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SEW EURODRIVE

MOVIDRIVE® MD_60A
Absolute Positioning

Edition

03/2001

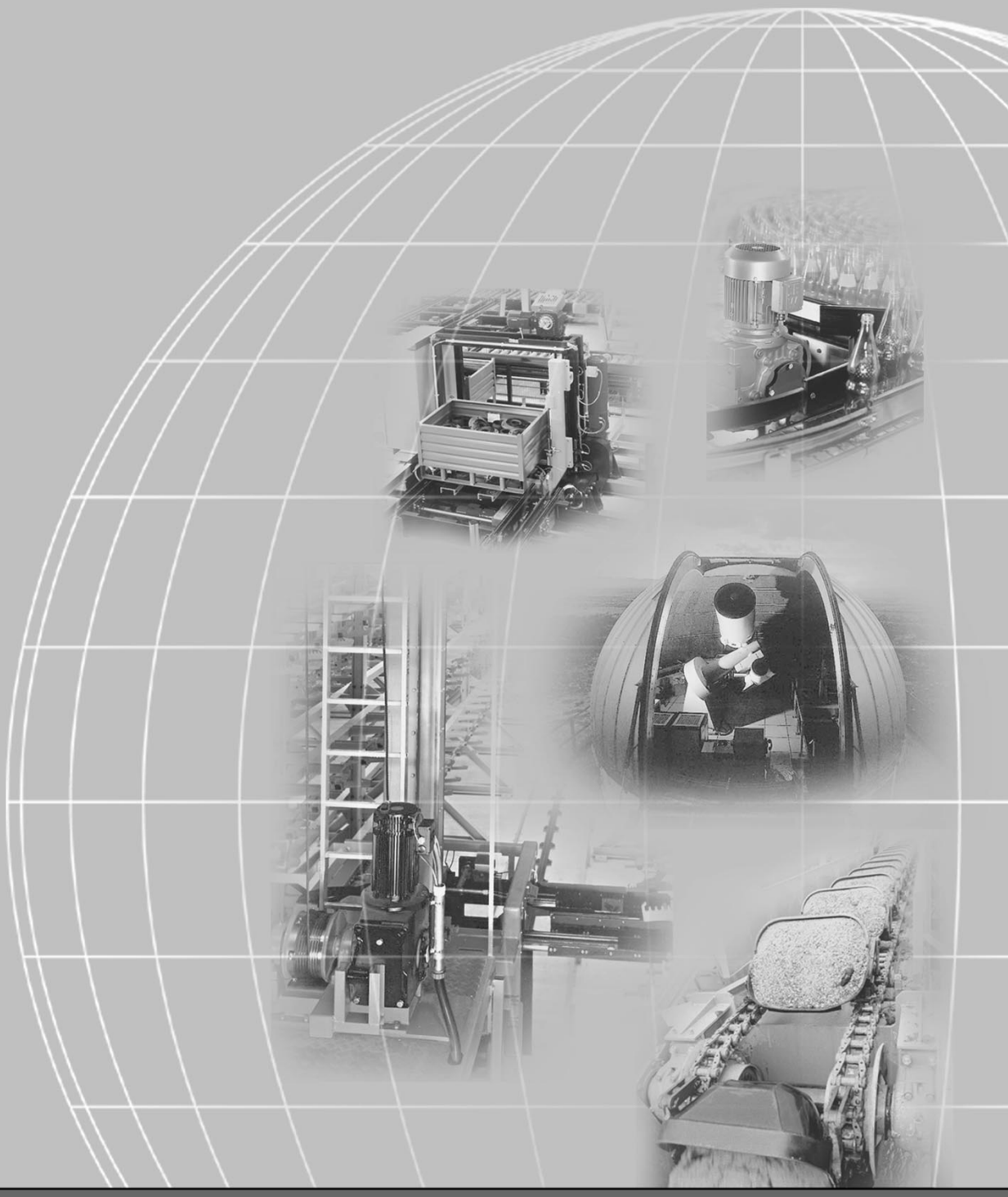


Manual

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1 Important Notes

- **This manual does not replace the detailed operating instructions!**
- **Installation and startup only by trained personnel observing applicable accident prevention regulations and the MOVIDRIVE® operating instructions!**

Documentation

- Read through this manual carefully before you commence installation and startup of MOVIDRIVE® drive inverters with this application module.
- This manual assumes that the user has access to and 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.
- The documentation has to be observed to satisfy the requirements for fault-free operation and fulfillment of any rights to claim under guarantee.

Safety and warning instructions

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



Electrical hazard
Possible consequences: Severe or fatal injuries.



Hazard
Possible consequences: Severe or fatal injuries.



Hazardous situation
Possible consequences: Slight or minor injuries.



Harmful situation
Possible consequences: Damage to the unit and the environment.



Tips and useful information.

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2 System Description

2.1 Application fields

The "absolute positioning" application module is especially suited for applications which are prone to vibration when moving as a result of their mechanical structure. The absolute encoder is used for positioning, not for position control. This prevents the application's tendency towards vibration from being exacerbated by possible resonance between the mechanism and the absolute encoder.

A further advantage of absolute positioning is that AC motors without encoders can be used in conjunction with MOVIDRIVE® MDF60A.

The "absolute positioning" application module is especially suited for the following sectors:

- **Materials handling technology**
  - Trolleys
  - Hoists
  - Rail vehicles
- **Logistics**
  - Storage and retrieval units for high-bay warehouses
  - Transverse carriages
- **Palletizing/handling**
  - Multi-axis handling robots
  - Gantries

Absolute positioning offers the following advantages in these applications:

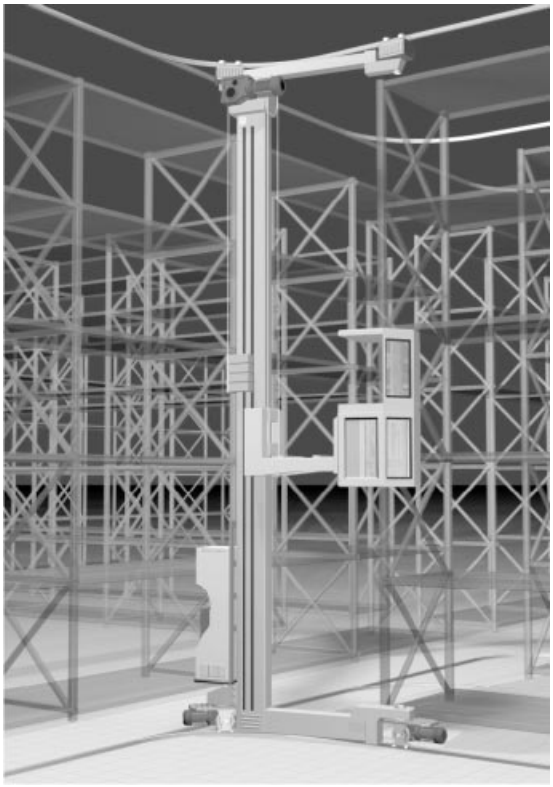
- AC motors without encoders are adequate in conjunction with MOVIDRIVE® MDF60A
- User-friendly user interface
- You only have to enter the parameters required for absolute positioning (ratios, speeds, diameters)
- User-friendly application programs guide you through the process of setting parameters, so there is no need for complicated programming
- Monitor mode for optimum diagnosis
- You do not need any programming experience
- Optimized for distance measurement with laser distance measuring equipment
- Long travel distances possible (2^{18} • travel unit)
- It does not take long to get to know the system

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2.2 Application examples

Storage and retrieval unit for high-bay warehouse

The travel axis of a storage and retrieval unit represents a typical application example of the "absolute positioning" application module. Storage and retrieval units for high-bay warehouses are particularly prone to vibration as a result of their tall mechanical structure, especially if a laser distance measuring unit is used for position control. Absolute positioning suppresses their tendency to vibrate.

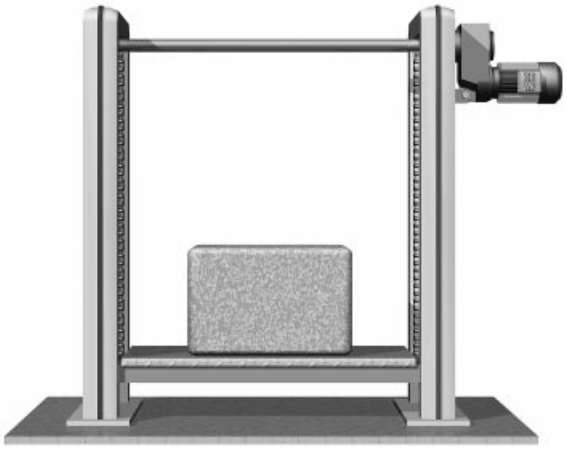


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Fig. 1: Application example of a storage and retrieval unit for high-bay warehouse

Hoist

Another typical application example is a hoist. A cable-operated encoder can be used as an absolute encoder for position detection.



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Fig. 2: Application example of a hoist

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3 Project Planning

3.1 Pre-requisites

PC and software

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

Licence

According to the licence conditions, there must be a licence label applied to each MOVIDRIVE® unit which is equipped with an application module. The application module is not allowed to be used on MOVIDRIVE® units without a licence label. The licence label should be applied directly below the type label (TERMINAL slot). The label contains the code number you need to activate the application module.

Inverters, motors and encoders

- **Inverters**

  absolute positioning can be performed using MOVIDRIVE® MDF/MDV/MDS60A units. absolute positioning does not require a speed-controlled drive, i.e. it is sufficient to combine a MOVIDRIVE® MDF60A with an AC motor without an encoder.

  The application always requires an absolute encoder, i.e. you always need the "absolute encoder interface type DIP11A" MOVIDRIVE® option.

  You will also need the MOVIDRIVE® fieldbus option (DFP11A, DFP21A, DFI11A, DFI21A, DFC11A, DFO11A, DFD11A) corresponding to the bus type you have selected for your application. However, you do not need an additional fieldbus option if you are going to use the standard system bus (SBus).

- **Motors**
  - For operation on MOVIDRIVE® MDF60A: DR/DT/DV/D AC motors without encoder.
  - For operation on MOVIDRIVE® MDV60A: CT/CV Asynchronous servomotors (encoder installed as standard) or DR/DT/DV/D AC motors with encoder option or AV1Y combination encoder.
  - For operation on MOVIDRIVE® MDS60A: DS/DY Ssynchronous servomotors, resolver installed as standard.

- **Absolute encoder**

  The application always requires an absolute encoder. The absolute encoder must always be connected to the "absolute encoder interface type DIP11A" MOVIDRIVE® option.

  - Interlocking (= zero slip) connection between the motor shaft and the load: The absolute encoder can either be mounted on the line or on the motor.
  - Non-positive (= with slip) connection between the motor shaft and the load: The absolute encoder must be mounted on the line.

  The permitted absolute encoders are listed in the DIP selection list (→ MOVIDRIVE® MD_60A system manual, description of parameter P950).

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3.2 Functional description

Functional characteristics

The "absolute positioning" application offers the following functional characteristics:

- Any number of target positions can be defined and selected by means of a fieldbus/ system bus.
- Long travel distance possible. The maximum possible travel distance depends on the set travel unit:

Travel unit	Maximum possible travel distance
1/10 mm	26.2144 m
mm	262.144 m
m	262 144 m

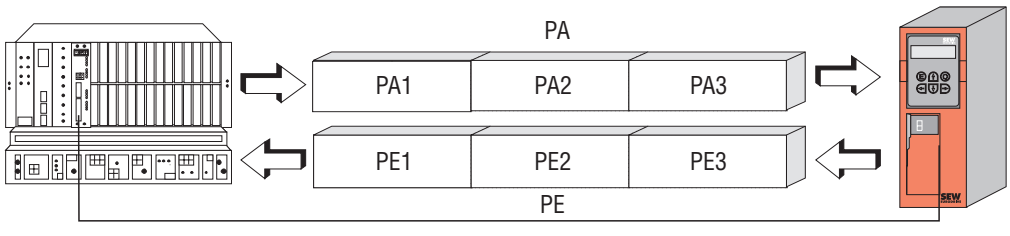
- Software limit switches can be defined and evaluated.
- Only absolute encoders are used for position measurement.
- No motor encoder is required, MOVIDRIVE® MDF60A is sufficient.
- Several motors can be operated on one inverter.
- Simple connection to the machine control (PLC).

