SEW EURODRIVE

Manual

MOVIDRIVE® MDX61B

Automotive AMA0801 Application Module

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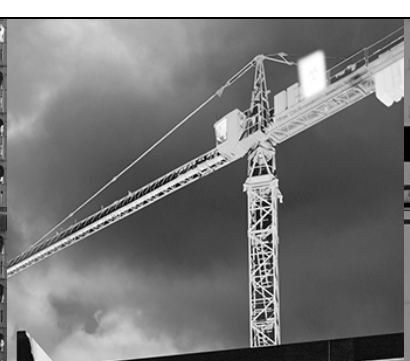


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1 General Information

1.1 Structure of the safety notes

The safety notes in this manual are structured as follows:

Pictogram	SIGNAL WORD
	Type and source of danger. Possible consequence(s) if disregarded. • Measure(s) to prevent the danger.

Pictogram	Signal word	Meaning	Consequences if disregarded
Example:  General danger  Specific danger, e.g. electric shock	**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
	**INFORMA-TION**	Useful information or tip. Simplifies the handling of the drive system.	

1.2 Rights to claim under warranty

A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you adhere to the information in the **operating instructions**. **Therefore, read the operating instructions** before you start operating the unit.

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

1.3 Exclusion of liability

You must comply with the information contained in these operating instructions to ensure safe operation of the **MOVIDRIVE® MDX60B/61B inverters 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 operating instructions. In such cases, any liability for defects is excluded.**

1.4 Copyright

1.5 Other applicable documentation

- This manual does not replace the detailed operating instructions and the corresponding manuals.
- Installation and startup only by trained personnel observing the relevant accident prevention regulations and the following documents:
  - "MOVIDRIVE® MDX60B/61B" operating instructions and associated manuals

2 System Description

2.1 Areas of application

The "Automotive AMA0801" application module makes it possible to implement lifting devices, conveyor systems and machinery with drives that have to move at a synchronous angle to one another occasionally or permanently.

The "Automotive AMA0801" application module has a selectable process data interface. Setpoints can be specified in a variable or binary manner.

The program is used to control individual drives. In "synchronous operation" mode, these drives can be synchronized to a master drive.

The "Automotive AMA0801" application module has the following advantages:

- One program for master and slave drive.
- Guided startup and extensive diagnostics functions.
- Very similar to the "DriveSync via fieldbus" application module.
- The selected IPOS encoder source (X13, X14, DIP) is also effective in synchronous operation.
- The master value for the "synchronous operation" mode can be adjusted.
- A mechanical vertical shaft can be replaced by transferring the virtual master value via an SBus connection.
- Configurable process data interface with "Positioning mode with variable or binary setpoint".
- Binary coded selection of the following operating modes:
  - Jog mode
  - Teach mode
  - Referencing mode
  - Positioning mode
  - Synchronous operation
- Additional functions (only in operating mode "Positioning mode with binary setpoint"):
  - Smooth component transfer
  - Cam controller
  - Automatic alignment carried out once when changing the state in position control (if activated in the "Automotive AMA0801" application module)
  - Correction value, for example for averaging mounting positions
- Additional functions
  - Software limit switch processing
  - Hardware limit switch processing

Features of synchronous operation:

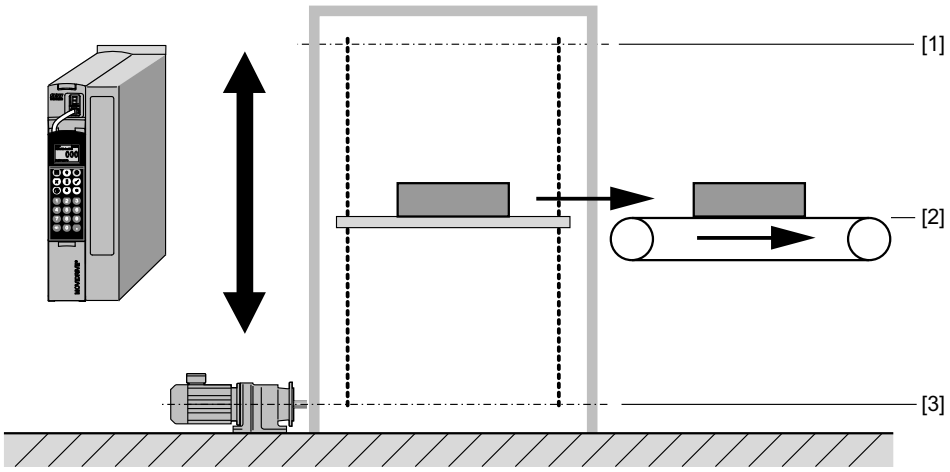
- The electrical connection of the master/slave can be made using the X14 connection or an SBus connection.
- The contents of the send object can be adjusted when the SBbus connection is used. For example, the value of any IPOS$^{plus®}$ variable can be transferred instead of the IPOS$^{plus®}$ variable of the master drive.

2.2 Application examples

The "Automotive AMA0801" application module offers a wide range of possible applications. Some examples are given in this section.

Finite (linear) movement of the master and slave axis

Example 1: Lifting device with smooth component transfer (with binary setpoint)



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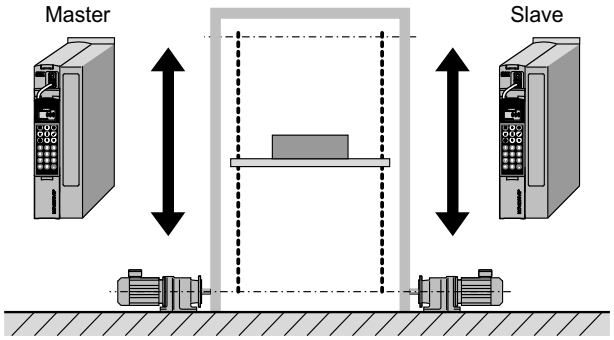
[1] Home position

[2] Removal position (= "smooth component transfer" position)

[3] Target position

The component is transferred smoothly onto the removal position [2] (= "Smooth component transfer" position) of the subsequent conveyor belt. Next, the component carrier moves underneath the removal position [2] until it has reached the target position [3].

Example 2: Hoist



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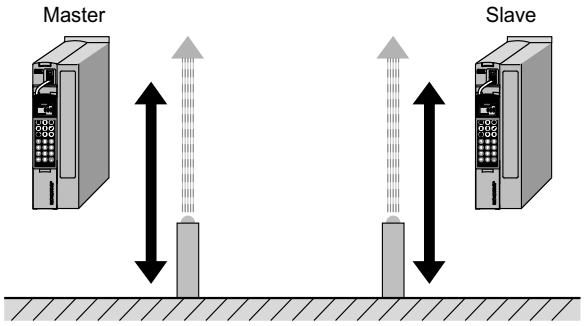
- Master axis: Linear axis
  Operating mode: Positioning mode

- Slave axis: Linear axis
  Operating mode: Synchronous operation

Example 3: 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 axes 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 Project Planning

3.1 Requirements

PC and software

The "Automotive AMA0801" application module is implemented as IPOS$^{plus®}$ program and is part of the MOVITOOLS® MotionStudio engineering software from version 5.5x. MOVITOOLS® MotionStudio and the included programs are 32-bit applications. One of the following operating systems is required:

- Windows® 2000
- Windows® XP/SP2
- Windows® Vista

Additionally, you have to install the following software:

- Microsoft.NET Framework 2.0
- Microsoft Visual J# 2.0

	INFORMATION
	• If Microsoft.NET is not installed on your PC, you can install it as part of the MOVITOOLS® MotionStudio installation. • Microsoft.NET cannot be executed under Windows® 95.

Inverters, motors and encoders

- **Inverters**

  The "Automotive AMA0801" application module is controlled via fieldbus with 6 process data words and can only be operated with MOVIDRIVE® MDX61B in application version (...0T).

- **Motors and encoders**

  All motors with a connected motor encoder are supported.

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 / DEH21B / DEH11B / DER11B

General information

- 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/DEH21B absolute encoder card" option.
- If operated with asynchronous motors, the inverter can be started up in the "VFC n-control & IPOS" or "CFC & IPOS" mode.
- If operated with synchronous motors, the inverter must be started up in the "SERVO & IPOS" mode.

3.2 Description of functions

Functional characteristics

The "Automotive AMA0801" application module offers the following functional characteristics:

- **Jog mode**

  The drive is moved clockwise or counterclockwise using two bits for direction selection. When activating variable setpoint, you can change velocity and ramp via fieldbus during ongoing movement. Startup with binary setpoint means that velocity and ramp are statically stored in the inverter.

- **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".

- **Synchronous operation**

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

  The "synchronous operation" mode can be started without prior reference travel.

  The synchronization process is started once "synchronous operation" is selected. Once the slave drive has been synchronized with the master, the slave moves synchronously with the master.

  Synchronous operation is terminated by resetting the "start bit" or by deselecting synchronous operation.

  In addition, you can offset the reference to the master drive without having to exit the operating mode by specifying a correction value *SyncOffset* (PO6).

- **Teach mode (only with binary setpoint)**

  Movement can be performed to every individual position in jog mode and can then be stored in teach mode.

- **Positioning mode with binary setpoint**
  - Fieldbuses with 6 process data words are supported.
  - Up to 16 target positions are selected by requesting a table position.
  - Each individual position is fed back as an individual bit. The following applies: Position n + position window > position (n + 1) + position window > ....
  - You can change the traveling velocity and ramp by switching to another operating speed/creep speed or ramp.
  - Target position, velocity and ramp can be changed dynamically during ongoing positioning.
  - Referenced axes can evaluate up to 16 cams (range signals).
  - The position reference can be shifted using the "correction value" function.
  - The actual position is reported back via two process data words.
  - Positioning is only performed when the axis has been referenced.

- **Positioning mode with variable setpoint**
  - Fieldbuses with 6 process data words are supported.
  - The target positions are specified by the higher-level controller.
  - Target position, velocity and ramp can be changed during ongoing positioning.
  - The target position can be changed during ongoing movement.
  - The actual position is reported back via two process data words.
  - Positioning is only performed when the axis has been referenced.

Special functions for positioning mode with binary setpoint

- **"Smooth component transfer" function**

  Using the "smooth component transfer" function lets you influence the travel profile of a positioning process in such a way that the drive is briefly decelerated to standstill at the specified "smooth component transfer" position. This function can be used in one of the following directions of movement:

  - On both sides
  - Positive
  - Negative

  The function is inactive if the position of the smooth component transfer lies outside the travel range.

- **"Cam control" function**
  - Output cams are mapped to process output data word 5 via IPOS encoder status queries.
  - Cam area entries are sorted automatically as follows:
    - Cam CCW < cam CW
      If the actual position is located between the cam areas, the output bit is set to TRUE.
    - Cam CCW < cam CW
      If the actual position is located between the cam areas, the output bit is set to FALSE.

- **"Automatic adjustment" function**

  To activate this function, the drive must be enabled and "positioning mode" selected. This function allows for detecting and correcting even minor deviations from the last target position (for example caused by a sagging hoist with brake application and release).

  The following steps are carried out each time the inverter re-enters position control:

  – Check whether the actual position is located within one of the stored table positions. Search always begins from table position 1 to 16 and is aborted as soon as the first valid position is found.
  – The table position for the referenced axis is written once to the target position and adjustment is started.
  – The position is maintained.

- **"Correction value" function**

  – Using the "correction value" function allows for correcting the setpoint positions stored in the table by the variable correction value (adding the correction value to the table value). If assigning the value"0", no offset will be performed.
  – Specifying a "positive" correction value will move the position reference by the given value in "positive direction". A "negative" value will move the value in the "negative direction".
  – If you want to store the correction value remanently, you have to call the startup wizard.
  – You can use this function, for example, to average a mounting position.

- **"Runtime measurement" function**

  – The runtime is measured independent of the selected operating mode by comparing the two system variables *H491 TargetPos* and *H492 SetpointPos*. Runtime control is started with the condition H491 TargetPos unequal *H492 SetpointPos* and is ended with the condition *H491 TargetPos* equal *H492 SetpointPos*. Runtime measurement measures the travel time of the last positioning in milliseconds.

3.3 Scaling 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.

Drive without external encoder (interlocking 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 ($i_{gear\ unit}$, 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 $s_{spindle}$

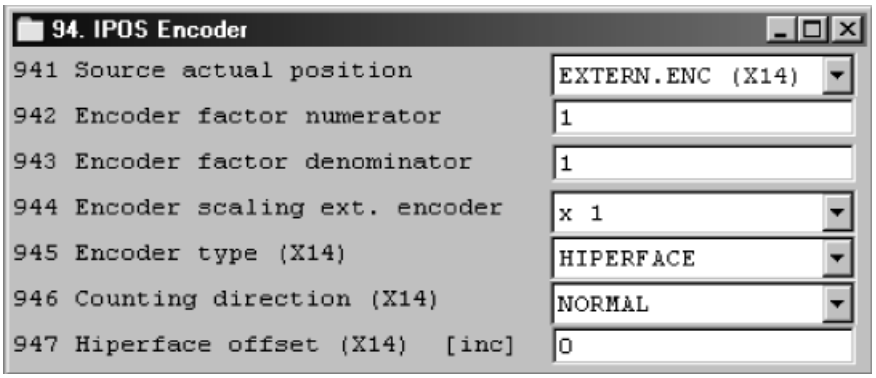
- Speed scaling factor

  Numerator factor in [1/min] and denominator value in "speed unit".

You can also enter the distance and velocity scaling factors directly. If you enter a unit other than [mm] or [1/10 mm] as 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.

Drive with external encoder (non-positive connection)

In this case, you must have activated and scaled the external encoder **before starting up** the "AMA0801" application module. To do so, make the following settings in the Shell program **before starting the** Automotive AMA0801 application module (see following figure).



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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

	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® MDX61B0 Absolute Encoder Card DIP11B" manual.

3.4 Limit switches, reference cams and machine zero

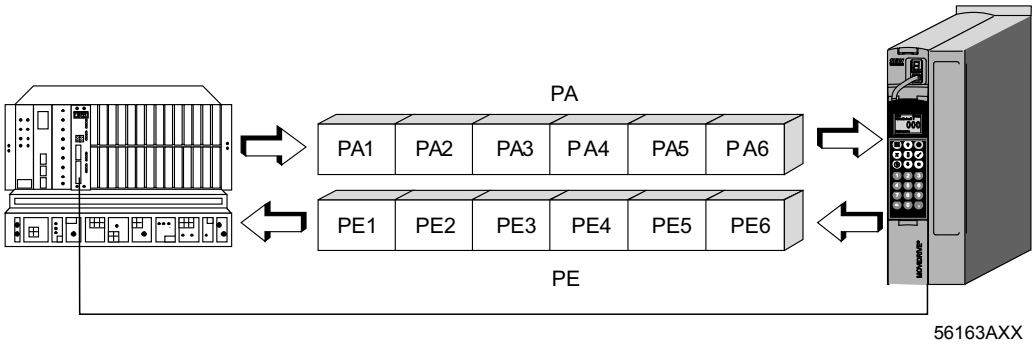
Note the following points during project planning:

- 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. Fault 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 Sec. "Software limit switches."

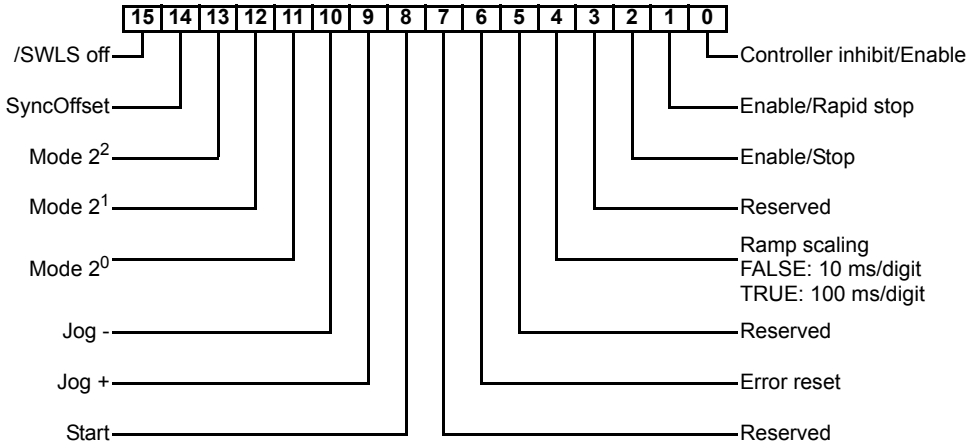
3.5 Process data assignment

The higher-level controller (PLC) sends 6 process output data words (PO1 - PO6) to the inverter and receives 6 process input data words (PI1 to PI6) from the inverter.

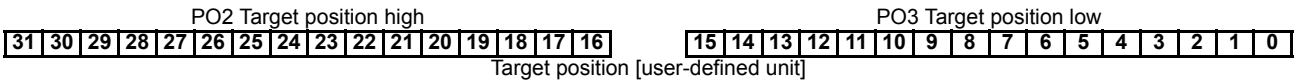


3.5.1 Assignment of process output data in the "variable setpoint" operating mode

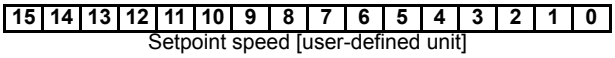
- PO1: Control word 2



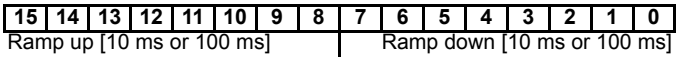
- PO2 + PO3: Target position



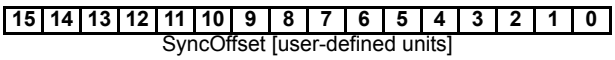
- PO4: Setpoint speed



- PO5: Ramp up (high byte) and down (low byte)

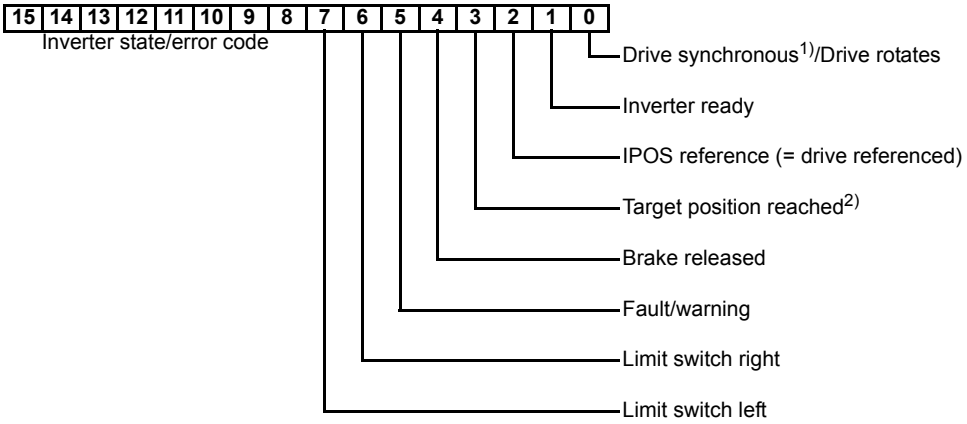


- PO6: SyncOffset



3.5.2 Assignment of process input data in the "variable setpoint" operating mode

- PI1: Status word



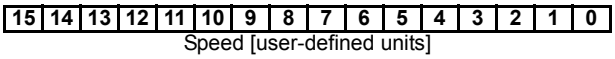
1) In "synchronous operation" mode, bit 0 is assigned "Drive synchronous". In the other operating modes, it is assigned "Drive rotates". The signal "Drive rotates" is created when the speed drops below the speed reference value of 20. Parameters P400 - P403 are used for this purpose in the program.

2) In "teach mode", the signal "target position reached" is set to TRUE when the teaching process has been successfully completed. In the remaining operating modes, the signal is set to TRUE if the condition [Value (target position − actual position) < position window] is met for the reference axis. The individual bits are only set when the drive is at standstill to avoid a "flickering" single-bit position feedback in PI4.

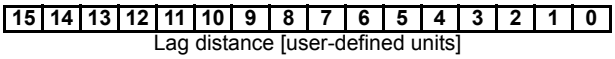
	INFORMATION
	The fault code is displayed in the high byte (bits 8 to 15) of the status word if bit 5 "Fault/warning" is set. If there is no fault, the current unit status is displayed in the high byte of the status word.

