MicroAutoBox II

Hardware Installation and Configuration

Release 2021-A – May 2021

dSPACE

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

About This Document

Content

This document will show you the installation and hardware configuration of the different variants of MicroAutoBox II. The variants are:

- MicroAutoBox II 1401/1507
- MicroAutoBox II 1401/1511
- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513
- MicroAutoBox II 1401/1513/1514
- All MicroAutoBox II variants named above with MicroAutoBox Embedded PC
- MicroAutoBox Embedded DSU

It describes the hardware installation procedure and shows how to configure the hardware. It also gives you information about connecting external devices to the dSPACE system.

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.

Symbol	Description
	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.

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

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

Safety Precautions

Introduction

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

dSPACE General Safety Precautions

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

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

Where to go from here

Information in this section

Intended Use

Intended use of MicroAutoBox II

MicroAutoBox II is intended to be used for the developing, researching, and testing of functions for electronic control units (ECU). Using MicroAutoBox II 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.

MicroAutoBox II 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 absolute maximum levels, refer to the data sheets of MicroAutoBox II.

You are not allowed to open, modify, or service MicroAutoBox II 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.

Intended use of MicroAutoBox Embedded PC

MicroAutoBox Embedded PC is intended to be used for the developing, researching, and testing of advanced driver assistance, infotainment, telematics, and image processing applications. Using MicroAutoBox Embedded PC for purposes other than the intended one (e.g., in vehicles intended for sale to consumers, or in machines as part of production machinery) is considered to be improper and non-contractual use.

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

You are not allowed to open, modify, or service MicroAutoBox Embedded PC 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.

Intended use of MicroAutoBox Embedded DSU

MicroAutoBox Embedded DSU is intended to be connected to the following devices for mass data recording:

- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor
- PC connection option for Embedded DSU (order number: PC_CON_EMB_DSU)

Connecting MicroAutoBox Embedded DSU to other devices is considered to be improper and non-contractual use.

MicroAutoBox Embedded DSU must be used in a clean and dry environment (pollution degree 2, according to IEC IEC 61010-1664).

You are not allowed to open, modify, or service MicroAutoBox Embedded DSU 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.

Electromagnetic compatibility

A MicroAutoBox (MicroAutoBox II, MicroAutoBox Embedded PC, MiroAutoBox Embedded DSU) 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 the data sheets.

Safety Precautions for Installing and Connecting the Hardware

User qualification

Only qualified persons with experience in installing computer hardware and electric devices are allowed to install or uninstall hardware.

In the specific case that electric devices must be soldered, special qualifications for soldering are recommended. For details, refer to Soldering devices on page 20.

Installation sequence

- Read the instructions carefully before starting installation.
- Note all given warnings.
- Install the components of your system in the exact order stated.

  Any other sequence may lead to unpredictable results or even damage the system. For the installation and configuration procedure, refer to Installation and Configuration Overview on page 35.

Connecting to power supply

- Do not supply MicroAutoBox with voltage levels above the operating voltage range:
  - Max. 32 V DC for MicroAutoBox Embedded PC.
  - Max. 36 V DC for MicroAutoBox II.
- If the MicroAutoBox Embedded PC is built in a MicroAutoBox II, the power input connector of the MicroAutoBox Embedded PC is covered with a protective cap. Do not remove the protective cap.
- 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 Connecting to Power Supply on page 42.

Using MicroAutoBox on wet locations

MicroAutoBox (MicroAutoBox II, MicroAutoBox Embedded PC, MiroAutoBox Embedded DSU) is not moisture-proof and is not intended to be used on wet locations according to IEC 61010-1 (product safety).

- Use MicroAutoBox only on dry locations and avoid condensation.

Avoiding interference with radio communication devices

MicroAutoBox Embedded PC can provide radio interfaces such as WLAN.

The 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, MicroAutoBox Embedded PC is restricted to indoor use.
- Attach only the delivered antennas to the WLAN and Bluetooth interfaces (), and the LTE interface. Do not use antennas that are not provided by dSPACE.

  To the GNSS interface, only attach recommended antennas. dSPACE does not provide GNSS antennas.

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.

Installing or uninstalling hardware

You install and uninstall dSPACE hardware 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.

Before doing any installation or uninstallation work, make sure that:

- The power supply (vehicle engine) is switched off.
- No external devices are connected to the dSPACE system.

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

Soldering devices

In some specific cases, electric devices must be soldered to the dSPACE hardware. Unprofessional soldering will damage the hardware and/or lead to lost of hardware functionality.

You solder devices at your own risk. Any damage to or malfunction of dSPACE hardware caused by improper soldering is not covered by the warranty.

To avoid hardware damage:

- Only qualified persons with knowledge and experience in the following areas should solder electric devices:
  - Soldering in general (in particular, soldering SMD devices)
  - PCB (printed circuit boards) assembly
- Use only the correct tools: e.g., a suitable SMD soldering station.

Connecting and disconnecting devices

To prevent damage to the hardware:

- Do not apply voltages or currents outside the specified ranges to the connector pins.
- Do not connect or disconnect any devices while the dSPACE system is powered up and/or external devices are switched on. Make sure that external devices are turned off beforehand.

MicroAutoBox II 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.

Notes on using MicroAutoBox II 1401/1507

Installing, uninstalling and configuring IP modules might result in personal injury and will damage MicroAutoBox II 1401/1507.

- Do not install/uninstall IP modules to MicroAutoBox II 1401/1507 yourself.

  If you want to use IP modules with your MicroAutoBox II 1401/1507, the IP modules must be installed by dSPACE. The assembling positions of the DS1401 Base Board and the DS1507 I/O Board in the MicroAutoBox housing do not allow direct access to the IP slots of the DS1507.
- Do not configure a IP module yourself (soldering resistors for the wake-up function).

  If you want to use the wake-up function, the configuration must be done by dSPACE.

Safety Precautions for Using MicroAutoBox II/Embedded PC in a Vehicle

Connecting to the battery/power supply

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.

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

Guidelines for safe and trouble-free use

- Turn off the vehicle engine while connecting or disconnecting the vehicle battery. Even a brief disconnection of the battery while the engine is running results in a load dump of the car generator, producing hazardous voltages of more than 100 V.
- Double-check the supply voltage polarity of MicroAutoBox II. Reverse polarity might instantly destroy parts of MicroAutoBox II under some circumstances, even if the remote control input is turned off.
- 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.

Safe In-Vehicle Use of dSPACE Products

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.

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 II to the terminal points of the break-out boxes.
- Do not connect or disconnect sensors or actuators while the power supply of the MicroAutoBox II 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 II

Shipping a MicroAutoBox II

Observe the following when shipping a MicroAutoBox II:

- 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 II 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 the MicroAutoBox II data sheet.

Safety Precautions for Disposing dSPACE Hardware

Disposing dSPACE hardware

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:

- DS1401 Processor Board: A Lithium battery is permanently installed to the board.

  If you are shipping the MicroAutoBox II to a disposal or recycling center, observe the notes on shipment. Refer to Safety Precautions for Shipping a MicroAutoBox II on page 24.

  For battery characteristics, refer to the data sheet of the MicroAutoBox II variant.

- MicroAutoBox II Embedded PC: A lithium manganese dioxide coin cell battery is permanently installed.

Introduction to MicroAutoBox II

Introduction

The dSPACE system based on MicroAutoBox II comprises hardware and software.

Where to go from here

Information in this section

Hardware

Introduction

MicroAutoBox II combines the advantages of a rapid prototyping (RCP) system with those of an automotive electronic control unit (ECU). Therefore, it is ideally suited as hardware for prototyping in a vehicle.

MicroAutoBox II can operate without user intervention, just like an ECU, and can be installed virtually anywhere in the vehicle. At the same time MicroAutoBox II provides all the benefits of a dSPACE real-time system. A PC or notebook can be attached temporarily for program download, data analysis and calibration.

Variants

Different variants of MicroAutoBox II are available. This document describes the installation and configuration of all variants:

- MicroAutoBox II 1401/1507
- MicroAutoBox II 1401/1511
- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513

- MicroAutoBox II 1401/1513/1514
- All MicroAutoBox II variants named above with MicroAutoBox Embedded PC

  MicroAutoBox Embedded PC is a compact PC system. MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor can also be used as stand-alone system.

For detailed information on the hardware differences of the various variants, refer to the corresponding data sheets in this document. For detailed information on the software differences of the various variants, refer to Hardware Concept (MicroAutoBox II Features 📖).

Content of the package

MicroAutoBox II consists of two resp. three boards in a milled aluminum box. The package contains:

- MicroAutoBox II containing a DS1401 Base Board and one or two I/O boards (DS1507, DS1511, DS1513, DS1514) depending on the variant.
- A power input cable and a separate power input connector to grant access to power supply of the MicroAutoBox II.
- All variants with the exception of MicroAutoBox II 1401/1507:

  156-pin zero insertion force (ZIF) I/O connector for matching the corresponding connector at the MicroAutoBox II. It grants access to the input and output signals provided by MicroAutoBox II.

  Each ZIF I/O connector is delivered with:

  - Five stickers with the names of the different I/O boards printed on. You can use these stickers to mark the connector unambiguously.
  - One coding kit. To code the ZIF I/O connector to prevent faulty connections.
  - A jumper cable with crimp contacts to connect two pins inside the ZIF I/O connector.

  The package of MicroAutoBox II 1401/1511/1514 and MicroAutoBox II 1401/1513/1514 contains two ZIF I/O connectors and coding kits.
- Only MicroAutoBox II 1401/1507:

  78-pin, male Sub-D connector. It grants access to the I/O signals of CAN, FlexRay, LIN and the serial interfaces.
- A host interface cable is included for the connection between MicroAutoBox II and your host PC.
- A crimper tool, crimp contacts (AWG 20-22) and a tool to remove the contacts are included to build the I/O connector according to your needs.
- An external 1000 µF capacitor to be connected in parallel to a lab power supply output, to prevent the MicroAutoBox II inrush current from triggering the power supply's overcurrent protection.
- A printed document "dSPACE General Safety Precautions".

The image below shows a MicroAutoBox II 1401/1511 with some parts coming with the package.

Optional accessories

- Additional I/O connectors and cables are available from dSPACE upon request.
- MicroAutoBox Break-Out Boxes are supplied on demand. The boxes provide easy access to signals on the MicroAutoBox I/O connectors. It allows you to measure signals and to reconnect signals without changing an existing cable harness.

  For details, refer to Using the MicroAutoBox Break-Out Box DS1541 on page 169.
- MicroAutoBox Embedded DSU

  MicroAutoBox Embedded DSU (Data Storage Unit) provides a mass data storage capacity for data logging in combination with the following devices:
  - MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor
  - PC connection option for Embedded DSU (order number: PC_CON_EMB_DSU)

  MicroAutoBox Embedded DSU lets you continuously record and play back large volumes of sensor and vehicle network data for testing purposes, especially in fields such as advanced driver assistance systems (ADAS), automated driving, self-driving vehicles, and robotics.

  For details, refer to Data Sheet MicroAutoBox Embedded DSU on page 493.

Software

Host PC software

The dSPACE software, such as the implementation and the experiment software, comes on DVD and has to be installed first. For further information, refer to Basics on dSPACE Software Installation (Installing dSPACE Software 🕮). You can find the document in PDF format on the dSPACE DVD.

Overview of MicroAutoBox II Variants

Hardware feature comparison The following table gives a hardware feature overview of MicroAutoBox II:

Feature		MicroAutoBox II				
		1401/1507	1401/1511	1401/1511/1514	1401/1513	1401/1513/1514
Analog inputs	ADC unit type 4[1]	–	✓	✓	✓	✓
	AIO type 1 ADC unit[1]	–	–	–	✓	✓
Analog outputs	DAC unit type 3[2]	–	✓	✓	–	–
	AIO type 1 DAC unit[2]	–	–	–	✓	✓
Digital inputs		–	✓	✓	✓	✓
Digital outputs		–	✓	✓	✓	✓
ECU interface		✓	✓	✓	✓	✓
ECU interface connector		✓	✓	✓	✓	✓
Slots for IP modules (e.g., FlexRay)		✓	–	✓	–	✓
Slot for I/O module	DS1552 Multi-I/O Module	–	–	✓	–	✓
	DS1554 Engine Control I/O Module[3]	–	–	✓	–	✓
CAN		✓	✓	✓	✓	✓
LIN		✓	✓	✓	✓	✓
Serial interface		✓	✓	✓	✓	✓
Ethernet host interface		✓	✓	✓	✓	✓
Ethernet I/O interface		✓	✓	✓	✓	✓
Power input connector		✓	✓	✓	✓	✓
ZIF I/O connector		–	✓	✓	✓	✓
Sub-D I/O connector		✓	–	–	–	–
USB connector (for flight recording)		✓	✓	✓	✓	✓

1) For details on the ADC unit types, refer to Overview of the A/D Conversion Units (MicroAutoBox II Features 🕮).
2) For details on the DAC unit types, refer to Overview of the D/A Conversion Units (MicroAutoBox II Features 🕮).
3) You can extend your MicroAutoBox only by using the *FPGA1401Tp1 with DS1554 Engine Control Module* framework from the RTI FPGA Programming Blockset.

DS1401 Base Board revisions MicroAutoBox II was first released in October 2010. The major updates of the DS1401 Base Board and the I/O boards are listed below.

These are the most important DS1401 Base Board revisions of MicroAutoBox II:

Date	Revision	Modifications	Boot Firmware Version	dSPACE Release[1)]
Q2/2010	22	First released version of MicroAutoBox II: ▪ Processor: PPC750GL ▪ CPU clock: 900 MHz ▪ Memory: 16 MB ▪ Ethernet host interface ▪ Ethernet I/O interface	▪ 2.7 For MicroAutoBox II 1401/1507 ▪ 3.0 For MicroAutoBox II 1401/1511	Using the new components requires at least Release 6.6.
		▪ Watchdog handling	▪ 3.3 (System PLD version 1.4)	7.4
		▪ Challenge-response monitoring	▪ 3.3 (System PLD version 1.5)	2016-B
		▪ Memory Integrity and Extras	▪ 3.3 (System PLD version 1.6)	2017-A
Q4/2011	23	▪ Ethernet host interface and Ethernet I/O interface with GBit support	▪ 3.2	7.2
		▪ Onboard pressure sensor	▪ 3.2 (System PLD version 1.3)	7.3
		▪ Onboard acceleration sensor	▪ 3.3 (System PLD version 1.4)	7.4
Q2/2012	25	Internal Ethernet switch	▪ 3.3 (System PLD version 1.4)	7.4
Q3/2019 (planned)	26	New Flash module	▪ 3.10 (System PLD version 2.0.2, Host IF firmware version 5.0.0, Host IF PLD firmware version 6.2.0)	2019-A

1) The hardware is delivered independently of a dSPACE Release. This column shows the first dSPACE Release that provides the required boot firmware version.

Note

The table lists the minimum boot firmware version required by the respective board revision to support the new feature. Higher boot firmware versions can be used without problems. With lower boot firmware versions, MicroAutoBox II does not work.

A real-time application for MicroAutoBox II can be executed on newer revisions, if the specified I/O is available and the boot firmware version is at least the firmware version listed above. You can possibly not use the entire memory, see the table above.

I/O board revisions

The following I/O board revisions are of interest:

Date	Revision	Features	Boot Firmware Version	dSPACE Release
DS1507				
Q4/2005	01	▪ LIN support ▪ FlexRay support ▪ 2 ECU interfaces	not relevant	Using DS1507 requires at least Release 4.0.
DS1511				
Q4/2010	03	New I/O board providing: ▪ ADC Type 4 ▪ DAC Type 3 ▪ DIO Type 3 ▪ Updated CAN Type 1	3.0.1	7.0
Q4/2011	03	New I/O features for DIO Type 3: ▪ Multichannel PWM signal generation ▪ SENT receiver	not relevant (DIO Type 3 PLD version 1.3)	7.2
Q2/2012	03	New I/O feature for DIO Type 3: ▪ SPI master	not relevant (DIO Type 3 PLD version 1.4)	7.3
Q4/2015	03	New I/O feature for DIO Type 3: ▪ Pulse width measurement (PW2D)	not relevant (DIO Type 3 PLD version 1.5)	2015-B
Q4/2019 (planned)	07	New Flash module	not relevant (ADC Type 4 PLD version 1.2.3, DIO Type 3 PLD version 1.6.5)	2019-A
DS1513				
Q3/2013	01	New I/O board providing: ▪ ADC Type 4 ▪ AIO Type 1 ▪ DIO Type 4 ▪ Updated CAN Type 1	3.3	2013-B
Q4/2015	01	New I/O feature for DIO Type 4: ▪ Pulse width measurement (PW2D)	not relevant (DIO Type 4 PLD version 1.5)	2015-B
Q3/2019 (planned)	05	New Flash module	not relevant (ADC Type 4 PLD version 1.2.3, AIO Type 1 PLD version 1.1.1, DIO Type 4 PLD version 1.6.5)	2019-A

Date	Revision	Features	Boot Firmware Version	dSPACE Release
DS1514				
Q2/2015	01	New I/O board providing: ▪ Xilinx® Kintex®-7 FPGA XC7K325T ▪ Support of DS1552 Multi-I/O Module	3.9	2015-A
Q2/2016	01	Support of DS1554 Engine Control I/O Module	3.9	2016-A

Before You Start

First steps

Make yourself familiar with the installation and configuration procedures of MicroAutoBox II and check if your system fulfills the system requirements.

Where to go from here

Information in this section

Installation and Configuration Overview

Installation sequence

NOTICE

Changing the installation sequence may lead to unpredictable results or even damage the system.

- Install the components of your system in exactly the order stated.
- Read the instructions carefully before starting installation.
- Consider all given warnings.

Installing the MicroAutoBox II requires the following steps in the specified order.

1. Check whether the software has been installed on the host PC.

   You must first install the software before connecting MicroAutoBox II to the host PC. For detailed instructions on installing the software, refer to Installing dSPACE Software.

Note

You need administrator rights to install dSPACE software.

2. Check whether your hardware meets the requirements for MicroAutoBox II. Refer to Checking the System Requirements on page 37.
3. If you use MicroAutoBox Embedded PC with WLAN, refer to the following topics to avoid interference with radio communication devices.
   - MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Attaching Antennas to MicroAutoBox Embedded PC on page 142
   - MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Attaching Antennas to the MicroAutoBox Embedded PC on page 153
4. If you use FlexRay IP modules (DS4340 or third-party) or CAN FD modules (DS4342) in MicroAutoBox II, check whether the IP modules are already installed. For details on installing IP modules, refer to How to Install IP Modules on page 188.
5. If you want to use MicroAutoBox II as the LIN master, you must add a pull-up resistor and a diode to the LIN network. You can add these electric components to the I/O board of MicroAutoBox II. For details, refer to How to Configure MicroAutoBox II as the LIN Master on page 99.
6. If you terminate a CAN bus on MicroAutoBox II 1401/1511 and 1401/1511/1514, you can solder termination resistors on the DS1511 I/O Board. For details on soldering the resistors, refer to How to Terminate the CAN Bus on page 110.
7. To set MicroAutoBox II into operation for the first time in your laboratory you have to connect the box to the power supply. Refer to Connecting to Power Supply on page 42.
8. You must connect MicroAutoBox II to your host PC via Ethernet. For this MicroAutoBox II is treated as a network client. After connecting MicroAutoBox II to the host PC via network cable, you have to set up the Ethernet connection. Refer to Connecting the MicroAutoBox II to the Host PC via Ethernet on page 61.
9. Before working with MicroAutoBox II in a vehicle you should put the system into operation in your laboratory to configure the dSPACE system and to get started with MicroAutoBox II loading applications to the system. Refer to Building the Power and I/O Connections on page 41, Connecting the MicroAutoBox II to the Host PC via Ethernet on page 61, and Connecting MicroAutoBox II to a FlexRay, LIN, or CAN Bus on page 77.
10. If you want to install MicroAutoBox II in a vehicle, refer to How to Install MicroAutoBox II/Embedded PC/Embedded DSU in a Vehicle on page 135.

Configuration sequence

After you install your MicroAutoBox II, you can configure it in the following steps:

1. Using the flight recorder of MicroAutoBox II requires some preparatory steps.
2. Check if your platform is ready to run real-time applications.

3. The firmware of the MicroAutoBox II can be updated if you install a new dSPACE Release.

Installation problems

Tip

If you encounter any problems during installation and configuration:

- Check the Support section of our website.
  See http://www.dspace.com/go/support.
- The FAQ section and application notes provide a lot of useful information.
  See http://www.dspace.com/go/FAQ.
- To stay up-to-date with information on possible problems, you should periodically check the known problem reports.
  See http://www.dspace.com/go/ProblemReports.

If self-help does not solve the problem, contact dSPACE Support and give them information about your dSPACE environment and the problems you have. The best way to do this is with the support request form provided on the website at http://www.dspace.com/go/supportrequest, but you can also send an e-mail or phone us. For details, refer to Providing Diagnostic Information 🕮 .

Next steps

After you install and configure your system, you are ready to implement a model – either via a Simulink model including blocks from dSPACE's Real-Time Interface (RTI) or via a handcoded algorithm – and download the corresponding application to your real-time hardware. You can use ControlDesk to experiment with your real-time application. Refer to DS100x, DS110x, MicroAutoBox II, MicroLabBox – Software Getting Started 🕮 .

Related topics

Basics

Checking the System Requirements

Introduction

Before installing dSPACE's hardware, you have to check whether your hardware meets the system requirements.

Host PC

Your host PC must fulfill the system requirements concerning:

- The dSPACE software and other required third-party software,
- The requirements for the hardware which is needed for connecting the host PC and MicroAutoBox II.

  This connection has to be established via Ethernet interface.

For details, refer to Appendix (Installing dSPACE Software 📖).

Power supply

MicroAutoBox II MicroAutoBox II requires a power supply in the range 6 V … 40 V. The required power depends on the MicroAutoBox II variant. Refer to the type plate on the bottom of MicroAutoBox II.

MicroAutoBox II draws an inrush current of several amperes, depending on the operating voltage. At 12 V operating voltage, a power supply that delivers 5 A peak is sufficient. If you use a lab power supply with a lower output power capability, it is recommended to connect a 1000 µF capacitor in parallel to the power supply output.

Note

- If you use a power supply with a lower output power capability without a 1000 µF capacitor, MicroAutoBox II might start in secured mode, i.e., the host PC LED is flashing red. Refer to Checking MicroAutoBox II on page 506.

MicroAutoBox Embedded PC MicroAutoBox Embedded PC requires a power supply in the range 8 V … 36 V. The required power depends on the MicroAutoBox variant that is used together with MicroAutoBox Embedded PC. Refer to the type plate on the bottom of the MicroAutoBox variant.

MicroAutoBox II and MicroAutoBox Embedded PC draw an inrush current of several amperes, depending on the operating voltage. At 12 V operating voltage, a power supply that delivers 12 A peak is sufficient (8 A peak for MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor).

If you use a lab power supply with a lower output power capability, it is recommended to connect a 1000 µF capacitor in parallel to the power supply output.

Note

- If you use a power supply with a lower output power capability without a 1000 µF capacitor, MicroAutoBox II might start in secured mode, i.e., the host PC LED is flashing red. Refer to Checking MicroAutoBox II on page 506.

Power cable

Requirements on the power cable:

- Make sure that you insert a fuse into the power supply cable close to the vehicle battery/power supply.
- 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.

For more information, refer to Connecting to Power Supply on page 42.

Building the Power and I/O Connections

Where to go from here

Information in this section

Notes on Connecting to Power Supply, Sensors and Actuators

EMC precautions

To maintain compliance with CE directives, common EMC filter and shielding practices must be applied when wiring up MicroAutoBox II. With long unshielded cables a common ferrite clamp surrounding all wires should be mounted as close as possible to the main connector of MicroAutoBox II.

Where to go from here

Information in this section

Connecting to Power Supply

Introduction

MicroAutoBox (MicroAutoBox II, MicroAutoBox Embedded PC, MicroAutoBox Embedded DSU) provides a power input connector. It 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).

Feature for MicroAutoBox Embedded PC The pinout of the power input connector features two additional signals for remote control when MicroAutoBox II is combined with MicroAutoBox Embedded PC.

Refer to the following topics:

- MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Power Input Connector on page 464 and Power Inputs and Outputs on page 466
- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Power Input Connector on page 481 and Power Inputs and Outputs on page 486

Safety precautions

⚠ WARNING

Disconnecting the vehicle battery can result in serious injury or death.

Even briefly disconnecting the battery while the engine is running results in a load dump of the car generator, producing hazardous voltages of more than 100 V.

- Turn off the engine while 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.
- If the MicroAutoBox Embedded PC is built in a MicroAutoBox II, the power input connector of the MicroAutoBox Embedded PC is covered with a protective cap. Do not remove the protective cap.

⚠ CAUTION

Connected components can cause fire

MicroAutoBox II 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.

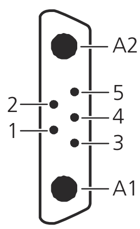
NOTICE

Reverse polarity might destroy parts of MicroAutoBox II immediately under some circumstances, even if the remote control input is turned off.

- Double-check the supply voltage polarity of MicroAutoBox II.

Required connections

To connect MicroAutoBox II to the vehicle battery or power supply, the power input connector of MicroAutoBox II provides the following pins:

Power Input Connector [1]	Pin	Signal	Pin	Signal
	A2	VBAT	5	REMOTE_Pullup
	2	Reserved for MicroAutoBox Embedded PC [2]	4	REMOTE
	1	Do not connect	3	Reserved for MicroAutoBox Embedded PC [2]
	A1	GND		

[1] Front view
[2] Refer to Power Input Connector on page 464 or Power Input Connector on page 481.

The following table gives a description of the pins used for power input and output for MicroAutoBox II:

Pin	Signal	Description/Function
A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery or power supply. For information on the supply power, refer to the signal description of the power input in the data sheet of the MicroAutoBox variant you use. Make sure that you insert a time-lag fuse into the power supply cable close to the battery/power supply. The fuse must release if the cable is stressed with the maximum current value that is supported by the used cable cross section. A 2.5 mm² cable with a 15 A/80 V time-lag fuse is suitable for all MicroAutoBox II variants.
A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery or power supply. This signal is also connected to the housing of MicroAutoBox II, and MicroAutoBox Embedded PC.
4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin to VBAT directly, MicroAutoBox II will always be turned on, and the vehicle battery will soon be exhausted if the engine is not running. Thus, a switch is highly recommended.

Pin	Signal	Description/Function
		You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference 📖). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage. ▪ Only valid for MicroAutoBox II 1401/1513 and 1401/1513/1514: To wake up MicroAutoBox II via CAN messages, the **REMOTE** pin must be left open when MicroAutoBox II is powered down. This is due to the fact that there is an additional internal connection to the **REMOTE** pin. Nevertheless, you can always use a remote switch to supply voltage (e.g., VBAT) to start MicroAutoBox II.
5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

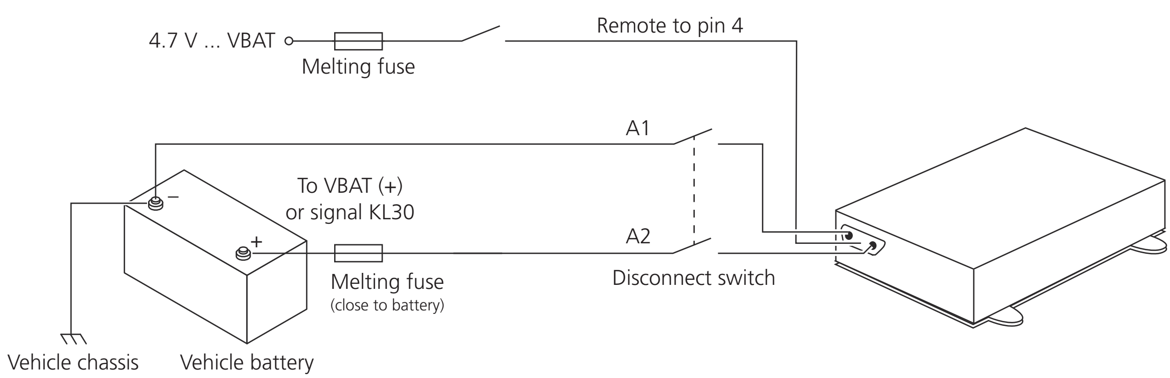
Connecting a vehicle battery

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

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



You can use the following cables with the specified protection for all variants of MicroAutoBox II:

Connection	Required Protection	Wire			Connector	
		Cross section	Maximum Temperature	Flame-Retardant Test Specification	Maximum Temperature	Flame-Retardance Class
Power supply (A1 and A2 pins)	15 A/80 V time lag fuse[1].	2.5 mm² (AWG 14)	105 °C (220 °F)	IEC 60332-1-2, IEC 60332-2-2, or UL VW-1	105 °C (220 °F)	V-2, conform to IEC 60695-11-10 or UL 94
Remote control (REMOTE pins)	Max. 1 A during short circuit[1].	0.25 mm² ... 0.5 mm² (AWG 20 ... AWG 23)				

1) The interrupting rating must be greater than the short-circuit current of the respective current path at the applied supply 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.

Preconfigured matching power cable

dSPACE provides a preconfigured cable for the supply voltage. This cable is intended for operating MicroAutoBox II with a laboratory power supply during development. Therefore, the REMOTE input (pin 4) is shorted to VBAT (pin A2) in the connector in order to save a separate switch. Do not use this cable in the vehicle. Otherwise, MicroAutoBox II will always be turned on. The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

1) The cable is labeled with this type number.

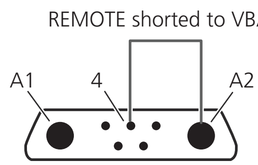
CAUTION

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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

The following illustration shows the connector of the power supply cable:



Note

If you power MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor with a preconfigured cable, the cable must be labeled CB1401PW-03-<number>.
This cable type is delivered as of dSPACE Release 2017-B and provides the matching fuse type to ensure proper operation of this MicroAutoBox Embedded PC variant.

Related topics

Basics

Providing the Supply Voltage to Drive Digital I/O Interfaces

Introduction

The ZIF I/O connectors provide a VDRIVE pin to supply digital I/O interfaces of MicroAutoBox II. 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 provided voltage level of MicroAutoBox II or an external voltage supply.

The digital input and output circuits of the following signals must be driven by a voltage supply that is connected to the VDRIVE pin.

- DS1511 I/O Board: DIO Type 3 signals
- DS1513 I/O Board: DIO Type 4 signals
- DS1552 Multi-I/O Module: DIO 1552 Type 1 signals
- DS1554 Engine Control I/O Module: Digital output signals

The bidirectional digital I/O interfaces of the DS1552 and DS1554 I/O modules are supplied by an internal voltage and not via the VDRIVE pin.

Provided voltages to supply VDRIVE

MicroAutoBox II provides an automotive-compatible voltage level and a 5 V voltage level to supply VDRIVE.

Note

- To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.
- *The VDRIVE pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.* You have to connect VDRIVE to VSENS or VBATprot yourself. Use the preconfigured jumper cable which is included in the MicroAutoBox II package.

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

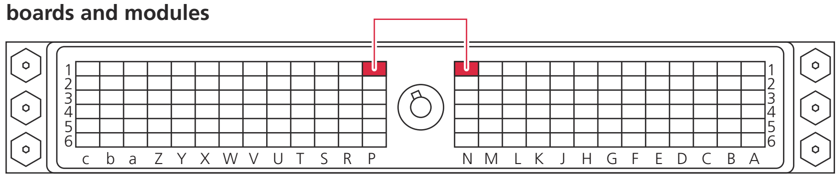
Signal	ZIF I/O Connector	Pin	Description/ Function
VDRIVE	All connectors	N1	This input supplies all digital input and output circuits of the I/O board. ▪ Connect this input to VSENS to set a 5 V logic levels for the inputs/outputs. ▪ Connect this input to VBATprot to set automotive-compatible logic levels for the inputs/outputs. ▪ 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	All connectors	P1	Protected VBAT output. Use this output to drive VDRIVE when automotive logic levels are required. Refer to Providing automotive-compatible levels on page 49.
VSENS	▪ DS1511 ▪ DS1513	M1	Sensor supply output. VSENS is switched on and off with the REMOTE pin. Use this output to drive VDRIVE when 5 V logic levels are required. Refer to Providing 5 V logic levels on page 49.
VSENS+	DS1514	b6	VSENS+ is provided by the installed I/O module. ▪ DS1552 Multi-I/O Module: Adjustable sensor supply output.

Signal	ZIF I/O Connector	Pin	Description/ Function
			Only an FPGA application built with the RTI FPGA Programming Blockset can activate this sensor supply and set the output voltage. You cannot use this sensor supply with real-time applications built with RTI/RTLib. ▪ DS1554 Engine Control I/O Module: Fixed sensor supply with 5 V logic level. An FPGA application built with the RTI FPGA Programming Blockset must activate the sensor supply. For connecting, refer to DS1514 I/O board with DS1554 Engine Control I/O Module on page 50. **Note** If you use VSENS+ to supply VDRIVE, you have to connect VSENS- (c6 pin) 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. The following illustration shows the connection.

Common for all I/O boards and modules

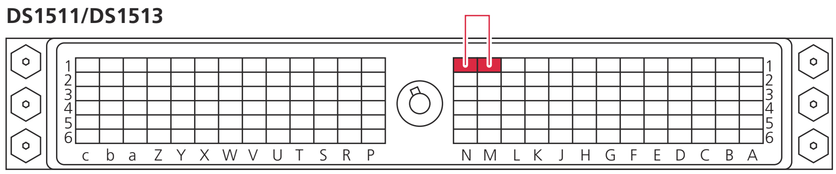


Providing 5 V logic levels

The provision of 5 V logic levels depends on the the I/O boards and I/O modules.

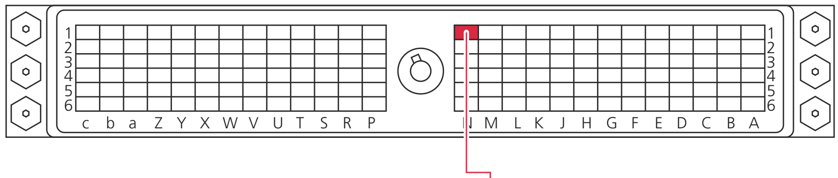
DS1511 and DS1513 I/O boards Connect the VSENS pin M1 with the VDRIVE pin N1 to provide 5 V logic levels for the digital I/O interfaces. The following illustration shows the connection.

DS1511/DS1513

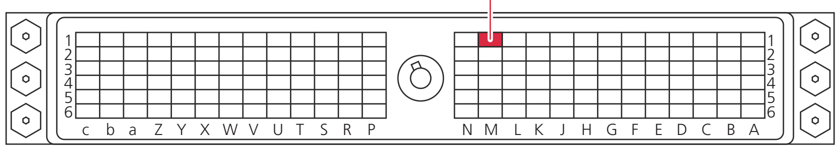


DS1514 I/O boards with DS1552 Multi-I/O Module If you use MicroAutoBox II with a DS1552 Multi-I/O Module, connect the VSENS pin M1 of the other I/O board with the VDRIVE pin N1 to provide 5 V logic levels. The following illustration shows the connection.

DS1514 with
DS1552 Multi-I/O Module



DS1511/DS1513



Note

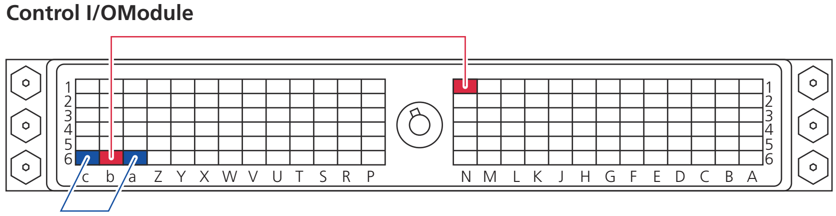
Distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514) even if VDRIVE of the DS1552 I/O module is supplied by VSENS of the DS1511/DS1513 I/O board.

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 to the illustration of the DS1514 I/O board with the DS1554 Engine Control I/O Module.

DS1514 I/O board with DS1554 Engine Control I/O Module If you use MicroAutoBox II with a DS1554 Engine Control I/O Module, connect the VSENS+ pin b6 with the VDRIVE pin N1 and the VSENS- pin c6 with GND to provide 5 V logic levels. The following illustration shows the connection.

DS1514 with DS1554 Engine
Control I/OModule



Related topics

Basics

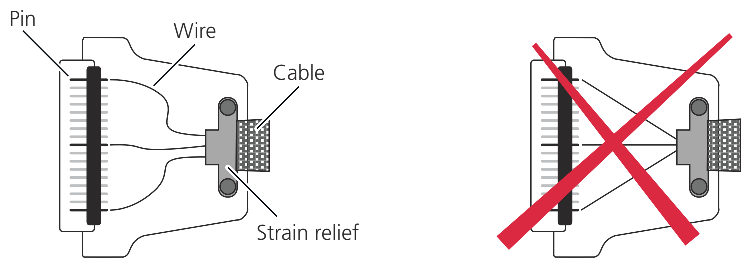
Using Sub-D Connectors

Checking connectors before first use

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

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

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

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

  This helps you hold the connector straight for plugging.

Plugging the connector

> **NOTICE**
>
> **Improper plugging might deform connector pins**
>
> Using connectors with deformed connector pins might result in defective contacts and disturbed signals.
>
> - Hold the connector shell straight and do not force the connector.
>   Holding the connector at an angle might deform pins.

Connecting Sensor Ground Lines to MicroAutoBox II

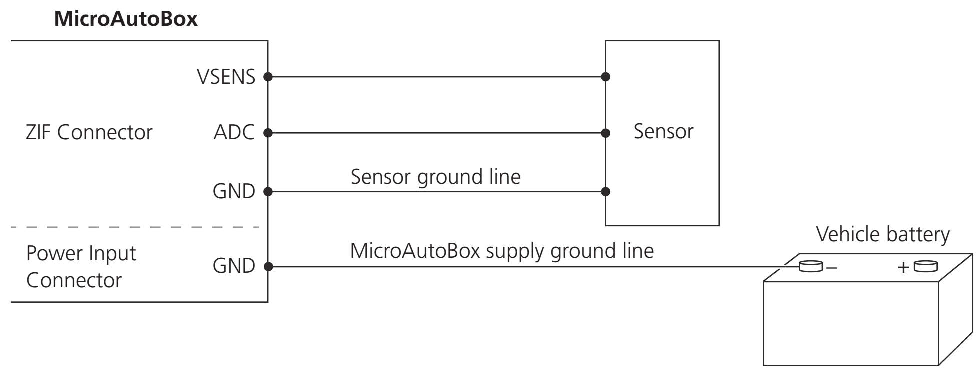
Introduction

The measurement result of sensor input signals can be impaired by improper grounding. Use ideal grounding for best measurement results.

Ideal grounding

Ideal grounding as shown in the illustration below is strongly recommended. Do not share the same wire for sensor ground and supply ground of MicroAutoBox.

Use separate wires for each sensor ground line and connect them as close as possible to a GND pin of the MicroAutoBox II I/O connector.

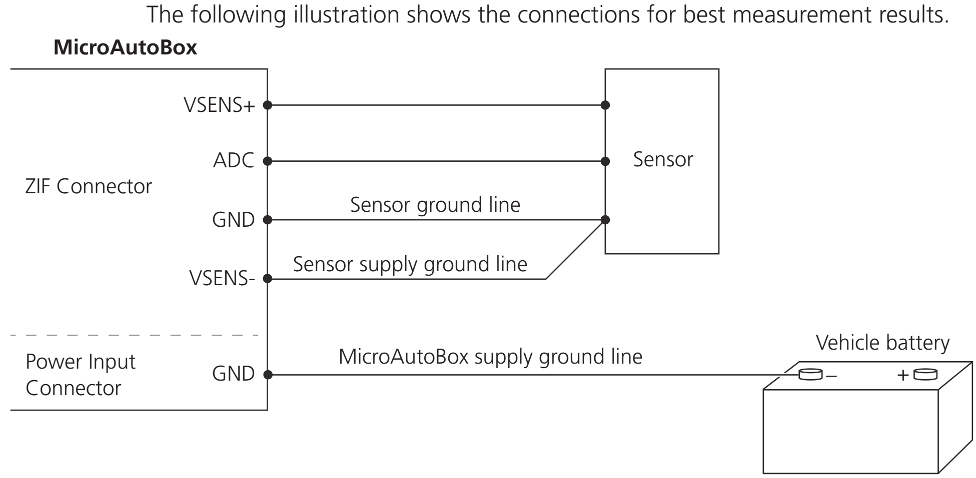


Tip

It is highly recommended to use the power input connector to connect MicroAutoBox II to the vehicle battery. This automatically separates the sensor ground and the supply ground.

Ideal grounding with DS1552 and DS1554 I/O modules The sensor supply of the DS1552/DS1554 I/O modules provides an additional reference potential to separate the sensor supply ground and the sensor ground.

The following illustration shows the connections for best measurement results.



Note

VSENS- and GND must be connected. If you connect MicroAutoBox II via a single ground line to the sensor, you have to connect VSENS- to GND at MicroAutoBox.

Related topics

Basics

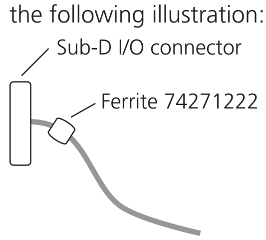
Fulfilling the Requirements for CE Certification

Affected MicroAutoBox variants

The requirements given below are valid only for MicroAutoBox II 1401/1507. Other variants are not affected. Therefore these variants are not shipped with the required ferrites.

Attaching ferrites

To fulfill the requirements for *CE* certification, you have to attach the enclosed ferrite with part number *74271222* close to the Sub-D I/O connector. Refer to the following illustration:



Tip

Place the ferrites as close as possible to the related connector of the MicroAutoBox cable harness for optimum results.

Shielded CAN connection cables

To fulfill the requirements for *CE* certification, you must use shielded CAN connection cables and connect shields to ground pins of the MicroAutoBox.

Using dSPACE MicroAutoBox Crimper Tool

Where to go from here

Information in this section

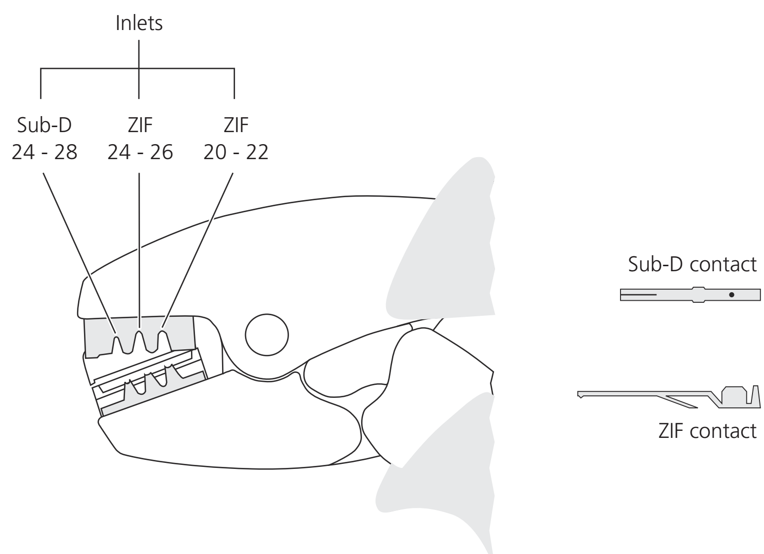
Details on the MicroAutoBox Crimping Tool

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 MicroAutoBox II are ZIF 20 - 22.

How to Crimp Contacts with the Crimping Tool

Objective

Crimping contacts with the dSPACE MicroAutoBox crimping tool.

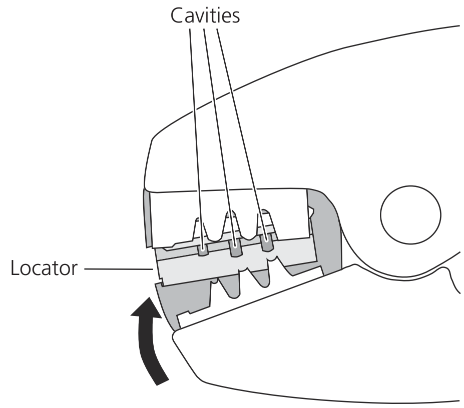
Precondition

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

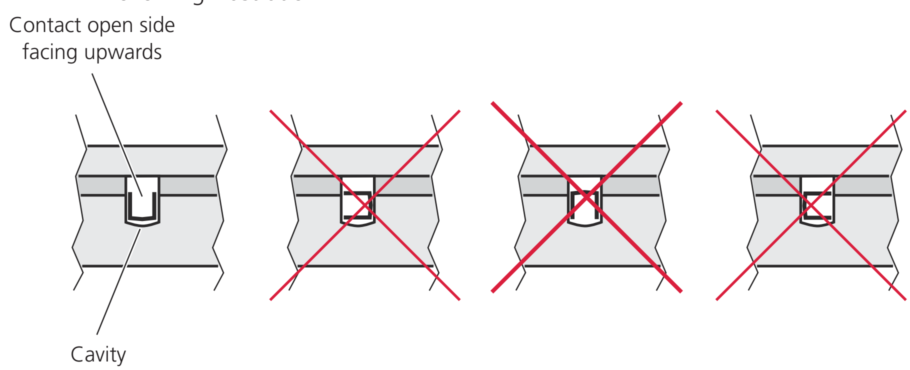
Method

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.

Preparing the ZIF I/O Connector

Introduction

Before connecting, you have to fasten the wires and fix the connector cover. To prevent wrong connections, it is recommended to mount coding pins on your I/O connector.

Where to go from here

Information in this section

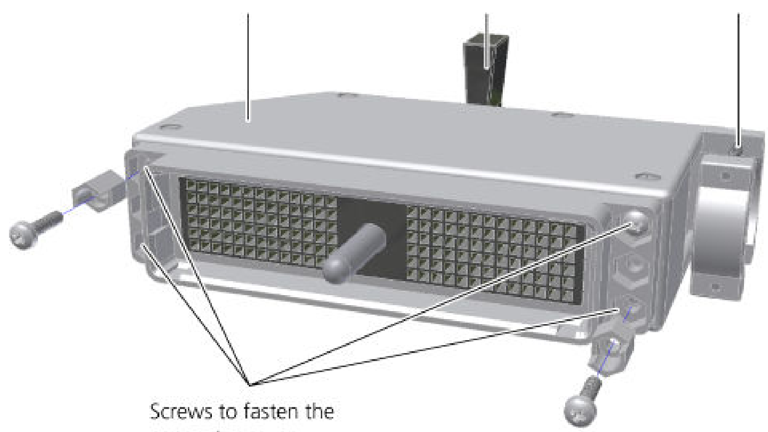
How to Fasten the Wires at the ZIF I/O Connector

Objective

Before connecting the ZIF connector to MicroAutoBox II, 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 58.
3. Tighten the strain relief clamp.

Next step

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

Coding the ZIF I/O Connector

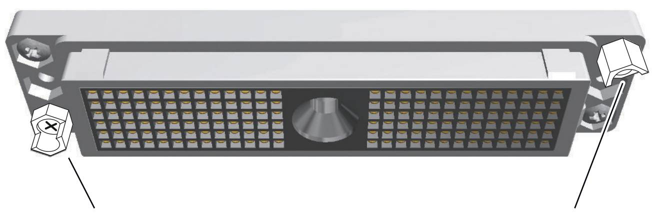
Introduction

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 MicroAutoBox II. The following table shows the possible codes and the coding pins.

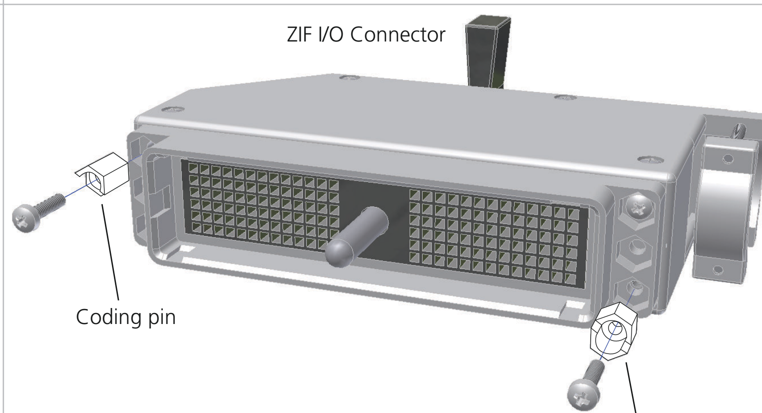
Code	Characteristics	Connector
Code 1		DS1511 ZIF I/O Connector
Code 2		DS1514 ZIF I/O Connector

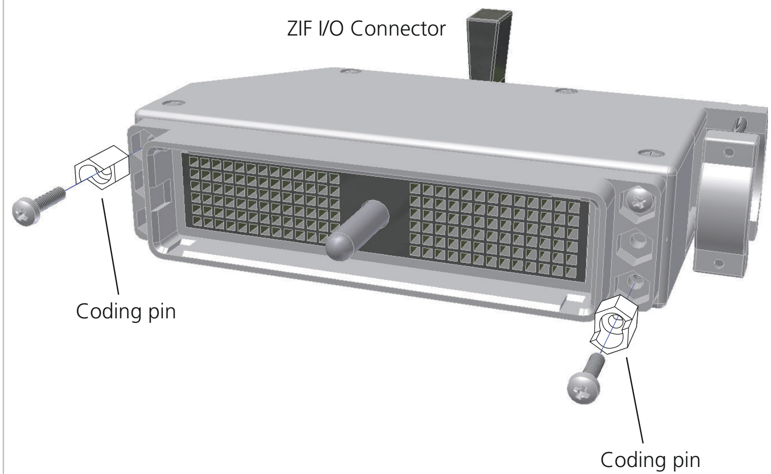
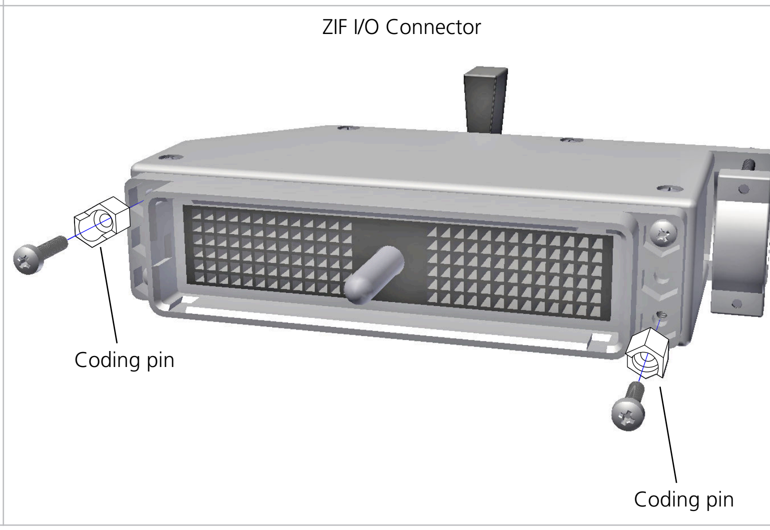
Code	Characteristics	Connector
Code 4		DS1513 ZIF I/O Connector

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.	

Connecting the MicroAutoBox II to the Host PC via Ethernet

Introduction

You must connect MicroAutoBox II to your host PC via Ethernet. For this MicroAutoBox II is treated as a network client.

After connecting MicroAutoBox II to the host PC via network cable, you have to set up the Ethernet connection.

Where to go from here

Information in this section

Setting Up The Ethernet Connection

Where to go from here

Information in this section

Proceeding the Setup

Introduction

The connection between the PC (host) and MicroAutoBox II (client) is based on the TCP/IP protocol provided by Windows. There are two ways to connect a client to the host:

- *Peer-to-peer connection (P2P)*

  MicroAutoBox II and the host PC are directly connected in a peer-to-peer configuration.
- *Integration in an existing network*

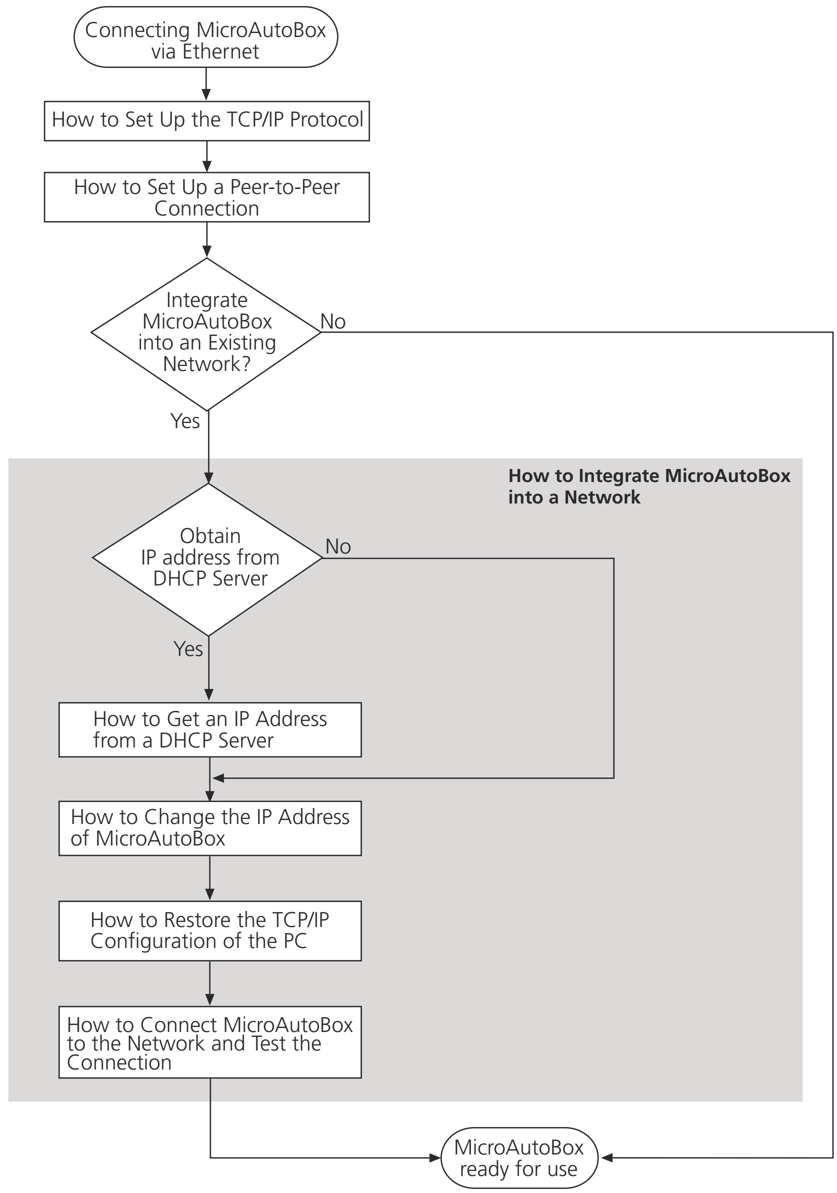
  MicroAutoBox II becomes part of an existing network using TCP/IP, for example, a local area network.

Tip

For tips on best practices concerning the host interface of MicroAutoBox II, refer to Using the host interface on page 130.

Setup procedure

To connect MicroAutoBox II via Ethernet, follow the instructions given in the flow chart below. The boxes in the flow chart refer to the corresponding sections in the text.



How to Set up the TCP/IP Protocol of the Host PC Network Adapter

Objective

Before you can connect the MicroAutoBox II to the host PC via Ethernet, you have to set up the TCP/IP protocol of the network adapter of your host PC.

Precondition

> **Note**
>
> Setting up the TCP/IP configuration requires administrator rights.

Previous TCP/IP configuration

During this procedure, write down the previous TCP/IP configuration for later restoration.

Method

To set up the TCP/IP protocol of the host PC network adapter

1. Click the Windows Start button and select Settings – Network & Internet – Network and Sharing Center.
   The Network and Sharing Center dialog opens.
2. In View your active networks, select Ethernet.
   The Ethernet Status dialog opens.
3. In the Ethernet Status dialog, click Properties.
   The Ethernet Properties dialog opens.
4. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.
   The Internet Protocol 4 (TCP/IPv4) Properties dialog opens.
5. From the Internet Protocol 4 (TCP/IPv4) Properties dialog, write down all the configured values and options so that you can restore them later.
6. In the Internet Protocol 4 (TCP/IPv4) Properties dialog, select Use the following IP address, and enter a value in the range `192.168.140.2` ... `192.168.140.254` in the IP address edit field.

   > **Note**
   >
   > - MicroAutoBox II uses `192.168.140.1` as the default IP address.
   > - If you also want to connect the DCI-GSI2, note its default IP address (`192.168.140.2`).

7. In the Subnet Mask edit field, enter the value `255.255.255.0`.
8. Click OK to close the Internet Protocol 4 (TCP/IPv4) Properties dialog.
9. Click Close to close the Ethernet Properties dialog.
10. Click Close to close the Ethernet Status dialog.
11. If prompted, confirm to restart the host PC.

Next steps

Proceed with:

- How to Set Up a Peer-to-Peer Connection on page 65 *or*
- Integrating MicroAutoBox II into a Network on page 67.

Solving problems

> **Tip**
>
> If a problem occurs when you set up the TCP/IP protocol, see Problems When Setting Up the TCP/IP Protocol on page 511.

Related topics

Basics

Proceeding the Setup..62

How to Set Up a Peer-to-Peer Connection

Objective

A peer-to-peer connection means that the host PC and the MicroAutoBox II are directly connected with a network cable.

You should carry out this step, even if you want to integrate MicroAutoBox II into an existing network. In that case the IP address of MicroAutoBox II must comply with the conventions of the network. So its default IP address (192.168.140.1) must be changed after setting up a peer-to-peer connection between the host PC and MicroAutoBox II.

Limitation

If you want to use a permanent peer-to-peer connection, you must always deactivate the DHCP server connection (default setting MicroAutoBox II: DHCP server connection = off). For instructions on deactivating a DHCP server connection, refer to How to Get an IP Address from a DHCP Server on page 71.

Method

To set up and test a peer-to-peer connection

1. If the host PC is already part of an existing network, switch it off, and disconnect it from the network.
2. Connect MicroAutoBox II to the host PC, using the supplied patch cable.
3. Turn on the host PC and power MicroAutoBox II.
   The connection between the host PC and MicroAutoBox II can now be tested.
4. Open a Command Prompt window (DOS window): For example, from the Start menu, choose Run ..., enter cmd and click OK.
5. Enter the command: **`ping 192.168.140.1`**, which is the default IP address of MicroAutoBox II.
   It is assumed that the default IP address is active.

If the following message appears, the peer-to-peer connection is ready for use (the values vary on different computers and networks):

```
Pinging 192.168.140.1 with 32 bytes of data:
Reply from 192.168.140.1: bytes=32 time<10ms TTL=32
Reply from 192.168.140.1: bytes=32 time<10ms TTL=32
Reply from 192.168.140.1: bytes=32 time<10ms TTL=32
Reply from 192.168.140.1: bytes=32 time<10ms TTL=32
```

Next steps

- If MicroAutoBox II is used *only in a peer-to-peer connection*, the network setup is now complete.

  Continue with DS100x, DS110x, MicroAutoBox II, MicroLabBox – Software Getting Started 🕮.
- If MicroAutoBox II is to be *used in an existing network*, proceed with How to Change the IP Address of MicroAutoBox II on page 68.

Related topics

Basics

Integrating MicroAutoBox II into a Network

Where to go from here

Information in this section

Workflow for Integrating MicroAutoBox II into a Network

Setup steps

The following step-by-step instructions show you how to integrate MicroAutoBox II into an existing network:

1. Establish a temporary peer-to-peer connection to check the basic characteristics of the connection between host PC and MicroAutoBox. Refer to How to Set Up a Peer-to-Peer Connection on page 65.
2. Change the IP address of MicroAutoBox II so it complies with the IP addresses used in the network. Refer to How to Change the IP Address of MicroAutoBox II on page 68.
3. After you changed the IP address of MicroAutoBox II, you can restore the previous IP address of the host PC. Refer to How to Restore the TCP/IP Configuration of the PC on page 74.
4. Finish by performing the steps in How to Connect MicroAutoBox II to the Network and Test the Connection on page 75.

Related topics

HowTos

How to Change the IP Address of MicroAutoBox II

Objective

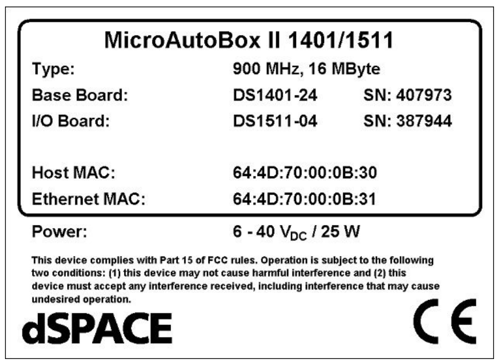
Use the MicroAutoBox II Configuration Tool to change the IP address of your MicroAutoBox II.

Required information

For changing the IP address, you need

- Either the current IP address
- Or the Host MAC address and base board serial number of your MicroAutoBox II. These are printed on a type plate on the bottom of your MicroAutoBox II.

  Type plate example:



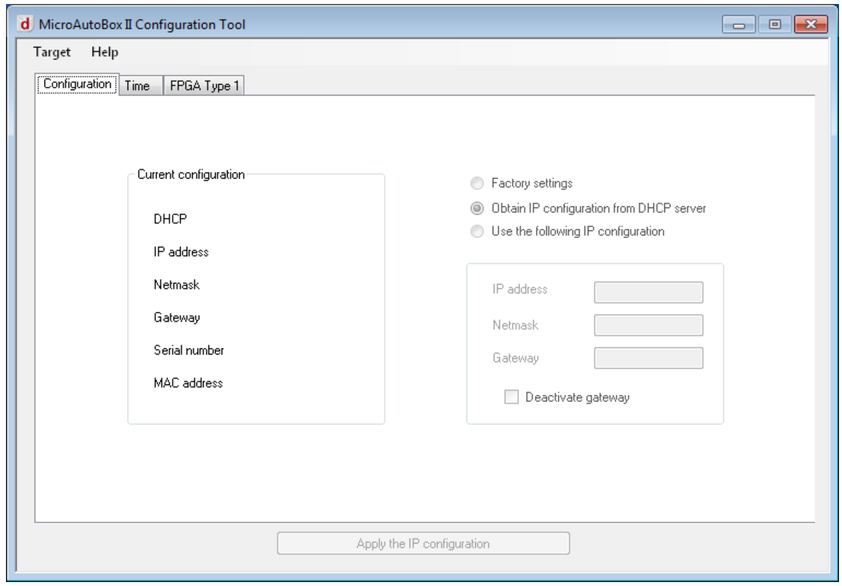
Method

To change the IP address

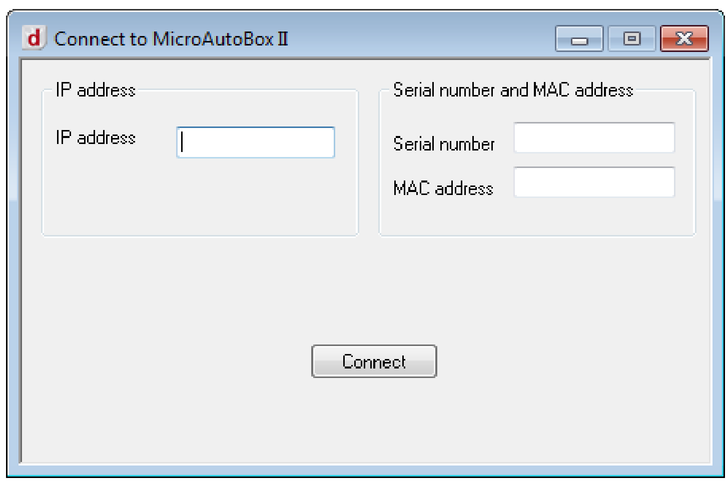
1. Contact your network administrator to obtain an unused IP address that you can use for your MicroAutoBox II.
2. On the Start menu of Windows, select dSPACE RCP and HIL <Version> — Command Prompt for dSPACE RCP and HIL <Version>.

   A Command Prompt window opens.

3 Enter `ds1401configgui.exe` to open the MicroAutoBox II Configuration Tool.



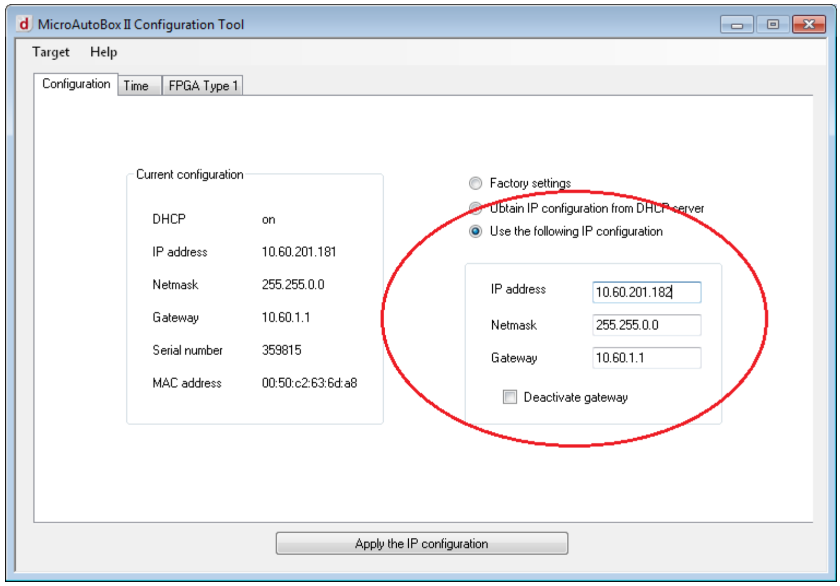
4 Choose Target — Connect to MicroAutoBox II and enter either the current IP address or the serial number <u>and</u> the MAC address in the Connect to MicroAutoBox II window shown below and click Connect.



Note

Using the serial number and MAC address instead of the IP address for connecting MicroAutoBox II to the DHCP server causes broadcasts which can increase network traffic.
To avoid problems in this case, you should establish a peer-to-peer connection between host PC and MicroAutoBox II when using the MicroAutoBox II Configuration Tool.

5 Choose Use the following IP configuration, change the settings in IP address and Netmask.



6 If no gateway is needed, select Deactivate gateway.

7 Click Apply the IP configuration and restart MicroAutoBox II so that the changes become effective.

Result

You have changed the MicroAutoBox II IP address.

For specifying the DHCP server setting, refer to How to Get an IP Address from a DHCP Server on page 71.

Next step

Proceed with How to Restore the TCP/IP Configuration of the PC on page 74.

Factory default settings

Choose Factory settings to reset the MicroAutoBox II:

- IP address: 192.168.140.1
- Netmask: 255.255.255.0
- DHCP: off

Target menu

The entries of the Target menu are listed in the table below:

Entry	Description
Connect to MicroAutoBox II	Opens the Connect to MicroAutoBox II window to find a MicroAutoBox II on the basis of either the current IP address or the serial number and the MAC address.

Entry	Description
Show all MicroAutoBox II units	Opens a window that lists all available MicroAutoBox II in your network.

Command line utility

The command line utility `ds1401configcmd` provides all functionalities of the MicroAutoBox II Configuration Tool. Type `ds1401configcmd /?` in a dSPACE Command Shell window to get all options.

FPGA Type 1 page

The FPGA Type 1 page can only be used with the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

For further information, refer to FPGA Support (MicroAutoBox II Features 🕮).

User functions in ControlDesk

ControlDesk allows you to embed MicroAutoBox II Configuration Tool as user function. For further information, refer to Adding User Functions to ControlDesk (ControlDesk Customization 🕮).

Related topics

Basics

How to Get an IP Address from a DHCP Server

Objective

You can get an IP address for MicroAutoBox II automatically from a DHCP server. A DHCP server manages the network configuration centrally. As a precondition, your network administrator has to map the MAC address of your MicroAutoBox II to an IP address in the DHCP server configuration beforehand.

To activate the connection to the DHCP server, use the MicroAutoBox II Configuration Tool.

Required information

For the settings in the MicroAutoBox II Configuration Tool, you need

- Either the mapped IP address on the DHCP server
- Or the MAC address and serial number of your MicroAutoBox II. These are printed on a type plate on the bottom of your MicroAutoBox II.

Method

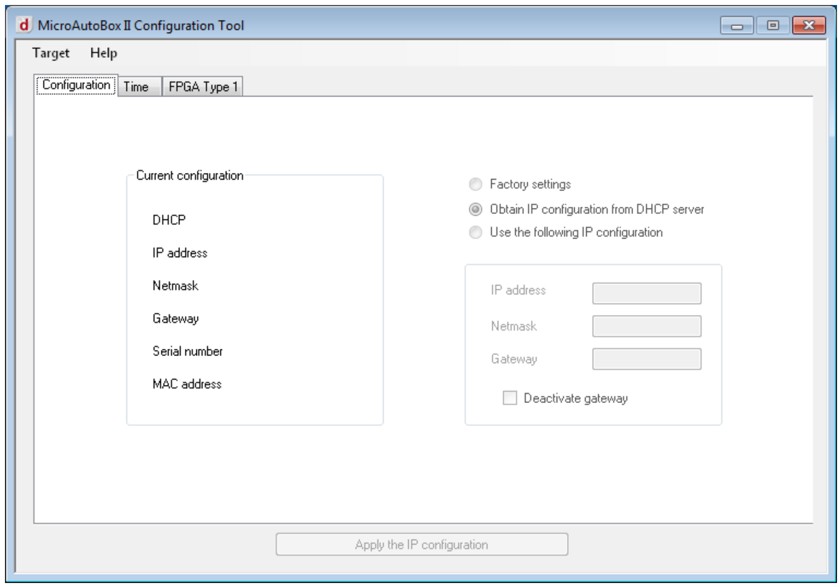
To get an IP address from a DHCP server

1 Contact your network administrator to provide the MAC address of your MicroAutoBox II and to obtain the mapped IP address that you can use for configuration, for example, in your experimentation software.

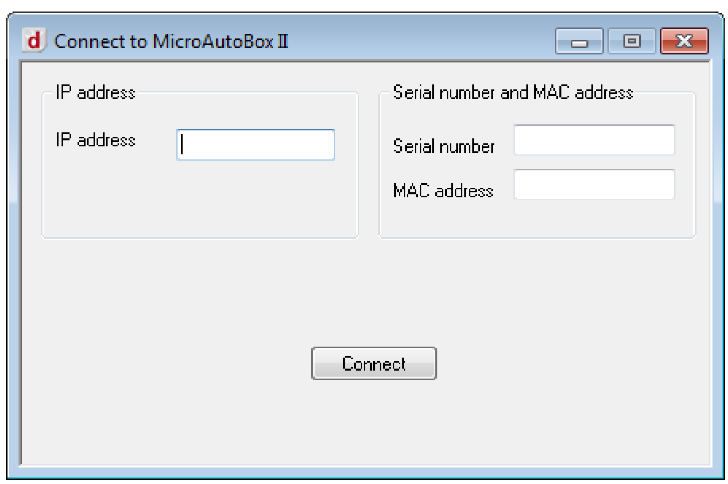
2 On the Start menu of Windows, select dSPACE RCP and HIL <Version> — Command Prompt for dSPACE RCP and HIL <Version>.

   A Command Prompt window opens.

3 Enter `ds1401configgui.exe` to open the MicroAutoBox II Configuration Tool.



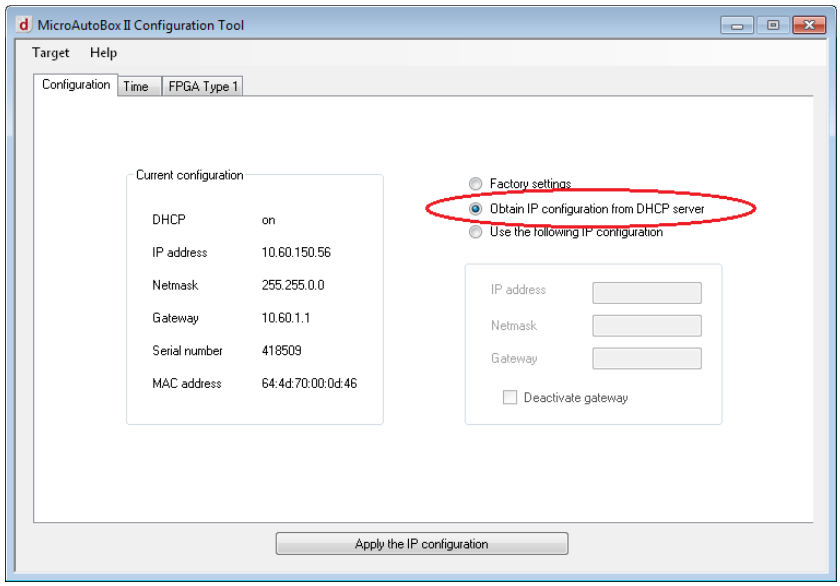
4 Choose Target — Connect to MicroAutoBox II and enter either the current IP address or the serial number <u>and</u> the MAC address in the Connect to MicroAutoBox II window shown below and click Connect.



Note

Using the serial number and MAC address instead of the IP address for connecting MicroAutoBox II to the DHCP server causes broadcasts which can increase network traffic. To avoid problems in this case, you should establish a peer-to-peer connection between host PC and the MicroAutoBox II when using the MicroAutoBox II Configuration Tool.

5 Choose Obtain IP configuration from DHCP server and click Apply the IP configuration.



You have to restart MicroAutoBox II so that the changes become effective.

Next step

Proceed with How to Restore the TCP/IP Configuration of the PC on page 74.

Command line utility

The command line utility **`ds1401configcmd`** provides all functionalities of the MicroAutoBox II Configuration Tool. Type **`ds1401configcmd /?`** in a dSPACE Command Shell window to get all options.

FPGA Type 1 page

The FPGA Type 1 page can only be used with the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

For further information, refer to FPGA Support (MicroAutoBox II Features 📖).

User functions in ControlDesk

Tip

ControlDesk allows you to embed MicroAutoBox II Configuration Tool as user function. For further information, refer to Adding User Functions to ControlDesk (ControlDesk Customization 📖).

Related topics

Basics

How to Restore the TCP/IP Configuration of the PC

Objective

After you have changed the IP address of the MicroAutoBox II to integrate it in a network, you can restore the previous IP address of the host PC.

Precondition

To restore the TCP/IP configuration of the host PC, you need the values and options which you wrote down when setting up the TCP/IP protocol (see How to Set up the TCP/IP Protocol of the Host PC Network Adapter on page 63).

Method

To restore the TCP/IP configuration of the host PC

1. Click the Windows Start button and select Settings – Network & Internet – Network and Sharing Center.

   The Network and Sharing Center dialog opens.
2. In View your active networks, select Ethernet.

   The Ethernet Status dialog opens.
3. Click Properties.

   The Ethernet Properties dialog opens.
4. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.

   The Internet Protocol (TCP/IP) Properties dialog opens.
5. Enter all the configured values and options you wrote down before.
6. Click OK to close the Internet Protocol (TCP/IP) Properties dialog.
7. Click Close to close the Ehternet Properties dialog.
8. Click Close to close the Ethernet Status dialog.
9. If prompted, confirm to restart the host PC.

Next steps

Proceed with How to Connect MicroAutoBox II to the Network and Test the Connection on page 75.

Related topics

Basics

How to Connect MicroAutoBox II to the Network and Test the Connection

Method

To connect MicroAutoBox II to the network and test the connection

1. Turn off MicroAutoBox II.
2. Connect MicroAutoBox II and the host PC to the network.
3. Turn on MicroAutoBox II.
   The connection between the host PC and MicroAutoBox II can now be tested.
4. Open a Command Prompt window (DOS window): For example, from the Start menu, choose Run ..., enter cmd and click OK.
5. Enter the command:
   `ping <IP address of MicroAutoBox II>`

Result

If the following message appears, the network connection is ready for use (the values vary on different computers and networks). The IP address 10.1.202.178 serves as an example.

```
Pinging 10.1.202.178 with 32 bytes of data:
Reply from 10.1.202.178: bytes=32 time<10ms TTL=32
Reply from 10.1.202.178: bytes=32 time<10ms TTL=32
Reply from 10.1.202.178: bytes=32 time<10ms TTL=32
Reply from 10.1.202.178: bytes=32 time<10ms TTL=32
```

Solving problems

Tip

If any problem comes up when you integrate MicroAutoBox II in a network, see General Errors Using Ethernet Connection on page 510.

Related topics

Basics

Connecting MicroAutoBox II to a FlexRay, LIN, or CAN Bus

Where to go from here

Information in this section

Connecting to a FlexRay Bus

Introduction

MicroAutoBox II 1401/1507, 1401/1511/1514, and 1401/1513/1514 can be connected to a FlexRay bus if they are equipped with FlexRay IP modules.

Where to go from here

Information in this section

Supported FlexRay IP Modules

Introduction

This topic provides information on which MicroAutoBox variants are supported and which FlexRay IP modules can be used.

MicroAutoBox variants

FlexRay IP modules can only be installed in the following MicroAutoBox variants:

- MicroAutoBox II 1401/1507
- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

FlexRay IP modules

The DS4340 FlexRay Interface Module can be installed in MicroAutoBox II and is supported by dSPACE implementation software.

Software support

The *RTI FlexRay Configuration Blockset* supports the DS4340 FlexRay Interface Module.

Related topics

Basics

Connecting Real-Time Systems to the FlexRay Bus (FlexRay Configuration Features 📖)
Installing and Uninstalling IP Modules.. 188

Basics on DS4340 FlexRay Interface Modules

Introduction

Basic information on the DS4340's features, bus termination, feed-through lines, and connecting the bus lines is given below.

Features of DS4340 modules

DS4340 FlexRay Interface Modules are FlexRay communication modules provided by dSPACE. They have the following features:

- Freescale MFR43x0 FlexRay Communication Controller
- Dual physical layer interface with TJA1080
- Feed-through for FlexRay bus signals in passive-linear bus topology
- Switchable termination circuit

DS4340 FlexRay Interface Modules are supported by the RTI FlexRay Configuration Blockset.

Bus termination

You can terminate the bus lines if the channels of the DS4340 module are connected at the end of the FlexRay bus. The termination resistance is switched via software in the RTIFLEXRAYCONFIG CONTROLLER SETUP block, refer to Options Page (RTIFLEXRAYCONFIG CONTROLLER SETUP) (RTI FlexRay

Configuration Blockset Reference 📖). For a detailed description of bus termination, refer to DS4340 Connections in Different Topologies on page 84.

Feed-through lines

If the DS4340 is not connected at an end of the FlexRay bus, but 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 FlexRay signal integrity, especially in a topology consisting of many nodes and long distances between the splices or ECUs. For details, refer to DS4340 Connections in Different Topologies on page 84.

Pinout, pin description

If DS4340 modules are installed in MicroAutoBox II, all their pins for the bus lines are connected to the I/O connector on the rear side (Sub-D or ZIF).

For details on the signals and pinouts, refer to Data Sheet DS4340 FlexRay Interface Module on page 431.

Related topics

HowTos

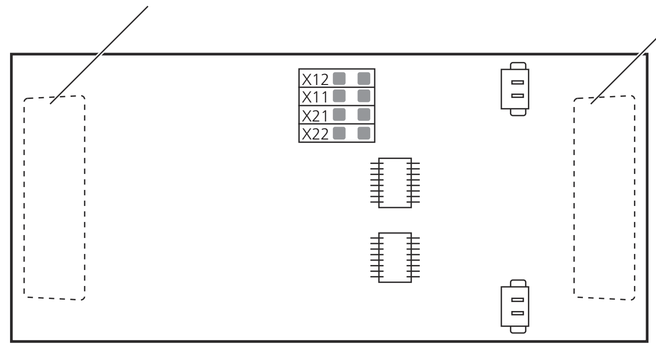
DS4340 Module Overview and Connector Pinouts

Introduction

A DS4340 FlexRay Interface Module provides two 50-pin connectors for connecting a real-time processor to a FlexRay bus.

Overview illustration

The illustration shows where the connectors are located on the module. The illustration is not to scale.



Components

The DS4340 contains the following connectors:

- *Interface connector* for connecting the DS4340 module to the DS1507 (resp., DS1514) I/O Board of MicroAutoBox II. The interface connector has the signals for the real-time processor.
- *I/O connector* for connecting the DS4340 module to the DS1507 (resp., DS1514) I/O Board of MicroAutoBox II. The I/O connector has the signals which are routed to the I/O connector on the rear side of the MicroAutoBox II.

FR_CAB1 and FR_CAB3 FlexRay Interface Cable for MicroAutoBox II

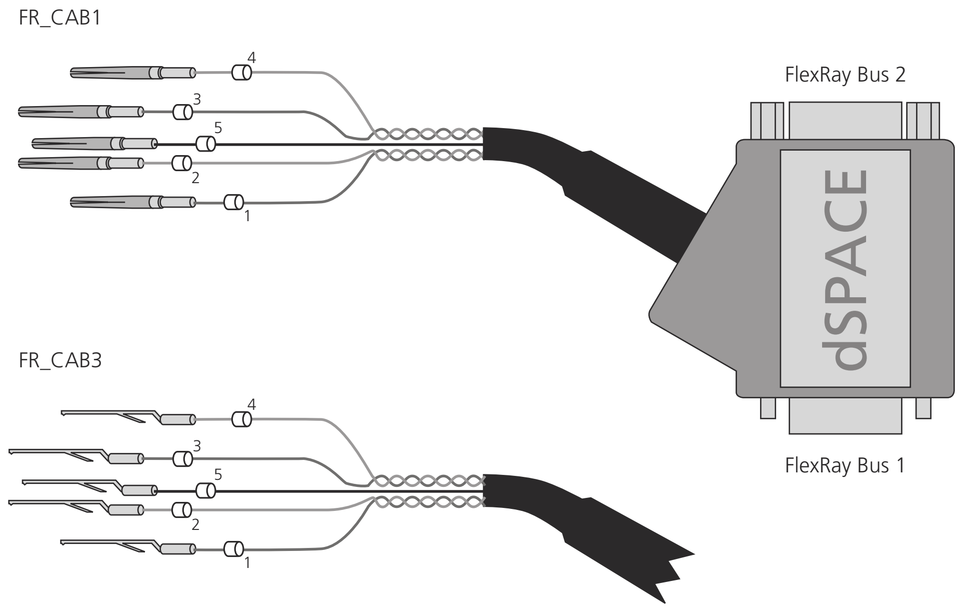
Introduction

The FR_CAB1 (for MicroAutoBox II 1401/1507) and FR_CAB3 (for MicroAutoBox II 1401/1511/1514 and 1401/1513/1514) FlexRay Interface Cable for MicroAutoBox II can be used to connect FlexRay bus lines to MicroAutoBox II if it has DS4340 modules. The cable has two 9-pin Sub-D connectors to connect it to the FlexRay bus lines.

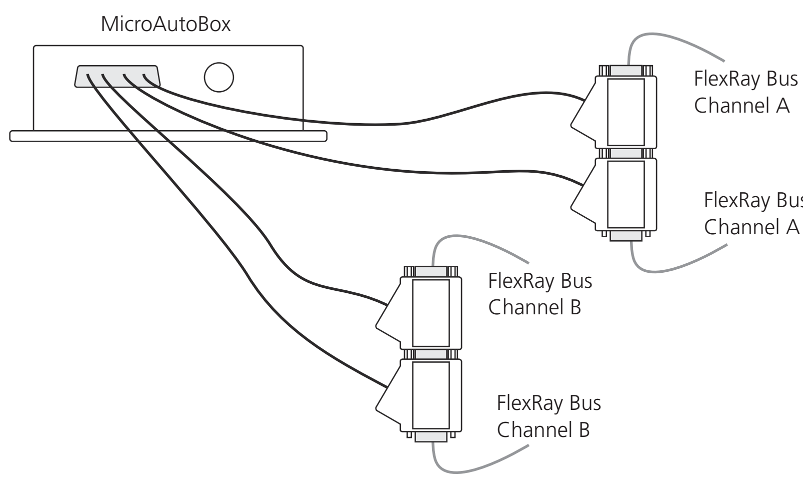
Features

The FlexRay Interface Cable provides the following features:

- Connecting one FlexRay channel (A or B) to MicroAutoBox II.
- Specially designed for using the feed-through functionality of the DS4340 (see DS4340 Connections in Different Topologies on page 84).
- 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)



The following illustration shows how the FlexRay Interface Cable is used. In this example, MicroAutoBox II 1401/1507 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 MicroAutoBox II

The FlexRay Interface Cable has crimped contact plugs matching the Sub-D or ZIF I/O Connector of MicroAutoBox II. 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	BP[1)]	7	-
2	Green	BM[1)]	2	-

Label	Color	Signal	Female 9-pin Sub-D Connector	Male 9-pin Sub-D Connector
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.

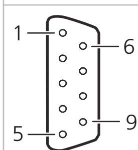
All pins for the FlexRay bus lines are connected to the I/O connector on the rear side (Sub-D or ZIF).

For details on the signals and pinouts, refer to Data Sheet DS4340 FlexRay Interface Module on page 431.

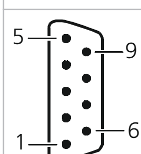
Connecting the cable to the FlexRay bus

Both Sub-D connectors are 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	BM	6	Connected to pin 6 of male Sub-D connector
	3	GND	7	BP
	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	BM_FT	7	BP_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 II units, connect the appropriate FlexRay channels of each module to their FlexRay Interface Cables. Then plug the Interface Cables into each other. Several FlexRay Interface Cables can be mounted directly next to each other.

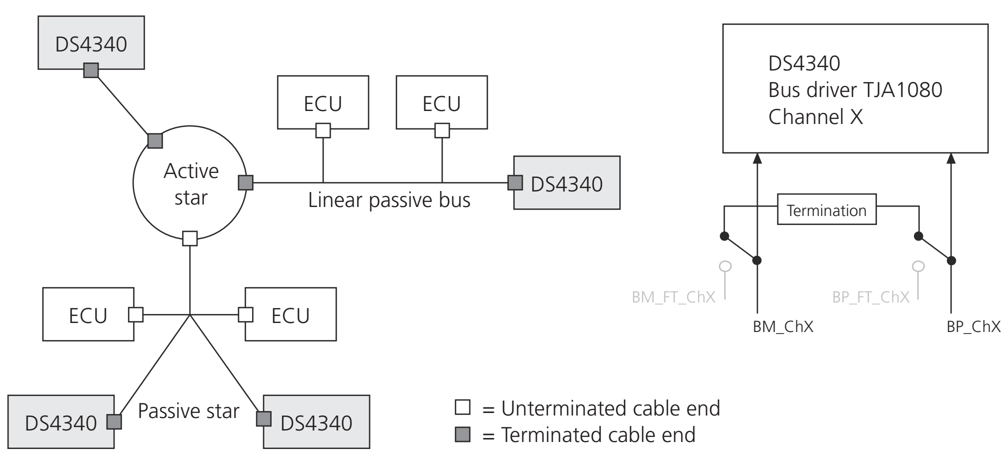
DS4340 Connections in Different Topologies

Introduction

You can terminate bus lines of the DS4340 FlexRay Interface module or use them unterminated. You can use feed-through pins to shorten the stub length if the DS4340 is used in a linear passive bus. This topic gives you information on the bus topology and termination. You can configure the termination in the RTIFLEXRAYCONFIG CONTROLLER SETUP (RTI FlexRay Configuration Blockset Reference 📖) block.

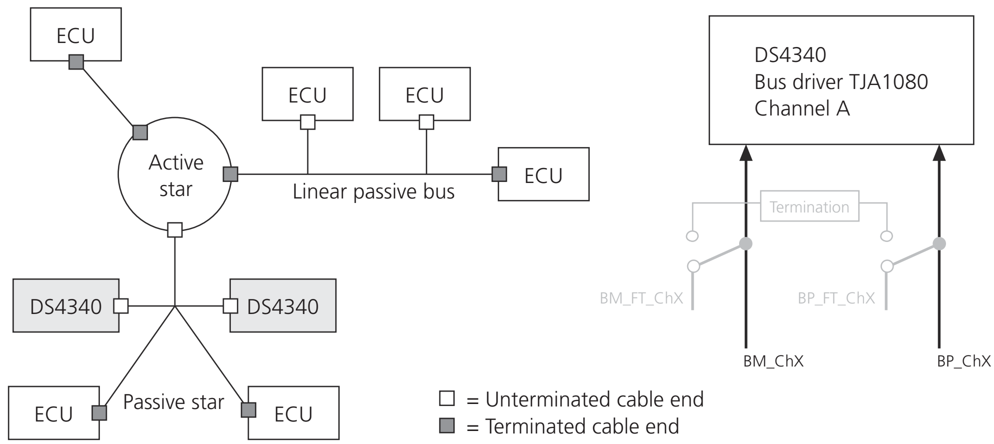
Terminated cable end without feed-through

If the DS4340 is connected at an end of the FlexRay bus, its bus lines must be terminated. The termination resistor is activated via software (see above).



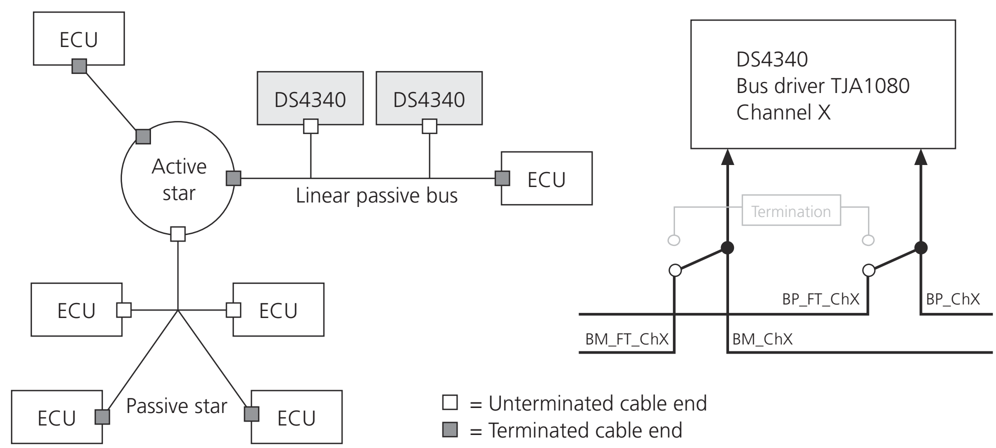
Unterminated cable end without feed-through

If the DS4340 is not connected at an end of the FlexRay bus, its bus lines must be unterminated. The termination resistor is deactivated via software (see RTIFLEXRAYCONFIG CONTROLLER SETUP (RTI FlexRay Configuration Blockset Reference 📖)).



Unterminated cable end with feed-through

If a DS4340 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.



dSPACE provides a special interface cable to support the feed-through functionality, refer to FR_CAB1 and FR_CAB3 FlexRay Interface Cable for MicroAutoBox II on page 81.