Operating modes

The functions are implemented with two operating modes:

- **Jog mode**
  - The drive is moved clockwise or counterclockwise using bits 9 or 10 in control word 2 (PA1).
  - Changing between two jog speeds is achieved using bit 13 in control word 2 (PA1).

- **Automatic mode**
  - Positioning is started in automatic mode with bit 8 in control word 2 (PA1).
  - The target position is specified using process output data words PA2 and PA3.
  - The actual position is signaled back cyclically in user travel units using process input data words PE2 and PE3.
  - Confirmation of the target position to which movement has taken place via virtual binary output "target position reached."



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Fig. 3: Data exchange via process data

PA	= Process output data	PE	= Process input data
PA1	= Control word	PE1	= Status word
PA2	= Target position high	PE2	= Actual position high
PA3	= Target position low	PE3	= Actual position low

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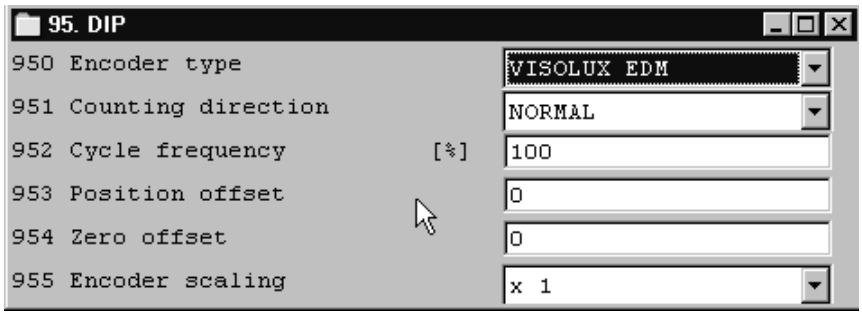
3.3 Scaling of the drive

The control needs to know the number of encoder pulses (increments) per travel unit so it can calculate the travel information and position the drive correctly. Furthermore, you can use the scaling function to set the user travel unit matching your application.

Activating the absolute encoder

You must activate the absolute encoder and set its scale before you can start using absolute positioning. You can accomplish this by opening the menu for parameter group 95_ "DIP" in MOVITOOLS/SHELL and making the following settings:

- Use parameter P950 "Encoder type" (DIP selection list) to select the connected absolute encoder.
- Parameters P951 – P955 do not have to be set. All necessary DIP settings are made when absolute positioning is started.



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Fig. 4: Activating the absolute encoder

Important:

The DIP startup function in MOVITOOLS cannot be used on drives without a motor encoder (MOVIDRIVE® MDF60A).

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3.4 Limit switches and machine zero

Machine zero

Note the following points during project planning:

- You need to set parameter P954 "Zero offset" (→ Fig. 4) if the machine zero (= reference point for absolute positioning) is to be different from the displayed position of the absolute encoder.
- The following formula applies: Machine zero = Absolute position + Zero offset

Software limit switches

Software limit switches perform an additional safety function by defining the limits of the travel range. Note the following points:

- Travel commands are not performed if their target positions lie beyond the software limit switches.
- Message 29 (1D hex) "software limit switch active" is sent in the status word to the machine control if a target position beyond the software limit switches is specified via the fieldbus/system bus. This message does not generate a fault. Fault bit PE1:5 "Fault/warning" is not set as a result.

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3.5 Process data assignment

The machine control (PLC) sends three process output data words (PA1 – PA3) to the inverter and receives three process input data words (PE1 – PE3) from the inverter.

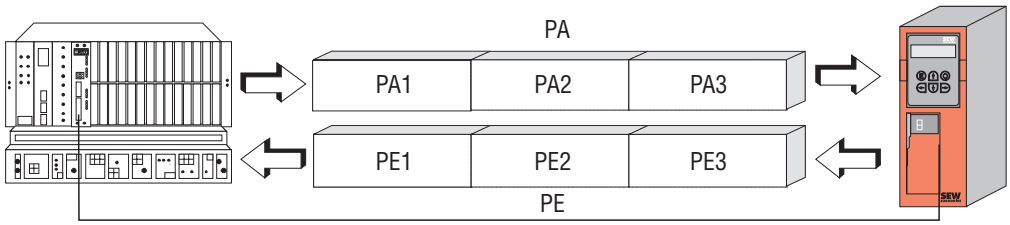


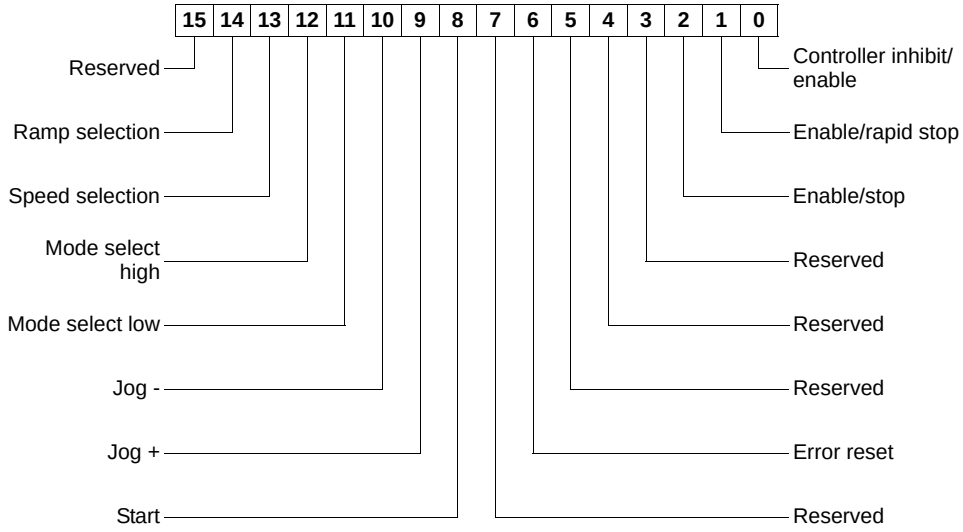
Fig. 5: Data exchange via process data

PA	= Process output data	PE	= Process input data
PA1	= Control word	PE1	= Status word
PA2	= Target position high	PE2	= Actual position high
PA3	= Target position low	PE3	= Actual position low

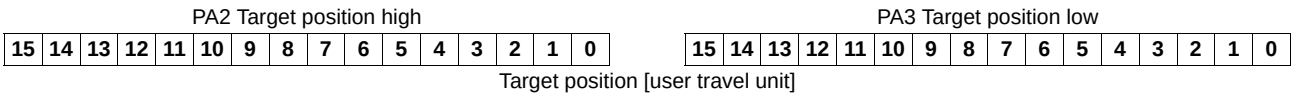
Process output data

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

- PA1: Control word



- PA2 + PA3: Target position

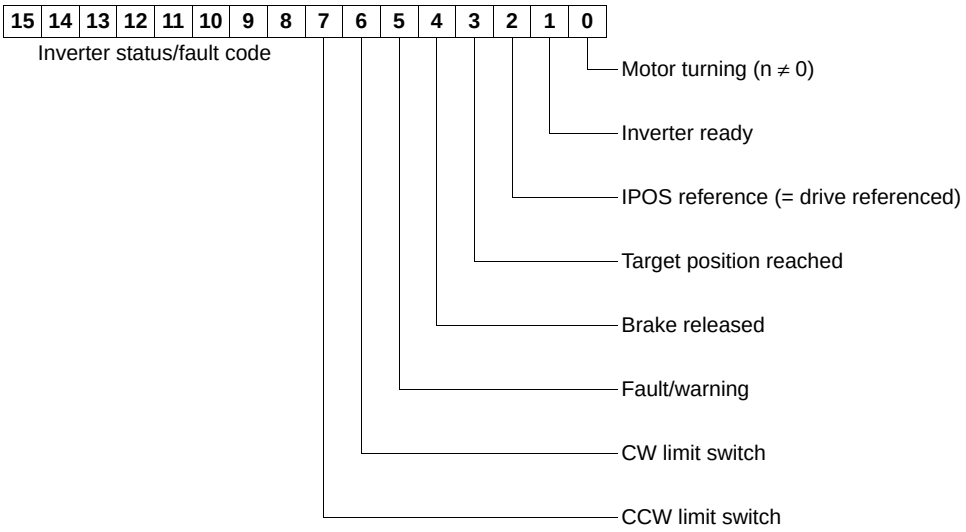


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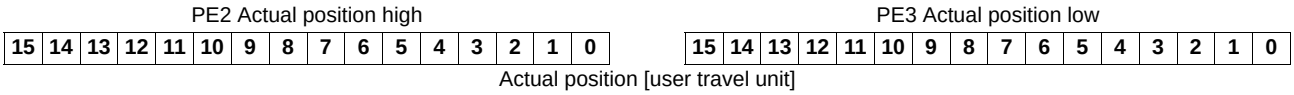
Process input data

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

- PE1: Status word



- PE2 + PE3: Actual position



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4 Installation

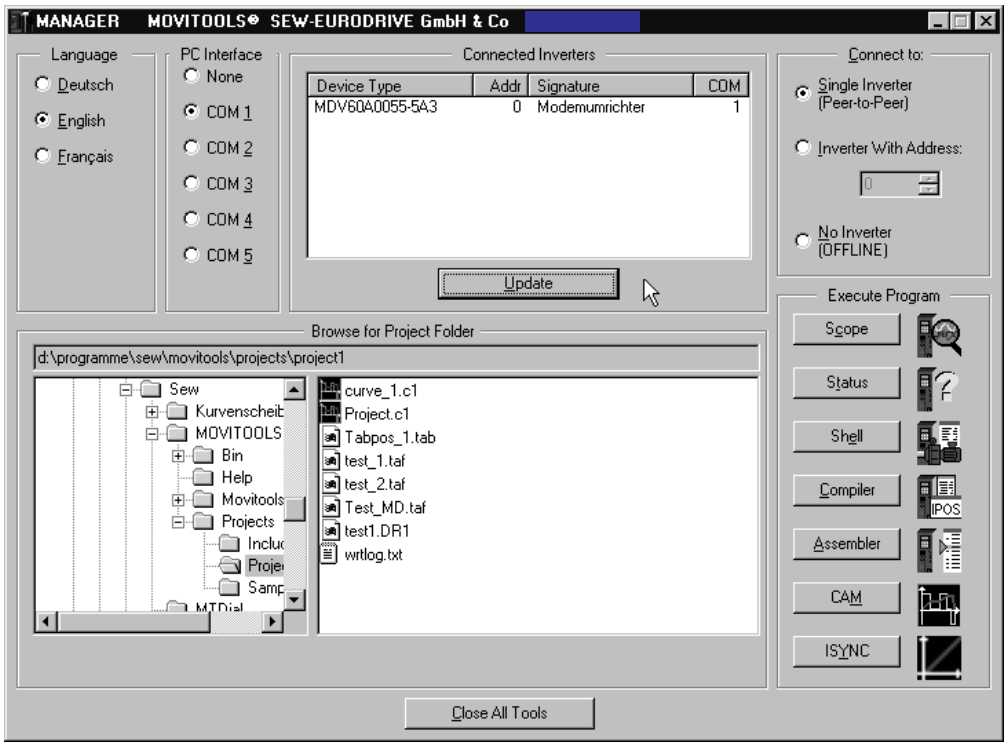
4.1 Software

MOVITOOLS

The "absolute positioning" application module is part of the SEW MOVITOOLS software package (version 2.50 and higher). Proceed as follows to install MOVITOOLS on your computer:

- Place the MOVITOOLS CD into the CD ROM drive of your PC.
- Select "Start/Run...."
- Type "{Drive letter of your CD drive}:setup" and press the Enter key.
- The MOVITOOLS setup menu appears. Follow the instructions of the installation wizard.

You can now use the Program Manager to start MOVITOOLS. If a MOVIDRIVE® unit is connected to your PC, select the correct port (PC COM port) and set point-to-point connection. Select <Update> to display the inverter in the "Connected Units" window.