- PI2 + PI3: Actual position

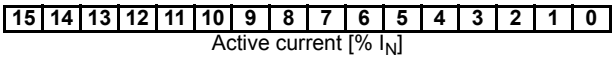
- PI4: Actual speed



- PI5: Master/slave position difference

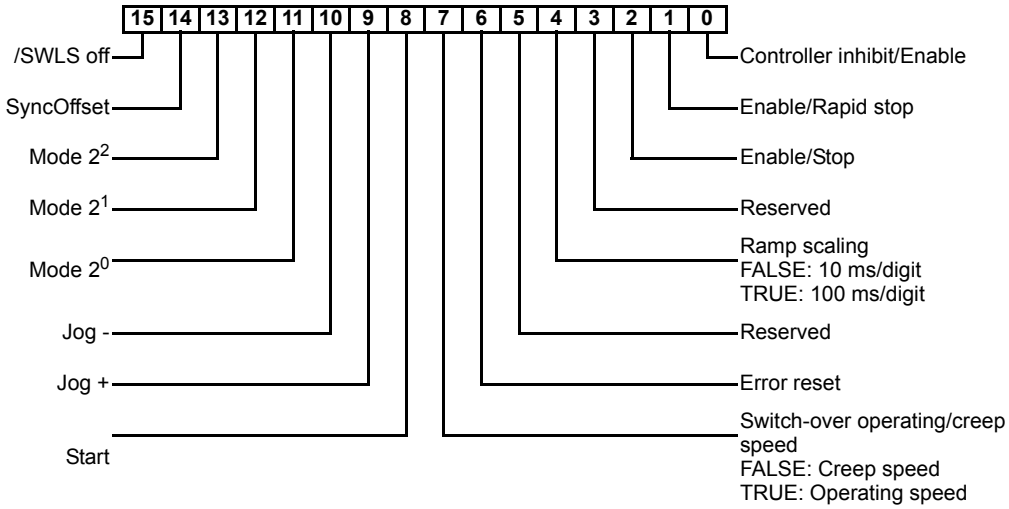


- PI6: Active current

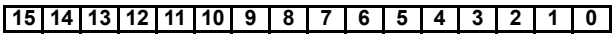


3.5.3 Assignment of process output data in the "binary setpoint" operating mode

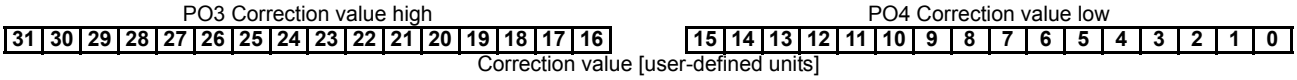
- PO1: Control word 2



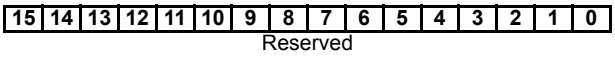
- PO2: 16 single-bit positions



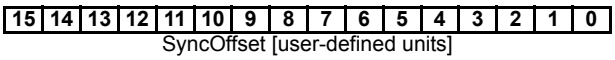
- PO3 + PO4: Correction value



- PO5: Reserved

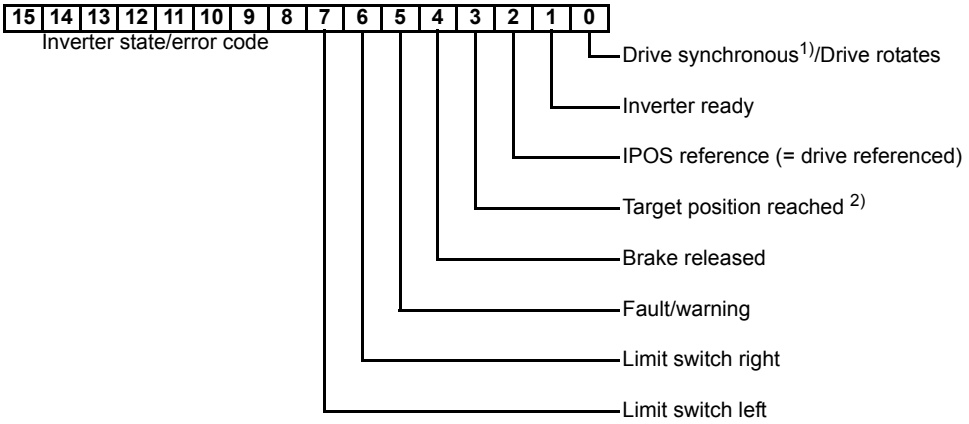


- PO6: SyncOffset



3.5.4 Assignment of process input data in the "binary setpoint" operating mode

- PI1: Status word



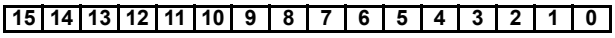
1) In "synchronous operation" mode, bit 0 is assigned "Drive synchronous". In the other operating modes, it is assigned "Drive rotates". The signal "Drive rotates" is created if the speed drops below the speed reference value of 20. Parameters P400 - P403 are used for this purpose in the program.

2) In "teach mode", the signal "target position reached" is set to TRUE when the teaching process has been successfully completed. In the remaining operating modes, the signal is set to TRUE if the condition [Value (target position − actual position) < position window] is met for the referenced axis. Individual bits are only set when the drive is at standstill to avoid "flickering" single-bit position feedback in PI4.

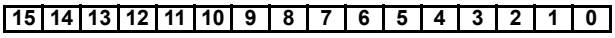
	INFORMATION
	The fault code is displayed in the high byte (bits 8 to 15) of the status word if bit 5 "Fault/warning" is set. If there is no fault, the current unit status is displayed in the high byte of the status word.

- PI2 + PI3: Actual position

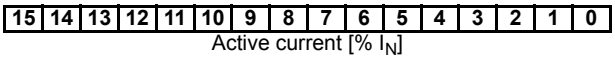
- PI4: 16 single bit position signal and drive does not rotate



- PI5: 16 Single-bit cam



- PI6: Active current



3.5.5 Assignment of binary inputs and outputs on MOVIDRIVE® B

Binary input	Assignment
X13:1 (DI00)	/Controller inhibit
X13:2 (DI01)	Enable/Stop
X13:3 (DI02	Error reset
X13:4 (DI03)	Reference cam
X13:5 (DI04)	/LIM. SWITCH CW
X13.6 (DI05)	/LIM. SWITCH CCW
X16:1 (DI06)	Reserved
X16:2 (DI07)	/Ext. error (is activated in the "External Error" selection field under "Synchronous operation interface master" during startup in the event of an "Error on slave axis")

Digital output	Assignment
X10:3 (DB00)	Brake output
X10:5 (DO01)	Ready
X10:7 (DO02	No malfunction
X16:3 (DO03)	Reserved
X16:4 (DO04)	Reserved
X16.5 (DO05)	Reserved

3.6 Software limit switches

General information

The "software limit switch" monitoring function is used to check that the target position is set to appropriate values. During this process, it is not important where the drive is positioned. In contrast to the monitoring of the hardware limit switches, the monitoring function for the software limit switches makes it possible to detect whether there is an error in the target specifications before the axis starts to move. The software limit switches are active when the axis is referenced; that is, when the "IPOS reference" bit is set in PI1.

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

Moving clear of software limit switches

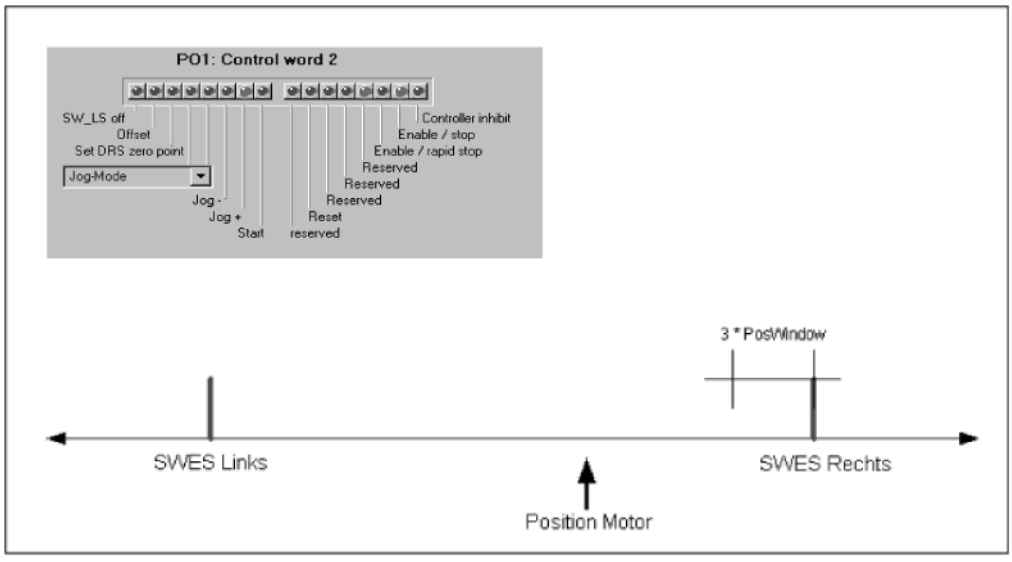
When using an absolute encoder or multiturn Hiperface® encoder it may be necessary for the drive to be moved within the range of the software limit switches (for example, after an encoder has been replaced). For this purpose, bit 15 in the process output data word 1 (PO1) is set to "/SWLS" (= Moving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

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).

Example 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.



11119AEN

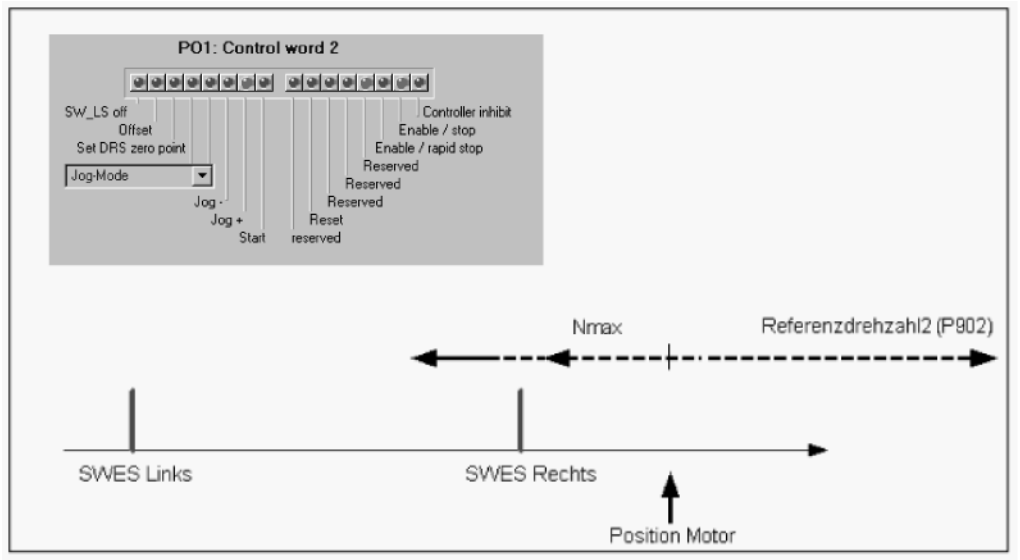
In **jog mode**, the drive runs until it is three position windows (P922) before the software limit switch and then stays there.

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.

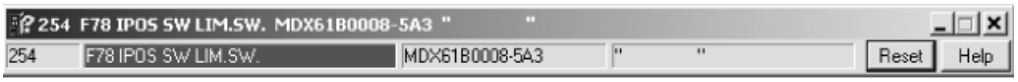
Example 2

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



11120AEN

The following error message appears once the drive is enabled:



10983AEN

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 figure above), the drive can be moved at two different velocities depending on the specified direction of the motor rotation:

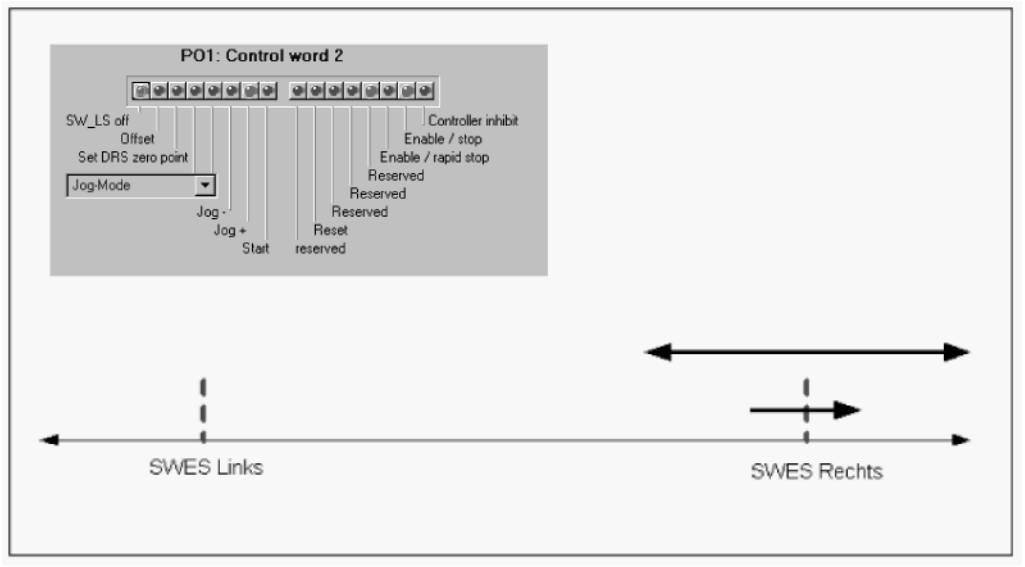
- Closer toward the travel range of the software limit switch at reference speed 2 (P902).
- Away from the travel range of the software limit switches at maximum speed.

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.

Example 3

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



11121AEN

The monitoring function is deactivated in "Jog mode" and "Referencing mode". 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.

DANGER

Risk of crushing if the motor starts up unintentionally.

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).

3.7 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.

INFORMATION

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

- MOVIDRIVE® MDX60B / 61B Safe Disconnection - Conditions
- MOVIDRIVE® MDX60B/61B Safe Disconnection - Applications

3.8 Functions

3.8.1 "Positioning interruption detection" function

The "Positioning interruption detection" function is used to monitor the travel profile during ongoing positioning. Unintended operating states that result in the target position being exceeded are detected and an error response is triggered.

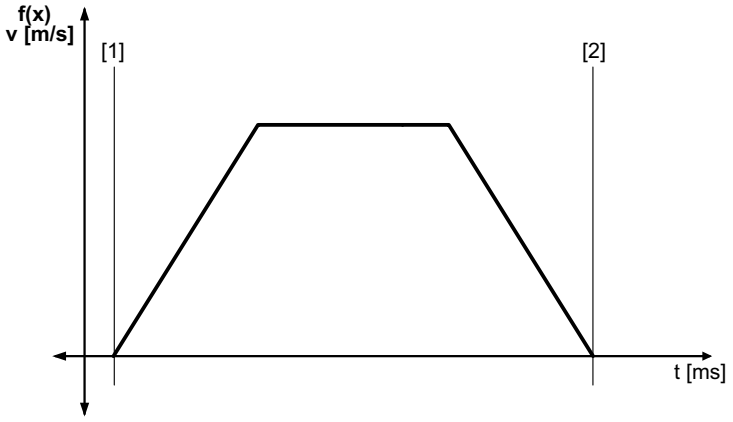
Requirements

- The "Positioning interruption detection" function is implemented in firmware version ".12" and higher.
- The "Positioning interruption detection" function was activated during startup with AMA0801 version V1.04.
- The "positioning interruption detection" function was set to "On" using parameter *P924 Positioning monitoring*.
- Parameter *P839 Response to positioning interruption* was set to "Immediate stop/Fault".
- The "positioning interruption detection" function is active in the following positioning operating modes:
  - Jog mode
  - Positioning mode (bidirectional smooth component transfer/positive smooth component transfer/negative smooth component transfer)

Functional description

- Normal operation

  In normal operation, e.g., in an uninterrupted positioning process, the drive signals inverter status "A via PO1 bit 8 - 15.



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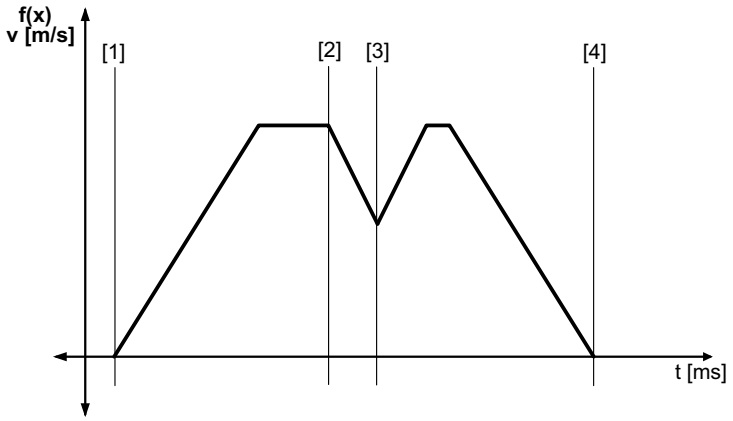
[1] Start of the positioning movement

[2] Target position reached

- Enable signal briefly deactivated before reaching the target.

  A lose input terminal (wiring error) e.g. X13.1 "enable" results in single unintentional speed reductions during the positioning process. The deceleration of the drive is triggered via the stop ramp. If the drive is at "standstill", the operator receives a "No enable" message. In the following figure, the enable is briefly toggled. This can only be detected via a runtime monitoring function. The positioning process is continued without an error message.



64728AXX

[1] Start of the positioning movement

[2] Enable signal is removed at setpoint speed

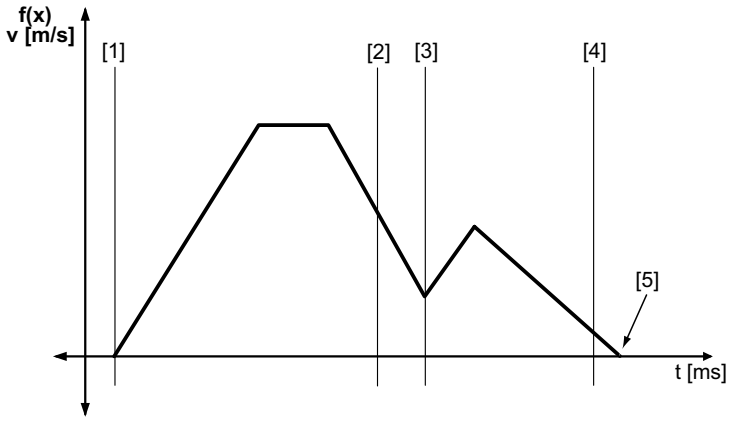
[3] Enable signal is provided during deceleration via the stop ramp

[4] Target position reached

- Enable is briefly removed with the deceleration ramp already triggered (position interruption detection = off)

  The following effect might occur when the enable signal is removed with the deceleration ramp already triggered and the "positioning interruption detection" function deactivated:

  The drive exceeds the target position, reverses and moves to the target position without an error message.



64729AXX

[1] Start of the positioning movement

[2] Enable signal is removed with triggered deceleration ramp

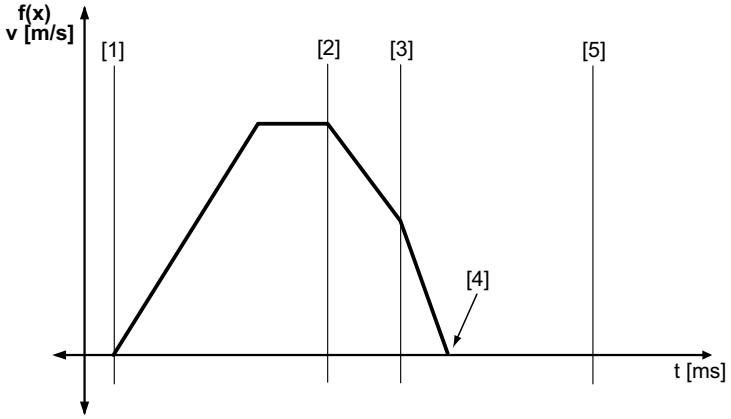
[3] Enable signal is provided with triggered deceleration ramp

[4] Target position reached

[5] Error (with deactivated "positioning interruption detection" function): Drive exceeds target position and returns to target position without an error message

- Enable signal is briefly removed with the deceleration ramp already triggered (position interruption detection = on)

  When the "positioning interruption detection" function is active, a check is made every time the enable terminal is connected whether the target position can still be approached directly with the calculated travel profile (no error) or whether it would be exceeded (error). A suitable error response will abort the positioning process and generate an error message.



