SEW EURODRIVE

# Manual



## MOVIDRIVE® MDX61B

"DriveSync via Fieldbus" Application

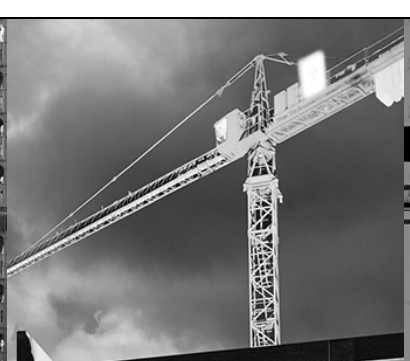
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# 1 General Information

## 1.1 Use of the manual

The manual is part of the product and contains important information. The manual is for everyone working with 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 with the software and the connected units from SEW-EURODRIVE, have read through the manual carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

## 1.2 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 warranty

You must observe this manual as the prerequisite for fault-free operation and fulfillment of any right to claim under warranty. Therefore, read the documentation before you start working with the software and the connected units from SEW-EURODRIVE.

Make sure that the documentation is available to persons responsible for the machinery and its operation as well as to persons who work independently on the devices. You must also ensure that the documentation is legible.

## 1.4 Exclusion of liability

You must observe this manual and the documentation of the connected devices from SEW-EURODRIVE to ensure safe operation 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 the documentation. In such cases, any liability for defects is excluded.

## 1.5 Copyright

© 2010 - SEW-EURODRIVE. All rights reserved.

Copyright law prohibits the unauthorized duplication, modification, distribution, and use of this document, in whole or in part.

## 1.6 Applicable documentation

Observe the following applicable documentation:

- "MOVIDRIVE® MDX60B/61B" operating instructions

# 2 Safety Notes

## 2.1 General information

The following basic safety notes must be read carefully to prevent injury to persons and damage to property. The operator must ensure that the basic safety notes are read and observed. Ensure that persons responsible for the machinery and its operation as well as persons who work independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, please contact SEW-EURODRIVE.

The following safety notes refer to the use of the software. Also take into account the supplementary safety notes in the individual sections of this manual and in the documentation of the connected devices from SEW-EURODRIVE.

Read through this manual carefully before you begin working with the software.

This document does not replace detailed operating instructions of the connected devices. This manual assumes that the user has access to and is familiar with the documentation for all connected units from SEW-EURODRIVE.

## 2.2 Designated use

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

The "DriveSync via fieldbus" application module must only be used in connection with MOVIDRIVE® MDX61B as application variant (0T) with the corresponding fieldbus interfaces.

## 2.3 Target group

Any work with the used software may only be performed by adequately qualified personnel. Qualified personnel in this context are persons who have the following qualifications:

- Appropriate instruction.
- Knowledge of this documentation and other applicable documentation.
- SEW-EURODRIVE recommends additional product training for the products which are operated with this software.

In addition to that, they must be familiar with the relevant safety regulations and laws, especially with the requirements of the performance levels according to DIN EN ISO 13849-1 and all other standards, directives and laws specified in this documentation. The persons mentioned must have the authorization expressly issued by the company, to operate, program, configure, label and ground units, systems and circuits in accordance with the standards of safety technology.

All work in further areas of transportation, storage, operation and waste disposal must only be carried out by persons who are trained appropriately.

## 2.4 Bus systems

A bus system makes it possible to adapt frequency inverters and/or motor starters to the particulars of the machinery within wide limits. There is the risk that a change of parameters that cannot be detected externally can result in unexpected, though not uncontrolled, system behavior.

## 2.5 Operating mode "synchronous operation"

The motion controller in synchronous operation processes setpoint changes at the master drive. Set the application module in such a way that an unintended motor start is not possible.

The following measures increase operational safety:

- Deactivating the synchronous operation mode
  - when warnings or errors occur within the sync group or when the drives are not ready for operation
  - when the sync group has been stopped
- Selecting the synchronous operation mode with querying the "ready for operation" message and the "technology options" operating status of all drives.
- If an absolute position reference is required, arrange the individual drives in the positioning operation mode (no offset control).

# 3 System Description

## *3.1 Areas of application*

The "DriveSync via fieldbus" application module makes it possible to implement conveyor systems and machinery with drives that have to move at a synchronous angle occasionally or permanently.

The program can be used for the master drive and the slave drive. The master works in the "Jog" and "Positioning" operating modes, for example, while the slave drives are operated in "synchronous operation" mode.

If the "Synchronous operation" mode is deselected for the slave drives, they can be operated with free-running in "Jog" and "Positioning" operating modes.

**The "DriveSync via fieldbus" application offers the following advantages:**

- One program for the master and slave drive.
- Guided startup and extensive diagnostics functions.
- High degree of similarity with the "Extended positioning via bus" application module.
- The selected IPOS encoder source (X13, X14, DIP) is also effective in synchronous operation.
- The master value for "synchronous operation" mode can be adjusted.
- A mechanical vertical shaft can be replaced by transferring the virtual master value via an SBus connection.
- Endless rotary movements can be implemented by the modulo function.

**Features of synchronous operation:**

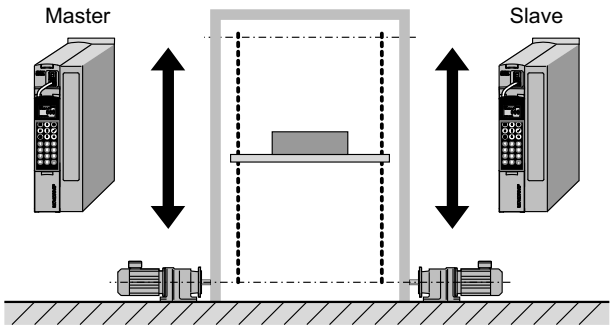
- The electrical connection of the master/slave can be made using the X14 connection or an SBus connection.
- The contents of the send object can be adjusted when the SBus connection is used. For example, the value of any IPOS$^{plus®}$ variable can be transferred instead of the IPOS$^{plus®}$ variable of the master drive.
- Time or position-related sequence of motion for synchronization procedures.
- The engaging process can also be started with interrupt control.

## 3.2 Application examples

The "DriveSync via fieldbus" application module offers a wide range of possible applications. Some examples are given in this section.

### 3.2.1 Finite (linear) movement of the master and slave axis

Example 1: Hoist



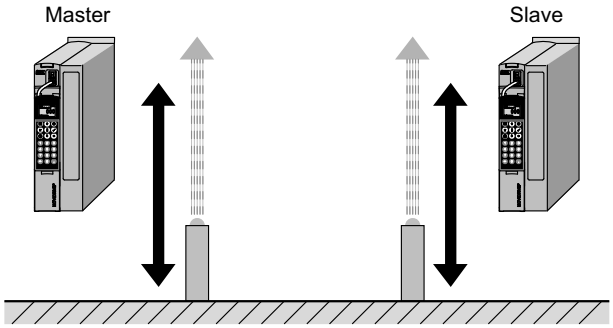

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- Master axis: Linear axis

  Operating mode: Positioning mode
- Slave axis: Linear axis

  Operating mode: Synchronous operation

Example 2: Gantry crane with slip compensation through absolute encoder evaluation




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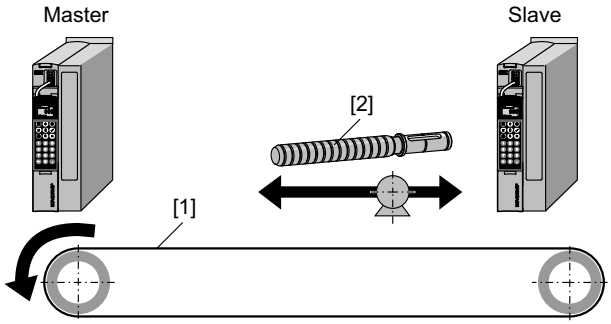
- Master axis: Linear axis

  Operating mode: Positioning mode using additional absolute encoder (IPOS encoder)
- Slave axis: Linear axis

  Operating mode: Synchronous operation using an additional absolute encoder
- Master value: Master position (absolute value encoder position) is transferred via SBus
- Features: Slip between motor and absolute encoder is compensated by the firmware. Additional performance is achieved by controlling the master and slave axis using the virtual encoder. Both drives are controlled in "Synchronous operation" mode for this purpose. The master drive is started with the master value "virtual encoder" and transfers the setpoint position to the slave drive via SBus.

### 3.2.2 Finite (linear) movement of the slave axis and infinite movement of the master axis

Example 3: Belt drive with embossing punch (flying saw)




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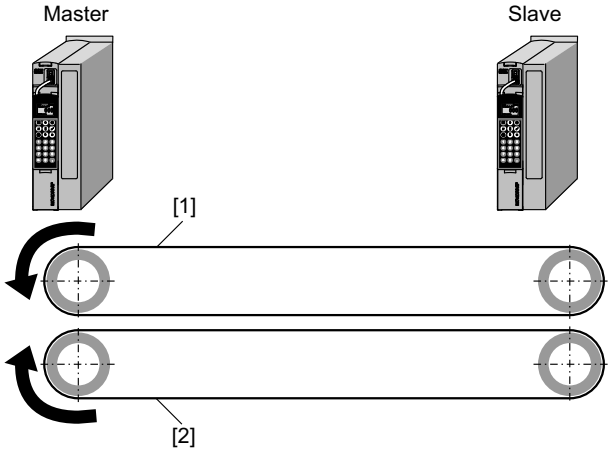
- Master axis: Belt drive [1]

  Operating mode: Speed specification, i.e. jog mode
- Slave axis: Spindle drive [2]

  Operating mode: Synchronous operation forward; Start cycle via interrupt event. Once a certain actual position has been reached, the operating mode changes to "Positioning mode".
- Features: Interrupt-controlled engaging

### 3.2.3 Finite movements with master and slave axes

Example 4: Caterpillar drive with position reference (360°)



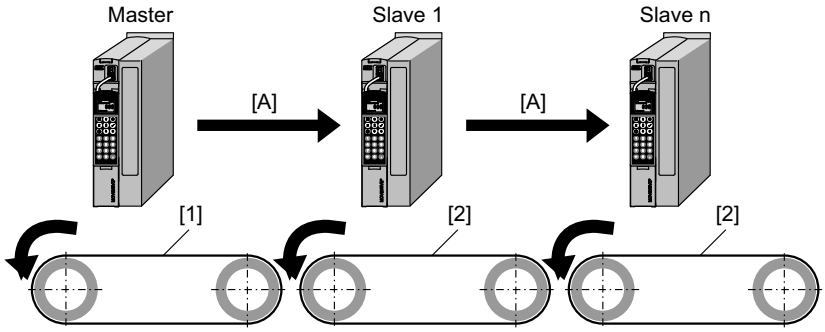

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- Master axis: Belt drive [1]

  Operating mode: Positioning mode with position specified in modulo format
- Slave axis: Belt drive [2]

  Operating mode: Synchronous operation with feedback in modulo format
- Features: Retained position reference due to modulo function with infinite division factors of the gear ratio (i gear unit).

Example 5: Electronic replacement of the mechanical vertical shaft.




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- Master axis: Belt drive [1]

  Operating mode: Synchronous operation with master value transfer to the subsequent slaves via SBus object.

- Slave axis: Belt drive [2]

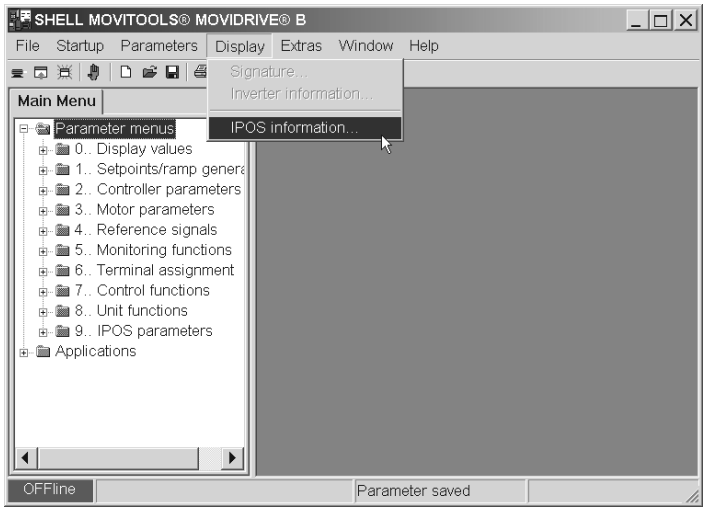
  Operating mode: Synchronous operation

  Fluctuating actual speeds of the master drive are not transferred to the subsequent slave drives because the virtual master encoder position is transferred.

## 3.3 Program identification

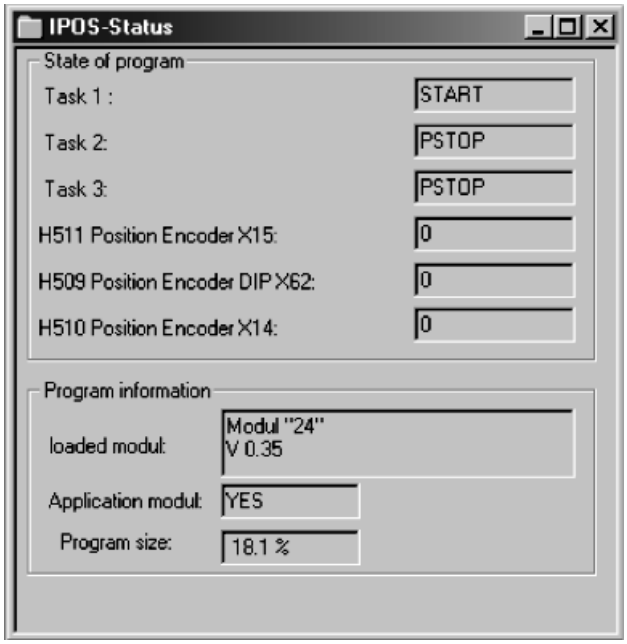
You can use the MOVITOOLS® software package to identify which application program was last loaded into the MOVIDRIVE® MDX61B unit. Proceed as follows:

- Connect MOVIDRIVE® to the PC via the serial port.
- Start MOVITOOLS®.
- In MOVITOOLS®, start the program "Shell".
- In the Shell program, choose [Display] / [IPOS Information...].




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- The "IPOS status" window appears. The entries in this window tell you which application software is stored in MOVIDRIVE® MDX61B.




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# 4 Project Planning

## 4.1 Prerequisites

### 4.1.1 PC and software

The "DriveSync via fieldbus" application module is implemented as an IPOS$^{plus®}$ program and forms part of the SEW MOVITOOLS® software package from version 4.30. In order to use MOVITOOLS®, you must have a PC with one of the following operating systems: Windows® 95, Windows® 98, Windows® NT 4.0, Windows® XP, or Windows® 2000.

### 4.1.2 Inverters, motors and encoders

- **Inverter**

  The application module is controlled via fieldbus with 6 process data words and can only be implemented with MOVIDRIVE® MDX61B units in application version (...0T).

- **Motors and encoders**

  All motors with a connected motor encoder are supported.

### 4.1.3 Possible combinations

- MOVIDRIVE® MDX61B with the following fieldbus interfaces

| | **Connection of motor shaft and load** | | |
|---|---|---|---|
| | **Interlocking: External encoder is not required** | **Non-positive: External encoder required** | |
| Encoder type (external encoder) | - | Incremental encoder | Absolute encoder |
| Bus type (required option) | PROFIBUS (DFP) / INTERBUS (DFI) / CAN bus (DFC) / DeviceNet (DFD) / Ethernet (DFE) / system bus (SBus) no option required | | |
| Additional MOVIDRIVE® option required | DEH11B or DER11B | | DIP11B / DEH11B / DER11B |

### 4.1.4 Additional notes

- The source of the actual position is the motor encoder. In systems subject to slip, an external encoder can additionally be fitted or an absolute encoder can be used in combination with the "DIP11B absolute encoder card" option.
- If operated with asynchronous motors, the drive inverter must be started up in the "CFC & IPOS" operating mode.
- If operated with synchronous servomotors, the drive inverter must be started up in the "SERVO & IPOS" operating mode.
- In the "VFC n-control & IPOS" operating mode, the master and slave drives must not be connected via SBus.

## 4.2 Functional description

### 4.2.1 Functional characteristics

The "DriveSync via fieldbus" application offers 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 via fieldbus.

- **Referencing mode**

  Reference travel is started with the start signal. Reference travel establishes the reference point (machine zero) for absolute positioning operations. The axis must be referenced for selecting "positioning mode".

- **Positioning mode**

  The machine control specifies the target position via process output data words PO2 and PO3. The speed and the ramp can be varied using the fieldbus. The current actual position is reported back via process input data words PI2 and PI3.

  The program cyclically queries the target position so that position changes are possible during positioning. Positioning is only performed when the axis has been referenced.

- **Synchronous operation**

  "Synchronous mode" is motion control based on the technology function "Internal synchronous operation" (ISYNC).

  After "synchronous operation" has been selected, the engaging process is started by a engaging event that is defined during the startup procedure. Once the slave drive has been synchronized with the master, the slave moves synchronously with the master.

  Synchronous operation is exited by resetting the “start bit” or deselecting "synchronous operation".

  "Synchronous operation" can be started without prior reference travel.

  In addition, a bus offset value (PO6) can be specified in synchronous mode to shift the reference to the master axis without having to exit the operating mode.

### 4.2.2 Additional startup functions

You can choose the following additional functions at startup:

- **Encoder in positioning mode (IPOS encoder source)**
  - Positive connection:

    The incremental encoder, sin/cos encoder, or Hiperface® encoder can be connected to terminal X15 of the DEH11B / DER11B option.
  - Non-positive connection:

    An encoder for slip compensation can be connected to terminal X14 of the DEH11B / DER11B option in addition to the motor encoder. Alternatively, slip can be compensated via the evaluation of an SSI absolute encoder (requires absolute encoder card DIP11B option).
- **Selecting the master drive source in "synchronous operation"**
  - Incremental encoder input X14 of the DEH11B / DER11B option for reading in the master encoder value (is not allowed to be used if the input is already being used as an IPOS encoder source).
  - Simulation with the virtual master encoder. Variable specification of the position, speed as well as acceleration via process output data words PO2 to PO5.
  - Received "SBus data object" with read-in master encoder actual value of the master drive. For example, each application module can operate as master and transfer the specified IPOS encoder source via SBus.
- **Control via fieldbus**
  - Fieldbuses with communication via 6 process data words (PROFIBUS, INTERBUS, DeviceNet, CANopen, Ethernet, SBus 2) are supported.
- **Special function "positioning in modulo format" for endless movements**
  - Positioning can be in modulo format for endless movements (e.g. conveyor belts). As a result, it is possible to achieve endless movements without losing the position reference to the reference position.
  - The modulo travel range is limited to 0 ... < 360°
  - The modulo travel strategy can be changed as follows in positioning mode:

    Jog + = FALSE and Jog – = FALSE

    The setpoint position is always reached on the "shortest route".

    Jog+ = TRUE and Jog– = FALSE

    The setpoint position is always reached by traveling "clockwise".

    Jog+ = FALSE and Jog– = TRUE

    The setpoint position is always reached by traveling "counterclockwise".

## 4.3 Scaling of the drive

The controller must be able to detect the number of encoder pulses (increments) per travel unit to position the drive. The scaling function is used to set a user unit suitable to the application.

### 4.3.1 Drive without external encoder (positive connection)

In drives without an external encoder, the system can calculate the scaling automatically **during startup** of the application module. Enter the following data:

- Diameter of the drive wheel ($d_{drive\ wheel}$) or slope of the spindle ($s_{spindle}$)
- Gear ratio of the gear unit ($i_{gear\ unit}$ speed-reduction)
- Gear ratio of the additional gear ($i_{additional\ gear}$ speed-reduction)

The following scaling factors are calculated:

- Pulses / distance scaling factor [inc/mm] using the formula:

  Pulses = $4096 \times i_{gear\ unit} \times i_{additional\ gear}$

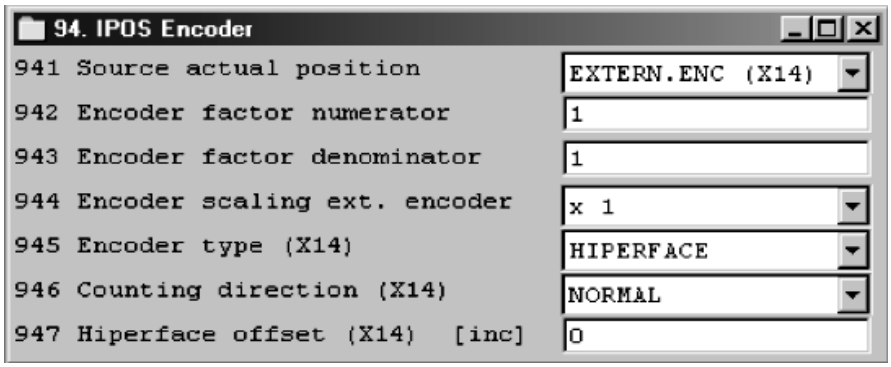
  Distance = $\pi \times d_{drive\ wheel}$ or $\pi \times s_{spindle}$
- Speed scaling factor

  Numerator factor in [rpm] and denominator value in "speed units".

You can also enter the distance and velocity scaling factors directly. If you enter a unit other than [mm] or [1/10 mm] for the travel unit, this user unit will also be used for the position of the software limit switches, the reference offset and the maximum travel distances.

### 4.3.2 Drive with external encoder (non-positive connection)

In this case, you must have activated and scaled the external encoder **before starting up** the "DriveSync via fieldbus" application module. To do so, make the following settings in the Shell program **before** starting up the "DriveSync via fieldbus" application module.




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- P941 Source actual position

  If an incremental encoder or an absolute encoder (DIP11) is connected, set P941 to "EXT. ENCODER (X14)". You can also make this setting during the startup procedure of the application module.

- P942 Encoder factor numerator / P943 Encoder factor denominator / P944 Encoder scaling ext. Encoder

Calculation of the scaling is blocked during startup of the application module.

**INFORMATION**

- For more information about scaling an external encoder, refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual.
- When using an absolute encoder, note the startup instructions in the "MOVIDRIVE® MDX61B Absolute Encoder Card DIP11B" manual.

## 4.4 Limit switches, reference cams and machine zero

Note the following points during project planning:

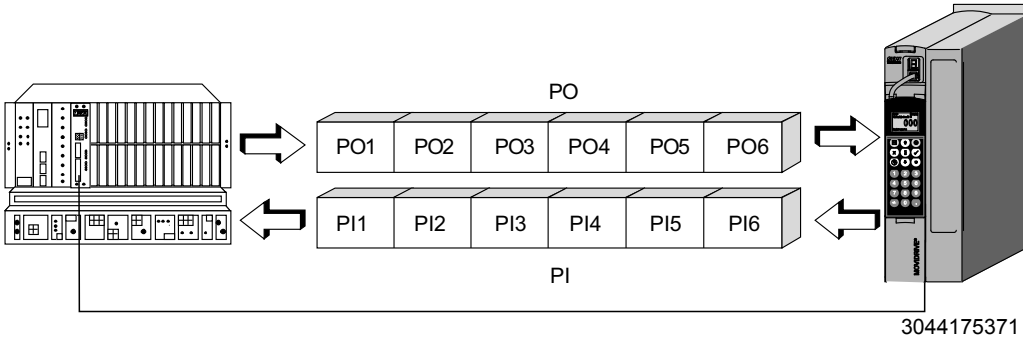
- The software limit switches must be located within the travel range of the hardware limit switches.
- When defining the reference position (position of the reference cam) and the software limit switches, make sure they **do not** overlap. Error message F78 "IPOS SW limit switch" is generated in the event of an overlap during referencing.
- You can enter a reference offset during startup if you do not want the machine zero to be 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.

**INFORMATION**

Please also refer to the information in chapter "Software limit switches".

## *4.5 Process data assignment*

The machine control (PLC) sends 6 process output data words (PO1 – PO6) to the inverter and receives 6 process input data words (PI1 – PI6) from the inverter.

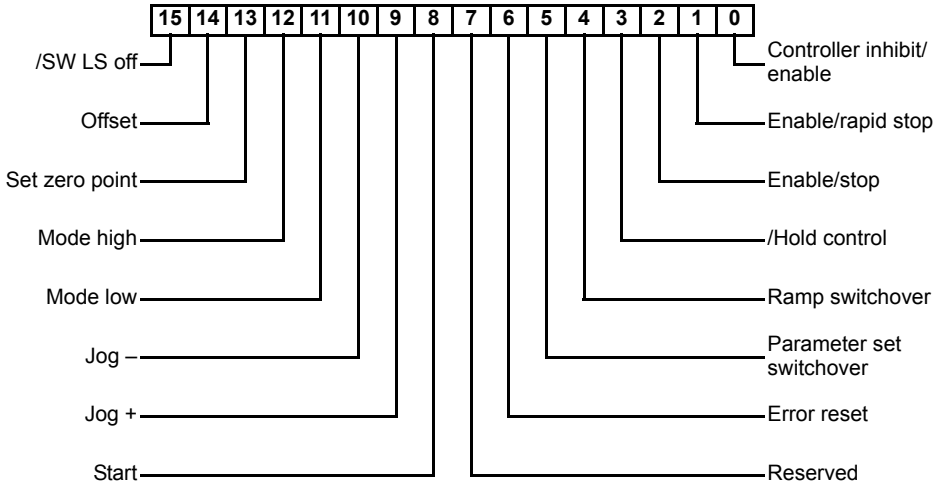



PO= Process output data
PO1 = Control word 2
PO2 = Target position high
PO3 = Target position low
PO4 = Setpoint speed (IPOS PO data)
PO5 = Acceleration and deceleration ramp (IPOS PO data)
PO6 = Offset (IPOS PO data)
PI= Process input data
PI1 = Status word (IPOS PI data)
PI2 = Actual pos. high (IPOS PI data)
PI3 = Actual pos. low (IPOS PI data)
PI4 = Actual speed (IPOS PO data)
PI5 = Master/slave position difference (IPOS PI data)
PI6 = Active current (IPOS PI data)

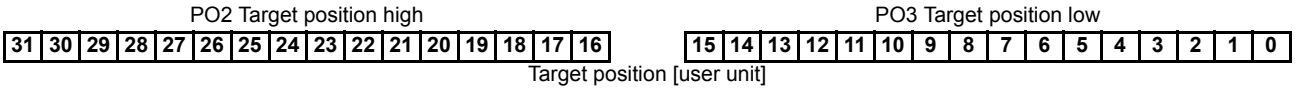
### 4.5.1 Process output data

The process output data words are assigned as follows:

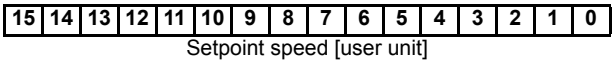
- PO1: Control word 2



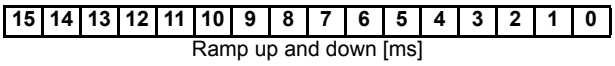

- PO2 + PO3: Target position



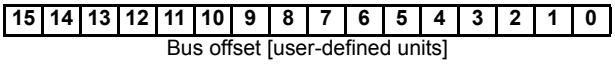

- PO4: Setpoint speed




- PO5: Ramp up and down



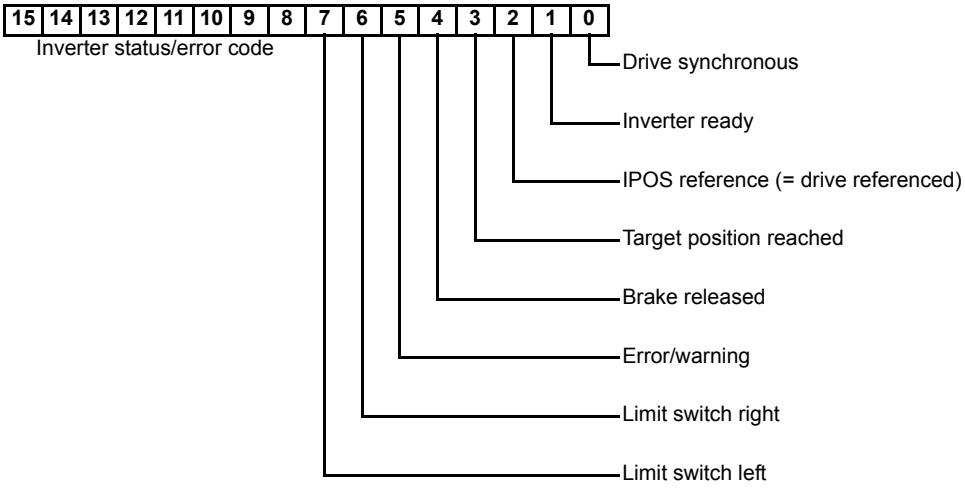

- PO6: Offset



### 4.5.2 Process input data

The process input data words are assigned as follows:

- PI1: Status word



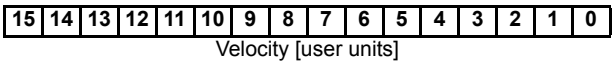

**INFORMATION**

The fault code is displayed in the high byte (bits 8 to 15) of the status word if bit 5 "Fault/warning" is set. If there is no fault, the current unit status is displayed in the high byte of the status word.

