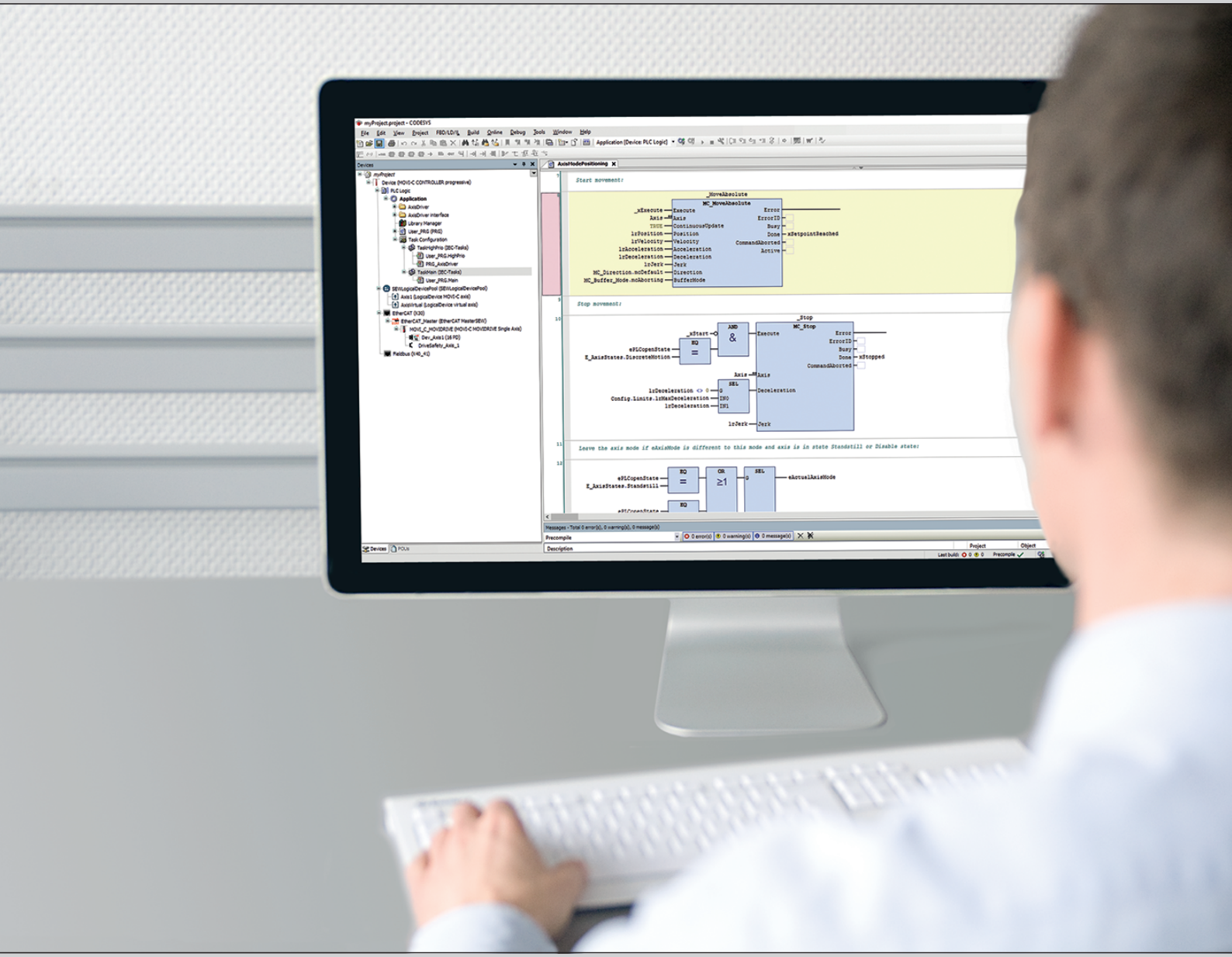
SEW EURODRIVE

Manual



Software Platform
MOVIRUN® open

Edition 12/2022

27795004/EN

Table of contents

27795004/EN – 12/2022

27795004/EN – 12/2022

1 General information

1.1 About this documentation

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure that this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work with the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

1.2 Content of the documentation

The descriptions in this documentation refer to the software and firmware versions at the time of publication. These descriptions might differ if you install later software or firmware versions. In this case, contact SEW-EURODRIVE.

You can always find the latest version of the documentation in Online Support on the website of SEW-EURODRIVE.

1.3 Structure of the warning notes

1.3.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes:

Signal word	Meaning	Consequences if disregarded
⚠ **DANGER**	Imminent hazard	Severe or fatal injuries
⚠ **WARNING**	Possible dangerous situation	Severe or fatal injuries
⚠ **CAUTION**	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment
INFORMATION	Useful information or tip: Simplifies handling of the product.	

1.3.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

27795004/EN – 12/2022

Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard

1.3.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

⚠ **SIGNAL WORD!** Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

1.4 Decimal separator in numerical values

In this document, a period is used to indicate the decimal separator.

Example: 30.5 kg

1.5 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

1.6 Product names and trademarks

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.6.1 Trademark of Beckhoff Automation GmbH

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.7 Copyright notice

27795004/EN – 12/2022

1.8 Applicable documentation

For all other components, refer to the corresponding documentation.

Always use the latest edition of the documentation and the software.

The SEW-EURODRIVE website (www.sew-eurodrive.com) provides a wide selection of documents for download in various languages. If required, you can also order printed and bound copies of the documentation from SEW-EURODRIVE.

1.9 Short designation

The following short designations are used in this documentation:

Short designation	Description
Software	MOVIRUN® open

27795004/EN – 12/2022

2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Target group

Software specialist

Any work with the software may only be performed by a specialist with suitable training. A specialist in this context is someone who has the following qualifications:

- Appropriate training
- Knowledge of this documentation and other applicable documentation
- SEW-EURODRIVE recommends additional training for products that are operated using this software.

2.3 IT security

2.3.1 Contact

If you need support with the configuration, contact SEW-EURODRIVE Service. You can obtain information about current security-related issues by e-mail or on the Product Security Management website. There you will find various contact options for reporting security-related problems.

2.3.2 IT security of the product

The product has no access levels.

The IT security of the product is only guaranteed when used in an environment secured by defense-in-depth strategies.

2.3.3 IT security of the environment

For drive and control components that are integrated in a network (e.g. fieldbus or Ethernet network), settings can even be made from more remote locations. There is a risk that a change of parameters that cannot be detected externally may result in unexpected, but not uncontrolled, system behavior and may have a negative impact on operational safety, system availability, or data security.

Ensure that unauthorized access is prevented, particularly with respect to Ethernet-based networked systems and engineering interfaces. Using IT-specific security standards, such as network segmentation, adds to the protection of access to the ports. A port overview and an overview of the provided services of the communication interfaces can be found in the documentation of the software. The IT security of the product is only guaranteed when used in an environment secured by defense-in-depth strategies.

Ensure that clear responsibility for security is ensured during operation. SEW-EURODRIVE recommends an IT security management system in accordance with ISO/IEC 27001 and ISO/IEC 62443-2-4.

27795004/EN – 12/2022

2.3.4 Hardening measures

Perform the following hardening measures:

- Regularly check if updates are available for your products.
- Report incidents concerning IT security by e-mail to cert@sew-eurodrive.com.
- Regularly check which Security Advisories are available in the Online Support of SEW-EURODRIVE.
- Evaluate the error memories and diagnostics information of your products regularly and check whether there are entries that affect IT security.

2.4 Designated use

MOVIRUN® open is the open automation platform for MOVI-C® components and third-party components. MOVIRUN® open offers full flexibility in managing MOVIKIT® software modules and allows applications to be programmed in a programming tool based on IEC 61131-3 and PLCopen.

Use the device-independent MOVISUITE® engineering software to start up and configure the axes and to download the complete configuration to a MOVI-C® CONTROLLER.

Observe the documentation for the components used.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

27795004/EN – 12/2022

3 Project planning information

3.1 General

Correct project planning and proper installation of the components is required for successful startup and operation.

For detailed project planning information, refer to the documentation of the respective components.

3.2 Hardware

The following hardware is required:

- MOVI-C® CONTROLLER (all performance classes)

3.3 Software

The following software is required:

- MOVISUITE® engineering software

  Available as a download from Online Support on the SEW-EURODRIVE website. For more detailed information regarding the hardware requirements, refer to the associated documentation.

- "MOVIRUN_open x.x.x.x.exe" installation package

  Available as a download from Online Support on the SEW-EURODRIVE website.

For more detailed information on the hardware requirements of the individual software components, see the documentation for the respective software.

3.4 Licensing

The following licenses are available or are required. The license is activated in MOVISUITE®.

- MOVIRUN® flexible – License for the MOVIRUN® open software platform for the following controllers:
  - MOVI-C® CONTROLLER UHX25A - SMR0001-020
  - MOVI-C® CONTROLLER UHX45A - SMR0001-040
  - MOVI-C® CONTROLLER UHX65A - SMR0001-060
  - MOVI-C® CONTROLLER UHX85A - SMR0001-080

For more information on licensing, refer to the documents "MOVIKIT® Licensing" and "MOVI-C® Software Components". You can download the documents from the SEW-EURODRIVE website (www.sew-eurodrive.com).

27795004/EN – 12/2022

4 System description

4.1 MOVIRUN® software platform

MOVIRUN® is the software platform for MOVI-C® CONTROLLER and the basis for using MOVIKIT® software modules. The software platform determines whether the MOVIKIT® software modules can be used as a purely parameterizable function with fieldbus interface or with programming interface, e.g. according to the "PLCopen" standard.

- MOVIRUN® smart (in preparation)

  Platform for purely parameterizable utilization of MOVIKIT® software modules. A wide range of motion control functions is available via a fieldbus interface without further programming of the MOVI-C® CONTROLLER.

- MOVIRUN® flexible

  Extension of MOVIRUN® smart to include a modern programming system based on IEC 61131-3. This makes it easy to add customer-specific additions and extensions.

- MOVIRUN® open

  The open automation platform for MOVI-C® components and third-party components. MOVIRUN® open offers full flexibility in managing MOVIKIT® software modules and allows customer applications to be programmed in a programming tool based on IEC 61131-3 and the "PLCopen" standard.

4.1.1 MOVIRUN® open

MOVIRUN® open is the software platform for motion control and automation solutions specifically for users who want to use more movements on the MOVI-C® CONTROLLER than just the parameterizable movements from SEW-EURODRIVE. In this way, the MOVI-C® CONTROLLER becomes a value-added platform for customers' own software know-how.

The CODESYS based MOVIRUN® open Editor supports programmers in the entire engineering process. Everything from selecting and configuring software functions to creating the program and testing it in simulation or with real hardware is done in one tool. Many software functions of the MOVIKIT® software modules (e.g. gearing, electronic cam, cam) can be easily integrated and controlled via standardized PLCopen modules. Configuring and operating numerous interfaces such as PROFINET master, OPC-UA or EtherCAT® as well as creating visualizations (either as web visualization on the MOVI-C® CONTROLLER or stand-alone on a Windows operating system) also takes place in this programming environment.

CODESYS also offers numerous add-ons, such as source code management, test manager, and static code analysis that optimally support the programmer in the software development process.

27795004/EN – 12/2022

4.2 Functions

Overview of functions:

- Selection, configuration, and programming of software in one tool.
- Simple connection of automation components by supporting various interfaces, such as EtherCAT® and PROFINET.
- Connection to higher-level systems via conventional fieldbus interfaces or OPC UA.
- Integrated visualization system as web visualization or stand-alone installation.
- State-of-the-art programming system according to IEC 61131 for creating modular, reusable software.
- MOVIKIT® software modules with standardized PLCopen interface.
- PackML-compliant automation framework with machine modules.
- Axis driver sample program for simple control of axes.
- Support of many CODESYS add-ons for professional software development (source code management, test manager, code analysis).

27795004/EN – 12/2022

5 Installation

MOVIRUN® open is installed as an extension of a CODESYS 64-bit installation (version 3.5.17.20 or later). Proceed as follows:

✓ CODESYS version 3.5.17.20 (64-bit) or later is installed.

✓ The installation package `MOVIRUN_open x.x.x.x.exe` has been downloaded from Online-Support on the SEW website and is available on the engineering PC.

✓ CODESYS and MOVISUITE® are closed.

1. Start installing the installation package `MOVIRUN_open x.x.x.x.exe` with administrator rights (select "Run as administrator" from the context menu of the file).
2. Follow the instructions of the installation wizard.

⇨ The installation of MOVIRUN® open is complete. The installation includes all extensions for MOVIRUN® open and the MOVIKIT® PLCopen MotionControl software module.