64730AXX

[1] Start of the positioning movement

[2] Enable signal is removed with triggered deceleration ramp

[3] Enable signal is provided during the deceleration ramp

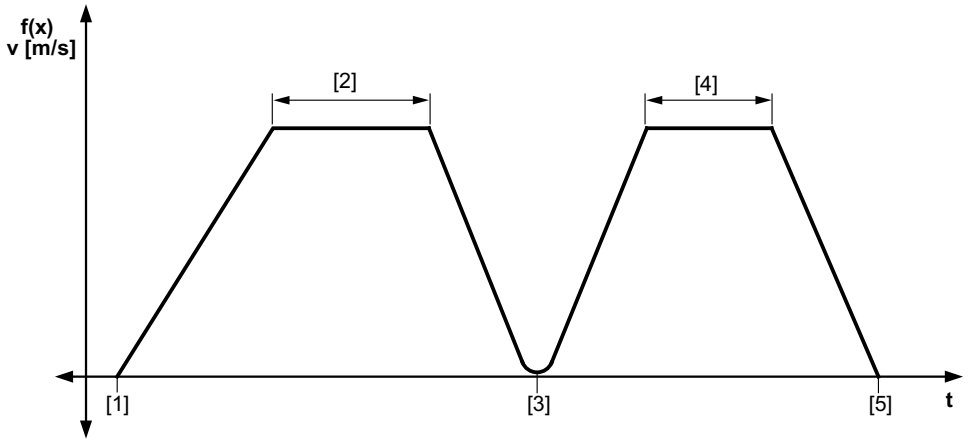
[4] With the "positioning interruption detection" function activated, the positioning movement is aborted and an error message is generated

[5] Target position reached

3.8.2 "Smooth component transfer " function

The "smooth component transfer" function is implemented for startup in the "positioning mode with binary setpoint" mode.

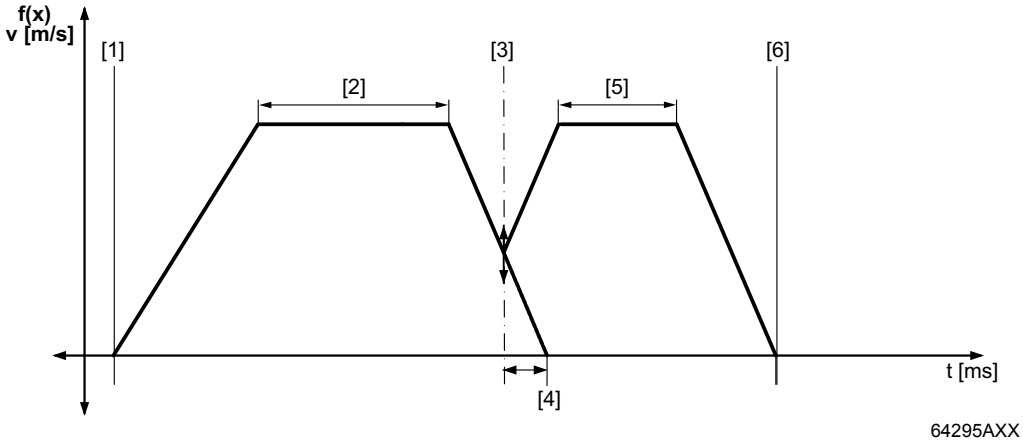
- Smooth component transfer without offset



63440AXX

[1] Start of the positioning movement
[2], [4] Travel at setpoint speed
[3] "Smooth component transfer" position reached
[5] Target position reached

- Smooth component transfer with offset



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[1] Start of the positioning movement
[2], [5] Travel at setpoint speed
[3] "Smooth component transfer" position reached
[4] Smooth component transfer with offset
[6] Target position reached

Requirement

- Axis is referenced
- Selected positioning operating mode:
  - Bidirectional smooth component transfer
  - Positive smooth component transfer
  - Negative smooth component transfer
- The position where smooth component transfer takes place is within the start and target position

Functional description

By selecting one of the following operation modes

- Bidirectional smooth component transfer
- Positive smooth component transfer
- Negative smooth component transfer,

the program makes sure that the drive passes the smooth component transfer position in a "smoothly" manner. If the offset value is set to 0, the velocity will be reduced up to standstill. Increasing the offset value means increasing the speed at the "smooth component transfer" position.

If a correction value (offset) is transferred via bus, all position values (also the smooth component transfer position) will be offset by the correction value.

The offset value must be smaller than the deceleration distance. If a higher offset value is specified, the smooth component transfer position is passed with the specified positioning speed.

If the smooth component transfer position can be exceeded along the travel distance, the travel profile is affected on-the-fly.

The function is inactive if the position of the smooth component transfer lies outside the travel range.

"Bidirectional smooth component transfer" mode

Bidirectional smooth component transfer is effective in upward and downward movements.

- PO1: Bit 11 = FALSE
- PO1: Bit 12 = TRUE
- PO1: Bit 13 = FALSE

"Positive smooth component " mode

Positive smooth component transfer is only effective in upward movements.

- PO1: Bit 11 = FALSE
- PO1: Bit 12 = TRUE
- PO1: Bit 13 = TRUE

"Negative smooth component " mode

Negative smooth component transfer is only effective in downward movements.

- PO1: Bit 11 = TRUE
- PO1: Bit 12 = TRUE
- PO1: Bit 13 = TRUE

3.8.3 "Cam controller" function

The "cam controller" function is implemented for startup in the "positioning mode with binary setpoint" mode.

Requirement

- Axis is referenced
- Inverter is ready for operation

Functional description

Output cams are mirrored to process output data word 5 (PO5) via IPOS encoder status queries.

Cam area entries are sorted automatically as follows:

- Cam CCW < cam CW

  If the actual position is located between the cam areas, the output bit is set to TRUE.
- Cam CCW < cam CW

  If the actual position is located between the cam areas, the output bit is set to FALSE.

Number of cams

16 user-defined cam areas

3.8.4 "Automatic adjustment" function

The "automatic adjustment" function is implemented for startup in the "positioning mode with binary setpoint" mode.

Requirement

- "Automatic adjustment" function was activated in AMA0801 during startup.
- Axis is referenced
- Inverter is ready for operation
- Selected positioning operating mode:
  - Bidirectional smooth component transfer
  - Positive smooth component transfer
  - Negative smooth component transfer

Functional description

The following steps are performed whenever the inverter re-enters the position control if "Positioning mode with binary setpoint selection" is selected:

- Check whether an actual position is located within one of the stored table positions. Search always begins from table position 1 to 16 and is aborted as soon as the first valid position is found.
- The table position for the referenced axis is written to the target position and adjustment is started.
- The position is maintained.

This function allows for detecting even minor deviations from the last target position (for example caused by a sagging hoist with brake application / brake release) and for correcting them using automatic repositioning.

Start/position selection

Not required. A valid table position is searched automatically and is processed as target.

Mode selection

See section "Prerequisites"

3.8.5 "Correction value" function

The "correction value" function is implemented for startup in the "positioning mode with binary setpoint" mode.

Requirement

- Axis is referenced
- Inverter is ready for operation

Functional description

Using the "correction value" function allows for correcting the setpoint positions stored in the table by a variable correction value (adding the correction value to the table value). If the correction value is set to "0", the setpoint position will not be offset.

A "positive" correction value shifts the position reference in the "positive direction", and vice versa.

If you want to store the correction value remanently, you have to call the startup wizard. Then you can add the correction value to the set position values and cam positions.

Mode selection

- Selected positioning operating mode:
  - Bidirectional smooth component transfer
  - Positive smooth component transfer
  - Negative smooth component transfer

Start

With process output data word 1, bit 8 (PO1:8).

Correction value

With process output data words 3 and 4 (PO3, PO4).

3.8.6 "Actual position in user-defined units" function

Start

The following IPOS$^{plus®}$ variables are available to the user for diagnosing the actual position values on site:

- H000: REM_ActPosUser

  Actual position of the selected IPOS encoder in user-defined units
- H001: REM_ActPosInc

  Actual position of the selected IPOS encoder in increments

3.8.7 "Runtime measurement" function

Functional description

Every new motion sequence is detected by a timer and stored until the positioning movement is stopped. With this function you can determine the time for a higher-level ru time measurement. IPOS$^{plus®}$ variable *H002 REM_ActPosRuntime* indicates the measured value in milliseconds:

The runtime is measured independent of the selected operating mode by comparing the two system variables *H491 TargetPos* and *H492 SetpointPos*. Runtime control is started with the condition *H491 TargetPos* unequal *H492 SetpointPos* and is ended with the condition *H491 TargetPos* equal *H492 SetpointPos*.

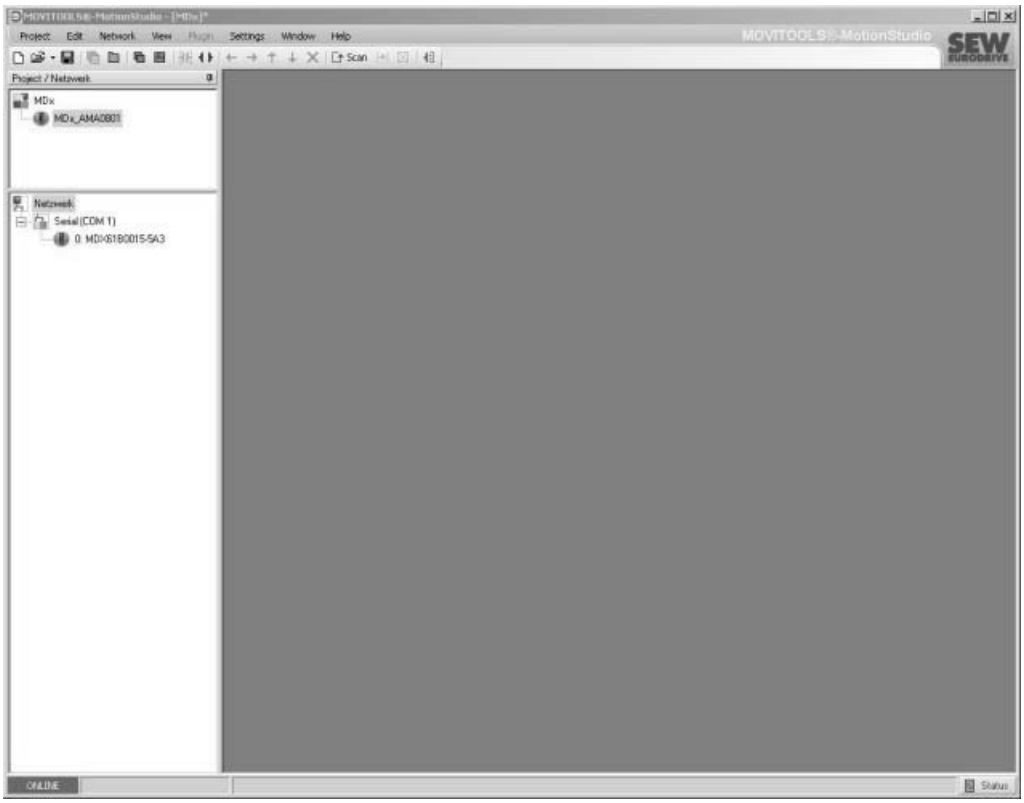
4 Installation

4.1 MOVITOOLS® MotionStudio engineering software

MOVITOOLS MotionStudio®

The "AMA0801" application module is available in the MOVITOOLS® MotionStudio engineering software from version 5.5x. Proceed as follows to install MOVITOOLS® MotionStudio on your computer:

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



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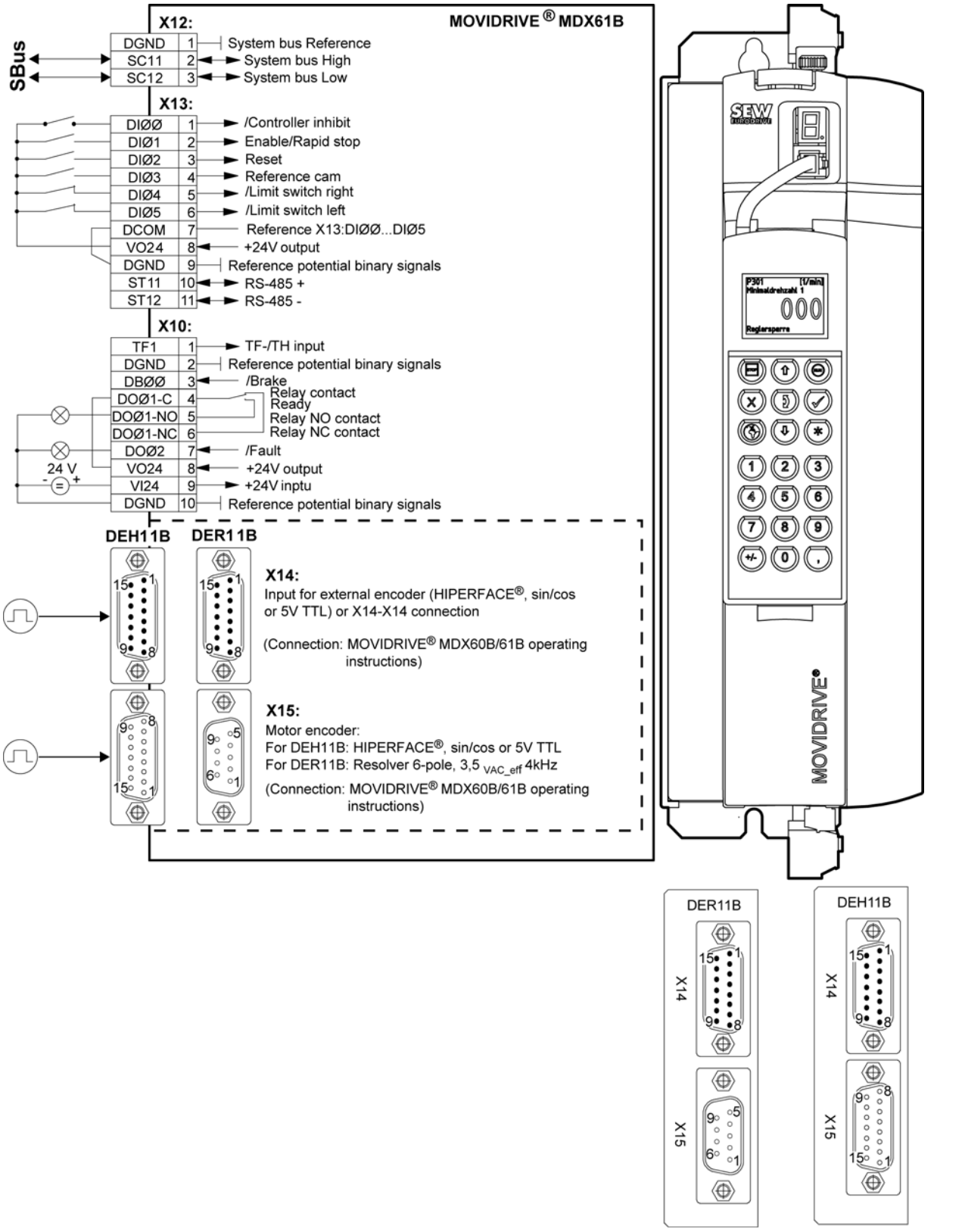
Application version

The "Automotive AMA0801" application module can be used with MOVIDRIVE® units in application version (-0T). The application modules cannot be used on units in the standard version (-00).

4.2 Wiring diagram for MOVIDRIVE® MDX61B master (no synchronous operation)



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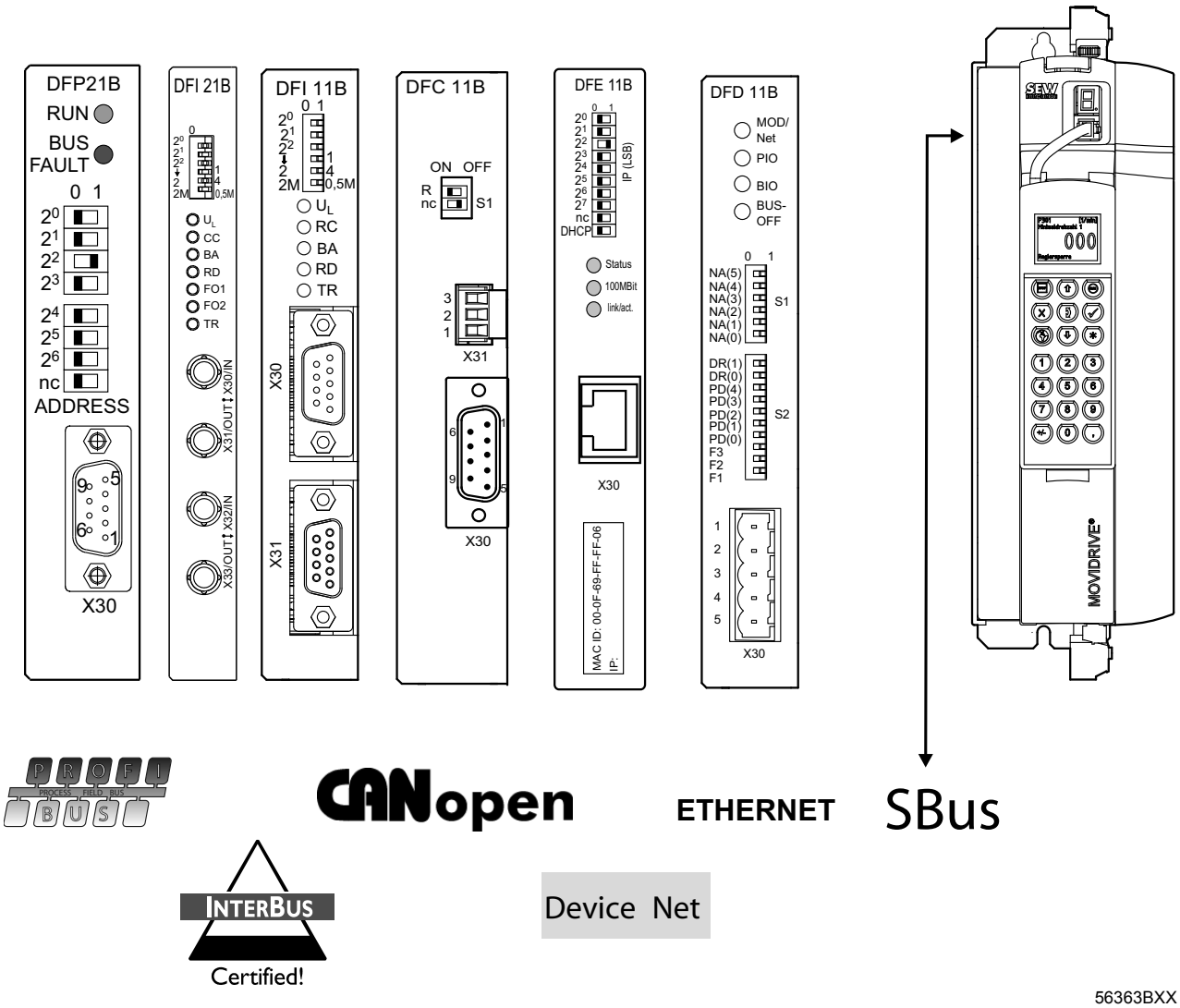
4.3 MOVIDRIVE® MDX61B bus installation

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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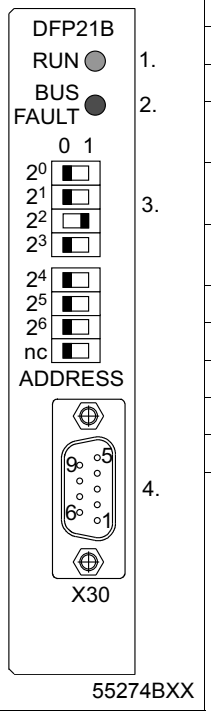
PROFIBUS (DFP21B)

For more detailed information, refer to the "MOVIDRIVE® MDX61B Fieldbus interface DFP21B PROFIBUS DP" manual. This manual can be ordered 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 facilitate startup.

