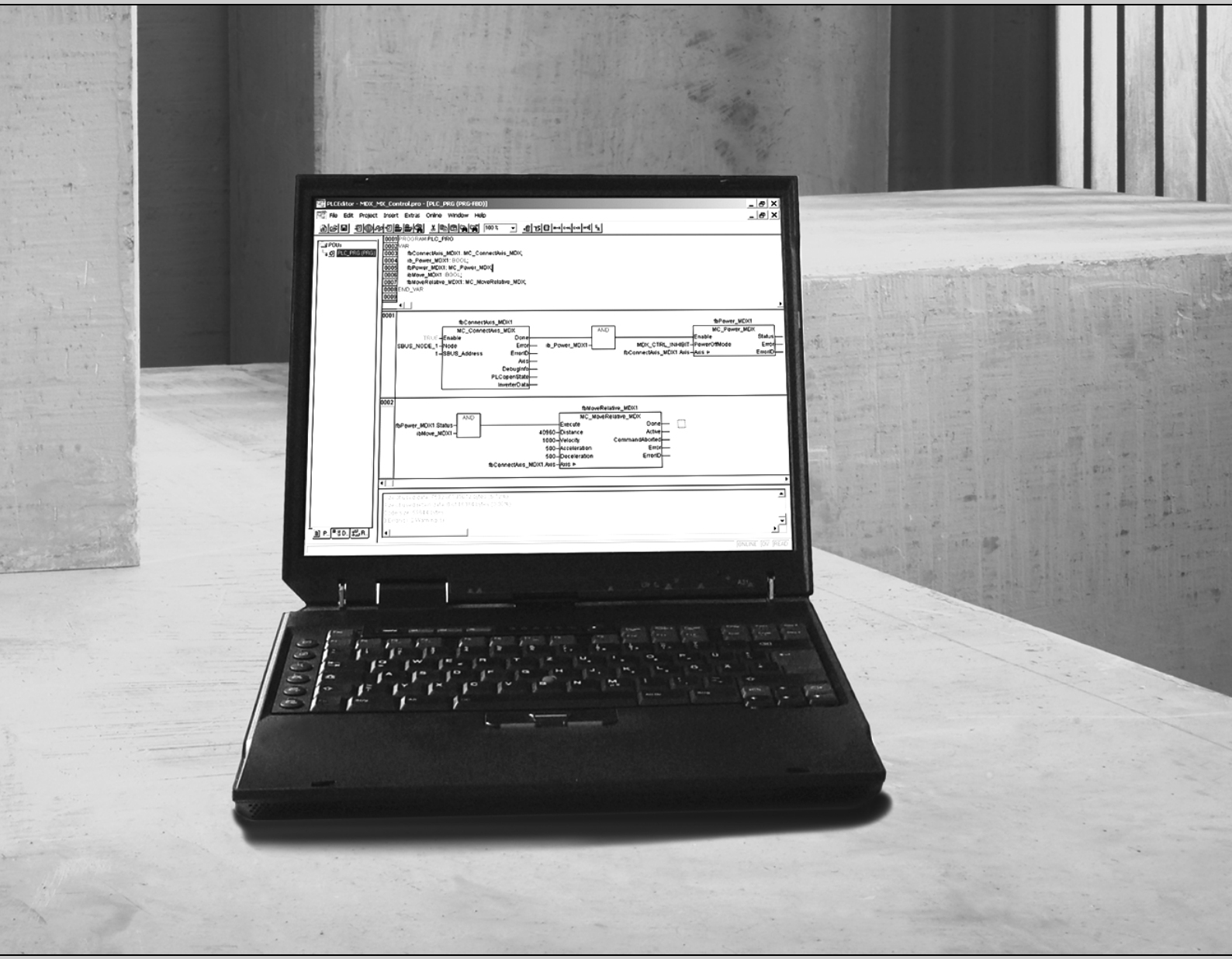
SEW EURODRIVE

Manual

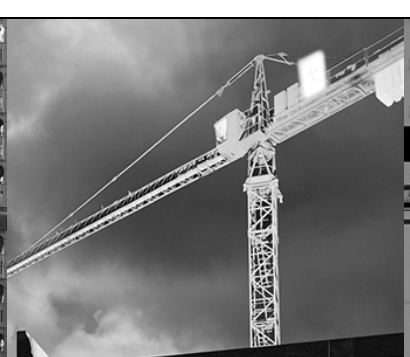


MOVI-PLC®

"SyncCrane" Application Solution

Edition 04/2010

16945611 / EN




MAX.GW.
TARE
MAX.CW.
CU.CAP.
KKFU 144794 3
42G1

Contents

1 General Information

1.1 Use of the manual

The manual is part of the product and contains important information on operation and service. The manual is written for everyone starting up or servicing this product.

The manual must be accessible and legible. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the manual carefully and understood it. Consult SEW-EURODRIVE if you have any questions or if you require further information.

1.2 Structure of the safety notes

1.2.1 Meaning of the signal words

The following table shows the grading and meaning of the signal words for safety notes, notes on potential risks of damage to property, and other notes.

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

1.2.2 Structure of the section-related safety notes

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

This is the formal structure of a section safety note:

⚠ SIGNAL WORD

Type and source of danger.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the danger.

1.2.3 Structure of the embedded safety notes

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

This is the formal structure of an embedded safety note:

- ⚠ **SIGNAL WORD** Nature and source of hazard.

  Possible consequence(s) if disregarded.

  – Measure(s) to prevent the danger.

1.3 Right to claim under limited warranty

A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you adhere to the information in the documentation. Consequently, read the operating instructions and manuals before you start working with the unit!

Make sure that the operating instructions and manuals are available to persons responsible for the plant and its operation, as well as to persons who work independently on the unit. You must also ensure that the documentation is legible.

1.4 Exclusion of liability

You must comply with the information contained in the operating instructions to ensure safe operation of MOVIFIT®, MOVIDRIVE® or MOVITRAC® and to achieve the specified product characteristics and performance requirements. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

1.5 Product names and trademarks

The brands and product names contained in this documentation are trademarks or registered trademarks of the titleholders.

1.6 Copyright notice

2 Safety Notes

2.1 Other applicable documentation

- Read through this document carefully before you startup the application module.

The following publications and documents apply for the operation and installation of units that are controlled by the application module:

- Documentation of connected units (e.g. operating instructions of MOVIDRIVE® B)
- Manuals of the controllers used
- Manual/online help for the MOVITOOLS® MotionStudio engineering software.

You must adhere to the information in the documentation as a prerequisite to fault-free operation and fulfillment of warranty claims.

2.2 Target group

The user of this application module is a qualified person who has been trained accordingly.

SEW-EURODRIVE recommends that the user also participates in additional product training courses for the units and motors which are operated by this application module.

Only qualified electricians are authorized to install, startup or service the units or correct unit faults (observing IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE 0110 as well as national accident prevention guidelines).

Qualified personnel in the context of these basic safety notes are: All persons familiar with installation, assembly, startup and operation of the product who possess the necessary qualifications.

Any activities regarding transportation, storage, operation, and disposal must be carried out by persons who have been instructed appropriately.

2.3 Designated use

The SyncCrane application module is used to implement applications in which drives move at a synchronous angle to one another permanently or occasionally.

The SyncCrane application module must only be used in connection with components that are permitted for it:

- **Inverter:** MOVIDRIVE® B with the relevant options for encoder evaluation.
- **Controller:** DHP11B, DHR41B and DHF41B. All controllers must have technology level T2.

2.3.1 Safety functions

MOVIDRIVE® MDX60/61B inverters may not perform safety functions without higher-level safety systems. Use higher-level safety systems to ensure protection of equipment and personnel.

For safety applications, refer to the information in the following publications:

- Safe disconnection for MOVIDRIVE® MDX60B/61B – Conditions
- Safe disconnection for MOVIDRIVE® MDX60B/61B – Applications

2.4 Bus systems

A bus system makes it possible to adapt frequency inverters to the particulars of the machinery within wide limits. As with all bus systems, there is a danger of invisible, external (as far as the inverter is concerned) modifications to the parameters which give rise to changes in the unit behavior. This may result in unexpected, though not uncontrolled, system behavior.

2.5 Safety functions

MOVIDRIVE® MDX60B/61B and MOVITRAC® B inverters may not perform any safety functions without higher-level safety systems. Use higher-level safety systems to ensure protection of equipment and personnel. For safety applications, ensure that the information in the following publications is observed: "Safe Disconnection for MOVIDRIVE® MDX60B/61B / MOVITRAC® B".

2.6 Hoist applications

MOVIDRIVE® MDX60B/61B, MOVITRAC® B and MOVIAXIS® must not be used as a safety device in hoist applications.

Use monitoring systems or mechanical protection devices as safety equipment to avoid possible damage to property or injury to people.

2.7 Disposal

Observe the applicable national regulations.

Dispose of the following materials separately in accordance with the country-specific regulations in force, as:

- Electronics scrap
- Plastics
- Sheet metal
- copper

3 Description

3.1 Fields of application

The SyncCrane application module is used to implement applications in which drives move at a synchronous angle to one another permanently or occasionally, such as:

- Lifting devices
- Cranes
- Hoists
- Trolleys

The IEC program controls up to 8 MOVIDRIVE® individual axes. In Automatic mode, it sends a virtual master signal to the individual axes switched in synchronous operation.

Control of 4 additional auxiliary drives is supported:

- Hoist
- Crane trolley drives
- Hydraulic power units, etc.

3.1.1 Advantages of the SyncCrane application

The SyncCrane application offers the following advantages:

- Only one MOVI-PLC® is required for controlling the individual axes.
- Open IEC programming lets users make application-specific adjustments.
- The software wizard ensures guided startup and comprehensive diagnostic functions.
- High degree of similarity with "SEW application modules".
- In addition to the motor encoder, external absolute encoders (HIPERFACE®/SSI) can be connected and evaluated.
- Common setpoint for automatic mode is ensured by controlling the single axis via virtual encoder.
- Indirect positioning or indirect synchronization allows for safe system operation in the following cases:
  - Different wear of the drive axes
  - Slip, for example between drive gear and steel rail
  - Design susceptible to vibration

This application solution provides the user with an easy-to-use and guided startup standard solution based on the principle of "indirect positioning/synchronization".

This solution approach allows the following applications:

- Applications with high requirements on the dynamic properties.
- Applications that are susceptible to vibration due to mechanical conditions (e.g. due to high elasticity and/or unfavorable load distribution between the drivelines).

3.1.2 Characteristics of positioning mode and jog mode

Characteristics of positioning mode and jog mode:

- Positioning mode based on motor encoder with optional indirect position adjustment based on external distance encoder.
- Group/individual axis control of the connected axes (not synchronized).
- Software and hardware limit switch evaluation

3.1.3 Characteristics of referencing mode

Characteristics of referencing mode:

- Referencing the motor encoder system to the specified reference offset.
- Adjusting the external encoder signal to the specified reference offset.
- Group/individual axis control of all connected axes.
- Axis control when using the "standstill" reference travel type.

3.1.4 Characteristics of automatic mode

The characteristics of automatic mode (synchronized) are:

- Automatic alignment of the physical axes with each restart.
- Synchronous operation with automatic indirect synchronization of the external encoder system to the virtual encoder position.
- Virtual master value processing with jerk-limited ramp specification.
- Group control for all connected axes.
- Automatic interruption of the motion sequence if an axis fails and/or the specified synchronicity is violated.
- Configurable synchronization methods for different applications

3.1.5 Characteristics of emergency mode

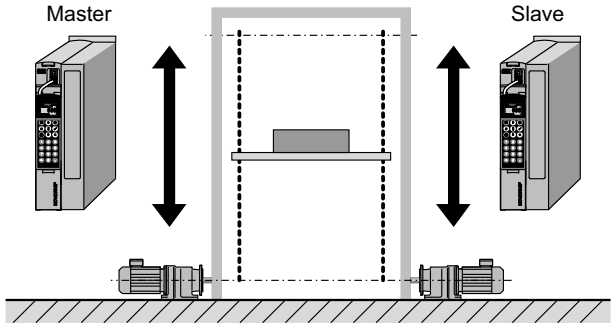
Characteristics of emergency mode:

- Jog mode (speed controlled).
- Group / individual axis control of the connected axes.
- Optional deactivation of the selected absolute encoder detection and monitoring.

3.2 Application examples

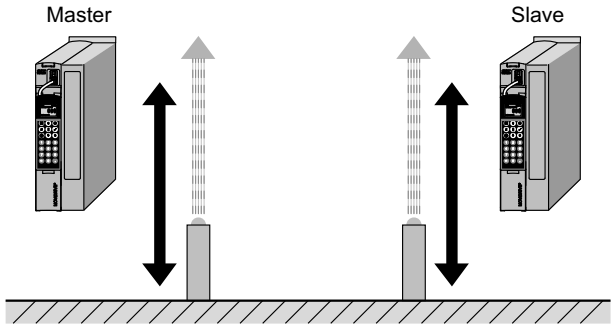
The SyncCrane application module offers a wide range of possible applications. Some examples are given in this section.

Example 1: Multiple column hoist with positioning and synchronization based on HIPERFACE® motor encoder.



511850891

Example 2: Gantry crane with indirect positioning and automatic slip compensation by means of absolute encoder evaluation.



511852427

3.3 Functional principle of indirect positioning and synchronization

3.3.1 The problem

Existing applications with evaluation of the absolute encoder as IPOS encoder (see IPOS manual chapter "Position detection and Positioning") limit the control dynamics due to the properties of the absolute encoder systems and the mechanical conditions (e.g. mounting of the encoder system).

Due to mechanical feedback, the entire system is susceptible to vibrations, which often requires complex optimization of the control parameters on site.

The IPOS-based application module "DriveSync" was implemented according to this principle. Especially when it comes to lifting devices and assembly-hall cranes, where evaluation of an absolute encoder is necessary in addition, compromises have to be made in project planning with respect to dynamics.

The SyncCrane application solution simplifies startup and operation.

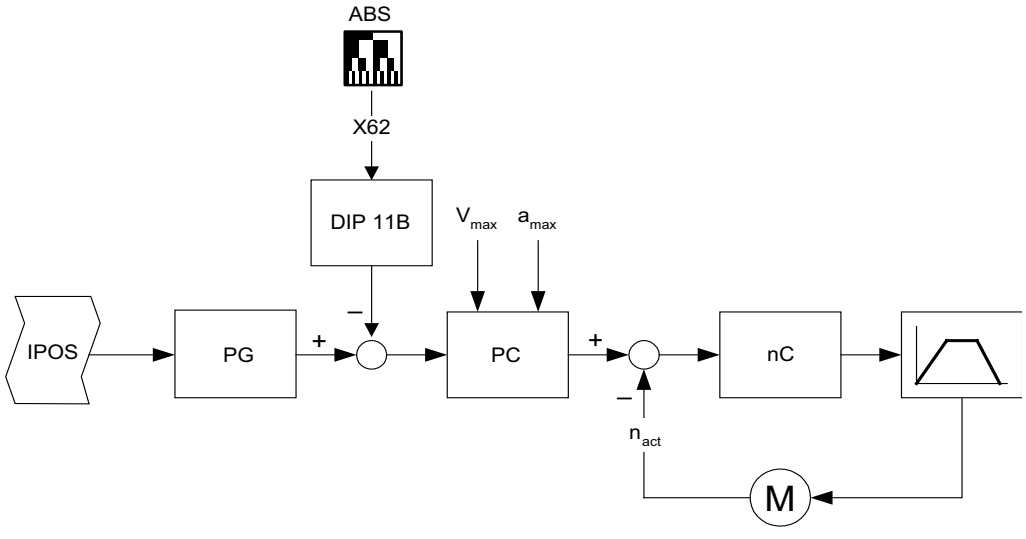
3.3.2 Positioning mode with direct positioning to values of absolute encoders

The necessary SHELL parameters are determined during guided startup (SHELL/DIP startup). Direct position control is part of the firmware.

During the positioning operation, the cyclically scanned actual position (absolute encoder/motor encoder position) is read by the profile generator and adjusted by the speed controller in case of deviations.

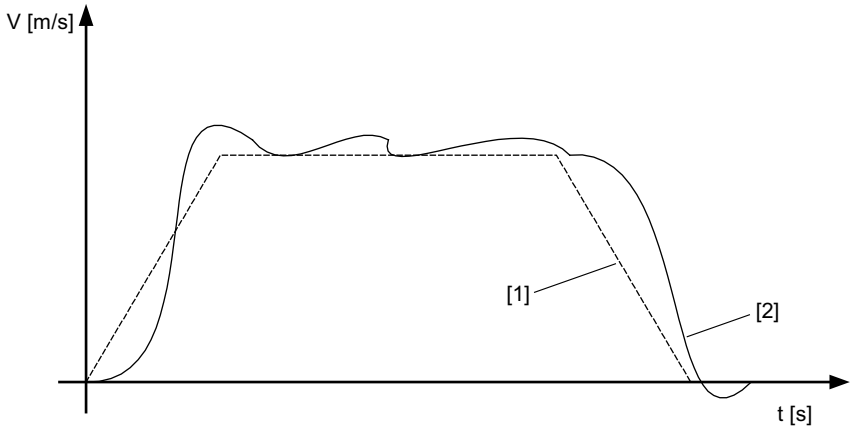
Deviations caused, for example, by slip between motor encoder and absolute encoder thus directly affect the speed profile of the drive.

The following figure shows direct position control with position correction.



v_{max}	Maximum speed	nC	Speed controller
a_{max}	Maximum acceleration	n_{act}	Actual speed
PG	Profile generator	ABS	Absolute encoder
PC	Position controller	IPOS	IPOS$^{plus®}$ program

The following figure shows the speed profile (motor encoder) for direct position control.



[1] Optimal speed process
[2] Real speed process

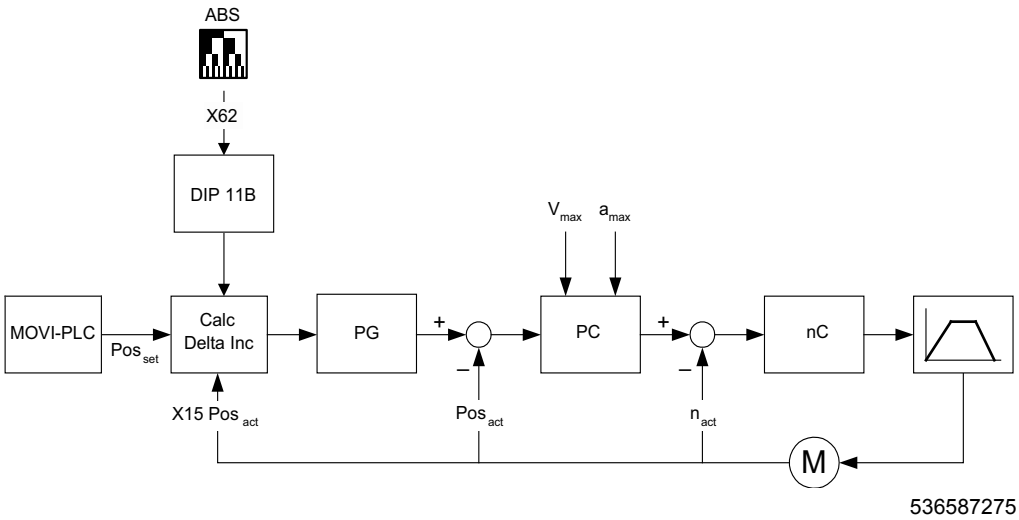
3.3.3 SyncCrane solution with indirect position control

Unlike direct position control, the absolute encoder signal is only evaluated for correcting the specified target position.

During the travel process, the speed profile of the drive is not changed.

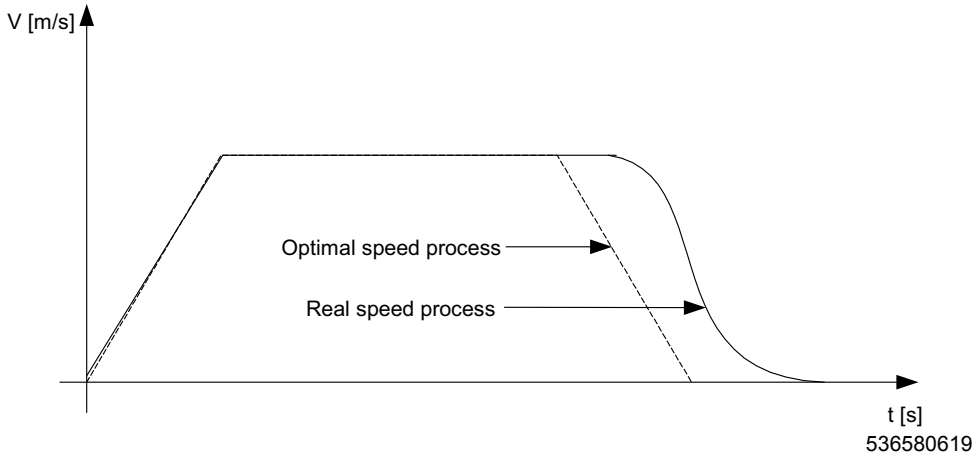
Susceptibility to vibration caused by retroactive effects, for example deviations between the absolute encoder detection and motor encoder detection, are minimized in this way.

The following figure shows indirect position control with absolute encoder.



v_{max}	Maximum speed	POS_{act}	Actual position motor encoder
a_{max}	Maximum acceleration	POS_{set}	Setpoint position motor encoder
PG	Profile generator	ABS	Absolute encoder
PC	Position controller	n_{act}	Actual speed
nC	Speed controller		

The following figure shows the speed profile (motor encoder) for indirect position control.



Result

The following properties do not have an effect on the speed profile of the drive but on the target position of the position controller if positioning tasks are solved using indirect position control:

- Slip
- Properties of the absolute encoder
- Mechanical elasticities between absolute encoder sensing and the drive

This leads to a higher dynamic response and thus to improved operating characteristics for dynamic positioning applications.

This solution with indirect positioning has been successfully implemented at SEW-EURODRIVE for some time in the area of SRUs with cornering ability, etc.

3.3.4 SyncCrane solution: Indirect synchronization to virtual master encoder

Due to the mentioned positive characteristics in relation to indirect positioning, we are currently testing if this can also be applied to synchronous operation.

We are working on the approach to superimpose a higher-level control loop for slip compensation on the firmware function "internal synchronous operation".

Internal control loop: Angular synchronous operation of the motor encoder

Angular synchronous operation is ensured by using the "internal synchronous operation" technology function.

The specified value for the virtual master is created via SBus object from the MOVI-PLC®. The optimum master value is ensured for the physical axes because the master value can be specified with limited jerk.

The controller parameters can be set "hard" by direct coupling of the drive trains.

Higher-level control loop: Indirect synchronization

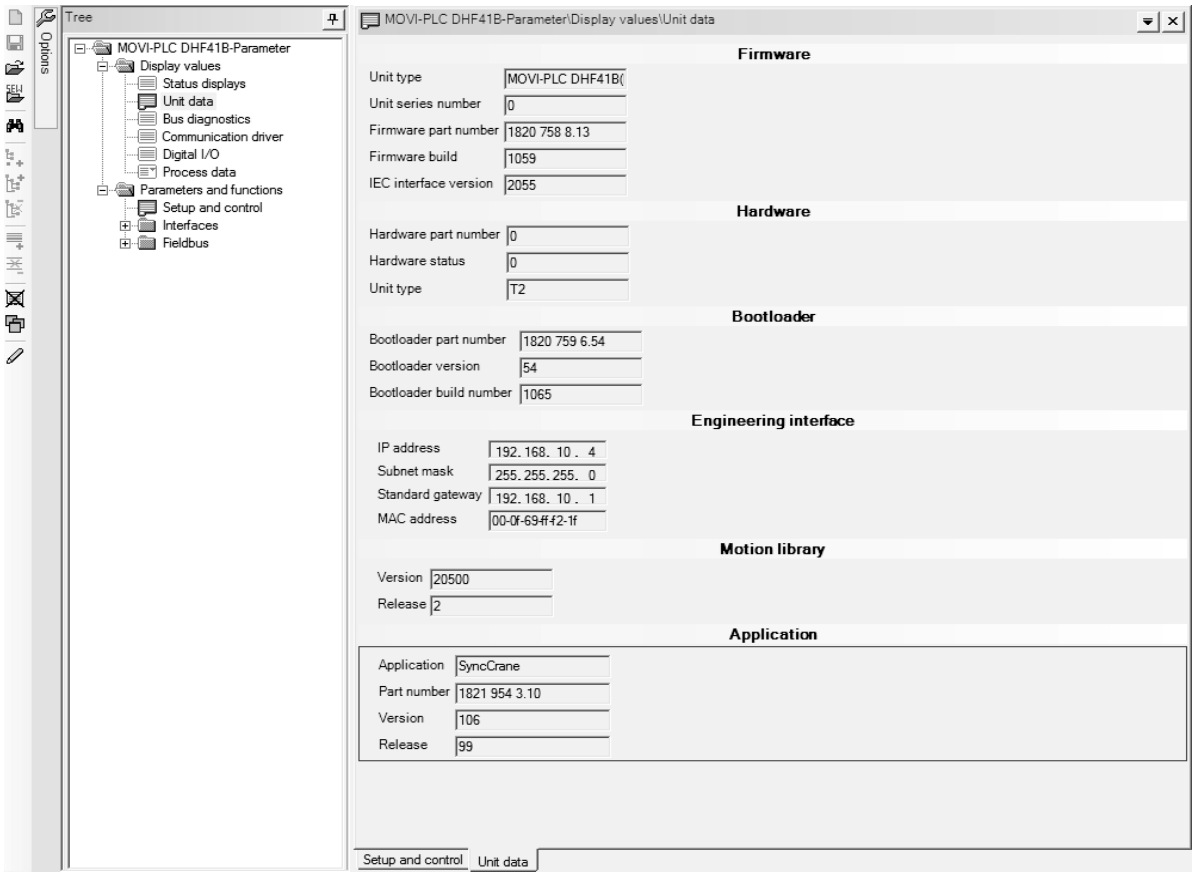
To prevent mechanical strain, e.g. caused by slight differences in the crane wheel diameter of gantry cranes, the actual position value read in via an absolute encoder must be compared with the position setpoint of the virtual encoder and corrected if necessary. This is implemented by the higher-level indirect synchronization.

