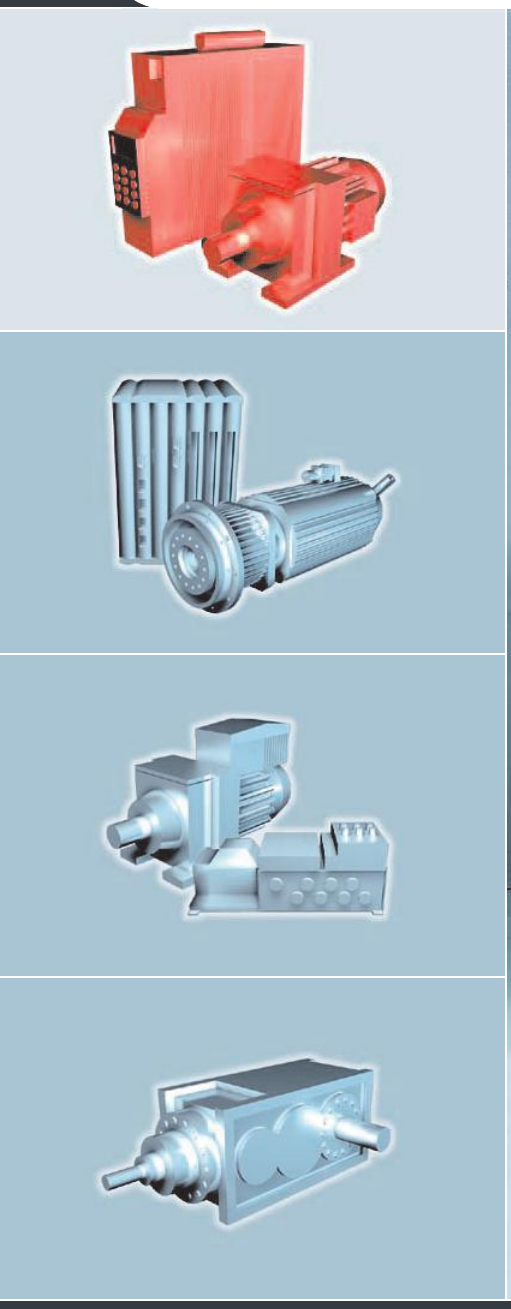
SEW EURODRIVE



MOVIDRIVE® MDX60B / 61B

EA430000

Edition 09/2006

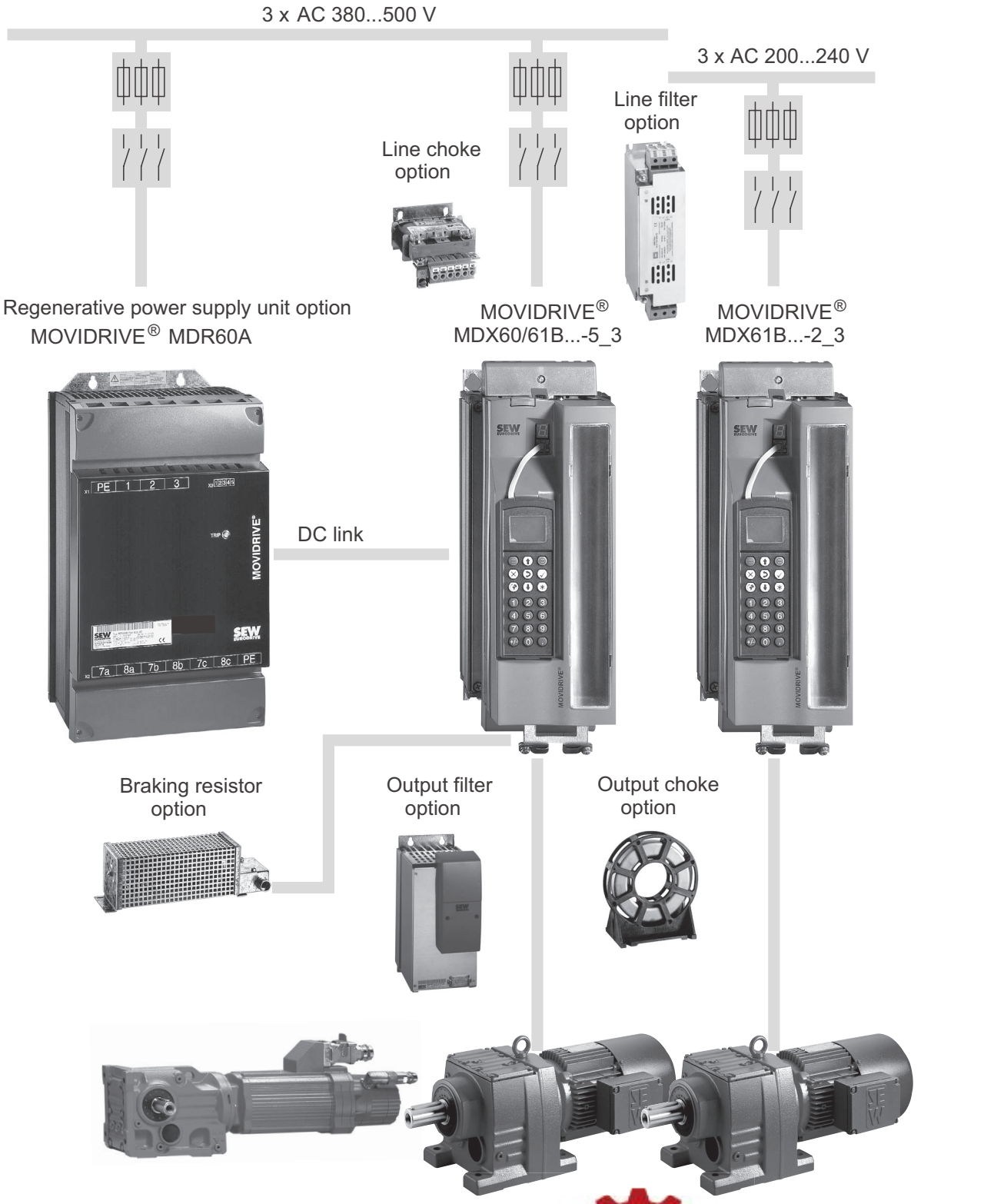
11427813 / EN

System Manual

1 System Description

1.1 System overview of MOVIDRIVE® MDX60B/61B

Power components



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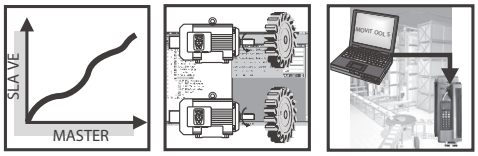
Encoder and communication options

MDX60/61B standard version IPOS plus® as standard

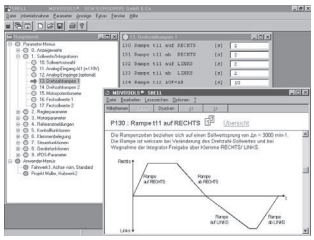
System bus (SBus)

MDX60/61B application version for using "Electronic cam", "Internal synchronous operation" or the application modules.



