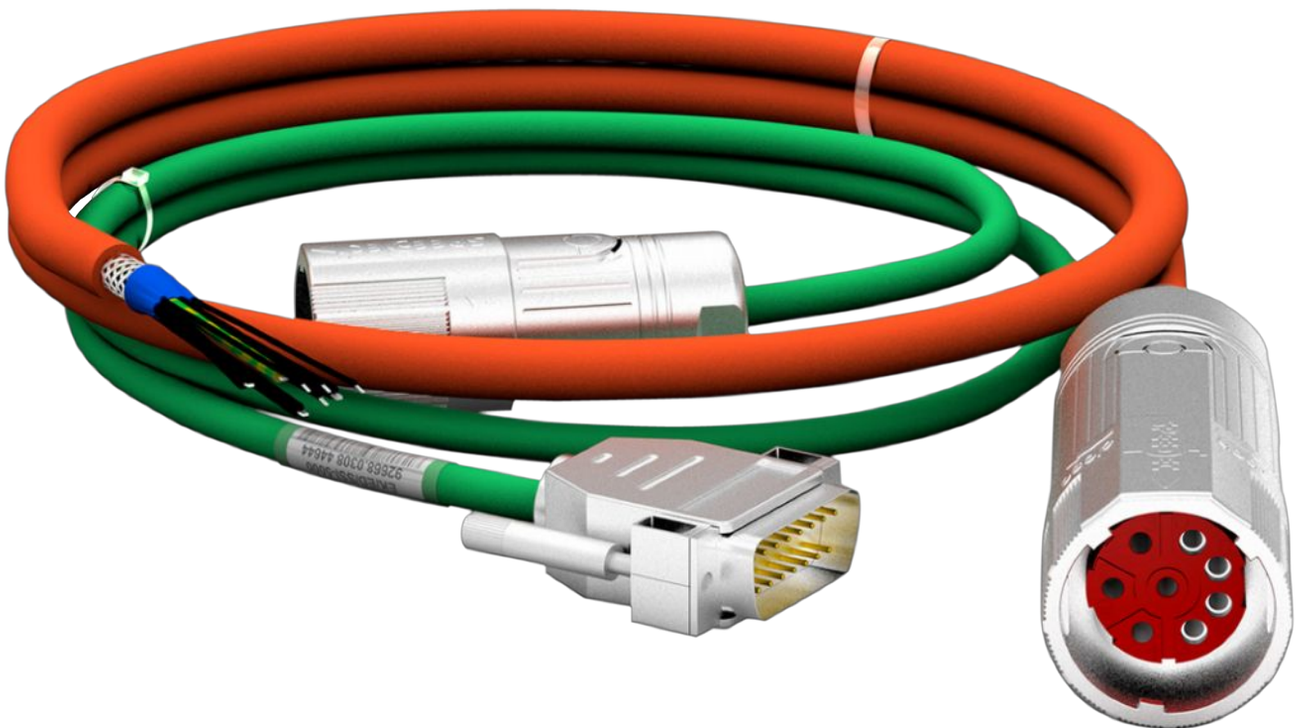

Connection method
Manual

en-US
08/2019
ID 443102.01

STÖBER

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1 Foreword

A drive controller, cable and motor that are not coordinated with one another can lead to impermissibly high voltage peaks in the drive system, which may cause damage to the motor. The legal requirements of (EMC) Directive 2014/30/EU must also be observed.

Combining STOBER motors, STOBER cables and STOBER drive controller enables you to comply with these legal requirements.

STOBER offers a range of cables to match. Cables are available in different lengths and are ready-made on both ends.

Using unsuitable connection cables may void any claims made under the warranty.

Features

- Torsional stress ±30°/m
- Bending resistance
- Oil resistance
- Chemical resistance

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2 User information

This documentation describes the available STOBER power, encoder and hybrid cables. It provides you with assistance in selecting the right cable and with relevant information about properly connecting to the motor and drive controller without any errors.

2.1 Timeliness

Check whether this document is the latest version of the documentation. We make the latest document versions for our products available for download on our website:
http://www.stoeber.de/en/downloads/.

2.2 Original language

The original language of this documentation is German; all other language versions are derived from the original language.

2.3 Limitation of liability

This documentation was created taking into account the applicable standards and regulations as well as the current state of technology.

STOBER shall assume no responsibility for damage resulting from failure to comply with the documentation or from use that deviates from the intended use of the product. This is especially true for damage caused by individual technical modifications to the product or projecting and operation of the product by unqualified personnel.

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2.4 Formatting conventions

Orientation guides in the form of signal words, symbols and special text markups are used to emphasize specific information so that you are able identify it in this documentation quickly.

2.4.1 Use of symbols

Safety instructions are identified with the following symbols. They indicate special risks when handling the product and are accompanied by relevant signal words that express the extent of the risk. Furthermore, useful tips and recommendations for efficient, error-free operation are specially highlighted.

