item MotionSoft® – Version 2.3
Product manual

Original user guide

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Contents

1 General
1.1 Documentation

This manual is designed to ensure users can work safely with the parameterisation program item MotionSoft® for the item servo positioning controllers.

This version of the software manual describes the functions of software version 2.3. As a result, screenshots have been taken from version 2.3.

- "item Servo Positioning Controller C 1 Series" product manual: Description of technical data and device functionality, plus information on installing and operating servo positioning controllers C 1-02, C 1-05 and C 1-08.

- "item Servo Positioning Controller C 3 Series" product manual: Description of technical data and device functionality, plus information on installing and operating servo positioning controllers C 3-05 and C 3-10.

- "item Servo Positioning Controller C Series" CANopen manual: Description of the implemented CANopen protocol as per DSP402

- "item Servo Positioning Controller C Series" PROFIBUS/PROFINET manual: Description of the implemented PROFIBUS-DP protocol.

The full software functionality of the item C Series servo positioning controller is being implemented as part of a gradual development process.

This version of the software manual describes the functions of firmware version 1.3 and those of firmware version 1.x, which is in preparation.

Corresponding section titles and sections of text include indications as to the availability of functions from firmware versions.

In some cases, the windows illustrated in this manual are not shown in their final version and may differ from those shown in the parameterisation program item MotionSoft®.

1.2 Scope of supply for item MotionSoft®

item MotionSoft® software is currently available as a download only. The installation file for item MotionSoft® can be downloaded from the Online Shop, which can be accessed via www.item24.com.

2 Safety instructions for electric drives and controllers
2.1 Symbols used

Symbol	Explanation
	Information Important information and instructions.
	Application Further information on usage.
	Caution! Non-observance can result in serious material damage.
	DANGER! Failure to observe this instruction can result in material damage and personal injury.
	Caution! Potentially fatal voltage. This safety instruction indicates that a potentially fatal voltage may be present.

2.2 General information

item Industrietechnik GmbH accepts no liability in the event of damage caused by failure to observe the warning notices in this user guide.

 You must read and understand the safety instructions starting on page 8 in full before the setup process.

If you are unable to fully understand the documentation in the language you are currently reading, please notify the supplier and inquire about a version in a language you can understand perfectly.

In order for the servo drive controller to operate perfectly and safely, it must be transported, stored, assembled and installed properly and professionally and operated and maintained with care. Electrical systems must be handled only by trained and qualified staff.

For the purposes of this product manual and/or the warning notices on the product itself, trained and qualified staff are individuals who are sufficiently familiar with setting up, installing, commissioning and operating the product and with all warnings and precautions as per the user guide in this product manual and who have the qualifications required for their activities:

- Training and instruction/authorisation regarding activating, deactivating and earthing devices/systems in line with safety technology standards and labelling devices/systems appropriately in line with work requirements.
- Training and instruction in line with safety technology standards on the maintenance and use of appropriate safety equipment.
- First-aid training.

To prevent personal injuries and/or material damage, the following instructions must be read before the system is switched on for the first time:

These safety instructions must be followed at all times.

Do not attempt to install or start up the servo drive controller before you have carefully read all the safety instructions for electric drives and controllers in this document. These safety instructions and all other user information must be read through before any work is undertaken with the servo drive controller.

If no user information for the servo drive controller is available to you, contact your sales representative. Request that these documents are immediately sent to those responsible for the safe operation of the servo drive controller.

If the servo drive controller is sold, rented out or otherwise handed over, these safety instructions must also be handed over with it.

Due to safety and warranty reasons, users are not permitted to open the servo drive controller.

Specialist project engineering is an essential requirement to ensure the servo drive controller functions perfectly!

DANGER!
Improper handling of the servo drive controller, failure to observe the warning notices set out here and tampering with the safety equipment can cause material damage, personal injury, electric shock and, in extreme cases, death.

2.3 Hazards caused by incorrect use

DANGER!
High electrical voltage and high operating current!
Risk of death or serious injury caused by electric shock!

High electrical voltage due to incorrect connection!
Risk of death or injury caused by electric shock!

Surfaces of the device enclosure may be hot!
Risk of injury! Risk of burns!

Risk from movements!
Risk of death, serious injury and material damage caused by unintended movements from the motors!

2.4 Safety instructions
2.4.1 General information

The servo drive controller satisfies protection class IP20 and pollution degree 1. It is important to ensure that the surrounding area corresponds with this protection class and pollution degree.

Use only accessories and spare parts that have been approved by the manufacturer.

In line with EN standards and VDE specifications, the servo drive controllers must be connected to the mains supply in such a way that they can be cut off from the mains supply by suitable separation devices (e.g. ON/OFF button, contactor, power switch).

The servo drive controller can be protected using an AC/DC-sensitive 300 mA RCD protection switch (RCD = Residual Current protective Device).

Gold contacts or contacts with a high contact pressure should be used to switch the control contacts.

As a precaution, interference suppression measures must be taken for switchgear, such as using RC elements or diodes to connect contactors and relays.

The safety rules and regulations of the country in which the device is being operated must be followed.

The environmental conditions set out in the product documentation must be maintained. Safety-critical applications are not permitted, unless specifically approved by the manufacturer.

Information on installation in line with EMC requirements can be found in the product manual for the item C-series devices. The manufacturer of the system or machine is responsible for ensuring compliance with the limits required by national regulations.

The technical data and the connection and installation conditions for the servo drive controller are to be found in this product manual and must be met.

DANGER!
The general setup and safety regulations for work on power installations (e.g. DIN, VDE, EN, IEC or other national and international regulations) must be followed.

Non-compliance may result in death, personal injury or serious material damage.

Without any claim of completeness, the following regulations and standards apply, among others:

VDE 0100	Low-voltage electrical installations up to 1000 volts
EN 60204	Safety of machinery. Electrical equipment of machines
EN 50178	Electronic equipment for use in power installations

2.4.2 Safety instructions for installation and maintenance

The relevant DIN, VDE, EN and IEC regulations as well as all national and local safety regulations and accident prevention rules always apply to the installation and maintenance of the system. The system manufacturer and/or operator must ensure the following directions are followed:

The servo drive controller must only be operated, maintained and/or repaired by personnel trained and qualified for working on or with electrical devices.

Preventing accidents, personal injuries and/or material damage:

Take additional steps to ensure there is no dropping or sinking on vertical axes once the motor has been switched off, for example by installing:

- A mechanical locking device on the vertical axes
- External braking, trapping or clamping devices
- Adequate counterweights for the axes

Neither the motor holding brake supplied as standard nor an external motor holding brake actuated by the drive controller are suitable on their own for personal safety purposes!

Use the main switch to disconnect the electrical equipment from the power supply, take precautions to prevent the power supply from being switched back on and wait until the intermediate circuit is discharged before carrying out:

- Maintenance and repair work
- Cleaning
- Long operational shutdowns

Before carrying out maintenance work, ensure that the power supply has been switched off, locked out and that the intermediate circuit is discharged.

The external or internal brake resistor carries dangerous intermediate circuit voltage during operation and can continue to do so for approximately five minutes after being switched off. Contact may result in death or serious personal injury.

Take care when carrying out installation work. During installation and subsequent operation of the drive, ensure that no drilling chips, metal dust or assembly components (screws, nuts, cable sections) fall into the servo drive controller.

Also ensure that the external power supply of the controller (24 V) is switched off.

The intermediate circuit or the mains supply must always be switched off prior to switching off the 24 V controller supply.

Carry out work in the machine area only when the AC and/or DC supplies are switched off and locked out. Deactivating power stages or controller enabling does not constitute a suitable means of locking out the power supply. If adopting this approach, a fault could lead to the inadvertent operation of the drive.

To prevent mechanical damage caused by e.g. the motors turning in the wrong direction, perform setup with the motors running idle.

Electronic devices are fundamentally not failsafe. Users are responsible for ensuring their system is guided to a safe state if the electrical device fails.

The servo drive controller and in particular the braking resistor can reach high temperatures both externally and internally and contact with these components can cause serious burns.

2.4.3 Protection against contact with electrical parts

This section only concerns devices and drive components carrying voltages exceeding 50 V. Contact with parts carrying voltages of more than 50 V can be dangerous for people and may cause electric shock. When electrical devices are being operated, some parts of these devices will inevitably carry dangerous voltages.

> **DANGER!**
>
> High electrical voltage!
>
> Risk of death, injury caused by electric shock and serious personal injury!

The relevant DIN, VDE, EN and IEC regulations as well as all national and local safety regulations and accident prevention rules always apply to operation. The system manufacturer and/or operator must ensure the following directions are followed:

> Before switching on, ensure the covers and safety fixtures designed to prevent contact have been installed on the devices. Built-in devices must be fitted with an external housing such as a switchbox to protect against direct contact with electrical parts. VBG 4 regulations must be followed!
>
> Always connect the ground conductor of the electrical equipment and devices securely to the mains supply. Due to the integrated line filter, the leakage current is greater than 3.5 mA!
>
> Ensure the ground conductor connection exhibits the minimum copper cross-section as stipulated in standard EN 60617 over its entire length!
>
> Prior to setup, including for short calibration or testing purposes, always connect the ground conductor on all electrical devices as per the terminal diagram or connect to the earthing line. If this is not done, high voltages can occur on the housing that can cause electric shock.
>
> Do not touch the electrical connections of components when switched on.
>
> Prior to accessing electrical parts carrying voltages exceeding 50 volts, disconnect the device from the mains or power supply. Ensure it cannot be switched back on again.
>
> During installation work, take note of the intermediate circuit voltage level, particularly with regard to insulation and protective measures. Ensure proper grounding, conductor dimensioning and corresponding short-circuit protection.
>
> The device features a rapid discharge circuit for the intermediate circuit as per EN 60204, Section 6.2.4. However, in certain device constellations – primarily when multiple servo drive controllers are connected in parallel in the intermediate circuit or when a braking resistor is not connected – rapid discharge may be rendered ineffective. In such cases, the servo drive controllers can carry dangerous voltage for up to five minutes after being switched off (residual capacitor charge).

2.4.4 Protection against electric shock (protective extra-low voltage – PELV)

All connectors and terminals with voltages of between 5 and 50 volts at the servo positioning controller exhibit protective extra-low voltages that are designed in line with the following standards to protect against contact.

International: IEC 60364-4-41

European countries in the EU: EN 50178/1998, Section 5.2.8.1.

> **DANGER!**
>
> High electrical voltage due to incorrect connection!
>
> Risk of death or injury caused by electric shock!

Only devices, electrical components and wires with a protective extra-low voltage (PELV) may be connected to connectors and terminals with voltages between 0 and 50 volts.

Only connect voltages and circuits with protection against dangerous voltages. Such protection may be achieved using isolation transformers, safe optocouplers or battery operation.

2.4.5 Protection against dangerous movements

Dangerous movements can occur if connected motors are not being controlled properly. There can be various different causes:

- Improper or faulty wiring or cabling
- Faulty operation of components
- Error in sensor or transducer
- Faulty or non-EMC-compliant components
- Software error in superordinated control system

These errors can occur directly after switching on the device or after an indeterminate period of operation.

The monitoring measures in the drive components largely rule out malfunctions in the connected drives. With regard to personal safety, particularly the risk of personal injury and/or material damage, sole reliance on these monitoring measures is not permitted. Faulty drive movements must always be anticipated in the space of time until the built-in monitoring measures take effect. The extent of these faulty drive movements will vary depending on the type of controller and on the operating state.

DANGER!

Risk from movements!

Risk of death, injury, serious personal injury and material damage!

For the reasons mentioned above, personal safety must be ensured by means of monitoring measures or other measures that are superordinate to the system. These are installed as appropriate to the specific circumstances of the system and a hazard and error analysis by the system manufacturer. The safety regulations applying to the system are also taken into consideration. Deactivating, circumventing or failing to activate safety features can result in random movements on the machine and other malfunctions.

2.4.6 Protection against contact with hot parts

DANGER!

Surfaces of the device enclosure may be hot!

Risk of injury! Risk of burns!

Do not touch device surfaces near heat sources! Risk of burns!

Before accessing devices, allow them to cool down for 10 minutes after switching them off.

Contact with hot parts of the equipment, such as the device enclosure, which houses heat sinks and resistors, can cause burns!

2.4.7 Safety during handling and installation

Under adverse conditions, unsuitable handling and installation of certain parts and components may cause injuries.

> **DANGER!**
> Risk of injury caused by improper handing!
> Personal injury caused by crushing, shearing, cutting, impacts!

General safety instructions apply:

> Follow the general setup and safety regulations for handling and installation.
> Use suitable installation and transport equipment.
> Take appropriate precautions to prevent entrapment and crushing.
> Use only suitable tools. Use special tools when their use is stipulated.
> Use lifting mechanisms and tools properly.
> If necessary, use suitable safety equipment (for example, safety eyewear, safety footwear, safety gloves).
> Do not stop under hanging loads.
> If any liquids spill onto the floor, clean them up immediately to avoid the risk of slipping.

3 General information on the parameterisation program

3.1 Key information

The parameterisation program item MotionSoft® is a program that enables users to parameterise the servo positioning controllers of the item C series.

The information provided in this manual relates to the following versions of the firmware and parameterisation software:

- item C-series servo positioning controller firmware for product stage 1.3
- item MotionSoft® parameterisation software for product stages up to 2.3

Unless explicitly documented, the functions of older versions are generally also incorporated into subsequent version updates.

The firmware of the item C-series servo positioning controllers must match the item MotionSoft® parameterisation software being used. This means that when functions are extended in a new version of the firmware, a corresponding version of item MotionSoft® is usually also required.

3.2 Performance features of item MotionSoft®

You can use item MotionSoft® parameterisation software to adapt the item C-series servo positioning controllers optimally to their application.

The parameterisation program offers the following performance features:

- Parameterising the C 1 and C 3 servo positioning controllers
- Convenient, automatic commissioning
- Configuring all parameters from a PC
- Displaying operating parameters
- Loading new firmware versions
- Loading and saving parameter sets
- Oscilloscope function
- Languages supported: German, English, French, Spanish, Italian, Polish
- Extensive context-sensitive help

3.3 Hardware and software requirements

Requirements for installing the parameterisation program:

- Administrator rights
- IBM-compatible PC, Pentium processor with at least 256 MB primary memory and at least 300 MB free disk space or higher
- Microsoft .NET Framework 4.5.2 or higher
- Microsoft C++ Runtime 2013
- Operating system (32/64 Bit) Windows® 7, Windows® 8 or Windows® 10
- Free USB interface
- Free serial interface (when using the RS232 parameterisation interface)

4 Installing item MotionSoft®

The installation file for item MotionSoft® can be downloaded conveniently from the Online Shop, which can be accessed via www.item24.com. You will need a user account to download the file.

4.1 Registration / creating a user account

Open your web browser and go to item24.com. If you already have a user account, use it to log in. Otherwise, create a free account.
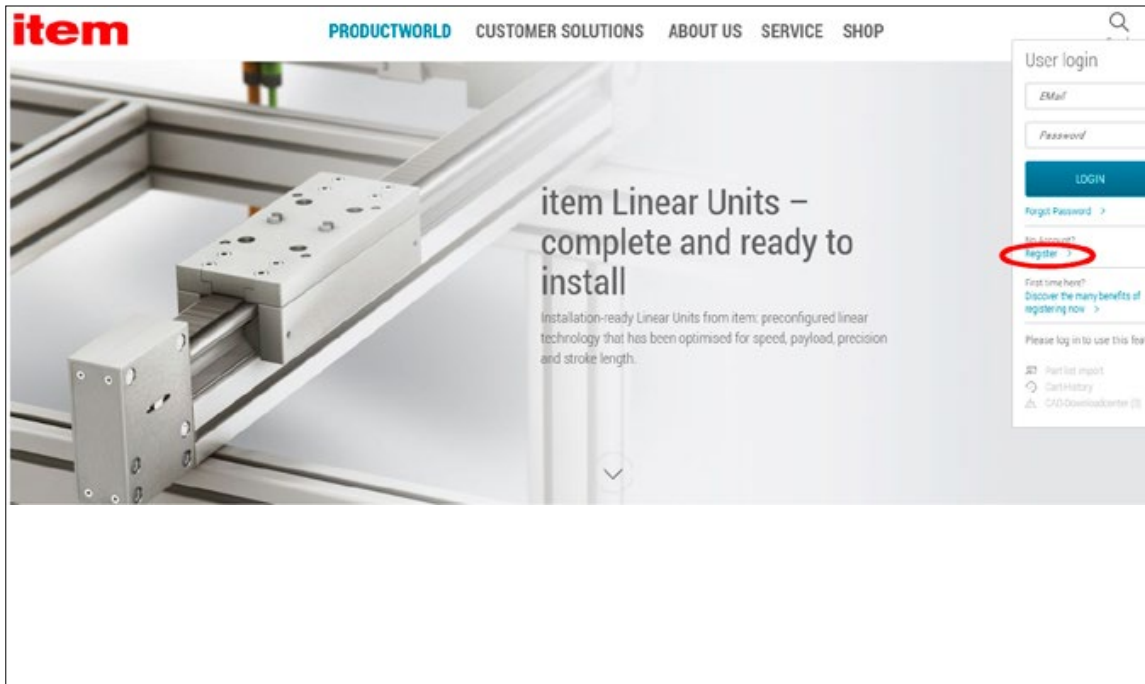
Figure 1: Registering with item

To do so, select "Register" in the menu.

Complete the registration form that appears in the subsequent dialogue box. We will then send you an email with a link. Open the email and click the registration button to complete the process. If you do not receive an email, please check the spam folder of your email account.

4.2 Downloading the installation file

At this point, you should already be logged into item with your account. Next, go to the item Shop and search for item Motion-Soft®.
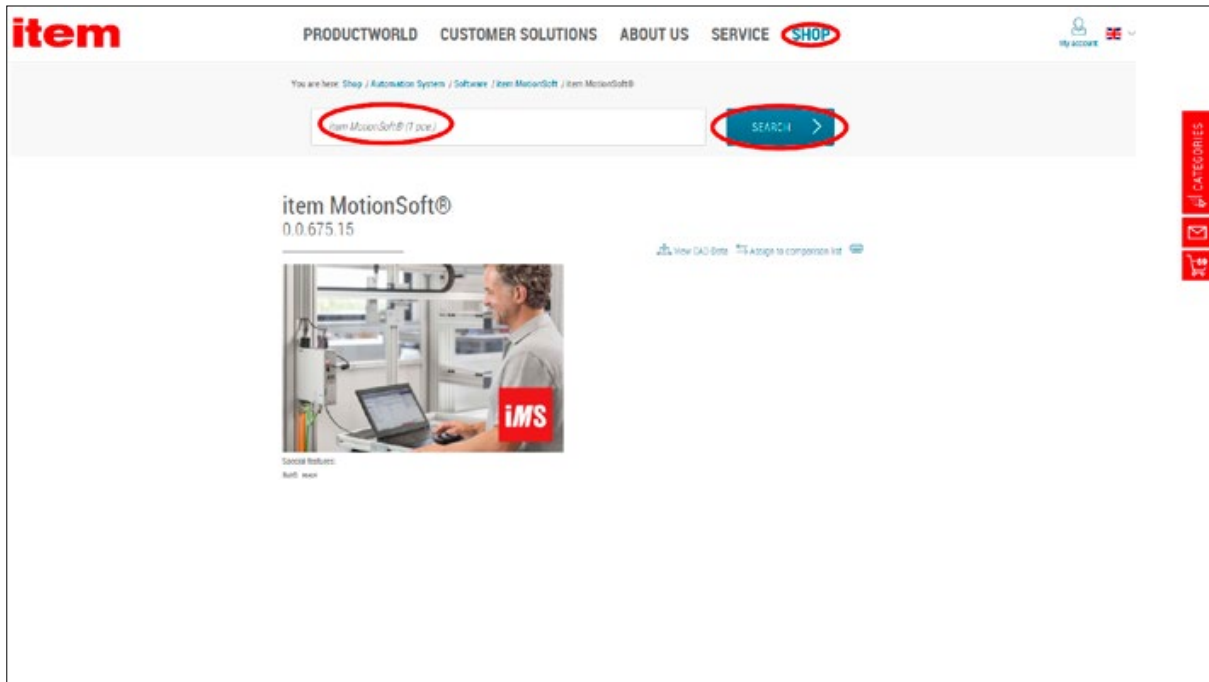
Figure 2: Searching for item MotionSoft® in the item

Your search will produce a result. Select the search result and scroll down to the download section.
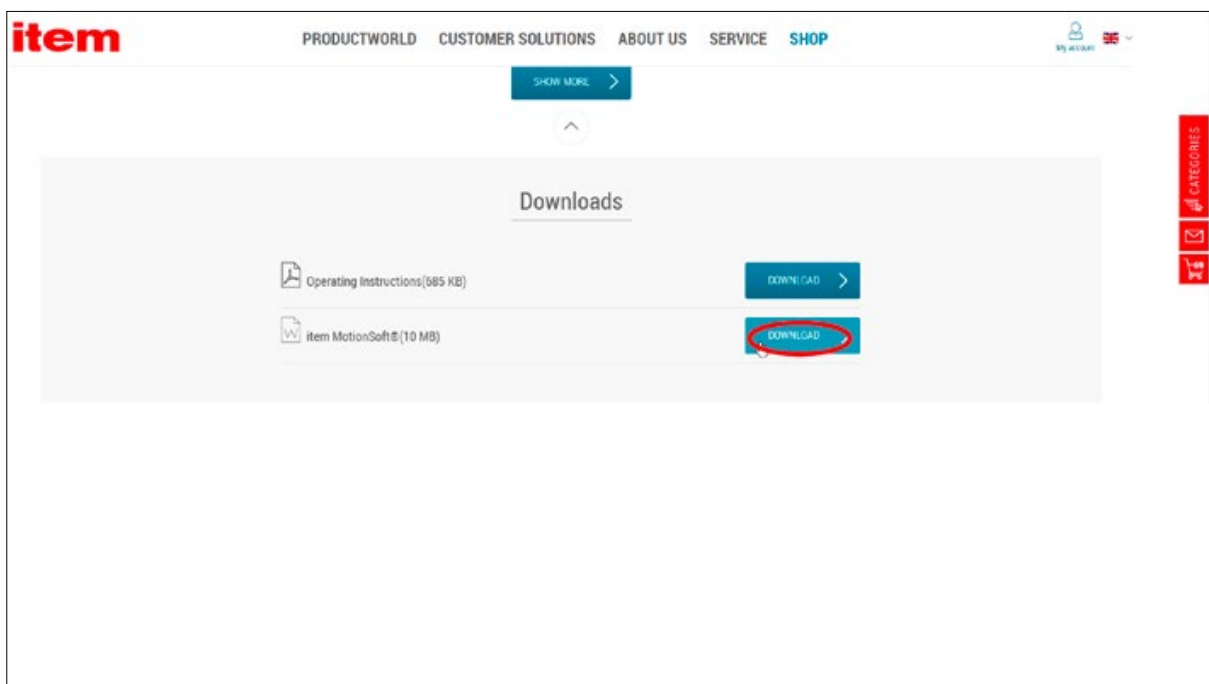
Figure 3: Downloading the installation file

Click the DOWNLOAD button to save the zip folder. This will usually be saved by default to the Downloads folder in your Windows directory. Alternatively, you can select a different destination.

4.3 Installation

The folder you have downloaded contains the Setup.exe file. Double-click this file to launch setup. To do this, you will need administrator rights.

Accept any security warnings that your system issues. The installation wizard will guide you through the installation process. You will need at least 165 MB of free space on the drive you select.

4.4 Connecting to the item linear motion unit

The Controller manual tells you how to connect the Controller and hardware. After doing that, connect the Controller to your computer. Initially, use a USB or RS232 connection for this purpose. You can find further information on this in Section 4.6 Important information for connecting via UDP / IP

4.5 Important information for connecting via USB when using Windows 10

Use a USB cable to connect your computer to the X19 USB port on the item Controller.

