USB to CAN/CAN FD/LIN Converter (DCI-CAN/LIN1)

DCI-CAN/LIN1 Feature Reference

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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.
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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 Reference

Content	This document provides feature-oriented access to the information you need to interface CAN/LIN devices to your host PC by using the DCI-CAN/LIN1.

Symbols

dSPACE user documentation uses the following symbols:

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

Naming conventions

dSPACE user documentation uses the following naming conventions:

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

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

Special folders

Some software products use the following special folders:

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

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

or

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

Documents folder   A standard folder for user-specific documents.

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

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

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

Accessing dSPACE Help and PDF Files

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

dSPACE Help (local)   You can open your local installation of dSPACE Help:
- On its home page via Windows Start Menu
- On specific content using context-sensitive help via **F1**

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

Warning About Using a DCI-CAN/LIN1

Introduction

Note the following warning when using a DCI-CAN/LIN1.

Danger potential

Connecting a DCI-CAN/LIN1 to a CAN and/or LIN bus can affect system behavior. This can lead to unexpected or critical situations, or even constitute a risk of death. Therefore, only persons who are qualified to use a DCI-CAN/LIN1, and who have been informed of the dangers and possible consequences, are permitted to use the DCI-CAN/LIN1.

Before integrating the DCI-CAN/LIN1 and starting operation, read the warnings in this document carefully.

> ⚠ **WARNING**
>
> **Risk of serious injury or death due to electrical shock**
> The DCI-CAN/LIN1 is designed to be connected to devices that do not transmit hazardous voltages. According to the EN 61010 standard, a voltage higher than 33 V_{RMS}/ 46.7 V_{PEAK} AC and 70 V DC is classified as hazardous. It constitutes a risk of serious injury or even death.
>
> **Make sure that your system provides safety provisions so that no hazardous voltages are applied to the DCI-CAN/LIN1, even in the event of electrical faults.**
>
> If there is a risk of hazardous voltages being applied to a DCI-CAN/LIN1, the DCI-CAN/LIN1 and all devices connected to it must be within a separate test area according to the locally valid safety standards for the installation and operation of electrical test equipment.

Liability

It is your responsibility to adhere to instructions and warnings. Any unskilled operation or other improper use of this product in violation of the respective safety instructions, warnings, or other instructions contained in the user documentation constitutes contributory negligence, which may lead to a limitation of liability by dSPACE GmbH, its representatives, agents and regional dSPACE companies, to the point of total exclusion, as the case may be. Any exclusion or limitation of liability according to other applicable regulations, individual agreements, and applicable general terms and conditions remain unaffected.

Working with the DCI-CAN/LIN1

Where to go from here

Information in this section

Feature Overview

Introduction

The DCI-CAN/LIN1 has:

- Two interfaces to connect it to a CAN/CAN FD and/or LIN bus

  The interface transfers messages between the networks and the host PC via
  the universal serial bus (USB).

- One interface to connect it to the host PC

DCI-CAN/LIN1 illustration   The following illustration shows the DCI-CAN/LIN1:

CAN features   You can connect up to two CAN networks to the host PC via the DCI-CAN/LIN1.

Support of CAN FD   The DCI-CAN/LIN1 supports CAN FD.

CAN FD stands for *CAN with Flexible Data Rate*. The CAN FD protocol is based on the CAN protocol as specified in ISO 11898-1. Compared with the classic CAN protocol, CAN FD comes with an increased bandwidth for serial communication. This improvement is based on two factors:

- The CAN FD protocol allows you to use CAN messages with longer data fields (up to 64 bytes).
- The CAN FD protocol allows you to use a higher bit rate. It is possible to switch inside the message to the faster bit rate.
- The DCI-CAN/LIN1 supports ISO CAN FD (compliant to the ISO standard 11898-1:2015) and non-ISO CAN FD.

  For information on how to switch between ISO CAN FD and non-ISO CAN FD, refer to Configuring and Operating the DCI-CAN/LIN1 on page 12.

Support of CAN 2.0A and CAN 2.0B   The DCI-CAN/LIN1 supports CAN messages according to CAN 2.0A and 2.0B specifications (11- and 29-bit identifiers).

Bit rates   The DCI-CAN/LIN1 supports the following bit rates:

	Bit Rate
CAN	40 kbit/s … 1 Mbit/s
CAN FD	40 kbit/s … 8 Mbit/s[1]

[1] The maximum bit rate for CAN FD depends on the environment (cable harness, topology and interferences).

