SEW EURODRIVE

MOVIDRIVE® MDX61B
Absolute Encoder Card DIP11B

FA361771

Edition 01/2006

11413026 / EN

Manual

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1 Important Notes

- **This manual does not replace the detailed operating instructions!**
- **Only specialists are allowed to perform installation and startup observing relevant accident prevention regulations and the MOVIDRIVE® MDX60B/61B operating instructions!**

Documentation

- Read through this manual carefully before you commence installation and startup of MOVIDRIVE® drive inverters with the DIP11B option.
- In addition to this user manual for the DIP11B option, you should order the following additional publications from SEW-EURODRIVE:
  - MOVIDRIVE® MDX60/61B system manual
  - IPOS$^{plus®}$ Positioning and Sequence Control 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.
- A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you observe the information in the documentation.

Safety and warning notes

Always observe 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.

2 System Description

2.1 Areas of application

The DIP11B absolute encoder card option expands the MOVIDRIVE® system to include an SSI connection for absolute encoders. This permits positioning functions to be implemented with IPOS$^{plus®}$ that offer the following opportunities:

- No reference travel required when the system is started or after a power failure.
- Positioning can take place either with the absolute encoder or the incremental encoder/resolver installed on the motor.
- Replacement of positioning switches along the travel distance even without motor encoder feedback.
- Free processing of the absolute position in the IPOS$^{plus®}$ program.
- Both synchronous and asynchronous motors can be used in all MOVIDRIVE® operating modes (P700/P701).
- The absolute encoder can be mounted either on the motor or along the distance (e.g. high-bay warehouse).
- Simple encoder adjustment with user-guided startup.
- Endless positioning in combination with activated modulo function. Pay attention to the notes in the "IPOS$^{plus®}$ manual" as well as the MOVIDRIVE® MDX60B/61B system manual (→ section "Parameter descriptions").

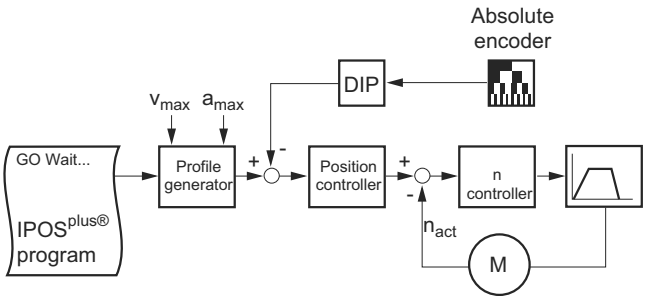
2.2 Absolute encoders used

Connect only those encoders listed in the following table to the DIP11B option.

Manufacturer	Encoder designation	Order designation	Comments
Heidenhain	ROQ 424 (AY1Y)	312 219-67	Rotary encoder
T&R	T&R CE58	Cx58xxxSSI	Rotary encoder
	T&R CE65	Cx65xxxSSI	Rotary encoder
	T&R CE100MSSI	Cx100xxxMSSI	Rotary encoder
	T&R ZE65 M	Zx65xxxSSI	Rotary encoder
	T&R LA66K SSI	-	Linear distance sensor
	T&R LE100 SSI	LE100SSI	Laser distance measuring instrument
	T&R LE200	2200-00002	Laser distance measuring instrument
Leuze	Leuze BPS37	BPS37xx MA4.7	Barcode measuring system
	Leuze OMS1		Laser encoder
	Leuze OMSE2	OMS2xx PB	Laser encoder
Sick / Stegmann	Sick ATM60	ATM60 AxA12*12	Rotary encoder
	Sick DME 3000	DME 3000-x11	Laser distance measuring instrument
	Sick DME 5000	DME 5000-x11	Laser distance measuring instrument
	Stegmann AG100 MSSI	-	Rotary encoder
	Stegmann AG626	ATM60 AxA12*12	Rotary encoder
Stahl	Stahl WCS2	WCS2-LS311	Linear distance sensor
	Stahl WCS3	WCS3-LS311	Linear distance sensor
VISOLUX	EDM	-	Laser distance measuring instrument
IVO	IVO GM401	GM401.x20 xxxx	Rotary encoder

2.3 DIP11A and processing in IPOS$^{plus®}$

Direct position control with absolute encoder (case 1)



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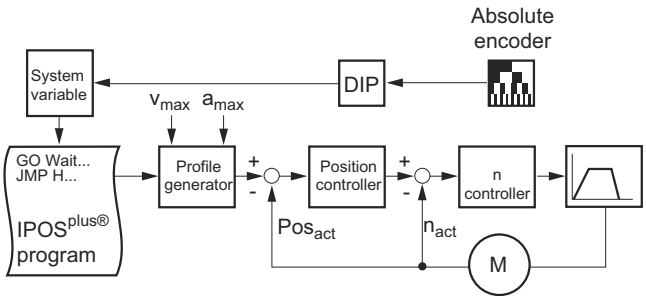
- Direct position control in IPOS$^{plus®}$ by means of the absolute encoder connected via DIP11B option.
- An encoder (X15) is always required on the motor for speed feedback.
- Automatic slip compensation between the encoder of the motor and the absolute encoder.
- In IPOS$^{plus®}$, positioning commands such as "GOA ..." are performed with reference to the source actual position (in this case: absolute encoder connected to DIP11B.
- The dynamic response that can be achieved depends on the properties and the installation of the absolute encoder as well as the position resolution.

Position control with incremental encoder on motor, processing of absolute encoder position in the IPOS$^{plus®}$ program (case 2)



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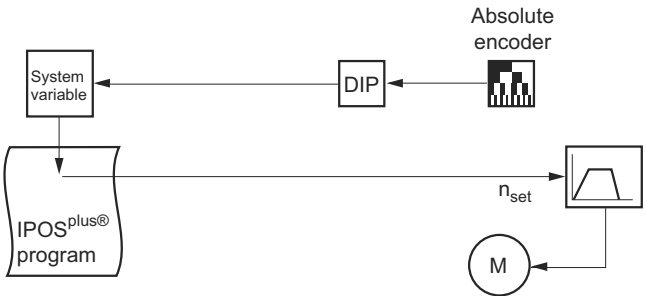
- Position control takes place in IPOS$^{plus®}$ with motor encoder connected to motor.
- An encoder is always required on the motor for speed feedback.
- The high dynamic response of the inverter can be used directly for positioning.
- The position information of the absolute encoder is automatically reflected in an IPOS$^{plus®}$ variable and can be processed using program control.
- The use of the DIP11B eliminates the need for reference travel.

Processing of the absolute encoder position in the IPOS$^{plus®}$ program (case 3)



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- The position information of the absolute encoder is automatically reflected in an IPOS$^{plus®}$ variable and can be processed using program control.
- The DIP11B can be used in particular to replace applications in which positioning usually takes place using rapid speed/creep speed by means of several proximity switches.
- No encoder is required on the motor for speed feedback; a standard asynchronous motor can be used.

2.4 Encoder sensing

- The counting direction can be set using parameters.
- When an encoder is replaced, startup must be repeated using MOVITOOLS®. Individual parameters can also be altered using the DBG60B keypad.
- The unit comes equipped with an automatic setting function for parameters in case the encoder is replaced.

2.5 Encoder monitoring

The DIP11B option comes equipped with the following monitoring and correction mechanisms; these are necessary because the SSI interface does not have its own protocol safeguard feature.

- If supported by the encoder: Evaluation of a power failure or error bit (bit 25).
- Plausibility check of the actual position signaled by the encoder.
- Compensation of delays due to read cycles of the encoder (refresh time).

2.6 Control functions

- **Touch probe function**

  Touch probe makes it possible to detect the current position of the absolute encoder with minimum time delay. For example, this makes it possible to register positions very precisely using proximity switch signals and process these positions in the program.

- **Modulo function**

  Applications with infinite rotation, such as conveyor belts or rotary tables can be represented in modulo format (360 ° ≙ 2^{16}).

  There will be no position loss (even in case of a gear unit ratio i with a relatively large number of decimal positions).

  The monitoring function for the display space of the encoder is deactivated, which means positioning can take place infinitely without position loss.

3 Assembly / Installation Instructions

3.1 Notes on combination of DIP11B with DIO11B

The DIPI11B option card must be installed in the expansion slot. All parameters relevant to the DIP11B can be set using the DBG60B.

Note terminal assignment

MOVIDRIVE® MDX61B permits the assignment of eight binary input terminals and eight binary output terminals on one option card. In case the DIP11B option is used with the DIO11B option card or a fieldbus option, note the listed grouping of input and output terminals.

Terminal assignment for input terminals (DI10 ... DI17)

Function			**Option**			
			DIO11B	**DIP11B**	**DIO11B**	**DIP11B**
Read terminals with	**a variable**		H483		H520	
	Bit	DIP11B with DIO11B	6 ... 13	14 ... 21	8 ... 15	16 ... 23
		DIP11B with or without fieldbus card	-	6 ... 13	-	8 ... 15
Parameter 61.. effective for	DIP11B with DIO11B		Yes	-	Yes	-
	DIP11B with or without fieldbus card		-	Yes	-	Yes

Terminal assignment for output terminals (DI10 ... DO17)

Function			**Option**	
			DIO11B	**DIP11B**
Set terminals with	**a variable**		H480	
	Bit	DIP11B with DIO11B	0 ... 7	8 ... 15
		DIP11B with or without fieldbus card	-	0 ... 7
Parameter 63.. effective for	DIP11B with DIO11B		Yes	-
	DIP11B with or without fieldbus card		-	Yes

It is always possible to set and read terminals with variables, regardless of the additional option used along with the DIP11B. If the DIP11B is used in conjunction with a fieldbus card, the virtual fieldbus terminals are only available in IPOS$^{plus®}$ by reading the process output data (GETSYS Hxxx PO-DATA).

3.2 Installation of the DIP11B option card

- **The DIP11B option card can only be installed in MOVIDRIVE® MDX61B sizes 1 to 6, not in size 0.**
- **The DIP11B option must be installed in the expansion slot.**

Before you begin **Read the following notes before installing or removing an option card:**

- Disconnect the inverter from the power. Switch off the 24 V DC and the supply voltage.
- Take appropriate measures to protect the option card from electrostatic charge (use discharge strap, conductive shoes, etc.) before touching it.
- **Before installing** the option card, remove the keypad and the front cover.
- **After installing** the option card, replace the front cover and the keypad.
- Keep the option card in its original packaging until immediately before you are ready to install it.
- Hold the option card by its edges only. Do not touch any components.

Installation and removal of an option card

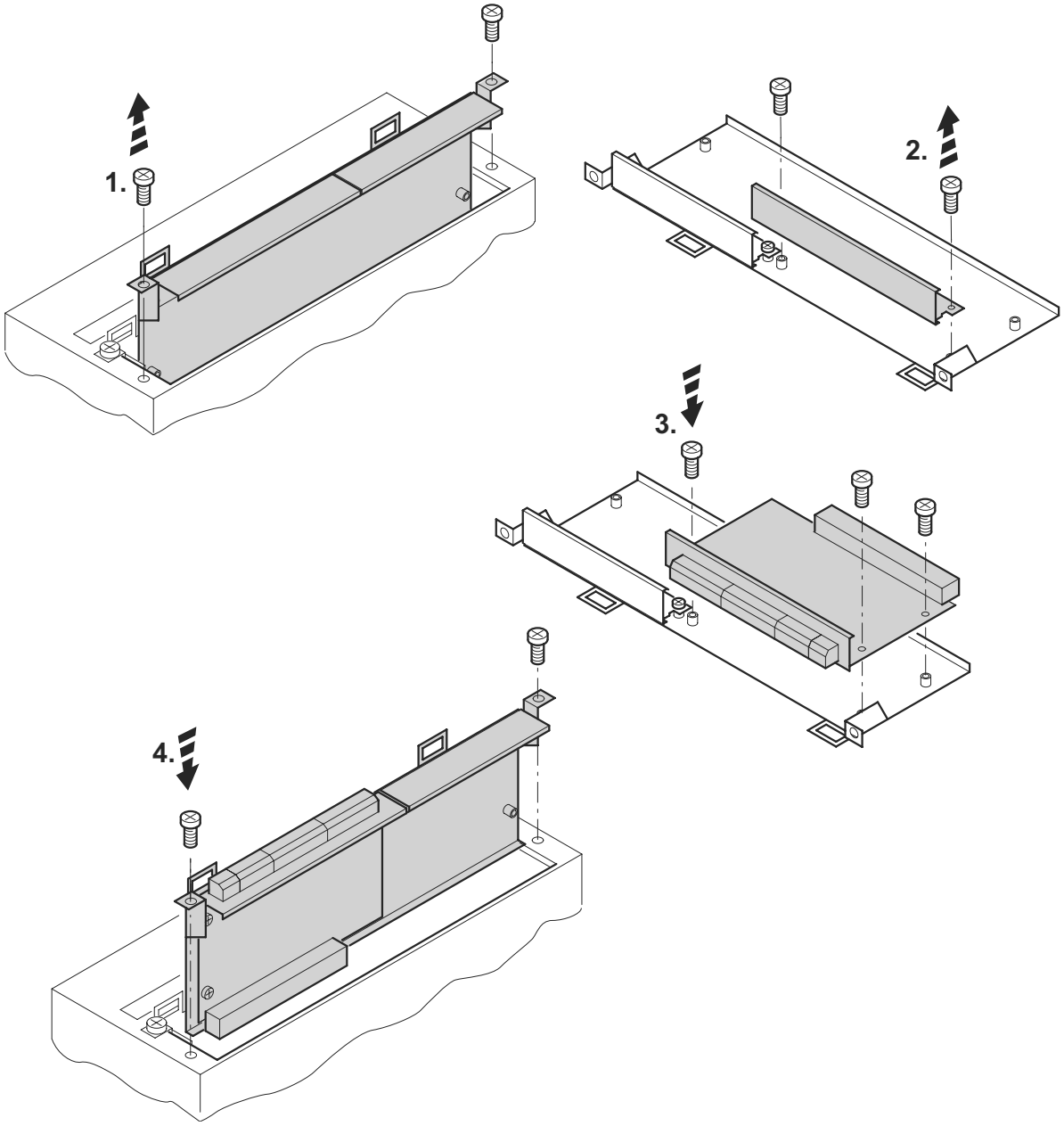

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Figure 1: Installing an option card in MOVIDRIVE® MDX61B sizes 1 to 6

1. Remove the retaining screws holding the card retaining bracket. Pull the card retaining bracket out evenly from the slot (do not twist!).
2. Remove the retaining screws of the black cover plate on the card retaining bracket. Remove the black cover plate.
3. Position the option card onto the retaining bracket so that the retaining screws fit into the corresponding bores on the card retaining bracket.
4. Insert the retaining bracket with installed option card into the slot, pressing slightly so it is seated properly. Secure the card retaining bracket with the retaining screws.
5. To remove the option card, follow the instructions in reverse order.