The cyclically calculated difference value triggers a compensation movement if specified position windows are exceeded (distinction is made between dynamic and static case). The dynamics of the compensation movement is set during startup.

3.4 Program identification

You can use the MOVITOOLS® MotionStudio® software package to identify the program that was loaded last into the MOVI-PLC®.

Select the menu item [Startup] / [Parameter tree] / [Unit data]. This menu item shows the current application.



832287115

"SyncCrane" application	
Part number	A loaded *SyncCrane* application module can be identified by the part number 18219543.xx
Version	The current main version of the application module is displayed in this field.
Release	The current release of the application module is displayed in this field.

4 Project Planning

4.1 Prerequisites

4.1.1 MOVITOOLS® MotionStudio

The SyncCrane application module is implemented in MOVI-PLC® as IEC code and is part of the MOVITOOLS® MotionStudio engineering software.

You need a PC with MOVITOOLS® MotionStudio (version 5.6 or higher) installed to use SyncCrane.

For installation requirements, refer to the documentation (online help or manual) of MOVITOOLS® MotionStudio.

For older MOVITOOLS® MotionStudio versions or for updates of the application module, you can execute the installation file `SyncCrane.exe`.

4.1.2 Inverter

MOVIDRIVE®

- MOVIDRIVE® B with encoder feedback.
- Optional absolute encoder evaluation or HIPERFACE® encoder evaluation.
- Firmware 824 854 0.18 or higher.
- Prior motor startup of the individual axes using the SHELL software
- Subsequent configuration of the individual axis for operation with MOVI-PLC® via DriveStartup. Make sure that different SBus individual addresses are specified. Assign the numbers in increasing order beginning with 1. It is important that the communication is set to 1 Mbaud.

4.1.3 Motors / gear units

- Asynchronous or synchronous servomotors with motor encoder
- Gear unit / additional gear
  - Optimum control behavior is only achieved with mechanically identical design of slave axes (same gear ration, wheel diameter, etc.).

4.1.4 Controller

You need one of the following controllers (with technology level T2) to use SyncCrane:

Controller type	Performance class	Firmware version
MOVI-PLC® *basic* DHP11B	-	2010r9
DHF41B	CCU advanced	1059
DHR41B		

4.2 Functional description

The SyncCrane application has the following functional characteristics:

Jog mode

- The drive is moved clockwise or counterclockwise using two bits for direction selection.
- The speed and the ramp can be varied using the fieldbus.

Referencing mode

- Position adjustment is initiated with the start signal of the external encoder.
- Reference travel establishes the reference point (machine zero) for absolute positioning operations.

Positioning mode

- The target position is specified by the process output data words PO4 and PO5. The speed and the ramp can be varied using the fieldbus. The current actual position is reported back via the process input data words PI4 and PI5. The program cyclically queries the target position so that position changes are possible during ongoing positioning.
- When external HIPERFACE®/SSI absolute encoders are processed, the motor target position is adjusted during the travel process so that possible slip can be compensated.

Automatic mode

- Automatic mode is used as motion control based on the technology function "Internal Synchronous Operation" (ISYNC) and is controlled in the inverter. Once automatic mode is selected, the axis system is adjusted to a common "adjust position" in positioning mode and the axis system is synchronized accordingly. The axis system can then be moved using the virtual master encoder.
- Master value specification via virtual encoder is made either in jog or positioning mode.
- The startup wizard lets you specify a jerk time for the virtual encoder.
- Position deviations between virtual encoder position and external distance encoder are compensated cyclically during ongoing movement. This is to adjust, for example, varying wear on the drive wheels without limiting positioning accuracy.

Emergency mode

- The drive is moved clockwise or counterclockwise using two bits for direction selection.
- The speed and the ramp can be varied using the fieldbus.

4.3 Scaling the drive

All values for position representation (for startup data and for cyclical data exchange of the process data interface) are related to the external encoder system. In the program, these values are converted to the motor encoder. It is described below how the scaling factors are determined.

4.3.1 Determining the scaling factors for motor encoder/absolute encoder

Distance resolution of motor encoder:

$$ScaleFactorMotEncoder = \frac{Encoder\ Resolution \times Gear\ Box\ Numerator}{\pi \times Diameter \times Gear\ Box\ Denominator} \frac{[Inc]}{[mm]}$$

$$ScaleFactorMotEncoder = \frac{ScaleMotEnc\ Num}{ScaleMotEncDenom}$$

Distance resolution of external encoder (e.g. for draw-wire encoder):

$$ScaleFactorAbsEncoder = \frac{Encoder\ Resolution \times Encoder\ Scaling\ Factor \times Gear\ Box\ Numerator}{\pi \times Diameter \times Gear\ Box\ Denominator} \frac{[Inc]}{[mm]}$$

$$ScaleFactorAbsEncoder = \frac{ScaleAbsEnc\ Num}{ScaleAbsEncDenom}$$

Distance resolution of external encoder (e.g. for laser distance encoder):

$$ScaleFactorAbsEncoder = \frac{Encoder\ Resolution \times Encoder\ Scaling\ Factor}{1} \frac{[Inc]}{[mm]}$$

$$ScaleFactorAbsEncoder = \frac{ScaleAbsEnc\ Num}{ScaleAbsEncDenom}$$

Conversions

This means the motor encoder position is calculated as follows with a specified absolute encoder position:

$$MotEncoderPos = \frac{ScaleFactorMotEncoder \times AbsEncoderPos}{ScaleFactorAbsEncoder}$$

As well as the absolute encoder position

$$AbsEncoderPos = \frac{ScaleFactorAbsEncoder \times MotEncoderPos}{ScaleFactorMotEncoder}$$

4.3.2 Determining the scaling factors for virtual encoder

- Setpoint specification refers to the actual position of the absolute encoder.
- The actual position is displayed in the resolution of the absolute encoder.
- Enter the values determined for the external encoder system as conversion factors.

INFORMATION

The user interface limits the scaling factors to 2^{16}.

4.4 Limit switches, reference cams and machine zero

Note the following points during project planning:

- The software limit switches must be located within the travel range of the hardware limit switches.
- When defining the reference position (position of the reference cam) and the software limit switches, make sure they do not overlap.
- You can enter a reference offset during startup if the machine zero is not located on the reference cam.

  The following formula applies: Machine zero = reference position + reference offset

  This way, you can alter the machine zero without having to move the reference cam.
- Use the startup wizard to make the necessary settings.

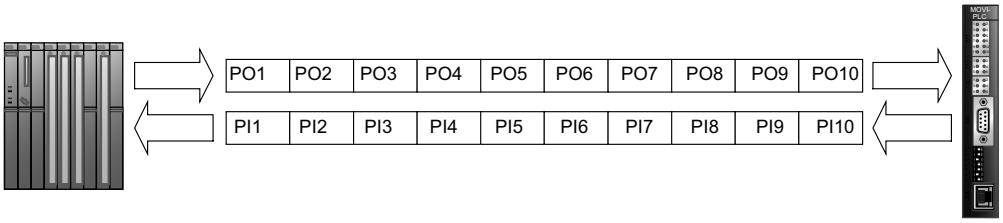
  The following unit parameters are reserved:

  - *P900* reference offset
  - *P920* software limit switch CW
  - *P921* software limit switch CCW

4.5 Process data assignment

The higher-level controller (PLC) sends 10 process output data words (PO1 ... PO10) via PROFIBUS. The MOVI-PLC® sends 10 process input data words (PI1 ... PI10) to the higher-level controller .

The following figure shows the data exchange via the first 10 process data words:



511853963

The following extension of process data words is optional:

- Up to 32 PD for DHP11B
- Up to 64 PD for DHF41B and DHR41B

The position values are specified/returned in [inc.] or in the user-defined units [mm] or [1/10 mm].

PO= Process output data	
PO1	Control word 1
PO2	Control word 2
PO3	Axis selection: • 1 ... 8 for single-axis operation • 99 for group drive
PO4	Target position in positioning mode (not synchronized) high
PO5	Target position in positioning mode (synchronized) low
PO6	Target position virtual encoder in automatic mode high
PO7	Target position virtual encoder in automatic mode low
PO8	Setpoint speed in [rpm] / [mm/s] / [m/min]
PO9	Acceleration ramp [in ms based on Δn of 3000 rpm]
PO10	Deceleration ramp [in ms based on Δn of 3000 rpm]

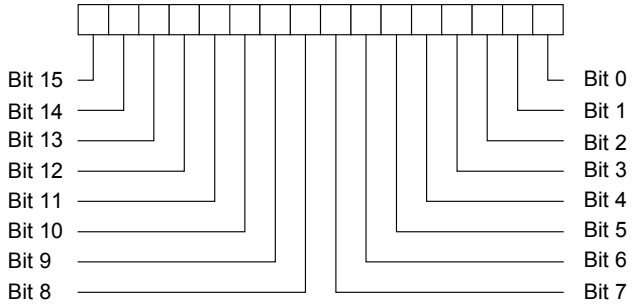
PI= Process input data	
PI1	Status word 1
PI2	Status word 2
PI3	Axis selection: • 1 ... 8 for single-axis operation • 99 for group drive
PI4	• In single-axis mode: Current single-axis position high • In group mode: Averaged position of the group
PI5	• In single-axis mode: Current single-axis position low • In group mode: Averaged position of the group
PI6	Actual position virtual encoder in automatic mode high
PI7	Actual position virtual encoder in automatic mode low
PI8	Diagnostic bits high byte, low byte
PI9	Diagnostic bits high byte, low byte
PI10	Diagnostic bits high byte, low byte
PI11	Actual position axis 1 high
PI12	Actual position axis 1 low
PI13	Actual position axis 2 high
PI14	Actual position axis 2 low

Expanding the process data words to a number of 32 means the following single-axis positions are transferred:

PI= Process input data	
PI11	Actual position axis 1 positioning mode high
PI12	Actual position axis 1 positioning mode low
PI13	Actual position axis 2 positioning mode high
PI14	Actual position axis 2 positioning mode low

4.5.1 Process output data words

The process output data words are assigned as follows:

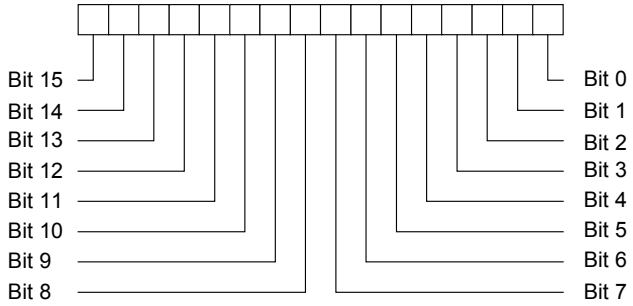


Data word	Bit no.	Description
Process output data word 1	Bit 0	/Controller inhibit
	Bit 1	Enable/rapid stop
	Bit 2	Enable/stop
	Bit 3	Reserved
	Bit 4	Reserved
	Bit 5	Reserved
	Bit 6	Error reset
	Bit 7	Reserved
	Bit 8	Start
	Bit 9	Jog +
	Bit 10	Jog–
	Bit 11	Mode selection bit 2^0
	Bit 12	Mode selection bit 2^1
	Bit 13	Mode selection bit 2^2
		Mode: 0: Reserved 1: Jog mode single/group 2: Reference mode single/group 3: Positioning mode group 4: Automatic mode group 5: Emergency mode single/group
	Bit 14	Reserved
	Bit 15	/SW LS

Data word	Bit no.	Description
Process output data word 2 (Control word virtual encoder)	Bit 0	Reserved
	Bit 1	Reserved
	Bit 2	Reserved
	Bit 3	Reserved
	Bit 4	Reserved
	Bit 5	Reserved
	Bit 6	Reset cold MOVI-PLC®
	Bit 7	Reserved
	Bit 8	Start
	Bit 9	Jog +
	Bit 10	Jog–
	Bit 11	Mode selection bit 2^0
	Bit 12	Mode selection bit 2^1
	Bit 13	Mode selection bit 2^2
		Mode: 0: Reserved 1: Jog mode group 2: Reserved 3: Positioning mode single/group 4: Reserved 5: Reserved
	Bit 14	Reserved
	Bit 15	/SW LS
Process output data word 3 Axis number	–	Single axis selection: 1 ... 8 Group selection: 99
Process output data word 4 Target position high byte	–	Position specification for physical axis in positioning mode (not synchronized)
Process output data word 5 Target position low byte	–	Position specification for physical axis in positioning mode (not synchronized)
Process output data word 6 Target position high byte	–	Position specification for virtual axis in positioning mode (synchronized)
Process output data word 7 Target position low byte	–	Position specification for virtual axis in positioning mode (synchronized)
Process output data word 8 Setpoint speed	–	Setpoint speed [rpm] / in user-defined units in jog/positioning mode
Process output data word 9 Acceleration	–	Acceleration ramp [ms] in automatic mode with limitation in jog/positioning mode
Process output data word 10 Deceleration	–	Deceleration ramp [ms] in automatic mode with limitation in jog/positioning mode

4.5.2 Process input data words

The process input data words have the following meaning:



Data word	Bit no.	Description
Process input data word 1	Bit 0	Motor is turning
	Bit 1	Frequency inverter ready for operation
	Bit 2	Axis referenced
	Bit 3	In position
	Bit 4	Operating mode active
	Bit 5	Frequency inverter fault/warning
	Bit 6	FB Fault/warning
	Bit 7	Encoder error
	Bit 8 ... 15	(with single selection) Inverter/error state
Process input data word 2	Bit 0	Virtual incremental encoder turning
	Bit 1	Reserved
	Bit 2	Reserved
	Bit 3	Virtual incremental encoder in position
	Bit 4	Axes synchronous/Ready for virtual encoder
	Bit 5	Lag error
	Bit 6	Virtual incremental encoder fault/warning
	Bit 7	MLC LifeCycleBit
	Bit 8 ... 15	Reserved
Process input data word 3 Selected axis number	–	Single axis selection: 1 ... 8 Axis system: 99
Process input data word 4 Actual position high byte	–	Actual position in user-defined units with single-axis selection (not synchronized)
Process input data word 5 Actual position low byte	–	Actual position in user-defined units with single-axis selection (not synchronized)
Process input data word 6 Actual position high byte	–	Actual position virtual master encoder in user-defined units (synchronized)
Process input data word 7 Actual position low byte	–	Actual position virtual master encoder in user-defined units (synchronized)
Process input data word 8 Diagnostics variables, e.g. powered	–	Assignment is configurable
Process input data word 9 Diagnostics variables, e.g. error	–	Assignment is configurable
Process input data word 10 Diagnostics variables, e.g. InGear	–	Assignment is configurable

Data word	Bit no.	Description
Process input data word 11 Axis 1 actual position high byte	–	Actual position axis 1 in user-defined units
Process input data word 12 Axis 1 actual position low byte	–	Actual position axis 1 in user-defined units
Process input data word 13 Axis 2 actual position high byte	–	Actual position axis 2 in user-defined units
Process input data word 14 Axis 2 actual position low byte	–	Actual position axis 2 in user-defined units

4.6 Software limit switches

The *software limit switch* monitoring function is used to check that the target position is set to appropriate values. During this process, it is not important where the drive is positioned.

In contrast to the monitoring of the hardware limit switches, the monitoring function for the software limit switches makes it possible to detect whether there is an error in the target specifications before the axis starts to move.

4.6.1 Moving clear of the software limit switch

Moving outside the software limit switches is also possible. For this purpose, the *DisableLS* bit is assigned in automatic mode in process output data word 1 (PO1) and/or process output data word 2 (PO).

- For unsynchronized motion PO1:15 / SW LS = TRUE
- For synchronized motion (automatic mode) PO1:15 / SW LS = TRUE and PO2:15 / SW LS = TRUE

4.7 Hardware limit switches

4.7.1 Preliminary work

Hardware limit switch processing is not supported by default. If you still want to use hardware limit switches, you will have to perform the following steps:

- Example of 2 inverters each of them with own hardware limit switches:
  - Connect the CW hardware limit switch of inverter 1 in series with inverter 2.
  - Set a hardware input for each inverter to "/Hardware limit switch CW".
  - Connect the CW hardware limit switches to the two inputs.
  - Wire the CCW hardware limit switch in an analogous manner.

4.7.2 Fault response

In the event of a fault, the drive inverter goes to status F29 "Limit switch approached". Ongoing movements are interrupted with the "Emergency stop ramp".

4.7.3 Moving clear of the hardware limit switch

Correct the operating mode selection in such a way that travel movement away from the hardware limit switch position can be triggered.

You can use one of the following ways to do so:

- Move group unsynchronized away from the limit switch:
  - Select "jog" mode.
  - Specify the jog direction away from the limit switch position.
  - Acknowledge the fault.
  - The travel movement is started.
  - The drives have moved clear of the limit switch once they change from unit status "9" (limit switch approached) to "A".
  - You can interrupt the motion sequence by deselecting the operating mode.
- Move group synchronized away from the limit switch:
  - Select "automatic" mode.
  - Select the jog mode of the virtual encoder.
  - Specify the jog direction away from the limit switch position.
  - Acknowledge the fault.
  - The travel movement is started.
  - The drives have moved clear of the limit switch once they change from unit status "9" (limit switch approached) to "A".
  - You can interrupt the motion sequence by deselecting the operating mode.

4.8 Safe stop

A *Safe stop* can only be achieved by safe disconnection of the jumpers at terminal X17 (with safety switch or safety PLC).

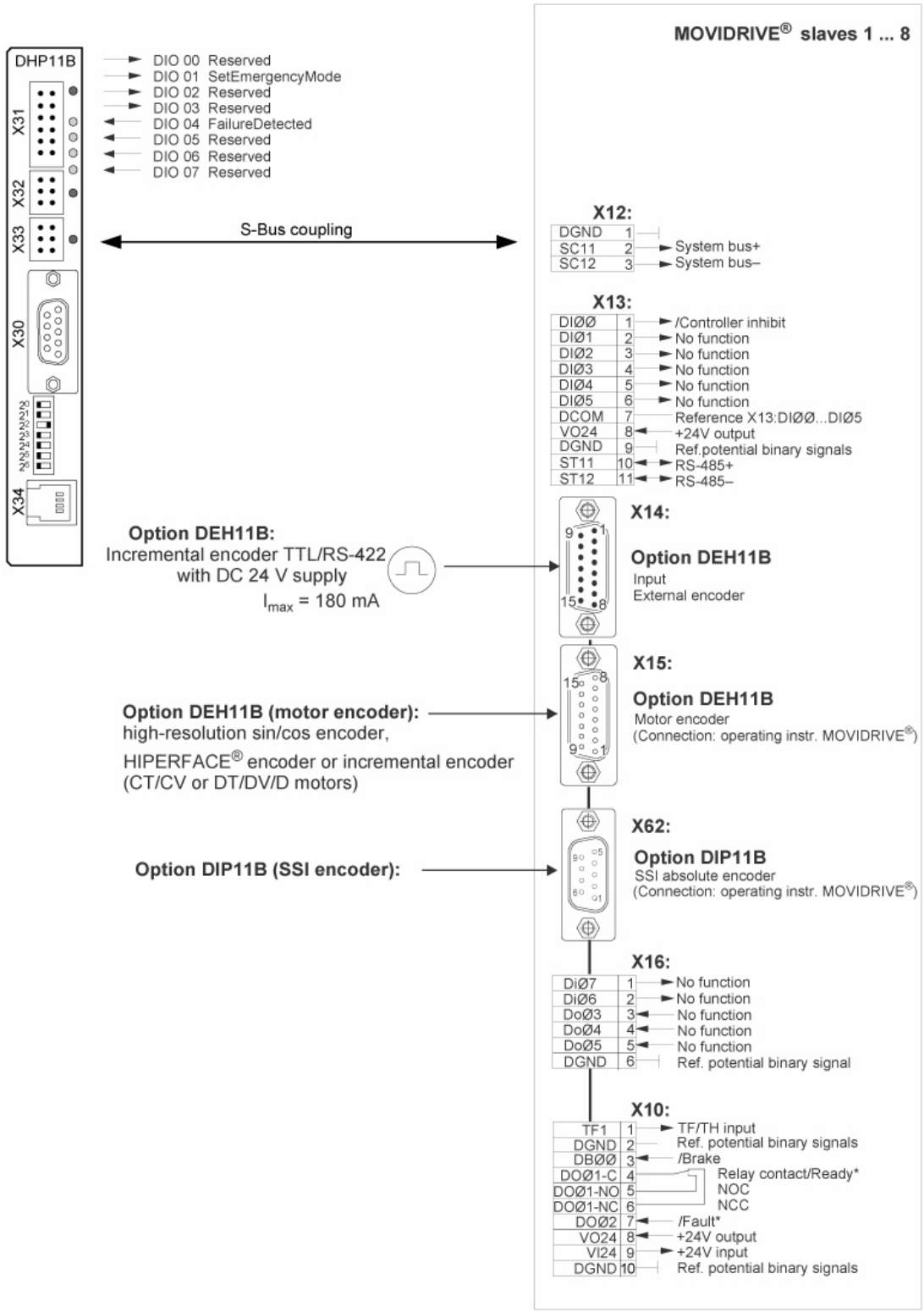
The 7-segment display shows a "U" to indicate *Safe stop active* state.

For more information on the *Safe stop* function, refer to the following publications:

- Safe disconnection for MOVIDRIVE® MDX60B/61B - Conditions
- Safe disconnection for MOVIDRIVE® MDX60B/61B - Applications

5 Installation

5.1 Wiring diagram



672388747

* Factory setting

6 Startup

6.1 Prerequisites

Correct project planning and installation are the prerequisites for successful startup. For detailed project planning information, refer to the "MOVIDRIVE® MDX60/61B" system manual.

Check the installation, the encoder connection and the installation of the DHP11B control card by following the installation instructions in the "MOVIDRIVE® MDX60B/61B" operating instructions, in the fieldbus manuals, and in the document at hand ("Installation" chapter).

For additional information, refer to the following documents:

- For information on the theory of operation of the MPLCMotion_MDX library as well as on the startup of MOVIDRIVE® inverters with MOVI-PLC®, refer to the "MPLCMotion_MDX Library for MOVI-PLC®" manual.
- For notes on the theory of operation of the MPLCTecGearMotion_MDX library, refer to the "MPLCTec..._MDX MPLCTecVirtualEncoder Libraries for MOVI-PLC®" manual.
- For supplementary notes on the theory of operation of the "internal synchronous operation" technology function, refer to the "MOVIDRIVE® MDX61B Internal Synchronous Operation (ISYNC)" manual.

6.2 Startup procedure

You need the MOVITOOLS® MotionStudio engineering software for startup.

The scope of delivery includes the "SyncCrane" application module and the technology editor "Drive Startup for MOVI-PLC®".

The **"Drive Startup for MOVI-PLC®"** technology editor is used for the first startup steps:

Drive startup for MOVI-PLC	Procedure
Step 1	Motor startup of the individual axes
Step 2	Preparing the individual axes for operation on the controller

The **"SyncCrane"** application module is used for the other startup steps:

SyncCrane	Procedure
Step 1	Starting "SyncCrane"
Step 2	Selection of startup steps
Step 3	Making the project settings
Step 4	Position scaling
Step 5	Scaling the virtual encoder
Step 6	Limiting the travel distance
Step 7	Setting and checking synchronous operation parameters
Step 8	Setting and checking monitoring functions
Step 9	Saving the data

To complete the startup procedure, it is necessary to execute the **"Drive Startup for MOVI-PLC®"** technology editor again (step "Initialize motor startup") for optimizing the speed controller.

The sample application "gantry crane" is presented below. This application is used to describe the startup steps listed here in detail.

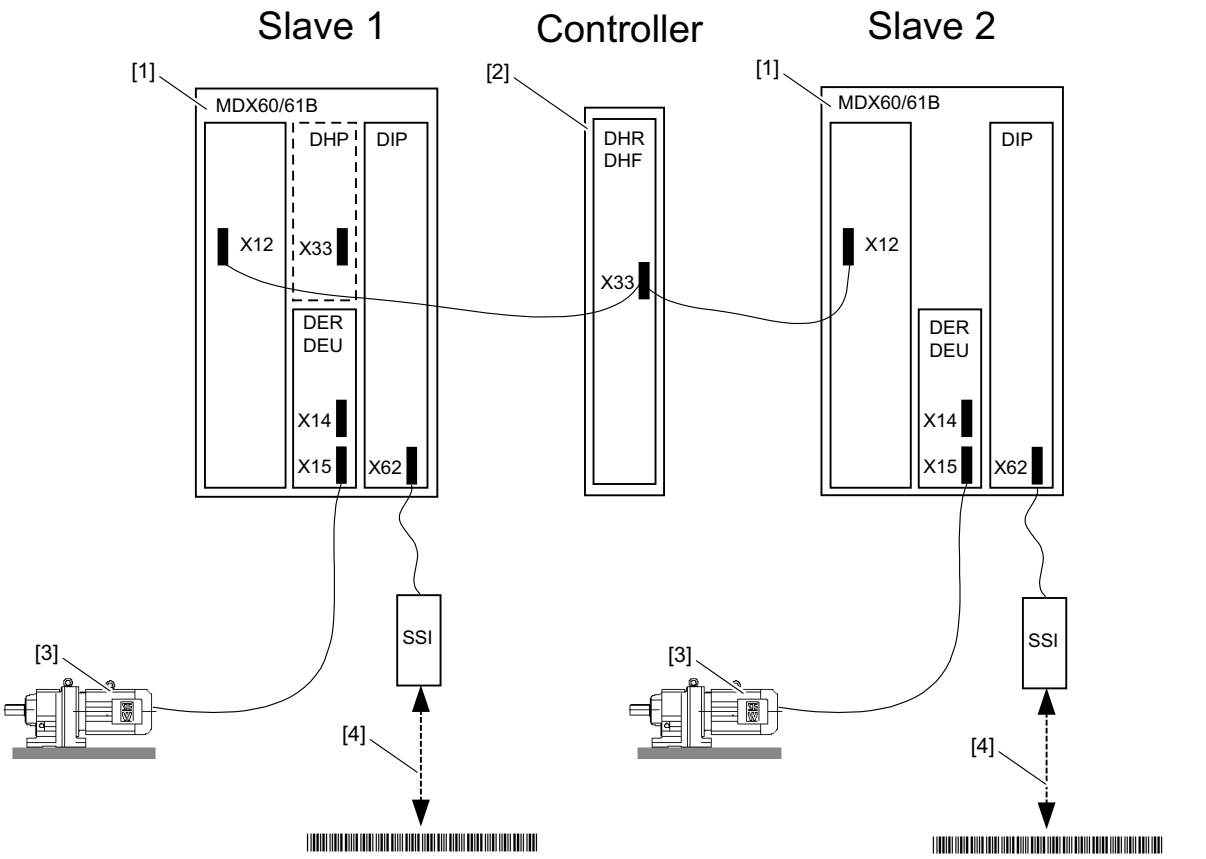
The following (iterative) procedure has proven to be particularly effective for setting some parameters:

- Setting an initial value
- Checking the setting by running the drive
- Determining an optimized value

The startup and configuration data (initial value and optimized value) of the sample application is always listed after the overview of the respective windows (see "Values of the sample application").