Example of Connecting One DS4340 Module to a FlexRay Bus

Introduction

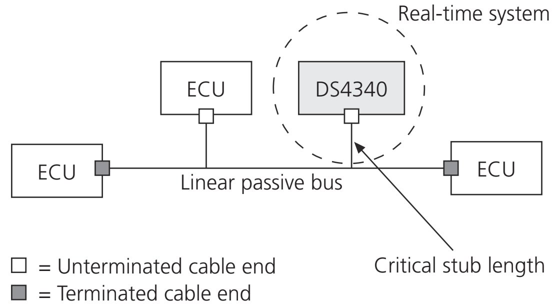
This example shows how one DS4340 module of MicroAutoBox II can be connected to a linear passive FlexRay bus. The DS4340 module is not connected at the end of the FlexRay bus. The termination resistor is therefore not activated.

Note

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

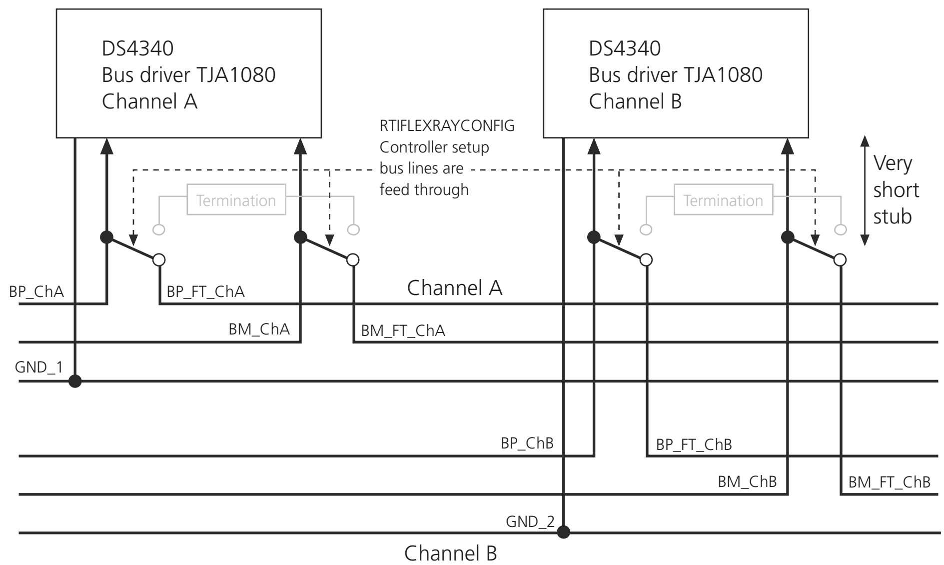
Topology

The following illustration shows the network that the DS4340 module of MicroAutoBox II is connected to.



Circuit

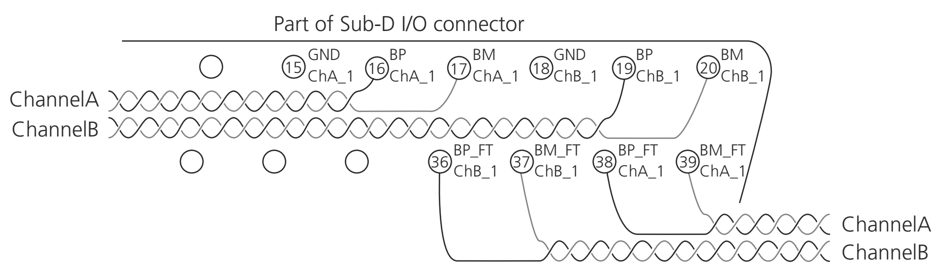
The following illustration shows the connection of the FlexRay bus lines plus and minus. The incoming bus lines are connected to the BP_ChA and BM_ChA pins (BP_ChB and BM_ChB, respectively). The outgoing bus lines are connected to the feed-through pins BP_FT_ChA and BM_FT_ChA (BP_FT_ChB and BM_FT_ChB, respectively). The incoming and outgoing bus lines are connected directly on 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 (see RTIFLEXRAYCONFIG CONTROLLER SETUP (RTI FlexRay Configuration Blockset Reference 🕮)).



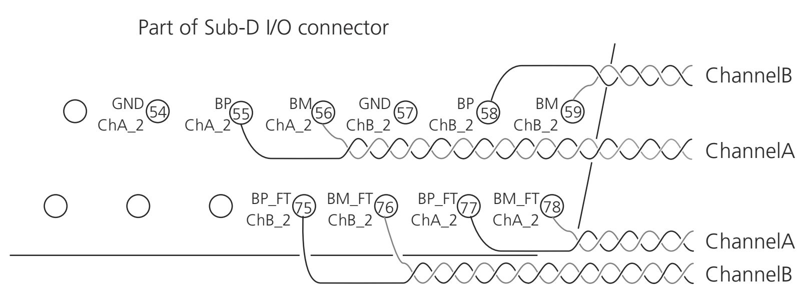
Sub-D I/O connector

MicroAutoBox II 1401/1507 provide the FlexRay signals on a Sub-D connector.

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



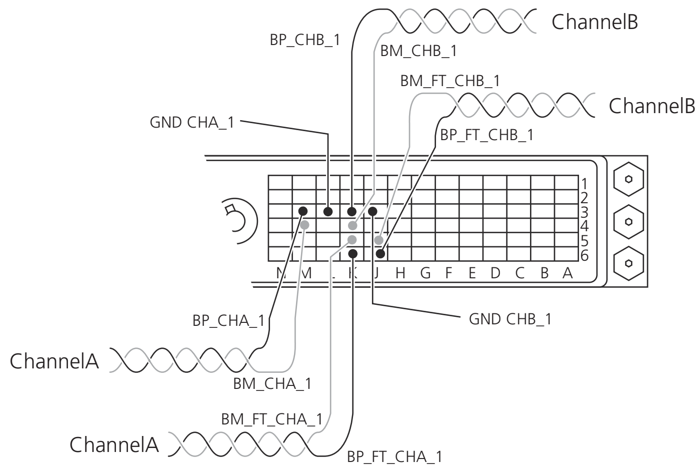
DS4340 installed in slot 2 The following illustration shows a part of the Sub-D I/O connector with the connected bus lines if the DS4340 is installed in slot 2.



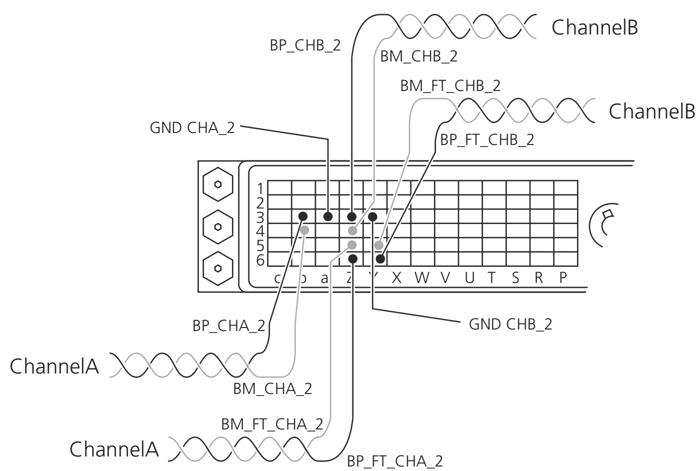
ZIF I/O connector

MicroAutoBox II 1401/1511/1514 and MicroAutoBox II 1401/1513/1514 provide the FlexRay signals 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 dSPACE FlexRay Interface Cable (FR_CAB1: DS1507, FR_CAB3: DS1514) is used to connect the FlexRay bus lines to MicroAutoBox II, 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 on which the DS4340 module is mounted.

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 DS1507 Sub-D I/O Connector	Pin at DS1514 ZIF I/O Connector
1st Cable	BP_ChA_1	1	16	M3
	BM_ChA_1	2	17	M4
	BP_FT_ChA_1	3	38	K6
	BM_FT_ChA_1	4	39	K5
	GND	5	15	L3

The following table shows the pins of channel B.

Cable	Signal	Pin Label	Pin at DS1507 Sub-D I/O Connector	Pin at DS1514 ZIF I/O Connector
2nd Cable	BP_ChB_1	1	19	K3
	BM_ChB_1	2	20	K4
	BP_FT_ChB_1	3	36	J6
	BM_FT_ChB_1	4	37	J5
	GND	5	18	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 DS1507 Sub-D I/O Connector	Pin at DS1514 ZIF I/O Connector
1st Cable	BP_ChA_2	1	55	b3
	BM_ChA_2	2	56	b4
	BP_FT_ChA_2	3	77	Z6
	BM_FT_ChA_2	4	78	Z5
	GND	5	54	a3

The following table shows the pins of channel B.

Cable	Signal	Pin Label	Pin at DS1507 Sub-D I/O Connector	Pin at DS1514 ZIF I/O Connector
2nd Cable	BP_ChB_2	1	58	Z3
	BM_ChB_2	2	59	Z4
	BP_FT_ChB_2	3	75	Y6
	BM_FT_ChB_2	4	76	Y5
	GND	5	57	Y3

The incoming and outgoing FlexRay bus lines must be connected to the Sub-D connector of the FlexRay Interface Cable, see FR_CAB1 and FR_CAB3 FlexRay Interface Cable for MicroAutoBox II on page 81.

Related topics

Basics

Example of Connecting Two DS4340 Modules to a FlexRay Bus

Introduction

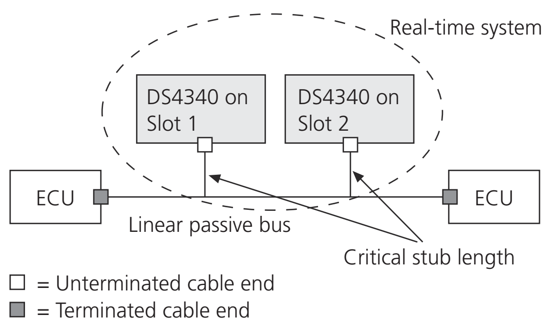
This example shows how two DS4340 modules of MicroAutoBox II can be connected to a linear passive FlexRay bus. The DS4340 modules are not connected at the end of the FlexRay bus. The termination resistor is therefore not activated.

Note

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

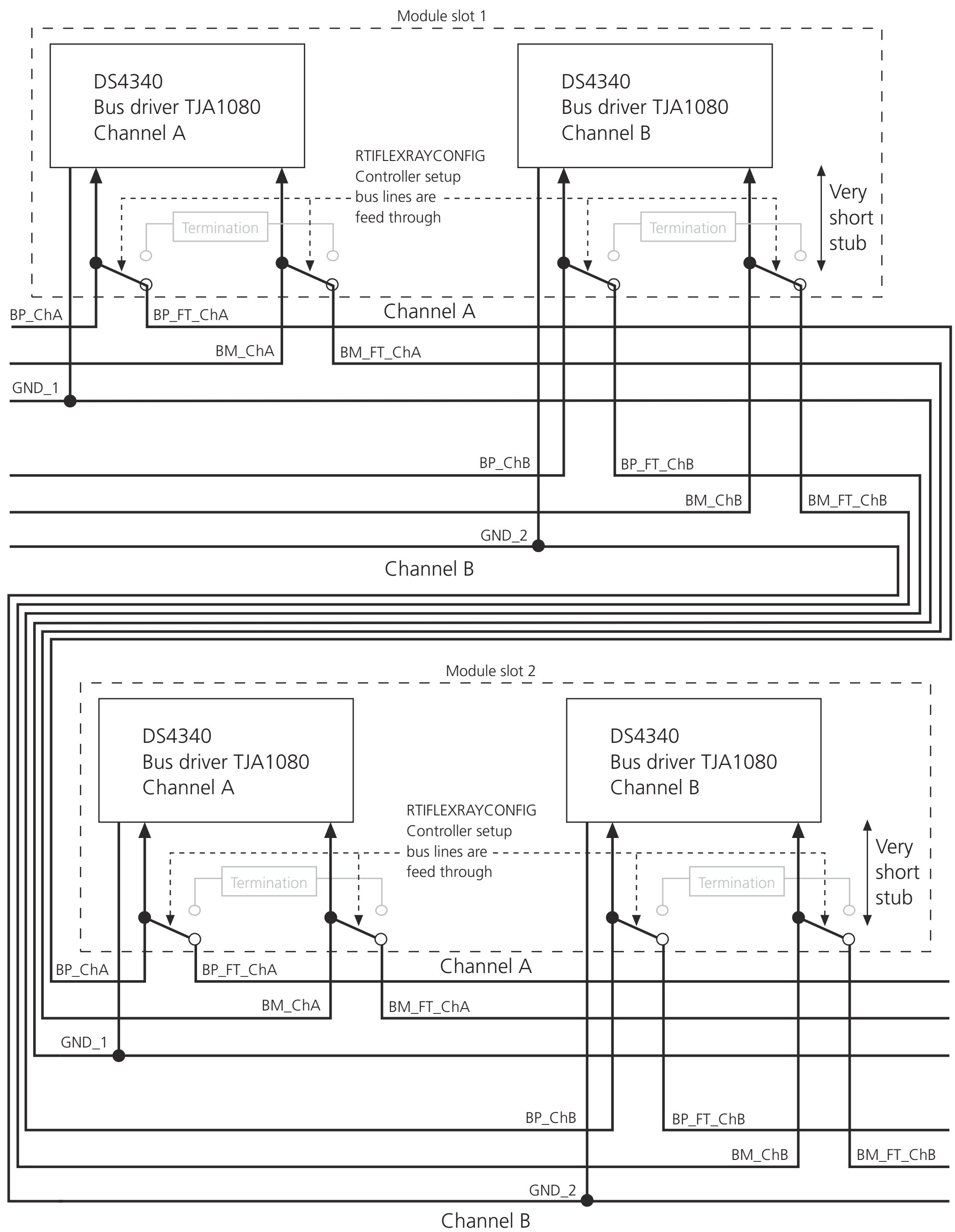
Topology

The following illustration shows the topology that the DS4340 modules of MicroAutoBox II are connected to.



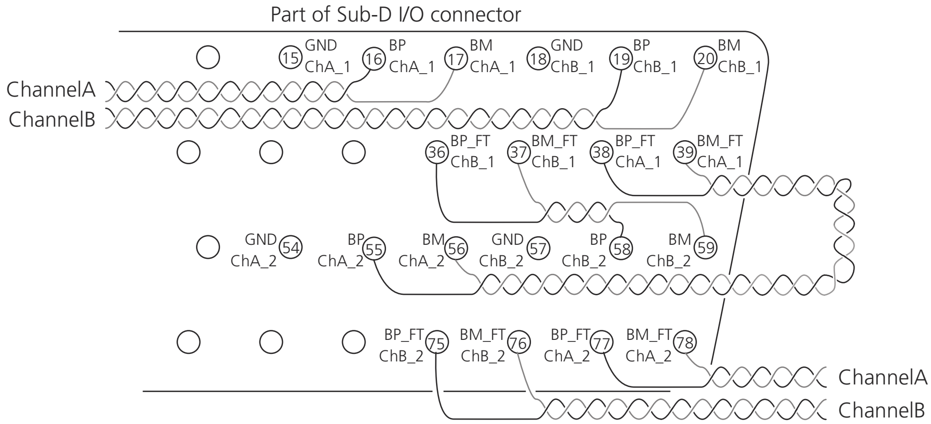
Circuit

The following illustration shows the connection to the FlexRay bus lines plus and minus on both modules. The incoming bus lines are connected to the BP_ChA and BM_ChA pins (BP_ChB and BM_ChB, respectively). The outgoing bus lines are connected to the feed-through pins BP_FT_ChA and BM_FT_ChA (BP_FT_ChB and BM_FT_ChB, respectively). The incoming and outgoing bus lines are connected directly on 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 (see RTIFLEXRAYCONFIG CONTROLLER SETUP (RTI FlexRay Configuration Blockset Reference 🕮)).


Module slot 1
DS4340
Bus driver TJA1080
Channel A
DS4340
Bus driver TJA1080
Channel B
RTIFLEXRAYCONFIG
Controller setup
bus lines are
feed through
Termination
Termination
Very
short
stub
BP_ChA
BP_FT_ChA
Channel A
BM_ChA
BM_FT_ChA
GND_1
BP_ChB
BP_FT_ChB
BM_ChB
BM_FT_ChB
GND_2
Channel B
Module slot 2
DS4340
Bus driver TJA1080
Channel A
DS4340
Bus driver TJA1080
Channel B
RTIFLEXRAYCONFIG
Controller setup
bus lines are
feed through
Termination
Termination
Very
short
stub
BP_ChA
BP_FT_ChA
Channel A
BM_ChA
BM_FT_ChA
GND_1
BP_ChB
BP_FT_ChB
BM_ChB
BM_FT_ChB
GND_2
Channel B

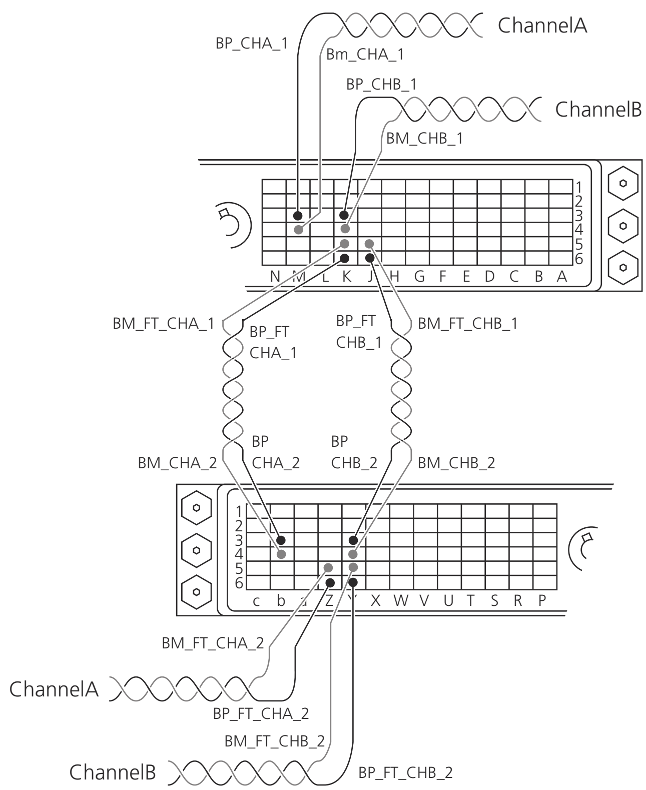
Sub-D I/O connector

The following illustration shows a part of the Sub-D I/O connector with the connected bus lines.



ZIF I/O connector

The bus lines are connected to the DS1514 ZIF I/O connector. The following illustration shows a part of the ZIF I/O connector with the connected bus lines.



FlexRay Interface Cable

If FR_CAB1 (DS1507) or FR_CAB3 (DS1514) FlexRay Interface Cable for MicroAutoBox II is used to connect the FlexRay bus lines to MicroAutoBox II, two cables are required. One cable is used for channel A, another cable is used for channel B. The pins of the Sub-D I/O connector (DS1507) or ZIF I/O connector (DS1514) to be connected depend on the slot on which the DS4340 module is mounted. The following table shows the pins of channel A if the DS4340 modules are mounted in slots 1 and 2.

Cable	Signal	Pin Label	Pin at DS1507 Sub-D I/O Connector	Pin at DS1514 ZIF I/O Connector
1st Cable	BP_ChA	1	16	M3
	BM_ChA	2	17	M4
	BP_FT_ChA	3	38	K6
	BM_FT_ChA	4	39	K5
	GND	5	15	L3
2nd Cable	BP_ChA	1	55	b3
	BM_ChA	2	56	b4
	BP_FT_ChA	3	77	Z6
	BM_FT_ChA	4	78	Z5
	GND	5	54	a3

The following table shows the pins of channel B.

Cable	Signal	Pin Label	Pin at DS1507 Sub-D I/O Connector	Pin at DS1514 ZIF I/O Connector
3rd Cable	BP_ChB	1	19	K3
	BM_ChB	2	20	K4
	BP_FT_ChB	3	36	J6
	BM_FT_ChB	4	37	J5
	GND	5	18	J3
4th Cable	BP_ChB	1	58	Z3
	BM_ChB	2	59	Z4
	BP_FT_ChB	3	75	Y6
	BM_FT_ChB	4	76	Y5
	GND	5	57	Y3

To connect the FlexRay bus lines of the DS4340 modules, the 1st cable must be connected to the 2nd cable and the 3rd cable must be connected to the 4th cable.

The incoming and outgoing FlexRay bus lines must be connected to the Sub-D connector of the FlexRay Interface Cable, see FR_CAB1 and FR_CAB3 FlexRay Interface Cable for MicroAutoBox II on page 81.

Related topics

Basics

How to Wake Up MicroAutoBox II by Activity on the FlexRay Bus

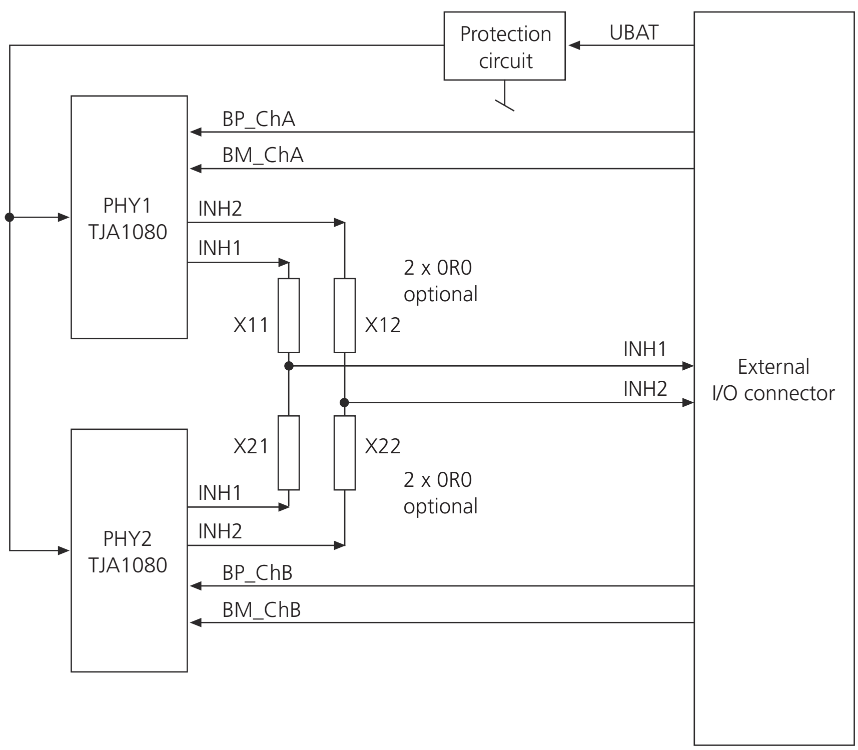
Objective

You can configure MicroAutoBox II with DS4340 modules to be woken up when the FlexRay bus comes alive.

Basics

A DS4340 FlexRay Interface Module is supplied with two transceivers TJA1080. Each transceiver provides two inhibit signals (INH1 and INH2) which can be used for waking up MicroAutoBox II. When the transceiver detects activity on the FlexRay bus, the inhibit signals are set to UBAT voltage level; a special wake-up frame is not required. This starts MicroAutoBox II if the inhibit signals are connected to the REMOTE pin of MicroAutoBox II (for example, on zero insertion force (ZIF) connector, M 3 pin). For detailed information on the inhibit signals (INH1 and INH2), refer to the TJA1080 data sheet (http://www.nxp.com).

The inhibit signals are not connected to the Sub-D I/O (DS1507) or the ZIF I/O (DS1514) connector by default. To connect them, you must solder SMD resistors (resistance: 0 Ω, size: 1206) on the DS4340, see the following circuit.



Valid only for MicroAutoBox II 1401/1507

NOTICE

Do not configure IP modules that are installed in MicroAutoBox II 1401/1507 yourself. You might destroy parts of MicroAutoBox II.

All modules that are installed in MicroAutoBox II 1401/1507 must be configured by dSPACE. The assembling positions of the DS1401 Base Board and the DS1507 I/O Board in the MicroAutoBox II housing do not allow direct access to the IP slots of the DS1507.

Method

To wake up MicroAutoBox II by activity on the FlexRay bus

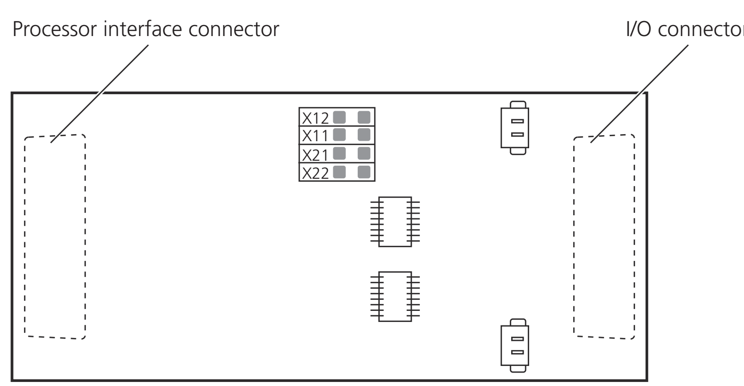
1. If the DS4340 module is installed in MicroAutoBox II, you must uninstall it first. Refer to How to Uninstall IP Modules on page 191.
2. Solder the resistors on the soldering pads of the inhibit signals. The positions depend on the monitored channel and inhibit signal used, see the following table.

Channel	Inhibit Signal	Solder Pad
A	INH1	X11
A	INH2	X12
B	INH1	X21
B	INH2	X22

Note

It is recommended to use either channel A or channel B.

The following illustration shows the locations of the solder pads on the DS4340.



3. Install the DS4340 module in MicroAutoBox II, see How to Install IP Modules on page 188.

4 Connect the pins. The pins which must be connected depend on the selected inhibit signal (channel A or channel B) and module (slot 1 or slot 2).
   - Connect the inhibit pin of the Sub-D I/O connector (DS1507) or the ZIF I/O connector (DS1514) to the REMOTE pin of the power input connector.
   - Connect the battery voltage to the VBAT pins of the power input connector.
   - Connect battery ground to the GND pin of the power input connector.
   - Connect the FlexRay bus to the Sub-D I/O connector (DS1507) or the ZIF I/O connector (DS1514).
   - Connect the FlexRay power input pin and the GND pin to the battery. (In the example 2: H5 and L3)

   For general information on connecting MicroAutoBox II, refer to Building the Power and I/O Connections on page 41.

   For information on the pinouts, refer to
   - MicroAutoBox II 1401/1507: Connector Pinouts on page 205
   - MicroAutoBox II 1401/1511/1514: Connector Pinouts on page 267
   - MicroAutoBox II 1401/1513/1514: Connector Pinouts on page 347

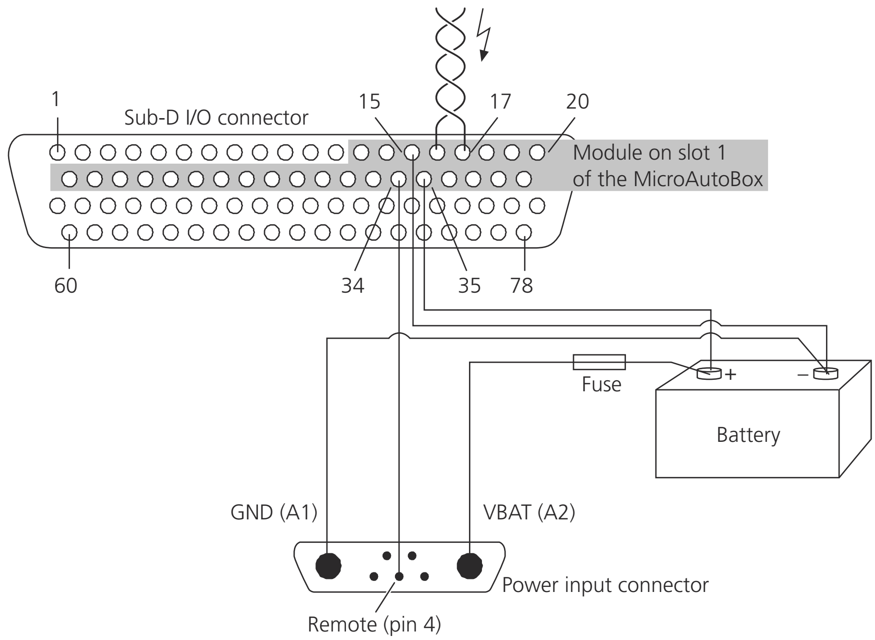
Result

When activity is detected on the selected FlexRay channel, MicroAutoBox II starts.

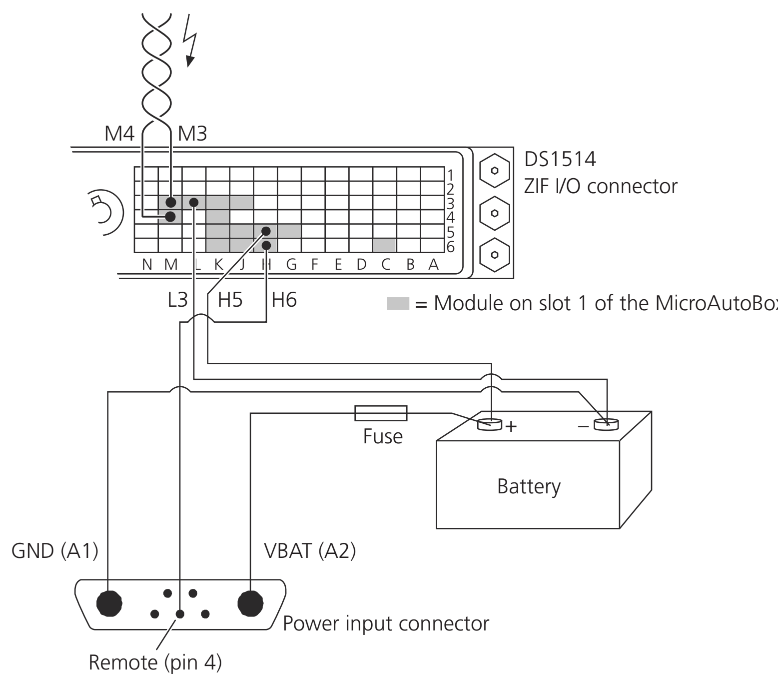
Examples

The following illustrations show examples of how MicroAutoBox II can be connected to a FlexRay bus. In these examples, channel A of module on slot 1 is used for waking up. The inhibit signal INH2_1 (Sub-D pin 34)(1401/1511/1514, and 1401/1513/1514: ZIF pin H6) is connected to the REMOTE pin.

Example 1 - for MicroAutoBox II 1401/1507



Example 2 - for MicroAutoBox II 1401/1511/1514 and 1401/1513/1514



Tip

The VBAT, GND and REMOTE pins are also located on the ZIF I/O connector. However it is recommended to use the pins only on the power input connector. Do not use the pins on the power input connector and on the ZIF I/O connector at the same time.

Connecting to a LIN Bus

How to Configure MicroAutoBox II as the LIN Master

Default configuration

If you run MicroAutoBox II within a LIN network, it is configured as a LIN slave by default. You must reconfigure MicroAutoBox II if you want to use it as the LIN master.

Changing the default configuration

You can configure MicroAutoBox II as the LIN master by adding a series connection consisting of a 1 kΩ pull-up resistor and a diode. This circuit must be wired in parallel to the LIN transceiver. For detailed information, refer to the specification of the LIN transceiver used.

> **Note**
>
> Because LIN and K-line use the same circuits, wiring a 1 kΩ pull-up resistor also affects the operation of the K-line.

Possible methods

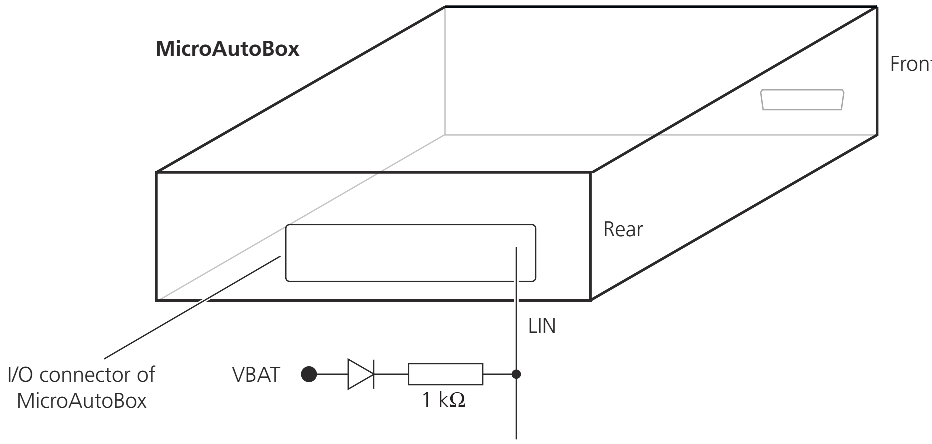
- Add the series connection of the pull-up resistor and diode externally.
  This is possible for all MicroAutoBox variants, refer to Method 1 on page 99.
- Add the pull-up resistor internally by soldering it to the I/O board. The diode is already soldered on the I/O board.
  The configuration varies according to the MicroAutoBox variant.
  - For MicroAutoBox II 1401/1507, refer to Method 2 on page 101.
  - For MicroAutoBox II 1401/1511, refer to Method 3 on page 102.
  - For MicroAutoBox II 1401/1511/1514, refer to Method 4 on page 103.
  - For MicroAutoBox II 1401/1513, refer to Method 5 on page 105.
  - For MicroAutoBox II 1401/1513/1514, refer to Method 6 on page 106.

Method 1

To configure MicroAutoBox II as the LIN master

1 Disconnect MicroAutoBox II from the power supply.

2 Solder the series connection of a diode and a 1 kΩ resistor between the VBAT and the LIN signal. See the following illustration.



NOTICE

Do not exceed a maximum supply voltage of 32 V. Higher supply voltages can damage the LIN transceiver.

The pinout depends on the MicroAutoBox variant. Refer to:

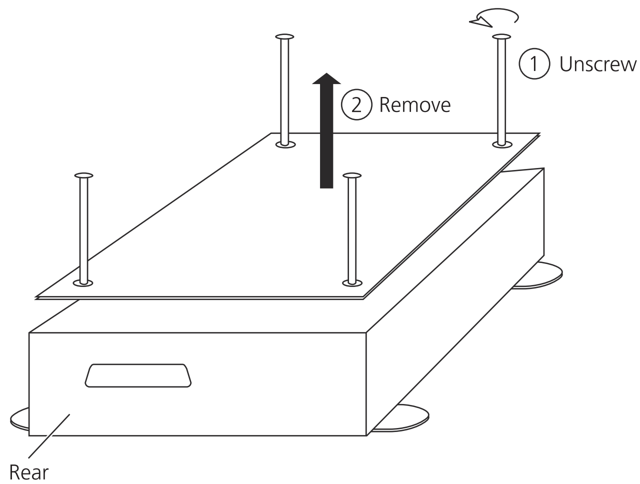
- MicroAutoBox II 1401/1507: Sub-D I/O Connector on page 205Sub-D I/O Connector on page 205
- MicroAutoBox II 1401/1511: ZIF I/O Connector on page 230ZIF I/O Connector on page 230
- MicroAutoBox II 1401/1511/1514: DS1511 ZIF I/O Connector on page 267DS1511 ZIF I/O Connector on page 267
- MicroAutoBox II 1401/1513: ZIF I/O Connector on page 310ZIF I/O Connector on page 310
- MicroAutoBox II 1401/1513/1514: DS1513 ZIF I/O Connector on page 347

Method 2

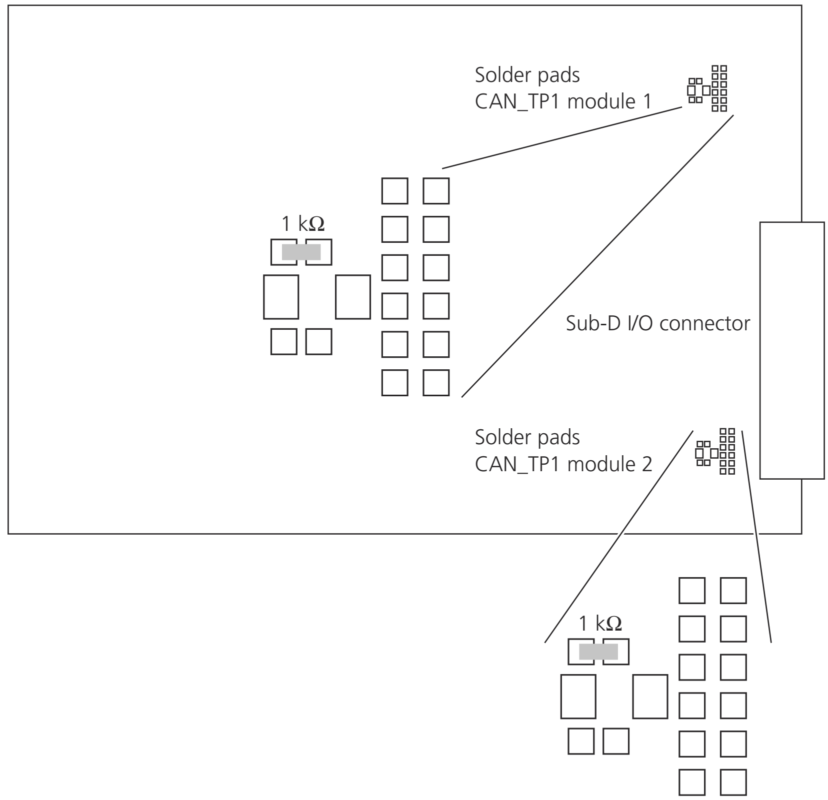
To configure MicroAutoBox II 1401/1507 as the LIN master by soldering a pull-up resistor

1 Disconnect MicroAutoBox II from the power supply.

2 Open the enclosure of MicroAutoBox II as shown in the illustration below. Use a 2.5 mm hexagon socket wrench.



3 The solder pads of the two CAN_TP1 modules are on the top. Solder 1 kΩ 0805 SMD resistors to the marked solder pads (see illustration below) as the master pull-up.



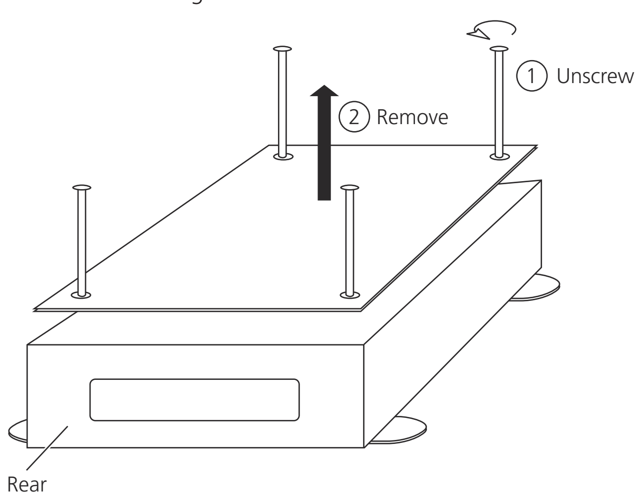
4 Mount the cover of the MicroAutoBox II.

Method 3

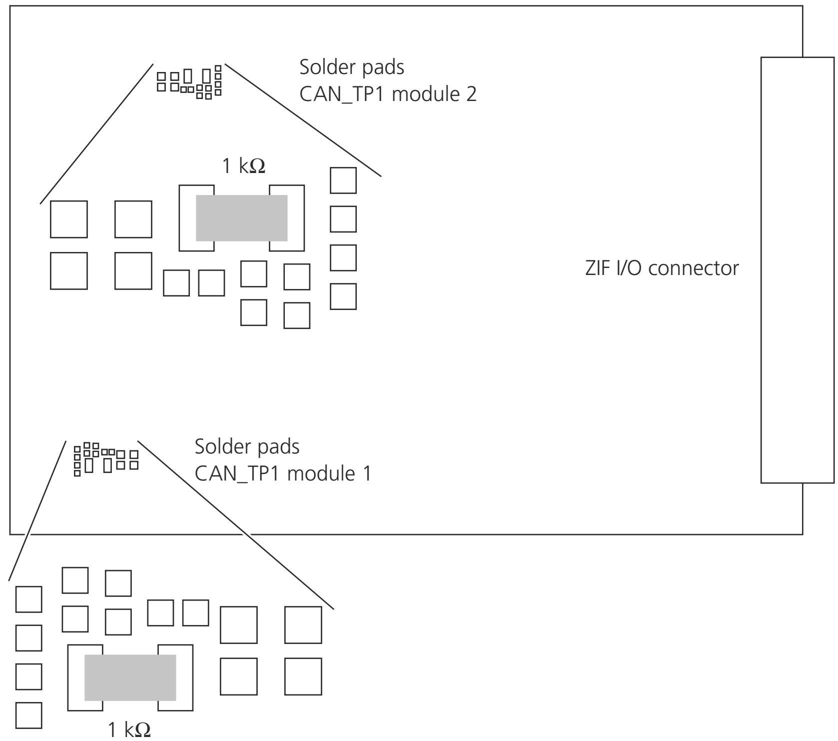
To configure MicroAutoBox II 1401/1511 as the LIN master by soldering a pull-up resistor

1 Disconnect MicroAutoBox II from the power supply.

2 Open the enclosure of MicroAutoBox II as shown in the illustration below. Use a 2.5 mm hexagon socket wrench.



3 The solder pads of the two CAN_TP1 modules are on the top. Solder 1 kΩ 2512 SMD resistors to the marked solder pads (see illustration below) as the LIN master pull-up.



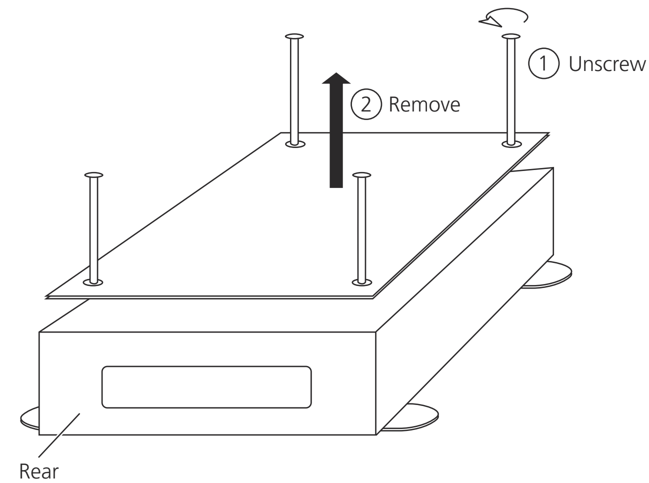
4 Mount the cover of the MicroAutoBox II.

Method 4

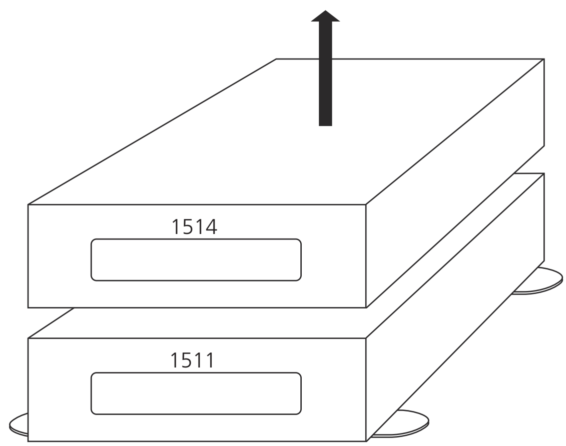
To configure MicroAutoBox II 1401/1511/1514 as the LIN master by soldering a pull-up resistor

1 Disconnect MicroAutoBox II from the power supply.

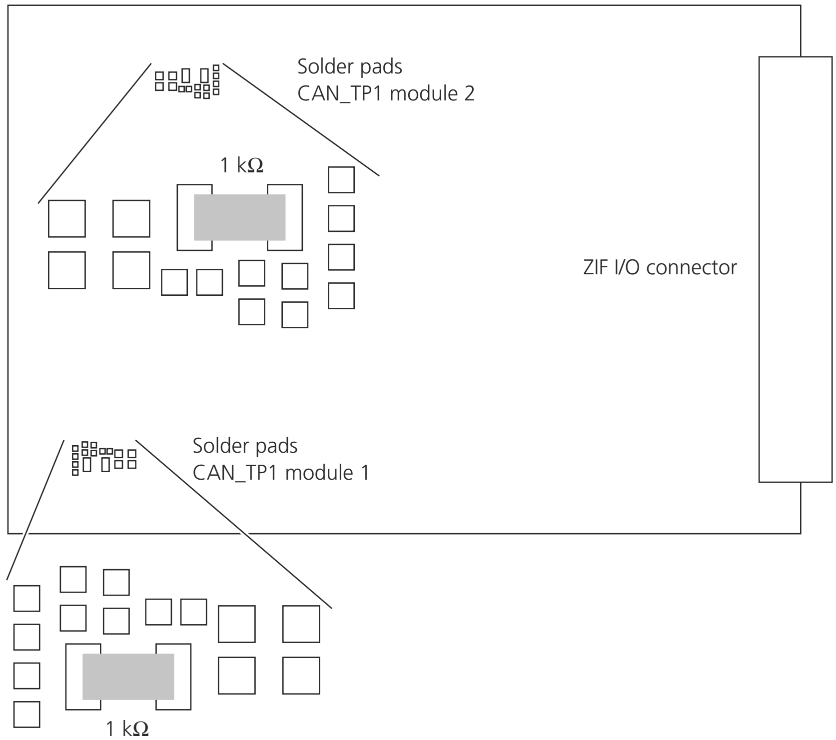
2 Open the enclosure of MicroAutoBox II as shown in the illustration below (on the example of MicroAutoBox II 1401/1511). Use a 2.5 mm hexagon socket wrench.



3 Remove the upper unit of the MicroAutoBox II (DS1514).



4 The solder pads of the two CAN_TP1 modules are on the top of the DS1511. Solder 1 kΩ 2512 SMD resistors to the marked solder pads (see illustration below) as the LIN master pull-up.



5 Install the removed unit (DS1514).

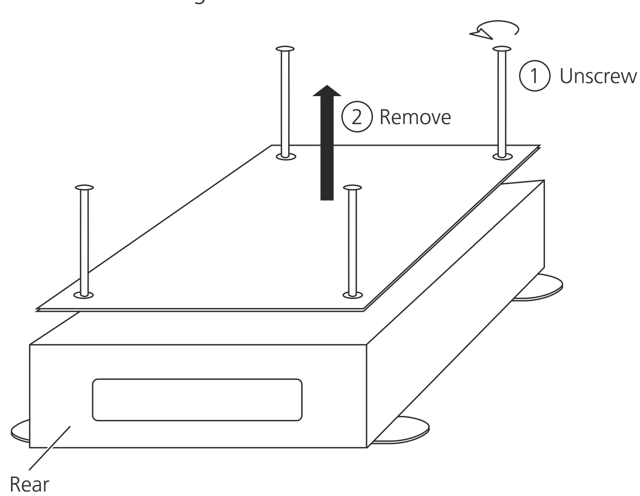
6 Mount the cover of the MicroAutoBox II.

Method 5

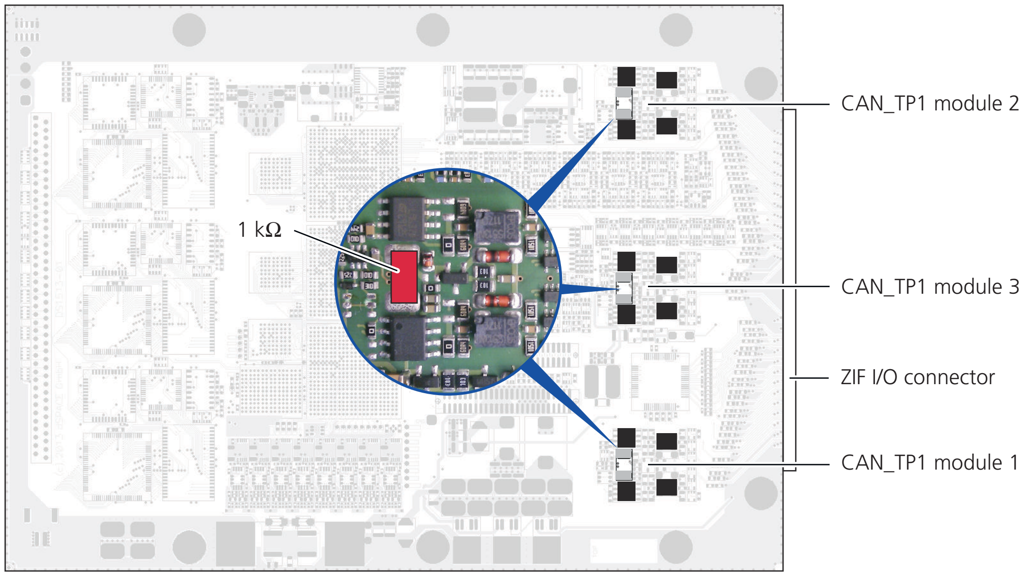
To configure MicroAutoBox II 1401/1513 as the LIN master by soldering a pull-up resistor

1 Disconnect MicroAutoBox II from the power supply.

2 Open the enclosure of MicroAutoBox II as shown in the illustration below. Use a 2.5 mm hexagon socket wrench.



3 The solder pads of the three CAN_TP1 modules are on the top of the DS1513. Solder 1 kΩ 2512 SMD resistors to the marked solder pads (see illustration below) as the LIN master pull-up.



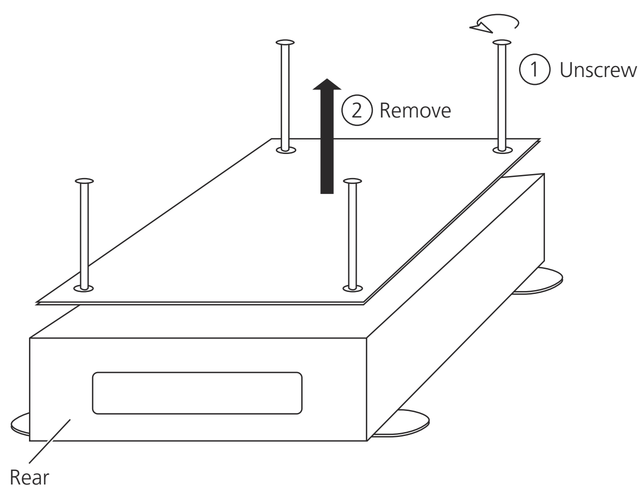
4 Mount the cover of the MicroAutoBox II.

Method 6

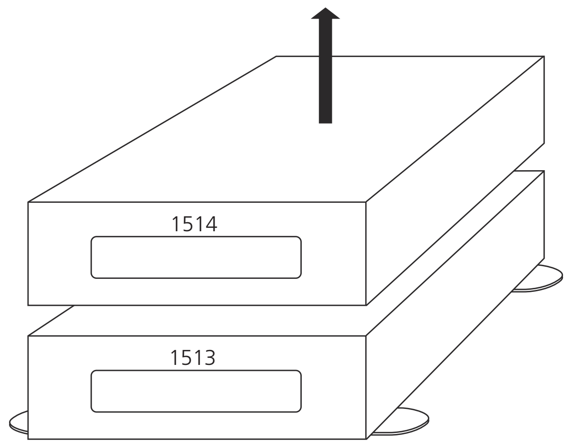
To configure MicroAutoBox II 1401/1513/1514 as the LIN master by soldering a pull-up resistor

1 Disconnect MicroAutoBox II from the power supply.

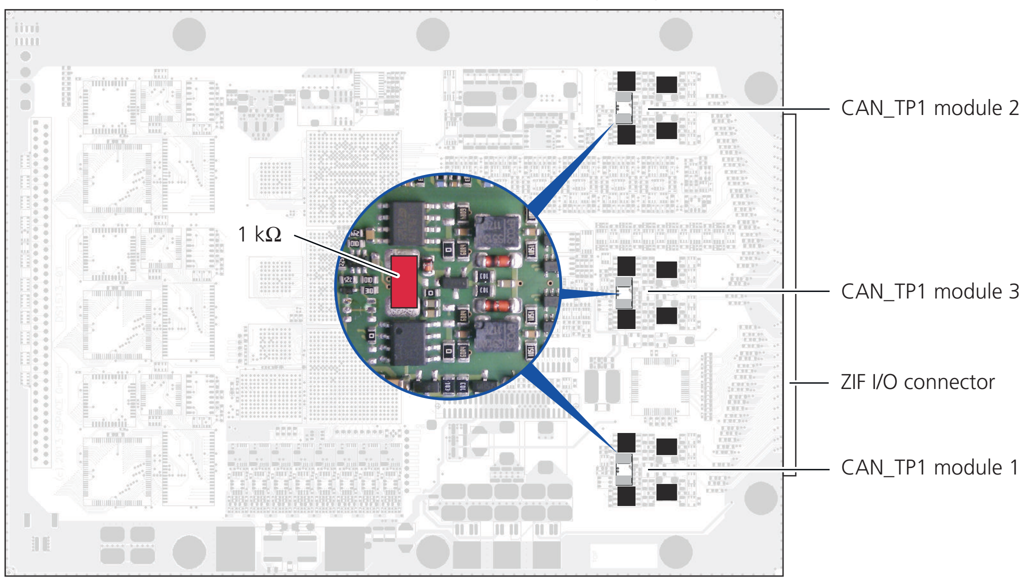
2 Open the enclosure of MicroAutoBox II as shown in the illustration below (on the example of MicroAutoBox II 1401/1513). Use a 2.5 mm hexagon socket wrench.



3 Remove the upper unit of the MicroAutoBox II (DS1514).



4 The solder pads of the three CAN_TP1 modules are on the top of the DS1513. Solder 1 kΩ 2512 SMD resistors to the marked solder pads (see illustration below) as the LIN master pull-up.



5 Install the removed unit (DS1514).

6 Mount the cover of the MicroAutoBox II.

Result

MicroAutoBox II is configured as the LIN master.

Connecting to a CAN Bus

Introduction

You can connect MicroAutoBox II to a CAN bus. MicroAutoBox II 1401/1507, 1401/1511/1514, and 1401/1513/1514 can also be equipped with CAN FD modules to support the CAN with Flexible Data-Rate (CAN FD) protocol.

Where to go from here

Information in this section

General Information on CAN Bus Termination

Where to go from here

Information in this section

Basics on CAN Bus Termination

Introduction

A CAN bus must be terminated with an impedance to minimize signal reflection on the bus. It is recommended to terminate the beginning and the end of the bus. ISO-11898 requires that the CAN bus have a nominal characteristic line impedance of 120 Ω. So each end of the bus must be terminated with a 120 Ω resistor. MicroAutoBox II 1401/1511 and 1401/1511/1514 support two different termination methods located on the DS1511 I/O Board.

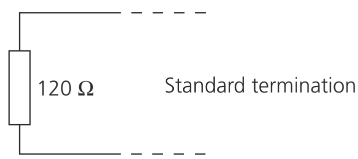
Note

The MicroAutoBox II 1401/1513 and 1401/1513/1514 provide a split termination. The CAN bus termination resistors are switchable by software. For further information, refer to Setup Page (RTICANMM ControllerSetup) (RTI CAN MultiMessage Blockset Reference 📖) or Unit Page (RTICAN CONTROLLER SETUP) (RTI CAN Blockset Reference 📖).

For all other MicroAutoBox variants, you have to terminate your CAN bus externally.

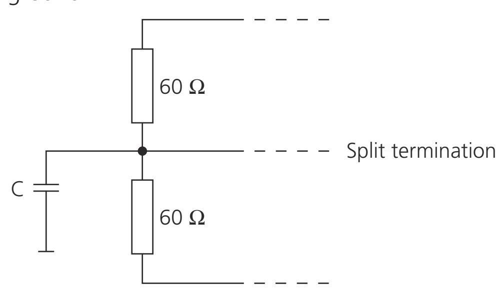
Standard termination

The standard termination uses a single 120 Ω resistor at each end of the bus. This method is used in many CAN systems.



Split termination

Emission reduction can be achieved with split termination. In contrast to the standard termination, the split termination splits the single 120 Ω resistor into two 60 Ω resistors, with a bypass capacitor tied between the resistors and to ground.



Related topics

HowTos

How to Terminate the CAN Bus

Objective

MicroAutoBox II 1401/1511 and 1401/1511/1514 provide solder pads for CAN bus termination resistors. These resistors are not equipped by default. If you need to terminate the CAN bus MicroAutoBox II is connected to, you can easily solder resistors to the hardware.

> **Note**
>
> The MicroAutoBox II 1401/1513 and 1401/1513/1514 provide a split termination. The CAN bus termination resistors are switchable by software. For further information, refer to Setup Page (RTICANMM ControllerSetup) (RTI CAN MultiMessage Blockset Reference 📖) or Unit Page (RTICAN CONTROLLER SETUP) (RTI CAN Blockset Reference 📖).

Possible methods

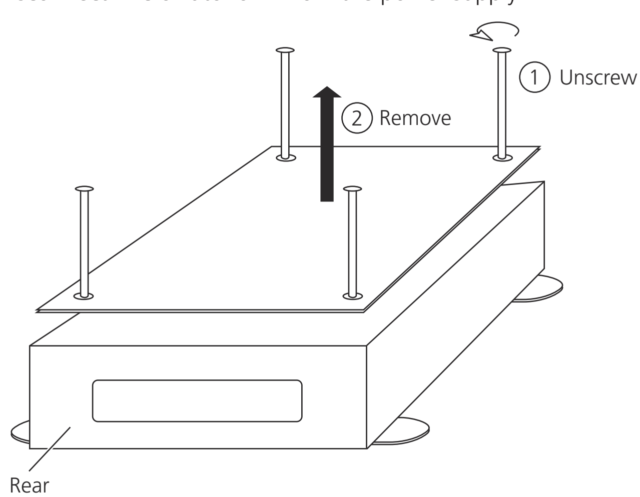
The configuration varies according to the MicroAutoBox variant.

- For MicroAutoBox II 1401/1511, you can add termination resistors internally. The capacitor for split termination is already soldered on the DS1511. Refer to Method 1.
- For MicroAutoBox II 1401/1511/1514, you can add termination resistors internally. You have to uninstall the DS1514 before. The capacitor for split termination is already soldered on the DS1511. Refer to Method 2.

Method 1

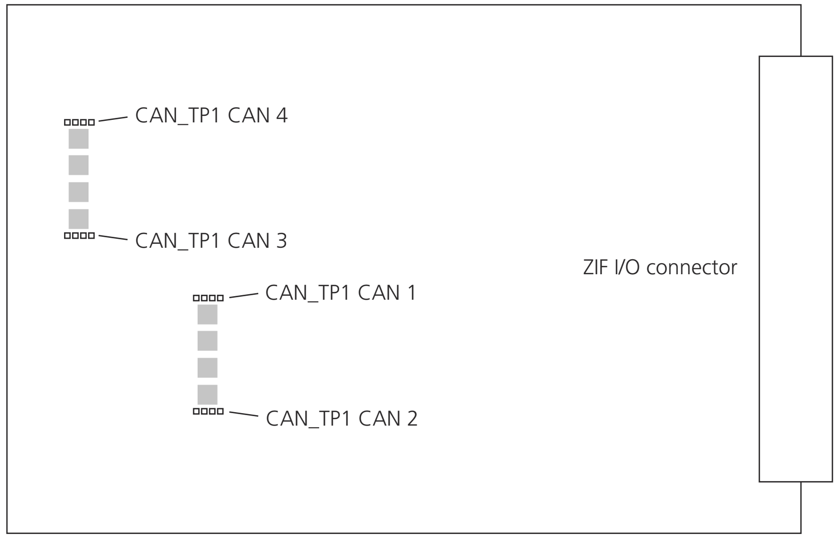
To set termination resistors on MicroAutoBox II 1401/1511

1 Disconnect MicroAutoBox II from the power supply.

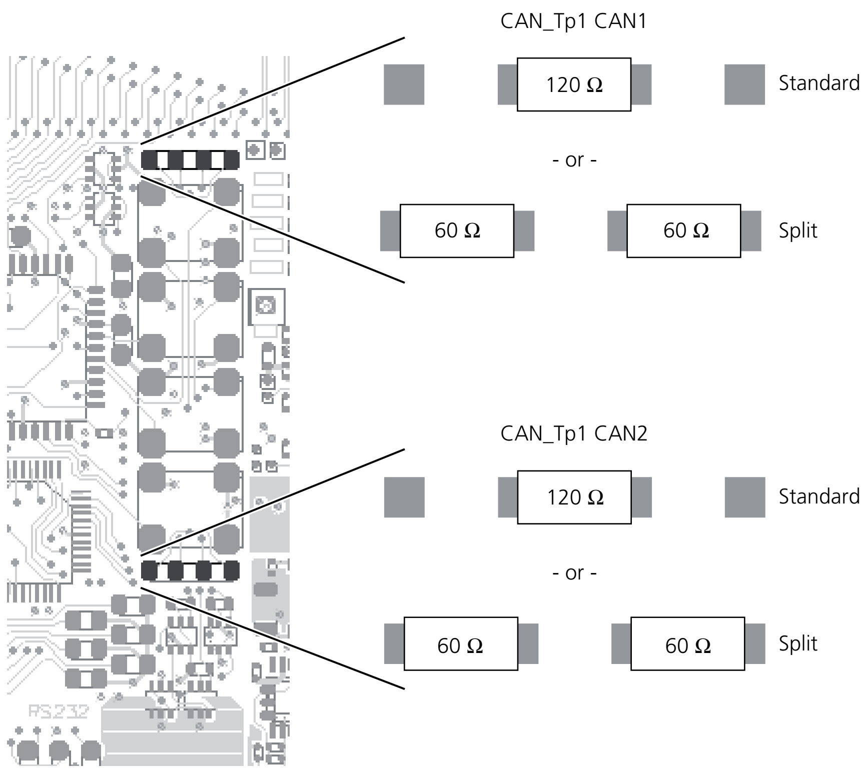


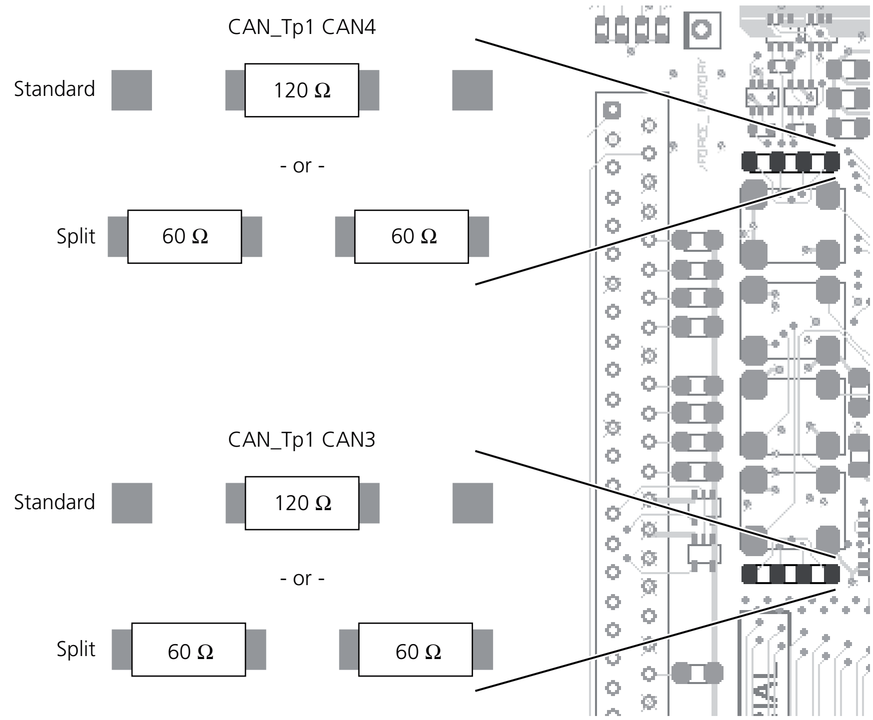
2 Unbolt the screws of the cover with a 2.5 mm hexagon socket wrench and remove the cover.

3 The two CAN_TP1 modules are on the top.



4 Solder 0805 SMD resistors as termination.





5 Mount the cover of the MicroAutoBox II.

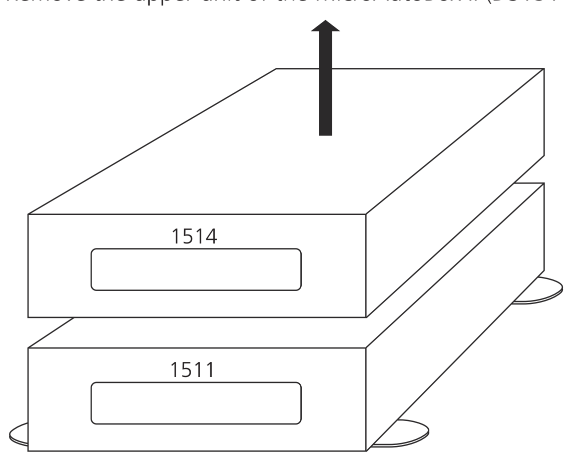
Method 2

To set termination resistors on MicroAutoBox II 1401/1511/1514

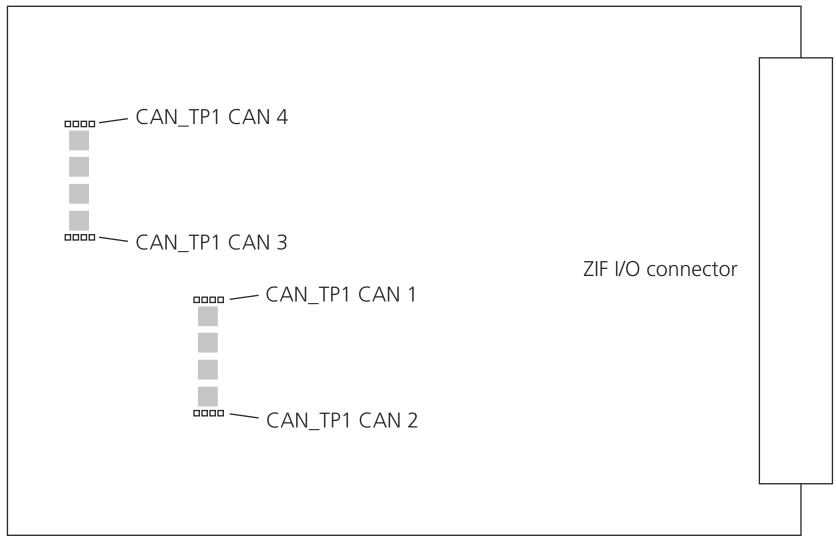
1 Disconnect MicroAutoBox II from the power supply.

2 Unbolt the screws of the cover with a 2.5 mm hexagon socket wrench and remove the cover.

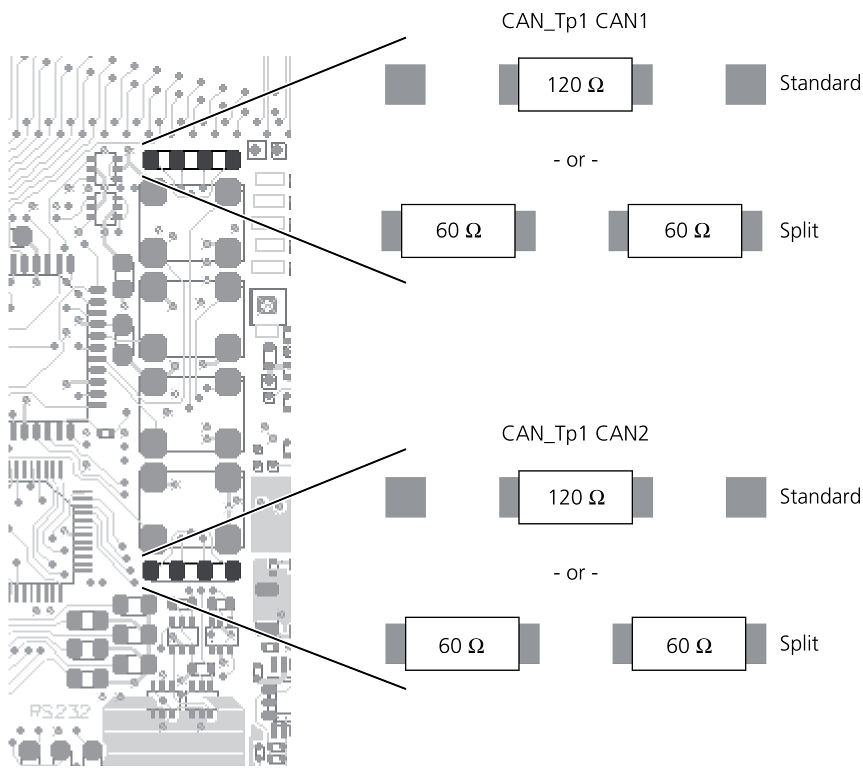
3 Remove the upper unit of the MicroAutoBox II (DS1514).

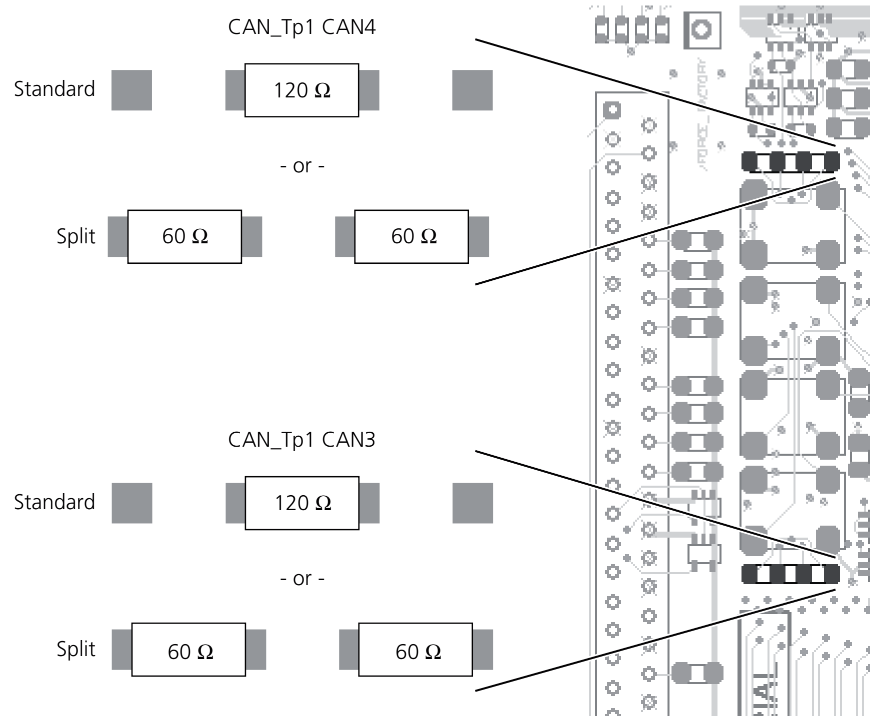


4 The solder pads of the two CAN_TP1 modules are on the top of the DS1511.



5 Solder 0805 SMD resistors as termination.





6 Install the removed unit (DS1514).

7 Mount the cover of the MicroAutoBox II.

Related topics

Basics

General Information on CAN FD Modules

Supported CAN FD Modules

Introduction

This topic provides information on which MicroAutoBox variants are supported and which CAN FD modules can be used.

MicroAutoBox variants

CAN FD modules can only be installed in

- MicroAutoBox II 1401/1507
- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

CAN FD modules

The following CAN FD modules can be installed in MicroAutoBox II and are supported by dSPACE implementation software:

- DS4342 CAN FD Interface Module

Software support

The RTI CAN MultiMessage Blockset supports the CAN FD modules listed above.

Related topics

Basics

Using DS4342 Modules..117

CAN Partial Networking with the DS1513 I/O Board of MicroAutoBox II

How to Configure MicroAutoBox II with the DS1513 I/O Board for CAN Partial Networking

Objective

You can configure MicroAutoBox II 1401/1513 and 1401/1513/1514 to be woken up by CAN partial networking wake-up messages.

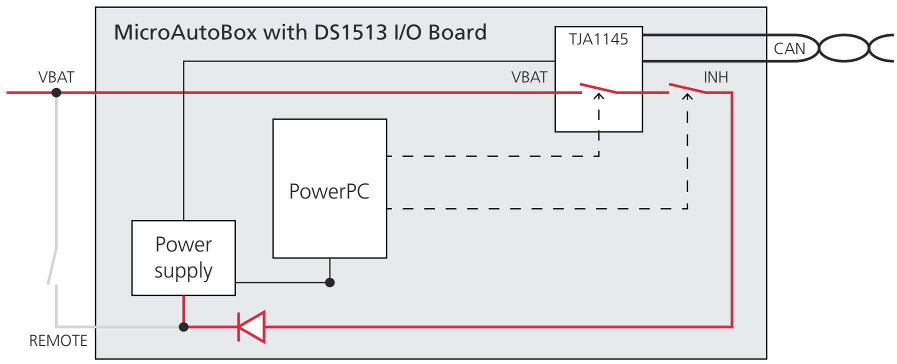
Basics on the wake-up functionality

Each CAN channel is equipped with a TJA1145T/FD transceiver supporting ISO 11898-6 compliant CAN partial networking. For detailed information on the TJA1145T/FD transceiver, refer to the TJA1145T/FD data sheet (at http://www.nxp.com).

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

Via a real-time application, MicroAutoBox II with DS1513 I/O Board can switch the transceiver into sleep mode and configure it to monitor the CAN bus for a wake-up request. Each transceiver has an internal inhibit pin (INH) to wake up MicroAutoBox II. When a transceiver detects a wake-up message on the CAN bus, its inhibit pin is set to VBAT voltage level to wake up MicroAutoBox II.

To use the wake-up functionality with the DS1513 I/O Board, the REMOTE input of MicroAutoBox II must be disconnected from VBAT (see the following schematic).



The states of the internal switches and the transceiver configuration are kept as long as the VBAT voltage is connected to the transceiver(s).

Method

To configure MicroAutoBox II with DS1513 I/O Board for CAN partial networking

1 The REMOTE input (KL15) of MicroAutoBox II must be disconnected from VBAT.

2 The pins to be connected depend on the selected inhibit signal and module slot.

- Connect the battery voltage to the VBAT pins of the power input connector.
- Connect the battery ground to the GND pin of the power input connector.
- Connect the CAN bus to the ZIF I/O connector (DS1513).

> **Note**
>
> The VBAT, GND and REMOTE pins are also located on the ZIF I/O connector. However, it is recommended to use the pins only on the power input connector. Do not use the pins on the power input connector and on the ZIF I/O connector at the same time.

Tip

For general information on connecting MicroAutoBox II, refer to Building the Power and I/O Connections on page 41.

For information on the pinouts, refer to

- MicroAutoBox II 1401/1513: Connector Pinouts on page 310
- MicroAutoBox II 1401/1513/1514: Connector Pinouts on page 347

Result

When a wake-up message is detected on the selected CAN channel, MicroAutoBox II starts.

Using DS4342 Modules

Introduction

DS4342 CAN FD Interface Modules are CAN communication modules that support the CAN with Flexible Data-Rate (CAN FD) protocol.

Where to go from here

Information in this section

Basics on DS4342 CAN FD Interface Modules

Introduction

Basic information on the DS4342's features, bus termination, feed-through lines, and connecting the bus lines is given below.

Features of DS4342 modules

DS4342 CAN FD Interface Modules are CAN communication modules that support the CAN with Flexible Data-Rate (CAN FD) protocol. A DS4342 module provides two CAN channels with the following features for each CAN channel:

- A CAN FD communication controller
- A physical layer interface with a TJA1145T/FD transceiver compliant to ISO11898-6 (partial networking)
- Feed-through wiring for CAN bus signals
- Switchable software-controlled termination circuit
- Transceiver inhibit signals on the I/O connector in order to power up a MicroAutoBox II via the CAN bus

DS4342 modules are supported by the RTI CAN MultiMessage Blockset.

Up to two DS4342 CAN FD Interface Modules can be installed in MicroAutoBox II 1401/1507, 1401/1511/1514, and 1401/1513/1514.

Bus termination

You can terminate the bus lines if the channels of the DS4342 module are connected at the end of the CAN bus. The termination is switched via software in the RTICANMM ControllerSetup block, refer to Setup Page (RTICANMM ControllerSetup) (RTI CAN MultiMessage Blockset Reference 📖). For a detailed description of bus termination, refer to DS4342 Connections in Different Topologies on page 120.

Feed-through lines

If the DS4342 is not connected at an end of the CAN bus, but 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 signal integrity, especially in a topology consisting of many nodes and long distances between the splices or ECUs. For details, refer to DS4342 Connections in Different Topologies on page 120.

Pinout, pin description

If DS4342 modules are installed in MicroAutoBox II, all their pins for the bus lines are connected to the I/O connector on the rear side (Sub-D or ZIF).

For details on the signals and pinouts, refer to Data Sheet DS4342 CAN FD Interface Module on page 443.

Related topics

Basics

DS4342 Module Overview and Connector Pinouts

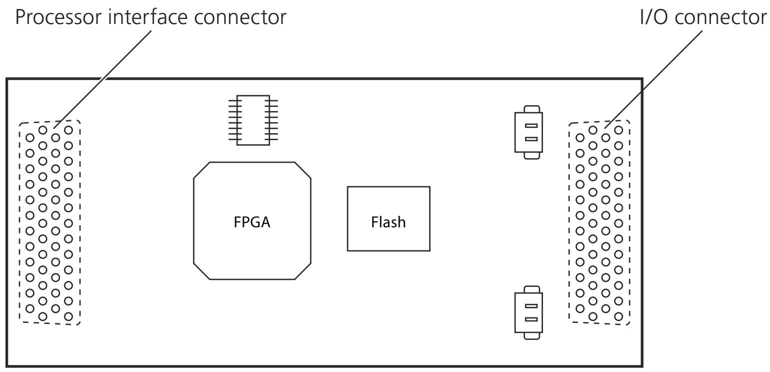
Introduction

A DS4342 CAN FD Interface Module provides two 50-pin connectors for connecting a real-time processor to a CAN bus.

Each CAN (FD) channel has a CAN high (CANH), CAN low (CANL), ground (GND) and inhibit (INH) pin. To reduce the stub length, each CAN channel also provides a CAN high feedthrough (CANH_FT) and CAN low feedthrough (CANL_FT) pin.

Overview illustration

The illustration shows where the connectors are located on the module. The illustration is not to scale.



Components

The DS4342 CAN FD Interface Module has the following connectors:

- *Processor interface connector* for connecting the DS4342 module to the DS1507 or DS1514 I/O Board of MicroAutoBox II. The processor interface connector provides the signals for the real-time processor.
- *I/O connector* for connecting the DS4342 module to the DS1507 or DS1514 I/O Board of MicroAutoBox II. The I/O connector provides the signals that are routed to the I/O connector on the rear side of the MicroAutoBox II.

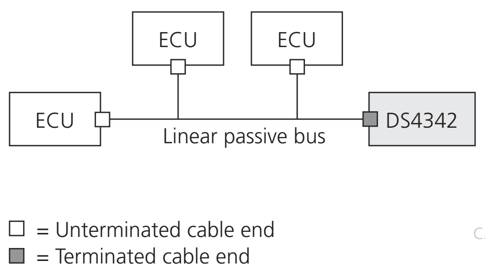
DS4342 Connections in Different Topologies

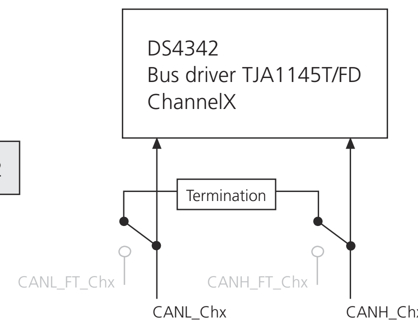
Introduction

You can terminate bus lines of the DS4342 CAN FD Interface Module or use them unterminated. You can use feed-through pins to shorten the stub length if the DS4342 is used in a linear passive bus. This topic gives you information on the bus topology and termination. You can configure the termination in the RTICANMM ControllerSetup block.

Terminated cable end without feed-through

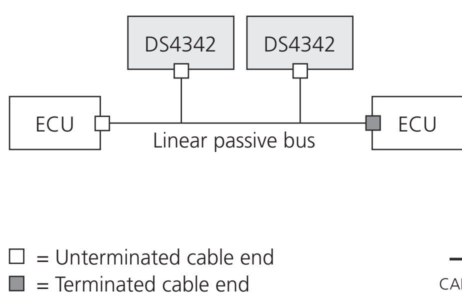
If the DS4342 is connected at an end of the CAN bus, its bus lines must be terminated. The termination resistor is activated via software (see above).

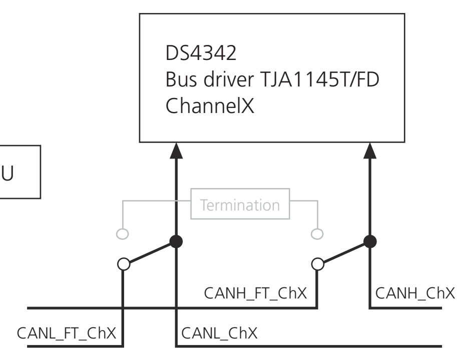




Unterminated cable end with feed-through

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.





Example of Connecting One DS4342 Module to a CAN Bus

Introduction

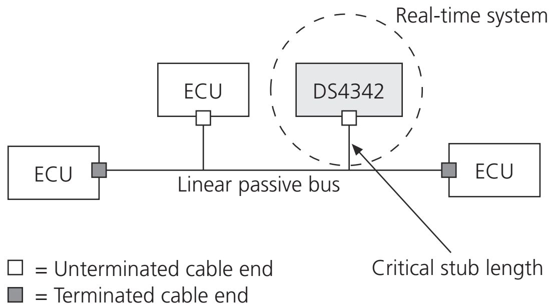
This example shows how one DS4342 module of MicroAutoBox II can be connected to a linear CAN bus. The DS4342 module is not connected at the end of the bus. The termination resistor is therefore not activated.

Note

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

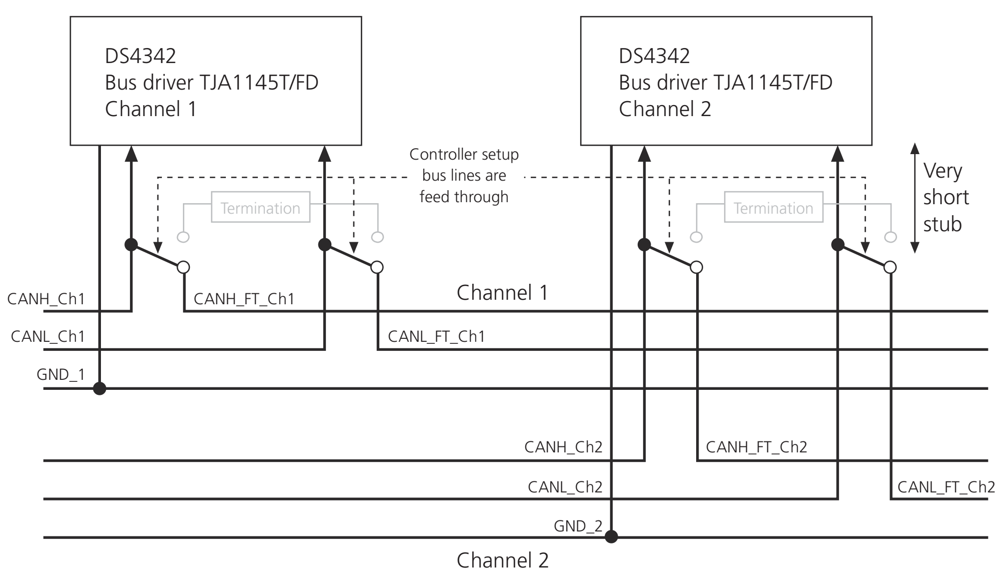
Topology

The following illustration shows the network that the DS4342 module of MicroAutoBox II is connected to.



Circuit

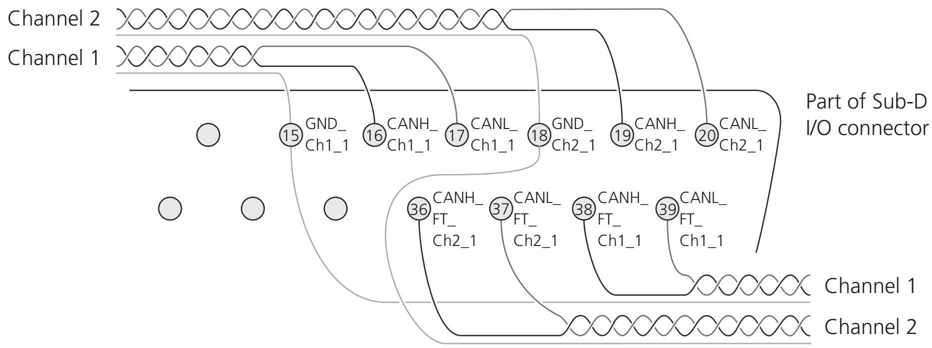
The following illustration shows the connection of the CAN high bus lines and CAN low bus lines. The incoming bus lines are connected to the CANH_Ch1 and CANL_Ch1 pins (CANH_Ch2 and CANL_Ch2, respectively). The outgoing bus lines are connected to the feed-through pins CANH_FT_Ch1 and CANL_FT_Ch1 (CANH_FT_Ch2 and CANL_FT_Ch2, respectively). The incoming and outgoing bus lines are connected directly on the DS4342 module, which results in a very short stub length from the connection to the transceiver. The switch for the connection is set via software (see RTICANMM ControllerSetup (RTI CAN MultiMessage Blockset Reference)).



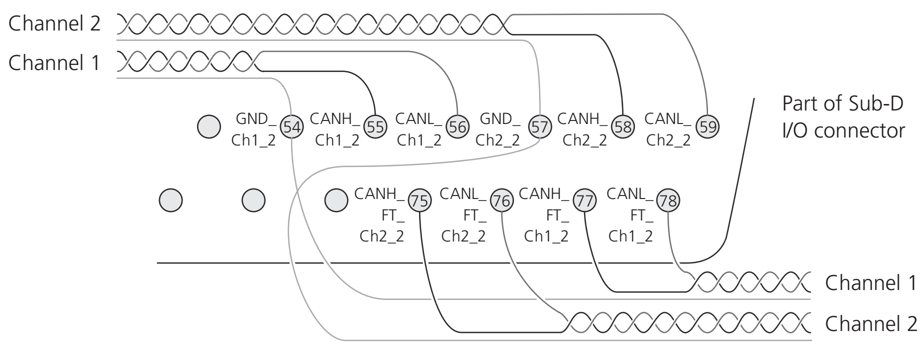
Sub-D I/O connector

MicroAutoBox II 1401/1507 provide the CAN signals on a Sub-D connector.

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



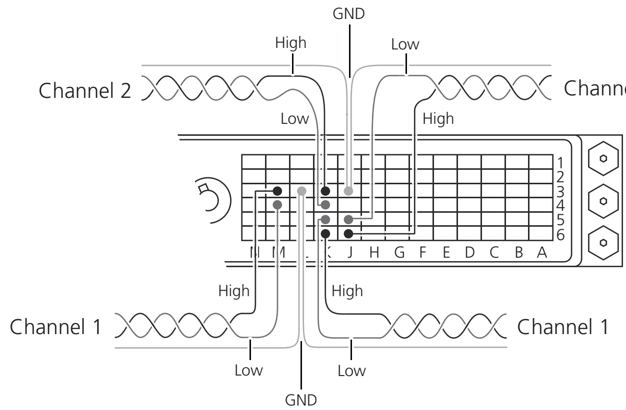
DS4342 installed in slot 2 The following illustration shows a part of the Sub-D I/O connector with the connected bus lines if the DS4342 is installed in slot 2.



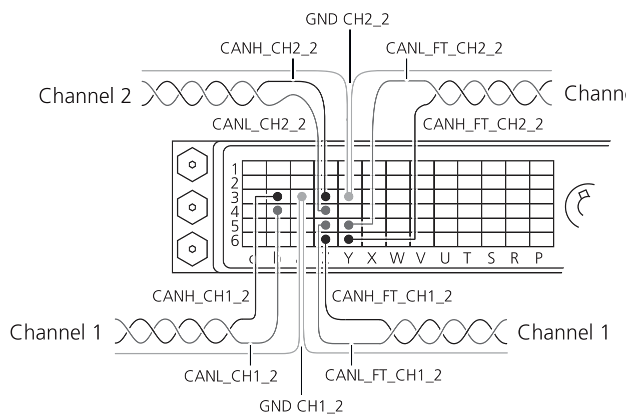
ZIF I/O connector

MicroAutoBox II 1401/1511/1514 and MicroAutoBox II 1401/1513/1514 provide the CAN signals 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.



How to Configure MicroAutoBox II and a DS4342 for CAN Partial Networking

Objective

You can configure MicroAutoBox II that is equipped with a DS4342 module to be woken up by CAN partial networking wake-up messages.

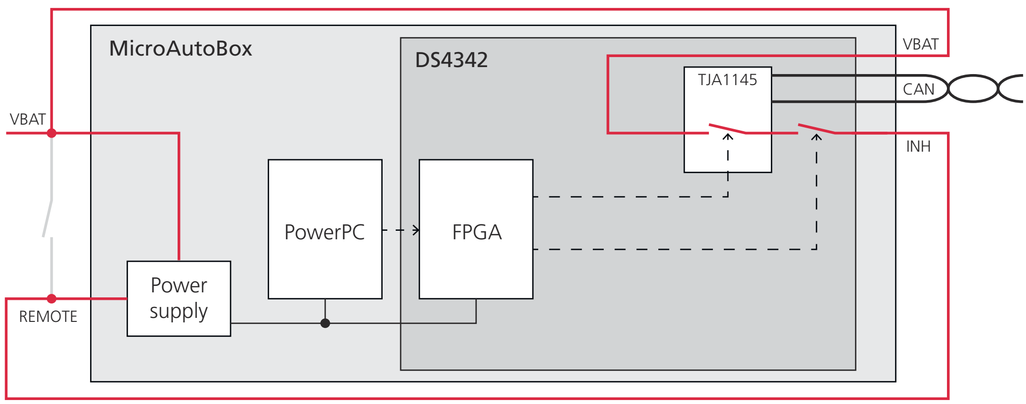
Basics on the wake-up functionality of the DS4342

Each CAN channel of a DS4342 CAN FD Interface Module is equipped with a TJA1145T/FD transceiver supporting ISO 11898-6 compliant CAN partial networking. For detailed information on the TJA1145T/FD transceiver, refer to the TJA1145T/FD data sheet (at http://www.nxp.com).

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

Via a real-time application, MicroAutoBox II can switch the transceiver into sleep mode and configure it to monitor the CAN bus for a wake-up request. Each transceiver provides an inhibit pin (INH) to wake up MicroAutoBox II. When a transceiver detects a wake-up message on the CAN bus, its inhibit pin is set to VBAT voltage level to wake up MicroAutoBox II.

