

## System Requirements for dSPACE Release 2022-B

If your system meets the following requirements, you can work with dSPACE software (RTI, ConfigurationDesk, MotionDesk, ModelDesk, AutomationDesk, TargetLink, Model Compare, ControlDesk, SystemDesk, SYNECT and VEOS). The system requirements of the current dSPACE Release, are also available at <https://www.dspace.com/go/sysreq>. The requirements for SIMPHERA are listed at <https://www.dspace.com/go/SIMPHERA-Admin>. The requirements for AURELION are listed at <http://dspace.com/go/aurelion-download>.

### Host PC Hardware

#### Host Processor

All dSPACE software products require at least any x86-64 processor with AVX2 instruction set support.

#### Main Memory

All dSPACE software products require at least 8 GB RAM (recommended: 32 GB RAM or more).

#### Disk Space

- Installation of all dSPACE software products which support Windows:
  - You need up to 28 GB of free hard disk space on the program partition.
  - In addition you need up to 20 GB of free disk space on the system partition, for example, for run-time software like the Microsoft .NET Framework.
- SYNECT Server: 1 GB of free disk space on the system partition required.
- Installation of all dSPACE software products which support Linux:
  - Up to 1 GB of free disk space on the /opt mount point
  - Up to 500 MB of free disk space on the /usr mount point

#### Disk Drives

DVD drive for the software installation from DVD. SYNECT Server: It is recommended to use a solid state drive for the system partition.

### Required Ports for Connecting Hardware

#### dSPACE System with Ethernet connection

The DS1007, MicroAutoBox II, MicroAutoBox III, MicroLabBox, and the SCALEXIO system establish a communication to the host PC via integrated Ethernet. To connect your dSPACE system via an Ethernet connection, your host PC must have a 10BASE-T network adapter (twisted pair, 10 Mbit/s or faster). 10BASE-T: Adapted and reprinted with permission from IEEE. Copyright IEEE 2018. All rights reserved.

#### TargetLink

For processor-in-the-loop (PIL) simulation, you need a serial port (RS232) or a free USB port (depending on the type of the evaluation board).

#### ControlDesk

- To connect DCI-KLine1, you need a USB port version 1.1 (compatible with USB 2.0). dSPACE does not guarantee compatibility with USB 3.0 or higher.
- To connect DCI-CAN2 and DCI-CAN/LIN1, you need a USB port version 2.0 (compatible with USB 1.1 and USB 3.0 or higher).
- To use the Steering Controller instrument, you need a USB port to connect a game controller device.
- To use the graphical user interface of the ControlDesk XIL API EESPort via the RS232 interface, your host PC needs an RS232 serial port that can run at 9,600 bit/s to connect the Failure Insertion Unit (FIU) of PHS-bus-based HIL systems. As an alternative you can use an external RS232 converter:

- USB-to-RS232 converter: Only converters with an FTDI chipset and the newest FTDI driver are supported. Refer to <https://www.ftdichip.com/FTDrivers.htm>.

- Ethernet-to-RS232 converter: The IOLAN DS1 converter from Perle is recommended by dSPACE. Refer to <https://www.dspace.com/go/eth2rs232>.

- There are limitations if you use an external RS232 converter: Software triggers and dynamic errors are not supported. Communication is also time-critical and can cause communication errors.
- To connect a GNSS receiver to the GNSS device, you need a COM port (RS232), a USB port (USB 1.1 up to USB 3.0), or a USB-to-RS232 converter, depending on the GNSS receiver you are using. In ControlDesk, the connected GNSS receiver is assigned to the GNSS device via a COM port.

#### Graphics Adapter and Display

To work with dSPACE products, you need a standard graphics adapter with a minimum resolution of 1024 x 768 pixel.

