MicroAutoBox III

Hardware Installation and Configuration

Release 2021-A – May 2021

How to Contact dSPACE

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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

Board-Specific and Module-Specific Installation Instructions 97

About This Document

Content

This document will show you the installation and hardware configuration to operate the MicroAutoBox III and the MicroAutoBox III (WLAN).

It provides details on the the hardware and gives information on the cable harness for connecting external devices.

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 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/go/help.

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 MicroAutoBox III, 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 of the MicroAutoBox III

The MicroAutoBox III is intended to be used for the developing, researching, and testing of functions for electronic control units (ECU). Using MicroAutoBox III for purposes other than these (e.g., in vehicles intended for sale to consumers, or in machines as part of production machinery) is considered to be improper and noncontractual use.

The MicroAutoBox III must be used in a clean and dry environment (pollution degree 2, according to IEC 61010-1).

Connect only external devices with voltages inside the specified ranges. For the protected voltage ranges, refer to General Characteristics on page 240.

The MicroAutoBox III 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 more information on product compliance, refer to Certifications on page 250.

You are not allowed to open, modify, or service MicroAutoBox III unless the required instructions are explicitly stated in the user documentation or were sent to you by dSPACE Support in writing. Perform the instructions only if you have the required skills.

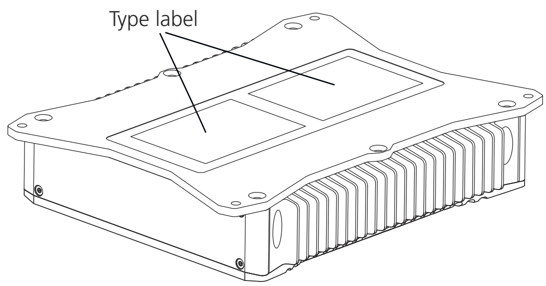
Type Label and Product Safety Labels

Introduction

The type label and product safety labels must be permanently attached to the product. If product safety labels are damaged or not clearly legible, replace them immediately. For replacement labels contact dSPACE Support.

Type label

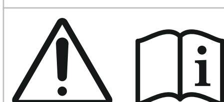
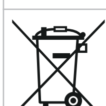
The type label at the bottom clearly identifies the product. The information on the type label is required for using the product and for questions to dSPACE Support.



The type label provides the following information:

- Information to identify the product:
  Name of the product, product type, and serial number
- Operating voltage range
- Rated operating power
- Products with radio interfaces only: Regulatory information
- Contact information

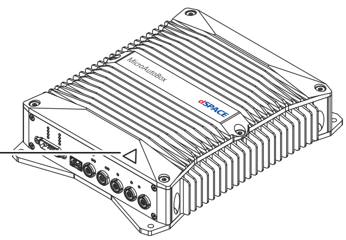
Symbols on the type label The following table describes the symbols used on the type label. Not all symbols are used on every product.

Symbol	Description
	Read the user documentation for your dSPACE product. This will give you all the information required to use your dSPACE product safely and efficiently. Keep the user documentation for future reference.
	The product complies with the requirements of the applicable EU directives.
	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.

Symbol	Description
	The product complies with the requirements of the applicable Japanese radio equipment regulations. The type certifications are printed to the right of the symbol.

Product safety labels

The following illustration shows the location of the attached product safety label.



The following table describes the symbol used.

Symbol	Description
	The product can heat up during operation. ▪ Verify the temperature of the product before you touch it.

Safety Precautions for Connecting to Power Supply/Vehicle Battery

Using the correct operating voltage

The MicroAutoBox III must be supplied with the correct operating voltage to avoid electric shock and malfunctions.

- Make sure that the power supply/vehicle battery does not exceed the maximum operating voltage. The operating voltage range is printed on the type label at the bottom of the MicroAutoBox III.
- Do not use plugs for the power supply cable that can lead to an accidental connection to hazardous supply voltages, such as the mains voltage.
- Do not use the preconfigured power supply cable from dSPACE at supply voltages > 32 V DC.

  For operation with DC voltages > 32 V DC, you must build a power supply cable. For building a power supply cable, refer to Building the Power Supply Cable on page 84.
- If the Embedded PC is built in a MicroAutoBox III, the power input connector of the Embedded PC is covered with a protective cap. Do not remove the protective cap.
- To avoid hardware damage and the risk of electric shock, do not connect the MicroAutoBox III to an AC power source.

Building the power supply cable

A vehicle battery can supply high currents. If a short circuit occurs, e.g., in the cable harness, the current of the vehicle battery (power supply) generates heat in the connected cables. The heat might cause a fire.

- Insert fuses into the power supply cable and other cables that are connected to the battery/power supply to avoid an electrical fire.
- Locate the fuses close to the battery/power supply.
- Choose fuse ratings that ensure that the fuses break the circuit if the connected cables are loaded with the maximum currents supported by the cross sections of the cables used.
- Make sure that you use flame-retardant cables specified for temperatures up to 105 °C (220 °F) that were tested in conformity with IEC 60332-1-2, IEC 60332-2-2, or UL VW-1.
- Make sure that you use flame-retardant connectors specified for temperatures up to 105 °C (220 °F) and V-2 classified in conformity with IEC 60695-11-10 or UL 94.

Connecting to a vehicle battery

Even a brief disconnection of the battery during engine operation can cause the vehicle generator to generate hazardous voltages of more than 100 V (load dump).

- Turn off the vehicle engine before connecting or disconnecting the vehicle battery.

Batteries cannot be switched off. Therefore, locate a disconnect switch in the power supply cabling:

- Use an all-pole disconnect switch that matches the rating of the MicroAutoBox III.
- Make sure that the disconnect switch can be reached by the user in case of an emergency.

Using power supply cables with non-insulated ends

Using a power supply cable with non-insulated ends can lead to an electric shock when connecting the MicroAutoBox III to an energized power supply.

The connection of the cable is comparable to switch bouncing. The bouncing, the inrush current, the inductivity of the cable, and the input circuit of the MicroAutoBox III can lead to a hazardous voltage.

- Make sure that the power supply is voltage-free before connecting the MicroAutoBox III.

  If you use a vehicle battery, make sure that the disconnect switch is open. For more information on the disconnect switch, refer to Connecting a vehicle battery on page 85.

Powering a MicroAutoBox III with a built-in Cooling Unit

Voltages that are connected to the power input connector of the MicroAutoBox III Cooling Unit are directly looped through to its power output connector.

- Make sure that the power output connector of the Cooling Unit is connected to the power input connector of the MicroAutoBox III before you connect the laboratory power supply/vehicle battery.
- The screws of the power output connector must always be tight when you power up the Cooling Unit. Do not loosen the screws before the power supply/vehicle battery is disconnected.
- The cable of the power output connector must not be kinked or damaged.

Related topics

Basics

Building the Power Supply Cable.. 84

Safety Precautions for Installing the MicroAutoBox III

Installing or uninstalling the MicroAutoBox III

You install and uninstall the MicroAutoBox III at your own risk. Any damage to or malfunction of dSPACE hardware caused by improper installation or uninstallation is not covered by the warranty, unless the handling and installation instructions are shown to be defective.

For example, installation work includes:

- Mounting a module on a board.
- Connecting/disconnecting external devices and the power supply.
- Connecting/disconnecting break-out boxes.
- Connecting/disconnecting dSPACE ECU communication and bypass interfaces.

Before doing any installation or uninstallation work, observe the following points:

- Check the MicroAutoBox III for external damages. You must not put into operation any damaged hardware.
- Disconnect the power supply/vehicle battery.
- Disconnect the external devices from the MicroAutoBox III.

  In case of a fault, connected external devices might conduct dangerous high voltage to the MicroAutoBox III or parts of the circuitry.

The safety precautions in this document must be carried out for installation work and for system operation.

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.

Connecting and disconnecting external devices

To prevent damage to the hardware:

- Apply voltages/currents to the connector pins only inside the specified ranges.
- Do not connect or disconnect any devices while the MicroAutoBox III is powered up and/or external devices are switched on. Make sure that external devices are turned off beforehand.
- Make sure that the wiring material fulfills the required characteristics.
- Before you connect an external device to the MicroAutoBox III, use measurement instruments, such as an oscilloscope or a tester device, to verify the I/O signals generated by your MicroAutoBox III. If you cannot test the I/O signals, ensure that no one is in the potential danger zone of the device (test bench, etc.) when the changes first take effect. This can also be necessary if you have updated the firmware or changed the cable harness via a break-out box.
- Do not use radio connections for safety-relevant functions. The performance of radio connections can be significantly reduced or the connection can be lost due to radio dead spots, insufficient radio range, radio disturbances, or radio shadow.

The MicroAutoBox III provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. This particularly concerns the VSENS, VBATprot, and the USB ports pins.

- To prevent a fire, apply the general fire safety regulations, e.g., supervise the operation, remove fire loads, and use fire-proof materials and enclosures.

Connecting to local area networks (LAN)

All the Ethernet ports of the MicroAutoBox III contain safety extra-low voltage (SELV) circuits, which must be connected only to other SELV circuits.

- To avoid electric shock, do not connect the Ethernet ports of the MicroAutoBox III to non-SELV circuits, e.g., telecommunication network voltage (TNV) circuits.
- The LAN or LAN segment of the MicroAutoBox III and all connected equipment must be part of the same low-voltage power distribution system.

- Do not use RJ45 connectors of wide area network (WAN) ports, because WAN ports can contain TNV circuits.
- LAN cables can occasionally be subject to hazardous transient voltages, such as lightning or disturbances in the electric utilities power grid. Handle exposed metal components of the network with caution.

Safety Precautions for Using the MicroAutoBox III

Observing environmental conditions

Make sure that the following environmental conditions are fulfilled when using the MicroAutoBox III:

- Use the MicroAutoBox III only in a normal clean and dry environment and avoid condensation.

  According to IEC 61010-1, using MicroAutoBox III in wet locations (i.e., an electroconductive liquid is present that reduces the human impedance between the electric contacts of the hardware and the user) can result in electric shock due to hazardous voltages or can damage the hardware. Ensure that the MicroAutoBox III is not put into operation in an environment with a pollution degree higher than 2 according to IEC 61010-1.
- Use the MicroAutoBox III only at an altitude below 2,000 m.

  The air section and current leakage path changes at altitudes higher than 2,000 m, which reduces the product safety.
- Do not use the MicroAutoBox III with damaged cables.

  Route all the external cables so that they are neither likely to be walked on nor pinched by items placed upon or against them.

  Replace any damaged cables.
- Observe the operating temperature range of the MicroAutoBox III. Refer to General Characteristics on page 240.

Guidelines for safe in-vehicle use of dSPACE products

Any in-vehicle use of dSPACE products in line with the contractual purposes requires the use of enclosed test tracks that are specially safety-secured for the specific purpose, i.e., with appropriately restricted access and additional appropriate safety measures.

If you intend to use dSPACE products outside enclosed tracks, you have to check with the relevant authorities in your country under which circumstances this is possible. You and the local authorities involved bear full responsibility for this type of use.

You must take appropriate measures to ensure that the overall system enters a safe state if a dangerous situation occurs, e.g., by implementing emergency shutdown or a limp-home mode. This particularly applies in the following cases:

- Where safety-critical interventions that affect vehicle behavior are performed, e.g., the stimulation of a bus system, such as CAN, or the calibration or bypassing of in-vehicle electronic control units (ECUs) that control powertrain, chassis, or body systems.

- Where dSPACE products are deployed in conjunction with ECUs that can pose a hazard if they malfunction.

Accordingly, the guidelines apply to the use of dSPACE products in aircraft or vessels in compliance with the contractual purposes.

Avoiding interference to radio communication devices

The MicroAutoBox III can provide a WLAN radio interface. An improper installation or unauthorized use of radio interfaces can cause harmful interference with radio communication devices:

- If you operate the WLAN interface in the 5 GHz frequency range, the MicroAutoBox III is restricted to indoor use.
- Attach only the delivered antennas to the WLAN interfaces (). Use only antennas that are provided by dSPACE for this product.

Observing workplace regulations

To avoid the risk of personal injury and hardware damage, you have to follow the workplace regulations defined by the national law of your country.

For example:

- Do not use electric devices near explosive materials or flammable fluids, gases, or dusts.
- Do not use electric devices outside the environmental conditions described in the user documentation.

Avoiding burns

The MicroAutoBox III can heat up during operation.

- Verify the temperature of the housing before you touch it, especially if the environment temperature is high.

Protecting the data privacy

The MicroAutoBox III provides memory components that can store non-volatile data. To avoid the unauthorized propagation of non-volatile data, clear the memory before you pass the MicroAutoBox III to another person.

Non-volatile memory is used, for example, for real-time applications, which will instantly start when powering on the hardware, FPGA applications, or explicitly implemented non-volatile data handling.

Safety Precautions for Using MicroAutoBox Break-Out Boxes

Working with break-out boxes

Depending on the connected devices, there can be hazardous voltages on the contacts of the boxes caused by failures.

- Do not touch bare contacts, connector pins, or any connected terminals and devices while the system is powered.

Changing the existing cable harness via a break-out box can cause uncontrolled movements of connected devices or damage them.

- Before changing the cabling, think through the effects of the changes you are planning.
- Make sure that no one is in the potential danger zone of the device (test bench, etc.) when the changes first take effect.

Connecting devices

- Do not connect any high-voltage devices to the I/O connectors of the break-out box.
- Do not apply voltages or currents outside the specified ranges of the used MicroAutoBox III to the terminal points of the break-out boxes.
- Do not connect or disconnect sensors or actuators while the power supply of the MicroAutoBox III or the power supply of any connected device is switched on.
- Observe all safety precautions described in the documentation of the connected devices.

The break-out box provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. This particularly concerns the VSENS and VBATprot pins.

- Apply the general fire safety regulations, e.g., supervise the operation, remove fire loads, and use fire-proof materials and enclosures.

Installation location

- Do not use the break-out boxes in the vehicle's engine compartment.
- Use the break-out boxes only in dry locations and avoid condensation.

  The break-out boxes are not moisture-proof. They must not be moistened by any liquids.

Safety Precautions for Shipping a MicroAutoBox III

Shipping a MicroAutoBox III

Observe the following when shipping a MicroAutoBox III:

- The packaging must be stable and withstand a 1.2 m (47 in.) drop test.
- The packaging must bear the *Lithium Battery Mark* label with UN number 3091 and a phone number of your company for further information.

  A person must be available at the phone number provided who can provide information about the device being sent. The phone number must begin with the country code.
- The *Lithium Battery Mark* label must be at least 110 mm (4.4 in.) high and at least 120 mm (4.8 in.) wide.
- If the MicroAutoBox III is shipped by plane, enter the following note to the *Nature and Quantity of Goods* field of the airbill:

  Lithium metal batteries in compliance with Section II of PI 970

For battery characteristics, refer to Battery Characteristics on page 264.

Safety Precautions for Disposing dSPACE Hardware

Disposing a MicroAutoBox III

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 Batteries are installed to the following boards:

- DS1403 Processor Board: A Lithium battery is permanently installed to the board.

  If you are shipping the MicroAutoBox III to a disposal or recycling center, observe the notes on shipment. Refer to Safety Precautions for Shipping a MicroAutoBox III on page 27.

  For battery characteristics, refer to Battery Characteristics on page 264.
- Embedded PC: A lithium manganese dioxide coin cell battery is permanently installed.

Package Contents

Contents of a MicroAutoBox III Package

Introduction

A MicroAutoBox III can be ordered with different I/O boards and modules to match the I/O requirements of your application. Therefore, the package contents depends on the MicroAutoBox III configuration you ordered.

General package contents

The table shows the items that are delivered with every MicroAutoBox III.

Contents	Description
1 x MicroAutoBox III	-
1 x CB6073PW	Power supply cable to connect the MicroAutoBox III to a power supply.
1 x 7W2 Sub-D connector	To build a power supply cable.
1 x ETH_CAB1 Ethernet Connection Cable	Host interface cable to connect the MicroAutoBox III to the host PC.
1 x dSPACE General Safety Precautions	Printed document to prevent personal injury and damage to dSPACE hardware due to improper handling.

DS1511 package contents

The table shows the additional items that are delivered with the DS1511 Multi-I/O Board.

Contents	Description
1 x ZIF I/O connector	156-pin zero insertion force (ZIF) I/O connector to connect the DS1511 Multi-I/O Board.
1 x Package with crimp contacts	To build the ZIF I/O connector.
1 x Coding kit	To code the ZIF I/O connector to prevent faulty connections.
1 x Sheet of stickers	To mark the ZIF I/O connector unambiguously.

Contents	Description
1 x Jumper cable with crimp contacts	To connect the supply voltage to the digital I/O interfaces of the DS1511 Multi-I/O Board.
1 x dSPACE MicroAutoBox Crimping Tool[1)]	To crimp the contacts of the I/O connectors.

[1)] Not more than one crimping tool per MicroAutoBox III

DS1513 package contents

The table shows the additional items that are delivered with the DS1513 Multi-I/O Board.

Contents	Description
1 x ZIF I/O connector	156-pin zero insertion force (ZIF) I/O connector to connect the DS1511 Multi-I/O Board.
1 x Package with crimp contacts	To build the ZIF I/O connector.
1 x Coding kit	To code the ZIF I/O connector to prevent faulty connections.
1 x Sheet of stickers	To mark the ZIF I/O connector unambiguously.
1 x Jumper cable with crimp contacts	To connect the supply voltage to the digital I/O interfaces of the DS1513 Multi-I/O Board.
1 x dSPACE MicroAutoBox Crimping Tool[1)]	To crimp the contacts of the I/O connectors.

[1)] Not more than one crimping tool per MicroAutoBox III

DS1514 package contents

The table shows the additional items that are delivered with the DS1514 FPGA Base Board.

Contents	Description
1 x ZIF I/O connector	156-pin zero insertion force (ZIF) I/O connector to connect the DS1511 Multi-I/O Board.
1 x Package with crimp contacts	To build the ZIF I/O connector.
1 x Coding kit	To code the ZIF I/O connector to prevent faulty connections.
1 x Sheet of stickers	To mark the ZIF I/O connector unambiguously.
1 x Jumper cable with crimp contacts	To connect the supply voltage to the digital I/O interfaces of the installed I/O module.

DS1521 package contents

The table shows the additional items that are delivered with the DS1521 Multi-I/O Board.

Contents	Description
6 x 9-pin female Sub-D connector	Connector to connect CAN/FlexRay buses.
1 x 25-pin female Sub-D connector	Connector to connect GPIO signals and LIN/UART buses.

DS1552 package contents

No additional items are delivered with the DS1552 Multi-I/O Module.

DS1553 package contents

No additional items are delivered with the DS1553 AC Motor Control Module.

DS1554 package contents

The table shows the additional items that are delivered with the DS1554 Engine Control I/O Module.

Contents	Description
1 x 37-pin female Sub-D connector	Connector to connect the engine signals of the DS1554 Engine Control I/O Module.

DS4340 package contents

No additional items are delivered with the DS4340 FlexRay Interface Module.

DS4342 package contents

No additional items are delivered with the DS4342 CAN FD Interface Module.

Embedded PC

The table shows the additional items that are delivered with installed modules of a built-in Embedded PC.

Installed Module	Contents	Description
DS932 Automotive Ethernet	1 x AETH_CAB1	Preconfigured automotive Ethernet connection cable.
DS933 CAN FD	1 x 9-pin female Sub-D connector	Connector to connect a CAN network.

Cooling Unit

No additional items are delivered with a built-in MicroAutoBox III Cooling.

Related topics

Basics

References

Introduction to the MicroAutoBox III

Where to go from here

Information in this section

Hardware Components of the MicroAutoBox III and their Features

Hardware components

A MicroAutoBox III consists of a processor board and at least one I/O board.

The processor board executes the real-time application and the I/O board provides the electrical interfaces for measuring and controlling signals of external devices and for bus and network communication, such as CAN or Ethernet communication.

You can order a MicroAutoBox III with different I/O boards to match the I/O requirements of the application. The I/O board configuration of a delivered MicroAutoBox III cannot be changed, but you can add or replace the I/O modules of the DS1514 FPGA Base Board.

A MicroAutoBox III variant with WLAN interface (MicroAutoBox III (WLAN)) provides a radio interface.

Processor board

The DS1403 Processor Board provides a processor for executing the real-time application and the communication to the host PC. The host communication lets you access the MicroAutoBox III with the host PC for downloading and controlling the real-time application, for example.

For more information on the features of the DS1403 Processor Board, refer to Features of the DS1403 Processor Board on page 260.

I/O boards

The following I/O boards are available for the MicroAutoBox III:

I/O Board	Description	Feature Overview
DS1511 Multi-I/O Board	The DS1511 Multi-I/O Board is a universal I/O board that provides additional digital I/O channels. The DS1511B1 is a variant of the DS1511 Multi-I/O Board with an extended measuring range for analog inputs.	Features of the DS1511 Multi-I/O Board on page 288
DS1513 Multi-I/O Board	The DS1513 Multi-I/O Board is a universal I/O board that provides additional analog I/O channels and CAN interfaces.	Features of the DS1513 Multi-I/O Board on page 323
DS1514 FPGA Base Board	The DS1514 FPGA Base Board provides an FPGA for application-specific I/O extensions and for user-programmable FPGA applications. You must install I/O modules in this board providing the I/O interface.	Features of the DS1514 FPGA Base Board on page 356
DS1521 Bus Board	The DS1521 Bus Board is a bus and network board that mainly provides automotive bus interfaces, such as CAN FD and automotive Ethernet.	Features of the DS1521 Bus Board on page 362

I/O modules

You can install the following I/O modules in the DS1514 FPGA Base Board.

I/O Module	Description	Feature Overview
DS1552 Multi-I/O Module	The DS1552 Multi-I/O Module is a universal I/O module. The DS1552B1 is a variant of the DS1552 Multi-I/O Module with an extended measuring range for analog inputs.	Features of the DS1552 Multi-I/O Module on page 389
DS1553 AC Motor Control Module	The DS1553 AC Motor Control Module provides an I/O interface that is optimized for controlling various electric drives.	Features of the DS1553 AC Motor Control Module on page 423

I/O Module	Description	Feature Overview
DS1554 Engine Control I/O Module	The DS1554 Engine Control I/O Module provides an I/O interface for the advanced control of combustion engines.	Features of the DS1554 Engine Control I/O Module on page 443
DS4340 FlexRay Interface Module	The DS4340 FlexRay Interface Module provides a FlexRay interface.	Features of the DS4340 FlexRay Interface Module on page 472
DS4342 CAN FD Interface Module	The DS4342 CAN FD Interface Module provides two CAN channels supporting flexible data rates (CAN FD).	Features of the DS4342 CAN FD Interface Module on page 479

Built-in Embedded PC

A MicroAutoBox III Embedded PC is a compact PC system that can be integrated into the housing of a MicroAutoBox III. The Embedded PC can be used for developing and validating advanced driver assistance, infotainment, and telematics, or to execute ControlDesk directly on the MicroAutoBox III system.

For more information, refer to Embedded PC Features (MicroAutoBox III Embedded PC Hardware Installation and Configuration).

Built-in Cooling Unit

The MicroAutoBox III Cooling Unit ensures an adequate heat dissipation to use the MicroAutoBox III at operating temperatures up to 80 °C (176 °F).

For more information, refer to Features of the MicroAutoBox III Cooling Unit on page 504.

Requirements on the Host PC

Hardware requirements

The host PC is a standard PC on which the dSPACE test and experiment software is installed.

For the minimum hardware requirements, refer to Host PC Hardware (Installing dSPACE Software).

For general host PC requirements, refer to Appendix: System Requirements (Installing dSPACE Software).

Software requirements

The following software is required to use a MicroAutoBox III:

- Microsoft Windows as operating system for the host PC, refer to Operating System (Installing dSPACE Software).
- ConfigurationDesk to implement and build real-time applications by means of a signal chain using graphical elements.
- A tool to model the application, such as MATLAB®/Simulink®. To use MATLAB/Simulink, dSPACE Model Interface Package for Simulink is required.

- Experiment software such as ControlDesk to control the experiments and carry out measurements.

Firewall settings

The firewall of the host PC must allow communication between the MicroAutoBox III and the host PC. Windows firewalls are automatically adapted during the installation of dSPACE software, but you have to adapt third-party firewalls manually.

If you are using third-party firewall software on the host PC, ensure that the TCP/IP communication of dSPACE software is not blocked. For more information on allowing communication, refer to Operating System (Installing dSPACE Software 📖).

Related topics

Basics

Powering Features

Remote control

A REMOTE pin lets you start the MicroAutoBox III via an external switch, for example, the ignition switch.

Using a laboratory power supply In a laboratory, you can directly switch on/off the MicroAutoBox III with the switch of the laboratory power supply. Therefore, you can bridge the REMOTE pin to VBAT to operate the MicroAutoBox III continuously.

Starting the real-time application automatically

The MicroAutoBox III can automatically start a real-time application after power up. Therefore, you can download the real-time application to the flash memory and activate the autostart feature. The flash application starts running 2 s to 3 s after you switched on the MicroAutoBox III.

Prestart feature If a faster start of the flash application is essential, use the prestart feature to separate the start of the MicroAutoBox III and the start of the flash application.

For more information, refer to Basics on Prestarting the MicroAutoBox III on page 190.

Behavior in case of overtemperature The MicroAutoBox III monitors its internal temperature to detect an overtemperature. If an overtemperature is detected, the MicroAutoBox III switches itself off to prevent hardware damages. The PWR LED of the DS1403 lights up red to display the overtemperature.

Once the MicroAutoBox III has cooled down sufficiently, it automatically switches back on:

- As of firmware 5.1, the MicroAutoBox III prevents the flash applications from starting automatically after overheating. You have to start the flash application via the host PC, or you can switch the MicroAutoBox III off and back on.
- Up to firmware 5.0, the MicroAutoBox III does not prevent flash applications from starting automatically.

Wake-up functionality of the bus interfaces

A MicroAutoBox III can switch the bus transceiver into sleep mode and configure it to monitor the connected bus for a wake-up request. When a transceiver detects a wake-up request on the bus, it wakes up the MicroAutoBox III.

Note

The states of the internal switches and the transceiver configuration are kept as long as the VBAT voltage is connected to the MicroAutoBox III. If the MicroAutoBox III is disconnected from VBAT, you have to initialize the internal switches and the transceiver configuration again.

CAN partial networking Partial networking is a CAN bus feature that lets you activate nodes selectively in response to dedicated CAN wake-up messages. Only required nodes are active on the CAN bus, while the other nodes remain in sleep mode until they are required.

Bus interfaces supporting wake-up requests The following bus interfaces let you switch the MicroAutoBox III from standby mode to operating mode.

Interface	Wake-up Event	Board/Module
CAN	Depends on the transceiver configuration: ▪ Activity on the CAN bus ▪ CAN wake-up message (partial networking)	▪ DS1513 Multi-I/O Board This board supports only CAN without partial networking. ▪ DS1521 Bus Board ▪ DS4342 CAN FD Interface Module
LIN	LIN wake-up message	DS1521 Bus Board

Installation and configuration information For installation and configuration information, refer to the following topics:

- How to Support CAN Wake-up Requests with the DS1513 on page 113
- How to Support Bus Wake-up Requests with the DS1521 on page 121
- How to Support CAN Wake-up Requests with the DS4342 on page 167

Power hold

The real-time application can prevent the shutdown of the MicroAutoBox III. For more information, refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide).

Related topics

Basics

Functional Safety

Functional safety in general

Functional safety (FuSa) depends on a system that functions correctly in response to its inputs. FuSa is part of an overall safety concept to avoid unacceptable risk of injury.

Different standards describe processes to achieve FuSa, for example ISO 26262 for automotive applications or ISO 61508 for industrial applications. The standards include the following steps as a minimum requirement:

1. Identifying the required safety functions.
2. Assessing the required risk reduction by the safety functions, including a safety integrity level (SIL/ASIL) assessment.
3. Verifying the entire system by checking a minimum level of redundancy, determining the probability of a dangerous fault, and checking the systematic capability.
4. Performing functional safety audits.

Functional safety can be determined only by considering the entire system and the environment with which it interacts.

Functional safety with the MicroAutoBox III

The MicroAutoBox III FuSa is a safety concept that includes a set of FuSa functionalities. The FuSa functionalities let you implement elements of functional safety in a prototyping system.

> **Note**
>
> The MicroAutoBox III does not comply with a safety integrity level (SIL/ASIL) or provides functional safety as required by common standards, such as ISO 61508 or ISO 26262. The MicroAutoBox III is a prototyping device for a wide range of applications for which the required safety functions cannot be generally identified.

The MicroAutoBox III safety concept The MicroAutoBox III is designed on the basis of the three-layer safety concept:

- Layer 1 is the functional layer that executes the application functionality, such as the control algorithms and the I/O functionality.

  Layer 1 corresponds to a real-time application without FuSa functionality.

- Layer 2 is the function monitoring layer that executes safety functions to monitor the functionality of layer 1.

  You implement the safety functions to the real-time application, such as a plausibility check of the input signals.
- Layer 3 is the hardware monitoring layer that monitors the hardware that executes the functions of layer 1 and layer 2.

  The safety functions of layer 3 are less application-specific and are automatically activated when a real-time application uses the FuSa functionality. Furthermore, a background process automatically monitors the FuSa functionality itself.

If a safety function detects a FuSa error, it triggers the MicroAutoBox III FuSa unit. The FuSa unit stands for the functionality to respond to a detected FuSa error and to report it.

Error responses

The FuSa unit of the MicroAutoBox III responds to detected FuSa errors with basic error responses and additional error responses.

Basic error responses You cannot configure or disable the following error responses:

- The FuSa relay of the MicroAutoBox III opens.
- The FuSa LED on the MicroAutoBox III lights up red.
- An error message is generated and stored in the non-volatile memory. The message is displayed on the **FUNCTIONAL SAFETY** page of the MicroAutoBox III web interface. Refer to FUNCTIONAL SAFETY Page on page 234.
- The generated error message is also sent to a connected host PC (if available). The message is displayed in on the **MESSAGES** page of the MicroAutoBox III web interface. Refer to MESSAGES Page on page 232.

Additional error responses You can enable and configure the following additional error responses:

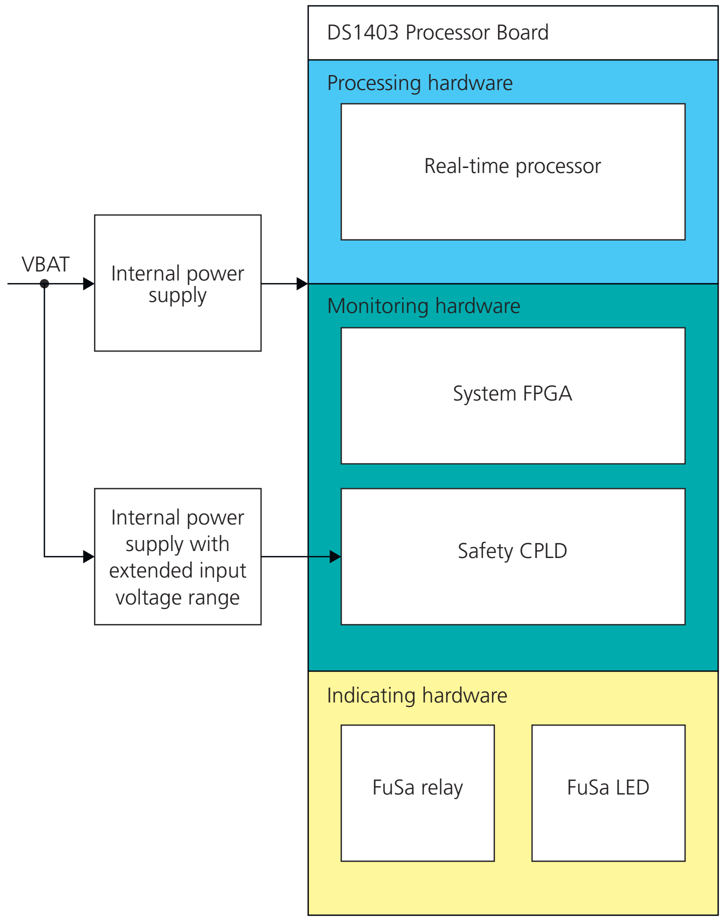
- Providing an I/O event to the behavior model
- Rebooting the MicroAutoBox III
- Terminating the currently running real-time application

  Termination means the real-time application stops and the I/O is reset to its initial states. No more actions are performed.

You cannot use the latter two responses simultaneously in a real-time application.

MicroAutoBox III hardware components for the FuSa functionality

The following illustration shows the internal hardware components of the MicroAutoBox III for the FuSa functionality.



Description of the hardware components:

- Real-time processor

  The real-time processor executes the real-time application. The real-time application includes the application functionality and its monitoring.
- System FPGA

  The system FPGA provides FuSa functionalities such as challenge-response monitoring. Furthermore, the system FPGA reports detected FuSa errors.
- Safety CPLD

  The safety CPLD performs the following tasks:
  - Switching the FuSa relay.
  - Controlling the FuSa LED.
  - Resetting the MicroAutoBox III if a reboot is configured as FuSa error response.

The reset includes the active discharging of the internal supply voltages.

An additional power supply and clock ensures that the Safety CPLD runs autonomously. The power supply of the Safety CPLD has an extended input voltage range. This means that the Safety CPLD is also supplied below the minimum operating voltage of the MicroAutoBox III.

- FuSa LED and FuSa relay

  The FuSa LED (FS LED) and the FuSa relay are outputs to signal the FuSa state of the MicroAutoBox III.

  The FuSa relay can be used to integrate the MicroAutoBox III in a higher-level FuSa system or to switch an indicator lamp, for example.

MicroAutoBox III FuSa states

The MicroAutoBox III can assume one of the following FuSa states:

- *Inactive* state

  The FuSa functionality is not activated or the initialization process has not been finished. The FuSa LED is off and the FuSa relay is open in this state.
- *Active* state

  The FuSa functionality is active and no FuSa errors are detected. The FuSa LED lights green and the FuSa relay is closed in this state.
- *Error* state

  The FuSa functionality is active and at least one FuSa error is detected.

  This state can be changed only by unloading the real-time application or by restarting the MicroAutoBox III. The FuSa LED lights red and the FuSa relay is open in this state.

Functional safety with the MicroAutoBox III Embedded PC

A MicroAutoBox III Embedded PC is not part of the MicroAutoBox III safety concept.

Activating and implementing the FuSa functionality

The MicroAutoBox III automatically activates FuSa if the real-time application uses the FuSa functionality. For implementing the FuSa functionality to the real-time application, refer to Basics on Using FuSa with the MicroAutoBox III (ConfigurationDesk I/O Function Implementation Guide 📖).

Related topics

References

FUNCTIONAL SAFETY Page 234
FuSa Interface Characteristics 273

Web Interface

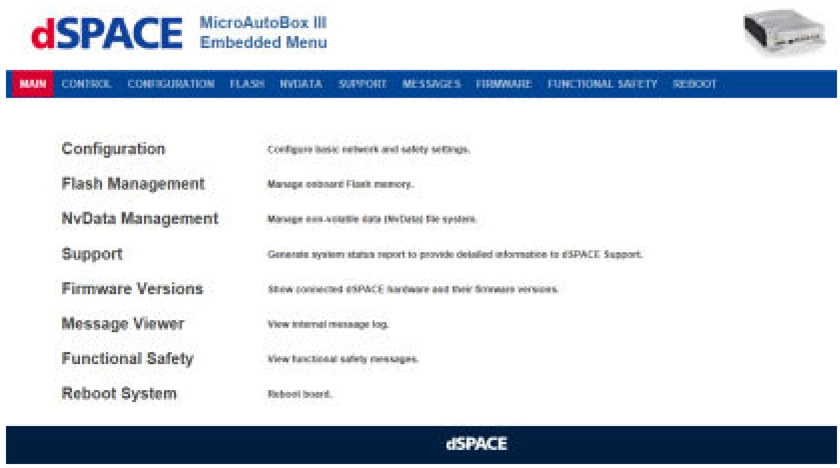
Purpose

The MicroAutoBox III has a web interface for configuration, support, and status information.

Basics on the web interface

You can access the web interface by typing the IP address of the MicroAutoBox III in the address bar of an Internet browser. By default, the IP address for the host communication is preconfigured as `192.168.140.10` .

The following illustration shows the main page of the web interface that opens after you entered the IP address.



If the web interface does not open, refer to How to Open the Web Interface on page 58.

Related topics

HowTos

References

Before you Start

Recommended Workflow to Install and Configure the MicroAutoBox III

Steps to install and configure a MicroAutoBox III

Perform first functionality tests of your application in a laboratory before you use the MicroAutoBox III in a vehicle.

Proceeding the following steps lets you early find and eliminate installation failures:

1. Connect the MicroAutoBox III to the host PC.
   - Powering the MicroAutoBox III with a Laboratory Power Supply on page 45
   - Setting Up the Connection to the Host PC on page 55
2. Build the cable harness to connect external devices.
   - Workflow for Building the Cable Harness on page 72
3. Perform first functionality tests of your application in the laboratory.
4. Install the MicroAutoBox III to the vehicle.
   - Workflow to Install the MicroAutoBox III in a Vehicle on page 173
5. Put your application into operation.

Powering the MicroAutoBox III for Configuring and First Functionality Tests

Powering the MicroAutoBox III with a Laboratory Power Supply

Introduction

Before you install MicroAutoBox III in a vehicle, you are recommended to perform first functionality tests of your application in a laboratory and to configure the hardware.

Safety precautions

⚠ **CAUTION**

Operating preconfigured power supply cables above 32 V DC can lead to injuries and/or material damage

An electrical fire might cause personal injury or material damage.

- Do not use the preconfigured power supply cable from dSPACE at supply voltages > 32 V DC.
  For operation with DC voltages > 32 V DC, you must build a power supply cable. For building a power supply cable, refer to Building the Power Supply Cable on page 84.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

⚠ CAUTION

Risk of electric shock due to power cables with non-insulated ends

Using a power supply cable with non-insulated ends can lead to an electric shock when connecting the MicroAutoBox III to an energized power supply. The connection of the cable is comparable to switch bouncing. The bouncing, the inrush current, the inductivity of the cable, and the input circuit of the MicroAutoBox III can lead to a hazardous voltage.

- Make sure that the power supply is voltage-free before connecting the MicroAutoBox III.
  If you use a vehicle battery, make sure that the disconnect switch is open. For more information on the disconnect switch, refer to Connecting a vehicle battery on page 85.

⚠ CAUTION

Connected components can cause fire

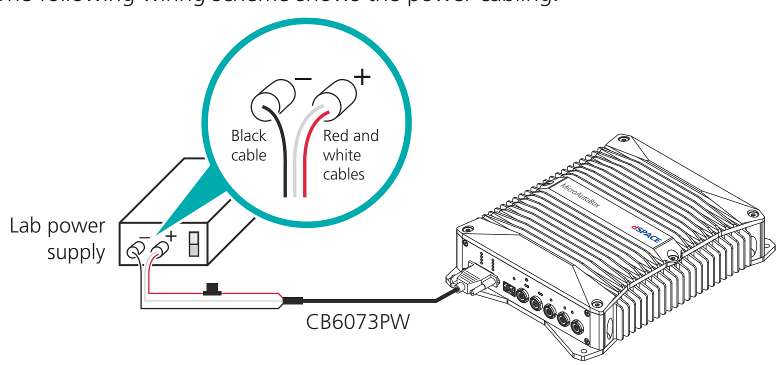
The MicroAutoBox III provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. This particularly concerns the VSENS, VBATprot, and the USB ports pins.

- To prevent a fire, apply the general fire safety regulations, e.g., supervise the operation, remove fire loads, and use fire-proof materials and enclosures.

Using a laboratory power supply

In a laboratory, you can directly switch on/off the MicroAutoBox III with the switch of the laboratory power supply. Therefore you can use the preconfigured CB6073PW power supply cable to operate the MicroAutoBox III continuously.

The following wiring scheme shows the power cabling.



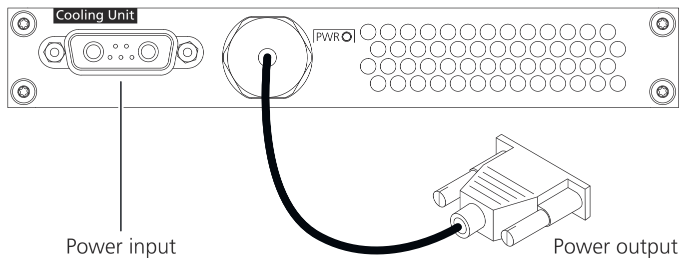
Observe the following instructions:

- Switch off the laboratory power supply.
- Connect the white cable of the CB6073PW to the positive pole of the laboratory power supply to support continuous operation.

- Do not use plugs for the power supply cable that can lead to an accidental connection to hazardous supply voltages, such as the mains voltage.

MicroAutoBox III with built-in Cooling Unit If you use a MicroAutoBox III with a built-in Cooling Unit, the power input connector of the Cooling Unit is used to power the MicroAutoBox III.

- Make sure that the power output connector of the Cooling Unit is connected to the power input connector of the DS1403.
- Connect the CB6073PW cable to the power input connector of the Cooling Unit.



MicroAutoBox III with a built-in Embedded PC If an Embedded PC is integrated into the housing of the MicroAutoBox III, you must shut down the Embedded PC before you switch off the power supply. This can be done via a switch between the white wire of the CB6073PW and the positive pole of the laboratory power supply, for example.

For more information, refer to Powering the Embedded PC with a Laboratory Power Supply (MicroAutoBox III Embedded PC Hardware Installation and Configuration 📖).

Required power and supply voltage The required power and supply voltage that must be provided by the laboratory power supply depends on the installed boards. Refer to the type label at the bottom of the MicroAutoBox III.

Using the prestart feature

The CB6073PW power supply cable does not provide a connection to the PRESTART pin of the MicroAutoBox III. You have to build a power supply cable to connect the laboratory power supply.

For information on building a power supply cable, refer to Building the Power Supply Cable on page 84.

Related topics

Basics

HowTos

Switching on/off the MicroAutoBox III

Where to go from here

Information in this section

How to Switch On a MicroAutoBox III

Objective

Switching on a MicroAutoBox III in different use scenarios.

Using a MicroAutoBox III with Cooling Unit

⚠ WARNING

Risk of electric shock due to hazardous voltages at the power output connector

Voltages that are connected to the power input connector of the MicroAutoBox III Cooling Unit are directly looped through to its power output connector.

- Make sure that the power output connector of the Cooling Unit is connected to the power input connector of the MicroAutoBox III before you connect the laboratory power supply/vehicle battery.
- The screws of the power output connector must always be tight when you power up the Cooling Unit. Do not loosen the screws before the power supply/vehicle battery is disconnected.
- The cable of the power output connector must not be kinked or damaged.

Using the CB6073PW power supply cable

⚠ CAUTION

Operating preconfigured power supply cables above 32 V DC can lead to injuries and/or material damage

An electrical fire might cause personal injury or material damage.

- Do not use the preconfigured power supply cable from dSPACE at supply voltages > 32 V DC.
  For operation with DC voltages > 32 V DC, you must build a power supply cable. For building a power supply cable, refer to Building the Power Supply Cable on page 84.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Safety precautions for connected components

⚠ CAUTION

Connected components can cause fire

The MicroAutoBox III provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. This particularly concerns the VSENS, VBATprot, and the USB ports pins.

- To prevent a fire, apply the general fire safety regulations, e.g., supervise the operation, remove fire loads, and use fire-proof materials and enclosures.

Precondition

The MicroAutoBox III is connected to a power supply.

Possible methods

The following table shows the use cases that effects the method to switch on the MicroAutoBox III.

Use case	Description	Required Power Supply Cable	Method
Configuring and performing first functionality tests in a laboratory.	Simple wiring to a laboratory power supply to operate the MicroAutoBox III continuously. The REMOTE pin is bridged to VBAT.	One of the following cables: ▪ Preconfigured CB6073PW power supply cable ▪ Self-made power supply cable for continuous operation[1)]	Method 1
	Switching on/off the MicroAutoBox III via a control signal to shut down a built-in Embedded PC before the laboratory power supply is switched off.	One of the following cables: ▪ Preconfigured CB6073PW power supply cable ▪ Self-made power supply cable with remote control[1)]	Method 2

Use case	Description	Required Power Supply Cable	Method
Operating MicroAutoBox III in a vehicle.	Switching on/off the MicroAutoBox III via a control signal to prevent the vehicle battery from depletion.	One of the following cables: ▪ Preconfigured CB6073PW power supply cable ▪ Self-made power supply cable with remote control[1]	Method 2
Shortening the start-up time of the real-time application by separating the start of the MicroAutoBox III and the start of the real-time application.[2]	Prestarting the MicroAutoBox III via control signals. For more information, refer to Basics on Prestarting the MicroAutoBox III on page 190.	Self-made power supply cable with remote and prestart control[1]	Method 3

[1] For more information, refer to Building Power Supply Cables for Different Use Cases on page 86.
[2] Not supported by a built-in Embedded PC.

Method 1

To switch on a MicroAutoBox III in a laboratory

1. If you use the CB6073PW power supply cable, ensure that the white wire is connected to the positive pole of the laboratory power supply.
2. Switch on the laboratory power supply.
   The MicroAutoBox III powers up.
3. Wait until the PWR LED of the DS1403 lights up green.

Method 2

To switch on a MicroAutoBox III with remote control

1. Make sure that the PWR LED of the DS1403 flashes blue.
2. Switch the REMOTE pin (pin 4) to high level, for example, to VBAT. If you use the CB6073PW power supply cable, connect the white wire to a high level.
   The MicroAutoBox III powers up.
3. Wait until the PWR LED lights up green.

Method 3

To switch on a MicroAutoBox III with prestart control

1. Make sure that the prestart feature is activated. Refer to How to Activate and Configure the Prestart Feature on page 194.
2. Make sure that the PWR LED of the DS1403 flashes blue.
3. Switch the PRESTART input (pin 3) to high level, for example, to VBAT.
   The MicroAutoBox III prestarts with the rising edge of the signal.
4. Wait until the PWR LED lights up green and the APP LED lights red.
5. Switch the REMOTE pin (pin 4) to high level, for example, to VBAT.
6. Wait until the APP LED lights up green.

Result

You switched on a MicroAutoBox III. If a real-time application is downloaded to the flash memory and configured to be started automatically, the real-time application starts.

If the **SYS** LED flashes green or orange/green, the Ethernet connection to the host PC has not been established. Refer to Setting Up the Connection to the Host PC on page 55.

For more information, refer to Downloading and Executing Real-Time Applications (ConfigurationDesk Real-Time Implementation Guide).

Related topics

Basics

HowTos

References

How to Switch Off a MicroAutoBox III

Objective

Safely switching off a MicroAutoBox III.

Avoiding undefined output states

> **Note**
>
> Disconnecting the VBAT and/or GND connection while the real-time application is running can lead to undefined states of electrical outputs for a brief moment.
>
> - Wait until the **APP** LED lights up red or the **PWR** LED of the DS1403 is off before you open the disconnect switch/switch off the power supply.

Possible methods

The method depends on the wiring.

- To switch off a continuously powered MicroAutoBox III, refer to Method 1.
- To switch off a MicroAutoBox III with power control, refer to Method 2.

Method 1

To switch off a continuously powered MicroAutoBox III

1. Stop the real-time application that runs on the MicroAutoBox III, for example, via the Platform Manager of a dSPACE software.
2. Wait until the APP LED lights up red.
3. Switch off the power supply.

Method 2

To switch off a MicroAutoBox III with power control

1. Change the voltage level at the REMOTE pin (pin 4) from high to low, for example, by switching off the remote signal.
2. Before you open the disconnect switch or switch off the power supply, wait until the PWR LED of the DS1403 flashes blue.

   If the MicroAutoBox III does not shut down, the real-time application might prevent the system shutdown. For more information, refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide 📖).

Result

You safely switched off a MicroAutoBox III.

Next step

Now you can disconnect the power supply cable without voltage.

Related topics

Basics

System Shutdown (ConfigurationDesk I/O Function Implementation Guide 📖)

Setting Up the Connection to the Host PC

Where to go from here

Information in this section

Connecting a MicroAutoBox III to the Host PC

Introduction

To work with a MicroAutoBox III, you must connect it to a host PC. Via the host PC, you can configure the MicroAutoBox III, download a real-time application, and control the experiment.

Required material

You connect the host PC to the MicroAutoBox III via Ethernet in a LAN or WLAN.

Using LAN The Ethernet ports of MicroAutoBox III are LEMO connectors. Adapter cables provided by dSPACE are required to connect Ethernet devices.

You can use the delivered ETH_CAB1 Ethernet Connection Cable to connect the host PC. For an overview of suitable adapter cables, refer to Connecting Ethernet Devices to the DS1403 via LAN on page 99.

Using WLAN The MicroAutoBox III (WLAN) provides a radio interface for WLAN. To use WLAN, you have to attach the WLAN antenna first. Refer to Attaching Antennas to the DS1403 on page 98.

A LAN connection is required to configure the WLAN interface. For instructions, refer to How to Configure the WLAN Interface on page 66.

Basics on IP network configuration

The host PC communicates with the MicroAutoBox III via a TCP/IP Ethernet connection. Therefore, the network configuration of the MicroAutoBox III must use a unique IP address within the Ethernet network.

To specify the network configuration of the MicroAutoBox III, you can use either the DHCP mode, where a dynamic host configuration protocol (DHCP) server sets the network configuration, or you can use the static mode and you specify a static IP address.

IP address set by DHCP server You can have a DHCP server to obtain an IP address for the host communication of the MicroAutoBox III. The DHCP server not only defines the IP address but also defines the required network configurations automatically.

Depending on the DHCP server configuration, the server can define a static IP address or a dynamic IP address that can change each time the MicroAutoBox III signs onto the network.

> **Note**
>
> In DHCP mode, the MicroAutoBox III attempts to retrieve its network configuration from a DHCP server during startup. If no DHCP server is found or the server fails to assign an IP address, the MicroAutoBox III uses the static configuration provided in its network configuration. This lets you access the web interface to change the network settings.
> However, you cannot register the MicroAutoBox III with a dSPACE software product if the MicroAutoBox III is in DHCP mode and no DHCP server is found or the server fails to assign an IP address.

IP address set manually You can manually define a static IP address. You are responsible for ensuring that the IP address is unique. A static IP address is primarily useful in a direct connection of the host PC, but you can also use one in a LAN. You have to observe some basic principles of IP networking when you define a static IP address.

Working with different MicroAutoBox III units

If you work with different MicroAutoBox III units that use the same ControlDesk project, you can simplify work by using alias names. Refer to Using an Alias Name for a MicroAutoBox III on page 68.

Basic IP networking principles

Principles of an IP network.

- With the IP address, you specify two parts for IP networking:
  - You specify a unique IP address for the MicroAutoBox III.
  - You specify the subnetwork the MicroAutoBox III is connected to via the subnet mask.

    The subnet mask determines the most significant bits of the IP address as the subnetwork address. The least significant bits determine the host address. The subnetwork address indicates the members of the same subnetwork. This means all members must use the same Internet Protocol version, subnetwork address, and subnet mask. The members differ only in the host address.

    Example: The IP address is `192.168.140.10` and the subnet mask is `255.255.255.0`. The resulting subnetwork address is `192.168.140`. All IP addresses of this subnetwork must begin with `192.168.140`.
- The default gateway can send Ethernet frames to other subnetworks. Therefore, you have to enter the IP address of the default gateway to the MicroAutoBox III if the host PC is a member of another subnetwork.

Note

If the host PC is directly connected to the MicroAutoBox III, the host PC and the MicroAutoBox III must use the same subnetwork address, which is defined by the IP address and the subnet mask.
You can use alternate IP addresses for the host PC to specify a static IP address. This lets you use a DHCP server in a LAN and a static IP address in a direct connection. Refer to How to Prepare the Host PC (MicroAutoBox III - Getting Started 📖).

Address spaces

In general, you can use any IP address as a static IP address. If a MicroAutoBox III is connected to the host PC via a network, you have to ensure that the IP address is unique in the entire network.

Private address spaces Some IP addresses might cause problems if a MicroAutoBox III is connected to a network that has Internet access. For this reason, it is recommended to use special addresses that are free for local networks and will not disturb any Internet connections. The following list shows the private address spaces:

- `10.0.0.0` to `10.255.255.255`
- `172.16.0.0` to `172.31.255.255`
- `192.168.0.0` to `192.168.255.255`

Host addresses reserved for special purposes The following addresses are reserved for special purposes:

- The first IP address of the subnetwork if all bits of the host part are set to 0. These addresses represent the entire network.

  For example: `192.168.140.0` with the subnet mask 255.255.255.0
- Broadcast addresses: The last IP address of the subnetwork if all bits of the host part are set to 1.

  For example: `192.168.140.255` with the subnet mask 255.255.255.0

Related topics

HowTos

How to Open the Web Interface

Objective

Configuring the MicroAutoBox III via the web interface and providing support and status information.

Preconditions

The following preconditions must be fulfilled:

- The IP address of the MicroAutoBox III must be known.

  The default IP address of a MicroAutoBox III is `192.168.140.10`.

  > **Tip**
  >
  > The Platform Manager displays the IP address of registered MicroAutoBox III units. Refer to How to Register dSPACE Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide).

- If the MicroAutoBox III is directly connected to the host PC without using a LAN, the host PC must use a static IP address of the same subnetwork. For instructions on setting a static IP address for the host PC, refer to How to Prepare the Host PC (MicroAutoBox III - Getting Started).
- The host PC must use the autonegotiation mode for Ethernet communication.

  The autonegotiation mode is commonly used for Ethernet communication, but the mode can be deactivated on the host PC.

Method

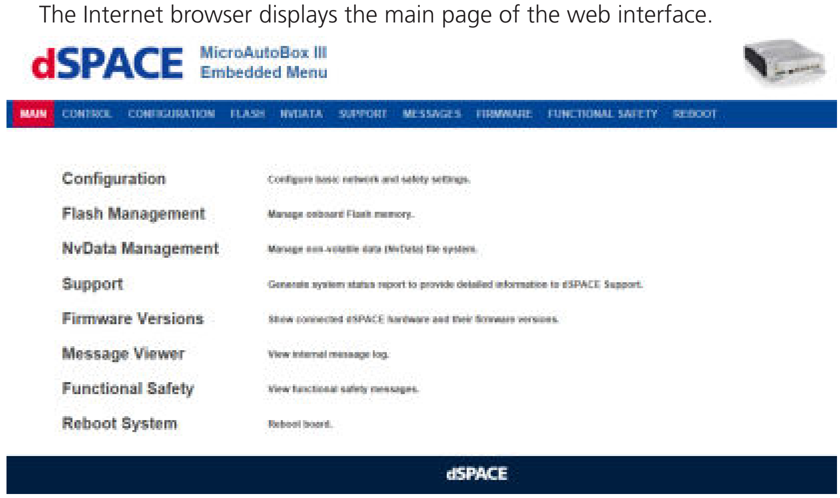
To open the web interface

1. Switch on the MicroAutoBox III.

   The MicroAutoBox III has booted completely when the SYS LED is green or flashes orange and green.

2. On the host PC, enter the IP address of the MicroAutoBox III in the address bar of an Internet browser.

   The Internet browser displays the main page of the web interface.



Result

You opened the web interface.

Related topics

HowTos

How to Change the Network Configuration via the Web Interface

Objective

Changing the network configuration if the current IP address of the MicroAutoBox III is known.

IP networking principles

For principles of IP networking, refer to Connecting a MicroAutoBox III to the Host PC on page 56.

> **Note**
>
> In DHCP mode, the MicroAutoBox III attempts to retrieve its network configuration from a DHCP server during startup. If no DHCP server is found or the server fails to assign an IP address, the MicroAutoBox III uses the static configuration provided in its network configuration. This lets you access the web interface to change the network settings.
> However, you cannot register the MicroAutoBox III with a dSPACE software product if the MicroAutoBox III is in DHCP mode and no DHCP server is found or the server fails to assign an IP address.

Preconditions

The IP address of the MicroAutoBox III must be known. If the current IP address is unknown, refer to How to Set the Network Configuration via Command Prompt Window on page 62.

The default IP address of a MicroAutoBox III is `192.168.140.10`.

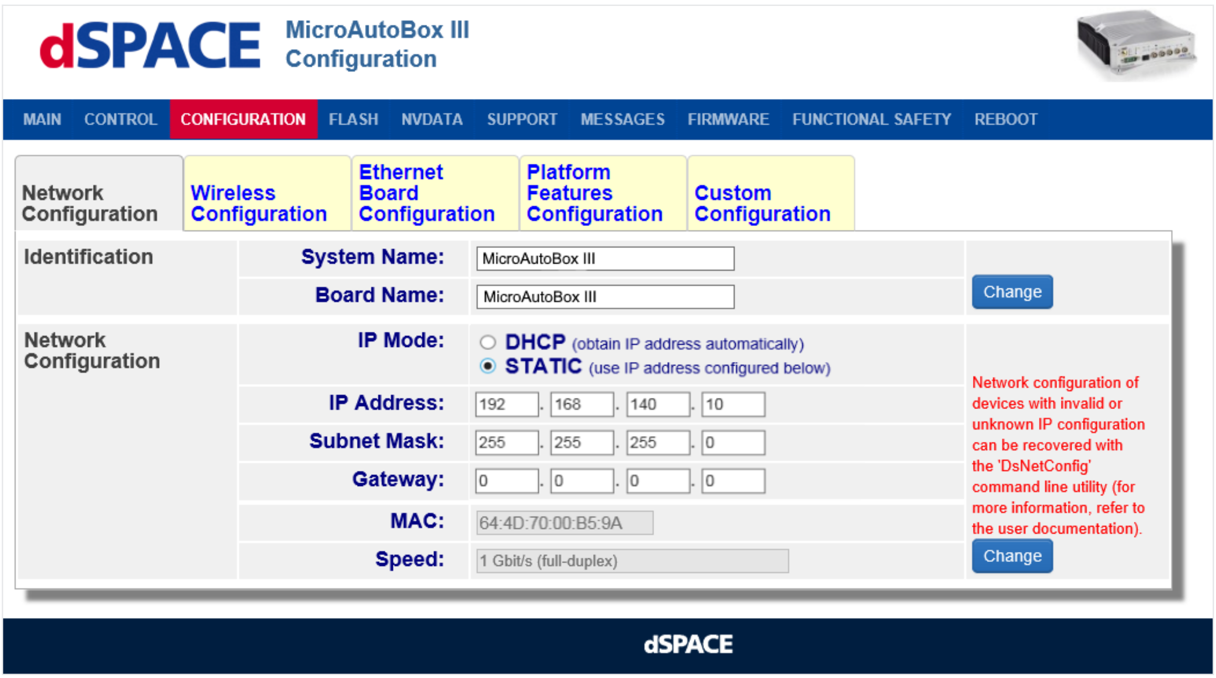
> **Tip**
>
> The Platform Manager displays the IP address of registered MicroAutoBox III units. Refer to How to Register dSPACE Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide).

Method

To change the network configuration via the web interface

1 On the host PC, open the web interface.
For instructions, refer to How to Open the Web Interface on page 58.

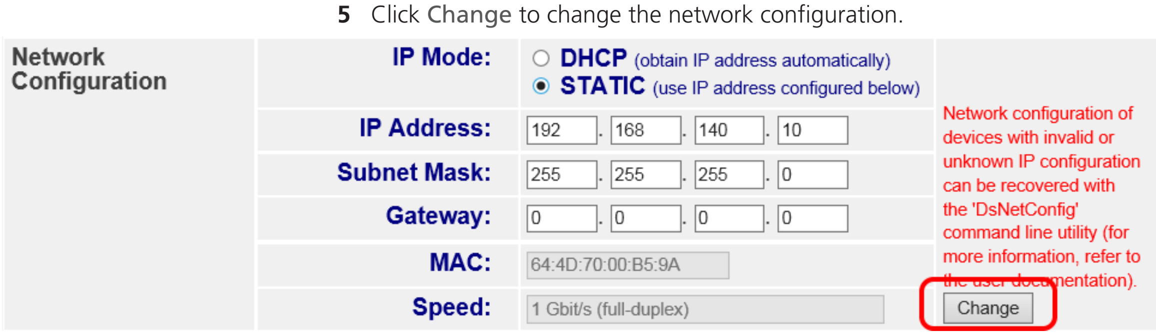
2 On the Configuration page, open the Network Configuration tab.



3 If you want to set a static IP address, enter the following:
- Select Static.
- Enter the new IP address and subnet mask.
- If required, enter the gateway address.

4 If you want to enable the DHCP mode, select DHCP.

5 Click Change to change the network configuration.



6 Open the MicroAutoBox III System Reboot page and click Restart.

The new configuration becomes active after you restart the MicroAutoBox III.

Result

You set the network configuration of a MicroAutoBox III.

Tip

To check the Ethernet configuration, type the new IP address of the MicroAutoBox III in the address bar of an Internet browser on the host PC. If the browser displays the web interface, the Ethernet configuration is correct.
Remember that the host PC and the MicroAutoBox III must use the same subnetwork address, which is defined by the IP address and the subnet mask, if the MicroAutoBox III is not connected to a LAN. Refer to Connecting a MicroAutoBox III to the Host PC on page 56.

Related topics

Basics

HowTos

References

How to Set the Network Configuration via Command Prompt Window

Objective

Setting the network configuration if the current IP address of the MicroAutoBox III is unknown.

IP networking principles

For principles of IP networking, refer to Connecting a MicroAutoBox III to the Host PC on page 56.

Preconditions

The following preconditions must be fulfilled:

- The MAC address of the MicroAutoBox III must be known.
  The type label at the bottom of the MicroAutoBox III shows the MAC address.
- The MicroAutoBox III must be directly connected to the host PC without using a LAN.

- The host PC must have a static IP address.

  For instructions on setting a static IP address for the host PC, refer to How to Prepare the Host PC (MicroAutoBox III - Getting Started).
- The dSPACE software must be installed on the host PC.
- If you are using third-party firewall software on the host PC, the network communication of dSPACE software must not be blocked. For more information, refer to Operating System (Installing dSPACE Software).

  The Windows firewall is automatically adapted by the dSPACE software.
- The host PC must use the autonegotiation mode for Ethernet communication.

  The autonegotiation mode is commonly used for Ethernet communication, but the mode can be deactivated on the host PC.

Method

To set the network configuration via a Command Prompt window

1. Switch on the host PC and the MicroAutoBox III.

   The MicroAutoBox III has booted completely when the **SYS** LED is green or flashes orange and green.
2. On the Windows **Start** menu, select **dSPACE RCP and HIL 20xx-x – Command Prompt for dSPACE RCP and HIL 20xx-x** to open a Command Prompt window in which the required paths and environment settings are preset.
3. If you want to enable the DHCP mode, enter the following:
   - `DsNetConfig <MAC_address_of_MicroAutoBox> -dhcp`

     For example:

     `DsNetConfig 64:4d:70:00:18:3a -dhcp`
4. If you want to enter a static IP address, 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_MicroAutoBox> -ip <IP_address>
     <subnet_mask>
     ```

     For example:

     ```
     DsNetConfig 64:4d:70:00:18:3a -ip 192.168.140.10
     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_MicroAutoBox> -ip <IP_address>
     <subnet_mask> -gw <gateway_address>
     ```

     For example:

```
DsNetConfig 64:4d:70:00:18:3a -ip 192.168.140.10
255.255.255.0 -gw 192.168.140.1
```

5 Check whether the configuration was successful. The SYS LED and the APP LED indicate the configuration state.

LED States	Configuration State
SYS and APP LEDs flash green (3 times)	The configuration was successful. Continue with step 6.
SYS and APP LEDs flash red (3 times)	The MicroAutoBox III received the configuration command but the configuration was not successful. Make sure that the MicroAutoBox III is not being accessed by software, such as ConfigurationDesk or ControlDesk, and that no real-time application is loaded to the MicroAutoBox III. Then repeat step 3 or 4.
No reaction	The MicroAutoBox III has not received the configuration command. Check the configuration of the host PC and/or the Ethernet connection between the MicroAutoBox III and the host PC. Then repeat step 3 or 4.

6 Switch off the MicroAutoBox III and wait until all LEDs are off.

The new configuration becomes active after you restart the MicroAutoBox III.

Result

You set the network configuration of a MicroAutoBox III.

Tip

To check the Ethernet configuration, type the new IP address of the MicroAutoBox III in the address bar of an Internet browser on the host PC. If the browser displays the web interface, the Ethernet configuration is correct.
Remember that the host PC and the MicroAutoBox III must use the same subnetwork address, which is defined by the IP address and the subnet mask, if the MicroAutoBox III is not connected to a LAN. Refer to Connecting a MicroAutoBox III to the Host PC on page 56.

Related topics

Basics

HowTos

Basics on the WLAN Interface

Introduction

The MicroAutoBox III (WLAN) lets you connect the host PC via WLAN for host communication. The WLAN interface cannot be used for I/O Ethernet communication.

Configuring the WLAN interface

The WLAN interface of the MicroAutoBox III (WLAN) can be used in the following WLAN modes:

- The *client mode* lets you connect the MicroAutoBox III to an available WLAN. Use this mode to connect the MicroAutoBox III to a WLAN of the laboratory, for example.
- The *access point mode* lets you provide a WLAN. The MicroAutoBox III sets the WLAN channel and login credentials for the WLAN. Use this mode to connect a host PC to the MicroAutoBox III via WLAN in a vehicle, for example.

  Note

  Normally, there is no DHCP server if you use the WLAN access point mode. Therefore, use a static IP address for the host communication.

  In access point mode, the provided WLAN is restricted to the 2.4 GHz RF band.

For more information, refer to How to Configure the WLAN Interface on page 66.

Setting the IP address

The host controller provides a common IP address for the host communication. The default IP address of a MicroAutoBox III is `192.168.140.10` with the subnet mask `255.255.255.0`.

For instructions on setting the IP address, refer to How to Change the Network Configuration via the Web Interface on page 60.

Connecting the host PC

Connect a host PC either via LAN or WLAN to the MicroAutoBox III. Using LAN and WLAN simultaneously to connect a host PC can cause an Ethernet loop.

Related topics

HowTos

How to Configure the WLAN Interface

Objective

Configuring the WLAN interface that is provided by the MicroAutoBox III (WLAN).

Basics on the WLAN Interface

The host controller provides a common IP address for the wired and wireless host communication.

For more information, refer to Basics on the WLAN Interface on page 65.

For setting the IP address, refer to How to Change the Network Configuration via the Web Interface on page 60.

Preconditions

The following preconditions must be fulfilled:

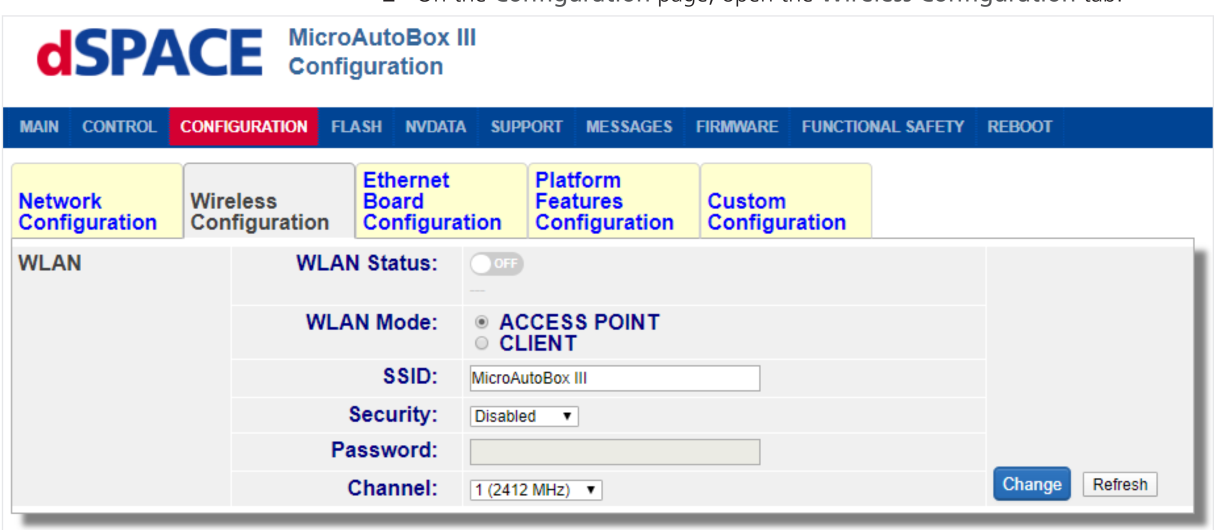
- The MicroAutoBox III variant with WLAN interface is used.
- The WLAN antenna is attached. Refer to Attaching Antennas to the DS1403 on page 98.
- The host PC is connected to the MicroAutoBox III (WLAN) via LAN. Refer to Connecting a MicroAutoBox III to the Host PC on page 56.

Method

To configure the WLAN interface

1 On the host PC, open the web interface.
  For instructions, refer to How to Open the Web Interface on page 58.

2 On the Configuration page, open the Wireless Configuration tab.



3 Select the WLAN mode and enter the login credentials:
   - WLAN mode: Lets you select the WLAN mode.
     In the access point mode, the MicroAutoBox III provides a WLAN. In the client mode, the MicroAutoBox III can access a WLAN. For more information on the WLAN modes, refer to Basics on the WLAN Interface on page 65.
   - SSID: Lets you enter a name as service set identifier (SSID).
     With the SSID, WLAN devices can distinguish between WLANs in the environment.
   - Security: Lets you select the security mode of the WLAN.
   - Password: Lets you enter the password to access the WLAN.

4 If the access point mode is selected, select a WLAN channel.
   In the client mode, the MicroAutoBox III searches for a suitable WLAN and automatically sets the WLAN channel.

5 Move the **WLAN Status** slider to the right to switch on the WLAN interface.

6 Click **Change** to change the configuration of the WLAN interface.

7 Open the **MicroAutoBox III System Reboot** page and click **Restart**.
   The new configuration becomes active after you restart the MicroAutoBox III.

Result

You configured the radio interface for WLAN.

Next step

Disconnect the host PC from the MicroAutoBox III before you connect the host PC via WLAN.

> **Tip**
>
> To check the WLAN configuration, type the IP address of the MicroAutoBox III in the address bar of an Internet browser on the host PC. If the browser displays the web interface, the WLAN configuration is correct.
> If the MicroAutoBox III is in the access point mode, the host PC and the MicroAutoBox III must use the same subnetwork address and static IP addresses. For more information on basic IP network principles, refer to Connecting a MicroAutoBox III to the Host PC on page 56.

Related topics

Basics

HowTos

Using an Alias Name for a MicroAutoBox III

Introduction

When you use multiple MicroAutoBox III units in an Ethernet network, you can work with alias names. This is especially useful if you want to use one project on different MicroAutoBox III units.

Basics on alias names

On a host PC, an alias name can be mapped to exactly one IP address. This is done via the `hosts` file on the host PC. The mapping structure is <IP_address> <alias_name>, for example:

```
192.168.0.32      Experiment1
192.168.0.64      Experiment2
```

The `hosts` file is available with every Windows operating system and located on `%SystemRoot%\system32\drivers\etc`, by default. The hosts file provides an easy way of changing the mapping between IP address and alias name, for example, by specifying a different IP address for the alias name.

Note

- To make changes within the `hosts` file, you must have administrator rights on the host PC.
- To use alias names, the following preconditions must be met:
  - A connection between the host PC and a MicroAutoBox III must be established via Ethernet.
  - If you want to use an alias name with a MicroAutoBox III whose IP address is set by a DHCP server, the server must generate a static IP address.

Using alias names

You can use alias names in projects using dSPACE software products, such as ControlDesk. To assign a project to a MicroAutoBox III, you can specify either the IP address or an alias name. If you define an alias name, you can use the project with different MicroAutoBox III units without reconfiguring the project.

Example Two MicroAutoBox III units have the IP addresses `192.168.0.15` and `192.168.0.20`.

Each MicroAutoBox III is controlled by a separate host PC (host PC 1 and host PC 2).

The alias name in the `hosts` file of both host PCs is Experiment1, i.e., both MicroAutoBox III units have the same alias name but on different host PCs:

IP Address	Alias Name	Specified in `hosts` File of
192.168.0.15	Experiment1	Host PC 1
192.168.0.20	Experiment1	Host PC 2

Tip

Alias names defined in the `hosts` file of a host PC are valid only on that host PC. Thus, different host PCs can use the same alias name without causing conflicts.

In a ControlDesk project, the alias name Experiment1 is used to assign the project to a MicroAutoBox III. This project is used by both host PCs. Each host PC accesses the respective MicroAutoBox III via the alias name Experiment1, so the project can be used on both MicroAutoBox III units without reconfiguring it.

For instructions on registering platforms via alias names, refer to How to Register a Platform (ControlDesk Platform Management 📖).

Related topics

Basics

Handling Registered Hardware (ConfigurationDesk Real-Time Implementation Guide 📖)

HowTos

How to Register a Platform (ControlDesk Platform Management 📖)

Building the Cable Harness

Where to go from here

Information in this section

Workflow and Notes on Building the Cable Harness

Where to go from here

Information in this section

Workflow for Building the Cable Harness

Influencing other devices

NOTICE

Hardware damage or temporary malfunction of devices caused by improperly assembled cable harness

An improperly assembled cable harness can emit or absorb electrical, magnetic and electromagnetic waves, resulting in system malfunction that can cause hardware damage.

- Comply with the rules for building the external cable harness.

Steps to build the cable harness

Building the external cable harness includes the following steps:

1. Calculate the the external cable harness in ConfigurationDesk. Refer to How to (Re)Calculate the External Cable Harness (ConfigurationDesk Real-Time Implementation Guide).
2. Export the cable harness to get the wiring information. Refer to How to Export Wiring Information for an External Cable Harness (ConfigurationDesk Real-Time Implementation Guide).
3. Build the cable harness according to the wiring information provided by ConfigurationDesk:
   - Use recommended wiring material. Refer to Requirements on the Wiring Material on page 73.
   - Comply with the rules for building the external cable harness. Refer to General Rules for Building the Cable Harness on page 74.

- Observe the board-specific and module-specific information and guidelines to connect external devices. Refer to Board-Specific and Module-Specific Cabling Requirements on page 75.

4. Code the ZIF I/O connectors of the cable harness to prevent incorrect connections. Refer to Coding the ZIF I/O Connector on page 77.
5. Build the power supply cable. Refer to Building the Power Supply Cable on page 84.

Requirements on the Wiring Material

Selecting the wiring material

The following aspects must be taken into account when selecting the wiring material:

- Characteristics of the fuses implemented in signal, bus, and power lines
- Conductor material (copper, aluminum, etc.) and cross section
- Isolation (PVC, ETFE, etc.)
- Ambient temperature
- Routing system of the external cable harness (bundle, conduit, number of charged wires, etc.)
- Mechanical stress of the external cable harness
- Shielding

It is your responsibility to select approved wiring material with an appropriate cross section, isolation, etc.

Flame-retardant wiring material

Use flame-retardant cables and connectors:

- Use cables that fulfill one of the following flame retardant test specifications:
  - IEC 60332-1-2
  - IEC 60332-2-2
  - UL VW-1
- Use flame retardant connectors conform to IEC 60695-11-10 or UL 94, at least V-2 connectors.

Related topics

Basics

Building the Power Supply Cable.. 84

General Rules for Building the Cable Harness

Ground types

The following definitions help you distinguish between the different types of ground:

- *Signal ground*

  Signal ground is the reference potential of a signal. An ideal signal ground line carries the same amount of current as the corresponding signal line.

  A common term for signal ground is signal return.
- *Common ground*

  A common ground levels out reference voltage differences between a MicroAutoBox III and a connected device. A common ground line can also be used as signal ground for robust digital signals.
- *Supply ground*

  Supply ground is the reference potential of a supply voltage.
- *Power ground*

  The power ground is the supply ground of a power supply, such as a laboratory power supply or the vehicle battery.

  A power ground carries high and varying currents resulting in significant (AC) voltage drops along the cable. Never use the same wire for signal ground and power ground of a MicroAutoBox III.
- *Chassis ground*

  Chassis ground is the power supply ground of vehicles. The chassis ground must be connected to the negative pole of the vehicle battery to operate a MicroAutoBox III.

Wiring rules

Comply with the following guidelines to avoid electromagnetic interference between signals when you build the external cable harness.

Basic wiring rules The following wiring rules are the minimum requirements to ensure basic signal quality:

- Keep the wiring as short as possible in the vehicle or test bench.
- If the external device has a signal pin and a signal ground pin for a signal, route both lines from the external device to a MicroAutoBox III.
- Route signal lines and their corresponding signal ground lines close to each other, for example, by routing them in a bundle.
- Keep signal lines that are used by analog signals far away from signal lines that are used by digital signals.
- Do not route signal lines through conduits that also contain power lines.
- Distinguish between the signals of two I/O connectors. For example, do not use a signal pin of one I/O connector and a ground pin of the other I/O connector together.
- Do not twist two signal lines.

- Keep cabling away from noise sources. Protect signal lines from magnetic fields caused by devices such as monitors, electric motors, welding equipment, transformers, etc., for example, by running the lines through special metal conduits.

Reducing wiring For best signal quality, route every signal ground line from a MicroAutoBox III to the external device separately. However, if the external device does not provide a signal ground pin for each signal, you can switch multiple signal ground lines to one pin to reduce wiring. If you do so, you must take the following precautions:

- Use separate signal grounds for signal measurement channels and signal generation channels.

Precautions when handling sensitive signals If you work with sensitive signals such as analog input signals with low currents, high-impedance resistors, or analog output signals, take the following precautions to ensure optimal signal quality:

- Twist signal lines with their signal ground lines.
- Keep lines of signals with high currents far away from sensitive analog signals.
- Route the twisted signal lines from the external device directly to a MicroAutoBox III. If the external device does not provide a signal ground pin, connect the signal ground line to a ground close to the external device.
- Use shielded twisted pair cables to shield highly sensitive signals.

  The shielding must be connected directly to the housing of the external device. Some connectors of sensors and actuators have dedicated shield pins.

  At the MicroAutoBox III, connect the shield to a GND pin of the MicroAutoBox III.

Board-Specific and Module-Specific Cabling Requirements

Specific cabling information

The installed I/O boards and modules place specific requirements on the cabling. For more information, refer to the following topics:

- DS1403 Processor Board
  - Connecting Ethernet Devices to the DS1403 via LAN on page 99
  - How to Connect and Remove USB Devices on page 100
  - Notes on Using the FuSa Relay on page 101
- DS1511/DS1511B1 Multi-I/O Board
  - Driving the Digital I/O Interfaces of the DS1511 on page 103
  - Connecting Sensors to the DS1511 on page 105
- DS1513 Multi-I/O Board
  - Driving the Digital I/O Interfaces of the DS1513 on page 109
  - Connecting Sensors to the DS1513 on page 111

- DS1521 Bus Board
  - Grounding of Analog and Digital Signals of the DS1521 on page 124
  - How to Support Bus Wake-up Requests with the DS1521 on page 121
- DS1552 Multi-I/O Module
  - Driving the Digital I/O Interfaces of the DS1552 on page 126
  - Connecting Sensors to the DS1552 on page 129
- DS1554 Engine Control I/O Module
  - Driving the Digital Out 7 Channels of the DS1554 on page 142
  - Connecting Sensors to the DS1554 on page 144

Assembling and Coding ZIF I/O Connectors

Where to go from here

Information in this section

Coding the ZIF I/O Connector

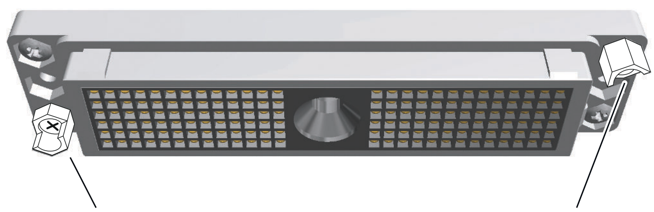
Introduction

Each ZIF I/O connector is delivered with a coding kit to prevent incorrect connections. The kit contains coding pins that you can install in the ZIF I/O connector.

Coding at connector socket

Two coding pins are installed on each ZIF I/O connector of a MicroAutoBox III. The following table shows the possible codes and the coding pins.

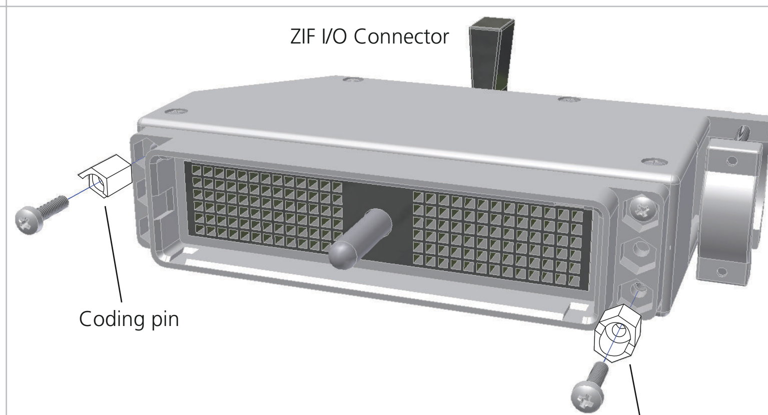
Code	Characteristics	Connector
Code 1		DS1511 ZIF I/O Connector
Code 2		DS1514 ZIF I/O Connector

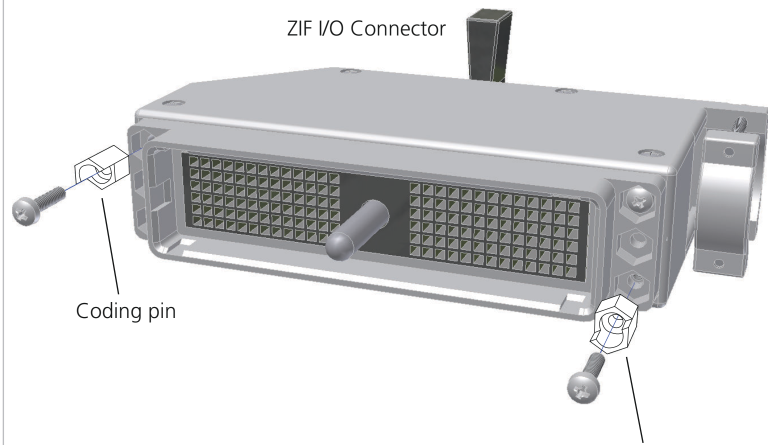
Code	Characteristics	Connector
Code 4		DS1513 ZIF I/O Connector

Coding at ZIF I/O connector

You have to code the ZIF I/O connector yourself according to the code used at the connector socket. The coding kit delivered with each I/O connector contains the required pins and screws. Install the pins in a position that matches the pins at the socket.

The following table shows the codes and the required mounting positions of the pins.

Code/Connector	Characteristics
Code 1 for a DS1511 ZIF I/O Connector.	

Code/Connector	Characteristics
Code 2 for the DS1514 ZIF I/O Connector.	
Code 4 for the DS1513 ZIF I/O Connector.	

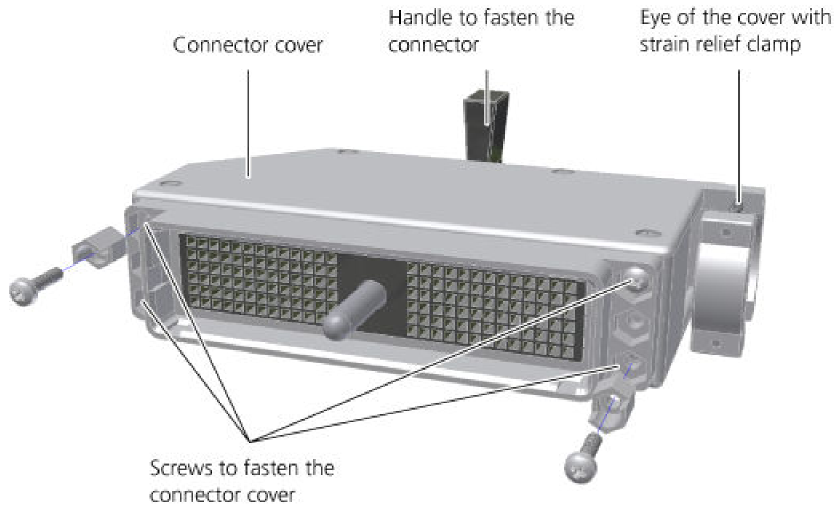
How to Fasten the Wires at the ZIF I/O Connector

Objective

Before connecting the ZIF connector to a MicroAutoBox III, you have to fasten the wires.

Items of the ZIF cable connector

The following illustration shows the items of the connector.



Method

To fasten the wires at the ZIF I/O connector

1 Insert the wires in the eye of the connector cover.

2 Use the four screws to fasten the cover. Meanwhile, use the coding kit to code the connector. Refer to Coding the ZIF I/O Connector on page 77.

3 Tighten the strain relief clamp.

Next step

You can now insert the connector into the socket of the MicroAutoBox III and turn the handle to the LOCK position to make the electrical connection.

Using the dSPACE MicroAutoBox Crimping Tool

Where to go from here

Information in this section

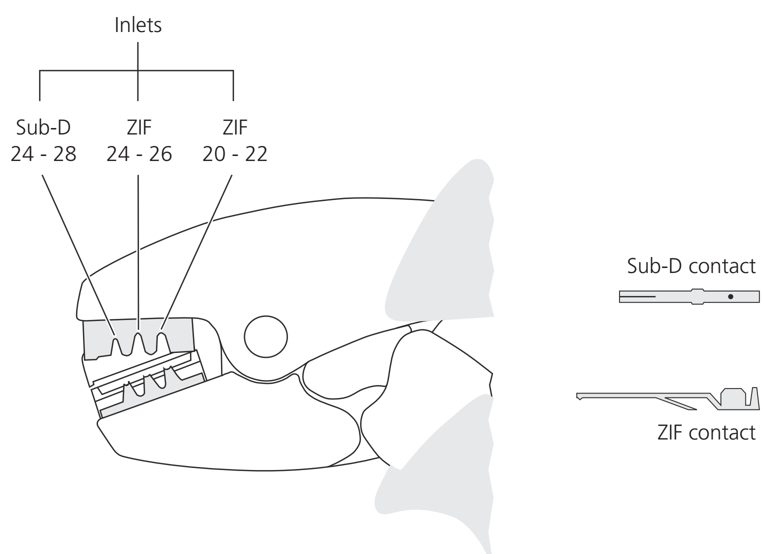
Details on the MicroAutoBox Crimping Tool

Introduction

dSPACE provides a crimper specially designed to crimp the contacts needed for the Sub-D connector and the zero insertion force (ZIF) connector.

Overview

The following illustration shows the crimper and the Sub-D and ZIF contacts which can be crimped with it. You can crimp contacts for different wire dimensions.



Precondition for a proper crimp

For a crimp contact to be properly crimped to the wire, the wire dimension, strip length, contact, and crimping tool must all match.

Possible wire dimensions

The crimper supplied by dSPACE supports the following wire dimensions:

Inlet	AWG[1]	Diameter (mm)	Cross Section (mm^2)
ZIF 20 – 22	20	0.812	0.518
	21	0.723	0.411
	22	0.644	0.326
ZIF 24 – 26	24	0.511	0.205
	25	0.455	0.163
	26	0.405	0.129
Sub-D 24 – 28	24	0.511	0.205
	25	0.455	0.163
	26	0.405	0.129
	27	0.360	0.096
	28	0.330	0.080

[1] AWG = American Wire Gauge

The AWG range for each cavity is indicated on the crimping tool.

The crimp contacts supplied with a MicroAutoBox III are ZIF 20 - 22.

How to Crimp Contacts with the Crimping Tool

Objective

Crimping contacts with the dSPACE MicroAutoBox crimping tool.

Precondition

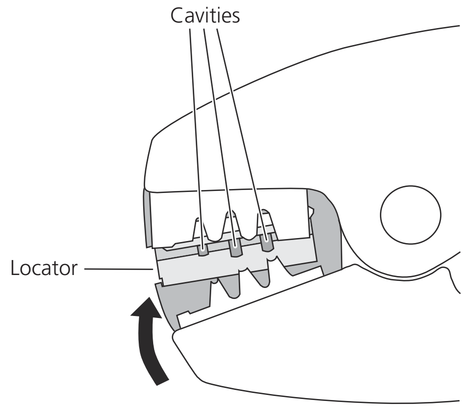
The end of the wire is stripped for 3 mm … 4 mm (0.11 in ... 0.15 in).

Method

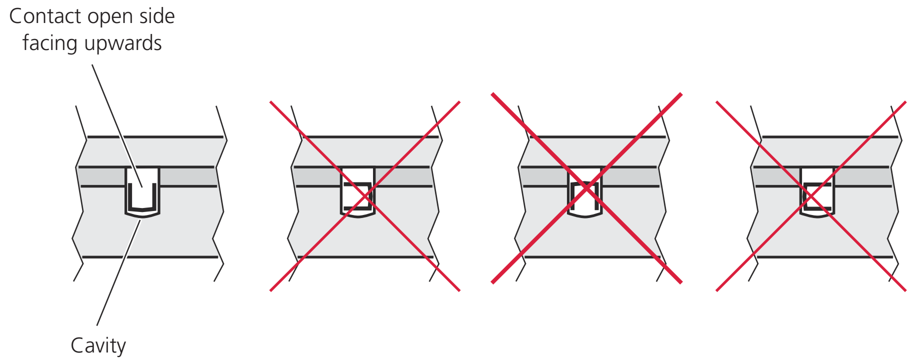
To crimp contacts with the crimping tool

1 To open the crimping tool, press the handles of the tool together.

2 Push up the locator a little to see the crimping cavity. Refer to the following illustration.



3 Hold the contact with the open side facing upwards and insert it into the specific cavity, so that the open side points towards the top. Refer to the following illustration.



4 Insert the wire.

5 To crimp the contact, completely close the crimper.

When it is completely closed, it automatically reopens. If the tool does not automatically open, it has not been closed completely.

Result

You properly connected the contact and the wire.

Building the Power Supply Cable

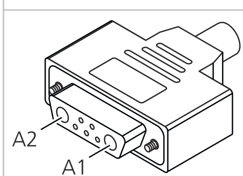
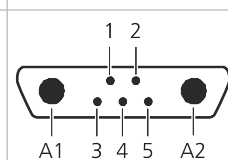
Where to go from here

Information in this section

Requirements on the Power Cabling

General requirements on the power supply cabling

The connector of the power supply cable must be a 7-pin, female Sub-D connector with two high-current pins (mixed-layout 7W2 Sub-D). This is a special variant of a 15-pin Sub-D connector. The following table shows the cable connector and the pin numbering of the MicroutoBox III connector.

Cable Connector	Pin Numbering of the MicroAutoBox III Power Input Connector[1)]
	

[1)] Front view

The following requirements must be fulfilled by the power supply cable:

- Insert fuses into the power supply cable and other cables that are connected to the battery/power supply to avoid an electrical fire.
- Locate the fuses close to the battery/power supply.
- Choose fuse ratings that ensure that the fuses break the circuit if the connected cables are loaded with the maximum currents supported by the cross sections of the cables used.
- Make sure that you use flame-retardant cables specified for temperatures up to 105 °C (220 °F) that were tested in conformity with IEC 60332-1-2, IEC 60332-2-2, or UL VW-1.
- Make sure that you use flame-retardant connectors specified for temperatures up to 105 °C (220 °F) and V-2 classified in conformity with IEC 60695-11-10 or UL 94.

- Do not use plugs for the power supply cable that can lead to an accidental connection to hazardous supply voltages, such as the mains voltage.

> **Note**
>
> The power supply cable causes a voltage drop so that the supply voltage might fall below the required operating voltage at the power input connector. Especially if you use low operating voltages, choose a sufficiently large cross section for the power supply cable or make sure that the vehicle battery/power supply provides enough voltage to compensate for the voltage drop.
> If in doubt, use the recommended wiring material.

Recommended wiring material You can use the following wires with the specified protection for all MicroAutoBox III and Embedded PC variants. Locate fuses close to the power supply/battery.

Wiring material		**Connection to Power Input Connector**				
		Power Supply Input	**Remote Control Input**	**Prestart Input**	**FuSa Error Input**	**FuSa Relay**
		Pin A1, pin A2	**Pin 4**	**Pin 3**	**Pin 5**	**Pin 1, pin 2**
Fuse and Fuse Carrier	Current rating	25 A time lag fuse.	0.1 A time lag fuse.			0.5 A time lag fuse
	Voltage rating	Depends on the supply voltage VBAT: ▪ VBAT = 12 V or 24 V: 32 V DC ▪ VBAT > 24 V: 80 V DC				Depends on the switching voltage: ▪ $V_{switch} \le$ 24 V: 32 V DC ▪ $V_{switch} >$ 24 V: 80 V DC
	Interrupting rating	The interrupting rating must be greater than the short-circuit current of the respective current path at the applied supply voltage.				
Cable	Cross section	4 mm² (AWG 12)	0.25 mm² ... 0.5 mm² (AWG 20 ... AWG 23)			0.25 mm² ... 0.5 mm² (AWG 20 ... AWG 23)
	Maximum temperature	105 °C (220 °F)				
	Flame retardant test specification	IEC 60332-1-2, IEC 60332-2-2, or UL VW-1				

Connecting a vehicle battery Batteries cannot be switched off. Therefore, the following requirements must be fulfilled besides the general requirements on the power supply cabling:

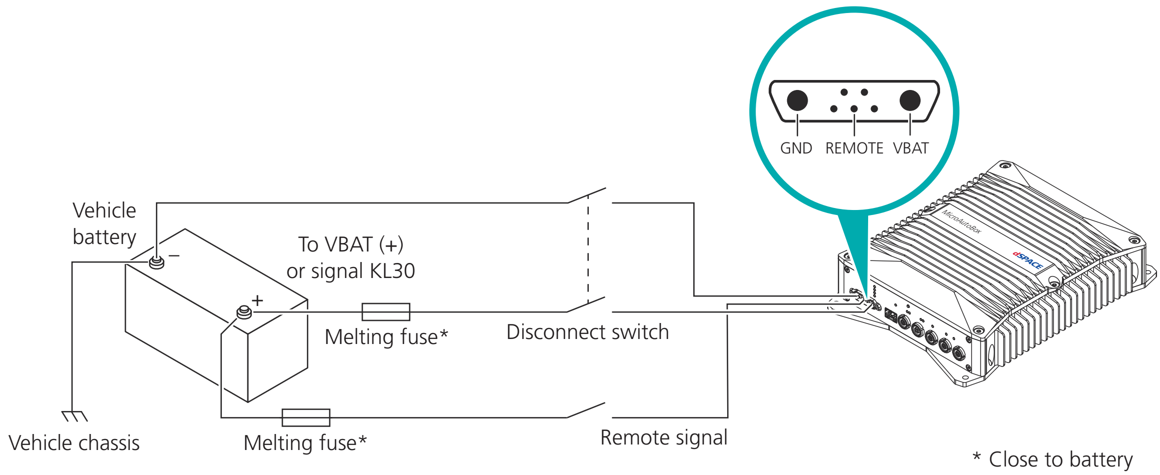
- Insert a remote control to switch on/off the MicroAutoBox III via the REMOTE pin. The remote control prevents the vehicle battery from depletion.
- Locate a disconnect switch in the power supply cabling:
  - Use an all-pole disconnect switch that matches the rating of the MicroAutoBox III. Refer to General Characteristics on page 240.

- Make sure that the disconnect switch can be reached by the user in case of an emergency.

The disconnect switch has the following functions:

- Disconnecting the MicroAutoBox III from the battery in case of an emergency.
- Enabling the MicroAutoBox III to be connected in a voltage-free state.

The following illustration shows the required cabling, fuses, and switches to connect the MicroAutoBox III.



Related topics

Basics

Building Power Supply Cables for Different Use Cases

Introduction

The cabling to the power supply depends on the use case. For example, the connection to a vehicle battery requires a remote control.

Requirements on the power cabling

For requirements on the power supply cabling, refer to Requirements on the Power Cabling on page 84.

Supported use cases

The following table shows the use cases that effects the power cabling.

Use case	Feature	Wiring Scheme
Configuring and performing first functionality tests in a laboratory.	Simple wiring to a laboratory power supply to operate the MicroAutoBox III continuously. The REMOTE pin is bridged to VBAT.	Power cabling for continuous operation on page 87
Operating MicroAutoBox III in a vehicle.	Switching on/off the MicroAutoBox III via a control signal to prevent the vehicle battery from depletion.	Power cabling with remote control on page 88
Shortening the start-up time of the real-time application by separating the start of the MicroAutoBox III and the start of the real-time application.	Prestarting the MicroAutoBox III via control signals.	Power cabling to support the prestart mode on page 89

Additional signals of the power input connector

Beside the signals for powering the MicroAutoBox III, the power input connector provides access to the functional safety (FuSa) relay to signal the FuSa state.

For more information, refer to FuSa Interface Characteristics on page 273.

Power cabling for continuous operation

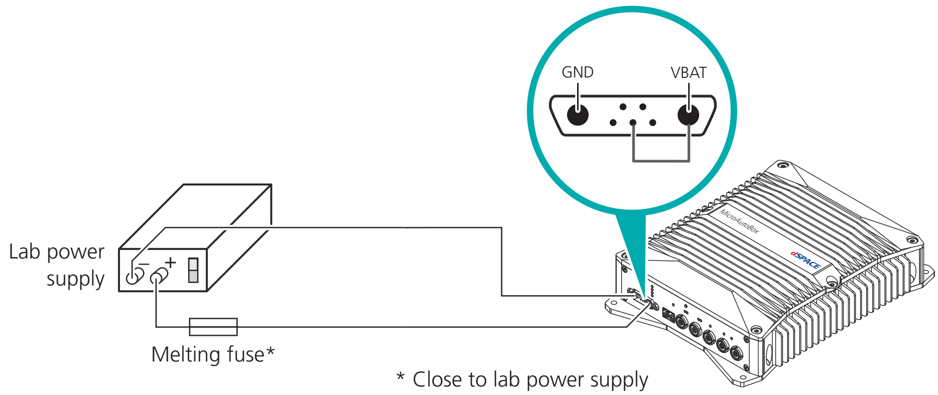
You can directly switch on/off a MicroAutoBox III with the switch of the laboratory power supply. If you build a power supply cable to be used in a laboratory, connect the REMOTE pin (pin 4) to VBAT (pin A2) in the cable connector to operate the MicroAutoBox III continuously. This saves a separate switch.

Note

The operating system of the Embedded PC must shut down before you switch off the power supply. This can be done via the REMOTE pin.

- Use the Power cabling with remote control on page 88 for a MicroAutoBox III with Embedded PC.

The following wiring scheme shows the wiring to connect a laboratory power supply. The magnifier shows the front view of the power input connector.

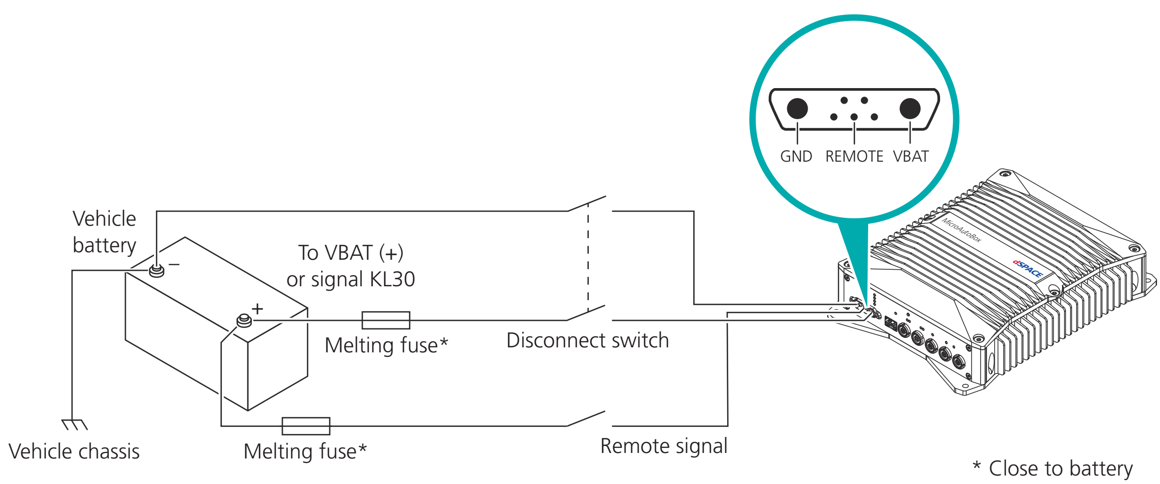


Do not use this cabling in the vehicle. Otherwise, the connected MicroAutoBox III will always be switched on.

