SEW
EURODRIVE

Manual

MOVIDRIVE® MDX61B
DEU21B Multi-Encoder Card

Contents

1   General Information

1.1   *Structure of the safety notes*

The safety notes in these operating instructions are designed as follows:

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

Pictogram	Signal word	Meaning	Consequences if disregarded
Example: ⚠ General danger ⚡ Specific danger, e.g. electric shock	⚠ DANGER	Imminent danger	Severe or fatal injuries
	⚠ WARNING	Possible dangerous situation	Severe or fatal injuries
	⚠ CAUTION	Possible dangerous situation	Minor injuries
	NOTICE	Possible damage to property	Damage to the drive system or its environment
i	INFORMATION	Useful information or tip. Simplifies the handling of the drive system.	

1.2   *Rights to claim under warranty*

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

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

1.3 Exclusion of liability

You must comply with the information contained in the MOVIDRIVE® documentation to ensure safe operation and to achieve the specified product characteristics and performance requirements. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

1.4 Copyright

2 Safety Notes

2.1 Other applicable documentation

- Only electrical specialists are allowed to perform installation and startup observing relevant accident prevention regulations and the MOVIDRIVE® MDX60B/61B operating instructions.

- Read through this manual carefully before you commence installation and startup of the DEU21B option.

- You must adhere to the information in the documentation as a prerequisite to fault-free operation and fulfillment of warranty claims.

2.2 Safety functions

The MOVIDRIVE® MDX60B/61B inverters may not perform safety functions without higher-level safety systems. Use higher-level safety systems to ensure protection of equipment and personnel. For safety applications, ensure that the information in the following publications is observed: "Safe Disconnection for MOVIDRIVE® MDX60B/61B".

2.3 Hoist applications

MOVIDRIVE® MDX60B/61B is not designed for use as a safety device in hoist applications.

Use monitoring systems or mechanical protection devices as safety equipment to avoid possible damage to property or injury to people.

2.4 Product names and trademarks

The brands and product names contained within this manual are trademarks or registered trademarks of the titleholders.

2.5 Disposal

Observe the applicable national regulations.

Dispose of the following materials separately in accordance with the country-specific regulations in force, as:

- Electronics scrap
- Plastic
- Sheet metal
- Copper
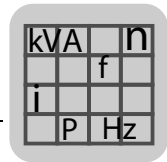
3 System Description

3.1 Areas of application

With the DEU21B multi-encoder card option, the MOVIDRIVE® system is upgraded with an absolute encoder connection. 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 motor encoder.

- 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 track (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®" as well as the MOVIDRIVE® MDX60B/61B system manual (→ section "Parameter descriptions").

|	INFORMATION
i	It is not possible to operate the DEU21B and the DIP11B simultaneously.

3.2 Application examples

3.2.1 Speed control, positioning with reference travel

For speed control, the encoder is used in order to provide for an optimized motor control and thus optimized speed and torque characteristics.

As the position is not stored when the unit is switched off, a reference travel is required after startup.
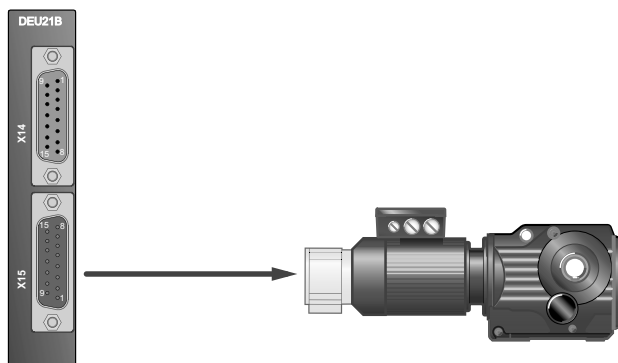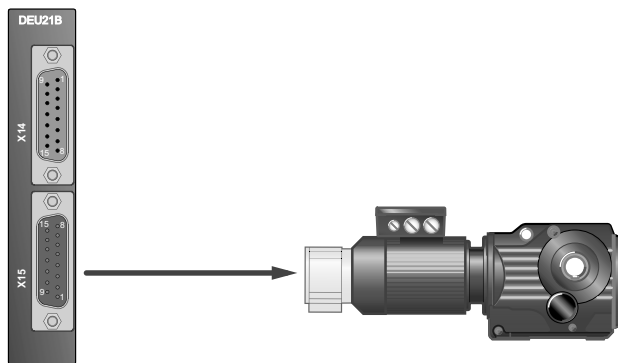

2035933323

Ideally, for asynchronous motors you would use a SIN/COS encoder such as the AS7S in this case. Due to the analog signal, this encoder can realize a better resolution for the speed control. For synchronous motors, you should use a single-turn combination encoder. The encoder is connected to the X15 of the DEU21B.

You could also use a TTL or HTL encoder. In order to provide for a sufficient speed control quality, the periodicity should not be smaller than 1024.

3.2.2 Absolute positioning with combination encoder

Apart from an incremental signal (SIN/COS, TTL, HTL), combination encoders have a signal for the absolute position. This absolute position is usually transmitted via a serial interface. There are combination encoders with different transmission protocols such as HIPERFACE®, SSI or EnDat.
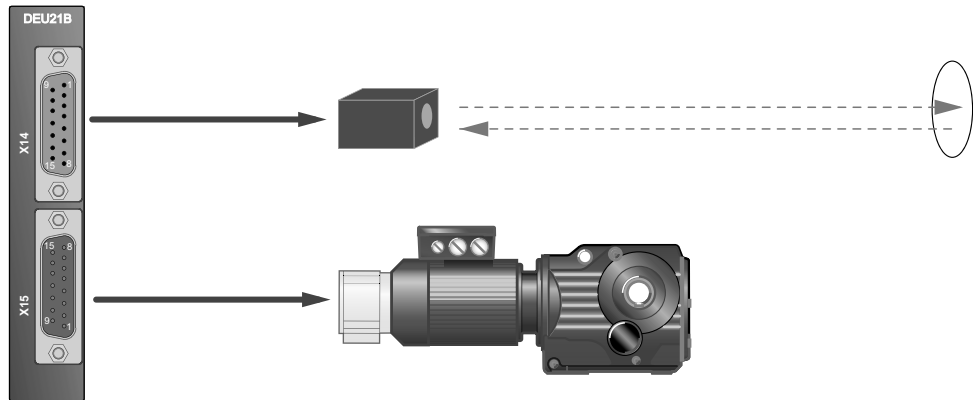

2035933323

This system is ideal for applications with rigid coupling to the distance. The major advantage is that there is no additional encoder required for the track. If you use the incremental signal for speed control, you have to connect the combination encoder to X15.

3.2.3 Absolute positioning with synchronous encoder

With systems subject to slip, it is not possible to detect the position via the motor encoder. This is why an additional measuring system is required for the track. This can be laser distance encoders, barcode encoders, draw-wire encoders or length scales. One advantage of measuring the length directly at the track can be that temperature-related length changes are also detected.

2035933323

Ideally, for asynchronous motors you would use a SIN/COS encoder as motor encoder in this case. For synchronous motors, you should use a single-turn combination encoder. The motor encoder is connected to the X15 of the DEU21B. The distance encoder is connected to the X14 of the DEU21B.

3.2.4 Special applications

The DEU21B allows for detecting 2 absolute values simultaneously. Apart from the signals of the combination encoder connected to X15, you can read in another absolute signal via X14.
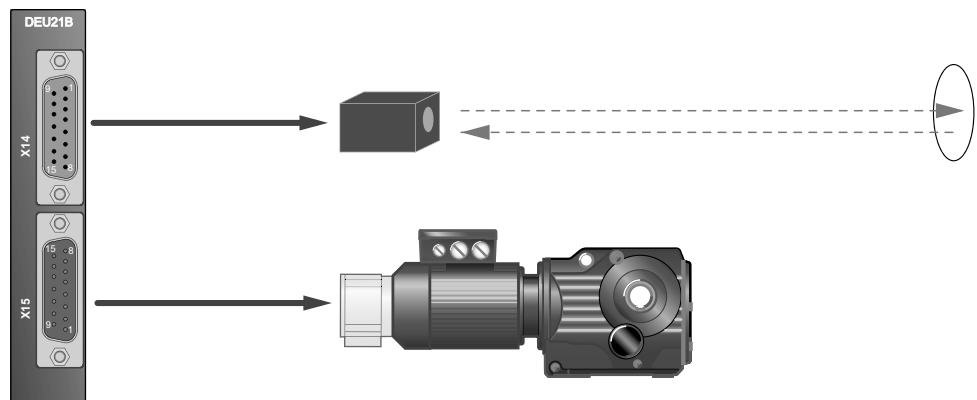
2035933323