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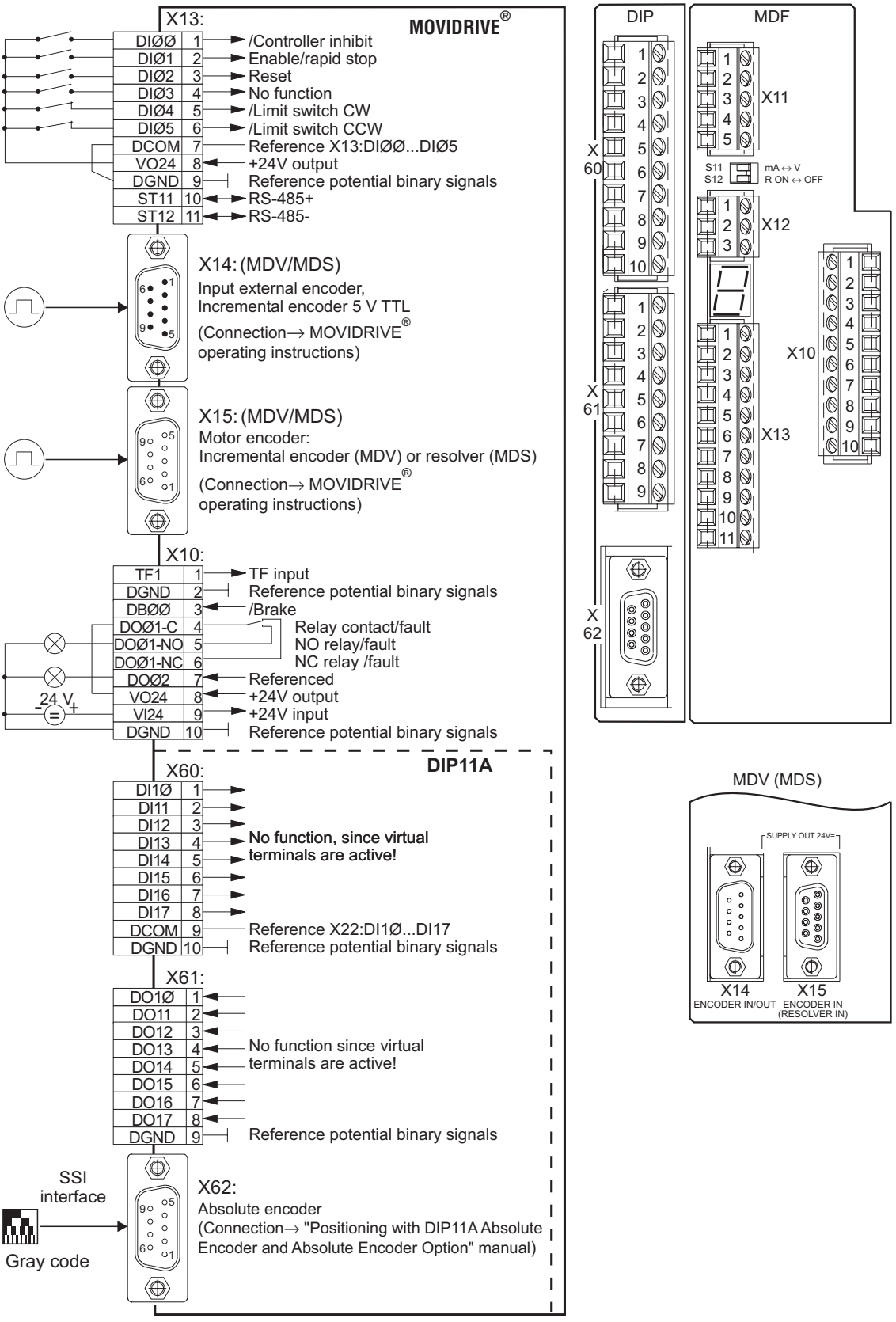
Fig. 6: MOVITOOLS window

Licence

According to the licence conditions, there must be a licence label applied to each MOVIDRIVE® unit which is equipped with an application module. The application module is not allowed to be used on MOVIDRIVE® units without a licence label. The licence label should be applied directly below the type label (TERMINAL slot). The label contains the code number for activating the application module.

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4.2 Basic unit with "absolute encoder interface type DIP11A" option



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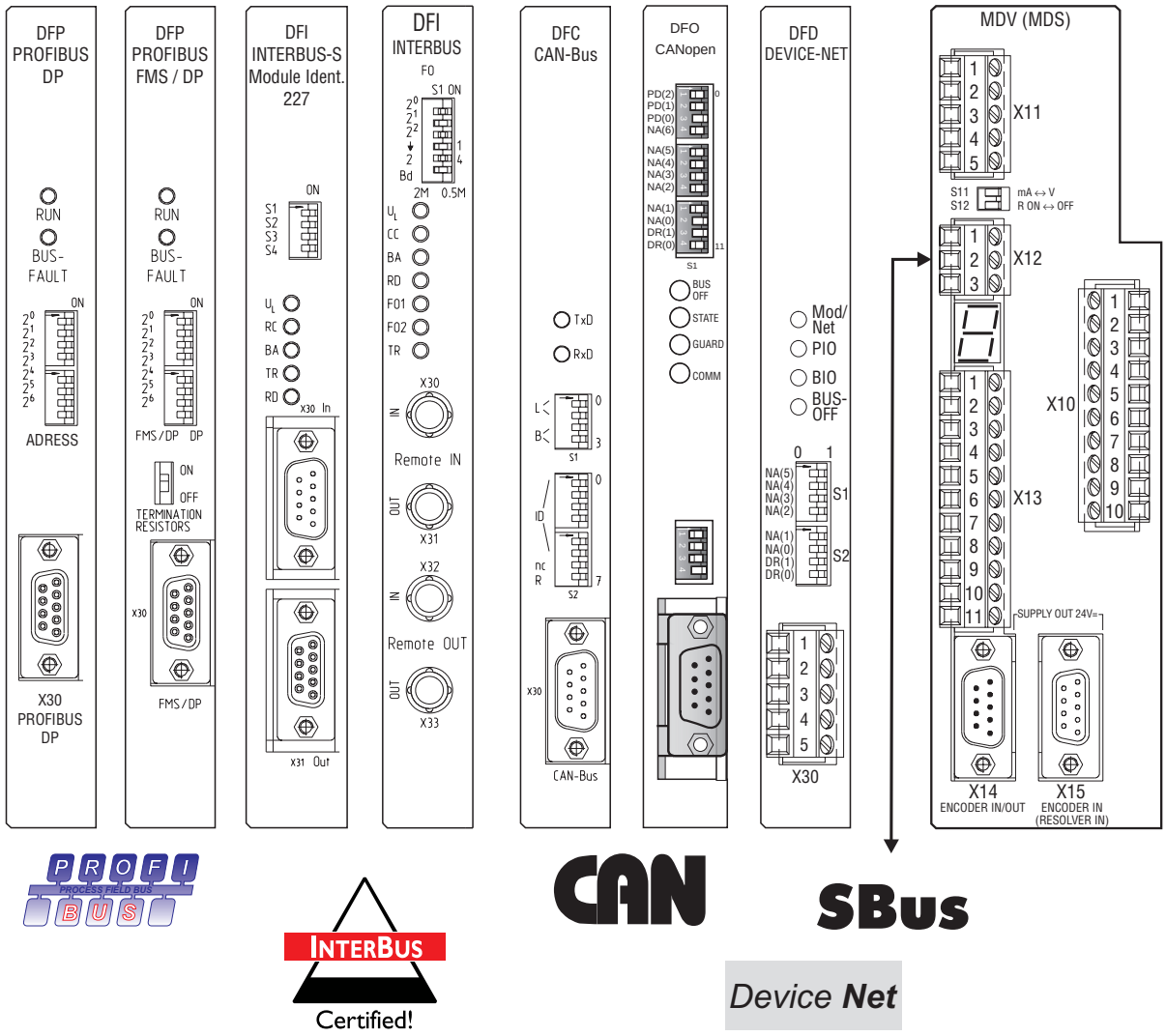
Fig. 7: Wiring diagram for basic unit with DIP11A option

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4.3 Bus installation

Overview

For the bus installation, please note the information in the relevant fieldbus manuals which are included with the fieldbus interfaces. Please refer to the operating instructions for information about installing the system bus (SBus).



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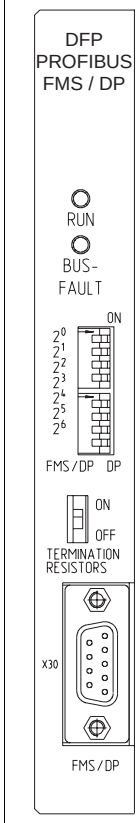
Fig. 8: Bus types

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PROFIBUS (DFP11A)

The PROFIBUS documentation package contains detailed information. This package can be ordered from SEW. This documentation package contains the GSD files and type files for MOVIDRIVE® in order to help with project planning and facilitate startup.

Technical data

	Option	PROFIBUS fieldbus interface type DFP11A
	Part number	822 724 1
	Startup and diagnostic tool	MOVITOOLS software and DBG11A keypad
	Protocol options	• PROFIBUS-DP to EN 50170 V2 / DIN E 19245 P3 • PROFIBUS-FMS to EN 50170 V2 / DIN E 19245 P3 • Mixed mode PROFIBUS DP/FMS (combi-slave)
	Supported baud rates	Automatic detection of baud rate: • 9.6 kbaud • 19.2 kbaud • 93.75 kbaud • 187.5 kbaud • 500 kbaud • 1500 kbaud
	Connection	9-pin sub D socket Assignment to EN 50170 V2 / DIN 19245 P3
	Bus termination	Can be activated for cable type A (up to 1500 kbaud) to EN 50170 V2 / DIN 19245 P3
	Station address	0 – 125, can be set using DIP switch
	Default bus parameter	Min-T_{SDR} for FMS/DP or DP mode can be selected via DIP switch
	GSD file	SEW_6000.GSD
	Weight	0.2 kg (0.44 lb)

1. Green LED: RUN
2. Red LED: BUS FAULT
3. DIP switch for setting the station address and changing from FMS/DP mixed mode to pure DP mode.
4. DIP switch for switching the bus terminating resistor on and off
5. 9-pin sub D socket: bus connection

Pin assignment

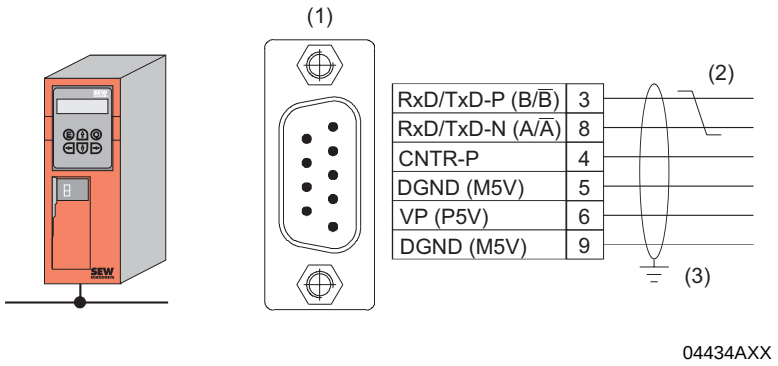


Fig. 9: Assignment of 9-pin sub D plug to EN 50170 V2

(1) 9-pin sub D plug

(2) Twist the signal wires together!

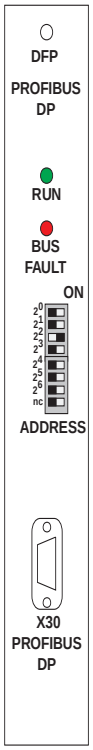
(3) Conductive connection is necessary between the plug housing and the shield!

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PROFIBUS (DFP21A)

The PROFIBUS documentation package contains detailed information. This package can be ordered from SEW. This documentation package contains the GSD files and type files for MOVIDRIVE® in order to help with project planning and to facilitate startup.