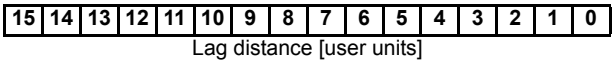
- PI2 + PI3: Actual position



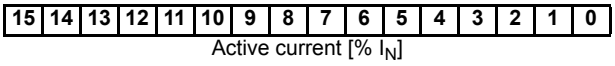

- PI4: Actual speed




- PI5: Master/slave position difference




- PI6: Active current



## 4.6 Software limit switches

### 4.6.1 General information

The "software limit switch" monitoring function is used to ensure that the target position is set to appropriate values. During this process, it is not important where the drive is positioned. Unlike 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. The software limit switches are active when the axis is referenced; that is, when the bit "IPOS reference" is set in PI1.

**INFORMATION**

The "software limit switch" monitoring function is disabled in **synchronous mode**.

### 4.6.2 Moving clear of the software limit switches

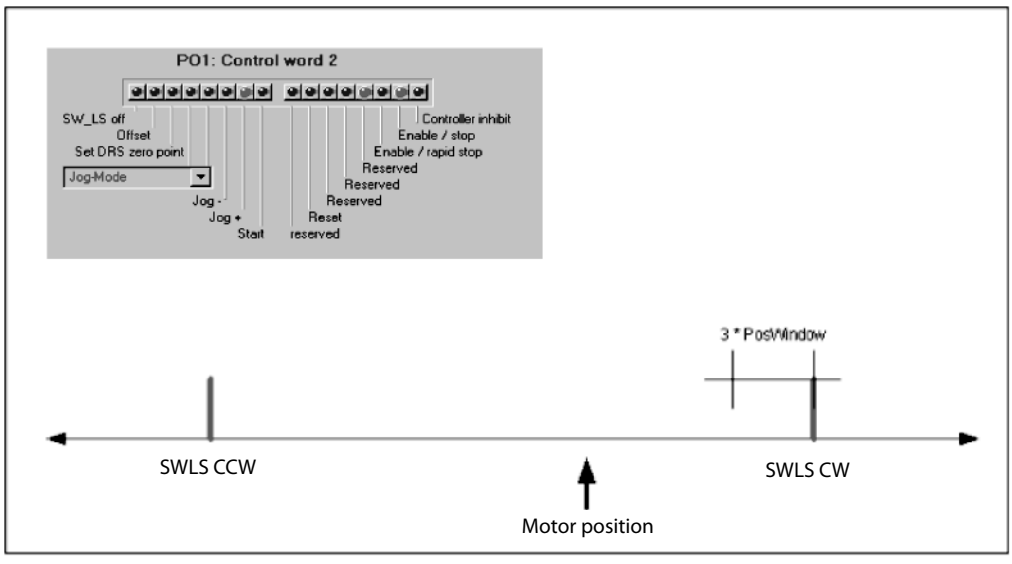
When using an absolute encoder or multi-turn Hiperface® encoder it may be necessary for the drive to be moved within the range of the software limit switches (for example, after an encoder has been replaced). For this purpose, Bit 15 in the process output data word 1 (PO1) is set to "/SWLS" (= Moving clear of the software limit switches).

Bit 15 "/SWLS" is only available in "jog mode" and "referencing mode". If bit 15 is set, the drive can be moved out of the valid positioning range into the area of the software limit switches (→ example 3).

*Case no. 1*

It is necessary to differentiate between the following three examples:

- Requirements:
  - Bit 15 "/SWLS" in the process output data word 1 (PO1) is not set.
  - Drive is within valid positioning area.
  - Software limit switch monitoring function is active.




3044199819

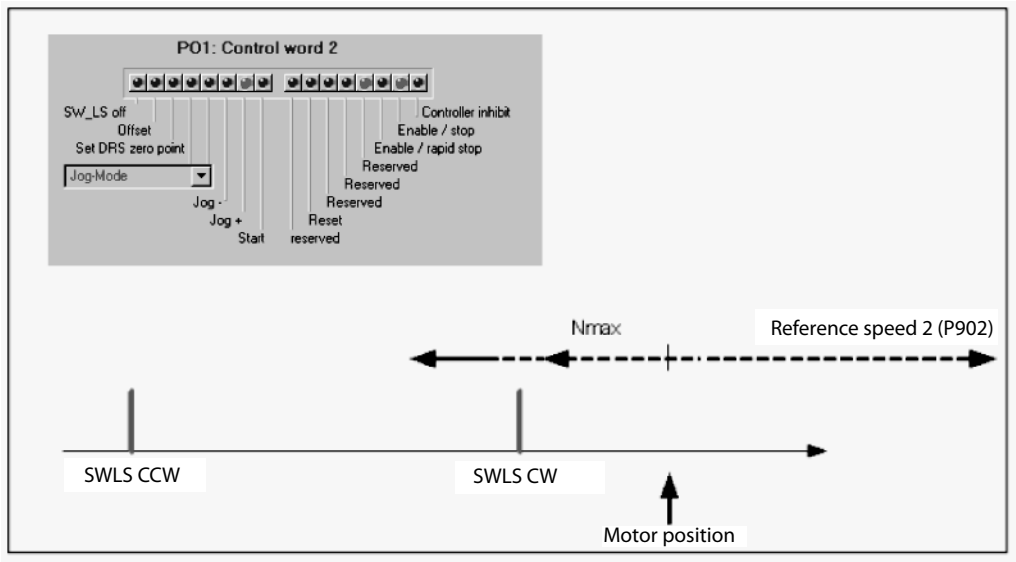
In **jog mode**, the drive runs until it is three position windows (P922) before the software limit switch and then stays there.

In **positioning mode**, the drive can be positioned up to the software limit switches but not beyond.

In **referencing mode**, the software limit switches are not active, which means the drive can move past the software limit switches during reference travel.

*Case no. 2*

- Requirements:
  - Bit 15 "/SWLS" in the process output data word 1 (PO1) is not set.
  - The drive is outside the software limit switches.




3044204811

The following error message appears once the drive is enabled:




3044227851

Click <Reset> to acknowledge the error message. The monitoring function is deactivated. For example, if the drive is right to the software limit switch (see above figure), the drive can be moved at two different velocities depending on the specified direction of the motor rotation:

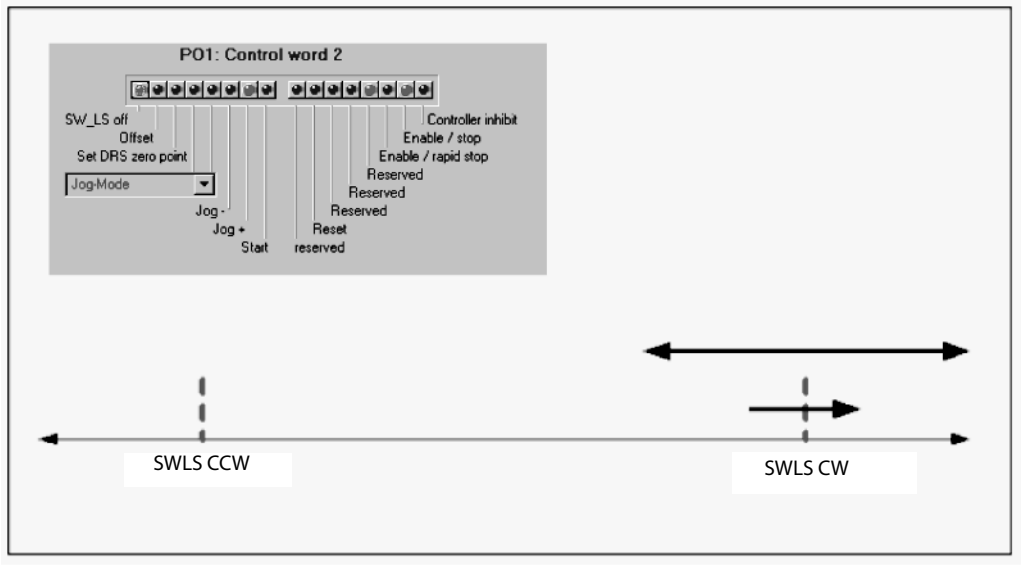
- Closer toward the travel range of the software limit switch at reference speed 2 (P902).
- Away from the travel range of the software limit switches at maximum speed.

The monitoring function is reactivated when:

- The actual position of the drive set using P941 enters the permitted positioning range again.
- A positioning job is issued via the opposite software limit switch.
- The unit is switched off and on again.

*Case no. 3*

- Requirement:
  - Bit 15 "/SWLS" in the process output data word 1 (PO1) is set.




3044210443

The monitoring function is deactivated in the modes "jog" and "referencing". The drive can be moved within the travel area of the software limit switches and from the valid positioning range into the area of the software limit switches without an error message being generated. The speed can be varied.



**⚠ WARNING**

Risk of crushing if the motor starts coasting.

Severe or fatal injuries.

- You must not change the monitoring function of the software limit switches (PO1, Bit 15 "/SWLS") during operation (i.e. when the axis is in motion).
- Observe startup notes.

## *4.7 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 "Safe stop active" state is indicated by a "U" in the 7-segment display. In the application module, this state is treated in the same way as the "CONTROLLER INHIBIT" state.

**INFORMATION**

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 MOVITOOLS® software

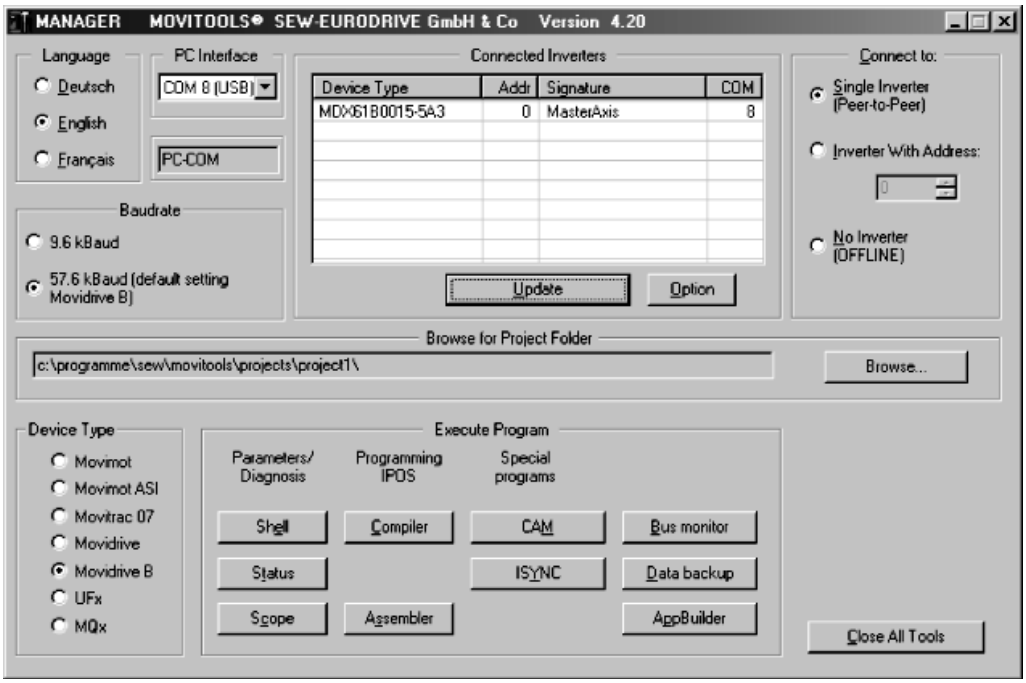
### 5.1.1 MOVITOOLS®

The "DriveSync via fieldbus" application module is part of the MOVITOOLS® software (version 4.30 and higher). Proceed as follows to install MOVITOOLS® on your computer:

- Insert the MOVITOOLS® CD into the CD-ROM drive of your PC.
- The MOVITOOLS® setup menu is started. You will be guided through the installation process: Follow the instructions.

You can now use the Program Manager to start MOVITOOLS®. Proceed as follows to perform startup for the inverter using the MOVITOOLS® Manager:

- Select the language you want in the "Language" group.
- In the "PC COM" selection field, select the PC port (e.g. COM 1) to which the inverter is connected.
- In the "Device type" group, select "MOVIDRIVE B".
- In the "Baud rate" field, select the baud rate set on the basic unit with the DIP switch S13 (standard setting "57.6 kbaud").
- Click [Update] to display the connected inverter.

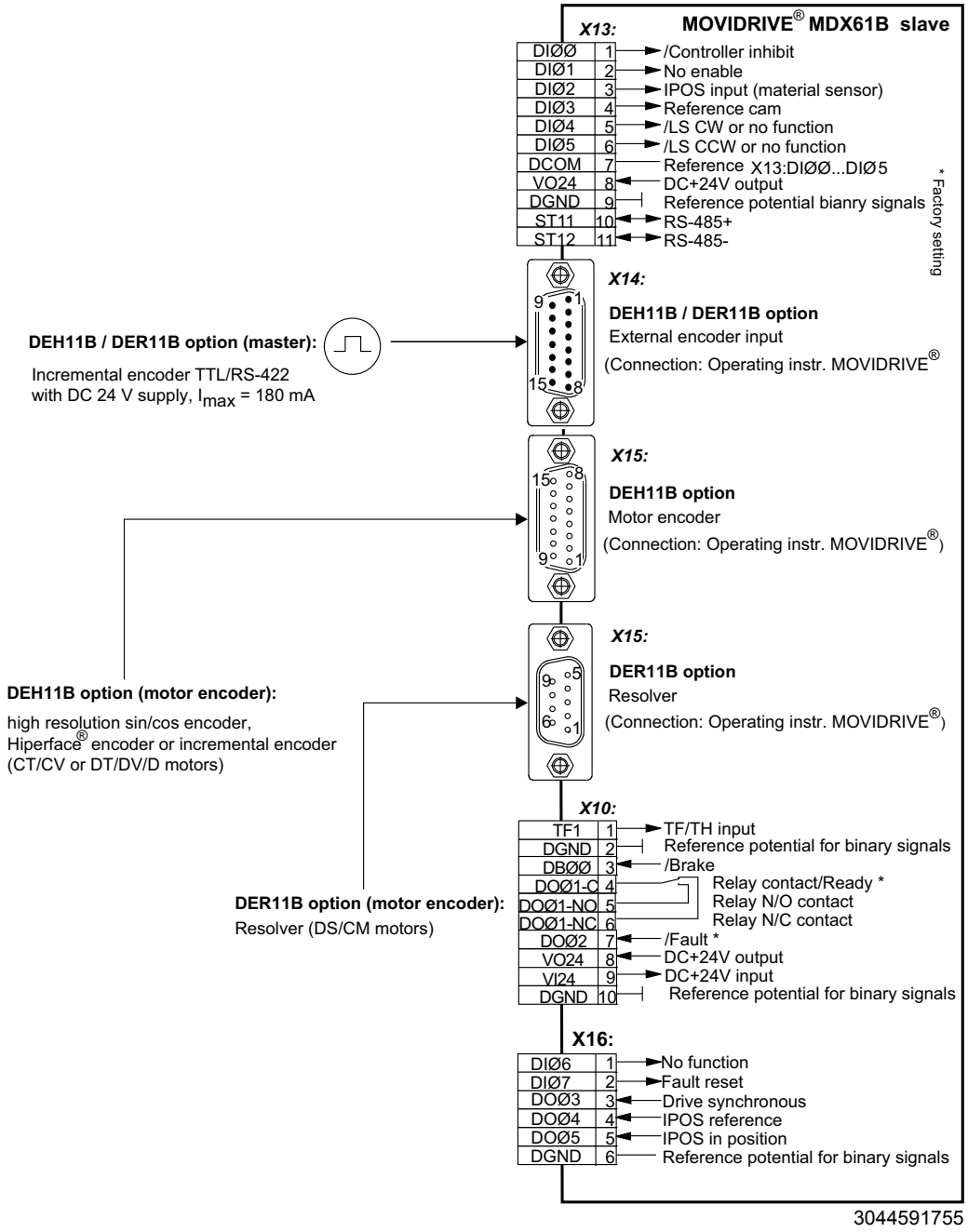



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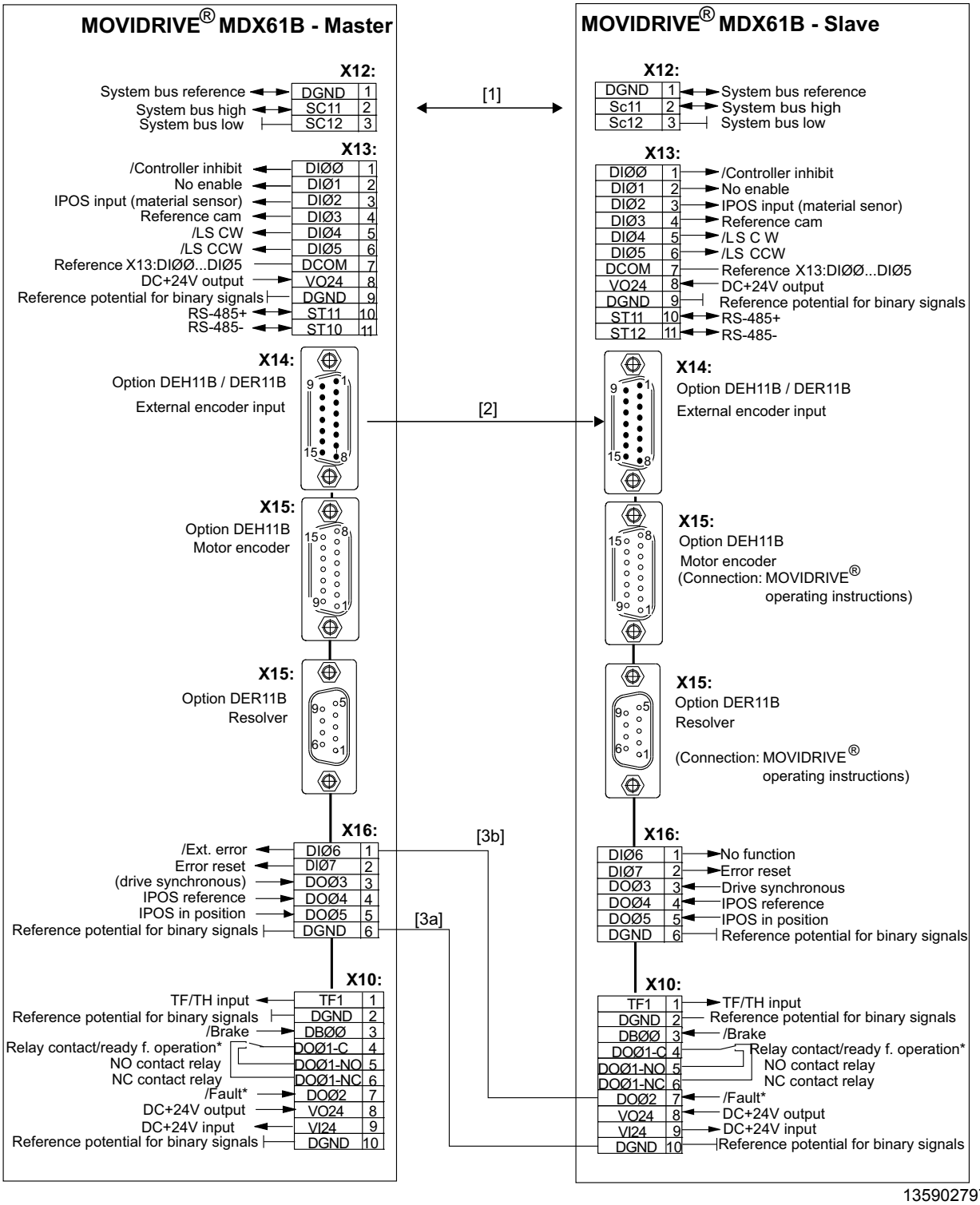
### 5.1.2 Application variant

The "DriveSync via fieldbus" application module can be used with the MOVIDRIVE® application variant (-0T). The application modules cannot be used on units in the standard version (-00).

## 5.2 Wiring diagram for incremental encoder master / MDX61B slave



## 5.3 Wiring diagram for MDX61B master / MDX61B slave




[1] Synchronous mode master value is transferred via SBus connection (e.g. with a number of slaves > 1)

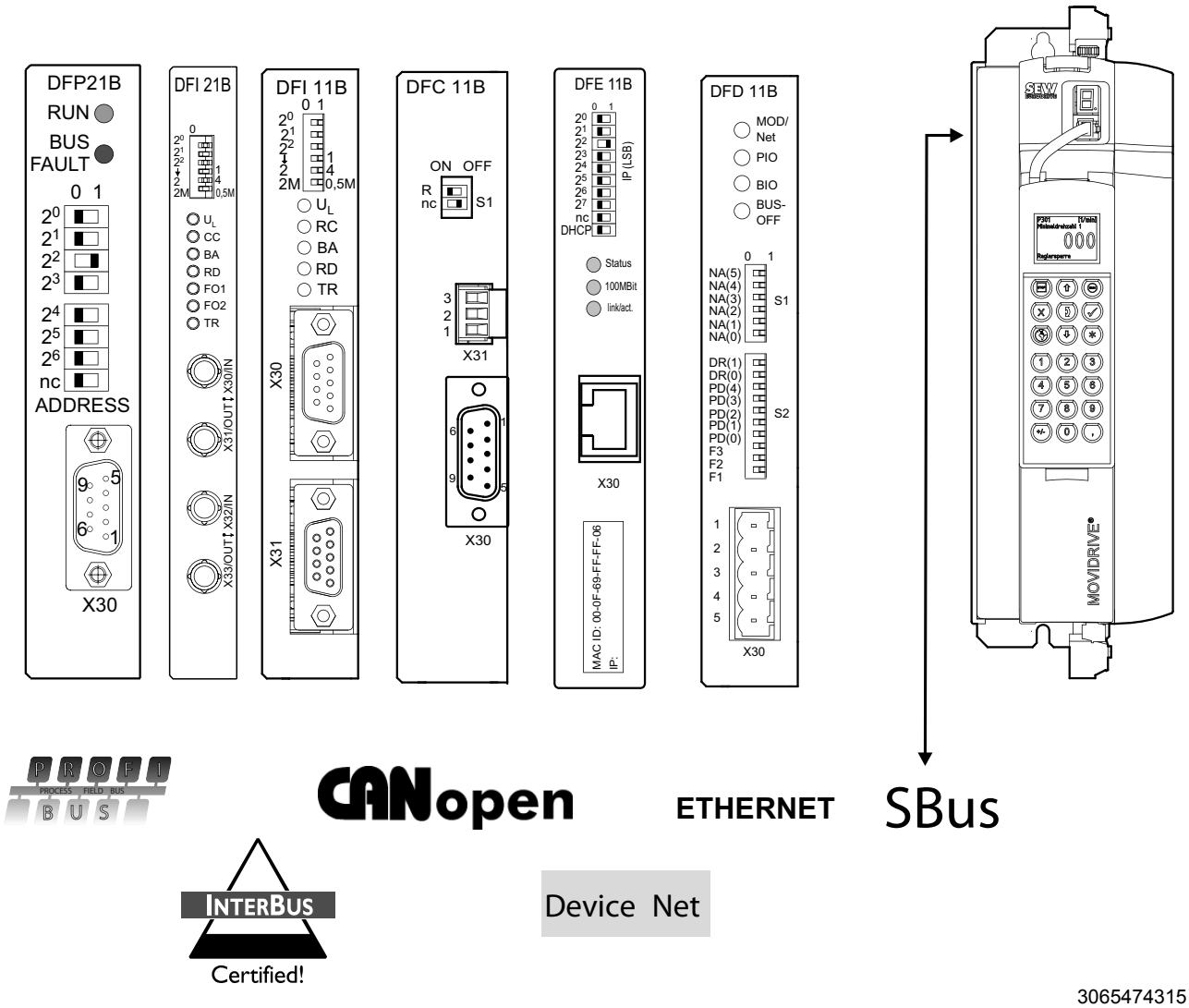
[2] Synchronous mode master value is transferred via DEH11B / DER11B option, X14

[3a, 3b] Wiring when using the "Immediate switch-off of the master drive in case of slave faults via (/ext. fault)" function

## 5.4 MOVIDRIVE® MDX61B bus installation

### 5.4.1 Overview

For bus installation, comply with the information in the relevant fieldbus manuals supplied with the fieldbus interfaces. Refer to the MOVIDRIVE® MDX60B/61B operating instructions for information on installing the system bus (SBus).

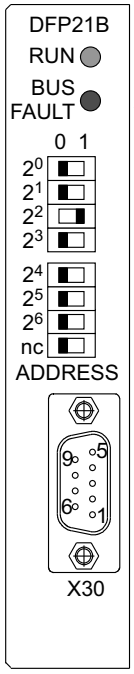



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### 5.4.2 PROFIBUS (DFP21B)

For more detailed information, refer to the "MOVIDRIVE® MDX61B Fieldbus Interface DFP21B PROFIBUS DP" manual. You can order this manual from SEW-EURODRIVE. You can download the unit master data files (GSD) and type files for MOVIDRIVE® MDX61B from the SEW homepage (under the heading "Software") to simplify startup.