Technical data

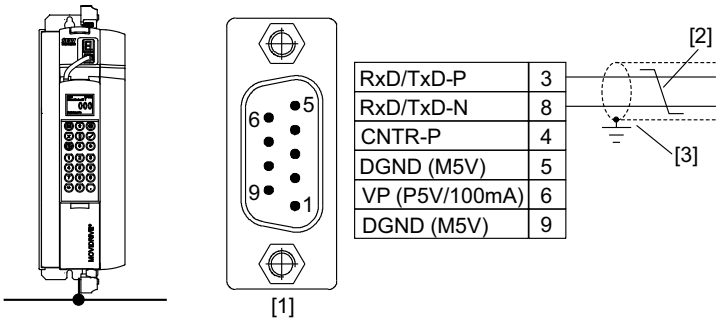
	Option	PROFIBUS type DFP21B fieldbus interface
	Part number	824 240 2
	Resources for startup and diagnostics	MOVITOOLS® MotionStudio software and DBG60B keypad
	Protocol variant	PROFIBUS DP and DP-V1 to IEC 61158
	Supported baud rates	Automatic baud rate detection from 9.6 kBaud ... 12 MBaud
	Connection	9-pin D-sub socket Assignment to IEC 61158
	Bus termination	Not integrated, must be implemented in the PROFIBUS connector.
	Station address	0...125, can be set using DIP switch
	GSD file	SEWA6003.GSD
	DP ID number	6003 hex = 24579 dec
	Max. number of process data	10 process data
	Weight	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.



[1] 9-pin D-sub connector

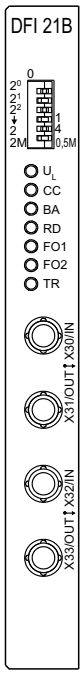
[2] Twist the signal wires together!

[3] Conductive connection is necessary between the plug housing and the shield!

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® MotionStudio software, DBG60B keypad and CMD tool
	Supported baud rates	500 kBaud and 2 MBaud, can be selected via DIP switch
	Connection	Remote bus input: 2 F-SMA connectors Remote bus output: 2 F-SMA connectors Optically controlled FO interface
	Weight	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

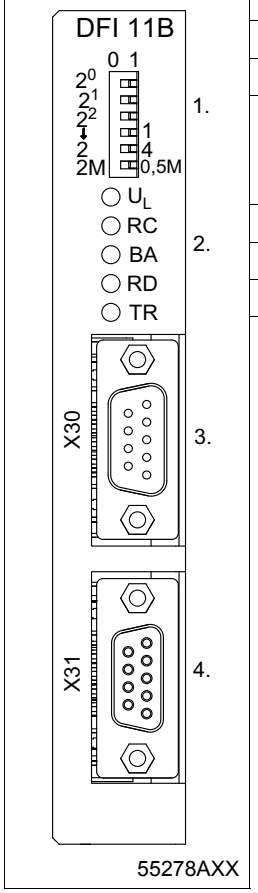
Connection assignment

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)

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

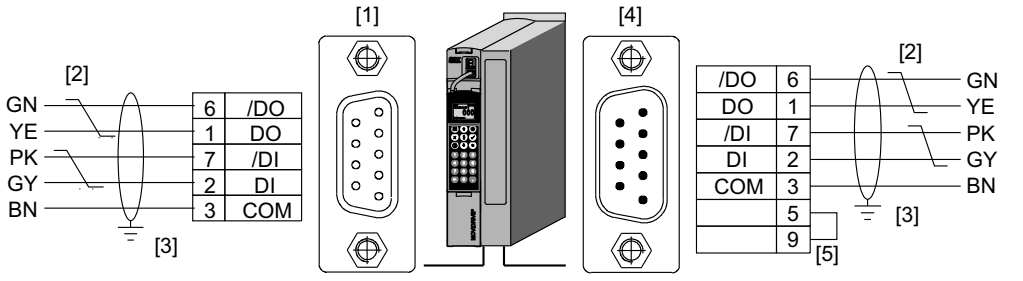


Option	INTERBUS fieldbus interface type DFI11B
Part number	824 309 3
Resources for startup and diagnostics	MOVITOOLS® MotionStudio software and DBG60B keypad
Supported baud rates	500 kBaud and 2 MBaud, can be selected via DIP switch
Connection	Remote bus input: 9-pin D-sub connector Remote bus output: 9-pin D-sub socket RS-485 transmission technology, 6-core shielded and twisted-pair cable
Module ID	$E3_{hex} = 227_{dec}$
Max. number of process data	6 process data
Weight	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

Core color abbreviations to IEC 757.



04435AXX

[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!

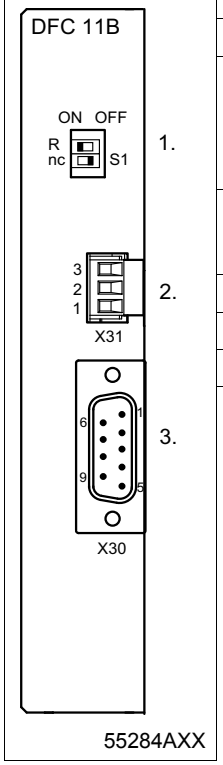
[4] 9-pin sub D plug of the outgoing remote bus cable

[5] Jumper pin 5 with pin 9!

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



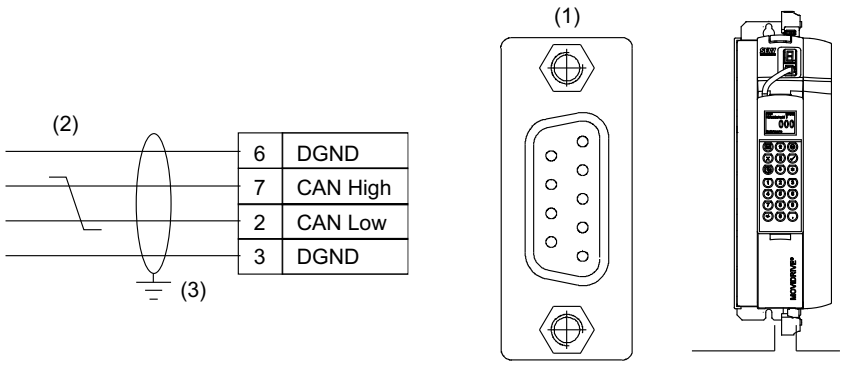
	Option	CANopen fieldbus interface type DFC11B
	Part number	824 317 4
	Resources for startup and diagnostics	MOVITOOLS® MotionStudio software and DBG60B keypad
	Supported baud rates	Setting using parameter P894: • 125 kbaud • 250 kbaud • 500 kbaud • 1000 kbaud
	Connection	9-pin sub D connector (X30) Assignment to CiA standard 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
	Weight	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)



06507AXX

[1] 9-pin D-sub socket

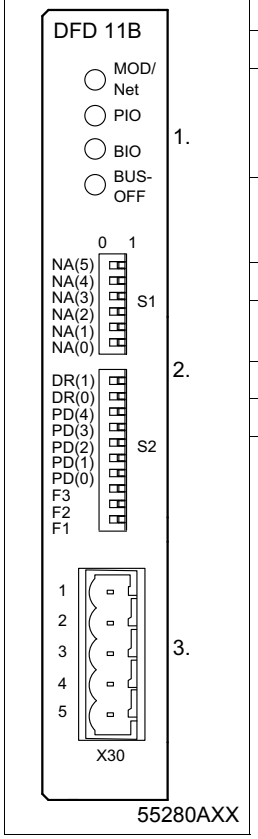
[2] Twist the signal wires together!

[3] Conductive connection is necessary between the plug housing and the shield!

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 facilitate startup.

Technical data



	Option	DeviceNet fieldbus interface type DFD11B
	Part number	824 972 5
	Resources for startup and diagnostics	MOVITOOLS® MotionStudio software and DBG60B keypad
	Supported baud rates	Can be selected using DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud
	Connection	5-pin Phoenix terminal Assignment according to DeviceNet specification (Volume I, Appendix A)
	Permitted cable 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 using DIP switch
	Weight	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

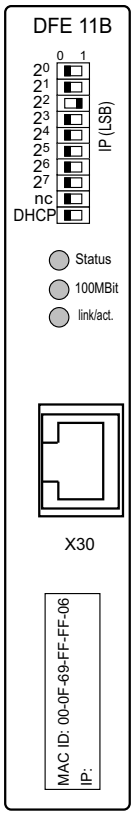
The assignment of connecting terminals is described in the DeviceNet specification Volume I, Appendix A.

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)

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

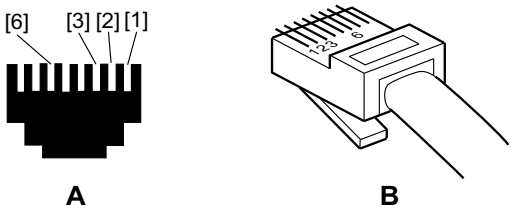


	Option	Ethernet fieldbus interface type DFE11B
	Part number	1820 036 2
	Resources for startup and diagnostics	MOVITOOLS® MotionStudio software and DBG60B keypad
	Automatic baud rate detection	10 MBaud / 100 MBaud
	Connection	RJ45 modular jack 8-8
	Addressing	4 byte IP address
	Weight	0.2 kg (0.44 lb)

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. The following figure shows the assignment of the RJ45 plug connector.



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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.

4.4 System bus (SBus 1) connection

Only if P816 "SBus baud rate" = 1000 kbaud:

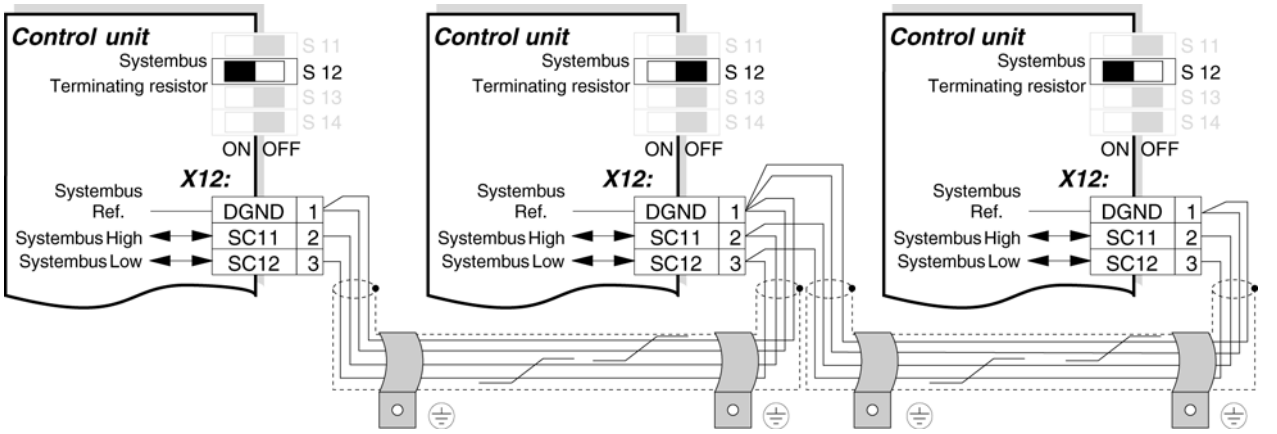
Do not combine MOVIDRIVE® *compact* MCH4_A units with other MOVIDRIVE® units in the same system bus combination.

The units may be combined at baud rates ≠ 1000 kbaud.

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

The "Serial Communication" manual contains detailed information about the system bus. You can order this manual from SEW-EURODRIVE.

SBus wiring diagram



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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:
  - Core cross section 0.25 ... 0,75 mm^2 (AWG 23 to AWG 18)
  - Line 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):
  - 125 kBaud →320 m
  - 250 kBaud →160 m
  - **500 kBaud → 80 m**
  - 1000 kBaud → 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).

	**NOTICE**
	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.

5 Startup

5.1 General information

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

Check the installation, the encoder connection and the installation of the fieldbus interfaces by following the installation notes in the MOVIDRIVE® MDX60B/61B operating instructions, in the fieldbus manuals and in this manual.

5.2 Preliminary work

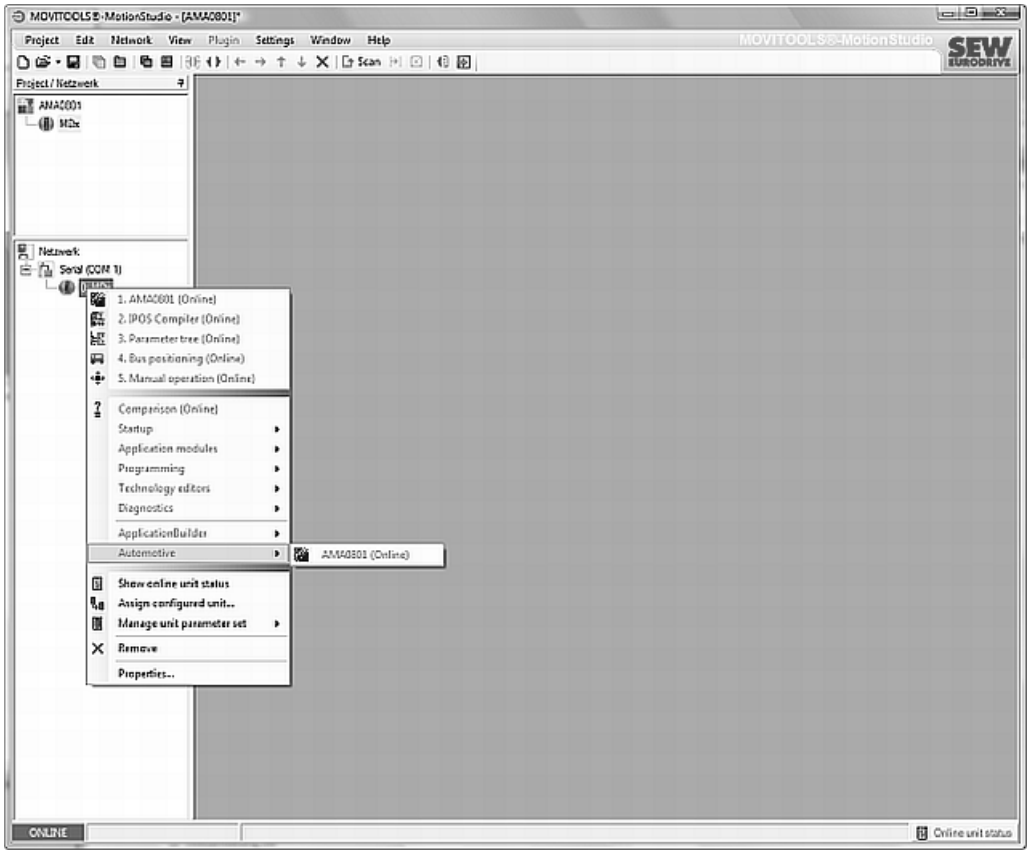
Perform the following steps before startup of the "Automotive AMA0801" application:

- Connect the "XT" connection on the inverter to PC-COM via the UWS21A option (serial interface).
- Install the MOVITOOLS® MotionStudio software (version 5.5x or higher).
- Start up the inverter using "MOVITOOLS® MotionStudio/Shell".
  - MDX61B with asynchronous motor: **CFC of VFC n-control** 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.
- If you want to use the "synchronous operation" mode, set parameter *P078 Technology function* to "Internal synchronous operation".
- Enter a "0" signal at terminal DIØØ "/CONTROLLER INHIBIT".

5.3 Starting the "AMA0801" program

General information

- Start MOVITOOLS® MotionStudio.
- From the "Automotive" folder, select the file <AMA0801> (see figure below).



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Initial screen

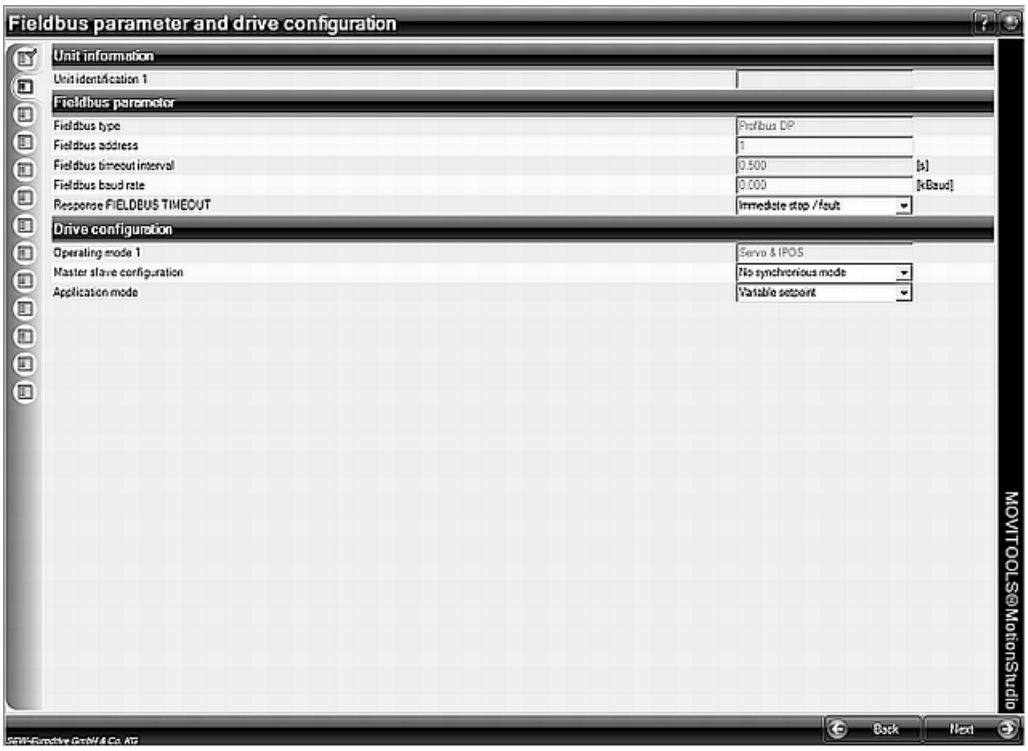
The initial screen of the "Automotive AMA0801" application opens (see figure below).

12197AEN

- To commence startup of the "Automotive AMA0801" application, click the [Load a configuration] button. The following chapters describe the further procedure.
- If you want to switch to monitor mode, click the [Monitoring the application] button. For more information, refer to section "Operation and Service.

	INFORMATION
	• The [Monitoring the application] button is disabled if – you are not online – the application module has not been detected • For restartup of the "Automotive AMA0801" application module, you can load the data to the inverter by clicking the [Load a configuration] button.

Fieldbus parameters and drive configuration



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Make the following settings in this window:

"Unit information" section

- "Signature" display field

  This field displays the signature of the inverter. You can change the signature in MOVITOOLS® MotionStudio. To do so, choose [Properties] from the [Project Management] menu.

"Fieldbus parameters" section

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

  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.

"Drive configuration" section

- "Operating mode 1" display field

  The selected operating mode is displayed.

  – MOVIDRIVE® MDX61B with asynchronous motors: CFC&IPOS or VFC n-control&IPOS
  – MOVIDRIVE® MDX61B with servomotors: SERVO&IPOS

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

- "Master/slave configuration" display field

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

– "No synchronous mode" option
  Synchronous operation is blocked in this operating mode. SBus communication is disabled.

– "Activating synchronous slave" option
  You can select the following operating modes:"Jog mode", "Referencing mode" and "Positioning mode. SBus communication can be activated.

– "Activating synchronous master" option:
  You can select the following operating modes:"Jog mode", "Referencing mode" and "Positioning mode. SBus communication can be activated.