Technical data

	Option	PROFIBUS fieldbus interface type DFP21A
	Part number	823 618 6
	Startup and diagnostic tool	MOVITOOLS software and DBG11A keypad
	Protocol option	PROFIBUS-DP to EN 50170 V2 / DIN E 19245 P3
	Supported baud rates	Automatic detection of baud rate from 9.6 kbaud – 12 Mbaud
	Connection	9-pin sub D socket Assignment to EN 50170 V2 / DIN 19245 P3
	Bus termination	Not integrated, must be implemented in the PROFIBUS connector.
	Station address	0 – 125, can be set using DIP switch
	GSD file	SEW_6003.GSD
	DP identity number	6003 hex = 24579 dec
	Weight	0.2 kg (0.44 lb)

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

Pin assignment

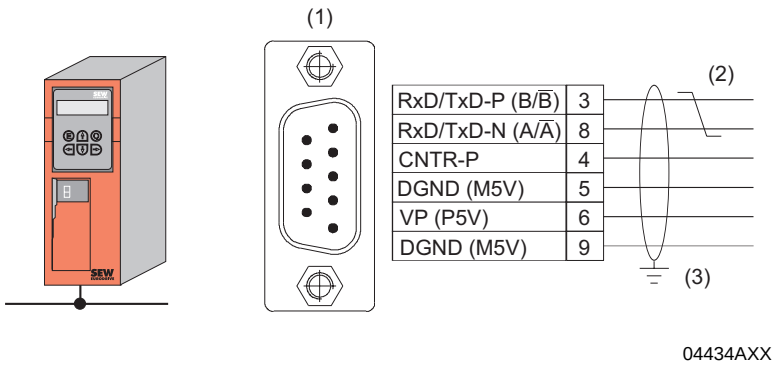


Fig. 10: Assignment of 9-pin sub D plug to EN 50170 V2

(1) 9-pin sub D plug

(2) Twist the signal wires together!

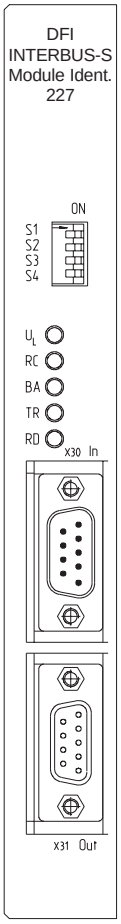
(3) Conductive connection is necessary between the plug housing and the shield!

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INTERBUS (DFI11A)

The INTERBUS documentation package contains detailed information. This package can be ordered from SEW.

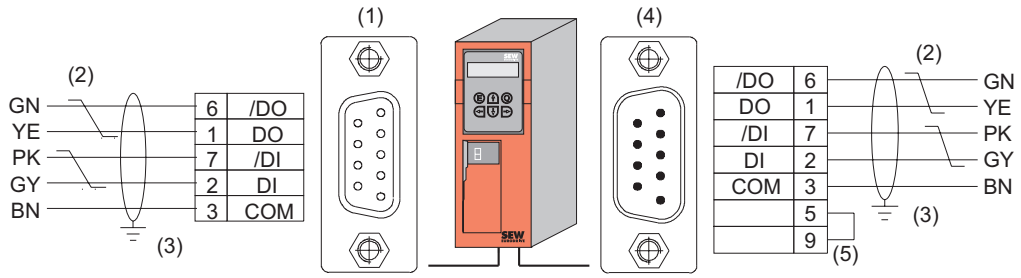
Technical data

	Option	INTERBUS fieldbus interface type DFI11A
	Part number	822 723 3
	Startup and diagnostic tool	MOVITOOLS software and DBG11A keypad
	Connection	Remote bus input: 9-pin sub D plug Remote bus output: 9-pin sub D socket RS-485 transmission technology, 6-core shielded and twisted-pair cable
	Module ID	$E3_{hex} = 227_{dec}$
	Weight	0.2 kg (0.44 lb)

1. DIP switch for setting the number of process data items
2. 4 × green LED: Diagnostic LEDs
3. 1 × red LED: Diagnostic LED
4. 9-pin sub D plug: Remote bus input
5. 9-pin sub D socket: Remote bus output

Pin assignment

Conductor color abbreviations to IEC 757.



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Fig. 11: 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

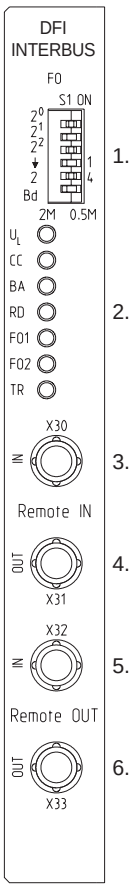
(5) Jumper pin 5 with pin 9!

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INTERBUS with fiber optic cable (DFI21A)

The INTERBUS FO documentation package contains detailed information. This package can be ordered from SEW.

Technical data

	Option	INTERBUS fieldbus interface type DFI21A (FO)
	Part number	823 093 5
	Startup and diagnostic tool	MOVITOOLS software, DBG11A keypad and CMD tool
	Supported baud rates	500 kbaud and 2 Mbaud, selection via DIP switch
	Connection	Remote bus input: 2 F-SMA plugs Remote bus output: 2 F-SMA plugs Optically regulated FO interface Optical converter (RS-485 → FO) possible
	Weight	0.2 kg (0.44 lb)

1. DIP switch for 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: Continuing remote bus

Connection assignment

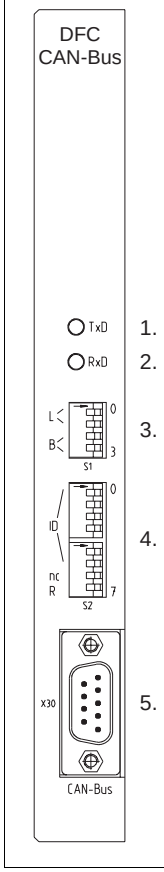
Position	Signal	Direction	FO core color
3	FO remote IN	Receive data	Orange (OG)
4	Incoming remote bus	Send data	Black (BK)
5	FO remote OUT	Receive data	Black (BK)
6	Outgoing remote bus	Send data	Orange (OG)

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CAN bus (DFC11A)

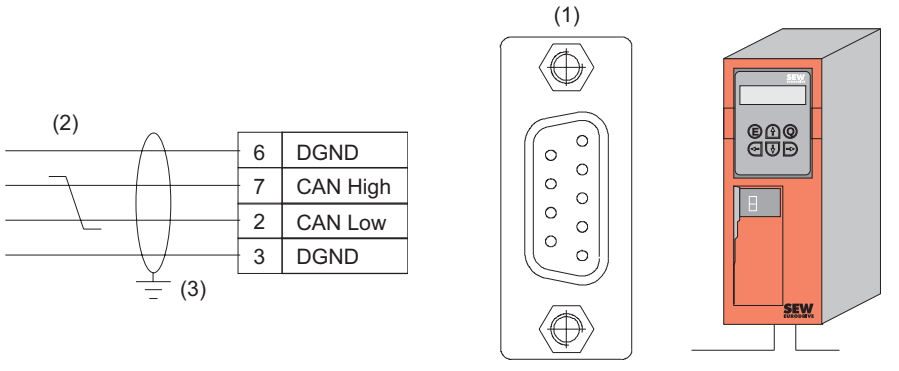
The CAN bus documentation package contains detailed information. This package can be ordered from SEW.

Technical data

	Option	CAN fieldbus interface type DFC11A
	Part number	822 725 X
	Startup and diagnostic tool	MOVITOOLS software and DBG11A keypad
	Supported baud rates	Can be selected via DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud • 1000 kbaud
	Connection	9-pin sub D plug Assignment to CiA standard 2-core twisted cable to ISO 11898
	Bus termination	Can be switched on using DIP switch (120 Ω)
	Address range	0 – 63, can be selected via DIP switch
	Weight	0.2 kg (0.44 lb)

1. Green LED: TxD
2. Red LED: RxD
3. DIP switch for setting the process data length and baud rate
4. DIP switch for setting the base ID and switching the bus terminating resistor on and off
5. 9-pin sub D plug: bus connection

Pin assignment



04436AXX

Fig. 12: Assignment of 9-pin sub D socket of the bus cable

(1) 9-pin sub D socket

(2) Twist the signal wires together!

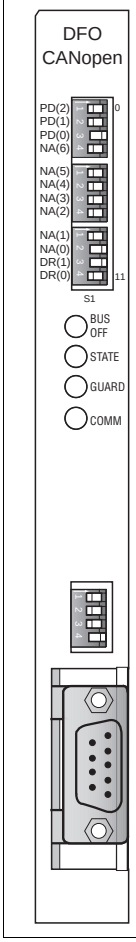
(3) Conductive connection is necessary between the plug housing and the shield!

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CANopen (DFO11A)

The CANopen documentation package contains detailed information. This package can be ordered from SEW.

Technical data

	Option	CANopen fieldbus interface type DFO11A
	Part number	823 162 1
	Startup and diagnostic tool	MOVITOOLS software and DBG11A keypad
	Supported baud rates	Can be selected via DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud • 1000 kbaud
	Connection	9-pin sub D plug Assignment to CiA standard 2-core twisted cable to ISO 11898
	Bus termination	Can be switched on using DIP switch (120 Ω)
	Address range	1 – 127, can be selected via DIP switch
	Weight	0.2 kg (0.44 lb)

1. DIP switch for process data length, module ID and baud rate
2. Display and diagnostic LEDs
3. DIP switch for switching the bus terminating resistor on and off
4. 9-pin sub D plug: bus connection

Pin assignment

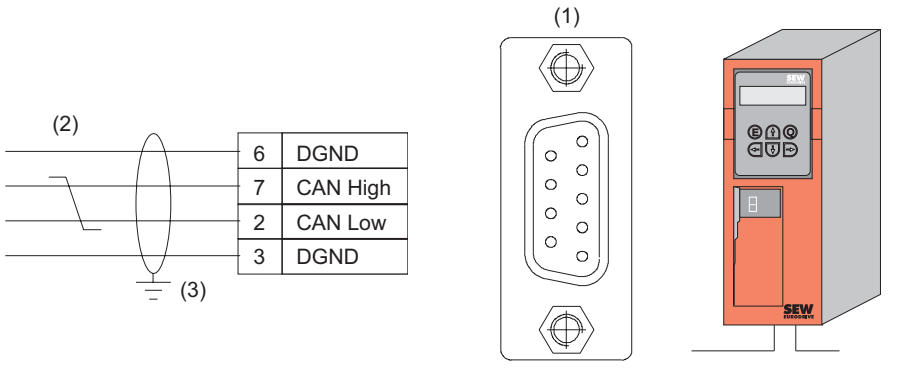


Fig. 13: Assignment of 9-pin sub D socket of the bus cable

(1) 9-pin sub D socket

(2) Twist the signal wires together!

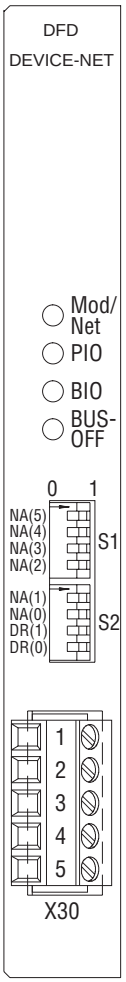
(3) Conductive connection is necessary between the plug housing and the shield!

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DeviceNet (DFD11A)

The DeviceNet documentation package contains detailed information. This package can be ordered from SEW.

Technical data

	Option	DeviceNet fieldbus interface type DFD11A
	Part number	822 887 6
	Startup and diagnostic tool	MOVITOOLS software and DBG11A keypad
	Supported baud rates	Can be selected via DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud
	Connection	5-pin Phoenix terminal Assignment to DeviceNet specification (Volume I, Appendix B)
	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 the bus segment.
	Address range which can be set (MAC-ID)	0 – 63, can be selected using DIP switch
	Weight	0.2 kg (0.44 lb)

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

Terminal assignment

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

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

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System bus (SBus)

The "System bus (SBus)" manual contains detailed information. This manual can be ordered from SEW.

Max. 64 CAN bus stations can be interconnected using the system bus (SBus). The SBus supports transmission systems compliant with ISO 11898.

