SEW EURODRIVE

MOVIDRIVE® MDX61B
Extended Positioning via Bus Application

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Manual

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1 Important notes

Always follow the safety and warning instructions contained in this section!

1.1 Explanation of the icons

Hazard

Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

Warning

Indicates an imminently hazardous situation caused by the product which, if not avoided, WILL result in death or serious injury. You will also find this signal to indicate the potential for damage to property.

Caution

Indicates a potentially hazardous situation which, if not avoided, MAY result in minor injury or damage to products.

Note

Indicates a reference to additional information, for example on startup, or other useful data.

Documentation reference

Indicates a reference to a document, such as operating instructions, catalog, data sheet.

1.2 Safety notes and general information

Risk of an electrical shock

Possible consequences: Death or serious injury.

Only electrical specialists are allowed to install and start up MOVIDRIVE® drive inverters observing the applicable accident prevention regulations and the MOVIDRIVE® operating instructions.

Potentially hazardous situation which, if not avoided, may result in damage to products or the surrounding area.

Possible consequences: Damage to the product

Read through this manual carefully before you commence installation and startup of MOVIDRIVE® drive inverters with this application module. This manual does not replace the detailed operating instructions!

A requirement of fault-free operation and the possibility of any rights to claim under guarantee is that you observe the information in the documentation.

Documentation reference

This manual was written assuming that the user is familiar with the MOVIDRIVE® documentation, in particular the MOVIDRIVE® system manual.

In this manual, cross references are marked with "→". For example, (→ Sec. X.X) means: Further information can be found in section X.X of this manual.

2 System Description

2.1 Application areas

The "Extended positioning via bus" application module is particularly suited to applications in which it is necessary to move to any number of positions at different speeds and with different acceleration ramps. Positioning to an external encoder is necessary when there is a non-positive connection between the motor shaft and the load. In this case, either an incremental encoder or an absolute encoder can be used.

The "Extended positioning via bus" application module is especially suitable for the following branches of industry and applications:

- **Materials handling technology**
  - Trolleys
  - Hoists
  - Rail vehicles
- **Logistics**
  - Storage and retrieval systems
  - Transverse carriages

The "Extended positioning via bus" module offers the following advantages in these applications:

- User-friendly user interface.
- You only have to enter the parameters required for "Extended bus positioning" (ratios, speeds, diameters).
- Guided parameter setting process instead of complicated programming.
- Monitor mode for optimum diagnostics.
- Users do not require any programming experience.
- Long travel distances possible ($2^{18} \times$ travel unit)
- Either an incremental encoder or an absolute encoder can be used as the external encoder.
- It does not take long to get to know the system.

2.2 Application example

Transverse carriage

A transverse carriage represents a typical application example of the "Extended positioning via bus" application module. The following figure shows a transverse carriage in a high-bay warehouse. Goods to be moved in and out of storage are transported between the shelf aisles and the distribution table. The transverse carriage has to cover long distances in this process. It also has to accelerate with different ramps and move at different speeds depending on the load.

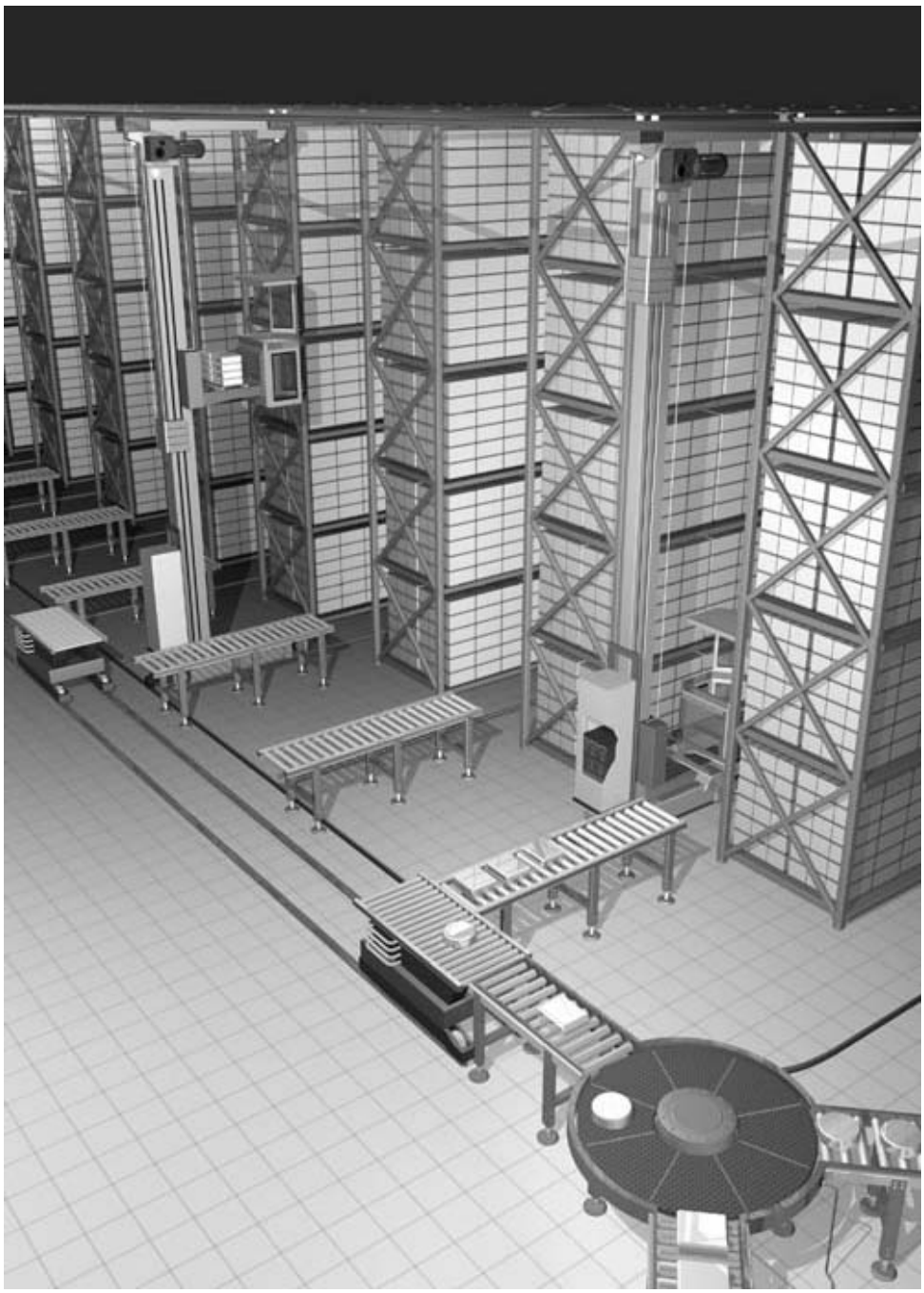

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Figure 1: Application example of a transverse carriage

2.3 Program identification

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

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

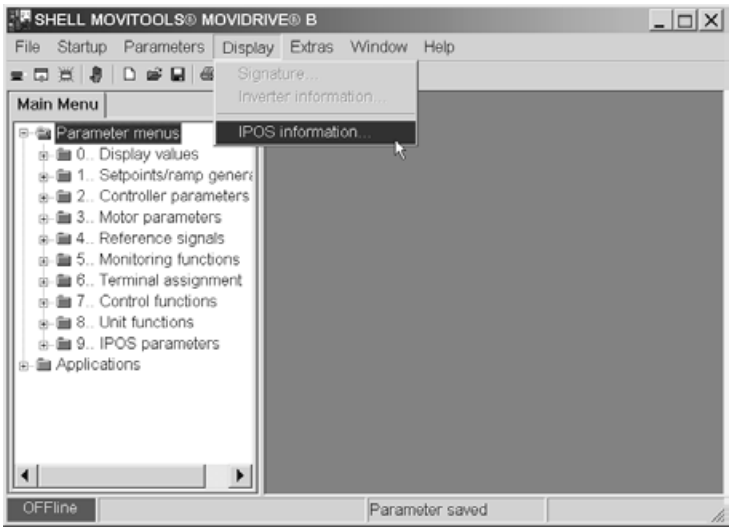

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Figure 2: IPOS information in Shell

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

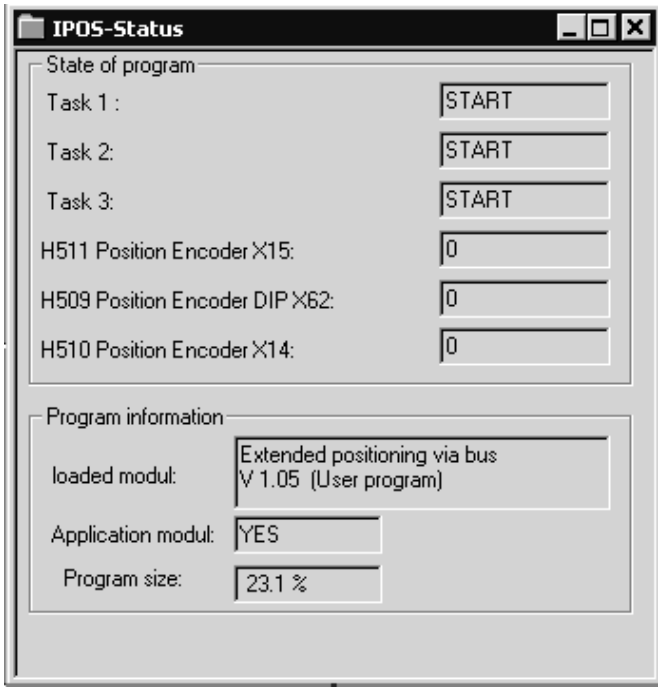

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Figure 3: Display of the current IPOS program version

3 Project Planning

3.1 Prerequisites

PC and software

The "Extended positioning via bus" application module is implemented as an IPOS$^{plus®}$ program and forms part of the SEW MOVITOOLS® software package from version 4.20. In order to use MOVITOOLS®, you must have a PC with one of the following operating systems: Windows® 95, Windows® 98, Windows NT® 4.0 or Windows® 2000.

SIMATIC S7 sample projects

There is a SIMATIC S7 sample project for you to try out the functionality of the "Extended positioning via bus" module. To access this sample project, go to the SEW homepage (www.sew-eurodrive.de) and select the heading "Software."

Inverters, motors and encoders

- **Inverters**

Application version

"Extended positioning via bus" can only be implemented on MOVIDRIVE® MDX61B units in application version (...-0T).

Encoder feedback

It is essential for the "Extended positioning via bus" module to have encoder feedback, which means it **cannot** be implemented with MOVIDRIVE® MDX60B.

MOVIDRIVE® MDX61B

"Extended positioning via bus" uses 4 or 6 process data words. A MOVIDRIVE® option will be required (→ table extract "Possible combinations" below), depending on the bus type used.

An external encoder is required for positioning in applications with a non-positive connection between the motor shaft and the load. If an absolute encoder is used as the external encoder, the MOVIDRIVE® option "Absolute encoder interface type DIP11B" is also required.

- **Motors**
  - For operation on MOVIDRIVE® MDX61B with option DEH11B: CT/CV asynchronous servomotors (encoder installed as standard) or DR/DT/DV AC motors with encoder option (Hiperface®, sin/cos or TTL).
  - For operation on MOVIDRIVE® MDX61B with option DER11B: CM/DS synchronous servomotors, resolver installed as standard.
- **External encoders**
  - Interlocking connection between the motor shaft and the load:
    An external encoder is not required. If you also want to use an external encoder for positioning when there is an interlocking connection, you have to proceed in the same way as with a non-positive connection.
  - Non-positive connection between the motor shaft and the load:
    An external encoder is required in addition to the motor encoder/resolver.
    Incremental encoder as external encoder: Connection to basic unit at X14.
    Absolute encoder as external encoder: Connection to option DIP11 at X62.
- **Possible combinations**

	Motor shaft/load connection		
	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		DIP11 / DEH11B / DER11B

3.2 Description of functions

Functional characteristics

The "Extended positioning via bus" application offers the following functional characteristics:

- Any number of target positions can be specified via the fieldbus.
- Speed selection via fieldbus (for the LINEAR and JERK LIMITED ramp functions, the changes can be made during movement).
- Activation of software limit switches.
- Cyclical checkback of actual speed, actual position in the user unit, active current and unit utilization via process output data.
- Confirmation of the target position to which movement has taken place via bit PI1:3 "Target position reached" in the status word.
- Source actual position (motor encoder, external encoder or absolute encoder) can be selected.
- Simple connection to the machine control (PLC).
- Four (4) process data items instead of six (6) can be used for operation (... in this case, the ramp function does not have to be specified).

Three operating modes

- **Jog mode (PO2:11 = "1" and PO2:12 = "0")**
  - The drive is moved clockwise or counterclockwise using bits 9 or 10 in control word 2 (PO1).
  - The speed and ramps are variable and are specified by the PLC via the fieldbus.

- **Referencing mode (PO1:11 = "0" and PO1:12 = "1")**
  - Reference travel is started with bit 8 in control word 2 (PO1). Reference travel establishes the reference point (**machine zero**) for absolute positioning operations.

- **Automatic mode (PO1:11 = "1" and PO1:12 = "1")**
  - Positioning is started in automatic mode with bit 8 in control word 2 (PO1).
  - The target position is specified using process output data words PO2 and PO3.
  - The actual position is signaled back cyclically in user travel units using process input data words PI2 and PI3.
  - The set speed is specified using process output data word PO4.
  - The actual speed is signaled back cyclically using process input data word PI4.
  - Acceleration and deceleration ramps are specified using process output data words PO5 and PO6.
  - The active current and unit utilization are signaled back cyclically using process input data words PI5 and PI6.
  - Confirmation that the selected position has been reached is sent via bit 3 of the status word (PI1) "Target position reached."

The maximum possible travel distance depends on the travel unit set. Examples:

- Travel unit [1/ 10 mm] → max. possible travel distance = 26.2 m
- Travel unit [mm] → max. possible travel distance = 262 m

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 extended positioning via bus function. 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 = $4096 \times i_{gear\ unit} \times i_{additional\ gear}$

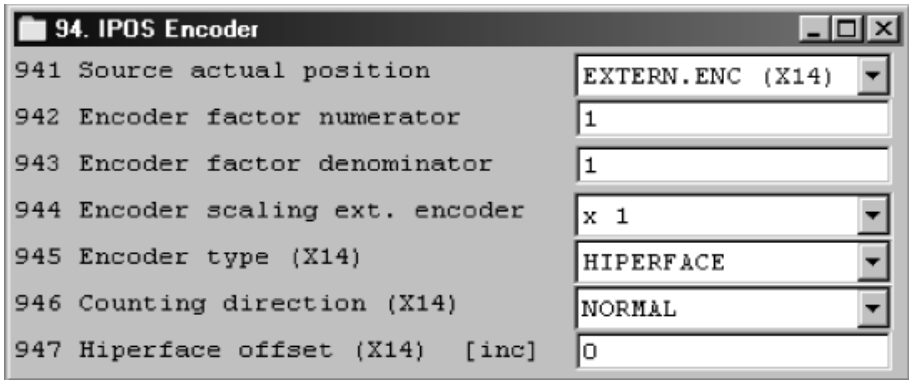
  Distance = $\Pi \times d_{drive\ wheel}$ or $\Pi \times s_{spindle}$
- Speed scaling factor

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

You can also enter the distance and speed 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** the "Extended positioning via bus" module. To do so, make the following settings in the Shell program **before starting** the extended positioning via bus module (→ 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 extended positioning via bus module.
- P942 Encoder factor numerator / P943 Encoder factor denominator / P944 Encoder scaling ext. encoder

The scaling calculation function is now blocked during startup of the extended positioning via bus module.

- 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.

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

3.5 Process data assignment

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

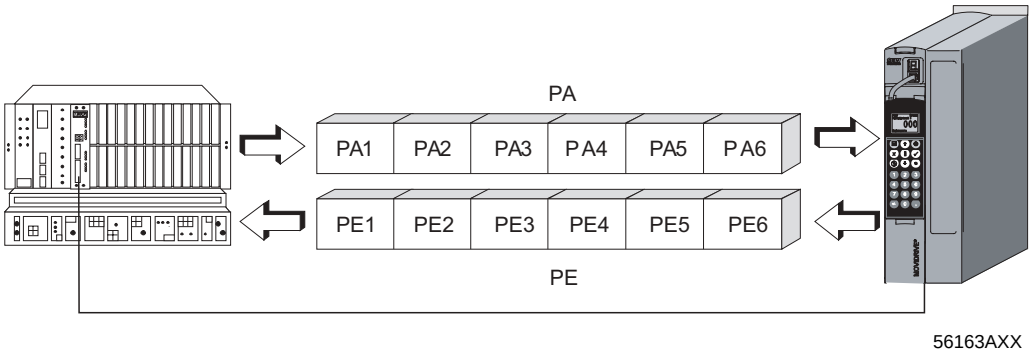


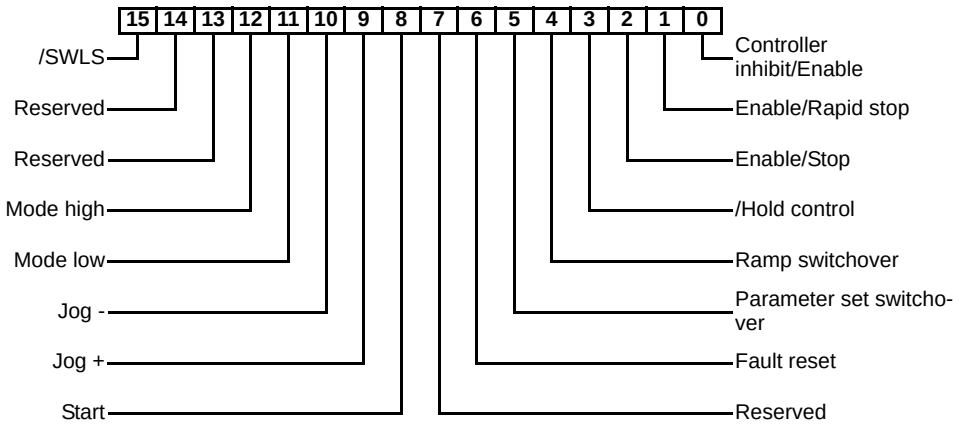
Figure 4: Data exchange via process data

PA	= Process output data	PE	= Process input data
PA1	= Control word 2	PE1	= Status word (IPOS PI data)
PA2	= Target position high	PE2	= Actual position high (IPOS PI data)
PA3	= Target position low	PE3	= Actual position low (IPOS PI data)
PA4	= Set speed (IPOS PO data)	PE4	= Actual speed (IPOS PI data)
PA5	= Accelerating ramp (IPOS PO data)	PE5	= Active current (IPOS PI data)
PA6	= Deceleration ramp (IPOS PO data)	PE6	= Unit utilization (IPOS PI data)