To use the wake-up functionality of the DS4342 CAN FD Interface Module, you must prepare the wiring of the IP module and MicroAutoBox II. The REMOTE input of MicroAutoBox II must be disconnected from VBAT and connected to at least one of the INH pins to wake up the MicroAutoBox II if a wake-up message was received (see the following schematic).



The states of the internal switches and the transceiver configuration are kept as long as the VBAT voltage is connected to the transceiver(s).

Valid only for MicroAutoBox II 1401/1507

NOTICE

Do not configure IP modules that are installed in MicroAutoBox II 1401/1507 yourself. You might destroy parts of MicroAutoBox II.

All modules that are installed in MicroAutoBox II 1401/1507 must be configured by dSPACE. The assembling positions of the DS1401 Base Board and the DS1507 I/O Board in the MicroAutoBox II housing do not allow direct access to the IP slots of the DS1507.

Method

To configure MicroAutoBox II and a DS4342 for CAN partial networking

1. The REMOTE input (KL15) of MicroAutoBox II must be disconnected from VBAT.
2. The pins to be connected depend on the selected inhibit signal and IP module slot.
   - Connect the inhibit pin(s) of the Sub-D I/O connector (DS1507) or the ZIF I/O connector (DS1514) to the REMOTE pin of the power input connector.
   - Connect the battery voltage to the VBAT pins of the power input connector.

- Connect the battery ground to the GND pin of the power input connector.
- Connect the CAN bus to the Sub-D I/O connector (DS1507) or the ZIF I/O connector (DS1514).
- Connect the battery voltage to the VBAT inputs of the DS4342 module.

Note

The VBAT, GND and REMOTE pins are also located on the ZIF I/O connector. However, it is recommended to use the pins only on the power input connector. Do not use the pins on the power input connector and on the ZIF I/O connector at the same time.

Tip

For general information on connecting MicroAutoBox II, refer to Building the Power and I/O Connections on page 41.

For information on the pinouts, refer to

- MicroAutoBox II 1401/1507: Connector Pinouts on page 205
- MicroAutoBox II 1401/1511/1514: Connector Pinouts on page 267
- MicroAutoBox II 1401/1513/1514: Connector Pinouts on page 347

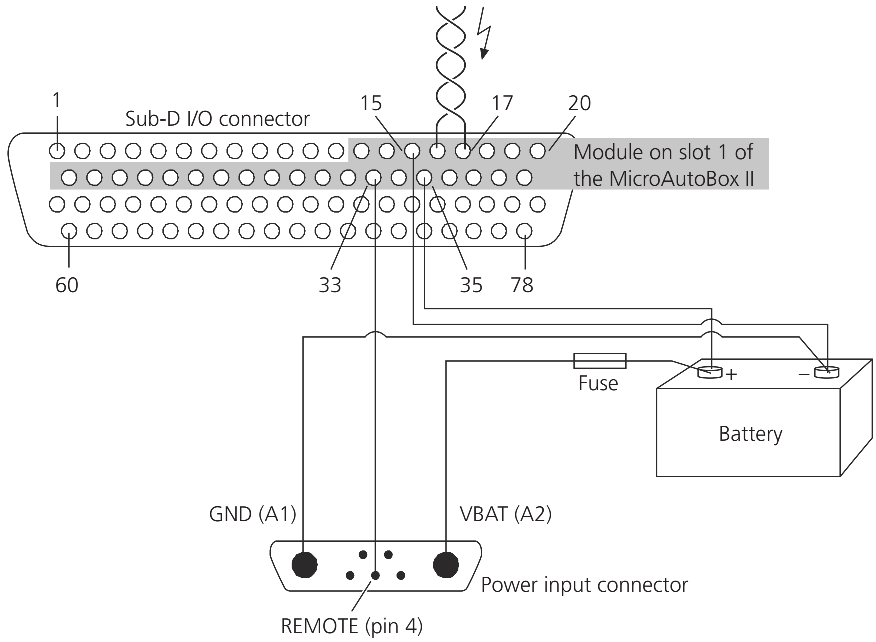
Result

When a wake-up message is detected on the selected CAN channel, MicroAutoBox II starts.

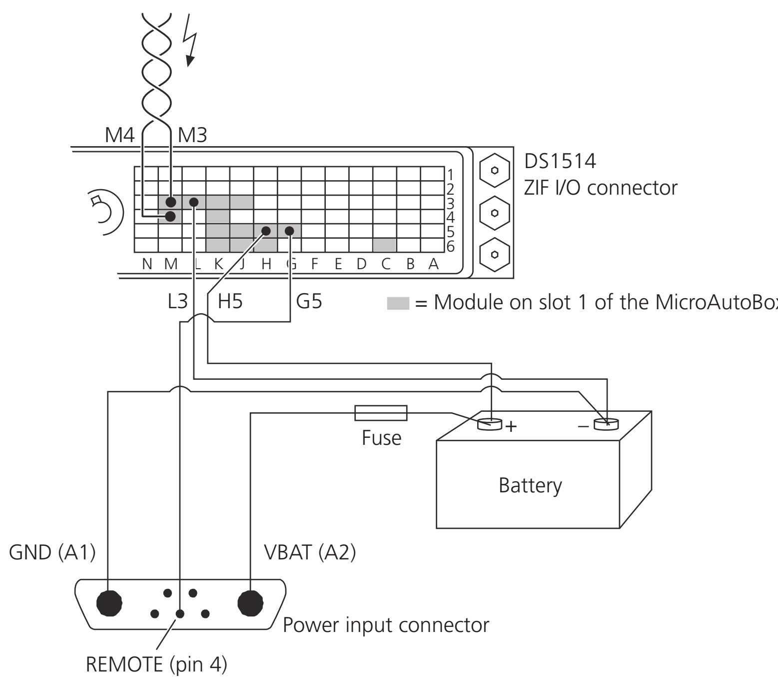
Examples

The following illustrations show examples of how MicroAutoBox II can be connected to a CAN bus. In these examples, CAN channel 1 of the module in slot 1 is used for waking up. The inhibit signal INH1_1 (Sub-D pin 33) (1401/1511/1514 and 1401/1513/1514: ZIF pin G5) is connected to the REMOTE pin.

Example 1 - for MicroAutoBox II 1401/1507



Example 2 - for MicroAutoBox II 1401/1511/1514 and 1401/1513/1514



MicroAutoBox II in Use

Introduction

Before working with MicroAutoBox II in a vehicle you should put the system into operation in your laboratory to configure the dSPACE system and to get started with MicroAutoBox II loading applications to the system.

Where to go from here

Information in this section

Identifying Operation States of MicroAutoBox II

Introduction

MicroAutoBox II provides LEDs to show you different states and potential malfunctions.

Precondition

To set MicroAutoBox II into operation for the first time in your laboratory you have to connect the box to the power supply. For information, refer to Connecting to Power Supply on page 42.

Status LED

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED shows different states indicated by the LED color:

LED is red Reset state and no application is downloaded to the real-time processor.

LED is green Application is running.

LED flashes red MicroAutoBox II is in secured mode. For further details, refer to Checking MicroAutoBox II on page 506.

How to Set the System Time on MicroAutoBox II

Objective

Since flight recorder data has time stamps, it is recommended to have the same system time on both MicroAutoBox II and the host PC.

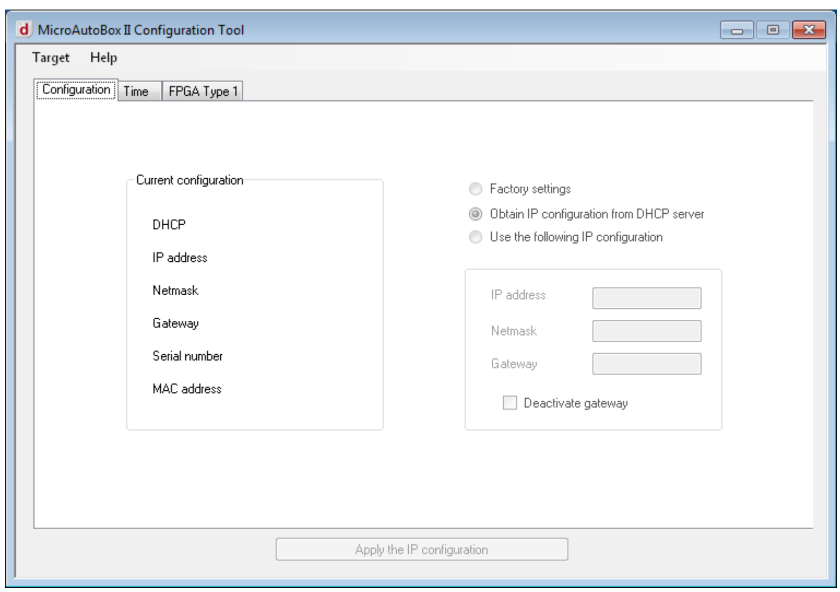
Method

To set the system time on MicroAutoBox II

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

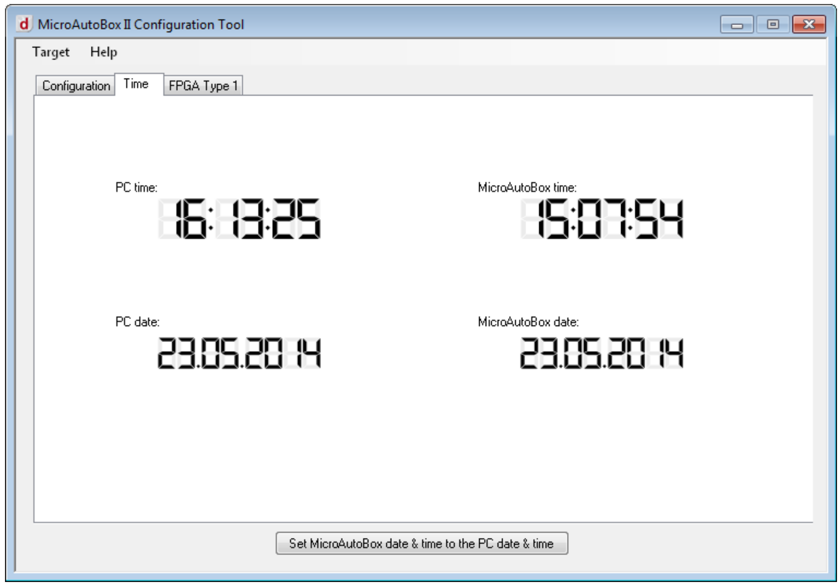
A Command Prompt window opens.

2 Enter `ds1401configgui.exe` to open the MicroAutoBox II Configuration Tool.



3 Choose Target — Show all MicroAutoBox II units, select your MicroAutoBox II an click Connect.

4 Choose the Time page and click Set MicroAutoBox date & time to the PC date & time.



Result

The time and the date of your host PC and the MicroAutoBox II are synchronized.

Notes and Tips on Working with MicroAutoBox II in a Vehicle

Introduction

MicroAutoBox II operates as a stand-alone system in a vehicle. You have to download the control model to the flash memory of MicroAutoBox II.

Safety precautions

⚠ WARNING

Even a brief disconnection of the battery while the engine is running results in a load dump of the car generator, producing hazardous voltages of more than 100 V.

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

Example of a working strategy

The following list shows one of several strategies for working with MicroAutoBox II in a vehicle.

- Prepare your application as usual on your PC in a laboratory. You may integrate the flight recorder function for data acquisition.

- Connect MicroAutoBox II to the host PC, load the application to the global memory of MicroAutoBox II, and use ControlDesk to check the application.
- Load the application to the flash memory of MicroAutoBox II. Thus, the application will be started automatically on power-up.
- Install MicroAutoBox II in the vehicle, connect MicroAutoBox II to the power supply and to the I/O signals.

  Connect MicroAutoBox II as described in Connecting to Power Supply on page 42 to start MicroAutoBox II when starting the engine.
- Perform the tests with the vehicle: MicroAutoBox II operates automatically and the flight recorder will collect the data.

Using the host interface

Best practices concerning the host interface of MicroAutoBox II are described below.

Host PC on company LAN - MicroAutoBox II on Peer-to-peer If you need to be connected to your company LAN with your host PC and you want to work with MicroAutoBox II at the same time, it is recommended to install a second network adapter or to use a USB Ethernet adapter so you do not need to reconfigure the network connection settings of your PC.

Moving MicroAutoBox II from company LAN to the vehicle If you move the MicroAutoBox II from the company LAN to the vehicle you must reconfigure the Ethernet settings of MicroAutoBox II. This is because in most cases MicroAutoBox II is connected to your portable PC in the vehicle peer-to-peer.

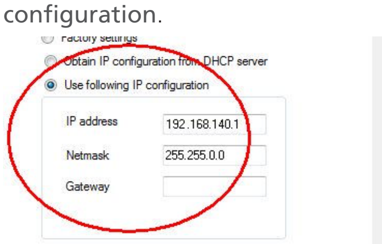
The easiest method is to reconfigure the MicroAutoBox II while it is connected to your company LAN.

Use the MicroAutoBox II Configuration Tool.

Execute the `ds1401configgui.exe` to open the MicroAutoBox II Configuration Tool. It is located in `<RCP_HIL_InstallationPath>\Exe`.

Choose Target — Connect to MicroAutoBox II and enter either the current IP address or the serial number and the MAC address in the Connect to MicroAutoBox II window shown below and click Connect.

Choose Use the following IP configuration, change the settings in IP address and Netmask as shown in the illustration below and click Apply the IP configuration.



After this you can power off the MicroAutoBox II and install it in the vehicle.

You have to restart MicroAutoBox II so that the changes become effective.

Moving MicroAutoBox II from the vehicle to company LAN To move the MicroAutoBox II from the vehicle back to the company LAN, it is recommended to first activate the DHCP client on the MicroAutoBox II.

Execute the **ds1401configgui.exe** to open the MicroAutoBox II Configuration Tool. It is located in <RCP_HIL_InstallationPath>\Exe.

Choose Target — Connect to MicroAutoBox II and enter either the current IP address or the serial number and the MAC address in the Connect to MicroAutoBox II window shown below and click Connect.

Choose Obtain IP configuration from DHCP server as shown in the illustration below and click Apply the IP configuration.

Then you are ready to work with MicroAutoBox II on your company LAN.

You have to restart MicroAutoBox II so that the changes become effective.

Related topics

HowTos

Notes on Updating the Firmware

Update process

After updating the firmware of MicroAutoBox II (especially the System PLD, Host IF, Host IF PLD, ADC Type 4, FPGA Type 1, DIO Type 3, DIO Type 4, and AIO Type 1 firmware), you have to turn off MicroAutoBox II. After a restart the firmware changes take effect.

For details on updating the firmware, refer to Firmware Manager Manual 📖 .

How to Physically Combine RapidPro and MicroAutoBox II

Objective

The following instructions show you how to use the dSPACE joining plates on the example of a two-unit RapidPro stack and a MicroAutoBox II 1401/1511.

Preconditions

Before doing any installation work, make sure that:

- The RapidPro system and MicroAutoBox II are disconnected from the power supply.

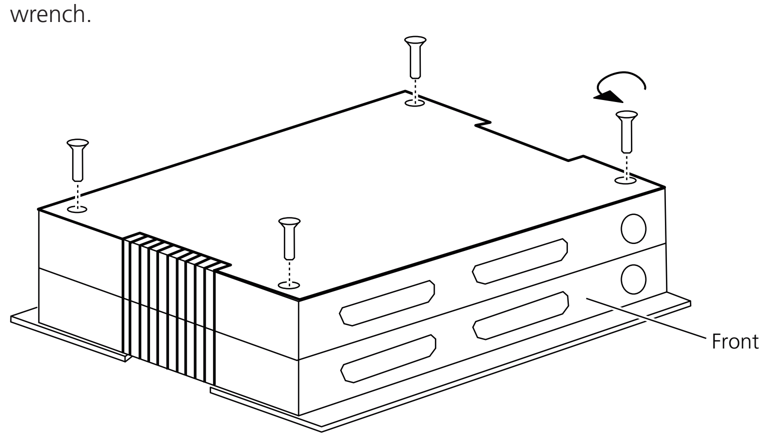
- No external devices are connected to the RapidPro system and MicroAutoBox II.
- You have all the items in the table below:

Items	Count	Description
Hexagon socket wrench	1	2.5 mm
	1	3.0 mm
Hexagon socket countersunk screw	4	To mount the joining plates on the cover of the RapidPro stack. M4 X 18 mm
	4	To attach MicroAutoBox II to the RapidPro stack. M5 X 10 mm
Spring lock washer	4	M5
Joining plate	2	—

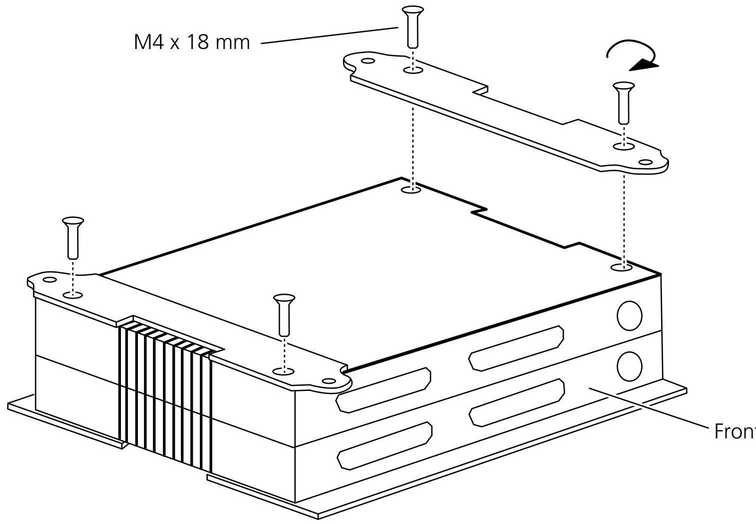
Method

How to physically combine RapidPro and MicroAutoBox II

1 Remove the cover screws of the RapidPro with a 2.5 mm hexagon socket wrench.



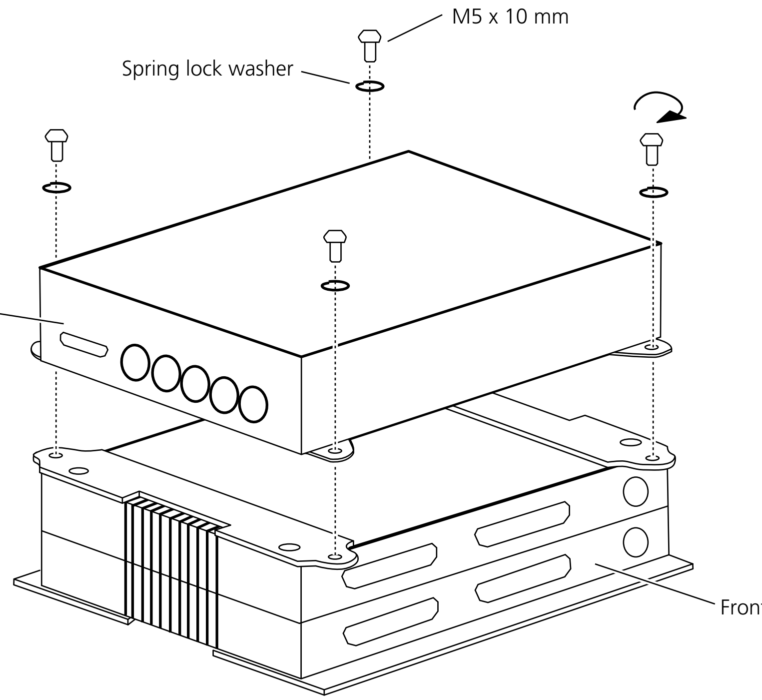
2 Mount the joining plates with the M4 X 18 mm hexagon socket countersunk screws on the top of the RapidPro stack.



Note

- The countersunks of the joining plates must point up.
- The gap of each joining plate must point outwards to avoid covering up the RapidPro's cooling ribs.

3 Fasten MicroAutoBox II with the M5 X 10 mm hexagon socket countersunk screws and the spring lock washers. Use a 3.0 mm hexagon socket wrench.



Result

MicroAutoBox II and RapidPro stack are now physically connected as one unit.

NOTICE

The vibration and shock certifications listed in the data sheets of both products are not valid when the products are combined with the joining plates.

If the unit of MicroAutoBox II and RapidPro stack is used under the constraint of vibration and shock load, you have to ensure a suitable mechanical locking of the unit to the place of installation.

If you mount the unit of MicroAutoBox II and RapidPro stack in a vehicle, note the changed weight and chassis dimensions.

Any damage to or malfunction of dSPACE hardware caused by improper installation is not covered by the warranty, unless the handling and installation instructions are shown to be defective.

In-Vehicle Installation

How to Install MicroAutoBox II/Embedded PC/Embedded DSU in a Vehicle

Safety precautions

Comply with the following safety precaution for MicroAutoBox Embedded PC that has protruding connectors for video and 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 mounting positions

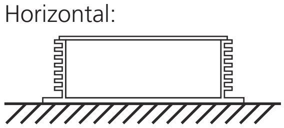
You can install the MicroAutoBox variants in the following positions.

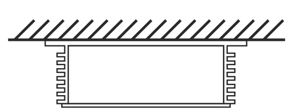
MicroAutoBox II MicroAutoBox II without MicroAutoBox Embedded PC can be mounted in any position. For the cable harness, observe enough clearances from the front and rear panels to walls, other devices or objects.

MicroAutoBox Embedded PC For MicroAutoBox Embedded PC (stand-alone or combined with MicroAutoBox II) you have to observe the following clearances and mounting positions:

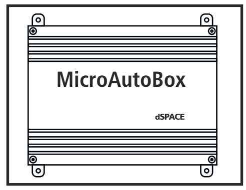
- For sufficient heat dissipation and free airflow, observe the minimum clearances of 200 mm (7.9 in.) from the front and rear panels to walls, other devices or objects.
- To prevent hot liquids from leaking from ventilation slots in the exceptional case of an internal fire, observe the illustrated mounting positions.

Horizontal:



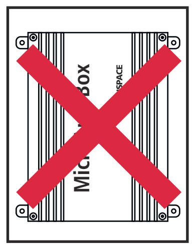


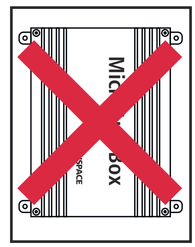
Vertical:



The following mounting positions are not allowed.

Vertical:





MicroAutoBox Embedded DSU MicroAutoBox Embedded DSU can be mounted in any position. For the cable harness, observe enough clearances from the front and rear panels to walls, other devices or objects.

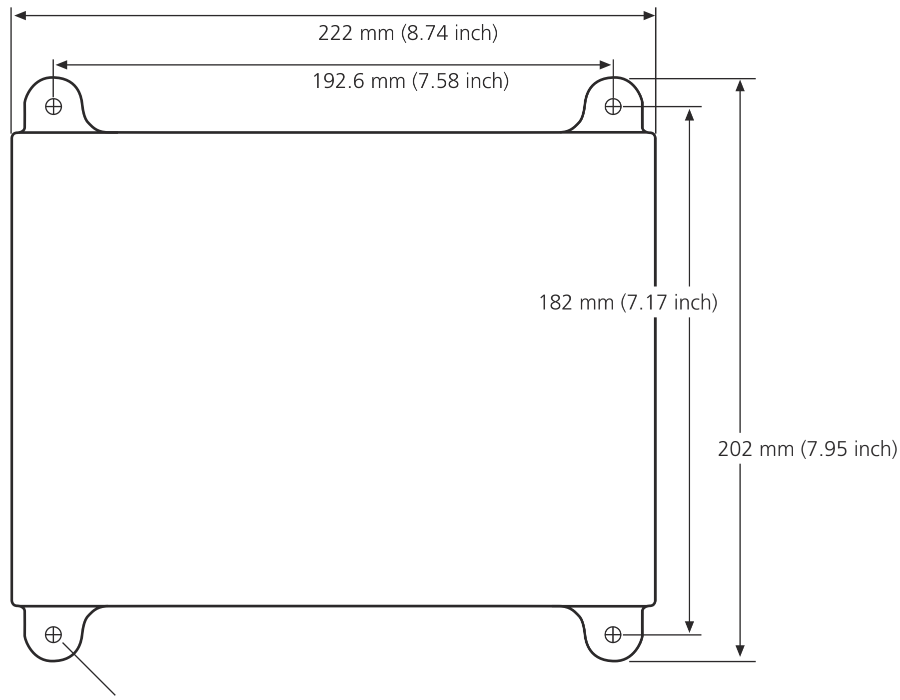
Method

To install MicroAutoBox II/Embedded PC/Embedded DSU in a vehicle

1 Determine the place where you want to install the MicroAutoBox variant and clean the surface.

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 prepare four threads.

Use four bolts – M5 is recommended – to fasten the MicroAutoBox variant to the vehicle.

Related topics

Basics

Safety Precautions for Installing and Connecting the Hardware 19

Using MicroAutoBox Embedded PC

Introduction

MicroAutoBox Embedded PC can extend your MicroAutoBox II system to use devices such as video cameras or human-machine interfaces (HMI) with your real-time system.

Where to go from here

Information in this section

Information in other sections

MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor

Where to go from here

Information in this section

Information in other sections

Features of MicroAutoBox Embedded PC

Introduction

Any MicroAutoBox II variant can be used with the MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor to increase the possible applications. For example, you can work with video processing or an electronic horizon.

Feature Overview

These are the main features of the MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor:

- Compact system consisting of real-time hardware and PC.

  All MicroAutoBox II variants can be enhanced with the MicroAutoBox Embedded PC.

- 3rd Generation Intel® Core™ i7-3517UE Processor, 2 x 1.7 / 2.8 GHz clock frequency, 4 MB cache

  (support of OpenGL 3.1 and OpenCL 1.1).
- Flash memory
  - Integrated 64 GB mSATA SSD.
  - 64 GB CFast card, exchangeable by the user.
- Operating systems:
  - Windows 7 Ultimate (64 bit, Service Pack1), installed by default.
  - Linux distribution as image file on USB recovery stick.
- 8 GB DDR3-RAM.
- One internal Mini PCI Express slot (for PCI Mini Card Electromechanical Specification 1.2).
- One ExpressCard slot, for example, to enhance the system with FireWire.

  The slots can take ExpressCards with form factors ExpressCard/34.
- Three additional 100/1000 MBit/s Ethernet connectors with internal Gigabit Ethernet switch.
- Single-link DVI-I connector for graphical devices, such as a TFT monitor.
- Four USB connectors.
  - 2 x USB 2.0

    2 x USB 3.0
- Common power input with remote inputs.

  You can control the power-on and power-off behavior of the entire system. For further information, refer to Power On/Off Behavior of MicroAutoBox Embedded PC and MicroAutoBox II on page 145.

Wake on LAN

The built-in network adapter of the MicroAutoBox Embedded PC supports Wake on LAN (Magic Packet™).

Note

To use the Wake on LAN feature the supply voltage must be on at the MicroAutoBox Embedded PC.

End user agreement

The MicroAutoBox Embedded PC is an extension to the dSPACE MicroAutoBox II and is manufactured by Janz Tec AG.

If the MicroAutoBox Embedded PC is delivered with a preinstalled Windows operating system, the EULA terms at http://www.dspace.com/goto?eula-epc apply.

Installation of dSPACE Software

Installing dSPACE software

You can install dSPACE software, such as ControlDesk, on the MicroAutoBox Embedded PC. For more information on the compatibility of dSPACE software and Microsoft operating systems and detailed instructions, refer to Installing dSPACE Software 🕮.

Note

- Before installing software on the MicroAutoBox Embedded PC:
  - Stop the application on the MicroAutoBox II and disconnect all I/O wiring from the system (LEMO, ZIF, Sub-D connectors).
- To avoid data loss, back up the data of the MicroAutoBox Embedded PC periodically.
- Contact your network administrator if you want to connect the MicroAutoBox Embedded PC to a company LAN.

Attaching Antennas to MicroAutoBox Embedded PC

Avoiding interference with radio communication devices

MicroAutoBox Embedded PC can provide a radio interface for WLAN. Consider the following before you attach the antennas:

- Attach only the delivered antennas to the WLAN interfaces (📶). Use only antennas that are provided by dSPACE for this product.
- Before you attach the antennas to the WLAN connectors, check the delivered antennas for integrity. Replace damaged antennas by new antennas.

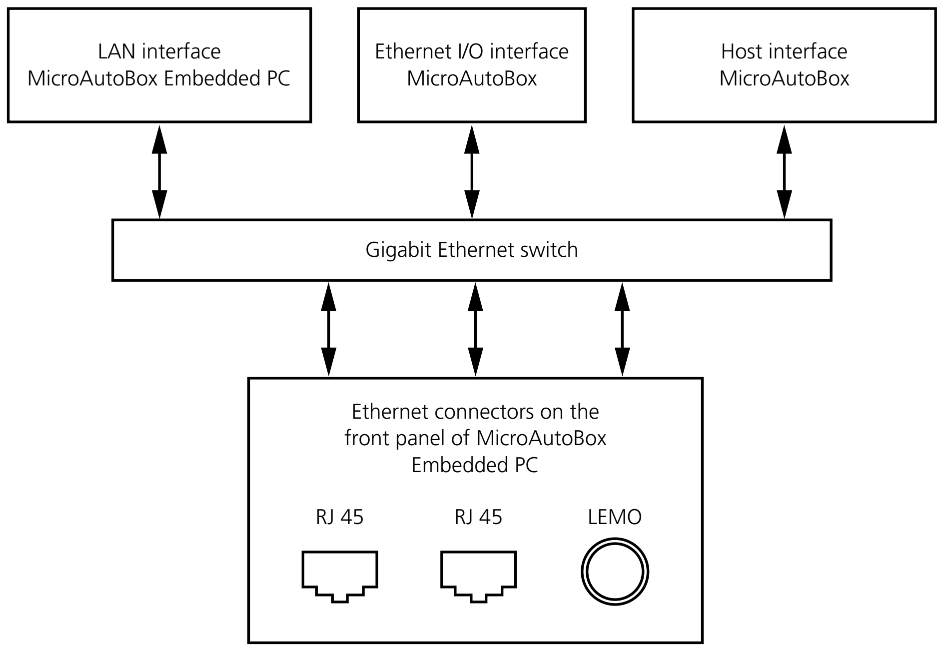
  The dSPACE order number is WIFI_ANT (Wi-Fi antenna).
- Consider the restrictions and measurements to avoid interferences to radio communication devices. Refer to Avoiding interference with radio communication devices on page 166.

Integrating MicroAutoBox II with MicroAutoBox Embedded PC into a Network

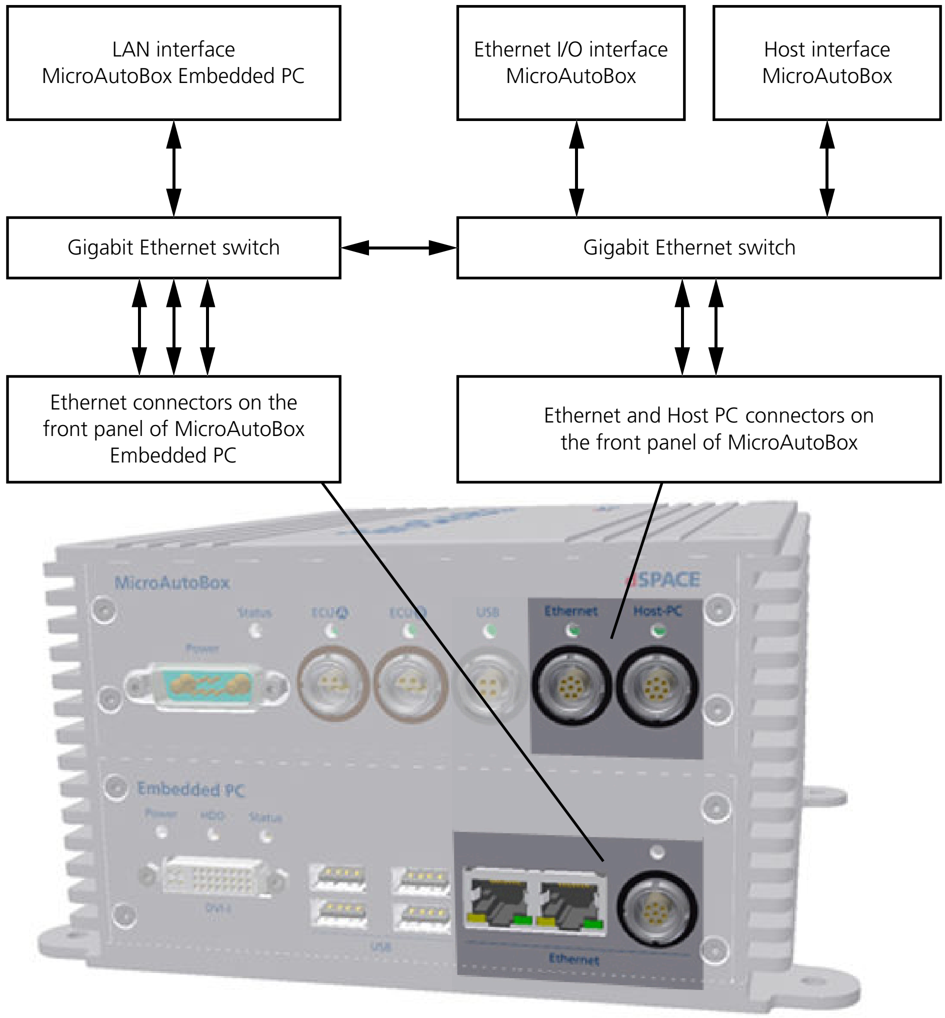
Introduction

MicroAutoBox Embedded PC and MicroAutoBox II form a single unit and are internally connected via a common gigabit Ethernet switch (DS1401-24 and earlier) or via two internally connected gigabit Ethernet switches (DS1401-25 and later). Keep this in mind when you connect the unit, for example, to your company LAN.

Valid for board revision DS1401 - 24 and earlier



Valid for board revision DS1401-25 and later



With the integrated Ethernet switches, both units can be accessed, for example, by the host PC via the same Ethernet connection.

Connecting to company LAN

If you need to be connected to your company LAN, note the existing IP address space and consult your system administrator.

Note that if you connect the MicroAutoBox Embedded PC to your company LAN, all the Ethernet devices which are connected to the switch of the Embedded PC are also connected to the company LAN.

Status LED

MicroAutoBox Embedded PC and MicroAutoBox II provide LEDs to indicate data traffic on the Ethernet switch. For further information on these LEDs and all the unit's other status LEDs, refer to Housing Components on page 454.

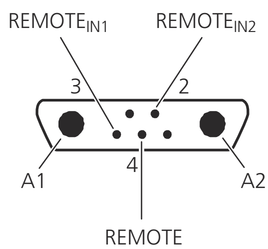
Power On/Off Behavior of MicroAutoBox Embedded PC and MicroAutoBox II

Introduction

The MicroAutoBox Embedded PC and MicroAutoBox II are joined to form a single unit and get their power via a common connector. Nevertheless, you can power them up and shut them down independently, for example, to boot the Embedded PC before the MicroAutoBox II automatically starts its application on power-up.

Remote inputs

The remote inputs are located on the power input connector on the MicroAutoBox II front panel as shown in the illustration below.



NOTICE

Risk of material damage

Do not switch off MicroAutoBox II and the MicroAutoBox Embedded PC by disconnecting the VBAT and/or GND connection or by pulling the power input connector when the operating system of the MicroAutoBox Embedded PC is running.

- Shut down the operating system of the MicroAutoBox Embedded PC via the remote inputs before the system is switched off.

For further information on the characteristics of the inputs on the power input connector, refer to Power Inputs and Outputs on page 466.

Logic switch conditions

The $REMOTE_{IN2}$ input let you decide whether the REMOTE input or the $REMOTE_{IN1}$ input triggers the power on/off behavior of the MicroAutoBox Embedded PC.

The following table lists several use scenarios. For the high/low levels descriptions, refer to Power Input Connector on page 464.

Use Scenario	VBAT	REMOTE	$\text{REMOTE}_{\text{IN1}}$ [1)]	$\text{REMOTE}_{\text{IN2}}$ [1)]
Start both, DS1401 Base Board and Embedded PC	Low -> high	High	Don't care	Low
	High	Low -> high	Don't care	Low
Shutdown both, DS1401 Base Board and Embedded PC (after operating system shutdown time)	High	High -> low	Don't care	Low
Boot Embedded PC before starting the application on the DS1401 Base Board by means of the ignition key.	High	Low -> high	High	High
Start Embedded PC via the application on the DS1401 Base Board, for example, by controlling a digital output connected to REMOTE IN1.	High	High	Low -> high	High
Shut down Embedded PC via the application on the DS1401 Base Board, for example, by controlling a digital output connected to REMOTE IN1.	High	High	High -> low	High
Shut down DS1401 Base Board while the Embedded PC continues to run.	High	High -> low	High	High

[1)] This input provides an internal pull-down resistor and is defined to low level if not connected.

Related topics

References

How to Secure an ExpressCard with the Embedded PC CardSafe

Objective

The rear panel of the MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor provides an ExpressCard/34 slot for ExpressCards.

You can secure the inserted ExpressCard against accidental disconnection with the Embedded PC CardSafe if the MicroAutoBox Embedded PC is exposed to environments where shock and vibration levels are high.

Preconditions

Before doing any installation work, make sure that:

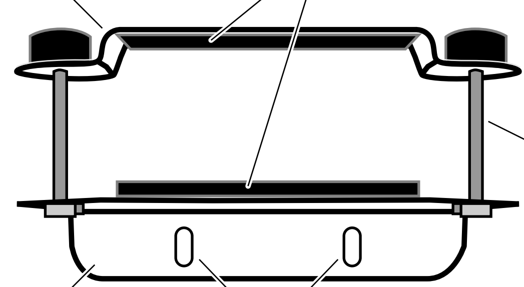
- The MicroAutoBox Embedded PC is disconnected from the power supply.
- No external devices are connected to the MicroAutoBox Embedded PC and MicroAutoBox II.
- You have all the items in the table below:

Items	Count	Description
Phillips screwdriver	1	PH0
Phillips screw [1)]	2	M3 X 8 mm
Spring lock washer [1)]	2	M5
Spring washer [1)]	2	M5
Top clamp plate	1	see illustration below
Bottom clamp plate	1	see illustration below
Self adhesive foam rubber strips	2	-
Thumb screws	2	M2.5 X 20 mm

[1)] Already part of the MicroAutoBox Embedded PC to fix the plate which covers the ExpressCard slot.

The following illustration shows the parts of the Embedded PC CardSafe:

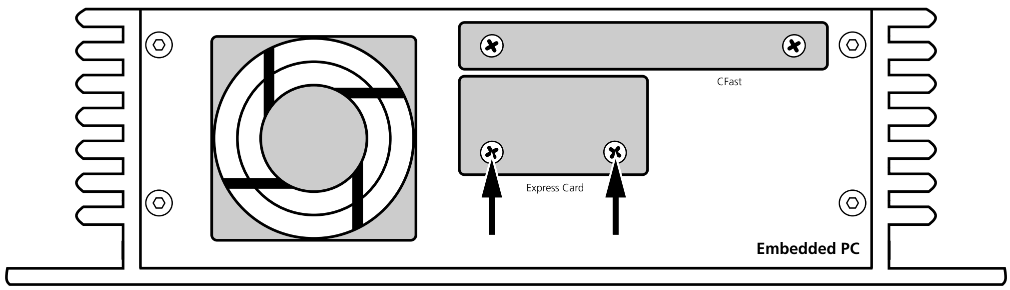
Front view



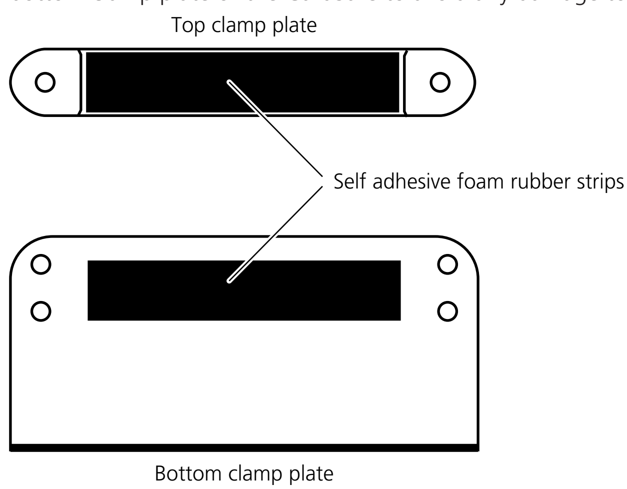
Method

How to secure an ExpressCard with the Embedded PC CardSafe

1 Remove the cover plate from the ExpressCard slot by removing the two screws, spring washers, and washers.



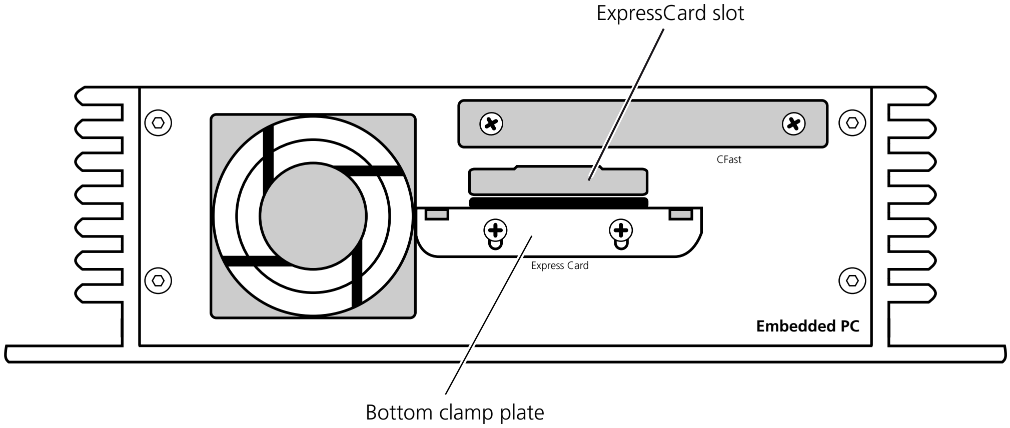
2 Put the self adhesive foam rubber strips on the top clamp plate and the bottom clamp plate of the CardSafe to avoid any damage to the ExpressCard.



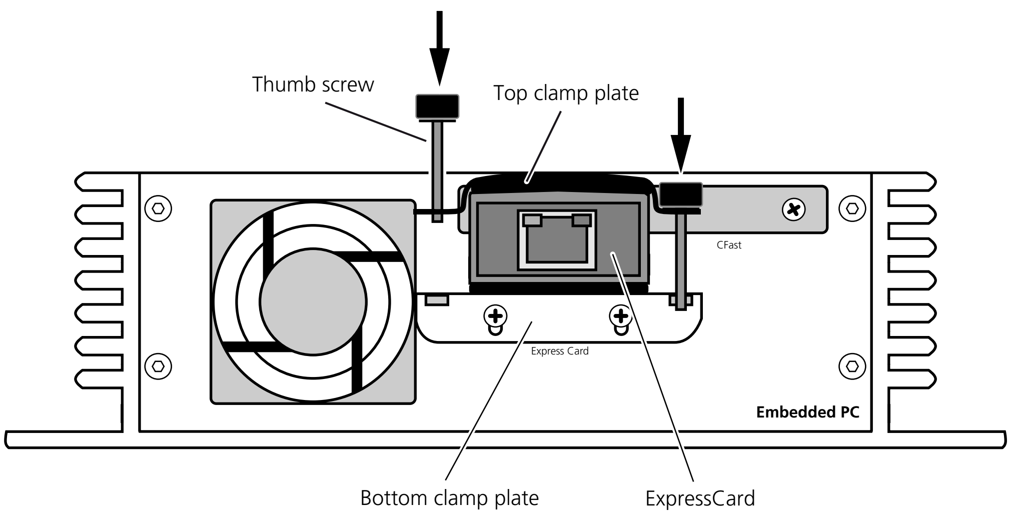
3 Attach the bottom clamp plate of the CardSafe by using the previously removed screws, spring washers, and washers.

Tighten the screws that you can adjust the height of the bottom clamp plate with its elongated holes.

4 Insert the ExpressCard into the left side of the ExpressCard slot and adjust the height of the bottom clamp plate and tighten the screws.



5 Fix the ExpressCard with the top clamp plate of the CardSafe by using the included thumb screws.



Result

The ExpressCard is now protected against accidental disconnection.

How to Insert a CFast Card

Objective

The rear panel of the MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor provides a CFast slot to expand the storage capacity.

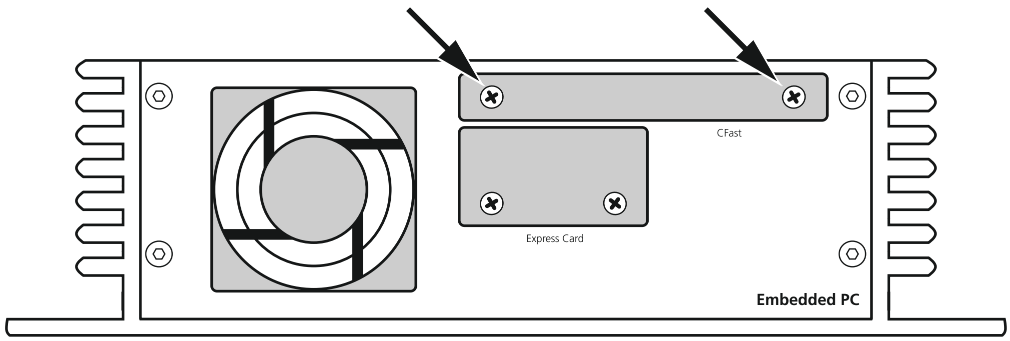
Preconditions

Before doing any installation work, make sure that:
- The MicroAutoBox Embedded PC is disconnected from the power supply.
- No external devices are connected to the MicroAutoBox Embedded PC and MicroAutoBox II.
- You have Phillips screwdriver (PH0) ready to hand.

Method

How to insert a CFast card

1 Remove the cover plate from the CFast slot by removing the two screws, spring washers, and washers.



2 Insert the CFast card.

3 Mount the cover plate to the CFast slot with the two screws, spring washers, and washers.

Result

The storage capacity is expanded.

How to Remove a CFast Card

Objective

These instructions refer to the MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor.

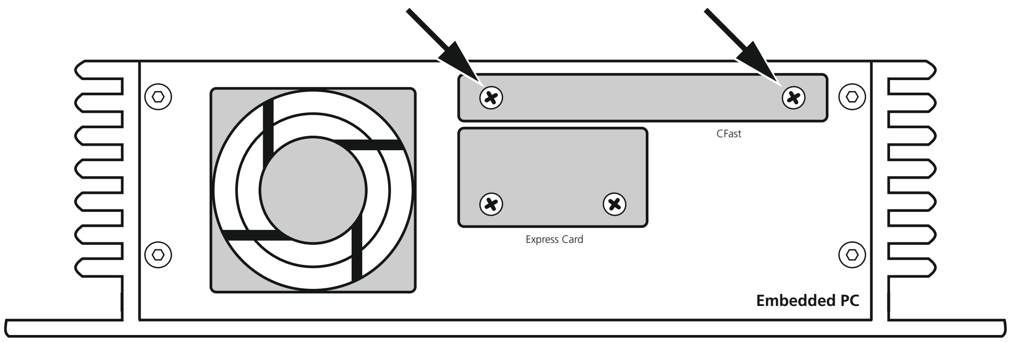
Preconditions

Before doing any installation work, make sure that:
- The MicroAutoBox Embedded PC is disconnected from the power supply.
- No external devices are connected to the MicroAutoBox Embedded PC and MicroAutoBox.
- You have Phillips screwdriver (PH0) ready to hand.

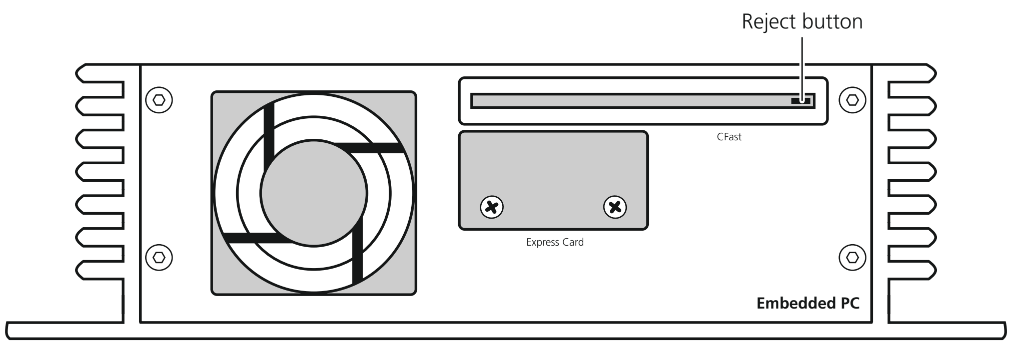
Method

How to remove a CFast card

1 Remove the cover plate from the CFast slot by removing the two screws, spring washers, and washers.



2 Remove the CFast card with pushing the mechanical reject button shown in the illustration below.



3 Mount the cover plate to the CFast slot with the two screws, spring washers, and washers.

Result

The CFast Card is removed.

MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor

Where to go from here

Information in this section

Information in other sections

Features of MicroAutoBox Embedded PC

Introduction

MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor is a compact PC system.

Feature Overview

These are the main features of the MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor:

- Compact PC system that can be used stand-alone or combined with a variant of MicroAutoBox II to form a single unit.
- 6th Gen. Intel® Core™ i7-6822EQ Processor with a clock frequency of 4 x 2.0 GHz/2.8 GHz and 8 MB cache.

- 128 GB internal flash memory. Upgradeable with MicroAutoBox Embedded DSU.
- Operating systems:
  - 64-bit version of Microsoft® Windows® 10 IoT Enterprise LTSB 2016, installed by default.
  - Linux distribution as image file on USB recovery stick.
- Three 10/100/1000 Mbit/s Ethernet connectors with internal Gigabit Ethernet switch.
- One DisplayPort™ connector for up to two monitors.
- Four USB 3.0 connectors.
- Up to three optional interface modules can be mounted by dSPACE.
- Power input with remote inputs.

  If MicroAutoBox Embedded PC is combined with MicroAutoBox II, you can control the power-on and power-off behavior of the entire system.

Wake on LAN

The built-in network adapter of the MicroAutoBox Embedded PC supports Wake on LAN.

Note

To use the Wake on LAN feature the supply voltage must be on at the MicroAutoBox Embedded PC.

End user agreement

The MicroAutoBox Embedded PC is manufactured by Janz Tec AG.

If the MicroAutoBox Embedded PC is delivered with a preinstalled Windows operating system, the EULA terms at http://www.dspace.com/go/eula-epc apply.

Attaching Antennas to the MicroAutoBox Embedded PC

Avoiding interference with radio communication devices

The MicroAutoBox Embedded PC can provide a radio interface for WLAN. Consider the following before you attach the antennas:

- Attach only the delivered antennas to the WLAN interfaces (). Use only antennas that are provided by dSPACE for this product.
- Check the delivered antennas for integrity. Replace damaged antennas by new antennas.

  The dSPACE order number is WIFI_ANT (Wi-Fi antenna).

- Consider the restrictions and measurements to avoid interferences to radio communication devices. Refer to Avoiding interference with radio communication devices on page 166.

Related topics

References

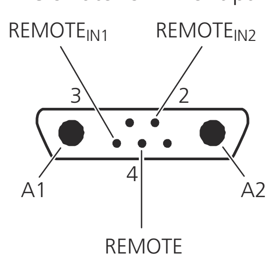
Advanced Remote Control for MicroAutoBox II with MicroAutoBox Embedded PC

Introduction

If MicroAutoBox II and MicroAutoBox Embedded PC are joined to form a single unit, they are powered via a common connector. Nevertheless, you can power them up and shut them down independently, for example, to boot the MicroAutoBox Embedded PC before the MicroAutoBox II automatically starts its application on power up.

Remote inputs

The remote inputs are located on the power input connector on the MicroAutoBox II front panel as shown in the illustration below.



For more information on the characteristics of the inputs on the power input connector, refer to Power Inputs and Outputs on page 486.

Logic switch conditions

The REMOTE$_{IN2}$ input lets you decide whether the REMOTE input or the REMOTE$_{IN1}$ input triggers the power on/off behavior of the MicroAutoBox Embedded PC.

The following table lists several use scenarios. For the high/low levels descriptions, refer to Power Inputs and Outputs on page 486.

Use Scenario	VBAT	REMOTE	$REMOTE_{IN1}$ [1)]	$REMOTE_{IN2}$ [1)]
Start both, DS1401 Base Board and Embedded PC	Low -> high	High	Don't care	Low
	High	Low -> high	Don't care	Low
Shutdown both, DS1401 Base Board and Embedded PC (after operating system shutdown time)	High	High -> low	Don't care	Low
Boot Embedded PC before starting the application on the DS1401 Base Board by means of the ignition key.	High	Low -> high	High	High
Start Embedded PC via the application on the DS1401 Base Board, for example, by controlling a digital output connected to REMOTE IN1.	High	High	Low -> high	High
Shut down Embedded PC via the application on the DS1401 Base Board, for example, by controlling a digital output connected to REMOTE IN1.	High	High	High -> low	High
Shut down DS1401 Base Board while the Embedded PC continues to run.	High	High -> low	High	High

[1)] This input provides an internal pull-down resistor and is defined to low level if not connected.

Related topics

Basics

References

How to Switch On MicroAutoBox Embedded PC

Objective

To switch on MicroAutoBox Embedded PC in different use scenarios.

Power on/off behavior

The power input connector provides a remote input to power on/off all variants of MicroAutoBox II.

If MicroAutoBox Embedded PC is joined with MicroAutoBox II, the power input connector provides additional remote inputs to control the power on/off behavior. For an overview of the possible use scenarios, refer to Advanced Remote Control for MicroAutoBox II with MicroAutoBox Embedded PC on page 154.

Possible methods

- If you use MicroAutoBox Embedded PC with the preconfigured power supply cable in a laboratory, refer to Method 1 on page 156.
- If you use the stand-alone variant of MicroAutoBox Embedded PC in a vehicle, refer to Method 2 on page 156.
- If you use MicroAutoBox II with MicroAutoBox Embedded PC in a vehicle, use one the following methods:
  - If you want to switch on both MicroAutoBoxes at the same time, refer to Method 3 on page 156.
  - If you want to switch on MicroAutoBox Embedded PC before MicroAutoBox II, refer to Method 4 on page 157.
  - If you want to switch on MicroAutoBox Embedded PC after MicroAutoBox II, refer to Method 5 on page 157.

Method 1

To switch on MicroAutoBox Embedded PC in a laboratory

1. Connect MicroAutoBox Embedded PC to the power supply via the preconfigured power supply cable.
2. Switch on the power supply.

   MicroAutoBox Embedded PC and the optionally joined MicroAutoBox II power up.
3. Wait until all Power LEDs light up in green.

Method 2

To switch on the stand-alone variant of MicroAutoBox Embedded PC

1. Make sure that the supply voltage is provided at the power input connector (A1 and A2 pins).
2. Change the voltage level at the REMOTE input (pin 4) from low to high.
3. Wait until the Power LED lights up in green.

Method 3

To switch on MicroAutoBox Embedded PC and MicroAutoBox II at the same time

1. Make sure that the supply voltage is provided at the power input connector (A1 and A2 pins).
2. Make sure that the voltage level at the $\text{REMOTE}_{\text{IN2}}$ input (pin 2) of the power input connector is low.
3. Change the voltage level at the REMOTE input (pin 4) from low to high.
4. Wait until all Power LEDs light up in green.

Method 4

To switch on MicroAutoBox Embedded PC before MicroAutoBox II

1. Make sure that the supply voltage is provided at the power input connector (A1 and A2 pins).
2. Make sure that the voltage levels at the $\text{REMOTE}_{\text{IN1}}$ input (pin 3) and the $\text{REMOTE}_{\text{IN2}}$ input (pin 2) are high.
3. Change the voltage level at the REMOTE input (pin 4) from low to high, e.g., so you can use the ignition key.
4. Wait until all Power LEDs light up in green.

Method 5

To switch on MicroAutoBox Embedded PC after MicroAutoBox II

1. Make sure that the supply voltage is provided at the power input connector (A1 and A2 pins).
2. Make sure that the voltage level at the $\text{REMOTE}_{\text{IN2}}$ input (pin 2) of the power input connector is high.
3. Change the the voltage level at the REMOTE input (pin 4) from low to high, e.g., so you can use the ignition key.
4. Change the voltage level at the $\text{REMOTE}_{\text{IN1}}$ input (pin 3) from low to high, e.g., so you can use a digital output of MicroAutoBox II to switch on MicroAutoBox Embedded PC.
5. Wait until all Power LEDs light up in green.

Result

You switched on MicroAutoBox Embedded PC and the optionally joined MicroAutoBox II.

Related topics

Basics

Advanced Remote Control for MicroAutoBox II with MicroAutoBox Embedded PC................ 154

HowTos

How to Switch Off MicroAutoBox Embedded PC.. 158

How to Switch Off MicroAutoBox Embedded PC

Objective

To safely switch off MicroAutoBox Embedded PC.

Safety precaution

NOTICE

Risk of data loss or damage to the operating system

Switching off MicroAutoBox Embedded PC by disconnecting the VBAT and/or GND connection when MicroAutoBox Embedded PC is running might lead to data loss or damages the operating system.

- Shut down the operating system of the MicroAutoBox Embedded PC before the system is switched off.

Power on/off behavior

The power input connector provides a remote input to power on/off all variants of MicroAutoBox II.

If MicroAutoBox Embedded PC is joined with MicroAutoBox II, the power input connector provides additional inputs to control the power on/off behavior. For an overview of the possible use scenarios, refer to Advanced Remote Control for MicroAutoBox II with MicroAutoBox Embedded PC on page 154.

Possible methods

- If you use MicroAutoBox Embedded PC and the optionally joined MicroAutoBox II with the preconfigured power supply cable in a laboratory, refer to Method 1 on page 158.
- If you use the stand-alone variant of MicroAutoBox Embedded PC in a vehicle, refer to Method 2 on page 159.
- If you use MicroAutoBox II with MicroAutoBox Embedded PC in a vehicle, use one the following methods:
  - If you want to switch off both MicroAutoBoxes at the same time, refer to Method 3 on page 159.
  - If you want to switch off MicroAutoBox Embedded PC before MicroAutoBox II, refer to Method 4 on page 159.
  - If you want to switch off MicroAutoBox Embedded PC after MicroAutoBox II, refer to Method 5 on page 159.

Method 1

To switch off MicroAutoBox Embedded PC in a laboratory

1. Shutdown the operating system that runs on the MicroAutoBox Embedded PC.
2. If MicroAutoBox Embedded PC is combined with MicroAutoBox II, stop the real-time application that runs on MicroAutoBox II with your experiment software.

3 Wait until the operating system of MicroAutoBox Embedded PC is shut down.
4 Switch off the power supply.

Method 2

To switch off the stand-alone variant of MicroAutoBox Embedded PC

1. Shutdown the operating system that runs on the MicroAutoBox Embedded PC.
2. Change the voltage level at the REMOTE input (pin 4) from high to low.
3. Before you disconnect the vehicle battery, wait until the Power LED is off.

Method 3

To switch off MicroAutoBox Embedded PC and MicroAutoBox II at the same time

1. Make sure that the voltage level at the $\text{REMOTE}_{\text{IN2}}$ input (pin 2) of the power input connector is low.
2. Change the voltage level at the REMOTE input (pin 4) from high to low.
3. Before you disconnect the vehicle battery, wait until the Power LED is off.

Method 4

To switch off MicroAutoBox Embedded PC before MicroAutoBox II

1. Make sure that the voltage level at the $\text{REMOTE}_{\text{IN2}}$ input (pin 2) of the power input connector is high.
2. Change the voltage level at the $\text{REMOTE}_{\text{IN1}}$ input (pin 3) from high to low, e.g., so you can use a digital output of MicroAutoBox II to shut down MicroAutoBox Embedded PC.
3. Change the the voltage level at the REMOTE input (pin 4) from high to low, e.g., so you can use the ignition key.
4. Before you disconnect the vehicle battery, wait until all Power LEDs are off.

Method 5

To switch off MicroAutoBox Embedded PC after MicroAutoBox II

1. Make sure that the voltage level at the $\text{REMOTE}_{\text{IN2}}$ input (pin 2) of the power input connector is high.
2. Change the the voltage level at the REMOTE input (pin 4) from high to low, e.g., so you can use the ignition key.
3. Change the voltage level at the $\text{REMOTE}_{\text{IN1}}$ input (pin 3) from high to low, e.g., so you can use an optional switch.
4. Before you disconnect the vehicle battery, wait until all Power LEDs are off.

Result

You safely switched off MicroAutoBox Embedded PC and the optionally joined MicroAutoBox II.

Related topics

Basics

HowTos

Integrating MicroAutoBox Embedded PC into an Ethernet Network

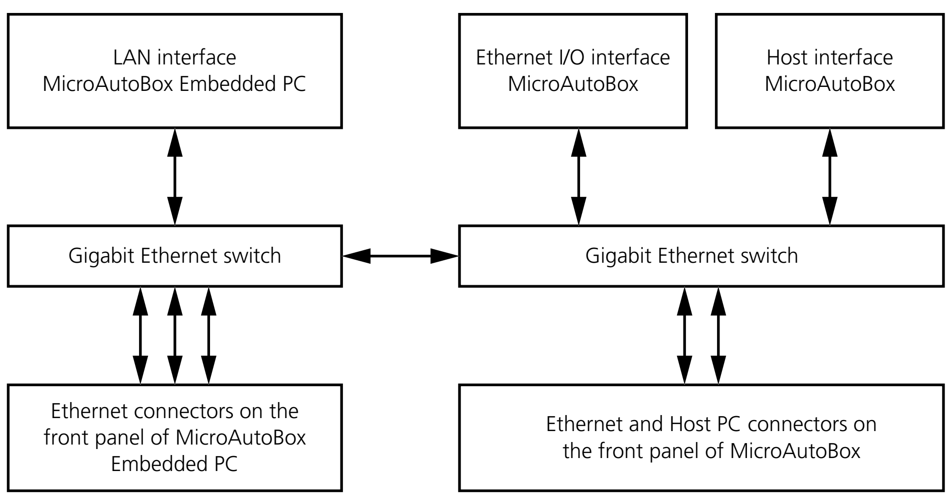
Connecting to company LAN

If you have to be connected to your company LAN, note the existing IP address space and consult your system administrator.

If you connect the MicroAutoBox Embedded PC to your company LAN, all the Ethernet devices that are connected to the switch of the Embedded PC are also connected to the company LAN.

Internal Ethernet switch configuration

If MicroAutoBox Embedded PC and MicroAutoBox II form a single unit, their Gigabit switches are internally connected. With the internal connection, both units can be accessed, for example, by the host PC via the same Ethernet connection. Keep this in mind when you connect the unit, for example, to your company LAN.



Note

To enable the communication between the MicroAutoBox Embedded PC and a MicroAutoBox II, you must set a static IP address and a subnet mask on the MicroAutoBox Embedded PC.

The default settings of the MicroAutoBox II are:

- IP address: 192.168.140.1.
- Subnet mask: 255.255.255.0.

It is recommended to use the following settings for the MicroAutoBox Embedded PC:

- IP address: 192.168.140.4.
- Subnet mask: 255.255.255.0.

Indicating data traffic

MicroAutoBox Embedded PC and MicroAutoBox II provide LEDs to indicate data traffic on the Ethernet switch. For more information on these LEDs and all the other status LEDs of the unit, refer to LED Status on page 491.

Related topics

References

How to Install the Operating System

Objective

Reinstalling the Microsoft Windows operating system or installing the delivered Linux distribution.

Installation medium

The provided USB stick contains the operating systems as a bootable ISO image.

Required devices

The following devices are required:

- Power supply
- Monitor with DisplayPort input
- DisplayPort cable
- USB keyboard
- USB mouse

Preconditions

Observe the following preconditions:
- You saved all user data from the MicroAutoBox Embedded PC.
- Only the power cable is connected to the MicroAutoBox Embedded PC. All I/O wiring from the system (Ethernet, LEMO, ZIF, Sub-D connectors) is removed.
- The MicroAutoBox Embedded PC is switched off.

Method

Installing the operating system

1. Connect a monitor to the DisplayPort connector of the MicroAutoBox Embedded PC.
2. Connect the keyboard and mouse to the USB connectors of the .
3. Plug the USB stick with the ISO image into a USB connector.
4. Switch on the MicroAutoBox Embedded PC.
5. Follow the menu-driven application.
6. If you installed Linux, install the Linux drivers for the MicroAutoBox Embedded PC:
   - Change to the `driverInstallation` directory on the USB stick.
   - Execute the `sudo sh installDriver.sh` command.
     The user password is `user`.

Result

You installed the operating system.

Related topics

HowTos

How to Check and Replace the Dust Filter

Objective

Ensuring a sufficient airflow for cooling.

Checking interval

You have to check the dust filter at least once a year. More frequent checks might be necessary, depending on the operating conditions.

Effect of clogged dust filters

A clogged dust filter blocks the input air stream and increases the temperature in the MicroAutoBox Embedded PC, which might shorten the life of the hardware components. Cleaning the dust filter is not sufficient to restore the characteristics of a new one.

Tools

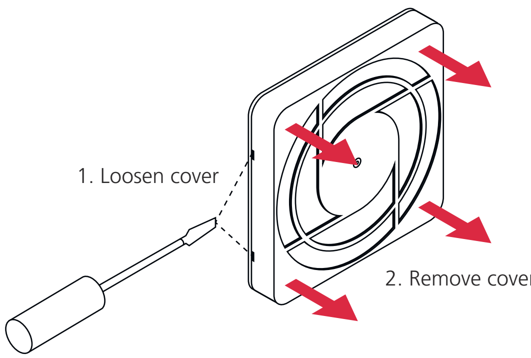
Use a slotted screwdriver, blade about 3 mm (0.1 inch).

Method

To check and replace the dust filter

1 Switch off the MicroAutoBox Embedded PC and remove all wires.

2 Remove the cover of the dust filter. To do this, use a slotted screwdriver as shown below.



3 Remove the dust filter and check for dust.

If required, replace it with a new filter. For obtaining a new filter, contact dSPACE Support.

4 Place the dust filter to the cover of the filter.

5 Put the cover on the MicroAutoBox Embedded PC.

Result

You checked and if necessary replaced the dust filter.

Notes on Regulations, Software Licenses, and Agreements

Where to go from here

Information in this section

Radio Devices Regulatory Notice

Introduction

> **Note**
>
> The following information is valid only if the MicroAutoBox Embedded PC is delivered with a WLAN interface.

The MicroAutoBox Embedded PC complies with the radio frequency and safety standards of any country or region in which it has been approved for wireless use. Depending on configurations, this product may or may not contain AR5BHB116 (WPEA-121N) wireless radio device (Radiolan) of Qualcomm Atheros. This device must be used in strict accordance with the regulations and constraints of the country of use. For further information, please contact the local regulatory office in the country of use.

Europe: EU Declaration of conformity

CE

Marking by the above symbol indicates compliance with the essential requirements of the radio equipment directive of the European Union (2014/53/EU). This equipment meets the following conformance standards:

- EN300 328
- EN301 893
- EN301 489-1
- EN301 489-17
- EN60950

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

To obtain a full copy of the EU declaration of conformity, contact dSPACE Support.

Declaration of Conformity in Languages of the European Community

Česky [Czech]	*Qualcomm Atheros* tímto prohlašuje, že tento Radiolan je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/EU.
Dansk [Danish]	Undertegnede *Qualcomm Atheros* erklærer herved, at følgende udstyr Radiolan overholder de væsentlige krav og øvrige relevante krav i direktiv 2014/53/EU.
Deutsch [German]	Hiermit erklärt *Qualcomm Atheros*, dass sich das Gerät Radiolan in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2014/53/EU befindet.
Eesti [Estonian]	Käesolevaga kinnitab *Qualcomm Atheros* seadme Radiolan vastavust direktiivi 2014/53/EU põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
English	Hereby, *Qualcomm Atheros*, declares that this Radiolan is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
Español [Spanish]	Por medio de la presente *Qualcomm Atheros* declara que el Radiolan cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/EU.
Ελληνική [Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ *Qualcomm Atheros* ΔΗΛΩΝΕΙ ΟΤΙ Radiolan ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/EU.
Français [French]	Par la présente *Qualcomm Atheros* déclare que l'appareil Radiolan est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/EU.
Italiano [Italian]	Con la presente *Qualcomm Atheros* dichiara che questo Radiolan è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/EU.
Latviski [Latvian]	Ar šo *Qualcomm Atheros* deklarē, ka Radiolan atbilst Direktīvas 2014/53/EU būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
Lietuvių [Lithuanian]	Šiuo *Qualcomm Atheros* deklaruoja, kad šis Radiolan atitinka esminius reikalavimus ir kitas 2014/53/EU Direktyvos nuostatas.
Nederlands [Dutch]	Hierbij verklaart *Qualcomm Atheros* dat het toestel Radiolan in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EU.
Malti [Maltese]	Hawnhekk, *Qualcomm Atheros*, jiddikjara li dan Radiolan jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 2014/53/EU.
Magyar [Hungarian]	Alulírott, *Qualcomm Atheros* nyilatkozom, hogy a Radiolan megfelel a vonatkozó alapvetõ követelményeknek és az 2014/53/EU irányelv egyéb elõírásainak.
Polski [Polish]	Niniejszym *Qualcomm Atheros* oświadcza, że Radiolan jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/EU.
Português [Portuguese]	*Qualcomm Atheros* declara que este Radiolan está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/EU.

Slovensko [Slovenian]	*Qualcomm Atheros* izjavlja, da je ta Radiolan v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/EU.
Suomi [Finnish]	*Qualcomm Atheros* vakuuttaa täten että Radiolan tyyppinen laite on direktiivin 2014/53/EU oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Svenska [Swedish]	Härmed intygar *Qualcomm Atheros* att denna Radiolan står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EU.
Íslenska [Icelandic]	Hér með lýsir *Qualcomm Atheros* yfir því að Radiolan er í samræmi við grunnkröfur og aðrar kröfur, sem gerðar eru í tilskipun 2014/53/EU.
Norsk [Norwegian]	*Qualcomm Atheros* erklærer herved at utstyret Radiolan er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 2014/53/EU.

Restrictions for use of 2.4 GHz frequencies in European Community Countries This device can only be used indoors in the frequency bands 5150 MHz … 5250 MHz and 5250 MHz … 5350 MHz in all EU member states and EFTA countries.

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 the 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.

Radiation exposure statement

This equipment must be installed and operated with a minimum distance of 200 mm (7.87 in.) between the radiator (antenna) and persons.

Avoiding interference with radio communication devices

The 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 Embedded PC 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.
- Emission limits can sporadically be exceeded by small amounts and can cause interference in the immediate vicinity of the MicroAutoBox Embedded PC. Do not use other radio communication devices in the immediate vicinity of the MicroAutoBox Embedded PC.
- Any modification of the antennas will void the FCC certification 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.

FCC statement

Federal Communication Commission Interference Statement This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Related topics

Basics

Attaching Antennas to the MicroAutoBox Embedded PC..153

Linux Open Source Software Notice

Information on used Linux packages and kernel

A PDF file that provides information on the used Linux packages, versions, and license types is available on the USB recovery stick.

To get a list of the used Linux packages, execute the `dpkg -l` command in a terminal.

The source code of the modified Linux kernel and a make environment for compiling are part of the installation/Linux image. The source code and the make environment are located in the `/home/usr/kernel/` directory.

The source code of selected Linux packages can be obtained on request and at self cost.

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 MicroAutoBox II 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 all MicroAutoBox II variants.

  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 520.

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

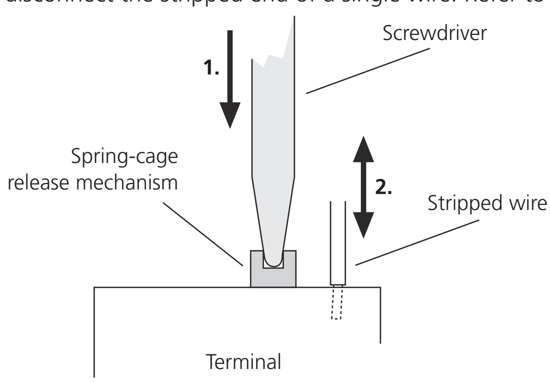
Connected components can cause fire

MicroAutoBox II 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

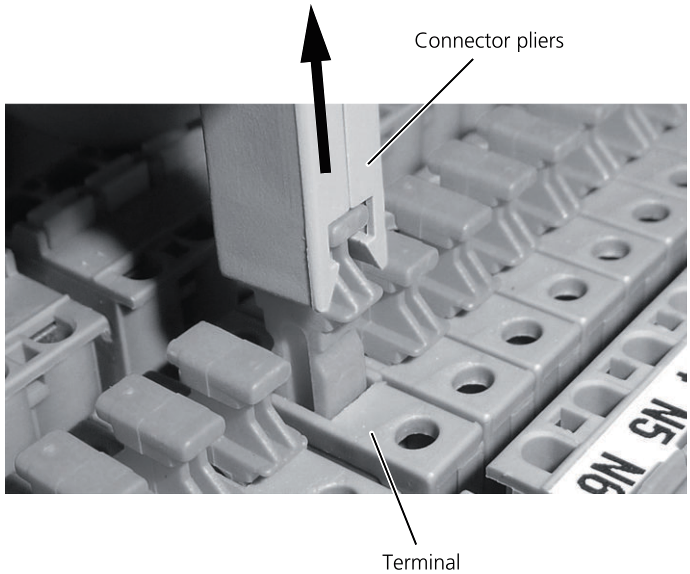
1) AWG = American Wire Gauge

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.

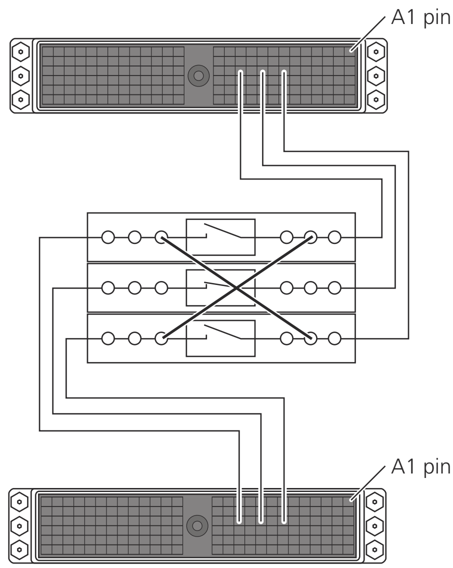
Note

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

Connecting Examples - MicroAutoBox Break-Out Box DS1541

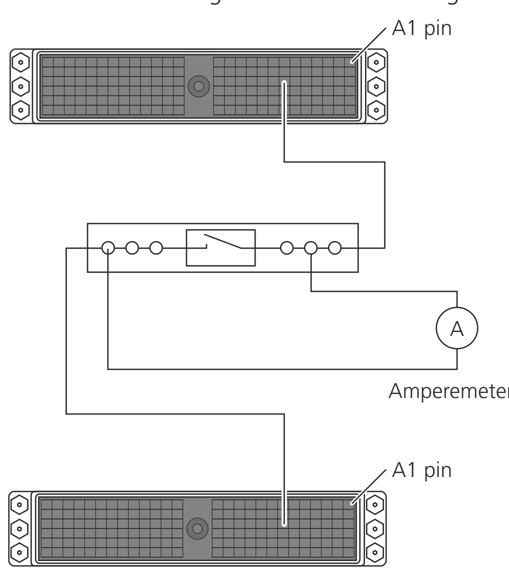
Changing signal paths

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:



Installing and Uninstalling I/O Modules and IP Modules

Introduction

You can add or replace one I/O module and up to two IP modules to adapt the I/O functionality of MicroAutoBox II to your needs.

Where to go from here

Information in this section

Installing and Uninstalling I/O Modules

Introduction

I/O modules provide the I/O interfaces for the DS1514 I/O boards. I/O modules are, for example, the DS1552 Multi-I/O Module and the DS1554 Engine Control I/O Module.

Where to go from here

Information in this section

How to Uninstall I/O Modules

Objective

The following instructions apply if you want to uninstall a DS1552 Multi-I/O Module or a DS1554 Engine Control I/O Module from MicroAutoBox II. The I/O module is installed in the DS1514 I/O Board.

Preconditions

- To avoid risk of injury and/or damage to the dSPACE hardware, read and ensure that you comply with the safety precautions, see Safety Precautions for Installing and Connecting the Hardware on page 19.
- Ensure you have all the items in the table below before starting:

Items	Count	Description
Hexagon socket wrench	1	2.5 mm
Pozidriv screwdriver	1	PZ0
Additional items to uninstall the DS1554 Engine Control I/O Module:		
Hexagon socket wrench	1	2 mm
Hex nut screwdriver	1	3/16 in.

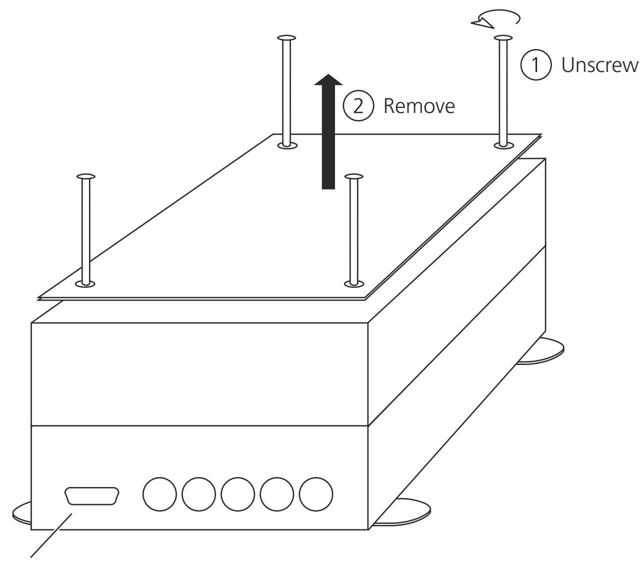
Possible methods

- To uninstall a DS1552 Multi-I/O Module, refer to Method 1 on page 177.
- To uninstall a DS1554 Engine Control I/O Module, refer to Method 2 on page 179.

Method 1

To uninstall a DS1552 Multi-I/O Module

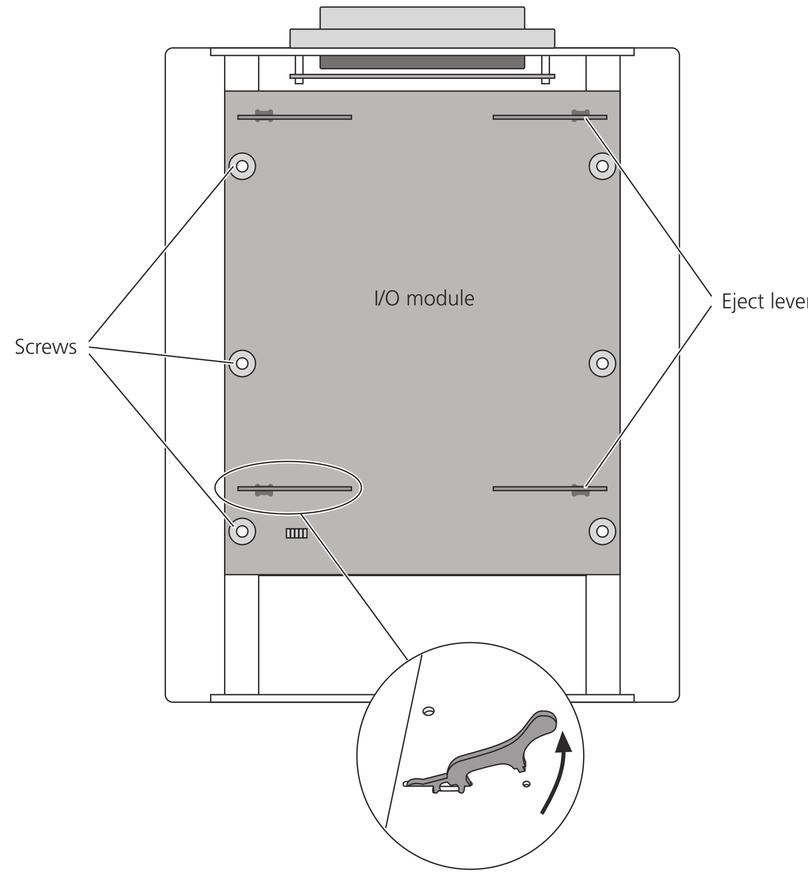
1 Disconnect MicroAutoBox II from the power supply.
2 Remove the top cover of MicroAutoBox II. Use a 2.5 mm hexagon socket wrench.



The DS1514 I/O board is on top.

3 Remove the six screws which secure the I/O module against accidental disconnection. Use a PZ0 Pozidriv screwdriver.

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

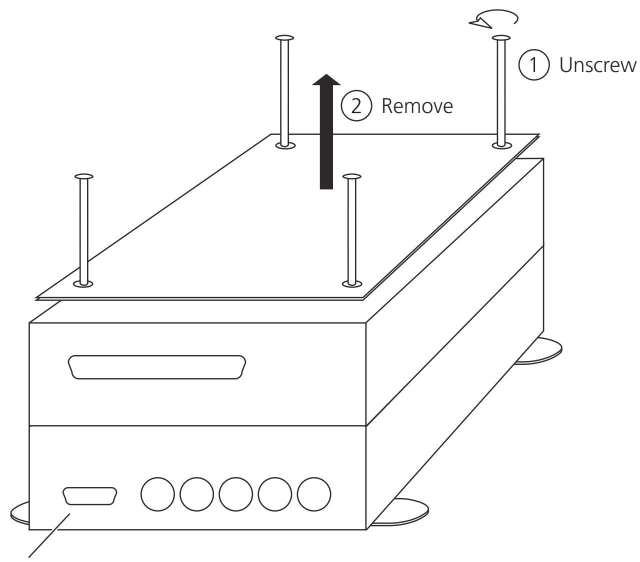


5 Remove the I/O board.

Method 2

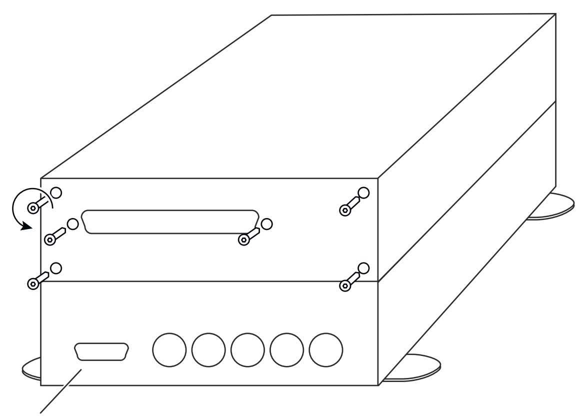
To uninstall a DS1554 Engine Control I/O Module

1. Disconnect MicroAutoBox II from the power supply.
2. Remove the top cover of MicroAutoBox II. Use a 2.5 mm hexagon socket wrench.

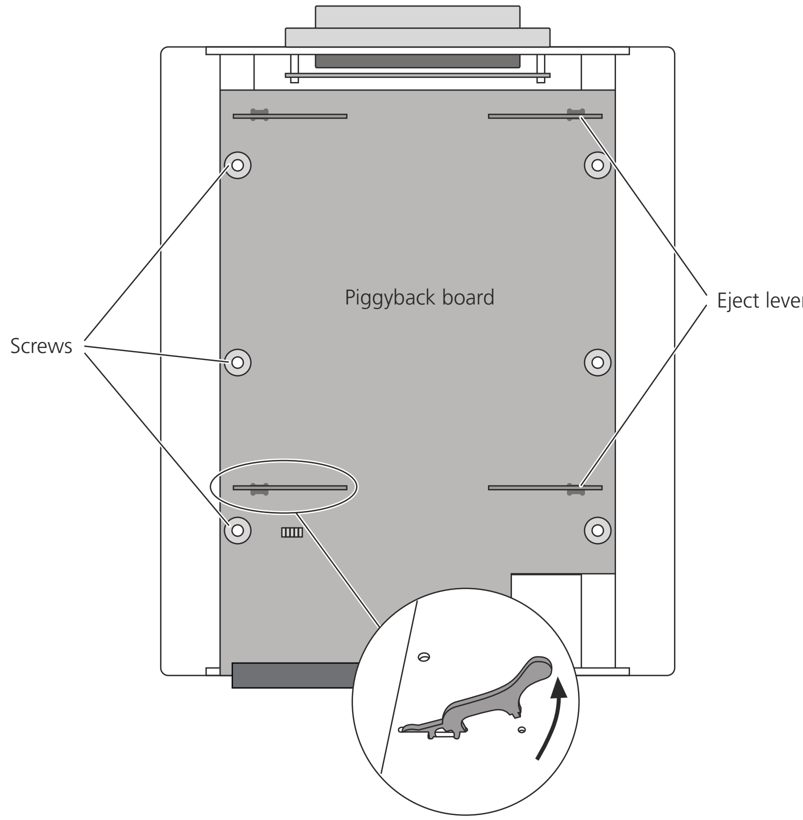


The DS1514 I/O board is on top.

3. Remove the upper front cover of teh MicroAutoBox II. Use a 2 mm hexagon socket wrench for the outer screws and a 3/16 in. hex nut screwdriver for the screws of the Sub-D I/O connector.



4 Remove the six screws which secure the I/O module against accidental disconnection. Use a PZ0 Pozidriv screwdriver.



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

6 Remove the I/O board.

Result

The I/O module is uninstalled.

Next steps

You can install or uninstall IP modules, or you install another I/O module.

Related topics

HowTos

How to Install I/O Modules

Objective

The following instructions apply if you want to plug an I/O module into the DS1514 I/O board.

Suitable I/O modules

You can use the DS1552 Multi-I/O Module with the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

You can use the DS1554 Engine Control I/O Module with the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

Preconditions

- To avoid risk of injury and/or damage to the dSPACE hardware, read and ensure that you comply with the safety precautions, see Safety Precautions for Installing and Connecting the Hardware on page 19.
- MicroAutoBox II is disconnected from the power supply.
- The top cover of MicroAutoBox II is removed. For removing the top cover, refer to How to Uninstall I/O Modules on page 176.
- No I/O modul is installed. For uninstalling the I/O modul, refer to How to Uninstall I/O Modules on page 176.
- Ensure you have all the items in the table below before starting:

Items	Count	Description
Hexagon socket wrench	1	2.5 mm
Pozidriv screwdriver	1	PZ0
Additional item to install the DS1554 Engine Control I/O Module:		
Hexagon socket wrench	1	2 mm
Hex nut screwdriver	1	3/16 in.

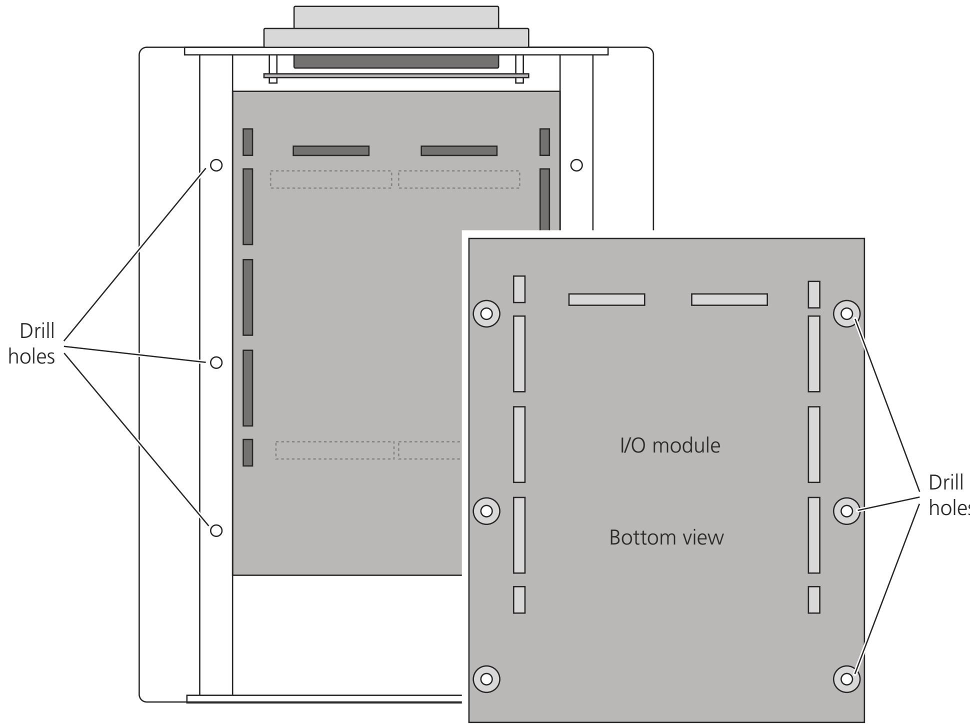
Possible methods

- To install a DS1552 Multi-I/O Module, refer to Method 1 on page 182.
- To install a DS1554 Engine Control I/O Module, refer to Method 2 on page 184.

Method 1

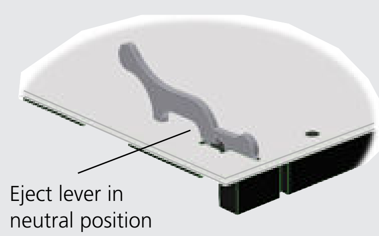
To install a DS1552 Multi-I/O Module

1 Consider the connectors at the bottom of the I/O module and on the I/O board to get the correct position for mounting as shown below.

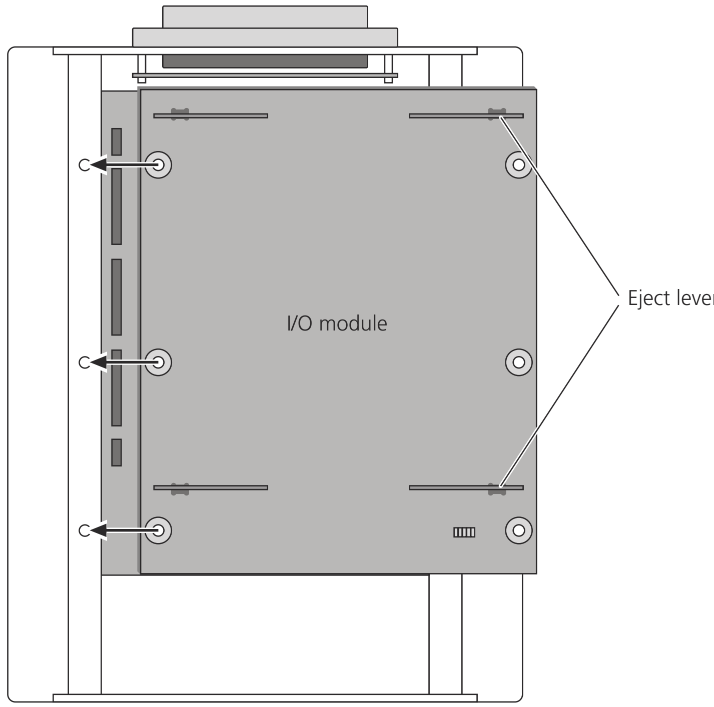


2 **Note**

Take care that the eject levers are in neutral position as shown in the illustration below.