6.3 Components of the sample application

The following illustration shows the components of the "gantry crane" sample application. The components are the same for each drive train.



536572299

[1]	Inverter including options	Component selection for gantry crane
	Type	MDX61B0015
	Encoder option	DEH11B
	Expansion option	DIP11B absolute encoder interface

[2]	Controller	Component selection for gantry crane
	Type	One of the following controllers: • DHP11B (integrated in inverter) • DHR41B/UOH21B (stand-alone unit) • DHF41B/UOH21B (stand-alone unit)

[3]	Motor with motor encoder	Component selection for gantry crane
	Motor type	DT71D4
	Motor encoder type	SIN/COS encoder 1024 pulses/revolution

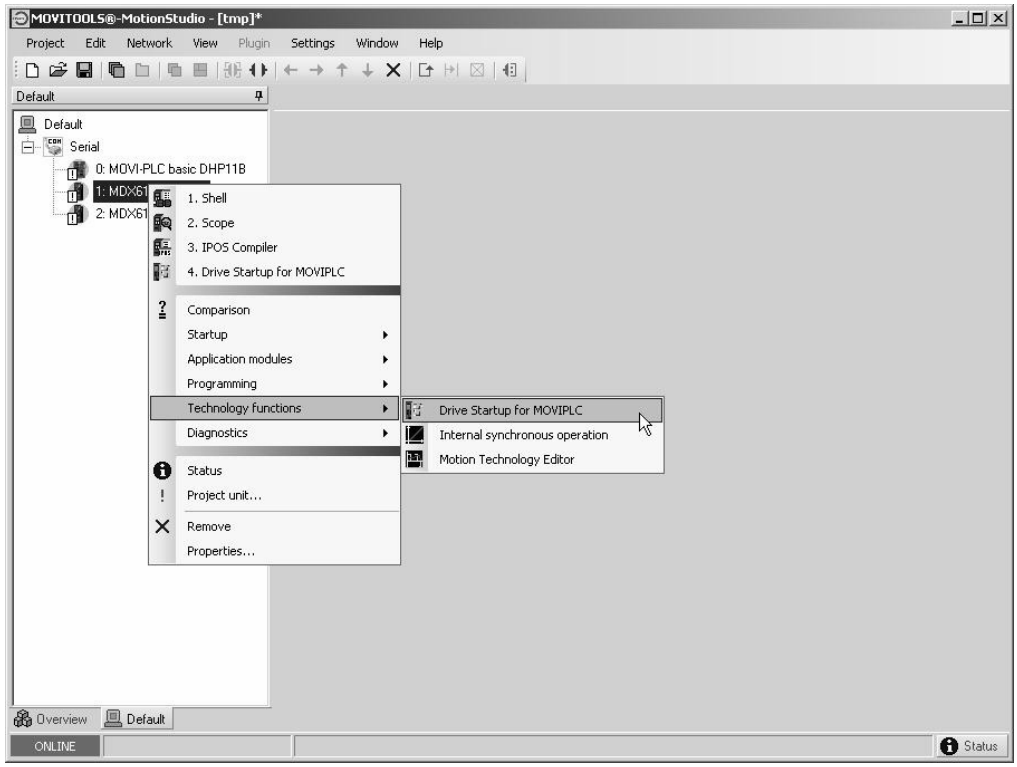
[4]	Distance encoder	Component selection for gantry crane
	Type	SSI absolute encoder Designation: Stahl WCS2/3-LS311
	Position detection	Barcode Physical resolution: 0.8 mm/increment ≙ 1.25 increments/mm

6.4 Startup with "DriveStartup for MOVI-PLC®"

6.4.1 Step 1: Startup of the individual axes

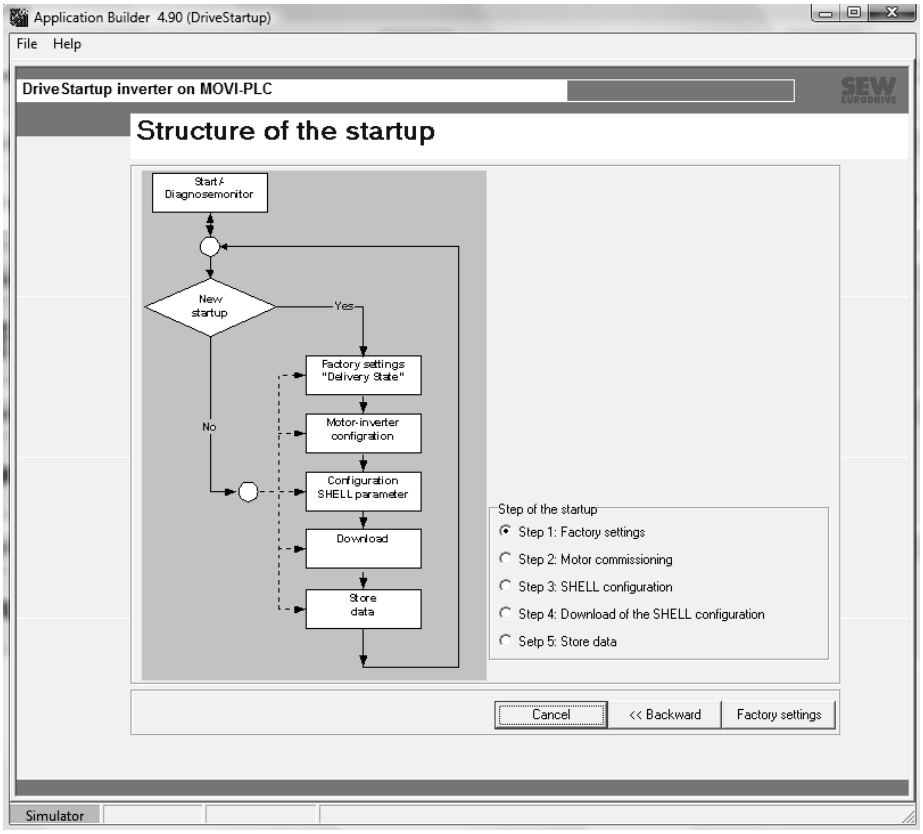
Start up the individual MOVIDRIVE® axes as follows:

1. Open [MotionStudio] / [Technology Editors] / [DriveStartup for MOVI-PLC].



511964555

2. Select the startup step "Initialize motor startup"



2806527627

3. Follow the instructions of the startup wizard to adjust every MOVIDRIVE® inverter to the connected motor and encoder.
4. Select a suitable operating mode:

MOVIDRIVE® MDX61B with asynchronous motor	Operating mode CFC&IPOS or VFC N-control & IPOS[1)]
MOVIDRIVE® MDX61B with synchronous motor	Operating mode SERVO&IPOS

1) SEW-EURODRIVE recommends the operating mode CFC&IPOS This operating mode is a prerequisite for the sample application.

5. Enter the settings/values of the sample application (see table).

Values of the sample application

The following settings apply for the "gantry crane" sample application:

Startup parameters	Setting/value
Control modes	CFC&IPOS
Motor	DT71D4
Stiffness	Initial value: 1.0 Optimized value: 1.2 (determined under full load and in automatic mode)
Load inertia	Initial value: 32 (8 times J_0) Optimized value: 37 (determined under full load and in automatic mode)
J_0 of the motor	4.609
Drive	With backlash

Optimization of the speed controller

INFORMATION

Only optimize the speed controller when the startup procedure with SyncCrane has been completed.

1. Open [MotionStudio] / [Technology Editors] / [DriveStartup for MOVI-PLC].
2. Select the startup step "Initialize motor startup"

6.4.2 Step 2: Preparing the individual axes for operation on the controller

Prepare the single axes for operation on the controller as follows:

1. Open [MotionStudio] / [Technology Editors] / [DriveStartup for MOVI-PLC].
2. Select the startup step "SHELL configuration" to prepare the MOVIDRIVE® axes for operation on MOVI-PLC®.
3. Assign different SBus addresses (1 ... 8) in increasing order, beginning with 1.
4. Make sure that a baud rate of 1 Mbaud is set.

Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
SBus address of the first MDXB	1
SBus address of the second MDXB	2
Baud rate	1 Mbaud

6.5 Startup with "SyncCrane"

6.5.1 Step 1: Starting SyncCrane

Preparing the SD card

If you have a controller with SD card, you must first prepare the SD card for use with "SyncCrane".

Proceed as follows:

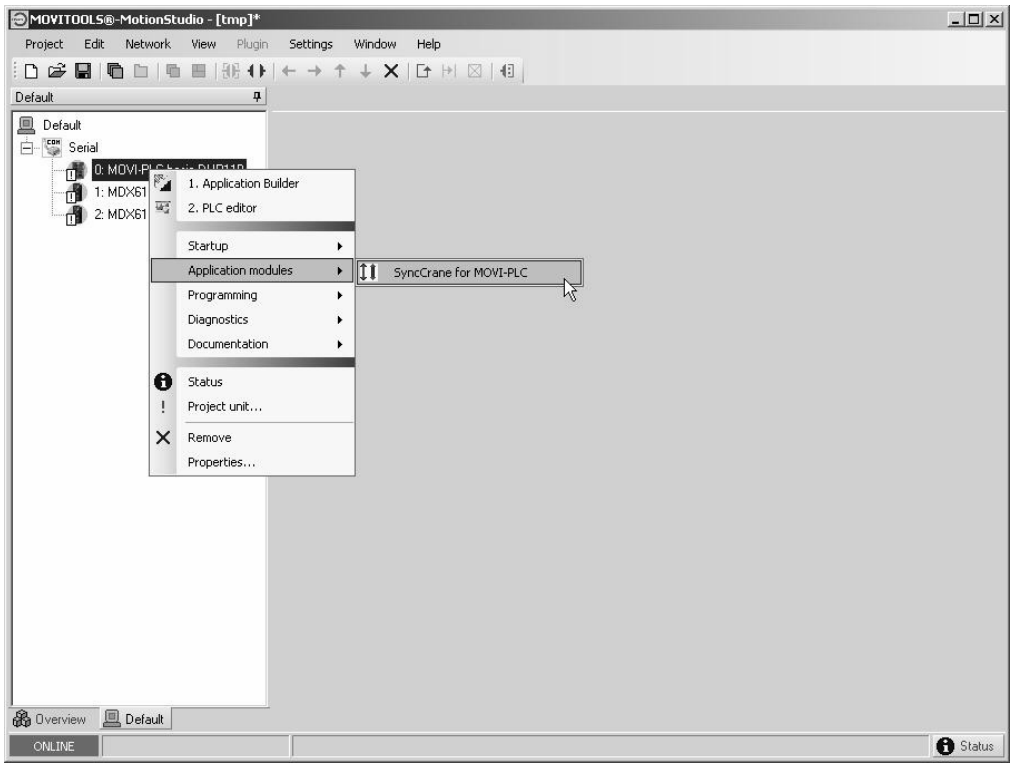
1. Open the file explorer of your operating system.
2. Go to the program directory of your MOVITOOLS® MotionStudio software.
3. Go to the sub-directory that is named after your unit. For example, the menu path for the controller DHR41B is:

   ```
   C:\Program Files\SEW\MotionStudio\AppBuilderProjects\SyncCrane\
   IEC_DHR41B\SDImage
   ```

4. Copy all files in this directory to the SD card.

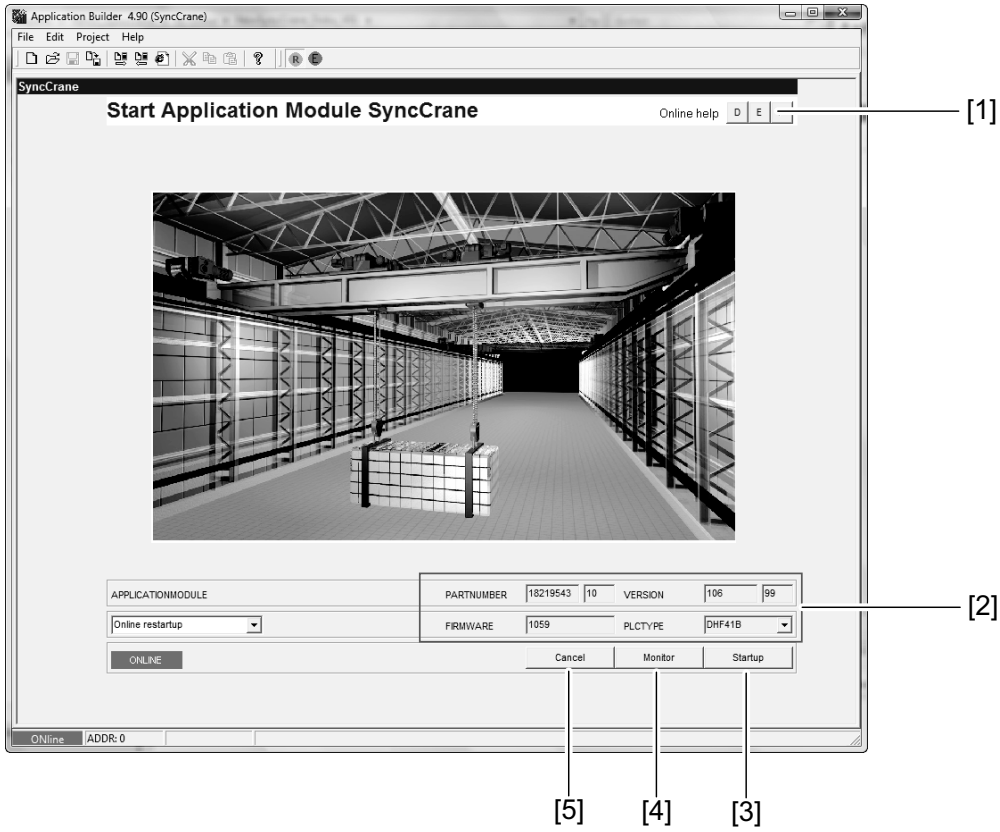
Starting "SyncCrane"

Make a right mouse click on 0:MOVI-PLC® and select [Application modules]/[SyncCrane for MOVI-PLC®].



511968651

The initial screen of the "SyncCrane" application is opened.



9007199766711179

Position	Button/area	Description
[1]	[Help]	Button for opening the online help file
[2]	Status display area	Display of the following data: • SyncCrane part number • Version • Release • Firmware version • PLC type
[3]	[Startup]	Open the startup screen Click this button to take the application into operation.
[4]	[Monitor]	Online diagnostics and control mode The button is disabled if • you are not online • the application module has not been detected
[5]	[Cancel]	User interface is closed without saving

⚠ DANGER

Risk of crushing if the motor starts up unintentionally.

Severe or fatal injuries.

- Stop the system before you begin startup and bring the system into a safe condition.
- Make sure that the system cannot be activated during startup.

6.5.2 Step 2: Selecting the startup steps

For initial startup, you have to perform each step one after the other. If you perform a re-startup, you can directly go to the required startup step.

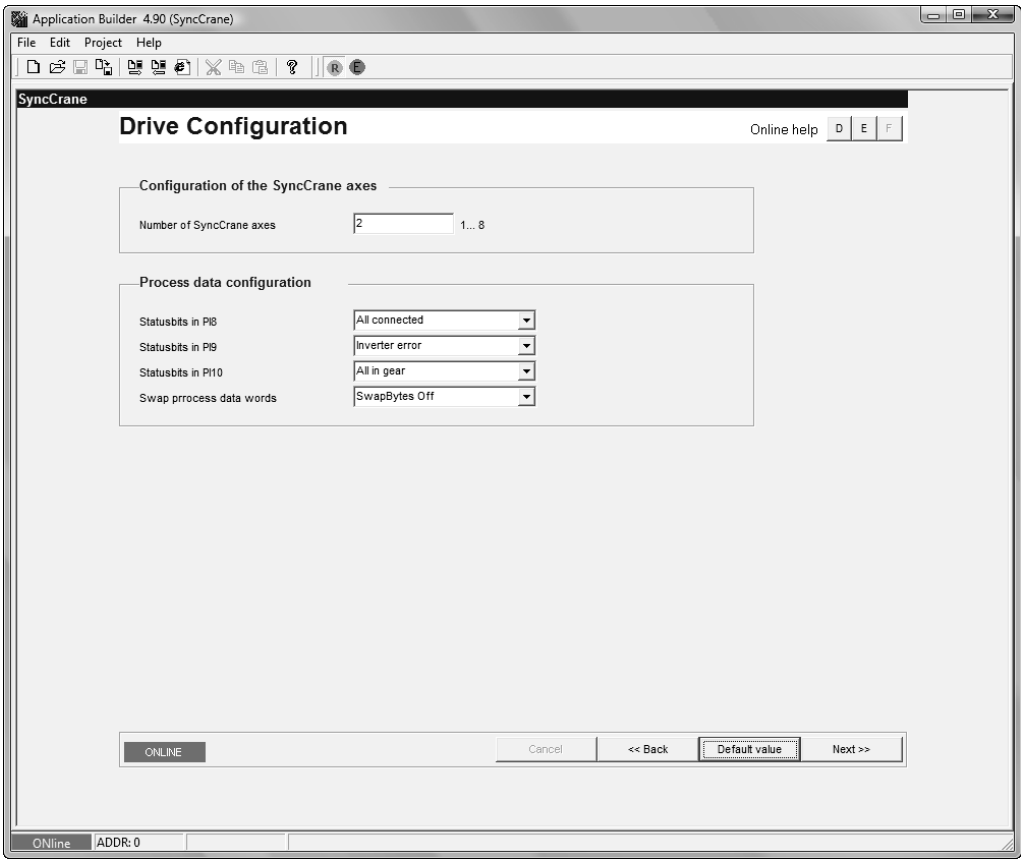
When the startup procedure is initialized, the inverters are inhibited.

The "Download" step is required as last step both for partial and complete startup. Only after this step, the inverters are enabled again.

9007199766712715

Position	Button/area	Description
[1]	Individual axis/ scaling factors group	Selection list for choosing the axes Note that the same scaling factors are set for all axes when you select "Set all Axes".

6.5.3 Step 3: Making the project settings



18014399021455243

Group	Field	Description
SyncCrane configuration	Number of axes	This input field is used to specify the number of individual axes in the axis system. The value range is limited to 1...8.
Process data configuration	• Status bits in PI8 • Status bits in PI9 • Status bits in PI10	Use the selection fields to choose the information you want to have transmitted via process input data words 8, 9, and 10.
	Swap process data words	• Swap bytes off: Word transmission as high then as low byte • Swap bytes on: Word transmission as low then as high byte

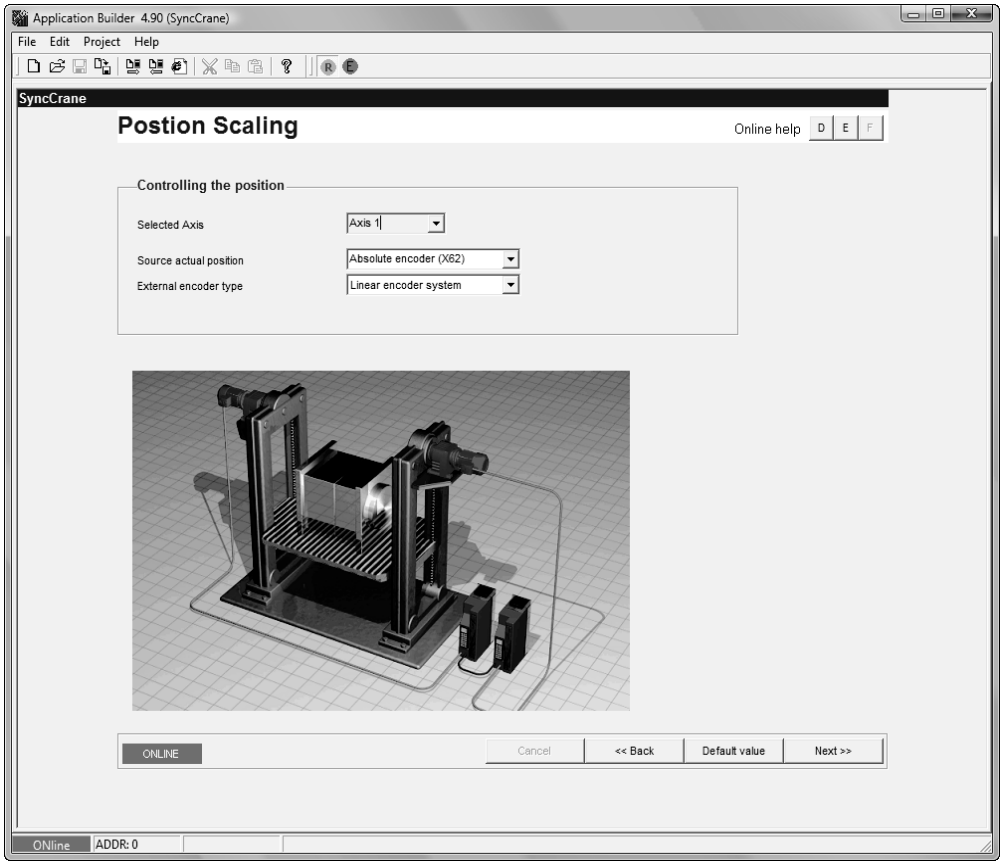
Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
SyncCrane configuration	Number of axes: 2
Process data configuration	Swap process data words: "Swap bytes on"

6.5.4 Step 4: Position scaling

Overview This window is used to define the basic settings for position scaling.



9007199766715787

Field	Description
Source actual position	This selection field lets you choose between motor encoder and external distance encoder and/or SSI encoder.
External encoder type	Here, you determine the mechanical design of your distance measuring system. You can choose between multi-turn encoder (rotary) or linear encoder system (laser distance measuring unit). When selecting "actual position source = motor encoder (X15)", the external encoder type must be set to multi-turn encoder.

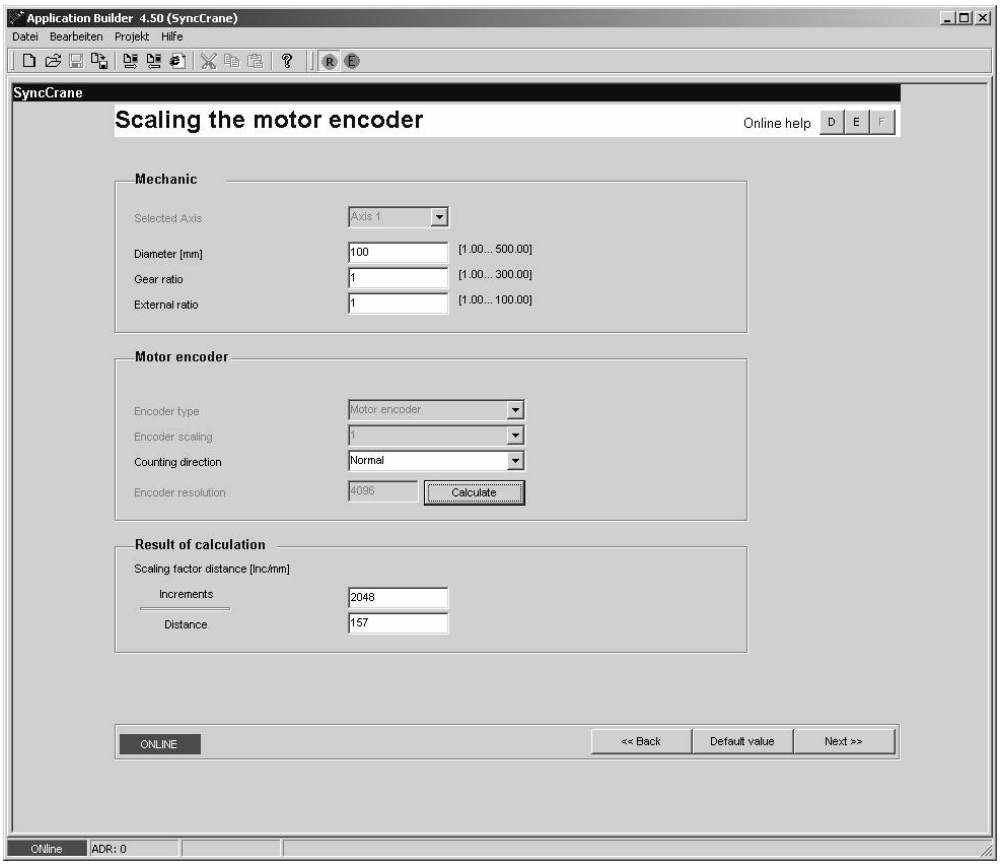
Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
Source actual position	SSI absolute encoder (X62)
External encoder type	Linear encoder system (laser distance measuring unit)

Scaling the motor encoder

On this startup screen you determine the position resolution for the motor encoder.