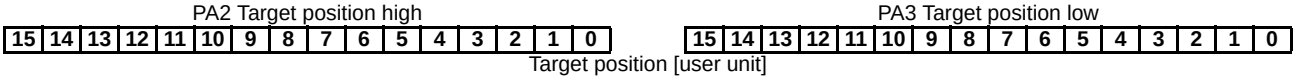
Process output data

The assignment of the process output data words is as follows:

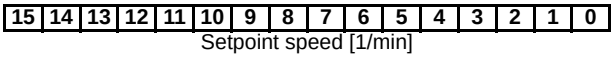
- PO1: Control word 2



- PA2 + PA3: Target position



- PA4: Setpoint speed



- PA5 + PA6: Acceleration ramp and deceleration ramp

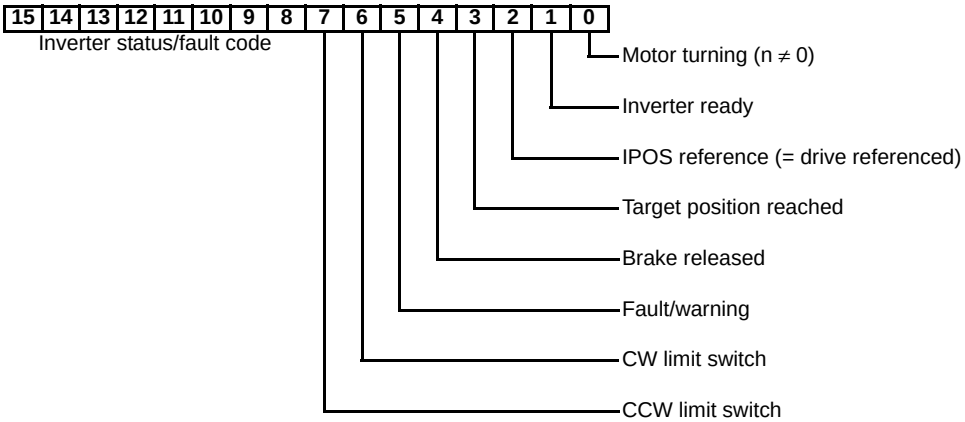
PA5 Acceleration ramp

PA6 Deceleration ramp

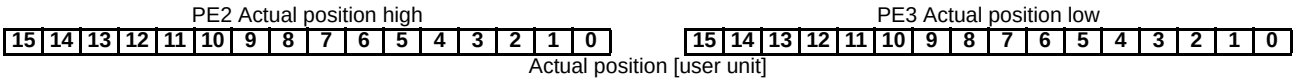
Process input data

The assignment of the process input data words is as follows:

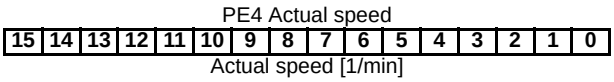
- PE1: Status word



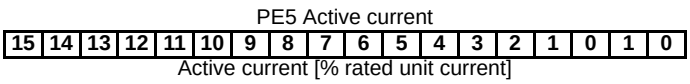
- PE2 + PE3: Actual position



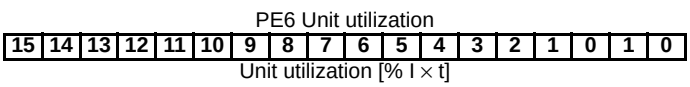
- PE4: Actual speed



- PE5: Active current



- PE6: Unit utilization



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 Bit 1 "IPOS reference" is set in PI1.

Moving clear of the software limit switch

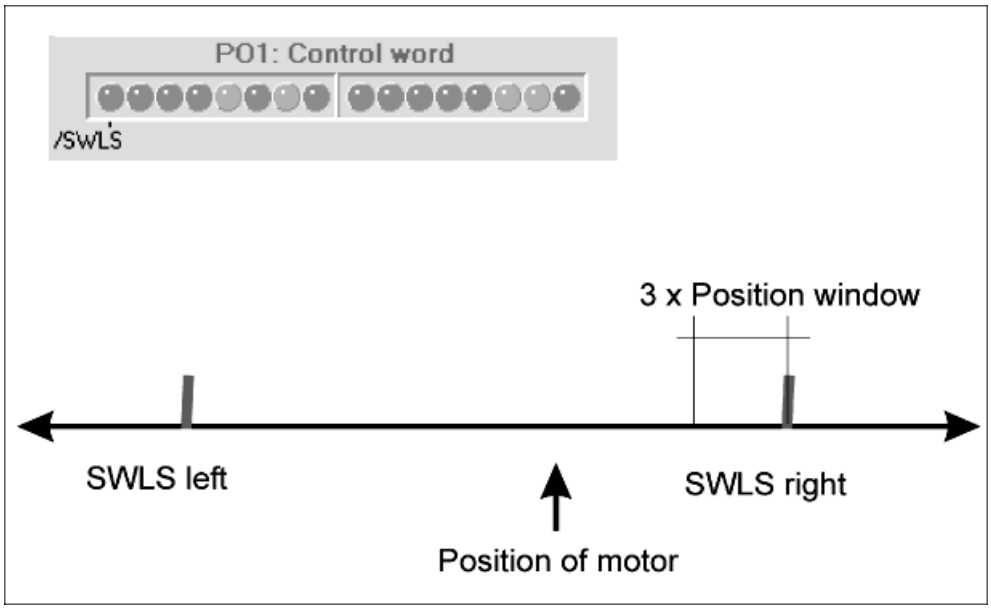
When using an absolute encoder or Multiturn Hiperface® encoder it may be necessary for the drive to be moved within the range of the software limit switches (for example, after an encoder has been replaced). For this purpose, Bit 15 in the process output data word 1 (PO1) is set to "/SWLS" (= Moving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

It is necessary to differentiate between the following three examples:

Example 1

- Prerequisites:
  - 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.



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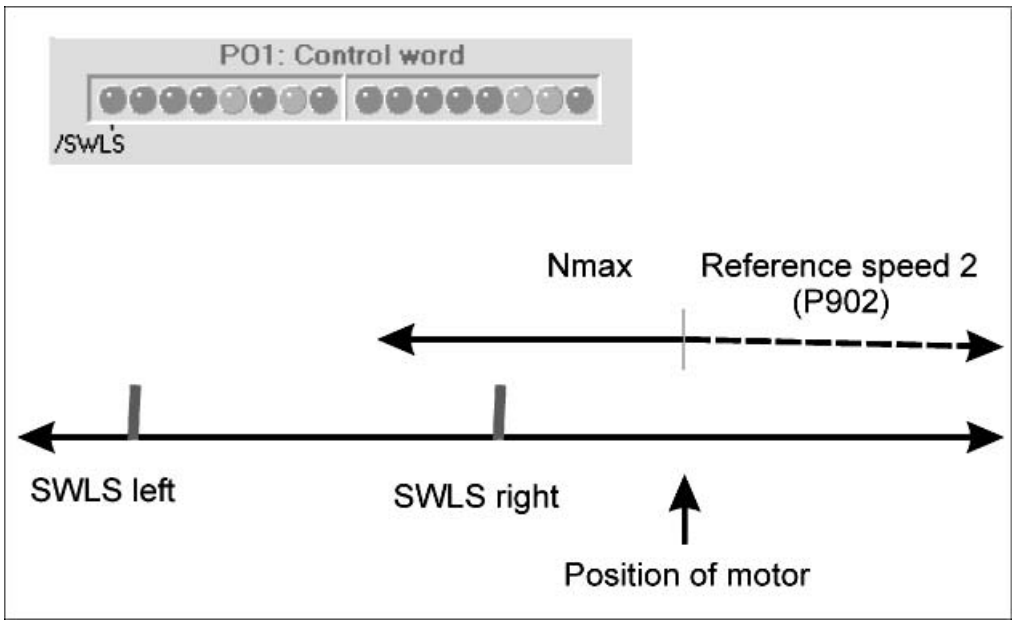
In jog mode, the drive runs until it is three position windows (P922) before the software limit switch and then stays there.

In automatic 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

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



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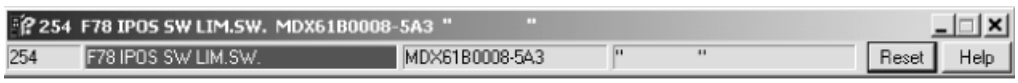
The following error message appears once the drive is enabled:



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You can confirm the error message by pressing the reset button. The monitoring function is deactivated. In the area of the software limit switches, the drive can be moved at two different speeds as follows:

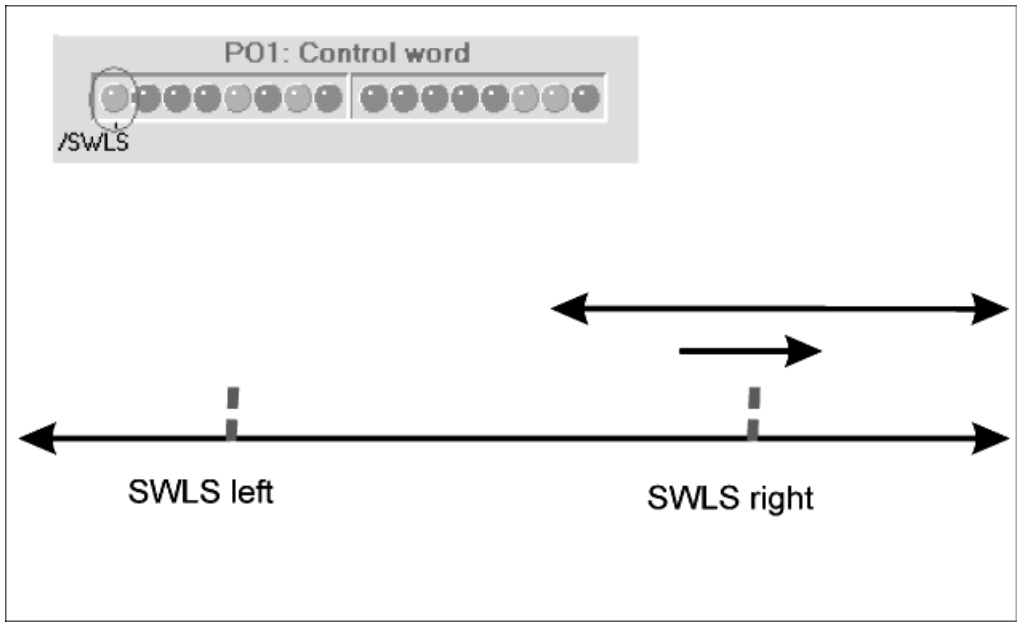
- Closer toward the travel range of the software limit switch at reference speed 2 (P902).
- Away from the travel range of the software limit switches at maximum speed.

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

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



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

Changing the monitoring function of the software limit switches during operation!

Possible consequences: Risk of injury.

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 IPOS$^{plus®}$ processing speed

The speed of the IPOS$^{plus®}$ program in MOVIDRIVE® MDX61B can be changed using the following parameters:

- P938 IPOS speed TASK1, setting range 0 - 9
- P939 IPOS speed TASK2, setting range 0 - 9

Setting value "0" for both parameters results in the same IPOS$^{plus®}$ processing speed as for MOVIDRIVE® MD_60A.

- P938 = 0 ≙ TASK1 = 1 command/ms
- P938 = 0 ≙ TASK2 = 2 commands/ms

Values greater than zero are added to the IPOS$^{plus®}$ processing speed of MOVIDRIVE® MD_60A. Note that the total of the commands per millisecond (commands/ms) for TASK1 and TASK2 must not be greater than 9.

If you start up the application module on a MOVIDRIVE® MDX61B unit, the parameters will be set as follows to ensure a sequence with optimized timing:

- P938 = 5 ≙ TASK1 = 1 command / ms + 5 commands / ms = 6 commands / ms
- P939 = 4 ≙ TASK2 = 2 commands / ms + 4 commands / ms = 6 commands / ms

3.8 Safe stop

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

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

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

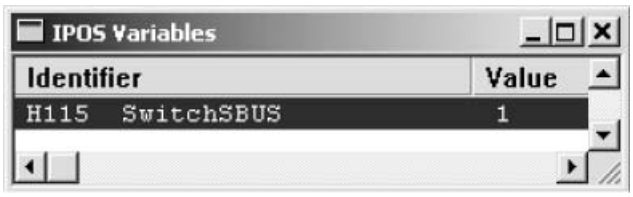
- MOVIDRIVE® MDX60B / 61B Safe Disconnection - Conditions
- MOVIDRIVE® MDX60B/61B Safe Disconnection - Applications

3.9 SBus send object

You have the option of setting up an SBus send object for transferring the cyclical actual position of the drive. In this way, the "Extended positioning via bus" module can be used as a master for the "DriveSync" application module or any IPOS$^{plus®}$ program.

Activating the SBus send object

To set up the SBus send object, set the IPOS$^{plus®}$ variable *H115 SwitchSBUS* to "1" and restart the IPOS$^{plus®}$ program (→following screenshot).



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Settings for the SBus objects

The send and synchronization objects are initialized automatically once the IPOS$^{plus®}$ program has been restarted. The content of the send object is set to IPOS$^{plus®}$ encoder.

	Send object	Synchronization object
ObjectNo	2	1
CycleTime	1	5
Offset	0	0
Format	4	0
DPointer	IPOS Encoder	-

4 Installation

4.1 MOVITOOLS® software

MOVITOOLS®

The "Extended positioning via bus" application module is part of the MOVITOOLS® software (version 4.20 and higher). Proceed as follows to install MOVITOOLS® on your computer:

- Insert the MOVITOOLS® CD into the CD-ROM drive of your PC.
- The MOVITOOLS® setup menu is started. Follow the instructions of the installation wizard.

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

- Select the language you want in the "Language" selection field.
- In the "PC Interface" selection field, select the PC port (e.g. COM 1) to which the inverter is connected.
- In the "Device Type" field, select "Movidrive B".
- In the "Baudrate" field, select the baud rate set on the basic unit with the DIP switch S13 (standard setting → "57.6 kBaud").
- Click the <Update> button to display the connected inverter.

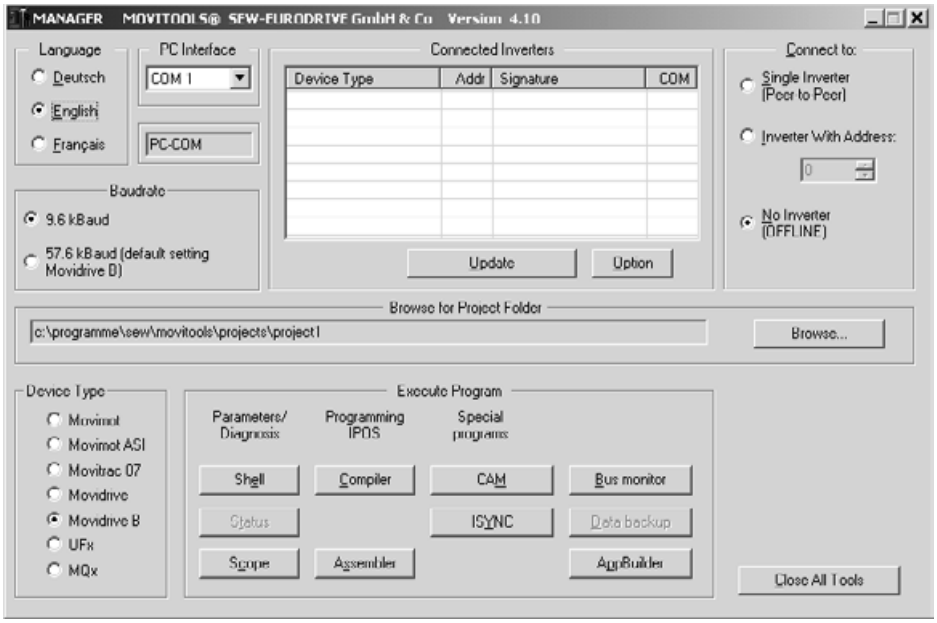

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Figure 5: MOVITOOLS® window

Application version

The "Extended positioning via bus" application module can only be used on MOVIDRIVE® units in application version (...-0T). The application modules cannot be used with units in the standard version (-00).