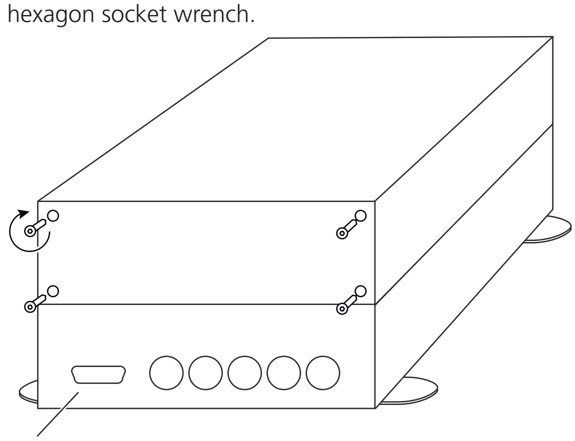


3 Align the drill holes of the module and the housing and insert the I/O module by pressing evenly on the six drill holes.



4 Tighten six screws to secure the I/O module against accidental disconnection. Use a PZ0 Pozidriv screwdriver.

5 If the upper front cover is removed, attach a blank front cover. Use a 2 mm hexagon socket wrench.



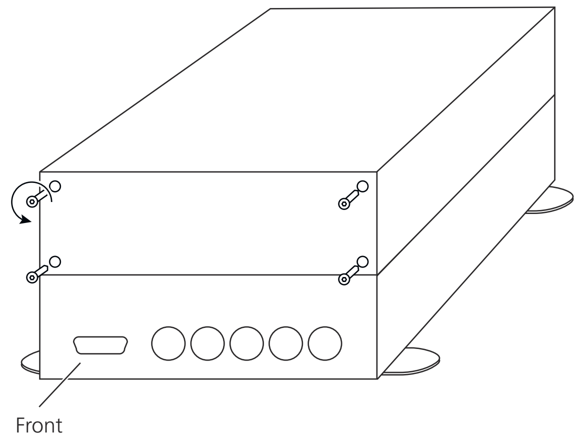
> **Note**
>
> Do not use MicroAutoBox II with an open housing. Contact dSPACE Support if you do not have a suitable front cover.

6 Attach the top cover of MicroAutoBox II. Use a 2.5 mm hexagon socket wrench.

Method 2

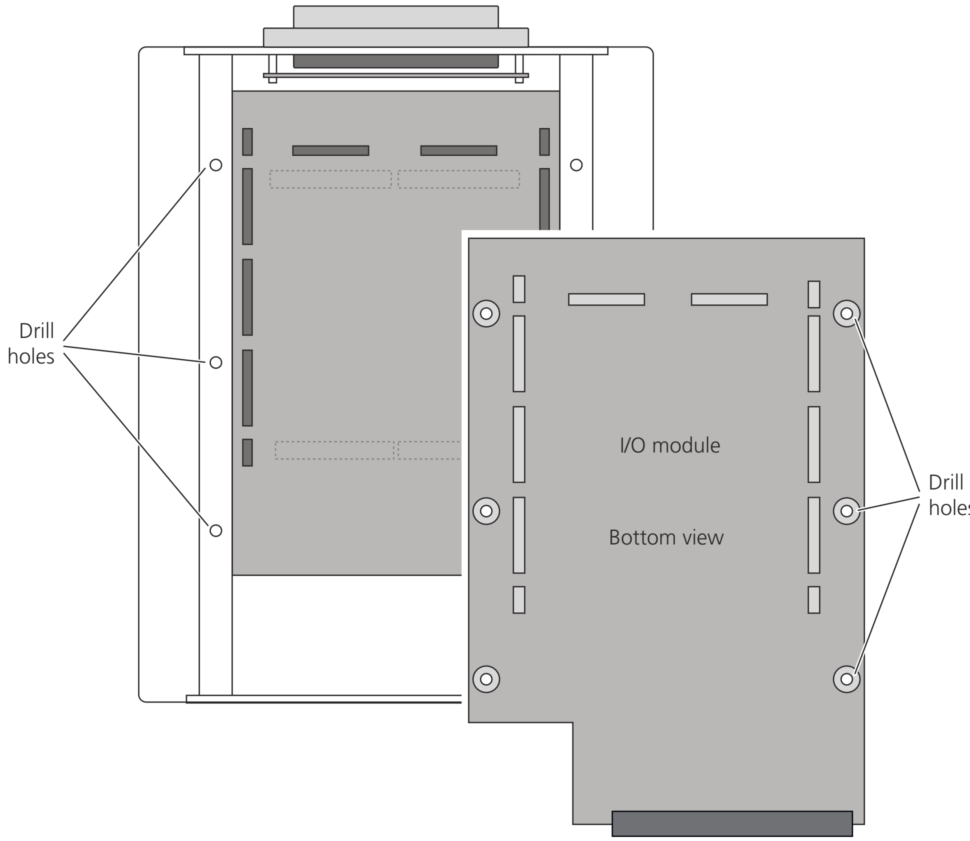
To install a DS1554 Engine Control I/O Module

1 If the upper front cover is not removed, remove the front cover. Use a 2 mm hexagon socket wrench.



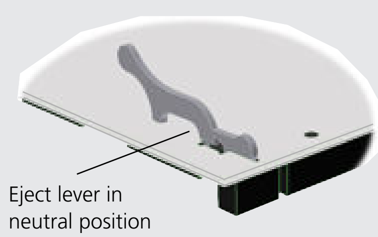
> **Tip**
>
> Keep the front cover you just removed. If you want to uninstall the I/O module, you need the cover to close the housing of MicroAutoBox II.

2 Consider the connectors at the bottom of the I/O module and on the I/O board to get the correct position for mounting as shown below.

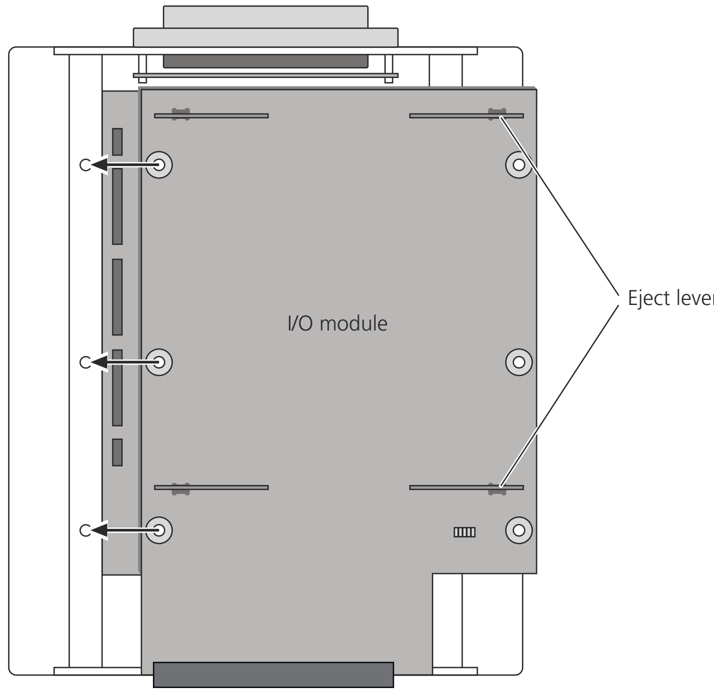


3 **Note**

Take care that the eject levers are in neutral position as shown in the illustration below.

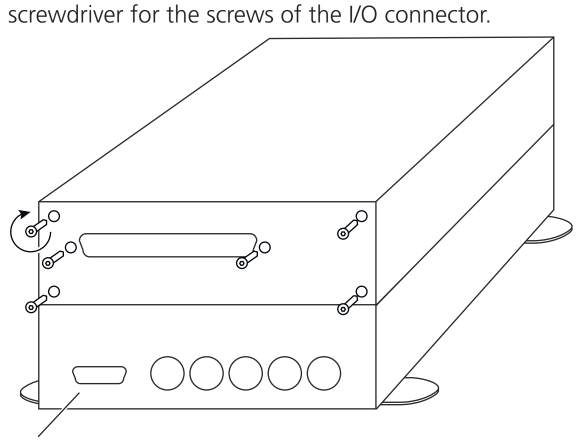


4 Align the drill holes of the module and the housing and insert the I/O module by pressing evenly on the six drill holes.



5 Tighten six screws to secure the I/O module against accidental disconnection. Use a PZ0 Pozidriv screwdriver.

6 Attach the front cover by tightening the relevant screws. Use a 2 mm hexagon socket wrench for the outer screws and a 3/16 in. hex nut screwdriver for the screws of the I/O connector.



7 Attach the top cover of the MicroAutoBox II. Use a 2.5 mm hexagon socket wrench.

Result

The I/O module is installed to MicroAutoBox II.

Related topics

HowTos

How to Install IP Modules.. 188

Installing and Uninstalling IP Modules

Introduction

MicroAutoBox II 1401/1507, 1401/1511/1514, and 1401/1513/1514 can be equipped with up to two IP modules. IP modules that are installed to MicroAutoBox II provide additional interfaces to communication buses such as FlexRay or CAN.

Where to go from here

Information in this section

How to Install IP Modules

Objective

MicroAutoBox II 1401/1507, 1401/1511/1514, and 1401/1513/1514 provide two IP slots (each with two AMP connectors) to install IP modules.

Valid only for MicroAutoBox II 1401/1507

NOTICE

Do not install/uninstall IP modules to MicroAutoBox II 1401/1507 yourself. You may destroy parts of MicroAutoBox II

If you want to use IP modules (DS4342, DS4340 or third-party) with your MicroAutoBox II 1401/1507, the IP modules must be installed by dSPACE. The assembling positions of the DS1401 Base Board and the DS1507 I/O Board in the MicroAutoBox II housing do not allow direct access to the IP slots of the DS1507.

Supported IP modules

For information on which IP modules are supported, refer to:

- Supported FlexRay IP Modules on page 78
- Supported CAN FD Modules on page 114

Preconditions

- To avoid risk of injury and/or damage to the dSPACE hardware, read and ensure that you comply with the safety precautions, see Safety Precautions for Installing and Connecting the Hardware on page 19.
- Ensure you have all the items in the table below before starting:

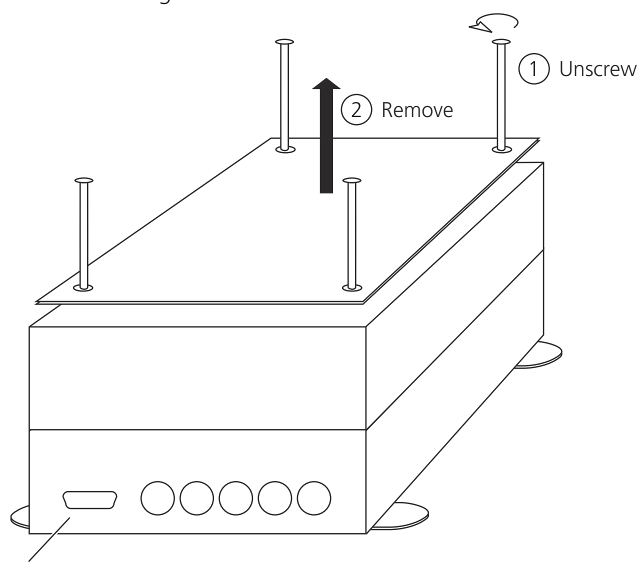
Items	Count	Description
Hexagon socket wrench	1	2.5 mm (0.1 in.)
Philips screwdriver	1	PH0

Method

To install IP modules

1 Disconnect MicroAutoBox II from the power supply.

2 Open the housing of MicroAutoBox II as shown in the illustration below. Use a 2.5 mm hexagon socket wrench.

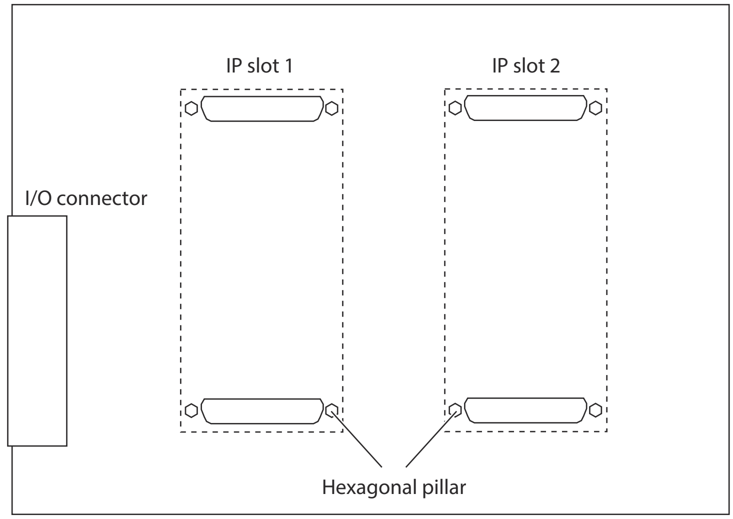


The DS1507 or DS1514 I/O Board with the IP slots is on top.

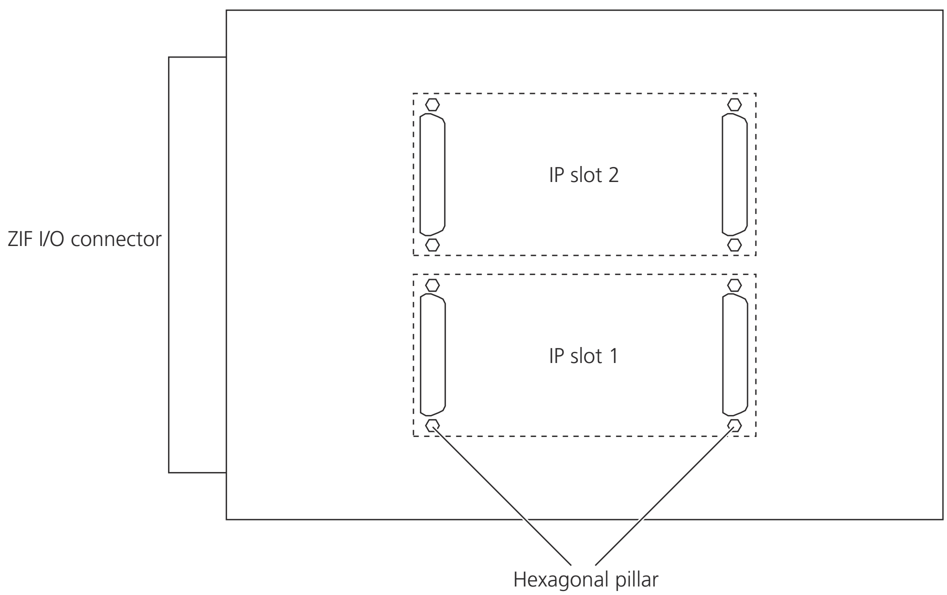
If an I/O module (such as the DS1552 Multi-I/O Module) is installed on the DS1514, remove it as described in How to Uninstall I/O Modules on page 176.

3 Install the IP modules. Secure the IP modules against accidental disconnection. Attach the IP modules by tightening the 4 delivered M2 Philips screws and washers to the hexagonal pillars. Use a PH0 Philips screwdriver.

The following illustration shows the IP slots on the DS1507:



The following illustration shows the IP slots on the DS1514:



4 If a I/O module was installed on the DS1514, install it again as described in How to Install I/O Modules on page 181.

5 Mount the cover of MicroAutoBox II.

Result

The IP modules are installed in MicroAutoBox II and the IP module signals are available at the 78-pin Sub-D connector (DS1507) or the ZIF I/O connector (DS1514) of the corresponding MicroAutoBox II. Note that the pinouts differ depending on the IP module used. See:

- For the DS4340 FlexRay Interface Module: Connector Pinouts on page 434
- For the DS4342 CAN FD Interface Module: Connector Pinouts on page 446Connector Pinouts on page 446

- For third-party IP modules:
  - Sub-D I/O Connector on page 205 (for MicroAutoBox II 1401/1507)
  - IP Module Connectors on page 270 (for MicroAutoBox II 1401/1511/1514)
  - IP Module Connectors on page 351 (for MicroAutoBox II 1401/1513/1514)

Related topics

HowTos

How to Uninstall IP Modules

Objective

MicroAutoBox II 1401/1507, 1401/1511/1514, and 1401/1513/1514 might contain IP modules.

Valid only for MicroAutoBox II 1401/1507

NOTICE

Do not install/uninstall IP modules to MicroAutoBox II 1401/1507 yourself. You may destroy parts of MicroAutoBox II

If you want to use IP modules (DS4342, DS4340 or third-party) with your MicroAutoBox II 1401/1507, the IP modules must be installed by dSPACE. The assembling positions of the DS1401 Base Board and the DS1507 I/O Board in the MicroAutoBox II housing do not allow direct access to the IP slots of the DS1507.

Preconditions

- To avoid risk of injury and/or damage to the dSPACE hardware, read and ensure that you comply with the safety precautions, see Safety Precautions for Installing and Connecting the Hardware on page 19.
- Ensure you have all the items in the table below before starting:

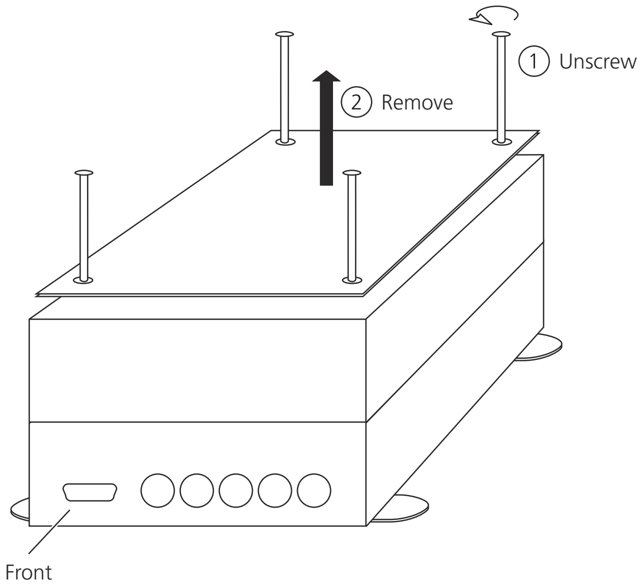
Items	Count	Description
Hexagon socket wrench	1	2.5 mm (0.1 in.)
Philips screwdriver	1	PH0

Method

To uninstall IP modules

1 Disconnect MicroAutoBox II from the power supply.

2 Open the housing of MicroAutoBox II as shown in the illustration below. Use a 2.5 mm hexagon socket wrench.

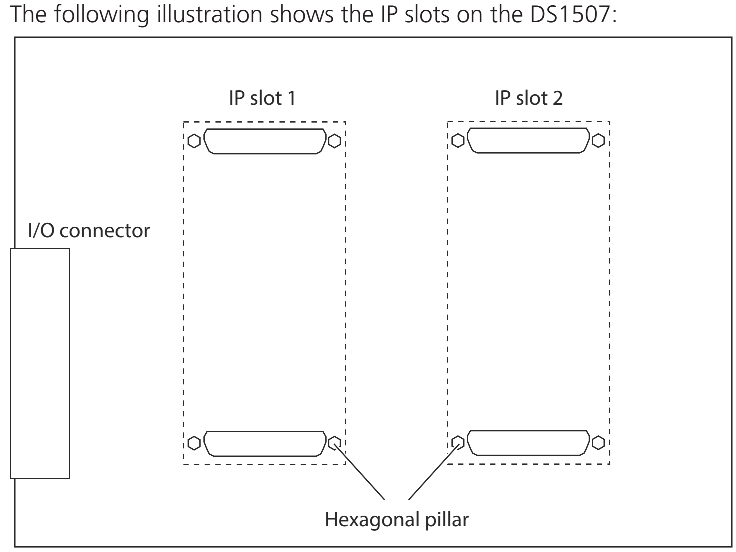


The DS1507 or DS1514 I/O Board with the IP slots is on top.

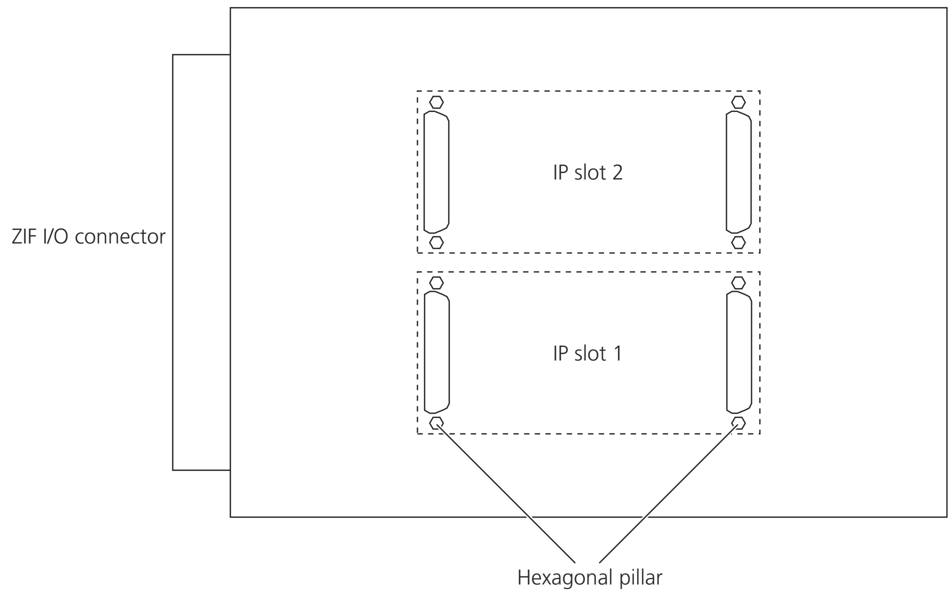
If an I/O module (such as the DS1552 Multi-I/O Module) is installed on the DS1514, remove it as described in How to Uninstall I/O Modules on page 176.

3 Uninstall the IP modules. Each module is screwed to the hexagonal pillars of the I/O board with 4 M2 Philips screws and washers. Use a PH0 Philips screwdriver to unscrew the modules and unplug the modules.

The following illustration shows the IP slots on the DS1507:



The following illustration shows the IP slots on the DS1514:



4 If a I/O module was installed on the DS1514, install it again as described in How to Install I/O Modules on page 181.

5 Mount the cover of the MicroAutoBox II.

Result

The IP modules are uninstalled.

Uninstalling the System

Uninstallation order

All components of a dSPACE system, software and hardware, can be removed from the host PC in the following order:

1. You have first to remove the software.
2. Afterwards you can remove the hardware.

Where to go from here

Information in this section

Information in other sections

Removing dSPACE Software (Installing dSPACE Software 📖)

How to Remove the Hardware

Objective

Uninstalling the hardware means to remove MicroAutoBox (MicroAutoBox II, MivroAutoBox Embedded PC, and MicroAutoBox Embedded DSU) from the vehicle.

Method

To remove MicroAutoBox from a vehicle

> ⚠ **WARNING**
>
> **Even a brief disconnection of the battery while the engine is running results in a load dump of the car generator, producing hazardous voltages of more than 100 V.**
>
> - Turn off the engine while connecting or disconnecting the vehicle battery.

1. Turn off the vehicle engine.
2. Disconnect the MicroAutoBox from the power supply.
3. Disconnect the I/O wiring.
4. Remove the four bolts and remove the box from the vehicle.

Data Sheet MicroAutoBox II 1401/1507

Where to go from here

Information in this section

Overview and General Information

Where to go from here

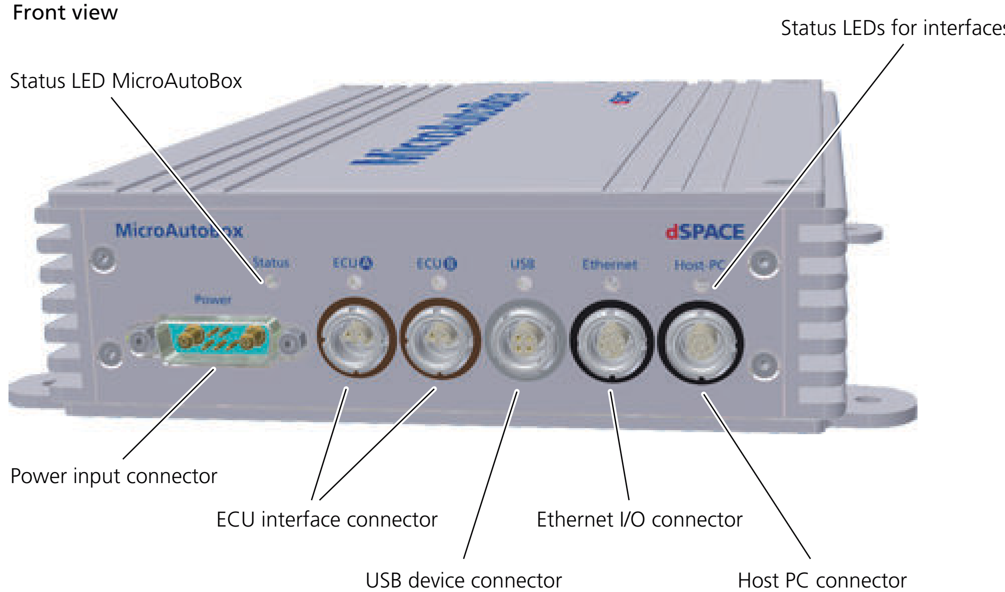
Information in this section

Housing Components

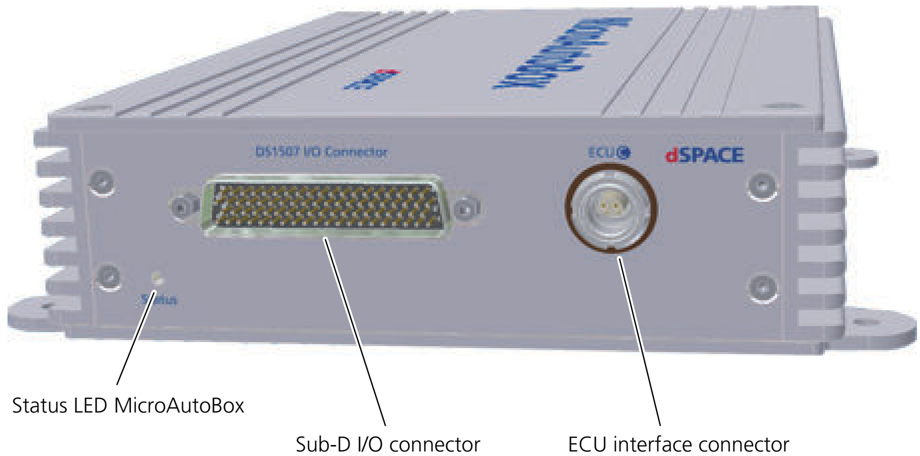
Connectors and status LEDs

The illustrations show where the connectors and status LEDs are located on MicroAutoBox II 1401/1507.

Front view



Rear view



MicroAutoBox II 1401/1507 contains the following connectors and LEDs (from left to right):

Power input connector Supplies the required power to MicroAutoBox II. It is a 7-pin, male Sub-D connector with two high-current pins.

A preconfigured cable with a matching connector and a separate power input connector are included in each MicroAutoBox II package. For the pinout and further details on the preconfigured cable, refer to Power Input Connector on page 210.

Status LED MicroAutoBox Shows you different states and potential malfunctions.

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED (= dual LED) shows different states indicated by the LED color:

- LED is red: Reset state and no application is downloaded to the real-time processor.
- LED is green: Application is running.
- LED is flashing red: MicroAutoBox II is in secured mode. For further instructions, refer to Checking MicroAutoBox II on page 506.

The status LED on the front panel has the same functionality as the status LED on the rear panel of MicroAutoBox II.

ECU interface connectors Provide communication to ECUs based on the LVDS standard, for example, in bypassing scenarios or to connect a RapidPro system (used as I/O subsystem). The ECU interface connectors are 4-pin LEMO connectors. Matching cables are supplied from dSPACE on request.

The corresponding LED is lit green, if power at both ends of the link is available and the relevant connection is serviceable. The LED flashes when data is being sent or received.

The table below shows the different ECU interfaces integrated into MicroAutoBox II and the display names they are mapped to in the experiment software, for example, ControlDesk.

Display Name in Software	Connectors Built-in at MicroAutoBox II		
	ECU A	ECU B	ECU C
ECU 1	–	–	✓
ECU 2	✓	–	–
ECU 3	–	✓	–

USB device connector A 4-pin LEMO connector to connect an USB mass storage device to use the USB Flight Recorder feature of MicroAutoBox II. A matching cable with a LEMO-USB adapter is supplied from dSPACE on request.

Note

To use the USB Flight Recorder, a separate license is required.

The possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	No USB device is connected.
Green	USB device is connected and flight recorder is not running.
Green blinking	USB device is connected and flight recorder is running.
Orange	USB device is full and the active flight recorder is specified not to overwrite old files.
Red	Write error when accessing the USB device, for example, if the device was removed while the flight recorder was running.

For further information, refer to Flight Recorder (MicroAutoBox II Features 📖).

Ethernet I/O connector An 8-pin LEMO connector that provides communication to external devices, such as PCs or ECUs based on the UDP/IP Ethernet protocol, for example, in bypassing scenarios.

A matching cable with a LEMO-RJ45 adapter is supplied from dSPACE on request.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

For installation instructions, refer to How to Connect a MicroAutoBox II to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 📖).

Host PC connector Provides the communication between MicroAutoBox II and your host PC based on the Ethernet TCP/IP protocol. The connector is a 8-pin LEMO connector. A matching cable is included in each MicroAutoBox II package.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

Tip

The Ethernet I/O connector and the Host PC connector are internally connected by a common gigabit Ethernet switch (valid for base board DS1401-25ff).

This simplifies the connection options. For an example, refer to Connecting an ECU with DCI-GSI2 for Simultaneous Calibration and ECU Interfacing (ECU Interfaces Hardware Installation and Configuration 📖).

Sub-D I/O connector The 78-pin Sub-D I/O connector is used to connect CAN, LIN, FlexRay and the IP modules. For the pinout, refer to Sub-D I/O Connector on page 205.

General Data

General characteristics The following table shows some general characteristics of MicroAutoBox II:

Parameter		Specification[1]
Base board (DS1401-20ff.)	Processor	▪ PPC750 GL Power PC ▪ 900 MHz clock frequency ▪ Real-time clock ▪ 100 MHz bus clock
	Memory	▪ 8 MB global RAM ▪ 16 MB local RAM ▪ 16 MB flash memory
	Onboard sensors[2]	Pressure sensor: ▪ Base board DS1401-23ff. ▪ Range: 50 kPa … 115 kPa ▪ Accuracy: 1 kPa ▪ Sample rate: approx. 200 Hz Acceleration sensor ▪ Base board DS1401-23ff. ▪ Range: ±2 g … ±8 g in 3 axis (x/y/z) ▪ Resolution: 10 bit per axis ▪ Sample rate: max. 800 Hz ▪ FIFO buffer: 512 words (to read and write bursts)
Communication interfaces		▪ 1 x Host PC interface based on Ethernet TCP/IP protocol ▪ 1 x Ethernet I/O interface based on Ethernet UDP/IP protocol for Ethernet bypassing scenarios ▪ 3 x ECU interface based on LVDS standard ▪ 1 x USB interface for USB flight recording (separate license)
I/O connectors		▪ 1 x 78-pin Sub-D I/O connector ▪ 1 x 7-pin power supply input connector

Parameter		Specification[1)]
Housing dimensions	Width	202 mm (7.95 in.)
	Height	50 mm (1.97 in.)
	Depth	222 mm (8.74 in.)
Weight		About 2.1 kg (4.6 lb.) without external cables

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) For further information on the sensors, refer to Onboard Sensors (MicroAutoBox II Features 📖).

Supported features

For an overview of the features that this MicroAutoBox II variant supports, refer to Feature Support (MicroAutoBox II Features 📖).

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

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

Parameter	Specification[1)]	Condition / Description
VBAT	–40 V … +100 V	Load dump- and reverse protection
REMOTE	–40 V … +100 V	Load dump- and reverse protection
RS232 transceiver output	–30 V … +30 V	—
RS232 transceiver input	–30 V … +30 V	—
CAN transceiver[2)]	–60 V … +60 V	—
Serial K/ LIN	–20 V … +32 V, but not more than VBAT	—
Serial L	–24 V … +30 V, but not more than VBAT	—
FlexRay bus lines	Provided by the optional DS4340 FlexRay Interface Module (refer to Absolute Maximum Levels on page 432).	
All outputs short circuit to GND	Continuous	—
Continuous power dissipation	Max. 25 W	$T_{operating}$ = +85 °C
Operating temperature	–40 °C … +85 °C	—

Parameter	Specification[1]	Condition / Description
Storage temperature	–55 °C ... +90 °C	—
Relative humidity	10% ... 95%	Noncondensing
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

[2] If the DS4342 CAN FD Interface Module is installed on the DS1507 I/O Board, the I/O connectors provide additional CAN interfaces. For maximum absolute levels, refer to Absolute Maximum Levels on page 444.

Battery Characteristics

Characteristics of the internal battery

The following table shows the characteristics of the battery mounted on the DS1401 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

Safety Precautions for Shipping a MicroAutoBox II.......24

Certifications

CE compliance

MicroAutoBox II meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Vibration and shock tests

To verify the reliability of MicroAutoBox II under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox II executed a program without any failures.

Applied standards

The characteristics of MicroAutoBox II 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 204.
	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 27.8 m/s^2
	EN 60068-2-6	Test conditions: ▪ Swept sine, 1 octave per minute, 3-axis test ▪ 5 … 2000 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

1) Tested with an I/O cable length < 3 m.

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 II during run time. Otherwise, you might influence the measurements.

Connector Pinouts

Where to go from here

Information in this section

Sub-D I/O Connector

Introduction

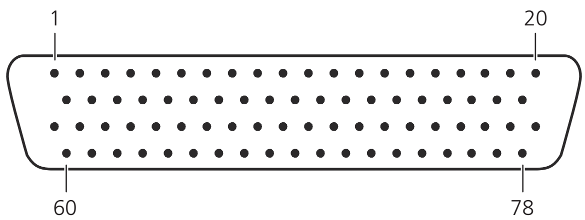
MicroAutoBox II 1401/1507 provides a 78-pin, male Sub-D connector that grants access to various I/O signals provided by the DS1507 I/O Board and the optional IP modules (DS4340, DS4342, or third-party modules).

Pinout

The table below shows the pinout and the signal mapping to the I/O connectors of the IP slots. The pin numbering used for Sub-D connectors is not standardized. The following illustration shows the numbering used (front view).

Note

Do not rely on the numbers written on the Sub-D connectors.



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	CAN 1 high			40	CAN 3 high		
2	CAN 1 low	21	GND	41	CAN 3 low	60	GND
3	GND	22	GND	42	GND	61	GND
4	CAN 2 high	23	GND	43	CAN 4 high	62	GND
5	CAN 2 low	*24*	IP slot 1, pin 5 (I/O)	44	CAN 4 low	*63*	IP slot 2, pin 5 (I/O)
6	GND	25	GND	45	GND	64	GND
7	Serial 1 TXD	26	GND	46	Serial 3 TXD	65	GND
8	Serial 1 RXD	27	GND	47	Serial 3 RXD	66	GND
9	GND	28	GND	48	GND	67	GND
10	Serial 2 K/LIN	29	GND	49	Serial 4 K/LIN	68	GND
11	Serial 2 L	30	GND	50	Serial 4 L	69	GND
12	GND	31	GND	51	GND	70	GND
13	Reserved	32	GND	52	Reserved	71	GND
14	GND	*33*	IP slot 1, pin 14 (I/O)	53	GND	*72*	IP slot 2, pin 14 (I/O)
15	IP slot 1, pin 48 (I/O)	*34*	IP slot 1, pin 15 (I/O)	*54*	IP slot 2, pin 48 (I/O)	*73*	IP slot 2, pin 15 (I/O)
16	IP slot 1, pin 50 (I/O)	*35*	IP slot 1, pin 16 (I/O)	*55*	IP slot 2, pin 50 (I/O)	*74*	IP slot 2, pin 16 (I/O)
17	IP slot 1, pin 49 (I/O)	*36*	IP slot 1, pin 17 (I/O)	*56*	IP slot 2, pin 49 (I/O)	*75*	IP slot 2, pin 17 (I/O)
18	IP slot 1, pin 44 (I/O)	*37*	IP slot 1, pin 18 (I/O)	57	IP slot 2, pin 44 (I/O)	*76*	IP slot 2, pin 18 (I/O)
19	IP slot 1, pin 46 (I/O)	*38*	IP slot 1, pin 19 (I/O)	*58*	IP slot 2, pin 46 (I/O)	*77*	IP slot 2, pin 19 (I/O)
20	IP slot 1, pin 45 (I/O)	*39*	IP slot 1, pin 20 (I/O)	*59*	IP slot 2, pin 45 (I/O)	*78*	IP slot 2, pin 20 (I/O)

Pinout for using IP modules

For the pinout of the IP modules' signals, refer to the following topics:

- DS4340 FlexRay Interface Module: DS1507 Sub-D I/O Connector on page 434
- DS4342 CAN FD Interface Module: DS1507 Sub-D I/O Connector on page 446

Signal descriptions

For descriptions of the signals which are available on the Sub-D I/O connector, refer to Interfaces on page 213.

Related topics

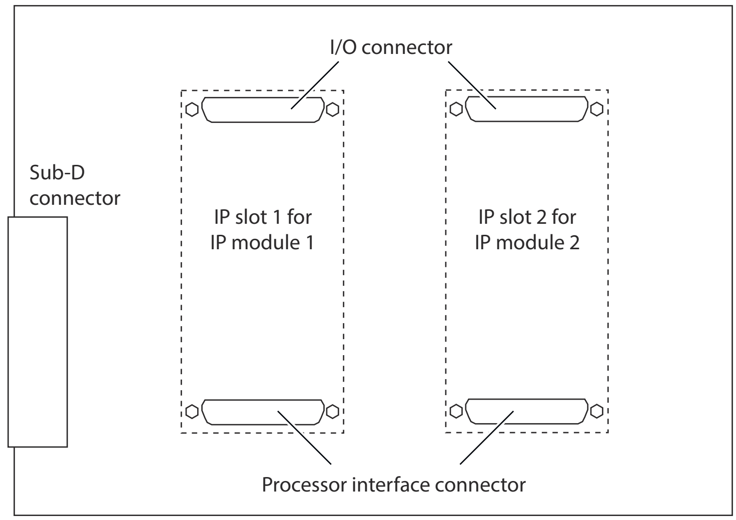
References

IP Module Connectors...207

IP Module Connectors

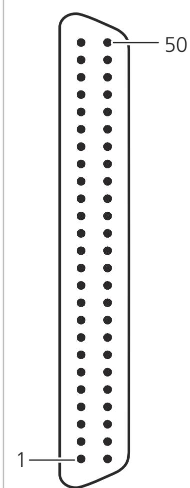
Introduction

The DS1507 provides two slots to install IP modules. Each slot provides two AMP connectors: I/O connector and processor interface connector. The following illustration shows the top view of MicroAutoBox II.

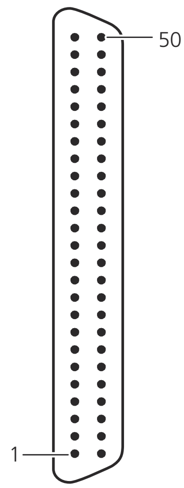


Signal Mapping

I/O connector - IP module slot 1 The following table shows the signal mapping of the IP module I/O connector on slot 1 to the Sub-D I/O Connector:

IP Module I/O Connector	Pin	Sub-D Connector Pin		Pin	Sub-D Connector Pin
	25	-		50	16
	24	-		49	17
	23	-		48	15
	22	-		47	-
	21	-		46	19
	20	39		45	20
	19	38		44	18
	18	37		43	-
	17	36		42	-
	16	35		41	-
	15	34		40	-
	14	33		39	-
	13	-		38	-
	12	-		37	-
	11	-		36	-
	10	-		35	-
	9	-		34	-
	8	-		33	-
	7	-		32	-
	6	-		31	-
	5	24		30	-
	4	-		29	-
	3	-		28	-
	2	-		27	-
	1	-		26	-

I/O connector - IP module slot 2 The following table shows the signal mapping of the IP module I/O connector on slot 2 to the Sub-D I/O Connector:

IP Module I/O Connector	Pin	Sub-D Connector Pin		Pin	Sub-D Connector Pin
	25	-		50	55
	24	-		49	56
	23	-		48	54
	22	-		47	-
	21	-		46	58
	20	78		45	59
	19	77		44	57
	18	76		43	-
	17	75		42	-
	16	74		41	-
	15	73		40	-
	14	72		39	-
	13	-		38	-
	12	-		37	-
	11	-		36	-
	10	-		35	-
	9	-		34	-
	8	-		33	-
	7	-		32	-
	6	-		31	-
	5	63		30	-
	4	-		29	-
	3	-		28	-
	2	-		27	-
	1	-		26	-

Processor interface connector - slot 1 and slot 2 The pinout of the processor interface connector (slot 1 and slot 2) complies with IP Modules Draft Standard VITA 4-1995. For further information, refer to the documentation of the standard.

Power Input Connector

Introduction

MicroAutoBox II provides a power input connector. It 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).

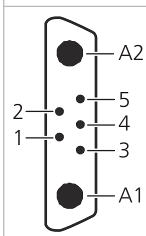
Feature for MicroAutoBox Embedded PC The pinout of the power input connector features two additional signals for remote control when MicroAutoBox II is combined with MicroAutoBox Embedded PC.

Refer to the following topics:

- MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Power Input Connector on page 464 and Power Inputs and Outputs on page 466
- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Power Input Connector on page 481 and Power Inputs and Outputs on page 486

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (6 V … 36 V DC)		
			5	REMOTE_PULLUP
	2	Reserved for MicroAutoBox Embedded PC [2]	4	REMOTE[3]
	1	Do not connect	3	Reserved for MicroAutoBox Embedded PC [2]
	A1	GND		

[1] NOTE: Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] Refer to Power Input Connector on page 464 or Power Input Connector on page 481.

[3] The REMOTE input must be connected via switch or bridge to VBAT to run the MicroAutoBox II.

Matching cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is for running MicroAutoBox II with a laboratory power supply during development. Therefore, the REMOTE pin (pin 4) is shorted to the VBAT pin (pin A2) inside the connector in order to save a separate switch. Do not use this cable in the vehicle. Otherwise, MicroAutoBox II will always be turned on.

The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1] The cable is labeled with this type number.

⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Pin description

The following tables provide a description of the pins used for power input, remote input, and supply of digital I/O circuits.

Connector	Pins	Signal	Description / Function
Power input connector	A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
	A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery/power supply. This signal is also connected to the housing of MicroAutoBox II.
	4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin directly to VBAT, MicroAutoBox II will always be on, and the vehicle battery will soon be depleted if the engine is not running. Thus, a switch is highly recommended. Refer to Connecting to Power Supply on page 42. You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference 📖). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage.
	5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up	6		36[2]	V
	VBAT	Operating	4		36[2]	V
	VBAT	Reverse protection			–40	V
	VBAT	Load dump protection			+100	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≥ $V_{iHRemote}$		1.3		A
	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		5		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
Inrush current	$I_{VBAT\ inrush}$	All inputs/outputs unconnected	see Power supply on page 38			

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] With an additional absolute maximum tolerance of +4 V.

Related topics

Basics

Connecting to Power Supply..42

Interfaces

Pin description

The following table gives a description of the pins of the 78-pin Sub-D I/O connector. Which I/O signals are available depends on the IP module you use (DS4340, DS4342, or third-party).

> **Tip**
>
> The pinout of the ECU interface connectors, USB device connector, and Ethernet I/O connector is not documented. Use a suitable dSPACE connection cable.

Sub-D I/O connector

The following tables give a description of the interface pins provided by the 78-pin Sub-D I/O connector. The installed CAN_TP1 Modules provides the basic communication interfaces of the Sub-D I/O connector.

You can add communication interfaces by installing IP modules of various types to the DS1507:

- DS4340 FlexRay Interface Module
- DS4342 CAN FD Interface Module
- Third-party FlexRay IP module

CAN_TP1 Module 1 The CAN_TP1 Module 1 has the following pins:

> **Note**
>
> Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error (see below).

The interfaces are provided by CAN_TP1 modules. Each module support two CAN channels, one RS232 channel, and either one LIN channel or one ISO 9141 channel.

<table>
<tr><th>Pin</th><th>Signal</th><th>Module type</th><th>Module Number</th><th>Description / Function</th></tr>
<tr><td>1</td><td>CAN 1 high</td><td rowspan="2">CAN Type 1</td><td rowspan="4">Module 1</td><td rowspan="4">CAN controller:
▪ CAN 1 = CAN of module number 1, channel number 1
▪ CAN 2 = CAN of module number 1, channel number 2

▪ ISO 11898 interface
▪ The MicroAutoBox II CAN buses are not equipped with bus termination by default. For information on terminating the CAN buses, refer to How to Terminate the CAN Bus on page 110.</td></tr>
<tr><td>2</td><td>CAN 1 low</td></tr>
<tr><td>4</td><td>CAN 2 high</td><td rowspan="2">CAN Type 1</td></tr>
<tr><td>5</td><td>CAN 2 low</td></tr>
<tr><td>7</td><td>Serial 1 TXD</td><td rowspan="2">CAN Type 1</td><td rowspan="2">Module 1</td><td rowspan="2">RS232 interface of module 1</td></tr>
<tr><td>8</td><td>Serial 1 RXD</td></tr>
<tr><td>10</td><td>Serial 2 K/LIN</td><td rowspan="2">CAN Type 1</td><td rowspan="2">Module 1</td><td rowspan="2">LIN or ISO 9141 interface of module 1
The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT.</td></tr>
<tr><td>11</td><td>Serial 2 L</td></tr>
</table>

Pin	Signal	Module type	Module Number	Description / Function
				For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.

CAN_TP1 Module 2 The CAN_TP1 Module 2 has the following pins:

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error (see below).

The interfaces are provided by CAN_TP1 modules. Each module support two CAN channels, one RS232 channel, and either one LIN channel or one ISO 9141 channel.

Pin	Signal	Module type	Module Number	Description / Function
40	CAN 3 high	CAN Type 1	Module 2	▪ CAN 3 = CAN of CAN controller 1, module 2 ▪ CAN 4 = CAN of CAN controller 2, module 2 ▪ ISO 11898 interface ▪ The MicroAutoBox II CAN buses do not have integrated bus termination.
41	CAN 3 low			
43	CAN 4 high	CAN Type 1		
44	CAN 4 low			
46	Serial 3 TXD	CAN Type 1	Module 2	RS232 interface of module 2
47	Serial 3 RXD			
49	Serial 4 K/LIN	CAN Type 1	Module 2	LIN or ISO 9141 interface of module 2 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
50	Serial 4 L			

DS4340 FlexRay Interface Module For a description of the interface pins of the DS4340 FlexRay Interface Module, refer to Interfaces on page 439.

DS4342 CAN FD Interface Module For a description of the interface pins of the DS4342 CAN FD Interface Module, refer to Interfaces on page 451.

(FlexRay) IP Module 1 The table describes the pins if a third-party FlexRay IP module or is installed in slot 1.

Note

The Sub-D connector can also be used to access the signals of a standard IP module installed on the DS1507. Because the connector is primarily used for FlexRay, not all signals of the IP modules are available. See Sub-D I/O Connector on page 205.

Pins	Signal	Module	Description / Function
13	IP wakeup 1	IP_Type1	You do not need to connect this pin because wake-up functionality is not supported.

Pins	Signal	Module	Description / Function
14	IP $\overline{\text{reset 1}}$	IP_Type1	▪ Only valid for third-party IP modules ▪ You do not need to connect this pin because MicroAutoBox II handles reset functionality itself.
15	IP GND 1	IP_Type1	Connection to GND
16	IP bus high/A 1	IP_Type1	FlexRay 1 high in/out (FlexRay-H)
17	IP bus low/B 1	IP_Type1	FlexRay 1 low in/out (FlexRay-L)
18	IP GND 2	IP_Type1	Connection to GND
19	IP bus high/A 2	IP_Type1	FlexRay 2 high in/out (FlexRay-H)
20	IP bus low/B 2	IP_Type1	FlexRay 2 low in/out (FlexRay-L)
33	Reserved	-	Do not connect
34	Reserved	-	Do not connect
35	Reserved	-	Do not connect
36	Reserved	-	Do not connect
37	Reserved	-	Do not connect
38	Reserved	-	Do not connect
39	Reserved	-	Do not connect

(FlexRay) IP Module 2 The table describes the pins if a third-party FlexRay IP module is installed in slot 2.

Note

The Sub-D connector can also be used to access the signals of a standard IP module installed on the DS1507. Because the connector is primarily used for FlexRay, not all signals of the IP modules are available. See Sub-D I/O Connector on page 205.

Pin	Signal	Module	Description / Function
52	IP wakeup 2	IP_Type1	You do not need to connect this pin because wake-up functionality is not supported.
53	IP $\overline{\text{reset 2}}$	IP_Type1	▪ Only valid for third-party IP modules ▪ You do not need to connect this pin because MicroAutoBox II handles reset functionality itself.
54	IP GND 3	IP_Type1	Connection to GND
55	IP bus high/A 3	IP_Type1	FlexRay 1 high in/out (FlexRay-H)
56	IP bus low/B 3	IP_Type1	FlexRay 1 low in/out (FlexRay-L)
57	IP GND 4	IP_Type1	Connection to GND
58	IP bus high/A 4	IP_Type1	FlexRay 2 high in/out (FlexRay-H)
59	IP bus low/B 4	IP_Type1	FlexRay 2 low in/out (FlexRay-L)
72	Reserved	-	Do not connect
73	Reserved	-	Do not connect
74	Reserved	-	Do not connect

Pin	Signal	Module	Description / Function
75	Reserved	-	Do not connect
76	Reserved	-	Do not connect
77	Reserved	-	Do not connect
78	Reserved	-	Do not connect

Characteristics

The characteristics are specified for the following conditions unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to the A1 pin (GND) on the power input connector.
- All voltage values specify voltages on the connector pins.

Interface	Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
Host PC	Protocol	TCP/IP				
	Bitrate			▪ 10/1000[2)] ▪ 10/100[3)]		Mbit
	Data throughput				2.6	MB/s
	Voltage levels	Ethernet standard				
Ethernet I/O	Protocol	UDP/IP				
	Bitrate			1000		Mbit
	Voltage levels	Ethernet standard				

Interface	Parameter[1]	Conditions / Comments		Min.	Typ.	Max.	Unit
USB	USB 2.0 standard (USB Flight Recording)						
	Data throughput	without connected host tool				1280	kB/sec
		with connected host tool				1024	kB/sec
		without data loss during cold start (dependent on the boot time of the host interface)				640	kB/sec
	Current					1.3	A
	Voltage					5	V
ECU	Bit rate	LVDS mode				250	MBit
		LVDS2 mode				560	
	Cable length	2-paired twisted pair				5	m
	Cable type			CAT5			
	Voltage levels	LVDS standard					
	Full duplex data rate[4]	LVDS mode	Single transfer			5	MWord /s
		LVDS2 mode	Single transfer			11.2	MWord /s
			Block transfer			28	MWord /s
	RAM size[4]	LVDS / LVDS2 mode		16			kWord
	FIFO size[4]	LVDS / LVDS2 mode (Transmit buffer)		1			kWord
CAN	Bit rate	ISO 11898 interface				1	MBaud
CAN FD (with DS4342)	Bit rate	ISO 11898 interface				> 2	MBaud
Serial 1 RS232-Interface	Bit rate			5		115.2k	Baud
	TX output voltage swing	3 kΩ load		±5	±9		V
	$V_{RxinLow}$	RX input threshold low			1.4	0.8	V
	$V_{RxinHigh}$	RX input threshold high		2.0	1.4		V
	Word length			5		8	bit
Serial 2 ISO9141-Interface	Bit rate	R_{KO} = 510 Ω; $C_K \leq$ 1.3 nF		5		50k	Baud
	Word length			5		8	bit
LIN ISO9141-Interface	Bit rate			1		20k	Baud
	Node type	30 kΩ resistor for LIN slave					
		1 kΩ pull-up resistor for LIN master					
FlexRay (with DS4340)	Bit rate					2 x 10	MBaud
	Frame length					12	byte
IP module carrier	Clocking			8		32	MHz
	Access type				byte / word		

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

Interface	Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit

[2] Since board revision DS1401-23 (available since dSPACE Release 7.2).
[3] Before board revision DS1401-23
[4] Word is 16-bit wide

Baud rate calculation of the serial interface

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error.

The UART baud rate generator provides several baud rates:

To calculate the divisor T for a chosen baud rate

$$T = \text{Round}\left(\frac{230400}{\text{BR (chosen)}}\right)$$

BR (chosen) = The baudrate to be generated
T = The baudrate generator divisor ($2 \leq T \leq 65535$)

To calculate the real baud rate from a given divisor T

$$\frac{\text{BR (real)}}{\text{Baud}} = \frac{230400}{T}$$

BR (real) = The baudrate you get
T = The baudrate generator divisor ($2 \leq T \leq 65535$)

To calculate the resulting error

$$\frac{\text{Error}_{\text{BR}}}{100\%} = \frac{\text{BR (real)} - \text{BR (chosen)}}{\text{BR (chosen)}}$$

Note

If $\text{Error}_{\text{BR}} \leq 2\%$, messages will be transferred and received correctly.

Related topics

Basics

CAN Support (MicroAutoBox II Features 📖)
ECU Interface (MicroAutoBox II Features 📖)
FlexRay Support (MicroAutoBox II Features 📖)
LIN Support (MicroAutoBox II Features 📖)

References

Serial Interface (MicroAutoBox II Features 📖)

Data Sheet MicroAutoBox II 1401/1511

Where to go from here

Information in this section

Overview and General Information

Where to go from here

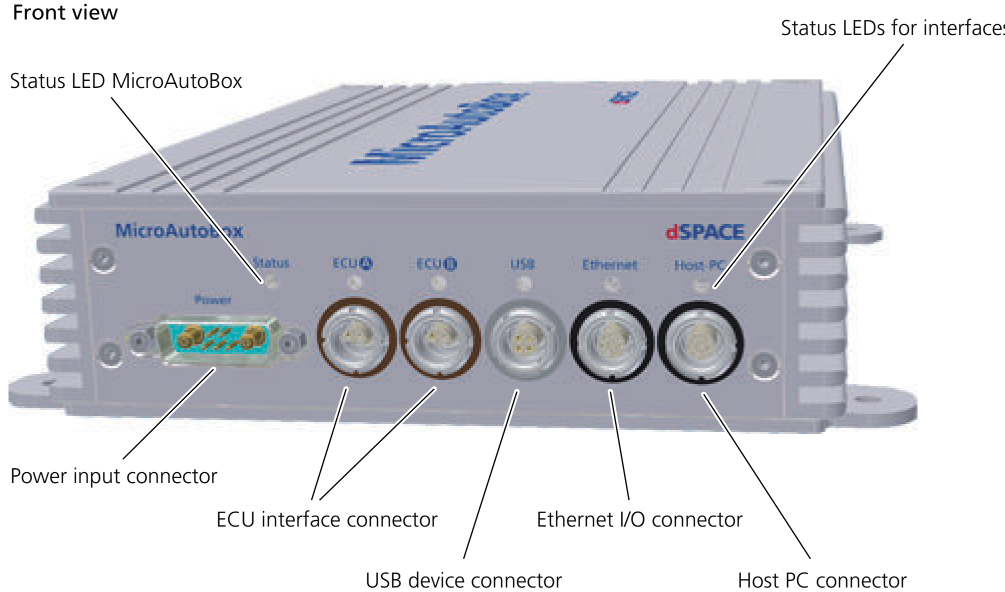
Information in this section

Housing Components

Connectors and status LEDs

The illustrations show where the connectors and status LEDs are located on MicroAutoBox II 1401/1511.

Front view



Rear view

Status LED MicroAutoBox

ZIF I/O connector

MicroAutoBox II 1401/1511 contains the following connectors and LEDs (from left to right):

Power input connector Supplies the required power to MicroAutoBox II. It is a 7-pin, male Sub-D connector with two high-current pins.

A preconfigured cable with a matching connector and a separate power input connector are included in each MicroAutoBox II package. For the pinout and further details on the preconfigured cable, refer to Power Input Connector on page 232.

Status LED MicroAutoBox Shows you different states and potential malfunctions.

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED (= dual LED) shows different states indicated by the LED color:

- LED is red: Reset state and no application is downloaded to the real-time processor.
- LED is green: Application is running.
- LED is flashing red: MicroAutoBox II is in secured mode. For further instructions, refer to Checking MicroAutoBox II on page 506.

The status LED on the front panel has the same functionality as the status LED on the rear panel of MicroAutoBox II.

ECU interface connectors Provide communication to ECUs based on the LVDS standard, for example, in bypassing scenarios or to connect a RapidPro system (used as I/O subsystem). The ECU interface connectors are 4-pin LEMO connectors. Matching cables are supplied from dSPACE on request.

The corresponding LED is lit green, if power at both ends of the link is available and the relevant connection is serviceable. The LED flashes when data is being sent or received.

The table below shows the different ECU interfaces integrated into MicroAutoBox II and the display names they are mapped to in the experiment software, for example, ControlDesk.

Display Name in Software	Connectors Built-in at MicroAutoBox II	
	ECU A	ECU B
ECU 1	✓	–
ECU 2	–	✓

USB device connector A 4-pin LEMO connector to connect an USB mass storage device to use the USB Flight Recorder feature of MicroAutoBox II. A matching cable with a LEMO-USB adapter is supplied from dSPACE on request.

Note

To use the USB Flight Recorder, a separate license is required.

The possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	No USB device is connected.
Green	USB device is connected and flight recorder is not running.
Green blinking	USB device is connected and flight recorder is running.
Orange	USB device is full and the active flight recorder is specified not to overwrite old files.
Red	Write error when accessing the USB device, for example, if the device was removed while the flight recorder was running.

For further information, refer to Flight Recorder (MicroAutoBox II Features 📖).

Ethernet I/O connector An 8-pin LEMO connector that provides communication to external devices, such as PCs or ECUs based on the UDP/IP Ethernet protocol, for example, in bypassing scenarios.

A matching cable with a LEMO-RJ45 adapter is supplied from dSPACE on request.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

For installation instructions, refer to How to Connect a MicroAutoBox II to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 📖).

Host PC connector Provides the communication between MicroAutoBox II and your host PC based on the Ethernet TCP/IP protocol. The connector is a 8-pin LEMO connector. A matching cable is included in each MicroAutoBox II package.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

Tip

The Ethernet I/O connector and the Host PC connector are internally connected by a common gigabit Ethernet switch (valid for base board DS1401-25ff).

This simplifies the connection options. For an example, refer to Connecting an ECU with DCI-GSI2 for Simultaneous Calibration and ECU Interfacing (ECU Interfaces Hardware Installation and Configuration 📖).

ZIF I/O connector The 156-pin zero insertion force (ZIF) I/O connector provides access to the most input and output signals provided by MicroAutoBox II. A matching connector is included in each MicroAutoBox II package.

For the pinout, refer to ZIF I/O Connector on page 230.

General Data

General characteristics The following table shows some general characteristics of MicroAutoBox II:

Parameter		**Specification[1)]**
Base board (DS1401-20ff.)	Processor	▪ PPC750 GL Power PC ▪ 900 MHz clock frequency ▪ Real-time clock ▪ 100 MHz bus clock
	Memory	▪ 8 MB global RAM ▪ 16 MB local RAM ▪ 16 MB flash memory
	Onboard sensors[2)]	Pressure sensor: ▪ Base board DS1401-23ff. ▪ Range: 50 kPa … 115 kPa ▪ Accuracy: 1 kPa ▪ Sample rate: approx. 200 Hz Acceleration sensor ▪ Base board DS1401-23ff. ▪ Range: ±2 g … ±8 g in 3 axis (x/y/z) ▪ Resolution: 10 bit per axis ▪ Sample rate: max. 800 Hz ▪ FIFO buffer: 512 words (to read and write bursts)
Communication interfaces		▪ 1 x Host PC interface based on Ethernet TCP/IP protocol ▪ 1 x Ethernet I/O interface based on Ethernet UDP/IP protocol for Ethernet bypassing scenarios ▪ 2 x ECU interface based on LVDS standard ▪ 1 x USB interface for USB flight recording (separate license)

Parameter		Specification[1]
I/O connectors		▪ 1 x 156-pin ZIF I/O connector ▪ max. 15 mΩ contact resistance ▪ 10000 cycles durability ▪ max. 2.5 A continuous current per pin ($T_{operating}$ = +85 °C) ▪ 1 x 7-pin power supply input connector
Housing dimensions	Width	202 mm (7.95 in.)
	Height	50 mm (1.97 in.)
	Depth	222 mm (8.74 in.)
Weight		About 2.1 kg (4.6 lb.) without external cables

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

[2] For further information on the sensors, refer to Onboard Sensors (MicroAutoBox II Features 📖).

Supported features

For an overview of the features that this MicroAutoBox II variant supports, refer to Feature Support (MicroAutoBox II Features 📖).

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

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

Parameter	Specification[1]	Condition / Description
VBAT	–40 V … +100 V	Load dump- and reverse protection
VDRIVE	0 V … +45 V	—
All digital output voltages	(VDRIVE – 45 V) … +45 V	—
All digital input voltages	(VDRIVE – 45 V) … +45 V	—
All analog output voltages	–30 V … +40 V	—
All analog input voltages	–40 V … +40 V	—
VSENS output	0 V … +40 V	—

Parameter	Specification[1)]	Condition / Description
VBATprot output	0 V … +45 V	—
RS232 transceiver output	–30 V … +30 V	—
RS232 transceiver input	–30 V … +30 V	—
$V_{CAN\ high}$, $V_{CAN\ low}$	–60 V … +60 V	Voltage level on CAN high and CAN low pins.
$V_{Diff\ (CAN\ high\ -\ CAN\ low)}$	–3.5 V … +3.5 V	Voltage difference between CAN high and CAN low pins (due to termination resistors).
Serial 2 K / LIN	–20 V … +32 V, but not more than VBAT	—
Serial 2 L	–24 V … +30 V, but not more than VBAT	—
All outputs short circuit to GND	Continuous	—
Continuous power dissipation	Max. 25 W	$T_{operating}$ = +85 °C Power dissipated by the MicroAutoBox II itself. The power of the connected loads (VBATprot/VSENS) must be added.
Operating temperature	–40 °C … +85 °C	—
Storage temperature	–55 °C … +90 °C	—
Relative humidity	10% ... 95%	Noncondensing
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

Battery Characteristics

Characteristics of the internal battery

The following table shows the characteristics of the battery mounted on the DS1401 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

Certifications

CE compliance

MicroAutoBox II meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Applied standards

The characteristics of MicroAutoBox II 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 229.
	CISPR 11, EN 55011 Group 1, Class A	Emission standard for industrial environments
	RTCA/DO160G: Dec. 2010: Section 21.4	Environmental conditions and test procedures for airborne equipment: Conducted RF Emissions, Category: B, L, M&H[2)]
	RTCA/DO160G: Dec. 2010: Section 21.5	Environmental conditions and test procedures for airborne equipment: Radiated RF Emissions, Category: M[2)]
Vibration	ISO 16750-3:2007 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 4 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 4 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 … 2000 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 A Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 ms, 10 pulses per axis

Tested Characteristics	Applied Standard	Description
		▪ 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.
[2] For further information, refer to dSPACE Support.

Vibration and shock tests

To verify the reliability of MicroAutoBox II under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox II 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 II during run time. Otherwise, you might influence the measurements.

Connector Pinouts

Where to go from here

Information in this section

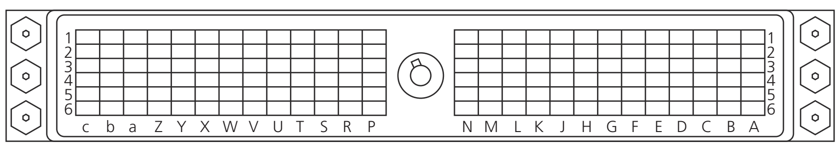
ZIF I/O Connector

Introduction

The I/O connector is a 156-pin zero insertion force (ZIF) connector giving access to the most input and output signals provided by MicroAutoBox II.

Pinout

The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of the I/O connector:

1		2		3		4		5		6		
GND	in	CAN 4 high	i/o	CAN 4 low	i/o	GND	in	Serial 4 K / LIN[1]	i/o	Serial 4 L[1]	in	*A*
GND	in	CAN 3 high	i/o	CAN 3 low	i/o	GND	in	Serial 3TXD[1]	out	Serial 3 RXD[1]	in	*B*
GND	in	GND	in	GND	in	GND	in	GND	in	GND	in	*C*
GND	in	DigP 1 ch 8[2]	out	DigP 1 ch 16	out	DigP 2 ch 8[2]	out	DigP 2 ch 16	out	DigP 3 ch 8	out	*D*
GND	in	DigP 1 ch 7	out	DigP 1 ch 15	out	DigP 2 ch 7	out	DigP 2 ch 15	out	DigP 3 ch 7	out	*E*
GND	in	DigP 1 ch 6	out	DigP 1 ch 14	out	DigP 2 ch 6	out	DigP 2 ch 14	out	DigP 3 ch 6	out	*F*
GND	in	DigP 1 ch 5	out	DigP 1 ch 13	out	DigP 2 ch 5	out	DigP 2 ch 13	out	DigP 3 ch 5	out	*G*
GND	in	DigP 1 ch 4	out	DigP 1 ch 12	out	DigP 2 ch 4	out	DigP 2 ch 12	out	DigP 3 ch 4	out	*H*
GND	in	DigP 1 ch 3	out	DigP 1 ch 11	out	DigP 2 ch 3	out	DigP 2 ch 11	out	DigP 3 ch 3	out	*J*
GND	in	DigP 1 ch 2	out	DigP 1 ch 10	out	DigP 2 ch 2	out	DigP 2 ch 10	out	DigP 3 ch 2	out	*K*

1		2		3		4		5		6		
GND	in	DigP 1 ch 1	out	DigP 1 ch 9	out	DigP 2 ch 1	out	DigP 2 ch 9	out	DigP 3 ch 1	out	*L*
VSENS	out	DigP 1 ch 8 [2]	in	DigP 1 ch 16	in	DigP 2 ch 8[2]	in	DigP 2 ch 16	in	DigP 3 ch 8	in	*M*
VDRIVE	in	DigP 1 ch 7	in	DigP 1 ch 15	in	DigP 2 ch 7	in	DigP 2 ch 15	in	DigP 3 ch 7	in	*N*
VBAT prot	out	DigP 1 ch 6	in	DigP 1 ch 14	in	DigP 2 ch 6	in	DigP 2 ch 14	in	DigP 3 ch 6	in	*P*
REMOTE	in	DigP 1 ch 5	in	DigP 1 ch 13	in	DigP 2 ch 5	in	DigP 2 ch 13	in	DigP 3 ch 5	in	*R*
GND	in	DigP 1 ch 4	in	DigP 1 ch 12	in	DigP 2 ch 4	in	DigP 2 ch 12	in	DigP 3 ch 4	in	*S*
GND	in	DigP 1 ch 3	in	DigP 1 ch 11	in	DigP 2 ch 3	in	DigP 2 ch 11	in	DigP 3 ch 3	in	*T*
GND	in	DigP 1 ch 2	in	DigP 1 ch 10	in	DigP 2 ch 2	in	DigP 2 ch 10	in	DigP 3 ch 2	in	*U*
GND	in	DigP 1 ch 1	in	DigP 1 ch 9	in	DigP 2 ch 1	in	DigP 2 ch 9	in	DigP 3 ch 1	in	*V*
GND	in	Analog ch 4	out	Analog ch 4	in	Analog ch 8	in	Analog ch 12	in	Analog ch 16	in	*W*
GND	in	Analog ch 3	out	Analog ch 3	in	Analog ch 7	in	Analog ch 11	in	Analog ch 15	in	*X*
GND	in	Analog ch 2	out	Analog ch 2	in	Analog ch 6	in	Analog ch 10	in	Analog ch 14	in	*Y*
GND	in	Analog ch 1	out	Analog ch 1	in	Analog ch 5	in	Analog ch 9	in	Analog ch 13	in	*Z*
GND	in	SGND	in	Ana trigger 1	in	Ana trigger 2	in	Ana trigger 3	in	Ana trigger 4	in	*a*
GND	in	CAN 2 high	i/o	CAN 2 low	i/o	GND	in	Serial 2 K / LIN[1]	i/o	Serial 2 L[1]	in	*b*
GND	in	CAN 1 high	i/o	CAN 1 low	i/o	GND	in	Serial 1 TXD[1]	out	Serial 1 RXD[1]	in	*c*

1) For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 🕮).

2) DigP = Port number; ch = Channel number

Note

To use the digital inputs and outputs, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the logic level needed. *This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.* You have to connect VDRIVE (pin N1) to VSENS (pin M1) or VBATprot (pin P1). Use the preconfigured jumper cable which is included in the MicroAutoBox II package.

Signal descriptions

For descriptions of the signals which are available on the ZIF I/O connector, refer to:

- Power Inputs and Outputs on page 234
- Digital Inputs on page 237
- Digital Outputs on page 239
- Analog Inputs on page 244
- Analog Outputs on page 248
- CAN, LIN, serial: Interfaces on page 249

Power Input Connector

Introduction

MicroAutoBox II provides a power input connector. It 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).

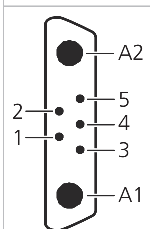
Feature for MicroAutoBox Embedded PC The pinout of the power input connector features two additional signals for remote control when MicroAutoBox II is combined with MicroAutoBox Embedded PC.

Refer to the following topics:

- MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Power Input Connector on page 464 and Power Inputs and Outputs on page 466
- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Power Input Connector on page 481 and Power Inputs and Outputs on page 486

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (6 V … 36 V DC)	5	REMOTE_PULLUP
	2	Reserved for MicroAutoBox Embedded PC [2]	4	REMOTE[3]
	1	Do not connect	3	Reserved for MicroAutoBox Embedded PC [2]
	A1	GND		

[1] NOTE: Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] Refer to Power Input Connector on page 464 or Power Input Connector on page 481.

[3] The REMOTE input must be connected via switch or bridge to VBAT to run the MicroAutoBox II.

Matching cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is for running MicroAutoBox II with a laboratory power supply during development. Therefore, the REMOTE pin (pin 4) is shorted to the VBAT pin (pin A2) inside the connector in order to save a separate switch. Do not use this cable in the vehicle. Otherwise, MicroAutoBox II will always be turned on.

The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1)] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1)] The cable is labeled with this type number.

⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Pin description

The following tables provide a description of the pins used for power input, remote input, and supply of digital I/O circuits.

Connector	Pins	Signal	Description / Function
Power input connector	A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
	A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery/power supply. This signal is also connected to the housing of MicroAutoBox II.
	4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin directly to VBAT, MicroAutoBox II will always be on, and the vehicle battery will soon be depleted if the engine is not running. Thus, a switch is highly recommended. Refer to Connecting to Power Supply on page 42.

Connector	Pins	Signal	Description / Function
			You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference 📖). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage.
	5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.
ZIF I/O connector	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	GND	Main power supply return and reference for all input and output signals. Use the nearest possible GND pin as reference for your signals in order to keep noise levels at minimum. The housing of MicroAutoBox II is also connected to GND.
	a2	SGND	Internally connected to GND with a 0 Ω resistor.
	N1	VDRIVE	This input supplies all digital input and output circuits. ▪ Connect this input to VSENS to set 5 V logic levels for your inputs/outputs. ▪ Connect this input to VBATprot to set automotive-compatible logic levels for your inputs/outputs. ▪ Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected at this signal. For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
	M1	VSENS	Sensor supply output. VSENS is switched on and off with the REMOTE pin. Use this output to supply your sensors and/or VDRIVE. If you need 5 V logic levels at the inputs/outputs connect VSENS to VDRIVE.
	P1	VBAT prot	Protected VBAT output. VBATprot follows VBAT within the specified range and is switched on and off with the REMOTE pin. Use this output to supply VDRIVE when automotive logic levels are needed.
	R1	REMOTE	▪ The remote voltage may be used for starting MicroAutoBox II with a remote switch: KL15, for example (output of the ignition/driving switch). ▪ If you connect the remote pin to the vehicle battery directly, MicroAutoBox II will always be turned on, and the vehicle battery will

Connector	Pins	Signal	Description / Function
			soon be exhausted if the engine is not running. Thus, a switch is highly recommended. ▪ The remote voltage should not exceed the supply voltage.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up	6		36[2]	V
	VBAT	Operating	4		36[2]	V
	VBAT	Reverse protection			–40	V
	VBAT	Load dump protection			+100	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≥ $V_{iHRemote}$		1.3		A
	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		5		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
Inrush current	$I_{VBAT\ inrush}$	All inputs/outputs unconnected	see Power supply on page 38			
Digital I/O voltage supply input	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		20		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		1		A
Outputs						
Sensor supply output	VSENS	Output voltage	4.84	5.05	5.25	V
	VSENS = f(T)	Temperature caused voltage drift $T_{Housing}$ = –40 °C … +85 °C	–2		2	%
	$I_{VSENS,\ max}$	Maximum output current	750			mA
Protected VBAT output	VBATprot [3]	I_{Load} = 1A; VBAT = 12 V	11.56	11.78	12	V
	$I_{VBATprot,\ max}$	Maximum output current			1000	mA
	$I_{ProtPeak}$	Overload current limit (–40 °C … 85 °C)	4		9	A
	t(overload)	Time to shut off $I_{ProtPeak}$			5	ms

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

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit

[2] With an additional absolute maximum tolerance of +4 V.
[3] VBATprot follows VBAT within the specified range.

Related topics

Basics

Digital Inputs

Pin description

The following table gives a description of the digital input pins:

Pins (DS1511)	Port Number	Signal	Description/ Function
V2, U2, T2, S2, R2, P2, N2, M2, V3, U3, T3, S3, R3, P3, N3, M3	1	Channel 1 … 16 DIO Type 3	Standard discrete digital input with pull-up.
V4, U4, T4, S4, R4, P4, N4, M4, V5, U5, T5, S5, R5, P5, N5, M5	2	Channel 1 … 16 DIO Type 3	
V6, U6, T6, S6, R6, P6, N6, M6	3	Channel 1 … 8 DIO Type 3	

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
Digital input channel 1 … 40	V_{iH}	Input high voltage	3.1			V
	V_{iL}	Input low voltage			1.2	V
	V_{iHys}	Input hysteresis voltage		1		V
	R_{DigIn}	Pull-up resistor to VDRIVE	17	18	19	kΩ
	C_{DigIn}	Input capacitance		1		nF
REMOTE	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
AC characteristics						
Inputs	t_{LowMin}	Minimum pulse width low		250	500	ns
	$t_{HighMin}$	Minimum pulse width high		300	600	ns
	F_{max}	Duty cycle: 50 %		1.8		MHz
		Duty cycle: 1 % or 99 %		33		kHz

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

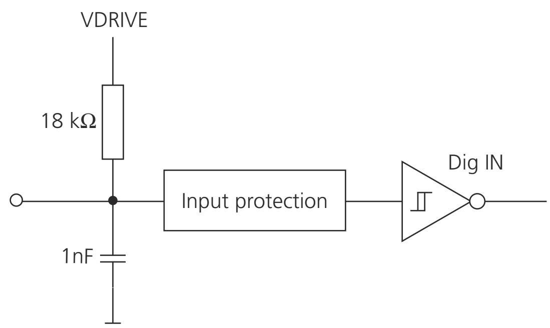
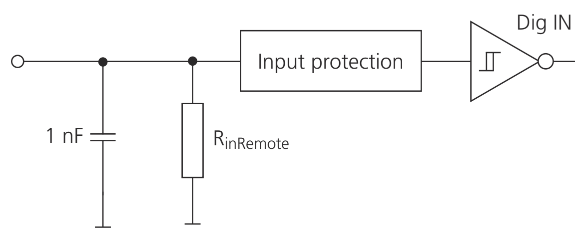
Powering digital inputs and outputs of the DS1511 ZIF I/O connector

Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.
For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the digital inputs:

Signal		I/O Circuit
Digital inputs	Channel 1 … 40	 For proper operation, VDRIVE must have a level above the maximum input voltage.
	Remote	

Related topics

Basics

Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 📖)
Providing the Supply Voltage to Drive Digital I/O Interfaces.. 47

Digital Outputs

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.

Pin description

The following table gives a description of the digital output pins:

Pins (DS1511)	Port Number	Signal	Default state	Description / Function
L2, K2, J2, H2, G2, F2, E2, D2, L3, K3, J3, H3, G3, F3, E3, D3	1	Channel 1 … 16 DIO Type 3	Tristate	Standard discrete digital output.
L4, K4, J4, H4, G4, F4, E4, D4, L5, K5, J5, H5, G5, F5, E5, D5	2	Channel 1 … 16 DIO Type 3		
L6, K6, J6, H6, G6, F6, E6, D6	3	Channel 1 … 8 DIO Type 3		

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC Characteristics						
Digital output channel 1 … 40	V_{oH}	I_{Load} = 0 mA; VDRIVE = 5 V	4.4	4.6		V
	V_{oL}	I_{Load} = 0 mA; VDRIVE = 5 V		0.1	0.3	V
	V_{oH}	I_{Load} = 5 mA; VDRIVE = 5 V	3.2	3.4		V
	V_{oL}	I_{Load} = –5 mA; VDRIVE = 5 V		0.7	0.9	V
	V_{oH}	I_{Load} = 0 mA; VDRIVE = 12 V	11.3	11.6		V
	V_{oL}	I_{Load} = 0 mA; VDRIVE = 12 V		0.1	0.3	V
	V_{oH}	I_{Load} = 5 mA; VDRIVE = 12 V	10.3	10.5		V
	V_{oL}	I_{Load} = –5 mA; VDRIVE = 12 V		0.7	0.9	V
	$\lvert I_{OHmax} \rvert$	Current limit high $T_{Housing}$ = –40 °C … +85 °C	5	13	17	mA
	$\lvert I_{OLmax} \rvert$	Current limit low $T_{Housing}$ = –40 °C … +85 °C	5	14	18	mA
	$\lvert I_{OTLeak} \rvert$	Leakage current tristate $T_{Housing}$ = -40 °C … +85 °C			100	µA

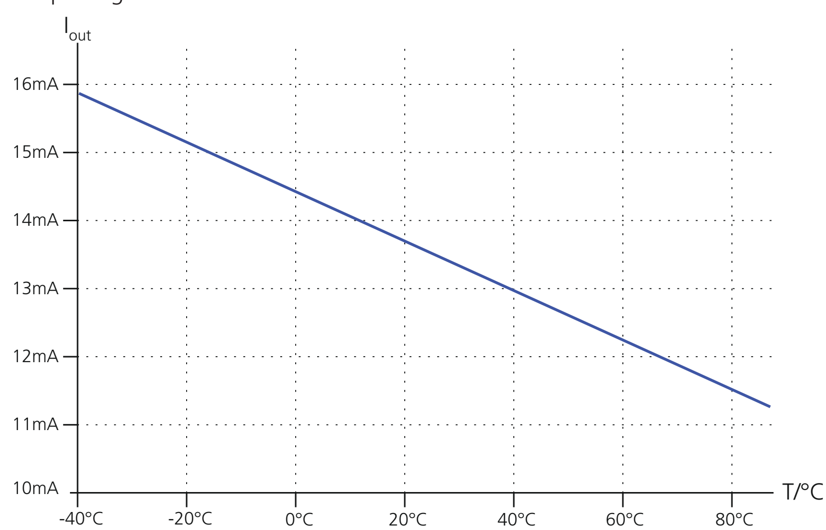
Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics						
Outputs	$t_{minPulseHigh}$	Minimum pulse width high, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		700	1400	ns
	$t_{minPulseLow}$	Minimum pulse width low, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		200	400	ns
	F_{max}	Duty cycle: 50 % VDRIVE = 5 V or 12 V		0.7[2]		MHz
		Duty cycle: 1 % or 99 % VDRIVE = 5 V or 12 V		14		kHz

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

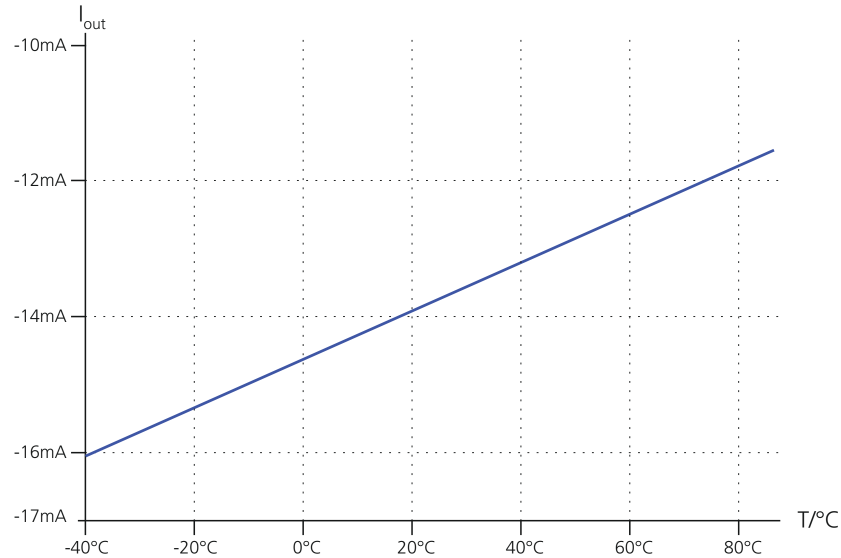
2) Limited by software to 150 kHz

The following illustrations show the maximum output current of a digital output circuit as a function of ambient temperature (VDRIVE = 12 V; output is shorted to 6 V):

- Output high

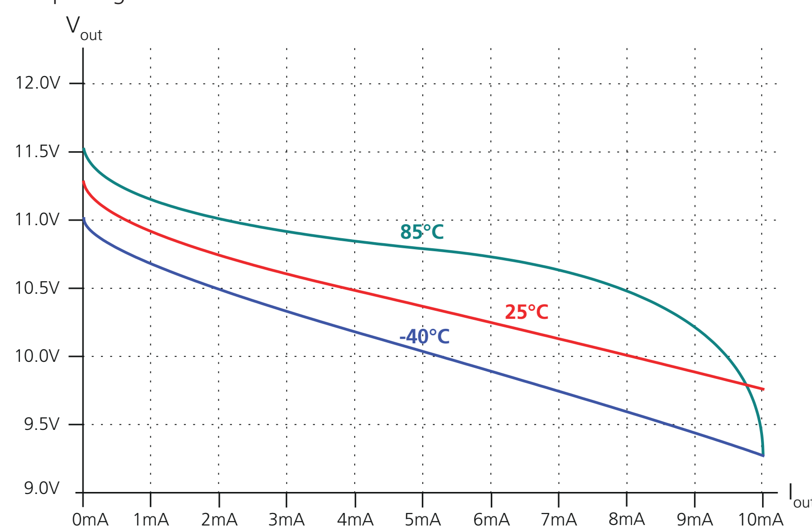


- Output low

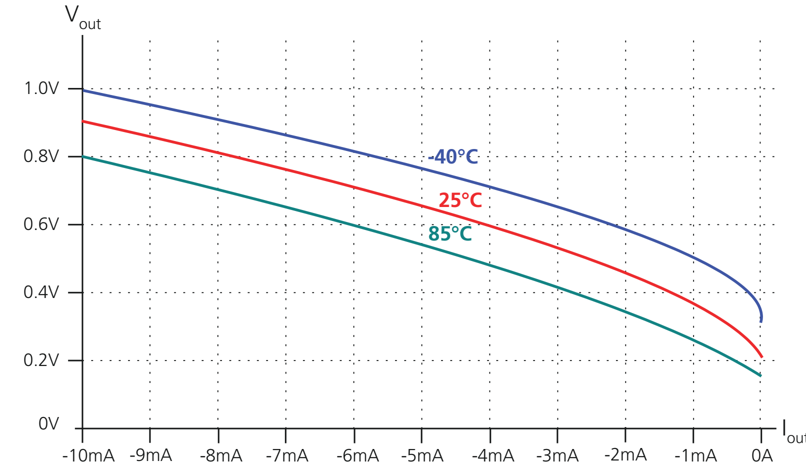


The following illustrations show the typical digital output voltage as a function of the output current (VDRIVE = 12 V):

- Output high



- Output low

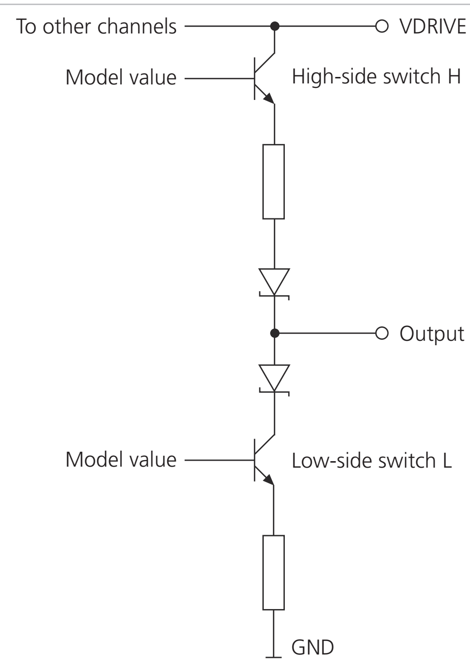


Powering digital inputs and outputs of the DS1511 ZIF I/O connector

> **Note**
>
> To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.
> For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the digital outputs:

Signal	I/O Circuit
Digital outputs	

Related topics

Basics

Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 🕮)
Providing the Supply Voltage to Drive Digital I/O Interfaces.. 47

Analog Inputs

Pin description

The following table gives a description of the analog input pins:

Pins	Signal	Module	Description / Function
Z3, Y3, X3, W3, Z4, Y4, X4, W4, Z5, Y5, X5, W5, Z6, Y6, X6, W6	ADC channel 1 … 16	ADC Type 4	Analog inputs: ▪ DS1511: 0 V … 5 V ▪ DS1511B1: -10 V … +10 V
a3, a4, a5, a6	External trigger 1 … 4		For information on function of the trigger signals, refer to Trigger signals (MicroAutoBox II Features 🕮).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics						
ADC (all 16 channels)	Number of independent input channels			16		
	Resolution			16		bit
	Sample rate	Burst mode with more than 1 sample			1	MSPS
	Input voltage range	DS1511	0		5	V
		DS1511B1	-10		10	V
	Conversion timer	Separate for each channel.				
		Width	27			bit
		Resolution	10			ns
		Interval			1.342	s
	Timer for time stamping	Common for all channels. Two channels are required to carry one 32 bit value.				
		Width	32			bit
		Resolution	10			ns
		Interval			42.9	s
	Buffer size	Software-configurable	1		8192	Samples
	Buffers per channel		3			
	Number of external trigger inputs		4			

Signal[1)]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics - DS1511						
ADC (all 16 channels)	Initial offset error	Below 750 KSPs	-0.5		0.5	mV
	Initial gain error	Below 750 KSPs	-0.25		0.25	%
	Input impedance			192		kΩ
	Offset drift			±10		μV/K
	Gain drift			±6		ppm/K
	Overvoltage protection	Continuous	-20		+30	
		Short term	-50		50	V
External trigger	Input voltage	V_{iH}	2.3			V
		V_{iL}			0.4	V
	Period				1	MHz
	Overvoltage protection	Continuous	-48		50	V
DC characteristics - DS1511B1						
ADC (all 16 channels)	Initial offset error	Below 750 KSPs	-3		3	mV
	Initial gain error	Below 750 KSPs	-0.25		0.25	%
	Input impedance	Dynamic (ΔU/ΔI) [2)]		117		kΩ
	Offset drift			±40		μV/K
	Gain drift			±6		ppm/K
	Overvoltage protection	Continuous	-30		+30	
		Short term	-50		50	V
External trigger	Input voltage	V_{iH}	2.3			V
		V_{iL}			0.4	V
	Period				1	MHz
	Overvoltage protection	Continuous	-48		50	V
AC Characteristics						
ADC Type 4 (all 16 channels)	No missing codes		15			bit
	SNR	12.4 kHz signal @ 200 KSPs	80			dB
	Input bandwidth	Full power bandwidth	400			kHz
	Channel crosstalk	100 kHz			-96	dB
		200 kHz			-92	dB
		400 kHz			-90	dB

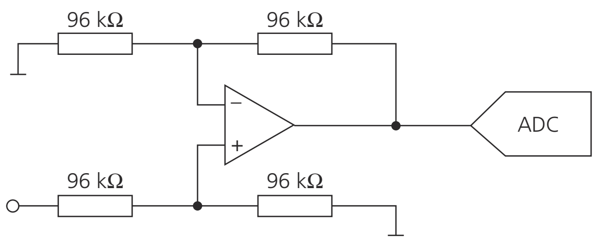
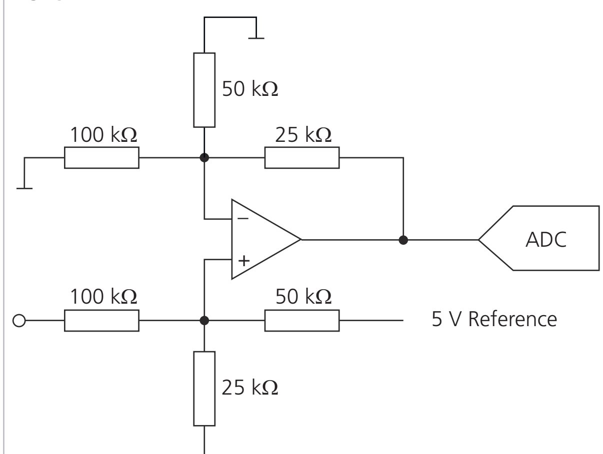
1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Signal[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit

[2] The current flow into the ADC input pin is affected by the input signal and the internal reference voltage (refer to Circuit diagrams on page 247). Therefore, a specific static impedance (R = U/I) does not exist for this ADC, because it changes with the absolute voltage of the input signal. Instead, the dynamic impedance is specified (R = ΔU/ΔI), because the dynamic impedance takes only changes of the DC signal into account, not the absolute values.

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the analog inputs:

Signal		I/O Circuit
Analog inputs	ADC Type 4 channel 1 … 16	DS1511: 
		DS1511B1: 

Related topics

Basics

ADC Unit Type 4 (MicroAutoBox II Features 📖)

Analog Outputs

Pin description

The following table gives a description of the analog output pins:

Pins	Signal	Module	Default state	Description / Function
Z2, Y2, X2, W2	DAC1 … DAC4	DAC Type 3	0 V	Standard analog outputs 12-bit digital values are converted to analog ouputs by the DAC module.