Keypad option

MOVITOOLS® operating software



Encoder connection options

HIPERFACE® (sin/cos, TTL)
Resolver

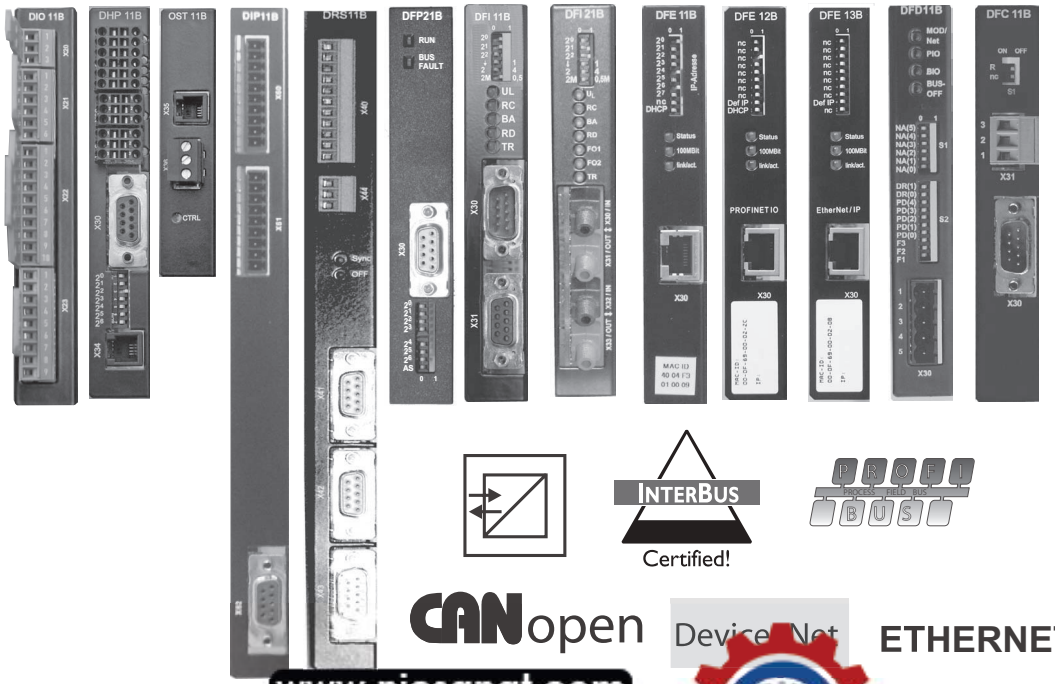
Interface adapter option

UWS 21B

UWS 11A

USB 11A

Input/output card / MOVI-PLC® / Fieldbus interface options



CANopen DeviceNet ETHERNET

General description

MOVIDRIVE® MDX60B/61B is the new generation of drive inverters from SEW-EURODRIVE. The new series B MOVIDRIVE® drive inverters feature a modular design, provide enhanced functions in the lower power range, more basic functions and greater overload capacity.

AC drives with the latest digital inverter technology can now be used without restrictions in the 0.55 to 160 kW power range. The levels of dynamic performance and control quality that can now be achieved with MOVIDRIVE® for asynchronous AC motors were previously only possible using servo drives or DC motors. The integrated control functionality and the option to extend the drive using technology and communication options creates drive systems that are designed to be particularly cost-effective with regards to the application range, project planning, startup and operation.

Low-emission

The MOVIDRIVE® MDX60B/61B drive inverters are produced according to particularly low-emission regulations, but with the usual high level of quality. One particular feature is the consistent use of lead-free soldering materials in the production of electronics products. These lead-free processes are in line with the RoHS EU Directive and the law on electronic equipment.

Unit range

The **MOVIDRIVE®** unit range includes three series:

- MOVIDRIVE® MDX60B: Drive inverter for asynchronous AC motors without encoder feedback. The units are not option-capable.
- MOVIDRIVE® MDX61B: Drive inverter for asynchronous AC motors with or without encoder feedback, or for asynchronous and synchronous servomotors. The units are option-capable.
- MOVIDRIVE® MDR60A: Regenerative power supply unit; MOVIDRIVE® drive inverters (400/500 V units) operate in regenerative mode to feed energy back into the supply system.

Unit versions

MOVIDRIVE® MDX60B/61B drive inverters are each available in two versions, namely the standard version and the application version.

Standard version

The units are equipped with the integrated IPOS$^{plus®}$ positioning and sequence control system as standard. MOVIDRIVE® MDX61B can be expanded with the available options.

The standard version is indicated by the "00" digits at the end of the unit designation.

Application version

In addition to the features of the standard version, these units include the technology functions "electronic cam" and "internal synchronous operation." You can also use all the application modules available in the MOVITOOLS® software package with the application versions.

The application version is indicated by the "0T" digits at the end of the unit designation.

Modular unit concept

The option-capable MOVIDRIVE® MDX61B units have the following option slots:

- Size 0 (0005 ... 0014) → 2 option slots
  - 1 option slot for encoder connection
  - 1 option slot for a communication option
- Sizes 1 ... 6 (0015 ... 1320) → 3 option slots
  - 1 option slot for encoder connection
  - 1 option slot for a communication option
  - 1 option slot for an expansion option

	NOTES
	• **Option cards can only be installed and removed later by customers for MDX61B sizes 1 to 6. The firmware of the option cards and the basic unit must be compatible.** • For **MDX61B size 0 units, option cards can only be installed and removed later by SEW-EURODRIVE.** Please take this aspect into account when you place your order/perform project planning.

Size 0 (0005 ... 0014) Sizes 1 ... 6 (0015 ... 1320)

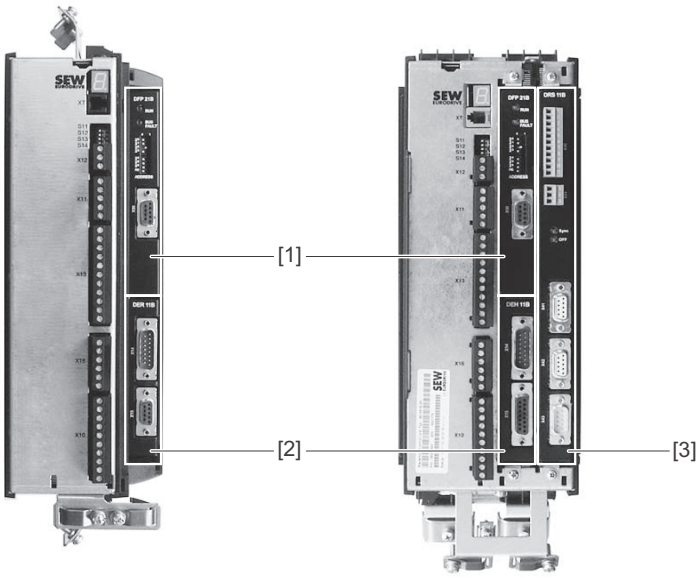


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Figure 1: Options slots for MOVIDRIVE® MDX61B

[1] Fieldbus slot for communication option

[2] Encoder slot for encoder option

[3] Expansion slot for communication option (only sizes 1 - 6)

The modular unit concept allows you to choose the right option according to your application. For example, when you have an asynchronous AC motor with encoder feedback (HIPERFACE®, sin/cos or TTL), you would need the HIPERFACE® encoder card type option DEH11B.