4.2 Wiring diagram for MOVIDRIVE® MDX61B

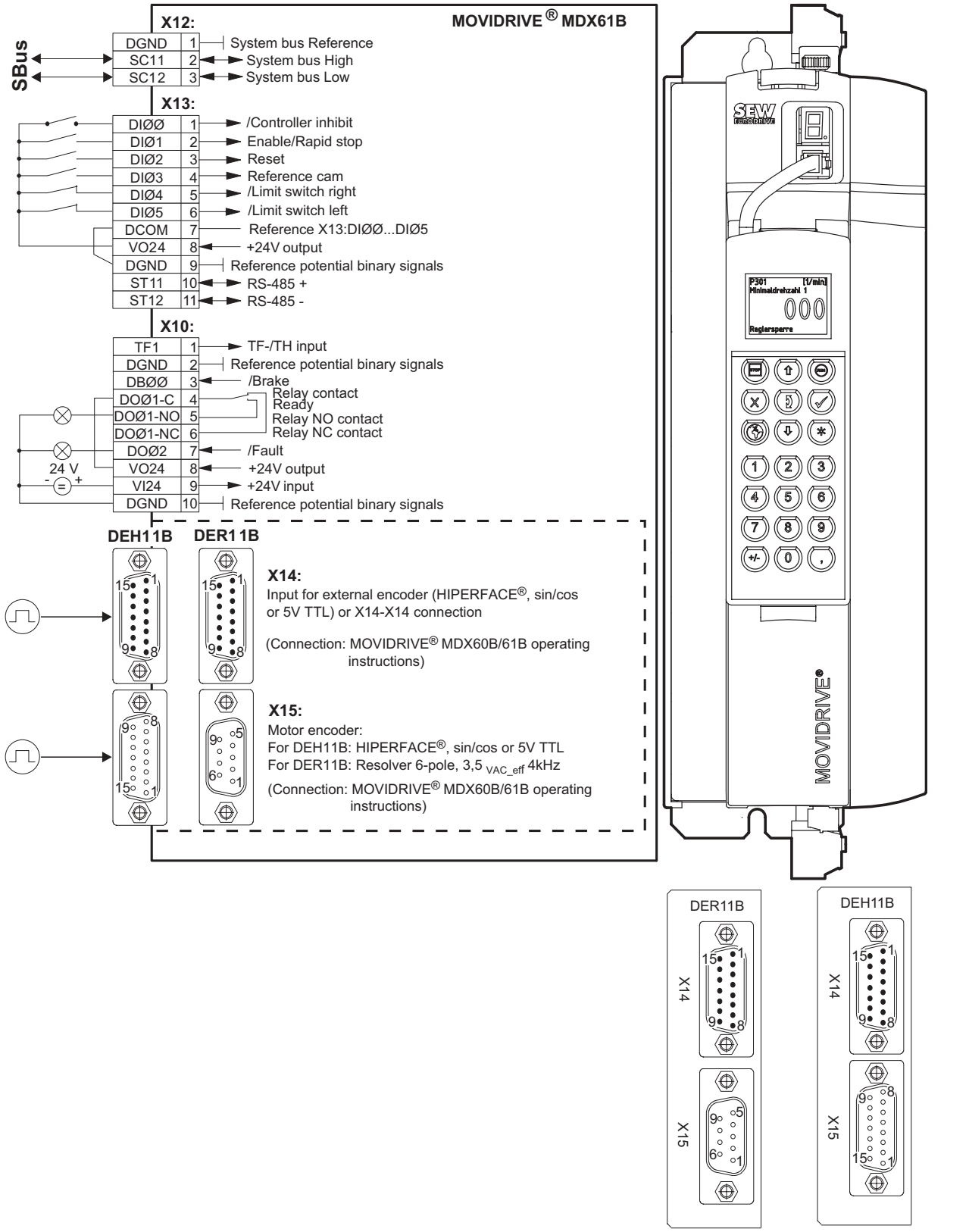

Figure 6: Wiring diagram for MOVIDRIVE® MDX61B with option DEH11B or DER11B

4.3 Bus installation for MOVIDRIVE® MDX61B

Overview

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

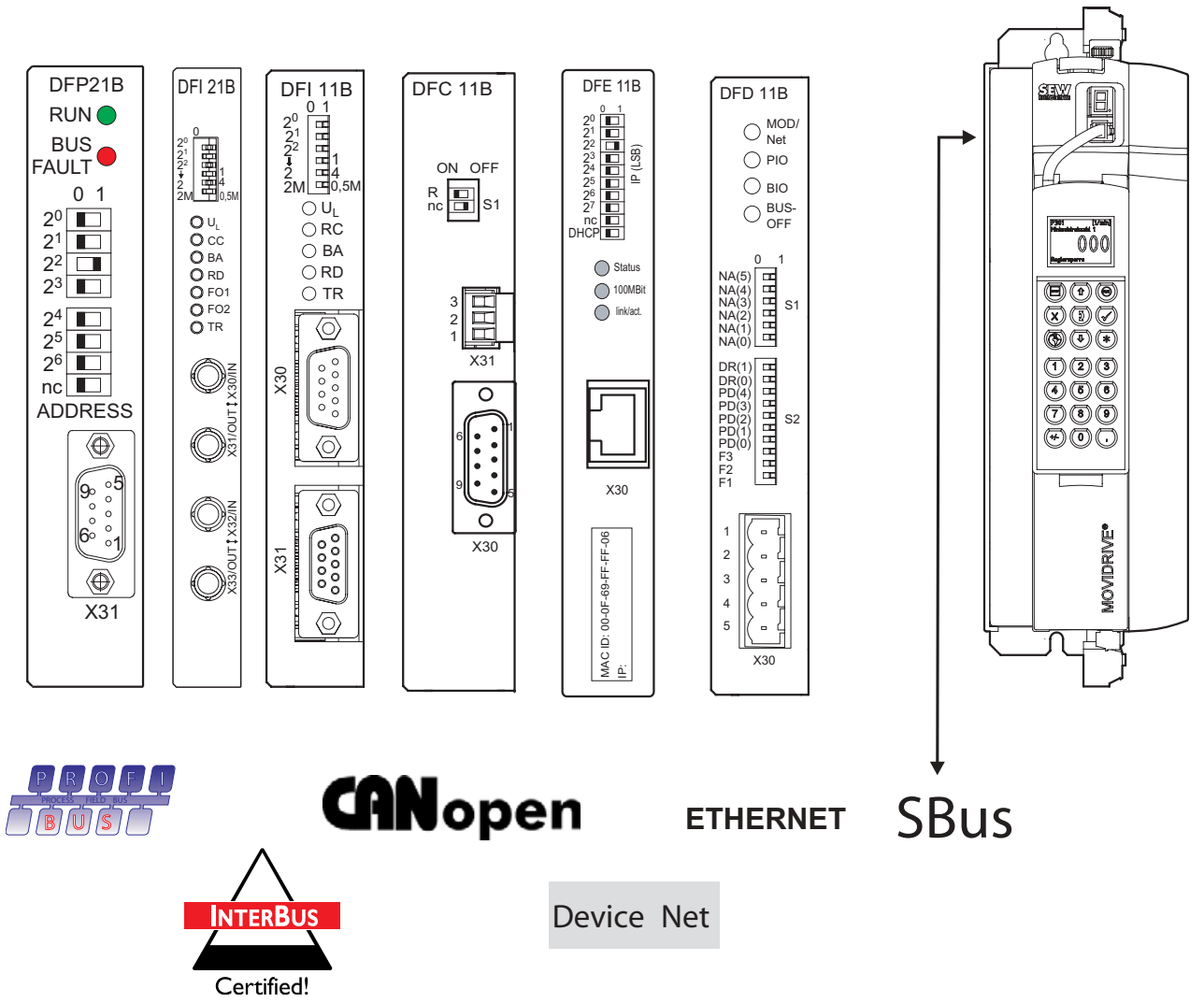

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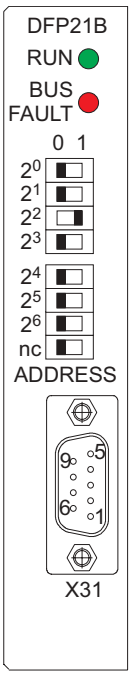
Figure 7: Bus types

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 fieldbus interface type DFP21B
	Part number	824 240 2
	Resources for startup/diagnostics	MOVITOOLS® software and DBG60B keypad
	Protocol option	PROFIBUS DP and DP-V1 to IEC 61158
	Supported baud rates	Automatic baud rate detection from 9.6 kbaud ... 12 Mbaud
	Connection	9-pin Sub-D 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 ident number	6003 hex = 24579 dec
	Max. number of process data	10 process data
	Mass	0.2 kg (0.44 lb)

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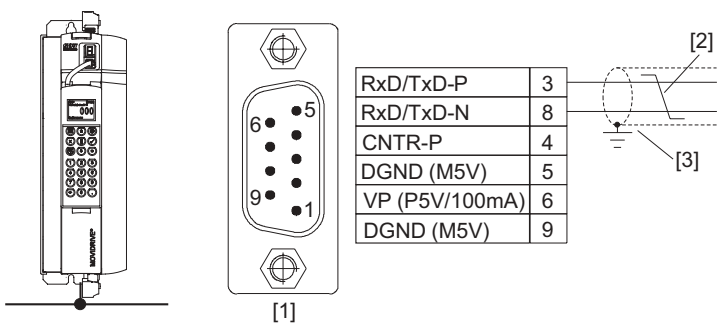
1. Green LED: RUN
2. Red LED: BUS FAULT
3. DIP switch for setting the station address.
4. 9-pin sub D socket: bus connection

Pin assignment



RxD/TxD-P	3
RxD/TxD-N	8
CNTR-P	4
DGND (M5V)	5
VP (P5V/100mA)	6
DGND (M5V)	9

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Figure 8: Assignment of 9-pin sub D plug to IEC 61158

(1) 9-pin sub D connector

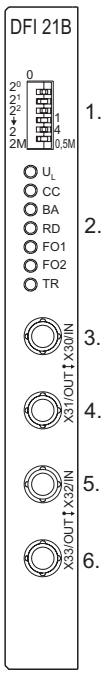
(2) Twist the signal wires together!

(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. This manual can be ordered from SEW-EURODRIVE.

Technical data

	Option	INTERBUS fieldbus interface type DFI21B (FO)
 55288AXX	Part number	824 311 5
	Resources for startup/diagnostics	MOVITOOLS® 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
	Mass	0.2 kg (0.44 lb)

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

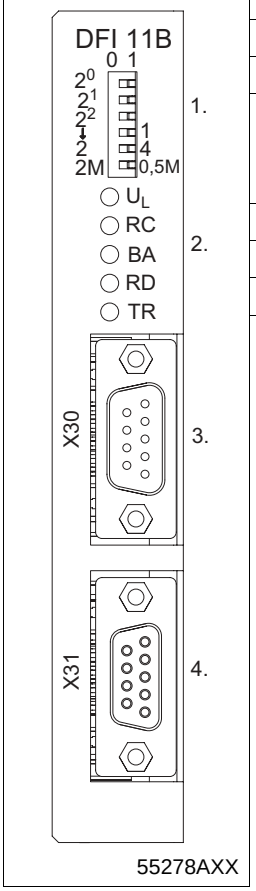
Connection assignment

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

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/diagnostics	MOVITOOLS® software and DBG60B keypad
	Supported baud rates	500 kbaud and 2 Mbaud, can be selected via DIP switch
	Connection	Remote bus input: 9-pin sub D connector Remote bus output: 9-pin Sub-D 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
	Mass	0.2 kg (0.44 lb)

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

Pin assignment

Conductor color abbreviations to IEC 757.

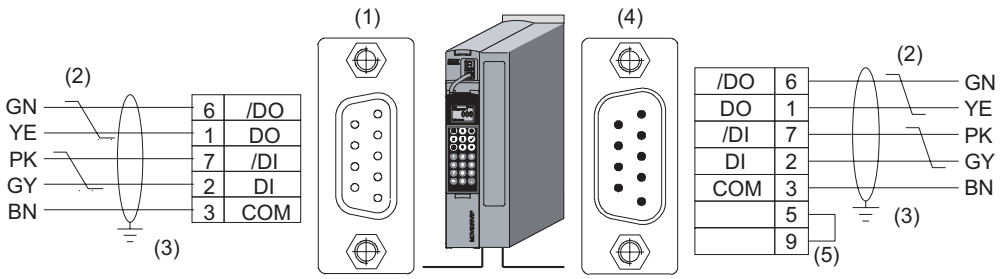


Figure 9: Assignment of the 9-pin sub D socket of the incoming remote bus cable and the 9-pin sub D plug of the outgoing remote bus cable

(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!

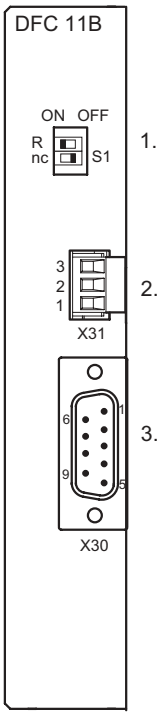
(4) 9-pin sub D plug of the outgoing remote bus cable

(5) Jumper pin 5 with pin 9!

CANopen (DFC11B)

For more information, refer to the "Communication" manual. This manual can be ordered from SEW-EURODRIVE (provisionally from 03/2005).

Technical data

	Option	CANopen fieldbus interface type DFC11B
 55284AXX	Part number	824 317 4
	Resources for startup/diagnostics	MOVITOOLS® 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
	Mass	0.2 kg (0.44 lb)

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

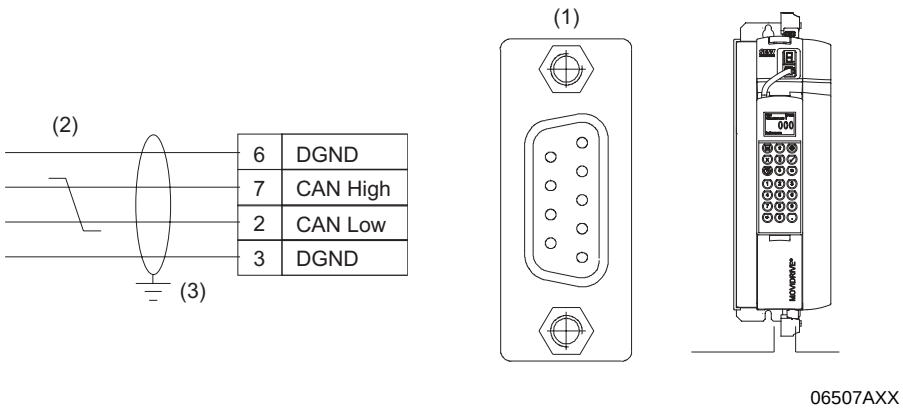


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Figure 10: Assignment of 9-pin sub D socket of the bus cable

(1) 9-pin Sub-D socket

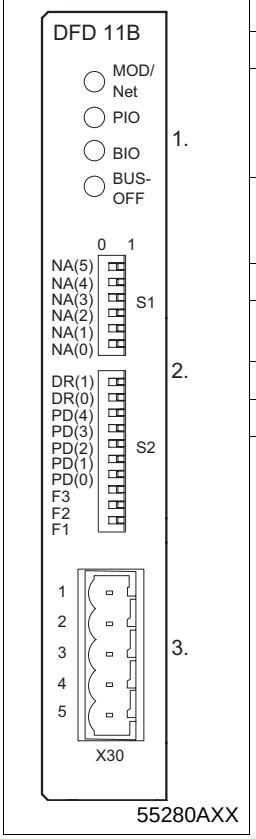
(2) Twist the signal wires together!

(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/diagnostics	MOVITOOLS® 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 line cross section	According to DeviceNet specification
	Bus termination	Use of bus connectors with integrated bus terminating resistor (120 Ω) at the start and finish of a bus segment.
	Address range that can be set (MAC-ID)	0 ... 63, can be selected using DIP switch
	Mass	0.2 kg (0.44 lb)

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

Terminal assignment

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

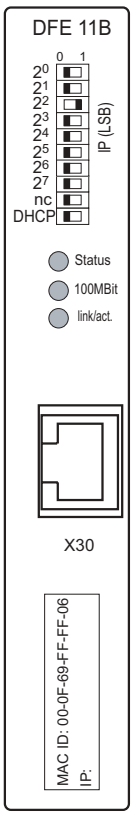
Terminal	Description	Color
X30:1	V- (0V24)	Black (BK)
X30:2	CAN_L	Blue (BU)
X30:3	DRAIN	Blank
X30:4	CAN_H	White (WH)
X30:5	V+ (+24 V)	Red (RD)

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/diagnostics	MOVITOOLS® software and DBG60B keypad
	Automatic baud rate detection	10 MBaud / 100 MBaud
	Connection	RJ45 modular jack 8-8
	Addressing	4 byte IP address
	Mass	0.2 kg (0.44 lb)



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

MOVIDRIVE® / Ethernet connection

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

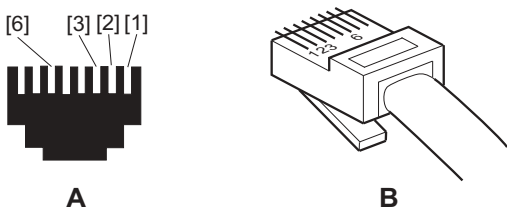


Figure 11: Pin assignment of an RJ45 plug connector

A = Front view	[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 require a cross over cable.

4.4 System bus connection (SBus 1)

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

MOVIDRIVE® *compact* MCH4_A units must not be combined 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 using the 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 compliant with ISO 11898.

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

SBus wiring diagram

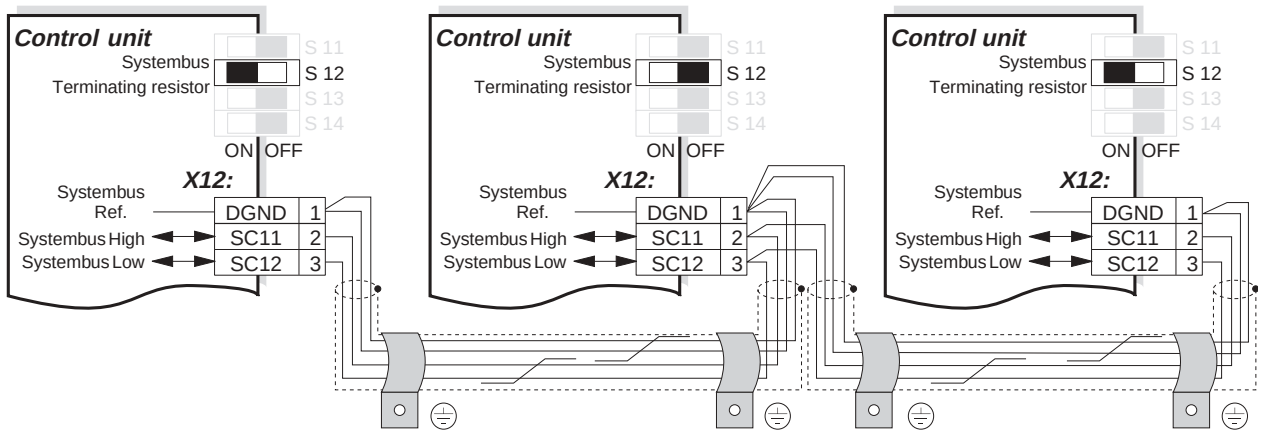


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Figure 12: System bus connection

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 ... AWG 18)
  - Line resistance 120 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz

  Suitable cables include CAN bus or DeviceNet cables.

Shielding

- 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 (1056 ft)
  - 250 kbaud → 160 m (528 ft)
  - **500 kbaud → 80 m (264 ft)**
  - 1000 kbaud → 40 m (132 ft)

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).

- There must not be any potential displacement between the units connected with the SBus. Take suitable measures to avoid potential displacement, such as connecting the unit ground connectors using a separate line.

4.5 Connecting hardware limit switches

The cams of the hardware limit switches must cover the travel range up to the stop.

Only use hardware limit switches with normally closed contacts (low-active)!

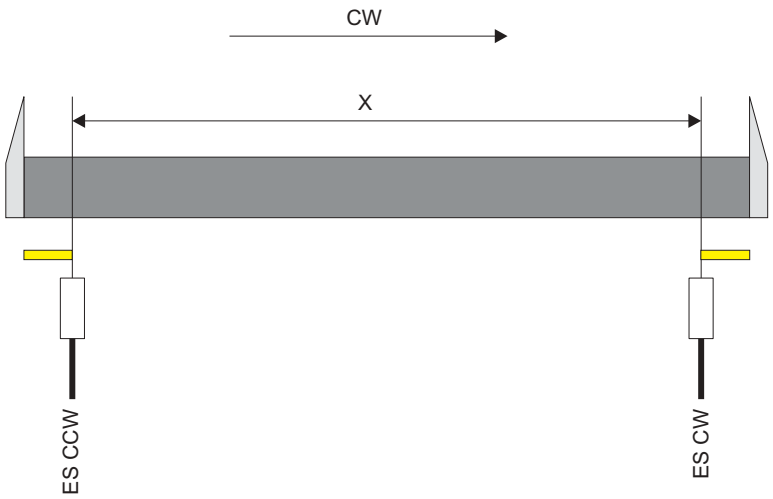

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Figure 13: Connecting hardware limit switches

CW	= Clockwise drive inverter
X	= travel distance
LS CW	= CW hardware limit switch
LS CCW	= CCW hardware limit switch

Make sure the hardware limit switch is assigned correctly. This means clockwise movement (CW) should be towards the clockwise hardware limit switch (LS CW) and counterclockwise movement (CCW) should be towards the counterclockwise hardware limit switch (LS CCW).

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 instructions.

Check the installation, the encoder connection and the installation of the fieldbus cards by following the installation instructions in the MOVIDRIVE® MDX60B/61B operating instructions, in the fieldbus manuals and in this manual (→ Sec. Installation).

Use an absolute encoder as the external encoder (connect to DIP11B, X62). Also note the information on installation and startup in the "MOVIDRIVE® MDX61B Absolute Encoder Card DIP11B" manual.