SBus wiring diagram

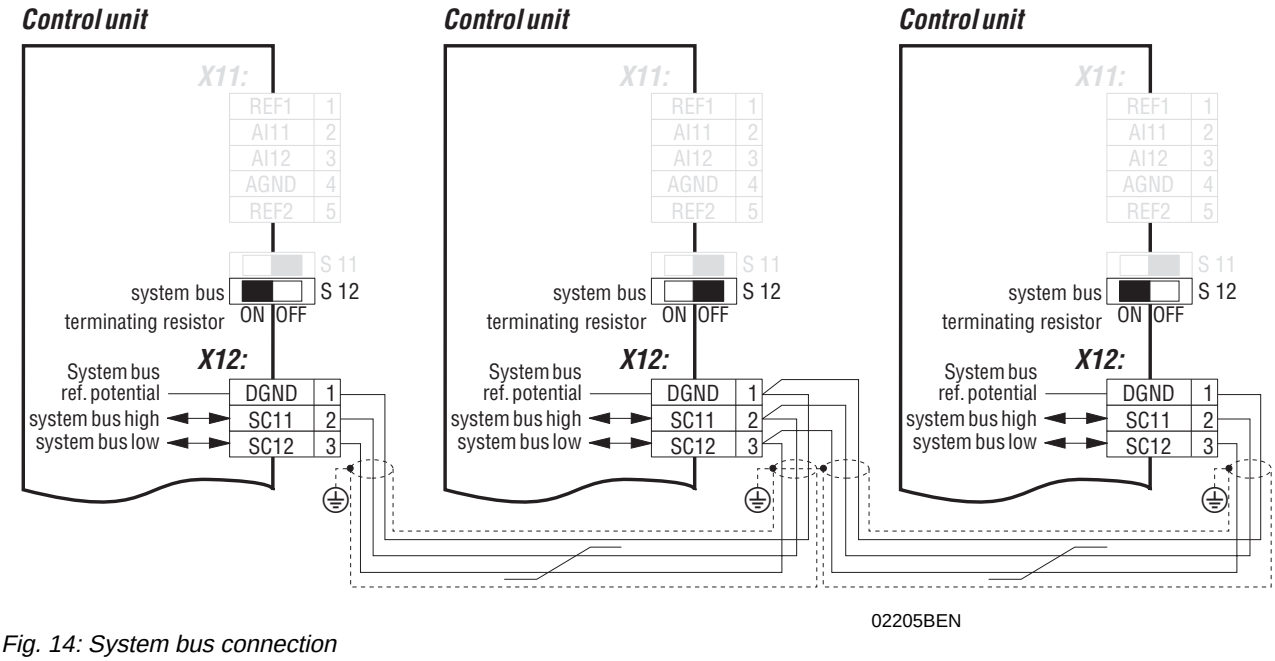


Fig. 14: System bus connection

Cable specification

- Use a 2-core twisted and shielded copper cable (data transmission cable with shield comprising copper braiding). The cable must meet the following specifications:
  - Conductor cross section 0.75 mm^2 (AWG 18)
  - Cable resistance 120 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz

  Suitable cables are CAN bus or DeviceNet cables, for example.

Shield contact

- Connect the shield at either end to the electronics shield clamp of the inverter or the master control and ensure the shield is connected over a large area. Also connect the ends of the shield to DGND.

Line 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 finish of the system bus connection. Switch off the terminating resistor on the other units (S12 = OFF).

STOP

- There must not be any potential displacement between the units which are connected using the SBus. Take suitable measures to avoid a potential displacement, e.g. by connecting the unit ground connectors using a separate lead.

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4.4 Connecting the limit switches

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

Use limit switches with NC contacts (low-active) only!

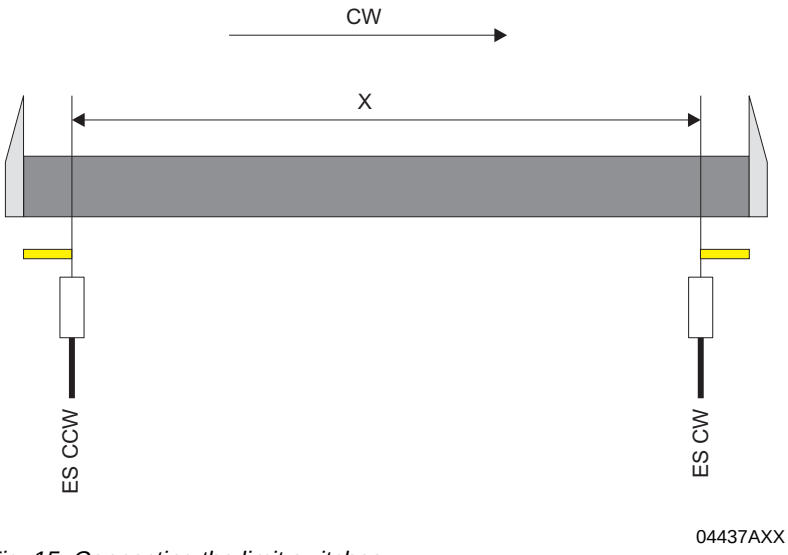


Fig. 15: Connecting the limit switches

CW	= Clockwise drive inverter
X	= Travel distance
LS CW	= Limit switch clockwise
LS CCW	= Limit switch counterclockwise

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

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5 Startup

5.1 General information

Correct project planning and installation are the pre-requisites for successful startup. The MOVIDRIVE® MD_60A system manual contains detailed project planning information. This system manual is part of the MOVIDRIVE® MD_60A documentation package which you can order from SEW.

Check the installation, the absolute encoder connection and, if present, the motor encoder by referring to the installation instructions in the MOVIDRIVE® MD_60A operating instructions and in this handbook (→ Sec. Installation).

Also follow the installation and startup instructions for the absolute encoder in the "Positioning with Absolute Encoder and Absolute Encoder Interface DIP11A" manual which you can order from SEW.

Licence

According to the licence conditions, there must be a licence label applied to each MOVIDRIVE® unit which is equipped with an application module. The application module is not allowed to be used on MOVIDRIVE® units without a licence label.

5.2 Preliminary work

Perform the following steps before startup:

- Connect the inverter to the PC using the serial port (RS-232, USS21A on PC-COM).
- Install the SEW MOVITOOLS software (version 2.50 or higher).
- Start up the inverter with "MOVITOOLS/Shell."
  - With MOVIDRIVE® MDF60A, in VFC operating mode.
  - With MOVIDRIVE® MDV60A with DR/DT/DV/D motors, in VFC-n-CONTROL operating mode.
  - With MOVIDRIVE® MDV60A with CT/CV motors, in CFC operating mode.
  - With MOVIDRIVE® MDS60A with DS/DY motors, in SERVO operating mode.
- Set parameter P955 "Encoder scaling." This setting is necessary so you get a whole number encoder resolution per travel unit.

  Example: WCS2 encoder (Stahl)

  Encoder resolution 1.25 increments/mm

  1.25 increments/mm • 8 = 10 increments/mm

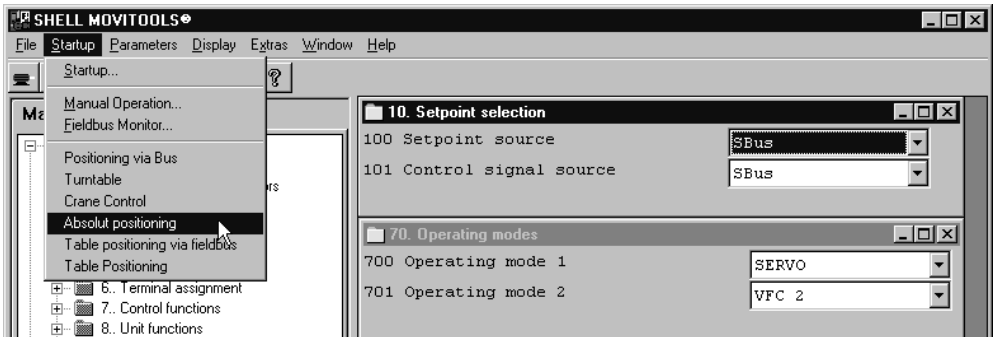
  → Set P955 "Encoder scaling" to 8.

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5.3 Starting the "absolute positioning" program

General information

- Start "MOVITOOLS/Shell".
- Select "Startup/Absolute Positioning."



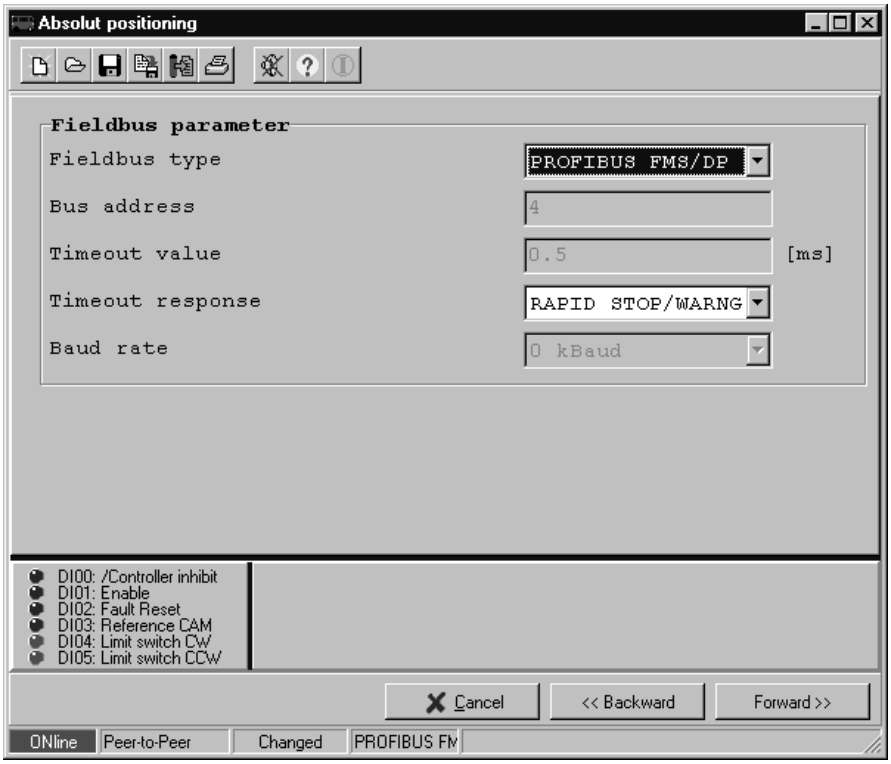
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Fig. 16: Starting the "absolute positioning" program

Initial startup

When absolute positioning is started for the first time, a dialog box appears in which you are prompted to enter the activation code (= licence number on the licence label). This step is followed by the "absolute positioning" startup window. The following settings are made there:

Fieldbus parameters



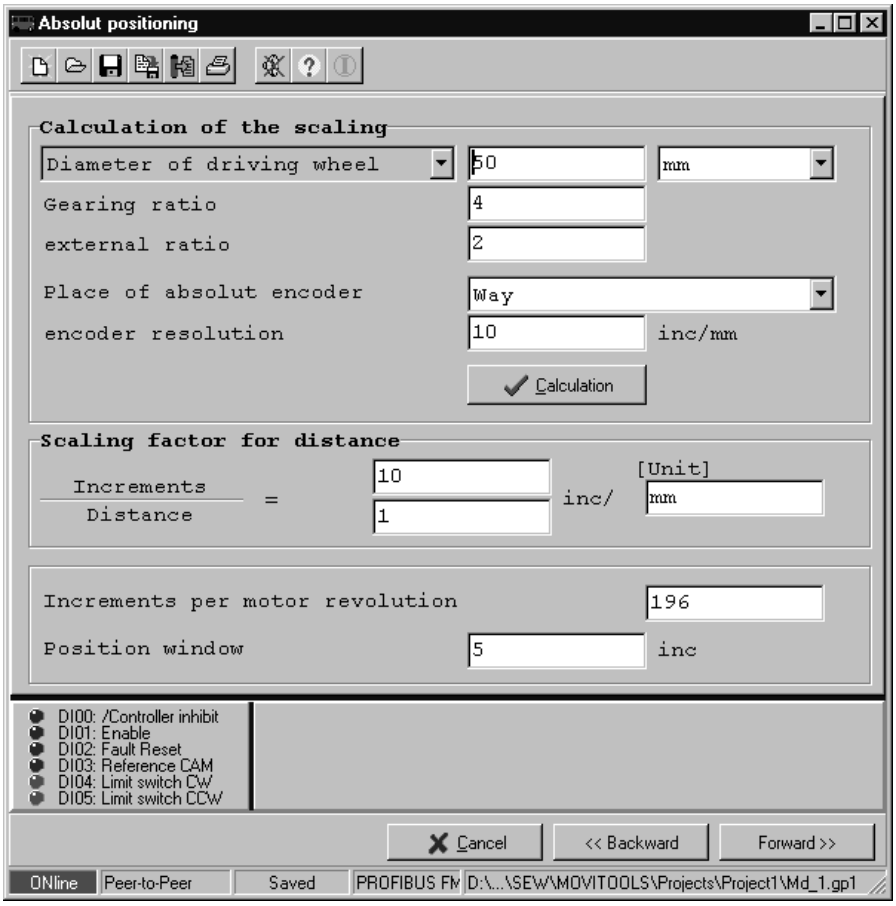
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Fig. 17: Setting the fieldbus parameters

- Set the correct fieldbus type.
- Set the required bus parameters.
- Press "Forward," after which the next startup window appears.