Default state means the state of the signal during reset.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

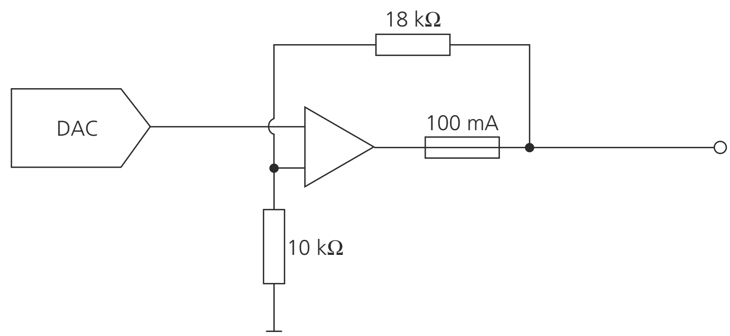
- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
DAC1 … DAC4	V_{DAC}	Full scale	4.44	4.50	4.56	V
	Resolution	Fully monotonic	12			bit
	Offset error	Delivery state; $T_{Housing}$ = 25 °C		2		mV
	Gain error			0.5		LSB
	Offset error	$T_{Housing}$ = –40 °C ... +85 °C	–10		+10	LSB
	Gain error		–0.5		0.5	%
	I_{DACout}	max. sink/ source current	–5		5	mA
	V_{DACSAT}	Output voltage when sinking I_{DACout} = –5 mA and CODE = 000H			0.3	V
AC characteristics						
DAC1 … DAC4	Settling time	Settling time of output (to 1 LSB)			150	µs
	f_{gDAC}	Low-pass cutoff frequency of reconstruction filter (3 dB)	10.2	10.8	11.4	kHz

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

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the analog outputs:

Signal		I/O Circuit
Analog outputs	DAC1 … DAC4 (DAC Type 3)	

Related topics

Basics

DAC Unit Type 3 (MicroAutoBox II Features 🕮)

Interfaces

Pin description

The following table gives a description of the interface pins available at the ZIF I/O connector.

Tip

The pinout of the ECU interface connectors, USB device connector, and Ethernet I/O connector is not documented. Use a suitable dSPACE connection cable.

The interfaces are provided by CAN_TP1 modules. Each module support two CAN channels, one RS232 channel, and either one LIN channel or one ISO 9141 channel.

Pins	Signal	Module Type	Module Number	Description / Function
c3	CAN 1 low	CAN Type 1	Module 1	CAN controller: ▪ CAN 1 = CAN of module number 1, channel number 1 ▪ CAN 2 = CAN of module number 1, channel number 2 ▪ CAN 3 = CAN of module number 2, channel number 1 ▪ CAN 4 = CAN of module number 2, channel number 2
c2	CAN 1 high			

Pins	Signal	Module Type	Module Number	Description / Function
b3	CAN 2 low	CAN Type 1		▪ ISO 11898 interface ▪ The MicroAutoBox II CAN buses are not equipped with bus termination by default. For information on terminating the CAN buses, refer to How to Terminate the CAN Bus on page 110.
b2	CAN 2 high			
B3	CAN 3 low	CAN Type 1	Module 2	
B2	CAN 3 high			
A3	CAN 4 low	CAN Type 1		
A2	CAN 4 high			
c6	Serial 1 RXD[1]	CAN Type 1	Module 1	RS232 interface: Serial 1 = RS232 of module number 1
c5	Serial 1 TXD[1]			
b5	Serial 2 K / LIN[1]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 2 = LIN of modul number 1 ▪ ISO 9141 interface: Serial 2 = K and L lines of modul number 1 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
b6	Serial 2 L[1]			
B6	Serial 3 RXD[1]	CAN Type 1	Module 2	RS232 interface: Serial 3 = RS232 of module number 2
B5	Serial 3 TXD[1]			
A5	Serial 4 K / LIN[1]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 4 = LIN of modul number 2 ▪ ISO 9141 interface: Serial 4 = K and L lines of modul number 2 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
A6	Serial 4 L[1]			

1) For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 📖).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Interface[1)]	**Parameter**	**Conditions / Comments**	**Min.**	**Typ.**	**Max.**	**Unit**
Host PC	Protocol	TCP/IP				
	Bitrate			▪ 10/1000[2)] ▪ 10/100[3)]		Mbit
	Data throughput				2.6	MB/sec
	Voltage levels	Ethernet standard				
Ethernet I/O	Protocol	UDP/IP				
	Bitrate			1000		Mbit
	Voltage levels	Ethernet standard				

Interface[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
USB	USB 2.0 standard (USB Flight Recording)					
	Data throughput	without connected host tool			1280	kB/sec
		with connected host tool			1024	kB/sec
		without data loss during cold start (dependent on the boot time of the host interface)			640	kB/sec
	Current				1.3	A
	Voltage				5	V
ECU	Bit rate	LVDS mode			250	MBit
		LVDS2 mode			560	
	Cable length	2-paired twisted pair			5	m
	Cable type		CAT5			
	Voltage levels	LVDS standard				
	Full duplex data rate[4]	LVDS mode — Single transfer			5	MWord /s
		LVDS2 mode — Single transfer			11.2	MWord /s
		LVDS2 mode — Block transfer			28	MWord /s
	RAM size[4]	LVDS / LVDS2 mode	16			kWord
	FIFO size[4]	LVDS / LVDS2 mode (Transmit buffer)	1			kWord
CAN	Bit rate	ISO 11898 interface			1	MBaud
Serial 1/3 RS232-Interface	Bit rate		14		115.2k	Baud
	TX output voltage swing	3 kΩ load	±5	±9		V
	$V_{RxinLow}$	RX input threshold low		1.4	0.8	V
	$V_{RxinHigh}$	RX input threshold high	2.0	1.4		V
	Word length		5		8	bit
Serial 2/4 ISO9141-Interface	Bit rate	R_{KO} = 510 Ω; C_K ≤ 1.3 nF	14		50k	Baud
	Word length		5		8	bit
Serial 2/4 LIN Interface	Bit rate		14		20k	Baud

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) Since board revision DS1401-23 (available since dSPACE Release 7.2).
3) Before board revision DS1401-23
4) Word is 16-bit wide

Baud rate calculation of the serial interface

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error.

The UART baud rate generator provides several baud rates:

To calculate the divisor T for a chosen baud rate

$$T = \mathrm{Round}\left(\frac{921600}{\mathrm{BR\ (chosen)}}\right)$$

BR (chosen) = The baudrate to be generated
T = The baudrate generator divisor ($8 \le T \le 65535$)

To calculate the real baud rate from a given divisor T

$$\frac{\mathrm{BR\ (real)}}{\mathrm{Baud}} = \frac{921600}{T}$$

BR (real) = The baudrate you get
T = The baudrate generator divisor ($8 \le T \le 65535$)

To calculate the resulting error

$$\frac{\mathrm{Error_{BR}}}{100\%} = \frac{\mathrm{BR\ (real)} - \mathrm{BR\ (chosen)}}{\mathrm{BR\ (chosen)}}$$

Note

If $\mathrm{Error_{BR}} \le 2\%$, messages will be transferred and received correctly.

Related topics

Basics

CAN Support (MicroAutoBox II Features)
LIN Support (MicroAutoBox II Features)

References

Serial Interface (MicroAutoBox II Features)

Data Sheet MicroAutoBox II 1401/1511/1514

Where to go from here

Information in this section

Overview and General Information

Where to go from here

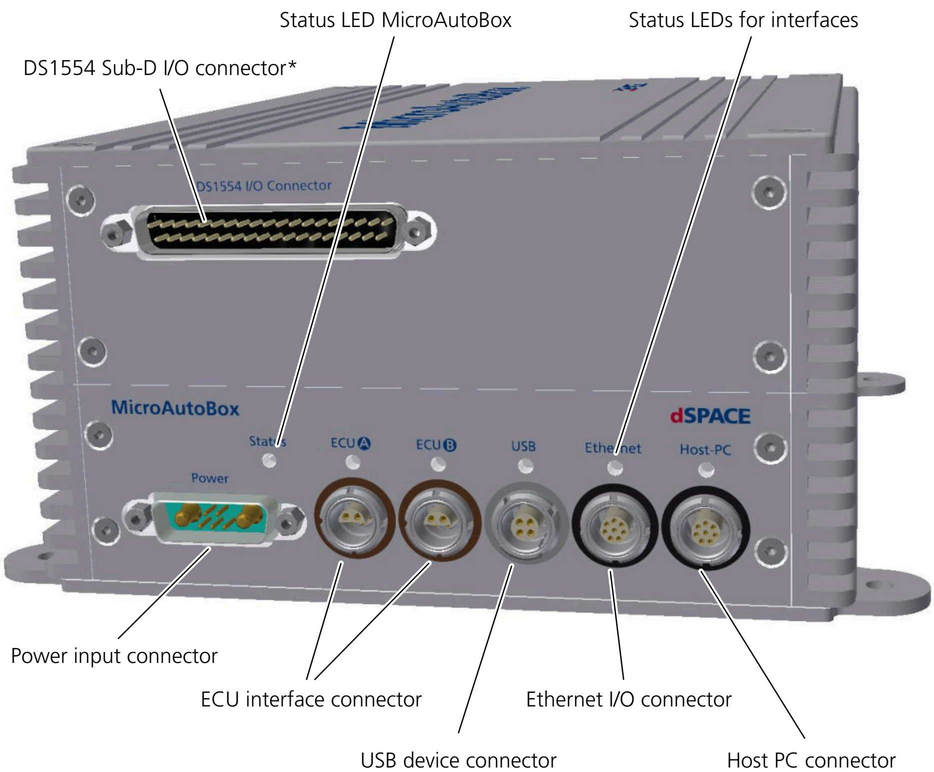
Information in this section

Housing Components

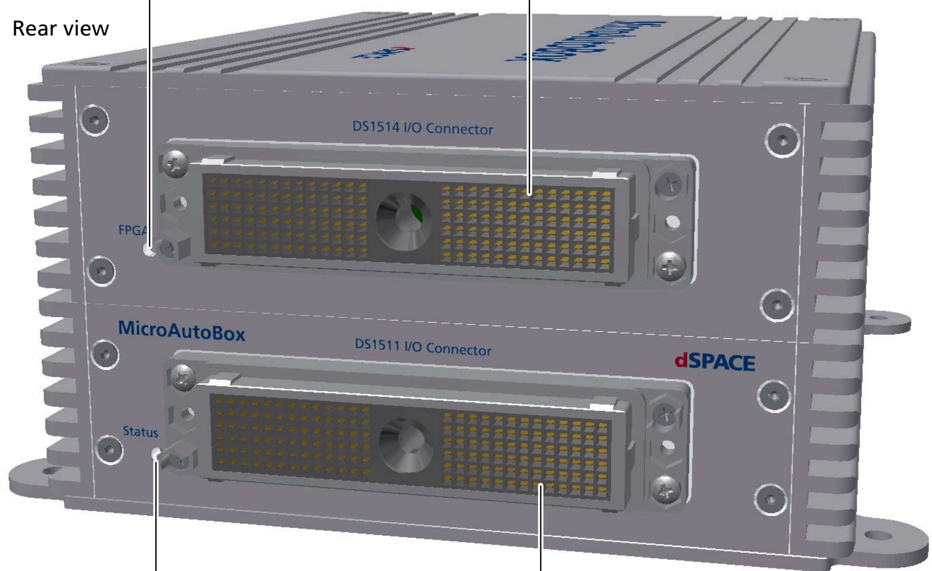
Connectors and status LEDs

The illustrations show where the connectors and status LEDs are located on MicroAutoBox II 1401/1511/1514.

Front view



* Only with DS1554 Engine Control I/O Module



MicroAutoBox II 1401/1511/1514 contains the following connectors and LEDs:

Power input connector Supplies the required power to MicroAutoBox II. It is a 7-pin, male Sub-D connector with two high-current pins.

A preconfigured cable with a matching connector and a separate power input connector are included in each MicroAutoBox II package. For the pinout and further details on the preconfigured cable, refer to Power Input Connector on page 274.

Status LED MicroAutoBox Shows you different states and potential malfunctions.

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED (= dual LED) shows different states indicated by the LED color:

- LED is red: Reset state and no application is downloaded to the real-time processor.
- LED is green: Application is running.
- LED is flashing red: MicroAutoBox II is in secured mode. For further instructions, refer to Checking MicroAutoBox II on page 506.

The status LED on the front panel has the same functionality as the status LED on the rear panel of MicroAutoBox II.

ECU interface connectors Provide communication to ECUs based on the LVDS standard, for example, in bypassing scenarios or to connect a RapidPro system (used as I/O subsystem). The ECU interface connectors are 4-pin LEMO connectors. Matching cables are supplied from dSPACE on request.

The corresponding LED is lit green, if power at both ends of the link is available and the relevant connection is serviceable. The LED flashes when data is being sent or received.

The table below shows the different ECU interfaces integrated into MicroAutoBox II and the display names they are mapped to in the experiment software, for example, ControlDesk.

Display Name in Software	Connectors Built-in at MicroAutoBox II	
	ECU A	ECU B
ECU 1	✓	–
ECU 2	–	✓

USB device connector A 4-pin LEMO connector to connect an USB mass storage device to use the USB Flight Recorder feature of MicroAutoBox II. A matching cable with a LEMO-USB adapter is supplied from dSPACE on request.

> **Note**
>
> To use the USB Flight Recorder, a separate license is required.

The possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	No USB device is connected.
Green	USB device is connected and flight recorder is not running.
Green blinking	USB device is connected and flight recorder is running.
Orange	USB device is full and the active flight recorder is specified not to overwrite old files.
Red	Write error when accessing the USB device, for example, if the device was removed while the flight recorder was running.

For further information, refer to Flight Recorder (MicroAutoBox II Features 📖).

Ethernet I/O connector An 8-pin LEMO connector that provides communication to external devices, such as PCs or ECUs based on the UDP/IP Ethernet protocol, for example, in bypassing scenarios.

A matching cable with a LEMO-RJ45 adapter is supplied from dSPACE on request.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

For installation instructions, refer to How to Connect a MicroAutoBox II to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 📖).

Host PC connector Provides the communication between MicroAutoBox II and your host PC based on the Ethernet TCP/IP protocol. The connector is a 8-pin LEMO connector. A matching cable is included in each MicroAutoBox II package.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

Tip

The Ethernet I/O connector and the Host PC connector are internally connected by a common gigabit Ethernet switch (valid for base board DS1401-25ff).
This simplifies the connection options. For an example, refer to Connecting an ECU with DCI-GSI2 for Simultaneous Calibration and ECU Interfacing (ECU Interfaces Hardware Installation and Configuration 📖).

DS1554 Sub-D I/O connector The 37-pin Sub-D I/O connector is used to connect the following sensors to the DS1554 Engine Control I/O Module:

- Crankshaft and camshaft sensors
- Knock sensors

This connector is available only if the DS1554 Engine Control I/O Module is installed.

For the pinout, refer to DS1554 Sub-D I/O Connector on page 412.

Status LED FPGA

- If the DS1552 Multi-I/O Module is installed and you use the RTI DS1552 I/O Extension Blockset the possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	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 you use the RTI FPGA Programming Blockset the possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	FPGA is not configured.
Green	Correct behavior.
Orange	The FPGA application can control the LED to light orange. For further information, refer to FPGA_IO_WRITE_BL (FPGA1401Tp1 with Multi-I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖) or FPGA_IO_WRITE_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (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.

LED Status	Meaning
Flashing blue	The FPGA die temperature reaches a critical range for operating. 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.[1]
Blue	The FPGA die temperature is too hot for operating. 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 MicroAutoBox II or reload the user application.

[1] For details on reading the die temperature measurement, refer to FPGA_IO_READ_BL (FPGA1401Tp1 with Multi-I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference) or FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference).

DS1511 ZIF I/O connector The 156-pin zero insertion force (ZIF) I/O connector provides access to the most input and output signals provided by MicroAutoBox II. A matching connector is included in each MicroAutoBox II package. For the pinout, refer to DS1511 ZIF I/O Connector on page 267.

DS1514 ZIF I/O connector The 156-pin zero insertion force (ZIF) I/O connector provides the signals of the installed I/O module and IP modules. For the pinout, refer to DS1514 ZIF I/O Connector on page 269.

General Data

General characteristics The following table shows some general characteristics of MicroAutoBox II:

Parameter		Specification[1]
Base board (DS1401-20ff.)	Processor	▪ PPC750 GL Power PC ▪ 900 MHz clock frequency ▪ Real-time clock ▪ 100 MHz bus clock
	Memory	▪ 8 MB global RAM ▪ 16 MB local RAM ▪ 16 MB flash memory
	Onboard sensors[2]	Pressure sensor: ▪ Base board DS1401-23ff. ▪ Range: 50 kPa … 115 kPa ▪ Accuracy: 1 kPa ▪ Sample rate: approx. 200 Hz

Parameter		Specification[1]
		Acceleration sensor ▪ Base board DS1401-23ff. ▪ Range: ±2 g … ±8 g in 3 axis (x/y/z) ▪ Resolution: 10 bit per axis ▪ Sample rate: max. 800 Hz ▪ FIFO buffer: 512 words (to read and write bursts)
Communication interfaces		▪ 1 x Host PC interface based on Ethernet TCP/IP protocol ▪ 1 x Ethernet I/O interface based on Ethernet UDP/IP protocol for Ethernet bypassing scenarios ▪ 2 x ECU interface based on LVDS standard ▪ 1 x USB interface for USB flight recording (separate license)

I/O connectors		▪ 2 x 156-pin ZIF I/O connector
		  ▪ Contact resistance: max. 15 mΩ
		  ▪ Durability: 10000 cycles
		  ▪ Continuous current per pin ($T_{operating}$ = +85 °C): max. 2.5 A
		▪ 1 x 7-pin power supply input connector

FPGA (on DS1514 I/O Board)		Xilinx® Kintex®-7 FPGA XC7K325T
Housing dimensions	Width	202 mm (7.95 in.)
	Height	96 mm (3.78 in.)
	Depth	222 mm (8.74 in.)
Weight		About 3.2 kg (7.05 lb.) without external cables and modules

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

2) For further information on the sensors, refer to Onboard Sensors (MicroAutoBox II Features 🕮).

Supported features

For an overview of the features that this MicroAutoBox II variant supports, refer to Feature Support (MicroAutoBox II Features 🕮).

Absolute Maximum Levels

Avoiding damage to the system

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

Levels

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

Parameter	Specification[1)]	Condition / Description
VBAT	–40 V … +100 V	Load dump- and reverse protection
VDRIVE	0 V … +45 V	—
All digital output voltages	(VDRIVE – 45 V) … +45 V	—
All digital input voltages	(VDRIVE – 45 V) … +45 V	—
All analog output voltages	–30 V … +40 V	—
All analog input voltages	–40 V … +40 V	—
VSENS output on DS1511 ZIF I/O connector	0 V … +40 V	—
VSENS output on DS1514 ZIF I/O connector	Provided by the DS1552 Multi-I/O Module (refer to Absolute Maximum Levels on page 380) or the DS1554 Engine Control I/O Module (refer to Absolute Maximum Levels on page 408).	
VBATprot output	0 V … +45 V	—
RS232 transceiver output on the DS1511 ZIF I/O connector	–30 V … +30 V	—
RS232 transceiver input on the DS1511 ZIF I/O connector	–30 V … +30 V	—
RS232 transceiver on the DS1514 ZIF I/O connector	Provided by the DS1552 Multi-I/O Module (refer to Absolute Maximum Levels on page 380) if it is installed.	
$V_{CAN\ high}$, $V_{CAN\ low}$ on the DS1511 ZIF I/O connector	–60 V … +60 V.	Voltage level on CAN high and CAN low pins.
$V_{Diff\ (CAN\ high\ -\ CAN\ low)}$ on the DS1511 ZIF I/O connector	–3.5 V … +3.5 V	Voltage difference between CAN high and CAN low pins (due to termination resistors).
CAN interface on the DS1514 ZIF I/O connector	Provided by the optional DS4342 CAN FD Interface Module (refer to Absolute Maximum Levels on page 444).	
Serial K / LIN	–20 V … +32 V, but not more than VBAT	—
Serial L	–24 V … +30 V, but not more than VBAT	—
FlexRay bus lines	Provided by the optional DS4340 FlexRay Interface Module (refer to Absolute Maximum Levels on page 432).	
All outputs short circuit to GND	Continuous	—
Continuous power dissipation	Max. 50 W	$T_{operating}$ = +85 °C Power dissipated by the MicroAutoBox II itself. The power of the connected loads (VBATprot/VSENS) must be added.
Operating temperature	–40 °C … +85 °C [2)]	—
Storage temperature	–55 °C … +90 °C	—

Parameter	Specification[1]	Condition / Description
Relative humidity	10% ... 95%	Noncondensing
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

[2] Mounted modules and a FPGA application with a high FPGA utilization or toggle rate increase the power dissipation. This might lead to a reset of the FPGA while the operating temperature is less than 85 °C. For details, refer to Parameters Page (FPGA_IO_READ_BL) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).

Battery Characteristics

Characteristics of the internal battery

The following table shows the characteristics of the battery mounted on the DS1401 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

Safety Precautions for Shipping a MicroAutoBox II... 24

Certifications

CE compliance

MicroAutoBox II meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Applied standards

The characteristics of MicroAutoBox II 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 266.
	CISPR 11, EN 55011 Group 1, Class A	Emission standard for industrial environments
	RTCA/DO160G: Dec. 2010: Section 21.4	Environmental conditions and test procedures for airborne equipment: Conducted RF Emissions, Category: B, L, M&H[2)]
	RTCA/DO160G: Dec. 2010: Section 21.5	Environmental conditions and test procedures for airborne equipment: Radiated RF Emissions, Category: M[2)]
Vibration	ISO 16750-3:2007 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 4 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 4 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 … 2000 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 A Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 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.
2) For further information, refer to dSPACE Support.

Vibration and shock tests

To verify the reliability of MicroAutoBox II under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox II 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 II during run time. Otherwise, you might influence the measurements.

Connector Pinouts

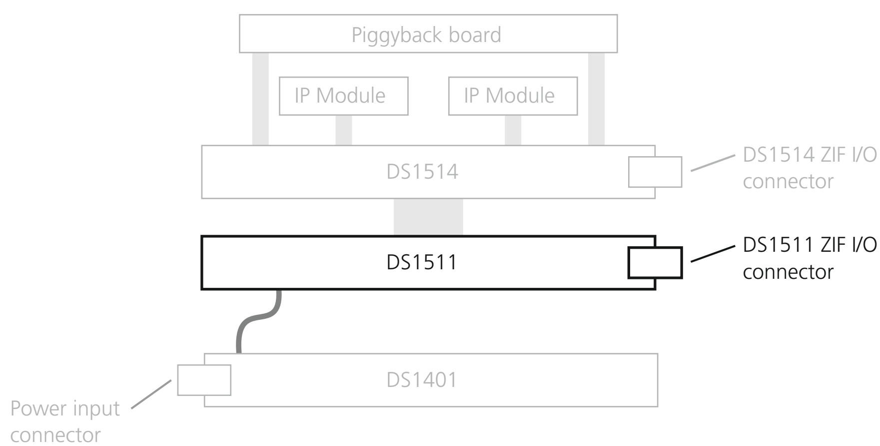
Where to go from here

Information in this section

DS1511 ZIF I/O Connector

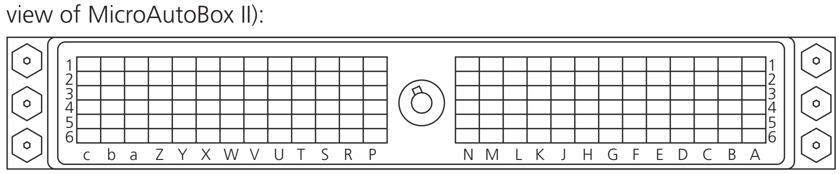
Introduction

The **DS1511 I/O connector** is a 156-pin zero insertion force (ZIF) connector giving access to the input and output signals provided by DS1511 I/O Board. The illustration below shows the internal assembly of the MicroAutoBox II 1401/1511/1514.



Pinout

The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of the I/O connector:

1		2		3		4		5		6		
GND	in	CAN 4 high	i/o	CAN 4 low	i/o	GND	in	Serial 4 K / LIN[1]	i/o	Serial 4 L[1]	in	*A*
GND	in	CAN 3 high	i/o	CAN 3 low	i/o	GND	in	Serial 3TXD[1]	out	Serial 3 RXD[1]	in	*B*
GND	in	GND	in	GND	in	GND	in	GND	in	GND	in	*C*
GND	in	DigP 1 ch 8[2]	out	DigP 1 ch 16	out	DigP 2 ch 8[2]	out	DigP 2 ch 16	out	DigP 3 ch 8	out	*D*
GND	in	DigP 1 ch 7	out	DigP 1 ch 15	out	DigP 2 ch 7	out	DigP 2 ch 15	out	DigP 3 ch 7	out	*E*
GND	in	DigP 1 ch 6	out	DigP 1 ch 14	out	DigP 2 ch 6	out	DigP 2 ch 14	out	DigP 3 ch 6	out	*F*
GND	in	DigP 1 ch 5	out	DigP 1 ch 13	out	DigP 2 ch 5	out	DigP 2 ch 13	out	DigP 3 ch 5	out	*G*
GND	in	DigP 1 ch 4	out	DigP 1 ch 12	out	DigP 2 ch 4	out	DigP 2 ch 12	out	DigP 3 ch 4	out	*H*
GND	in	DigP 1 ch 3	out	DigP 1 ch 11	out	DigP 2 ch 3	out	DigP 2 ch 11	out	DigP 3 ch 3	out	*J*
GND	in	DigP 1 ch 2	out	DigP 1 ch 10	out	DigP 2 ch 2	out	DigP 2 ch 10	out	DigP 3 ch 2	out	*K*
GND	in	DigP 1 ch 1	out	DigP 1 ch 9	out	DigP 2 ch 1	out	DigP 2 ch 9	out	DigP 3 ch 1	out	*L*
VSENS	out	DigP 1 ch 8 [2]	in	DigP 1 ch 16	in	DigP 2 ch 8[2]	in	DigP 2 ch 16	in	DigP 3 ch 8	in	*M*
VDRIVE	in	DigP 1 ch 7	in	DigP 1 ch 15	in	DigP 2 ch 7	in	DigP 2 ch 15	in	DigP 3 ch 7	in	*N*
VBAT prot	out	DigP 1 ch 6	in	DigP 1 ch 14	in	DigP 2 ch 6	in	DigP 2 ch 14	in	DigP 3 ch 6	in	*P*
REMOTE	in	DigP 1 ch 5	in	DigP 1 ch 13	in	DigP 2 ch 5	in	DigP 2 ch 13	in	DigP 3 ch 5	in	*R*
GND	in	DigP 1 ch 4	in	DigP 1 ch 12	in	DigP 2 ch 4	in	DigP 2 ch 12	in	DigP 3 ch 4	in	*S*
GND	in	DigP 1 ch 3	in	DigP 1 ch 11	in	DigP 2 ch 3	in	DigP 2 ch 11	in	DigP 3 ch 3	in	*T*
GND	in	DigP 1 ch 2	in	DigP 1 ch 10	in	DigP 2 ch 2	in	DigP 2 ch 10	in	DigP 3 ch 2	in	*U*
GND	in	DigP 1 ch 1	in	DigP 1 ch 9	in	DigP 2 ch 1	in	DigP 2 ch 9	in	DigP 3 ch 1	in	*V*
GND	in	Analog ch 4	out	Analog ch 4	in	Analog ch 8	in	Analog ch 12	in	Analog ch 16	in	*W*
GND	in	Analog ch 3	out	Analog ch 3	in	Analog ch 7	in	Analog ch 11	in	Analog ch 15	in	*X*
GND	in	Analog ch 2	out	Analog ch 2	in	Analog ch 6	in	Analog ch 10	in	Analog ch 14	in	*Y*
GND	in	Analog ch 1	out	Analog ch 1	in	Analog ch 5	in	Analog ch 9	in	Analog ch 13	in	*Z*
GND	in	SGND	in	Ana trigger 1	in	Ana trigger 2	in	Ana trigger 3	in	Ana trigger 4	in	*a*
GND	in	CAN 2 high	i/o	CAN 2 low	i/o	GND	in	Serial 2 K / LIN[1]	i/o	Serial 2 L[1]	in	*b*
GND	in	CAN 1 high	i/o	CAN 1 low	i/o	GND	in	Serial 1 TXD[1]	out	Serial 1 RXD[1]	in	*c*

[1] For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 📖).

[2] DigP = Port number; ch = Channel number

Note

To use the digital inputs and outputs, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the logic level needed. *This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.* You have to connect VDRIVE (pin N1) to VSENS (pin M1) or VBATprot (pin P1). Use the preconfigured jumper cable which is included in the MicroAutoBox II package.

Signal descriptions

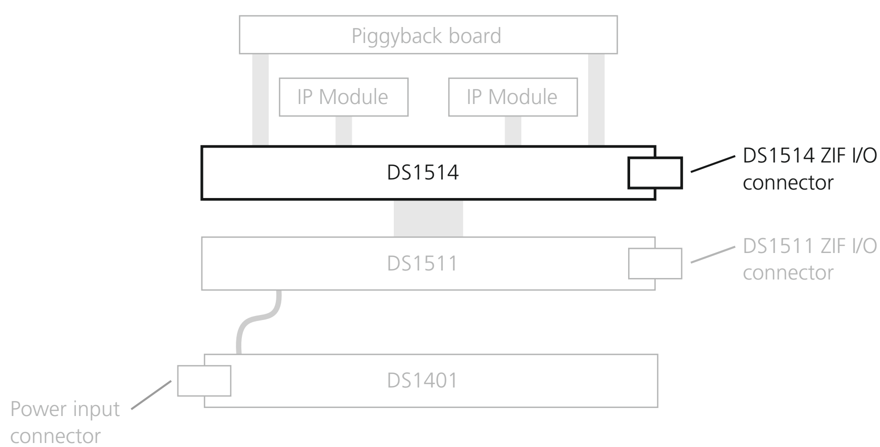
For descriptions of the signals which are available on the DS1511 ZIF I/O connector, refer to:

- Digital Inputs on page 279
- Digital Outputs on page 282
- Analog Inputs on page 287
- Analog Outputs on page 292
- CAN, LIN, serial: Interfaces on page 294

DS1514 ZIF I/O Connector

Introduction

The **DS1514 I/O connector** is a 156-pin zero insertion force (ZIF) connector giving access to various I/O signals if an IP module and/or an I/O module are/is installed. The following illustration shows the internal assembly of the MicroAutoBox II 1401/1511/1514 with IP modules and an I/O module installed.



Pinout

The DS1514 ZIF I/O connector provides only signals of the installed I/O module and IP modules.

For pinouts of the DS1514 ZIF I/O connector, refer to the following topics:

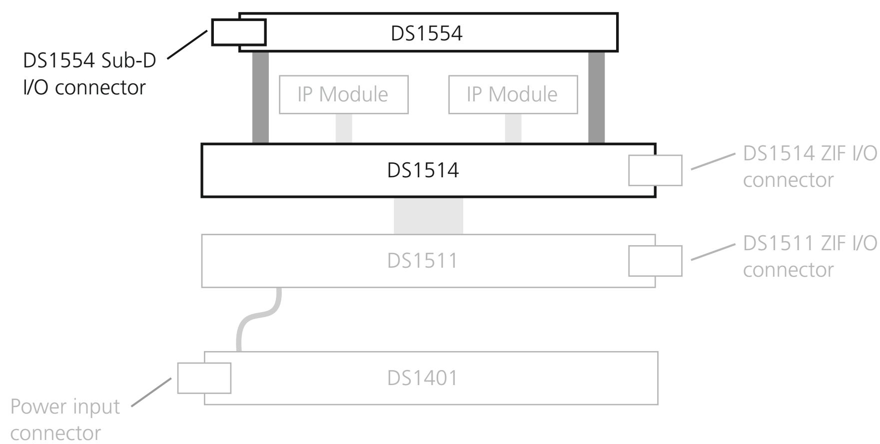
- DS1552 Multi-I/O Module: DS1514 ZIF I/O Connectors on page 382
- DS1554 Engine Control I/O Module: DS1514 ZIF I/O Connector on page 410
- DS4340 FlexRay Interface Module: DS1514 ZIF I/O Connectors on page 436
- DS4342 CAN FD Interface Module: DS1514 ZIF I/O Connectors on page 448

DS1554 Sub-D I/O Connector

Introduction

The DS1554 Engine Control I/O Module provides a 37-pin, male Sub-D connector at the front of MicroAutoBox II.

The illustration below shows the internal assembly of a MicroAutoBox II 1401/1511/1514 with a DS1554 Engine Control I/O Module installed.



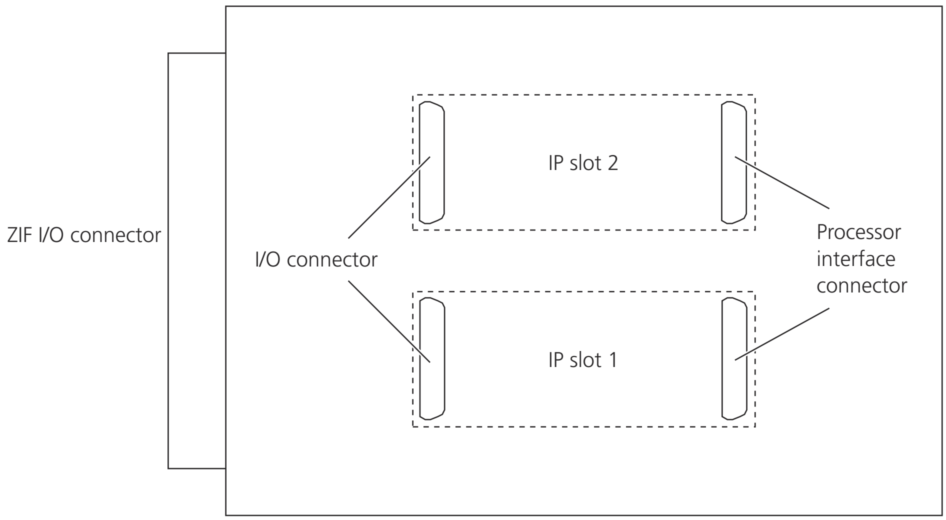
Pinout

The DS1554 Sub-D I/O connector only provides signals of the installed DS1554 Engine Control I/O Module. For the pinout, refer to DS1554 Sub-D I/O Connector on page 412.

IP Module Connectors

Introduction

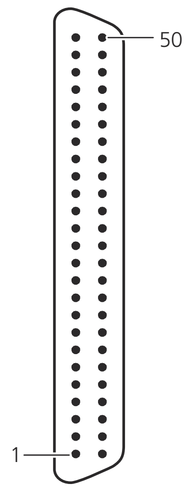
The DS1514 provides two slots to install IP modules. Each slot provides two AMP connectors: I/O connector and processor interface connector. The following illustration shows the top view of MicroAutoBox II.



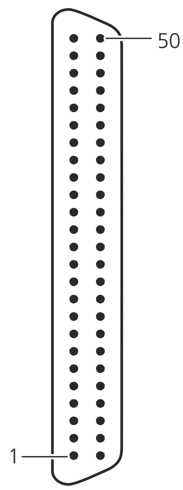
ZIF I/O connector
I/O connector
IP slot 2
IP slot 1
Processor interface connector

Pinout

I/O connector - IP module slot 1 The following table shows the signal mapping of the IP module I/O connector on slot 1 to the DS1514 ZIF I/O connector (rear of MicroAutoBox II):

IP Module I/O Connector	Pin	ZIF Pin for IP Slot 1		Pin	ZIF Pin for IP Slot 1
	25	-		50	M3
	24	-		49	M4
	23	-		48	L3
	22	-		47	-
	21	-		46	K3
	20	K5		45	K4
	19	K6		44	J3
	18	J5		43	-
	17	J6		42	-
	16	H5		41	-
	15	H6		40	-
	14	G5		39	-
	13	-		38	-
	12	-		37	-
	11	-		36	-
	10	-		35	-
	9	-		34	-
	8	-		33	-
	7	-		32	-
	6	-		31	-
	5	C6		30	-
	4	-		29	-
	3	-		28	-
	2	-		27	-
	1	-		26	-

I/O connector - IP module slot 2 The following table shows the signal mapping of the IP module I/O connector on slot 2 to the DS1514 ZIF I/O connector (rear of MicroAutoBox II):

IP Module I/O Connector	Pin	ZIF Pin for IP Slot 2	Pin	ZIF Pin for IP Slot 2
	25	-	50	b3
	24	-	49	b4
	23	-	48	a3
	22	-	47	-
	21	-	46	Z3
	20	Z5	45	Z4
	19	Z6	44	Y3
	18	Y5	43	-
	17	Y6	42	-
	16	X5	41	-
	15	X6	40	-
	14	W5	39	-
	13	-	38	-
	12	-	37	-
	11	-	36	-
	10	-	35	-
	9	-	34	-
	8	-	33	-
	7	-	32	-
	6	-	31	-
	5	S6	30	-
	4	-	29	-
	3	-	28	-
	2	-	27	-
	1	-	26	-

Processor interface connector - slot 1 and slot 2 The pinout of the processor interface connector (slot 1 and slot 2) complies with IP Modules Draft Standard VITA 4-1995. For further information, refer to the documentation of the standard.

Power Input Connector

Introduction

MicroAutoBox II provides a power input connector. It 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).

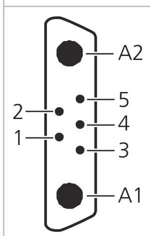
Feature for MicroAutoBox Embedded PC The pinout of the power input connector features two additional signals for remote control when MicroAutoBox II is combined with MicroAutoBox Embedded PC.

Refer to the following topics:

- MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Power Input Connector on page 464 and Power Inputs and Outputs on page 466
- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Power Input Connector on page 481 and Power Inputs and Outputs on page 486

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (6 V … 36 V DC)		
			5	REMOTE_PULLUP
	2	Reserved for MicroAutoBox Embedded PC [2]	4	REMOTE[3]
	1	Do not connect	3	Reserved for MicroAutoBox Embedded PC [2]
	A1	GND		

[1] NOTE: Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] Refer to Power Input Connector on page 464 or Power Input Connector on page 481.

[3] The REMOTE input must be connected via switch or bridge to VBAT to run the MicroAutoBox II.

Matching cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is for running MicroAutoBox II with a laboratory power supply during development. Therefore, the REMOTE pin (pin 4) is shorted to the VBAT pin (pin A2) inside the connector in order to save a separate switch. Do not use this cable in the vehicle. Otherwise, MicroAutoBox II will always be turned on.

The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1)] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1)] The cable is labeled with this type number.

⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Pin description

The following tables provide a description of the pins used for power input, remote input, and supply of digital I/O circuits.

Power input connector The following table lists the pin description of the power input connector on the front:

Pins	Signal	Description / Function
A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery/power supply. This signal is also connected to the housing of MicroAutoBox II.
4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin directly to VBAT, MicroAutoBox II will always be on, and the vehicle battery will soon be depleted if the engine is not running. Thus, a switch is highly recommended. Refer to Connecting to Power Supply on page 42. You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference 📖). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage.

Pins	Signal	Description / Function
5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

DS1511 ZIF I/O connector The following table lists the pin description of the DS1511 I/O Boards ZIF I/O connector on the rear:

Pins	Signal	Description / Function
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	GND	Main power supply return and reference for all input and output signals. Use the nearest possible GND pin as reference for your signals in order to keep noise levels at minimum. The housing of MicroAutoBox II is also connected to GND.
a2	SGND	Internally connected to GND with a 0 Ω resistor.
N1	VDRIVE	This input supplies all digital input and output circuits located on the DS1511 I/O Board. ▪ Connect this input to VSENS to set 5 V logic levels for your inputs/outputs. ▪ Connect this input to VBATprot to set automotive-compatible logic levels for your inputs/outputs. ▪ Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected at this signal. For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
M1	VSENS	Sensor supply output. VSENS is switched on and off with the REMOTE pin. Use this output to supply your sensors and/or VDRIVE. If you need 5 V logic levels at the inputs/outputs connect VSENS to VDRIVE.
P1	VBAT prot	Protected VBAT output. VBATprot follows VBAT within the specified range and is switched on and off with the REMOTE pin. Use this output to supply VDRIVE when automotive logic levels are needed.
R1	REMOTE	▪ The remote voltage may be used for starting MicroAutoBox II with a remote switch: KL15, for example (output of the ignition/driving switch). ▪ If you connect the remote pin to the vehicle battery directly, MicroAutoBox II will always be turned on, and the vehicle battery will soon be exhausted if the engine is not running. Thus, a switch is highly recommended. ▪ The remote voltage should not exceed the supply voltage.

DS1514 ZIF I/O connector For the pin description, refer to the following topics:

- DS1552 Multi-I/O Module: Power Inputs and Outputs on page 385
- DS1554 Engine Control I/O Module: Power Inputs and Outputs on page 414

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up with an input power consumption < 35 W	6		36[2]	V
	VBAT	Operating	4.5		36[2]	V
	VBAT	Reverse protection			–40	V
	VBAT	Load dump protection			+100	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≥ $V_{iHRemote}$		2		A
	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		5		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
Inrush current	$I_{VBAT\ inrush}$	All inputs/outputs unconnected	see Power supply on page 38			
Digital I/O voltage supply input on DS1511 ZIF I/O connector	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		20		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		1		A
Digital I/O voltage supply input on DS1514 ZIF I/O connector	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		10		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		500		mA
Outputs						
Sensor supply output on DS1511 ZIF I/O connector	VSENS	Output voltage	4.84	5.05	5.25	V
	VSENS = f(T)	Temperature caused voltage drift $T_{Housing}$ = –40 °C ... +85 °C	–2		2	%
	$I_{VSENS,\ max}$	Maximum output current	750			mA

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Sensor supply output on DS1514 ZIF I/O connector	VSENS	Provided by DS1552 (refer to Power Inputs and Outputs on page 385) or DS1554 (refer to Power Inputs and Outputs on page 414).				
Protected VBAT output	VBATprot [3]	I_{Load} = 1A; VBAT = 12 V	11.56	11.78	12	V
	$I_{VBATprot, max}$	Maximum output current			1000	mA
	$I_{ProtPeak}$	Overload current limit (–40 °C ... 85 °C)	4		9	A
	t(overload)	Time to shut off $I_{ProtPeak}$			5	ms

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) With an additional absolute maximum tolerance of +4 V.
3) VBATprot follows VBAT within the specified range.

Related topics

Basics

Digital Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the DS1511 ZIF I/O connector and the DS1514 ZIF I/O connector. For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the digital input pins of the DS1511 ZIF I/O connector:

Pins	Port Number	Signal	Description / Function
V2, U2, T2, S2, R2, P2, N2, M2, V3, U3, T3, S3, R3, P3, N3, M3	1	Channel 1 ... 16 DIO Type 3	Standard discrete digital input with pull-up.
V4, U4, T4, S4, R4, P4, N4, M4, V5, U5, T5, S5, R5, P5, N5, M5	2	Channel 1 ... 16 DIO Type 3	
V6, U6, T6, S6, R6, P6, N6, M6	3	Channel 1 ... 8 DIO Type 3	

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]		Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics							
Digital input channel 1 … 40 DIO Type 3		V_{iH}	Input high voltage	3.1			V
		V_{iL}	Input low voltage			1.2	V
		V_{iHys}	Input hysteresis voltage		1		V
		R_{DigIn}	Pull-up resistor to VDRIVE	17	18	19	kΩ
		C_{DigIn}	Input capacitance		1		nF
DIO Type 3	REMOTE	$V_{iHRemote}$	Input high voltage	4.7			V
		$V_{iLRemote}$	Input low voltage			0.8	V
		$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
		$R_{inRemote}$	Input impedance	60		185	kΩ
AC characteristics							
DIO Type 3	Inputs	t_{LowMin}	Minimum pulse width low		250	500	ns
		$t_{HighMin}$	Minimum pulse width high		300	600	ns
		F_{max}	Duty cycle: 50 %		1.8		MHz
			Duty cycle: 1 % or 99 %		33		kHz

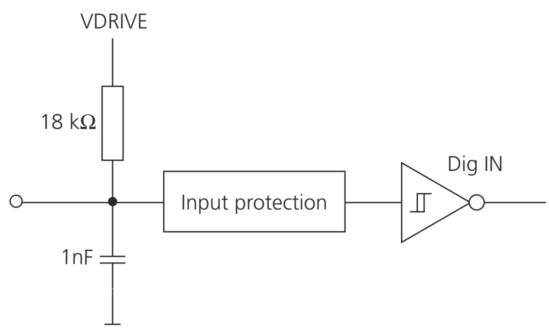
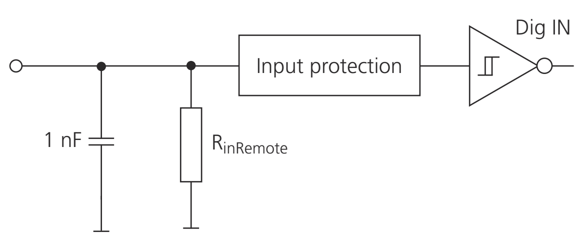
1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Powering digital inputs and outputs of the DS1511 ZIF I/O connector

> **Note**
>
> To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.
>
> For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the digital inputs:

Signal		I/O Circuit
DIO Type 3	Channel 1 ... 40	 For proper operation, VDRIVE must have a level above the maximum input voltage.
	Remote	

Digital inputs on the DS1514 ZIF I/O connector

Only I/O modules can provide digital inputs on the DS1514 ZIF I/O connector. For signal descriptions of the DS1552 Multi-I/O Module, refer to Digital Inputs on page 387.

Related topics

Basics

Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 🕮)
Providing the Supply Voltage to Drive Digital I/O Interfaces.. 47

Digital Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the DS1511 ZIF I/O connector and the DS1514 ZIF I/O connector. For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

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.

Pin description

The following table gives a description of the digital output pins on the DS1511 ZIF I/O connector:

Pins	Port Number	Signal	Default state	Description / Function
L2, K2, J2, H2, G2, F2, E2, D2, L3, K3, J3, H3, G3, F3, E3, D3	1	Channel 1 … 16 DIO Type 3	Tristate	Standard discrete digital output.
L4, K4, J4, H4, G4, F4, E4, D4, L5, K5, J5, H5, G5, F5, E5, D5	2	Channel 1 … 16 DIO Type 3		
L6, K6, J6, H6, G6, F6, E6, D6	3	Channel 1 … 8 DIO Type 3		

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

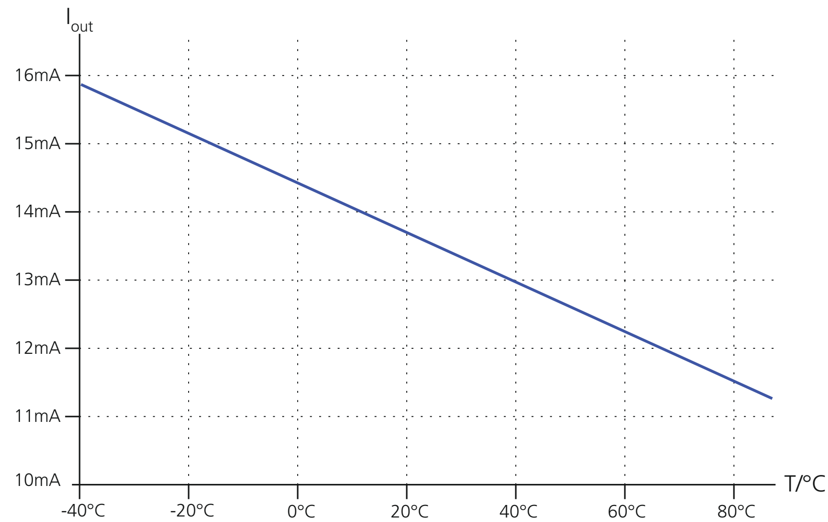
Signal[1]		Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC Characteristics							
Digital output channel 1 … 40 DIO Type 3		V_{oH}	I_{Load} = 0 mA; VDRIVE = 5 V	4.4	4.6		V
		V_{oL}	I_{Load} = 0 mA; VDRIVE = 5 V		0.1	0.3	V
		V_{oH}	I_{Load} = 5 mA; VDRIVE = 5 V	3.2	3.4		V
		V_{oL}	I_{Load} = –5 mA; VDRIVE = 5 V		0.7	0.9	V
		V_{oH}	I_{Load} = 0 mA; VDRIVE = 12 V	11.3	11.6		V
		V_{oL}	I_{Load} = 0 mA; VDRIVE = 12 V		0.1	0.3	V
		V_{oH}	I_{Load} = 5 mA; VDRIVE = 12 V	10.3	10.5		V
		V_{oL}	I_{Load} = –5 mA; VDRIVE = 12 V		0.7	0.9	V
		$\lvert I_{OHmax} \rvert$	Current limit high $T_{Housing}$ = –40 °C … +85 °C	5	13	17	mA
		$\lvert I_{OLmax} \rvert$	Current limit low $T_{Housing}$ = –40 °C … +85 °C	5	14	18	mA
		$\lvert I_{OTLeak} \rvert$	Leakage current tristate $T_{Housing}$ = -40 °C … +85 °C			100	µA
AC Characteristics							
DIO Type 3	Outputs	$t_{minPulseHigh}$	Minimum pulse width high, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		700	1400	ns
		$t_{minPulseLow}$	Minimum pulse width low, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		200	400	ns
		F_{max}	Duty cycle: 50 % VDRIVE = 5 V or 12 V		0.7 [2]		MHz
			Duty cycle: 1 % or 99 % VDRIVE = 5 V or 12 V		14		kHz

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

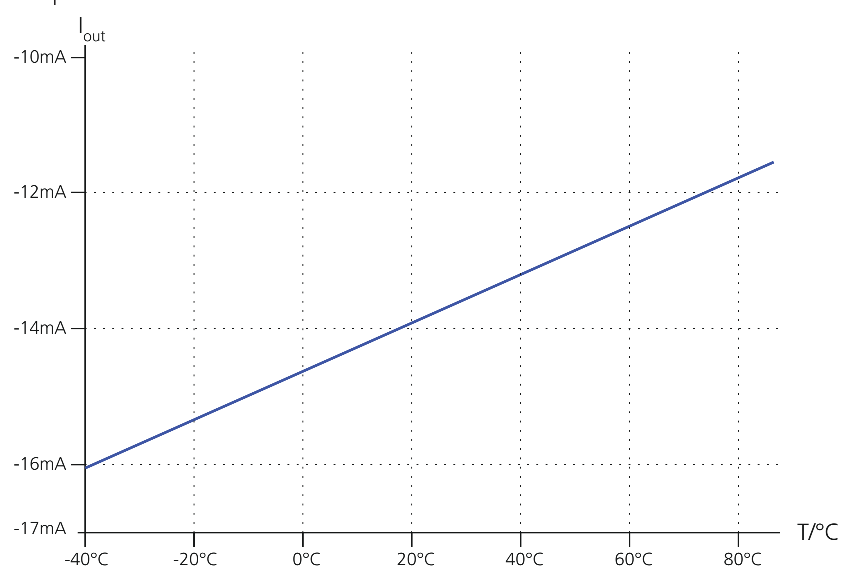
2) Limited by software to 150 kHz

The following illustrations are valid for DIO Type 3 and DIO 1552 Type 1, and show the maximum output current of a digital output circuit as a function of ambient temperature (VDRIVE = 12 V; output is shorted to 6 V):

- Output high

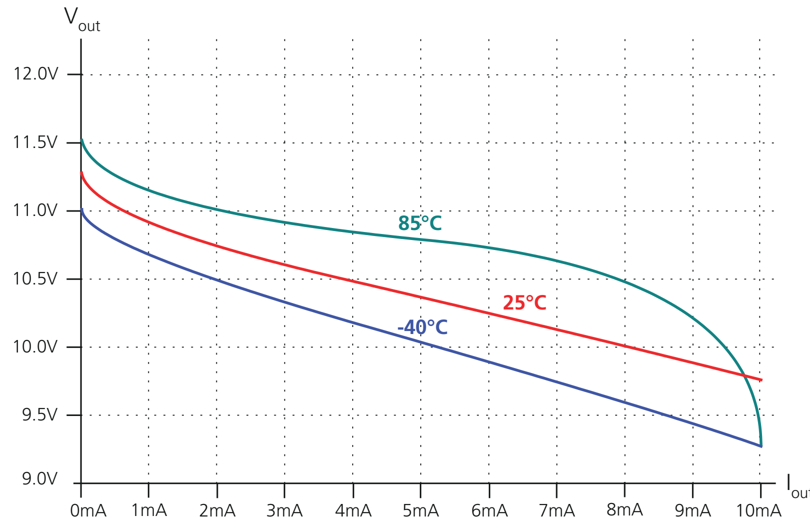


- Output low

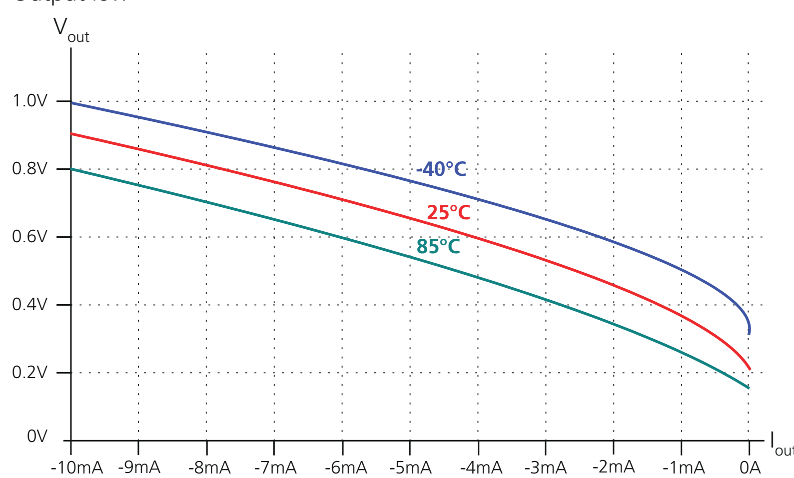


The following illustrations show the typical digital output voltage as a function of the output current (VDRIVE = 12 V):

- Output high



- Output low



Powering digital inputs and outputs of the DS1511 ZIF I/O connector

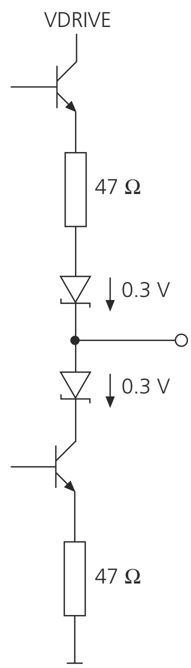
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the digital outputs:

Signal	I/O Circuit
Digital outputs: DIO Type 3	

Digital outputs on the DS1514 ZIF I/O connector

Only I/O modules provide digital outputs on the DS1514 ZIF I/O connector.

For signal descriptions, refer to the following topics:

- If you use a DS1552 Multi-I/O Module, refer to Digital Outputs on page 389.
- If you use a DS1554 Engine Control I/O Module, refer to Digital Outputs on page 416.

Related topics

Basics

Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 📖)
Providing the Supply Voltage to Drive Digital I/O Interfaces.. 47

Digital I/O (Bidirectional)

Introduction

The information on the digital bidirectional I/O channels is relevant only if the DS1514 I/O Board is equipped with an I/O module.

For information on the digital bidirectional I/O channels, refer to the following topics:

- If you use a DS1552 Multi-I/O Module, refer to Digital I/O (Bidirectional) on page 392.
- If you use a DS1554 Engine Control I/O Module, refer to Digital I/O (Bidirectional) on page 421.

Analog Inputs

Note on the cable harness

> **Note**
>
> To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog input pins on the DS1511 ZIF I/O connector:

Pins	Signal	Module	Description / Function
Z3, Y3, X3, W3, Z4, Y4, X4, W4, Z5, Y5, X5, W5, Z6, Y6, X6, W6	ADC channel 1 … 16	ADC Type 4	Analog inputs: ▪ DS1511: 0 V … 5 V ▪ DS1511B1: -10 V … +10 V
a3, a4, a5, a6	External trigger 1 … 4		For information on function of the ADC Type 4 module's trigger signals, refer to Trigger signals (MicroAutoBox II Features 📖).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

ADC Type 4 module The following table shows the characteristics of the ADC Type 4 module of the DS1511 I/O Board.

Signal[1)]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics						
ADC (all 16 channels)	Number of independent input channels			16		
	Resolution			16		bit
	Sample rate	Burst mode with more than 1 sample			1	MSPs
	Input voltage range	DS1511	0		5	V
		DS1511B1	-10		10	V
	Conversion timer	Separate for each channel.				
		Width	27			bit
		Resolution	10			ns
		Interval			1.342	s
	Timer for time stamping	Common for all channels. Two channels are required to carry one 32 bit value.				
		Width	32			bit
		Resolution	10			ns
		Interval			42.9	s
	Buffer size	Software-configurable	1		8192	Samples
	Buffers per channel		3			
	Number of external trigger inputs		4			

Signal[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics - DS1511						
ADC (all 16 channels)	Initial offset error	Below 750 KSPs	-0.5		0.5	mV
	Initial gain error	Below 750 KSPs	-0.25		0.25	%
	Input impedance			192		kΩ
	Offset drift			±10		µV/K
	Gain drift			±6		ppm/K
	Overvoltage protection	Continuous	-20		+30	
		Short term	-50		50	V
External trigger	Input voltage	V_{iH}	2.3			V
		V_{iL}			0.4	V
	Period				1	MHz
	Overvoltage protection	Continuous	-48		50	V
DC characteristics - DS1511B1						
ADC (all 16 channels)	Initial offset error	Below 750 KSPs	-3		3	mV
	Initial gain error	Below 750 KSPs	-0.25		0.25	%
	Input impedance	Dynamic (ΔU/ΔI) [2]		117		kΩ
	Offset drift			±40		µV/K
	Gain drift			±6		ppm/K
	Overvoltage protection	Continuous	-30		+30	
		Short term	-50		50	V
External trigger	Input voltage	V_{iH}	2.3			V
		V_{iL}			0.4	V
	Period				1	MHz
	Overvoltage protection	Continuous	-48		50	V

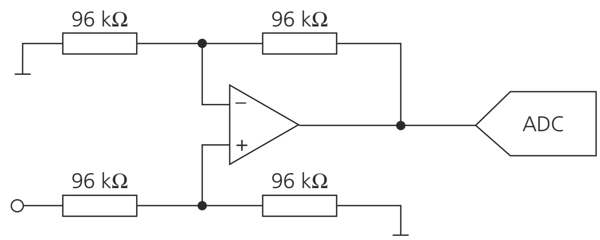
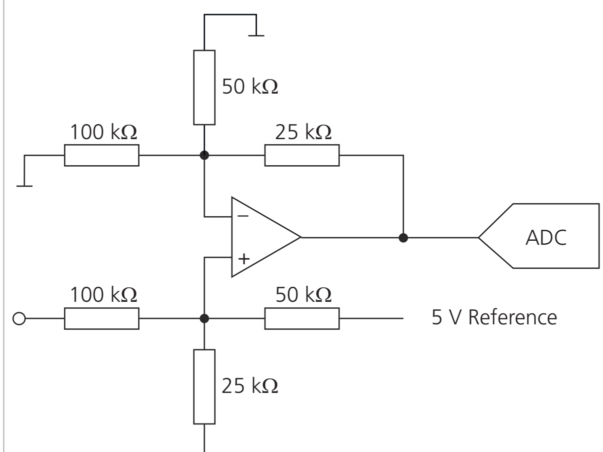
Signal[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics						
ADC Type 4 (all 16 channels)	No missing codes		15			bit
	SNR	12.4 kHz signal @ 200 KSPs	80			dB
	Input bandwidth	Full power bandwidth	400			kHz
	Channel crosstalk	100 kHz			-96	dB
		200 kHz			-92	dB
		400 kHz			-90	dB

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

2) The current flow into the ADC input pin is affected by the input signal and the internal reference voltage (refer to Circuit diagrams on page 291). Therefore, a specific static impedance (R = U/I) does not exist for this ADC, because it changes with the absolute voltage of the input signal. Instead, the dynamic impedance is specified (R = ΔU/ΔI), because the dynamic impedance takes only changes of the DC signal into account, not the absolute values.

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the analog inputs:

Signal		**I/O Circuit**
Analog inputs	ADC Type 4 channel 1 … 16	DS1511: 
		DS1511B1: 

Analog inputs on the DS1514 ZIF I/O connector

Only I/O modules provide analog inputs on the DS1514 ZIF I/O connector.

For signal descriptions, refer to the following topics:

- If you use a DS1552 Multi-I/O Module, refer to Analog Inputs on page 395.
- If you use a DS1554 Engine Control I/O Module, refer to Analog Inputs on page 424.

Related topics

Basics

ADC Unit Type 4 (MicroAutoBox II Features 🕮)

References

Analog Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog output pins on the DS1511 ZIF I/O connector:

Pins	Signal	Module	Default state	Description / Function
Z2, Y2, X2, W2	DAC1 … DAC4	DAC Type 3	0 V	Standard analog outputs 12-bit digital values are converted to analog outputs by the DAC module.

Default state means the state of the signal during reset.

Characteristics

The characteristics are specified for the following conditions unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

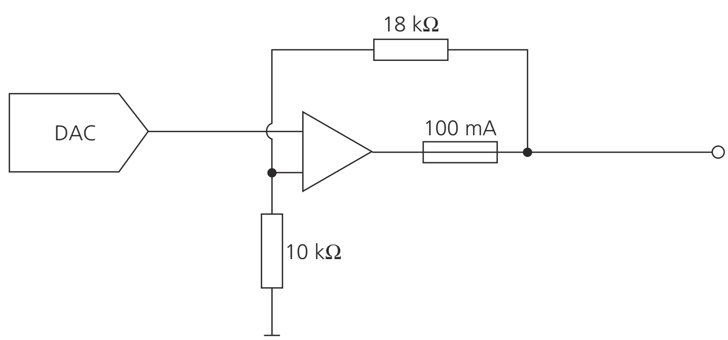
Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
DAC Type 3	V_{DAC}	Full scale	4.44	4.50	4.56	V
	Resolution	Fully monotonic	12			bit
	Offset error	Delivery state; $T_{Housing}$ = 25 °C		2		mV
	Gain error			0.5		LSB
	Offset error	$T_{Housing}$ = –40 °C … +85 °C	–10		+10	LSB
	Gain error		–0.5		0.5	%
	I_{DACout}	max. sink/ source current	–5		5	mA
	V_{DACSAT}	Output voltage when sinking I_{DACout} = –5 mA and CODE = 000H			0.3	V

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
AC characteristics						
DAC Type 3	Settling time	Settling time of output (to 1 LSB)			150	µs
	f_{gDAC}	Low-pass cutoff frequency of reconstruction filter (3 dB)	10.2	10.8	11.4	kHz

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

Circuit diagram

The following table shows a *simplified* diagram of the I/O circuitry of the analog outputs:

Signal	I/O Circuit
DAC Type 3 DAC1 … DAC4	

Analog outputs on the DS1514 ZIF I/O connector

Only I/O modules provide analog outputs on the DS1514 ZIF I/O connector. For signal descriptions of the DS1552 Multi-I/O Module, refer to Analog Outputs on page 400.

Related topics

Basics

DAC Unit Type 3 (MicroAutoBox II Features)

Interfaces

Pin description

The following tables give a description of the interface pins provided by the two ZIF connectors.

> **Tip**
>
> The pinout of the ECU interface connectors, USB device connector, and Ethernet I/O connector is not documented. Use a suitable dSPACE connection cable.

DS1511 ZIF I/O connector

The DS1511 ZIF I/O connector provides the interface pins to connect CAN bus interfaces, LIN bus interfaces, or for serial communication.

The interfaces are provided by CAN_TP1 modules. Each module support two CAN channels, one RS232 channel, and either one LIN channel or one ISO 9141 channel.

Pins	Signal	Module Type	Module Number	Description / Function
c3	CAN 1 low	CAN Type 1	Module 1	CAN controller: ▪ CAN 1 = CAN of module number 1, channel number 1 ▪ CAN 2 = CAN of module number 1, channel number 2 ▪ CAN 3 = CAN of module number 2, channel number 1 ▪ CAN 4 = CAN of module number 2, channel number 2 ▪ ISO 11898 interface ▪ The MicroAutoBox II CAN buses are not equipped with bus termination by default. For information on terminating the CAN buses, refer to How to Terminate the CAN Bus on page 110.
c2	CAN 1 high			
b3	CAN 2 low	CAN Type 1		
b2	CAN 2 high			
B3	CAN 3 low	CAN Type 1	Module 2	
B2	CAN 3 high			
A3	CAN 4 low	CAN Type 1		
A2	CAN 4 high			
c6	Serial 1 RXD[1)]	CAN Type 1	Module 1	RS232 interface: Serial 1 = RS232 of module number 1
c5	Serial 1 TXD[1)]			
b5	Serial 2 K / LIN[1)]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 2 = LIN of modul number 1 ▪ ISO 9141 interface: Serial 2 = K and L lines of modul number 1
b6	Serial 2 L[1)]			

Pins	Signal	Module Type	Module Number	Description / Function
				The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
B6	Serial 3 RXD[1)]	CAN Type 1	Module 2	RS232 interface: Serial 3 = RS232 of module number 2
B5	Serial 3 TXD[1)]			
A5	Serial 4 K / LIN[1)]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 4 = LIN of modul number 2 ▪ ISO 9141 interface: Serial 4 = K and L lines of modul number 2 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
A6	Serial 4 L[1)]			

1) For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 🕮).

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error (see Baud rate calculation of the serial interface).

DS1514 ZIF I/O connector

The following tables give a description of the interface pins provided by the DS1514 ZIF I/O connector.

You can install IP modules of various types to the DS1514:

- DS4340 FlexRay Interface Modules
- DS4342 CAN FD Interface Modules
- Third-party FlexRay IP modules
- Standard IP modules

DS4340 FlexRay Interface Module For a description of the interface pins of the DS4340 FlexRay Interface Module, refer to Interfaces on page 439.

DS4342 CAN FD Interface Module For a description of the interface pins of the DS4342 CAN FD Interface Module, refer to Interfaces on page 451.

(FlexRay) IP Module 1 The table describes the pins when a third-party FlexRay IP module is installed.

Pins	Signal	Module	Description / Function
C6	IP wakeup 1	IP_Type1	You do not need to connect this pin because wake-up functionality is not supported.
L3	IP GND 1	IP_Type1	Connection to GND
M3	IP bus high/A 1	IP_Type1	FlexRay 1 high in/out (FlexRay-H)
M4	IP bus low/B 1	IP_Type1	FlexRay 1 low in/out (FlexRay-L)
J3	IP GND 2	IP_Type1	Connection to GND
K3	IP bus high/A 2	IP_Type1	FlexRay 2 high in/out (FlexRay-H)
K4	IP bus low/B 2	IP_Type1	FlexRay 2 low in/out (FlexRay-L)
G5	Reserved	-	Do not connect
H6	Reserved	-	Do not connect
H5	Reserved	-	Do not connect
J6	Reserved	-	Do not connect
J5	Reserved	-	Do not connect
K6	Reserved	-	Do not connect
K5	Reserved	-	Do not connect

(FlexRay) IP Module 2 The table describes the pins when a third-party FlexRay IP module is installed.

Pins	Signal	Module	Description / Function
S6	IP wakeup 1	IP_Type1	You do not need to connect this pin because wake-up functionality is not supported.
a3	IP GND 3	IP_Type1	Connection to GND
b3	IP bus high/A 3	IP_Type1	FlexRay 1 high in/out (FlexRay-H)
b4	IP bus low/B 3	IP_Type1	FlexRay 1 low in/out (FlexRay-L)
Y3	IP GND 4	IP_Type1	Connection to GND
Z3	IP bus high/A 4	IP_Type1	FlexRay 2 high in/out (FlexRay-H)
Z4	IP bus low/B 4	IP_Type1	FlexRay 2 low in/out (FlexRay-L)
W5	Reserved	-	Do not connect
X6	Reserved	-	Do not connect
X5	Reserved	-	Do not connect
Y6	Reserved	-	Do not connect
Y5	Reserved	-	Do not connect
Z6	Reserved	-	Do not connect
Z5	Reserved	-	Do not connect

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to GND pins of the ZIF connectors.
- All voltage values specify voltages on the connector pins.

<table>
<tr><th>dSPACE Board</th><th>Interface</th><th>Parameter</th><th colspan="2">Conditions / Comments</th><th>Specification[1]</th></tr>
<tr><td rowspan="14">DS1401</td><td rowspan="4">Host PC</td><td>Protocol</td><td colspan="2">TCP/IP</td><td>—</td></tr>
<tr><td>Bitrate</td><td colspan="2">—</td><td>▪ 10/1000[2]
▪ 10/100[3]</td></tr>
<tr><td>Data throughput</td><td colspan="2">—</td><td>max. 2.6 MB/sec</td></tr>
<tr><td>Voltage levels</td><td colspan="2">Ethernet standard</td><td>—</td></tr>
<tr><td rowspan="3">Ethernet I/O</td><td>Protocol</td><td colspan="2">UDP/IP</td><td>—</td></tr>
<tr><td>Bitrate</td><td colspan="2">—</td><td>typ. 1000 Mbit</td></tr>
<tr><td>Voltage levels</td><td colspan="2">Ethernet standard</td><td>—</td></tr>
<tr><td rowspan="6">USB</td><td colspan="4">USB 2.0 standard (USB Flight Recording)</td></tr>
<tr><td rowspan="3">Data throughput</td><td colspan="2">without connected host tool</td><td>max. 1280 kB/sec</td></tr>
<tr><td colspan="2">with connected host tool</td><td>max. 1024 kB/sec</td></tr>
<tr><td colspan="2">without data loss during cold start (depend on the boot time of the host interface)</td><td>max. 640 kB/sec</td></tr>
<tr><td>Current</td><td colspan="2">—</td><td>max. 1.3 A</td></tr>
<tr><td>Voltage</td><td colspan="2">—</td><td>max. 5 V</td></tr>
<tr><td rowspan="13">DS1511</td><td rowspan="11">ECU</td><td rowspan="2">Bit rate</td><td colspan="2">LVDS mode</td><td>max. 250 Mbit</td></tr>
<tr><td colspan="2">LVDS2 mode</td><td>max. 500 Mbit</td></tr>
<tr><td>Cable length</td><td colspan="2" rowspan="2">2-paired twisted pair</td><td>max. 5 m (16.4 ft.)</td></tr>
<tr><td>Cable type</td><td>CAT5</td></tr>
<tr><td>Voltage levels</td><td colspan="2">LVDS standard</td><td>—</td></tr>
<tr><td rowspan="3">Full duplex data rate [4]</td><td>LVDS mode</td><td>Single transfer</td><td>max. 5 MWord/s</td></tr>
<tr><td rowspan="2">LVDS2 mode</td><td>Single transfer</td><td>max. 11.2 MWord/s</td></tr>
<tr><td>Block transfer</td><td>max. 28 MWord/s</td></tr>
<tr><td>RAM size [4]</td><td colspan="2">LVDS / LVDS2 mode</td><td>16 kWord</td></tr>
<tr><td>FIFO size[4]</td><td colspan="2">LVDS / LVDS2 mode (Transmit buffer)</td><td>1 kWord</td></tr>
<tr><td>CAN</td><td>Bit rate</td><td colspan="2">ISO 11898 interface</td><td>max. 1 MBaud</td></tr>
<tr><td>Serial 1/3 RS232-Interface</td><td>Bit rate</td><td colspan="2">—</td><td>▪ min. 14 Baud</td></tr>
</table>

dSPACE Board	Interface	Parameter	Conditions / Comments	Specification[1]
				▪ max. 115.2 kBaud
		TX output voltage swing	3 kΩ load	▪ min. ±5 V ▪ typ. ±9 V
		$V_{RxinLow}$	RX input threshold low	▪ typ. 1.4 V ▪ max. 0.8 V
		$V_{RxinHigh}$	RX input threshold high	▪ min. 2.0 V ▪ typ. 1.4 V
		Word length	—	▪ min. 5 bit ▪ max. 8 bit
	Serial 2/4 ISO9141-Interface	Bit rate	R_{KO} = 510 Ω; $C_K \le$ 1.3 nF	▪ min. 14 Baud ▪ max. 50 kBaud
		Word length	—	▪ min. 5 bit ▪ max. 8 bit
	Serial 2/4 LIN Interface	Bit rate	—	▪ min. 14 Baud ▪ max. 20 kBaud
DS1514	FlexRay	Bit rate	—	max. 2 x 10 MBaud
		Frame length	—	max. 12 byte
	CAN FD	Bit rate	ISO 11898 interface	max. 2 x > 2 MBaud
	IP module carrier	Clocking	—	▪ min. 8 MHz ▪ max. 32 MHz
		Access type	—	byte / word

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] Since board revision DS1401-23 (available since dSPACE Release 7.2).
[3] Before board revision DS1401-23
[4] Word is 16-bit wide

Baud rate calculation of the serial interface

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error.

The UART baud rate generator provides several baud rates:

To calculate the divisor T for a chosen baud rate

$$T = \text{Round}\left(\frac{921600}{\text{BR (chosen)}}\right)$$

BR (chosen) = The baudrate to be generated
T = The baudrate generator divisor ($8 \le T \le 65535$)

To calculate the real baud rate from a given divisor T

$$\frac{\text{BR (real)}}{\text{Baud}} = \frac{921600}{\text{T}}$$

BR (real) = The baudrate you get
T = The baudrate generator divisor (8 ≤ T ≤ 65535)

To calculate the resulting error

$$\frac{\text{Error}_{\text{BR}}}{100\%} = \frac{\text{BR (real)} - \text{BR (chosen)}}{\text{BR (chosen)}}$$

Note

If $\text{Error}_{\text{BR}} \leq 2\%$, messages will be transferred and received correctly.

Related topics

Basics

CAN Support (MicroAutoBox II Features 📖)
FlexRay Support (MicroAutoBox II Features 📖)
IP Module Support (MicroAutoBox II Features 📖)
LIN Support (MicroAutoBox II Features 📖)

References

Serial Interface (MicroAutoBox II Features 📖)

Data Sheet MicroAutoBox II 1401/1513

Where to go from here

Information in this section

Overview and General Information

Where to go from here

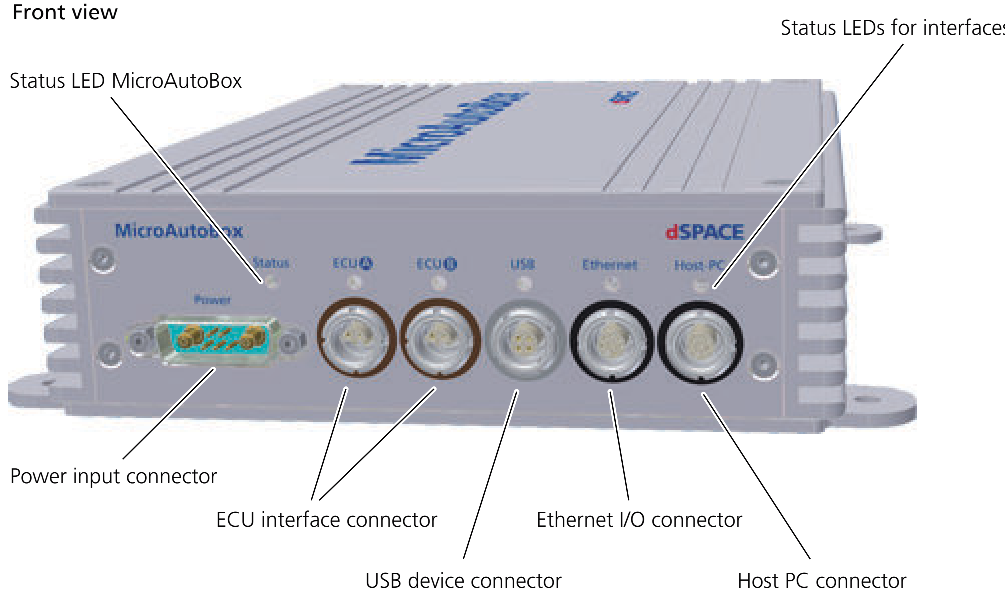
Information in this section

Housing Components

Connectors and status LEDs

The illustrations show where the connectors and status LEDs are located on MicroAutoBox II 1401/1513.

Front view



Rear view

Status LED MicroAutoBox

ZIF I/O connector

MicroAutoBox II 1401/1513 contains the following connectors and LEDs (from left to right):

Power input connector Supplies the required power to MicroAutoBox II. It is a 7-pin, male Sub-D connector with two high-current pins.

A preconfigured cable with a matching connector and a separate power input connector are included in each MicroAutoBox II package. For the pinout and further details on the preconfigured cable, refer to Power Input Connector on page 312.

Status LED MicroAutoBox Shows you different states and potential malfunctions.

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED (= dual LED) shows different states indicated by the LED color:

- LED is red: Reset state and no application is downloaded to the real-time processor.
- LED is green: Application is running.
- LED is flashing red: MicroAutoBox II is in secured mode. For further instructions, refer to Checking MicroAutoBox II on page 506.

The status LED on the front panel has the same functionality as the status LED on the rear panel of MicroAutoBox II.

ECU interface connectors Provide communication to ECUs based on the LVDS standard, for example, in bypassing scenarios or to connect a RapidPro system (used as I/O subsystem). The ECU interface connectors are 4-pin LEMO connectors. Matching cables are supplied from dSPACE on request.

The corresponding LED is lit green, if power at both ends of the link is available and the relevant connection is serviceable. The LED flashes when data is being sent or received.

The table below shows the different ECU interfaces integrated into MicroAutoBox II and the display names they are mapped to in the experiment software, for example, ControlDesk.

Display Name in Software	Connectors Built-in at MicroAutoBox II	
	ECU A	ECU B
ECU 1	✓	–
ECU 2	–	✓

USB device connector A 4-pin LEMO connector to connect an USB mass storage device to use the USB Flight Recorder feature of MicroAutoBox II. A matching cable with a LEMO-USB adapter is supplied from dSPACE on request.

Note

To use the USB Flight Recorder, a separate license is required.

The possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	No USB device is connected.
Green	USB device is connected and flight recorder is not running.
Green blinking	USB device is connected and flight recorder is running.
Orange	USB device is full and the active flight recorder is specified not to overwrite old files.
Red	Write error when accessing the USB device, for example, if the device was removed while the flight recorder was running.

For further information, refer to Flight Recorder (MicroAutoBox II Features 🕮).

Ethernet I/O connector An 8-pin LEMO connector that provides communication to external devices, such as PCs or ECUs based on the UDP/IP Ethernet protocol, for example, in bypassing scenarios.

A matching cable with a LEMO-RJ45 adapter is supplied from dSPACE on request.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

For installation instructions, refer to How to Connect a MicroAutoBox II to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 🕮).

Host PC connector Provides the communication between MicroAutoBox II and your host PC based on the Ethernet TCP/IP protocol. The connector is a 8-pin LEMO connector. A matching cable is included in each MicroAutoBox II package.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

Tip

The Ethernet I/O connector and the Host PC connector are internally connected by a common gigabit Ethernet switch (valid for base board DS1401-25ff).

This simplifies the connection options. For an example, refer to Connecting an ECU with DCI-GSI2 for Simultaneous Calibration and ECU Interfacing (ECU Interfaces Hardware Installation and Configuration 📖).

ZIF I/O connector The 156-pin zero insertion force (ZIF) I/O connector provides access to the most input and output signals provided by MicroAutoBox II. A matching connector is included in each MicroAutoBox II package.

For the pinout, refer to ZIF I/O Connector on page 310.

General Data

General characteristics The following table shows some general characteristics of MicroAutoBox II:

Parameter		Specification[1)]
Base board (DS1401-20ff.)	Processor	▪ PPC750 GL Power PC ▪ 900 MHz clock frequency ▪ Real-time clock ▪ 100 MHz bus clock
	Memory	▪ 8 MB global RAM ▪ 16 MB local RAM ▪ 16 MB flash memory
	Onboard sensors[2)]	Pressure sensor: ▪ Base board DS1401-23ff. ▪ Range: 50 kPa … 115 kPa ▪ Accuracy: 1 kPa ▪ Sample rate: approx. 200 Hz Acceleration sensor ▪ Base board DS1401-23ff. ▪ Range: ±2 g … ±8 g in 3 axis (x/y/z) ▪ Resolution: 10 bit per axis ▪ Sample rate: max. 800 Hz ▪ FIFO buffer: 512 words (to read and write bursts)
Communication interfaces		▪ 1 x Host PC interface based on Ethernet TCP/IP protocol ▪ 1 x Ethernet I/O interface based on Ethernet UDP/IP protocol for Ethernet bypassing scenarios ▪ 2 x ECU interface based on LVDS standard ▪ 1 x USB interface for USB flight recording (separate license)

Parameter		Specification[1]
I/O connectors		▪ 1 x 156-pin ZIF I/O connector ▪ max. 15 mΩ contact resistance ▪ 10000 cycles durability ▪ max. 2.5 A continuous current per pin ($T_{operating}$ = +85 °C) ▪ 1 x 7-pin power supply input connector
Housing dimensions	Width	202 mm (7.95 in.)
	Height	50 mm (1.97 in.)
	Depth	222 mm (8.74 in.)
Weight		About 2.1 kg (4.6 lb.) without external cables

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

2) For further information on the sensors, refer to Onboard Sensors (MicroAutoBox II Features 📖).

Supported features

For an overview of the features that this MicroAutoBox II variant supports, refer to Feature Support (MicroAutoBox II Features 📖).

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

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

Parameter	Specification[1]	Condition / Description
VBAT	–40 V ... +100 V	Load dump- and reverse protection
VDRIVE	0 V ... +45 V	—
All digital output voltages	(VDRIVE – 45 V) ... +45 V	—
All digital input voltages	(VDRIVE – 45 V) ... +45 V	—
All analog output voltages	–30 V ... +40 V	—
All analog input voltages	–40 V ... +40 V	—
VSENS output	0 V ... +40 V	—

Parameter	Specification[1]	Condition / Description
VBATprot output	0 V ... +45 V	—
RS232 transceiver output	–30 V ... +30 V	—
RS232 transceiver input	–30 V ... +30 V	—
$V_{CAN\ high}$, $V_{CAN\ low}$	–58 V ... +58 V	Voltage level on CAN high and CAN low pins.
$V_{Diff\ (CAN\ high\ -\ CAN\ low)}$	–5 V ... +5 V	Voltage difference between CAN high and CAN low pins (due to termination resistors).
Serial 2 K / LIN	–20 V ... +32 V, but not more than VBAT	—
Serial 2 L	–24 V ... +30 V, but not more than VBAT	—
All outputs short circuit to GND	Continuous	—
Continuous power dissipation	Max. 25 W	$T_{operating}$ = +85 °C Power dissipated by the MicroAutoBox II itself. The power of the connected loads (VBATprot/VSENS) must be added.
Operating temperature	–40 °C ... +85 °C	—
Storage temperature	–55 °C … +90 °C	—
Relative humidity	10% ... 95%	Noncondensing
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

Battery Characteristics

Characteristics of the internal battery

The following table shows the characteristics of the battery mounted on the DS1401 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

Certifications

CE compliance

MicroAutoBox II meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Applied standards

The characteristics of MicroAutoBox II 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 309.
	CISPR 11, EN 55011 Group 1, Class A	Emission standard for industrial environments
	RTCA/DO160G: Dec. 2010: Section 21.4	Environmental conditions and test procedures for airborne equipment: Conducted RF Emissions, Category: B, L, M&H[2)]
	RTCA/DO160G: Dec. 2010: Section 21.5	Environmental conditions and test procedures for airborne equipment: Radiated RF Emissions, Category: M[2)]
Vibration	ISO 16750-3:2007 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 4 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 4 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 … 2000 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 A Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 ms, 10 pulses per axis

Tested Characteristics	Applied Standard	Description
		▪ 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.

2) For further information, refer to dSPACE Support.

Vibration and shock tests

To verify the reliability of MicroAutoBox II under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox II 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 II during run time. Otherwise, you might influence the measurements.

Connector Pinouts

Where to go from here

Information in this section

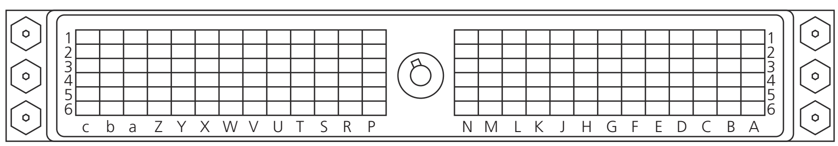
ZIF I/O Connector

Introduction

The I/O connector is a 156-pin zero insertion force (ZIF) connector giving access to the most input and output signals provided by MicroAutoBox.

Pinout

The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of the I/O connector:

1		2		3		4		5		6		
GND	in	CAN 4 high	i/o	CAN 4 low	i/o	GND	in	Serial 4 K / LIN[1]	i/o	Serial 4 L[1]	in	*A*
GND	in	CAN 3 high	i/o	CAN 3 low	i/o	GND	in	Serial 3 TXD[1]	out	Serial 3 RXD[1]	in	*B*
GND	in	DigP 1 ch 5[2]	out	DigP 1 ch 10	out	DigP 1 ch 15	out	DigP 2 ch 4	out	GND	in	*C*
GND	in	DigP 1 ch 4	out	DigP 1 ch 9	out	DigP 1 ch 14	out	DigP 2 ch 3	out	DigP 2 ch 8	out	*D*
GND	in	DigP 1 ch 3	out	DigP 1 ch 8	out	DigP 1 ch 13	out	DigP 2 ch 2	out	DigP 2 ch 7	out	*E*
GND	in	DigP 1 ch 2	out	DigP 1 ch 7	out	DigP 1 ch 12	out	DigP 2 ch 1	out	DigP 2 ch 6	out	*F*
GND	in	DigP 1 ch 1	out	DigP 1 ch 6	out	DigP 1 ch 11	out	DigP 1 ch 16	out	DigP 2 ch 5	out	*G*
GND	in	DigP 1 ch 5	in	DigP 1 ch 10	in	DigP 1 ch 15	in	DigP 2 ch 4	in	GND	in	*H*
GND	in	DigP 1 ch 4	in	DigP 1 ch 9	in	DigP 1 ch 14	in	DigP 2 ch 3	in	DigP 2 ch 8	in	*J*
GND	in	DigP 1 ch 3	in	DigP 1 ch 8	in	DigP 1 ch 13	in	DigP 2 ch 2	in	DigP 2 ch 7	in	*K*

1		2		3		4		5		6		
GND	in	DigP 1 ch 2	in	DigP 1 ch 7	in	DigP 1 ch 12	in	DigP 2 ch 1	in	DigP 2 ch 6	in	*L*
VSENS	out	DigP 1 ch 1[2]	in	DigP 1 ch 6	in	DigP 1 ch 11[2]	in	DigP 1 ch 16	in	DigP 2 ch 5	in	*M*
VDRIVE	in	CAN 6 high	i/o	CAN 6 low	i/o	GND	in	Serial 6 K / LIN[1]	i/o	Serial 6 L[1]	in	*N*
VBAT prot	out	CAN 5 high	i/o	CAN 5 low	i/o	GND	in	Serial 5 TXD[1]	out	Serial 5 RXD[1]	in	*P*
REMOTE	in	GND	in	GND	in	GND	in	GND	in	GND	in	*R*
GND	in	AnalogOut ch 8	out	AnalogIn ch 4	in	AnalogIn ch 8	in	AnalogIn ch 12	in	AnalogIn ch 16	in	*S*
GND	in	AnalogOut ch 7	out	AnalogIn ch 3	in	AnalogIn ch 7	in	AnalogIn ch 11	in	AnalogIn ch 15	in	*T*
GND	in	AnalogOut ch 6	out	AnalogIn ch 2	in	AnalogIn ch 6	in	AnalogIn ch 10	in	AnalogIn ch 14	in	*U*
GND	in	AnalogOut ch 5	out	AnalogIn ch 1	in	AnalogIn ch 5	in	AnalogIn ch 9	in	AnalogIn ch 13	in	*V*
GND	in	AnalogOut ch 4	out	Analog ch 4	in	Analog ch 8	in	Analog ch 12	in	Analog ch 16	in	*W*
GND	in	AnalogOut ch 3	out	Analog ch 3	in	Analog ch 7	in	Analog ch 11	in	Analog ch 15	in	*X*
GND	in	AnalogOut ch 2	out	Analog ch 2	in	Analog ch 6	in	Analog ch 10	in	Analog ch 14	in	*Y*
GND	in	AnalogOut ch 1	out	Analog ch 1	in	Analog ch 5	in	Analog ch 9	in	Analog ch 13	in	*Z*
GND	in	SGND	in	Ana trigger 1	in	Ana trigger 2	in	Ana trigger 3	in	Ana trigger 4	in	*a*
GND	in	CAN 2 high	i/o	CAN 2 low	i/o	GND	in	Serial 2 K / LIN[1]	i/o	Serial 2 L[1]	in	*b*
GND	in	CAN 1 high	i/o	CAN 1 low	i/o	GND	in	Serial 1 TXD[1]	out	Serial 1 RXD[1]	in	*c*

[1] For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features).

[2] DigP = Port number; ch = Channel number

Note

To use the digital inputs and outputs, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the logic level needed. *This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.* You have to connect VDRIVE (pin N1) to VSENS (pin M1) or VBATprot (pin P1). Use the preconfigured jumper cable which is included in the MicroAutoBox II package.

Signal descriptions

For descriptions of the signals which are available on the ZIF I/O connector, refer to:

- Power Inputs and Outputs on page 314
- Digital Inputs on page 317
- Digital Outputs on page 319
- Analog Inputs on page 324
- Analog Outputs on page 328
- CAN, LIN, serial: Interfaces on page 330

Power Input Connector

Introduction

MicroAutoBox II provides a power input connector. It 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).

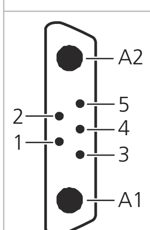
Feature for MicroAutoBox Embedded PC The pinout of the power input connector features two additional signals for remote control when MicroAutoBox II is combined with MicroAutoBox Embedded PC.

Refer to the following topics:

- MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Power Input Connector on page 464 and Power Inputs and Outputs on page 466
- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Power Input Connector on page 481 and Power Inputs and Outputs on page 486

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (6 V … 36 V DC)		
			5	REMOTE_PULLUP
	2	Reserved for MicroAutoBox Embedded PC [2]	4	REMOTE[3]
	1	Do not connect	3	Reserved for MicroAutoBox Embedded PC [2]
	A1	GND		

[1] NOTE: Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] Refer to Power Input Connector on page 464 or Power Input Connector on page 481.