Connection to a CAN bus   The DCI-CAN/LIN1 is physically connected to a CAN bus by one of the 9-pin, male Sub-D connectors. You can use your own CAN cables to connect CAN devices to the DCI-CAN/LIN1. For the pinout of the connectors, refer to Connector Pinout on page 20.

For instructions on how to connect a DCI-CAN/LIN1, refer to How to Connect the DCI-CAN2 or DCI-CAN/LIN1 (ECU Interfaces Hardware Installation and Configuration 📖).

LIN features

You can connect up to two LIN networks to the host PC via the DCI-CAN/LIN1.

The DCI-CAN/LIN1:

- Can be used as a LIN master or slave (resolution of the master task: 1 ms)

> **Note**
>
> The dSPACE software currently does not support the LIN master functionality of the DCI-CAN/LIN1.

- Supports automatic bit rate, frame length, and checksum type recognition
- Supports unconditional, event, sporadic, and diagnostic frames

Bit rates   The DCI-CAN/LIN1 supports bit rates up to 20 kBit/s.

Connection to a LIN bus   The DCI-CAN/LIN1 is physically connected to a LIN bus by one of the 9-pin, male Sub-D connectors. You can use your own LIN cables to connect LIN devices to the DCI-CAN/LIN1. For the pinout of the connectors, refer to Connector Pinout on page 20.

For instructions on how to connect a DCI-CAN/LIN1, refer to How to Connect the DCI-CAN2 or DCI-CAN/LIN1 (ECU Interfaces Hardware Installation and Configuration 📖).

USB connection to the host PC

The DCI-CAN/LIN1 supports the universal serial bus (USB) for connection to the host PC.

Connection to the host PC   The DCI-CAN/LIN1 supports USB for connection to the host PC. It therefore supports hot plug-and-play capability.

Physical connection to USB   You can connect the DCI-CAN/LIN1 to the host PC via the fixed USB connection cable. You do not need any further adjustments on the host PC.

Supplying external devices

Power can be supplied by the DCI-CAN/LIN1 via pin 1 of the Sub-D connector.

Galvanic isolation

The DCI-CAN/LIN1 has integrated galvanic isolation:
- CAN:
  Up to 500 V against USB and LIN. Each CAN connection is isolated separately.

- LIN:

Up to 500 V against USB and CAN. Both LIN connections have a common ground.

> **Note**
>
> The LIN connections are not galvanically isolated against each other.

Related topics

Basics

Configuring and Operating the DCI-CAN/LIN1

Introduction

You can configure and operate the DCI-CAN/LIN1 via ControlDesk or via the dSPACE CAN API.

dSPACE CAN FD ISO Mode

The interface supports ISO CAN FD (compliant to the ISO standard 11898-1:2015) and non-ISO CAN FD.

To switch between ISO CAN FD and non-ISO CAN FD, you can use the **dSPACE CAN FD ISO Mode** (`DsCanFdIsoMode.exe`) tool. It is installed in the `C:\Program Files <(x86)>\Common Files\dSPACE\ DSCanApi_<Version>\` folder.
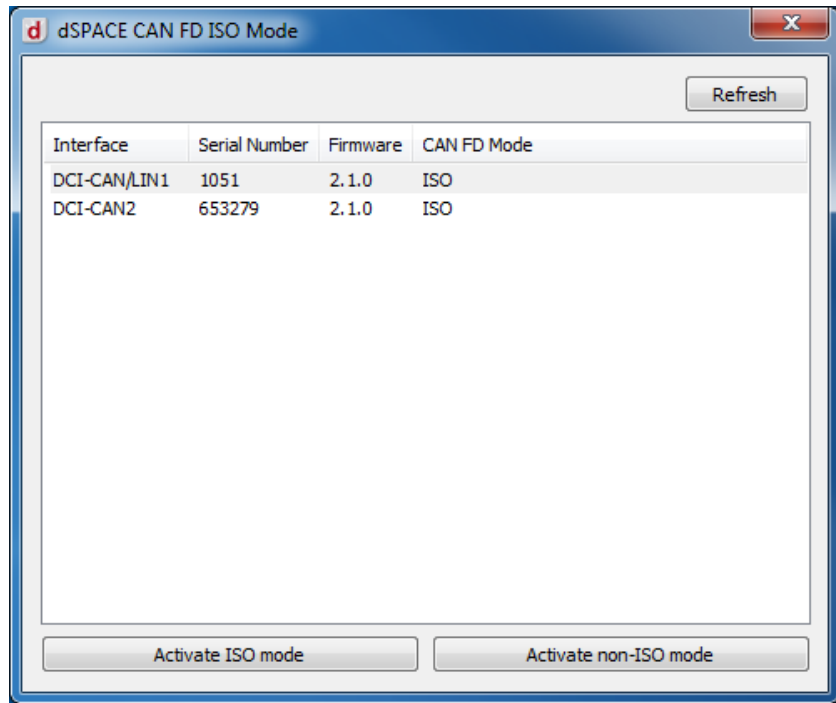
ControlDesk