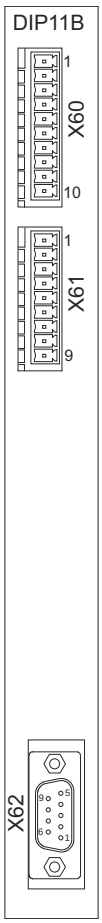
3.3 Connection and terminal description of the DIP11B option

Part number Absolute encoder card option type DIP11B: 824 969 5

The DIP11B option can only be installed in connection with MOVIDRIVE® MDX61B sizes 1 to 6, not with size 0.

The DIP11B option must be installed in the expansion slot.

The DIP11B option must be supplied with 24V DC.

Front view of DIP11B	Description	Terminal	Function
	**X60: Connection binary inputs**	**X60:1 ... 8** **X60:9** **X60:10**	Connection binary inputs DI10 ... DI17 isolated via optocoupler (R_i=3 kΩ , I_E=10 mA, scanning time 1 ms, PLC compatible) Signal level (according to EN 61131-2): "1" = DC+13 V ... DC+30 V "0" = DC–3 V ... DC+5 V DCOM reference for binary inputs DGND reference potential for binary signals and 24VIN (X61:9): • Without jumper X60:9-X60:10 (DCOM-DGND) → Isolated binary inputs • With jumper X60:9-X60:10 (DCOM-DGND) → Non-isolated binary inputs
	X61: Connection binary outputs	**X61:1 ... 8** **X61:9**	Connection binary outputs DO10 ... DO17 (response time 1 ms, PLC compatible) Signal level **(Do not apply external voltage!)**: "1" = DC 24 V "0" = DC 0 V I_{max} = DC 50 mA, short-circuit proof and protected against external voltage 24VIN Input supply voltage: Mandatory for binary outputs and encoders (reference potential DGND)
	X62: Connection absolute encoder	**X62:1** **X62:3** **X62:5** **X62:6** **X62:8** **X62:9**	Data + Cycle + DGND Data – cycle – DC 24 V output

Voltage supply of the DIP11B

The DIP11B absolute encoder card requires a DC 24 V voltage supply at voltage input 24VIN (X61:9). You have the following two options to provide this DC 24 V voltage supply.

Option 1: Total load lower than 400 mA

DC 24 V voltage supply via the auxiliary voltage output VO24 (X10:8) of the basic unit. This option is only permitted if the total load of all outputs of the basic unit and the currently connected options (including encoder) is less than 400 mA.

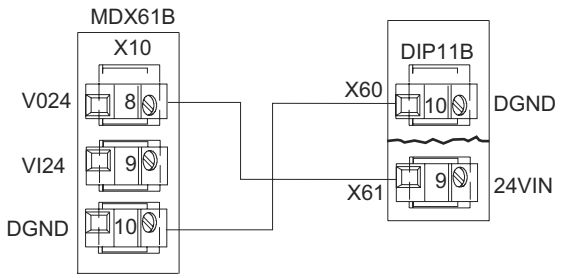


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Figure 2: Wiring diagram of the auxiliary voltage output VO24

Option 2: Total load higher than 400 mA

DC 24 V voltage supply via an external 24 V power supply unit. This option will become necessary if the total load of all outputs of the basic unit and the currently connected options (including encoder) is higher than 400 mA. The below illustrations show two wiring examples.

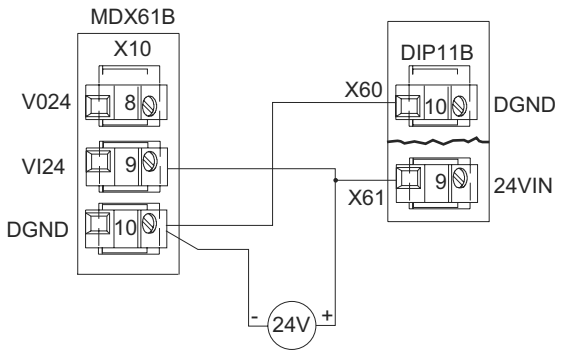

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Figure 3: External DC 24 V voltage supply (connection example 1)

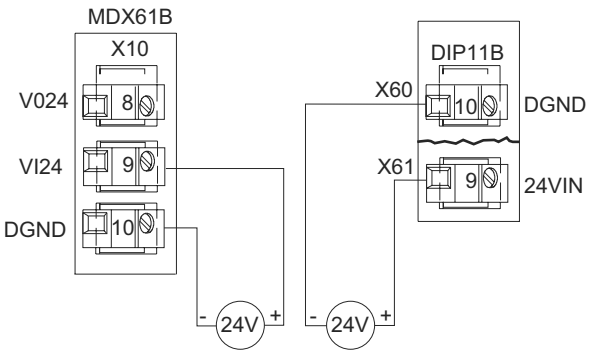

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Figure 4: External DC 24 V voltage supply (connection example 2)

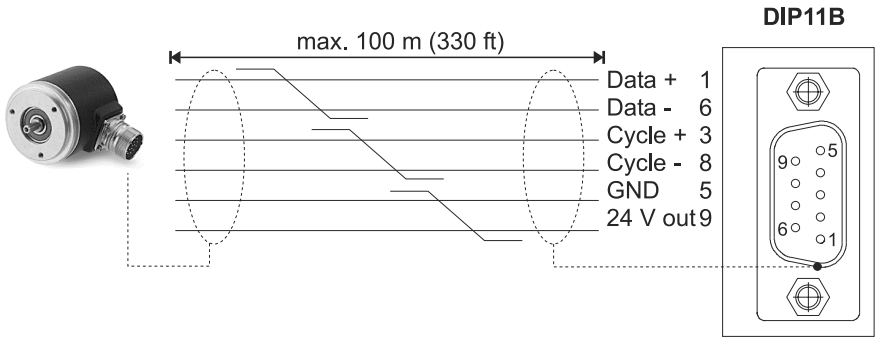
3.4 Absolute encoder connection

General installation information

- Max. line length DIP11B option (inverter absolute encoder):
  100 m with a capacitance per unit length 120 nF/km
- Core cross section: 0,20 ... 0.5 mm (AWG24 ... 20)
- Use shielded cables with twisted pair conductors and make sure it is earthed on both ends over a large surface area:
  - At the encoder in the cable gland or in the encoder plug
  - to the inverter in the housing of the sub D plug or
  - to the metal clamp / strain relief on the bottom of the inverter
- Route the encoder cable separately from the power cables.

Prefabricated cables / wiring diagrams

- Wiring diagram for absolute encoder at the DIP11B option:



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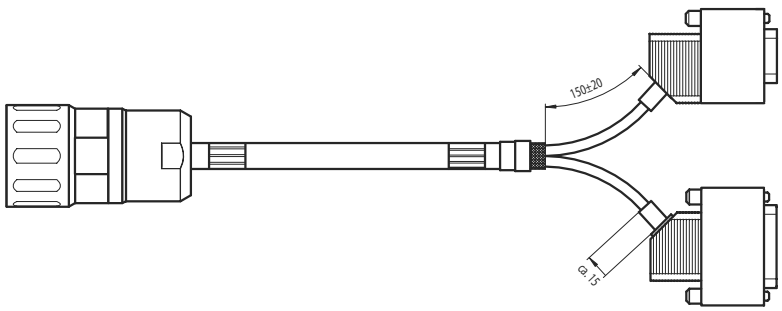
- Y cable to connect the AV1Y absolute encoder with plug connector on the motor side. The following encoder tracks are evaluated with the Y cable:
  - SSI track of the AV1Y absolute encoder and at DIP11B X62
  - sin/cos track of the AV1Y absolute encoder at DEH11B X15



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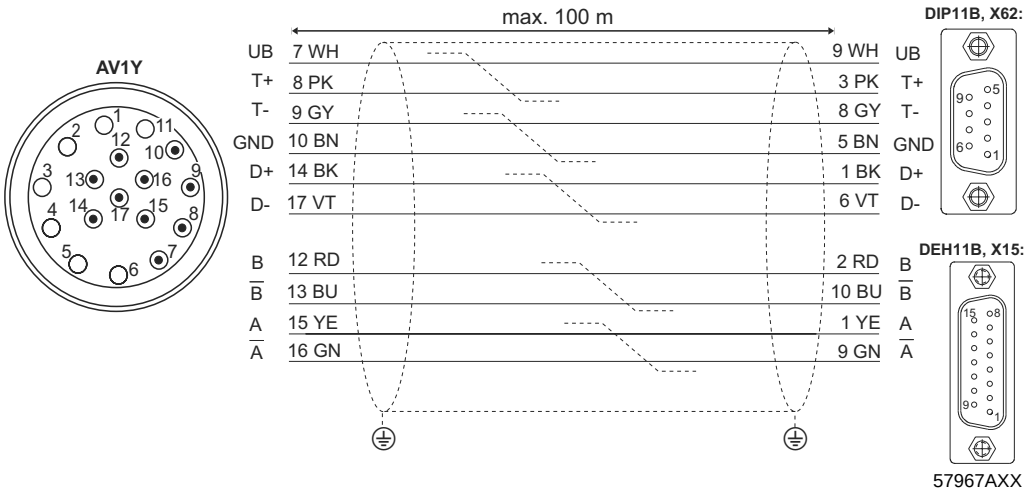
Part numbers of the prefabricated cables:

- For fixed routing: 1332 813 1
- For cable carrier routing: 1332 812 3

Wiring diagram for the Y cable:



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- CM and DS motors with integrated resolver: Additional cable to connect the AV1Y absolute encoder with plug connector connection on the motor side to DIP11B X62.

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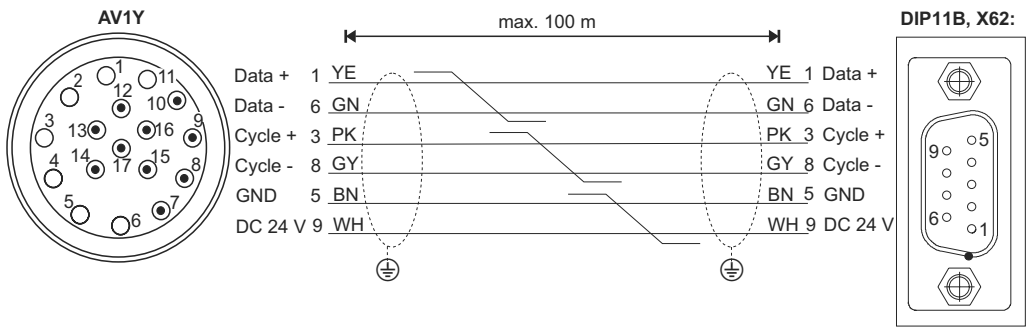
Part numbers of the prefabricated cables:

– For fixed routing: 198 929 4
– For cable carrier routing: 198 930 8

Wiring diagram:



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4 Project Planning

4.1 Encoder selection

When selecting the absolute encoder, the following points should be considered to achieve optimum travel characteristics and good dynamic properties in the system:

- **Position measurement should be conducted without slip.**

  Operate the encoder in positive engagement via toothed belt. Avoid all friction wheel connections.
- **Position measurement must be rigid.**

  Avoid elasticity and clearance.
- **The resolution of the position measurement must be as high as possible.**

  The more increments the encoder counts per unit-distance traveled,
  - the more exactly it approaches the target position
  - and the more rigid the control system can be set.
- **The "refresh time"** (the time taken for the absolute encoder to determine a new actual position) **should be less than 1 ms**.

  This value exerts a decisive influence on the dynamic characteristics of the drive.
- **The position output by the absolute encoder should not be averaged or filtered,** otherwise the dynamic properties of the drive are severely reduced.

Encoders which can be used with the DIP11B option are divided into three categories:

- Multiturn encoder, e.g. T&R CE58, CE 65, Sick ATM60
- Laser distance measuring devices, e.g. T&R LE200, Sick DME5000
- Linear distance measuring devices, e.g. Leuze BPS37, Stahl WCS2, Stahl WCS3

Multiturn encoder

- Multiturn encoders are ideally suited in applications with positive power transmission from the motor shaft to the load.

  In this case, the absolute encoder can be mounted onto the motor shaft of the drive. This keeps the installation costs very low while the position resolution is generally very high due to the gear ratio.
- If the position measurement is performed using an externally mounted incremental encoder (synchronous encoder), it is essential to make sure the ratio between the encoder and the toothed belt is adequate.

The ratio of position resolution between motor encoder and synchronous encoder must not exceed factor 8.

Example

Travel drive with the following data:

- Gearmotor: R97DV160L4BMIG11, i = 25.03
- Drive wheel diameter: 150 mm
- Encoder wheel diameter: 65 mm
- Encoder T&R CE65MSSI with:4096 x 4096 increments

Calculation of position resolution with encoder mounted to motor shaft:

$\rightarrow$ i x 4096 / (π x 150 mm) = 217 increments/mm

Calculation of position resolution with encoder mounted on the line:

→ 4096 / (π x 65 mm) = 20 inc/mm

Result: The ratio between the position resolution of the motor/track is 10.9 (greater than 8). The diameter of the encoder wheel should be reduced.

