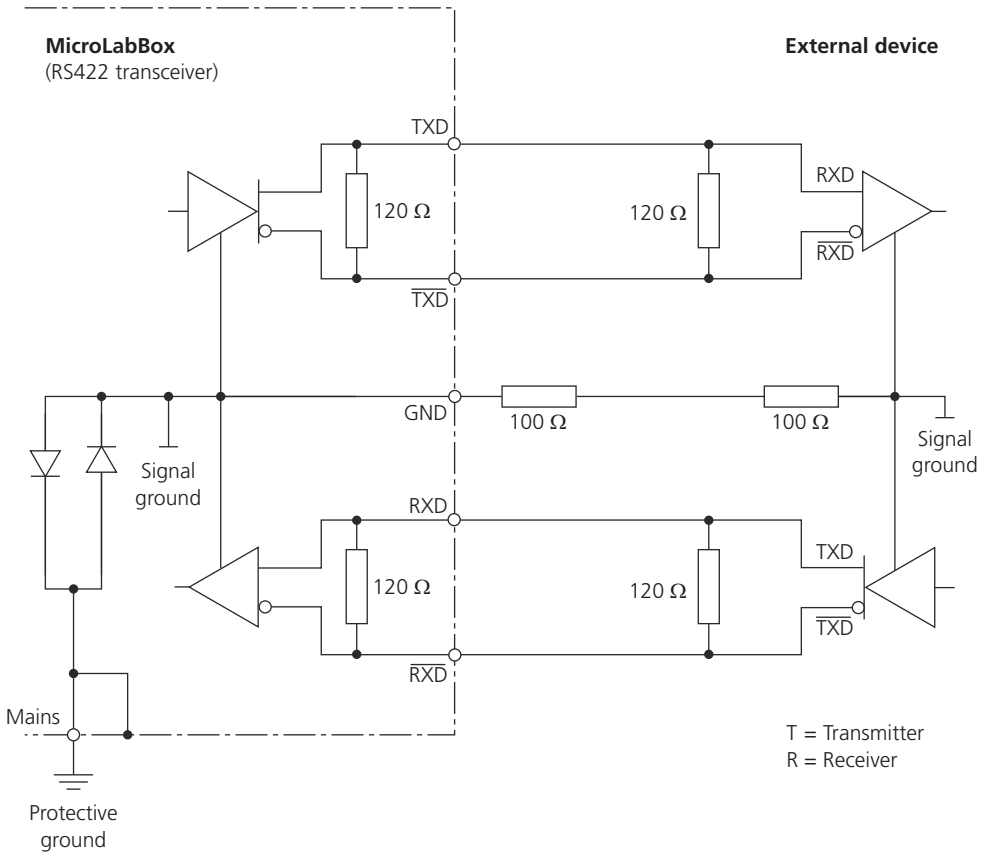
Line termination

In RS422 mode, line termination at the transmitter and the receiver is essential, especially for faster data transfer rates and long cables. The transmitter and receiver must therefore be equipped with termination resistors (120 Ω) between the differential transmit lines (TXD and $\overline{\text{TXD}}$) and the differential receive lines (RXD and $\overline{\text{RXD}}$).

- Make sure that only the ends of the bus are terminated.
- Keep the stub lengths as short as possible.

MicroLabBox provides 120 Ω terminations that are supported by the RTI FPGA Programming Blockset.

The reasons for correct termination are reflections at the ends of the line, and the minimum transmitter load requirement.



Ground connection

For correct operation of the transmitter and the receiver, a return signal path between the grounding of the individual devices is required. This can be realized by a third wire, as shown above. Resistors should be connected in series to limit unwanted high currents resulting from ground potential differences.

Related topics

Basics

Basics on Proper Cabling 36
Serial Interface of MicroLabBox (MicroLabBox Features)

References

Connector Pinouts 96
Signal Description 122

Connecting RS485 Devices

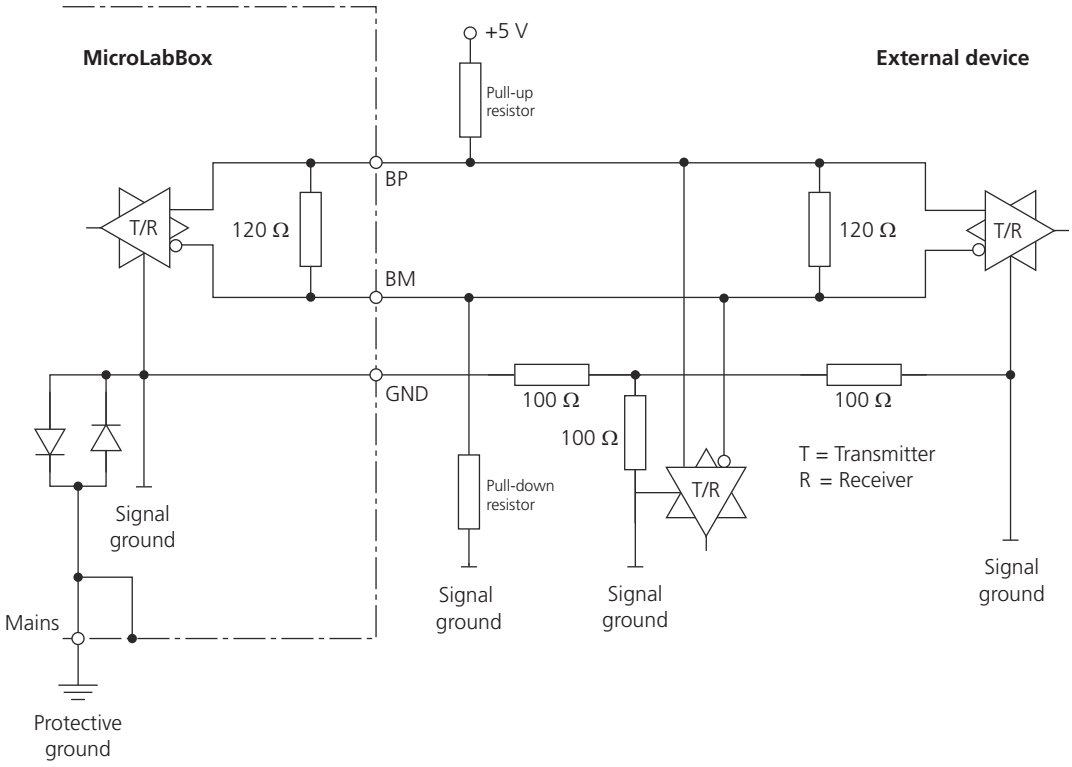
Line termination

If you use the RS485 transceiver mode, line termination is essential, especially for faster data transfer rates and long cables. The reasons for correct termination are reflections at the ends of the line, and the minimum transmitter load requirement.

The illustration below shows a typical RS485-compliant network, with transmitters/receivers at both ends of the cable and transmitters/receivers placed along the length of the cable. Since each device communicates bidirectionally, it is impossible to determine where the transmitter is and to which device the transmitter is currently transmitting. Moreover, it is also possible for the transmitter to be in the middle of the line. Thus, both ends of the line have to be terminated with a resistor.

- Make sure that only the ends of the bus are terminated.
- Keep the stub lengths as short as possible.

MicroLabBox provides 120 Ω terminations that are supported by the RTI FPGA Programming Blockset.



Open-line fail-safe termination

Without a pull-up and a pull-down resistor, undefined bus levels occur if no transmitter is active. MicroLabBox itself is fail-safe in this context. If a external device's transmitter is not fail-safe, you must provide a pull-up and a pull-down resistor (e.g. 1 kΩ) as shown above.

Ground connection

For correct operation of the transmitter and the receiver, a return signal path between the grounding of the individual devices is required. This can be realized by a third wire, as shown above. Resistors should be connected in series to limit unwanted high currents resulting from ground potential differences.

Related topics

Basics

Basics on Proper Cabling..... 36
Serial Interface of MicroLabBox (MicroLabBox Features)

References

Connector Pinouts..... 96
Signal Description..... 122

Connecting and Disconnecting USB Devices

Connecting USB devices

One USB device can be connected to MicroLabBox.

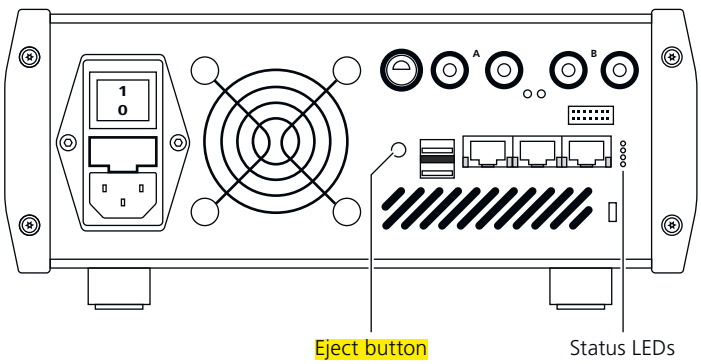
Note

Connect USB devices only to the *USB Port A*. The *USB Port B* is reserved for future development.

Disconnecting USB mass storage devices

Before you disconnect the USB device, press the Eject button. When the LED of the Eject button is off, you can disconnect the USB device safely.

For a description of the Eject button's LED status, refer to LED Status Description on page 136.



Related topics

Basics

Running an Application from a USB Mass Storage Device (MicroLabBox Features)
USB Flight Recorder (MicroLabBox Features)

Configuring the Ethernet Communication

Introduction

You can configure an internal Ethernet switch that manages the communication between MicroLabBox, Ethernet I/O, and the host PC.

Configuring the Internal Ethernet Switch

Ethernet communication types

MicroLabBox uses Ethernet to perform two different types of communication: Host PC communication and Ethernet I/O communication.

Host PC communication This is the communication between the host communication node (HCN) on MicroLabBox and your host PC.

The host PC communication is used as follows:

- To register MicroLabBox
- To load, start and stop applications
- To transfer calibration and measurement data from MicroLabBox using host applications such as ControlDesk

The Host PC communication is optimized for data throughput and can be peer-to-peer or network communication. Its settings are configured by using the `DsNetConfig` command-line utility.

Ethernet I/O communication This is the communication between the computation node (CN) running the application and the connected Ethernet I/O: e.g., the communication between the real-time model and an Ethernet sensor. I/O Ethernet communication is optimized for latency. The application configures the settings of the I/O Ethernet communication.

Inside MicroLabBox an internal Ethernet switch manages the host PC and Ethernet IO communication to the Ethernet ports.

Configuring the Ethernet switch

Depending on the Ethernet switch configuration, the host PC and the Ethernet I/O are either together in one network or in separate networks. By default, the host PC and the Ethernet I/O are in one network.

To prevent network conflicts and high Ethernet traffic it can be useful to separate the host PC and the Ethernet I/O communication into different networks. If your application uses Ethernet I/O communication, each message that reaches the computation node must be handled. By separation you can reduce the Ethernet traffic at the computation node, so fewer messages must be handled.

You can configure the Ethernet switch via a web interface. For details, refer to Basics on the Web Interface on page 57.

Configuring Ethernet I/O communication

Your application sets the Ethernet I/O communication. There are no more Ethernet configurations needed.

Using the Web Interface

Introduction

With MicroLabBox's web interface you can configure the system and manage downloaded applications.

Where to go from here

Information in this section

Basics on the Web Interface

Introduction

For system configuration and support, MicroLabBox has a web interface that you can open in any ordinary web browser.

Precondition

MicroLabBox is connected to the host PC with the delivered Ethernet cable. Using the **Host PC** connector is recommended. This connector provides a host PC communication at all Ethernet switch configurations.

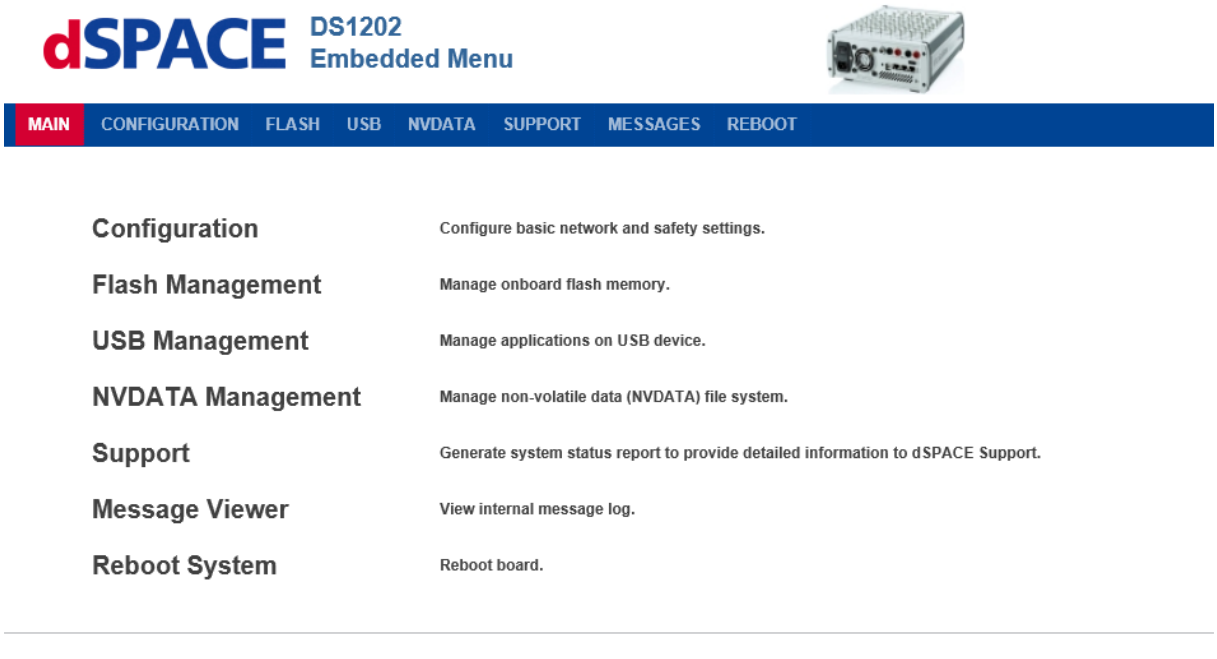
Accessing the web interface

To access the web interface, type MicroLabBox's IP address in the browser's address bar of your host PC. The default IP address is 192.168.140.7 .

If you cannot access the web interface, refer to Setting up a Connection Between the Host PC and MicroLabBox on page 23.

Embedded Menu

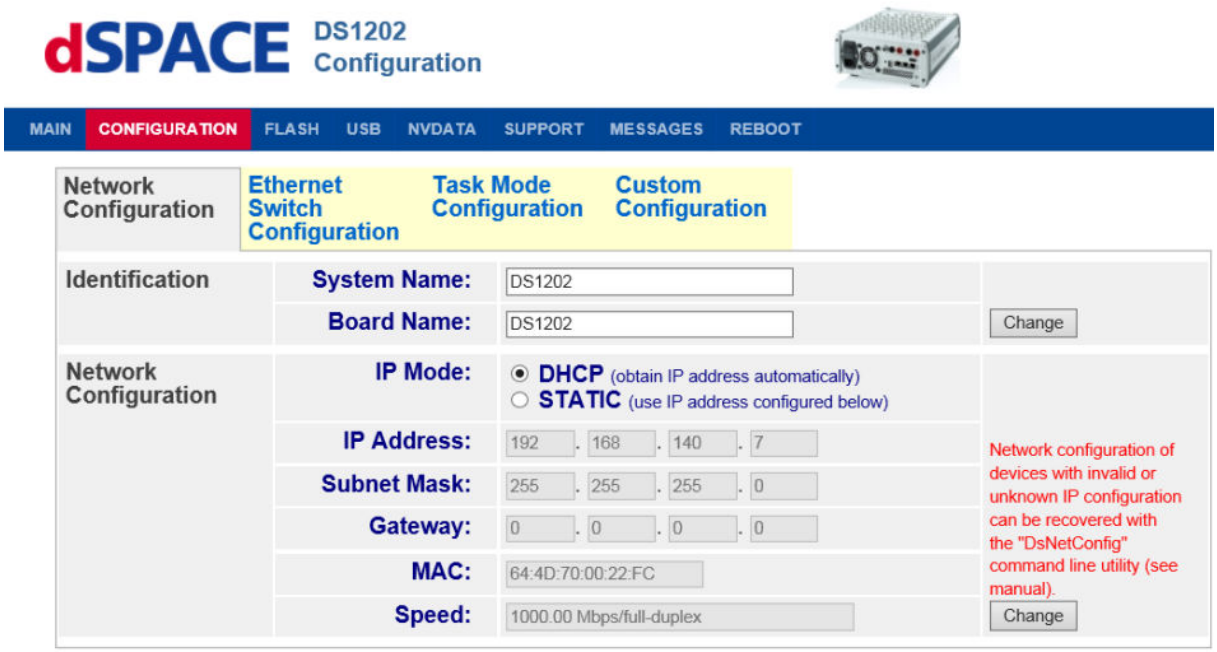
The following illustration shows the DS1202 Embedded Menu page of the web interface. This page gives you access to several sub pages.



Configuration

On the DS1202 Configuration page, you can set the network configuration and the Ethernet switch configuration for MicroLabBox. To access the Configuration page, click CONFIGURATION.

Network Configuration The following illustration shows the Network Configuration tabbed page. On the Network Configuration tabbed page, you can configure the network.



- Identification

  You can assign a system name and a board name. The board name identifies a single MicroLabBox, whereas the system name can be used to combine several MicroLabBoxes into a logical group.

- Network Configuration

  In DHCP mode, MicroLabBox attempts to retrieve its IP address from a DHCP server upon startup. If no DHCP server is found, MicroLabBox will use the static IP address provided in its network configuration.

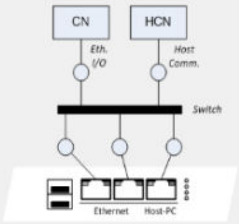
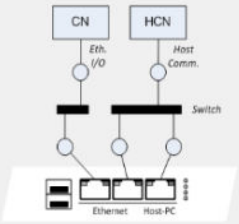
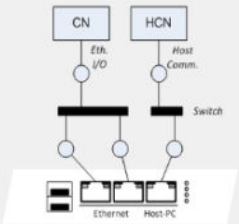
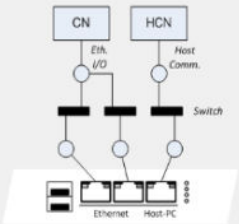
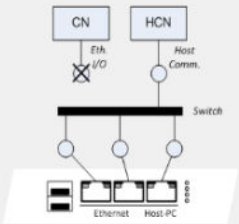
  This lets you access MicroLabBox with a peer-to-peer connection and via company LAN in the laboratory.