If driver installation does not start automatically, follow the steps below:

- Check whether the driver has been installed. To do so, open the device manager on your computer by clicking the Windows icon on your task bar and then typing in "Device Manager" as a search term. Alternatively, you can open the device manager through the Control Panel by going to Control Panel → Hardware and Sound → Device Manager.
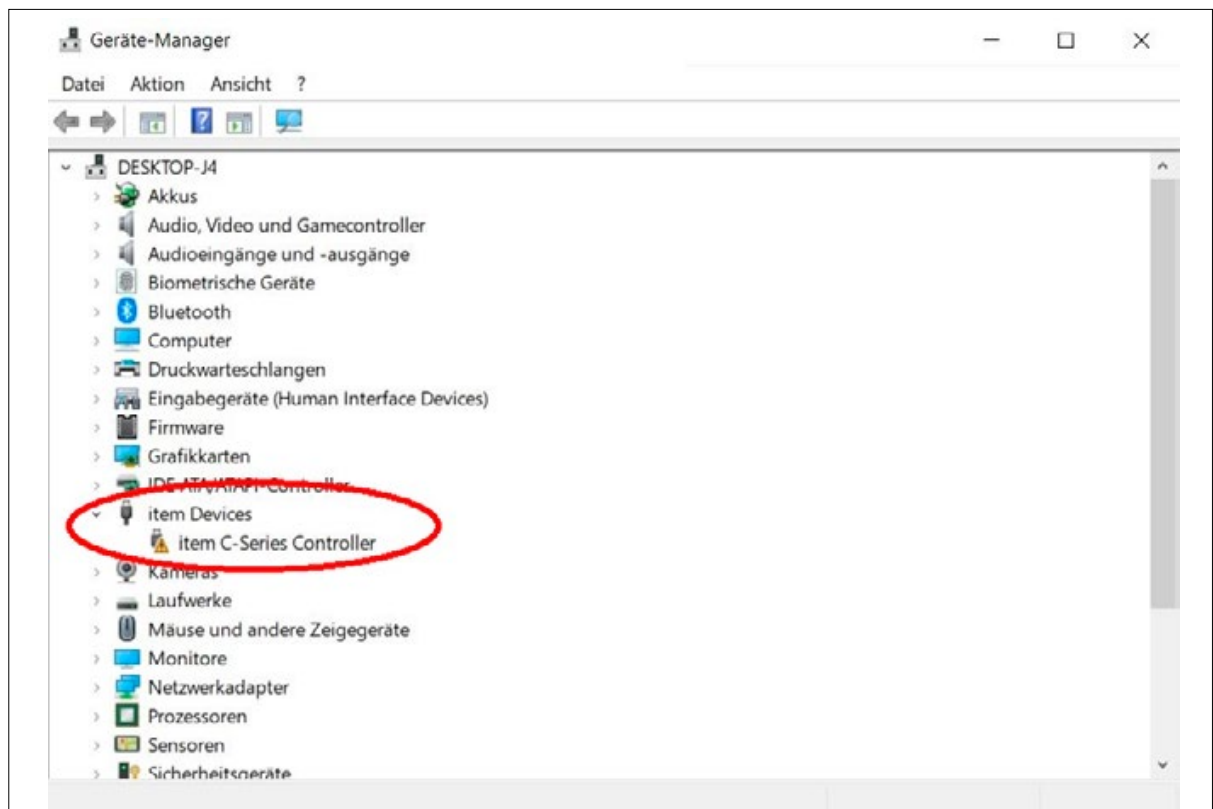
Figure 4: The Device Manager

- The Device Manager will contain the keyword "item Devices" with the subitem "item C-Series Controller". If there is a yellow exclamation mark next to the icon, the driver has not been installed.
- In this case, copy the following link into the address bar of your web browser and save the driver file.
- http://downloads.item-motionsoft.de/Releases/item%20Controller%20Driver%203.2%20Setup.exe
- Install the driver by double-clicking the Setup.exe file. To do this, you will need administrator rights.
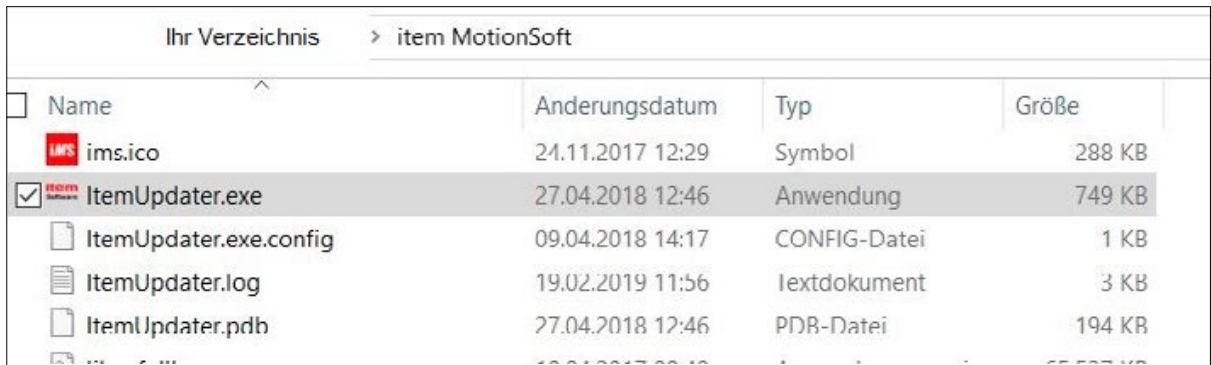
Once this has been done, the driver will be installed and the yellow exclamation mark will disappear from the Device Manager.

4.6 Important information for connecting via UDP / IP

An Ethernet connection can only be established when the network has already been configured. To configure the network, you must use the USB or RS232 interface and item MotionSoft®.

5 Launching the program for the first time

First, launch the itemUpdater by clicking the desktop link (if there is one) or by double-clicking ItemUpdater.exe in the directory where you saved it during installation.

Figure 5: Starting the itemUpdater

When you launch the program for the first time, you will be asked to confirm data protection settings. It is strongly recommended that you confirm these settings to ensure you are always using the latest version of item MotionSoft®.

In general, item MotionSoft® should always be launched through the itemUpdater.

5.1 itemUpdater – Home
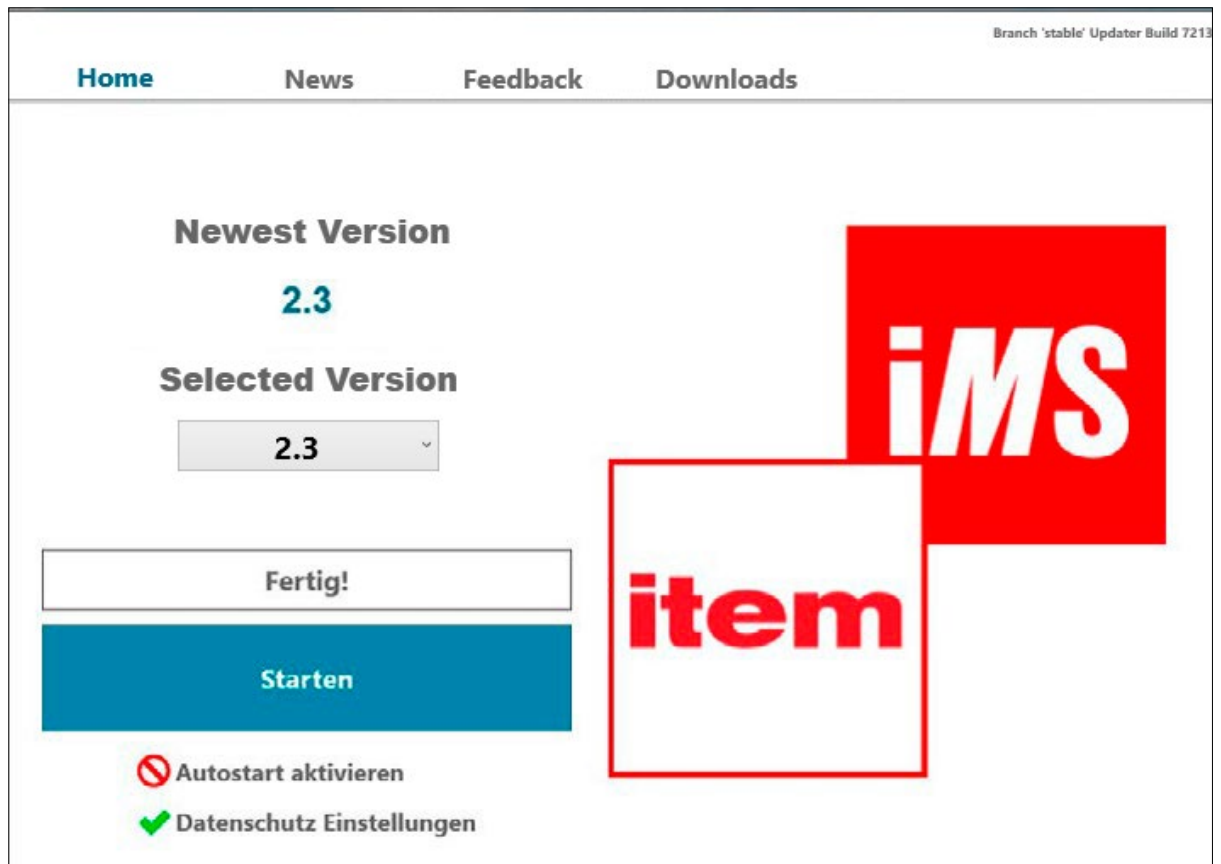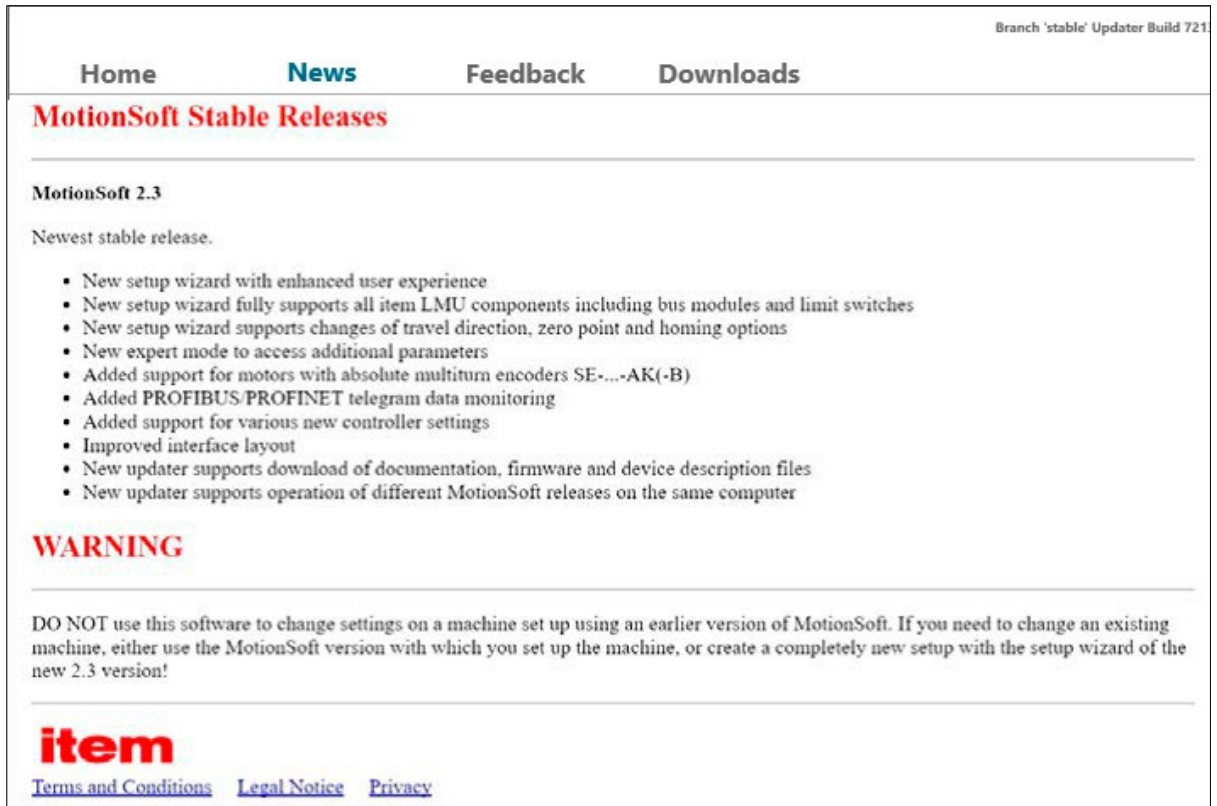
Figure 6: The itemUpdater Home tab

The Home tab of the itemUpdater gives you the option to choose which version of item MotionSoft® is to be launched. This version is also updated when an update becomes available.

5.2 itemUpdater – News

Figure 7: The itemUpdater News tab

The News tab of the itemUpdater is where you can read about the improvements contained in the latest update.

5.3 itemUpdater – Feedback

Figure 8: The itemUpdater Feedback tab

The Feedback tab is where you can describe a bug that you have found so that we can fix it as quickly as possible. You can also submit an idea for an improvement and ask a support question here.

5.4 itemUpdater – Downloads

Figure 9: The itemUpdater Downloads tab

The Downloads tab is where the itemUpdater documents what it has done since the last time the program was launched.

Documentation and the software development kit can also be downloaded here. Furthermore, you can select which version of item MotionSoft® is to be installed. The default is for the latest version to be selected.

6 Using item MotionSoft®

When item MotionSoft® is launched for the first time, it opens at the Overview – Setup page.

6.1 The user interface

Figure 10: The user interface

1: The navigation bar
The navigation bar is where you can select which of the five main pages in item MotionSoft® you wish to work on. For detailed information on the individual pages, please see the corresponding section of this manual.

2: The side menu
When on the Parameters and Run pages, this menu enables you to choose which type of actions or changes you wish to carry out. The individual functions are described in detail in the following sections.

3: System monitoring
The individual sections under system monitoring can be displayed as separate windows that can be freely positioned and resized. To do so, click the desired section heading then use the mouse to drag and drop the section as a separate window.

The first section displays the actual values of the connected item linear motion unit.

The second section can be used to check the current status of the digital inputs and outputs. A green LED indicates that the associated input or output is currently active.

The Oscilloscope section displays an oscilloscope that can be compiled as required. The timeframe can be set at between 10 ms and 1000 ms. Next, the following values can be added to or removed from the oscilloscope:

- Following error

- Each as a setpoint and actual value: Torque, speed, position

The Help section displays the help texts associated with the page that is currently shown.

4: Status bar

The far left of the status bar shows whether and how an axis is connected. The connection can also be broken. If the LED is green, the axis is properly connected.

Alongside this, the status bar indicates whether the item linear motion unit is ready. This is the case when no errors are present.

The current status of the power stage is shown alongside. Before the axis can be moved, the power stage must be switched to active by enabling the controller.

The error LED turns red when an error is present. Click it to see which error is present and to delete errors that have been resolved.

If an STO module is connected, the status of this module is also shown here.

A drop-down menu on the right-hand side of the status bar can also be used to set the operating mode. The options are Torque control, Speed control, Motion profile, Jogging mode and Motion profile/jogging mode.

On the far right is a button that can be used for controller enabling insofar as this is permitted in the settings under Parameters → Device parameters → Controller enable.

5: Information

The information icon appears on most setup pages. Click this icon to access additional, important information on the current stage in the setup process.

6.2 Overview – Setup

This menu can be used to start up the item linear motion unit® for the first time.
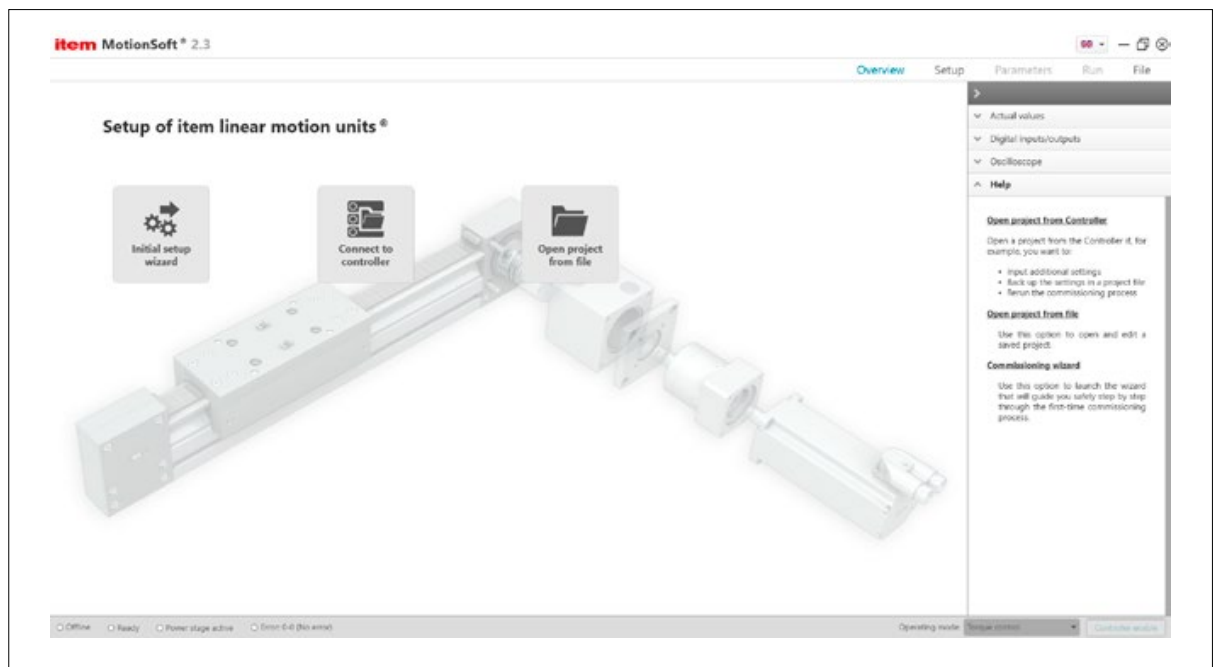
Figure 11: Setup – not connected

Initial setup wizard: Use this option to launch the wizard, which will reliably guide you step by step through the setup process.

Connect to controller: Open a project from the Controller if you intend to

- input additional settings.
- back up the settings in a project file.
- perform a new setup process.

Open project from file: Use this option to open and edit a saved project.
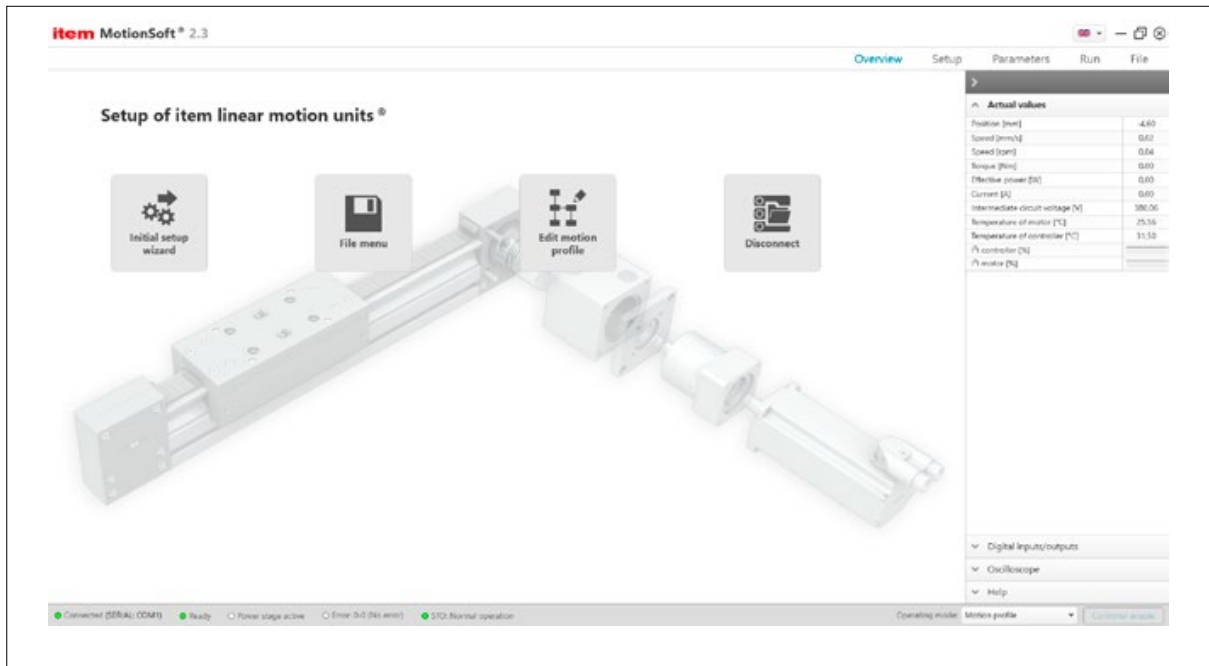
Figure 12: Setup – connected

Initial setup wizard: If you need to repeat the setup process, select this option to rerun the wizard.

Save project to file: Select this option to go to the File menu, where you can save the project on the Controller to your hard drive.

Edit motion profile: Select this option to edit the motion profile stored in the project.

Disconnect: Break the connection to the item linear motion unit®.

6.3 Setup

Setup starts when you click Setup in the navigation bar or launch the initial setup wizard. The first thing item MotionSoft® does is attempt to automatically connect to an item Controller. If no connection is made, please note that a connection needs to be established first, either via USB or RS232. If connecting via USB in Windows 10, please see Section 4.5.
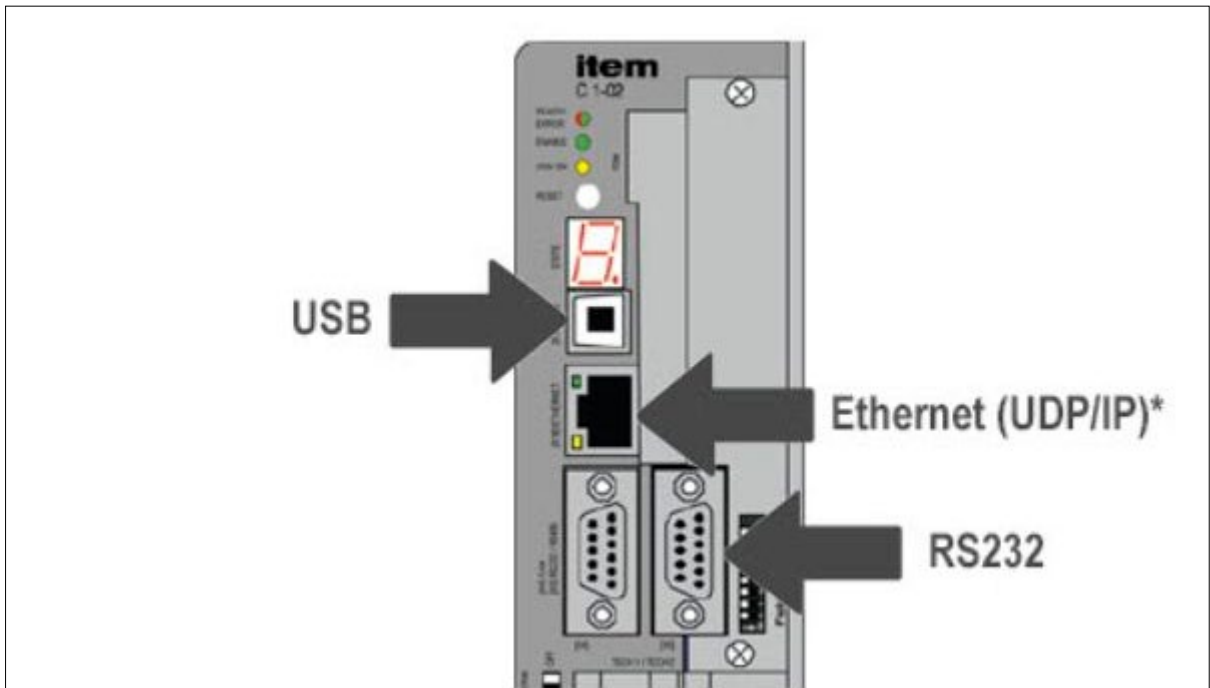
Figure 13: Parameterising interfaces

You can also create a connection manually using the status bar. To do this, click the **Offline** button and select a connection type.

RS232: Select RS232 if the Controller is connected to your PC via a serial interface. item MotionSoft® inputs the relevant settings for connection options automatically (COM port, baud rate).

Note: If the system is unable to establish a connection, please check whether the connection cable is connected to the Controller via the **[X5] RS232 / RS485 communication interface** (connection on right). Check whether the pin assignment of the connection cable is correct – it may be that the send and receive cables have been mixed up. A null-modem adapter can help with this. Please also consult the Controller manual on this.

UDP: Select UDP if the Controller is connected to your PC via a network connection. The system will attempt to establish a connection using the options set under **Parameters → Communication → Ethernet**.

Tip: When delivered with its factory settings intact, the Controller does not have a fixed IP address. Instead, it obtains this address from a "DHCP server". To do this, integrate a router between your PC and the Controller – the router can automatically assign addresses. Please note that the network adapter settings on your PC must also be set to **obtain an IP address automatically** for this process. You may need to contact your network administrator about this.

USB: Select USB if you wish to connect to the Controller via USB. However, item MotionSoft® must be correctly installed when selecting this option.

When a connection has been successfully established, this is indicated at the bottom left, in the status bar. **[Connected (USB)]**

6.3.1 Type of setup
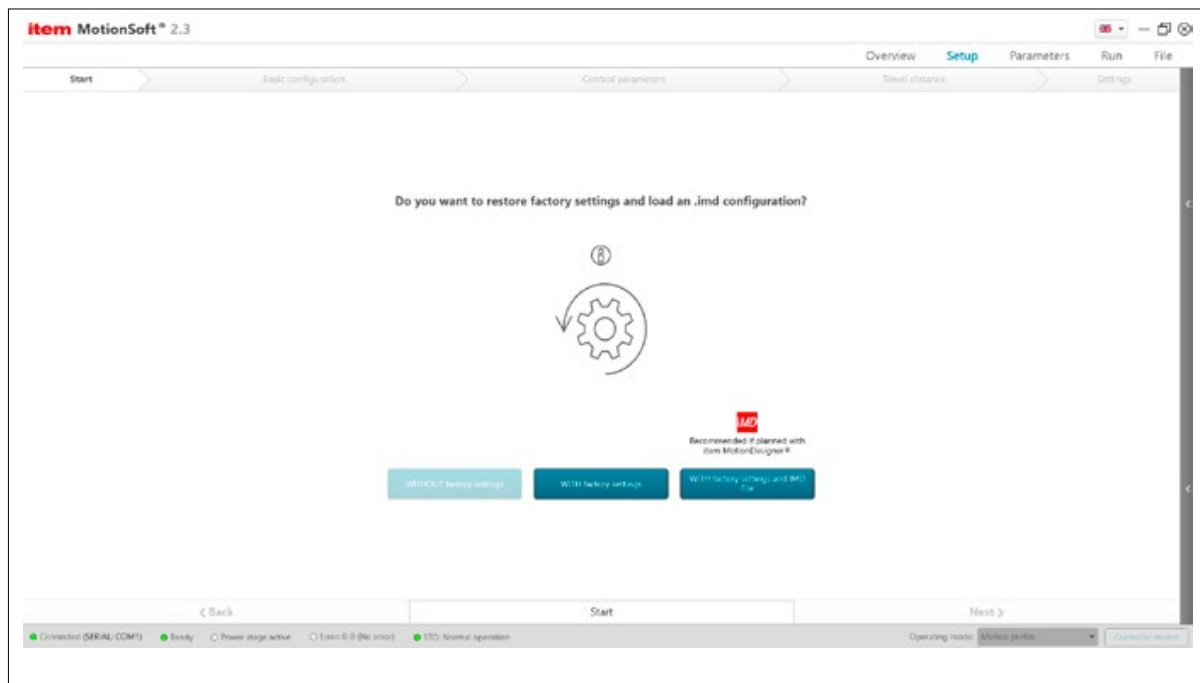
Figure 14: Setup type

You can launch the setup in this window. There are three options.