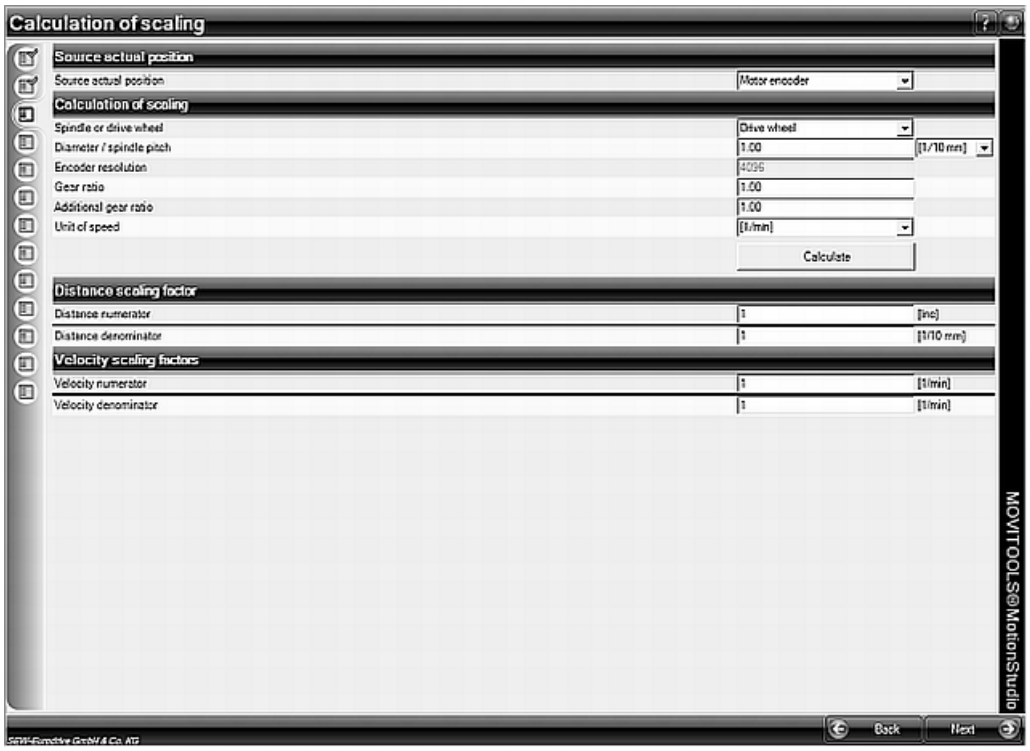
• "Operating mode" dropdown menu

  Selecting "variable setpoint" lets you change the assignment of the 6 process data words. Variable process data processing is used to variably specify the values for setpoint position, setpoint velocity, and setpoint ramp.

  When selecting binary process data processing, the values will be retrieved from previous table positions stored in the drive inverter.

Setting distance and velocity scaling factors

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



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Make the following settings in this window:

- **"Source 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 "Automotive AMA0801" 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 from the dropdown menu "Diameter of driving wheel" or "Spindle pitch" (only for motor encoder). For the unit you can choose from millimeters [mm], 1/10 millimeters [1/10 mm] or 1/100 millimeters [1/100 mm].
  - In the "Gear ratio" input field enter the ratio of the gear unit. In the "External ratio" input field enter the gear ratio of the additional gear.
  - From the "Unit of speed" dropdown menu, choose from [mm/s], [m/min] and [rpm].
  - For positioning with an absolute encoder, choose the "on the motor shaft" entry from the "Position of absolute encoder" dropdown menu.
  - Click the [Calculate] button. The "distance" and "speed" scaling factors are calculated by the program.

- **Example 2: External encoder or absolute encoder on the track (source 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 following section) or manually (see example 2).

  Automatic calculation of the velocity scaling factor:

  - From the "Actual position source" dropdown menu, select the entry "Motor encoder".
  - Enter a value in the "Drive wheel diameter" field or the "Spindle pitch" field. Select the unit [mm], [1/10 mm] or [1/100 mm] in the adjacent selection field.
  - In the input fields "Gearing ratio" and "External ratio" enter the respective values for the gear ratios.
  - Click the [Calculate] button. The scaling factor for speed is calculated by the program.

  Calculating the distance scaling factor:

  - From the "Actual position source" selection field, select the entry "External encoder" or "Absolute encoder". For positioning with an absolute encoder, choose the entry "On the track" in the "Position of absolute encoder" selection list.
  - In the group box "Scaling factor for distance", enter the number of pulses supplied by the encoder per travel unit in the "Increments" 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 (increments / 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
- 1/100 mm
- Increments

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 unit) = 12.34
  - Gear ratio of the additional gear (i additional gear) = 1
  - Diameter of the carrying wheel = 200 mm
- Encoder data:
  - Type: Stahltronik WCS3 absolute encoder
  - Physical resolution = 1 increment / 0.8mm
  - 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 unit) = 12.34
  - Gear ratio of the additional gear (i additional gear) = 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 the "distance" is 32767.

Converting the velocity into user units

In the group box "Calculation of the scaling", choose one of the three entries in the dropdown 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 unit) = 15.5
  - Gear ratio of the additional gear (i additional gear) = 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 = $i_{gear\ unit} \times i_{add.\ gear} \times 60$

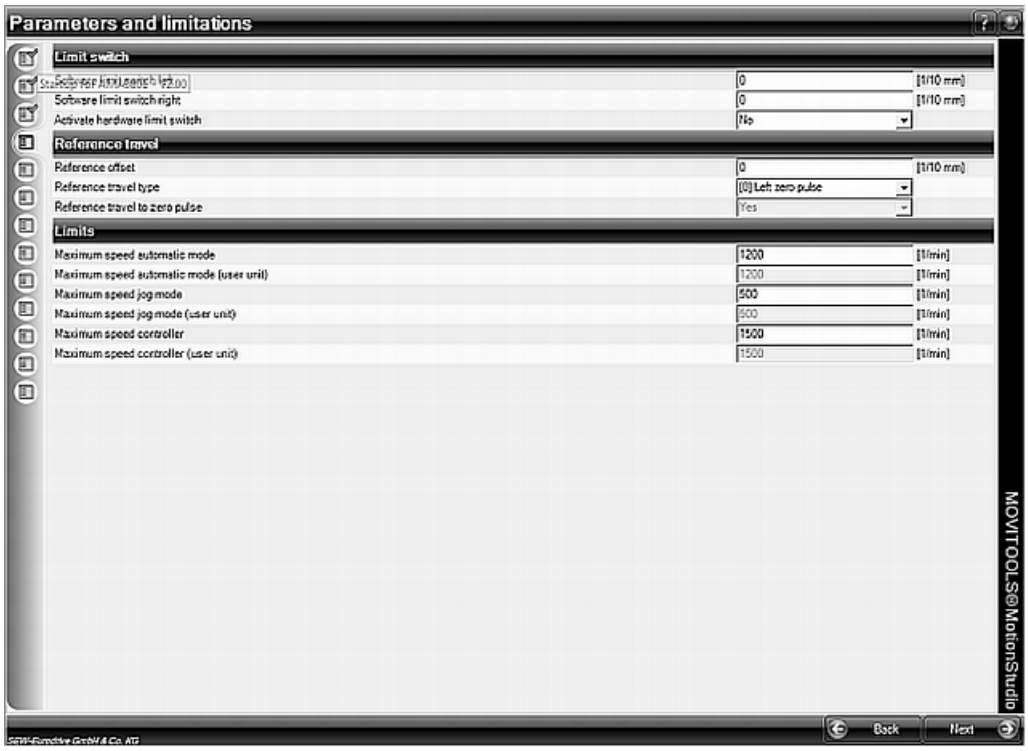
  Numerator = $15.5 \times 2 \times 60 = 1860$
- Denominator = $\Pi \times d_{drive\ wheel}$ (or spindle pitch)

  Denominator = $3.14 \times 200 = 628$

  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.

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



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- **"Limit switch" section**
  - "Software limit switch left/right" edit boxes
    Enter the travel range between software limit switches left/right. If you enter the value "0", the monitoring function is disabled.
  - "Hardware limit switch" dropdown menu
    If set to "No", the binary inputs DI04 and DI05 are set to "No function."
- **"Reference travel" section**
  - "Reference offset" edit box
    Enter the reference offset in the unit set in the parameters.
  - "Reference travel type" dropdown menu
    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.
  - "Reference to zero pulse" selection field
    Yes: Reference travel takes place to the zero pulse of the encoder.
    No: Reference travel does not take place to the zero pulse of the encoder.

- **"Limits" section**
  - "Maximum velocity in automatic mode" edit box
    You can limit the positioning speed specified by PO4 by entering a value into this field.
  - "Maximum velocity in jog mode" edit box
    You can limit the jog speed specified by PO4 by entering a value into this field.
  - "Maximum velocity of the speed controller" edit box
    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.

Binary travel parameters

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- "Positioning mode fast speed" edit box

  Input value in rpm limited with "maximum positioning speed" for table positions 6 - 16.

- "Positioning mode slow speed" edit box

  Input value in rpm limited with "maximum positioning speed" for table positions 6 - 16.

- "Positioning mode ramp up/down" edit box in ms for table cells 6 - 16.

- "Jog mode fast speed" edit box

  Entered in rpm. limited with "Maximum speed jog mode"
- "Jog mode slow speed" edit box

  Entered in rpm. limited with "Maximum speed jog mode"

- "Jog mode ramp up/down" edit box in ms.

- Edit fields in the "Parameter positions" area

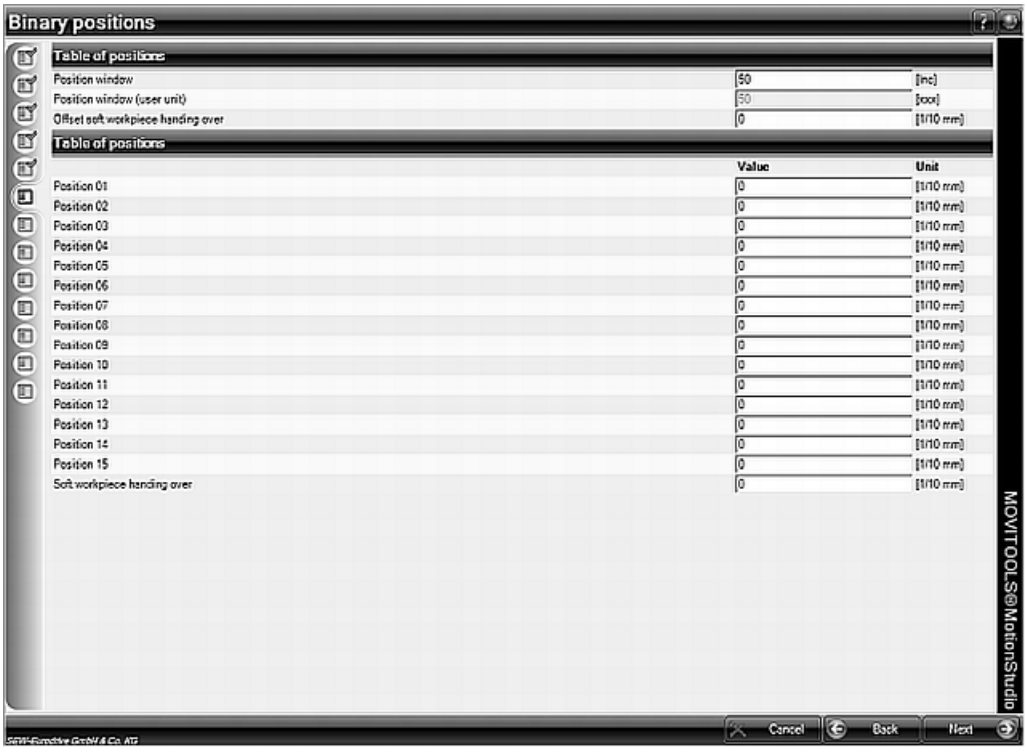
  Input values for the travel parameters of the first 5 table positions.

  When PO1:Bit 7 (changeover operating speed/slow speed) is set to TRUE, the values entered for the velocity are applied directly.

  When PO1:Bit 7 (changeover operating speed/slow speed) is set to FALSE, the values entered for the velocity are accepted divided by the factor 10.

  From table positions 6 - 16, the edit boxes "Automatic mode parameters" are applied.

Binary positions



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- "Position window" edit box

  This edit box has an effect on the 16 single-bit position feedback in PI4. The respective single-bits are set when "motor rotates" is set and the actual position lies within the range "position ± position window".

- "Smooth component transfer offset" edit box.

  If the offset value is set to 0, the speed will be reduced up to standstill. Increasing the offset value means increasing the speed at the "smooth component transfer" position.

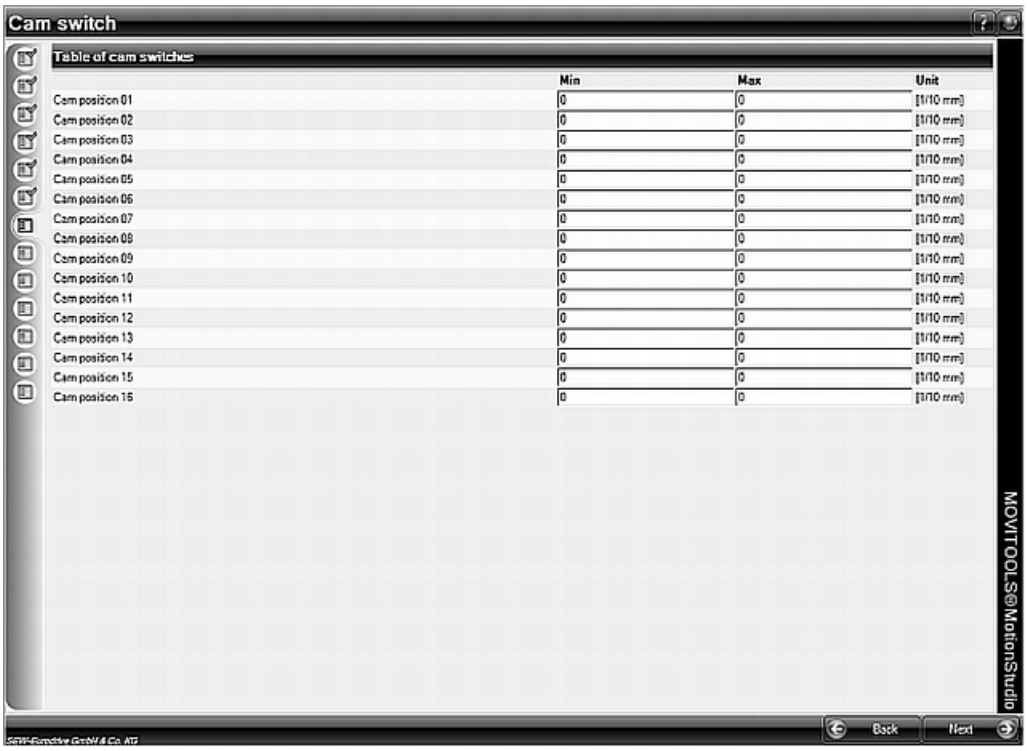
- "Positions 1 - 15" edit box.

  Input value in user units limited by software limit switches. Additionally, you can store setpoints for the velocity as well as for the acceleration and deceleration ramps for the first 5 table positions.

- "Smooth component transfer" edit box.

  The specified value for "smooth component transfer" can be entered in table position 16. The smooth component transfer function can be deactivated by entering a value other than the selected default values for setpoint positions 1 - 15.

Cam switch



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You can define the output level of the cam by entering the cam position:

- Cam CCW < cam CW

  In the cam area, the output bit is set to TRUE.

- Cam CCW < cam CW

  In the cam area, the output bit is set to FALSE

- "Number of cams" edit box

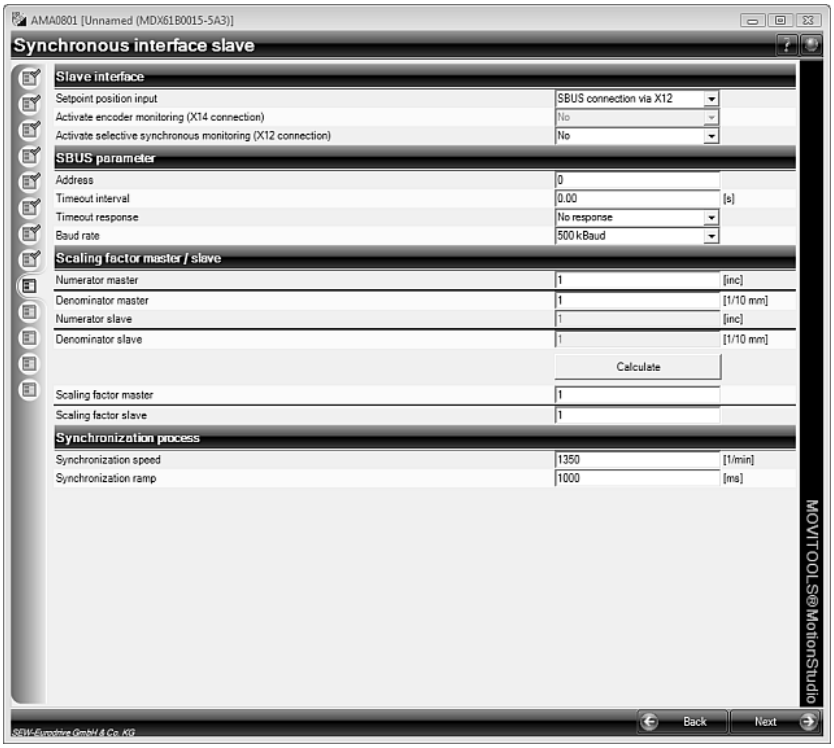
  You can take up to 16 software cams into operation. Enter the number of required cams.

- "Cam 1 left limit value" selection field
  Cam starts when the output data bit PI5:0 is set.

- "Cam 1 right limit value" selection field
  Cam starts when the output data bit PI5:0 is deleted.

Synchronous interface slave

In this window, you configure the slave interface.



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You have to make the following settings in the **"Slave interface" section**:

- **"Setpoint position input" dropdown menu**
  You can choose from the following options:
  – "Encoder connection via 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.

  – "SBus connection 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 slave drives) or when several slave axes are connected to a common master.

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

- **"Activating encoder monitoring (X14 connection)" dropdown menu**

  Choosing "Yes" checks for correct connection of the incremental encoder in enabled state of the slave drive. In the event of wire breakage, fault message "F14 Encoder fault" is issued. When set to "No", wire breakage monitoring is disabled.

- **"Activating selective synchronous monitoring X12 connection)" dropdown menu**

  Choosing "Yes" activates the monitoring function.

  The monitoring function is used to stop the axis system during synchronized movement once an inverter error occurs at an axis.

  The unit status of the engaged axes is monitored cyclically. In the event of an error, the error number is sent to the master axis via SBus. The master axis or the slave axis configured to the virtual encoder interrupts the ongoing movement by triggering error *F116 suberror 81 Start condition*.

  The error is acknowledged via reset (bus or terminal). Doing so activates synchronous monitoring for the slave axis again and the error state is acknowledged on the master axis.

- **"SBus parameters" section**

  SBus parameters can only be set if the "SBus connection via X12" is set in the "Setpoint position input" selection field.

  – "Address" edit box
  Set the SBus address.

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

  – "Timeout response" dropwdown menu
  You can set a timeout response if the "SBus connection via X12" option is selected.

  – Baud rate
  The baud rate set for system bus 1 is displayed. The input fields for SBus monitoring are disabled if no SBus object is sent or received.

You have to make the following settings in the **"Scaling factor master/slave" section**:

- **"Numerator master / denominator master" edit boxes**

  Enter the resolution of the master drive into the "Numerator Master" and "Denominator Master" edit boxes.

- **"Numerator Slave / Denominator Slave" display fields**

  These fields display the values determined in the "Calculating the scaling" window (see section "Setting the scaling factors distance and speed).

- **"Calculate" button**

  The scaling factors determined from the specified values are displayed in the "Scaling factor master / slave/ display fields.