- ConfigurationDesk: A standard graphics adapter with a resolution of 1280 x 800 pixels or more is recommended
- ControlDesk:
  - Full HD graphics adapter with a resolution of 1920 x 1080 pixels is recommended.
  - If you use ControlDesk in a VMware environment, 3-D support must be enabled in VMware.
- Limitations for SYNECT: If you use high-DPI monitors, the SYNECT user interface might not be displayed properly in some cases, but this does not cause functional limitations.
- Limitations for Real-Time Testing: The Real-Time Test Manager (the graphical user interface for handling RTT sequences), does not support working with high-DPI monitors.

#### Requirements for License Handling

- CodeMeter Runtime Version 7.51a or later is required for Microsoft Windows (is installed with dSPACE Setup).
- CodeMeter Runtime Version 7.40b is required for Ubuntu Linux
- CodeMeter Runtime requires the DigiCert Trusted Root G4 root certificate
- Single-user licenses: To connect the dongle, you need a USB port (Version 1.1 min.).
- Floating network licenses:
  - All the PCs on which you want to run dSPACE software (dSPACE License Clients) must be able to establish a TCP/IP connection to the dSPACE License Server. A standard TCP/UDP protocol is required. The default port number is 22350 (TCP and UDP), which is an officially registered port number (IANA). If needed, you can change the port number.
  - For activating licenses, dSPACE Installation Manager needs an Internet connection to connect to dSPACE License Central (<https://licensing.dspace.de/gateways>, HTTPS, Port 443). It can work with proxy servers and can also handle proxy servers with authentication (user name,

password).

- For a host PC on which only dSPACE Installation Manager is installed or which only works as license server, the following minimum hardware is required: Any x86-64 processor with AVX2 instruction set support, 4 GB RAM main memory (or more).

## Required Slots in the Host PC

- To install a DS1104, you need one free 33 MHz/32-bit 5 V PCI slot or one PCIe slot, depending on the board variant.
- To connect your modular system based on DS1006 to the host PC via a bus connection, you need link boards in your host PC:
  - The DS817 Link Board (PC) requires one free 5 V PCI slot (up to DS817-03) or one free 3.3 V / 5 V Universal PCI slot (DS817-04 and later).
  - The DS819 Link Board (PC) requires one free PCI Express slot (x1 ... x32).
  - The DS821-34 mm Link Board (PC) requires one free ExpressCard/34 slot or one free ExpressCard/54 slot.
  - The DS821-54 mm Link Board (PC) requires one free ExpressCard/54 slot.

## Operating System

### Windows Operating System on Host PC

The dSPACE products support the following operating systems:

- The following editions and servicing options of Windows® 10:
  - Windows 10 Professional, Education, and Enterprise (64-bit versions). The Windows 10 Home and Windows 10 S editions are not supported.
  - Long-Term Servicing Channel LTSC 2019
  - Long-Term Servicing Channel LTSC 2021
  - General Availability Channel (replaces the previous Semi-Annual Channel): The compatibility statement of Microsoft applies. This means that newer versions released in this channel should be compatible with all previous versions. dSPACE used the 21H2 version of the General Availability Channel for testing.
- The following editions and servicing options of Windows 11:
  - Windows 11 Professional, Education, and Enterprise (64-bit versions). The Windows 11 Home edition is not supported.  
Valid for the FPGA Programming Blockset: Only the FPGA Programming Blockset - Processor Interface supports Windows 11. Windows 11 cannot be used to model or handcode FPGA applications due to missing Xilinx support.
  - General Availability Channel: The compatibility statement of Microsoft applies. This means that newer versions released in this channel should be compatible with all previous versions. dSPACE used the 21H2 version of the General Availability Channel for testing.
- Windows Server LTSC 2019 Standard and Datacenter editions, each with the Desktop Experience installation option. The Windows Server 2019 Essentials edition is not supported.

**Support of Windows Docker:** You can also run some dSPACE products in a Windows Docker container. For more details, contact dSPACE Support (<https://www.dspace.com/go/supportrequest>).

### Linux Operating System on Host PC

The dSPACE products of dSPACE Release 2022-B with Linux compatibility support the following operating system:

- Ubuntu 20.04 LTS with the General Availability Kernel in the Desktop, Server, and Cloud version

**Support of Linux Docker:** You can also run the dSPACE products with Linux compatibility in a Linux Docker container. For more details, refer to <https://www.dspace.com/go/ProductsForLinux>.