3.3 Suitable non-SEW encoders

	INFORMATION
i	For a list of suitable encoders, refer to our homepage: → **www.sew-eurodrive.com**

3.3.1 SSI encoder

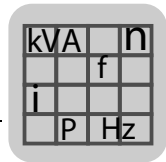| Manufacturer	Encoder designation	Order designation	Encoder type	DEU21B	
				X14	**X15**
Balluff	BTL5-S112B-M1500-P-S32	BTL5-S112B-Mxxxx-P-xxx	Linear distance sensor	×	
	BTL5-S112-M1500-P-S32	BTL5-S112-Mxxxx-P-xxx	Linear distance sensor	×	
Elgo	LIMAX2	LIMAX2-00-030-0125-SSG1-D15M0	Linear distance sensor	×	
IVO	GM 401	GM401.x20xxxx	Rotary encoder	×	
Kuebler	9081	8.9081xxxx2003	Rotary encoder	×	
	9081	8.9081xxxx2004	Rotary encoder	×	
Leuze	AMS 200/200	AMS200/xxx-11-x	Laser dist. measuring instr.	×	
	BPS 37	BPS37xx-xxx-xx	Barcode distance sensor	×	
MTS Sensors	RP	RP-x-xxxxM-xxx-1-S3G1105	Linear distance sensor	×	
	RH	RH-x-xxxxM-xxx-1-S3G1105	Linear distance sensor	×	
	RF	RF-x-xxxxxM-xxx-1-S3G1105	Linear distance sensor	×	
	RD4	RD4-x-xx-xxxxM-xxx-S3G1105	Linear distance sensor	×	
Pepperl+Fuchs	VDM100-150	VDM100-150	Laser dist. measuring instr.	×	
	WCS2(A)-LS311	WCS2(A)-LS311	Barcode distance sensor	×	
	WCS3(A)-LS311	WCS3(A)-LS311	Barcode distance sensor	×	
	WCS3(B)-LS311	WCS3(B)-LS311	Barcode distance sensor	×	
Sick/Stegmann	DME3000-x17	DME3000-x17	Laser dist. measuring instr.	×	
	DME4000-x11 0,1mm	DME4000-x11 0,1mm	Laser dist. measuring instr.	×	
	DME4000-x11 1mm	DME4000-x11 1mm	Laser dist. measuring instr.	×	
	DME5000-x11 0,1mm	DME5000-x11 0,1mm	Laser dist. measuring instr.	×	
	DME5000-x11 1mm	DME5000-x11 1mm	Laser dist. measuring instr.	×	
	AG 100 MSSI	AG100 412400000000	Rotary encoder	×	
	AG 626	ATM60AxA12X12	Rotary encoder	×	
	ARS60	ARS60-Axxxxxxx	Rotary encoder	×	
	ATM60	ATM60-AxA12X12	Rotary encoder	×	
	ATM90	ATM90-AxA12X12	Rotary encoder	×	
	POMUX KH53	POMUX KH54	Linear distance sensor	×	
	TTK70 / only after consultation with SEW	–	Linear distance sensor	×	×
SIKO	MSA1000	MSA1000	Linear distance sensor	×	
TR Electronic	CE 58M SSI	Cx58M-SSI/SEW	Rotary encoder	×	
	CE 65M SSI	Cx65M-SSI/SEW	Rotary encoder	×	
	LA41K	304-00319-xxxx	Linear distance sensor	×	
	LE200	LE200 SSI 2200-20002	Laser dist. measuring instr.	×	

3.3.2 SSI combination encoder

Manufacturer	Encoder designation	Order designation	Encoder type	DEU21B	
				X14	X15
Pepperl+Fuchs	Axx58/AVM58X-1212	Axx58x-xxxxxxGx-1212	Rotary encoder	×	×
Heidenhain	ROQ424	ROQ424	Rotary encoder	×	×
Hübner	AMG73 S24 S2048	AMG73 S24 S2048	Rotary encoder	×	×
	AMG83 S24 S2048	AMG83 S24 S2048	Rotary encoder	×	×

3.3.3 Hiperface® encoders

Manufacturer	Encoder designation	Order designation	Encoder type	DEU21B	
				X14	X15
Sick/Stegmann	DME4000-x17	DME4000-x17	Laser dist. measuring instr.	×	
Sick/Stegmann	DME5000-x17	DME5000-x17	Laser dist. measuring instr.	×	
Sick/Stegmann	SKM 36	SKM36-HVx0-K02	Rotary encoder	×	×
Sick/Stegmann	SKS 36	SKS36-HVx0-K02	Rotary encoder	×	×
Sick/Stegmann	SRM 50	SRM50-HGx0-K0x	Rotary encoder	×	×
Sick/Stegmann	SRM 60	SRM60-HGx0-K0x	Rotary encoder	×	×
Sick/Stegmann	SRM 64	SRM64-HRx0-K0x	Rotary encoder	×	×
Sick/Stegmann	SRS 50	SRS50-HGx0-K0x	Rotary encoder	×	×
Sick/Stegmann	SRS 60	SRS60-HGx0-K0x	Rotary encoder	×	×
Sick/Stegmann	SRS 64	SRS64-HRx0-K0x	Rotary encoder	×	×
Sick/Stegmann	LinCoder L230	L230-P58002S00000	Linear encoder	×	×

3.3.4 CANopen encoder

Manufacturer	Encoder designation	Order designation	Encoder type	DEU21B	
				X14	X15
Pepperl+Fuchs	WCS3(B)-LS410	WCS3(B)-LS410	Barcode distance sensor	×	
Sick/Stegmann	DME4000-x19	DME4000-x19	Laser distance measuring instrument	×	
TR Electronic	CE 58M CAN/open	Cx58M-CAN/open	Rotary encoder	×	
TR Electronic	LE200 CAN/open	LE200 CAN/open	Linear encoder	×	

3.3.5 EnDat encoder

Manufacturer	Encoder designation	Order designation	Encoder type	DEU21B	
				X14	X15
Heidenhain	ECN1313	ECN1313/EnDat01	Rotary encoder	×	×
	EQN1125	EQN1125/EnDat01	Rotary encoder	×	×
	EQN1325	EQN1325/EnDat01	Rotary encoder	×	×
	EQN425	EQN425/EnDat01	Rotary encoder	×	×

4 Assembly and Installation Instructions

4.1 Before you begin

Observe the following notes before installing or removing the DEU21B option card:

- Disconnect the inverter from the power. Switch off the DC 24 V 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 of the components.

4.2 Installing the DEU21B option card

|	INFORMATION
i	• **The DEU21B option card can be installed in MOVIDRIVE® MDX61B sizes 0 to 7. Only SEW-EURODRIVE staff may install or remove the DEU21B option for MOVIDRIVE® MDX61B size 0.** • The DEU21B option card must be plugged into the encoder slot.