The following settings are required in the **"Synchronization process"** section:

- **"Synchronization speed" edit box**

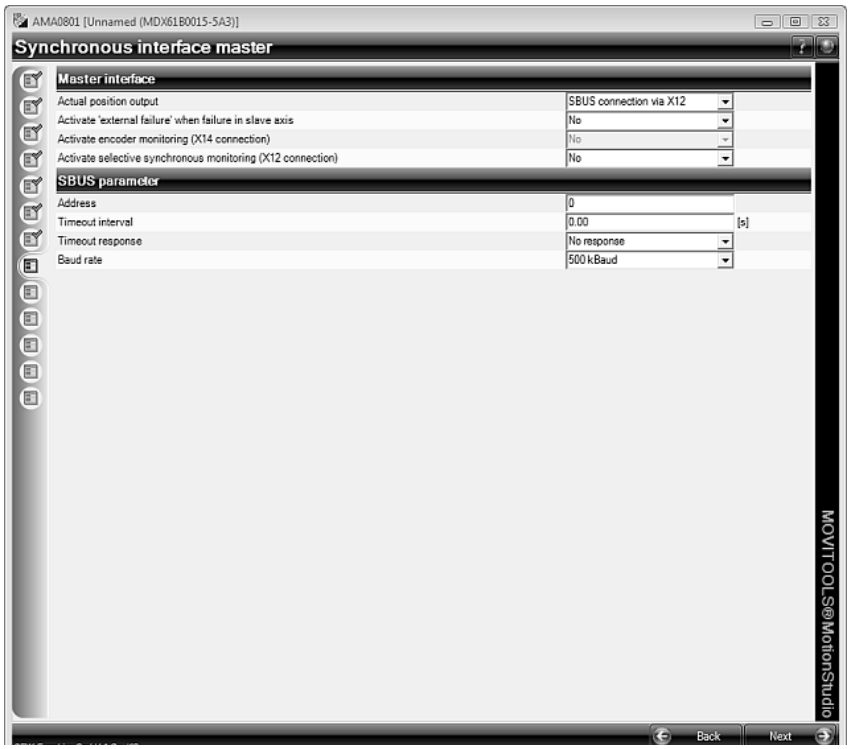
  Enter the maximum speed setpoint for synchronization with the master drive. To avoid lag errors, you should set the synchronization speed about 20% higher than the master speed.

- **"Synchronization ramp" edit box**

  Enter the ramp time to be used for synchronization. To avoid lag errors, you should set the synchronization ramp about 20% steeper than the master ramp.

Synchronous interface master

In this window, you configure the master interface.



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You have to make the following settings in the **"Master interface" section**:

- **"Actual position output" dropwdown menu**

  You can choose from the following options:

  – "Encoder connection via 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.

  – "SBus connection 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).

- **"External error" dropdown menu in the event of an error on the slave axis**

  Choosing "Yes", errors on the slave axis cause the master axis to stop immediately. You have to connect binary output DO02 (/Malfunction) on the slave axis to binary input DI07 (External error) on the master axis.

- **"Activating encoder monitoring (X14 connection)" dropdown menu**

  Choosing "Yes" checks for correct connection of the incremental encoder in enabled state of the master drive. In the event of wire breakage, fault message "F14 Encoder fault" is issued. When set to "No", wire breakage monitoring is disabled.

- **"Activating selective synchronous monitoring X12 connection)" dropdown menu**

  Choosing "Yes" activates the monitoring function.

  The monitoring function is used to stop the axis system during synchronized movement once an inverter error occurs at an axis.

  The unit status of the engaged axes is monitored cyclically. In the event of an error, the error number is sent to the master axis via SBus. The master axis or the slave axis configured to the virtual encoder interrupts the ongoing movement by triggering error *F116 suberror 81 Start condition*.

  The error is acknowledged via reset (bus or terminal). Doing so activates synchronous monitoring for the slave axis again and the error state is acknowledged on the master axis.

Make the following settings in the **"SBus parameters" section**:

- **SBus parameters**

  SBus parameters can only be set if the "SBus connection via X12" is set in the "Actual position output" selection field.

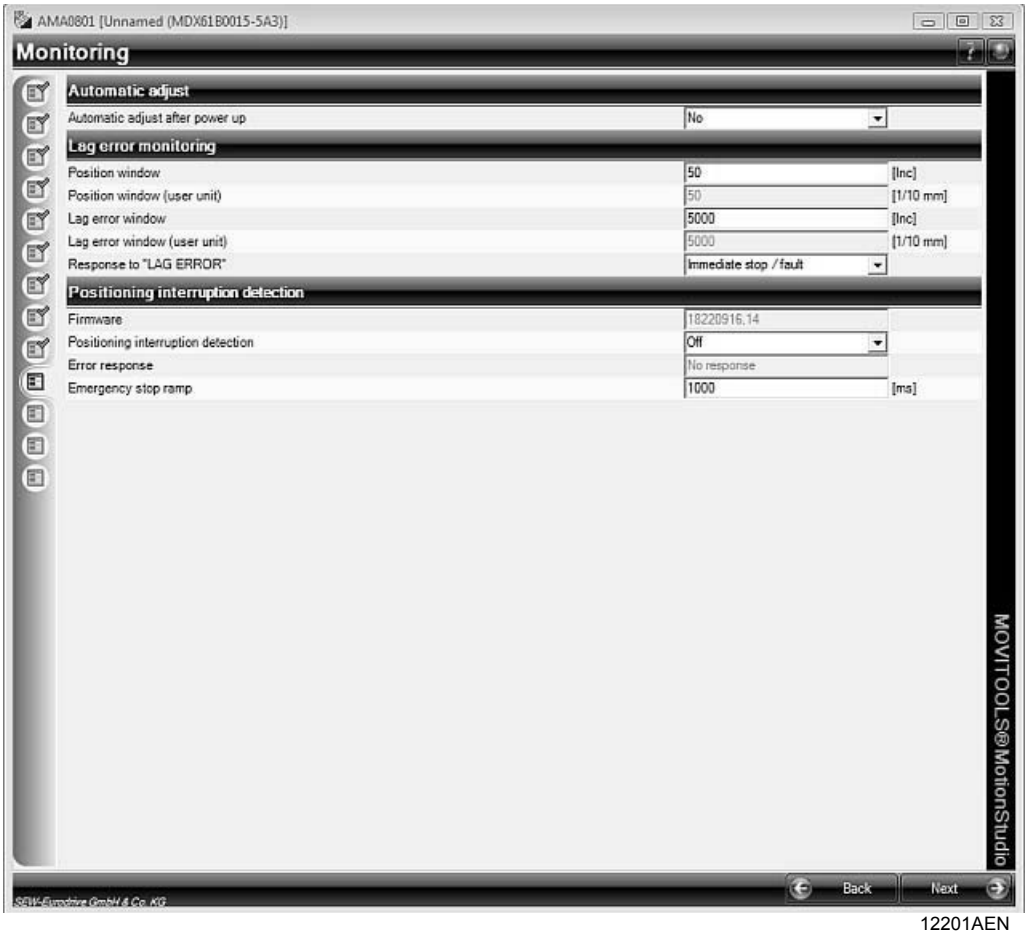
  – "Address" edit box
    Set the SBus address.

  – Timeout interval
    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 if the "SBus connection via X12" option is selected.

  – Baud rate
    The baud rate set for system bus 1 is displayed. The input fields for SBus monitoring are disabled if no SBus object is sent or received.

Monitoring functions



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The following settings are required in the **"Automatic adjustment" section**:

- "Automatic adjustment after power-up" dropwdown menu

  Set to "Yes": Automatic adjustment (independent of the specified position) is active. With a binary setpoint selection, you can use this function to track the internal target position of the position control. Doing so avoids a drift of position, for example caused by revoking enable.

  Set to"No": Automatic adjustment is disabled.

The following settings are required in the **"Lag error monitoring" section**:

- "Position window" edit box

  Edit box in user units. The edit box has an effect on the "In Position" signal in PI1:Bit 3 (target position reached). The "In position" message is generated when the referenced drive is within the position window.

- "Lag error window" edit box

  Edit box in user units. F42 (lag error) is generated at the MOVIDRIVE® B if this value is exceeded.

- "Lag error response" dropdown menu

  Choose the required error response. SEW-EURODRIVE recommends to choose "EMERGENCY STOP MALFUNCTION".

The following settings are required in the **"Positioning interruption detection" section**:

- "Firmware" display field

  Display of the MOVIDRIVE® B firmware version.

- "Positioning interruption detection" dropdown menu

  Set to "Yes": The "positioning interruption detection" function is active. The function monitors the travel profile during ongoing positioning. Unintended operating states that result in the target position being exceeded are detected and the "Emergency stop/malfunction error response is triggered. The feedback (inverter status) is performed via the "No. text display TEXT" error number.

  Set to "No": The "positioning interruption detection" function is disabled. There is no monitoring. The error response is set to "No function".

INFORMATION

- **Compatibility check of the startup wizard:**

  Click the [Next] button to check the firmware version. The following message is generated in case of incompatibility:

  The "positioning interruption detection" function cannot be activated with this unit firmware. Consult SEW Service to update the firmware or deactivate "positioning interruption detection".

- **Compatibility check of the IPOS$^{plus®}$ program:**

  The MOVIDRIVE® B firmware version is checked whenever the IPOS$^{plus®}$ program is started. If the "positioning interruption detection" function is active and the firmware version is incompatible, then the IPOS$^{plus®}$ program stops and issues error message "F116 - suberror code F38". In this case, update the firmware or deactivate the "positioning interruption detection" function.

- "Emergency ramp" input field

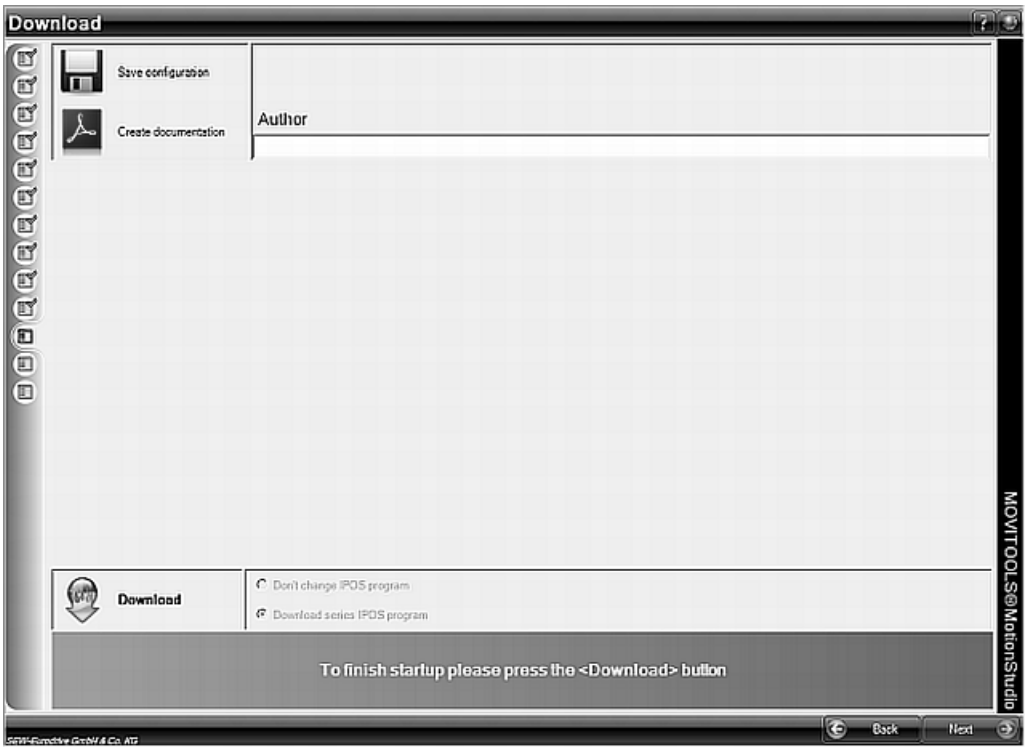
  The emergency ramp is activated in the event of an error. The system monitors whether the drive reaches zero speed within the set time. After the set time expires, the output stage is inhibited and the brake applied even if zero speed has not yet been reached. In order to be able to rule out application errors (e.g. positioning ramp shorter than emergency ramp), the minimum positioning ramp is limited to the emergency ramp in the IPOS$^{plus®}$ program.

- Position window for single-bit position evaluation

  In "binary setpoint" mode, a separate position window can be stored in PI4 for the 16 single-bits (position signal).

Download

Once you have entered all the parameters, click [Download]. The data is loaded into the inverter. Startup is now complete.



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The following functions are performed during download:

- Stopping an IPOS$^{plus®}$ program that may have been started
- Downloading input values
- Starting the IPOS$^{plus®}$ program

5.4 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... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
PD monitor		
H000	REM_ActPosUser Actual position in user units	D = User-defined units
H001	REM_ActPos Actual position in increments	D = Increments
H002	REM_ActPosRuntime Runtime measurement in ms	D = ms
H771	PO1	D
H772	PO2	D
H773	PO3	D
H774	PO4	D
H775	PO5	D
H776	PO6	D
H791	PI1	D
H792	PI2	D
H793	PI3	D
H794	PI4	D
H795	PI5	D
H796	PI6	D
ISYNC monitor		
H427	SynchronousState	D
H434	LagError	D
H183	SetpPosSync Position setpoint (master position)	D
Initial screen		
P091	Fieldbus type	D = without fieldbus error message
P093	Bus address	D
P819	Timeout interval	S = ms
P831	Timeout response	S
P092	Baud rate	D
P700	Operating mode	S = set to .... &IPOS
P100	Setpoint source	S = unipolar/fixed setpoint
H005	REM_FlagSyncSlave Master/slave configuration	S = 0: no ISYNC S = 1: Activating synchronous slave S = 1: Activating synchronous master
P078	Technology function	Enabling ISYNC if technology unit otherwise error message
H006	REM_FlagBinarySetpoint	S = 0: variable process data processing S = 1: binary process data processing

Parameter number P... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
Scaling of the drive		
P941	Actual position source for position control	S = IPOS encoder
H010	REM_ScalingType Scaling of the drive	S = 0: Diameter S = 1: Spindle pitch
H011	REM_Diameter Diameter	S = Diameter in 0.01
H012	REM_PosResolution User-defined unit for position processing	S = mm, 1/10 mm, 1/100 mm, incr.
H013	REM_EncoderResolution Encoder resolution	S = Resolution of the external encoder source in increments
H014	REM_GearRatio gear unit i	S = 0.01
H015	REM_ExtRatio Additional gear	S = 0.01
H016	REM_SpeedResolution User-defined unit for velocity processing	S = 0: rpm S = 1: mm/s S = 2: m/min
	Calculate button	
H020	REM_ScalNominatorD Distance numerator scaling factor	S = 1 ... 2^{13}
H021	REM_ScalDenominatorD Distance denominator scaling factor	S = 1 ... 2^{13}
H022	REM_ScalNominatorV Velocity numerator scaling factor	S = 1 ... 2^{13}
H023	REM_ScalDenominatorV Velocity denominator scaling factor	S = 1 ... 2^{13}
Parameters and limits		
P920	SW_CW limit switch	S = Increments
P921	SW_CCW limit switch	S = Increments
H025	REM_FlagHWLimitSwitch	S = 0: No S = 1: Yes
P603	Binary input DI04	S = /CW limit switch or "no function"
P604	Binary input DI05	S = /CCW limit switch or "no function"
P900	Reference offset	S = Increments
P903	Reference type	S = 0 ... 8
P904	Reference to zero pulse	S = 0: Yes S = 1: No
H026	REM_MaxSpeedAuto	S = rpm
H027	REM_MaxSpeedJog	S = rpm
P302	Maximum speed	S = rpm
H028	REM_MaxTargetPos Maximum target position	S = increments

Parameter number P... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
Binary setpoints (skip window if variable process data processing was selected)		
H30	REM_SpeedAuto_1 Speed 1 positioning mode	S = rpm
H31	REM_SpeedAuto_2 Speed 2 positioning mode	S = rpm
H32	REM_RampAuto Ramp specification positioning mode	S = ms
H33	REM_SpeedJog_1 Speed 1 jog mode	S = rpm
H34	REM_SpeedJog_2 Speed 2 jog mode	S = rpm
H35	REM_RampJog Ramp specification jog mode	S = ms
H36	REM_WWU_Offset Offset value for increasing the velocity in the "smooth component transfer position"	S = user-defined units
H37	REM_Pos_1_Speed	S = rpm
H38 HighWord	REM_Pos_1_RampUp	S = ms
H38 LowWord	REM_Pos_1_RampDown	S = ms
H39	REM_Pos_2_Speed	S = rpm
H40 HighWord	REM_Pos_2_RampUp	S = ms
H40 LowWord	REM_Pos_2_RampDown	S = ms
H57	REM_Pos_3_Speed	S = rpm
H58 HighWord	REM_Pos_3_RampUp	S = ms
H58 LowWord	REM_Pos_3_RampDown	S = ms
H59	REM_Pos_4_Speed	S = rpm
H60 HighWord	REM_Pos_4_RampUp	S = ms
H60 LowWord	REM_Pos_4_RampDown	S = ms
H93	REM_Pos_5_Speed	S = rpm
H94 HighWord	REM_Pos_5_RampUp	S = ms
H94 LowWord	REM_Pos_5_RampDown	S = ms
H41	REM_Pos_1	S = target position 1 for positioning mode in increments
H42	REM_Pos_2	S = target position 2 for positioning mode in increments
H43	REM_Pos_3	S = target position 3 for positioning mode in increments
H44	REM_Pos_4	S = target position 4 for positioning mode in increments
H45	REM_Pos_5	S = target position 5 for positioning mode in increments
H46	REM_Pos_6	S = target position 6 for positioning mode in increments
H47	REM_Pos_7	S = target position 7 for positioning mode in increments
H48	REM_Pos_8	S = target position 8 for positioning mode in increments

Parameter number P... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
H49	REM_Pos_9	S = target position 9 for positioning mode in increments
H50	REM_Pos_10	S = target position 10 for positioning mode in increments
H51	REM_Pos_11	S = target position 11 for positioning mode in increments
H52	REM_Pos_12	S = target position 12 for positioning mode in increments
H53	REM_Pos_13	S = target position 13 for positioning mode in increments
H54	REM_Pos_14	S = target position 14 for positioning mode in increments
H55	REM_Pos_15	S = target position 15 for positioning mode in increments
H56	REM_Pos_16 "Smooth component transfer" position	S = Position for smooth component transfer
Cam switch (skip window if variable process data processing was selected)		
H61	REM_Cam_1_Min Cam 1 CCW limit	S = limit value CCW limit cam 1 in increments
H62	REM_Cam_1_Max Cam 1 CW limit	S = limit value CW limit cam 1 in increments
H63	REM_Cam_2_min Cam 2 CCW limit	S = limit value CCW limit cam 2 in increments
H64	REM_Cam_2_Max Cam 2 CW limit	S = limit value CW limit cam 2 in increments
H65	REM_Cam_3_min Cam 3 CCW limit	S = limit value CCW limit cam 3 in increments
H66	REM_Cam_3_Max Cam 3 CW limit	S = limit value CW limit cam 3 in increments
H67	REM_Cam_4_min Cam 4 CCW limit	S = limit value CCW limit cam 4 in increments
H68	REM_Cam_4_Max Cam 4 CW limit	S = limit value CW limit cam 4 in increments
H69	REM_Cam_5_min Cam 5 CCW limit	S = limit value CCW limit cam 5 in increments
H70	REM_Cam_5_Max Cam 5 CW limit	S = limit value CW limit cam 5 in increments
H71	REM_Cam_6_min Cam 6 CCW limit	S = limit value CCW limit cam 6 in increments
H72	REM_Cam_6_Max Cam 6 CW limit	S = limit value CW limit cam 6 in increments
H73	REM_Cam_7_min Cam 7 CCW limit	S = limit value CCW limit cam 7 in increments
H74	REM_Cam_7_Max Cam 7 CW limit	S = limit value CW limit cam 7 in increments
H75	REM_Cam_8_min Cam 8 CCW limit	S = limit value CCW limit cam 8 in increments
H76	REM_Cam_8_Max Cam 8 CW limit	S = limit value CW limit cam 8 in increments
H77	REM_Cam_9_min Cam 9 CCW limit	S = limit value CCW limit cam 9 in increments
H78	REM_Cam_9_Max Cam 9 CW limit	S = limit value CW limit cam 9 in increments