5.2 Preliminary work

Perform the following steps before starting up the "Extended positioning via bus" module:

- Connect the "Xterminal" connection on the inverter to PC-COM via the UWS21A option (serial interface).
- Install the MOVITOOLS® software (version 4.20 or higher).
- Start up the inverter with "MOVITOOLS/Shell."
  - MDX61B with asynchronous motor: **CFC operating modes / VFC n-control**
  - MDX61B with synchronous motor: **SERVO operating modes**
- Only for operation with an external encoder (absolute or incremental encoder):
  - Absolute encoder: Start up the DIP11B absolute encoder card. The parameters P942 ... P944 are set during this process (→ "MOVIDRIVE® MDX61B Absolute encoder Card DIP11B" manual).
  - Incremental encoder: Set the parameters 942 ... P944 *Encoder factor numerator*, *Encoder factor denominator* and *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.
- In [MOVITOOLS] / [Shell] / choose the menu item [Startup] and select the application "Extended positioning via bus."
- Enter a "0" signal at terminal DIØØ "/CONTROLLER INHIBIT/".

5.3 Starting the "Extended positioning via bus" program

General information

- Start [MOVITOOLS] / [Shell].
- Choose [Startup] / [Extended positioning via bus.]

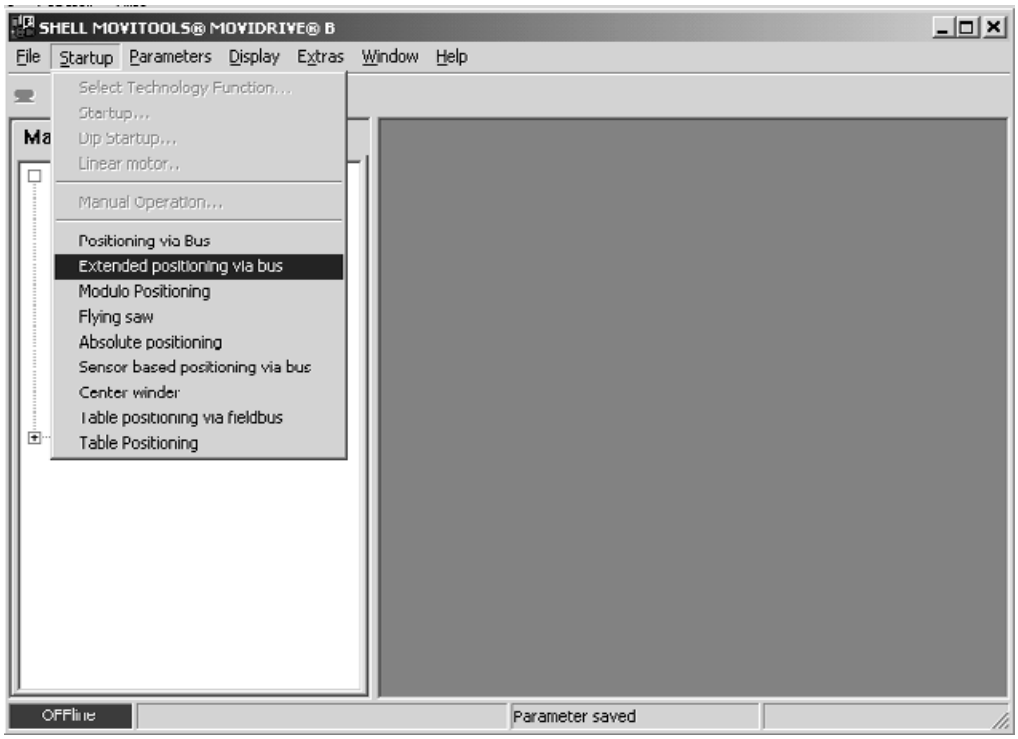

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Figure 14: Starting the "Extended positioning via bus" program

Setting the field-bus parameters

Once the "Extended positioning via bus" module has been started, all parameters important for extended bus positioning are read.

If a valid application module has not yet been loaded into the inverter, the following window appears after extended positioning via bus has been started:

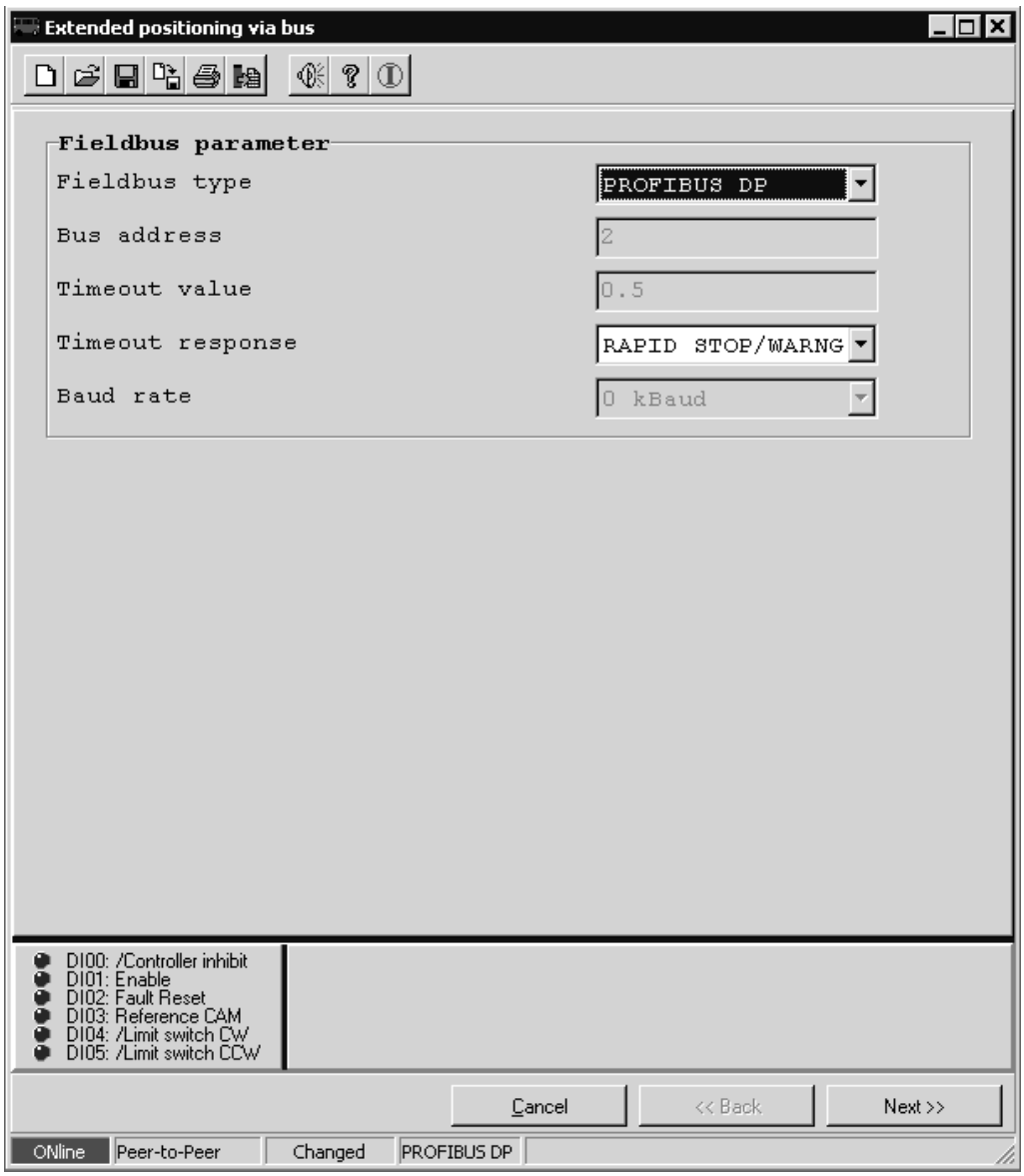

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Figure 15: Setting the fieldbus parameters

You have to make the following settings in this window:

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

  The system bus (SBus) can always be set; no option is required.

  If a fieldbus card (DFP, DFI, DFC, DFD or DFE) is plugged into the fieldbus slot, PROFIBUS, INTERBUS, CAN, DEVICENET or ETHERNET can also be selected.

Setting the distance and speed scaling factors

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

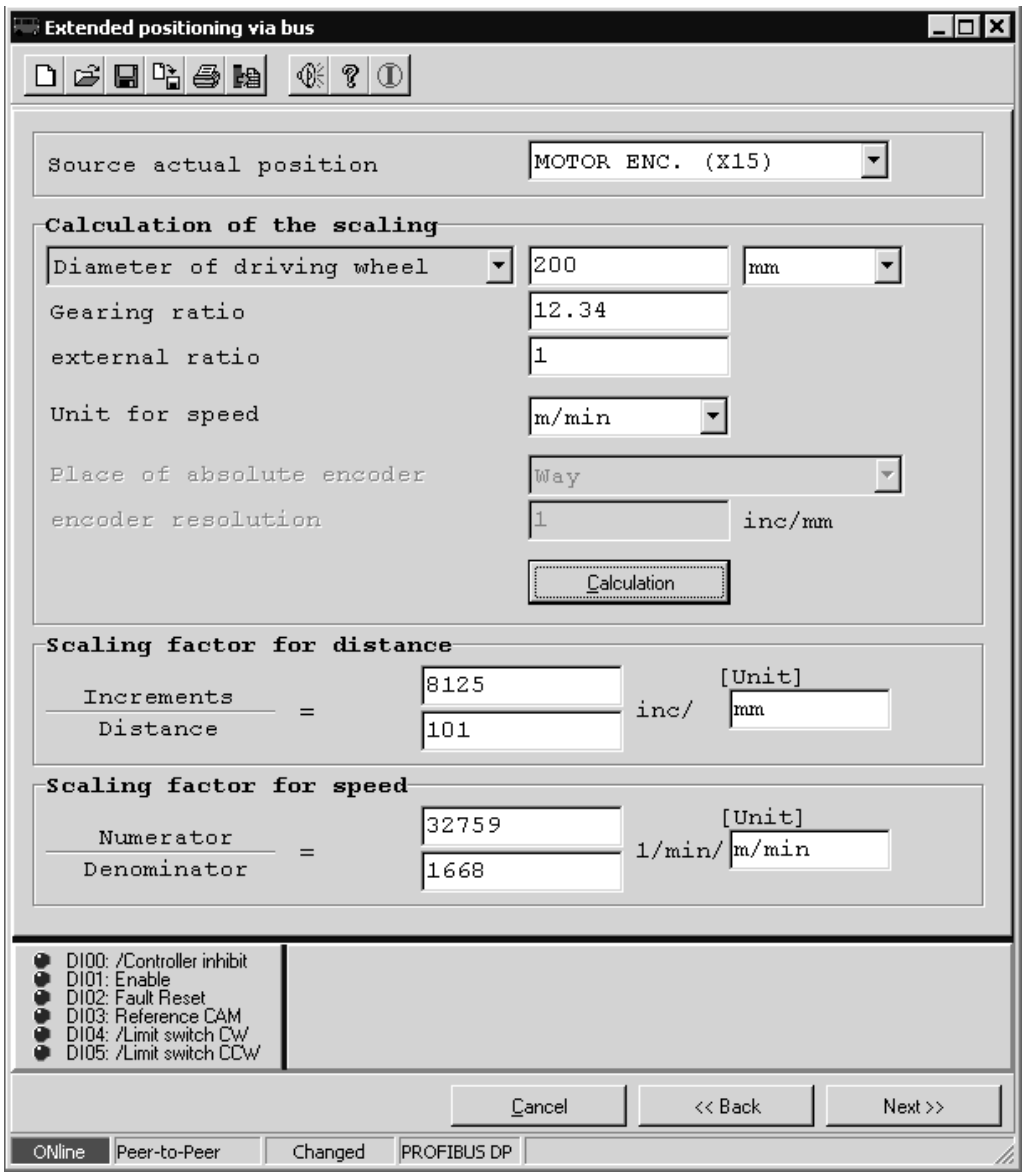

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Figure 16: Setting the scaling

You have to 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 an incremental encoder as the external encoder.
  - ABSOLUTE ENCODER (DIP) with an absolute encoder as the external encoder or on the motor shaft.

If you use an absolute encoder, you must start up the DIP11B option **before** you start the "Extended positioning via bus" application module!

Calculating the scaling factors

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

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

  Automatic calculation of the scaling factor for speed:

  - In the "Source actual position" selection field, select the entry "Motor encoder".
  - Enter a value in the "Diameter of driving wheel" field or the "Spindle slope" field. Select the unit [mm] or [1/10 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 <Calculation> button. The scaling factor for speed is calculated by the program.

  Calculating the distance scaling factor:

  - In the "Source actual position" selection field, select the entry "External encoder" or "Absolute encoder". For positioning with an absolute encoder, in the "Place of absolute encoder" selection field, choose the entry "Way".
  - 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 travel 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 the automatic calculation:

- mm
- 1/10 mm

When using an external encoder or an absolute encoder on the track, you have to calculate the distance scaling factor manually (→ 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 scaling factor for speed:

  Numerator / denominator = 32759 / 1668 unit [m/min]
- Calculating 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
- Calculating 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]

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.). This expansion does not limit the maximum travel range. The maximum value for "pulses" or the "distance" is 32767.

Converting the speed into user travel units

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

- 1/min
- mm/sec
- m/min

If you want to enter the speed in a different unit, you can calculate the scaling factor for speed (→ 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 slope)

  Denominator = $3.14 \times 200 = 628$

  Unit = mm/s

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.). This expansion does not limit the maximum travel range. The maximum value for the numerator or denominator is 32767.

Setting the ramp times and limits

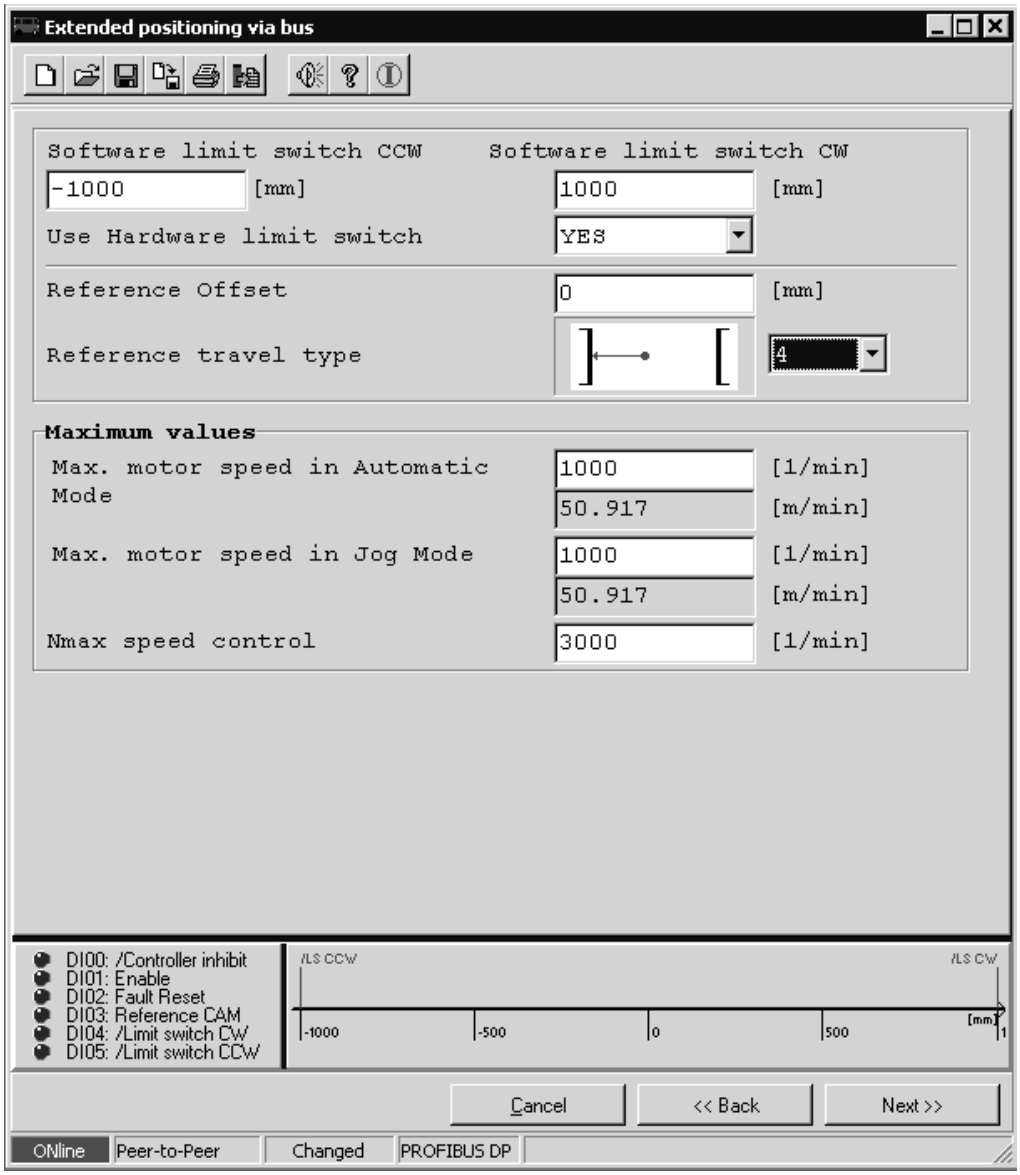

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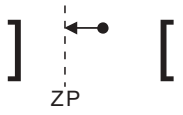
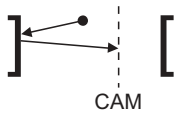
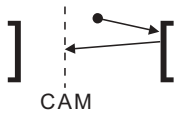
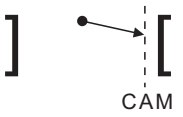
Figure 17: Setting ramp times and limits

In this window, you can enter the position of the software limit switches, the reference offset, the reference travel type, ramp times and limits. The entries are made in the user units of the scaling.

- In the input fields "Software limit switch CCW / CW", enter the position of the software limit switches. Make sure the positions of the software limit switches are **within** the travel distance of the hardware limit switches and that they do not overlap the reference position. If you enter the value "0" in both input fields, the software limit switches are deactivated.
- In the "Reference offset" input field, enter the reference offset. The machine zero is corrected using the reference offset. The following formula applies:

  Machine zero = reference position + reference offset

- Select the correct type of reference travel (0 8) from the "Reference travel type" selection box. The reference travel type specifies the reference travel strategy with which the machine zero of a machine should be established. The IPOS$^{plus®}$ variable *H127 ZeroPulse* specifies whether reference travel should react to an edge change of the reference cam ("0") or the following zero pulse of the encoder ("1"). The IPOS$^{plus®}$ variable *H127* can be edited using the IPOS Compiler.