4.2.1 Basic procedure for installing/removing an option card

The following figure shows the basic procedure for installing an option card in MOVIDRIVE® MDX61B size 1 - 7
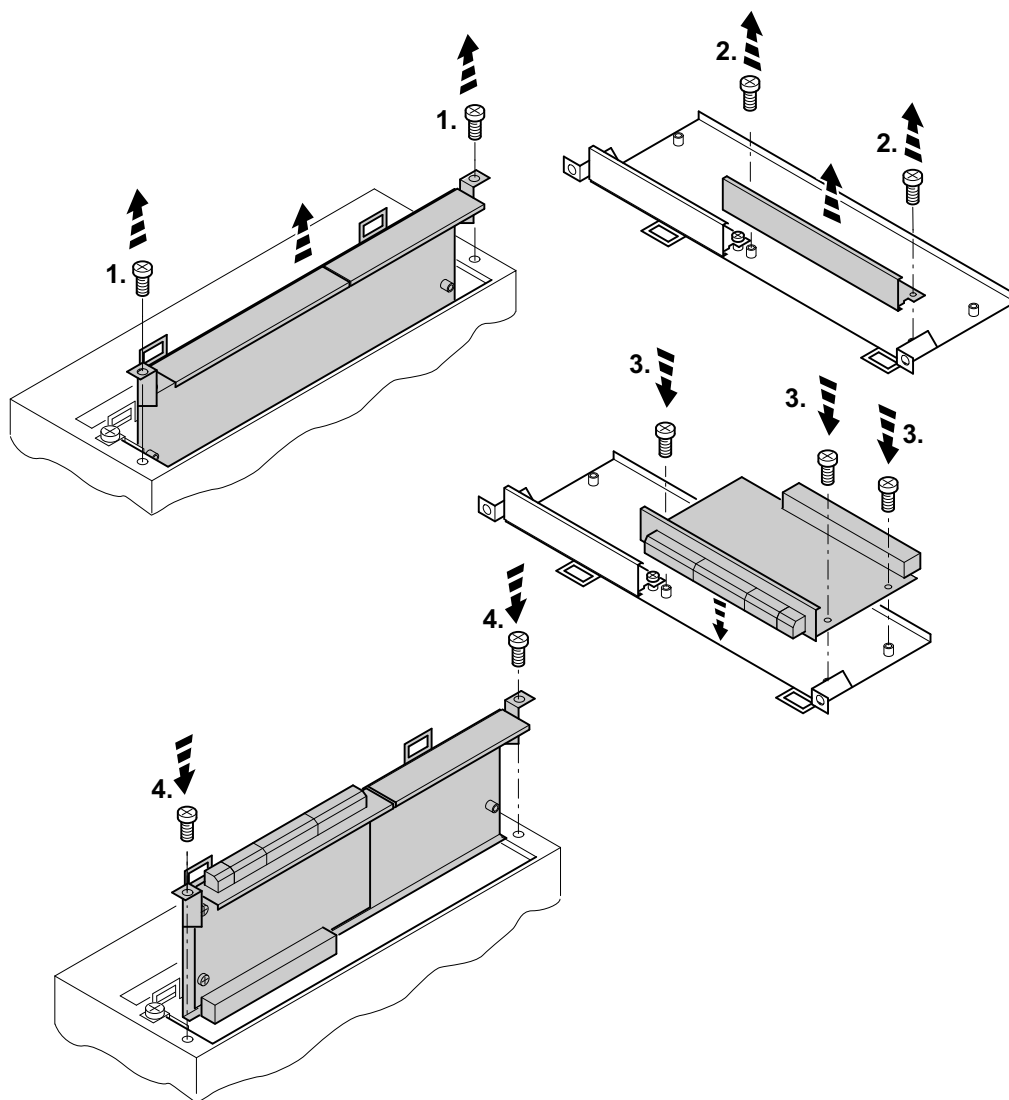
1. Remove the retaining screws holding the card retaining bracket. Pull the card retaining bracket out evenly from the slot (do not twist!).

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 the 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.

4.3 Connection and terminal description of the DEU21B option

4.3.1 Part number

Multi-encoder card option type DEU21B: 18221696

	INFORMATION
i	• The "DEU21B multi-encoder card" option can only be used with MOVIDRIVE® MDX61B, not with MDX60B. • The DEU21B option must be plugged into the encoder slot.

Front view of DEU21B	Description	Terminal	Function
DEU21B X14 9 · · 1 15 · · 8 X15 15 · · 8 9 · · 1	**X14: Input for external encoder or output for incremental encoder simulation** **Output for incremental encoder simulation:** • Signal level to RS422 • The number of pulses is the same as on X15 motor encoder input	X14:1 X14:2 X14:3 X14:4 X14:5/6 X14:7 X14:8 X14:9 X14:10 X14:11 X14:12 X14:13 X14:14 X14:15	(COS+) signal track A (K1) (SIN+) signal track B (K2) Signal track C (K0) / pulse + DATA+ CANHigh Reserved Switching Reference potential DGND (COS–) Signal track $\overline{A}$ ($\overline{K1}$) (SIN–) Signal track $\overline{B}$ ($\overline{K2}$) Signal track $\overline{C}$ ($\overline{K0}$) / pulse – DATA- CANLow DC 24 V encoder supply[1] Reserved DC 12 V encoder supply (tolerance range DC 10.5 – 13 V)[2]
	X15: Motor encoder input	X15:1 X15:2 X15:3 X15:4 X15:5 X15:6 X15:7 X15:8 X15:9 X15:10 X15:11 X15:12 X15:13 X15:14 X15:15	(COS+) signal track A (K1) (SIN+) signal track B (K2) Signal track C (K0) / pulse + DATA+ Reserved Reference potential TF/TH/KTY– Reserved Reference potential DGND (COS–) Signal track $\overline{A}$ ($\overline{K1}$) (SIN–) Signal track $\overline{B}$ ($\overline{K2}$) Signal track $\overline{C}$ ($\overline{K0}$) / pulse – DATA- DC 24 V encoder supply[1] TF/TH/KTY+ connection DC 12 V (tolerance range DC 10.5 – 13 V)[2]

[1] If the overall unit load on the 24 V level exceeds 400 mA, you must connect an external DC 24 V supply to X10:9/X10:10. Observe the "Project planning" chapter in the MOVIDRIVE® MDX60B/61B system manual.

[2] The maximum load on X14:15 and X15:15 is DC 650 mA in total.

	NOTICE
⚠	The connections on X14 and X15 must not be installed or removed during operation. Electrical components in the encoder or on the encoder card could be destroyed. De-energize the inverter before plugging or removing the encoder connections. Switch off the supply voltage and the DC 24 V (X10:9).

	INFORMATION
i	• If X14 is used as an incremental encoder simulation output, the switchover (X14:7) must be jumpered with DGND (X14:8). • The 24 V encoders from SEW (except HTL and Hiperface®) have a wide voltage range (DC 10 V – 30 V) and can be supplied alternatively with DC 24 V (PIN13) or DC 12 V (PIN15).

4.4 DC 24 V voltage supply of the DEU21B

The total maximum load X14:15 / X15:15 is DC 650 mA. If the total load on the 24 V level of the MOVIDRIVE® MDX60B/61B exceeds 400 mA, you have to connect an external DC 24 V supply to X10:9 / X10:10. The internal power supply provides 29 W, observe section "Project planning" in the MOVIDRIVE® MDX60B/61B system manual.

4.5 Connecting an absolute encoder

4.5.1 General installation notes

- Max. line length DEU21B option (inverter) motor encoder:
  - HTL encoder ES7C and EG7C (from SEW-EURODRIVE): 300 m (984 ft)
  - Standard HTL encoder: 200 m (656 ft)
  - Other encoders: 100 m (328 ft)
  - The maximum cable length might be reduced depending on the technical data of the respective encoder. Observe the manufacturer specifications.
- Core cross section: 0.2 mm^2 – 0.5 mm^2 (AWG24 – AWG21)
- Use shielded cables with twisted pair conductors and make sure they are grounded 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 D-sub connector, or
  - to the metal clamp on the bottom of the inverter or to the strain relief.
- Route the encoder cable separately from the power cables.

4.5.2 Prefabricated cables for connection to X15 of the DEU21B option

The following overviews show the possible connections at X15 of the DEU21B option.

Meaning of the symbols

The connection cables are assigned a part number and a symbol. The symbols have the following meaning:

Symbol	Meaning
	Connection cable connector → connector for fixed installation
	Extension connection cable connector → connector for fixed installation
	Connection cable connector → connector for cable carrier installation
	Extension connection cable connector → connector for cable carrier installation
	Connection cable connector → conductor end sleeves for fixed installation
	Connection cable connector → conductor end sleeves for cable carrier installation
	Connection cable conductor end sleeves → Y-cable with connector for fixed installation
	Connection cable conductor end sleeve → Y-cable with connector for cable carrier installation
	Connection cable encoder connection cover → Y-cable with connector for fixed installation
	Connection cable encoder connection cover → Y-cable with connector for cable carrier installation
	Connection cable connector → encoder connection cover for fixed installation
	Connection cable connector → encoder connection cover for cable carrier installation
	Connection via plug connector on the motor side
	Connection via encoder connection cover on the motor side