Parameter number P... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
H79	REM_Cam_10_min Cam 10 CCW limit	S = limit value CCW limit cam 10 in increments
H80	REM_Cam_10_Max Cam 11 CW limit	S = limit value CW limit cam 10 in increments
H81	REM_Cam_11_min Cam 11 CCW limit	S = limit value CCW limit cam 11 in increments
H82	REM_Cam_11_Max Cam 11 CW limit	S = limit value CW limit cam 11 in increments
H83	REM_Cam_12_min Cam 12 CCW limit	S = limit value CCW limit cam 12 in increments
H84	REM_Cam_12_Max Cam 12 CW limit	S = limit value CW limit cam 12 in increments
H85	REM_Cam_13_min Cam 13 CCW limit	S = limit value CCW limit cam 13 in increments
H86	REM_Cam_13_Max Cam 13 CW limit	S = limit value CW limit cam 13 in increments
H87	REM_Cam_14_min Cam 14 CCW limit	S = limit value CCW limit cam 14 in increments
H88	REM_Cam_14_Max Cam 14 CW limit	S = limit value CW limit cam 14 in increments
H89	REM_Cam_15_min Cam 15 CCW limit	S = limit value CCW limit cam 15 in increments
H90	REM_Cam_15_Max Cam 15 CW limit	S = limit value CW limit cam 15 in increments
H91	REM_Cam_16_min Cam 16 CCW limit	S = limit value CCW limit cam 16 in increments
H92	REM_Cam_16_Max Cam 16 CW limit	S = limit value CW limit cam 16 in increments
Master/slave configuration (skip window if master/slave configuration 1 or 2 was selected)		
H95	REM_Mastersource Master source	S = 0: X14 S = 1: SBus S = 2: VEncoder
H96	REM_SBusCtlWordDetection	S = 0: Monitoring inactive S = 1: Send active S = 2: Receive active
H97	REM_SCOM_Pointer	S = 0 ... 1024
P606	General switch-off in the event of a master error	S = no function or external error
P621	General switch-off in the event of a slave error	S = no function or external error
P506	Activate wire breakage monitoring external encoder in the slave?	S = 0: Off S = 1: On
P881	Timeout interval SBus1	S = ms
P836	Response to SBus1 timeout	S
P884	Baud rate SBus1	S = (125/250/200/1000) kBaud
P894	Baud rate SBus2	S
P885	SBus1 synchronization ID	S = 0: Sender S = 1: Receiver

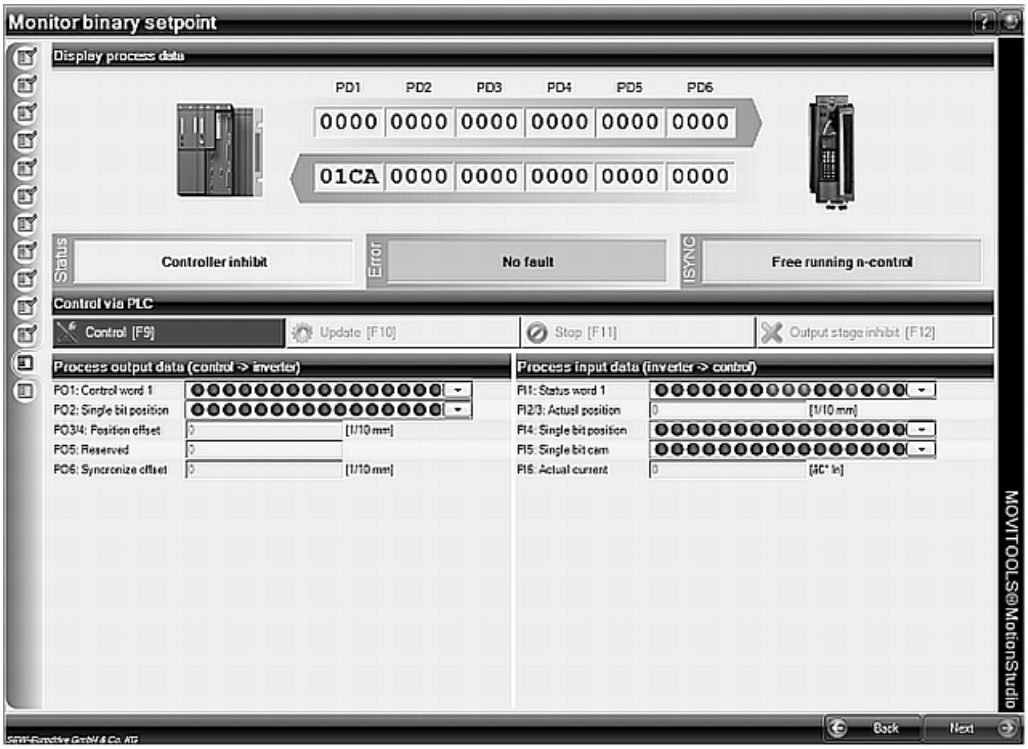
Parameter number P... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
ISYNC-1 (skip window if master/slave configuration is not "2")		
H100	REM_M_Diameter Master diameter	S = diameter in 0.01
H101	REM_M_GearRatio Master gear unit i	S = 0.01
H102	REM_M_SubGearRatio Master additional gear	S = 0.01
H103	REM_M_ScalNominatorD Distance numerator scaling factor master	S
H104	REM_M_ScalDenominatorD Distance denominator scaling factor slave	S
H105	REM_GF_Master	S = 1 ... $\pm 2^{31}$ ("1" with virtual encoder / external slave encoder)
H106	REM_GF_Slave	S = 1 ... $\pm 2^{31}$ ("1" with virtual encoder / external slave encoder)
H107	REM_SyncEncoderNum	S = 1 ... 2^{31}
H108	REM_SyncEncoderDenom	S = 1 ... 2^{31}
ISYNC-2 (skip window if master/slave configuration is not "2")		
P240	Synchronization speed	S = rpm
P241	Synchronization ramp	S = ms
P228	Precontrol filter DRS	S = ms
Monitoring functions		
H029	REM_PosWindow_PI4 Position window for PI4	S = 0...50 (default)...20000
H110	REM_SwicthHoldTabPos Automatic adjustment function	S = 0: Automatic adjustment disabled S = 1: Automatic adjustment
H120	REM_TouchCtrl IPOS variable for version check	S = 0: Off S = 1: On
P076	Basic unit firmware	Read in
P924	Positioning interruption detection	S = 0: Off S = 1: On
P839	Error response	S = 0: No response S = 1: Emergency stop/Malfunction
P137	Emergency ramp	S = ms
P605	Reserved	Reserved
P622	Reserved	Reserved
P923	Lag error window	Firmware monitoring function
P834	Error response to lag error	Default: Emergency stop malfunction

Parameter number P... IPOS$^{plus®}$ variable H...	Description	D = Display S = Setting R = Reserved
Download		
P400	Speed reference value	S = 20.0 1/rpm (for standstill)
P401	Hysteresis	S = 2 1/rpm (for standstill)
P402	Delay time	S = 0.1 s (for standstill)
P403	Signal = 1 with $n < n_{ref}$	$n < n_{ref}$ (for standstill)
P600	Binary input DI01	S = enable/stop
P601	Binary input DI02	S = error reset
P602	Binary input DI03	S = Reference cam
P603	Binary input DI04	S = CW limit switch
P604	Binary input DI05	S = CCW limit switch
P605	Reserved	Reserved
P606	Binary input DI07	S = No function/ext. error
P620	Binary output DO01	S = Ready
P621	Binary output DO02	S = /Malfunction
P622	Binary output DO03	S = IPOS output
P700	Ready	S = ...&IPOS
P870	Setpoint description PO1	S = IPOS PO DATA
P871	Setpoint description PO2	S = IPOS PO DATA
P872	Setpoint description PO3	S = IPOS PO DATA
P873	Setpoint description PI1	S = IPOS PI DATA
P874	Setpoint description PI	S = IPOS PI DATA
P875	Setpoint description PI3	S = IPOS PI DATA
P876	PO data enable	S = On
P938	IPOS speed task 1	9
P939	IPOS speed task 2	0
P960	Modulo function	Off

6 Operation and Service

6.1 Starting the drive

Following the download, switch to the "AMA0801" application module monitor by selecting "Yes." (see figure below).



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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 DIØ1 "ENABLE/STOP" must have a "1" signal. • **Only with operation 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/STOP" = "1."

6.1.1 Operating modes with variable setpoint

Operating mode	PO1:11 Mode 2^0	PO1:12 Mode 2^1	PO1:13 Mode 2^2
Jog mode	0	0	0
Referencing mode	1	0	0
Positioning mode	0	1	0
Synchronous operation	1	1	0

- **Jog mode**

  Once you have selected the direction of rotation, the single axis can be moved in jog mode. If you have assigned software limit switches, the travel range is restricted to these limits.

- **Referencing mode (with variable and binary setpoint)**

  The actual position is added to the specified reference offset depending on the selected reference travel type.

- **Positioning mode**

  With the axes referenced and the start set, the imported values setpoint position, speed specification and ramp specification cause a positioning process. All specified values can be changed during ongoing movement.

- **Synchronous operation**

  With the "Internal synchronous operation" technology function (ISYNC), the slave drive follows the set master source at a synchronous angle. A relative offset to the master position can be specified using the "SyncOffset" function.

6.1.2 Operating modes with binary setpoint

Operating mode	PO1:11 Mode 2^0	PO1:12 Mode 2^1	PO1:13 Mode 2^2
Jog mode	0	0	0
Referencing mode	1	0	0
Positioning mode with smooth component transfer[1)]	0	1	0
Synchronous operation	1	1	0
Reserved	0	0	1
Teach mode	1	0	1
Positioning mode with smooth component transfer in positive direction[1)]	0	1	1
Positioning mode with smooth component transfer in negative direction[1)]	1	1	1

1) Smooth component transfer

- **Jog mode**

  The values specified for velocity and ramp are retrieved from the stored startup data.

- **Positioning mode**

  The table cells are selected via PO2. The drive moves to the specified target position with the axes referenced and the start set. The motion sequence is also influenced by the functions "smooth component transfer", "automatic adjustment" and "correction value".

- **Synchronous operation**

  The values specified for position, velocity and ramp are retrieved from the stored startup data. The "correction value " function is enabled.

- **Teach mode**

  The table cell to be described with the actual position is selected via PO2. The actual position is stored remanently using the "start" input.

6.2 Referencing mode

Mode selection

- PO1:11 = "1"
- PO1:12 = "0"
- PO1:13 = "0"

Requirement

The operating mode is selected and start is set. The drive is enabled. Exception: Reference travel type 8. This type references the axis without axis movement.

Operating principle

Reference travel is triggered via PO1:8 "Start". The subsequent sequence of motion is controlled by the firmware. Reference travel can be interrupted by deselecting the operating mode or by revoking the start signal. Once reference travel has been completed, PI1:2 "IPOS reference" is set.

6.3 Jog mode

Mode selection

- PO1:11 = "0"
- PO1:12 = "0"
- PO1:13 = "0"

Requirement

The operating mode is selected and the drive is enabled.

Operating principle

The direction is selected via PO1:9 "Jog +" or PO1:10 "Jog –". If the CW software limit switch is set to a higher value than the CCW software limit switch, the travel range will be limited up to 3 position windows before the corresponding software limit switch.

If PO1:15 SWLS_OFF is set to _1_, the limitation of the travel range is disabled. Without evaluation of the software limit switches, the axis can be moved endlessly.

The drive stops with position control if the direction selection is not enabled or both directions are selected at the same time.

The ramp time specified using PO1:4 with the specified ramp scaling (PO1:Bit 4) is used for accelerating or decelerating the drive.

The specified velocity of the jog mode is compared with the velocity limit and is limited, if necessary.

6.4 Teach mode (binary setpoint)

Mode selection
- PO1:11 = "1"
- PO1:12 = "0"
- PO1:13 = "1"

Strobe
- PO1:8 edge change "FALSE" – "TRUE" – "FALSE"

Start
- PO1:8 edge change "FALSE" – "TRUE" – "FALSE"

Teach position selection
- PO2:0 = Table position 1
- PO2:15 = Table position 15
- PO2:16 = Smooth component transfer position

Target position reached
- PI1:3 = Feedback "In position / axis at standstill" reached

Requirement
- The operating mode is selected
- Axis is referenced
- The drive is in position control, safe stop, controller inhibit or no enable
- A valid table position was selected

Operating principle

In "teach mode", the table positions stored at startup may be overwritten with the actual position.

If a valid table position was selected and the drive is referenced, the actual position can be tought to the table position by addressing "Strobe" with the sequence "FALSE" – "TRUE" – "FALSE".

The positive edge change of the "target position reached" output indicates that the position has been saved.

6.5 Positioning mode

Mode selection

- PO1:11 = "0"
- PO1:12 = "1"
- PO1:13 = "0"

  In positioning mode, position setpoints are controlled in relation to the set IPOS encoder source.
- Set PO1:8 "Start" to "1" to start positioning.

- 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.

- If the maximum input value of *[(2^{31}) – 1] / distance numerator* is exceeded in the resolution "mm" or "1/10 mm", the the positioning job will be discarded and the drive stops with position control.

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" or PO1:8 = "0"	The drive stops using the ramp time defined in process output data word PO5. At standstill, the drive remains stopped with position control (motor remains energized).

6.6 Synchronous operation

Mode selection

- PO1:11 = "1"
- PO1:12 = "1"
- PO1:13 = "0"

  In synchronous mode, the actual position is adjusted to the setpoint position based on the "Internal synchronous operation (ISYNC)" technology function.
- Set PO1:8 "Start" to "1" to start synchronous operation. As soon as the startup cycle 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 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. Other conditions for the startup cycle of the synchronization slave are set by setting the parameters for the startup cycle mode.

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. 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. 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. Master/slave connection and lag error monitoring remain active.
PO1:11 = "0" and PO12 = "0" or PO1:8 = "0"	The drive stops using the ramp time defined in process output data word PO5. At standstill, the drive remains stopped with position control (motor remains energized). The slave is disengaged and lag error monitoring is disabled.

Example of synchronous operation

Observe the following notes to avoid a permanent position offset between master and slave drives.

- **Engaging**
  - Enable the slave drive first, select the operating mode and query the checkback PI1:0 "Drive synchronous."
  - Then activate the master drive and start the motion sequence.
    Important: Everytime when entering "synchronous operation" mode, the present actual position of the master drive is set as the new reference position for the slave drive. This means the previous orientation of the slave to the master drive (or vice versa) must be made by the user.

- **Disengaging**
  - First stop the master drive.
  - Next deactivate the slave drive.

- **Interruption**
  - First stop the master drive.
  - The decelerating master drive causes the slave drive to be run down, i.e. the position reference is maintained.
  - Stop the slave drive after switching off the master drive.

- **Adjust axes**
  - Adjust master and/or slave drive in positioning mode.
  - Next activate synchronous operation for the adjusted slave drive.

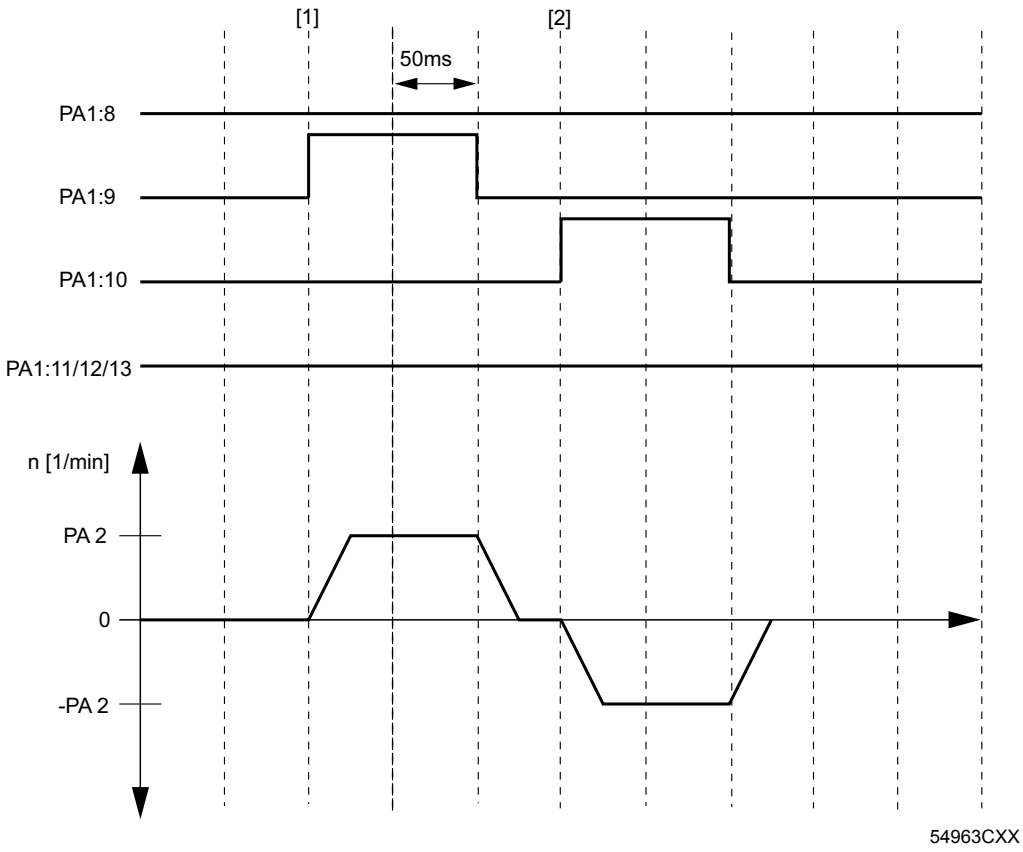
6.7 Cycle diagrams

The following conditions apply to the cycle diagrams:

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

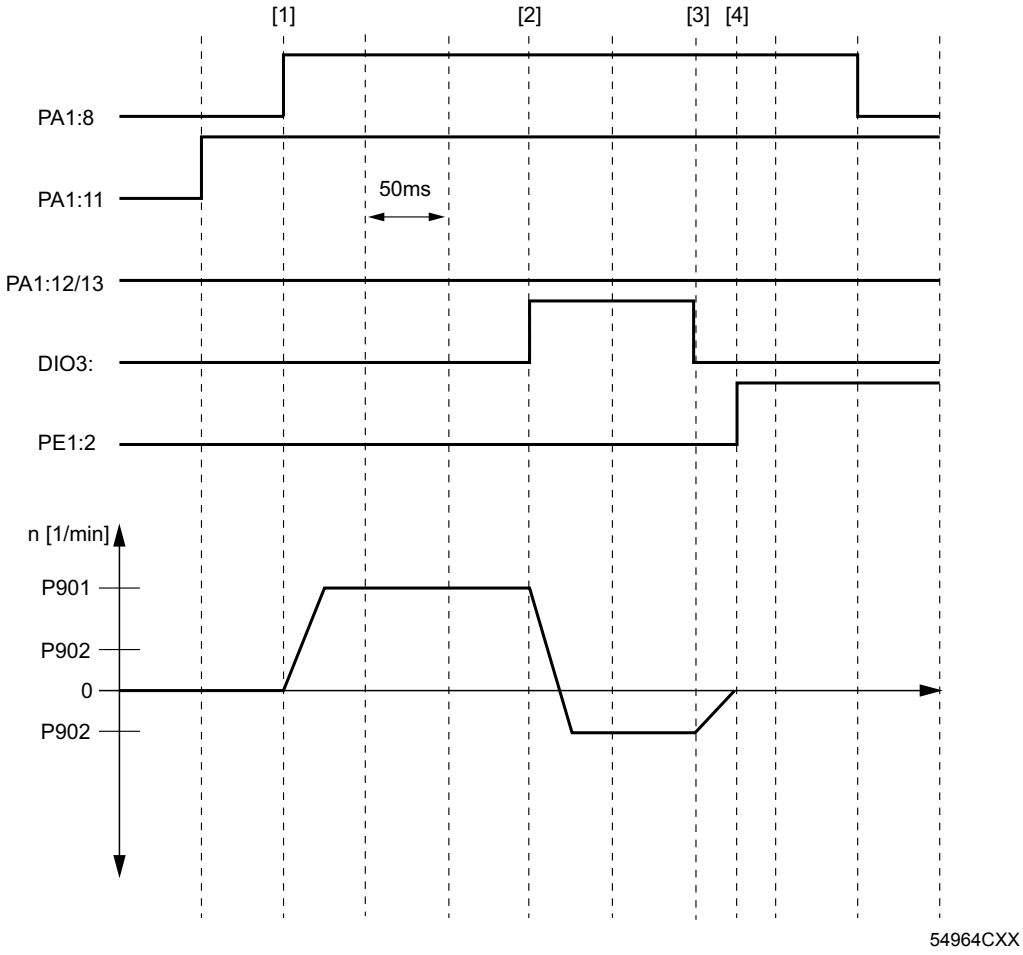
	INFORMATION
	With control via fieldbus/system bus, you must set the following bits in control word PO1: • PO1:1 = "1" (ENABLE/STOP) • PO1:2 = "1" (ENABLE/STOP)