ATTENTION!

Notice

This indicates that damage to property may occur

- if the stated precautionary measures are not taken.

⚠ CAUTION!

Caution

This word with a warning triangle indicates that minor personal injury may occur

- if the stated precautionary measures are not taken.

⚠ WARNING!

Warning

This word with a warning triangle means there may be a considerable risk of fatal injury

- if the stated precautionary measures are not taken.

⚠ DANGER!

Danger

This word with a warning triangle indicates that there is a considerable risk of fatal injury

- if the stated precautionary measures are not taken.

Information

Information indicates important information about the product or serves to emphasize a section in the documentation that deserves special attention from the reader.

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2.4.2 Distinction of text elements

Certain elements of the continuous text are distinguished as follows.

Important information	Words or expressions with a special meaning
Interpolated position mode	Optional: File or product name or other name
Detailed information	Internal cross-reference
http://www.samplelink.com	External cross-reference

2.4.3 Conventions for cables

In the cable connection descriptions, core colors are shortened and used as follows.

Cable colors

BK:	BLACK	PK:	PINK
BN:	BROWN	RD:	RED
BU:	BLUE	VT:	VIOLET
GN:	GREEN	WH:	WHITE
GY:	GRAY	YE:	YELLOW
OG:	ORANGE		

Formatting conventions

Two-colored core:	WHYE	WHITEYELLOW (white and yellow)
Single-colored core:	BK/BN	BLACK/BROWN (black or brown)

2.5 Trademarks

The following names are trademarks or registered trademarks of other companies:

EnDat®	EnDat® and the EnDat® logo are registered trademarks of Dr. Johannes Heidenhain GmbH, Traunreut, Germany.
HIPERFACE®	HIPERFACE® and the HIPERFACE DSL® logo are registered trademarks of SICK STEGMANN GmbH, Donaueschingen, Germany.
speedtec®	speedtec® ist a registered trademark of TE Connectivity Industrial GmbH, Niederwinkling, Germany.

All other trademarks not listed here are the property of their respective owners.

Products that are registered as trademarks are not specially indicated in this documentation. Existing property rights (patents, trademarks, protection of utility models) are to be observed.

3 General safety instructions

There are risks associated with the product described in this documentation that can be prevented by complying with the described warning and safety instructions as well as the included technical rules and regulations.

3.1 Directives and standards

The following European directives and standards are relevant for STOBER cables:

- Low Voltage Directive 2014/35/EU

Subsequent references to the standards do not specify the respective year in order to improve readability.

3.2 Applicable documentation

This documentation is a supplement to the motor operating manual and the drive controller manual. You may use this documentation only in combination with the applicable documents; see the chapter Detailed information [▶ 96].

3.3 Qualified personnel

In order to be able to perform the tasks described in this documentation, the persons instructed to perform them must have the appropriate professional qualification and be able to assess the risks and residual hazards when handling the products. For this reason, all work on the products as well as their operation and disposal may be performed only by professionally qualified personnel.

Qualified personal are persons who have acquired authorization to perform these tasks either through training to become a specialist and/or instruction by specialists.

Furthermore, valid regulations, legal requirements, applicable basic rules, this documentation and the safety instructions included in it must be carefully read, understood and observed.

3.4 Intended use

STOBER cables are used exclusively to transmit electrical energy for the purposes of supplying power and conveying information. The building regulations and installation requirements valid for the respective system must always be observed when using these cables.

Use outside the applicable technical specifications constitutes improper use.

3.5 Transport and storage

Inspect the delivery for any transport damage immediately after you receive it. Notify the transport company of any damage immediately. Do not put a damaged product into operation.

To ensure the faultless and safe operation of the products, they must be professionally configured, installed, operated and maintained. If you have to transport or store the products, you must protect them from mechanical impacts and vibrations as well as observe the recommended transport and storage conditions in the technical data.

Store the products in a dry and dust-free room if you do not install them immediately.

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3.6 Operational environment and operation

Always operate the products within the limits specified by the technical data.

The following applications are prohibited:

- Use in potentially explosive atmospheres
- If not otherwise specified in the technical data: Use in environments with harmful substances as specified by EN 60721, such as oils, acids, gases, vapors, dust and radiation

3.7 Working on the machine

Before all work on machines and systems, apply the 5 safety rules in accordance with DIN VDE 0105-100 (Operation of electrical installations – Part 100: General requirements) in the order listed:

- Disconnect (also ensure that the auxiliary circuits are disconnected).
- Ensure power cannot be switched on again.
- Ensure that everything is de-energized.
- Ground and short circuit.
- Cover adjacent live parts.

Information

Note that the you can only determine that voltage is no longer present once the discharge time has elapsed. The discharge time depends on the self-discharge of the drive controller. You can find the discharge time in the general technical data of the drive controller.