4.5.3 Connection options for encoders at X15 DEU21B
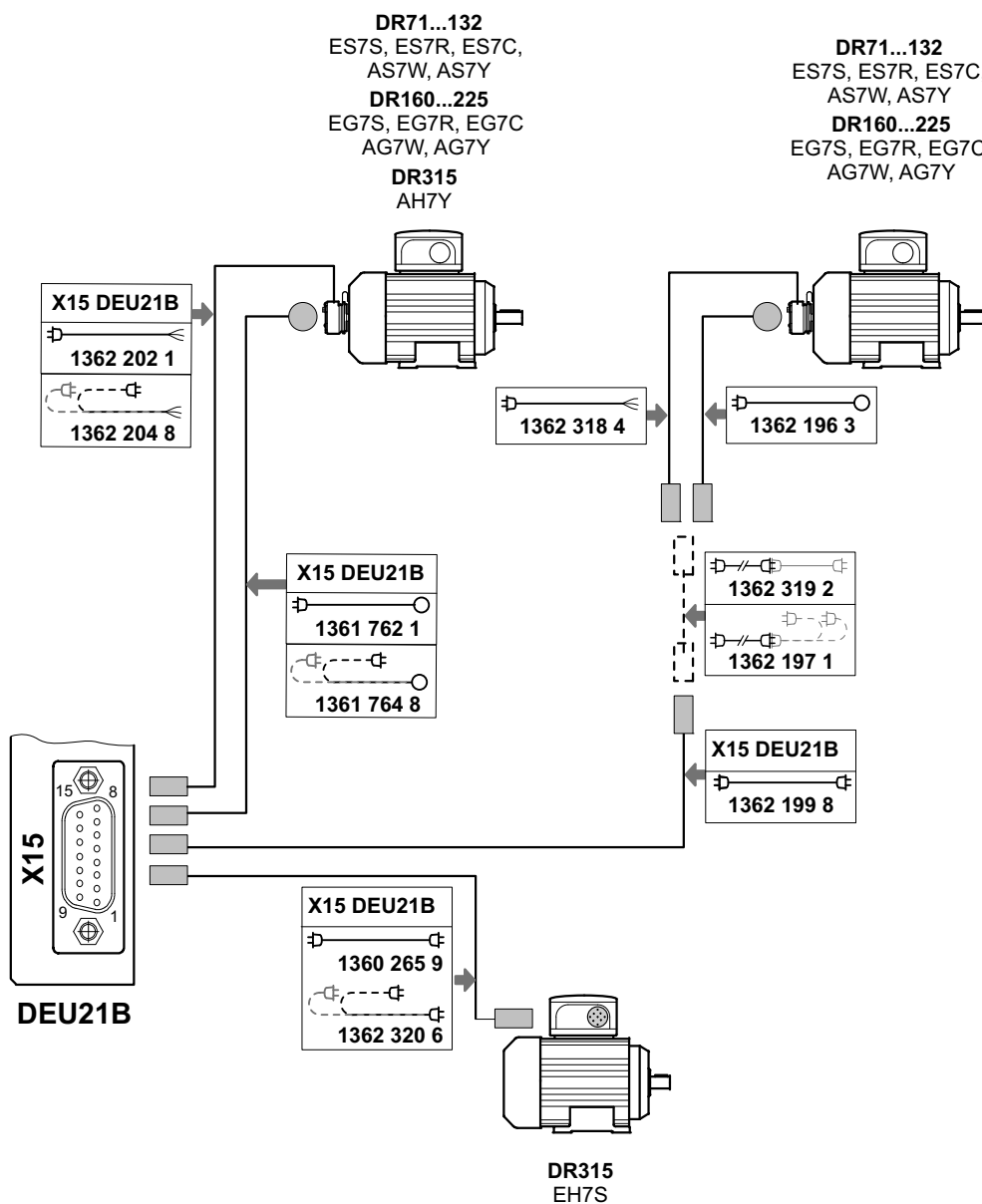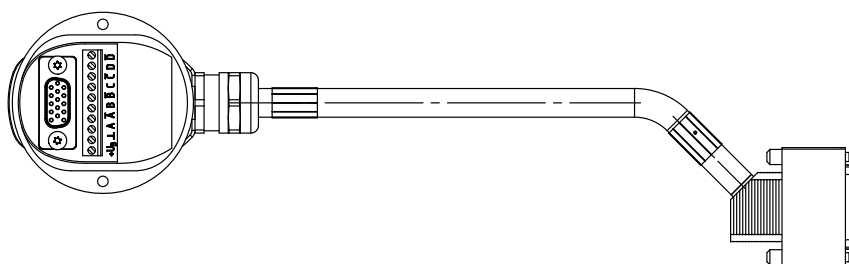

2505815435

Dashed line: Shows extension cables that can be used as option.

- Encoder connection:

    – ES7S, ES7R, ES7C, AS7W, AS7Y with DR71 – 132 motors

    – EG7S, EG7R, EG7C, AG7W, AG7Y with DR160 – 225 motors
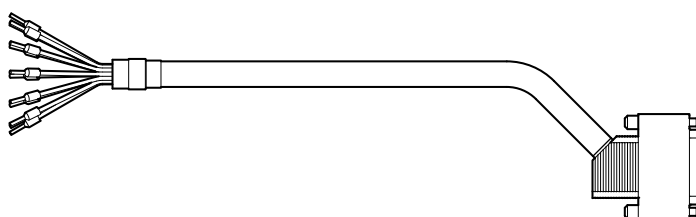
    – AH7Y with DR315 motor

  Required prefabricated cables:

  – Possibility 1: Cable with D-sub 15 plug connector and encoder connection cover:

2047431819

  – Possibility 2: Cable with D-sub 15 plug connector and conductor end sleeves:

2047433483

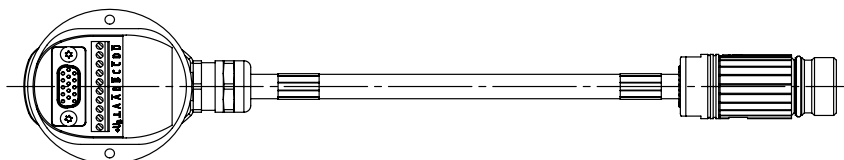| Motor size	Encoder type	Encoder cable	
		Installation	Part number
DR71 – 132 DR160 – 225 DR315	ES7S, ES7R, ES7C, AS7W, AS7Y EG7S, EG7R, EG7C, AG7W, AG7Y, AH7Y		1361 762 1
			1361 764 8
			1362 202 1
			1362 204 8

- Encoder connection:

  - ES7S, ES7R, ES7C, AS7W, AS7Y with DR71 – 132 motors

  - EG7S, EG7R, EG7C, AG7W, AG7Y with DR160 – 225 motors
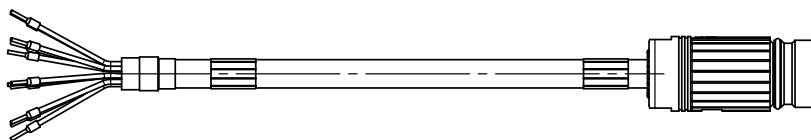
Required prefabricated cables:

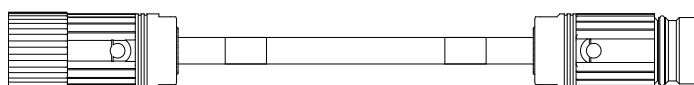- Possibility 1: Cable with encoder connection cover and M23 plug connector:

2047435147

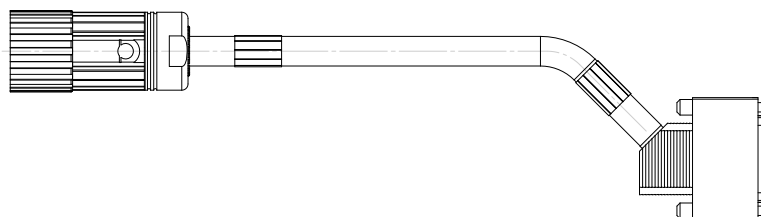- Possibility 2: Cable with conductor end sleeves and M23 plug connector:

2047436811

- Optional: Extension cable with M23 plug connector on both sides:

2047438475

- Cable with M23 plug connector and D-sub 15 plug connector:

2047504139

Motor size	Encoder type	Encoder cable	
		Installation	Part number
DR71 – 132 DR160 – 225	ES7S, ES7R, ES7C, AS7W, AS7Y, EG7S, EG7R, EG7C, AG7W, AG7Y		1362 196 3
			1362 318 4
			1362 319 2
			1362 197 1
			1362 199 8

- Connecting EH7S encoder to DR315 motors

  Required prefabricated cables:

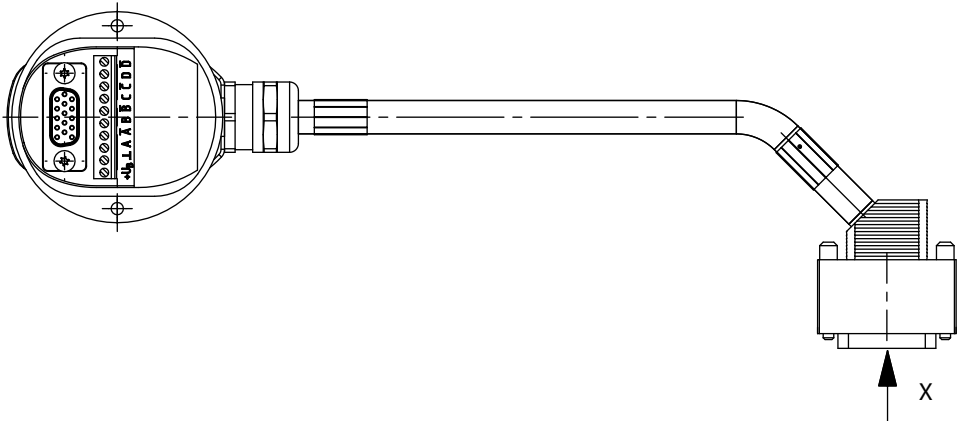 – Cable with M23 plug connector and D-sub 15 plug connector:
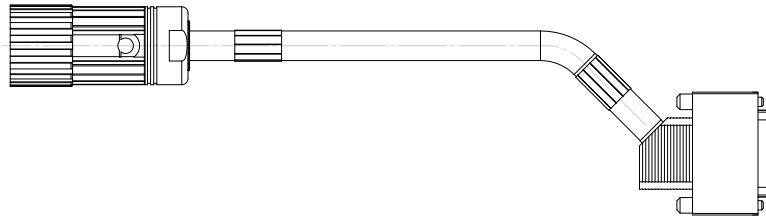
  2047504139