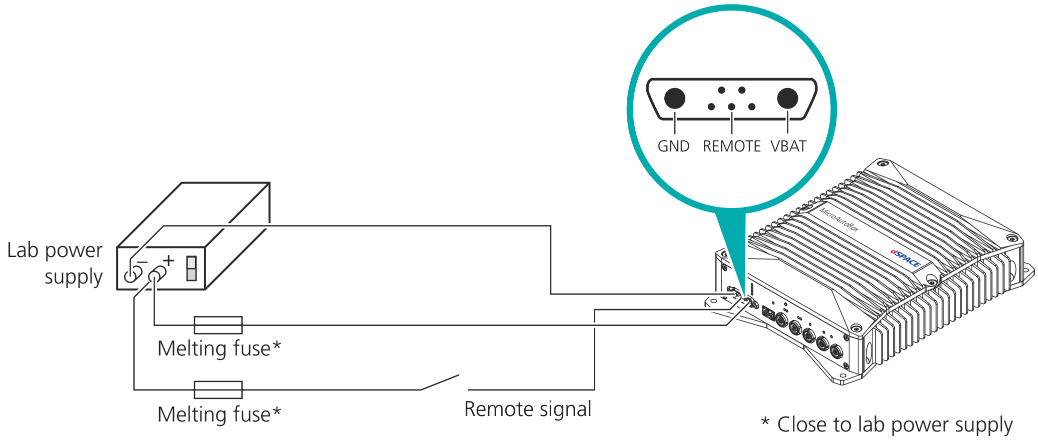
Power cabling with remote control

The remote control lets you switch on/off the MicroAutoBox III via an external switch, for example, the ignition switch. The remote control is essential if you connect the MicroAutoBox III to a battery.

The following wiring scheme shows the wiring to connect a vehicle battery. The magnifier shows the front view of the power input connector.



The following wiring scheme shows the wiring to connect a laboratory power supply. The magnifier shows the front view of the power input connector.



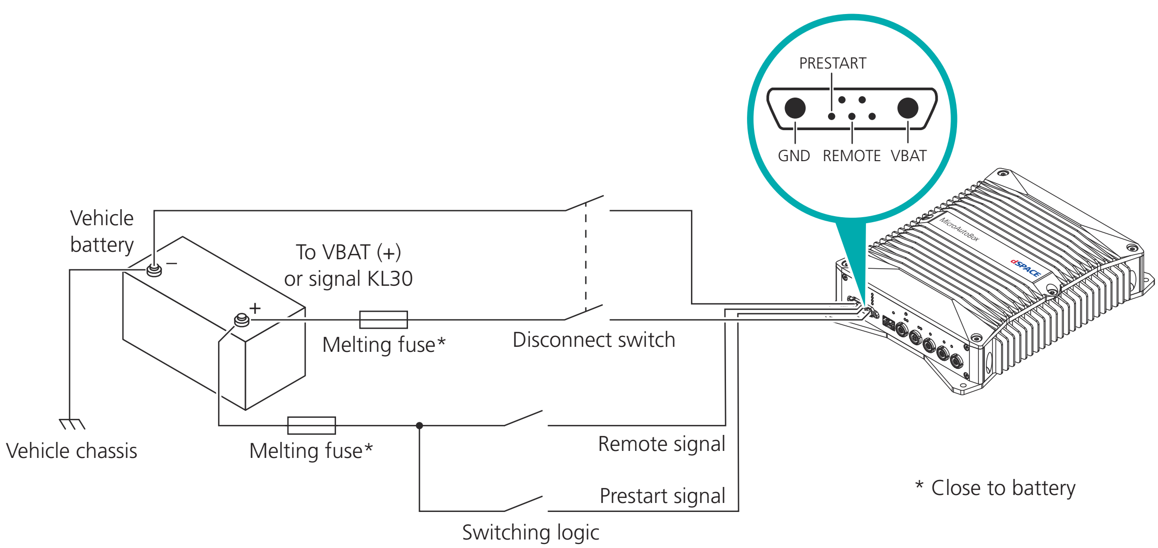
Power cabling to support the prestart mode

If a short duration to start the real-time application is essential for your application, use the prestart feature to separate the start of the MicroAutoBox III and the start of the real-time application. For information on using the prestart feature, refer to Basics on Prestarting the MicroAutoBox III on page 190.

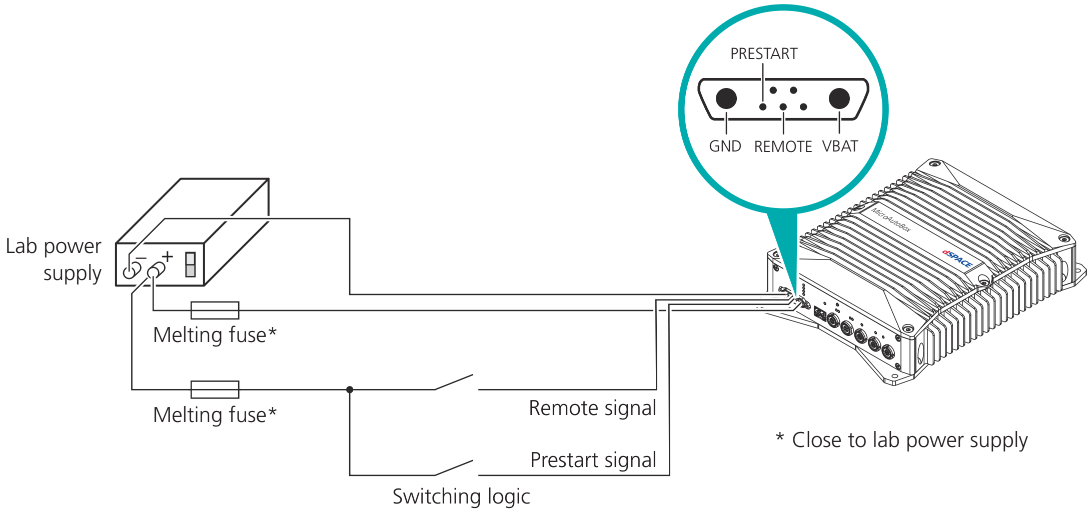
For the prestart signal, implement a switching logic that is capable of triggering the prestart process. A rising edge switches on the MicroAutoBox III, but does not start the real-time application.

The switching logic triggers the prestart process before the real-time application will start. You can use a switch inside the door for the vehicle driver to switch on the MicroAutoBox III, for example.

The following wiring scheme shows an example wiring to connect a vehicle battery. The magnifier shows the front view of the power input connector.



The following wiring scheme shows the wiring to connect a laboratory power supply. The magnifier shows the front view of the power input connector.



Note

You must configure and activate the prestart feature before you can use it. Refer to Prestarting the MicroAutoBox III on page 190.

Related topics

HowTos

References

Using the MicroAutoBox Break-Out Box DS1541

Introduction

⚠ WARNING

Risk of serious injury or death

Changing the existing cable harness via a break-out box can cause uncontrolled movements and/or damage to connected devices.

- Before changing the cabling, think through the effects of the changes you are planning.
- Ensure that no one is in the potential danger zone of the device (test bench, etc.) when the changes first take effect.

The MicroAutoBox Break-Out Boxes provide easy access to all the signals of the MicroAutoBox III ZIF I/O connectors. For example, you can:

- Check and/or reconnect signals without changing the existing cable harness
- Connect sensors and/or actuators
- Connect measurement devices

Where to go from here

Information in this section

Information in other sections

Features of the MicroAutoBox Break-Out Box DS1541

Main features

The MicroAutoBox Break-Out Box DS1541 provides the following main features:

- Easily connects to the MicroAutoBox III.

  A connecting cable with zero insertion force (ZIF) I/O connectors is shipped with the break-out box.
- One labeled terminal for each signal of the ZIF I/O connector.

Via terminals, you can:

- Break the signal path with an isolating connector.
- Connect test plugs and/or stripped wires on 6 points on each terminal.

More features

For a complete overview of the features, refer to Data Overview - Break-Out Box DS1541 on page 502.

Working Principles - MicroAutoBox Break-Out Box DS1541

Introduction

You can connect signals to the terminal points of MicroAutoBox Break-Out Box DS1541 either with test plugs or with stripped wires. The signal paths can be interrupted via the isolating connector without disconnecting a test plug or wire.

Notes

⚠ WARNING

Risk of serious injury or death due to electric shock

Depending on the connected devices, there can be hazardous voltages on the contacts of the boxes caused by failures.

Do not touch bare contacts.

⚠ WARNING

Risk of serious injury or death

Changing the existing cable harness via a break-out box can cause uncontrolled movements and/or damage to connected devices.

- Before changing the cabling, think through the effects of the changes you are planning.
- Ensure that no one is in the potential danger zone of the device (test bench, etc.) when the changes first take effect.

⚠ CAUTION

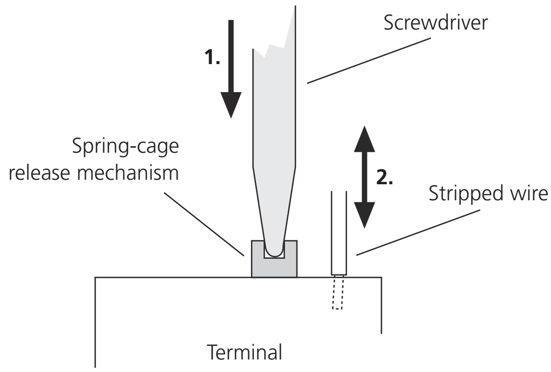
Connected components can cause fire

The MicroAutoBox III provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. This particularly concerns the VSENS, VBATprot, and the USB ports pins.

- To prevent a fire, apply the general fire safety regulations, e.g., supervise the operation, remove fire loads, and use fire-proof materials and enclosures.

Connecting/disconnecting stripped wires

Push down the spring-cage connection release mechanism to connect or disconnect the stripped end of a single wire. Refer to the following illustration:



Tip

Use a 3 mm (0.12 in.) slotted screwdriver to push down the spring-cage connection release mechanism.

Wire dimensions The spring-cage connection supports cable dimensions in the range AWG14 ... AWG24. Refer to the following table:

AWG[1]	Diameter		Cross Section	
	mm	inch	mm^2	$inch^2$
14	1.63	0.06	2.1	0.0032
24	0.511	0.02	0.205	0.0003

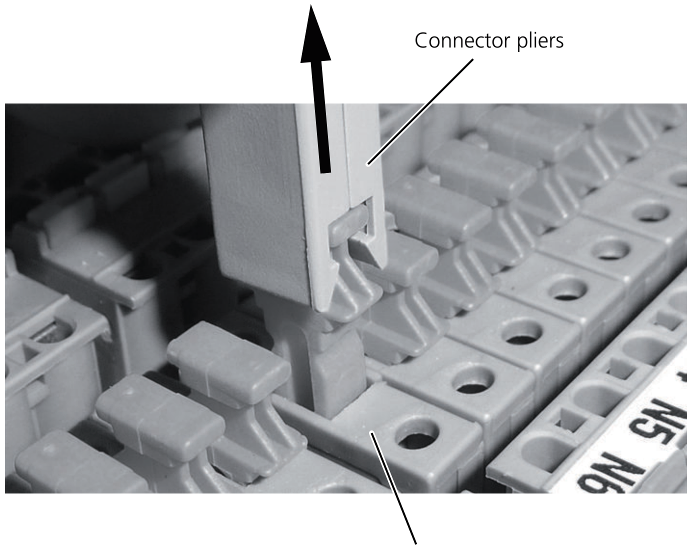
[1] AWG = American Wire Gauge

Connecting test plugs

You can connect the terminals with test plugs (banana plugs) that have a metal pin with a diameter of 2.0 mm (0.08 in).

Interrupting the signal path

Each terminal provides an isolating connector to interrupt a signal path, for example, for measuring purposes. The following illustration shows how to open an isolating connector:



Tip

Use the connector pliers to lift the isolating connectors.

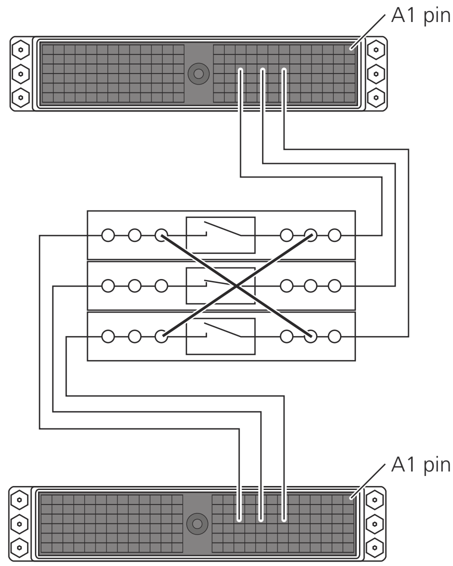
Note

Move the isolating connector to its upper position until it locks in place to ensure signal interruption.

Connecting Examples - MicroAutoBox Break-Out Box DS1541

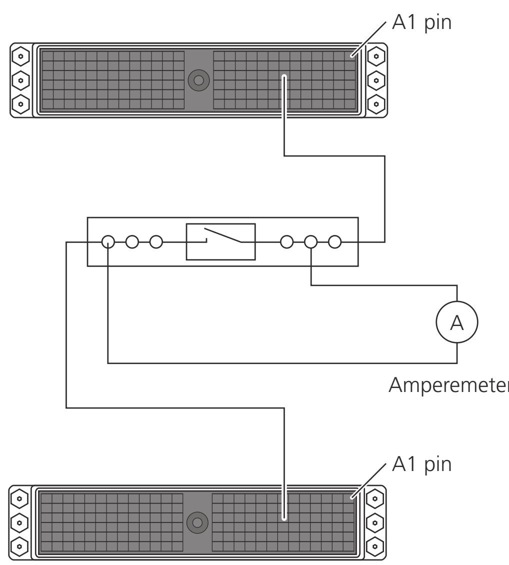
Changing signal paths

You can change signal paths if you open the isolating connectors of the signal terminals and reconnect the signals with test plugs or wires. Refer to the following illustration:



Current measuring

Open the isolating connector of a signal terminal and connect an amperemeter for current measuring. Refer to the following illustration:



Board-Specific and Module-Specific Installation Instructions

Where to go from here

Information in this section

DS1403 Processor Board

Where to go from here

Information in this section

Attaching Antennas to the DS1403

Checking the antenna

The MicroAutoBox III (WLAN) provides a radio interface.

Consider the following before you attach the antenna:

- Check the antenna for integrity. Replace a damaged antenna by a new antenna.
- Attach only the antenna to the radio connector ( ) that is delivered by dSPACE for this product.
- Consider the restrictions and measurements to avoid interferences to radio communication devices. Refer to Avoiding interference with radio communication devices on page 255.

Related topics

HowTos

Connecting Ethernet Devices to the DS1403 via LAN

Required adapter cables

The Ethernet ports of MicroAutroBox III are LEMO connectors. Adapter cables provided by dSPACE are required to connect Ethernet devices. The following table shows the adapter cables that you can order from dSPACE.

Board	Port	Proper Cable	Feature
DS1403	AETH (7-pin)	AETH_CAB2	5 m automotive Ethernet cable with open wires and max. 1 Gbit/s transfer rate. The DS1403 as of revision 5[1)] provides a 7-pin AETH connector.
	AETH (4-pin)	AETH_CAB1	5 m automotive Ethernet cable with open wires and max. 100 Mbit/s transfer rate. Only the DS1403 revision 4[1)] provides a 4-pin AETH connector.
	ETH	ETH_CAB1	5 m Ethernet cable with RJ45 jack.
		ETH_CAB2	4.5 m Ethernet cable with galvanic isolation and RJ45 jack.
		ETH_CAB3	5 m Ethernet cable with LEMO jack, for example, to connect a DCI-GSI2.
		ETH_CAB4	10 m Ethernet cable with RJ45 jack.
		ETH_CAB5	5 m Ethernet cable with extended operating temperature range and RJ45 jack.
		ETH_CAB6	5 m Ethernet cable with extended operating temperature range and LEMO jack, for example, to connect a DCI-GSI2.
		ETH_CAB7	10 m Ethernet cable with extended operating temperature range and LEMO jack, for example, to connect a DCI-GSI2.
	HOST	ETH_CAB1	5 m Ethernet cable to connect the host PC. One cable is delivered with the MicroAutoBox III.
		ETH_CAB2	4.5 m Ethernet cable with galvanic isolation to connect the host PC.
		ETH_CAB4	10 m Ethernet cable to connect the host PC.
		ETH_CAB5	5 m Ethernet cable with extended operating temperature range to connect the host PC.

[1)] The revision number is displayed in the Platform Manager after you register the MicroAutoBox III.

For technical data of the Ethernet connection cables, refer to Ethernet Connection Cables on page 512.

Connecting AETH ports

For the AETH port, you can build an automotive Ethernet cable. For the matching cable connector and the pinout, refer to AETH Connector Pinout (DS1403) on page 266.

Related topics

Basics

References

How to Connect and Remove USB Devices

Objective

Connecting USB devices to the LEMO connector and removing them safely.

Supported ports

Only USB port A is supported. USB port B is for future use.

Required material

A USB_CAB14 cable is required. You must order the cable from dSPACE.

Part 1

To connect a USB device

1. Connect the USB_CAB14 cable to the USB connector of the MicroAutoBox III.
2. Connect the USB 2.0 compatible device to the USB connector of the USB_CAB14 cable.

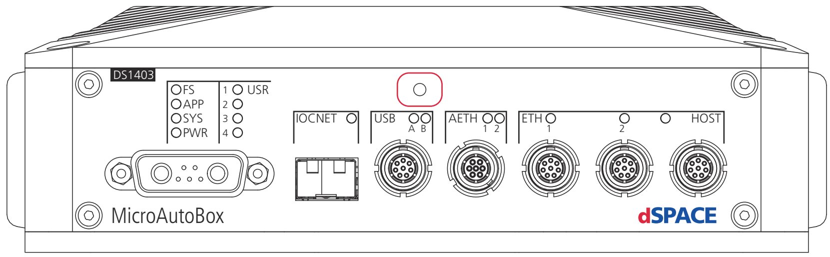
   The MicroAutoBox III automatically mounts the USB device to its file system.

Part 2

To remove a USB device

> ***NOTICE***
>
> **Data loss due to improper disconnection**
>
> Removing a USB device without unmounting can result in data loss.
>
> - Proceed with the following steps to safely disconnect the USB device.

1 Press the USB eject button to disconnect the USB device.



2 Wait until the USB LEDs are off.

Any data values still to be written are saved on the USB device before the MicroAutoBox III unmounts the device from its file system. An unmounted USB device cannot be used by the MicroAutoBox III.

3 Remove the USB device.

Result

You connected and removed a USB device.

Related topics

Basics

General Information on Data Logging (ControlDesk Measurement and Recording 🕮)

References

USB Connector Characteristics..277

Notes on Using the FuSa Relay

Introduction

The FuSa relay outputs the FuSa state of the MicroAutoBox III.

Connecting the FuSa relay

Observe the following requirements to connect the FuSa relay.

Limiting the induced voltage Switching of an inductive load can induce high voltages.

- Do not exceed the maximum inductive load $\frac{L}{R} = 40\ ms$ if you connect an inductive load such as the coil of a relay.
- DS1403-04 Processor Board only: If you connect an inductive load to the FuSa relay of the DS1403 revision 4, make sure that the inductive energy can pass through a freewheeling diode when switching off the load.

  As of revision 5, the FuSa relay is internally protected.

The revision number is displayed in the Platform Manager after you register the MicroAutoBox III.

Reliable detection of the MicroAutoBox III FuSa state Relay bounce, voltage spikes, and other effects must not affect the reliable detection of the MicroAutoBox III FuSa state by the connected device.

- The switching signal must be stable for at least 1 ms to reliably detect a change in the MicroAutoBox III FuSa state.

  Especially if the connected device uses a digital input, a low-pass filter is required.

Related topics

Basics

Functional Safety.. 38

References

FuSa Interface Characteristics.. 273

DS1511 Multi-I/O Board

Where to go from here

Information in this section

Driving the Digital I/O Interfaces of the DS1511

Introduction

The DS1511 ZIF I/O connector provides a VDRIVE pin to supply the digital I/O interfaces of the DS1511 Multi-I/O Board. By connecting a voltage supply to the VDRIVE pin, you can adapt the logic level of the digital I/O circuits to the provided voltage level. The voltage supply can be a voltage supply of the DS1511 or an external voltage supply.

Voltages provided to supply VDRIVE

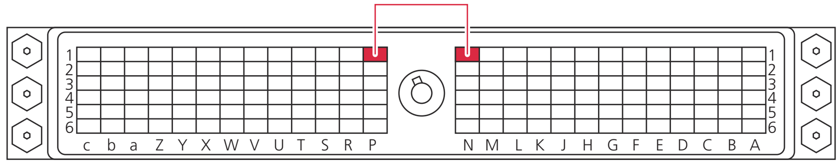
The DS1511 Multi-I/O Board provides an automotive-compatible voltage level and a 5 V voltage level to supply VDRIVE.

The following connections are relevant for driving the input/output circuits. The pins are located on the DS1511 ZIF I/O connector.

Signal	Pin	Description/ Function
VDRIVE	N1	This input supplies all digital input and output circuits of the I/O board. Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected for this signal.
VBATprot	P1	Protected VBAT output. VBATprot is switched on and off with the MicroAutoBox III.
VSENS	M1	5 V sensor supply output. VSENS is switched on and off with the MicroAutoBox III.

Providing automotive-compatible levels

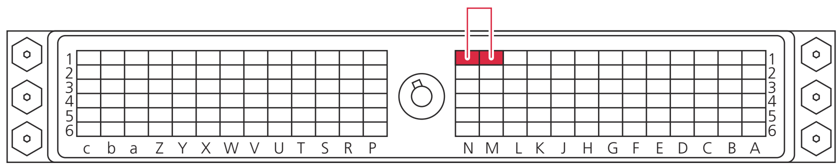
Connect the VBATprot pin P1 with the VDRIVE pin N1 to provide automotive-compatible voltage levels for the digital I/O interfaces. Refer to the following illustration.



A jumper cable with crimp contacts to supply the digital I/O interface is delivered with the MicroAutoBox III.

Providing 5 V logic levels

Connect the VSENS pin M1 with the VDRIVE pin N1 to provide 5 V logic levels for the digital I/O interfaces. Refer to the following illustration.



A jumper cable with crimp contacts to supply the digital I/O interface is delivered with the MicroAutoBox III.

Related topics

Basics

Workflow for Building the Cable Harness.......72

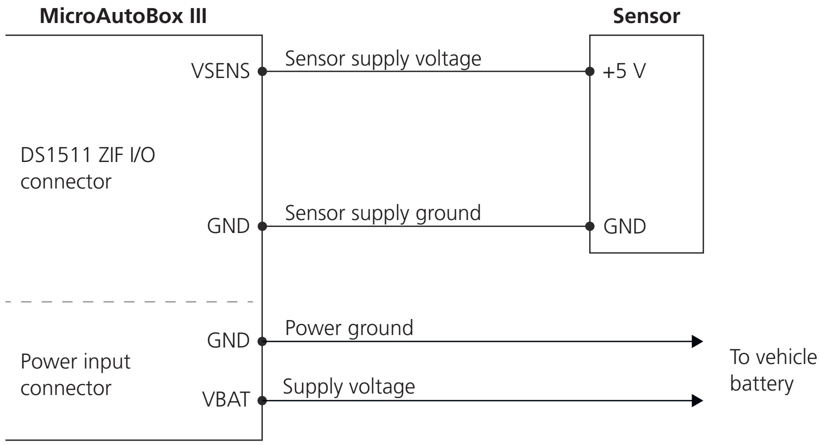
References

Digital In 4 Characteristics.......304
Digital Out 4 Characteristics.......307
DS1511 Sensor Supply Characteristics (VSENS).......317
VBATprot Characteristics.......318

Connecting Sensors to the DS1511

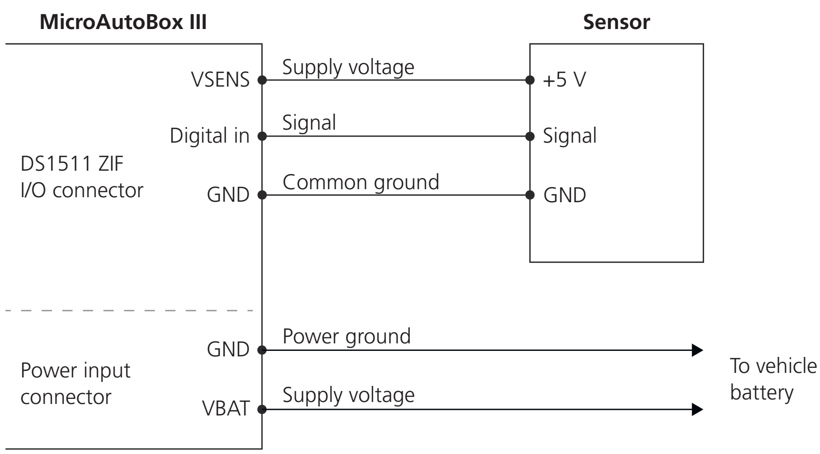
Supplying the sensor

The DS1511 Multi-I/O Board provides a 5 V sensor supply. The following illustration shows the cabling of the sensor supply.

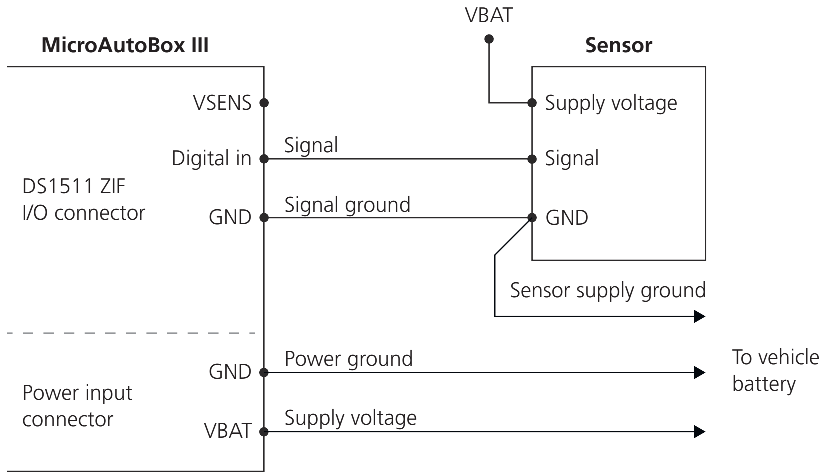


Grounding digital signals

The following example shows the grounding of a digital sensor that is supplied via VSENS.



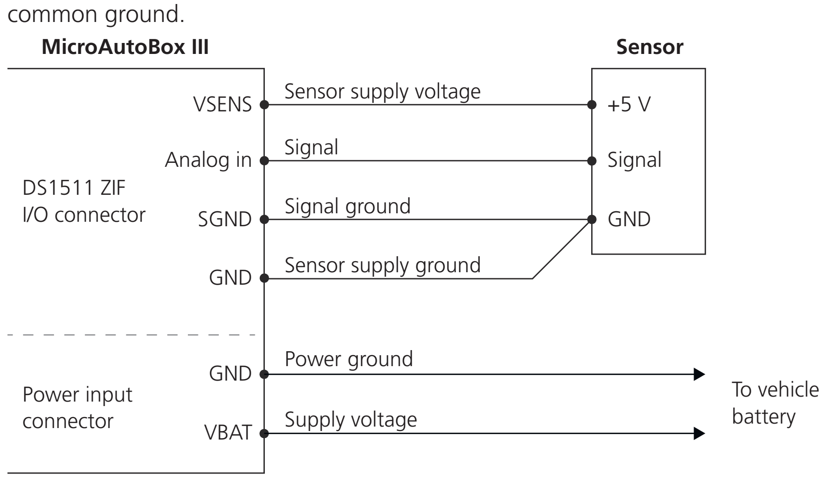
The following example shows the grounding of a digital sensor that is supplied via VBAT.



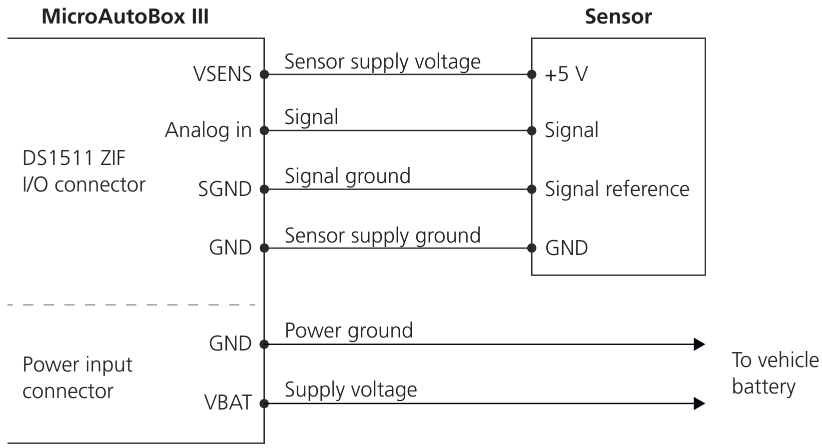
Grounding analog signals

Proper grounding as shown in the illustrations below is strongly recommended for analog sensor signals. The more sensitive a signal is, the more care must be taken to ensure good signal quality. The measurement result of sensor input signals can be impaired by improper grounding.

The following example shows the grounding of an analog sensor that provides a common ground.



The following example shows the grounding of an analog sensor that provides a signal reference and a supply ground.



Related topics

Basics

References

How to Change the LIN Interface of the DS1511 to Master

Objective

Using LIN channels of the DS1511 Multi-I/O Board as LIN master.

Electrical characteristics of a LIN master

A LIN master has a series connection consisting of a pull-up resistor and a diode between VBAT and LIN. This circuit must be wired in parallel to the LIN transceiver. The DS1511 Multi-I/O Board is configured as LIN slave by default.

Required tools and material

1 x diode and 1 x 1 kΩ pull-up resistor for each LIN channel.

Method

To change the LIN Interface of the DS1511 to master

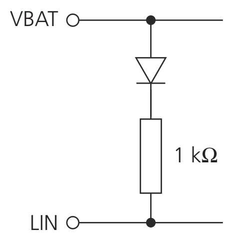
1 ***NOTICE***

Damage to the LIN interface

A pull-up resistor to voltage levels higher than 32 V can damage the LIN interface.

- Make sure that VBAT does not exceed 32 V.

2 Add a diode in series to a 1 kΩ resistor to the external cable harness. Refer to the following illustration:



LIN Signal	DS1511 ZIF I/O Connector
LIN of module 1	Pin b5
LIN of module 2	Pin A5

Result

You changed a LIN interface of the DS1511 Multi-I/O Board to LIN master.

Related topics

References

LIN 3 Characteristics..347

DS1513 Multi-I/O Board

Where to go from here

Information in this section

Driving the Digital I/O Interfaces of the DS1513

Introduction

The DS1513 ZIF I/O connector provides a VDRIVE pin to supply the digital I/O interfaces of the DS1513 Multi-I/O Board. By connecting a voltage supply to the VDRIVE pin, you can adapt the logic level of the digital I/O circuits to the provided voltage level. The voltage supply can be a voltage supply of the DS1513 or an external voltage supply.

Voltages provided to supply VDRIVE

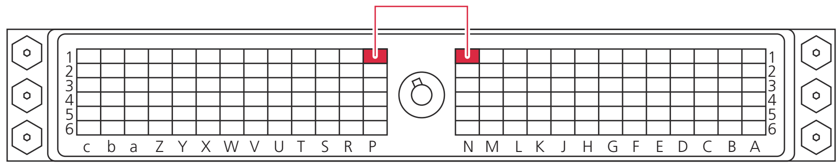
The DS1513 Multi-I/O Board provides an automotive-compatible voltage level and a 5 V voltage level to supply VDRIVE.

The following connections are relevant for driving the input/output circuits. The pins are located on the DS1513 ZIF I/O connector.

Signal	Pin	Description/ Function
VDRIVE	N1	This input supplies all digital input and output circuits of the I/O board. Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected for this signal.
VBATprot	P1	Protected VBAT output. VBATprot is switched on and off with the MicroAutoBox III.
VSENS	M1	5 V sensor supply output. VSENS is switched on and off with the MicroAutoBox III.

Providing automotive-compatible levels

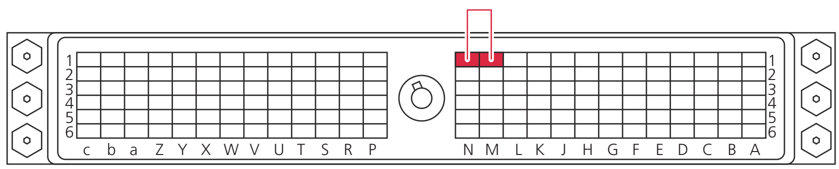
Connect the VBATprot pin P1 with the VDRIVE pin N1 to provide automotive-compatible voltage levels for the digital I/O interfaces. Refer to the following illustrations:



A jumper cable with crimp contacts to supply the digital I/O interface is delivered with the MicroAutoBox III.

Providing 5 V logic levels

Connect the VSENS pin M1 with the VDRIVE pin N1 to provide 5 V logic levels for the digital I/O interfaces. Refer to the following illustrations:



A jumper cable with crimp contacts to supply the digital I/O interface is delivered with the MicroAutoBox III.

Related topics

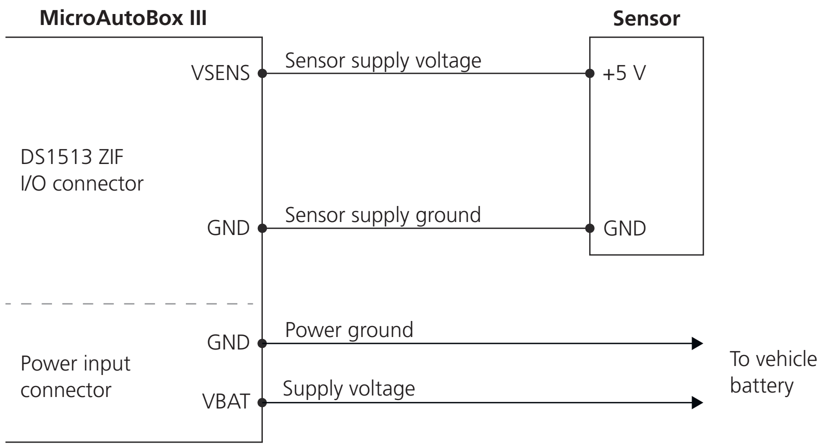
Basics

References

Connecting Sensors to the DS1513

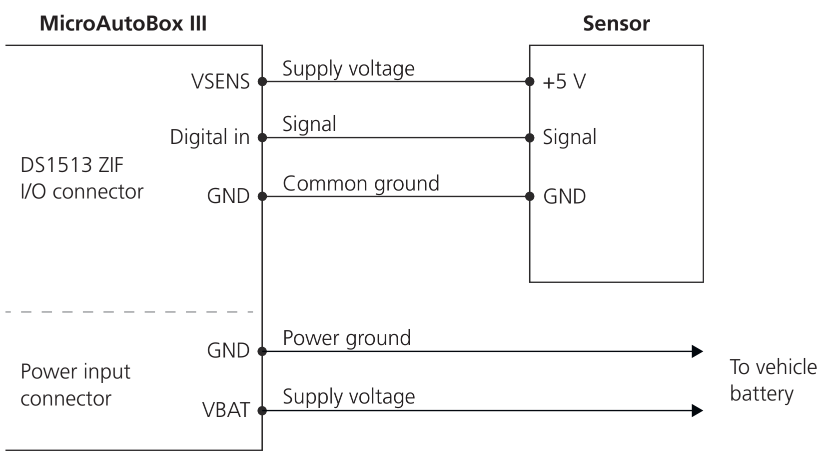
Supplying the sensor

The DS1513 Multi-I/O Board provides a 5 V sensor supply. The following illustration shows the wiring for a sensor supply.

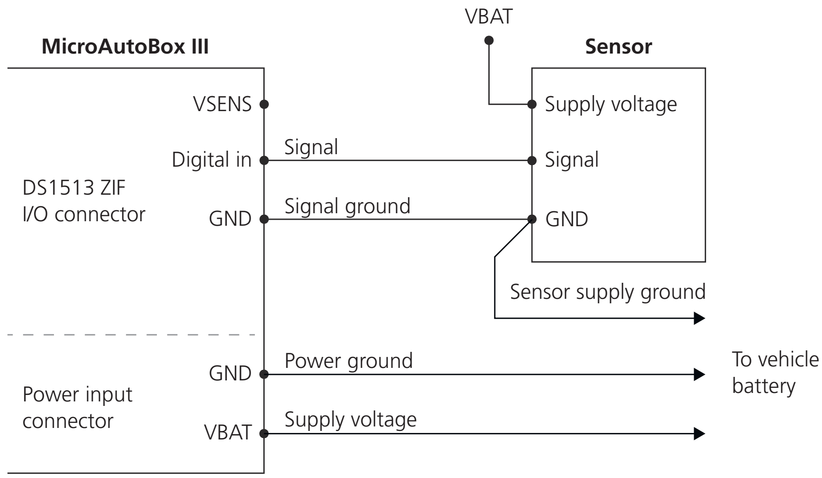


Grounding digital signals

The following example shows the grounding of a digital sensor that is supplied via VSENS.



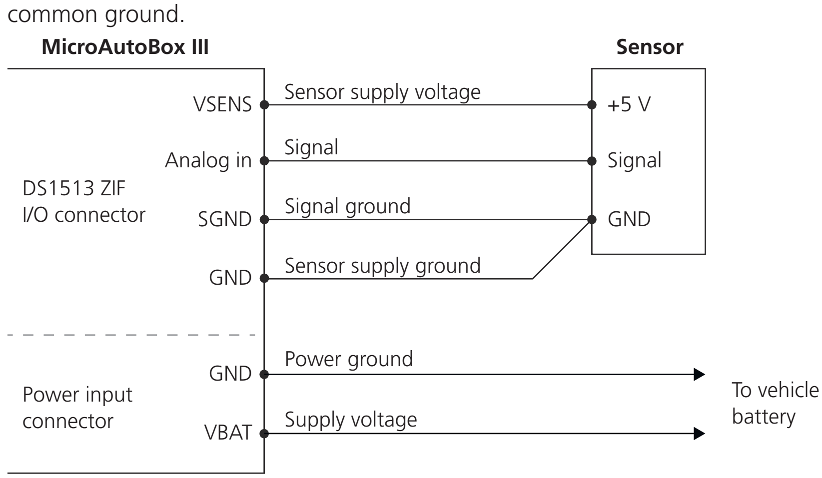
The following example shows the grounding of a digital sensor that is supplied via VBAT.



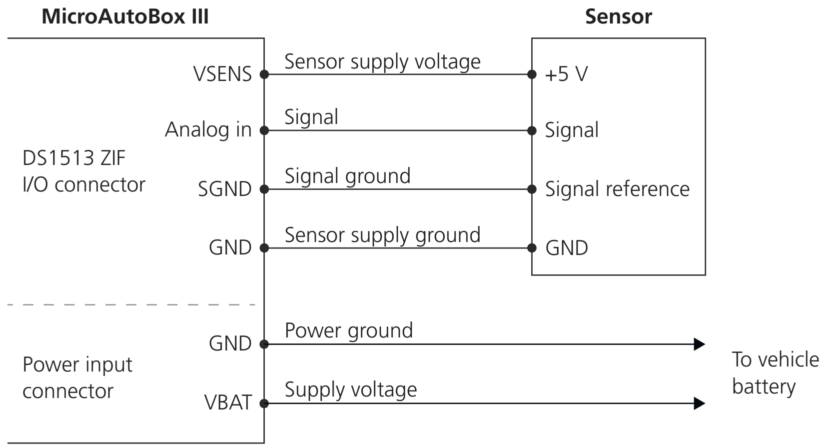
Grounding analog signals

Proper grounding as shown in the illustrations below is strongly recommended for analog sensor signals. The more sensitive a signal is, the more care must be taken to ensure good signal quality. The measurement result of sensor input signals can be impaired by improper grounding.

The following example shows the grounding of an analog sensor that provides a common ground.



The following example shows the grounding of an analog sensor that provides a signal reference and a supply ground.



Related topics

Basics

References

How to Support CAN Wake-up Requests with the DS1513

Objective

Enabling a CAN transceiver to support the wake-up functionality.

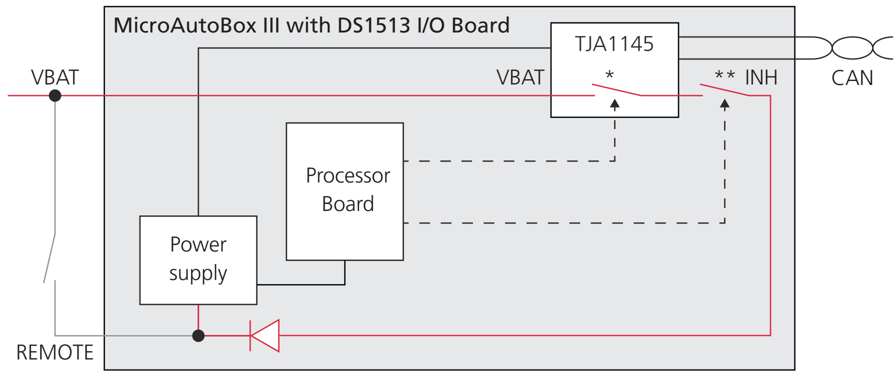
Basics on the wake-up functionality

For basics on the wake-up functionality, refer to Powering Features on page 36.

Preconditions

The following preconditions must be fulfilled:

- To use the wake-up functionality with the DS1513 Multi-I/O Board, the REMOTE pin of the MicroAutoBox III must be disconnected from VBAT while the MicroAutoBox III is in the standby mode. For wiring, refer to the following schematic.



* Switchable via ‘Low-power mode’ property in ConfigurationDesk
** Switchable via ‘Power wake-up’ property in ConfigurationDesk

- A real-time application that configures the used bus transceiver as follows:
  - It enables the power wake-up for the used transceiver.

    For more information, refer to Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide).
  - It activates the test automation support for the **Mode** function port.

    For more information, refer to Configuring Test Automation Support (ConfigurationDesk I/O Function Implementation Guide).
- You can change the value of the **Mode** function port with your experiment software, for example, with ControlDesk.
- The real-time application must be loaded to the flash and configured for the automatic start process.

  For checking the autostart status, refer to FLASH Page on page 227.

Method

To support CAN wake-up requests

1. Switch on the MicroAutoBox III.

   The real-time application starts and configures the transceiver.
2. Change the transceiver mode to the sleep mode with your experiment software, for example, with ControlDesk.
3. Switch off the MicroAutoBox III via the REMOTE pin, but do not disconnect VBAT.

Result

When the transceiver detects a wake-up message, the MicroAutoBox III changes the operating mode from standby to normal operating - application runs.

To switch-off the MicroAutoBox III, it is recommended that the real-time application uses the **System shutdown** function block to switch off the MicroAutoBox III. Refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide).

Related topics

Basics

Basics on Using the System Shutdown Functionality (ConfigurationDesk I/O Function Implementation Guide 🕮)
Power On Signal In (ConfigurationDesk I/O Function Implementation Guide 🕮)

References

CAN 4 Characteristics... 344

How to Change the LIN Interface of the DS1513 to Master

Objective

Using LIN channels of the DS1513 Multi-I/O Board as a LIN master.

Electrical characteristics of a LIN master

A LIN master has a series connection consisting of a pull-up resistor and a diode between VBAT and LIN. This circuit must be wired in parallel to the LIN transceiver. The DS1513 Multi-I/O Board is configured as a LIN slave by default.

Required tools and material

1 x diode and 1 x 1 kΩ pull-up resistor for each LIN channel.

Method

To change the LIN Interface of the DS1513 to master

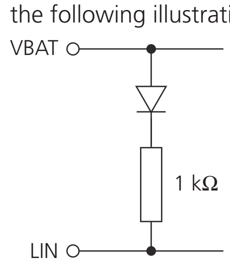
1 ***NOTICE***

Damage to the LIN interface

A pull-up resistor to voltage levels higher than 32 V can damage the LIN interface.

- Make sure that VBAT does not exceed 32 V.

2 Add a diode in series to a 1 kΩ resistor to the external cable harness. Refer to the following illustration:



LIN Signal	DS1513 ZIF I/O Connector
LIN of module 1	Pin b5
LIN of module 2	Pin A5
LIN of module 3	Pin N5

Result

You changed a LIN interface of the DS1513 Multi-I/O Board to LIN master.

Related topics

References

LIN 3 Characteristics.. 347

DS1521 Bus Board

Where to go from here

Information in this section

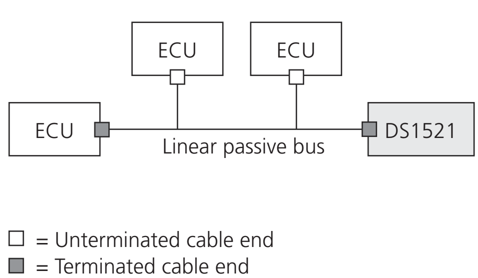
Using Termination and Feed-through lines with the DS1521

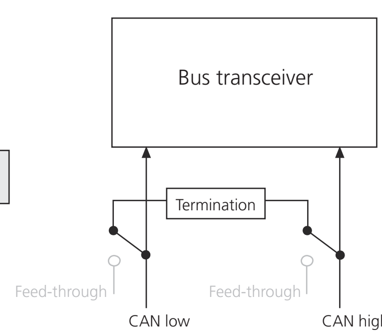
Introduction

The DS1521 Bus Board can terminate CAN and FlexRay bus lines, and feed-through pins can shorten the stub length. The termination and feed-through lines are activated via software.

Terminated cable end without feed-through

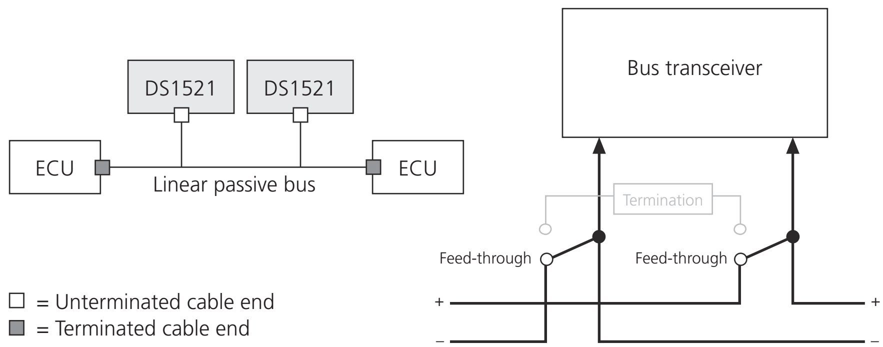
If a CAN/FlexRay interface is connected to a linear passive bus end, the bus lines must be terminated. The termination resistor is activated via software.





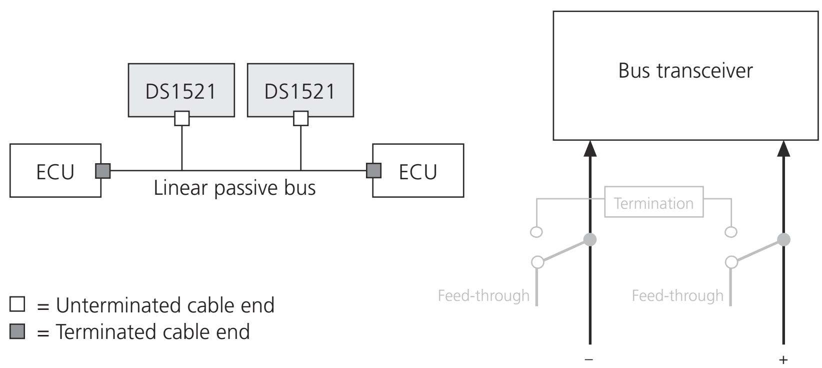
Unterminated cable end with feed-through

If a CAN/FlexRay interface is connected to a linear passive bus, you can use the feed-through bus lines to keep the stub length as short as possible. This improves the EMC robustness and bus signal integrity, especially in a topology consisting of many nodes and long distances between the splices or ECUs.



Unterminated cable end without feed-through

If the CAN/FlexRay interface is not connected at an end of a bus, its bus lines must be unterminated. The termination resistor is deactivated.



Related topics

Basics

Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide 📖)
Configuring the Basic Functionality (FlexRay) (ConfigurationDesk I/O Function Implementation Guide 📖)

References

Example of Connecting DS1521 to a CAN/FlexRay Bus

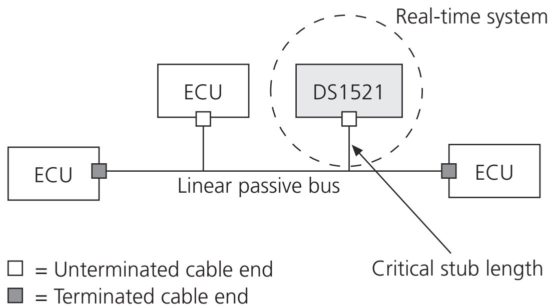
Introduction

This example shows how one bus transceiver can be connected to a CAN or FlexRay bus. The DS1521 Bus Board is not connected at the end of the bus. The termination resistor is therefore not activated.

> **Note**
>
> To keep the stub length as short as possible, the feed-through pins are used.

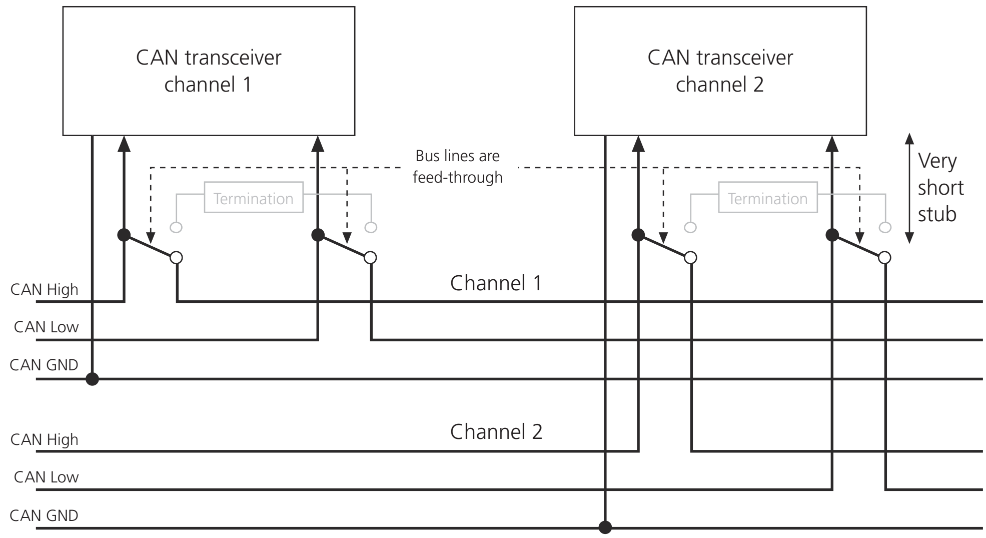
Topology

The following illustration shows the network that the DS1521 Bus Board is connected to.



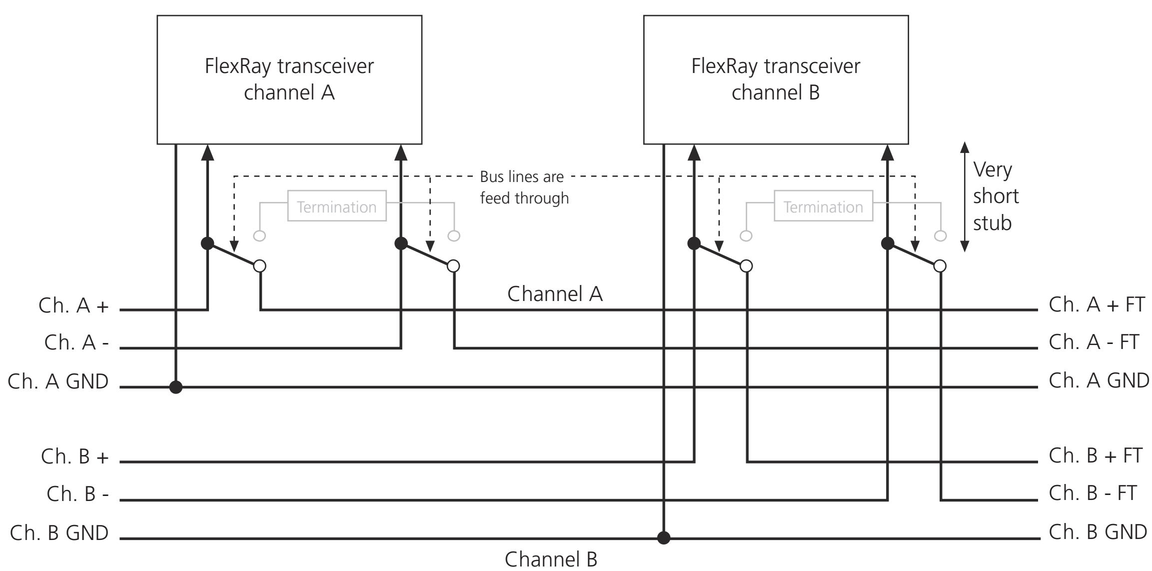
CAN circuit

The following illustration shows the connection of the CAN high bus lines and CAN low bus lines. The incoming bus lines are connected to the CAN 6 Ch. 1 High and CAN 6 Ch. 1 Low pins (CAN 6 Ch. 2 High and CAN 6 Ch. 2 Low, respectively). The outgoing bus lines are connected to the feed-through pins CAN 6 Ch. 1 High FT and CAN 6 Ch. 1 Low FT (CAN 6 Ch. 2 High FT and CAN 6 Ch. 2 Low FT, respectively). The incoming and outgoing bus lines are connected directly on the DS1521 Bus Board, which results in a very short stub length from the connection to the transceiver. The switch for the connection is set via software.



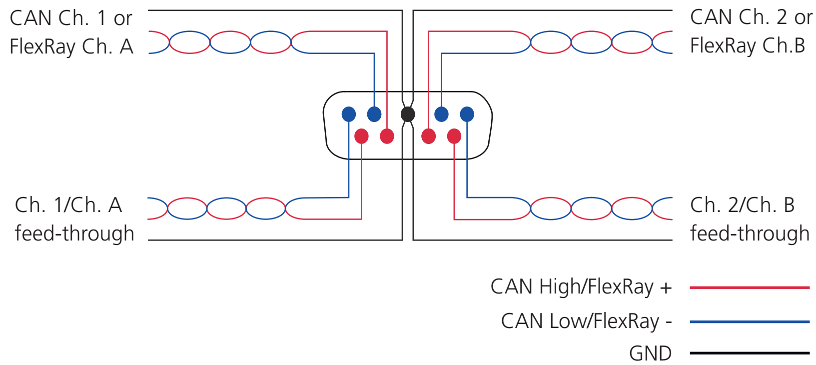
FlexRay circuit

The following illustration shows the connection of the FlexRay bus lines plus and minus. The incoming bus lines are connected to the Channel X+ and Channel X- pins. The outgoing bus lines are connected to the feed-through pins Channel X+ FT and Channel X- FT. The incoming and outgoing bus lines are connected directly at the DS1521 Bus Board, which results in a very short stub length from the connection to the transceiver. The switch for the connection is set via software.



Connecting the bus lines

The DS1521 Bus Board provides the CAN and FlexRay signals on 9-pin Sub-D connectors. The following illustration shows the connected bus lines (front view).



Related topics

Basics

Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide)
Configuring the Basic Functionality (FlexRay) (ConfigurationDesk I/O Function Implementation Guide)

References

CAN 6 Characteristics....374
CAN FD Connector Pinout....366
FlexRay 4 Characteristics....378
FlexRay Connector Pinout....366

How to Support Bus Wake-up Requests with the DS1521

Objective

Initializing a bus transceiver to support the wake-up functionality.

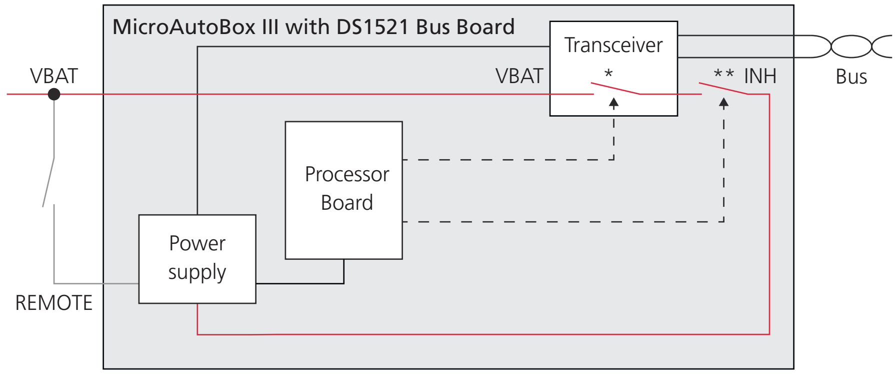
Basics on the wake-up functionality

For basics on the wake-up functionality, refer to Powering Features on page 36.

Preconditions

The following preconditions must be fulfilled:

- To use the wake-up functionality with the DS1521 Bus Board, the REMOTE pin of the MicroAutoBox III must be disconnected from VBAT while the MicroAutoBox III is in the standby mode. For wiring, refer to the following schematic.



* CAN only: Switchable via 'Low-power mode' property in ConfigurationDesk
** Switchable via 'Power wake-up' property in ConfigurationDesk

- A real-time application that configures the used bus transceiver as follows:
  - It enables the power wake-up for the used transceiver.

    For more information, refer to Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide) or Configuring the Basic Functionality (LIN) (ConfigurationDesk I/O Function Implementation Guide).
  - CAN only: It activates the test automation support for the **Mode** function port.

    For more information, refer to Configuring Test Automation Support (ConfigurationDesk I/O Function Implementation Guide).
- CAN only: You can change the value of the **Mode** function port with your experiment software, for example, with ControlDesk.
- The real-time application must be loaded to the flash memory and configured for the automatic start process.
- The prestart feature is deactivated. If the prestart feature is activated, the wake-up request starts the MicroAutoBox III, but the real-time application does not start.

  For more information on the prestart feature, refer to Basics on Prestarting the MicroAutoBox III on page 190.

Method

To support bus wake-up requests

1. Switch on the MicroAutoBox III.

   The real-time application starts and configures the transceiver.
2. If you use CAN, change the transceiver mode to the sleep mode with your experiment software, for example, with ControlDesk.
3. Switch off the MicroAutoBox III via the REMOTE pin, but do not disconnect VBAT.

Result

When the transceiver detects a wake-up message, the MicroAutoBox III changes the operating mode from standby to normal operating - application runs.

To switch off the MicroAutoBox III, it is recommended that the real-time application uses the **System shutdown** function block to switch off the MicroAutoBox III. Refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide 📖).

Related topics

Basics

References

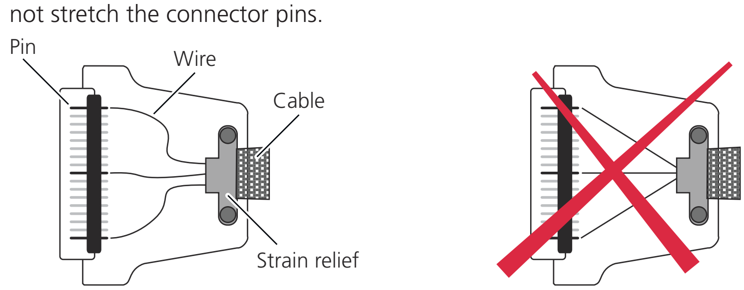
Using Sub-D Connectors

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.

Connecting Ethernet Devices to the DS1521

Pinout and required material

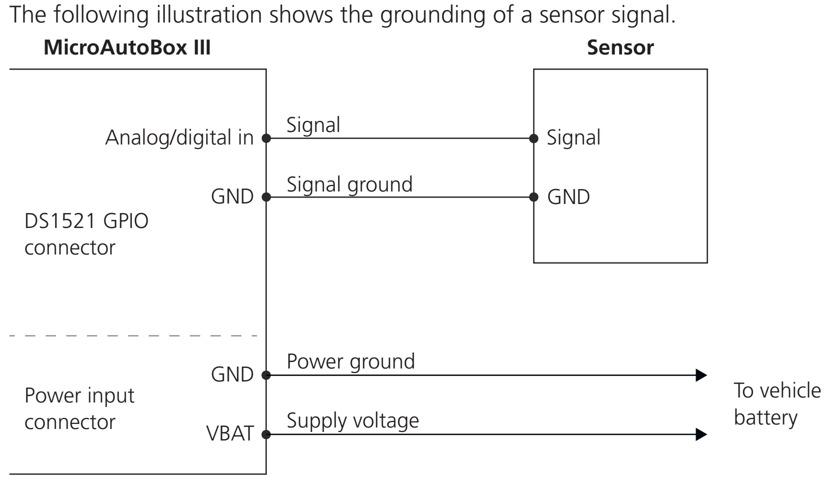
For matching cable connectors and pinout information, refer to AETH Connector Pinout (DS1521) on page 365.

Grounding of Analog and Digital Signals of the DS1521

Signal grounding

Proper grounding as shown in the illustrations below is strongly recommended for analog sensor signals. The more sensitive a signal is, the more care must be taken to ensure good signal quality. The measurement result of sensor input signals can be impaired by improper grounding.

The following illustration shows the grounding of a sensor signal.



Related topics

References

Analog In 17 Characteristics...369
Digital In/Out 10 Characteristics...371

DS1552 Multi-I/O Module

Where to go from here

Information in this section

Driving the Digital I/O Interfaces of the DS1552

Introduction

The DS1514 ZIF I/O connector provides a VDRIVE pin to supply the following unidirectional channel types of the DS1552 Multi-I/O Module: Digital Out 5 and Digital In 5.

By connecting a voltage supply to the VDRIVE pin, you can adapt the logic level of the digital I/O circuits to the provided voltage level. The voltage supply can be a voltage supply of the DS1552 or an external voltage supply.

Note

The Digital In/Out 6, Digital In 6, and Digital In 7 channel types of the DS1552 Multi-I/O Module are supplied by an internal voltage and not via the VDRIVE pin.

Voltages provided to supply VDRIVE

The DS1514 ZIF I/O connector provides an automotive-compatible voltage level and the adjustable voltage level of the DS1552 Multi-I/O Module to supply VDRIVE.

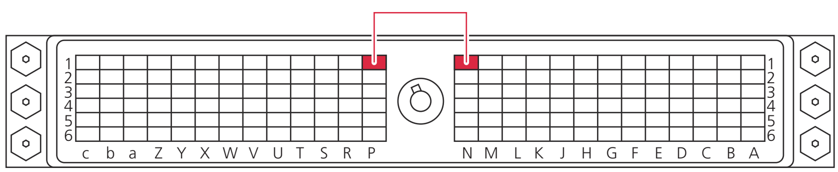
The following connections are relevant for driving the input/output circuits. The pins are located on the DS1514 ZIF I/O connector.

Signal	Pin	Description/ Function
VDRIVE	N1, M1	This input supplies the Digital Out 5 output circuits and Digital In 5 input circuits of the I/O board.

Signal	Pin	Description/ Function
		Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected for this signal.
VBATprot	P1, R1	Protected VBAT output. VBATprot is switched on and off with the MicroAutoBox III.
VSENS+	c6	Adjustable sensor supply in the range 2 V ... 20 V.
VSENS-	b6	**Note** ▪ An FPGA application built with the RTI FPGA Programming Blockset is required to use the sensor supply of the DS1552. ▪ If you use VSENS+ to supply VDRIVE, you have to connect VSENS- to GND.

Providing automotive-compatible levels

Connect the VBATprot pin P1 with the VDRIVE pin N1 to provide automotive-compatible voltage levels for the digital I/O interfaces. Refer to the following illustration:

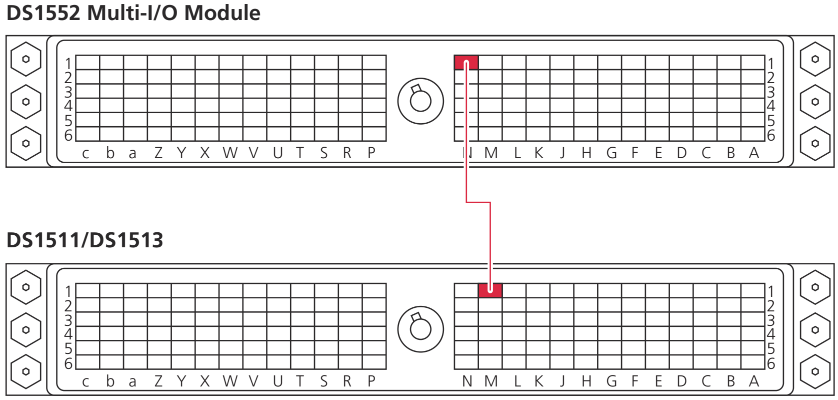


A jumper cable with crimp contacts to supply the digital I/O interface is delivered with the MicroAutoBox III.

Providing 5 V logic levels

The DS1552 Multi-I/O Board does not provide a 5 V voltage supply. Use the supply voltage of a DS1511/DS1513 board instead. Connect the VSENS pin M1 of the DS1511/DS1513 board with the VDRIVE pin N1 to provide 5 V logic levels. Refer to the following illustration:

DS1514 with
DS1552 Multi-I/O Module



Note

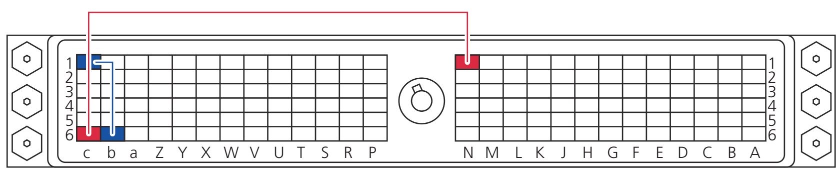
Distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514) even if VDRIVE of the DS1552 Multi-I/O Module is supplied by VSENS of the DS1511/DS1513.

Tip

If an FPGA application built with the RTI FPGA Programming Blockset uses the DS1552 Multi-I/O Module, you can set the adjustable sensor supply to 5 V.
For the connection, refer Providing an adjustable voltage level on page 128.

Providing an adjustable voltage level

Connect the VSENS+ pin c6 with the VDRIVE pin N1 and the VSENS- pin b6 with GND to provide the adjustable voltage level of VSENS. Refer to the following illustration:



Note

The minimum voltage level to drive the digital I/O interface is 4.5 V.

Related topics

Basics

References

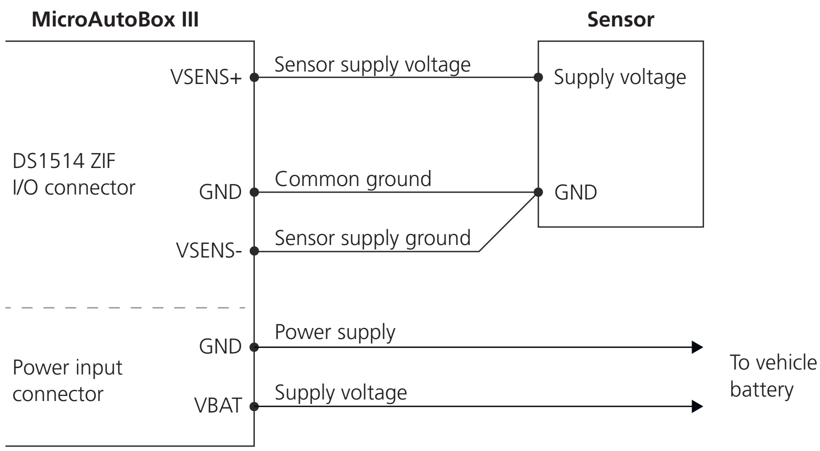
Connecting Sensors to the DS1552

Supplying the sensor

> **Note**
>
> An FPGA application built with the RTI FPGA Programming Blockset is required to use the sensor supply of the DS1552.

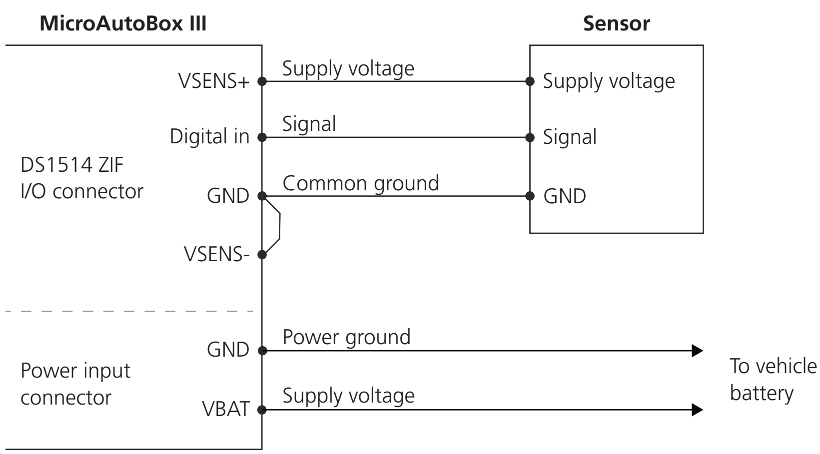
The DS1552 Multi-I/O Module provides an adjustable sensor supply with VSENS = 2 V … 20 V. The sensor supply provides an additional reference potential VSENS- to separate the sensor supply ground and the sensor ground. However, VSENS- and GND must be connected to prevent voltage drifts. For best measurement results, VSENS- is connected to GND at the sensor.

The following illustration shows the wiring for a sensor supply.

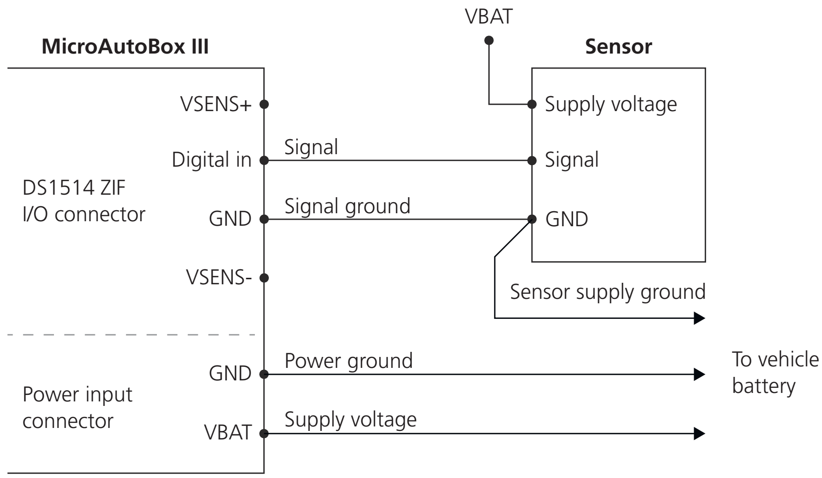


Grounding digital signals

The following example shows the grounding of a digital sensor that is supplied via VSENS.



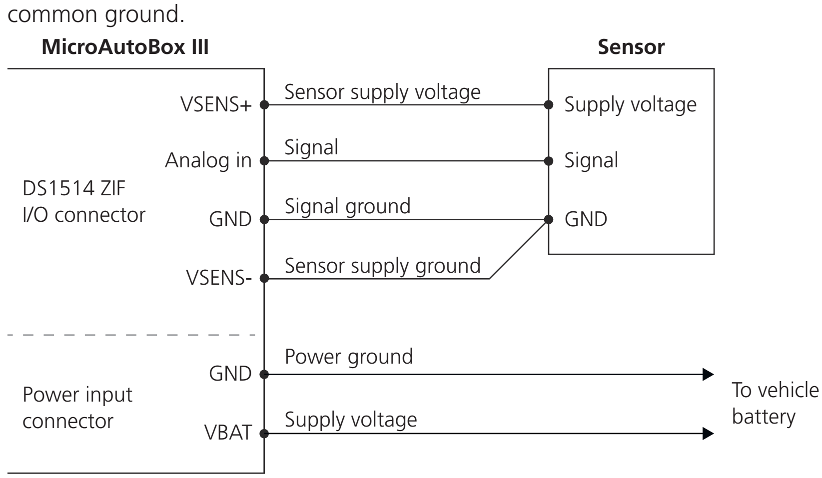
The following example shows the grounding of a digital sensor that is supplied via VBAT.



Grounding analog signals

Proper grounding as shown in the illustrations below is strongly recommended for analog sensor signals. The more sensitive a signal is, the more care must be taken to ensure good signal quality. The measurement result of sensor input signals can be impaired by improper grounding.

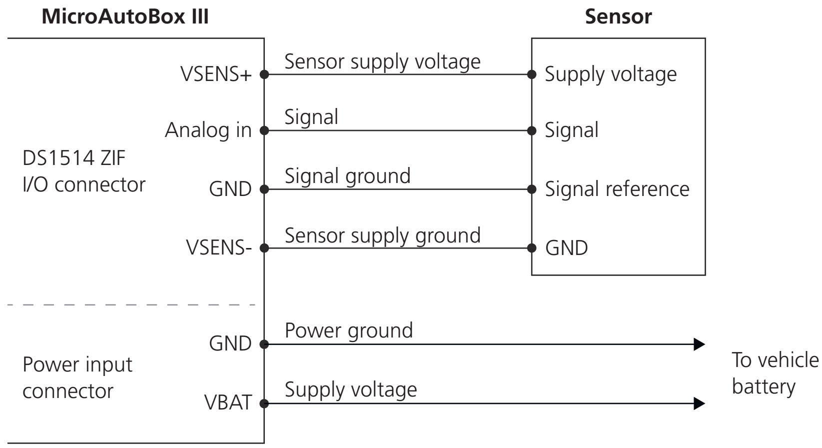
The following example shows the grounding of an analog sensor that provides a common ground.



Note

VSENS- and GND must be connected. If you connect a MicroAutoBox III to the sensor via a common ground line, you have to connect VSENS- to GND at the ZIF I/O connector.

The following example shows the grounding of an analog sensor that provides a signal reference and a supply ground.



Related topics

Basics

References

How to Remove DS1552 Multi-I/O Modules

Objective

Removing the DS1552 Multi-I/O Module from the DS1514 FPGA Base Board.

Required tools

The following tools are required:

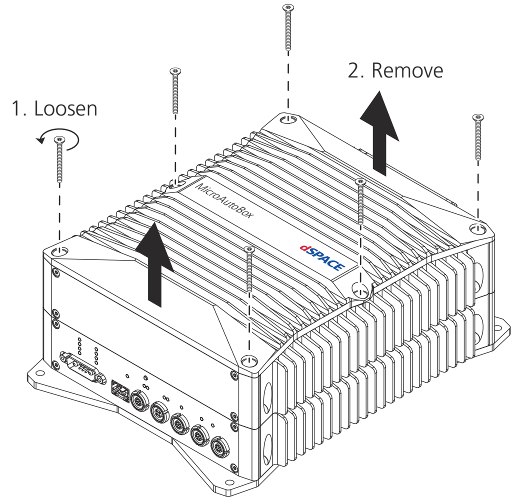
- TX 25 Torx screwdriver
- TX 10 Torx screwdriver

Method

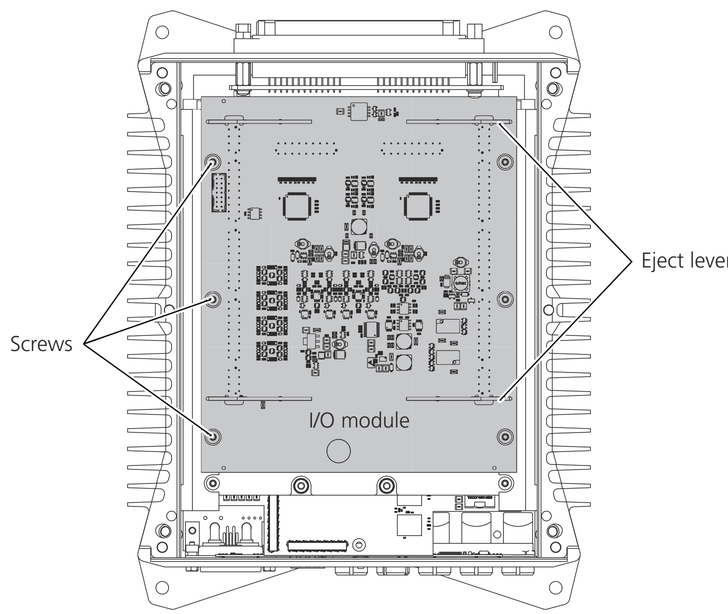
To remove the DS1552 Multi-I/O Module

1 Disconnect the MicroAutoBox III from the power supply and remove the cable harness.

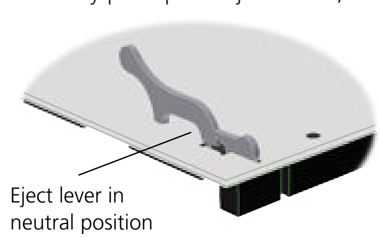
2 Remove the top plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.



3 Remove the six screws that attach the DS1552 as shown in the following illustration. Use a TX 10 Torx screwdriver.



4 Carefully pull up the eject levers, first on the one side and then on the other.



5 Remove the DS1552 Multi-I/O Module.

Result

You removed the DS1552 Multi-I/O Module.

Next step

You can now install an I/O module. Refer to one of the following topics:

- How to Install DS1552 Multi-I/O Modules on page 133.
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148.
- How to Install DS4340 FlexRay Interface Modules on page 161.
- How to Install DS4342 CAN FD Interface Modules on page 170.

How to Install DS1552 Multi-I/O Modules

Objective

Installing a DS1552 Multi-I/O Module on the DS1514 FPGA Base Board.

Suitable I/O boards of the MicroAutoBox III

The DS1552 Multi-I/O Module can be installed only on the DS1514 FPGA Base Board.

Required tools and material

The following tools and material is required:

- TX 25 Torx screwdriver
- TX 10 Torx screwdriver
- If the DS1552 Multi-I/O Module replaces a DS1554 Engine Control I/O Module: A blank front cover

Preconditions

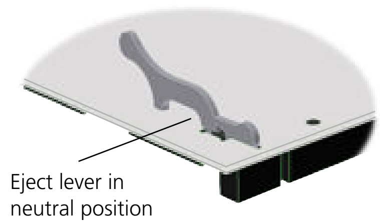
The following preconditions must be fulfilled:

- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The I/O module is removed from the FPGA base board. Refer to one of the following topics:
  - How to Remove DS1552 Multi-I/O Modules on page 131
  - How to Remove DS1553 AC Motor Control Modules on page 136
  - How to Remove DS1554 Engine Control I/O Modules on page 146
- The top plate of the MicroAutoBox III is removed.

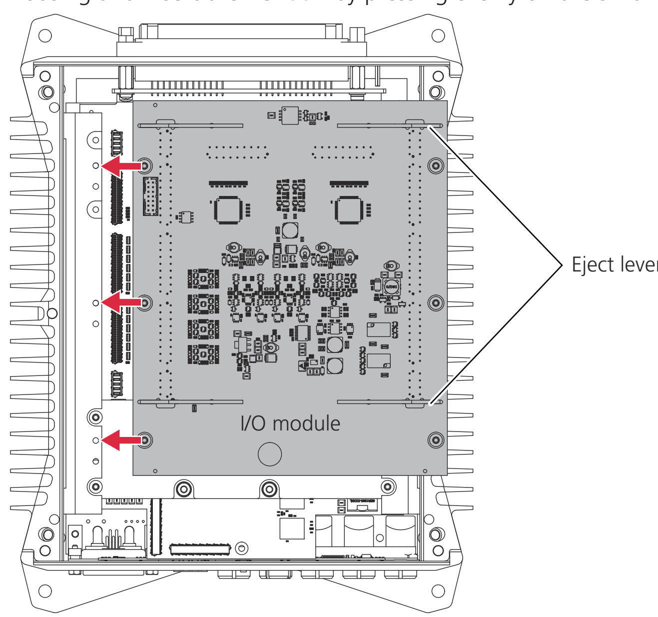
Method

To install the DS1552 Multi-I/O Module

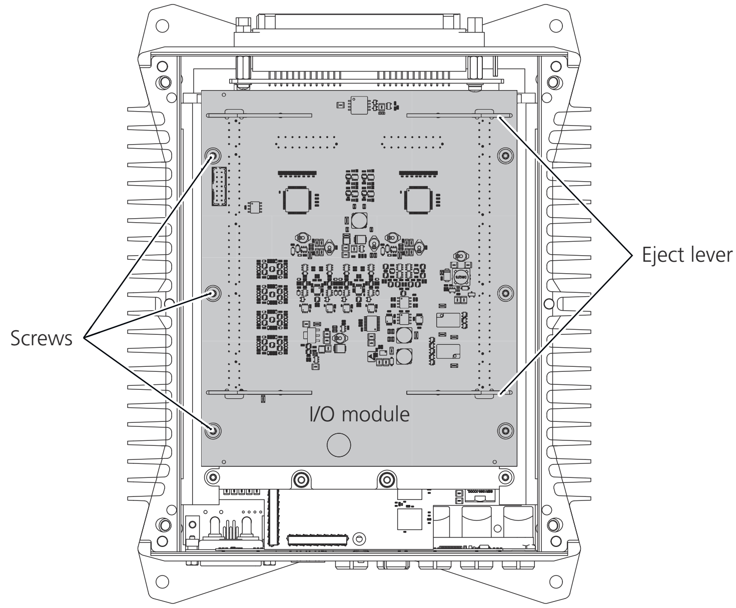
1 Make sure that the eject levers of the DS1552 are in the neutral position. Refer to the following illustration.



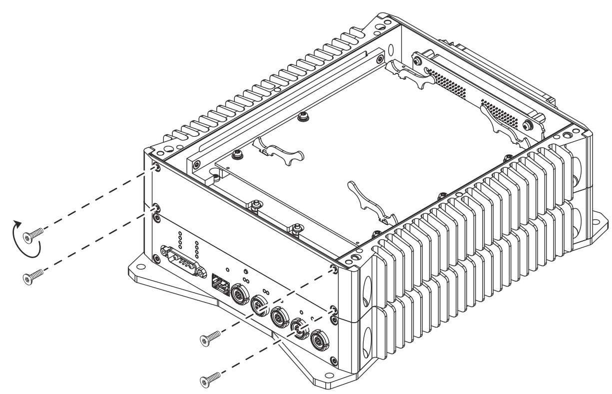
2 Align the drill holes of the DS1552 with those of the MicroAutoBox III housing and insert the DS1552 by pressing evenly on the six drill holes.



3 Tighten the six screws to attach the DS1552. Use a TX 10 Torx screwdriver.



4 If the upper front cover is removed, attach a blank front cover. Use a TX 10 Torx screwdriver.



Note

Do not operate a MicroAutoBox III with an open housing. If you do not have a suitable front cover, contact dSPACE Support (www.dspace.com/go/supportrequest).

5 Attach the top plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.

Result

You installed a DS1552 Multi-I/O Module in a MicroAutoBox III.

DS1553 AC Motor Control Module

Where to go from here

Information in this section

How to Remove DS1553 AC Motor Control Modules

Objective

Removing the DS1553 AC Motor Control Module from the FPGA base board.

Required tools

The following tools are required:

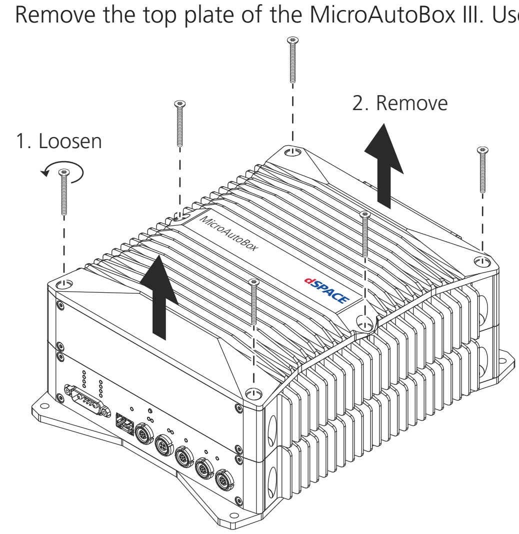
- TX 25 Torx screwdriver
- TX 10 Torx screwdriver

Method

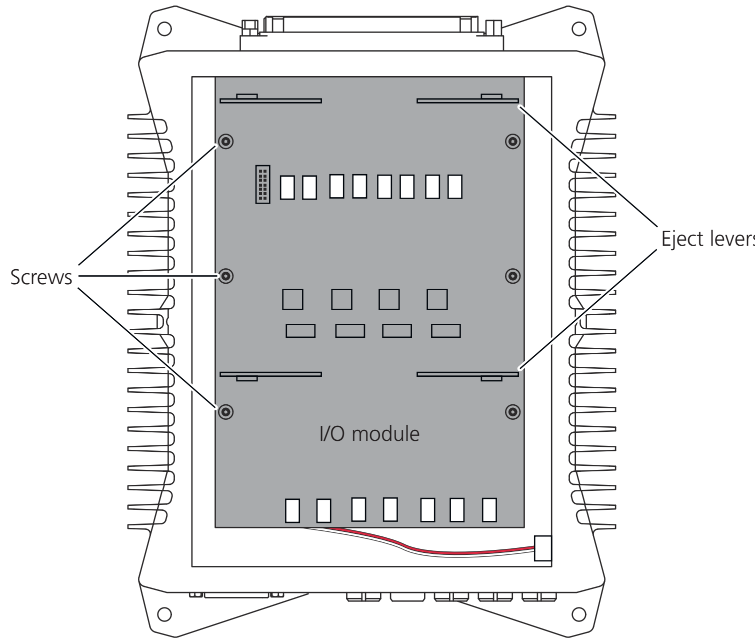
To remove the DS1553 AC Motor Control Module

1 Disconnect the MicroAutoBox III from the power supply and remove the cable harness.

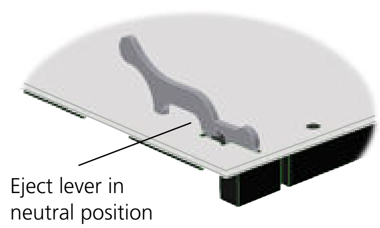
2 Remove the top plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.



3 Remove the six screws that attach the DS1553 as shown in the following illustration. Use a TX 10 Torx screwdriver.



4 Carefully pull up the eject levers, first on the one side and then on the other.



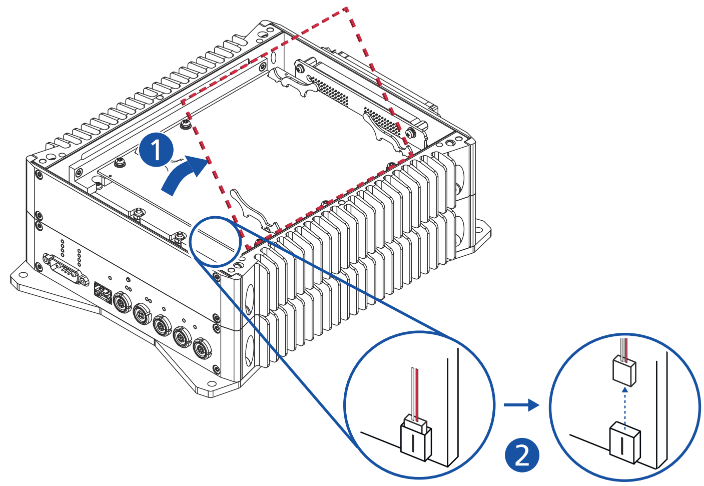
5 **NOTICE**

Risk of hardware damage

An internal power cable is connected to the bottom of the DS1553.

- Carefully remove the DS1553 without pulling the power cable.

6 Disconnect the power cable from the DS1553.



7 If you are planning to replace the DS1553 by another I/O module, remove the power cable from the DS1511/DS1513 Multi-I/O Board. The I/O board is installed underneath the DS1514 FPGA Base Board.

Result

You removed the DS1553 AC Motor Control Module.

Next step

You can now install an I/O module. Refer to one of the following topics:

- How to Install DS1552 Multi-I/O Modules on page 133.
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148.
- How to Install DS4340 FlexRay Interface Modules on page 161.
- How to Install DS4342 CAN FD Interface Modules on page 170.

How to Install DS1553 AC Motor Control Modules

Objective

Installing DS1553 AC Motor Control Modules on the FPGA base board.

Suitable I/O boards of the MicroAutoBox III

The DS1553 AC Motor Control Module can be installed only on the FPGA base board.

Required tools and material

The following tools and material are required:

- TX 25 Torx screwdriver
- TX 10 Torx screwdriver

- If the DS1553 AC Motor Control Module replaces another I/O module, the following material is required:
  - Additional power supply cable, delivered with the DS1553.
  - Replacing a DS1554 Engine Control I/O Module: A blank front cover

Preconditions

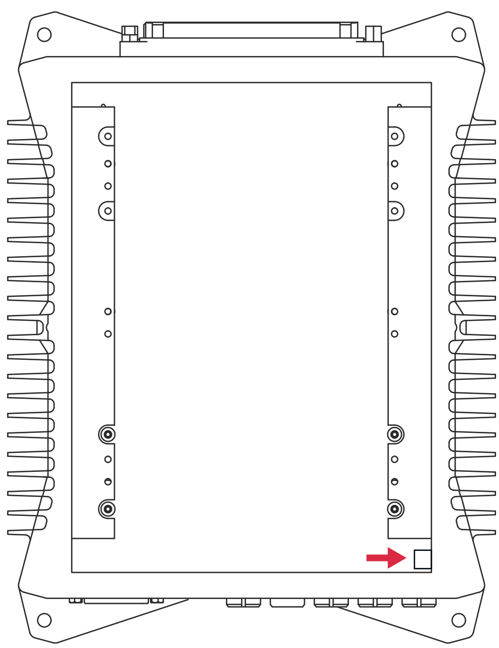
The following preconditions must be fulfilled:

- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The I/O module is removed from the FPGA base board. Refer to one of the following topics:
  - How to Remove DS1552 Multi-I/O Modules on page 131
  - How to Remove DS1553 AC Motor Control Modules on page 136
  - How to Remove DS1554 Engine Control I/O Modules on page 146
- The top plate of the MicroAutoBox III is removed.

Method

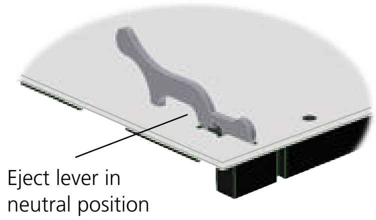
To install the DS1553 AC Motor Control Module

1 If the power cable is not already connected from removing the DS1553, connect the power cable of the DS1553 to the DS1511/DS1513 Multi-I/O Board. The I/O board is installed under the DS1514 FPGA Base Board.

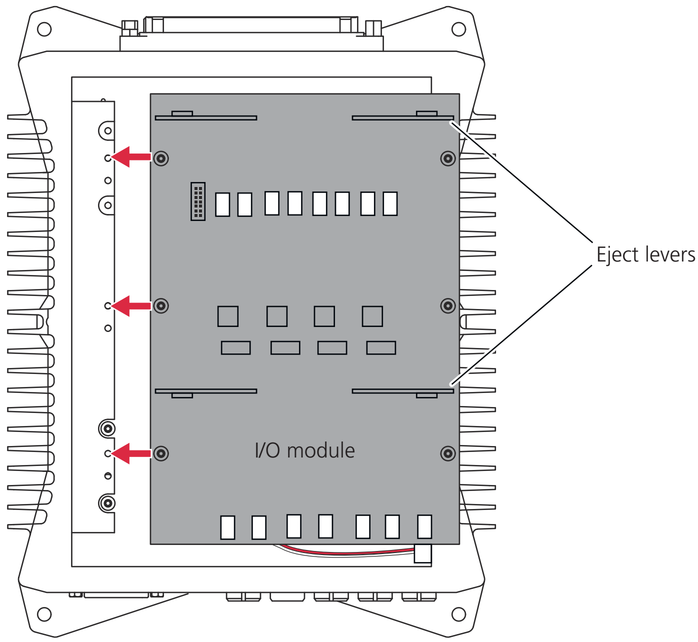


2 Connect the power cable to the DS1553.

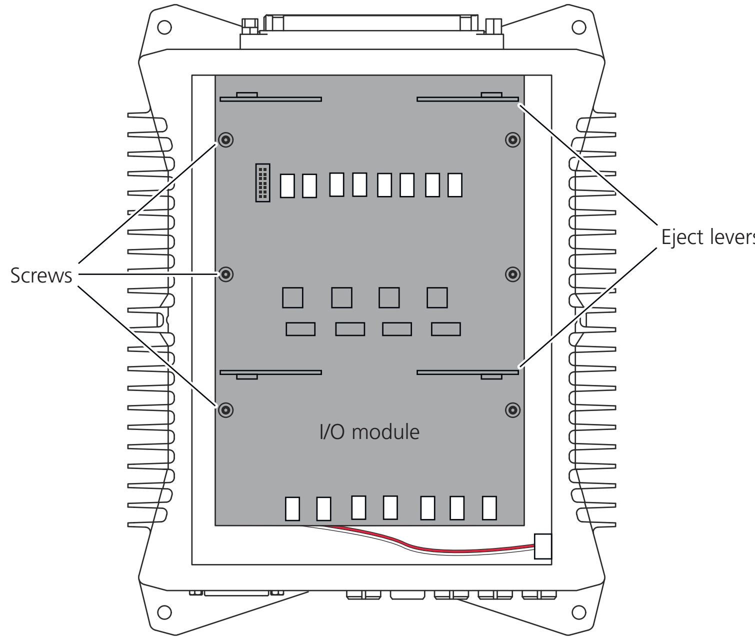
3 Make sure that the eject levers of the DS1553 are in the neutral position. Refer to the following illustration.



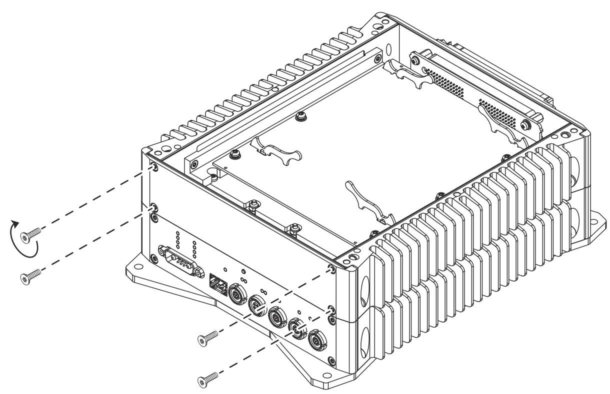
4 Align the drill holes of the DS1553 with those of the MicroAutoBox III housing and insert the DS1553 by pressing evenly on the six drill holes.



5 Tighten the six screws to attach the DS1553. Use a TX 10 Torx screwdriver.



6 If the upper front cover is removed, attach a blank front cover. Use a TX 10 Torx screwdriver.



Note

Do not operate a MicroAutoBox III with an open housing. If you do not have a suitable front cover, contact dSPACE Support (www.dspace.com/go/supportrequest).

7 Attach the top plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.

Result

You installed a DS1553 AC Motor Control Module in a MicroAutoBox III.

DS1554 Engine Control I/O Module

Where to go from here

Information in this section

Driving the Digital Out 7 Channels of the DS1554

Introduction

The DS1514 ZIF I/O connector provides a VDRIVE pin to supply the Digital Out 7 channel type of the DS1554 Engine Control I/O Module.

By connecting a voltage supply to the VDRIVE pin, you can adapt the logic level of the digital I/O circuits to the provided voltage level. The voltage supply can be a voltage supply of the DS1554 or an external voltage supply.

> **Note**
>
> The Digital In/Out 8, Digital In 9, and Digital In 10 channel types of the DS1554 Engine Control I/O Module are supplied by an internal voltage and not via the VDRIVE pin.

Voltages provided to supply VDRIVE

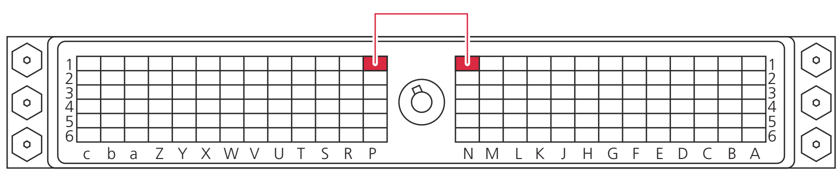
The DS1514 ZIF I/O connector provides an automotive-compatible voltage level and a 5 V voltage level to supply VDRIVE.

The following connections are relevant for driving the input/output circuits. The pins are located on the DS1514 ZIF I/O connector.

Signal	Pin	Description/ Function
VDRIVE	N1, M1	This input supplies the output circuits of the **Digital Out 7** channels. Do not connect this pin directly to VBAT, because the output circuits are not load-dump-protected or reverse-voltage-protected for this signal.
VBATprot	P1, R1	Protected VBAT output. VBATprot is switched on and off with the MicroAutoBox III.
VSENS+	b6	5 V sensor supply output. **Note** If you use VSENS+ to supply VDRIVE, you have to connect VSENS- to GND.
VSENS-	c6	

Providing automotive-compatible levels

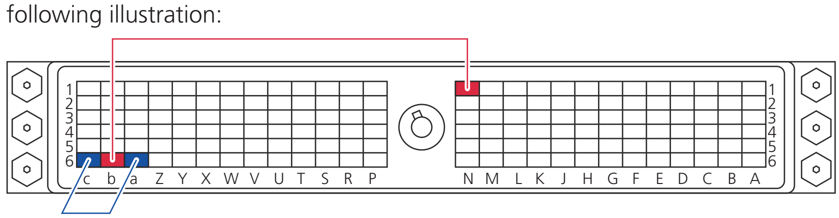
Connect the VBATprot pin P1 with the VDRIVE pin N1 to provide automotive-compatible voltage levels for the digital I/O interfaces. Refer to the following illustration:



A jumper cable with crimp contacts to supply the digital I/O interface is delivered with the MicroAutoBox III.

Providing 5 V logic levels

Connect the VSENS+ pin b6 with the VDRIVE pin N1 and the VSENS- pin c6 with GND to provide 5 V logic levels for the digital I/O interfaces. Refer to the following illustration:



Related topics

Basics

References

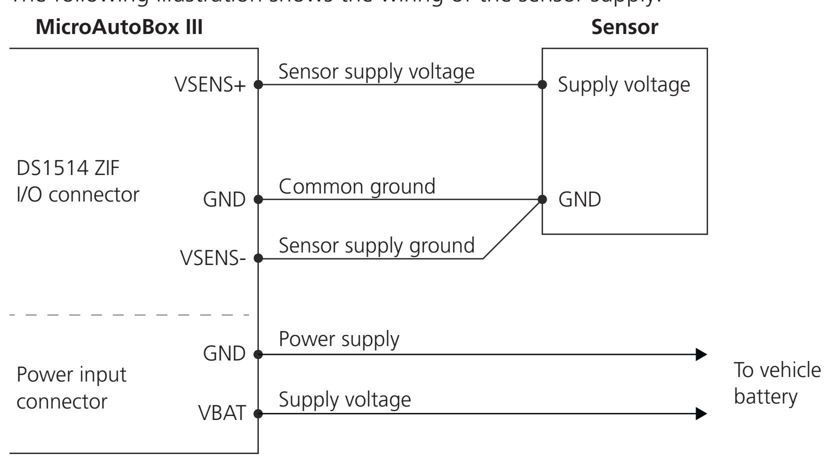
Connecting Sensors to the DS1554

Supplying the sensor

The DS1554 Engine Control I/O Module provides a 5 V sensor supply.