Laser distance measuring units

Distance measurement with laser systems is based on a run-time measurement of pulsed infrared beams. Various measurement values have to be processed in the encoder to determine an accurate position with this procedure. The result is a delay in position measurement with these systems of up to 50 ms. This delay has a negative effect on the dynamics and positioning accuracy of the drive.

Consider the following points when using and configuring laser distance measuring devices:

- Ensure a vibration-free design when mounting the measurement system, e.g. in case of travel drives for storage/retrieval systems. Install the measuring system on the bottom in this instance because the swinging motion of the tower will otherwise have an adverse effect on the measurement.
- The maximum acceleration of the drive is not to exceed 0.8 ms^{-2}.
- The encoder characteristics will usually result in a positioning accuracy of ± 1...3 mm.
- The long delay
  - may demand a drastic reduction in velocity precontrol (P915).
  - may limit the amplification of the position controller (P910) to small values (0.1 ... 0.4). This means high dynamic properties cannot be achieved.
- There is a lag fault which is dependent on the speed, making it harder to monitor the drive (delayed shut-off in the event of a fault).

Material measure by metal rule

The operating principle of this system corresponds to that of the multiturn encoder. There is no averaging, so this system is not subject to a delay in position measurement.

A linear position measuring system offers the following advantages:

- No reduction in dynamic properties.
- Velocity precontrol (P915) of 100% means there is no lag fault.
- The monitoring functions are fully effective; a small lag fault window is possible.

Disadvantages of a linear position measuring system:

- Position resolution of 0.8 mm. The required positioning accuracy should not be less than ± 2 mm.
- Rather complicated mechanical installation due to the need for routing the metal rule.

4.2 Setting the encoder parameters

The following points must be observed in the design and construction of encoders and when setting their parameters:

- **HEIDENHAIN ROQ 424 (AV1Y)**

  The SSI version with 10 ... 30 V is supported. The unit designation specifies all additional conditions.

- **T&R CE 58, CE 65, CE 100 MSSI, LE 100 SSI, LE 200, LA 66K-SSI, ZE 65**
  - Make a setting of 24 data bits and program signal bits to logical 0. Either 0 or an error or power fail bit may be present in the 25th bit. Other special bits following the position will not be evaluated. The 25-bit version is not supported.
  - The output code must be programmed to "Gray".
  - The output mode must be "Direct".
  - The interface must be set to "SSI".

- **STEGMANN AG100 MSSI, AG626, ATM60**

  Only the 24-bit version is supported.

- **SICK DME-5000-111**
  - The interface must be set to "SSI".
  - Set "24 data bits + error bit".
  - Set the resolution to 0.1 mm.
  - The plausibility must be set to "Normal".
  - The coding must be set to "Gray".

- **STAHL WCS2-LS311, WCS3**

  The unit designation specifies all necessary conditions. The line length to the encoder is not to exceed 10 m (33 ft.).

- **VISOLUX EDM 30/120/140 - 2347/2440**

  All modes are supported. Recommendation: Mode 0 (DIP switches 3 and 4 in ON position) or mode 3 (DIP switches 3 and 4 in OFF position) and measuring for triple reflector (DIP switch 2 in OFF position).

- **LEUZE OMS1, OMSE2, BPS37**
  - Set "24 data bits + error bit".
  - Set the resolution to 0.1 mm.
  - The coding must be set to "Gray".

5 Startup

5.1 General startup instructions

The drive must be started up in conjunction with the MOVIDRIVE® MDX61B drive inverter as described in the MOVIDRIVE® MDX60B/61B system manual. It must be possible to move the drive using a suitable setpoint and control source.

Make sure that

- the installation of the DIP11B option
- the cabling
- the terminal assignment and
- the safety cut-outs

have been configured correctly and are suited to the application.

There is no need to activate the factory settings. If you call up a factory setting, the MOVIDRIVE® MDX61B parameters will be reset to the default values. This also affects the terminal assignment, which must be altered to the required settings if necessary.

5.2 Startup with a PC and MOVITOOLS®

MOVITOOLS® software version 4.20 or higher is required for startup with a PC.

General information

- Terminal X13:1 (DIØØ "/CONTROL.INHIBIT") must receive a "0" signal!
- Start MOVITOOLS®.
- Select the language you want in the "Language" selection field.
- From the "PC-COM" drop down menu, select the PC port (e.g. COM 1) to which the inverter is connected.
- In the "Device type" field, select "Movidrive B".
- In the "Baudrate" field, select the baud rate set on the basic unit with the DIP switch S13 (standard setting → "57.6 kBaud").
- Click the [Update] button to display the connected inverter.

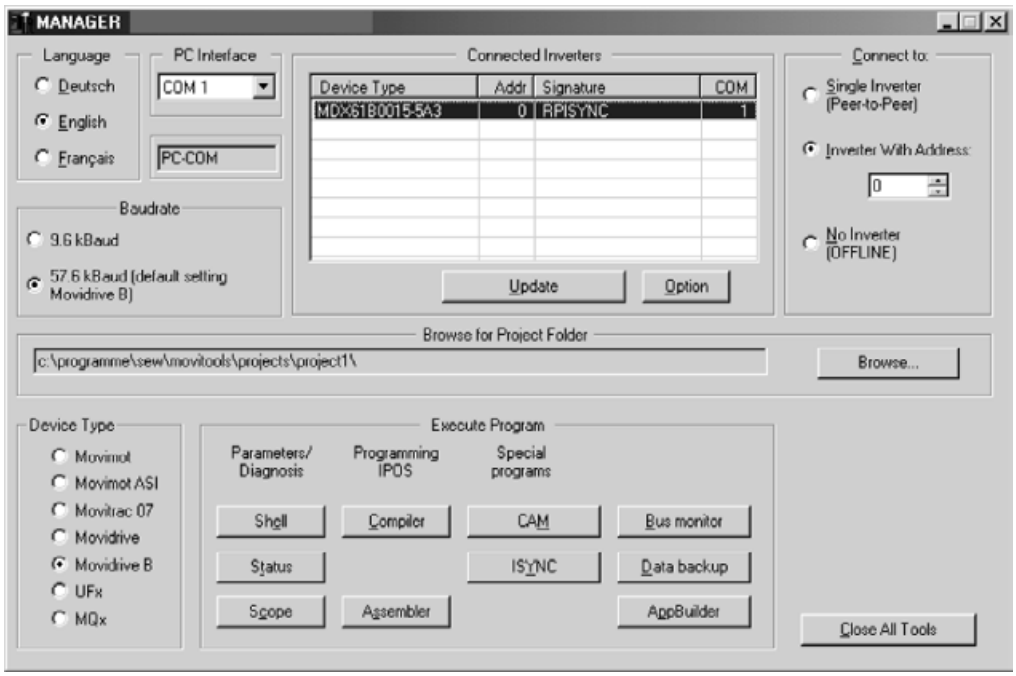

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Figure 5: MOVITOOLS® initial screen

- Before you startup up the DIP11B option, you have to startup the connected MOVIDRIVE® B unit.

Commencing startup

- In the "Execute Program" selection field, press the "Shell" button under "Parameters/Diagnosis". The Shell program is started.
- In the Shell program, select the [Startup] / [DIP Startup...] menu command.

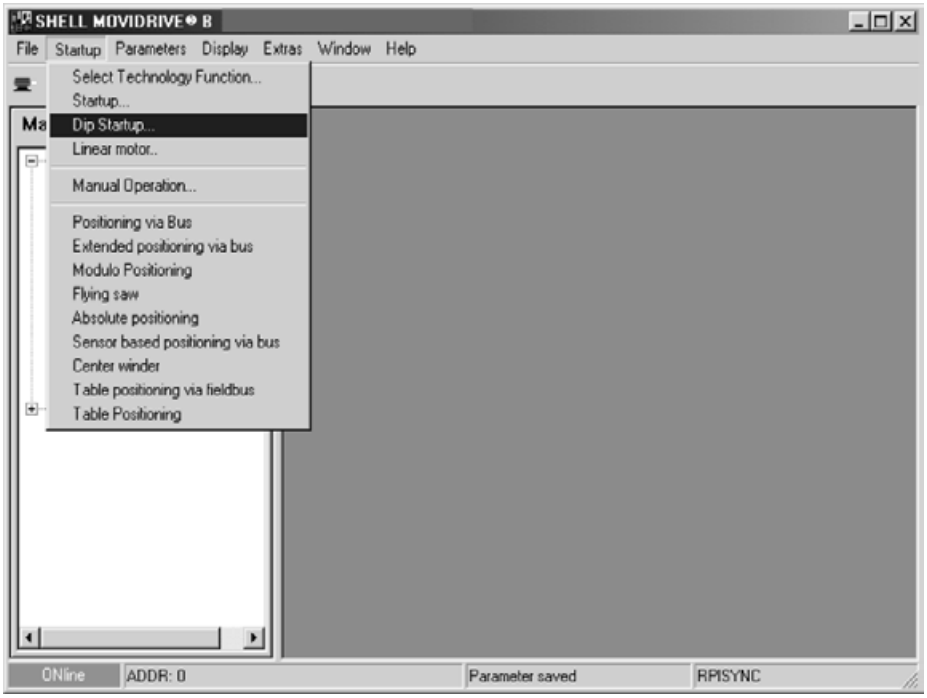

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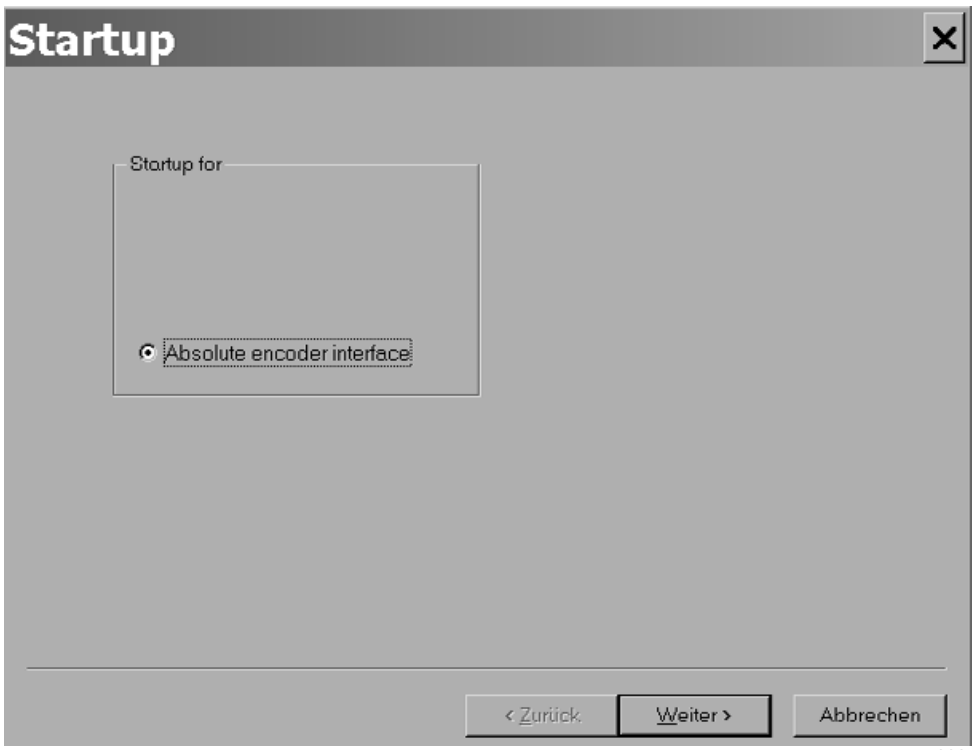
Figure 6: Open DIP startup

- MOVITOOLS® opens the startup menu for DIP absolute encoders (→ following figure). For questions on startup, refer to the MOVITOOLS® online help. Click [Next] to continue.



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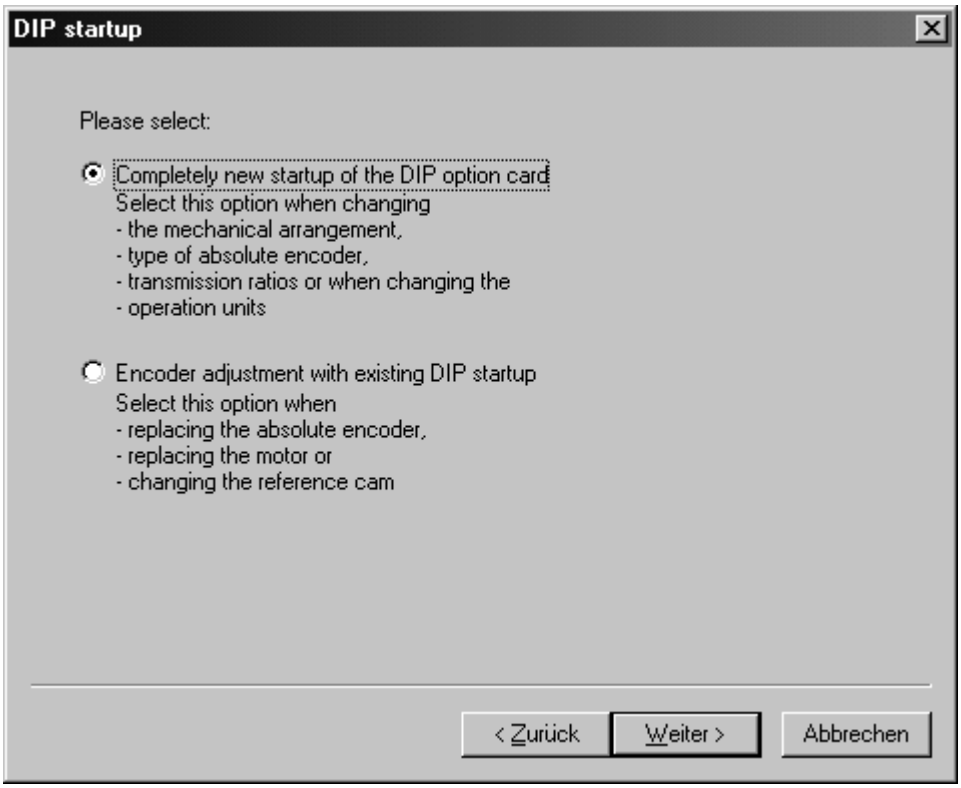
New startup of the DIP11B