### Installing ControlDesk on MicroAutoBox

ControlDesk can also be installed on MicroAutoBox III Embedded PC, running on Microsoft Windows 10 IoT Enterprise, LTSC 2019, 64-bit version.

### Operating System on SYNECT Server

SYNECT server supports the same operating systems as listed above for all dSPACE products. In addition, the 64-bit version of Windows Server 2016 is supported.

### Allowing Communication via Additional Firewall Rules

Additional Windows firewall rules are installed during the installation of various dSPACE software products. For example, one rule allows communication with a dSPACE expansion box such as AutoBox and another rule allows MotionDesk to receive motion data from a network channel.

If you are running third-party firewall software on your host PC, ensure that the TCP/IP communication of dSPACE software is not blocked:

- VEOS requires the following open TCP/IP network ports:
  - For Windows: 111 (TCP and UDP), 3702 (UDP), 7214 (TCP and TCP6), 7215 (TCP and UDP), 7216 (TCP), 8090 (TCP), 9923 (UDP), 49152 ... 65535 (TCP, TCP6 and UDP)
  - For Linux: 111 (TCP and UDP), 7215 (TCP and UDP), 7216 (TCP), 8090 (TCP), 9923 (UDP), 32768 ... 60999 (TCP, TCP6 and UDP)
- MotionDesk requires the following open TCP/IP network port: 15000 (UDP)
- ConfigurationDesk used together with one or more connected MATLAB installations require up to 10 open TCP/IP network ports in the range 49196 ... 49205 (TCP):
  - Whenever a connected MATLAB is started, the first available port from the specified range is taken.
  - When ConfigurationDesk is started, it also uses the first free port from the specified range.
  - If ConfigurationDesk is not running or no MATLAB instance is running, then no ports from the specified range are used
- dSPACE Installation Manager and CodeMeter licensing software require the following open TCP/IP network ports:
  - 22350 (TCP and UDP) for communication in a LAN network (if not changed from the default setting).
  - 22352 (TCP and UDP): To access CodeMeter WebAdmin via http.
  - 22353 (TCP and UDP): To access CodeMeter WebAdmin via https.
- dSPACE Help requires an open TCP/IP network port for interprocess communication between its components. The default port number is 11000. If this port number is already in use, another free port is used automatically. The related processes can be identified via the following prefixes: HelpApsLayer<xxx>, HelpInstaller<xxx>.

## Operating System on dSPACE License Server

If you purchased floating network licenses, you have to specify one of the network PCs as a license server. Every PC with CodeMeter Runtime software can be used as a license server.

- **Valid for servers without dSPACE software:**
  - You can use operating systems from Microsoft Windows on a license server in combination with protected dSPACE software.
  - If you want to use Ubuntu Linux as operating system for the license server, contact dSPACE Support ([www.dspace.com/go/supportrequest](http://www.dspace.com/go/supportrequest)).
  - Other operating systems are not tested. You can use them at your own risk. dSPACE does not provide support in this case.
- **Valid for servers with dSPACE Installation Manager:** dSPACE Installation Manager supports the same operating systems as other dSPACE software products.

## Limitations for Using Windows Features

Some limitations apply when you use dSPACE software in conjunction with features of Windows:

- **Installing and running dSPACE software within the Windows service accounts:** Non-service-based dSPACE software is not designed to be installed or run in the context of any predefined Windows service account (LocalService, NetworkService, LocalSystem).
- **Fast user switching:** The dSPACE software does not support the fast user switching feature of Windows.
- **User Account Control:** It is recommended to disable Windows' User Account Control (UAC) during the installation of dSPACE software. If you cannot disable it, you should note the following Windows behavior: If UAC is enabled, the setup programs run with the administrator account instead of the user account. Therefore it is important that the administrator account has access to the required drives, particularly to the required network drives.
- **Using high-DPI monitors:** The following dSPACE software products have limitations for working with high-DPI monitors:
  - SYNECT: If you use high-DPI monitors, the SYNECT user interface might not be displayed properly in some cases, but this does not cause functional limitations.
  - Real-Time Testing: The Real-Time Test Manager (the graphical user interface for handling RTT sequences), does not support working with high-DPI monitors.
- **High-contrast mode:** dSPACE software was not developed for or tested against the Windows high-contrast mode. You are recommended to disable the mode. Otherwise, the visualization of the user interfaces might be impaired.
- **Long path names:** dSPACE software does not support the long path name syntax of the Windows API. If a path name that exceeds 260 characters is used directly or indirectly, the behavior of the dSPACE software is not defined.
- **Windows 8dot3name creation option:** It is strongly recommended that the Windows 8dot3name creation option is enabled for all drives (drives used for installation and drives used for work) before you install third-party software, such as MATLAB®/Simulink®, and the dSPACE software.
- **FIPS support:** dSPACE software was not developed for or tested against the FIPS PUB 140-2 U.S. government computer security standard (Security Requirements for Cryptographic Modules). For more information on FIPS, refer to <https://docs.microsoft.com/en-us/windows/security/threat-protection/fips-140-validation>.
- **Settings for user locale and system locale must match:** MATLAB reads the user locale and system locale settings that are specified in Windows operating systems. The user locale and the system locale must match. If these settings are not the same, the system might not

behave as expected when working with MATLAB and dSPACE software.

- **Limitation for using single-user licenses:** If you use a PC with a Windows Server operating system, for example, Windows Server 2019, and you want to work with dSPACE software on this PC via Microsoft Remote Desktop Connection, you have to use a floating network license to activate license-protected software. Single-user licenses are not supported in this case.

## Limitations for Using Linux Features

Some limitations apply when you use dSPACE software in conjunction with features of Linux:

- **FIPS support:** dSPACE software was not developed for or tested against the FIPS PUB 140-2 U.S. government computer security standard (Security Requirements for Cryptographic Modules). For more information on FIPS, refer to: For Ubuntu 20.04 LTS: <https://ubuntu.com/blog/fips-certification-ubuntu-20-04-lts>.
- **Long paths:** dSPACE software does not support the available path length of 4,096 characters. If a path that exceeds 260 characters is used directly or indirectly, the behavior of the dSPACE software is not defined.
- **Locale:** dSPACE software was tested only on a system with a US English locale.

## Third-Party Software

### MATLAB®/Simulink®

Working with various dSPACE products requires that you have installed one of the following MATLAB releases: R2021a, R2021b, R2022a, R2022b.

Note the following exceptions and limitations:

- R2022a and R2022b are not supported by the FPGA Programming Blockset – FPGA Interface.
- MATLAB/Simulink Student Suite is not supported by Automotive Simulation Models (ASM).

For system requirements of MathWorks software, refer to

<https://www.mathworks.com/support/requirements/matlab-system-requirements.htm>.

### Code Generation

For code generation with RTI, RTI-MP, various RTI blocksets, ConfigurationDesk (when working with Simulink models), Model Interface Package for Simulink, and for C code generation of Automotive Simulation Models (ASM), you need Simulink Coder and MATLAB Coder from The MathWorks.

### C/C++ Compiler for RCP and HIL Software

- For building MATLAB MEX files for software products that require a MEX compiler, such as the RTI CAN MultiMessage Blockset, and RTI LIN MultiMessage Blockset, you need one of the following C/C++ compilers and have to configure it as a MEX compiler in MATLAB:
  - Microsoft Visual Studio 2019
  - MinGW compiler as supported by the related MATLAB release: MinGW (GNU Compiler Collection (GCC 6.3.0)): MATLAB R2021a, R2021b, R2022a, and R2022b.
- For MicroAutoBox II, DS1104, and the RapidPro Control Unit with MPC5554, you must install the Microtec PowerPC C/C++ Compiler Ver. 3.8.7. The compiler is installed automatically with the dSPACE software as encrypted archive. If you ordered the required license, you can decrypt the archive and use the compiler afterwards.