Application	Required option	Option slot
Encoder option		
Asynchronous AC motor with encoder feedback (HIPERFACE®, sin/cos, TTL)	HIPERFACE® encoder card DEH11B	1
Asynchronous or synchronous servomotor with HIPERFACE® encoder		
Synchronous servomotor with resolver	Resolver card type DER11B	
Communication option		
User-programmable MOVI-PLC® controller	MOVI-PLC® *basic* DHP11B controller	2 (3 only if slot 2 is occupied)
Additional RS485 interface (only in combination with option DHP11B)	DHP11B + OST11B	• DHP11B in 2, OST11B in 1 • If 1 is occupied: DHP11B + OST11B in 3
Additional analog and binary inputs/outputs are required	Input/output card type DIO11B	2 (3 only if slot 2 is occupied)
Integration into a PROFIBUS system	PROFIBUS interface? type DFP21B	2
Integration into an INTERBUS system	INTERBUS interface type DFI11B / DFI21B	
Integration into an Ethernet system	Ethernet interface type DFE11B, DFE12B, DFE13B	
Integration into a DeviceNet system	DeviceNet interface type DFD11B	
Integration into a CANopen system	CANopen interface type DFC11B	
Expansion option		
SSI encoder interface	DIP11B absolute encoder card	3
Phase-synchronous operation	Synchronous operation board DRS11B	

Control modes

The VFC (Voltage Flux Control) and CFC (Current Flux Control)/SERVO control modes are features of MOVIDRIVE® MDX60B/61B drive inverters. The continuous calculation of the complete motor model forms the basis for both control modes.

VFC (Voltage Flux Control) control mode	CFC (Current Flux Control)/SERVO control mode
Voltage-controlled control mode for asynchronous AC motors with and without encoder feedback. • With encoder feedback – At least 150 % torque, even with the motor stopped – Characteristics similar to servo operation • Without encoder feedback – at least 150 % torque up to 0.5 Hz	Current-controlled control mode for asynchronous and synchronous servomotors. Encoder feedback is always required. • At least 160 % torque, even with the motor stopped • Maximum precision and concentric running characteristics right down to standstill. • Servo characteristics and torque control even for asynchronous AC motors • Reacts to load changes within a few milliseconds

System bus (SBus)

The system bus (SBus) is available as standard. It allows several MOVIDRIVE® drive inverters to be networked together. This system bus enables fast data exchange between the units. The MOVILINK® unit profile is used for communication via the SBus. MOVILINK® is the uniform SEW-EURODRIVE standard for serial communication. The SBus [illegible]

MOVILINK®

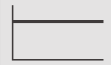
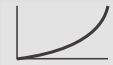
MOVILINK® always uses the same message format independent of the selected interface (SBus, RS232, RS485, fieldbus interfaces). As a result, the control software is independent of the selected interface.

IPOS$^{plus®}$

A significant feature of MOVIDRIVE® drive inverters is that the IPOS$^{plus®}$ positioning and sequence control system is integrated as standard. IPOS$^{plus®}$ enables you to control sequences of motion directly in the inverter close to the machine. This way, load is taken off the master controller and modular concepts can be implemented more easily.

Overview of the units

MOVIDRIVE® MDX60/61B for 3 × AC 380 ... 500 V supply voltage (400/500 V units):

Recommended motor power (VFC)		Continuous output current	MOVIDRIVE® type		Size
		(CFC)	MDX60B not option-capable	MDX61B option-capable	(Techn. data)
0.55 kW	0.75 kW	AC 2.0 A	0005-5A3-4-..	0005-5A3-4-..	0 (→ page 33
0.75 kW	1.1 kW	AC 2.4 A	0008-5A3-4-..	0008-5A3-4-..	
1.1 kW	1.5 kW	AC 3.1 A	0011-5A3-4-..	0011-5A3-4-..	
1.5 kW	2.2 kW	AC 4.0 A	0014-5A3-4-..	0014-5A3-4-..	
1.5 kW	2.2 kW	AC 4.0 A	–	0015-5A3-4-..	1 (→ page 35)
2.2 kW	3.0 kW	AC 5.5 A	–	0022-5A3-4-..	
3.0 kW	4.0 kW	AC 7.0 A	–	0030-5A3-4-..	
4.0 kW	5.5 kW	AC 9.5 A	–	0040-5A3-4-..	
5.5 kW	7.5 kW	AC 12.5 A	–	0055-5A3-4-..	2S, 2 (→ page 37)
7.5 kW	11 kW	AC 16 A	–	0075-5A3-4-..	
11 kW	15 kW	AC 24 A	–	0110-5A3-4-..	
15 kW	22 kW	AC 32 A	–	0150-503-4-..	3 (→ page 39)
22 kW	30 kW	AC 46 A	–	0220-503-4-..	
30 kW	37 kW	AC 60 A	–	0300-503-4-..	
37 kW	45 kW	AC 73 A	–	0370-503-4-..	4 (→ page 41)
45 kW	55 kW	AC 89 A	–	0450-503-4-..	
55 kW	75 kW	AC 105 A	–	0550-503-4-..	5 (→ page 43
75 kW	90 kW	AC 130 A	–	0750-503-4-..	
90 kW	110 kW	AC 170 A	–	0900-503-4-..	6 (→ page 45)
110 kW	132 kW	AC 200 A	–	1100-503-4-..	
132 kW	160 kW	AC 250 A	–	1320-503-4-..	