Without factory settings: This launches the setup without restoring factory settings and without a pre-prepared configuration. **This option is not advisable.** Old settings could compromise the setup.

With factory settings: This restores the C series to its factory settings and launches the setup. **This option is recommended when an .imd file is not available.** Previous settings are deleted.

With factory settings and IMD file: This restores the C series to its factory settings and launches the setup with an item MotionDesigner® configuration. **This option is recommended if you designed your system using the item MotionDesigner® online configurator.** You can download an .imd configuration file from the results page in item MotionDesigner®. This contains information about your components and, if appropriate, the motion profile you created. item MotionSoft® adopts both types of information, which makes the setup and application configuration processes easier. Previous settings are lost.

If you launch this option, a new window opens where you can select the .imd file.

6.3.2 Select components
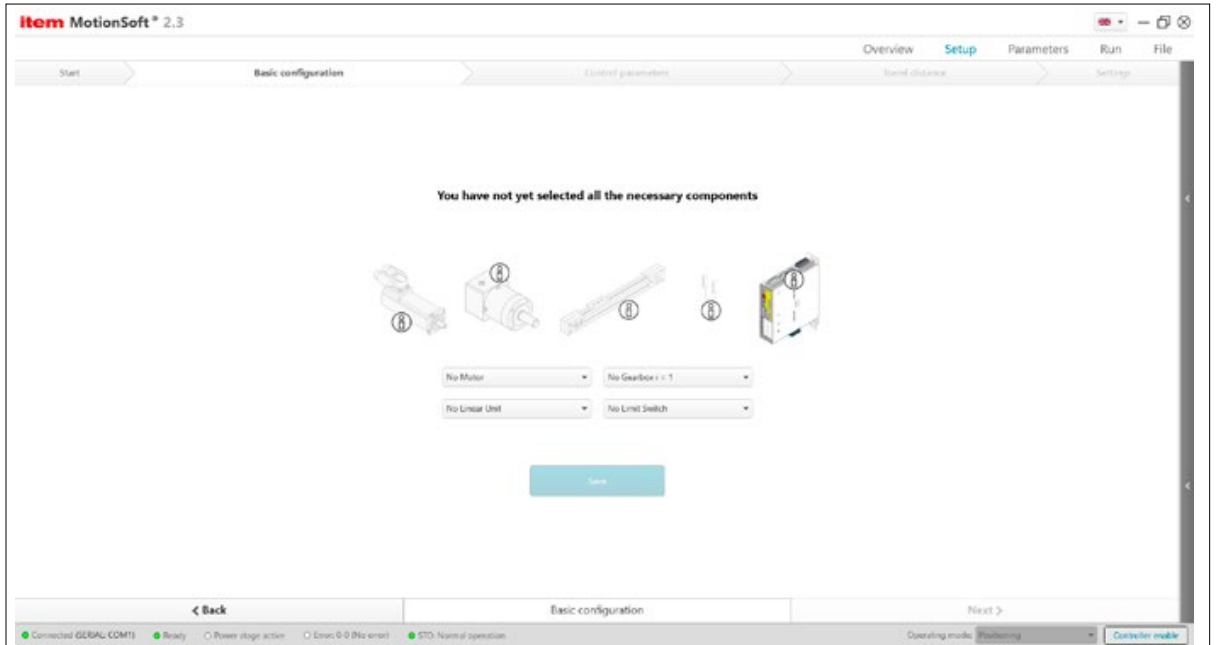
Figure 15: Selecting components

6.3.2.1 Select components

Use the relevant drop-down menus to select your Linear Unit and any Gearbox that is installed. When you select a Linear Unit, the relevant safety parameters are automatically adopted in the background. If you are not using a Gearbox, set the factor to i = 1. Match the set data with the data shown on the specification plates of the Linear Unit and Gearbox.

6.3.2.2 Depiction of components

A picture of the selected Linear Unit is shown here. Please check whether the Unit shown here is identical to the Unit in front of you.

6.3.2.3 Technical data

This is a list of the most important technical data for the selected product. This information is summarised at the end of the setup process.

Gear factor: Gear ratio.

Feed constant: The feed constant describes how far the carriage of a Linear Unit moves for each revolution on the input side. That means, when using a timing-belt drive, you will need to enter the effective circumference of the Reverse Unit.

Total feed: Feed constant in mm per motor revolution.
Calculation: Total feed = Feed constant of Linear Unit / Gear factor

Max. speed: Maximum permissible speed of the selected Linear Unit.

Max. acceleration: Maximum permissible acceleration of the selected Linear Unit.

Max. travel distance: Maximum possible travel distance of the selected Linear Unit.

Safety clearance: The safety clearance describes a buffer zone between mechanical limit stops and end positions stored in the software. This clearance is taken into account in the initial setup wizard during the subsequent calibration run.

6.3.2.4 Select motor

Select Motor: Select a Motor that is installed on your Linear Unit. If appropriate, check the selection against the details on the specification plate of the Motor. Once you have made your selection, you can access the technical data by clicking the info button.

Motor data: This list shows the motor data for the selected motor. If data has already been stored in the Controller previously, this list shows a comparison of the data for the selected Motor and the motor data that is currently stored in the Controller. Click the "Save" or "Next" button to overwrite the stored data with the values you have selected.

6.3.3 Installation position and direction of travel
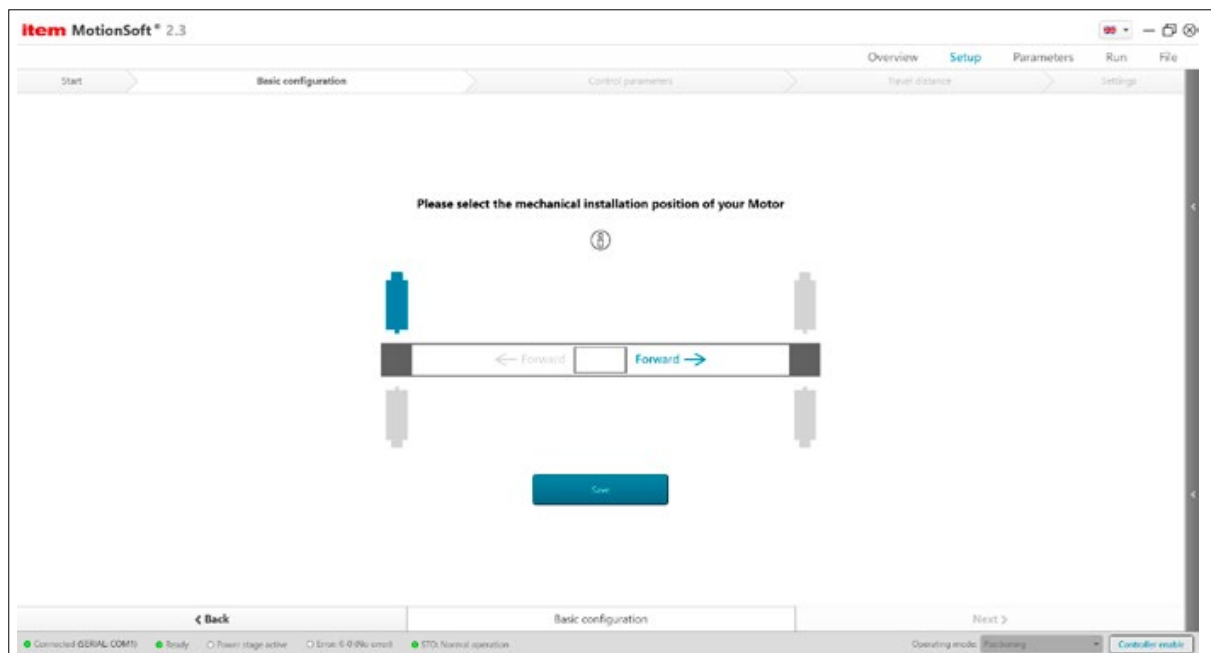
Figure 16: Installation position of the motor

The positive travel direction on the carriage is derived from the installation position of the Motor. Please use the schematic plan view of the axis to identify the installation position of the Motor – select the Motor that matches the physical installation position on your Linear Unit.

The selected forward arrow shows you the positive travel direction for your carriage, as derived from the installation position of the Motor. You can reverse the counting system and thus change the positive travel direction by selecting the greyed-out arrow.

6.3.4 Power stage enable and controller enable

The item C series must be enabled via the digital inputs on the top. To enable the power stage, 24 V DC must be supplied to digital input DIN 4 (I/O connection [X1.21] on the top of the Controller). The connection can be permanent or made via a switching contact. An auxiliary voltage of +24 V can be used at I/O connection [X1.18].
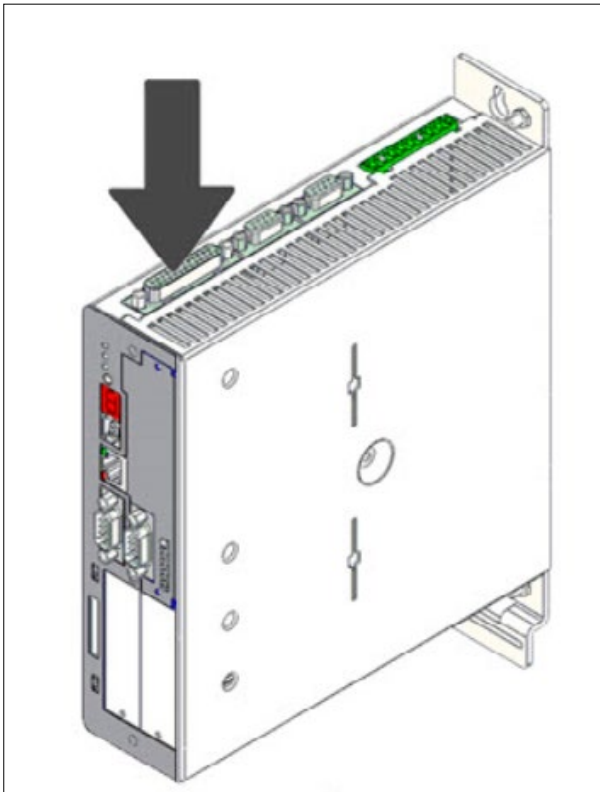
Figure 17: Location of connection X1

Please note that the power stage must be enabled at DIN 4 before controller enabling is activated at DIN 5.
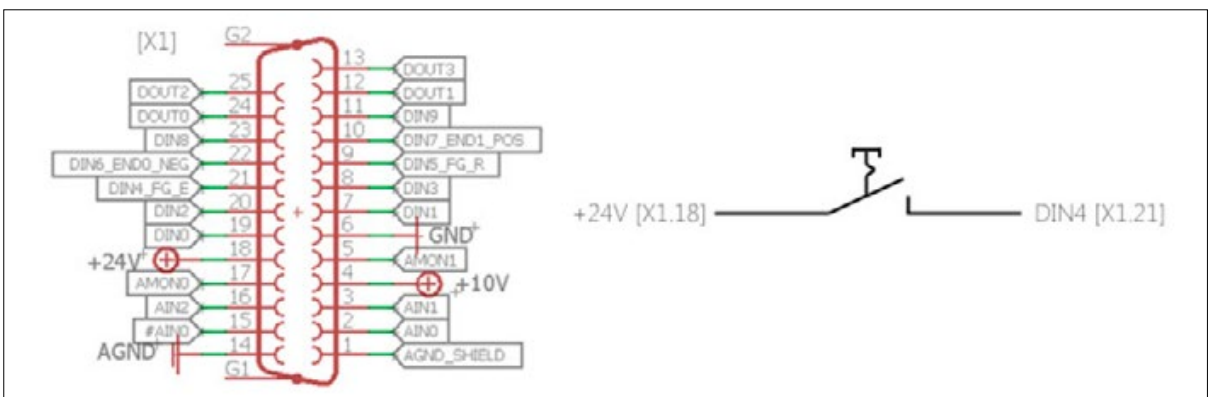
Figure 18: Pin assignment of X1

An I/O Transfer Module (0.0.688.62) can be used to simplify wiring in the switchbox. This carries the Sub-D connection [X1] on spring terminals and is suitable for rail mounting.

6.3.5 Calibrate control parameters
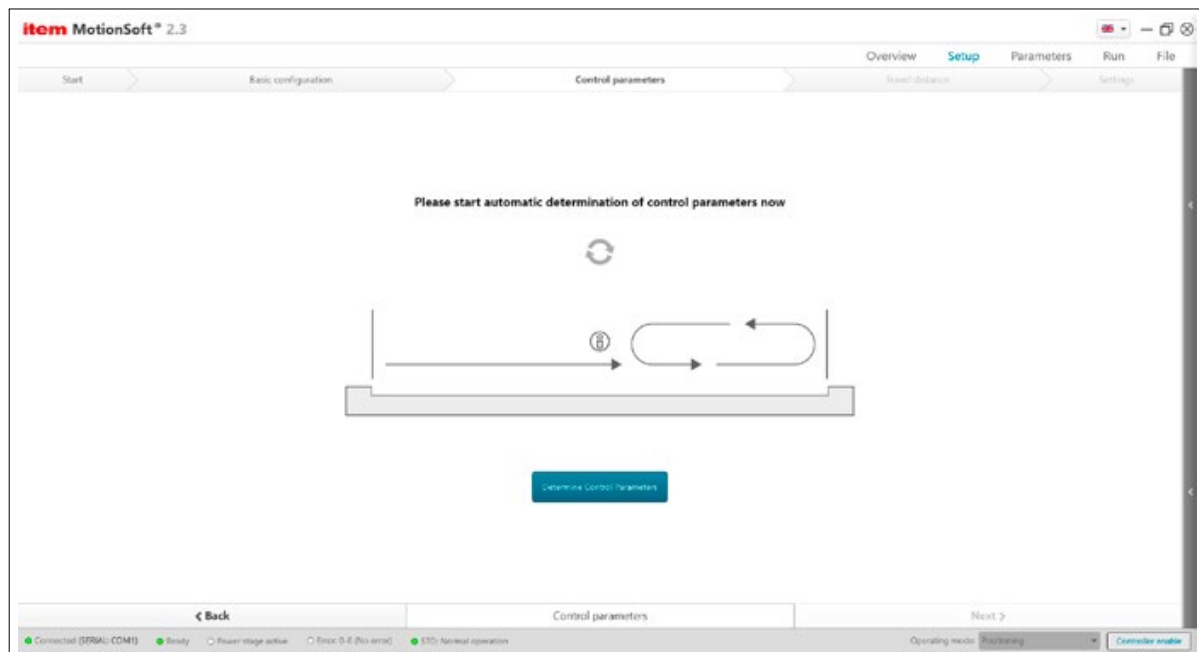
Figure 19: Determining parameters

During this step in the commissioning process, the system automatically calculates the most suitable control parameters for your application. Optimum control parameters are essential to ensure a smooth positioning run!

Ensure the carriage can be moved from one limit stop to the other.

To achieve optimum results, you can perform this step in the setup process with a load on the carriage that is equal to the average weight of your application.

Start the run: Start the function by first enabling the Controller and then pressing the **Determine control parameters** button. You can cancel the optimisation run by pressing the **Stop** button.

Minor deviations may occur in the values for gain and time constant when repeating automatic calibration.

Current controller, speed controller, position controller: The parameters for the relevant controllers are shown here before and after the automatic optimisation run.

Status of optimisation:

0B: Sudden drop detected on axis. If necessary, modify parameters and restart sequence.

0D: Axis blocked, both stops identified, please check the Linear Unit or, if necessary, adjust parameters and restart sequence.

6.3.6 Calibrate the system
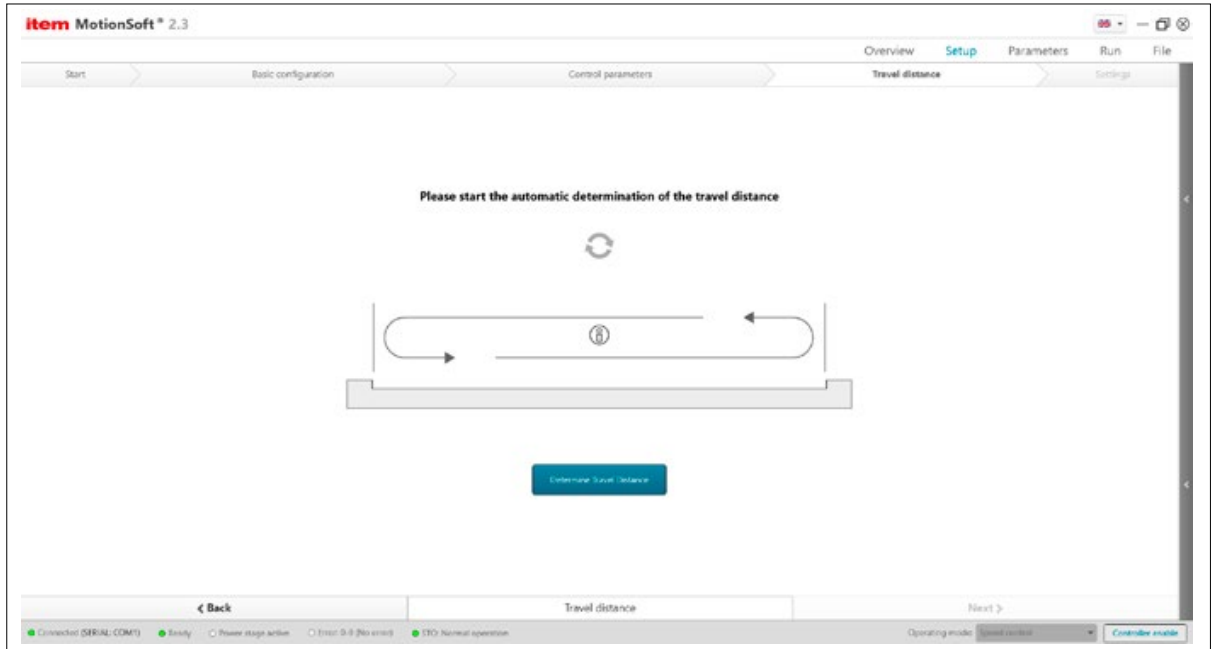
Figure 20: Determining travel distance

The item linear motion unit you ordered is automatically calibrated during the Calibrate system step of the setup process. During this run, the carriage travels from limit stop to limit stop, measuring the maximum positioning range. The safety clearance of each Linear Unit is factored into this process. If you have incorporated limit switches or homing switches, these will also be shown with the corresponding position. Once the run has ended and you have clicked the **Save** button, the setup process is complete and the values that have been calculated are adopted in the corresponding safety parameters. **Ensure the carriage of your Linear Unit can be moved from one limit stop to the other. You may need to retrofit an end limit stop. For further information on this, please consult the installation guide.**

Start the run: Start the calibration run by first enabling the controller and then pressing the **Determine travel distance** button. You can cancel the calibration run by pressing the **Stop** button.

6.3.7 Set up homing run
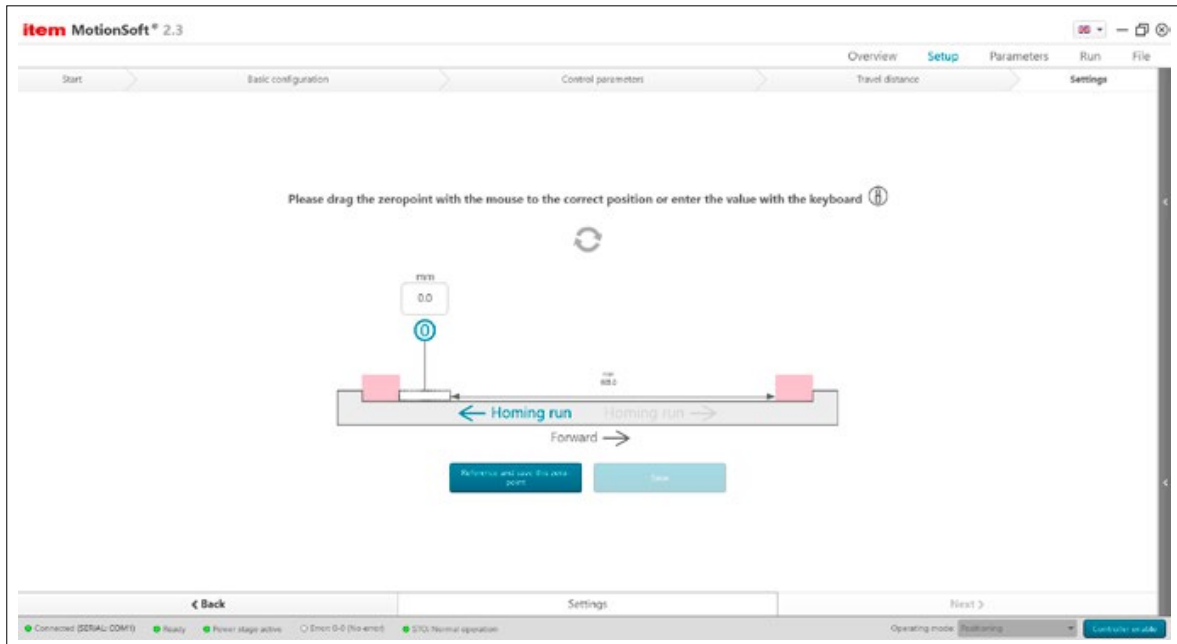
Figure 21: Setting up a homing run

To select where the zero point of your application, i.e. the position with the value 0 mm, should be, displace the zero point relative to the positive travel direction and the measured travel distance.

After a homing run, the carriage returns as standard to this position (0 mm). If you are using an absolute encoder, you will only need to carry out this homing run once, during this initial setup.

The distance from the zero point to the end position moving in the forward direction of travel is stated as a positive travel distance. The distance from the zero point to the end position moving against the direction of travel is stated as a negative travel distance. In the case of axes that do not have limit switches, the safety clearance of the Linear Unit dictates how far in front of the mechanical limit stop the end position is located. When using limit switches, the end position is located 10 mm in front of the limit switch trigger point as standard.

The standard setting for software end positions is such that the maximum travel range to either side is extended by 5 mm. This ensures the carriage can travel to the maximum position on each side without the system reporting an error.

Start the homing run by clicking the **Homing run button and save this zero point.** Next, use the corresponding button to save the settings that have been made.

6.3.8 Start homing run
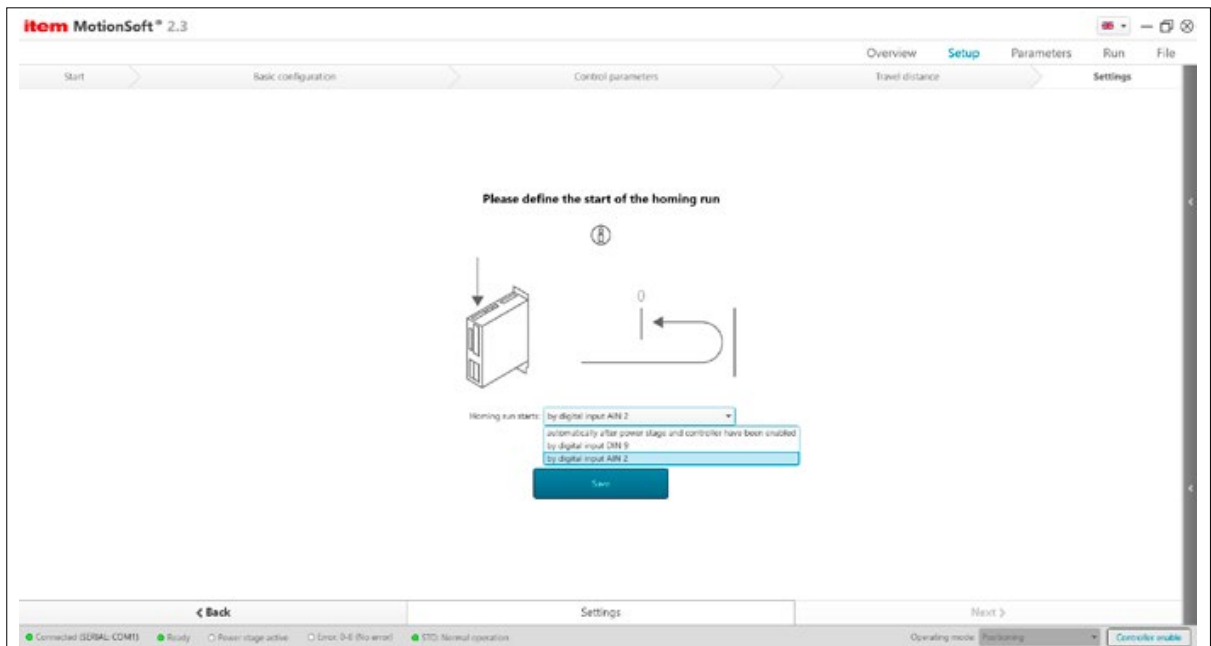
Figure 22: Starting a homing run

If you are not using a Motor with an absolute encoder, you will need to specify when the Controller performs a homing run. A homing run must be performed each time the C series is restarted.