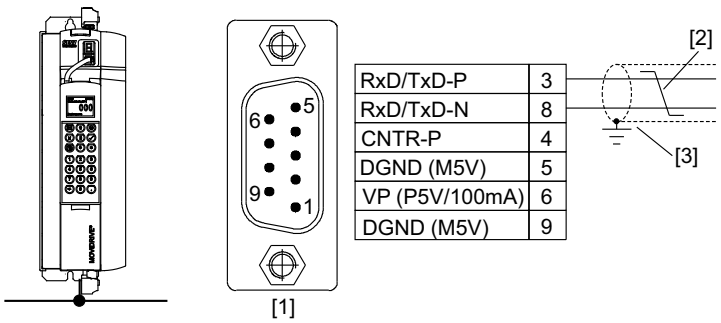
*Technical data*

| | Option | PROFIBUS type DFP21B fieldbus interface |
|---|---|---|
|  3065477643 | Part number | 824 240 2 |
| | Resources for startup and diagnostics | MOVITOOLS® software and DBG60B keypad |
| | Protocol variant | PROFIBUS DP and DP-V1 to IEC 61158 |
| | Supported baud rates | Automatic baud rate detection from 9.6 kBd – 12 MBd |
| | Connection | 9-pin D-sub socket<br>Assignment to IEC 61158 |
| | Bus termination | Not integrated, must be implemented in the PROFIBUS connector. |
| | Station address | 0 – 125, can be set via DIP switch |
| | GSD file | SEWA6003.GSD |
| | DP ID number | $6003_{hex} = 24579_{dec}$ |
| | Max. number of process data | 10 process data |
| | Mass | 0.2 kg (0.44 lb) |

1. Green LED: RUN
2. Red LED: BUS FAULT
3. DIP switch for setting the station address.
4. 9-pin Sub-D socket: Bus connection

*Pin assignment*

The following figure shows the assignment of the 9-pin D-sub connector according to IEC 61158.



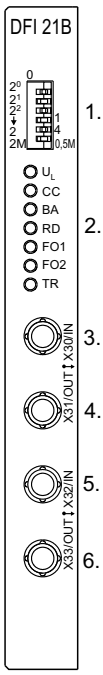

3065481355

[1] 9-pin D-sub connector
[2] Twist the signal wires together!
[3] Conductive connection is necessary between the plug housing and the shield.

### 5.4.3 INTERBUS with fiber optic cable (DFI21B)

For more detailed information, refer to the "MOVIDRIVE® MDX61B Fieldbus Interface DFI21B INTERBUS with Fiber Optic Cable" manual. You can order this manual from SEW-EURODRIVE.

*Technical data*

| | Option | INTERBUS fieldbus interface type DFI21B (FO) |
|---|---|---|
|  | Part number | 824 311 5 |
| | Resources for startup and diagnostics | MOVITOOLS® software, DBG60B keypad and CMD tool |
| | Supported baud rates | 500 kBd and 2 MBd, can be selected via DIP switch |
| | Connection | Remote bus input: 2 F-SMA connectors<br>Remote bus output: 2 F-SMA connectors<br>Optically controlled FO interface |
| | Mass | 0.2 kg (0.44 lb) |

1. DIP switches for setting the process data length, PCP length and baud rate
2. Diagnostic LEDs
3. FO: Remote IN
4. FO: Incoming remote bus
5. FO: Remote OUT
6. FO: Outgoing remote bus

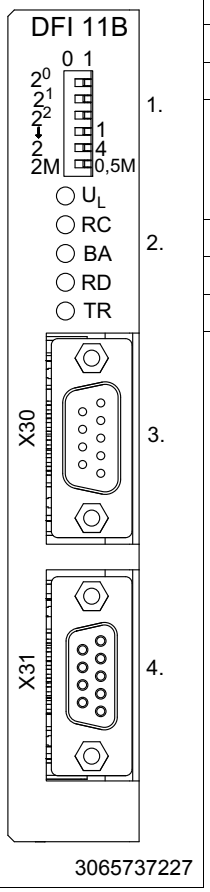
*Connection assignment*

| Position | Signal | Direction | Wire color of FO cable |
|---|---|---|---|
| **3** | FO Remote IN | Receive data | Orange (OG) |
| **4** | Incoming remote bus | Send data | Black (BK) |
| **5** | FO Remote OUT | Receive data | Black (BK) |
| **6** | Outgoing remote bus | Send data | Orange (OG) |

### 5.4.4 INTERBUS (DFI11B)

For more detailed information, refer to the "MOVIDRIVE® MDX61B Fieldbus Interface DFI11B INTERBUS" manual. This manual can be ordered from SEW-EURODRIVE.

*Technical data*

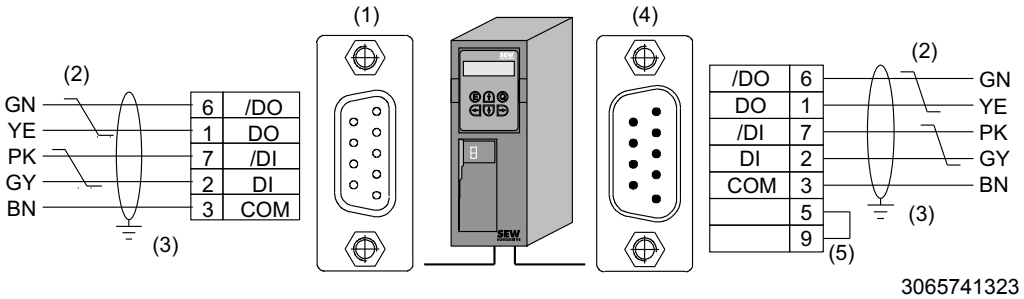
| | Option | INTERBUS fieldbus interface type DFI11B |
|---|---|---|
|  | Part number | 824 309 3 |
| | Resources for startup and diagnostics | MOVITOOLS® software and DBG60B keypad |
| | Supported baud rates | 500 kBd and 2 MBd, can be selected via DIP switch |
| | Connection | Remote bus input: 9-pin D-sub connector<br>Remote bus output: 9-pin D-sub socket<br>RS-485 transmission technology, 6-core shielded and twisted-pair cable |
| | Module ID | $E3_{hex} = 227_{dec}$ |
| | Maximum number of process data | 6 process data |
| | Mass | 0.2 kg (0.44 lb) |



1. DIP switches for setting the process data length, PCP length and baud rate
2. Diagnostic LEDs: 4 x green LED ($U_L$, RC, BA, TR); 1 x red LED (RD)
3. 9-pin sub-D connector: Remote bus input
4. 9-pin Sub-D socket: Remote bus output

*Pin assignment*

The following figure shows the assignment of the 9-pin D-sub socket of the incoming remote bus cable and the 9-pin D-sub plug of the outgoing remote bus cable Core color abbreviations to IEC 757.

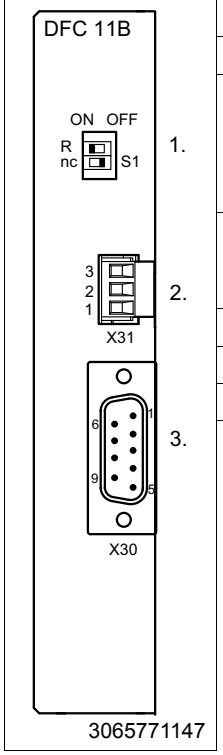



[1] 9-pin sub D socket of the incoming remote bus cable
[2] Twist the signal wires together!
[3] Conductive connection is necessary between the plug housing and the shield.
[4] 9-pin sub D plug of the outgoing remote bus cable
[5] Jumper pin 5 with pin 9!

### 5.4.5 CANopen (DFC11B)

For more detailed information, refer to the "MOVIDRIVE® MDX60B/61B Communication and Fieldbus Device Profile" manual. You can order this manual from SEW-EURODRIVE.

*Technical data*



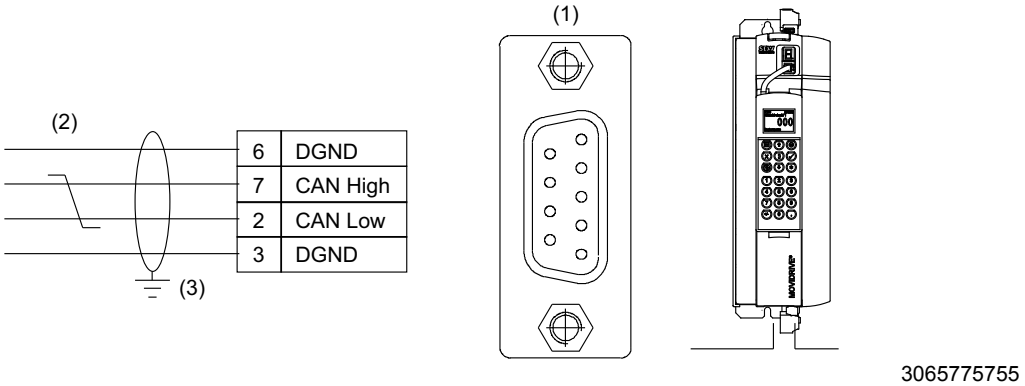

| Option | CANopen fieldbus interface type DFC11B |
|---|---|
| Part number | 824 317 4 |
| Resources for startup and diagnostics | MOVITOOLS® software and DBG60B keypad |
| Supported baud rates | Setting using parameter P894:<br>• 125 kBd<br>• 250 kBd<br>• 500 kBd<br>• 1000 kBd |
| Connection | 9-pin sub D connector (X30)<br>Assignment to CiA standard<br>2-core twisted cable to ISO 11898 |
| Bus termination | Can be activated using DIP switch (120 Ω) |
| Address range | 1 – 127, can be selected using DIP switch |
| Mass | 0.2 kg (0.44 lb) |

1. DIP switch for setting the bus terminating resistor
2. X31: CAN bus connection
3. X30: 9-pin sub-D connector: CAN bus connection

*Connection MOVIDRIVE® - CAN*

The DFC11B option is connected to the CAN bus at X30 or X31 in the same way as the SBus in the basic unit (X12). In contrast to the SBus1, SBus2 is electrically isolated and made available via option DFC11B.

*Pin assignment (X30)*

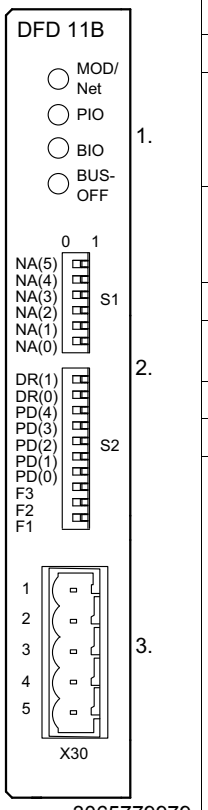



[1] 9-pin D-sub socket
[2] Twist the signal wires together!
[3] Conductive connection is necessary between the plug housing and the shield!

### 5.4.6 DeviceNet (DFD11B)

For more detailed information, refer to the "MOVIDRIVE® MDX61B Fieldbus Interface DFD11B DeviceNet" manual. This manual can be ordered from SEW-EURODRIVE. You can download the EDS files for MOVIDRIVE® MDX61B from the SEW homepage (under the heading "Software") to simplify startup.

*Technical data*

| | Option | DeviceNet fieldbus interface type DFD11B |
|---|---|---|
|  | Part number | 824 972 5 |
| | Resources for startup and diagnostics | MOVITOOLS® software and DBG60B keypad |
| | Supported baud rates | Can be selected via DIP switch:<br>• 125 kBd<br>• 250 kBd<br>• 500 kBd |
| | Connection | 5-pin Phoenix terminal<br>Assignment according to DeviceNet specification (Volume I, Appendix A) |
| | Permitted line cross section | According to DeviceNet specification |
| | Bus termination | Use bus connectors with integrated bus terminating resistor (120 Ω) at the beginning and end of a bus segment. |
| | Address range that can be set (MAC-ID) | 0 – 63, can be selected via DIP switch |
| | Mass | 0.2 kg (0.44 lb) |

1. LED display
2. DIP switch for setting the node address (MAC-ID), the process data lengths and baud rate
3. 5-pin Phoenix terminal: Bus connection

*Terminal assignment*

The assignment of connecting terminals is described in the DeviceNet specification Volume I, Appendix A.

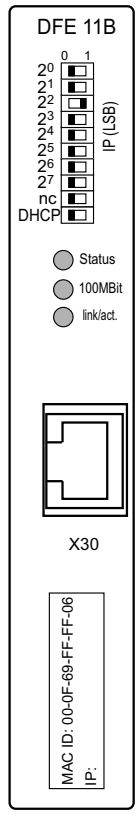
| Terminal | Meaning | Color |
|---|---|---|
| **X30:1** | V- (0V24) | Black (BK) |
| **X30:2** | CAN_L | Blue (BU) |
| **X30:3** | DRAIN | Blank |
| **X30:4** | CAN_H | White (WH) |
| **X30:5** | V+ (+24 V) | Red (RD) |

### 5.4.7 Ethernet (DFE11B)

For more detailed information, refer to the "MOVIDRIVE® MDX61B Fieldbus Interface DFE11B Ethernet" manual. This manual can be ordered from SEW-EURODRIVE.

*Technical data*

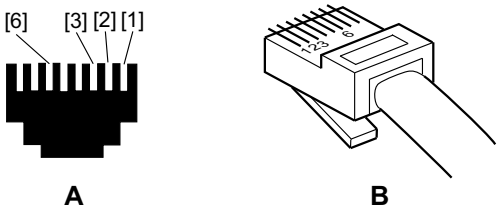
| | Option | Ethernet fieldbus interface type DFE11B |
|---|---|---|
| | Part number | 1820 036 2 |
| | Resources for startup and diagnostics | MOVITOOLS® software and DBG60B keypad |
| | Automatic baud rate detection | 10 MBd / 100 MBd |
| 1. | Connection | RJ45 modular jack 8-8 |
| | Addressing | 4 byte IP address |
| | Mass | 0.2 kg (0.44 lb) |




1. DIP switch for setting the least significant bytes (LSB) of the IP address
2. LED "Status" (red/yellow/green), "100 Mbit" (green), "link/act" (green)
3. X30: Ethernet connection
4. MAC address

*MOVIDRIVE®-Ethernet connection*

To connect DFE11B to the Ethernet, connect the Ethernet interface X30 (RJ45 plug connector) to the hub or switch provided using a category 5, class D twisted-pair cable in accordance with IEC 11801 edition 2.0. To do this, use a patch cable.




| | | | |
|---|---|---|---|
| A | View from front | [1] | Pin 1 TX+ Transmit Plus |
| B | View from back | [2] | Pin 2 TX− Transmit Minus |
| [3] | Pin 3 RX+ Receive Plus | [6] | Pin 6 RX− Receive Minus |

If you want to connect the DFE11B option card directly to your project planning computer, you need a cross over cable.

## 5.5 Connecting the system bus (SBus 1)

### INFORMATION

**Only when P816 "SBus baud rate" = 1000 kBd:**

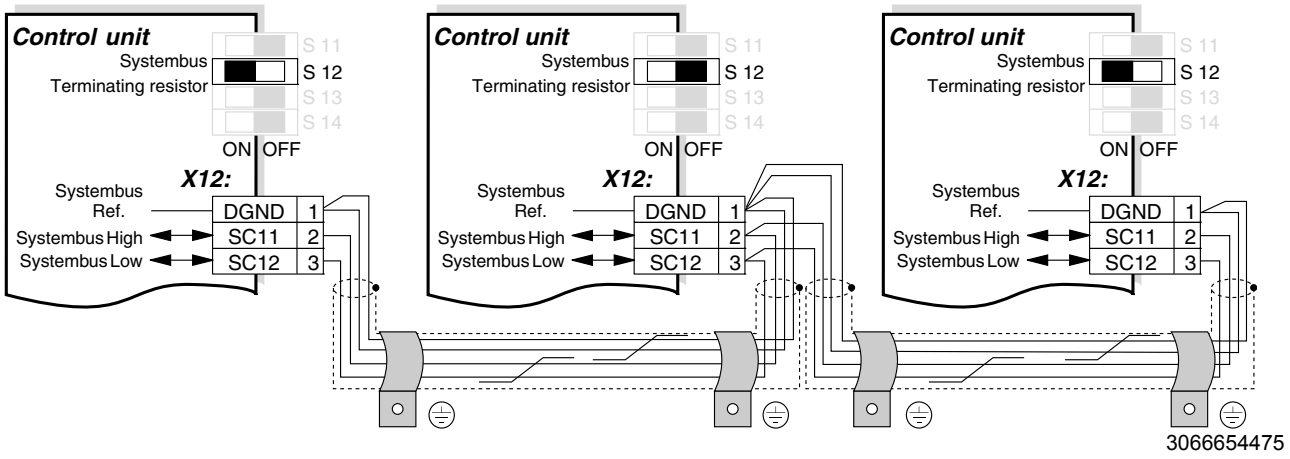
MOVIDRIVE® *compact* MCH4_A units are not allowed to be combined with other MOVIDRIVE® units in the same system bus combination.

The units are allowed to be mixed when baud rates ≠ 1000 kBd.

Max. 64 CAN bus stations can be addressed via system bus (SBus). Use a repeater after 20 or 30 nodes, depending on the length of the cables and the cable capacity. The SBus supports transmission technology compliant with ISO 11898.

The "Serial Communication" manual contains detailed information about the system bus that can be ordered from SEW-EURODRIVE.

### 5.5.1 SBus wiring diagram




*Cable specification*

- Use a 4-core twisted and shielded copper cable (data transmission cable with braided copper shield). The cable must meet the following specifications:
  - Cable cross-section 0.25 to 0.75 mm$^2$ (AWG 23 - AWG 18)
  - Cable resistance 120 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m at 1 kHz

  Suitable cables include CAN bus or DeviceNet cables.

*Connecting the shield*

- Connect the shield to the electronics shield clamp on the inverter or master controller and make sure it is connected over a wide area at both ends.

*Cable length*

- The permitted total cable length depends on the baud rate setting of the SBus (P816):

| SBus baud rate (P816) | Permitted cable length in total |
|---|---|
| 125 kBd | 320 m |
| 250 kBd | 160 m |
| **500 kBd** | **80 m** |
| 1000 kBd | 40 m |

*Terminating resistor*

- Switch on the system bus terminating resistor (S12 = ON) at the start and end of the system bus connection. Switch off the terminating resistor on the other units (S12 = OFF).

**INFORMATION**

There must not be any potential displacement between the units connected with the SBus. This may affect the functionality of the units.

Take suitable measures to avoid potential displacement, such as connecting the unit ground connectors using a separate cable.

# 6 Startup

## 6.1 General information

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 fieldbus options by following the installation instructions in the MOVIDRIVE® MDX60B/61B operating instructions, in the fieldbus manuals and in this manual (see chapter "Installation").

## 6.2 Preliminary work

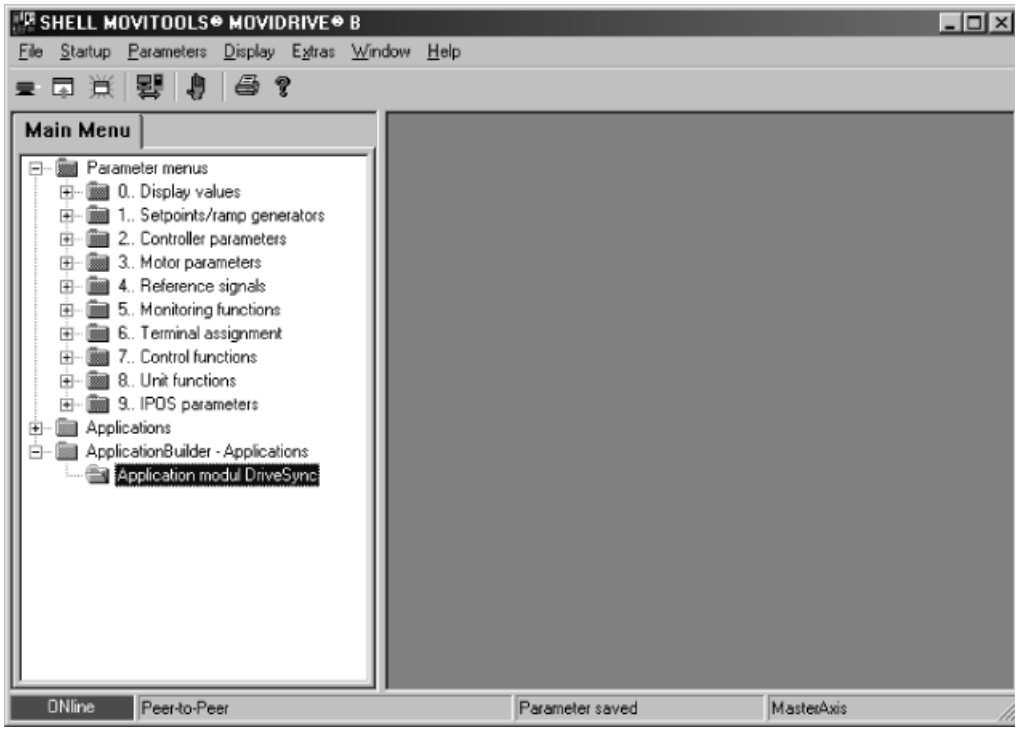
Perform the following steps before starting the "DriveSync via fieldbus" application:

- Connect the "Xterminal" port on the inverter to PC-COM via the UWS21A option (serial interface).
- Install the MOVITOOLS® software (version 4.30 or higher).
- Start up the inverter with "MOVITOOLS/Shell."
  - MDX61B with asynchronous motor: **CFC** operating mode
  - MDX61B with synchronous motor: **SERVO** operating mode
- Only for operation with an external encoder (absolute or incremental encoder):
  - Absolute encoder: Start up the DIP11B absolute encoder card. *P942 Encoder factor numerator*, *P943 Encoder factor denominator* and *P944 Encoder scaling ext. encoder* are set during this process (see "MOVIDRIVE® MDX61B Absolute Encoder Card DIP11B" manual).
  - Incremental encoder: Set the parameters *P942 Encoder factor numerator*, *P943 Encoder factor denominator* and *P944 Encoder scaling ext. encoder* in the Shell program. Refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual for a detailed description of the parameters.
- Send a "0" signal to terminal DIØØ "/CONTROLLER INHIBIT".

## 6.3 Starting the "DriveSync via fieldbus" program

### 6.3.1 General information

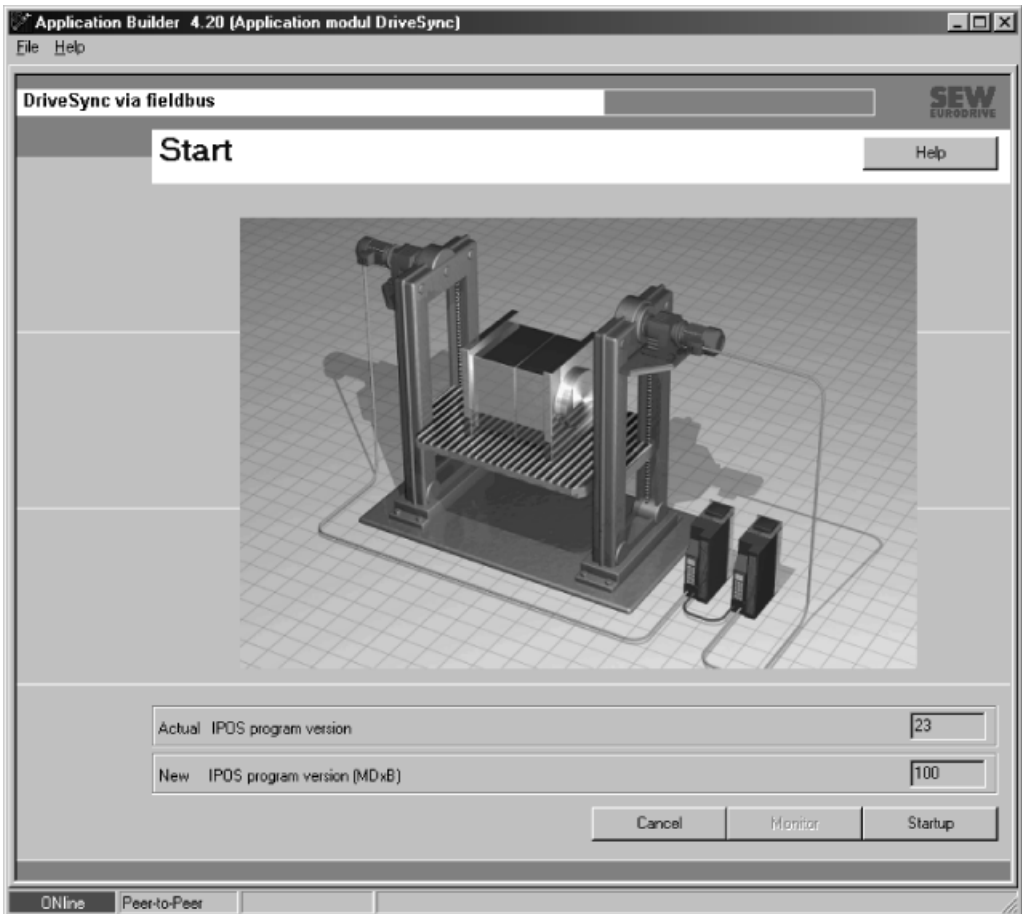
- Start [MOVITOOLS] / [Shell].
- From the folder "ApplicationBuilder applications", choose the file <DriveSync application module>.




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### 6.3.2 Initial screen

The initial screen of the "DriveSync via fieldbus" application opens.



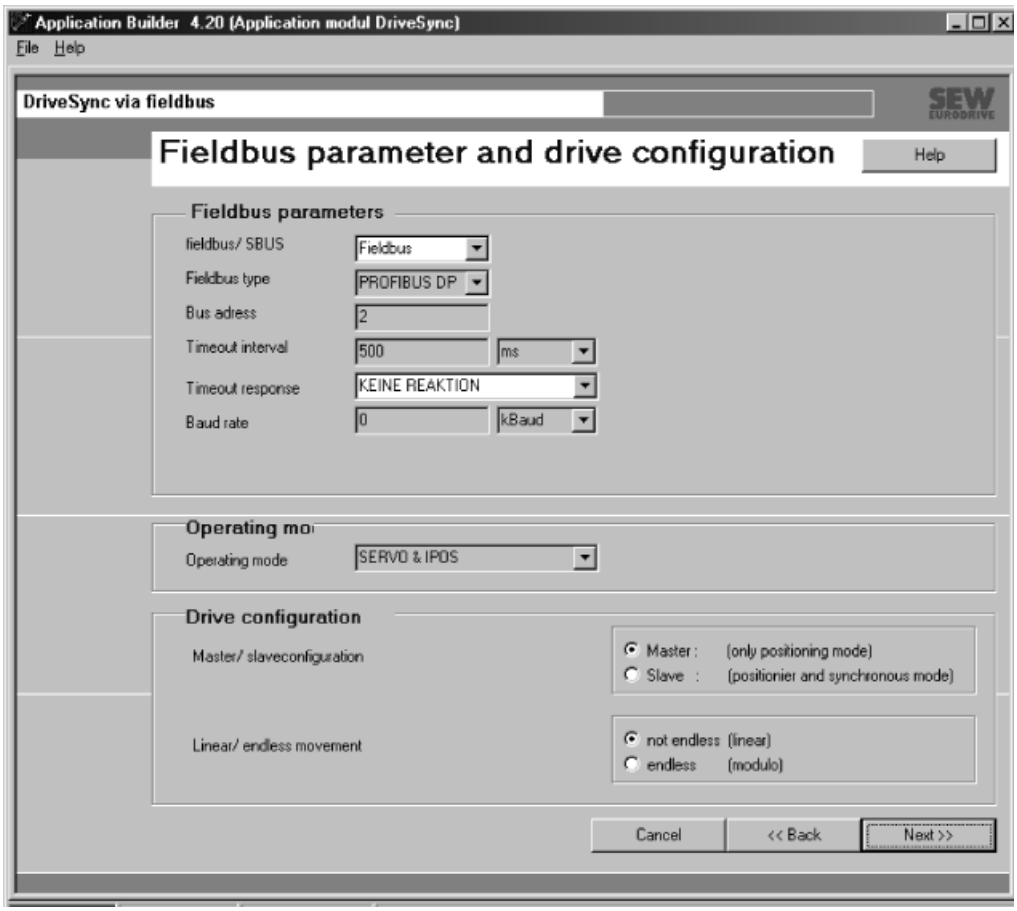

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- To commence startup of the "DriveSync via fieldbus" application, click the [Startup] button. The following chapters describe the next steps.
- If you want to switch to monitor mode, click the [Diagnostics monitor] button. For more information, refer to chapter "Operation and service".

