SCALEXIO Rack

Getting Started

Release 2021-A – May 2021

dSPACE

How to Contact dSPACE

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

How to Contact dSPACE Support

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

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

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

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

Software Updates and Patches

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

Important Notice

Contents

About This Document

Contents

This guide introduces you to the first steps with a SCALEXIO rack. It describes how to connect and register a SCALEXIO rack that contains processing hardware at the host PC.

Target group

This document is primarily targeted at engineers who want to work with a SCALEXIO rack.

Required knowledge

Knowledge in handling computer hardware, the host PC, and working with Microsoft Windows is assumed.

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.

Symbol	Description
🕮	Precedes the document title in a link that refers to another document.

Naming conventions

dSPACE user documentation uses the following naming conventions:

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

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

Special folders

Some software products use the following special folders:

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

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

or

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

Documents folder A standard folder for user-specific documents.

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

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

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

Accessing dSPACE Help and PDF Files

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

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

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

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

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

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

Safety Precautions and Notes

Introduction

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

Where to go from here

Information in this section

General Safety Precautions

Potential hazards

Using and installing a SCALEXIO system can be dangerous. Your actions affect or control electronic systems using the SCALEXIO system. Your actions can cause hazards which result in death, serious injury, fire, and/or property damage.

Therefore, it is essential to read carefully the following notes and the documents provided by dSPACE. Observe all the warnings which are attached to the system and its components.

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.

User qualification

A SCALEXIO system and the connected electric equipment must be installed only by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician and in accordance with electrical engineering rules and regulations.

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

Overview of safety precautions

⚠ WARNING

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

- Safety Precautions for Installing a SCALEXIO System on page 9
- Safety Precautions for Connecting a SCALEXIO System on page 11
- Safety Precautions for Working with a SCALEXIO System on page 14
- Safety Precautions for Simulating Electrical Errors with a SCALEXIO System on page 16
- Safety Precautions for Using Inductive Loads on page 18

Related topics

Basics

Safety Precautions for Using Inductive Loads....18
Safety Precautions for Working with a SCALEXIO System....14

Safety Precautions for Installing a SCALEXIO System

Requirements on the location

- Do not place the SCALEXIO system on an unstable cart, stand, or table. The cart, stand, or table must be able to carry the weight of the SCALEXIO system as well as the external cable harness, external devices, etc.
- Do not drop the SCALEXIO system or its components.
- Position the SCALEXIO system away from heat sources such as radiators, heat storage devices, power amplifiers, and other products producing heat.
- When positioning the SCALEXIO system, make sure that you can easily unplug the power cords if you have to disconnect the system from the power supply.
- The SCALEXIO system and its components are not waterproof. Do not expose them to water or other liquids.
- Route all the external cables so that they are not likely to be walked on or pinched by items placed on or against them.
- Do not block the ventilation inlets and outlets at the front and rear of the SCALEXIO rack. There must be a space of at least 50 mm (2.0 in) in front of these openings.
- Ensure that the required environment conditions are fulfilled, refer to Data Sheet of a Typical SCALEXIO Rack on page 36.

Transporting the SCALEXIO system

You can transport a SCALEXIO system with all its boards installed. However, there are some transportation conditions you have to comply with.

To prevent personal injury or property damage, comply with the following transportation conditions:

- Disconnect the host PC and all the external devices (e.g., ECU, external loads, tester devices) from the SCALEXIO system.
- Disconnect all external cabling from the SCALEXIO system, for example, the external cable harness, the Ethernet connection cable, the power cords.
- If the SCALEXIO system has transport handles, use all the transport handles on both sides of the system to lift it. All the handles must bear an equal load.
- Depending on the weight of the SCALEXIO system, use a cart to transport it.
- If the SCALEXIO system or rack has wheels, move it only on a firm level surface. Do not move it on stairs or steps. Move it only when it is disconnected from the power source and external devices.
- Handle the SCALEXIO system with care and do not drop it. The SCALEXIO system and/or its components can be damaged if the system is dropped.

- The SCALEXIO system and its components are not waterproof. Do not expose them to water or other liquids.
- Ensure that the temperature is in the range -20 °C … +80 °C (-4 °F … 176 °F) while transporting the SCALEXIO system.

Installing hardware

Only qualified persons with experience in installing computer hardware and electric devices should perform the installation. 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.

Before doing any installation work:

- Read the related instructions carefully and note all warnings given.
- Make sure that the power supply of the system is switched off.
- Before opening the SCALEXIO system, disconnect the power supplies of the host PC and the SCALEXIO system from the power source.
- Make sure that no external devices are connected to the SCALEXIO system.

During the installation process, install the components of your system in exactly the order stated. Any other sequence may lead to unpredictable results or even damage the system.

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.

Handling hardware with fans

Improper handling can damage the fans of SCALEXIO hardware:

- Do not touch any components of a fan during operation.
- Do not try to stop a rotating fan that is slowing down with your fingers or with tools.
- Do not apply pressure to a fan bearing or fan blade during installation and removal of any hardware.

Safety Precautions for Connecting a SCALEXIO System

Connecting external devices

To avoid risk of injury and prevent damage to the hardware:

- Do not connect to the ECU/load connectors any external devices which generate voltages above the safety extra-low voltage (SELV) limits.
- Do not apply voltages/currents outside the specified ranges to the connector pins.
- To prevent uncontrolled current flow, it is recommended to avoid direct connections between signal ground (KL 31) and earth ground. For details on ground potentials, refer to Ground Potentials (SCALEXIO Hardware Installation and Configuration 🕮).
- The maximum potential difference between signal ground and earth ground must not exceed 10 V (max.).
- Ensure that the system's I/O signals stay within the SELV limits if larger ground shifts are likely to occur.
- Do not connect or disconnect any devices while the SCALEXIO system is powered up and/or external devices are switched on. Make sure that the host PC, the SCALEXIO system and external devices are turned off beforehand.
- High voltages can be present at pins of the ECU/load connectors. Therefore, do not leave the connectors unconnected during operation.
- During electrical error simulation, high currents and voltages might be present on board channels and/or connector pins, which is not expected. This can result in death, personal injury, fire, and/or damage to the SCALEXIO system and connected external devices.
- To reduce the risk of damage and fire, always use approved wiring material with an appropriate cross-section, isolation, etc. for building the external cable harness. Route the external cable harness along a path that is fire-protected.
- To reduce the risk of uncontrolled fire spreading, it is recommended to operate the SCALEXIO system including all external devices in a fire-protected area.
- To avoid the risk of stumbling, do not lay the external cables along a route where people have to walk.

Establishing LAN connections

All the local area network (LAN) ports of a SCALEXIO system contain safety extra-low voltage (SELV) circuits, which must be connected only to other SELV circuits.

- To avoid electric shock, do not connect the LAN ports of a SCALEXIO system to non-SELV circuits, e.g., telecommunication network voltage (TNV) circuits.
- The LAN or LAN segment of a SCALEXIO system and all connected equipment must be part of the same low-voltage power distribution system and be located within a single building.
- Do not use RJ45 connectors of wide area network (WAN) ports, because WAN ports can contain TNV circuits.