27795004/EN – 12/2022

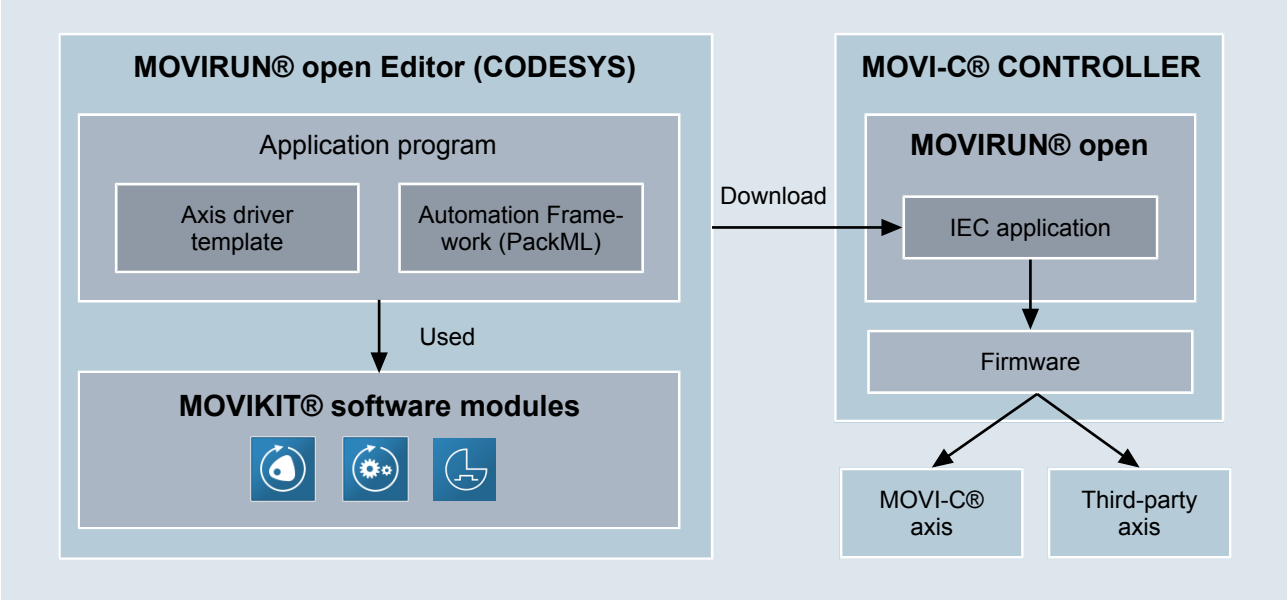
6 Functional description

6.1 Functional principle

Users can use the CODESYS programming system (MOVIRUN® open Editor) to program the MOVI-C® CONTROLLER. The programming system manages and configures software functions, libraries and devices, and creates the application. Various templates, such as the PackML-compliant automation framework or the axis driver program example, make it easier to start creating applications.

The MOVIKIT® software modules are also available in the programming environment. These can be used in the user program to implement complex motion and automation tasks. Some of the software modules have so-called logical devices that can be used for graphical configuration, diagnostics, and manual operation of the corresponding functions. The MOVIKIT® software modules are operated via a PLCopen-compliant interface.

Hardware is integrated into the project automatically by scanning the EtherCAT® system bus or manually via the device catalog. The connection between logical devices that represent the software functions and hardware on the system bus is also made in the programming system. The strict separation between logical devices and real hardware enables hardware-independent software to be developed and the application to be quickly adapted to different hardware configurations.

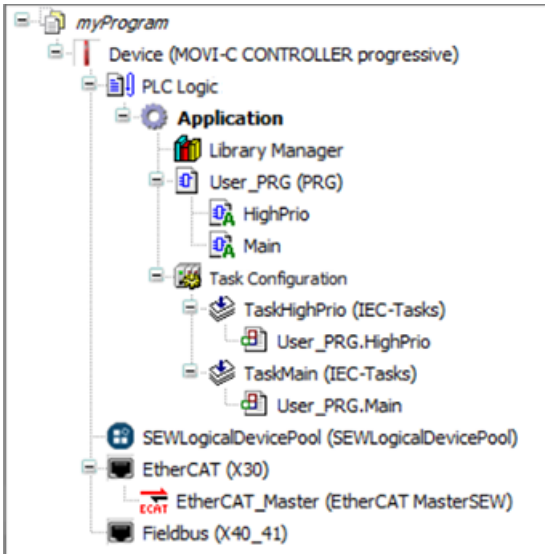


39643796619

27795004/EN – 12/2022

6.2 Project structure

IEC projects created with MOVIRUN® open have the following structure:



39044762251

Component	Description
Device	Selected MOVI-C® CONTROLLER
PLC logic	IEC application
Library Manager	Library manager for adding new libraries or searching for blocks.
User_PRG	Main program with the two actions *HighPrio* and *Main*. The program is created in the previously selected programming language.
Task configuration	Task configuration with the two tasks *HighPrio* and *Main*. The MotionControl core is added automatically to the *HighPrio* task. PLCopen blocks must be processed in the *HighPrio* task.
SEWLogicalDevicePool	SEWLogicalDevicePool for inserting logical devices (e.g. MOVIKIT® software modules).
EtherCAT_Master	Insert devices via scan or manually.
Fieldbus	Activate fieldbus slave connection of the MOVI-C® CONTROLLER.

27795004/EN – 12/2022

6.3 Logical devices

Many MOVIKIT® software modules are represented in MOVIRUN® open by so-called logical devices. The respective software functions of the software module are encapsulated in these logical devices and are available to the programmer for easy access and use in the programming environment. Especially in the field of motion control, these logical devices serve to simplify the handling and, above all, the configuration of axes and additional motion control functionalities. For example, many of the logical devices offer graphical user interfaces for configuring the settings or diagnosing the function.

For instructions on adding logical devices, refer to chapter "Inserting logical devices" (→ 🗎 38).

Overview of the features of logical devices:

- Logical devices represent a software object in the controller.
- A logical device represents one MOVIKIT® software module each.
- Logical devices provide graphical user interfaces in CODESYS.
- Logical devices ensure a simple connection of the drives and the periphery.
- The name of a logical device is used to ensure a simple and standardized application of the motion control functionalities in the user program as an axis reference for the "PLCopen" function blocks.

27795004/EN – 12/2022

6.4 Devices (hardware)

The hardware used is mapped in the IEC project in the device tree. To display these devices, first add them to the IEC project. For instructions on adding devices, refer to chapter "Inserting devices and connecting them to logical devices" (→ 🗎 45).

6.4.1 Structure of devices

Devices are displayed in CODESYS below the "EtherCAT_Master" object in the device tree. A device consists of the device object (in the example: MOVI_C_MOVIDRIVE (MOV-C MOVIDRIVE SingleAxis)) and 2 to 4 device slots subordinate to the object in the device tree.

Slot1 (in the example: Standard_16_PD) represents the standard process data of the device. This device slot can be connected to a logical device. Slot2 (in the example: Container_PROFIsafe) represents the safety process data area. If a safety option card is installed in the MOVI-C® inverter, a safety routing component can be plugged into the second slot.

The MOVI-C® single axis (system or modular) has a standard slot and a safety process data slot. Accordingly, the MOVI-C® double-axis has 2 standard slots and 2 safety slots. The following figure shows the structure of a single axis and of a double axis:

39642381323

27795004/EN – 12/2022

6.4.2 Designation of devices

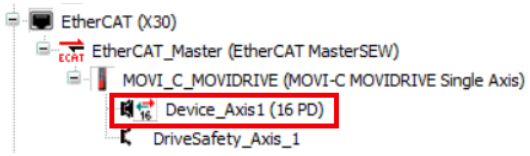
A name can be assigned to both the device and its standard process data slots. The names for the safety slots are assigned automatically and cannot be changed.

Since devices are located directly below the EtherCAT® bus and the name of the devices is no longer used, it is recommended to use the device type (e.g. "MOVI_C_MOVIDRIVE") as the name for the devices.

Since the standard process data slot represents the actual drive on the inverter, we recommend assigning a unique name.

If you want to use the automatic axis replacement function in the event of an inverter replacement, the name of the standard process data slot must be identical to the name of the device in MOVISUITE®.

Devices (device slot 1) in CODESYS



Devices in MOVISUITE®

39542464779

6.5 Device connections

A connection can be established between the real devices added in the IEC project and logical devices.

6.5.1 Overview of connections

For an overview of which logical devices are connected to real devices on EtherCAT®, refer to the configuration of the MOVI-C® CONTROLLER in the "Links" tab. The table displayed there shows the name and type of the logical device and the associated real device.

6.5.2 Establishing a connection

To connect a logical device to a real device, proceed as follows:

1. Open the context menu of Slot1 (non-safe process data slot) of the corresponding device or the context menu of a logical device.
2. Click the [Link device] menu item to check whether there is a matching logical device for the selected slot. Only this device is then offered for connection. Click [Link to any device] to display all available devices. The [Link to any device] function is used to connect CiA402 axes.
3. In the menu, click [Build] > [Rebuild] to update the display of the connections.
   ⇨ The connection from real device to logical device has been established.

6.5.3 Disconnecting a connection

INFORMATION

If a device on the EtherCAT® or a logical device is deleted, the connection is also automatically disconnected.

To disconnect existing connections from logical devices to real devices, proceed as follows:

Disconnecting a device

1. Open the context menu of Slot1 (non-safe process data slot) of the corresponding device or the context menu of a logical device.
2. Click the [Unlink device] menu item.
3. In the menu, click [Build] > [Rebuild] to update the display of the connections.
   ⇨ The connection from real device to logical device has been disconnected.

Disconnecting all devices

4. Open the context menu of the "SEWLogicalDevicePool".
5. Click the [Unlink all physical/logical devices] menu item.
   ⇨ The connections of all real devices to logical devices have been disconnected.

27795004/EN – 12/2022

6.6 Axis driver template

INFORMATION

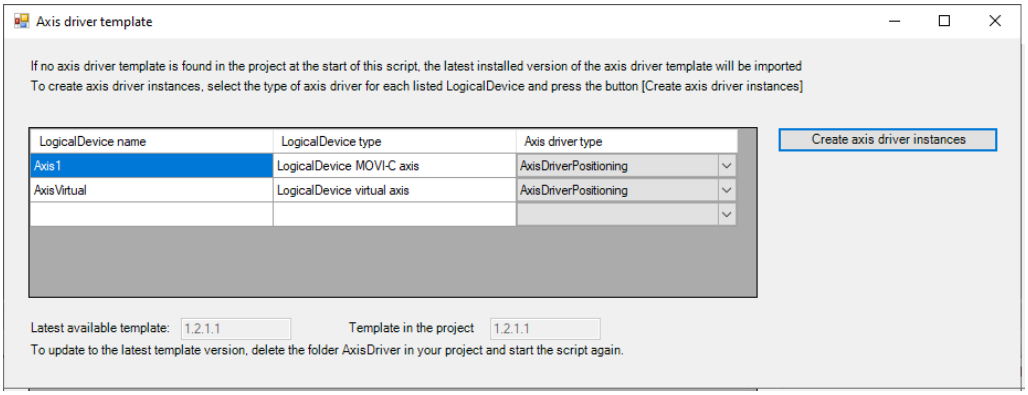
The axis driver template is a special and free service that demonstrates only the basic approach to generating an axis driver module. SEW-EURODRIVE is not liable for the content and function of the sample code or any damage caused by it. A detailed description of the axis driver functions as well as the interface elements can be found in the comments of the axis driver source code.

MOVIRUN® open provides an axis driver template to facilitate the control of axes. The axis driver template is included in the installation of MOVIRUN® open, but can also be installed separately. The axis driver template is a sample code that represents the essential functions of an axis. This sample code serves as an interface to the axis and can be operated in the user program.

6.6.1 Integrating the axis driver template

The template is integrated using a CODESYS script. The script is installed with the axis driver template. To integrate the template, proceed as follows:

1. Open the context menu of the "Application" object in the device tree.
2. Select the menu item [Scripting] > [Scripts] > [T] > [Template_PLCopen_AxisDriver.py].
   ⇨ If there is no axis driver template in the project yet (no folder with the name "AxisDriver"), then the latest version installed on the computer is imported when the script is started.
   ⇨ The "Axis driver template" dialog is displayed. The dialog lists all logical devices that can be used with the axis driver template.



39123422347

3. Select the appropriate axis driver type for the axes. The following axis drivers are available in the template:

Axis driver type	Description
AxisDriverBasic	Basic functions of an axis, such as enable axis and acknowledge fault as well as the output of actual values such as ActualVelocity, ActualPosition, etc. This axis driver type does not contain any motion commands. Use this axis driver type if you want to execute the motion commands in the program directly via PLCopen function blocks.

27795004/EN – 12/2022

Axis driver type	Description
AxisDriverPositioning	In addition to AxisDriverBasic, this axis driver type includes operating modes for jogging, speed control, referencing, and positioning.
AxisDriverGearing	In addition to AxisDriverPositioning, this axis driver type contains the operating modes for synchronous operation.
AxisDriverCamming	In addition to AxisDriverGearing, this axis driver type contains the operating modes for the cams.

4. Click [Create axis driver instances].

The following actions are performed by the script:

- A folder with the name "AxisDriver interfaces" is created.
- In this folder, a program named "PRG_AxisDriver" is created by creating an instance of the selected axis driver and a block call with the respective name of the logical device for each logical device.

```
PRG_AxisDriver
PROGRAM PRG_AxisDriver
VAR
    Axis1_AxCtrl : AxisDriverPositioning;
    AxisVirtual_AxCtrl : AxisDriverPositioning;
END_VAR
```

```
    // AixsDriver Axis1
    AxisInterface[1].In.Axis REF= Axis1;
    Axis1_AxCtrl(
                    xInhibit            := AxisInterface[1].In.xInhibit,
                    xEnable_Stop        := AxisInterface[1].In.xEnable_Stop,
                    xEnable_RapidStop   := AxisInterface[1].In.xEnable_RapidStop ,
                    xReset              := AxisInterface[1].In.xReset ,
                    eAxisMode           := AxisInterface[1].In.eAxisMode,
                    xStart              := AxisInterface[1].In.xStart,
```

39123424523

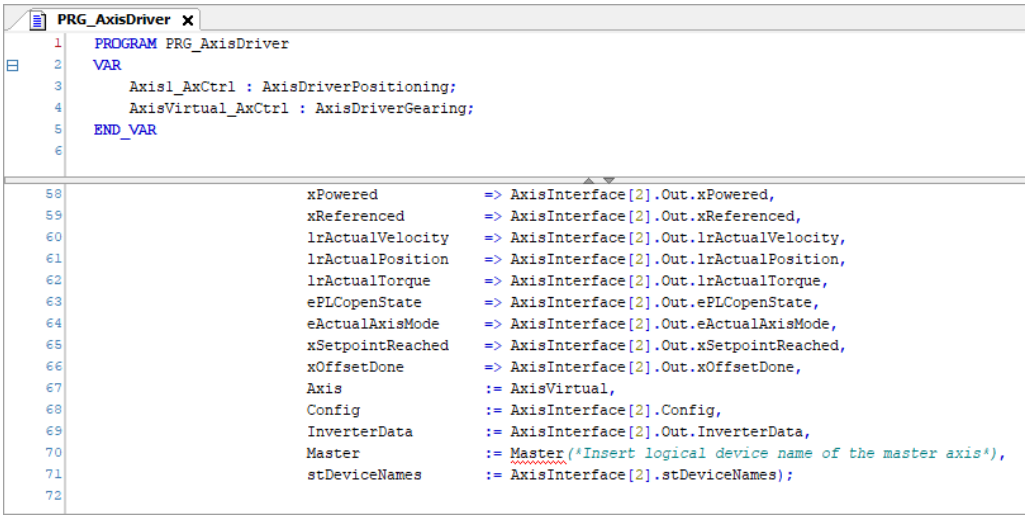
- A global variable list with the name "GVL_AxisDriver" is created. An ARRAY of the type *ST_AxisInterface* is created here. The size of the array corresponds to the number of instances of axis drivers.

```
GVL_AxisDriver
VAR_GLOBAL
    // AxisDriver version: 1.2.1.1
    AxisInterface : ARRAY[1..2] OF ST_AxisInterface;
END_VAR
```

39123426699

- The created "PRG_AxisDriver" program is added to the *TaskHighPrio*.