3.8 Disposal

Observe the current national and regional regulations when disposing of the product! Dispose of the individual product parts depending on their properties, e.g. as:

- Electronic waste (circuit boards)
- Plastic
- Sheet metal
- Copper
- Aluminum
- Battery

4 Overview

4.1 Encoder cables

Encoder	Motor plug connector size			
	con.15	con.17	con.23 synchronous	con.23 asynchronous
EnDat 2.1/2.2 digital	✓	✓	✓	
Incremental (HTL)				✓
SSI				✓
Resolver	✓	✓	✓	
EnDat 2.1 sin/cos	✓	✓	✓	

Information

In combination with a HIPERFACE DSL encoder, you require hybrid cables which feature encoder communication and power transmission in a shared cable.

More detailed information on motor connection using hybrid cables can be found in the chapter One Cable Solution [▶ 84].

Encoder	Supply cores (pair)	Signal cores (pair)	Cable ∅	Bending radius 1 (min.)	Bending radius 2 (min.)
EnDat 2.1/2.2 digital	2 × 0.25 mm²	2 × 0.14 mm²	Max. 8.5 mm	85 mm	42.5 mm
Incremental (HTL)	2 × 0.25 mm²	2 × 0.14 mm²	Max. 8.5 mm	85 mm	42.5 mm
SSI	2 × 0.25 mm²	2 × 0.14 mm²	Max. 8.5 mm	85 mm	42.5 mm
Resolver	2 × 0.25 mm²	2 × 0.14 mm²	Max. 11.4 mm	114 mm	57.0 mm
EnDat 2.1 sin/cos	2 × 0.34 mm²	2 × 0.14/0.25 mm²	Max. 13.0 mm	130 mm	65.0 mm
Bending radius: 1 = free to move, 2 = fixed installation					

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4.2 Power cables

Design	Motor plug connector size			
	con.15	con.23	con.40	con.58
Quick lock	✓			
speedtec quick lock		✓	✓	
Screw technology		On request	On request	✓

Power cores (3 + PE)	Brake cores (pair)	Temperature sensor cores (pair)	Cable ∅	Bending radius 1 (min.)	Bending radius 2 (min.)
4 × 1.0 mm²	2 × 0.5 mm²	2 × 0.34 mm²	Max. 10.5 mm	105.0 mm	52.5 mm
4 × 1.5 mm²	2 × 1.0 mm²	2 × 0.5 mm²	Max. 12.7 mm	127.0 mm	63.5 mm
4 × 2.5 mm²	2 × 1.0 mm²	2 × 1.0 mm²	Max. 15.3 mm	153.0 mm	76.5 mm
4 × 4.0 mm²	2 × 1.0 mm²	2 × 0.75 mm²	Max. 16.0 mm	160.0 mm	80.0 mm
4 × 6.0 mm²	2 × 1.5 mm²	2 × 1.0 mm²	Max. 19.4 mm	194.0 mm	97.0 mm
4 × 10.0 mm²	2 × 1.5 mm²	2 × 1.0 mm²	Max. 23.5 mm	235.0 mm	117.5 mm
4 × 16.0 mm²	2 × 1.5 mm²	2 × 1.5 mm²	Max. 25.5 mm	255.0 mm	191.0 mm
4 × 25.0 mm²	2 × 1.5 mm²	2 × 1.5 mm²	Max. 28.8 mm	288.0 mm	216.0 mm
Bending radius: 1 = free to move, 2 = fixed installation					

4.3 One Cable Solution

Design	Motor plug connector size	
	con.23	con.40
speedtec quick lock	✓	✓

Power cores (3 + PE)	Brake cores (pair)	Signal cores (pair)	Cable ∅	Bending radius 1 (min.)	Bending radius 2 (min.)
4 × 1.5 mm²	2 × 0.75 mm²	2 × AWG22	Max. 13.5 mm	94.5 mm	67.5 mm
4 × 2.5 mm²	2 × 1.0 mm²	2 × AWG22	Max. 15.0 mm	105.0 mm	75.0 mm
Bending radius: 1 = free to move, 2 = fixed installation					

5 Encoder cables

STOBER motors are equipped with encoder systems and plug connectors as standard.

STOBER provides suitable cables in various lengths, conductor cross-sections and connector sizes.

Depending on the respective motor types, different encoder systems can be used.

5.1 Connection description and technical data

Connection description and technical data of the available encoder cables can be found in the following chapters.