[3] The REMOTE input must be connected via switch or bridge to VBAT to run the MicroAutoBox II.

Matching cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is for running MicroAutoBox II with a laboratory power supply during development. Therefore, the REMOTE pin (pin 4) is shorted to the VBAT pin (pin A2) inside the connector in order to save a separate switch. Do not use this cable in the vehicle. Otherwise, MicroAutoBox II will always be turned on.

The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1)] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1)] The cable is labeled with this type number.

⚠ **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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Pin description

The following tables provide a description of the pins used for power input, remote input, and supply of digital I/O circuits.

Connector	Pins	Signal	Description / Function
Power input connector	A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
	A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery/power supply. This signal is also connected to the housing of MicroAutoBox II.
	4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin directly to VBAT, MicroAutoBox II will always be on, and the vehicle battery will soon be depleted if the engine is not running. Thus, a switch is highly recommended. Refer to Connecting to Power Supply on page 42.

Connector	Pins	Signal	Description / Function
			You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference 📖). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage. ▪ To wake up MicroAutoBox II via CAN messages, the **REMOTE** pin must be left open when MicroAutoBox II is powered down. This is due to the fact that there is an additional internal connection to the **REMOTE** pin. Nevertheless, you can always use a remote switch to supply voltage (e.g., VBAT) to start MicroAutoBox II.
	5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.
ZIF I/O connector	A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, N4, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4	GND	Main power supply return and reference for all input and output signals. Use the nearest possible GND pin as reference for your signals in order to keep noise levels at minimum. The housing of MicroAutoBox II is also connected to GND.
	a2	SGND	Internally connected to GND with a 0 Ω resistor.
	N1	VDRIVE	This input supplies all digital input and output circuits. ▪ Connect this input to VSENS to set 5 V logic levels for your inputs/outputs. ▪ Connect this input to VBATprot to set automotive-compatible logic levels for your inputs/outputs. ▪ Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected at this signal. For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
	M1	VSENS	Sensor supply output. VSENS is switched on and off with the REMOTE pin. Use this output to supply your sensors and/or VDRIVE. If you need 5 V logic levels at the inputs/outputs connect VSENS to VDRIVE.
	P1	VBAT prot	Protected VBAT output. VBATprot follows VBAT within the specified range and is switched on and off with the REMOTE pin.

Connector	Pins	Signal	Description / Function
			Use this output to supply VDRIVE when automotive logic levels are needed.
	R1	REMOTE	▪ The remote voltage may be used for starting MicroAutoBox II with a remote switch: KL15, for example (output of the ignition/driving switch). ▪ If you connect the remote pin to the vehicle battery directly, MicroAutoBox II will always be turned on, and the vehicle battery will soon be exhausted if the engine is not running. Thus, a switch is highly recommended. ▪ The remote voltage should not exceed the supply voltage.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up	6		36[2)]	V
	VBAT	Operating	4		36[2)]	V
	VBAT	Reverse protection			–40	V
	VBAT	Load dump protection			+100	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≥ $V_{iHRemote}$		1.3		A
	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		5		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
Inrush current	$I_{VBAT\ inrush}$	All inputs/outputs unconnected	see Power supply on page 38			
Digital I/O voltage supply input	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		20		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		1		A

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Outputs						
Sensor supply output	VSENS	Output voltage	4.84	5.05	5.25	V
	VSENS = f(T)	Temperature caused voltage drift $T_{Housing}$ = –40 °C ... +85 °C	–2		2	%
	$I_{VSENS, max}$	Maximum output current	750			mA
Protected VBAT output	VBATprot [3]	I_{Load} = 1 A; VBAT = 12 V	11.56	11.78	12	V
	$I_{VBATprot, max}$	Maximum output current			1000	mA
	$I_{ProtPeak}$	Overload current limit (–40 °C ... 85 °C)	4		9	A
	t(overload)	Time to shut off $I_{ProtPeak}$			5	ms

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] With an additional absolute maximum tolerance of +4 V.
[3] VBATprot follows VBAT within the specified range.

Related topics

Basics

Digital Inputs

Pin description

The following table gives a description of the digital input pins:

Pins (DS1513)	Port Number	Signal	Description / Function
M2, L2, K2, J2, H2, M3, L3, K3, J3, H3, M4, L4, K4, J4, H4, M5	1	Channel 1 ... 16 DIO Type 4	Standard discrete digital input with pull-up.
L5, K5, J5, H5, M6, L6, K6, J6	2	Channel 1 ... 8 DIO Type 4	

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
Digital input channel 1 ... 24	V_{iH}	Input high voltage	3.1			V
	V_{iL}	Input low voltage			1.2	V
	V_{iHys}	Input hysteresis voltage		1		V
	R_{DigIn}	Pull-up resistor to VDRIVE	17	18	19	kΩ
	C_{DigIn}	Input capacitance		1		nF
REMOTE	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
AC characteristics						
Inputs	t_{LowMin}	Minimum pulse width low		250	500	ns
	$t_{HighMin}$	Minimum pulse width high		300	600	ns
	F_{max}	Duty cycle: 50 %		1.8		MHz
		Duty cycle: 1 % or 99 %		33		kHz

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

Powering digital inputs and outputs of the DS1513 ZIF I/O connector

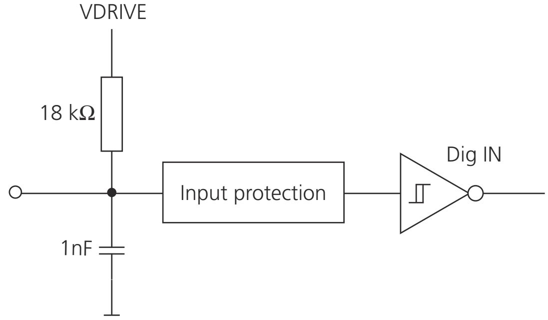
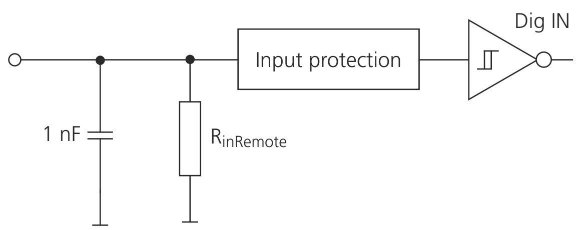
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the digital inputs:

Signal		**I/O Circuit**
Digital inputs	Channel 1 ... 24	 For proper operation, VDRIVE must have a level above the maximum input voltage.
	Remote	

Related topics

Basics

Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 📖)
Providing the Supply Voltage to Drive Digital I/O Interfaces..47

Digital Outputs

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.

Pin description

The following table gives a description of the digital output pins:

Pins (DS1513)	**Port Number**	**Signal**	**Default state**	**Description / Function**
G2, F2, E2, D2, C2, G3, F3, E3, D3, C3, G4, F4, E4, D4, C4, G5	1	Channel 1 ... 16 DIO Type 4	Tristate	Standard discrete digital output.
F5, E5, D5, C5, G6, F6, E6, D6	2	Channel 1 ... 8 DIO Type 4		

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	**Symbol**	**Conditions / Comments**	**Min.**	**Typ.**	**Max.**	**Unit**
DC Characteristics						
Digital output channel 1 ... 24	V_{oH}	I_{Load} = 0 mA; VDRIVE = 5 V	4.4	4.6		V
	V_{oL}	I_{Load} = 0 mA; VDRIVE = 5 V		0.1	0.3	V
	V_{oH}	I_{Load} = 5 mA; VDRIVE = 5 V	3.2	3.4		V
	V_{oL}	I_{Load} = –5 mA; VDRIVE = 5 V		0.7	0.9	V
	V_{oH}	I_{Load} = 0 mA; VDRIVE = 12 V	11.3	11.6		V
	V_{oL}	I_{Load} = 0 mA; VDRIVE = 12 V		0.1	0.3	V
	V_{oH}	I_{Load} = 5 mA; VDRIVE = 12 V	10.3	10.5		V
	V_{oL}	I_{Load} = –5 mA; VDRIVE = 12 V		0.7	0.9	V
	$\lvert I_{OHmax} \rvert$	Current limit high $T_{Housing}$ = –40 °C ... +85 °C	5	13	17	mA
	$\lvert I_{OLmax} \rvert$	Current limit low $T_{Housing}$ = –40 °C ... +85 °C	5	14	18	mA
	$\lvert I_{OTLeak} \rvert$	Leakage current tristate $T_{Housing}$ = -40 °C ... +85 °C			100	µA

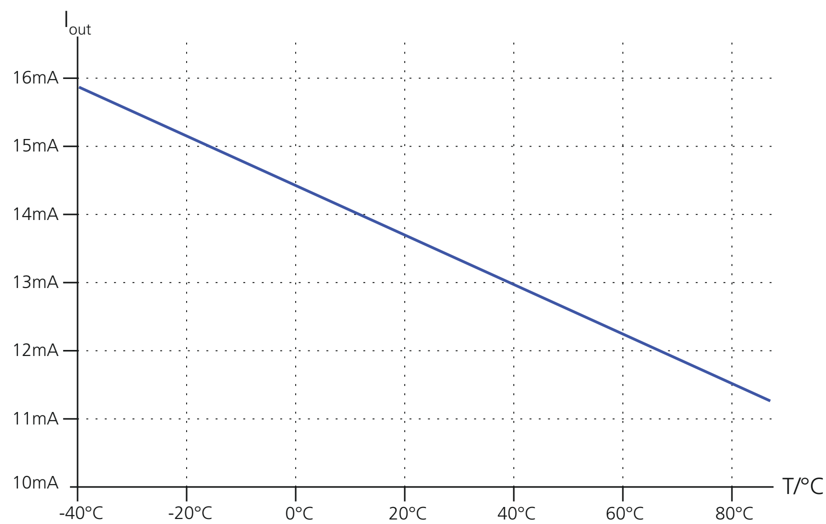
Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics						
Outputs	$t_{minPulseHigh}$	Minimum pulse width high, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		700	1400	ns
	$t_{minPulseLow}$	Minimum pulse width low, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		200	400	ns
	F_{max}	Duty cycle: 50 % VDRIVE = 5 V or 12 V		0.7[2]		MHz
		Duty cycle: 1 % or 99 % VDRIVE = 5 V or 12 V		14		kHz

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

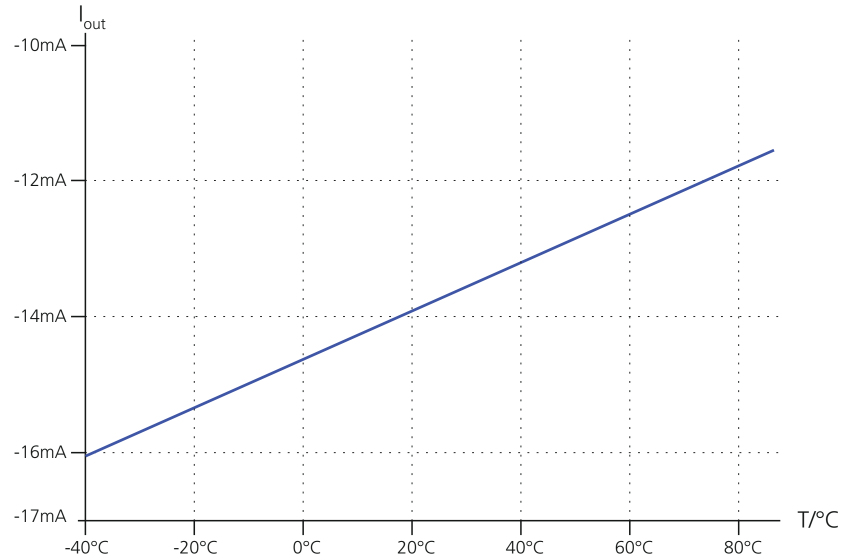
2) Limited by software to 150 kHz

The following illustrations show the maximum output current of a digital output circuit as a function of ambient temperature (VDRIVE = 12 V; output is shorted to 6 V):

- Output high

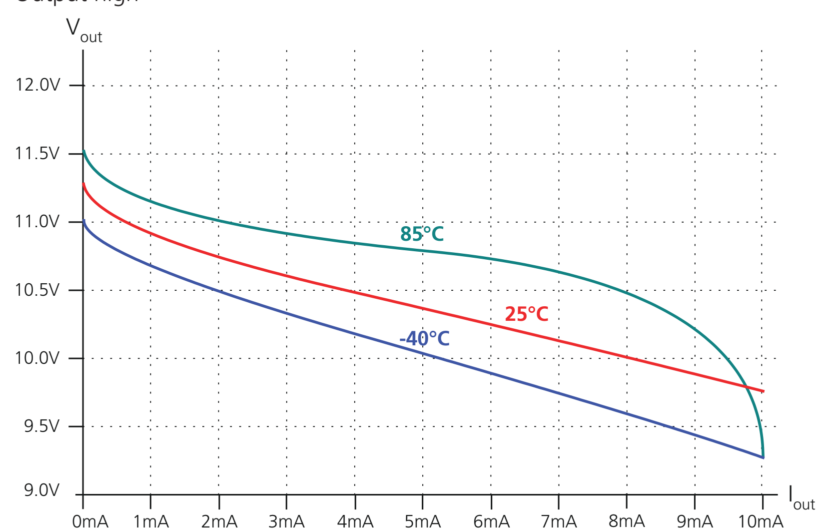


- Output low

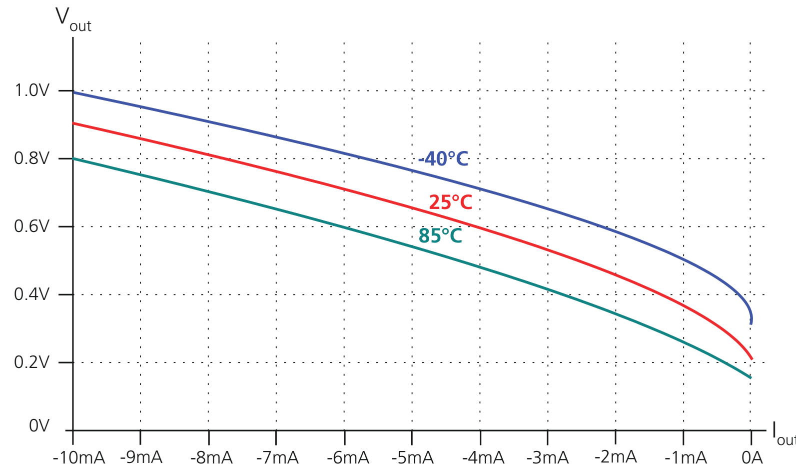


The following illustrations show the typical digital output voltage as a function of the output current (VDRIVE = 12 V):

- Output high



- Output low



Powering digital inputs and outputs of the DS1513 ZIF I/O connector

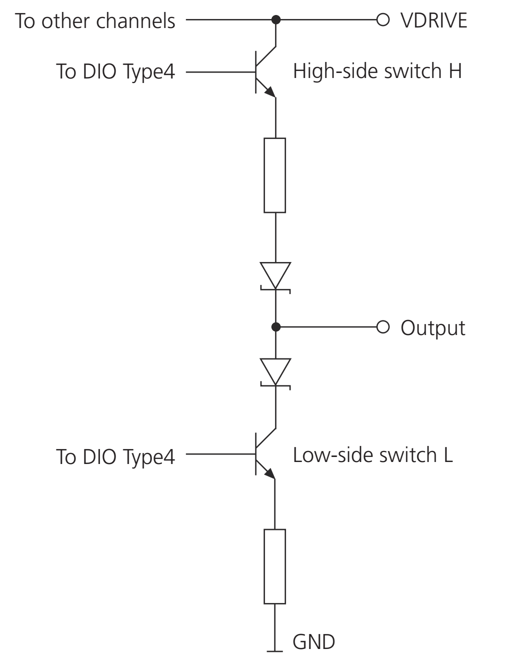
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the digital outputs:

Signal	I/O Circuit
Digital outputs	

Related topics

Basics

Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 📖)
Providing the Supply Voltage to Drive Digital I/O Interfaces..47

Analog Inputs

Pin description

The following table gives a description of the analog input pins:

Pins	Signal	Module	Description / Function
Z3, Y3, X3, W3, Z4, Y4, X4, W4, Z5, Y5, X5, W5, Z6, Y6, X6, W6	ADC channel 1 ... 16	ADC Unit Type 4	-10 V ... +10 V
a3, a4, a5, a6	External trigger 1 ... 4		For information on function of the trigger signals, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).

Pins	Signal	Module	Description / Function
V3, U3, T3, S3, V4, U4, T4, S4, V5, U5, T5, S5, V6, U6, T6, S6	ADC channel 1 ... 16	AIO Type 1 ADC Unit	-10 V ... +10 V

Characteristics of the ADC Unit Type 4

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

The following table shows the characteristics of the ADC Unit Type 4 channels.

Signal[1)]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics						
ADC (all 16 channels)	Number of independent input channels			16		
	Resolution			16		bit
	Sample rate	Burst mode with more than 1 sample			1	MSPS
	Input voltage range		-10		10	V
	Conversion timer	Separate for each channel.				
		Width	27			bit
		Resolution	10			ns
		Interval			1.342	s
	Timer for time stamping	Common for all channels. Two channels are required to carry one 32 bit value.				
		Width	32			bit
		Resolution	10			ns
		Interval			42.9	s
	Buffer size	Software-configurable	1		8192	Samples
	Buffers per channel		3			
	Number of external trigger inputs		4			

Signal[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
ADC Type 4 (all 16 channels)	Initial offset error	Below 750 KSPs	-3		3	mV
	Initial gain error	Below 750 KSPs	-0.25		0.25	%
	Input impedance	Dynamic (ΔU/ΔI) [2]		117		kΩ
	Offset drift			±40		µV/K
	Gain drift			±6		ppm/K
	Overvoltage protection	Continuous	-30		+30	V
		Short term	-50		50	V
External trigger	Input voltage	V_{iH}	2.3			V
		V_{iL}			0.4	V
	Period				1	MHz
	Overvoltage protection	Continuous	-48		50	V
AC Characteristics						
ADC Type 4 (all 16 channels)	No missing codes		15			bit
	SNR	12.4 kHz signal @ 200 KSPs	80			dB
	Input bandwidth	Full power bandwidth	400			kHz
	Channel crosstalk	100 kHz			-96	dB
		200 kHz			-92	dB
		400 kHz			-90	dB

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

[2] The current flow into the ADC input pin is affected by the input signal and the internal reference voltage (refer to Circuit diagrams on page 328). Therefore, a specific static impedance (R = U/I) does not exist for this ADC, because it changes with the absolute voltage of the input signal. Instead, the dynamic impedance is specified (R = ΔU/ΔI), because the dynamic impedance takes only changes of the DC signal into account, not the absolute values.

Characteristics of the AIO Type 1 ADC Unit

The characteristics are specified for the following conditions, unless otherwise noted:

- V_{BAT}=+12 V
- T_{CASE}=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

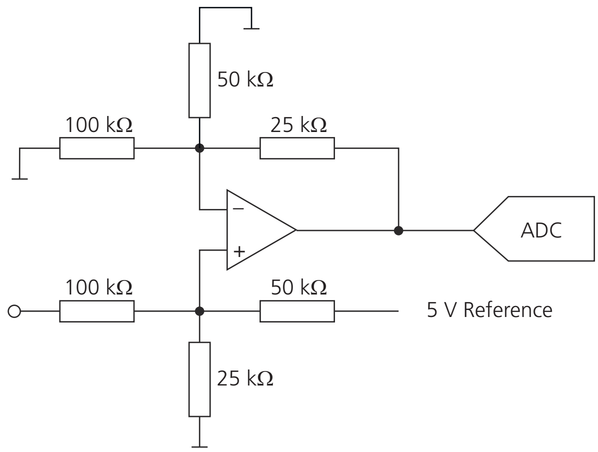
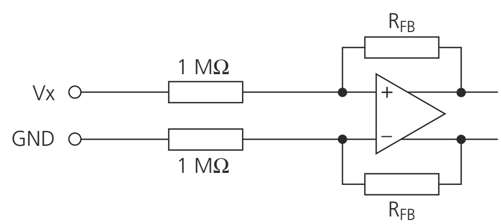
The following table shows the characteristics of the AIO Type 1 ADC Unit channels.

Parameter[1)]	**Conditions / Comments**	**Min.**	**Typ.**	**Max.**	**Unit**
General characteristics					
Number of independent input channels			16		
Resolution			16		bit
Sample rate				200	kSPs
Input voltage range		-10		10	V
Conversion time	inclusive transfer time		5		µs
DC characteristics					
Offset error		-2		2	mV
Gain error		-1		1	% of FSR
Input impedance			1		MΩ
AC Characteristics					
Low pass filter	3 dB frequency		23		kHz

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

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the analog inputs:

Signal		I/O Circuit
Analog inputs	ADC Type 4	
	AIO Type 1 ADC Unit	

Related topics

Basics

ADC Unit Type 4 (MicroAutoBox II Features 📖)
AIO Unit Type 1 (ADC) (MicroAutoBox II Features 📖)

Analog Outputs

Pin description

The following table gives a description of the analog output pins:

Pins	Signal	Module	Default state	Description / Function
Z2, Y2, X2, W2, V2, U2, T2, S2	DAC1 … DAC8	AIO Type 1 DAC Unit	High impedance	Standard analog outputs 16-bit digital values are converted to analog outputs by the DAC module.

Default state means the state of the signal during reset.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

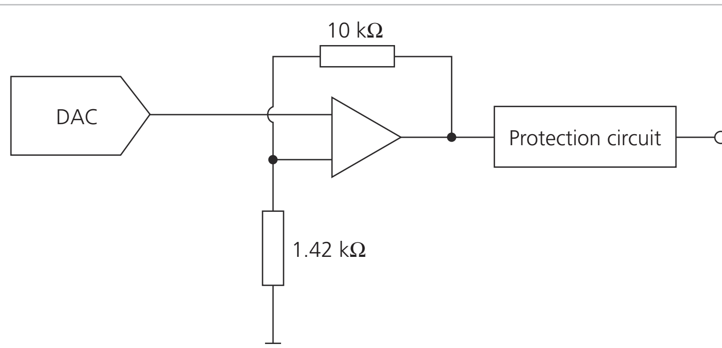
Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
DAC1 ... DAC8	Output voltage range		-10		+10	V
	Resolution			16		bit
	Offset error		-4		4	mV
	Gain error		-0.25		0.25	%
	I_{DACout}		-8		8	mA
	C_{DACout}	Maximum load capacitance			22	nF
AC characteristics						
DAC1 ... DAC8	Settling time	Settling time of output (to 1 %)			1	µs
	f_{gDAC}	Low-pass cutoff frequency of reconstruction filter (3 dB)	500			kHz
	f_{out}[2)]	Square, ±10 V, C_{DACout} = 1 nF			150	kHz

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

2) Utilizable output frequency depends on voltage swing and capacitive load.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the analog outputs:

Signal		I/O Circuit
Analog outputs	DAC1 … DAC8 (AIO Type 1)	

Related topics

Basics

AIO Unit Type 1 (DAC) (MicroAutoBox II Features 📖)

Interfaces

Pin description

The following table gives a description of the interface pins available at the ZIF I/O connector.

Tip

The pinout of the ECU interface connectors, USB device connector, and Ethernet I/O connector is not documented. Use a suitable dSPACE connection cable.

The interfaces are provided by CAN_TP1 modules. Each module support two CAN channels, one RS232 channel, and either one LIN channel or one ISO 9141 channel.

Pins	Signal	Module Type	Module Number	Description / Function
c3	CAN 1 low	CAN Type 1	Module 1	CAN controller: ▪ CAN 1 = CAN of module number 1, channel number 1 ▪ CAN 2 = CAN of module number 1, channel number 2 ▪ CAN 3 = CAN of module number 2, channel number 1 ▪ CAN 4 = CAN of module number 2, channel number 2 ▪ CAN 5 = CAN of module number 3, channel number 1 ▪ CAN 6 = CAN of module number 3, channel number 2 ▪ ISO 11898 interface ▪ The DS1513 provide a split termination. The CAN bus termination resistors are switchable by software. For further information, refer to Setup Page (RTICANMM ControllerSetup) (RTI CAN MultiMessage
c2	CAN 1 high			
b3	CAN 2 low	CAN Type 1		
b2	CAN 2 high			
B3	CAN 3 low	CAN Type 1	Module 2	
B2	CAN 3 high			

Pins	Signal	Module Type	Module Number	Description / Function
A3	CAN 4 low	CAN Type 1		Blockset Reference) or Unit Page (RTICAN CONTROLLER SETUP) (RTI CAN Blockset Reference).
A2	CAN 4 high			
P3	CAN 5 low	CAN Type 1	Module 3	
P2	CAN 5 high			
N3	CAN 6 low	CAN Type 1		
N2	CAN 6 high			
c6	Serial 1 RXD[1)]	CAN Type 1	Module 1	RS232 interface: Serial 1 = RS232 of module number 1
c5	Serial 1 TXD[1)]			
b5	Serial 2 K / LIN[1)]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 2 = LIN of modul number 1 ▪ ISO 9141 interface: Serial 2 = K and L lines of modul number 1 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
b6	Serial 2 L[1)]			
B6	Serial 3 RXD[1)]	CAN Type 1	Module 2	RS232 interface: Serial 3 = RS232 of module number 2
B5	Serial 3 TXD[1)]			
A5	Serial 4 K / LIN[1)]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 4 = LIN of modul number 2 ▪ ISO 9141 interface: Serial 4 = K and L lines of modul number 2 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
A6	Serial 4 L[1)]			
P6	Serial 5 RXD[1)]	CAN Type 1	Module 3	RS232 interface: Serial 5 = RS232 of module number 3
P5	Serial 5 TXD[1)]			
N5	Serial 6 K / LIN[1)]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 6 = LIN of modul number 3 ▪ ISO 9141 interface: Serial 6 = K and L lines of modul number 3

Pins	Signal	Module Type	Module Number	Description / Function
N6	Serial 6 L[1]			The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.

[1] For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 🕮).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Interface	Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
Host PC	Protocol	TCP/IP				
	Bitrate			▪ 10/1000[2] ▪ 10/100[3]		Mbit
	Data throughput				2.6	MB/sec
	Voltage levels	Ethernet standard				
Ethernet I/O	Protocol	UDP/IP				
	Bitrate			1000		Mbit
	Voltage levels	Ethernet standard				

Interface	Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
USB	USB 2.0 standard (USB Flight Recording)					
	Data throughput	without connected host tool			1280	kB/sec
		with connected host tool			1024	kB/sec
		without data loss during cold start (dependent on the boot time of the host interface)			640	kB/sec
	Current				1.3	A
	Voltage				5	V
ECU	Bit rate	LVDS mode			250	MBit
		LVDS2 mode			560	
	Cable length	2-paired twisted pair			5	m
	Cable type		CAT5			
	Voltage levels	LVDS standard				
	Full duplex data rate [4]	LVDS mode; Single transfer			5	MWord/s
		LVDS2 mode; Single transfer			11.2	MWord/s
		LVDS2 mode; Block transfer			28	MWord/s
	RAM size [4]	LVDS / LVDS2 mode	16			kWord
	FIFO size[4]	LVDS / LVDS2 mode (Transmit buffer)	1			kWord
CAN	Bit rate	ISO 11898 interface			1	MBaud
Serial 1/3/5 RS232-Interface	Bit rate		14		115.2k	Baud
	TX output voltage swing	3 kΩ load	±5	±9		V
	$V_{RxinLow}$	RX input threshold low		1.4	0.8	V
	$V_{RxinHigh}$	RX input threshold high	2.0	1.4		V
	Word length		5		8	bit
Serial 2/4/6 ISO9141-Interface	Bit rate	R_{KO} = 510 Ω; $C_K \leq$ 1.3 nF	14		50k	Baud
	Word length		5		8	bit
Serial 2/4/6 LIN Interface	Bit rate		14		20k	Baud

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) Since board revision DS1401-23 (available since dSPACE Release 7.2).
3) Before board revision DS1401-23
4) Word is 16-bit wide

Baud rate calculation of the serial interface

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error.

The UART baud rate generator provides several baud rates:

To calculate the divisor T for a chosen baud rate

$$T = \text{Round}\left(\frac{921600}{\text{BR (chosen)}}\right)$$

BR (chosen) = The baudrate to be generated
T = The baudrate generator divisor ($8 \leq T \leq 65535$)

To calculate the real baud rate from a given divisor T

$$\frac{\text{BR (real)}}{\text{Baud}} = \frac{921600}{T}$$

BR (real) = The baudrate you get
T = The baudrate generator divisor ($8 \leq T \leq 65535$)

To calculate the resulting error

$$\frac{\text{Error}_{BR}}{100\%} = \frac{\text{BR (real)} - \text{BR (chosen)}}{\text{BR (chosen)}}$$

Note

If $\text{Error}_{BR} \leq 2\%$, messages will be transferred and received correctly.

Related topics

Basics

CAN Support (MicroAutoBox II Features 📖)
LIN Support (MicroAutoBox II Features 📖)

References

Serial Interface (MicroAutoBox II Features 📖)

Data Sheet MicroAutoBox II 1401/1513/1514

Where to go from here

Information in this section

Overview and General Information

Where to go from here

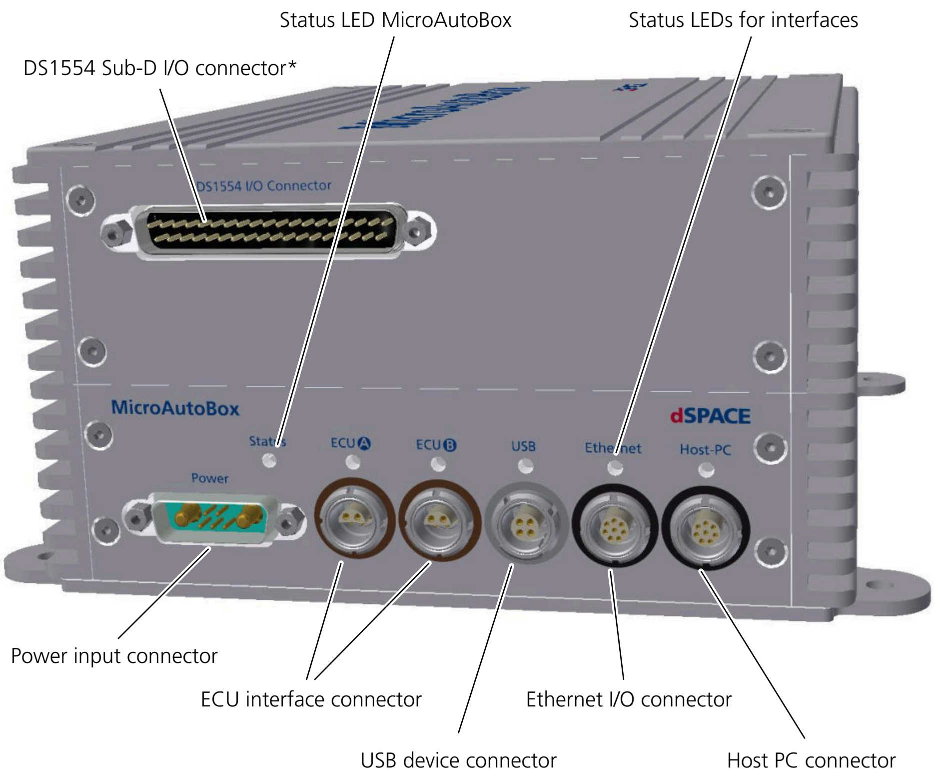
Information in this section

Housing Components

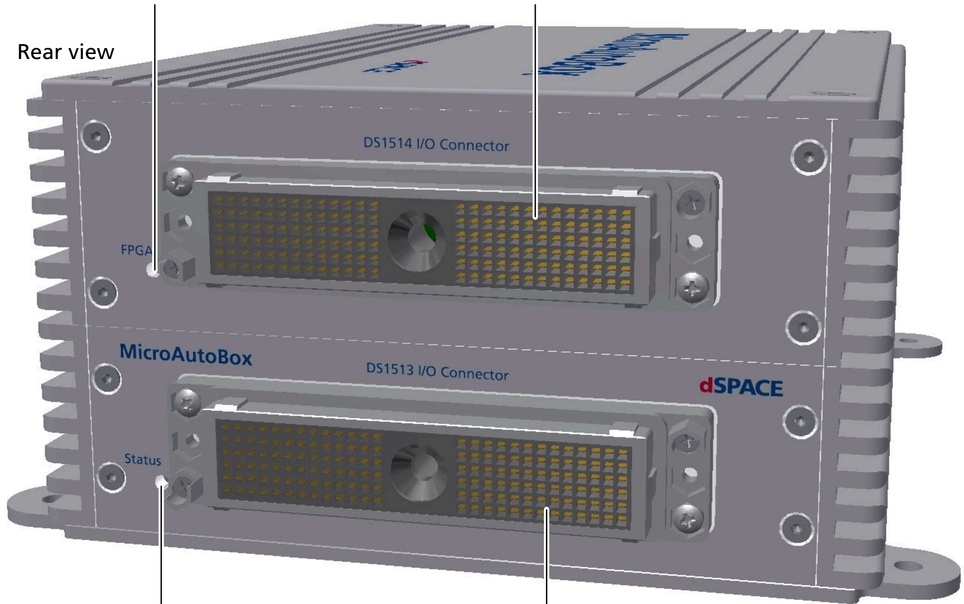
Connectors and status LEDs

The illustrations show where the connectors and status LEDs are located on MicroAutoBox II 1401/1513/1514.

Front view



* Only with DS1554 Engine Control I/O Module



MicroAutoBox II 1401/1513/1514 contains the following connectors and LEDs:

Power input connector Supplies the required power to MicroAutoBox II. It is a 7-pin, male Sub-D connector with two high-current pins.

A preconfigured cable with a matching connector and a separate power input connector are included in each MicroAutoBox II package. For the pinout and further details on the preconfigured cable, refer to Power Input Connector on page 354.

Status LED MicroAutoBox Shows you different states and potential malfunctions.

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED (= dual LED) shows different states indicated by the LED color:

- LED is red: Reset state and no application is downloaded to the real-time processor.
- LED is green: Application is running.
- LED is flashing red: MicroAutoBox II is in secured mode. For further instructions, refer to Checking MicroAutoBox II on page 506.

The status LED on the front panel has the same functionality as the status LED on the rear panel of MicroAutoBox II.

ECU interface connectors Provide communication to ECUs based on the LVDS standard, for example, in bypassing scenarios or to connect a RapidPro system (used as I/O subsystem). The ECU interface connectors are 4-pin LEMO connectors. Matching cables are supplied from dSPACE on request.

The corresponding LED is lit green, if power at both ends of the link is available and the relevant connection is serviceable. The LED flashes when data is being sent or received.

The table below shows the different ECU interfaces integrated into MicroAutoBox II and the display names they are mapped to in the experiment software, for example, ControlDesk.

Display Name in Software	Connectors Built-in at MicroAutoBox II	
	ECU A	ECU B
ECU 1	✓	–
ECU 2	–	✓

USB device connector A 4-pin LEMO connector to connect an USB mass storage device to use the USB Flight Recorder feature of MicroAutoBox II. A matching cable with a LEMO-USB adapter is supplied from dSPACE on request.

Note

To use the USB Flight Recorder, a separate license is required.

The possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	No USB device is connected.
Green	USB device is connected and flight recorder is not running.
Green blinking	USB device is connected and flight recorder is running.
Orange	USB device is full and the active flight recorder is specified not to overwrite old files.
Red	Write error when accessing the USB device, for example, if the device was removed while the flight recorder was running.

For further information, refer to Flight Recorder (MicroAutoBox II Features 📖).

Ethernet I/O connector An 8-pin LEMO connector that provides communication to external devices, such as PCs or ECUs based on the UDP/IP Ethernet protocol, for example, in bypassing scenarios.

A matching cable with a LEMO-RJ45 adapter is supplied from dSPACE on request.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

For installation instructions, refer to How to Connect a MicroAutoBox II to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 📖).

Host PC connector Provides the communication between MicroAutoBox II and your host PC based on the Ethernet TCP/IP protocol. The connector is a 8-pin LEMO connector. A matching cable is included in each MicroAutoBox II package.

The corresponding LED is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED flashes green when data is being sent or received.

Tip

The Ethernet I/O connector and the Host PC connector are internally connected by a common gigabit Ethernet switch (valid for base board DS1401-25ff).
This simplifies the connection options. For an example, refer to Connecting an ECU with DCI-GSI2 for Simultaneous Calibration and ECU Interfacing (ECU Interfaces Hardware Installation and Configuration 🕮).

DS1554 Sub-D I/O connector The 37-pin Sub-D I/O connector is used to connect the following sensors to the DS1554 Engine Control I/O Module:

- Crankshaft and camshaft sensors
- Knock sensors

This connector is available only if the DS1554 Engine Control I/O Module is installed.

For the pinout, refer to DS1554 Sub-D I/O Connector on page 412.

Status LED FPGA

- If the DS1552 Multi-I/O Module is installed and you use the RTI DS1552 I/O Extension Blockset the possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	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 you use the RTI FPGA Programming Blockset the possible states of the corresponding LED are listed in the table below:

LED Status	Meaning
Off	FPGA is not configured.
Green	Correct behavior.
Orange	The FPGA application can control the LED to light orange. For further information, refer to FPGA_IO_WRITE_BL (FPGA1401Tp1 with Multi-I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 🕮) or FPGA_IO_WRITE_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (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.

LED Status	Meaning
Flashing blue	The FPGA die temperature reaches a critical range for operating. 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.[1]
Blue	The FPGA die temperature is too hot for operating. 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 MicroAutoBox II or reload the user application.

[1] For details on reading the die temperature measurement, refer to FPGA_IO_READ_BL (FPGA1401Tp1 with Multi-I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖) or FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).

DS1513 ZIF I/O connector The 156-pin zero insertion force (ZIF) I/O connector provides access to the most input and output signals provided by MicroAutoBox II. A matching connector is included in each MicroAutoBox II package. For the pinout, refer to DS1513 ZIF I/O Connector on page 347.

DS1514 ZIF I/O connector The 156-pin zero insertion force (ZIF) I/O connector provides the signals of the installed I/O module and IP modules. For the pinout, refer to DS1514 ZIF I/O Connector on page 349.

General Data

General characteristics The following table shows some general characteristics of MicroAutoBox II:

Parameter		Specification[1]
Base board (DS1401-20ff.)	Processor	▪ PPC750 GL Power PC ▪ 900 MHz clock frequency ▪ Real-time clock ▪ 100 MHz bus clock
	Memory	▪ 8 MB global RAM ▪ 16 MB local RAM ▪ 16 MB flash memory
	Onboard sensors[2]	Pressure sensor: ▪ Base board DS1401-23ff. ▪ Range: 50 kPa … 115 kPa ▪ Accuracy: 1 kPa ▪ Sample rate: approx. 200 Hz

Parameter		Specification[1)]
		Acceleration sensor ▪ Base board DS1401-23ff. ▪ Range: ±2 g … ±8 g in 3 axis (x/y/z) ▪ Resolution: 10 bit per axis ▪ Sample rate: max. 800 Hz ▪ FIFO buffer: 512 words (to read and write bursts)
Communication interfaces		▪ 1 x Host PC interface based on Ethernet TCP/IP protocol ▪ 1 x Ethernet I/O interface based on Ethernet UDP/IP protocol for Ethernet bypassing scenarios ▪ 2 x ECU interface based on LVDS standard ▪ 1 x USB interface for USB flight recording (separate license)

I/O connectors		▪ 2 x 156-pin ZIF I/O connector
		  ▪ Contact resistance: max. 15 mΩ
		  ▪ Durability: 10000 cycles
		  ▪ Continuous current per pin ($T_{operating}$ = +85 °C): max. 2.5 A
		▪ 1 x 7-pin power supply input connector

FPGA (on DS1514 I/O Board)		Xilinx® Kintex®-7 FPGA XC7K325T
Housing dimensions	Width	202 mm (7.95 in.)
	Height	96 mm (3.78 in.)
	Depth	222 mm (8.74 in.)
Weight		About 3.2 kg (7.05 lb.) without external cables and modules

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

2) For further information on the sensors, refer to Onboard Sensors (MicroAutoBox II Features 📖).

Supported features

For an overview of the features that this MicroAutoBox II variant supports, refer to Feature Support (MicroAutoBox II Features 📖).

Absolute Maximum Levels

Avoiding damage to the system

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

Levels

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

Parameter	Specification[1)]	Condition / Description
VBAT	–40 V ... +100 V	Load dump- and reverse protection
VDRIVE	0 V ... +45 V	—
All digital output voltages	(VDRIVE – 45 V) ... +45 V	—
All digital input voltages	(VDRIVE – 45 V) ... +45 V	—
All analog output voltages	–30 V ... +40 V	—
All analog input voltages	–40 V ... +40 V	—
VSENS output on DS1513 ZIF I/O connector	0 V ... +40 V	—
VSENS output on DS1514 ZIF I/O connector	Provided by the DS1552 Multi-I/O Module (refer to Absolute Maximum Levels on page 380) or the DS1554 Engine Control I/O Module (refer to Absolute Maximum Levels on page 408).	
VBATprot output	0 V ... +45 V	—
RS232 transceiver output on the DS1513 ZIF I/O connector	–30 V ... +30 V	—
RS232 transceiver input on the DS1513 ZIF I/O connector	–30 V ... +30 V	—
RS232 transceiver on the DS1514 ZIF I/O connector	Provided by the DS1552 Multi-I/O Module (refer to Absolute Maximum Levels on page 380) if it is installed.	
$V_{CAN\ high}$, $V_{CAN\ low}$ on the DS1513 ZIF I/O connectorr	–58 V ... +58 V	Voltage level on CAN high and CAN low pins.
$V_{(Diff\ CAN\ high\ -\ CAN\ low)}$ on the DS1513 ZIF I/O connector	–5 V ... +5 V	Voltage difference between CAN high and CAN low pins (due to termination resistors).
CAN interface on the DS1514 ZIF I/O connector	Provided by the optional DS4342 CAN FD Interface Module (refer to Absolute Maximum Levels on page 444).	
Serial K / LIN	–20 V ... +32 V, but not more than VBAT	—
Serial L	–24 V ... +30 V, but not more than VBAT	—
FlexRay bus lines	Provided by the optional DS4340 FlexRay Interface Module (refer to Absolute Maximum Levels on page 432).	
All outputs short circuit to GND	Continuous	—
Continuous power dissipation	Max. 50 W	$T_{operating}$ = +85 °C Power dissipated by the MicroAutoBox II itself. The power of the connected loads (VBATprot/VSENS) must be added.
Operating temperature	–40 °C … +85 °C [2)]	—
Storage temperature	–55 °C … +90 °C	—

Parameter	Specification[1]	Condition / Description
Relative humidity	10% ... 95%	Noncondensing
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

[2] Mounted modules and a high FPGA utilization or toggle rate increase the power dissipation. This might lead to a reset of MicroAutoBox while the operating temperature is less than 85 °C. For details, refer to Parameters Page (FPGA_IO_READ_BL) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).

Battery Characteristics

Characteristics of the internal battery

The following table shows the characteristics of the battery mounted on the DS1401 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

Safety Precautions for Shipping a MicroAutoBox II..24

Certifications

CE compliance

MicroAutoBox II meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Applied standards

The characteristics of MicroAutoBox II 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 346.
	CISPR 11, EN 55011 Group 1, Class A	Emission standard for industrial environments
	RTCA/DO160G: Dec. 2010: Section 21.4	Environmental conditions and test procedures for airborne equipment: Conducted RF Emissions, Category: B, L, M&H[2)]
	RTCA/DO160G: Dec. 2010: Section 21.5	Environmental conditions and test procedures for airborne equipment: Radiated RF Emissions, Category: M[2)]
Vibration	ISO 16750-3:2007 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 4 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 4 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 … 2000 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 A Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 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.
2) For further information, refer to dSPACE Support.

Vibration and shock tests

To verify the reliability of MicroAutoBox II under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox II 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 II during run time. Otherwise, you might influence the measurements.

Connector Pinouts

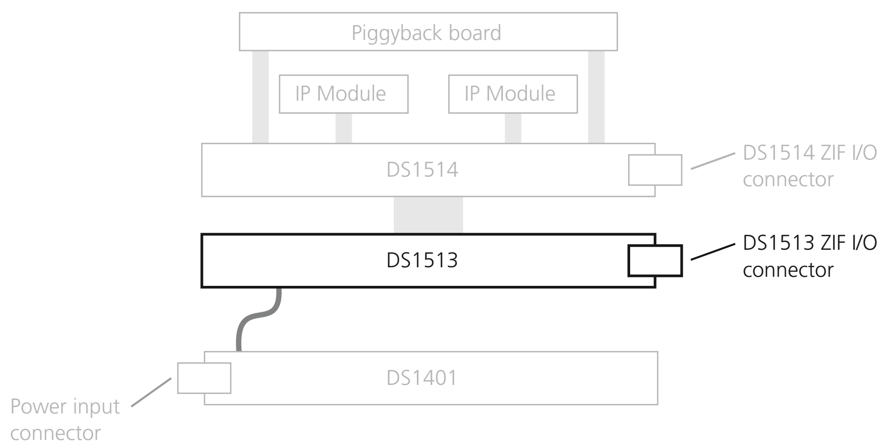
Where to go from here

Information in this section

DS1513 ZIF I/O Connector

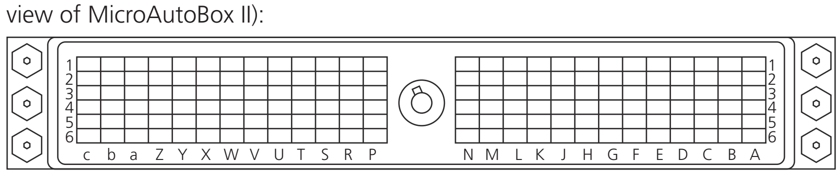
Introduction

The **DS1513 I/O connector** is a 156-pin zero insertion force (ZIF) connector giving access to the input and output signals provided by DS1513 I/O Board. The illustration below shows the internal assembly of the MicroAutoBox II 1401/1513/1514.



Pinout

The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



> **Note**
>
> There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of the I/O connector:

1		2		3		4		5		6		
GND	in	CAN 4 high	i/o	CAN 4 low	i/o	GND	in	Serial 4 K / LIN[1]	i/o	Serial 4 L[1]	in	*A*
GND	in	CAN 3 high	i/o	CAN 3 low	i/o	GND	in	Serial 3 TXD[1]	out	Serial 3 RXD[1]	in	*B*
GND	in	DigP 1 ch 5[2]	out	DigP 1 ch 10	out	DigP 1 ch 15	out	DigP 2 ch 4	out	GND	in	*C*
GND	in	DigP 1 ch 4	out	DigP 1 ch 9	out	DigP 1 ch 14	out	DigP 2 ch 3	out	DigP 2 ch 8	out	*D*
GND	in	DigP 1 ch 3	out	DigP 1 ch 8	out	DigP 1 ch 13	out	DigP 2 ch 2	out	DigP 2 ch 7	out	*E*
GND	in	DigP 1 ch 2	out	DigP 1 ch 7	out	DigP 1 ch 12	out	DigP 2 ch 1	out	DigP 2 ch 6	out	*F*
GND	in	DigP 1 ch 1	out	DigP 1 ch 6	out	DigP 1 ch 11	out	DigP 1 ch 16	out	DigP 2 ch 5	out	*G*
GND	in	DigP 1 ch 5	in	DigP 1 ch 10	in	DigP 1 ch 15	in	DigP 2 ch 4	in	GND	in	*H*
GND	in	DigP 1 ch 4	in	DigP 1 ch 9	in	DigP 1 ch 14	in	DigP 2 ch 3	in	DigP 2 ch 8	in	*J*
GND	in	DigP 1 ch 3	in	DigP 1 ch 8	in	DigP 1 ch 13	in	DigP 2 ch 2	in	DigP 2 ch 7	in	*K*
GND	in	DigP 1 ch 2	in	DigP 1 ch 7	in	DigP 1 ch 12	in	DigP 2 ch 1	in	DigP 2 ch 6	in	*L*
VSENS	out	DigP 1 ch 1[2]	in	DigP 1 ch 6	in	DigP 1 ch 11[2]	in	DigP 1 ch 16	in	DigP 2 ch 5	in	*M*
VDRIVE	in	CAN 6 high	i/o	CAN 6 low	i/o	GND	in	Serial 6 K / LIN[1]	i/o	Serial 6 L[1]	in	*N*
VBAT prot	out	CAN 5 high	i/o	CAN 5 low	i/o	GND	in	Serial 5 TXD[1]	out	Serial 5 RXD[1]	in	*P*
REMOTE	in	GND	in	GND	in	GND	in	GND	in	GND	in	*R*
GND	in	AnalogOut ch 8	out	AnalogIn ch 4	in	AnalogIn ch 8	in	AnalogIn ch 12	in	AnalogIn ch 16	in	*S*
GND	in	AnalogOut ch 7	out	AnalogIn ch 3	in	AnalogIn ch 7	in	AnalogIn ch 11	in	AnalogIn ch 15	in	*T*
GND	in	AnalogOut ch 6	out	AnalogIn ch 2	in	AnalogIn ch 6	in	AnalogIn ch 10	in	AnalogIn ch 14	in	*U*
GND	in	AnalogOut ch 5	out	AnalogIn ch 1	in	AnalogIn ch 5	in	AnalogIn ch 9	in	AnalogIn ch 13	in	*V*
GND	in	AnalogOut ch 4	out	Analog ch 4	in	Analog ch 8	in	Analog ch 12	in	Analog ch 16	in	*W*
GND	in	AnalogOut ch 3	out	Analog ch 3	in	Analog ch 7	in	Analog ch 11	in	Analog ch 15	in	*X*
GND	in	AnalogOut ch 2	out	Analog ch 2	in	Analog ch 6	in	Analog ch 10	in	Analog ch 14	in	*Y*
GND	in	AnalogOut ch 1	out	Analog ch 1	in	Analog ch 5	in	Analog ch 9	in	Analog ch 13	in	*Z*
GND	in	SGND	in	Ana trigger 1	in	Ana trigger 2	in	Ana trigger 3	in	Ana trigger 4	in	*a*

1		2		3		4		5		6		
GND	in	CAN 2 high	i/o	CAN 2 low	i/o	GND	in	Serial 2 K / LIN[1]	i/o	Serial 2 L[1]	in	*b*
GND	in	CAN 1 high	i/o	CAN 1 low	i/o	GND	in	Serial 1 TXD[1]	out	Serial 1 RXD[1]	in	c

[1] For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 📖).
[2] DigP = Port number; ch = Channel number

Note

To use the digital inputs and outputs, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the logic level needed. *This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.* You have to connect VDRIVE (pin N1) to VSENS (pin M1) or VBATprot (pin P1). Use the preconfigured jumper cable which is included in the MicroAutoBox II package.

Signal descriptions

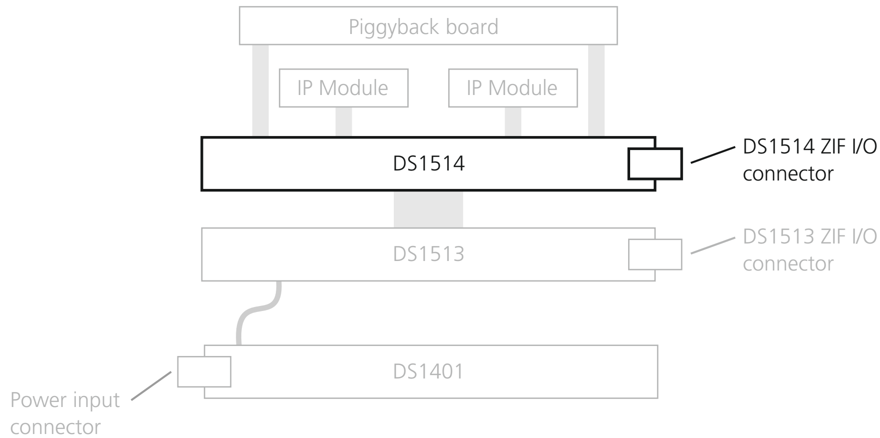
For descriptions of the signals which are available on the DS1513 ZIF I/O connector, refer to:

- Digital Inputs on page 359
- Digital Outputs on page 362
- Analog Inputs on page 367
- Analog Outputs on page 371
- CAN, LIN, serial: Interfaces on page 373

DS1514 ZIF I/O Connector

Introduction

The DS1514 I/O connector is a 156-pin zero insertion force (ZIF) connector giving access to various I/O signals if an IP module and/or an I/O module are/is installed. The illustration below shows the internal assembly of the MicroAutoBox II 1401/1513/1514 with a I/O module installed.



Pinout

The DS1514 ZIF I/O connector provides only signals of the installed I/O module and IP modules.

For pinouts of the DS1514 ZIF I/O connector, refer to the following topics:

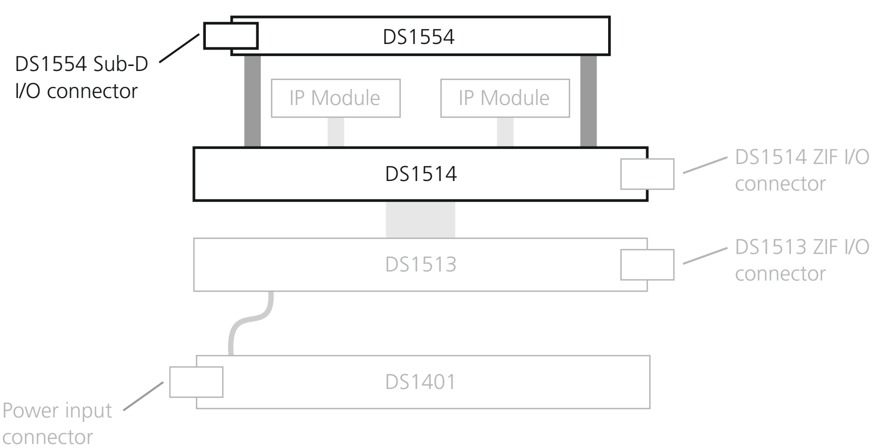
- DS1552 Multi-I/O Module: DS1514 ZIF I/O Connectors on page 382
- DS1554 Engine Control I/O Module: DS1514 ZIF I/O Connector on page 410
- DS4340 FlexRay Interface Module: DS1514 ZIF I/O Connectors on page 436
- DS4342 CAN FD Interface Module: DS1514 ZIF I/O Connectors on page 448

DS1554 Sub-D I/O Connector

Introduction

The DS1554 Engine Control I/O Module provides a 37-pin, male Sub-D connector at the front of MicroAutoBox II.

The illustration below shows the internal assembly of a MicroAutoBox II 1401/1513/1514 with a DS1554 Engine Control I/O Module installed.



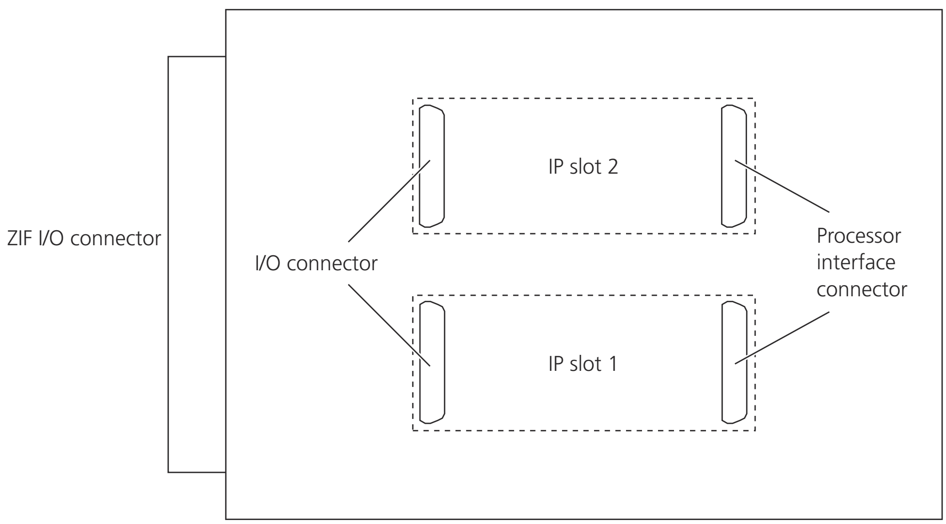
Pinout

The DS1554 Sub-D I/O connector only provides signals of the installed DS1554 Engine Control I/O Module. For the pinout, refer to DS1554 Sub-D I/O Connector on page 412.

IP Module Connectors

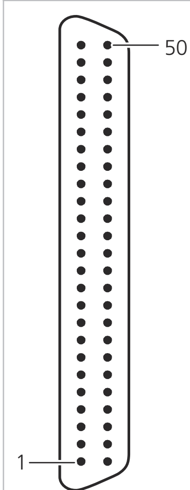
Introduction

The DS1514 provides two slots to install IP modules. Each slot provides two AMP connectors: I/O connector and processor interface connector. The following illustration shows the top view of MicroAutoBox II.

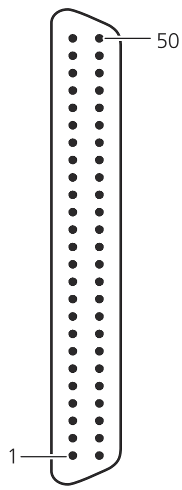


Pinout

I/O connector - IP module slot 1 The following table shows the signal mapping of the IP module I/O connector on slot 1 to the DS1514 ZIF I/O connector (rear of MicroAutoBox II):

IP Module I/O Connector	Pin	ZIF Pin for IP Slot 1	Pin	ZIF Pin for IP Slot 1
	25	-	50	M3
	24	-	49	M4
	23	-	48	L3
	22	-	47	-
	21	-	46	K3
	20	K5	45	K4
	19	K6	44	J3
	18	J5	43	-
	17	J6	42	-
	16	H5	41	-
	15	H6	40	-
	14	G5	39	-
	13	-	38	-
	12	-	37	-
	11	-	36	-
	10	-	35	-
	9	-	34	-
	8	-	33	-
	7	-	32	-
	6	-	31	-
	5	C6	30	-
	4	-	29	-
	3	-	28	-
	2	-	27	-
	1	-	26	-

I/O connector - IP module slot 2 The following table shows the signal mapping of the IP module I/O connector on slot 2 to the DS1514 ZIF I/O connector (rear of MicroAutoBox II):

IP Module I/O Connector	Pin	ZIF Pin for IP Slot 2	Pin	ZIF Pin for IP Slot 2
	25	-	50	b3
	24	-	49	b4
	23	-	48	a3
	22	-	47	-
	21	-	46	Z3
	20	Z5	45	Z4
	19	Z6	44	Y3
	18	Y5	43	-
	17	Y6	42	-
	16	X5	41	-
	15	X6	40	-
	14	W5	39	-
	13	-	38	-
	12	-	37	-
	11	-	36	-
	10	-	35	-
	9	-	34	-
	8	-	33	-
	7	-	32	-
	6	-	31	-
	5	S6	30	-
	4	-	29	-
	3	-	28	-
	2	-	27	-
	1	-	26	-

Processor interface connector - slot 1 and slot 2 The pinout of the processor interface connector (slot 1 and slot 2) complies with IP Modules Draft Standard VITA 4-1995. For further information, refer to the documentation of the standard.

Power Input Connector

Introduction

MicroAutoBox II provides a power input connector. It 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).

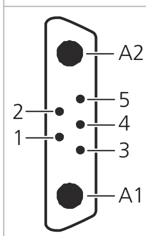
Feature for MicroAutoBox Embedded PC The pinout of the power input connector features two additional signals for remote control when MicroAutoBox II is combined with MicroAutoBox Embedded PC.

Refer to the following topics:

- MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: Power Input Connector on page 464 and Power Inputs and Outputs on page 466
- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor: Power Input Connector on page 481 and Power Inputs and Outputs on page 486

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (6 V … 36 V DC)		
			5	REMOTE_PULLUP
	2	Reserved for MicroAutoBox Embedded PC [2]	4	REMOTE[3]
	1	Do not connect	3	Reserved for MicroAutoBox Embedded PC [2]
	A1	GND		

[1] NOTE: Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] Refer to Power Input Connector on page 464 or Power Input Connector on page 481.

[3] The REMOTE input must be connected via switch or bridge to VBAT to run the MicroAutoBox II.

Matching cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is for running MicroAutoBox II with a laboratory power supply during development. Therefore, the REMOTE pin (pin 4) is shorted to the VBAT pin (pin A2) inside the connector in order to save a separate switch. Do not use this cable in the vehicle. Otherwise, MicroAutoBox II will always be turned on.

The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1)] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1)] The cable is labeled with this type number.

⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Pin description

The following tables provide a description of the pins used for power input, remote input, and supply of digital I/O circuits.

Power input connector The following table lists the pin description of the power input connector on the front:

Pins	Signal	Description / Function
A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery/power supply. This signal is also connected to the housing of MicroAutoBox II.
4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin directly to VBAT, MicroAutoBox II will always be on, and the vehicle battery will soon be depleted if the engine is not running. Thus, a switch is highly recommended. Refer to Connecting to Power Supply on page 42.

Pins	Signal	Description / Function
		You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage. ▪ To wake up MicroAutoBox II via CAN messages, the **REMOTE** pin must be left open when MicroAutoBox II is powered down. This is due to the fact that there is an additional internal connection to the **REMOTE** pin. Nevertheless, you can always use a remote switch to supply voltage (e.g., VBAT) to start MicroAutoBox II.
5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

DS1513 ZIF I/O connector The following table lists the pin description of the DS1513 I/O Boards ZIF I/O connector on the rear:

Pins	Signal	Description / Function
A1, A4, B1, B4, C1, C6, D1, E1, F1, G1, H1, H6, J1, K1, L1, N4, P4, R2 ... R6, S1, T1, U1, V1, W1, X1, Y1, Z1, a1, b1, b4, c1, c4	GND	Main power supply return and reference for all input and output signals. Use the nearest possible GND pin as reference for your signals in order to keep noise levels at minimum. The housing of MicroAutoBox II is also connected to GND.
a2	SGND	Internally connected to GND with a 0 Ω resistor.
N1	VDRIVE	This input supplies all digital input and output circuits located on the DS1513 I/O Board. ▪ Connect this input to VSENS to set 5 V logic levels to your inputs/outputs. ▪ Connect this input to VBATprot to set automotive-compatible logic levels to your inputs/outputs. ▪ Do not connect this pin directly to VBAT, because the input and output circuits are not load-dump-protected or reverse-voltage-protected at this signal. For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
M1	VSENS	Sensor supply output. VSENS is switched on and off with the REMOTE pin. Use this output to supply your sensors and/or VDRIVE. If you need 5 V logic levels at the inputs/outputs connect VSENS to VDRIVE.
P1	VBAT prot	Protected VBAT output. VBATprot follows VBAT within the specified range and is switched on and off with the REMOTE pin. Use this output to supply VDRIVE when automotive logic levels are needed.
R1	REMOTE	▪ The remote voltage may be used for starting MicroAutoBox II with a remote switch: KL15, for example (output of the ignition/driving switch). ▪ If you connect the remote pin to the vehicle battery directly, MicroAutoBox II will always be turned on, and the vehicle battery will soon be exhausted if the engine is not running. Thus, a switch is highly recommended. ▪ The remote voltage should not exceed the supply voltage.

DS1514 ZIF I/O connector For the pin description, refer to the following topics:

- DS1552 Multi-I/O Module: Power Inputs and Outputs on page 385
- DS1554 Engine Control I/O Module: Power Inputs and Outputs on page 414

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up with an input power consumption < 35 W	6		36[2)]	V
	VBAT	Operating	4.5		36[2)]	V
	VBAT	Reverse protection			–40	V
	VBAT	Load dump protection			+100	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≥ $V_{iHRemote}$		2		A
	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		5		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
Inrush current	$I_{VBAT\ inrush}$	All inputs/outputs unconnected	see Power supply on page 38			
Digital I/O voltage supply input on DS1513 ZIF I/O connector	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		20		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		1		A
Digital I/O voltage supply input on DS1514 ZIF I/O connector	VDRIVE	Supply for digital input/output circuits			45	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		10		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		500		mA

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Outputs						
Sensor supply output on DS1513 ZIF I/O connector	VSENS	Output voltage	4.84	5.05	5.25	V
	VSENS = f(T)	Temperature caused voltage drift $T_{Housing}$ = –40 °C ... +85 °C	–2		2	%
	$I_{VSENS, max}$	Maximum output current	750			mA
Sensor supply output on DS1514 ZIF I/O connector	VSENS	Provided by DS1552 (refer to Power Inputs and Outputs on page 385) or DS1554 (refer to Power Inputs and Outputs on page 414).				
Protected VBAT output	VBATprot [3]	I_{Load} = 1 A; VBAT = 12 V	11.56	11.78	12	V
	$I_{VBATprot, max}$	Maximum output current			1000	mA
	$I_{ProtPeak}$	Overload current limit (–40 °C ... 85 °C)	4		9	A
	t(overload)	Time to shut off $I_{ProtPeak}$			5	ms

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) With an additional absolute maximum tolerance of +4 V.
3) VBATprot follows VBAT within the specified range.

Related topics

Basics

Digital Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the DS1513 ZIF I/O connector and the DS1514 ZIF I/O connector. For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the digital input pins on the DS1513 ZIF I/O connector:

Pins	Port Number	Signal	Description / Function
M2, L2, K2, J2, H2, M3, L3, K3, J3, H3, M4, L4, K4, J4, H4, M5	1	Channel 1 ... 16 DIO Type 4	Standard discrete digital input with pull-up.
L5, K5, J5, H5, M6, L6, K6, J6	2	Channel 1 ... 8 DIO Type 4	

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
Digital input channel 1 ... 24	V_{iH}	Input high voltage	3.1			V
	V_{iL}	Input low voltage			1.2	V
	V_{iHys}	Input hysteresis voltage		1		V
	R_{DigIn}	Pull-up resistor to VDRIVE	17	18	19	kΩ
	C_{DigIn}	Input capacitance		1		nF
REMOTE	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
AC characteristics						
Inputs	t_{LowMin}	Minimum pulse width low		250	500	ns
	$t_{HighMin}$	Minimum pulse width high		300	600	ns
	F_{max}	Duty cycle: 50 %		1.8		MHz
		Duty cycle: 1 % or 99 %		33		kHz

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

Powering digital inputs and outputs of the DS1513 ZIF I/O connector

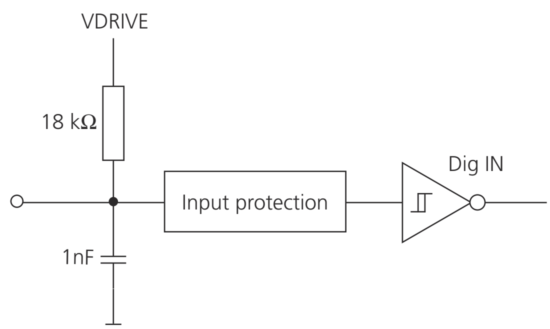
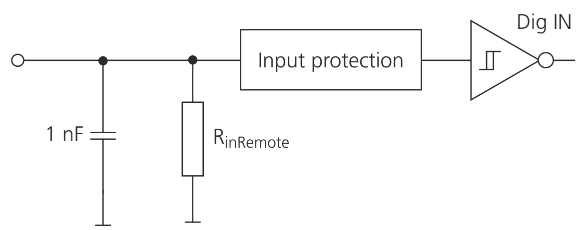
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the digital inputs:

Signal		**I/O Circuit**
Digital inputs	Channel 1 ... 24	 For proper operation, VDRIVE must have a level above the maximum input voltage.
	Remote	

Digital inputs on the DS1514 ZIF I/O connector

Only I/O modules can provide digital inputs on the DS1514 ZIF I/O connector. For signal descriptions of the DS1552 Multi-I/O Module, refer to Digital Inputs on page 387.

Related topics

Basics

Digital Outputs

Note on the cable harness

> **Note**
>
> To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the DS1513 ZIF I/O connector and the DS1514 ZIF I/O connector. For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

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.

Pin description

The following table gives a description of the digital output pins on the DS1513 ZIF I/O connector:

Pins	Port Number	Signal	Description / Function
G2, F2, E2, D2, C2, G3, F3, E3, D3, C3, G4, F4, E4, D4, C4, G5	1	Channel 1 ... 16 DIO Type 4	Standard discrete digital output.
F5, E5, D5, C5, G6, F6, E6, D6	2	Channel 1 ... 8 DIO Type 4	

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

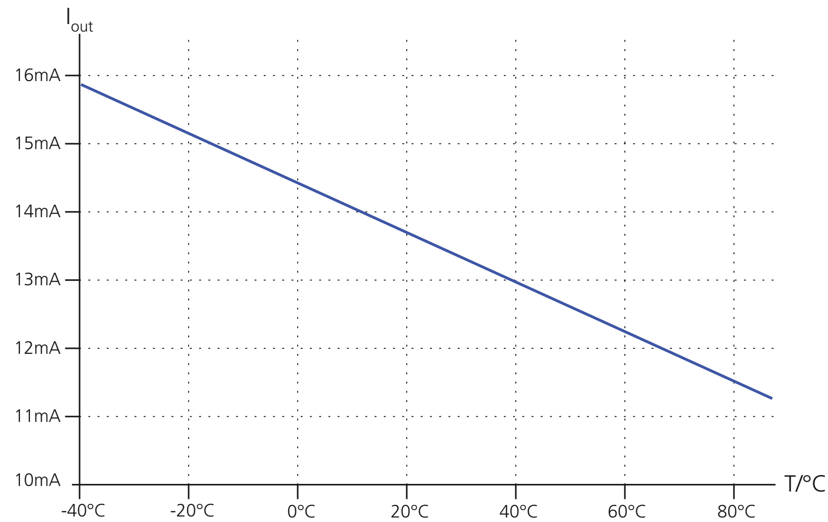
Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC Characteristics						
Digital output channel 1 ... 24	V_{oH}	I_{Load} = 0 mA; VDRIVE = 5 V	4.4	4.6		V
	V_{oL}	I_{Load} = 0 mA; VDRIVE = 5 V		0.1	0.3	V
	V_{oH}	I_{Load} = 5 mA; VDRIVE = 5 V	3.2	3.4		V
	V_{oL}	I_{Load} = –5 mA; VDRIVE = 5 V		0.7	0.9	V
	V_{oH}	I_{Load} = 0 mA; VDRIVE = 12 V	11.3	11.6		V
	V_{oL}	I_{Load} = 0 mA; VDRIVE = 12 V		0.1	0.3	V
	V_{oH}	I_{Load} = 5 mA; VDRIVE = 12 V	10.3	10.5		V
	V_{oL}	I_{Load} = –5 mA; VDRIVE = 12 V		0.7	0.9	V
	$\lvert I_{OHmax} \rvert$	Current limit high $T_{Housing}$ = –40 °C ... +85 °C	5	13	17	mA
	$\lvert I_{OLmax} \rvert$	Current limit low $T_{Housing}$ = –40 °C ... +85 °C	5	14	18	mA
	$\lvert I_{OTLeak} \rvert$	Leakage current tristate $T_{Housing}$ = -40 °C ... +85 °C			100	µA
AC Characteristics						
Outputs	$t_{minPulseHigh}$	Minimum pulse width high, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		700	1400	ns
	$t_{minPulseLow}$	Minimum pulse width low, VDRIVE = 5 V or 12 V, R_{Load}=1 kΩ		200	400	ns
	F_{max}	Duty cycle: 50 % VDRIVE = 5 V or 12 V		0.7[2]		MHz
		Duty cycle: 1 % or 99 % VDRIVE = 5 V or 12 V		14		kHz

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

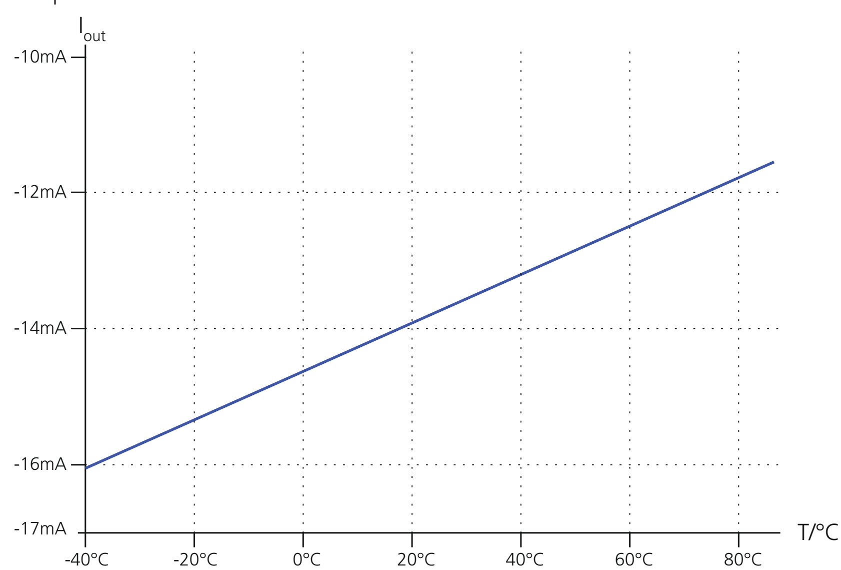
2) Limited by software to 150 kHz

The following illustrations show the maximum output current of a digital output circuit as a function of ambient temperature (VDRIVE = 12 V; output is shorted to 6 V):

- Output high

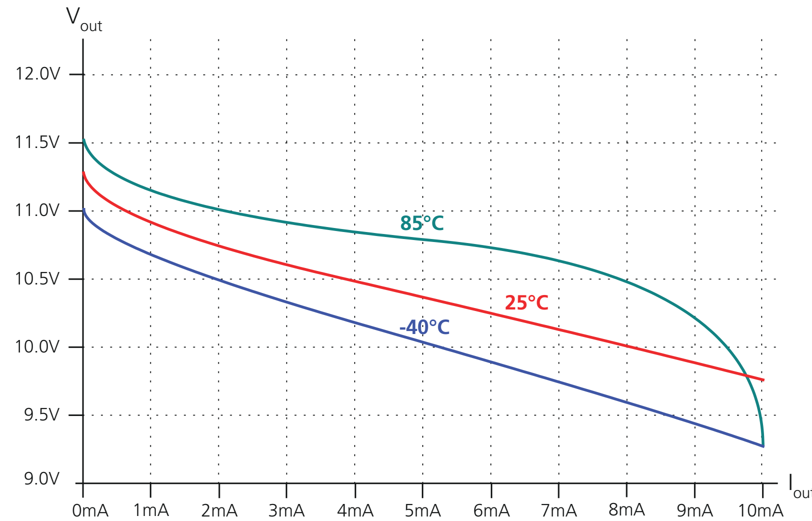


- Output low

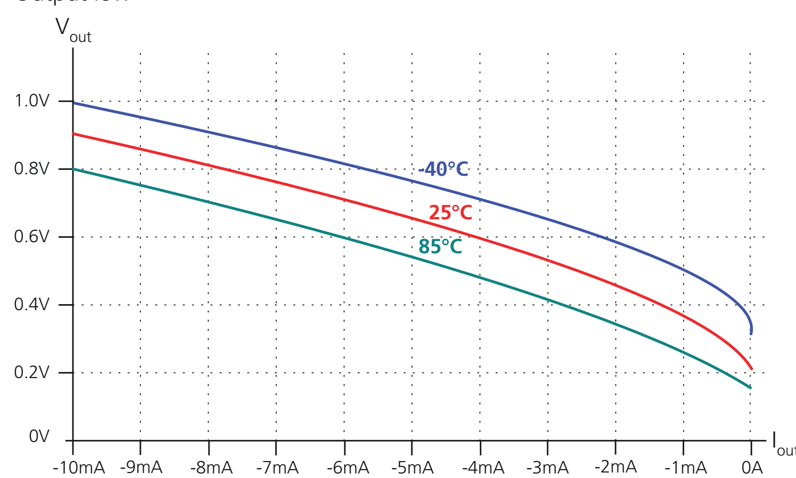


The following illustrations show the typical digital output voltage as a function of the output current (VDRIVE = 12 V):

- Output high



- Output low



Powering digital inputs and outputs of the DS1513 ZIF I/O connector

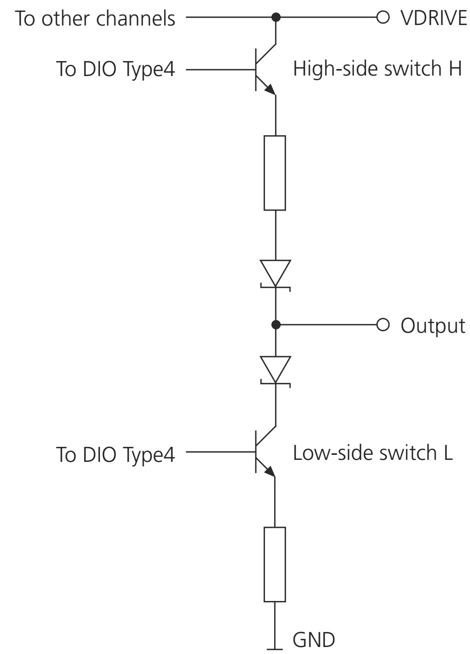
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the digital outputs:

Signal	I/O Circuit
Digital outputs	

Digital outputs on the DS1514 ZIF I/O connector

Only I/O modules provide digital outputs on the DS1514 ZIF I/O connector.

For signal descriptions, refer to the following topics:

- If you use a DS1552 Multi-I/O Module, refer to Digital Outputs on page 389.
- If you use a DS1554 Engine Control I/O Module, refer to Digital Outputs on page 416.

Related topics

Basics

Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 📖)
Providing the Supply Voltage to Drive Digital I/O Interfaces..47

Digital I/O (Bidirectional)

Introduction

The information on the digital bidirectional I/O channels is relevant only if the DS1514 I/O Board is equipped with an I/O module.

For information on the digital bidirectional I/O channels, refer to the following topics:

- If you use a DS1552 Multi-I/O Module, refer to Digital I/O (Bidirectional) on page 392.
- If you use a DS1554 Engine Control I/O Module, refer to Digital I/O (Bidirectional) on page 421.

Analog Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog input pins on the DS1513 ZIF I/O connector:

Pins	Signal	Module	Description / Function
Z3, Y3, X3, W3, Z4, Y4, X4, W4, Z5, Y5, X5, W5, Z6, Y6, X6, W6	ADC channel 1 ... 16	ADC Unit Type 4	-10 V ... +10 V
a3, a4, a5, a6	External trigger 1 ... 4		For information on function of the trigger signals, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).
V3, U3, T3, S3, V4, U4, T4, S4, V5, U5, T5, S5, V6, U6, T6, S6	ADC channel 1 ... 16	AIO Type 1 ADC Unit	-10 V ... +10 V

Characteristics of the ADC Unit Type 4

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

The following table shows the characteristics of the ADC Unit Type 4 channels.

Signal[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics						
ADC (all 16 channels)	Number of independent input channels			16		
	Resolution			16		bit
	Sample rate	Burst mode with more than 1 sample			1	MSPS
	Input voltage range		-10		10	V
	Conversion timer	Separate for each channel.				
		Width	27			bit
		Resolution	10			ns
		Interval			1.342	s
	Timer for time stamping	Common for all channels. Two channels are required to carry one 32 bit value.				
		Width	32			bit
		Resolution	10			ns
		Interval			42.9	s
	Buffer size	Software-configurable	1		8192	Samples
	Buffers per channel		3			
	Number of external trigger inputs		4			
DC characteristics						
ADC Type 4 (all 16 channels)	Initial offset error	Below 750 KSPs	-3		3	mV
	Initial gain error	Below 750 KSPs	-0.25		0.25	%
	Input impedance	Dynamic (ΔU/ΔI) [2]		117		kΩ
	Offset drift			±40		µV/K
	Gain drift			±6		ppm/K
	Overvoltage protection	Continuous	-30		+30	V
		Short term	-50		50	V
External trigger	Input voltage	V_{iH}	2.3			V
		V_{iL}			0.4	V
	Period				1	MHz
	Overvoltage protection	Continuous	-48		50	V

Signal[1]	Parameter	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics						
ADC Type 4 (all 16 channels)	No missing codes		15			bit
	SNR	12.4 kHz signal @ 200 KSPs	80			dB
	Input bandwidth	Full power bandwidth	400			kHz
	Channel crosstalk	100 kHz			-96	dB
		200 kHz			-92	dB
		400 kHz			-90	dB

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

[2] The current flow into the ADC input pin is affected by the input signal and the internal reference voltage (refer to Circuit diagrams on page 370). Therefore, a specific static impedance (R = U/I) does not exist for this ADC, because it changes with the absolute voltage of the input signal. Instead, the dynamic impedance is specified (R = ΔU/ΔI), because the dynamic impedance takes only changes of the DC signal into account, not the absolute values.

Characteristics of the AIO Type 1 ADC Unit

The characteristics are specified for the following conditions, unless otherwise noted:

- V_{BAT}=+12 V
- T_{CASE}=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

The following table shows the characteristics of the AIO Type 1 ADC Unit channels.

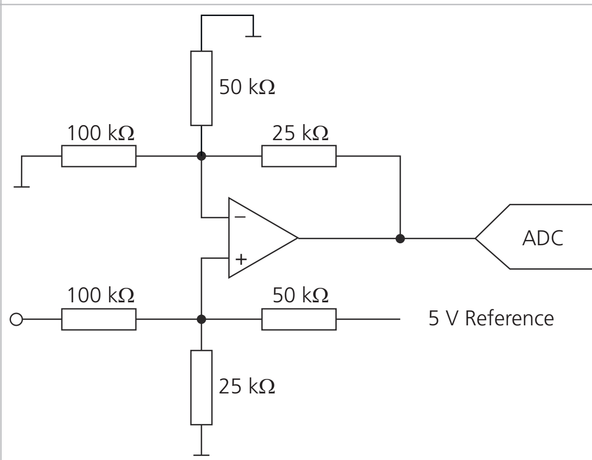
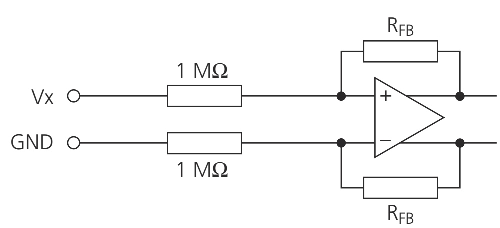
Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			16		
Resolution			16		bit
Sample rate				200	kSPs
Input voltage range		-10		10	V
Conversion time	inclusive transfer time		5		µs
DC characteristics					
Offset error		-2		2	mV
Gain error		-1		1	% of FSR
Input impedance			1		MΩ

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics					
Low pass filter	3 dB frequency		23		kHz

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

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the analog inputs:

Signal		I/O Circuit
Analog inputs	ADC Type 4	
	AIO Type 1 ADC Unit	

Analog inputs on the DS1514 ZIF I/O connector

Only I/O modules provide analog inputs on the DS1514 ZIF I/O connector.

For signal descriptions, refer to the following topics:

- If you use a DS1552 Multi-I/O Module, refer to Analog Inputs on page 395.
- If you use a DS1554 Engine Control I/O Module, refer to Analog Inputs on page 424.

Related topics

Basics

ADC Unit Type 4 (MicroAutoBox II Features 🕮)
AIO Unit Type 1 (ADC) (MicroAutoBox II Features 🕮)

References

Analog Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog output pins on the DS1513 ZIF I/O connector:

Pins (DS1513)	Signal	Module	Default State	Description / Function
Z2, Y2, X2, W2, V2, U2, T2, S2	DAC1 … DAC8	AIO Type 1 DAC Unit	High impedance	Standard analog outputs 16-bit digital values are converted to analog outputs by the DAC module.

Default state means the state of the signal during reset.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

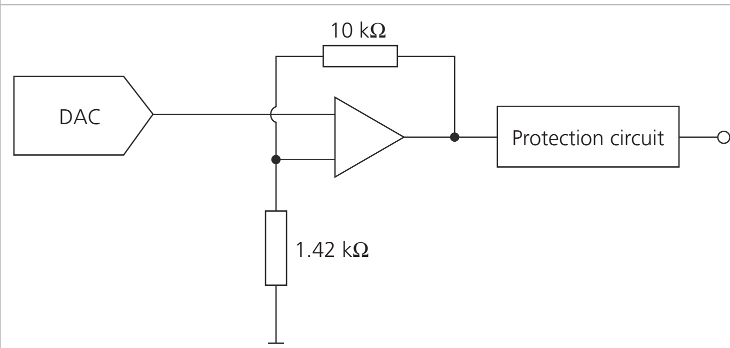
- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to SGND pin a2.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
DAC1 ... DAC8	Output voltage range		-10		+10	V
	Resolution			16		bit
	Offset error		-4		4	mV
	Gain error		-0.25		0.25	%
	I_{DACout}		-8		8	mA
	C_{DACout}	Maximum load capacitance			22	nF
AC characteristics						
DAC1 ... DAC8	Settling time	Settling time of output (to 1 %)			1	µs
	f_{gDAC}	Low-pass cutoff frequency of reconstruction filter (3 dB)	500			kHz
	f_{out}[2]	Square, ±10 V, C_{DACout} = 1 nF			150	kHz

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] Utilizable output frequency depends on voltage swing and capacitive load.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the analog outputs:

Signal		I/O Circuit
Analog outputs	DAC1 … DAC8 (AIO Type 1)	

Analog outputs on the DS1514 ZIF I/O connector

Only I/O modules provide analog outputs on the DS1514 ZIF I/O connector. For signal descriptions of the DS1552 Multi-I/O Module, refer to Analog Outputs on page 400.

Related topics

Basics

AIO Unit Type 1 (DAC) (MicroAutoBox II Features)

Interfaces

Pin description

The following tables give a description of the interface pins provided by the two ZIF connectors.

Tip

The pinout of the ECU interface connectors, USB device connector, and Ethernet I/O connector is not documented. Use a suitable dSPACE connection cable.

DS1513 ZIF I/O connector

The DS1513 ZIF I/O connector provides the interface pins to connect CAN bus interfaces, LIN bus interfaces, or for serial communication.

The interfaces are provided by CAN_TP1 modules. Each module support two CAN channels, one RS232 channel, and either one LIN channel or one ISO 9141 channel.

Pins	Signal	Module Type	Module Number	Description / Function
c3	CAN 1 low	CAN Type 1	Module 1	CAN controller: ▪ CAN 1 = CAN of module number 1, channel number 1 ▪ CAN 2 = CAN of module number 1, channel number 2 ▪ CAN 3 = CAN of module number 2, channel number 1 ▪ CAN 4 = CAN of module number 2, channel number 2 ▪ CAN 5 = CAN of module number 3, channel number 1 ▪ CAN 6 = CAN of module number 3, channel number 2 ▪ ISO 11898 interface ▪ The DS1513 provide a split termination. The CAN bus termination resistors are switchable by software. For further information, refer to Setup Page (RTICANMM ControllerSetup) (RTI CAN MultiMessage Blockset Reference) or Unit Page (RTICAN CONTROLLER SETUP) (RTI CAN Blockset Reference).
c2	CAN 1 high			
b3	CAN 2 low	CAN Type 1		
b2	CAN 2 high			
B3	CAN 3 low	CAN Type 1	Module 2	
B2	CAN 3 high			
A3	CAN 4 low	CAN Type 1		
A2	CAN 4 high			
P3	CAN 5 low	CAN Type 1	Module 3	
P2	CAN 5 high			
N3	CAN 6 low	CAN Type 1		
N2	CAN 6 high			

Pins	Signal	Module Type	Module Number	Description / Function
c6	Serial 1 RXD[1]	CAN Type 1	Module 1	RS232 interface: Serial 1 = RS232 of module number 1
c5	Serial 1 TXD[1]			
b5	Serial 2 K / LIN[1]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 2 = LIN of modul number 1 ▪ ISO 9141 interface: Serial 2 = K and L lines of modul number 1 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
b6	Serial 2 L[1]			
B6	Serial 3 RXD[1]	CAN Type 1	Module 2	RS232 interface: Serial 3 = RS232 of module number 2
B5	Serial 3 TXD[1]			
A5	Serial 4 K / LIN[1]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 4 = LIN of modul number 2 ▪ ISO 9141 interface: Serial 4 = K and L lines of modul number 2 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
A6	Serial 4 L[1]			
P6	Serial 5 RXD[1]	CAN Type 1	Module 3	RS232 interface: Serial 5 = RS232 of module number 3
P5	Serial 5 TXD[1]			
N5	Serial 6 K / LIN[1]	CAN Type 1		LIN or ISO 9141 interface: ▪ LIN interface: Serial 6 = LIN of modul number 3 ▪ ISO 9141 interface: Serial 6 = K and L lines of modul number 3 The K line/LIN interface is bidirectional. The L line is input only. Both lines have no pull-up. For proper function of the K line connect an external pull-up resistor (4.7 kΩ) from this line to VBAT. For information on configuring a LIN master, refer to Connecting to a LIN Bus on page 99.
N6	Serial 6 L[1]			

[1] For a mapping of converter and channel numbers, as used in RTI and RTLib, refer to Basics on Serial Interface (MicroAutoBox II Features 🕮).

Note

Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error (see Baud rate calculation of the serial interface).

DS1514 ZIF I/O connector

The following tables give a description of the interface pins provided by the DS1514 ZIF I/O connector.

You can install IP modules of various types to the DS1514:

- DS4340 FlexRay Interface Modules
- DS4342 CAN FD Interface Modules
- Third-party FlexRay IP modules
- Standard IP modules

DS4340 FlexRay Interface Module For a description of the interface pins of the DS4340 FlexRay Interface Module, refer to Interfaces on page 439.

DS4342 CAN FD Interface Module For a description of the interface pins of the DS4342 CAN FD Interface Module, refer to Interfaces on page 451.

(FlexRay) IP Module 1 and DS4340 Module 1 The table describes the pins when a third-party FlexRay IP module is installed.

Pins	Signal	Module	Description / Function
C6	IP wakeup 1	IP_Type1	You do not need to connect this pin because wake-up functionality is not supported.
L3	IP GND 1	IP_Type1	Connection to GND
M3	IP bus high/A 1	IP_Type1	FlexRay 1 high in/out (FlexRay-H)
M4	IP bus low/B 1	IP_Type1	FlexRay 1 low in/out (FlexRay-L)
J3	IP GND 2	IP_Type1	Connection to GND
K3	IP bus high/A 2	IP_Type1	FlexRay 2 high in/out (FlexRay-H)
K4	IP bus low/B 2	IP_Type1	FlexRay 2 low in/out (FlexRay-L)
G5	Reserved	-	Do not connect
H6	Reserved	-	Do not connect
H5	Reserved	-	Do not connect
J6	Reserved	-	Do not connect
J5	Reserved	-	Do not connect
K6	Reserved	-	Do not connect
K5	Reserved	-	Do not connect

(FlexRay) IP Module 2 and DS4340 Module 2 he table describes the pins when a third-party FlexRay IP module is installed.