- When connecting external devices, e.g., an ECU, to the LAN ports of a SCALEXIO system, keep in mind that the LAN ports' shield conductors are galvanically connected to the earth ground (protective earth) of the SCALEXIO system.
- To avoid a fire caused by overheated wiring due to excessive current flow in the shield conductor, do not connect LAN shield conductors to ECU housings, ECU grounds, or the signal ground of the SCALEXIO system.
- LAN cables can occasionally be subject to hazardous transient voltages, such as lightning or disturbances in the electric utilities power grid. Handle exposed metal components of the network with caution.
- Do not connect the RJ45 connectors of a DS6330M1 Automotive Ethernet Module with a standard Ethernet network.

Establishing RS232 and USB connections

Observe the following notes when connecting a device via RS232 or USB to a DS6001 Processor Board.

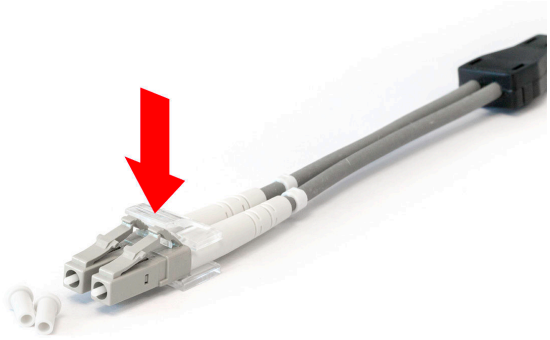
- Connecting a device to the DS6001 Processor Board via RS232 or USB can bridge the SCALEXIO system ground to the earth ground (protective earth) and establish a ground loop with external devices that are connected to the SCALEXIO system.
- A ground loop can cause an uncontrolled, excessive current flow in the SCALEXIO system ground which can disturb the I/O signals of the SCALEXIO system.
- To avoid an excessive current flow make sure that there is no potential shift in the earth connection between the SCALEXIO system and any external device.

Handling fiber-optic cables and modules

Do not damage the fiber optics.

- Handle the fiber optics with care.
- Make sure that fiber-optic cables are not stretched or overstretched.
- Do not bend fiber-optic cables past a radius of 40 mm.
- When you unplug fiber-optic connections, handle only the connector housings and locking mechanisms. Do not pull the fiber-optic cables.
- Use protective caps for all the unused ports of fiber-optic modules.
- Place protective caps on the ends of unconnected fiber-optic cables. Do not touch the ends of fiber-optic cables when they are unprotected.

Locking mechanisms of fiber-optic cables The connectors of fiber-optic cables are assembled in pairs. These two connectors have a locking mechanism. To release the cables from a fiber-optic module, press down the latch on the connectors. Refer to the following illustration:



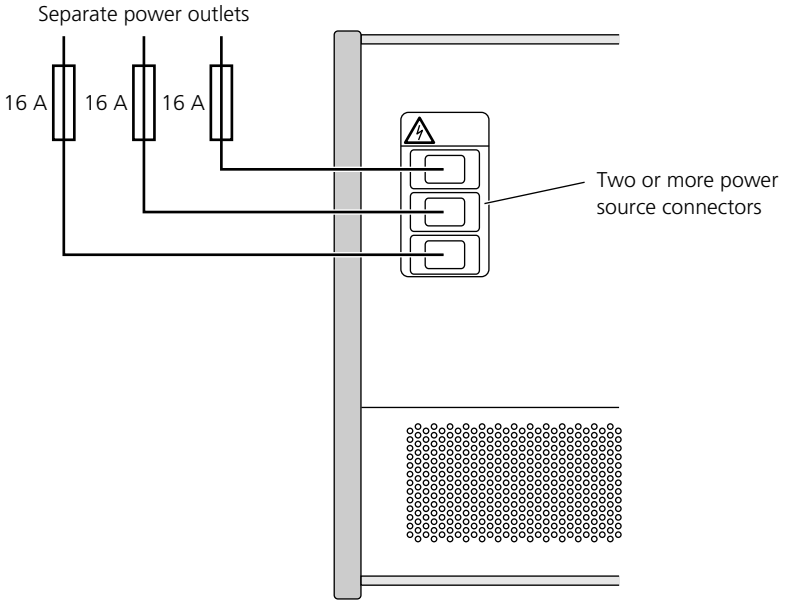
The two connectors are clipped together loosely and can shift. Make sure that the two connectors stay next to each other when you plug them into a fiber-optic module.

Connecting to a 240 V AC power source

Note the following points when connecting the SCALEXIO system to a 240 V AC power source:

- Operate the SCALEXIO system only from the kind of power source indicated on the rear panel.
- Use appropriate miniature circuit breakers with a rated current of max. 16 A.
- It is recommended to connect the SCALEXIO system via residual current operated protective devices.
- Always use approved power cords with an appropriate cross-section, isolation, etc. for connection to the power source.
- You have to connect all the main connectors of the SCALEXIO system to the power source.
- The SCALEXIO system has protection class 1: The system must be operated with a protective earth/ground connection via the protective earth/grounding conductor of the power cord(s).
- Always ensure that the system is operated from properly grounded wall outlets only.
- Use multiple socket outlets only if they comply with the system's power requirements. Multiple socket outlets can cause hazardous touch currents due to the accumulation of earth leakage currents.
- It is recommended to connect each of the system's power source connectors to a separate power outlet with its own separate circuit breaker (16 A).

The illustration below shows an example with three power source connectors.



Safety Precautions for Working with a SCALEXIO System

Potential hazards

⚠ WARNING

Risk of death, serious injury, fire, and/or property damage

The SCALEXIO system can carry high currents and high voltages. According to international standards, a voltage higher than 33 V_{RMS}/46.7 V_{PEAK} AC and 70 V DC is classified as hazardous. This presents a risk to people and equipment (death, serious injury, fire, and/or property damage). Therefore, personnel who work with the SCALEXIO system must be informed about the possible dangers and must take suitable safety precautions.

Operating the SCALEXIO system

Note the following points during the operation of the SCALEXIO system:

- The operator must keep unauthorized people away from the SCALEXIO system by taking suitable safety precautions, for example, locking the system or training the personnel.
- Use the SCALEXIO system only for measurements of measurement category I. Do not use it for measurements of categories II, III, or IV.
- It is recommended not to use a battery simulation power supply unit exceeding a maximum output current of 80 A. Output currents greater than 80 A can cause unsafe operating conditions or damage the SCALEXIO hardware. Contact dSPACE if you want to use a battery simulation power supply unit providing output currents greater than 80 A.