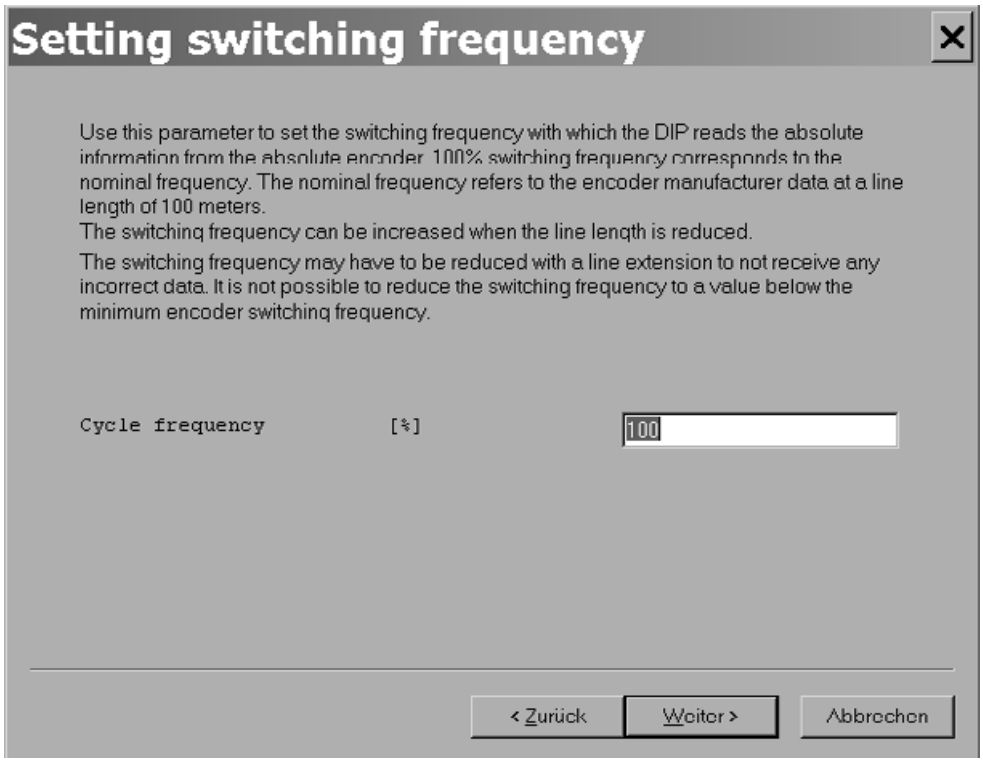


10710AEN

Figure 7: Set desired startup

- Choose one of the following options and click the [Next] button:
  - Completely new startup of the DIP11B option card, for example after initial installation
  - Encoder adjustment with existing DIP startup, for example after having replaced the absolute encoder (→ section "Restartup of the DIP11B").
- The following sections describe a complete new installation of the DIP11B.

Setting the cycle frequency



11239AEN

Figure 8: Setting the cycle frequency

- Set the cycle frequency at which the DIP11B reads the absolute information of the absolute encoder. 100 % cycle frequency corresponds to the nominal frequency. The nominal frequency relates to the encoder manufacturers information for a cable length of 100 m (→ Section "Encoder connection").
- If the line length < 100 m (330 ft.), you can increase the cycle frequency. Reading out the position values more quickly improves the closed-loop control properties. The cycle frequency may not be less than the minimum encoder cycle frequency.
- Click the [Next] button.

Select absolute encoder

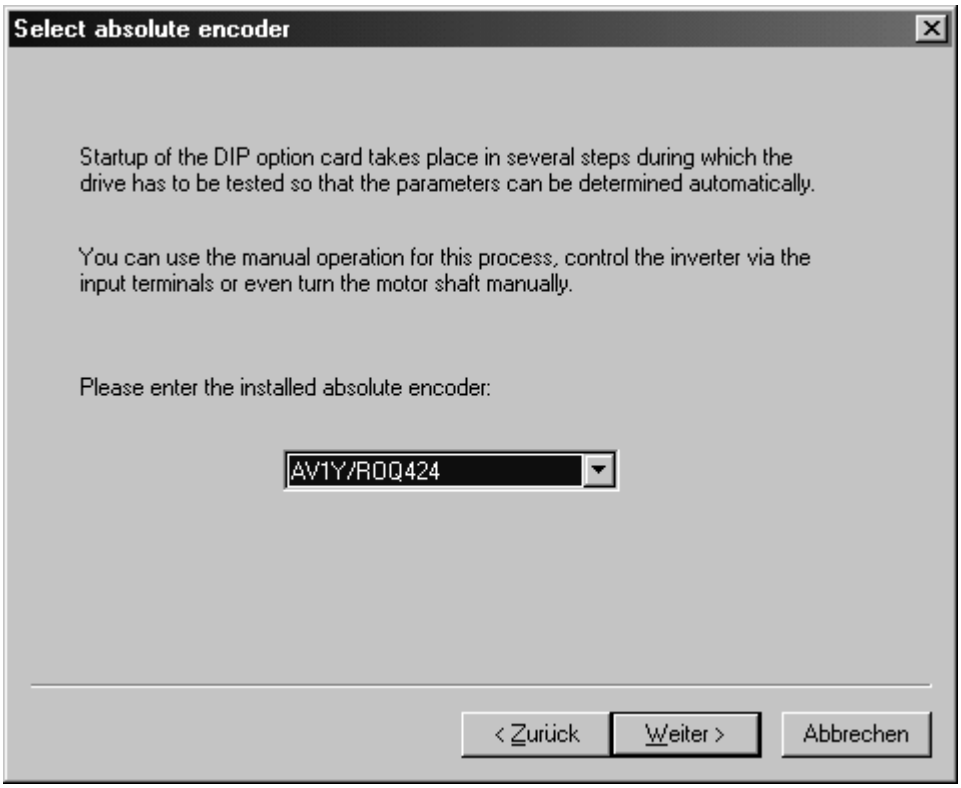


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Figure 9: Select absolute encoder

- Select the connected absolute encoder from the list of possible encoders.
- Click [Next] to continue.

Choose the increments or user units option

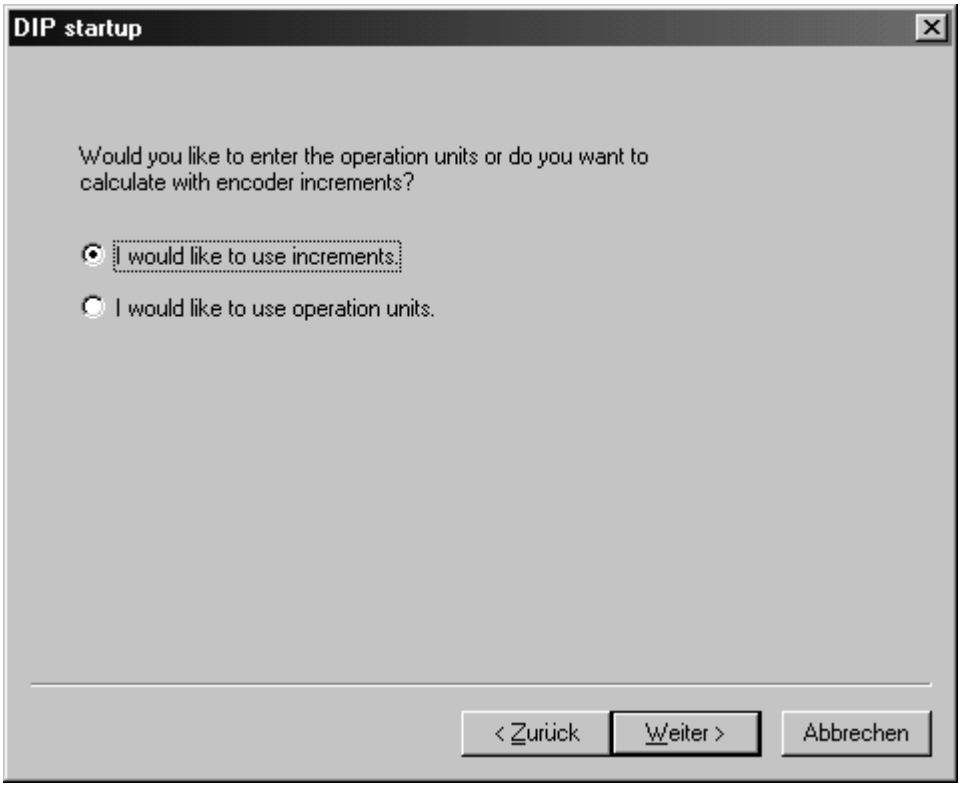

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Figure 10: Select increment option

- Select one of the two options "I would like to use increments" or "I would like to use operation units". Click [Next] to continue.

Set the operation range of the encoder

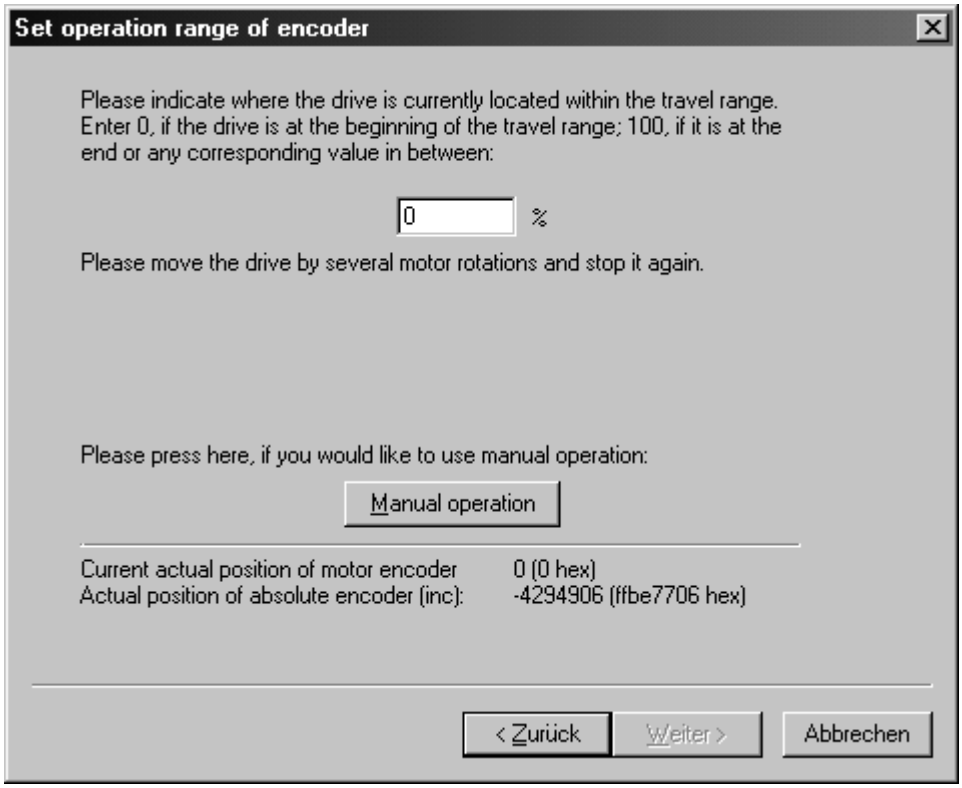

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Figure 11: Set the ratio of the connected encoder to the motor encoder

- You will have to move the drive by a few motor revolutions to set the ratio of connected encoder to motor encoder. Click the [Next] button for this purpose. The "Parameter" window opens (→ section "Entering IPOS$^{plus®}$ parameters").
- If you want to operate the drive in manual mode, click the "Manual operation" button. The "Manual operation" window opens (→ section "Manual operation").

Manual operation

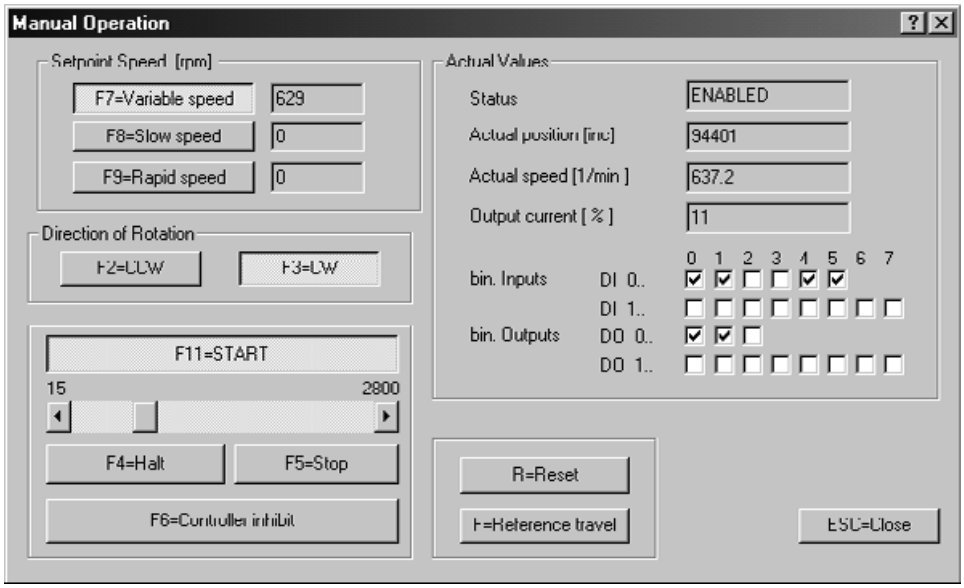

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Figure 12: Setting reference travel in manual operation

- Use buttons [F7=variable speed], [F8=slow speed] or [F9=rapid speed] to set the setpoint speed.
- Set binary input DI00 "/Controller inhibit" to the value "1".
- Use buttons [F2=CCW] and [F3=CW] to set direction of rotation.
- Click on button [F11=START] and move the drive by a few motor revolutions.
- Click on button [F5=Stop] and reset binary input DI00 to "0". Click ESC=Close. The current encoder setpoint will be activated. Confirm the next message with [OK].
- The window "Operation range of the encoder" will open up once again. Click [Next] to continue.