Ethernet Switch Configuration The following illustration shows the Ethernet Switch Configuration tabbed page. On the Ethernet Switch Configuration tabbed page, you can configure whether the Ethernet I/O and the host PC are in the same network or in separate networks. For details on configuring the Ethernet switch, refer to Connecting Ethernet Devices on page 47

dSPACE DS1202 Configuration

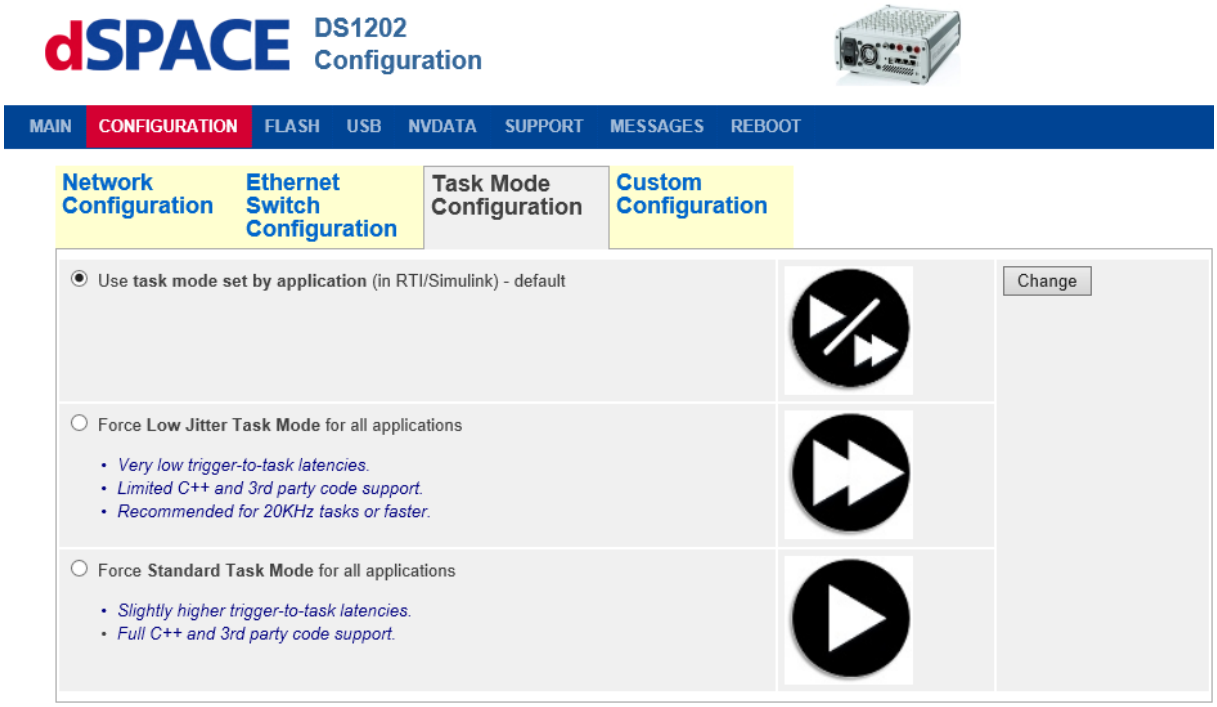
MAIN | CONFIGURATION | FLASH | USB | NVDATA | SUPPORT | MESSAGES | REBOOT

Network Configuration | Ethernet Switch Configuration | Task Mode Configuration | Custom Configuration

◉ Three switched ports for Ethernet I/O and host communication		○ One port for Ethernet I/O, two switched ports for host communication		Specify the communication partner to be reached from each port. Change
○ Two switched ports for Ethernet I/O, one port for host communication		○ Two non-switched ports for Ethernet I/O, one port for host communication		
○ No port for Ethernet I/O, three switched ports for host communication				

CN = computation node, used for real-time applications
HCN = host communication node, used to handle communication with the host PC

Task Mode Configuration The following illustration shows the Task Mode Configuration tabbed page.



On the Task Mode Configuration tabbed page, you can configure the mode in which the tasks of the real-time application are executed:

- Use Task Mode Set by Application

  The real-time application sets the task mode. You can specify the task mode by specifying build options before you build the application. The default task mode is the low jitter task mode.

- Force Low Jitter Task Mode for all applications

  The real-time applications' task mode settings are ignored and the applications are executed in the low jitter task mode. In this task mode, the task handling is based on interrupts, which lets you achieve a low trigger-to-task latency.

  The low jitter task mode is recommended for a task frequency of 20 kHz and higher.

  Note

  The support of C++ and third-party code is limited in low jitter task mode.

- Force Standard Task Mode for all applications

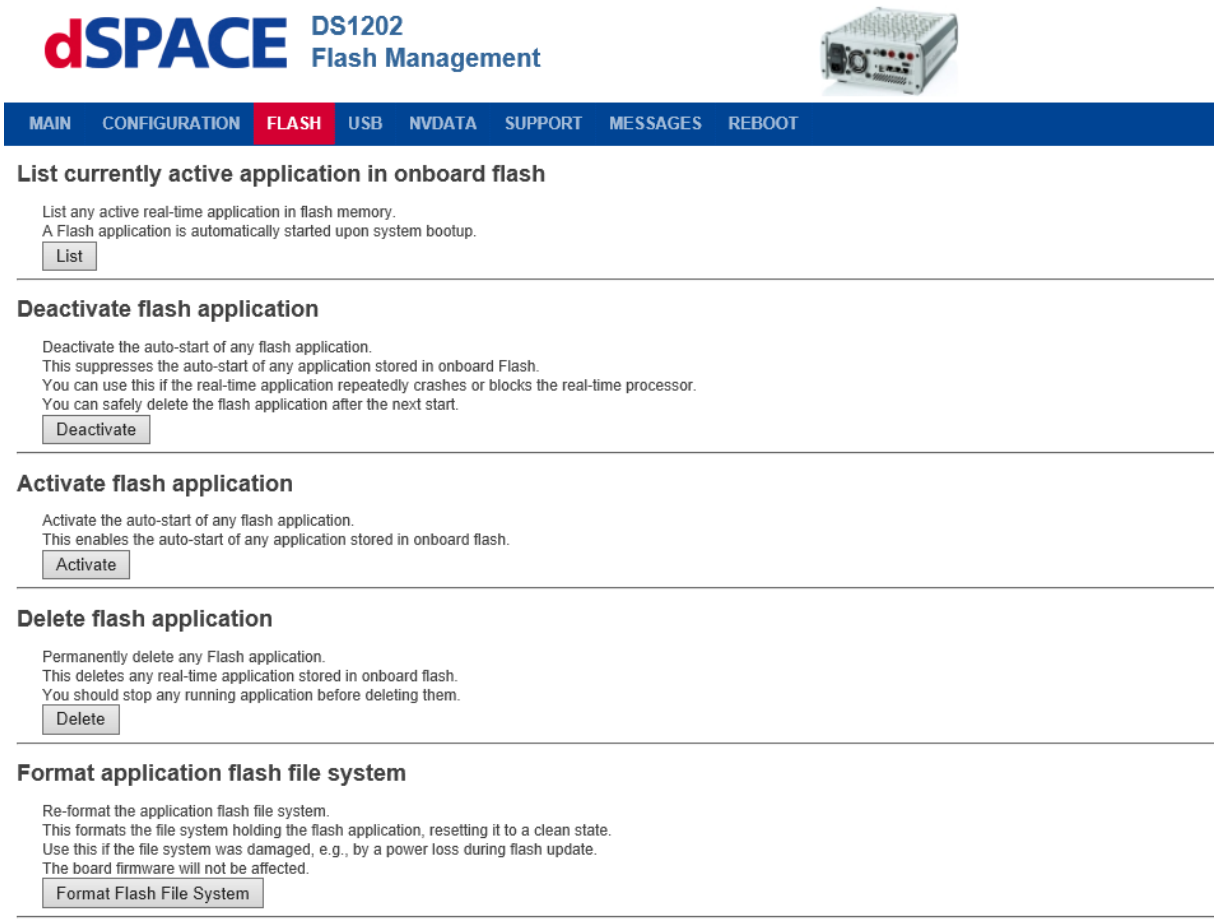
  The real-time applications' task mode settings are ignored and the applications are executed in the standard task mode. In this task mode, the task handling is based on threads, which lets you include C++ and third-party code without limitations.

Custom Configuration The Custom Configuration tabbed page is relevant only if you have instructions from dSPACE support to add or change custom options.

Flash Management

The following illustration shows the DS1202 Flash Management page. On this page, you can manage the flash applications. For further information on starting flash applications, refer to Running an Application from Flash Memory (🕮 MicroLabBox Features).

To access the DS1202 Flash Management page, click FLASH.

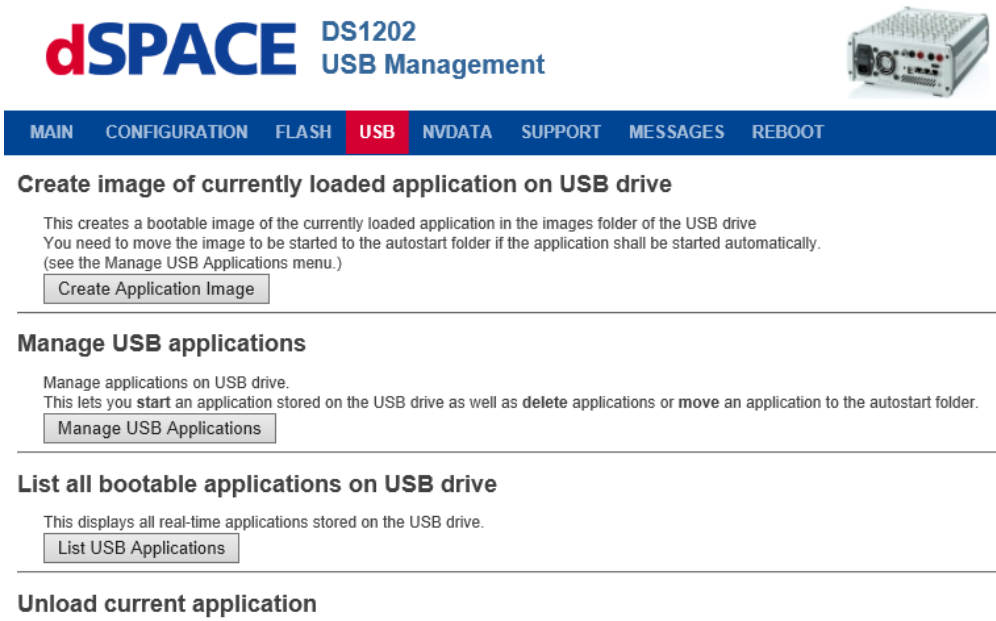


USB Management

The following illustration shows the DS1202 USB Management page. On this page, you can manage the USB applications that are stored on a connected USB mass storage device.

For further information on starting USB applications, refer to Running an Application from a USB Mass Storage Device (🕮 MicroLabBox Features).

To access the DS1202 USB Management page, click USB.

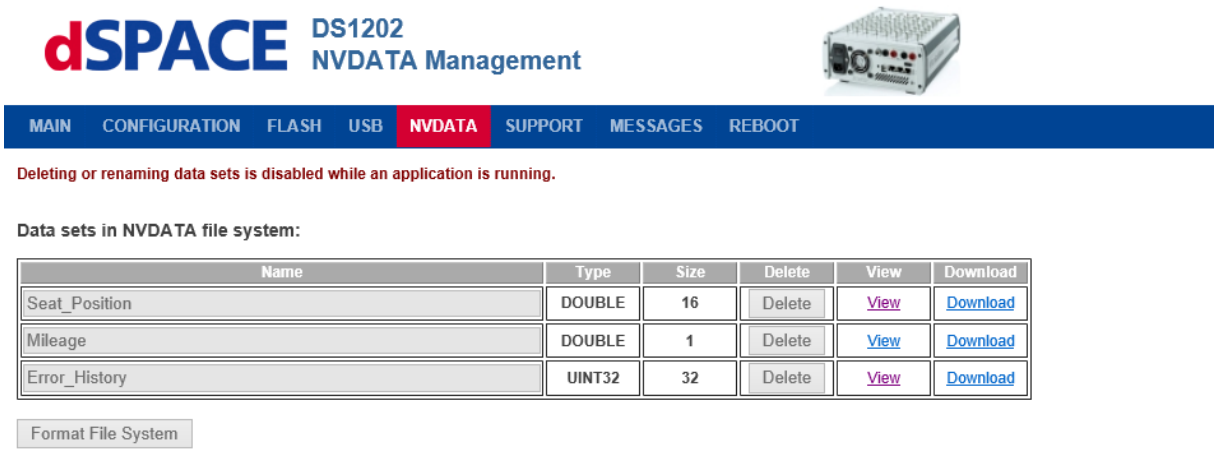


NVDATA management

The following illustration shows the DS1202 NVDATA Management page. On this page, you can manage the data sets that are saved in the nonvolatile data (NVDATA) file system. The page lets you view, export, rename, and delete data sets and format the NVDATA file system.

For further information on managing the NVDATA file system, refer to Nonvolatile Data Handling (NVDATA) (🕮 MicroLabBox Features).

To access the DS1202 NVDATA Management page, click NVDATA.



Support Report and Message Viewer

The Support Report page is relevant only if you need support from dSPACE.

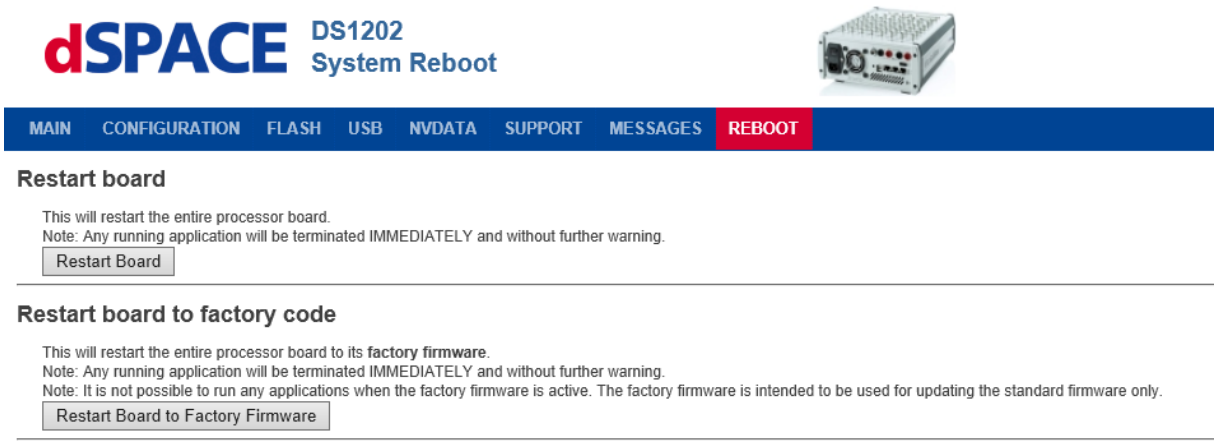
The Message Viewer page shows all host messages sent by MicroLabBox. You can use it to check for possible status or error messages. Note, that the messages are displayed in reverse order, i.e. the newest messages will always appear on top of the message list.

To access the Support Report or Message Viewer page, click SUPPORT or MESSAGES.

Reboot System

The following illustration shows the DS1202 System Reboot page. On this page you can restart MicroLabBox.

To access the DS1202 System Reboot page, click REBOOT.



Related topics

Basics

Connecting Ethernet Devices 47
Nonvolatile Data Handling (NVDATA) (📖 MicroLabBox Features)
Running an Application from a USB Mass Storage Device (📖 MicroLabBox Features)
Running an Application from Flash Memory (📖 MicroLabBox Features)
Setting up a Connection Between the Host PC and MicroLabBox 23

HowTos

How to Set Up a Network Connection 29

How to Delete Flash Applications

Objective

To delete flash applications without dSPACE software. With dSPACE software, you can use the *Platform Manager* to delete the flash applications.

Precondition

MicroLabBox and the host PC are connected via an Ethernet connection.

Method

To delete a flash application

1. In the browser's address bar of your host PC, enter MicroLabBox's IP address.
2. On the Embedded Menu page, click FLASH.
   The DS1202 Flash Management page appears.
3. On the DS1202 Flash Management page, deactivate the flash application and confirm the deactivation.
4. Click REBOOT.
5. On the DS1202 Reboot System page, click Restart Board and confirm the restart.
6. Click FLASH.
7. On the DS1202 Flash Management page, delete any flash application and confirm the deletion.

Result

The flash applications are deleted.

Related topics

Basics

Using the Web Interface 57

HowTos

How to Clear an Application from the Flash Memory of dSPACE Real-Time Hardware (📖 ControlDesk Platform Management)

Maintenance

Introduction

Lets you ensure a long-term use of MicroLabBox.

Where to go from here

Information in this section

Firmware Handling

Handling the firmware

To handle the firmware, use the dSPACE Firmware Manager. Refer to
Firmware Manager Manual.

Related topics

HowTos

Cleaning the Housing of MicroLabBox

Precondition	All external devices and MicroLabBox are switched off.
Cleaning the housing	If the housing is dusty, remove the dust with a dry soft cloth. Do not use any solvents, abrasives or corrosive liquids.

Troubleshooting

Getting further support

Support Knowledge Base If the information in this section does not help you to solve the problem, check the Support Knowledge Base on our website. See http://www.dspace.com/go/kb.

dSPACE Support If self-help does not help you to solve the problem, contact dSPACE Support and provide information about your dSPACE environment and the problems you have. It is recommended to use the support request form provided on the website at http://www.dspace.com/go/supportrequest. However, you can also send an e-mail or phone us.

Where to go from here

Information in this section

Checking MicroLabBox

Check list

Perform the following checks if MicroLabBox does not operate correctly:

- Check the power cord to MicroLabBox.
- Check the power socket.
- Check the Ethernet connection from the host PC to MicroLabBox.
- Check the status LEDs. For details on the LEDs, refer to LED Status on page 136.
- Use ControlDesk to check the board properties. For details, refer to Handling Platforms (🕮 ControlDesk Platform Management).

Problems When Connecting to the Host PC

Platform cannot be registered

Description The Register Platforms dialog cannot find the MicroLabBox.

Remedy Perform the following steps if the MicroLabBox is connected to a LAN:

1. Ensure that the LAN is connected to the **Host PC** connector of the MicroLabBox.
2. Connect the host PC and the MicroAutoBox III to the same network. If the subnetwork address is different, the scan process of the **Register Platform** dialog does not find the MicroLabBox.
3. Set a new network configuration. Refer to How to Set Up a Network Connection on page 29.

Perform the following steps if the MicroLabBox is directly connected to the host PC (peer-to-peer):

1. Ensure that the host PC is connected to the **Host PC** connector of the MicroLabBox.
2. Use the same subnet mask for the host PC as the MicroLabBox uses.

   If you do not know the subnet mask, specify a new network setting for the MicroLabBox. Refer to How to Set Up a Network Connection on page 29.
3. Set the IP address of the host PC to a static IP address of the subnetwork that is specified by the subnet mask.