You can have the homing run start automatically after power stage enabling and controller enabling. The advantage to this is that the system is referenced after a restart and after the necessary enabling without any further measures or additional wiring/switches. **A homing run is only repeated on the system when both the power stage and controller have been re-enabled, and not when only the controller has been disabled and re-enabled.**

Some applications will not allow automatic homing runs or repeated homing runs once the safety function has been requested and the system enabled. In such instances, use a digital input to start the homing run manually. DIN 9 and DIN AIN 2 can be selected during setup. The homing run starts with an edge from 0 V DC to 24 V DC at the selected input. Other inputs can also be selected later, in the digital inputs submenu.

Where limit switches have been installed, the homing run is carried out against the limit switches, otherwise it is carried out against the end limit stop. Additional methods are available in the homing run submenu.

Afterwards, it is still necessary to select how controller enabling is to be executed in the future.

Figure 23: Enabling the controller

If one of the three options underneath is selected for controller enabling, an AND link is created in the Controller as a requirement. If controller enabling is set to DIN 5 and PC, it is not possible to operate the Linear Unit unless it is connected to a computer.

6.3.9 Setup successfully completed
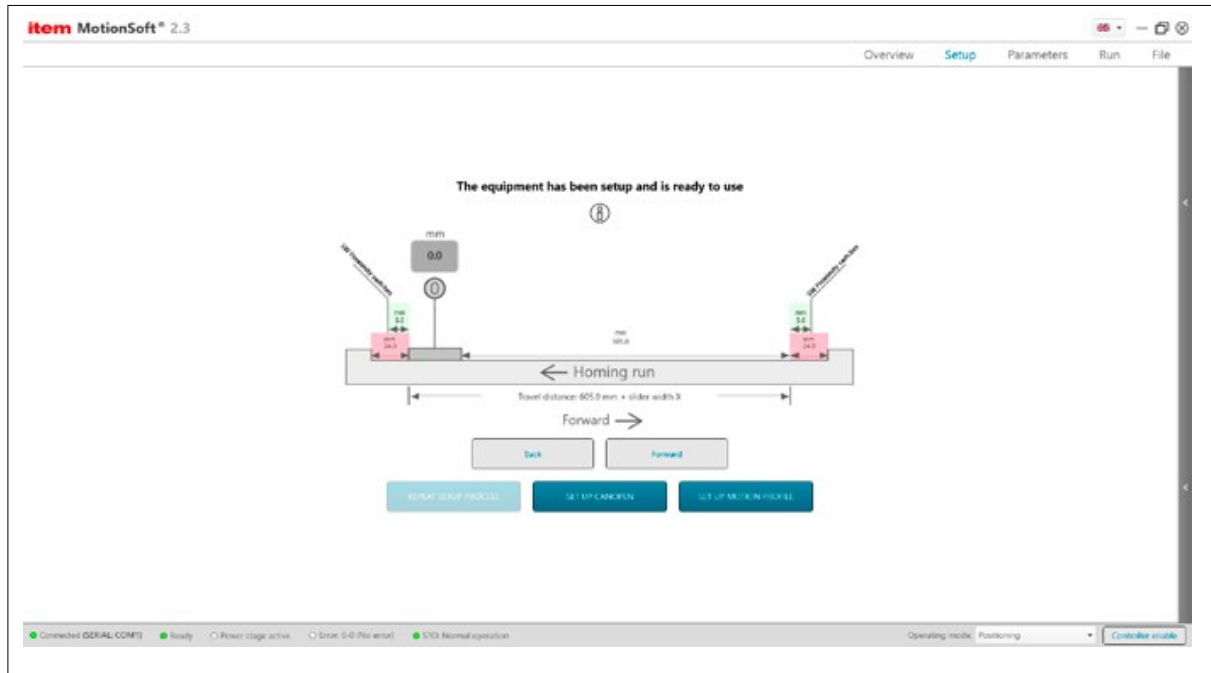
Figure 24: Successful setup

The setup process has been completed successfully and data has been automatically stored in the Controller. The illustration shows the maximum travel distance of the Linear Unit. Homing / limit switches, if any have been incorporated, are also shown in their installed position.

You can use the Forward and Back buttons to manually move the axis. If you run into a software limit switch, the axis comes to a halt and an error is triggered. Click the error so you can delete it. You can move the axis again once controller enabling has been performed again via the status bar.

6.4 Parameters – Basic configuration

Use this menu to enter basic settings for the application.
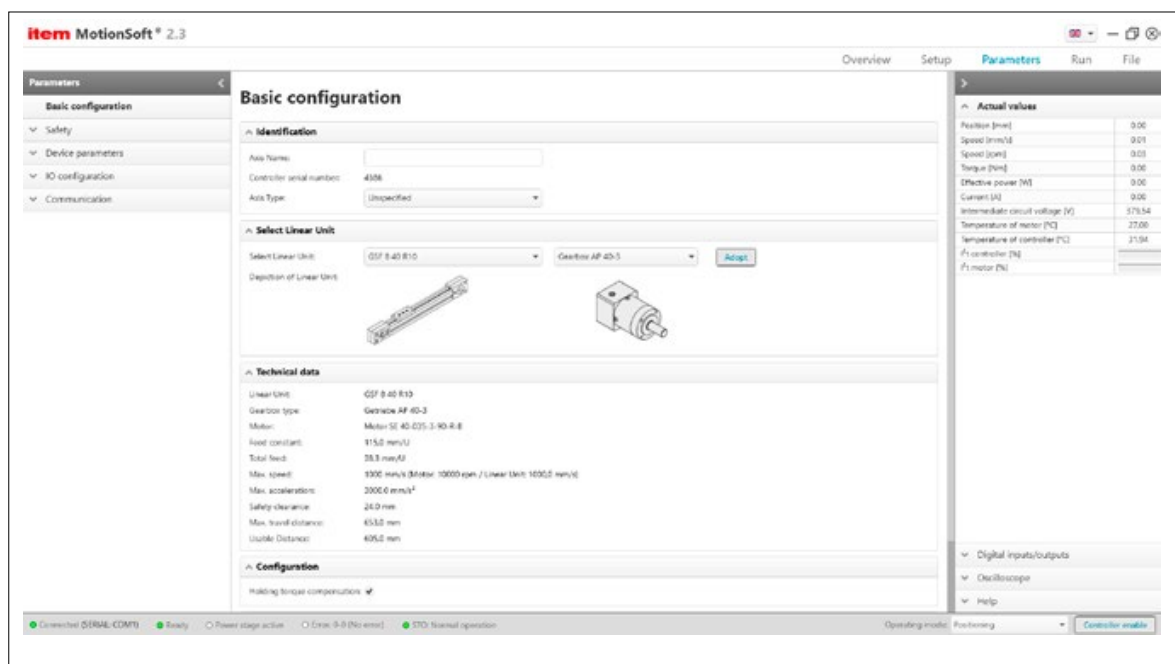
Figure 25: Basic configuration

6.4.1 Select Linear Unit

Select Linear Unit: Select your Linear Unit from the drop-down list. When you select a Linear Unit, the relevant max. threshold values of the application are displayed. To save this data in the Controller, you will need to adopt it. The values are then adopted in the corresponding safety parameters of the program.

Depiction of Linear Unit: A picture of the selected Linear Unit is shown here. Please check whether the Unit shown here is identical to the Unit in front of you.

6.4.2 Technical data

Gear factor: If a Gearbox is fitted to your Linear Unit, enter the gear factor here. The gear factor is shown on the specification plate of the Gearbox (e.g. i = 3). If your Linear Unit is not fitted with a Gearbox, enter the factor i = 1.

Feed constant: You can set the feed constant of the Linear Unit here. The feed constant describes how far the carriage of a Linear Unit moves for each revolution on the input side. That means, when using a timing-belt drive, you will need to enter the effective circumference of the Reverse Unit.

Total feed: Feed constant in mm per motor revolution.

Total feed = Feed constant of Linear Unit / Gear factor

Max. speed: Set the maximum permissible speed for the Linear Unit here. When you make this entry, the safety parameters **Speed limit, positive; Speed limit, negative** and **Motor overspeed protection** are automatically set to this value in the background.

Max. acceleration: Set the maximum permissible acceleration for the Linear Unit here.

Max. travel distance: Set the maximum travel distance for the application here. When a Linear Unit is selected, the max. stroke is entered. Please adjust the values to suit your application or repeat the setup process.

Safety clearance: Enter the safety clearance of your Linear Unit here. The safety clearance describes a buffer zone between mechanical limit stops and end positions stored in the software. This clearance is taken into account in the initial setup wizard during the subsequent calibration run.

6.4.3 Configuration

Holding torque compensation: Check this box if the application is subject to permanent torque in one direction (e.g. gravity on a vertical axis). In this case, in order to minimize sudden drop in the axis due to its dead weight, holding torque is pilot-controlled in the Controller when the holding brake is released during torque and position control and during positioning.

6.4.4 Limit switches

Use this menu to specify the logic for the limit switches. Limit switch logic describes the correlation between the logical and physical position of the limit switches.

You can choose whether the limit switches operate as openers or closers.

The Controller can evaluate two limit switches that can be used to specify the travel range. Each limit switch specifies the travel limit for one direction of rotation.

The assignment of the physical limit switches connected to DIN 6 and DIN 7 can be swapped.

Design: Enter whether the limit switch is to operate as an opener or closer.

Reversed (change limit switch): Reverse the limit switches: The physical limit switch connected to DIN 6 adopts the operating principle of the limit switch connected to DIN 7 and vice versa.

6.5 Parameters – Safety

This menu looks at various safety aspects.

6.5.1 Safety parameters
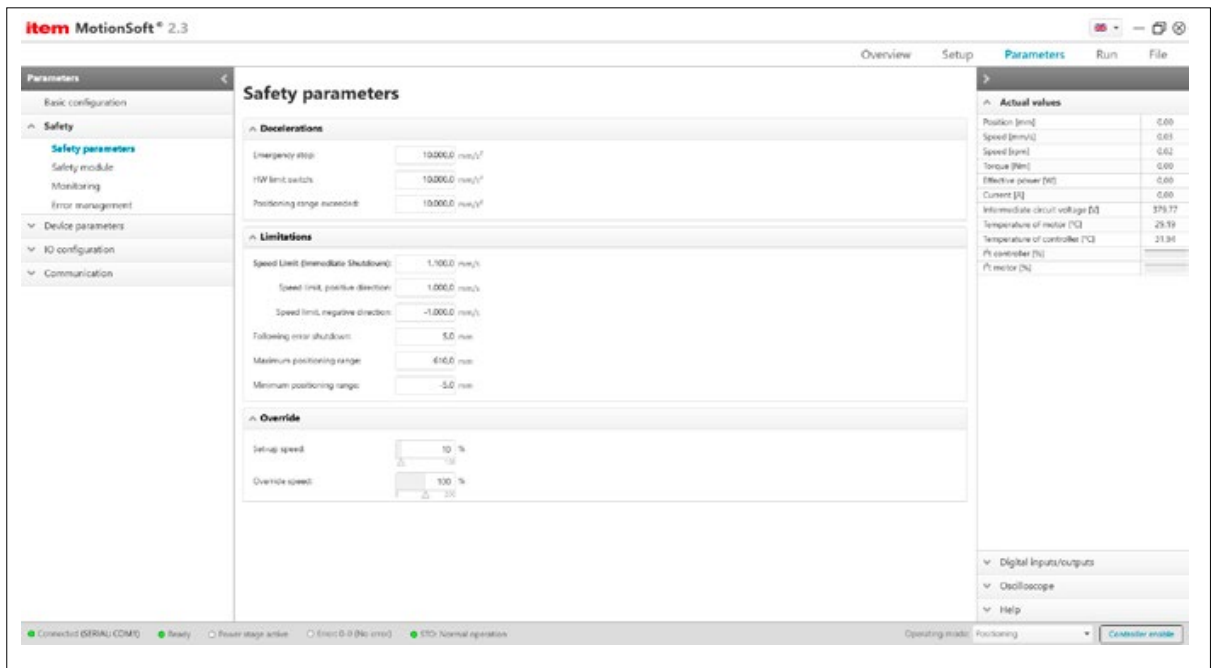
Figure 26: Setting safety parameters

6.5.1.1 Decelerations

Emergency stop: This deceleration exerts a braking effect if the controller is disabled.

HW limit switch: This deceleration exerts a braking effect if a hardware limit switch has been reached.

Positioning range exceeded (only in positioning mode): This deceleration exerts a braking effect if the carriage leaves the permitted positioning range when the Linear Unit is in positioning mode. The start of a positioning run that exceeds the valid positioning range is suppressed. It is possible that the range could be exceeded in the following circumstances:

- Positioning at final speed <> 0
- Position-synchronous operation

6.5.1.2 Limitations

Speed Limit (Immediate Shutdown): If the current speed exceeds the value that has been parameterised here, error 10 "Overspeed (motor overspeed protection)" is triggered.

Speed limit, positive direction: This is where you can enter the maximum positive speed for your application. However, the effective speed limit depends on the settings for Override and Set-up speed.

Speed limit, negative direction: This is where you can enter the maximum negative speed for your application. However, the effective speed limit depends on the settings for Override and Set-up speed.

Following error shutdown: If the current following error exceeds the limit that has been set, the reaction specified in error management is triggered.

Minimum / Maximum positioning range: This is where the current positioning range is depicted. Positioning runs can be executed within this range only.

6.5.1.3 Override

Set-up speed: In set-up mode, the maximum permissible speed setpoint is symmetrically reduced to a percentage value (0 … 100%) of the maximum speed. Either the negative or positive speed limit – whichever of the two is the smaller value – is used.

Example:
Positive speed limit: 500 rpm
Negative speed limit: -300 rpm
Set-up speed: 10%

When set-up mode is active, the maximum speed setpoint is +/- 30 rpm.

The position control system also recognises set-up mode. In positioning mode, the pre-defined speed is reduced below the maximum speed setpoint under certain circumstances in order to prevent the sudden appearance of a following error. However, if the override is a value over 100%, this function can be overridden. Under such circumstances, a following error does occur, as the speed setpoint specified in the position control system is limited. Consequently, the calculated position setpoint course cannot be maintained.

Set-up mode can be activated via a digital input – see the IO configuration menu for further details.

Override speed: In positioning mode, the current travel speed of an ongoing positioning run, which is predefined by the position control system, is also determined by a factor (override). Consequently, the cyclic calculations always factor in the travel speed stored in the positioning set, multiplied by the override. The override is thus equally valid for all positioning sets, including during a homing run. When set at 100%, it has virtually no effect.

The override is used primarily by fieldbus systems, which overwrite the value on a cyclical basis. It can also be helpful during setup. For example, it can be used to temporarily reduce the travel speeds of all positioning sets without having to change each positioning set individually.

The override is not saved. After a reset it will always be 100%.

6.5.2 Safety module

The Safety module dialogue shows the status and device data for the currently installed module and is used to configure the application following a module replacement.

To ensure functional safety, modifications must be traceable. To guarantee this, the specifications for module type, serial number and version are stored in the installed functional safety module. This data is stored in the basic unit as comparison values, which means that modifications to the components can be detected.

When a modification is detected, for example a module replacement, a non-acknowledgeable error is triggered. This modification must be configured before the application can be put back into operation with the Controller. That means the modification must be explicitly adopted or confirmed. In relation to functional safety modules FSM 2.0 – STO and FSM 2.0 – FBA, these traceable modifications relate to a module replacement.

Functional safety module FSM 2.0 – STO itself does not need to be parameterised.
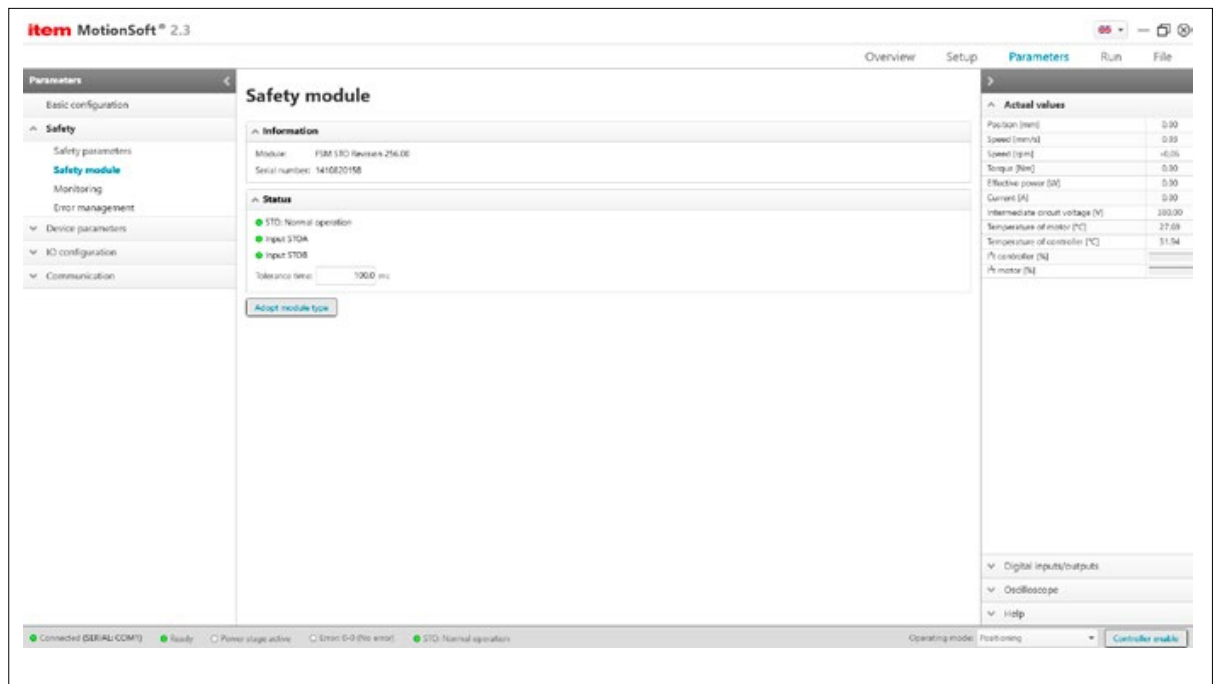
Figure 27: Information about the safety module

6.5.2.1 Information

This field displays the device data that has been stored on the functional safety module or in the hardware of the permanently integrated safety function during factory setup.

Module: Precise type designation, e.g. FSM 2.0 – STO, and version number of the module hardware.

Serial number: The serial number is assigned during production and stored on the module and in the hardware of the permanently integrated safety function. It is unique to each product of the relevant type and to each item of hardware.

6.5.2.2 Status

Display using three LEDs:
- Normal operation
- Safe Torque Off (STO)
- Safety circuit error

All LEDs off: The functional safety module has not been initialised / is not ready.

Normal operation on: Non-safe state. Module FSM 2.0 – STO is error free and ready.

STO on: Safe state. The output power stage of the Controller has been safely deactivated.

Error, safety circuit: Safety conditions have been violated. The detected status of the two driver supply voltages does not match a status that has been specified as valid. The PWM has been deactivated, the output power stage is not reliably switched off, i.e. the system is in a "non-safe state".

Input STOA: The driver supply is switched off / switched on.

Input STOB: The driver supply is switched off / switched on.

Tolerance time: The transition between a safe state and a non-safe state is introduced by level changes at the STOA and STOB control inputs of the safety module. According to the specification of the safety function, both levels must be identical, otherwise an error message is generated. These level changes do not normally occur perfectly simultaneously due, for example, to component tolerances or bouncing outputs on safety controllers. The firmware tolerates this as long as the second input follows within a specified period of time, known as the tolerance time.

6.5.2.3 Adopt module type

In the lower part of the Safety module dialogue is the Adopt module type button.

You must click this button to confirm a module swap. Once you have done so, functional safety is parameterised or configured. When this process has been completed and a subsequent Save & Reset has been carried out, any error message that was previously generated because a module had been replaced will no longer appear.

6.5.3 Monitoring

This menu contains setting options for analogue and digital temperature monitoring.
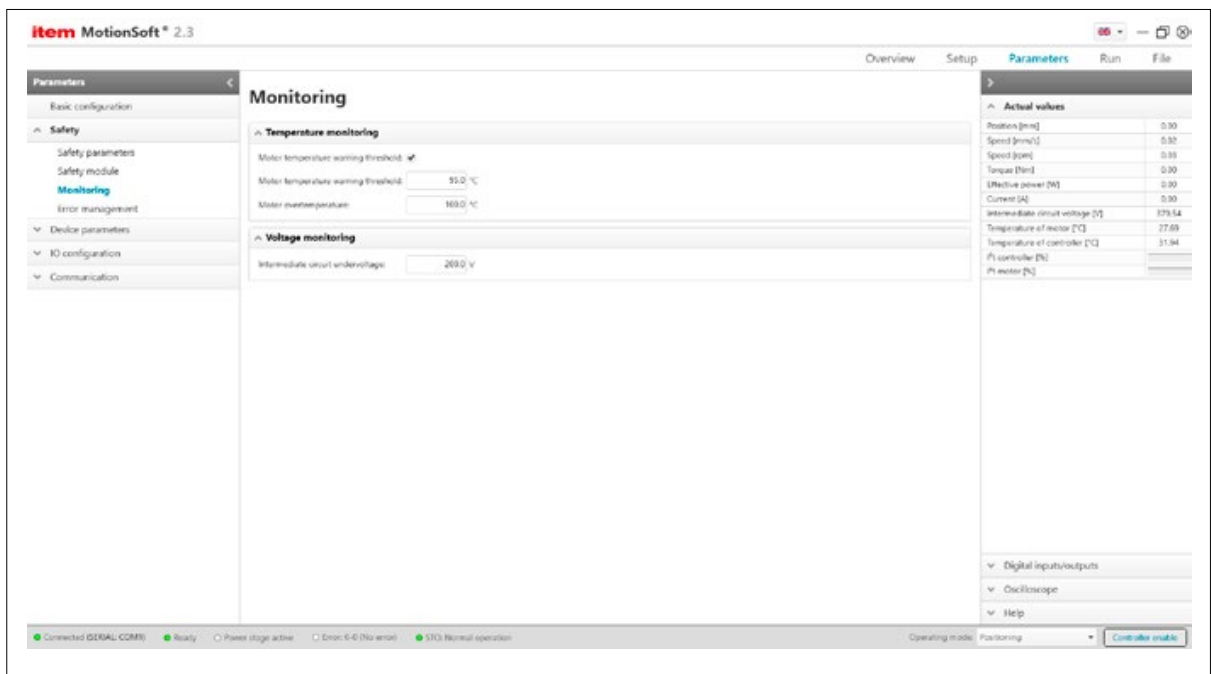
Figure 28: Monitoring parameters

6.5.3.1 Temperature monitoring

Motor temperature warning threshold: If you check this box, a warning will be generated when the set temperature is reached. Enter the warning threshold for the motor temperature in °C.

Motor overtemperature: Enter the threshold at which overtemperature is to be identified. When the set temperature is reached, the Controller is deactivated. Additional reaction stages can be set to trigger the identification of overtemperature under "Error management".

6.5.3.2 Voltage monitoring

Intermediate circuit undervoltage: Enter a value that when reached and/or breached triggers the identification of undervoltage in the intermediate circuit. Intermediate circuit voltages that are too low can trigger an error insofar as the user has parameterised this in the error management menu.

If the intermediate circuit voltage becomes too high (overvoltage), an integrated brake chopper activates a parallel resistor so that the voltage can be decreased via this braking resistor. If the voltage continues to increase, the controller immediately deactivates the power stage. This reaction is not parameterisable.