5. If you use the axis driver "AxisDriverGearing" or "AxisDriverCamming", you must still enter the corresponding master axis (name of the logical device of the master axis) in the "PRG_AxisDriver".



39123429259

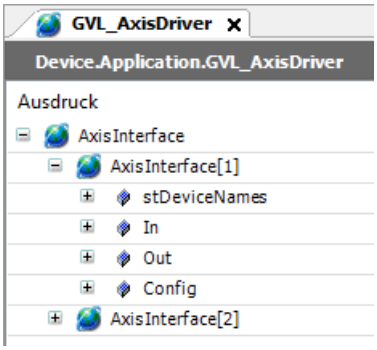
⇨ The axis driver template is now ready to run.

27795004/EN – 12/2022

6.6.2 Axis driver interface

The axis driver can be operated either directly via the inputs/outputs or via the global variable interface. By default, the global variable *AxisInterface[x]* is linked to the inputs and outputs of the axis driver module.

IEC interface



39123432459

- **AxisInterface[].stDeviceNames**

  In this structure, there are two string variables containing the name of the logical device (*stLogicalDeviceName*) and the associated real device (*stPhysicalDeviceSlotName*). These two variables are for diagnostic purposes only and should not be copied and used further due to the size of the string variables. For simulated and virtual axes, the variable *stPhysicalDeviceSlotName* has the value "Simulated".
- **AxisInterface[].In**

  This structure contains the control variables for the axis.
- **AxisInterface[].Out**

  This structure contains the status and actual values of the axis.
- **AxisInterface[].Config**

  This structure contains configuration values of the axis and the various modes.

7 MOVIKIT® PLCopen MotionControl

MOVIKIT® PLCopen MotionControl is used in the application example to explain the function of MOVIRUN® open in chapter "Startup" (→ 🗎 35). This is where you will find more information to enhance understanding.

MOVIKIT® PLCopen MotionControl provides single-axis motion control functions according to the "PLCopen" standard with profile generation on the MOVI-C® CONTROLLER or in the inverter.

7.1 Licensing

The following licenses are available or are required. The license is activated in MOVISUITE®. **NOTE:** xxx stands for the performance class (020-080) of the MOVI-C® CONTROLLER used.

- MOVIKIT® PLCopen MotionControl add-on Gearing – SMK0016-xxx

  License for using the synchronous operation (gearing) function. The license check is performed in the "MC_GearIn" call.
- MOVIKIT® PLCopen MotionControl add-on Camming – SMK0017-xxx

  License for using the cam function. The license check is performed in the "MC_CamIn" call.
- MOVIKIT® CamSwitch – SMK0014-000

  License for using the cam controller function (MOVIKIT® CamSwitch) for position-dependent switching of digital outputs.

For more information on licensing, refer to the documents "MOVIKIT® Licensing" and "MOVI-C® Software Components". You can download the documents from the SEW-EURODRIVE website (www.sew-eurodrive.com).

7.2 Logical devices

MOVIKIT® PLCopen MotionControl provides logical devices for different axis types.

7.2.1 LogicalDevice MOVI-C axis

The logical device "LogicalDevice MOVI-C axis" represents an axis from the MOVI-C® modular automation system.

This axis is an interpolating axis in which setpoint generation is performed for the vast majority of PLCopen motion blocks on the MOVI-C® CONTROLLER. Only the following two exceptions use an inverter-based function:

- MC_Home: Uses inverter-based reference travel FCB 12. MOVI-C® CONTROLLER-based reference travel can be configured as an option.
- MC_TorqueControl: Uses the inverter-based function FCB 07.

7.2.2 LogicalDevice virtual axis

The logical device "LogicalDevice virtual axis" represents a virtual axis. The virtual axis always uses controller-based setpoint generation, i.e. referencing with MC_Home is also controller-based.

27795004/EN – 12/2022

7.2.3 LogicalDevice MOVI-C auxiliary axis (in preparation)

The logical device "LogicalDevice MOVI-C auxiliary axis" represents an axis from the MOVI-C® modular automation system.

This axis is a non-interpolating axis in which setpoint generation is performed for all PLCopen motion modules on the inverter.

- MC_Home: Uses inverter-based reference travel FCB 12. Controller-based reference travel can be configured as an option.
- MC_TorqueControl: Uses the inverter-based function FCB 07.
- MC_MoveVelocity: Uses the inverter-based function FCB 05.
- MC_MoveAbsolute / MC_MoveRelative / MC_MoveAdditive: Use the inverter-based function FCB 09.
- Synchronized movements (MC_GearIn / MC_CamIn) are not possible.
- Superimposed movements (MC_MoveSuperimposed) are not possible.

7.2.4 LogicalDevice CiA402 axis

The logical device "LogicalDevice CiA402 axis" represents any axis according to the CiA402 standard.

27795004/EN – 12/2022

7.3 Configuration

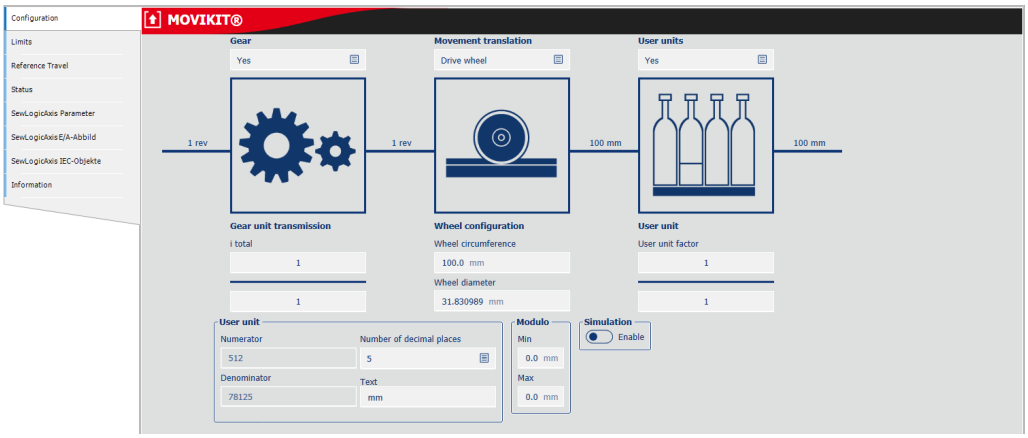
INFORMATION

After changing the configuration, an online change or the "Load all" command is requested the next time you log in. It is recommended to perform "Load all" because the new configuration values are only applied when the MOVI-C® CONTROLLER is started.

The software module is configured via various submenus in the configuration of the logical device in CODESYS. The tab is opened by double-clicking the logical device in the device tree.

7.3.1 Configuration

The "Configuration" configuration menu contains the following setting options:



39121850379

Parameter name	Description
Gear	Configure a gear unit for real axes. To do so, specify the gear unit ratio with numerator and denominator.
Movement translation	Configure an additional customer mechanics for real axes. • Not selected – No additional customer mechanics available. • Drive wheel – Specify the circumference or diameter of the drive wheel in [mm]. The other value is calculated automatically during input. • Toothed belt – Specify the pitch of the belt in [mm] and the number of teeth of the belt.

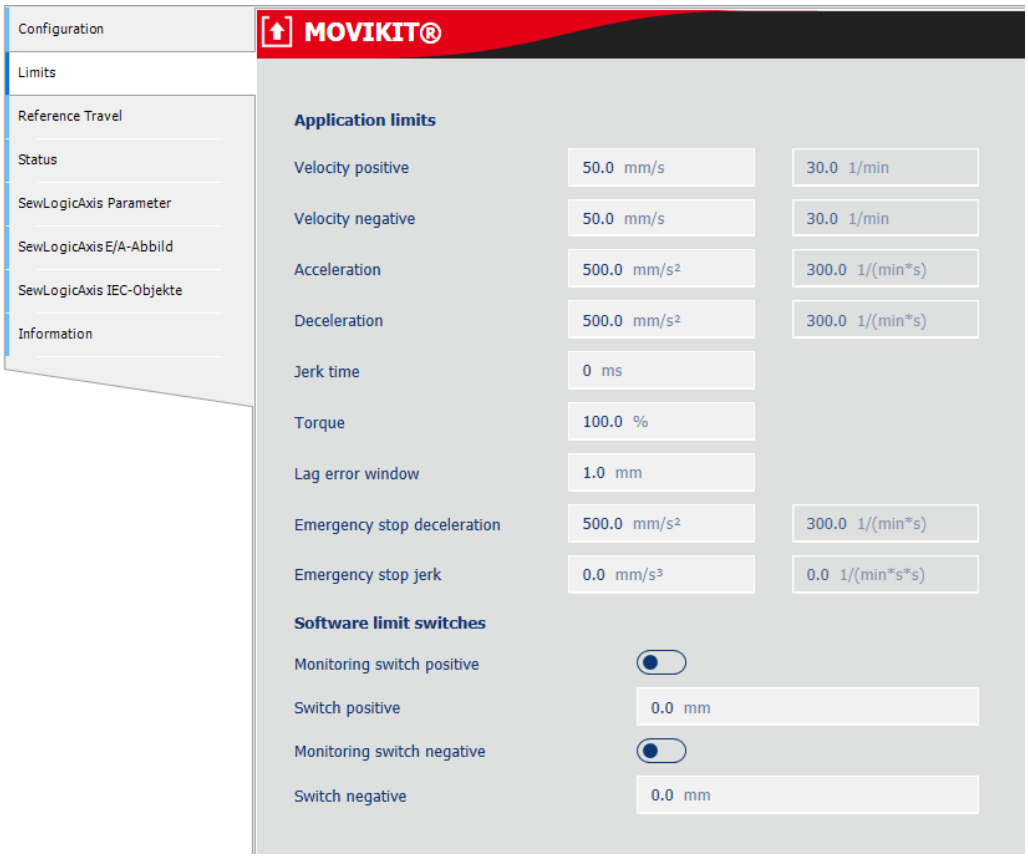
27795004/EN – 12/2022

Parameter name	Description
User units	Configure your customer-specific user units, for example [degrees]. • Numerator - denominator value for customer-specific user units for real axes. • Denominator – Denominator value for customer-specific user units for real axes. • Number of decimal places – Number of decimal places to be specified via the user program. **INFORMATION:** For the best possible resolution, the ratio between "Numerator" and "Denominator" should be < 1. If this is not the case, increase the number of decimal places. Increasing the decimal places reduces the maximum travel range. • Text – Text of the customer-specific user unit.
Modulo	Set the modulo limits for endlessly rotating axes: • Min – Lower limit value of the modulo positioning range in user units. • Max – Upper limit value of the modulo positioning range in user units.
Simulation	Activate the simulation of the logical device for real axes without inverter. **INFORMATION:** Not all signals and functions of the inverter can be simulated.

27795004/EN – 12/2022

7.3.2 Limits

The "Limits" configuration menu contains the following settings. Depending on the axis type (MOVI-C®, CiA402, etc.), these settings are partially transferred to the inverter.



39638866827

Parameter name	Description
Application limits	
Velocity positive	Maximum positive speed Is written to parameter 8357.10 for MOVI-C® axes.
Velocity negative	Maximum negative speed Is written to parameter 8357.11 for MOVI-C® axes.
Acceleration	Maximum acceleration Is written to parameter 8357.12 for MOVI-C® axes.
Deceleration	Maximum deceleration Is written to parameter 8357.13 for MOVI-C® axes.
Jerk time	Jerk time in [ms] of the MOVI-C® inverter Used for stop FCBs 13/14/15 and in the event of an inverter fault. Is written to parameter 8357.14 for MOVI-C® axes.
Torque	Maximum torque in % motor torque Is written to parameter 8357.15 for MOVI-C® axes.