No connection to the host PC due to Ethernet hardware

Description Ethernet hardware (such as cables or switches) that does not support the Gigabit transfer rate of 1 Gbit/s might cause this problem. In exceptional cases, autonegotiation does not lead to a stable Ethernet connection.

Remedy Manually reduce the transfer rate of one Ethernet device (e.g., the host PC) to an Ethernet transfer rate of 100 Mbit/s.

Problems Related to the Execution and Loading of Real-Time Applications

Description

MicroLabBox shows the following unexpected behavior:

- MicroLabBox terminates a running real-time application and no real-time applications can be loaded.
- The buzzer sounds.
- The SYS LED lights up red.

  Red indicates that MicroLabBox measures a high internal temperature and/or ventilation malfunctions.

Remedy

Perform the following steps to clear the fault:

- Make sure that the ambient temperature is within the specified range.

  To achieve sufficient air circulation ensure that sufficiently cool air is available, especially when operating MicroLabBox at high temperatures.
- Switch off MicroLabBox and disconnect it from the power supply.
- At the rear of the MicroLabBox, clean the ventilation slots with a soft brush to avoid clogging. Do not use a vacuum cleaner, because it can destroy the fan.
- Check whether the fan can rotate.
- Switch on MicroLabBox.

  If the SYS LED lights up red again and the buzzer sounds, contact dSPACE Support.

How to Solve Problems Related to the Firmware

Objective

If you cannot start applications, the firmware might be corrupt. You have to update MicroLabBox with valid firmware.

Method

To solve problems related to the firmware

1. Switch off MicroLabBox.
2. Switch on MicroLabBox. On the rear side the status LED *SYS* is lit orange. MicroLabBox started with the factory firmware and is in secured mode.

   If MicroLabBox did not automatically start with the factory firmware you must manually force a restart with the factory firmware. For details on restarting MicroLabBox with factory firmware, refer to How to Force a Restart with Factory Firmware on page 72.
3. Update the firmware. For details on updating firmware, refer to 🕮 Firmware Manager Manual.
4. Restart MicroLabBox.

Result

MicroLabBox operates correctly with valid firmware.

How to Force a Restart with Factory Firmware

Objective

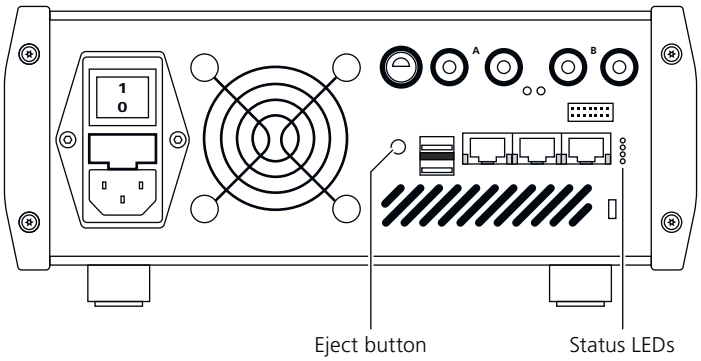
If the firmware of MicroLabBox is corrupted and MicroLabBox does not start automatically with the factory firmware, you must force a restart with factory firmware.

Method

To force a restart with factory firmware

1 Switch off MicroLabBox.

2 On the rear side push the Eject button next to the USB connector.



3 Hold the Eject button and switch on MicroLabBox.

The status LED *SYS* is lit orange. MicroLabBox started with the factory firmware.

Result

MicroLabBox is in secured mode.

Next step

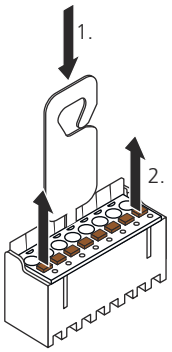
Update MicroLabBox with a valid firmware, refer to 🕮 Firmware Manager Manual.

Replacing Defective Terminal Blocks

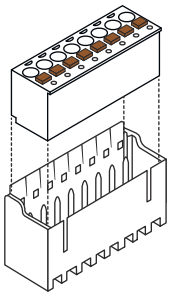
Unplugging and plugging the terminal block

You can unplug the terminal blocks from the spring-cage variant of MicroLabBox to replace defective terminal blocks.

Unplugging the terminal block A plugged terminal block is locked against unplugging. To unplug the terminal block, use the unlocking tool to release the terminal block and pull the block out as shown in the following illustration.



Plugging in the terminal block To plug in the terminal block, point the wired side of the terminal block to the pins of the sockets at the top panel. Then, push down the block until it snaps into place as shown in the following illustration.



How to Replace the Power Fuses

Objective	If the LED *PWR* on the rear side does not light up when MicroLabBox is switched on, the power fuses might be defect.
Required material	▪ 2 glass fuses, IEC 127-III, 5 x 20 mm, T2A
Preconditions	▪ The power cord and the power socket are checked. ▪ MicroLabBox is switched off. ▪ The power cord is disconnected from MicroLabBox. ▪ All external devices are disconnected from MicroLabBox.

Method

To replace the power fuse

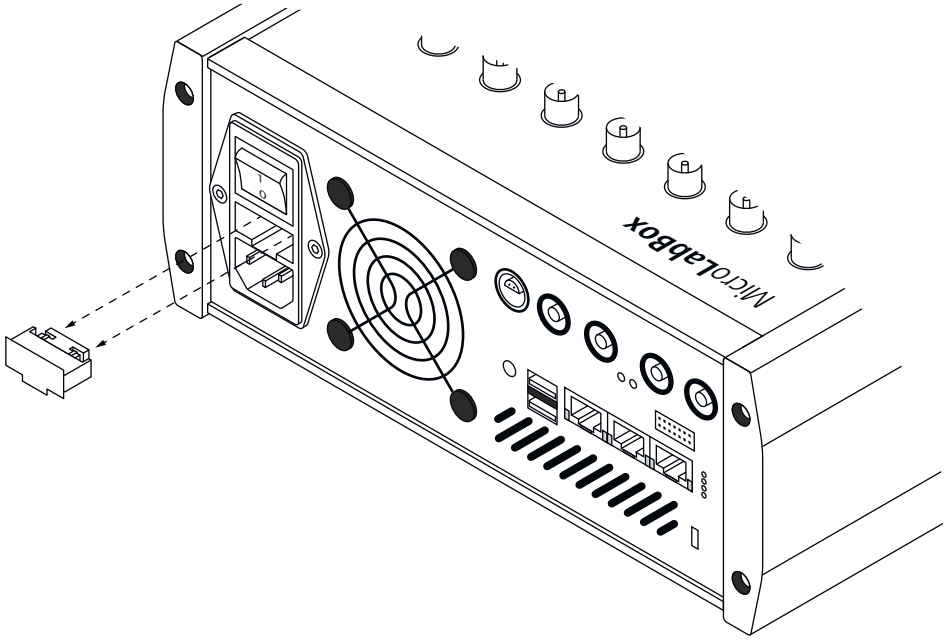
⚠ WARNING

Risk of electric shock due to improper fuses

Replacing fuses with improper fuses can result in serious personal injury.

- Only replace fuses with glass fuses, IEC 127-III, 5 x 20 mm, T2A.

1 On the rear side of MicroLabBox, open the fuse enclosure.



2 Replace the defective fuse(s).

3 Close the fuse enclosure.

4 Connect the power cord to MicroLabBox.

Result

When you switch on MicroLabBox, the LED PWR lights up. If the LED PWR does not light up, contact dSPACE Support.

Related topics

Basics

Checking MicroLabBox 70

Data Sheet

Where to go from here

Information in this section

Overview

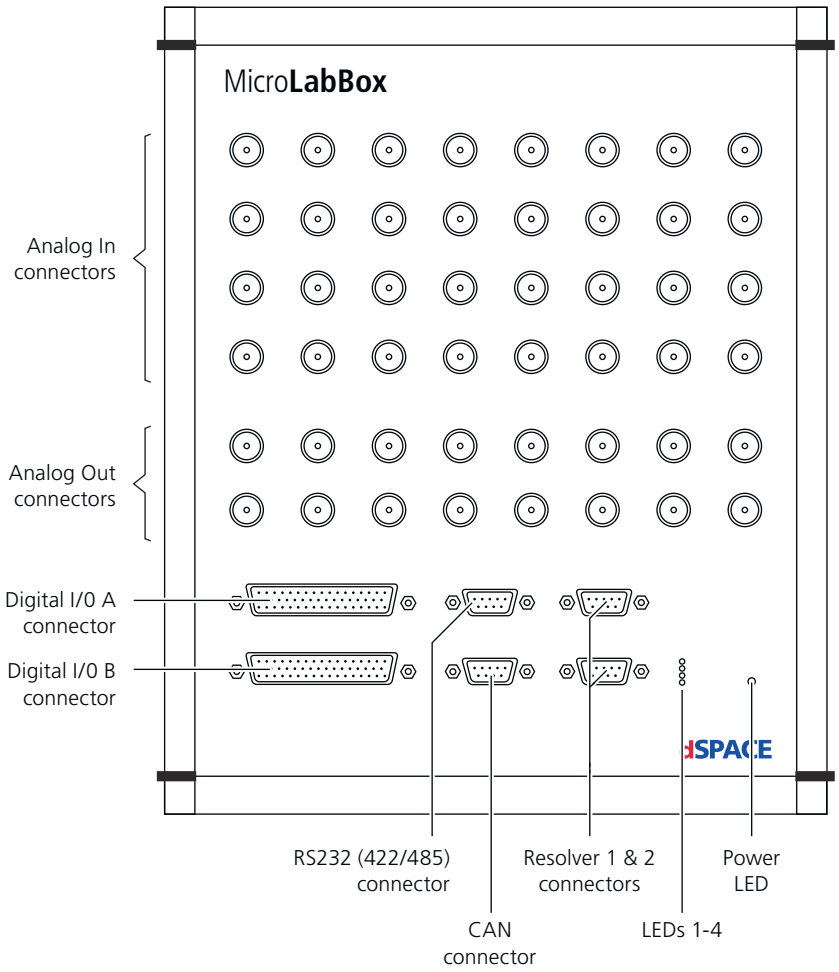
Where to go from here

Information in this section

Housing Components of the MicroLabBox BNC Variant

Top panel

The MicroLabBox BNC variant provides the I/O signals on the top panel.



Component		Details

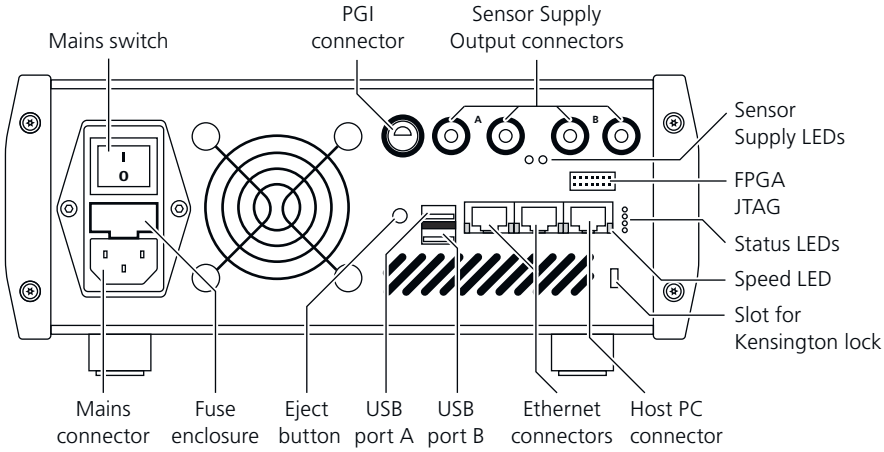
Connectors	Analog In	To connect up to 24 analog signals to Class 1 inputs and up to 8 analog signals to Class 2 inputs.
		▪ For the pinout, refer to Analog In and Analog Out Connectors (BNC) on page 100.
		▪ For the analog Class 1 input description, refer to Analog Class 1 Inputs on page 122.
		▪ For the analog Class 2 input description, refer to Analog Class 2 Inputs on page 124.
		▪ For details on implementation features, refer to:
		  ▪ ADC Class 1 (🕮 MicroLabBox Features)
		  ▪ ADC Class 2 (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)

Component		Details
	Analog Out	To connect up to 16 analog signals to Class 1 outputs. ▪ For the pinout, refer to Analog In and Analog Out Connectors (BNC) on page 100. ▪ For the analog Class 1 output description, refer to Analog Class 1 Outputs on page 125. ▪ For details on implementation features, refer to: ▪ DAC Class 1 (🕮 MicroLabBox Features)
	CAN	To connect up to two CAN networks. ▪ For the pinout, refer to CAN Connector (Sub-D) on page 117. ▪ For the interface description, refer to Communication Interfaces on page 135. ▪ For details on implementation features, refer to CAN Support (🕮 MicroLabBox Features).
	Digital I/O A	To connect up to 32 digital signals to Class 1 bidirectional channels. Your application sets each channel to be either an input or an output. ▪ For the pinout, refer to Digital I/O A Connector (Sub-D) on page 106. ▪ For the digital Class 1 channel description, refer to Digital Class 1 I/O (Bidirectional) on page 126. ▪ For details on implementation features, refer to: ▪ Bit I/O (DIO Class 1) (🕮 MicroLabBox Features) ▪ Electric Motor Control (🕮 MicroLabBox Features) ▪ Timing I/O (🕮 MicroLabBox Features)
	Digital I/O B	To connect up to 16 digital signals to Class 1 bidirectional channels and up to 12 digital signals to Class 2 bidirectional channels. Your application sets each channel to be either an input or an output. ▪ For the pinout, refer to Digital I/O B Connector (Sub-D) on page 108. ▪ For the digital Class 1 channel description, refer to Digital Class 1 I/O (Bidirectional) on page 126. ▪ For the digital Class 2 channel description, refer to Digital Class 2 I/O (Bidirectional) on page 129. ▪ For details on implementation features, refer to: ▪ Bit I/O (DIO Class 1) (🕮 MicroLabBox Features) ▪ Bit I/O (DIO Class 2) (🕮 MicroLabBox Features) ▪ Electric Motor Control (🕮 MicroLabBox Features) ▪ Serial Peripheral Interface (DIO Class 1) (🕮 MicroLabBox Features) ▪ Timing I/O (🕮 MicroLabBox Features)
	Resolver 1 Resolver 2	To connect up to two resolvers. ▪ For the pinout and signal mapping, refer to Resolver Connectors (Sub-D) on page 114. ▪ For the interface description, refer to Resolver Interfaces on page 131. ▪ For details on implementation features, refer to Resolver Interface (🕮 MicroLabBox Features).
	RS232 (422/485)	To connect up to two serial buses. ▪ For the pinout and signal mapping, refer to RS232 (422/485) Connector (Sub-D) on page 119. ▪ For the interface description, refer to Communication Interfaces on page 135. ▪ For details on implementation features, refer to Serial Interface of MicroLabBox (🕮 MicroLabBox Features).

Component		Details
LEDs	LED 1	You can use up to 4 customizable LEDs to display status information on your application. If being not set by the application, the customizable LEDs do not light. For details on the customizable LEDs, refer to LED Control (MicroLabBox Features).
	LED 2	
	LED 3	
	LED 4	
	Power	For the LED status description, refer to LED Status on page 136.

Rear panel

All MicroLabBox variants have the same rear panel.



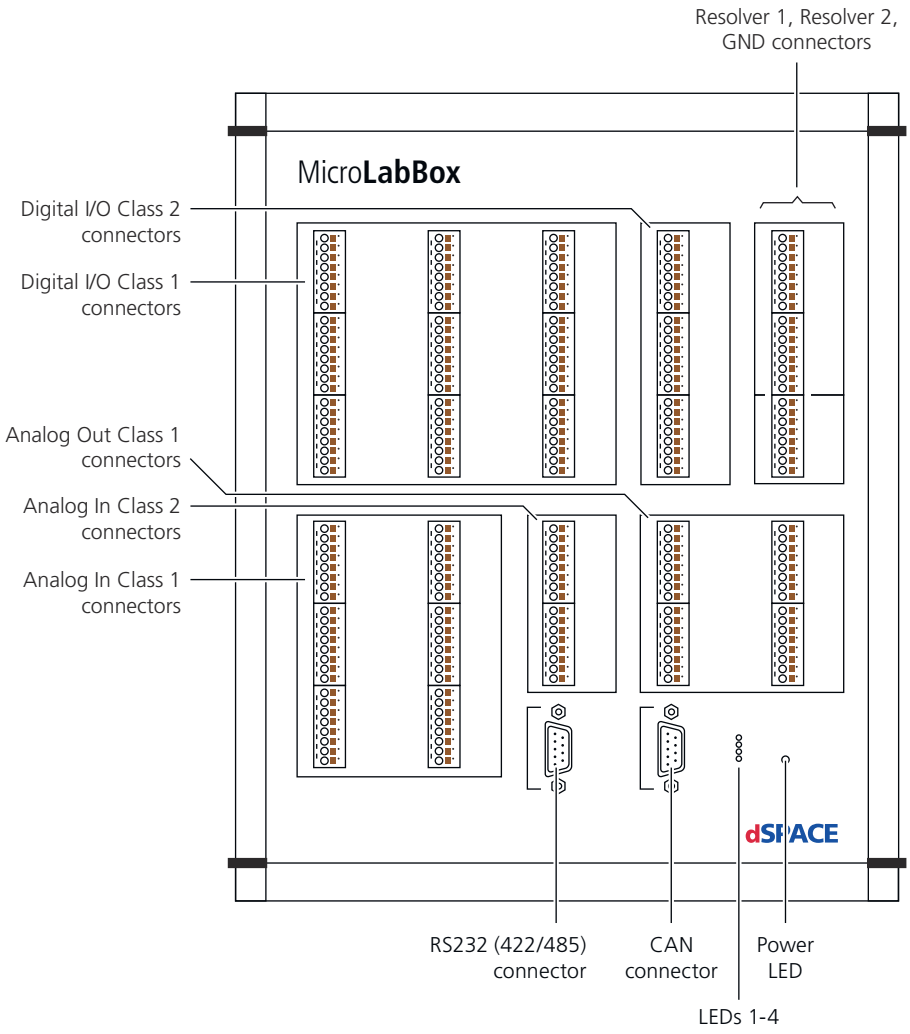
Component		Details
Button or switch	Eject	▪ To unmount USB devices. Before you disconnect the USB device, press the Eject button. When the LED of the Eject button is off, you can disconnect the USB device safely. For a description of the Eject button's LED status, refer to LED Status Description on page 136. ▪ To force a restart with factory firmware. For details, refer to How to Force a Restart with Factory Firmware on page 72.
	Mains	To switch MicroLabBox on and off.