511976331

Field	Description
Diameter	Use these input fields to specify the mechanical data. You can enter values with two decimal places.
Gear unit	
Additional gear	
Counting direction	This field lets you invert the direction of rotation of the motor.
Calculate	The determined position resolution for the motor encoder system is entered in the input fields "Increments" and "Distance". The determined scaling factors are limited to 2^{16}.

Values of the sample application

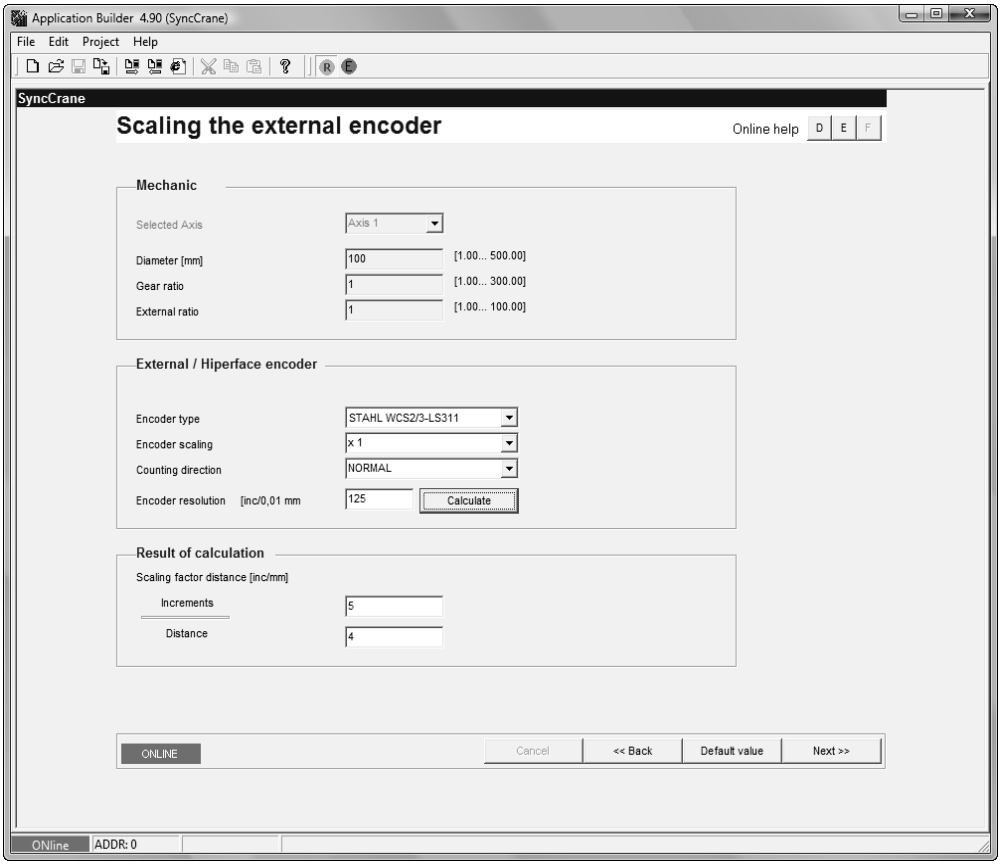
The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
Diameter	125
Gear unit	24.5
Counting direction	**Motor 1** • Initial value: Normal • Optimized value: Inverted[1)] **Motor 2:** Normal
Incremental resolution	8171
Distance resolution	32

1) The correct setting depends on the design and mounting position of the motor/gear unit combination. In this case, the initial setting was "Normal". This setting had to be changed to "Inverted", because the crane system tilted in the operating mode "Jog mode - not synchronized".

Scaling the distance encoder

In this startup window, you determine the feed unit for the distance encoder. If you have selected "actual position source = motor encoder", some input fields are disabled and show the default values of the motor encoder.



9007199766718859

Field	Description
Diameter	Use these input fields to specify the mechanical data for multi-turn encoders. You can enter values with two decimal places. These values are only required for multi-turn encoders.
Gear unit	
Additional gear	

Field	Description
Startup of the distance encoder:	
Encoder type	Choose the encoder type from this field.
Encoder scaling	Here, you can scale up the physical resolution of the absolute encoder. SEW recommends the default setting "1".
Counting direction	In this field you can invert the counting direction of the distance encoder depending on the direction of rotation of the motor.
Encoder resolution	This field is used to enter the resolution of the absolute encoder.
Calculate	The determined position resolution for the motor encoder system is entered in the input fields "Increments" and "Distance". The determined scaling factors are limited to 2^{16}.

INFORMATION

If you use a laser distance measuring instrument in the above example, then you can directly enter the resolution specified by the manufacturer, for instance 8 increments/mm, in the input fields "125 increments" and "100 mm". Do NOT press the [Calculate] button in this case.

Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
Diameter	100
Gear unit	1
Counting direction	Normal
Encoder resolution	125 (see following note)
Encoder scaling	1[1)]
Incremental resolution	5
Distance resolution	4

1) SEW recommends to use the suggested value "1". Upscaling this value does not improve the control behavior, it only multiplies the distance encoder signal internally.

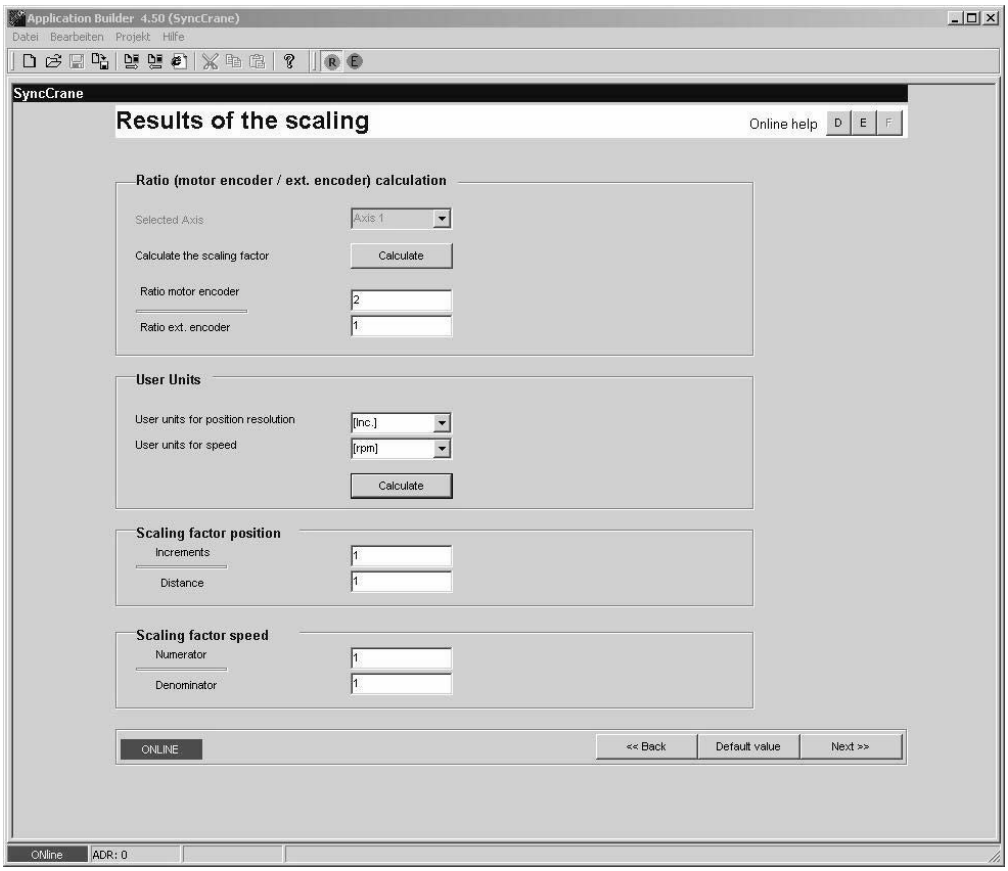
Determining the encoder resolution

- The value for the encoder resolution is calculated from the physical resolution according to the following formula:

$$Setting\_value\_for\_encoder\_resolution = \frac{100}{physical\_encoder\_resolution} = \frac{1}{0.8}\frac{[Inc]}{[mm]} = 12.5$$

Result of encoder scaling

This window is used to determine the resolution between motor encoder and distance encoder, and to define the user units for the position setpoint.



511979403

Field/button	Description
[Calculate]	Press this button to determine the values for the "Motor encoder" and "Distance encoder" input fields resulting from the position resolution of motor encoder and distance encoder.
User units for position resolution	After having selected the unit for the position resolution in this selection field, you have to activate it by clicking the "Calculate" button.
Unit for speed specification	After having selected the unit for the position resolution in this selection field, you have to activate it by clicking the "Calculate" button.

Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
Motor encoder resolution	8171 (see following note)
Distance encoder resolution	40
Distance scaling factor	Increments: 1 Travel distance: 1
Speed scaling factor	Numerator: 1 Denominator: 1

INFORMATION

Observe the following if you have upscaled the resolution of the distance encoder:

- Make sure that the ratio between "motor encoder resolution" and "distance encoder resolution" is between 1 and 4.
  This ensures a higher degree of accuracy when calculating the set values (speed and ramp) for the virtual encoder.

Checking the direction of rotation of motor encoder and distance encoder

⚠ DANGER

Damage to the crane system by tilting due to counter-rotating axes.

Severe or fatal injuries.

- Never check the encoders in the group selection and in the synchronized operating mode "Automatic".
- Reference the axes again after changing the counting direction.
  Reason: When changing the counting direction, the actual position changes abruptly.

Check the direction of rotation of the motor encoder and distance encoder as follows:

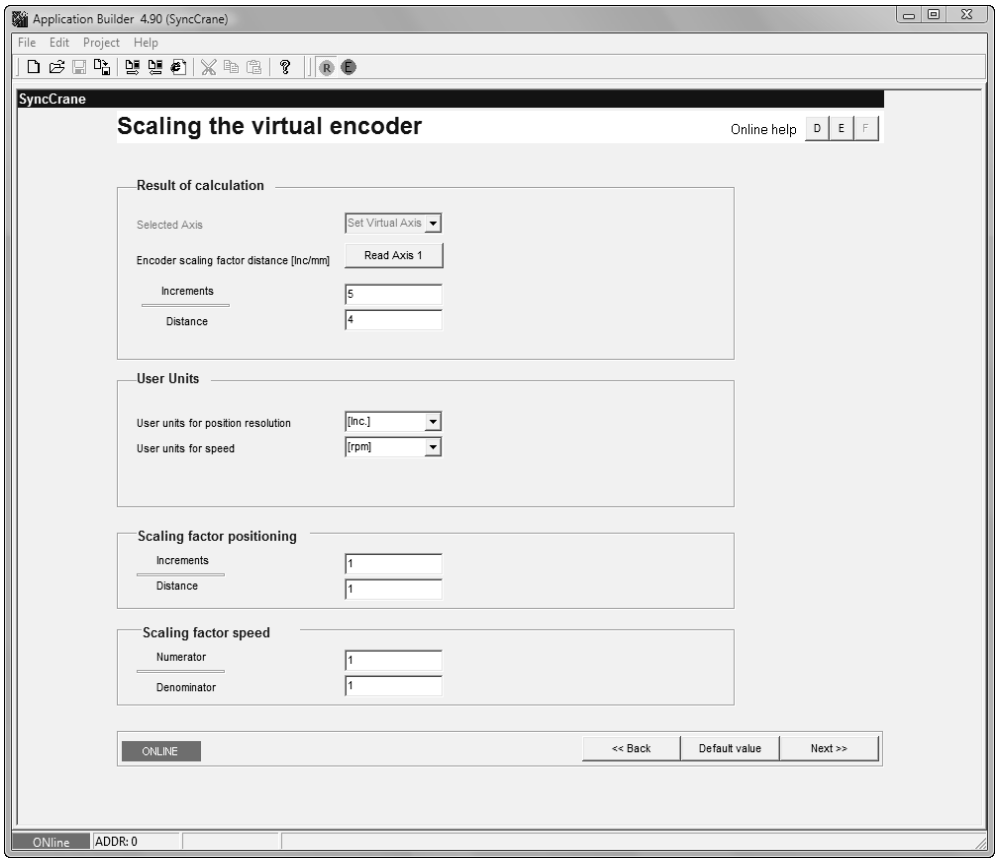
1. Select the operating mode "Jog, not synchronized" for axis 1.
2. Run the drives in creep speed (e.g. 10 rpm).
3. Go to "single-axis diagnostics" and observe the counting direction of the motor encoder and distance encoder.
4. Adjust the counting directions of motor encoder and distance encoder via the SyncCrane startup, if necessary.

   If the set directions of rotation are identical (e.g. Jog CW), the encoder signals of the motor and distance encoder should also be handled identically (e.g. both inverted).
5. Repeat this check for all axes to make sure that the counting directions of all encoder systems match the mechanical directions of movement.

6.5.5 Step 5: Scaling the virtual encoder

Scaling the virtual encoder

A description of the input fields on this window is already included in the description for the previous windows.



9007199766721931

Enter the values from the already determined values from the "Scaling the distance encoder" field in the "Scaling the virtual encoder" field.

INFORMATION

The input fields described in steps 5 are not relevant for you if you choose the "Group" option in the dropdown menu "Individual axis/scaling factor group" described in chapter 3 "Selecting the individual startup steps".

In this case, the values from "Scaling the distance encoder" are used.

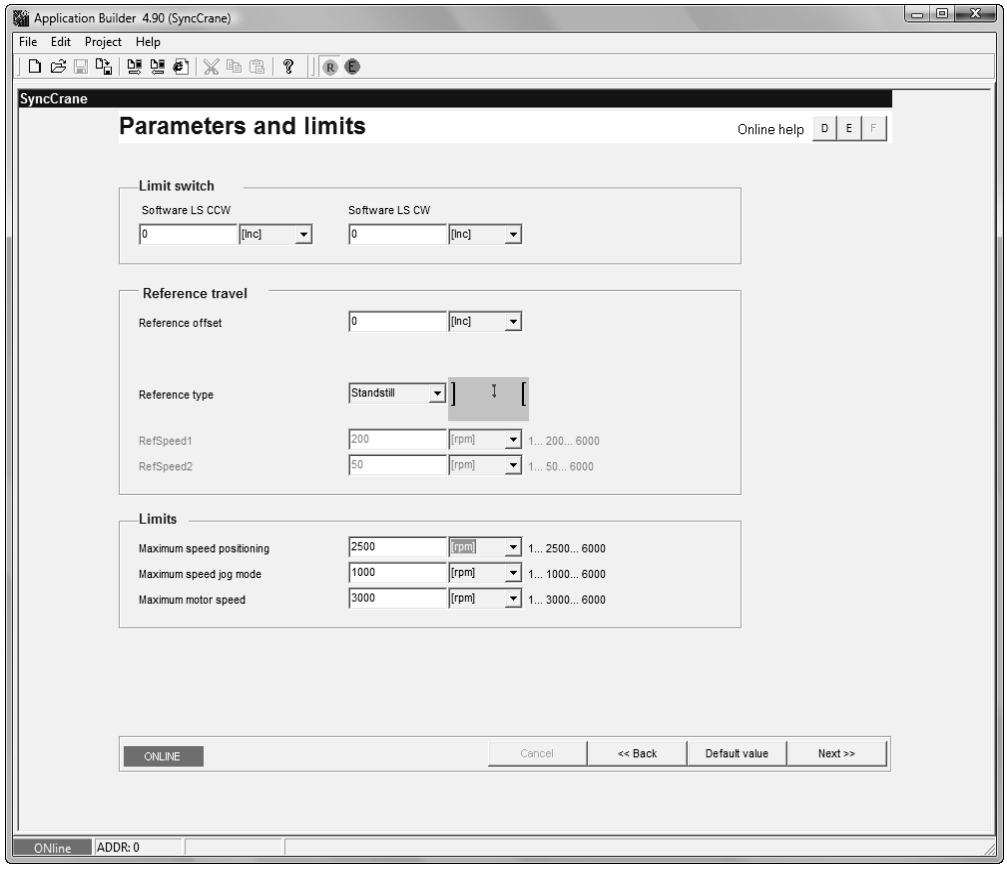
Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
Incremental resolution	5
Distance resolution	4
Distance scaling factor	Increments: 1 Travel distance: 1
Speed scaling factor	Numerator: 1 Denominator: 1

6.5.6 Step 6: Limiting the travel distance

You can set the limits for travel range and velocity in this window.



9007199927589131

Group	Field	Description
Limit switch	Software LS CW	The software limit switches limit the permissible travel range for the "Jog", "Positioning", and "Automatic" operating modes. The specified value refers to the increments of the distance encoder.
	Software LS CCW	
Reference travel	Reference offset	Enter the reference offset in increments in relation to the distance encoder.
	Reference travel type	The axes are referenced to the specified reference position at standstill.
Limits	Maximum speed for positioning	You can limit the specified positioning speed by entering the value.
	Maximum speed in jog mode	You can limit the specified jog speed by entering the value.
	P302 Nmax speed controller	Enter a value at least 10 % higher than the maximum positioning and/or jog speed.

Values of the sample application

The following settings apply for the "gantry crane" sample application:

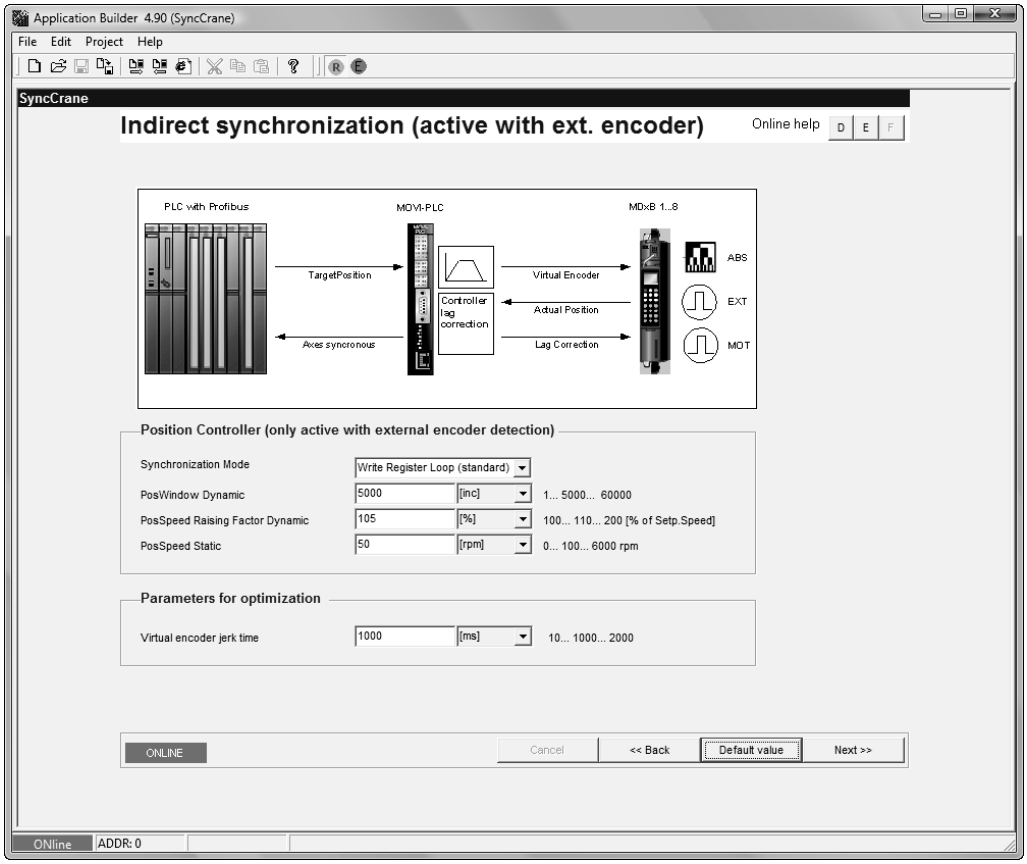
Parameter	Setting/value
Maximum speed for positioning	2500 min^{-1}
Maximum speed in jog mode	1000 min^{-1}
P302 Nmax speed controller	3000 min^{-1}

6.5.7 Step 7: Setting and checking synchronous operation parameters

This window is used to make the settings for indirect synchronization.

In "Automatic" operating mode, the entire SyncCrane axis system if following the virtual master encoder. Synchronicity with the master value of the virtual encoder is ensured locally in MOVIDRIVE® by the technology function "Internal synchronous operation". The MOVIDRIVE® units continuously synchronize the motor encoder position to the cyclical master value of the virtual encoder of MOVI-PLC®.

In MOVI-PLC®, the absolute encoder position is also monitored centrally in the higher-level control loop and adjusted according to the selected synchronization mode. The synchronization modes can be configured using the wizard.



9007199927593483

Group	Field	Description
Position control	Synchronization mode	4 synchronization modes are supported: • **Deactivated** Position deviations are not compensated. This setting is recommended for systems without distance encoder or without slip between the motor encoder and the distance encoder. • **Register loop** (default setting): Recommended standard mode to correct position deviations even in case of an unfavorable mechanical design. Position deviations are copied cyclically to the *LagController* of the inverter using the "Register loop" inverter function. The position deviation is compared with the current correction value and can be corrected directly. • **Offset automat.** Position deviations are compensated using the "Offset automat." inverter function. Another correction value can only be processed after a compensation. This method is not suitable if the set values for speed/ramps are changed dynamically, or if increased slip is expected. Position deviations are compensated using the "Offset automat." inverter function. Another correction value can only be processed after a compensation. This method is not suitable if the set values for speed/ramps are changed dynamically, or if increased slip is expected. • **ISYNC** The distance encoder signals are processed directly in the position control loop of the inverter using the "Internal synchronous operation" technology function. Processing is continuous, i.e. the set values for dynamic position window, speed raising, and minimum synchronization speed are not taken into account. This mode is suitable for a design with low-vibration mechanics and a motor encoder/ext. distance encoder ratio < 10.
	Dynamic position window	When the position deviation is exceeded by the value of the "dynamic position window", the position is corrected according to the selected synchronization mode "Register loop" or "Offset automat.". The prerequisite for this is the moving and synchronized axis system.
	PosSpeed Raising Factor Dynamic	The speed of the compensation movement is calculated from the selected PosSpeed Raising Factor Dynamic multiplied by the current speed setpoint (limited by n_{min} = PosSpeed Static).
	PosSpeed Static	When the synchronized axis system is at a standstill, each axis is controlled with "PosSpeed Static" until it is within the position window defined in the monitoring functions.
Parameters for optimization	Jerk time virtual encoder	The positioning behavior of systems prone to vibration can be improved significantly by specifying a jerk limit of the virtual encoder.

Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value	
Synchronization mode	Write register loop	
PosWindow Dynamic	Initial value: 5000 Optimized value: 100 (see following note)	
PosSpeed Raising Factor Dynamic	Initial value: 110	
	Optimized value: 102	With this low value, the compensation movements are performed with minimal dynamics
PosSpeed Static	100	
Jerk limitation of virtual encoder	1000	For systems with slip or mechanical components susceptible to vibration, SEW recommends to increase this value to 2000 ms.

Determining the optimized value

The optimized value for a dynamic position window of 80 mm is determined according to the following formula:

$$Dyn.\_position\_window(opt.\_value) = \frac{80\,mm}{1} \times \frac{5}{4}\frac{[Inc]}{[mm]} = 100\,distance\_encoder\_increments$$

With this rather low value, you can correct even the slightest deviations. The compensation process is started as soon as this value is exceeded. For cranes with high dynamics, SEW recommends to set a larger position window.