Pins	Signal	Module	Description / Function
S6	IP wakeup 1	IP_Type1	You do not need to connect this pin because wake-up functionality is not supported.
a3	IP GND 3	IP_Type1	Connection to GND
b3	IP bus high/A 3	IP_Type1	FlexRay 1 high in/out (FlexRay-H)
b4	IP bus low/B 3	IP_Type1	FlexRay 1 low in/out (FlexRay-L)
Y3	IP GND 4	IP_Type1	Connection to GND

Pins	Signal	Module	Description / Function
Z3	IP bus high/A 4	IP_Type1	FlexRay 2 high in/out (FlexRay-H)
Z4	IP bus low/B 4	IP_Type1	FlexRay 2 low in/out (FlexRay-L)
W5	Reserved	-	Do not connect
X6	Reserved	-	Do not connect
X5	Reserved	-	Do not connect
Y6	Reserved	-	Do not connect
Y5	Reserved	-	Do not connect
Z6	Reserved	-	Do not connect
Z5	Reserved	-	Do not connect

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to GND pins of the ZIF connectors.
- All voltage values specify voltages on the connector pins.

dSPACE Board	Interface	Parameter	Conditions / Comments	Specification[1)]
DS1401	Host PC	Protocol	TCP/IP	—
		Bitrate	—	▪ 10/1000[2)] ▪ 10/100[3)]
		Data throughput	—	max. 2.6 MB/sec
		Voltage levels	Ethernet standard	—
	Ethernet I/O	Protocol	UDP/IP	—
		Bitrate	—	typ. 1000 Mbit
		Voltage levels	Ethernet standard	—
	USB	USB 2.0 standard (USB Flight Recording)		
		Data throughput	without connected host tool	max. 1280 kB/sec
			with connected host tool	max. 1024 kB/sec
			without data loss during cold start (dependend on the boot time of the host interface)	max. 640 kB/sec
		Current	—	max. 1.3 A
		Voltage	—	max. 5 V

dSPACE Board	Interface	Parameter	Conditions / Comments		Specification[1]
DS1513	ECU	Bit rate	LVDS mode		max. 250 Mbit
			LVDS2 mode		max. 500 Mbit
		Cable length	2-paired twisted pair		max. 5 m (16.4 ft.)
		Cable type			CAT5
		Voltage levels	LVDS standard		—
		Full duplex data rate [4]	LVDS mode	Single transfer	max. 5 MWord/s
			LVDS2 mode	Single transfer	max. 11.2 MWord/s
				Block transfer	max. 28 MWord/s
		RAM size [4]	LVDS / LVDS2 mode		16 kWord
		FIFO size[4]	LVDS / LVDS2 mode (Transmit buffer)		1 kWord
	CAN	Bit rate	ISO 11898 interface		max. 1 MBaud
	Serial 1/3/5 RS232-Interface	Bit rate	—		▪ min. 14 Baud ▪ max. 115.2 kBaud
		TX output voltage swing	3 kΩ load		▪ min. ±5 V ▪ typ. ±9 V
		$V_{RxinLow}$	RX input threshold low		▪ typ. 1.4 V ▪ max. 0.8 V
		$V_{RxinHigh}$	RX input threshold high		▪ min. 2.0 V ▪ typ. 1.4 V
		Word length	—		▪ min. 5 bit ▪ max. 8 bit
	Serial 2/4/6 ISO9141-Interface	Bit rate	R_{KO} = 510 Ω; $C_K \leq$ 1.3 nF		▪ min. 14 Baud ▪ max. 50 kBaud
		Word length	—		▪ min. 5 bit ▪ max. 8 bit
	Serial 2/4/6 LIN Interface	Bit rate	—		▪ min. 14 Baud ▪ max. 20 kBaud
DS1514	FlexRay	Bit rate	—		max. 2 x 10 MBaud
		Frame length	—		max. 12 byte
	CAN FD	Bit rate	ISO 11898 interface		max. 2 x > 2 MBaud
	IP module carrier	Clocking	—		▪ min. 8 MHz ▪ max. 32 MHz
		Access type	—		byte / word

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) Since board revision DS1401-23 (available since dSPACE Release 7.2).
3) Before board revision DS1401-23
4) Word is 16-bit wide

Baud rate calculation of the serial interface

> **Note**
>
> Due to the limitations of the UART baud rate generator, not all baud rates can be programmed exactly to the desired baud rate without error.

The UART baud rate generator provides several baud rates:

To calculate the divisor T for a chosen baud rate

$$T = \mathrm{Round}\left(\frac{921600}{\mathrm{BR\ (chosen)}}\right)$$

BR (chosen) = The baudrate to be generated
T = The baudrate generator divisor ($8 \leq T \leq 65535$)

To calculate the real baud rate from a given divisor T

$$\frac{\mathrm{BR\ (real)}}{\mathrm{Baud}} = \frac{921600}{T}$$

BR (real) = The baudrate you get
T = The baudrate generator divisor ($8 \leq T \leq 65535$)

To calculate the resulting error

$$\frac{\mathrm{Error}_{BR}}{100\%} = \frac{\mathrm{BR\ (real)} - \mathrm{BR\ (chosen)}}{\mathrm{BR\ (chosen)}}$$

> **Note**
>
> If $\mathrm{Error}_{BR} \leq 2\%$, messages will be transferred and received correctly.

Related topics

Basics

CAN Support (MicroAutoBox II Features 🕮)
FlexRay Support (MicroAutoBox II Features 🕮)
IP Module Support (MicroAutoBox II Features 🕮)
LIN Support (MicroAutoBox II Features 🕮)

References

Serial Interface (MicroAutoBox II Features 🕮)

Data Sheet DS1552 Multi-I/O Module

Where to go from here

Information in this section

Information in other sections

General Information

Where to go from here

Information in this section

Hardware Support

Suitable MicroAutoBox variants

You can use the DS1552 Multi-I/O Module with the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

The absolute maximum voltage levels that the DS1552 Multi-I/O Module is designed for are listed in the following table. The voltage levels do not imply a functional operation. All voltages are referenced to GND, unless otherwise stated.

Parameter	Specification[1)]	Condition / Description
VDRIVE	0 V ... +45 V	—
All digital output voltages	(VDRIVE – 45 V) ... +45 V	—
All digital input voltages	(VDRIVE – 45 V) ... +45 V	—
All analog output voltages	–30 V ... +40 V	—
All analog input voltages	–40 V ... +40 V	—
VSENS+, VSENS–	0 V ... +40 V	—
VBATprot output	0 V ... +45 V	—

Parameter	Specification[1]	Condition / Description
RS232, RS485/422	–25 V ... +25 V	—
All outputs short circuit to GND	Continuous	—

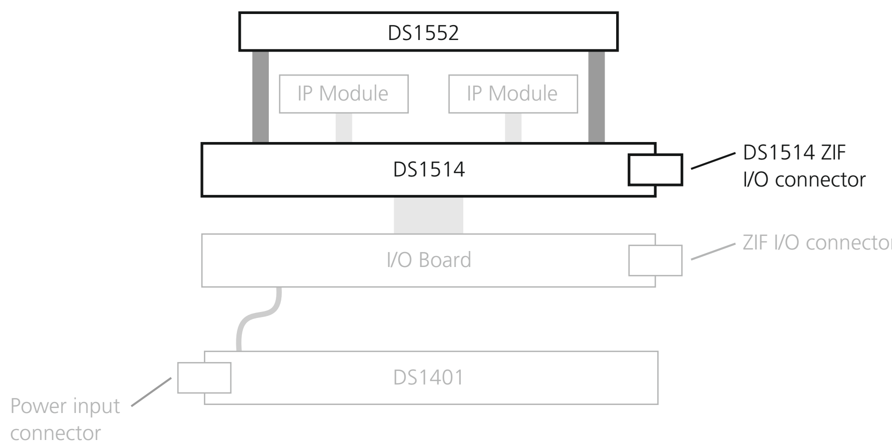
[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

Connector Pinouts

DS1514 ZIF I/O Connectors

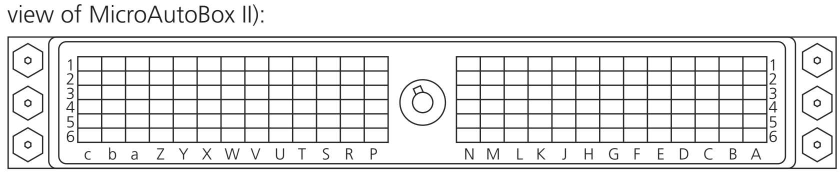
Introduction

The **DS1514 I/O connector** is a 156-pin zero insertion force (ZIF) connector giving access to the I/O signals of the DS1552 Multi-I/O Module. The illustration below shows the internal assembly of MicroAutoBox II with a DS1552 Multi-I/O Module installed.



Pinout

The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):

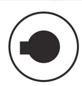


Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of the I/O connector and the signal mapping to the IP connectors:

1		**2**		**3**		**4**		**5**		**6**		
GND	in	GND	in	CrankCam+ ch 3	in	CrankCam– ch 3	in	DigOut ch 15	out	DigOut ch 16	out	*A*
GND	in	DigOut ch 12	out	CrankCam+ ch 2	in	CrankCam– ch 2	in	DigOut ch 13	out	DigOut ch 14	out	*B*

1		2		3		4		5		6		
GND	in	DigOut ch 9	out	DigOut ch 10	out	GND	in	DigOut ch 11	out	IP slot 1, pin 5	i/o	*C*
GND	in	DigOut ch 4	out	DigOut ch 5	out	DigOut ch 6	out	DigOut ch 7	out	DigOut ch 8	out	*D*
GND	in	AnalogIn ch 16[1]	in	AnalogIn+ ch 8[2]	in	AnalogIn- ch 8[2,4]	in	DigOut ch 2	out	DigOut ch 3	out	*E*
GND	in	AnalogIn ch 15[1]	in	AnalogIn+ ch 7[2]	in	AnalogIn- ch 7[2,4]	in	DigOut ch 1	out	GND	in	*F*
GND	in	AnalogIn ch 14[1]	in	AnalogIn+ ch 6[2]	in	AnalogIn- ch 6[2,4]	in	IP slot 1, pin 14	i/o	GND	in	*G*
GND	in	AnalogIn ch 13[1]	in	AnalogIn+ ch 5[2]	in	AnalogIn- ch 5[2,4]	in	IP slot 1, pin 16	i/o	IP slot 1, pin 15	i/o	*H*
GND	in	AnalogIn ch 12[1]	in	IP slot 1, pin 44	i/o	GND	in	IP slot 1, pin 18	i/o	IP slot 1, pin 17	i/o	*J*
GND	in	AnalogIn ch 11[1]	in	IP slot 1, pin 46	i/o	IP slot 1, pin 45	i/o	IP slot 1, pin 20	i/o	IP slot 1, pin 19	i/o	*K*
GND	in	AnalogIn ch 10[1]	in	IP slot 1, pin 48	i/o	DigIO ch 8	i/o	GND	in	GND	in	*L*
VDRIVE	In	AnalogIn ch 9[1]	in	IP slot 1, pin 50	i/o	IP slot 1, pin 49	i/o	DigIO ch 6	i/o	DigIO ch 7	i/o	*M*
VDRIVE	In	DigIO ch 1	i/o	DigIO ch 2	i/o	DigIO ch 3	i/o	DigIO ch 4	i/o	DigIO ch 5	i/o	*N*
												
VBAT prot	Out	GND	in	ZeroDetection+	in	ZeroDetection–	in	DigIn ch 15	in	DigIn ch 16	in	*P*
VBAT prot	Out	DigIn ch 12	in	CrankCam+ ch 1	in	CrankCam– ch 1	in	DigIn ch 13	in	DigIn ch 14	in	*R*
GND	in	DigIn ch 9	in	DigIn ch 10	in	GND	in	DigIn ch 11	in	IP slot 2, pin 5	i/o	*S*
GND	in	DigIn ch 4[3]	in	DigIn ch 5	in	DigIn ch 6	in	DigIn ch 7	in	DigIn ch 8	in	*T*
GND	in	AnalogIn ch 8[1]	in	AnalogIn+ ch 4[2]	in	AnalogIn- ch 4[2,4]	in	DigIn ch 2[3]	in	DigIn ch 3[3]	in	*U*
GND	in	AnalogIn ch 7[1]	in	AnalogIn+ ch 3[2]	in	AnalogIn- ch 3[2,4]	in	DigIn ch 1[3]	in	GND	in	*V*
GND	in	AnalogIn ch 6[1]	in	AnalogIn+ ch 2[2]	in	AnalogIn- ch 2[2,4]	in	IP slot 2, pin 14	i/o	GND	in	*W*
GND	in	AnalogIn ch 5[1]	in	AnalogIn+ ch 1[2]	in	AnalogIn- ch 1[2,4]	in	IP slot 2, pin 16	i/o	IP slot 2, pin 15	i/o	*X*
GND	in	AnalogIn ch 4[1]	in	IP slot 2, pin 44	i/o	GND	in	IP slot 2, pin 18	i/o	IP slot 2, pin 17	i/o	*Y*
GND	in	AnalogIn ch 3[1]	in	IP slot 2, pin 46[5]	i/o	IP slot 2, pin 45[5]	i/o	IP slot 2, pin 20[5]	i/o	IP slot 2, pin 19[5]	i/o	*Z*
GND	in	AnalogIn ch 2[1]	in	IP slot 2, pin 48	i/o	Serial 1 (DS1552)[6]	i/o	Serial 1 (DS1552)[6]	i/o	Serial 1 (DS1552)[6]	i/o	*a*

1		2		3		4		5		6		
GND	in	AnalogIn ch 1[1]	in	IP slot 2, pin 50	i/o	IP slot 2, pin 49	i/o	Serial 1 (DS1552)[6]	i/o	VSENS-	out	*b*
GND	in	AnalogOut ch 1	out	AnalogOut ch 2	out	AnalogOut ch 3	out	AnalogOut ch 4	out	VSENS+	out	*c*

[1] ADC 1552 type 2
[2] ADC 1552 type 1
[3] The DigIn channels 1 ... 4 of the DIO 1552 Type 1 unit can be used whether as digital inputs or as external trigger inputs.
[4] Negative input line of the ADC channel is connected to GND.
[5] Serial 2 (DS1552): If you want to use the second serial interface channel the hardware must be modified by dSPACE. The ZIF pins Z3, Z4, Z5, Z6 are connected by default to the IP Slot 2.
[6] For details on the RS232, full duplex RS485/422, or half duplex RS485/422 mode, refer to Interfaces on page 404.

Signal descriptions

For descriptions of the signals which are available on the DS1514 ZIF I/O connector, refer to:

- Digital Inputs on page 387
- Digital Outputs on page 389
- Digital I/O (Bidirectional) on page 392
- Analog Inputs on page 395
- Analog Outputs on page 400
- Digital Crank/Cam Inputs on page 401
- Inductive Zero Voltage Detector on page 403
- Serial: Interfaces on page 404

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the power inputs and outputs on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Description / Function
M1, N1	VDRIVE	This input supplies all digital input and output circuits located on the DS1552 Multi-I/O Module. ▪ For providing 5 V logic levels, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47. ▪ Connect this input to VBATprot to set automotive-compatible logic levels for your inputs/outputs.

Pins	Signal	Description / Function
		▪ Do not connect this pin directly to VBAT[1], because the input and output circuits are not load-dump-protected or reverse-voltage-protected at this signal. For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
c6	VSENS+	Supported only by FPGA applications build with the RTI FPGA Programming Blockset: ▪ Adjustable sensor supply output. Use this output to supply your sensors and/or VDRIVE. ▪ The supply must be activated by the FPGA application. ▪ VSENS- lets you separate the sensor ground and the supply ground for ideal grounding if you supply a sensor. For best measurement results, use separate ground lines to connect VSENS- (supply ground) and GND of MicroAutoBox II (sensor ground) to the ground potential of the sensor. Refer to Connecting Sensor Ground Lines to MicroAutoBox II on page 51. ▪ If you use VSENS+ to supply VDRIVE, you have to connect VSENS- to GND of MicroAutoBox II. Refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47. The sensor supply outputs are accessible via the RTI FPGA Programming Blockset. Refer to Parameters Page (FPGA_IO_WRITE_BL) (RTI FPGA Programming Blockset - FPGA Interface Reference 🕮).
b6	VSENS-	
P1, R1	VBAT prot	Protected VBAT output. VBATprot follows VBAT within the specified range and is switched on and off with the REMOTE pin. Use this output to supply VDRIVE when automotive logic levels are needed. The REMOTE pin is located on the Sub-D power input connector of MicroAutoBox II.

[1] VBAT is the main power supply input voltage of MicroAutoBox II.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

VBAT is the main power supply input voltage of MicroAutoBox II.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Inputs						
Digital I/O voltage supply input	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		10		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		500		mA

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Outputs						
Sensor supply output	VSENS+	Output voltage, isolated and adjustable, controlled by a DAC (referenced to VSENS-)	2		20	V
	$P_{VSENS, max}$	Maximum output power (if VSENS+ is in range 5 V ... 20 V and VSENS- is connected to GND)		1		W
Protected VBAT output	VBATprot [2]	I_{Load} = 1A; VBAT = 12 V	11.56	11.78	12	V
	$I_{VBATprot, max}$	Maximum output current			1000	mA
	$I_{ProtPeak}$	Overload current limit (–40 °C ... 85 °C)	4		9	A
	t(overload)	Time to shut off $I_{ProtPeak}$			5	ms

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] VBATprot follows VBAT within the specified range.

Related topics

Basics

ADC 1552 Type 1 Unit (MicroAutoBox II Features)
ADC 1552 Type 2 Unit (MicroAutoBox II Features)
Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features)
DAC 1552 Type 1 Unit (MicroAutoBox II Features)
Providing the Supply Voltage to Drive Digital I/O Interfaces.. 47

Digital Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the digital input pins on the DS1514 ZIF I/O connectors that are internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Description / Function
V5, U5, U6, T2, T3, T4, T5, T6, S2, S3, S5, R2, R5, R6, P5, P6	Channel 1 ... 16 DIO 1552 Type 1	Standard discrete digital input with pull-up.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
Channel 1 ... 16 DIO 1552 Type 1	V_{iH}	Input high voltage	3.1			V
	V_{iL}	Input low voltage			1.2	V
	V_{iHys}	Input hysteresis voltage		1		V
	R_{DigIn}	Pull-up resistor to VDRIVE	17	18	19	kΩ
	C_{DigIn}	Input capacitance		1		nF
AC characteristics						
DIO 1552 Type 1 Inputs	t_{LowMin}	Minimum pulse width low		250	500	ns
	$t_{HighMin}$	Minimum pulse width high		300	600	ns
	F_{max}	Duty cycle: 50 %		1.8		MHz
		Duty cycle: 1 % or 99 %		33		kHz

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

Powering digital inputs and outputs

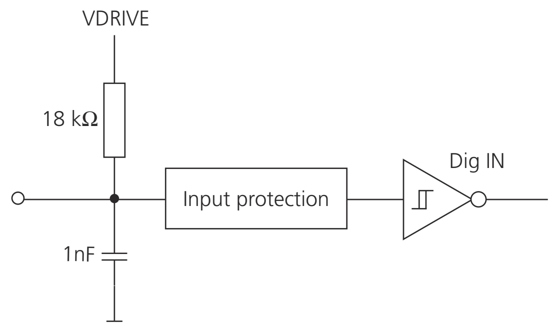
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagram

The following table shows a *simplified* diagram of the I/O circuitry of the digital inputs:

Signal	I/O Circuit
DIO 1552 Type 1	 For proper operation, VDRIVE must have a level above the maximum input voltage.

Related topics

Basics

Digital Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

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.

Pin description

The following table gives a description of the digital output pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Description / Function
F5, E5, E6, D2 ... D6, C2, C3, C5, B2, B5, B6, A5, A6	Channel 1 ... 16 DIO 1552 Type 1	Standard discrete digital output.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent output channels			16		
Supply voltage	The digital output circuits are supplied via the VDRIVE pin.	4.5		40	V
Protected supply voltage				45	V
Power-up default		All outputs are in high-impedance state.			
DC Characteristics					
Output high voltage level without load	VDRIVE = 5 V	4.1	4.3		V
	VDRIVE = 12 V	11.0	11.2		V
Output high voltage level with 5 mA load	VDRIVE = 5 V	3.2	3.4		V
	VDRIVE = 12 V	10.1	10.3		V
Output low voltage level without load	VDRIVE = 5 V		0.1	0.3	V
	VDRIVE = 12 V		0.1	0.3	V
Output low voltage level with –5 mA load	VDRIVE = 5 V		0.7	0.9	V
	VDRIVE = 12 V		0.7	0.9	V
Current limit high level	$T_{Housing}$ = -40 °C ... +85 °C	5	13		mA
Current limit low level	$T_{Housing}$ = -40 °C ... +85 °C	5	14		mA
Leakage current tristate	$T_{Housing}$ = -40 °C ... +85 °C			100	µA

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics					
Minimum pulse width high level with 1 kΩ load	VDRIVE = 5 V or 12 V		700		ns
Minimum pulse width low level with 1 kΩ load	VDRIVE = 5 V or 12 V		200		ns
Output Frequency at 50% duty cycle	VDRIVE = 5 V or 12 V		0.7 [2]		MHz
Output frequency at 1% or 99% duty cycle	VDRIVE = 5 V or 12 V		14		kHz

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] RTI and RTI-MP limits the frequency to 150 kHz. Only the RTI FPGA Programming Blockset supports a higher frequency.

Powering digital inputs and outputs

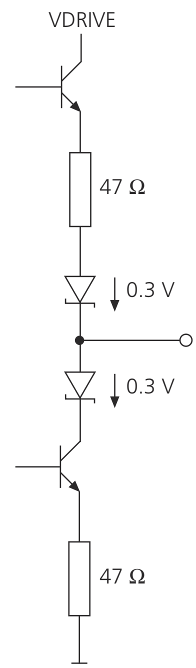
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagram

The following table shows a *simplified* diagram of the I/O circuitry of the digital outputs:

Signal	I/O Circuit
DIO 1552 Type 1	

Related topics

Basics

ADC 1552 Type 1 Unit (MicroAutoBox II Features 📖)
ADC 1552 Type 2 Unit (MicroAutoBox II Features 📖)
Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 📖)
DAC 1552 Type 1 Unit (MicroAutoBox II Features 📖)
Providing the Supply Voltage to Drive Digital I/O Interfaces..47

Digital I/O (Bidirectional)

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the digital I/O pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Description / Function
N2, N3, N4, N5, N6, M5, M6, L4	Channel 1 ... 8 DIO 1552 Type 2	8 digital bidirectional channels for: ▪ Digital In (Type B) ▪ Digital Out (Type B)

Note

The digital bidirectional channels are available only via the RTI FPGA Programming Blockset. For details, refer to RTI Block Settings for the FPGA1401Tp1 with Multi-I/O Module Frameworks (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

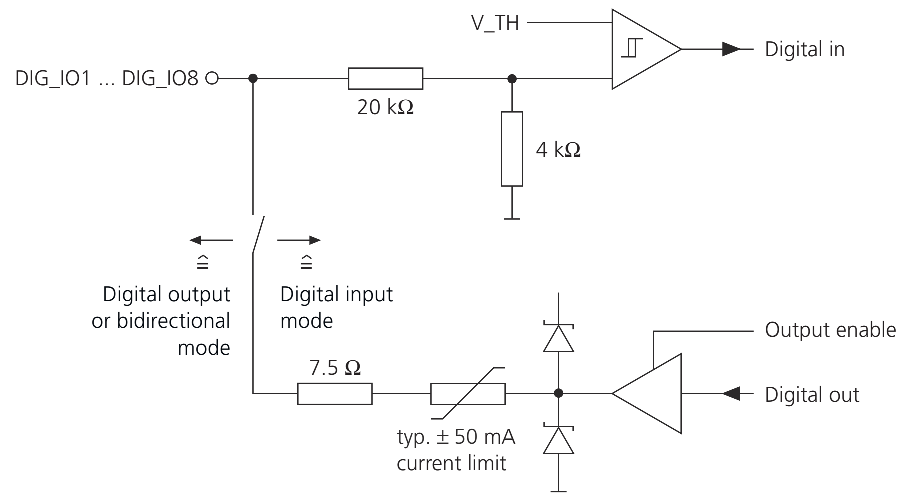
Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent I/O channels			8		
Power-up default		All digital I/O lines are used as inputs. They are set to 5 V logic level and to a defined logical low level by built-in 24 kΩ pull-down resistors.			
DC Characteristics					
Input voltage	High	V_TH + 0.5 * V_Hyst		15	V
	Low	0		V_TH - 0.5 * V_Hyst	V
Overvoltage protection		-50		+50	V
Threshold voltage (V_TH) range [2)]		1.0		7.5	V

Parameter[1]	**Conditions / Comments**	**Min.**	**Typ.**	**Max.**	**Unit**
Threshold voltage (V_TH) accuracy		± (5 % V_TH + 150 mV)			V
Hysteresis (V_Hyst)	Fixed voltage		0.7		V
Input impedance			24		kΩ
Output voltage level with ±10 mA load	High level at 5 V logic level[2]	4.6	5.0		V
	High level at 3.3 V logic level[2]	2.8	3.2		V
	Low level		0.2		V
Output current during short circuit		±45		±75	mA
AC Characteristics					
Input frequency	5 V logic level with 50% duty cycle and V_TH = 2.5 V			10	MHz
Input pulse width	5 V logic level with 20% duty cycle and V_TH = 2.5 V	20			ns
Output frequency	Max. 100 pF capacitive load			40	MHz
Output pulse width	Max. 100 pF capacitive load	12.5			ns

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

Circuit diagram

The following table shows a *simplified* diagram of the I/O circuitry of the digital I/O channels:

<table>
<tr><th>Signal</th><th>I/O Circuit</th></tr>
<tr><td>Channel 1 ... 8
DIO 1552 Type 2
1)</td><td>
</td></tr>
</table>

1) Only available via the RTI FPGA Programming Blockset (see RTI Block Settings for the FPGA1401Tp1 with Multi-I/O Module Frameworks (RTI FPGA Programming Blockset - FPGA Interface Reference 🕮)).

Related topics

Basics

ADC 1552 Type 1 Unit (MicroAutoBox II Features 🕮)
ADC 1552 Type 2 Unit (MicroAutoBox II Features 🕮)
Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 🕮)
DAC 1552 Type 1 Unit (MicroAutoBox II Features 🕮)

Analog Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog input pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Module	Description / Function
X4, X3, W4, W3, V4, V3, U4, U3, H4, H3, G4, G3, F4, F3, E4, E3	ADC channel 1 ... 8	ADC 1552 Type 1	High sample rate analog to digital converter inputs. ▪ DS1552: 0 V ... 5 V ▪ DS1552B1: -10 V ... +10 V
V5, U5, U6, T2	External trigger 1 ... 4[1]		For information on function of the ADC 1552 Type 1 module's trigger signals, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features).
b2, a2, Z2, Y2, X2, W2, V2, U2, M2, L2, K2, J2, H2, G2, F2, E2	ADC channel 1 ... 16	ADC 1552 Type 2	Low sample rate analog to digital converter inputs.

[1] DIO 1552 Type 1 unit

Characteristics of the ADC 1552 Type 1 module

The following table shows the characteristics of the ADC 1552 Type 1 module of the DS1552 Multi-I/O module.

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to X4...U4 and H4...E4.
- All voltage values specify voltages on the connector pins.

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			8		
Resolution			16		bit
Sample rate	Burst mode with more than 1 sample			1	MSPS
Input voltage range	DS1552	0		5	V
	DS1552B1	-10		10	V
DC characteristics - DS1552					
Initial offset error	Below 750 KSPs	-0.5		0.5	mV
Initial gain error	Below 750 KSPs	-0.25		0.25	%
Input impedance			192		kΩ
Offset drift			±10		µV/K
Gain drift			±6		ppm/K
Overvoltage protection	Continuous	-20		+30	V
	Short term	-50		50	V

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics - DS1552B1					
Initial offset error	Below 750 KSPs	-3.0		+3.0	mV
Initial gain error	Below 750 KSPs	-0.25		0.25	% of FSR
Input impedance	Dynamic (ΔU/ΔI) [2]		117		kΩ
Offset drift			±40		μV/K
Gain drift			±6		ppm/K
Overvoltage protection	Continuous	-30		+30	V
	Short term	-50		50	V
AC Characteristics					
No missing codes		15			bit
SNR	12.4 kHz signal @ 200 KSPs	80			dB
Input bandwidth	Full power bandwidth	400			kHz
Channel crosstalk	100 kHz			-96	dB
	200 kHz			-92	dB
	400 kHz			-90	dB
Characteristics if you use the RTI DS1552 I/O Extension Blockset (MicroAutoBox II RTI Reference).					
Conversion timer	Separate for each channel.				
	Width	27			bit
	Resolution	10			ns
	Interval			1.342	s
Timer for time stamping	Common for all channels. Two channels are required to carry one 32 bit value.				
	Width	32			bit
	Resolution	10			ns
	Interval			42.9	s
Buffer size	Software-configurable	1		8192	Samples
Buffers per channel		3			
Number of external trigger inputs		4			
External trigger: Input voltage	V_{iH}	2.3			V
	V_{iL}			0.4	V
Period				1	MHz
Overvoltage protection	Continuous	-48		50	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 current flow into the ADC input pin is affected by the input signal and the internal reference voltage (refer to Circuit diagrams on page 399). Therefore, a specific static impedance (R = U/I) does not exist for this ADC, because it changes with the absolute voltage of the input signal. Instead, the dynamic impedance is specified (R = ΔU/ΔI), because the dynamic impedance takes only changes of the DC signal into account, not the absolute values.

Characteristics of the ADC 1552 Type 2 module

The following table shows the characteristics of the ADC 1552 Type 2 module of the DS1552 Multi-I/O module.

The characteristics are specified for the following conditions, unless otherwise stated:

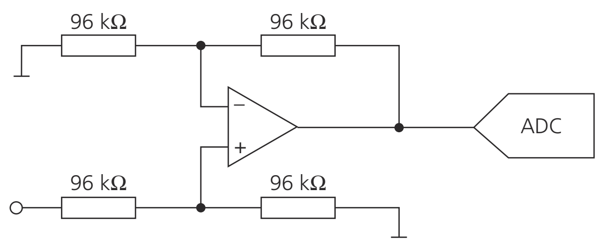
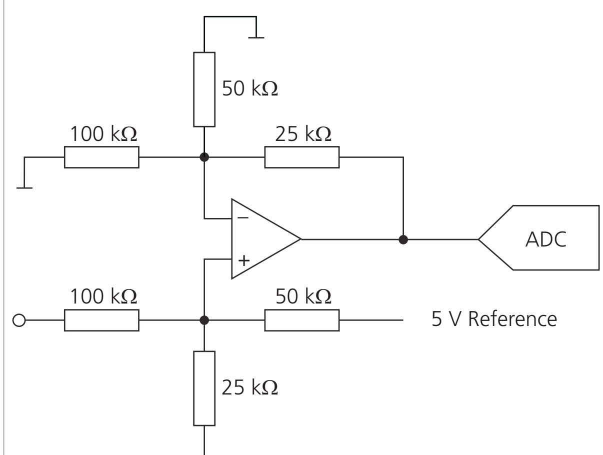
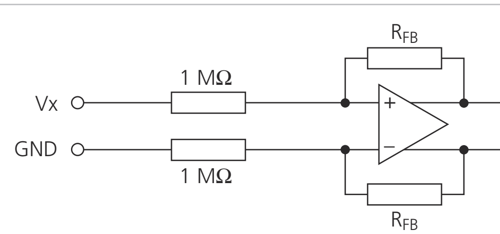
- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			16		
Resolution			16		bit
Sample rate				200	kSPs
Input voltage range		-10		10	V
No damage voltage input range		-45		45	
Conversion time	inclusive transfer time		5		µs
DC characteristics					
Offset error		-2		2	mV
Gain error		-1		1	% of FSR
Input impedance			1		MΩ
AC Characteristics					
Low pass filter	3 dB frequency		23		kHz

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

Circuit diagrams

The following table shows *simplified* diagrams of the I/O circuitry of the analog inputs:

Signal	I/O Circuit
ADC 1552 Type 1 channel 1 … 8	DS1552: 
	DS1552B1: 
ADC 1552 Type 2 channel 1 … 16	

Related topics

Basics

ADC 1552 Type 1 Unit (MicroAutoBox II Features 🕮)
ADC 1552 Type 2 Unit (MicroAutoBox II Features 🕮)
Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 🕮)
DAC 1552 Type 1 Unit (MicroAutoBox II Features 🕮)

Analog Outputs

Note on the cable harness

> **Note**
>
> To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog output pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Default State	Description / Function
c2, c3, c4, c5	DAC1 … DAC4 DAC 1552 Type 1	High impedance	Standard analog outputs 16-bit digital values are converted to analog outputs by the DAC module.

Default state means the state of the signal during reset.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

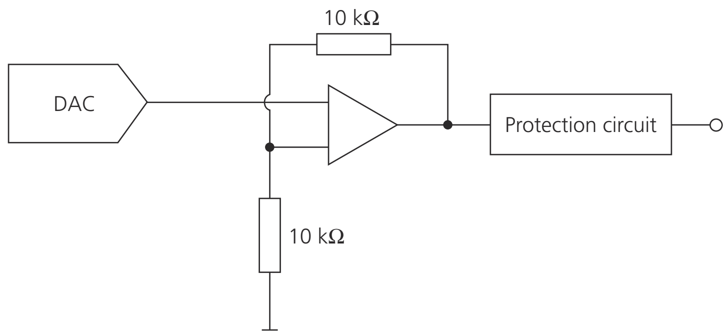
- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
DC characteristics						
DAC 1552Type 1	Output voltage range		0		5	V
	Resolution			16		bit
	Offset error		-2		2	mV
	Gain error		-0.25		0.25	%
	I_{DACout}		-8		8	mA
	C_{DACout}	Maximum load capacitance			22	nF
AC characteristics						
DAC 1552Type 1	Settling time	Settling time of output (to 1 %)			1	µs
	f_{gDAC}	Low-pass cutoff frequency of reconstruction filter (3 dB)	500			kHz

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

Circuit diagram

The following table shows a *simplified* diagram of the I/O circuitry of the analog outputs:

Signal	I/O Circuit
DAC 1552 Type 1 DAC1 ... DAC4	

Related topics

Basics

ADC 1552 Type 1 Unit (MicroAutoBox II Features)
ADC 1552 Type 2 Unit (MicroAutoBox II Features)
Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features)
DAC 1552 Type 1 Unit (MicroAutoBox II Features)

Digital Crank/Cam Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the digital crank/cam input pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Description / Function
A3, A4, B3, B4, R3, R4	Digital Crank/Cam Sensor	Digital input with pull-up for crankshaft and camshaft sensors.

Note

The digital channels for for crankshaft and camshaft sensors are available only via the RTI FPGA Programming Blockset. For details, refer to RTI Block Settings for the FPGA1401Tp1 with Multi-I/O Module Frameworks (RTI FPGA Programming Blockset - FPGA Interface Reference).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

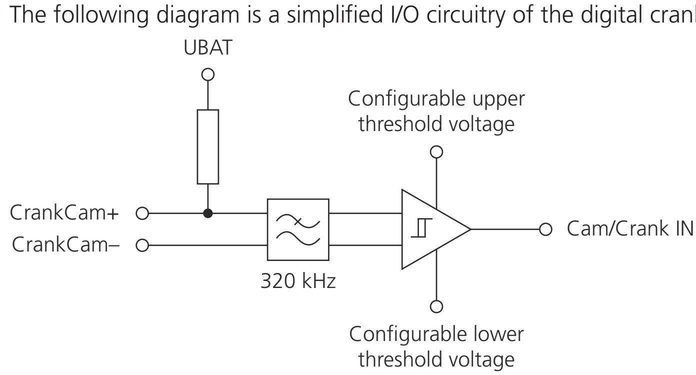
- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			3		
Input voltage range		-55		+55	V
DC characteristics					
Threshold voltage range	Lower and upper thresholds software-configurable	-40		+40	V
Threshold voltage accuracy	Accuracy depends on the configured threshold voltage levels V_{Th}	-1% of V_{Th} - 100 mV		+1% of V_{Th} + 100 mV	–
Input impedance			170		kΩ
AC Characteristics					
Low pass filter	3 dB frequency		320		kHz

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

Circuit diagram

The following diagram is a simplified I/O circuitry of the digital crank/cam inputs:



Related topics

References

Parameters Page (FPGA_IO_READ_BL) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)

Inductive Zero Voltage Detector

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the inductive zero voltage detector pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Pins	Signal	Description / Function
P3, P4	Inductive zero voltage detector	Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in notched wheel position sensors.

Note

The inductive zero voltage detector is available only via the RTI FPGA Programming Blockset. For details, refer to RTI Block Settings for the FPGA1401Tp1 with Multi-I/O Module Frameworks (RTI FPGA Programming Blockset - FPGA Interface Reference 📖).

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

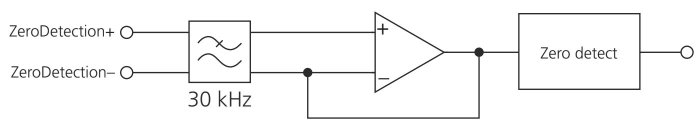
- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			1		
DC characteristics					
Input voltage range		-60		+60	V
Input impedance			67		kΩ
AC Characteristics					
Low pass filter	3 dB frequency		30		kHz

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

Circuit diagram

The following diagram is a simplified I/O circuitry of the inductive zero voltage detector:



Related topics

References

Parameters Page (FPGA_IO_READ_BL) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)

Interfaces

Serial interface of the DS1552 Multi-I/O Module

With the DS1552 Multi-I/O Module you can use up to two serial interface channels in different modes. For further information, refer to RTI FPGA Programming Blockset - FPGA Interface Reference 📖.

Note

The ZIF pins Z3, Z4, Z5, Z6 are connected by default to the IP Slot 2. If you want to use the second serial interface channel the hardware must be modified by dSPACE.

The following table gives a description of the interface pins on the DS1514 ZIF I/O connector that is internally connected to the DS1552 Multi-I/O Module:

Serial Interface Mode	Pins	Signal	Description / Function
RS232 Mode	b5	RX[1]	UART channel 1 receive input
	a4	CTS[1]	UART channel 1 clear to send input
	a5	TX[1]	UART channel 1 transmit input
	a6	RTS[1]	UART channel 1 request to send input
	Z3	RX[2]	UART channel 2 receive input
	Z4	CTS[2]	UART channel 2 clear to send input
	Z5	TX[2]	UART channel 2 transmit input
	Z6	RTS[2]	UART channel 2 request to send input
Full Duplex RS485/422 Mode	b5	RX–[1]	UART channel 1 inverting receiver input
	a4	RX+[1]	UART channel 1 noninverting receiver input
	a5	TX–[1]	UART channel 1 inverting transmit input
	a6	TX+[1]	UART channel 1 noninverting transmit input
	Z3	RX–[2]	UART channel 2 inverting receiver input
	Z4	RX+[2]	UART channel 2 noninverting receiver input
	Z5	TX–[2]	UART channel 2 inverting transmit input
	Z6	TX+[2]	UART channel 2 noninverting transmit input
Half Duplex RS485/422 Mode	b5	—	Do not connect
	a4	—	Do not connect
	a5	BM[1]	UART channel 1 inverting receive/transmit input/output (Bus Minus)
	a6	BP[1]	UART channel 1 inverting receive/transmit input/output (Bus Plus)
	Z3	—	Do not connect
	Z4	—	Do not connect
	Z5	BM[2]	UART channel 2 inverting receive/transmit input/output (Bus Minus)
	Z6	BP[2]	UART channel 2 inverting receive/transmit input/output (Bus Plus)

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to GND pins of the ZIF connectors.
- All voltage values specify voltages on the connector pins.

Interface	Parameter	Conditions / Comments	Specification[1)]
RS232	Data rate	—	max. 1 Mbit/s
RS485/422	Data rate	Configurable on-board termination for RS485	max. 10 Mbit/s

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

Baud rates of the DS1552's serial interface

dSPACE provides a list of baud rates in a file (`FPGA1401Tp1_uart_parameters.mat`). That lets you select a matching baud rate.

Location of the file:
`<InstallationFolder>\RCPHIL\MATLAB\RTIFPGA\Frameworks\FPGA1401Tp1_<DS1552 Variant>_<FPGA Variant>\`

Related topics

Basics

ADC 1552 Type 1 Unit (MicroAutoBox II Features 📖)
ADC 1552 Type 2 Unit (MicroAutoBox II Features 📖)
Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 📖)
DAC 1552 Type 1 Unit (MicroAutoBox II Features 📖)

Data Sheet DS1554 Engine Control I/O Module

Where to go from here

Information in this section

Information in other sections

General Information

Where to go from here

Information in this section

Hardware and Software Support

Suitable MicroAutoBox variants

You can use the DS1554 Engine Control I/O Module with the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

Software support

The DS1554 Engine Control I/O Module is supported only by the RTI FPGA Programming Blockset. Refer to RTI FPGA Programming Blockset Guide.

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

The absolute maximum voltage levels that the DS1554 Engine Control I/O Module is designed for are listed in the following table. The voltage levels do not imply a functional operation. All voltages are referenced to GND, unless otherwise stated.

Parameter	Specification[1)]	Condition / Description
VDRIVE	0 V ... +45 V	—
All digital output voltages	(VDRIVE – 45 V) ... +45 V	—
All digital input voltages	(VDRIVE – 45 V) ... +45 V	—

Parameter	Specification[1)]	Condition / Description
All analog input voltages	–40 V ... +40 V	—
VSENS+, VSENS–	0 V ... +20 V	—
VBATprot output	0 V ... +45 V	—
All outputs short circuit to GND	Continuous	—

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

Connector Pinouts

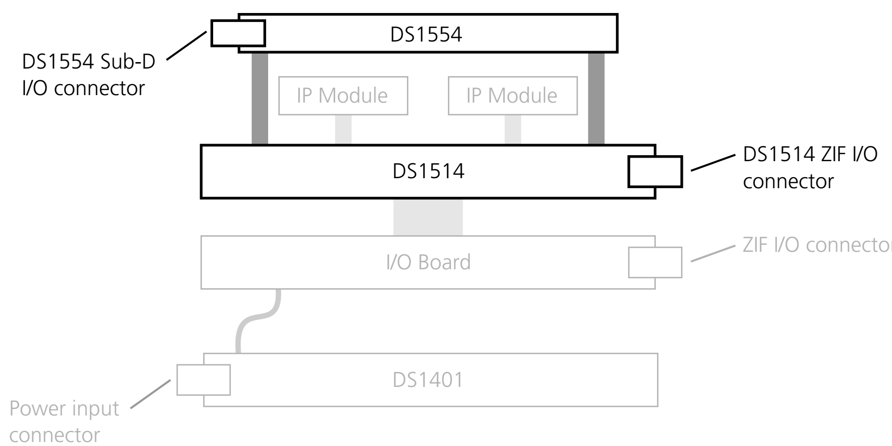
Where to go from here

Information in this section

DS1514 ZIF I/O Connector

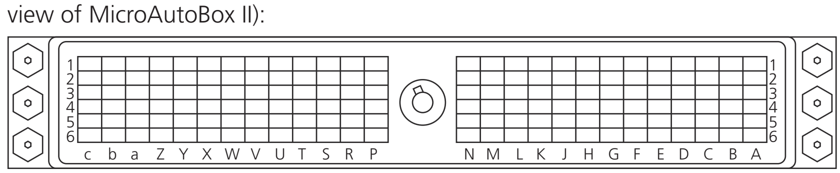
Introduction

The **DS1514 I/O connector** is a 156-pin zero insertion force (ZIF) connector giving access to various I/O signals of the DS1554 Engine Control I/O Module. The following illustration shows the internal assembly of MicroAutoBox II with a DS1554 Engine Control I/O Module installed.



Pinout

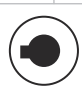
The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of the I/O connector and the signal mapping to the IP connectors:

1		**2**		**3**		**4**		**5**		**6**		
GND	in	DigOut ch 30	out	DigOut ch 27	out	GND	in	DigOut ch 31	out	DigOut ch 26	out	*A*
GND	in	DigOut ch 32	out	DigOut ch 19	out	GND	in	DigOut ch 23	out	DigOut ch 29	out	*B*
GND	in	DigOut ch 22	out	DigOut ch 11	out	GND	in	DigOut ch 15	out	IP slot 1, pin 5	i/o	*C*
GND	in	DigOut ch 28	out	DigOut ch 3	out	GND	in	DigOut ch 7	out	DigOut ch 25	out	*D*
GND	in	DigOut ch 18	out	DigOut ch 35	out	GND	in	DigOut ch 36	out	DigOut ch 21	out	*E*
GND	in	DigOut ch 24	out	DigOut ch 40	out	GND	in	DigOut ch 33	out	DigOut ch 17	out	*F*
GND	in	DigOut ch 20	out	DigOut ch 39	out	GND	in	IP slot 1, pin 14	i/o	DigOut ch 13	out	*G*
GND	in	DigOut ch 14	out	DigOut ch 37	out	GND	in	IP slot 1, pin 16	i/o	IP slot 1, pin 15	i/o	*H*
GND	in	DigOut ch 16	out	IP slot 1, pin 44	i/o	GND	in	IP slot 1, pin 18	i/o	IP slot 1, pin 17	i/o	*J*
GND	in	DigOut ch 10	out	IP slot 1, pin 46	i/o	IP slot 1, pin 45	i/o	IP slot 1, pin 20	i/o	IP slot 1, pin 19	i/o	*K*
GND	in	DigOut ch 12	out	IP slot 1, pin 48	i/o	GND	in	DigOut ch 1	out	DigOut ch 9	out	*L*
VDRIVE	In	DigOut ch 8	out	IP slot 1, pin 50	i/o	IP slot 1, pin 49	i/o	DigOut ch 38	out	DigOut ch 5	out	*M*
VDRIVE	In	DigOut ch 2	out	DigOut ch 6	out	GND	in	DigOut ch 4	out	DigOut ch 34	out	*N*
												
VBAT prot	Out	AnalogIn– ch 14	in	AnalogIn+ ch 14	in	GND	in	AnalogIn+ ch 13	in	AnalogIn– ch 13	in	*P*
VBAT prot	Out	AnalogIn– ch 3	in	AnalogIn– ch 12	in	GND	in	AnalogIn+ ch 11	in	AnalogIn– ch 11	in	*R*
GND	in	AnalogIn+ ch 3	in	AnalogIn+ ch 12	in	GND	in	AnalogIn+ ch 9	in	IP slot 2, pin 5	i/o	*S*
GND	in	AnalogIn+ ch 4	in	AnalogIn+ ch 7	in	GND	in	AnalogIn+ ch 10	in	AnalogIn– ch 9	in	*T*
GND	in	AnalogIn– ch 4	in	AnalogIn– ch 7	in	GND	in	AnalogIn+ ch 8	in	AnalogIn– ch 10	in	*U*
GND	in	AnalogIn– ch 1	in	AnalogIn– ch 6	in	GND	in	AnalogIn+ ch 5	in	AnalogIn– ch 8	in	*V*
GND	in	AnalogIn+ ch 1	in	AnalogIn+ ch 6	in	GND	in	IP slot 2, pin 14	i/o	AnalogIn– ch 5	in	*W*
GND	in	AnalogIn– ch 2	in	GND	in	GND	in	IP slot 2, pin 16	i/o	IP slot 2, pin 15	i/o	*X*
GND	in	AnalogIn+ ch 2	in	IP slot 2, pin 44	i/o	GND	in	IP slot 2, pin 18	i/o	IP slot 2, pin 17	i/o	*Y*
GND	in	DigIO ch 8	i/o	IP slot 2, pin 46	i/o	IP slot 2, pin 45	i/o	IP slot 2, pin 20	i/o	IP slot 2, pin 19	i/o	*Z*

1		2		3		4		5		6		
GND	in	DigIO ch 7	i/o	IP slot 2, pin 48	i/o	GND	in	GND	in	GND	in	*a*
GND	in	DigIO ch 3	i/o	IP slot 2, pin 50	i/o	IP slot 2, pin 49	i/o	DigIO ch 2	i/o	VSENS+	out	*b*
GND	in	DigIO ch 6	i/o	DigIO ch 1	i/o	DigIO ch 5	i/o	DigIO ch 4	i/o	VSENS-	out	*c*

Signal descriptions

For descriptions of the signals available on the DS1514 ZIF I/O connector, refer to:

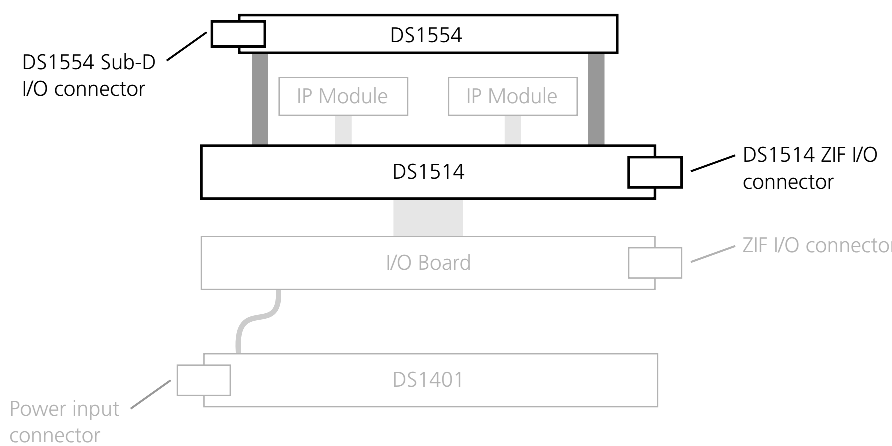
- Power Inputs and Outputs on page 414
- Digital I/O (Bidirectional) on page 421
- Digital Outputs on page 416
- Analog Inputs on page 424

DS1554 Sub-D I/O Connector

Introduction

The DS1554 Engine Control I/O Module provides a 37-pin, male Sub-D connector at the front of MicroAutoBox II.

The illustration below shows the internal assembly of a MicroAutoBox II with a DS1554 Engine Control I/O Module installed.

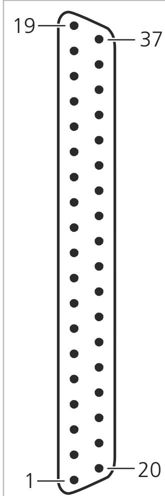


Pinout

Because the pin numbering used for Sub-D connectors is not standardized, the following figure shows the numbering scheme used (front view).

Note

Do not rely on the numbers written on the Sub-D connectors.

DS1554 Sub-D I/O Connector	Pin	Signal	Pin	Signal
	19	KnockIn+ ch 4		
	18	KnockIn+ ch 3	37	KnockIn– ch 4
	17	KnockIn+ ch 2	36	KnockIn– ch 3
	16	KnockIn+ ch 1	35	KnockIn– ch 2
	15	CrankCam GND	34	KnockIn– ch 1
	14	CrankCamIn ch 3	33	CrankCamIn ch 4
	13	CrankCamIn ch 1	32	CrankCamIn ch 2
	12	CrankCamIn ch 5	31	Reserved
	11	CrankCam GND	30	Reserved
	10	ZeroDetection+	29	ZeroDetection–
	9	Reserved	28	Reserved
	8	Reserved	27	Reserved
	7	Reserved	26	Reserved
	6	Reserved	25	Reserved
	5	Reserved	24	Reserved
	4	Reserved	23	Reserved
	3	Reserved	22	Reserved
	2	Reserved	21	Reserved
	1	Reserved	20	Reserved

Signal descriptions

For descriptions of the signals available on the DS1554 Sub-D I/O connector, refer to:

- Digital Crank/Cam Inputs on page 426
- Inductive Zero Voltage Detector on page 427
- Knock Sensor Input on page 429

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the power input and output on the DS1514 ZIF I/O connector that are connected to the DS1554 Engine Control I/O Module:

Pins	Signal	Description / Function
M1, N1	VDRIVE	This input supplies the digital output circuits located on the DS1554 Engine Control I/O Module. ▪ Connect this input to VSENS to set 5 V logic levels for your inputs/outputs. ▪ Connect this input to VBATprot to set automotive-compatible logic levels for your inputs/outputs. ▪ Do not connect this pin directly to VBAT[1)], because the input and output circuits are not load-dump-connected or reverse-voltage-protected at this signal. For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
b6	VSENS+	▪ Fixed sensor supply output. Use this output to supply your sensors and/or VDRIVE.

Pins	Signal	Description / Function
c6	VSENS-	▪ The supply must be activated by an FPGA application build with the RTI FPGA Programming Blockset. ▪ VSENS- lets you separate the sensor ground and the supply ground for ideal grounding if you supply a sensor. For best measurement results, use separate ground lines to connect VSENS- (supply ground) and GND of MicroAutoBox II (sensor ground) to the ground potential of the sensor. Refer to Connecting Sensor Ground Lines to MicroAutoBox II on page 51. ▪ If you use VSENS+ to supply VDRIVE, you have to connect VSENS- to GND of MicroAutoBox II. Refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.
R1, P1	VBAT prot	Protected VBAT output. VBATprot follows VBAT within the specified range and is switched on and off with the REMOTE pin. Use this output to supply VDRIVE when automotive logic levels are needed.

1) VBAT is the main power supply input voltage of MicroAutoBox II.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

VBAT is the main power supply input voltage of MicroAutoBox II.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Inputs						
Digital I/O voltage supply input	VDRIVE	Supply for digital input/output circuits	4.5		40	V
	$I_{VDRIVE\ no\ load}$	All inputs/outputs unconnected		10		mA
	$I_{VDRIVE\ maximum\ load}$	All outputs shorted to GND		500		mA
Outputs						
Sensor supply output	VSENS+	Fixed and isolated output voltage relative to VSENS- I_{Load} = 0 mA		5.25 ± 5 %		V
		Fixed and isolated output voltage relative to VSENS- I_{Load} = 400 mA		5.0 ± 5 %		V
	$P_{VSENS,\ max}$	Maximum output power		2		W

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Protected VBAT output	VBATprot [2]	I_{Load} = 1A; VBAT = 12 V	11.56	11.78	12	V
	$I_{VBATprot,\ max}$	Maximum output current			1000	mA
	$I_{ProtPeak}$	Overload current limit (–40 °C ... 85 °C)	4		9	A
	t(overload)	Time to shut off $I_{ProtPeak}$			5	ms

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] VBATprot follows VBAT within the specified range.

Related topics

Basics

Providing the Supply Voltage to Drive Digital I/O Interfaces...47

References

FPGA_IO_WRITE_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)

Digital Outputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

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.

Pin description

The following table gives a description of the digital output pins on the DS1514 ZIF I/O connector:

Pins	Signal	Description / Function
L5, N2, D3, N5, M6, N3, D5, M2, L6, K2, C3, L2, G6, H2, C5, J2, F6, E2, B3, G2, E6, C2, B5, F2, D6, A6, A3, D2, B6, A2, A5, B2, F5, N6, E3, E5, H3, M5, G3, F3	Channel 1 ... 40 Digital Out (Type A)	Standard discrete digital output.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

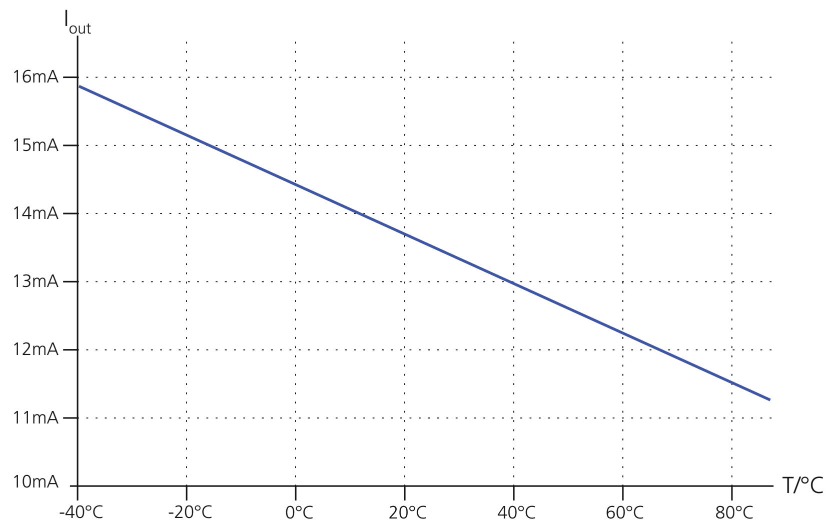
Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent output channels			40		
Supply voltage	The digital output circuits are supplied via the VDRIVE pin.	4.5		40	V
Protected supply voltage				45	V
Power-up default		All outputs are in high-impedance state.			
DC Characteristics					
Output high voltage level without load	VDRIVE = 5 V	4.1	4.3		V
	VDRIVE = 12 V	11.0	11.2		V
Output high voltage level with 5 mA load	VDRIVE = 5 V	3.2	3.4		V
	VDRIVE = 12 V	10.1	10.3		V
Output low voltage level without load	VDRIVE = 5 V		0.1	0.3	V
	VDRIVE = 12 V		0.1	0.3	V
Output low voltage level with –5 mA load	VDRIVE = 5 V		0.7	0.9	V
	VDRIVE = 12 V		0.7	0.9	V
Current limit high level	$T_{Housing}$ = -40 °C ... +85 °C	5	13		mA
Current limit low level	$T_{Housing}$ = -40 °C ... +85 °C	5	14		mA
Leakage current tristate	$T_{Housing}$ = -40 °C ... +85 °C			100	µA

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics					
Minimum pulse width high level with 1 kΩ load	VDRIVE = 5 V or 12 V		700		ns
Minimum pulse width low level with 1 kΩ load	VDRIVE = 5 V or 12 V		200		ns
Output Frequency at 50% duty cycle	VDRIVE = 5 V or 12 V		0.7		MHz
Output frequency at 1% or 99% duty cycle	VDRIVE = 5 V or 12 V		14		kHz

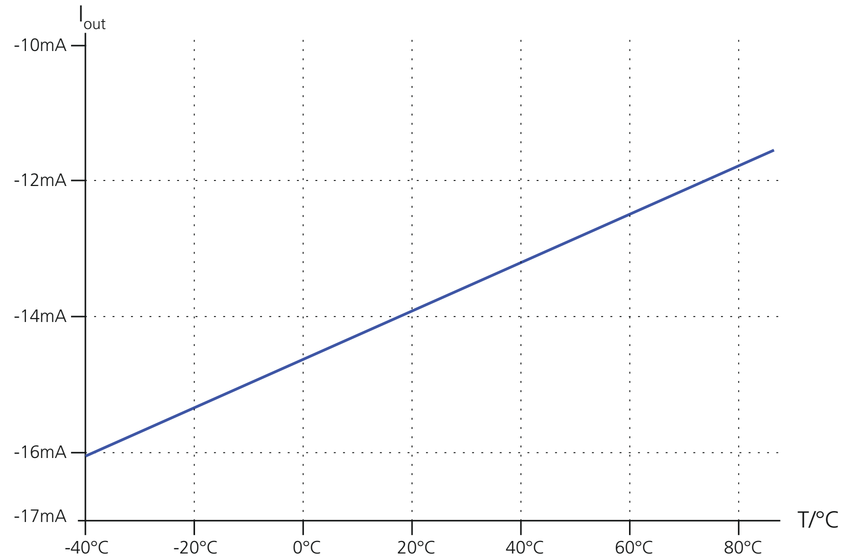
[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.

The following illustrations show the maximum output current of a digital output circuit as a function of ambient temperature (VDRIVE = 12 V; output is shorted to 6 V):

- Output high

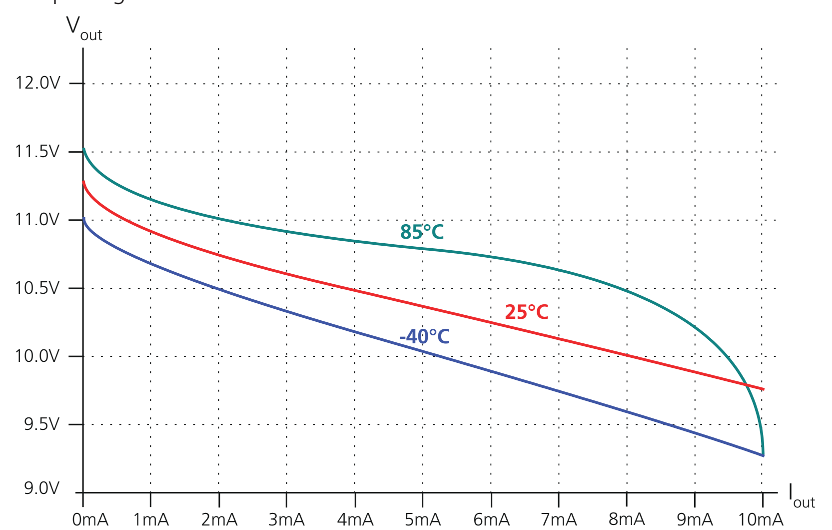


- Output low

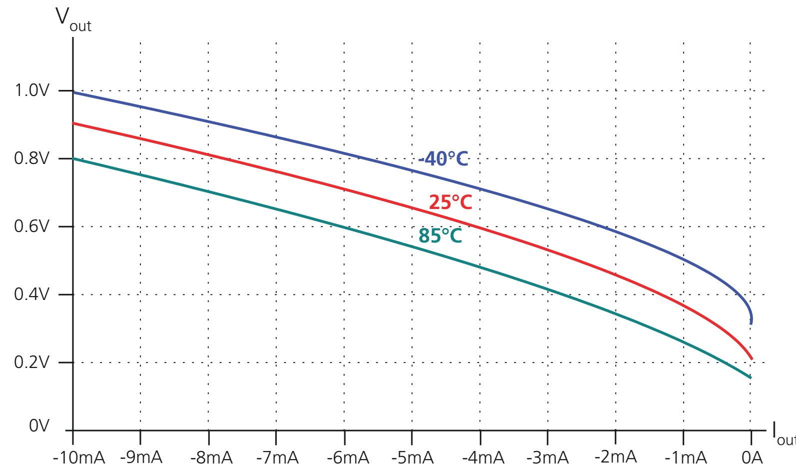


The following illustrations show the typical digital output voltage as a function of the output current (VDRIVE = 12 V):

- Output high



- Output low



Powering digital outputs

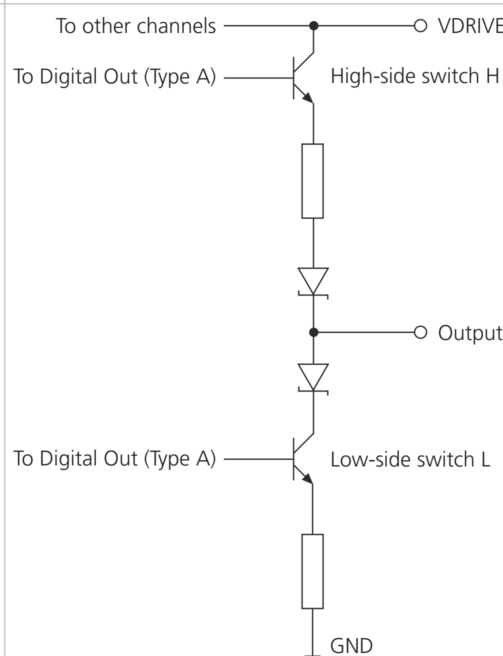
Note

To use the digital I/O signals of the ZIF I/O connector, you have to connect the VDRIVE pin inside the ZIF I/O connector according to the required logic level. This pin is not preconfigured in the ZIF I/O connector delivered with each MicroAutoBox II.

For more information, refer to Providing the Supply Voltage to Drive Digital I/O Interfaces on page 47.

Circuit diagrams

The following table shows a *simplified* diagram of the I/O circuitry of the digital outputs:

Signal	I/O Circuit
Digital Out (Type A)	

Related topics

Basics

Providing the Supply Voltage to Drive Digital I/O Interfaces..47

References

FPGA_IO_WRITE_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)

Digital I/O (Bidirectional)

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

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.

Pin description

The following table gives a description of the digital I/O pins on the DS1514 ZIF I/O connector:

Pins	Signal	Description / Function
c3, b5, b2, c5, c4, c2, a2, Z2	Channel 1 ... 8 Digital In (Type B) and Digital Out (Type B)	Digital bidirectional channels

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

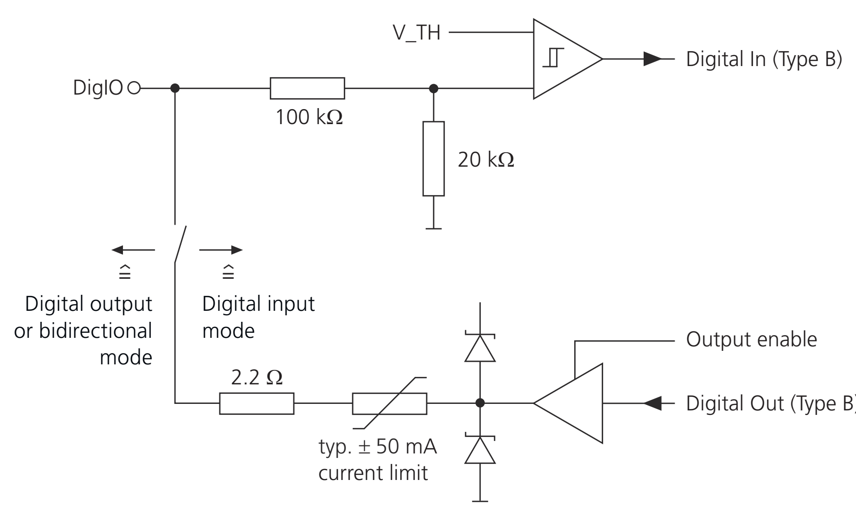
Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent I/O channels			8		
Power-up default		All digital I/O lines are used as inputs. They are set to 5 V logic level and to a defined logical low level by built-in 120 kΩ pull-down resistors.			
DC Characteristics					
Input voltage	High	V_TH + 0.5 * V_Hyst		15	V
	Low	0		V_TH - 0.5 * V_Hyst	V
Overvoltage protection		-50		+50	V
Threshold voltage (V_TH) range [2)]		1.0		7.5	V
Threshold voltage (V_TH) accuracy		± (5 % V_TH + 150 mV)			V
Hysteresis (V_Hyst)	Fixed voltage		0.7		V
Input impedance			100		kΩ
Output voltage level with ±10 mA load	High level at 5 V logic level[2)]	4.6	5.0		V
	High level at 3.3 V logic level[2)]	2.8	3.2		V
	Low level		0.2		V
Output current during short circuit		±45		±75	mA

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics					
Input frequency	5 V logic level with 50% duty cycle and V_TH = 2.5 V			10	MHz
Input pulse width	5 V logic level with 20% duty cycle and V_TH = 2.5 V	20			ns
Output frequency	Max. 100 pF capacitive load			40	MHz
Output pulse width	Max. 100 pF capacitive load	12.5			ns

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

Circuit diagram

The following table shows a *simplified* diagram of the I/O circuitry of the digital I/O channels:

Signal	I/O Circuit
Digital In (Type B) and Digital Out (Type B)	

Related topics

References

FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)
FPGA_IO_WRITE_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)

Analog Inputs

Note on the cable harness

> **Note**
>
> To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the analog input pins on the DS1514 ZIF I/O connector:

Pins	Signal	Description / Function
(W2;V2),(Y2;X2), (S2;R2), (T2;U2), (V5;W6), (W3;V3), (T3;U3), (U5;V6), (S5;T6), (T5;U6), (R5;R6), (S3;R3), (P5;P6), (P3;P2)	ADC channel 1 ... 14 ADC (Type A)	Differential analog inputs

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

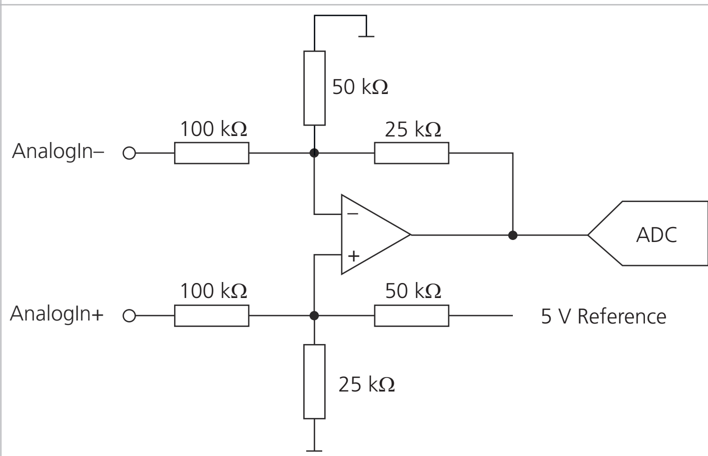
Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			14		–
Resolution			16		bit
Sample rate	Burst mode with more than 1 sample			1	MSPS
Input voltage range	Voltage difference between the non-inverted and inverted input	-10		+10	V
Working input voltage range	Voltage difference between GND and each input	-11		+11	V
DC characteristics					
Initial offset error	Below 750 KSPs	-3.0		+3.0	mV
Initial gain error	Below 750 KSPs	-0.25		+0.25	%
Input impedance	Differential [2)]		200		kΩ
Offset drift			±40		µV/K
Gain drift			±6		ppm/K
Overvoltage protection	Continuous	-30		+30	V
	Short-term	-50		+50	V

Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC Characteristics					
No missing codes		15			bit
SNR	12.4 kHz signal at 200 KSPs	80			dB
Input bandwidth	Full-power bandwidth	400			kHz
Channel crosstalk	100 kHz			-96	dB
	200 kHz			-92	dB
	400 kHz			-90	dB

[1] Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
[2] Impedance between the non-inverted and inverted input.

Circuit diagrams

The following table shows a simplified diagram of the I/O circuitry of the analog input:

Signal	I/O Circuit
ADC (Type A)	

Related topics

References

FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference)

Digital Crank/Cam Inputs

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the digital camshaft input pins on the DS1554 Sub-D I/O connector:

Pins	Signal	Description / Function
13, 32, 14, 33, 12	Channel 1 ... 5 Digital Crank/Cam Sensor	Digital inputs for crankshaft and camshaft sensors.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

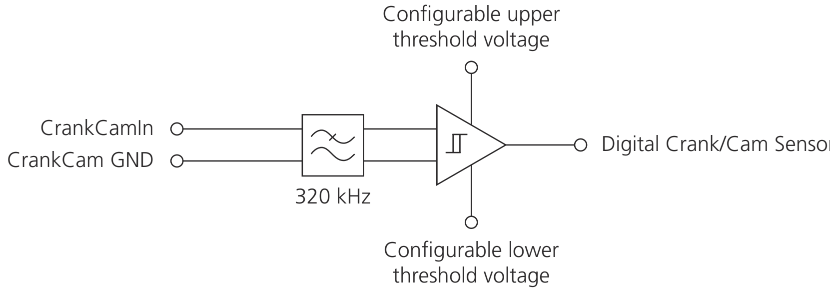
- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			5		–
Input voltage range		-40		+60	V
Overvoltage protection		-70		+70	V
DC characteristics					
Threshold voltage range	Lower and upper thresholds software-configurable in 100 mV steps.	-40		+40	V
Threshold voltage accuracy	Accuracy depends on the configured threshold voltage levels V_{Th}.	± [1% of V_{Th} + 100 mV]			
Input impedance			170		kΩ
AC Characteristics					
Low-pass filter	3 dB frequency		320		kHz

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

Circuit diagram

The following diagram is a simplified I/O circuitry of the digital crankshaft/camshaft sensor inputs:

Signal	I/O Circuit
Digital Crank/Cam Sensor	

Related topics

References

FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference)

Inductive Zero Voltage Detector

Note on the cable harness

Note

To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the crankshaft input pins on the DS1554 Sub-D I/O connector:

Pins	Signal	Description / Function
10, 29	Channel 1 Inductive Zero Voltage Detector	Input for detecting a zero crossing from positive to negative of a reluctance magnetic coil as used in crankshaft sensors.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

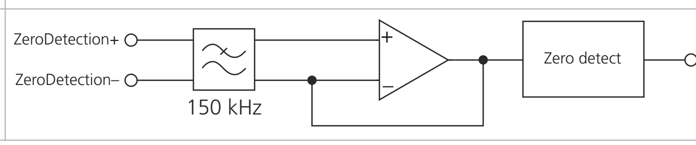
- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			1		
DC characteristics					
Input voltage range		-60		+60	V
Input impedance			67		kΩ
AC Characteristics					
Low-pass filter	3 dB frequency		150		kHz

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

Circuit diagram

The following diagram is a simplified I/O circuitry of the inductive zero voltage detector input:

Signal	I/O Circuit
Inductive Zero Voltage Detector	

Related topics

References

FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference)

Knock Sensor Input

Note on the cable harness

> **Note**
>
> To avoid malfunction and/or poor signal quality, it is recommended to distinguish between the signals of the two ZIF I/O connectors (DS1511/DS1513 and DS1514). For example, do not use a signal pin of one ZIF I/O connector and a GND pin of the other ZIF I/O connector together.

Pin description

The following table gives a description of the knock sensor input pins on the DS1554 Sub-D I/O connector:

Pins	Signal	Description / Function
(16;34), (17;35), (18;36), (19;37)	Channel 1 ... 4 Knock Sensor	Differential analog inputs to connect knock sensors.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Parameter[1)]	Conditions / Comments	Min.	Typ.	Max.	Unit
General characteristics					
Number of independent input channels			4		
Resolution			16		bit
Sample rate				1	MSPS
Input voltage range	Voltage difference between the noninverted and inverted input	-5		+5	V
Working input voltage range	Voltage difference between GND and each input	-11		+11	V
DC characteristics					
Initial offset error	Below 750 KSPs	-1.5		+1.5	mV
Initial gain error	Below 750 KSPs	-0.25		+0.25	%
Input impedance	Differential [2)]		200		kΩ
Offset drift			±20		µV/K
Gain drift			±6		ppm/K

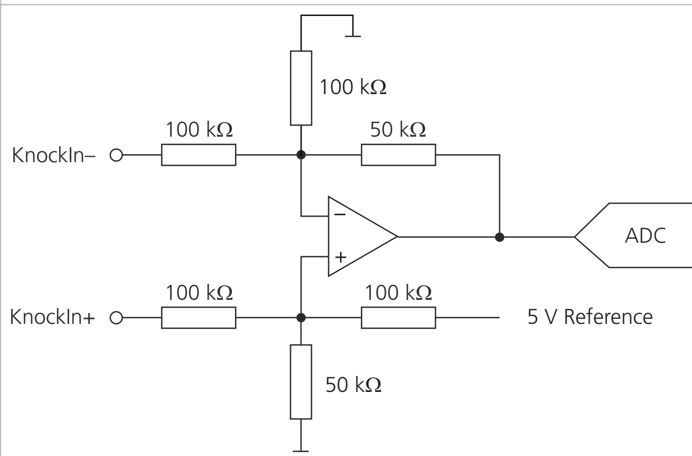
Parameter[1]	Conditions / Comments	Min.	Typ.	Max.	Unit
AC characteristics					
No missing codes		15			bit
SNR	12.4 kHz signal at 200 KSPs	80			dB
Input bandwidth	Full-power bandwidth	400			kHz
Channel crosstalk	100 kHz			-96	dB
	200 kHz			-92	dB
	400 kHz			-90	dB

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

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

Circuit diagram

The following diagram is a simplified I/O circuitry of the knock sensor input:

Signal	I/O Circuit
Knock Sensor	

Related topics

References

FPGA_IO_READ_BL (FPGA1401Tp1 with Engine Control I/O Module Settings) (RTI FPGA Programming Blockset - FPGA Interface Reference 📖)

Data Sheet DS4340 FlexRay Interface Module

Where to go from here

Information in this section

Information in other sections

General Information

Where to go from here

Information in this section

Hardware Support

Suitable MicroAutoBox variants

You can use the DS4340 Flexray Interface Module inside the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1507
- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

The absolute maximum voltage levels that the DS4340 FlexRay Interface Module is designed for are listed in the following table. The voltage levels do not imply a functional operation. All voltages are referenced to GND, unless otherwise stated.

Parameter	Specification[1)]	Description
V_{BAT}	–0.2 V ... +60 V	Voltage level on VBAT pin
V_{INH}, V_{WAKE}	–0.2 V ... $+V_{BAT}$	Voltage level on INH1, INH2, and Wake-up pins
V_{BP}, V_{BM}	–58 V ... +58 V	Voltage level on BP and BM pins.

Parameter	Specification[1)]	Description
$V_{Diff\ (BP\ -\ BM)}$	–5 V ... +5 V	Voltage difference between BP and BM pins (due to termination resistors).

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

Connector Pinouts

Where to go from here

Information in this section

DS1507 Sub-D I/O Connector

Introduction

MicroAutoBox II 1401/1507 provides the signals of installed IP modules at the DS1507 Sub-D I/O connector.

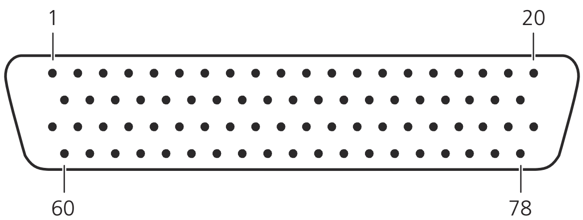
Pinout

The DS1507 Sub-D I/O connector is a 78-pin, male Sub-D connector giving access to the I/O signals provided by the DS4340 FlexRay Interface Modules. The pin numbering used for Sub-D connectors is not standardized. The following illustration shows the numbering used (front view).

Note

Do not rely on the numbers written on the Sub-D connectors.

The following table shows the signals of two DS4340 FlexRay Interface Module installed to the IP slots:

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
							
1				40			
2		21		41		60	
3		22		42		61	
4		23		43		62	
5		24	Reserved	44		63	Reserved
6		25		45		64	
7		26		46		65	
8		27		47		66	
9		28		48		67	
10		29		49		68	
11		30		50		69	
12		31		51		70	
13		32		*52*		71	
14		*33*	*INH1_1*	*53*		*72*	*INH1_2*
15	*GND_ChA_1*	*34*	*INH2_1*	*54*	*GND_ChA_2*	*73*	*INH2_2*
16	*BP_ChA_1*	*35*	*VBAT_1*	*55*	*BP_ChA_2*	*74*	*VBAT_2*
17	*BM_ChA_1*	*36*	*BP_FT_ChB_1*	*56*	*BM_ChA_2*	*75*	*BP_FT_ChB_2*
18	*GND_ChB_1*	*37*	*BM_FT_ChB_1*	*57*	*GND_ChB_2*	*76*	*BM_FT_ChB_2*
19	*BP_ChB_1*	*38*	*BP_FT_ChA_1*	*58*	*BP_ChB_2*	*77*	*BP_FT_ChA_2*
20	*BM_ChB_1*	*39*	*BM_FT_ChA_1*	*59*	*BM_ChB_2*	*78*	*BM_FT_ChA_2*

Signal names The signal names of the FlexRay bus lines consist of up to four parts separated by an underscore:

- Bus line plus (BP) or bus line minus (BM)
- Normal bus line (" ") or feed-through line (FT)
- FlexRay channel (ChA or ChB)
- Module slot (1 or 2)

For example, BP_FT_ChB_2 means: bus line plus, feed-through line, channel B, 2nd module slot.

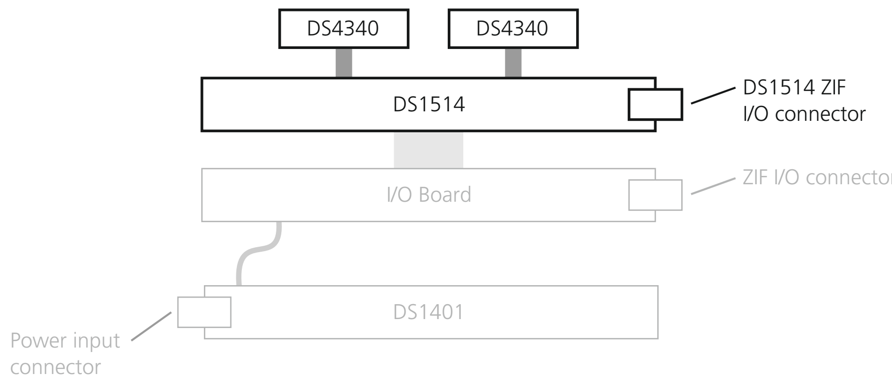
For pin descriptions, refer to Interfaces on page 439.

DS1514 ZIF I/O Connectors

Introduction

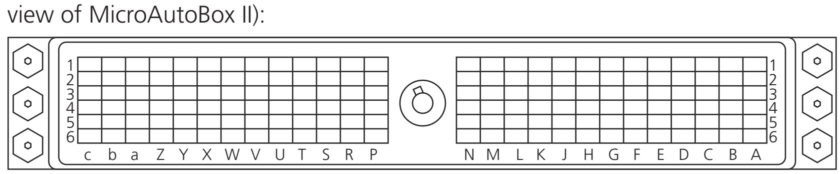
The **DS1514 I/O connector** is a 156-pin zero insertion force (ZIF) connector giving access to the I/O signals of the DS4340 FlexRay Interface Modules.

The illustration below shows the internal assembly of MicroAutoBox II with two DS4340 FlexRay Interface Modules installed.



Pinout

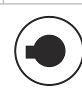
The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of two DS4340 FlexRay Interface Module installed to the IP slots:

1	2	3	4	5	6	
						A
						B
					Wake-up_1	*C*
						D
						E
						F
				INH1_1		*G*
				VBAT_1	INH2_1	*H*
		GND_ChB_1		BM_FT_ChB_1	BP_FT_ChB_1	*J*
		BP_ChB_1	BM_ChB_1	BM_FT_ChA_1	BP_FT_ChA_1	*K*
		GND_ChA_1				*L*
		BP_ChA_1	BM_ChA_1			*M*
						N
						
						P
						R
					Wake-up_2	*S*
						T
						U
						V
				INH1_2		*W*
				VBAT_2	INH2_2	*X*
		GND_ChB_2		BM_FT_ChB_2	BP_FT_ChB_2	*Y*
		BP_ChB_2	BM_ChB_2	BM_FT_ChA_2	BP_FT_ChA_2	*Z*
		GND_ChA_2				*a*
		BP_ChA_2	BM_ChA_2			*b*
						c

Signal names The signal names of the FlexRay bus lines consist of up to four parts separated by an underscore:

- Bus line plus (BP) or bus line minus (BM)
- Normal bus line (" ") or feed-through line (FT)
- FlexRay channel (ChA or ChB)
- Module slot (1 or 2)

For example, BP_FT_ChB_2 means: bus line plus, feed-through line, channel B, 2nd module slot.

Signal descriptions

For signal descriptions, refer to Interfaces on page 439.

Signal Descriptions

Interfaces

Pin and signal description

The following tables give a description of the interface pins and signals provided by the DS4340 FlexRay Interface Module.

DS4340 installed to IP slot 1

Pins		Signal	Description / Function
DS1507 Sub-D I/O Connector	**DS1514 ZIF I/O Connector**		
13	C6	Wake-up_1	Connection to an external wake-up signal for module 1 The WakeUp pin is connected to the WAKE input of TJA1080 devices. This pin has no pull-up resistor. To set the wake flag on the TJA1080, a falling edge is needed. See the TJA1080 manual for the functionality of the WAKE pin.
15	L3	GND_ChA_1	Ground for FlexRay channel A, module 1
16	M3	BP_ChA_1	FlexRay channel A, bus line plus, module 1
17	M4	BM_ChA_1	FlexRay channel A, bus line minus, module 1
18	J3	GND_ChB_1	Ground for FlexRay channel B, module 1
19	K3	BP_ChB_1	FlexRay channel B, bus line plus, module 1
20	K4	BM_ChB_1	FlexRay channel B, bus line minus, module 1
33	G5	INH1_1	Inhibit outputs from TJA1080 to switch external voltage regulator of module 1. They can be used to wake up MicroAutoBox II. The outputs are on the voltage level of VBAT and can be connected directly to the KL15IN (Remote) pin of MicroAutoBox II. The pins are not connected by default. If you want to use the pins, the hardware of your MicroAutoBox II must be adapted, see How to Wake Up MicroAutoBox II by Activity on the FlexRay Bus on page 94.
34	H6	INH2_1	
35	H5	VBAT_1	To power the TJA1080 transceivers of module 1.
36	J6	BP_FT_ChB_1	FlexRay channel B, feed-through bus line plus, module 1. Feed-through lines are useful to keep the stub length in a linear passive bus as short as possible, see DS4340 Connections in Different Topologies on page 84.
37	J5	BM_FT_ChB_1	FlexRay channel B, feed-through bus line minus, module 1
38	K6	BP_FT_ChA_1	FlexRay channel A, feed-through bus line plus, module 1
39	K5	BM_FT_ChA_1	FlexRay channel A, feed-through bus line minus, module 1

DS4340 installed to IP slot 2

Pins DS1507 Sub-D I/O connector	Pins DS1514 ZIF I/O connector	Signal	Description / Function
52	S6	Wake-up_2	Connection to an external wake-up signal for module 2 The WakeUp pin is connected to the WAKE input of TJA1080 devices. This pin has no pull-up resistor. To set the wake flag on the TJA1080, a falling edge is needed. See the TJA1080 manual for the functionality of the WAKE pin.
54	a3	GND_ChA_2	Ground for FlexRay channel A, module 2
55	b3	BP_ChA_2	FlexRay channel A, bus line plus, module 2
56	b4	BM_ChA_2	FlexRay channel A, bus line minus, module 2
57	Y3	GND_ChB_2	Ground for FlexRay channel B, module 2
58	Z3	BP_ChB_2	FlexRay channel B, bus line plus, module 2
59	Z4	BM_ChB_2	FlexRay channel B, bus line minus, module 2
72	W5	INH1_2	Inhibit outputs from TJA1080 to switch external voltage regulator of module 2. They can be used to wake up MicroAutoBox II. The outputs are on the voltage level of VBAT and can be connected directly to the KL15IN (Remote) pin of MicroAutoBox II. The pins are not connected by default. If you want to use the pins, the hardware of your MicroAutoBox II must be adapted, see How to Wake Up MicroAutoBox II by Activity on the FlexRay Bus on page 94.
73	X6	INH2_2	
74	X5	VBAT_2	To power the TJA1080 transceivers of module 2.
75	Y6	BP_FT_ChB_2	FlexRay channel B, feed-through bus line plus, module 2. Feed-through lines are useful to keep the stub length in a linear passive bus as short as possible, see DS4340 Connections in Different Topologies on page 84.
76	Y5	BM_FT_ChB_2	FlexRay channel B, feed-through bus line minus, module 2
77	Z6	BP_FT_ChA_2	FlexRay channel A, feed-through bus line plus, module 2
78	Z5	BM_FT_ChA_2	FlexRay channel A, feed-through bus line minus, module 2

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- $T_{Housing}$=+25 °C
- All voltages are referenced to GND pins of the ZIF connectors.
- All voltage values specify voltages on the connector pins.

Interface	Parameter	Conditions / Comments	Specification[1)]
FlexRay	Bit rate	—	max. 2 x 10 MBaud
	Frame length	—	max. 12 byte
IP module carrier	Clocking	—	▪ min. 8 MHz

Interface	Parameter	Conditions / Comments	Specification[1]
			▪ max. 32 MHz
	Access type	—	byte / word

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

Data Sheet DS4342 CAN FD Interface Module

Where to go from here

Information in this section

Information in other sections

General Information

Where to go from here

Information in this section

Hardware Support

Suitable MicroAutoBox variants

You can use the DS4342 CAN FD Interface Module inside the following MicroAutoBox II variants:

- MicroAutoBox II 1401/1507
- MicroAutoBox II 1401/1511/1514
- MicroAutoBox II 1401/1513/1514

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels

The absolute maximum voltage levels that the DS4342 CAN FD Interface Module is designed for are listed in the following table. The voltage levels do not imply a functional operation. All voltages are referenced to GND, unless otherwise stated.

Parameter	Specification[1)]	Description
V_{BAT}	–0.2 V ... +40 V	Voltage level on VBAT pin
V_{INH}	–0.2 V ... +40 V	Voltage level on INH1 and INH2 pins
$V_{CAN\ high}$, $V_{CAN\ low}$	–58 V ... +58 V	Voltage level on CAN high and CAN low pins.

Parameter	Specification[1]	Description
$V_{Diff\ (CAN\ high\ -\ CAN\ low)}$	–5 V ... +5 V	Voltage difference between CAN high and CAN low pins (due to termination resistors).

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

Connector Pinouts

Where to go from here

Information in this section

DS1507 Sub-D I/O Connector

Introduction

MicroAutoBox II 1401/1507 provides the signals of installed IP modules at the DS1507 Sub-D I/O connector.

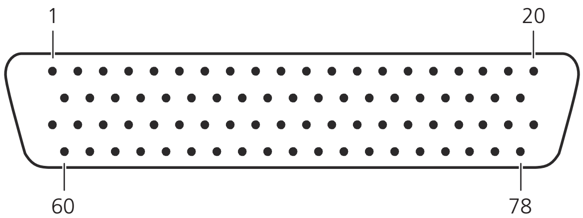
Pinout

The DS1507 Sub-D I/O connector is a 78-pin, male Sub-D connector giving access to the I/O signals provided by the DS4342 CAN FD Interface Modules. The pin numbering used for Sub-D connectors is not standardized. The following illustration shows the numbering used (front view).

Note

Do not rely on the numbers written on the Sub-D connectors.

The following table shows the signals of two DS4342 CAN FD Interface Modules installed to the IP slots:



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1				40			
2		21		41		60	
3		22		42		61	
4		23		43		62	
5		24	Reserved	44		63	Reserved
6		25		45		64	
7		26		46		65	
8		27		47		66	
9		28		48		67	
10		29		49		68	
11		30		50		69	
12		31		51		70	
13		32		52		71	
14		33	*INH1_1*	53		72	*INH1_2*
15	*GND_Ch1_1*	34	*INH2_1*	54	*GND_Ch1_2*	73	*INH2_2*
16	*CANH_Ch1_1*	35	*VBAT_1*	55	*CANH_Ch1_2*	74	*VBAT_2*
17	*CANL_Ch1_1*	36	*CANH_FT_Ch2_1*	56	*CANL_Ch1_2*	75	*CANH_FT_Ch2_2*
18	*GND_Ch2_1*	37	*CANL_FT_Ch2_1*	57	*GND_Ch2_2*	76	*CANL_FT_Ch2_2*
19	*CANH_Ch2_1*	38	CANH_FT_Ch1_1	58	*CANH_Ch2_2*	77	*CANH_FT_Ch2_2*
20	*CANL_Ch2_1*	39	CANL_FT_Ch1_1	59	*CANL_Ch2_2*	78	*CANL_FT_Ch2_2*

Signal names The signal names of the CAN bus lines consist of up to four parts separated by an underscore:

- CAN high (CANH) or CAN low (CANL)
- Normal bus line (" ") or feed-through line (FT)
- CAN channel (Ch1 or Ch2)
- Inhibit signal (INH1 or INH2)
- Signal ground (GND)
- Module slot (1 or 2)

For example, CANH_FT_Ch2_2 means: CAN high, feed-through line, channel 2, 2nd module position.