Motor size	Encoder type	Encoder cable	
		Installation	Part number
DR315	EH7S		1360 265 9
			1362 320 6

4.5.4 Connection diagrams for prefabricated cables

1361 762 1

<table>
<tr><th colspan="6">Pin assignment</th></tr>
<tr><th>A
Pin</th><th>Signal</th><th></th><th>Cable
Core color</th><th>Signal
MDX</th><th>B
Pin</th></tr>
<tr><td>360° contact on A-side</td><td></td><td>Stranding</td><td>Shield</td><td>360° contact on B-side</td><td></td></tr>
<tr><td>A</td><td>cos+</td><td></td><td>Red (RD)</td><td>A</td><td>1</td></tr>
<tr><td>$\overline{A}$</td><td>cos-</td><td></td><td>Blue (BU)</td><td>$\overline{A}$</td><td>9</td></tr>
<tr><td>B</td><td>sin+</td><td></td><td>Yellow (YE)</td><td>B</td><td>2</td></tr>
<tr><td>$\overline{B}$</td><td>sin-</td><td></td><td>Green (GN)</td><td>$\overline{B}$</td><td>10</td></tr>
<tr><td>C</td><td>C +</td><td></td><td>Brown (BN)</td><td>C</td><td>3</td></tr>
<tr><td>$\overline{C}$</td><td>C-</td><td></td><td>White (WH)</td><td>$\overline{C}$</td><td>11</td></tr>
<tr><td>D</td><td>Data+</td><td></td><td>Black (BK)</td><td>D</td><td>4</td></tr>
<tr><td>$\overline{D}$</td><td>Data–</td><td></td><td>Violet (VT)</td><td>$\overline{D}$</td><td>12</td></tr>
<tr><td>UB</td><td>UB</td><td></td><td>Red-Blue+Gray (RD-BU+GY)</td><td>UB</td><td>15</td></tr>
<tr><td></td><td>DGND</td><td></td><td>Gray-Pink+Pink (GY-PK+PK)</td><td></td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>Shield</td><td></td><td></td></tr>
</table>

2087418123

1362 202 1

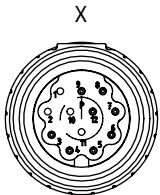| Pin assignment					
A Pin	**Signal**		Cable Core color	**Signal** MDX	**B Pin**
360° contact on A-side		Stranding	Shield	360° contact on B-side	
	A (cos+)		Red (RD)	A (cos+)	
	$\overline{A}$ (cos-)		Blue (BU)	$\overline{A}$ (cos-)	
	B (sin+)		Yellow (YE)	B (sin+)	
	$\overline{B}$ (sin-)		Green (GN)	$\overline{B}$ (sin-)	
	C +		Brown (BN)	C +	
	C -		White (WH)	C -	
	D +		Black (BK)	D +	
	D -		Violet (VT)	D -	
	UB		Red-Blue+Gray (RD-BU-GY)	UB	
	GND		Gray-Pink+Pink (GY-PK+PK)	GND	
			Shield		

Y

2087421707

1362 196 3

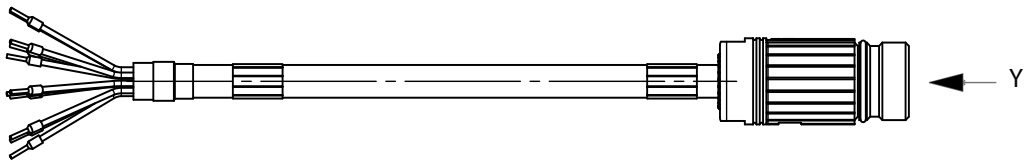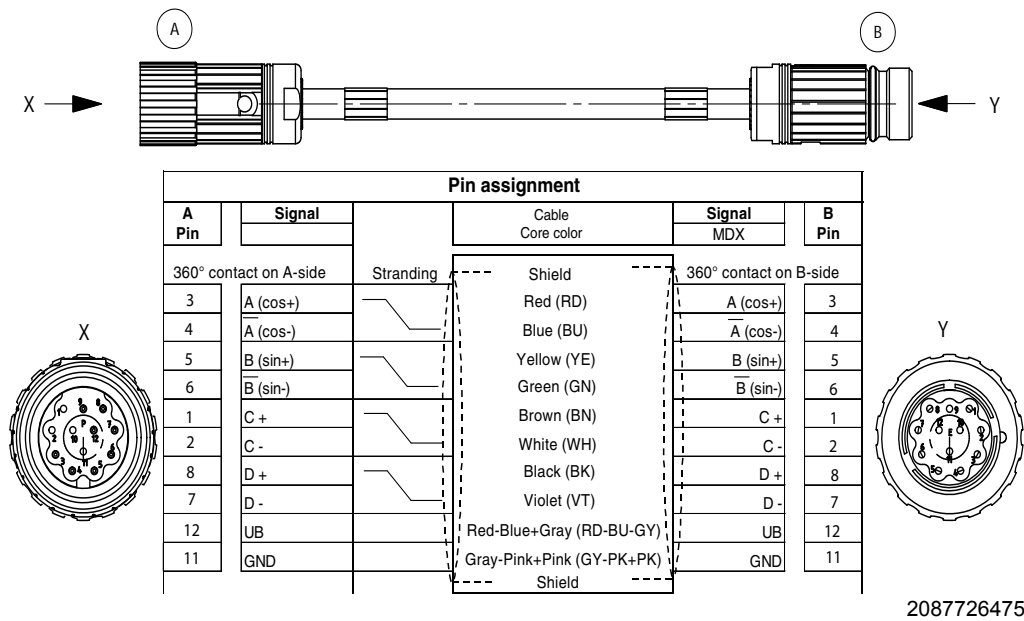| Pin assignment					
A Pin	**Signal**		Cable Core color	**Signal** MDX	**B Pin**
360° contact on A-side		Stranding	Shield	360° contact on B-side	
	A (cos+)		Red (RD)	A (cos+)	
	$\overline{A}$ (cos-)		Blue (BU)	$\overline{A}$ (cos-)	
	B (sin+)		Yellow (YE)	B (sin+)	
	$\overline{B}$ (sin-)		Green (GN)	$\overline{B}$ (sin-)	
	C +		Brown (BN)	C +	
	C -		White (WH)	C -	
	D +		Black (BK)	D +	
	D -		Violet (VT)	D -	
	UB		Red-Blue+Gray (RD-BU-GY)	UB	
	GND		Gray-Pink+Pink (GY-PK+PK)	GND	
			Shield		