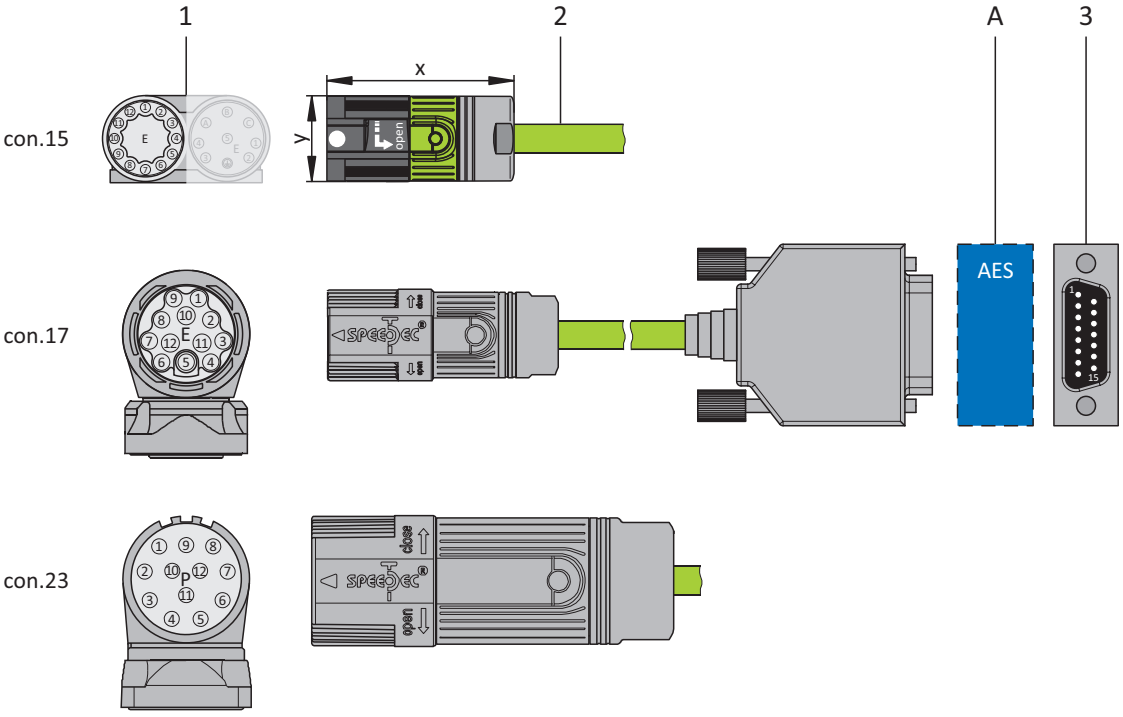
5.1.1 EnDat 2.1/2.2 digital encoders

Suitable encoder cables are described below.

5.1.1.1 Connection description

Depending on the size of the motor plug connector, encoder cables are available in the following designs:

- Quick lock for con.15
- speedtec quick lock for con.17 and con.23



1: Plug connector

2: STOBER encoder cable

A: Only con.15 and con.17: Optional Absolute Encoder Support (AES) battery module

3: D-sub X4/X140

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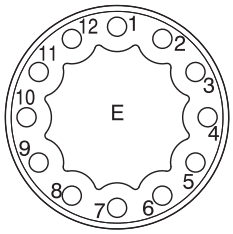
Encoder cables – con.15 plug connectors

The power supply is buffered for EnDat 2.2 digital "EBI 1135" and "EBI 135" inductive encoders with a multi-turn function. In this case, pin 2 and pin 3 of the motor are assigned to the U_{2BAT} buffer battery. Note that the encoder cable must not be connected to the encoder interface of the drive controller, but rather to the AES battery module for these encoders.

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4/X140
	1	Clock+	VT	YE	8
	2	Sense U_2	BU	PK	12
		U_{2BAT+} [1]			
	3	—	WH	GY	3
		U_{2BAT-} [2]			
	4	—	—	—	—
	5	Data−	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock−	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U_2	BNGN	RD	4
	Housing	Shield	—	—	—

Tab. 1: con.15 encoder cable pin assignment, EnDat 2.1/2.2 digital

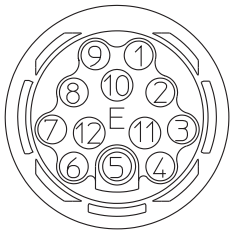
Length x [mm]	Diameter y [mm]
42	18.7

Tab. 2: con.15 connector dimensions

[1] Only relevant for EBI encoders
[2] Only relevant for EBI encoders

Encoder cables – con.17 plug connectors

The power supply is buffered for EnDat 2.2 digital "EBI 1135" and "EBI 135" inductive encoders with a multi-turn function. In this case, pin 2 and pin 3 of the motor are assigned to the U_{2BAT} buffer battery. Note that the encoder cable must not be connected to the encoder interface of the drive controller, but rather to the AES battery module for these encoders.