6.5.4 Error management

Use this dialogue to specify which operating statuses of the Controller initiate which reaction.
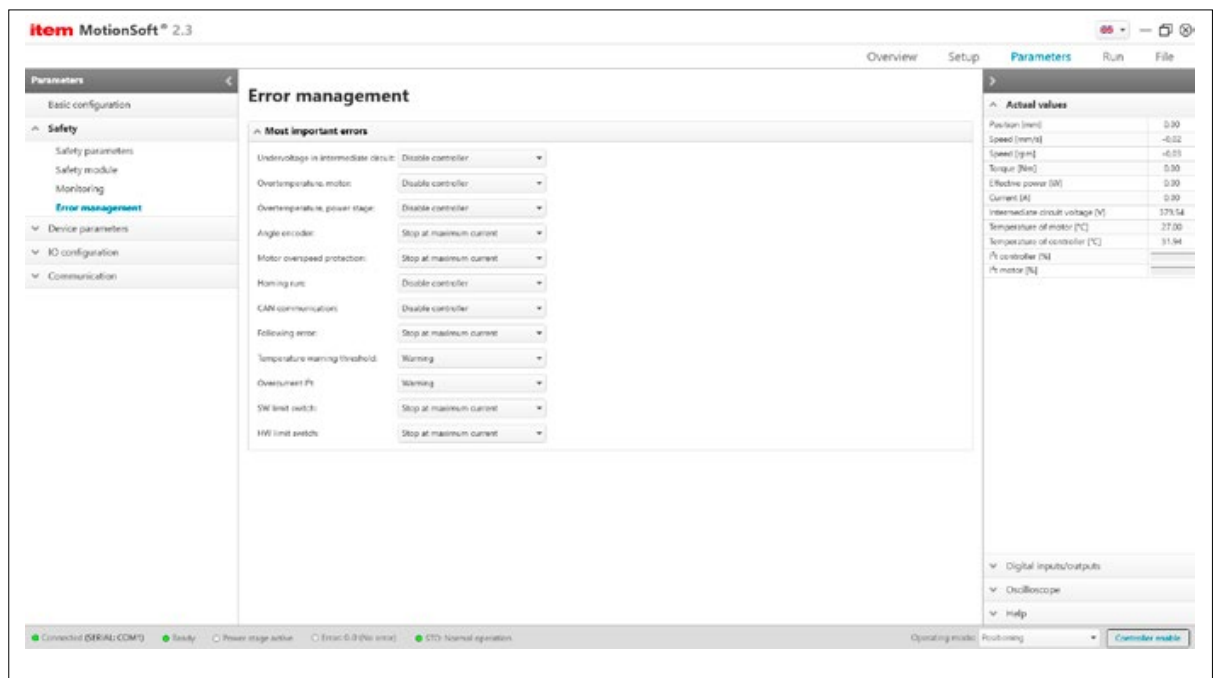
Figure 29: Error management

6.5.4.1 Most important errors

This dialogue lists the most important events that can trigger error reactions.
To set the error reaction, select the event that contains the desired error event.

6.5.4.2 Parameterisable reactions

Deactivate power stage immediately: If this option is active, the drive coasts to a stop because power is switched off to the power stage.

Stop at maximum current: If this option is active, the drive is brought to a stop with maximum current.

Disable controller: If this option is active, the application is shut down with the emergency stop ramp, see "Safety parameters – Deceleration".

Warning: If this option is active, the event is briefly displayed on the Controller's seven-segment display.

Entry in buffer: The event is stored only in the error buffer. The event is not displayed and the application continues to run unaffected.

Some events are so serious that certain reactions cannot be deselected. This is indicated by greyed-out checkboxes (see example: "Disable controller", "Warning", "Entry in buffer").

6.6 Parameters – Device parameters

This menu is where various device parameters can be configured.

6.6.1 Motor data

You can enter all relevant motor data in this menu. If you have selected an item Motor from a list, all the parameters will already be correctly set here.
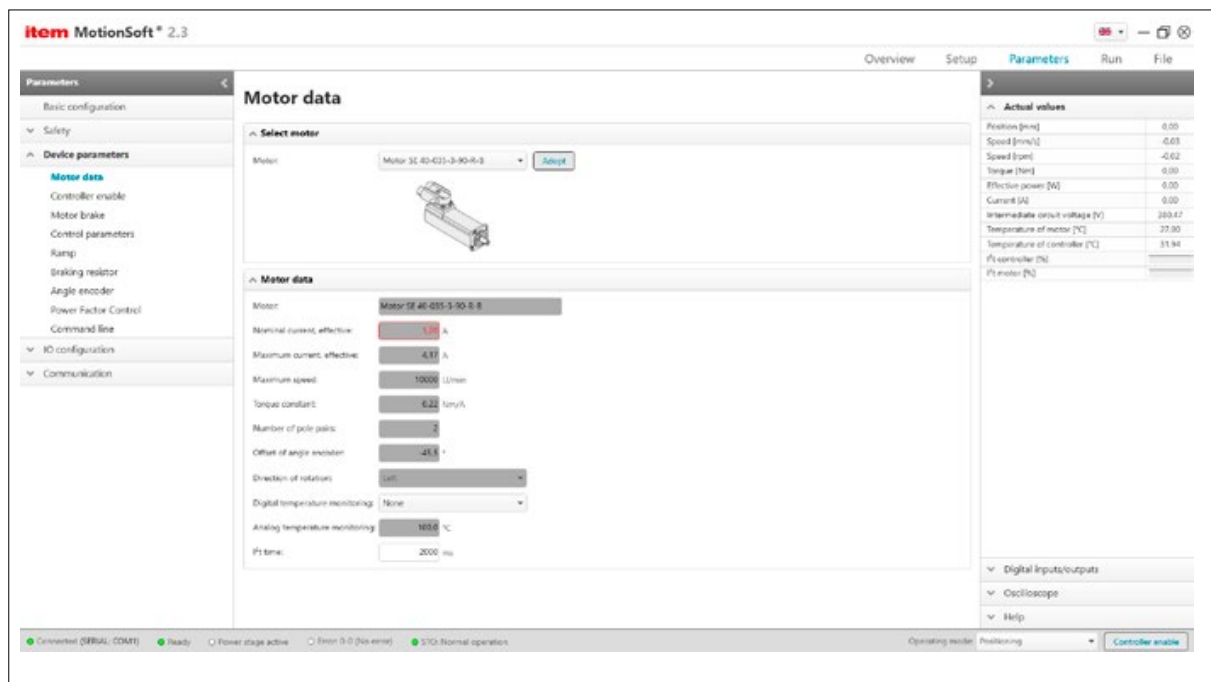
Figure 30: Motor data

To protect the motor from overload, the permissible motor current values must be specified for the Controller. These specifications must be entered before the current controller is parameterised. The permissible limits can be found on the data sheet for the motor. **Please note that the values to be entered are effective values! If the current values are too high, the motor may be destroyed. Never exceed the limits stated by the motor manufacturer!**

Nominal current, effective: Enter the nominal current (effective value) of the motor here. The Controller will use this current when the I²t monitoring system has responded.

Maximum current, effective: Enter the permissible peak current (effective value) that is allowed to flow briefly in the motor here. The Controller will use this current for as long as the I²t monitoring system is responding.

Maximum speed: Enter the maximum speed of the motor in revolutions per minute here.

Torque constant: Current setpoints are specified in Amperes and current values are displayed in Amperes. As the effective current is proportional to torque, however, the values can also be displayed in Nm. The torque constant of the motor must be entered so that current can be converted into torque. This value can be found on the motor data sheet.

Number of pole pairs: If the number of pole pairs set in the Controller does not match the motor, the phase currents cannot be commutated correctly. In this case, the motor will not run smoothly. It will lock in certain positions and develop a strong holding torque.

The motor manufacturer can tell you the number of pole pairs in your motor. However, the initial setup wizard can also be used to carry out the identification automatically in the "Calibrate control parameters" step.

Offset of angle encoder: The angle encoder offset is the angular difference between the electrical and mechanical position. The value must be entered correctly to ensure the motor works correctly with the Controller. It is difficult to determine the angle encoder offset manually, which is why we recommend performing an automatic calibration. However, the initial setup wizard can also be used to carry out the identification automatically in the **Calibrate control parameters** step.

Direction of rotation: You can set the direction of rotation on the angle encoder here.

Digital temperature monitoring: Specify whether the sensor is an opener (normally closed) or a closer (normally open). This monitoring system is active only when the intermediate circuit is charged.

Analogue temperature monitoring: This is where the maximum permissible motor temperature is displayed.

I²t time: The I²t time is the interval during which the I²t value rises to 100%.

6.6.2 Controller enable

Use this menu to specify the conditions that need to be met to enable the controller.
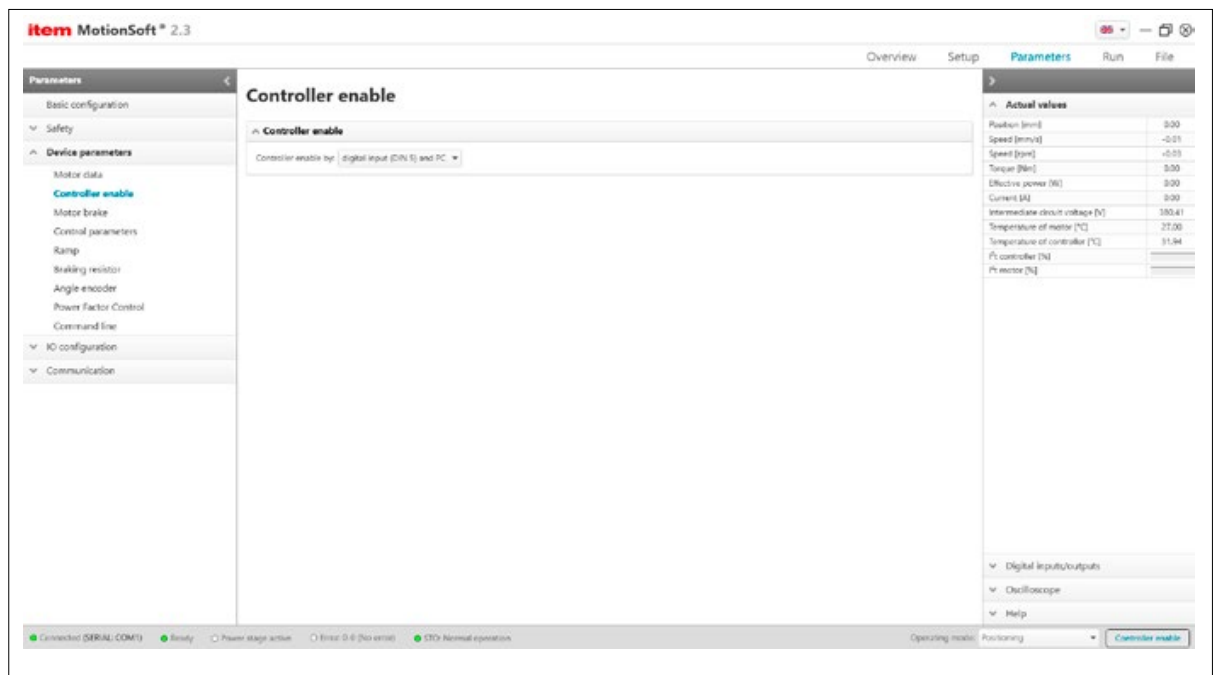
Figure 31: Parameterising controller enabling

The digital input must always be used to enable the controller. In addition, the serial interface or a fieldbus system can be interconnected as an AND condition.

In the event of standalone operation without control via fieldbus or PC, the controller enabling setting must first be switched from "DIN 5 and PC" to "DIN 5".

6.6.3 Motor brake

If your motor is equipped with a locking brake, the brake can be supplied with power by the Controller. The Controller can operate only locking brakes that have a nominal voltage of 24 V DC.
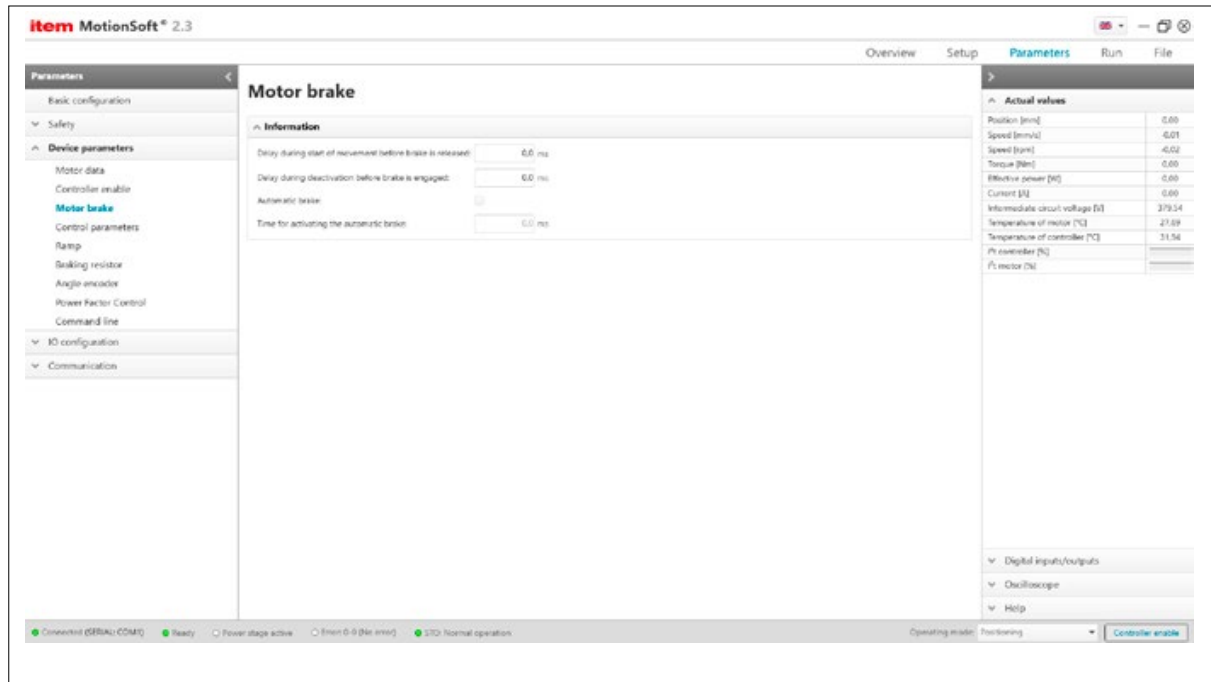
Figure 32: Parameterising the motor brake

The Controller has a digital output for operating the brake. The brake is always released when the controller is enabled. Delays can be parameterised for holding brakes with significant mechanical inertia. This prevents the following:

- Increased wear when the controller is enabled, as movement is delayed.
- A sudden drop on a vertical axis when the controller is disabled.

Delay during start of movement before brake is released: When the controller is disabled, the speed setpoint will be set to zero. When the actual speed is approximately zero, the holding brake is activated. The set delay time also takes effect from this point in time. During this time, the drive is kept in its current position until the holding brake has developed its full torque. Only then will the controller be disabled internally. This prevents a sudden drop that could otherwise be caused when the controller is prematurely disabled. It also prevents additional wear caused by the drop in the activating brake.

Automatic brake: This function is effective only in positioning mode. When the automatic brake is active, the time between the completion of one positioning process and the start of the next is monitored. If no new requirements are issued, the brake is activated once the parameterised waiting time has elapsed and the torque setpoint is set to zero. Controller enabling and thus the power stage remain active. This functionality reduces the thermal load on the motor, which can be particularly beneficial for small motors and/or vertical applications.

Automatic brake + Delay during start...: When a positioning request is issued, the brake release is triggered. The torque setpoint is enabled and the holding brake is released. However, the actual start of the positioning sequence is held back in line with the parameterised start delay. Once this delay time has elapsed, the positioning sequence starts.

Automatic brake + Delay during deactivation...: If both an automatic brake and a stop delay are active, the following happens: Once the waiting time (automatic brake) has elapsed, the stop delay takes effect. During the stop delay, the drive is kept in its current position until the holding brake has developed its full holding torque. The torque setpoint is then set to zero. Controller enabling and the power stage remain active.

6.6.4 Control parameters
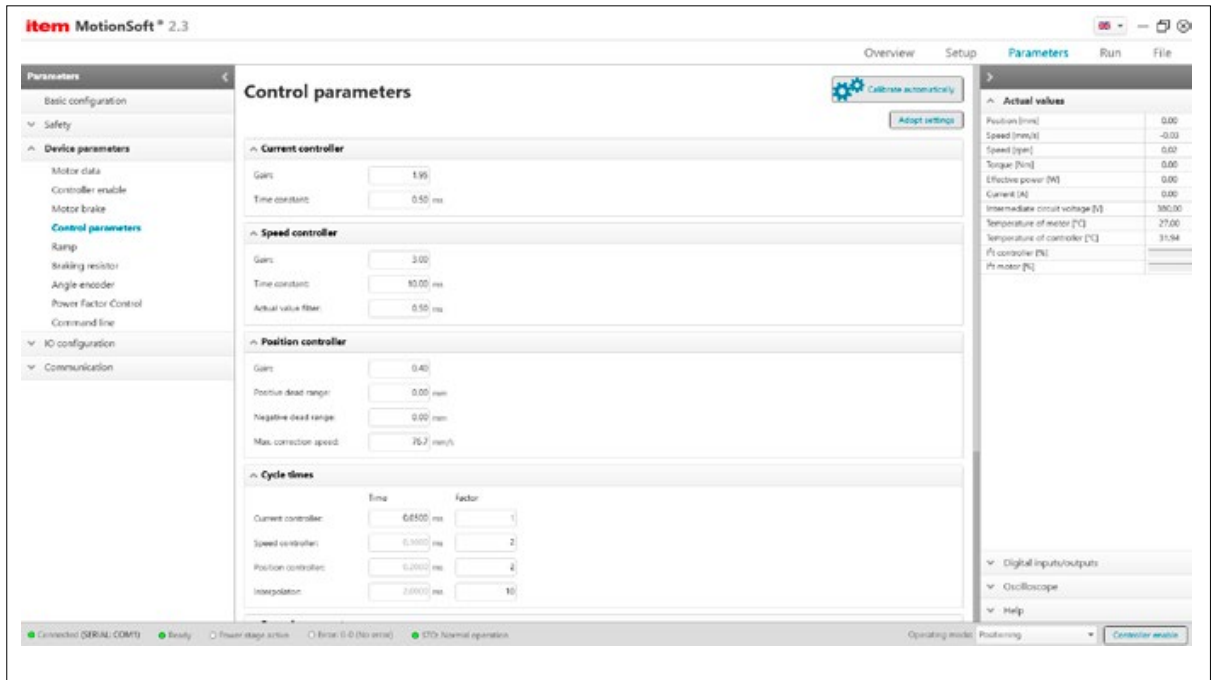
Figure 33: Control parameters

6.6.4.1 Calibrate automatically

Use this button to execute the automatic controller optimisation function.

Ensure the carriage can be moved from one limit stop to the other. If necessary, use mechanical limit stops to restrict the travel range.

Before this function is started, the maximum currents as per the motor data sheet must be correctly set and there must be no more errors in the Controller. The automatic calibration of the current and speed controllers identifies the **optimum gain** and the **optimum time constant**.

Minor variations may occur in the values for gain and time constant when repeating the automatic calibration. This is no cause for concern.

6.6.4.2 Current controller

The current controller is used to optimise the way that the current setpoint is applied to the windings of the connected motor. Finding the correct settings for the current controller is a crucial prerequisite for subsequently calibrating the speed controller to the motor that is being used.

It is advisable to set the current controller automatically. It is difficult to set the current controller manually. Please contact your distribution partner for more information.

Gain: Gain indicates the extent to which a differential between a setpoint value and an actual value is taken into account in the PI controller. It is not advisable to enter settings manually.

Time constant: The time constant indicates the extent to which a differential over time between a setpoint value and an actual value is taken into account in the PI controller. It is not advisable to enter settings manually. Instead, please use the Calibrate automatically button.

6.6.4.3 Speed controller

You can use this menu to set the parameters for speed control. Configuring these settings is about finding a compromise between the rigidity of the drive, stability and noise levels. Before doing this, it is important to first optimise the current controller.

Gain: Gain indicates the extent to which a differential between a setpoint value and an actual value is taken into account in the PI controller.

Time constant: The time constant indicates the extent to which a differential over time between a setpoint value and an actual value is taken into account in the PI controller.

Actual value filter: The speed actual value filter indicates how speed is filtered before it is integrated into the speed control process.

Since the speed actual value filter is incorporated into the speed control circuit as an additional time constant, it should be set as low as possible. We therefore recommend that a value of 0.4 ms is adopted during initial setup. If a time constant of the speed actual value filter is too large, the dynamics of the system suffer because there is a delay in registering disturbance variables.

In adverse cases, an unsuitable time constant can impair the stability of the speed control circuit. The additional running time can cause vibrations. You should therefore ensure the time constant is always as low as possible.

6.6.4.4 Position controller

You can use this menu to set the parameters for position control. The position controller overlays the speed controller. The input variable is the difference between the position setpoint and the actual position, while the output variable is a speed setpoint.

The position controller can only be used in conjunction with the position control system or the synchronisation control system.

Gain: Gain indicates the extent to which a differential between the position setpoint and the actual position is taken into account in the P controller.

Dead range (positive dead range, negative dead range): This is where you can specify a permissible distance between the setpoint value and the actual value, within which the position controller stays inactive. If you enter a positive value and a negative value, you can define an asymmetrical interval. The specification of a dead range is intended for drives with backlash, e.g. due to a Gearbox or timing belt. It is not possible to provide general recommendations. In the case of drives without backlash, the dead range can be set to a very small value or to 0.

Max. correction speed: This parameter describes the maximum speed that is added to the travel speed in the event of a following error. It should initially be set to approx. +/-500 rpm.

6.6.4.5 Reversing generator

The reversing generator is not used for normal operation but only to optimize the speed and position controllers. When in reversing mode, the Linear Unit keeps running back and forth between two positions. This is necessary, for example, to optimize the speed controller and the position controller.

Modifications affecting the reversing distance are adopted only after the reversing generator has been restarted. Changes to the other parameters are adopted at the reversal points. The carriage stops for a few milliseconds at the reversal points.

Reversing distance: This is where you can specify a distance difference for travelling back and forth. Both the start point and the end point are located directly in the middle of this distance. As a result, the drive always moves symmetrically with regard to the position where the reversing generator is started. When it is deactivated, the drive also moves back to its original start position. This means the range of movement can be better assessed, particularly in the case of linear arrangements with limited room for movement. The system always starts in the positive direction of movement.

Acceleration: This is where the desired acceleration or deceleration is set. A square function is usually required for the speed setpoint. In this case, the maximum values should be entered into the fields "Acceleration" and "Deceleration".

Speed: This is where travel speed is set.

Times: The resultant times for the start-up and braking procedure are calculated based on the speed and accelerations and are displayed in the interface.

Start reversing generator: Starts the reversing generator.

Stop reversing generator: Stops the reversing generator.

Use the oscilloscope to check the controller settings. To do that, display the setpoint and actual values for speed.

6.6.5 Ramp

The setpoint integrator ensures the setpoint is "smoothed" in the form of a ramp if the setpoints are specified with sudden changes. It can be used to configure various ramps in both directions so that the resulting setpoint pattern can be adapted to suit the dynamics of the relevant motor and load.
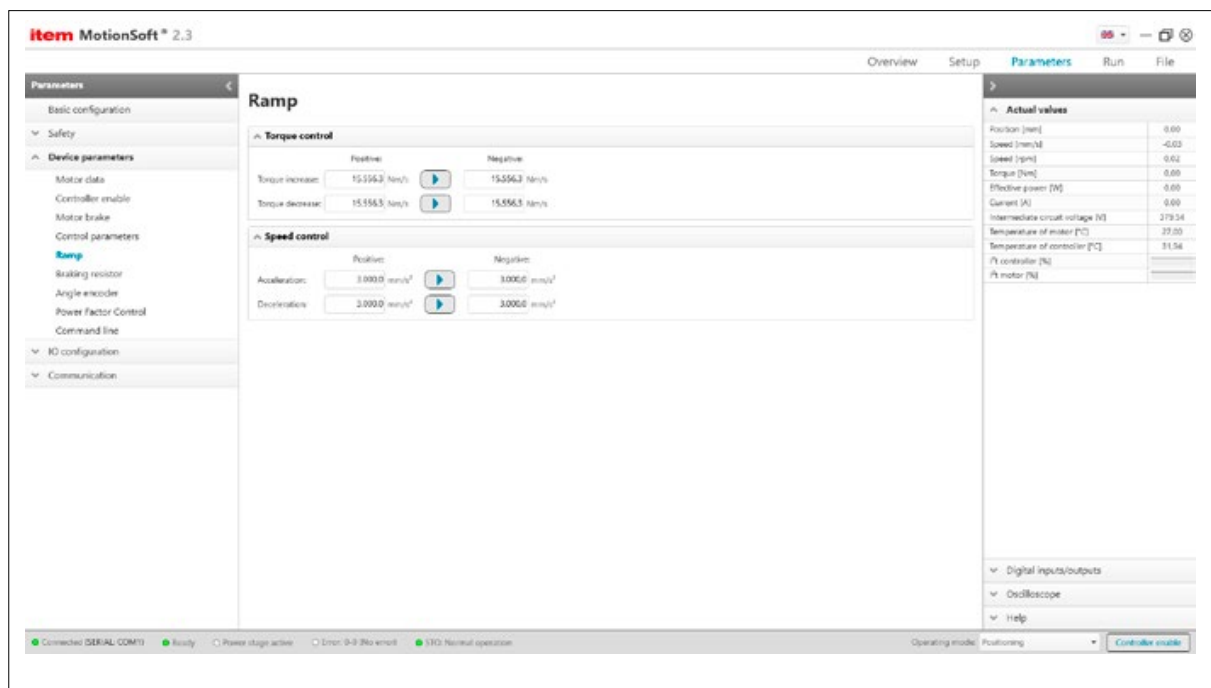
Figure 34: Parameterising ramps

Torque control

- Torque increase specifies the ramp with which torque is increased in the case of a sudden, rapid change if the torque either jumps from zero in a positive range or drops in a negative range.

- Torque decrease specifies the ramp with which torque is reduced if the torque is to be adjusted toward zero, either by dropping in the case of positive torque or rising closer to 0 Nm in the case of negative torque.

The arrow button between the positive and negative input copies the positive value into the negative entry.