Checking the dynamic position window

Proceed as follows to check the dynamic position window:

1. Select the operating mode "Automatic, synchronized group" and the virtual encoder in "Positioning mode".
2. Start the test with a dynamic position window of ≈ 10 cm.
3. Optimize the size of the dynamic position window according to your requirements. Use the following table as a reference:

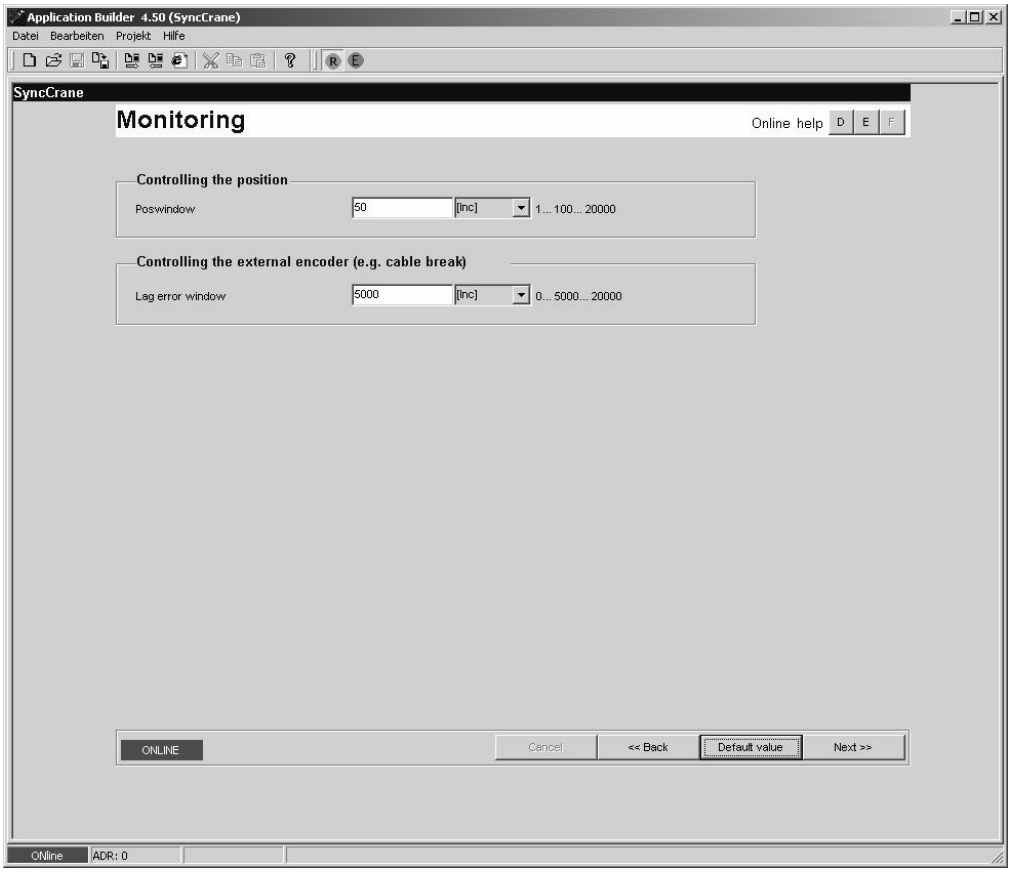
Size of the position window	Behavior of the drive
Too small (≤ 50-fold encoder scaling)	• Rough running with constant compensation processes. • The sensitive setting constantly triggers compensation processes, which causes the system to oscillate.
Optimum	• Smooth, quiet running with accurate stop. • The target position is approached directly. The drive does not overshoot. • The repetition accuracy of the positioning process meets the requirements.
Too large	• Noticeable "retraction" of the axes after reaching the target. • During the travel process, there are no or too few compensation processes. The resulting offset is only corrected after the virtual encoder has come to a standstill with the specified minimum synchronization speed.

4. Repeat the test with positioning processes over longer distances (> 3 m).
5. Check whether the drives overshoot upon reaching the target position when traveling > 3 m.

   If this happens, make the dynamic position window smaller.
6. Change the values in the "PosSpeed Raising Factor Dynamic" input field, if necessary. This changes the dynamic properties for the correction of position deviations.

6.5.8 Step 8: Setting and checking monitoring functions

This window is used to set the monitoring functions.



672860427

Group	Field	Description
Position monitoring	Position window	The specified value in relation to the distance encoder influences the "IPOSinPosition" message. The value must be set in such a way that the "IPOSinPosition" message does not change after having reached the target.
Lag error monitoring	Lag error window	It is not possible to switch to "Automatic" operating mode if the distance encoder positions deviate from each other by the value of the lag error window.

Values of the sample application

The following settings apply for the "gantry crane" sample application:

Parameter	Setting/value
Position window	Initial value: 50 Optimized value: 13 (rounded, see following note)
Lag error window	Initial value: 5000 Optimized value: 250 (see following note)

Determining the optimized values

The optimized value for a position window of 10 mm is determined according to the following formula:

$$Position\_window\,(opt.\_value) = \frac{10\,mm}{1} \times \frac{5}{4}\frac{[Inc]}{[mm]} = 12.5\,distance\_encoder\_increments$$

The optimized value for a lag error window of 200 mm is determined according to the following formula:

$$Lag\_error\_window\,(opt.\_value) = \frac{200\,mm}{1} \times \frac{5}{4}\frac{[Inc]}{[mm]} = 250\,distance\_encoder\_increments$$

Synchronization only starts if the lag error window is not exceeded. If the lag error window is exceeded while the axis is moving, the moving axis will be stopped immediately.

The lag error window must be larger than the dynamic position window and the position window.

Checking the position window

Proceed as follows to check the position window:

1. Select the operating mode "Positioning mode, not synchronized, group".
2. Start the test with positioning processes over short distances (e.g. 10 cm).
3. Optimize the size of the position window according to your requirements. Use the following table as a reference:

Size of the position window	Behavior of the drive
Too small (≤ 50-fold encoder scaling)	The drive oscillates around the target position. The output bit "In position" constantly changes its status (toggling).
Optimum	The target position is approached without overshooting. The repetition accuracy of the positioning process meets the requirements.
Too large	The positioning control of the drive is deactivated as soon as it reaches the positioning window. This results in a lower repetition accuracy for positioning.

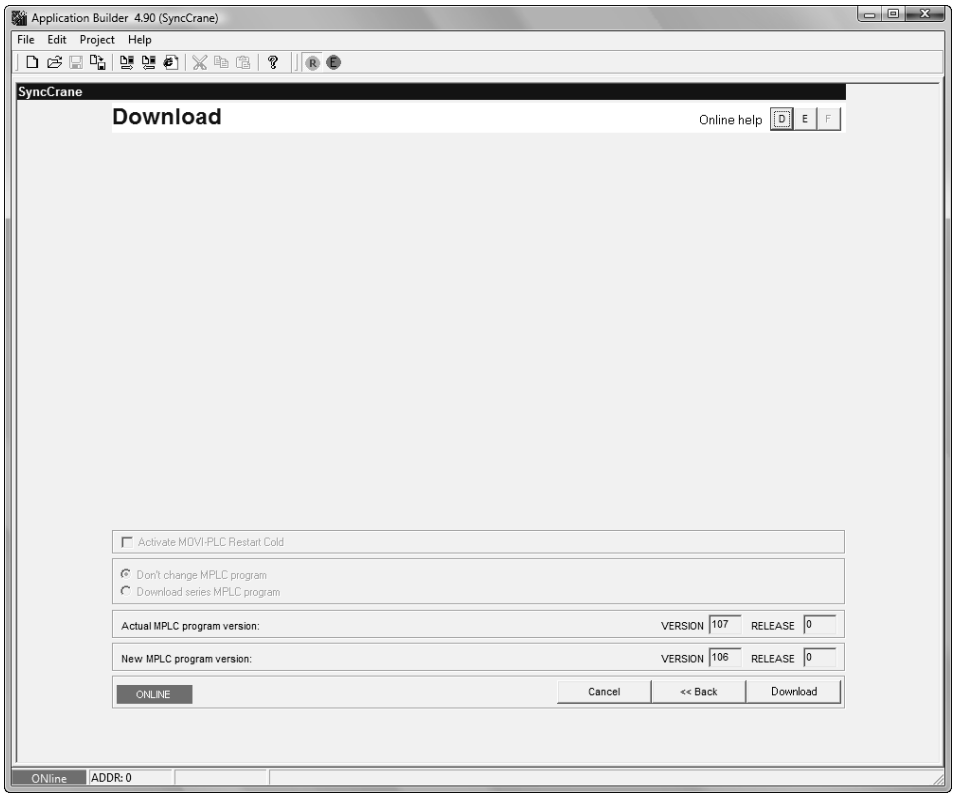
4. Repeat the test with positioning processes over longer distances (e.g. 1 m).

6.5.9 Step 9: Saving the data

Downloading the data to the controller

Proceed as follows to transfer the SyncCrane application data to the controller:

1. Click on the [Download] button.



9007199766723467

2. Wait until the progress bar for the download is closed.

The following functions are performed during download:

- Downloading the MOVI-PLC® application program to the controller
- Downloading the SyncCrane application data to the controller
- Starting the MOVI-PLC® application program

INFORMATION

- Before you click the [Download] button, make sure that all applications of the MOVITOOLS® MotionStudio engineering software are closed (PLC Editor, parameter tree, etc.).
- Do not start any applications and do not change to other applications after having pressed the [Download] button.
- Wait until the progress bar for the download is closed.

With the download of the data to the controller, the startup process of the main axes is complete. If you want to startup auxiliary axes, refer to chapter "Auxiliary drives (auxiliary axes)" (page 87).

After completing the startup procedure, SEW recommends to optimize the speed controller, refer to chapter "Optimization of the speed controller" (page 39).

Uploading the data to the PC

You can save your application and unit parameters permanently on your PC using the MOVITOOLS® MotionStudio engineering software.

Note that you have to save both your data in the controller and your data in the inverters. In both cases, the data is first uploaded from the unit and then saved on the PC.

Transferring the unit parameters of the inverters

Proceed as follows to save the parameters of both inverters:

1. Select the first MDXB in the network view.
2. In the context menu, select the command [Manage unit parameter set] / [Upload (unit -> PC)].

   A dialog box opens in Windows Explorer
3. Enter the file name and the directory in which you want to save the unit parameters.
4. Confirm by clicking [Save].

   The dialog box displays a progress bar that informs you about the status of the data transfer.
5. Acknowledge the completion of the data transfer by clicking on [OK].
6. Repeat the steps for the second MDXB.

INFORMATION

The procedure described here ensures that the settings of parameters SBus 1 and SBus 2 are saved.

Transferring the unit parameters of the controller

The unit parameters of the controller and the MOVI-PLC® application are saved using the project management of MOVITOOLS® MotionStudio.

For detailed information about project management, refer to the documentation (online help or manual) of the MOVITOOLS® MotionStudio engineering software.

7 Operation

7.1 Starting the drive

After the download, switch to the monitor of the SyncCrane application module.

INFORMATION

Selection of the modes and plausible feedback of the status bits are only ensured if an axis number (99 for broadcast, or 1 ... 12 for single axis mode) is transferred via process data word 3.

7.1.1 Operating modes for fieldbus control

Operating mode	PO1:13	PO1:12	PO1:11	Description
Default	0	0	0	No axis is moved.
Jog mode	0	0	1	• An individual axis or the group can be moved via the *Jog+* and *Jog–* inputs. • The travel parameters *velocity*, *acceleration ramp* and *deceleration ramp* can be specified via process output data words PD8, PD9, and PD10. If no velocity is specified, the axis will move at 1 rpm. • Unsynchronized motion sequence is supported for controlling single axes or a group of axes.
Referencing mode	0	1	0	• The distance encoder position is referenced when start is set. • Reference travel establishes the reference point (machine zero) for positioning operations. • Single-axis/group control is supported.
Positioning mode	0	1	1	• After a target position has been specified (PO4, PO5) and start has been set, the referenced single axis or group can be moved. • The travel parameters *velocity*, *acceleration ramp* and *deceleration ramp* can be specified via process output data words PD8, PD9, and PD10. If no velocity is specified, the axis will move at 1 rpm. • Single-axis or group control is supported for unsynchronized motion sequences.
Automatic operation (virtual encoder and synchronous operation)	1	0	0	• When start is set, the group is aligned and the technology function "internal synchronous operation" is activated. • Controlling the virtual encoder lets you move the axis system (jog mode or positioning mode). Note: Only group control is permitted for this operating mode.
Emergency operation	1	0	1	• An individual axis or the group can be moved via the *Jog+* and *Jog–* inputs. • The travel parameters *velocity*, *acceleration ramp* and *deceleration ramp* can be specified using process output date words PD8, PD9, PD10. If no velocity is specified, the axis will move at 1 rpm. • Moving the axes without encoder evaluation is supported. • Unsynchronized motion sequence is supported for controlling single axes or a group of axes.

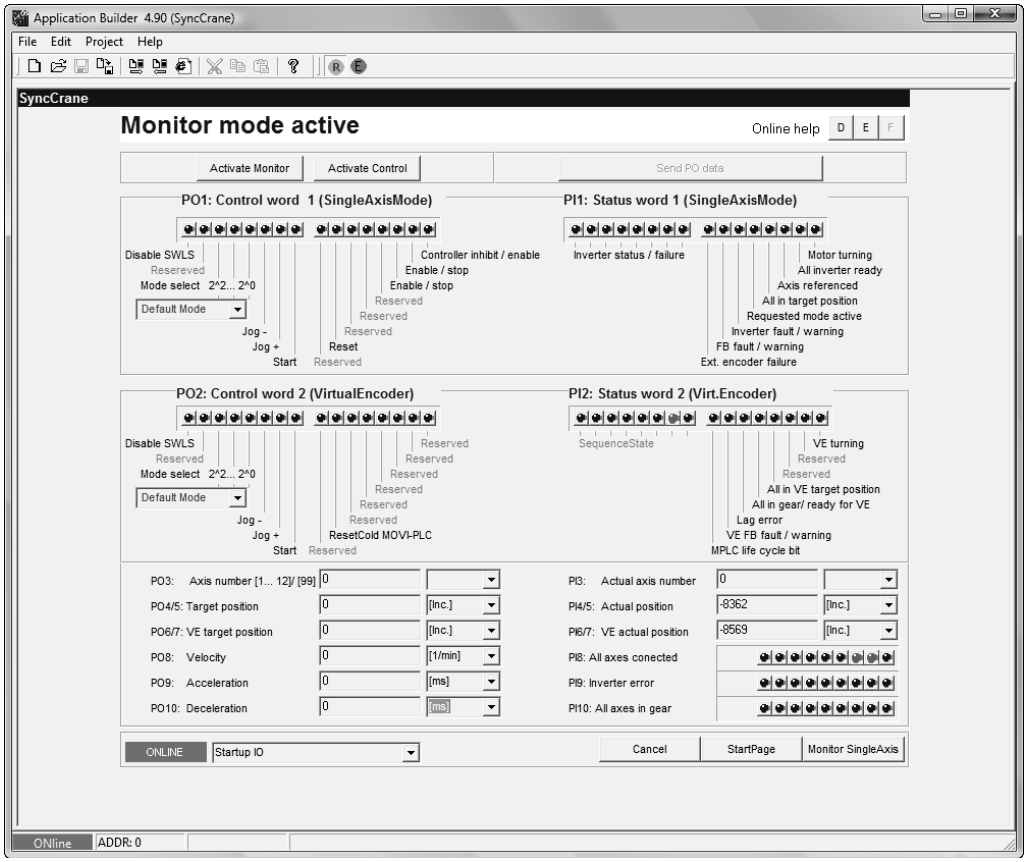
7.2 Diagnostics monitor

7.2.1 Diagnostics monitor: Monitor mode

During ongoing operation, you can open the monitor using the following menu path:

[MotionStudio]/[Application modules]/[SyncCrane for MOVI-PLC]

In monitor mode, the process input and process output data transferred via fieldbus are displayed in decoded format.



9007199766763403

7.2.2 Diagnostics monitor: Control mode

To control the application module without higher-level controller, click the [Controller] button.

7.3 Jog mode - not synchronized

Interface description		
Mode selection	PO1:Bit11 = TRUE PO1:Bit12 = FALSE PO1:Bit13 = FALSE	
Jog +	PO1:9	
Jog–	PO1:10	
Disable SWLS	PO1:15	
Axis number	PO3 Broadcast 99 or single axis mode 1 ... 8	
Velocity specification	PO8 in [rpm] or [user units]	
Velocity limit	Startup parameter	
Position limiting	Software limit switch startup parameter	
Ramp specification	PO9 Acceleration ramp in [ms] PO10 Deceleration ramp in [ms]	
Brief description	After selecting a direction of rotation, the single axis (PO3 1 ... 8) or the entire axis system (PO3 = 99) can be operated in jog mode. If software limit switches were assigned, the travel range is restricted to these limits.	
	Requirement	• Operating mode is selected • Drive is enabled
	Functional description	The direction is selected using Jog+ or Jog–. If the software limit switch right is set > software limit switch left, the travel range is limited to 3 position windows (startup) before the respective software limit switch. If the Disable SWLS bit is set, the limitation of the travel range is deactivated. For the travel movement, positioning indirectly takes place to the external encoder. Without evaluation the limit switches, the axis can be moved endlessly. The drive stops with position control if the direction selection is not enabled or both directions are selected at the same time. The specified ramp time is used for accelerating/ decelerating the drive. The specified velocity of the jog mode is compared to the velocity limit and limited if necessary.

7.3.1 Supplement jog mode of the virtual axis - synchronized

For documentation of the operating mode, see above. For differences in the interface, see below.

Mode selection	PO2:Bit11 = TRUE PO2:Bit12 = FALSE PO2:Bit13 = FALSE	
	Prerequisite	All axes are engaged. This is indicated by PI2:4 "Axes synchronous". **Prerequisite**: • "Automatic" mode is selected and "Start" is set via process data word 1. • The axes are enabled (display "A: technology function" of the 7-segment display)
Jog +	PO2:9	
Jog–	PO2:10	
Disable SWLS	PO2:15	
Velocity specification	PO8 in [rpm] or [user units]	
Velocity limit	Startup parameter	
Jerk limitation	Startup parameter	
Position limiting	Software limit switch startup parameter	
Ramp specification	PO9 Acceleration ramp in [ms] PO10 Deceleration ramp in [ms]	

7.4 Referencing mode

Interface description		
Mode selection	PO1:Bit11 = FALSE PO1:Bit12 = TRUE PO1:Bit13 = FALSE	
Start referencing	PO1:8	
Axis number	PO3 Broadcast 99 or single axis mode 1 ... 8	
Speed selection	–	
Velocity limit	Startup parameter	
Ramp specification	–	
Reference travel type	Startup parameter	
Reference offset	• Startup parameter • Specification of actual position of the encoder after reference travel has been completed.	
Reference speed 1	Setpoint speed for search travel to the reference cam	
Reference speed 2	Setpoint speed for moving clear of the reference cam	
Brief description	Depending on the selected reference type, the encoders (motor encoder and external or absolute encoders) are set to the specified reference offset at a standstill or by traveling to a cam.	
	Requirement	• Axes have been mechanically aligned, e.g. in jog mode. • Operating mode is selected and start is set • Drive is enabled
	Functional description	Encoder adjustment is initiated using bit PO1:8 “Start”. The individual axes have to be aligned mechanically prior to reference travel, e.g. by selecting single axis in jog mode. • The actual position of the drives is the reference point. Enable is withdrawn and reference travel type 8 is started in the inverter. Individual axes can be referenced using this reference type only.

7.5 Positioning mode – not synchronized

Interface description		
Mode selection	PO1:Bit11 = TRUE PO1:Bit12 = TRUE PO1:Bit13 = FALSE	
Start referencing	PO1:8	
Disable SWLS	PO1:15	
Axis number	PO3 Broadcast 99 or single axis mode 1 ... 8	
Position setpoint	PO4 and PO5 in [inc] or user-defined units	
Velocity specification	PO8	
Velocity limit	Startup parameter	
Position limiting	Software limit switch startup parameter	
Ramp specification	• PO9 acceleration ramp • PO10 deceleration ramp	
Jerk limitation	–	
Brief description	Movement takes place to the specified target position when the setpoint position is selected and start is set. It is possible to move an individual axis (PO3 1 ... 8) or the entire axis system (PO3 = 99).	
	Requirement	• Operating mode is selected • Drive is enabled
	Functional description	The positioning sequence is started using bit PO1:8 Start. The user specifies the absolute target position via fieldbus. Speed and ramp times are adopted from the specified process data words and compared to the limitations from the startup. The position specification can be changed during ongoing operation. When the drive reaches the target position, it stops with position control and sends back the “In position” signal by setting bit PO1:3. If software limit switches are defined, the target position will be checked cyclically for plausibility. If a position is specified, which lies outside the software limit switch range, a fault message will be issued and the ongoing movement will be stopped. This monitoring function can be deactivated with the input bit Disable SWLS.

7.5.1 Supplementary positioning mode of the virtual axis – synchronized

The following table shows the differences in the interface. Prerequisite is that "Automatic" mode is selected with "Start" set via process data word 1.

Interface description	
Mode selection	PO2:Bit11 = TRUE PO2:Bit12 = TRUE PO2:Bit13 = FALSE
Requirement	All axes are engaged. This is indicated by PI2:4 "Axes synchronous". **Prerequisite**: • "Automatic" mode is selected and "Start" is set via process data word 1. • The axes are enabled (display "A: technology function" of the 7-segment display)
Start	PO2:8
Disable SWLS	PO2:15
Position setpoint	PO6 and PO7 in [inc] or user-defined units
Velocity specification	PO8
Velocity limit	Startup parameter
Jerk limitation	Startup parameter
Position limiting	Software limit switch startup parameter
Ramp specification	• PO9 acceleration ramp • PO10 deceleration ramp

7.6 Automatic mode

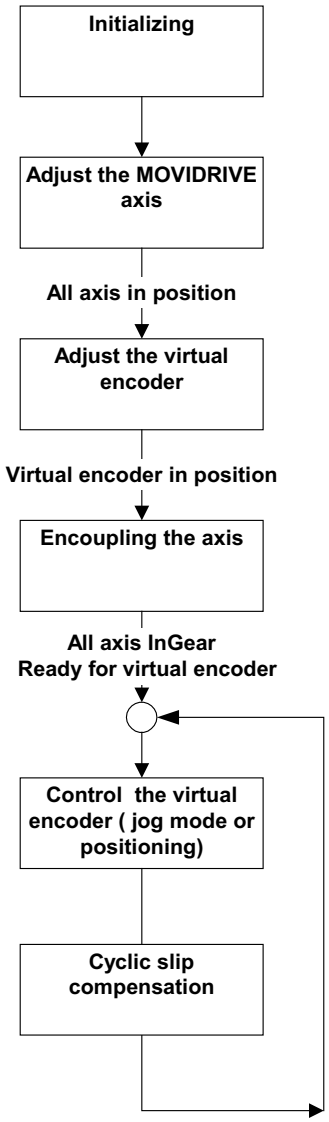
Selecting "Automatic" mode means a sequencer is run through and the following functions are processed:

Automatic mode is initialized	• The axis system is adjusted to the calculated common "adjust position". • The virtual encoder position is referenced to the adjust position. • "Synchronous operation" mode is activated
Cyclical program section: Processing the virtual encoder	• Cyclical processing of the virtual setpoints • Cyclical correction/slip compensation between the virtual master encoder position and the read-in external encoder position in synchronous operation. • Monitoring of lag error, encoder error, and inverter error

Initialization is repeated in the following cases:

- Selecting an operating mode
- Positive edge of Start
- Reset of the axes following an encoder error
- Drives change to "A" state (technology function)

The following figure shows the automatic mode:



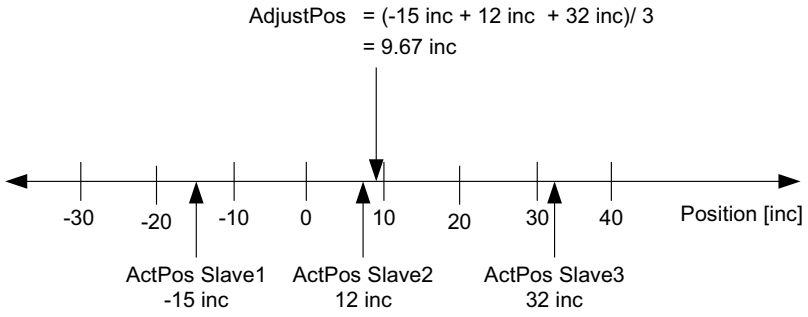
536573963

7.6.1 Interface description

Interface description		
Mode selection	PO1:Bit11 = FALSE PO1:Bit12 = FALSE PO1:Bit13 = TRUE	
Mode selection virtual encoder	See description jog mode/positioning mode (supplement virtual encoder)	
Start	PO1:8	
Axis number	PO3 Broadcast 99	
Position setpoint	PO6 and PO7 virtual master encoder position	
Position limiting	Startup parameter limitation of virtual master encoder	
Ramp specification	• PO9 acceleration ramp [ms] • PO10 deceleration ramp [ms]	
Brief description	The entire system is moved synchronously in automatic mode.	
	Prerequisite	• Operating mode is selected and start is set • Drive is enabled • No axis fault present • No lag error • No external encoder error • No error on PI1:Bit 6
	Functional description	Automatic mode enables the user to operate the axis system synchronously. After selecting automatic mode or upon changing to the inverter status "A", the slave axes are adjusted to a calculated "adjust position". The slave axes signal a completed adjustment process via feedback bit PO2:Bit4 "Axes synchronous". From this time on, the axis system can be moved by controlling the virtual encoder. This is done by activating PO2 and *jog mode* or *positioning mode*. The axis system follows the actual value of the virtual encoder according to the principle of indirect synchronization. This means the setpoint is converted for the motor encoder to a position setpoint of the internal synchronous operation. At the same time, slip is compensated by monitoring the external encoder position. The slave axes signal during the movement whether a lag warning error was issued by means of feedback bits. Refer to the following chapters for detailed information on the *adjustment mode* and *synchronization* functions.

7.6.2 Submode adjustment mode

The following figure shows the calculation of the adjustment position, for example for 3 slave axes.