 55260AXX	**Type 0:** The reference position is the first zero pulse CCW of the starting position of the reference travel.
 54947AXX	**Type 1:** The reference position is the CCW end of the reference cam. Machine zero = reference position + reference offset H127 = "1" Referencing to encoder zero pulse H127 = "0" Referencing to edge change
 54948AXX	**Type 2**: The reference position is the CW end of the reference cam. Machine zero = reference position + reference offset H127 = "1" Referencing to encoder zero pulse H127 = "0" Referencing to edge change
 54949AXX	**Type 3**: The reference position is the CW hardware limit switch. No reference cam is required. After leaving the hardware limit switch (positive edge), the drive continues to move clear of it by 4096 increments. Machine zero = reference position + reference offset – 4096
 54950AXX	**Type 4**: The reference position is the CCW hardware limit switch. No reference cam is required. After leaving the hardware limit switch (positive edge), the drive continues to move clear of it by 4096 increments. Machine zero = reference position + reference offset + 4096
 54951AXX	**Type 5**: No reference travel. The reference position is the current position without reference to a zero pulse. Machine zero = current position + reference offset
 54952AXX	**Type 6**: The reference position is the CW end of the reference cam. Machine zero = reference position + reference offset
 54953AXX	**Type 7**: The reference position is the CCW end of the reference cam. Machine zero = reference position + reference offset
 54951AXX	**Type 8**: No reference travel. The reference position is the current position without reference to a zero pulse. In contrast to type 5, type 8 reference travel can also be performed when the system status is not set to "A". Machine zero = current position + reference offset

Setting the ramp times in jog and automatic mode

- In the "Ramp values" group box, enter the ramp times in the input fields "Ramp value jog mode" and "Ramp value auto.mode (1) and (2)". Bit 15 in process output data word 1 is used to change between ramp 1 and ramp 2 in automatic mode. The corresponding acceleration is displayed in the unit [mm/s^2].

The ramp time always refers to a speed of 3000 min^{-1}.

For a ramp time of 1 s the drive would be accelerated to a speed of 1500 min^{-1} in 500 ms.

Download

The download window appears after the settings have been saved.

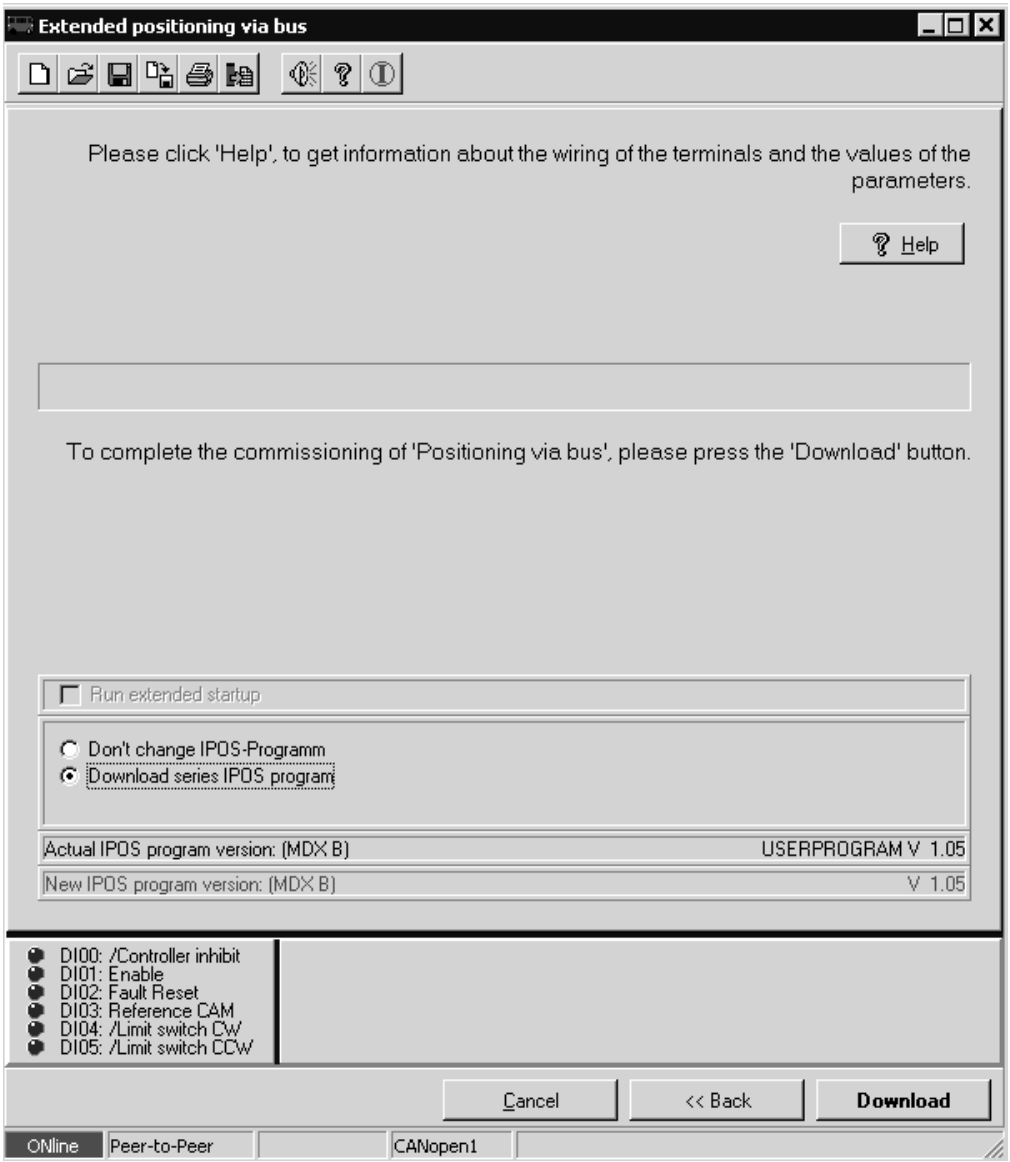


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Figure 18: Download window

Click the <Download> button. All the required settings are made automatically in the inverter, and the IPOS$^{plus®}$ program for "Extended positioning via bus" is started.

After the download, the program asks you if you want to start the monitor. In the monitor, you can run a diagnostic of your application and check the control signals.

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Figure 19: Start monitor: Yes/No

Select <Yes> to switch to the monitor where you can start it in the required operating mode. Select <No> to switch to MOVITOOLS/Shell.

Monitor

If "Extended positioning via bus" is started **after** the startup procedure has been performed, the monitor appears immediately.

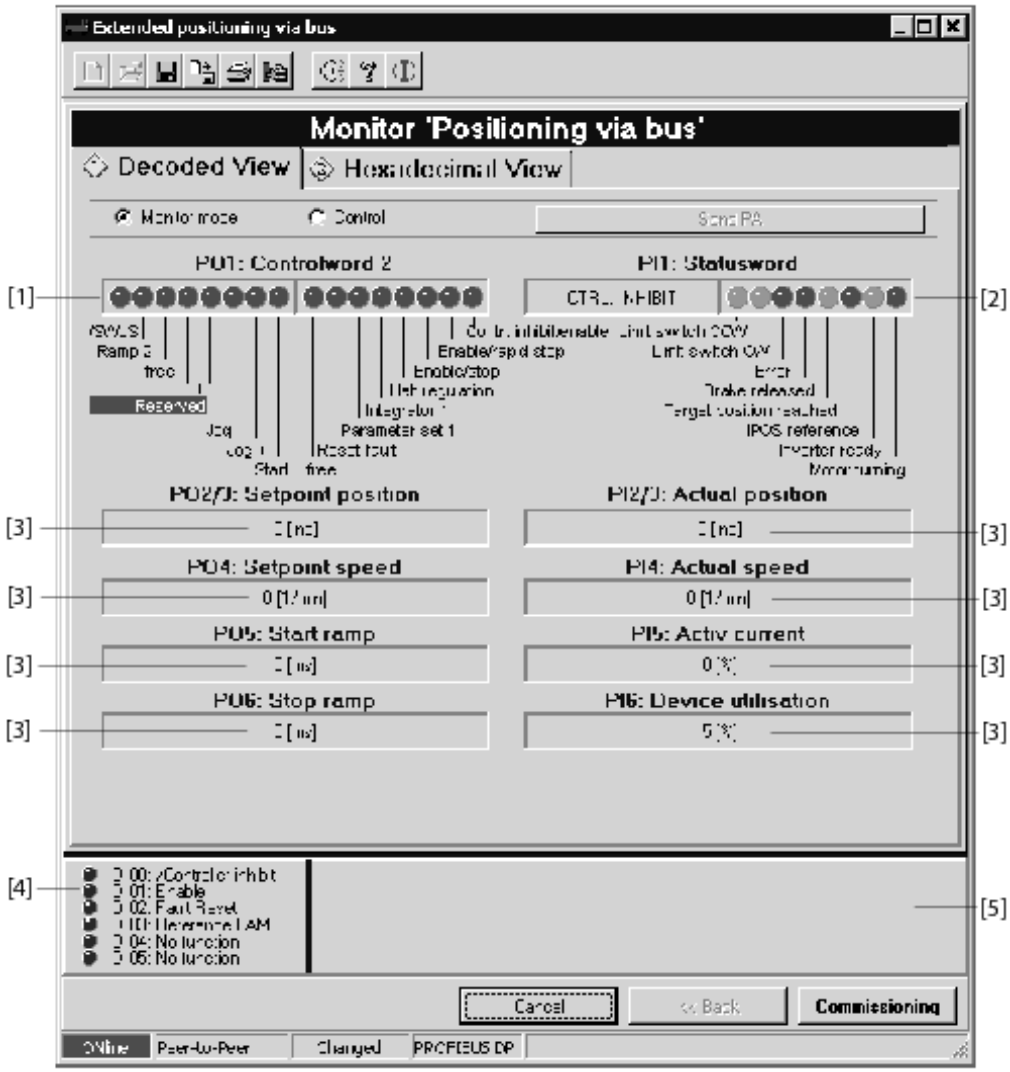

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Figure 20: Extended positioning via bus monitor

[1] PO1 control word 2, decoded into individual bits

[2] PI1 status word, decoded into individual bits

[3] Process data in decimal format and with user units

[4] Status of the binary inputs of the basic unit

[5] Position of the software limit switches and current position of the drive

Repeated startup

Press <Startup> if you want to repeat startup. A window appears in which you can enter the settings for the fieldbus parameters (→ Section "Setting fieldbus parameters").

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...	Index	Description	Value
100	8461	Setpoint source	Fieldbus
101	8462	Control signal source	Fieldbus
300		Start/stop speed 1	0
301		Minimum speed 1	0
302		Maximum speed 1	Can be set in the interface
600	8335	Binary input DI01	Enable/Rapid stop
601	8336	Binary input DI02	No function
602	8337	Binary input DI03	Reference cam
603	8338	Binary input DI04	/Right limit switch
604	8339	Binary input DI05	/CCW limit switch
605	8919	Binary input DI06 (MDX61B only)	No change
606	8920	Binary input DI07 (MDX61B only)	No change
610	8340	Binary input DI10	No function
611	8341	Binary input DI11	
612	8342	Binary input DI12	
613	8343	Binary input DI13	
614	8344	Binary input DI14	
615	8345	Binary input DI15	
616	8346	Binary input DI16	
617	8347	Binary input DI17	
620	8350	Binary output D001	/Fault
621	8351	Binary output D002	Ready
630	8352	Binary output D010	No function
631	8353	Binary output D011	
632	8354	Binary output D012	
633	8355	Binary output D013	
634	8356	Binary output D014	
635	8357	Binary output D015	
636	8358	Binary output D016	
637	8359	Binary output D017	
700	8574	Operating mode	... & IPOS
730	8584	Brake function 1	ON
813	8600	SBus address	Can be set in the interface
815	8602	SBus timeout delay	
816	8603	SBus baud rate	
819	8606	Fieldbus timeout delay	
831	8610	Response fieldbus timeout	
836	8615	Response SBus timeout	

Parameter number P...	Index	Description	Value
870	8304	Setpoint description PO1	Control word 2
871	8305	Setpoint description PO2	IPOS PO-DATA
872	8306	Setpoint description PO3	
873	8307	Actual value description PI1	
874	8308	Actual value description PI2	
875	8309	Actual value description PI3	
876	8622	PO data enable	ON
900	8623	Reference offset	Can be set in the interface
903	8626	Reference travel type	
941		Source actual position	

IPOS$^{plus®}$ variable	Description
H1	Max. motor speed in automatic mode
H2	Max. motor speed in jog mode
H3	Scaling factor for distance numerator
H4	Scaling factor for distance denominator
H5	Scaling factor for speed numerator
H6	Scaling factor for speed denominator
H7	Ramp 1
H8	Ramp 2
H102	Drive wheel diameter (x1000)
H103	Gear ratio (x1000)
H104	Additional gear ratio (x1000)
H115	Switch SBUS
H125	Pointer to Scope variable H474
H126	Pointer to Scope variable H475
H127	Referencing to encoder zero pulse
H496 SLS_right	Software limit switch CW (INCR)
H497 SLS_left	Software limit switch CCW (INCR)
H509 ActPos_Abs	Actual position DIP
H510 ActPos_Ext	Actual position X14
H511 ActPos_Mot	Actual position X15
H1002	ScopeDelay

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

5.5 Recording IPOS$^{plus®}$ variables

IPOS$^{plus®}$ variables can be recorded during operation using the "Scope" program in MOVITOOLS® This is only possible for the MOVIDRIVE® MDX61B inverter.

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

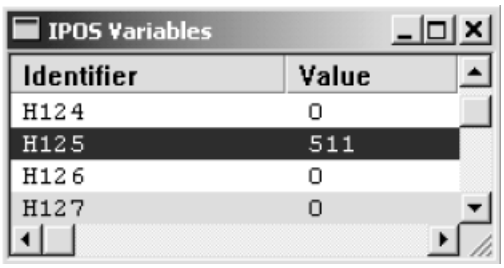
- H125 → Scope474Pointer
- H126 → Scope475Pointer

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

Example

The IPOS$^{plus®}$ variable *H511 Current motor position* is to be recorded. Proceed as follows:

- In the "Scope" program, enter the value 511 in variable H125 in the variable window.



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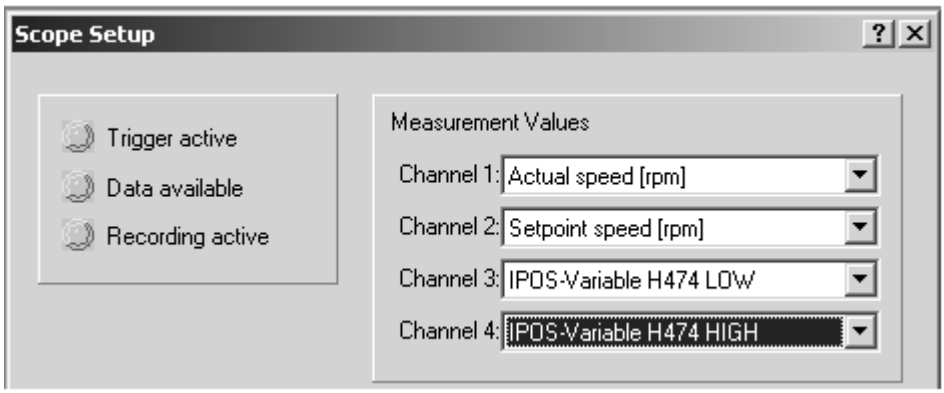
- In the "Scope" program, choose [File] / [New]. Set channel 3 to *IPOS variable H474 LOW* and channel 4 to *IPOS variable H474 HIGH*. The "Scope" program now records the value of the IPOS$^{plus®}$ variable H511.



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- The pointer variables are copied to the IPOS$^{plus®}$ variable H474 or H475 in TASK 3 of the IPOS$^{plus®}$.
- The speed (commands / ms) of TASK3 is dependent on the processor utilization of MOVIDRIVE® MDX61B.
- The time (ms) needed in Task 3 to copy the values from the pointer variables to the IPOS$^{plus®}$ variables H474 and H475 is stored in variable H1002. If the value is zero, the copying process lasts less than 1 ms.

6 Operation and Service

6.1 Starting the drive

Following the download, switch to the "Extended positioning via bus" monitor by selecting "Yes." You can select the operating mode using bits 11 and 12 of "PO1: Control word 2".

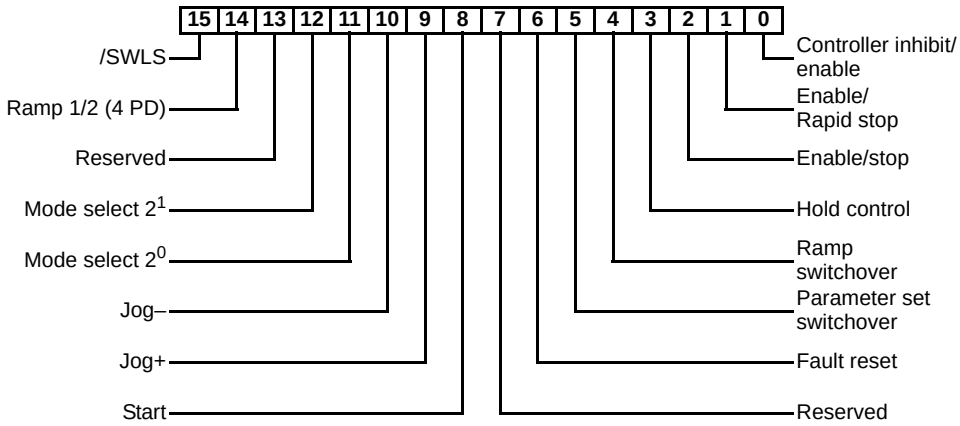
Note the following points to start the drive. This procedure applies to all operating modes:

- Binary inputs DIØØ "/CONTROLLER INHIBIT/" and DIØ3 "ENABLE/RAPID STOP" must be assigned a "1" signal.
- **For control via fieldbus or system bus:** Set the control bit PO1:0 "CONTROLLER INHIBIT/ENABLE" = "0" and the control bits PO1:1 "ENABLE/RAPID STOP" and PO1:2 "ENABLE/STOP" = "1".

Operating modes

The process output data word 1 (PO1) has the following assignment:

- PO1: Control word 2



The option "Moving clear of the software limit switches" in jog mode (Bit 15:/SWLS) is only available in conjunction with MOVIDRIVE® MDX61B.

- **Jog mode (DI11 = "1" and DI12 = "0")**
  - In jog mode, the drive can be moved CW or CCW via bits 9 and 10 in control word 2 (PO1).
  - The speed in jog mode can be varied and is specified by the PLC via the bus.

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

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

- **Automatic mode (DI11 = "1" and DI12 = "1")**

  The target position is based on the machine zero, which was determined beforehand by reference travel. Reference travel is mandatory.

The maximum possible travel distance depends on the travel unit set. Examples:

- Travel unit [1/ 10 mm] → Travel distance = 3.27 m
- Travel unit [mm] → Travel distance = 32.7 m

6.2 Monitor mode

The "Extended positioning via bus" monitor mode displays the data that is transmitted via the fieldbus. The process input and output data are read in cyclically and displayed in hexadecimal format.