MOVIDRIVE® MDX60/61B for 3 × AC 200 ... 240 V supply voltage (230 V units):

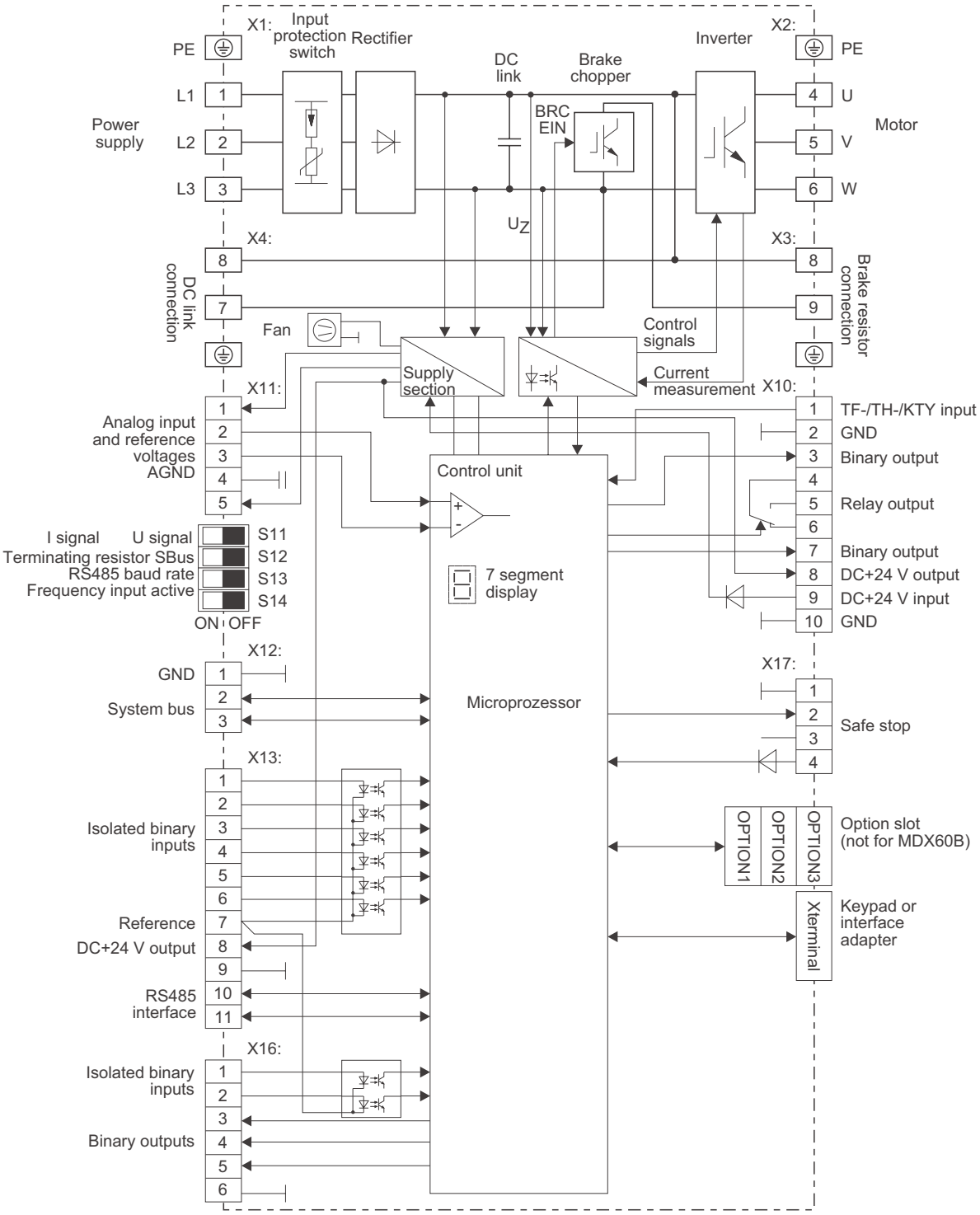
Recommended motor power (VFC)		Continuous output current (CFC)	MOVIDRIVE® type MDX61B option-capable	Size (Technical data)
1.5 kW	2.2 kW	AC 7.3 A	0015-2A3-4-..	1 (→ page 47)
2.2 kW	3.7 kW	AC 8.6 A	0022-2A3-4-..	
3.7 kW	5.0 kW	AC 14.5 A	0037-2A3-4-..	
5.5 kW	7.5 kW	AC 22 A	0055-2A3-4-..	2 (→ page 49)
7.5 kW	11 kW	AC 29 A	0075-2A3-4-..	
11 kW	15 kW	AC 42 A	0110-203-4-..	3 (→ page 51)
15 kW	22 kW	AC 54 A	0150-203-4-..	
22 kW	30 kW	AC 80 A	0220-203-4-..	4 (→ page 53)
30 kW	37 kW	AC 95 A	0300-203-4-..	

MOVIDRIVE® MDR60A regenerative power supply units for 400/500 V units:

MOVIDRIVE® MDR60A regenerative power supply units		Size (technical data)	MOVIDRIVE®MDX60B/61B...-5_3
0370-503-00	I_{mains} = AC 66 A, $I_{DC\ link}$ = DC 70 A	3 (→ page 70)	0005 ... 0370
0750-503-00	I_{mains} = AC 117 A, $I_{DC\ link}$ = DC 141 A	4 (→ page 70)	0005 ... 0750
1320-503-00	I_{mains} = AC 260 A, $I_{DC\ link}$ = DC 340 A	6 (→ page 70)	0005 ... 1320

Block circuit diagram

The following block circuit diagram shows the basic structure and theory of operation of MOVIDRIVE® MDX60B/61B drive inverters.



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1.2 Functions

Unit features

- Wide voltage range
  - 400 / 500 V units for the voltage range 3 × AC 380 ... 500 V
  - 230 V units for the voltage range 3 × AC 200 ... 240 V
- High overload capacity
  - Size 0: 200 % I_N for at least 60 s
  - Sizes 1 ... 6: 150 % I_N for at least 60 s
  - All sizes: 125 % I_N for sustained operation without overload (pumps, fans)
- With 4 kHz switching frequency, I_N is permitted for an ambient temperature ϑ = 50 °C
- 4Q capability due to integrated brake chopper installed as standard
- Compact unit mounting position for minimum control cabinet space requirement and optimum utilization of control cabinet volume
- Integrated input filter fitted as standard in sizes 0, 1, 2S and 2, adherence to class A limit on the input side without any additional measures
- Eight isolated binary inputs and six binary outputs, one of which is a relay output; programmable inputs/outputs
- One TF / TH / KTY input for motor protection using a PTC thermistor or thermocontact
- 7-segment display for operating and fault states
- Separate DC 24 V voltage input for powering the inverter electronics (parameter setting, diagnostics and data storage even when the supply system is switched off)
- Separable electronic terminals
- Separable power terminals for size 0 and 1 units