27795004/EN – 12/2022

Parameter name	Description
Lag error window	Lag error window in user units Is written to parameter 8510.4 for MOVI-C® axes.
Emergency stop deceleration	Emergency stop deceleration in user units Is written to parameter 8357.20 for MOVI-C® axes.
Emergency stop jerk	Emergency stop jerk in user units
Software limit switches	
Monitoring switch positive	Activation of the positive software limit switches. The software limit switches are monitored in the controller.
Switch positive	Positive software limit switch
Monitoring switch negative	Activation of the negative software limit switches. The software limit switches are monitored in the controller.
Switch negative	Negative software limit switch

27795004/EN – 12/2022

7.3.3 Reference travel

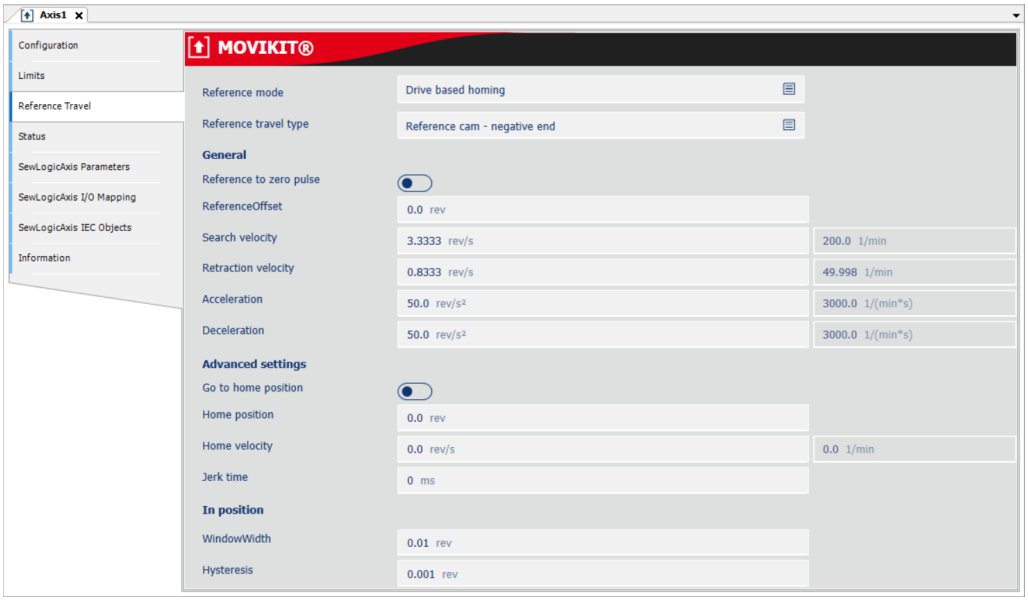
For referencing axes, a controller-based reference travel is available for all axis types (MOVI-C® axis, virtual axis, CiA402 axis). Reference travel is implemented via the MOVI-C® CONTROLLER. The inverter-based reference travel is available additionally for MOVI-C® axes. Inverter-based referencing uses the inverter function FCB 12 to reference the axis.

You can select from several reference travel types. All reference travel settings can also be specified from the application at any time using the *MC_SEW_ConfigHoming* function block. The settings in the logical device are transferred to the inverter when the MOVI-C® CONTROLLER is started.

For reference travel types with reference cams or limit switches, the sensors must be wired to the following inputs of the inverter:

- Reference cam – DI 03
- Negative limit switch – DI 04
- Positive limit switch – DI 05

The "Reference travel" configuration menu contains the following settings:



39122256139

Reference mode

Parameter name	Description
Controller based homing	Reference travel is implemented in the MOVI-C® CONTROLLER.
Drive based homing	When reference travel is performed via MC_Home, the inverter function "Reference travel" is executed. Currently, this operating mode is only supported by MOVI-C® axes.

27795004/EN – 12/2022

Reference travel type

Parameter name	Description
Deactivated	Reference travel is deactivated. Referencing is not possible.
Zero pulse – negative direction	Referencing is performed to the zero pulse (reference pulse of the encoder). The first search direction is negative. Reference point is the first zero pulse. A reference cam is not required.
Reference cam – negative end	Referencing is performed to the negative end of the reference cam. The first search direction is negative.
Reference cam – positive end	Referencing is performed to the positive end of the reference cam. The first search direction is positive.
Limit switch positive/negative	The reference point is at the end of the left/right limit switch.
Referencing without travel	With this reference travel type, the reference point is set at the current position of the drive. The drive does not perform any movement.
Reference cam flush – positive end	Referencing is performed to a reference cam. The reference cam must start just before or in line with the positive hardware limit switch and must project into the limit switch. Reference travel starts at search speed in positive direction. When the negative end of the reference cam is reached, the drive turns and leaves the reference cam again at retraction speed. If no reference cam is found in the positive direction of rotation, an error is triggered at the positive limit switch. If the positive limit switch is hit during deceleration on the reference cam, this is ignored and referencing is continued.
Reference cam flush – negative end	Referencing is performed to a reference cam. The reference cam must start just before or in line with the negative hardware limit switch and must project into the limit switch. Reference travel starts at search speed in negative direction. When the positive end of the reference cam is reached, the drive turns and leaves the reference cam again at retraction speed. If no reference cam is found in the negative direction of rotation, an error is triggered at the negative limit switch. If the negative limit switch is hit during deceleration on the reference cam, this is ignored and referencing is continued.
Fixed stop positive/negative	Referencing is performed to a fixed stop. The system must be designed so that the fixed stop can withstand the load from the respective speed without damage. The search direction is positive/negative. Reference point is the positive/negative fixed stop. Information: Any hardware limit switches connected to the inverter are ignored in this reference travel configuration. Risk of jamming and crushing.

27795004/EN – 12/2022

Parameter name	Description
Absolute position of encoder	With this reference travel type, only the reference bit is set and the current position of the encoder is adopted as the actual position. The reference travel type is only useful for encoders that have a direct reference to the system, such as linear encoders. The reference offset parameter is not used.
Use drive settings	Only used for drive-based reference travel. Use this setting when a reference type of a particular device is not listed in this list. With this setting, the software module does not parameterize the reference travel of the drives. The reference travel of the drives can be configured manually using the device-specific engineering tool.

Setting values for the various reference travel types

Parameter name	Description
Reference to zero pulse	The input specifies whether the zero pulse (reference pulse of the encoder) is used as the reference point. The parameter is used for the following reference travel types: • Reference cam – negative end • Reference cam – positive end • Positive limit switch • Negative limit switch • Reference cam flush – limit switch positive • Reference cam flush – limit switch negative
Reference offset	Reference offset in user units
Search velocity	Speed in user unit(s) used to search for a reference cam or hardware limit switch
Retraction velocity	Speed in user unit(s) used during reference travel in the following cases: When leaving a reference cam or hardware limit switch. With the reduced speed, the drive can travel exactly to the end of the reference cam or limit switch. When searching a zero pulse (reference pulse of the encoder). During reference travel to a fixed stop.
Acceleration	Acceleration at start or direction of rotation of reference travel
Deceleration	Deceleration for stopping or reversing the direction of rotation during reference travel
Got to home position	The parameter specifies whether a home position should be approached after reference travel. FALSE: The drive stops at the reference point. TRUE: The drive moves from the reference point to the home position with home velocity.

27795004/EN – 12/2022

Parameter name	Description
Home position	Basic position
Home velocity	Homing speed
Jerk time	Jerk time
In position – Window width	Position window for starting homing.
In position hysteresis	Position hysteresis for homing.
Velocity changeover before fixed stop	The input specifies when the search speed changes to retraction speed. Not selected Limit switch Reference cam
Dwell time at fixed stop	Time in ms for how long the fixed stop remains hit as soon as the value defined in the "torque limit fixed stop" parameter is reached. Only after this time the drive is referenced.
Torque limit at fixed stop	Torque limit in % nominal motor torque for referencing to fixed stop. After reaching this limit, the fixed stop remains hit as long as defined in the "dwell time at fixed stop" parameter.

7.4 Diagnostics

MOVIKIT® PLCopen MotionControl provides a graphical diagnostic interface in CODESYS. Various diagnostic values of the axis, such as the status or the current position, can be viewed here. The digital values are located in the configuration of the logical device of the software module in the "Online" tab in the "Actual values" area.

39123223051

7.5 Manual mode

MOVIKIT® PLCopen MotionControl provides manual mode in CODESYS. This means the axes can be moved in jog mode even if no motion functions have been programmed yet. Manual mode and its control elements are located in the configuration of the logical device of the software module in the "Online" tab in the "Control" area.

39123223051

To move an axis in manual mode, proceed as follows:

1. In the "Manual Control" tab, activate the "Enable manual control" check box.
2. Specify the following parameters to control the axis:

Name	Description
Enable axis	Enable the axis
< >	Move the axis in jog mode. The axis moves as long as the button is pressed, and stops as soon as the button is released.
Velocity	Setpoint speed
Acceleration	Acceleration
Deceleration	Deceleration
Reset	Acknowledge an error (e.g. axis error)

27795004/EN – 12/2022

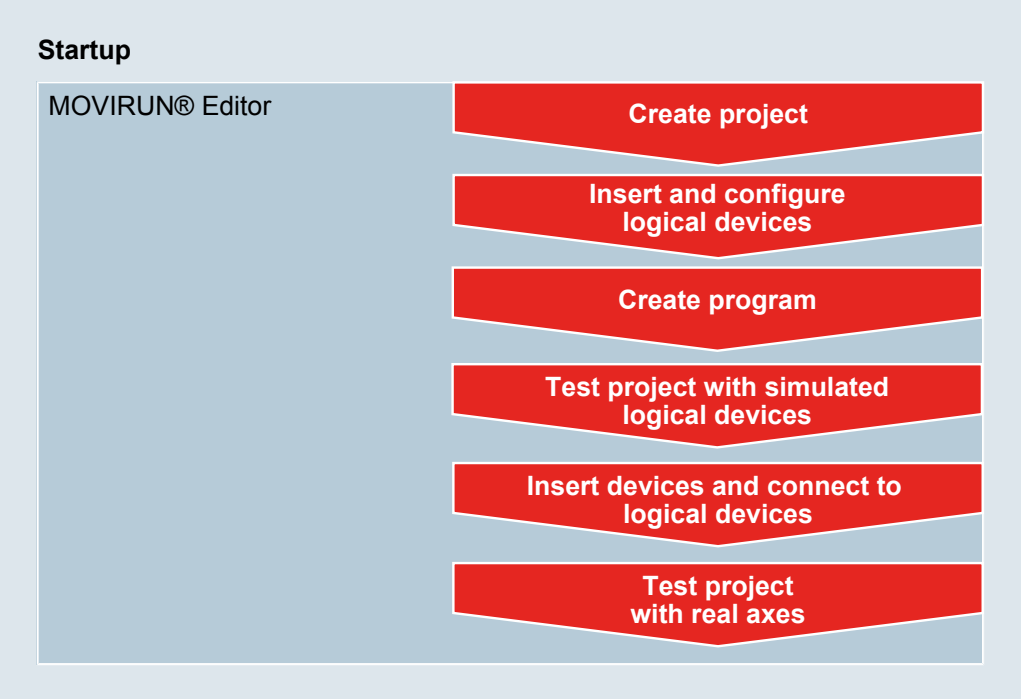
8 Startup

This chapter uses an application example to explain how a programmer creates a project, selects and configures software modules, and inserts and assigns devices to the software modules.

The operation of the inverters and the startup and operation of the drive train are not described. This information can be found in the MOVISUITE® documentation. For detailed information on PLCopen modules, refer to the CODESYS library manager and the CODESYS online help. Additionally, an EtherCAT®/SBus^{PLUS} manual is available that describes all the functions related to SBus^{PLUS}.

8.1 Startup procedure

The following diagram shows the startup procedure for a MOVIRUN® open application. The SEW drives can be started up before or after this.

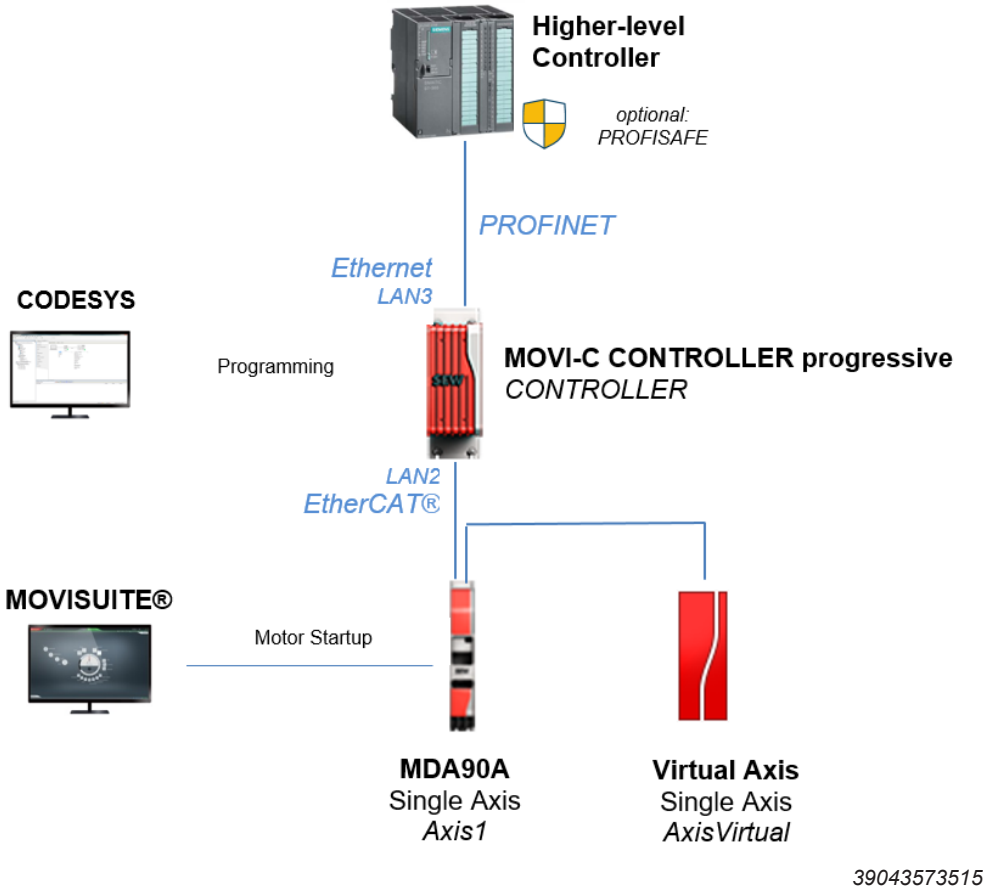


39537880843

8.2 Structure of the example project

The example project contains the MOVI-C® CONTROLLER progressive, an axis with MOVIDRIVE® modular inverter, and a virtual axis. The following figure illustrates this structure in a schematic way.