Jog mode



PO1:8 = Start
PO1:9 = Jog +
PO1:10 = Jog -
PO1:11 = Mode 2^0
PO1:12 = Mode 2^1
PO1:13 = Mode 2^2
[1] = Axis starts when the "jog+" bit is set
[2] = Axis starts when the "jog –" bit is set

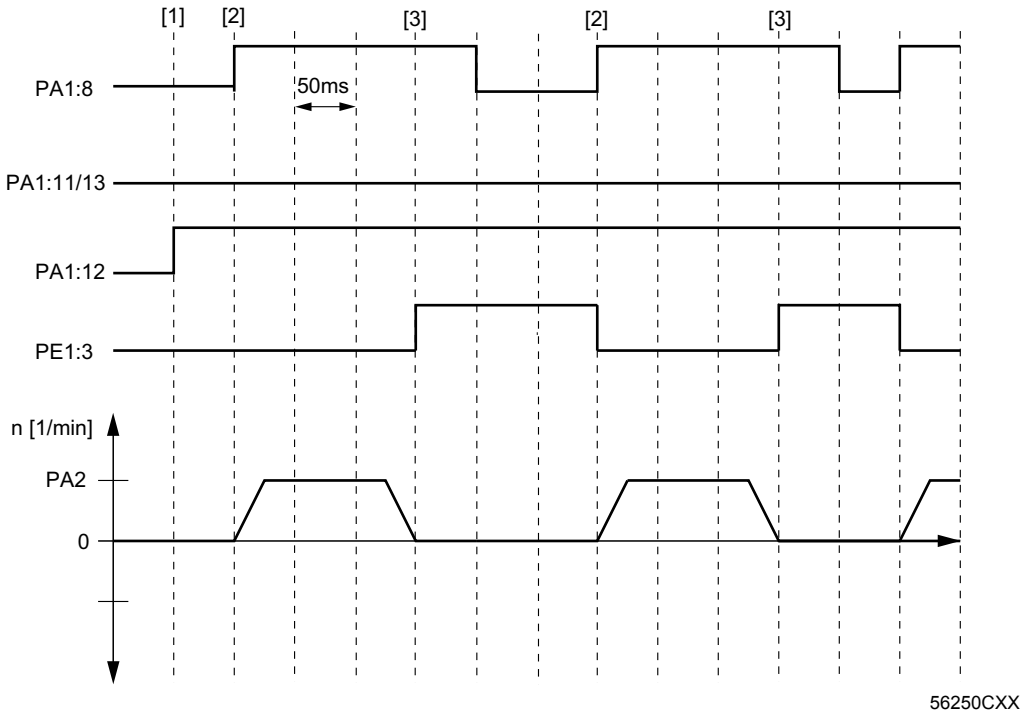
Referencing mode



PO1:8 = Start
PO1:11 = Mode 2^0
PO1:12 = Mode 2^1
PO1:13 = Mode 2^2
DI03 = Reference cam
PI1:2 = IPOS reference

[1] = Start of reference travel (reference travel type 2)
[2] = Moved to reference cam
[3] = Leave reference cam
[4] = When the drive is at a standstill, PE1:2 "IPOS reference" is set. The drive is now referenced.

Positioning mode

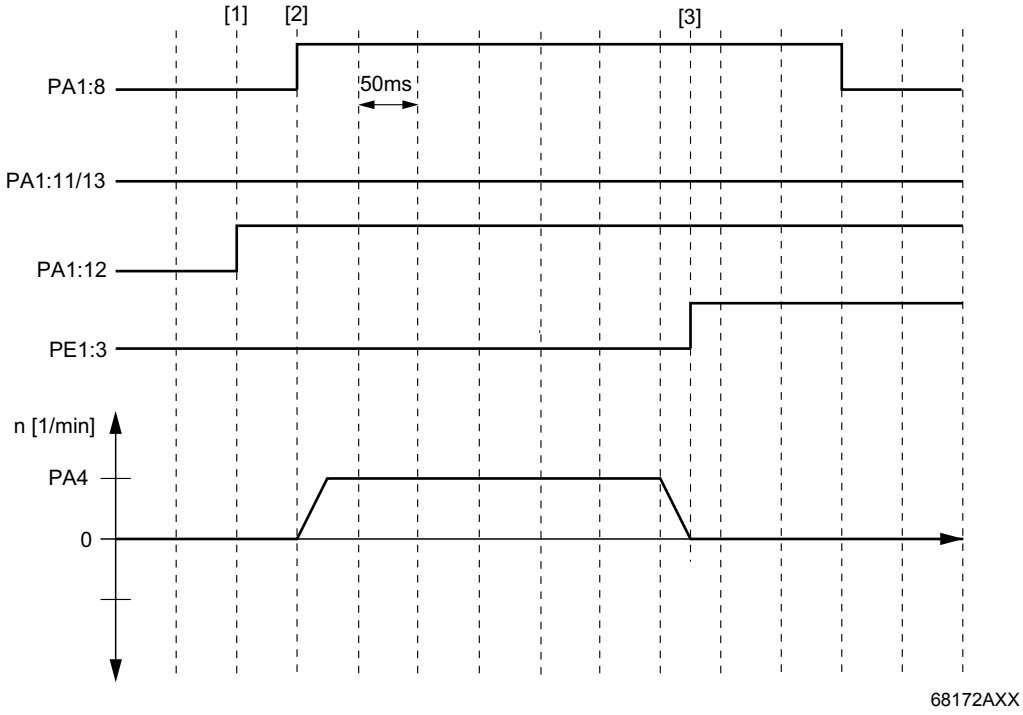


PO1:8 = Start
PO1:11 = Mode 2^0
PO1:12 = Mode 2^1
PO1:13 = Mode 2^2
PI1:3 = Target position reached

[1] = Automatic absolute selected
[2] = Start positioning (target position = PO3)
[3] = Target position reached

Synchronous operation

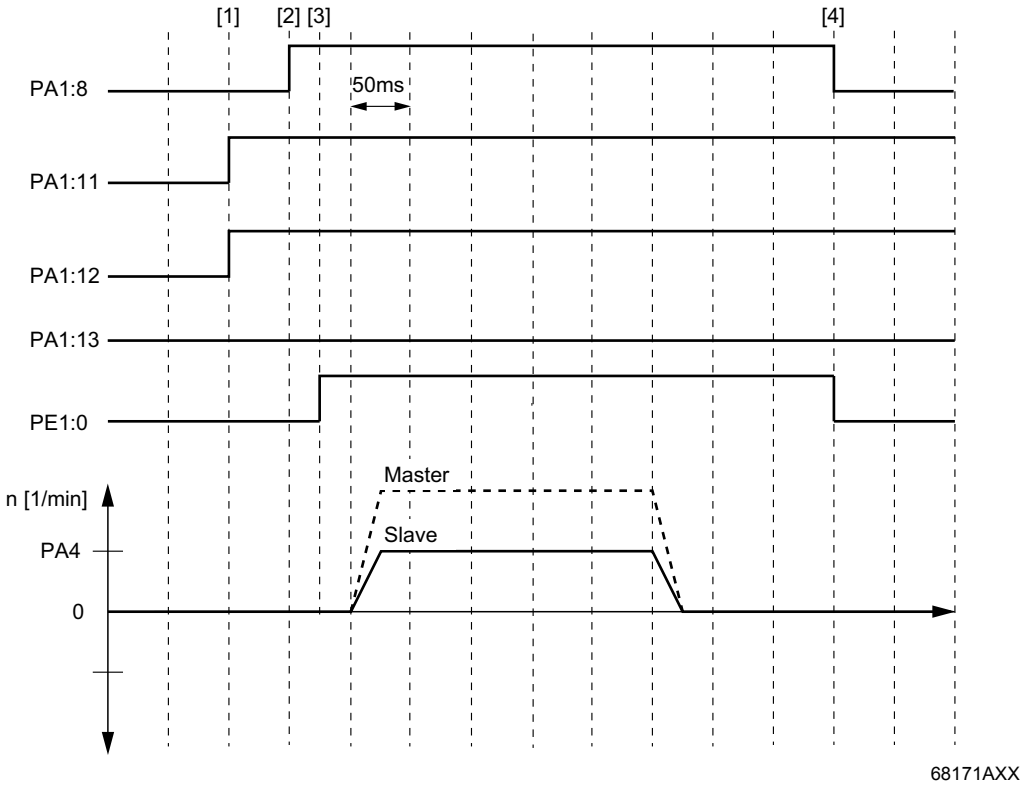
Master drive in positioning mode with variable setpoint



PO1:8 = Start
PO1:11 = Mode 2^0
PO1:12 = Mode 2^1
PO1:13 = Mode 2^2
PI1:3 = Target position reached

[1] = Automatic positioning mode
[2] = Start positioning (target position = PO3)
[3] = Target position reached

Slave drive in synchronous operation with variable setpoint



PO1:8 = Start
PO1:11 = Mode 2^0
PO1:12 = Mode 2^1
PO1:13 = Mode 2^2
PI1:0 = Drive synchronous

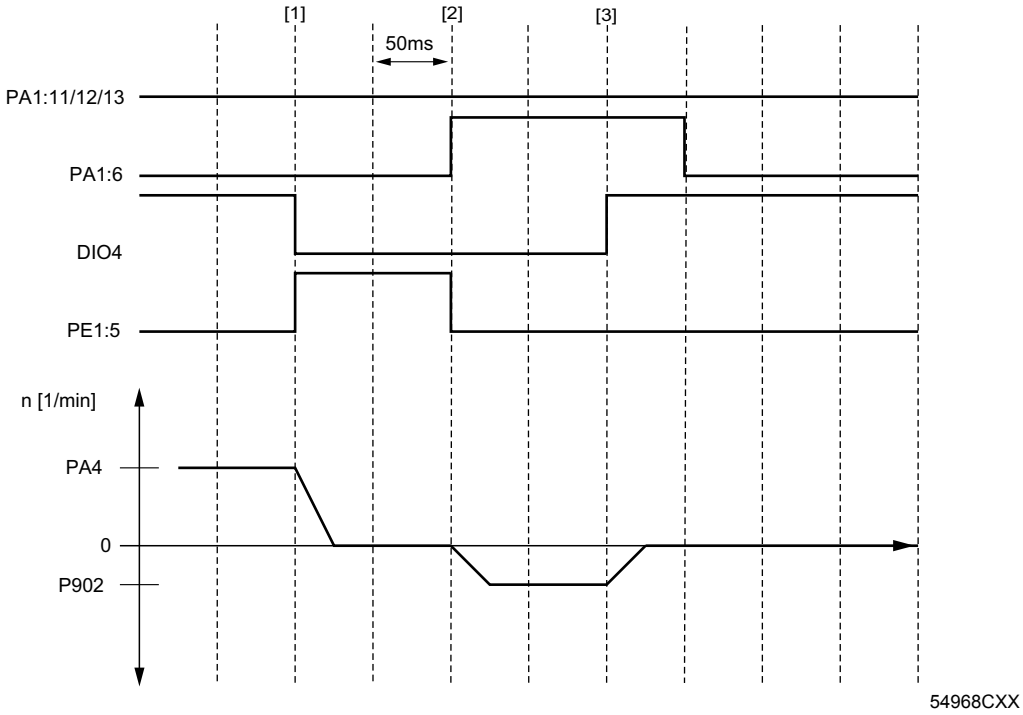
[1] = Automatic synchronous mode
[2] = Start synchronous mode
[3] = Drive synchronous
[4] = Disengage, e.g. by revoking start bit PO1:8

Moving clear of hardware limit switches

Once a hardware limit switch (DI04 = "0" or DI05 ="0") has been reached, the bit PI1:5 "Fault" 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 "Fault" is deleted.
- The drive automatically moves clear of the hardware limit switch at the speed specified in *P902 Reference speed 2*.
- During the firmware-controlled motion sequence, the value "9" (= limit switch reached) is indicated by PI1:8 to PI1:15. You can evaluate a defect by measuring the runtime in the higher-level controller.
- Once the drive has moved clear of the hardware limit switch (PI1:8 to PI1:15 change to "A" technology function), you can delete PO1:6 "Reset" and select the required operating mode.



PO1:11 = Mode 2^0 PO1:6 = Reset

PO1:12 = Mode 2^1 PI1:5 = Error

PO1:13 = Mode 2^2 DI04 = CW hardware limit switch

[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. The hardware moves clear of hardware limit switch.

[3] = Drive moved clear of hardware limit switch

	INFORMATION
	If the hardware limit switch with which the drive has come into contact is faulty (no positive edge at DI04 or DI05 as the drive moves clear), you must stop the drive by revoking the enable (terminal or bus). To do so, monitor the runtime of the clearing process in the higer-level controller.

6.8 Fault information

The fault memory (P080) stores the last five error messages (errors t-0...t-4). 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", "State of binary inputs/outputs", "Operating state of the inverter", "Inverter state", "Heat sink temperature", "Speed", "Output current", "Active current", "Unit utilization", "DC link voltage", "Hours of operation", "Enable hours", "Parameter set", "Motor utilization".

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

- **Immediate switch-off:**

  The unit can no longer brake the drive; the output stage goes to high resistance in the event of an error and the brake is applied immediately (DBØØ "/Brake" = "0").

- **Rapid stop:**

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

Reset

An error message can be acknowledged by:

- Switching the power supply off and on again.

  Recommendation: Observe a minimum switch-off time of 10 s for the input contactor K11.

- Reset via binary input DIØ4. Startup of the "DriveSync" application module causes this binary input to be assigned with the "Reset" function.
- Only for control with fieldbus/system bus: "0"→ "1" signal at bit PO1:6 in control word PO1.
- Press the reset button in the MOVITOOLS® MotionStudio Manager.
- Manual reset in MOVITOOLS® Shell (P840 = "YES" or [Parameter] / [Manual reset]).
- Manual reset using the DBG60B.

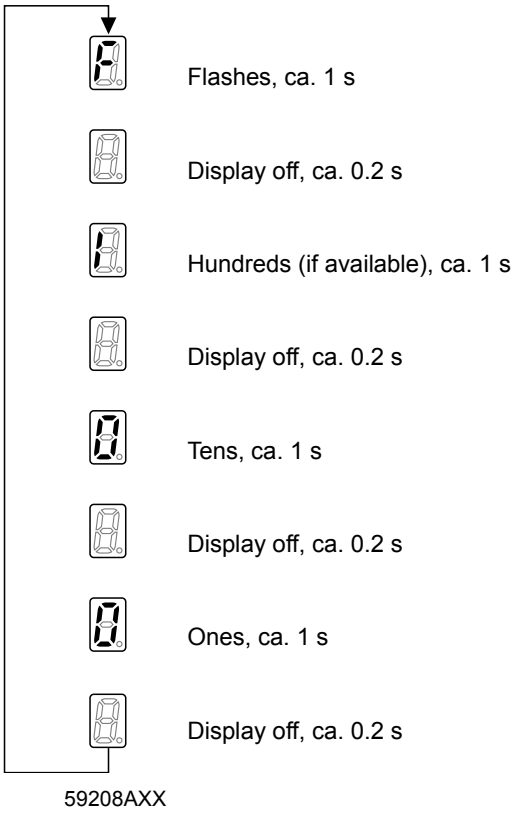
Timeout active

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.

6.9 Error messages

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.

Display suberror code

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

Error list

The factory set error response appears in the "Response (P)" column. (P) indicates that the response is programmable (via *P83_error response* or with IPOS$^{plus®}$). In the event of error 108, (P) indicates that the response can be programmed via *P555 DCS error response* In the event of error 109, (P) indicates that the response can be programmed via *P556 DCS alarm response*

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 • Check supply cable to the braking resistor • Check technical data of braking resistor
			1			
08	Speed monitoring	Immediate switch-off (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. • Encoder not connected correctly or incorrect direction of rotation. • n_{max} is exceeded during torque control. • In operating mode VFC: Output frequency ≥ 150 Hz • In operating mode U/f: Output frequency ≥ 600 Hz	• Reduce load • Increase deceleration time (P501 or P503). • Check encoder connection, swap A/A and B/B pairs if necessary • Check the voltage supply of the encoder • Check current limitation • Extend ramps if necessary • Check motor cable and motor • Check mains phases
			3	System limit "Actual speed" exceeded. Speed difference between ramp setpoint and actual value for 2×ramp time higher than expected slip.		
			4	Maximum rotating field speed exceeded. Maximum rotating field frequency (with VFC max 150 Hz and U/f max 600 Hz) exceeded.		
10	IPOS-ILLOP	Emergency stop	0	Invalid IPOS command	• Incorrect command detected during IPOS$^{plus®}$ program execution. • Incorrect conditions during command execution.	• Check the content of the program memory and, if necessary, correct. • Load the correct program into the program memory. • 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 • Short circuit/broken encoder wire • Encoder defective	Check encoder cable and shield for correct connection, short circuit and open circuit.
			25	Encoder fault X15 - speed range exceeded. Encoder at X15 turns faster than 6542 rpm.		
			26	Encoder fault X15 - defective card Error in quadrant evaluation.		
			27	Encoder fault - defective encoder connection or encoder		
			28	Encoder fault X15 - communication error RS485 channel		
			29	Encoder fault X14 - communication error RS485 channel		
			30	Unknown encoder type at X14/X15		
			31	Plausibility check error Hiperface® X14/X15 Increments have been lost.		
			32	Encoder fault X15 Hiperface® Hiperface® encoder at X15 signals error		
			33	Encoder fault X14 Hiperface® Hiperface® encoder at X14 signals error		
			34	Encoder fault X15 Resolver 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	"Fieldbus timeout" error	No communication between master and slave within the projected response monitoring.	• Check the communication routine of the master • Extend fieldbus timeout time (P819)/deactivate monitoring
			2	Fieldbus interface does not boot		
31	TF/TH trip	None Response (P)	0	Thermal motor protection error	• Motor too hot, TF/TH has triggered • TF/TH of the motor not connected or connected incorrectly • Connection between MOVIDRIVE® and TF/TH on motor interrupted	• Let motor cool down and reset error • Check connection between MOVIDRIVE® and TF/TH. • If a TF/TH is not connected: Jumper X 10:1 with X 10:2 • Set P835 to "No response"
36	Option missing	Immediate disconnection	0	Hardware is missing or not permitted.	• Type of option card not allowed • Setpoint source, control signal source or operating mode not permitted for this option card • Incorrect encoder type set for DIP11B	• Use correct option card • Set correct setpoint source (P100) • Set correct control signal source (P101) • Set correct operating mode (P700 or P701) • 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 switch-off (P)	0	Lag error positioning	• Encoder connected incorrectly • Acceleration ramps too short • P component of positioning controller too small • Incorrectly set speed controller parameters • Value for lag error tolerance too small	• Check encoder connection • Extend ramps • Set P-component to higher value • Reset speed controller parameters • Increase lag error tolerance • Check encoder wiring, motor and mains phase wiring. • 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:** Programmed target position is outside travel range delimited by software limit switches.	• Check the user program • Check position of software limit switches

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SEW-EURODRIVE
Driving the world

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

➞ **www.sew-eurodrive.com**