Control functionality

- VFC or CFC control modes for field-oriented operation (asynchronous servo)
- IPOS$^{plus®}$ positioning and sequence control system integrated as standard
- Two complete parameter sets
- Automatic motor calibration
- Automatic brake control by the inverter
- DC braking to decelerate the motor even in 1Q mode
- Energy-saving function for optimizing the magnetization current automatically
- Slip compensation for high static speed accuracy, even without encoder feedback
- Flying restart circuit for synchronizing the inverter to an already rotating motor
- Hoist capability with all motor systems that can be connected
- Motor stall protection through sliding current limitation in the field weakening range
- Function to hide speed window to avoid mechanical resonances
- Heating current for avoiding condensation in the motor
- Parameter lock for protection against changes to parameters
- Speed controller and encoder input with the option cards DEH11B (incremental or Hiperface® encoder) and DER11B (resolver); user-friendly controller setting tool in the user interface
- Protective functions for complete protection of the inverter and motor (short-circuit, overload, overvoltage/undervoltage, low-impedance ground fault, overtemperature in the inverter, motor stall prevention, overtemperature in the motor)
- Speed monitoring and monitoring of the motor and regenerative limit power

- Programmable signal range monitoring (speed, current, maximum current)
- Memory for displaying x/t diagrams using SCOPE process data visualization (8 channels, real-time capable)
- Fault memory (5 memory locations) with all relevant operating data at time of the fault
- Elapsed-time counter for hours of operation (unit connected to supply system or DC 24 V) and enable hours (output stage energized)
- Modular option technology for application-specific unit configuration
- Uniform operation, identical parameter setting and the same unit connection technology for the entire MOVIDRIVE® unit series

Setpoint technology

- Ramp switchover (total of 4 ramps)
- Motor potentiometer, can be combined with analog setpoint and internal fixed setpoints
- External setpoint selections: DC (0 ... +10 V, –10 V ... +10 V, 0 ... 20 mA, 4 ... 20 mA)
- S pattern for jerk-free speed changes
- Programmable input characteristic for flexible setpoint processing
- 6 bipolar fixed setpoints which can be mixed with external setpoints and motor potentiometer function
- Primary frequency input
- Adjustable jerk limitation

Communication / operation

- System bus for networking max. 64 MOVIDRIVE® units to one another
- RS485 interface for communication between one PLC / IPC and up to 31 inverters
- Simple startup and parameter setting using the keypad or PC
- Pluggable memory module for quick unit replacement during service

System expansion

- Extensive expansion options, for example:
  - Removable plain text keypad with parameter memory
  - USB11A, RS232 ↔ RS485 interface adapter
  - Fieldbus interface, either PROFIBUS, INTERBUS, Ethernet, DeviceNet, CAN / CANopen
  - Input/output card
  - Braking resistors, line filters, line chokes, output chokes, output filters
- MOVITOOLS® operating software with SCOPE process data visualization
- Application version with access to technology functions and application modules for specific applications
- MOVIDRIVE® MDR60A regenerative power supply unit. Regenerative energy is fed back into the supply system, which removes the thermal load from the control cabinet and saves costs.

Standards / certificates

- UL, cUL, C-Tick approval. The MOVIDRIVE® MDR60A1320-503-00 unit does not have UL or cUL or C-Tick approval.
- Safe disconnection of power and electronic connections according to EN 61800-5-1.
- Fulfills all the requirements for CE certification of machines and plants equipped with MOVIDRIVE® units on the basis of the EC Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC. Complies with the EMC product standard EN 61800-3.
- Complies with the safety requirement "Safe stop" according to EN 954-1, category 3

1.3 Additional functions of the application version

SEW-EURODRIVE offers additional functions for special applications. You can use these additional functions with MOVIDRIVE® units in the application version (...-0T).

The following additional functions are available:

- Electronic cam
- Internal synchronous operation

	NOTE
	Refer to the "Electronic Cam" and "Internal Synchronous Operation" manuals for detailed information about the additional functions.

Electronic cam;

You can use the MOVIDRIVE® range of units with "electronic cam" whenever you need to harmonize complex sequences of motion in cyclical machines. This solution gives you much greater flexibility in comparison to the mechanical cam. As a result, it meets the needs of modern production and processing lines.

A user-friendly cam editor supports you during startup. You also have the option of importing existing cam data You can also set application-specific parameters for the engagement and disengagement phases using the cam editor.

Note the following points:

- The "electronic cam" can only be implemented with MOVIDRIVE® MDX61B units in application version (...-0T).
- Encoder feedback is mandatory. This is why the "electronic cam" can only be realized in "CFC," "SERVO" and "VFC-n control" operating modes with master/slave connection via X14-X14 or with an SBus connection.
- The "electronic cam" is only available in parameter set 1.
- The "synchronous operation board type DRS11B" option cannot be used together with the "electronic cam" function.

Motors and encoders

Use the following motor types:

- For operation with MOVIDRIVE® MDX61B...-4-0T:
  - CT/CV asynchronous servomotor, high-resolution sin/cos encoder installed as standard or HIPERFACE® encoder
  - DT/DV/D AC motors with incremental encoder, preferably high-resolution sin/cos encoder or HIPERFACE® encoder.
  - DS/CM/CMD/CMP synchronous servomotors, resolver (installed as standard) or HIPERFACE® encoder.

High-resolution speed measurement is required for optimum operation of the electronic cam. The encoder installed as standard in the CT/CV and DS/CM/CMD/CMP motors meets the requirements. SEW-EURODRIVE recommends using high-resolution sin/cos encoders as incremental encoders if DT/DV/D motors are used.

Example

The figure below shows a typical application for the "electronic cam." Filled yogurt pots are transported for further processing. The "electronic cam" function allows for smooth movement, which is an important requirement for this application.

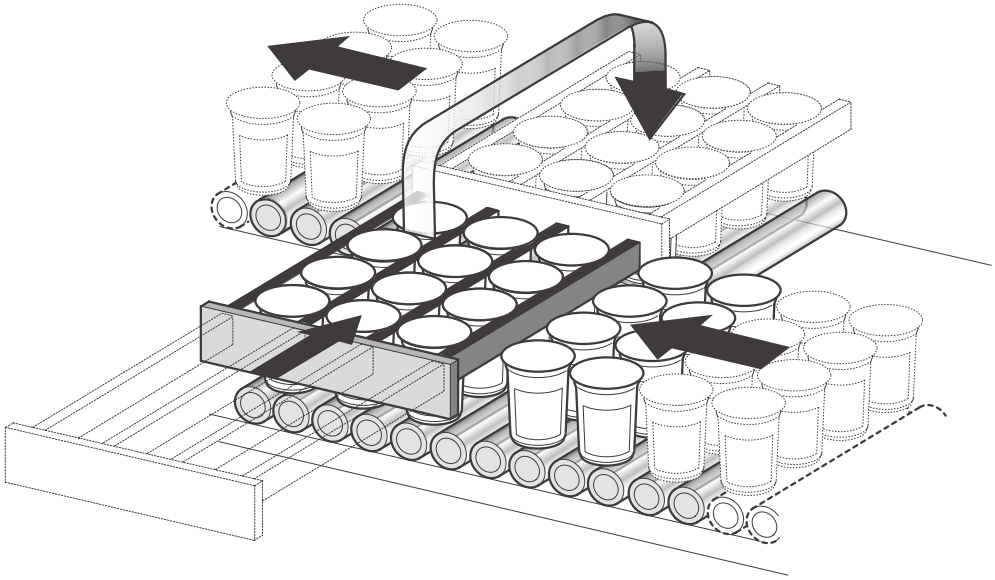

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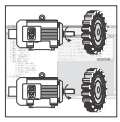
Figure 2: Application example for the "electronic cam."