- For the DS1006, the required dSPACE DS1006 C/C++ Compiler (Ver. 3.0, based on GNU C/C++ Compiler Ver. 4.8.3) is installed automatically together with the dSPACE software.
- For the DS1007 and MicroLabBox, the required QNX Compiler for dSPACE systems (Ver. 3.1, based on GNU C/C++ compiler Ver. 5.2) is installed automatically together with the dSPACE software as encrypted archive. If you ordered the required license, you can decrypt the archive and use the compiler afterwards.
- For MicroAutoBox III and SCALEXIO systems, the required Compiler for ConfigurationDesk Platforms Version 2.0 based on GNU C/C++ Compiler Ver. 10.3 is installed automatically together with the dSPACE software.
- For compiling slave applications for the DS2302, DS2210, and DS2211 I/O boards, you must install TMS 320C3x/C4x Code Generation Tools Ver. 4.70 or 5.11 or TMS 320C3x/C4x Code Composer Tools Release 4.10 from Texas Instruments.

### C Compiler for Internal Bypass Targets Used by the RTI Bypass Blockset

For compiling real-time applications for internal bypass targets, you need a C compiler depending on the target microcontroller family:

- HighTec, Green Hills, or the Standard GNU compiler for the Freescale MPCxxx and Renesas V850x processor families
- HighTec or the Green Hills compiler for the Infineon TriCore processor family
- GNU, Green Hills, or the Standard GNU compiler for ARM Cortex-R4/R5 processor family

The GNU compiler is part of the RCP and HIL software package and installed automatically together with the dSPACE software.

### C/C++ Compiler for VEOS

You must install one of the following C/C++ compilers to build software-in-the-loop (SIL) simulation applications:

- Microsoft Visual C/C++ Compiler as in Visual Studio 2017 and 2019. Enterprise, Professional, Build Tools, and Community editions of this version are also supported.
- C/C++ Compiler of the GNU Compiler Collection (GCC). The GCC Ver. 5.2 is shipped with the dSPACE software and installed automatically.
- C/C++ Cross Compiler for Linux of the GNU Compiler Collection (GCC). The GCC Ver. 5.5 is shipped with the dSPACE software and installed automatically.

### Third-Party Software for ControlDesk

- API and driver for CAN/LIN interfaces from Vector Informatik GmbH  
To use CAN/LIN interfaces from Vector Informatik GmbH with ControlDesk, you need the appropriate API and driver:
  - API: XL Driver Library 9.7.26 or later (provided by the ControlDesk installation)
  - Driver: Vector Driver Ver. 9.8 or later. You need a driver version that is compatible with the API you use.  
Download the driver from <https://www.vector-informatik.de>.
- Driver for CAN/LIN Interfaces from Kvaser  
To use Kvaser CAN/LIN interfaces with ControlDesk, you need the appropriate Kvaser driver: Kvaser CAN Ver. 5.17 or later, or Kvaser LIN Ver. 5.17 or later. Download it from <https://www.kvaser.com>.

### Third-Party Software for SYNECT and SYNECT Server

- Compatible third party software for SYNECT:
  - Microsoft Office Version 2013, 2016, 365: To import items such as test cases from Excel files.
  - MATLAB (for compatible versions refer to SYNECT documentation): To open and execute Simulink models, to import and export Simulink model files.
  - IronPython 2.7 (64-bit): To program server scripts.
  - Apache™ Subversion® 1.7 ... 1.14, or PTC® Integrity 10, or Azure DevOps Server 2019: To connect SYNECT with a configuration management (CM) system
- Supported databases for SYNECT Server:
  - Microsoft SQL Server 2014, 2016, 2017, 2019 (recommended for production servers)
  - Microsoft SQL Server 2019 Express is provided by the dSPACE Setup and can be used for development.