- The maximum voltage of I/O signals must not exceed 60 V.
- Operate a SCALEXIO system only with closed enclosures, i.e., all unused slots of the system must be covered by front plates.
- Do not work on the external cable harness while the SCALEXIO system is running.
- Before connecting the SCALEXIO system to the power source, perform a visual inspection of the enclosure and all the connected cables. Do not operate the SCALEXIO system if it looks damaged.
- Some circuits are live even with the main supply turned off. Before opening the enclosure, switch the power supplies of the host PC and the SCALEXIO system off and unplug the power cord(s). Wait at least five minutes to allow all components to discharge. Some of the components, for example, power supply capacitors, can carry residual voltage.
- The On/Off switch or button at the front of the SCALEXIO system does not disconnect the system from the power source. For complete disconnection, unplug all the power cords from the sockets.
- The SCALEXIO hardware provides electrical energy at the I/O pins, which can cause a fire if external components such as sensors/actuators are not appropriately connected. 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.
- High voltages can be present at pins of the ECU/load connectors. Therefore, do not leave the connectors unconnected during operation.
- High currents can be present at connector pins or interfaces where they are not expected, for example, due to electrical error simulation or incorrect external wiring.
- 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 the SCALEXIO system during run time. Otherwise, you might influence the measurements.

Using measurement instruments

To avoid an electric shock and/or property damage, note the following points when you work with measurement instruments (for example, oscilloscope or tester device):

- Use only suitable and tested measuring instruments. Observe all the safety instructions when making measurements.
- Connect and disconnect the measuring instruments only when the SCALEXIO system is turned off.
- Before starting measurements, check that the measuring instruments and their cables are in perfect condition.

Unexpected behavior of the SCALEXIO system

If the miniature circuit breaker or residual current device switches off the SCALEXIO system, disconnect the system from the power source immediately and make sure that it cannot be switched on unintentionally. The SCALEXIO system must not be put into operation again until it has been analyzed, repaired, and approved by dSPACE or an authorized support engineer.

Performing SCALEXIO relay maintenance

Ensure that no supply voltage might damage connected ECUs or sensitive loads during SCALEXIO relay maintenance of a SCALEXIO rack:

- You must switch off or disconnect all external power supply voltages from the SCALEXIO system.
- You must disconnect all ECUs and sensitive loads from the SCALEXIO system if you use a system without a SCALEXIO battery simulation controller.
- In a SCALEXIO system with a SCALEXIO battery simulation controller, such as the DS2907 Battery Simulation Controller or the onboard controller of the DS2680 I/O Unit, the power supply voltages are switched off automatically when relay cleaning is being performed. However, if you do not disconnect all ECUs and sensitive loads from the SCALEXIO system, you perform SCALEXIO relay maintenance at your own risk.

Protecting the SCALEXIO system

- Before a lightning storm, disconnect the LAN and power cords. Alternatively, install appropriate protection devices.
- Do not unplug the connectors by pulling the cables. Hold the plug itself to pull it out.
- Route external cables so that they are not likely to be walked on or pinched by items placed upon or against them.

Cleaning the SCALEXIO system

- Before cleaning, disconnect the SCALEXIO system from the power source.
- Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

Related topics

Basics

Safety Precautions for Connecting a SCALEXIO System (SCALEXIO Hardware Installation and Configuration 🕮)
Safety Precautions for Simulating Electrical Errors with a SCALEXIO System 16
Safety Precautions for Using Inductive Loads 18

Safety Precautions for Simulating Electrical Errors with a SCALEXIO System

Introduction

You must consider some safety precautions to perform electrical error simulation with a SCALEXIO Systems.

General warning

⚠ WARNING

Risk of unexpected high currents and voltages due to electrical error simulation

During electrical error simulation, high currents and voltages might be present on board channels and/or connector pins, which is not expected. This can result in death, personal injury, fire, and/or damage to the SCALEXIO system and connected external devices.

Note

Especially signal measurement channels (such as channels connected in parallel or interconnected reference lines) can carry high currents.

You must ensure that no voltages or currents outside the specified ranges of the I/O channels can occur during electrical error simulation.

Switching FRU relays

To prevent damage to the relays, switching is normally done when no current load is present. However, a current load cannot be avoided during switching in the following cases:

- Switching multiple electrical errors
- Load or signal disconnection when switching short circuits between channels

If FRU relays are switched for electrical error simulation, note the following warnings.

NOTICE

Risk of increased wear and permanent damage to the relays of the integrated SCALEXIO failure simulation hardware

To a varying extent, depending on which loads are connected and which currents and voltages are switched, electric arcs and contact erosion can occur in the FRU relays involved. This will eventually destroy the FRU relays. The board or unit on which they are mounted will no longer be usable and will have to be repaired or replaced.

Operating the relays outside the permitted range (i.e., above the maximum switching capacity) can also destroy the relays and will probably damage the board or unit on which they are mounted.

Before using FRU relays for electrical error simulation, you must fulfill the following preconditions:

- To minimize the risk of damage in a multiple error scenario, operate the relays only within the permitted conditions and ranges (i.e., under the maximum switching capacity). For concrete values, refer to FRU Relays Data Sheet (SCALEXIO Hardware Installation and Configuration 🕮).
- If the connected loads are inductive and you want to simulate electrical errors in their wiring, you must protect the dSPACE hardware from induced high voltages. Refer to Safety Precautions for Using Inductive Loads on page 18.
- Consider the increased risk of material wear or damage before you set **Activation by FRU relay** to **Allowed** in ConfigurationDesk.

Note that defects caused by material wear, misuse or operation outside the permitted ranges are not covered by any warranty, and no liability is accepted by dSPACE for any direct or indirect damage arising from such defects.

NOTICE

Risk of damage to a connected load

When FRU relays are switched for electrical error simulation, load rejection can be delayed up to 30 ms due to the switching times of the relays involved. A connected load can be damaged during these 30 ms.

Safety Precautions for Using Inductive Loads

Introduction

If the loads installed or connected to the I/O boards of your SCALEXIO system are inductive, and you want to simulate electrical errors in their wiring, you must protect the SCALEXIO hardware from induced high voltages.

Basics on inductors

Inductors (inductive loads) store energy in a magnetic field. The energy *W* stored in the load depends on the inductance L and the current i that flows through the inductor:

$$W = \frac{1}{2} \cdot L \cdot i^2$$

If the current i is suddenly reduced, for example, by opening the circuit, the energy stored in the load will induce high voltage u according to the following formula:

$$u = L \cdot \frac{di}{dt}$$

The induced high voltage can damage the connected hardware.

Inductors and electrical error simulation

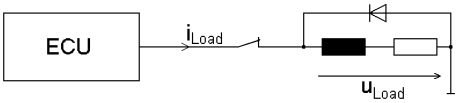
When simulating electrical errors in the wiring, the error potentials are switched by relays. In case an inductor is connected to your system, you must take precautionary measures to prevent the connected hardware from being damaged due to induced high voltage. You are recommended to use a freewheeling diode to avoid induced high voltage.

NOTICE

Overvoltage pulses in relays can cause electric arcs at the contacts of the relays. The electric arcs can weld the relays' contacts, which causes the contacts to be permanently short-circuited. A permanent short circuit can damage the hardware due to overheating.

Freewheeling diode

A freewheeling diode can avoid induced high voltage. It provides a discharge current path for the energy stored in a load. It allows the energy to dissipate slowly, rather than appearing as a voltage spike as it dissipates instantaneously. The following illustration shows an inductive load with a connected freewheeling diode.



Getting Started with a SCALEXIO Rack

Where to go from here

Information in this section

Basics on SCALEXIO Racks

Introduction

A SCALEXIO rack is part of the SCALEXIO family. It consists of several components.