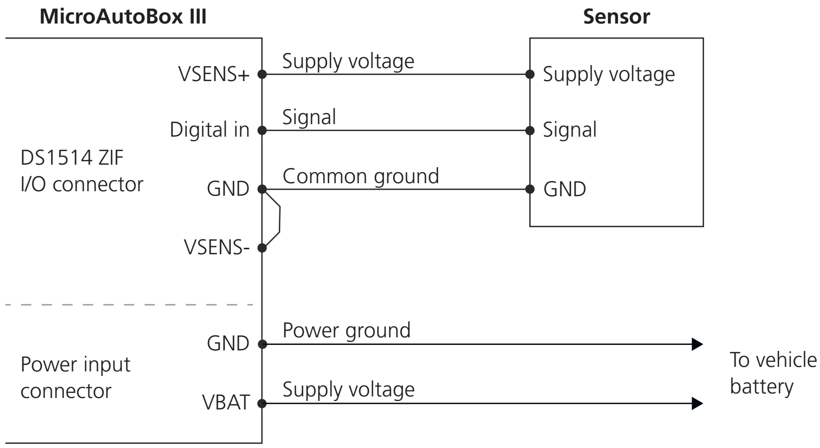
The sensor supply is galvanically isolated and provides an additional reference potential VSENS- to separate the sensor supply ground and the sensor ground. However, VSENS- must be connected to the sensor ground (GND). For best measurement results, VSENS- is connected to GND at the sensor.

The following illustration shows the wiring of the sensor supply.

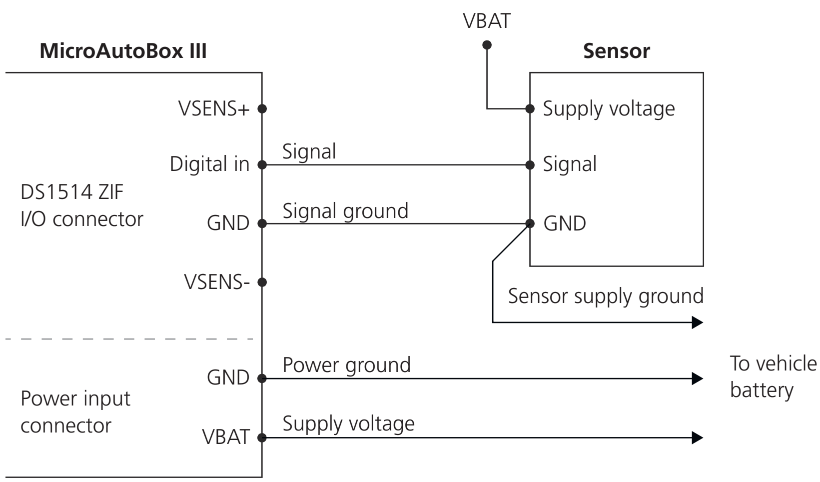


Grounding digital signals

The following example shows the grounding of a digital sensor that is supplied via VSENS.



The following example shows the grounding of a digital sensor that is supplied via VBAT.



Related topics

Basics

Workflow for Building the Cable Harness.......72

References

Digital In/Out 8 Characteristics.......459
DS1554 Sensor Supply Characteristics.......469

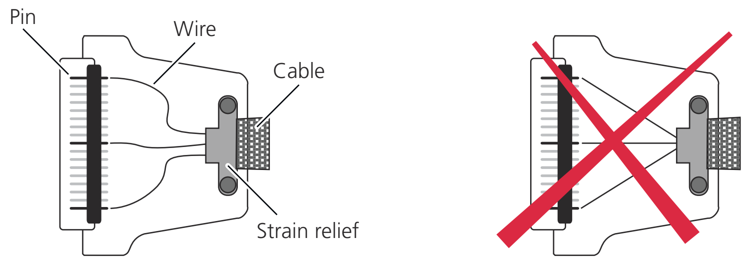
Using Sub-D Connectors

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.

How to Remove DS1554 Engine Control I/O Modules

Objective

Removing the DS1554 Engine Control I/O Module from the DS1514 FPGA Base Board.

Required tools

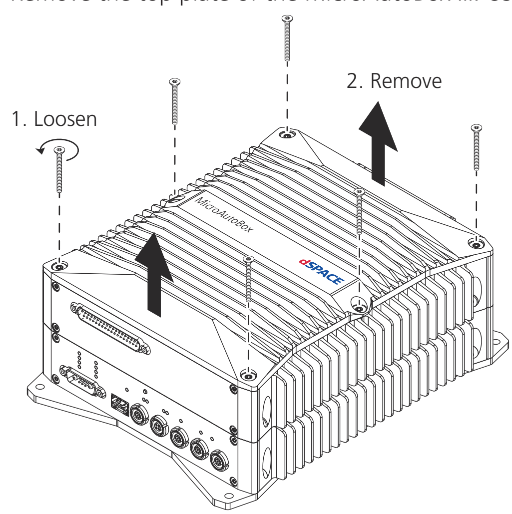
The following tools are required:
- TX 25 Torx screwdriver
- TX 10 Torx screwdriver
- 3/16 in. hex nut screwdriver

Method

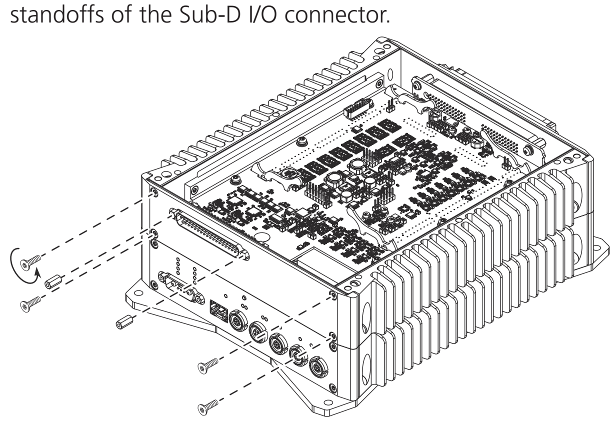
To remove a DS1554 Engine Control I/O Module

1 Disconnect the MicroAutoBox III from the power supply and remove the cable harness.

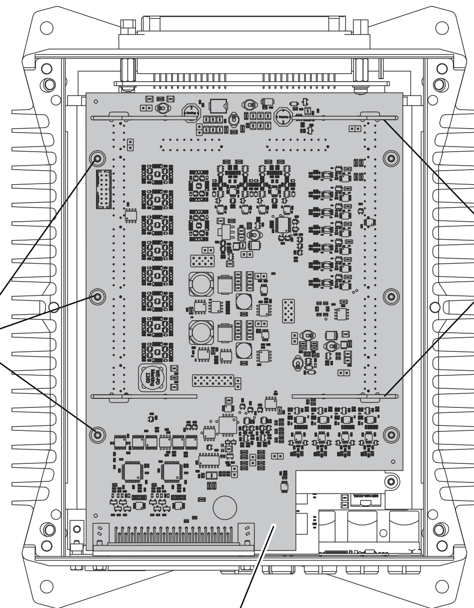
2 Remove the top plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.



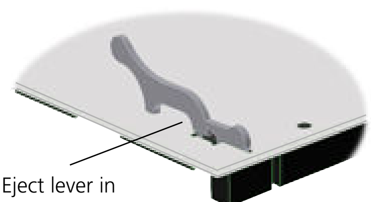
3 Remove the DS1554 panel with the Sub-D I/O connector. Use a TX 10 Torx screwdriver for the outer screws and a 3/16 in. hex nut screwdriver for the standoffs of the Sub-D I/O connector.



4 Remove the six screws that attach the DS1554 Engine Control I/O Module as shown in the following illustration. Depending on the screw, use a TX 10 Torx screwdriver.



5 Carefully pull up the eject levers, first on the one side and then on the other.



6 Remove the DS1554 Engine Control I/O Module.

Result

You removed the DS1554 Engine Control I/O Module.

Next step

You can now install an I/O module. Refer to one of the following topics:

- How to Install DS1552 Multi-I/O Modules on page 133.
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148.
- How to Install DS4340 FlexRay Interface Modules on page 161.
- How to Install DS4342 CAN FD Interface Modules on page 170.

How to Install the DS1554 Engine Control I/O Modules

Objective

Installing a DS1554 Engine Control I/O Module on the DS1514 FPGA Base Board.

Suitable I/O boards of the MicroAutoBox III

The DS1554 Engine Control I/O Module can be installed only on the DS1514 FPGA Base Board.

Required tools

The following tools are required:
- TX 25 Torx screwdriver
- TX 10 Torx screwdriver
- 3/16 in. hex nut screwdriver

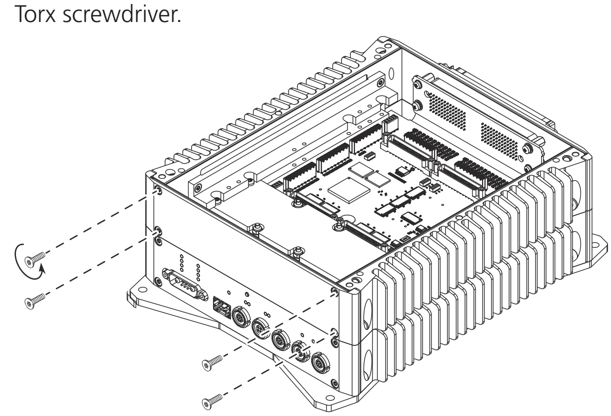
Preconditions

The following preconditions must be fulfilled:
- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The I/O module is removed from the FPGA base board. Refer to one of the following topics:
  - How to Remove DS1552 Multi-I/O Modules on page 131
  - How to Remove DS1553 AC Motor Control Modules on page 136
  - How to Remove DS1554 Engine Control I/O Modules on page 146
- The top plate of the MicroAutoBox III is removed.

Method

To install the DS1554 Engine Control I/O Module

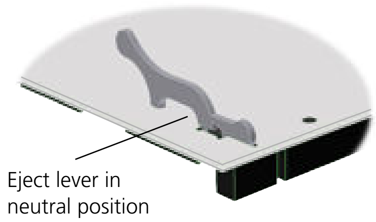
1 If the upper front cover is not removed, remove the front cover. Use a TX 25 Torx screwdriver.



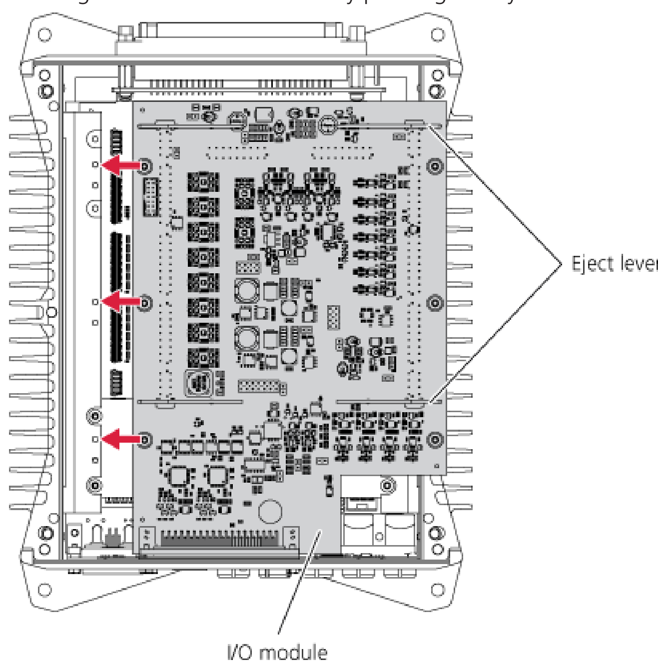
Note

Keep the front cover you just removed. If you want to remove the DS1554 again, you need the cover to close the housing of the MicroAutoBox III.

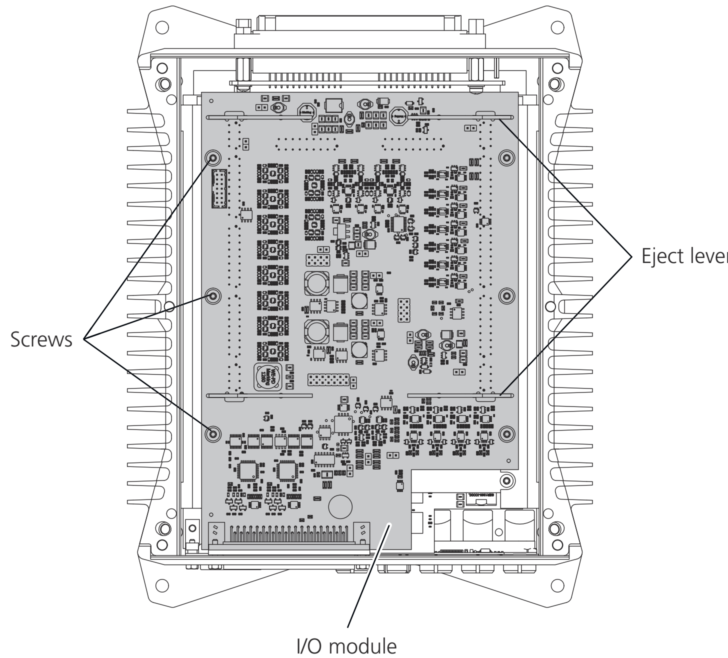
2 Make sure that the eject levers of the DS1554 are in the neutral position. Refer to the following illustration.



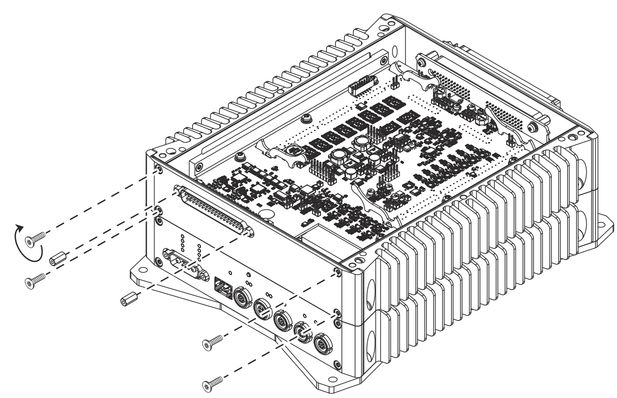
3 Align the drill holes of the DS1554 with those of the MicroAutoBox III housing and insert the DS1554 by pressing evenly on the six drill holes.



4 Tighten the six screws to attach the DS1554. Depending on the screw, use a TX 10 Torx screwdriver.



5 Attach the DS1554 panel with the Sub-D connector by tightening the relevant screws and UNC standoffs. Use a TX 25 Torx screwdriver for the outer screws and a 3/16 in. hex nut screwdriver for the standoffs of the I/O connector.



6 Attach the top plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.

Result

You installed a DS1554 Engine Control I/O Module in a MicroAutoBox III.

DS4340 FlexRay Interface Module

Where to go from here

Information in this section

Using Preconfigured FlexRay Interface Cables

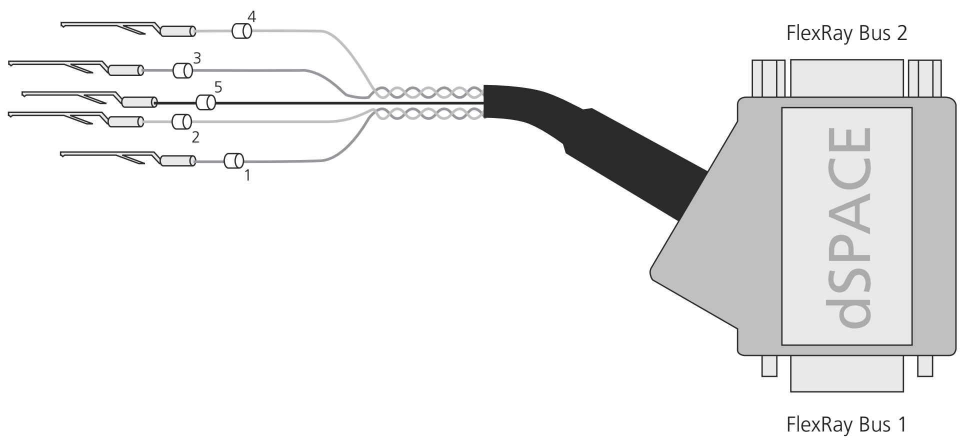
Introduction

The FR_CAB3 FlexRay interface cable can be used to connect FlexRay bus lines to DS4340 modules. The cable has two 9-pin Sub-D connectors for connection to the FlexRay bus lines.

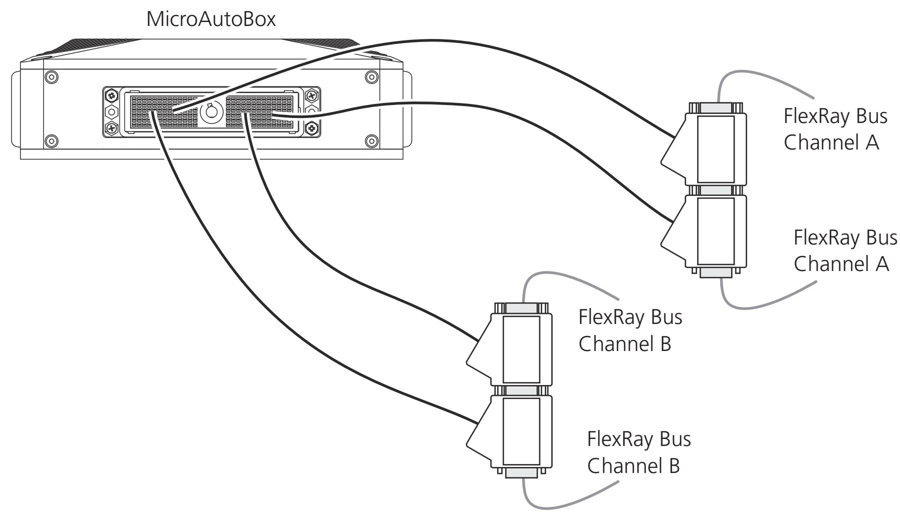
Features

The FR_CAB3 FlexRay interface cable provides the following features:

- Connecting one FlexRay channel (A or B) to the DS4340.
- Specially designed for the feed-through functionality of the DS4340.
- Female 9-pin Sub-D connector for FlexRay Bus 1 (connector for incoming bus lines).
- Male 9-pin Sub-D connector for FlexRay Bus 2 (connector for outgoing (feed-through) bus lines).
- Labeled wires with crimped contact plugs matching the ZIF I/O connector of a MicroAutoBox III.



The following illustration shows how to use the FlexRay interface cable. In this example, a DS1514 FPGA Base Board with two DS4340 modules is connected to a FlexRay bus. This requires four FlexRay interface cables because a cable can only connect one channel (A or B).



Connecting the cable to the DS4340

The FlexRay interface cable has crimped contact plugs matching the ZIF I/O connector of a MicroAutoBox III. The following table shows the assignments of the signals to the connectors of the FlexRay interface cable.

Label	Color	Signal	Female 9-Pin Sub-D Connector	Male 9-Pin Sub-D Connector
1	Pink	Channel X +[1)]	7	-
2	Green	Channel X -[1)]	2	-

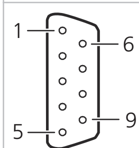
Label	Color	Signal	Female 9-Pin Sub-D Connector	Male 9-Pin Sub-D Connector
3	Pink	Channel X + FT[2)]	-	7
4	Green	Channel X - FT[2)]	-	2
5	Black	GND	3	3

[1)] The wires of + and - signals are twisted.
[2)] The feed-through wires are twisted.

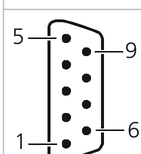
Connecting the cable to the FlexRay bus

Both Sub-D connectors are used for the FlexRay bus lines. The female Sub-D connector connects the incoming bus lines. The male Sub-D connector connects the outgoing (feed-through) bus lines. Pin 5 of both connectors is connected to the shielding of the connectors. Pins 1, 4, 6, 8, 9 of both connectors are connected to the pins with the same number.

The FlexRay bus 1 connector (female Sub-D connector) has the following pinout:

Connector	Pin	Signal	Pin	Signal
	1	Connected to pin 1 of male Sub-D connector		
	2	Channel X -	6	Connected to pin 6 of male Sub-D connector
	3	GND	7	Channel X +
	4	Connected to pin 4 of male Sub-D connector	8	Connected to pin 8 of male Sub-D connector
	5	Connected to shielding of connector	9	Connected to pin 9 of male Sub-D connector

The FlexRay bus 2 connector (male Sub-D connector) has the following pinout:

Connector	Pin	Signal	Pin	Signal
	5	Connected to shielding of connector		
	4	Connected to pin 4 of female Sub-D connector	9	Connected to pin 9 of female Sub-D connector
	3	GND	8	Connected to pin 8 of female Sub-D connector
	2	Channel X - FT	7	Channel X + FT
	1	Connected to pin 1 of female Sub-D connector	6	Connected to pin 6 of female Sub-D connector

Tip

If you want to build a linear FlexRay bus consisting of two or more FlexRay IP modules on one or more MicroAutoBox III units, connect the appropriate FlexRay channels of each module to their FlexRay interface cables. Then connect the interface cables with each other. You can install several FlexRay cables directly next to each other.

Related topics

Examples

Example of Connecting DS4340 to a FlexRay Bus........ 157

References

FR_CAB3 FlexRay Interface Cable for a MicroAutoBox II/III........ 521

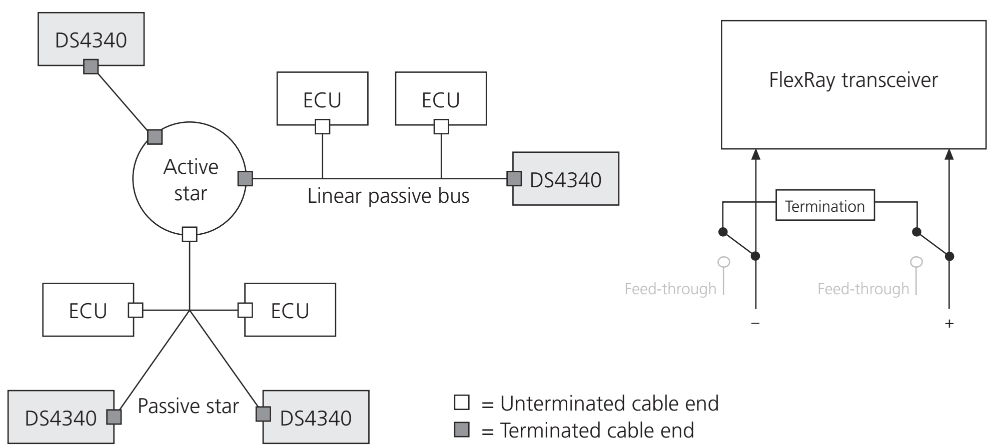
Using the DS4340 in Different Topologies

Introduction

The DS4340 FlexRay Interface Module can terminate the FlexRay bus, and feed-through pins can shorten the stub length. The termination and feed-through lines are activated via software.

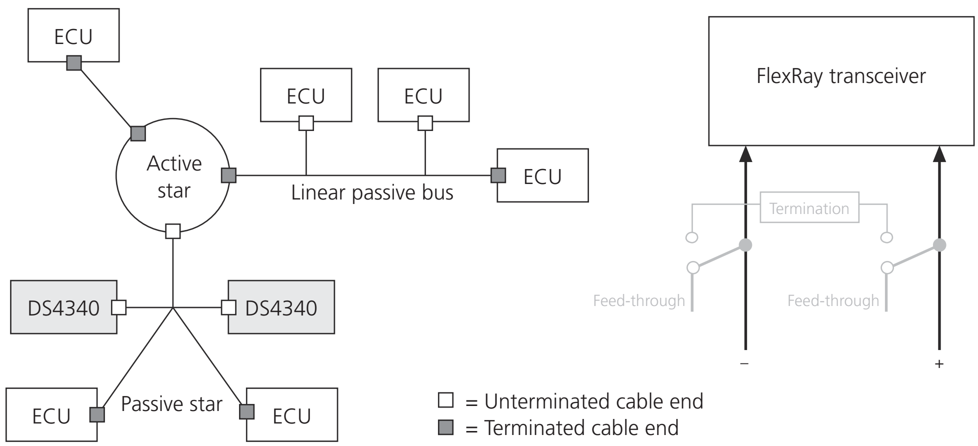
Terminated cable end without feed-through

If the DS4340 FlexRay Interface Module is connected at an end of the FlexRay bus, its bus lines must be terminated. The termination resistor is activated.



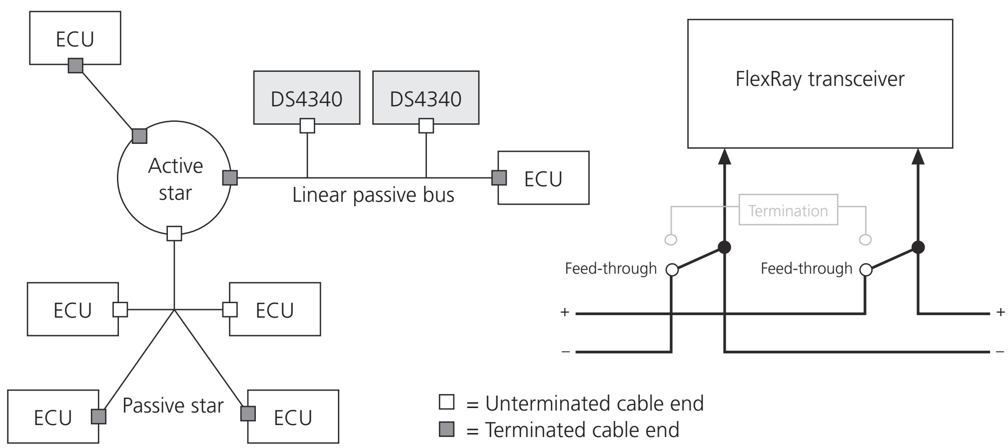
Unterminated cable end without feed-through

If the DS4340 FlexRay Interface Module is not connected at an end of the FlexRay bus, its bus lines must be unterminated. The termination resistor is deactivated.



Unterminated cable end with feed-through

If a DS4340 FlexRay Interface Module is connected at a linear passive bus, you can connect the feed-through bus lines to keep the stub length as short as possible. This improves the EMC robustness and FlexRay signal integrity, especially in a topology consisting of many nodes and long distances between the splices or ECUs.



Related topics

Basics

Configuring the Basic Functionality (FlexRay) (ConfigurationDesk I/O Function Implementation Guide 📖)

References

FlexRay 3 Characteristics..475

Example of Connecting DS4340 to a FlexRay Bus

Introduction

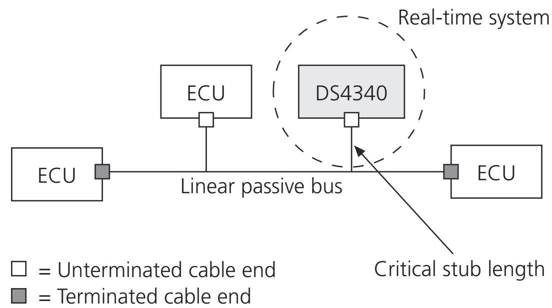
This example shows how one DS4340 FlexRay Interface Module installed on a DS1514 FPGA Base Board can be connected to a linear passive FlexRay bus. The DS4340 is not connected at the end of the FlexRay bus. The termination resistor is therefore not activated.

Note

To keep the stub length as short as possible, the feed-through bus lines are used.

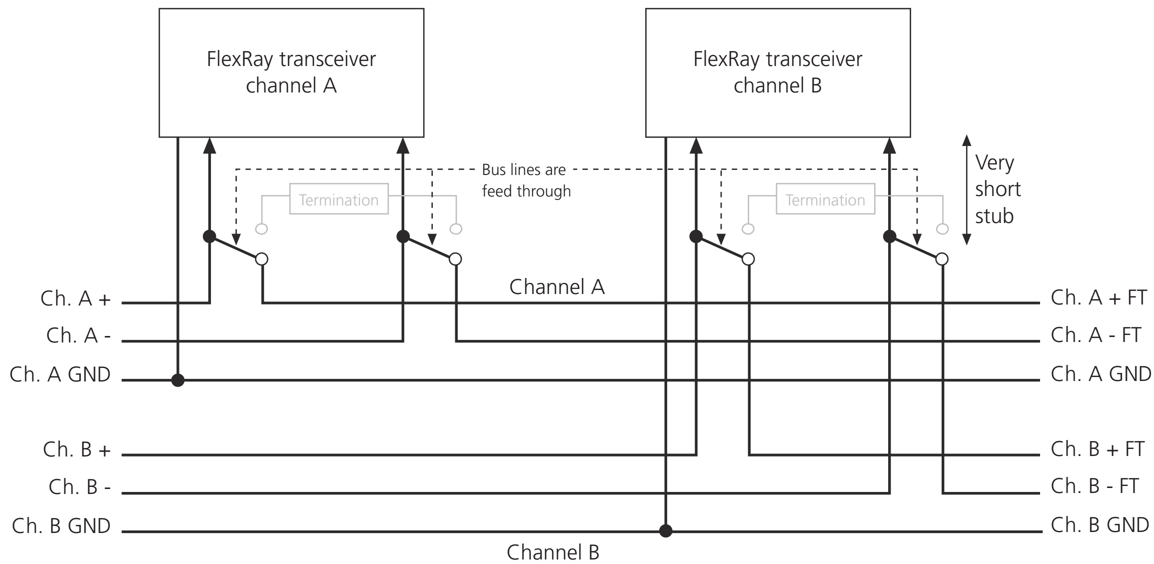
Topology

The following illustration shows the network that the DS4340 FlexRay Interface Module is connected to.



Circuit

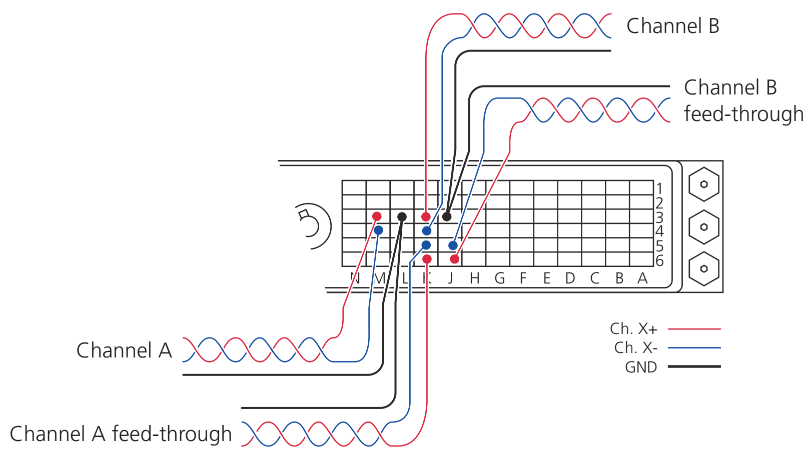
The following illustration shows the connection of the FlexRay bus lines plus and minus. The incoming bus lines are connected to the Channel X+ and Channel X- pins. The outgoing bus lines are connected to the feed-through pins Channel X+ FT and Channel X- FT. The incoming and outgoing bus lines are connected directly at the DS4340 module, which results in a very short stub length from the connection to the transceiver. The switch for the connection is set via software.



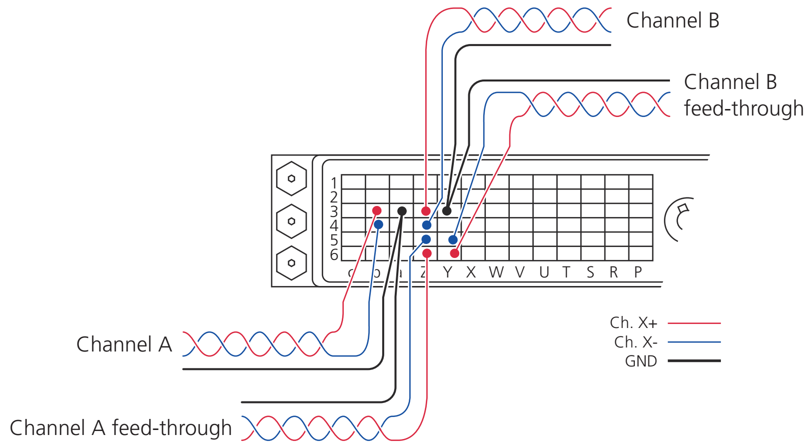
ZIF I/O connector

A MicroAutoBox III provides the FlexRay signals of the DS4340 on the DS1514 ZIF I/O connector.

DS4340 installed in slot 1 The following illustration shows a part of the ZIF I/O connector with the connected bus lines if the DS4340 is installed in slot 1.



DS4340 installed in slot 2 The following illustration shows a part of the ZIF I/O connector with the connected bus lines if the DS4340 is installed in slot 2.



FlexRay interface cable

If the FR_CAB3 FlexRay interface cable is used to connect the FlexRay bus lines to a MicroAutoBox III, two cables are required. One cable is used for Channel A, another cable is used for Channel B. The pins of the I/O connector to be connected depend on the slot in which the DS4340 module is installed.

DS4340 installed in slot 1 The following table shows the pins of Channel A if the DS4340 module is installed in slot 1.

Cable	Signal	Pin Label	Pin at DS1514 ZIF I/O Connector
First cable	FlexRay 3-1 Ch. A+	1	M3
	FlexRay 3-1 Ch. A-	2	M4
	FlexRay 3-1 Ch. A+ FT	3	K6
	FlexRay 3-1 Ch. A- FT	4	K5
	FlexRay 3-1 Ch. A GND	5	L3

The following table shows the pins of Channel B.

Cable	Signal	Pin Label	Pin at DS1514 ZIF I/O Connector
Second cable	FlexRay 3-1 Ch. B+	1	K3
	FlexRay 3-1 Ch. B-	2	K4
	FlexRay 3-1 Ch. B+ FT	3	J6
	FlexRay 3-1 Ch. B- FT	4	J5
	FlexRay 3-1 Ch. B GND	5	J3

DS4340 installed in slot 2 The following table shows the pins of Channel A if the DS4340 module is installed in slot 2.

Cable	Signal	Pin Label	Pin at DS1514 ZIF I/O Connector
First cable	FlexRay 3-2 Ch. A+	1	b3
	FlexRay 3-2 Ch. A-	2	b4
	FlexRay 3-2 Ch. A+ FT	3	Z6
	FlexRay 3-2 Ch. A- FT	4	Z5
	FlexRay 3-2 Ch. A GND	5	a3

The following table shows the pins of Channel B.

Cable	Signal	Pin Label	Pin at DS1514 ZIF I/O Connector
Second cable	FlexRay 3-2 Ch. B+	1	Z3
	FlexRay 3-2 Ch. B-	2	Z4
	FlexRay 3-2 Ch. B+ FT	3	Y6
	FlexRay 3-2 Ch. B- FT	4	Y5
	FlexRay 3-2 Ch. B GND	5	Y3

The incoming and outgoing FlexRay bus lines must be connected to the Sub-D connector of the FR_CAB3 FlexRay interface cable.

Related topics

Basics

Configuring the Basic Functionality (FlexRay) (ConfigurationDesk I/O Function Implementation Guide 📖)
Using Preconfigured FlexRay Interface Cables........ 152

References

DS1514 ZIF I/O Connector Pinout (DS4340)........ 473
FlexRay 3 Characteristics........ 475
FR_CAB3 FlexRay Interface Cable for a MicroAutoBox II/III........ 521

How to Install DS4340 FlexRay Interface Modules

Objective	Installing a DS4340 FlexRay Interface Module on the DS1514 FPGA Base Board.
Suitable I/O boards of the MicroAutoBox III	The DS4340 FlexRay Interface Module can be installed only on the DS1514 FPGA Base Board.

Required tools and material

The following tools and material are required:
- PH0 Phillips screwdriver.
- 4 x M2 Phillips screws and washers.
  The screws and washers are delivered with the DS4340.

Preconditions

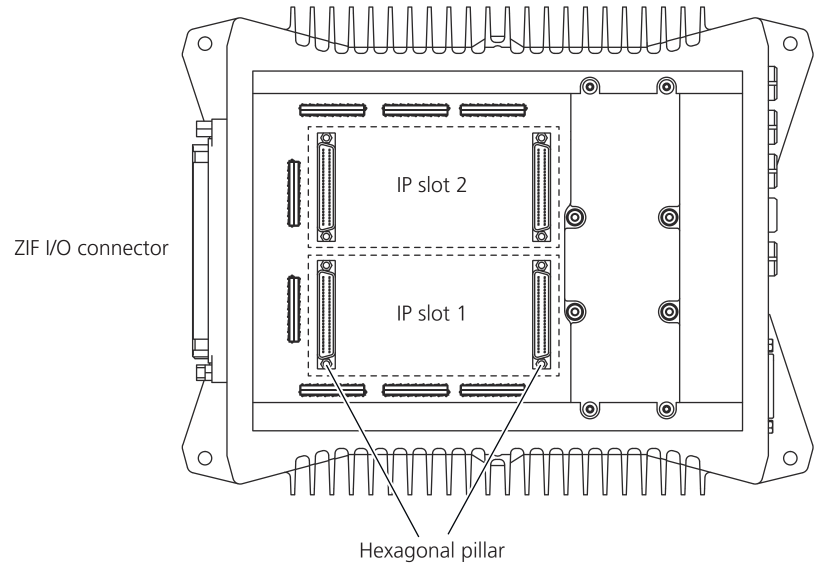
The following preconditions must be fulfilled:
- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The I/O module is removed from the FPGA base board. Refer to one of the following topics:
  - How to Remove DS1552 Multi-I/O Modules on page 131
  - How to Remove DS1553 AC Motor Control Modules on page 136
  - How to Remove DS1554 Engine Control I/O Modules on page 146
- The top plate of the MicroAutoBox III is removed.

Method

To install a DS4340 FlexRay Interface Module

1. Check the connectors at the bottom of the DS4340 and on the DS1514 FPGA Base Board to identify the correct installation position.

The following illustration shows the IP slots on the DS1514 FPGA Base Board:



2 Plug the DS4340 into the DS1514 FPGA Base Board.

3 Attach the DS4340 to the hexagonal pillars with four M2 Phillips screws and washers. Use a PH0 Phillips screwdriver.

4 Install the DS155<x> I/O module again. Refer to one of the following topics:
- How to Install DS1552 Multi-I/O Modules on page 133
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148

Result

You installed the DS4340 FlexRay Interface Module in a MicroAutoBox III.

How to Remove DS4340 FlexRay Interface Modules

Objective

Removing the DS4340 FlexRay Interface Module from a MicroAutoBox III.

Required tools

A PH0 Phillips screwdriver is required.

Preconditions

The following preconditions must be fulfilled:
- The I/O module is removed from the FPGA base board. Refer to one of the following topics:
  - How to Remove DS1552 Multi-I/O Modules on page 131
  - How to Remove DS1553 AC Motor Control Modules on page 136
  - How to Remove DS1554 Engine Control I/O Modules on page 146

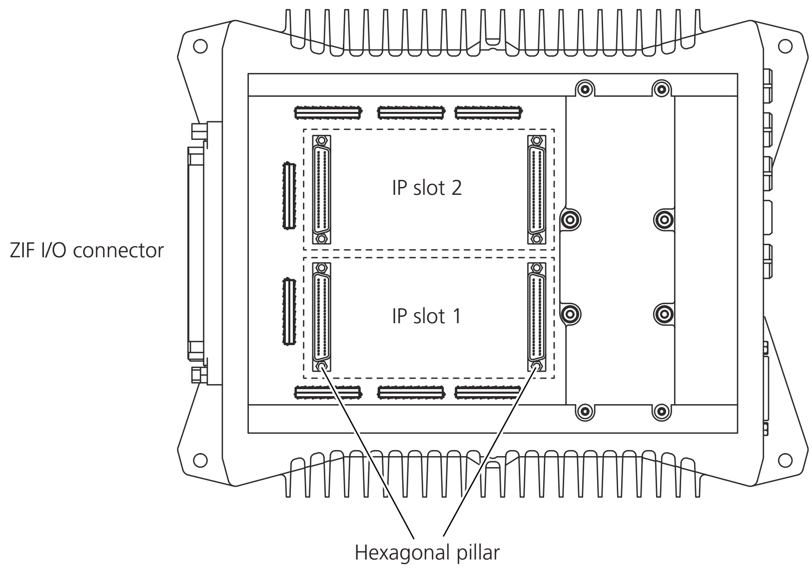
- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The top plate of the MicroAutoBox III is removed.

Method

To remove the DS4340 FlexRay Interface Module

1 Remove the four M2 Phillips screws and washers that attach the DS4340 to the hexagonal pillars of the DS1514 FPGA Base Board. Use a PH0 Phillips screwdriver.

The following illustration shows the slots in which the DS4340 can be installed:



2 Remove the DS4340.

Result

You removed the DS4340 FlexRay Interface Module from the MicroAutoBox III.

Next step

You can now install an I/O module. Refer to one of the following topics:

- How to Install DS1552 Multi-I/O Modules on page 133.
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148.
- How to Install DS4340 FlexRay Interface Modules on page 161.
- How to Install DS4342 CAN FD Interface Modules on page 170.

DS4342 CAN FD Interface Module

Where to go from here

Information in this section

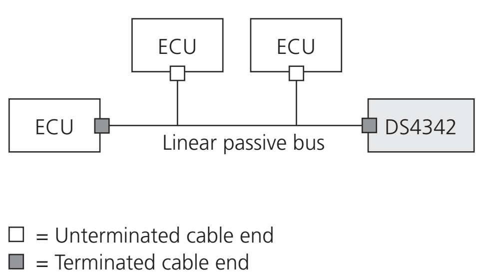
Using Termination and Feed-through lines with the DS4342

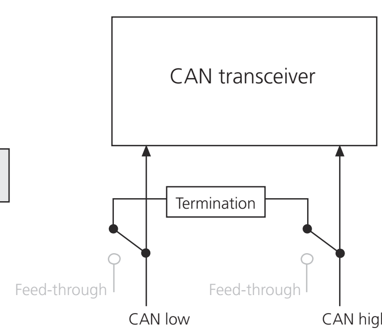
Introduction

The DS4342 CAN FD Interface Module can terminate the CAN bus, and feed-through pins can shorten the stub length. The termination and feed-through lines are activated via software.

Terminated cable end without feed-through

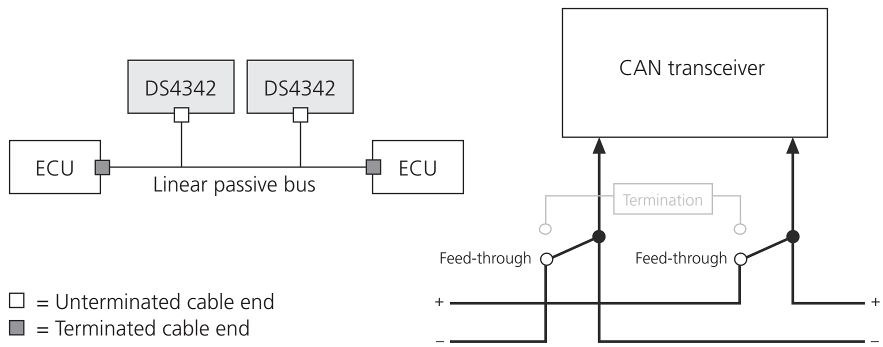
If the DS4342 is connected at an end of the CAN bus, its bus lines must be terminated. The termination resistor is activated via software.





Unterminated cable end with feed-through

If a DS4342 is connected at a linear passive bus, you can connect the feed-through bus lines to keep the stub length as short as possible. This improves the EMC robustness and bus signal integrity, especially in a topology consisting of many nodes and long distances between the splices or ECUs.



Related topics

Basics

Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide 📖)

References

CAN 5 Characteristics..482

Example of Connecting DS4342 to a CAN Bus

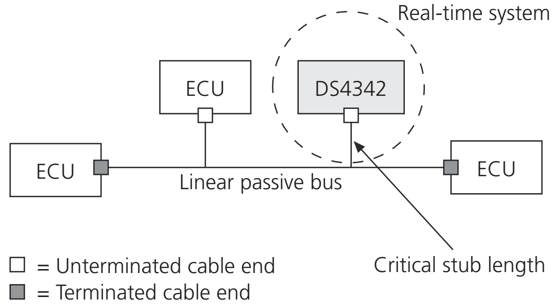
Introduction

This example shows how one DS4342 CAN FD Interface Module can be connected to a linear CAN bus. The DS4342 I/O module is not connected at the end of the bus. The termination resistor is therefore not activated.

> **Note**
>
> To keep the stub length as short as possible, the feed-through bus lines are used.

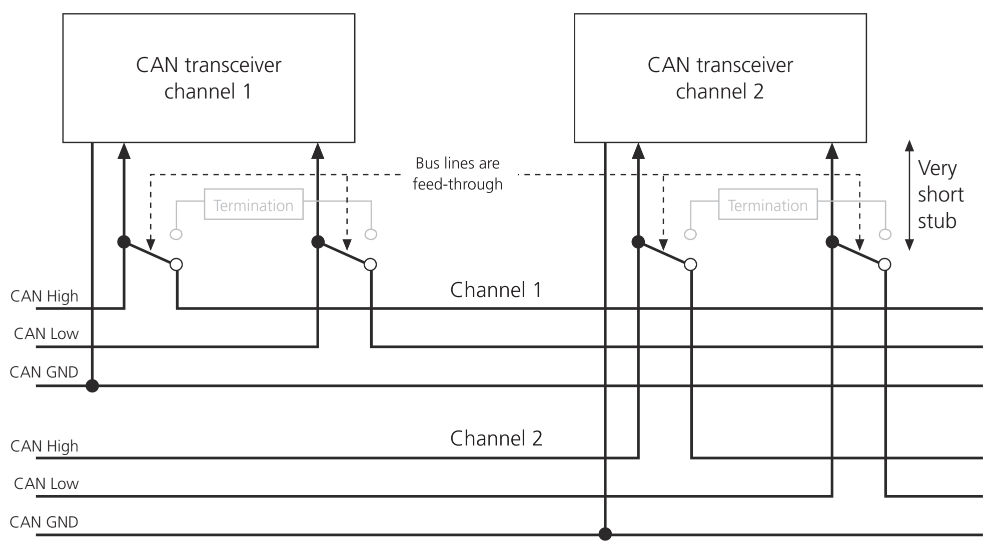
Topology

The following illustration shows the network that the DS4342 CAN FD Interface Module is connected to.



Circuit

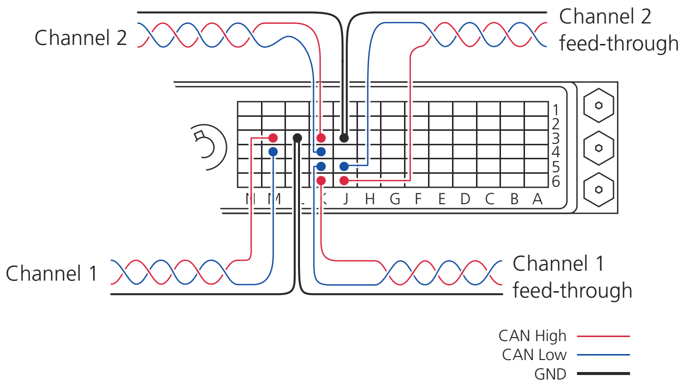
The following illustration shows the connection of the CAN high bus lines and CAN low bus lines. The incoming bus lines are connected to the CAN 5 Ch. 1 High and CAN 5 Ch. 1 Low pins (CAN 5 Ch. 2 High and CAN 5 Ch. 2 Low, respectively). The outgoing bus lines are connected to the feed-through pins CAN 5 Ch. 1 High FT and CAN 5 Ch. 1 Low FT (CAN 5 Ch. 2 High FT and CAN 5 Ch. 2 Low FT, respectively). The incoming and outgoing bus lines are connected directly on the DS4342 I/O module, which results in a very short stub length from the connection to the transceiver. The switch for the connection is set via software.



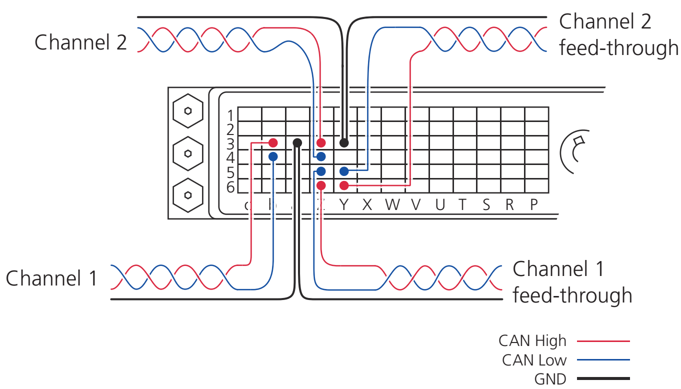
ZIF I/O connector

A MicroAutoBox III provides the CAN signals of the DS4342 CAN FD Interface Module on the DS1514 ZIF I/O connector.

DS4342 installed in slot 1 The following illustration shows a part of the ZIF I/O connector with the connected bus lines if the DS4342 is installed in slot 1.



DS4342 installed in slot 2 The following illustration shows a part of the ZIF I/O connector with the connected bus lines if the DS4342 is installed in slot 2.



Related topics

Basics

Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide 📖)

References

CAN 5 Characteristics 482
DS1514 ZIF I/O Connector Pinout (DS4342) 480

How to Support CAN Wake-up Requests with the DS4342

Objective Enabling a CAN transceiver to support the wake-up functionality.

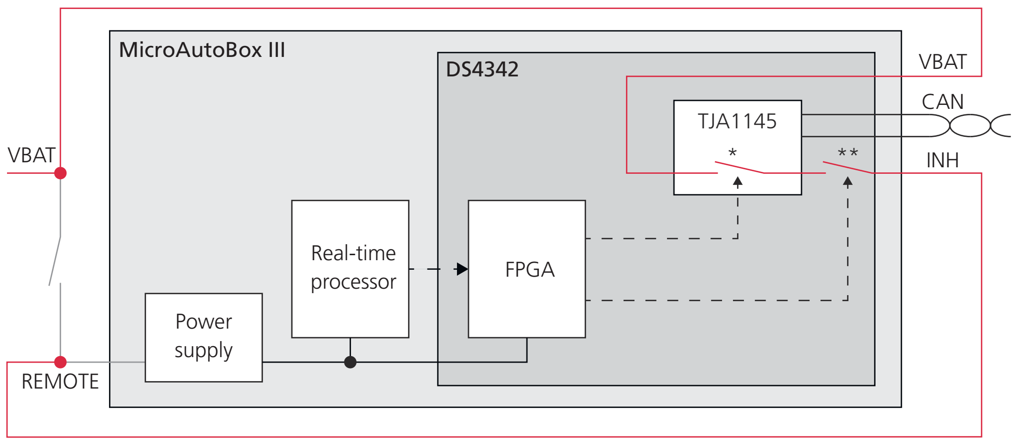
Basics on the wake-up functionality

For basics on the wake-up functionality, refer to Powering Features on page 36.

Preconditions

The following preconditions must be fulfilled:

- To use the wake-up functionality with the DS4342 CAN FD Interface Module, the Inhibit pin of the CAN transceiver must be connected to the REMOTE pin of the MicroAutoBox III. The REMOTE pin must be disconnected from VBAT while the MicroAutoBox III is in the standby mode. For wiring, refer to the following schematic.



* Switchable via 'Low-power mode' property in ConfigurationDesk
** Switchable via 'Power wake-up' property in ConfigurationDesk

- A real-time application that configures the used bus transceiver as follows:
  - It enables the power wake-up for the used transceiver.

    For more information, refer to Configuring the Basic Functionality (CAN) (ConfigurationDesk I/O Function Implementation Guide 📖).
  - It activates the test automation support for the **Mode** function port.

    For more information, refer to Configuring Test Automation Support (ConfigurationDesk I/O Function Implementation Guide 📖).
- You can change the value of the **Mode** function port with your experiment software, for example, with ControlDesk.
- The real-time application must be loaded to the flash memory and configured for the automatic start process.

  For checking the autostart status, refer to FLASH Page on page 227.

Method

To support CAN wake-up requests

1. Switch on the MicroAutoBox III.

   The real-time application starts and configures the transceiver.
2. Change the transceiver mode to the sleep mode with your experiment software, for example, with ControlDesk.

3 Switch off the MicroAutoBox III via the REMOTE pin, but do not disconnect VBAT.

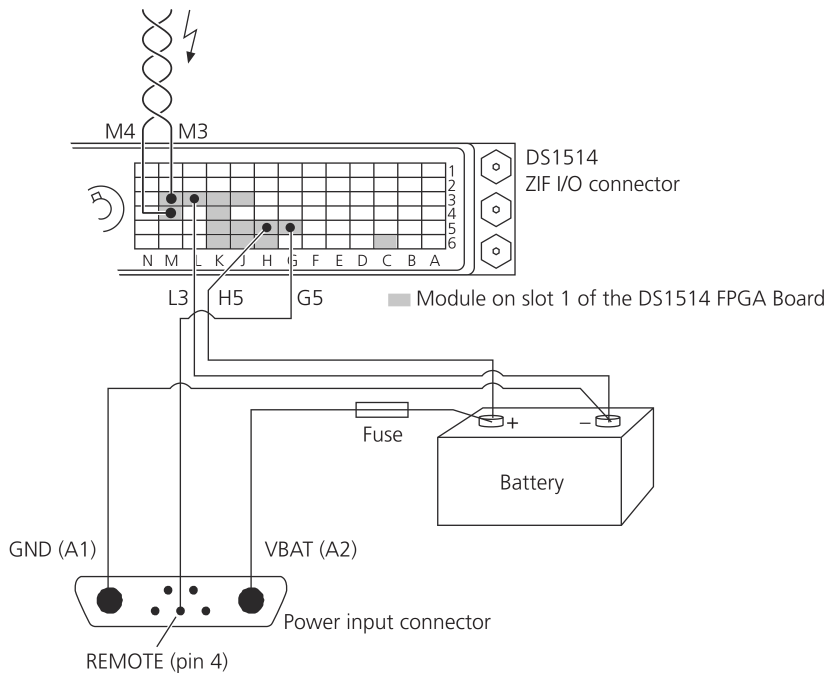
Result

When the transceiver detects a wake-up message, the MicroAutoBox III changes the operating mode from standby to normal operating - application runs.

To switch-off the MicroAutoBox III, it is recommended that the real-time application uses the **System shutdown** function block to switch off the MicroAutoBox III. Refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide 📖).

Wiring example

The following example shows a MicroAutoBox III that is connected to a CAN bus. In this examples, CAN channel 1 of the DS4342 module on slot 1 is used for waking up. The INH1_1 inhibit signal (pin G5) is connected to the REMOTE pin.



For proper wiring, refer to Workflow and Notes on Building the Cable Harness on page 72.

Related topics

Basics

Power On Signal In (ConfigurationDesk I/O Function Implementation Guide 📖)

References

CAN 5 Characteristics......482
DS1514 ZIF I/O Connector Pinout (DS4342)......480
Power Input Connector Pinout......265

How to Install DS4342 CAN FD Interface Modules

Objective

Installing a DS4342 CAN FD Interface Module on the DS1514 FPGA Base Board.

Suitable I/O boards

The DS4342 CAN FD Interface Module can be installed only to the DS1514 FPGA Base Board.

Required tools and material

The following tools and material are required:

- PH0 Phillips screwdriver.
- 4 x M2 Phillips screws and washers.
  The screws and washers are delivered with the DS4342.

Preconditions

The following preconditions must be fulfilled:

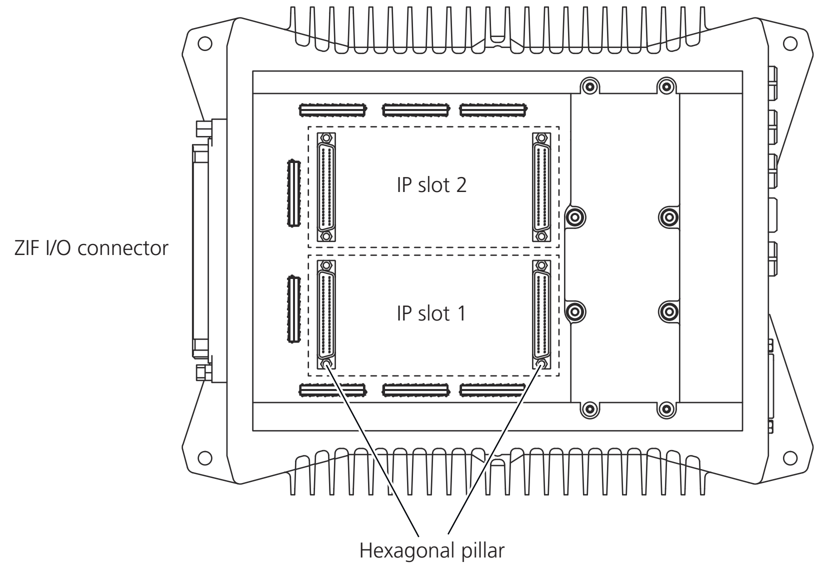
- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The I/O module is removed from the FPGA base board. Refer to one of the following topics:
  - How to Remove DS1552 Multi-I/O Modules on page 131
  - How to Remove DS1553 AC Motor Control Modules on page 136
  - How to Remove DS1554 Engine Control I/O Modules on page 146
- The top plate of the MicroAutoBox III is removed.

Method

To install a DS4342 CAN FD Interface Module

1 Check the connectors at the bottom of the DS4340 and on the DS1514 FPGA Base Board to identify the correct installation position.

The following illustration shows the IP slots on the DS1514 FPGA Base Board:



2 Plug the DS4342 into an IP slot of the DS1514 FPGA Base Board.

3 Attach the DS4342 to the hexagonal pillars with four M2 Phillips screws and washers. Use a PH0 Phillips screwdriver.

4 Install the DS155<x> I/O module again. Refer to one of the following topics:
- How to Install DS1552 Multi-I/O Modules on page 133
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148

Result

You installed the DS4342 CAN FD Interface Module in a MicroAutoBox III.

How to Remove DS4342 CAN FD Interface Modules

Objective

Removing the DS4342 CAN FD Interface Module from a MicroAutoBox III.

Required tools

A PH0 Phillips screwdriver is required.

Preconditions

The following preconditions must be fulfilled:
- No I/O module is installed. For uninstalling the I/O module, refer to How to Remove DS1552 Multi-I/O Modules on page 131 or How to Remove DS1554 Engine Control I/O Modules on page 146.

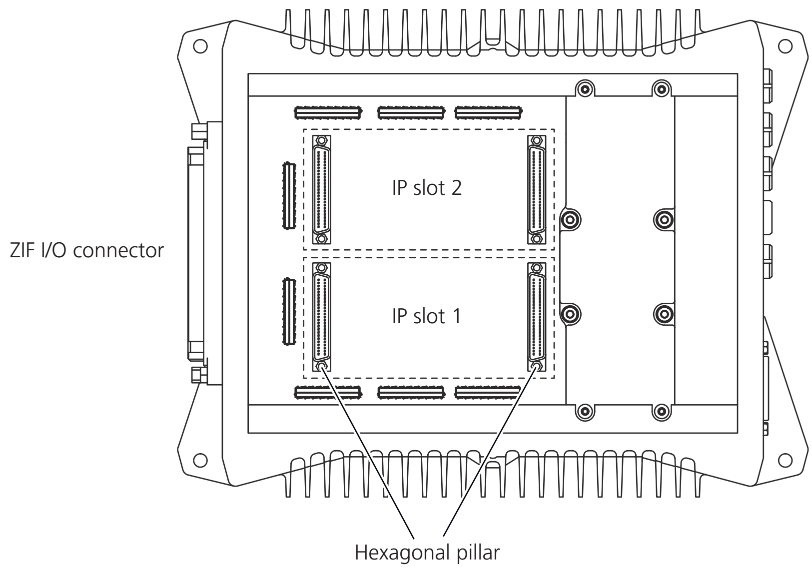
- The MicroAutoBox III is disconnected from the power supply and the cable harness is removed.
- The top plate of the MicroAutoBox III is removed.

Method

To remove the DS4342 CAN FD Interface Module

1 Remove the four M2 Phillips screws and washers that attach the DS4342 to the hexagonal pillars of the DS1514 FPGA Base Board. Use a PH0 Phillips screwdriver.

The following illustration shows the slots in which the DS4342 can be inserted:



2 Remove the DS4342.

Result

You removed the DS4342 CAN FD Interface Module from a MicroAutoBox III.

Next step

You can now install an I/O module. Refer to one of the following topics:

- How to Install DS1552 Multi-I/O Modules on page 133.
- How to Install DS1553 AC Motor Control Modules on page 138
- How to Install the DS1554 Engine Control I/O Modules on page 148.
- How to Install DS4340 FlexRay Interface Modules on page 161.
- How to Install DS4342 CAN FD Interface Modules on page 170.

Using the MicroAutoBox III in a Vehicle

Where to go from here

Information in this section

Workflow to Install the MicroAutoBox III in a Vehicle

Avoiding personal injury and hardware damage

⚠ **WARNING**

Disconnecting the vehicle battery can result in serious injury or death

Even a brief disconnection of the battery during engine operation can cause the vehicle generator to generate hazardous voltages of more than 100 V (load dump).

- Turn off the vehicle engine before connecting or disconnecting the vehicle battery.

⚠ CAUTION

Short circuit between cables connected to the vehicle battery/power supply can lead to electric arcs or fire

If a short circuit occurs, e.g., in the cable harness, the current of the vehicle battery (power supply) generates heat in the connected cables. The heat might cause a fire. Batteries always supply high currents if a short circuit occurs.

- Insert fuses into the power supply cable and other cables that are connected to the battery/power supply to avoid an electrical fire.
- Locate the fuses close to the battery/power supply.
- Choose fuse ratings that ensure that the fuses break the circuit if the connected cables are loaded with the maximum currents supported by the cross sections of the cables used.
- Make sure that you use flame-retardant cables specified for temperatures up to 105 °C (220 °F) that were tested in conformity with IEC 60332-1-2, IEC 60332-2-2, or UL VW-1.
- Make sure that you use flame-retardant connectors specified for temperatures up to 105 °C (220 °F) and V-2 classified in conformity with IEC 60695-11-10 or UL 94.

⚠ CAUTION

Risk of electric shock due to power cables with open ends

Using a power supply cable with non-insulated ends can lead to an electric shock when connecting the MicroAutoBox III to an energized power supply.

The connection of the cable is comparable to switch bouncing. The bouncing, the inrush current, the inductivity of the cable, and the input circuit of the MicroAutoBox III can lead to a hazardous voltage.

- Make sure that the power supply is voltage-free before connecting the MicroAutoBox III.

  If you use a vehicle battery, make sure that the disconnect switch is open. For more information on the disconnect switch, refer to Connecting a vehicle battery on page 85.

⚠ CAUTION

Supply voltages above the operating level can result in personal injury or hardware damage

High voltages can lead to electric shock or damage the MicroAutoBox III.

- Do not use voltage levels above the maximum operating voltage. The operating voltage is printed on the type label at the bottom of the MicroAutoBox III.

⚠ CAUTION

Connected components can cause fire

The MicroAutoBox III provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. This particularly concerns the VSENS, VBATprot, and the USB ports pins.

- To prevent a fire, apply the general fire safety regulations, e.g., supervise the operation, remove fire loads, and use fire-proof materials and enclosures.

Workflow for in-vehicle installation

Proceed the following steps to install the MicroAutoBox III in a vehicle.

1. Build the cable harness for the external devices. Refer to Workflow for Building the Cable Harness on page 72 and Board-Specific and Module-Specific Installation Instructions on page 97.
2. Check the cable harness and the wiring for correctness. Correct failures in the wiring.
3. Build the power supply cable. Refer to Building the Power Supply Cable on page 84.
4. Turn off the vehicle engine and disconnect the vehicle battery.
5. Install the cable harness with the power supply cable.
6. Mount the MicroAutoBox III to the vehicle. Refer to How to Install a MicroAutoBox III in a Vehicle on page 176.
7. Connect the MicroAutoBox III and the external devices to the cable harness.
8. Connect the vehicle battery.

Related topics

Basics

How to Install a MicroAutoBox III in a Vehicle

Safety precaution

Comply with the following safety precaution for the MicroAutoBox III (WLAN) that provids connectors for radio signals.

NOTICE

Risk of material damage due to mechanical shock

Protruding connectors that are exposed to mechanical shock can be damaged and lose their functionality.

- Handle protruding connectors with care.

Clearances and installation positions

It is recommended to install the MicroAutoBox III in a horizontal position with the bolt holes at the bottom. The recommended installation position is relevant for heat distribution in order to achieve good heat dissipation.

For the cable harness, observe enough clearances from the front and rear panels to walls, other devices, and objects.

MicroAutoBox III with Cooling Unit The MicroAutoBox III with built-in Cooling Unit must be installed in a horizontal position with the bolt holes at the bottom.

Air circulation

Take care for a sufficient air circulation to ensure an adequate heat dissipation, especially when operating the MicroAutoBox III at high temperatures. Remove all objects that prevent the air circulation with the cooling fins of the MicroAutoBox III.

If you use a MicroAutoBox III with Cooling Unit or Embedded PC, make sure that there is also enough clearances from the front and rear panels to walls, other devices, and objects for the internal fans.

Required tools and material

The following tools and material are required:

- 4 x bolts that ensure a secure hold under the loads expected to be caused by shock and vibration. M5 is recommended.
- Drilling tools and tools to create threads, such as thread taps.
- Cleaning material.

Method

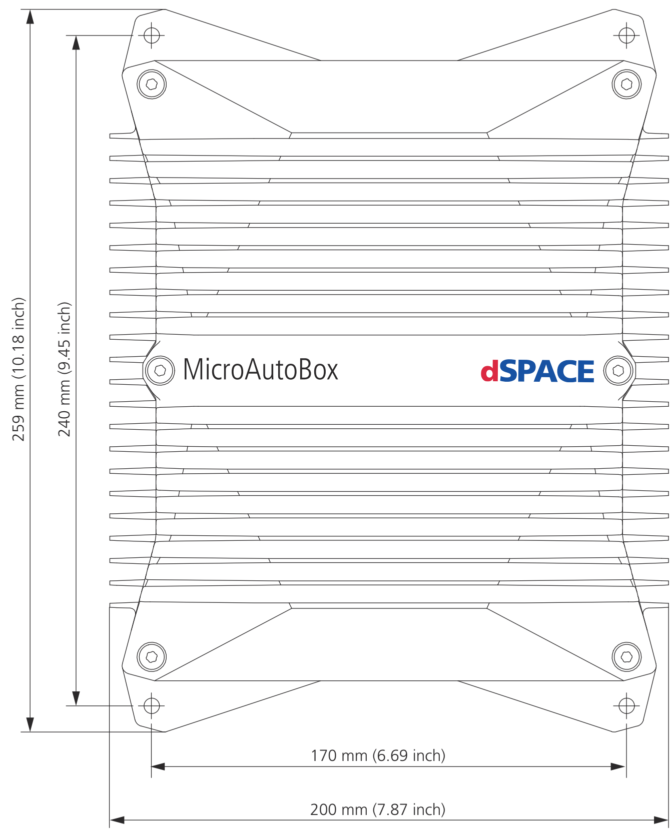
To install a MicroAutoBox III in a vehicle

1 Determine the installation location. Observe the following conditions for the surface and the environment:
   - The surface must be flat and clean.
   - The surface must be suitable for thread cutting.

- The surface must provide a secure hold.
- The environment must be clean and dry (pollution degree 2, according to IEC IEC 61010-1).

2 Use the following illustration to determine the positions of the bolts.

> **Note**
>
> The illustration is not to scale.



3 Drill the four holes and cut four threads. M5 is recommended. Use four bolts to attach the MicroAutoBox III to the vehicle.

4 Attach the MicroAutoBox III.

Result

You installed the MicroAutoBox III.

Advanced Configuration Features

Where to go from here

Information in this section

Configuring the I/O Ethernet Communication

Where to go from here

Information in this section

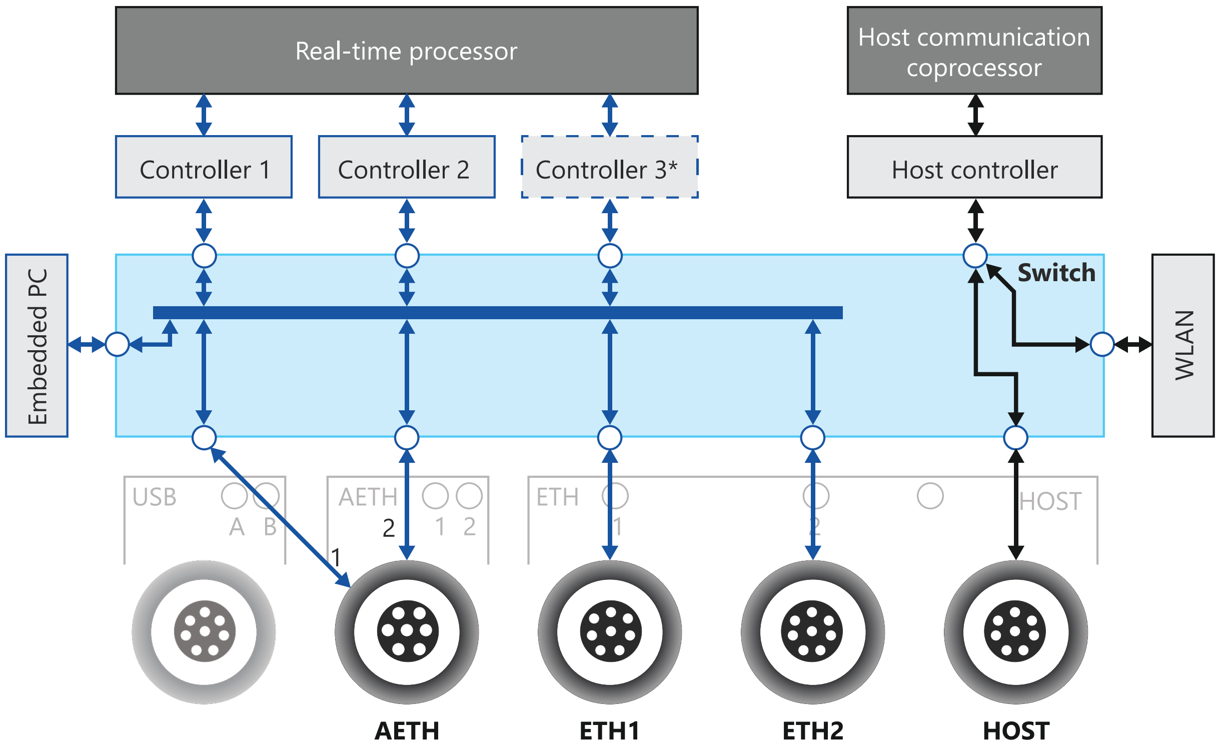
Basics on the Internal Ethernet Switch

Introduction

The internal Ethernet switch is configurable to support different use cases, for example, to separate the host communication and the I/O Ethernet communication.

Internal Ethernet components of the DS1403

The DS1403 Processor Board provides two Ethernet controllers for I/O Ethernet communication and one host controller for the communication with the host PC.



* Controller for fast bypassing. Enabled via web interface.　　Bidirectional　　Unidirectional

Configuring the Ethernet interfaces You can configure the Ethernet switch ports and the PHYs of the Ethernet ports via the web interface, the Platform Manager in ConfigurationDesk/ControlDesk, and optionally via the real-time application. The table below contrasts the features of the configuration via web interface and via the real-time application.

Ethernet Switch Configuration		
Via Web Interface	**Via Platform Manager**	**Via Real-Time Application**
Lets you select predefined Ethernet configurations for specific use cases.		Lets you configure the Ethernet traffic routing based on the Ethernet switch ports or VLANs.
Individual configuration of the physical layer (PHY) of the ETH/AETH ports.		
The selected configuration takes effect in the following operation states: ▪ No real-time application is running. ▪ A real-time application is running, but the application does not provide an Ethernet switch configuration.		The specified configuration takes effect while the real-time application is running.

Related topics

Basics

HowTos

References

How to Configure the Internal Ethernet Switch

Objective

Configuring the Ethernet connections between the Ethernet controllers and the ports.

Possible methods

Use one of the following methods:

- Select a predefined Ethernet configuration via the web interface as described below. This configuration takes effect if no real-time application is running or the running real-time application does not provide a configuration.
- Select a predefined Ethernet configuration via the Platform Manager. This configuration takes effect if no real-time application is running or the running real-time application does not provide a configuration. Refer to How to Configure Internal Ethernet Switches (ConfigurationDesk Real-Time Implementation Guide 📖).
- Configure the internal Ethernet switch via a real-time application. This configuration is used as long as the real-time application is running. Refer to Ethernet Switch (ConfigurationDesk I/O Function Implementation Guide 📖).

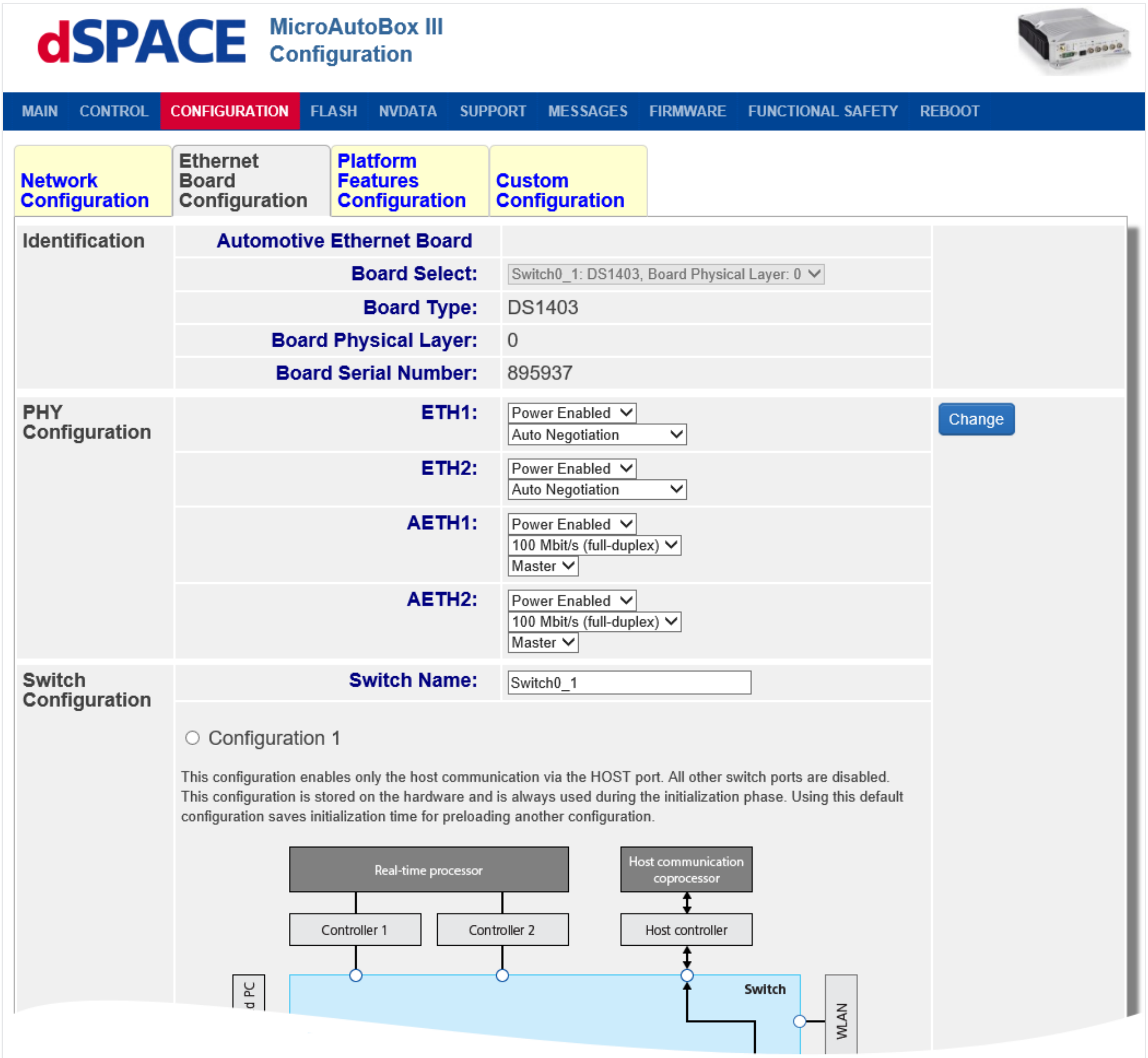
Method

To configure the internal Ethernet switch via the web interface

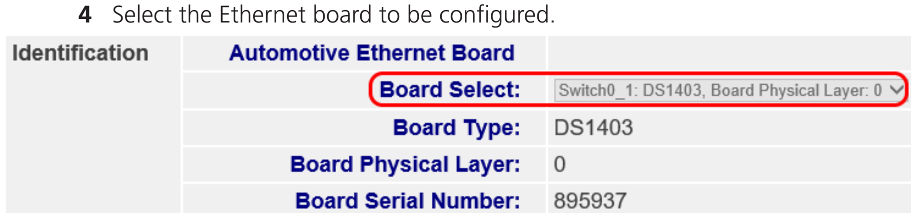
1. Open the web interface. For instructions, refer to How to Open the Web Interface on page 58.
2. Perform the following steps to stop and unload running real-time applications:
   - Click CONTROL to open the MicroAutoBox III Application Control page.
   - If a real-time application is loaded, click Unload and confirm the unloading.

     If no real-time application is loaded, Unload is not available.

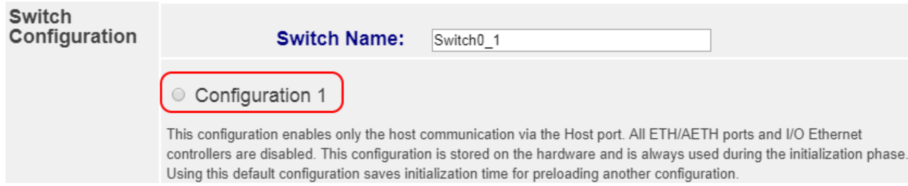
3 Open the CONFIGURATION - Ethernet Board Configuration page.



4 Select the Ethernet board to be configured.



5 Select a predefined Ethernet switch configuration, such as Configuration 1.



Note

Limited data transfer capacity for configurations with monitoring channels

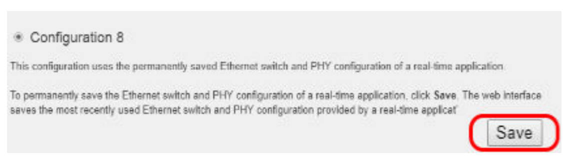
A high data throughput at the Ethernet ports can lead to data loss on the unidirectional monitoring channel. However, the data flow through the monitored ports is not affected.

For example: The monitoring of the transmit and receive data lines in full duplex mode via an unidirectional monitoring channel can exceed the maximum data rate of 1 GBit/s.

6 To save the most recently used Ethernet switch and PHY configuration of a real-time application, observe the following steps:

- Make sure that the MicroAutoBox III has not been restarted since the last use of the real-time application.

  The last used configuration of the real-time application is temporarily saved and not available if you switch off the MicroAutoBox III.
- Click Save.



  The web interface permanently saves the Ethernet switch and PHY configuration of the real-time application.

7 Click Change to change the Ethernet switch setting.

8 Open the MicroAutoBox III System Reboot page and click Restart.

The new configuration becomes active after you restart the MicroAutoBox III.

Result

You selected a predefined Ethernet switch configuration for the MicroAutoBox III that will be used each time the MicroAutoBox III is switched on.

However, if a real-time application is running with its own Ethernet switch configuration, the configuration of the real-time application is used while the application is running.

Related topics

Basics

References

How to Configure I/O Ethernet Ports

Objective

Configuring the physical layer (PHY) of the ETH/AETH ports, such as the data rate.

Possible methods

Use one of the following methods:

- Configure the I/O Ethernet ports via the web interface as described below. This configuration takes effect if no real-time application is running or the running real-time application does not provide a configuration.
- Configure the I/O Ethernet ports via the Platform Manager. This configuration takes effect if no real-time application is running or the running real-time application does not provide a configuration. Refer to How to Configure I/O Ethernet Ports (ConfigurationDesk Real-Time Implementation Guide 🕮).
- Configure the I/O Ethernet ports via a real-time application. This configuration is used as long as the real-time application is running. Refer to Ethernet Switch (ConfigurationDesk I/O Function Implementation Guide 🕮).

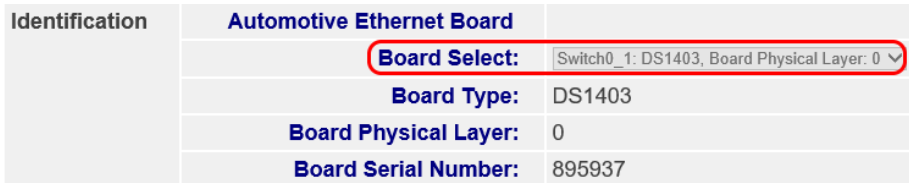
Method

To configure the I/O Ethernet ports

1. Open the web interface. Refer to How to Open the Web Interface on page 58.
2. Perform the following steps to stop and unload running real-time applications:
   - Click CONTROL to open the MicroAutoBox III Application Control page.
   - If a real-time application is loaded, click Unload and confirm the unloading.

     If no real-time application is loaded, Unload is not available.
3. Open the CONFIGURATION - Ethernet Switch Configuration page.

4 Select the Ethernet board to be configured.



5 Select the PHY configuration for the ETH and AETH ports:
- Enable/disable the PHY of the port.
  Power enabled enables the PHY of the port, Power Disabled disables the PHY of the port.
- Enable the autonegotiation mode to automatically detect the data rate and duplex mode, or select a data rate and duplex mode.
- Set the PHY of each AETH port to master or slave.
  To establish a link between two automotive Ethernet ports, one PHY must be the master, the other the slave.

6 Click Change.

7 Open the MicroAutoBox III System Reboot page and click Restart.
The new configuration becomes active after you restart the MicroAutoBox III.

Result

You configured the physical layer of the I/O Ethernet ports.

However, if a real-time application is running with its own physical layer configuration, the configuration of the real-time application is used while the application is running.

Related topics

Basics

Basics on the Internal Ethernet Switch........180

References

CONFIGURATION - Ethernet Board Configuration Page........215

How to Improve ECU Interfacing

Objective

Activating an Ethernet controller that is optimized for fast bypassing.

Limitation

The activated Ethernet controller can be used only for fast bypassing.

Method

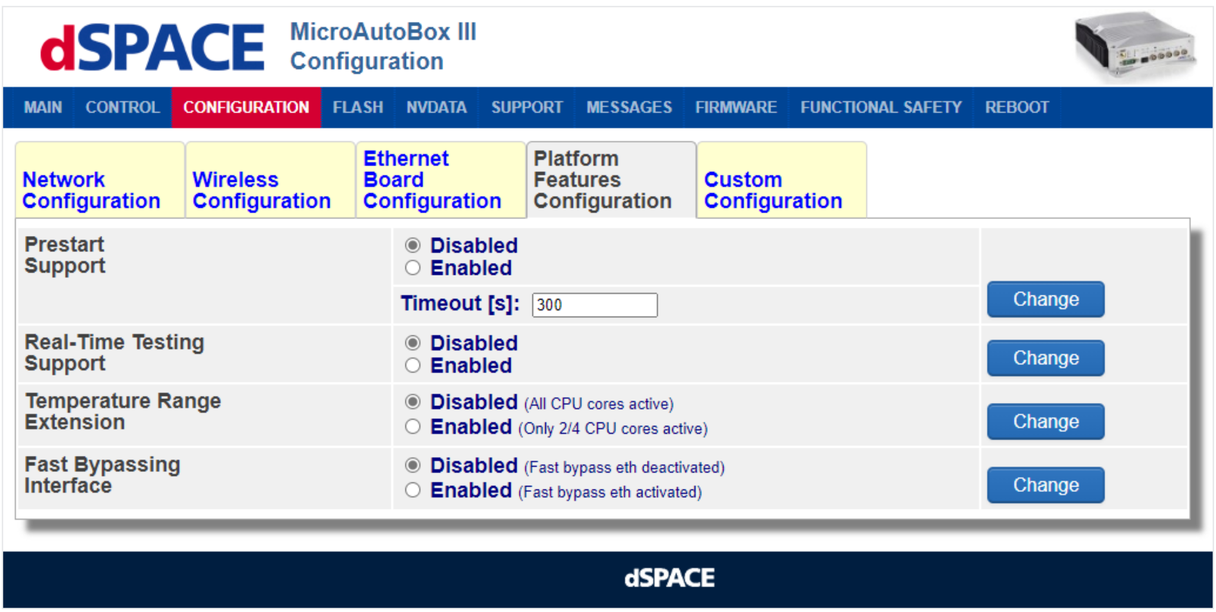
To improve ECU interfacing

1 Open the web interface. For instructions, refer to How to Open the Web Interface on page 58.

2 Perform the following steps to stop and unload running real-time applications:
- Click CONTROL to open the MicroAutoBox III Application Control page.
- If a real-time application is loaded, click Unload and confirm the unloading.

  If no real-time application is loaded, Unload is not available.

3 Open the CONFIGURATION - Platform Features Configuration page.



4 Enable the Fast Bypassing Interface.

  If enabled, the third Ethernet controller of the DS1403 Processor Board is activated.

5 Click Change.

6 Open the MicroAutoBox III System Reboot page and click Restart.

  The new configuration becomes active after you restart the MicroAutoBox III.

Result

You activated the Ethernet controller for fast bypassing.

Related topics

Basics

RCP Use Cases (ECU Interfacing Overview 🕮)

Operating the MicroAutoBox III at High Temperatures

How to Extend the Operating Temperature

Objective

Extending the maximum operating temperature from 70 °C (158 °F) to 80 °C (176 °F) without using a MicroAutoBox III Cooling Unit.

Basic information

You can decrease the power dissipation of the processor board to support a maximum operating temperature of 80 °C (176 °F).

Limitations

The following limitations apply:

- Multicore applications that use more than two cores are not supported.
- The DS1521 Bus Board supports the extended temperature range only with a built-in MicroAutoBox III Cooling Unit.
- The following hardware components never supports the extended temperature range.

Hardware Component	Supported Temperature Range
WLAN Module (MicroAutoBox III (WLAN))	-40 °C ... +70 °C (-40 °F ... +158 °F)
MicroAutoBox III Embedded PC	0 °C ... +60 °C (+32 °F ... +140 °F)
DS1553 AC Motor Control Module	0 °C … +70 °C (+32 °F … +158 °F)

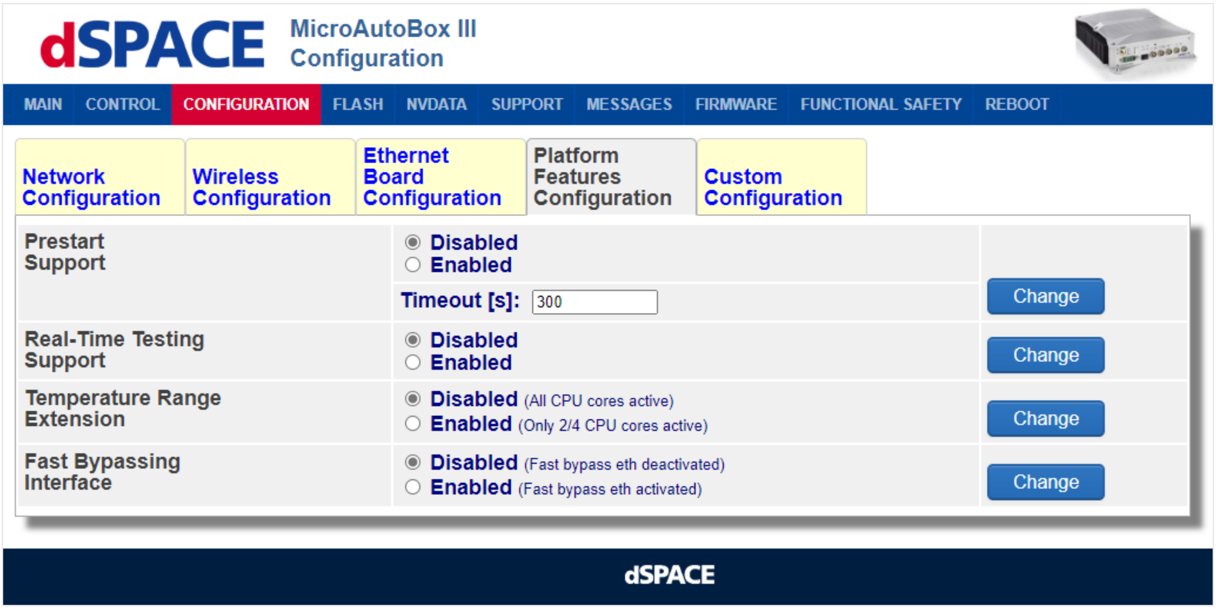
Method

To extend the operating temperature

1. Open the web interface. Refer to How to Open the Web Interface on page 58.
2. Perform the following steps to stop and unload running real-time applications:
   - Click CONTROL to open the MicroAutoBox III Application Control page.
   - If a real-time application is loaded, click Unload and confirm the unloading.

     If no real-time application is loaded, Unload is not available.

3 Open the CONFIGURATION - Platform Features Configuration page.



4 Enable the Temperature Range Extension.

If enabled, the DS1403 Processor Board uses only 2 of 4 processor cores to decrease the power consumption.

5 Click Change.

6 Open the MicroAutoBox III System Reboot page and click Restart.

The new configuration becomes active after you restart the MicroAutoBox III.

Result

You extended the operating temperature of the MicroAutoBox III.

Prestarting the MicroAutoBox III

Where to go from here

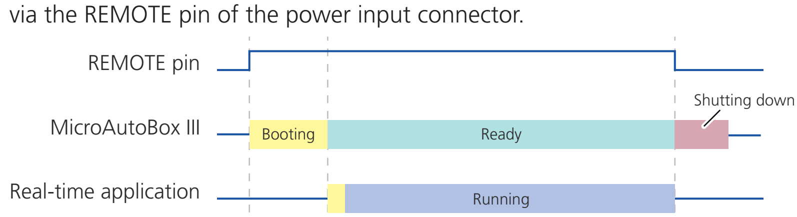
Information in this section

Basics on Prestarting the MicroAutoBox III

Introduction

After you switched on the MicroAutoBox III, the MicroAutoBox III can automatically start a flash application. It takes 2 s to 3 s until the real-time application is loaded from the flash and the real-time application runs.

The following example shows the process if you switch on the MicroAutoBox III via the REMOTE pin of the power input connector.



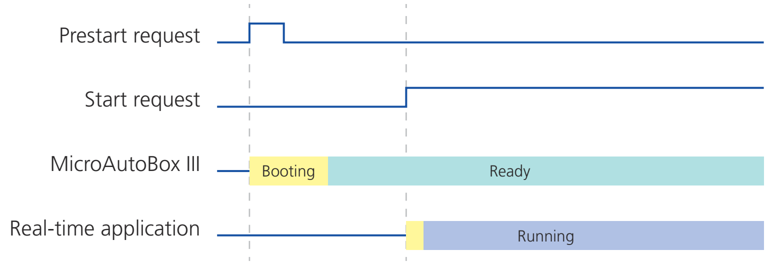
If it is essential that the real-time application starts quickly, use the prestart feature to start the MicroAutoBox III and the real-time application separately.

Basic process

The prestart feature lets you separate the start of the MicroAutoBox III and the start of the flash application via two requests:

- A *prestart request* starts the MicroAutoBox III and loads the real-time application from the flash.
- The *start request* starts the real-time application.

The following illustration shows the process:



As soon as the MicroAutoBox III is ready for operation, a start request starts the real-time application in less than 250 ms. The duration to start the real-time application depends on the application size and configuration.

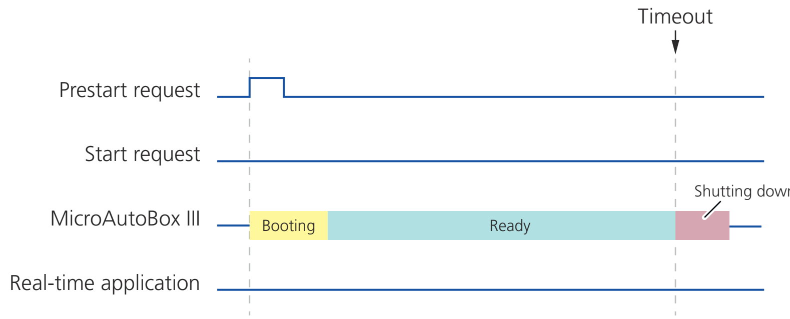
Inputs for the start and prestart requests

The following table shows the possible inputs for the start and prestart requests.

Request	Possible Inputs	Description
Prestart request	PRESTART pin of the power input connector.	A rising edge at the PRESTART pin prestarts the MicroAutoBox III.
Start request	REMOTE pin of the power input connector.	A high level at the REMOTE pin requests the start of the real-time application. A low level switches off the MicroAutoBox III.
	CAN wake-up requests	Activity on the CAN bus or a CAN wake-up message can request the start of the real-time application: ▪ How to Support CAN Wake-up Requests with the DS1513 on page 113 ▪ How to Support Bus Wake-up Requests with the DS1521 on page 121 ▪ How to Support CAN Wake-up Requests with the DS4342 on page 167 The CAN transceiver cannot shut down the MicroAutoBox III. Therefore, the real-time application must shut down the MicroAutoBox III. Refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide 📖).
	LIN wake-up requests	A LIN wake-up message can request to start the real-time application. Refer to How to Support Bus Wake-up Requests with the DS1521 on page 121. The LIN transceiver cannot shut down the MicroAutoBox III. Therefore, the real-time application must shut down the MicroAutoBox III. Refer to System Shutdown (ConfigurationDesk I/O Function Implementation Guide 📖).

Prestart timeout

To prevent the vehicle battery from depletion, the MicroAutoBox III shuts down after a configurable timeout has expired and no start is requested.



The MicroAutoBox III boots again if a new prestart is requested.

Using the prestart feature

To use the prestart feature, you have to configure the following:

- The prestart feature must be activated.

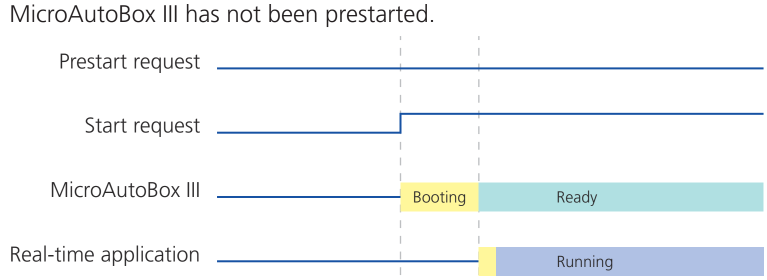
  For activating, refer to How to Activate and Configure the Prestart Feature on page 194.
- The real-time application must be loaded to the flash and configured for the automatic start process.

  For checking the autostart status, refer to FLASH Page on page 227.

Operation behavior during different scenarios

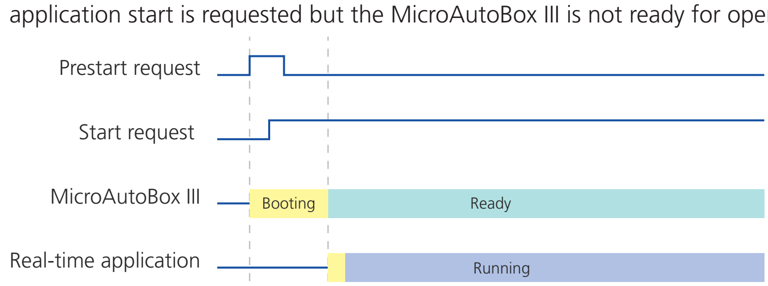
The following examples shows the operation behavior during different scenarios.

Starting without prestart The start signal changes to high, but the MicroAutoBox III has not been prestarted.



The MicroAutoBox III starts just like without the prestart feature in 2 s to 3 s.

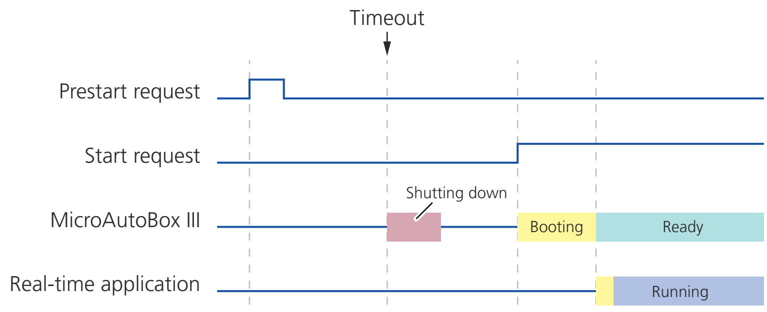
Premature start request The MicroAutoBox III is prestarted and the application start is requested but the MicroAutoBox III is not ready for operation.



The MicroAutoBox III starts booting with the prestart request. As soon as the MicroAutoBox III is ready for operation, the real-time application starts.

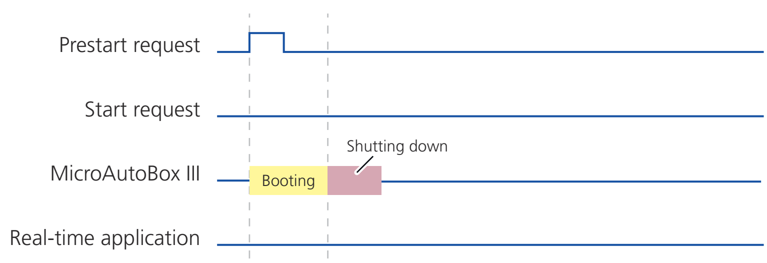
It takes 2 s to 3 s until the real-time application runs.

Delayed start request The application start is requested, but the timeout expired and switched off the MicroAutoBox III.



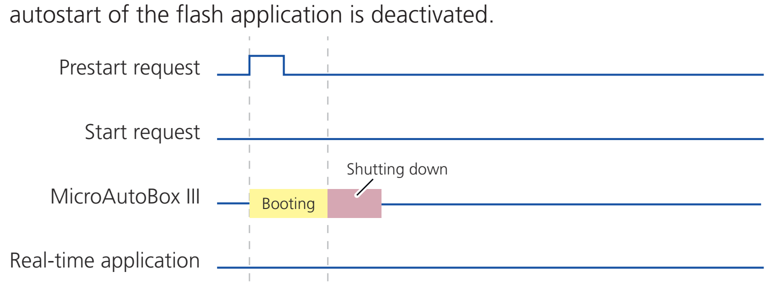
The MicroAutoBox III starts booting with the start request and it takes 2 s to 3 s until the real-time application runs.

Prestart feature not activated A prestart is requested, but the prestart feature is not activated.



The MicroAutoBox III shuts down after 2 s to 3 s.

No runnable real-time application No flash application is available or the autostart of the flash application is deactivated.



The MicroAutoBox III shuts down after 2 s to 3 s.

Related topics

Basics

References

How to Activate and Configure the Prestart Feature

Objective

Activating the prestart feature to start the MicroAutoBox III via a prestart request.

Use case

If it is essential that the real-time application starts quickly, use the prestart feature to start the MicroAutoBox III and the real-time application separately.

Prestart process

For information on the prestart feature, refer to Basics on Prestarting the MicroAutoBox III on page 190.