### Third-Party Software for the FPGA Programming Blockset

Working with the FPGA Programming Blockset requires the following products of the Xilinx® Vivado® Design Suite version 2022.1:

- Xilinx Vivado for designing, simulating, and building the FPGA application.
- Xilinx Vitis Model Composer (includes the former Xilinx System Generator for DSP Blockset (XSG)) for modeling FPGA applications with Simulink. As of Vivado 2021.1 the Xilinx System Generator for DSP is part of the Vitis Model Composer. This is the unified Xilinx add-on for Matlab and Simulink. For licensing issues related to this change, refer to <https://xilinx.com/support/answers/76039.html>.

The Windows Server operating systems are not officially supported by Xilinx Vivado, but tested by dSPACE.

### Required Browser Software

The dSPACE products of dSPACE Release 2022-B support the following browsers:

- Google Chrome released in the stable channel, starting with version 104.0, which dSPACE used for testing. The compatibility statement of Google applies. According to Google, later versions released in this channel will be compatible with all previous versions.
- Mozilla Firefox released in the release or ESR channel, starting with version 102.1.0, which dSPACE used for testing. The compatibility statement of Mozilla applies. According to Mozilla, later versions released in this channel will be compatible with all previous versions.
- Microsoft Edge released in the stable channel, starting with version 104.0, which dSPACE used for testing. The compatibility statement of Microsoft applies. According to Microsoft, later versions released in this channel will be compatible with all previous versions.

### C Compiler for TargetLink

You must install one of the following C compilers to build MATLAB MEX files and software-in-the-loop (SIL) simulation applications:

- Microsoft Visual Studio C/C++ Professional/Enterprise 2015 (Ver. 14.0), 2017 (Ver. 15.0), 2019 (Ver. 16.0), or 2022 (Ver. 17.0) for MATLAB R2021a, R2021b, R2022a, and R2022b.
- MinGW (GNU Compiler Collection (GCC 6.3.0)) for MATLAB R2021a, R2021b, R2022a, and R2022b.

The LCC compiler cannot be used to build 64-bit MEX files, because the shipped LCC-Win64 compiler does not support building MEX files or S-functions. For a list of supported compilers, refer to <https://www.mathworks.com/support/requirements/supported-compilers.html>.

- A target-specific compiler has to be available (see table below)
- If your target is not listed here, refer to the TargetLink PIL Support website at <https://www.dspace.com/go/tpil>

Processor-in-the-Loop (PIL) Simulation:

- An evaluation board (EVB) has to be available (see table below)

Compatible Evaluation Boards for PIL Simulation in TargetLink	Compatible TargetLink Compilers
Emerge-Engineering ARM MEDKit	Keil 5.2
Lauterbach Simulator for ARM CortexM3 <sup>1)</sup>	Keil 5.2
Freescale MPC5748GEVB	Green Hills 2022
	Wind River Diab 5.9
Freescale EVB9S12XEP100	Cosmic 4.8
	Metrowerks CodeWarrior 5.1
I+ME Promotion Package 166	Altium TASKING C166/ST10 Toolset 8.6
Infineon TriBoard TriCore 1766	Altium TASKING TriCore VX-Toolset 3.2
Infineon TriBoard TriCore 1766 20 MHz	Altium TASKING TriCore VX-Toolset 3.2
Infineon TriBoard TriCore 1767	Altium TASKING TriCore VX-Toolset 3.2
Infineon TriBoard TriCore 1796	Altium TASKING TriCore VX-Toolset 3.2
Infineon TriBoard TriCore 275	Altium TASKING TriCore VX-Toolset 6.3
	HighTec GNU 4.9
Lauterbach Simulator for TriCore 275 <sup>1)</sup>	Altium TASKING TriCore VX-Toolset 4.2
Infineon EasyKit XC2287	Altium TASKING C166/ST10 VX-Toolset 3.0
Renesas YRH850F1L_R7F7010354	Green Hills 2021
Renesas EVB7058	Renesas 9.3
Renesas SH72513 System Development Kit	Renesas 9.4
Renesas AB_050_Fx4_70F4012	Green Hills 2022
Texas Instruments LAUNCHXL2570LC43	Texas Instruments Code Composer Studio 7.0

<sup>1)</sup> The instruction set simulators are not supplied by dSPACE and have to be obtained from their respective providers.