Speed control

- Acceleration specifies the ramp with which speed is increased in the case of a sudden, rapid change if the speed either jumps from zero in a positive range or drops in a negative range.

- Deceleration specifies the ramp with which speed is reduced if speed is to be decelerated towards zero.

The arrow button between the positive and negative input copies the positive value into the negative entry.

6.6.6 Braking resistor

Use this menu to select and/or check whether an external braking resistor is connected. This is relevant when calculating the power loss of the brake chopper.
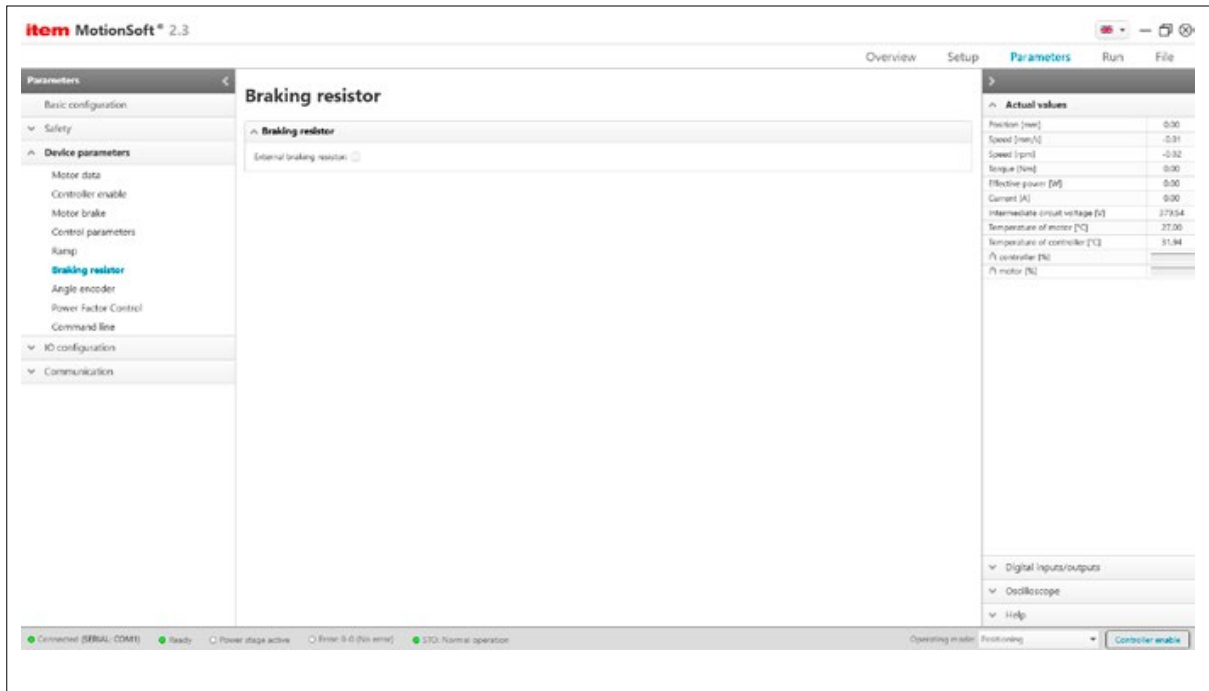
Figure 35: Selecting an external braking resistor

In the case of the "C1-series" Controllers, the checkbox needs to be marked in line with the connection. If an external braking resistor is connected but the box is not checked, power loss will continue to be calculated for the internal braking resistor. As a result, the system will not make use of any potentially higher load-carrying capacity offered by the external braking resistor.

I²t monitoring for the brake chopper is only active when using the internal braking resistor.

The checkbox must be selected when using an external resistor.

6.6.7 Angle encoder
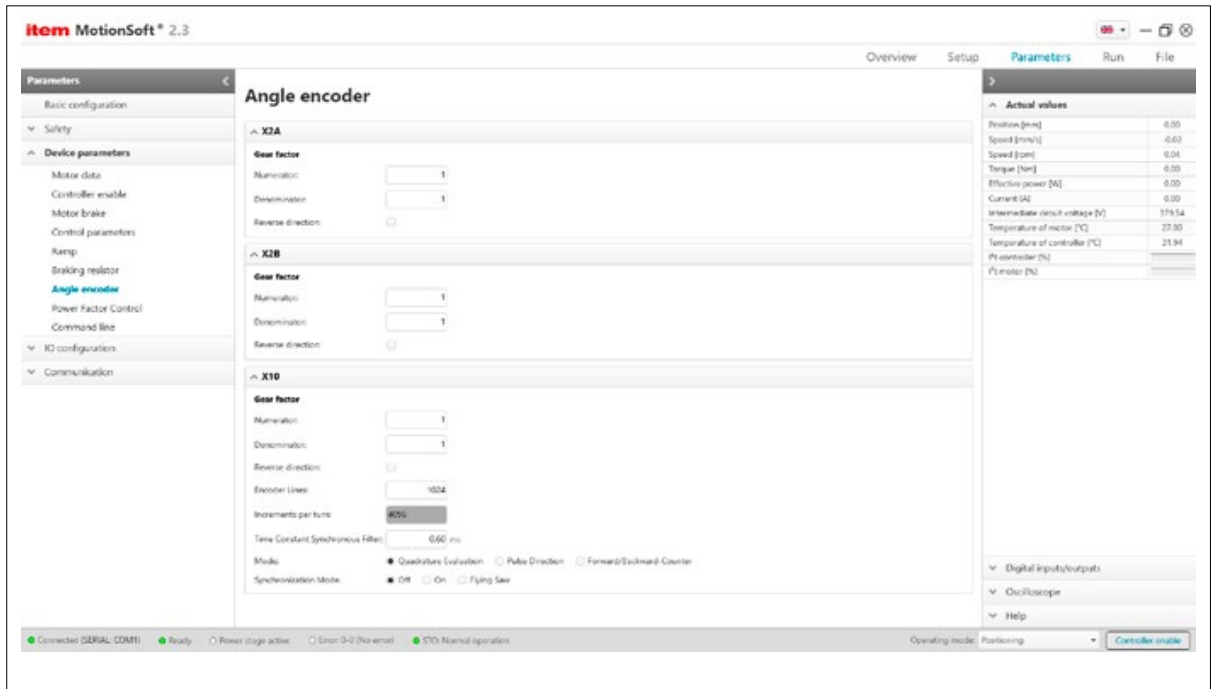
Figure 36: Parameterising angle encoders

X2A / X2B / X10:

The default setting is Ingoing shaft = Outgoing shaft = 1. Enter other values if you are using an angle encoder with a number of pole pairs > 1. This is the case, for example, when more than 1 index pulse occurs for each revolution of the angle encoder.

These settings relate only to the gear factor of the angle encoder! If you want to parameterise an application with a Gearbox (parameters in units of the outgoing shaft), enter this gear factor in the Basic configuration menu!

Reverse direction: This is where the direction in which the measurement system counts can be adjusted.

Encoder lines: Incremental encoders supply their angle information via track signals. These provide periodic rectangular (digital) or sinusoidal (analogue) signals at constant speed. The encoder line count corresponds to the number of complete periods of a track per revolution. In most cases, the encoder line count can be taken from a datasheet or the specification plate of the angle encoder. The incremental input generally uses a quadruple evaluation. Accordingly, the resolution is a factor of four higher than the encoder line count itself. This effective encoder line count is presented under increments per revolution.

Quadrature evaluation: The signals are interpreted as standard incremental signals. Two rectangular track signals that are each phase displaced by 90° are evaluated. As an option, this mode has a zero track with a periodic signal "per encoder line count".

Pulse Direction: In this operating mode, one signal supplies the position change, while another supplies information about the direction of rotation. Based on the quadruple evaluation, the encoder line count is to be stated here relative to 90°.

Forward/Backward-Counter: This operating mode has two signals that each supply the position change for a direction of rotation separately. As a result, when there is a pulse sequence on one signal wire, the other signal wire should be at rest. Based on the quadruple evaluation, the encoder line count is to be stated here relative to 90°.

6.6.8 Power Factor Control

This menu can be used to activate or deactivate Power Factor Control (PFC) for the devices that use a single-phase power supply (C1-02 / C1-05). Using PFC ensures a sinusoidal mains current is drawn in stationary mode. This results in compliance with the corresponding EN standard (mains harmonics). Furthermore, the increased intermediate circuit voltage offers a power reserve for your drive.
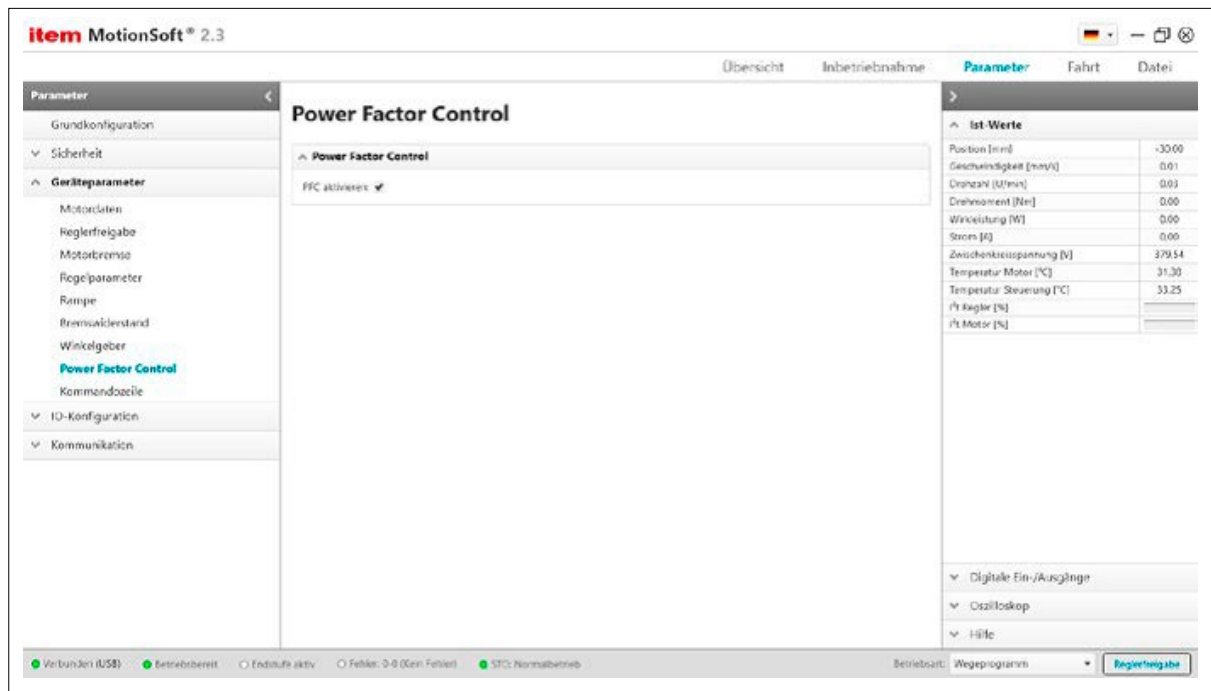
Figure 37: Power Factor Control

Activate/deactivate Power Factor Control here.

PFC must not be used if the Controller is being run with an intermediate circuit coupling or the Motor has not been designed for the increased intermediate circuit voltage.

All item SE Motors are suitable for PFC operation.

6.7 Parameters – IO configuration

This menu is where inputs and outputs can be configured.

6.7.1 Digital inputs

You can use this menu to allocate functions for the digital inputs.
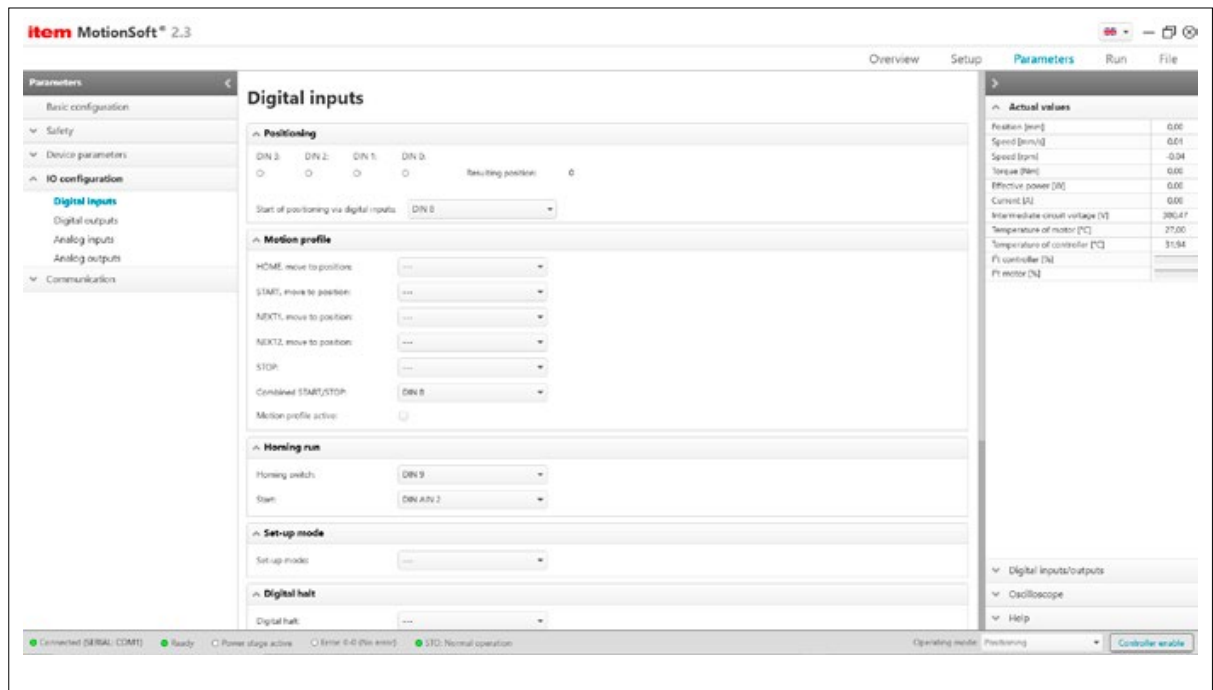
Figure 38: Parameterising digital inputs

6.7.1.1 Positioning

This is where the "Positioning selector bits" can be observed. In the factory settings, inputs DIN 0 ... DIN 3 are used to pre-select position data sets 0 to 15 via the binary system. If more inputs are required for position selection, please contact the technical support team.

Resulting position: This is where the currently preselected position is displayed.

Start of positioning via digital inputs: Choose an input here that is to be used to initiate the run to the preselected position. If motion profile options are activated in the position set that has been selected via the digital position selector, this input can also be used to start a motion profile (only in "Motion profile positioning" mode).

6.7.1.2 Motion profile

The parameterisable digital inputs here are used to control the integrated motion profile function. The evaluation of these inputs is edge-sensitive. This means a function will only be initiated on the rising edge of the parameterised digital input, unless it is described differently.

HOME: When the specified digital input has been activated, the carriage will be moved to the HOME position when in motion profile mode. This position can be defined under the global positioning settings.

START: When the specified digital input has been activated, the carriage will be moved to the START position when in motion profile mode. This position can be defined under the global positioning settings.

NEXT1: The input specified here can be used for the conditional linking of positions in the motion profile. For further information, see "Run – Motion profile".

NEXT2: The input specified here can be used for the conditional linking of positions in the motion profile. For further information, see "Run – Motion profile".

STOP: When the digital input specified here is activated, the motion profile is stopped. The ongoing positioning run will, in any case, still be completed. The positioning sets can still be configured to specify whether stopping the motion profile at the end of this set should not be permitted. In this case, the subsequent linked positioning run will be initiated, regardless of the stop input being set.

Combined START/STOP: This function can be used to control the starting and stopping of a motion profile via a single digital input. The carriage is moved toward the general START position of the motion profile when the rising edge of the digital input is detected. The aforementioned stop function of the motion profile will then be activated on the falling edge.

The following sequence of priorities applies to the evaluation of these inputs: STOP (STOP from combined START/STOP (falling edge of the assigned input)) → START (START from combined START/STOP (rising edge of the assigned input)) → HOME → NEXT1 → NEXT2.

If the program registers edges on two or more of these digital inputs within the same cycle, only the action with the highest priority will be executed. The other actions will be ignored. As a consequence, it is not possible to stop and start a motion profile simultaneously.

6.7.1.3 Homing run

Homing switch: Some homing functions use a homing switch. Enter the digital input that is connected to the homing switch here.

Start: Specify the digital input that is to initiate a homing run. Cancelling the digital input has no influence on a current homing run and will not cause the run to be stopped.

Set-up mode: Set-up mode is a percentage speed limitation that takes effect in all operating modes. This limitation can be parameterised in the Safety parameters menu.

Digital halt: When the "Speed control" and "Positioning" operating modes are active, this digital input can be used to stop the drive. How it behaves depends on the operating mode:

- Positioning: When an input has been specified, an ongoing positioning run is cancelled. The drive slows down with the deceleration ramp of the current positioning set. The stipulated input also suppresses the initiation of additional positioning runs by the digital start input. Removing the input does not result in any actions. Positioning runs can then be started again without any limitations.
  The general stop input also cancels an active motion profile. The current positioning run and the motion profile are cancelled immediately.
- Speed control: When an input has been specified, all speed setpoints are blocked. The drive stops with the "stop" ramp. This input is evaluated at intervals of 10ms. The drive can therefore only react to the input at these intervals. During the changeover from high level to low level, the drive is accelerated back up to the currently applicable overall speed setpoint.

6.7.1.4 Jogging mode

Move forwards: When in positioning mode, the input specified here can be used to start jogging in the positive direction. Further settings for jogging mode can be made in the motion profile menu.

Move backwards: When in positioning mode, the input specified here can be used to start jogging in the negative direction. Further settings for jogging mode can be made in the motion profile menu.

Sample input: The firmware allows the rising and falling edges of a digital input to be used to sample the current position. Enter the digital input you want to use for this function here.

6.7.1.5 Other

Use DOUT 2 as digital input DIN 10: If this checkbox is selected, DOUT 2 will be used as an input pin for the DIN 10 signal.

Use DOUT 3 as digital input DIN 11: If this checkbox is selected, DOUT 3 will be used as an input pin for the DIN 11 signal.

Use AIN 1 as digital input DIN AIN 1: If this checkbox is selected, the signal at AIN 1 will be interpreted as digital DIN AIN 1 signal.

Use AIN 2 as digital input DIN AIN 2: If this checkbox is selected, the signal at AIN 2 will be interpreted as digital DIN AIN 2 signal.

6.7.2 Digital outputs

This menu can be used to configure the functionality of the digital outputs. The layout of the menu depends on whether any technology modules with IO extension (additional IOs) are connected and, if so, how many. **The digital outputs of the basic unit must not be used in safety-related applications.**
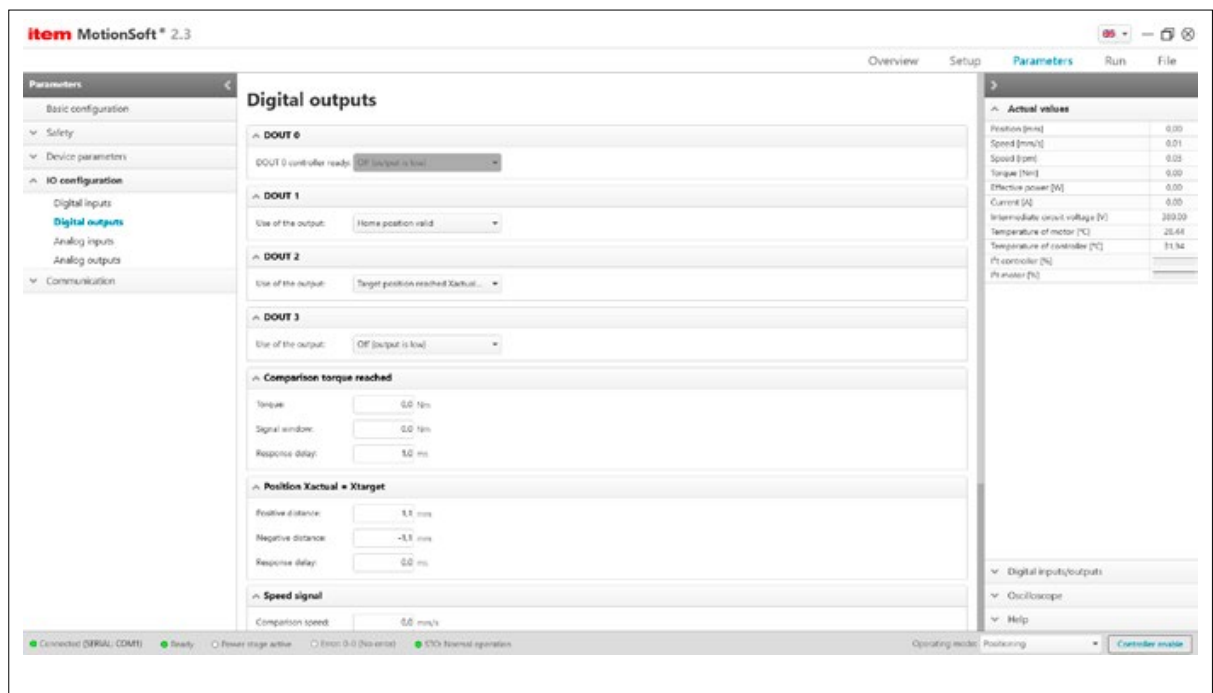
Figure 39: Parameterising digital outputs

DOUT 0: This output indicates the operational readiness of the item Controller.

The function of this digital output is specified by the firmware and cannot be changed!

DOUT 1 … DOUT 3: The function of the digital outputs can be defined as desired – see the information below.

- **Off:** The output is always LOW

- **On:** The output is always HIGH

- **I²t monitoring active:** Motor load in critical range – see also the motor data menu.

- **Comparison speed reached:** The current speed is greater than or equal to the comparison speed that is to be configured in the Comparison speed menu below.

- **Xset = Xtarget:** The position setpoint is in range of the target position. For further settings see the Position reached menu below.

- **Xactual = Xtarget:** The actual position is in range of the target position. For further settings see the position reached menu below.
- **Remaining distance:** The actual position is less than a specified remaining distance away from the target position. For information on how to specify the value for remaining distance see the Run – Motion profile menu.
- **Homing active:** The output is active as long as the homing run is active.
- **Home position valid:** This output is high after a successful homing run has been completed.
- **Undervoltage in intermediate circuit:** The output is active when there is undervoltage in the intermediate circuit. Further settings on this can be found in the Parameters – Safety – Monitoring menu.
- **Following error:** The amount of the difference between the position setpoint and the actual position exceeds a predefined value. For further settings see the "Following error" menu. The display threshold for a following error must not be confused with the shutdown threshold of a following error, which is set in the Parameters – Safety – Safety parameters menu!
- **Power stage active:** The output is active once the motor is supplied with current.
- **Locking brake released:** The output is active once the brake has been released. Further settings for this can be found in the Parameters – Device parameters – Motor brake menu.
- **Linear motor detected:** This output is active when the commutation position has been found. In the case of angle encoders without commutation signals, the commutation position is determined with the help of an automatic function. This process has to be completed before a positioning run, for instance, should be started.
- **Position trigger 1 to 4:** Further settings for this can be found in the Position triggers menu.
- **Setpoint lock active:** This output is active if one or both setpoint locks have been triggered by a limit switch.
- **Alternative target reached:** This output is active if a positioning run has been terminated because e.g. a comparison torque has been reached. In such a case, a condition such as Xactual = Xtarget is not fulfilled.
- **Comparison torque reached:** This output is activated if the comparison torque parameterised below has been reached.
- **Positioning set active:** This output can be activated from a positioning dataset.
- **Ready for enabling:** This output is activated when the controller is ready to be enabled

Comparison torque reached: The parameters Torque, Signal window and Response delay can be used to control the "Comparison torque reached" function of a digital output.

The output is activated when the current torque is in the range of (Comparison torque - Signal window ... Comparison torque + Signal window). However, it will only be activated if the range is not left at least for the time stated under Response delay.

Target position reached: You can use these parameters to control the function "Xactual = Xtarget" of a digital output.

The output is activated when the current position is in the range of (Xtarget - Negative distance ... Xtarget + Positive distance). However, it will only be activated if the range is not left again at least for the time stated under Response delay.

The output is not deactivated until the range of the target window is left. For example, the output remains active during the start of positioning if the new target for a positioning run is still within the target window.

In an active motion profile, the signal affects only the end position.

Speed signal: The parameters Comparison speed, Signal window and Response delay can be used to control the "Comparison speed reached" function of a digital output.

The output is activated when the current speed is in the range of (Comparison speed - Signal window ... Comparison speed + Signal window). However, it will only be activated if the range is not left at least for the time stated under Response delay.

Threshold value: The Threshold value parameter is used to set a second comparison speed. At present, this second speed is evaluated only by fieldbus systems on the basis of status words.

Following error: You can use these parameters to control the "Following error" function of a digital output.

The output is activated if the actual position is outside the range of (Xset - Negative limit ... Xset + Positive limit). However, it will only be activated if the range is left at least for the time stated under "Response delay".

The "Following error" signal is not the same as the "Following error" error. The latter is set in the Safety parameters menu!

6.7.3 Analogue inputs

Use this menu to adjust the analogue inputs for controlling the application. You can specify how the input signal is converted into a torque value, speed value or position setpoint.

Depending on the application, the torque and speed values are either setpoint values or limits.