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4/X140
	1	Clock+	VT	YE	8
	2	Sense U_2	BU	PK	12
		U_{2BAT+} [3]			
	3	—	WH	GY	3
		U_{2BAT-} [4]			
	4	—	—	—	—
	5	Data−	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock−	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U_2	BNGN	RD	4
	Housing	Shield	—	—	—

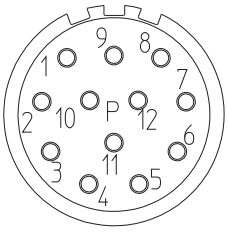
Tab. 3: con.17 encoder cable pin assignment, EnDat 2.1/2.2 digital

Length x [mm]	Diameter y [mm]
56	22

Tab. 4: con.17 connector dimensions

[3] Only relevant for EBI encoders
[4] Only relevant for EBI encoders

Encoder cables – con.23 plug connectors

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4/X140
	1	Clock+	VT	YE	8
	2	Sense U_2	BU	PK	12
	3	—	—	—	—
	4	—	—	—	—
	5	Data−	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock−	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U_2	BNGN	RD	4
	Housing	Shield	—	—	—

Tab. 5: con.23 encoder cable pin assignment, EnDat 2.1/2.2 digital

Length x [mm]	Diameter y [mm]
58	26

Tab. 6: con.23 dimensions

5.1.1.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Ultra-fine stranded wire made of bare Cu wires based on DIN VDE 0812. Single wire, 0.11 mm with a nominal cross-section of 0.14 and 0.25 mm². Internal structure twisted without tension.

Peak operating voltage

- Peak operating voltage (DIN VDE): pilot cores max. 350 V
- Voltage (UL/CSA): pilot cores max. 300 V

Test voltage

Core/core and core/shield: all cores 2000 V

Insulation resistance at 20 °C

Min. 100 MΩ × km

Limit temperature

Temperature range / operating mode	DIN VDE	UL/CSA
Not in motion	−30 °C to +90 °	Up to +80 °C
In motion	−30 °C to +90 °	Up to +80 °C

Max. tensile stress when being laid

50 N for each mm² of conductor cross-section

Smallest permissible bending radius

- Freely movable: 10 x d_{out}
- Permanently installed: 5 x d_{out}

Torsional stress

± 30°/m

Bending resistance

Trailable with 5 million bending cycles at a travel velocity of 180 m/min and an acceleration of 5 m/s² under optimum ambient conditions

Resistance

- Oil resistant: very good in accordance with VDE 0282, part 10+HD 22.10
- Chemical: good against acids, bases, solvents, hydraulic fluids, etc.; more detailed information on request

Outer sheath

PUR (TMPU in accordance with DIN VDE 0282, part 10)

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Banding

Fleece tape with overlapping

Core insulation

PP, thermoplastic based on polypropylene, fulfills 9YI1 in accordance with DIN VDE 0207 part 7

Core identification

Pair	Colors	
2 × 0.14	YE	GN
2 × 0.14	BN	WH
2 × 0.14	PK	GY
2 × 0.25	BU	RD

Sheath: color Desina GREEN, similar to RAL 6018 with "STÖBER 49484" imprint

Shield structure

- Shield: copper braiding, tin-plated
- Cover: ≥ 90%

Insulation material

Halogen-free, silicone-free, PWIS non-critical (PWIS = free of paint-wetting impairment substances)

Flammability

Combustion behavior: flame retarding and self-extinguishing in accordance with IEC 60322-1, CSA FT1 and UL FT1

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections

Cable diameter	Description	Weight
Max. 8.5 mm	(3 x 2 x 0.14 mm^2 + 2 x 0.25 mm^3)	68 g/m

"(...)" = Shield

Design

UL/CSA (E172204)

Capacitance, inductance

Capacitance in accordance with VDE 0472 part 504 test type A; core/core[5]	
Pair 0.14 mm²	Max. 30 nF/km
Pair 0.25 mm²	Max. 35 nF/km

Capacitance in accordance with VDE 0472 part 504 test type B; core/remainder[6]	
Pair 0.14 mm²	Max. 110 nF/km
Pair 0.25 mm²	Max. 130 nF/km

Inductance in accordance with EN 50289-1-12:2005; core/core	
Pair 0.14 mm²	Max. 800 µH/km
Pair 0.25 mm²	Max. 800 µH/km

[5] Details in accordance with EN 50289-1-5:2001 in preparation
[6] Details in accordance with EN 50289-1-5:2001 in preparation

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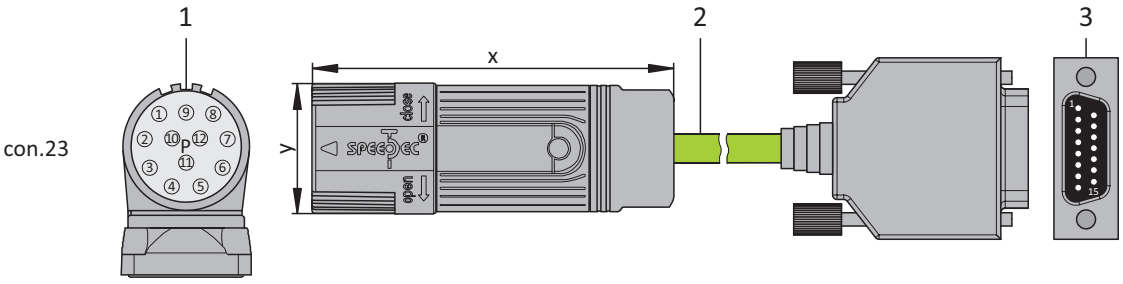
5.1.2 Differential HTL incremental encoders

Suitable encoder cables are described below.