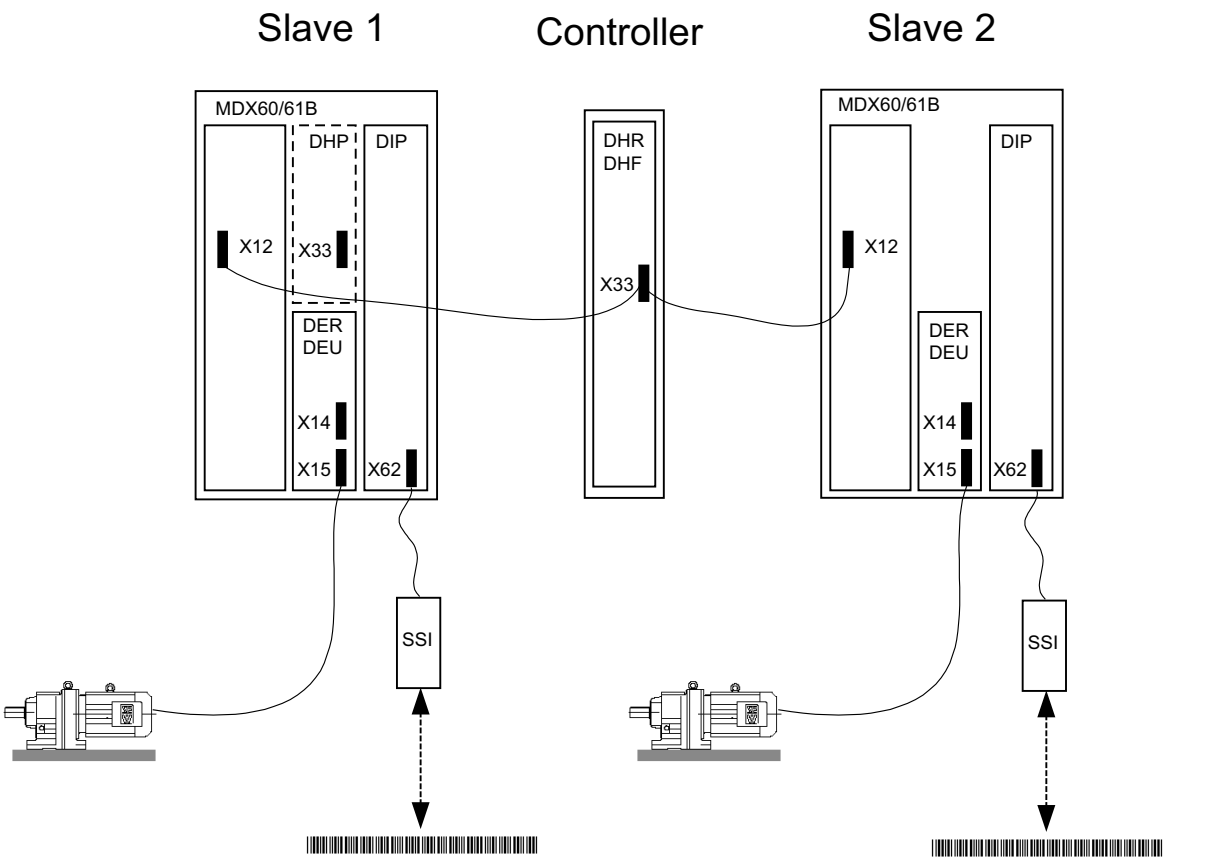
536577291

Interface description

Interface description	
Mode selection	Not required (adjust position is determined cyclically)
Brief description	The absolute position offset of all connected axes is read in and then the mean position deviation is calculated. At the start of the adjustment process, all axes are adjusted to this position.
Functional description	The calculated position offset is compensated by a positioning movement of the slave axes with the specified speed and ramp limits. "InPosition" is signaled back after completed compensation movement.

7.6.3 Submode synchronous mode

The following figure shows synchronous mode with absolute encoder sensing.



2807932939

Interface description

Interface description		
Velocity limit	Startup parameters synchronization speed	
Ramp limit	Startup parameters synchronization ramp	
Master source	Virtual master encoder	
Slave source ISYNC	Startup parameter	
Slave source slip detection	External HIPERFACE® encoder or absolute encoder	
Synchronization mode	Startup parameter	
Brief description	The technology function ISYNC ensures angular synchronism between master and motor encoder. At a higher level, the position difference between the virtual master encoder and the absolute encoder system (or external HIPERFACE® encoder) is detected and corrected by the selected synchronization process.	
	Requirement	• Operating mode is selected • Drive is enabled
	Functional description	For information/descriptions of the *ISYNC* technology function, refer to the "MOVIDRIVE® MDX61B Internal Synchronous Operation (ISYNC)" manual. For information on the operating principle of the higher-level slip compensation, refer to chapters "Functional principle of indirect positioning and synchronization" (page 14) and "Synchronous operation parameters" (page 56).

7.7 Emergency mode

Interface description		
Mode selection	PO1:Bit11 = TRUE PO1:Bit12 = FALSE PO1:Bit13 = TRUE	
Jog +	PO1:9	
Jog–	PO1:10	
Axis number	PO3 Broadcast 99 or single axis mode 1 ... 12	
Velocity specification	PO8 in [rpm] or [user units]	
Velocity limit	Startup parameter	
Ramp specification	PO9 Acceleration ramp in [ms] PO10 Deceleration ramp in [ms]	
Digital input	You can influence the emergency mode by activating the digital input "Set-EmergencyMode-DI01 X31:4": • DI01 SetemergencyMode = *False*: The position-controlled procedure switches the inverter to "speed specification" mode. • DI01 SetemergencyMode = *True*: The position-controlled procedure switches the inverter to "speed specification" mode and disables the external encoder or absolute encoder, if installed. In this way, the drive can even be moved with a defective absolute encoder.	
Brief description	If emergency mode was activated using the user interface, the drive can also be moved in the event of an encoder error.	
	Requirement	• Operating mode is selected • Drive is enabled • MOVI-PLC® was restarted
	Functional description	MOVI-PLC® can be rebooted via the process data interface by setting the input bit PO2: bit 6 "Reset-Cold MOVI-PLC" to TRUE for about 50 ms. The direction is selected using Jog+ or Jog–. The travel movement is triggered by a specified speed. Once emergency mode is selected using the ApplicationBuilder startup, other operating modes cannot be selected any longer. The drive stops with position control if the direction selection is not enabled or both directions are selected at the same time. The specified ramp time is used for accelerating/ decelerating the drive. The specified velocity of the jog mode is compared to the velocity limit and limited if necessary. Automatic mode cannot be selected anymore when the digital input (set emergency mode DI01 X31:4) is activated.

7.8 Additional functions

7.8.1 External encoder monitoring function

Interface description		
Lag error window	Startup parameter	
Brief description	To detect wire breakage of draw-wire encoders, the positions between motor encoder and distance encoder are sensed cyclically during ongoing movement. If this condition is violated, feedback is provided by the described status bits and an error message in the IEC.	
	Requirement	Ongoing movement (actual speed > 50 rpm)

7.8.2 Lag error window monitoring function

Interface description		
Lag error prewarning window	Startup parameter	
Brief description	In *Automatic* mode, a position comparison is made cyclically between the calculated averaged position of all axes involved, and the position offset of each axis to the reference position. If this condition is violated, feedback is provided by the described status bits and an error message in the IEC.	
	Requirement	• Ongoing movement • Automatic active

7.8.3 Fieldbus master monitoring function

Interface description		
Operating principle	Diagnostics function, which monitors the bus communication to the master controller cyclically. If this condition is violated, feedback is provided by the described status bits and an error message in the IEC.	
	Prerequisite	Control via the PROFIBUS interface

7.9 Cycle diagrams

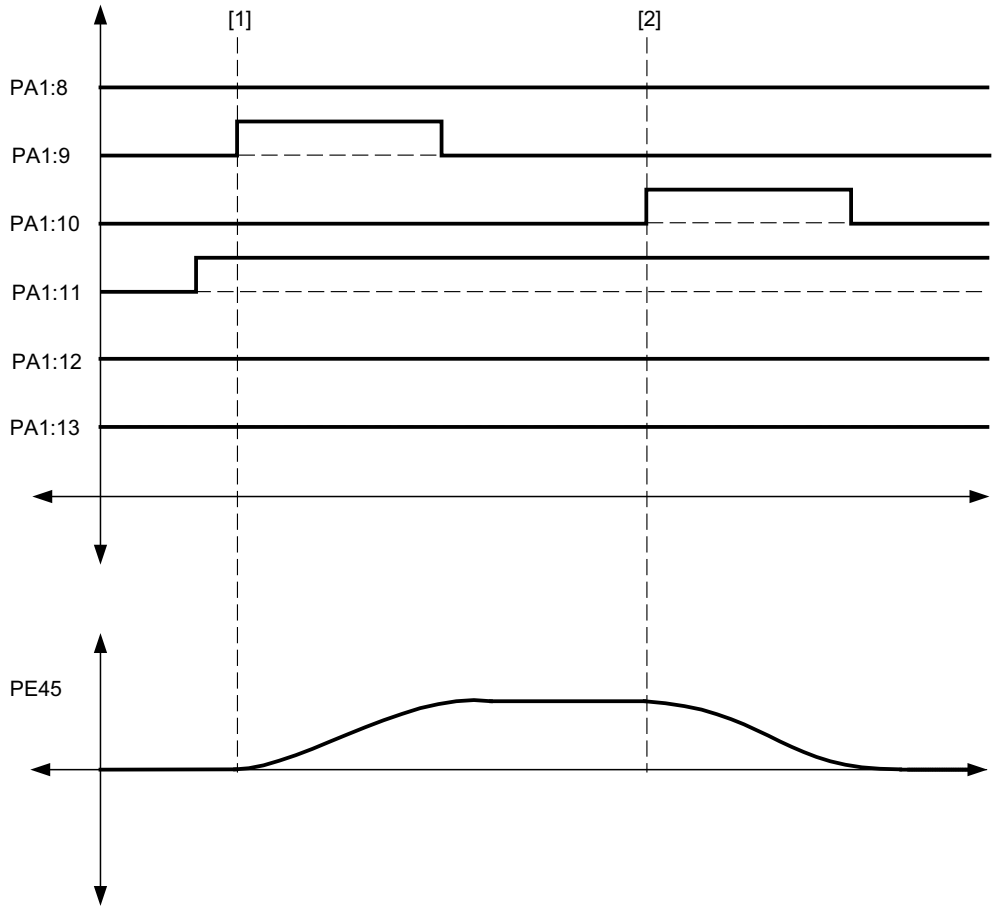
The following conditions apply to the cycle diagrams:

- Startup has been performed correctly
- DI00 "/Controller inhibit" = "1" (no inhibit)
- PO1:1 = "1" (Enable/halt)
- PO1:2 = "1" (Enable/stop)
- PO3 = "99" for group control or "1 ... 12" for single axis selection

The values for the dynamic parameters are transferred using the following process output data words:

- PO8 = Setpoint velocity
- PO9 = Acceleration ramp
- PO10 = Deceleration ramp
- PO45 = Target position for positioning mode (unsynchronized)
- PO67 = Target position for automatic mode (synchronized)

7.9.1 Jog mode

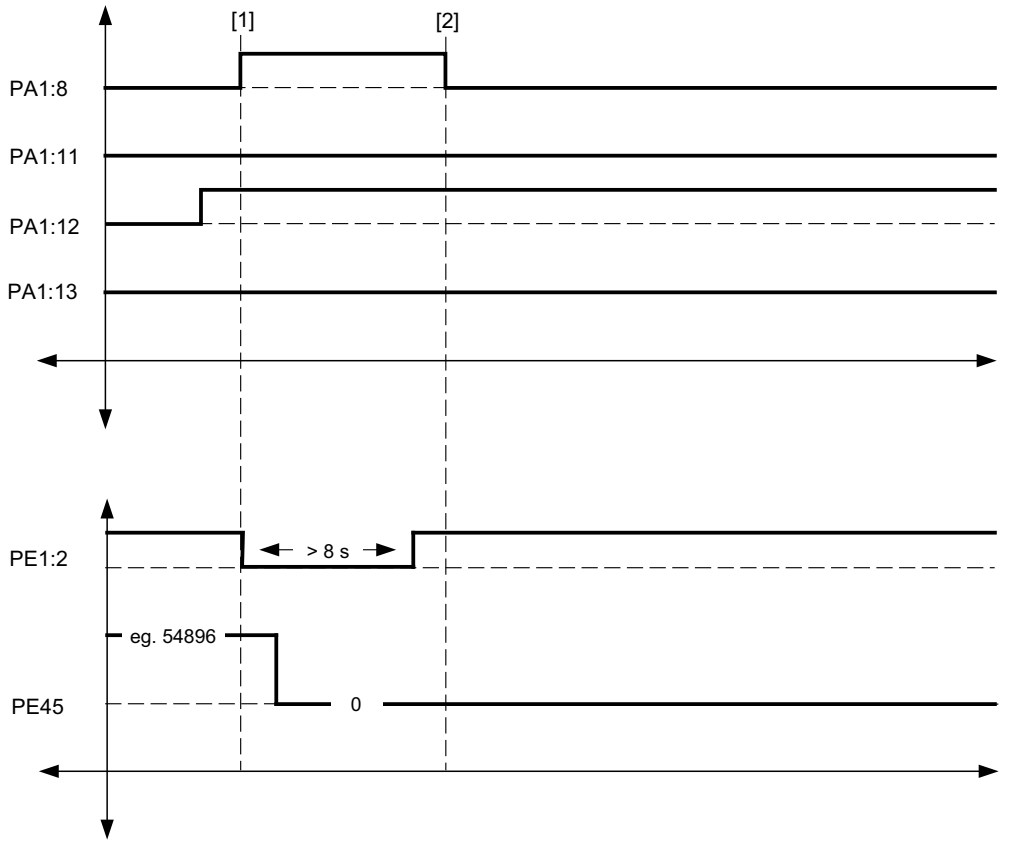


536573963

[1] Axis starts when the *jog+* bit is set
[2] Axis starts when the *jog–* bit is set

Position	Description
PO1:8	Start
PO1:9	Jog +
PO1:10	Jog–
PO1:11	"0" Mode 2^0
PO1:12	"0" Mode 2^1
PO1:13	"0" Mode 2^2
PI45	Actual position 32 bit

7.9.2 Referencing mode

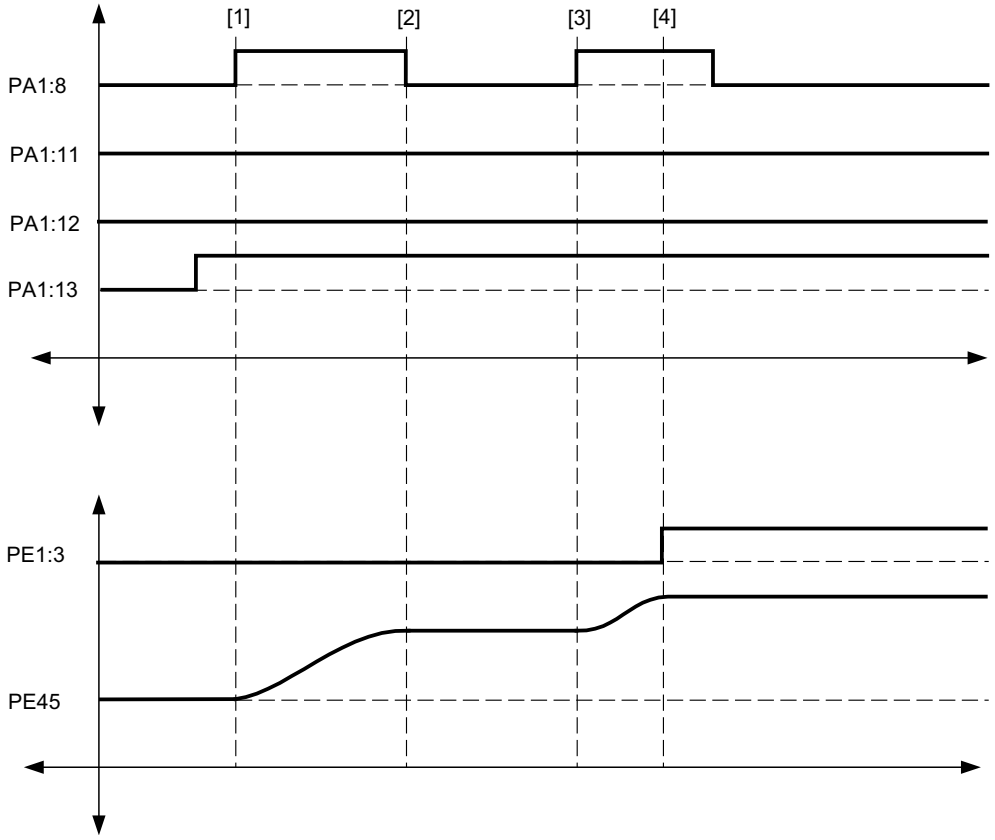


[1] Referencing starts when the *start* bit is set
[2] The drive is referenced once the PI1:2 message (IPOS reference) is set.

Position	Description
PO1:8	Start
PO1:11	"0" Mode 2^0
PO1:12	"1" Mode 2^1
PO1:13	"0" Mode 2^2
PI1:2	IPOS reference
PI45	Actual position 32 bit

7.9.3 Positioning mode

The following figure shows unsynchronized positioning operation of the individual axis/ group.



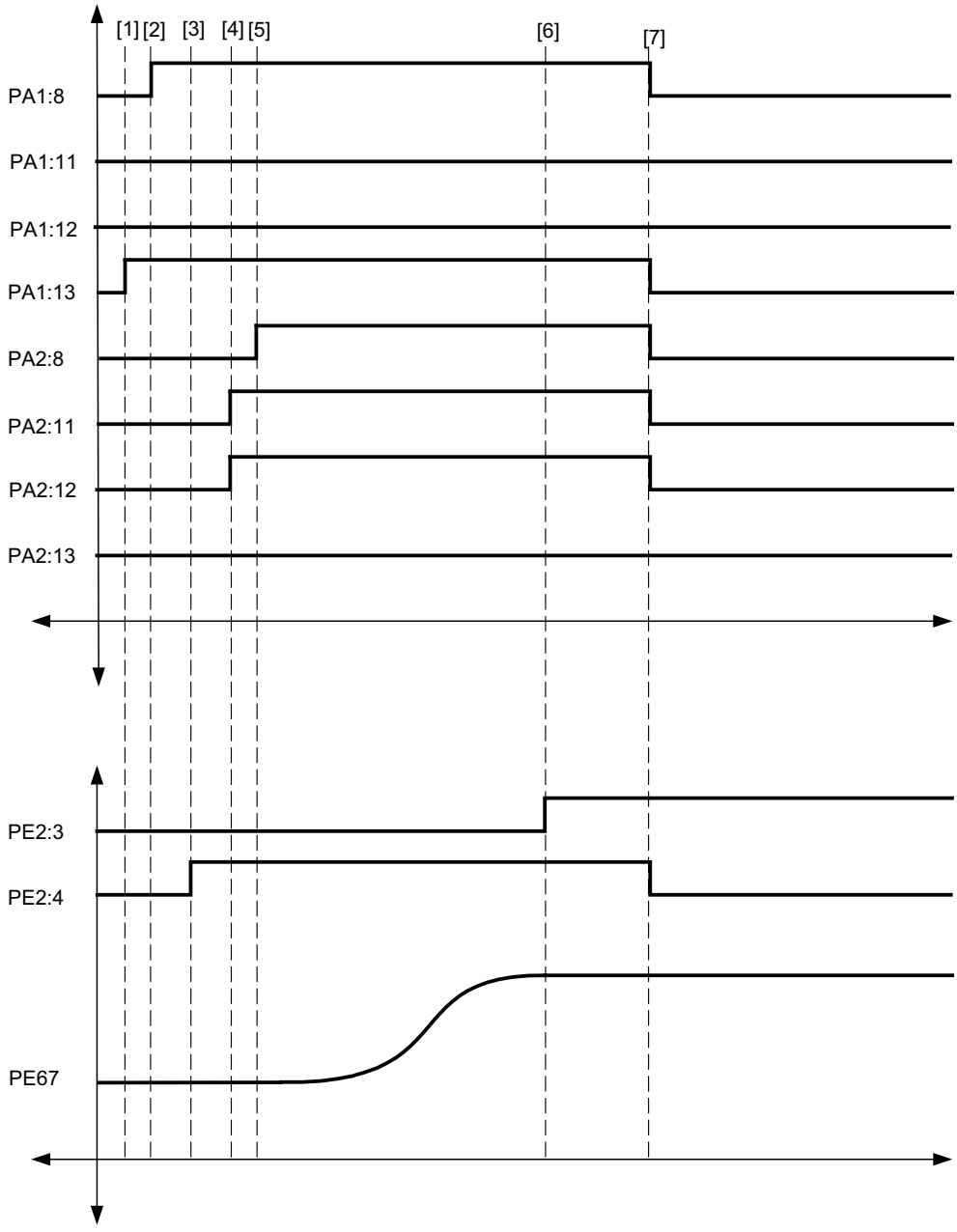
536590603

[1] Start positioning
[2] Positioning is interrupted by revoking start
[3] Positioning
[4] Positioning finished. PI1:3 message (IPOS in position) set.

Position	Description
PO1:8	Start
PO1:11	"0" Mode 2^0
PO1:12	"1" Mode 2^1
PO1:13	"1" Mode 2^2
PO45	Setpoint position
PI1:3	IPOS in position
PI45	Actual position 32 bit

7.9.4 Automatic mode

The following figure show synchronized positioning mode of the group with positioning of the virtual encoder.



536575627

[1] *Automatic* mode selected
[2] Activation of operating mode with the start input
[3] Feedback "Axis system synchronized – ready for virtual encoder"
[4] *Positioning of the virtual encoder* mode selected
[5] Start of movement PO2:8 input "start"
[6] Positioning finished. PI2:3 message (virtual encoder in position) set.
[7] Decoupling of axis system by deselecting the operating mode

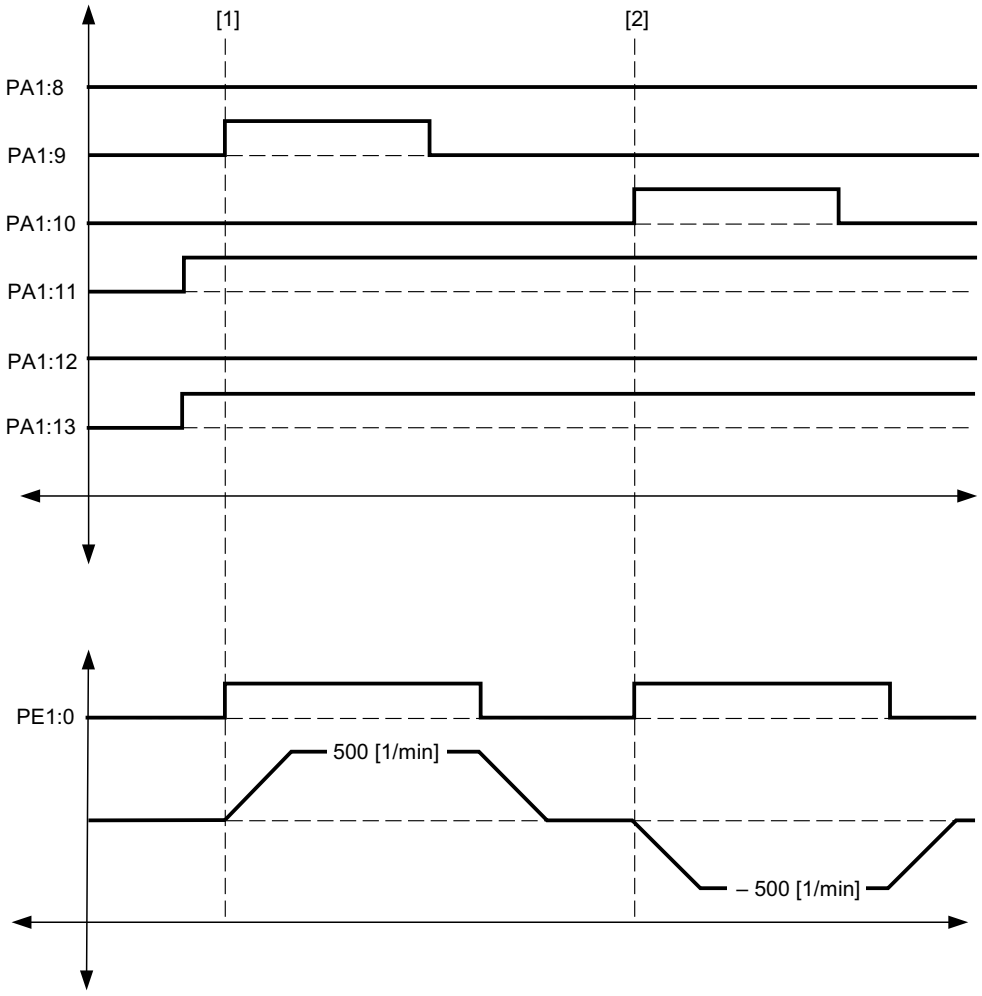
Position	Description
PO1:8	Start (automatic mode)
PO1:11	"0" Mode 2^0 (automatic mode)
PO1:12	"0" Mode 2^1
PO1:13	"1" Mode 2^2
PO2:8	Start (start of virtual encoder)
PO2:11	"1" Mode 2^0 (positioning mode of the virtual encoder)
PO2:12	"1" Mode 2^1
PO2:13	"0" Mode 2^1
PO67	Setpoint position virtual encoder
PI2:3	Virtual position reached
PI2:4	Axis system synchronized – ready for virtual encoder
PI67	Actual position of axis system 32 bit

7.9.5 Emergency mode

The following figure shows unsynchronized emergency mode of the individual axis/ group.

The following additional prerequisites apply to emergency mode:

- X31:4 (DI01 set emergency mode) was set.
- MOVI-PLC® was restarted with set DI01.



536588939

[1] Axis starts when the *jog+* bit is set
[2] Axis starts when the *jog–* bit is set

Position	Description
PO1:8	Start
PO1:9	Jog +
PO1:10	Jog–
PO1:11	"1" Mode 2^0
PO1:12	"0" Mode 2^1
PO1:13	"1" Mode 2^2
PI1:0	Motor is turning

7.10 Fault information

7.10.1 Table of error codes

Error code	Description	Description in English
FF0201h	E_MPLC_INVALIDNUMBEROFAXIS	Invalid number of axes. A maximum of 8 axes can be selected.
FF0202h	E_MPLC_INVALIDACTAXISNUMBER	Invalid axis selection. Permitted: • PO3 = 99 (group control) • PO3 = 1 ... 8 (single axis control)
FF0203h	E_MPLC_SYNCCRANE_LIMITSWITCHCW	The specified position or actual position is outside the defined software limit switch.
FF0204h	E_MPLC_SYNCCRANE_LIMITSWITCHCCW	The specified position or actual position is outside the defined software limit switch.
FF0205h	E_MPLC_SYNCCRANE_FIELDBUSTIMEOUT	Fieldbus communication was interrupted. All setpoints are cleared internally.
FF0206h	E_MPLC_SYNCCRANE_EXTENCODER	External encoder provides implausible values. Axis system is stopped in automatic mode.
FF0207h	E_MPLC_SYNCCRANE_HMIFAILURE	Communication while accessing the wizard was interrupted. All setpoints are cleared internally.
FF0208h	E_MPLC_SYNCCRANE_LAGERROR	The set lag error was exceeded in automatic mode (distance from external encoder position to virtual master encoder). The axis system is stopped.