## Expansion Box Requirements

### Connecting an Expansion Box and Host PC via Bus Connection

- The DS814 Link Board has to be installed in the expansion box.
- The DS817, DS819, or DS821 Link Board has to be installed in the host PC.

### Connecting an Expansion Box and Host PC via Ethernet

- Valid for DS1006 systems: A slot CPU with an integrated network adapter has to be installed in the expansion box.
- Valid for DS1007 systems: The DS1007 provides an onboard Ethernet interface to connect the system installed in the expansion box to the host PC via Ethernet.
- The host PC must have a 10BASE-T (twisted pair, 10 Mbit/s or faster) network adapter. 10BASE-T: Adapted and reprinted with permission from IEEE. Copyright IEEE 2018. All rights reserved.

### Required Slots

- To install a modular system based on DS1006, or DS1007, you need as many free slots in the box as the number of boards you want to install. Note that the DS2210 requires two adjacent brackets altogether. The DS5203 requires two adjacent brackets, if the DS5203M1 I/O modules are installed. The DS2202, DS2211, DS4003, and DS4004 each require a total of three adjacent brackets.
- Valid for DS1006: One free full-size ISA slot is required either by the DS814 (bus connection) or the slot CPU (Ethernet connection).
- The DS1006 has special slot requirements to ensure proper cooling of the AMD Opteron™ processor:
  - In a PX20, the slot requirement depends on the board revision: Up to board revision DS1006-03, each DS1006 requires four slots (including one slot for the DS814 Link Board or the slot CPU). As of board revision DS1006-06, each DS1006 requires three slots. However, none of the slots can be used for the DS814 Link Board or the slot CPU.
  - In a PX10, the DS1006 requires either two slots (with Gigalink module) or one slot (without Gigalink module), if installed next to the box's power supply (recommended).

## Installing a DS1006 in an Expansion Box

- The DS1006-based modular system must be installed in a PX10 or PX20 Expansion Box. PX10 supports one, PX20 up to two DS1006 boards.
- The expansion boxes need special power supplies and connectors which meet the DS1006 requirements. For information on whether your existing expansion box meets these requirements, refer to <https://www.dspace.com/go/pxboxvers>.
- You cannot insert a DS1006 in a PX4 Expansion Box, or an AutoBox/Tandem-AutoBox.

## Installing DS1007 in an Expansion Box

- The DS1007-based modular system can be installed in a PX10 or PX20 Expansion Box or in an AutoBox/Tandem-AutoBox. PX10 and AutoBox support one, PX20 and Tandem-AutoBox support up to two DS1007.
- You cannot insert a DS1007 in a PX4 Expansion Box.

## 3-D Online Animation via MotionDesk

For 3-D online animation via MotionDesk, your system has to meet additional requirements. They are also listed at <https://www.dspace.com/go/mdhwrequ>.

### Software Requirements

- The latest driver for the graphics adapter must be installed. This driver must support OpenGL Ver. 4.2.

### Hardware Requirements

- At least any x86-64 processor with AVX2 instruction set support, 8 GB RAM is required (32 GB RAM or more is recommended).
- At least 8 GB of free disk space for the initial installation.
- For a multi-PC solution with DS1006 (not possible for MicroAutoBox II), you need additional hardware (not required for DS1007, MicroLabBox, MicroAutoBox III, SCALEXIO systems, VEOS): a MotionDesk Multi-PC Interface Kit for the simulator and an Ethernet card (10 Mbit/s or faster) for each connected MotionDesk PC.
- For a Simulink simulation, the Simulation PC and each connected MotionDesk PC must have at least a 10 Mbit/s Ethernet card. If simulation and visualization run on the same PC, one 10 Mbit/s Ethernet card is sufficient for that PC.