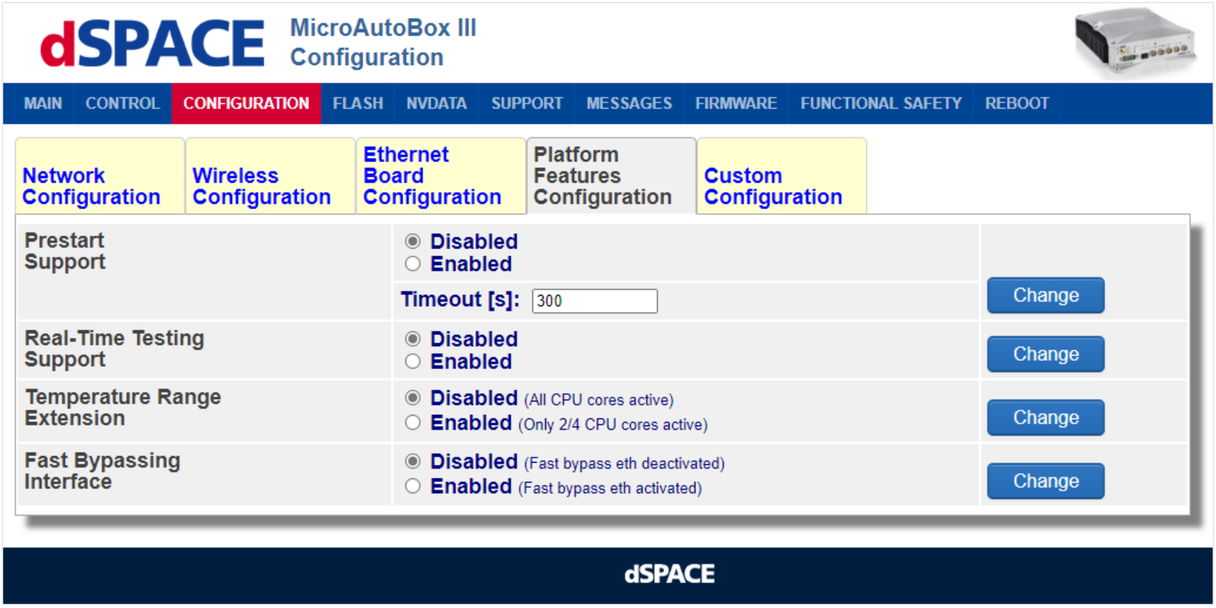
Method

To activate and configure the prestart feature

1. Open the web interface. Refer to How to Open the Web Interface on page 58.
2. Perform the following steps to stop and unload running real-time applications:
   - Click CONTROL to open the MicroAutoBox III Application Control page.
   - If a real-time application is loaded, click Unload and confirm the unloading.

     If no real-time application is loaded, Unload is not available.

3 Open the CONFIGURATION - Platform Features Configuration page.



4 At Prestart Support, enable the prestart of MicroAutoBox III.

5 Specify a timeout after which the MicroAutoBox III shuts down if the MicroAutoBox III is prestarted, but no request start the real-time application.

The timeout prevents the vehicle battery from depletion.

6 Click Change.

7 Open the MicroAutoBox III System Reboot page and click Restart.

The new configuration becomes active after you restart the MicroAutoBox III.

Result

You activated the prestart feature.

Related topics

Basics

Building Power Supply Cables for Different Use Cases........ 86

Removing the MicroAutoBox III

Where to go from here

Information in this section

How to Clear the Nonvolatile Memory

Objective

To avoid the unauthorized propagation of nonvolatile data before you pass the MicroAutoBox III to another person.

Workflow

Observe the following workflow to clear the memory.

- Clear the memory for nonvolatile data (NvData). Refer to Part 1.
- Clear the flash memory with the real-time application. Refer to Part 2.

Part 1

To clear the memory for NvData

1. Open the web interface of the MicroAutoBox III. Refer to How to Open the Web Interface on page 58.
2. Click NVDATA.
   The MicroAutoBox III NvData Management page opens.
3. Click Delete All Entries and confirm the deletion.

Part 2

To clear the flash memory

1 Click FLASH.
The MicroAutoBox III Flash Management page opens.
2 Click Format and confirm the formatting.

Result

You deleted all nonvolatile data from the memory.

How to Remove the MicroAutoBox III from a Vehicle

Objective

Safely removing the MicroAutoBox III.

Method

To remove the MicroAutoBox III from a vehicle

⚠ WARNING

Disconnecting the vehicle battery can result in serious injury or death

Even a brief disconnection of the battery during engine operation can cause the vehicle generator to generate hazardous voltages of more than 100 V (load dump).

- Turn off the vehicle engine before connecting or disconnecting the vehicle battery.

1 Turn off the vehicle engine.
2 Open the disconnect switch.
3 Disconnect the power supply cable.
4 Disconnect the I/O wiring.
5 Remove the four bolts and remove the MicroAutoBox III from the vehicle.

Result

You removed the MicroAutoBox III and its cable harness.

Related topics

Basics

Safety Precautions for Disposing dSPACE Hardware.......27
Safety Precautions for Shipping a MicroAutoBox III.......27

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.

Providing information for dSPACE Support

Adding a support report to your support request form will significantly shorten the response time of dSPACE Support.

For instructions on generating a support report, refer to How to Capture and Download Information for dSPACE Support on page 205.

Where to go from here

Information in this section

Checking the MicroAutoBox III

Check list

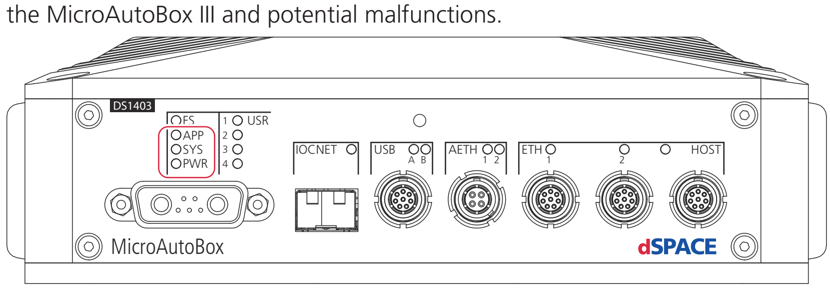
Perform the following checks if the MicroAutoBox III does not operate correctly:

- Check the status LEDs of the board panels. Refer to Checking the status LEDs on page 200.
- Check the connection from the host PC to the MicroAutoBox III. Refer to Problems When Connecting to the Host PC on page 201.
- Check the configuration of the MicroAutoBox III via the web interface. Refer to Checking the Configuration on page 201.
- Check the board properties with the dSPACE Platform Manager. Refer to How to Register dSPACE Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide 📖).

Checking the status LEDs

Status LEDs of the following panels indicate potential malfunctions.

DS1403 panel The PWR, SYS and APP LEDs display the operation state of the MicroAutoBox III and potential malfunctions.

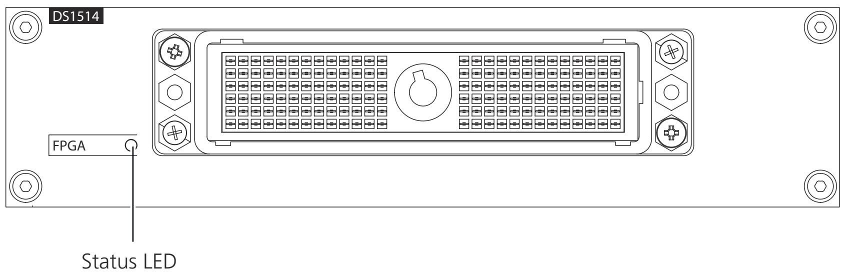


LED	State	Description
PWR	Off	No supply voltage applied. ▪ Check the power supply of the system, including the fuses. Refer to Building Power Supply Cables for Different Use Cases on page 86. For replacing the fuse of the CB6073PW power supply cable, refer to How to Replace the Fuse of the CB6073PW Power Supply Cable on page 204.
	Blue flashing	The MicroAutoBox III is switched off. ▪ Check the wiring to see if the voltage level at the REMOTE pin changes from low to high. ▪ Only if you use the CB6073PW power supply cable: Check the conductivity of the white wire for remote control. An internal fuse might be defective. If the fuse is defective, you have to replace the cable. You must not replace the fuse.

LED	State	Description
SYS	Red (permanent)	The MicroAutoBox III is in secured mode. ▪ Repair the firmware. Refer to Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 📖).

For more information, refer to LED States of the DS1403 Panel on page 282.

DS1514 panel If the status LED of the DS1514 FPGA Base Board lights blue, the FPGA die temperature is too high for operation.



The following measures can reduce the die temperature:

- Reduce the ambient temperature or increase the air flow.
- If you use FPGA custom functions: You can decrease the temperature by reducing the FPGA's toggle rate (e.g., by using clock enable) or by reducing the utilization of the FPGA resources.

Checking the Configuration

You can enable/disable features of the MicroAutoBox III via the web interface. Check the configuration for correctness. For example, enable Real-Time Testing (RTT) if you want to perform RTT.

For instructions on opening the web interface, refer to How to Open the Web Interface on page 58.

For descriptions on the settings of web interface, refer to Web Interface Reference on page 207.

Problems When Connecting to the Host PC

Platform cannot be registered

Description The Register Platforms dialog cannot find the MicroAutoBox III.

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

1. Ensure that the LAN is connected to the **HOST** port of the MicroAutoBox III.
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 MicroAutoBox III.
3. Set a new network configuration. Refer to How to Set the Network Configuration via Command Prompt Window on page 62.

Perform the following steps if the MicroAutoBox III is directly connected to the host PC:

1. Ensure that the host PC is connected to the **HOST** port of the MicroAutoBox III.
2. Use the same subnet mask for the host PC as the MicroAutoBox III uses.

   If you do not know the subnet mask, specify a new network setting for the MicroAutoBox III. Refer to How to Set the Network Configuration via Command Prompt Window on page 62.
3. Set the IP address of the host PC to a static IP address of the subnetwork that is specified by the subnet mask. Refer to Connecting a MicroAutoBox III to the Host PC on page 56.

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.

Related topics

Basics

Connecting a MicroAutoBox III to the Host PC..56

HowTos

How to Prepare the Host PC (MicroAutoBox III - Getting Started 🕮)

Problems Related to the Execution of the Real-Time Application

Applications that crash/block the real-time processor

Description If a real-time application repeatedly crashes or blocks the processor, you can deactivate the autostart or delete the flash application.

Remedy Perform the following steps to safely delete the real-time application:

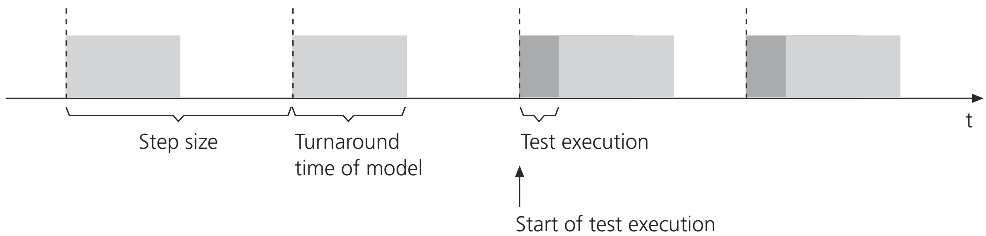
- Open the web interface. Refer to How to Open the Web Interface on page 58.
- Open the **FLASH** page.
- Click **Deactivate** and confirm the deactivation.

  The real-time application will not start automatically when you switch on the MicroAutoBox III.
- If required, click **Delete** to delete the real-time application from the flash memory.

Task overruns

Description If the calculation of the model (turnaround time) becomes tight for the simulation step size, deactivating Real-Time Testing (RTT) can relax the timing because the deactivation saves computing time.

The basis of RTT is a Python interpreter running on the processor board. The processor board calls the Python interpreter and executes the real-time application in each sampling step. The following illustration shows the required processing time to execute the Python interpreter.



Remedy Perform the following steps to deactivate the RTT support:

1. Open the web interface. For instructions, refer to How to Open the Web Interface on page 58.
2. On the **Configuration** page, open the **Platform Features Configuration** tab.
3. Disable the Real-Time Testing support and click **Change**.

Corrupt firmware

Description If the standard firmware of the MicroAutoBox III becomes corrupt, the MicroAutoBox III attempts to reboot with the factory firmware. If the factory firmware is loaded, the MicroAutoBox III is the secured mode and the *SYS* status LED lights up red. No real-time application can be loaded if the MicroAutoBox III is in secured mode.

The factory firmware lets you install a valid standard firmware.

Normally, the firmware can become corrupt only if the MicroAutoBox III is switched off during a firmware update.

Remedy Perform the following steps to repair corrupt firmware.

- If the *SYS* status LED lights up red, install valid standard firmware. Refer to Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 📖).
- If the MicroAutoBox III cannot boot the factory firmware, force a restart with the factory firmware. Refer to How to Force a Start with Factory Firmware on page 203.

How to Force a Start with Factory Firmware

Objective

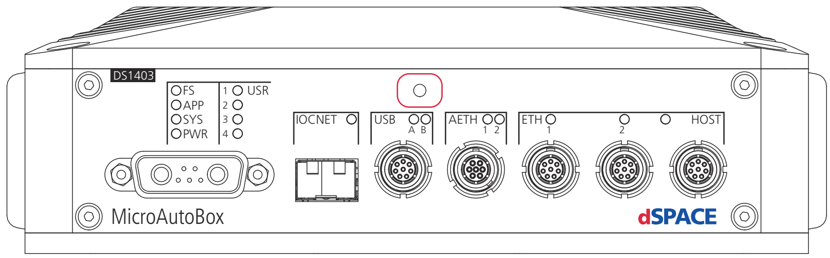
Installing a valid firmware if the current firmware is corrupted.

Method

To force a restart with factory firmware

1 Switch off the MicroAutoBox III.

2 On the DS1403 panel, push and hold the USB eject button and switch on the MicroAutoBox III.



Result

You started the MicroAutoBox III with factory firmware. The *SYS* status LED lights up red. The MicroAutoBox III is in secured mode.

Next step

You can now re-install the MicroAutoBox III firmware. Refer to Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 📖).

How to Replace the Fuse of the CB6073PW Power Supply Cable

Objective

Replacing the fuse of the CB6073PW power supply cable.

Spare fuse

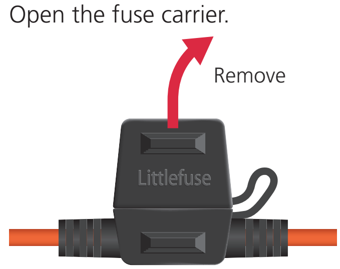
Regular 25A/32V ATO fuse

Method

To replace the fuse of the CB6073PW power supply cable

1 Disconnect the CB6073PW power supply cable from the power supply/battery.

2 Open the fuse carrier.



3 Replace the fuse with a regular 25A/32V ATO fuse.
4 Close the fuse carrier.

Result

You replaced the fuse.

How to Capture and Download Information for dSPACE Support

Objective

To generate different types of system status reports for dSPACE Support if self-help does not help you to solve the problem.

Method

To capture and download information for dSPACE Support

1. Open the web interface. Refer to How to Open the Web Interface on page 58.
2. Click **SUPPORT**.
   The **SUPPORT** page opens.
3. Download diagnostic information:
   - Click **Full Report** to download a report of the system and the binary of the real-time application.
   - Click **Limited Report** to download a report that includes only system information.
4. Optionally, you can capture a system timing trace of the real-time application. You should do this only if instructed by dSPACE Support.
   If instructed by dSPACE Support, capture a system timing trace of the real-time application.
   - Select the length of the timing trace in seconds.
   - Start the real-time application.
   - While the real-time application is running, click **Capture** to capture a relevant timing trace.

Result

You captured different system information that you can provide to dSPACE Support.

To contact dSPACE Support, use the support request form provided on the website at http://www.dspace.com/go/supportrequest.

Web Interface Reference

Where to go from here

Information in this section

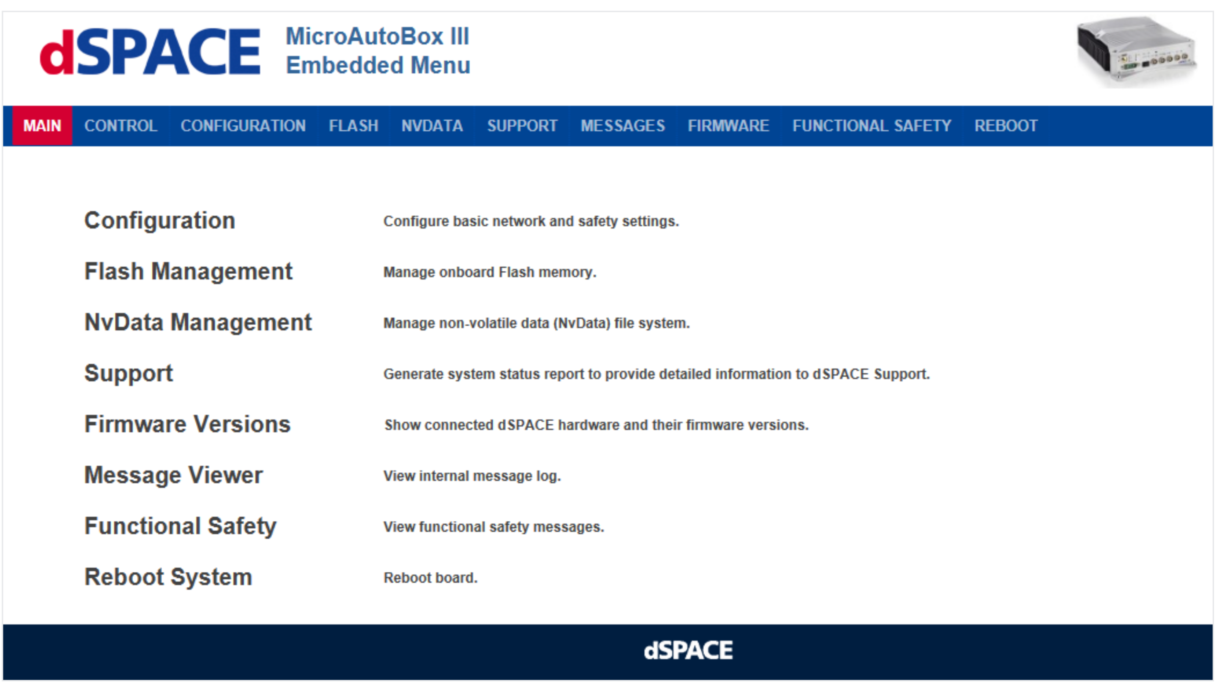
MAIN Page

Introduction

This page gives you an overview on the pages for system configuration and support.

Description

The MAIN page is displayed after you opened the web interface with an Internet browser.



Related topics

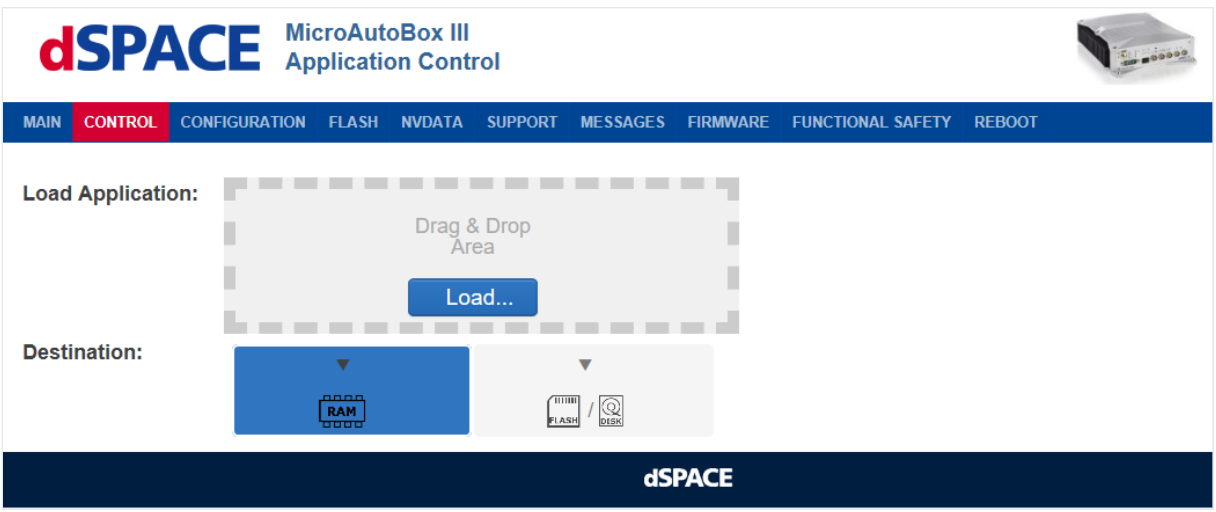
HowTos

CONTROL Page

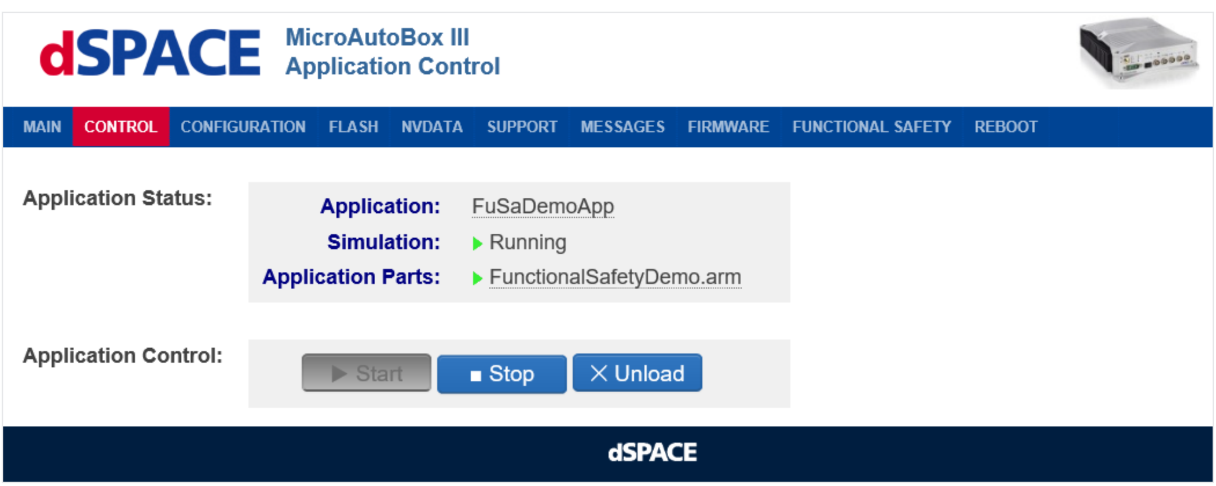
Introduction

This page lets you load real-time applications and control loaded applications.

The following illustration shows the CONTROL page if no real-time application is loaded:



The following illustration shows the CONTROL page if a real-time application is loaded:



Load application	Lets you load a real-time application from the host PC to the MicroAutoBox III. The following methods are supported. ▪ Drag & drop a real-time application to the drag & drop area. ▪ Click Load. An upload dialog opens and let you select the application file for uploading. The web interface checks the real-time application for compatibility. Incompatible applications cannot be uploaded.
Destination	Lets you select the destination to which the real-time application will be uploaded. ▪ RAM: Uploading to the RAM of the MicroAutoBox III. ▪ Flash/Disk: Uploading to the flash memory of the MicroAutoBox III.
Application status	Displays status information on the loaded real-time application. **Application** Displays the name of the real-time application. **Simulation** Displays status information. The following status information are possible: ▪ Running: All the tasks of the real-time application are executed. ▪ Stopped: Tasks are not executed. ▪ Terminated: This is a final state. No more actions are performed, and the application can be restarted only by uploading it again. **Application parts** Displays the names of the application processes that are part of the real-time application. The number of application processes depends on the application type: ▪ Single-core real-time applications consist of one application process. ▪ Multicore real-time applications consist of several application processes that are executed in parallel on different cores.
Application control	The control buttons let you control the real-time application as follows: ▪ Start: The real-time application starts. The MicroAutoBox III starts with specified initial output signal until new output signals are available from the application. ▪ Stop: The real-time application stops. The MicroAutoBox III outputs specified stop signals or outputs the last run-time value. ▪ Unload: Removes the real-time application from the memory.

CONFIGURATION Page

Introduction

This page lets you specify the basic configuration of the MicroAutoBox III.

Provided tabbed pages

The Configuration page provides the following tabbed pages:

- Network Configuration page

  This page lets you specify the identification of the MicroAutoBox III in a network and the IP network configuration to access the MicroAutoBox III via the host PC. For more information, refer to CONFIGURATION - Network Configuration Page on page 211.
- Wireless Configuration page

  This page lets you configure the WLAN interface for host communication. This page is displayed only for the MicroAutoBox III (WLAN).

  For more information, refer to CONFIGURATION - Wireless Configuration Page on page 214.
- Ethernet Board Configuration page

  This page lets you select an Ethernet board and configure the physical layers (PHYs) of the ETH/AETH ports and the internal Ethernet switch. For more information, refer to CONFIGURATION - Ethernet Board Configuration Page on page 215.
- Platform Features Configuration page

  This page lets you configure platform-specific features. For more information, refer to CONFIGURATION - Platform Features Configuration Page on page 225.
- Custom Configuration page

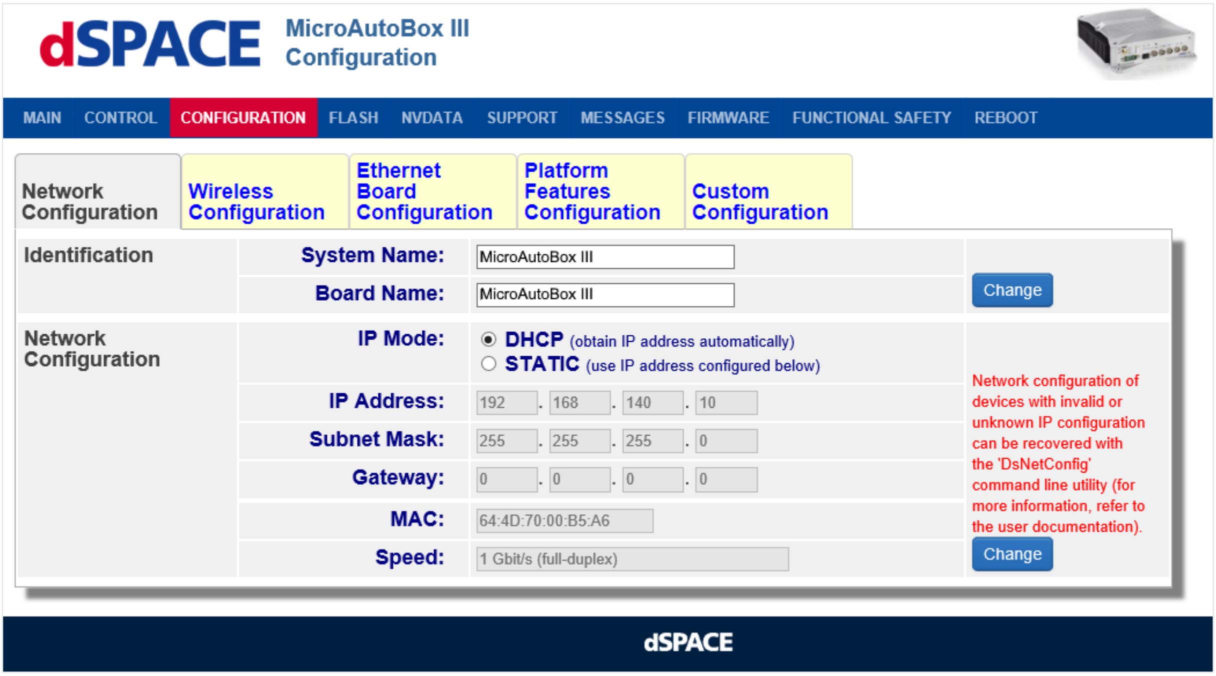
  This page is used only for support purposes.

  > **Note**
  >
  > Do not edit the Options edit field without consulting dSPACE Support.

CONFIGURATION - Network Configuration Page

Introduction

This page lets you specify the identification of the MicroAutoBox III in a network and the IP network configuration to access the MicroAutoBox III via the host PC.



Identification

Lets you enter and displays names for identification.

The following table shows the description of the provided parameters.

Parameter	Description
System name	Lets you enter a name to combine multiple MicroAutoBox III units into a logical group.
Board name	Lets you enter an individual name for the MicroAutoBox III to identify the MicroAutoBox III in a network.

The Change button lets you change the setting of the configuration.

Network configuration

Lets you configure the host controller of the MicroAutoBox III for the host communication.

The following table shows the description of the provided parameters.

Parameter	Description
IP mode	Lets you select the IP mode: ▪ In DHCP mode, the MicroAutoBox III attempts to retrieve its IP address from a DHCP server upon startup. If no DHCP server is found, the MicroAutoBox III uses the static IP address provided in its network configuration. ▪ In the static mode, the MicroAutoBox III uses the static IP address provided in its network configuration.

Parameter	Description
IP address	Lets you enter a static IP address for the host communication with the MicroAutoBox III. The IP address is a common IP address for the wired and wireless host communication. You can change the IP address only if the static mode is selected.
Subnet mask	Lets you specify the subnetwork address the MicroAutoBox III is connected to by entering the subnet mask. The subnet mask determines the most significant bits of the IP address as the subnetwork address, the least significant bits determine the host address of the MicroAutoBox III. You can change the subnetwork mask only if the static mode is selected.
Gateway	Lets you enter the IP address of the default gateway. A default gateway lets you send IP packets outside the local subnetwork that you specified via the subnet mask and the IP address. The default gateway to other networks can be the router of your network. You can change the IP address only if the static mode is selected.
MAC	Displays the MAC address of the host controller.
Speed	Displays the current data rate and duplex mode of the HOST port. The data rate and duplex mode is set via autonegotiation.

The **Change** button lets you change the setting of the configuration.

Related topics

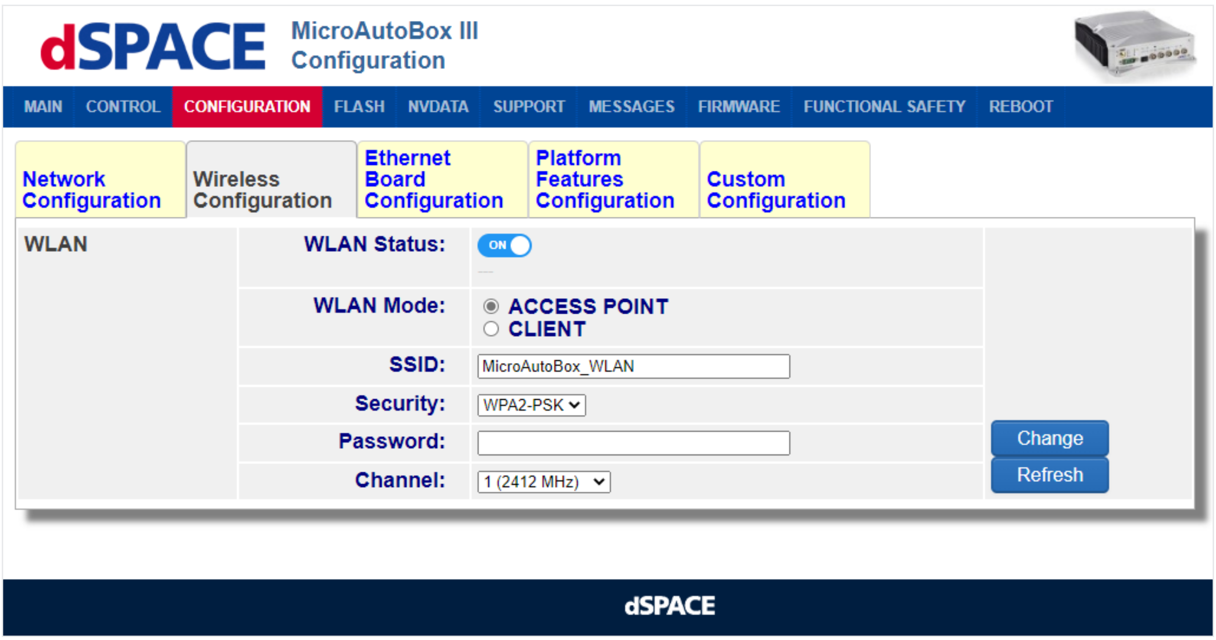
HowTos

How to Change the Network Configuration via the Web Interface.. 60
How to Set the Network Configuration via Command Prompt Window.................................. 62

CONFIGURATION - Wireless Configuration Page

Introduction

This page lets you configure the WLAN interface for host communication. This page is displayed only for the MicroAutoBox III (WLAN).



WLAN

Lets you switch on and configure the WLAN interface.

The following table shows the description of the provided parameters.

Parameter	Description
WLAN status	Lets you switch on/off the WLAN interface.
WLAN mode	Lets you select the WLAN mode. In the access point mode, the MicroAutoBox III provides a WLAN. In the client mode, the MicroAutoBox III can access a WLAN. For more information on the WLAN modes, refer to Basics on the WLAN Interface on page 65.
SSID	Lets you enter a name as service set identifier (SSID). With the SSID, WLAN devices can distinguish between WLANs in the environment.
Security	Lets you select the security mode of the WLAN.
Password	Lets you enter the password to access the WLAN.
Channel	Lets you select a radio channel that is used in the access point mode to provide a WLAN. This parameter is displayed only in the access point mode.

The **Change** button lets you change the setting of the configuration.

The **Refresh** button lets you get the parameters of the current configuration of the WLAN interface.

Related topics

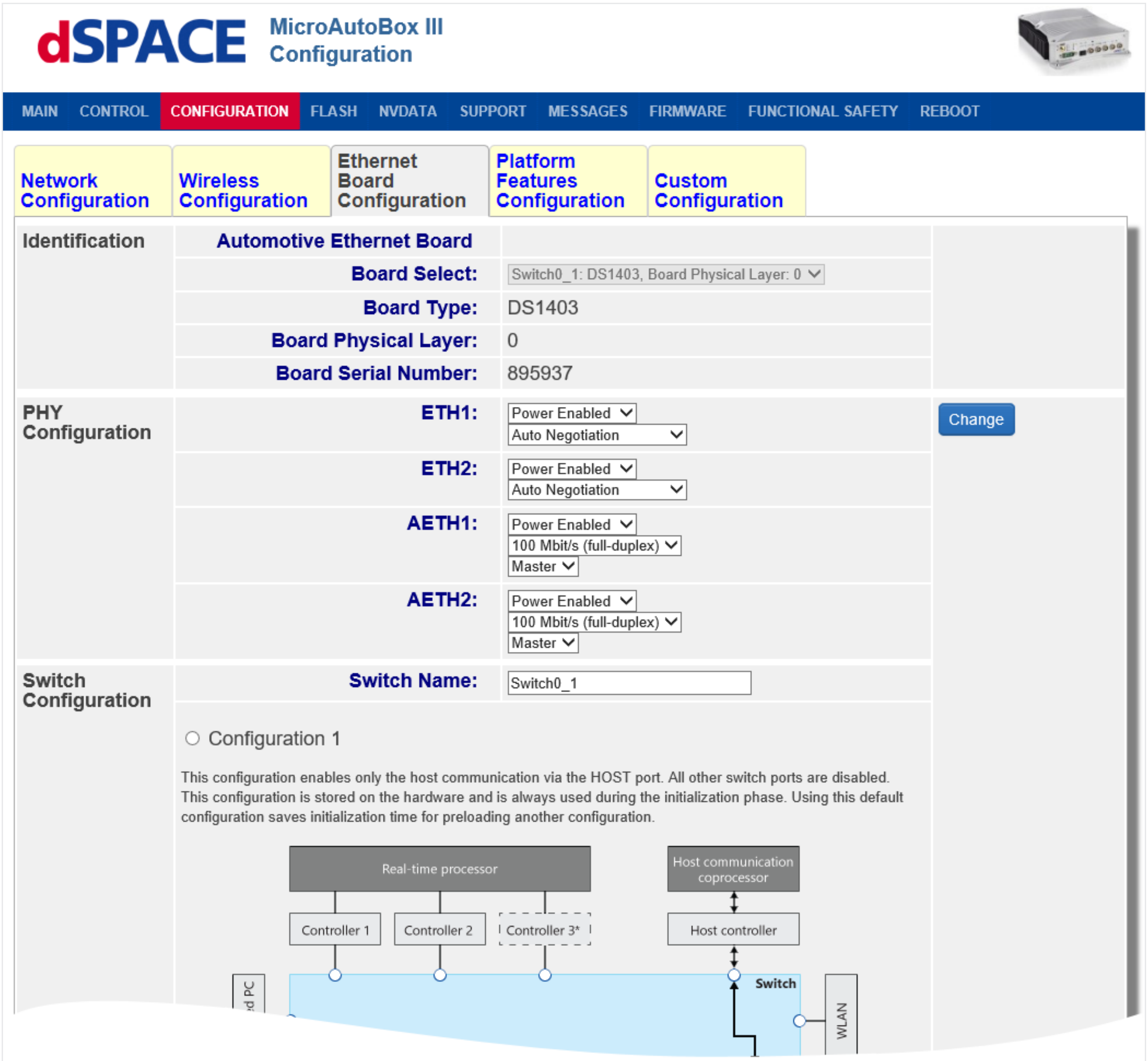
Basics

HowTos

CONFIGURATION - Ethernet Board Configuration Page

Introduction

This page lets you select an Ethernet board and configure the physical layers (PHYs) of the ETH/AETH ports and the internal Ethernet switch.



Identification

Lets you select and identify the Ethernet board to be configured.

The following table shows the description of the provided parameters.

Parameter	Description
Board Select	Lets you select a board that provides I/O Ethernet.
Board Type	Displays the DS number of the board that provides the selected Ethernet switch.
Board Layer	Displays the layer of the MicroAutoBox III to which the board is installed to. The processor board is always installed to layer 0.

Parameter	Description
Board Serial Number	Displays the serial number of the board that provides the selected Ethernet switch.

PHY configuration settings

The following table shows the description of the selectable PHY settings for the displayed Ethernet ports.

PHY Setting	Description
Power Enabled/Disabled	The PHY of the port is switched on/off.
Data rate settings for ETH ports: ▪ 10 Mbit/s (full-duplex) ▪ 10 Mbit/s (half-duplex) ▪ 100 Mbit/s (full-duplex) ▪ 100 Mbit/s (half-duplex) ▪ 1 Gbit/s (full-duplex) ▪ Autonegotiation Data rate settings for AETH ports: ▪ 100 Mbit/s (full-duplex) ▪ 1 Gbit/s (full-duplex)	The port uses the selected data rate and duplex mode. If the port is set to **Autonegotiation**, the port automatically detects the data rate and the duplex mode. The autonegotiation mode is standard for Gigabit Ethernet.
AETH ports only: Master/Slave	One PHY of an automotive Ethernet connection must be the master, the other must be the slave to establish a link between the connected ports. ▪ Master The PHY of the MicroAutoBox III starts the training process to establish a link between the AETH port and the connected automotive Ethernet device. ▪ Slave The connected automotive Ethernet device starts the required link training process.

Switch configuration

Lets you configure the the internal Ethernet switch if the selected Ethernet board provides a switch.

The following table shows the description of the provided parameters.

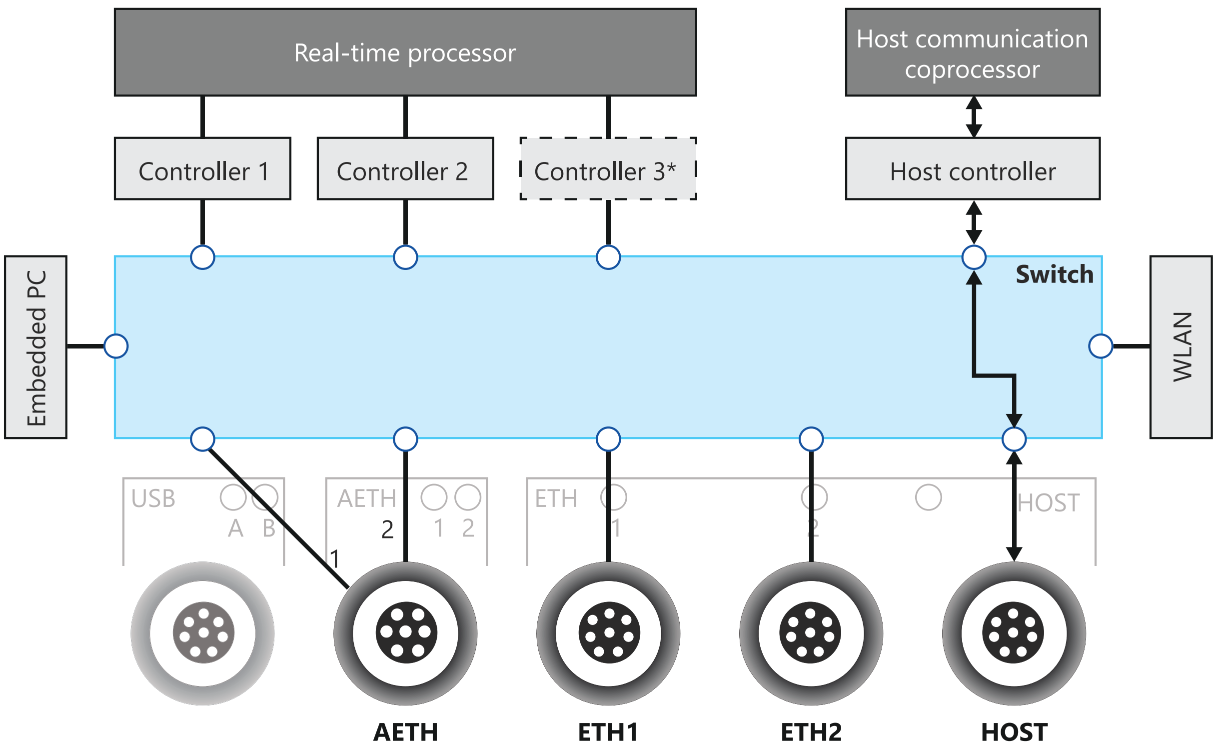
Parameter	Description
Switch Name	Lets you enter a new name for the Ethernet switch. The name is case-sensitive and the number of characters is limited to 63.
Configuration 1 … 8	Lets you select a preconfigured setting for the Ethernet switch. For descriptions of the configurations, refer to Predefined Ethernet switch configurations on page 218.

The **Change** button lets you change the setting of the configuration.

Predefined Ethernet switch configurations

You can select one of the following predefined Ethernet configurations for the DS1403 Processor Board.

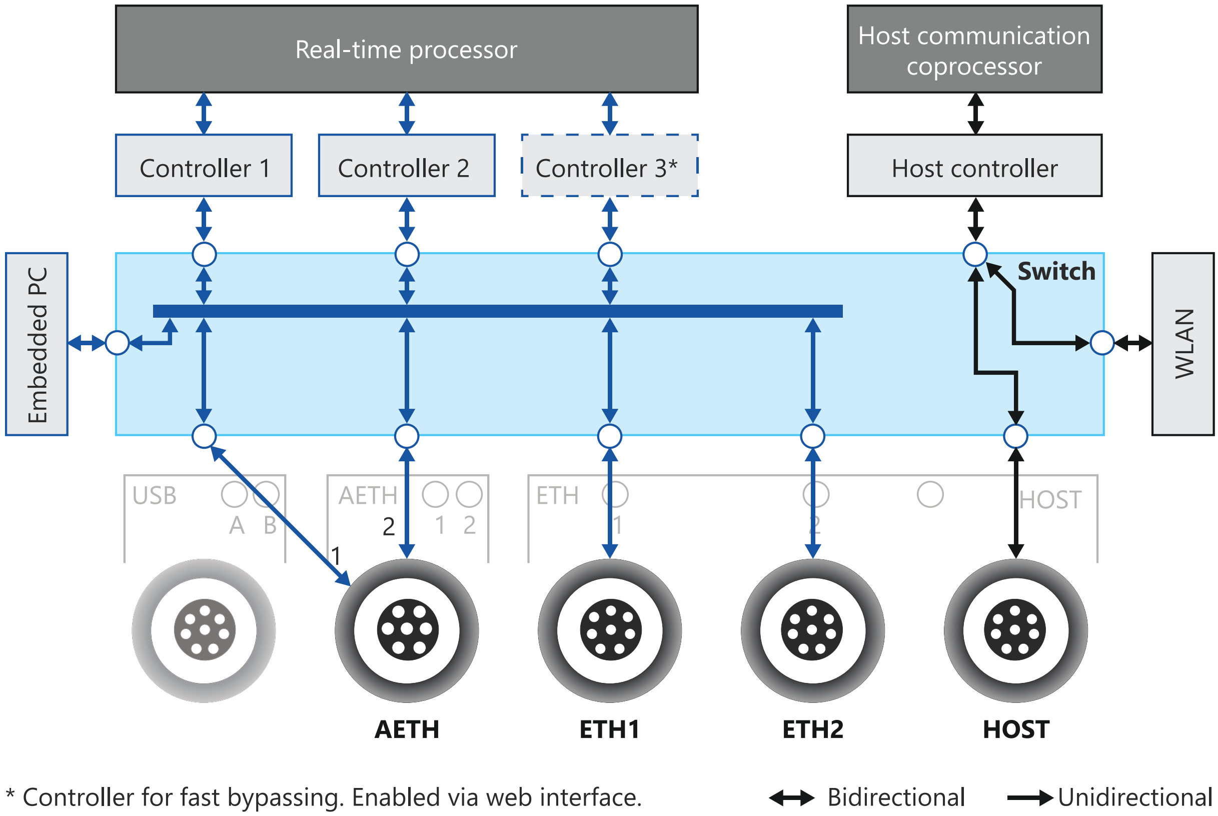
Configuration 1 This configuration enables only the host communication via the HOST port. All other switch ports are disabled. This configuration is stored on the hardware and is always used during the initialization phase. Using this default configuration saves initialization time for preloading another configuration.



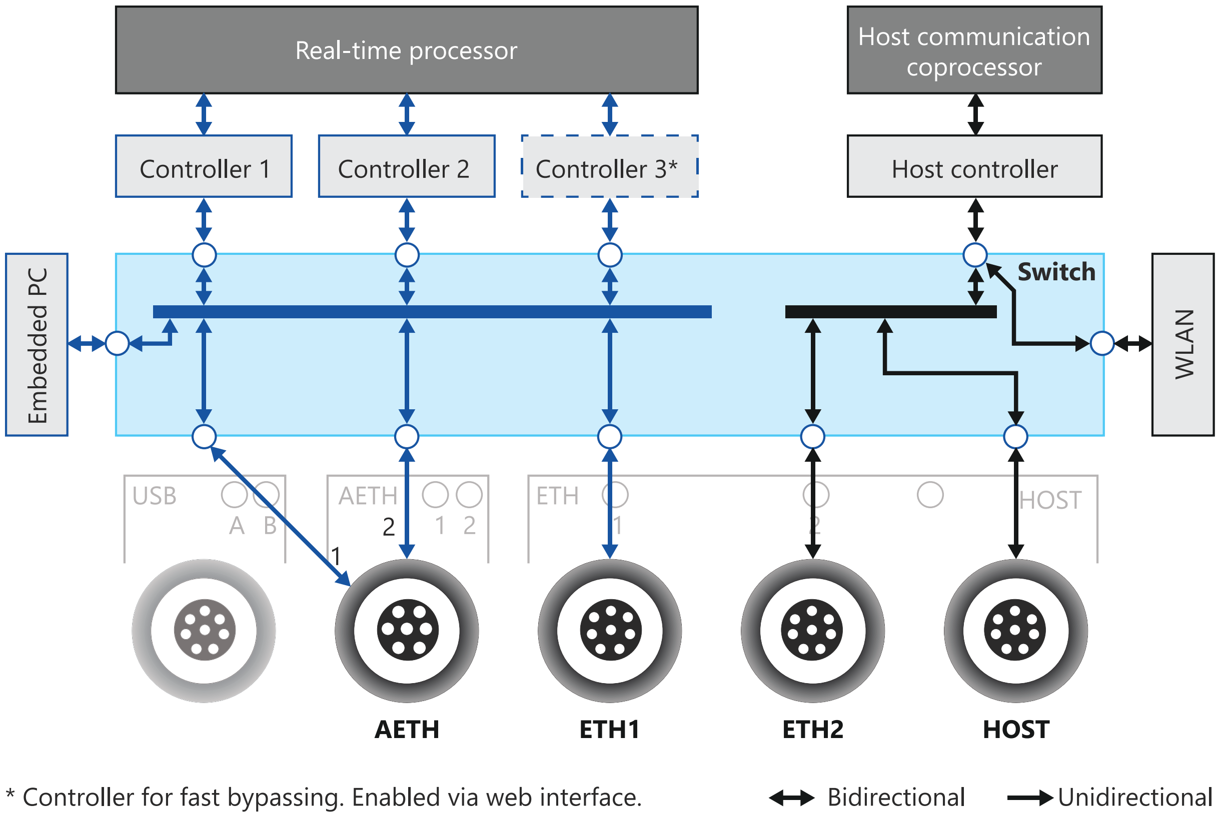
* Controller for fast bypassing. Enabled via web interface. ↔ Bidirectional → Unidirectional

Configuration 2 This configuration separates the host communication and the I/O Ethernet communication. The ports for I/O Ethernet communication are switched to each other.

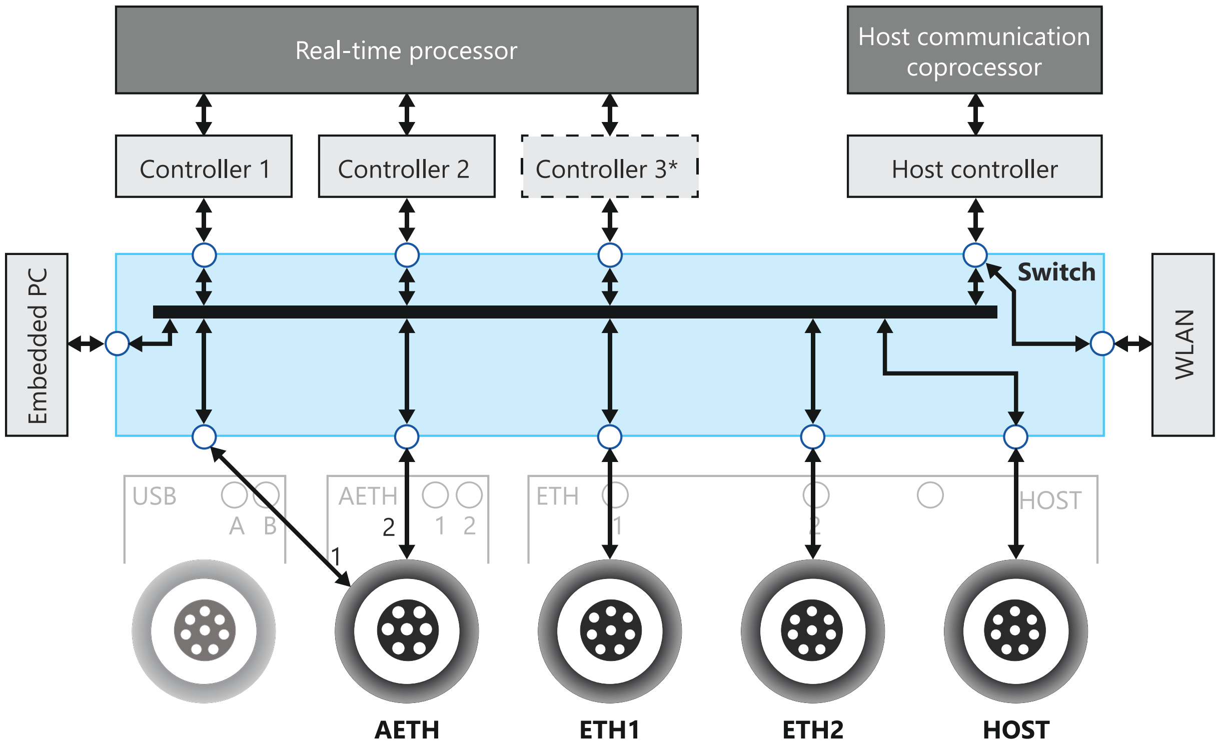
Configuration 2 is the default configuration of the MicroAutoBox III.



Configuration 3 This configuration sets the ETH2 port as an additional port for the wired host communication. The host communication and the I/O Ethernet communication are separated. The ports for wired host communication are switched to each other, just as the ports for I/O Ethernet communication.

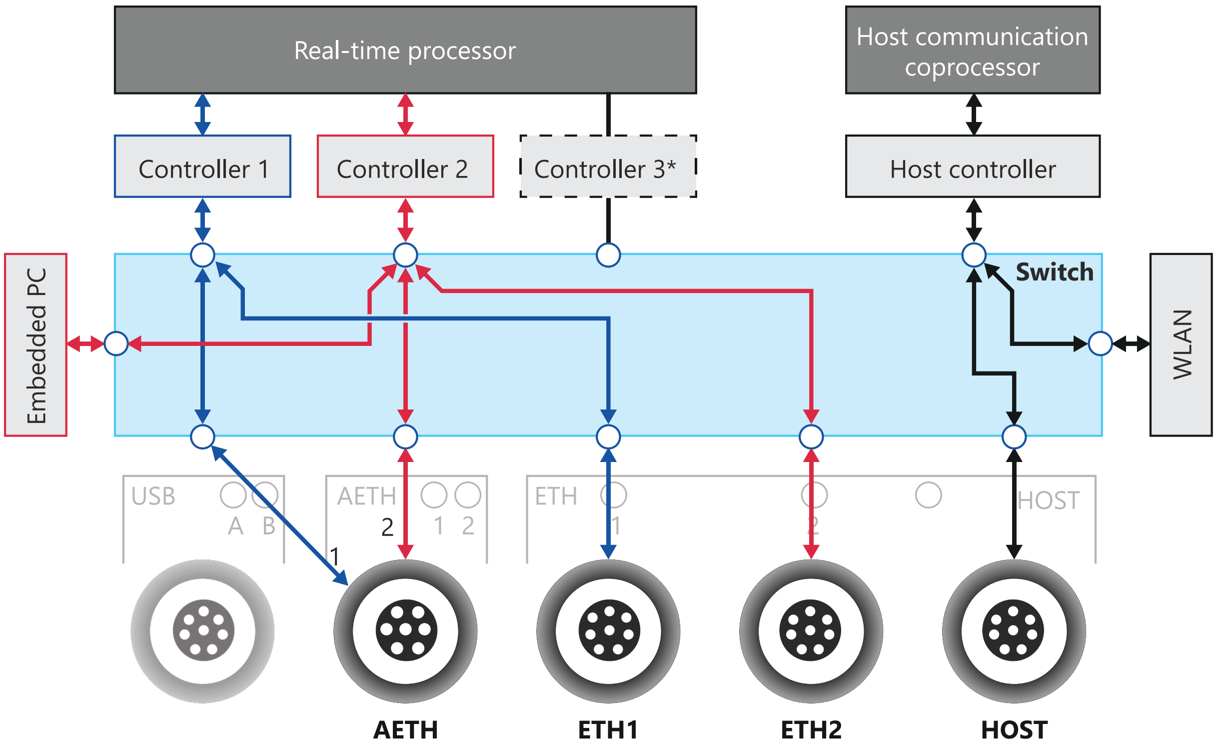


Configuration 4 This configuration sets the internal Ethernet switch to the unmanaged mode. All switch ports are switched to each other, except WLAN. The wired host communication is not separated from the I/O Ethernet communication.



* Controller for fast bypassing. Enabled via web interface. Bidirectional Unidirectional

Configuration 5 This configuration connects each switch port for I/O Ethernet communication to a specific Ethernet controller. The switch ports are unswitched. It is recommended to use only one port per I/O Ethernet controller, either the AETH port, the ETH port, or the switch port for a built-in Embedded PC.

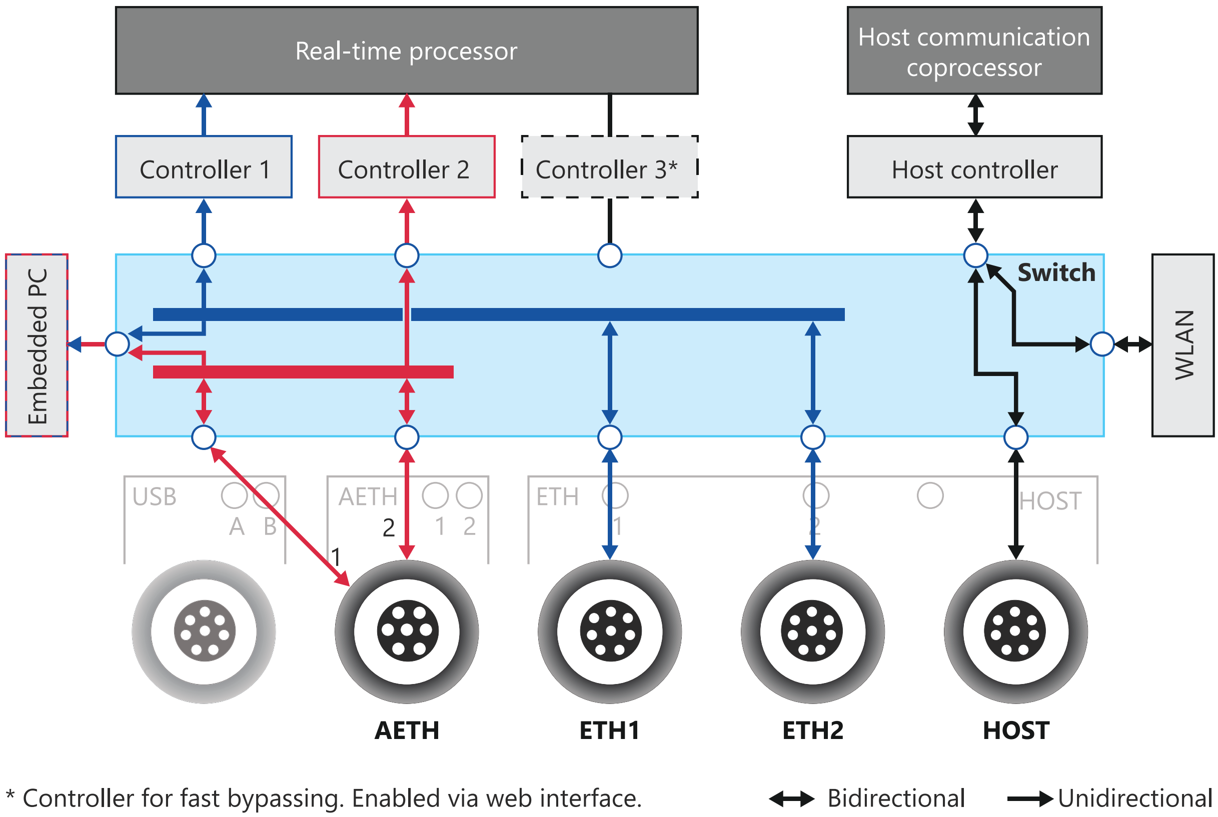


* Controller for fast bypassing. Enabled via web interface.

Configuration 6 This configuration provides one pass-through monitoring channel for standard I/O Ethernet and one for automotive I/O Ethernet. The I/O Ethernet controllers and a built-in Embedded PC can monitor the I/O Ethernet communication.

A high data throughput at the Ethernet ports can lead to data loss on the unidirectional monitoring channel. However, the data flow through the monitored ports is not affected.

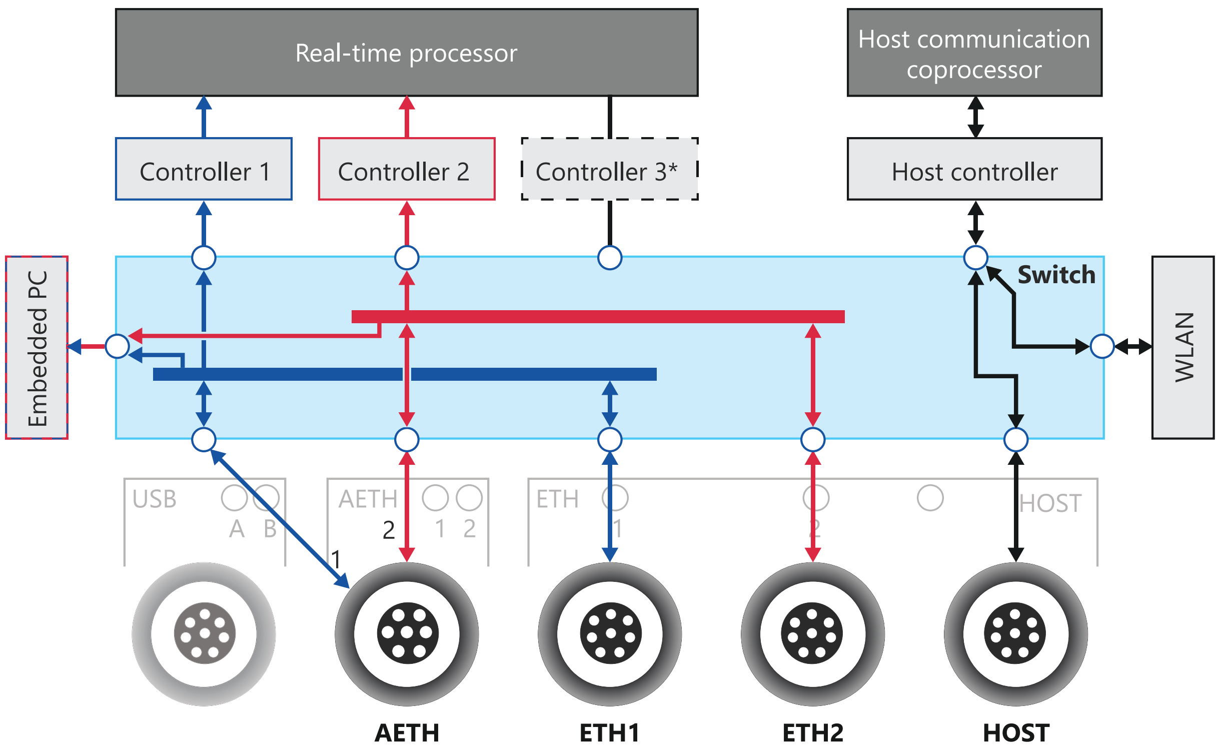
For example: The monitoring of the transmit and receive data lines in full duplex mode via an unidirectional monitoring channel can exceed the maximum data rate of 1 GBit/s.



Configuration 7 This configuration provides two channels for converting automotive Ethernet to standard Ethernet and vice versa. The I/O Ethernet controllers and a built-in Embedded PC can monitor the I/O Ethernet communication.

A high data throughput at the Ethernet ports can lead to data loss on the unidirectional monitoring channel. However, the data flow through the monitored ports is not affected.

For example: The monitoring of the transmit and receive data lines in full duplex mode via an unidirectional monitoring channel can exceed the maximum data rate of 1 GBit/s.



* Controller for fast bypassing. Enabled via web interface. ⟷ Bidirectional ⟶ Unidirectional

Configuration 8 This configuration uses the permanently saved Ethernet switch and PHY configuration of a real-time application.

To permanently save the Ethernet switch and PHY configuration of a real-time application, click **Save**. The web interface saves the most recently used Ethernet switch and PHY configuration provided by a real-time application.

The most recently used Ethernet switch and PHY configuration can be saved only if the real-time application is unloaded and the MicroAutoBox III is not restarted.

Related topics

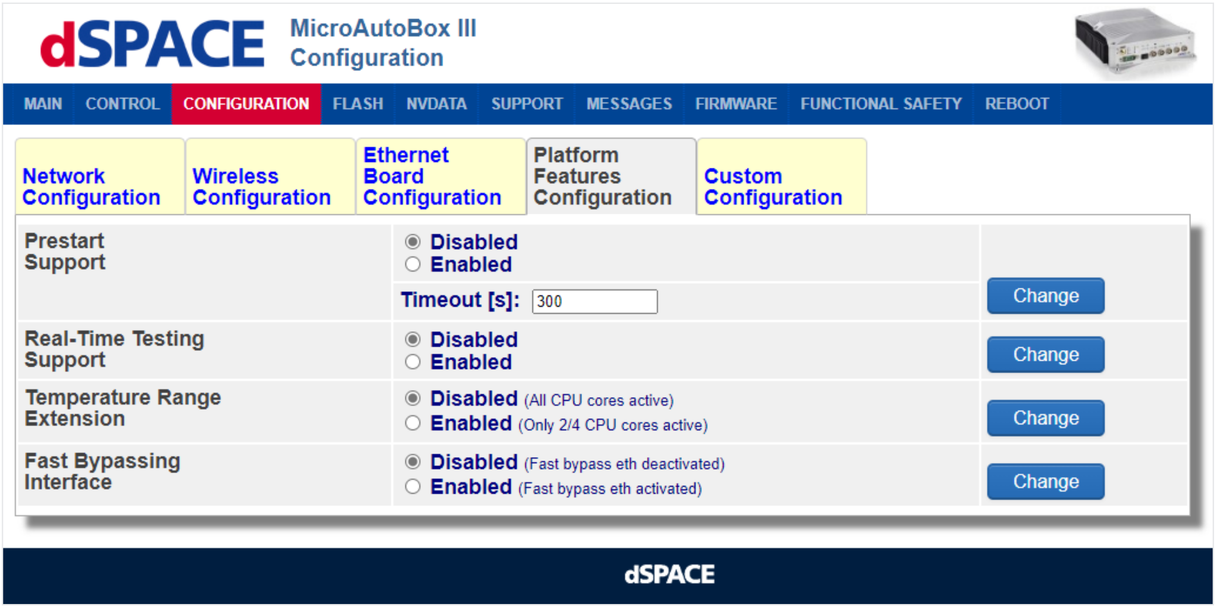
HowTos

How to Configure I/O Ethernet Ports..185
How to Configure the Internal Ethernet Switch..182

CONFIGURATION - Platform Features Configuration Page

Introduction

This page lets you configure platform-specific features.



Prestart support

Lets you enable/disable the prestart feature to separate the start of the MicroAutoBox III and the start of the real-time application.

The Timeout parameter lets you specify a timeout after which the MicroAutoBox III shuts down if the MicroAutoBox III is prestarted but the start of the real-time application was not requested. The timeout prevents the vehicle battery from depletion.

You can change the timeout only if the prestart support is activated.

The Change button lets you change the setting of the configuration.

For more information on prestarting the MicroAutoBox III, refer to Basics on Prestarting the MicroAutoBox III on page 190.

Real-Time Testing support

Lets you enable/disable the execution of Real-Time Testing (RTT) sequences.

If the calculation of the model (turnaround time) becomes tight for the simulation step size, you can deactivate RTT to relax the timing.

The Change button lets you change the setting of the configuration.

For more information on Real-Time Testing, refer to How to Enable Real-Time Testing for MicroAutoBox III (Real-Time Testing Guide 📖).

Temperature range extension	Lets you enable/disable the reduction of CPU cores to operate the MicroAutoBox III up to 80 °C (176 °F). If enabled, the processor board uses only 2 of 4 cores to decrease the power dissipation. The Change button lets you change the setting of the configuration.
Fast bypassing interface	Lets you enable/disable an Ethernet controller that is optimized for low-latency bypassing during ECU interfacing. Do not enable this Ethernet controller for other Ethernet applications than bypassing. The Change button lets you change the setting of the configuration.

Related topics

Basics

Basics on Prestarting the MicroAutoBox III.......... 190

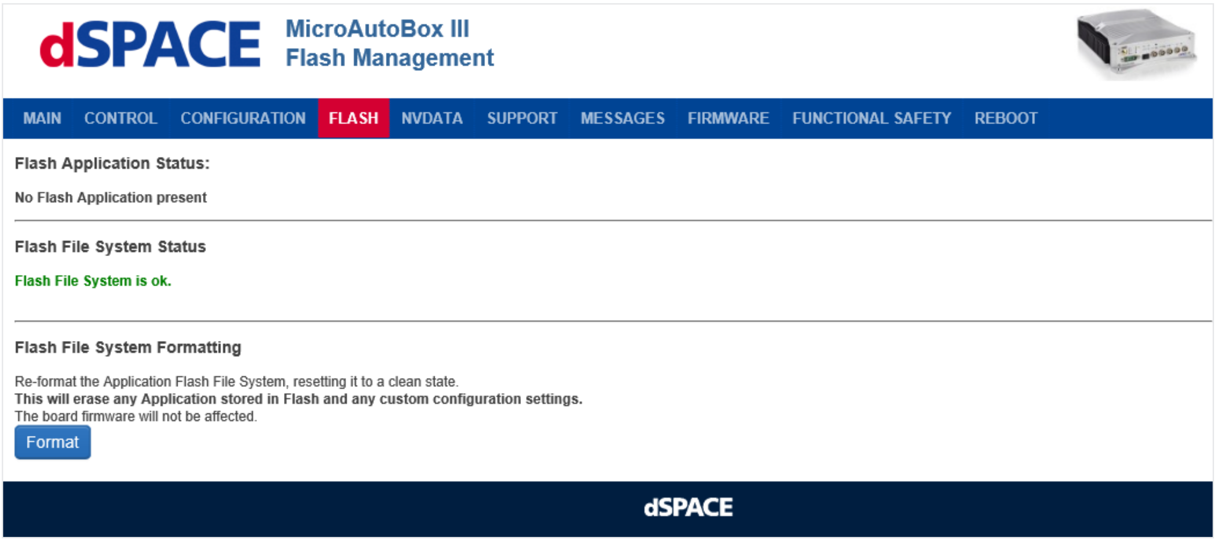
HowTos

How to Activate and Configure the Prestart Feature.......... 194
How to Extend the Operating Temperature.......... 188
How to Improve ECU Interfacing.......... 186

FLASH Page

Introduction

This page lets you manage the real-time applications loaded to the flash (flash applications).



Flash application status

If an application is stored in the flash memory, the flash application status table provides basic information on the flash application.

The following table shows the description of the provided parameters.

Parameter	Description
ApplicationName	Displays the name of the real-time application that is loaded to the flash memory (flash application).
Type	Displays whether the flash application is a multicore or single-core application.
Path on host	Displays the path on the host PC from which the real-time application is loaded to the MicroAutoBox III.
Build Time	Displays the date and time the real-time application was built. Time format: yyyy-mm-dd hh:mm:ss
Load Time	Displays the system time when the real-time application was loaded to the MicroAutoBox III.
Autostart Status	Displays whether the flash applications automatically starts when the voltage level at the REMOTE pin is high or not: ▪ ACTIVE The flash application automatically starts. ▪ DEACTIVE The flash application does not start automatically.

Delete button The Delete button lets you delete the flash application from the flash memory after confirmation.

Before you delete the application, stop any running application.

Activate/Deactivate button The Activate/Deactivate button lets you activate/deactivate the autostart of the flash application.

If the autostart is active, the real-time application automatically starts when the voltage level at the REMOTE pin of the power input connector changes to high.

If a real-time application repeatedly crashes or blocks the processor, you can deactivate the autostart to safely delete the flash application.

Flash file system status

Displays status information on the flash file system.

Mount button The Mount button lets you mount the flash memory to the file system of the MicroAutoBox III after confirmation.

This button is available only if the MicroAutoBox III is in the secured mode and the factory firmware is loaded.

Flash file system formatting

The Format button lets you format the file system for flash applications after confirmation.

The formatting erases any flash application and any custom configuration settings, incl. the Ethernet switch configuration.

Related topics

Basics

Problems Related to the Execution of the Real-Time Application..202

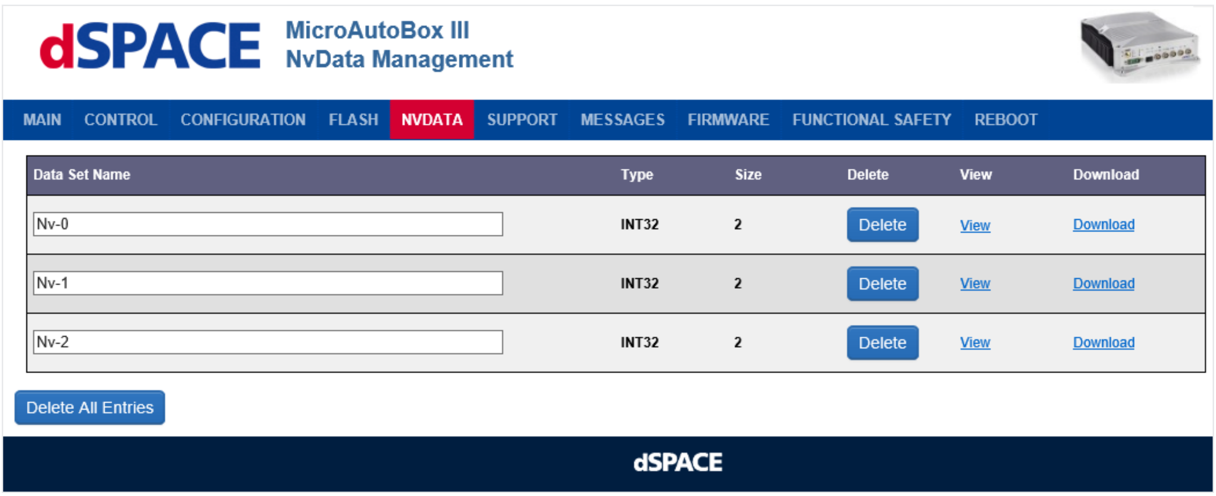
HowTos

How to Clear the Nonvolatile Memory...197

NVDATA Page

Introduction

This page lets you manage the data sets that are saved in the nonvolatile data (NvData) file system.



Data sets table

Lets you view, rename, delete, and export data sets.

The following table shows the description of the provided parameters.

Parameter	Description
Data set name	Lets you rename the data set.
Type	Displays the data type of the data set. Refer to Supported data types on page 230.
Size	Displays the number of data values that are saved in the data set.
Delete	Lets you delete the data set after confirmation.
View	Lets you display the data values of the data set.
Download	Lets you download the data values of the data set to the host PC.

Delete All Entries button

The Delete All Entries button lets you delete all data sets after confirmation.

Supported data types

The elements of a data set must be of the same data type. The following data types can be specified:

Data Type	Meaning
Int8	8-bit integer values Allocates 1 byte
UInt8	8-bit integer values (unsigned) Allocates 1 byte
Int16	16-bit integer values Allocates 2 bytes
UInt16	16-bit integer values (unsigned) Allocates 2 bytes
Int32	32-bit integer values Allocates 4 bytes
UInt32	32-bit integer values (unsigned) Allocates 4 bytes
Single (Float32)	32-bit float values Allocates 4 bytes
Double (Float64)	64-bit float values Allocates 8 bytes

Related topics

Basics

Non-Volatile Memory Access (ConfigurationDesk I/O Function Implementation Guide 📖)

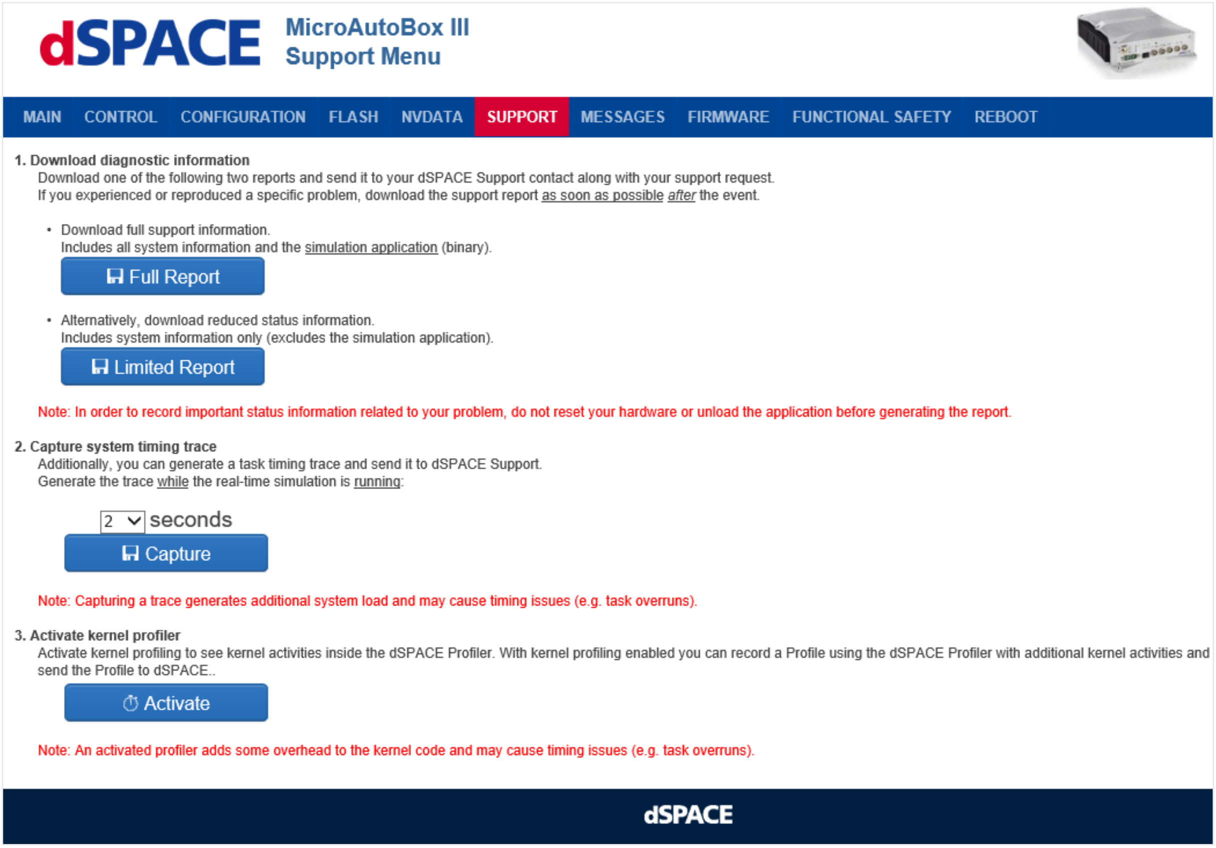
HowTos

How to Clear the Nonvolatile Memory.. 197

SUPPORT Page

Description

This page lets you provide detailed information to dSPACE Support.



Related topics

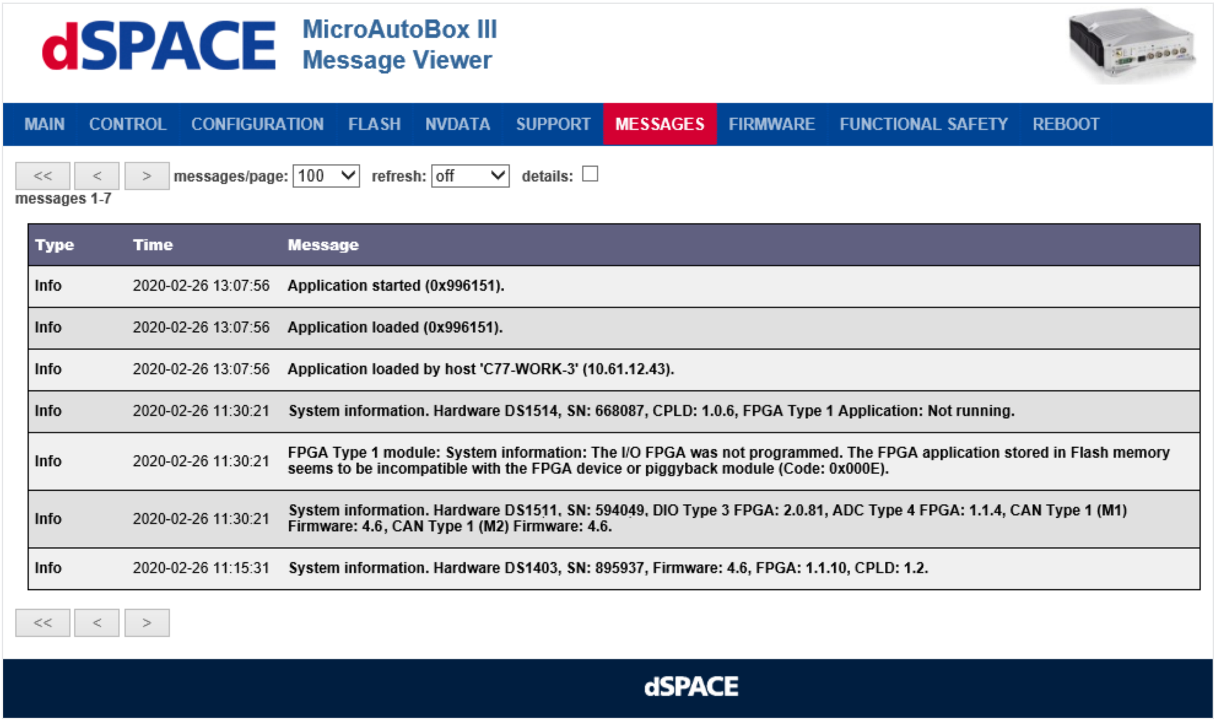
HowTos

How to Capture and Download Information for dSPACE Support.......................................205

MESSAGES Page

Description

This page lets you check for possible status, warning, and error messages.



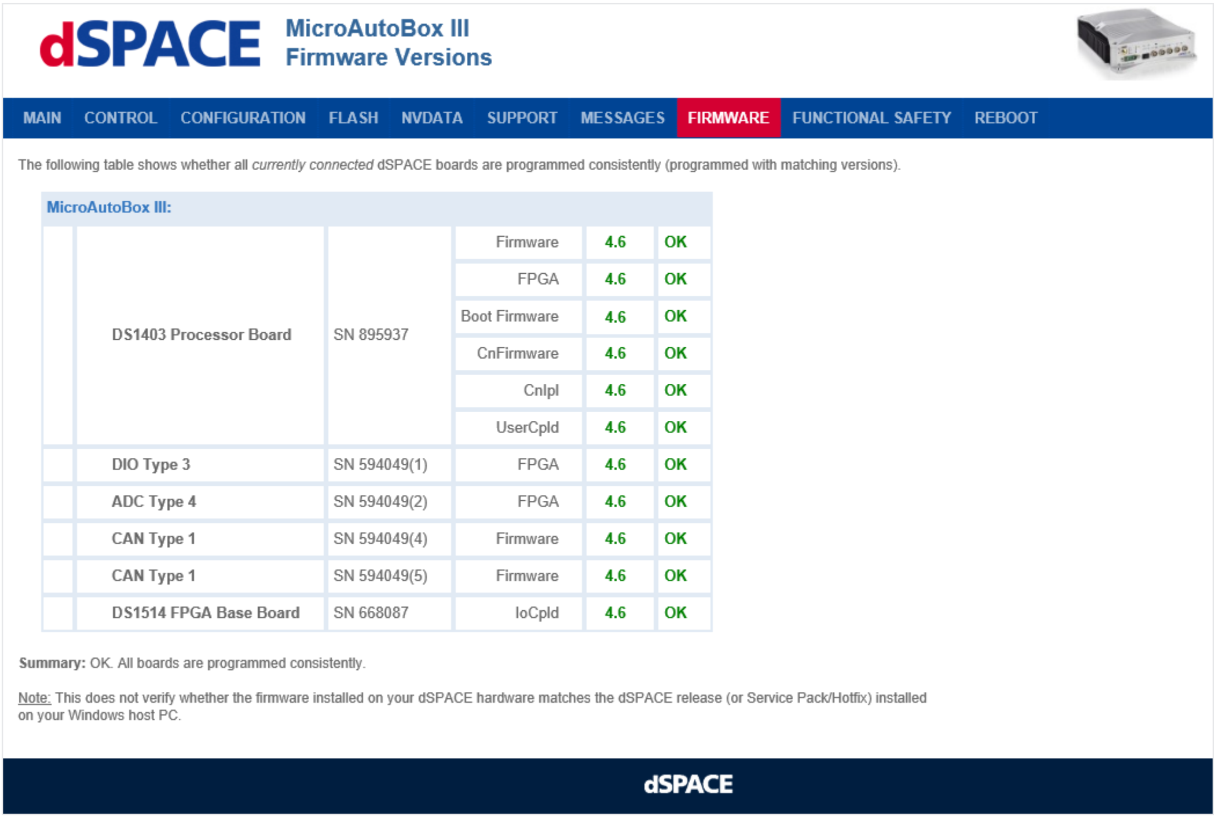
The MESSAGES page lists the messages with the newest one at the top.

FIRMWARE VERSIONS Page

Description

This page lets you check whether all boards and modules of the MicroAutoBox III are programmed with matching firmware versions.

For instructions on repairing and updating the firmware, refer to Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 📖).



dSPACE MicroAutoBox III Firmware Versions

MAIN CONTROL CONFIGURATION FLASH NVDATA SUPPORT MESSAGES FIRMWARE FUNCTIONAL SAFETY REBOOT

The following table shows whether all *currently connected* dSPACE boards are programmed consistently (programmed with matching versions).

MicroAutoBox III:				
DS1403 Processor Board	SN 895937	Firmware	4.6	OK
		FPGA	4.6	OK
		Boot Firmware	4.6	OK
		CnFirmware	4.6	OK
		Cnlpl	4.6	OK
		UserCpld	4.6	OK
DIO Type 3	SN 594049(1)	FPGA	4.6	OK
ADC Type 4	SN 594049(2)	FPGA	4.6	OK
CAN Type 1	SN 594049(4)	Firmware	4.6	OK
CAN Type 1	SN 594049(5)	Firmware	4.6	OK
DS1514 FPGA Base Board	SN 668087	IoCpld	4.6	OK

Summary: OK. All boards are programmed consistently.

Note: This does not verify whether the firmware installed on your dSPACE hardware matches the dSPACE release (or Service Pack/Hotfix) installed on your Windows host PC.

dSPACE

Related topics

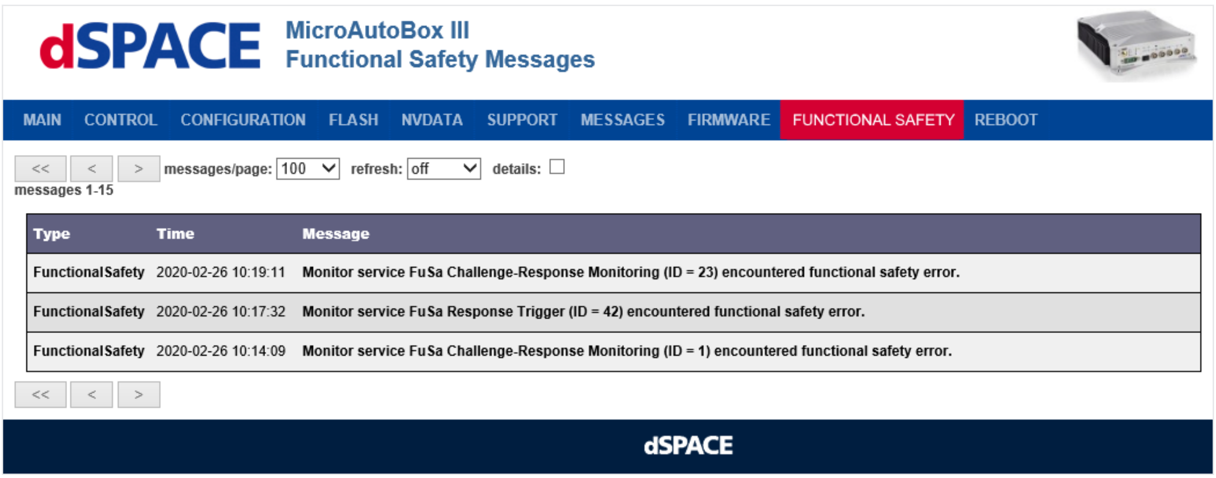
Basics

Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 📖)

FUNCTIONAL SAFETY Page

Description

This page lets you check for possible FuSa error messages. FuSa error messages are persistently written to the FuSa error log and cannot be deleted.



The FUNCTIONAL SAFETY page lists the messages with the newest one at the top.

Related topics

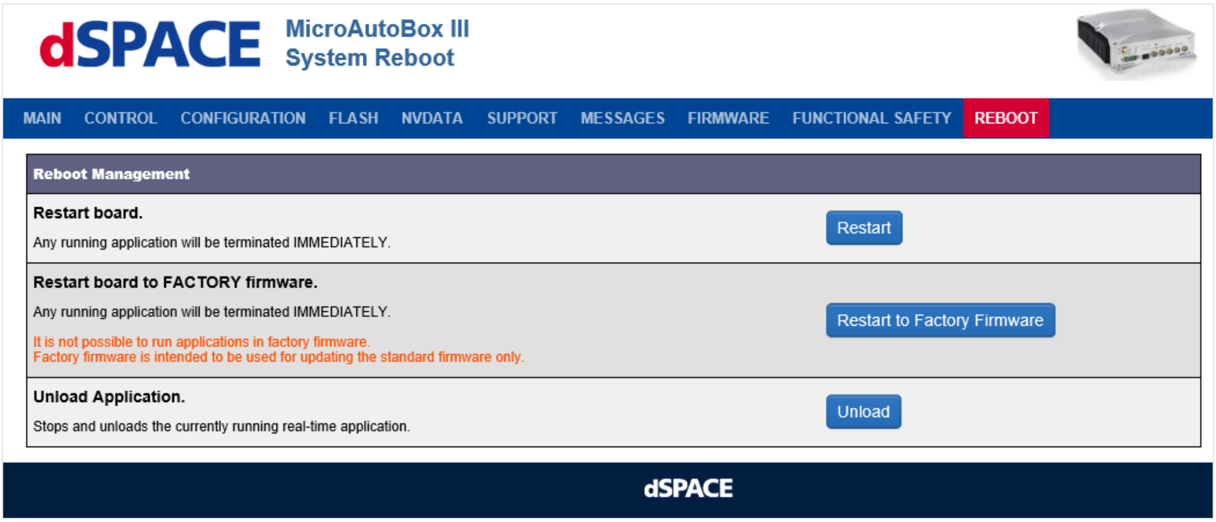
Basics

Basics on Using FuSa with the MicroAutoBox III (ConfigurationDesk I/O Function Implementation Guide 📖)
Functional Safety.. 38

REBOOT Page

Introduction

This page lets you restart the MicroAutoBox III and unload the real-time application.



Reboot Management table

The Reboot Management table lets you manage the restart of MicroAutoBox III or unload the real-time application.

Restart board The Restart button lets you restart the MicroAutoBox III after confirmation. Any running application will be terminated.

Restart board to factory firmware The Restart to Factory Firmware button lets you restart the MicroAutoBox III after confirmation. After the restart, the MicroAutoBox III is in secured mode.

In secured mode, you can repair the MicroAutoBox III firmware. Refer to Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 📖).

Unload application The Unload button lets you unload the real-time application, for example, to change the Ethernet switch configuration. Any running application will be terminated.

MicroAutoBox III Data Sheets

Where to go from here

Information in this section

Information in other sections

For characteristics of the MicroAutoBox III Cooling Unit, refer to the following topic:

For characteristics of the MicroAutoBox III Embedded PC, refer to the following topics:

Data Sheet of the Embedded PC (MicroAutoBox III Embedded PC Hardware Installation and Configuration 🕮)

Module Data Sheets (MicroAutoBox III Embedded PC Hardware Installation and Configuration 🕮)

General Information

Where to go from here

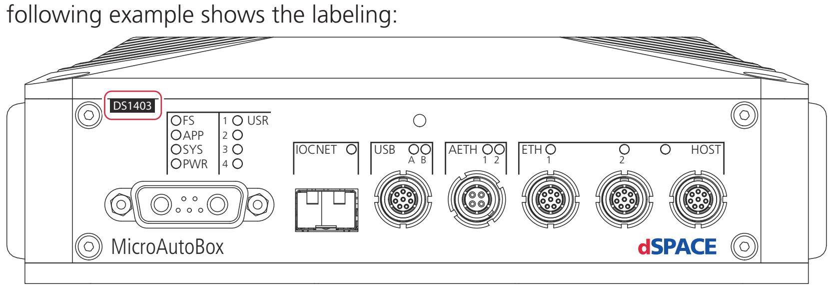
Information in this section

Housing Components

Components descriptions

The available connectors, LEDs, and buttons depend on the installed boards and I/O modules.

The board panels are labeled with the DS number of the board to identify them. Optional panels are labeled with the DS number of the I/O module. The following example shows the labeling:



For the description of the connectors, LEDs, and buttons, refer to the panel-specific component descriptions:

- DS1403 Panel Components on page 258
- DS1511 Panel Components on page 287
- DS1513 Panel Components on page 321
- DS1514 Panel Components on page 355
- DS1521 Panel Components on page 360
- DS1554 Panel Components on page 442

- MicroAutoBox III Cooling Unit Panel Components on page 509
- Embedded PC Panel Components (MicroAutoBox III Embedded PC Hardware Installation and Configuration 📖)

General Characteristics

Power input characteristics (VBAT)

> **Note**
>
> Refer to the type label at the bottom of the MicroAutoBox III to supply the MicroAutoBox III with the correct voltage and power.

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1]		Description
Operating voltage range	VBAT	10 V DC ... 36 V DC	Without Embedded PC[2]	–
	VBAT	10 V DC ... 32 V DC	With Embedded PC	–
Start-up voltage	U_{s6}	6 V	▪ DS1403 ▪ DS1511 ▪ DS1513 ▪ DS1514 ▪ DS1521[3] ▪ Cooling Unit[3]	ISO 16750-2: Starting profile level IV
	U_s	6.5 V		
	V_{start}	8 V	Embedded PC	For a maximum of 10 s only.
Load dump protection	U_{s*}	70 V	▪ DS1403 ▪ DS1521 ▪ Cooling Unit	ISO 16750-2: Test B
	Class	A		
	U_{s*}	60 V	▪ DS1511 ▪ DS1513 ▪ DS1514	
	Class	C		
	$VBAT_{protected}$	Up to +60 V	Embedded PC	–
Superimposed alternating voltage	U_{pp}	4 V	▪ DS1403 ▪ DS1511 ▪ DS1513 ▪ DS1514 ▪ DS1521[3] ▪ Cooling Unit[3]	ISO 16750-2: basic standard
	f_{min}	50 Hz		
	f_{max}	25 kHz		
	–		Embedded PC	–

Parameter	Symbol	Specification[1]		Description
Reverse voltage	V_N	-40 V[2]		Reverse voltage protection of the power input connector.
Operating power (rated power)[4]	P_{VBAT}	50 W[5]	DS1403	Power of installed boards with rated load.
		55 W	DS1511	
		55 W	DS1513	
		65 W	DS1514	
		25 W	DS1521	
		80 W	Embedded PC	
Operating power (power consumption)	P_{VBAT}	45 W[5]	DS1403	Power consumption of installed boards.
		5 W	DS1511	
		5 W	DS1513	
		25 W	DS1514	
		25 W	DS1521	
		62 W	Embedded PC	
Standby current	$IBAT_{standby}$	▪ Max. 10 mA at VBAT = 12 V ▪ Typ. 1.5 mA without Embedded PC ▪ Typ. 6.5 mA with Embedded PC		The MicroAutoBox III is in the standby mode.

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) A MicroAutoBox III 1403/1521 and a MicroAutoBox III 1403/1521/1521 that support 48 V vehicle voltage will be available in the future.
3) Tests pending.
4) The rated power is the sum of the power consumption and the power of the connected loads (VBATprot, VSENS, USB, …).
5) The operating power of the DS1403 includes 10 W for an optional Cooling Unit.

Interface characteristics

The electrical characteristics of the analog, digital, and communication interfaces depends on the installed boards and modules.

The following table shows the data sheets of the boards and modules.

Board/Module	Data Sheet
DS1403 Processor Board	DS1403 Processor Board Data Sheet on page 257
DS1511 Multi-I/O Board	DS1511 Multi-I/O Board Data Sheet on page 286
DS1513 Multi-I/O Board	DS1513 Multi-I/O Board Data Sheet on page 321
DS1521 Bus Board	DS1521 Bus Board Data Sheet on page 360
DS1514 FPGA Base Board	Depends on the installed I/O modules: DS1552, DS1553, DS1554, DS4340, and DS4342.
DS1552 Multi-I/O Module	DS1552 Multi-I/O Module Data Sheet on page 388
DS1553 AC Motor Control Module	DS1553 AC Motor Control Module Data Sheet on page 422
DS1554 Engine Control I/O Module	DS1554 Engine Control I/O Module Data Sheet on page 442

Board/Module	Data Sheet
DS4340 FlexRay Interface Module	DS4340 FlexRay Interface Module Data Sheet on page 472
DS4342 CAN FD Interface Module	DS4342 CAN FD Interface Module Data Sheet on page 479
Embedded PC	Data Sheet of the Embedded PC (MicroAutoBox III Embedded PC Hardware Installation and Configuration)

Environmental conditions

The following table shows the environmental conditions the MicroAutoBox III is designed for.

Note

The following built-in hardware limits the temperature ranges of the MicroAutoBox III:

- WLAN module of the MicroAutoBox III (WLAN)
- Built-in Embedded PC
- DS1553 AC Motor Control Module

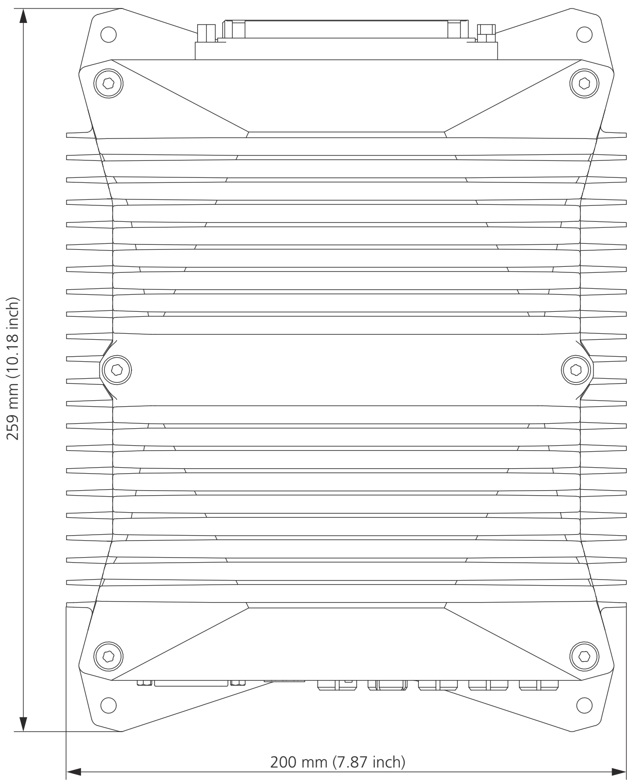
Parameter	Specification	
Environment	For in-vehicle and indoor use.	
Air circulation	Take care for a sufficient air circulation to ensure an adequate heat dissipation, especially when operating the MicroAutoBox III at high temperatures. Remove all objects that prevent the air circulation with the cooling fins of the MicroAutoBox III.If you use a MicroAutoBox III with Cooling Unit or Embedded PC, make sure that there is also enough clearances from the front and rear panels to walls, other devices, and objects for the internal fans.	
Operating temperature range	-40 °C … +70 °C (-40 °F … +158 °F)	Standard operating temperature range.
	-40 °C … +80 °C (-40 °F … +176 °F)	Extended temperature range that is supported by the following MicroAutoBox III variants: ▪ MicroAutoBox III with Cooling Unit ▪ MicroAutoBox III without DS1521 and two processor cores deactivated[1)] Limitations for the MicroAutoBox III WLAN, Embedded PC, and DS1553 apply even if you connect a MicroAutoBox III Cooling Unit or you deactivate processor cores.
	-40 °C ... +70 °C (-40 °F ... +158 °F)	Limited operating temperature range of the MicroAutoBox III (WLAN).
	0 °C ... +60 °C (+32 °F ... +140 °F)	Limited operating temperature range of the MicroAutoBox III with built-in Embedded PC.
	0 °C … +70 °C (+32 °F … +158 °F)	Limited operating temperature range of the MicroAutoBox III with DS1553 AC Motor Control Module.

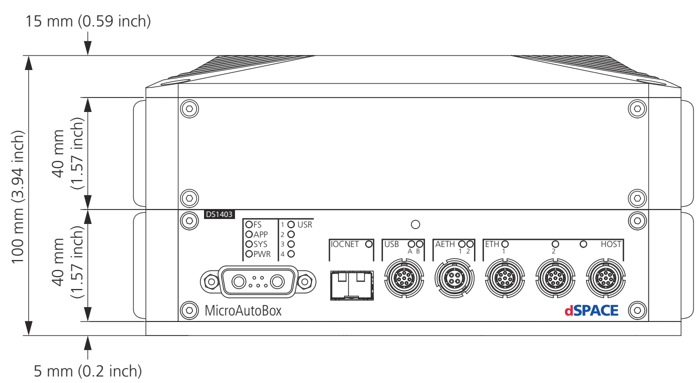
Parameter	Specification	
Storage temperature range	-55 °C … +90 °C (-67 °F … +194 °F)	Standard storage temperature range.
	-20 °C … +70 °C (-4 °F … +158 °F)	Limited storage temperature range of the MicroAutoBox III with built-in Embedded PC.
Relative humidity	10% ... 95%, noncondensing	
Pollution degree	2, according to IEC 61010-1 (normal clean and dry environment)	
Altitude	Up to 2,000 m	

1) Refer to How to Extend the Operating Temperature on page 188.