In ControlDesk, you do not configure or operate the DCI-CAN/LIN1 directly. Instead, you configure a device (such as an XCP on CAN device, CAN Bus Monitoring device, or LIN Bus Monitoring device) that uses the DCI-CAN/LIN1 as the interface between ControlDesk and the CAN/LIN bus.

For details on the configuration, refer to Handling Devices (ControlDesk Platform Management 🕮).

dSPACE CAN API

The dSPACE CAN API allows you to configure and operate the DCI-CAN/LIN1 stand-alone without ControlDesk. With the dSPACE CAN API, you can write your own application that accesses the CAN bus via the DCI-CAN/LIN1. This application can be a simple monitoring application or even a more complex application that sends and receives CAN messages.

Refer to dSPACE CAN API 2.0 C Reference 🕮.

Related topics

Basics

Fields of Application of the DCI-CAN/LIN1

Introduction
With the DCI-CAN/LIN1 you can connect CAN-based devices to your host PC. The DCI-CAN/LIN1 forwards the CAN messages from and to the host PC.

Connecting ECUs
The DCI-CAN/LIN1 can be used to connect ECUs to the host PC.

Connecting ECUs with XCP on CAN With the DCI-CAN/LIN1, you can connect an ECU that supports the XCP on CAN protocol to the host PC. Refer to Connecting an ECU with CCP or XCP on CAN (ECU Interfaces Hardware Installation and Configuration 🕮).

Connecting ECUs with CCP With the DCI-CAN/LIN1, you can connect an ECU that supports the CCP protocol to the host PC. Refer to Connecting an ECU with CCP or XCP on CAN (ECU Interfaces Hardware Installation and Configuration 🕮)

Connecting ECUs with diagnostic protocols With the DCI-CAN/LIN1, you can connect ECUs with implemented diagnostic protocols to the host PC. This allows you to perform ECU diagnostics tasks and program the flash memory of ECUs via diagnostic protocols. Refer to How to Connect an ECU with Implemented Diagnostic Protocol via CAN (ECU Interfaces Hardware Installation and Configuration 🕮).

> **Tip**
>
> For ECU diagnostics access via CAN, you can use the same DCI-CAN/LIN1 as that used for measurement and calibration, that is, the CAN interface can be shared by measurement, calibration, and ECU diagnostics tasks.

CAN bus monitoring
Via the DCI-CAN/LIN1, you can monitor the data stream on a CAN/CAN FD bus within ControlDesk. CAN monitoring is restricted to the CAN bus members that are described in a specific database file, such as DBC, FIBEX, or the AUTOSAR system template. After you add the database file to ControlDesk's CAN Bus Monitoring device, you can show and analyze the signal values of the connected CAN bus members. Refer to Connecting PC-Based Interfaces for Bus Monitoring (ECU Interfaces Hardware Installation and Configuration 🕮).

LIN bus monitoring
Via the DCI-CAN/LIN1, you can monitor the data stream on a LIN bus within ControlDesk. LIN monitoring is restricted to the LIN bus members that are described in a specific database file, such as LDF, FIBEX, or the AUTOSAR system template. After you add the database file to ControlDesk's LIN Bus Monitoring device, you can show and analyze the signal values of the connected LIN bus members. Refer to Connecting PC-Based Interfaces for Bus Monitoring (ECU Interfaces Hardware Installation and Configuration 🕮).

Support of time-stamping

All measured or monitored data are given time stamps by the DCI-CAN/LIN1. The data is sent to ControlDesk with these time stamps. They have a resolution of 1 μs. Thus, ControlDesk can take data from different sources into account, in a time-correlated form.

Related topics

Basics

DCI-CAN/LIN1 Data Sheet

Introduction

This data sheet provides the technical data of the DCI-CAN/LIN1 and the connector pinout.