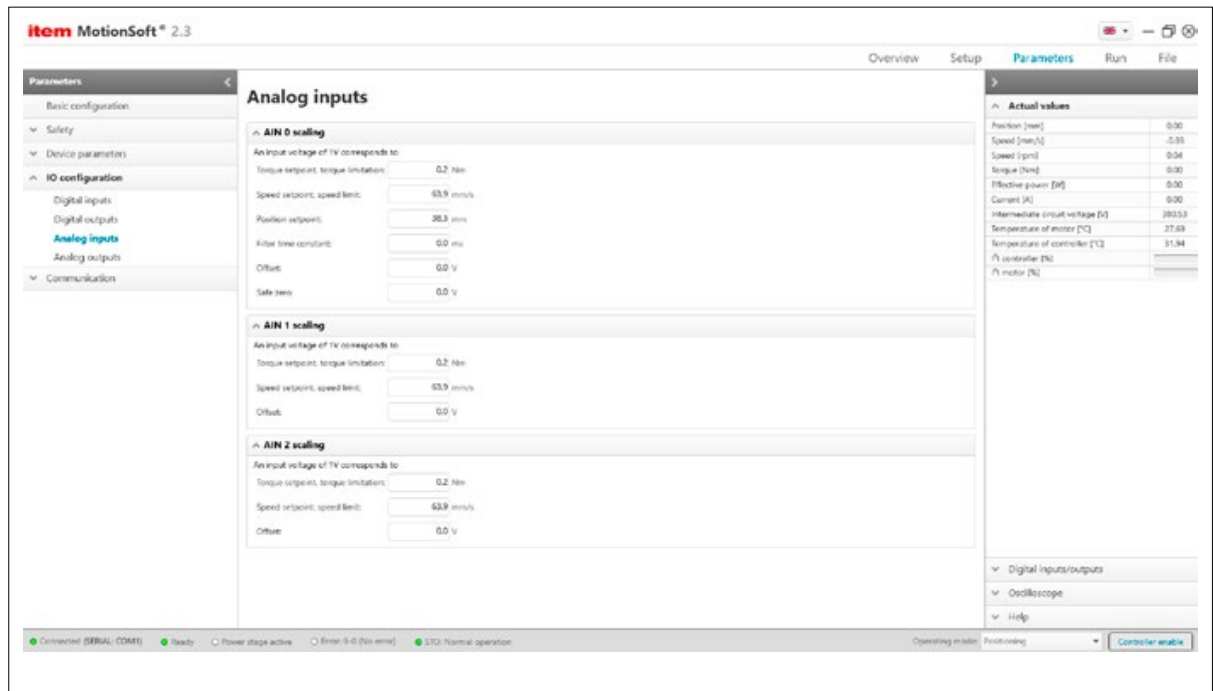Input voltages in the range of -10V … +10V can be processed.

Figure 40: Parameterising analogue inputs

AIN 0 scaling: You can use this tab to adapt the parameters for analogue input AIN 0. Specify which value an input voltage of 1V corresponds to.

Torque setpoint, torque limitation / Speed setpoint, speed limit / Position setpoint / Filter time constant

Analog input AIN 0 has a resolution of 16 bits. This signal is fundamentally filtered. The filtered signal is then interpreted as a torque, speed or position setpoint. This field indicates the filter time constant.

Offset: A common problem is that an externally stipulated voltage of 0 Volt still generates a small speed or torque value. The offset value must be calibrated to this by a few millivolts. You can do this manually by setting the offset value accordingly.

However, it is also possible to perform an automatic offset calibration (see below).

Auto offset calibration: To perform an automatic offset calibration, short-circuit the input or connect it to the potential corresponding to the zero setpoint. Next, click the "Auto offset calibration" button.

Safe zero: In certain circumstances, you may wish to obtain a defined setpoint of 0, regardless of offset drift, noise, etc. This applies to all interpretations (torque setpoint, torque limitation, etc.) as a means of e.g. achieving a defined standstill in "Speed control" mode. The parameterisable offset is taken into account in this. If the safe zero parameter has a value > 0, the following characteristic diagram is valid for the speed setpoint when U_in = U_AIN 0 - Offset, for example:

In the input voltage range of [-U_zero_safe … +U_zero_safe] the resulting speed setpoint is zero.

AIN 1 scaling: You can use this tab to adapt the parameters for analogue input AIN 1. See AIN 0 scaling for an explanation of the **individual elements.** The "Safe zero" functionality is not available for this input.

AIN 2 scaling: You can use this tab to adapt the parameters for analogue input AIN 2. See AIN 0 scaling for an explanation of the **individual elements.** The "Safe zero" functionality is not available for this input.

6.7.4 Analogue outputs

The Controller has two analogue outputs for displaying control variables which can be visualized using an external oscilloscope. The output voltages are in the range of -10V to +10V.

This menu can be used to configure the analogue monitor.
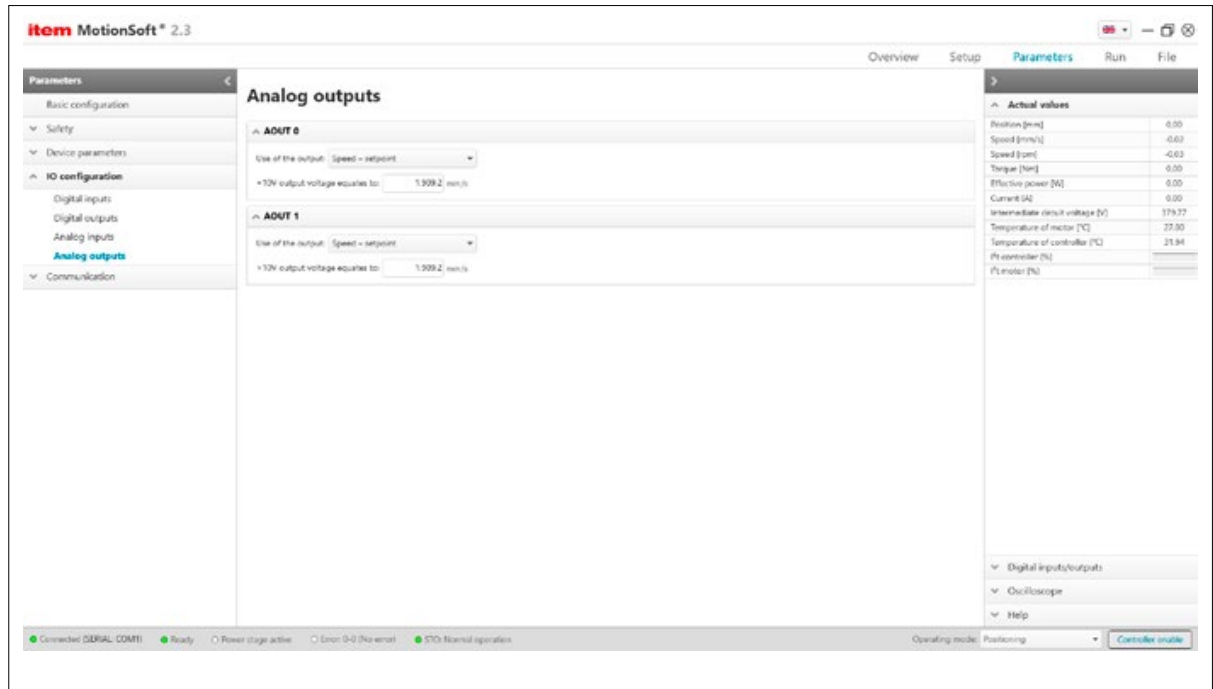
Figure 41: Parameterising analogue outputs

AOUT 0: You can adjust the configuration for AOUT 0 here.

Use of the output: You can select various sources for this output here.

If the option fixed voltage value is selected, a constant voltage will be output on the analogue output. Another input field appears in the user interface where you can set the desired voltage.

Scaling: Use this field to enter the value of the variable to be recorded that is to correspond to an output level of 10 Volts.

AOUT 1: You can adjust the configuration for AOUT 1 here. See AOUT 0 for an explanation of the individual elements.

6.8 Parameters – Communication

This menu is where the communication parameters can be configured.

6.8.1 Ethernet

You can use this menu to set the Ethernet communication parameters of the Controller and the target address of the controller that item MotionSoft® is to connect to.

Please contact your network administrator to ensure your PC can communicate with the controller via the network.

Figure 42: Ethernet communication interface

Description of functionality: You can use this menu to set the Ethernet communication parameters of the PC.

6.8.1.1 Settings – PC

IP address: Use this field to enter the IP address of the Controller with which UDP communication is to be established.

6.8.1.2 Settings – controller

Obtain an IP address automatically: When this option is selected, the item Controller obtains the IP address automatically from the network that is available, for example via a DHCP server.

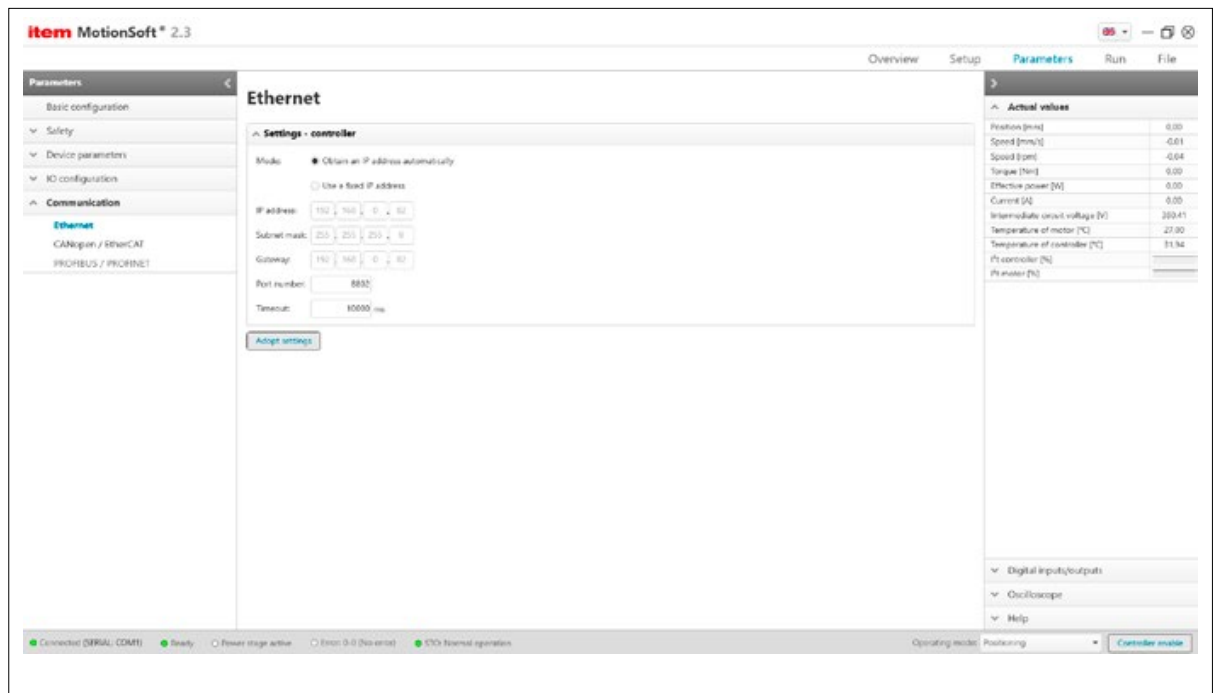**Use a fixed IP address:** When this option is selected, the corresponding input boxes can be edited and the IP address can be set manually. Use the arrow keys to navigate between the individual input boxes.

IP address: Use this field to enter the Controller IP address that is to be used to establish UDP communication.

Subnet mask: Use this field to enter the Controller subnet mask that is to be used to select the subnet for Ethernet communication. Please consult your network administrator to establish which subnet mask you need to use.

Gateway: Use this field to enter the IP address of the gateway that the interface uses to direct Ethernet communication when the host is not in the dedicated subnet. Please consult your network administrator to establish which gateway you need to use.

Port number: Use this field to enter the Controller port number that is to be used to set up controller UDP communication.

Timeout: Use this field to enter the timeout time for automatically logging out a user. The Ethernet interface monitors the continuity of UDP communication. When this communication is broken, the user is automatically logged out. Communication can be resumed at any time.

Note: Changes that you make to the IP address only take effect after a save & reset has been performed on the Controller.
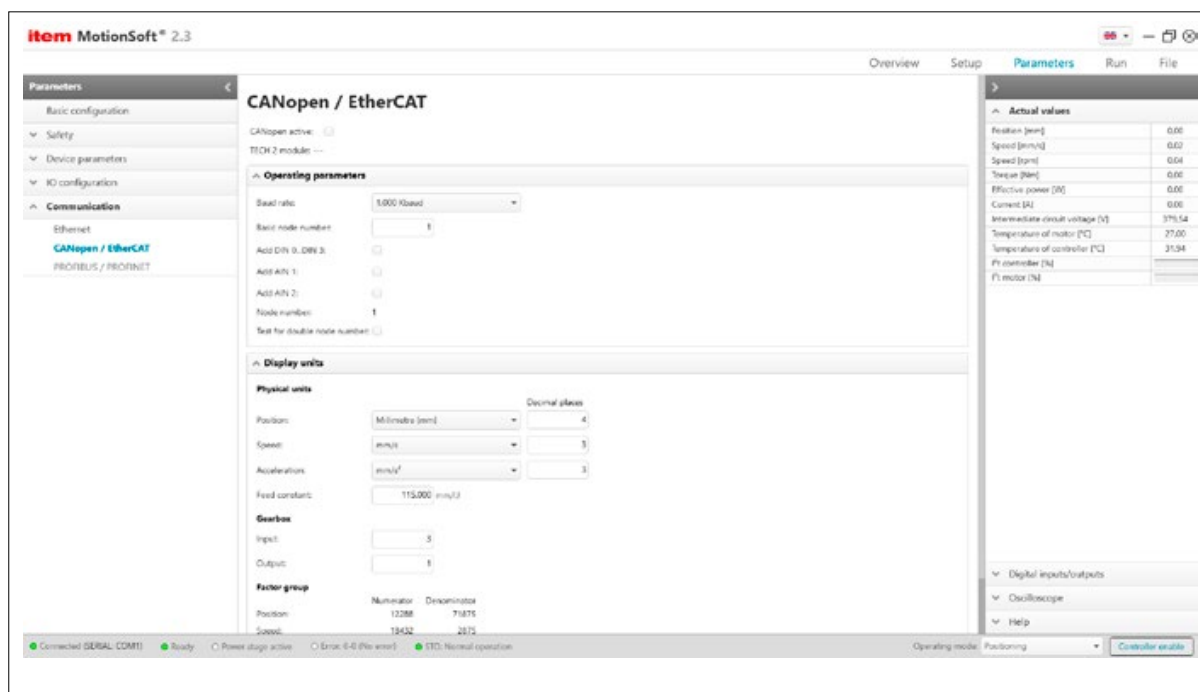
6.8.2 CANopen / EtherCAT

Figure 43: CANopen & EtherCAT communication interfaces

CANopen: You can use this menu to adapt the CANopen communication parameters of the Controller to your CANopen bus network.

CANopen active: Use this checkbox to activate and deactivate fieldbus communication with the set parameters.

Baud rate: This parameter determines the baud rate used on the CANopen bus.

Basic node number: This parameter contains the basic node address of the corresponding device. The identifiers of the individual messages are based on the node address. Each node address can be assigned only once in a CANopen network. The digital inputs can also be included when calculating the node address (see below).

Offset from adding DIN 0 ... DIN 3 to the node number: The value of the digital inputs DIN 0 ... DIN 3 is added to the basic node address. The input combination is read out only once, directly after the Controller reset. As a result, up to 16 different device addresses can be assigned by using simple bridges to the 24 V supply in the connector housing.

Offset from adding AIN 1 to the node number: The analogue input AIN 1 is included in the generation of the node number with a valence of 16. It can remain unused for a low level, but the input must be bridged to Vref = 10V for a high level.

Offset from adding AIN 2 to the node number: The analogue input AIN 2 is included in the generation of the slave address with a valence of 32. It can remain unused for a low level, but the input must be bridged to Vref = 10V for a high level.

Node number: The effective node number results from the basic node number and the various optional offsets (see above).

Test for double node number: When this option is activated, the Controller automatically checks whether a node address could have been duplicated in the CANopen network. If this is the case, an error is shown in the display.

EtherCAT: EtherCAT is a real-time Ethernet technology. The Controller works as an EtherCAT slave with support from the CoE (CANopen over EtherCAT) protocol.

EtherCAT active: You can use this checkbox to activate or deactivate EtherCAT communication with the CoE (CANopen over EtherCAT) protocol.

The EtherCAT master manages all node numbers independently, therefore these CAN-specific parameters are not relevant.
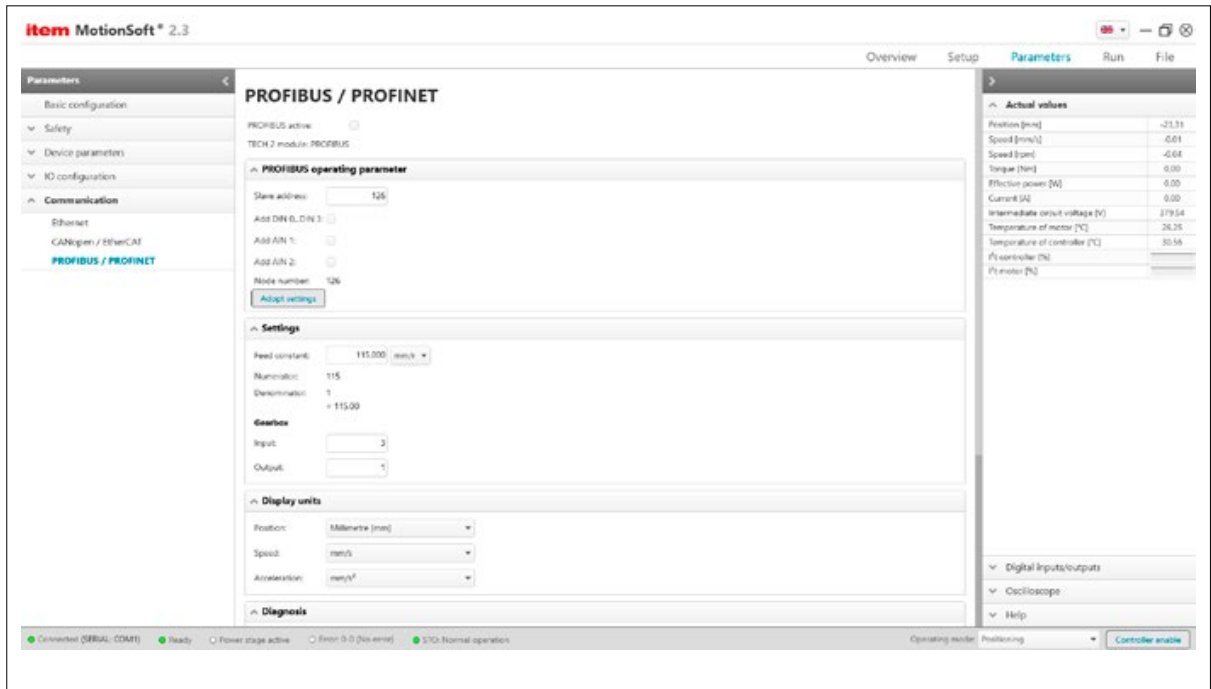
6.8.3 PROFIBUS / PROFINET

Figure 44: PROFIBUS / PROFINET communication interfaces

6.8.3.1 PROFIBUS operating parameters

You can use this menu to adapt the PROFIBUS / PROFINET communication parameters of the Controller to your PROFIBUS / PROFINET network.

PROFIBUS active: Use this checkbox to activate and deactivate fieldbus communication with the set parameters.

Slave address: This parameter contains the slave address of the corresponding device. The identifiers of the individual messages are based on the slave address. Each slave address can be assigned only once in a PROFIBUS network. It is possible to also include the digital inputs when calculating the slave address (see below).

Offset from adding DIN 0 … DIN 3 to the slave address: The value of the digital inputs DIN 0 ... DIN 3 is added to the basic slave address. The input combination is read out only once, directly after the Controller reset. As a result, up to 16 different device addresses can be assigned by using simple bridges to the 24 V supply in the connector housing.

Offset from adding AIN 1 to the slave address: The analogue input AIN 1 is included in the generation of the slave address with a valence of 16. It can remain unused for a low level, but the input must be bridged to Vref = 10V for a high level.

Offset from adding AIN 2 to the slave address: The analogue input AIN 2 is included in the generation of the slave address with a valence of 32. It can remain unused for a low level, but the input must be bridged to Vref = 10V for a high level.

Effective slave address (node number): The effective slave address results from the basic slave address and the various optional offsets (see above).

Display units: This is where you can set the units for the displays and specify the Gearbox parameters.

Feed constant: The feed constant describes how far the carriage moves with each revolution of the drive shaft.

Gearbox input / output: The transmission ratio is indicated by stating the ratio between input and output. As a result, when a gear ratio of i=3 is in use, 3 must be entered for input and 1 for output.

6.8.3.2 PROFINET operating parameters

PROFINET active: Use this checkbox to activate and deactivate fieldbus communication with the set parameters. If PROFINET communication is active, only the PROFIenergy setting can be changed. **To change the other parameters, first deactivate PROFINET then reactivate it after making the changes.**

TECH 2 module: Displays the current module that is inserted into TECH 2.

Device name: All that is needed to configure communication on the Controller side is the device name. The IP address is assigned based on the device name and with the aid of the DCP protocol (Discovery and Basic Configuration protocol). This assignment process requires that a DCP-capable Controller is included in the network. This is the PROFINET device name that is used to initialise the device in the PROFINET network. Please follow the rules for the structure of the device name.

The following characters are permitted: a … z / 0 ... 9 / . / -

The device name:
- Has the general structure: Label[.Label]n, where n = 0.3 / .Label = max. 63 characters.
- Does not start with: Numbers / . / - / port-nnn, where n = 0.9 / xn—
- Does not end with: . / -
- Does not have the structure: n.n.n.n, where n = 0.999

PROFIenergy: This menu can be used to activate and deactivate the standardised PROFIenergy energy efficiency profile.

IP configuration (PROFINET): A unique IP address must be assigned to the Controller. If the addresses are assigned dynamically, the IP address and the associated subnet mask and gateway are assigned via the DCP protocol (based on the device name). Any static IP address, which may have been assigned beforehand, will be overwritten.

IP address: Use this field to enter the Controller IP address that is to be used to establish PROFINET communication.

Subnet mask: The Controller subnet mask that is to be used to select the subnet for Ethernet communication must be entered in this field.

Gateway: Use this field to enter the IP address of the gateway that the interface uses to direct Ethernet communication when the host is not in the dedicated subnet.

MAC address bus node: Display of the MAC address for normal PROFINET communication (IP and cyclic process data).

MAC address port 1, MAC address port 2: Display of the MAC addresses for the two PROFINET Ethernet ports for communication with specific protocols (e.g. LLDP).

Parameterisation interface: The parameterisation or diagnostics of the Controller can be performed either via the onboard Ethernet interface (X18) or via the PROFINET network. If the UDP communication of the parameterisation program is used in the PROFINET network, PROFINET must be configured as the parameterisation interface.

Port number: Use this field to enter the Controller port number that is to be used to establish UDP communication.

Display units: (see above)

Adopt settings: Changes to the parameterisation interface and port number will not become effective until the **Adopt settings** button has been selected. The settings are saved in the parameter set and the Controller then has to be reset.

Diagnosis: The current value of the control or status word is shown as a hexadecimal number. The individual bits are shown as LEDs. The top LED represents bit 0 and the bottom LED bit 15 of the corresponding word. Since the bit assignment of the control/status word varies depending on the mode of operation, the texts that are displayed are altered according to the mode and bit function. Furthermore, the command last received (in the case of the control word) and the current status (in the case of the status word) are displayed as plain text. The bits that are evaluated to calibrate the command/status are displayed in square brackets.

6.9 Run – Homing run

When started up, every position control system needs a repeatable, defined zero point, which is identified in a homing run. The Controller can perform this homing run automatically. During this process, a distinction is made between the target and the home position. The target can be the limit switch, a homing switch, the index pulse or the end limit stop, for example. The home position can be the target itself or, for example, the index pulse.

You can start a homing run by issuing a command via the serial interface (RS232, CAN, ...) or have it start automatically when the controller is enabled.

When the 24 V DC power supply is switched on or after the Controller has been reset, the current actual position is used as the "zero point". In the case of angle encoders that supply an absolute position message on the basis of one revolution (e.g. resolvers), the zero point is set by the zero position of the angle encoder. Consequently, although a home position exists, the drive is not considered as being "referenced".