7.10.2 Reading out the error information

The user can read out the error information via the startup wizard under [Monitor] / [Single-axis monitor] / [Display field FB error]. The error information can also be read out via the process input data. In case of an error, bit 6 (FB error/warning) in PI1 is set to "TRUE" and the last digit of the error code is sent via the high byte in PI2.

8 Auxiliary Drives (Auxiliary Axis)

8.1 System description

8.1.1 Fields of application

Many applications with the SyncCrane application module are characterized by controlling several independent sequences of motion via a common interface between MOVI-PLC® and the higher-level fieldbus master.

In many crane applications, for example, more auxiliary drives are required in addition to the feed axes synchronized using the SyncCrane application module in order to control the lifting and Z movement of the load suspension.

Example: Hall crane with 3 motion axes:

682447883

Axis	Description
X	Motion sequence of the synchronized feed axes controlled via SyncCrane interface.
Z	Position-controlled axis for moving the load suspension.
Y	Position-controlled axis for lifting movement of the load suspension.

Up to 4 auxiliary axes can be integrated without additional programming work. The ApplicationBuilder wizard is available for startup and diagnostics.

Users can choose between up to 3 different profiles to cover an as large as possible application area:

- Bus positioning (16 bit position representation)
- Extended bus positioning (32 bit position representation)
- Velocity (velocity specification without position representation)

The profiles can be set separately for each of the max. 4 auxiliary drives.

Due to the maximum processing of 32 process data words with DHP11B, the process data width of the auxiliary drives was reduced to 4 process data words.

The controllers DHF41B and DHR41B require 6 process data words per auxiliary drive.

8.1.2 Application examples

- Hall crane with 2 additional auxiliary axes for handling the load suspension using the "extended bus positioning" profile.
- Travel carriage with control of an additional hydraulic unit using the "velocity" profile. The hydraulic unit is operated without encoder by specifying a setpoint speed.

8.2 Project planning for auxiliary drives

8.2.1 Functional description

Mode	Profile 1 Bus positioning	Profile 2 Extended positioning via bus	Profile 3 Velocity
Mode 0	Default mode	Default mode	Default mode
Mode 1	Jog mode	Jog mode	Jog mode with velocity specification
Mode 2	Referencing mode	Referencing mode	Default mode
Mode 3	Positioning mode	Positioning mode	Default mode

Functional characteristics

The auxiliary drives provide the following functional characteristics:

Mode	Description
Jog mode	• The drive is moved clockwise or counterclockwise with position control using two bits for direction selection. • Velocity and ramp can be specified via fieldbus as required depending on the profile.
Jog mode with startup of the "velocity" profile	• The set operating mode can also be used without encoder. • The drive is moved clockwise or counterclockwise using two bits for direction selection. • Velocity and ramp can be specified via fieldbus as required.
Referencing mode	• Reference travel and position adjustment of the external encoder are initiated with the start signal. • Reference travel establishes the reference point (machine zero) for absolute positioning operations.
Positioning mode	• When the axes are referenced and start is set, the received target position results in a positioning operation. • Velocity and ramp can be specified via fieldbus as required depending on the profile.

8.2.2 Process data assignment

The higher-level controller (PLC) sends a process data range of 4 PD for each auxiliary drive via PROFIBUS.

Addressing of process data words for DHP11B:

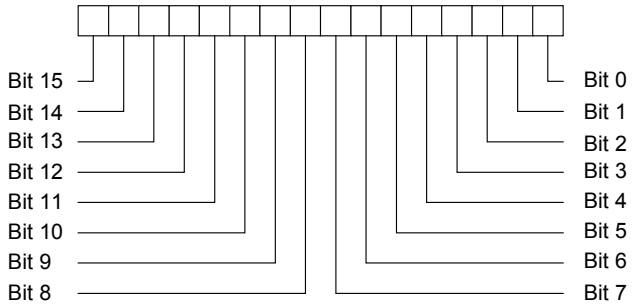
Number of auxiliary drives	1	2	3	4
Axis 1 PD	29 ... 32	25 ... 28	21 ... 24	17 ... 20
Axis 2 PD	–	29 ... 32	25 ... 28	21 ... 24
Axis 3 PD	–	–	29 ... 32	25 ... 28
Axis 4 PD	–	–	–	29 ... 32

Addressing of process data words for DHF41B and DHR41B:

Number of auxiliary drives	1	2	3	4
Axis 1 PD	20 ... 25	20 ... 25	20 ... 25	20 ... 25
Axis 2 PD	–	26 ... 31	26 ... 31	26 ... 31
Axis 3 PD	–	–	32 ... 37	32 ... 37
Axis 4 PD	–	–	–	38 ... 43

Process output data words

PO1 = Control word 1



512061835

Bit no.	Description
Bit 0	/Controller inhibit
Bit 1	Enable/rapid stop
Bit 2	Enable/stop
Bit 3	Reserved
Bit 4	Reserved
Bit 5	Reserved
Bit 6	Error reset
Bit 7	Reserved
Bit 8	Start
Bit 9	Jog+
Bit 10	Jog–
Bit 11	Mode 2^0
Bit 12	Mode 2^1
Bit 13	Reserved
Bit 14	Ramp switch-over[1)] / reserved
Bit 15	Disable SWLS

1) For DHP11B and "extended positioning" profile

Process output data words for DHP11B:

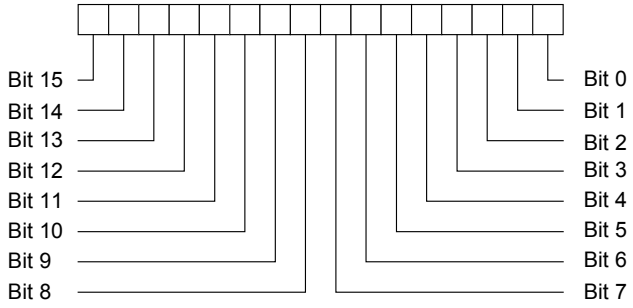
Process output data word	Profile 1 Bus positioning	Profile 2 Extended positioning via bus	Profile 3 Velocity
PO1	Control word	Control word	Control word
PO2	Setpoint speed	Setpoint speed	Setpoint speed
PO3	Ramp	Position HighWord	Ramp
PO4	Position 16 bit	Position LowWord	Reserved

Process output data words for DHF41B and DHR41B:

Process output data word	Profile 1 Bus positioning	Profile 2 Extended positioning via bus
PO1	Control word	Control word
PO2	Position HighWord	Reserved
PO3	Position LowWord	Reserved
PO4	Setpoint speed	Setpoint speed
PO5	RampUp	RampUp
PO6	RampDown	RampDown

Process input data words

PI1 = Status word 1



512061835

Bit no.	Description
Bit 0	Motor is turning
Bit 1	Frequency inverter ready for operation
Bit 2	IPOS axis referenced
Bit 3	IPOS in position
Bit 4	Brake released
Bit 5	Frequency inverter fault/warning
Bit 6	Limit switch CW
Bit 7	Limit switch CCW
Bit 8 ... 15	Inverter/error state

Process input data words for DHP11B:

Process input data word	Profile 1 Bus positioning	Profile 2 Extended positioning via bus	Profile 3 Velocity
PI1	Status word	Status word	Status word
PI2	Actual velocity	Actual velocity	Actual velocity
PI3	Reserved	Actual position High-Word	Reserved
PI4	Actual position 16 bit	Actual position LowWord	Actual position 16 bit

Process input data words for DHF41B and DHR41B:

Process input data word	Profile 1 Bus positioning	Profile 3 Velocity
PI1	Status word	Status word
PI2	Actual position High-Word	Actual position HighWord
PI3	Actual position Low-Word	Actual position LowWord
PI4	Actual velocity	Actual velocity
PI5	Output current	Output current
PI6	Unit utilization	Unit utilization

8.2.3 Control configuration

The SyncCrane application module is designed for controlling a maximum of 4 additional auxiliary drives. The inverters are connected via CAN2 of the MOVI-PLC® (X:32) with a baud rate of 500 kbaud.

The inverters have to be set with SBus address 9 ... 12. It is recommended that you make the setting using the DriveStartup tool.

Number of auxiliary axes	1	2	3	4
SBus baud rate (kbaud)	500	500	500	500
SBus address axis 1	9	9	9	9
SBus address axis 2	–	10	10	10
SBus address axis 3	–	–	11	11
SBus address axis 4	–	–	–	12

8.3 Startup of auxiliary drives

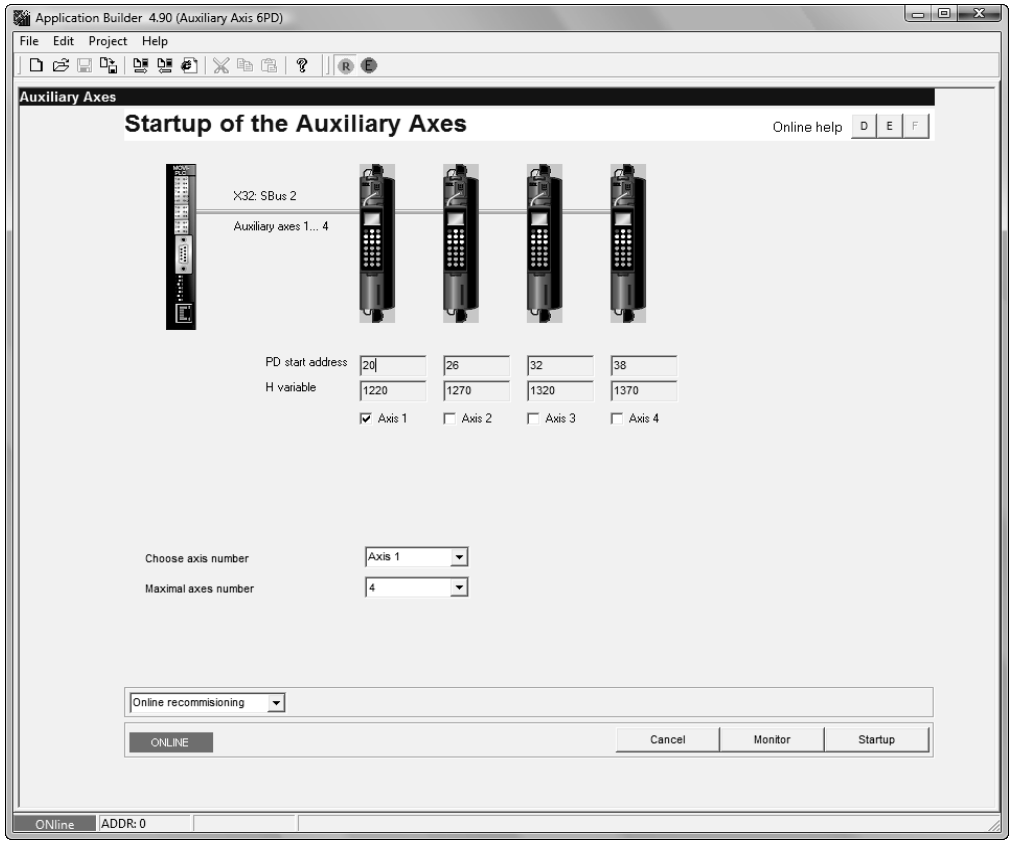
8.3.1 Starting the "Auxiliary axis" program

Make a right mouse click on Serial 0:MOVI-PLC® and select:

[Application modules] / [SyncCrane for MOVI-PLC auxiliary axis]

Initial screen

The initial screen of the "Auxiliary Axis" application is opened.



18014399267355915

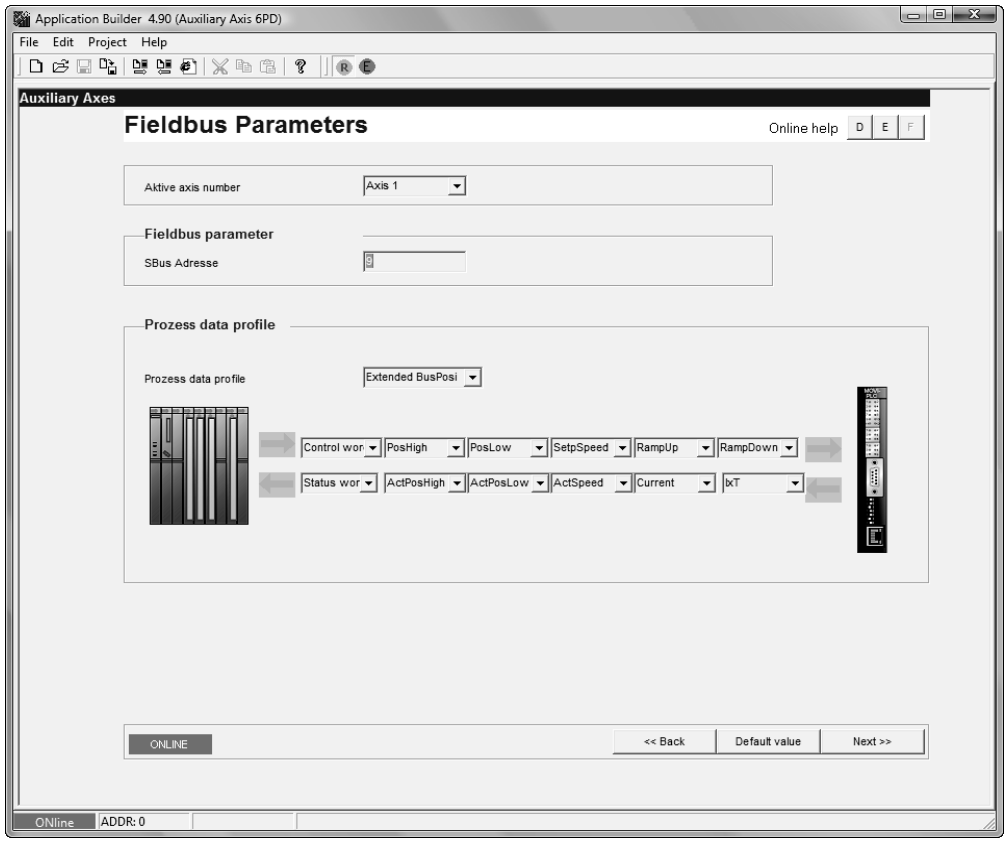
Field/button	Description
PD start address	Read out the start address for the first process data word here.
H variable	Display variable for localizing the start address for the startup/diagnostic area.
Startup	Checkbox to display the operating status
Choose axis number	Here, you can select a single-axis number to go to the respective startup or monitor area. NOTE: The single-axis number must not be higher than the maximum axis number.
Maximum axis number	Here, you set the maximum number of auxiliary axes.
[Startup]	Button to begin the startup procedure for the application. The following chapters describe the next steps.
[Monitor]	Button to start the process data monitor. It is disabled if: • You are not online • The application module has not been detected
[Cancel]	Button to leave the startup wizard.

Proceed as follows to perform initial startup:

- Begin initial startup of the individual axes with axis 1. To do so, choose "Axis 1" from the "Select individual axis number" selection field.
- Enter the number of required auxiliary axes in the "Maximum number of axes" selection field. You can choose a maximum of 4 axes.

Fieldbus parameters

This window is used to specify the process data profile of your auxiliary axis.

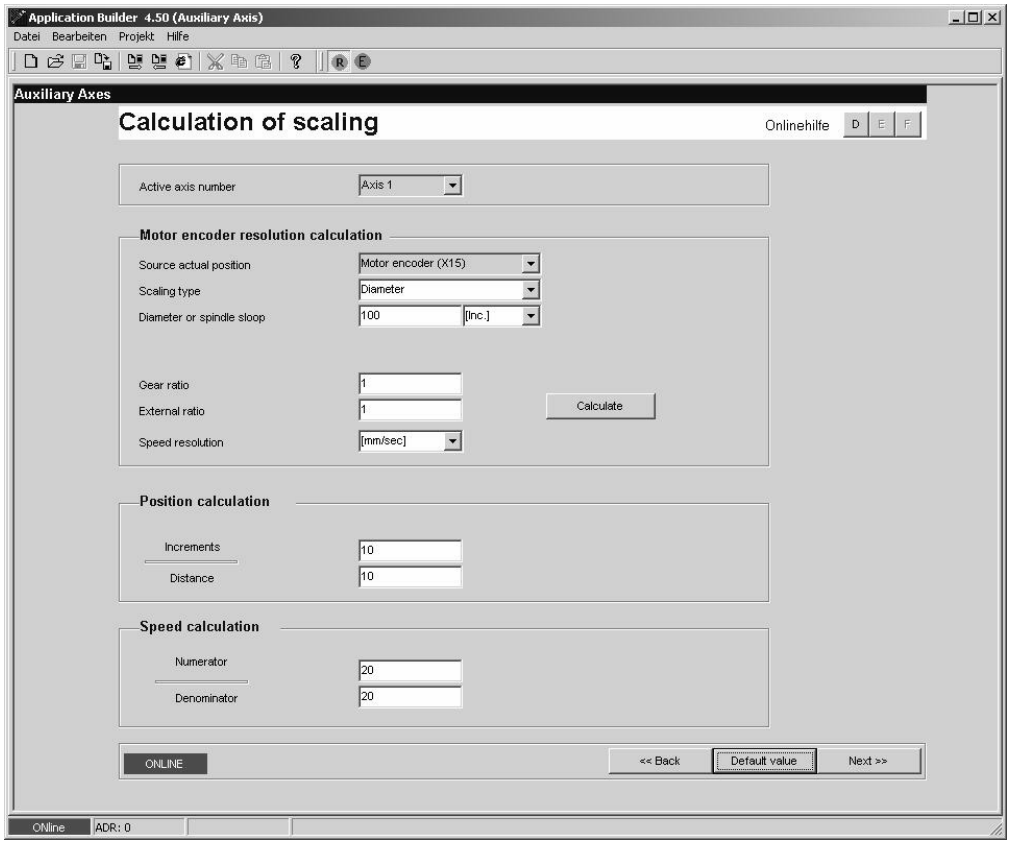


9007200012620683

Field	Description
Active axis number	You can read the selected axis number from this field.
SBus address	You can read the required SBus address from this field.
Process data profile	Choose a process data profile. The following 3 process data profiles are supported: • Bus positioning (only available for DHP11B) • Extended positioning via bus • Velocity

Calculating the scaling factors

On this startup screen you determine the feed units for the selected encoder system.

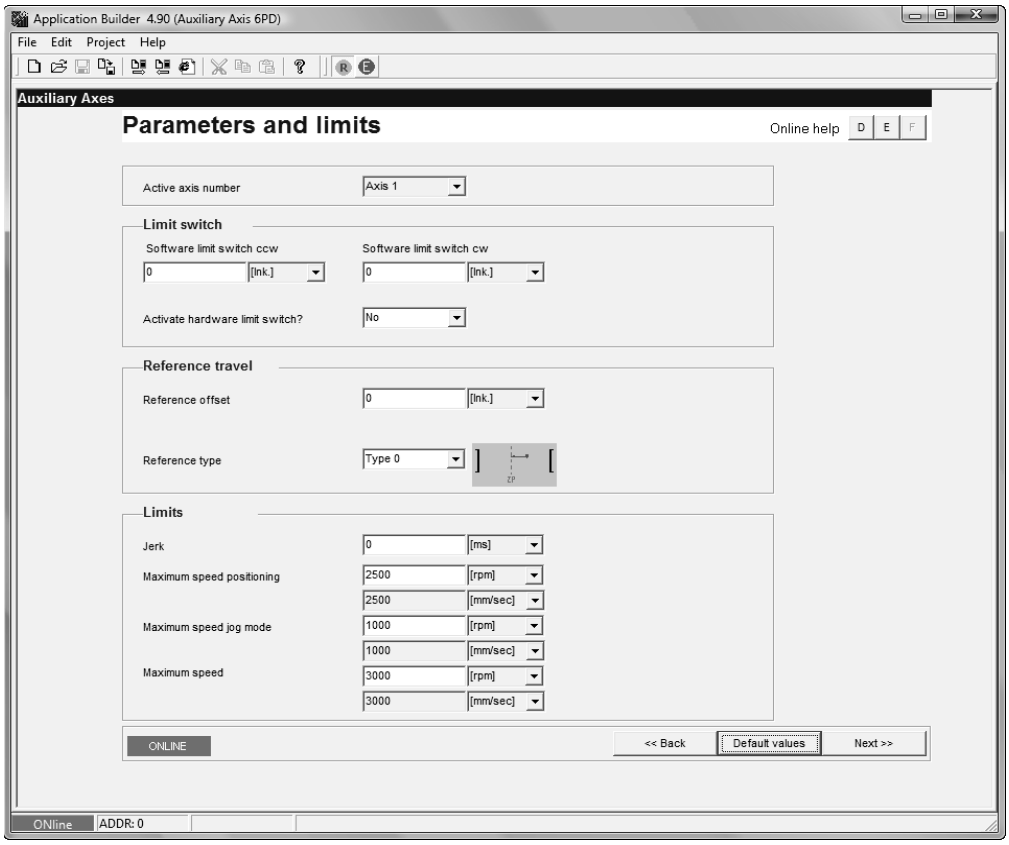


757885835

Field/button	Description
Diameter	Enter the mechanical data in this field. You can enter values with two decimal places.
i gear unit	
i additional gear	
Unit for position and speed specification	Enter the unit for position and speed specification here and click on the [Calculation] button.
[Calculate]	Button for determining the distance/speed scaling with user-defined units. The determined scaling factors are limited to 2^{16}.

Parameters and limits

In this window you can set the travel range and velocity limits.



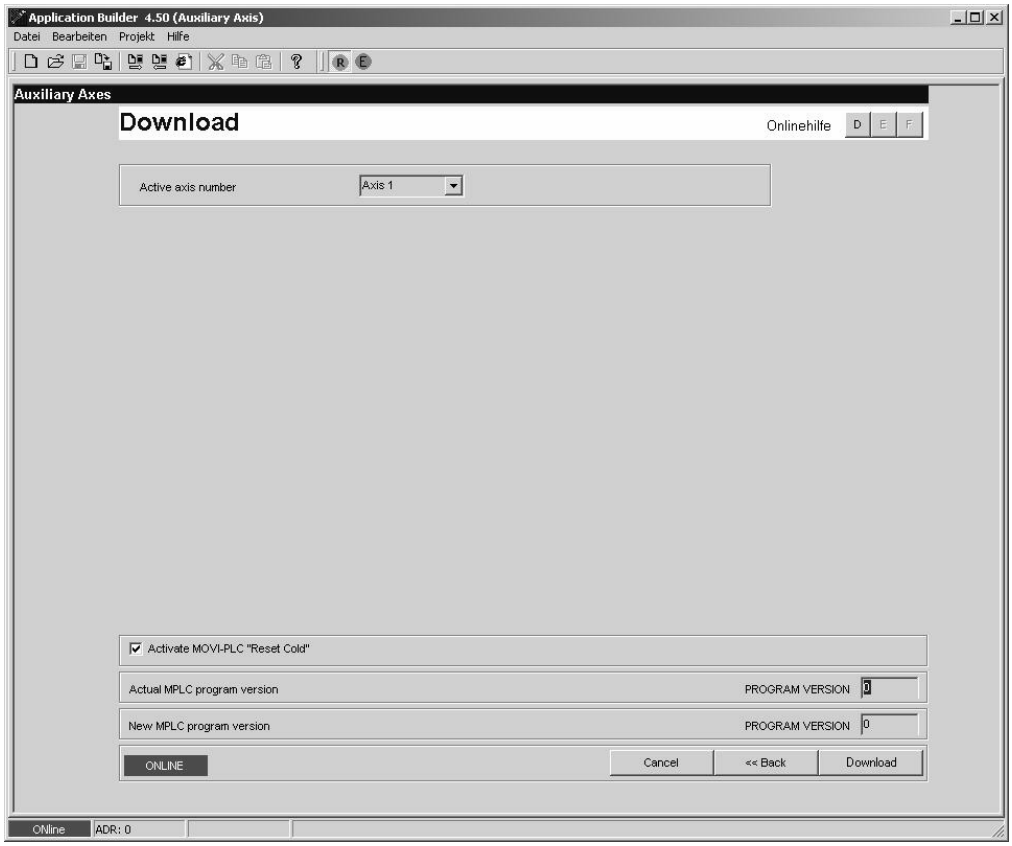
9007200012632715

Group	Field	Description
Limit switch	Software limit switch right	The software limit switches limit the permitted travel range for the following operating modes: • Jog • Positioning • Automatic The specified value refers to the increments of the distance encoder.
	Software limit switch left	
	Hardware limit switch	Choose whether you want hardware limit switches to be evaluated. They are evaluated on MOVIDRIVE® as follows: • X13:5 DI04 with /Limit switch right • X13:6 DI05 with /Limit switch left
Reference travel	Reference offset	Enter the reference offset in increments in relation to the distance encoder.
	Reference type	The reference type defines the movement sequence for detecting the mechanical zero point.
	Ramp 1	Ramp specification 1 for acceleration and deceleration ramps. NOTE: Ramp 1 is only effective in the "extended bus positioning" profile.
	Ramp 2	Ramp specification 2 for acceleration and deceleration ramps. NOTE: Ramp 2 is only effective in the "extended bus positioning" profile with the DHP11B unit.
	Jerk time	Enter the duration of the torque formation here. NOTE: The jerk time is not effective in the "velocity" profile.