5.1.2.1 Connection description

The encoder cable is available in plug connector size con.23 with a speedtec quick lock.



1: Plug connectors

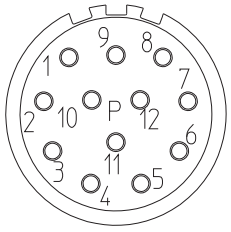
2: STOBER encoder cable

3: D-sub X4

Information

For the connection of an HTL incremental encoder to terminal X4 of the SC6 or SI6 drive controller, you need the HT6 adapter (ID No. 56665). HT6 takes over level conversion from HTL signals to TTL signals.

Encoder cables – con.23 plug connectors

Motor (1)					Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color up to size 80	Core color size 90 or larger	Core color	Pin X4
	1	B–	PK	BK	YE	9
	2	—	—	YE	—	—
	3	N+	BU	PK	PK	3
	4	N–	RD	WH	GY	10
	5	A+	GN	GN	BN	6
	6	A–	YE	BN	WH	11
	7	—	—	—	—	—
	8	B+	GY	GY	GN	1
	9	—	—	—	—	—
	10	GND	WH	BU	BU	2[7]
	11	—	—	VT	—	—
	12	U_2	BN	RD	RD	4
	Housing	Shield	—	—	—	—

Tab. 7: con.23 encoder cable pin assignment, incremental HTL

[7] Pin 12 (Sense) with pin 2 (GND) bridged: The bridge is constructed in the cable connector that is connected to X4.

Length x [mm]	Diameter y [mm]
58	26

Tab. 8: con.23 dimensions

5.1.2.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Ultra-fine stranded wire made of bare Cu wires based on DIN VDE 0812. Single wire, 0.11 mm with a nominal cross-section of 0.14 and 0.25 mm². Internal structure twisted without tension.

Peak operating voltage

- Peak operating voltage (DIN VDE): pilot cores max. 350 V
- Voltage (UL/CSA): pilot cores max. 300 V

Test voltage

Core/core and core/shield: all cores 2000 V

Insulation resistance at 20 °C

Min. 100 MΩ × km

Limit temperature

Temperature range / operating mode	DIN VDE	UL/CSA
Not in motion	−30 °C to +90 °	Up to +80 °C
In motion	−30 °C to +90 °	Up to +80 °C

Max. tensile stress when being laid

50 N for each mm² of conductor cross-section

Smallest permissible bending radius

- Freely movable: 10 x d_{out}
- Permanently installed: 5 x d_{out}

Torsional stress

± 30°/m

Bending resistance

Trailable with 5 million bending cycles at a travel velocity of 180 m/min and an acceleration of 5 m/s² under optimum ambient conditions

Resistance

- Oil resistant: very good in accordance with VDE 0282, part 10+HD 22.10
- Chemical: good against acids, bases, solvents, hydraulic fluids, etc.; more detailed information on request

Outer sheath

PUR (TMPU in accordance with DIN VDE 0282, part 10)

Banding

Fleece tape with overlapping

Core insulation

PP, thermoplastic based on polypropylene, fulfills 9YI1 in accordance with DIN VDE 0207 part 7

Core identification

Pair	Colors	
2 × 0.14	YE	GN
2 × 0.14	BN	WH
2 × 0.14	PK	GY
2 × 0.25	BU	RD

Sheath: color Desina GREEN, similar to RAL 6018 with "STÖBER 49484" imprint

Shield structure

- Shield: copper braiding, tin-plated
- Cover: ≥ 90%

Insulation material

Halogen-free, silicone-free, PWIS non-critical (PWIS = free of paint-wetting impairment substances)

Flammability

Combustion behavior: flame retarding and self-extinguishing in accordance with IEC 60322-1, CSA FT1 and UL FT1

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections

Cable diameter	Description	Weight
Max. 8.5 mm	(3 x 2 x 0.14 mm² + 2 x 0.25 mm³)	68 g/m

"(...)" = Shield

Design

UL/CSA (E172204)

Capacitance, inductance

Capacitance in accordance with VDE 0472 part 504 test type A; core/core[8]	
Pair 0.14 mm²	Max. 30 nF/km
Pair 0.25 mm²	Max. 35 nF/km

Capacitance in accordance with VDE 0472 part 504 test type B; core/remainder[9]	
Pair 0.14 mm²	Max. 110 nF/km
Pair 0.25 mm²	Max. 130 nF/km

Inductance in accordance with EN 50289-1-12:2005; core/core	
Pair 0.14 mm²	Max. 800 µH/km
Pair 0.25 mm²	Max. 800 µH/km