27795004/EN – 12/2022



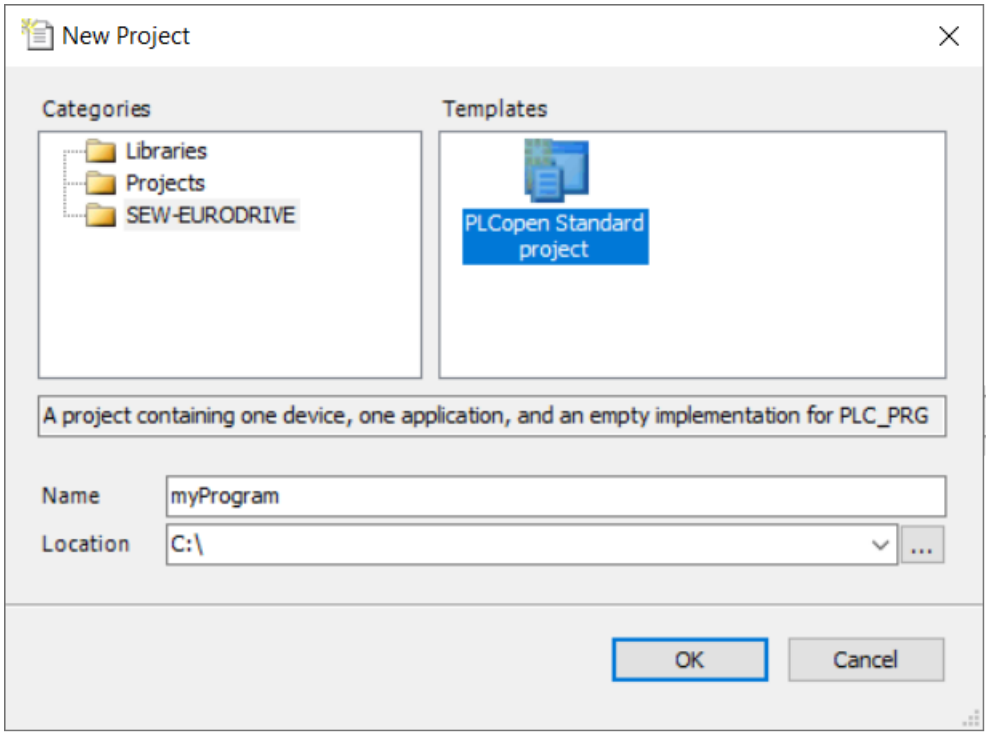
27795004/EN – 12/2022

8.3 Creating a project

✓ CODESYS version 3.5.17.20 (64-bit) or later has been installed.

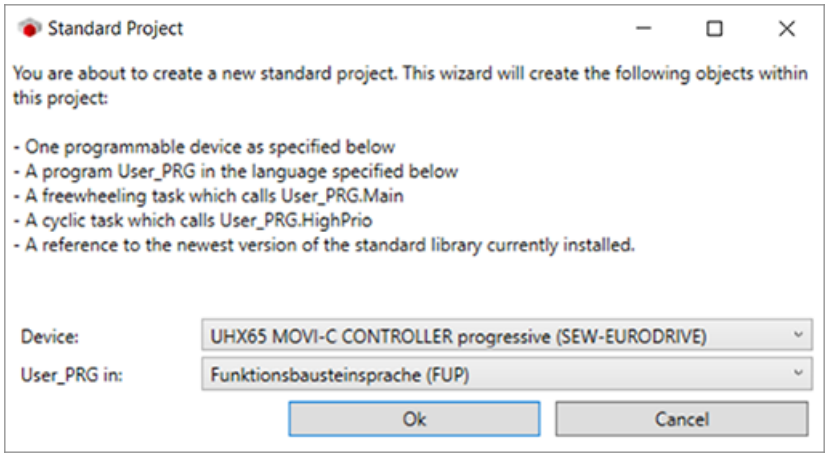
✓ The `MOVIRUN open 7.2.0.200.exe` installation package has been installed.

1. Start CODESYS 3.5.17.20 (64-bit) with the "MOVIRUN open for V3.5.17 Patch 2 64Bit" profile. A shortcut to this profile is created on the desktop during installation.
2. Select the menu command [File] > [New project].
   ⇨ The "New project" dialog is displayed.
3. Select the "PLCopen Standard project" template in the "SEW-EURODRIVE" category.
4. Enter a name, specify the storage location, and click [OK].



39043641227

⇨ The "Standard project" dialog is displayed.



39044759179

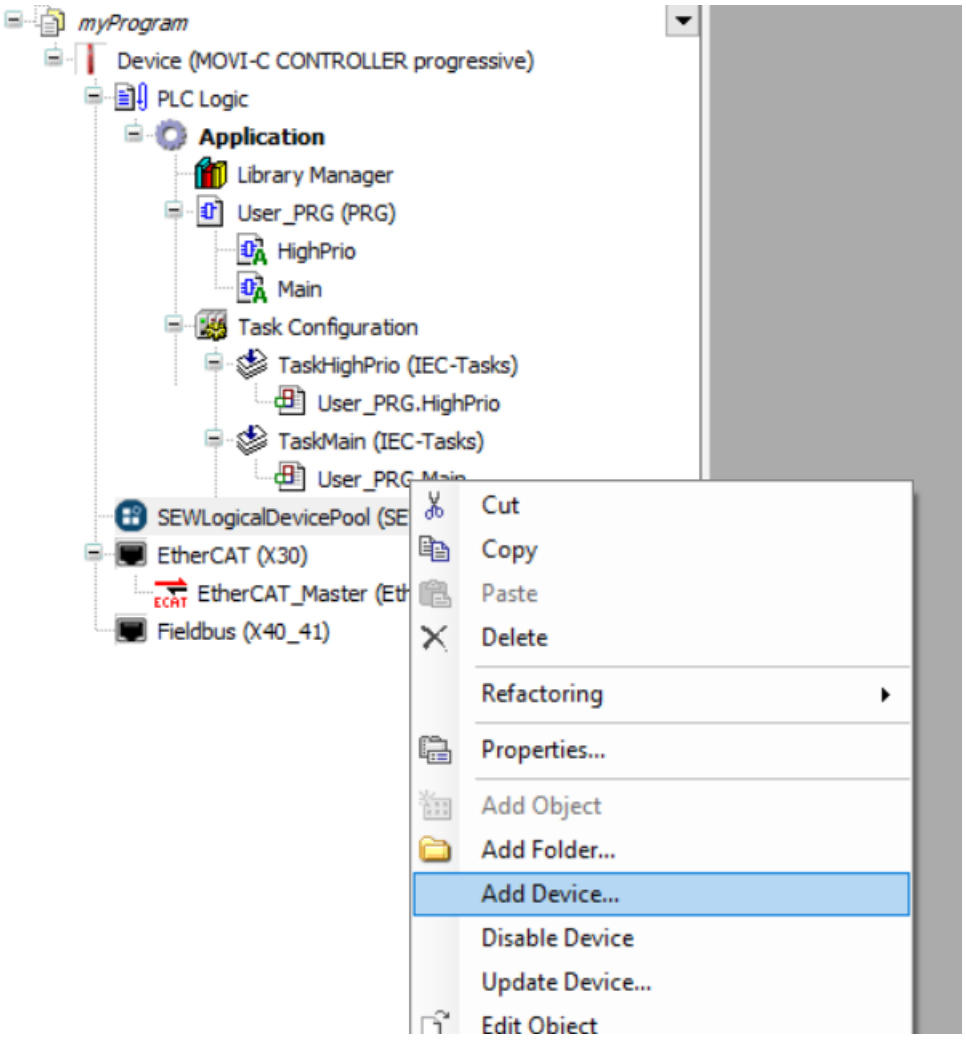
27795004/EN – 12/2022

5. Select a MOVI-C® CONTROLLER in the "Device" field.
6. In the "User_PRG in" field, select the programming language for the user program and click [OK].
   ⇨ A "standard project" (→ 🗎 15) is created.

8.4 Inserting logical devices

Logical devices are inserted and managed via the "SEWLogicalDevicePool". To insert logical devices, proceed as follows:

1. Open the context menu of "SEWLogicalDevicePool" and click [Add device].

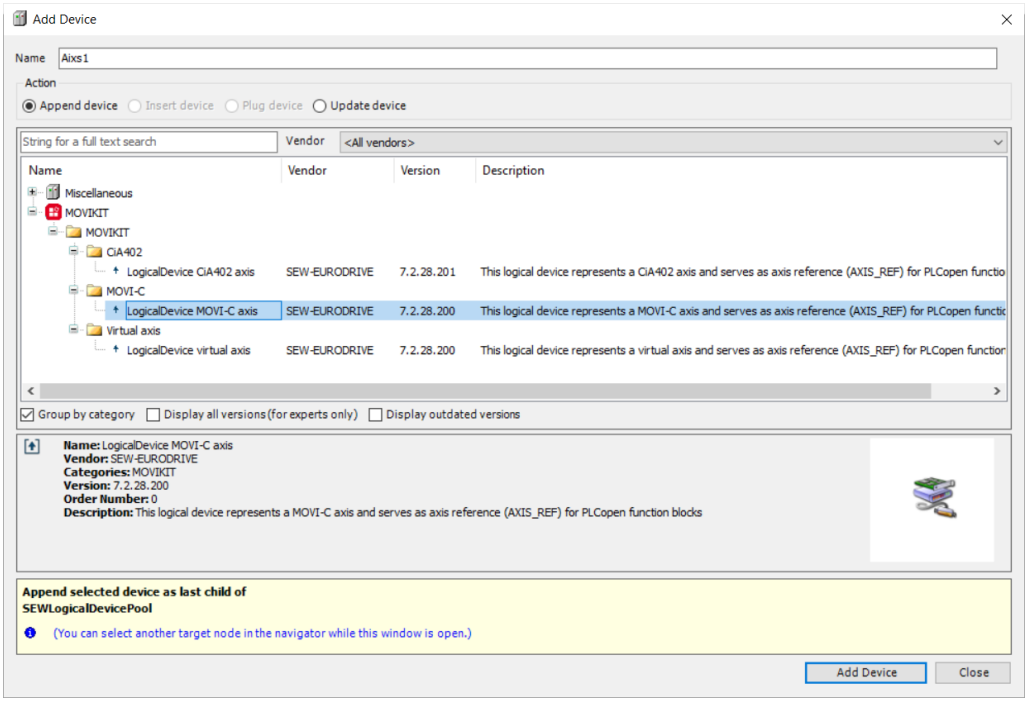


39537912843

⇨ The "Add device" dialog is displayed.

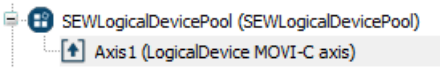
27795004/EN – 12/2022

2. Select the logical device "LogicalDevice MOVI-C axis" from the "MOVIKIT" category in the "MOVI-C" folder and assign it the name "Axis1". Next click [Add device].



39044769291

⇨ The logical device "Axis1 (LogicalDevice MOVI-C axis)" is added below the "SEWLogicalDevicePool" in the device tree.



39045322123

3. Select the logical device "LogicalDevice virtual axis" from the "MOVIKIT" category in the "MOVI-C" folder and assign it the name "AxisVirtual". Next click [Add device].

⇨ The logical device "AxisVirtual (LogicalDevice virtual axis)" is added below the "SEWLogicalDevicePool" in the device tree.

8.5 Configuring logical devices

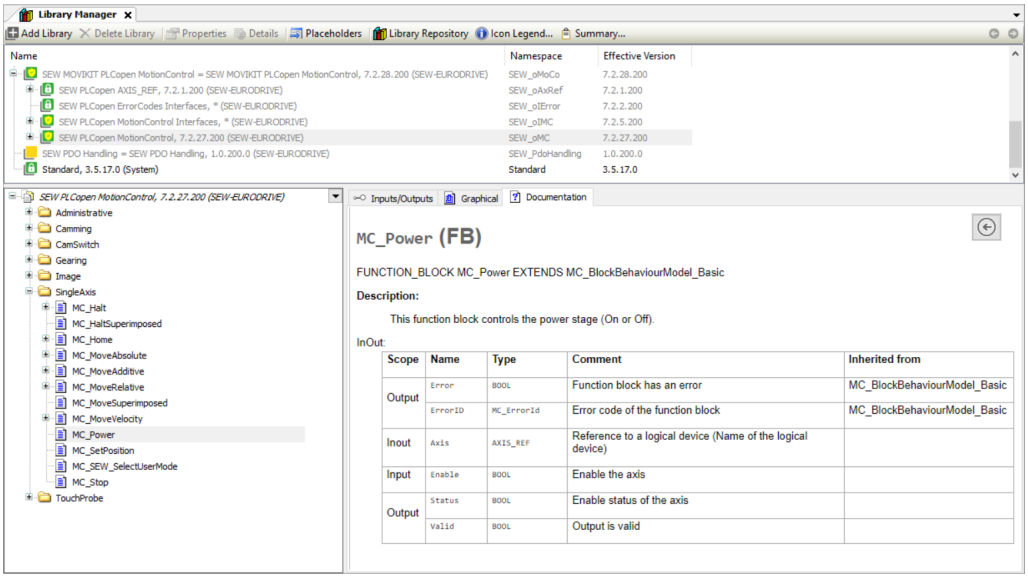
The logical devices of a MOVIKIT® software module offer various setting options via graphical user interfaces. The set values are default values and can be changed at any time in the user program by means of the function blocks. Configure the MOVIKIT® PLCopen MotionControl software module as follows:

1. Open the "configuration" (→ 🗎 26) of the logical devices "Axis1".
2. Make the following settings in the "Configuration" configuration menu:
   - ⇨ Gear – Not selected
   - ⇨ Movement translation – Not selected
   - ⇨ User units – Not selected
   - ⇨ User unit – Numerator: 1; Denominator: 1; Text: mm; Number of decimal places : 5
   - ⇨ Modulo – Min: 0; Max: 0
   - ⇨ Simulation - Enable
3. Make the following settings in the "Reference travel" configuration menu:
   - ⇨ Reference mode – Drive-based homing
   - ⇨ Reference travel type – Referencing without reference travel
4. Open the "configuration" (→ 🗎 26) of the logical device "AxisVirtual".
5. Make the following settings in the "Configuration" configuration menu:
   - ⇨ User units – Numerator: 360; Denominator: 1; Text: degree
   - ⇨ Modulo - Min: 0; Max: 360
6. Make the following settings in the "Reference travel" configuration menu:
   - ⇨ Reference mode – Controller-based homing
   - ⇨ Reference travel type – Referencing without reference travel
7. Use the default values for both axes in the "Limits" configuration menu.