Component			Details
Connectors and Ports	Ethernet		To connect the Ethernet I/O and the host PC. ▪ For the pinout, refer to Ethernet and Host PC Connectors (RJ45) on page 118. ▪ For the signal description, refer to Communication Interfaces on page 135. ▪ For details on implementation I/O Ethernet features, refer to Ethernet I/O Interface (🕮 MicroLabBox Features). The Ethernet and Host PC connectors are connected internally by a common Gigabit Ethernet switch. For details, refer to Connecting Ethernet Devices on page 47.
	Host PC		
	FPGA JTAG		Reserved for future development.
	Mains (IEC C14)		To connect the mains. A suitable inlet connector (C13) for non-heating apparatus is delivered with MicroLabBox.
	PGI		To connect dSPACE Programmable Generic Interface (PGI) solutions via LVDS. For further information, contact dSPACE. For matching cables, refer to LVDS Link Cables on page 141.
	Sensor Supply Output A		To supply sensors. Sensor Supply Output A is a fixed and Sensor Supply Output B is a adjustable voltage power supply. Sensor Supply Output B is controlled by your application. ▪ For the pinout, refer to Sensor Supply Output Connectors (Banana Jacks) on page 117. ▪ For the signal description, refer to Sensor Supply Outputs on page 133. ▪ For details on implementation features, refer to Sensor Supply (🕮 MicroLabBox Features).
	Sensor Supply Output B		
	USB Port A		To connect a USB mass storage device. You can use one USB mass storage device for the following tasks: ▪ To store time histories of real-time variables with the USB Flight Recorder feature. For further information, refer to USB Flight Recorder (🕮 MicroLabBox Features). ▪ To boot an application from the USB mass storage device. For further information, refer to MicroLabBox Application Start (🕮 MicroLabBox Features). For the signal description, refer to Communication Interfaces on page 135.
	USB Port B		Reserved for future development.
LEDs	Sensor supply		For the LED status description, refer to LED Status on page 136.
	Speed		
	Status	USB	
		APP	
		SYS	
		PWR	
Fuse enclosure			For details on replacement of the power fuses, refer to How to Replace the Power Fuses on page 74.
Slot for Kensington lock			To insert a Kensington lock.

Housing Components of the MicroLabBox Spring-Cage Variant

Top panel

The MicroLabBox spring-cage variant provides the I/O signals on the top panel.



Component		Details

Connectors	Analog In Class 1	To connect up to 24 analog signals to Class 1 inputs.
		▪ For the pinout, refer to Analog In Class 1 Connectors (Spring-Cage) on page 101.
		▪ For the analog Class 1 input description, refer to Analog Class 1 Inputs on page 122.
		▪ For details on implementation features, refer to:
		  ▪ ADC Class 1 (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)

	Analog In Class 2	To connect up to 8 analog signals to Class 2 inputs.
		▪ For the pinout, refer to Analog In Class 2 Connectors (Spring-Cage) on page 103.
		▪ For the analog Class 2 input description, refer to Analog Class 2 Inputs on page 124.
		▪ For details on implementation features, refer to:
		  ▪ ADC Class 2 (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)

	Analog Out Class 1	To connect up to 16 analog signals to Class 1 outputs. ▪ For the pinout, refer to Analog Out Class 1 Connectors (Spring-Cage) on page 104. ▪ For the analog Class 1 output description, refer to Analog Class 1 Outputs on page 125. ▪ For details on implementation features, refer to: ▪ DAC Class 1 (🕮 MicroLabBox Features)
	CAN	To connect up to two CAN networks. ▪ For the pinout, refer to CAN Connector (Sub-D) on page 117. ▪ For the interface description, refer to Communication Interfaces on page 135. ▪ For details on implementation features, refer to CAN Support (🕮 MicroLabBox Features).

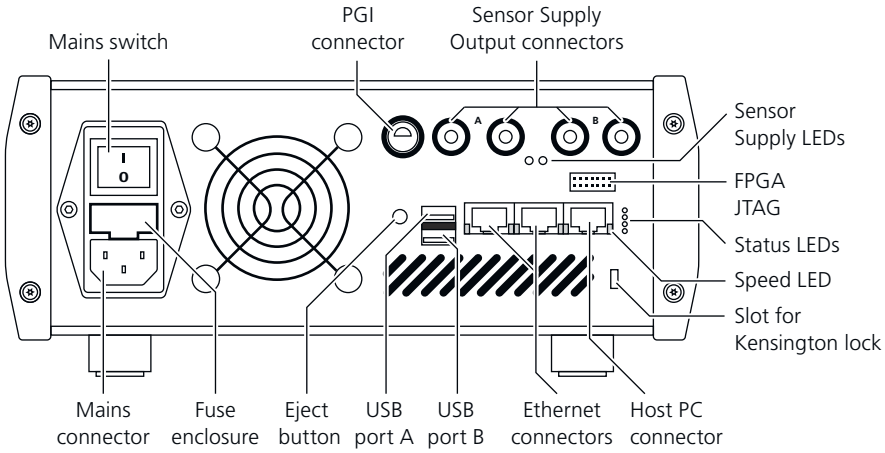
	Digital I/O Class 1	To connect up to 48 digital signals to Class 1 bidirectional channels. Your application sets each channel to be either an input or an output.
		▪ For the pinout, refer to Digital I/O Class 1 Connectors (Spring-Cage) on page 110.
		▪ For the digital Class 1 channel description, refer to Digital Class 1 I/O (Bidirectional) on page 126.
		▪ For details on implementation features, refer to:
		  ▪ Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)
		  ▪ Serial Peripheral Interface (DIO Class 1) (🕮 MicroLabBox Features)
		  ▪ Timing I/O (🕮 MicroLabBox Features)

	Digital I/O Class 2	To connect up to up to 12 digital signals to Class 2 bidirectional channels. Your application sets each channel to be either an input or an output.
		▪ For the pinout, refer to Digital I/O Class 2 Connectors (Spring-Cage) on page 112.
		▪ For the digital Class 2 channel description, refer to Digital Class 2 I/O (Bidirectional) on page 129.
		▪ For details on implementation features, refer to:
		  ▪ Bit I/O (DIO Class 2) (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)

Component		Details
	Resolver 1	To connect up to two resolvers. ▪ For the pinout and signal mapping, refer to Resolver Connectors (Spring-Cage) on page 115. ▪ For the interface description, refer to Resolver Interfaces on page 131. ▪ For details on implementation features, refer to Resolver Interface (🕮 MicroLabBox Features).
	Resolver 2	
	RS232 (422/485)	To connect up to two serial buses. ▪ For the pinout and signal mapping, refer to RS232 (422/485) Connector (Sub-D) on page 119. ▪ For the interface description, refer to Communication Interfaces on page 135. ▪ For details on implementation features, refer to Serial Interface of MicroLabBox (🕮 MicroLabBox Features).
LEDs	LED 1	You can use up to 4 customizable LEDs to display status information on your application. If being not set by the application, the customizable LEDs do not light. For details on the customizable LEDs, refer to LED Control (🕮 MicroLabBox Features).
	LED 2	
	LED 3	
	LED 4	
	Power	For the LED status description, refer to LED Status on page 136.

Rear panel

All MicroLabBox variants have the same rear panel.



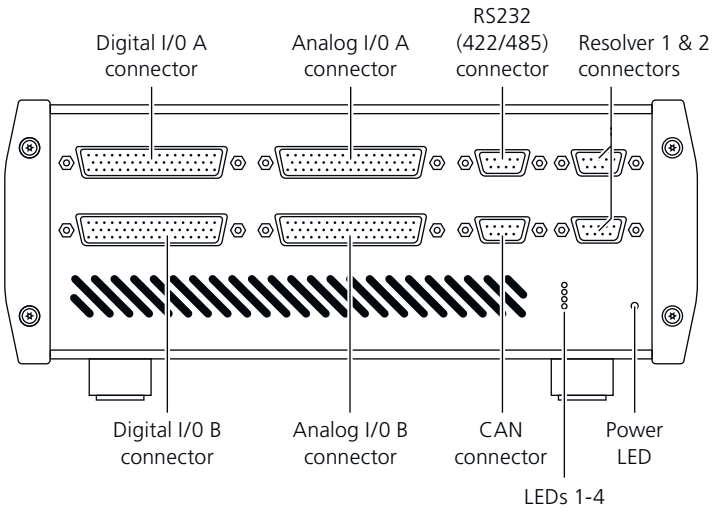
Component		Details
Button or switch	Eject	▪ To unmount USB devices. Before you disconnect the USB device, press the Eject button. When the LED of the Eject button is off, you can disconnect the USB device safely. For a description of the Eject button's LED status, refer to LED Status Description on page 136. ▪ To force a restart with factory firmware. For details, refer to How to Force a Restart with Factory Firmware on page 72.
	Mains	To switch MicroLabBox on and off.

Component			Details
Connectors and Ports	Ethernet		To connect the Ethernet I/O and the host PC. ▪ For the pinout, refer to Ethernet and Host PC Connectors (RJ45) on page 118. ▪ For the signal description, refer to Communication Interfaces on page 135. ▪ For details on implementation I/O Ethernet features, refer to Ethernet I/O Interface (🕮 MicroLabBox Features). The Ethernet and Host PC connectors are connected internally by a common Gigabit Ethernet switch. For details, refer to Connecting Ethernet Devices on page 47.
	Host PC		
	FPGA JTAG		Reserved for future development.
	Mains (IEC C14)		To connect the mains. A suitable inlet connector (C13) for non-heating apparatus is delivered with MicroLabBox.
	PGI		To connect dSPACE Programmable Generic Interface (PGI) solutions via LVDS. For further information, contact dSPACE. For matching cables, refer to LVDS Link Cables on page 141.
	Sensor Supply Output A		To supply sensors. Sensor Supply Output A is a fixed and Sensor Supply Output B is a adjustable voltage power supply. Sensor Supply Output B is controlled by your application. ▪ For the pinout, refer to Sensor Supply Output Connectors (Banana Jacks) on page 117. ▪ For the signal description, refer to Sensor Supply Outputs on page 133. ▪ For details on implementation features, refer to Sensor Supply (🕮 MicroLabBox Features).
	Sensor Supply Output B		
	USB Port A		To connect a USB mass storage device. You can use one USB mass storage device for the following tasks: ▪ To store time histories of real-time variables with the USB Flight Recorder feature. For further information, refer to USB Flight Recorder (🕮 MicroLabBox Features). ▪ To boot an application from the USB mass storage device. For further information, refer to MicroLabBox Application Start (🕮 MicroLabBox Features). For the signal description, refer to Communication Interfaces on page 135.
	USB Port B		Reserved for future development.
LEDs	Sensor supply		For the LED status description, refer to LED Status on page 136.
	Speed		
	Status	USB	
		APP	
		SYS	
		PWR	
Fuse enclosure			For details on replacement of the power fuses, refer to How to Replace the Power Fuses on page 74.
Slot for Kensington lock			To insert a Kensington lock.

Housing Components of the MicroLabBox Sub-D Variant

Front panel

The MicroLabBox Sub-D variant provides the I/O signals on the front panel.



Component		Details

Connectors	Analog I/O A	To connect up to 24 analog signals to Class 1 inputs.
		▪ For the pinout, refer to Analog I/O A Connector (Sub-D) on page 97.
		▪ For the input description, refer to Analog Class 1 Inputs on page 122.
		▪ For details on implementation features, refer to:
		  ▪ ADC Class 1 (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)

	Analog I/O B	To connect up to 8 analog signals to Class 2 inputs and up to 16 analog signals to Class 1 outputs.
		▪ For the pinout, refer to Analog I/O B Connector (Sub-D) on page 98.
		▪ For the input description, refer to Analog Class 2 Inputs on page 124.
		▪ For the output description, refer to Analog Class 1 Outputs on page 125.
		▪ For details on implementation features, refer to:
		  ▪ ADC Class 2 (🕮 MicroLabBox Features)
		  ▪ DAC Class 1 (🕮 MicroLabBox Features)

	CAN	To connect up to two CAN networks. ▪ For the pinout, refer to CAN Connector (Sub-D) on page 117. ▪ For the interface description, refer to Communication Interfaces on page 135. ▪ For details on implementation features, refer to CAN Support (🕮 MicroLabBox Features).

Component		Details

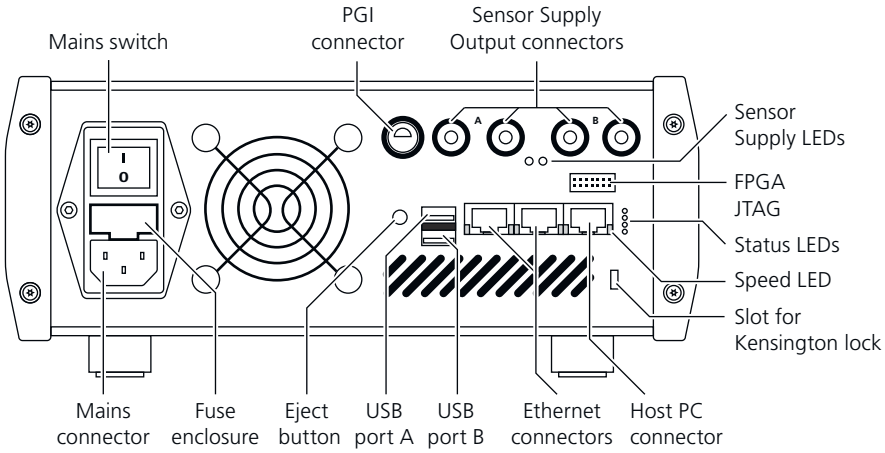
	Digital I/O A	To connect up to 32 digital signals to Class 1 bidirectional channels. Your application sets each channel to be either an input or an output.
		▪ For the pinout, refer to Digital I/O A Connector (Sub-D) on page 106.
		▪ For the digital Class 1 channel description, refer to Digital Class 1 I/O (Bidirectional) on page 126.
		▪ For details on implementation features, refer to:
		  ▪ Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)
		  ▪ Timing I/O (🕮 MicroLabBox Features)

	Digital I/O B	To connect up to 16 digital signals to Class 1 bidirectional channels and up to 12 digital signals to Class 2 bidirectional channels. Your application sets each channel to be either an input or an output.
		▪ For the pinout, refer to Digital I/O B Connector (Sub-D) on page 108.
		▪ For the digital Class 1 channel description, refer to Digital Class 1 I/O (Bidirectional) on page 126.
		▪ For the digital Class 2 channel description, refer to Digital Class 2 I/O (Bidirectional) on page 129.
		▪ For details on implementation features, refer to:
		  ▪ Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
		  ▪ Bit I/O (DIO Class 2) (🕮 MicroLabBox Features)
		  ▪ Electric Motor Control (🕮 MicroLabBox Features)
		  ▪ Serial Peripheral Interface (DIO Class 1) (🕮 MicroLabBox Features)
		  ▪ Timing I/O (🕮 MicroLabBox Features)

	Resolver 1 Resolver 2	To connect up to two resolvers. ▪ For the pinout and signal mapping, refer to Resolver Connectors (Sub-D) on page 114. ▪ For the interface description, refer to Resolver Interfaces on page 131. ▪ For details on implementation features, refer to Resolver Interface (🕮 MicroLabBox Features).
	RS232 (422/485)	To connect up to two serial buses. ▪ For the pinout and signal mapping, refer to RS232 (422/485) Connector (Sub-D) on page 119. ▪ For the interface description, refer to Communication Interfaces on page 135. ▪ For details on implementation features, refer to Serial Interface of MicroLabBox (🕮 MicroLabBox Features).
LEDs	LED 1 LED 2 LED 3 LED 4	You can use up to 4 customizable LEDs to display status information on your application. If being not set by the application, the customizable LEDs do not light. For details on the customizable LEDs, refer to LED Control (🕮 MicroLabBox Features).
	Power	For the LED status description, refer to LED Status on page 136.

Rear panel

All MicroLabBox variants have the same rear panel.



Component		Details
Button or switch	Eject	▪ To unmount USB devices. Before you disconnect the USB device, press the Eject button. When the LED of the Eject button is off, you can disconnect the USB device safely. For a description of the Eject button's LED status, refer to LED Status Description on page 136. ▪ To force a restart with factory firmware. For details, refer to How to Force a Restart with Factory Firmware on page 72.
	Mains	To switch MicroLabBox on and off.

Component			Details
Connectors and Ports	Ethernet		To connect the Ethernet I/O and the host PC. ▪ For the pinout, refer to Ethernet and Host PC Connectors (RJ45) on page 118. ▪ For the signal description, refer to Communication Interfaces on page 135. ▪ For details on implementation I/O Ethernet features, refer to Ethernet I/O Interface (🕮 MicroLabBox Features). The Ethernet and Host PC connectors are connected internally by a common Gigabit Ethernet switch. For details, refer to Connecting Ethernet Devices on page 47.
	Host PC		
	FPGA JTAG		Reserved for future development.
	Mains (IEC C14)		To connect the mains. A suitable inlet connector (C13) for non-heating apparatus is delivered with MicroLabBox.
	PGI		To connect dSPACE Programmable Generic Interface (PGI) solutions via LVDS. For further information, contact dSPACE. For matching cables, refer to LVDS Link Cables on page 141.
	Sensor Supply Output A		To supply sensors. Sensor Supply Output A is a fixed and Sensor Supply Output B is a adjustable voltage power supply. Sensor Supply Output B is controlled by your application. ▪ For the pinout, refer to Sensor Supply Output Connectors (Banana Jacks) on page 117. ▪ For the signal description, refer to Sensor Supply Outputs on page 133. ▪ For details on implementation features, refer to Sensor Supply (🕮 MicroLabBox Features).
	Sensor Supply Output B		
	USB Port A		To connect a USB mass storage device. You can use one USB mass storage device for the following tasks: ▪ To store time histories of real-time variables with the USB Flight Recorder feature. For further information, refer to USB Flight Recorder (🕮 MicroLabBox Features). ▪ To boot an application from the USB mass storage device. For further information, refer to MicroLabBox Application Start (🕮 MicroLabBox Features). For the signal description, refer to Communication Interfaces on page 135.
	USB Port B		Reserved for future development.
LEDs	Sensor supply		For the LED status description, refer to LED Status on page 136.
	Speed		
	Status	USB	
		APP	
		SYS	
		PWR	
Fuse enclosure			For details on replacement of the power fuses, refer to How to Replace the Power Fuses on page 74.
Slot for Kensington lock			To insert a Kensington lock.