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Scaling



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Fig. 18: Setting the scaling

- Enter the value for "Diameter of driving wheel" or "spindle pitch" in [mm] or [0.1 mm].
- Enter the values for "gearing ratio" and "external ratio."
- Select whether the absolute encoder is mounted "on the motor shaft" or "on the line."
- Enter the value for the "encoder resolution." Note that this value must take into account the value for the encoder scaling (P955).
  - Absolute encoder "on the motor shaft:" increments/revolution • P955
  - Absolute encoder"on the line:" increments/mm • P955

  Example: Encoder WCS2 (Stahl),

  Physical encoder resolution 1.25 increments/mm

  Encoder scaling P955 = 8

  Encoder resolution with encoder scaling = 10 increments/mm [inc/mm]
- Click "Calculation" to start calculation of the distance scaling factor (pulses/distance) in [inc/mm] or [inc/(0.1 mm)]. You can also calculate the numerator/denominator factors yourself and enter them directly.
- Enter the position window value. This value determines the area on either side of the target position within which the "position reached" message is created. The value for the encoder scaling (P955) must be taken into account.

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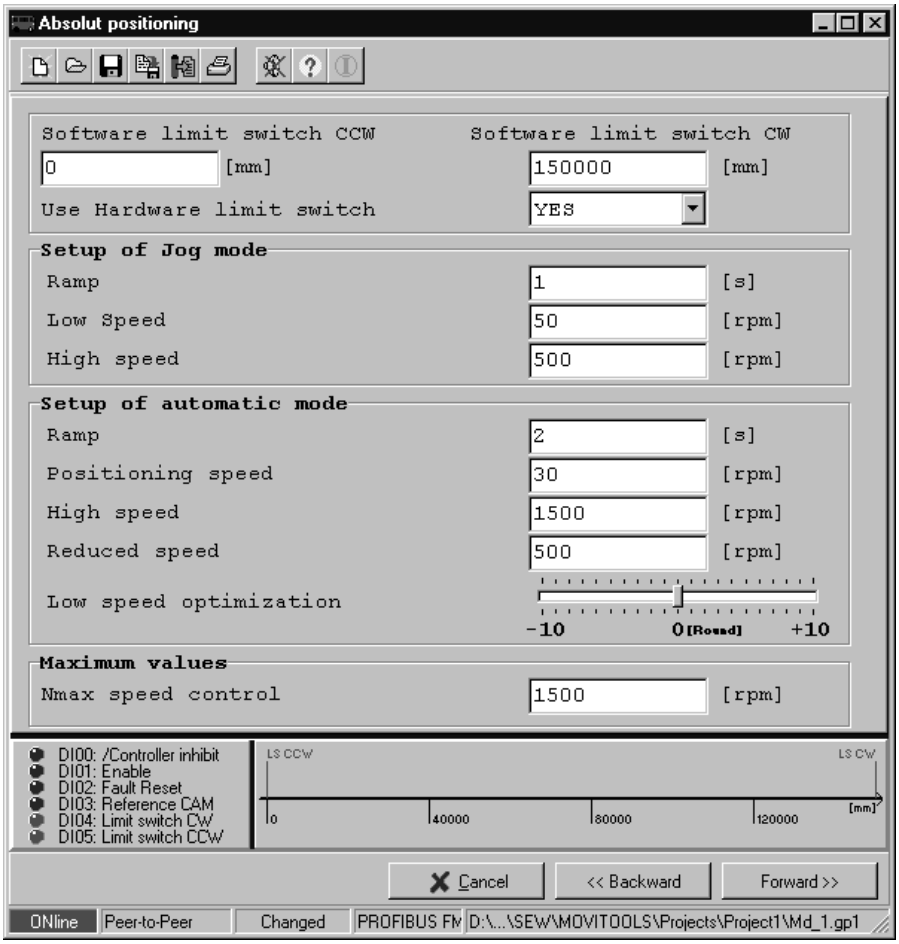
Example: WCS2 encoder (Stahl)
Encoder resolution 1.25 increments/mm
P955 "Encoder scaling" = 8
Required accuracy ± 0.5 mm

8 • 1.25 increments/mm • 0.5 mm = 5 increments

→ "Position window" = 5 increments

- Press "Forward," after which the next startup window appears.

Limit switches, ramps, speeds and limits



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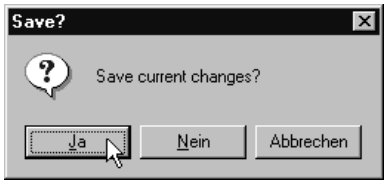
Fig. 19: Setting limit switches, ramps and speeds

- Enter the position of the software limit switches. Entering "0" for both limit switches deactivates the software limit switches. Make sure the positions of the software limit switches puts them within the travel limits of the hardware limit switches. The position of the software limit switches is displayed on the number bar in the bottom part of the screen.
- Enter the ramps and speeds for jog mode and automatic mode.
- Enter the maximum approved motor speed in "maximum values."
- Press "Forward," after which the next startup window appears.

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Saving changes

The program prompts you to save the entries you have made.

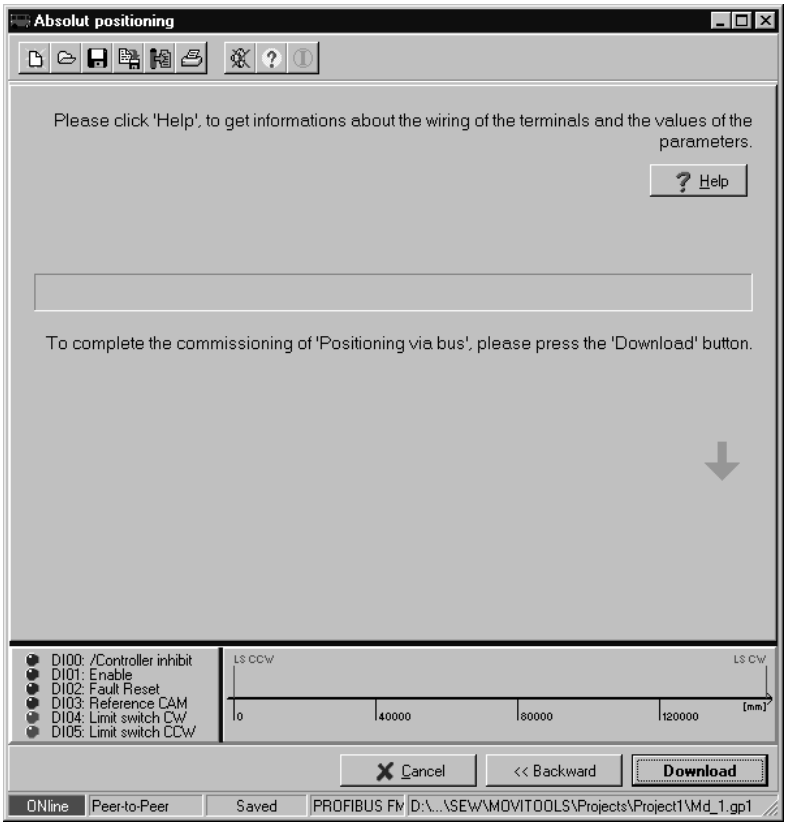


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Fig. 20: Saving changes

Download

Press "Download" to automatically make all necessary settings in the inverter and to start the "absolute positioning" IPOS program.

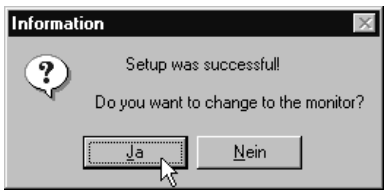


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Fig. 21: Download window

Switching to the monitor

After the download, the program asks you if you want to switch to the monitor.



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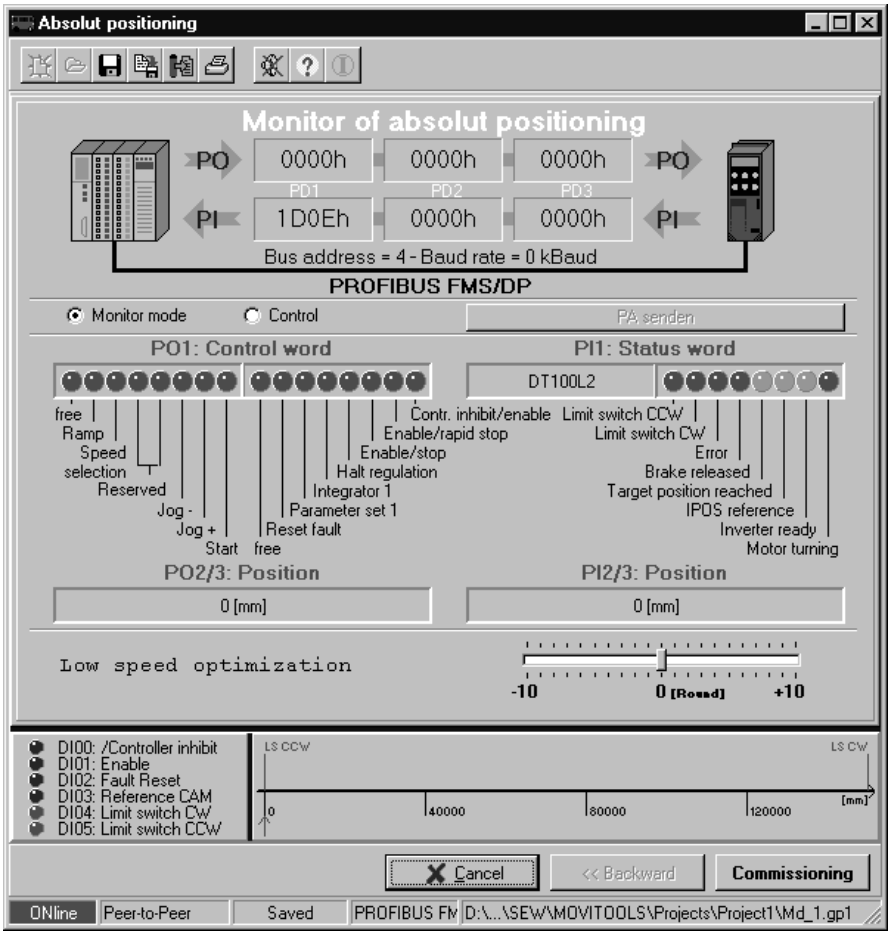
Fig. 22: Monitor Yes/No

Select "Ja" to switch to the monitor and start in the desired operating mode. Select "Nein" to switch to MOVITOOLS/Shell.

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Repeating startup

The absolute positioning monitor appears immediately if absolute positioning is restarted after initial startup has already been performed. There is no prompt for the activation code and the startup window does not appear.