[8] Details in accordance with EN 50289-1-5:2001 in preparation
[9] Details in accordance with EN 50289-1-5:2001 in preparation

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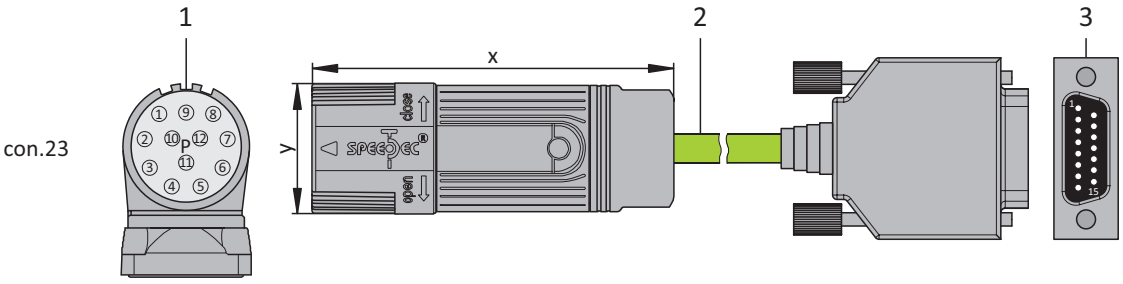
5.1.3 SSI encoders

Suitable encoder cables are described below.

5.1.3.1 Connection description

The encoder cable is available in plug connector size con.23 with a speedtec quick lock.

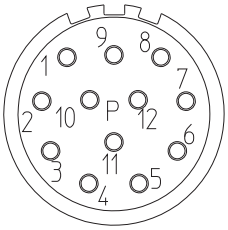


1: Plug connectors

2: STOBER encoder cable

3: D-sub X4

Encoder cables – con.23 plug connectors

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	Clock+	VT	YE	8
	2	Sense U_2	BNGN	PK	12
	3	—	—	—	—
	4	—	—	—	—
	5	Data–	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock–	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U_2	BNGN	RD	4
	Housing	Shield	—	—	—

Tab. 9: con.23 encoder cable pin assignment, SSI

Length x [mm]	Diameter y [mm]
58	26

Tab. 10: con.23 dimensions

5.1.3.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Ultra-fine stranded wire made of bare Cu wires based on DIN VDE 0812. Single wire, 0.11 mm with a nominal cross-section of 0.14 and 0.25 mm². Internal structure twisted without tension.

Peak operating voltage

- Peak operating voltage (DIN VDE): pilot cores max. 350 V
- Voltage (UL/CSA): pilot cores max. 300 V

Test voltage

Core/core and core/shield: all cores 2000 V

Insulation resistance at 20 °C

Min. 100 MΩ × km

Limit temperature

Temperature range / operating mode	DIN VDE	UL/CSA
Not in motion	−30 °C to +90 °	Up to +80 °C
In motion	−30 °C to +90 °	Up to +80 °C

Max. tensile stress when being laid

50 N for each mm² of conductor cross-section

Smallest permissible bending radius

- Freely movable: 10 x d_{out}
- Permanently installed: 5 x d_{out}

Torsional stress

± 30°/m

Bending resistance

Trailable with 5 million bending cycles at a travel velocity of 180 m/min and an acceleration of 5 m/s² under optimum ambient conditions

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Resistance

- Oil resistant: very good in accordance with VDE 0282, part 10+HD 22.10
- Chemical: good against acids, bases, solvents, hydraulic fluids, etc.; more detailed information on request

Outer sheath

PUR (TMPU in accordance with DIN VDE 0282, part 10)

Banding

Fleece tape with overlapping

Core insulation

PP, thermoplastic based on polypropylene, fulfills 9YI1 in accordance with DIN VDE 0207 part 7

Core identification

Pair	Colors	
2 × 0.14	YE	GN
2 × 0.14	BN	WH
2 × 0.14	PK	GY
2 × 0.25	BU	RD

Sheath: color Desina GREEN, similar to RAL 6018 with "STÖBER 49484" imprint

Shield structure

- Shield: copper braiding, tin-plated
- Cover: ≥ 90%

Insulation material

Halogen-free, silicone-free, PWIS non-critical (PWIS = free of paint-wetting impairment substances)

Flammability

Combustion behavior: flame retarding and self-extinguishing in accordance with IEC 60322-1, CSA FT1 and UL FT1

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections

Cable diameter	Description	Weight
Max. 8.5 mm	(3 x 2 x 0.14 mm² + 2 x 0.25 mm³)	68 g/m

"(...)" = Shield

Design

UL/CSA (E172204)

Capacitance, inductance

Capacitance in accordance with VDE 0472 part 504 test type A; core/core[10]	
Pair 0.14 mm²	Max. 30 nF/km
Pair 0.25 mm²	Max. 35 nF/km

Capacitance in accordance with VDE 0472 part 504 test type B; core/remainder[11]	
Pair 0.14 mm²	Max. 110 nF/km
Pair 0.25 mm²	Max. 130 nF/km