**INFORMATION**

- The [Diagnostics monitor] button is disabled if
  - you are not online
  - the application module was not detected
- For restartup of the "DriveSync via fieldbus" application module, you can load the data to the inverter by clicking the <Startup> button.
- If you want to load saved application data, choose [File] / [Open...] from the menu in the window "Fieldbus parameters and drive configuration" (see next chapter).

### 6.3.3 Fieldbus parameters and drive configuration




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Make the following settings in this window:

- **Setting fieldbus parameters:** Set the required fieldbus parameters. Fixed parameters are grayed out and cannot be changed.

  The system bus 2 (SBus2) can be set if the DFC11B option is installed.

  If the DFC11B option is installed, you can choose between the protocols MOVILINK® and CANopen.

  If a fieldbus interface (DFP, DFI, DFC, DFD or DFE) is plugged into the fieldbus slot, then PROFIBUS, INTERBUS, INTERBUS with FO, CANopen, DEVICENET or ETHERNET can also be selected.

- **Operating mode:**The selected operating mode is displayed.

  MOVIDRIVE® MDX61B with asynchronous motors: CFC&IPOS or SERVO&IPOS

  MOVIDRIVE® MDX61B with servomotors: SERVO&IPOS

  If no permitted operating mode is selected, an error message will prompt you to perform startup using MOVITOOLS® / Shell.

- **Setting the drive configuration:** Set the drive configuration.

  Master / slave configuration:

  Only one drive may be started up as the master in a group of several MOVIDRIVE® MDX61B inverters. Applications with variable master/slave relationship are not supported.

  – "Master drive" option: You can select the following operating modes: "Jog mode", "Referencing mode" and "Positioning mode". The "synchronous operation" mode cannot be selected. Startup is completed with the startup window "Master/slave connection" (see chapter "Configuring the master/slave connection"). When calling the blocked mode "synchronous operation", the drive stops and remains in the current position with position control.

  – "Slave drive" option: You can select the following operating modes: "Jog mode", "Referencing mode"."Positioning mode", and "Synchronous mode".

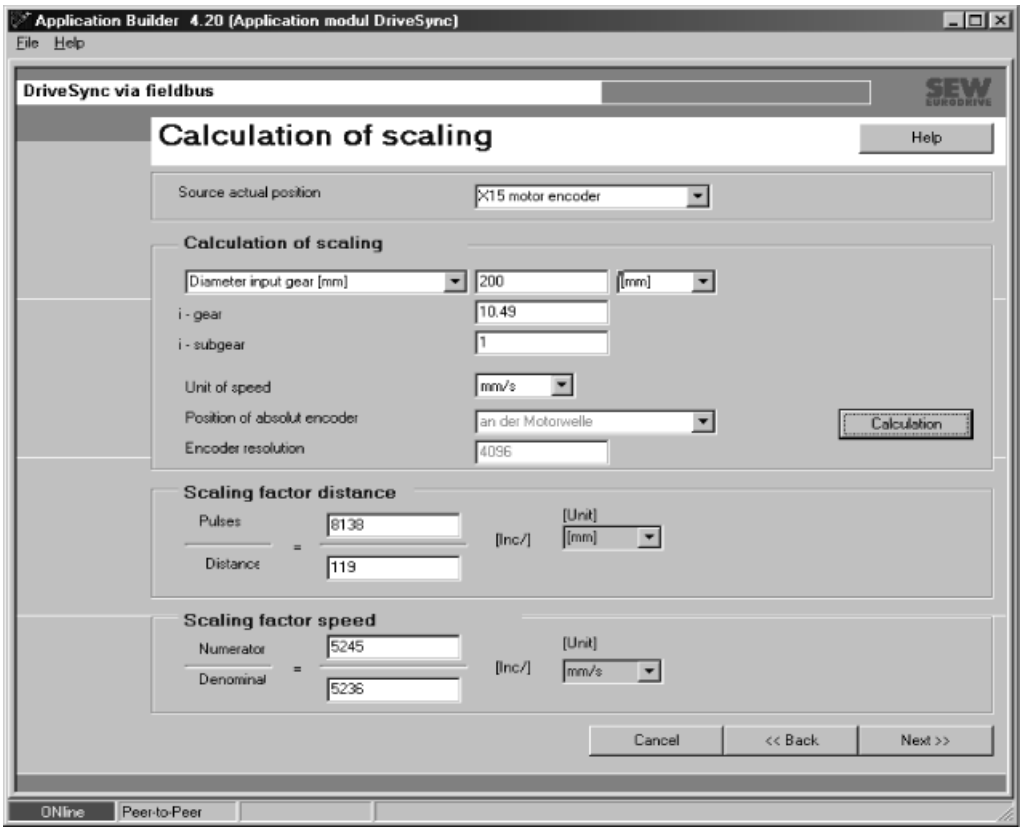
  Finite/infinite movement:

  – "Finite (linear)" option: This is the default setting. Examples are hoists, spindle drives, etc. with finite position reference.

  – "Infinite (rotary with modulo)" option: This option is used for endless sequences of motion, such as conveyor belts or turntables. Positioning is also possible with infinite gear unit ratios (i gear) without position drift.

### 6.3.4 Setting distance and velocity scaling factors

You can set the scaling factors for distance and speed in this window.




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Make the following settings in this window:

- **"Source of actual position" selection field:** Select which encoder is to be used for distance measurement in positioning:
  - MOTOR ENCODER (X15)
  - EXT. ENCODER (X14) with incremental encoder as external encoder.
  - ABSOLUTE ENCODER (DIP) with an absolute encoder as the external encoder or on the motor shaft.

**INFORMATION**

If you use an absolute encoder or an external encoder, you must start up the DIP11B option **before** you start the "DriveSync via fieldbus" application module.

*Calculating the scaling factors*

- **Example 1: Motor encoder or absolute encoder on the motor shaft (source actual position)**
  - Choose the unit you require in the selection field "Diameter of driving wheel" or "Spindle pitch" (only for motor encoder). For the unit, you can choose between [mm] or 1/10 millimeter [1/10 mm].
  - In the "i gear" input field, enter the ratio of the gear unit. In the "i subgear" input field, enter the gear ratio of the additional gear.
  - In the "Unit of speed" selection field, choose between [mm/s], [m/min] und [rpm].
  - For positioning with an absolute encoder, choose "Motor shaft" in the "Position of absolute encoder" selection field.
  - Click the [Calculation] button. The "distance" and "speed" scaling factors are calculated by the program.

- **Example 2: External encoder or absolute encoder on the track (source of actual position)**

  When using an external encoder or an absolute encoder on the track, you have to calculate the distance scaling factor manually. The scaling factor for the speed can be calculated automatically (see next chapter) or manually (see example 2).

  **Automatic calculation of the velocity scaling factor:**

  - In the "Source of actual position" selection field, select the entry "Motor encoder".
  - Enter a value in the "Diameter of driving wheel" field or the "Spindle pitch" field. Select the unit [mm] or [1/10 mm] in the adjacent selection field.
  - In the input fields "i gear" and "i subgear", enter the respective values for the gear ratios.
  - Click the [Calculation] button. The scaling factor for speed is calculated by the program.

  **Calculating the distance scaling factor:**

  - In the "Source of actual position" selection field, select either "External encoder" or "Absolute encoder". For positioning with an absolute encoder, choose "On the track" in the "Position of absolute encoder" selection field.
  - In the group box "Scaling factor for distance", enter the number of pulses supplied by the encoder per travel unit in the "Pulses" input field. The unit of the pulses is always increments [inc]. In the "Distance" input field, enter the corresponding track distance.
  - In the "Scaling factor for distance" group box, enter the unit of the scaling factor for the distance in the "Unit" input field. Any other information, such as the software limit switch, reference offset or the target position are specified in the selected unit.

*Converting the distance resolution into user units*

The scaling factor for distance (pulses/distance) is used to determine the user travel unit (e.g. mm, revolutions, ft). For positioning with a motor encoder, the scaling factor for distance can be calculated automatically. The following units can be selected for automatic calculation:

- mm
- 1/10 mm

When using an external encoder or an absolute encoder on the track, you have to calculate the distance scaling factor manually (see examples 1 and 2).

**Example 1:** A drive is to be positioned using an **absolute encoder on the track**. The speed is to be given in the unit [m/min].

- Drive data:
  - Gear unit ratio (i gear) = 12.34
  - Gear ratio of the additional gear (i subgear) = 1
  - Diameter of the carrying wheel = 200 mm
- Encoder data:
  - Type: Stahltronik WCS3 absolute encoder
  - Physical resolution = 1 increment / 0.8 mm
  - Encoder scaling P955 = x8 (set automatically during startup of the DIP11B option).
- Automatic calculation of the velocity scaling factor:

  Numerator / denominator = 32759 / 1668 unit [m/min]
- Calculate the scaling factor for distance manually:
  - Electrical resolution = 1 increment / 0.8 mm × P955 encoder scaling

    Result: 1 increment / 0.8 mm × 8 = 8 [inc/0.8 mm]

  **Result**: Pulses / distance = 80 / 8 [mm]

**Example 2:** A drive is to be positioned using an **external encoder on the track**.

- Drive data:
  - Gear unit ratio (i gear) = 12.34
  - Gear ratio of the additional gear (i subgear) = 1
- Encoder data:
  - Physical resolution = 1024 increments / revolution
  - Diameter of the carrying wheel ($d_{carrying\ wheel}$) = 65 mm
  - Encoder scaling P944 = x2
- Calculate the scaling factor for distance manually:
  - Pulses = Number of increments / revolution × 4 × P944

    Pulses = 1024 increments / revolution × 4 × 2 = 8192 increments
  - Distance = $\pi \times d_{carrying\ wheel}$

    Distance = 3.14 × 65 mm = 204.2 mm

  **Result:** Pulses / distance = 8192 / 204 unit [mm]

### INFORMATION

If the numerator (pulses) or denominator (distance) are non-integer values, the conversion can be made more accurate if both numerator and denominator are multiplied by the same expansion factor (e.g. 10, 100, 1000, etc.). Doing so will not limit the travel range. The maximum value for "Pulses" or "Distance" is 32767.

*Converting the speed into user units*

In the group box "Calculation of the scaling", choose one of the three entries in the drop-down menu "Unit of speed". The scaling factors can be calculated automatically. The following speed units are available:

- rpm
- mm/sec
- m/min

If you want to enter the speed in another unit, you can calculate the velocity scaling factor (see following example).

**Example 1:** A drive is to be positioned using an **absolute encoder on the track**. The speed is to be specified in mm/s.

- Drive data:
  - Gear unit ratio (i gear) = 15.5
  - Gear ratio of the additional gear (i subgear) = 2
  - Diameter of the drive wheel ($d_{drive\ wheel}$) = 200 mm
- Encoder data:
  - Type: Stahltronik WCS2 linear distance measuring system
  - Physical resolution = 0.833 mm = 1.2 increments/mm
  - Encoder scaling P955 = x8 (set automatically during startup of the DIP11B option).
- Numerator = $i_{gear\ unit} \times i_{add.\ gear} \times 60$

  Numerator = 15.5 × 2 × 60 = 1860
- Denominator = $\pi \times d_{drive\ wheel}$ (or spindle pitch)

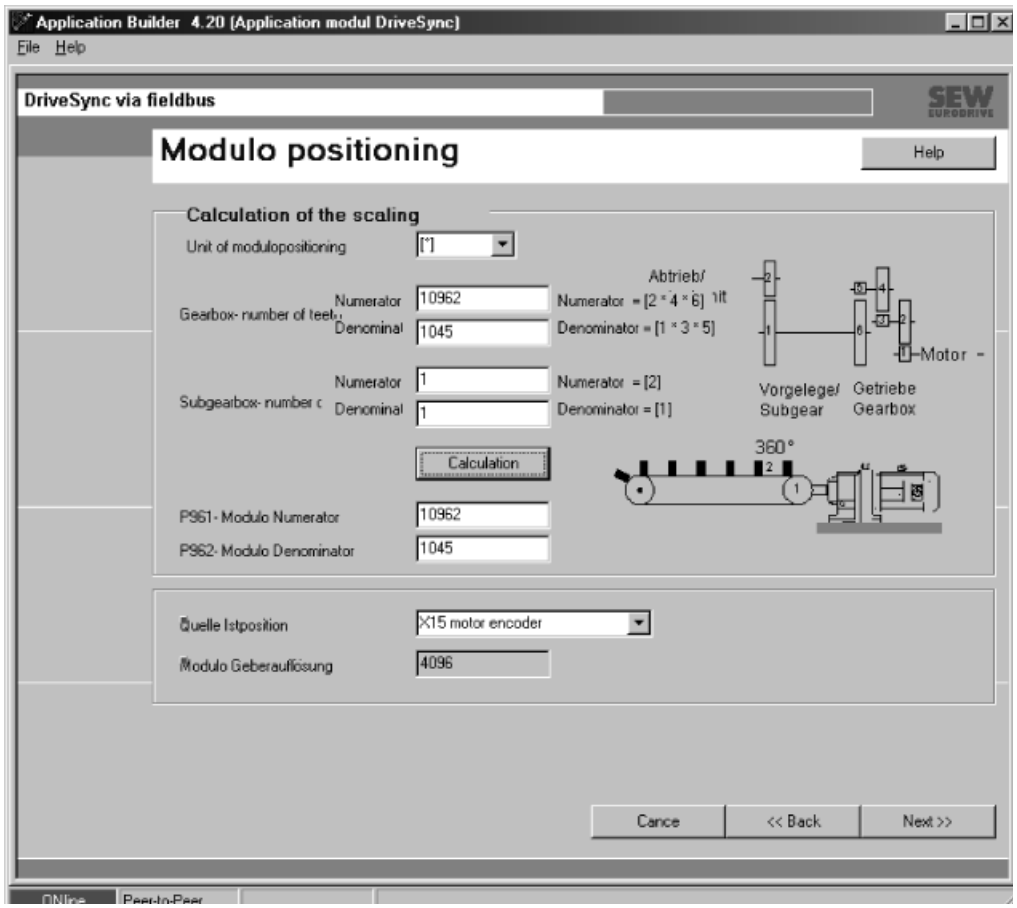
  Denominator = 3.14 × 200 = 628

  Unit = mm/s

### INFORMATION

If the numerator or denominator are non-integer values, the conversion can be made more accurate if both numerator and denominator are multiplied by the same expansion factor (e.g. 10, 100, 1000, etc.). Doing so will not limit the travel range. The maximum value for the numerator or denominator is 32767.

### 6.3.5 Determining the modulo parameters for infinite motion sequences




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Make the following settings to determine the modulo parameters (P961 Modulo numerator, P962 Modulo denominator):

- **"Determining modulo parameters" group**
  - "Gear unit number of teeth / numerator" input fields

    If you use a Hiperface® encoder, you can read the required values under [MOVITOOLS] / [Shell] / [Display] / [Motor encoder data]. If you do not use a Hiperface® encoder, contact SEW-EURODRIVE.
  - "Additional gear unit number of teeth / numerator" input fields

    Enter the respective values.
  - [Calculate] button

    To calculate the modulo parameters, click the <Calculation> button. If the calculated value resulting from the multiplication of modulo numerator × encoder resolution exceeds the value $2^{31}$, then you cannot use the modulo function. In this case, you can solve the problem by installing an external encoder.

*Example for determining the modulo parameters of motor encoder operation*

The following step-by-step example shows how the entered data is processed in the startup interface. The modulo parameters are calculated automatically once you have entered the number of teeth of the gear unit.

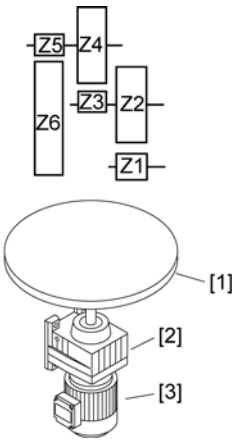
Gear unit data:

- KA47B
- Output speed: 19 $min^{-1}$
- Motor speed: 2000 $min^{-1}$
- Transmission ratio: 104,37

**Step 1: Determining the number of teeth of the gear unit**

Please contact SEW-EURODRIVE when determining the numbers of teeth. In this example, the following numbers of teeth were determined:

Z1 = 17 / Z2 = 74 / Z3 = 8 / Z4 = 33 / Z5 = 16 / Z6 = 93




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[1] Output

[2] Gear unit

[3] Motor with motor encoder

**Step 2: Calculate gear unit data (modulo numerator/denominator)**

$$\text{Modulo } \frac{\text{numer.}}{\text{denom.}} = \frac{1}{i_{\text{Gear unit}}}$$

$$\text{Modulo } \frac{\text{numer.}}{\text{denom.}} = \frac{1}{\frac{Z1 \times Z3 \times Z5}{Z2 \times Z4 \times Z6}}$$

$$\text{Modulo } \frac{\text{numer.}}{\text{denom.}} = \frac{1}{\frac{17 \times 8 \times 16}{74 \times 33 \times 93}} \times \frac{1}{\frac{227106}{2176}} = \frac{113553}{1088}$$

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**Result:**

- Modulo numerator = 113553
- Modulo denominator = 1088
- Modulo encoder resolution = 4096

**Step 3: Check the modulo range of representation and determine the maximum target position**

This step is performed automatically after the numerator/denominator factors have been entered in the startup interface. Only integers in 32-bit format can be processed in the system. Consequently, you must check the startup interface to see if the range of representation has been exceeded. The program performs the following check:

- **Check the modulo range of representation:**

  The product of the modulo encoder resolution and modulo numerator must be $< 2^{31}$ (decimal: 2.147.483648).

  Example: 113553 x 4096 ≤ $2^{31}$. The condition is fulfilled. The modulo range of representation is not exceeded, the target position can be represented.

- **Check the maximum target position:**

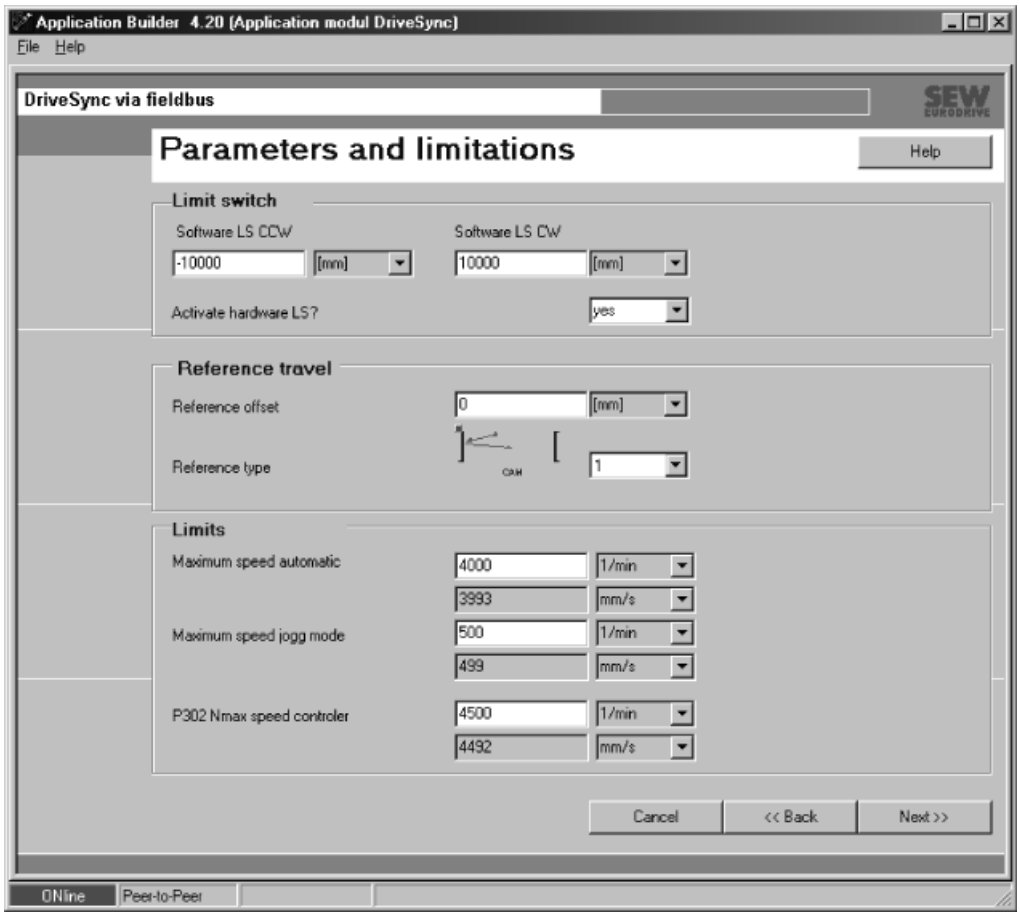
$$\text{Max. target position} = \frac{2^{31}}{\text{Modulo } 360°} = \frac{2^{31}}{\text{Modulo num. x Modulo denom.}} = \frac{2^{31}}{113553 \text{ x } 1088} = 4.6$$

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The maximum target position corresponds to 4.6 output rotations or 1662°. The modulo range of representation is not violated.

### 6.3.6 Setting limits

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




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- **"Limit switch" group**
  - "Software LS CCW" and "Software LS CW" input fields

    The software limit switches can only be edited in finite positioning mode. Enter the travel range between software limit switches CCW/CW. If you enter the value "0", the monitoring function is disabled.
  - Dropdown menu "Activate hardware limit switch?"

    The hardware limit switches can only be edited in finite positioning mode. If set to "No", the binary inputs DI04 and DI05 are set to "No function".

- **"Reference travel" group**
  - "Reference offset" input field

    Enter the reference offset in the unit set in the parameters.
  - Dropdown menu "Reference type"

    The reference travel type defines the movement sequence for recording the mechanical zero point. You can choose between 8 different reference travel types: The selected reference travel type is displayed in a small image next to the dropdown menu. Refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual for a detailed description of the reference travel types.

- **"Limits" group**
  - "Maximum speed automatic" input field

    You can limit the positioning speed specified by PO4 by entering a value into this field.
  - "Maximum speed jog mode" input field

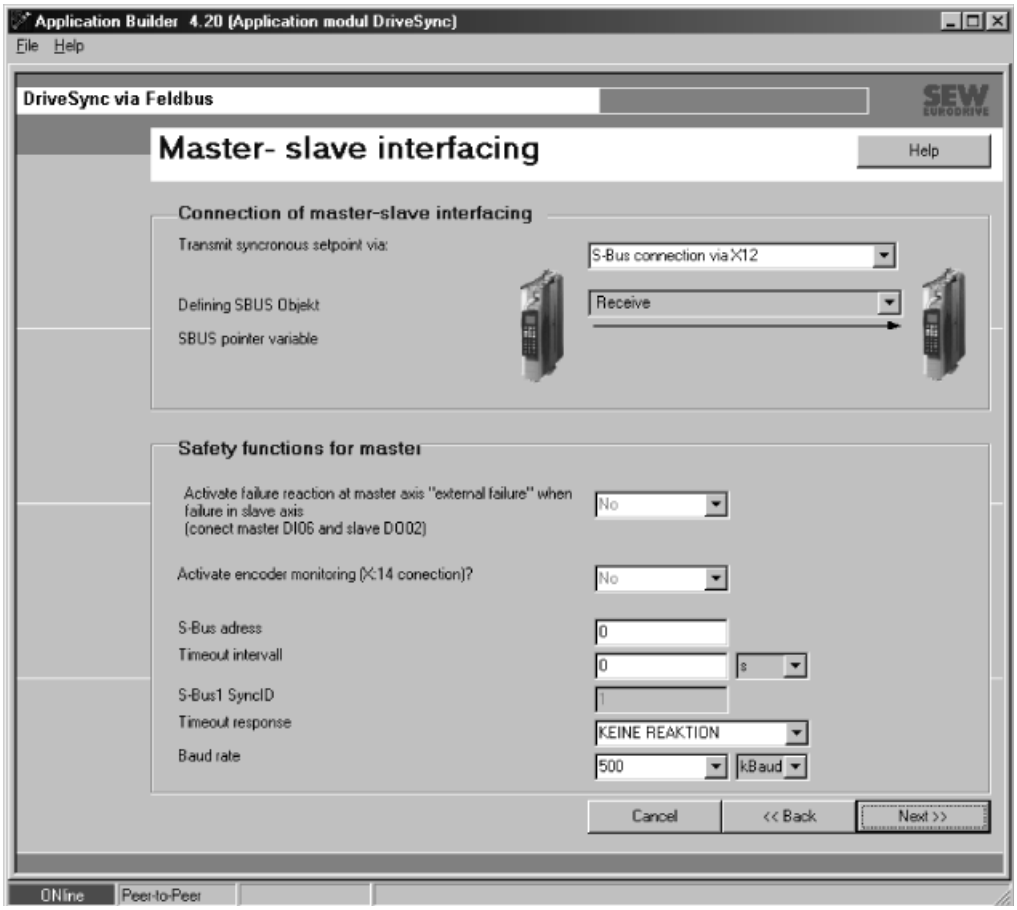
    You can limit the jog speed specified by PO4 by entering a value into this field.
  - "P302 Nmax speed controller" input field

    Enter a value at least 10% higher than the maximum positioning or jog speed. In addition, the limit values are converted into user units and displayed.

### 6.3.7 Configuring the master-slave interface

In the "Synchronous operation" mode, you can use this window to set how the encoder master value is to be transferred from the master to the slave drive. The selection options are displayed depending on the master or slave drive you have selected (see chapter "Fieldbus parameters and drive configuration").

When you configure a master drive, the "Download" window opens (see chapter "Download").




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In the group box "Connection of master-slave interface", you set how the encoder master value is transferred.

- **"Set position source for synchronous operation" dropdown menu**
  - "External encoder X14" option

    Direct, physical encoder connection between the master and slave drive. The actual position of the master drive can be read in IPOS$^{plus®}$ variable H510 for diagnostic purposes. This option is used when connecting a MOVIDRIVE® MDX61B slave to a MOVIDRIVE® MDX61B master. The advantage is that the increments of the master drive are transferred to the encoder input of the slave drive. This setting prevents setpoint changes on the slave during reference travel of the motor.

Important:

When connecting a motor encoder to X15 of the encoder card, the PPR count is quadrupled and scaled to 4096 increments/motor revolution for position control. This signal can be routed from the encoder card via the incremental encoder simulation output (X14) to a downstream inverter.

The incremental encoder simulation supplies the PPR count of the selected encoder. When connected to the input of the downstream inverter, the PPR count is quadrupled, **but not scaled to 4096 increments/motor revolution**. If the PPR count (multiplied by 4) deviates from the IPOS motor encoder resolution 4096 increments/motor revolution, you must adjust it via the gear unit factors of the slave inverter.