SCALEXIO rack

A SCALEXIO rack is available in different sizes. The following illustration shows an example of the version with 9 U (height units).

A SCALEXIO rack contains all the hardware components of a SCALEXIO system or parts of it. Normally, a SCALEXIO rack contains a SCALEXIO Processing Unit as SCALEXIO processing hardware. In addition, the rack provides sufficient space for MultiCompact units, HighFlex I/O boards, and SCALEXIO I/O boards. To insert I/O boards into the rack, slot units in two sizes are available (6 slots and 20 slots). To simulate a car battery, a SCALEXIO rack can have a battery simulation power supply unit that can be controlled by the SCALEXIO system.

For details, refer to SCALEXIO Racks (SCALEXIO Hardware Installation and Configuration 🕮).

SCALEXIO Processing Unit

A SCALEXIO Processing Unit is based on a SCALEXIO Real-Time PC, a real-time operating system, and a DS2502 IOCNET Link Board for communication with other SCALEXIO components. The SCALEXIO Processing Unit comes in a 19" unit as a rack-mount version with front brackets to be inserted into a SCALEXIO rack or as a desktop version with feet to be used on a desktop.

SCALEXIO Real-Time PC The SCALEXIO Real-Time PC provides the calculation power to execute the real-time application. The SCALEXIO Real-Time PC consists of a high-standard industry ATX motherboard and a multicore main processor that is qualified by dSPACE for use with SCALEXIO. Its operating system is a Linux-based real-time operating system. One of the available

processor cores is reserved for service jobs, the others are used for computing real-time models.

By default, the Ethernet port for the host PC connection of SCALEXIO processing hardware is preconfigured as follows:

- IP address: 192.168.140.10
- Network mask: 255.255.255.0

DS2502 IOCNET Link Board The DS2502 IOCNET Link Board is the interface of the SCALEXIO Processing Unit for connecting the related SCALEXIO Real-Time PC to IOCNET or Gigalink. It is installed in a specific PCIe slot of the SCALEXIO Real-Time PC. A DS2502 IOCNET Link Board has 4 or 8 optical ports. It provides also 6 angle clocks (APUs) as master.

For details, refer to SCALEXIO Processing Unit (SCALEXIO Hardware Installation and Configuration 🕮).

SCALEXIO I/O boards

SCALEXIO I/O boards provide a large number of I/O channels with dedicated channel types and a focus on I/O functions without a current-related functionality. To use a SCALEXIO I/O boards, you can insert them in SCALEXIO LabBox or in a slot unit of a SCALEXIO rack.

For details, refer to SCALEXIO I/O Boards (SCALEXIO Hardware Installation and Configuration 🕮).

HighFlex I/O boards

HighFlex I/O boards are versatile and finely scalable. You can use its channels for different I/O functions that you can select and configure in ConfigurationDesk. The channels are galvanically isolated from each other, so they can be used for channel multiplication (using several channels for one I/O function to enhance their physical characteristics, for example, to increase the maximum current). The channels have failure routing units, so they can be used for failure simulation. To use a HighFlex I/O board, you must insert it in a slot unit of a SCALEXIO rack.

For details, refer to HighFlex I/O Boards (SCALEXIO Hardware Installation and Configuration 🕮).

MultiCompact I/O units

MultiCompact I/O units have a great number of I/O channels for specific applications. The units have IOCNET routers to connect them to a SCALEXIO Processing Unit or further I/O units. They are installed in a SCALEXIO rack.

For details, refer to MultiCompact I/O Units and Boards (SCALEXIO Hardware Installation and Configuration 🕮).

CompactPCI® Serial boards

You can use up to five Ethernet boards and dSPACE-qualified CompactPCI® Serial boards in the extended I/O slots of a SCALEXIO AutoBox/LabBox if the AutoBox/LabBox has a DS6001 Processor Board.

For details, refer to I/O Boards for Extended I/O Slots (SCALEXIO Hardware Installation and Configuration 🕮).

Battery simulation power supply unit

The battery simulation power supply unit is used to simulate the vehicle battery. The battery simulation power supply unit is controlled via software by a battery simulation controller, such as the DS2907 Battery Simulation Controller or the onboard controller of the DS2680 I/O Unit. There are different battery simulation power supply units that can be installed in a SCALEXIO rack.

For details, refer to Battery Simulation Power Supply Unit (SCALEXIO Hardware Installation and Configuration 🕮).

Related topics

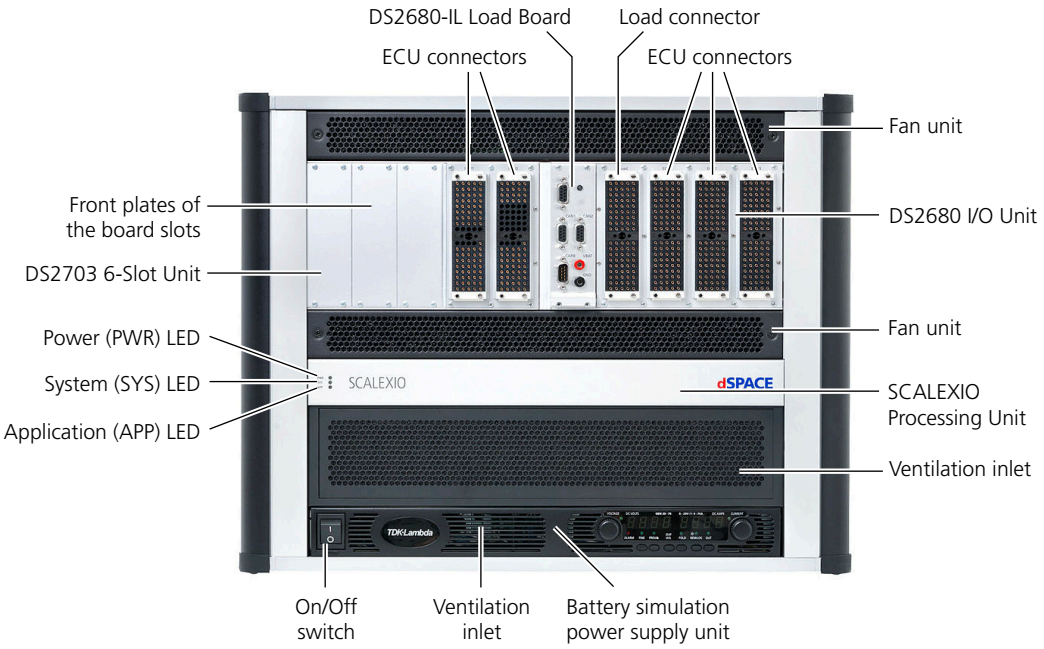
Basics

Overview of SCALEXIO Racks 24
Overview of the SCALEXIO Hardware (SCALEXIO Hardware Installation and Configuration 🕮)