Housing dimensions

The following illustrations show the dimensions of the MicroAutoBox III with two I/O boards. The height depends on the boards that are installed to the different layers.





The following table shows the height of the different housing components to calculate the total height:

Component	Height
DS1511 panel	40 mm (1.57 in.)
DS1513 panel	40 mm (1.57 in.)
DS1514 panel	40 mm (1.57 in.)
DS1521 panel	40 mm (1.57 in.)
Cooling Unit	25 mm (0.98 in.)
Embedded PC	52 mm (2.05 in.)

Component	Height
Bottom plate	5 mm (0.20 in.)
Top plate	15 mm (0.59 in.)

The panel of the processor board is on the rear and does not affect the height of the MicroAutoBox III.

Example The MicroAutoBox III 1403/1511 consists of a DS1403 Processor Board and a DS1511 Multi-I/O Board.

$$\begin{aligned}\text{Height}_{\text{MicroAutoBox III}} &= \text{Height}_{\text{DS1511 panel}} + \text{Height}_{\text{bottom plate}} + \text{Height}_{\text{top plate}} \\ &= 40\text{ mm} + 5\text{ mm} + 15\text{ mm} \\ &= 60\text{ mm (2.36 in.)}\end{aligned}$$

Weight

The weight of MicroAutoBox III depends on the installed I/O boards. The following table shows the weight of the housing and the different boards to calculate the total weight of the MicroAutoBox III.

Component	Weight
Housing, incl. DS1403 Processor Board	▪ Housing for one layer: 2,800 g (99 oz) ▪ Housing for two layers: 3,500 g (123 oz) ▪ Housing for three layers: 4,200 g (148 oz)
DS1511 Multi-I/O Board	400 g (14 oz)
DS1513 Multi-I/O Board	500 g (18 oz)
DS1514 FPGA Base Board, incl. I/O modules	900 g (32 oz)
DS1521 Bus Board	600 g (21 oz)
Cooling Unit	1,300 g (46 oz)
Embedded PC	2,500 g (88 oz)

Example The MicroAutoBox III 1403/1521 consists of a DS1403 Processor Board and a DS1521 Bus Board.

$$\begin{aligned}m_{\text{MicroAutoBox III}} &= m_{\text{housing}} + m_{\text{DS1521}} \\ &= 2{,}800\text{ g} + 600\text{ g} \\ &= 3{,}400\text{ g (120 oz)}\end{aligned}$$

Requirements on the Installation Location

Clearances

For the cable harness, observe enough clearances from the front and rear panels to walls, other devices, and objects.

Air circulation

Take care for a sufficient air circulation to ensure an adequate heat dissipation, especially when operating the MicroAutoBox III at high temperatures. Remove all objects that prevent the air circulation with the cooling fins of the MicroAutoBox III.

Installation positions

It is recommended to install the MicroAutoBox III in a horizontal position with the bolt holes at the bottom. The recommended installation position is relevant for heat distribution in order to achieve good heat dissipation.

MicroAutoBox III with Cooling Unit The MicroAutoBox III with built-in Cooling Unit must be installed in a horizontal position with the bolt holes at the bottom.

Related topics

HowTos

How to Install a MicroAutoBox III in a Vehicle..176

Operating Modes when Switching On/Off the MicroAutoBox III

Introduction

There are different methods to switch on/off the MicroAutoBox III. Depending on the used method, the MicroAutoBox III enters different operating modes.

Status LEDs of the DS1403 Processor Board let you identify the current operating mode.

Methods to switch on/off the MicroAutoBox III

You can use the following methods to switch on/off the MicroAutoBox III:

- Using the REMOTE pin of the power input connector.
  This is the standard method for most applications.
- Using the prestart feature to start the MicroAutoBox III and the real-time application separately.
- Controlling the system shutdown with the real-time application, e.g., to log off from a network before the MicroAutoBox III switches off.

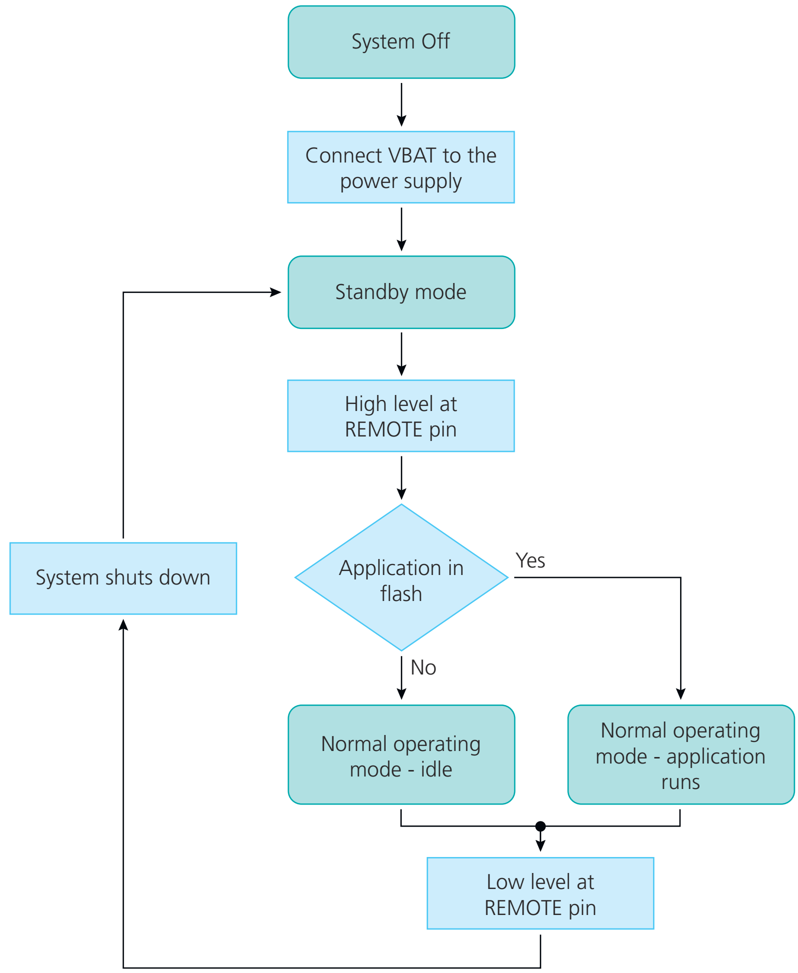
Possible operating modes and LED states

The following table lists the possible operating modes and the LED states to identify the mode.

Operating Mode	Definition	DS1403 LED States	
		PWR	APP
System off	The MicroAutoBox III is not powered.	Off	Off
Standby mode	The MicroAutoBox III is powered, but not switched on.	Flashing blue	Off
Normal operating mode - idle	The MicroAutoBox III is switched on and ready, but no real-time application runs.	Green	Off
Normal operating mode - application runs	The MicroAutoBox III is switched on and a real-time application runs.	Green	Green
Prestart mode	The MicroAutoBox III loaded a real-time application, but the application does not run.	Green	Red

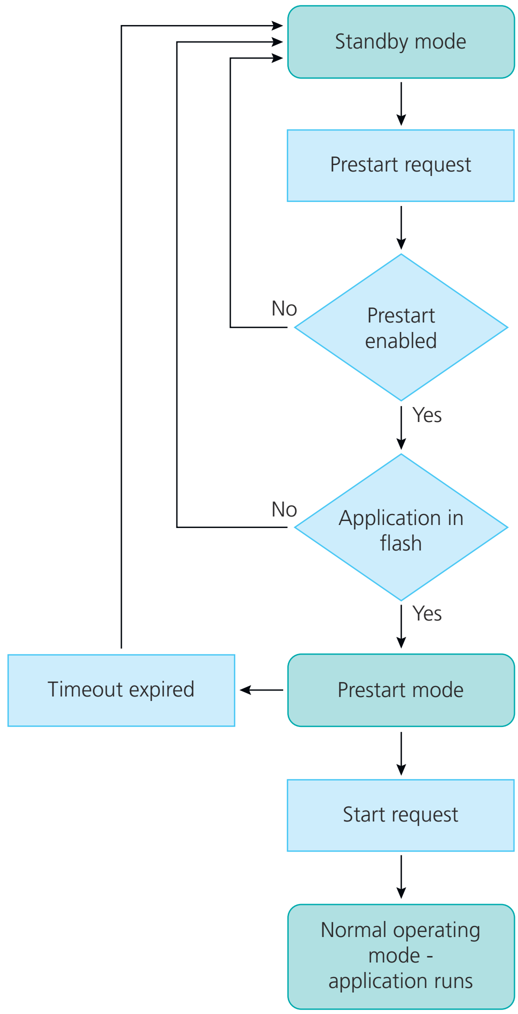
Flow chart when using the REMOTE pin

The following simplified flow chart displays the operating modes when using the REMOTE pin to switch on/off the MicroAutoBox III.



Flow chart when using the prestart feature

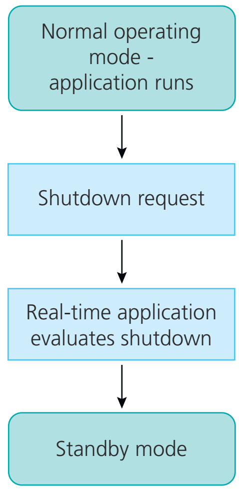
The following simplified flow chart displays the operating modes when using the prestart feature to enter the normal operating mode.



For more information, refer to Basics on Prestarting the MicroAutoBox III on page 190.

Flow chart when using the application-controlled system shutdown

The following simplified flow chart displays the operating modes when using the System Shutdown function block.



For more information, refer to Basics on Using the System Shutdown Functionality (ConfigurationDesk I/O Function Implementation Guide 📖).

Related topics

Basics

Certifications

CE compliance

MicroAutoBox III meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

The MicroAutoBox III (WLAN) meets the requirements of the European directive 2014/53/EU (Radio Equipment Directive) for CE marking. Refer to Radio Devices Regulatory Notice on page 253.

Applied standards

The characteristics of the MicroAutoBox III were tested according to the standards shown in the following table:

Tested Characteristics	Applied Standard	Description
Electromagnetic compatibility (EMC)	EN 61326-1 Table 2	Immunity standard for industrial environments[1)] Refer to Influences through connected cables on page 251.
	CISPR 11, EN 55011 Group 1, Class A	Emission standard for industrial environments
Vibration	ISO 16750-3:2007 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 2 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 2 h per axis, based on DO160F Section 8, Category B1
	EN 60068-2-6	Test conditions: ▪ Swept sine, 1 octave per minute, 3-axis test ▪ 5 … 2,000 Hz, up to 5 g, 2 sweeps per axis ▪ Operating
Shock	ISO 16750-3:2007 / 4.2.2.	▪ Linear shock (1/2 sine pulse), 6-axis ▪ 500 m/s^2, 6 ms, 10 pulses per axis ▪ Operating
	RTCA / DO-160F Section 7 Test 7.2 Category D Test type R	Operational shocks test (low frequency): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 20 ms, 10 pulses per axis ▪ Operating

[1)] Tested with an I/O cable length < 3 m.

Vibration and shock tests

To verify the reliability of the MicroAutoBox III under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, the MicroAutoBox III executed a program without any failures.

Influences through connected cables

Connected cables might affect the specified characteristics due to physical effects like 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 MicroAutoBox III during run time. Otherwise, you might influence the measurements.

Related topics

References

Certifications (MicroAutoBox III Embedded PC Hardware Installation and Configuration 📖)

Notes on Regulations, Software Licenses, and Agreements

Where to go from here

Information in this section

Radio Devices Regulatory Notice

Introduction

The MicroAutoBox III (WLAN) complies with the radio frequency and safety standards of any country or region in which it has been approved for wireless use.

The MicroAutoBox III (WLAN) contains the AirborneM2M^{TM} module APMN-Q551 of B+B SmartWorx to provide a WLAN interface. The WLAN module must be used in strict accordance with the regulations and constraints of the country of use. For more information, contact the local regulatory office in the country of use.

In the following, product stands for the MicroAutoBox III (WLAN), device for the WLAN module, and equipment for the WLAN module with the delivered antenna.

Radiation exposure statement

This product must be installed and operated with a minimum distance of 200 mm (7.87 in) between the product and persons and between the product and external antennas.

Modifications to the equipment

Any changes or modifications to this equipment not expressly approved by dSPACE could void the user’s authority to operate the equipment.

The device is an integral part of the product and cannot be removed.

Europe: EU declaration of conformity

CE

This device bears the CE mark in accordance with Directive 2014/53/EU.

To obtain a full copy of the EU declaration of conformity, contact dSPACE Support.

This equipment may be operated in:							
AT	BE	CY	CZ	DK	EE	FI	FR
DE	GR	HU	IE	IT	LV	LT	LU
MT	NL	PL	PT	SK	SI	ES	SE
GB	IS	LI	NO	CH	BG	RO	TR

RF band restrictions in European Community Countries WLAN operation in the 5 GHz RF band is restricted to indoor use.

For outdoor operation in EU member states and EFTA countries, the user must use the 2.4 GHz RF band to comply with European spectrum usage laws for wireless LAN operation. The user must use a wireless LAN utility to check the current channel of operation. If the device is operated outside of the allowable frequencies for outdoor use, as listed above, the user must contact the applicable national spectrum regulator to request a license for outdoor operation.

FCC interference statement

This equipment has been tested and found to comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- WLAN operation in the 5 GHz RF band are restricted to indoor use.

ISED RSS-GEN statement

This device has been approved by Industry Canada to operate with the delivered antenna with the maximum permissible gain indicated. Other antennas are strictly prohibited for use with this device.

This device complies with Innovation, Science and Economic Development Canada license-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les livrer antenne et ayant un gain admissible maximal. Autre antennes sont strictement interdits pour l'exploitation de l'émetteur.

Le présent appareil est conforme aux CNR Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes:

1. L’appareil ne doit pas produire de brouillage.
2. L’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Avoiding interference with radio communication devices

An improper installation or unauthorized use of radio interfaces can cause harmful interference with radio communication devices:

- If you operate the WLAN interface in the 5 GHz frequency range, the device is restricted to indoor use.
- Attach only the delivered antennas to the equipment. Do not use antennas that are not provided by dSPACE.
- Any modification of the antennas will void the FCC/ISED and CE certifications and your warranty.

The following statement applies to the products covered in this document, unless otherwise specified herein. The statement for other products will appear in the accompanying documentation.

dSPACE GmbH is not responsible for any harmful interference with radio communications caused by unauthorized modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by dSPACE GmbH. The correction of interference caused by such unauthorized modification, substitution, or attachment will be the responsibility of the user.

The use of shielded communication cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so can violate FCC and ICES rules.

Regulatory IDs

The table shows the regulatory IDs that cover the device:

Country	Standard	ID
Canada	RSS 210, modular approval	3913A-WLNN551
Japan	Standard Certification Ordinance, article 2, section 1, No. 19, 19-3, 19-3-2	208-150044
USA	FCC Part 15, Sec. 15.107, 15.109, 15.207, 15.209, 15.247, modular approval	F4AWLNN551

Supplier's Declaration of Conformity

47 CFR § 2.1077 Compliance Information

Unique Identifier: MicroAutoBox III (WLAN)

Identification of the authorized components used in the assembly:

Name:	MicroAutoBox III (WLAN)
Model Number:	MABX_III_WIFI
FCC IDs:	F4AWLNN551

Responsible Party - U.S. Contact Information

Contact

	Dr. Peter Waeltermann
Address:	dSPACE Inc., 50131 Pontiac Trail, Wixom, MI, USA 48393-2020
Phone:	+1 248 295-4700
Fax:	+1 248 295-2950
Email:	info@dspaceinc.com
Website:	www.dspaceinc.com

FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

DS1403 Processor Board Data Sheet

Where to go from here

Information in this section

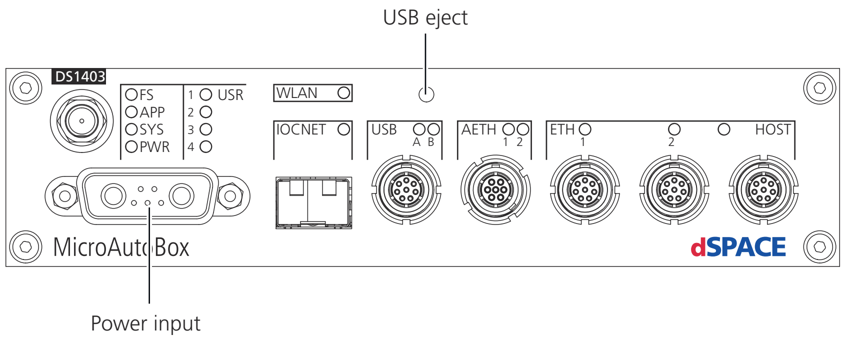
Overview and General Information

Where to go from here

Information in this section

DS1403 Panel Components

Panel overview



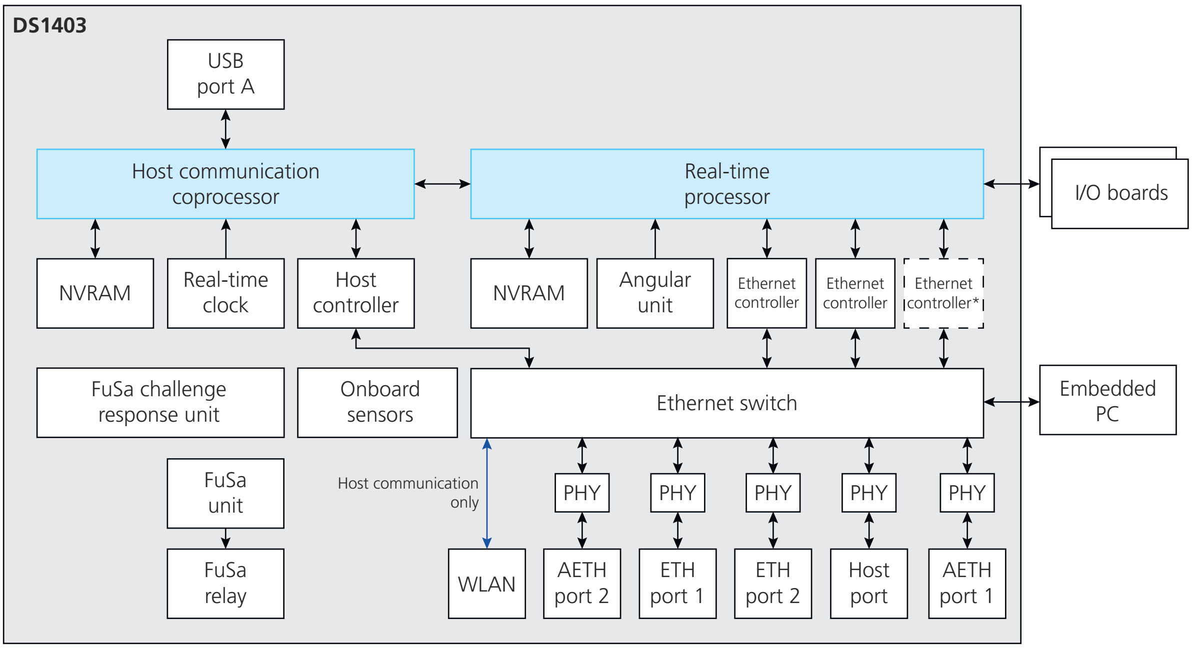
Component		**Description**
Button	USB eject	▪ Lets you safely remove the USB device. Refer to How to Connect and Remove USB Devices on page 100. ▪ Lets you force a start with factory firmware. Refer to How to Force a Start with Factory Firmware on page 203.
Connectors	Power input	Supplies and switches on/off the MicroAutoBox III, and provides access to the FuSa interface. ▪ For the power input characteristics, refer to Power Input Characteristics on page 279. ▪ For FuSa interface characteristics, refer to FuSa Interface Characteristics on page 273. ▪ For the pinout, refer to Power Input Connector Pinout on page 265.
	IOCNET	For future use.
	USB	Provides two USB ports to connect a USB mass storage device. ▪ Matching adapter cables with standard USB connectors are provided by dSPACE. Refer to USB_CAB14 Interface Cable on page 524. ▪ For the interface characteristics, refer to USB Connector Characteristics on page 277.
	AETH	Provides two automotive Ethernet ports. ▪ Matching adapter cables can be ordered from dSPACE. Refer to Ethernet Connection Cables on page 512. ▪ For the pinout, refer to AETH Connector Pinout (DS1403) on page 266. ▪ For the interface characteristics, refer to AETH Port Characteristics (DS1403) on page 271.
	ETH	Provides two standard Ethernet ports to connect I/O Ethernet devices. ▪ Matching adapter cables can be ordered from dSPACE. Refer to Ethernet Connection Cables on page 512.

Component		Description
		▪ For the interface characteristics, refer to ETH Port Characteristics on page 270.
	HOST	Provides one standard Ethernet port to connect the host PC. ▪ A matching adapter cable is delivered with the MicroAutoBox III. More adapter cables can be ordered from dSPACE. Refer to Ethernet Connection Cables on page 512. ▪ For the interface characteristics, refer to HOST Port Characteristics on page 272.
		Optional connector to attach a WLAN antenna. This connector is available only for MicroAutoBox III (WLAN). ▪ Attach only a delivered antenna to this radio interface. Do not use antennas that are not provided by dSPACE for this product. Refer to Attaching Antennas to the DS1403 on page 98. ▪ For the WLAN characteristics, refer to WLAN Module Characteristics on page 273.
LED	FS	For the LED status description, refer to LED States of the DS1403 Panel on page 282.
	APP	
	SYS	
	PWR	
	USR	
	WLAN	
	IOCNET	
	USB	
	AETH	
	ETH	
	HOST	

Features of the DS1403 Processor Board

Block diagram

The following block diagram provides a functional view of the DS1403 Processor Board.



*Controller for fast bypassing. Enabled via web interface.

The following table shows you more details.

Feature	Description
Real-time processor	▪ Texas Instruments AM5K2E04 processor ▪ Four ARM® Cortex®-A15 processor cores ▪ 32 kB L1 instruction and data caches per core ▪ 4 MB L2 cache shared by all cores ▪ 2 GB DDR3L RAM ▪ 64 MB flash memory[1)] ▪ 256 kB NVRAM (FRAM)
Host communication coprocessor	▪ ARM® Cortex®-A9 (dual core) ▪ 1 GB DDR3L RAM ▪ 256 kB NVRAM (FRAM)

Communication interfaces	▪ 5 x Ethernet ports that are mapped to a managed Ethernet switch.
	  ▪ 1 x Host port
	  For interface characteristics, refer to HOST Port Characteristics on page 272.
	  ▪ 2 x automotive Ethernet
	  For interface characteristics, refer to AETH Port Characteristics (DS1403) on page 271.

Feature	Description
	▪ 2 x standard I/O Ethernet For interface characteristics, refer to ETH Port Characteristics on page 270. ▪ 1 x optional WLAN interface The radio interface is provided only by the MicroAutoBox III (WLAN). For interface characteristics, refer to WLAN Module Characteristics on page 273. ▪ 1 x USB port for mass storage devices. For interface characteristics, refer to USB Connector Characteristics on page 277.
Onboard sensors	▪ 1 x acceleration sensor unit For sensor characteristics, refer to Acceleration Sensor Unit 1 Characteristics on page 276. ▪ 1 x pressure sensor unit For sensor characteristics, refer to Pressure Sensor Unit 1 Characteristics on page 277. ▪ 1 x temperature sensor
Angular units	6 angular units to provide angle values. For angular unit characteristics, refer to DS1403 Angular Unit Characteristics on page 263.
Real-time clock	Battery-backed real-time clock. When you download the first real-time application after system start, the system time of the MicroAutoBox III is automatically set to the system time of the host PC.
Power control	▪ Remote control input to switch on/off MicroAutoBox III. For signal characteristics and mapping, refer to Remote Input Characteristics on page 279. ▪ Prestart input to switch on the MicroAutoBox III without starting the real-time application. For signal characteristics and mapping, refer to Prestart Input Characteristics on page 280. For information on the MicroAutoBox III operating modes, refer to Operating Modes when Switching On/Off the MicroAutoBox III on page 246.
FuSa units	Hardware components of the MicroAutoBox III safety concept. For FuSa relay characteristics and mapping, refer to FuSa Interface Characteristics on page 273. For basics on the FuSa functionality of the MicroAutoBox III, refer to Functional Safety on page 38.

Connectors	▪ 1 x Power input connector that includes the signals for remote control, prestart, and FuSa relay.
	▪ 5 x LEMO connectors:
	  ▪ 1 USB connector that provides two USB ports.
	  ▪ 1 AETH connector that provides two automotive Ethernet ports.
	  ▪ 2 ETH connectors that provide a total of two standard Ethernet ports for I/O Ethernet devices.
	  ▪ 1 x Host connector that provides a standard Ethernet port for the host PC.

Embedded PC	If an Embedded PC is installed to the housing of the MicroAutoBox III, the DS1403 and the Embedded PC are internally connected via Ethernet. For more information, refer to The Embedded PC and a MicroAutoBox III in one Housing (MicroAutoBox III Embedded PC Hardware Installation and Configuration 📖).

[1] For the real-time application and/or custom libraries.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the channel types of the DS1403 Processor Board.

Function Block Type	Purpose	Channel Type
Acceleration In	The Acceleration In function block type reads the measured acceleration and angular velocity values on three axes (x, y, z) from an onboard acceleration sensor and provides the values to the behavior model.	Acceleration Sensor Unit 1
Atmospheric Pressure In	The Atmospheric Pressure In function block type reads the measured atmospheric pressure value from an onboard pressure sensor and provides the value to the behavior model.	Pressure Sensor Unit 1
Ethernet Setup	With the Ethernet Setup function block type, you can configure and initialize the access to an Ethernet controller of your dSPACE real-time hardware. The function block works as a provider: Other function blocks can use it to access the configured Ethernet controller.	Ethernet Adapter 2
Ethernet Switch	The Ethernet Switch function block lets you configure the switching of Ethernet traffic and the characteristics of the physical layer transceivers (PHYs).	Ethernet Switch 2
FuSa Setup	The FuSa Setup function block provides the basic functionality for implementing functional safety in your system. The function block triggers basic error responses and lets you enable additional error responses.	FuSa Unit 1
FuSa Challenge-Response Monitoring	Each FuSa Challenge-Response Monitoring function block works as a challenge-response monitor to support functional safety in your application. Based on the challenge and response principle, you can implement advanced monitoring services, for example, monitor periodic tasks or the correct execution of subsystems.	FuSa Challenge-Response Monitoring Unit 1
LED Out	Each LED Out function block type provides access to one of the 4 user LEDs on the MicroAutoBox III. The LEDs can be controlled from the behavior model, for example, to display status information on the real-time application.	LED Out
Power On Signal In	The Power On Signal In function block type monitors hardware based shutdown requests for the SCALEXIO LabBox (with DS6001 Processor Board), SCALEXIO AutoBox (with DS6001 Processor Board) and MicroAutoBox III. The request state can be provided to the behavior model and/or can be accessed in the experiment software.	-
System Shutdown	The System Shutdown function block type lets you control the shutdown of a SCALEXIO LabBox or SCALEXIO AutoBox (both with a DS6001 Processor Board installed) or a MicroAutoBox III from within the behavior	-

Function Block Type	Purpose	Channel Type
	model and/or the experiment software. Hardware based shutdown requests can be ignored or delayed.	
System Temperature Monitoring	With the System Temperature Monitoring function block type, you can monitor the internal temperature of MicroAutoBox III via a real-time application.	-
USB Eject	The USB Eject function block provides a trigger from the behavior model to eject (unmount) a USB mass storage device from the dSPACE system. Removing a USB device from the USB port without unmounting can result in data loss.	-

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide 🕮.

Data logging

ControlDesk lets you log data to a USB mass storage device. For more information, refer to General Information on Data Logging (ControlDesk Measurement and Recording 🕮).

Related topics

Basics

References

DS1403 Angular Unit Characteristics

Purpose

Counter to provide an angle value.

Angular unit characteristics

The angular units have the following characteristics:

Parameter	Specification[1)]
Supported function blocks	-
Number of units	6
Angular range modes	2 modes: 360° mode and 720° mode
Speed range	-1,200,000 °/s … 1,200,000 °/s (-200,000 rpm … 200,000 rpm)
Speed resolution	0.616 °/s (0.103 rpm)

Parameter	Specification[1]
Angular resolution	▪ 360° mode: 360°/2^{15} ≈ 0.011° (15-bit resolution) ▪ 720° mode: 720°/2^{16} ≈ 0.011° (16-bit resolution)

[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

Battery Characteristics

Characteristics of the internal battery

The following table shows the characteristics of the battery mounted on the DS1403 Processor Board.

Parameter	Specification
Manufacturer	Tadiran Batteries GmbH
Type	SL-550
Lithium content	350 mg
UN test	Passed
Nominal capacity	900 mAh

Related topics

Basics

Connector Pinouts

Where to go from here

Information in this section

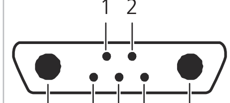
Power Input Connector Pinout

Purpose

Connector to supply and switch on/off the MicroAutoBox III, and to provide access to signals for functional safety.

Pinout

The power input connector is a 7-pin, male connector with two high-current pins. It is a special variant of a 15-pin Sub-D connector (mixed-layout 7W2 Sub-D). The following illustration shows the pin numbering of the Power Input connector (front view of the MicroAutoBox III):

Power Input Connector	Pin	Signal
	A1	GND
	A2	VBAT
	1	SAFETY Out 1
	2	SAFETY Out 2
	3	PRESTART
	4	REMOTE
	5	SAFETY In

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
VBAT	Power input to supply the MicroAutoBox III.	General Characteristics on page 240
GND	Power supply ground. GND is also connected to the housing of the MicroAutoBox III.	
REMOTE	Remote control input to switch on/off the MicroAutoBox III and to start the real-time application.	Remote Input Characteristics on page 279
PRESTART	Prestart input to switch on the MicroAutoBox III without starting the real-time application.	Prestart Input Characteristics on page 280

Signal	Description	Characteristics
SAFETY Out	Relay output to signal the FuSa state of the MicroAutoBox III.	FuSa Interface Characteristics on page 273
SAFETY In	Input to trigger a FuSa response.	

Related topics

Basics

Building the Power Supply Cable.. 84

AETH Connector Pinout (DS1403)

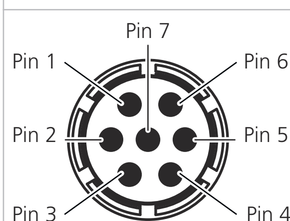
Purpose

Connector to provide two automotive Ethernet ports.

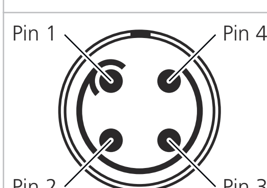
Pinout

The Pinout depends on the board revision. The revision number is displayed in the Platform Manager after you register the MicroAutoBox III.

As of DS1403-05 The AETH connector of the DS1403 as of revision 5 (Release 2020-A) is a 7-pin LEMO connector. The following illustration shows the pin numbering of the AETH connector (front view of the MicroAutoBox III):

LEMO Connector	Pin	Signal
	1	TRX+ Port 1
	2	GND
	3	TRX- Port 2
	4	TRX+ Port 2
	5	GND
	6	TRX- Port 1
	7	GND

DS1403-04 The AETH connector of the DS1403-04 is a 4-pin LEMO connector. The following illustration shows the pin numbering of the AETH connector (front view of the MicroAutoBox III):

LEMO Connector	Pin	Signal
	1	TRX+ Port 1
	2	TRX- Port 2
	3	TRX+ Port 2
	4	TRX- Port 1

Signal descriptions

The following table shows the description of the signals.

Signal	Description	Characteristics
TRX+	Positive bus signal	AETH Port Characteristics (DS1403) on page 271
TRX-	Negative bus signal	

Ethernet connection cable

The following Ethernet connection cables are provided by dSPACE to connect the automotive Ethernet port to a network:

- 7-pin LEMO connector: AETH_CAB2 Automotive Ethernet Connection Cable.
  For technical data, refer to AETH_CAB2 Automotive Ethernet Connection Cable on page 514.
- 4-pin LEMO connector: AETH_CAB1 Automotive Ethernet Connection Cable.
  For technical data, refer to AETH_CAB1 Automotive Ethernet Connection Cable on page 513.

Matching cable connector

To build an Ethernet cable, use the following standard LEMO connector:

- Connector type: LEMO Connector 1B Series with G-coding
- 7-pole LEMO connector example: FGG.1B.307.CLAD72Z
  4-pole LEMO connector example: FGG.1B.304.CYCD

For more information, refer to www.lemo.com.

Related topics

References

Ethernet Characteristics

Where to go from here

Information in this section

Ethernet Adapter 2 Characteristics (DS1403)

Purpose

Ethernet adapter to communicate with external devices via Ethernet. The controller of the adapter is connected to the ports via an internal Ethernet switch.

Controller characteristics

Parameter		Specification[1)]
Supported function blocks		Ethernet Setup
Controller		▪ 2 x Intel® I210 Gigabit LAN ▪ 1 x additional controller for fast bypassing. Refer to How to Improve ECU Interfacing on page 186.
Supported protocols	Network protocols	▪ IPv4 ▪ IPv6
	Transport protocols	▪ UDP ▪ TCP
	Measurement and application protocol	XCP for bypassing

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

Switch characteristics

Refer to Ethernet Switch 2 Characteristics on page 269.

PHY/Port characteristics

Refer to the following topics:

- ETH Port Characteristics on page 270
- AETH Port Characteristics (DS1403) on page 271
- HOST Port Characteristics on page 272

Port mapping

The following table shows the ports that provide the Ethernet signals. The mapping of the controllers to the ports is configurable via the internal Ethernet switch. Refer to How to Configure the Internal Ethernet Switch on page 182.

Port	Connector
Standard I/O Ethernet	ETH[1]
Automotive Ethernet	AETH
Standard host port[2]	HOST[1]

1) Matching adapter cables are provided by dSPACE. Refer to Ethernet Connection Cables on page 512.
2) Recommended port for communication with the host PC.

For the location of the ports, refer to DS1403 Panel Components on page 258.

Related topics

References

Features of the DS1403 Processor Board..260

Ethernet Switch 2 Characteristics

Purpose

Internal Ethernet switch that is configurable via software.

Ethernet switch characteristics

The Ethernet switch is a switch of the Ethernet Switch 2 channel type with the following characterists:

Parameter	Specification[1]
Supported function blocks	Ethernet Switch
Number of switches	1
Type	1 x Marvell® Link Street®-88E6390X

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

Related topics

HowTos

References

ETH Port Characteristics

Purpose

Ethernet port to connect external devices via standard Ethernet.

ETH Port characteristics

Parameter	Specification[1]
Supported function blocks	Ethernet Switch
Number of ports	2
Supported network	Standard Ethernet
Physical layer transceiver (PHY)	Gigabit Ethernet PHYs of the Ethernet switch
Supported standards	▪ 10BASE-T[2] ▪ 100BASE-TX[2] ▪ 1000BASE-T[2]
Data rate	Configurable via software: ▪ 10 Mbit/s (half or full-duplex) ▪ 100 Mbit/s (half or full-duplex) ▪ 1000 Mbit/s (full-duplex)
Autonegotiation mode	Supported

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

[2] Adapted and reprinted with permission from IEEE.

Ethernet connection cable

Adapter cables provided by dSPACE are required to connect Ethernet devices. Refer to Ethernet Connection Cables on page 512.

Related topics

HowTos

How to Configure I/O Ethernet Ports........ 185

References

Features of the DS1403 Processor Board........ 260

AETH Port Characteristics (DS1403)

Purpose

Ethernet port to connect external devices via automotive Ethernet.

PHY characteristics

Parameter	**Specification**[1]
Supported function blocks	Ethernet Switch
Number of ports	2
Supported network	Automotive Ethernet
Physical layer transceiver (PHY)	Marvell® 88Q2112
Supported standards	▪ 100BASE-T1[2] ▪ 1000BASE-T1[2]
Data rate	Configurable via software: ▪ 100 Mbit/s ▪ 1,000 Mbit/s
PHY Mode	Configurable via software: ▪ Master ▪ Slave
Autonegotiation mode	Not supported

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

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Related topics

HowTos

References

HOST Port Characteristics

Purpose

Ethernet port to connect the host PC.

Port characteristics

Parameter	**Specification**[1]
Supported function blocks	-
Number of ports	1
Supported network	Standard Ethernet
Supported standards	▪ 10BASE-T[2] ▪ 100BASE-TX[2] ▪ 1000BASE-T[2]
Data rate	Autonegotiation mode: ▪ 10 Mbit/s (half or full-duplex) ▪ 100 Mbit/s (half or full-duplex) ▪ 1,000 Mbit/s (full-duplex)

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] Adapted and reprinted with permission from IEEE.

Ethernet connection cable

Adapter cables provided by dSPACE are required to connect Ethernet devices. Refer to Ethernet Connection Cables on page 512.

Related topics

References

WLAN Module Characteristics

Purpose

Provides a radio interface for WLAN communication.

WLAN characteristics

WLAN is provided only by a MicroAutoBox III (WLAN).

Parameter	Specification
Module type	AirborneM2M™ module APMN-Q551 of B+B SmartWorx
Standard	IEEE 802.11a/b/g/n[1)]
RF band	Depends on the WLAN mode: ▪ WLAN client: 2.4 GHz and 5 GHz ▪ WLAN access point: 2.4 GHz
Channel	Depends on the WLAN mode: ▪ WLAN client: 1 … 11, 36, 40, 44, 48, 52, 56, 60, 64, 149, 153, 157, 161, 165 ▪ WLAN access point: 1 … 11
Connector	▪ 1 x RP-SMA connector ▪ Attach only a delivered antenna to this radio interface. Do not use antennas that are not provided by dSPACE for this product. ▪ For the location, refer to DS1403 Panel Components on page 258.

1) Adapted and reprinted with permission from IEEE.

Related topics

References

Functional Safety Interface Characteristics

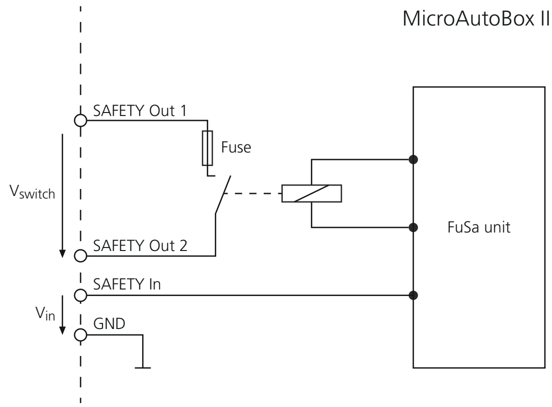
FuSa Interface Characteristics

Purpose

Interface to signal the FuSa state of the MicroAutoBox III and/or to trigger a FuSa response.

Circuit diagram

Simplified circuit diagram of the FuSa interface.



FuSa interface characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

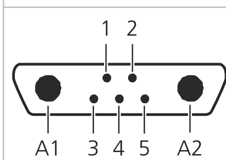
Parameter	Symbol	Specification[1)]
SAFETY Out		
Supported function blocks	-	FuSa Setup
Relay type	-	Normally open
Output states	-	Output states if the FuSa functionality is activated and initialized: ▪ Open: The FuSa functionality detected at least one FuSa error. ▪ Closed: The FuSa functionality detected no FuSa error. If the FuSa functionality is not activated/initialized, the relay remains open.
Switching voltage range	V_{switch}	12 V DC ... 60 V DC
Switching current range	I_{switch}	3 mA ... 500 mA
Switching power	P_{switch}	Min. 60 mW
Inductive load	$\frac{L_{load}}{R_{load}}$	▪ DS1403-04: Max. 40 ms, freewheeling diode required ▪ As of DS1403-05: Max. 40 ms, freewheeling diode optional
Connection voltage	V_{pin}	Max. 60 V DC between a SAFETY Out pin and GND
Bouncing time	t_{bounce}	Typ. 0.5 ms
SAFETY In		
Supported function blocks	-	FuSa System Monitoring
Input voltage range	V_{in}	0 V … VBAT

Parameter	Symbol	Specification[1]
Input high voltage	V_{ih}	Min. 4.7 V
Input low voltage	V_{il}	Max. 0.8 V
Input hysteresis voltage	V_{hys}	Min. 0.5 V, typ. 1 V
Input resistance	R_{in}	Min. 60 kΩ, max. 185 kΩ
Input type	-	Level triggered input. A high level can trigger a FuSa response.

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

Signal mapping

The following table shows the connector pins of the power input connector that provides the access to the FuSa relay.

Power Input Connector	Signal	Pin
	SAFETY Out 1	1
	SAFETY Out 2	2
	SAFETY In	5
	SAFETY In Signal Ground	
	GND	A1

For the complete pinout, refer to Power Input Connector Pinout on page 265.

Related topics

Basics

References

Onboard Sensor Characteristics

Where to go from here

Information in this section

Acceleration Sensor Unit 1 Characteristics

Purpose

Onboard sensor unit that measures the acceleration of the vehicle. In addition, the sensor unit can measure the angular velocity.

Acceleration Sensor Unit 1 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)

Parameter	Specification[1]
Supported function blocks	Acceleration In
Number of channels	1
Acceleration measurement	
Range	±2 g … ±16 g in 3 axis
Resolution	16 bit per axis
Sample rate	Max. 952 Hz
Angular velocity measurement	
Range	±245 °/s … ±2,000 °/s in 3 axis
Resolution	10 bit per axis
Sample rate	Max. 952 Hz

[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

Features of the DS1403 Processor Board......260

Pressure Sensor Unit 1 Characteristics

Purpose

Onboard sensor unit that measures the atmospheric pressure.

Pressure Sensor Unit 1 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)

Parameter	Specification[1]
Supported function blocks	Atmospheric Pressure In
Number of channels	1
Range	20 kPa … 110 kPa
Resolution	20 bit
Sample rate	Approx. 100 Hz

[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

Features of the DS1403 Processor Board....................260

USB Characteristics

USB Connector Characteristics

Purpose

Two USB 2.0 ports to connect a USB mass storage device, for example.

USB port characteristics

Parameter	Specification[1]
Supported function blocks	USB Eject
Number of ports	2, port A and B Port B is for future use.

Parameter	Specification[1]
Standard	USB 2.0
Output current	Max. 1 A per port

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

Port mapping

The following table shows the USB connector that provides the USB ports.

Port	Internal Connection	Adapter Cable
USB port A	Host communication coprocessor	USB_CAB14 Interface Cable on page 524
USB port B	Real-time processor	-

For the location of the port, refer to DS1403 Panel Components on page 258.

Related topics

HowTos

How to Load a Data Logging Configuration to the Real-Time Hardware (ControlDesk Measurement and Recording)

References

Supply Characteristics

Where to go from here

Information in this section

Power Input Characteristics

Purpose

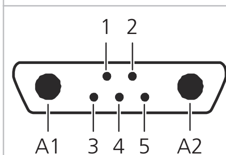
Power input to supply the MicroAutoBox III.

VBAT characteristics

The characteristics depends on the installed boards. Refer to General Characteristics on page 240.

Signal mapping

The following table shows the connector pins of the power input connector that provides the power input to supply MicroAutoBox III.

Power Input Connector	Supply	Pin
	VBAT	A2
	Supply Ground	
	GND	A1

For the complete pinout, refer to Power Input Connector Pinout on page 265.

Related topics

References

Remote Input Characteristics

Purpose

Remote control input to switch on/off the MicroAutoBox III.

Remote characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

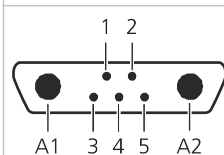
Parameter	Specification[1)]
Supported function blocks	Power On Signal In
Input voltage range	0 V … VBAT
Input high voltage	Min. 4.7 V
Input low voltage	Max. 0.8 V

Parameter	Specification[1]
Input hysteresis voltage	Min. 0.5 V, typ. 1 V
Input resistance	Min. 60 kΩ, max. 185 kΩ
Input type	Level-based input A high level switches on the MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the power input connector.

Power Input Connector	Signal	Pin
	REMOTE	4
	Signal Ground	
	GND	A1

For the complete pinout, refer to Power Input Connector Pinout on page 265.

Related topics

References

Prestart Input Characteristics

Purpose

Prestart input to switch on the MicroAutoBox III without starting the real-time application.

Prestart signal characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

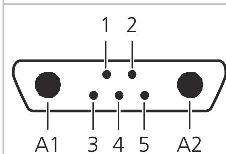
Parameter	Specification[1]
Supported function blocks	-
Input voltage range	0 V … VBAT
Input high voltage	Min. 4.7 V, max. VBAT
Input low voltage	Max. 0.8 V

Parameter	Specification[1]
Input hysteresis voltage	Min. 0.5 V, typ. 1 V
Input resistance	Min. 60 kΩ, max. 185 kΩ
Input type	Edge-triggered input A low-to-high transition can prestart the MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the power input connector.

Power Input Connector	Signal	Pin
	PRESTART	3
	Signal Ground	
	GND	A1

For the complete pinout, refer to Power Input Connector Pinout on page 265.

Related topics

Basics

Basics on Prestarting the MicroAutoBox III......190

HowTos

How to Activate and Configure the Prestart Feature......194

References

Features of the DS1403 Processor Board......260

LED Status Descriptions

LED States of the DS1403 Panel

Status LEDs: APP, SYS, and PWR

The DS1403 panel provides three LEDs for status information on the MicroAutoBox III.

LED Name	Description
PWR	The PWR LED indicates the state of the power supply.
SYS	The SYS LED indicates the states of the boot and initialization processes of the processor board.
APP	The APP LED indicates the states of the execution of the real-time application.

The following table describes the different states that can be output by the status LEDs:

LED States			Description
PWR	**SYS**	**APP**	
Off	Off	Off	No supply voltage applied.
Blue flashing	Off	Off	The MicroAutoBox III is in the standby mode. The supply voltage is applied, but the MicroAutoBox III is switched off.
Green	Any	Any	The internal power supply is OK.
Green	Off (permanent)	Off	If the MicroAutoBox III is switched on and the SYS LED is off for longer than 10 s, the processor board is defective. Contact dSPACE Support (www.dspace.com/go/supportrequest)
Green	Red	Off	The bootloader initialization is complete. If the SYS LED does not change, the MicroAutoBox III is in secured mode. You have to re-install the MicroAutoBox III firmware. Refer to Updating and Repairing the Firmware of dSPACE Real-Time Hardware (Firmware Manager Manual 🕮).
Green	Red/orange flashing	Red/orange flashing	Internal FPGA cannot be reached. Contact dSPACE Support (www.dspace.com/go/supportrequest).
Green	Red/orange flashing	Off	The bootloader initialization is still running.
Green	Green flashing	Off	The MicroAutoBox III has booted. The Ethernet connection to the host PC has not been established (yet).
Green	Orange/green flashing	Off	The MicroAutoBox III is ready. The Ethernet connection to the host PC has been established. The IP address has not

LED States			Description
PWR	SYS	APP	
			been set (yet). MicroAutoBox III is waiting for the DHCP server.
Green	Green	Off	No real-time application is loaded. The MicroAutoBox III is ready for operation. The Ethernet connection to the host PC has been established. The IP address has been set.
Green	Green flashing (three times)	Green flashing (three times)	Status message when specifying the network configuration: The network configuration was successful. Shut down and restart the MicroAutoBox III to activate the settings.
Green	Red flashing (three times)	Red flashing (three times)	Status message when specifying the network configuration: The MicroAutoBox III detected the configuration service, but the configuration was not successful. Ensure that the MicroAutoBox III is not accessed by software, such as ConfigurationDesk or ControlDesk, and no real-time application is loaded to the system.
Green	Green	Green	An application is loaded and running.
Green	Green	Red	The MicroAutoBox III is in one of the following operating modes: ▪ Normal operating mode - idle An loaded application has been stopped or terminated. ▪ Prestart mode An application is loaded, but not requested to start.
Red	Off	Off	The MicroAutoBox III switched itself off because of overtemperature: ▪ Wait until the MicroAutoBox III has cooled down. When the MicroAutoBox III has cooled down sufficiently, it automatically switches on again without starting the real-time application automatically. Refer to Starting the real-time application automatically on page 36. ▪ Improve heat dissipation, for example, by increasing air circulation.

For troubleshooting, refer to Checking the MicroAutoBox III on page 200.

For the location of the LEDs, refer to DS1403 Panel Components on page 258.

Ethernet LEDs: HOST, ETH, AETH

The DS1403 panel provides 5 LEDs for information concerning the Ethernet connection of the different ports.

LED Name	Description
Host	The Host LED displays the connection state of the port for the host PC.
ETH	The ETH LEDs display the connection states of the standard Ethernet ports for external devices.

LED Name	Description
AETH	The AETH LEDs display the connection states of the automotive Ethernet ports for external devices.

The following table describes the different states that can be output by the Ethernet LEDs:

LED Status	Description
Off	No Ethernet connection established.
Green	1,000 Mbit connection - no traffic
Green flashing	1,000 Mbit connection - traffic
Yellow	100 Mbit connection - no traffic
Yellow flashing	100 Mbit connection - traffic
Orange	10 Mbit connection - no traffic
Orange flashing	10 Mbit connection - traffic

For the location of the LEDs, refer to DS1403 Panel Components on page 258.

WLAN LED

Displays status information concerning the WLAN interface. The WLAN interface is available only for the MicroAutoBox III (WLAN).

FS LED

The FuSa LED displays status information concerning the functional safety (FuSa) functionality.

LED Status	Description
Off	The FuSa functionality is deactivated or processes the initialization.
Green	The FuSa functionality is activated, initialized, and detected no FuSa error.
Red	The FuSa functionality detected a FuSa error.

For the location of the LED, refer to DS1403 Panel Components on page 258.

IOCNET LED

For future use.

USB LED A

Displays status information concerning the USB port A.

LED Status	Description
Off	▪ No USB device is connected. ▪ A USB device is connected but unmounted from the file system (ejected). You can safely remove the USB device.
Green	A USB device is connected - no traffic.

LED Status	Description
Green flashing	A USB device is connected - traffic.
Orange	No free memory on the USB device to save data values. The MicroAutoBox III overwrites old files.
Red	An error occurred while the USB device was accessed.

For the location of the LEDs, refer to DS1403 Panel Components on page 258.

USB LED B

For future use.

USR LEDs

LEDs that can be controlled from the real-time application. If being not set by the application, the LEDs do not light.

Parameter	Specification
Supported function blocks	LED Out
Number of LEDs	4
Adjustable colors	▪ Red ▪ Yellow ▪ Green ▪ Blue

For the location of the LEDs, refer to DS1403 Panel Components on page 258.

Related topics

Basics

References

DS1511 Multi-I/O Board Data Sheet

DS1511 variants

The DS1511 Multi-I/O Board is available with different analog channel types:

- The DS1511 Multi-I/O Board can measure analog signals in the range 0 V … 5 V.
- The DS1511B1 Multi-I/O Board can measure analog signals in the range -10 V … +10 V.

The board variant is printed on the type label at the bottom of the MicroAutoBox III.

Where to go from here

Information in this section

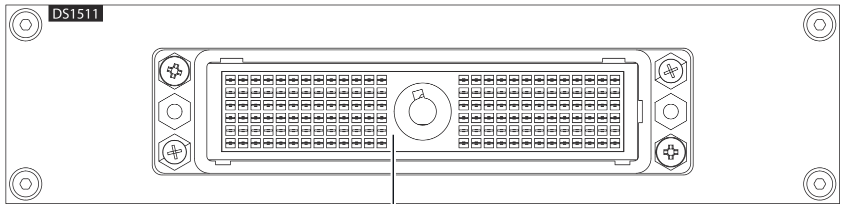
Overview and General Information

Where to go from here

Information in this section

DS1511 Panel Components

Panel overview



ZIF I/O connector

Component	Description
ZIF I/O connector	Provides access to all I/O channels of the DS1511 Multi-I/O Board: ▪ Max. contact resistance of 15 mΩ ▪ Durability 10,000 cycles For the pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

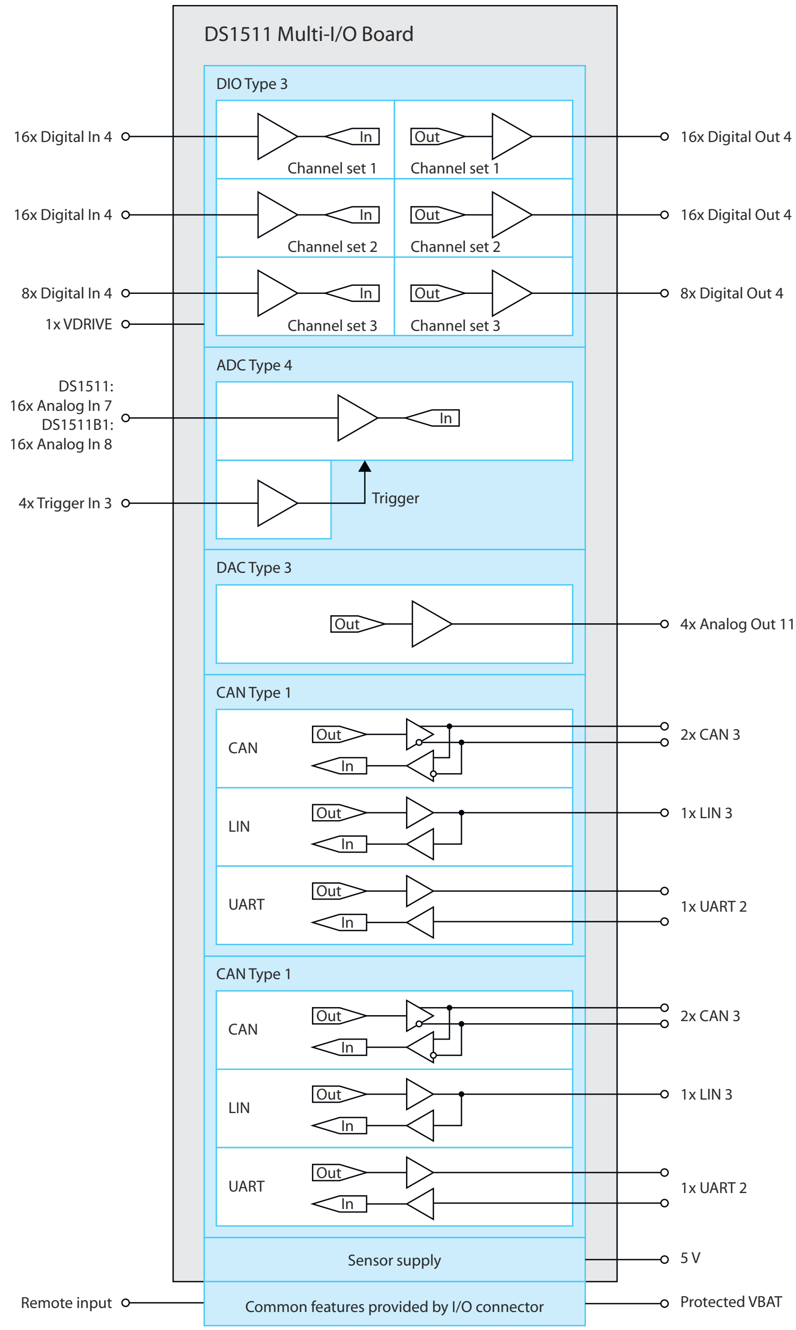
Related topics

References

Features of the DS1511 Multi-I/O Board

Main features

The following block diagram provides a functional view of the main features and the provided channel types.



The following table shows more details.

Feature	Description
Channels for signal measurement	▪ 40 digital input channels of the Digital In 4 channel type. For signal characteristics and mapping, refer to Digital In 4 Characteristics on page 304. ▪ 16 analog input channels. The channel type depends on the board variant: ▪ DS1511: Analog In 7 For signal characteristics and mapping, refer to Analog In 7 Characteristics (DS1511) on page 295. ▪ DS1511B1: Analog In 8 For signal characteristics and mapping, refer to Analog In 8 Characteristics (DS1511B1) on page 297. ▪ 4 trigger inputs to trigger the analog measurement. The inputs are of the Trigger In 3 channel type. For signal characteristics and mapping, refer to Trigger In 3 Characteristics on page 300.
Channels for signal generation	▪ 40 digital output channels of the Digital Out 4 channel type. For signal characteristics and mapping, refer to Digital Out 4 Characteristics on page 307. ▪ 4 analog output channels of the Analog Out 11 channel type. For signal characteristics and mapping, refer to Analog Out 11 Characteristics on page 301.
Communication channels	▪ 4 CAN channels of the CAN 3 channel type. For signal characteristics and mapping, refer to CAN 3 Characteristics on page 311. ▪ 2 LIN channels of the LIN 3 channel type. For signal characteristics and mapping, refer to LIN 3 Characteristics on page 313. ▪ 2 RS232 channels of the UART 2 channel type. For signal characteristics and mapping, refer to UART 2 Characteristics on page 314.
Supply outputs	▪ 5 V sensor supply to supply sensors or to drive the digital I/O circuits of the DS1511 Multi-I/O Board. For signal characteristics and mapping, refer to DS1511 Sensor Supply Characteristics (VSENS) on page 317. ▪ Protected VBAT ($VBAT_{prot}$) to drive the digital I/O circuits of the DS1511 Multi-I/O Board with an automotive-compatible voltage level. For signal characteristics and mapping, refer to VBATprot Characteristics on page 318.
Supply inputs	Drive voltage input for the digital I/O circuits of the DS1511 Multi-I/O Board (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level. For signal characteristics and mapping, refer to DS1511 VDRIVE Input Characteristics on page 316.
Remote control	Remote input signal to switch on/off the MicroAutoBox III. The same input signal is provided by the power input connector. For signal characteristics and mapping, refer to Remote Input Characteristics (DS1511) on page 319.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the DS1511 Multi-I/O Board.

Function Block Type	Purpose	Channel Type
Basic I/O		
Voltage In	The Voltage In function block type digitizes analog voltage signals coming from an external device.	▪ Analog In 7 (DS1511) ▪ Analog In 8 (DS1511B1)
Trigger in	The Trigger In function block type generates a trigger signal each time the external input signal matches the defined triggering conditions. The function block works as a provider: Other function blocks can use the generated trigger signal as trigger source.	Trigger In 3
Voltage Out	The Voltage Out function block provides the possibility to output analog voltages.	Analog Out 11
Multi Bit In	The Multi Bit In function block type lets you measure digital signals coming from an external device.	Digital In 4
Multi Bit Out	The Multi Bit Out function block type lets you stimulate digital inputs of an external device.	Digital Out 4
Digital Pulse Out	The Digital Pulse Out function block generates a digital pulse with each model step of the behavior model or with each trigger event of another function block.	Digital Out 4
PWM/PFM Out	The PWM/PFM Out function block type can be used to generate one-phase pulse-width modulated signals and frequency output signals.	Digital Out 4
Multi-Channel PWM Out	The Multi-Channel PWM Out function block type synchronously generates multiple PWM signals with a common frequency. The function block can work as a provider: Other function blocks can use the generated trigger signal as a trigger source.	Digital Out 4
PWM/PFM In	With the PWM/PFM In function block, you can measure one-phase pulse-width-modulated signal patterns.	Digital In 4
Advanced I/O		
Digital Incremental Encoder In	The Digital Incremental Encoder In function block provides access to rotary or linear digital incremental encoders. The function block can be used, for example, to measure the angular position and the speed of an electric motor.	Digital In 4
Voltage Signal Capture (ADC Type 4)	With the Voltage Signal Capture (ADC Type 4) function block, you can measure analog voltage signals (coming from an external device) by capturing signal sequences, for example, at configurable sample rates. The function block type is exclusively designed to be used for the ADC Type 4 module of the DS1511, DS1511B1, and DS1513 Multi-I/O Boards.	▪ Analog In 7 (DS1511) ▪ Analog In 8 (DS1511B1)
Communication		
SENT In	The SENT In function block receives SENT messages. SENT is a protocol used between sensors and ECUs to transmit data of high-resolution sensors as an alternative to an analog interface. The sensors are typically throttle position sensors or mass air flow sensors.	Digital In 4

Function Block Type	Purpose	Channel Type
SPI Master	The SPI Master function block controls and performs a short-distance communication via the serial peripheral interface (SPI). SPI communication is a master-slave architecture with a single master.	Digital In 4 with Digital Out 4
CAN	The CAN function block is one part of implementing CAN communication in real-time applications. The CAN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 🕮).	CAN 3
LIN	The LIN function block is one part of implementing LIN communication in real-time applications. The LIN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 🕮).	LIN 3

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide 🕮.

Related topics

Basics

References

Connector Pinouts

DS1511 ZIF I/O Connector Pinout

Purpose

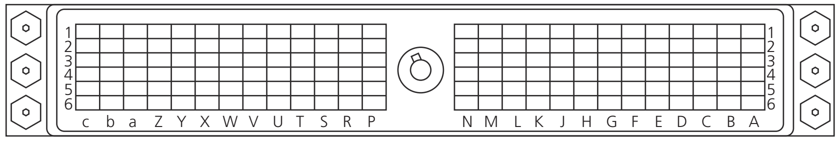
Connector to provide access to all I/O channels of the DS1511 Multi-I/O Board.

Pinout

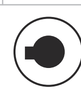
Note

- There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).
- To use the digital I/O channels, you have to connect the VDRIVE pin according to the required logic level.
  For more information, refer to Driving the Digital I/O Interfaces of the DS1511 on page 103.

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of the I/O connector:

1	2	3	4	5	6	
GND	CAN 3-2 Ch. 2 High	CAN 3-2 Ch. 2 Low	GND	LIN 3-2 Signal	Do not connect	*A*
GND	CAN 3-2 Ch. 1 High	CAN 3-2 Ch. 1 Low	GND	UART 2-2 TX	UART 2-2 RX	*B*
GND	GND	GND	GND	GND	GND	*C*
GND	Digital Out 4-1 Channel 8 Signal	Digital Out 4-1 Channel 16 Signal	Digital Out 4-2 Channel 24 Signal	Digital Out 4-2 Channel 32 Signal	Digital Out 4-3 Channel 40 Signal	*D*
GND	Digital Out 4-1 Channel 7 Signal	Digital Out 4-1 Channel 15 Signal	Digital Out 4-2 Channel 23 Signal	Digital Out 4-2 Channel 31 Signal	Digital Out 4-3 Channel 39 Signal	*E*
GND	Digital Out 4-1 Channel 6 Signal	Digital Out 4-1 Channel 14 Signal	Digital Out 4-2 Channel 22 Signal	Digital Out 4-2 Channel 30 Signal	Digital Out 4-3 Channel 38 Signal	*F*
GND	Digital Out 4-1 Channel 5 Signal	Digital Out 4-1 Channel 13 Signal	Digital Out 4-2 Channel 21 Signal	Digital Out 4-2 Channel 29 Signal	Digital Out 4-3 Channel 37 Signal	*G*
GND	Digital Out 4-1 Channel 4 Signal	Digital Out 4-1 Channel 12 Signal	Digital Out 4-2 Channel 20 Signal	Digital Out 4-2 Channel 28 Signal	Digital Out 4-3 Channel 36 Signal	*H*
GND	Digital Out 4-1 Channel 3 Signal	Digital Out 4-1 Channel 11 Signal	Digital Out 4-2 Channel 19 Signal	Digital Out 4-2 Channel 27 Signal	Digital Out 4-3 Channel 35 Signal	*J*
GND	Digital Out 4-1 Channel 2 Signal	Digital Out 4-1 Channel 10 Signal	Digital Out 4-2 Channel 18 Signal	Digital Out 4-2 Channel 26 Signal	Digital Out 4-3 Channel 34 Signal	*K*
GND	Digital Out 4-1 Channel 1 Signal	Digital Out 4-1 Channel 9 Signal	Digital Out 4-2 Channel 17 Signal	Digital Out 4-2 Channel 25 Signal	Digital Out 4-3 Channel 33 Signal	*L*
VSENS Supply Output	Digital In 4-1 Channel 8 Signal	Digital In 4-1 Channel 16 Signal	Digital In 4-2 Channel 24 Signal	Digital In 4-2 Channel 32 Signal	Digital In 4-3 Channel 40 Signal	*M*
VDRIVE Supply Input	Digital In 4-1 Channel 7 Signal	Digital In 4-1 Channel 15 Signal	Digital In 4-2 Channel 23 Signal	Digital In 4-2 Channel 31 Signal	Digital In 4-3 Channel 39 Signal	*N*
						
VBATprot Supply Output	Digital In 4-1 Channel 6 Signal	Digital In 4-1 Channel 14 Signal	Digital In 4-2 Channel 22 Signal	Digital In 4-2 Channel 30 Signal	Digital In 4-3 Channel 38 Signal	*P*
REMOTE Input	Digital In 4-1 Channel 5 Signal	Digital In 4-1 Channel 13 Signal	Digital In 4-2 Channel 21 Signal	Digital In 4-2 Channel 29 Signal	Digital In 4-3 Channel 37 Signal	*R*
GND	Digital In 4-1 Channel 4 Signal	Digital In 4-1 Channel 12 Signal	Digital In 4-2 Channel 20 Signal	Digital In 4-2 Channel 28 Signal	Digital In 4-3 Channel 36 Signal	*S*
GND	Digital In 4-1 Channel 3 Signal	Digital In 4-1 Channel 11 Signal	Digital In 4-2 Channel 19 Signal	Digital In 4-2 Channel 27 Signal	Digital In 4-3 Channel 35 Signal	*T*
GND	Digital In 4-1 Channel 2 Signal	Digital In 4-1 Channel 10 Signal	Digital In 4-2 Channel 18 Signal	Digital In 4-2 Channel 26 Signal	Digital In 4-3 Channel 34 Signal	*U*

1	2	3	4	5	6	
GND	Digital In 4-1 Channel 1 Signal	Digital In 4-1 Channel 9 Signal	Digital In 4-2 Channel 17 Signal	Digital In 4-2 Channel 25 Signal	Digital In 4-3 Channel 33 Signal	*V*
GND	Analog Out 11 Channel 4 Signal	Analog In Channel 4 Signal[1)]	Analog In Channel 8 Signal[1)]	Analog In Channel 12 Signal[1)]	Analog In Channel 16 Signal[1)]	*W*
GND	Analog Out 11 Channel 3 Signal	Analog In Channel 3 Signal[1)]	Analog In Channel 7 Signal[1)]	Analog In Channel 11 Signal[1)]	Analog In Channel 15 Signal[1)]	*X*
GND	Analog Out 11 Channel 2 Signal	Analog In Channel 2 Signal[1)]	Analog In Channel 6 Signal[1)]	Analog In Channel 10 Signal[1)]	Analog In Channel 14 Signal[1)]	*Y*
GND	Analog Out 11 Channel 1 Signal	Analog In Channel 1 Signal[1)]	Analog In Channel 5 Signal[1)]	Analog In Channel 9 Signal[1)]	Analog In Channel 13 Signal[1)]	*Z*
GND	SGND	Trigger In 3 Channel 1 Signal	Trigger In 3 Channel 2 Signal	Trigger In 3 Channel 3 Signal	Trigger In 3 Channel 4 Signal	*a*
GND	CAN 3-1 Ch. 2 High	CAN 3-1 Ch. 2 Low	GND	LIN 3-1 Signal	Do not connect	*b*
GND	CAN 3-1 Ch. 1 High	CAN 3-1 Ch. 1 Low	GND	UART 2-1 TX	UART 2-1 RX	*c*

[1)] The channel type depends on the I/O board. The DS1511 provides the Analog In 7 channel type, the DS1511B1 provides the Analog In 8 channel type.

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
Analog I/O		
Analog In	DS1511 Multi-I/O Board: Analog In 7 Input to measure analog signals in the range 0 V ... 5 V.	Analog In 7 Characteristics (DS1511) on page 295
	DS1511B1 Multi-I/O Board: Analog In 8 Input to measure analog signals in the range -10 V ... +10 V.	Analog In 8 Characteristics (DS1511B1) on page 297
Trigger In 3	Input to trigger the analog measurement of the Analog In 7/Analog In 8 channel type.	Trigger In 3 Characteristics on page 300
Analog Out 11	Output to generate analog signals in the range 0 V ... 4.5 V.	Analog Out 11 Characteristics on page 301
Digital I/O		
Digital In 4	Input to measure digital signals with a fixed threshold voltage. Signal naming: Digital In 4-n for channel set 1 … 3	Digital In 4 Characteristics on page 304
Digital Out 4	Output to generate digital signals. Signal naming: Digital Out 4-n for channel set 1 … 3	Digital Out 4 Characteristics on page 307
Communication Interfaces		
CAN 3	ISO 11898 interface to communicate via a CAN bus. Signal naming: CAN 3-n for module 1 or module 2.	CAN 3 Characteristics on page 311

Signal	Description	Characteristics
LIN 3	Interface to communicate via a LIN bus. Signal naming: LIN 3-n for module 1 or module 2.	LIN 3 Characteristics on page 313
UART 2	Interface to communicate with an RS232 device. Signal naming: ▪ Receive line: RX ▪ Transmit line: TX ▪ Module number: UART 2-n for module 1 or module 2.	UART 2 Characteristics on page 314
Supply Inputs and Outputs		
REMOTE	Input to switch on/off the MicroAutoBox III.	Remote Input Characteristics (DS1511) on page 319
VDRIVE	Drive voltage input for the digital I/O circuits of the DS1511 Multi-I/O Board (VDRIVE).	DS1511 VDRIVE Input Characteristics on page 316
VSENS	Provides a 5 V supply voltage.	DS1511 Sensor Supply Characteristics (VSENS) on page 317
VBATprot	Protected supply voltage with an automotive-compatible voltage level.	VBATprot Characteristics on page 318
Ground Potentials		
GND	Common ground for all signals. GND is also connected to the housing of the MicroAutoBox III.	-
SGND	Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.	-

Related topics

Basics

Analog Interface Characteristics

Where to go from here

Information in this section

Analog In 7 Characteristics (DS1511)

Purpose

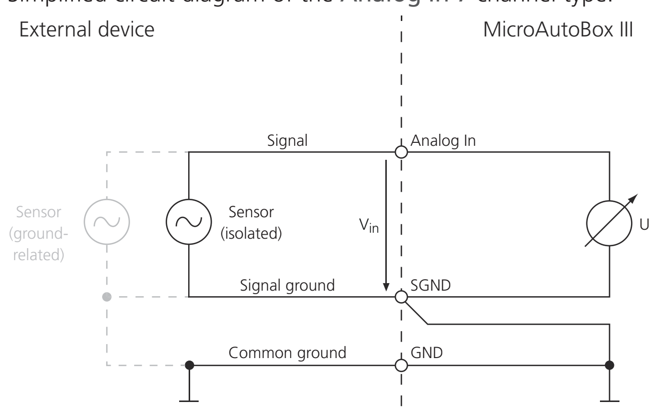
Input to measure analog signals in the range 0 V ... 5 V.

Variant dependency

The Analog In 7 channel type is provided by the DS1511 Multi-I/O Board, but not by the DS1511B1 Multi-I/O Board. The board variant is printed on the type label of the MicroAutoBox III.

Circuit diagram

Simplified circuit diagram of the Analog In 7 channel type:



If the input is open, a non-zero voltage at the input pins can be measured due to the internal structure of the channel type.

Analog In 7 characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT=+12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Voltage In ▪ Voltage Signal Capture (ADC Type 4)
Number of channels	-	16
Input voltage range	V_{in}	0 V ... 5 V
Resolution	-	16 bit
No missing codes	-	15 bit
Offset error	-	-0.5 mV ... +0.5 mV below 750 kS/s
Offset drift	-	Typ. ±10 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 192 kΩ
Sample rate	f_s	Max. 1 MS/s
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth
Protected voltage range (short-term)	$V_{in\{prot\}}$	-50 V ... +50 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-20 V ... +30 V

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the Analog In 7 channel type.

Signal	DS1511 ZIF I/O Connector Pin
Analog In 7 Channel 1 Signal	Z3
Analog In 7 Channel 2 Signal	Y3
Analog In 7 Channel 3 Signal	X3
Analog In 7 Channel 4 Signal	W3
Analog In 7 Channel 5 Signal	Z4
Analog In 7 Channel 6 Signal	Y4
Analog In 7 Channel 7 Signal	X4
Analog In 7 Channel 8 Signal	W4
Analog In 7 Channel 9 Signal	Z5
Analog In 7 Channel 10 Signal	Y5
Analog In 7 Channel 11 Signal	X5

Signal	DS1511 ZIF I/O Connector Pin
Analog In 7 Channel 12 Signal	W5
Analog In 7 Channel 13 Signal	Z6
Analog In 7 Channel 14 Signal	Y6
Analog In 7 Channel 15 Signal	X6
Analog In 7 Channel 16 Signal	W6
Signal reference	
SGND[1]	a2
GND[2]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.
[2] Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

Analog In 8 Characteristics (DS1511B1)

Purpose

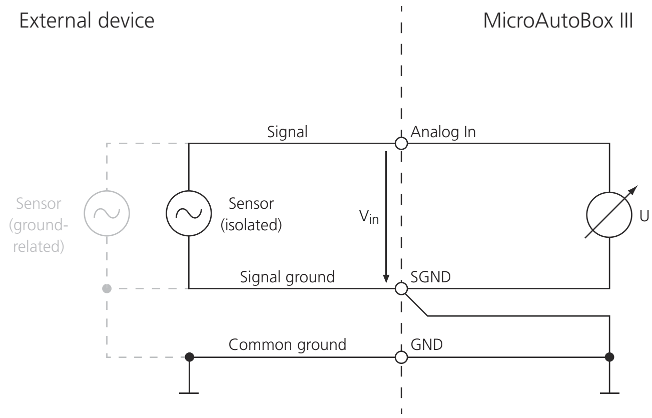
Input to measure analog signals in the range -10 V ... +10 V.

Variant dependency

The Analog In 8 channel type is provided by the DS1511B1 Multi-I/O Board, but not by the DS1511 Multi-I/O Board. The board variant is printed on the type label of MicroAutoBox III.

Circuit diagrams

Simplified circuit diagram of the Analog In 8 channel type:



If the input is open, a non-zero voltage at the input pins can be measured due to the internal structure of the channel type.

Analog In 8 characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT=+12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	**Symbol**	**Specification**[1)]
Supported function blocks	-	▪ Voltage In ▪ Voltage Signal Capture (ADC Type 4)
Number of channels	-	16
Input voltage range	V_{in}	-10 V ... +10 V
Resolution	-	16 bit
No missing codes	-	15 bit
Offset error	-	-3 mV ... +3 mV below 750 kS/s
Offset drift	-	Typ. ±40 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 117 kΩ
Sample rate	f_s	Max. 1 MS/s

Parameter	Symbol	Specification[1)]
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth
Protected voltage range (short-term)	$V_{in\{prot\}}$	-50 V ... +50 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-30 V ... +30 V

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the Analog In 8 channel type.

Signal	DS1511 ZIF I/O Connector Pin
Analog In 8 Channel 1 Signal	Z3
Analog In 8 Channel 2 Signal	Y3
Analog In 8 Channel 3 Signal	X3
Analog In 8 Channel 4 Signal	W3
Analog In 8 Channel 5 Signal	Z4
Analog In 8 Channel 6 Signal	Y4
Analog In 8 Channel 7 Signal	X4
Analog In 8 Channel 8 Signal	W4
Analog In 8 Channel 9 Signal	Z5
Analog In 8 Channel 10 Signal	Y5
Analog In 8 Channel 11 Signal	X5
Analog In 8 Channel 12 Signal	W5
Analog In 8 Channel 13 Signal	Z6
Analog In 8 Channel 14 Signal	Y6
Analog In 8 Channel 15 Signal	X6
Analog In 8 Channel 16 Signal	W6
Signal Reference	
SGND[1)]	a2
GND[2)]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.
2) Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

Features of the DS1511 Multi-I/O Board........288

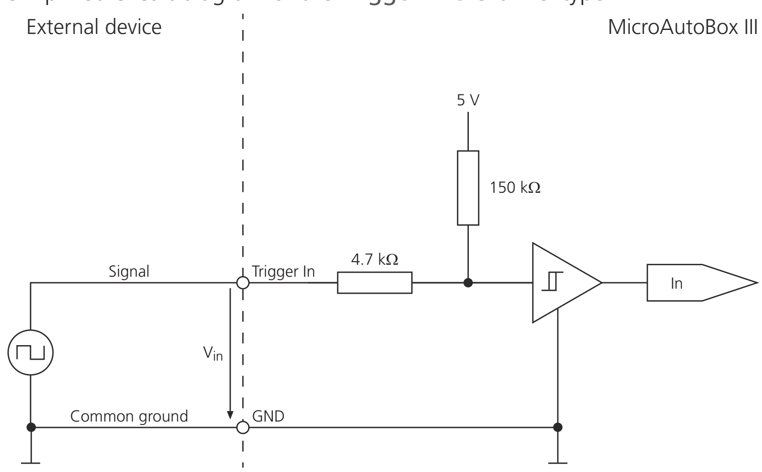
Trigger In 3 Characteristics

Purpose

Input to trigger the analog measurement of the Analog In 7/Analog In 8 channel type.

Circuit diagram

Simplified circuit diagram of the Trigger In 3 channel type:



Trigger In 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	Trigger In
Number of channels	-	4
Input high voltage	V_{ih}	Min. 2.3 V
Input low voltage	V_{il}	Max. 0.4 V

Parameter	Symbol	Specification[1]
Protected voltage range (continuous)	$V_{in\{prot\}}$	-48 V ... 50 V
Trigger rate	$f_{trigger}$	Max. 1 MHz

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the Trigger In 3 channel type.

Signal	DS1511 ZIF I/O Connector Pin
Trigger In 3 Channel 1 Signal	a3
Trigger In 3 Channel 2 Signal	a4
Trigger In 3 Channel 3 Signal	a5
Trigger In 3 Channel 4 Signal	a6
Signal reference	
GND[1]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

Features of the DS1511 Multi-I/O Board........ 288

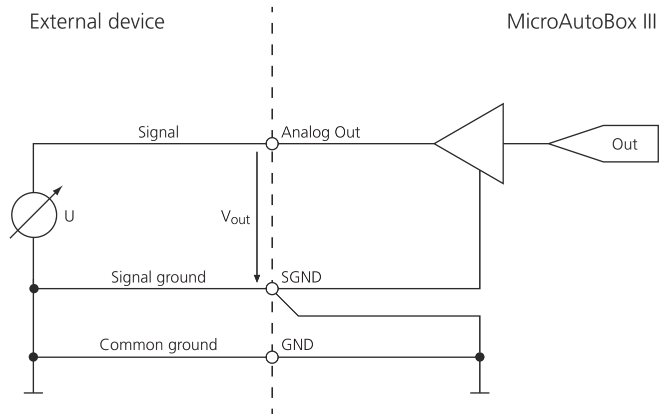
Analog Out 11 Characteristics

Purpose

Output to generate analog signals in the range 0 V ... 4.5 V.

Circuit diagram

Simplified circuit diagram of the Analog Out 11 channel type:



Analog Out 11 characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT=+12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	Voltage Out
Number of channels	-	4
Output voltage range	V_{out}	0 V ... 4.5 V
Output voltage at full scale	V_{out}	4.44 V … 4.56 V, typ. 4.50 V
Resolution	-	12 bit
Offset error	-	-11 mV ... +11 mV for the complete operating temperature range
Gain error	-	-0.5% ... +0.5% for the complete operating temperature range
-3 dB cutoff frequency	f_{-3dB}	Typ. 10.8 kHz
Settling time (to 1 LSB)	-	Max. 150 µs
Working current range	I_{out}	-5 mA ... +5 mA
	V_{DACSAT}	Max. 0.3 V, output voltage when sinking I_{out} = –5 mA
Protected voltage range	$V_{out(prot)}$	-30 V … +40 V

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the Analog Out 11 channel type.

Signal	DS1511 ZIF I/O Connector Pin
Analog Out 11 Ch. 1 Signal	Z2
Analog Out 11 Ch. 2 Signal	Y2
Analog Out 11 Ch. 3 Signal	X2
Analog Out 11 Ch. 4 Signal	W2
Signal reference	
SGND[1)]	a2
GND[2)]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.
2) Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

Digital Interface Characteristics

Where to go from here

Information in this section

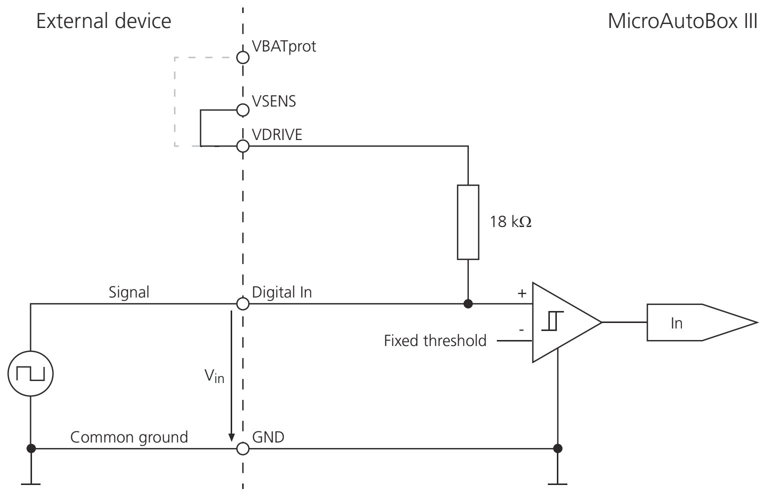
Digital In 4 Characteristics

Purpose

Input to measure digital signals with a fixed threshold voltage.

Circuit diagram

Simplified circuit diagram of the Digital In 4 channel type. The channels are provided by DIO Type 3 modules.



Note

To use the digital I/O channels, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital I/O Interfaces of the DS1511 on page 103.

Digital In 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Multi Bit In ▪ PWM/PFM In ▪ Digital Pulse In ▪ Digital Incremental Encoder In ▪ SENT In ▪ SPI Master

Parameter	Symbol	Specification[1]
Number of channels	-	40, divided into 3 channel sets
Input high voltage	V_{ih}	Min. 3.1 V
Input low voltage	V_{il}	Max. 1.2 V
Input hysteresis voltage	V_{hys}	Typ. 1 V
Minimum input pulse width low	t_{LowMin}	Typ. 250 ns
Minimum input pulse width high	$t_{HighMin}$	Typ. 300 ns
Maximum input frequency[2]	f_{max}	▪ Typ. 1.8 MHz at duty cycle = 50% ▪ Typ. 33 kHz at duty cycle = 1% (99%)
Pull-up resistor to VDRIVE	$R_{pull-up}$	Min. 17 kΩ, max. 19 kΩ
Input capacitance	C_{in}	Typ. 1 nF
Protected voltage range	$V_{in\{prot\}}$	(VDRIVE - 45 V) ... +45 V

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

[2] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 1 MHz.

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the Digital In 4 channel type.

Signal	Channel Set[1]	DS1511 ZIF I/O Connector Pin
Digital In 4-1 Channel 1 Signal	1	V2
Digital In 4-1 Channel 2 Signal	1	U2
Digital In 4-1 Channel 3 Signal	1	T2
Digital In 4-1 Channel 4 Signal	1	S2
Digital In 4-1 Channel 5 Signal	1	R2
Digital In 4-1 Channel 6 Signal	1	P2
Digital In 4-1 Channel 7 Signal	1	N2
Digital In 4-1 Channel 8 Signal	1	M2
Digital In 4-1 Channel 9 Signal	1	V3
Digital In 4-1 Channel 10 Signal	1	U3
Digital In 4-1 Channel 11 Signal	1	T3
Digital In 4-1 Channel 12 Signal	1	S3
Digital In 4-1 Channel 13 Signal	1	R3
Digital In 4-1 Channel 14 Signal	1	P3
Digital In 4-1 Channel 15 Signal	1	N3
Digital In 4-1 Channel 16 Signal	1	M3
Digital In 4-2 Channel 17 Signal	2	V4

Signal	Channel Set[1]	DS1511 ZIF I/O Connector Pin
Digital In 4-2 Channel 18 Signal	2	U4
Digital In 4-2 Channel 19 Signal	2	T4
Digital In 4-2 Channel 20 Signal	2	S4
Digital In 4-2 Channel 21 Signal	2	R4
Digital In 4-2 Channel 22 Signal	2	P4
Digital In 4-2 Channel 23 Signal	2	N4
Digital In 4-2 Channel 24 Signal	2	M4
Digital In 4-2 Channel 25 Signal	2	V5
Digital In 4-2 Channel 26 Signal	2	U5
Digital In 4-2 Channel 27 Signal	2	T5
Digital In 4-2 Channel 28 Signal	2	S5
Digital In 4-2 Channel 29 Signal	2	R5
Digital In 4-2 Channel 30 Signal	2	P5
Digital In 4-2 Channel 31 Signal	2	N5
Digital In 4-2 Channel 32 Signal	3	M5
Digital In 4-3 Channel 33 Signal	3	V6
Digital In 4-3 Channel 34 Signal	3	U6
Digital In 4-3 Channel 35 Signal	3	T6
Digital In 4-3 Channel 36 Signal	3	S6
Digital In 4-3 Channel 37 Signal	3	R6
Digital In 4-3 Channel 38 Signal	3	P6
Digital In 4-3 Channel 39 Signal	3	N6
Digital In 4-3 Channel 40 Signal	3	M6
Signal reference		
GND[2]	-	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] The digital channels are divided into three channel sets. I/O channels can be assigned to function blocks only within one channel set. This ensures data consistency.

[2] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

Basics

References

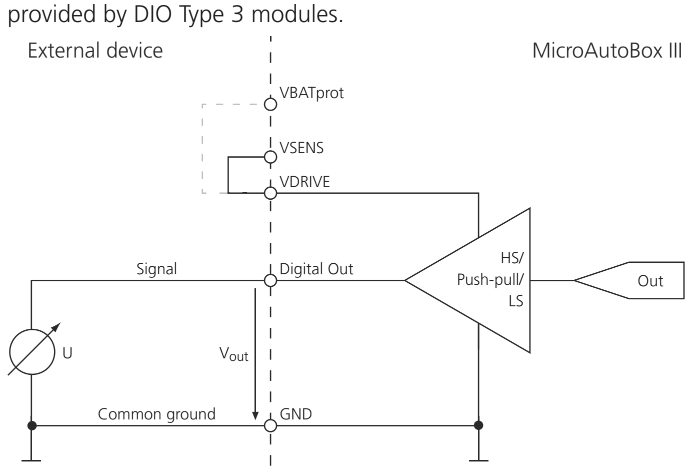
Digital Out 4 Characteristics

Purpose

Output to generate digital signals.

Circuit diagram

Simplified circuit diagram of the Digital Out 4 channel type. The channels are provided by DIO Type 3 modules.



Note

To use the digital I/O channels, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital I/O Interfaces of the DS1511 on page 103.

General behavior of digital signals

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

Digital Out 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Multi Bit Out ▪ Digital Pulse Out ▪ PWM/PFM Out ▪ Multi-Channel PWM Out ▪ SPI Master
Number of channels	-	40, divided into 3 channel sets
Output high voltage	V_{oh}	VDRIVE = 5 V ▪ Min. 4.4 V, typ. 4.6 V at I_{out} = 0 mA ▪ Min. 3.2 V, typ. 3.4 V at I_{out} = 5 mA VDRIVE = 12 V ▪ Min. 11.3 V, typ. 11.6 V at I_{out} = 0 mA ▪ Min. 10.3 V, typ. 10.5 V at I_{out} = 5 mA
Output low voltage	V_{ol}	▪ Max. 0.3 V, typ. 0.1 V at I_{out} = 0 mA ▪ Max. 0.9 V, typ. 0.7 V at I_{out} = -5 mA
Working current range	$I_{out\{work\}}$	-5 mA ... +5 mA
Output current limit high	$I_{oh\{lim\}}$	Typ. 13 mA, max. 17 mA
Output current limit low	$I_{ol\{lim\}}$	Typ. -14 mA, max. -18 mA
Minimum output pulse width high	$t_{HighMin}$	Typ. 700 ns
Minimum output pulse width low	t_{LowMin}	Typ. 200 ns
Maximum output frequency[2]	f_{max}	▪ Typ. 700 kHz at duty cycle = 50% ▪ Typ. 14 kHz at duty cycle = 1% (99%)
Leakage current tristate	I_{leak}	Max. 100 µA
Protected voltage range	V_{prot}	(VDRIVE - 45 V) ... +45 V

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

[2] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 150 kHz.

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the Digital Out 4 channel type.

Signal	Channel Set[1)]	DS1511 ZIF I/O Connector Pin
Digital Out 4-1 Channel 1 Signal	1	L2
Digital Out 4-1 Channel 2 Signal	1	K2
Digital Out 4-1 Channel 3 Signal	1	J2
Digital Out 4-1 Channel 4 Signal	1	H2
Digital Out 4-1 Channel 5 Signal	1	G2
Digital Out 4-1 Channel 6 Signal	1	F2
Digital Out 4-1 Channel 7 Signal	1	E2
Digital Out 4-1 Channel 8 Signal	1	D2
Digital Out 4-1 Channel 9 Signal	1	L3
Digital Out 4-1 Channel 10 Signal	1	K3
Digital Out 4-1 Channel 11 Signal	1	J3
Digital Out 4-1 Channel 12 Signal	1	H3
Digital Out 4-1 Channel 13 Signal	1	G3
Digital Out 4-1 Channel 14 Signal	1	F3
Digital Out 4-1 Channel 15 Signal	1	E3
Digital Out 4-1 Channel 16 Signal	1	D3
Digital Out 4-2 Channel 17 Signal	2	L4
Digital Out 4-2 Channel 18 Signal	2	K4
Digital Out 4-2 Channel 19 Signal	2	J4
Digital Out 4-2 Channel 20 Signal	2	H4
Digital Out 4-2 Channel 21 Signal	2	G4
Digital Out 4-2 Channel 22 Signal	2	F4
Digital Out 4-2 Channel 23 Signal	2	E4
Digital Out 4-2 Channel 24 Signal	2	D4
Digital Out 4-2 Channel 25 Signal	2	L5
Digital Out 4-2 Channel 26 Signal	2	K5
Digital Out 4-2 Channel 27 Signal	2	J5
Digital Out 4-2 Channel 28 Signal	2	H5
Digital Out 4-2 Channel 29 Signal	2	G5
Digital Out 4-2 Channel 30 Signal	2	F5
Digital Out 4-2 Channel 31 Signal	2	E5
Digital Out 4-2 Channel 32 Signal	3	D5
Digital Out 4-3 Channel 33 Signal	3	L6

Signal	Channel Set[1]	DS1511 ZIF I/O Connector Pin
Digital Out 4-3 Channel 34 Signal	3	K6
Digital Out 4-3 Channel 35 Signal	3	J6
Digital Out 4-3 Channel 36 Signal	3	H6
Digital Out 4-3 Channel 37 Signal	3	G6
Digital Out 4-3 Channel 38 Signal	3	F6
Digital Out 4-3 Channel 39 Signal	3	E6
Digital Out 4-3 Channel 40 Signal	3	D6
Signal Reference		
GND[2]	-	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4
Digital I/O Interface Supply		
VBATprot	-	P1
VSENS	-	M1
VDRIVE	-	N1

[1] The digital channels are divided into three channel sets. I/O channels can be assigned to function blocks only within one channel set. This ensures data consistency.
[2] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

Basics

References

Communication Interface Characteristics

Where to go from here

Information in this section

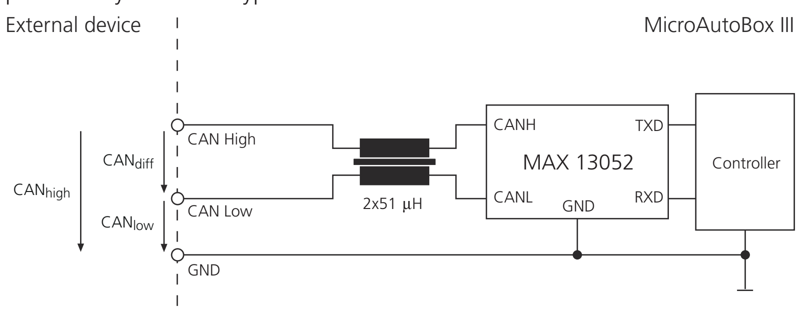
CAN 3 Characteristics

Purpose

ISO 11898 interface to communicate via a CAN bus.

Circuit diagram

Simplified circuit diagram of the **CAN 3** channel type. The CAN channels are provided by two CAN Type 1 modules.



CAN 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	CAN
Number of channels	4, two channels per CAN Type 1 module
Data rate	15 kbit/s ... 1 Mbit/s
Transceiver type	MAX13052ASA+
Supported standards	▪ High-speed, according to ISO 11898-2:2016 ▪ High-Speed CAN at 125 kbit/s, according to SAE J2284-1:2016 ▪ High-Speed CAN at 250 kbit/s, according to SAE J2284-2:2016 ▪ High-Speed CAN at 500 kbit/s, according to SAE J2284-3:2016
Protected voltage range	▪ -80 V … +80 V between CAN pins and GND (CAN_{high}, CAN_{low})

Parameter	Specification[1]
	▪ -7.75 V … +7.75 V between CAN High pin and CAN Low pin (CAN_{diff})

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the CAN 3 channel type.

Signal[1]	CAN Type 1 Module	DS1511 ZIF I/O Connector Pin
CAN 3-1 Channel 1 High	1	c2
CAN 3-1 Channel 1 Low	1	c3
CAN 3-1 Channel 2 High	1	b2
CAN 3-1 Channel 2 Low	1	b3
CAN 3-2 Channel 1 High	2	B2
CAN 3-2 Channel 1 Low	2	B3
CAN 3-2 Channel 2 High	2	A2
CAN 3-2 Channel 2 Low	2	A3
Ground reference		
GND[2]	-	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Provided by CAN Type 1 modules.
[2] Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

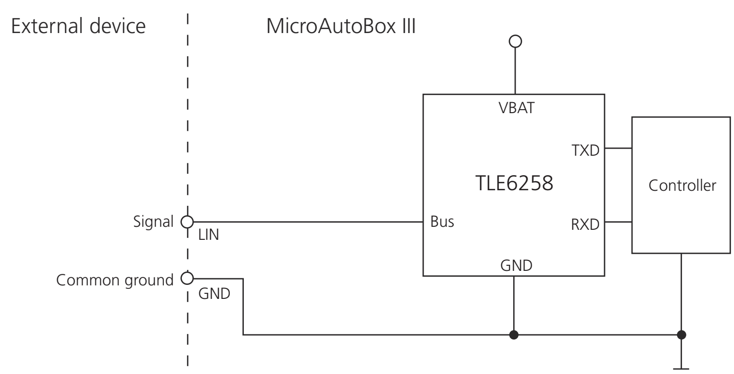
LIN 3 Characteristics

Purpose

Interface to communicate via a LIN bus.

Circuit diagram

Simplified circuit diagram of the LIN 3 channel type. The LIN channels are provided by two CAN Type 1 modules.



LIN 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	LIN
Number of channels	2, one channel per CAN Type 1 module
Data rate	500 bit/s ... 20 kbit/s
Transceiver type	TLE6258-2G
Termination resistance	Typ. 30 kΩ (slave termination)
Supported standards	Conforms to LIN specification 1.2, 1.3, 2.0, 2.1
Working voltage range	6 V … 27 V
Protected voltage range	–27 V … +32 V

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the LIN 3 channel type.

Signal[1)]	CAN Type 1 Module	DS1511 ZIF I/O Connector Pin
LIN 3-1 Signal	1	b5
LIN 3-2 Signal	2	A5
Signal Reference		
GND[2)]	-	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Provided by CAN Type 1 modules.
2) Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291 and Power Input Connector Pinout on page 265.

Related topics

HowTos

References

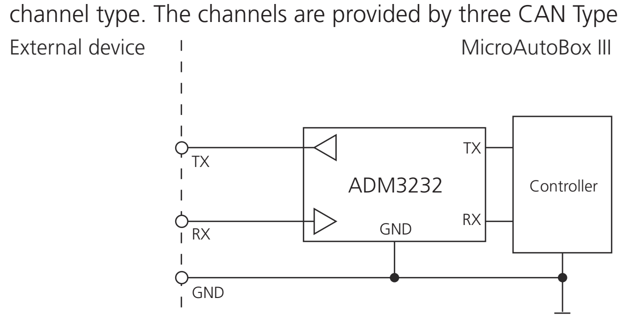
UART 2 Characteristics

Purpose

Interface to communicate with an RS232 device.

Circuit diagram

Simplified circuit diagram of the RS232 interfaces provided by the UART 2 channel type. The channels are provided by three CAN Type 1 modules.



UART 2 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Supported function blocks	Supported only by a custom function block. Refer to Implementing UART Serial Communication in ConfigurationDesk (ConfigurationDesk UART Implementation 📖).
Number of channels	2, one channel per CAN Type 1 module
Data rate	14 Bit/s … 115,200 Bit/s
Transceiver type	ADM3232E
Input threshold voltage high	Min 2.0 V
Input threshold voltage low	Max. 0.8 V
Protected voltage range	-30 V … +30 V

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the RS232 signals of the UART 2 channel type.

Signal[1]	CAN Type 1 Module	DS1511 ZIF I/O Connector Pin
UART 2-1 TX	1	c5
UART 2-1 RX	1	c6
UART 2-2 TX	2	B5
UART 2-2 RX	2	B6
Ground reference		
GND[2]	-	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Provided by CAN Type 1 modules.
[2] Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

Supply Characteristics

Where to go from here

Information in this section

DS1511 VDRIVE Input Characteristics

Purpose

Drive voltage input for the digital I/O circuits of the DS1511 Multi-I/O Board (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level.

VDRIVE characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Input voltage range	4.5 V … 40 V
Protected input voltage	Max. 45 V, no protection against load dump and reverse voltage.
Input current	▪ Typ. 20 mA if all digital inputs/outputs are disconnected. ▪ Up to 1 A, depending on the application.

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the VDRIVE input.

Signal	DS1511 ZIF I/O Connector Pin
VDRIVE	N1
Signal reference	
GND[1]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

DS1511 Sensor Supply Characteristics (VSENS)

Purpose

Provides a 5 V supply voltage.

Sensor supply characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Output voltage	4.84 V ... 5.25 V, typ. 5.05 V
Temperature-caused voltage drift	-2% ... 2% for the complete operating temperature range
Working current range	0 mA ... 750 mA
On/off behavior	Switched on and off with the MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the signals of the sensor supply.

Note

For information on supplying sensors, refer to Connecting Sensors to the DS1511 on page 105.

Signal	DS1511 ZIF I/O Connector Pin
VSENS	M1
Signal reference	
GND[1)]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

Basics

Connecting Sensors to the DS1511 105

References

Features of the DS1511 Multi-I/O Board 288

VBATprot Characteristics

Purpose

Provides an automotive-compatible voltage level to drive the digital I/O circuits of the DS1511 Multi-I/O Board.

VBATprot characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Output voltage	▪ VBATprot follows VBAT within the operating voltage range of the MicroAutoBox III. ▪ With I_{load} = 1 A and VBAT = 12 V: 11.56 V ... 12.00 V, typ. 11.78 V
Working current range	0 A ... 1 A
Output current limit	▪ 4 A ... 9 A for the complete operating temperature range ▪ Shut off after max. 5 ms
On/off behavior	Switched on and off with the MicroAutoBox III

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector that provide the protected VBAT voltage.

Signal	DS1511 ZIF I/O Connector Pin
VBATprot	P1
Signal reference	
GND[1]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Common ground for all signals.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291.

Related topics

References

Remote Input Characteristics (DS1511)

Purpose

Input to switch on/off the MicroAutoBox III.

The remote signal is also provided by the power input connector.

Remote characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Supported function blocks	Power On Signal In
Input voltage range	0 V … VBAT
Input high voltage	Min. 4.7 V
Input low voltage	Max. 0.8 V
Input hysteresis voltage	Min. 0.5 V, typ. 1 V
Input resistance	Min. 60 kΩ, max. 185 kΩ
Input type	Level-based input A high level switches on the MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the DS1511 ZIF I/O connector.