General Data

General characteristics

The following table shows the general characteristics of MicroLabBox:

Parameter		Specification[1)]
Base Board (DS1202)	Real-time processor	▪ Freescale QorIQ P5020 64-bit dual-core processor with 2 GHz CPU clock ▪ 32 KB L1 data cache per core ▪ 32 KB L1 instruction cache per core ▪ 512 KB L2 cache per core ▪ 2 MB L3 cache ▪ 100 MHz bus clock
	Memory	▪ 1 GB DRAM ▪ 96 MB flash for firmware ▪ 32 MB flash for user applications ▪ 128 KB fast nonvolatile memory (FRAM)
	Host communication co-processor	Freescale QorIQ P1011
	Timer	Three general-purpose timers for each core
	Interrupt controller	One interrupt controller for each core for handling real-time events
I/O Board (DS1302)	FPGA	▪ Xilinx® Kintex®-7 XC7K325T ▪ 326,080 logic cells ▪ 50,950 slices ▪ 4,000 kbit distributed RAM (max.) ▪ 840 DSP slices ▪ 16,020 kbit block RAM ▪ 10 Clock Management Tiles
	Memory	36 Mbit ZBT SRAM (not user programmable)
Communication interfaces	CAN	2 x high-speed ISO 11898 CAN interfaces
	Ethernet	▪ 3 x Ethernet ports that are connected to a configurable Ethernet switch. ▪ High-speed Gigabit Ethernet for communication with the host PC. ▪ Low-latency Gigabit Ethernet for communication with external devices.
	Serial	2 x serial interfaces ▪ Each serial interface can be configured to RS232, RS422, or RS485.
	USB	1 x USB interface for USB flight recording (USB Port A)

Parameter		Specification[1)]
Analog and digital I/O		▪ 24 analog Class 1 inputs ▪ 8 analog Class 2 inputs ▪ 16 analog Class 1 outputs ▪ 48 digital Class 1 bidirectional channels ▪ 12 digital Class 2 bidirectional channels
Environment		For indoor use only
Altitude		Up to 3000 m
Degree of protection		IP20, according to EN 60529
Relative humidity		10% ... 80% (noncondensing)
Pollution degree		2, according to IEC 664 (normal clean and dry environment)
Mains connection		100 V ... 240 V AC, 50/60 Hz, max. 125 W
Protection class		1
Maximum I/O voltage levels		All voltages must not exceed the absolute maximum levels against protective ground, refer to Absolute Maximum Levels on page 93.
Housing dimensions	Depth	310 mm (12.2 in)
	Width	250 mm (9.8 in)
	Height	115 mm (4.5 in)
Weight		4.5 kg

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Floating ground

The housing of MicroLabBox is connected to the protective ground of your laboratory via the power cord. There is no galvanic isolation between signal ground and the housing of MicroLabBox. Between the protective ground and the signal ground, there might be a potential difference of typical ±0.6 V. The floating connection to protective ground (floating ground) prevents parasitic ground loops and compensating currents caused by ground loops.

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

Do not exceed the maximum levels, because this might permanently damage the system.

Levels

The absolute maximum levels of voltage, temperature, etc., for which MicroLabBox is designed are listed in the following table. The voltage levels do not imply a functional operation of MicroLabBox. All voltages are referenced to protective ground, unless otherwise stated.

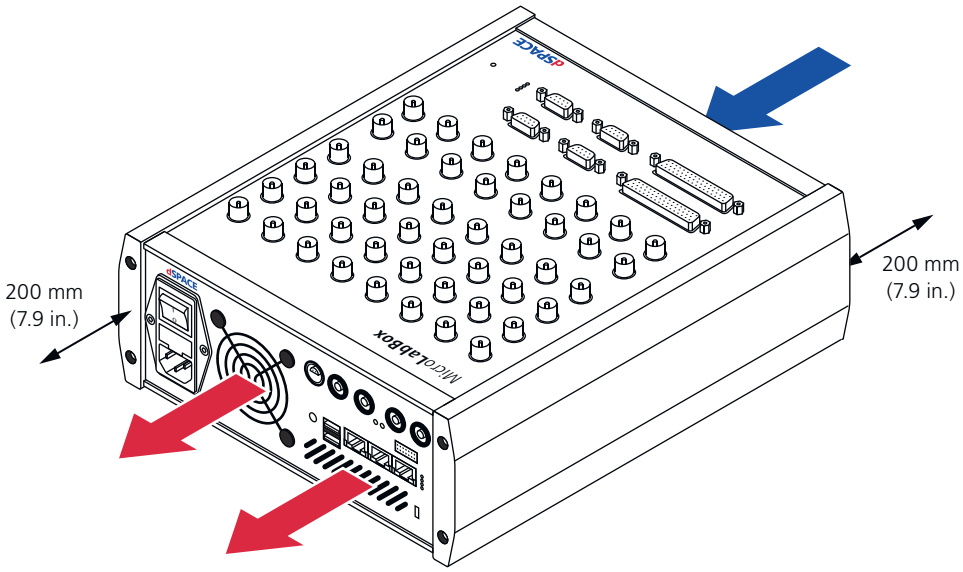
Parameter	Specification[1)]
All analog input signals	-35 V ... +35 V
All analog output signals	-35 V ... +35 V
All digital I/O signals	-35 V ... +35 V
Resolver signals	-12 V ... +12 V
CAN signals	-35 V ... +35 V
RS232, RS422, RS485 signals	RX pins: -25 V ... +25 V TX pins: -13.2 V ... +9 V
Operating temperature	0 °C ... 50 °C (32 °F ... 122 °F)
Storage temperature	-20 °C ... +85 °C (12 °F ... 161 °F)

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Clearances

Heat dissipation and free airflow

For sufficient heat dissipation and free airflow, observe the minimum clearances to walls, other devices or objects.



Certifications

CE compliance

MicroLabBox meets the requirements of the European directives 2014/30/EU (Electromagnetic Compatibility Directive) and 2014/35/EU (Low Voltage Directive) for CE marking.

Applied standards

MicroLabBox fulfills the following standards:

Tested Characteristics	Applied Standard	Description
Electromagnetic compatibility (EMC)	EN 61326-1 Table 2	Immunity standard for industrial environments[1)]
	CISPR 11, EN 55011 Group 1, Class A	Emission standard for industrial environments

Tested Characteristics	Applied Standard	Description
Safety requirements	EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use

[1] Tested with an I/O cable length < 3 m. Connected cables might affect the specified characteristics due to physical effects such as crosstalk, voltage drops, and influences through electromagnetic fields. If you measure analog signals with unshielded I/O cables, do not operate mobile phones, hand-held transceivers, or any other sources of electromagnetic fields close to the cable harness of MicroLabBox during run time. Otherwise, you might influence the measurements.

Connector Pinouts

Where to go from here

Information in this section

Analog I/O A Connector (Sub-D)

Valid MicroLabBox variants

The following MicroLabBox variants provide the Analog I/O A Sub-D connector:

- MicroLabBox Sub-D variant

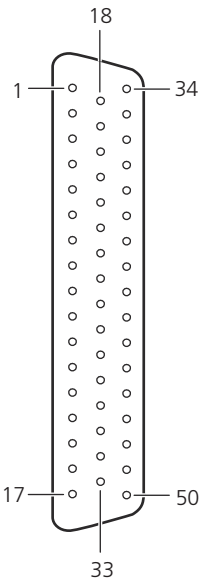
Pinout

The Analog I/O A connector is a 50-pin female Sub-D connector and it is located only on the front panel. It provides access to 24 analog Class 1 inputs.

Note

The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.

Analog I/O A Connector	Pin	Signal	Pin	Signal	Pin	Signal
	1	GND			34	$\overline{\text{AI1 ch24}}$
	2	$\overline{\text{AI1 ch23}}$	18	AI1 ch24	35	AI1 ch23
	3	AI1 ch22	19	$\overline{\text{AI1 ch22}}$	36	$\overline{\text{AI1 ch21}}$
	4	$\overline{\text{AI1 ch20}}$	20	AI1 ch21	37	AI1 ch20
	5	AI1 ch19	21	$\overline{\text{AI1 ch19}}$	38	$\overline{\text{AI1 ch18}}$
	6	$\overline{\text{AI1 ch17}}$	22	AI1 ch18	39	AI1 ch17
	7	AI1 ch16	23	$\overline{\text{AI1 ch16}}$	40	$\overline{\text{AI1 ch15}}$
	8	$\overline{\text{AI1 ch14}}$	24	AI1 ch15	41	AI1 ch14
	9	AI1 ch13	25	$\overline{\text{AI1 ch13}}$	42	$\overline{\text{AI1 ch12}}$
	10	$\overline{\text{AI1 ch11}}$	26	AI1 ch12	43	AI1 ch11
	11	AI1 ch10	27	$\overline{\text{AI1 ch10}}$	44	$\overline{\text{AI1 ch9}}$
	12	$\overline{\text{AI1 ch8}}$	28	AI1 ch9	45	AI1 ch8
	13	AI1 ch7	29	$\overline{\text{AI1 ch7}}$	46	$\overline{\text{AI1 ch6}}$
	14	$\overline{\text{AI1 ch5}}$	30	AI1 ch6	47	AI1 ch5
	15	AI1 ch4	31	$\overline{\text{AI1 ch4}}$	48	$\overline{\text{AI1 ch3}}$
	16	$\overline{\text{AI1 ch2}}$	32	AI1 ch3	49	AI1 ch2
	17	AI1 ch1	33	$\overline{\text{AI1 ch1}}$	50	GND

Pin naming

Channel	Pin Name	Description
Class 1 input	AI1 ch<x>[1)]	AI1: Analog Class 1 non-inverted input ch<x>: Channel number
	$\overline{\text{AI1}}$ ch<x>[1)]	$\overline{\text{AI1}}$: Analog Class 1 inverted input ch<x>: Channel number
-	GND	Signal ground

1) <x> is in the range of 1 ... 24.

Further information

- For a description of the available signals on the connector, refer to Analog Class 1 Inputs on page 122.
- For details on implementation features, refer to:
  - ADC Class 1 (🕮 MicroLabBox Features)
  - Electric Motor Control (🕮 MicroLabBox Features)

Related topics

Basics

Using Sub-D Connectors..... 43

Analog I/O B Connector (Sub-D)

Valid MicroLabBox variants

The following MicroLabBox variants provide the Analog I/O B Sub-D connector:

- MicroLabBox Sub-D variant

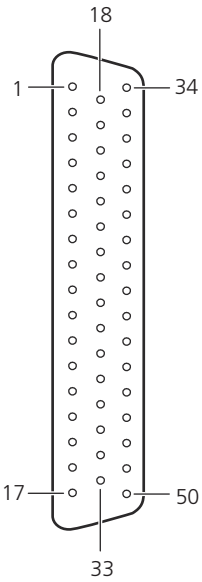
Pinout

The Analog I/O B connector is a 50-pin female Sub-D connector and it is located only on the front panel. It provides access to 8 analog Class 2 inputs and 16 analog Class 1 outputs.

Note

The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.

Analog I/O B Connector	Pin	Signal	Pin	Signal	Pin	Signal
	1	GND			34	AO1 ch16ref
	2	AO1 ch15ref	18	AO1 ch16	35	AO1 ch15
	3	AI2 ch8	19	$\overline{\text{AI2 ch8}}$	36	AO1 ch14ref
	4	AO1 ch13ref	20	AO1 ch14	37	AO1 ch13
	5	AI2 ch7	21	$\overline{\text{AI2 ch7}}$	38	AO1 ch12ref
	6	AO1 ch11ref	22	AO1 ch12	39	AO1 ch11
	7	AI2 ch6	23	$\overline{\text{AI2 ch6}}$	40	AO1 ch10ref
	8	AO1 ch9ref	24	AO1 ch10	41	AO1 ch9
	9	AI2 ch5	25	$\overline{\text{AI2 ch5}}$	42	AO1 ch8ref
	10	AO1 ch7ref	26	AO1 ch8	43	AO1 ch7
	11	AI2 ch4	27	$\overline{\text{AI2 ch4}}$	44	AO1 ch6ref
	12	AO1 ch5ref	28	AO1 ch6	45	AO1 ch5
	13	AI2 ch3	29	$\overline{\text{AI2 ch3}}$	46	AO1 ch4ref
	14	AO1 ch3ref	30	AO1 ch4	47	AO1 ch3
	15	AI2 ch2	31	$\overline{\text{AI2 ch2}}$	48	AO1 ch2ref
	16	AO1 ch1ref	32	AO1 ch2	49	AO1 ch1
	17	AI2 ch1	33	$\overline{\text{AI2 ch1}}$	50	GND

Pin naming

Channel	Pin Name	Description
Class 2 input	AI2 ch<x>[1)]	AI2: Analog Class 2 non-inverted input ch<x>: Channel number
	$\overline{\text{AI2 ch<x>}}$[1)]	$\overline{\text{AI2}}$: Analog Class 2 inverted input $\overline{\text{ch<x>}}$: Channel number

Channel	Pin Name	Description
Class 1 output	AO1 ch<x>[2)]	AO1: Analog Class 1 output ch<x>: Channel number
	AO1 ch<x>ref[2)]	AO1 ch<x>ref: Analog Class 1 output, signal ground (reference pin for proper cabling) ch<x>: Channel number
-	GND	Signal ground

[1)] <x> is in the range of 1 ... 8.
[2)] <x> is in the range of 1 ... 16.

Further information

- For a description of the available signals on the connector, refer to:
  - Analog Class 2 Inputs on page 124
  - Analog Class 1 Outputs on page 125
- For details on implementation features, refer to:
  - ADC Class 2 (🕮 MicroLabBox Features)
  - DAC Class 1 (🕮 MicroLabBox Features)

Related topics

Basics

Using Sub-D Connectors..... 43

Analog In and Analog Out Connectors (BNC)

Valid MicroLabBox variants

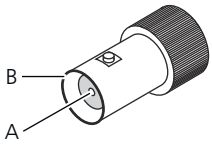
The following MicroLabBox variants provide the Analog In and Analog Out BNC connectors:

- MicroLabBox BNC variant

Pinout

The Analog In and Out connectors are BNC connectors and they are located only on the top panel. They give you access to the following channels:

- 24 analog Class 1 inputs
- 8 analog Class 2 inputs
- 16 analog Class 1 outputs

Connector	Channel	Position	Signal
	Analog Class 1 Input	A	Non-inverted input
		B	Inverted input
	Analog Class 2 Input	A	Non-inverted input
		B	Inverted input
	Analog Class 1 Output	A	Output
		B	Signal ground

BNC connector naming

Channel	BNC Connector Name	Description
Class 1 input	AI1 ch<x>[1]	AI1: Analog Class 1 input ch<x>: Channel number
Class 2 input	AI2 ch<x>[2]	AI2: Analog Class 2 input ch<x>: Channel number
Class 1 output	AO1 ch<x>[3]	AO1: Analog Class 1 output ch<x>: Channel number

1) <x> is in the range of 1 ... 24.
2) <x> is in the range of 1 ... 8.
3) <x> is in the range of 1 ... 16.

Further information

- For a description of the available signals on the connector, refer to:
  - Analog Class 1 Inputs on page 122
  - Analog Class 2 Inputs on page 124
  - Analog Class 1 Outputs on page 125
- For details on implementation features, refer to:
  - ADC Class 1 (MicroLabBox Features)
  - ADC Class 2 (MicroLabBox Features)
  - DAC Class 1 (MicroLabBox Features)
  - Electric Motor Control (MicroLabBox Features)

Analog In Class 1 Connectors (Spring-Cage)

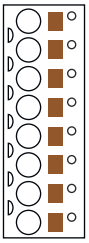
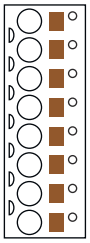
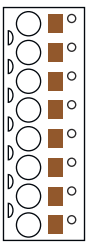
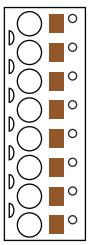
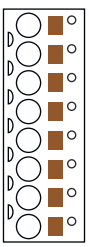
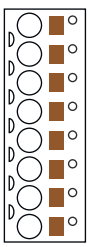
MicroLabBox variant

The following MicroLabBox variants provide the Analog In Class 1 connectors with spring-cage terminals:

- MicroLabBox spring-cage variant

Pinout

The Analog In Class 1 connectors are spring-cage terminal blocks and they are located on the top panel. They give you access to 24 analog Class 1 inputs.

Terminal Block	Signal	Terminal Block	Signal
	AI1 ch1		AI1 ch13
	$\overline{\text{AI1 ch1}}$		$\overline{\text{AI1 ch13}}$
	AI1 ch2		AI1 ch14
	$\overline{\text{AI1 ch2}}$		$\overline{\text{AI1 ch14}}$
	AI1 ch3		AI1 ch15
	$\overline{\text{AI1 ch3}}$		$\overline{\text{AI1 ch15}}$
	AI1 ch4		AI1 ch16
	$\overline{\text{AI1 ch4}}$		$\overline{\text{AI1 ch16}}$
	AI1 ch5		AI1 ch17
	$\overline{\text{AI1 ch5}}$		$\overline{\text{AI1 ch17}}$
	AI1 ch6		AI1 ch18
	$\overline{\text{AI1 ch6}}$		$\overline{\text{AI1 ch18}}$
	AI1 ch7		AI1 ch19
	$\overline{\text{AI1 ch7}}$		$\overline{\text{AI1 ch19}}$
	AI1 ch8		AI1 ch20
	$\overline{\text{AI1 ch8}}$		$\overline{\text{AI1 ch20}}$
	AI1 ch9		AI1 ch21
	$\overline{\text{AI1 ch9}}$		$\overline{\text{AI1 ch21}}$
	AI1 ch10		AI1 ch22
	$\overline{\text{AI1 ch10}}$		$\overline{\text{AI1 ch22}}$
	AI1 ch11		AI1 ch23
	$\overline{\text{AI1 ch11}}$		$\overline{\text{AI1 ch23}}$
	AI1 ch12		AI1 ch24
	$\overline{\text{AI1 ch12}}$		$\overline{\text{AI1 ch24}}$

Pin naming

Channel	Pin Name	Description
Class 1 input	AI1 ch<x>[1)]	AI1: Analog Class 1 non-inverted input ch<x>: Channel number
	$\overline{\text{AI1 ch<x>}}$[1)]	$\overline{\text{AI1}}$: Analog Class 1 inverted input $\overline{\text{ch<x>}}$: Channel number

1) <x> is in the range of 1 ... 24.

Wire configuration

Parameter	Specification
Wire cross section	0.2 mm² ... 1.5 mm² (24 AWG ... 14 AWG)
Strip length	8 mm ... 9 mm (0.31 in. ... 0.35 in.)

Further information

- For a description of the available signals on the connector, refer to Analog Class 1 Inputs on page 122.
- For details on implementation features, refer to:
  - ADC Class 1 (MicroLabBox Features)
  - Electric Motor Control (MicroLabBox Features)

Related topics

Basics

Inserting Wires into Spring-Cage Terminals and Removing Wires..... 44

Analog In Class 2 Connectors (Spring-Cage)

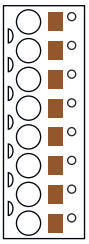
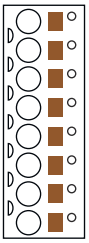
MicroLabBox variant

The following MicroLabBox variants provide the Analog In Class 2 connectors with spring-cage terminals:

- MicroLabBox spring-cage variant

Pinout

The Analog In Class 2 connectors are spring-cage terminal blocks and they are located on the top panel. They give you access to 8 analog Class 2 inputs.