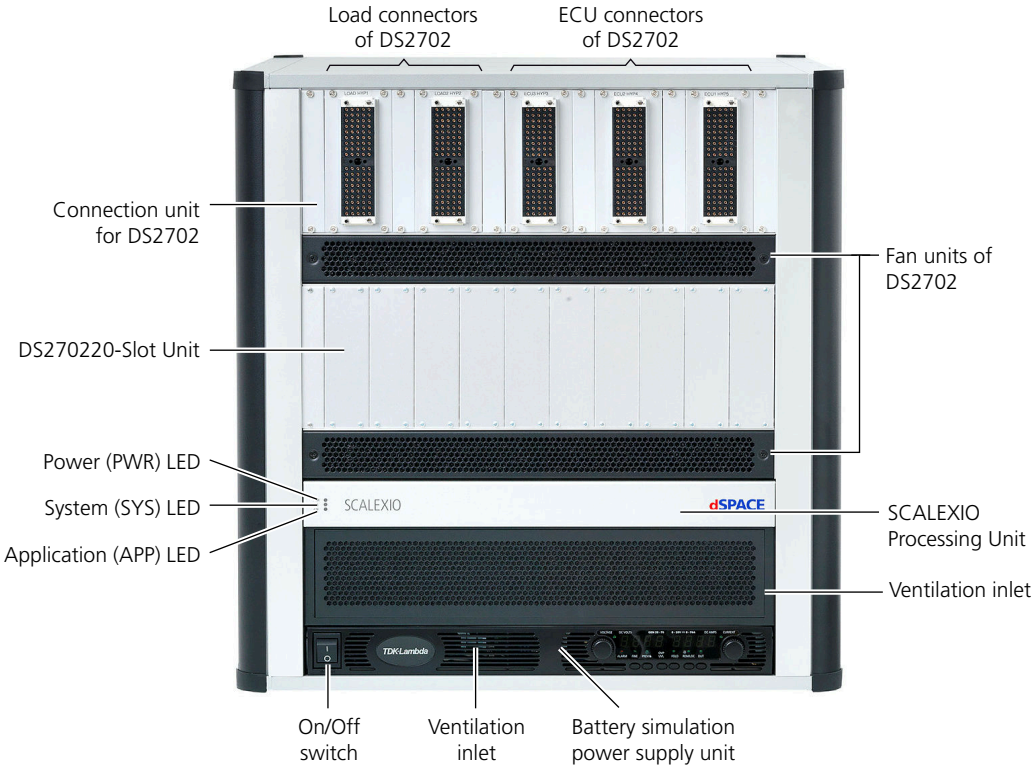
Overview of SCALEXIO Racks

Typical SCALEXIO racks

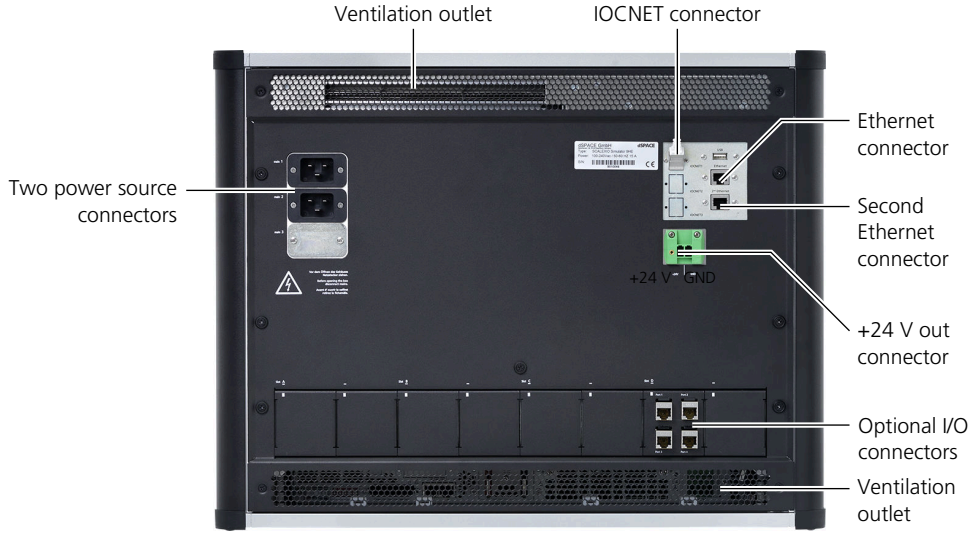
9 U SCALEXIO rack The following illustration shows the front view of a 9 U SCALEXIO rack that includes a DS2703 6-Slot Unit and a DS2680 I/O Unit.



12 U SCALEXIO rack The following illustration shows the front view of a 12 U SCALEXIO system that includes of a DS2702 20-Slot Unit.



Typical rear view The following illustration shows an example of a rear view of a 9 U SCALEXIO rack.



Connectors

A typical rack front of a SCALEXIO system for HIL can have the following connectors:

- **ECU connectors** to connect the ECU to the SCALEXIO system. The connectors contain all input and output signals for the ECU (sensor signals, actuator signals, bus signals, and power supply).
- **Load connector** to connect external loads to the SCALEXIO system. The actuators or an equivalent load (external load) must be connected to the ECU via the SCALEXIO system so the system can measure the signals for actuators.

If the rack has a DS2680 I/O Unit, the rack also has the following connectors at the front:

- **CAN <x> connector** to connect a device to a CAN bus.
- **LIN 1 connector** to connect a device to a LIN bus.
- **CARB connector** to connect a tester device to the SCALEXIO system.
- **Battery simulation connectors** to connect external devices to the simulated vehicle battery.

A typical rack rear can have the following connectors:

- **Power source** connectors (two or more) to connect the rack to the power source.
- **Ethernet** connector to connect the SCALEXIO system to the Ethernet for communication with the software tools running on the host PC.
- **Second Ethernet** connector to establish an independent Ethernet connection to a customer-specific device. For more details, refer to Implementing an Ethernet Interface (ConfigurationDesk Real-Time Implementation Guide 🕮).
- **IOCNET** connector to connect the rack to another SCALEXIO system, I/O unit, or PHS-bus-based system.
- **+24 V out** connector to provide a supply voltage of +24 V for an external device (max. 10 A). (The power that is externally consumed reduces the power to operate the rack-internal I/O units and boards.)
- **Optional I/O connectors** to provide additional connectors, for example, additional Ethernet connectors.

On/Off switch

The **On/Off switch** of a rack-mount SCALEXIO system is located at the front of the rack and is part of the battery simulation power supply unit. It lets you switch the rack-mount SCALEXIO system on or off. When the **On/Off switch** is pressed, it can take some seconds to carry out the switching operation.

The **On/Off switch** does not disconnect the rack from the power source. For complete disconnection, unplug the power cords from the sockets.

Note

If the housing variant of the SCALEXIO Real-Time PC has an **ON/OFF** button and/or a **Reset** button on the front, the buttons are disabled.