The following table lists the gear unit factors determined on the basis of the PPR count. If the mechanical design of the master and slave axes is the same, you can adopt the determined gear unit factors directly. Enter these values in the startup window "Parameters for synchronous operation (part 1)" in the "GFMaster" and "GFSlave" entry fields.

| Encoder | | Gear unit factor | |
|---|---|---|---|
| **Type** | **Resolution** | **GFMaster** | **GFSlave** |
| **AK0H** | 128 | 8 | 1 |
| **AV1Y** | 512 | 2 | 1 |
| **ES7R** | 1024 | 1 | 1 |
| **AS7W** | 2048 | 1 | 2 |

– "SBus coupling via X12" option

  The actual value is transferred via SBus. This variant is used, for example, in a system prone to slip (IPOS encoder = ext. encoder, or absolute encoder, or several drive slaves). The transferred SBus content can be read in IPOS$^{plus®}$ variable H10 for diagnostic purposes.

  When "SBus coupling via X12" is selected, no adjustment is necessary. The internal scaling 4096 increments/motor revolution of the "IPOS encoder source" is transferred.

– "Virtual encoder simulation" option

  The master value of the master drive is simulated by the virtual encoder simulation. In "synchronous mode", process output data words PO2 to PO5 are used to transfer the relevant values for target position (PO2 and PO3), setpoint speed (PO4), and acceleration (PO5).

  If several slave drives are to follow a virtual master value, only one slave drive must be taken into operation with the "virtual encoder simulation" option. As the position is transferred automatically via SBus, the other slave drives are set to "SBus connection via X12".

  The "Virtual encoder simulation" option can be used for a replaced mechanical vertical shaft and more than one connected slave drive. Cascade effects, such as offset start timing, can be eliminated by transferring the virtual actual position.

- **"Content of send object" display window**

  The content of the information that is sent to other MOVIDRIVE® drive inverters or received by them via SBus depends on the encoder source you have selected (see dropdown menu "Set position source for synchronous operation").

  – "Do not set up send/receive object" display

    Is displayed if you have set "External encoder X14" as encoder source.

  – "Set up receive object" display

    Is displayed if the drive is to operate as slave drive.

  – "Send object with IPOS encoder position" display

    Default setting if the drive is to operate as master drive.

  – "Send object with virtual encoder position" display

    Is displayed if the virtual slave position of a slave drive is to be transferred to other slave drives.

  The actual value can be read out in IPOS$^{plus®}$ variable H10 of the slave drive in order to check the contents of the received object.

  The content of the send object can be freely chosen by setting the IPOS$^{plus®}$ variable H122 to "4" and using the IPOS$^{plus®}$ variable H88 to enter the address of the IPOS$^{plus®}$ variable that is to be sent.

  Example:

  - H122 = 4
  - H88 = 510 ( = system variable H510)

  In the above example, the motor position is transferred cyclically.

- **"Safety functions for master" group**

  – "Switch off master drive in case of a slave error?"

    Yes: The binary input DI06 of the master drive is parameterized to "/Ext. error". This requires a wire connection between the binary input DI06 of the master drive and the binary output DO02 of the slave drive. The master drive switches off in case of a slave drive failure.

    No: The master drive is not switched off in case of a slave drive failure.

  – "Activate encoder monitoring (X14 connection)?" option

    Yes: The incremental encoder connection is checked even in non-enabled condition of the slave drive. The error message "F14 Encoder error" will be issued in case of a fault (e.g wire break).

    No: Wire breakage monitoring is not active.

  – "Timeout interval" option

    The timeout interval set for the SBus is displayed if the option "SBus connection via X12" was selected in the "Set position source for synchronous operation" dropdown menu.

– "Timeout response" dropdown menu

  You can set a timeout response for SBus 1 operation.

– "Baud rate" option

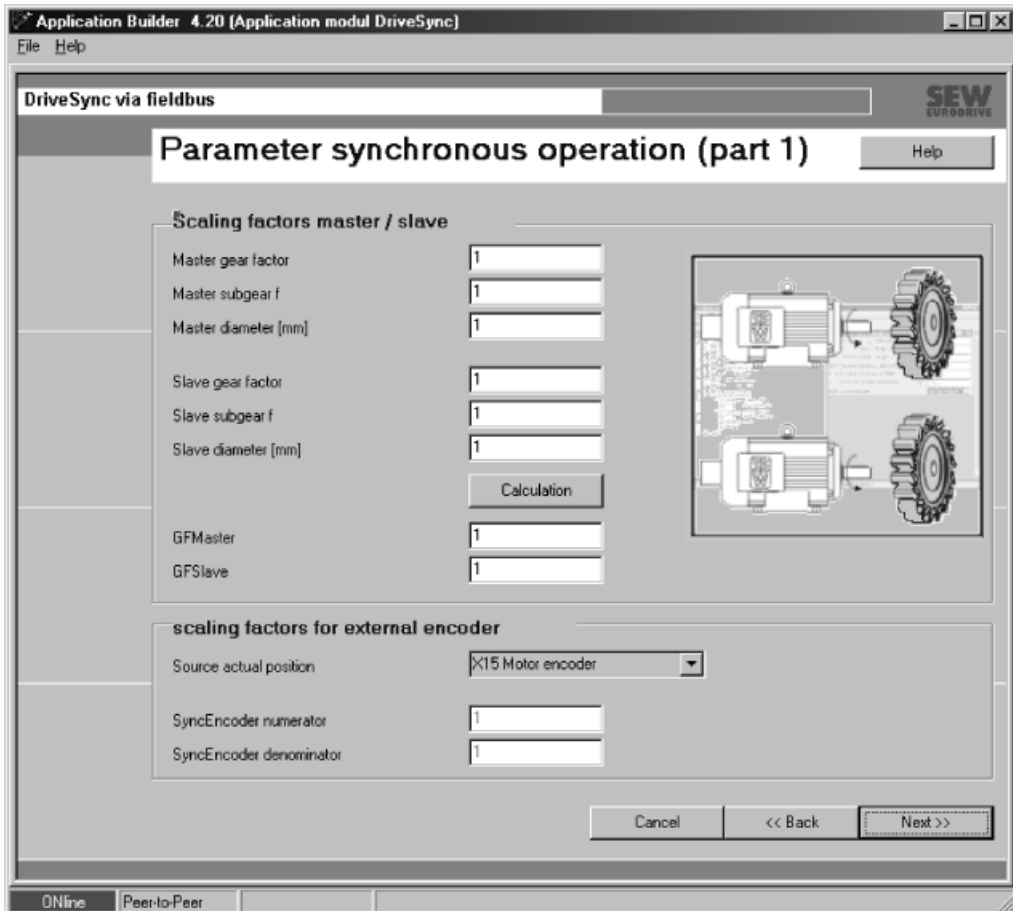
  The set baud rate of the SBus1 is displayed. The input fields for SBus monitoring are disabled if no SBus object is sent or received.

### 6.3.8 Setting parameters for synchronous operation (part 1)

Mechanical differences between the master and slave drives can be compensated by entering scaling factors so that the outputs of both drives move with the same speed.

You have to enter different scaling factors depending on the set encoder source:

- Positioning based on the motor encoder: Master/slave scaling factors.
- Positioning based on the absolute encoder or external encoder: Scaling factors IPOS encoder source.




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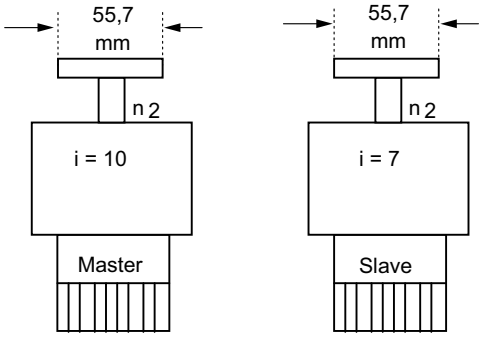
- **"Master/slave scaling factors" group**

  Set the scaling factors. Both factors are set to "1" if the mechanical structures are identical.

  <Calculation> button: With the resulting function, the entered data is reduced in such a way that it can be represented in the scaling factors (GFMaster, GFSlave).

Example:

Two drives with different gear unit reduction ratios are to be moved at a synchronous angle to the master drive at the same output speed $n_2$ = 20 rpm.




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Requirement: $n_{2_Master} = n_{2_Slave}$

$$\frac{GF_{Slave}}{GF_{Master}} = \frac{GF_{Slave} \text{ x Master add. gear x slave length}}{GF_{Master} \text{ x Slave add. gear x master length}}$$

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$$\frac{GF_{Slave}}{GF_{Master}} = \frac{10 \text{ x } 1 \text{ x } (3{,}14 \text{ x } 55{,}7 \text{ mm})}{7 \text{ x } 1 \text{ x } (3{,}14 \text{ x } 55{,}7 \text{ mm})} = \frac{10}{7}$$

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GFSlave = 10

GFMaster = 7

Two further examples with different output speeds $n_2$ of master and slave are shown in the following table.

| | | Setpoint speed $n_2$ [rpm] | $n_1$ [rpm] | Gear unit reduction ratio i | Scaling factor |
|---|---|---|---|---|---|
| **Example 1** | Master | 20 | 200 | 10 | 7 *GFMaster* |
| | Slave | | 140 | 7 | 10 *GFSlave* |
| **Example 2** | Master | 20 | 200 | 10 | 7 *GFMaster* |
| | Slave | 10 | 70 | 7 | 20 *GFSlave* |
| **Example 3** | Master | 20 | 200 | 10 | 7 *GFMaster* |
| | Slave | 40 | 280 | 7 | 5 *GFSlave* |

- **"Scaling factors for IPOS encoder source" group**

  Determining the input values of scaling factors for IPOS encoder sources, e.g. drive with external encoder (non-positive) or absolute encoder.

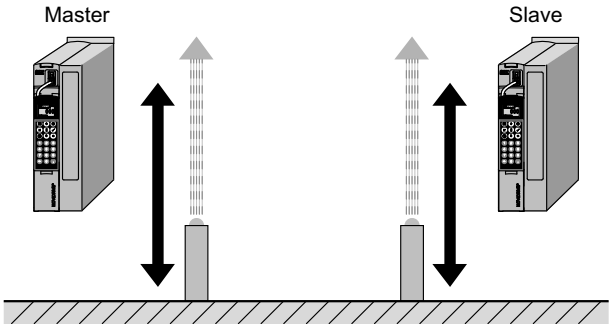
## INFORMATION

Refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual for more information.

*Example*

Task: Startup of a synchronous application with slip, e.g. gantry crane with steel crane rollers on steel rails.

Solution: Evaluation of an additional absolute encoder for slip compensation

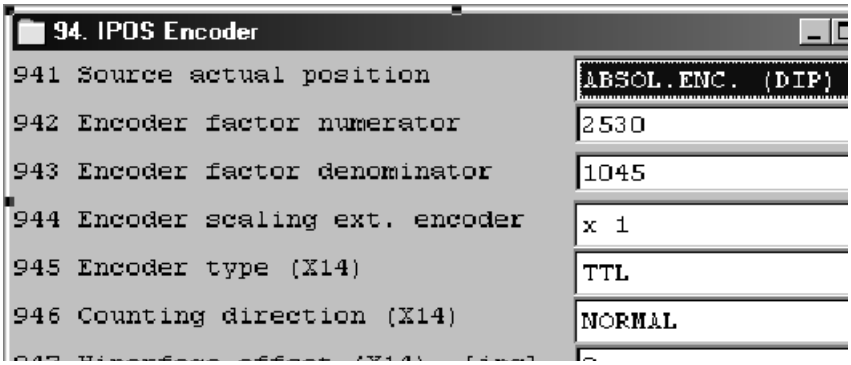



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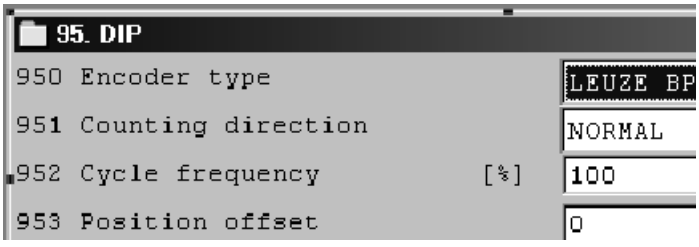
Do the following:

- Start up the absolute encoder.
  - In MOVITOOLS®, choose [Startup] / [DIP startup] from the menu. Follow the instructions of the wizard. For detailed information, refer to the "MOVIDRIVE® MDX61B DIP11B Absolute Encoder Card" manual.

    Once you have started up the absolute encoder, the parameters of parameter group 94 and 95 are automatically set (see following figures).



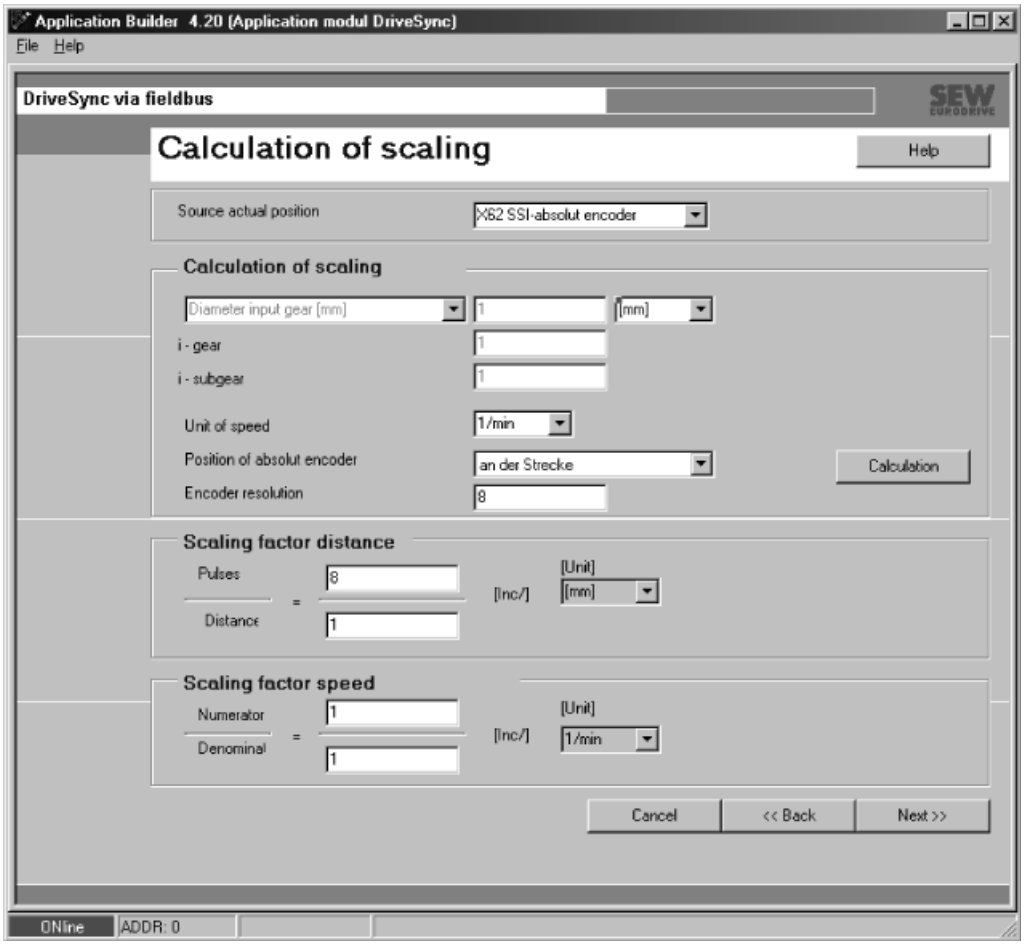

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- Set the parameters of the absolute encoder system for position control for the master and slave axes in the "DriveSync via fieldbus" application module.
  - The started up absolute encoder is to be used for position control in the master and slave axes. In the "Calculation of scaling" window, choose the entry "SSI absolute encoder" from the "Source of actual encoder" dropdown menu.

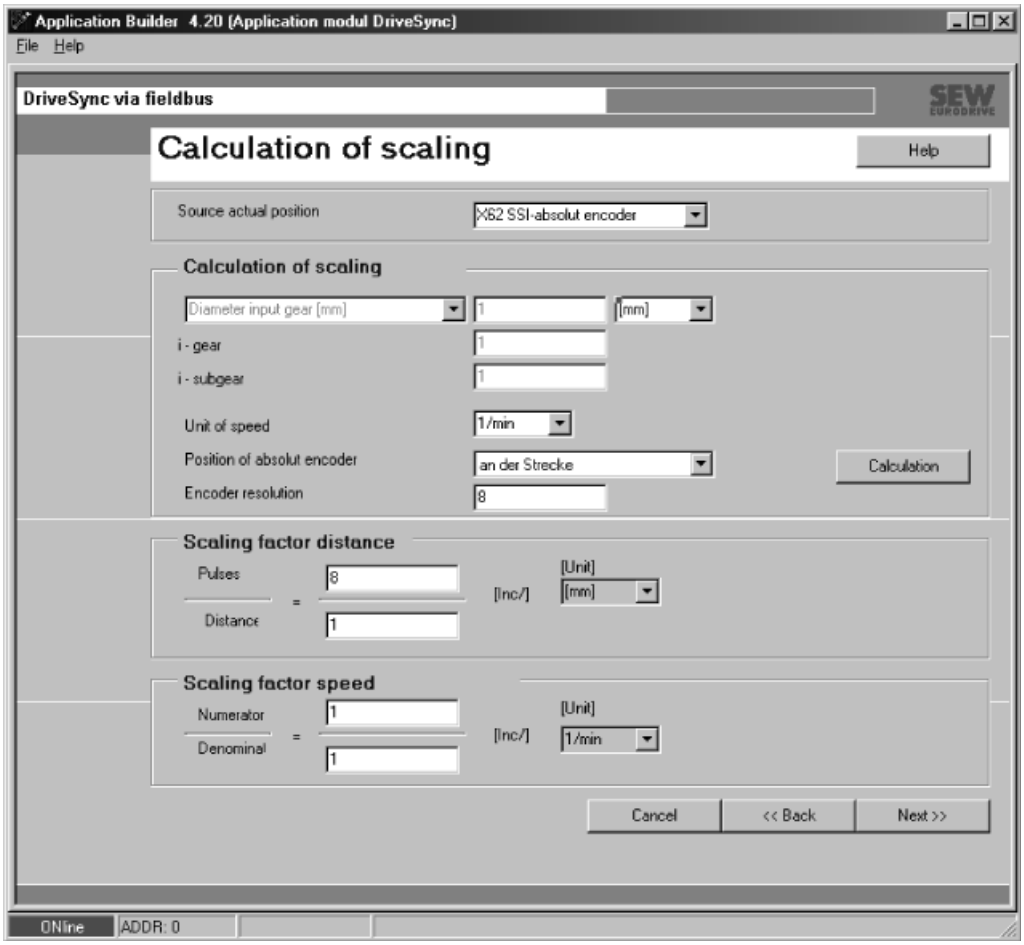
    The physical resolution of the encoder system must be multiplied by the value read from *P955 Encoder scaling*. According to the set encoder type "Leuze BPS37", the physical resolution of 1 increment/mm is multiplied with the read-out value "8". The result "8" is displayed in the "Encoder resolution" input field (see following figure).




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- Parameterize the absolute encoder system for synchronous operation control of the slave axis (see following figure).
  - The started up absolute encoder is to be used for position control in the master and slave axes. In the "Calculation of scaling" window, choose the entry "SSI absolute encoder" from the "Source of actual encoder" dropdown menu.

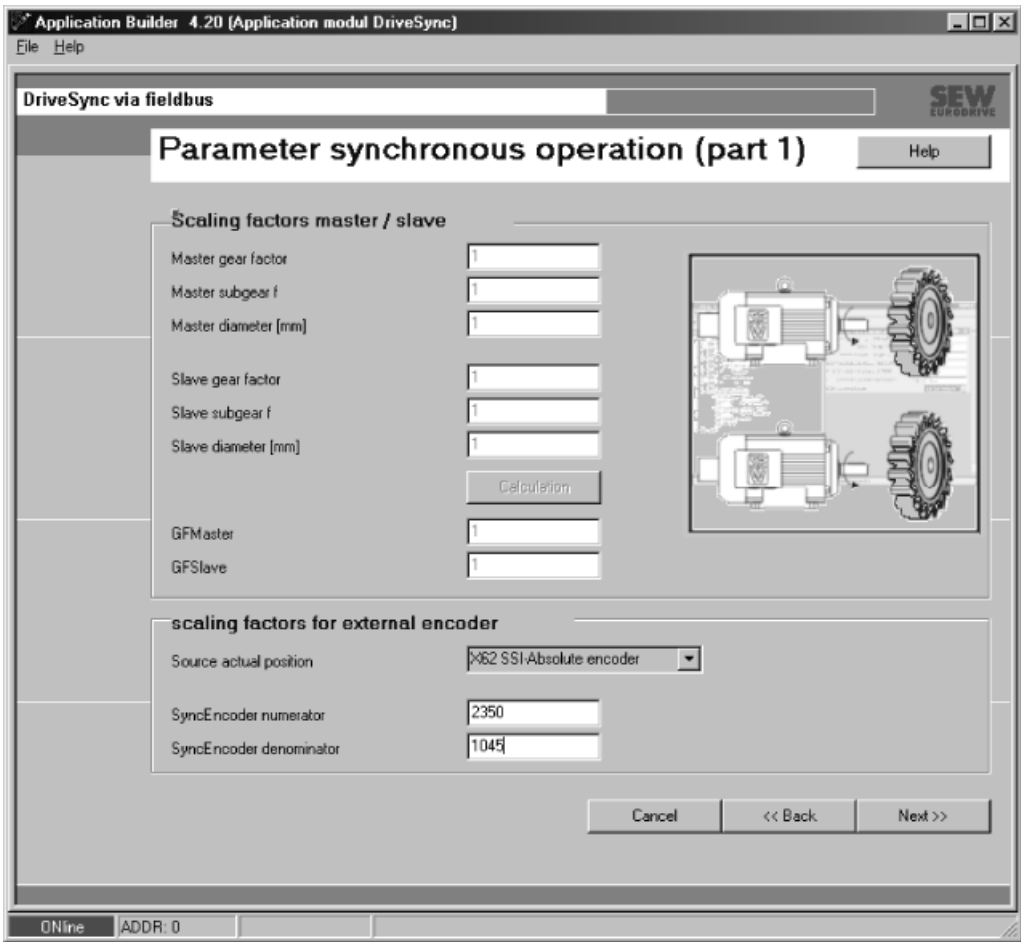
    The physical resolution of the encoder system must be multiplied by the value read from *P955 Encoder scaling*. According to the set encoder type "Leuze BPS37", the physical resolution of 1 increment/mm is multiplied with the read-out value "8". The result "8" is displayed in the "Encoder resolution" input field (see following figure).




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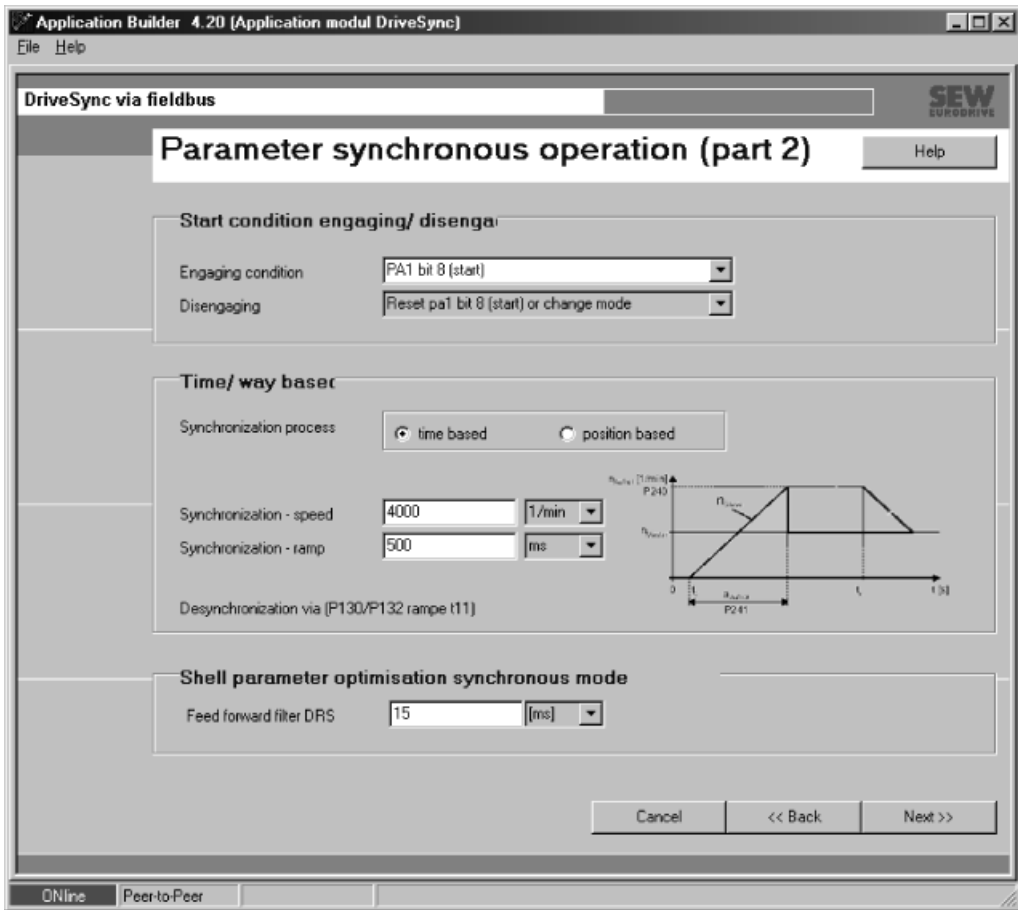
- Parameterize the absolute encoder system for synchronous operation control of the slave axis (see following figure).
  - In the "Parameters for synchronous operation (part 1)" window, you have to enter the exact ratio between the set IPOS encoder system (= absolute encoder) and the motor encoder of the slave axis.

    A lag error will only be compensated if you enter the exact scaling factors for the IPOS encoder source.
  - Enter the parameter value of *P942 Encoder factor numerator* into the "SyncEncoder Numerator" input field.
  - Enter the parameter value of *P943 Encoder factor denominator* into the "SyncEncoder Denominator" input field.




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### 6.3.9 Setting parameters for synchronous operation (part 2)




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- **"Start conditions engaging/disengaging" group**

  Dropdown menu "Engaging condition": You can define here how the engaging sequence is started. The inverter must be enabled and "Synchronous operation" must be set. You can choose from the following options:

  – PO1:8 Start
  – PO1:8 Start with edge change on DI02
  – PO1:8 Start with zero pulse of the master encoder

  Dropdown menu "Disengaging condition" Here, you can define the condition under which the disengaging sequence is started:

  – Deselection of operating mode or "No start"
  – Reserved

**INFORMATION**

When in "synchronous operation" mode, the inputs DI01 (enable) or DI00 (/controller inhibit) are set to "0" instead of the mentioned disengaging conditions, the slave drive stops in the selected operating mode.

When the slave drive is engaged again, a possible offset is processed. The reference to the master axis will not be lost.