Terminal Block	Signal
	AI2 ch1
	$\overline{\text{AI2 ch1}}$
	AI2 ch2
	$\overline{\text{AI2 ch2}}$
	AI2 ch3
	$\overline{\text{AI2 ch3}}$
	AI2 ch4
	$\overline{\text{AI2 ch4}}$
	AI2 ch5
	$\overline{\text{AI2 ch5}}$
	AI2 ch6
	$\overline{\text{AI2 ch6}}$
	AI2 ch7
	$\overline{\text{AI2 ch7}}$
	AI2 ch8
	$\overline{\text{AI2 ch8}}$

Pin naming

Channel	Pin Name	Description
Class 2 input	AI2 ch<x>[1)]	AI2: Analog Class 2 non-inverted input ch<x>: Channel number
	$\overline{\text{AI2}}$ ch<x>[1)]	$\overline{\text{AI2}}$: Analog Class 2 inverted input $\overline{\text{ch<x>}}$: Channel number

[1)] <x> is in the range of 1 ... 8.

Wire configuration

Parameter	Specification
Wire cross section	0.2 mm² ... 1.5 mm² (24 AWG ... 14 AWG)
Strip length	8 mm ... 9 mm (0.31 in. ... 0.35 in.)

Further information

- For a description of the available signals on the connector, refer to Analog Class 2 Inputs on page 124.
- For details on implementation features, refer to:
  - ADC Class 2 (🕮 MicroLabBox Features)
  - Electric Motor Control (🕮 MicroLabBox Features)

Related topics

Basics

Inserting Wires into Spring-Cage Terminals and Removing Wires..... 44

Analog Out Class 1 Connectors (Spring-Cage)

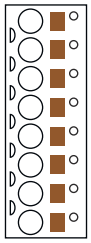
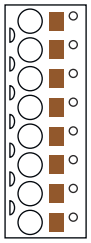
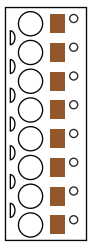
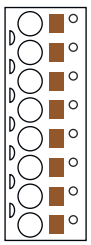
MicroLabBox variant

The following MicroLabBox variants provide the Analog Out Class 1 connectors with spring-cage terminals:

- MicroLabBox spring-cage variant

Pinout

The Analog Out Class 1 connectors are spring-cage terminal blocks and they are located on the top panel. They give you access to 16 analog Class 1 outputs.

Terminal Block	Signal	Terminal Block	Signal
	AO1 ch1		AO1 ch9
	$\overline{\text{AO1 ch1}}$		$\overline{\text{AO1 ch9}}$
	AO1 ch2		AO1 ch10
	$\overline{\text{AO1 ch2}}$		$\overline{\text{AO1 ch10}}$
	AO1 ch3		AO1 ch11
	$\overline{\text{AO1 ch3}}$		$\overline{\text{AO1 ch11}}$
	AO1 ch4		AO1 ch12
	$\overline{\text{AO1 ch4}}$		$\overline{\text{AO1 ch12}}$
	AO1 ch5		AO1 ch13
	$\overline{\text{AO1 ch5}}$		$\overline{\text{AO1 ch13}}$
	AO1 ch6		AO1 ch14
	$\overline{\text{AO1 ch6}}$		$\overline{\text{AO1 ch14}}$
	AO1 ch7		AO1 ch15
	$\overline{\text{AO1 ch7}}$		$\overline{\text{AO1 ch15}}$
	AO1 ch8		AO1 ch16
	$\overline{\text{AO1 ch8}}$		$\overline{\text{AO1 ch16}}$

Pin naming

Channel	Pin Name	Description
Class 1 output	AO1 ch<x>[1)]	AO1: Analog Class 1 non-inverted output ch<x>: Channel number
	$\overline{\text{AO1 ch<x>}}$[1)]	$\overline{\text{AO1}}$: Analog Class 1 inverted output $\overline{\text{ch<x>}}$: Channel number

1) <x> is in the range of 1 ... 16.

Wire configuration

Parameter	Specification
Wire cross section	0.2 mm² ... 1.5 mm² (24 AWG ... 14 AWG)
Strip length	8 mm ... 9 mm (0.31 in. ... 0.35 in.)

Further information

- For a description of the available signals on the connector, refer to Analog Class 1 Outputs on page 125.
- For details on implementation features, refer to:
  - DAC Class 1 (MicroLabBox Features)
  - Electric Motor Control (MicroLabBox Features)

Related topics

Basics

Inserting Wires into Spring-Cage Terminals and Removing Wires..... 44

Digital I/O A Connector (Sub-D)

Valid MicroLabBox variants

The following MicroLabBox variants provide the Digital I/O A Sub-D connector:

- MicroLabBox Sub-D variant
- MicroLabBox BNC variant

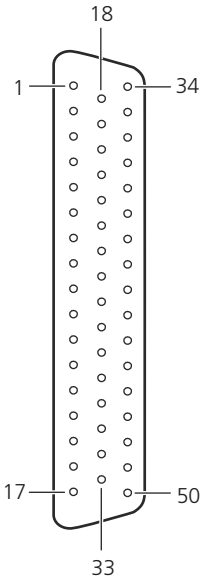
Pinout

The Digital I/O A connector is a 50-pin female Sub-D connector and it is located either on the front or on the top panel. It provides access to 32 digital Class 1 channels. Your application sets the direction to be either an input or an output.

Note

The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.



Digital I/O A	Pin	Signal	Pin	Signal	Pin	Signal
	1	GND			34	DIO1 ch32
	2	DIO1 ch16	18	GND	35	DIO1 ch31
	3	DIO1 ch15	19	GND	36	DIO1 ch30
	4	DIO1 ch14	20	GND	37	DIO1 ch29
	5	DIO1 ch13	21	GND	38	DIO1 ch28
	6	DIO1 ch12	22	GND	39	DIO1 ch27
	7	DIO1 ch11	23	GND	40	DIO1 ch26
	8	DIO1 ch10	24	GND	41	DIO1 ch25
	9	DIO1 ch9	25	GND	42	DIO1 ch24
	10	DIO1 ch8	26	GND	43	DIO1 ch23
	11	DIO1 ch7	27	GND	44	DIO1 ch22
	12	DIO1 ch6	28	GND	45	DIO1 ch21
	13	DIO1 ch5	29	GND	46	DIO1 ch20
	14	DIO1 ch4	30	GND	47	DIO1 ch19
	15	DIO1 ch3	31	GND	48	DIO1 ch18
	16	DIO1 ch2	32	GND	49	DIO1 ch17
	17	DIO1 ch1	33	GND	50	GND

Pin naming

Channel	Pin Name	Description
Class 1	DIO1 ch<x>[1)]	DIO1: Digital Class 1 input or output ch<x>: Channel number
	GND	GND: Signal ground

[1)] <x> is in the range of 1 ... 32.

Further information

- For a description of the available signals on the connector, refer to Digital Class 1 I/O (Bidirectional) on page 126.

- For details on implementation features, refer to:
  - Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
  - Electric Motor Control (🕮 MicroLabBox Features)
  - Timing I/O (🕮 MicroLabBox Features)

Related topics

Basics

Using Sub-D Connectors..... 43

Digital I/O B Connector (Sub-D)

Valid MicroLabBox variants

The following MicroLabBox variants provide the Digital I/O B Sub-D connector:

- MicroLabBox Sub-D variant
- MicroLabBox BNC variant

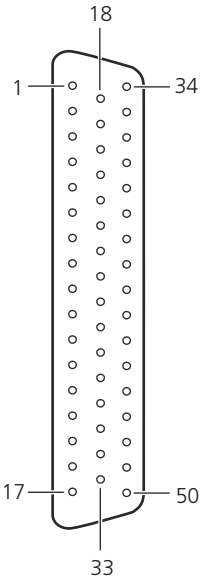
Pinout

The Digital I/O B connector is a 50-pin female Sub-D connector and it is located either on the front or on the top panel. It provides access to 16 digital Class 1 and 12 digital Class 2 channels. Your application sets the direction to be either an input or an output.

Note

The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.



Digital I/O B	Pin	Signal	Pin	Signal	Pin	Signal
	1	GND			34	GND
	2	DIO1 ch48	18	GND	35	$\overline{\text{DIO2 ch12}}$
	3	DIO1 ch47	19	DIO2 ch12	36	$\overline{\text{DIO2 ch11}}$
	4	DIO1 ch46	20	DIO2 ch11	37	$\overline{\text{DIO2 ch10}}$
	5	DIO1 ch45	21	DIO2 ch10	38	GND
	6	DIO1 ch44	22	GND	39	$\overline{\text{DIO2 ch9}}$
	7	DIO1 ch43	23	DIO2 ch9	40	$\overline{\text{DIO2 ch8}}$
	8	DIO1 ch42	24	DIO2 ch8	41	$\overline{\text{DIO2 ch7}}$
	9	DIO1 ch41	25	DIO2 ch7	42	GND
	10	DIO1 ch40	26	GND	43	$\overline{\text{DIO2 ch6}}$
	11	DIO1 ch39	27	DIO2 ch6	44	$\overline{\text{DIO2 ch5}}$
	12	DIO1 ch38	28	DIO2 ch5	45	$\overline{\text{DIO2 ch4}}$
	13	DIO1 ch37	29	DIO2 ch4	46	GND
	14	DIO1 ch36	30	GND	47	$\overline{\text{DIO2 ch3}}$
	15	DIO1 ch35	31	DIO2 ch3	48	$\overline{\text{DIO2 ch2}}$
	16	DIO1 ch34	32	DIO2 ch2	49	$\overline{\text{DIO2 ch1}}$
	17	DIO1 ch33	33	DIO2 ch1	50	GND

Pin naming

Channel	Pin Name	Description
Class 1	DIO1 ch<x>[1)]	DIO1: Digital Class 1 input or output ch<x>: Channel number
	GND	GND: Signal ground
Class 2	DIO2 ch<x>[2)]	DIO2: Digital Class 2 input or output, non-inverted signal ch<x>: Channel number
	$\overline{\text{DIO2 ch<x>}}$[2)]	$\overline{\text{DIO2}}$: Digital Class 2 input or output, inverted signal $\overline{\text{ch<x>}}$: Channel number

1) <x> is in the range of 33 ... 48.
2) <x> is in the range of 1 ... 12.

Further information

- For a description of the available signals on the connector, refer to:
  - Digital Class 1 I/O (Bidirectional) on page 126
  - Digital Class 2 I/O (Bidirectional) on page 129
- For details on implementation features, refer to:
  - Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
  - Bit I/O (DIO Class 2) (🕮 MicroLabBox Features)
  - Electric Motor Control (🕮 MicroLabBox Features)
  - Serial Peripheral Interface (DIO Class 1) (🕮 MicroLabBox Features)
  - Timing I/O (🕮 MicroLabBox Features)

Related topics

Basics

Using Sub-D Connectors..... 43

Digital I/O Class 1 Connectors (Spring-Cage)

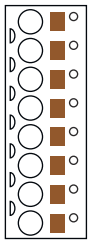
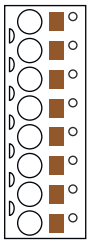
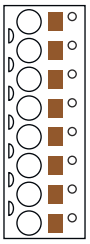
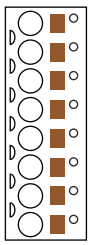
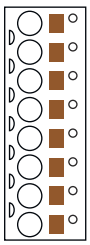
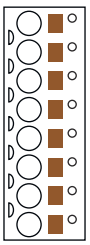
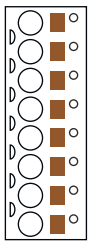
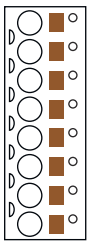
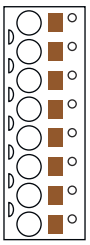
Valid MicroLabBox variants

The following MicroLabBox variants provide the Digital I/O Class 1 connectors with spring-cage terminals:

- MicroLabBox spring-cage variant

Pinout

The Digital I/O Class 1 connectors are spring-cage terminal blocks and they are located on the top panel. They provide access to 48 digital Class 1 channels. Your application sets the direction to be either an input or an output.

Terminal Block	Signal	Terminal Block	Signal	Terminal Block	Signal
	DIO1 ch1		DIO1 ch17		DIO1 ch33
	GND		GND		GND
	DIO1 ch2		DIO1 ch18		DIO1 ch34
	DIO1 ch3		DIO1 ch19		DIO1 ch35
	GND		GND		GND
	DIO1 ch4		DIO1 ch20		DIO1 ch36
	DIO1 ch5		DIO1 ch21		DIO1 ch37
	GND		GND		GND
	DIO1 ch6		DIO1 ch22		DIO1 ch38
	DIO1 ch7		DIO1 ch23		DIO1 ch39
	GND		GND		GND
	DIO1 ch8		DIO1 ch24		DIO1 ch40
	DIO1 ch9		DIO1 ch25		DIO1 ch41
	GND		GND		GND
	DIO1 ch10		DIO1 ch26		DIO1 ch42
	DIO1 ch11		DIO1 ch27		DIO1 ch43
	GND		GND		GND
	DIO1 ch12		DIO1 ch28		DIO1 ch44
	DIO1 ch13		DIO1 ch29		DIO1 ch45
	GND		GND		GND
	DIO1 ch14		DIO1 ch30		DIO1 ch46
	DIO1 ch15		DIO1 ch31		DIO1 ch47
	GND		GND		GND
	DIO1 ch16		DIO1 ch32		DIO1 ch48

Pin naming

Channel	Pin Name	Description
Class 1	DIO1 ch<x>[1)]	DIO1: Digital Class 1 input or output ch<x>: Channel number
	GND	GND: Signal ground

[1)] <x> is in the range of 1 ... 48.

Wire configuration

Parameter	Specification
Wire cross section	0.2 mm² ... 1.5 mm² (24 AWG ... 14 AWG)
Strip length	8 mm ... 9 mm (0.31 in. ... 0.35 in.)

Further information

- For a description of the available signals on the connector, refer to Digital Class 1 I/O (Bidirectional) on page 126.
- For details on implementation features, refer to:
  - Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
  - Electric Motor Control (🕮 MicroLabBox Features)
  - Serial Peripheral Interface (DIO Class 1) (🕮 MicroLabBox Features)
  - Timing I/O (🕮 MicroLabBox Features)

Related topics

Basics

Inserting Wires into Spring-Cage Terminals and Removing Wires..... 44

Digital I/O Class 2 Connectors (Spring-Cage)

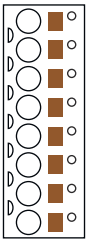
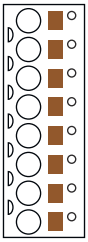
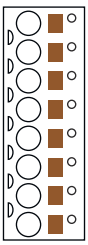
Valid MicroLabBox variants

The following MicroLabBox variants provide the Digital I/O Class 2 connectors with spring-cage terminals:

- MicroLabBox spring-cage variant

Pinout

The Digital I/O Class 2 connectors are spring-cage terminal blocks and they are located on the top panel. They provide access to 12 digital Class 2 channels. Your application sets the direction to be either an input or an output.

Terminal Block	Signal
	DIO2 ch1
	$\overline{\text{DIO2 ch1}}$
	DIO2 ch2
	$\overline{\text{DIO2 ch2}}$
	DIO2 ch3
	$\overline{\text{DIO2 ch3}}$
	DIO2 ch4
	$\overline{\text{DIO2 ch4}}$
	DIO2 ch5
	$\overline{\text{DIO2 ch5}}$
	DIO2 ch6
	$\overline{\text{DIO2 ch6}}$
	DIO2 ch7
	$\overline{\text{DIO2 ch7}}$
	DIO2 ch8
	$\overline{\text{DIO2 ch8}}$
	DIO2 ch9
	$\overline{\text{DIO2 ch9}}$
	DIO2 ch10
	$\overline{\text{DIO2 ch10}}$
	DIO2 ch11
	$\overline{\text{DIO2 ch11}}$
	DIO2 ch12
	$\overline{\text{DIO2 ch12}}$

Pin naming

Channel	Pin Name	Description
Class 2	DIO2 ch<x>[1)]	DIO2: Digital Class 2 input or output, non-inverted signal ch<x>: Channel number
	$\overline{\text{DIO2 ch<x>}}$[1)]	$\overline{\text{DIO2}}$: Digital Class 2 input or output, inverted signal $\overline{\text{ch<x>}}$: Channel number

[1)] <x> is in the range of 1 ... 12.

Wire configuration

Parameter	Specification
Wire cross section	0.2 mm² ... 1.5 mm² (24 AWG ... 14 AWG)
Strip length	8 mm ... 9 mm (0.31 in. ... 0.35 in.)

Further information

- For a description of the available signals on the connector, refer to Digital Class 2 I/O (Bidirectional) on page 129.
- For details on implementation features, refer to:
  - Bit I/O (DIO Class 2) (MicroLabBox Features)
  - Electric Motor Control (MicroLabBox Features)

Related topics

Basics

Inserting Wires into Spring-Cage Terminals and Removing Wires..... 44

Resolver Connectors (Sub-D)

Valid MicroLabBox variants

The following MicroLabBox variants provide the Resolver Sub-D connectors:

- MicroLabBox Sub-D variant
- MicroLabBox BNC variant

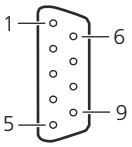
Pinout

The Resolver connectors are 9-pin female Sub-D connectors and are located either on the front or on the top panel.

Note

The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.

Resolver Connector	Pin	Signal	Pin	Signal
	1	GND		
	2	COS	6	$\overline{\text{COS}}$
	3	SIN	7	$\overline{\text{SIN}}$
	4	EXC	8	GND
	5	GND	9	$\overline{\text{EXC}}$

Pin naming

Pin Name	Description
GND	Signal ground
COS	Non-inverted cosine input signal
$\overline{\text{COS}}$	Inverted cosine input signal
SIN	Non-inverted sine input signal
$\overline{\text{SIN}}$	Inverted sine input signal
EXC	Non-inverted excitation output signal
$\overline{\text{EXC}}$	Inverted excitation output signal

Further information

- For a description of the available signals on the connector, refer to Resolver Interfaces on page 131.
- For details on implementation features, refer to Resolver Interface (🕮 MicroLabBox Features).

Related topics

Basics

Using Sub-D Connectors..... 43

Resolver Connectors (Spring-Cage)

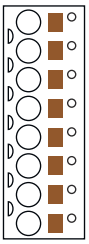
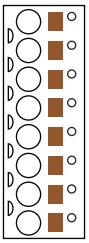
Valid MicroLabBox variants

The following MicroLabBox variants provide the Resolver connectors with spring-cage terminals:

- MicroLabBox spring-cage variant

Pinout

The Resolver connectors are spring-cage terminal blocks and they are located on the top panel.