Signal	DS1511 ZIF I/O Connector
REMOTE	R1
Signal reference	
GND[1]	A1, A4, B1, B4, C1 ... C6, D1, E1, F1, G1, H1, J1, K1, L1, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Common ground for all signals.

The remote signal is also provided by the power input connector.

For the complete pinout, refer to DS1511 ZIF I/O Connector Pinout on page 291 and Power Input Connector Pinout on page 265.

Related topics

References

DS1513 Multi-I/O Board Data Sheet

Where to go from here

Information in this section

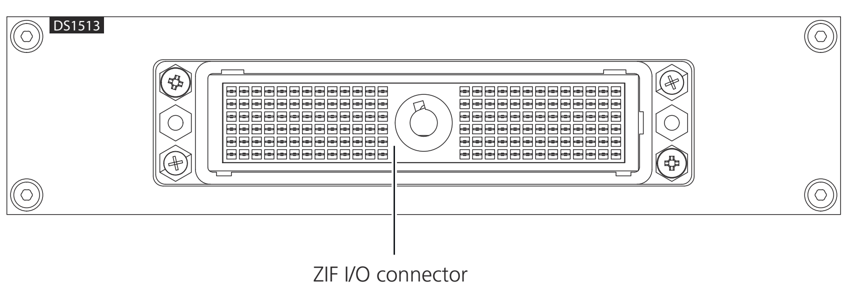
Overview and General Information

Where to go from here

Information in this section

DS1513 Panel Components

Panel overview



Component	Description
ZIF I/O connector	Provides access to all I/O channels of the DS1513 Multi-I/O Board: ▪ Max. contact resistance of 15 mΩ ▪ Durability 10,000 cycles For the pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

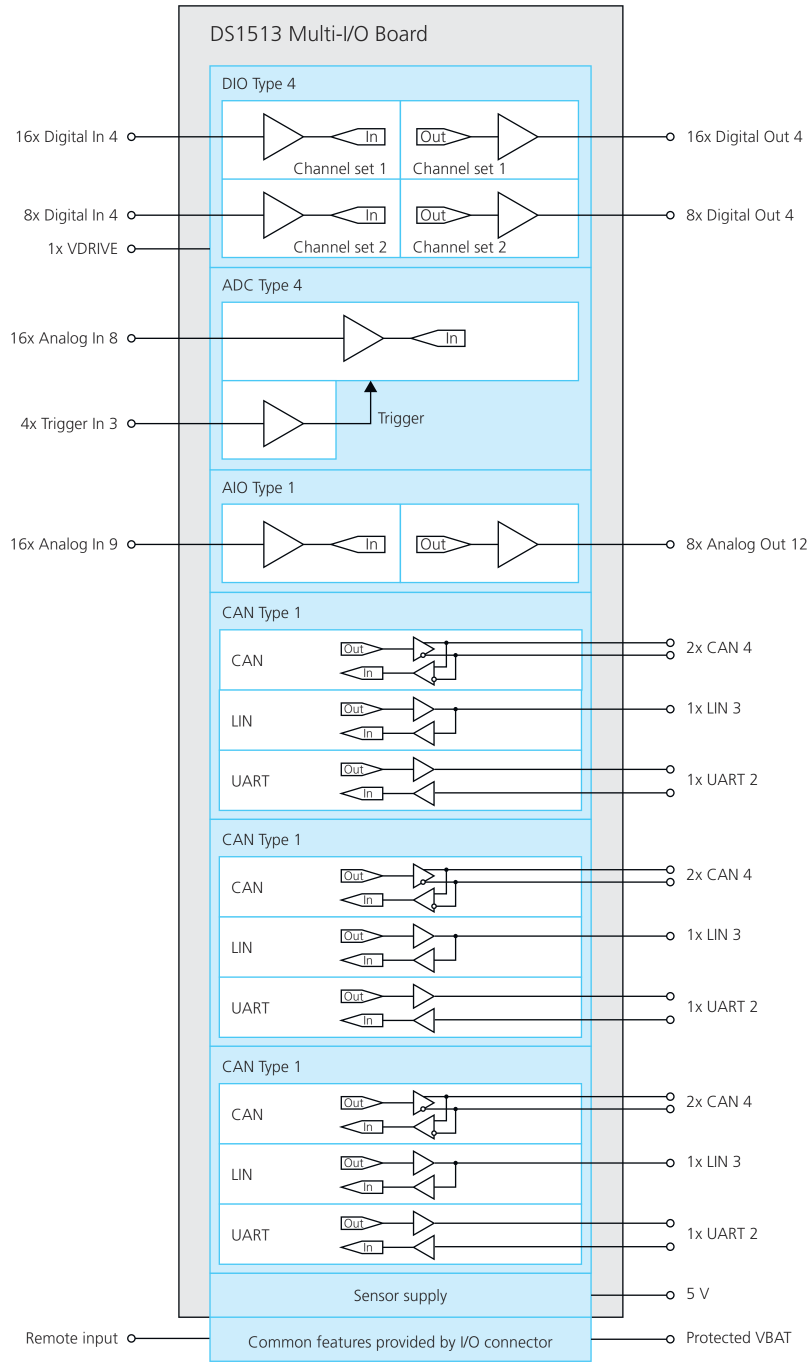
References

Features of the DS1513 Multi-I/O Board..323

Features of the DS1513 Multi-I/O Board

Main features

The following block diagram provides a functional view of the main features and the provided channel types.



The following table shows you more details.

Feature	Description
Channels for signal measurement	▪ 24 digital input channels of the Digital In 4 channel type. For signal characteristics and mapping, refer to Digital In 4 Characteristics on page 338. ▪ 16 analog input channels of the Analog In 8 channel type. For signal characteristics and mapping, refer to Analog In 8 Characteristics on page 330. ▪ 16 analog input channels of the Analog In 9 channel type. For signal characteristics and mapping, refer to Analog In 9 Characteristics on page 334. ▪ 4 trigger inputs to trigger the analog measurement of Analog In 8 channels. The inputs are of the Trigger In 3 channel type. For signal characteristics and mapping, refer to Trigger In 3 Characteristics on page 332.
Channels for signal generation	▪ 24 digital output channels of the Digital Out 4 channel type. For signal characteristics and mapping, refer to Digital Out 4 Characteristics on page 341. ▪ 8 analog output channels of the Analog Out 12 channel type. For signal characteristics and mapping, refer to Analog Out 12 Characteristics on page 336.
Communication channels	▪ 6 CAN channels of the CAN 4 channel type. For signal characteristics and mapping, refer to CAN 4 Characteristics on page 344. ▪ 3 LIN channels of the LIN 3 channel type. For signal characteristics and mapping, refer to LIN 3 Characteristics on page 347. ▪ 3 RS232 channels of the UART 2 channel type. For signal characteristics and mapping, refer to UART 2 Characteristics on page 348.
Supply outputs	▪ 5 V sensor supply to supply sensors or to drive the digital I/O circuits of the DS1513 Multi-I/O Board. For signal characteristics and mapping, refer to DS1513 Sensor Supply Characteristics (VSENS) on page 351. ▪ Protected VBAT ($VBAT_{prot}$) to drive the digital I/O circuits of the DS1513 Multi-I/O Board with an automotive-compatible voltage level. For signal characteristics and mapping, refer to VBATprot Characteristics on page 352.
Supply inputs	Drive voltage input for the digital I/O circuits of the DS1513 Multi-I/O Board (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level. For signal characteristics and mapping, refer to DS1513 VDRIVE Input Characteristics on page 350.
Remote control	Remote input signal to switch on/off the MicroAutoBox III. The same input signal is provided by the power input connector. For signal characteristics and mapping, refer to Remote Input Characteristics (DS1513) on page 353.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the DS1513 Multi-I/O Board.

Function Block Type	Purpose	Channel Type
Basic I/O		
Voltage In	The Voltage In function block type digitizes analog voltage signals coming from an external device.	▪ Analog In 8 ▪ Analog In 9
Trigger in	The Trigger In function block type generates a trigger signal each time the external input signal matches the defined triggering conditions. The function block works as a provider: Other function blocks can use the generated trigger signal as trigger source.	Trigger In 3
Voltage Out	The Voltage Out function block provides the possibility to output analog voltages.	Analog Out 12
Multi Bit In	The Multi Bit In function block type lets you measure digital signals coming from an external device.	Digital In 4
Multi Bit Out	The Multi Bit Out function block type lets you stimulate digital inputs of an external device.	Digital Out 4
Digital Pulse Out	The Digital Pulse Out function block generates a digital pulse with each model step of the behavior model or with each trigger event of another function block.	Digital Out 4
PWM/PFM Out	The PWM/PFM Out function block type can be used to generate one-phase pulse-width modulated signals and frequency output signals.	Digital Out 4
Multi-Channel PWM Out	The Multi-Channel PWM Out function block type synchronously generates multiple PWM signals with a common frequency. The function block can work as a provider: Other function blocks can use the generated trigger signal as a trigger source.	Digital Out 4
PWM/PFM In	With the PWM/PFM In function block, you can measure one-phase pulse-width-modulated signal patterns.	Digital In 4
Advanced I/O		
Digital Incremental Encoder In	The Digital Incremental Encoder In function block provides access to rotary or linear digital incremental encoders. The function block can be used, for example, to measure the angular position and the speed of an electric motor.	Digital In 4
Voltage Signal Capture (ADC Type 4)	With the Voltage Signal Capture (ADC Type 4) function block, you can measure analog voltage signals (coming from an external device) by capturing signal sequences, for example, at configurable sample rates. The function block type is exclusively designed to be used for the ADC Type 4 module of the DS1511, DS1511B1, and DS1513 Multi-I/O Boards.	Analog In 8
Communication		
SENT In	The SENT In function block receives SENT messages. SENT is a protocol used between sensors and ECUs to transmit data of high-resolution sensors as an alternative to an analog interface. The sensors are typically throttle position sensors or mass air flow sensors.	Digital In 4
SPI Master	The SPI Master function block controls and performs a short-distance communication via the serial peripheral interface (SPI). SPI communication is a master-slave architecture with a single master.	Digital In 4 with Digital Out 4

Function Block Type	Purpose	Channel Type
CAN	The CAN function block is one part of implementing CAN communication in real-time applications. The CAN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	CAN 4
LIN	The LIN function block is one part of implementing LIN communication in real-time applications. The LIN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	LIN 3

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide 📖.

Related topics

Basics

DS1513 Multi-I/O Board...109

References

DS1513 ZIF I/O Connector Pinout...326

Connector Pinouts

DS1513 ZIF I/O Connector Pinout

Purpose

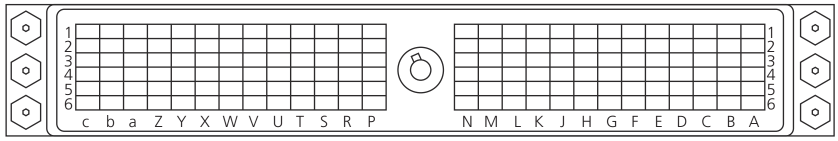
Connector to provide access to all I/O channels of the DS1513 Multi-I/O Board.

Pinout

Note

- There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).
- To use the digital I/O channels, you have to connect the VDRIVE pin according to the required logic level.
  For more information, refer to Driving the Digital I/O Interfaces of the DS1513 on page 109.

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of the I/O connector:

1	2	3	4	5	6	
GND	CAN 4-2 Ch. 2 High	CAN 4-2 Ch. 2 Low	GND	LIN 3-2 Signal	Do not connect	*A*
GND	CAN 4-2 Ch. 1 High	CAN 4-2 Ch. 1 Low	GND	UART 2-2 TX	UART 2-2 RX	*B*
GND	Digital Out 4-1 Channel 5 Signal	Digital Out 4-1 Channel 10 Signal	Digital Out 4-1 Channel 15 Signal	Digital Out 4-2 Channel 20 Signal	GND	*C*
GND	Digital Out 4-1 Channel 4 Signal	Digital Out 4-1 Channel 9 Signal	Digital Out 4-1 Channel 14 Signal	Digital Out 4-2 Channel 19 Signal	Digital Out 4-2 Channel 24 Signal	*D*
GND	Digital Out 4-1 Channel 3 Signal	Digital Out 4-1 Channel 8 Signal	Digital Out 4-1 Channel 13 Signal	Digital Out 4-2 Channel 18 Signal	Digital Out 4-2 Channel 23 Signal	*E*
GND	Digital Out 4-1 Channel 2 Signal	Digital Out 4-1 Channel 7 Signal	Digital Out 4-1 Channel 12 Signal	Digital Out 4-2 Channel 17 Signal	Digital Out 4-2 Channel 22 Signal	*F*
GND	Digital Out 4-1 Channel 1 Signal	Digital Out 4-1 Channel 6 Signal	Digital Out 4-1 Channel 11 Signal	Digital Out 4-1 Channel 16 Signal	Digital Out 4-2 Channel 21 Signal	*G*
GND	Digital In 4-1 Channel 5 Signal	Digital In 4-1 Channel 10 Signal	Digital In 4-1 Channel 15 Signal	Digital In 4-2 Channel 20 Signal	GND	*H*
GND	Digital In 4-1 Channel 4 Signal	Digital In 4-1 Channel 9 Signal	Digital In 4-1 Channel 14 Signal	Digital In 4-2 Channel 19 Signal	Digital In 4-2 Channel 24 Signal	*J*
GND	Digital In 4-1 Channel 3 Signal	Digital In 4-1 Channel 8 Signal	Digital In 4-1 Channel 13 Signal	Digital In 4-2 Channel 18 Signal	Digital In 4-2 Channel 23 Signal	*K*
GND	Digital In 4-1 Channel 2 Signal	Digital In 4-1 Channel 7 Signal	Digital In 4-1 Channel 12 Signal	Digital In 4-2 Channel 17 Signal	Digital In 4-2 Channel 22 Signal	*L*
VSENS Supply Output	Digital In 4-1 Channel 1 Signal	Digital In 4-1 Channel 6 Signal	Digital In 4-1 Channel 11 Signal	Digital In 4-1 Channel 16 Signal	Digital In 4-2 Channel 21 Signal	*M*
VDRIVE Supply Input	CAN 4-3 Ch. 2 High	CAN 4-3 Ch. 2 Low	GND	LIN 3-3 Signal	Do not connect	*N*
VBATprot Supply Output	CAN 4-3 Ch. 1 High	CAN 4-3 Ch. 1 Low	GND	UART 2-3 TX	UART 2-3 RX	*P*
REMOTE Input	GND	GND	GND	GND	GND	*R*
GND	Analog Out 12 Channel 8 Signal	Analog In 9 Channel 4 Signal	Analog In 9 Channel 8 Signal	Analog In 9 Channel 12 Signal	Analog In 9 Channel 16 Signal	*S*
GND	Analog Out 12 Channel 7 Signal	Analog In 9 Channel 3 Signal	Analog In 9 Channel 7 Signal	Analog In 9 Channel 11 Signal	Analog In 9 Channel 15 Signal	*T*
GND	Analog Out 12 Channel 6 Signal	Analog In 9 Channel 2 Signal	Analog In 9 Channel 6 Signal	Analog In 9 Channel 10 Signal	Analog In 9 Channel 14 Signal	*U*
GND	Analog Out 12 Channel 5 Signal	Analog In 9 Channel 1 Signal	Analog In 9 Channel 5 Signal	Analog In 9 Channel 9 Signal	Analog In 9 Channel 13 Signal	*V*

1	2	3	4	5	6	
GND	Analog Out 12 Channel 4 Signal	Analog In 8 Channel 4 Signal	Analog In 8 Channel 8 Signal	Analog In 8 Channel 12 Signal	Analog In 8 Channel 16 Signal	*W*
GND	Analog Out 12 Channel 3 Signal	Analog In 8 Channel 3 Signal	Analog In 8 Channel 7 Signal	Analog In 8 Channel 11 Signal	Analog In 8 Channel 15 Signal	*X*
GND	Analog Out 12 Channel 2 Signal	Analog In 8 Channel 2 Signal	Analog In 8 Channel 6 Signal	Analog In 8 Channel 10 Signal	Analog In 8 Channel 14 Signal	*Y*
GND	Analog Out 12 Channel 1 Signal	Analog In 8 Channel 1 Signal	Analog In 8 Channel 5 Signal	Analog In 8 Channel 9 Signal	Analog In 8 Channel 13 Signal	*Z*
GND	SGND	Trigger In 3 Channel 1 Signal	Trigger In 3 Channel 2 Signal	Trigger In 3 Channel 3 Signal	Trigger In 3 Channel 4 Signal	*a*
GND	CAN 4-1 Ch. 2 High	CAN 4-1 Ch. 2 Low	GND	LIN 3-1 Signal	Do not connect	*b*
GND	CAN 4-1 Ch. 1 High	CAN 4-1 Ch. 1 Low	GND	UART 2-1 TX	UART 2-1 RX	*c*

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
Analog I/O		
Analog In 8	Input to measure analog signals in the range -10 V ... +10 V.	Analog In 8 Characteristics on page 330
Analog In 9	Input to measure analog signals in the range -10 V ... +10 V.	Analog In 9 Characteristics on page 334
Trigger In 3	Input to trigger the analog measurement of the Analog In 8 channel type.	Trigger In 3 Characteristics on page 332
Analog Out 12	Output to generate analog signals in the range -10 V ... 10 V.	Analog Out 12 Characteristics on page 336
Digital I/O		
Digital In 4	Input to measure digital signals with a fixed threshold voltage. Signal naming: Digital In 4-n for channel set 1 … 2	Digital In 4 Characteristics on page 338
Digital Out 4	Output to generate digital signals. Signal naming: Digital Out 4-n for channel set 1 … 2	Digital Out 4 Characteristics on page 341
Communication Interfaces		
CAN 4	ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination via software and partial networking. Signal naming: CAN 4-n for module 1 … 3.	CAN 4 Characteristics on page 344
LIN 3	Interface to communicate via a LIN bus. Signal naming: LIN 3-n for module 1 … 3.	LIN 3 Characteristics on page 347
UART 2	Interface to communicate with an RS232 device. Signal naming: ▪ Receive line: RX	UART 2 Characteristics on page 348

Signal	Description	Characteristics
	▪ Transmit line: TX ▪ Module number: UART 2-n for module 1 … 3.	
Supply Inputs and Outputs		
REMOTE	Input to switch on/off the MicroAutoBox III.	Remote Input Characteristics on page 279
VDRIVE	Drive voltage input for the digital I/O circuits of the DS1513 Multi-I/O Board (VDRIVE).	DS1513 VDRIVE Input Characteristics on page 350
VSENS	Provides a 5 V supply voltage.	DS1513 Sensor Supply Characteristics (VSENS) on page 351
VBATprot	Protected supply voltage with an automotive-compatible voltage level.	VBATprot Characteristics on page 352
Ground Potentials		
GND	Common ground for all signals. GND is also connected to the housing of the MicroAutoBox III.	-
SGND	Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.	-

Related topics

Basics

Analog Interface Characteristics

Where to go from here

Information in this section

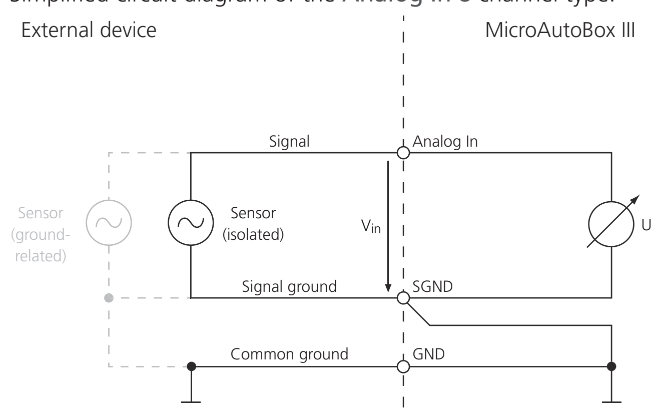
Analog In 8 Characteristics

Purpose

Input to measure analog signals in the range -10 V ... +10 V.

Circuit diagrams

Simplified circuit diagram of the Analog In 8 channel type:



If the input is open, a non-zero voltage at the input pins can be measured due to the internal structure of the channel type.

Analog In 8 characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT=+12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Voltage In ▪ Voltage Signal Capture (ADC Type 4)
Number of channels	-	16
Input voltage range	V_{in}	-10 V ... +10 V
Resolution	-	16 bit
No missing codes	-	15 bit

Parameter	Symbol	Specification[1)]
Offset error	-	-3 mV ... +3 mV below 750 kS/s
Offset drift	-	Typ. ±40 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 117 kΩ
Sample rate	f_s	Max. 1 MS/s
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth
Protected voltage range (short-term)	$V_{in\{prot\}}$	-50 V ... +50 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-30 V ... +30 V

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the Analog In 8 channel type.

Signal	DS1513 ZIF I/O Connector Pin
Analog In 8 Channel 1 Signal	Z3
Analog In 8 Channel 2 Signal	Y3
Analog In 8 Channel 3 Signal	X3
Analog In 8 Channel 4 Signal	W3
Analog In 8 Channel 5 Signal	Z4
Analog In 8 Channel 6 Signal	Y4
Analog In 8 Channel 7 Signal	X4
Analog In 8 Channel 8 Signal	W4
Analog In 8 Channel 9 Signal	Z5
Analog In 8 Channel 10 Signal	Y5
Analog In 8 Channel 11 Signal	X5
Analog In 8 Channel 12 Signal	W5
Analog In 8 Channel 13 Signal	Z6
Analog In 8 Channel 14 Signal	Y6
Analog In 8 Channel 15 Signal	X6
Analog In 8 Channel 16 Signal	W6

Signal	DS1513 ZIF I/O Connector Pin
Signal Reference	
SGND[1)]	a2
GND[2)]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.
2) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

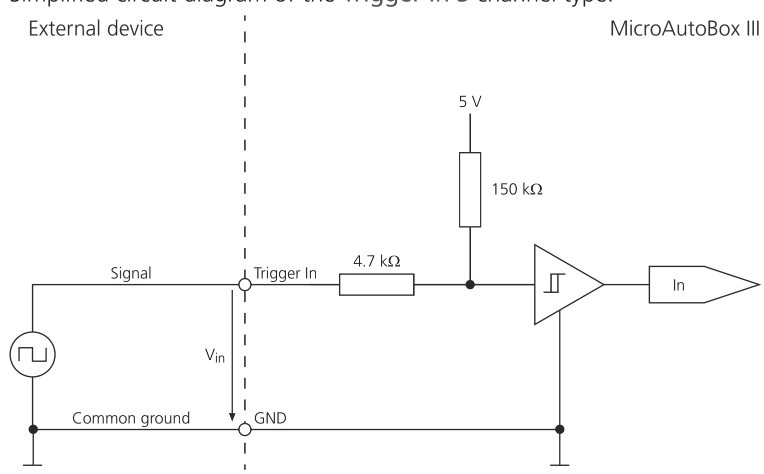
Trigger In 3 Characteristics

Purpose

Input to trigger the analog measurement of the Analog In 8 channel type.

Circuit diagram

Simplified circuit diagram of the Trigger In 3 channel type:



Trigger In 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	Trigger In
Number of channels	-	4
Input high voltage	V_{ih}	Min. 2.3 V
Input low voltage	V_{il}	Max. 0.4 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-48 V ... 50 V
Trigger rate	$f_{trigger}$	Max. 1 MHz

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

Signal mapping

The following table shows the connecor pins of the DS1513 ZIF I/O connector that provide the signals of the Trigger In 3 channel type.

Signal	DS1513 ZIF I/O Connector Pin
Trigger In 3 Channel 1 Signal	a3
Trigger In 3 Channel 2 Signal	a4
Trigger In 3 Channel 3 Signal	a5
Trigger In 3 Channel 4 Signal	a6
Signal Reference	
GND[1)]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

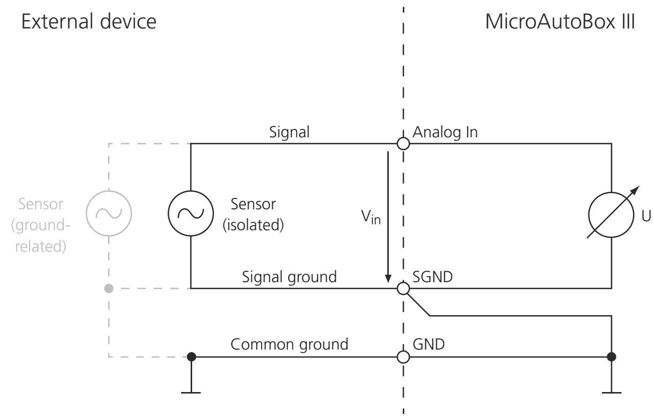
Analog In 9 Characteristics

Purpose

Input to measure analog signals in the range -10 V ... +10 V.

Circuit diagram

Simplified circuit diagram of the Analog In 9 channel type:



Analog In 9 characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT=+12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	Voltage In
Number of channels	-	16
Input voltage range	V_{in}	-10 V … 10 V
Resolution	-	16 bit
Offset error	-	-2 mV ... +2 mV
Gain error	-	-1% ... +1%
Input resistance	R_{in}	Typ. 1 MΩ
Sample rate	f_s	Max. 200 kS/s
-3 dB cutoff frequency	f_{-3dB}	Typ. 23 kHz

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the Analog In 9 channel type.

Signal	DS1513 ZIF I/O Connector Pin
Analog In 9 Channel 1 Signal	V3
Analog In 9 Channel 2 Signal	U3
Analog In 9 Channel 3 Signal	T3
Analog In 9 Channel 4 Signal	S3
Analog In 9 Channel 5 Signal	V4
Analog In 9 Channel 6 Signal	U4
Analog In 9 Channel 7 Signal	T4
Analog In 9 Channel 8 Signal	S4
Analog In 9 Channel 9 Signal	V5
Analog In 9 Channel 10 Signal	U5
Analog In 9 Channel 11 Signal	T5
Analog In 9 Channel 12 Signal	S5
Analog In 9 Channel 13 Signal	V6
Analog In 9 Channel 14 Signal	U6
Analog In 9 Channel 15 Signal	T6
Analog In 9 Channel 16 Signal	S6
Signal Reference	
SGND[1)]	a2
GND[2)]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.

2) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

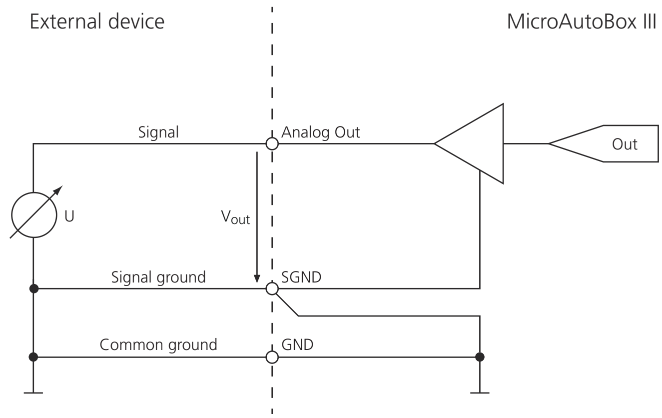
Analog Out 12 Characteristics

Purpose

Output to generate analog signals in the range -10 V ... 10 V.

Circuit diagrams

Simplified circuit diagram of the Analog Out 12 channel type.



Analog Out 12 characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT=+12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	Voltage Out
Number of channels	-	8
Output voltage range	V_{out}	-10 V ... +10 V
Resolution	-	16 bit
Offset error	-	-4 mV ... +4 mV
Gain error	-	-0.25% ... +0.25%
-3 dB cutoff frequency	f_{-3dB}	Min. 500 kHz
Settling time (to 1 %)	-	Max. 1 µs
Working currrent range	I_{out}	-8 mA ... +8 mA
Load capacitance	-	Max. 22 nF
Protected voltage range	$V_{out\{prot\}}$	-30 V … +40 V

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the Analog Out 12 channel type.

Signal	DS1513 ZIF I/O Connector Pin
Analog Out 12 Channel 1 Signal	Z2
Analog Out 12 Channel 2 Signal	Y2
Analog Out 12 Channel 3 Signal	X2
Analog Out 12 Channel 4 Signal	W2
Analog Out 12 Channel 5 Signal	V2
Analog Out 12 Channel 6 Signal	U2
Analog Out 12 Channel 7 Signal	T2
Analog Out 12 Channel 8 Signal	S2
Signal Reference	
SGND[1)]	a2
GND[2)]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Analog signal ground. Internally connected to GND. Use the SGND pin as a reference for analog signals to achieve optimum analog performance.

2) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

Digital Interface Characteristics

Where to go from here

Information in this section

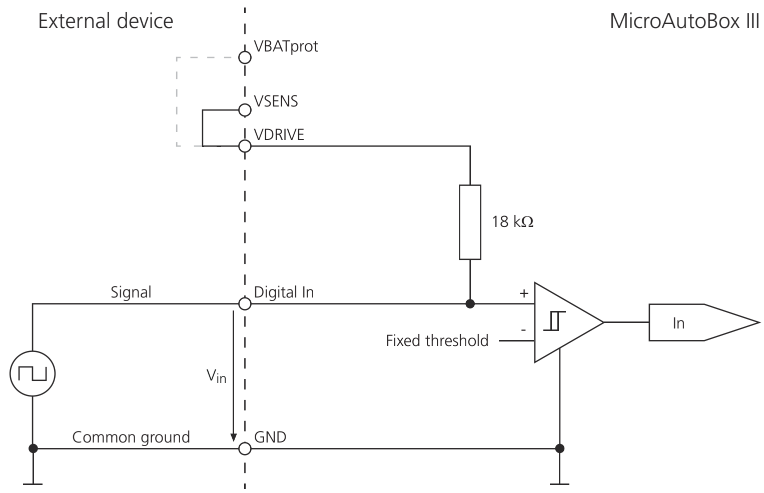
Digital In 4 Characteristics

Purpose

Input to measure digital signals with a fixed threshold voltage.

Circuit diagram

Simplified circuit diagram of the Digital In 4 channel type. The channels are provided by DIO Type 3 modules.



Note

To use the digital I/O channels, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital I/O Interfaces of the DS1513 on page 109.

Digital In 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)
Supported function blocks	-	▪ Multi Bit In ▪ PWM/PFM In ▪ Digital Pulse In ▪ Digital Incremental Encoder In ▪ SENT In ▪ SPI Master

Parameter	Symbol	Specification[1]
Number of channels	-	24, divided into 2 channel sets
Input high voltage	V_{ih}	Min. 3.1 V
Input low voltage	V_{il}	Max. 1.2 V
Input hysteresis voltage	V_{hys}	Typ. 1 V
Minimum input pulse width low	t_{LowMin}	Typ. 250 ns
Minimum input pulse width high	$t_{HighMin}$	Typ. 300 ns
Maximum input frequency[2]	f_{max}	▪ Typ. 1.8 MHz at duty cycle = 50% ▪ Typ. 33 kHz at duty cycle = 1% (99%)
Pull-up resistor to VDRIVE	$R_{pull-up}$	Min. 17 kΩ, max. 19 kΩ
Input capacitance	C_{in}	Typ. 1 nF
Protected voltage range	$V_{in\{prot\}}$	(VDRIVE - 45 V) ... +45 V

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

[2] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 1 MHz.

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the Digital In 4 channel type.

Signal	Channel Set[1]	DS1513 ZIF I/O Connector Pin
Digital In 4-1 Channel 1 Signal	1	M2
Digital In 4-1 Channel 2 Signal	1	L2
Digital In 4-1 Channel 3 Signal	1	K2
Digital In 4-1 Channel 4 Signal	1	J2
Digital In 4-1 Channel 5 Signal	1	H2
Digital In 4-1 Channel 6 Signal	1	M3
Digital In 4-1 Channel 7 Signal	1	L3
Digital In 4-1 Channel 8 Signal	1	K3
Digital In 4-1 Channel 9 Signal	1	J3
Digital In 4-1 Channel 10 Signal	1	H3
Digital In 4-1 Channel 11 Signal	1	M4
Digital In 4-1 Channel 12 Signal	1	L4
Digital In 4-1 Channel 13 Signal	1	K4
Digital In 4-1 Channel 14 Signal	1	J4
Digital In 4-1 Channel 15 Signal	1	H4
Digital In 4-1 Channel 16 Signal	1	M5
Digital In 4-2 Channel 17 Signal	2	L5

Signal	Channel Set[1]	DS1513 ZIF I/O Connector Pin
Digital In 4-2 Channel 18 Signal	2	K5
Digital In 4-2 Channel 19 Signal	2	J5
Digital In 4-2 Channel 20 Signal	2	H5
Digital In 4-2 Channel 21 Signal	2	M6
Digital In 4-2 Channel 22 Signal	2	L6
Digital In 4-2 Channel 23 Signal	2	K6
Digital In 4-2 Channel 24 Signal	2	J6
Signal Reference		
GND[2]	-	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] The digital channels are divided into two channel sets. I/O channels can be assigned to function blocks only within one channel set. This ensures data consistency.
[2] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

Basics

References

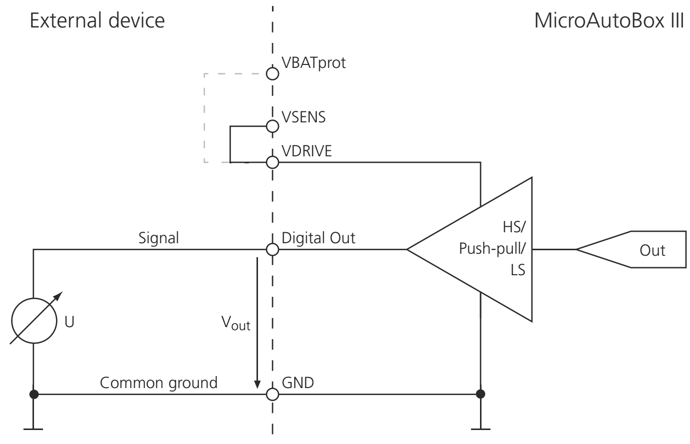
Digital Out 4 Characteristics

Purpose

Output to generate digital signals.

Circuit diagram

Simplified circuit diagram of the Digital Out 4 channel type. The channels are provided by DIO Type 3 modules.



Note

To use the digital I/O channels, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital I/O Interfaces of the DS1513 on page 109.

General behavior of digital signals

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

Digital Out 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Multi Bit Out ▪ Digital Pulse Out

Parameter	Symbol	Specification[1]
		▪ PWM/PFM Out ▪ Multi-Channel PWM Out ▪ SPI Master
Number of channels	-	24, divided into 2 channel sets
Output high voltage	V_{oh}	VDRIVE = 5 V ▪ Min. 4.4 V, typ. 4.6 V at I_{out} = 0 mA ▪ Min. 3.2 V, typ. 3.4 V at I_{out} = 5 mA VDRIVE = 12 V ▪ Min. 11.3 V, typ. 11.6 V at I_{out} = 0 mA ▪ Min. 10.3 V, typ. 10.5 V at I_{out} = 5 mA
Output low voltage	V_{ol}	▪ Max. 0.3 V, typ. 0.1 V at I_{out} = 0 mA ▪ Max. 0.9 V, typ. 0.7 V at I_{out} = -5 mA
Working current range	$I_{out\{work\}}$	-5 mA ... +5 mA
Output current limit high	$I_{oh\{lim\}}$	Typ. 13 mA, max. 17 mA
Output current limit low	$I_{ol\{lim\}}$	Typ. -14 mA, max. -18 mA
Minimum output pulse width high	$t_{HighMin}$	Typ. 700 ns
Minimum output pulse width low	t_{LowMin}	Typ. 200 ns
Maximum output frequency[2]	f_{max}	▪ Typ. 700 kHz at duty cycle = 50% ▪ Typ. 14 kHz at duty cycle = 1% (99%)
Leakage current tristate	I_{leak}	Max. 100 µA
Protected voltage range	V_{prot}	(VDRIVE - 45 V) ... +45 V

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 150 kHz.

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the Digital Out 4 channel type.

Signal	Channel Set[1]	DS1513 ZIF I/O Connector Pin
Digital Out 4-1 Channel 1 Signal	1	G2
Digital Out 4-1 Channel 2 Signal	1	F2
Digital Out 4-1 Channel 3 Signal	1	E2
Digital Out 4-1 Channel 4 Signal	1	D2
Digital Out 4-1 Channel 5 Signal	1	C2
Digital Out 4-1 Channel 6 Signal	1	G3
Digital Out 4-1 Channel 7 Signal	1	F3
Digital Out 4-1 Channel 8 Signal	1	E3

Signal	Channel Set[1]	DS1513 ZIF I/O Connector Pin
Digital Out 4-1 Channel 9 Signal	1	D3
Digital Out 4-1 Channel 10 Signal	1	C3
Digital Out 4-1 Channel 11 Signal	1	G4
Digital Out 4-1 Channel 12 Signal	1	F4
Digital Out 4-1 Channel 13 Signal	1	E4
Digital Out 4-1 Channel 14 Signal	1	D4
Digital Out 4-1 Channel 15 Signal	1	C4
Digital Out 4-1 Channel 16 Signal	1	G5
Digital Out 4-2 Channel 17 Signal	2	F5
Digital Out 4-2 Channel 18 Signal	2	E5
Digital Out 4-2 Channel 19 Signal	2	D5
Digital Out 4-2 Channel 20 Signal	2	C5
Digital Out 4-2 Channel 21 Signal	2	G6
Digital Out 4-2 Channel 22 Signal	2	F6
Digital Out 4-2 Channel 23 Signal	2	E6
Digital Out 4-2 Channel 24 Signal	2	D6
Signal Reference		
GND[2]	-	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4
Digital I/O Interface Supply		
VBATprot	-	P1
VSENS	-	M1
VDRIVE	-	N1

[1] The digital channels are divided into two channel sets. I/O channels can be assigned to function blocks only within one channel set. This ensures data consistency.

[2] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

Basics

References

Communication Interface Characteristics

Where to go from here

Information in this section

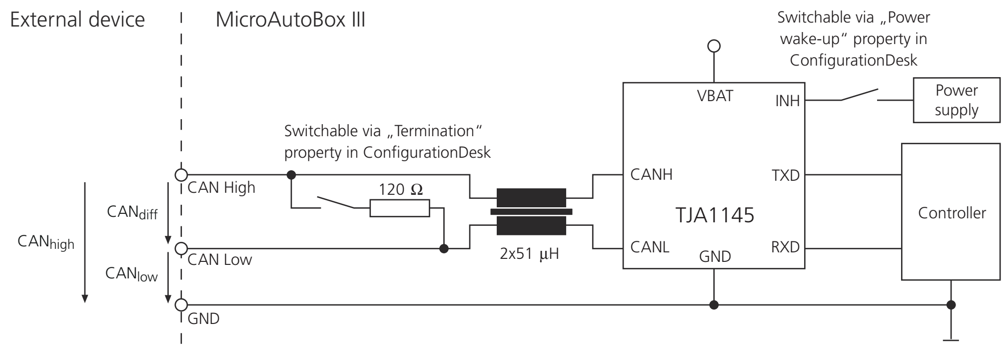
CAN 4 Characteristics

Purpose

ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination via software and partial networking.

Circuit diagram

Simplified circuit diagram of the CAN 4 channel type. The CAN channels are provided by three CAN Type 1 modules.



CAN 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Supported function blocks	CAN
Number of channels	6, two channels per CAN Type 1 module
Data rate	15 kbit/s … 1 Mbit/s
Transceiver type	TJA1145T/FD
Supported standards	▪ High-speed, according to ISO 11898-2:2016 ▪ Low-power mode, according to ISO 11898-5:2007 ▪ Selective wake-up, according to ISO 11898-6:2013 ▪ High-speed CAN at 125 kbit/s, according to SAE J2284-1:2016 ▪ High-speed CAN at 250 kbit/s, according to SAE J2284-2:2016 ▪ High-speed CAN at 500 kbit/s, according to SAE J2284-3:2016
Termination resistance	120 Ω, configurable via software
Protected voltage range	▪ -58 V … +58 V between CAN pins and GND (CAN_{high}, CAN_{low}) ▪ -7.75 V … +7.75 V between CAN High pin and CAN Low pin (CAN_{diff})

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the CAN 4 channel type.

Signal[1)]	CAN Type 1 Module	DS1513 ZIF I/O Connector Pin
CAN 4-1 Channel 1 High	1	c2
CAN 4-1 Channel 1 Low	1	c3
CAN 4-1 Channel 2 High	1	b2
CAN 4-1 Channel 2 Low	1	b3
CAN 4-2 Channel 1 High	2	B2
CAN 4-2 Channel 1 Low	2	B3
CAN 4-2 Channel 2 High	2	A2
CAN 4-2 Channel 2 Low	2	A3
CAN 4-3 Channel 1 High	3	P2
CAN 4-3 Channel 1 Low	3	P3
CAN 4-3 Channel 2 High	3	N2
CAN 4-3 Channel 2 Low	3	N3
Ground Reference		
GND[2)]	-	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Provided by CAN Type 1 modules.
2) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

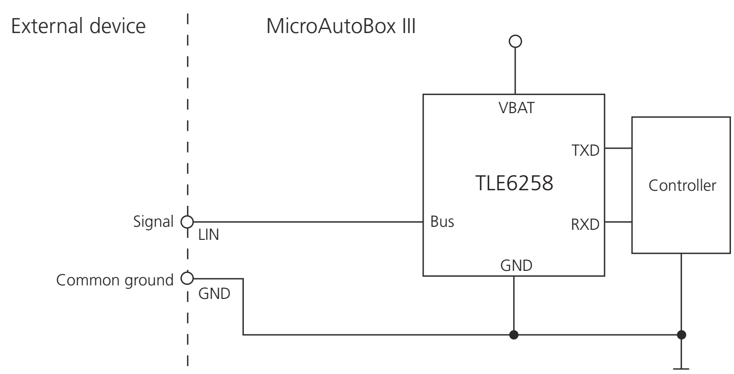
LIN 3 Characteristics

Purpose

Interface to communicate via a LIN bus.

Circuit diagram

Simplified circuit diagram of the LIN 3 channel type. The LIN channels are provided by two CAN Type 1 modules.



LIN 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Supported function blocks	LIN
Number of channels	3, one channel per CAN Type 1 module
Data rate	500 bit/s ... 20 kbit/s
Transceiver type	TLE6258-2G
Termination resistance	Typ. 30 kΩ (slave termination)
Supported standards	Conforms to LIN specification 1.2, 1.3, 2.0, 2.1
Working voltage range	6 V … 27 V
Protected voltage range	–27 V … +32 V

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the LIN 3 channel type.

Signal[1)]	CAN Type 1 Module	DS1513 ZIF I/O Connector Pin
LIN 3-1 Signal	1	b5
LIN 3-2 Signal	2	A5
LIN 3-3 Signal	3	N5
Signal Reference		
GND[2)]	-	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Provided by CAN Type 1 modules.
2) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326 and Power Input Connector Pinout on page 265.

Related topics

References

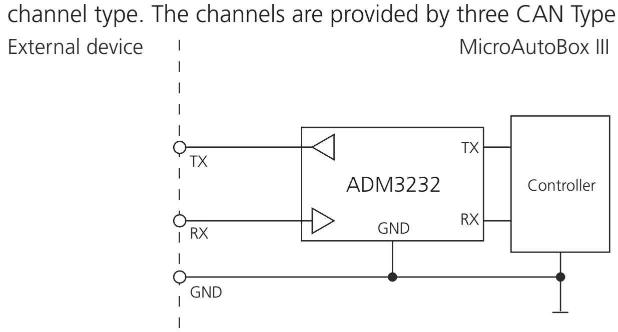
UART 2 Characteristics

Purpose

Interface to communicate with an RS232 device.

Circuit diagram

Simplified circuit diagram of the RS232 interfaces provided by the UART 2 channel type. The channels are provided by three CAN Type 1 modules.



UART 2 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	Supported only by a custom function block. Refer to Implementing UART Serial Communication in ConfigurationDesk (ConfigurationDesk UART Implementation 📖).
Number of channels	3, one channel per CAN Type 1 module
Data rate	14 Bit/s … 115,200 Bit/s
Transceiver type	ADM3232E
Input threshold voltage high	Min 2.0 V
Input threshold voltage low	Max. 0.8 V
Protected voltage range	-30 V … +30 V

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the RS232 signals of the UART 2 channel type.

Signal[1)]	CAN Type 1 Module	DS1513 ZIF I/O Connector Pin
UART 2-1 TX	1	c5
UART 2-1 RX	1	c6
UART 2-2 TX	2	B5
UART 2-2 RX	2	B6
UART 2-3 TX	3	P5
UART 2-3 RX	3	P6
Ground Reference		
GND[2)]	-	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Provided by CAN Type 1 modules.
2) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

Supply Characteristics

Where to go from here

Information in this section

DS1513 VDRIVE Input Characteristics

Purpose

Drive voltage input for the digital I/O circuits of the DS1513 Multi-I/O Board (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level.

VDRIVE characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Input voltage range	4.5 V … 40 V
Protected input voltage	Max. 45 V, no protection against load dump and reverse voltage.

Parameter	Specification[1]
Input current	▪ Typ. 20 mA if all digital inputs/outputs are disconnected. ▪ Up to 1 A, depending on the application.

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the VDRIVE input.

Signal	DS1513 ZIF I/O Connector Pin
VDRIVE	N1
Signal Reference	
GND[1]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

DS1513 Sensor Supply Characteristics (VSENS)

Purpose

Provides a 5 V supply voltage.

Sensor supply characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Output voltage	4.84 V ... 5.25 V, typ. 5.05 V
Temperature-caused voltage drift	-2% ... 2% for the complete operating temperature range

Parameter	Specification[1]
Working current range	0 mA ... 750 mA
On/off behavior	Switched on and off with the MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the signals of the sensor supply.

Note

For information on supplying sensors, refer to Connecting Sensors to the DS1513 on page 111.

Signal	DS1513 ZIF I/O Connector Pin
VSENS	M1
Signal Reference	
GND[1]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1] Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

Features of the DS1513 Multi-I/O Board..323

VBATprot Characteristics

Purpose

Provides an automotive-compatible voltage level to drive the digital I/O circuits of the DS1513 Multi-I/O Board.

VBATprot characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Output voltage	▪ VBATprot follows VBAT within the operating voltage range of the MicroAutoBox III. ▪ With I_{load} = 1 A and VBAT = 12 V: 11.56 V ... 12.00 V, typ. 11.78 V
Working current range	0 A ... 1 A
Output current limit	▪ 4 A ... 9 A for the complete operating temperature range ▪ Shut off after max. 5 ms
On/off behavior	Switched on and off with the MicroAutoBox III

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector that provide the protected VBAT voltage.

Signal	DS1513 ZIF I/O Connector Pin
VBATprot	P1
Signal Reference	
GND[1)]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

1) Common ground for all signals.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326.

Related topics

References

Remote Input Characteristics (DS1513)

Purpose

Input to switch on/off the MicroAutoBox III.

The remote signal is also provided by the power input connector.

Remote characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	Power On Signal In
Input voltage range	0 V … VBAT
Input high voltage	Min. 4.7 V
Input low voltage	Max. 0.8 V
Input hysteresis voltage	Min. 0.5 V, typ. 1 V
Input resistance	Min. 60 kΩ, max. 185 kΩ
Input type	Level-based input A high level switches on the MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the DS1513 ZIF I/O connector.

Signal	DS1513 ZIF I/O Connector
REMOTE	R1
Signal Reference	
GND[1)]	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1,P4,R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4

[1)] Common ground for all signals.

The remote signal is also provided by the power input connector.

For the complete pinout, refer to DS1513 ZIF I/O Connector Pinout on page 326 and Power Input Connector Pinout on page 265.

Related topics

References

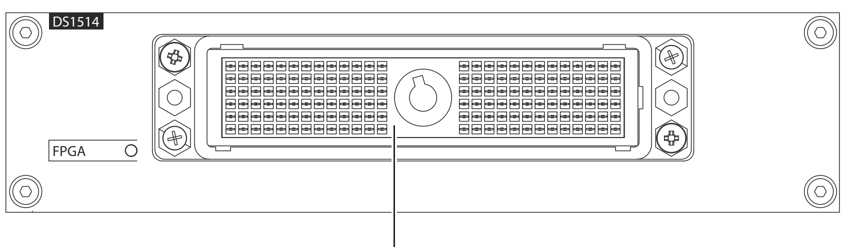
DS1514 FPGA Base Board Data Sheet

Where to go from here

Information in this section

DS1514 Panel Components

Panel overview



Component	Description
ZIF I/O connector	Provides access to the I/O channels of the installed I/O modules. ▪ Max. contact resistance of 15 mΩ ▪ Durability 10,000 cycles The pinout depends on the installed I/O modules. Refer to the following topics. ▪ DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391 ▪ DS1514 ZIF I/O Connector Pinout (DS1553) on page 424 ▪ DS1514 ZIF I/O Connector Pinout (DS1554) on page 446 ▪ DS1514 ZIF I/O Connector Pinout (DS4340) on page 473 ▪ DS1514 ZIF I/O Connector Pinout (DS4342) on page 480
LED	For the LED status description, refer to LED States of the DS1514 Panel on page 359.

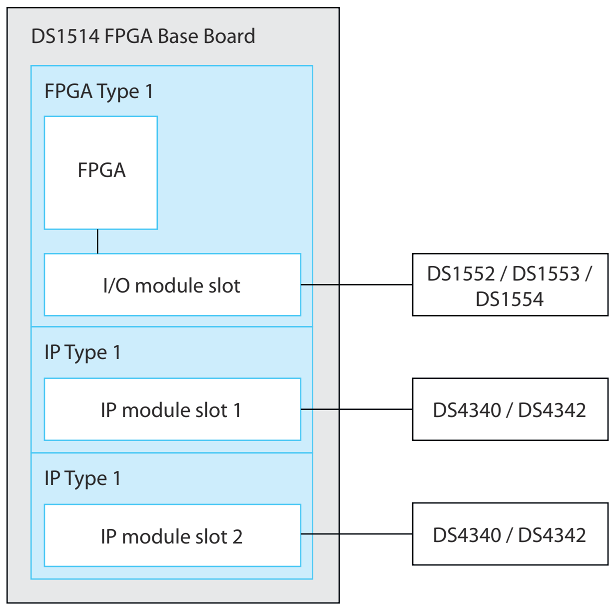
Related topics

References

Features of the DS1514 FPGA Base Board

Main features

The following block diagram provides a functional view of the main features.



The following table shows the features:

Feature	Description
Programmable FPGA	▪ Xilinx Kintex®-7 XC7K325T ▪ 326,080 logic cells ▪ 50,950 slices ▪ 4,000 kbit distributed RAM (max.) ▪ 840 DSP slices ▪ 80 MHz hardware clock frequency. ▪ Multiple clock domains: Up to ten clock domains can be used to process FPGA subsystems with individual clock periods.

Feature	Description
I/O module slots	I/O interfaces are provided by modules that are connected to the FPGA base board. Refer to Supported modules on page 357.
IP module slots	
Feedback elements	▪ Status In: State of the initialization sequence that is started after programming the FPGA. ▪ Temperature: Sensor to measure the FPGA's die temperature. ▪ LED Out: FPGA Status LED.

Using the FPGA

The DS1514 supports the following FPGA applications. However, simultaneous use of the applications is not supported:

- A standard FPGA application provides the I/O features of the installed I/O modules for function blocks of ConfigurationDesk.

  The standard FPGA application is automatically programmed to the FPGA if the real-time application that you load to the hardware does not contain a custom FPGA application.
- A custom FPGA application lets you implement customized functionalities, such as complex signal processing.

  A custom FPGA application must be added to the real-time application via FPGA custom function blocks. Refer to Implementing FPGA Custom Function Blocks (ConfigurationDesk I/O Function Implementation Guide 🕮).

  You use the RTI FPGA Programming Blockset and Xilinx® Vivado® to generate the custom FPGA application. Refer to Software Tools for Working With the RTI FPGA Programming Blockset (RTI FPGA Programming Blockset Guide 🕮).

Supported modules

The DS1514 FPGA Base Board provides the following slots to install I/O modules:

- 1 x I/O module slots
- 2 x IP module slots

I/O module slot The following I/O modules can be installed in the I/O module slot:

- DS1552 Multi-I/O Module
- DS1553 AC Motor Control Module
- DS1554 Engine Control I/O Module

IP module slots The following I/O modules can be installed in the IP module slots:

- DS4340 FlexRay Interface Module
- DS4342 CAN FD Interface Module

Related topics

References

DS1514 Connector Pinouts.. 358

DS1514 Connector Pinouts

Pinout

The pinout depends on the installed I/O modules. Refer to the following topics.

- DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391
- DS1514 ZIF I/O Connector Pinout (DS1553) on page 424
- DS1514 ZIF I/O Connector Pinout (DS1554) on page 446
- DS1514 ZIF I/O Connector Pinout (DS4340) on page 473
- DS1514 ZIF I/O Connector Pinout (DS4342) on page 480

Related topics

References

Features of the DS1514 FPGA Base Board.. 356

DS1514 Signal Characteristics

Provided signals

All signals are provided by I/O modules. Refer to the data sheet of the installed I/O module:

- DS1552 Multi-I/O Module Data Sheet on page 388
- DS1553 AC Motor Control Module Data Sheet on page 422
- DS1554 Engine Control I/O Module Data Sheet on page 442
- DS4340 FlexRay Interface Module Data Sheet on page 472
- DS4342 CAN FD Interface Module Data Sheet on page 479

Related topics

References

Features of the DS1514 FPGA Base Board.. 356

LED States of the DS1514 Panel

FPGA LED

If the standard FPGA application is used to support function blocks of ConfigurationDesk, the following LED states are possible:

LED Status	Meaning
Off	The FPGA is not configured.
Green	Correct behavior.
Yellow	▪ Malfunction ▪ Overload ▪ One or more supply voltages on the I/O module are beyond a rated value.

If a custom FPGA application is used, the following LED states are possible:

LED Status	Meaning
Off	FPGA is not configured.
Green	Correct behavior.
Orange	The FPGA application can make the LED light up orange. For more information, refer to RTI Block Settings for the FPGA1403Tp1 with Multi-I/O Module Frameworks (RTI FPGA Programming Blockset - FPGA Interface Reference 📖) or RTI Block Settings for the FPGA1403Tp1 with Engine Control I/O Module Framework (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).
Yellow	▪ Malfunction ▪ Overload ▪ One or more supply voltages on the I/O module are beyond a rated value.
Flashing blue	The FPGA die temperature reaches a critical range for operation. A high ambient temperature and an FPGA application with a very high FPGA utilization and/or toggle rate increase the FPGA die temperature (internal chip temperature). If the die temperature exceeds 105 °C, the FPGA might work incorrectly. For more information on reading the die temperature measurement, refer to RTI Block Settings for the FPGA1403Tp1 with Multi-I/O Module Frameworks (RTI FPGA Programming Blockset - FPGA Interface Reference 📖) or RTI Block Settings for the FPGA1403Tp1 with Engine Control I/O Module Framework (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).
Blue	The FPGA die temperature is too high for operation. If the die temperature exceeds 125 °C, the FPGA resets itself. The reset stays active until the die temperature falls below 85 °C and you restart the MicroAutoBox III or reload the user FPGA application.

Related topics

References

DS1521 Bus Board Data Sheet

Where to go from here

Information in this section

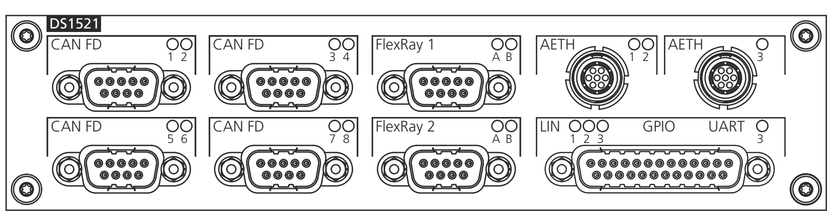
Overview and General Information

Where to go from here

Information in this section

DS1521 Panel Components

Panel overview



Component		Description
Connectors	CAN FD	Each connector provides the signals of two CAN channels. For the signal characteristics, refer to CAN 6 Characteristics on page 374.

Component		Description
		For the pinout, refer to CAN FD Connector Pinout on page 366.
	FlexRay	Each connector provides the channels A and B of one FlexRay controller. For the signal characteristics, refer to FlexRay 4 Characteristics on page 378. For the pinout, refer to FlexRay Connector Pinout on page 366.
	AETH	The left connector provides two automotive Ethernet ports, the right connector provides one port. Matching adapter cables can be ordered from dSPACE. Refer to Ethernet Connection Cables on page 512. For the interface characteristics, refer to Ethernet Adapter 3 Characteristics on page 377. For the pinout and matching cable connectors, refer to AETH Connector Pinout (DS1521) on page 365.
	GPIO	Provides general-purpose I/O signals. For the signal characteristics, refer to the following topics: ▪ Analog In 17 Characteristics on page 369 ▪ Digital In/Out 10 Characteristics on page 371 ▪ LIN 4 Characteristics on page 380 ▪ UART 4 Characteristics on page 382 For the pinout, refer to GPIO Connector Pinout on page 367.
LED	CAN FD	For the LED status description, refer to LED States of the DS1521 Panel on page 385.
	FlexRay	
	AETH	
	LIN	
	UART	

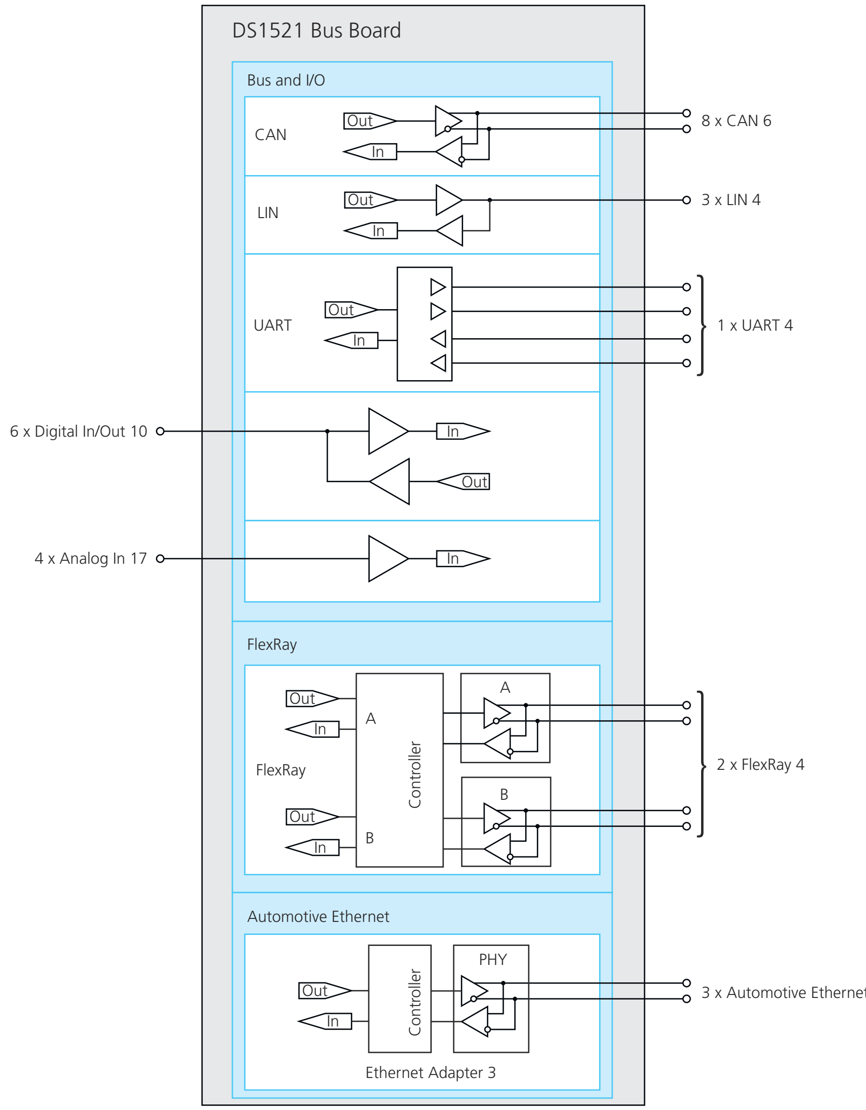
Related topics

References

Features of the DS1521 Bus Board

Main features

The following block diagram provides a functional view of the main features and the provided channel types.



The following table shows more details.

Feature	Description
Communication channels	▪ 8 CAN channels of the CAN 6 channel type. For signal characteristics and mapping, refer to CAN 6 Characteristics on page 374. ▪ 3 Ethernet controllers of the Ethernet Adapter 3 channel type. Each controller is directly mapped to an automotive Ethernet port.

Feature	Description
	For signal characteristics and mapping, refer to Ethernet Adapter 3 Characteristics on page 377. ▪ 2 FlexRay controllers of the FlexRay 4 channel type. Each FlexRay 4 controller provides the FlexRay channels A and B. For signal characteristics and mapping, refer to FlexRay 4 Characteristics on page 378. ▪ 3 LIN channels of the LIN 4 channel type. For signal characteristics and mapping, refer to LIN 4 Characteristics on page 380. ▪ 1 RS232/422/485 channel of the UART 4 channel type. For signal characteristics and mapping, refer to UART 4 Characteristics on page 382.
Channels for signal measurement	▪ 4 analog input channels of the Analog In 17 channel type. For signal characteristics and mapping, refer to Analog In 17 Characteristics on page 369.
Bidirectional channels	▪ 6 digital input/output channels of the Digital In/Out 10 channel type. For signal characteristics and mapping, refer to Digital In/Out 10 Characteristics on page 371.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the DS1521 Bus Board.

Function Block Type	Purpose	Channel Type
Communication		
CAN	The CAN function block is one part of implementing CAN communication in real-time applications. The CAN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	CAN 6
Ethernet Setup	With the Ethernet Setup function block type, you can configure and initialize the access to an Ethernet controller of your dSPACE real-time hardware. The function block works as a provider: Other function blocks can use it to access the configured Ethernet controller.	Ethernet Adapter 1
FlexRay	The FlexRay function block type is one part of implementing FlexRay communication in real-time applications. It lets you specify the hardware access for FlexRay communication and control the communication of the FlexRay network separately for each FlexRay controller and FlexRay channel (A and/or B). The FlexRay communication itself must be modeled and supplied via the dSPACE FlexRay Configuration Package (refer to Modeling a FlexRay Bus Interface (Model Interface Package for Simulink - Modeling Guide 📖)).	FlexRay 4
LIN	The LIN function block is one part of implementing LIN communication in real-time applications. The LIN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	LIN 4
Basic I/O		
Voltage In	The Voltage In function block type digitizes analog voltage signals coming from an external device.	Analog In 17

Function Block Type	Purpose	Channel Type
Multi Bit In	The Multi Bit In function block type lets you measure digital signals coming from an external device.	Digital In/Out 10
Multi Bit Out	The Multi Bit Out function block type lets you stimulate digital inputs of an external device.	Digital In/Out 10
PWM/PFM In	With the PWM/PFM In function block, you can measure one-phase pulse-width-modulated signal patterns.	Digital In/Out 10
PWM/PFM Out	The PWM/PFM Out function block type can be used to generate one-phase pulse-width modulated signals and frequency output signals.	Digital In/Out 10
Digital Pulse Capture	The Digital Pulse Capture function block type converts signals coming from an external device (e.g., ECU) to digital pulses.	Digital In/Out 10

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide.

Related topics

References

Connector Pinouts

Where to go from here

Information in this section

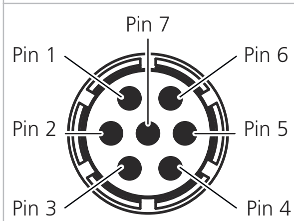
AETH Connector Pinout (DS1521)

Purpose

Connector to provide up to two automotive Ethernet ports.

Pinout

The AETH connectors of the DS1521 are 7-pin LEMO connectors. The following illustration shows the pin numbering of an AETH connector (front view of the MicroAutoBox III):

<table>
<tr><th>LEMO Connector</th><th>Pin</th><th>Signal</th></tr>
<tr><td rowspan="7">
</td><td>1</td><td>TRX+ Port 1</td></tr>
<tr><td>2</td><td>GND</td></tr>
<tr><td>3</td><td>TRX- Port 2</td></tr>
<tr><td>4</td><td>TRX+ Port 2</td></tr>
<tr><td>5</td><td>GND</td></tr>
<tr><td>6</td><td>TRX- Port 1</td></tr>
<tr><td>7</td><td>GND</td></tr>
</table>

Signal descriptions

The following table shows the description of the signals.

Signal	Description	Characteristics
TRX+	Positive bus signal	Ethernet Adapter 3 Characteristics on page 377
TRX-	Negative bus signal	
GND	Ground	

Ethernet connection cable

The AETH_CAB2 Automotive Ethernet Connection Cable can be used to connect the automotive Ethernet port to a network.

For technical data, refer to AETH_CAB2 Automotive Ethernet Connection Cable on page 514.

Matching cable connector

To build an Ethernet cable, use the following standard LEMO connector:

- Connector type: LEMO 7-pole Connector 1B Series with G-coding
- Example: FGG.1B.307.CLAD72Z

For more information, refer to www.lemo.com.

Related topics

References

CAN FD Connector Pinout

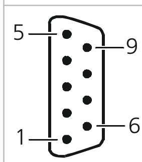
Purpose

Connector to provide the signals of two CAN 6 channels.

Pinout

> **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 CAN FD connectors of the DS1521 are 9-pin male Sub-D connectors. The following illustration shows the pin numbering of the I/O connectors (front view):

CAN FD Connector	Pin	Signal	Pin	Signal
	5	CAN 6 Ch. 2[1)] Low FT		
	4	CAN 6 Ch. 2[1)] Low	9	CAN 6 Ch. 2[1)] High FT
	3	GND	8	CAN 6 Ch. 2[1)] High
	2	CAN 6 Ch. 1[2)] Low	7	CAN 6 Ch. 1[2)] High
	1	CAN 6 Ch. 1[2)] Low FT	6	CAN 6 Ch. 1[2)] High FT

[1)] Depending on the connector: Channel 2, 4, 6, or 8

[2)] Depending on the connector: Channel 1, 3, 5, or 7

Signal descriptions

The following table shows the description of the signals.

Signal	Description	Characteristics
CAN 6	CAN FD-capable ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination, partial networking, and feed-through.	CAN 6 Characteristics on page 374

Related topics

References

FlexRay Connector Pinout

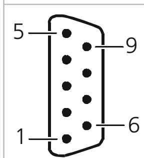
Purpose

Connector to provide the channels A and B of a FlexRay controller.

Pinout

> **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 FlexRay connectors of the DS1521 are 9-pin male Sub-D connectors. The following illustration shows the pin numbering of a FlexRay connector (front view):

FlexRay Connector	Pin	Signal	Pin	Signal
	5	FlexRay 4 B- FT		
	4	FlexRay 4 B-	9	FlexRay 4 B+ FT
	3	GND	8	FlexRay 4 B+
	2	FlexRay 4 A-	7	FlexRay 4 A+
	1	FlexRay 4 A- FT	6	FlexRay 4 A+ FT

Signal descriptions

The following table shows the description of the signals.

Signal	Description	Characteristics
FlexRay 4	Interface to communicate via a FlexRay bus. The interface supports bus termination and feed-through.	FlexRay 4 Characteristics on page 378

Related topics

References

GPIO Connector Pinout

Purpose

Connector to provide the following interfaces:

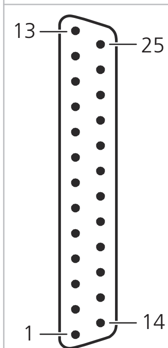
- Digital I/O interfaces
- Analog measuring inputs

- LIN interfaces
- UART interface

Pinout

> **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 GPIO connector is a 25-pin male Sub-D connector. The following illustration shows the pin numbering of the I/O connector (front view):

GPIO Connector	Pin	Signal	Pin	Signal
	13	UART 4 Serial RX-	25	GND
	12	UART 4 Serial RX+	24	GND
	11	UART 4 Serial TX+	23	GND
	10	UART 4 Serial TX-	22	GND
	9	Digital In/Out 10 Channel 6 Signal	21	Analog In 17 Channel 4 Signal
	8	Digital In/Out 10 Channel 5 Signal	20	Analog In 17 Channel 3 Signal
	7	Digital In/Out 10 Channel 4 Signal	19	Analog In 17 Channel 2 Signal
	6	Digital In/Out 10 Channel 3 Signal	18	Analog In 17 Channel 1 Signal
	5	Digital In/Out 10 Channel 2 Signal	17	GND
	4	Digital In/Out 10 Channel 1 Signal	16	GND
	3	LIN 4 Channel 3 Signal	15	GND
	2	LIN 4 Channel 2 Signal	14	GND
	1	LIN 4 Channel 1 Signal		

Signal descriptions

The following table shows the description of the signals.

Signal	Description	Characteristics
Analog In 17	Input to measure analog signals in the range -10 V … +10 V.	Analog In 17 Characteristics on page 369
Digital In/Out 10	Bidirectional channels to measure and generate digital signals.	Digital In/Out 10 Characteristics on page 371
LIN 4	Interface to communicate via a LIN bus. The interface supports master termination.	LIN 4 Characteristics on page 380

Signal	Description	Characteristics
UART 4	Interface to communicate with a RS232/422 device or via a RS485 bus.	UART 4 Characteristics on page 382

Related topics

References

Analog Interface Characteristics

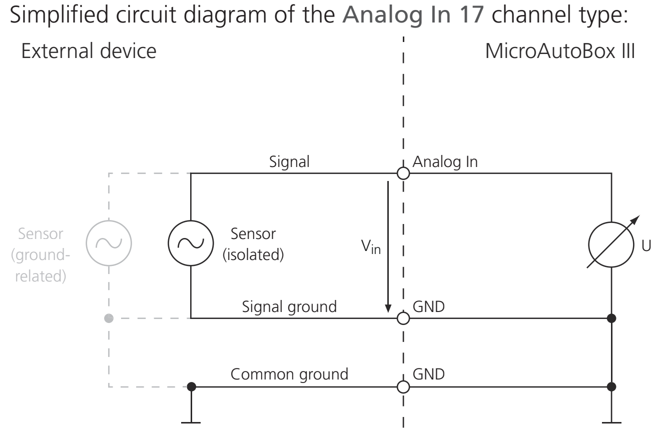
Analog In 17 Characteristics

Purpose

Input to measure analog signals in the range -10 V … +10 V.

Circuit diagram

Simplified circuit diagram of the Analog In 17 channel type:



Analog In 17 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	Voltage In
Number of channels	-	4
Input voltage range	V_{in}	-10 V … 10 V
Resolution	-	16 bit
Offset error	-	-2 mV ... +2 mV
Gain error	-	-1% ... +1%
Input resistance	R_{in}	Typ. 1 MΩ
Sample rate	f_s	333 kS/s
-3 dB cutoff frequency	f_{-3dB}	Typ. 24 kHz
Protected voltage range	$V_{in\{prot\}}$	-60 V … +60 V

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

Signal mapping

The following table shows the connector pins of the DS1521 GPIO connector that provide the signals of the Analog In 17 channel type.

Signal	DS1521 GPIO Connector Pin
Analog In 17 Channel 1 Signal	18
Analog In 17 Channel 2 Signal	19
Analog In 17 Channel 3 Signal	20
Analog In 17 Channel 4 Signal	21
Signal reference	
GND[1)]	14, 15, 16, 17, 22, 23, 24, 25

[1)] Common ground for all signals.

For the complete pinout, refer to GPIO Connector Pinout on page 367.

Related topics

Basics

Grounding of Analog and Digital Signals of the DS1521 124

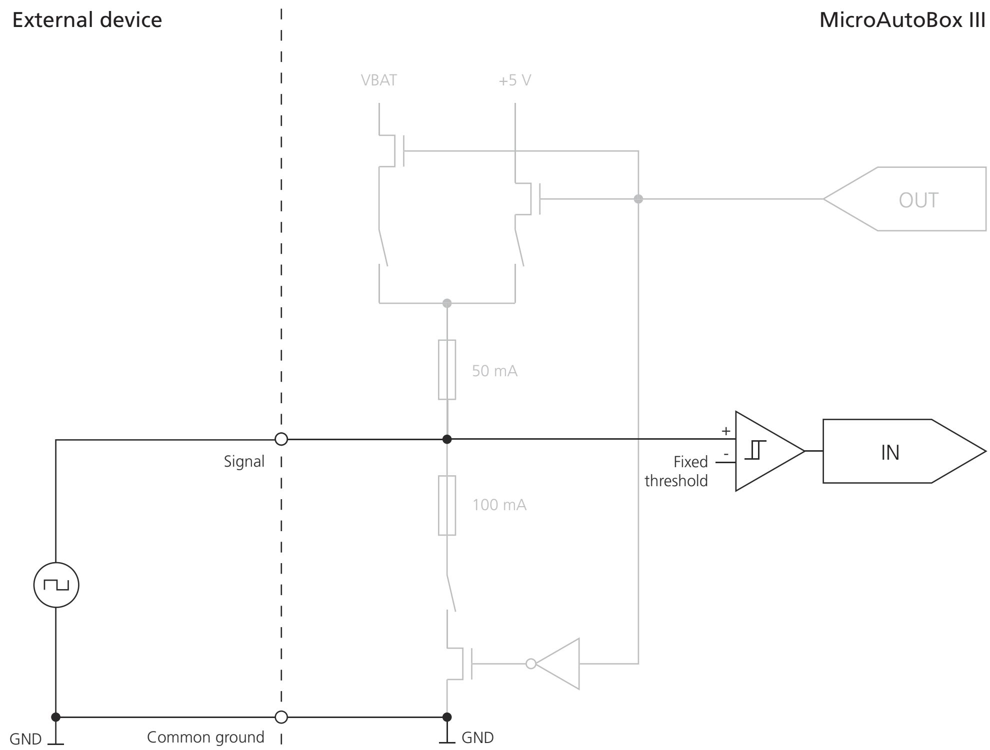
References

Features of the DS1521 Bus Board 362

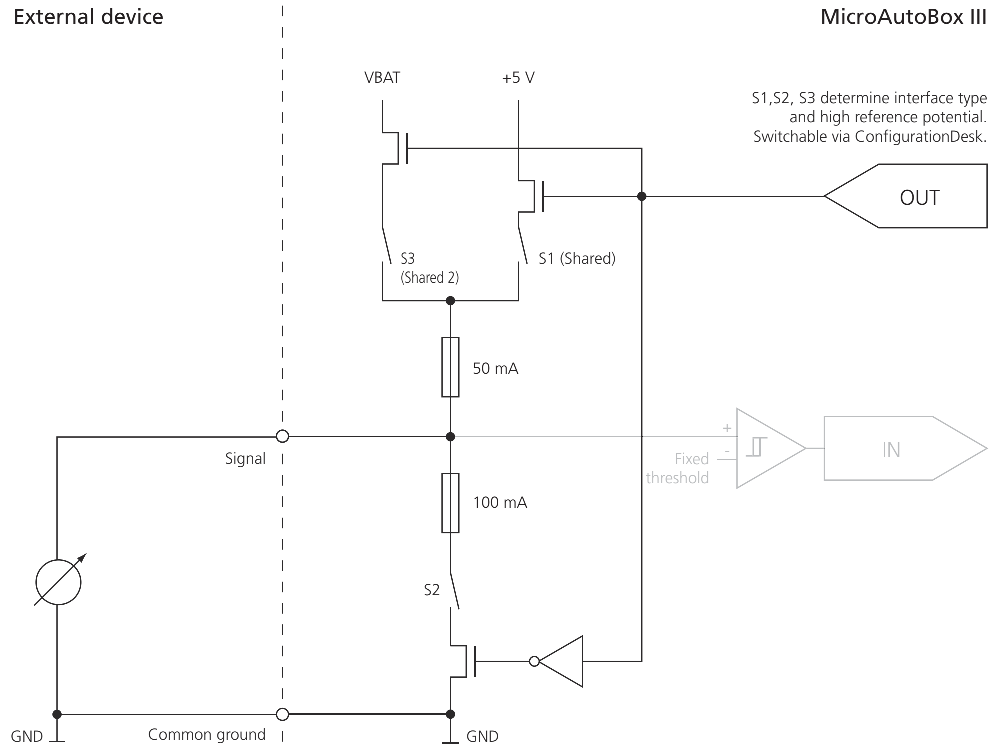
Digital Interface Characteristics

Digital In/Out 10 Characteristics

Purpose	Bidirectional channels to measure and generate digital signals.
Circuit diagram	Simplified circuit diagram of the **Digital In/Out 10** channel type used for measurement.



Simplified circuit diagram of the **Digital In/Out 10** channel type used for signal generation.



Digital In/Out 10 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Multi Bit In ▪ Multi Bit Out ▪ PWM/PFM In ▪ PWM/PFM Out ▪ Digital Pulse Capture
Number of channels	-	6
Protected voltage range	V_{prot}	-60 V … +60 V
Input Characteristics		
Input voltage range	V_{in}	0 V … 60 V
Input high voltage	V_{ih}	2.4 V … 60 V
Input low voltage	V_{il}	0.0 V … 1.2 V

Parameter	Symbol	Specification[1]
Input hysteresis voltage	V_{hys}	Typ. 0.4 V
Input threshold voltage	V_{th}	Typ. 1.8 V
Minimum input pulse width high/low	t_{min}	500 ns
Maximum input frequency	f_{max}	1 MHz
Input resistance	R_{in}	71 kΩ
Output Characteristics		
Output voltage range	V_{out}	▪ 5 V logic level: 0 V ... 5 V ▪ VBAT logic level: 0 V ... 55 V

Output high voltage	V_{oh}	▪ 5 V logic level:
		  ▪ Max. 5.2 V at I_{out} = 0 mA
		  ▪ Min. 4.6 V at I_{out} = 30 mA
		▪ VBAT logic level:
		  ▪ Max. 55 V at I_{out} = 0 mA
		  ▪ Min. VBAT-0.8 V at I_{out} = 30 mA

Output low voltage	V_{ol}	Typ. 0.5 V at I_{out} = -30 mA
Output current limit high	I_{olim}	Typ. 50 mA
Output current limit low	I_{olim}	Typ. -100 mA
Minimum output pulse width high/low	t_{min}	2 µS
Maximum output frequency	f_{max}	250 kHz

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

Signal mapping

The following table shows the connector pins of the DS1521 GPIO connector that provide the signals of the Digital In/Out 10 channel type.

Signal	DS1521 GPIO Connector Pin
Digital In/Out 10 Channel 1 Signal	4
Digital In/Out 10 Channel 2 Signal	5
Digital In/Out 10 Channel 3 Signal	6
Digital In/Out 10 Channel 4 Signal	7
Digital In/Out 10 Channel 5 Signal	8
Digital In/Out 10 Channel 6 Signal	9
Signal reference	
GND[1]	14, 15, 16, 17, 22, 23, 24, 25

[1] Common ground for all signals.

For the complete pinout, refer to GPIO Connector Pinout on page 367.

Related topics

Basics

References

Communication Interface Characteristics

Where to go from here

Information in this section

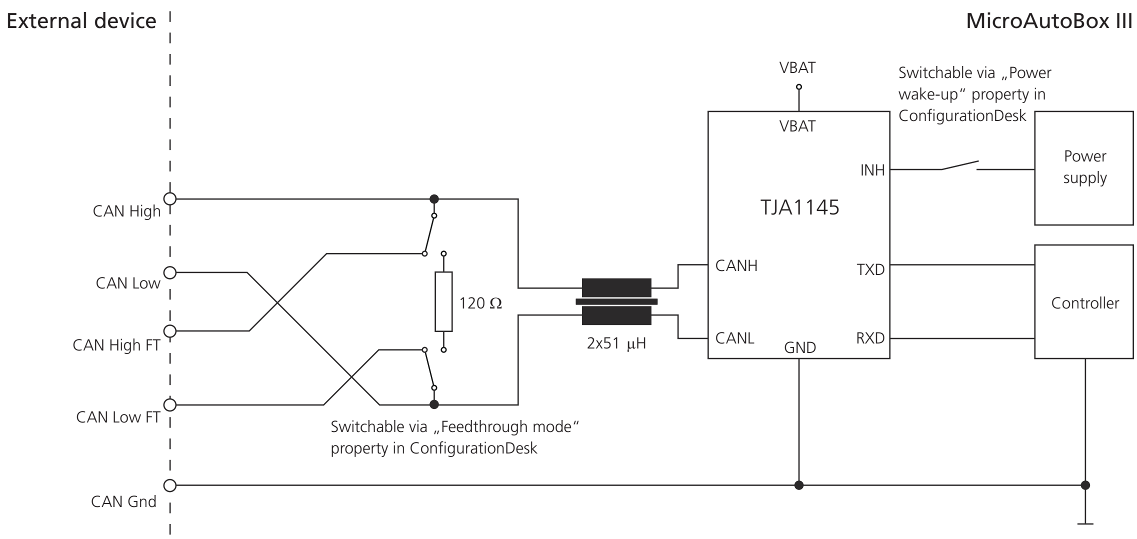
CAN 6 Characteristics

Purpose

CAN FD-capable ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination, partial networking, and feed-through.

Circuit diagram

Simplified circuit diagram of the CAN 6 channel type.



CAN 6 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	CAN
Number of channels	8
Data rate (arbitration)	15 kbit/s … 1,000 kbit/s
Data rate (payload)	15 kbit/s … 5 Mbit/s[2)]
Transceiver type	TJA1145T/FD
Supported standards	▪ Flexible Data Rate (CAN FD), according to ISO 11898-1:2015 ▪ High-speed, according to ISO 11898-2:2016 ▪ Low-power mode, according to ISO 11898-5:2007 ▪ Selective wake-up, according to ISO 11898-6:2013 ▪ High-speed CAN at 125 kbps, according to SAE J2284-1:2016 ▪ High-speed CAN at 250 kbps, according to SAE J2284-2:2016 ▪ High-speed CAN at 500 kbps, according to SAE J2284-3:2016 ▪ High-speed CAN at 500 kbps with CAN FD Data at 2 Mbps, according to SAE J2284-4:2016 ▪ High-speed CAN at 500 kbps with CAN FD Data at 5 Mbps, according to SAE J2284-5:2016
Termination resistance	120 Ω, switchable via software
Protected voltage range	▪ -58 V … +58 V between CAN pins and GND (CAN_{high}, CAN_{low})

Parameter	Specification[1]
	▪ -10.95 V … +10.95 V between CAN High pin and CAN Low pin (CAN_{diff})

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] Under laboratory conditions, you can achieve data rates up to 8 Mbit/s with an optimized cable management (i.e., differential signal lines, 120 Ω wave impedance, no stubs).

Signal mapping

The following table shows the connector pins of the DS1521 CAN FD Sub-D connectors that provide the signals of the CAN 6 channel type.

Four connectors provide eight CAN 6 channels. The connectors have the same pinout.

Signal	CAN FD Connector Pin
CAN 6 Ch. 1[1] High	7
CAN 6 Ch. 1[1] Low	2
CAN 6 Ch. 1[1] High FT	6
CAN 6 Ch. 1[1] Low FT	1
CAN 6 Ch. 2[2] High	8
CAN 6 Ch. 2[2] Low	4
CAN 6 Ch. 2[2] High FT	9
CAN 6 Ch. 2[2] Low FT	5
Signal reference	
GND	3

[1] Depending on connector: Channel 1, 3, 5, or 7
[2] Depending on connector: Channel 2, 4, 6, or 8

For a graphical pinout, refer to CAN FD Connector Pinout on page 366.

Related topics

Basics

Using Termination and Feed-through lines with the DS1521 117

HowTos

How to Support Bus Wake-up Requests with the DS1521 121

Examples

Example of Connecting DS1521 to a CAN/FlexRay Bus 119

References

Features of the DS1521 Bus Board 362

Ethernet Adapter 3 Characteristics

Purpose

Ethernet adapter to communicate with external devices via automotive Ethernet. Each controller of the adapter is directly mapped to a port.

Controller characteristics

Parameter		Specification[1]
Supported function blocks		Ethernet Setup
Controller		3 x Intel® I210 Gigabit LAN
Supported protocols	Network protocols	▪ IPv4 ▪ IPv6
	Transport protocols	▪ UDP ▪ TCP
	Measurement and application protocol	XCP for bypassing

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

Port characteristics

The following table shows the characteristics of the AETH connectors.

Parameter	Specification[1]
Supported function blocks	Ethernet Setup
Number of ports	3
Supported network	Automotive Ethernet
Physical layer transceiver (PHY)	Marvell® 88Q2112
Supported standards	▪ 100BASE-T1[2] ▪ 1000BASE-T1[2]
Data rate	Configurable via software: ▪ 100 Mbit/s ▪ 1,000 Mbit/s
PHY Mode	Configurable via software: ▪ Master ▪ Slave
Autonegotiation mode	Not supported

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) Adapted and reprinted with permission from IEEE. Copyright IEEE 2018. All rights reserved.

Port mapping

For the location of the ports, refer to DS1521 Panel Components on page 360.

Related topics

Basics

Basics on Implementing Ethernet Communication in ConfigurationDesk (ConfigurationDesk I/O Function Implementation Guide 📖)

References

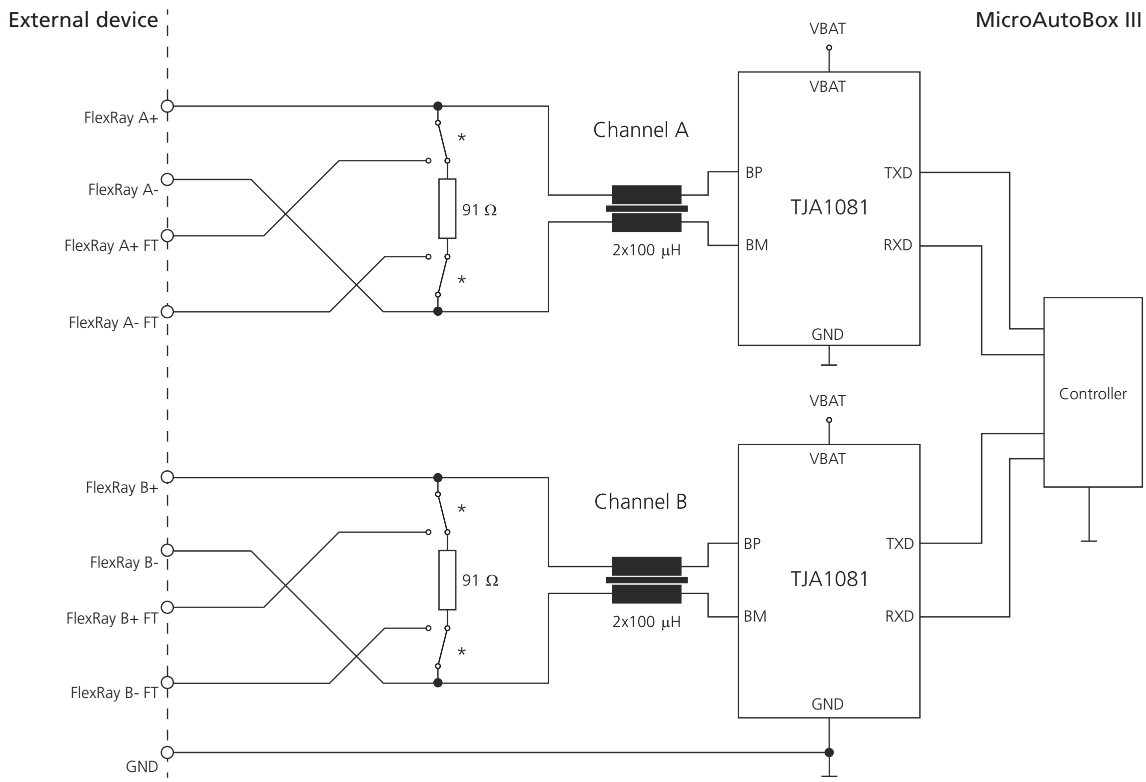
FlexRay 4 Characteristics

Purpose

Interface to communicate via a FlexRay bus. The interface supports bus termination and feed-through.

Circuit diagram

Simplified circuit diagram of the **FlexRay 4** channel type.



* Switchable via „Feedthrough Chx“ property in ConfigurationDesk

FlexRay 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	FlexRay
Number of controllers	2, each controller provides FlexRay channels A and B.
Data rate	1 Mbit/s … 10 Mbit/s
Transceiver type	TJA1081GTS
Supported standards	Physical layer according to ISO 17458-4:2013
Termination resistance	91 Ω, switchable via software
Protected voltage range	▪ -60 V … +60 V between a bus pin and GND

Parameter	Specification[1]
	▪ -9.5 V … +9.5 V between the non-inverted and inverted bus pins.

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

Signal mapping

The following table shows the connector pins of the DS1521 FlexRay connectors that provide the signals of the FlexRay 4 channel type.

Signal	FlexRay Connector
FlexRay 4 A+	7
FlexRay 4 A-	2
FlexRay 4 A+ FT	6
FlexRay 4 A- FT	1
FlexRay 4 B+	8
FlexRay 4 B-	4
FlexRay 4 B+ FT	9
FlexRay 4 B- FT	5
Ground Reference	
GND	3

For a graphical pinout, refer to FlexRay Connector Pinout on page 366.

Related topics

Basics

Examples

References

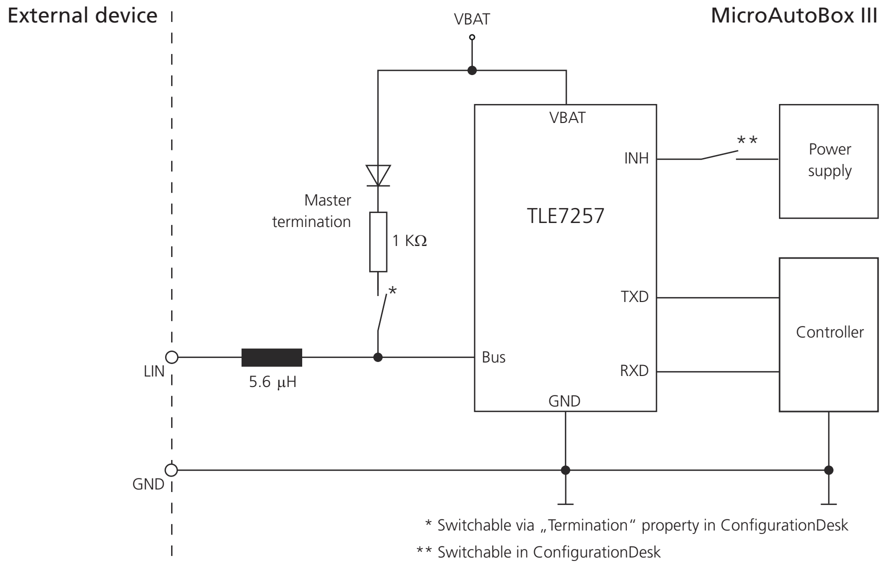
LIN 4 Characteristics

Purpose

Interface to communicate via a LIN bus. The interface supports master termination.

Circuit diagram

Simplified circuit diagram of the LIN 4 channel type.



LIN 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Supported function blocks	LIN
Number of channels	3
Data rate	Max. 20 kbit/s
Transceiver type	TLE7257SJ
Supported standards	▪ Conforms to LIN specification 1.2, 1.3, 2.0, 2.1 ▪ Remote wake-up
Termination resistance	Switchable master/slave termination: ▪ 1 kΩ (master termination) ▪ 30 kΩ (slave termination)
Working voltage range	+5.5 V … +40 V
Protected voltage range	–60 V … +60 V

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

Signal mapping

The following table shows the connector pins of the DS1521 GPIO connector that provide the signals of the LIN 4 channel type.

Signal	DS1521 GPIO Connector Pin
LIN 4 Channel 1 Signal	1
LIN 4 Channel 2 Signal	2
LIN 4 Channel 3 Signal	3
Signal reference	
GND[1)]	14, 15, 16, 17, 22, 23, 24, 25

1) Common ground for all signals.

For the complete pinout, refer to GPIO Connector Pinout on page 367.

Related topics

HowTos

References

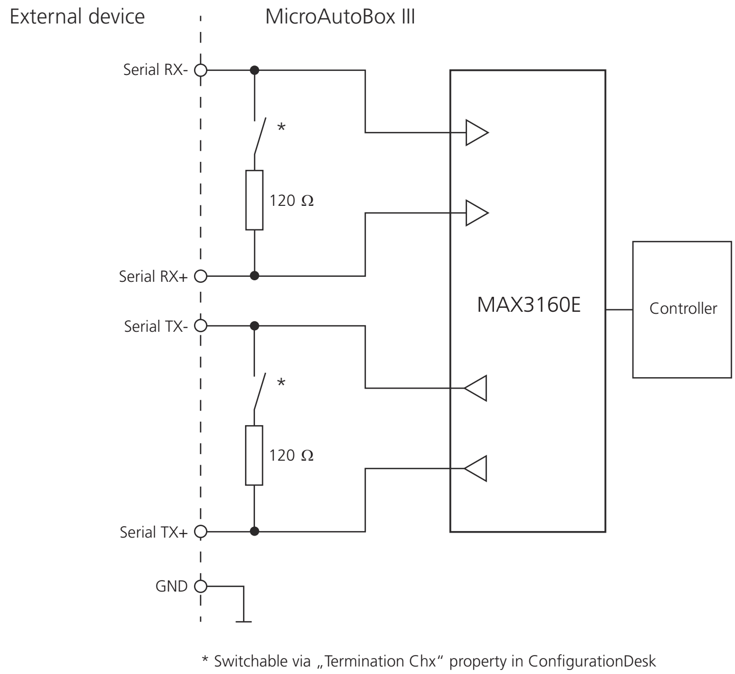
UART 4 Characteristics

Purpose

Interface to communicate with a RS232/422 device or via a RS485 bus.

Circuit diagram

Simplified circuit diagram of the UART 4 channel type.



Note

The signal mapping depends on the serial mode. Refer to Signal mapping on page 384.

UART 4 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	Supported only by a custom function block. Refer to Implementing UART Serial Communication in ConfigurationDesk (ConfigurationDesk UART Implementation 📖).
Number of channels	1
Transceiver type	MAX3160E
RS232 Characteristics	
Data rate	Max. 1 Mbit/s
Input threshold voltage high	Min. 2.0 V

Parameter	Specification[1]
Input threshold voltage low	Max. 0.8 V
Protected voltage range	-60 V … +60 V
RS422/485 Characteristics	
Data rate	Max. 10 Mbit/s
Termination resistance	120 Ω, switchable via software
Protected voltage range	▪ -60 V … +60 V between a bus pin and GND ▪ -10.95 V … +10.95 V between the noninverted and inverted signal pins, such as RX+ and RX-.

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

Signal mapping

The following table shows the connector pins of the DS1521 GPIO connector that provide the serial signals of the UART 4 channel type.

Signal	DS1521 GPIO Connector	
	Pin Name	Pin
RS232 Mode		
Serial transmit signal (TX)	UART 4 Serial TX-	10
Request to send (RTS)	UART 4 Serial TX+	11
Clear to send (CTS)	UART 4 Serial RX+	12
Serial receive signal (RX)	UART 4 Serial RX-	13
Full Duplex RS485/422 Mode		
Inverted serial transmit signal (TX-)	UART 4 Serial TX-	10
Noninverted serial transmit signal (TX+)	UART 4 Serial TX+	11
Noninverted serial receive signal (RX+)	UART 4 Serial RX+	12
Inverted serial receive signal (RX-)	UART 4 Serial RX-	13
Half Duplex RS485/422 Mode		
Inverted bus signal (BM)	UART 4 Serial TX-	10
-	UART 4 Serial TX+	11
Noninverted bus signal (BP)	UART 4 Serial RX+	12
-	UART 4 Serial RX-	13
Ground Reference		
Common ground	GND	14, 15, 16, 17, 22, 23, 24, 25

For the complete pinout, refer to GPIO Connector Pinout on page 367.

Related topics

References

LED Status Descriptions

LED States of the DS1521 Panel

AETH LEDs

The DS1521 panel provides 6 AETH LEDs for information concerning the Ethernet connection of the automotive Ethernet ports.

The following table describes the different states that can be output by the AETH LEDs:

LED Status	Description
Off	No Ethernet connection established.
Green	1,000 Mbit connection - no traffic
Green flashing	1,000 Mbit connection - traffic
Yellow	100 Mbit connection - no traffic
Yellow flashing	100 Mbit connection - traffic

For the location of the LEDs, refer to DS1521 Panel Components on page 360.

CAN FD LEDs

The DS1521 panel provides 8 CAN FD LEDs that indicate the states of the CAN FD channels.

The following table describes the different states that can be output by the CAN FD LEDs:

LED Status	Description
Off	The channel is not configured and cannot be used.
Yellow	The network is idle. The controller is in the Error Active mode.
Green	The network is busy. The controller is in the Error Active mode.
Red flashing	The controller is in the Error Passive mode.

LED Status	Description
Red	The controller is in the Bus Off mode, so the controller does not participate in the CAN communication.

For the location of the LEDs, refer to DS1521 Panel Components on page 360.

FlexRay LEDs

The DS1521 panel provides 4 **FlexRay** LEDs that indicate the states of the FlexRay channels.

The following table describes the different states that can be output by the FlexRay LEDs:

LED Status	Description
Off	The channel is not configured and cannot be used.
Yellow	The network is idle.
Green	The network is busy.
Red flashing	The controller detected received messages with transmission errors.

For the location of the LEDs, refer to DS1521 Panel Components on page 360.

LIN LEDs

The DS1521 panel provides 3 **LIN** LEDs that indicate the states of the LIN channels.

The following table describes the different states that can be output by the LIN LEDs:

LED Status	Description
Off	The channel is not configured and cannot be used.
Yellow	The network is idle.
Green	The network is busy.
Red flashing	The controller detected received messages with transmission errors.

For the location of the LEDs, refer to DS1521 Panel Components on page 360.

UART LED

The DS1521 panel provides a **UART** LED that indicates the states of the UART channel.

The following table describes the different state that can be output by the UART LED:

LED Status	Description
Off	The channel is not configured and cannot be used.
Yellow	The network is idle.
Green	The network is busy.

LED Status	Description
Red flashing	The controller detected received messages with transmission errors.

For the location of the LEDs, refer to DS1521 Panel Components on page 360.

Related topics

References

DS1552 Multi-I/O Module Data Sheet

DS1552 variants

The DS1552 Multi-I/O Module is available with different analog channel types:

- The DS1552 Multi-I/O Module provides the Analog In 10 channel type that can measure signals in the range 0 V … 5 V.
- The DS1552B1 Multi-I/O Module provides the Analog In 11 channel type that can measure analog signals in the range -10 V … +10 V.

The **Platform Manager** displays the boards and modules of registered MicroAutoBox III units. Refer to How to Register dSPACE Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide).