- **"Synchronization process" group**

  "Time-based" option (recommended): When time-based engaging is selected, the synchronization process has a specified speed and ramp. Engaging is possible in the positive or negative direction of rotation of the master drive.

  "Position-based" option: In position-based engaging, the dynamics result from the defined engaging distance of the master drive (see "position-based engaging").

  Time-based engaging:

  – "Synchronization speed" input field: Enter the maximum speed setpoint for synchronization with the master drive.
  – "Synchronization ramp" input field: Enter the ramp time to be used for synchronization.

**INFORMATION**

Choose your input values in such a way that the slave drive can accelerate and move more dynamically than the master drive. Else, "F42 Lag error" will occur on the slave drive.

Position-based engaging:

– Engaging distance: The dynamics of the synchronization process are determined by the signed distance entered for the master. The slave drive moves synchronously with the master drive from the moment of engagement until the specified position is reached.
– Selection window for the catch-up distance in offset mode: If you have selected the offset via fieldbus, this signed value is processed and the defined offset value (PO6) is reduced to zero within this distance.

**INFORMATION**

The slave drive can only be engaged if the signed input value of the engaging distance or the catch-up distance in offset mode matches the direction of travel of the master drive.

Example: The slave drive will not engage if you specify a positive engaging distance but the master drive moves in clockwise direction (which means the incoming incremental encoder values are decremented). This is indicated by the synchronous operation diagnosis "Axis remains in state 2 – engaging".

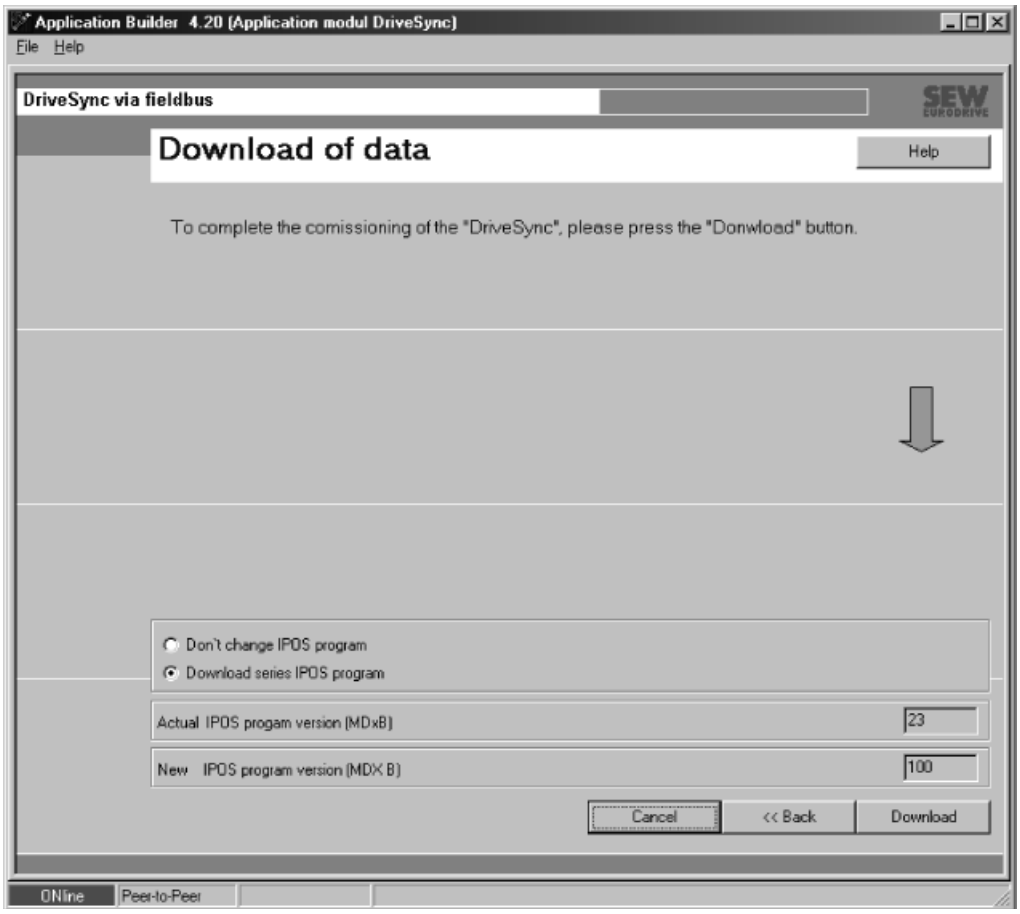
- **"Shell parameter for optimizing synchronous movement" group**

  Feedforward filter DRS (P228): Setting range 0 ... 100 ms

  Setpoint filter for the DRS11B synchronous operation feedforward control. The master speed (determined on the DRS) must be filtered for optimum acceleration feedforward control of the slave drive. Filtering requires the filter time constant. Value "0" indicates an unfiltered master speed.

### 6.3.10 Download

Click [Download] when you have entered all the parameters you require. The data is loaded into the inverter. Startup is now complete.




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- Stopping an IPOS$^{plus®}$ program that may have been started
- Setting the scaling parameters
- Setting the parameters for the ramps and maximum speeds
- Setting the synchronous operation parameters
- Downloading the IPOS$^{plus®}$ program
- Starting the IPOS$^{plus®}$ program

## 6.4 Parameters and IPOS$^{plus®}$ variables

The following parameters and IPOS$^{plus®}$ variables are set automatically during startup and are loaded into the inverter during the download.

| Parameter number P... | Index | Description | Setting |
|---|---|---|---|
| **100** | 8461 | Setpoint source | FIELDBUS |
| **101** | 8462 | Control word source | FIELDBUS or RS485 in control mode |
| **228** | | Feedforward filter DRS11B | Can be set (default 15 ms) |
| **240** | 8513 | Synchronous speed | Can be set (time-based engaging) |
| **241** | 8514 | Synchronous ramp | Can be set (time-based engaging) |
| **302** | 8517 | Maximum speed 1 | Can be set (0 – 6000 rpm) |
| **505** | 8903 | Synchronous encoder monitoring | Optional with monitoring activated |
| **600** | 8335 | Binary input DIØ1 | Enable/rapid stop |
| **601** | 8336 | Binary input DIØ2 | IPOS input (mark sensor) |
| **602** | 8337 | Binary input DIØ3 | Reference cam |
| **603** | 8338 | Binary input DIØ4 | /LIM. SWITCH CW or NO FUNCTION |
| **604** | 8339 | Binary input DIØ5 | /LIM. SWITCH CCW or NO FUNCTION |
| **605** | 8919 | Binary input DIØ6 | /Ext. fault or no function |
| **606** | 8920 | Binary input DIØ7 | No function |
| **620** | 8350 | Binary output DOØ1 | Output stage ON |
| **621** | 8351 | Binary output DOØ2 | /Fault |
| **700** | 8574 | Operating mode | ... & IPOS |
| **831** | 8610 | Fieldbus timeout response | No response<br>Display error<br>Immediate stop/malfunction<br>Emergency stop/malfunction<br>Rapid stop/malfunction<br>Immediate stop/warning<br>Emergency stop/warning<br>Rapid stop/warning |
| **836** | 8615 | Response SBus1 timeout | Can be set |
| **837** | 8936 | Response SBus2 timeout | Can be set |
| **870** | 8304 | Setpoint description PO1 | IPOS PO-DATA |
| **871** | 8305 | Setpoint description PO2 | POSITION HI |
| **872** | 8306 | Setpoint description PO3 | POSITION LO |
| **873** | 8307 | Setpoint description PI1 | IPOS PI-DATA |
| **874** | 8308 | Setpoint description PI2 | IPOS PI-DATA |
| **875** | 8309 | Setpoint description PI3 | IPOS PI-DATA |
| **876** | 8622 | PO data enable | On<br>OFF in control mode |
| **881** | 8600 | Address SBus1 | Can be set |
| **883** | 8602 | Timeout time SBus1 | Can be set |
| **884** | 8603 | Baud rate SBus1 | Can be set |
| **885** | 8604 | Synchronization ID SBus 1 | In slave 1, in master 0 |
| **890** | 8938 | Protocol SBus2 | Can be set |
| **891** | 8932 | Address SBus2 | Can be set |
| **893** | 8934 | Timeout time SBus2 | Can be set |

| Parameter number P... | Index | Description | Setting |
|---|---|---|---|
| **894** | 8939 | Baud rate SBus2 | Can be set |
| **900** | 8623 | Reference offset | Can be set |
| **903** | 8626 | Reference travel type | Can be set |
| **916** | 8632 | Ramp type | Linear or internal synchronous operation |
| **941** | 8729 | Actual position source | Can be set |
| **960** | 8835 | Modulo function | Reserved |
| **961** | 8836 | Modulo numerator | Can be set |
| **962** | 8837 | Modulo denominator | Can be set |
| **963** | 8838 | Modulo encoder resolution | Can be set |

| IPOS$^{plus®}$ variable | Description |
|---|---|
| **H001** | Automatic maximum speed |
| **H002** | Jog maximum speed |
| **H003** | Position resolution numerator |
| **H004** | Position resolution denominator |
| **H005** | Velocity numerator |
| **H006** | Velocity denominator |
| **H010** | SBus reception setpoint |
| **H012** | Absolute encoder position |
| **H014** | Reserved |
| **H015** | Limit switch on |
| **H016** | Reserved |
| **H017** | Distance resolution unit |
| **H018** | Position resolution unit |
| **H019** | Master / slave configuration |
| **H020** | Drive wheel diameter |
| **H021** | i gear |
| **H022** | i subgear |
| **H023** | Reserved |
| **H024** | Activate external error switch |
| **H025** | Position representation in modulo format |
| **H026** | Modulo switch |
| **H027** | Modulo gear unit numerator |
| **H028** | Modulo gear unit denominator |
| **H029** | Modulo additional gear numerator |
| **H030** | Modulo additional gear denominator |
| **H031** | Modulo numerator |
| **H032** | Modulo denominator |
| **H033** | Modulo maximum position |
| **H035** | Incremental modulo position representation |
| **H040** | Synchronous operation i gear unit master |
| **H041** | Synchronous operation i additional gear master |
| **H042** | Synchronous operation master length |
| **H043** | Synchronous operation i gear unit slave |
| **H044** | Synchronous operation i additional gear slave |
| **H045** | Synchronous operation slave length |

| IPOS$^{plus®}$ variable | Description |
|---|---|
| **H080** | SBus switch ON |
| **H088** | Pointer SBus master |
| **H089** | Virtual encoder operating mode |
| **H090** | Virtual encoder control bit |
| **H091** | Virtual encoder status |
| **H092** | Virtual encoder setpoint velocity |
| **H093** | Virtual encoder actual velocity value |
| **H094** | Virtual encoder setpoint position |
| **H095** | Virtual encoder actual position value |
| **H096** | Virtual encoder acceleration |
| **H109** | Synchronous operation gear unit numerator |
| **H110** | Synchronous operation gear unit denominator |
| **H111** | Synchronous operation additional gear numerator |
| **H112** | Synchronous operation additional gear denominator |
| **H116** | Master synchronous operation gear unit factor |
| **H117** | Slave synchronous operation gear unit factor |
| **H118** | Synchronous operation MFilter time |
| **H119** | Synchronous operation DxDT out |
| **H120** | Synchronous operation engaging mode |
| **H121** | Synchronous operation engaging condition |
| **H122** | Synchronous operation send object content |
| **H123** | Synchronous operation reserved |
| **H124** | Synchronous operation disengaging condition |
| **H125** | Synchronous operation position-based engaging distance |
| **H126** | Synchronous operation position-based offset length |
| **H127** | Reference travel to encoder zero track |
| **H128** | Reserved |
| **H125** | Pointer for scope pointer variable H474<br>Content of target variable is copied to H474 |
| **H126** | Pointer for scope pointer variable H475<br>Content of target variable is copied to H475 |

## INFORMATION

Do not alter these parameters and IPOS$^{plus®}$ variables after startup.

## 6.5 Recording IPOS$^{plus®}$ variables

IPOS$^{plus®}$ variables can be recorded during operation using the "Scope" program in MOVITOOLS®.

The two 32-Bit IPOS$^{plus®}$ variables *H474* and *H475* are available for recording. Two pointer variables (H125/H126) to *H474* and *H475* can be used to record any IPOS$^{plus®}$ variable using the "Scope" program:

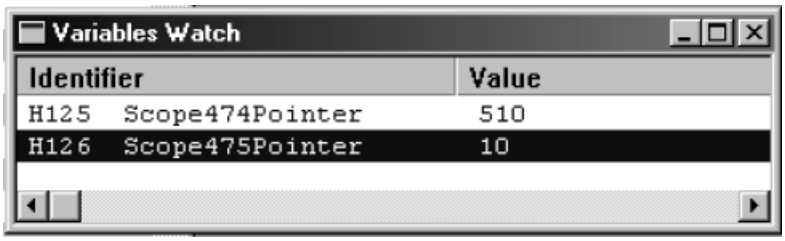
- H125 → Scope474Pointer
- H126 → Scope475Pointer

The number of the IPOS$^{plus®}$ variable that is to be recorded in "Scope" must be entered in the variable window of the IPOS Assembler or Compiler in one of the pointer variables H125 or H126.

### 6.5.1 Example

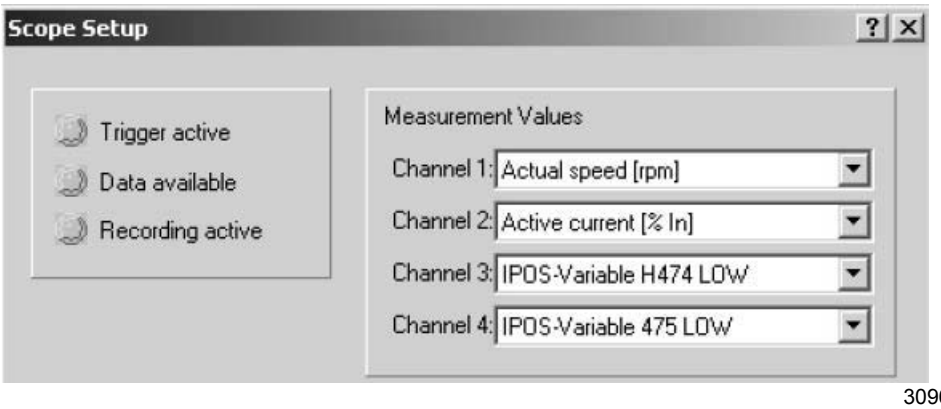
You want to record the IPOS$^{plus®}$ variables *H511 Current motor position* and *H10 Current SBus position setpoint in the slave axis*. Do the following:

- In the variable window of the IPOS Assembler or Compiler, enter the value 510 in variable H125 and the value 126 in variable H126.




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- In the "Scope" program, choose [File] / [New recording], set channel 3 to *IPOS variable H474 LOW* and channel 4 to *IPOS variable H475 LOW*. The "Scope" program now records the value of the IPOS$^{plus®}$ variables H130 and H132.




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**INFORMATION**

- The pointer variables are copied to the IPOS$^{plus®}$ variables H474 or H475 in TASK 3 of the IPOS$^{plus®}$ program.
- The speed (commands/ms) of task 3 is dependent on the processor utilization of MOVIDRIVE® MDX61B.
- The time (ms) needed in Task 3 to copy the values from the pointer variables to the IPOS$^{plus®}$ variables H474 and H475 is stored in variable H1002. If the value is zero, the copying process lasts less than 1 ms.

# 7 Operation and Servicing

## 7.1 Starting the drive

Following the download, switch to the monitor of the "DriveSync via fieldbus" application module by selecting "Yes".

Select the operating mode as follows:

- With control via fieldbus/system bus: Use bits 11 and 12 from "PO1:Control word 2"

### INFORMATION

Note the following points when starting the drive. This procedure applies to all operating modes:

- Binary inputs DIØØ "/CONTROLLER INHIBIT" and DIØ3 "ENABLE/STOP" must have a "1" signal.
- **Only with control via fieldbus/system bus:** Set the control bit PO1:0 "CONTROLLER INHIBIT/ENABLE" = "0" and the control bits PO1:1 "ENABLE/STOP" and PO1:2 "ENABLE/HALT" = "1."

### 7.1.1 Operating modes

| Operating mode | Virtual input terminal | |
|---|---|---|
| | DI11 Mode $2^0$ (PO1:11) | DI12 Mode $2^1$ (PO1:12) |
| **Jog mode** | "0" | "0" |
| **Referencing mode** | "1" | "0" |
| **Positioning mode** | "0" | "1" |
| **Synchronous operation** | "1" | "1" |

- **Jog mode (DI11 = "0" and DI112 = "0")**

  The direction of rotation is specified via the binary signals "Jog +" (DI10) and "Jog –" (DI09). With bus control, the set speed is specified by PO4. The drive is rotating at 0.2 rpm without or with negative setpoint speed.

- **Referencing mode (DI11 = "1" and DI12 = "0")**

  In referencing mode, reference travel can be started via bit 8 in control word 2 (PO1:8). Reference travel establishes the reference point (machine zero) for absolute positioning operations.

- **Positioning mode (DI11 = "0" and DI12 = "1")**

  The referenced axis starts positioning as soon as the binary "Start" signal is set.

### INFORMATION

"Positioning mode" cannot be selected without reference travel!

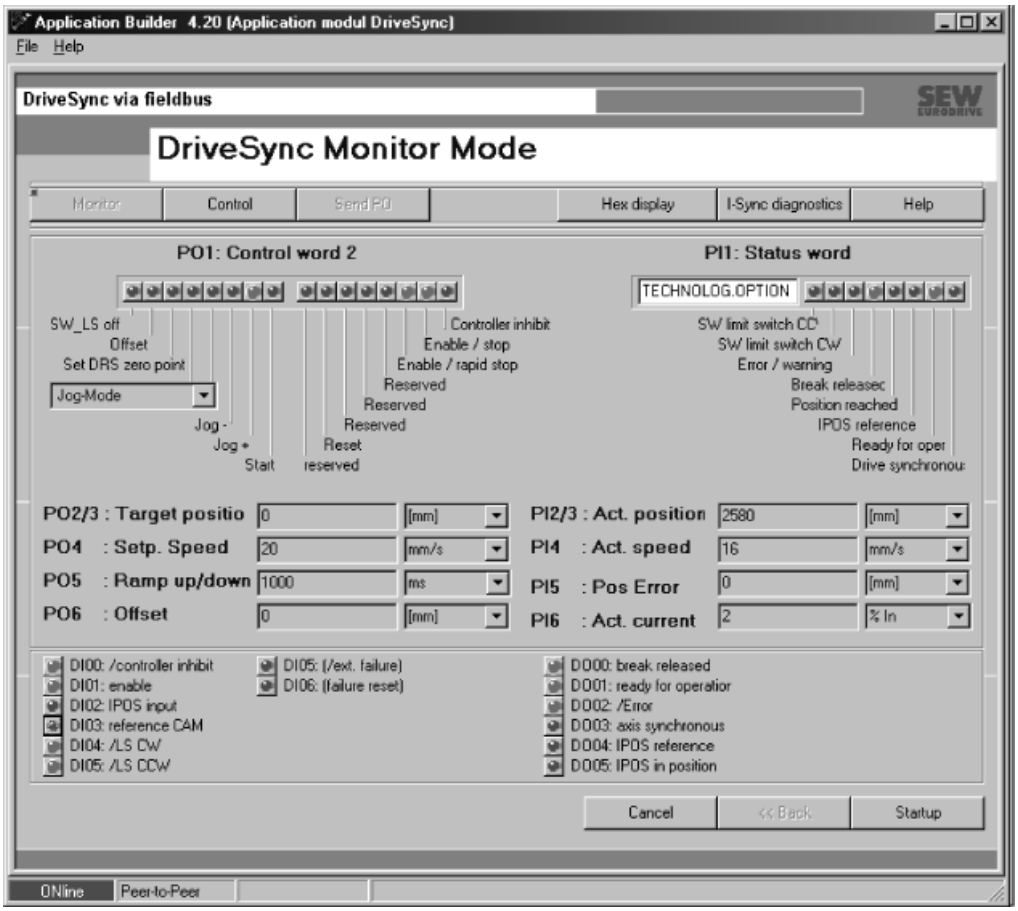
- **Synchronous operation (DI11 = "1" and DI12 = "1")**

  As soon as the engaging conditions defined during startup are met, the slave drive axis follows the master value signal of the synchronous operation master drive defined during startup. The PI1:0 "Axis synchronous" message indicates synchronous operation. It is possible to read the offset in relation to the master using process input data word PI5 "Master/slave positioning difference". You can specify a permanent position offset in relation to the master drive by defining an offset value with PI6 and starting offset processing via PO1:14.

## *7.2 Monitor mode*

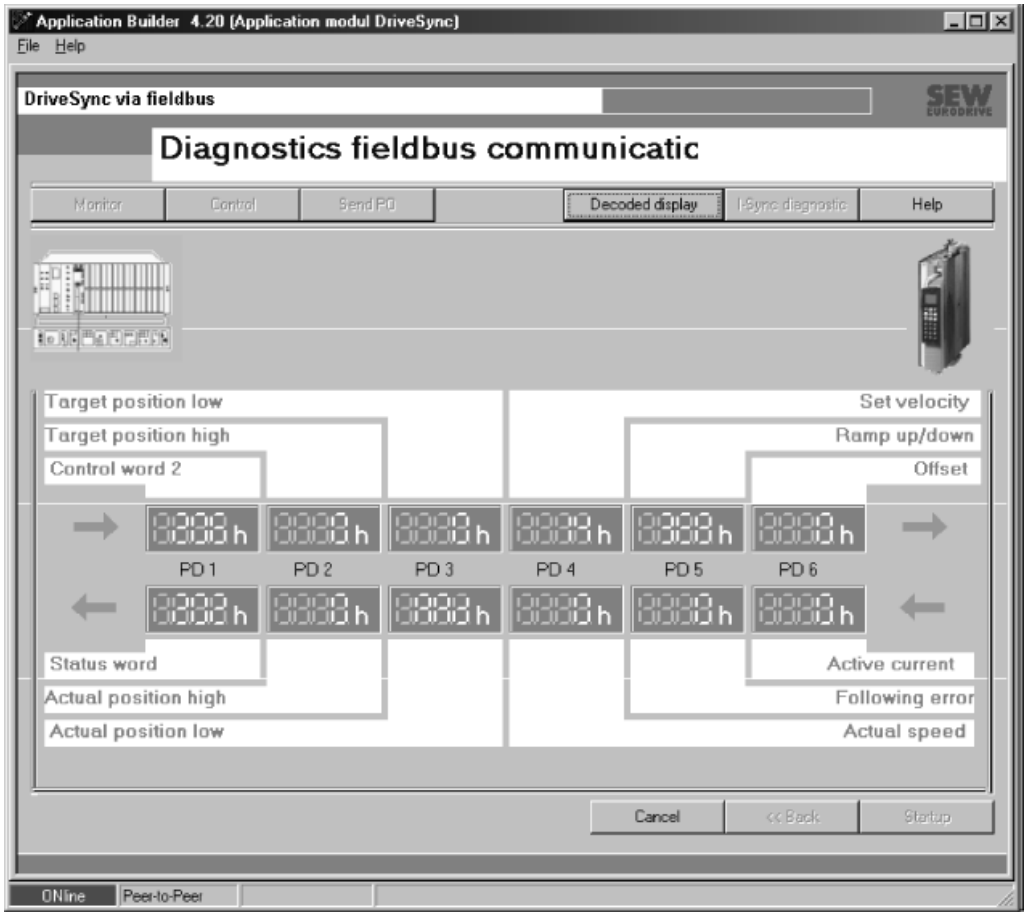
The monitor can be called up while the system is operating using [MOVITOOLS] / [Shell] / [Application Builder applications] / [DriveSync].

In monitor mode, the process input (PI1) and output data (PO1) that are transferred via fieldbus are displayed in decoded form in the middle of the window.




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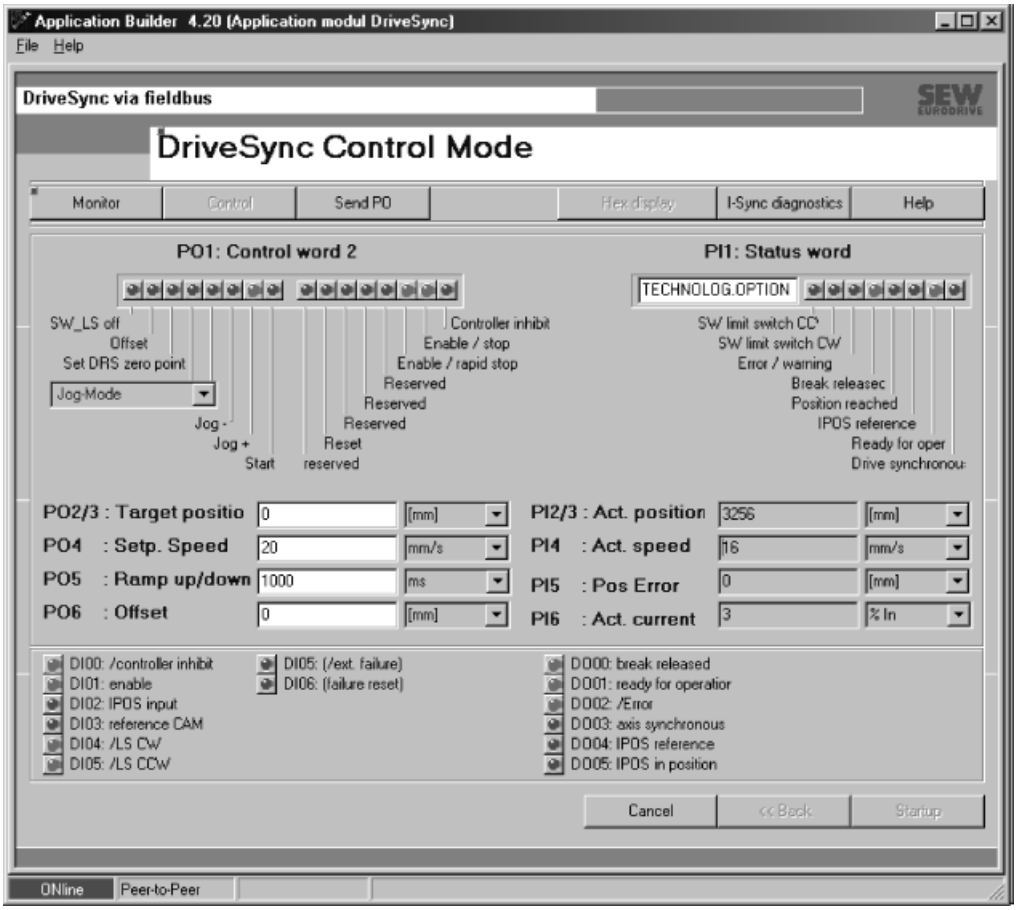
Click the [Hex display] button. The process input and output data are read in cyclically and displayed in hexadecimal format (see following figure).