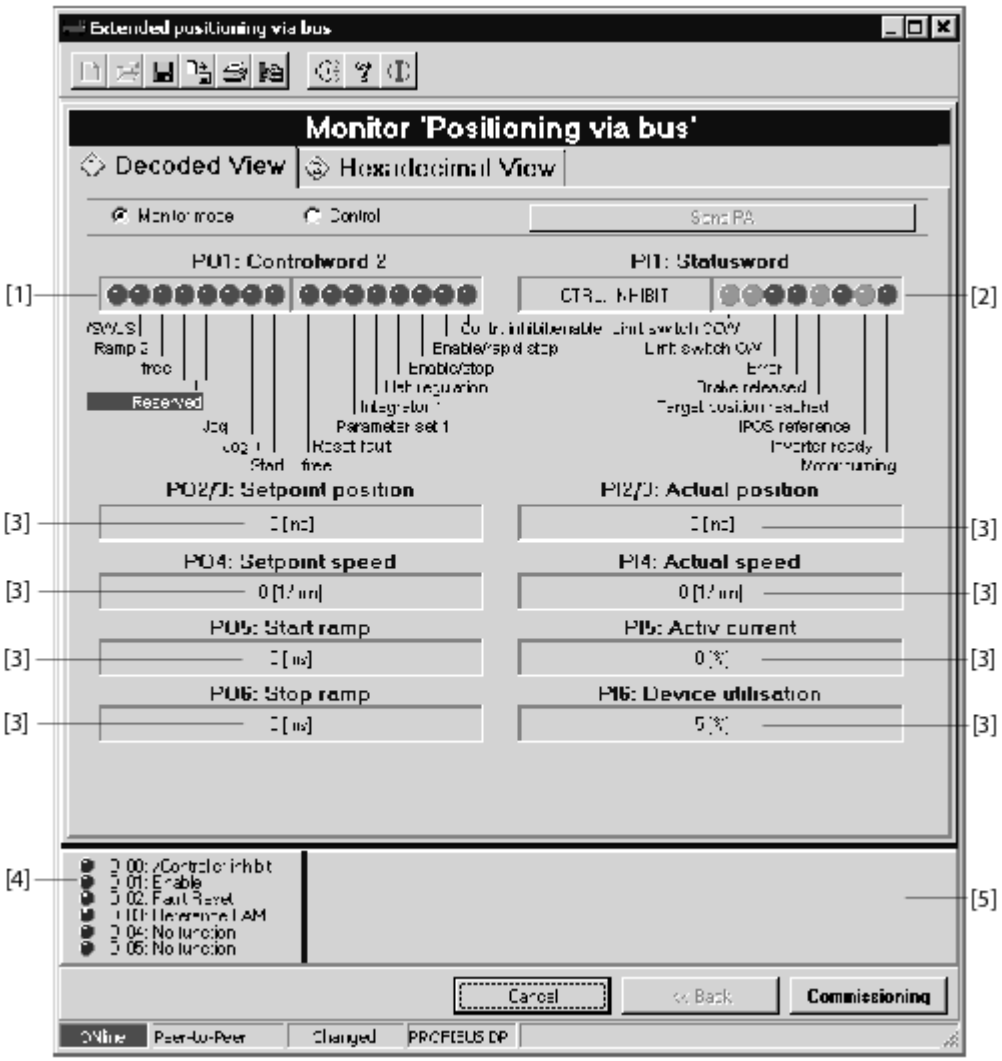


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Figure 21: Monitor mode

- The process input and output data are displayed in the middle of the window.
- You can change the control source by selecting the radio button "Monitor" or "Control":
  - Monitor: The process data are read from a machine control via fieldbus.
  - Control: The process data are specified via a PC. The drive can be controlled with a PC without a machine control. You can use the mouse to set or delete the individual bits in control word PO1. You have to enter the values in the input fields PO2 "Setpoint speed" and PO3 "Target position" as numerical values. To send the process data to the inverter, click the <Send PO> button.

6.3 Jog mode

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

You can use the jog mode when the unit is serviced to move the drive independent of the automatic mode. No reference travel is required beforehand.

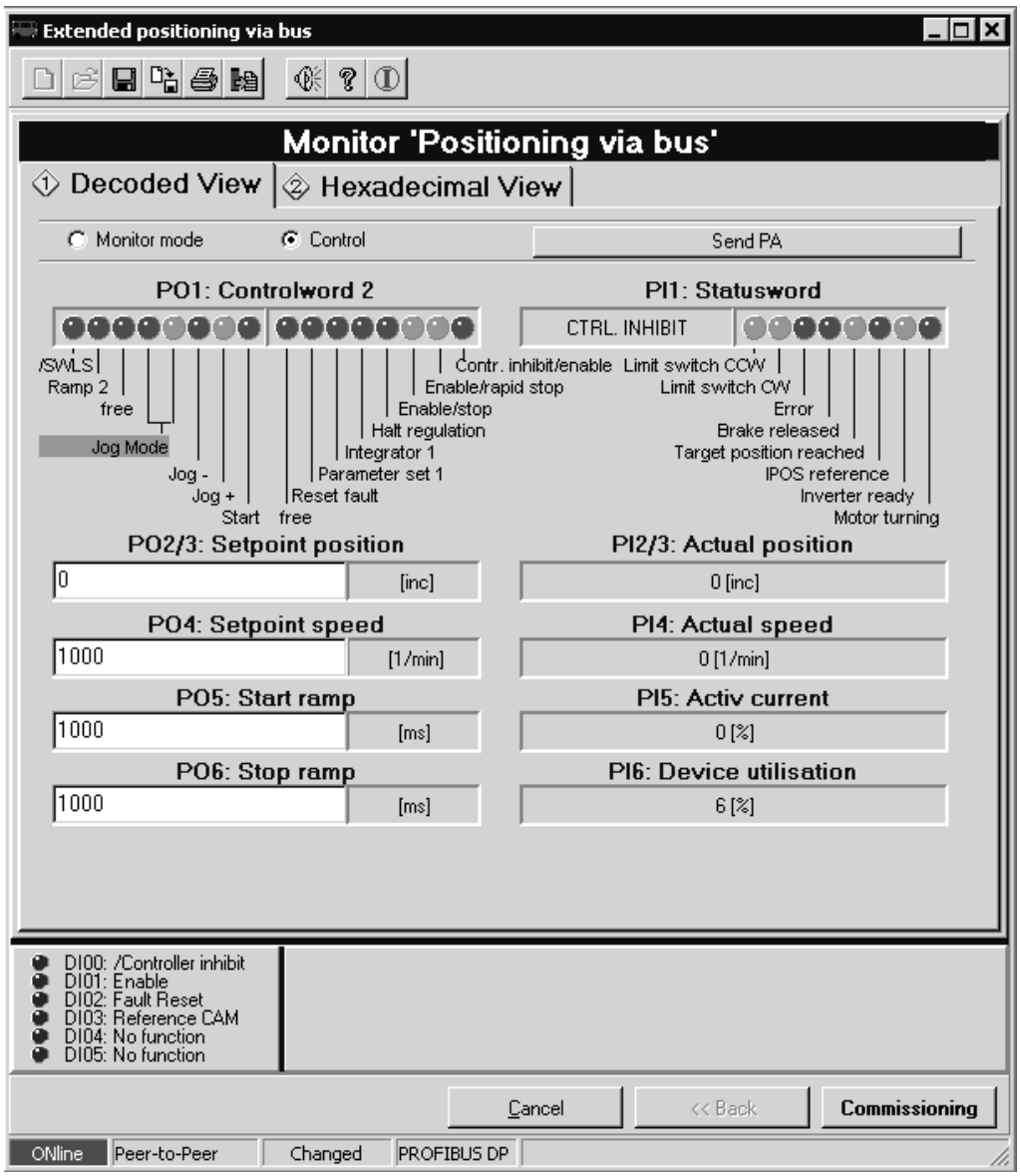

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Figure 22: Jog mode

- Start the drive by setting the control bit PO1:9 "Jog+" or PO1:10 "Jog–". This means you can move the drive in both directions. If the setting "Jog+" or "Jog–" is deleted, the drive stops.
- The speed is specified via PO2: Setpoint speed.

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

6.4 Referencing mode

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

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

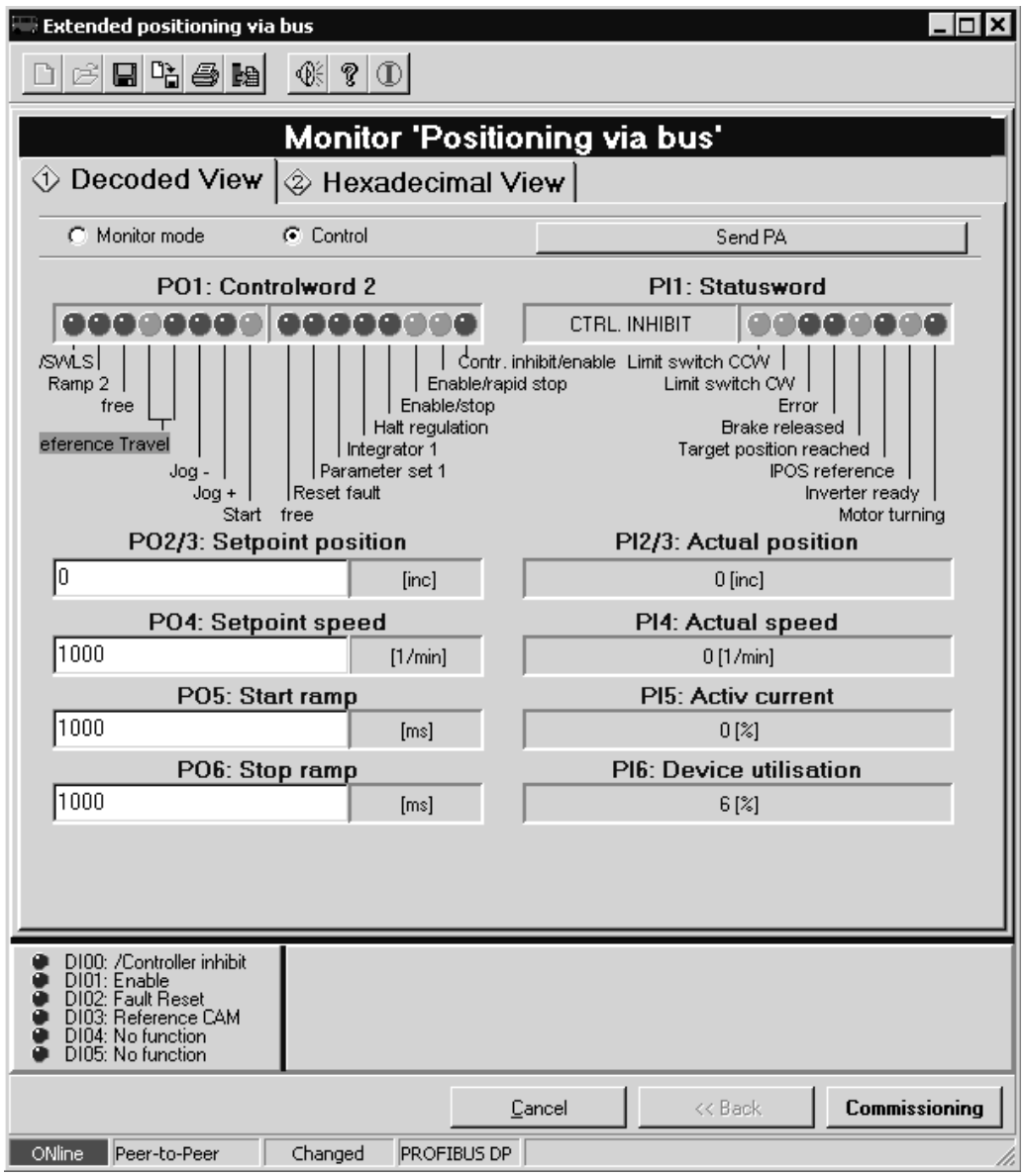

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Figure 23: Referencing mode

- Ensure that you have set the correct reference travel type (P903) **before starting** reference travel. If this is not the case, restart the startup procedure and set the required type of reference travel.
- Set PO1:8 "Start" to "1" to start reference travel. The "1" signal must be present for the entire duration of the reference travel. Once reference travel has been completed successfully, PI1:2 "IPOS reference" is set. The "1" signal at PO1:8 "Start" can now be revoked. The drive is now referenced.
- You can set the speeds for reference travel in parameters P901 and P902.

- The stop ramp (P136) is used for reference travel. If reference travel is interrupted by revoking the start bit, positioning ramp 1 (P911) is used.
- If referencing is set to the hardware limit switches (type 3 and 4), the drive continues to turn for 4096 increments after leaving the hardware limit switch.
- Please also refer to the information in Sec. "Software limit switches."

6.5 Automatic mode

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

In automatic mode, the drive can be positioned absolutely based on the machine zero point (reference position) (the axis must be referenced):

1. The target position is specified via PO2 and PO3, the speed via PO2, the acceleration ramp via PO5 and the brake ramp via PO6.
2. With control via four process data, the positioning ramp can be switched between two ramps specified at startup via PO1:15.
3. If the ramp function (P916) is set to "LINEAR" or "JERK LIMITED", you can change the speed and ramp time while the drive is moving. With all other ramp types, you can only change the speed and the ramp time when the drive is at standstill or if the axis is not enabled.

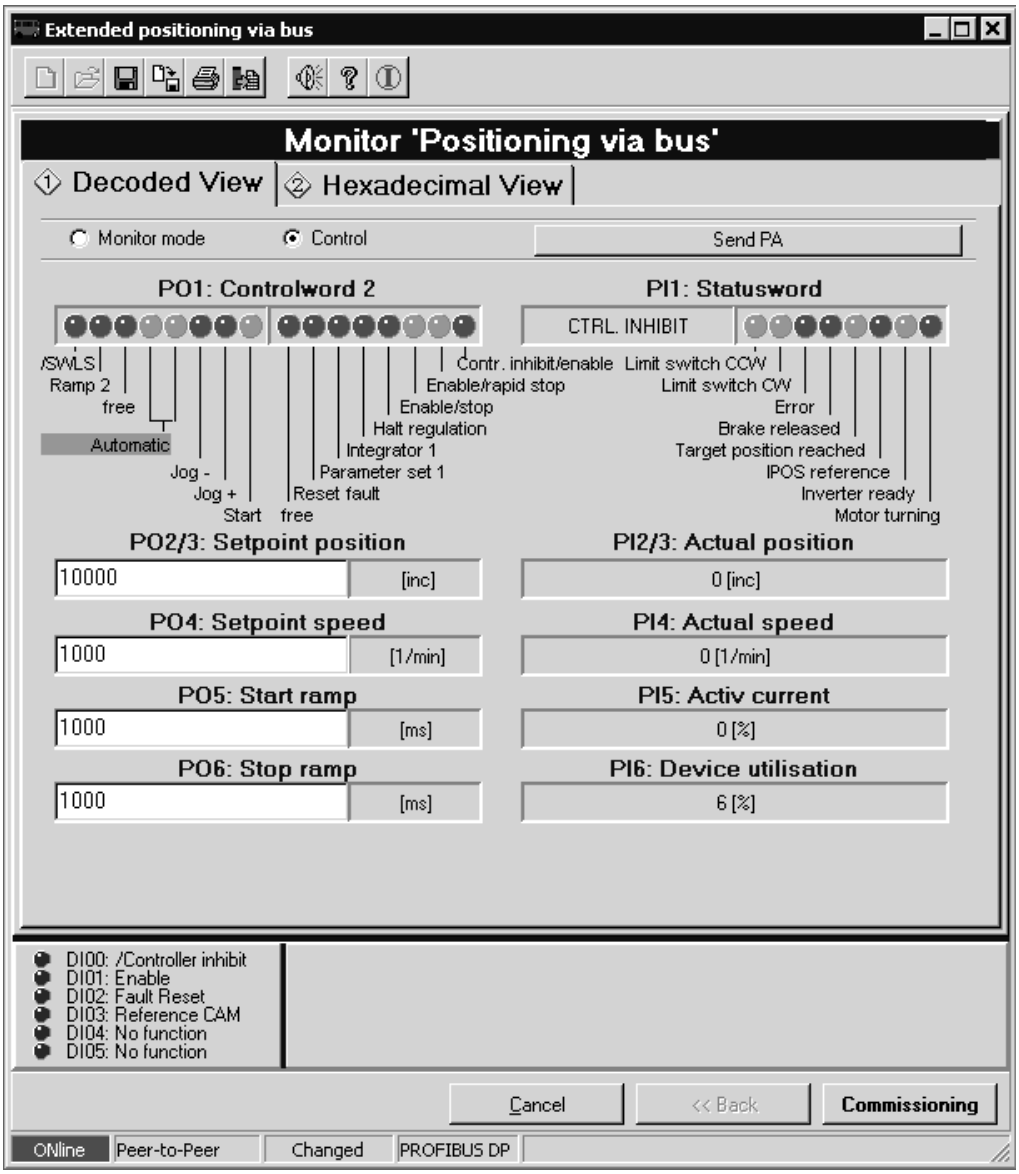

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Figure 24: Automatic mode

- Set PO1:8 "Start" to "1" to start positioning. The "1" signal must be present for the entire duration of the positioning procedure.

- Once positioning has been completed successfully, PI1:3 "Target position reached" is set. The drive comes to a standstill subject to position control.
- The drive moves immediately to a new position if control bit PO1:8 "Start" is set and a new target position is specified via PO3.

The inverter signals the actual position to the control cyclically using process input data words PI2 and PI3. In addition, the inverter signals the actual speed, the active current and the unit utilization to the control via PI4, PI5 and PI6.

Example: Specify the target position in the double word

Required target position: +70000 mm (11170 hex).

Content of PO2 and PO3 hexadecimal:

- POSITION HI:1
- POSITION LO:1170

Content of PO2 and PO3 decimal:

- POSITION HI:1
- POSITION LO: 4464

If the PLC specifies a negative target position, this is represented as follows in the two process data words:

- Required position: –70000 mm (FFFF EE90hex)

  Content of PO2 and PO3 hexadecimal:

  – POSITION HI: FFFF
  – POSITION LO: EE90

  Content of PO2 and PO3 decimal:

  – POSITION HI: – 1
  – POSITION LO: 61072

- Parameter P917 Ramp mode is used to determine the use of positioning ramp 2 (P912). If P917 is set to MODE 1, deceleration for travel to target position (spot braking) takes place with positioning ramp 2 (P912).
- If the travel speed changes during travel (P917 = MODE 1), positioning ramp 1 (P911) is used for deceleration.
- If the travel speed changes during travel when P917 is set to MODE 2, positioning ramp 2 (P912) is always used for deceleration.