Where to go from here

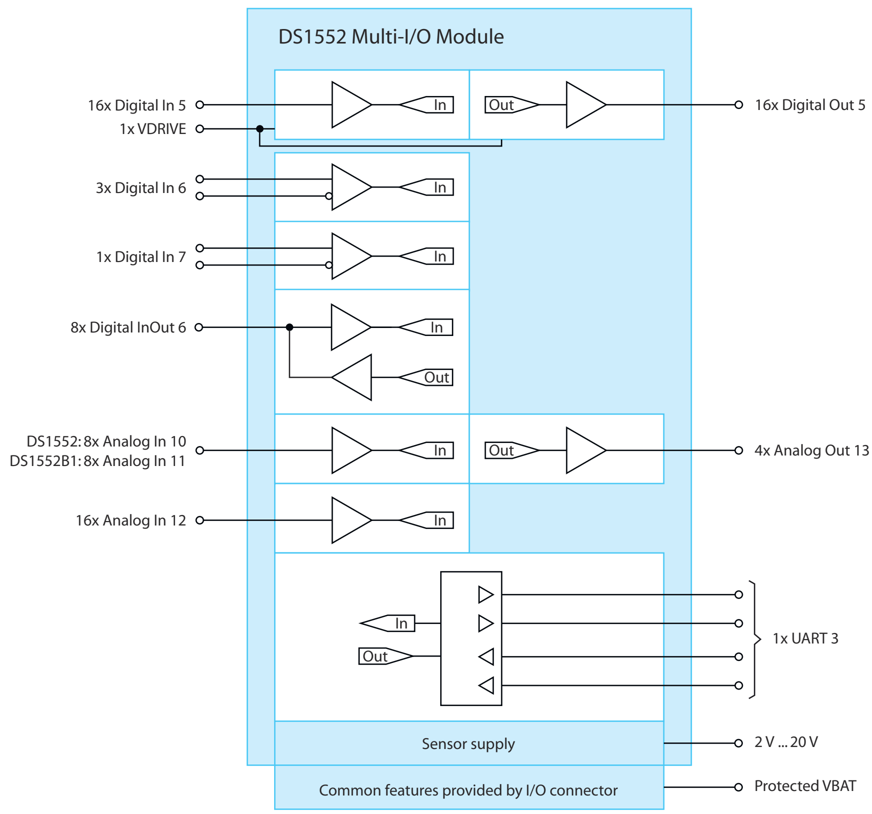
Information in this section

Overview and General Information

Features of the DS1552 Multi-I/O Module

Main features

The following block diagram provides a functional view of the main features and the provided channel types.



The following table shows you more details.

Feature	Description
Channels for signal measurement	▪ 16 digital input channels of the Digital In 5 channel type. For signal characteristics and mapping, refer to Digital In 5 Characteristics on page 404. ▪ 3 digital input channels of the Digital In 6 channel type. For signal characteristics and mapping, refer to Digital In 6 Characteristics on page 407. ▪ 1 digital input channel of the Digital In 7 channel type. For signal characteristics and mapping, refer to Digital In 7 Characteristics on page 408. ▪ 8 analog input channels. The channel type depends on the board variant: ▪ DS1552: Analog In 10 For signal characteristics and mapping, refer to Analog In 10 Characteristics (DS1552) on page 395.

Feature	Description
	▪ DS1552B1: Analog In 11 For signal characteristics and mapping, refer to Analog In 11 Characteristics (DS1552B1) on page 397. ▪ 16 analog input channels of the Analog In 12 channel type. For signal characteristics and mapping, refer to Analog In 12 Characteristics on page 400.
Channels for signal generation	▪ 16 digital output channels of the Digital Out 5 channel type. For signal characteristics and mapping, refer to Digital Out 5 Characteristics on page 412. ▪ 4 analog output channels of the Analog Out 13 channel type. For signal characteristics and mapping, refer to Analog Out 13 Characteristics on page 402.
Bidirectional channels	▪ 8 digital input/output channels of the Digital In/Out 6 channel type. For signal characteristics and mapping, refer to Digital In/Out 6 Characteristics on page 409.
Communication channels	▪ 1 RS232/422/485 channel of the UART 3 channel type. For signal characteristics and mapping, refer to UART 3 Characteristics on page 415.
Supply outputs	▪ 1 adjustable sensor supply to supply sensors or to drive the digital I/O circuits of the DS1552 Multi-I/O Module. For signal characteristics and mapping, refer to DS1552 Sensor Supply Characteristics on page 419. ▪ Protected VBAT ($VBAT_{prot}$) to drive the digital I/O circuits of the DS1552 Multi-I/O Module with an automotive-compatible voltage level. For signal characteristics and mapping, refer to VBATprot Characteristics on page 420.
Supply inputs	Drive voltage input for the digital I/O circuits of the Digital In 5 and Digital Out 5 channel types (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level. For signal characteristics and mapping, refer to DS1552 VDRIVE Input Characteristics on page 418.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the DS1552 Multi-I/O Module.

Function Block Type	Purpose	Channel Type
Basic I/O		
Voltage In	The Voltage In function block type digitizes analog voltage signals coming from an external device.	▪ Analog In 10 (DS1552) ▪ Analog In 11 (DS1552B1) ▪ Analog In 12
Trigger in	The Trigger In function block type generates a trigger signal each time the external input signal matches the defined triggering conditions. The function block works as a provider: Other function blocks can use the generated trigger signal as trigger source.	Digital In 5
Voltage Out	The Voltage Out function block provides the possibility to output analog voltages.	Analog Out 13

Function Block Type	Purpose	Channel Type
Multi Bit In	The Multi Bit In function block type lets you measure digital signals coming from an external device.	▪ Digital In 5 ▪ Digital In/Out 6
Multi Bit Out	The Multi Bit Out function block type lets you stimulate digital inputs of an external device.	▪ Digital Out 5 ▪ Digital In/Out 6
PWM/PFM Out	The PWM/PFM Out function block type can be used to generate one-phase pulse-width modulated signals and frequency output signals.	▪ Digital Out 5 ▪ Digital In/Out 6
PWM/PFM In	With the PWM/PFM In function block, you can measure one-phase pulse-width-modulated signal patterns.	▪ Digital In 5 ▪ Digital In/Out 6
Custom Functions		
FPGA Custom Function	FPGA custom function blocks contain the functionality of an FPGA application that must be defined with the RTI FPGA Programming Blockset.	All channel types

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide 📖.

Related topics

Basics

References

Connector Pinouts

DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1)

Purpose

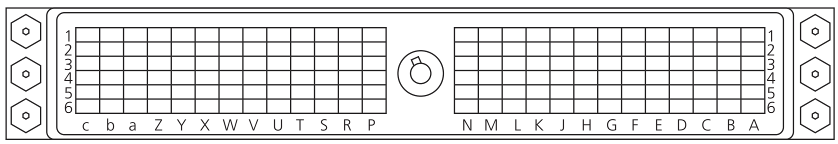
Connector to provide access to all I/O channels of the DS1552 Multi-I/O Module.

Pinout

Note

- There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).
- To use the digital I/O channels of the **Digital In 5** and **Digital Out 5** channel types, you have to connect the VDRIVE pin according to the required logic level.
  For more information, refer to Driving the Digital I/O Interfaces of the DS1552 on page 126.

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of the I/O connector:

1	**2**	**3**	**4**	**5**	**6**	
GND	GND	Digital In 6 Channel 3 +	Digital In 6 Channel 3 -	Digital Out 5 Channel 15 Signal	Digital Out 5 Channel 16 Signal	*A*
GND	Digital Out 5 Channel 12 Signal	Digital In 6 Channel 2 +	Digital In 6 Channel 2 -	Digital Out 5 Channel 13 Signal	Digital Out 5 Channel 14 Signal	*B*
GND	Digital Out 5 Channel 9 Signal	Digital Out 5 Channel 10 Signal	GND	Digital Out 5 Channel 11 Signal	IP slot 1, pin 5	*C*
GND	Digital Out 5 Channel 4 Signal	Digital Out 5 Channel 5 Signal	Digital Out 5 Channel 6 Signal	Digital Out 5 Channel 7 Signal	Digital Out 5 Channel 8 Signal	*D*
GND	Analog In 12 Channel 16 Signal	Analog In Channel 8 Signal[1)]	Analog In Channel 8 Reference[1)]	Digital Out 5 Channel 2 Signal	Digital Out 5 Channel 3 Signal	*E*
GND	Analog In 12 Channel 15 Signal	Analog In Channel 7 Signal[1)]	Analog In Channel 7 Reference[1)]	Digital Out 5 Channel 1 Signal	GND	*F*
GND	Analog In 12 Channel 14 Signal	Analog In Channel 6 Signal[1)]	Analog In Channel 6 Reference[1)]	IP slot 1, pin 14	GND	*G*
GND	Analog In 12 Channel 13 Signal	Analog In Channel 5 Signal[1)]	Analog In Channel 5 Reference[1)]	IP slot 1, pin 16	IP slot 1, pin 15	*H*
GND	Analog In 12 Channel 12 Signal	IP slot 1, pin 44	GND	IP slot 1, pin 18	IP slot 1, pin 17	*J*
GND	Analog In 12 Channel 11 Signal	IP slot 1, pin 46	IP slot 1, pin 45	IP slot 1, pin 20	IP slot 1, pin 19	*K*
GND	Analog In 12 Channel 10 Signal	IP slot 1, pin 48	Digital In/Out 6 Channel 8 Signal	GND	GND	*L*
VDRIVE Supply Input	Analog In 12 Channel 9 Signal	IP slot 1, pin 50	IP slot 1, pin 49	Digital In/Out 6 Channel 6 Signal	Digital In/Out 6 Channel 7 Signal	*M*

1	2	3	4	5	6	
VDRIVE Supply Input	Digital In/Out 6 Channel 1 Signal	Digital In/Out 6 Channel 2 Signal	Digital In/Out 6 Channel 3 Signal	Digital In/Out 6 Channel 4 Signal	Digital In/Out 6 Channel 5 Signal	*N*
VBATprot Supply Output	GND	Digital In 7 Channel 1 +	Digital In 7 Channel 1 -	Digital In 5 Channel 15 Signal	Digital In 5 Channel 16 Signal	*P*
VBATprot Supply Output	Digital In 5 Channel 12 Signal	Digital In 6 Channel 1 +	Digital In 6 Channel 1 -	Digital In 5 Channel 13 Signal	Digital In 5 Channel 14 Signal	*R*
GND	Digital In 5 Channel 9 Signal	Digital In 5 Channel 10 Signal	GND	Digital In 5 Channel 11 Signal	IP slot 2, pin 5	*S*
GND	Digital In 5 Channel 4 Signal	Digital In 5 Channel 5 Signal	Digital In 5 Channel 6 Signal	Digital In 5 Channel 7 Signal	Digital In 5 Channel 8 Signal	*T*
GND	Analog In 12 Channel 8 Signal	Analog In Channel 4 Signal[1]	Analog In Channel 4 Reference[1]	Digital In 5 Channel 2 Signal	Digital In 5 Channel 3 Signal	*U*
GND	Analog In 12 Channel 7 Signal	Analog In Channel 3 Signal[1]	Analog In Channel 3 Reference[1]	Digital In 5 Channel 1 Signal	GND	*V*
GND	Analog In 12 Channel 6 Signal	Analog In Channel 2 Signal[1]	Analog In Channel 2 Reference[1]	IP slot 2, pin 14	GND	*W*
GND	Analog In 12 Channel 5 Signal	Analog In Channel 1 Signal[1]	Analog In Channel 1 Reference[1]	IP slot 2, pin 16	IP slot 2, pin 15	*X*
GND	Analog In 12 Channel 4 Signal	IP slot 2, pin 44	GND	IP slot 2, pin 18	IP slot 2, pin 17	*Y*
GND	Analog In 12 Channel 3 Signal	IP slot 2, pin 46	IP slot 2, pin 45	IP slot 2, pin 20	IP slot 2, pin 19	*Z*
GND	Analog In 12 Channel 2 Signal	IP slot 2, pin 48	UART 3 Serial RX+	UART 3 Serial TX-	UART 3 Serial TX+	*a*
GND	Analog In 12 Channel 1 Signal	IP slot 2, pin 50	IP slot 2, pin 49	UART 3 Serial RX-	VSENS-	*b*
GND	Analog Out 13 Channel 1 Signal	Analog Out 13 Channel 2 Signal	Analog Out 13 Channel 3 Signal	Analog Out 13 Channel 4 Signal	VSENS+	*c*

[1] The channel type depends on the I/O board. The DS1552 provides the Analog In 10 channel type, DS1552B1 provides the Analog In 11 channel type.

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
Analog I/O		
Analog In	DS1552 Multi-I/O Module: Analog In 10 Input to measure analog signals in the range 0 V ... 5 V.	Analog In 10 Characteristics (DS1552) on page 395
	DS1552B1 Multi-I/O Module: Analog In 11 Input to measure analog signals in the range -10 V ... +10 V.	Analog In 11 Characteristics (DS1552B1) on page 397

Signal	Description	Characteristics
Analog In 12	Input with a low sample rate to measure analog signals in the range -10 V ... +10 V.	Analog In 12 Characteristics on page 400
Analog Out 13	Output to generate analog signals in the range 0 V ... 5 V.	Analog Out 13 Characteristics on page 402
Digital I/O		
Digital In 5	Input to measure digital signals or to trigger the analog measurement of the Analog In 10/11 channel types.	Digital In 5 Characteristics on page 404
Digital In 6	Differential input to measure signals of digital crankshaft and camshaft sensors. Signal naming: ▪ Positive input: + ▪ Negative input: -	Digital In 6 Characteristics on page 407
Digital In 7	Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in notched wheel position sensors. Signal naming: ▪ Positive input: + ▪ Negative input: -	Digital In 7 Characteristics on page 408
Digital In/Out 6	Bidirectional channel type to measure and generate digital signals.	Digital In/Out 6 Characteristics on page 409
Digital Out 5	Output to generate digital signals.	Digital Out 5 Characteristics on page 412
Communication Interfaces		
UART 3	Interface to communicate with a RS232/422 device or via a RS485 bus.	UART 3 Characteristics on page 415
Supply Inputs and Outputs		
VDRIVE	Drive voltage input for the digital I/O circuits of the Digital In 5 and Digital Out 5 channel types (VDRIVE).	DS1552 VDRIVE Input Characteristics on page 418
VSENS	Provides an adjustable sensor supply output.	DS1552 Sensor Supply Characteristics on page 419
VBATprot	Protected supply voltage with an automotive-compatible voltage level.	VBATprot Characteristics on page 420
Ground Potentials		
GND	Common ground for all signals. GND is also connected to the housing of the MicroAutoBox III.	-

Related topics

Basics

Driving the Digital I/O Interfaces of the DS1552 126

Analog Interface Characteristics

Where to go from here

Information in this section

Analog In 10 Characteristics (DS1552)

Purpose

Input to measure analog signals in the range 0 V ... 5 V.

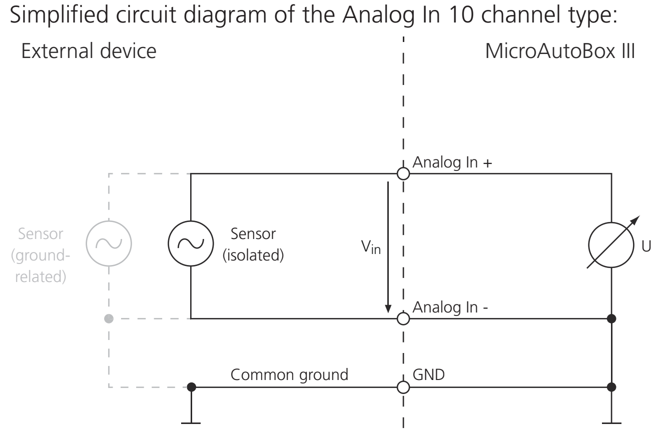
Variant dependency

The Analog In 10 channel type is provided by the DS1552 Multi-I/O Board, but not by the DS1552B1 Multi-I/O Board.

The **Platform Manager** displays the boards and modules of registered MicroAutoBox III units. Refer to How to Register dSPACE Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide).

Circuit diagram

Simplified circuit diagram of the Analog In 10 channel type:



If the input is open, a non-zero voltage at the input pins can be measured due to the internal structure of the channel type.

Analog In 10 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Voltage In ▪ FPGA custom function[2)]
Number of channels	-	8
Input voltage range	V_{in}	0 V ... 5 V
Resolution	-	16 bit
No missing codes	-	15 bit
Offset error	-	-0.5 mV ... +0.5 mV below 750 kS/s
Offset drift	-	Typ. ±10 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 192 kΩ
Sample rate	f_s	Max. 1 MS/s
Trigger rate	-	Max. 1 MHz, a **Digital In 5** channel can be used as trigger source.
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth
Protected voltage range (short-term)	$V_{in\{prot\}}$	-50 V ... +50 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-20 V ... +30 V

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog In 10 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog In 10 Channel 1 Signal	X3
Analog In 10 Channel 1 Reference	X4
Analog In 10 Channel 2 Signal	W3
Analog In 10 Channel 2 Reference	W4
Analog In 10 Channel 3 Signal	V3
Analog In 10 Channel 3 Reference	V4
Analog In 10 Channel 4 Signal	U3
Analog In 10 Channel 4 Reference	U4
Analog In 10 Channel 5 Signal	H3
Analog In 10 Channel 5 Reference	H4
Analog In 10 Channel 6 Signal	G3
Analog In 10 Channel 6 Reference	G4
Analog In 10 Channel 7 Signal	F3
Analog In 10 Channel 7 Reference	F4
Analog In 10 Channel 8 Signal	E3
Analog In 10 Channel 8 Reference	E4
Common Ground	
GND[1)]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1)] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

Analog In 11 Characteristics (DS1552B1)

Purpose

Input to measure analog signals in the range -10 V ... +10 V.

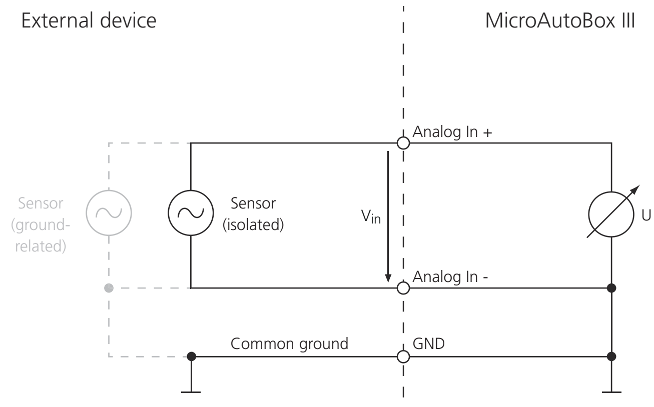
Variant dependency

The Analog In 11 channel type is provided only by the DS1552B1 Multi-I/O Board.

The **Platform Manager** displays the boards and modules of registered MicroAutoBox III units. Refer to How to Register dSPACE Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide 📖).

Circuit diagram

Simplified circuit diagram of the Analog In 11 channel type.



If the input is open, a non-zero voltage at the input pins can be measured due to the internal structure of the channel type.

Analog In 11 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Voltage In ▪ FPGA custom function[2)]
Number of channels	-	8
Input voltage range	V_{in}	-10 V ... +10 V
Resolution	-	16 bit
No missing codes	-	15 bit
Offset error	-	-3 mV ... +3 mV below 750 kS/s
Offset drift	-	Typ. ±40 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s

Parameter	Symbol	Specification[1]
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 117 kΩ
Sample rate	f_s	Max. 1 MS/s
Trigger rate	-	Max. 1 MHz, a **Digital In 5** channel can be used as trigger source.
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth
Protected voltage range (short-term)	$V_{in\{prot\}}$	-50 V ... +50 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-30 V ... +30 V

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog In 11 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog In 11 Channel 1 Signal	X3
Analog In 11 Channel 1 Reference	X4
Analog In 11 Channel 2 Signal	W3
Analog In 11 Channel 2 Reference	W4
Analog In 11 Channel 3 Signal	V3
Analog In 11 Channel 3 Reference	V4
Analog In 11 Channel 4 Signal	U3
Analog In 11 Channel 4 Reference	U4
Analog In 11 Channel 5 Signal	H3
Analog In 11 Channel 5 Reference	H4
Analog In 11 Channel 6 Signal	G3
Analog In 11 Channel 6 Reference	G4
Analog In 11 Channel 7 Signal	F3
Analog In 11 Channel 7 Reference	F4
Analog In 11 Channel 8 Signal	E3
Analog In 11 Channel 8 Reference	E4

Signal	DS1514 ZIF I/O Connector Pin
Signal Reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

Features of the DS1552 Multi-I/O Module.......................................389

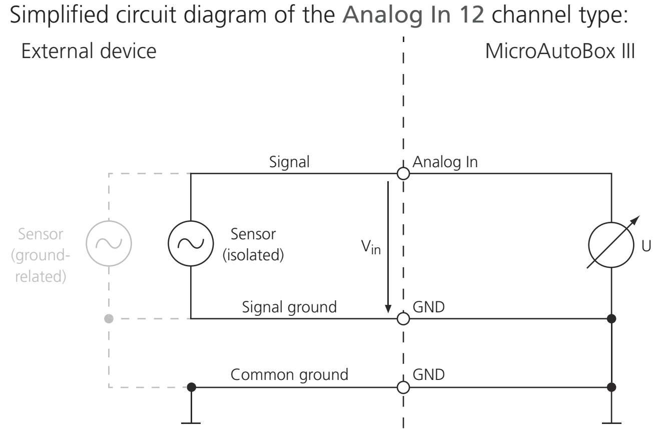
Analog In 12 Characteristics

Purpose

Input with a low sample rate to measure analog signals in the range -10 V ... +10 V.

Circuit diagram

Simplified circuit diagram of the Analog In 12 channel type:



Analog In 12 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.

- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Voltage In ▪ FPGA custom function[2)]
Number of channels	-	16
Input voltage range	V_{in}	-10 V … 10 V
Resolution	-	16 bit
Offset error	-	-2 mV ... +2 mV
Gain error	-	-1% ... +1%
Input resistance	R_{in}	Typ. 1 MΩ
Sample rate	f_s	Max. 200 kS/s
-3 dB cutoff frequency	f_{-3dB}	Typ. 23 kHz
Protected voltage range	$V_{in\{prot\}}$	-45 V … +45 V

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog In 12 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog In 12 Channel 1 Signal	b2
Analog In 12 Channel 2 Signal	a2
Analog In 12 Channel 3 Signal	Z2
Analog In 12 Channel 4 Signal	Y2
Analog In 12 Channel 5 Signal	X2
Analog In 12 Channel 6 Signal	W2
Analog In 12 Channel 7 Signal	V2
Analog In 12 Channel 8 Signal	U2
Analog In 12 Channel 9 Signal	M2
Analog In 12 Channel 10 Signal	L2
Analog In 12 Channel 11 Signal	K2
Analog In 12 Channel 12 Signal	J2
Analog In 12 Channel 13 Signal	H2
Analog In 12 Channel 14 Signal	G2
Analog In 12 Channel 15 Signal	F2
Analog In 12 Channel 16 Signal	E2

Signal	DS1514 ZIF I/O Connector Pin
Signal Reference	
GND[1)]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1)] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

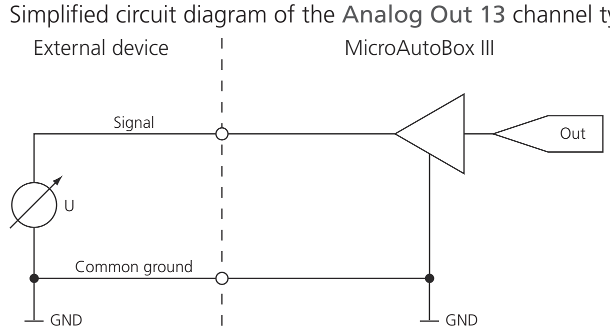
Analog Out 13 Characteristics

Purpose

Output to generate analog signals in the range 0 V ... 5 V.

Circuit diagram

Simplified circuit diagram of the Analog Out 13 channel type.



Analog Out 13 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Voltage Out ▪ FPGA custom function[2]
Number of channels	-	4
Output voltage range	V_{out}	0 V … +5 V
Resolution	-	16 bit
Offset error	-	-2 mV ... +2 mV
Gain error	-	-0.25% ... +0.25%
-3 dB cutoff frequency	f_{-3dB}	Min. 500 kHz
Settling time (to 1 %)	-	Max. 1 µs
Working currrent range	I_{out}	-8 mA ... +8 mA
Load capacitance	-	Max. 22 nF
Protected voltage range	$V_{out\{prot\}}$	-30 V … +40 V

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog Out 13 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog Out 13 Ch. 1 Signal	c2
Analog Out 13 Ch. 2 Signal	c3
Analog Out 13 Ch. 3 Signal	c4
Analog Out 13 Ch. 4 Signal	c5
Signal reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

Digital Interface Characteristics

Where to go from here

Information in this section

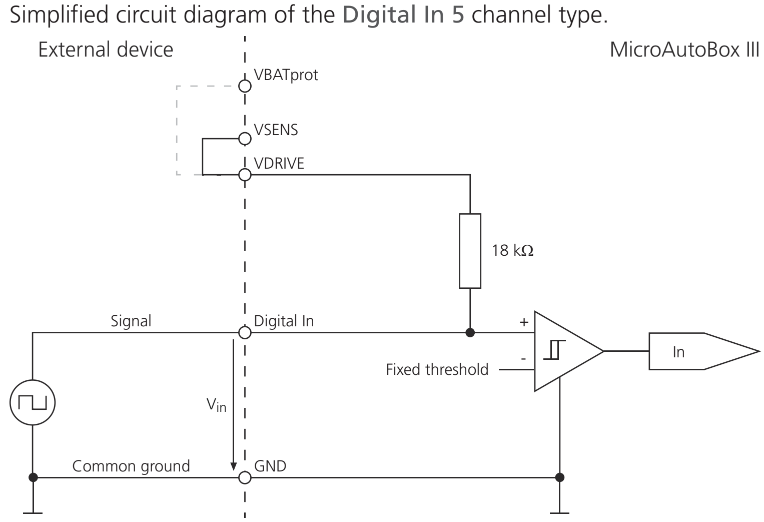
Digital In 5 Characteristics

Purpose

Input to measure digital signals or to trigger the analog measurement of the Analog In 10/11 channel types.

Circuit diagram

Simplified circuit diagram of the Digital In 5 channel type.



Note

To use the digital I/O channels of the Digital In 5 and Digital Out 5 channel types, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital I/O Interfaces of the DS1552 on page 126.

Digital In 5 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Multi Bit In ▪ PWM/PFM In ▪ Trigger In ▪ FPGA custom function[2]
Number of channels	-	16
Input high voltage	V_{ih}	Min. 3.1 V
Input low voltage	V_{il}	Max. 1.2 V
Input hysteresis voltage	V_{hys}	Typ. 1 V
Minimum input pulse width low	t_{LowMin}	Typ. 250 ns
Minimum input pulse width high	$t_{HighMin}$	Typ. 300 ns
Maximum input frequency[3]	f_{max}	▪ Typ. 1.8 MHz at duty cycle = 50% ▪ Typ. 33 kHz at duty cycle = 1% (99%)
Pull-up resistor to VDRIVE	$R_{pull\text{-}up}$	Min. 17 kΩ, max. 19 kΩ
Input capacitance	C_{in}	Typ. 1 nF
Protected voltage range	$V_{in\{prot\}}$	(VDRIVE - 45 V) ... +45 V

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.
[3] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 1 MHz.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital In 5 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital In 5 Channel 1 Signal	V5
Digital In 5 Channel 2 Signal	U5
Digital In 5 Channel 3 Signal	U6
Digital In 5 Channel 4 Signal	T2
Digital In 5 Channel 5 Signal	T3
Digital In 5 Channel 6 Signal	T4
Digital In 5 Channel 7 Signal	T5
Digital In 5 Channel 8 Signal	T6
Digital In 5 Channel 9 Signal	S2
Digital In 5 Channel 10 Signal	S3
Digital In 5 Channel 11 Signal	S5
Digital In 5 Channel 12 Signal	R2
Digital In 5 Channel 13 Signal	R5
Digital In 5 Channel 14 Signal	R6
Digital In 5 Channel 15 Signal	P5
Digital In 5 Channel 16 Signal	P6
Signal reference	
GND[1)]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1)] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

Basics

References

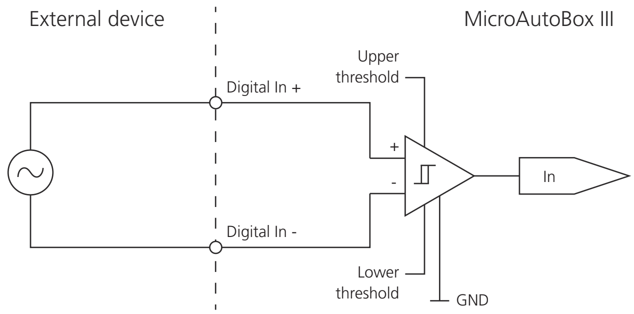
Digital In 6 Characteristics

Purpose

Differential input to measure signals of digital crankshaft and camshaft sensors.

Circuit diagram

Simplified circuit diagram of the Digital In 6 channel type.



Digital In 6 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	FPGA custom function[2)]
Number of channels	-	3
Input voltage range	V_{in}	-55 V …+55 V
Input threshold voltage range	V_{th}	-40 V …+40 V, upper and lower threshold
Threshold voltage accuracy	-	(-1% of V_{th} - 100 mV) … (+1% of V_{th} + 100 mV), upper and lower threshold
-3 dB cutoff frequency	f_{-3dB}	Typ. 320 kHz
Input resistance	R_{in}	Typ. 170 kΩ

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital In 6 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital In 6 Channel 1 +	R3
Digital In 6 Channel 1 -	R4
Digital In 6 Channel 2 +	B3
Digital In 6 Channel 2 -	B4
Digital In 6 Channel 3 +	A3
Digital In 6 Channel 3 -	A4

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

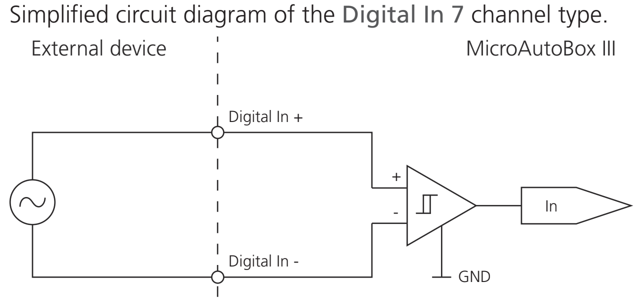
Digital In 7 Characteristics

Purpose

Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in notched wheel position sensors.

Circuit diagram

Simplified circuit diagram of the Digital In 7 channel type.



Digital In 7 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	FPGA custom function[2]
Number of channels	-	1
Input voltage range DC	V_{in}	-60 V DC … +60 V DC
-3 dB cutoff frequency	f_{-3dB}	Typ. 30 kHz
Input resistance	R_{in}	Typ. 67 kΩ

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital In 7 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital In 7 Channel 1 +	P3
Digital In 7 Channel 1 -	P4
Signal Reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

Features of the DS1552 Multi-I/O Module 389

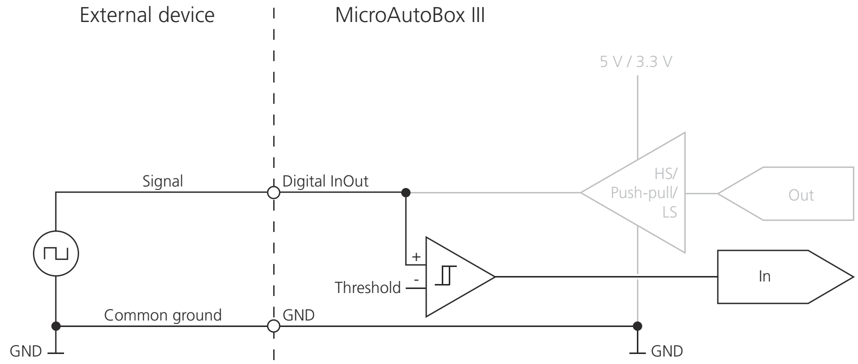
Digital In/Out 6 Characteristics

Purpose

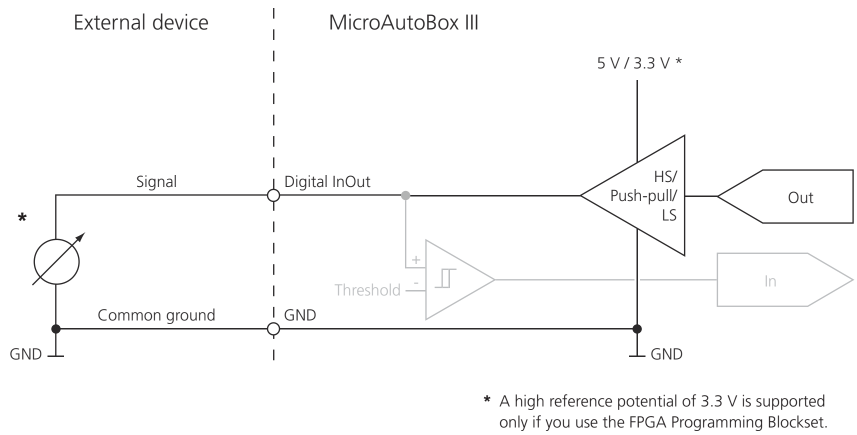
Bidirectional channel type to measure and generate digital signals.

Circuit diagram

Simplified circuit diagram of the **Digital In/Out 6** channel type used for measurement.



Simplified circuit diagram of the **Digital In/Out 6** channel type used for signal generation.



Digital In/Out 6 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	**Symbol**	**Specification**[1)]
Supported function blocks	-	▪ Multi Bit In ▪ Multi Bit Out ▪ PWM/PFM In ▪ PWM/PFM Out ▪ FPGA custom function[2)]

Parameter	Symbol	Specification[1]
Number of channels	-	8
Protected voltage range	V_{prot}	-50 V … +50 V
Input Characteristics		
Input voltage range	V_{in}	0 V … 15 V
Input high voltage	V_{ih}	$(V_{th} + 0.5 \cdot V_{hys})$ … 15 V
Input low voltage	V_{il}	0 V … $(V_{th} - 0.5 \cdot V_{hys})$
Input hysteresis voltage	V_{hys}	Typ. 0.7 V
Input threshold voltage range	V_{th}	1.0 V … 7.5 V
Minimum input pulse width high/low	t_{min}	20 ns
Maximum input frequency[3]	f_{max}	25 MHz at 5 V logic level, 50% duty cycle and 2.5 V threshold
Input resistance	R_{in}	Typ. 24 kΩ
Output Characteristics		
Output high voltage	V_{oh}	▪ 5 V logic level: Min. 4.6 V at I_{out} = 10 mA ▪ 3.3 V logic level: Min. 2.8 V at I_{out} = 10 mA 3.3 V logic level is supported only if you use the RTI FPGA Programming Blockset.
Output low voltage	V_{ol}	Typ. 0.2 V at I_{out} = -10 mA
Working current range	I_{out}	-10 mA … +10 mA
Output current limit high	I_{olim}	Min. 45 mA, max. 75 mA
Output current limit low	I_{olim}	Min. -45 mA, max. -75 mA
Minimum output pulse width high/low	t_{min}	12.5 ns
Maximum output frequency[4]	f_{max}	40 MHz at 100 pF capacitive load

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.
3) The maximum frequency that is supported by the PWM/PFM In function block in ConfigurationDesk is limited to 1 MHz.
4) The maximum frequency that is supported by the PWM/PFM Out function block in ConfigurationDesk is limited to 150 kHz.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital In/Out 6 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital In/Out 6 Channel 1 Signal	N2
Digital In/Out 6 Channel 2 Signal	N3
Digital In/Out 6 Channel 3 Signal	N4

Signal	DS1514 ZIF I/O Connector Pin
Digital In/Out 6 Channel 4 Signal	N5
Digital In/Out 6 Channel 5 Signal	N6
Digital In/Out 6 Channel 6 Signal	M5
Digital In/Out 6 Channel 7 Signal	M6
Digital In/Out 6 Channel 8 Signal	L4
Signal Reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

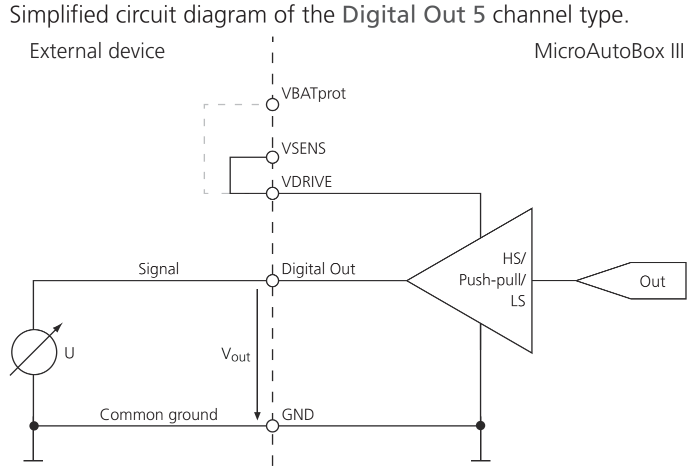
Digital Out 5 Characteristics

Purpose

Output to generate digital signals.

Circuit diagram

Simplified circuit diagram of the Digital Out 5 channel type.



Note

To use the digital I/O channels of the Digital In 5 and Digital Out 5 channel types, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital I/O Interfaces of the DS1552 on page 126.

General behavior of digital signals

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

Digital Out 5 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Multi Bit Out ▪ PWM/PFM Out ▪ FPGA custom function[2]
Number of channels	-	16
Output high voltage	V_{oh}	VDRIVE = 5 V ▪ Min. 4.4 V, typ. 4.6 V at I_{out} = 0 mA ▪ Min. 3.2 V, typ. 3.4 V at I_{out} = 5 mA VDRIVE = 12 V ▪ Min. 11.3 V, typ. 11.6 V at I_{out} = 0 mA ▪ Min. 10.3 V, typ. 10.5 V at I_{out} = 5 mA
Output low voltage	V_{ol}	▪ Max. 0.3 V, typ. 0.1 V at I_{out} = 0 mA ▪ Max. 0.9 V, typ. 0.7 V at I_{out} = -5 mA
Working current range	$I_{out\{work\}}$	-5 mA ... +5 mA
Output current limit high	$I_{oh\{lim\}}$	Typ. 13 mA, max. 17 mA
Output current limit low	$I_{ol\{lim\}}$	Typ. -14 mA, max. -18 mA
Minimum output pulse width high	$t_{HighMin}$	Typ. 700 ns
Minimum output pulse width low	t_{LowMin}	Typ. 200 ns
Maximum output frequency[3]	f_{max}	▪ Typ. 700 kHz at duty cycle = 50% ▪ Typ. 14 kHz at duty cycle = 1% (99%)

Parameter	Symbol	Specification[1]
Leakage current tristate	I_{leak}	Max. 100 µA
Protected voltage range	V_{prot}	(VDRIVE - 45 V) ... +45 V

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.
[3] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 150 kHz.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital Out 5 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital Out 5 Channel 1 Signal	F5
Digital Out 5 Channel 2 Signal	E5
Digital Out 5 Channel 3 Signal	E6
Digital Out 5 Channel 4 Signal	D2
Digital Out 5 Channel 5 Signal	D3
Digital Out 5 Channel 6 Signal	D4
Digital Out 5 Channel 7 Signal	D5
Digital Out 5 Channel 8 Signal	D6
Digital Out 5 Channel 9 Signal	C2
Digital Out 5 Channel 10 Signal	C3
Digital Out 5 Channel 11 Signal	C5
Digital Out 5 Channel 12 Signal	B2
Digital Out 5 Channel 13 Signal	B5
Digital Out 5 Channel 14 Signal	B6
Digital Out 5 Channel 15 Signal	A5
Digital Out 5 Channel 16 Signal	A6
Signal Reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1
Digital I/O Interface Supply	
VBATprot	P1, R1
VSENS+	c6

Signal	DS1514 ZIF I/O Connector Pin
VSENS-	b6
VDRIVE	M1, N1

[1] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

Basics

References

Communication Interface Characteristics

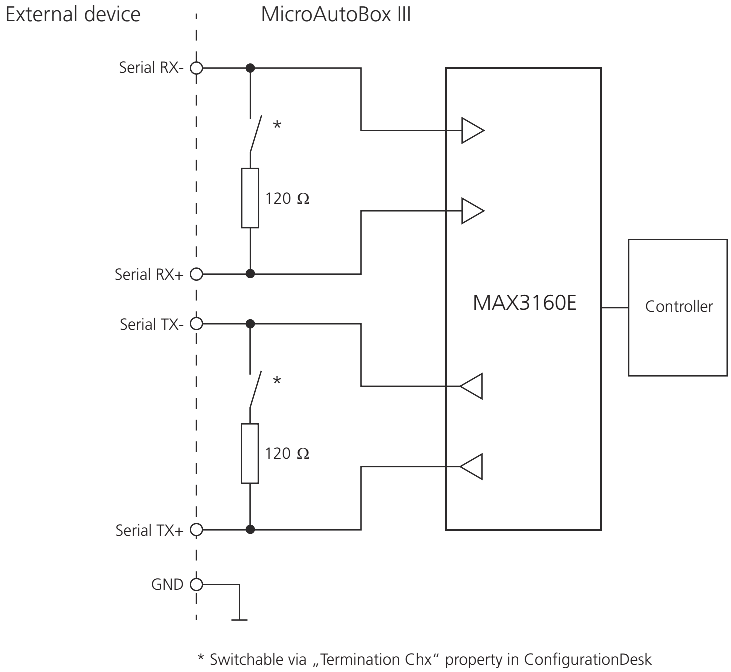
UART 3 Characteristics

Purpose

Interface to communicate with a RS232/422 device or via a RS485 bus.

Circuit diagram

Simplified circuit diagram of the UART 3 channel type.



> **Note**
>
> The signal mapping depends on the serial mode. Refer to Signal mapping on page 417.

UART 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	FPGA custom function[2)] Supported only by a custom function block. Refer to Implementing UART Serial Communication in ConfigurationDesk (ConfigurationDesk UART Implementation 📖).
Number of channels	1
Transceiver type	MAX3160E
RS232 Characteristics	
Data rate	Max. 1 Mbit/s
Input threshold voltage high	Min. 2.0 V

Parameter	Specification[1)]
Input threshold voltage low	Max. 0.8 V
Protected voltage range	-25 V … +25 V
RS422/485 Characteristics	
Data rate	Max. 10 Mbit/s
Termination resistance	120 Ω, switchable via software
Protected voltage range	▪ -25 V … +25 V between a bus pin and GND ▪ -7.75 V … +7.75 V between the noninverted and inverted signal pins, such as RX+ and RX-.

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the serial signals of the UART 3 channel type.

Signal	DS1514 ZIF I/O Connector	
	Pin Name	Pin
RS232 Mode		
Serial receive signal (RX)	UART 3 Serial RX-	b5
Clear to send (CTS)	UART 3 Serial RX+	a4
Serial transmit signal (TX)	UART 3 Serial TX-	a5
Request to send (RTS)	UART 3 Serial TX+	a6
Full Duplex RS485/422 Mode		
Inverted serial receive signal (RX-)	UART 3 Serial RX-	b5
Noninverted serial receive signal (RX+)	UART 3 Serial RX+	a4
Inverted serial transmit signal (TX-)	UART 3 Serial TX-	a5
Noninverted serial transmit signal (TX+)	UART 3 Serial TX+	a6
Half Duplex RS485/422 Mode		
-	UART 3 Serial RX-	b5
-	UART 3 Serial RX+	a4
Inverted bus signal (BM)	UART 3 Serial TX-	a5
Noninverted bus signal (BP)	UART 3 Serial TX+	a6
Ground Reference		
Common ground	GND	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6,

Signal	DS1514 ZIF I/O Connector	
	Pin Name	Pin
		W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

Supply Voltage Characteristics

Where to go from here

Information in this section

DS1552 VDRIVE Input Characteristics

Purpose

Drive voltage input for the digital I/O circuits of the Digital In 5 and Digital Out 5 channel types (VDRIVE).

VDRIVE characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Input voltage range	4.5 V … 40 V
Protected input voltage	Max. 45 V, no protection against load dump and reverse voltage.
Input current	▪ Typ. 20 mA if all digital inputs/outputs are disconnected. ▪ Up to 1 A, depending on the application.

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the VDRIVE input.

Signal	DS1514 ZIF I/O Connector Pin
VDRIVE	M1, N1
Signal Reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

DS1552 Sensor Supply Characteristics

Purpose

Provides an adjustable sensor supply output.

Sensor supply characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- All voltages are referenced to VSENS-.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Supported function blocks	FPGA custom function[2]
Output voltage range	2 V … 20 V relative to VSENS- The output voltage is isolated and adjustable.
Maximum output power	Typ. 1 W at 5 V … 20 V output voltage and VSENS- is connected to GND.
On/off behavior	Must be switched on/off by the FPGA custom function.

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the sensor supply.

Note

For information on supplying sensors, refer to Connecting Sensors to the DS1552 on page 129.

Signal	DS1514 ZIF I/O Connector Pin
VSENS+	c6
VSENS-	b6

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

VBATprot Characteristics

Purpose

Protected supply voltage with an automotive-compatible voltage level.

VBATprot characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Output voltage	▪ VBATprot follows VBAT within the operating voltage range of the MicroAutoBox III. ▪ With I_{load} = 1 A and VBAT = 12 V: 11.56 V ... 12.00 V, typ. 11.78 V
Working current range	0 A ... 1 A
Output current limit	▪ 4 A ... 9 A for the complete operating temperature range ▪ Shut off after max. 5 ms
On/off behavior	Switched on and off with the MicroAutoBox III

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the protected VBAT voltage.

Signal	DS1514 ZIF I/O Connector Pin
VBATprot	P1, R1
Signal Reference	
GND[1]	A1, A2, B1, C1, C4, D1, E1, F1, F6, G1, G6, H1, J1, J4, K1, L1, L5, L6, P2, S1, S4, T1, U1, V1, V6, W1, W6, X1, Y1, Y4, Z1, a1, b1, c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391.

Related topics

References

DS1553 AC Motor Control Module Data Sheet

Where to go from here

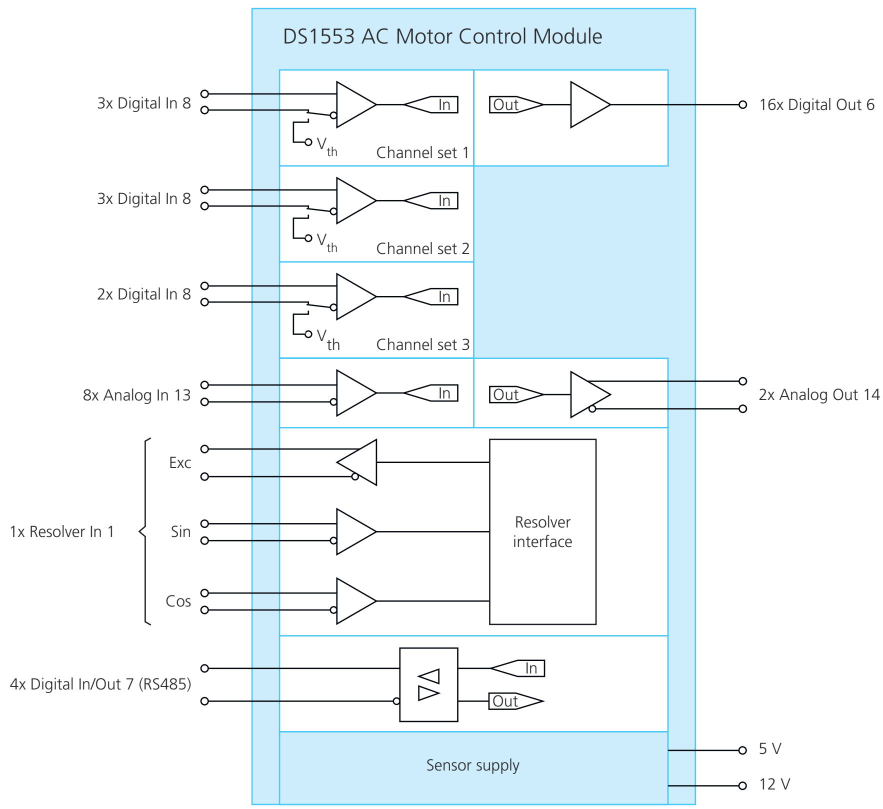
Information in this section

Overview and General Information

Features of the DS1553 AC Motor Control Module

Main features

The following block diagram provides a functional view of the main features and the provided channel types.



The following table shows you more details.

Feature	Description
Channels for signal measurement	▪ 8 digital input channels of the Digital In 8 channel type. For signal characteristics and mapping, refer to Digital In 8 Characteristics on page 431. ▪ 8 analog input channels of the Analog In 13 channel type. For signal characteristics and mapping, refer to Analog In 13 Characteristics on page 427.
Channels for signal generation	▪ 16 digital output channels of the Digital Out 6 channel type. For signal characteristics and mapping, refer to Digital Out 6 Characteristics on page 434. ▪ 2 analog output channels of the Analog Out 14 channel type. For signal characteristics and mapping, refer to Analog Out 14 Characteristics on page 429.

Feature	Description
Resolver interface	▪ 1 resolver interface of the Resolver In 1 channel type. For signal characteristics and mapping, refer to Resolver In 1 Characteristics on page 436.
Communication channels	▪ 4 RS485 channels of the Digital In/Out 7 channel type. For signal characteristics and mapping, refer to Digital In/Out 7 Characteristics (RS485) on page 438.
Supply outputs	▪ 2 sensor supplies. For signal characteristics and mapping, refer to DS1553 Sensor Supply Characteristics (VSENS) on page 440.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the DS1553 AC Motor Control Module.

Function Block Type	Purpose	Channel Type
Custom Functions		
FPGA Custom Function	FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.	All channel types

Related topics

Basics

DS1553 AC Motor Control Module.. 136

References

DS1514 ZIF I/O Connector Pinout (DS1553).. 424

Connector Pinouts

DS1514 ZIF I/O Connector Pinout (DS1553)

Purpose

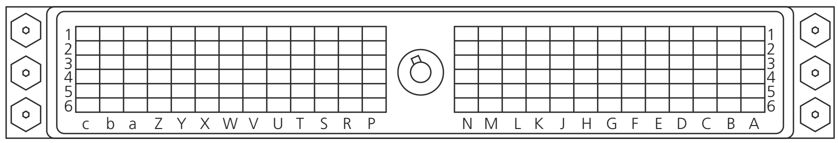
Connector to provide access to all I/O channels of the DS1553 AC Motor Control Module.

Pinout

Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of the I/O connector:

1	2	3	4	5	6	
GND	Analog In 13 Channel 1 -	Analog In 13 Channel 3 +	Analog In 13 Channel 2 -	Analog In 13 Channel 2 +	Analog In 13 Channel 1 +	*A*
GND	Not connected	Not connected	Analog In 13 Channel 4 -	Analog In 13 Channel 4 +	Analog In 13 Channel 3 -	*B*
GND	VSENS 12 V	Analog Out 14 Channel 1 +	Analog Out 14 Channel 1 -	Analog Out 14 Channel 2 +	IP slot 1, pin 5	*C*
GND	VSENS 12 V	Digital In 8 Channel 1 +	Digital In 8 Channel 2 +	Digital In 8 Channel 2 -	Analog Out 14 Channel 1 -	*D*
GND	VSENS 5 V	Digital In 8 Channel 8 -	Digital In 8 Channel 3 -	Digital In 8 Channel 3 +	Digital In 8 Channel 1 -	*E*
GND	VSENS 5 V	Digital Out 6 Channel 13 Signal	Digital Out 6 Channel 15 Signal	Digital Out 6 Channel 12 Signal	Digital In 8 Channel 8 +	*F*
GND	Not connected	Digital Out 6 Channel 9 Signal	Digital Out 6 Channel 10 Signal	IP slot 1, pin 14	Digital Out 6 Channel 16 Signal	*G*
GND	Not connected	Digital Out 6 Channel 7 Signal	Digital Out 6 Channel 8 Signal	IP slot 1, pin 16	IP slot 1, pin 15	*H*
GND	Not connected	IP slot 1, pin 44		IP slot 1, pin 18	IP slot 1, pin 17	*J*
GND	Not connected	IP slot 1, pin 46	IP slot 1, pin 45	IP slot 1, pin 20	IP slot 1, pin 19	*K*
GND	Not connected	IP slot 1, pin 48	Not connected	GND	GND	*L*
Do not connect	Not connected	IP slot 1, pin 50	IP slot 1, pin 49	Not connected	Not connected	*M*
Do not connect	Not connected	Not connected	Not connected	Not connected	Not connected	*N*
Do not connect	Not connected	Not connected	Not connected	Not connected	Not connected	*P*
Do not connect	Not connected	Digital Out 6 Channel 1 Signal	Digital Out 6 Channel 4 Signal	Digital Out 6 Channel 2 Signal	Digital Out 6 Channel 5 Signal	*R*
GND	Not connected	Digital Out 6 Channel 11 Signal	Digital Out 6 Channel 6 Signal	Digital Out 6 Channel 3 Signal	IP slot 2, pin 5	*S*

1	2	3	4	5	6	
GND	Not connected	Digital In 8 Channel 5 +	Digital Out 6 Channel 14 Signal	Digital In 8 Channel 7 +	Not connected	*T*
GND	Not connected	Digital In 8 Channel 4 +	Digital In 8 Channel 5 -	Digital In 8 Channel 4 -	Digital In 8 Channel 7 -	*U*
GND	Not connected	Digital In/Out 7[1)] Channel 2 -	Digital In/Out 7[1)] Channel 2 +	Digital In 8 Channel 6 -	Digital In 8 Channel 6 +	*V*
GND	Not connected	Digital In/Out 7[1)] Channel 1 +	Digital In/Out 7[1)] Channel 3 -	IP slot 2, pin 14	Digital In/Out 7[1)] Channel 3 +	*W*
GND	Not connected	Digital In/Out 7[1)] Channel 4 +	Digital In/Out 7[1)] Channel 1 -	IP slot 2, pin 16	IP slot 2, pin 15	*X*
GND	Analog In 13 Channel 8 -	Not connected	Digital In/Out 7[1)] Channel 4 -	IP slot 2, pin 18	IP slot 2, pin 17	*Y*
GND	Analog In 13 Channel 7 -	IP slot 2, pin 46	IP slot 2, pin 45	IP slot 2, pin 20	IP slot 2, pin 19	*Z*
GND	Analog In 13 Channel 7 +	IP slot 2, pin 48	Resolver In 1 Exc +	Resolver In 1 Sin +	Resolver In 1 Sin -	*a*
GND	Analog In 13 Channel 6 +	IP slot 2, pin 50	IP slot 2, pin 49	Resolver In 1 Cos -	Resolver In 1 Exc -	*b*
GND	Analog In 13 Channel 5 +	Analog In 13 Channel 5 -	Analog In 13 Channel 6 -	Analog In 13 Channel 8 +	Resolver In 1 Cos +	*c*

[1)] Used as RS485 Interface.

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
Analog I/O		
Analog In 13	Differential input to measure analog signals in selectable voltage ranges up to ±30 V.	Analog In 13 Characteristics on page 427
Analog Out 14	Output to generate analog signals. The signals can be used as single-ended and differential output.	Analog Out 14 Characteristics on page 429
Digital I/O		
Digital In 8	Input to measure digital signals in the single-ended or differential mode.	Digital In 8 Characteristics on page 431
Digital Out 6	Output to generate digital signals with a 5 V logic level.	Digital Out 6 Characteristics on page 434
Resolver Interfaces		
Resolver In 1	Interface to monitor resolver sensors.	Resolver In 1 Characteristics on page 436
Communication Interfaces		
Digital In/Out 7	RS485 Interface to read digital protocols from active rotor position sensors, such as EnDat and/or SSI.	Digital In/Out 7 Characteristics (RS485) on page 438

Signal	Description	Characteristics
Supply Outputs		
VSENS	Provides 5 V and 12 V supply voltages.	DS1553 Sensor Supply Characteristics (VSENS) on page 440
Ground Potentials		
GND	Common ground for all signals. GND is also connected to the housing of the MicroAutoBox III.	-

Analog Interface Characteristics

Where to go from here

Information in this section

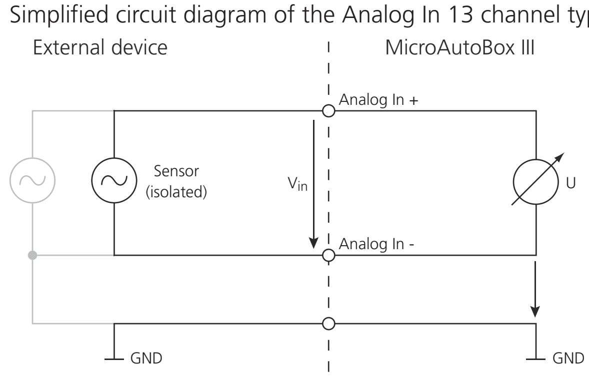
Analog In 13 Characteristics

Purpose

Differential input to measure analog signals in selectable voltage ranges up to ±30 V.

Circuit diagram

Simplified circuit diagram of the Analog In 13 channel type.



Analog In 14 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1]
Supported function blocks	FPGA custom function[2]
Number of channels	8
Differential input voltage range	Selectable via software: ▪ ±5 V ▪ ±15 V ▪ ±30 V
Resolution	14 bit
Accuracy	±0.2% of FSR
Effective noise	3 LSB
Input resistance	▪ 142 kΩ at ±5 V input voltage range ▪ 43 kΩ at ±15 V input voltage range ▪ 43 kΩ at ±30 V input voltage range
Sample rate	10 MS/s
-3 dB cutoff frequency	420 kHz
Protected voltage range	-30 V ... +30 V

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog In 13 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog In 13 Channel 1 +	A6
Analog In 13 Channel 1 -	A2
Analog In 13 Channel 2 +	A5
Analog In 13 Channel 2 -	A4
Analog In 13 Channel 3 +	A3
Analog In 13 Channel 3 -	B6
Analog In 13 Channel 4 +	B5
Analog In 13 Channel 4 -	B4

Signal	DS1514 ZIF I/O Connector Pin
Analog In 13 Channel 5 +	c2
Analog In 13 Channel 5 -	c3
Analog In 13 Channel 6 +	b2
Analog In 13 Channel 6 -	c4
Analog In 13 Channel 7 +	a2
Analog In 13 Channel 7 -	Z2
Analog In 13 Channel 8 +	c5
Analog In 13 Channel 8 -	Y2

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

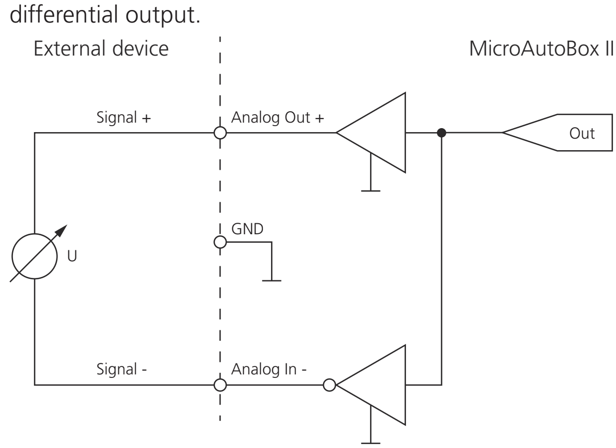
Analog Out 14 Characteristics

Purpose

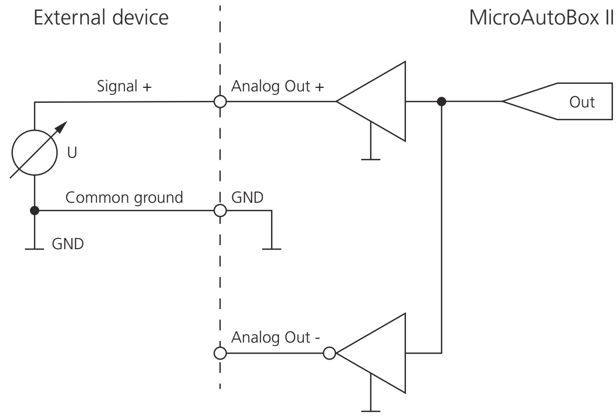
Output to generate analog signals. The signals can be used as single-ended and differential output.

Circuit diagram

Simplified circuit diagram of the **Analog Out 14** channel type used as a differential output.



Simplified circuit diagram of the **Analog Out 14** channel type used as a single-ended output.



Analog Out 14 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1)]
Supported function blocks	FPGA custom function[2)]
Number of channels	2
Output voltage range	▪ -20 V ... +20 V used as differential signal ▪ -10 V ... +10 V used as single-ended signal
Resolution	12 bit
Error	0.5% FSR
Slew rate	Typ. 5 V/µs
Working current range	-20 mA ... +20 mA
Protected voltage range	To achieve maximum speed performance, the channels are not protected by safety circuits. Backward feeding or short circuits can cause physical damage of the module.

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog Out 14 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog Out 14 Channel 1 +	C3
Analog Out 14 Channel 1 -	D6
Analog Out 14 Channel 2 +	C5
Analog Out 14 Channel 2 -	C4
Signal Reference	
GND[1)]	A1 … L1, S1 … Z1, a1 … c1

1) Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

Digital Interface Characteristics

Where to go from here

Information in this section

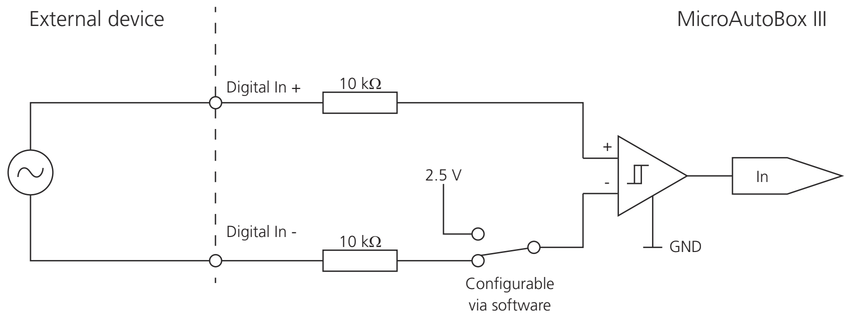
Digital In 8 Characteristics

Purpose

Input to measure digital signals in the single-ended or differential mode.

Circuit diagram

Simplified circuit diagram of the Digital In 8 channel type.



Digital In 8 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1]
Supported function blocks	FPGA custom function[2]
Number of channels	8
Input voltage range	▪ 0 V … 5 V in single-ended mode ▪ ±5 V in differential mode
Input resistance	22 kΩ
Threshold voltage	2.5 V
Input frequency range	0.1 Hz … 4 MHz or static inputs
Propagation delay time	▪ 100 ns for a rising edge ▪ 100 ns for a falling edge
Internal comparator hysteresis	±60 mV
Protected voltage range	-30 V ... +30 V

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.

Hardware modifications The following modifications are provided by dSPACE Engineering Services:

- Input voltage range for values up to 30 V
- Threshold voltage in the range of 0 V … 5 V

A modification also affects the other characteristics of the channels, except for the protected voltage range.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital In 8 channel type.

Signal	Channel Set[1)]	DS1514 ZIF I/O Connector Pin
Digital In 8 Channel 1 +	1	D3
Digital In 8 Channel 1 -	1	E6
Digital In 8 Channel 2 +	1	D4
Digital In 8 Channel 2 -	1	D5
Digital In 8 Channel 3 +	1	E5
Digital In 8 Channel 3 -	1	E4
Digital In 8 Channel 4 +	2	U3
Digital In 8 Channel 4 -	2	U5
Digital In 8 Channel 5 +	2	T3
Digital In 8 Channel 5 -	2	U4
Digital In 8 Channel 6 +	2	V6
Digital In 8 Channel 6 -	2	V5
Digital In 8 Channel 7 +	3	T5
Digital In 8 Channel 7 -	3	U6
Digital In 8 Channel 8 +	3	F6
Digital In 8 Channel 8 -	3	E3

1) The digital channels are divided into three channel sets. Channels of the same channel set must use the same input mode (single-ended or differential).

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

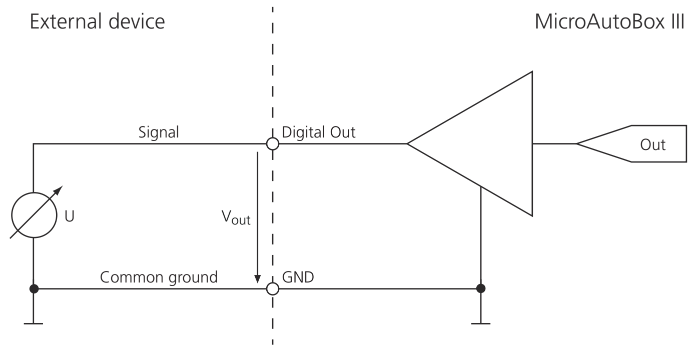
Digital Out 6 Characteristics

Purpose

Output to generate digital signals with a 5 V logic level.

Circuit diagram

Simplified circuit diagram of the Digital Out 6 channel type.



General behavior of digital signals

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

Digital Out 6 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1)]
Supported function blocks	FPGA custom function[2)]
Number of channels	16
Output high voltage	5 V
Output low voltage	0 V
Output impedance	33 Ω
Nominal output current	±24 mA
Slew rate	Up to 1,800 V/µs
Duty cycle resolution	Min. 25 ns
Output frequency	▪ Max. 20 MHz at duty cycle = 50% ▪ Max. 40 kHz for 0.1% duty cycle resolution
Required load impedance	Min. 200 Ω
Propagation delay time	▪ 10 ns for a rising edge

Parameter	Specification[1]
	▪ 10 ns for a falling edge
Protected voltage range	To achieve maximum speed performance, the channels are not protected by safety circuits. Backward feeding or short circuits can cause physical damage of the module.

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital Out 6 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital Out 6 Channel 1 Signal	R3
Digital Out 6 Channel 2 Signal	R5
Digital Out 6 Channel 3 Signal	S5
Digital Out 6 Channel 4 Signal	R4
Digital Out 6 Channel 5 Signal	R6
Digital Out 6 Channel 6 Signal	S4
Digital Out 6 Channel 7 Signal	H3
Digital Out 6 Channel 8 Signal	H4
Digital Out 6 Channel 9 Signal	G3
Digital Out 6 Channel 10 Signal	G4
Digital Out 6 Channel 11 Signal	S3
Digital Out 6 Channel 12 Signal	F5
Digital Out 6 Channel 13 Signal	F3
Digital Out 6 Channel 14 Signal	T4
Digital Out 6 Channel 15 Signal	F4
Digital Out 6 Channel 16 Signal	G6
Signal Reference	
GND[1]	A1 … L1, S1 … Z1, a1 … c1

[1] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

Resolver Interface Characteristics

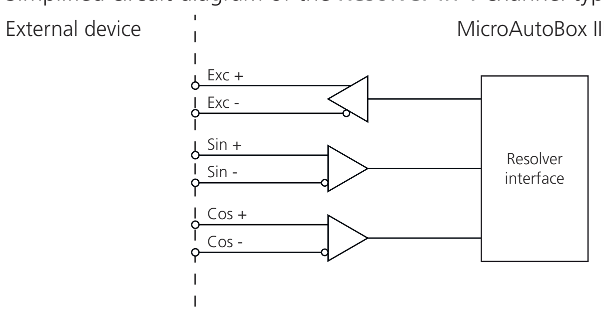
Resolver In 1 Characteristics

Purpose

Interface to monitor resolver sensors.

Circuit diagram

Simplified circuit diagram of the Resolver In 1 channel type.



Resolver In 1 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1)]
Supported function blocks	FPGA custom function[2)]
Number of channels	1
Configurable coupling factors $\left(\frac{V_{exc}}{V_{sin/cos}}\right)$	Factors with 3 V_{RMS} excitation voltage: ▪ 2 ▪ 0.857 ▪ 0.6 Factors with 7 V_{RMS} excitation voltage: ▪ 4.67 ▪ 2

Parameter	Specification[1]
	▪ 1.4 Factors with 10 V_{RMS} excitation voltage: ▪ 6.67 ▪ 2.857 ▪ 2
Output Characteristics	
Differential excitation output voltage	Configurable via software: ▪ 3 V_{RMS} ▪ 7 V_{RMS} ▪ 10 V_{RMS}
Excitation output frequency ranges	2 kHz … 20 kHz, configurable via software in 250 Hz increments
Excitation output current	Max. 70 mA
Excitation output protection	▪ Thermal protection (overload) ▪ Short circuit protection
Input Characteristics	
Differential sine and cosine input voltage	Configurable via software: ▪ 1.5 V_{RMS} ±27% ▪ 3.5 V_{RMS} ±27% ▪ 5 V_{RMS} ±27%
Sine and cosine input impedance	10 kΩ
Angular accuracy	▪ Typ. ±2.5 arcminutes + 1 LSB ▪ Max. ±5 arcminutes + 1 LSB
Angular resolution	Configurable via software: ▪ 10 bit ▪ 12 bit ▪ 14 bit ▪ 16 bit
Bandwidth	▪ 4 kHz at 10 bit angular resolution ▪ 2 kHz at 12 bit angular resolution ▪ 1 kHz at 14 bit angular resolution ▪ 250 Hz at 16 bit angular resolution
Tracking rate	▪ 2,500 rps at 10 bit angular resolution ▪ 1,000 rps at 12 bit angular resolution ▪ 500 rps at 14 bit angular resolution ▪ 125 rps at 16 bit angular resolution

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.

Hardware modifications The excitation output voltage ranges can be changed to custom values by dSPACE Engineering Services.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Resolver In 1 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Resolver In 1 Exc +	a4
Resolver In 1 Exc -	b6
Resolver In 1 Sin +	a5
Resolver In 1 Sin -	a6
Resolver In 1 Cos +	c6
Resolver In 1 Cos -	b5

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

Communication Interface Characteristics

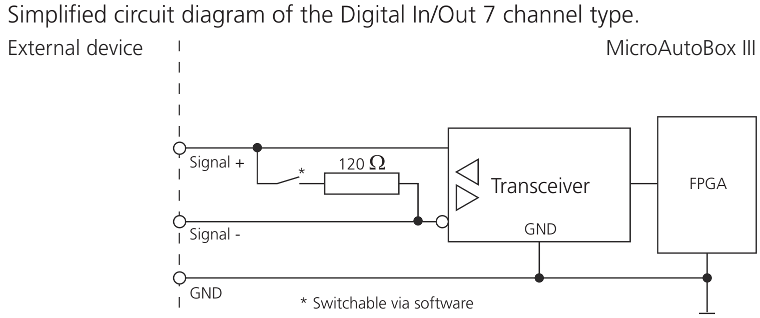
Digital In/Out 7 Characteristics (RS485)

Purpose

RS485 Interface to read digital protocols from active rotor position sensors, such as EnDat and/or SSI.

Circuit diagram

Simplified circuit diagram of the Digital In/Out 7 channel type.



Digital In/Out 7 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1)]
Supported function blocks	FPGA custom function[2)]
Number of channels	4
Protection	▪ Thermal protection (overload) ▪ Short circuit protection
Input Characteristics	
Differential threshold voltage	-0.2 V … +0.2 V
Input resistance	12 kΩ without termination
Termination resistance	120 Ω, switchable via software
Propagation delay time	▪ Max. 90 ns for a rising edge, typ. 65 ns ▪ Max. 90 ns for a falling edge, typ. 65 ns ▪ Max. 10 ns delay skew
Output Characteristics	
Output voltage	▪ 1.5 V at RS485 ▪ 2 V at RS422
Common-mode output voltage	3 V
Differential output delay	Typ. 22 ns, max. 35 ns
Differential output transition time	Typ. 8 ns, max. 25 ns
Propagation delay time	▪ Max. 35 ns for a rising edge, typ. 22 ns ▪ Max. 35 ns for a falling edge, typ. 22 ns ▪ Max. 8 ns delay skew
Short-circuit output current	-250 mA … +250 mA

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application. To use a DS1553 AC Motor Control Module, the custom FPGA application must be defined with the RTI FPGA Programming Blockset and the XSG AC Motor Control Solution.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the serial signals of the Digital In/Out 7 channel type (RS485).

Signal	DS1514 ZIF I/O Connector Pin
Digital In/Out 7 Channel 1 +	W3
Digital In/Out 7 Channel 1 -	X4
Digital In/Out 7 Channel 2 +	V4
Digital In/Out 7 Channel 2 -	V3
Digital In/Out 7 Channel 3 +	W6
Digital In/Out 7 Channel 3 -	W4
Digital In/Out 7 Channel 4 +	X3
Digital In/Out 7 Channel 4 -	Y4
Common Ground	
GND[1)]	A1 … L1, S1 … Z1, a1 … c1

[1)] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

Supply Voltage Characteristics

DS1553 Sensor Supply Characteristics (VSENS)

Purpose

Provides 5 V and 12 V supply voltages.

Sensor supply characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter	Specification[1)]
Output voltages	Two supply voltages are provided: ▪ 5 V ▪ 12 V

Parameter	Specification[1]
Current	Max. 50 mA
Series resistance	Typ. 25 Ω
Protection	Resettable polyswitch-fuse

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the sensor supplies.

Signal	DS1514 ZIF I/O Connector Pin
VSENS 5 V	E2, F2
VSENS 12 V	C2, D2
Signal Reference	
GND[1]	A1 … L1, S1 … Z1, a1 … c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1553) on page 424.

Related topics

References

DS1554 Engine Control I/O Module Data Sheet

Where to go from here

Information in this section

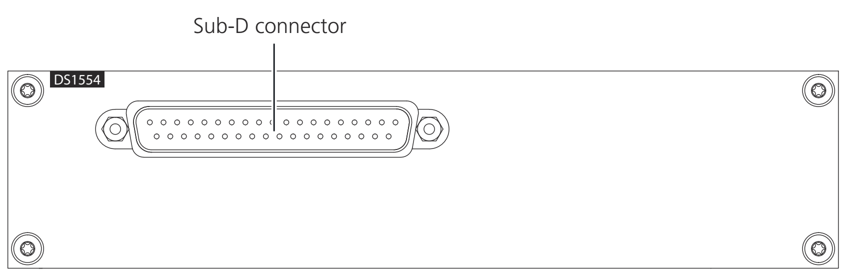
Overview and General Information

Where to go from here

Information in this section

DS1554 Panel Components

Panel overview



Component	Description
Sub-D Connector	Provides access to the I/O signals for engine control applications. For the pinout, refer to DS1554 Sub-D I/O Connector Pinout on page 449.

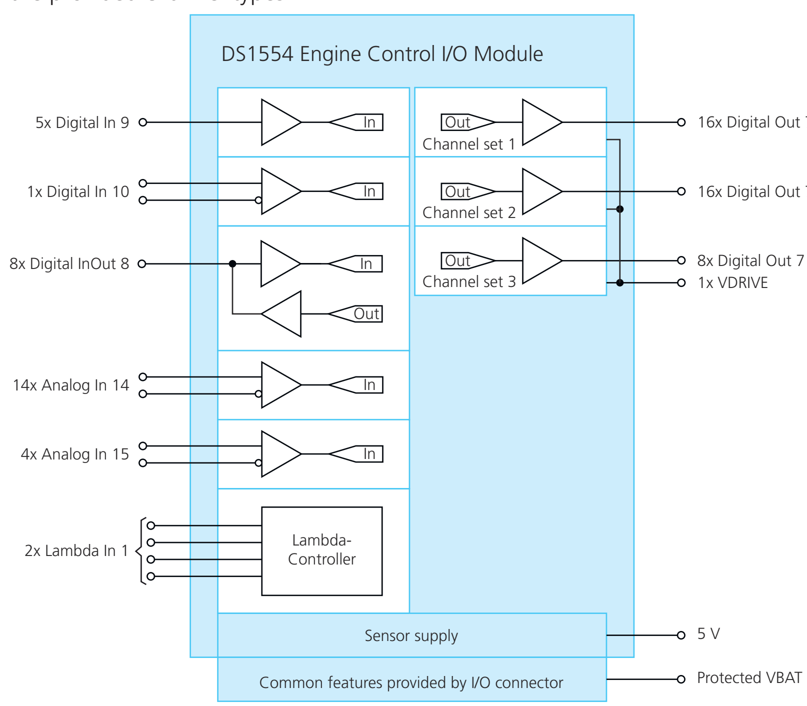
Related topics

References

Features of the DS1554 Engine Control I/O Module

Main features

The following block diagram provides a functional view of the main features and the provided channel types.



The following table shows you more details.

Feature	Description
Channels for signal measurement	▪ 5 digital input channels of the Digital In 9 channel type. For signal characteristics and mapping, refer to Digital In 9 Characteristics on page 456. ▪ 1 digital input channel of the Digital In 10 channel type. For signal characteristics and mapping, refer to Digital In 10 Characteristics on page 458. ▪ 14 analog input channels of the Analog In 14 channel type. For signal characteristics and mapping, refer to Analog In 14 Characteristics on page 451.

Feature	Description
	▪ 4 analog input channels of the Analog In 15 channel type. For signal characteristics and mapping, refer to Analog In 15 Characteristics on page 454. ▪ 2 interfaces of the Lambda In 1 channel type. For signal characteristics and mapping, refer to Lambda In 1 Characteristics on page 466.
Channels for signal generation	▪ 40 digital output channels of the Digital Out 7 channel type. For signal characteristics and mapping, refer to Digital Out 7 Characteristics on page 462.
Bidirectional channels	▪ 8 digital channels of the Digital In/Out 8 channel type. For signal characteristics and mapping, refer to Digital In/Out 8 Characteristics on page 459.
Supply outputs	▪ 5 V sensor supply to supply sensors or to drive the digital I/O circuits of the Digital Out 7 channel type. For signal characteristics and mapping, refer to DS1554 Sensor Supply Characteristics on page 469. ▪ Protected VBAT ($VBAT_{prot}$) to drive the digital I/O circuits of the DS1554 Engine Control I/O Module with an automotive-compatible voltage level. For signal characteristics and mapping, refer to VBATprot Characteristics on page 470.
Supply inputs	Drive voltage input for the digital I/O circuits of the Digital Out 7 channel type (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level. For signal characteristics and mapping, refer to DS1554 VDRIVE Input Characteristics on page 468.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the DS1554 Engine Control I/O Module.

Function Block Type	Purpose	Channel Type
Basic I/O		
Voltage In	The Voltage In function block type digitizes analog voltage signals coming from an external device.	Analog In 14
Multi Bit In	The Multi Bit In function block type lets you measure digital signals coming from an external device.	Digital In/Out 8
Multi Bit Out	The Multi Bit Out function block type lets you stimulate digital inputs of an external device.	▪ Digital In/Out 8 ▪ Digital Out 7
PWM/PFM Out	The PWM/PFM Out function block type can be used to generate one-phase pulse-width modulated signals and frequency output signals.	▪ Digital In/Out 8 ▪ Digital Out 7
PWM/PFM In	With the PWM/PFM In function block, you can measure one-phase pulse-width-modulated signal patterns.	Digital In/Out 8
Engine I/O		
Crank In	The Crank In function block type lets you measure the crankshaft of a piston engine and calculates the current position, speed and rotational direction of the engine. For performing these measurements, the	▪ Digital In 9 ▪ Digital In 10

Function Block Type	Purpose	Channel Type
	Crank In function block must be used in combination with at least one Cam In function block.	
Cam In	The Cam In function block type lets you measure the phase shift angle between a camshaft and the coupled crankshaft. Cam In must be used with the Crank In function block for synchronizing with the provided master APU and to evaluate the current engine position.	▪ Digital In 9 ▪ Digital In 10
Ignition Out	The Ignition Out function block type lets you generate ignition pulses for a real piston engine.	▪ Digital In/Out 8 ▪ Digital Out 7
Injection Out	The Injection Out function block type lets you generate injection pulses for a real piston engine.	▪ Digital In/Out 8 ▪ Digital Out 7
Knock In	The Knock In function block lets you analyze the noise of a piston engine to avoid/minimize preignitions caused by improper ignition timing.	Analog In 15
Engine Angular Pulse Out	The Engine Angular Pulse Out function block generates a periodic pulse pattern based on engine position data retrieved from an assigned master APU provider. The generated pulse pattern can be used, for example, for starting A/D conversions.	▪ Digital In/Out 8 ▪ Digital Out 7

Lambda Probe In	The Lambda Probe In function block lets you control LSU 4.9 and LSU ADV wideband lambda probes.	▪ Lambda In 1
		▪ For the heater control, one of the following channel types:
		  ▪ Digital In/Out 8
		  ▪ Digital Out 7

Custom Functions		
FPGA Custom Function	FPGA custom function blocks contain the functionality of an FPGA application that must be defined with the RTI FPGA Programming Blockset.	All channel types

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide.

Related topics

Basics

References

Connector Pinouts

Where to go from here

Information in this section

DS1514 ZIF I/O Connector Pinout (DS1554)

Purpose

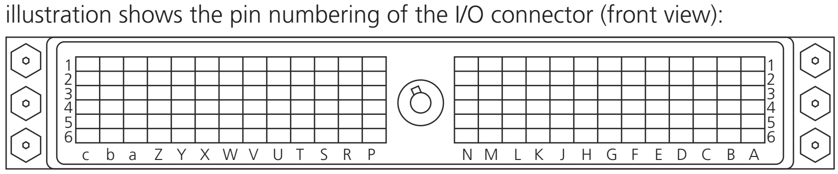
Connector to provide access to I/O channels of the DS1554 I/O Board, in addition to the I/O channels for engine control applications.

Pinout

Note

- There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).
- To use the digital I/O channels of the **Digital Out 7** channel type, you have to connect the VDRIVE pin according to the required logic level. For more information, refer to Driving the Digital Out 7 Channels of the DS1554 on page 142.

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of the I/O connector:

1	2	3	4	5	6	
GND	Digital Out 7-2 Channel 30 Signal	Digital Out 7-2 Channel 27 Signal	GND	Digital Out 7-2 Channel 31 Signal	Digital Out 7-2 Channel 26 Signal	*A*
GND	Digital Out 7-2 Channel 32 Signal	Digital Out 7-2 Channel 19 Signal	GND	Digital Out 7-2 Channel 23 Signal	Digital Out 7-2 Channel 29 Signal	*B*
GND	Digital Out 7-2 Channel 22 Signal	Digital Out 7-1 Channel 11 Signal	GND	Digital Out 7-1 Channel 15 Signal	IP slot 1, pin 5	*C*
GND	Digital Out 7-2 Channel 28 Signal	Digital Out 7-1 Channel 3 Signal	GND	Digital Out 7-1 Channel 7 Signal	Digital Out 7-2 Channel 25 Signal	*D*

1	2	3	4	5	6	
GND	Digital Out 7-2 Channel 18 Signal	Digital Out 7-3 Channel 35 Signal	GND	Digital Out 7-3 Channel 36 Signal	Digital Out 7-2 Channel 21 Signal	*E*
GND	Digital Out 7-2 Channel 24 Signal	Digital Out 7-3 Channel 40 Signal	GND	Digital Out 7-3 Channel 33 Signal	Digital Out 7-2 Channel 17 Signal	*F*
GND	Digital Out 7-2 Channel 20 Signal	Digital Out 7-3 Channel 39 Signal	GND	IP slot 1, pin 14	Digital Out 7-1 Channel 13 Signal	*G*
GND	Digital Out 7-1 Channel 14 Signal	Digital Out 7-3 Channel 37 Signal	GND	IP slot 1, pin 16	IP slot 1, pin 15	*H*
GND	Digital Out 7-1 Channel 16 Signal	IP slot 1, pin 44	GND	IP slot 1, pin 18	IP slot 1, pin 17	*J*
GND	Digital Out 7-1 Channel 10 Signal	IP slot 1, pin 46	IP slot 1, pin 45	IP slot 1, pin 20	IP slot 1, pin 19	*K*
GND	Digital Out 7-1 Channel 12 Signal	IP slot 1, pin 48	GND	Digital Out 7-1 Channel 1 Signal	Digital Out 7-1 Channel 9 Signal	*L*
VDRIVE Supply Input	Digital Out 7-1 Channel 8 Signal	IP slot 1, pin 50	IP slot 1, pin 49	Digital Out 7-3 Channel 38 Signal	Digital Out 7-1 Channel 5 Signal	*M*
VDRIVE Supply Input	Digital Out 7-1 Channel 2 Signal	Digital Out 7-1 Channel 6 Signal	GND	Digital Out 7-1 Channel 4 Signal	Digital Out 7-2 Channel 34 Signal	*N*
VBATprot Supply Output	Analog In 14 Channel 14 -	Analog In 14 Channel 14 +	GND	Analog In 14 Channel 13 +	Analog In 14 Channel 13 -	*P*
VBATprot Supply Output	Analog In 14 Channel 3 -	Analog In 14 Channel 12 -	GND	Analog In 14 Channel 11 +	Analog In 14 Channel 11 -	*R*
GND	Analog In 14 Channel 3 +	Analog In 14 Channel 12 +	GND	Analog In 14 Channel 9 +	IP slot 2, pin 5	*S*
GND	Analog In 14 Channel 4 +	Analog In 14 Channel 7 +	GND	Analog In 14 Channel 10 +	Analog In 14 Channel 9 -	*T*
GND	Analog In 14 Channel 4 -	Analog In 14 Channel 7 -	GND	Analog In 14 Channel 8 +	Analog In 14 Channel 10 -	*U*
GND	Analog In 14 Channel 1 -	Analog In 14 Channel 6 -	GND	Analog In 14 Channel 5 +	Analog In 14 Channel 8 -	*V*
GND	Analog In 14 Channel 1 +	Analog In 14 Channel 6 +	GND	IP slot 2, pin 14	Analog In 14 Channel 5 -	*W*
GND	Analog In 14 Channel 2 -	GND	GND	IP slot 2, pin 16	IP slot 2, pin 15	*X*
GND	Analog In 14 Channel 2 +	IP slot 2, pin 44	GND	IP slot 2, pin 18	IP slot 2, pin 17	*Y*
GND	Digital In/Out 8 Channel 8 Signal	IP slot 2, pin 46	IP slot 2, pin 45	IP slot 2, pin 20	IP slot 2, pin 19	*Z*
GND	Digital In/Out 8 Channel 7 Signal	IP slot 2, pin 48	GND	GND	GND	*a*

1	2	3	4	5	6	
GND	Digital In/Out 8 Channel 3 Signal	IP slot 2, pin 50	IP slot 2, pin 49	Digital In/Out 8 Channel 2 Signal	VSENS+	*b*
GND	Digital In/Out 8 Channel 6 Signal	Digital In/Out 8 Channel 1 Signal	Digital In/Out 8 Channel 5 Signal	Digital In/Out 8 Channel 4 Signal	VSENS-	*c*

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
Analog I/O		
Analog In 14	Differential input to measure analog signals in the range -10 V ... +10 V. Signal naming: ▪ Positive input: + ▪ Negative input: -	Analog In 14 Characteristics on page 451
Digital I/O		
Digital In/Out 8	Bidirectional channel type to measure and generate digital signals.	Digital In/Out 8 Characteristics on page 459
Digital Out 7	Output to generate digital signals. Signal naming: Digital Out 7-n for channel set 1 … 3	Digital Out 7 Characteristics on page 462
Supply Inputs and Outputs		
VDRIVE	Drive voltage input for the digital I/O circuits of the **Digital Out 7** channel type (VDRIVE).	DS1554 VDRIVE Input Characteristics on page 468
VSENS	Provides a 5 V supply voltage.	DS1554 Sensor Supply Characteristics on page 469
VBATprot	Protected supply voltage with an automotive-compatible voltage level.	VBATprot Characteristics on page 470
Ground Potentials		
GND	Common ground for all signals. GND is also connected to the housing of MicroAutoBox III.	-

Related topics

Basics

Driving the Digital Out 7 Channels of the DS1554 142

DS1554 Sub-D I/O Connector Pinout

Purpose

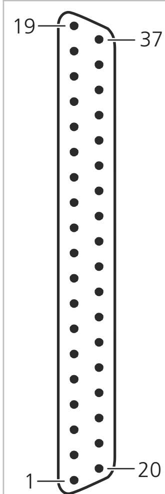
Connector to provide access to the I/O signals for engine control applications.

Pinout

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 DS1554 Sub-D I/O connector is a 37-pin male Sub-D connector. The following illustration shows the pin numbering of the I/O connector (front view):

DS1554 Sub-D I/O Connector	**Pin**	**Signal**	**Pin**	**Signal**
	19	Analog In 15 Channel 4 +		
	18	Analog In 15 Channel 3 +	37	Analog In 15 Channel 4 -
	17	Analog In 15 Channel 2 +	36	Analog In 15 Channel 3 -
	16	Analog In 15 Channel 1 +	35	Analog In 15 Channel 2 -
	15	Digital In 9 GND	34	Analog In 15 Channel 1 -
	14	Digital In 9 Channel 3 Signal	33	Digital In 9 Channel 4 Signal
	13	Digital In 9 Channel 1 Signal	32	Digital In 9 Channel 2 Signal
	12	Digital In 9 Channel 5 Signal	31	Reserved[1]
	11	Digital In 9 GND	30	Reserved[1]
	10	Digital In 10 +	29	Digital In 10 -
	9	Reserved[1]	28	Reserved[1]
	8	Reserved[1]	27	Reserved[1]
	7	Reserved[1]	26	Reserved[1]
	6	Reserved[1]	25	Reserved[1]
	5	Lambda In 1 Channel 2 IPE	24	Lambda In 1 Channel 2 RE
	4	Lambda In 1 Channel 2 MES	23	Lambda In 1 Channel 2 APE
	3	Lambda In 1 Channel 1 IPE	22	Lambda In 1 Channel 1 RE
	2	Lambda In 1 Channel 1 MES	21	Lambda In 1 Channel 1 APE
	1	Reserved[1]	20	Reserved[1]

[1] Do not connect.

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description	Characteristics
Analog I/O		
Analog In 15	Differential input to measure analog knock signals.	Analog In 15 Characteristics on page 454
Digital I/O		
Digital In 9	Input to measure signals of crankshaft and camshaft sensors with a common signal ground.	Digital In 9 Characteristics on page 456
Digital In 10	Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in crankshaft sensors.	Digital In 10 Characteristics on page 458
Lambda Interface		
Lambda In 1	Interface to monitor Lambda probes.	Lambda In 1 Characteristics on page 466

Related topics

References

Analog Interface Characteristics

Where to go from here

Information in this section

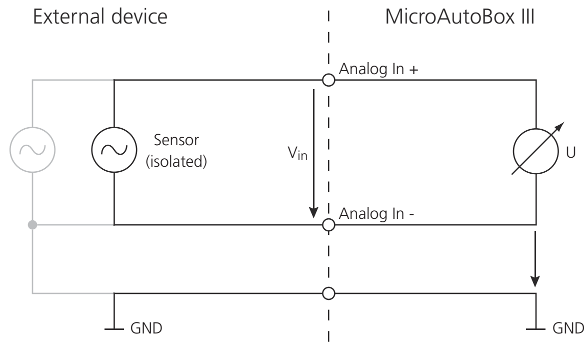
Analog In 14 Characteristics

Purpose

Differential input to measure analog signals in the range -10 V ... +10 V.

Circuit diagram

Simplified circuit diagram of the Analog In 14 channel type.



Analog In 14 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Voltage In ▪ FPGA custom function[2)]
Number of channels	-	14
Input voltage range	V_{in}	-10 V ... +10 V
Resolution	-	16 bit
No missing codes	-	15 bit
Offset error	-	-3 mV ... +3 mV below 750 kS/s
Offset drift	-	Typ. ±40 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 100 kΩ
Sample rate	f_s	Max. 1 MS/s
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth

Parameter	Symbol	Specification[1)
Protected voltage range (short-term)	$V_{in\{prot\}}$	-50 V ... +50 V
Protected voltage range (continuous)	$V_{in\{prot\}}$	-30 V ... +30 V

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Analog In 14 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Analog In 14 Channel 1 +	W2
Analog In 14 Channel 1 -	V2
Analog In 14 Channel 2 +	Y2
Analog In 14 Channel 2 -	X2
Analog In 14 Channel 3 +	S2
Analog In 14 Channel 3 -	R2
Analog In 14 Channel 4 +	T2
Analog In 14 Channel 4 -	U2
Analog In 14 Channel 5 +	V5
Analog In 14 Channel 5 -	W6
Analog In 14 Channel 6 +	W3
Analog In 14 Channel 6 -	V3
Analog In 14 Channel 7 +	T3
Analog In 14 Channel 7 -	U3
Analog In 14 Channel 8 +	U5
Analog In 14 Channel 8 -	V6
Analog In 14 Channel 9 +	S5
Analog In 14 Channel 9 -	T6
Analog In 14 Channel 10 +	T5
Analog In 14 Channel 10 -	U6
Analog In 14 Channel 11 +	R5
Analog In 14 Channel 11 -	R6
Analog In 14 Channel 12 +	S3
Analog In 14 Channel 12 -	R3
Analog In 14 Channel 13 +	P5
Analog In 14 Channel 13 -	P6

Signal	DS1514 ZIF I/O Connector Pin
Analog In 14 Channel 14 +	P3
Analog In 14 Channel 14 -	P2
Signal Reference	
GND[1)]	A1, A4, B1, B4, C1, C4, D1, D4, E1, E4, F1, F4, G1, G4, H1, H4, J1, J4, K1, L1, L4, N4, P4, R4, S1, S4, T1, T4, U1, U4, V1, V4, W1, W4, X1, X3, X4, Y1, Y4, Z1, a1, a4, a5, a6, b1, c1

1) Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1554) on page 446.

Related topics

References

Features of the DS1554 Engine Control I/O Module..443

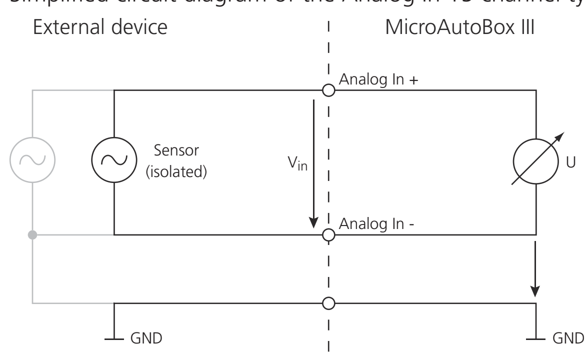
Analog In 15 Characteristics

Purpose

Differential input to measure analog knock signals.

Circuit diagram

Simplified circuit diagram of the Analog In 15 channel type.



Analog In 15 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.

- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Knock In ▪ FPGA custom function[2]
Number of channels	-	4
Input voltage range	V_{in}	-5 V ... +5 V
Resolution	-	16 bit
No missing codes	-	15 bit
Offset error	-	-1.5 mV ... +1.5 mV below 750 kS/s
Offset drift	-	Typ. ±20 µV/K
Gain error	-	-0.25% ... +0.25% below 750 kS/s
Gain drift	-	Typ. ±6 ppm/K
Signal-to-noise ratio	SNR	Min. 80 dB at 12.4 kHz and f_s = 200 kS/s
Channel crosstalk	-	▪ -96 dB at 100 kHz ▪ -92 dB at 200 kHz ▪ -90 dB at 400 kHz
Input resistance	R_{in}	Typ. 100 kΩ
Sample rate	f_s	Max. 1 MS/s
-3 dB cutoff frequency	f_{-3dB}	Min. 400 kHz full-power bandwidth

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1554 SUB-D I/O connector that provide the signals of the Analog In 15 channel type.

Signal	DS1554 SUB-D I/O connector Pin
Analog In 15 Channel 1 +	16
Analog In 15 Channel 1 -	34
Analog In 15 Channel 2 +	17
Analog In 15 Channel 2 -	35
Analog In 15 Channel 3 +	18
Analog In 15 Channel 3 -	36
Analog In 15 Channel 4 +	19
Analog In 15 Channel 4 -	37

For the complete pinout, refer to DS1554 Sub-D I/O Connector Pinout on page 449.

Related topics

References

Features of the DS1554 Engine Control I/O Module......443

Digital Interface Characteristics

Where to go from here

Information in this section

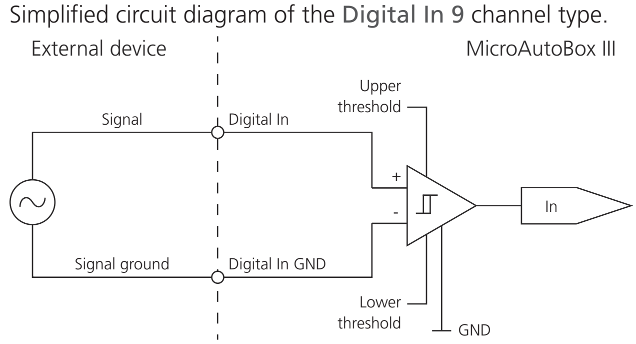
Digital In 9 Characteristics

Purpose

Input to measure signals of crankshaft and camshaft sensors with a common signal ground.

Circuit diagram

Simplified circuit diagram of the Digital In 9 channel type.



Digital In 9 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Crank In ▪ Cam In ▪ FPGA custom function[2)]
Number of channels	-	5
Input voltage range	V_{in}	-40 V …+60 V
Input threshold voltage range	V_{th}	-40 V …+40 V, upper and lower threshold
Threshold voltage accuracy	-	(-1% of V_{th} - 100 mV) … (+1% of V_{th} + 100 mV), upper and lower threshold
-3 dB cutoff frequency	f_{-3dB}	Typ. 320 kHz
Input resistance	R_{in}	Typ. 170 kΩ

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

2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1554 Sub-D I/O connector that provide the signals of the Digital In 9 channel type.

Signal	DS1554 Sub-D I/O Connector Pin
Digital In 9 Channel 1 Signal	13
Digital In 9 Channel 2 Signal	32
Digital In 9 Channel 3 Signal	14
Digital In 9 Channel 4 Signal	33
Digital In 9 Channel 5 Signal	12
Signal Reference	
Digital In 9 GND	11, 15

For the complete pinout, refer to DS1554 Sub-D I/O Connector Pinout on page 449.

Related topics

References

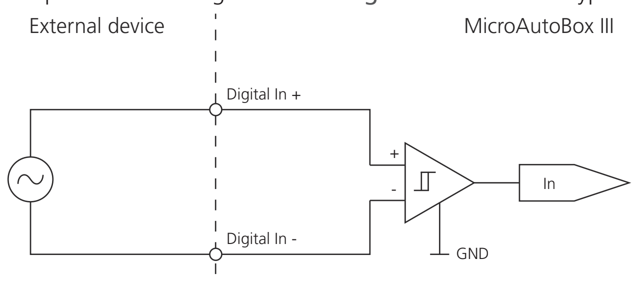
Digital In 10 Characteristics

Purpose

Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in crankshaft sensors.

Circuit diagram

Simplified circuit diagram of the Digital In 10 channel type.



Digital In 10 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Crank In ▪ Cam In ▪ FPGA custom function[2]
Number of channels	-	1
Input voltage range DC	V_{in}	-60 V DC … +60 V DC
-3 dB cutoff frequency	f_{-3dB}	Typ. 30 kHz
Input resistance	R_{in}	Typ. 67 kΩ

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Signal mapping

The following table shows the connector pins of the DS1554 Sub-D I/O connector that provide the signals of the Digital In 10 channel type.

Signal	DS1554 Sub-D I/O Connector Pin
Digital In 10 +	10
Digital In 10 -	29

For the complete pinout, refer to DS1554 Sub-D I/O Connector Pinout on page 449.

Related topics

References

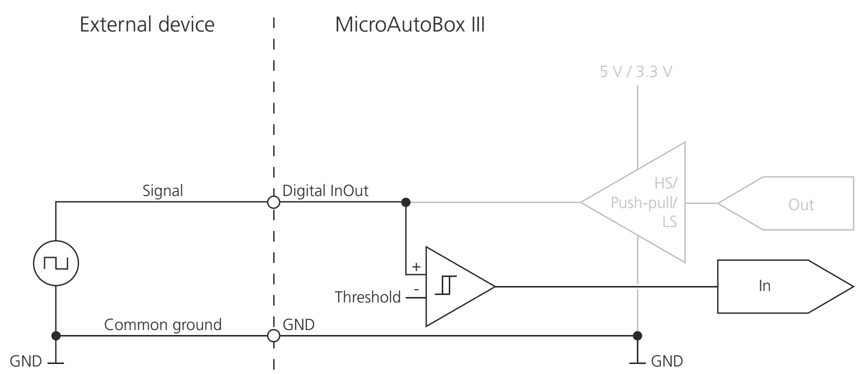
Digital In/Out 8 Characteristics

Purpose

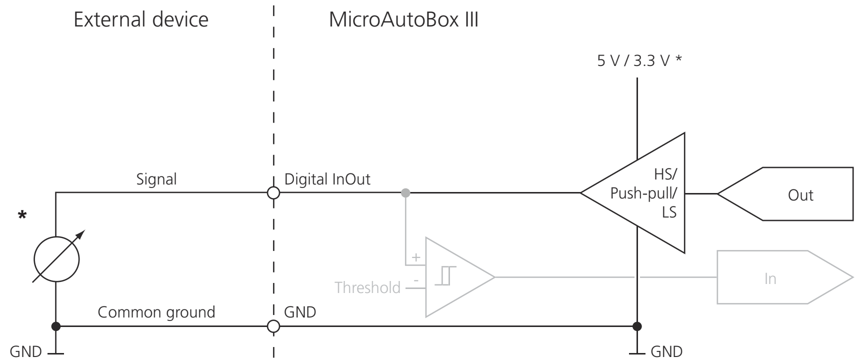
Bidirectional channel type to measure and generate digital signals.