Application Builder 4.20 (Application modul DriveSync)
File Help
DriveSync via fieldbus
SEW EURODRIVE
Diagnostics fieldbus communicatic
Monitor
Control
Send PD
Decoded display
I-Sync diagnostic
Help
Target position low
Target position high
Control word 2
Set velocity
Ramp up/down
Offset
PD 1
PD 2
PD 3
PD 4
PD 5
PD 6
Status word
Actual position high
Actual position low
Active current
Following error
Actual speed
Cancel
<< Back
Startup
ONline
Peer-to-Peer

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### 7.2.1 Diagnostics monitor: Control mode

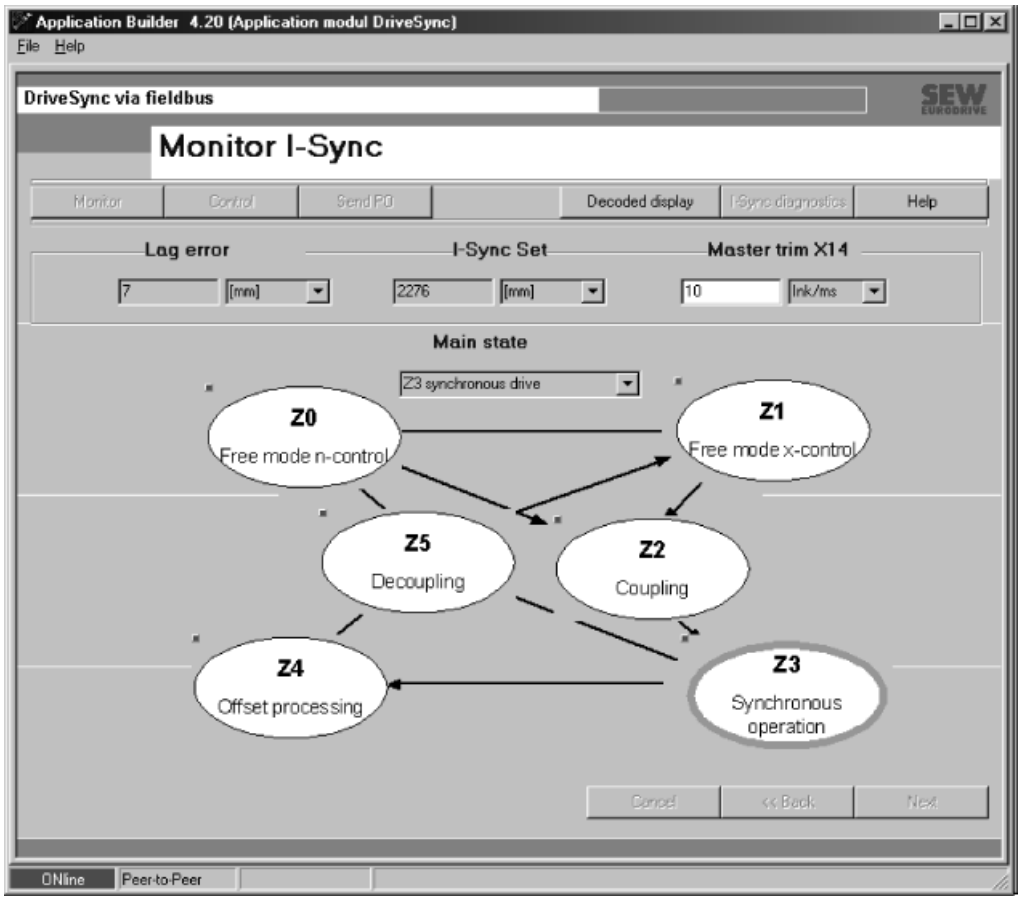
You can change from monitor to control mode when the inverter is in "CONTROLLER INHIBIT" state (PA1:0 = "1"). To do so, click on [Control]. In this mode, the "DriveSync via fieldbus" application can be controlled via the RS485 interface of the inverter if there is no bus interface module.




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You can observe the system status of the internal synchronous operation by clicking the [I-Sync diagnostics] button.

### 7.2.2 Diagnostics monitor: Status of internal synchronous operation



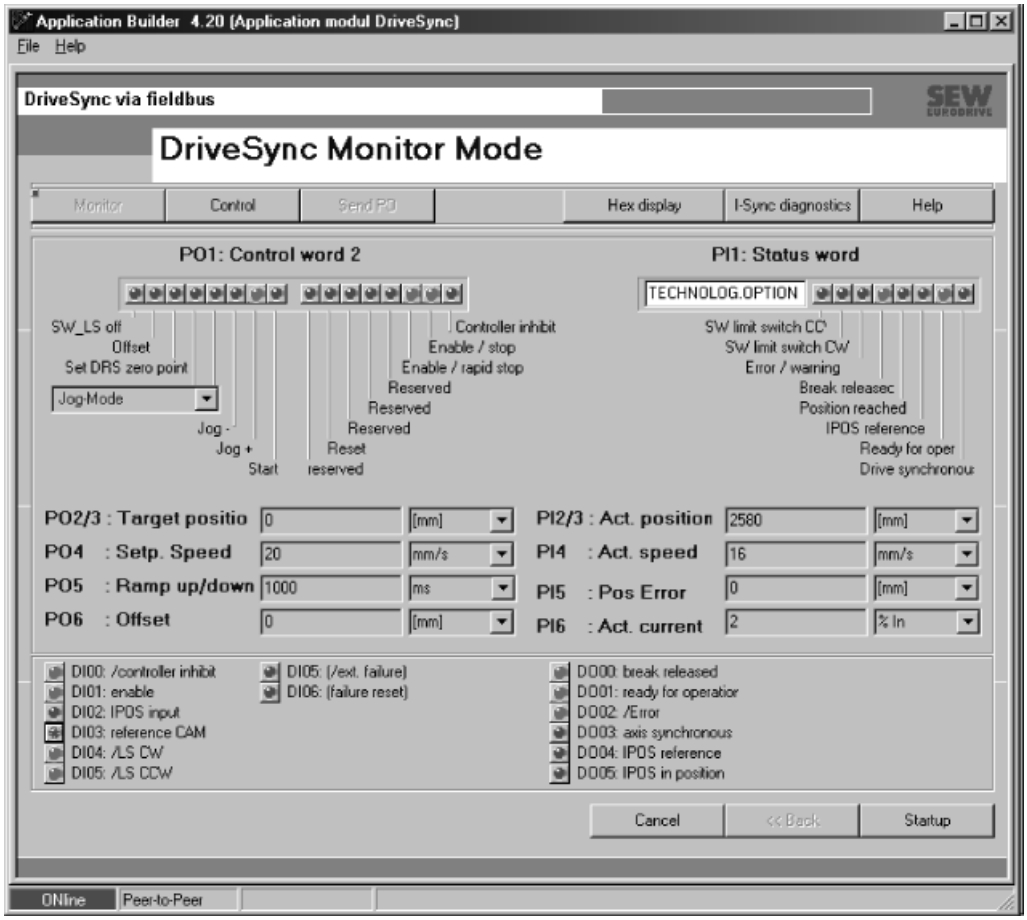

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**"Master trim X14" input field**

If master drive X14 is selected, you can enter a value to simulate incoming incremental encoder signals (inc/ms).

## 7.3 Jog mode

- PO1:12 = "0" and PO1:11 = "0"




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- The direction of rotation is specified via the binary signals "Jog +" (DI10) and "Jog -" (DI09). Jog mode is effective when the drive is referenced and the software limit switches have been defined up to 3 position windows in front of the software limit switch range. Otherwise, the axis can be moved endlessly.

- Once a direction of rotation has been selected, the drive can be moved in positioning mode within the range of the software limit switches.

- If no direction of rotation or both directions of rotations are selected, the drive will come to a halt subject to position control.

- The ramp time specified in PO5 is used for accelerating/decelerating the drive.

- The speed in jog mode is specified via PO4 and is limited by the IPOS$^{plus®}$ variable *H002 Jog maximum speed*. The drive is rotating at 0.2 min$^{-1}$ with or without negative speed specification.

### 7.3.1 Cancelation conditions

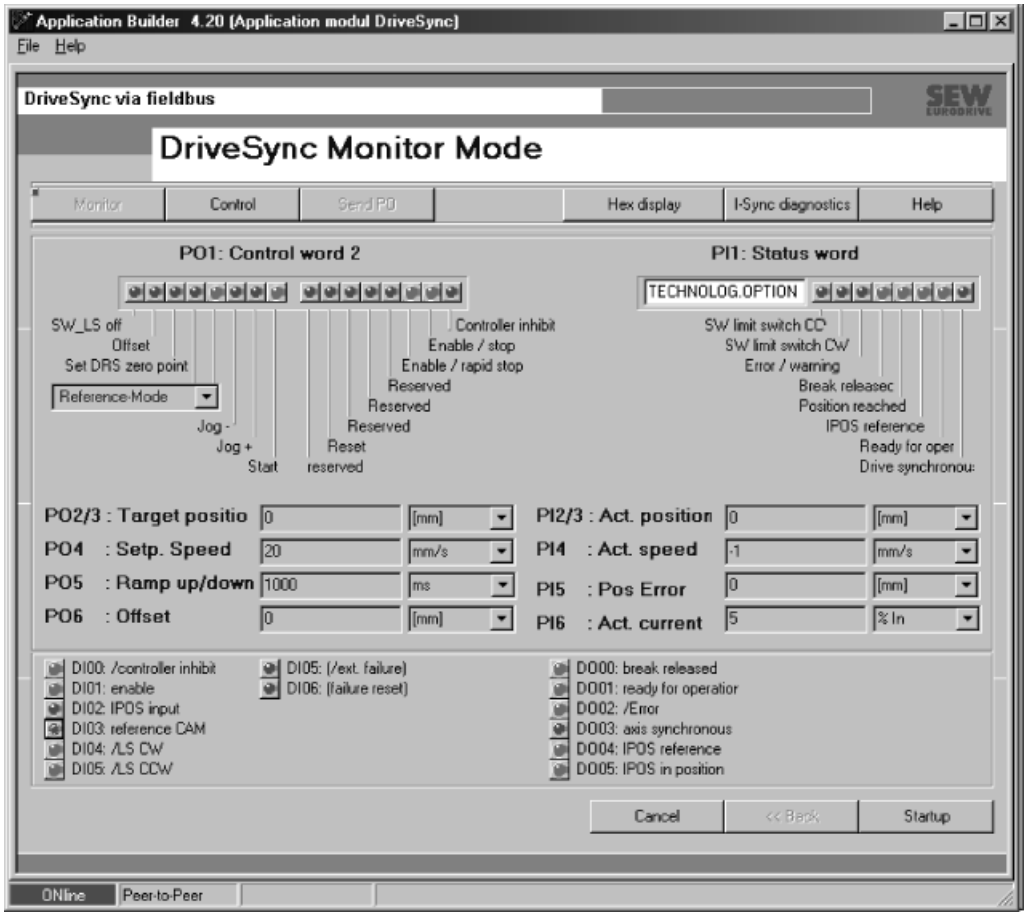
The following overview shows the conditions under which jog mode can be canceled.

| Cancelation condition | Description |
|---|---|
| DI00 = "0" or PO1:0 = "1" | **Not recommended!** The output stage switches off and the drive is not shut down in a controlled fashion but coasts to a stop or the mechanical brake is applied. |
| DI01 = "0" or PO1:1 = "0" | The drive is stopped using the *P136 stop ramp*. The mechanical brake is applied when the drive comes to a standstill. |
| PO1:2 = "0" | The drive stops using the ramp time set in *P131 ramp down CW* or *P133 ramp up CCW*. The mechanical brake is applied when the drive comes to a standstill. |
| PO1:8 = "0" and PO1:9 = "0" | The drive stops using the ramp time defined in process output data word PO5. The drive remains in standstill subject to position control (motor remains energized). |

## 7.4 Referencing mode

- PO1:12 = "0" and PO1:11 = "1"

  The reference position is defined through reference travel (e.g. to one of the two hardware limit switches).




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- Ensure that you have set the correct reference travel type (P903) **before starting** reference travel. You can choose between 8 different reference travel types: Preferably, reference travel should be to the edge of the reference cam. To have reference travel take place to the zero pulse of the encoder, set IPOS$^{plus®}$ variable H127 to "1".

- For the reference travel types 3 and 4, the drive automatically continues to move for an additional distance of 4096 increments after moving clear of the limit switch. This is in order to guarantee a safe distance from the limit switch.

- Set PO1:8 "Start" to "1" to start reference travel. The "1" signal must be present for the entire duration of the reference travel. The actual position (PO2 and PO3) is set to "0" once reference travel has been successfully completed. The "1" signal at PO1:8 "Start" can now be revoked. The drive is now referenced.

### 7.4.1 Cancelation conditions

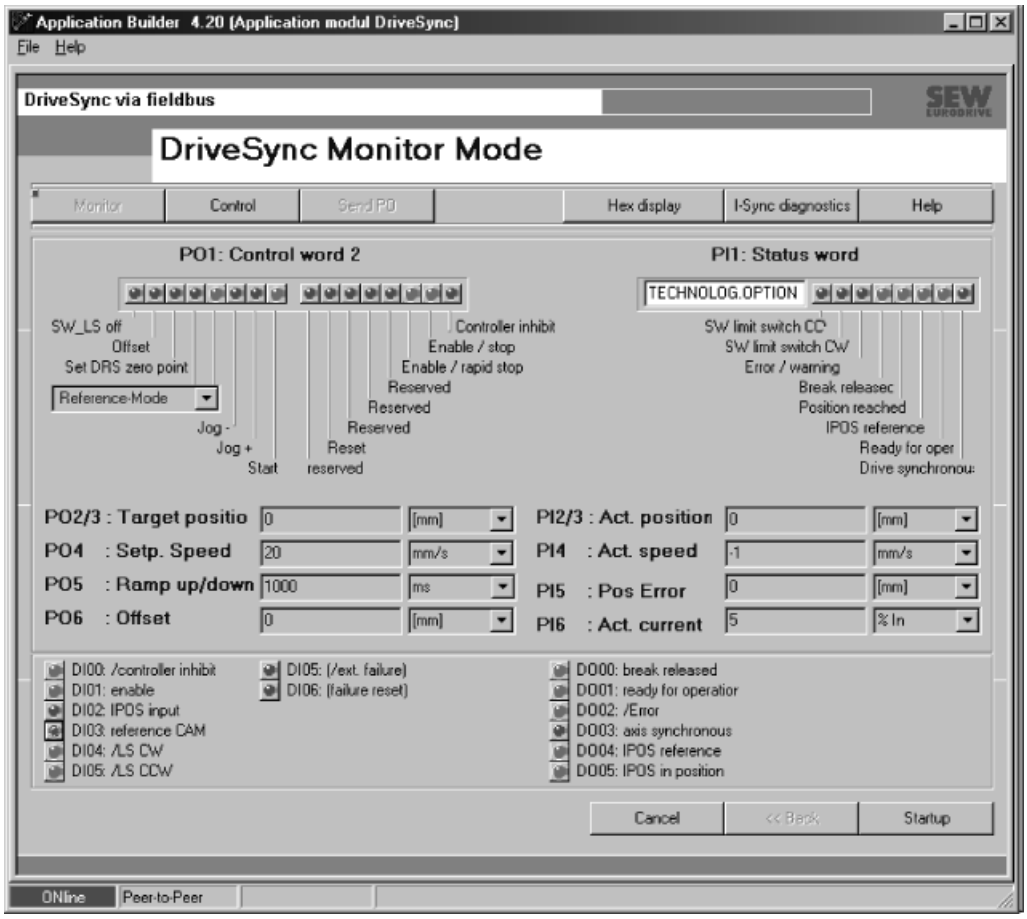
The following overview shows the conditions under which referencing mode can be canceled.

| Cancelation condition | Description |
|---|---|
| DI00 = "0" or PO1:0 = "1" | **Not recommended!** The output stage switches off and the drive is not shut down in a controlled fashion but coasts to a stop or the mechanical brake is applied. |
| DI01 = "0" or PO1:1 = "0" | The drive is stopped using the *P136 stop ramp*. The mechanical brake is applied when the drive comes to a standstill. |
| PO1:2 = "0" | The drive stops using the ramp time set in *P131 ramp down CW* or *P133 ramp up CCW*. The mechanical brake is applied when the drive comes to a standstill. |
| PO1:11 = "0" and PO12 = "0"<br>or PO1:8 = "0" | The drive stops. The drive remains in standstill subject to position control (motor remains energized). |

## 7.5 Positioning mode

- PO1:12 = "1" and PO1:11 = "0"

  In positioning mode, position setpoints are controlled in relation to the set IPOS encoder source.




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- Set PO1:8 "Start" to "1" to start positioning. You can specify the target position scaled in user units via the fieldbus with PO2/PO3. You can set the positioning ramp in process output data word PO5.

- The speed in jog mode is specified via PO4 and is limited by the IPOS$^{plus®}$ variable *H001 Automatic maximum speed*.

- You can change the target position during ongoing operation. Once the drive has reached the target position, it stops subject to position control and uses PO1:3 = "1" to signal the current position.

- The positioning job is discarded if the maximum input value of 262143 is exceeded in resolution "mm" or "1/10 mm". The drive then remains stopped with position control.

### 7.5.1 Cancelation conditions

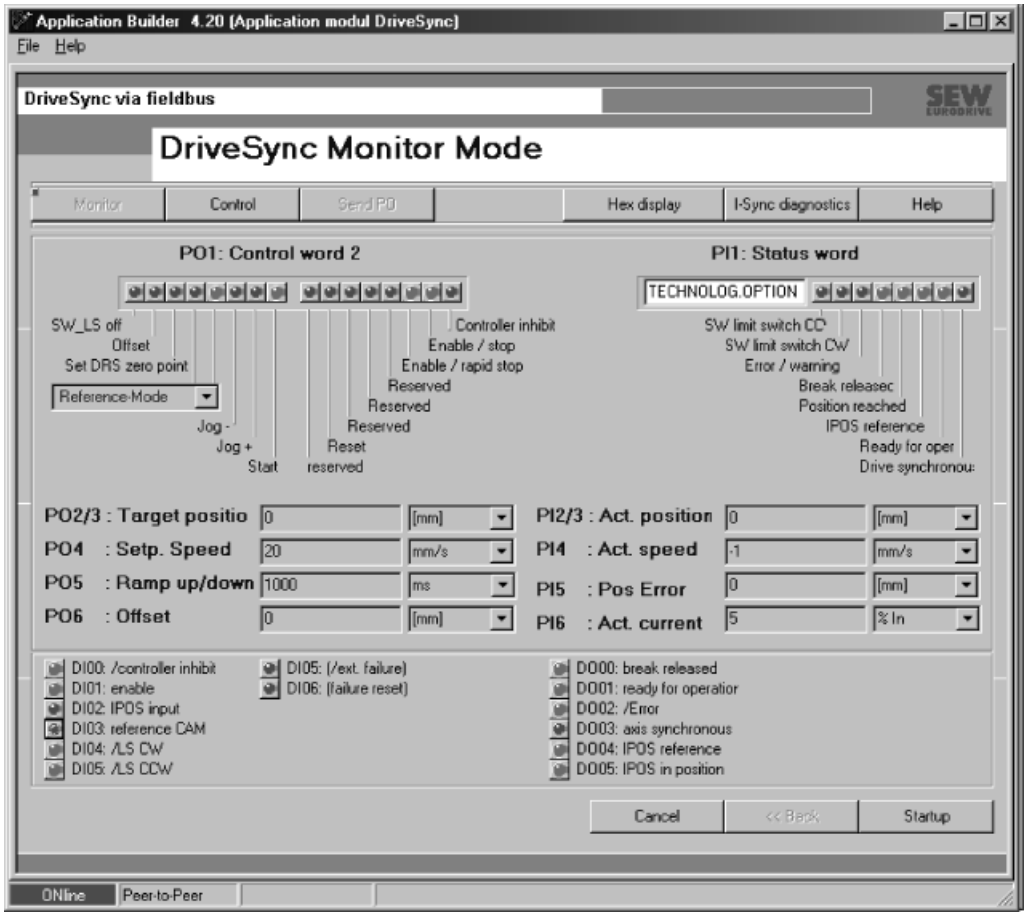
The following overview shows the conditions under which positioning mode can be canceled.

| Cancelation condition | Description |
|---|---|
| DI00 = "0" or PO1:0 = "1" | **Not recommended!** The output stage switches off and the drive is not shut down in a controlled fashion but coasts to a stop or the mechanical brake is applied. |
| DI01 = "0" or PO1:1 = "0" | The drive is stopped using the *P136 stop ramp*. The mechanical brake is applied when the drive comes to a standstill. |
| PO1:2 = "0" | The drive stops using the ramp time set in *P131 ramp down CW* or *P133 ramp up CCW*. The mechanical brake is applied when the drive comes to a standstill. |
| PO1:11 = "0" and PO12 = "0"<br>or PO1:8 = "0" | The drive stops using the ramp time defined in process output data word PO5. The drive remains in standstill subject to position control (motor remains energized). |

## 7.6 Synchronous operation

- PO1:12 = "1" and PO1:11 = "1"

  In synchronous mode, the actual position is adjusted to the setpoint position based on the "Internal synchronous operation (ISYNC)" technology function.




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- Set PO1:8 "Start" to "1" to start synchronous operation. As soon as the engaging event defined during startup occurs, the slave drive synchronizes with the master value of the master with time or position control. The master value can be generated as follows:
  - Via external encoder input X14
  - an SBus object from another drive with MDX61B
  - via a virtual master encoder signal generated within the system

- You can activate offset control via fieldbus when the drive is synchronous operation mode (PI1:0 = "1"). In this case, an offset value specified via the bus in synchronous mode is processed to correct the reference point between the master and slave drives. Additional conditions for engaging the synchronous operation slave are set by the parameters for engaging mode.

### 7.6.1 Cancelation conditions

The following overview shows the conditions under which synchronous mode can be canceled.

| Cancelation condition | Description |
|---|---|
| DI00 = "0" or PO1:0 = "1" | **Not recommended!** The output stage switches off and the drive is not shut down in a controlled fashion but coasts to a stop or the mechanical brake is applied.<br>The master/slave connection and lag error monitoring remain active. |
| DI01 = "0" or PO1:1 = "0" | The drive is stopped using the *P136 stop ramp*. The mechanical brake is applied when the drive comes to a standstill.<br>The master/slave connection and lag error monitoring remain active. |
| PO1:2 = "0" | The drive stops using the ramp time set in *P131 ramp down CW* or *P133 ramp up CCW*. The mechanical brake is applied when the drive comes to a standstill. The master/slave connection and lag error monitoring remain active. |
| PO1:11 = "0" and PO12 = "0"<br>or PO1:8 = "0" | The drive stops using the ramp time defined in process output data word PO5. The drive remains in standstill subject to position control (motor remains energized).<br>The slave is disengaged and lag error monitoring is disabled. |

### 7.6.2 Example for synchronous operation

The following example describes how to minimize a position offset between the master and the slave drive.

- **Engaging**
  - Make sure that the drives are ready for operation (PI1:1) and in "technology option" status.
  - Select the "synchronous operation" mode at the slave drive and set PO1:8 "Start" to "1".
  - You can start the motion sequence by activating the master.
  - The drives move in sync as long as the inverters show the "technology option" status and PI1:1 (inverter ready for operation) is "1".
  - Important: Each time the system changes to "synchronous operation", the current actual position of the master drive is set as the new reference position for the slave drive, i.e. the user must previously align the slave with the master drive, or vice versa (see "Aligning the drives").
- **Guided disengaging (reduced position offset)**

  Guided disengaging is recommended if a synchronous stop is required during travel. Synchronicity during the stop movement is only ensured if the synchronous operation ramp and the synchronous speed are more dynamic than the ramp and speed of the master drive.
  - During guided disengaging, the drives must indicate the status "technology option" and PI1:1 (inverter ready for operation) must be "1". In addition, the slave drives must be queried for PI1:0 = "1" (drive in sync). The PLC handles this query.
  - First, stop the master drive (with PO1:8 "Start" = "0" or PO1:0 "Enable" = "0"). The slave drive follows in sync with the stop movement of the master drive.
  - Once the master drive has stopped, disengage the slave drive by cancelling the synchronous operation mode or via PO1:8 "Start" = "0".
  - The axis system is dissolved when the slave drive signals "Drive in sync = 0" (PI1:0).
  - Observe the notes in "Aligning the drives" before re-engaging the drives.

- **Interruptions, e.g. in case an inverter error is detected**
  - Stop the drives, e.g. via PO1:2 = "0" (Enable/halt). Reset the selection of the operating mode. Set PO1:8 (Start) to "0".
  - The axis system is dissolved. The drives are no longer in sync.
  - In case of absolute position referencing, the axis system must be aligned subsequently.
  - The position deviation can be minimized by adjusting the ramp times defined under "Cancelation condition".
- **Aligning the drives**

  The following procedure is recommended if an absolute position reference is required between master and slave drive.
  - Make sure that the drives that are to be aligned are ready for operation (PI1:1 = "1") and in "technology option" status.
  - When positioning operation is selected, the drives are aligned to the target position sent by the PLC.
  - Query the completion of the alignment movement (PI1:3 = "1").

## 7.7 Cycle diagrams

The cycle diagrams only apply to enabled inverters that are ready for operation. This is indicated by an "A" in the 7-segment display.

You can see this by sending a query for the output terminals or via the process data interface.