X

2087423627

1362 318 4

← Y

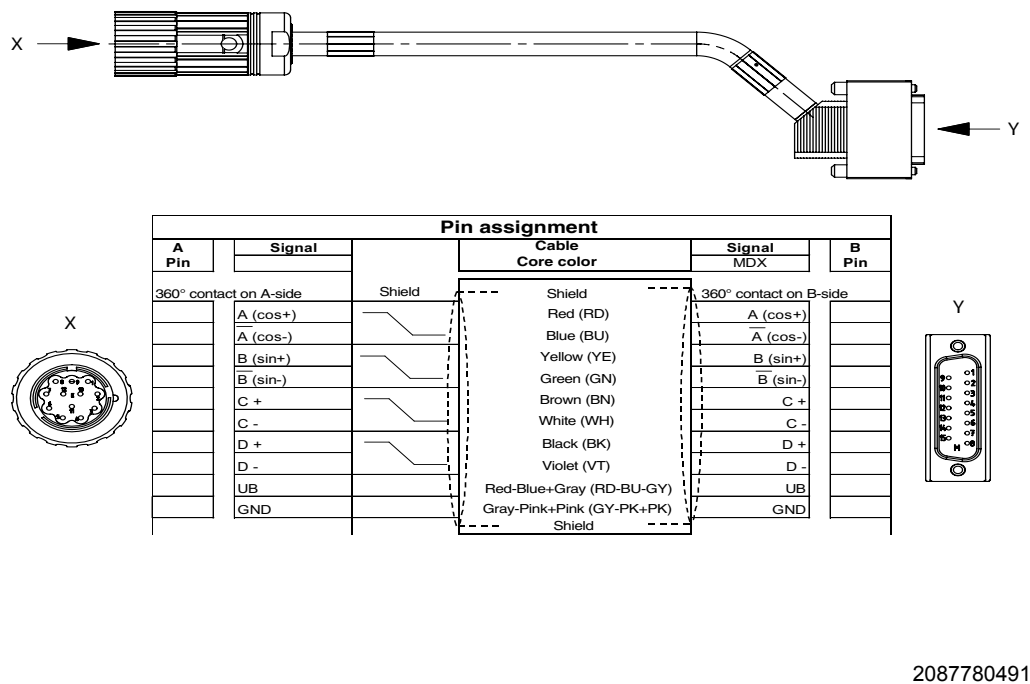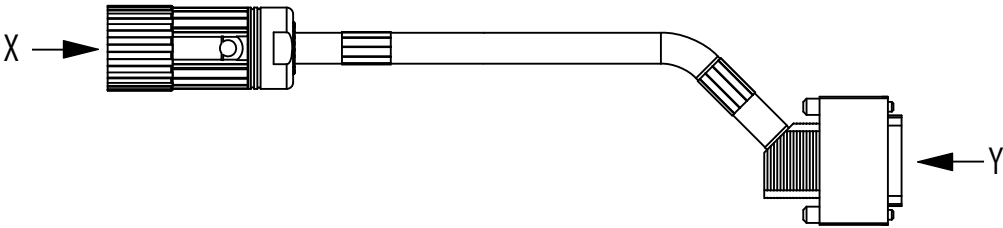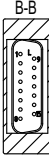| Pin assignment						
A Pin	Signal		Cable Core color	Signal MDX	B Pin	
360° contact on A-side		Stranding	Shield	360° contact on B-side		
	A (cos+)		Red (RD)	A (cos+)		
	$\overline{A}$ (cos-)		Blue (BU)	$\overline{A}$ (cos-)		
	B (sin+)		Yellow (YE)	B (sin+)		
	$\overline{B}$ (sin-)		Green (GN)	$\overline{B}$ (sin-)		
	C +		Brown (BN)	C +		
	C -		White (WH)	C -		
	D +		Black (BK)	D +		
	D -		Violet (VT)	D -		
	UB		Red-Blue+Gray (RD-BU-GY)	UB		
	GND		Gray-Pink+Pink (GY-PK+PK)	GND		
			Shield			

AKUA 020

2087471755

1362 319 2

Pin assignment					
A Pin	**Signal**		**Cable** Core color	**Signal** MDX	**B Pin**
360° contact on A-side		Stranding	Shield	360° contact on B-side	
3	A (cos+)		Red (RD)	A (cos+)	3
4	$\overline{A}$ (cos-)		Blue (BU)	$\overline{A}$ (cos-)	4
5	B (sin+)		Yellow (YE)	B (sin+)	5
6	$\overline{B}$ (sin-)		Green (GN)	$\overline{B}$ (sin-)	6
1	C +		Brown (BN)	C +	1
2	C -		White (WH)	C -	2
8	D +		Black (BK)	D +	8
7	D -		Violet (VT)	D -	7
12	UB		Red-Blue+Gray (RD-BU-GY)	UB	12
11	GND		Gray-Pink+Pink (GY-PK+PK)	GND	11
			Shield		

2087726475

1362 199 8

Pin assignment					
A Pin	**Signal**		**Cable** Core color	**Signal** MDX	**B Pin**
360° contact on A-side		Shield	Shield	360° contact on B-side	
	A (cos+)		Red (RD)	A (cos+)	
	A (cos-)		Blue (BU)	$\overline{A}$ (cos-)	
	B (sin+)		Yellow (YE)	B (sin+)	
	$\overline{B}$ (sin-)		Green (GN)	$\overline{B}$ (sin-)	
	C +		Brown (BN)	C +	
	C -		White (WH)	C -	
	D +		Black (BK)	D +	
	D -		Violet (VT)	D -	
	UB		Red-Blue+Gray (RD-BU-GY)	UB	
	GND		Gray-Pink+Pink (GY-PK+PK)	GND	
			Shield		

2087780491

1360 265 9

ASTA 021	A Pin	Signal	Cable Core color	Signal	B Pin	Sub-D 15-pins
			Shield			male B-B
0198 921 9 A - A	5	A (COS +)	Red (RD)	A / K1	1	
	8	B (SIN +)	Yellow (YE)	B / K2	2	
	3	C / 0	Brown (BN)	C / K0	3	
	10	GND	Pink / Violet (PK/VT)	GND	8	
	6	\A (COS -)	Blue (BU)	\A / \K1	9	
	1	\B (SIN -)	Green (GN)	\B / \K2	10	
	4	\C / 0	White (WH)	\C / \K0	11	
	12	U_B	Gray / Black (GR/BK)	U_B	15	
			Shield			

2462667403

5 Project Planning

5.1 *Absolute 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.**

  The rotary encoders should be driven with no slip. 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 DEU21B option are divided into three categories:

- Multiturn encoders, 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, Pepperl & Fuchs WCS2, Pepperl & Fuchs WCS3

5.1.1 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 motor encoder and the synchronous encoder is sufficient.

	INFORMATION
i	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:

→ 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 increments/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.

5.1.2 Laser distance measuring instruments

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 error which is dependent on the speed, making it harder to monitor the drive (delayed shut-off in the event of an error).

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

5.1.3 Material measure via metal ruler

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% possible, i.e. there is no lag error.

• The monitoring functions are fully effective; a small lag error 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 ruler.

5.2   Encoder parameterization

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, LA 41K-SSI, ZE 65**

  – Make a setting of 24 data bits and program signal bits to logical 0. Bit no. 25 may either contain 0 or an error or power fail bit. Other special bits following the position will not be evaluated. The 25-bit version is not supported.

  – The output mode must be "Direct".

  – The interface must be set to "SSI".

- **T&R CE 58 CANopen**

  – The termination switch must be set to "ON".

  – The node ID must be set to 1 via the 6-fold DIP switch.

  – The number of increments per revolution must be set to the standard value, 4096.

- **T&R LE200 CANopen**

  – Terminating resistor for bus termination required.

  – The node ID must be set to 1 via the 8-fold DIP switch.

- **SICK STEGMANN AG100 MSSI, AG626, ATM90, ATM60**

  Only the 24-bit version is supported.

- **SICK STEGMANN ARS60**

  Only the 15-bit version is supported.

- **SICK DME-5000-x111, DME-4000-x111**

  – The interface must be set to "SSI".

  – You have to set "24 data bits + error bit".

  – The resolution must be set to 0.1 mm or 1 mm.

  – The plausibility must be set to "Normal".

- **SICK DME-5000-x17, DME-4000-x17**

  – The interface must be set to "Hiperface®".

  – Set the resolution to 1 mm.

  – The plausibility must be set to "Normal".

- **SICK DME-4000-x19**

  – The interface must be set to "CANopen".

  – The node ID must be set to 1.

  – The resolution must be set to 0.1 mm or 1 mm.

  – The plausibility must be set to "Normal".

- **Pepperl & Fuchs WCS2(A)-LS311, WCS3(A)-LS311**

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

- **Pepperl & Fuchs WCS3B-LS410**

  – The node ID must be set to 1 (switches 1 – 6 of the 8-fold DIP switch)

  – The baud rate must be set to 250 kBaud (switches 6 – 7 of the 8-fold DIP switch)

  – The transmission mode must be set to "asynchronous 0 ms / 10 ms" (switches 1 – 3 of the 4-fold DIP switch)

  – The data protocol must be set to "data protocol 2" (switch 4 of the 4-fold DIP switch to "on")

- **Pepperl & Fuchs 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).

- **Pepperl & Fuchs VDM 100-150**

  – The operating mode must be set to mode 3 ([Menu] / [Parameters] / [operating modes] / [Mode 3]).

  – The coding must be set to "Gray".

  – The resolution must be set to 0.1 mm or 1 mm.

- **LEUZE AMS200, OMS1, OMS2, BPS37**

  – You have to set "24 data bits + error bit".

  – Set the resolution to 0.1 mm.