Circuit diagram

Simplified circuit diagram of the Digital In/Out 8 channel type used for measurement.



Simplified circuit diagram of the **Digital In/Out 8** channel type used for signal generation.



* A high reference potential of 3.3 V is supported only if you use the FPGA Programming Blockset.

Digital In/Out 8 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1)]
Supported function blocks	-	▪ Multi Bit In ▪ Multi Bit Out ▪ PWM/PFM In ▪ PWM/PFM Out ▪ Ignition Out ▪ Injection Out ▪ Engine Angular Pulse Out ▪ FPGA custom function[2)]
Number of channels	-	8
Protected voltage range	V_{prot}	-50 V … +50 V
Input Characteristics		
Input voltage range	V_{in}	0 V … 15 V
Input high voltage	V_{ih}	(V_{th} + 0.5 · V_{hys}) … 15 V
Input low voltage	V_{il}	0 V … (V_{th} - 0.5 · V_{hys})
Input hysteresis voltage	V_{hys}	Typ. 0.7 V
Input threshold voltage range	V_{th}	1.0 V … 7.5 V
Minimum input pulse width high/low	t_{min}	20 ns

Parameter	Symbol	Specification[1]
Maximum input frequency[3]	f_{max}	25 MHz at 5 V logic level, 50% duty cycle and 2.5 V threshold
Input resistance	R_{in}	Typ. 100 kΩ
Output Characteristics		
Output high voltage	V_{oh}	▪ 5 V logic level: Min. 4.6 V at I_{out} = 10 mA ▪ 3.3 V logic level: Min. 2.8 V at I_{out} = 10 mA 3.3 V logic level is supported only if you use the RTI FPGA Programming Blockset.
Output low voltage	V_{ol}	Typ. 0.2 V at I_{out} = -10 mA
Working current range	I_{out}	-10 mA … +10 mA
Output current limit high	I_{olim}	Min. 45 mA, max. 75 mA
Output current limit low	I_{olim}	Min. -45 mA, max. -75 mA
Minimum output pulse width high/low	t_{min}	12.5 ns
Maximum output frequency[4]	f_{max}	40 MHz at 100 pF capacitive load

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.
3) The maximum frequency that is supported by the PWM/PFM In function block in ConfigurationDesk is limited to 1 MHz.
4) The maximum frequency that is supported by the PWM/PFM Out function block in ConfigurationDesk is limited to 150 kHz.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital In/Out 8 channel type.

Signal	DS1514 ZIF I/O Connector Pin
Digital In/Out 8 Channel 1 Signal	c3
Digital In/Out 8 Channel 2 Signal	b5
Digital In/Out 8 Channel 3 Signal	b2
Digital In/Out 8 Channel 4 Signal	c5
Digital In/Out 8 Channel 5 Signal	c4
Digital In/Out 8 Channel 6 Signal	c2
Digital In/Out 8 Channel 7 Signal	a2
Digital In/Out 8 Channel 8 Signal	Z2
Signal Reference	
GND[1]	A1, A4, B1, B4, C1, C4, D1, D4, E1, E4, F1, F4, G1, G4, H1, H4, J1, J4, K1, L1, L4, N4, P4, R4, S1, S4, T1, T4, U1,

Signal	DS1514 ZIF I/O Connector Pin
	U4, V1, V4, W1, W4, X1, X3, X4, Y1, Y4, Z1, a1, a4, a5, a6, b1, c1

[1] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1554) on page 446.

Related topics

References

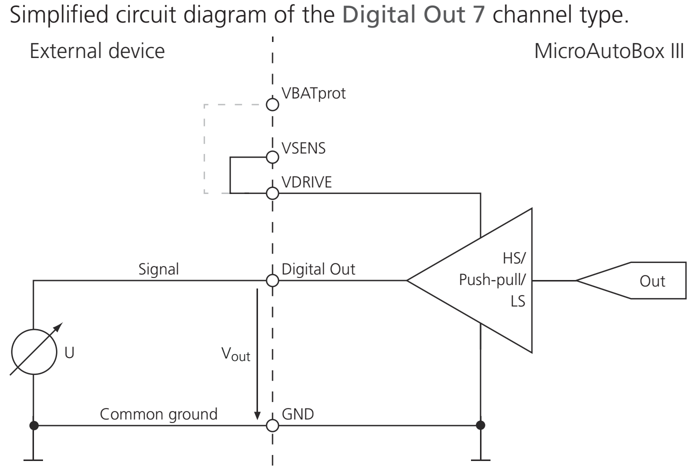
Digital Out 7 Characteristics

Purpose

Output to generate digital signals.

Circuit diagram

Simplified circuit diagram of the Digital Out 7 channel type.



Note

To use the digital I/O channels of the Digital Out 7 channel type, you have to connect the VDRIVE pin according to the required logic level.
For more information, refer to Driving the Digital Out 7 Channels of the DS1554 on page 142.

General behavior of digital signals

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

Digital Out 7 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C (+77 °F)
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply functional operation.

Parameter	Symbol	Specification[1]
Supported function blocks	-	▪ Multi Bit Out ▪ PWM/PFM Out ▪ Ignition Out ▪ Injection Out ▪ Engine Angular Pulse Out ▪ FPGA custom function[2]
Number of channels	-	40, divided into 3 channel sets
Output high voltage	V_{oh}	VDRIVE = 5 V ▪ Min. 4.1 V, typ. 4.3 V at I_{out} = 0 mA ▪ Min. 3.2 V, typ. 3.4 V at I_{out} = 5 mA VDRIVE = 12 V ▪ Min. 11.0 V, typ. 11.2 V at I_{out} = 0 mA ▪ Min. 10.1 V, typ. 10.3 V at I_{out} = 5 mA
Output low voltage	V_{ol}	▪ Max. 0.3 V, typ. 0.1 V at I_{out} = 0 mA ▪ Max. 0.9 V, typ. 0.7 V at I_{out} = -5 mA
Working current range	$I_{out\{work\}}$	-5 mA ... +5 mA
Output current limit high	$I_{oh\{lim\}}$	Typ. 13 mA
Output current limit low	$I_{ol\{lim\}}$	Typ. -14 mA
Minimum output pulse width high	$t_{HighMin}$	Typ. 700 ns
Minimum output pulse width low	t_{LowMin}	Typ. 200 ns
Maximum output frequency[3]	f_{max}	▪ Typ. 700 kHz at duty cycle = 50% ▪ Typ. 14 kHz at duty cycle = 1% (99%)
Leakage current tristate	I_{leak}	Max. 100 µA
Protected voltage range	V_{prot}	(VDRIVE - 45 V) ... +45 V

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

[2] FPGA custom function blocks contain the functionality of a custom FPGA application that must be defined with the RTI FPGA Programming Blockset.

Parameter	Symbol	Specification[1]

[3] The maximum frequency that is supported by function blocks of ConfigurationDesk is limited to 150 kHz.

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the Digital Out 7 channel type.

Signal	Channel Set[1]	DS1514 ZIF I/O Connector Pin
Digital Out 7-1 Channel 1 Signal	1	L5
Digital Out 7-1 Channel 2 Signal	1	N2
Digital Out 7-1 Channel 3 Signal	1	D3
Digital Out 7-1 Channel 4 Signal	1	N5
Digital Out 7-1 Channel 5 Signal	1	M6
Digital Out 7-1 Channel 6 Signal	1	N3
Digital Out 7-1 Channel 7 Signal	1	D5
Digital Out 7-1 Channel 8 Signal	1	M2
Digital Out 7-1 Channel 9 Signal	1	L6
Digital Out 7-1 Channel 10 Signal	1	K2
Digital Out 7-1 Channel 11 Signal	1	C3
Digital Out 7-1 Channel 12 Signal	1	L2
Digital Out 7-1 Channel 13 Signal	1	G6
Digital Out 7-1 Channel 14 Signal	1	H2
Digital Out 7-1 Channel 15 Signal	1	C5
Digital Out 7-1 Channel 16 Signal	1	J2
Digital Out 7-2 Channel 17 Signal	2	F6
Digital Out 7-2 Channel 18 Signal	2	E2
Digital Out 7-2 Channel 19 Signal	2	B3
Digital Out 7-2 Channel 20 Signal	2	G2
Digital Out 7-2 Channel 21 Signal	2	E6
Digital Out 7-2 Channel 22 Signal	2	C2
Digital Out 7-2 Channel 23 Signal	2	B5
Digital Out 7-2 Channel 24 Signal	2	F2
Digital Out 7-2 Channel 25 Signal	2	D6
Digital Out 7-2 Channel 26 Signal	2	A6
Digital Out 7-2 Channel 27 Signal	2	A3
Digital Out 7-2 Channel 28 Signal	2	D2
Digital Out 7-2 Channel 29 Signal	2	B6
Digital Out 7-2 Channel 30 Signal	2	A2
Digital Out 7-2 Channel 31 Signal	2	A5

Signal	Channel Set[1]	DS1514 ZIF I/O Connector Pin
Digital Out 7-2 Channel 32 Signal	2	B2
Digital Out 7-3 Channel 33 Signal	3	F5
Digital Out 7-3 Channel 34 Signal	3	N6
Digital Out 7-3 Channel 35 Signal	3	E3
Digital Out 7-3 Channel 36 Signal	3	E5
Digital Out 7-3 Channel 37 Signal	3	H3
Digital Out 7-3 Channel 38 Signal	3	M5
Digital Out 7-3 Channel 39 Signal	3	G3
Digital Out 7-3 Channel 40 Signal	3	F3
Signal Reference		
GND[2]	-	A1, A4, B1, B4, C1, C4, D1, D4, E1, E4, F1, F4, G1, G4, H1, H4, J1, J4, K1, L1, L4, N4, P4, R4, S1, S4, T1, T4, U1, U4, V1, V4, W1, W4, X1, X3, X4, Y1, Y4, Z1, a1, a4, a5, a6, b1, c1
Digital I/O Interface Supply		
VBATprot	-	P1, R1
VSENS+	-	b6
VSENS-	-	c6
VDRIVE	-	M1, N1

[1] The digital channels are divided into three channel sets. I/O channels can be assigned to function blocks only within one channel set. This ensures data consistency.
[2] Common ground for all digital signals. Connect a separate signal ground line to GND for each digital signal to minimize noise levels.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1554) on page 446.

Related topics

Basics

References

Lambda Interface Characteristics

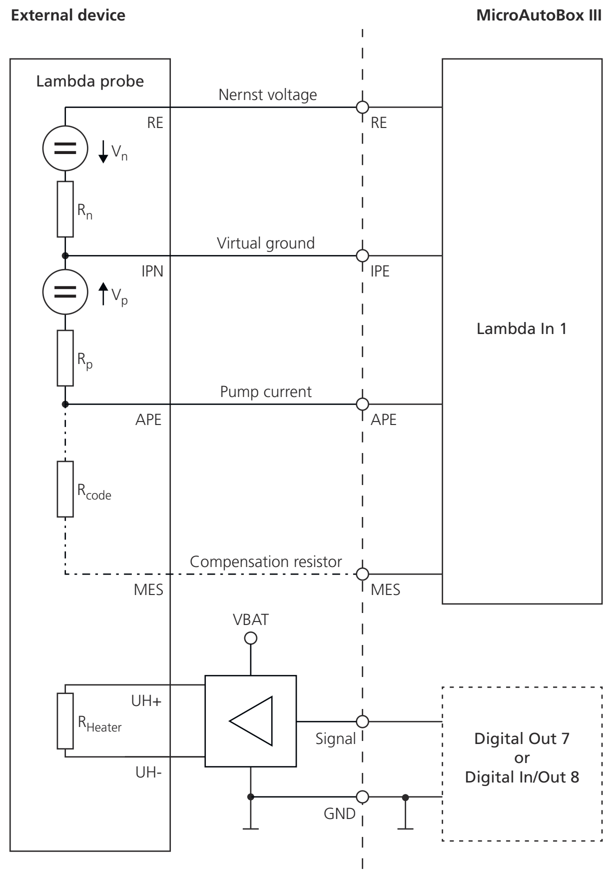
Lambda In 1 Characteristics

Purpose

Interface to monitor Lambda probes.

Circuit diagram

Simplified circuit diagram of the Lambda In 1 channel type.



V_n : Nernst cell voltage
R_n : Nernst cell resistance
V_p : Pump cell voltage
R_p : Pump cell resistance
R_{code} : Compensation resistor

Driving the heater of the probe The heater of the probe must be driven by an external driver, such as a suitable RapidPro power stage module. The driver is controlled by a digital output of the DS1554 Engine Control I/O Module.

Lambda In 1 characteristics

Parameter	Specification
Supported function blocks	Lambda Probe In
Number of channels	2
Supported lambda probes[1]	▪ LSU 4.9 ▪ LSU ADV

[1] The **Lambda Probe In** function block lets you select the lambda probe. Refer to Lambda Probe In (ConfigurationDesk I/O Function Implementation Guide 📖).

Signal mapping

The following table shows the connector pins of the DS1554 Sub-D I/O connector that provide the signals of the Lambda In 1 channel type.

Signal	DS1554 Sub-D I/O Connector Pin
Lambda In 1 Channel 1 RE	22
Lambda In 1 Channel 1 IPE	3
Lambda In 1 Channel 1 APE	21
Lambda In 1 Channel 1 MES	2
Lambda In 1 Channel 2 RE	24
Lambda In 1 Channel 2 IPE	5
Lambda In 1 Channel 2 APE	23
Lambda In 1 Channel 2 MES	4

For the complete pinout, refer to DS1554 Sub-D I/O Connector Pinout on page 449.

Related topics

References

Supply Voltage Characteristics

Where to go from here

Information in this section

DS1554 VDRIVE Input Characteristics

Purpose

Drive voltage input for the digital I/O circuits of the Digital Out 7 channel type (VDRIVE). By connecting a voltage supply, you adapt the logic level of the digital I/O channels to the provided voltage level.

VDRIVE characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Input voltage range	4.5 V … 40 V
Protected input voltage	Max. 45 V, no protection against load dump and reverse voltage.
Input current	▪ Typ. 20 mA if all digital inputs/outputs are disconnected. ▪ Up to 1 A, depending on the application.

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the VDRIVE input.

Signal	DS1514 ZIF I/O Connector Pin
VDRIVE	M1, N1
Signal Reference	
GND[1]	A1, A4, B1, B4, C1, C4, D1, D4, E1, E4, F1, F4, G1, G4, H1, H4, J1, J4, K1, L1, L4, N4, P4, R4, S1, S4, T1, T4, U1, U4, V1, V4, W1, W4, X1, X3, X4, Y1, Y4, Z1, a1, a4, a5, a6, b1, c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1554) on page 446.

Related topics

References

DS1554 Sensor Supply Characteristics

Purpose

Provides a 5 V supply voltage.

Sensor supply characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- All voltages are referenced to VSENS-.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter		Specification[1)]
Output voltage	V_{out}	4.84 V ... 5.25 V, typ. 5.05 V
Temperature-caused voltage drift	-	-2% ... 2% for the complete operating temperature range
Output current limit	$I_{out(prot)}$	400 mA
On/off behavior	-	Switched on and off with MicroAutoBox III.

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the sensor supply.

Note

For information on supplying sensors, refer to Connecting Sensors to the DS1554 on page 144.

Signal	DS1514 ZIF I/O Connector Pin
VSENS+	b6
VSENS-	c6

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1554) on page 446.

Related topics

References

VBATprot Characteristics

Purpose

Protected supply voltage with an automotive-compatible voltage level.

VBATprot characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1]
Output voltage	▪ VBATprot follows VBAT within the operating voltage range of the MicroAutoBox III. ▪ With I_{load} = 1 A and VBAT = 12 V: 11.56 V ... 12.00 V, typ. 11.78 V
Working current range	0 A ... 1 A
Output current limit	▪ 4 A ... 9 A for the complete operating temperature range ▪ Shut off after max. 5 ms
On/off behavior	Switched on and off with the MicroAutoBox III

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the protected VBAT voltage.

Signal	DS1514 ZIF I/O Connector Pin
VBATprot	P1, R1
Signal Reference	
GND[1]	A1, A4, B1, B4, C1, C4, D1, D4, E1, E4, F1, F4, G1, G4, H1, H4, J1, J4, K1, L1, L4, N4, P4, R4, S1, S4, T1, T4, U1, U4, V1, V4, W1, W4, X1, X3, X4, Y1, Y4, Z1, a1, a4, a5, a6, b1, c1

[1] Common ground for all signals.

For the complete pinout, refer to DS1514 ZIF I/O Connector Pinout (DS1554) on page 446.

Related topics

References

DS4340 FlexRay Interface Module Data Sheet

Where to go from here

Information in this section

Features of the DS4340 FlexRay Interface Module

Main feature

The DS4340 FlexRay Interface Module supports FlexRay protocol specification 2.1 and is downward compatible with previous standards. It provides a switchable termination circuit and feed-through lines.

For signal characteristics, refer to FlexRay 3 Characteristics on page 475.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the channel types of the DS4340 FlexRay Interface Module.

Function Block Type	Purpose	Channel Type
Communication		
FlexRay	The FlexRay function block type is one part of implementing FlexRay communication in real-time applications. It lets you specify the hardware access for FlexRay communication and control the communication of the FlexRay network separately for each FlexRay controller and FlexRay channel (A and/or B). The FlexRay communication itself must be modeled and supplied via the dSPACE FlexRay Configuration Package (refer to Modeling a FlexRay Bus Interface (Model Interface Package for Simulink - Modeling Guide 🕮)).	FlexRay 3

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide 🕮.

Related topics

Basics

References

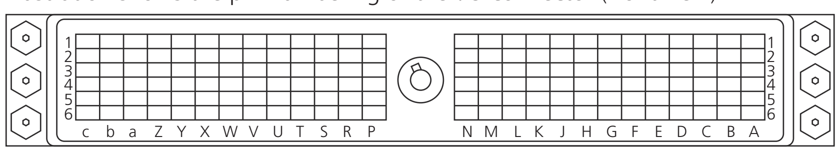
DS1514 ZIF I/O Connector Pinout (DS4340)

Purpose

Connector to provide access to all I/O channels of the installed DS4340 FlexRay Interface Modules.

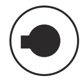
Pinout

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of two DS4340 FlexRay Interface Modules installed in the IP slots:

1	2	3	4	5	6	
-[1)]	-	-	-	-	-	*A*
-	-	-	-	-	-	*B*
-	-	-	-	-	Do not connect	*C*
-	-	-	-	-	-	*D*
-	-	-	-	-	-	*E*
-	-	-	-	-	-	*F*
-	-	-	-	Do not connect	-	*G*
-	-	-	-	FlexRay 3-1 VBAT	Do not connect	*H*
-	-	FlexRay 3-1 Ch. B GND	-	FlexRay 3-1 Ch. B- FT	FlexRay 3-1 Ch. B+ FT	*J*
-	-	FlexRay 3-1 Ch. B+	FlexRay 3-1 Ch. B-	FlexRay 3-1 Ch. A- FT	FlexRay 3-1 Ch. A+ FT	*K*
-	-	FlexRay 3-1 Ch. A GND	-	-	-	*L*
-	-	FlexRay 3-1 Ch. A+	FlexRay 3-1 Ch. A-	-	-	*M*

1	2	3	4	5	6	
-	-	-	-	-	-	*N*
						
-	-	-	-	-	-	*P*
-	-	-	-	-	-	*R*
-	-	-	-	-	Do not connect	*S*
-	-	-	-	-	-	*T*
-	-	-	-	-	-	*U*
-	-	-	-	-	-	*V*
-	-	-	-	Do not connect	-	*W*
-	-	-	-	FlexRay 3-2 VBAT	Do not connect	*X*
-	-	FlexRay 3-2 Ch. B GND	-	FlexRay 3-2 Ch. B- FT	FlexRay 3-2 Ch. B+ FT	*Y*
-	-	FlexRay 3-2 Ch. B+	FlexRay 3-2 Ch. B-	FlexRay 3-2 Ch. B- FT	FlexRay 3-2 Ch. A+ FT	*Z*
-	-	FlexRay 3-2 Ch. A GND	-	-	-	*a*
-	-	FlexRay 3-2 Ch. A+	FlexRay 3-2 Ch. A-	-	-	*b*
-	-	-	-	-	-	*c*

[1)] Signal of the DS155x I/O module.

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description
Communication Interfaces	
FlexRay 3	Interface to communicate via a FlexRay bus. The interface supports bus termination and feed-through. Signal naming: ▪ Bus line plus: + ▪ Bus line minus: - ▪ Feed-through lines: FT ▪ Module number: FlexRay 3-1 for module 1 or FlexRay 3-2 for module 2
Supply Inputs and Outputs	
FlexRay 3-n VBAT	Supply input to support the wake-up functionality.
Ground Potentials	
FlexRay 3-n GND	GND of the FlexRay bus.

Signal	Description
I/O Signals of the DS1552/DS1554	
-	Pinouts of the I/O modules: ▪ DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391 ▪ DS1514 ZIF I/O Connector Pinout (DS1554) on page 446

For the interface characteristics, refer to FlexRay 3 Characteristics on page 475.

Related topics

References

Features of the DS4340 FlexRay Interface Module....................472

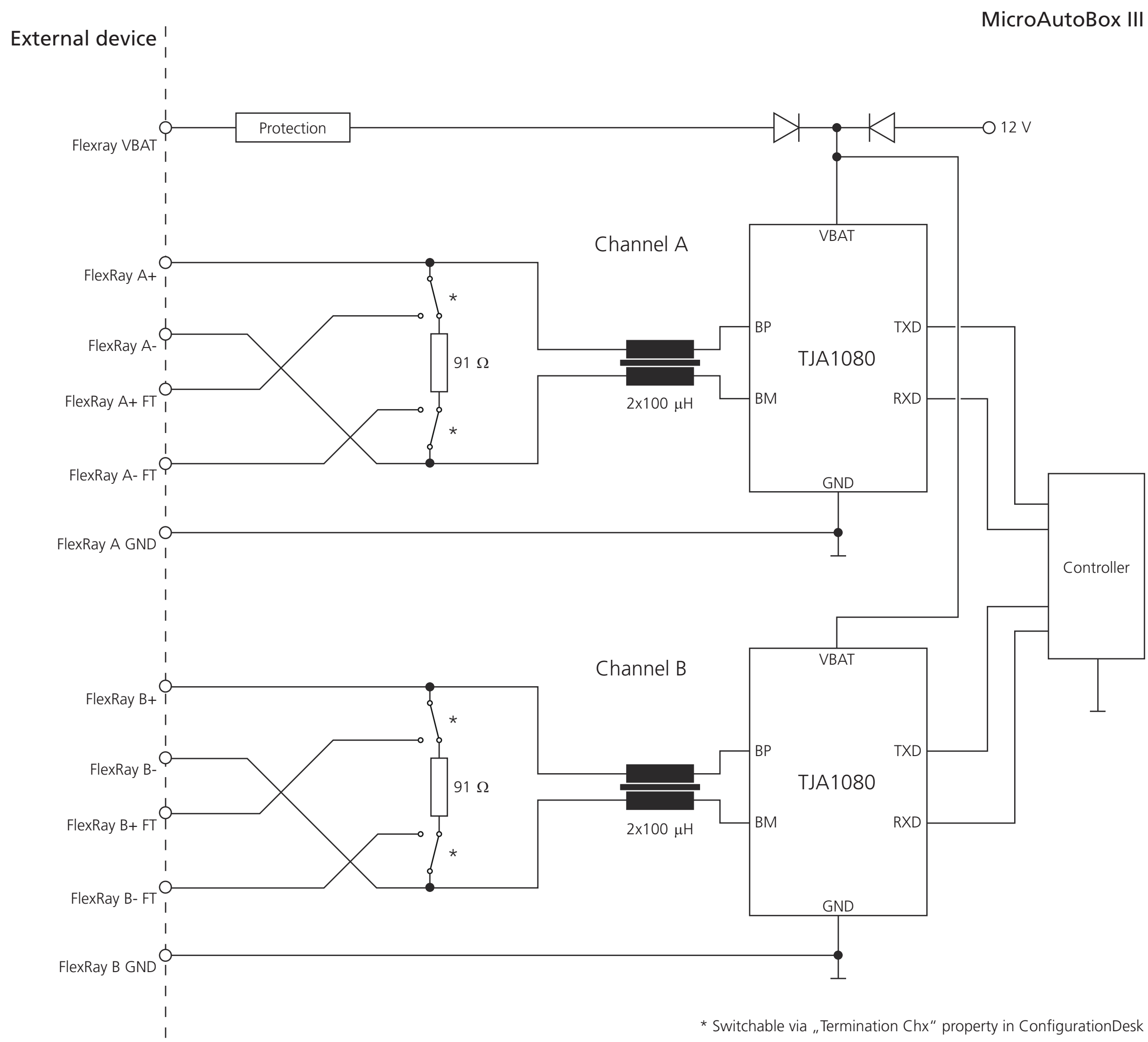
FlexRay 3 Characteristics

Purpose

Interface to communicate via a FlexRay bus. The interface supports bus termination and feed-through.

Circuit diagram

Simplified circuit diagram of the FlexRay 3 channel type.



FlexRay 3 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification 1)
Supported function blocks	FlexRay
Number of controllers	1 providing FlexRay channels A and B.
Data rate	1 Mbit/s … 10 Mbit/s

Parameter	Specification[1)]
Transceiver type	TJA1080TS
Supported standards	Physical layer according to ISO 17458-4:2013
Termination resistance	91 Ω, switchable via software
Protected voltage range	▪ -60 V … +60 V between a bus pin and GND ▪ -9.5 V … +9.5 V between the non-inverted and inverted bus pins.

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

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the FlexRay 3 channel type. Two modules can be installed.

Signal[1)]	Module	DS1514 ZIF I/O Connector Pin
FlexRay 3-1 Ch. A+	1	M3
FlexRay 3-1 Ch. A-	1	M4
FlexRay 3-1 Ch. A GND	1	L3
FlexRay 3-1 Ch. A+ FT	1	K6
FlexRay 3-1 Ch. A- FT	1	K5
FlexRay 3-1 Ch. B+	1	K3
FlexRay 3-1 Ch. B-	1	K4
FlexRay 3-1 Ch. B GND	1	J3
FlexRay 3-1 Ch. B+ FT	1	J6
FlexRay 3-1 Ch. B- FT	1	J5
FlexRay 3-1 VBAT	1	H5
FlexRay 3-2 Ch. A+	2	b3
FlexRay 3-2 Ch. A-	2	b4
FlexRay 3-2 Ch. A GND	2	a3
FlexRay 3-2 Ch. A+ FT	2	Z6
FlexRay 3-2 Ch. A- FT	2	Z5
FlexRay 3-2 Ch. B+	2	Z3
FlexRay 3-2 Ch. B-	2	Z4
FlexRay 3-2 Ch. B GND	2	Y3
FlexRay 3-2 Ch. B+ FT	2	Y6
FlexRay 3-2 Ch. B- FT	2	Y5
FlexRay 3-2 VBAT	2	X5

1) Provided by CAN Type 1 modules.

For a graphical pinout, refer to DS1514 ZIF I/O Connector Pinout (DS4340) on page 473.

Related topics

Basics

Using the DS4340 in Different Topologies..155

Examples

Example of Connecting DS4340 to a FlexRay Bus..157

DS4342 CAN FD Interface Module Data Sheet

Where to go from here

Information in this section

Features of the DS4342 CAN FD Interface Module

Main feature

The DS4342 CAN FD Interface Module provides two independent CAN channels, each of which can be used for CAN with flexible data rate (FD) or for standard CAN. It provides a switchable termination circuit and feed-through lines.

For signal characteristics, refer to CAN 5 Characteristics on page 482.

I/O functionality

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following table shows the function block types that support the channel types of the DS4342 CAN FD Interface Module.

Function Block Type	Purpose	Channel Type
Communication		
CAN	The CAN function block is one part of implementing CAN communication in real-time applications. The CAN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	CAN 5

For more information on the function block types, refer to ConfigurationDesk I/O Function Implementation Guide 📖.

Related topics

Basics

References

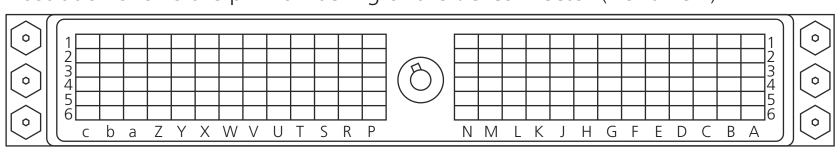
DS1514 ZIF I/O Connector Pinout (DS4342)

Purpose

Connector to provide access to all I/O channels of the installed DS4342 CAN FD Interface Modules.

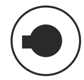
Pinout

The I/O connector is a 156-pin zero insertion force (ZIF) connector. The following illustration shows the pin numbering of the I/O connector (front view):



The following table shows the signals of two DS4342 CAN FD Interface Modules installed to the IP slots:

1	2	3	4	5	6	
-[1)]	-	-	-	-	-	*A*
-	-	-	-	-	-	*B*
-	-	-	-	-	Reserved	*C*
-	-	-	-	-	-	*D*
-	-	-	-	-	-	*E*
-	-	-	-	-	-	*F*
-	-	-	-	CAN 5-1 Inhibit 1	-	*G*
-	-	-	-	CAN 5-1 VBAT	CAN 5-1 Inhibit 2	*H*
-	-	CAN 5-1 Ch. 2 GND	-	CAN 5-1 Ch. 2 Low FT	CAN 5-1 Ch. 2 High FT	*J*
-	-	CAN 5-1 Ch. 2 High	CAN 5-1 Ch. 2 Low	CAN 5-1 Ch. 1 Low FT	CAN 5-1 Ch. 1 High FT	*K*
-	-	CAN 5-1 Ch. 1 GND	-	-	-	*L*
-	-	CAN 5-1 Ch. 1 High	CAN 5-1 Ch. 1 Low	-	-	*M*

1	2	3	4	5	6	
-	-	-	-	-	-	*N*
						
-	-	-	-	-	-	*P*
-	-	-	-	-	-	*R*
-	-	-	-	-	Reserved	*S*
-	-	-	-	-	-	*T*
-	-	-	-	-	-	*U*
-	-	-	-	-	-	*V*
-	-	-	-	CAN 5-2 Inhibit 1	-	*W*
-	-	-	-	CAN 5-2 VBAT	CAN 5-2 Inhibit 2	*X*
-	-	CAN 5-2 Ch. 2 GND	-	CAN 5-2 Ch. 2 Low FT	CAN 5-2 Ch. 2 High FT	*Y*
-	-	CAN 5-2 Ch. 2 High	CAN 5-2 Ch. 2 Low	CAN 5-2 Ch. 1 Low FT	CAN 5-2 Ch. 1 High FT	*Z*
-	-	CAN 5-2 Ch. 1 GND	-	-	-	*a*
-	-	CAN 5-2 Ch. 1 High	CAN 5-2 Ch. 1 Low	-	-	*b*
-	-	-	-	-	-	*c*

[1] Signal of the DS155x I/O module.

Signal descriptions

The following table shows the description of the signals. The signals are grouped by their functionality.

Signal	Description
Communication Interfaces	
CAN 5	CAN FD-capable ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination via software and partial networking. Signal naming: CAN 5-1 for module 1 or CAN 5-2 for module 2.
Supply Inputs and Outputs	
CAN 5 VBAT	Supply input to support the wake-up functionality.
CAN 5 Inhibit	Output to wake-up the MicroAutoBox III via the REMOTE pin.
Ground Potentials	
CAN 5 GND	GND of the CAN bus.

Signal	Description
I/O Signals of the DS1552/DS1554	
-	Pinouts of the I/O modules: ▪ DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391 ▪ DS1514 ZIF I/O Connector Pinout (DS1554) on page 446

For the interface characteristics, refer to CAN 5 Characteristics on page 482.

Related topics

References

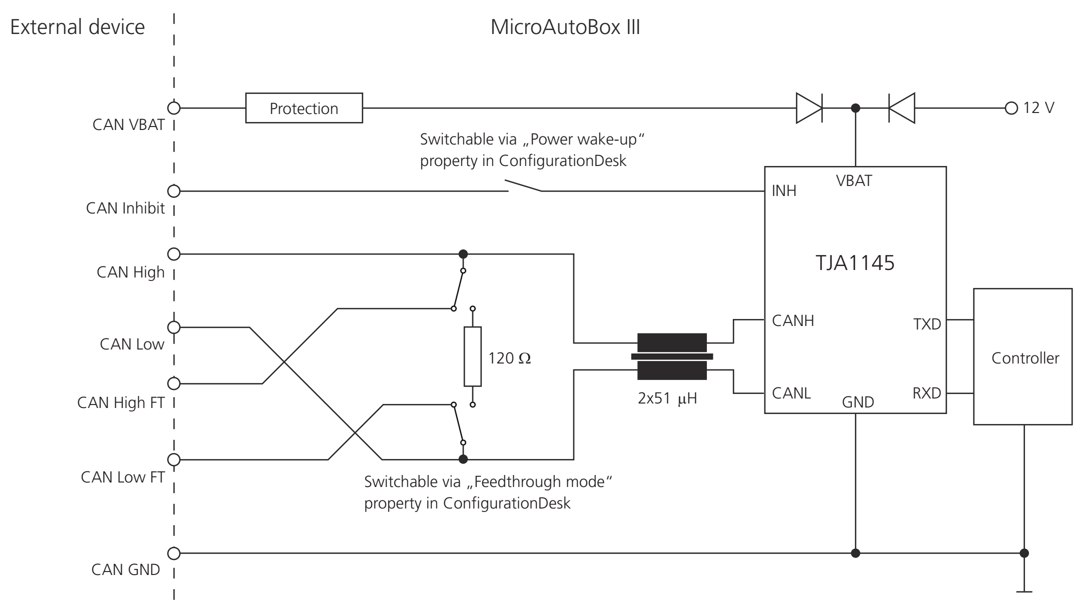
CAN 5 Characteristics

Purpose

CAN FD-capable ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination via software and partial networking.

Circuit diagram

Simplified circuit diagram of the CAN 5 channel type.



CAN 5 characteristics

The characteristics are specified for the following conditions, unless stated otherwise:

- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Specification[1)]
Supported function blocks	CAN
Number of channels	2
Data rate (arbitration)	15 kbit/s … 1 Mbit/s
Data rate (payload)	15 kbit/s … 5 Mbit/s[2)]
Transceiver type	TJA1145T/FD
Supported standards	▪ Flexible Data Rate (CAN FD), according to ISO 11898-1:2015 ▪ High-speed, according to ISO 11898-2:2016 ▪ Low-power mode, according to ISO 11898-5:2007 ▪ Selective wake-up, according to ISO 11898-6:2013 ▪ High-speed CAN at 125 kbps, according to SAE J2284-1:2016 ▪ High-speed CAN at 250 kbps, according to SAE J2284-2:2016 ▪ High-speed CAN at 500 kbps, according to SAE J2284-3:2016 ▪ High-speed CAN at 500 kbps with CAN FD Data at 2 Mbps, according to SAE J2284-4:2016 ▪ High-speed CAN at 500 kbps with CAN FD Data at 5 Mbps, according to SAE J2284-5:2016
Termination resistance	120 Ω, switchable via software
Input voltage range (VBAT)	-0.2 V … +40 V
Output voltage range (Inhibit)	-0.2 V … +40 V
Protected voltage range	▪ -58 V … +58 V between CAN pins and GND (CAN_{high}, CAN_{low}) ▪ -7.75 V … +7.75 V between CAN High pin and CAN Low pin (CAN_{diff})

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

2) Under laboratory conditions, you can achieve data rates up to 8 Mbit/s with an optimized cable management (i.e., differential signal lines, 120 Ω wave impedance, no stubs).

Signal mapping

The following table shows the connector pins of the DS1514 ZIF I/O connector that provide the signals of the CAN 5 channel type. Two modules can be installed.

Signal[1)]	Module	DS1514 ZIF I/O Connector Pin
CAN 5-1 VBAT	1	H5
CAN 5-1 Ch. 1 High	1	M3
CAN 5-1 Ch. 1 Low	1	M4
CAN 5-1 Ch. 1 GND	1	L3
CAN 5-1 Ch. 1 High FT	1	K6
CAN 5-1 Ch. 1 Low FT	1	K5
CAN 5-1 Inhibit 1	1	G5
CAN 5-1 Ch. 2 High	1	K3
CAN 5-1 Ch. 2 Low	1	K4
CAN 5-1 Ch. 2 GND	1	J3
CAN 5-1 Ch. 2 High FT	1	J6
CAN 5-1 Ch. 2 Low FT	1	J5
CAN 5-1 Inhibit 2	1	H6
CAN 5-2 VBAT	2	X5
CAN 5-2 Ch. 1 High	2	b3
CAN 5-2 Ch. 1 Low	2	b4
CAN 5-2 Ch. 1 GND	2	a3
CAN 5-2 Ch. 1 High FT	2	Z6
CAN 5-2 Ch. 1 Low FT	2	Z5
CAN 5-2 Inhibit 1	2	W5
CAN 5-2 Ch. 2 High	2	Z3
CAN 5-2 Ch. 2 Low	2	Z4
CAN 5-2 Ch. 2 GND	2	Y3
CAN 5-2 Ch. 2 High FT	2	Y6
CAN 5-2 Ch. 2 Low FT	2	Y5
CAN 5-2 Inhibit 2	2	X6

[1)] Provided by CAN Type 1 modules.

For a graphical pinout, refer to DS1514 ZIF I/O Connector Pinout (DS4342) on page 480.

Related topics

HowTos

Examples

Channel Type and I/O Functionality Overview

Where to go from here

Information in this section

Overview of MicroAutoBox III Channel Types

Introduction

A channel type indicates all the hardware resources (channels) in the hardware system that provide exactly the same characteristics. A hardware resource can be assigned to a function block in ConfigurationDesk.

Analog and trigger channel types

The following table shows the analog and trigger channel types of MicroAutoBox III boards and modules.

Channel Type	Description	Board/Module	
		DS Number	Number of Channels
Analog channel types			
Analog In 7	Input to measure analog signals in the range 0 V ... 5 V.	DS1511	16
Analog In 8	Input to measure analog signals in the range -10 V ... +10 V.	DS1511B1	16
		DS1513	16
Analog In 9	Input to measure analog signals in the range -10 V ... +10 V.	DS1513	16
Analog In 10	Input to measure analog signals in the range 0 V ... 5 V.	DS1552	8
Analog In 11	Input to measure analog signals in the range -10 V ... +10 V.	DS1552B1	8
Analog In 12	Input with a low sample rate to measure analog signals in the range -10 V ... +10 V.	DS1552/DS1552B1	16
Analog In 13	Differential input to measure analog signals in selectable voltage ranges up to ±30 V.	DS1553	8

Channel Type	Description	Board/Module	
		DS Number	Number of Channels
Analog In 14	Differential input to measure analog signals in the range -10 V ... +10 V.	DS1554	14
Analog In 15	Differential input to measure analog knock signals.	DS1554	4
Analog In 17	Input to measure analog signals in the range -10 V … +10 V.	DS1521	4
Analog Out 11	Output to generate analog signals in the range 0 V ... 4.5 V.	DS1511/DS1511B1	4
Analog Out 12	Output to generate analog signals in the range -10 V ... 10 V.	DS1513	8
Analog Out 13	Output to generate analog signals in the range 0 V ... 5 V.	DS1552/DS1552B1	4
Analog Out 14	Output to generate analog signals. The signals can be used as single-ended and differential output.	DS1553	2
Trigger channel types			
Trigger In 3	Input to trigger the analog measurement of the Analog In 7/Analog In 8 channel type.	DS1511/DS1511B1	4
		DS1513	4
Digital In 5	Input to measure digital signals or to trigger the analog measurement of the Analog In 10/11 channel types.	DS1552/DS1552B1	16

Digital channel types

The following table shows the digital channel types of MicroAutoBox III boards and modules.

Channel Type	Description	Board/Module	
		DS Number	Number of Channels
Digital In 4	Input to measure digital signals with a fixed threshold voltage.	DS1511/DS1511B1	40
		DS1513	24
Digital In 5	Input to measure digital signals or to trigger the analog measurement of the Analog In 10/11 channel types.	DS1552/DS1552B1	16
Digital In 8	Input to measure digital signals in the single-ended or differential mode.	DS1553	8
Digital In/Out 6	Bidirectional channel type to measure and generate digital signals.	DS1552/DS1552B1	8
Digital In/Out 8	Bidirectional channel type to measure and generate digital signals.	DS1554	8

Channel Type	Description	Board/Module	
		DS Number	Number of Channels
Digital In/Out 10	Bidirectional channels to measure and generate digital signals.	DS1521	6
Digital Out 4	Output to generate digital signals.	DS1511/DS1511B1	40
		DS1513	24
Digital Out 5	Output to generate digital signals.	DS1552/DS1552B1	16
Digital Out 6	Output to generate digital signals with a 5 V logic level.	DS1553	16
Digital Out 7	Output to generate digital signals.	DS1554	40

External sensor channel types

The following table shows the sensor channel types of MicroAutoBox III boards and modules.

Channel Type	Description	Board/Module	
		DS Number	Number of Channels
Digital In 6	Differential input to measure signals of digital crankshaft and camshaft sensors.	DS1552/DS1552B1	3
Digital In 7	Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in notched wheel position sensors.	DS1552/DS1552B1	1
Digital In 9	Input to measure signals of crankshaft and camshaft sensors with a common signal ground.	DS1554	5
Digital In 10	Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in crankshaft sensors.	DS1554	1
Lambda In 1	Interface to monitor Lambda probes.	DS1554	2
Resolver In 1	Interface to monitor resolver sensors.	DS1553	1

Onboard sensor channel types

The following table shows the onboard sensor channel types of MicroAutoBox III boards and modules.

Channel Type	Description	Board/Module	
		DS Number	**Number of Channels**
Acceleration Sensor Unit 1	Onboard sensor unit that measures the acceleration of the vehicle. In addition, the sensor unit can measure the angular velocity.	DS1403	1
Pressure Sensor Unit 1	Onboard sensor unit that measures the atmospheric pressure.	DS1403	1

Communication channel types

The following table shows the communication channel types of MicroAutoBox III boards and modules.

Channel Type	Description	Board/Module	
		DS Number	**Number of Channels**
CAN 3	ISO 11898 interface to communicate via a CAN bus.	DS1511/DS1511B1	4
CAN 4	ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination via software and partial networking.	DS1513	6
CAN 5	CAN FD-capable ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination via software and partial networking.	DS4342	2
CAN 6	CAN FD-capable ISO 11898 interface to communicate via a CAN bus. The interface supports bus termination, partial networking, and feed-through.	DS1521	8
Digital In/Out 7	RS485 Interface to read digital protocols from active rotor position sensors, such as EnDat and/or SSI.	DS1553	4
Ethernet Adapter 2	Ethernet adapter to communicate with external devices via Ethernet. The controller of the adapter is connected to the ports via an internal Ethernet switch.	DS1403	2
Ethernet Adapter 3	Ethernet adapter to communicate with external devices via automotive Ethernet. Each controller of the adapter is directly mapped to a port.	DS1521	3

Channel Type	Description	Board/Module	
		DS Number	Number of Channels
Ethernet Switch 2	Internal Ethernet switch that is configurable via software.	DS1403	1
FlexRay 3	Interface to communicate via a FlexRay bus. The interface supports bus termination and feed-through.	DS4340	1 [1)]
FlexRay 4	Interface to communicate via a FlexRay bus. The interface supports bus termination and feed-through.	DS1521	2 [1)]
LIN 3	Interface to communicate via a LIN bus.	DS1511/DS1511B1	2
		DS1513	3
LIN 4	Interface to communicate via a LIN bus. The interface supports master termination.	DS1521	3
UART 2	Interface to communicate with an RS232 device.	DS1511/DS1511B1	2
		DS1513	3
UART 3	Interface to communicate with a RS232/422 device or via a RS485 bus.	DS1552/DS1552B1	2
UART 4	Interface to communicate with a RS232/422 device or via a RS485 bus.	DS1521	1

1) Number of FlexRay controller. Each controller provides FlexRay channels A and B.

Channel types for future use

The following channel types of the DS1403 Processor Board are for future use:

- Angle Unit Set

Overview of MicroAutoBox III I/O Functionality

Introduction

You implement and configure the I/O functionality of the MicroAutoBox III in ConfigurationDesk via function blocks. Therefore, the following tables show the function block types that support the MicroAutoBox III.

Basic I/O

The following table shows the function block types for basic I/O functionality.

Function Block Type	Purpose	Board/Module
Voltage In	The Voltage In function block type digitizes analog voltage signals coming from an external device.	▪ DS1511 ▪ DS1513 ▪ DS5121

Function Block Type	Purpose	Board/Module
		▪ DS1552 ▪ DS1554
Trigger In	The Trigger In function block type generates a trigger signal each time the external input signal matches the defined triggering conditions. The function block works as a provider: Other function blocks can use the generated trigger signal as trigger source.	▪ DS1511 ▪ DS1513 ▪ DS1552
Voltage Out	The Voltage Out function block provides the possibility to output analog voltages.	▪ DS1511 ▪ DS1513 ▪ DS1552
Multi Bit In	The Multi Bit In function block type lets you measure digital signals coming from an external device.	▪ DS1511 ▪ DS1513 ▪ DS1521 ▪ DS1552 ▪ DS1554
Multi Bit Out	The Multi Bit Out function block type lets you stimulate digital inputs of an external device.	▪ DS1511 ▪ DS1513 ▪ DS1521 ▪ DS1552 ▪ DS1554
Digital Pulse Out	The Digital Pulse Out function block generates a digital pulse with each model step of the behavior model or with each trigger event of another function block.	▪ DS1511 ▪ DS1513
PWM/PFM Out	The PWM/PFM Out function block type can be used to generate one-phase pulse-width modulated signals and frequency output signals.	▪ DS1511 ▪ DS1513 ▪ DS1521 ▪ DS1552 ▪ DS1554
Multi-Channel PWM Out	The Multi-Channel PWM Out function block type synchronously generates multiple PWM signals with a common frequency. The function block can work as a provider: Other function blocks can use the generated trigger signal as a trigger source.	▪ DS1511 ▪ DS1513
Digital Pulse In	The Digital Pulse In function block type lets you measure the pulse duration of digital voltage signals coming from an external device.	▪ DS1511 ▪ DS1513
PWM/PFM In	With the PWM/PFM In function block, you can measure one-phase pulse-width-modulated signal patterns.	▪ DS1511 ▪ DS1513 ▪ DS1521 ▪ DS1552 ▪ DS1554
Digital Pulse Capture	The Digital Pulse Capture function block type converts signals coming from an external device (e.g., ECU) to digital pulses.	DS1521

Advanced I/O

The following table shows the function block types for advanced I/O functionality.

Function Block Type	Purpose	Board/Module
Digital Incremental Encoder In	The Digital Incremental Encoder In function block provides access to rotary or linear digital incremental encoders. The function block can be used, for example, to measure the angular position and the speed of an electric motor.	▪ DS1511 ▪ DS1513
Voltage Signal Capture (ADC Type 4)	With the Voltage Signal Capture (ADC Type 4) function block, you can measure analog voltage signals (coming from an external device) by capturing signal sequences, for example, at configurable sample rates. The function block type is exclusively designed to be used for the ADC Type 4 module of the DS1511, DS1511B1, and DS1513 Multi-I/O Boards.	▪ DS1511 ▪ DS1513

Engine I/O

The following table shows the function block types for engine I/O functionality.

Function Block Type	Purpose	Board/Module
Engine Angular Pulse Out	The Engine Angular Pulse Out function block generates a periodic pulse pattern based on engine position data retrieved from an assigned master APU provider. The generated pulse pattern can be used, for example, for starting A/D conversions.	DS1554
Crank In	The Crank In function block type lets you measure the crankshaft of a piston engine and calculates the current position, speed and rotational direction of the engine. For performing these measurements, the Crank In function block must be used in combination with at least one Cam In function block.	DS1554
Cam In	The Cam In function block type lets you measure the phase shift angle between a camshaft and the coupled crankshaft. Cam In must be used with the Crank In function block for synchronizing with the provided master APU and to evaluate the current engine position.	DS1554
Ignition Out	The Ignition Out function block type lets you generate ignition pulses for a real piston engine.	DS1554
Injection Out	The Injection Out function block type lets you generate injection pulses for a real piston engine.	DS1554
Knock In	The Knock In function block lets you analyze the noise of a piston engine to avoid/minimize preignitions caused by improper ignition timing.	DS1554
Lambda Probe In	The Lambda Probe In function block lets you control LSU 4.9 and LSU ADV wideband lambda probes.	DS1554

Communication

The following table shows the function block types for communication.

Function Block Type	Purpose	Board/Module
SENT In	The SENT In function block receives SENT messages. SENT is a protocol used between sensors and ECUs to transmit data of high-resolution sensors as an alternative to an analog interface. The sensors are typically throttle position sensors or mass air flow sensors.	▪ DS1511 ▪ DS1513
SPI Master	The SPI Master function block controls and performs a short-distance communication via the serial peripheral interface (SPI). SPI communication is a master-slave architecture with a single master.	▪ DS1511 ▪ DS1513
CAN	The CAN function block is one part of implementing CAN communication in real-time applications. The CAN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	▪ DS1511 ▪ DS1513 ▪ DS1521 ▪ DS4342
FlexRay	The FlexRay function block type is one part of implementing FlexRay communication in real-time applications. It lets you specify the hardware access for FlexRay communication and control the communication of the FlexRay network separately for each FlexRay controller and FlexRay channel (A and/or B). The FlexRay communication itself must be modeled and supplied via the dSPACE FlexRay Configuration Package (refer to Modeling a FlexRay Bus Interface (Model Interface Package for Simulink - Modeling Guide 📖)).	▪ DS4340 ▪ DS1521
LIN	The LIN function block is one part of implementing LIN communication in real-time applications. The LIN communication itself must be modeled with the Bus Manager in ConfigurationDesk. Refer to Overview of the Bus Manager (ConfigurationDesk Bus Manager Implementation Guide 📖).	▪ DS1511 ▪ DS1513 ▪ DS1521
Ethernet Setup	With the Ethernet Setup function block type, you can configure and initialize the access to an Ethernet controller of your dSPACE real-time hardware. The function block works as a provider: Other function blocks can use it to access the configured Ethernet controller.	▪ DS1403 ▪ DS1521
Ethernet Switch	The Ethernet Switch function block lets you configure the switching of Ethernet traffic and the characteristics of the physical layer transceivers (PHYs).	DS1403
ECU Interface Configuration	The ECU Interface Configuration function block is one part of implementing ECU interfacing in real-time applications. The ECU interface itself must be modeled with the ECU Interface Manager. Refer to Implementing the Real-Time Application with ConfigurationDesk (ECU Interfacing Overview 📖).	▪ DS1403 ▪ DS1521

System

The following table shows the function block types for system functionality.

Function Block Type	Purpose	Board/Module
Power On Signal In	The Power On Signal In function block type monitors hardware based shutdown requests for the SCALEXIO LabBox (with DS6001 Processor Board), SCALEXIO AutoBox (with DS6001 Processor Board) and MicroAutoBox III. The request state can be provided to the behavior model and/or can be accessed in the experiment software.	DS1403
System Shutdown	The System Shutdown function block type lets you control the shutdown of a SCALEXIO LabBox or SCALEXIO AutoBox (both with a DS6001 Processor Board installed) or a MicroAutoBox III from within the behavior model and/or the experiment software. Hardware based shutdown requests can be ignored or delayed.	DS1403
System Temperature Monitoring	With the System Temperature Monitoring function block type, you can monitor the internal temperature of MicroAutoBox III via a real-time application.	DS1403
USB Eject	The USB Eject function block provides a trigger from the behavior model to eject (unmount) a USB mass storage device from the dSPACE system. Removing a USB device from the USB port without unmounting can result in data loss.	DS1403
Non-Volatile Memory Access	The Non-Volatile Memory Access function block provides access to the non-volatile memory of the processing hardware. The function block creates a data set in the non-volatile memory and handles the data transfer between the behavior model and the non-volatile memory for this data set.	DS1403
FuSa Setup	The FuSa Setup function block provides the basic functionality for implementing functional safety in your system. The function block triggers basic error responses and lets you enable additional error responses.	DS1403
FuSa Challenge-Response Monitoring	Each FuSa Challenge-Response Monitoring function block works as a challenge-response monitor to support functional safety in your application. Based on the challenge and response principle, you can implement advanced monitoring services, for example, monitor periodic tasks or the correct execution of subsystems.	DS1403
Domain Clock	The Domain Clock function block represents a domain clock. The base time can be set and is updated by the processing hardware.	DS1403
Acceleration In	The Acceleration In function block type reads the measured acceleration and angular velocity values on three axes (x, y, z) from an onboard acceleration sensor and provides the values to the behavior model.	DS1403

Function Block Type	Purpose	Board/Module
Atmospheric Pressure In	The Atmospheric Pressure In function block type reads the measured atmospheric pressure value from an onboard pressure sensor and provides the value to the behavior model.	DS1403
LED Out	Each LED Out function block type provides access to one of the 4 user LEDs on the MicroAutoBox III. The LEDs can be controlled from the behavior model, for example, to display status information on the real-time application.	DS1403

Custom functions

The following table shows custom function block types.

Function Block Type	Purpose	Board/Module
FPGA Custom Function	FPGA custom function blocks contain the functionality of an FPGA application that must be defined with the RTI FPGA Programming Blockset.	DS1514 FPGA Base Board with one I/O module: ▪ DS1552 ▪ DS1553 ▪ DS1554

Related topics

Basics

Overview on the Available Function Block Types (ConfigurationDesk I/O Function Implementation Guide 📖)

Accessories

Where to go from here

Information in this section

MicroAutoBox Break-Out Boxes

Introduction

The MicroAutoBox Break-Out Boxes provide easy access to all the signals of the connectors of a MicroAutoBox II/III. For example, you can:

- Check and/or reconnect signals without changing the already existing cable harness
- Connect sensors and/or actuators
- Connect measurement devices

Data Sheet MicroAutoBox Break-Out Box DS1541

Introduction

The MicroAutoBox Break-Out Box DS1541 provides easy access to signals on the ZIF I/O connectors of all MicroAutoBox variants.

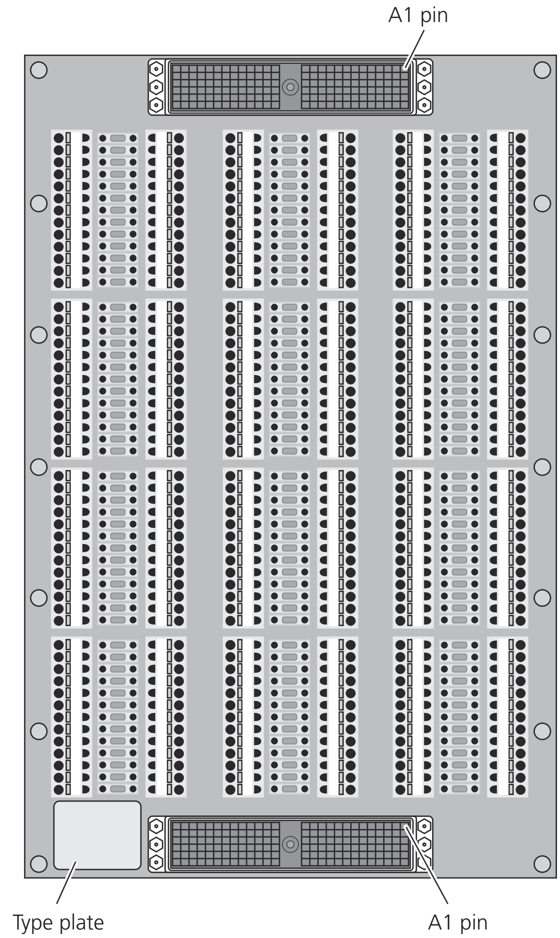
Where to go from here

Information in this section

Components and Their Functionality - MicroAutoBox Break-Out Box DS1541

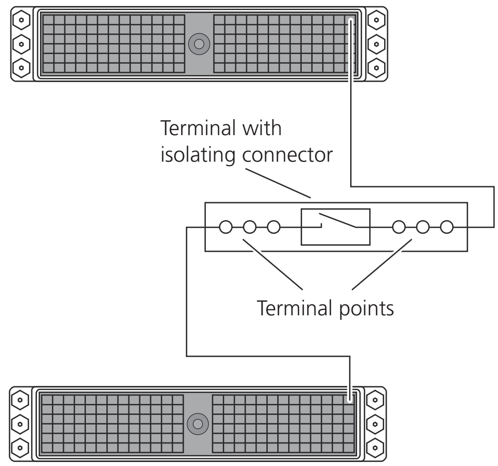
Schematic

Components of the MicroAutoBox Break-Out Box DS1541:



Block diagram

The block diagram shows the functional units, their functionality, and the signal paths in a simplified form.



The signals at the I/O connector pins on one side are routed to the same pins on the other side. This means that the Break-Out Box itself does not affect the cable harness. In addition to the same pinout, the ZIF I/O connectors also have the same orientation on the board.

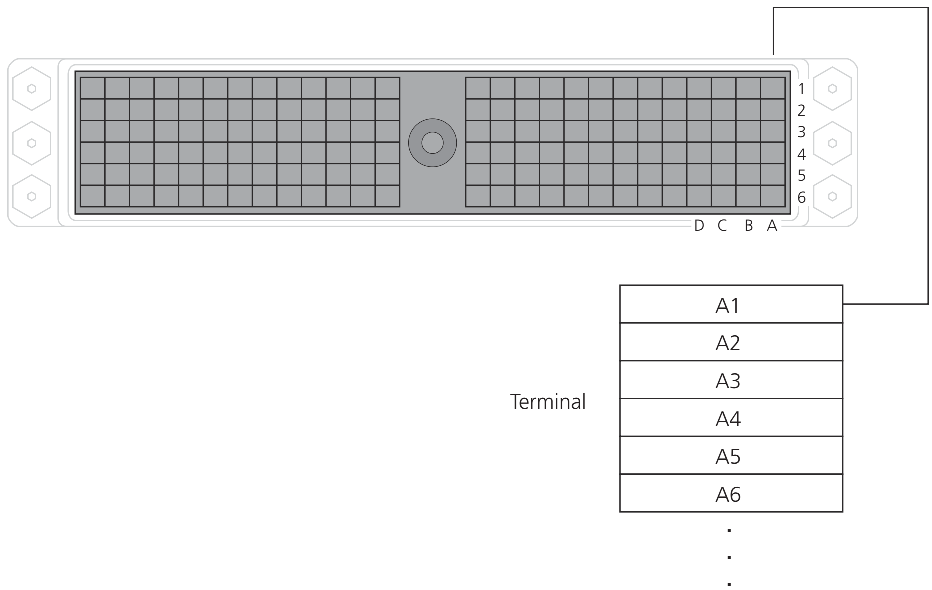
Terminals

The terminals are labeled according to the ZIF I/O connector pin numbering.

Terminal points You can connect stripped wires and test plugs to the signal path via terminal points.

Isolating connectors Each signal terminal provides a switch, called a isolating connector. This is to interrupt the signal between the cable harness and the MicroAutoBox II/III.

Terminal grouping The terminals are grouped according to ZIF connector. The illustration below shows the grouping scheme.

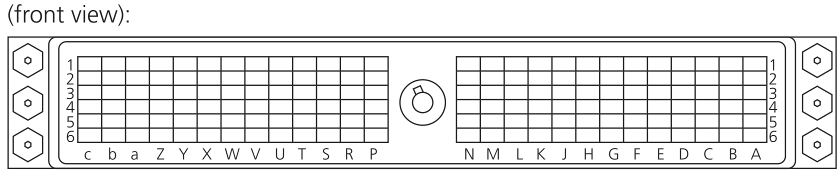


Zero Insertion Force Connector

Pin numbering

The main I/O connectors are 156-pin zero insertion force (ZIF) connectors, the same like the ZIF I/O connector of the MicroAutoBox II/III. Both ZIF connectors have the same pin numbering and orientation on the board.

The following illustration shows the pin numbering of the female ZIF connector (front view):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The terminals are grouped according to ZIF connector. For details, refer to Components and Their Functionality - MicroAutoBox Break-Out Box DS1541 on page 499.

Matching cable

Depending on your order, the break-out box is delivered with one standard cable (CB1541). For further information, refer to CB1541 Break-Out Box Connection Cable for MicroAutoBox II/III on page 522.

Pinout using MicroAutoBox III

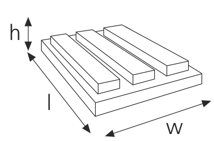
The signals available at the different pins depend on the ZIF I/O connector of the I/O board. Refer to one of the following pinouts:

- DS1511 ZIF I/O Connector Pinout on page 291
- DS1513 ZIF I/O Connector Pinout on page 326
- DS1514 ZIF I/O Connector Pinout (DS1552/DS1552B1) on page 391
- DS1514 ZIF I/O Connector Pinout (DS1554) on page 446

Data Overview - Break-Out Box DS1541

Characteristics

The following table shows the technical characteristics of the MicroAutoBox Break-Out Box DS1541.

Parameter		Specification [1]
I/O connectors		2 zero insertion force (ZIF) connectors to insert the Break-Out Box in an existing cable harness.
Terminals		One terminal for each signal of the ZIF I/O connector: ▪ 6 terminal points for each signal, 3 on each side of the isolating connector ▪ Isolating connectors to interrupt the signal path
Connection cables		Depending on your order, the break-out box is delivered with one standard cable (CB1541).
Mechanical characteristics	Physical size 	▪ l: 341 mm (13.43 in.) ▪ w: 224 mm (8.82 in.) ▪ h: 61 mm (2.40 in.)
	Weight	Approx. 2.5 kg (5.5 lb.)
Environmental conditions	Operating temperature	0 … +70 °C (+32 … +158 °F)

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

MicroAutoBox III Cooling Unit

Introduction

The MicroAutoBox III Cooling Unit is intended to cool a MicroAutoBox III, but must not be used with an Embedded PC.

Where to go from here

Information in this section

Safety Precautions

Intended use of the MicroAutoBox III Cooling Unit

The MicroAutoBox III Cooling Unit is intended to cool a MicroAutoBox III. The Cooling Unit must be attached to the MicroAutoBox III and used in a horizontal position with the bolt holes at the bottom. The Cooling Unit must not be used with a MicroAutoBox III Embedded PC, neither with the stand-alone variant nor with the built-in variant. Using the Cooling Unit for purposes other than this is considered to be improper and noncontractual use.

You are not allowed to open, modify, or service a MicroAutoBox III Cooling Unit unless the required instructions are explicitly stated in the user documentation or were sent to you by dSPACE Support in writing. Perform the instructions only if you have the required skills.

The MicroAutoBox III Cooling Unit must be used in a clean and dry environment (pollution degree 2, according to IEC 61010-1).

Powering the Cooling Unit

Voltages that are connected to the power input connector of the MicroAutoBox III Cooling Unit are directly looped through to its power output connector.

- Make sure that the power output connector of the Cooling Unit is connected to the power input connector of the MicroAutoBox III before you connect the laboratory power supply/vehicle battery.
- The screws of the power output connector must always be tight when you power up the Cooling Unit. Do not loosen the screws before the power supply/vehicle battery is disconnected.
- The cable of the power output connector must not be kinked or damaged.

Features of the MicroAutoBox III Cooling Unit

Main features

These are the main features of the MicroAutoBox III Cooling Unit:

- Cooling the MicroAutoBox III to ensure an adequate heat dissipation. The cooling lets you use the MicroAutoBox III at operating temperatures up to 80 °C (176 °F) with the DS1521 Bus Board and using all processor cores.

  Limitations for the MicroAutoBox III WLAN, Embedded PC, and DS1553 apply even if you connect a MicroAutoBox III Cooling Unit.
- Compact and robust design that meets the shock and vibration resistance requirements of a MicroAutoBox III.
- Integrated power supply cabling that lets you reuse available power supply cables.
- Automatic and autonomous power control that switches the Cooling Unit from standby to operate and vice versa.

  The Cooling Unit operates when all of the following conditions are met:
  - The MicroAutoBox III is in a operating or prestart mode.
  - The operating temperature is approximately room temperature or higher.

  If a condition is no longer fulfilled, the Cooling Unit switches to standby.
- Noise reduction through automatic control of the cooling power depending on the operating temperature.

How to Install the MicroAutoBox III Cooling Unit

Objective

To retrofit the MicroAutoBox III with an active cooling.

Required material

The package contents of a MicroAutoBox III Cooling Unit for retrofitting includes the required material. The following table shows the delivered items.

Contents	Description
1 x MicroAutoBox III Cooling Unit	–
4 x M5x20 mm TX 25 screws	To attach the MicroAutoBox III Cooling Unit.
4 x M4x12 mm slotted headless screws	To align the MicroAutoBox III Cooling Unit.

Required tools

The following tools are required:
- TX 25 Torx screwdriver
- 4 mm slotted screwdriver
- Workstation with electrostatic discharge (ESD) protection equipment

Avoiding ESD damages

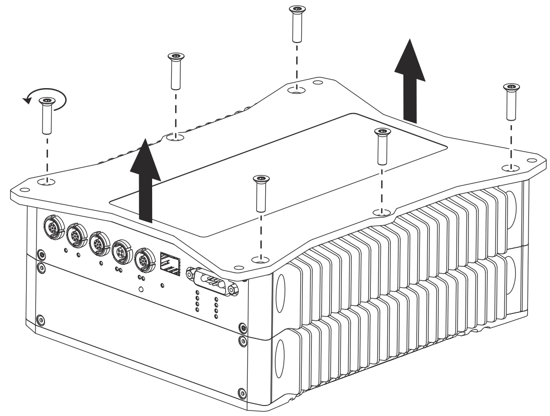
> ***NOTICE***
>
> **Risk of hardware damage when touching the disassembled hardware**
>
> Touching can result in an electrostatic discharge (ESD) that can damage the hardware or reduce its lifetime.
> - During installation work, place the hardware on a properly grounded workstation, such as a special ESD desk or desk mat.
> - Ensure potential equalization between the environment and you, e.g., by wearing a grounded ESD wristband.
> - Do not touch the electronic circuits or the contacts of the connectors.

Method

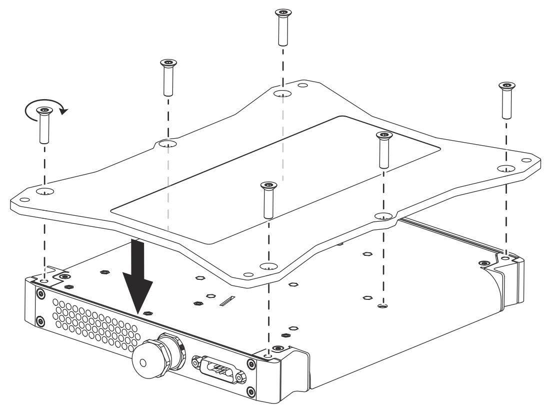
To install the MicroAutoBox III Cooling Unit

1 Disconnect the MicroAutoBox III from the power supply and remove the cable harness.

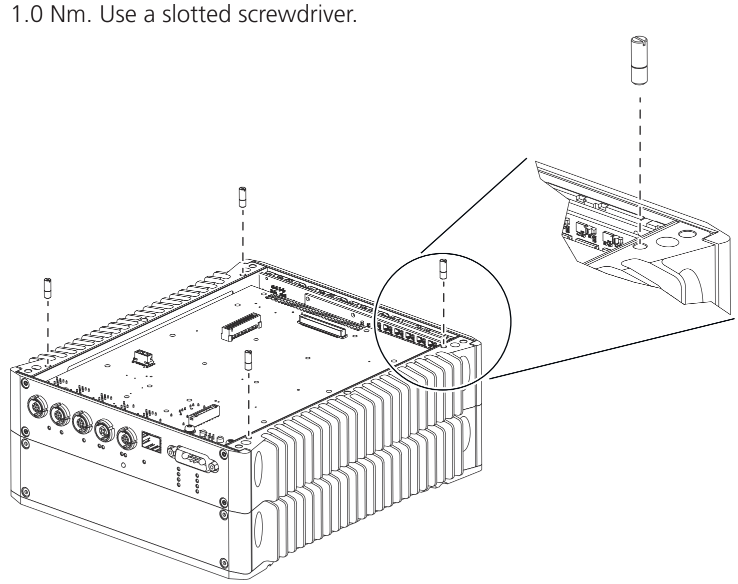
2 Remove the bottom plate of the MicroAutoBox III. Use a TX 25 Torx screwdriver.



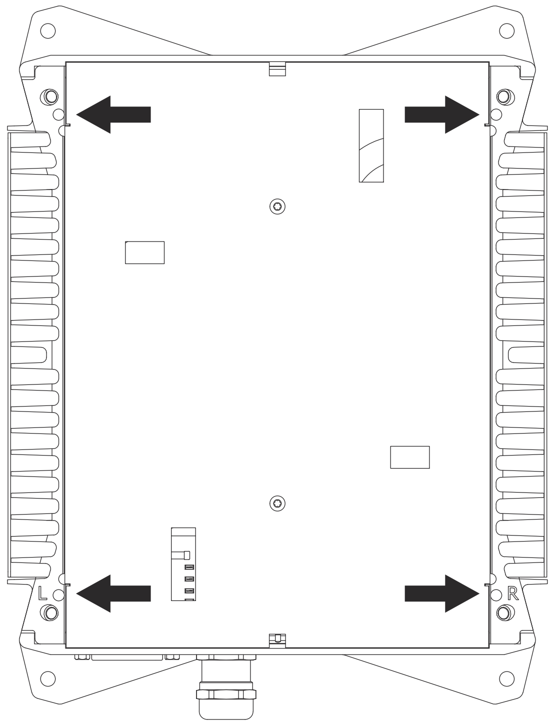
3 Attach the bottom plate to the MicroAutoBox III Cooling Unit. Reuse the screws that you removed in step 2 and tighten the screws with 4 Nm.



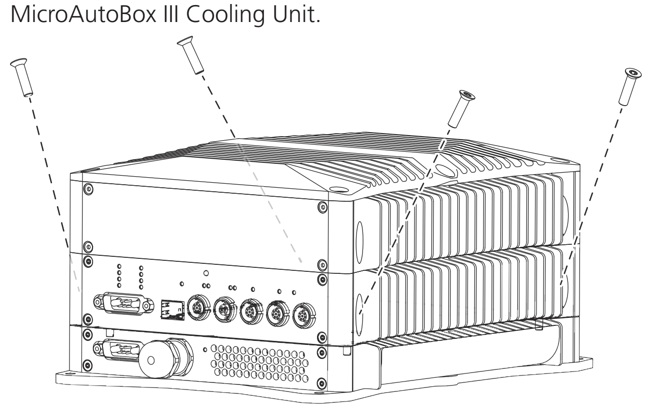
4 Tighten the slotted screws at the bottom of the MicroAutoBox III with 1.0 Nm. Use a slotted screwdriver.



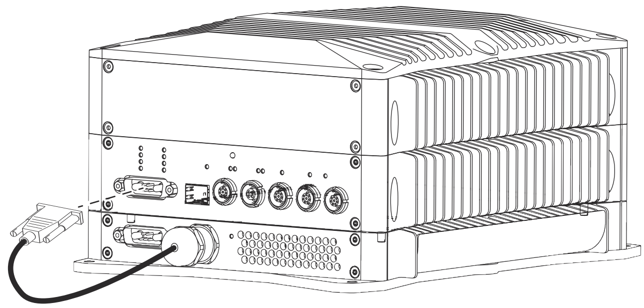
5 Align the slotted screws with the locating bores of the Cooling Unit and then join the MicroAutoBox III on to the Cooling Unit. The power input connector of the MicroAutoBox III and the connectors of the Cooling Unit must be on the same side.



6 Tighten the four delivered TX 25 screws with 4 Nm to attach the MicroAutoBox III Cooling Unit.



7 Connect the power output connector of the MicroAutoBox III Cooling Unit to the power input connector of the MicroAutoBox III and tighten the screws of the connector. Do not kink the cable when doing so.



If the cable is stiff due to cold, carefully bring the cable to room temperature.

Result

You installed the MicroAutoBox III Cooling Unit to the MicroAutoBox III. Now you use the power input connector of the MicroAutoBox III Cooling Unit to supply the entire system and connect the looped-through control and FuSa signals.

Using the Cooling Unit and In-Vehicle Installation

Powering the MicroAutoBox III with built-in Cooling Unit

⚠ WARNING

Risk of electric shock due to hazardous voltages at the power output connector

Voltages that are connected to the power input connector of the MicroAutoBox III Cooling Unit are directly looped through to its power output connector.

- Make sure that the power output connector of the Cooling Unit is connected to the power input connector of the MicroAutoBox III before you connect the laboratory power supply/vehicle battery.
- The screws of the power output connector must always be tight when you power up the Cooling Unit. Do not loosen the screws before the power supply/vehicle battery is disconnected.
- The cable of the power output connector must not be kinked or damaged.

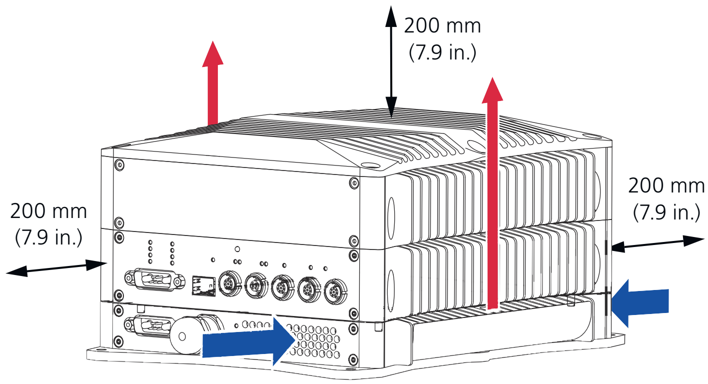
Connect the laboratory power supply/vehicle battery to the power input connector of the Cooling Unit to power the MicroAutoBox III with built-in Cooling Unit.

Installation position

The MicroAutoBox III with built-in Cooling Unit must be installed in a horizontal position with the bolt holes at the bottom.

Clearances

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



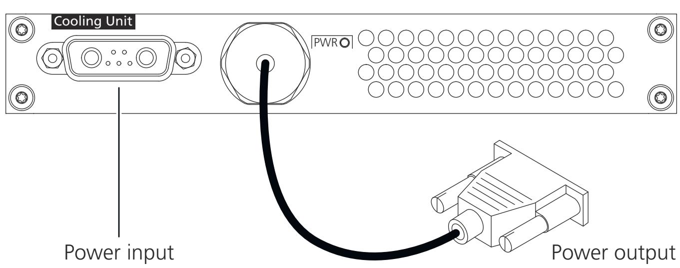
Installing to a vehicle

An installed Cooling Unit does not change the workflow to install the MicroAutoBox III.

For more information, refer to Workflow to Install the MicroAutoBox III in a Vehicle on page 173.

MicroAutoBox III Cooling Unit Panel Components

Panel Overview



Component		Description
Connectors	Power input	Power input to supply the MicroAutoBox III Cooling Unit. The supply voltage and all other signals are looped through to the power output connector. This power input connector has the same characteristics and pinout as the power input connector of the MicroAutoBox III: ▪ For the power input and control signal characteristics, refer to Supply Characteristics on page 278. ▪ For the FuSa interface characteristics, refer to Functional Safety Interface Characteristics on page 273.

Component		Description
		▪ For the pinout, refer to Power Input Connector Pinout on page 265.
	Power output	Provides the looped-through supply voltage and signals of the power input connector. Connect this connector to the power input connector of the MicroAutoBox III.
LED	PWR	Provides status information on the Cooling Unit. For the LED status description, refer to LED States of the Cooling Unit Panel on page 511.

General Characteristics and Pinout

Power input characteristics (VBAT)

Note

The MicroAutoBox III type label defines the operating voltage and power required to correctly supply the MicroAutoBox III with built-in Cooling Unit.

The characteristics are specified for the following conditions, unless stated otherwise:

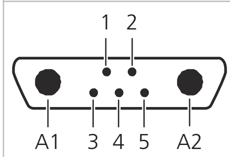
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.
- The protected voltage levels do not imply a functional operation.

Parameter	Symbol	Specification[1)]	Description
Operating voltage range	VBAT	Voltage range of the attached MicroAutoBox III. Refer to General Characteristics on page 240.	
Operating power	P_{VBAT}	10 W	Power consumption of the Cooling Unit.
Standby current	$IBAT_{standby}$	Max. 10 mA at VBAT = 12 V	▪ The Cooling Unit is in standby. ▪ Incl. the standby current of the attached MicroAutoBox III.

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

Power input connector pinout

The power input connector is a 7-pin, male connector with two high-current pins. It is a special variant of a 15-pin Sub-D connector (mixed-layout 7W2 Sub-D). The following illustration shows the pin numbering of the power input connector (front view of the MicroAutoBox III Cooling Unit):

<table>
<tr><th>Power Input Connector</th><th>Pin</th><th>Signal</th></tr>
<tr><td rowspan="7">
</td><td>A1</td><td>GND</td></tr>
<tr><td>A2</td><td>VBAT</td></tr>
<tr><td>1</td><td>SAFETY Out 1</td></tr>
<tr><td>2</td><td>SAFETY Out 2</td></tr>
<tr><td>3</td><td>PRESTART</td></tr>
<tr><td>4</td><td>REMOTE</td></tr>
<tr><td>5</td><td>SAFETY In</td></tr>
</table>

Housing dimensions

The MicroAutoBox III Cooling Unit has the following dimensions without the top and bottom plate:

- Length: 290 mm (9.67 in.), incl. power output cable
- Width: 200 mm (7.87 in.)
- Height: 25 mm (0.98 in.)

Weight

The MicroAutoBox III Cooling Unit weighs 1,300 g (46 oz).

LED States of the Cooling Unit Panel

PWR LED

Displays status information concerning the MicroAutoBox III Cooling Unit.

LED Status	Description
Off	The Cooling Unit is not supplied or in standby.
Green	The Cooling Unit operates without failures.
Red	The Cooling Unit detects a fan failure. Contact dSPACE Support (www.dspace.com/go/supportrequest).

Connection Cables

Where to go from here

Information in this section

Ethernet Connection Cables

Where to go from here

Information in this section

AETH_CAB1 Automotive Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

<table>
<tr><th>Parameter</th><th colspan="3">Specification[1)]</th></tr>
<tr><td>Purpose</td><td colspan="3">To connect a MicroAutoBox III (DS1403-04) or an Embedded PC to an automotive Ethernet network.</td></tr>
<tr><td>Illustration</td><td colspan="3">
</td></tr>
<tr><td>Connector</td><td>LEMO-1B, 4 pins</td><td></td><td>4 x open wire</td></tr>
<tr><td>Label on the cable</td><td colspan="3">AETH_CAB1</td></tr>
<tr><td>Length</td><td colspan="3">5 m (197 in.)</td></tr>
<tr><td>Operating temperature</td><td colspan="3">-40 °C … +85 °C (-40 °F … +185 °F)</td></tr>
<tr><td>Max. transfer rate</td><td colspan="3">100 Mbit/s</td></tr>
</table>

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

Color coding of the wires

The open wires are coded as follows:

Color Code	Signal
Orange-brown	TRX+
Orange-black	TRX-

AETH_CAB2 Automotive Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

<table>
<tr><th>Parameter</th><th colspan="3">Specification[1)]</th></tr>
<tr><td>Purpose</td><td colspan="3">To connect a DS1403 as of revision 5 (DS1403-05) or a DS1521 Bus Board to an automotive Ethernet network.</td></tr>
<tr><td>Connector</td><td>LEMO-1B, 7 pins</td><td></td><td>2 x cable, each cable with two open wires</td></tr>
<tr><td>Label on the cable</td><td colspan="3">AETH_CAB2</td></tr>
<tr><td>Length</td><td colspan="3">5 m (197 in.)</td></tr>
<tr><td>Operating temperature</td><td colspan="3">-40 °C … +85 °C (-40 °F … +185 °F)</td></tr>
<tr><td>Max. transfer rate</td><td colspan="3">1 Gbit/s</td></tr>
</table>

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

Color coding of the wires

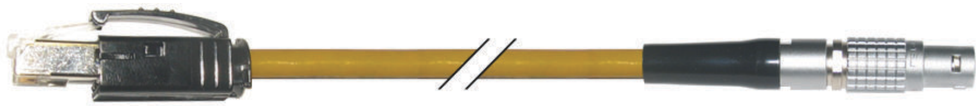
The open wires are coded as follows:

Color Code	Signal
Green	TRX+
White	TRX-

ETH_CAB1 Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

Parameter	**Specification**[1]		
Purpose	To connect a MicroAutoBox II/III/Embedded PC or a DCI-GSI2 to hardware with an RJ45 connector.		
Illustration			
Connector	RJ45 jack		LEMO-1B, 8 pins
Label on the cable	ETH_CAB1		
Length	5 m (197 in.)		
Operating temperature	-40 … +85 °C (-40 … +185 °F)		
Max. transfer rate	1 Gbit/s		

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

ETH_CAB2 Ethernet Connection Cable

Technical data

Up to revision CB1401C-02-xxx The revision number is written on the cable's label. The following table shows the technical specifications of the galvanically isolated connection cable:

Parameter	Specification[1]		
Purpose	To connect a MicroAutoBox II/III or a DCI-GSI2 to hardware with an RJ45 connector electrically safe up to 300 V DC/AC$_{RMS}$ and 600 V$_{peak}$.		
Illustration			
Connector	RJ45 jack	Galvanic isolation	LEMO-1B, 8 pins
Label on the cable	ETH_CAB2		
Length	4.5 m (177.2 in.)		
Electrical characteristics	Electrically safe up to 300 V DC/AC$_{RMS}$ and 600 V$_{peak}$[2]		
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.

As of revision CB1401C-03-xxx The revision number is written on the label of the cable. The following table shows the technical specifications of the galvanically isolated connection cable:

Parameter	Specification[1]		
Purpose	To connect a MicroAutoBox II/III or a DCI-GSI2 to hardware with an RJ45 connector electrically safe up to 300 V DC/AC$_{RMS}$ and 600 V$_{peak}$.		
Illustration			
Connector	RJ45 jack	Galvanic isolation	LEMO-1B, 8 pins
Label on the cable	ETH_CAB2		
Length	4.5 m (177.2 in.)		
Electrical characteristics	Electrically safe up to 300 V DC/AC$_{RMS}$ and 600 V$_{peak}$[2]		
Operating temperature	–40 … +85 °C (–40 … +185 °F)		
Max. transfer rate	1 Gbit/s		

[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.

ETH_CAB3 Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

Parameter	**Specification[1]**		
Purpose	To connect, for example, a DCI-GSI2 to a MicroAutoBox II/III.		
Illustration			
Connector	LEMO-1B, 8 pins		LEMO-1B, 8 pins
Label on the cable	ETH_CAB3		
Length	5 m (197 in.)		
Operating temperature	-40 … +85 °C (-40 … +185 °F)		
Max. transfer rate	1 Gbit/s		

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

Related topics

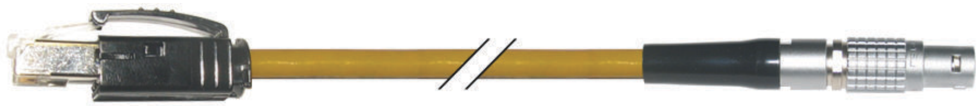
HowTos

How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 📖)
How to Connect a MicroAutoBox III to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 📖)

ETH_CAB4 Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

Parameter	Specification[1]		
Purpose	To connect a MicroAutoBox II/III/Embedded PC or a DCI-GSI2 to hardware with an RJ45 connector.		
Illustration			
Connector	RJ45 jack		LEMO-1B, 8 pins
Label on the cable	ETH_CAB4		
Length	10 m (394 in.)		
Operating temperature	-40 … +85 °C (-40 … +185 °F)		
Max. transfer rate	1 Gbit/s		

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

ETH_CAB5 Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

Parameter	Specification[1]		
Purpose	To connect a MicroAutoBox II/III/Embedded PC or a DCI-GSI2 to hardware with an RJ45 connector.		
Illustration			
Connector	RJ45 jack		LEMO-1B, 8 pins
Label on the cable	ETH_CAB5		
Length	5 m (197 in.)		
Operating temperature	-40 … +150 °C (-40 … +302 °F)		
Max. transfer rate	1 Gbit/s		

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

ETH_CAB6 Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

Parameter	**Specification**[1]		
Purpose	To connect, for example, a DCI-GSI2 to a MicroAutoBox II/III.		
Illustration			
Connector	LEMO-1B, 8 pins		LEMO-1B, 8 pins
Label on the cable	ETH_CAB6		
Length	5 m (197 in.)		
Operating temperature	-40 … +150 °C (-40 … +302 °F)		
Max. transfer rate	1 Gbit/s		

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

Related topics

HowTos

How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 🕮)
How to Connect a MicroAutoBox III to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 🕮)

ETH_CAB7 Ethernet Connection Cable

Technical data

The following table shows the technical specifications of the cable:

<table>
<tr><th>Parameter</th><th colspan="3">Specification[1)]</th></tr>
<tr><td>Purpose</td><td colspan="3">To connect, for example, a DCI-GSI2 to a MicroAutoBox II/III.</td></tr>
<tr><td>Illustration</td><td colspan="3"></td></tr>
<tr><td>Connector</td><td>LEMO-1B, 8 pins</td><td></td><td>LEMO-1B, 8 pins</td></tr>
<tr><td>Label on the cable</td><td colspan="3">ETH_CAB7</td></tr>
<tr><td>Length</td><td colspan="3">10 m (394 in.)</td></tr>
<tr><td>Operating temperature</td><td colspan="3">-40 … +150 °C (-40 … +302 °F)</td></tr>
<tr><td>Max. transfer rate</td><td colspan="3">1 Gbit/s</td></tr>
</table>

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

Related topics

HowTos

How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 🕮)
How to Connect a MicroAutoBox III to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 🕮)

FlexRay Connection Cables

Where to go from here

Information in this section

FR_CAB3 FlexRay Interface Cable for a MicroAutoBox II/III

Technical data

The following table shows the technical specifications of the FR_CAB3 FlexRay interface cable:

Parameter	Specification [1)]		
Purpose	The FR_CAB3 FlexRay Interface Cable can be used to connect FlexRay bus lines to a ZIF I/O connector of a MicroAutoBox II/III.		
Illustration			
Connector	5 crimped contacts for ZIF connector	–	Two 9-pin Sub-D connectors, one male, one female
Label on the cable	FR_CAB3		
Length	1 m (39.4 in.)		
Operating temperature	0 … +70 °C (+32 … +158 °F)		

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

The following table shows the assignments of the signals to the connectors of the FlexRay Interface Cable.

Label on the Identification Ring	Color	Signal	Female 9-pin Sub-D Connector	Male 9-pin Sub-D Connector
1	Pink	BP[1)]	7	-
2	Green	BM[1)]	2	-
3	Pink	BP_FT[2)]	-	7
4	Green	BM_FT[2)]	-	2
5	Black	GND	3	3

[1)] The wires of BP and BM signals are twisted.
[2)] The wires of BP_FT and BM_FT signals are twisted.

MicroAutoBox Break-Out Box Connection Cables

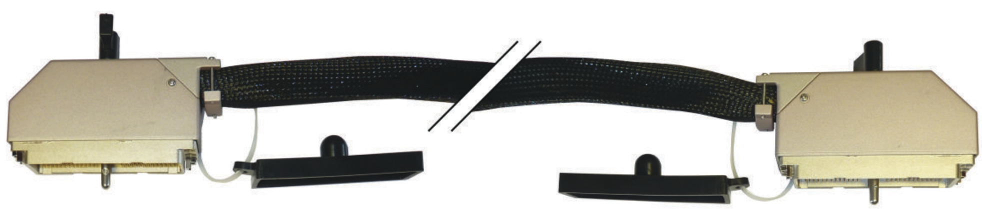
Where to go from here

Information in this section

CB1541 Break-Out Box Connection Cable for MicroAutoBox II/III

Technical data

The following table shows the technical specifications of the CB1541 Break-Out Box connection cable:

Parameter	**Specification**[1)]		
Purpose	To connect the Break-Out Box DS1541 to the MicroAutoBox II/III.		
Illustration			
Connector	Male zero insertion force connector with 156 signal pins	–	Male zero insertion force connector with 156 signal pins
Length	0.6 m (23.6 in.)		
Operating temperature	0 … +70 °C (+32 … +158 °F)		

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

Power Supply Cables

Where to go from here

Information in this section

CB6073PW Power Supply Cable

Technical data

The following table shows the technical specifications of the CB6073PW power supply cable:

Parameter	Specification[1]		
Purpose	To supply a MicroAutoBox III, MicroAutoBox III Embedded PC, or SCALEXIO AutoBox.		
			
Connector	7-pin female Sub-D Connector with two high-current pins (mixed-layout 7W2 Sub-D)		3 open wires
Label on the cable	CB6073PW		
Length	2.5 m (98 in.)		
Operating temperature	▪ –20 °C … +70 °C (–4 °F … + 158 °F) with movement ▪ –20 °C … +85 °C (–4 °F … + 185 °F) without movement		

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

Color coding of the wires

The open wires are coded as follows:

Color Code	Signal
Black	GND
Red	Positive voltage
White	Remote control

USB Connection Cable

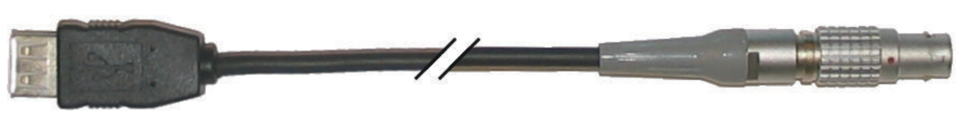
Where to go from here

Information in this section

USB_CAB14 Interface Cable

Technical data

The following table shows the technical specifications of the USB_CAB14 interface cable:

Parameter	Specification[1]		
Purpose	To connect USB mass storage devices to the LEMO connector of the MicroAutoBox III.		
Illustration			
Connector	1 x USB type A jack, 4 pins		LEMO-1B, male, 8 pins
Label on the cable	USB_CAB14		
Length	1.8 m (70.8 in.)		
Operating temperature	-20 °C … + 80 °C (-4 °F … + 176 °F)		

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

Glossary

Introduction

The glossary briefly explains the most important expressions and naming conventions used in the MicroAutoBox III documentation.

Where to go from here

Information in this section

A

AC motor control module Module type that is optimized for controlling various electric drives.

Automotive Ethernet Ethernet standard that uses a single twisted-pair cable to connect Ethernet devices. This standard is intended for in-vehicle applications.

B

Behavior model A part of the real-time model that contains the control algorithm, but not the I/O access to the MicroAutoBox III.

Behavior models can be modeled, for example, in MATLAB/Simulink by using Simulink Blocksets and Toolboxes from the MathWorks®.

Bus board A board type that mainly provides bus and serial interfaces.

C

CAN FD interface module Module type that provides CAN FD interfaces.

Channel type A category of channels on an I/O board or I/O module that provides exactly the same characteristics.

Chassis ground Ground potential of vehicles. The chassis ground must be connected to the negative pole of the vehicle battery to operate a MicroAutoBox III.

Common ground Ground potential that levels out reference voltage differences between connected devices. A common ground line can also be used as signal ground for robust digital signals.

ConfigurationDesk The dSPACE software product for configuring the I/O functionality of the MicroAutoBox III and to build the real-time application.

ControlDesk The dSPACE software product for experimenting with a dSPACE platform. It can be used for downloading the real-time application, calibrating parameters, and measuring signals.

Controller Circuit that provides the interface to a network. The electric signaling levels and methods of the network are handled by a transceiver or PHY.

D

DS number Unique number to identify dSPACE hardware.

Dynamic IP A network address that is assigned to an Ethernet controller by a DHCP server.

E

ECU Abbreviation of *electronic control unit*.

ECU interfacing Methods and tools that synchronously read and/or write individual variables of an application running on an ECU.

Engine control I/O module Module type that provides an I/O interface for the advanced control of combustion engines.

Ethernet adapter Circuit that provides access to an Ethernet network. An Ethernet adapter comprises a controller, a PHY, and a port.

Ethernet device Device that can be connected to an Ethernet network.

Ethernet switch Circuit that connects several Ethernet devices to create an Ethernet network. An Ethernet switch switches the data traffic so that data packets reach the receiver in a targeted manner.

Experiment software Generic term for software products that can be used for calibrating parameters and measuring signals of a real-time application. ControlDesk is the dSPACE software product for experimenting.

F

Feed-through pins Connector pins that loop bus signals. Feed-through pins shorten the stub length when connecting a bus device to a network.

Flash application Real-time application that is stored to the flash memory. A flash application can automatically start from the flash memory after the MicroAutoBox III is switched on.

FlexRay interface module Module type that provides FlexRay interfaces.

FPGA application An application that provides the custom-coded bitstream to program an FPGA base board. The FPGA application for a MicroAutoBox III is part of the real-time application.

FPGA base board A board type that provides an FPGA for FPGA applications. I/O modules are connected to the FPGA base board to provide the I/O functionality.

Function block A graphical representation in ConfigurationDesk that provides I/O functionality and access to the hardware.

Function block type A software plug-in for ConfigurationDesk that provides a specific I/O functionality. Every function block type has unique features that are different from other function block types. An instance of it is a function block.

G

Gain drift Parameter that indicates the dependency of the gain parameter to another physical parameter, mainly temperature.

Gain error Parameter that indicates the deviation of a measured gain from its ideal gain. With the MicroAutoBox III, the ideal gain is a linear gain.

GND Abbreviation of *ground*.

Common ground of the MicroAutoBox III.

H

Host communication Term for the communication between the host PC and the MicroAutoBox III.

Host PC Standard PC or laptop that is connected to the MixcroAutoBox III. Via the host PC, you can configure the MicroAutoBox III, download a real-time application, and control the experiment.

I

I/O board Generic term for multi-I/O boards, bus boards, and FPGA base boards.

I/O Ethernet Term for Ethernet used by the real-time application.

I/O Ethernet communication Term for the communication between the real-time application and the Ethernet devices that are connected to the MicroAutoBox III.

I/O module Generic term for modules that can be installed to an FPGA base board or for logical parts of an I/O board.

IOCNET Abbreviation of *I/O carrier network*.

dSPACE-specific high-speed serial communication bus that connects the I/O boards to the processor board.

IP mode Mode for setting the IP address of the host controller. Depending on the IP mode, the host controller uses a configurable static IP address or uses a dynamic IP.

M

Mounting Computing process that makes a device or file accessible by the operating system.

Multi-I/O board Board type that mainly provides analog and digital I/O interfaces.

Multi-I/O module Module type that mainly provides analog and digital I/O interfaces.

N

Normal operating mode Operating mode in which the MicroAutoBox III is switched on and ready to execute a real-time application or a real-time application runs.

NvData Abbreviation of *nonvolatile data*.

User-defined data that is retained when the power is shut off.

O

Offset drift Parameter that indicates the dependency of the offset parameter to another physical parameter, mainly temperature.

Offset error Parameter that indicates the deviation of a measured offset from its ideal offset. The ideal offset is assumed to be zero.

Operating power Parameter that indicates the required power to operate a device in the intended use at maximum load. The power consumption indicates the power consumed by the device itself. The rated power is the sum of the power consumption and the power of the connected loads (VBATprot, VSENS, USB, …).

Operating temperature Parameter that indicates the temperature at the cooling fins at which a device can be operated with the specified electrical characteristics.

Operating voltage Parameter that indicates the voltage for operating the device in the intended use. The operating voltage of the MicroAutoBox III refers to the voltages at the power input connector of the processor board.

Output current limit Parameter that indicates the current that an output can supply in the event of an error (short circuit).

P

PHY Abbreviation of *physical layer*.

Medium access circuit that provides the electrical interface to the Ethernet network.

Pinout Graphical overview of a connector for locating the signals.

Platform A dSPACE real-time hardware that can be registered and displayed in the Platform Manager, such as a MicroAutoBox III.

Platform Manager A pane of dSPACE software products that lets you handle registered platforms. You can download, start, and stop real-time applications via the Platform Manager. You can also update the firmware of the platform.

Port Mechanical interface for connecting a network cable.

Power ground Ground potential of the power supply, such as a laboratory power supply or the vehicle battery.

Power hold Powering feature that enables the real-time application to prevent the shutdown of the MicroAutoBox III.

Prestart mode Operating mode that separates the start of the MicroAutoBox III and the start of the real-time application. In this mode, the real-time application is loaded, but the application does not run.

Processor board Board type that provides a processor to execute the real-time application.

Protected voltage range Parameter that indicates the range of an applied voltage that does not cause damage.

The protected voltage range is important in the event of a fault and does not imply functional operation.

R

Real-time application An application that runs in real time on a platform. A real-time application is built from a real-time model.

Real-time model A model that is calculated in real time. For a MicroAutoBox III, it consists of a behavior model and the I/O functionality with the hardware access provided by ConfigurationDesk. The real-time application is automatically built from both model parts in ConfigurationDesk.

Real-time processor Processor that executes the real-time application.

Real-time testing A special execution environment that makes it possible to execute tests synchronously with the real-time application. A Python interpreter on a platform executes the tests (RTT sequence) which have access to model variables in every sampling step of the executed real-time application.

Remote control Powering feature that switches on/off the MicroAutoBox III via a pin of the power input connector.

S

Settling time Parameter that indicates the time required for an analog output to make a significant step in the output voltage and to remain in a given error band.

Signal ground Ground potential for connecting a signal. An ideal signal ground line carries the same amount of current as the corresponding signal line.

Signal mapping Overview of the connector pins that are relevant for a functional unit.

Standard Ethernet Ethernet interface that is commonly used for PC networks.

Standby mode Operating mode in which the MicroAutoBox III is powered, but not switched on.

Start-up voltage Parameter that indicates the required operating voltage during the start-up phase of a vehicle.

Static IP address A network address that is manually assigned to an Ethernet controller.

Subnet mask Bitmask that determines the most significant bits of the IP address as the subnetwork address, the least significant bits determine the host address.

Subnetwork Logical subdivision of an network that restricts the Ethernet communication to devices with the same subnetwork address. A default gateway is required to communicate with Ethernet devices of other networks.

Subnetwork address Address that identify the Ethernet controllers accessing the same subnetwork. The subnetwork address is derived from the IP address and the subnet mask.

Supply ground Ground potential of MicroAutoBox III supply voltages such as VSENS.

T

Transceiver Medium access circuit that provides the electrical interface to a network.

U

UART Abbreviation of *universal asynchronous receiver-transmitter*.

Circuit that provides the interface to an asynchronous serial network. The electric signaling levels and methods are handled by a connected transceiver.

V

VBAT Abbreviation of *battery voltage*.

Input voltage for powering the MicroAutoBox III. The power supply can be the vehicle battery or a laboratory power supply.

VBATprot Abbreviation of *protected battery voltage*.

Protected output voltage for driving digital I/O circuits or sensors with an automotive-compatible voltage level. VBATprot follows VBAT within the operating voltage range of the MicroAutoBox III. The DS1511, DS1513, DS1552, and DS1554 provide VBATprot.

VDRIVE Abbreviation of *drive voltage*.

Input voltage for driving the digital I/O circuits of the DS1511, DS1513, DS1552, and DS1554.

VSENS Abbreviation of *sensor voltage*.

Output voltage for driving digital I/O circuits or sensors. The voltage level depends on the I/O board or I/O module.

W

Web interface Graphical user interface for configuration, support, and status information. You open the web interface with the Internet browser of the host PC.

Working current range Parameter that indicates the range of the current flow through the connector pins of a functional unit during proper operation.

Working voltage range Parameter that indicates the range of the applied voltage at the connector pins of a functional unit during proper operation.

A

B

C

D

E

F

H

I

L

M