Related topics

Basics

Cooling Concept of SCALEXIO Racks (SCALEXIO Hardware Installation and Configuration 🕮)
DS2680 I/O Unit (SCALEXIO Hardware Installation and Configuration 🕮)

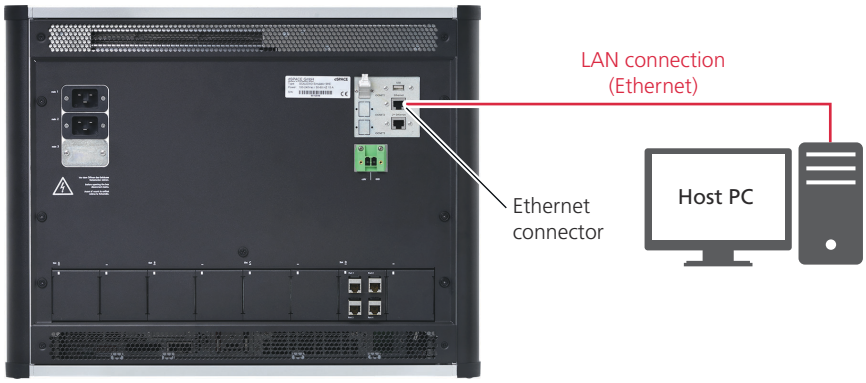
Connecting a SCALEXIO Rack

Introduction

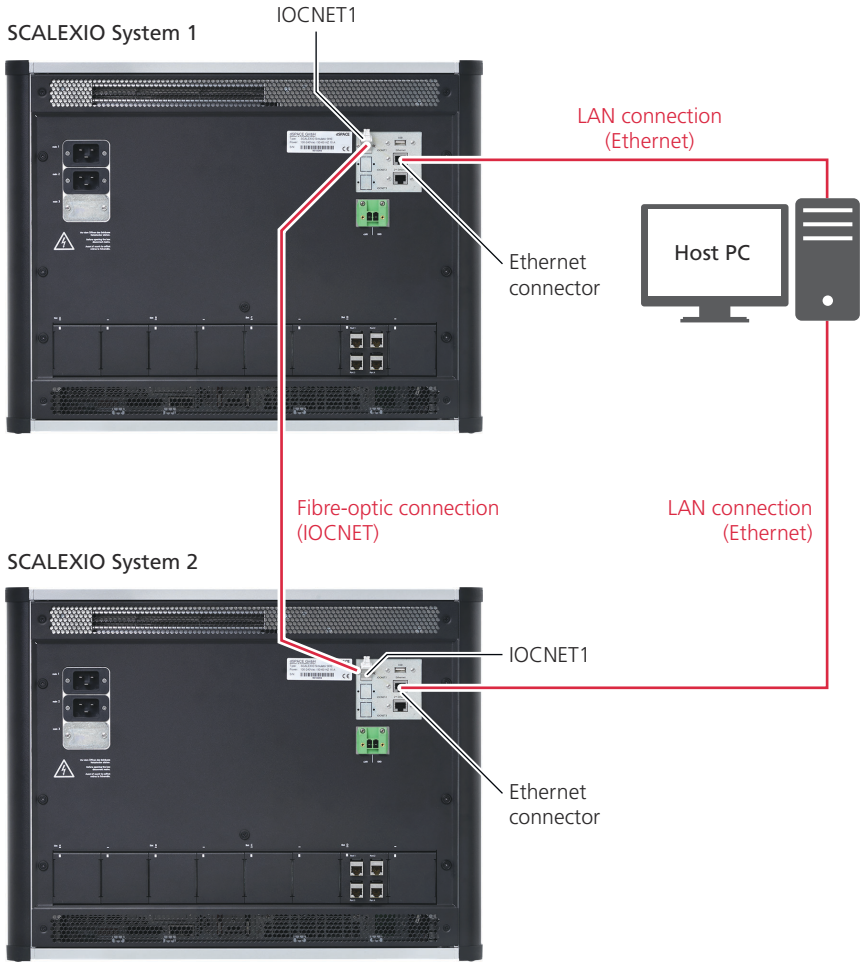
This topic show examples on how to connect a SCALEXIO rack.

A SCALEXIO rack is connected to the host PC or network via the **Ethernet** (RJ45) connector on the rack's rear.

Standard connection



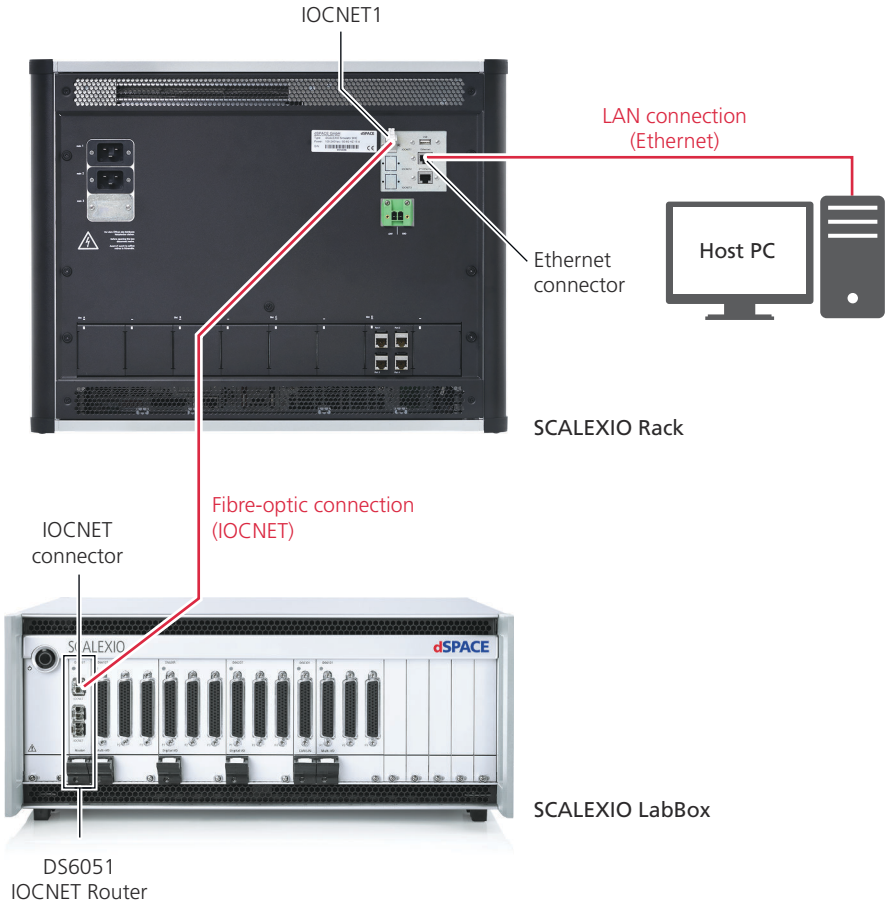
Use in a multiprocessor system



Note

The port 4 of the DS2502 IOCNET Link Board installed in the SCALEXIO Processing Unit is usually routed to the IOCNET1 connector on the SCALEXIO rack's rear.

Use as root in a distributed SCALEXIO system



Note

The port 4 of the DS2502 IOCNET Link Board installed in the SCALEXIO Processing Unit is usually routed to the IOCNET1 connector on the SCALEXIO rack's rear.

Related topics

Basics

Connecting the SCALEXIO System to the Host PC (SCALEXIO Hardware Installation and Configuration 🕮)
Overview of SCALEXIO Racks 24

How to Set Up the SCALEXIO System

Objective

To work with a SCALEXIO system, all of its components must be connected to the mains and to a host PC.