- **Output terminals**
  - DB00 = "1" (brake released)
  - DO01 = "1" (ready for operation)
  - DO02 = "1" (no fault)
- **Process data interface**
  - PI1:1 = "1" (ready for operation)
  - PI1:5 = "0" (no error/warning)
  - PI1:High byte = "10" (technology option)

The following conditions also apply to the cycle diagrams:

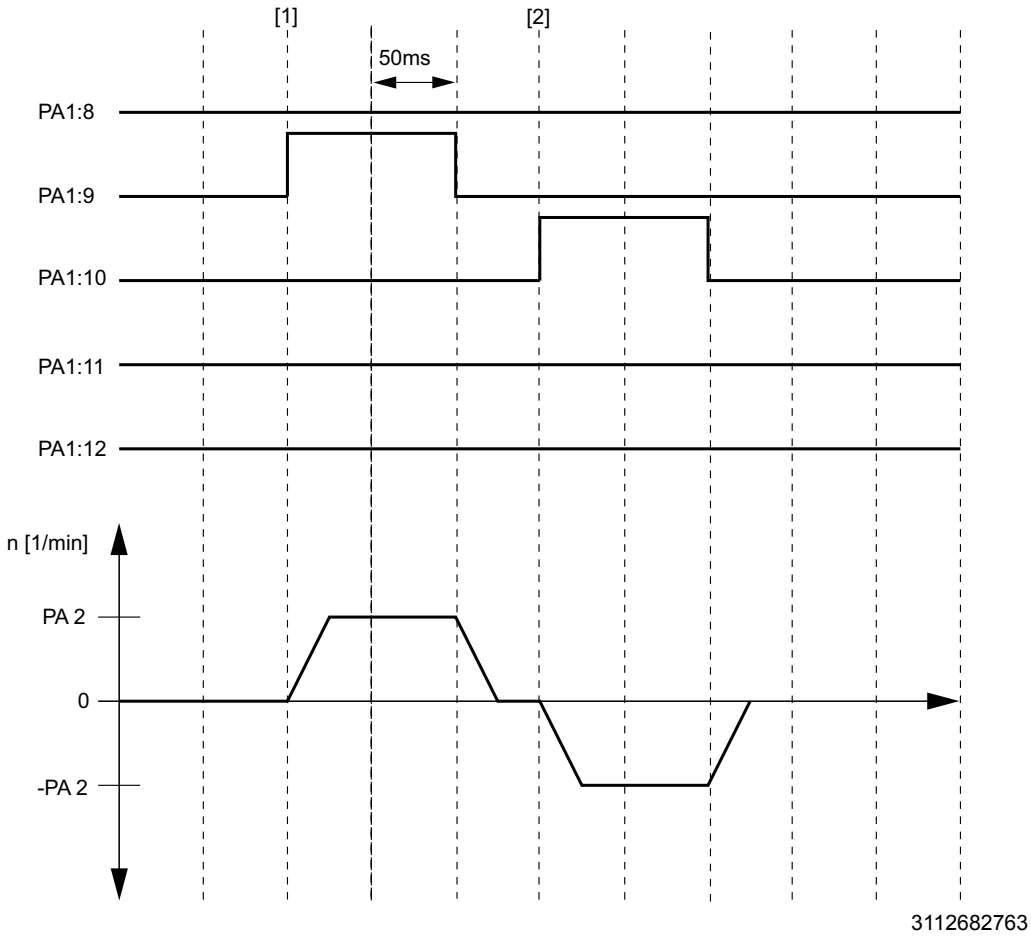
- Startup has been performed correctly
- DIØØ "/CONTROLLER INHIBIT" = "1" (no inhibit)
- DIØ1 "ENABLE/STOP" = "1"

### INFORMATION

With control via fieldbus/system bus, you must set the following bits in control word PO1:

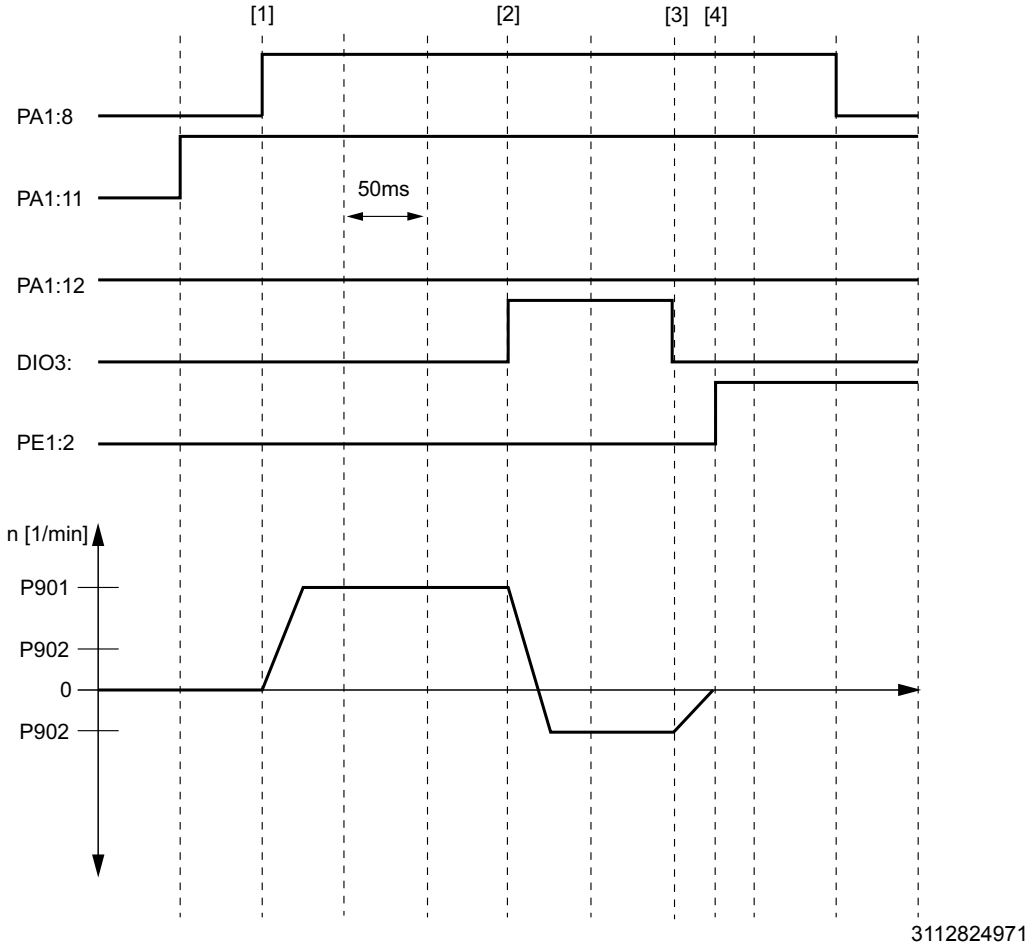
- PO1:1 = "1" (ENABLE/HALT)
- PO1:2 = "1" (ENABLE/STOP)

### 7.7.1 Jog mode



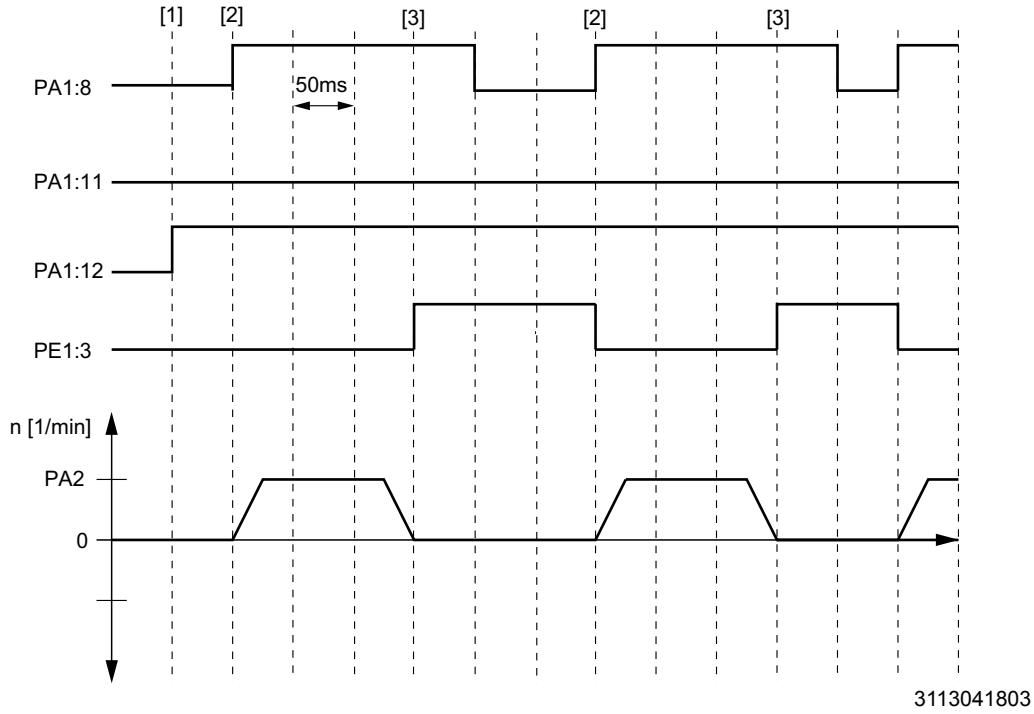

| | |
|---|---|
| [1] | Axis starts when the "Jog +" bit is set |
| [2] | Axis starts when the "Jog –" bit is set |
| PO1:8 | Start |
| PO1:9 | Jog + |
| PO1:10 | Jog – |
| PO1:11 | Mode low |
| PO1:12 | Mode high |

### 7.7.2 Referencing mode




[1] Axis starts when the "Start" bit is set
[2] DI03 "Reference cam" is reached, which reverses the direction of rotation (applies to reference travel type 3).
[3] DI03 "Reference cam" is cleared, which stops the movement
[4] PI1:2 "IPOS referenced" is set
PO1:8 Start
PO1:9 Jog +
PO1:10 Jog –
PO1:11 Mode low
PO1:12 Mode high

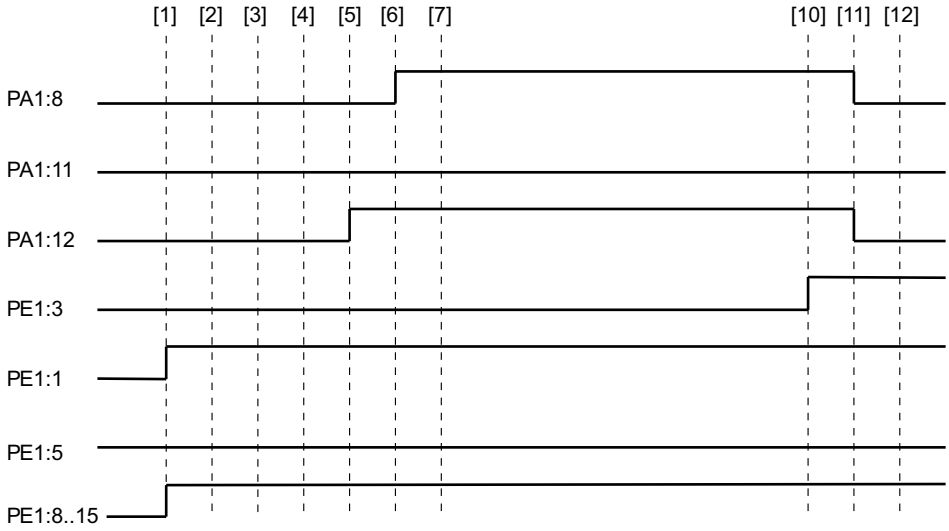
### 7.7.3 Positioning mode




[1] Automatic absolute selected
[2] Start positioning (target position = PO3)
[3] Target position reached
PO1:8 Start
PO1:11 Mode low
PO1:12 Mode high
PO1:3 Target position reached

### 7.7.4 Synchronous operation

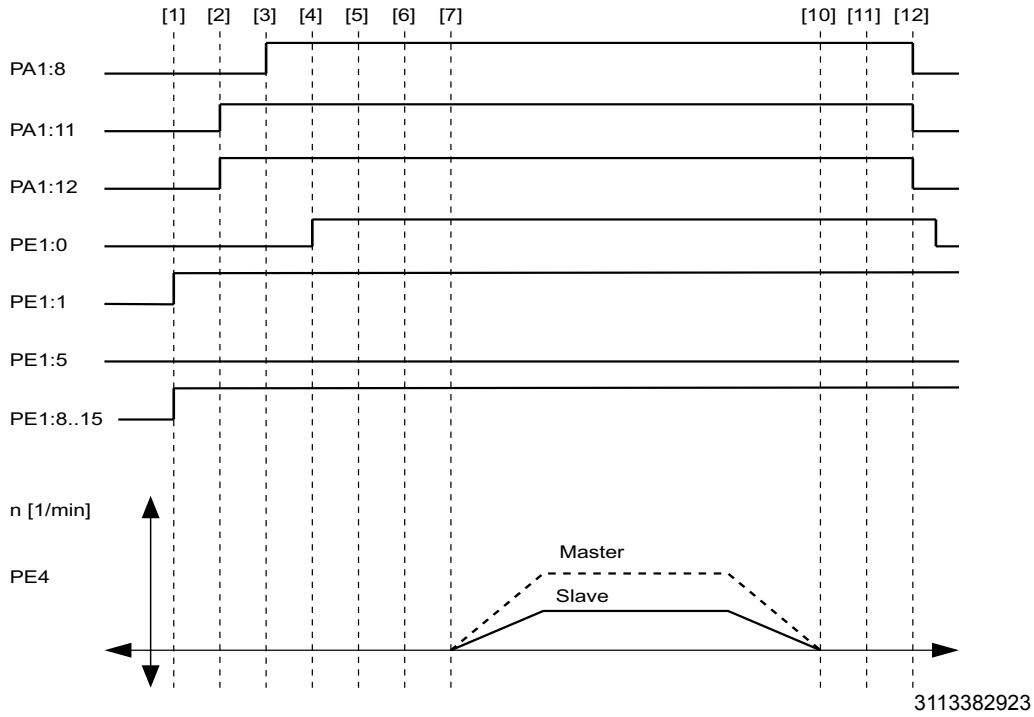
*Master drive in positioning mode*




3113161355

| | |
|---|---|
| [0] | DI00 "CONTROLLER INHIBIT" = "1" |
| | DI01 "ENABLE/STOP" = "1" |
| | PO1:1 "ENABLE/RAPID STOP" = "1" |
| | PO1:1 "ENABLE/HALT" = "1" |
| [1] | Ready for operation and in position control |
| [5] | Positioning mode selected |
| [6] | Start positioning |
| [7] | Cyclical monitoring |
| [10] | Target position reached |
| [11] | Operating mode and start deselected |
| PO1:8 | Start |
| PO1:11 | Mode low |
| PO1:12 | Mode high |
| PI1:1 | Inverter ready |
| PI1:3 | Target position reached |
| PI1:5 | Error/warning |
| PI1:8 – 15 | Inverter status/error code |

*Slave drive in synchronous mode*



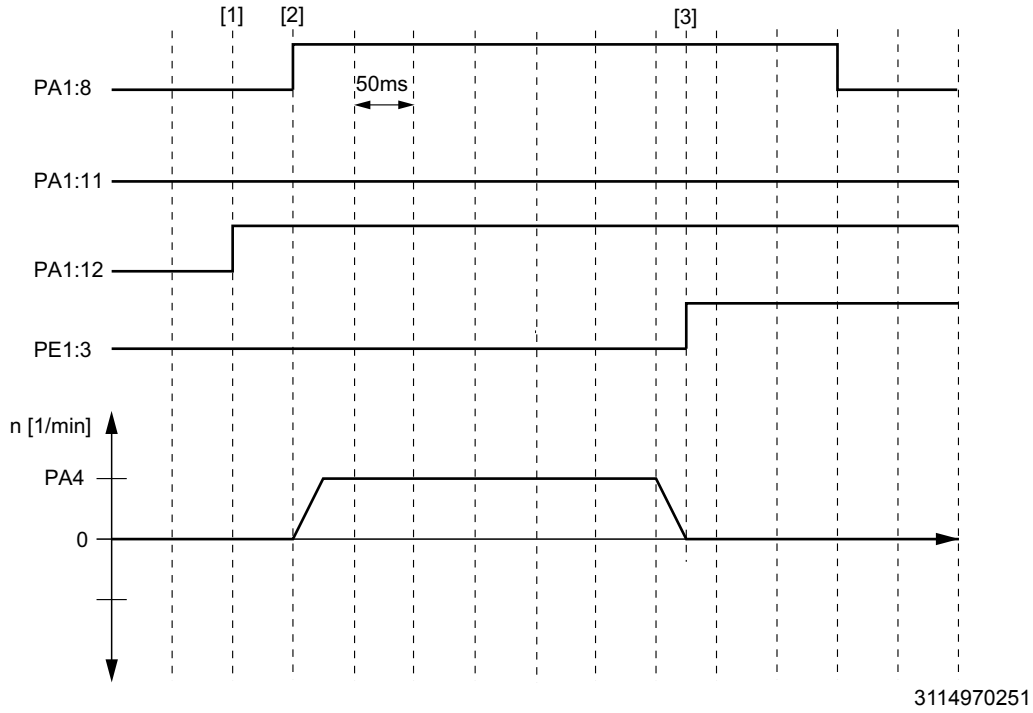

| | |
|---|---|
| [0] | DI00 "/CONTROLLER INHIBIT" = "1" |
| | DI01 "ENABLE/STOP" = "1" |
| | PO1:1 "ENABLE/RAPID STOP" = "1" |
| | PO1:1 "ENABLE/HALT" = "1" |
| [1] | Ready for operation and in position control |
| [2] | Synchronous operation selected |
| [3] | Start synchronous operation |
| [4] | Drive synchronous |
| [7] | Cyclical monitoring |
| [12] | Operating mode and start deselected |
| PO1:8 | Start |
| PO1:11 | Mode low |
| PO1:12 | Mode high |
| PI1:0 | Drive synchronous |
| PI1:1 | Inverter ready |
| PI1:3 | Target position reached |
| PI1:5 | Error/warning |
| PI1:8 – 15 | Inverter status/error code |

### 7.7.5 Moving clear of hardware limit switches

Once a hardware limit switch (DI04 = "0" or DI05 ="0") has been reached, the bit PI1:5 "Error" is set and the drive comes to a standstill using an emergency stop.

Proceed as follows to move the drive clear of the limit switch:

- Jog mode: Set the bits PO1:9 "Jog +" and PO1:10 "Jog –" to "0".
- Automatic mode: Set bit PO1:8 "Start" to "0".
- Set bit PO1:6 "Reset" to "1". The bit PI1:5 "Error" is deleted.
- The drive automatically moves clear of the hardware limit switch at the speed specified in *P902 Reference speed 2*.
- Once the drive has moved clear of the hardware limit switch, you can delete PA1:6 "Reset" and select the required operating mode.




[1] The drive has reached the CW hardware limit switch and comes to a halt using an emergency stop ramp.
[2] PO1:6 "Reset" is set. Drive moves clear of hardware limit switch.
[3] Drive moved clear of hardware limit switch
PO1:11 Mode low
PO1:12 Mode high
PO1:6 Reset
PO1:5 Error
DI04 CW hardware limit switch

## 7.8 Error information

### 7.8.1 Error memory

The error memory (P080) stores the last five error messages (errors t-0 to t4). The error message of longest standing is deleted whenever more than five error messages have occurred. The following information is stored when a malfunction occurs:

Error that has occurred · Status of binary inputs/outputs · Operating status of the inverter · Inverter status · Heat sink temperature · Speed · Output current · Active current · Unit utilization · DC link voltage · ON hours · Enable hours · Parameter set · Motor utilization.

### 7.8.2 Switch-off responses

There are three switch-off responses depending on the fault; the inverter remains inhibited in fault status:

*Immediate disconnection* — The unit can no longer brake the drive; the output stage goes to high resistance in the event of a fault and the brake is applied immediately (DBØØ "/Brake" = "0").

*Rapid stop* — The drive is braked with the stop ramp t13/t23. Once the stop speed is reached, the brake is applied (DBØØ "/Brake" = "0"). The output stage goes to high resistance after the brake reaction time has elapsed (P732 / P735).

*Emergency stop* — The drive is braked with the emergency ramp t14/t24. Once the stop speed is reached, the brake is applied (DBØØ "/Brake" = "0"). The output stage goes to high resistance after the brake reaction time has elapsed (P732 / P735).

### 7.8.3 Reset

An error message can be acknowledged by:

- Switching power off and on again

  Recommendation: Observe a minimum switch-off time of 10 s for the line contactor K11.
- Reset via input terminals; that is, via an appropriately assigned binary input (DIØ1 to DIØ7 with the basic unit, DI1Ø to DI17 with the DIO11B option).
- Manual reset in SHELL (P840 = “YES” or [Parameter] / [Manual reset]).
- Manual reset using the DBG60B.
- Auto reset performs up to five unit resets with an adjustable restart time.



**⚠ DANGER**

Risk of crushing if the motor starts up automatically after an auto reset.

Severe or fatal injuries.

- Do not use auto reset with drives where an automatic restart represents a danger to people or units.
- Perform a manual reset.

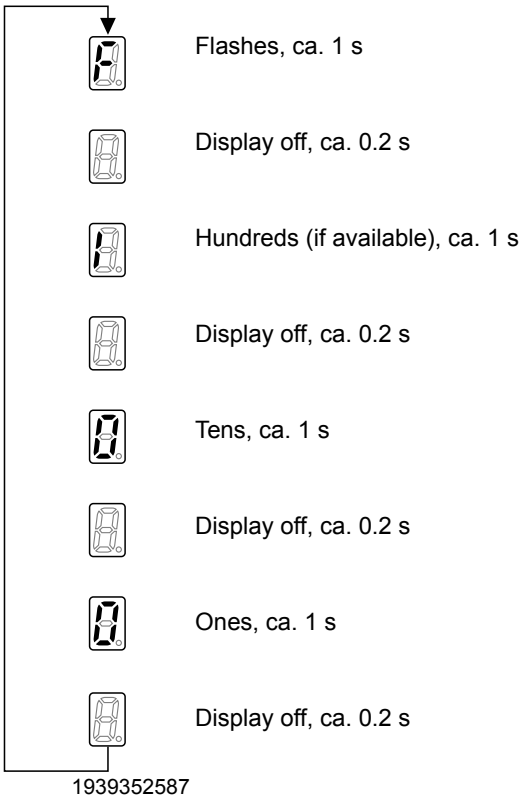
#### 7.8.4 Inverter waiting for data

If the inverter is controlled via a communication interface (fieldbus, RS485 or SBus) and the power was switched off and back on again or a fault reset was performed, then the enable remains ineffective until the inverter receives valid data again via the interface, which is monitored with a timeout.

## *7.9 Error messages and list of errors*

#### 7.9.1 Error message via 7-segment display

The error code is shown in a 7-segment display. The following display sequence is used (e.g. error code 100):




Following a reset or if the error code resumes the value "0", the display switches to the operating display.

#### 7.9.2 Suberror code display

The suberror code is displayed in MOVITOOLS® MotionStudio (as of version 4.50) or in the DBG60B keypad.

### 7.9.3 Error list

The following table shows a selection from the complete error list (see MOVIDRIVE® B operating instructions). Only those faults that can occur in this application are listed. The factory set error response is listed in the "Response P" column. (P) indicates that the response is programmable (via *P83_error response* or with IPOS$^{plus®}$).

| Error | | | Suberror | | | |
|---|---|---|---|---|---|---|
| **Code** | **Designation** | **Response (P)** | **Code** | **Designation** | **Possible cause** | **Measure** |
| **00** | No error | | | | | |
| **07** | DC link overvoltage | Immediate disconnection | 0 | DC link voltage too high in 2-Q operation | DC link voltage too high | • Extend deceleration ramps<br>• Check supply cable to the braking resistor<br>• Check technical data of braking resistor |
| | | | 1 | | | |
| | | | 2 | DC link voltage too high in 4-Q operation..<br>.. Phase U | | |
| | | | 3 | .. Phase V | | |
| | | | 4 | .. Phase W | | |
| **08** | Speed monitoring | Immediate disconnection (P) | 0 | Inverter in current limit or in slip limit | • Speed controller or current controller (in VFC operating mode without encoder) operating at setting limit due to mechanical overload or phase failure in the power supply or motor.<br>• Encoder not connected correctly or incorrect direction of rotation.<br>• $n_{max}$ is exceeded during torque control.<br>• In operating mode VFC: Output frequency ≥ 150 Hz<br>• In operating mode V/f: Output frequency ≥ 600 Hz | • Reduce load<br>• Increase deceleration time (P501 or P503).<br>• Check encoder connection, swap A/A and B/B pairs if necessary<br>• Check encoder voltage supply<br>• Check current limitation<br>• Extend ramps if necessary<br>• Check motor cable and motor<br>• Check line phases |
| | | | 3 | "Actual speed" system limit exceeded.<br>Speed difference between ramp setpoint and actual value for 2×ramp time higher than expected slip. | | |
| | | | 4 | Maximum rotating field speed exceeded.<br>Maximum rotating field frequency (with VFC max 150 Hz and V/f max 600 Hz) exceeded. | | |
| **10** | IPOS-ILLOP | Emergency stop | 0 | Invalid IPOS command | • Incorrect command detected during IPOS$^{plus®}$ program execution.<br>• Incorrect conditions during command execution. | • Check the content of the program memory and, if necessary, correct.<br>• Load the correct program into the program memory.<br>• Check program sequence (→ IPOS$^{plus®}$ manual) |

| Error | | | Suberror | | | |
|---|---|---|---|---|---|---|
| Code | Designation | Response (P) | Code | Designation | Possible cause | Measure |
| 14 | Encoder | Immediate disconnection | 0 | Encoder not connected, defective encoder, defective encoder cable | • Encoder cable or shield not connected correctly<br>• Short circuit/broken encoder wire<br>• Encoder defective | Check encoder cable and shield for correct connection, short circuit and broken wire. |
| | | | 25 | Encoder error X15 - Speed range exceeded.<br>Encoder at X15 turns faster than 6542 rpm. | | |
| | | | 26 | Encoder error X15 - Card is defective.<br>Error in the quadrant evaluation. | | |
| | | | 27 | Encoder error – encoder connection or encoder is defective | | |
| | | | 28 | Encoder error X15 - Communication error RS485 channel. | | |
| | | | 29 | Encoder error X14 - Communication error RS485 channel. | | |
| | | | 30 | Unknown encoder type at X14/X15 | | |
| | | | 31 | Plausibility check error Hiperface® X14/X15<br>Increments have been lost. | | |
| | | | 32 | Encoder error Hiperface® X15<br>Hiperface® encoder at X15 signals error | | |
| | | | 33 | Encoder error Hiperface® X14<br>Hiperface® encoder at X14 signals error | | |
| | | | 34 | Encoder error X15 resolver.<br>Encoder connection or encoder is defective. | | |
| 26 | External terminal | Emergency stop (P) | 0 | External terminal | Read in external error signal via programmable input. | Eliminate respective cause; reprogram terminal if necessary. |
| 28 | Fieldbus Timeout | Rapid stop (P) | 0 | Fault "Fieldbus timeout" | No communication between master and slave within the projected response monitoring. | • Check communications routine of the master<br>• Extend fieldbus timeout time (P819) or deactivate monitoring |
| | | | 2 | Fieldbus interface does not boot | | |
| 31 | TF/TH sensor tripped | None Response (P) | 0 | Thermal motor protection error | • Motor too hot, TF/TH has triggered<br>• TF/TH of the motor not connected or connected incorrectly<br>• MOVIDRIVE® connection and TF/TH connection on motor interrupted | • Let motor cool off and reset error<br>• Check connections/link between MOVIDRIVE® and TF/TH.<br>• If a TF/TH is not connected: Jumper X10:1 with X10:2.<br>• Set P835 to "No response". |
| 36 | Option missing | Immediate disconnection | 0 | Hardware is missing or not permitted. | • Type of option card not allowed<br>• Setpoint source, control signal source or operating mode not permitted for this option card<br>• Incorrect encoder type set for DIP11B. | • Use correct option card<br>• Set correct setpoint source (P100)<br>• Set correct control signal source (P101)<br>• Set correct operating mode (P700 or P701)<br>• Set the correct encoder type |
| | | | 2 | Encoder slot error. | | |
| | | | 3 | Fieldbus slot error. | | |
| | | | 4 | Expansion slot error. | | |

| Error | | | Suberror | | | |
|---|---|---|---|---|---|---|
| **Code** | **Designation** | **Response (P)** | **Code** | **Designation** | **Possible cause** | **Measure** |
| **42** | Lag error | Immediate disconnection (P) | 0 | Positioning lag error | • Encoder connected incorrectly<br>• Acceleration ramps too short<br>• P component of positioning controller too small<br>• Incorrect speed controller parameters<br>• Value of lag error tolerance too small | • Check encoder connection<br>• Extend ramps<br>• Set P component to higher value<br>• Reset speed controller parameters<br>• Increase lag error tolerance<br>• Check wiring of encoder, motor and line phase.<br>• Check whether mechanical system components can move freely or if they are blocked |
| **78** | IPOS SW limit switch | No response (P) | 0 | Software limit switch reached | **Only in IPOS$^{plus®}$ operating mode:**<br>Programmed target position is outside travel range delimited by software limit switches. | • Check the user program<br>• Check position of software limit switches |
| **99** | IPOS ramp calculation | Immediate disconnection | 0 | "Ramp calculation" error | **Only in IPOS$^{plus®}$ operating mode:**<br>Positioning ramp is sinusoidal or square and an attempt is made to change ramp times and traveling velocities with enabled inverter. | Rewrite the IPOS$^{plus®}$ program so that ramp times and traveling velocities can only be altered when the inverter is inhibited. |

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