27795004/EN – 12/2022

8.6 Creating a program

Create your user program using the *SEW MOVIKIT PLCopen MotionControl* library. The library is integrated automatically into the IEC project when inserting a logical device. The library contains a large number of PLCopen function blocks. For a detailed description of the library and the individual function modules, refer to the CODESYS library manager and the CODESYS online help.



39123245195

In addition to the PLCopen function blocks for creating the IEC program, SEW-EURODRIVE provides a sample code for controlling the axes. For further information, refer to chapter "Axis driver template" (→ 🗎 20).

8.7 Transferring the program and testing with simulated logical devices

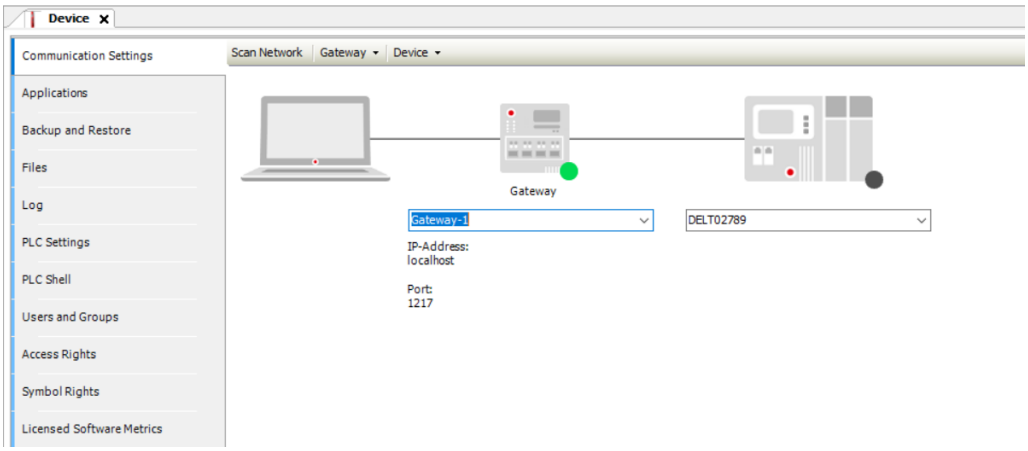
To perform a test with simulated logical devices, proceed as follows:

✓ The engineering PC is connected to the engineering interface of the MOVI-C® CONTROLLER via Ethernet. **INFORMATION:** For a point-to-point connection, set "Fixed IP address configured" in the Windows network settings for the Ethernet adapter of the engineering PC and assign an IP address that is in the same address range as the engineering interface of the MOVI-C® CONTROLLER (default IP address: `192.168.20.4`). Example: IP address of the engineering PC: 192.168.10.11, subnet mask: 255.255.255.0.

1. Open the configuration of the MOVI-C® CONTROLLER.

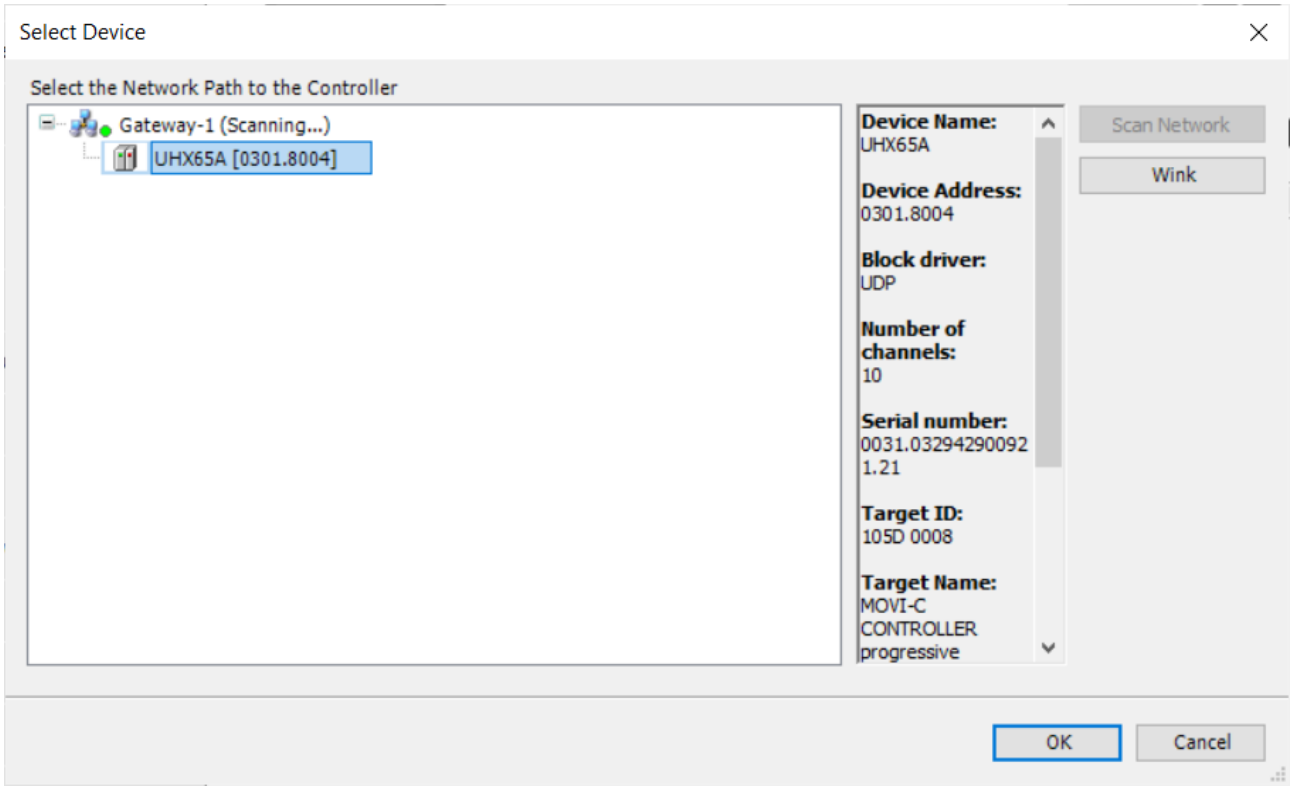
27795004/EN – 12/2022

2. In the "Communication" tab, click [Browse network].



39122396939

⇨ The "Select device" dialog is displayed.



39122399115

3. Select the MOVI-C® CONTROLLER below the corresponding gateway and click [OK].
   ⇨ The green LED in the "Communication" tab on the MOVI-C® CONTROLLER lights up and the connection to the MOVI-C® CONTROLLER is established.
   ⇨ You can optionally specify an IP address via which the MOVI-C® CONTROLLER is available in a network via the edit box below the MOVI-C® CONTROLLER.
4. Select [Online] > [Login] from the menu.
   ⇨ The program is loaded to the MOVI-C® CONTROLLER.

27795004/EN – 12/2022

5. Select [Debug] > [Start] from the menu.
   ⇨ The program is started.
6. Depending on the application and the software module used, perform the required tests using the "Diagnostics" (→ 🗎 33) tools and "Manual mode" (→ 🗎 34).

27795004/EN – 12/2022

8.8 Starting up the drives

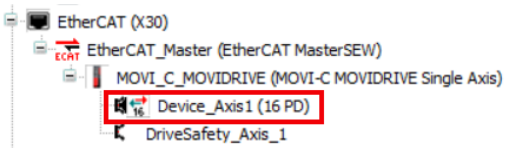
Before drives are integrated into the program, they should be started up. To do so, perform drive startup when using MOVI-C® components with the MOVISUITE® engineering software. For more detailed information on operating the MOVISUITE® engineering software and starting up the drive trains, refer to the corresponding documentation (**NOTE:** The MOVISUITE® manual is available in the software itself in the "More" > "Documents" menu or in Online Support. Furthermore, a video on this topic is available on the YouTube channel of SEW-EURODRIVE).

If you use third-party components, you will have to start up the drive using the corresponding engineering software of the manufacturer.

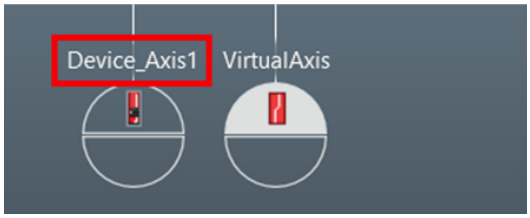
Observe the following notes when starting up MOVI-C® components with MOVISUITE® for MOVIRUN® open:

- Do not configure MOVIKIT® software modules on the drives in MOVISUITE®.
- No further settings need to be made on the MOVI-C® CONTROLLER.
- The names of the devices in the CODESYS device tree (device slot 1) are not synchronized with the names of the devices in MOVISUITE®. In MOVISUITE®, use the same names for the devices as in the CODESYS device tree.

Devices (device slot 1) in CODESYS

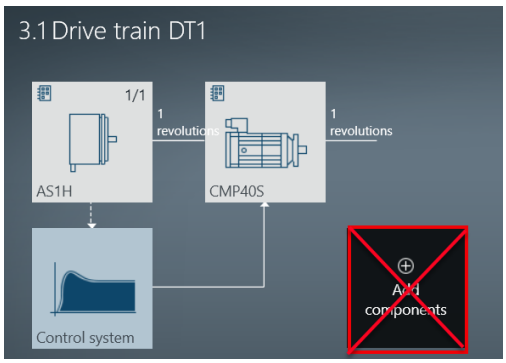


Devices in MOVISUITE®



39542464779

- As the user units are configured via the IEC project or PLCopen modules when using MOVIRUN® open, no other components such as gear unit or user units may be created and set in MOVISUITE®.



39638875531

8.9 Inserting devices and connecting them to logical devices

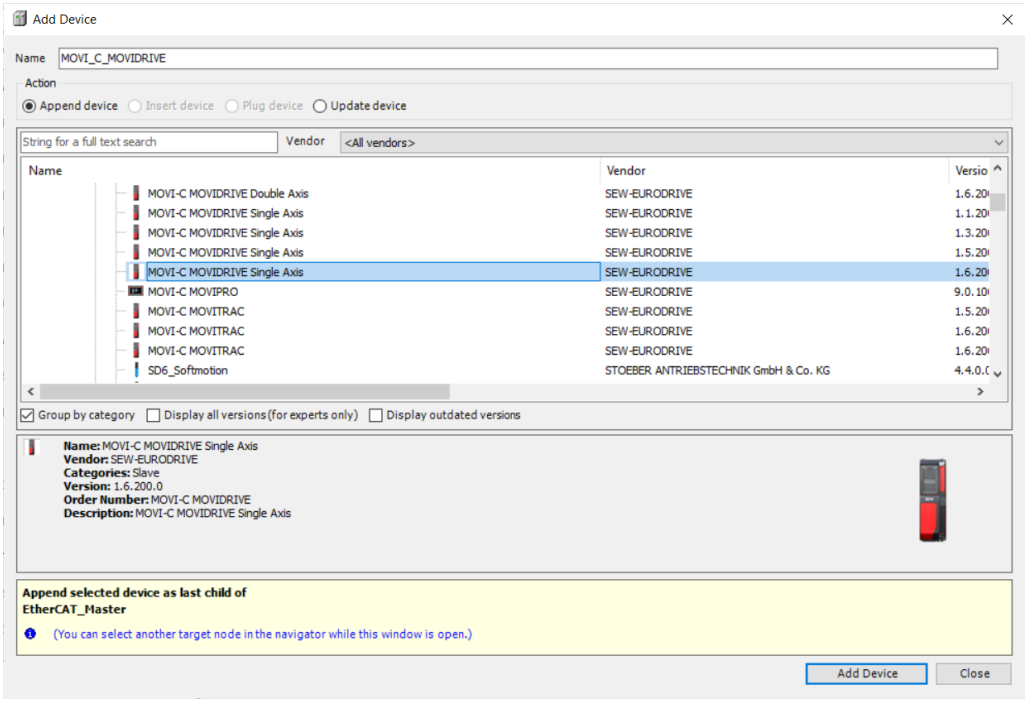
Once the drives have been started up with MOVISUITE®, the corresponding devices must also be inserted in the IEC project and connected to the created logical devices. You can insert them either manually via device description or automatically via device scan.

For the example project, insert the device "MOVI_C_MOVIDRIVE", enter the name "Dev_Axis1" in Slot1, and connect the device to the logical device "Axis1".