6.6 Cycle diagrams

The following conditions apply to the cycle diagrams:

- DIØØ "/CONTROLLER INHIBIT" = "1" (no lock)
- DIØ1 "ENABLE/RAPID STOP" = "1"
- PO1:1 "ENABLE/RAPID STOP" = "1"
- PA1:2 "ENABLE/STOP" = "1"

The output DB00 "/Brake" is set, the brake is released and the drive stops subject to position control (→ 7-segment display = "A")

Jog mode

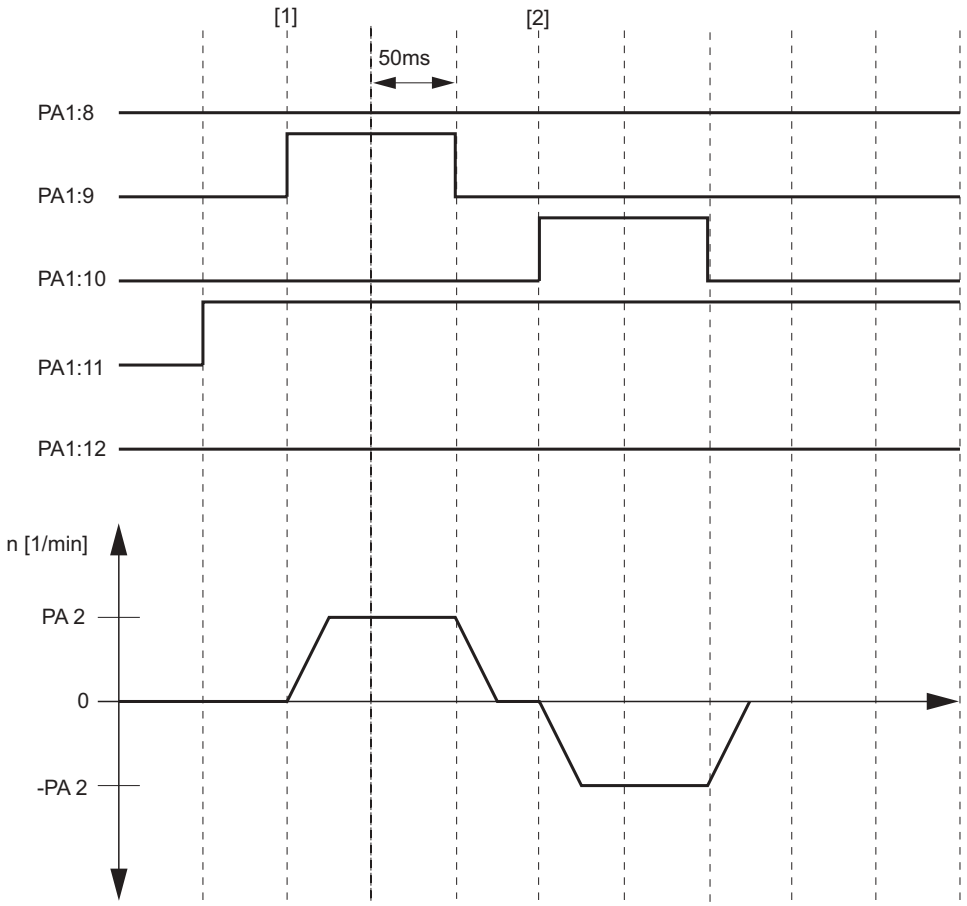

Figure 25: Cycle diagram: Jog mode

PA1:8	= Start	[1] = Axis starts when the bit "Jog +" is set
PA1:9	= Jog +	[2] = Axis starts when the bit "Jog –" is set
PA1:10	= Jog –	
PA1:11	= Mode Low	
PA1:12	= Mode High	

Referencing mode

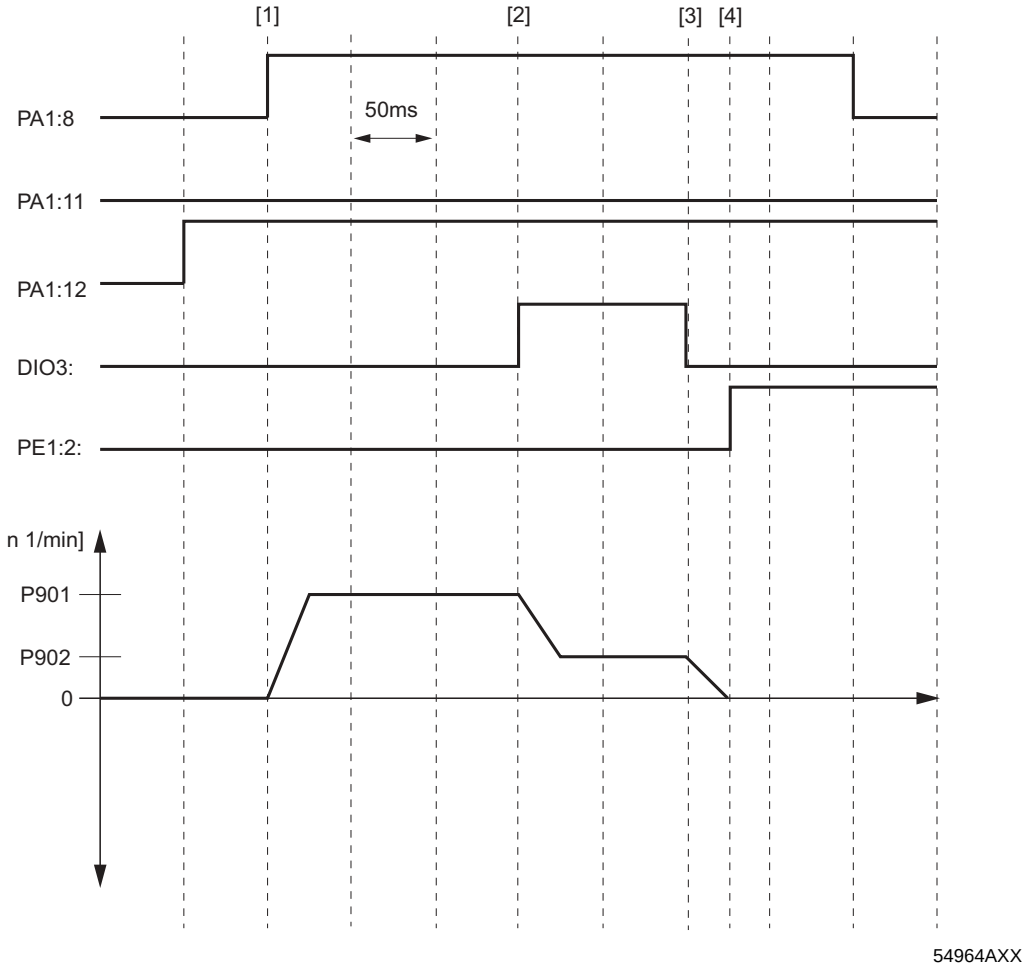

Figure 26: Cycle diagram: Referencing mode

PA1:8 = Start
PA1:11 = Mode Low
PA1:12 = Mode High
DI03 = Reference cam
PE1:2 = IPOS reference

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

Automatic mode

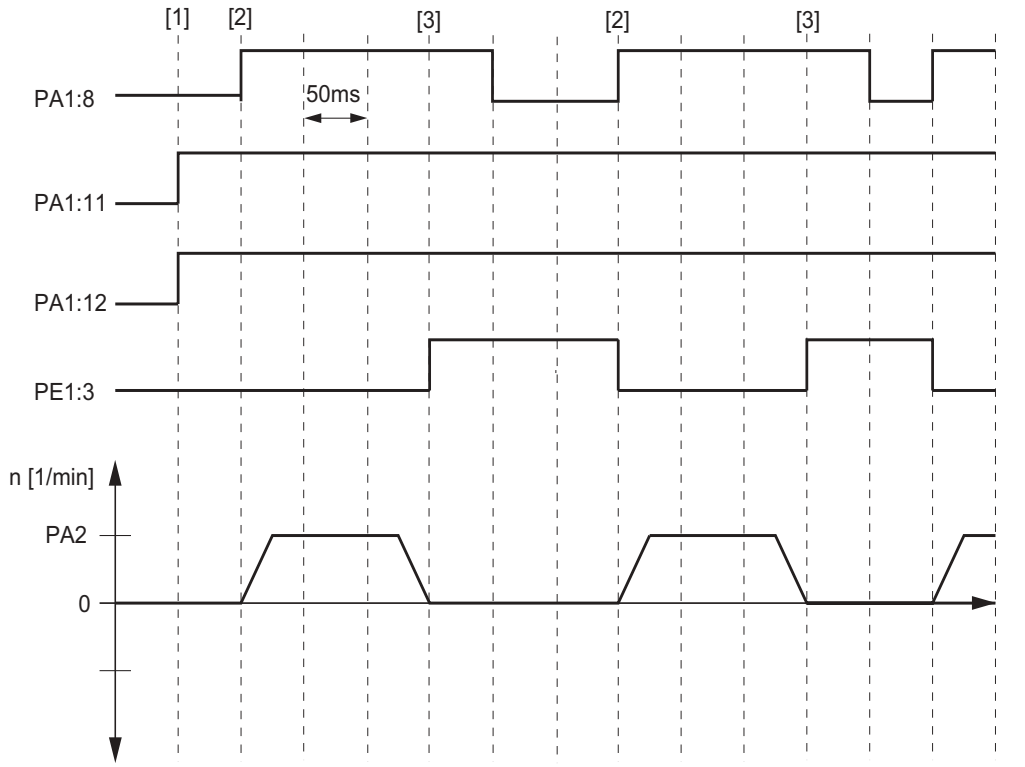

Figure 27: Cycle diagram: Automatic mode

PA1:8 = Start
PA1:11 = Mode Low
PA1:12 = Mode High
PE1:3 = Target position reached

[1] = Automatic absolute selected
[2] = Start positioning (target position = PA3)
[3] = Target position reached

Moving clear of hardware limit switches

Once a hardware limit switch (DI04 = "0" or DI05 ="0") has been reached, the bit PE1:5 "Fault" is set and the drive comes to a standstill using an emergency stop.

Proceed as follows to move the drive clear again:

- Jog mode: Set the bits PA1:9 "Jog+" = "0" and PA1:10 "Jog– " = "0".
- Automatic mode: Set bit PA1:8 "Start" = "0".
- Set bit PA1:6 "Reset" to "1". The bit PE1:5 "Fault" is deleted.
- The drive automatically moves clear of the hardware limit switch at the speed specified in *P902 Reference speed 2*.
- Once the drive has moved clear of the hardware limit switch, you can delete PA1:6 "Reset" and select the required operating mode.

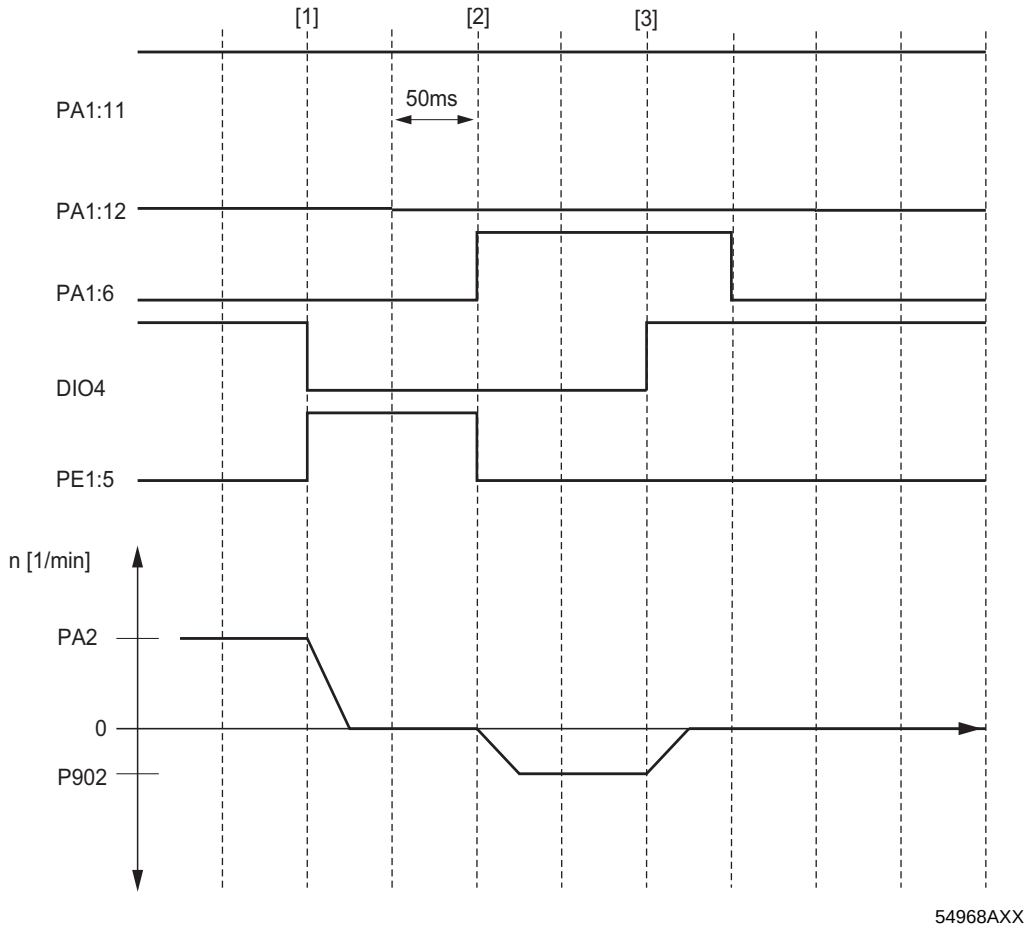

Figure 28: Cycle diagram: Moving clear of limit switches

PA1:11= Mode Low	PA1:6 = Reset
PA1:12= Mode High	PE1:5 = Fault
	DI04 = CW limit switch

[1] = The drive has reached the CW hardware limit switch and comes to a halt using an emergency stop ramp.

[2] = PA1:6 "Reset" is set. Drive moves clear of hardware limit switch.

[3] = Drive moves clear of hardware limit switch

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), the drive must be stopped by revoking the enable (terminal or bus).

6.7 Fault information

The fault memory (P080) stores the last five fault messages (faults t-0 to t-4). The oldest fault message is deleted whenever more than five fault messages have occurred. The following information is stored when a malfunction occurs:

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

There are three switch-off responses depending on the fault; the inverter remains blocked 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 a fault 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

A fault 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 supply system contactor K11.

- Reset via binary input DIØ3. Startup of the "Sensor based positioning via bus" application causes this binary input to be assigned with the "Reset" function.
- Only for control with fieldbus/system bus: "0"→∀1"→"1"signal at Bit PO1:6 in control word PO1.
- Press the reset button in the MOVITOOLS® Manager.

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Figure 29: Reset with MOVITOOLS®

- Manual reset in MOVITOOLS/Shell (P840 = "YES" or [Parameter] / [Manual reset]).
- Manual reset with DBG60B (MDX61B) or DBG11A (MCH4_A).

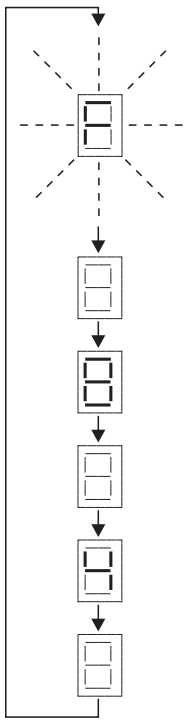
Timeout active

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.

6.8 Error messages

Display

The error or warning code is displayed in binary coded format. The following display sequence is adhered to:



Flashes, ca. 1 s

Display off, ca. 0.2 s

Tens, ca. 1 s

Display off, ca. 0.2 s

Ones, ca. 1 s

Display off, ca. 0.2 s

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

List of errors

The following table shows a selection from the complete error list (→ MOVIDRIVE® operating instructions). Only those errors are listed that can occur specifically with this application.

A dot in the "P" column indicates that the response is programmable (P83_ Fault response). The factory set fault response appears in the "Response" column.

Error code	Designation	Response	P	Possible cause	Action
00	No fault	-			
07	U_Z overvoltage	Immediate switch-off		DC link voltage too high	• Extend deceleration ramps • Check connection leads to the braking resistor • Check technical data of braking resistor
08	n-monitoring	Immediate switch-off		• 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.	• Reduce load • Increase deceleration time setting (P501 or P503) • Check encoder connection, swap A/A and B/B pairs if necessary • Check encoder voltage supply • Check current limitation • Extend ramps if necessary • Check motor cable and motor • Check mains phases
10	IPOS-ILLOP	Emergency stop		• Incorrect command detected during running of IPOS$^{plus®}$ program. • Incorrect conditions during command execution.	• Check program memory content and correct if necessary. • Load correct program into program memory. • Check program sequence (→ IPOS$^{plus®}$ manual)

Error code	Designation	Response	P	Possible cause	Action
14	Encoder	Immediate switch-off		• 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 broken wire.
25	EEPROM	Rapid stop		Access to the EEPROM of the memory card has failed	• Call up default setting, perform reset and set parameters again. • Contact SEW service if the error occurs again. • Replace memory card.
28	Fieldbus Timeout	Rapid stop	•	No communication between master and slave within the projected response monitoring.	• Check communications routine of the master • Extend fieldbus timeout time (P819)/deactivate monitoring
29	Limit switch reached	Emergency stop		A limit switch was reached in IPOS$^{plus®}$ operating mode.	• Check travel range. • Correct user program.
31	TF sensor	None Response	•	• Motor too hot, TF sensor has tripped • TF sensor of motor not connected or not connected properly • Connection of MOVIDRIVE® and TF on motor interrupted • No jumper between X10:1 and X10:2.	• Let motor cool off and reset fault • Check connections/link between MOVIDRIVE® and TF. • If no TF is connected: Jumper X10:1 with X10:2. • Set P835 to "NO RESPONSE"
36	No option	Immediate switch-off		• 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 DIP11A.	• 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.
42	Lag fault	Immediate switch-off	•	• Incremental encoder connected incorrectly • Accelerating ramps too short • P component of positioning controller too small • Speed controller parameters set incorrectly • Value of lag fault tolerance too small	• Check rotary encoder connection • Extend ramps • Set P component to higher value • Set speed controller parameters again • Increase lag fault tolerance • Check encoder, motor and mains phase wiring • Check mechanical components can move freely, possibly blocked up
94	EEPROM checksum	Immediate switch-off		Inverter electronics disrupted, possibly due to effect of EMC or a defect.	Send the unit in for repair.

7 Compatibility between MOVIDRIVE® A / B / *compact*

7.1 Important notes

The "Extended positioning via bus" application module for MOVIDRIVE® MDX61B offers a number of additional functions that are not available with MOVIDRIVE® MD_60A or MOVIDRIVE® *compact*. This section provides you with information on the differences between the application module when using a MOVIDRIVE® MD_60A or MOVIDRIVE® *compact* unit and gives you important information on project planning.