Terminal Block	Signal
	GND
	COS
	$\overline{\text{COS}}$
	SIN
	$\overline{\text{SIN}}$
	EXC
	$\overline{\text{EXC}}$
	GND
	GND
	COS
	$\overline{\text{COS}}$
	SIN
	$\overline{\text{SIN}}$
	EXC
	$\overline{\text{EXC}}$
	GND

Pin naming

Pin Name	Description
GND	Signal ground
COS	Non-inverted cosine input signal
$\overline{\text{COS}}$	Inverted cosine input signal
SIN	Non-inverted sine input signal
$\overline{\text{SIN}}$	Inverted sine input signal
EXC	Non-inverted excitation output signal
$\overline{\text{EXC}}$	Inverted excitation output signal

Wire configuration

Parameter	Specification
Wire cross section	0.2 mm² ... 1.5 mm² (24 AWG ... 14 AWG)
Strip length	8 mm ... 9 mm (0.31 in. ... 0.35 in.)

Further information

- For a description of the available signals on the connector, refer to Resolver Interfaces on page 131.

- For details on implementation features, refer to Resolver Interface (📖 MicroLabBox Features).

Related topics

Basics

Inserting Wires into Spring-Cage Terminals and Removing Wires..... 44

Sensor Supply Output Connectors (Banana Jacks)

Valid MicroLabBox variants

All MicroLabBox variants provide the Sensor Supply Output connectors.

Pinout

The Sensor Supply Output connectors are 4 mm (0.16 in.) banana jacks and are located on the rear side.

The red connectors provide the output voltage, the black connectors are connected to signal ground.

For proper cabling, always connect the ground line of *Sensor Supply Output* to the black connector of the used sensor supply output.

Further information

- For a signal description, refer to Sensor Supply Outputs on page 133.
- For details on implementation features, refer to Sensor Supply (📖 MicroLabBox Features).

CAN Connector (Sub-D)

Valid MicroLabBox variants

All MicroLabBox variants provide the CAN Sub-D connector.

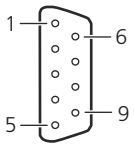
Pinout

The CAN connector is a 9-pin female Sub-D connector and is located either on the front or on the top panel. It provides access to the signals for up to two CAN networks.

Note

The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.

CAN Connector	Pin	Signal	Pin	Signal
	1	Not connected		
	2	CANL ch1	6	Not connected
	3	GND	7	CANH ch1
	4	CANL ch2	8	CANH ch2
	5	Not connected	9	Not connected

Pin naming

Pin Name	Description
CANH ch<x>[1)]	CANH: CAN High signal ch<x>: Channel number
CANL ch<x>[1)]	CANL: CAN Low signal ch<x>: Channel number
GND	GND: Signal ground

1) <x> is in the range of 1 ... 2.

Further information

- For a description of the available signals on the connector, refer to Communication Interfaces on page 135.
- For details on implementation features, refer to CAN Support (🕮 MicroLabBox Features).

Related topics

Basics

Using Sub-D Connectors..... 43

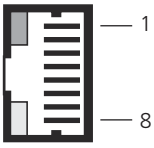
Ethernet and Host PC Connectors (RJ45)

Valid MicroLabBox variants

All MicroLabBox variants provide the Ethernet and Host PC connectors.

Pinout

The Ethernet and Host PC connectors are standard RJ45 sockets and they are located on the rear side. They provide access to the Ethernet interface of the host communication node and the computation node.

Connector	Pin	Signal (Gigabit)
	1	D1
	2	$\overline{D1}$
	3	D2
	4	D3
	5	$\overline{D3}$
	6	$\overline{D2}$
	7	D4
	8	$\overline{D4}$

Pin naming

Pin Name	Description
D<x>[1)]	D: Non-inverted signal ch<x>: Signal pair number
$\overline{D<x>}$[1)]	$\overline{D}$: Inverted signal $\overline{ch<x>}$: Signal pair number

1) <x> is in the range of 1 ... 4.

Further information

- For a description of the available signals on the connector, refer to Communication Interfaces on page 135.
- For details on implementation I/O Ethernet features, refer to Ethernet I/O Interface (🕮 MicroLabBox Features).
- For details on configuring the host interface, refer to Setting up a Connection Between the Host PC and MicroLabBox on page 23.

RS232 (422/485) Connector (Sub-D)

Valid MicroLabBox variants

All MicroLabBox variants provide the RS232(422/485) Sub-D connector.

Pinout and signal mapping

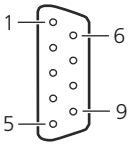
The RS232 (422/485) connector is a 9-pin female Sub-D connector and is located either on the front or the top panel. It provides access to the signals of two independent serial bus channels.

Note

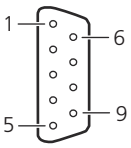
The pin numbering used for Sub-D connectors is not standardized.
Before you prepare the Sub-D connector, check whether the numbering on your connector matches the numbering used in this documentation.

The following illustration shows the connector's front view with the pin numbering used.

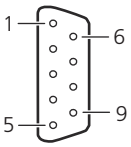
RS232 The following table shows the pinout with the signal mapping to connect RS232 devices.

RS232 (422/485) Connector	Pin	Pin Name	Signal	Description
	1	RXD ch2	RXD	Channel 2: Receive data
	2	RXD ch1	RXD	Channel 1: Receive data
	3	TXD ch1	TXD	Channel 1: Transmit data
	4	TXD ch2	TXD	Channel 2: Transmit data
	5	GND	—	Signal ground
	6	RTS ch2	RTS	Channel 2: Request to send
	7	RTS ch1	RTS	Channel 1: Request to send
	8	CTS ch1	CTS	Channel 1: Clear to send
	9	CTS ch2	CTS	Channel 2: Clear to send

RS422 The following table shows the pinout with the signal mapping to connect RS422 devices.

RS232 (422/485) Connector	Pin	Pin Name	Signal	Description
	1	RXD ch2	$\overline{RX}$	Channel 2: Receive data, inverted input
	2	RXD ch1	$\overline{RX}$	Channel 1: Receive data, inverted input
	3	TXD ch1	$\overline{TX}$	Channel 1: Transmit data, inverted input
	4	TXD ch2	$\overline{TX}$	Channel 2: Transmit data, inverted input
	5	GND	—	Signal ground
	6	RTS ch2	TX	Channel 2: Transmit data, non-inverted input
	7	RTS ch1	TX	Channel 1: Transmit data, non-inverted input
	8	CTS ch1	RX	Channel 1: Receive data, non-inverted input
	9	CTS ch2	RX	Channel 2: Receive data, non-inverted input

RS485 The following table shows the pinout with the signal mapping to connect RS485 devices.

RS232 (422/485) Connector	Pin	Pin Name	Signal	Description
	1	RXD ch2	—	Not connected
	2	RXD ch1	—	Not connected
	3	TXD ch1	BM	Channel 1: Bus minus
	4	TXD ch2	BM	Channel 2: Bus minus
	5	GND	—	Signal ground
	6	RTS ch2	BP	Channel 2: Bus plus
	7	RTS ch1	BP	Channel 1: Bus plus
	8	CTS ch1	—	Not connected
	9	CTS ch2	—	Not connected

Further information

- For a description of the available signals on the connector, refer to Communication Interfaces on page 135.
- For details on implementation features, refer to Serial Interface of MicroLabBox (🕮 MicroLabBox Features).

Related topics

Basics

Using Sub-D Connectors.....43

Signal Description

Where to go from here

Information in this section

Analog Class 1 Inputs

Characteristics

The following table shows the characteristics of the analog Class 1 inputs.

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F).

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent inputs			24		
Resolution			16		bit
Sample rate[2)]				1	MSPS
Differential input voltage range	Voltage difference between the non-inverted and inverted input.			±10	V
Working input voltage range	Voltage difference between signal ground and each input.	-11		+11	V
Conversion timer	Separate for each channel.				
	Width	27			bit
	Resolution	10			ns
	Interval			1.342	s

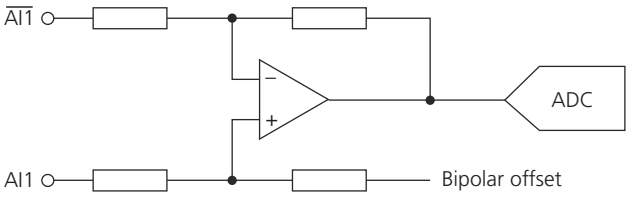
Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
Timer for time stamping	Common for all channels. Two additional channels are required to store one time stamp.				
	Width	32			bit
	Resolution	10			ns
	Time base range		42.9		s
Buffer size	Software-configurable	1		8192	Samples
Buffers per channel			3		
DC characteristics					
Initial offset error	Below 750 KSPs	-3		3	mV
Initial gain error	Below 750 KSPs	-0.25		0.25	%
Offset drift			±40		µV/K
Gain drift			±6		ppm/K
Input impedance	Impedance between signal ground and each input.		117		kΩ
Overvoltage protection	Referenced to protective ground.	-35		+35	V
AC characteristics					
SNR	12.4 kHz signal @ 200 KSPs ADC is in burst mode with timer as burst and conversion trigger.	85			dB
Input bandwidth	Full power bandwidth	400			kHz

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

2) All 24 inputs cannot be synchronously converted with maximum sample rate. Number of inputs, that are synchronously converted with maximum sample rate, is limited by available data throughput.

Circuit diagram

Simplified input circuitry of the analog Class 1 inputs:



Further information

- For the pinouts of the connectors that provide analog Class 1 inputs, refer to:
  - Analog In and Analog Out Connectors (BNC) on page 100
  - Analog In Class 1 Connectors (Spring-Cage) on page 101
  - Analog I/O A Connector (Sub-D) on page 97

- For details on implementation features, refer to:
  - ADC Class 1 (📖 MicroLabBox Features)
  - Electric Motor Control (📖 MicroLabBox Features)

Analog Class 2 Inputs

Characteristics

The following table shows the characteristics of the analog Class 2 inputs.

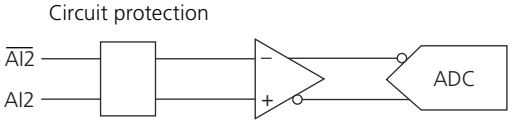
The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F).

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent inputs			8		
Resolution			14		bit
Sample rate	Fixed sample rate.		10		MSPS
Differential input voltage range	Voltage difference between the non-inverted and inverted input.			±10	V
Working input voltage range	Voltage difference between signal ground and each input.	-10		+10	V
DC characteristics					
Initial offset error		-10		+10	mV
Initial gain error		-0.5		+0.5	%
Offset drift		-50		+50	µV/K
Gain drift		-50		+50	ppm/K
Input impedance	Impedance between signal ground and each input.		1		MΩ
Overvoltage protection	Referenced to protective ground.	-35		+35	V

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Circuit diagram

Simplified input circuitry of the analog Class 2 inputs:



Further information

- For the pinouts of the connectors that provide analog Class 2 inputs, refer to:
  - Analog In and Analog Out Connectors (BNC) on page 100
  - Analog In Class 2 Connectors (Spring-Cage) on page 103
  - Analog I/O B Connector (Sub-D) on page 98
- For details on implementation features, refer to ADC Class 2 (📖 MicroLabBox Features).

Analog Class 1 Outputs

Characteristics

The following table shows the characteristics of the analog Class 1 outputs.

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F). All voltages are referenced to signal ground of MicroLabBox.

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent outputs			16		
Resolution			16		bit
DC Characteristics					
Output voltage range		-10		10	V
Output current range		-8		8	mA
Offset error		-4		4	mV
Gain error	Output current = ±1 mA	-0.25		0.25	%
AC Characteristics					
Settling time	Time required to reach and stay within an error band of 1 % of the final value.			1	µs
Low-pass cutoff frequency (3dB)	f_{gDAC}	500			kHz
Load capacitance				22	nF
Utilizable output frequency	Square, ±10 V, C_{DACout} = 1 nF Frequency depends on voltage swing and capacitive load.			150	kHz

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Protection

Protected against:

- Overcurrent

  When detecting an overcurrent, MicroLabBox deactivates the output after 15 µs. Every millisecond, MicroLabBox automatically reactivates the output, until it detects no overcurrent.

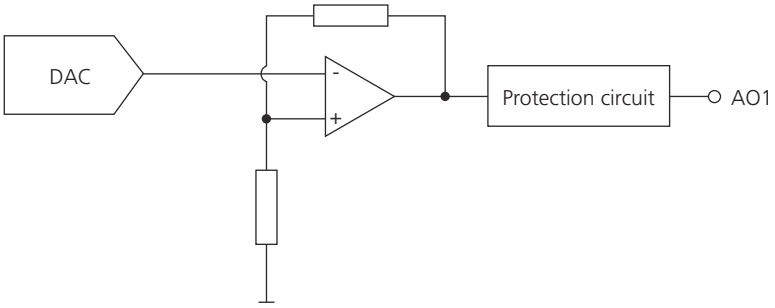
If a capacitive load causes the overcurrent, the output voltage will rise until the capacity is loaded.

- Overvoltage

  Protected against voltages in the range of -35 V ... +35 V referenced to protective ground.

Circuit diagram

Simplified circuitry of the analog Class 1 outputs:



Further information

- For the pinouts of the connectors that provide analog Class 1 outputs, refer to:
  - Analog In and Analog Out Connectors (BNC) on page 100
  - Analog Out Class 1 Connectors (Spring-Cage) on page 104
  - Analog I/O B Connector (Sub-D) on page 98
- For details on implementation features, refer to DAC Class 1 (🕮 MicroLabBox Features).

Digital Class 1 I/O (Bidirectional)

General characteristics

- Number of bidirectional I/O channels: 48
- Each digital Class 1 I/O channel can be set to either an input or an output.

Input characteristics

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F). All voltages are referenced to signal ground of MicroLabBox.

Parameter[1)]	Min.	Typ.	Max.	Unit
DC characteristics				
Input voltage range	-0.5		+5.5	V
Input high threshold	2			V
Input low threshold			0.8	V
Input impedance	24			kΩ

Parameter[1)]	Min.	Typ.	Max.	Unit
AC Characteristics				
Input pulse width	50			ns
Input frequency at 50% duty cycle			10	MHz
Input frequency at 1% or 99% duty cycle			200	kHz

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Output characteristics

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F). All voltages are referenced to signal ground of MicroLabBox.

Parameter[1)]	Signal Level[2)]	Min.	Typ.	Max.	Unit
DC characteristics					
Output high voltage without load	2.5 V	2.0	2.5		V
	3.3 V	2.4	3.3		V
	5 V	4.5	5.0		V
Output high voltage with 5 mA load	2.5 V	2.0	2.1		V
	3.3 V	2.4	3.0		V
	5 V	4.5	4.7		V
Output low voltage without load	2.5 V		0	0.4	V
	3.3 V		0	0.4	V
	5 V		0	0.4	V
Output low voltage with -5 mA load	2.5 V		0.3	0.4	V
	3.3 V		0.3	0.4	V
	5 V		0.3	0.4	V
Output current	2.5 V	-15		+15	mA
	3.3 V	-45		+45	mA
	5 V	-45		+45	mA
AC Characteristics					
Output pulse width at 100 pF load		50			ns
Output Frequency at 50% duty cycle				10	MHz
Output frequency at 1% or 99% duty cycle				200	kHz
Rise or fall time (10% / 90%)			5		ns

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

2) Configurable by your application at start-up

Protection

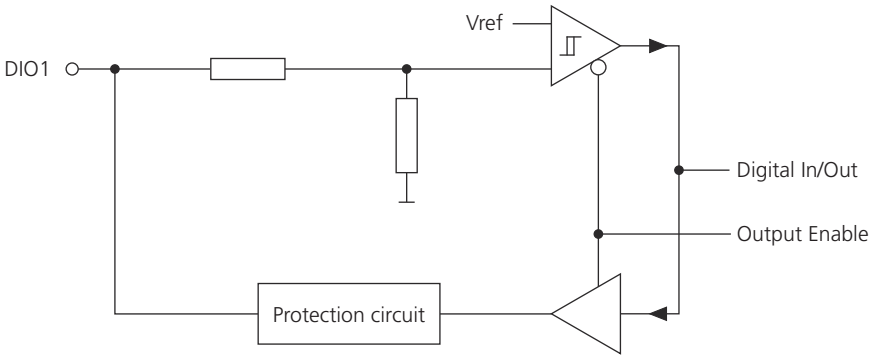
Protected against:

- Overcurrent
- Short circuit
- Feed in from external devices:

  Protected against overvoltage in the range of -35 V ... +35 V referenced to protective ground.

Circuit diagram

Simplified circuit diagram of the digital Class 1 bidirectional channels:



Further information

- For the pinouts of the connectors that provide digital Class 1 I/O, refer to:
  - Digital I/O A Connector (Sub-D) on page 106 (DIO1 CH1 ... DIO1 CH32)
  - Digital I/O B Connector (Sub-D) on page 108 (DIO1 CH33 ... DIO1 CH48)
  - Digital I/O Class 1 Connectors (Spring-Cage) on page 110
- For details on implementation features, refer to:
  - Bit I/O (DIO Class 1) (🕮 MicroLabBox Features)
  - Electric Motor Control (🕮 MicroLabBox Features)
  - Serial Peripheral Interface (DIO Class 1) (🕮 MicroLabBox Features)
  - Timing I/O (🕮 MicroLabBox Features)

Digital Class 2 I/O (Bidirectional)

General characteristics

- Number of bidirectional I/O channels: 12
- Each digital Class 2 I/O channel can be set to either an input or an output.

Input characteristics

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F).

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics					
Differential input voltage range	Voltage difference between the non-inverted and inverted input.			±5	V
Differential input threshold voltage	Voltage difference between the non-inverted and inverted input.	±200			mV
Working input voltage range	Voltage difference between signal ground and each input.	-7		+12	V
Input impedance (R_T)[2)]		120	145	220	Ω
AC Characteristics					
Input pulse width		50			ns
Input Frequency at 50% duty cycle				10	MHz
Input frequency at 1% or 99% duty cycle				200	kHz

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

2) Impedance between the non-inverted and inverted input.

Output characteristics

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F).

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics					
Output high differential voltage	Voltage difference between the non-inverted and inverted output.	2	2.4		V
Output low differential voltage	Voltage difference between the non-inverted and inverted output.		-2.4	-2	V
Output common mode voltage	Referenced to signal ground.	1	1.9	3	V

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics					
Output pulse width		50			ns
Output Frequency at 50% duty cycle				10	MHz
Output frequency at 1% or 99% duty cycle				200	kHz

[1)] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Protection

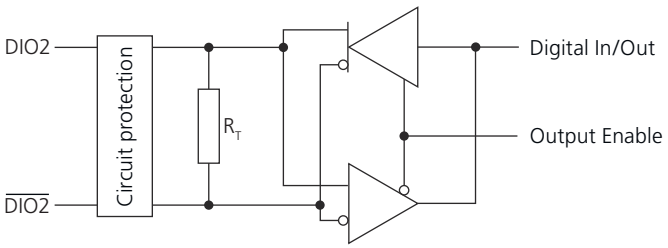
Protected against:

- Overcurrent
- Short circuit
- Feed in from external devices:

  Protected against overvoltage in the range of -35 V ... +35 V referenced to protective ground.