Internal synchronous operation



You can use the MOVIDRIVE® range of units with "internal synchronous operation" whenever a group of motors has to be operated at a synchronous angle in relation to one another or with an adjustable proportional ratio (electronic gear). A user-friendly editor guides you through the startup procedure.

Note the following points:

- "Internal synchronous operation" can only be implemented with MOVIDRIVE® MDX61B units in application version (...-0T).
- Encoder feedback is mandatory. This is why "internal synchronous operation" can only be realized in "CFC," "SERVO" and "VFC-n control" operating modes with master/slave connection via X14-X14 or with an SBus connection.
- "Internal synchronous operation" is only available in parameter set 1.
- The "synchronous operation board DRS11B" option cannot be used together with "internal synchronous operation."

Motors and encoders

Use the following motor types:

- For operation with MOVIDRIVE® MDX61B...-4-0T:
  - CT/CV asynchronous servomotor, high-resolution sin/cos encoder installed as standard or HIPERFACE® encoder
  - DT/DV/D AC motors with incremental encoder, preferably high-resolution sin/cos encoder or HIPERFACE® encoder.
  - DS/CM/CMD/CMP synchronous servomotors, resolver (installed as standard) or HIPERFACE® encoder.

High-resolution speed measurement is required for optimum operation of the "internal synchronous operation." The encoder installed as standard in the CT/CV and DS/CM/CMD/CMP motors meets the requirements. SEW-EURODRIVE recommends using high-resolution sin/cos encoders as incremental encoders if DT/DV/D motors are used.

Example

The figure below shows a typical application for the "internal synchronous operation." Extruder material must be cut to length. The saw receives a start signal and synchronizes with the material. During the sawing process, the saw moves synchronously with the material. At the end of the sawing process the saw moves back to its starting position.

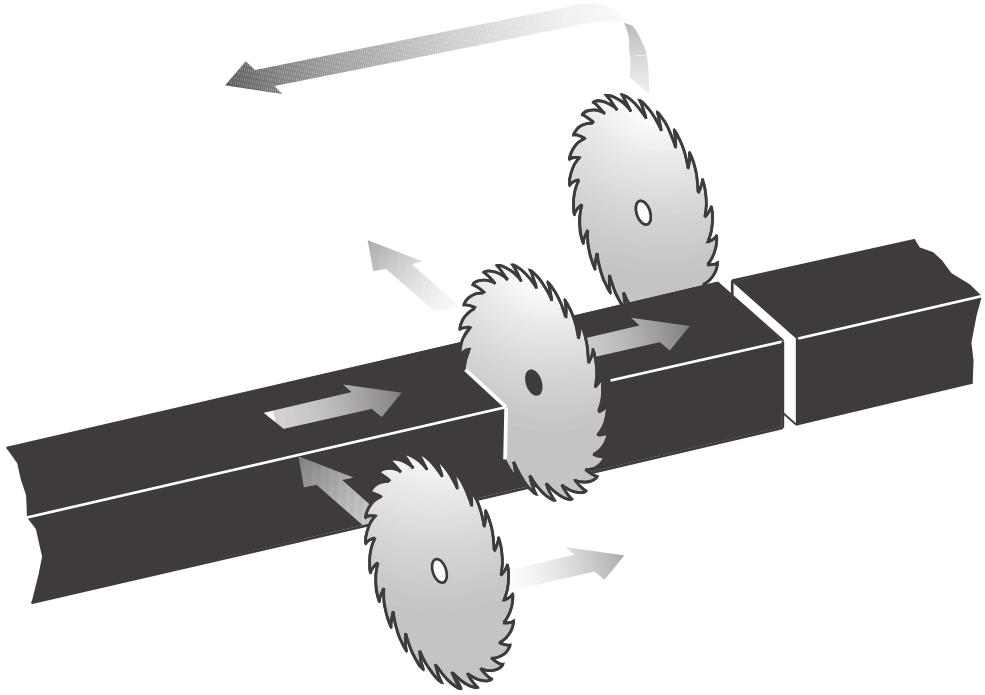


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Figure 3: Typical application for the "internal synchronous operation" function

1.4 Application modules for MOVIDRIVE® MDX61B

The drive application

The drive application often involves more than just adjusting the speed of a motor. The inverter often has to control motion sequences and take on typical PLC tasks. More and more complex drive applications have to be solved, without this resulting in lengthy project planning and startup.

The solution with MOVIDRIVE®

SEW-EURODRIVE offers various standardized control programs specifically for "positioning," "winding" and "controlling" applications. These programs are called application modules. The application modules are part of the MOVITOOLS® operating software and can be used with units in application version.

A user-friendly user interface guides you through the process of setting the parameters. All you have to do is enter the parameters you need for your application. The application module uses this information to create the control program and loads it into the inverter. MOVIDRIVE® takes over complete control of the motion processes, the load is taken off the machine control and decentralized concepts are easier to implement.

The advantages at a glance

- Wide range of functions
- User-friendly user interface
- You only have to enter the parameters needed for the application
- Guided parameter setting process instead of complicated programming
- No programming know-how required
- No lengthy training, therefore quick project planning and startup
- All movement functions are controlled directly in MOVIDRIVE®
- Decentralized concepts can be implemented more easily

Scope of delivery and documentation

The application modules are part of the MOVITOOLS® operating software and can be used with MOVIDRIVE® MDX61B units in application version (...-0T). The individual application manuals can also be downloaded as PDFs from the SEW homepage.

Available application modules

The application modules currently available are listed below. These application modules are explained in the following pages.

Positioning

Linear movement; the inverter manages the movement records:

- Table positioning via terminal or fieldbus

Linear movement; the PLC manages the movement records:

- Positioning via bus
- Extended positioning via bus
- Absolute positioning (Rapid / creep speed positioning)

Rotary motion:

- Module positioning via terminals: The inverter manages the movement records
- Module positioning via fieldbus: The PLC manages the movement records

Winding

- Center winder

Controlling

- Flying saw
- DriveSync via fieldbus
- Sensor-based positioning

Application

The following illustration shows an example of how the various SEW application modules are used in a high-bay warehouse.