Enter IPOS$^{plus®}$ parameters

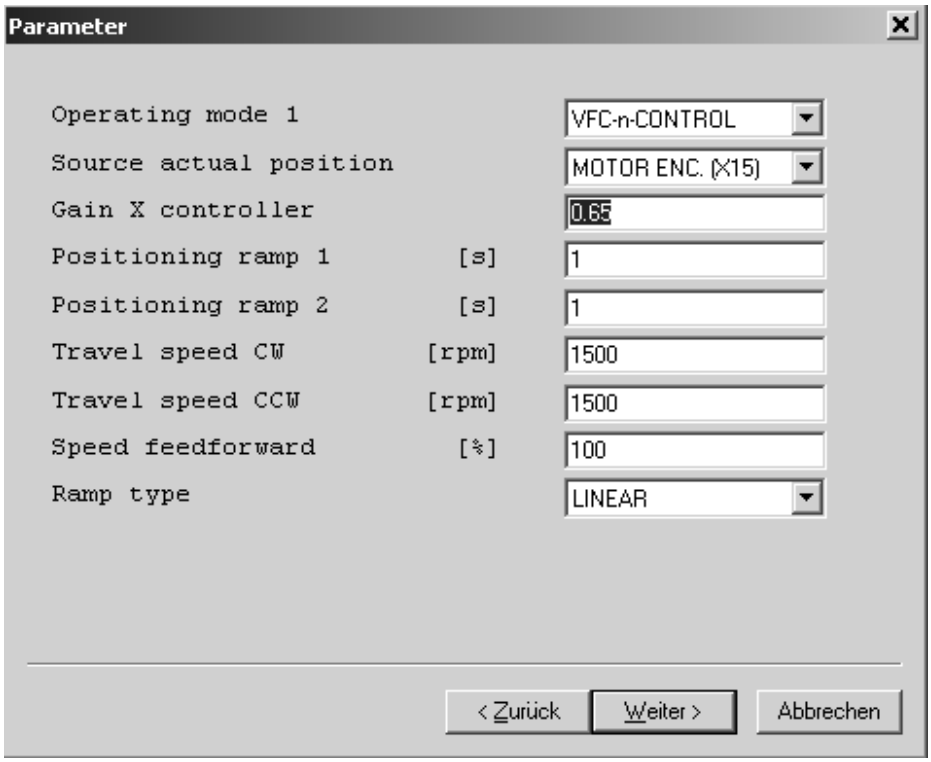

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Figure 13: Enter IPOS$^{plus®}$ parameters

- Enter all parameters (P910 and following) that are important for IPOS$^{plus®}$ programming. The parameters become effective in "...&IPOS" operating mode only.
- Click [Next] to continue.

Set parameters for reference travel

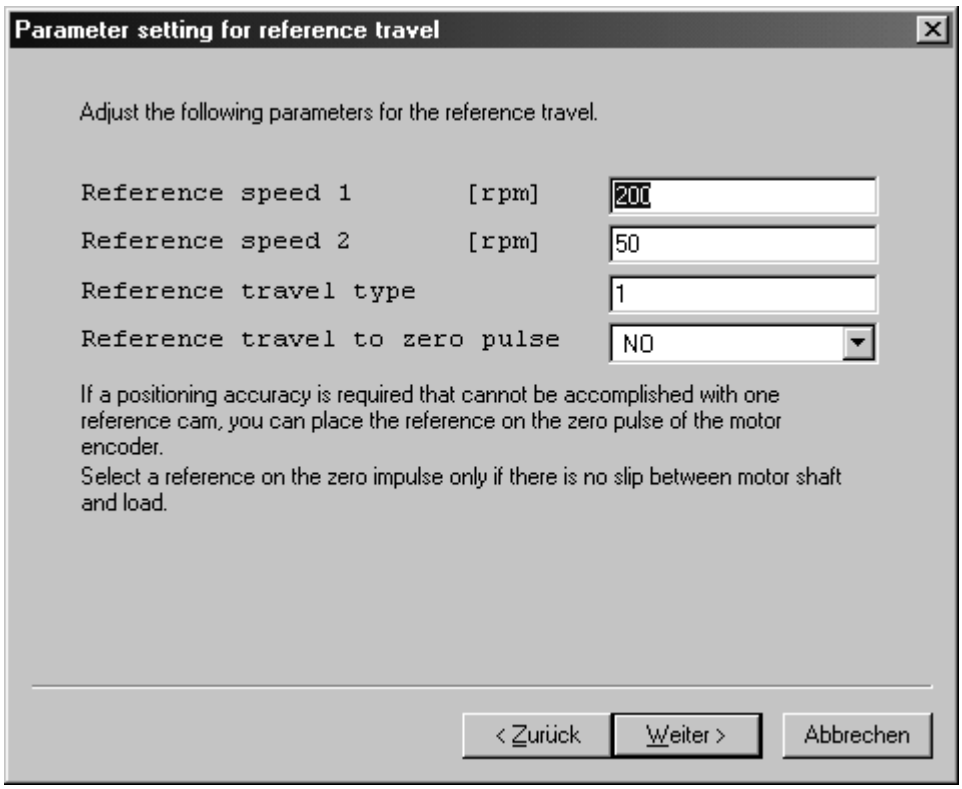

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Figure 14: Set parameters for reference travel

- A reference travel is necessary for precise assignment of the absolute encoder value to a mechanical reference point. Enter the necessary parameters (P900 and following). Click [Next] to start reference travel.

Start reference travel

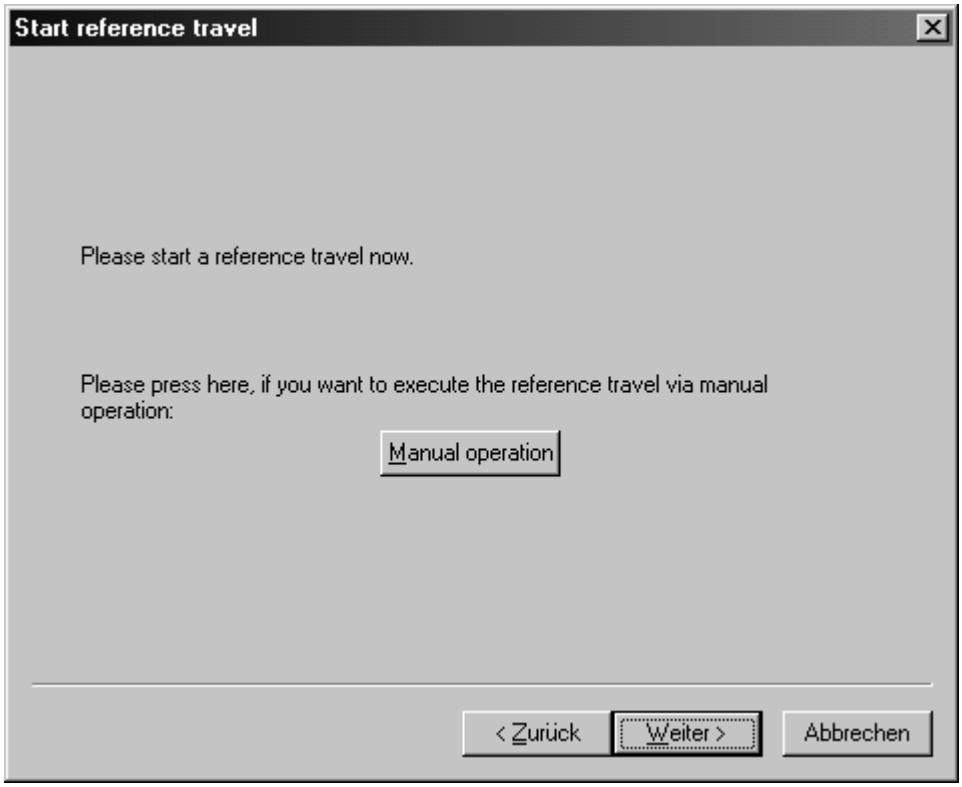

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Figure 15: Start reference travel

- If you want to perform reference travel by manual operation, click the [Manual operation] button. The "Manual operation" window opens (→ section "Perform reference travel by manual operation").
- After reference travel, click [Next] to continue. The window "Identify current absolute position" opens (→ section " Identify current absolute position).

Perform reference travel by manual operation

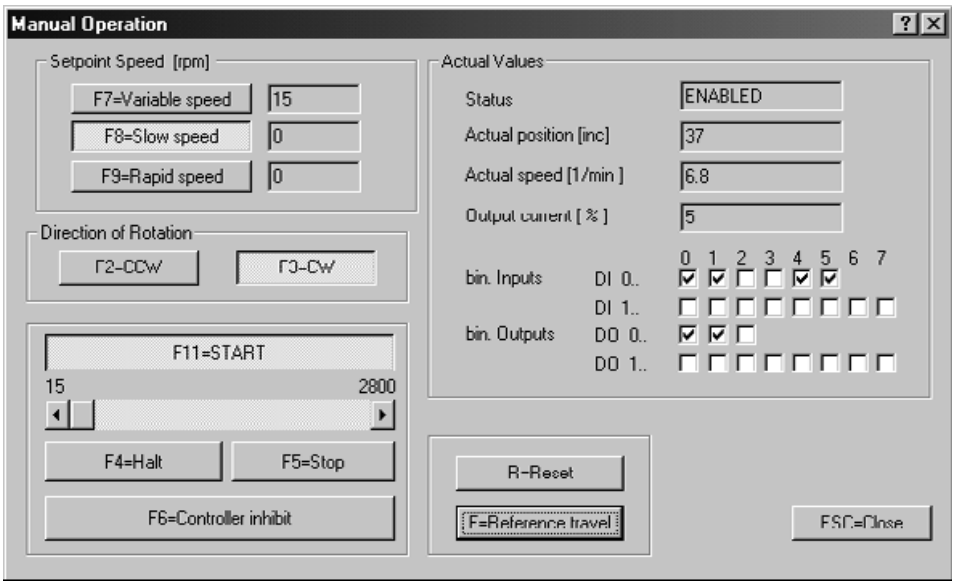

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Figure 16: Perform reference travel by manual operation

- Set binary input DI00 "/Controller inhibit" to the value "1".
- Use buttons [F2=CCW] and [F3=CW] to set direction of rotation.
- To start reference travel, click on the button [F11=START] and then on <F=Reference travel>.
- After reference travel, click the [F5=STOP] button. Reset the binary input DI00 to "0". Click ESC=Close. Confirm the next message with [OK].
- The window "Identify current absolute position" opens. Click the [Next] button.

Identify current absolute position

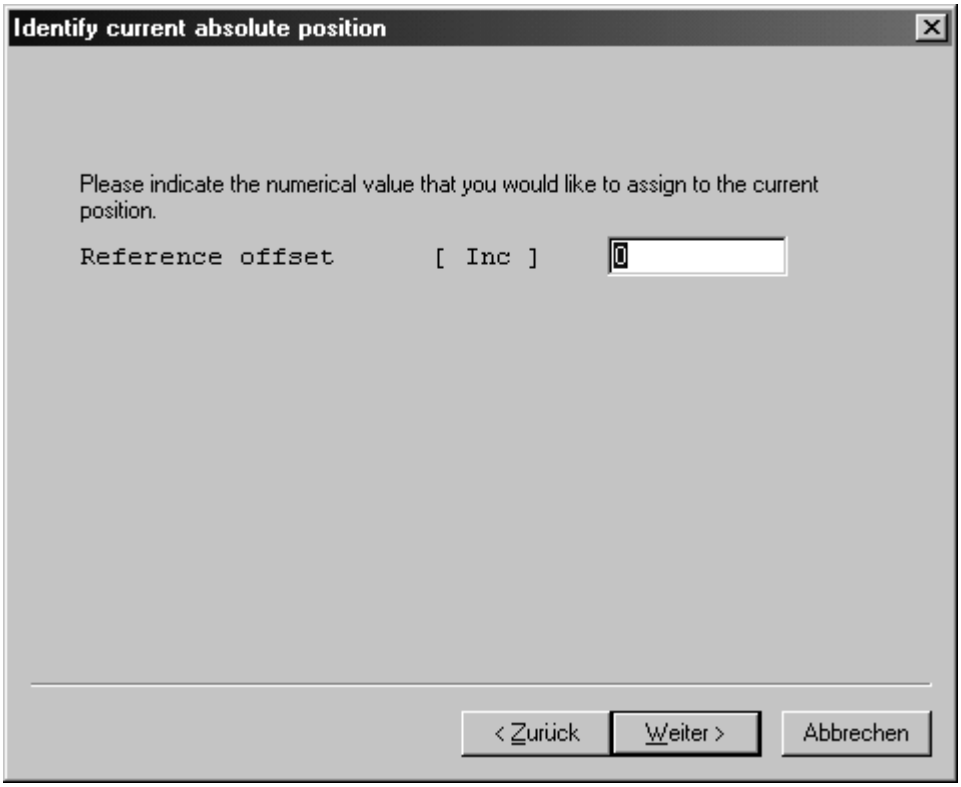

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Figure 17: Enter reference offset as incremental value

- Enter the numeric value that the current position is to correspond to in increments in the "Reference offset" entry field. Click [Next] to continue.