	INFORMATION
	The following applies for all parameterizable SSI encoders:
	– The interface must be set to "SSI".
	– You have to set "24 data bits + error bit" or "0 in bit 25".
	– Plausibility must be set to "normal = 0" when the plausibility check is activated.
	– The coding must be set to "Gray".

6   Startup

6.1   *General startup notes*

	INFORMATION
i	For startup, you require **MOVITOOLS® MotionStudio 5.60 SP1 HF1,** or a later version. Startup with an earlier version is not permitted.

- The drive must be started up in conjunction with the MOVIDRIVE® MDX61B 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 DEU21B option

  – 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.

	⚠ **DANGER**
	Encoder startup aborted with an earlier version of MOVITOOLS® MotionStudio. Severe or fatal injuries due to uncontrolled motor startup. • Always use MOVITOOLS® MotionStudio 5.60 SP1 HF1 or a later version.

6.2   Startup procedure

- Once the startup tool has been selected in MOVITOOLS® MotionStudio, the initial startup window is displayed.
  - Use the [back] and [next] buttons to switch between the pages.
  - Click [continue].

- Select your encoder setting for the motor encoder and the synchronous encoder. You have the following options:
  - "Manual editing", in order to select and parameterize an encoder.
  - "Automatic detection", in order to read out the connected encoder. This is only possible with SEW encoders Ex7S, ExxH, Ax7W and AxxH.
  - "Deselect", if there is no encoder connected to the card or if the application does not require an encoder.
  - "Position detection on", in order to detect the source of the actual values.
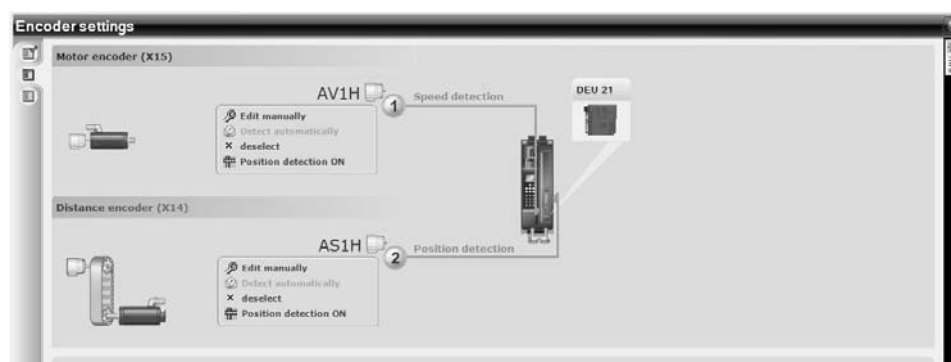
792945035
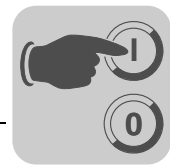
6.2.1 Editing SEW encoders manually

Proceed as follows to select an SEW encoder manually

- Select "SEW encoder".

- Configure the encoder designation according to the nameplate.
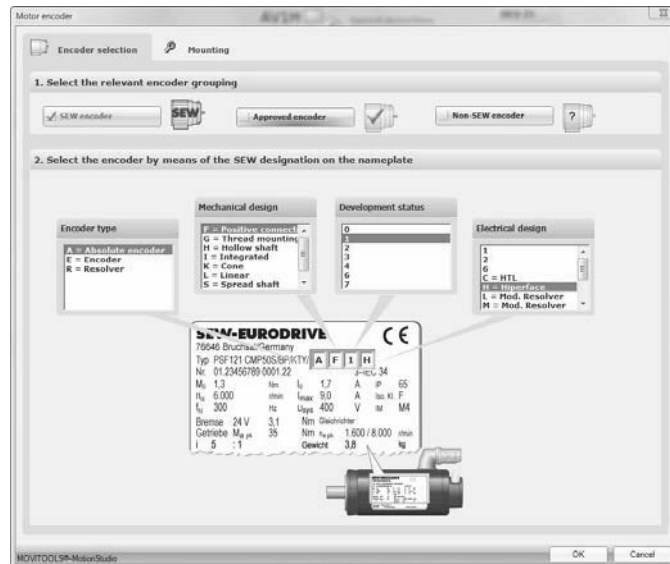
6.2.2 Editing approved encoders

Proceed as follows to select an SEW-approved encoder manually

- Select "Approved encoder".

- Select the respective encoder from the SEW database
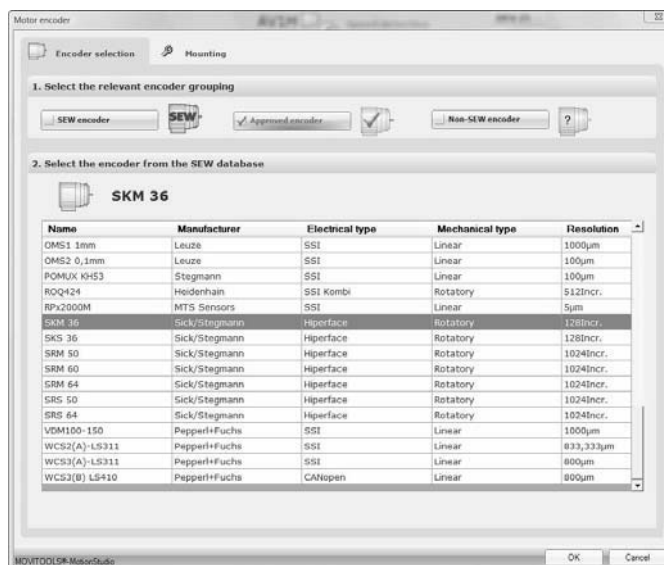
- Select the "Mount-on" tab and define the type of mounting.

6.2.3 Defining the encoder mounting

Proceed as follows to define the encoder mounting:

- Enter the counting direction of the encoder

- Specify the ratio between the motor and the encoder

- You might measure the ratio with the startup software. This is only possible after the inverter has been installed successfully.
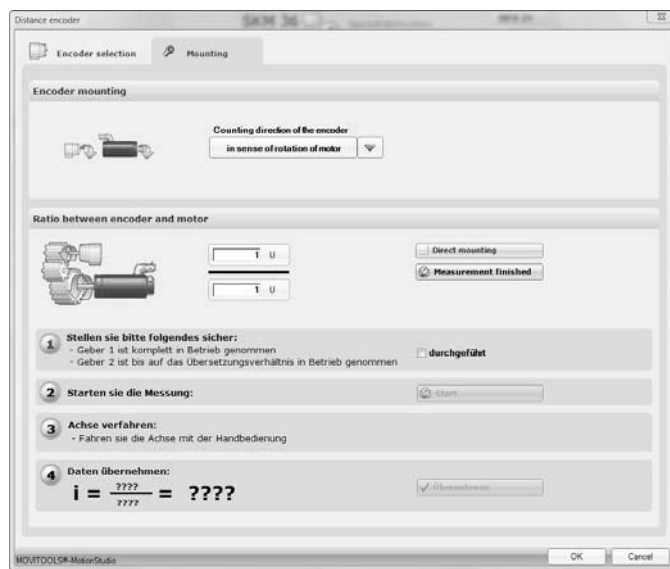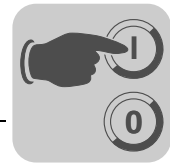
6.3   Unit replacement

6.3.1   Replacing incremental encoders

Incremental encoders for positioning always require a reference travel after startup. This is why there are no special measures required in the event of a unit or encoder (motor) replacement.

6.3.2   Replacing absolute encoders.

With absolute encoders, the position is stored in the inverter with 32 bits. This allows for representing a larger absolute area than with an encoder with typical 12 bits in the single turn range and 12 bits in the multiturn range. This also means, however, that a reference travel is required in the event of an inverter replacement as well as in the event of an encoder (motor) replacement.

6.3.3   Replacing linear encoder systems

The only exceptions are absolute linear encoder systems that do not have an encoder overflow. If these can replaced so that the encoder system provides the same values as before the replacement, a reference travel is not required.

6.3.4   Replacing Hiperface$^{®}$ encoders

With Hiperface$^{®}$ encoders, you can use parameter P948 to specify whether or not a reference travel is required after an encoder replacement.

7 Parameters

The DEU21B encoder cards are parameterized during startup. This is where you determine as to which encoder is connected to which terminal with which resolution.

In addition, you may provide for adaptations, e.g. regarding the counting direction or the clock rate, via the parameter tree.