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Fig. 23: Absolute positioning monitor

Press "Startup" if you want to repeat the startup. The startup window then appears (→ Initial startup).

Monitor

The absolute positioning monitor displays the process data which are transmitted via the fieldbus/SBus. The states of the individual bits of "PA1: Control word" and "PE1: Status word" are also displayed.

Controller in the monitor

As well as straightforward monitor operation, you can also simulate a controller when the monitor is operating. To do this, activate "Control" above "PA1: Control word." You can now activate and deactivate the individual bits of the control word (PA1) and specify the target position (PA2, PA3) in user travel units. Press "Send PA" to send these control words to the inverter.

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5.4 Parameters

Startup automatically sets the following parameters:

Parameter number	Parameter	Setting
P100	Setpoint source	FIELDBUS / SBus
P101	Control signal source	FIELDBUS / SBus
P136	Stop ramp	0.5 s
P137	Emergency ramp	0.5 s
P600	Binary input DIØ1	ENABLE/RAP.STOP
P601	Binary input DIØ2	Reset
P602	Binary input DIØ3	NO FUNCTION
P603	Binary input DIØ4	/LIM. SWITCH CW
P604	Binary input DIØ5	/LIM. SWITCH CCW
P819	Fieldbus timeout delay	0.01 – 650 s
P815	SBus timeout delay	
P831	Response FIELDBUS TIMEOUT	NO RESPONSE DISPLAY FAULT IMM. STOP/FAULT EMERG.STOP/FAULT RAPID STOP/FAULT IMM. STOP/WARNG EMERG.STOP/WARNG RAPID STOP/WARNG
P836	Response SBus TIMEOUT	
P813	SBus address	0 – 63
P816	SBus baud rate	125 kbaud 250 kbaud 500 kbaud 1000 kbaud
P870	Setpoint description PA1	CTRL. WORD 2
P871	Setpoint description PA2	POSITION HI
P872	Setpoint description PA3	POSITION LO
P873	Actual value description PE1	IPOS PE-DATA
P874	Actual value description PE2	IPOS PE-DATA
P875	Actual value description PE3	IPOS PE-DATA
P876	PA data enable	ON
P300	Start/stop speed 1	15 rpm
P301	Minimum speed 1	15 rpm
P302	Maximum speed 1	0 – 5500 rpm
P730	Brake function 1	ON
P941	Source actual position	ABSOL. ENC.



These parameters must not be altered after startup!

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5.5 Starting the drive

Following the download, switch to the absolute positioning monitor by selecting "Ja." You can select the operating mode using bits 11 and 12 of "PA: Control word."

Operating modes

Operating mode	Control word:Bit	
	PA1:12	PA1:11
Jog mode	"0"	"1"
Automatic mode	"1"	"1"
Invalid	"1"	"0"
Invalid	"0"	"0"

- Jog mode: Jog mode is normally required for servicing in order to move the drive independently of absolute positioning.
  - Use bits PA1: 9 "Jog+" and PA1: 10 "Jog-" to move the drive clockwise and counterclockwise.
  - Use bit PA1:13 "Selection" to switch between low speed (PA1:13 = "0") and rapid speed (PA1:13 = "0").

- Automatic mode:
  - The controller specifies the target position to the inverter using process output data (PA2 and PA3).
  - The controller starts positioning with PA1:8 "Start" = "1". The "1" signal must be present for the entire duration of the positioning process. You stop positioning with PA1:8 = "0".
  - The inverter signals the actual position to the controller cyclically using process input data (PE2 and PE3).
  - The inverter uses PE3:3 "Target position reached" = "1" to signal to the controller that it has reached the selected target position.

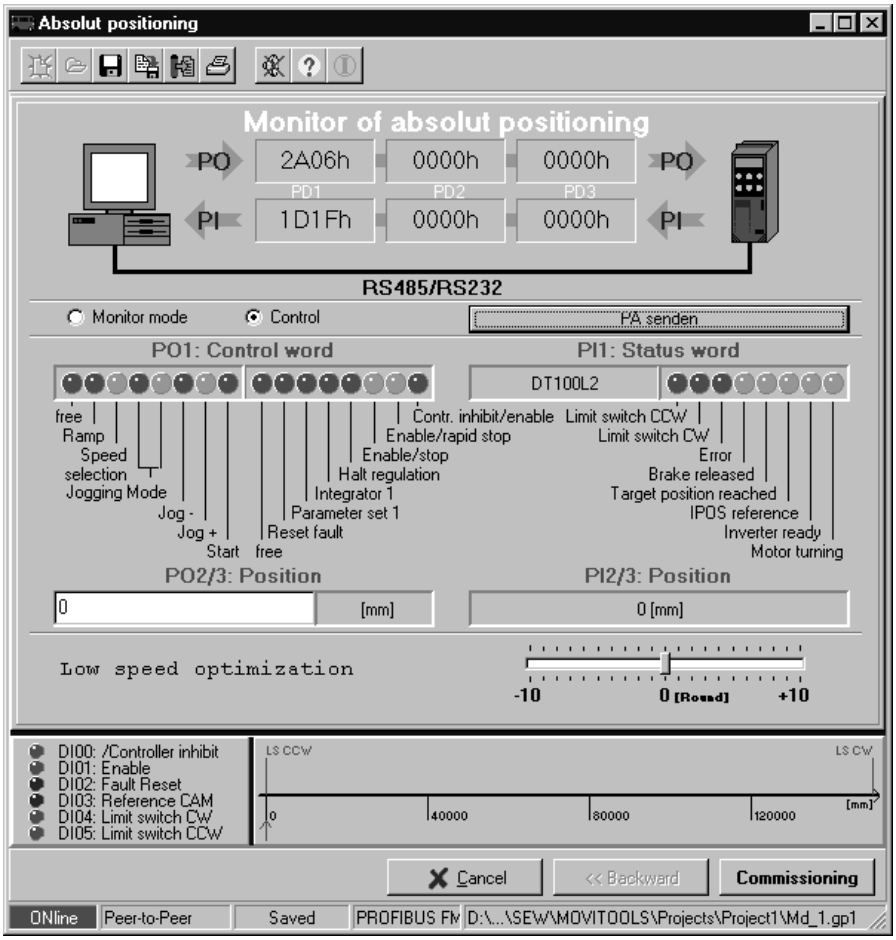
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Jog mode

- PA1:12 = "0" and PA1:11 = "1"

In jog mode, you can manually move the drive clockwise or counterclockwise using "1" signals at PA1:9 "Jog+" or PA1:10 "Jog-," regardless of automatic mode.

Use PA1:13 "Speed selection" to switch between low speed (PA1:13 = "0") and rapid speed (PA1:13 = "1").



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Fig. 24: Jog mode

Note

- The current position of the drive is shown by the green arrow on the line of numbers.

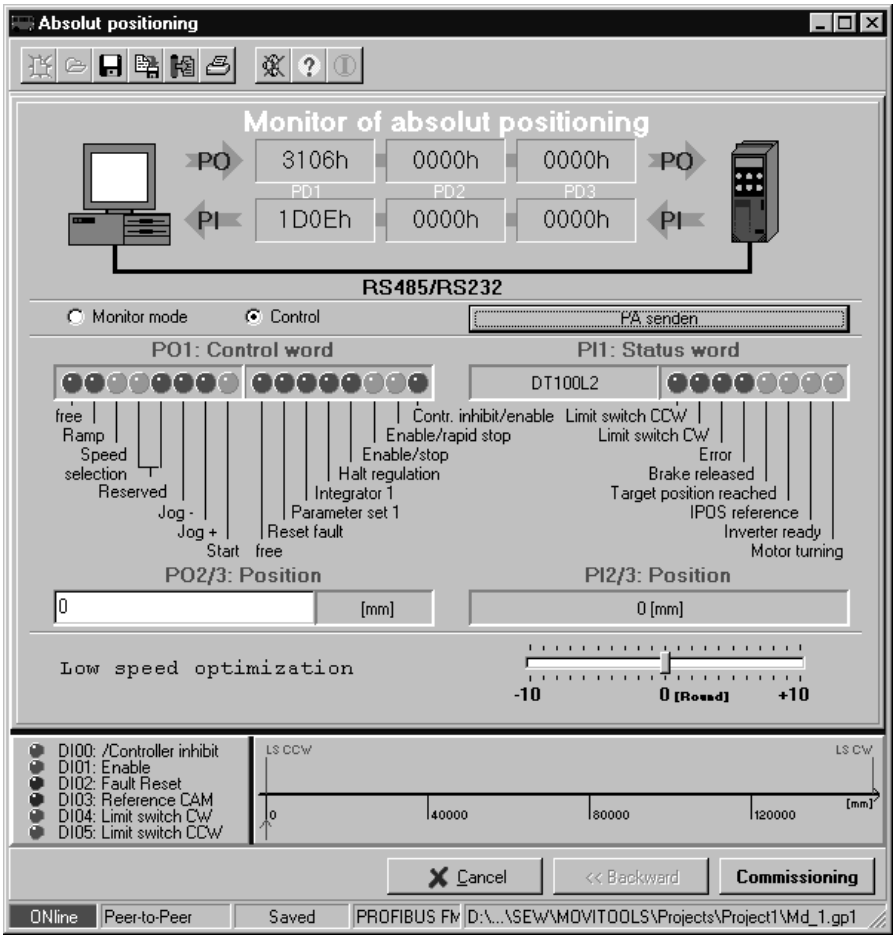
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Automatic mode

- PA1:12 = "1" and PA1:11 = "1"

In automatic mode, the controller specifies the target position to the inverter using process output data (PA2 and PA3). The controller starts positioning with PA1:8 "Start" = "1". The "1" signal must be present for the entire duration of the positioning process. You stop positioning with PA1:8 = "0."

The inverter signals the actual position to the controller cyclically using process input data (PE2 and PE3). The inverter uses PE3:3 "Target position reached" = "1" to signal to the controller that it has reached the selected target position.



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Fig. 25: Automatic mode

Notes

- The current position of the drive is shown by the green arrow on the line of numbers.
- The drive immediately moves to the new position if control bit PA1:8 "Start" remains "1" and a new target position is specified using PA2 and PA3.
- Control bit PA1:13 "Speed selection" can be used for switching between two speeds in automatic mode. Rapid speed is active when PA1:13 = "0" and the reduced speed is active when PA1:13 = "1."
- Control bit PA1:14 "Ramps" can be used for switching between two ramps in automatic mode. The automatic ramp is active when PA1:14 = "0", the jog mode ramp is active when PA1:14 = "1."

  Important: The ramp selection must be performed before the positioning operation.