Save DIP parameters

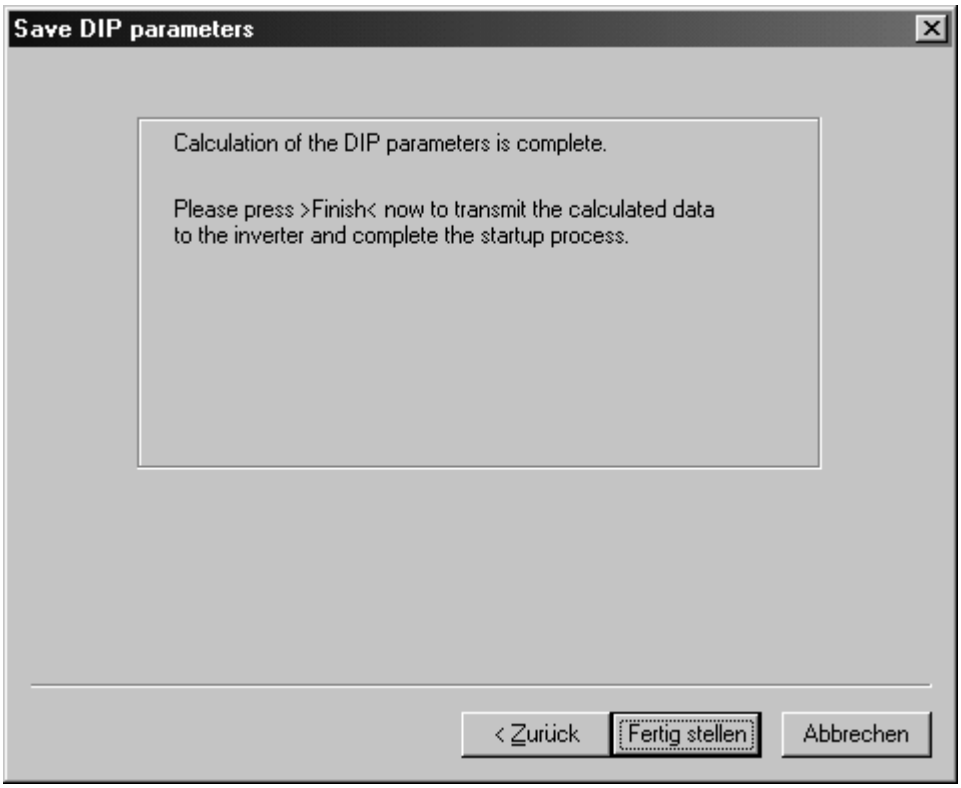

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Figure 18: Save DIP parameters

- Click [Finish] to transmit data to the inverter. This means the initial start is complete.

Restartup of the DIP11B

If startup of the DIP11B option has already been performed, the following window will open.

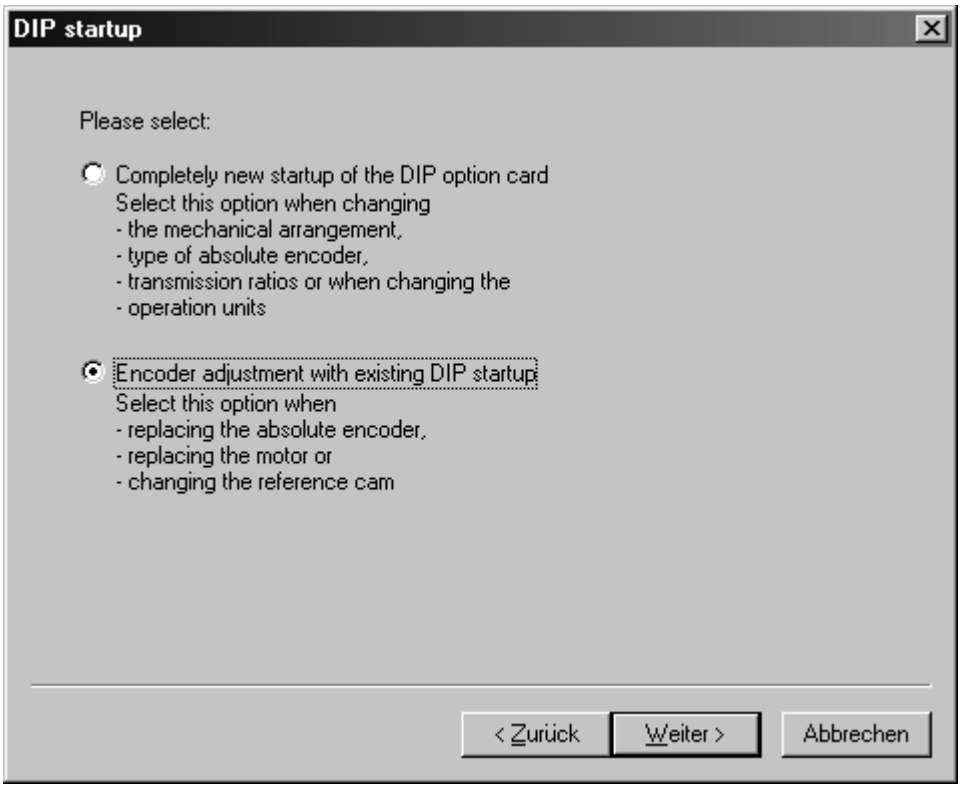

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Figure 19: Restartup of the DIP11B

- Select the option "Encoder adjustment with existing DIP startup" (e. g. after replacement of the absolute encoder).
- The following sections describe an encoder adjustment of the DIP11B.

Encoder adjustment

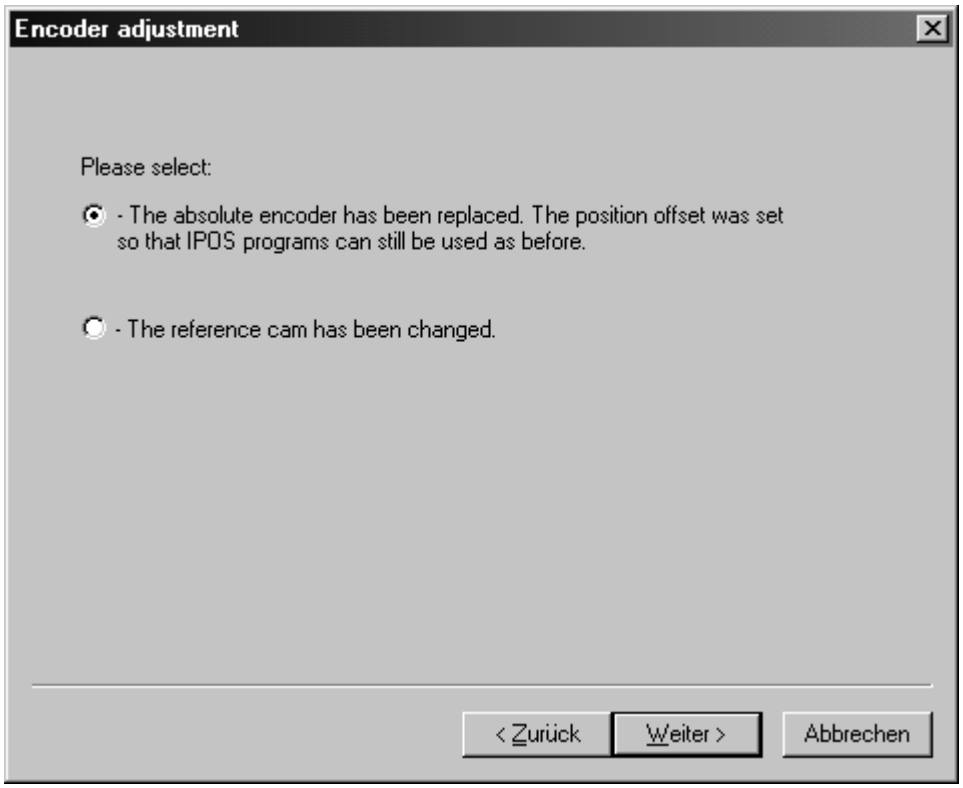

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Figure 20: Encoder adjustment

- Select one of the following options, depending on the particular application:
  - The absolute encoder has been replaced. The position offset was set so that IPOS$^{plus®}$ programs can be used without being edited.
  - The reference cam has been changed.
- Click [Next] to continue.

Start reference travel

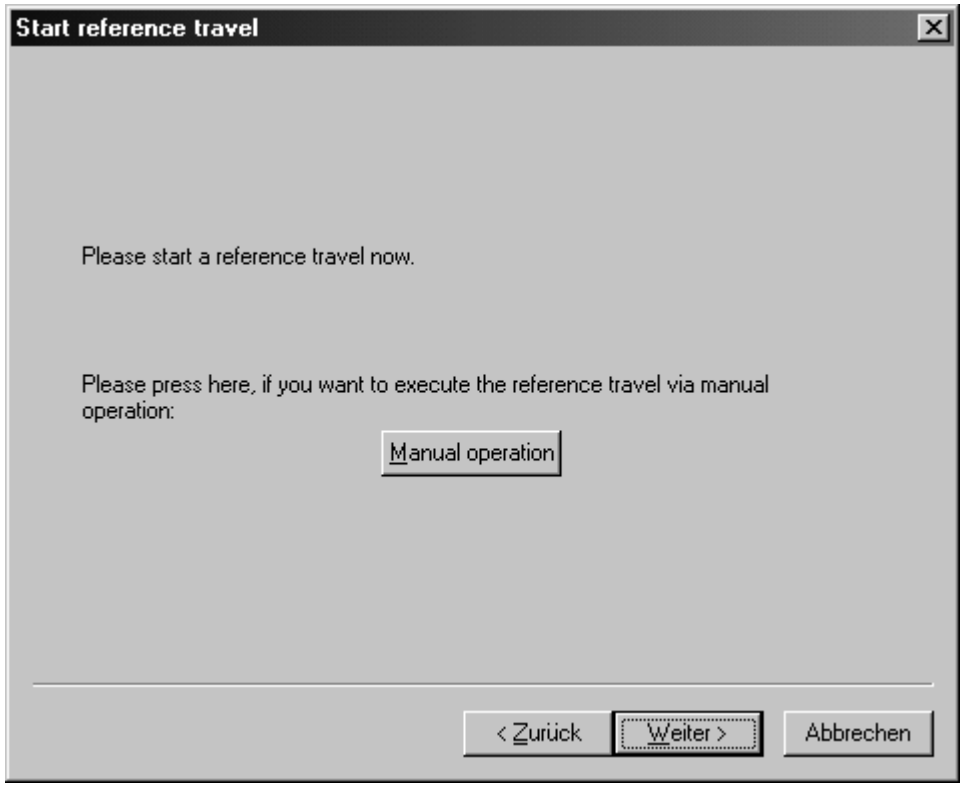

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Figure 21: Start reference travel

- If you want to perform reference travel by manual operation, click the [Manual operation] button. The "Manual operation" window opens (→ section "Perform reference travel by manual operation").
- After reference travel, click [Finish]. The data are automatically loaded to the inverter. This means the encoder adjustment is complete.

Perform reference travel by manual operation

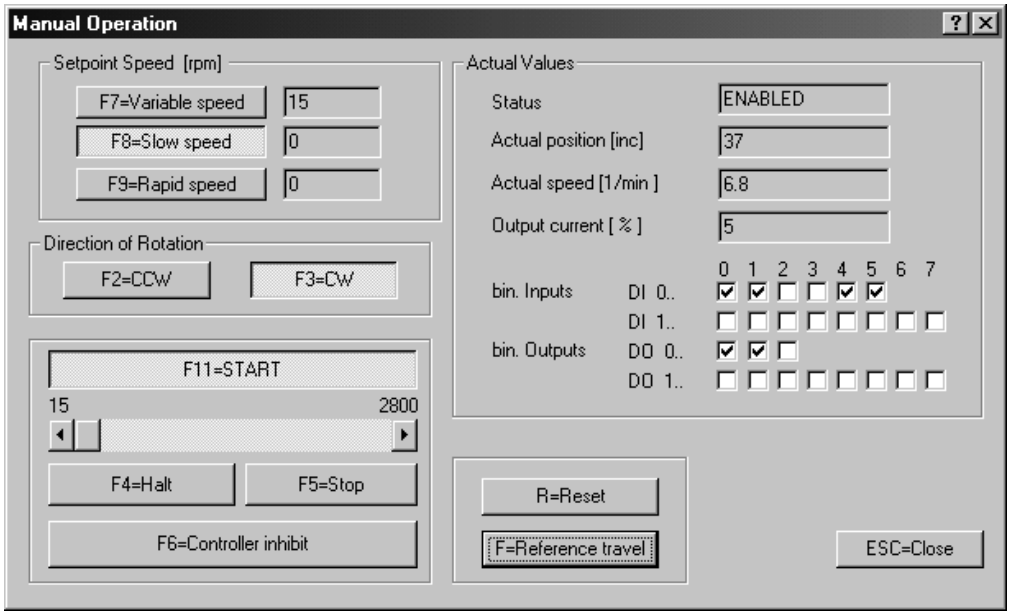

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Figure 22: Perform reference travel by manual operation

- Set binary input DI00 "/Controller inhibit" to the value "1".
- Use buttons [F2=CCW] and [F3=CW] to set direction of rotation.
- To start reference travel, click the button [F11=START] and next [F=Reference travel].
- After reference travel, click the [F5=STOP] button. Reset the binary input DI00 to "0". Click [ESC=Close]. Confirm the next message with [OK].
- The "Start reference travel" window opens. Click the [Finish] button. The data are loaded to the inverter. This means the encoder adjustment is complete.

5.3 Manual startup

Alternatively, you can perform the startup step-by-step with the DIP11B option as described below.

Select P950 encoder type

Select the absolute encoder connected to the DIP11B (X62) option. At present, **encoders** can be selected from the following list:

- VISOLUX EDM
- T&R CE65, CE58, CE100 MSSI
- T&R LE100
- T&R LA66K
- AV1Y / ROQ424
- STEGMANN AG100 MSSI
- SICK DME-3000-111
- STAHL
- WCS2-LS311
- STEGMANN AG626 / SICK ATM60
- IVO GM401
- STAHL WCS3
- LEUZE OMS1
- T&R ZE 65M
- LEUZE BPS37
- SICK DME 5000-111

You must check whether other encoders are suitable and released for use by SEW-EURODRIVE.