Where to go from here

Information in this section

Technical Specifications of the DCI-CAN/LIN1

Technical data

The following table summarizes the technical specifications of the DCI-CAN/LIN1:

Parameter	Specification[1]
CAN	▪ CAN FD 1.0 (compatible with CAN 2.0 A/B) ▪ Transmission standards: ▪ CAN FD ▪ ISO11898-2 (high-speed CAN) ▪ Bit rates: ▪ 40 kbit/s … 1 Mbit/s (CAN)

Parameter		Specification[1]
		• 40 kbit/s … 8 Mbit/s[2] (CAN FD) • Time stamp resolution: 1 µs • Transceiver: NXP TJA1044GT
LIN		• Specification: LIN specification 2.1 • Bit rates: 1 … 20 kbit/s • Time stamp resolution: 1 µs • Transceiver: NXP TJA1021/20
Host interface		USB 2.0 (compatible with USB 1.1 and USB 3.0)
Software configuration		Via: • ControlDesk • dSPACE CAN API
Electrical characteristics	Power supply	Power is supplied to the DCI-CAN/LIN1: • Via USB: • +5 V DC • max. 200 mA • Via pin 9 of the Sub-D connectors: • 8 … 18 V DC. The voltage is required for LIN operation.
	Supplying external devices	Power can be supplied by the DCI-CAN/LIN1 via pin 1 of the Sub-D connector: • +5 V DC • < 50 mA
	Termination	No termination of the CAN connector
	Galvanic isolation	The DCI-CAN/LIN1 has integrated galvanic isolation: • CAN: Up to 500 V against USB and LIN. Each CAN connection is isolated separately. • LIN: Up to 500 V against USB and CAN. Both LIN connections have a common ground. **Note** The LIN connections are not galvanically isolated against each other.
Mechanical characteristics	Chassis	Aluminum box
	Connectors	• Two 9-pin, male Sub-D connectors for connection to CAN and LIN. For the pin assignment, refer to Connector Pinout on page 20.

Parameter		Specification[1]
		• USB connector (plug type A) with 1.5 m (59 in.) cable for connection to the host PC
	Physical size (height x width x depth)	24 mm x 71.5 mm x 114 mm
	Weight	Approx. 220 g
Environmental	Operating temperature	–40 … +85 °C (–40 … +185 °F)
	Storage and transport temperature	–40 … +100 °C (–40 … +212 °F)
	Relative humidity	15 … 90%, not condensing
Ingress protection (IEC 60529)		IP 20
Electromagnetic compatibility		• EN 55024: 2011-09 • EN 55022: 2011-12 • EC directive 2014/30/EU

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

[2] The maximum bit rate for CAN FD depends on the environment (cable harness, topology and interferences).
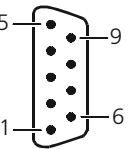
Related topics

References

Connector Pinout

Pinout of the Sub-D connectors of the DCI-CAN/LIN1

The following table shows the pinout of the two 9-pin, male Sub-D connectors.

The pinout for connection to CAN corresponds to CiA-DS 102-1.

Connector	Pin	Signal	Pin	Signal
5 — 9 1 — 6	5	LIN-GND		
	4	LIN	9	VBAT_LIN[1]
	3	CAN-GND	8	Not connected
	2	CAN-L	7	CAN-H
	1	+5 V_OUT[2]	6	LIN-GND
		Note Do not feed any voltage to this pin.		

[1] Supply voltage input (8 ... 18 V DC). Required for LIN operation.
[2] Power supply for the device connected to this connector; 5 V, max. 50 mA. Connected to the power supply of the host PC and not fused separately. A DC/DC converter is interconnected.

Tip

You can also find the pinout as an imprint on the underside of the DCI-CAN/LIN1.

Related topics

References

Status LEDs of the DCI-CAN/LIN1

Introduction	The DCI-CAN/LIN1 is equipped with several status LEDs.

LED description

The following table provides a description of the status LEDs:

LED	Status	Description
USB	Green (lit)	USB 2.0 connection to the host PC is established.
	Green (blinking)	Data is being transmitted via the USB 2.0 connection.
	Orange (lit)	▪ USB 1.1 connection to the host PC is established. or ▪ The DCI-CAN/LIN1 is in suspend mode (only if the voltage is supplied via USB, e.g., when the host PC is in standby mode).
	Orange (blinking)	Data is being transmitted via the USB 1.1 connection.
CAN1/2	Green (lit)	CAN interface is initialized. Connection to operating system driver is established.
	Green (slowly blinking)	Software application is connected to the CAN interface.
	Green (quickly blinking)	CAN data is being transmitted.
	Red (quickly blinking)	Error during CAN data transmission.
LIN1/2	Green (lit)	Connection to operating system driver is established.
	Green (slowly blinking)	LIN interface is initialized with a valid bit rate. Software application is connected to the LIN interface.
	Green (quickly blinking)	LIN data is being transmitted.

Related topics

References