Requirements for the host PC

The host PC is a standard PC that the dSPACE test and experiment software is installed on. Via the host PC, you can configure the SCALEXIO hardware, download a real-time application to the system and control the simulation.

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

- Software requirements: A dSPACE installation valid for SCALEXIO systems.
- Hardware requirements: A network interface card.

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

Method

To set up the SCALEXIO system

1. If you work with a distributed SCALEXIO system, you must connect the single SCALEXIO components via fiber-optic IOCNET cables.

   For examples on connecting a SCALEXIO rack, refer to Connecting a SCALEXIO Rack on page 27.

2. Connect the SCALEXIO rack to the host PC via a peer-to-peer connection or a network connection.

   You must always use the *autonegotiation* (also called NWay) mode for communication between the SCALEXIO system and the host PC.

   For further details on the LAN connection, refer to Setting up the Connection to the Host PC (SCALEXIO Hardware Installation and Configuration 🕮).

3. Connect all the components of the SCALEXIO system to the mains.
4. Use the **On/Off switch** at the front of SCALEXIO rack to power it up.

Result

You set up the SCALEXIO system.

The **SYS LED** of the SCALEXIO Processing Unit indicates different states of the boot and initialization processes. The SCALEXIO system is ready for operation when the **SYS LED** is green.

For details on the LED states of the SCALEXIO Processing Unit, refer to LEDs of the SCALEXIO Processing Unit (SCALEXIO Hardware Installation and Configuration 🕮).

Next steps

To access the SCALEXIO system via your host PC, you first have to register the processing hardware to make it known to the dSPACE software products, for

example, ConfigurationDesk. To do this, you need the IP address of the SCALEXIO system you want to register.

- If you want to change the IP address and the network mask, refer to How to Change the Network Configuration via a Command Prompt Window on page 31.
- To register your system with ConfigurationDesk, refer to How to Register a SCALEXIO System with ConfigurationDesk on page 34.

Related topics

HowTos

How to Register a SCALEXIO System with ConfigurationDesk 34

How to Change the Network Configuration via a Command Prompt Window

Objective

As an alternative to using the Web interface of the SCALEXIO processing hardware, you can use a Command Prompt window to change the network configuration of the processing hardware. This method is required if you do not know the current IP address of the SCALEXIO processing hardware.

Required information

For changing the network configuration, you need:

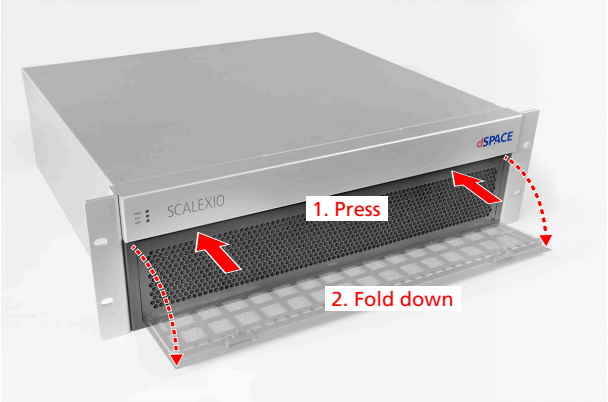
- Either the current IP address of the SCALEXIO system.
- Or the MAC address of the SCALEXIO system.

By default, the Ethernet port for the host PC connection of SCALEXIO processing hardware is preconfigured as follows:

- IP address: 192.168.140.10
- Network mask: 255.255.255.0

MAC address label of the SCALEXIO processing hardware

You find the individual MAC address of the SCALEXIO Processing Unit's host PC interface on a label behind the front flap. (The following illustration shows housing variant 3.)



Preconditions

- The SCALEXIO system must be connected to the host PC in a peer-to-peer connection.
- The host PC must have a static IP address.

Method

To change the network configuration

1 Switch on the host PC and the SCALEXIO system.

The SCALEXIO system has booted completely when the SYS LED of the SCALEXIO processing hardware is green or flashes orange and green.

2 On the Windows Start menu, select dSPACE RCP and HIL 20xx-x – Command Prompt for dSPACE RCP and HIL 20xx-x to open a Command Prompt window in which the required paths and environment settings are preset.

3 Enter `DsNetConfig -?`.

The syntax and all the available commands of the DsNetConfig tool are displayed.

4 **Note**

The SCALEXIO system and the Ethernet interface of the host PC must have the same network mask (for example, `255.255.255.0`).
The IP address of the SCALEXIO system and the IP address of the host PC's Ethernet interface must be part of the same subnetwork (for example, `192.168.1.x`).

You can now specify a static IP address or let a DHCP server set the IP address:

- To set a static IP address without gateway, enter the new IP address and the network mask:

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

(for example, `DsNetConfig 00:03:2D:19:09:3A -ip 192.168.0.2 255.255.255.0`)

- To set a static IP address with gateway, enter the new IP address, the network mask, and the gateway address:

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

  (for example, `DsNetConfig 00:03:2D:19:09:3A -ip 192.168.0.2 255.255.255.0 -gw 192.168.0.1`)
- To let a DHCP server set the IP address, enter:

  `DsNetConfig <MAC_address> -dhcp`

  (for example, `DsNetConfig 00:03:2D:19:09:3A -dhcp`)

  Depending on the DHCP configuration, the IP address is fixed or variable and might change each time the SCALEXIO system signs onto the network.

The SYS LED and the APP LED indicate the configuration state.

LED Status	Configuration State
Flashes green (3 times)	The configuration was successful. Continue with step 5.
Flashes red (3 times)	The SCALEXIO system received the configuration command but the configuration was not successful. Make sure that the SCALEXIO system is not being accessed by software, such as ConfigurationDesk or ControlDesk, and that no real-time application is loaded to the SCALEXIO system. Then repeat steps 2 … 4.
No reaction	The SCALEXIO system has not received the configuration command. Check the configuration of the host PC and/or the Ethernet connection between the SCALEXIO system and the host PC. Then repeat steps 2 … 4.

5 Shut down the SCALEXIO system.

6 Wait until the SCALEXIO system has shut down completely, then restart it to invoke the new IP address.

7 In the Command Prompt window, enter `DsNetConfig -scan`.

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

Tip

If the SCALEXIO system is not displayed:

- Check if the subnet masks of the SCALEXIO processing hardware and of the host PC are the same.
- Check if the IP address of the SCALEXIO system is part of the subnetwork of the host PC's Ethernet interface.
- Check if the IP address of the SCALEXIO system is within the valid ranges and specified correctly.

Result

You changed the network configuration for the processing hardware of your SCALEXIO system.

How to Register a SCALEXIO System with ConfigurationDesk

Objective

To access the hardware resources of your SCALEXIO system, you must register its processing hardware to make the system known to your host PC.

Basics on registering a SCALEXIO system

To register a SCALEXIO system, you can use one of the following products:

- AutomationDesk
- ConfigurationDesk
- ControlDesk

When registering the SCALEXIO system or managing the registration data, use only one of these programs and close the other program. The SCALEXIO system is also registered for the other program and present the next time you start it.