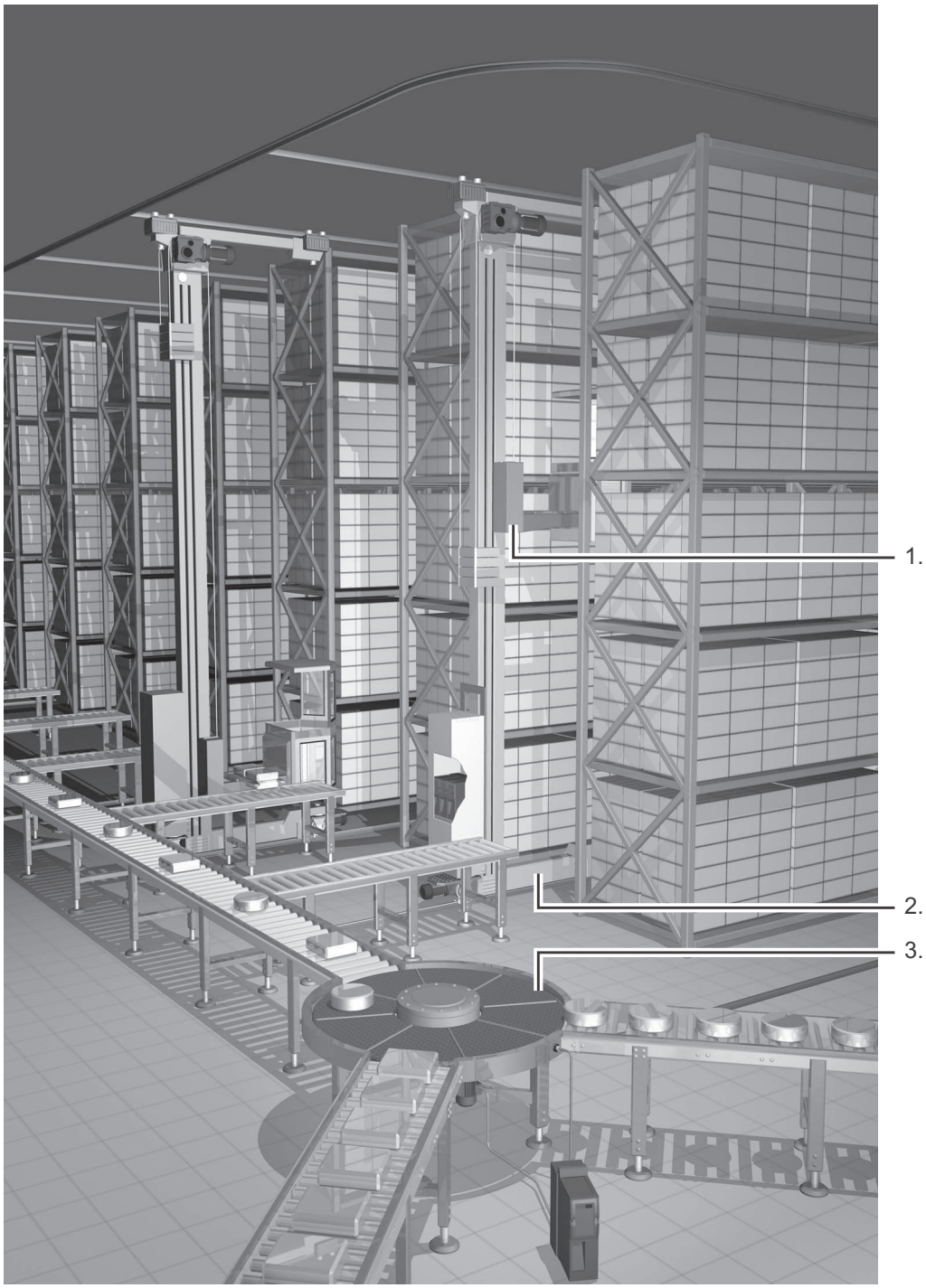

Figure 4: Use in a high-bay warehouse

1. Hoist: Table positioning
2. Travel axis: Absolute or bus positioning
3. Rotary distributor: Modulo positioning

Positioning

The application modules for the "Positioning" application are suited to all applications where target positions are specified and movement then takes place to those positions. Movement can either be linear or rotatory.

For example, trolleys, hoists, gantries, rotary tables, swiveling devices as well as storage and retrieval units.

Linear positioning

In the case of linear positioning application modules, SEW-EURODRIVE distinguishes between whether the movement records are managed in the inverter or in the master PLC.

Movement records in the inverter

- **Table positioning via terminals**
- **Table positioning via fieldbus**

These application modules are suited to applications in which movement only has to take place to a limited number of different target positions and in which the highest possible degree of independence from the machine control is required.

Up to 32 movement records can be managed in the inverter in these application modules. A movement record comprises target position, speed and ramp. The target position to which movement is to take place is selected using binary code, by means of the binary inputs of the inverter or via the virtual terminals (fieldbus, system bus). These application modules come with the following range of features:

- Up to 32 table positions can be defined and selected.
- The travel speed can be selected for each positioning movement.
- The ramp can be set separately for each positioning movement.
- Software limit switches can be defined and evaluated.
- Either increment or absolute encoders can be evaluated.
- Guided startup and diagnosis.

Four operating modes are available for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The machine zero is determined automatically for incremental position measurement.
- Teach-In: The saved position can be corrected without a programming device.
- Automatic mode: Higher-level PLC controls the process automatically.

Movement records in the PLC

- **Positioning via bus**
- **Extended positioning via bus**

These application modules are suited to applications with a large number of different target positions.

The movement records are managed in the PLC for these application modules. The target position and travel speed are specified via the fieldbus or system bus. These application modules come with the following range of features:

- Any number of target positions can be defined and selected via fieldbus / system bus.
- The travel speed can be selected as required via the fieldbus / system bus for each positioning movement.
- Software limit switches can be defined and evaluated.
- Either increment or absolute encoders can be evaluated.
- Straightforward continuation to the higher-level controller.

- Guided startup and diagnosis.

Three operating modes are available for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The machine zero is determined automatically for incremental position measurement.
- Automatic mode: Higher-level PLC controls the process automatically.

- **Absolute positioning (Rapid / creep speed positioning)**

This application module is suitable for applications in which there is a high tendency to vibrate, for example storage and retrieval units for high-bay warehouses or heavy trolleys.

In this application module, the movement records are also managed in the PLC and specified via the fieldbus or system bus. No motor encoder is required. The absolute encoder mounted on the travel path is used for positioning. This application module comes with the following range of features:

- Any number of target positions can be defined and selected via fieldbus / system bus.
- Software limit switches can be defined and evaluated.
- Only absolute encoders are used for position measurement.
- No motor encoder is required.
- Straightforward connection to the higher-level controller.
- Guided startup and diagnosis.

The following operating modes are available for controlling the machine:

- Jog mode: The machine can be moved manually.
- Automatic mode: Higher-level PLC controls the process automatically.