8.9.1 Via device description

To insert devices in CODESYS via device description, proceed as follows:

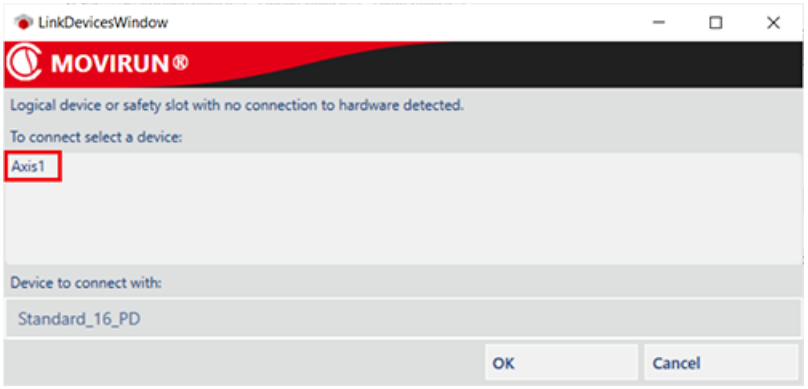
1. In the device tree, open the context menu of the "EtherCAT_Master" object.
2. Click the [Add device...] menu item.
   ⇨ The "Add device" dialog is displayed.
3. Open the "SEW-EURODRIVE – Drives" category and select the device used.



39125362443

4. Assign a name to the selected device. Since the device name is no longer used, we recommend that you use the device type (e.g. MOVI-C_MOVIDRIVE) as the name in this case.

5. Click [Add device].
   ⇨ If there are logical devices in the SEWLogicalDevicePool that are not yet assigned to a device, the "LinkDevicesWindow" dialog window is displayed:



39125364619

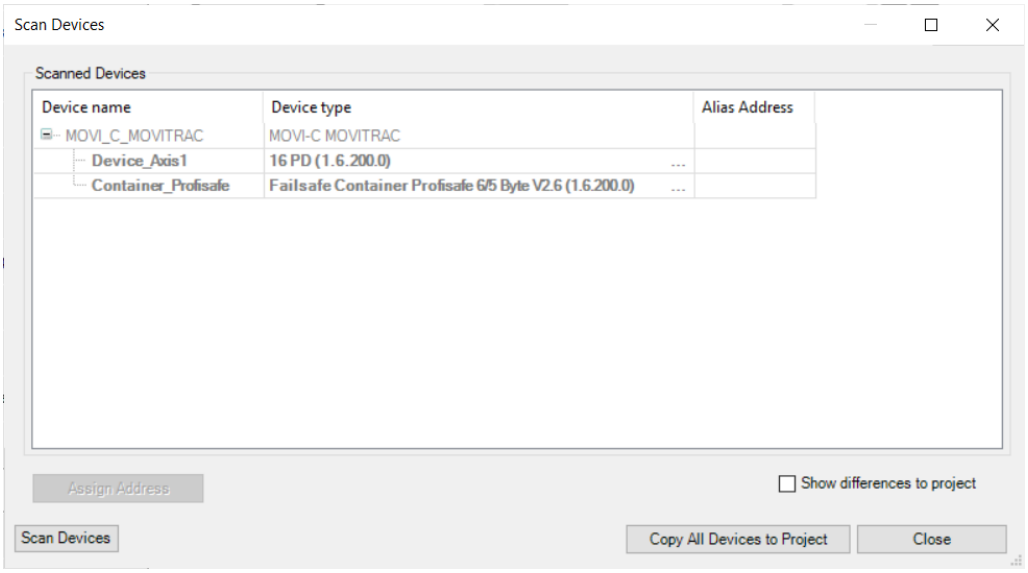
6. Select a logical device from the list that you want to connect to this device and click [OK].
   ⇨ The logical device and the device added in CODESYS are connected.
   ⇨ The dialog window is automatically displayed again for all devices that have not yet been assigned to a device.
7. Repeat these steps for all other devices. Assign a name for device slot 1 for each inserted device. See also "Designation of devices" (→ 🗎 18).

8.9.2 Via device scan

To insert devices in CODESYS via device scan, proceed as follows:

1. In the device tree, open the context menu of the "EtherCAT_Master" object.
2. Click the [Scan for devices...] menu item.
   ⇨ The "Scan devices" dialog window is displayed and a scan for devices on EtherCAT® is performed.
   ⇨ The devices found are displayed in the "Scan devices" dialog window. In this dialog, you can enter the name for devices and the device slot 1. To do so, double-click the respective object in the "Device name" column.

27795004/EN – 12/2022

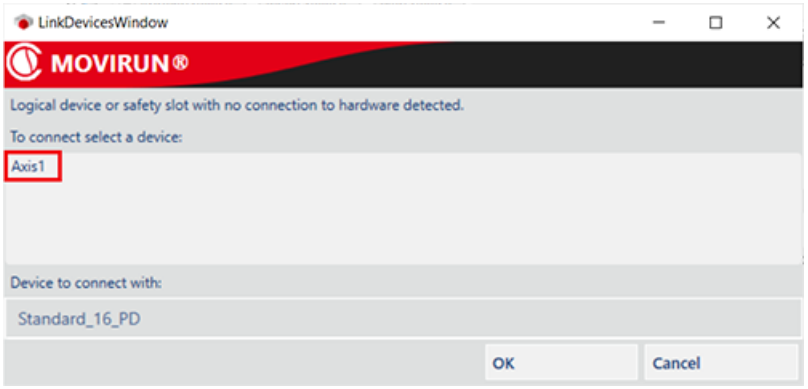


39220282123

INFORMATION

Double axes are detected and inserted as single axes during the device scan. In the device scan dialog window, the type for a double axis must therefore be adjusted manually. To do so, click on the three points and select the double axis in the following dialog window.

3. To apply all found devices, click [Copy all devices to project].
   ⇨ If there are logical devices in the SEWLogicalDevicePool that are not yet assigned to a device, the "Connect device" dialog window is displayed:



39125364619

4. Select a logical device from the list that you want to connect to this device and click [Add new device].
   ⇨ The logical device and the device added in CODESYS are connected.
   ⇨ The dialog window is automatically displayed again for all devices that have not yet been assigned to a device.
5. Repeat these steps for all other devices.

8.10 Testing the project with real axes

Once the real devices are inserted in the IEC project and connected to the logical devices, you can perform a test of your application with real axes.

To do so, first set the "Simulation" parameter to "off" in the "configuration" (→ 🗎 26) of the logical device "Axis1".

27795004/EN – 12/2022

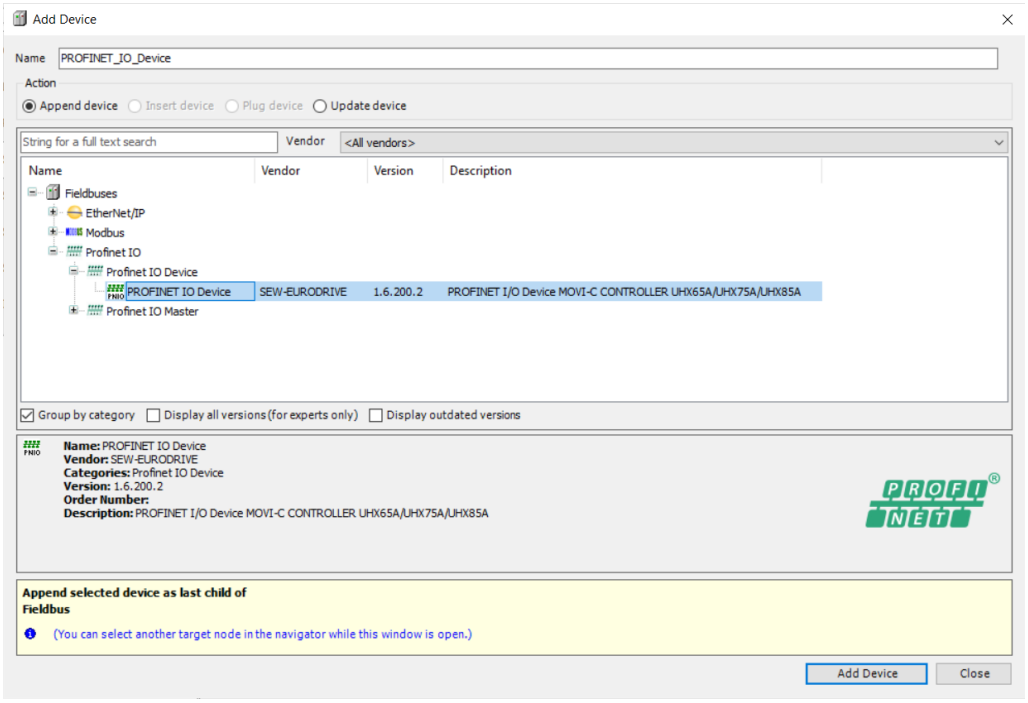
9 Further instructions

9.1 Setting up the fieldbus interface

9.1.1 Activating the fieldbus interface

To activate the fieldbus interface, proceed as follows:

1. In the device tree, open the context menu of the "Fieldbus" object.
2. Click the [Add device...] menu item.
   ⇨ The "Add device" dialog is displayed.



39125572747

3. Select one of the fieldbus protocols and click [Add device].
   ⇨ The selected fieldbus protocol is added to the "Fieldbus" object as an object in the device tree.

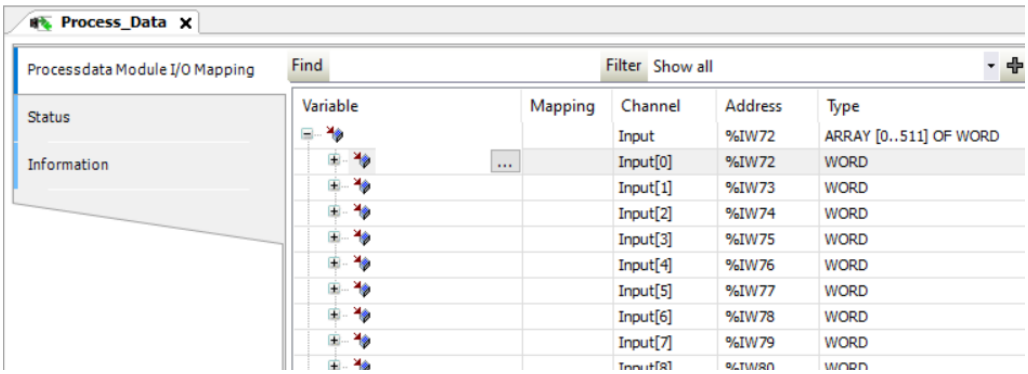
9.1.2 Setting up data exchange

Data can be exchanged between the IEC program and the fieldbus in various ways.

Mapping via the fieldbus node

To map variables from the IEC program with fieldbus data, proceed as follows:

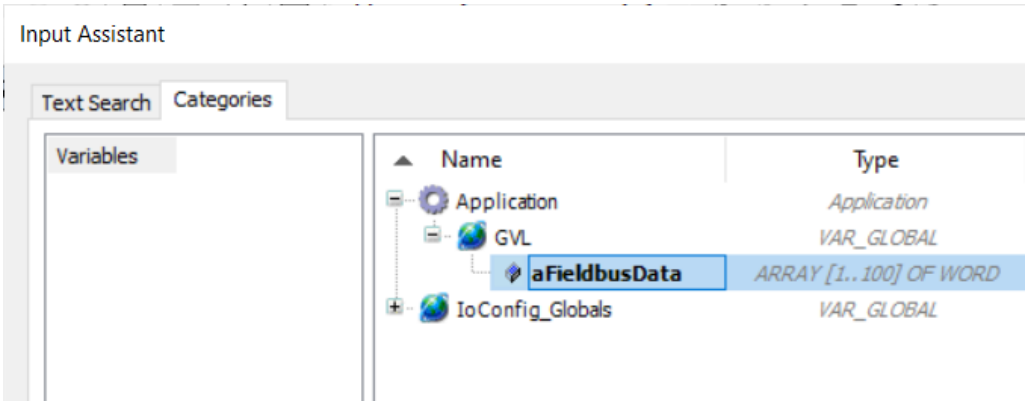
1. Open the configuration of the "Process_Data" object via the device tree below the "Fieldbus" object.
2. Click [...] for one of the variables.



39125594635

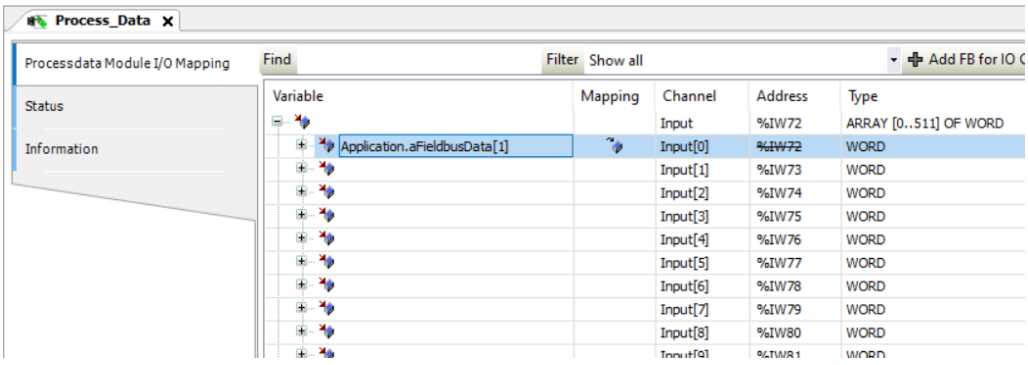
⇨ The "Input assistant" dialog is displayed.

3. Select a variable in the "Input assistant" dialog and click [OK].



39125596811

⇨ The mapping of data is displayed in the "Process_Data" tab.