### Graphics Card Specification

- Type: NVIDIA® graphics accelerator (OpenGL-compliant)
- Supported cards: NVIDIA Quadro; NVIDIA GeForce RTX family; NVIDIA GeForce GTX family higher than GeForce GTX 285; NVIDIA GeForce GTX Ti family, NVIDIA GeForce Titan family.
- Limited supported cards: Quadro FX, Intel graphics accelerators as of Intel HD Graphics 530 or faster. Limited support means comprehensive functionality is not tested and therefore not guaranteed.
- Unsupported cards: NVIDIA Quadro NVS, NVIDIA GeForce GT family, GTS family, ATI/AMD graphics accelerators, Intel graphics accelerators earlier than Intel HD Graphics 530.
- Graphics memory: At least 2 GB RAM. Recommended: at least 8 GB RAM and two output channels (one output channel to display MotionDesk, the other one to display ModelDesk, ControlDesk, or MATLAB).

## Additional Requirements for Notebooks

- MotionDesk has high requirements with regard to graphic performance and driver quality. In some cases MotionDesk will not operate properly on notebooks.
- The notebook should be equipped with a supported NVIDIA graphics accelerator (see list above).
- MotionDesk requires the NVIDIA GPU to be selected as the rendering GPU. This setting can be done in the NVIDIAControl Panel (on the Manage 3D Settings page).

## Onboard Graphic Adapters

dSPACE does not guarantee that MotionDesk runs on computers with onboard graphic adapters for the following reasons:

- The specialized onboard graphics processing units often behave differently from high-end graphics cards.
- Even if the technical specifications of these processing units match the formal requirements, drivers are often not stable enough to satisfy the requirements of 3-D real-time applications.

For trouble-free operation, the NVIDIA graphics accelerator must be the only active graphics accelerator.

## Using Sensor Simulation

You can use the SensorSim application with SCALEXIO systems or VEOS for sensor simulation. In these cases, your system must meet the following additional requirements. They are also listed at <http://www.dspace.com/go/sensimhwrequ>.

### Software Requirements

The latest driver for the graphics adapter must be installed.

### Hardware Requirements

dSPACE Sensor Simulation PC (recommended) with the following configuration:

- Intel Xeon E3-1275v6 (3.8 GHz)
- 4 cores
- 32 GB RAM
- 480 GB SSD

The graphics card (NVIDIA Quadro RTX 6000) can be ordered separately.

### Supported Environments

- The SensorSim application supports only NVIDIA® graphics cards.
- The SensorSim application supports only the Microsoft® Windows® operating system.

## Resource Requirements of dSPACE Boards

dSPACE boards require different resources in the host PC and the expansion box, depending on the installation.

### Installation in the Host PC

The following table lists the required I/O address ranges together with the default addresses and the required memory of dSPACE boards, when installed in the host PC. Some dSPACE boards support plug & play, in which case they require an interrupt request line (IRQ). However, the boards operate correctly even if no free IRQ is available.

Board	Slot Type	Required I/O Address Range	Default I/O Base Address	Required Memory Range	Required IRQ
DS1104	PCI	None	None	Two 4 KB blocks (Plug & play)	1 (PCI)
DS1104 (PCIe variant)	PCIe	None	None	Two 4 KB blocks (Plug & play)	1 (PCIe)
DS817	PCI	10H	Plug & play	None	1 (PCI)
DS819	PCI Express	10H	Plug & play	None	1 (PCI Express)
DS821	Express Card	10H	Plug & play	None	1 (PCI Express)

### Installation in the Expansion Box

When installed in an expansion box, dSPACE boards require the following resources in the expansion box:

Board	Required I/O Address Range	Default I/O Base Address
DS1006 up to board revision DS1006-03	10H	300H
DS1006 as of board revision DS1006-06 (multicore processor board)	40H	300H
DS2302	10H	380H

The DS1007 PPC Processor Board does not need any resources in the expansion box.

### **Connection via DS817, DS819, or DS821 Link Board**

The Link Boards require the following resources in the host PC:

Required I/O Address Range	Default I/O Base Address	Required Memory Range	Required IRQ	
10H	Plug & play	None	1	PCI for DS817 PCI Express for DS819/DS821

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