Circuit diagram

Simplified circuit diagram of the digital Class 2 bidirectional channels:



Further information

- For the pinouts of the connectors that provide digital Class 2 I/O, refer to:
  - Digital I/O B Connector (Sub-D) on page 108
  - Digital I/O Class 2 Connectors (Spring-Cage) on page 112
- For details on implementation features, refer to:
  - Bit I/O (DIO Class 2) (MicroLabBox Features)
  - Electric Motor Control (MicroLabBox Features)

Resolver Interfaces

Characteristics

The following table shows the characteristics of the resolver interfaces.

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F).

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
Configureable Characteristics[2]					
Differential excitation output voltage	Voltage difference between the non-inverted and inverted output.		3		V_{RMS}
			7		V_{RMS}
			10		V_{RMS}
Differential sine and cosine input voltage	Voltage difference between the non-inverted and inverted input.	1.1	1.5	1.9	V_{RMS}
		2.6	3.5	4.4	V_{RMS}
		3.7	5	6.3	V_{RMS}
Excitation output frequency	Configurable in 250 Hz increments	2		20	kHz
Resolver rotation speed	At 10 bits angular resolution			150,000	rpm
	At 12 bits angular resolution			60,000	rpm
	At 14 bits angular resolution			30,000	rpm
	At 16 bits angular resolution			7,500	rpm
Characteristics Depending on the Configuration					
Supported transformation ratios[3]	Refer to Supported transformation ratios on page 131.				
General characteristics					
Excitation output current				160	mA_{RMS}

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) Configurable by your application at start-up
3) Transformation ratio = input voltage / excitation voltage

Supported transformation ratios

The following table shows you the transformation ratios of resolvers that are supported by MicroLabBox. It also shows you the suitable sine/cosine input voltage configuration of MicroLabBox's resolver interface.

Excitation Voltage	Supported Transformation Ratios of the Resolvers	Sine/Cosine Input Voltage Configuration
3 V_{RMS}	0.37 ... 0.63	1.5 V_{RMS}
	0.87 ... 1.46	3.5 V_{RMS}
	1.24 ... 2.1	5 V_{RMS}

Excitation Voltage	Supported Transformation Ratios of the Resolvers	Sine/Cosine Input Voltage Configuration
7 V_{RMS}	0.16 ... 0.27	1.5 V_{RMS}
	0.38 ... 0.62	3.5 V_{RMS}
	0.53 ... 0.9	5 V_{RMS}
10 V_{RMS}	0.11 ... 0.19	1.5 V_{RMS}
	0.26 ... 0.44	3.5 V_{RMS}
	0.37 ... 0.63	5 V_{RMS}

Note

The transformation ratio of the resolver is valid only at the recommended excitation frequency of the used resolver.
For details on verifying the resolver interface, refer to Connecting Resolvers on page 45.

Protection

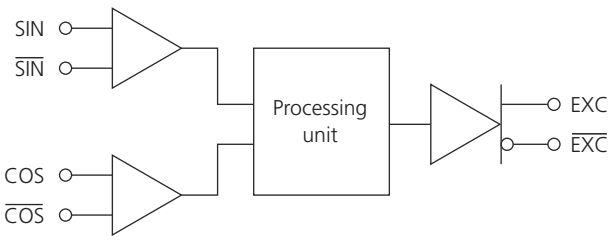
Protected against:

- Overcurrent
- Overvoltage

  Protected against voltages in the range of -12 V ... +12 V referenced to protective ground.

Circuit diagram

Simplified circuitry of the resolver interfaces:



Further information

- For the pinouts of the resolver connectors, refer to:
  - Resolver Connectors (Sub-D) on page 114
  - Resolver Connectors (Spring-Cage) on page 115
- For details on implementation features, refer to Electric Motor Control (🕮 MicroLabBox Features).

Sensor Supply Outputs

Sensor supply types

MicroLabBox provides two different types of sensor supplies:

- Fixed voltage supply (Sensor Supply Output A).
- Adjustable voltage supply (Sensor Supply Output B).

Characteristics

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F). All voltages are referenced to signal ground of MicroLabBox.

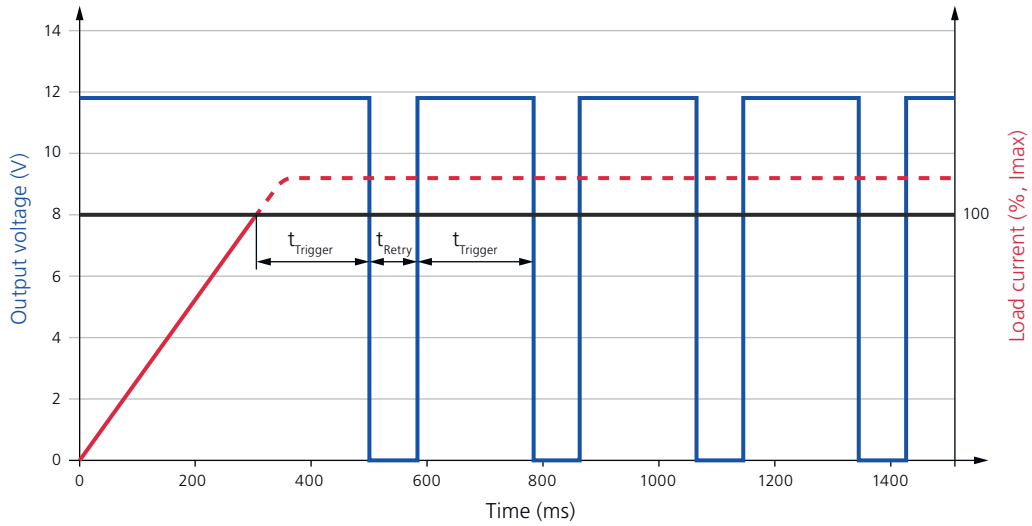
Sensor Supply Type	Parameter[1)]	Condition	Min.	Typ.	Max.	Unit
Fixed voltage supply	Voltage	I_{out} = 0 A	11.2	12	12.6	V
		I_{out} = 0.25 A	11.0			V
	Current				0.25	A
	Power				3	W
Adjustable voltage supply	Voltage		2		20	V
	Current				0.2	A
	Power				1	W
	Setting accuracy	V_{out} > 3 V		2	5	%

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Fault condition behavior

Both sensor supply outputs detect fault conditions. The sensor supply LEDs light red if a fault condition is detected.

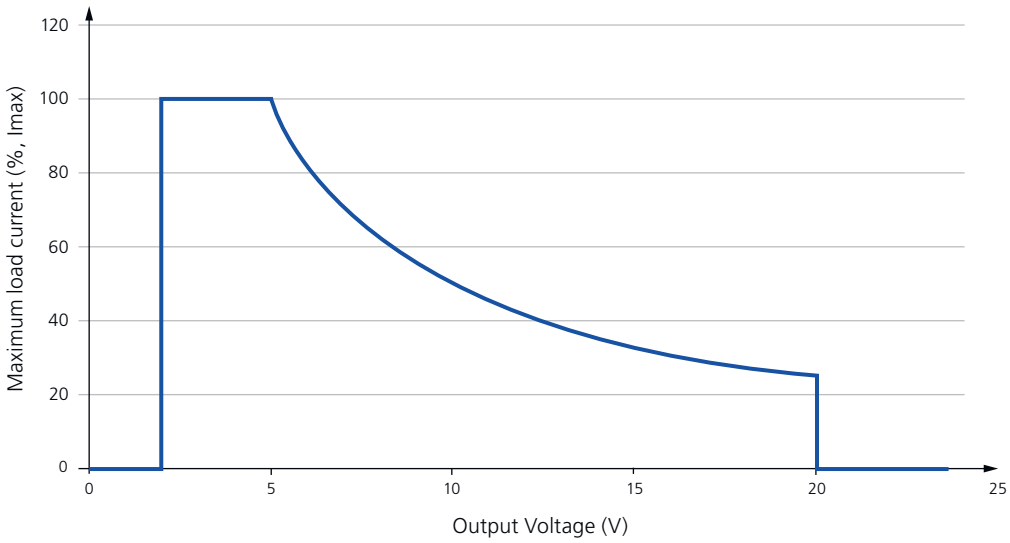
Fixed voltage supply Switches off and automatically tries to switch rear on if it detects a fault condition. The illustration shows the details on the fault condition behavior:



	Min.	Max.	Value
t_{Retry}	70	90	ms
$t_{Trigger}$ [1)]	0.2	500	ms

1) Trigger time depends on the load current.

Adjustable voltage supply Limits the current if it detects a fault condition. The illustration shows the details on the fault condition behavior:



Further information

- For details on implementation features, refer to Sensor Supply (🕮 MicroLabBox Features).

Communication Interfaces

Characteristics

The characteristics are specified for an ambient temperature of T = +25 °C (+77 °F). All voltages are referenced to signal ground of MicroLabBox.

Interface	Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
CAN	Bit rate	ISO 11898 interface			1	Mbit/s
	Termination	An internal 120 Ω termination can be activated by the application.				
Ethernet	Bit rate			10/100/1000		Mbit/s
	Voltage levels	Ethernet standard				
	Protocol	UDP/IP, TCP/IP, IPv4, supports IP fragmentation				
RS232	Bit rate		50		1M	bit/s
RS422	Bit rate		50		10M	bit/s
	Termination	The RTI FPGA Programming Blockset supports the activation of an internal 120 Ω termination.				
RS485	Bit rate		50		10M	bit/s
	Termination	The RTI FPGA Programming Blockset supports the activation of an internal 120 Ω termination.				
USB	Data throughput			7		MB/s
	Supply current for USB devices				1	A
	Voltage			5		V
	Protocol	USB 2.0 standard				

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Further information

- For the pinouts of the connectors that provide communication interfaces, refer to:
  - CAN Connector (Sub-D) on page 117
  - Ethernet and Host PC Connectors (RJ45) on page 118
  - RS232 (422/485) Connector (Sub-D) on page 119
- For details on implementation features, refer to:
  - CAN Support (🕮 MicroLabBox Features)
  - Ethernet I/O Interface (🕮 MicroLabBox Features)
  - Serial Interface of MicroLabBox (🕮 MicroLabBox Features)
  - USB Flight Recorder (🕮 MicroLabBox Features)
- For details on configuring the Ethernet interface, refer to Basics on the Web Interface on page 57.

LED Status Description

LED Status

Customizable LEDs

4 customizable LEDs are located either on the front or the top panel.

You can use up to 4 customizable LEDs to display status information on your application. If being not set by the application, the customizable LEDs do not light.

For details on the customizable LEDs, refer to LED Control (🕮 MicroLabBox Features).

Ethernet LEDs

Each RJ45 connector on the rear side provides one speed LED. The table below describes the LED:

LED Status	Meaning
Off	▪ MicroLabBox is switched off. ▪ No connection.
Green	1000 Mbit/s connected - no traffic
Green flashing	1000 Mbit/s connected - traffic
Orange	100 Mbit/s connected - no traffic
Orange flashing	100 Mbit/s connected - traffic
Green and orange	10 Mbit/s connected - no traffic
Green and orange flashing	10 Mbit/s connected - traffic

LED of the Eject button

The table below describes the LED which is located on the Eject button.

LED Status	Meaning
Off	▪ No USB device is connected. ▪ A USB device is connected but you have pressed the Eject button. The USB device is unmounted and you can safely remove it.
Green	A USB device is connected, but the flight recorder is not running.
Green flashing	A USB device is connected and the flight recorder is running.

Power LED

The table below describes the single power LED which is located on the front or the top panel.

LED Status	Meaning
Off	MicroLabBox's internal power supply is off. If this LED is not lit after MicroLabBox is switched on, check the mains connection. For a check list, refer to Checking MicroLabBox on page 70.
Green	MicroLabBox's internal power supply is on.

Sensor supply LEDs

The table below describes the 2 sensor supply LEDs which are located on the rear side next to the Sensor Supply Output connectors:

LED Status	Meaning
Off	The sensor supply is off.
Green	Output voltage is correct.
Red	The sensor supply is in fault condition.

Status LEDs

The table below describes the 4 status LEDs which are located on the rear side next to the Host PC connector:

LED	LED Status	Meaning
PWR	Off	MicroLabBox is off. If this LED is not lit after MicroLabBox is switched on: ▪ Check MicroLabBox. For details, refer to Checking MicroLabBox on page 70.
	Green	The internal voltages are correct.
	Orange	The board is powering up.
SYS	Off	▪ MicroLabBox is switched off. ▪ MicroLabBox is booting.
	Green	MicroLabBox is ready for operation.
	Orange	MicroLabBox started with the factory firmware and is in secured mode.
	Red	MicroLabBox stops running real-time applications and new applications cannot be loaded to prevent damage to the hardware. MicroLabBox measures a high internal temperature and/or ventilation malfunctions. Refer to Problems Related to the Execution and Loading of Real-Time Applications on page 71.
APP	Off	▪ MicroLabBox is switched off. ▪ No application loaded.
	Green	An application is loaded and running.
	Red	An application is loaded. The application has been stopped or terminated.

LED	LED Status	Meaning
USB	Off	▪ MicroLabBox is switched off. ▪ No USB device is connected. ▪ A USB device is connected but you have pressed the Eject button next to the USB connector. The USB device is unmounted and you can safely remove it.
	Green	A USB device is connected, but the flight recorder is not running.
	Green flashing	A USB device is connected and the flight recorder is running.
	Orange	The USB device is full and the active flight recorder is set to not overwrite old files.
	Red	A write error occurred when the USB device was accessed: e.g., the device was removed while the flight recorder was running.

Related topics

References

Housing Components of the MicroLabBox BNC Variant 79
Housing Components of the MicroLabBox Spring-Cage Variant 83
Housing Components of the MicroLabBox Sub-D Variant 87

Accessories

Connection Cables

Where to go from here

Information in this section

Ethernet Connection Cables

Where to go from here

Information in this section

HSL_PATCH_300V Galvanically Isolated PC Connection Cable

Technical data

The following table shows the technical specifications of the galvanically isolated connection cable:

Parameter	**Specification**[1)]		
Purpose	To connect the host PC to an ECU with XCP on Ethernet, to MicroLabBox, or to an expansion box (for example, PX10 with DS814 link board, AutoBox with DS1007 PPC Processor Board).		
Illustration			
Connector	RJ45 jack	Galvanic isolation	RJ45 jack
Label on the cable	HSL_PATCH_300V		
Length	4.5 m (177.2 in.)		
Electrical characteristics	Electrically safe up to 300 V DC/AC_{RMS} and 600 V_{peak}[2)]		

Parameter	Specification[1)]
Operating temperature	-40 … +85 °C (-40 … +185 °F)
Max. transfer rate	100 Mbit/s [3)]

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) The voltage levels relate to secondary circuits without direct electrical connection to the AC mains.
3) In exceptional cases, auto-negotiation of connected Gigabit devices (e.g., the host PC) does not lead to a stable Ethernet connection. To solve the problem, manually reduce the Ethernet transfer rate of the host PC to 100 Mbit/s.

LVDS Link Cables

Where to go from here

Information in this section

LVDS_CAB2 LVDS Link Cable

Technical data

The following table shows the technical specifications of the LVDS_CAB2 LVDS link cable:

Parameter	Specification[1)]		
Purpose	To connect two devices with LEMO-1S connectors via LVDS.		
Illustration			
Connector	LEMO-1S, 4 pins (2 male, 2 female)	–	LEMO-1S, 4 pins (2 male, 2 female)
Label on the cable	LVDS_CAB2		
Length	5.0 m (197 in.)		
Operating temperature	–20 … +60 °C (–4 … +140 °F)		

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

LVDS_CAB15 LVDS Link Cable

Technical data

The following table shows the technical specifications of the LVDS_CAB15 LVDS link cable:

Parameter	Specification[1]		
Purpose	To connect two devices with LEMO-1S connectors via LVDS.		
Illustration			
Connector	LEMO-1S, 4 pins (2 male, 2 female)	–	LEMO-1S, 4 pins (2 male, 2 female)
Label on the cable	LVDS_CAB15		
Length	5.0 m (197 in.)		
Operating temperature	–40 … +85 °C (–40 … +185 °F)		

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

MicroLabBox Connection Cables

Where to go from here

Information in this section

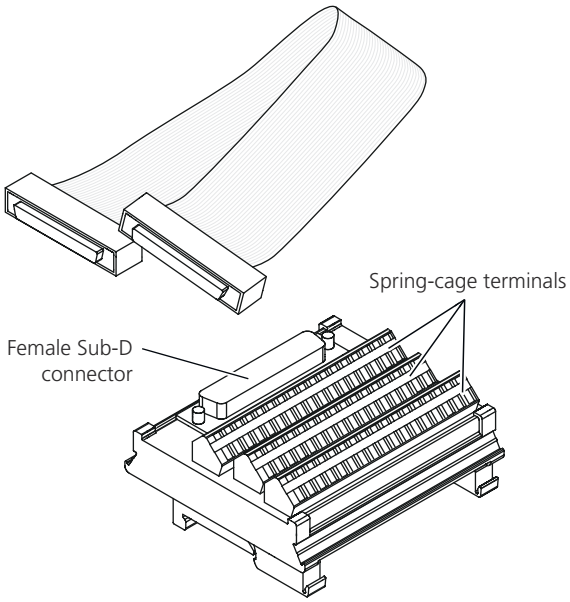
MLBX_CAB1 Interface Cable..... 142
To access signals of MicroLabBox's 50-pin Sub-D connectors via spring-cage terminals.

MLBX_CAB1 Interface Cable

Overview illustration

The MLBX_CAB1 interface cable consists of a Sub-D cable and an interface module that provides spring-cage terminals for connection.

The illustration shows the Sub-D cable and the interface module. The illustration is not scaled.



Technical data

The following table shows the technical specifications of the interface cable:

Parameter		**Specification** [1]
Purpose		To access signals of MicroLabBox's 50-pin Sub-D connectors via spring-cage terminals.
Connection to MicroLabBox		0.4 m (15.7 in.) standard 50-pin Sub-D cable
Spring-cage terminals	Number of terminals	50
	Pinout	The terminals are numbered similar to the pin numbering of the connected Sub-D connector. Therefore, the pinout of the terminals is the same as MicroLabBox's Sub-D connector pinouts. The pinouts are written on the housing of MicroLabBox. Pin numbers of the terminals are written on the terminals.
	Wire cross section	0.08 ... 2.5 mm² (28 ... 12 AWG)
	Strip length	5 ... 6 mm (0.20 ... 0.24 in.)
Physical size of the interface module		34 x 94 x 85 mm (1.339 x 3.701 x 3.346 in.)
Possible mounting		DIN rail (TS35)
Operating temperature		0 ... 50 °C (32 ... 122 °F)

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Related topics

References

R

S

T

U

W