Group	Field	Description
Limits	Maximum speed in positioning mode	You can limit the specified positioning speed by entering the value.
	Maximum speed in jog mode	You can limit the specified jog speed by entering the value.
	Maximum motor speed	Enter a value at least 10 % higher than the maximum positioning and/or jog speed.

Downloading data

The data are loaded to the MOVI-PLC® as soon as you have entered the startup parameters.



757909899

INFORMATION

If you tick the "Reset cold" checkbox, MOVI-PLC® is reset after the download.

In this case, the SBus communication with the connected inverters is temporarily interrupted and the message "MOVI-PLC timeout" is issued.

This message is pending until you acknowledge the associated error F116.

8.4 Operation of auxiliary drives

8.4.1 Starting the drive

After the download, switch to the monitor of the *Auxiliary axis* application module.

Operating modes (fieldbus control)

Operating mode	PO1:13	PO1:12	PO1:11	Description
Default	0	0	0	No axis is moved.

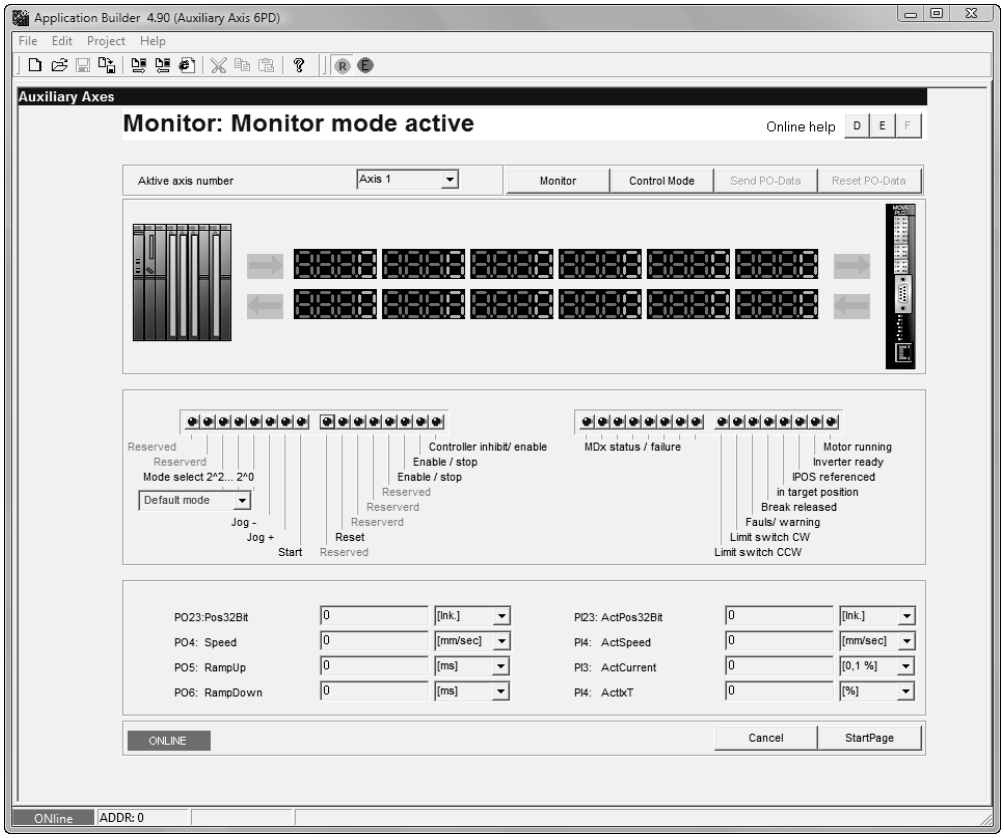
Jog mode	0	0	1	• Individual axes or the group can be moved via the Jog+ and Jog- inputs.
				• Specify the following values:
				  • Process output data words
				  • Travel parameters
				  • Velocity
				  • Ramp
				If no velocity is specified, the axis will move at 0.2 rpm.

Referencing mode	0	1	0	• The IPOS encoder position is referenced when start is set. • Reference travel establishes the reference point (machine zero) for positioning operations.
Positioning mode	0	1	1	• The referenced single axis can be moved once a target position is specified and start is set. • Specify the process output data words, travel parameters, velocity, and ramp. If no velocity is specified, the axis will move at 0.2 rpm.

Diagnostics monitor: Monitor mode

During ongoing operation, the monitor can be opened via [MotionStudio] / [Diagnostics] / [Application Builder] / [AuxiliaryAxis_E.mon].

In monitor mode, the process input and process output data transferred via fieldbus are displayed in decoded format.



9007200012658187

Parameter

Startup automatically sets the following parameters:

Parameter number	Parameter	Setting
SHELL P302	Maximum speed 1	Specified value from "Parameters and limits"
SHELL P920	SW limit switch CW	Specified value from "Parameters and limits"
SHELL P921	SW limit switch CCW	Specified value from "Parameters and limits"
SHELL P603	Binary input DI04	/Limit switch CW or no function
SHELL P604	Binary input DI05	/Limit switch CCW or no function
SHELL P903	Reference travel type	Specified value from "Parameters and limits"
SHELL P900	Reference offset	Specified value from "Parameters and limits"
H2047	H_STARTADDRESS	–
Hxxx + 1	H_OFFSET	–
Hxxx + 2	H_OFFSETAXIS	–
Hxxx + 3	PD_STARTADDRESS	–
Hxxx + 4	PD_OFFSET	–
Hxxx + 5	H_IBSTATUS_A1	–
Hxxx + 6	H_IBSTATUS_A2	–
Hxxx + 7	H_IBSTATUS_A3	–
Hxxx + 8	H_IBSTATUS_A4	–
Hxxx + 9	MONITOR_CTRL	–
Hxxx + 10	H_STARTADDRESS_A1	–
Hxxx + 11	H_STARTADDRESS_A2	–
Hxxx + 12	H_STARTADDRESS_A3	–
Hxxx + 13	H_STARTADDRESS_4	–
Hxxx + 14	H_MAXAXISNUMBER	–
Hxxx + 15	H_ACTAXISNUMBER	–
Hxxx + 16	H_AUXIBSTATUS	–
[H_STARTADDRESS_A1] + 0	PO1	–
[H_STARTADDRESS_A1] + 1	PO2	–
[H_STARTADDRESS_A1] + 2	PO3	–
[H_STARTADDRESS_A1] + 3	PO4	–
[H_STARTADDRESS_A1] + 10	PI1	–
[H_STARTADDRESS_A1] + 11	PI2	–
[H_STARTADDRESS_A1] + 12	PI3	–
[H_STARTADDRESS_A1] + 13	PI4	–
[H_STARTADDRESS_A1] + 20	BUS_ADDRESS	–
[H_STARTADDRESS_A1] + 21	BUS_PDPROIFILE	–
[H_STARTADDRESS_A1] + 25	SCALE_SOURCE	–
[H_STARTADDRESS_A1] + 26	SCALE_TYPE	–
[H_STARTADDRESS_A1] + 27	SCALE_VALUE	–
[H_STARTADDRESS_A1] + 28	SCALE_RESOLUTION	–
[H_STARTADDRESS_A1] + 29	SCALE_GEARINGRATIO	–
[H_STARTADDRESS_A1] + 30	SCALE_EXTRATIO	–
[H_STARTADDRESS_A1] + 31	SCALE_SPEEDRES	–

Parameter number	Parameter	Setting
[H_STARTADDRESS_A1] + 32	SCALE_INC	–
[H_STARTADDRESS_A1] + 33	SCALE_DISTANCE	–
[H_STARTADDRESS_A1] + 34	SCALE_NUMERATOR	–
[H_STARTADDRESS_A1] + 35	SCALE_DENOMINATOR	–
[H_STARTADDRESS_A1] + 40	LIM_LSCCW	–
[H_STARTADDRESS_A1] + 41	LIM_LSCW	–
[H_STARTADDRESS_A1] + 42	LIM_HWLS	–
[H_STARTADDRESS_A1] + 43	LIM_REFOFFSET	–
[H_STARTADDRESS_A1] + 44	LIM_REFTYPE	–
[H_STARTADDRESS_A1] + 45	LIM_Ramp1 / LIM-JERK	–
[H_STARTADDRESS_A1] + 46	LIM_Ramp2 / reserved	–
[H_STARTADDRESS_A1] + 47	LIM_MAXSPEEDAUTO	–
[H_STARTADDRESS_A1] + 48	LIM_MAXSPEEDJOG	–
[H_STARTADDRESS_A1] + 49	LIM_MAXSPEED	–
[H_STARTADDRESS_A2+ 0	PO1	Structure axis 2
[H_STARTADDRESS_A3+ 0	PO1	Structure axis 3
[H_STARTADDRESS_A4+ 0	PO1	Structure axis 4

9 Appendix

9.1 Frequently asked questions

- Why do the axes not signal "Connected"?
  - Was "DriveStartup" performed for each individual axis?
  - Are the SBus addresses different?
  - Are the baud rates set correctly?
  - Is the SBus wiring correct (terminating resistors)?
  - Is the firmware version of the inverters 8248540.18 or higher?
- Why does the enabled drive vibrate without mode selection?
  - Check the calculated scaling factors and position windows.

10 Address List

Germany			
Headquarters **Production** **Sales**	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 • D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Service Competence Center	**Central**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 1 D-76676 Graben-Neudorf	Tel. +49 7251 75-1710 Fax +49 7251 75-1711 sc-mitte@sew-eurodrive.de
	North	SEW-EURODRIVE GmbH & Co KG Alte Ricklinger Straße 40-42 D-30823 Garbsen (near Hannover)	Tel. +49 5137 8798-30 Fax +49 5137 8798-55 sc-nord@sew-eurodrive.de
	East	SEW-EURODRIVE GmbH & Co KG Dänkritzer Weg 1 D-08393 Meerane (near Zwickau)	Tel. +49 3764 7606-0 Fax +49 3764 7606-30 sc-ost@sew-eurodrive.de
	South	SEW-EURODRIVE GmbH & Co KG Domagkstraße 5 D-85551 Kirchheim (near München)	Tel. +49 89 909552-10 Fax +49 89 909552-50 sc-sued@sew-eurodrive.de
	West	SEW-EURODRIVE GmbH & Co KG Siemensstraße 1 D-40764 Langenfeld (near Düsseldorf)	Tel. +49 2173 8507-30 Fax +49 2173 8507-55 sc-west@sew-eurodrive.de
	Electronics	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal	Tel. +49 7251 75-1780 Fax +49 7251 75-1769 sc-elektronik@sew-eurodrive.de
	Drive Service Hotline / 24 Hour Service		+49 180 5 SEWHELP +49 180 5 7394357
	Additional addresses for service in Germany provided on request!		

France			
Production **Sales** **Service**	**Haguenau**	SEW-USOCOME 48-54 route de Soufflenheim B. P. 20185 F-67506 Haguenau Cedex	Tel. +33 3 88 73 67 00 Fax +33 3 88 73 66 00 http://www.usocome.com sew@usocome.com
Production	**Forbach**	SEW-USOCOME Zone industrielle Technopôle Forbach Sud B. P. 30269 F-57604 Forbach Cedex	Tel. +33 3 87 29 38 00
Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62 avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Nantes	SEW-USOCOME Parc d'activités de la forêt 4 rue des Fontenelles F-44140 Le Bignon	Tel. +33 2 40 78 42 00 Fax +33 2 40 78 42 20
	Paris	SEW-USOCOME Zone industrielle 2 rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
	Additional addresses for service in France provided on request!		

Algeria			
Sales	**Alger**	REDUCOM Sarl 16, rue des Frères Zaghnoune Bellevue 16200 El Harrach Alger	Tel. +213 21 8214-91 Fax +213 21 8222-84 sew-algeria@reducom-dz.com http://www.reducom-dz.com

Argentina			
Assembly **Sales** **Service**	**Buenos Aires**	SEW EURODRIVE ARGENTINA S.A. Centro Industrial Garin, Lote 35 Ruta Panamericana Km 37,5 1619 Garin	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 sewar@sew-eurodrive.com.ar http://www.sew-eurodrive.com.ar

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au

Austria			
Assembly **Sales** **Service**	**Wien**	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Strasse 24 A-1230 Wien	Tel. +43 1 617 55 00-0 Fax +43 1 617 55 00-30 http://www.sew-eurodrive.at sew@sew-eurodrive.at

Belarus			
Sales	**Minsk**	SEW-EURODRIVE BY RybalkoStr. 26 BY-220033 Minsk	Tel.+375 (17) 298 38 50 Fax +375 (17) 29838 50 sales@sew.by

Belgium			
Assembly **Sales** **Service**	**Brussels**	**SEW Caron-Vector** Avenue Eiffel 5 BE-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.be info@sew-eurodrive.be
Service Competence Center	**Industrial Gears**	**SEW Caron-Vector** Rue de Parc Industriel, 31 BE-6900 Marche-en-Famenne	Tel. +32 84 219-878 Fax +32 84 219-879 http://www.sew-eurodrive.be service-wallonie@sew-eurodrive.be
	Antwerp	**SEW Caron-Vector** Glasstraat, 19 BE-2170 Merksem	Tel. +32 3 64 19 333 Fax +32 3 64 19 336 http://www.sew-eurodrive.be service-antwerpen@sew-eurodrive.be

Brazil			
Production **Sales** **Service**	**Sao Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 152 - Rodovia Presidente Dutra Km 208 Guarulhos - 07251-250 - SP SAT - SEW ATENDE - 0800 7700496	Tel. +55 11 2489-9133 Fax +55 11 2480-3328 http://www.sew-eurodrive.com.br sew@sew.com.br

Bulgaria			
Sales	**Sofia**	BEVER-DRIVE GmbH Bogdanovetz Str.1 BG-1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 bever@mail.bg

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 33 431137 Fax +237 33 431137 electrojemba@yahoo.fr

Canada			
Assembly **Sales** **Service**	**Toronto**	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, ON L6T 3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca l.watson@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. Tilbury Industrial Park 7188 Honeyman Street Delta, BC V4G 1G1	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Lasalle, PQ H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 a.peluso@sew-eurodrive.ca
	Additional addresses for service in Canada provided on request!		

Chile			
Assembly **Sales** **Service**	**Santiago de Chile**	SEW-EURODRIVE CHILE LTDA. Las Encinas 1295 Parque Industrial Valle Grande LAMPA RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 75770-00 Fax +56 2 75770-01 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl

China			
Production **Assembly** **Sales** **Service**	**Tianjin**	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25323273 info@sew-eurodrive.cn http://www.sew-eurodrive.com.cn
Assembly **Sales** **Service**	**Suzhou**	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267922 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478388 Fax +86 27 84478389 wuhan@sew-eurodrive.cn
	Xi'An	SEW-EURODRIVE (Xi'An) Co., Ltd. No. 12 Jinye 2nd Road Xi'An High-Technology Industrial Development Zone Xi'An 710065	Tel. +86 29 68686262 Fax +86 29 68686311 xian@sew-eurodrive.cn
	Additional addresses for service in China provided on request!		

Colombia			
Assembly **Sales** **Service**	**Bogotá**	SEW-EURODRIVE COLOMBIA LTDA. Calle 22 No. 132-60 Bodega 6, Manzana B Santafé de Bogotá	Tel. +57 1 54750-50 Fax +57 1 54750-44 http://www.sew-eurodrive.com.co sewcol@sew-eurodrive.com.co

Croatia			
Sales **Service**	**Zagreb**	KOMPEKS d. o. o. Zeleni dol 10 HR 10 000 Zagreb	Tel. +385 1 4613-158 Fax +385 1 4613-158 kompeks@inet.hr

Czech Republic			
Sales	**Prague**	SEW-EURODRIVE CZ S.R.O. Business Centrum Praha Lužná 591 CZ-16000 Praha 6 - Vokovice	Tel. +420 255 709 601 Fax +420 220 121 237 http://www.sew-eurodrive.cz sew@sew-eurodrive.cz

Denmark			
Assembly **Sales** **Service**	**Copenhagen**	SEW-EURODRIVEA/S Geminivej 28-30 DK-2670 Greve	Tel. +45 43 9585-00 Fax +45 43 9585-09 http://www.sew-eurodrive.dk sew@sew-eurodrive.dk

Egypt			
Sales **Service**	**Cairo**	Copam Egypt for Engineering & Agencies 33 El Hegaz ST, Heliopolis, Cairo	Tel. +20 2 22566-299 + 1 23143088 Fax +20 2 22594-757 http://www.copam-egypt.com/ copam@datum.com.eg

Estonia			
Sales	**Tallin**	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 veiko.soots@alas-kuul.ee

Finland			
Assembly **Sales** **Service**	**Lahti**	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 sew@sew.fi http://www.sew-eurodrive.fi
Production **Assembly**	**Karkkila**	SEW Industrial Gears Oy Valurinkatu 6, PL 8 FI-03600 Karkkila, 03601 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 sew@sew.fi http://www.sew-eurodrive.fi

Gabon			
Sales	**Libreville**	ESG Electro Services Gabun Feu Rouge Lalala 1889 Libreville Gabun	Tel. +241 741059 Fax +241 741059 esg_services@yahoo.fr

Great Britain			
Assembly **Sales** **Service**	**Normanton**	SEW-EURODRIVE Ltd. Beckbridge Industrial Estate P.O. Box No.1 Normanton, West-Yorkshire WF6 1QR	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk

Greece			
Sales **Service**	**Athens**	Christ. Boznos & Son S.A. 12, K. Mavromichali Street P.O. Box 80136 GR-18545 Piraeus	Tel. +30 2 1042 251-34 Fax +30 2 1042 251-59 http://www.boznos.gr info@boznos.gr

Hong Kong			
Assembly **Sales** **Service**	**Hong Kong**	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 36902200 Fax +852 36902211 contact@sew-eurodrive.hk

Hungary			
Sales **Service**	**Budapest**	SEW-EURODRIVE Kft. H-1037 Budapest Kunigunda u. 18	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 office@sew-eurodrive.hu

India			
Registered Office **Assembly** **Sales** **Service**	**Vadodara**	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 3045200, +91 265 2831086 Fax +91 265 3045300, +91 265 2831087 http://www.seweurodriveindia.com sales@seweurodriveindia.com subodh.ladwa@seweurodriveindia.com
Assembly **Sales** **Service**	**Chennai**	SEW-EURODRIVE India Private Limited Plot No. K3/1, Sipcot Industrial Park Phase II Mambakkam Village Sriperumbudur - 602105 Kancheepuram Dist, Tamil Nadu	Tel. +91 44 37188888 Fax +91 44 37188811 c.v.shivkumar@seweurodriveindia.com

Ireland			
Sales **Service**	**Dublin**	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 info@alperton.ie http://www.alperton.ie

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il

Italy			
Assembly **Sales** **Service**	**Solaro**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Tel. +39 02 96 9801 Fax +39 02 96 799781 http://www.sew-eurodrive.it sewit@sew-eurodrive.it

Ivory Coast			
Sales	**Abidjan**	SICA Société industrielle & commerciale pour l'Afrique 165, Boulevard de Marseille 26 BP 1115 Abidjan 26	Tel. +225 21 25 79 44 Fax +225 21 25 88 28 sicamot@aviso.ci

Japan			
Assembly **Sales** **Service**	**Iwata**	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373855 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp

Kazakhstan			
Sales	**Almaty**	ТОО "СЕВ-ЕВРОДРАЙВ" 050061, Республика Казахстан г.Алматы, пр.Райымбека, 348	Тел. +7 (727) 334 1880 Факс +7 (727) 334 1881 http://www.sew-eurodrive.kz sew@sew-eurodrive.kz

Latvia			
Sales	**Riga**	SIA Alas-Kuul Katlakalna 11C LV-1073 Riga	Tel. +371 6 7139253 Fax +371 6 7139386 http://www.alas-kuul.com info@alas-kuul.com

Lebanon			
Sales	**Beirut**	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 510 532 Fax +961 1 494 971 ssacar@info.com.lb
	Beirut	Middle East Drives S.A.L. (offshore) Sin El Fil. B. P. 55-378 Beirut	Tel. +961 1 494 786 Fax +961 1 494 971 info@medrives.com http://www.medrives.com

Lithuania			
Sales	**Alytus**	UAB Irseva Statybininku 106C LT-63431 Alytus	Tel. +370 315 79204 Fax +370 315 56175 info@irseva.lt http://www.sew-eurodrive.lt

Luxembourg			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.lu info@caron-vector.be

Malaysia			
Assembly **Sales** **Service**	**Johore**	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my

Mexico			
Assembly **Sales** **Service**	**Quéretaro**	SEW-EURODRIVE MEXICO SA DE CV SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Quéretaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx

Morocco			
Sales	**Casablanca**	Afit Route D'El Jadida KM 14 RP8 Province de Nouaceur Commune Rurale de Bouskoura MA 20300 Casablanca	Tel. +212 522633700 Fax +212 522621588 fatima.haquiq@premium.net http://www.groupe-premium.com

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 http://www.vector.nu info@vector.nu

New Zealand			
Assembly **Sales** **Service**	**Auckland**	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 24 10 20 Fax +47 69 24 10 40 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Peru			
Assembly **Sales** **Service**	**Lima**	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe

Poland			
Assembly **Sales** **Service**	**Lodz**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 PL-92-518 Łódź	Tel. +48 42 676 53 00 Fax +48 42 676 53 45 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl
	24 Hour Service		Tel. +48 602 739 739 (+48 602 SEW SEW) serwis@sew-eurodrive.pl

Portugal			
Assembly **Sales** **Service**	**Coimbra**	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt

Romania			
Sales **Service**	**Bucharest**	Sialco Trading SRL str. Madrid nr.4 011785 Bucuresti	Tel. +40 21 230-1328 Fax +40 21 230-7170 sialco@sialco.ro

Russia			
Assembly **Sales** **Service**	**St. Petersburg**	ZAO SEW-EURODRIVE P.O. Box 36 195220 St. Petersburg Russia	Tel. +7 812 3332522 +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 338 494 770 Fax +221 338 494 771 senemeca@sentoo.sn http://www.senemeca.com

Serbia			
Sales	**Beograd**	DIPAR d.o.o. Ustanicka 128a PC Košum, IV floor SCG-11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 office@dipar.rs

Singapore			
Assembly **Sales** **Service**	**Singapore**	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644	Tel. +65 68621701 Fax +65 68612827 http://www.sew-eurodrive.com.sg sewsingapore@sew-eurodrive.com

Slovakia			
Sales	**Bratislava**	SEW-Eurodrive SK s.r.o. Rybničná 40 SK-831 06 Bratislava	Tel. +421 2 33595 202 Fax +421 2 33595 200 sew@sew-eurodrive.sk http://www.sew-eurodrive.sk
	Žilina	SEW-Eurodrive SK s.r.o. Industry Park - PChZ ulica M.R.Štefánika 71 SK-010 01 Žilina	Tel. +421 41 700 2513 Fax +421 41 700 2514 sew@sew-eurodrive.sk
	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-974 11 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk
	Košice	SEW-Eurodrive SK s.r.o. Slovenská ulica 26 SK-040 01 Košice	Tel. +421 55 671 2245 Fax +421 55 671 2254 sew@sew-eurodrive.sk

Slovenia			
Sales **Service**	**Celje**	Pakman - Pogonska Tehnika d.o.o. UI. XIV. divizije 14 SLO - 3000 Celje	Tel. +386 3 490 83-20 Fax +386 3 490 83-21 pakman@siol.net

South Africa			
Assembly **Sales** **Service**	**Johannesburg**	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 494-3104 http://www.sew.co.za info@sew.co.za
	Cape Town	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442 Cape Town	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 cfoster@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaco Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 cdejager@sew.co.za
	Nelspruit	SEW-EURODRIVE (PTY) LTD. 7 Christie Crescent Vintonia P.O.Box 1942 Nelspruit 1200	Tel. +27 13 752-8007 Fax +27 13 752-8008 robermeyer@sew.co.za

South Korea			
Assembly **Sales** **Service**	**Ansan-City**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate 1048-4, Shingil-Dong Ansan 425-120	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master.korea@sew-eurodrive.com
	Busan	SEW-EURODRIVE KOREA Co., Ltd. No. 1720 - 11, Songjeong - dong Gangseo-ku Busan 618-270	Tel. +82 51 832-0204 Fax +82 51 832-0230 master@sew-korea.co.kr

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es

Sweden			
Assembly **Sales** **Service**	**Jönköping**	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Tel. +46 36 3442 00 Fax +46 36 3442 80 http://www.sew-eurodrive.se jonkoping@sew.se

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch

Thailand			
Assembly **Sales** **Service**	**Chonburi**	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 79 40 88 77 Fax +216 79 40 88 66 tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 / 4419164 Fax +90 216 3055867 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

Ukraine			
Sales **Service**	**Dnepropetrovsk**	SEW-EURODRIVE Str. Rabochaja 23-B, Office 409 49008 Dnepropetrovsk	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua

USA			
Production **Assembly** **Sales** **Service** **Corporate Offices**	**Southeast Region**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manufacturing +1 864 439-9948 Fax Assembly +1 864 439-0566 Fax Confidential/HR +1 864 949-5557 http://www.seweurodrive.com cslyman@seweurodrive.com

USA			
Assembly **Sales** **Service**	**Northeast Region**	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Midwest Region	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 332-0038 cstroy@seweurodrive.com
	Southwest Region	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Western Region	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. +1 510 487-3560 Fax +1 510 487-6433 cshayward@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 http://www.sew-eurodrive.com.ve ventas@sew-eurodrive.com.ve sewfinanzas@cantv.net

Index




SEW-EURODRIVE
Driving the world

SEW-EURODRIVE GmbH & Co KG
P.O. Box 3023
D-76642 Bruchsal/Germany
Phone +49 7251 75-0
Fax +49 7251 75-1970
sew@sew-eurodrive.com

➞ **www.sew-eurodrive.com**