Parameter	Description
Encoder type:	The encoder set via the startup of the DEU21B option is displayed
Encoder scaling numerator:	The numerator of the encoder scaling set via the startup of the DEU21B option is displayed
Encoder scaling denominator:	The denominator of the encoder scaling set via the startup of the DEU21B option is displayed
Counting direction:	Defines the counting direction of the connected encoder. Make the settings so that the encoder counts in positive direction when the motor shaft turns clockwise.
Position mode:	With overflow counter: • Encoder overflows are counted and an internal 32-bit position is generated in the inverter Single-turn absolute position: • Only via singleturn absolute encoder. Position is displayed according to the encoder information. Encoder overflows are not counted Linear operation: • Position is displayed according to the encoder information. Encoder overflows are not counted
Encoder monitoring motor:	NO: • Wire break between frequency inverter and motor encoder is not detected directly. In case of a defective connection, error F08 Speed monitoring will be issued in enabled state unless it was deactivated. YES: • Wire break between frequency inverter and motor encoder will be detected directly when using sin/cos encoders and TTL encoders. The error message F14 Encoder error will be issued in case of an error. This error will also be generated in inhibited state. Note: Encoder monitoring is not a safety function! If you use a Hiperface$^{®}$ encoder, encoder monitoring is always active (for the track too) irrespective of the setting in P504.

Parameter	Description
Position offset:	Setting range: $(-2^{31} ... 0 ... 2^{31} -1)$ The position offset only needs to be set for incremental encoders; for other encoders, it should be set to 0. Note: The position value will be recalculated and overwritten automatically after successful completion of the reference travel.
SSI clock rate:	Setting range: 125, 250, 500, 1000, 2000 kHz Defines the cycle frequency at which absolute encoder information is transmitted from the encoder to the inverter.
EnDAT clock rate:	Setting range: 125, 250, 500, 1000, 2000 kHz Defines the cycle frequency at which absolute encoder information is transmitted from the encoder to the inverter.
CANopen baud rate:	Setting range: 125, 250, 500 kBaud, 1 MBaud determines the transmission speed of the CAN bus.

8 Error Messages

8.1 MOVIDRIVE® MDX61B with DEU21B option

The factory set error response is listed in the "Response (P)" column. (P) indicates that the response is programmable (via IPOS^{plus®}).

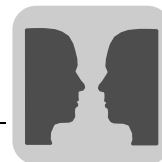| Error code	Designation	Response (P)	Suberror code	Designation	Possible cause	Measure
57	"TTL encoder"	Immediate disconnection	512	X15: Error in amplitude control	• Encoder cable or shield not connected correctly • Short circuit/broken encoder wire • Encoder defective • EMC interference	• Check encoder cable and shield for correct connection, short circuit and broken wire. • Replace the encoder • Providing for EMC measures
			16896	X14: Error in amplitude control		
			514	X15: Incorrectly set numerator/denominator values	Incorrect numerator/ denominator values	Correct the numerator/ denominator values
			16898	X14: Incorrectly set numerator/denominator values		
58	"Sin/cos encoder"	Immediate disconnection	512	X15: Error in amplitude control	• Encoder cable or shield not connected correctly • Short circuit/broken encoder wire • Encoder defective • EMC interference	• Check encoder cable and shield for correct connection, short circuit and broken wire. • Replace the encoder • Providing for EMC measures
			514	X15: Track signal error		
			16896	X14: Error in amplitude control		
			16897	X14: Initialization		
			16898	X14: Track signal error		
			513	X15: Initialization	Encoder defective	Replace the encoder
			515	X15: Incorrectly set numerator/denominator values	Incorrect numerator/ denominator values	Correct the numerator/ denominator values
			16899	X:14 Incorrect numerator/ denominator values		
59	"Encoder communication"	Rapid stop	1	X15: Track signal error	• Encoder cable or shield not connected correctly • Short circuit/broken encoder wire • Encoder defective • EMC interference	• Check encoder cable and shield for correct connection, short circuit and broken wire. • Replace the encoder • Providing for EMC measures
			16	X15: Data line error		
			64 – 576	X15: RS485 communication		
			1088 – 1388	X15: EnDat communication		
			16385	X14: Track signal error		
			16400	X14: Data line error		
			16448 – 16832	X14: RS485 communication		
			17472 – 17772	X14: EnDat communication		
			2	X15: Incorrect calibration of encoder	Incorrect encoder calibration or mechanical offset to motor	Delivery condition + new startup
			16386	X14: Incorrect calibration of encoder		
			1024	X15: Clocking and/or data line not connected	Clocking and/or data line not connected	Connect clocking and/or data line
			17408	X14: Clocking and/or data line not connected		

Error code	Designation	Response (P)	Suberror code	Designation	Possible cause	Measure
122	"Absolute encoder option"	Immediate disconnection	2	X15: Unknown encoder type	Connected encoder type unknown	Replace the encoder
			16386	X14: Unknown encoder type		
			1	X15: Plausibility check	• Encoder cable or shield not connected correctly • Short circuit/broken encoder wire • Encoder defective • EMC interference	• Check encoder cable and shield for correct connection, short circuit and broken wire. • Replace the encoder • Providing for EMC measures
			33	X15: Analog voltages not within tolerance		
			41 – 45	X15: RS485 communication		
			60	X15: Analog voltages not within tolerance		
			63	X15: Position error, excessive speed, unable to generate position		
			256	X15: Voltage dip		
			257	X15: Clocking or data line interrupted		
			258	X15: Change of position		
			261	X15: No high level present		
			513	X15: Plausibility check		
			768	X15: PDO timeout		
			770	X15: Change of position		
			16385	X14: Plausibility check.		
			16417	X14: Analog voltages not within tolerance		
			16444	X14: Analog voltages not within tolerance		
			16447	X14: Position error, excessive speed, unable to generate position		
			16425 – 16429	X14: RS485 communication		
			16640	X14: Voltage dip		
			16641	X14: Clocking or data line interrupted		
			16642	X14: Change of position		
			16645	X14: No high level present		
			16897	X14: Plausibility check		
			17152	X14: PDO timeout		
			17154	X14: Change of position		
			34 – 40	X15: Internal encoder error	Internal encoder error	Replace the encoder
			46 – 50	X15: Internal encoder error		
			64 – 67	X15: Internal encoder error		
			514 – 544	X15: Internal encoder error		
			772 – 774	X15: Internal encoder error		
			16418 – 16424	X14: Internal encoder error		
			16430 – 16434	X14: Internal encoder error		
			16448 – 16451	X14: Internal encoder error		
			16898 – 16928	X14: Internal encoder error		
			17156 – 17158	X14:Internal encoder error		

Error code	Designation	Response (P)	Suberror code	Designation	Possible cause	Measure
122	"Absolute encoder option"	Immediate disconnection	61	X15: Critical transmitter current	Soiled, transmitter broken	Replace the encoder
			16445	X14: Critical transmitter current		
			62	X15: Critical encoder temperature	Encoder temperature too high	Reduce motor and ambient temperature
			16446	X14: Critical encoder temperature		
			259	X15: Insufficient clock frequency	Incorrect encoder parameterization	Check encoder parameterization
			260	X15: Encoder signals programmable error		
			576	X15: Internal encoder warning		
			769	X15: Encoder signals programmable error		
			16643	X14: Insufficient clock frequency		
			16644	X14: Encoder signals programmable error		
			16960	X14: Internal encoder warning		
			17153	X14: Encoder signals programmable error		
			771	X15: Emergency signal		
			17155	X14: Emergency signal		

9 Technical Data

9.1 DEU21B option – electronics data

Description	Function
External encoder connection X14: **Output for incremental encoder simulation:** • Signal level to RS422 • The number of pulses is the same as on X15 motor encoder input	Permitted encoder types: • Hiperface® encoder • sin/cos encoder AC 1 V_{pp} • CANopen encoder • TTL encoder with negated tracks • HTL encoder • SSI encoder • SSI combination encoder • EnDat encoder • Encoder with signal level to RS422 • Permitted PPR count: 2-4096 increments Encoder power supply • DC 24 V encoder supply[1] • DC 12 V encoder supply[2]
Motor encoder connection X15:	Permitted encoder types: • Hiperface® encoder • sin/cos encoder AC 1 V_{pp} • TTL encoder with negated tracks • HTL encoder • SSI encoder • SSI combination encoder • EnDat encoder • Encoder with signal level to RS422 • Permitted PPR count: 2-4096 increments Encoder power supply • DC 24 V voltage supply[1] • DC 12 V voltage supply[2]

1) If the overall unit load on the 24 V level exceeds 400 mA, you must connect an external DC 24 V supply to X10:9/X10:10. Observe the "Project planning" chapter in the MOVIDRIVE® MDX60B/61B system manual.

2) The maximum load on X14:15 and X15:15 is DC 650 mA in total.

Index

**SEW-EURODRIVE
Driving the world**