Rotational positioning

- **Modulo positioning**

A large number of movements have to be controlled in automated conveyor and logistics applications to transport the material. Linear movements in the form of trolleys or hoists, and rotary movements via rotary tables play an important role in these applications.

Rotary movements are often synchronized (circular transfer tables); the material is fed at a specific degree value. However, there are also many rotational applications in which the material should be moved to its destination by the shortest possible route (distance-optimized positioning) or in which it is only permitted to move to the target position in a defined direction of rotation (positioning with fixed direction of rotation).

The position axis is represented on a numbered circle from 0 ° to 360 ° to meet these requirements. The actual position is always in this range.

The "modulo positioning" application module accomplishes these tasks using various operating modes which are selected via binary inputs (16 table positions) or virtual terminals (control via fieldbus, variable positions).

The following operating modes are available for controlling the machine:

- Jog mode
- Teach mode (terminal control only)
- Referencing mode
- Automatic mode with position optimization
- Automatic mode with direction of rotation inhibit (clockwise - counterclockwise)
- Synchronous automatic mode

The "modulo positioning" module offers the following advantages:

- User-friendly user interface
- Only the parameters required for Modulo positioning (number of teeth in the gear unit, speed) have to be entered
- Guided parameter setting instead of complicated programming
- Monitor mode for optimum diagnosis
- Users do not need any programming experience
- Rapid familiarization with the system

Winding

- **Center winder**

The "Central winder" application module is suitable for applications in which endless material, such as paper, plastic, fabrics, sheet metal or wire, must be wound, unwound or rewound continuously.

Control takes place either via the binary inputs of the inverter or using the virtual terminals (fieldbus, system bus).

The "Central winder" application module comes with the following range of features:

- Constant tensile force or web speed independent of the diameter.
- Automatic calculation of the speed-dependent friction factors via a teach-in run.
- Winding characteristics to prevent the winding material from becoming loose.
- Binary selection of 4 different winding cores.
- Diameter can be determined using a diameter calculator (master encoder required) or an analog input (distance sensor required).
- Free-running function (jog).
- CW / CCW winding, winding / unwinding.
- Simple connection to the master controller (PLC).
- Guided startup and diagnosis.

Four operating modes are available for controlling the machine:

- Jog mode: The machine can be moved to the right or the left manually.
- Teach-in run: The speed-dependent friction factors are determined automatically.
- Automatic mode with constant tension.
- Automatic mode with constant velocity.

Controlling

- **Flying saw**

The "Flying saw" application module is suited to applications in which endless material has to be cut, sawn or pressed, for example in diagonal saws or flying punches.

This application module is used to control the sequence of motion according to specific values. This application module comes with the following range of features:

- Choice of fieldbus or terminal control.
- Cut edge protection or sorting using the "pulling a gap" function.
- Immediate cut function by manual interrupt.
- Counter for material length.
- Straightforward connection to the higher-level controller.
- Guided startup and diagnosis.

Four operating modes are available for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The system reference point is determined.
- Positioning mode
- Automatic operation

- **DriveSync via fieldbus**

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

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

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

The "DriveSync via fieldbus" application module comes with the following range of features:

- Guided startup as well as extensive diagnostic functions.
- High degree of similarity with "Extended positioning via bus."
- One program module for the master and slave drive.
- The selected IPOS$^{plus®}$ encoder source 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.
- Endless rotation is supported by the modulo function.

Four operating modes are available for controlling the application:

- Jog mode
- Reference travel
- Positioning mode
- Synchronous operation
  - The electrical connection of the master/slave can be made using the X14 encoder connection or an SBus connection.
  - If the SBus connection is used, the content of the send object can be adjusted.
  - Time or position-related sequence of motion for synchronization processes.
  - The startup cycle process can also be started with interrupt control.

- **Sensor-based positioning**

This application module is used to position the drive using an external sensor signal plus an adjustable remaining distance. This application module is especially suitable for applications in the following industrial sectors:

- Materials handling
  - Trolleys
  - Hoists
  - Rail vehicles
- Logistics
  - Storage and retrieval units
  - Transverse carriages

1.5 MOVITOOLS® operating software

Description

MOVITOOLS® is a program package comprising SHELL, SCOPE and the IPOS$^{plus®}$ Compiler. You can use MOVITOOLS® to address either of the unit series: MOVIDRIVE® MDX60B/61B, MOVIDRIVE® *compact* and MOVITRAC® 07A.

- SHELL can be used to start up the drive and set its parameters quickly and easily.
- SCOPE provides extensive oscilloscope functions for drive diagnostics.
- IPOS$^{plus®}$ Compiler provides a convenient way of writing programs for applications in a high-level language.
- The assembler enables you to write programs directly on the machine.
- The device status shows you the status of the connected unit.

Various application modules, such as table positioning, are already stored in MOVITOOLS® as IPOS$^{plus®}$ programs and can be activated using the application version units.

MOVITOOLS® is supplied on a CD-ROM and can also be downloaded from the SEW homepage (http://www.sew-eurodrive.de). MOVITOOLS® can be operated with the following operating systems:

- Windows® 95
- Windows® 98
- Windows NT® 4.0
- Windows® 2000
- Windows® Me
- Windows® XP

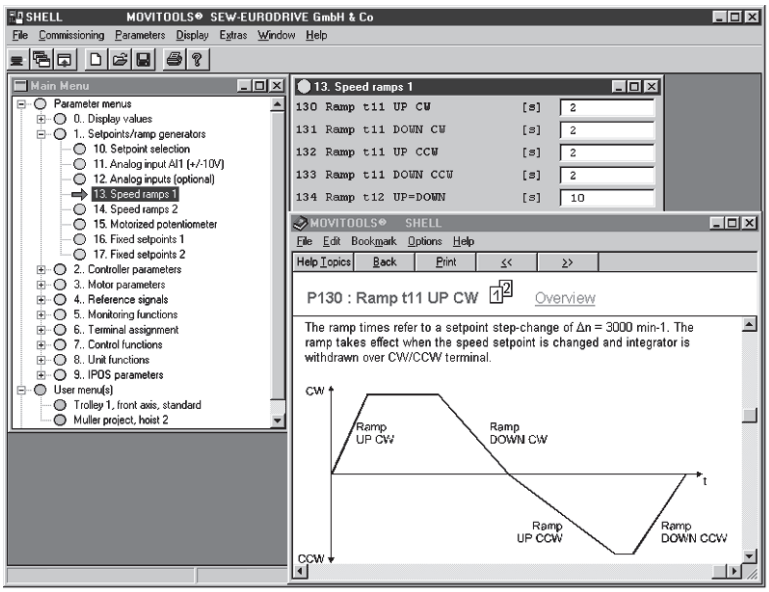

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Figure 5: MOVITOOLS® window