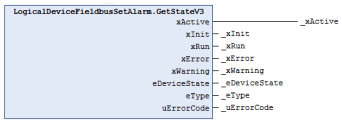
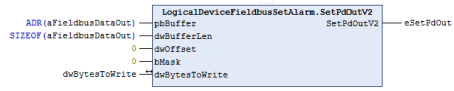
39125598987

27795004/EN – 12/2022

Mapping via logical device

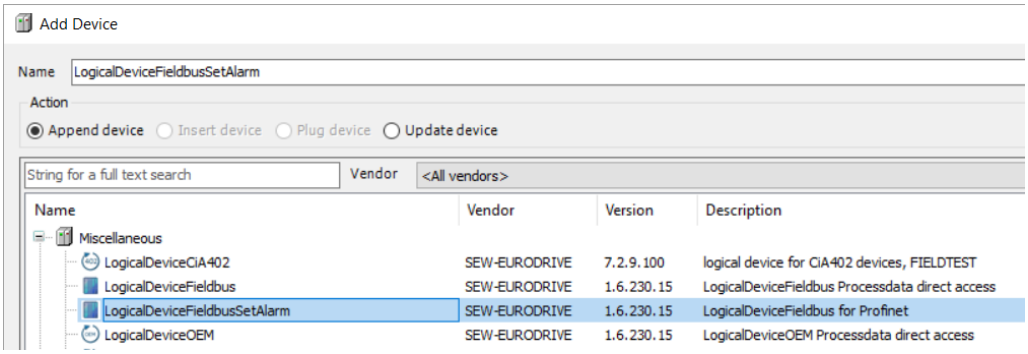
The fieldbus can also be accessed via a logical device (LogicalDeviceFieldbus-SetAlarm). Direct mapping is not possible in this case.

The following methods can be used for communication with the fieldbus via the logical device "LogicalDeviceFieldbus SetAlarm":

Name	Implementation	Description
GetStateV3		Method for providing the fieldbus state
GetPdInV2		Method for providing the incoming fieldbus data
SetPdOutV2		Method for writing the outgoing fieldbus data

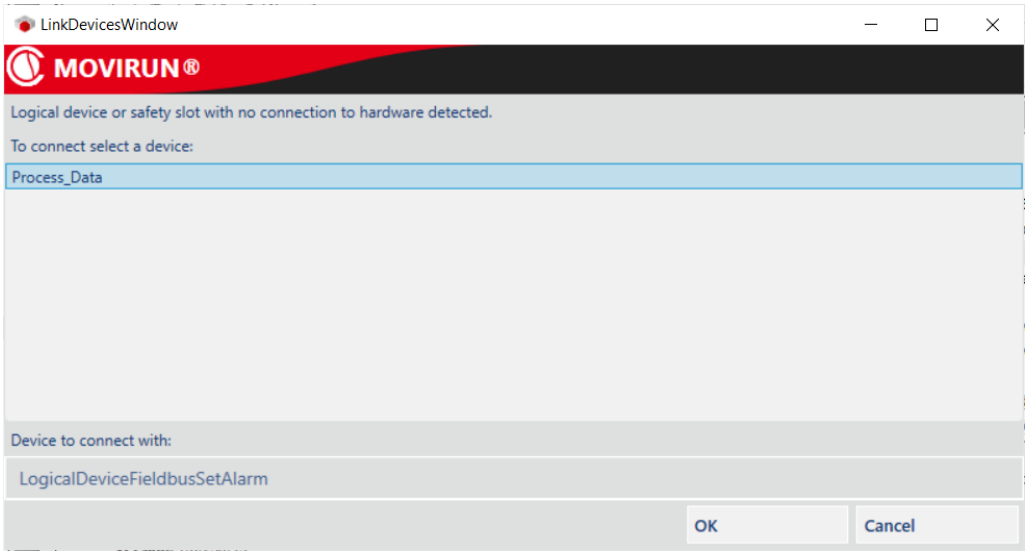
To insert a logical device for a fieldbus, proceed as follows:

1. Open the context menu of "SEWLogicalDevicePool" and click [Add device].
   ⇨ The "Add device" dialog is displayed.
2. Select the logical device "LogicalDeviceFieldbusSetAlarm" from the "Miscellaneous" category and click [Add device].



39125602187

⇨ If a fieldbus device has already been plugged into the fieldbus before, the dialog for connecting the logical device to the fieldbus device appears.



39125604363

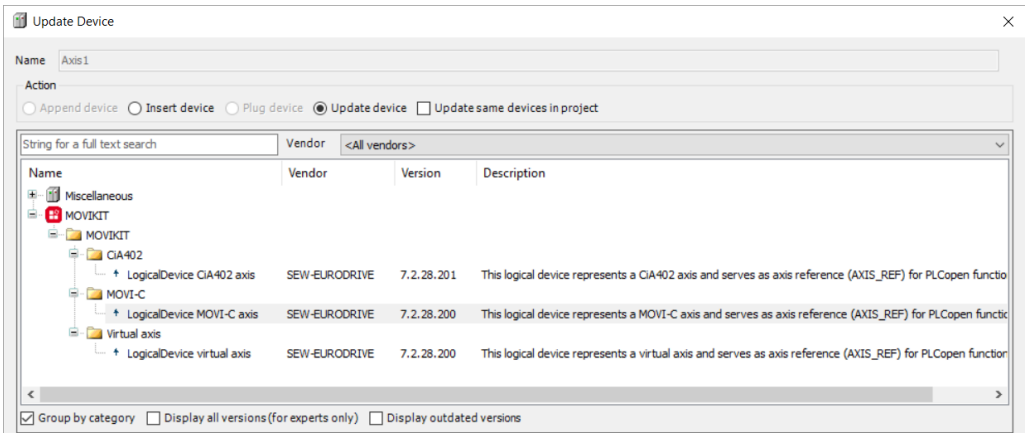
3. Select the "Process_Data" entry in the dialog and click [OK].
   ⇨ The logical device for accessing the fieldbus has been added and connected to the fieldbus device.

27795004/EN – 12/2022

9.2 Updating software modules

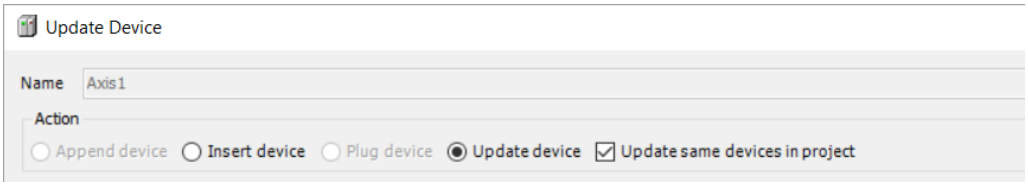
To update the logical devices of a MOVIKIT® software module, proceed as follows:

1. Close CODESYS.
2. Install the new version of the MOVIKIT® software module.
3. Open CODESYS and your IEC project.
4. Open the context menu of the logical device of MOVIKIT®.
5. Click the [Update device] menu item.
   - ⇨ The "Update device" dialog is displayed.
   - ⇨ The "Update device" dialog displays the latest version of MOVIKIT® installed on the computer.
   - ⇨ Activating the "Show all versions" check box will display all installed versions. This also allows you to switch to an older version.



39125684747

6. Select the required version in the "Update device" dialog.
   - ⇨ Checking the "Update same devices in project" check box will update all logical devices of the same type in the project to this version.



39125689099

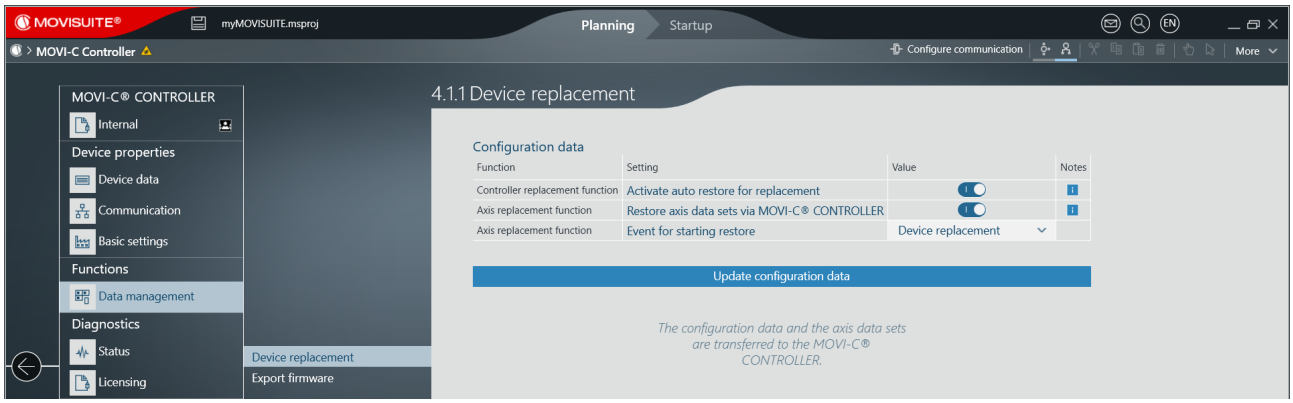
7. Click [Update device].
   - ⇨ The logical devices are updated to the required version.

9.3 Setting up the automatic axis replacement function

The MOVI-C® CONTROLLER provides an automatic axis replacement function that automatically loads the inverter data sets stored on the MOVI-C® CONTROLLER to the new inverter in the event of an inverter replacement. We recommend that you perform this function at the end of startup and after having made changes to inverter parameters.

To use this function, proceed as follows:

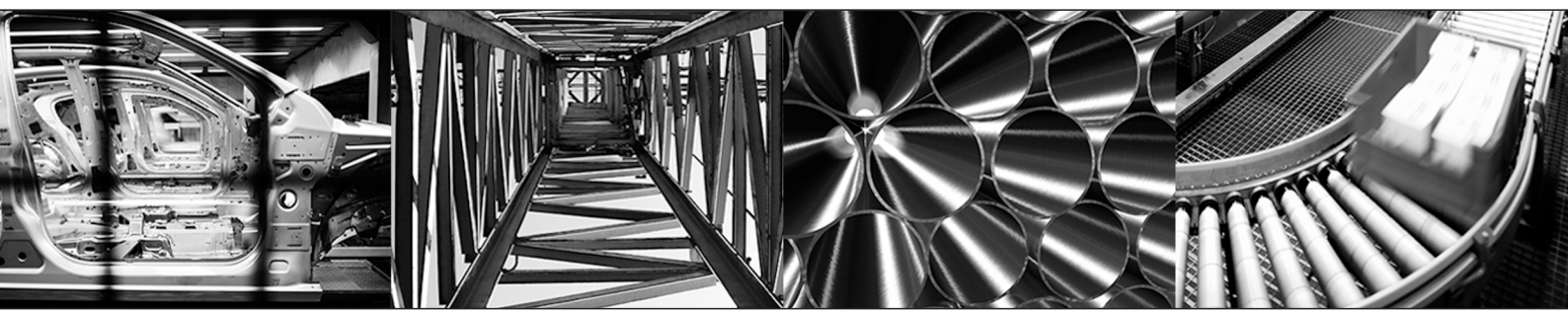
1. Create a MOVISUITE® project that contains the MOVI-C® CONTROLLER and the lower-level axes. Make sure that the names of the inverters in MOVISUITE® and the corresponding device slots in CODESYS are identical. See also "Designation of devices" (→ 🖹 18).
2. Open the configuration of the MOVI-C® CONTROLLER in MOVISUITE®.

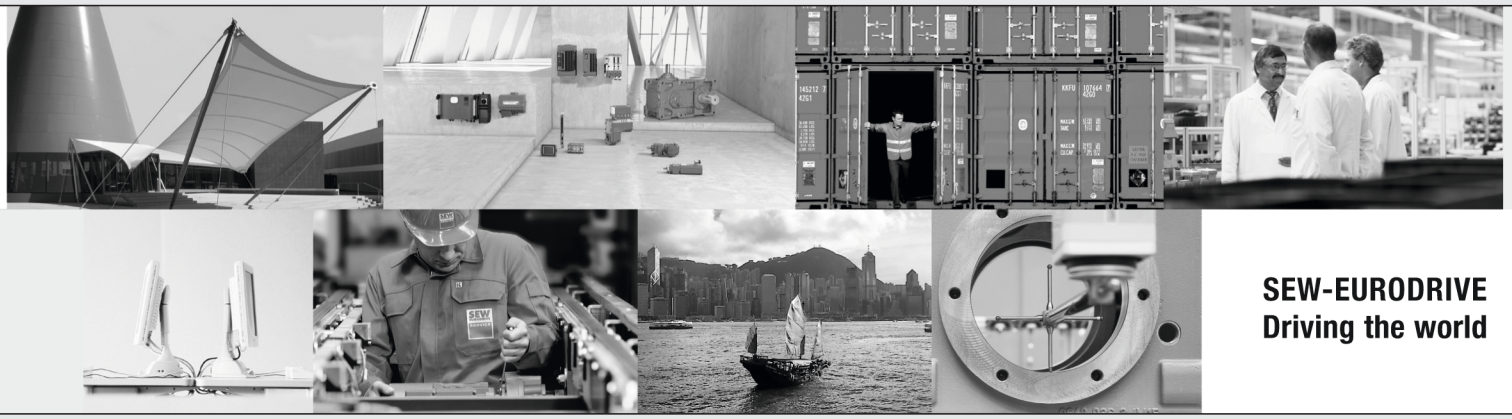


39125759243

3. To transfer the axis data sets to the MOVI-C® CONTROLLER (its memory card), click [Update configuration data].

27795004/EN – 12/2022





SEW-EURODRIVE
Driving the world

SEW-EURODRIVE GmbH & Co KG
Ernst-Blickle-Str. 42
76646 BRUCHSAL
GERMANY
Tel. +49 7251 75-0
Fax +49 7251 75-1970
sew@sew-eurodrive.com
➞ **www.sew-eurodrive.com**