Set P35x direction of motor rotation

Move the drive in positive direction at low speed. If the actual position P003 counts upwards, it is possible to leave parameter *P350 Change direction of rotation* unchanged (→ use SHELL or DBG60B keypad to display the actual position). Change P350 if the actual position counts downwards.

P951 Set the counting direction for the SSI absolute encoder

Move the drive in the positive direction at low speed. If the absolute encoder position (*H509 ACTPOS. ABS*) counts upwards, you do not have to change parameter *P951 Counting direction*. Change P951 if the absolute encoder position counts downwards.

Set P955 Encoder scaling

Set P955 to "1" if there is no motor encoder (no speed control). The position information from the absolute encoder is multiplied by this value. The parameter is set so the travel information ratio between the motor encoder and the absolute encoder is as close to "1" as possible.

Proceed as follows:

- Set P955 to "1" initially.
- Note the values of the variables *H509 ACTPOS.ABS* and *H511 ACTPOS.MOT*.
- Move the drive by about one increment.
- Calculate the difference between the values you wrote down and the new values of the variables:
  - H509 old – H509 new = H509 difference
  - H511 old – H511 new = H511 difference
- Get the quotient Q from H509 difference and H511 difference:

  Q = H511 difference / H509 difference
- Set *P955 Encoder scaling* to the value closest to the calculated quotient Q, preferably to the lower of the closest values.

Set P954 Zero offset

Zero offset is used for assigning the value you want to a specific position. The range of values can adopt positive or negative position values. The maximum valid parameter must not be exceeded. The limit is determined by the range of values of the numerator $\pm(2^{31}-1)$ and the range of values of the absolute encoder. Move the drive to a known position. Read in the value of variable *H509 ACT.POS.ABS* and enter the following value in parameter *P954 Zero offset*: P954 = Variable H509 – required value.

The required value is the display value you wish to have for the current position.

Set P942 / P943 encoder factor numerator / denominator

In the event of positioning to an external encoder (X14) or an absolute encoder (DIP), then these two parameters are used for adapting the resolution to the motor encoder (X15).

Proceed as follows:

- Note the values of the variables *H509 ACTPOS.ABS* and *H511 ACTPOS.MOT*.
- Move the drive by about 30 000 increments (H511).
- Calculate the difference between the values you wrote down and the new values of the variables:
  - H509 old – H509 new = H509 difference
  - H511 old – H511 new = H511 difference
- The values must not differ by more than 32 767 ($2^{15}-1$). If the values are greater, divide both differentials by the same number to obtain correspondingly smaller values. Alternatively, repeat the procedure with a shorter travel distance.
- Enter the result H511 difference in *P942 Encoder factor nominator* and H509 difference in *P943 Encoder factor denominator*.

If there is no motor encoder installed (no speed control by MOVIDRIVE®), we recommend that you at least make an estimation of the relationship between encoder resolution and motor revolution. Use a value of 4,096 increments per motor revolution for the motor encoder.

Determine the *P943 Encoder factor denominator* as described above. Set for *P942 Encoder factor numerator* the value "4096 x number of performed motor revolutions".

In this case, the accuracy of the encoder factors is not so important (no speed control). The values merely serve for checking the absolute values in the DIP11B which occurs at a subordinate level.

Set P941 Source actual position

This parameter determines the position encoder used for position control if an operating mode & IPOS" is set in *P700 Operating mode*.

There are positioning commands in the IPOS$^{plus®}$ program to control the motor connected to MOVIDRIVE® MDX61B. Set *P941 Source actual position* to "Absolute encoder DIP" if the motor is to be positioned using the absolute encoder.

The circuit gain for position control of IPOS$^{plus®}$, parameter *P910 Gain X controller* was preset during startup of the speed control loop. The presetting requires position control to the motor encoder. The difference in encoder resolution or the time characteristics of the absolute encoder (e.g. laser distance measuring instrument) may require a lower value setting.

- Set half the value of the calculated preset value.
- Start an IPOS$^{plus®}$ program with a positioning operation between two valid points at moderate speed.
- Reduce or increase parameter *P910 Gain X controller* step-by-step until the best movement and positioning characteristics have been set.
- The position value provided by the absolute encoder is available in variable *H509 ACTPOS.ABS*. The position value can be processed with the internal IPOS$^{plus®}$ control even without direct positioning.

6 Unit Functions

6.1 Encoder evaluation

All connected encoders are always evaluated regardless of the operating mode (P700). Operating modes with positioning (VFC-n-Reg. & IPOS, CFC & IPOS, SERVO & IPOS) always require a motor encoder at X15. The actual positions can be evaluated with the touch-probe function.

Encoder type		Absolute encoder on DIP11B P941: Absolute encoder (DIP)	Ext. encoder on X14 (P941: external encoder)	Motor encoder on X15 (P941:Motor encoder)
Connection		X62 on DIP11B	X14 on DEH/DER11B option	X15 on DEH/DER11B option
Actual value on variable		H509 ACTPOS.ABS	H510 ACTPOS.EXT	H511 ACTPOS.MOT
Resolution		Absolute position **after** conversion with: • Zero offset (P954), • Position offset (P953), • Counting direction (P951).	**Actual** number of encoder PPR count (with four time evaluation)	**Always** 4096 inc./motor revolution, regardless of the actual encoder resolution
Touch probe	**Edge at DI02**	H503 TP.POS1ABS	H506 TP.POS1EXT	H507 TP.POS1MOT
	Edge at DI03	H502 TP.POS2ABS	H504 TP.POS2EXT	H505 TP.POS2MOT
	Max. delay time	1 ms	100 µs	

6.2 Functions relevant for absolute encoders

The following monitoring functions do not depend on the use of the DIP11B. However, knowledge of the range of functions is important for optimum use.

Speed monitoring

Speed monitoring checks the correcting variable of the n-controller and, in M control mode, the actual speed range. The motor encoder is always used for the speed signal, so the "DIP11B encoder" is either not "checked" with speed monitoring P50_ or not 'checked' directly.

Lag error monitoring

When lag error monitoring is active, it checks the difference between the current setpoint position and the actual position. The maximum permitted amount is set using *P923 Lag error window*. Lag error monitoring is only effective if the drive is in positioning status. The resolution is always "encoder increments" (exception: *P941 Source actual position* = Motor encoder (X15)), independent of PPR count 4,096 incr./motor revolution).

Axis in position message

The function operates with the resolution encoder increments of the encoder set via P941 (exception: *P941 Source actual position* = Motor encoder (X15)), independent of PPR count 4,096 incr./motor revolution).

If no positioning operation has been set via P700 or if the drive is in reference travel status, the function will always show "Axis in position = 0."

Reference travel

The reference travel and the associated parameters P900 ... P903 as well as the reference travel commands refer to the motor position (X15) and therefore to the motor encoder.

The message "Axis referenced" refers to a referencing of the motor position.

The variable *H510 ACTPOS.EXT* (X14) may be set with IPOS$^{plus®}$.

The DIP11B position at variable *H509 ACTPOS.ABS* is the processed position value. It is created with the absolute value supplied from the encoder, taking account of the DIP11B parameters *P952 Counting direction* and *P954 Zero offset*.

Modulo function

You activate the modulo function with the Shell parameters (P960 and following) (→ MOVIDRIVE® MDX60B/61B system manual). You then have the option to represent the positioning process directly in the scaling 360° ≙ 2^{16}.

The actual position is displayed in variable *H455 ModActPos*. Positioning processes are triggered in case the target position (variable *H454 ModTagPos*) is written in enabled state. You will find additional information in the "MOVIDRIVE® IPOS$^{plus®}$ positioning and sequence control" manual.

System variables relevant for absolute encoders

System variable	Meaning
H503 TP.POS1ABS	Touch probe position DIP11B encoder
H502 TP.POS2ABS	Touch probe position DIP11B encoder
H509 ACTPOS.ABS	Absolute position after conversion with zero offset, position offset, counting direction, encoder scaling

Software limit switches

The function of the software limit switches monitors whether the current target position (H492 TARGET POSITION) is in the valid range. The function is active when the drive is referenced or parameter *P941 = source actual position* = absolute encoder (DIP) is set and the drive is in positioning status. If you position to "external encoder" and need the limit switches, you will have to perform a reference travel.

6.3 Display values

The SHELL operating software and the DBG60B keypad display in parameter group *P00_ Display values / Process values* the position information of the motor encoder. This also applies to the fieldbus information of the PI data "ACTUAL position LOW and HIGH".

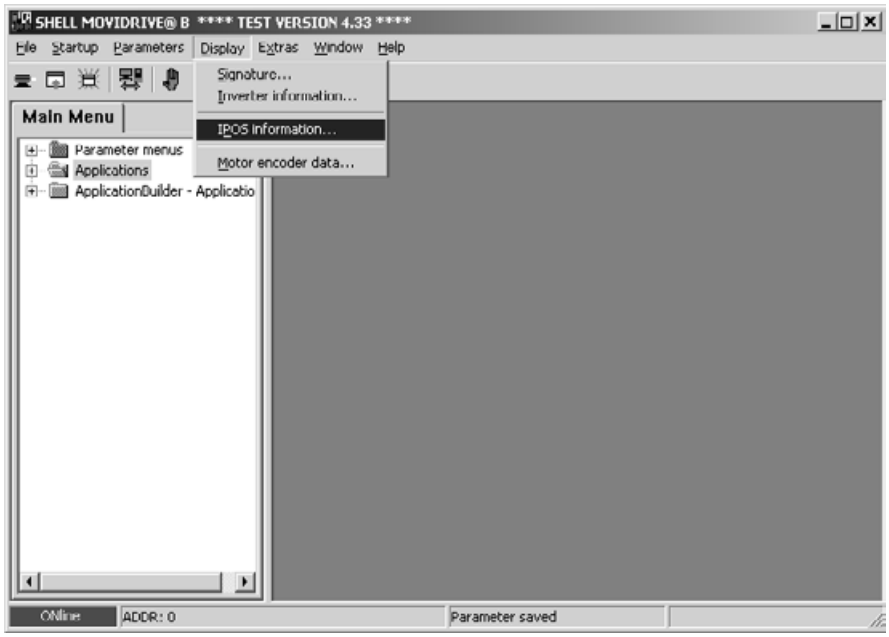
The system variable *H509 ACTPOS.ABS* includes the processed position value of the absolute encoder. You can view the value with SHELL and DBG60B. Transmission with the fieldbus is implemented by setting the PI data transfer P873/4/5 to "IPOS PI DATA" and writing the PI data with the *SetSys* command in the IPOS$^{plus®}$ program.

You can write PI data with the *SetSys* command if an actual position (regardless of the encoder) can be transmitted scaled.

6.4 Diagnostic method in Shell

You have the option to display the current program status (such as the current actual position of the absolute encoder). Proceed as follows:

In Shell, open the menu item [Display] / [IPOS Information].



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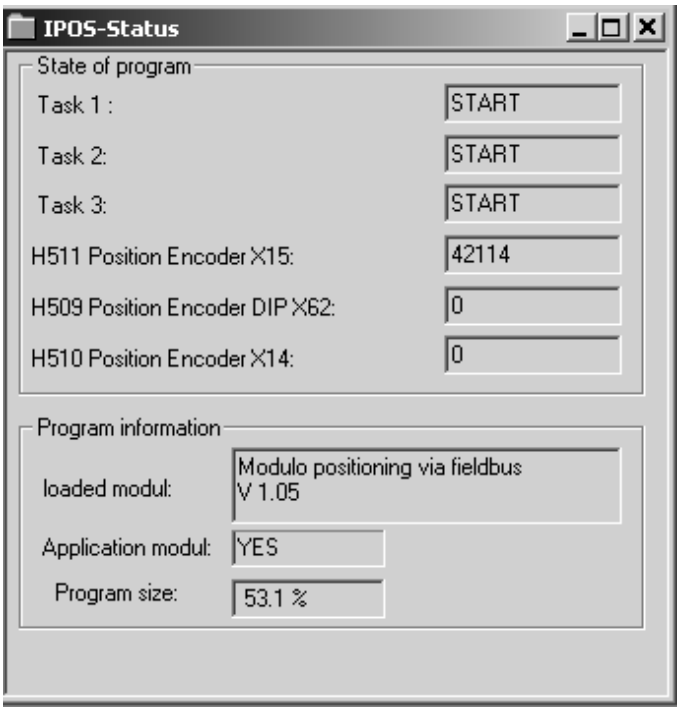
The window [IPOS status] opens. Here you can find the information on the current program status (→ following figure).



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7 IPOS$^{plus®}$ Parameters

7.1 Parameter description

The following is a description of the IPOS$^{plus®}$ parameters. The factory setting is indicated by underline.

P941 Source actual position

Setting range: Motor encoder (X15) / Ext. encoder (X14) / Absolute encoder (DIP)

This parameter defines the encoder to which IPOS$^{plus®}$ performs positioning movement:

P942 / P943 encoder factor numerator / denominator

Setting range: 1 ... 32767

In the event of positioning to an external encoder (X14) or an absolute encoder (DIP), then these two parameters are used for adapting the resolution to the motor encoder (X15).

Proceed as follows:

- Write down the values of variables *H509 DIP position* and *H511 Current motor position*.
- Move the drive by about 30 000 increments (H511).
- Calculate the difference between the values you wrote down and the new values of the variables:
  - H509 old – H509 new = H509 difference
  - H511 old – H511 new = H511 difference
- The values must not differ by more than 32 767 (2^{15} –1). If the values are greater, divide both differentials by the same number to obtain correspondingly smaller values. Alternatively, repeat the procedure with a shorter travel distance.
- Enter the result H511 difference in *P942 Encoder factor nominator* and H509 difference in *P943 Encoder factor denominator*.