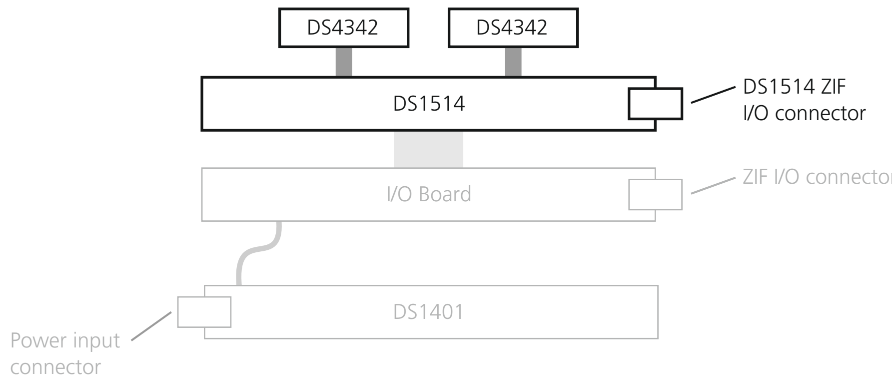
For pin descriptions, refer to Interfaces on page 451.

DS1514 ZIF I/O Connectors

Introduction

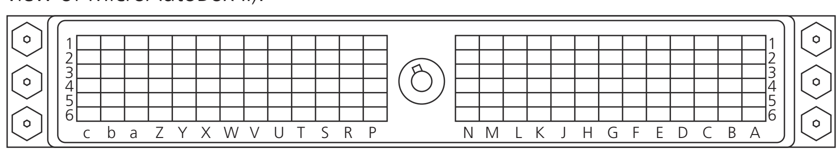
The **DS1514 I/O connector** is a 156-pin zero insertion force (ZIF) connectors giving access to the I/O signals of the DS4342 CAN FD Interface Modules.

The illustration below shows the internal assembly of MicroAutoBox II with two DS4342 CAN FD Interface Modules installed.



Pinout

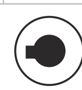
The following illustration shows the pin numbering of the I/O connector (front view of MicroAutoBox II):



Note

There are pins identified by uppercase letters (A, B, C, etc.) and pins identified by lowercase letters (a, b, c).

The following table shows the signals of two DS4342 CAN FD Interface Modules installed to the IP slots:

1	2	3	4	5	6	
						A
						B
					Reserved	*C*
						D
						E
						F
				INH1_1		*G*
				VBAT_1	INH2_1	*H*
		GND_Ch2_1		CANL_FT_Ch2_1	CANH_FT_Ch2_1	*J*
		CANH_Ch2_1	CANL_Ch2_1	CANL_FT_Ch1_1	CANH_FT_Ch1_1	*K*
		GND_Ch1_1				*L*
		CANH_Ch1_1	CANL_Ch1_1			*M*
						N
						
						P
						R
					Reserved	*S*
						T
						U
						V
				INH1_2		*W*
				VBAT_2	INH2_2	*X*
		GND_Ch2_2		CANL_FT_Ch2_2	CANH_FT_Ch2_2	*Y*
		CANH_Ch2_2	CANL_Ch2_2	CANL_FT_Ch1_2	CANH_FT_Ch1_2	*Z*
		GND_Ch1_2				*a*
		CANH_Ch1_2	CANL_Ch1_2			*b*
						c

Signal names The signal names of the CAN bus lines consist of up to four parts separated by an underscore:

- CAN high (CANH) or CAN low (CANL)
- Normal bus line (" ") or feed-through line (FT)
- CAN channel (Ch1 or Ch2)
- Inhibit signal (INH1 or INH2)
- Signal ground (GND)
- Module slot (1 or 2)

For example, CANH_FT_Ch2_2 means: CAN high, feed-through line, channel 2, 2nd module position.

Signal descriptions

For signal descriptions, refer to Interfaces on page 451.

Signal Descriptions

Interfaces

Pin and signal descriptions

The following tables gives a description of the interface pins and signals provided by the DS4342 CAN FD Interface Module.

DS4342 installed to IP slot 1

Pins		Signal	Description / Function
DS1507 Sub-D I/O Connector	**DS1514 ZIF I/O Connector**		
15	L3	GND_Ch1_1	Ground for CAN FD channel 1, module 1
16	M3	CANH_Ch1_1	CAN FD high channel 1, module 1
17	M4	CANL_Ch1_1	CAN FD low channel 1, module 1
18	J3	GND_Ch2_1	Ground for CAN FD channel 2, module 1
19	K3	CANH_Ch2_1	CAN FD high channel 2, module 1
20	K4	CANL_Ch2_1	CAN FD low channel 2, module 1
33	G5	INH1_1	Inhibit outputs from the TJA1145T/FD transceiver of module 1. They can be used to wake up MicroAutoBox II. The outputs are on the voltage level of VBAT and can be connected directly to the KL15IN (REMOTE) pin of MicroAutoBox II. If you want to use these pins, the hardware of your MicroAutoBox II must be adapted. Refer to How to Configure MicroAutoBox II and a DS4342 for CAN Partial Networking on page 123.
34	H6	INH2_1	
35	H5	VBAT_1	To power the TJA1145T/FD transceivers of module 1.
36	J6	CANH_FT_Ch2_1	CAN FD high channel 2, feed-through bus line, module 1. Feed-through lines are useful to keep the stub length in a linear passive bus as short as possible, see DS4342 Connections in Different Topologies on page 120.
37	J5	CANL_FT_Ch2_1	CAN FD low channel 2, feed-through bus line, module 1
38	K6	CANH_FT_Ch1_1	CAN FD high channel 1, feed-through bus line, module 1
39	K5	CANL_FT_Ch1_1	CAN FD low channel 1, feed-through bus line, module 1

DS4342 installed to IP slot 2

Pin		Signal	Description / Function
DS1507 Sub-D I/O connector	**DS1514 ZIF I/O connector**		
54	a3	GND_Ch1_2	Ground for CAN FD channel 1, module 2
55	b3	CANH_Ch1_2	CAN FD high channel 1, module 2
56	b4	CANL_Ch1_2	CAN FD low channel 1, module 2
57	Y3	GND_Ch2_2	Ground for CAN FD channel 2, module 2

Pin		Signal	Description / Function
DS1507 Sub-D I/O connector	**DS1514 ZIF I/O connector**		
58	Z3	CANH_Ch2_2	CAN FD high channel 2, module 2
59	Z4	CANL_Ch2_2	CAN FD low channel 2, module 2
72	W5	INH1_2	Inhibit outputs from the TJA1145T/FD transceiver of module 2. They can be used to wake up MicroAutoBox II. The outputs are on the voltage level of VBAT and can be connected directly to the KL15IN (Remote) pin of MicroAutoBox II. If you want to use these pins, the hardware of your MicroAutoBox II must be adapted. Refer to How to Configure MicroAutoBox II and a DS4342 for CAN Partial Networking on page 123.
73	X6	INH2_2	
74	X5	VBAT_2	To power the TJA1145T/FD transceivers of module 2.
75	Y6	CANH_FT_Ch2_2	CAN FD high channel 2, module 2 Feed-through lines are useful to keep the stub length in a linear passive bus as short as possible, see DS4342 Connections in Different Topologies on page 120.
76	Y5	CANL_FT_Ch2_2	CAN FD low channel 2, feed-through bus line, module 2
77	Z6	CANH_FT_Ch1_2	CAN FD high channel 1, feed-through bus line, module 2
78	Z5	CANL_FT_Ch1_2	CAN FD low channel 1, feed-through bus line, module 2

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- V_{BAT}=+12 V
- T_{CASE}=+25 °C
- All voltages are referenced to GND pins of the ZIF connectors.
- All voltage values specify voltages on the connector pins.

Interface	Parameter	Conditions / Comments	Specification[1)]
CAN FD	Bit rate	ISO 11898 interface	max. 2 x > 2 MBaud
IP module carrier	Clocking	—	▪ min. 8 MHz ▪ max. 32 MHz
	Access type	—	byte / word

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

Data Sheet MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor

Where to go from here

Information in this section

Overview and General Information

Where to go from here

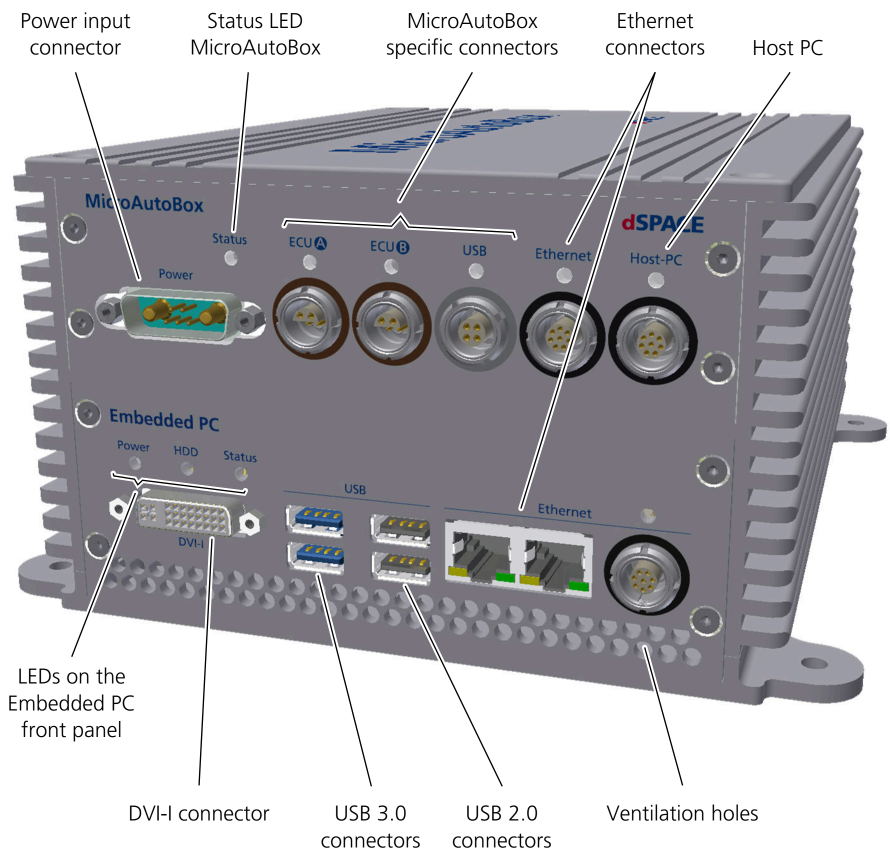
Information in this section

Housing Components

Connectors and status LEDs

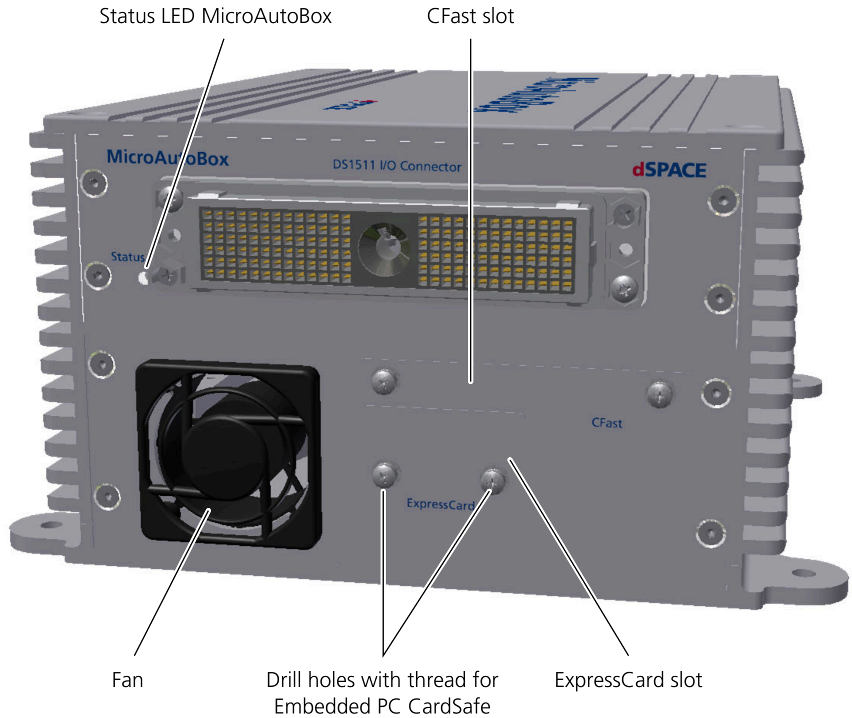
The illustrations show the locations of connectors and status LEDs on the MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor and the used MicroAutoBox variant.

Front view



Power input connector
Status LED MicroAutoBox
MicroAutoBox specific connectors
Ethernet connectors
Host PC
MicroAutoBox
dSPACE
Status
ECU A
ECU B
USB
Ethernet
Host-PC
Power
Embedded PC
Power
HDD
Status
USB
Ethernet
DVI-I
LEDs on the Embedded PC front panel
DVI-I connector
USB 3.0 connectors
USB 2.0 connectors
Ventilation holes

Rear view



MicroAutoBox Embedded PC and the MicroAutoBox variant contain the following connectors and LEDs:

Power input connector Supplies the required power to MicroAutoBox II and MicroAutoBox Embedded PC. It is a 7-pin, male Sub-D connector with two high-current pins.

Note

In contrast to MicroAutoBox variants without MicroAutoBox Embedded PC, the power input connector provides two additional remote inputs. These remote inputs control the power on/off behavior of MicroAutoBox Embedded PC and MicroAutoBox II. For further information, refer to Power On/Off Behavior of MicroAutoBox Embedded PC and MicroAutoBox II on page 145.

For the pinout, refer to Power Input Connector on page 464.

Status LED MicroAutoBox Shows you different states and potential malfunctions.

If battery power is switched on and the REMOTE signal/KL15 is activated (see Connecting to Power Supply on page 42), the status LED (= dual LED) shows different states indicated by the LED color:

- LED is red: Reset state and no application is downloaded to the real-time processor.
- LED is green: Application is running.

- LED is flashing red: MicroAutoBox II is in secured mode. For further instructions, refer to Checking MicroAutoBox II on page 506.

The status LED on the front panel has the same functionality as the status LED on the rear panel of MicroAutoBox II.

LEDs on the Embedded PC front panel The MicroAutoBox Embedded PC provides three LEDs above the DVI-I connector on its front panel.

- Power LED - is lit green if power is available
- HDD LED - is flashing green: indicates access to the internal hard disk.
- Status LED - User programmable LED

DVI-I connector The single-link DVI-I connector is a standard PC connector for connecting graphical devices, such as a TFT monitor.

USB connectors The four USB connectors let you connect devices such as a mouse, keyboard, external storage device, or touchpad feedback connector. There are 2 x USB 3.0 type A connectors left and 2 x USB 2.0 type A connectors right.

> **Note**
>
> The USB type A connectors are not internally connected to DS1401 Base Board and do not provide the USB Flight Recorder feature of MicroAutoBox II. Use the USB device connector (see below) for this.

Ethernet / Host PC connectors The MicroAutoBox Embedded PC provides three Ethernet connectors on its front panel. There are two RJ45, and one 8-pin LEMO connector which provide communication to external devices, such as the host PC, LAN connection, or ECUs based on the UDP/IP Ethernet protocol, for example, in bypassing scenarios. All three connectors have equal rights and are connected to an internal gigabit Ethernet switch.

- Each RJ45 connector provides two LEDs. The right, green LED is flashing for data traffic. The left, yellow LED is lit if power is available at both ends of the link and the relevant connection is serviceable.

  You can use standard Ethernet cables to connect devices.
- The LEMO connector provides a corresponding LED. It is lit green if power is available at both ends of the link and the relevant connection is serviceable. The LED is flashing green for data traffic.

Separate LEDs: Ethernet / Host PC There are two separate LEDs for Ethernet and host PC on the MicroAutoBox II front panel.

- Ethernet LED - is flashing green for data traffic on the bypass Ethernet I/O
- Host PC LED - is lit green if power is on. The LED is flashing green when data is being sent or received to/from the host PC interface.

CFast card slot The rear panel of the MicroAutoBox Embedded PC 3rd Gen. Intel® Core™ i7-3517UE Processor provides an CFast card slot. In this way you can enlarge the flash memory of the system.

ExpressCard slot The rear panel of the MicroAutoBox Embedded PC provides an ExpressCard/34 slot. In this way you can enhance the system with, for example, WLAN.

MicroAutoBox II - specific connectors

On the front and the rear of the unit, there are MicroAutoBox II connectors which depend on the specific variant (for example, DS1401/1507 or DS1401/1511/1514) that is mounted on the MicroAutoBox Embedded PC:

- USB device connector

> **Note**
>
> The USB device connector is not connected to MicroAutoBox Embedded PC. Do not connect a mouse, keyboard, etc., as it does not work. The connector can be used only to provide the USB Flight Recorder feature of MicroAutoBox II.

- ECU interface connectors and corresponding LED
- ZIF I/O connector(s)
- Sub-D I/O connector

For further information on these connectors, refer to:

- MicroAutoBox II 1401/1507 - Housing Components on page 198
- MicroAutoBox II 1401/1511 - Housing Components on page 222
- MicroAutoBox II 1401/1511/1514 - Housing Components on page 257
- MicroAutoBox II 1401/1513 - Housing Components on page 302
- MicroAutoBox II 1401/1513/1514 - Housing Components on page 337

General Data

General characteristics

The following table shows some general characteristics of MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor:

Parameter		Specification[1)]
Base board	Processor	▪ 3rd Gen. Intel® Core™ i7-3517UE Processor ▪ 2 x 1.7 / 2.8 GHz, 4 MB
	Memory	▪ 8 GB RAM, DDR3 RAM, 1.6 GHz ▪ Storage medium [2)]: ▪ internal MSATA, 64 GB

<table>
<tr><th colspan="3">Parameter</th><th>Specification[1]</th></tr>
<tr><td rowspan="2"></td><td colspan="2"></td><td>▪ CFast card, 64 GB (in the CFast card slot)</td></tr>
<tr><td colspan="2">Graphics display resolution</td><td>▪ Digital: Max. 1920 × 1200 pixels @ 60 Hz (single-link DVI)
▪ Analog: Max. 1920 x 1200 pixels @ 60 Hz</td></tr>
<tr><td colspan="3">Interfaces</td><td>▪ Ethernet (100/1000 Mbit/s)(Wake on LAN capable):
  ▪ 2 x RJ45 connectors
  ▪ 1 x LEMO connector
▪ USB connectors (type A)
  ▪ 2 x USB 3.0
  ▪ 2 x USB 2.0
▪ 1 x single-link DVI-I connector supporting DVI-A and single-link DVI-D.
▪ CFast card slot
▪ 1 x slot for ExpressCard/34
▪ 1 x internal Mini PCI Express slot (for PCI Mini Card Electromechanical Specification 1.1)</td></tr>
<tr><td colspan="3">Operating system</td><td>▪ Microsoft Windows 7 Ultimate (64 bit, Service Pack1)
▪ Linux distribution as image file on USB recovery stick</td></tr>
<tr><td rowspan="4">Housing dimensions</td><td colspan="2">Width</td><td>202 mm (7.95 in.)</td></tr>
<tr><td rowspan="2">Height</td><td>MicroAutoBox Embedded PC with:
▪ MicroAutoBox II DS1401/1507
▪ MicroAutoBox II DS1401/1511
▪ MicroAutoBox II DS1401/1513</td><td>105 mm (4.13 in.)</td></tr>
<tr><td>MicroAutoBox Embedded PC with:
▪ MicroAutoBox II DS1401/1511/1514
▪ MicroAutoBox II DS1401/1513/1514</td><td>151 mm (5.94 in.)</td></tr>
<tr><td colspan="2">Depth</td><td>222 mm (8.74 in.)</td></tr>
<tr><td rowspan="2">Weight (without external cable)</td><td colspan="2">MicroAutoBox Embedded PC with:
▪ MicroAutoBox II DS1401/1507
▪ MicroAutoBox II DS1401/1511
▪ MicroAutoBox II DS1401/1513</td><td>About 4.15 kg (9.15 lb.)</td></tr>
<tr><td colspan="2">MicroAutoBox Embedded PC with:
▪ MicroAutoBox II DS1401/1511/1514
▪ MicroAutoBox II DS1401/1513/1514</td><td>About 5.25 kg (11.58 lb.)</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.

[2] dSPACE may change the hard disk without notice.

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

- Do not exceed the maximum levels, because this may permanently damage the system.
- The operating temperature of MicroAutoBox Embedded PC limits the operating temperatures listed for the MicroAutoBox II variants.

Levels

The absolute maximum levels of voltage, temperature, etc., for which MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor is designed are listed in the following table. The voltage levels do not imply a functional operation of MicroAutoBox Embedded PC. All voltages are referenced to GND, unless otherwise stated.

Parameter	Specification[1)]

Continuous power dissipation ($T_{operating}$ = +60 °C)	▪ max. 60 W for MicroAutoBox Embedded PC joined with one of the following MicroAutoBox II variants:
	  ▪ MicroAutoBox II 1401/1507
	  ▪ MicroAutoBox II 1401/1511
	  ▪ MicroAutoBox II 1401/1513
	▪ max. 80 W for MicroAutoBox Embedded PC joined with one of the following MicroAutoBox II variants:
	  ▪ MicroAutoBox II 1401/1511/1514
	  ▪ MicroAutoBox II 1401/1513/1514

Operating temperature	0 °C ... +60 °C
Storage temperature	–55 °C ... +125 °C
Relative humidity	10% ... 95%, noncondensing
Pollution degree	2, according to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m

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

Clearances and Mounting Positions

Heat dissipation and free airflow

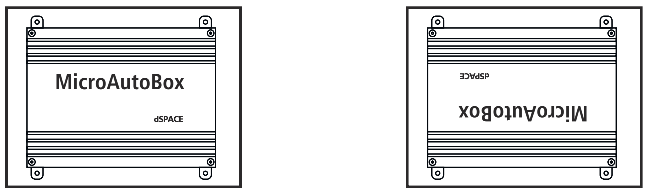
For sufficient heat dissipation and free airflow, observe the minimum clearances of 200 mm (7.9 in.) to walls, other devices or objects.

Mounting positions

To prevent hot liquids from leaking from ventilation slots in the exceptional case of an internal fire, observe the illustrated mounting positions.

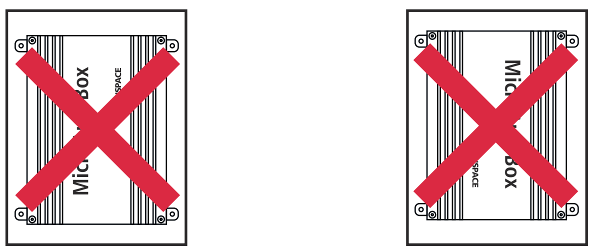
Horizontal:

Vertical:



The following mounting positions are not allowed.

Vertical:



Certifications

CE compliance

MicroAutoBox Embedded PC meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Vibration and shock tests

To verify the reliability of MicroAutoBox Embedded PC under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox Embedded PC executed a program without any failures.

Applied standards

The characteristics of MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor were tested according to the standards shown in the following table:

Tested Characteristics	Applied Standard	Description
Electromagnetic compatibility (EMC)	EN 55024:2010	Information technology equipment - Immunity characteristics
	EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use - immunity according table 2 (industrial environment) Refer to Influences through connected cables on page 462
	EN 55022:2010	Information technology equipment - Radio disturbance (class A)
	EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use Radio disturbance (class A)
	FCC 47 CFR Part 15	Radio disturbance Refer to Statement concerning FCC 47 CFR Part 15 on page 463.
Vibration	ISO 16750-3:2012 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 3h per axis, RMS-acceleration 27,8 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 2h 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 ... 2000 Hz, up to 3 g, 2 sweeps per axis ▪ Operating
Shock	ISO 16750-3:2012 / 4.2.2.	Test conditions: ▪ 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 A Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 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

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 II during run time. Otherwise, you might influence the measurements.

Statement concerning FCC 47 CFR Part 15

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.

Connector Pinouts

Power Input Connector

Introduction

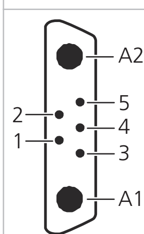
MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor is internally connected to the power input connector of the mounted MicroAutoBox II. MicroAutoBox II provides the connector on its front panel. It is a 7-pin, male connector with two high-current pins. It is a special variant of a 15-pin Sub-D connector (mixed-layout 7W2 Sub-D).

Note

The pinout of the power input connector features two additional signals when a MicroAutoBox Embedded PC is part of the system.

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (8 V … 36 V DC)		
			5	REMOTE_PULLUP
	2	$\text{REMOTE}_{\text{IN2}}$[2].	4	REMOTE[2), 3)]
	1	Do not connect	3	$\text{REMOTE}_{\text{IN1}}$[2]
	A1	GND		

[1] Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] The remote inputs (REMOTE, $\text{REMOTE}_{\text{IN1}}$, $\text{REMOTE}_{\text{IN2}}$) control the power on/off behavior of MicroAutoBox Embedded PC and MicroAutoBox II. For further information, refer to Power On/Off Behavior of MicroAutoBox Embedded PC and MicroAutoBox II on page 145.

[3] If you use the matching cable supplied by dSPACE, REMOTE is connected to VBAT within the connector shell. This cable is intended for use with a lab power supply only.

NOTICE

Risk of material damage

Do not switch off MicroAutoBox II and the MicroAutoBox Embedded PC by disconnecting the VBAT and/or GND connection or by pulling the power input connector when the operating system of the MicroAutoBox Embedded PC is running.

- Shut down the operating system of the MicroAutoBox Embedded PC via the remote inputs before the system is switched off.

Matching cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is for running MicroAutoBox II and the MicroAutoBox Embedded PC with a laboratory power supply during development. Therefore, the REMOTE pin (pin 4) is shorted to the VBAT pin (pin A2) inside the connector in order to save a separate switch. The $\mathrm{REMOTE_{IN1}}$ and $\mathrm{REMOTE_{IN2}}$ inputs are not connected, but both have internal pull-down resistors. The DS1401 Base Board and the MicroAutoBox Embedded PC are started and stopped together in this configuration.

Do not use the preconfigured cable in the vehicle. Otherwise, the units will always be turned on.

The VBAT wire (red) contains a melting fuse.

The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1)] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1)] The cable is labeled with this type number.

⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Power Inputs and Outputs

Pin description

The following tables give a description of the pins used for power input and remote input.

Connector	Pins	Signal	Description/Function
Power input connector	A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
	A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery or power supply. The housing of MicroAutoBox Embedded PC is also connected to GND.
	2	$REMOTE_{IN2}$	The remote inputs (REMOTE, $REMOTE_{IN1}$, $REMOTE_{IN2}$) control the power on/off behavior of MicroAutoBox Embedded PC and MicroAutoBox II. For further information, refer to Power On/Off Behavior of MicroAutoBox Embedded PC and MicroAutoBox II on page 145 ▪ If you connect the remote pin to the positive terminal of the vehicle battery directly, MicroAutoBox Embedded PC will always be turned on, and the vehicle battery will soon be exhausted if the engine is not running. Thus, a switch is highly recommended. If you use the matching cable supplied by dSPACE, REMOTE is connected to VBAT within the connector shell. This cable is intended for use with a lab power supply only. ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage.
	3	$REMOTE_{IN1}$	
	4	REMOTE	
	5	REMOTE_ Pullup	You can use this output to connect a remote switch between the remote inputs (REMOTE, $REMOTE_{IN1}$, $REMOTE_{IN2}$) and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up	8		32[2]	V
	VBAT	Operating	8 [3]		32[2]	V
	VBAT	Reverse protection			–40	V
	VBAT	Temporary overvoltage protection for max. 400 ms (load dump protection)			+80	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		5		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	4.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1		V
	$R_{inRemote}$	Input impedance	60		185	kΩ
$REMOTE_{IN1}$ and $REMOTE_{IN2}$voltage input	$V_{iHRemoteINx}$	Input high voltage	4.7			V
	$V_{iLRemoteINx}$	Input low voltage			0.8	V
	$R_{inRemoteINx}$	Input impedance		66		kΩ
Inrush current	$I_{VBAT\ inrush}$	All inputs/outputs unconnected	see Power supply on page 38			

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) With an additional absolute maximum tolerance of +4 V.
3) Valid for MicroAutoBox Embedded PC with 3rd Gen. Intel® Core™ i7-3517UE Processor: 8 ... 10 V for a maximum of 1 minute

Related topics

Basics

Connecting to Power Supply.. 42

Data Sheet MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor

Where to go from here

Information in this section

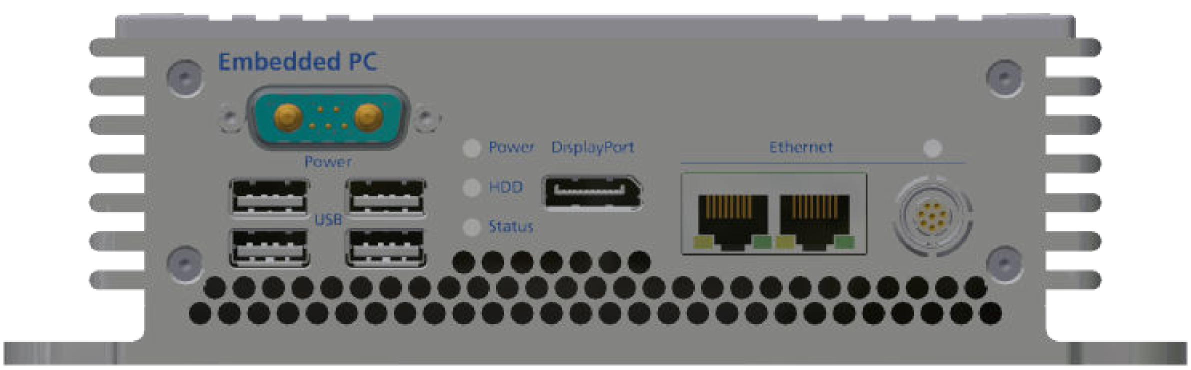
Overview and General Information

Where to go from here

Information in this section

Housing Components

Front



Component		Details
Connectors	Ethernet	To connect Ethernet devices: ▪ The connectors are two RJ45 connectors and one 8-pin LEMO connector. ▪ For the interface characteristics, refer to Interfaces on page 488.
	DisplayPort	To output digital video signals: ▪ The connector is a female DisplayPort connector. ▪ For the interface characteristics, refer to Interfaces on page 488.
	Power	Power input connector to supply the stand-alone variant of MicroAutoBox Embedded PC: ▪ The connector is a 7-pin, male Sub-D connector with two high-current pins. ▪ For the pinout, refer to Power Input Connector on page 481. ▪ For the electrical characteristics, refer to Power Inputs and Outputs on page 486.

Component		Details
		If MicroAutoBox Embedded PC is combined with MicroAutoBox II, MicroAutoBox II supplies MicroAutoBox Embedded PC via an internal connection.
	USB 3.0	To connect up to four USB devices: ▪ The connectors are USB 3.0 Type A connectors. ▪ For the interface characteristics, refer to Interfaces on page 488.
Antennas		Optional connectors to attach two antennas to connect wireless Ethernet devices: ▪ 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 MicroAutoBox Embedded PC on page 153. ▪ For the WLAN characteristics, refer to Interfaces on page 488.
LEDs	Ethernet	For the LED status description, refer to LED Status on page 491.
	Power	
	HDD	
	Status	

Rear

Component		Details
Connectors	SATA	To connect MicroAutoBox Embedded DSU: ▪ The connector is a SFF-8088 SATA connector. ▪ For the interface characteristics, refer to Interfaces on page 488.

	Module 1
	Module 2
	Module 3
		Connectors to provide signals of optionally installed interface modules inside MicroAutoBox Embedded PC. The interface modules that are installed are written on the type plate at the bottom of MicroAutoBox Embedded PC.
		The provided connectors and signals depend on the installed interface modules:
		▪ MicroAutoBox Embedded PC with CAN FD module:
		  ▪ The connector is a 9-pin, male Sub-D connector.
		  ▪ For the pinout, refer to Module Connectors 1 ... 3 on page 483.
		  ▪ For the interface characteristics, refer to Interfaces on page 488.
		▪ MicroAutoBox Embedded PC with automotive Ethernet module:
		  ▪ The connector is a 4-pin female LEMO connector.
		  ▪ For the pinout, refer to Module Connectors 1 ... 3 on page 483.

Component		Details
		▪ For the interface characteristics, refer to Interfaces on page 488.

MicroAutoBox II - housing components

If a MicroAutoBox II variant is mounted on the MicroAutoBox Embedded PC, the type of MicroAutoBox II connectors depend the specific variant of MicroAutoBox II.

Note

The USB device connector of MicroAutoBox II is not connected to MicroAutoBox Embedded PC. Do not connect a mouse, keyboard, etc., because these peripheral will not work. The connector can be used only to provide the USB Flight Recorder feature of MicroAutoBox II.

For more information, refer to the data sheet of the mounted MicroAutoBox variant:

- MicroAutoBox II 1401/1507 - Housing Components on page 198
- MicroAutoBox II 1401/1511 - Housing Components on page 222
- MicroAutoBox II 1401/1511/1514 - Housing Components on page 257
- MicroAutoBox II 1401/1513 - Housing Components on page 302
- MicroAutoBox II 1401/1513/1514 - Housing Components on page 337

Related topics

References

General Data..472

General Data

General characteristics

The following table shows some general characteristics of MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor:

Parameter		Specification[1)]
Base board	Processor	▪ 6th Gen. Intel® Core™ i7-6822EQ Processor ▪ 4 x 2.0 / 2.8 GHz clock frequency ▪ 8 MB cache
	Memory	▪ 16 GB DDR4 RAM, 1.6 GHz ▪ 128 GB internal flash memory
	Display interface	▪ 1 x DisplayPort 1.2

<table>
<tr><th colspan="3">Parameter</th><th>Specification[1]</th></tr>
<tr><td colspan="3">Interfaces</td><td>▪ Ethernet (10/100/1000 Mbit/s, Wake on LAN capable):
  ▪ 2 x RJ45 connectors
  ▪ 1 x LEMO connector
▪ USB connectors (type A)
  ▪ 4 x USB 3.0
▪ 3 x internal Mini PCI Express slot (for PCI Express Mini Card Electromechanical Specification 1.2)</td></tr>
<tr><td colspan="3">Operating system</td><td>▪ 64-bit version of Microsoft® Windows® 10 IoT Enterprise LTSB 2016
▪ Linux distribution as image file on USB recovery stick</td></tr>
<tr><td rowspan="5">Housing dimensions</td><td colspan="2">Width</td><td>202 mm (7.95 in.)</td></tr>
<tr><td rowspan="3">Height</td><td>Stand-alone MicroAutoBox Embedded PC</td><td>60 mm (2.37 in.)</td></tr>
<tr><td>MicroAutoBox Embedded PC combined with one of the following MicroAutoBox variants:
▪ MicroAutoBox II DS1401/1507
▪ MicroAutoBox II DS1401/1511
▪ MicroAutoBox II DS1401/1513</td><td>105 mm (4.13 in.)</td></tr>
<tr><td>MicroAutoBox Embedded PC combined with one of the following MicroAutoBox variants:
▪ MicroAutoBox II DS1401/1511/1514
▪ MicroAutoBox II DS1401/1513/1514</td><td>151 mm (5.94 in.)</td></tr>
<tr><td colspan="2">Depth</td><td>222 mm (8.74 in.)</td></tr>
<tr><td rowspan="3">Weight (without external cable)</td><td colspan="2">Stand-alone MicroAutoBox Embedded PC</td><td>About 2.8 kg (6.18 lb.)</td></tr>
<tr><td colspan="2">MicroAutoBox Embedded PC combined with one of the following MicroAutoBox variants:
▪ MicroAutoBox II DS1401/1507
▪ MicroAutoBox II DS1401/1511
▪ MicroAutoBox II DS1401/1513</td><td>About 4.25 kg (9.37 lb.)</td></tr>
<tr><td colspan="2">MicroAutoBox Embedded PC combined with one of the following MicroAutoBox variants:
▪ MicroAutoBox II DS1401/1511/1514
▪ MicroAutoBox II DS1401/1513/1514</td><td>About 5.35 kg (11.80 lb.)</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.

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

- Do not exceed the maximum levels, because this can permanently damage the system.
- The operating temperature of MicroAutoBox Embedded PC limits the operating temperatures listed for the MicroAutoBox II variants.

Absolute maximum levels of MicroAutoBox Embedded PC

The absolute maximum levels of voltage, temperature, etc., for which MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor is designed are listed in the following table. The voltage levels do not imply a functional operation of MicroAutoBox Embedded PC. All voltages are referenced to GND, unless otherwise stated.

Parameter	Condition / Description	Specification[1)]
VBAT	Load dump- and reverse protection	–40 V ... +80 V
CAN FD interface (optional feature)	Voltage level on CAN high and CAN low pins.	-40 V ... +40 V
	Voltage difference between CAN high and CAN low pins.	–5 V ... +5 V
Automotive Ethernet interface (optional feature)	Voltage level on Ethernet pins.	-40 V ... +40 V
	Voltage difference between the positive and negative signal of an Ethernet channel	–5 V ... +5 V
Continuous power dissipation ($T_{operating}$ = +55 °C)	Stand-alone MicroAutoBox Embedded PC	80 W
	MicroAutoBox Embedded PC joined with one of the following MicroAutoBox variants: ▪ MicroAutoBox II 1401/1507 ▪ MicroAutoBox II 1401/1511 ▪ MicroAutoBox II 1401/1513	105 W
	MicroAutoBox Embedded PC joined with one of the following MicroAutoBox variants: ▪ MicroAutoBox II 1401/1511/1514 ▪ MicroAutoBox II 1401/1513/1514	130 W
Operating temperature	—	0 °C ... +55 °C (+32 °F ... +130 °F)
Storage temperature	—	–55 °C ... +85 °C (-67 °F ... +185 °F)
Relative humidity	Noncondensing	10% ... 95%

Parameter	Condition / Description	Specification[1)]
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

Levels of a mounted MicroAutoBox II

The absolute maximum levels of a optional mounted MicroAutoBox II variant are listed in the following topics:

- MicroAutoBox II 1401/1507: Absolute Maximum Levels on page 202
- MicroAutoBox II 1401/1511: Absolute Maximum Levels on page 226
- MicroAutoBox II 1401/1511/1514: Absolute Maximum Levels on page 262
- MicroAutoBox II 1401/1513: Absolute Maximum Levels on page 306
- MicroAutoBox II 1401/1513/1514: Absolute Maximum Levels on page 342

Requirements on the Installation Location

Heat dissipation and free airflow

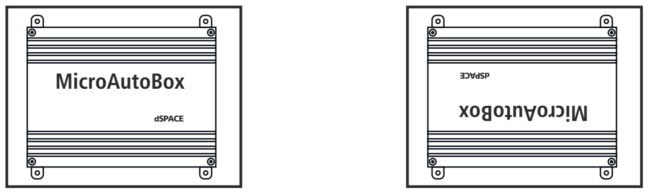
For sufficient heat dissipation and free airflow, observe the minimum clearances to walls, other devices, or objects.

Installation positions

To prevent hot liquids from leaking from ventilation slots in the exceptional case of an internal fire, observe the illustrated mounting positions.

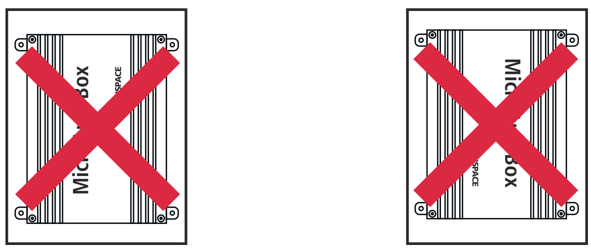
Horizontal:

Vertical:



The following mounting positions are not allowed.

Vertical:



Certifications

CE compliance

The MicroAutoBox Embedded PC without radio interfaces meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

If the MicroAutoBox Embedded PC is equipped with a WLAN module, the MicroAutoBox Embedded PC meets the requirements of the European directive 2014/53/EU (Radio Equipment Directive) for CE marking, refer to Radio Devices Regulatory Notice on page 164.

Vibration and shock tests

To verify the reliability of the MicroAutoBox Embedded PC under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, the MicroAutoBox Embedded PC executed a program without any faults.

Applied standards

The characteristics of the MicroAutoBox Embedded PC were tested according to the standards shown in the following table:

Tested Characteristics	Applied Standard	Description
Electromagnetic compatibility (EMC)	EN 55024:2010	Information technology equipment - immunity characteristics
	EN 61326-1:2013	Electric equipment for measurement, control and laboratory use - immunity according to table 2 (industrial environment)[1)]
	EN 55022:2010	Information technology equipment - radio disturbance (class A)
	EN 61326-1:2013	Electric equipment for measurement, control and laboratory use Radio disturbance (class A)
	FCC 47 CFR Part 15	Radio disturbance
Vibration	ISO 16750-3:2012 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 4 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 4 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 ... 2000 Hz, up to 5 g, 2 sweeps per axis ▪ Operating
Shock	ISO 16750-3:2012 / 4.2.2.	Test conditions: ▪ 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 A Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 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)] Connected cables might affect the specified characteristics due to physical effects, such as crosstalk, voltage drops, and influences through electromagnetic fields.

Presettings of the Operating Systems

Where to go from here

Information in this section

Microsoft® Windows® as the Operating System

Installed Windows variant

This topic shows the presettings of the MicroAutoBox Embedded PC with installed 64-bit version of Microsoft® Windows® 10 IoT Enterprise LTSB 2016.

Presettings of the Windows configuration

Windows is installed on the MicroAutoBox Embedded PC with standard configuration features. To increase the performance of the MicroAutoBox Embedded PC, Windows is preset as follows:

Presetting	Option
Computer name	MABXIIEPC
Domain name	Workgroup
Default network configuration	DHCP client is activated.
Power save	Sleep and Hibernate are deactivated.
Telnet client	Installed
Installed WLAN driver	Sparklan WPEA-121N
Installed CAN driver	PEAK-CAN & CAN-FD device driver 4.x
.NET and JAVA	Not installed
Virus scanner	Not installed
Windows firewall	Deactivated
User account control	Deactivated
User account rights	Administrator rights
	No login
Screensaver	Deactivated

Presetting		Option
Measures to reduce write access to the mSATA flash memory	ATA TRIM	Activated
	Automatic defragmentation	Deactivated
	Boot time defragmentation	Deactivated
	Superfetch and prefetch	Deactivated
	Readyboost/Readydrive	Deactivated
	Windows search and file indexing	Deactivated
	Time stamp	Deactivated
	Windows system restore	Deactivated
Supported languages		English, German, French, Italian, Japanese, Chinese

Drive presettings

Integrated 128 GB flash memory

- Drive name: System

  To store the operating system, programs, and data.
- Format: NTFS
- 15% non-partitioned disk space (free memory) to increase the life cycle of the memory.

BIOS presettings

The BIOS presettings are:

- The advanced host controller interface (AHCI) mode is activated to optimize read/write access to the mSATA flash memory.
- The USB connectors are first in the boot sequence, which enables you to boot from the USB stick that contains the operating system if reinstallation is required.

Linux as the Operating System

Installed operating system

This topic shows the presettings of the configuration when the Linux distribution ISO image from the USB stick is installed.

Presettings of the Linux configuration

A Linux distribution will be installed on the MicroAutoBox Embedded PC with standard configuration features. To increase the performance of the MicroAutoBox Embedded PC, the Linux distribution is preset as follows:

<table>
<tr><th colspan="2">Presetting</th><th>Option</th></tr>
<tr><td colspan="2">Computer name</td><td>MABXIIEPC</td></tr>
<tr><td colspan="2">User name</td><td>user</td></tr>
<tr><td colspan="2">User password</td><td>user</td></tr>
<tr><td colspan="2">Root password</td><td>epc</td></tr>
<tr><td colspan="2">User rights</td><td>▪ No root rights, root password required
▪ No logon</td></tr>
<tr><td colspan="2">Default network configuration</td><td>DHCP client is activated.</td></tr>
<tr><td colspan="2">Screensaver</td><td>Deactivated</td></tr>
<tr><td colspan="2">Power save</td><td>Suspend-to-Disk and Suspend-to-RAM are deactivated.</td></tr>
<tr><td colspan="2">SSH client and server</td><td>Installed</td></tr>
<tr><td colspan="2">Installed WLAN driver</td><td>Sparklan WPEA-121N</td></tr>
<tr><td colspan="2">Installed CAN driver</td><td>Peak PCAN-miniPCIe FD as of version 8.4</td></tr>
<tr><td colspan="2">Automotive Ethernet driver</td><td>dSPACE</td></tr>
<tr><td colspan="2">Ethernet timestamping</td><td>Linuxptp</td></tr>
<tr><td colspan="2">Measures to reduce write access to the mSATA flash memory</td><td>▪ Saving the last access time is deactivated.
▪ ATA Trim is activated.</td></tr>
<tr><td rowspan="3">Language</td><td>Display</td><td rowspan="2">English</td></tr>
<tr><td>Keyboard</td></tr>
<tr><td>Supported</td><td>English, German, French, Italian, Japanese, Chinese</td></tr>
</table>

Drive presettings

Integrated 128 GB flash memory

- Drive name: System
  To store the operating system and programs.
- Format: Ext4
- 15% non-partitioned disk space (free memory) to increase the life cycle of the memory.

BIOS presettings

The BIOS presettings are:

- The advanced host controller interface (AHCI) mode is activated to optimize read/write access to the mSATA flash memory.
- The USB connectors are first in the boot sequence, which enables you to boot from the USB stick that contains the operating system if reinstallation is required.

Connector Pinouts

Where to go from here

Information in this section

Power Input Connector

Introduction

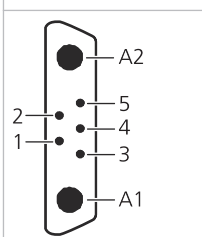
The stand-alone variant of MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor provides a power input connector. It is a 7-pin, male connector with two high-current pins. It is a special variant of a 15-pin Sub-D connector (mixed-layout 7W2 Sub-D).

Note

The power input connector of the MicroAutoBox Embedded PC is not available if the MicroAutoBox Embedded PC and MicroAutoBox II are joined to form a single unit. In this case MicroAutoBox II powers MicroAutoBox Embedded PC and features two additional remote signals to control the power on/off behavior.

Pinout

The following illustration shows the pinout (front view of MicroAutoBox II).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (8 V … 36 V DC)		
			5	REMOTE_PULLUP
	2	$REMOTE_{IN2}$ [2]	4	REMOTE [3]
	1	Do not connect	3	$REMOTE_{IN1}$ [2]
	A1	GND		

[1] Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.

[2] Inputs for advanced remote control. Refer to Advanced Remote Control for MicroAutoBox II with MicroAutoBox Embedded PC on page 154.

[3] If you use the matching cable supplied by dSPACE, REMOTE is connected to VBAT within the connector shell. This cable is intended for use with a lab power supply only.

NOTICE

Risk of material damage

Do not switch off MicroAutoBox II and the MicroAutoBox Embedded PC by disconnecting the VBAT and/or GND connection or by pulling the power input connector when the operating system of the MicroAutoBox Embedded PC is running.

- Shut down the operating system of the MicroAutoBox Embedded PC via the remote inputs before the system is switched off.

Preconfigured power cable

A preconfigured cable for the supply voltage is provided by dSPACE. This cable is intended to operate MicroAutoBox Embedded PC with a laboratory power supply during development. Therefore, the REMOTE input (pin 4) is shorted to VBAT (pin A2) inside the connector in order to save a separate switch.

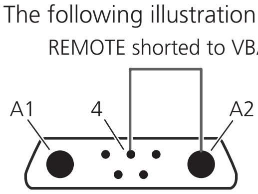
Do not use this cable in the vehicle. Otherwise, MicroAutoBox Embedded PC will always be on.

Matching cable type

Note

If you power MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor with a preconfigured cable, the cable must be labeled CB1401PW-03-<number>.
This cable type is delivered as of dSPACE Release 2017-B and provides the matching fuse type to ensure proper operation of this MicroAutoBox Embedded PC variant.

The following illustration shows the connector of the power supply cable:



Overview of all delivered cable types The following table gives you an overview of all cable types that are delivered with MicroAutoBox II.

Cable Type	Internal Fuse	Supply voltage	Cross Section	Delivered
CB1401PW-01-<number>	7.5 A	Max. 32 V DC	1.5 mm²	Up to dSPACE Release 2013-B
CB1401PW-02-001	7.5 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-02-003 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	dSPACE Release 2014-A ... 2017-A
CB1401PW-02-004 [1)]	10 A/80 V	Max. 32 V DC	1.5 mm²	
CB1401PW-03-001 [1)] ... CB1401PW-03-<number>	15 A/80 V	Max. 32 V DC	2.5 mm²	As of dSPACE Release 2017-B

[1)] The cable is labeled with this type number.

⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

References

Module Connectors 1 ... 3

Introduction

MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor provides the signals of optional interface modules at three module connectors.

The connector type and the pinout depend on the interfaces of the installed modules.

Installing the modules

All interface modules must be installed by dSPACE.

Installed modules

The type label at the bottom of your MicroAutoBox Embedded PC indicates the optionally installed interface modules and which module connector they use.

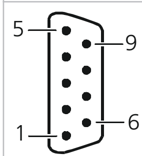
CAN FD interface

The connector is a 9-pin, male Sub-D connector providing access to the I/O signals provided by the optional CAN FD module.

Pinout The pin numbering used for Sub-D connectors is not standardized. The following illustration shows the numbering used (front view).

Note

Do not rely on the numbers written on the Sub-D connectors.

Sub-D Connector	Pin	Signal	Pin	Signal
	5	CANL_FT_Ch2		
	4	CANL_Ch2	9	CANH_FT_Ch2
	3	Ground	8	CANH_Ch2
	2	CANL_Ch1	7	CANH_Ch1
	1	CANL_FT_Ch1	6	CANH_FT_Ch1

For a description of the available signals on the connector, refer to Interfaces on page 488.

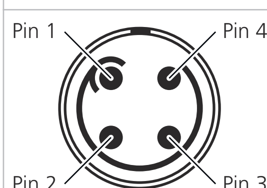
Pin naming The pins are named as follows:

Pin Name	Description
CANH_Ch<x>	CAN high, channel <x>
CANL_Ch<x>	CAN low, channel <x>
CANH_FT_Ch<x>	CAN high, feed-through line, channel <x>
CANL_FT_Ch<x>	CAN low, feed-through line, channel <x>

Automotive Ethernet

The connector is a 4-pin, female LEMO connector giving access to two automotive Ethernet channels provided by the optional installed automotive Ethernet module.

Pinout The following illustration shows the pin numbering and signals (front view of the MicroAutoBox Embedded PC).

LEMO Connector	Pin	Signal
	1	TRX+ Port 1
	2	TRX- Port 2
	3	TRX+ Port 2
	4	TRX- Port 1

For a description of the available signals on the connector, refer to Interfaces on page 488.

Pin naming The pins are named as follows:

Pin Name	Description
TRX+	Positive bus signal
TRX-	Negative bus signal

Ethernet connection cable The AETH_CAB1 Automotive Ethernet Connection Cable can be used to connect the automotive Ethernet port to a network.

For more information, refer to AETH_CAB1 Automotive Ethernet Connection Cable on page 522.

Matching cable connector To build an Ethernet cable, use the following standard LEMO connector:

- Connector type: LEMO 4-pole Connector 1B Series with G-coding
- Example: FGG.1B.304.CYCD

For more information, refer to www.lemo.com.

Related topics

References

Signal Descriptions

Where to go from here

Information in this section

Power Inputs and Outputs

Pin description

The following tables give a description of the pins used for power input and remote input.

Connector	Pins	Signal	Description/Function
Power input connector	A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery/power supply. Make sure that you insert a fuse into the power supply cable close to the battery/power supply. Refer to Connecting to Power Supply on page 42.
	A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the minus terminal of your vehicle battery/power supply. This signal is also connected to the housing of MicroAutoBox Embedded PC.
	4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox II. For example, you can use it for switching MicroAutoBox II with KL15 (output of the ignition/driving switch). If you connect the remote pin directly to VBAT, MicroAutoBox II will always be on, and the vehicle battery will soon be depleted if the engine is not running. Thus, a switch is highly recommended. Refer to Connecting to Power Supply on page 42. You can use the nonvolatile data feature to store data you may want to use again when restarting the application. For further information, refer to Nonvolatile Data Handling (MicroAutoBox II RTLib Reference 📖). ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage. If you use the matching cable supplied by dSPACE, REMOTE is connected to VBAT within the connector shell. This cable is intended for use with a lab power supply only.
	2	$REMOTE_{IN2}$	These remote inputs together with the REMOTE input provide advanced control of the power on/off behavior if MicroAutoBox Embedded PC and MicroAutoBox II are joined to form a single unit. For more information, refer to
	3	$REMOTE_{IN1}$	

Connector	Pins	Signal	Description/Function
			Advanced Remote Control for MicroAutoBox II with MicroAutoBox Embedded PC on page 154.
	5	REMOTE_ Pullup	You can use this output to connect a remote switch between the remote inputs (REMOTE, $\text{REMOTE}_{\text{IN1}}$, $\text{REMOTE}_{\text{IN2}}$) and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- T_{Housing} = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up	8		32[2]	V
	VBAT	Operating	8 [3]		32[2]	V
	VBAT	Reverse protection			–40	V
	VBAT	Temporary overvoltage protection for max. 400 ms (load dump protection)			+80	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≤ V_{iLRemote}		5		mA
REMOTE voltage input	V_{iHRemote}	Input high voltage	4.7			V
	V_{iLRemote}	Input low voltage			0.8	V
	$V_{\text{iHysRemote}}$	Input hysteresis voltage	0.5	1		V
	R_{inRemote}	Input impedance	60		185	kΩ
$\text{REMOTE}_{\text{IN1}}$ and $\text{REMOTE}_{\text{IN2}}$ voltage input	$V_{\text{iHRemoteINx}}$	Input high voltage	4.7			V
	$V_{\text{iLRemoteINx}}$	Input low voltage			0.8	V
	$R_{\text{inRemoteINx}}$	Input impedance		66		kΩ
Inrush current	$I_{\text{VBAT inrush}}$	All inputs/outputs unconnected	Refer to Power supply on page 38			

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) With an additional absolute maximum tolerance of +4 V.
3) 8 ... 10 V for a maximum of 1 minute.

Related topics

Basics

Interfaces

CAN interface characteristics

The following table shows the characteristics of the CAN interface.

Parameter		Specification 1)
CAN FD (optional feature)	Number of modules	Up to 3
	Channels per module	2, each channel provides feed-through lines
	Standard	ISO 11898
	CAN bit rate	25 kbit/s ... 1 Mbit/s
	Can FD bit rate	25 kbit/s ... 12 Mbit/s
	Connector	▪ 9-pin Sub-D connector. ▪ For the pinout, refer to Module Connectors 1 ... 3 on page 483. ▪ For the connector location, refer to Rear on page 471.

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

DisplayPort interface characteristics

The following table shows the characteristics of the DisplayPort interface.

Parameter	Specification 1)
Number of interfaces	1
Standard	DisplayPort 1.2
Connector	1 x DisplayPort connector For the location, refer to Front on page 470.

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

Ethernet interface characteristics

The following table shows the characteristics of the Ethernet interfaces.

Parameter	Specification 1)
Supported Ethernet variants	▪ Gigabit ▪ Optional: WLAN module providing WLAN with MIMO (multiple input and multiple output). ▪ Optional: Automotive Ethernet module

Parameter		Specification [1]
Gigabit	Number of interfaces	3, provided at three ports that are connected to an internal Ethernet switch
	Standard	▪ 1000BASE-T[2] ▪ IEEE 802.1 AS compatible
	Bit rate	10/100/1000 Mbit/s (autonegotiation)
	Wake on LAN	Supported
	Connectors	▪ 2 x RJ45 connector, located on front side. ▪ 1 x 8-pin LEMO connector. A matching cable with a LEMO-RJ45 adapter is supplied by dSPACE on request. ▪ For the location, refer to Front on page 470.
WLAN (optional feature)	Number of modules	1
	Standard	▪ IEEE 802.11a/b/g/n ▪ IEEE 802.11ac
	RF band	2.4 GHz and 5 GHz
	Connector	▪ 2 x ▪ Attach only a delivered antenna to this radio interface. Do not use antennas that are not provided by dSPACE for this product. Replace damaged antennas with the dSPACE antennas that have the order number WIFI_ANT (Wi-Fi antenna). ▪ For the location, refer to Front on page 470.
Automotive Ethernet (optional feature)	Number of modules	Up to 3
	Ports per module	2
	Standard	BroadR-Reach
	Bit rate	100 Mbit/s for each port
	Connector	▪ 4-pin LEMO connector. ▪ For the pinout and matching cable connector, refer to Module Connectors 1 ... 3 on page 483. ▪ For the connector location, refer to Rear on page 471.
	Limitation	Supported only by the Linux operation system.

[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.

SATA interface characteristics The following table shows the characteristics of the SATA interfaces.

Parameter	Specification [1]
Number of interfaces	4
Standard	SATA 3.0 compliant

Parameter	Specification [1]
Bandwidth	Max. 6 Gbit/s with speed negotiation to backward support 3 Gbit/s and 1.5 Gbit/s. Max. 1.5 Gbit/s under ESD influence.
Connector	1 x SFF-8088 SATA connector For the location, refer to Rear on page 471.

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

USB interface characteristics

The following table shows the characteristics of the USB interfaces.

Parameter	Specification [1]
Number of interfaces	4
Standard	USB 3.0
Band width	Max. 5 Gbit/s The ports are internally connected to a USB Hub.
Current	900 mA per connector
Connectors	4 x USB 3.0 Type A connector For the location, refer to Front on page 470.

[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

LED Status Descriptions

LED Status

Ethernet LEDs

The Ethernet LEDs are located on the front panel close to the Ethernet connectors.

RJ45 connector Two LEDs provide status information on each RJ45 connector. The table below describes the LEDs statuses:

LED Status	Meaning
Both LEDs off	Indicates no connection.
Left LED yellow	The connection is serviceable.
Right LED flashing green	Indicates data traffic.

LEMO connector One LED provides status information on the Ethernet LEMO connector. The table below describes the LED statuses:

LED Status	Meaning
Off	Indicates no data traffic.
Green	The connection is serviceable.
Green flashing	Indicates data traffic.

HDD LED

The HDD LED is located on the front panel. The table below describes the LED statuses:

LED Status	Meaning
Off	Indicates no access to the flash memory.
Green flashing	Indicates access to the flash memory.

Power LED

The Power LED is located on the front panel. The table below describes the LED statuses:

LED Status	Meaning
Off	The MicroAutoBox Embedded PC is not powered.
Green	The MicroAutoBox Embedded PC is powered.

Status LED

The Status LED is located on the front panel.

The Status LED is customizable and can be controlled by your applications.

Related topics

References

Housing Components..470

Data Sheet MicroAutoBox Embedded DSU

Where to go from here

Information in this section

Information in other sections

General Information

Where to go from here

Information in this section

Hardware Support

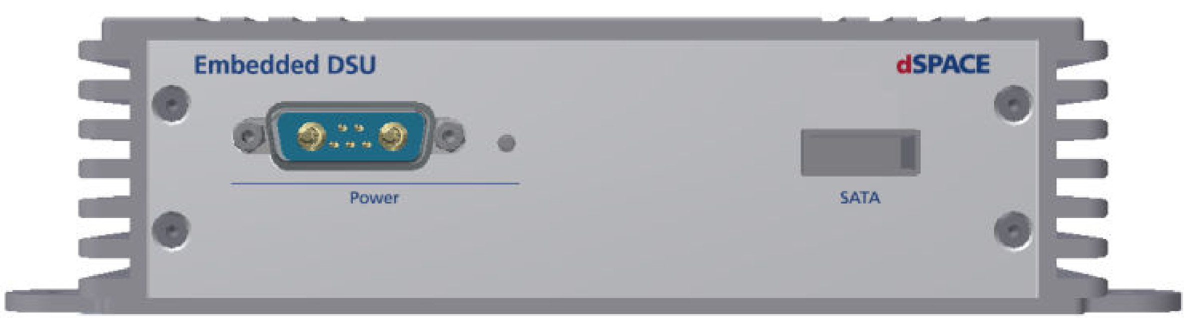
Suitable hardware devices

You can connect the MicroAutoBox Embedded DSU to the following devices:

- MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor
- PC connection option for Embedded DSU (order number: PC_CON_EMB_DSU)

Housing Components

Front



Connector	Details
Power	Power input connector to supply MicroAutoBox Embedded DSU: ▪ The connector is a 7-pin, male connector with two high-current pins. ▪ For the pinout, refer to Power Input Connector on page 498. ▪ For the interface characteristics, refer to Power Inputs on page 500.

Connector	Details
SATA	To connect MicroAutoBox Embedded DSU: ▪ The connector is a SFF-8088 Mini-SAS connector. ▪ For the interface characteristics, refer to SATA Interfaces on page 500. A matching cable is included and additional cables are supplied by dSPACE on request.

General Data

General characteristics

The following table shows some of the general characteristics of MicroAutoBox Embedded DSU:

Parameter		Specification[1)]
Memory		4 x 2 TB SSD
Interface		SATA III
Sequential read		520 MB/s
Sequential write		500 MB/s
Housing dimensions	Width	202 mm (7.95 in.)
	Height	50 mm (1.97 in.)
	Depth	222 mm (8.74 in.)
Weight (without external cable)		2.3 kg (5.07 lb.)

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

Absolute Maximum Levels

Avoiding damage to the system

NOTICE

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

Levels of MicroAutoBox Embedded DSU

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

Parameter	Specification[1)]	Condition / Description
VBAT	-60 V ... +60 V	Load dump- and reverse protection
Continuous power dissipation	Max. 50 W	$T_{operating}$ = +70 °C
Operating temperature	-20 °C ... +70 °C (-4 °F ... +158 °F)	—
Storage temperature	-20 °C ... +70 °C (-4 °F ... +158 °F)	—
Relative humidity	10% ... 95%	Noncondensing
Pollution degree	2	According to IEC 61010-1 (normal clean and dry environment)
Altitude	Up to 2000 m	—

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

Certifications

CE compliance

MicroAutoBox Embedded DSU meets the requirements of the European directive 2014/30/EU (Electromagnetic Compatibility Directive) for CE marking.

Vibration and shock tests

To verify the reliability of MicroAutoBox Embedded DSU under realistic operating conditions, it was exposed to vibration and shock tests. During the tests, MicroAutoBox Embedded DSU executed read/write operations without any failures.

Applied standards

The characteristics of MicroAutoBox Embedded DSU 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)]
	CISPR 11, EN 55011, Group 1, Class A	Emission standard for industrial environments
Vibration	ISO 16750-3:2012 / 4.1.2.4 Test IV	Test conditions: Broad band noise, 4 h per axis, RMS-acceleration 29.7 m/s^2
	DO-160F.8 / B1 Test Conditions	Test conditions: Broad band noise, 4 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 ... 2000 Hz, up to 5 g, 2 sweeps per axis ▪ Operating
Shock	ISO 16750-3:2012 / 4.2.2.	Test conditions: ▪ Linear shock (1/2 sine pulse), 6-axis

Tested Characteristics	Applied Standard	Description
		▪ 500 m/s^2, 6 ms, 10 pulses per axis ▪ Operating
	RTCA / DO-160G Section 7 Test 7.2, Category A, Test type R	Operational shocks test (standard): ▪ Saw-tooth wave, 6-axis ▪ 200 m/s^2, 11 ms, 10 pulses per axis ▪ Operating
	RTCA / DO-160G 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. Connected cables might affect the specified characteristics due to physical effects like crosstalk, voltage drops, and influences through electromagnetic fields.

Connector Pinouts

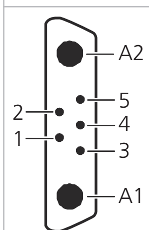
Power Input Connector

Introduction

MicroAutoBox Embedded DSU provides a power input connector. It 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).

Pinout

The following illustration shows the pinout (front view of MicroAutoBox Embedded DSU).

Connector	Pin	Signal	Pin	Signal
	A2[1]	VBAT (7 V … 54 V DC)		
			5	REMOTE_PULLUP
	2	Do not connect	4	REMOTE[2]
	1	Do not connect	3	Do not connect
	A1	GND		

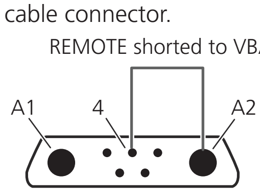
[1] Make sure that you insert a fuse into the power supply cable close to the battery/power supply.

[2] If you use the matching cable supplied by dSPACE, REMOTE is connected to VBAT within the connector shell. This cable is intended for use with a lab power supply only.

Preconfigured matching power cable

A preconfigured cable to operate MicroAutoBox Embedded DSU with a laboratory power supply is delivered with MicroAutoBox Embedded DSU. The cable is labeled **CB1401PW-03-**<number>.

If you use a preconfigured power supply cable, you directly switch on/off MicroAutoBox Embedded DSU with the switch of the laboratory power supply. Therefore, the REMOTE input (pin 4) is shorted to VBAT (pin A2) in the cable connector in order to save a separate switch. The following illustration shows the cable connector.



⚠ 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 Connecting to Power Supply on page 42.
- Always replace a defective fuse of the preconfigured power supply cable by a fuse with the same ratings.

Related topics

Basics

Signal Descriptions

Where to go from here

Information in this section

SATA Interfaces

Characteristics

The following table shows the characteristics of the SATA interfaces.

Parameter	Specification[1)]
Version	SATA 3.0 compliant
Number of interfaces	4
Bandwidth	Max. 6 Gbit/s with speed negotiation to backward support 3 Gbit/s and 1.5 Gbit/s.
Connector	1 x SFF-8088 Mini-SAS connector For the location, refer to Housing Components on page 494.

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

Power Inputs

Pin description

The following tables give a description of the pins used for power input and remote input.

Connector	Pins	Signal	Description/Function
Power input connector	A2	VBAT	Main power supply input. Connect this pin to the positive terminal of your vehicle battery or power supply. For information on the supply power, refer to Power Inputs on page 500. Make sure that you insert a time-lag fuse into the power supply cable close to the battery/power supply. The fuse must release if the cable is stressed with the maximum current value that is supported by the used cable cross

Connector	Pins	Signal	Description/Function
			section. A 2.5 mm² cable with a 15 A/80 V time-lag fuse is suitable for MicroAutoBox Embedded DSU.
	A1	GND	Main power supply return and reference for all input and output signals. Connect this pin to the negative terminal of your vehicle battery or power supply.
	4	REMOTE	▪ The REMOTE input must be connected via switch or bridge to VBAT to run MicroAutoBox Embedded DSU. For example, you can use it for switching MicroAutoBox Embedded DSU with KL15 (output of the ignition/driving switch). If you connect the remote pin to VBAT directly, MicroAutoBox Embedded DSU will always be on, and the vehicle battery will soon be exhausted if the engine is not running. Thus, a switch is highly recommended. ▪ The voltage connected to the REMOTE pin should not exceed the supply voltage.
	5	REMOTE_Pullup	You can use this output to connect a remote switch between REMOTE and this pin. REMOTE_Pullup is internally connected to VBAT via 39 kΩ pull-up resistor.

Characteristics

The characteristics are specified for the following conditions, unless otherwise stated:

- VBAT = +12 V
- $T_{Housing}$ = +25 °C
- All voltages are referenced to GND.
- All voltage values specify voltages on the connector pins.

Signal[1)]	Symbol	Conditions / Comments	Min.	Typ.	Max.	Unit
Power						
Operating voltage	VBAT	For start-up	7		54[2)]	V
	VBAT	Operating	7		54[2)]	V
	VBAT	Reverse protection			-60	V
Inputs						
Operating current	I_{VBAT}	REMOTE ≥ $V_{iHRemote}$ VBAT = 12 V	0.75		3.5	A
	I_{VBAT}	REMOTE ≤ $V_{iLRemote}$		<1		mA
REMOTE voltage input	$V_{iHRemote}$	Input high voltage	3.7			V
	$V_{iLRemote}$	Input low voltage			0.8	V
	$V_{iHysRemote}$	Input hysteresis voltage	0.5	1.8		V
	$R_{inRemote}$	Input impedance	60		185	kΩ

1) Unless stated otherwise, the specifications are valid only if the dSPACE hardware is correctly powered, switched on, and ready for operation.
2) With an additional absolute maximum tolerance of +6 V.

Related topics

Basics

Data Cable Characteristics

Data of the Delivered SATA Patch Cable

Technical data

The following table shows the technical specifications of the SATA patch cable that is delivered with MicroAutoBox Embedded DSU:

Parameter	Specification[1)]
Purpose	The SATA patch cable can be used to connect MicroAutoBox Embedded DSU to one of the following hardware devices: ▪ MicroAutoBox Embedded PC with 6th Gen. Intel® Core™ i7-6822EQ Processor ▪ PC connection option for Embedded DSU (order number: PC_CON_EMB_DSU)
Connectors	26-pin male SFF-8088 Mini-SAS connector to 26-pin male SFF-8088 Mini-SAS connector
Length	0.5 m (19.7 in.)

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

Troubleshooting

Getting further support

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

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

Where to go from here

Information in this section

Hardware Problems

Where to go from here

Information in this section

Checking MicroAutoBox II

Check list

Perform the following checks if MicroAutoBox II does not operate correctly:

- Check the power supply of the system (see Connecting to Power Supply on page 42).
- Check the connection cable to the power supply (refer to Connecting to Power Supply on page 42).
- Check the connection from the host PC to MicroAutoBox II.
- Use ControlDesk to check the board properties (see Board Details Properties (ControlDesk Platform Management 📖) (ControlDesk)).

Status LED

The status LED of MicroAutoBox II indicates the following malfunctions :

Behavior	Cause	Remedy
LED is not lit	The power supply is not connected correctly.	Check the power supply of the system (see Connecting to Power Supply on page 42).
LED is flashing red	MicroAutoBox II is in secured mode. The default factory code has been loaded.	Update the firmware (System PLD firmware and I/O module firmware). For instructions, refer to Firmware Manager Manual 📖.

Host PC LED

The host PC LED of MicroAutoBox II indicates the following malfunctions:

Behavior	Cause	Remedy
LED is flashing red	MicroAutoBox II is in secured mode. The default factory code has been loaded.	▪ Update the firmware (Host IF firmware and Host IF PLD firmware).

Behavior	Cause	Remedy
		For instructions, refer to Firmware Manager Manual 📖. ▪ Use a lab power supply with a higher output power capability or connect a 1000 µF capacitor to the outputs of the lab power supply.

Status LED FPGA

The status LED FPGA indicates the following malfunctions of the MicroAutoBox II 1401/1511/1514 and 1401/1513/1514:

Behavior	Cause	Remedy
LED lights blue	The FPGA die temperature is too hot for operating.	▪ Reduce the ambient temperature or increase the air flow. ▪ 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.

Problems Related to the Firmware

Corrupt firmware

> **Note**
>
> You should not switch off the power supply or disconnect MicroAutoBox II from the host PC while loading an application to the box. This might be the reason for a corrupted firmware.

Error messages

One of the following error messages may come up when you try to download an application to MicroAutoBox II. The application is not executed.

- *<board_name>: Startup code has not been executed correctly after loading <application>.*
- *<board_name>: No firmware (bootstrap code) found. Please load the firmware again.*

If the error messages are caused by a corrupted bootstrap loader which is included in the firmware, you have to re-program the firmware.

Remedy

1. Clear the flash memory, refer to How to Clear an Application from the Flash Memory (DS100x, DS110x, MicroAutoBox II, MicroLabBox – Software Getting Started 📖).

2. Update the boot firmware as described in Firmware Manager Manual.

   If there are problems updating the firmware, contact dSPACE Support.
3. To verify if the firmware problem is solved, download the demo application you find in `<InstallationFolder>\Demos\1401\Check`.
   - Load the demo application to the RAM, refer to Real-Time Application - Load (ControlDesk Platform Management).
   - Load the demo application to the flash memory, refer to Real-Time Application - Load to Flash (DS1006/DS1104/MicroAutoBox II) (ControlDesk Platform Management).

     Check the logfile for error messages.
4. Load your own real-time application to the RAM or FLASH.

   If there are problems, contact dSPACE Support.

How to Start MicroAutoBox II to Secured Mode

Objective

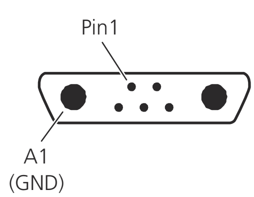
If MicroAutoBox II does not operate correctly and is not shown in the **Platforms/Devices** controlbar (ControlDesk), the firmware may be corrupt.

You have to start MicroAutoBox II to the secured mode to load valid firmware.

Method

To start MicroAutoBox II to secured mode

1. Switch off MicroAutoBox II.
2. Establish a connection between pin 1 and A1 (GND). The power input connector of MicroAutoBox II and its pinout are shown in the illustration below.



NOTICE

Ensure that you connect the correct pins to avoid damage.

3. Switch on MicroAutoBox II. The status LED flashes red. MicroAutoBox II is in secured mode.
4. Update the firmware corresponding to your ControlDesk variant.
5. Switch off MicroAutoBox II.
6. Remove the connection between pin 1 and A1.

Result

MicroAutoBox II provides valid firmware.

Updating the firmware

For information on updating the firmware with ControlDesk, refer to How to Update Firmware (ControlDesk Platform Management 🕮).

For general information on updating the firmware, refer to Firmware Manager Manual 🕮 .

Problems with the Ethernet Connection

Where to go from here

Information in this section

General Errors Using Ethernet Connection

Introduction

The following general errors may occur when you work with MicroAutoBox due to Ethernet problems.

IP address lost

If you do not know the current IP address of your MicroAutoBox II, you can use it's MAC address and serial number to set the IP address to the required one. The MAC address and serial number are printed on a type plate on the bottom of your MicroAutoBox II.

For further instructions and an example, refer to How to Change the IP Address of MicroAutoBox II on page 68.

Wrong IP address

The IP addresses of MicroAutoBox II and network, or MicroAutoBox II and host PC (for peer-to-peer connection) must adhere to the following rules:

- The network part of the IP address must be identical on both systems. Only the workstation part may differ. For details, refer to a definition of IP address classes.
- The IP address of each node must be unique within the network.
- The IP address must not be one of the reserved loopback addresses from 127.0.0.0 to 127.255.255.255 .

Changing connected MicroAutoBox II with an identical IP address

If you change a connected MicroAutoBox II to a MicroAutoBox II with an identical IP address it may take a few minutes to connect the host PC to this MicroAutoBox II. This is caused by invalid Ethernet address cache entries on your host PC.

Error message

Pinging 192.168.140.1 with 32 bytes of data:

Request timed out

MicroAutoBox II uses 192.168.140.1 as the default IP address.

This error message can appear, when you set up a peer-to-peer connection.

Perform the following checks to solve the problem:
- Check whether the network adapter of the host PC has been installed and configured correctly.
- Check the IP address of the host PC.
- Check whether MicroAutoBox II is configured to a wrong IP address: see How to Change the IP Address of MicroAutoBox II on page 68.

No connection to the host PC due to Ethernet hardware

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

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

Problems When Setting Up the TCP/IP Protocol

Troubleshooting

When you check the installation of the TCP/IP protocol with the `ping` command, the following error messages may occur.

Error Message	Reason	Solution
Bad command or file name	The TCP/IP protocol has not been installed properly.	Install the TCP/IP protocol again.
The name specified is not recognized as an internal or external command, operable program or batch file	The TCP/IP protocol has not been installed properly.	Install the TCP/IP protocol again.
Unable to contact IP driver, error code x found.	The TCP/IP protocol has not been installed properly.	Install the TCP/IP protocol again.
Pinging 127.0.0.1 with x bytes of data: Request timed out	The TCP/IP protocol has not been configured properly.	Check the configuration of the TCP/IP protocol. If you are uncertain, ask your system administrator.

Related topics

HowTos

Problems Due to Specific Use Cases

Problems with the Flight Recorder

Troubleshooting

One of the following error messages may come up when you use the flight recorder.

Error Message	Cause	Remedy
The flight recorder has saved no data	You did not use the flight recorder.	–
The file '<file name>' contains no flight recorder data	You tried to convert a file that contains no flight recorder data.	Select a BIN file with flight recorder data.
Overrun during flight recording detected (data incomplete)	During data saving, the bit rate was so high that some data could not be recorded. Reasons: ▪ Too many variables are saved in too short a period, or ▪ Data is written to the flash too fast. The flash of MicroAutoBox II has a bit rate of approx. 700 kByte/s. If this bit rate overruns, data is lost.	Reduce the variables or the cycle time of the model/program, so that the flash has a longer period to save the data.
Detected incomplete or faulty flight recorder data	During data saving or conversion, failures in the data structure occurred. The BIN file or the data in the flash memory is corrupt.	Contact dSPACE Support for further measures.

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.

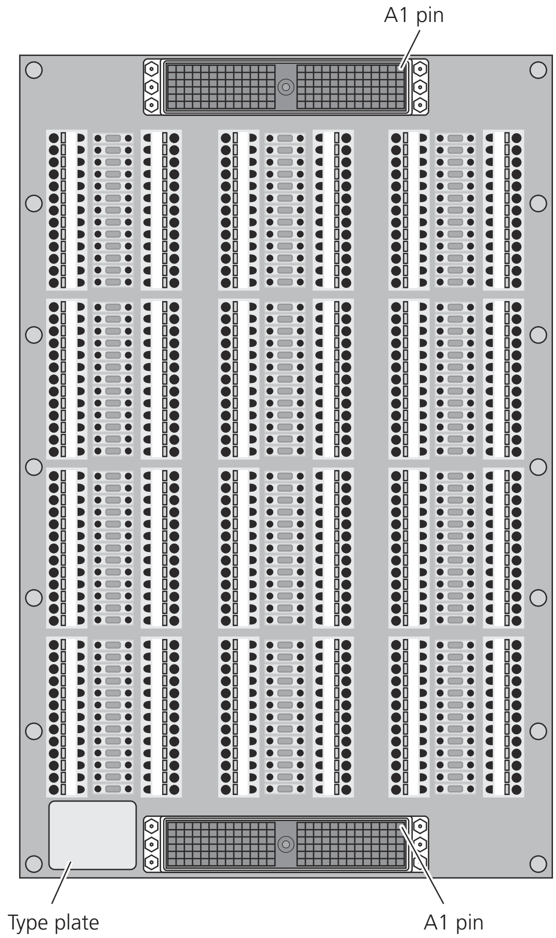
Where to go from here

Information in this section

Components and Their Functionality - MicroAutoBox Break-Out Box DS1541

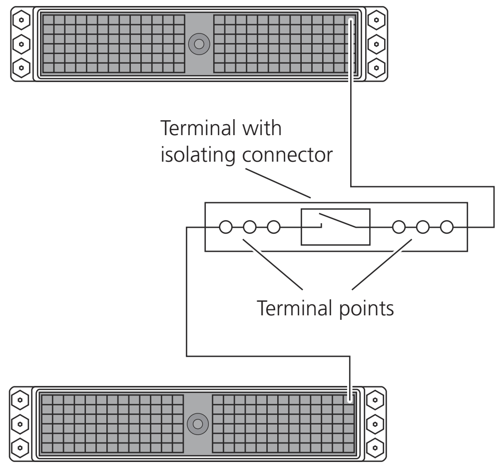
Schematic

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.

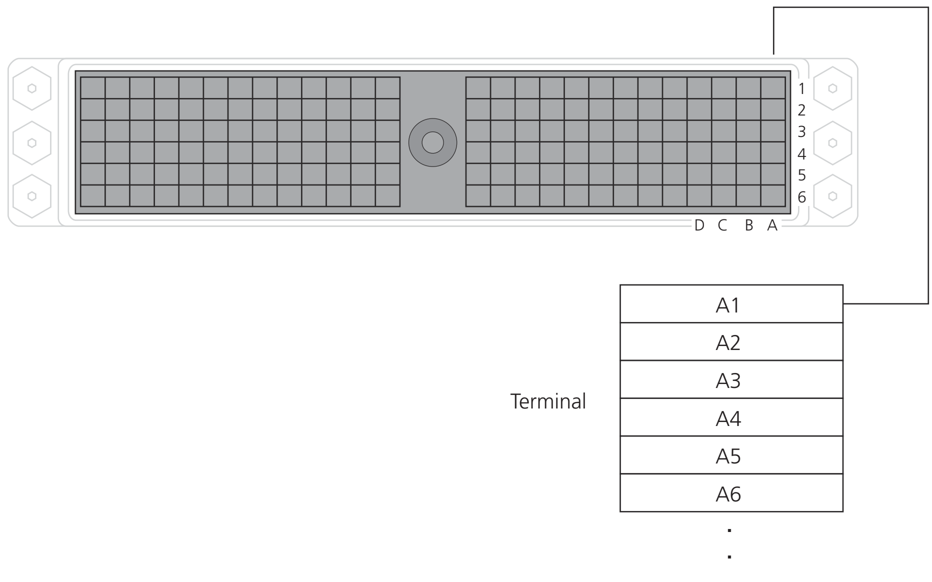
Terminals

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.

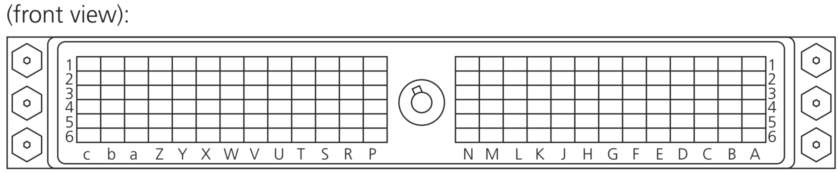


Zero Insertion Force Connector

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 517.

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 536.

Pinout using MicroAutoBox II

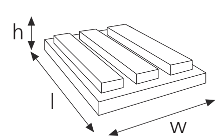
The signals available at the different pins depend on the MicroAutoBox II variant. For the pinout of the

- MicroAutoBox II 1401/1511, refer to ZIF I/O Connector on page 230.
- MicroAutoBox II 1401/1511/1514, refer to DS1511 ZIF I/O Connector on page 267 and DS1514 ZIF I/O Connector on page 269.
- MicroAutoBox II 1401/1513, refer to ZIF I/O Connector on page 310.
- MicroAutoBox II 1401/1513/1514, refer to DS1513 ZIF I/O Connector on page 347 and DS1514 ZIF I/O Connector on page 349.

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.

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:

Parameter	Specification[1]		
Purpose	To connect a MicroAutoBox III (DS1403-04) or an Embedded PC to an automotive Ethernet network.		
Illustration			
Connector	LEMO-1B, 4 pins		4 x open wire
Label on the cable	AETH_CAB1		
Length	5 m (197 in.)		
Operating temperature	-40 °C … +85 °C (-40 °F … +185 °F)		
Max. transfer rate	100 Mbit/s		

[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

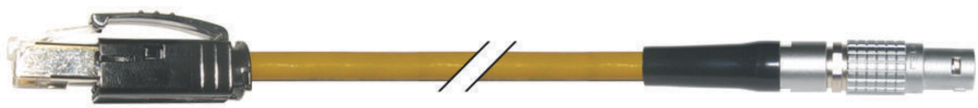
The open wires are coded as follows:

Color Code	Signal
Orange-brown	TRX+
Orange-black	TRX-

ETH_CAB1 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 II/III/Embedded PC or a DCI-GSI2 to hardware with an RJ45 connector.</td></tr>
<tr><td>Illustration</td><td colspan="3"></td></tr>
<tr><td>Connector</td><td>RJ45 jack</td><td></td><td>LEMO-1B, 8 pins</td></tr>
<tr><td>Label on the cable</td><td colspan="3">ETH_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 … +85 °C (-40 … +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.

Related topics

HowTos

How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 📖)

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

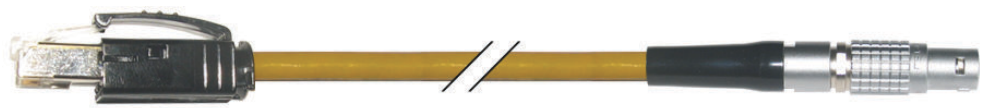
HowTos

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.

Related topics

HowTos

How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 📖)

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.

Related topics

HowTos

How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 🕮)

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:

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_CAB7		
Length	10 m (394 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)

FlexRay Connection Cables

Where to go from here

Information in this section

FR_CAB1 FlexRay Interface Cable for a MicroAutoBox II

Technical data

The following table shows the technical specifications of the FR_CAB1 FlexRay interface cable:

Parameter	**Specification**[1]		
Purpose	The FR_CAB1 FlexRay Interface Cable can be used to connect FlexRay bus lines to a MicroAutoBox II 1401/1507 if it has DS4340 modules. To connect FlexRay bus lines to the DS4505 Interface Board, use the FR_CAB2 FlexRay Interface Cable for DS4505 with crimped male contacts.		
Illustration			
Connector	5 crimped female contacts for Sub-D connector	–	Two 9-pin Sub-D connectors, one male, one female
Label on the cable	FR_CAB1		
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.

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.

LVDS Link Cables

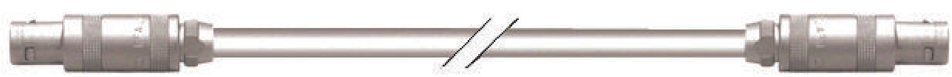
Where to go from here

Information in this section

LVDS_CAB2 LVDS Link Cable

Technical data

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

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

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

LVDS_CAB3 LVDS Link Cable

Technical data

The following table shows the technical specifications of the LVDS_CAB3 LVDS link cable:

Parameter	Specification[1]		
Purpose	To connect two devices with LEMO-1S connectors via LVDS.		
Illustration			
Connector	LEMO-1S, 4 pins (2 male, 2 female)	–	LEMO-1S, 4 pins (2 male, 2 female)
Label on the cable	LVDS_CAB3		
Length	5.0 m (197 in.)		
Operating temperature	–40 … +150 °C (–40 … +302 °F)		

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

LVDS_CAB13 LVDS-Ethernet Link Cable

Technical data

The following table shows the technical specifications of the LVDS_CAB13 LVDS-Ethernet link cable:

<table>
<tr><th>Parameter</th><th colspan="3">Specification[1)]</th></tr>
<tr><td>Purpose</td><td colspan="3">To connect MicroAutoBox II with a device via XCP on Ethernet (UDP/IP).</td></tr>
<tr><td>Illustration</td><td colspan="3"></td></tr>
<tr><td>Connector</td><td>▪ 2 open, soldered leads (power cable)
▪ 4 crimped contacts for ZIF connector (LVDS connection)</td><td></td><td>RJ45 connector</td></tr>
<tr><td>Input voltage range</td><td colspan="3">6 V ... 48 V</td></tr>
<tr><td>Label on the cable</td><td colspan="3">LVDS_CAB13</td></tr>
<tr><td>Length</td><td colspan="3">▪ 1 m (39 in) (power cable)
▪ 0.3 m (12 in) (LVDS connection)</td></tr>
<tr><td>Operating temperature</td><td colspan="3">–20 … +60 °C (–4 … +140 °F)</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.

Valid for MicroAutoBox II variants which provide ECU channels on the ZIF I/O connector.

The following table shows the pins of the ZIF I/O connector required for the LVDS connection:

LVDS_CAB13 (ZIF Contacts) Color of Wire	MicroAutoBox II ZIF I/O Connector Pin	Signal
White	a5	ECU / IF1 TX–
Orange	b5	ECU / IF1 TX+
Blue	Y5	ECU / IF1 RX+
White	Z5	ECU / IF1 RX–
Black	GND	GND

For information on the COM connector of the RapidPro Control Unit, refer to COM Connector (RapidPro System Hardware Reference 📖).

The following table shows the pin assignment of the power cable:

Color of Wire	Signal
Black	GND
Red	+

LVDS_CAB14 LVDS-Ethernet Link Cable

Technical data

The following table shows the technical specifications of the LVDS_CAB14 LVDS-Ethernet link cable:

Parameter	**Specification**[1]		
Purpose	To connect a DS4121 ECU Interface Board with a device via XCP on Ethernet (UDP/IP).		
Illustration			
Connector	▪ LEMO-1S (LVDS connection) ▪ 2 open, soldered leads (power cable)		RJ45 connector
Input voltage range	6 V ... 48 V		
Label on the cable	LVDS_CAB14		
Length	▪ 0.3 m (12 in) (LVDS connection) ▪ 1 m (39 in) (power cable)		
Operating temperature	–20 … +60 °C (–4 … +140 °F)		

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

The following table shows the pin assignment of the power cable:

Color of wire	**Signal**
Black	GND
Red	+

Related topics

HowTos

How to Connect a DS4121 to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 📖)
How to Connect a DS4121 to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 📖)
How to Connect a MicroAutoBox II to an ECU with DCI-GSI2 (ECU Interfaces Hardware Installation and Configuration 📖)
How to Connect a MicroAutoBox II to an ECU with XCP on Ethernet (UDP/IP) (ECU Interfaces Hardware Installation and Configuration 📖)

LVDS_CAB15 LVDS Link Cable

Technical data

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

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

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

MicroAutoBox Break-Out Box Connection Cables

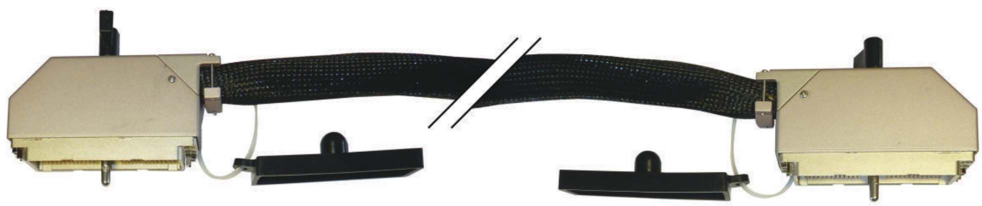
Where to go from here

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.

USB Connection Cable

Where to go from here

Information in this section

USB_CAB13 Interface Cable to Use the Flight Recorder Feature

Technical data

The following table shows the technical specifications of the USB_CAB13 interface cable:

Parameter	Specification[1]		
Purpose	To connect standard USB devices to the USB LEMO connector of the MicroAutoBox II to use the flight recorder feature.		
Illustration			
Connector	USB jack, 4 pins		LEMO-1B, male, 4 pins (grey)
Label on the cable	USB_CAB13		
Length	1.8 m (70.8 in)		
Operating temperature	–20 … +80 °C (–4 … +176°F)		

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

Note

Do not extend the USB_CAB13 Interface Cable with a standard USB cable to avoid malfunction of the connected USB devices.

A

B

C

D

P

R

S

T

U

W

Z