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6 Operation and Service

6.1 Timing diagrams

The following prerequisites apply to the timing diagrams:

- Startup performed correctly
- DIØØ "/Controller inhibit" = "1" (no inhibit)
- DIØ1 "Enable/rapid stop" = "1"

Jog mode

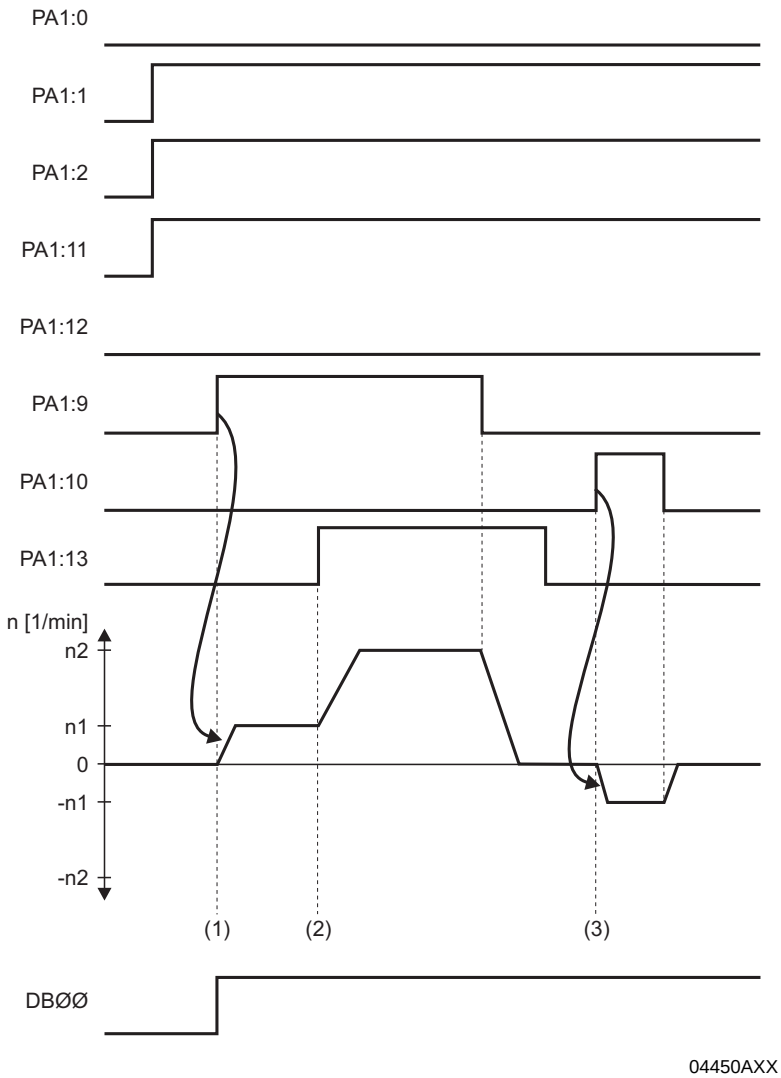


Fig. 26: Timing diagram of jog mode

PA1:1 = Enable/rapid stop
PA1:2 = Enable/stop
PA1:11 = Mode selection
PA1:12 = Mode selection
PA1:9 = Jog+
PA1:10 = Jog-
PA1:13 = Speed selection
DBØØ = /Brake

(1) = Start jog mode, Jog+
(2) = Selection rapid speed
(3) = Start jog mode, Jog-

n1 = Slow speed velocity
n2 = Rapid speed velocity

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Automatic mode

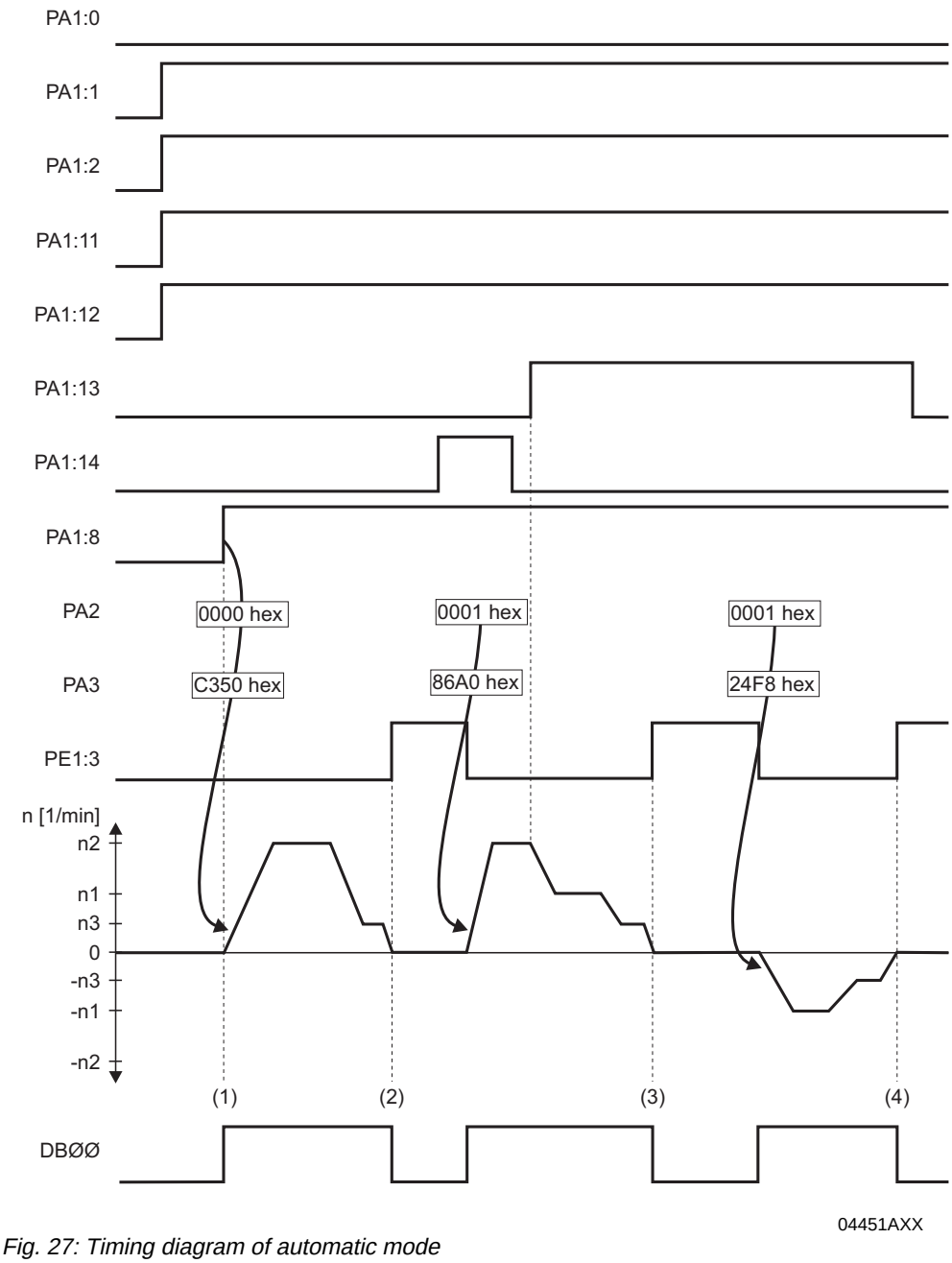


Fig. 27: Timing diagram of automatic mode

PA1:1 = Enable/rapid stop
PA1:2 = Enable/stop
PA1:11 = Mode selection
PA1:12 = Mode selection
PA1:13 = Speed selection
PA1:14 = Ramp selection
PA1:8 = Start
PA2 = Target position high
PA3 = Target position low
PE1:3 = Target position reached
DBØØ = /Brake

(1) = Start jog mode
(2) = Position 50000 reached
(3) = Position 100000 reached
(4) = Position 75000 reached

n1 = Reduced speed
n2 = Rapid speed velocity
n3 = Positioning speed

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Moving clear of limit switches

The inverter changes to operating status 09 and performs an emergency stop if you run up against a limit switch (DIØ4 or DIØ5 = "0").

The drive can be moved clear by turning in the opposite direction. Once the drive has moved clear, DIØ4 or DIØ5 is set from "0" to "1."

The inverter performs an emergency stop if it runs up against an illogical hardware limit switch, for example the CCW limit switch when turning CW. In addition, the PE1:5 bit "Error/warning" is set and error 29 "Limit switch reached" is displayed.

Perform the following steps:

- Correct the assignment of hardware limit switches.
- Perform an error reset.
- Move the drive clear in jog mode.

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6.2 Error information

The error memory (P080) stores the last five error messages (errors t-0 – t-4). The error message of longest standing is deleted whenever more than five error messages have occurred. The following information is stored when a malfunction takes place:

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

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

- **Immediate switch-off:**

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

- **Raped stop:**

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

- **Emergency stop:**

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

Reset

An error message can be acknowledged by:

- Switching the supply system off and on again.

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

- Reset via binary input DIØ2. Startup of the absolute positioning causes this binary input to be assigned the "Reset" function.

- Press the reset button in the MOVITOOLS manager.



02771AEN

Fig. 28: Reset with MOVITOOLS

- Manual reset in MOVITOOLS/Shell (P840 = "YES" or [Parameter] / [Manual reset])
- Manual reset using the DBG11A (pressing the <E> key in the event of a fault gives direct access to parameter P840)

Timeout active

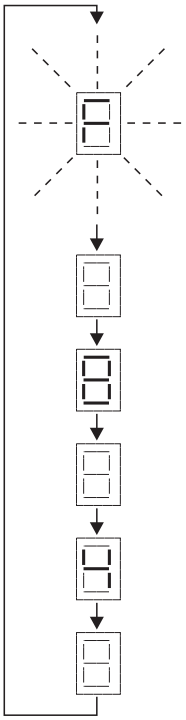
In case the inverter is controlled via a communications interface (fieldbus, RS-485 or SBus) and the power was switched off and back on again or an error reset was performed, then the enable remains ineffective until the inverter once again receives valid data via the interface which is monitored with a timeout.

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6.3 Error messages

Display

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



01038AXX

The display switches over to the operating display following a reset or if the error or warning code once more resumes the value "0."

List of faults

The following table shows a selection from the complete list of errors (→ MOVIDRIVE® MD_60A operating instructions). It only lists those errors which can occur specifically with absolute positioning.

A dot in the "P" column means that the response is programmable (P83_ Fault response). The factory set error response is listed in the "Response" column.

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Error code	Name	Response	P	Possible cause	Action
00	No error	-			
07	DC link overvoltage	Immediate shut-off		DC link voltage too high	• Extend deceleration ramps • Check connecting harness for braking resistor • Check technical data of braking resistor
08	n-monitoring	Immediate shut-off		• Speed controller or current controller (in VFC operating mode without encoder) operating at setting limit due to mechanical overload or phase fault in the power system 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 over A/A and B/B pairs if necessary • Check encoder voltage supply • Check current limitation • Extend ramps if appropriate • Check motor feeder and motor • Check supply system phases
14	Encoder	Immediate shut-off		• Encoder cable or shield not connected correctly • Short circuit/open circuit in encoder cable • Encoder defective	Check encoder cable and shield for correct connection, short circuit and open circuit.
27	Limit switches missing	Emergency stop		• Open circuit/both limit switches missing • Limit switches are swapped over in relation to direction of rotation of motor	• Check wiring of limit switches • Swap over limit switch connections • Reprogram terminals
28	Fieldbus timeout	Rapid stop	•	No master-slave communication took place within the configured response monitoring period.	• Check master communication routine • Extend fieldbus timeout time (P819) or switch off monitoring
29	Limit switch reached	Emergency stop		Limit switch was reached in IPOS operating mode.	• Check travel range • Correct user program
31	TF sensor	No response	•	• Motor too hot, TF has tripped • TF of motor not connected or not connected properly • MOVIDRIVE® connection and TF connection on motor interrupted • No link between X10:1 and X10:2. With MDS: X15:9 – X15:5 connection missing.	• Let motor cool down and reset fault • Check connections/link between MOVIDRIVE® and TF • If no TF is connected: Jumper X10:1 to X10:2. With MDS: Jumper X15:9 to X15:5. • Set P834 to "No response"
36	No option	Immediate shut-off		• Type of option card not allowed • Setpoint source, control 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
47	System bus timeout	Rapid stop	•	Fault during communication via system bus.	Check system bus connection.
92	DIP work area	Emergency stop		**With DIP11A option only:** Drive has moved beyond the approved work area of the absolute encoder. Setting of encoder type/work area DIP parameters may be incorrect.	Check position offset and zero offset parameters.

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Error code	Name	Response	P	Possible cause	Action
93	DIP encoder fault	Emergency stop		**With DIP11A option only:** The encoder signals a fault, e.g. power failure. • Connection cable between the encoder and DIP does not meet the requirements (twisted pair, shielded) • Cycle frequency too high for cable length • Permitted max. speed/ acceleration of encoder exceeded • Encoder defective	• Check absolute encoder connection • Check motor leads • Set correct cycle frequency • Reduce max. traveling velocity or ramp • Fit new absolute encoder
94	EEPROM checksum	Immediate shut-off		Inverter electronics disrupted, possibly due to EMC effect or fault.	Send the unit in for repair.
95	DIP plausibility error	Emergency stop		**With DIP11A option only:** Unable to determine a logical position. • Incorrect encoder type set • IPOS travel parameter set incorrectly • Numerator/denominator factor set incorrectly • Zero adjustment performed • Encoder defective	• Set the correct encoder type • Check IPOS travel parameter • Check traveling velocity • Correct numerator/ denominator factor • Reset after zero adjustment. • Fit new absolute encoder

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