For basics and further details (for example, advanced features) on registering hardware and on managing registered hardware, refer to Basics on Registering Real-Time Hardware (ConfigurationDesk Real-Time Implementation Guide 🕮).

In this topic, you will learn, how to register a SCALEXIO system with ConfigurationDesk.

Preconditions

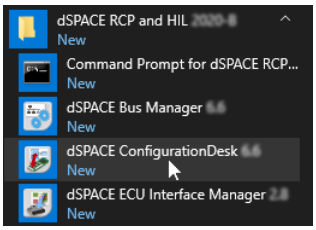
The following preconditions must be fulfilled:

- ConfigurationDesk is installed on your host PC and ConfigurationDesk must belong to the RCP and HIL installation that is currently active. For instructions, refer to How to Install dSPACE Software (Installing dSPACE Software 🕮).
- Your host PC must be connected to the same network as the SCALEXIO system you want to register in ConfigurationDesk.
- The SCALEXIO system is switched on.

Method

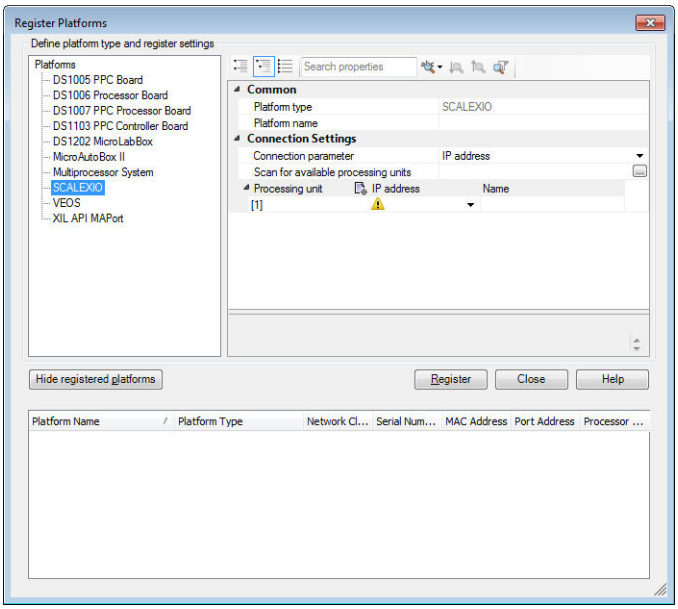
To register SCALEXIO hardware

1 Start ConfigurationDesk.



2 On the Platforms ribbon, click Platform Management – Register Platforms.

The Register Platforms dialog opens.



3 In the Platform name edit field, specify a unique user-defined platform name for the SCALEXIO system if required.

4 Specify the connection settings for the SCALEXIO system and its processing hardware you want to register: Specify either its IP address, its MAC address, board name, or its alias name.

Tip

You can also scan the local network for connected platform hardware. To do so, select the Scan local network entry from the IP address drop-down list. The scope is limited to the current subnetwork.

Note

If your SCALEXIO system is installed in a different subnetwork connected to your host PC's network via a router or gateway, you must enter the IP address for registering.

5 If you want to register a multiprocessor system, click  to add an new processing hardware and specify either its IP address, its MAC address, board name, or its alias name.

Note

You cannot subsequently add processing hardware to a SCALEXIO system that is already registered.

6 Click **Register** to complete the registration of the SCALEXIO system.

The registered processing hardware is displayed with its registration settings in the **Registered platforms** list.

7 Click **Close** to close the **Register Platforms** dialog.

Result

You have registered the SCALEXIO system independently of ConfigurationDesk projects and applications. ConfigurationDesk created a platform for each item of registered hardware. The registration data is stored in the recent platform configuration.

The **Platform Manager** displays the hardware topology of all the registered platforms. The hardware topologies are displayed in the order in which the registered hardware systems are detected in the network. Each hardware topology is displayed in a hierarchical structure.

Next steps

When you have started ConfigurationDesk and registered your SCALEXIO system, you can:

- Start to work with a demo application as described in Accessing the CfgStartingWithExternalDevices Demo Project and Its Applications (ConfigurationDesk Tutorial Starting with External Devices 🕮)
- Make yourself familiar with basic concepts of ConfigurationDesk as described in Basic Concepts of ConfigurationDesk (ConfigurationDesk Getting Started 🕮) or
- Make yourself familiar with the workflows in ConfigurationDesk as described in Typical Workflows for Beginners (ConfigurationDesk Getting Started 🕮).

Data Sheet of a Typical SCALEXIO Rack

Technical data

The following table shows the general technical data of a typical 9 U and 12 U SCALEXIO rack. (For technical data of the processing hardware, the I/O boards, and the I/O units installed, refer to the data sheets of the related components.)

Parameter	Specification
Environment	Indoor use
Altitude	Up to 2000 m
Operating temperature	0 °C ... +40 °C (32 … 104 °F)
Storage temperature	-20 °C … +80 °C (-4 °F … 176 °F)
Relative humidity	80% max. if < 31 °C (87.8 °F), decreases linearly to 50% at 40 °C (104 °F), noncondensing
Pollution degree	2, according to IEC 664 (normal clean and dry environment)
Protection class	1
Power source connection	100 V … 230 V AC, 50/60 Hz, 15 A (per power source connector)

Parameter	Specification
Ground swing[1]	10 V (max.)
Measurement category	I. (all the I/O signals are intended to be within the safety extra-low voltage (SELV) limits)
Rated current, rated voltage	Board-specific, refer to the related data sheets.
Battery simulation controller	The SCALEXIO system can be equipped with one of the following battery simulation controllers: ▪ DS2907 Battery Simulation Controller ▪ Or battery simulation controller of the DS2680 I/O Unit

Battery simulation power supply unit	The SCALEXIO system can be equipped with one of the following battery simulation power supply units:
	▪ A battery simulation power supply unit of the Genesys™ 1500W series:
	  ▪ GEN20-76 (20 V, 76 A)[2]
	  ▪ GEN40-38 (40 V, 38 A)
	  ▪ GEN60-25 (60 V, 25 A)
	▪ A battery simulation power supply unit of the Delta Elektronika SM 1500 series[3]:
	  ▪ SM 15-100 (15 V, 100 A)
	  ▪ SM 35-45 (35 V, 45 A)
	▪ A customer-specific battery simulation power supply unit.[4]

Output power of the rack-internal +24 V power supply units	▪ 9 U SCALEXIO system: 1 × 300 W (max.) ▪ 12 U SCALEXIO system: 2 × 300 W (max.)
+24 V external power supply output	10 A (max.), 240 W (max.)[5]
Power consumption of rack-internal fan units	3 × 7.2 W (max.)
Physical size of enclosure	19'' rack system, 9 U or 12 U
Mass	Depends on the individual system setup

1) Output swing between signal ground (KL 31) and earth ground (PE), refer to Ground Potentials (SCALEXIO Hardware Installation and Configuration 🕮).
2) The GEN20-76 is the default battery simulation power supply unit.
3) Contact dSPACE if you want to use a Delta Elektronika power supply unit.
4) Contact dSPACE if you want to use a customer-specific power supply unit.
5) .The power that is externally consumed reduces the power to operate the rack-internal I/O units and boards.

CE compliance

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