P950 Encoder type

The absolute encoder connected to X62 on the DIP11B is selected. At present, encoders can be selected from the following list:

- NO ENCODER
- VISOLUX EDM
- T&R CE65, CE58, CE100 MSSI
- T&R LE100
- T&R LA66K
- AV1Y / ROQ424
- STEGMANN AG100 MSSI
- SICK DME-3000-111
- STAHLWCS2-LS311
- STEGMANN AG626 / SICK ATM60
- IVO GM401
- STAHL WCS3
- LEUZE OMS1
- T&R ZE 65M
- LEUZE BPS37
- SICK DME 5000-111

P951 Counting direction

Setting range: NORMAL / INVERTED

Defines the counting direction of the absolute encoder. The setting must be made so the counting direction of the motor encoder (X15) and the absolute encoder (X62) match.

P952 Clock frequency

Setting range: 1 ... 200 %

Defines the cycle frequency at which absolute encoder information is transmitted from the encoder to the inverter. A cycle frequency of 100 % corresponds to the nominal frequency of the encoder in relation to a 100 m cable length.

P954 Zero offset

Setting range: $-(2^{31}-1)$ ... 0 ... $2^{31}-1$

Zero offset is used for assigning the value you want to a specific position. The range of values can adopt positive or negative position values. The maximum valid parameter must not be exceeded. The limit is determined by the range of values of the numerator $\pm(2^{31}-1)$ and the range of values of the absolute encoder. Move the drive to a known position. Read in the value of variable *H509 ACT.POS.ABS* and enter the following value in parameter *P954 Zero offset*: P954 = Variable H509 – required value.

The required value is the display value you wish to have for the current position.

P955 Encoder scaling

Setting range: x1 / x2 / x4 / x8 / x16 / x32 / x64

The significance of the travel resolution of the motor encoder and absolute encoder is adapted using this parameter. The parameter is set so the travel information ratio between the motor encoder and the external encoder is as close to "1" as possible. Set the parameter initially to "x1." To do this, note the values in variables H510 and H511.

Move the drive by about 1000 increments (H511). Determine the difference between the noted value and the current value and calculate the quotient. Set the parameter *P944 Encoder scaling ext. encoder* to the value that is closest to the calculated quotient.

Important: Encoder scaling directly influences parameters **P900 Reference offset**, *P942 Encoder factor numerator* and *P943 Encoder factor denominator* and the parameter group *P92x IPOS monitoring*. All positions of the IPOS$^{plus®}$ program have to be adjusted when using the external encoder. The setting of all listed parameters has to be adjusted every time the encoder scaling is changed.

8 Sample Application

8.1 Storage/retrieval system with extended bus positioning

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

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

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

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

- User-friendly operator interface
- You only have to enter the parameters required for "Extended bus 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 diagnostics.
- You do not need any programming experience.
- Long travel distances possible ($2^{18} \times$ travel unit)
- Either an incremental encoder or an absolute encoder can be used as the external encoder.
- It does not take long to get to know the system.

Functional characteristics

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

- Any number of target positions can be specified via the fieldbus.
- Long travel distance possible. The maximum possible travel distance depends on the travel unit which is set, for example:

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

- The speed and ramps must be set using the bus for positioning.
- Software limit switches can be defined and evaluated.
- Either incremental encoders or absolute encoders can be evaluated as external encoders.
- Simple connection to the machine control (PLC).

Operating modes

The functions are implemented with three operating modes:

- **Jog mode**
  - The drive is moved clockwise or counterclockwise using bits 9 or 10 in control word 2 (PO1).
  - The speed and the ramps are variable and are specified using the fieldbus.

- **Referencing mode**
  - Reference travel is started with bit 8 in control word 2 (PO1). Reference travel establishes the reference point (**machine zero**) for absolute positioning operations.
  - Reference travel can be performed even if an absolute encoder is used as the external encoder.

- **Automatic mode**
  - Positioning is started in automatic mode with bit 8 in control word 2 (PO1).
  - The target position is specified using process output data words PO2 and PO3.
  - The actual position is signaled back cyclically in user travel units using process input data words PI2 and PI3.
  - The set speed is specified using process output data word PO4.
  - The actual speed is signaled back cyclically using process input data word PI4.
  - Accelerating and deceleration ramps are specified using process output data words PO5 and PO6.
  - The active current and unit utilization are signaled back cyclically using process input data words PI5 and PI6.
  - Confirmation of the target position to which movement has taken place via virtual binary output "target position reached."

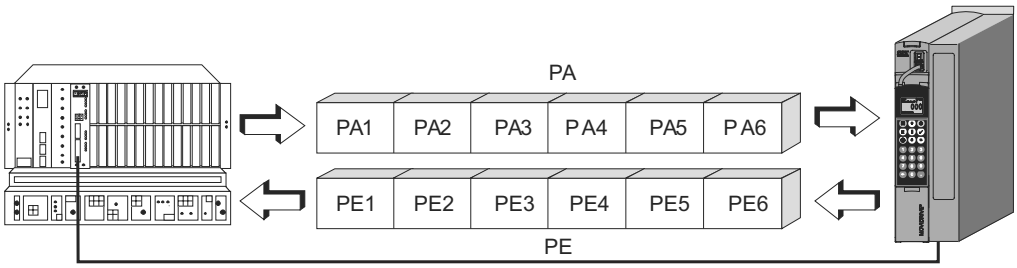

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Figure 23: Data exchange via process data

PO	= Process output data	PI	= Process input data
PO1	= Control word 2	PI1	= Status word
PO2	= Target position high	PI2	= Actual position high
PO3	= Target position low	PI3	= Actual position low
PO4	= Set speed	PI4	= Actual speed
PO5	= Acceleration ramp	PI5	= Active current
PO6	= Deceleration ramp	PI6	= Unit utilization

9 Error Messages

9.1 MOVIDRIVE® MDX61B with DIP11B option

The factory set error response appears in the "Response" column.

Error code	Designation	Response	Possible cause	Measure
36	Option missing	Immediate switch-off	• Type of option card not allowed. • Setpoint source, control signal source or operating mode not permitted for this option card. • Incorrect encoder type set for DIP11B.	• Use correct option card. • Set correct setpoint source (P100). • Set correct control signal source (P101). • Set correct operating mode (P700 or P701). • Set correct encoder type.
40	Boot synchronization	Immediate switch-off	Error during boot synchronization between inverter and option.	Install a new option card if this fault reoccurs.
41	Watchdog option IPOS watchdog	Immediate switch-off	• Error during communication between system software and option software. • Watchdog in the IPOS$^{plus®}$ program • An application module without the application version has been loaded in a MOVIDRIVE® B unit • The wrong technology function has been set if an application module is used.	• Contact SEW Service. • Check IPOS$^{plus®}$ program • Check whether the unit has been activated for the application version (P079) • Check the selected technology function (P078)
92	DIP encoder problem	Error display	• Encoder signals a fault.	• Possible cause: Encoder is dirty → clean encoder.
93	DIP encoder fault	Emergency stop	The encoder signals a fault, e.g. power failure: • Connection cable between the encoder and DIP11B does not meet the requirements (twisted pair, shielded). • Cycle frequency too high for line length. • Permitted max. speed/acceleration of encoder exceeded. • Encoder defective.	• Check absolute encoder connection. • Check connection cables. • Set correct cycle frequency. • Reduce maximum traveling velocity or ramp. • Install new absolute encoder.
95	DIP plausibility error	Emergency stop	No plausible position could be determined. • Incorrect encoder type set. • IPOS$^{plus®}$ travel parameter set incorrectly. • Numerator/denominator factor set incorrectly. • Zero adjustment performed. • Encoder defective.	• Set the correct encoder type. • Check IPOS$^{plus®}$ travel parameters. • Check traveling velocity. • Correct numerator/denominator factor. • After zero adjustment reset. • Install new absolute encoder.
99	IPOS ramp calculation error	Immediate switch-off	**Only in IPOS$^{plus®}$ operating mode:** Positioning ramp is sinusoidal or square and an attempt is made to change ramp times and traveling velocities with enabled inverter.	Rewrite the IPOS$^{plus®}$ program so that ramp times and traveling velocities can only be altered when the inverter is inhibited.

10 Technical Data

10.1 Electronic data DIP11B option

Description		Function
Connection binary inputs X60:1 ... 8		DI10 ... DI17 isolated via optocoupler, scanning time 1 ms, PLC compatible (EN 61131)
Internal resistance		$R_i \approx 3\ k\Omega$, $I_E \approx 10$ mA
Signal level (EN 61131)		"1" = DC+13 V ... +30 V "0" = DC–3 V ... +5 V
Function	**X60:1 ... 8**	DI10 ... DI17: Selection option → Parameter menu P61_
Connection binary outputs	**X61:1 ... 8**	DO10 ... DO17, PLC compatible (EN 61131), response time 1 ms I_{max} = DC 50 mA, short-circuit proof and protected against external voltage
Signal level (EN 61131)		"1" = DC+24 V "0" = DC 0 V **Important**: Do not apply external voltage > DC 30 V!
Function X61:1 ... 8		DO10 ... DO17: Selection option → Parameter menu P63_
Encoder connection	**X62:**	SSI encoder input
Reference terminals	**X60:9** **X60:10**	DCOM: Reference potential for binary inputs (DI10 ... DI17) DGND: Reference potential for binary signals and 24VIN • without jumper X60:9-X60:10 (DCOM-DGND) isolated binary inputs • With jumper X60:9-X60:10 (DCOM-DGND) non-isolated binary inputs
Voltage input	**X61:9**	24VIN: Supply voltage DC+24 V for binary outputs DO10 ... DO17 and encoder (mandatory)

11 Index of Changes

11.1 Changes to the previous version

The following section lists the changes made to the individual sections from edition 02/2004, publication number 11267313.

General information	The data of the correction sheet 11321016 was adopted.
Assembly / installation information	• The section "Voltage supply of the DIP11B" has been added. • The section "Prefabricated cables / wiring cables" has been added
Startup	The section "Startup" has been completely revised.
Error messages	The section "Error messages" has been amended.

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	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaceo Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 dtait@sew.co.za

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

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

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch

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

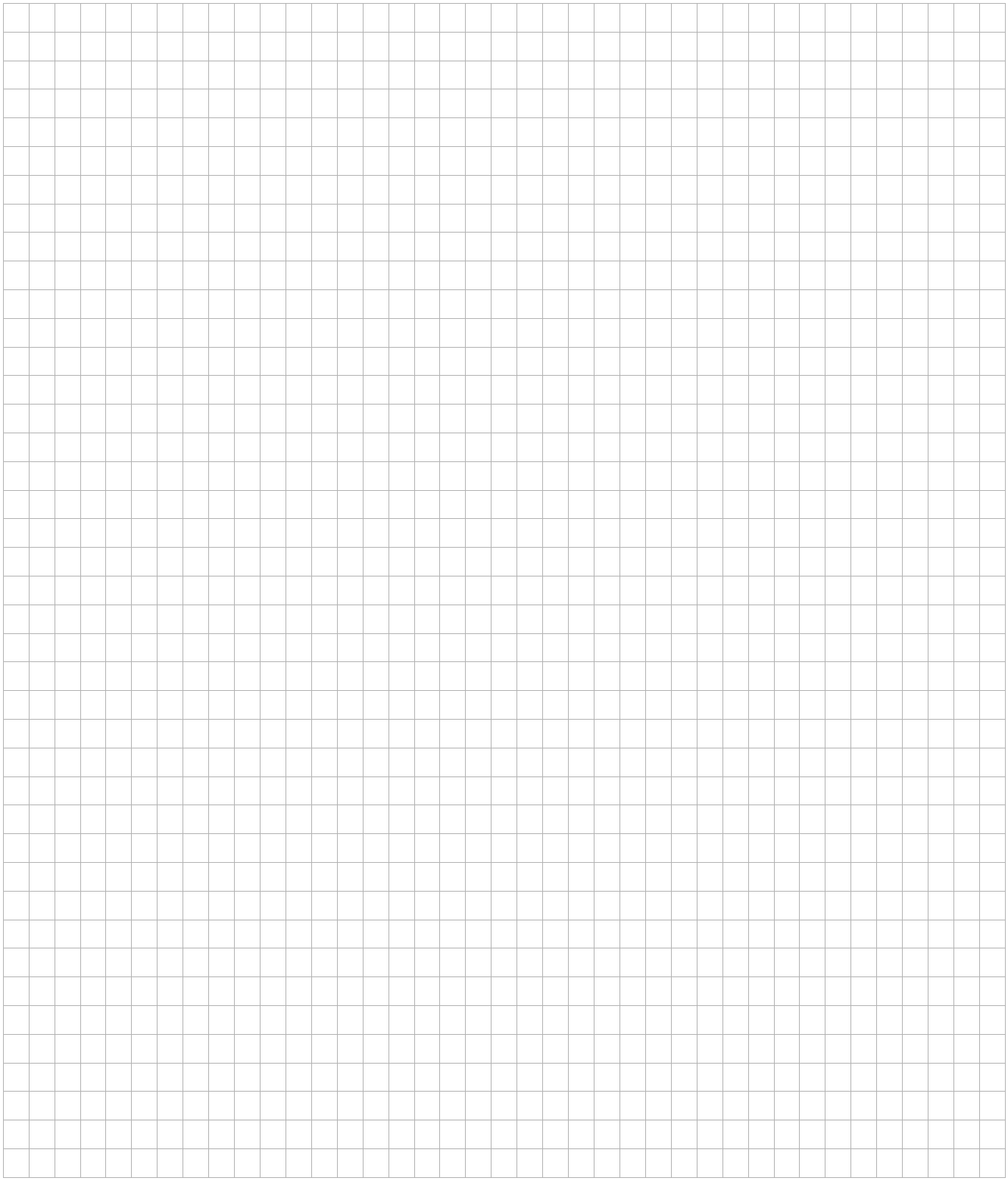
Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service 7, rue Ibn EI Heithem Z.I. SMMT 2014 Mégrine Erriadh	Tel. +216 1 4340-64 + 1 4320-29 Fax +216 1 4329-76

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

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

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

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



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