Project planning for MOVIDRIVE® MD_60A / MOVIDRIVE® compact

- Drive inverter

  It is essential for the "Extended positioning via bus" application module to have encoder feedback, which means it can only be implemented with the following drive inverters:

  – MOVIDRIVE® MDV60A / MDS60A
  – MOVIDRIVE® *compact* MCV / MCS
  – MOVIDRIVE® *compact* MCH41A /MCH42A

- Bus installation for MOVIDRIVE® MDV / MDS60A

  Extended positioning via bus uses 6 process data words. As a result, it is only possible to use the "PROFIBUS" and "INTERBUS with fiber optic cable" fieldbus types. When one of these two fieldbus types is used, MOVIDRIVE® MDV / MDS60A requires one of the options DFP21A, DFP11A or DFI21A.

  Please read the information in the relevant fieldbus manuals.

Compatibility between the hardware terminals

Compared to MOVIDRIVE® MD_60A, MOVIDRIVE® MDX61B has two extra digital inputs (DI06, DI07) and three additional digital outputs (DO03, DO04, DO05). The additional hardware inputs and outputs are set to "No function" during initial startup and are not processed in the program.

Software limit switches

The function to move clear of the software limit switches is only possible for MOVIDRIVE® MD_60A, MOVIDRIVE® *compact* MCx / MCH from the following firmware versions:

– MOVIDRIVE® MD_60A: 823 854 5.15
– MOVIDRIVE® *compact* MCx: 823 859 6.14
– MOVIDRIVE® *comapct* MCH: 823 947 9.17

Recording IPOS$^{plus®}$ variables

Recording IPOS$^{plus®}$ variables using the MOVITOOLS® program "Scope" is only possible with MOVIDRIVE® MDX61B.

SBus send object for DriveSync Slave

If you use MOVIDRIVE® MD_60A or MOVIDRIVE® *compact* MCx / MCH, you do not have the option of setting up an SBus send object to transfer the actual position. It is also not possible to integrate the "DriveSync" application module.

Wiring diagrams

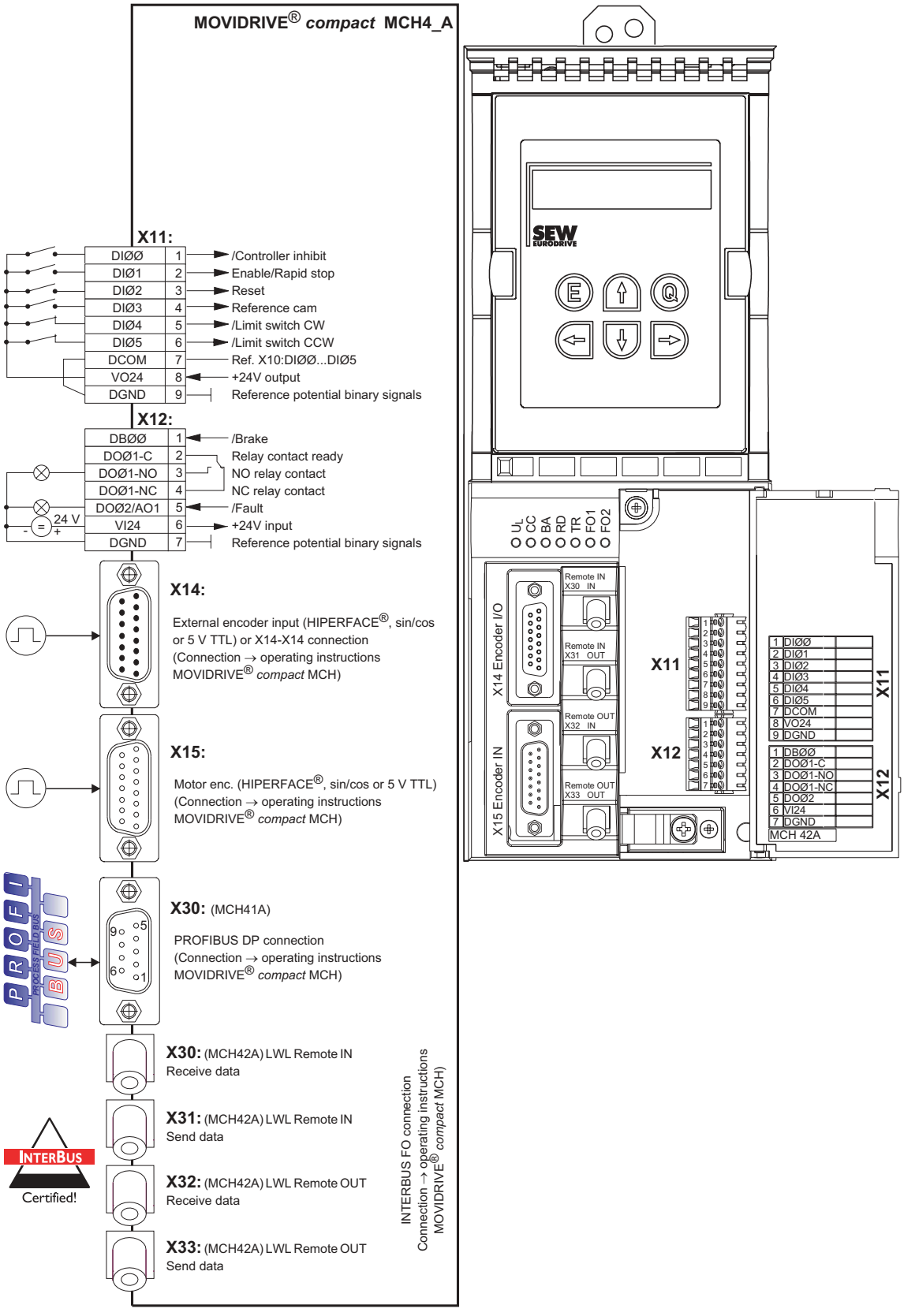

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Figure 30: MOVIDRIVE® compact MCH4_A

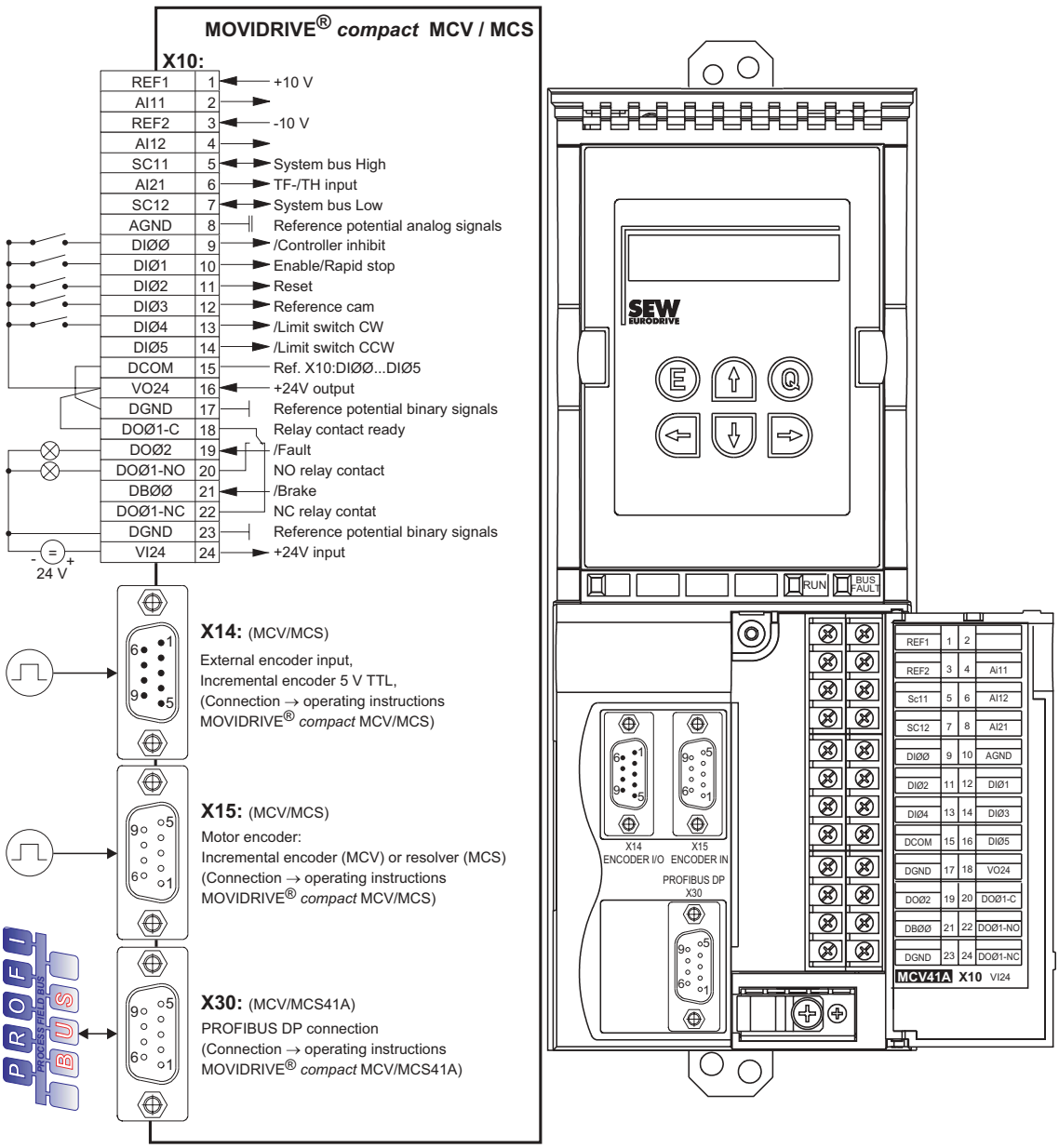

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Figure 31: MOVIDRIVE® compact MCV / MCS

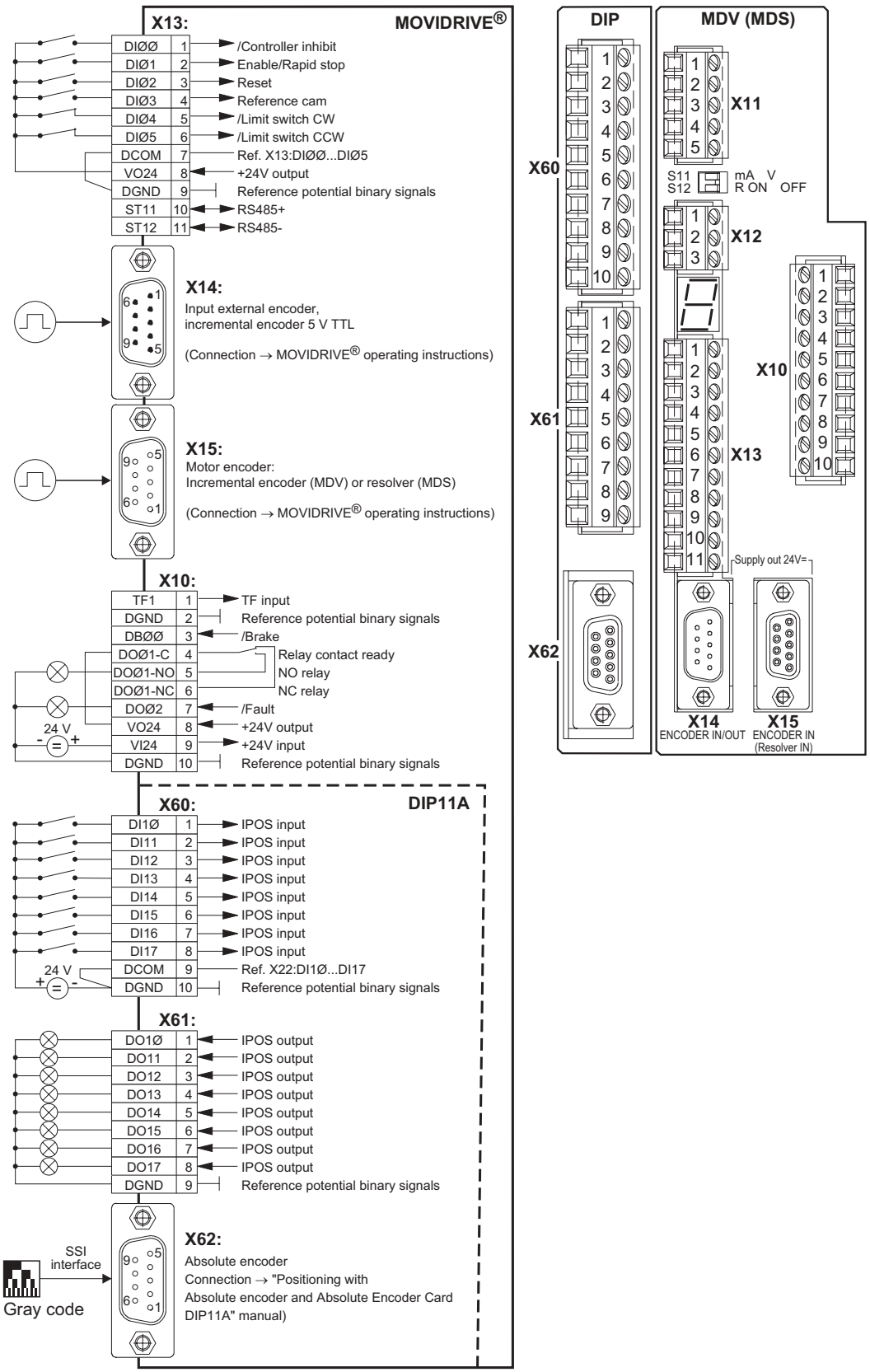

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Figure 32: MOVIDRIVE® MDV / MDS60_A

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	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz

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

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 849 47-70 Fax +221 849 47-71 senemeca@sentoo.sn

Serbia and Montenegro			
Sales	**Beograd**	DIPAR d.o.o. Kajmakcalanska 54 SCG-11000 Beograd	Tel. +381 11 3088677 / +381 11 3088678 Fax +381 11 3809380 dipar@yubc.net

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

Slovakia			
Sales	**Sered**	SEW-Eurodrive SK s.r.o. Trnavska 920 SK-926 01 Sered	Tel. +421 31 7891311 Fax +421 31 7891312 sew@sew-eurodrive.sk

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

South Africa			
Assembly **Sales** **Service**	**Johannesburg**	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 494-3104 dross@sew.co.za
	Capetown	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442 Cape Town	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 dswanepoel@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaceo Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 dtait@sew.co.za

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 9 4431 84-70 Fax +34 9 4431 84-71 sew.spain@sew-eurodrive.es

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

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 41717-17 Fax +41 61 41717-00 http://www.imhof-sew.ch info@imhof-sew.ch

Thailand			
Assembly **Sales** **Service**	**Chon Buri**	SEW-EURODRIVE (Thailand) Ltd. Bangpakong Industrial Park 2 700/456, Moo.7, Tambol Donhuaroh Muang District Chon Buri 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.co.th

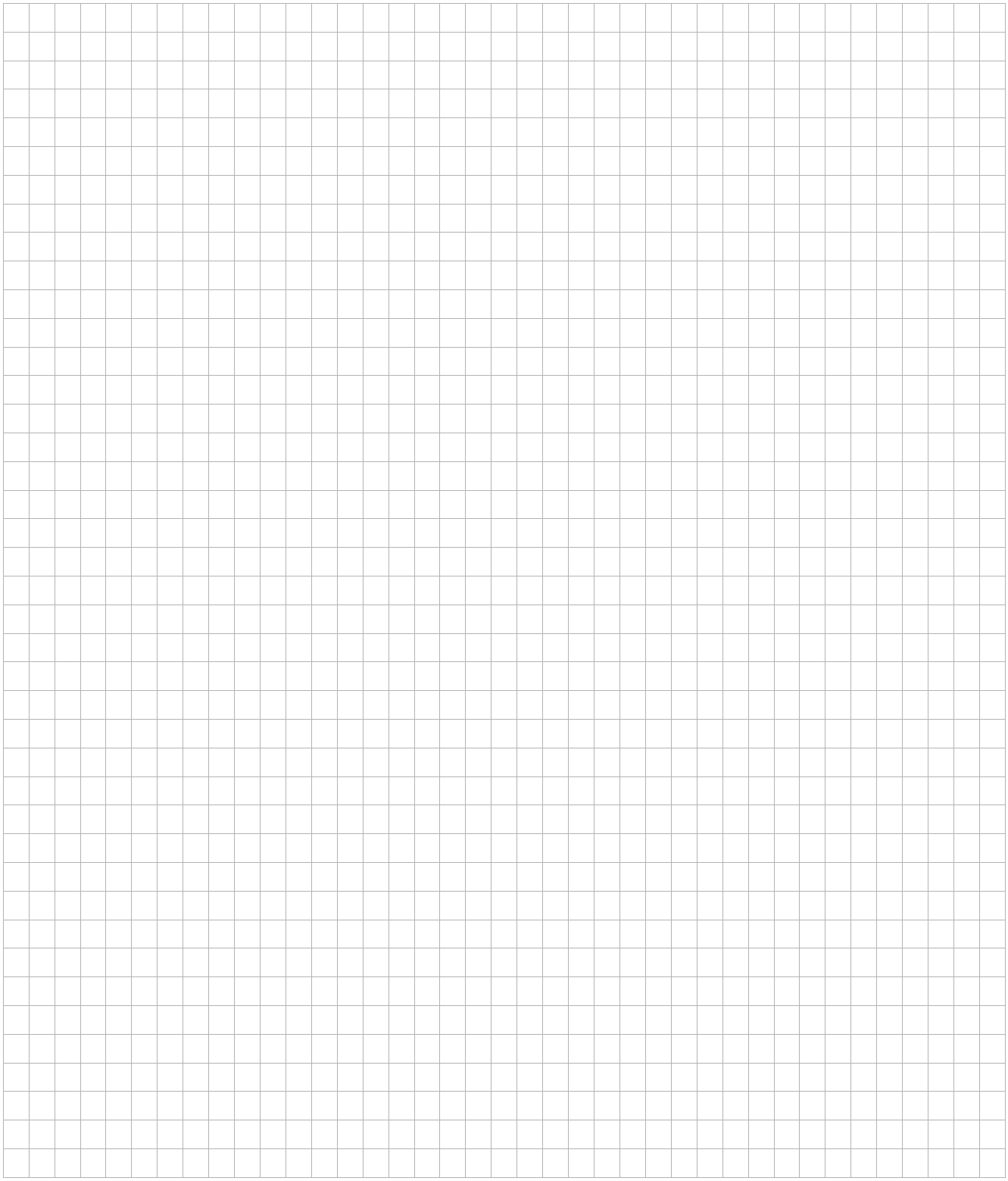
Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service 7, rue Ibn EI Heithem Z.I. SMMT 2014 Mégrine Erriadh	Tel. +216 1 4340-64 + 1 4320-29 Fax +216 1 4329-76

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri Sirketi Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 + 216 4419164 + 216 3838014 Fax +90 216 3055867 sew@sew-eurodrive.com.tr

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

USA			
Production **Assembly** **Sales** **Service**	**Greenville**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manuf. +1 864 439-9948 Fax Ass. +1 864 439-0566 Telex 805 550 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**San Francisco**	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, California 94544-7101	Tel. +1 510 487-3560 Fax +1 510 487-6381 cshayward@seweurodrive.com
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 sewventas@cantv.net sewfinanzas@cantv.net



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