The home position is retained regardless of whether controllers or power stages are enabled and also regardless of the operating mode. It is only lost after a reset or in the event of an angle encoder error.
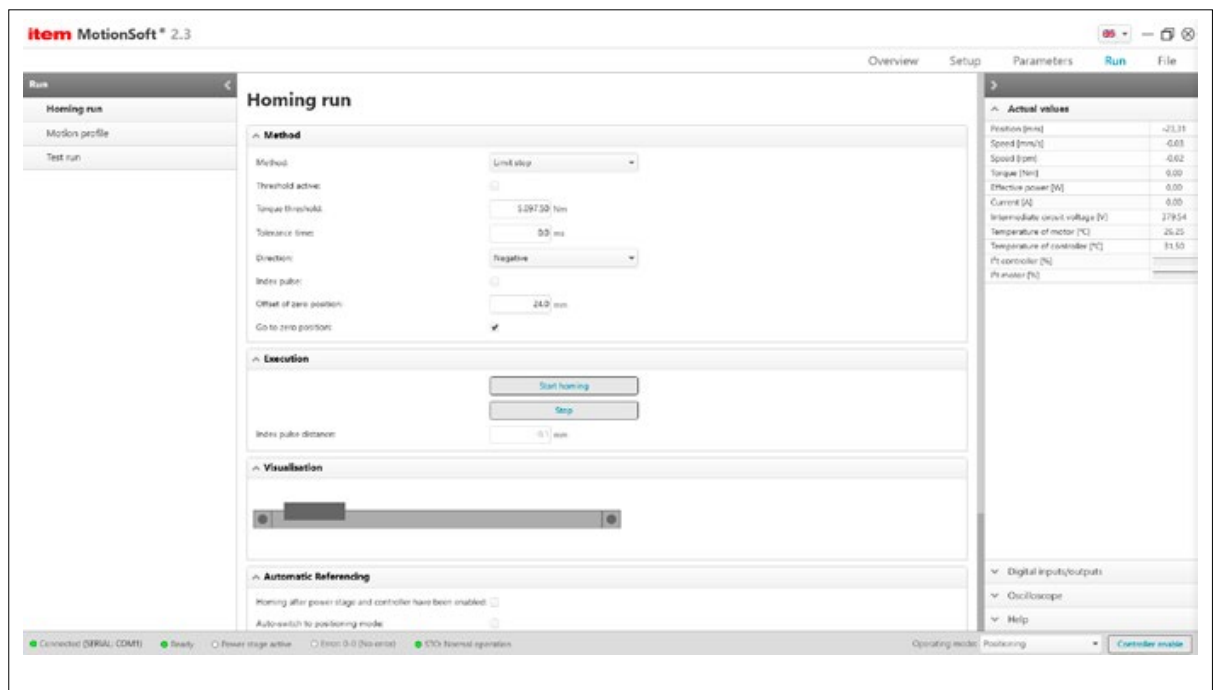

Figure 45: Parameterising a homing run

6.9.1 Speed, acceleration, jerk

This is where you can enter Speed and Acceleration values and Jerk-free sections for the following processes:

- Search run: Movement of the drive until it reaches the target (limit switch, homing switch, limit stop).
- Crawling: Reversal of movement (at low speed) to determine the contact threshold.
- Zero run: Optional movement to the zero point (home position) of the application.

Maximum search range: You can stipulate a maximum search range. If the system cannot detect any target signals (e.g. a limit switch) or the home position within this search range, it will issue an error message.

Offset of zero position: The actual home position – i.e. the mathematical zero point for the positioning runs that follow – is slightly offset from the home position of the homing run. This offset is specified under "Offset of zero position".

6.9.2 Method

Method (target): The drive is initially moved toward a target (e.g. limit switch) at search speed. You can set the target here.

You also have the option to refine the conventional "Limit stop" homing run method by "homing on a comparison torque". The target of the homing run is then identified on the basis of reaching a given comparison torque.

6.9.2.1 Limit stop

Threshold active: Activation checkbox.

Torque threshold: A homing value for comparison torque. The system monitors the achievement of this value.

Tolerance time: If the homing torque is reached during the tolerance time, the system ignores it. This is a useful way to block out an elevated start-up torque.

6.9.2.2 Limit switches

The target for this run is the limit switch. Limit switches are connected to digital inputs DIN 6 and DIN 7.

6.9.2.3 Homing switch

The target for this run is the homing switch. The homing switch can be connected to either digital input DIN 8 or DIN 9.

6.9.2.4 No travel

The home position of this homing run method is the current position plus the value set under "Offset of zero position". This homing run method also needs the controller to be enabled before it can be executed.

Direction: You can set the search direction for the homing run here. In the case of most homing run methods, the system must be told whether it is to search in a positive or negative direction.

Index pulse: If this box is checked, the zero point for the application is calculated from this home position. The index pulse is generated only once per revolution of the motor and can be used as a home position once a previous run to e.g. an end limit stop has been identified.

6.9.3 Execution

Start homing: Press this button to start a homing run.

Stop: Press this button to stop a homing run that has been started.

Index pulse distance: If "Limit stop" has been selected as the method and "Index pulse" has been checked, the index pulse distance is shown here on successful completion of a homing run. The index pulse distance is the distance measured in revolutions of the motor between the target and the homing point – i.e. between the end limit stop and index pulse. If the target is very close to the index pulse, a small change in the mechanical system can mean that, during the next homing run, the index pulse is taken as a homing point "before" or "after" the original index pulse.

6.9.4 Visualisation

This is where the sequence of the currently set homing run method is displayed.

6.10 Run – Motion profile

You can use this menu to edit the motion profile.

6.10.1 Motion profile

Figure 46: Editing a motion profile

Move to position: This is where you can enter the position that the carriage should be moved to when the start button is pressed. Press the Stop button to bring the carriage to a halt.

Start position: Enter the number of the motion profile to specify which motion profile is to be started first when the "Start" button is pressed. This is not necessarily the same motion profile that is activated by the digital inputs "Parameters – IO configuration – Digital inputs" for "Motion profile START, move to position". This motion profile is visually highlighted with a double frame around the position number.

"Start": Press the "Start" button to move the carriage to the position previously entered as the start position.

"Stop": Press the "Stop" button to stop an active run.

"START position and HOME position": Users can specify two positions with which the motion profile can be initiated: "HOME" and "START". Both positions are linked to different digital inputs (see the digital inputs menu). The HOME and START positions can each be assigned a positioning set number here.

6.10.2 Position

You can use this menu to specify position profiles. You can also generate sequences for the motion profile.
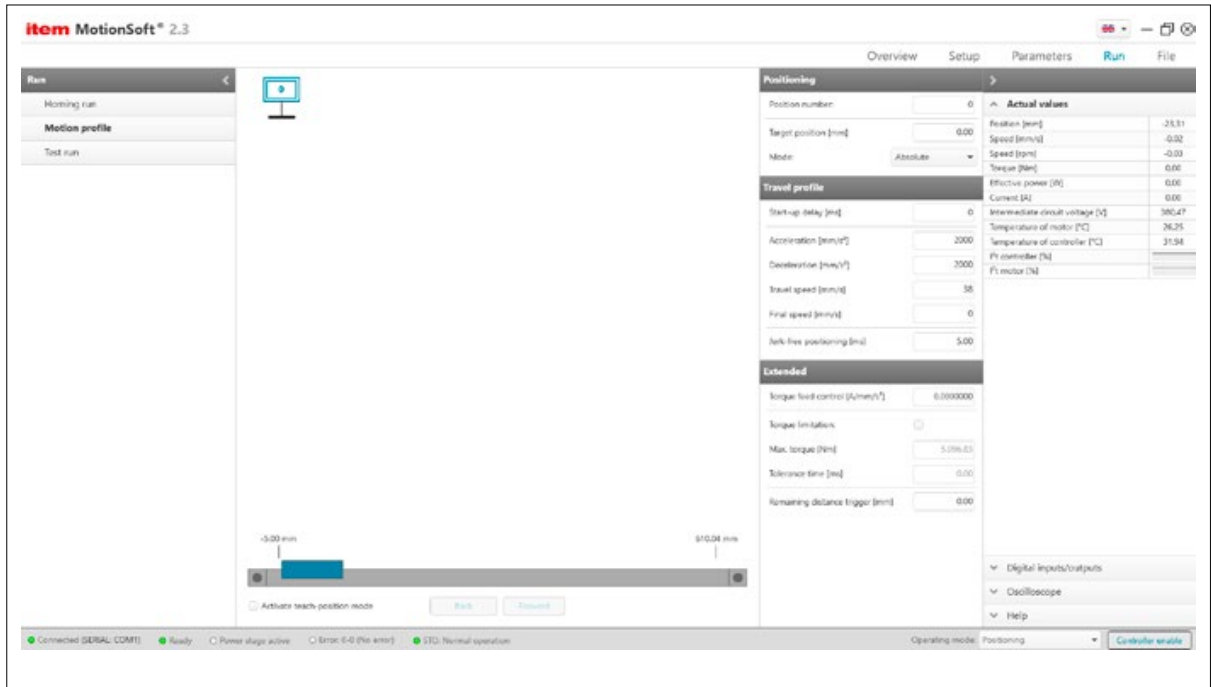

Figure 47: Editing a motion profile position

6.10.2.1 Positioning

Position number: Position 0 ... 255: These are user-defined positions that can be used freely. One of these positions can be initiated with a combination of the positioning selector and the digital "Start" input. These positions can also be initiated via fieldbus systems.

Position 259 + 260: (Jog0 / Jog1) Jogging mode is the controlled movement of a carriage to a specific position. The carriage continues to move as long as a certain input signal is active.

The Controller supports jogging mode in both positive (Jog0) and negative (Jog1) directions. Separate travel speeds and accelerations can be specified for each direction. Furthermore, an input can be assigned for jogging in each direction of travel, both positive and negative.

The activation of jogging mode via digital inputs takes place in the Command window.

Target position: You can use this field to specify the target position. The target position is interpreted differently depending on whether an absolute or relative positioning run has been selected.

To do this, select Absolute or Relative from the drop-down menu next to "Mode".

6.10.2.2 Travel profile

Start-up delay: Use this input field to define a delay that takes effect when the start command for a positioning run is issued, before the carriage is moved to the desired position.

Acceleration: The fields Acceleration and Deceleration can be used to parameterise the acceleration and deceleration values for speeding up and slowing down the drive.

Speed: Use this field to state the travel speed with which the run to the target should be executed. The final speed is the speed of the drive when the target position is reached. In most cases it is zero. If the final speed is not equal to zero, the motion profile is calculated such that the drive exhibits the specified final speed when the target position is reached and – as an option – continues to move at this speed.

Jerk-free positioning: The positioning process is smoothed by a filter to eliminate jerk. This is where you can set the filter time constant.

6.10.2.3 Extended

Torque feed control: You can use this field to make positioning runs more dynamic. The variable has to be determined by experimenting. The default setting is 0.

Caution: Only very small values can be entered here!

Torque limitation: When this checkbox is selected, the torque value entered under "Max. torque" is used as a limit for the selected positioning set.

Max. torque: This is where you can enter a torque value that the Controller will not exceed during a positioning run. This limit is active only when the checkbox is selected.

Tolerance time: If the target of this positioning set is a torque value (this option can be set only via the transfer window), the tolerance time is used to mask out the high torque during the start of a positioning run. During this period, the system does not execute any "Target torque achieved" checks.

Remaining distance trigger: You can use this field to parameterise trigger signals that can be issued via the fieldbus or a digital output. These trigger signals indicate the remaining distance up to the end of an ongoing positioning run.
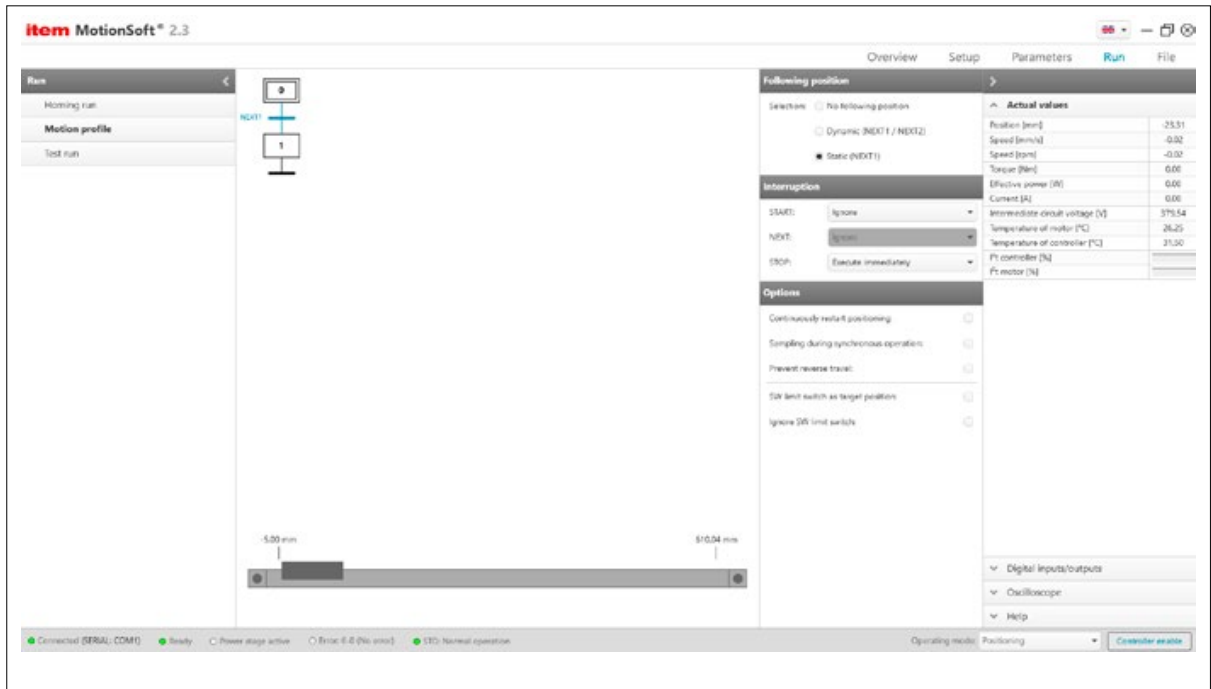
6.10.3 Linking positions

Figure 48: Linking positions

6.10.3.1 Following position (transition)

This is where you can interlink positions with subsequent positioning runs. You can define whether each position has a following position and how a run to this position can be initiated.

No following position: The preselected position does not have a following position and is therefore an end position.

Dynamic (NEXT1 / NEXT2): The preselected position has two following positions. This means you can incorporate branching into a motion profile so that the carriage can be moved dynamically to a waiting or starting position, for example. The NEXT1 and NEXT2 control inputs are configured under "Parameters – IO configuration – Digital inputs".

Static (NEXT1): The carriage is moved to the parameterised following position immediately on reaching the previous position.

6.10.3.2 Interruption / reactions

START (during ongoing positioning run):

- **Execute immediately:** The current positioning run is interrupted and the carriage is immediately moved to the new position. If the positioning mode is "relative", the reference position for the calculation of the new target position is the currently active position setpoint. By contrast, the reference position when using the "relative to the last target" option is the (old) target position of the positioning run that has just been interrupted.

- **Append:** The current positioning run is completed before the new positioning run is started. The next positioning run can be selected prior to the current positioning run. The new positioning run is started automatically when the current positioning run is completed. When starting a relative positioning run, the reference position for "relative" is normally the last target position.

- **Ignore:** The positioning command for the new position cannot be selected or started before the current positioning run has been completed.

NEXT: You can only make a selection here if dynamic branching has been incorporated under "Following position" above.

- **Execute immediately:** The digital inputs NEXT1 and NEXT2 are evaluated (branching). If the system detects a signal edge, the current positioning run may be interrupted and the carriage immediately moved to the new target position.

- **Append:** The digital inputs NEXT1 and NEXT2 are evaluated (branching). If the current positioning run has not yet been completed and the system detects a signal edge, the carriage is initially moved to the current position. It is then moved to the new target position. If there are multiple signal edges during the current positioning run, the last signal edge in each case is used.

- **Ignore:** The digital inputs NEXT1 and NEXT2 are evaluated (branching). If the current positioning run has not yet been completed, the digital inputs are ignored.

STOP: The motion profile stops when an end position has been reached or a STOP signal has been detected. The stop is activated only when a current positioning run has been completed. In some cases it may be desirable to ignore the STOP signal for certain positions because, although the motion profile as a whole is to be stopped, it is not to be stopped at this specific position. If this is the case, select the "Ignore" option for this position. The drive is then moved to the next position, where it is stopped – provided this option has not been selected for that position, too.

6.10.3.3 Options

NB: Do not change these settings unless you really understand the consequences (expert)! If necessary, contact your distribution partner!

Continuously restart positioning: This option is generally useful only when the option from analogue input AIN 0 or from the internal data buffer has been selected under Target position from AIN 0. When this option is selected, the positioning start command is continuously executed in the firmware, which means the drive continuously travels to e.g. the position acquired from AIN 0. Otherwise, the position is adopted only when the start command has been issued.

Sampling during synchronous operation: The current actual position of the master system can be captured using the fast digital SAMPLE input (trigger event). Synchronisation can then be started via the digital START input.

In every trigger event, the current master position is stored by the X10 input.

Only a new start command initiates a new synchronisation, during which the target is calculated using the stored synchronisation position. The advantage of this process is that it more accurately calibrates the synchronisation target, since jittering is reduced during the start of synchronisation.

The start command can be issued even before the travel range of the master position is reached. In such circumstances, the drive only starts the positioning run if the position stop has been completed.

Under certain circumstances, these settings can result in undesired positioning runs!

If a start command is generated without a preceding trigger signal, the error 41 – 0 is triggered.

Prevent reverse travel: In some cases it might be desirable to stop the drive as quickly as possible in positioning mode. This is the case, for example, during desynchronisation in the "flying saw" application. The positioning set for desynchronisation can be configured with "relative positioning, target position 0", for instance. If the drive is still moving and this positioning set is started, the drive goes past the target and has to reach the target by travelling in reverse. Activating this option suppresses this behaviour.

SW limit switch as target position: This option is normally used only for jogging mode positioning sets. Depending on the selected direction, either the negative or positive end of the positioning range is entered as the target position.
Caution! This option has a higher priority than Target position from AIN 0!

Ignore SW limit switch: The firmware usually checks whether the current position or the target position is within the valid positioning range. If this checkbox is selected, this monitoring process is deactivated for this positioning run.

6.11 Run – Test run

You can use this page to execute test runs in positioning, speed control and torque control modes. The operating mode is switched automatically for you when starting a run.
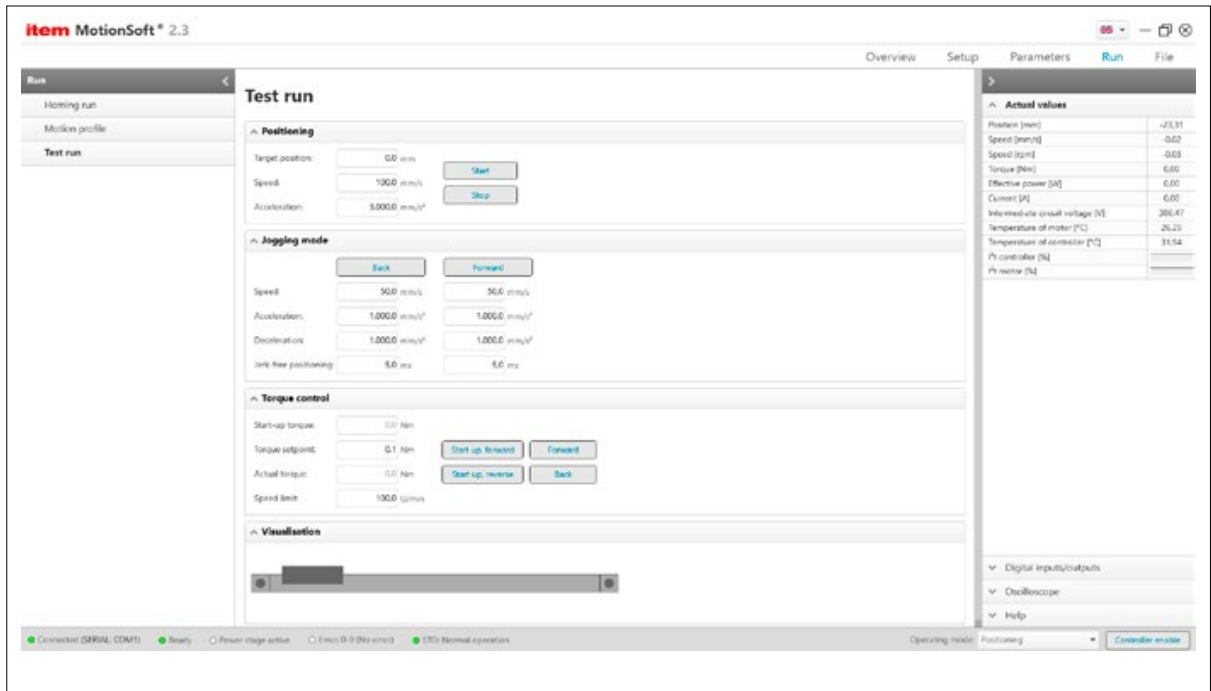

Figure 49: Executing test runs

6.11.1 Positioning

Target position: Enter the desired target position here.

Speed: Enter the speed at which the carriage is to be moved toward the target position here.

Acceleration: Enter the desired acceleration here. The value you enter here is applied equally to the acceleration and deceleration ramp.

Start, Stop: Use these buttons to start and stop a positioning run.

6.11.2 Speed control

Speed: Enter the desired (target) speed here.

Acceleration: Enter the acceleration you want to be applied to achieve the target speed here.

Torque limitation: You can use torque limitation to superimpose a maximum torque on torque control. **The range limits set under safety parameters can be overridden in "Torque control" mode.**

6.11.3 Torque control

This mode should be used by experts only! Do not use on vertical axes – risk of sudden drop!

Torque values relate to the motor shaft. If a Gearbox has been flange-mounted to the system, it will substantially multiply the torque!

Start-up torque: This is where the torque detected during the "Start up, forward" or "Start up, reverse" function is displayed.

Torque setpoint: Enter the desired torque setpoint here.

Please note that the torque relates to the motor shaft. If a Gearbox has been flange-mounted to the system, it will substantially multiply the torque!

Use the "Forward" and "Back"buttons to start the run.

Actual torque: This is where the torque that is currently visible for the motor is displayed.

Speed limit: Enter the maximum permitted speed during a test run in torque control here.

6.12 File
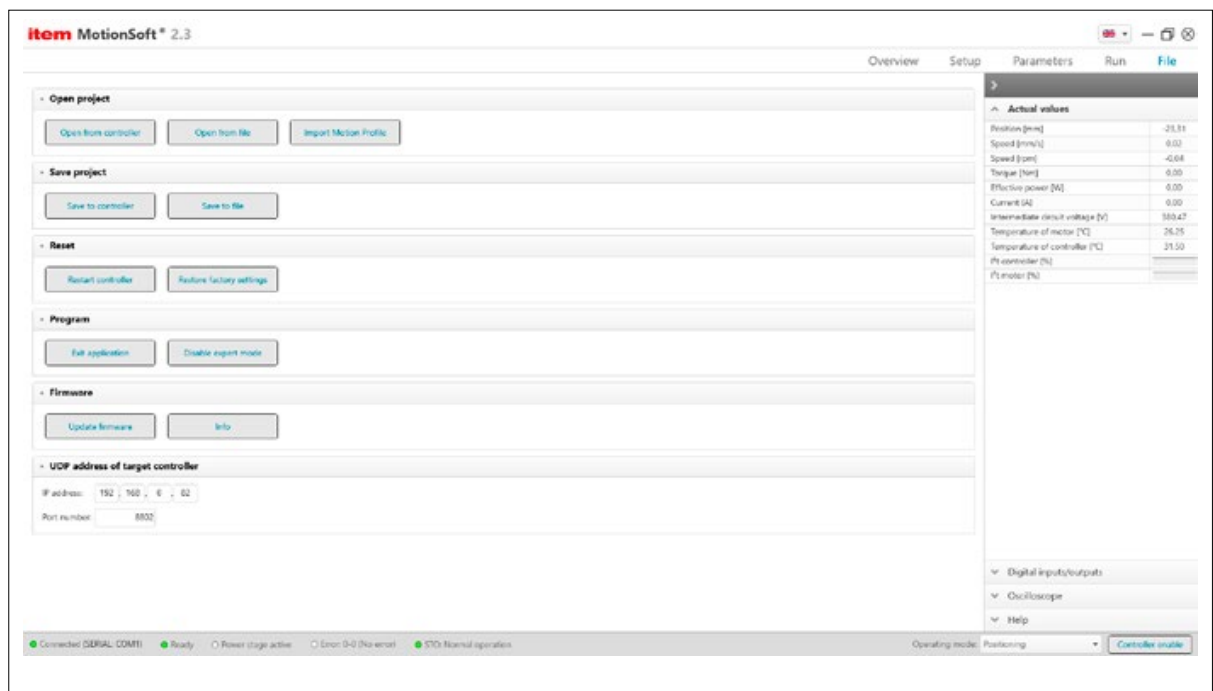
Figure 50: File

6.12.1 Open project

Open from file: Use this option to search the hard drive for a project file and modify it in item MotionSoft®.

Open from controller: Use this option to load a project file from the Controller and modify it with item MotionSoft®.

6.12.2 Save project

Save to controller: Use this option to save the current project to the Controller. **If you do not save a project, you will lose any changes you have made to it when resetting the Controller.**

Save to file: Use this option to save the current project to the hard drive so that you can complete it at a later time or to create a back-up.

6.12.3 Reset

Restart controller: Use this option to restart the Controller. **If you do not select "Save to Controller" before resetting the Controller, you will lose any changes you have made to a project.**

Restore factory settings: Use this option to restore the Controller to its factory settings. **All customised settings will be lost. If you have not saved a back-up to a data storage device, you will lose the Controller settings irretrievably.**

6.12.4 Program

Info: Use this option to create a list showing the system's status. This list contains crucial data that the support team will need in the event of an error.

List of figures

item

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