Inductance in accordance with EN 50289-1-12:2005; core/core	
Pair 0.14 mm²	Max. 800 µH/km
Pair 0.25 mm²	Max. 800 µH/km

[10] Details in accordance with EN 50289-1-5:2001 in preparation
[11] Details in accordance with EN 50289-1-5:2001 in preparation

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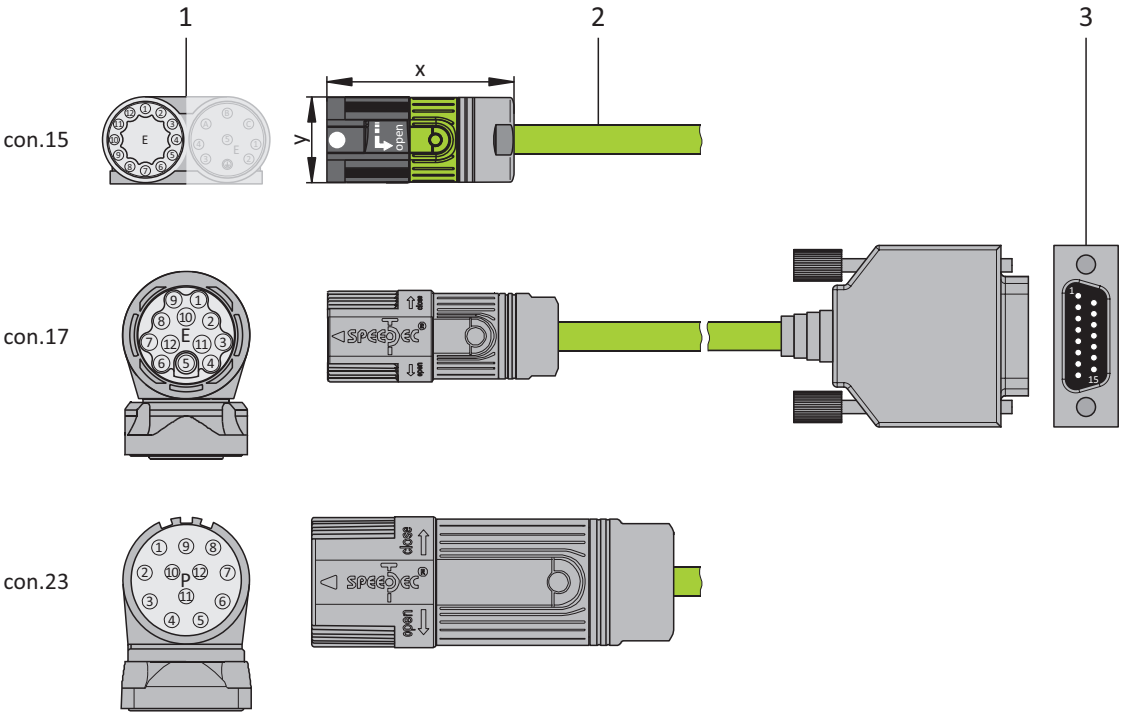
5.1.4 Resolver

Suitable encoder cables are described below.

5.1.4.1 Connection description

Depending on the size of the motor plug connector, encoder cables are available in the following designs:

- Quick lock for con.15
- speedtec quick lock for con.17 and con.23



1: Plug connector
2: STOBER encoder cable
3: D-sub X4/X140

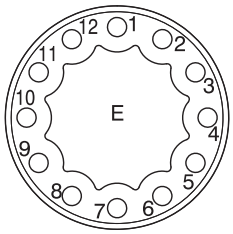
Information

Note that the cores for the temperature sensor in STOBER are routed in the power cable as standard. For motors that provide the temperature sensor at the encoder connection, you need an interface adapter to lead out the temperature sensor cores for connecting the cable to the drive controller.

Information

For connecting STOBER resolver cables with a 9-pin D-sub connector, such as the standard design for ED/EK synchronous servo motors, you must use the AP6A00 (ID No. 56498) or AP6A01 (ID No. 56522) interface adapter, available separately.

Encoder cables – con.15 plug connectors

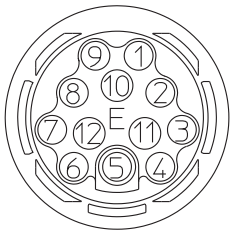
Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4/X140
	1	S3 Cos+	BK	YE	3
	2	S1 Cos−	RD	GN	11
	3	S4 Sin +	BU	WH	1
	4	S2 Sin−	YE	BN	9
	5	1TP1	BK	RD	7
	6	1TP2	WH	BU	14
	7	R2 Ref+	YEWH/ BKWH	GY	6
	8	R1 Ref−	RDWH	PK	2
	9	—	—	—	—
	10	—	—	—	—
	11	—	—	—	—
	12	—	—	—	—
	Housing	Shield	—	—	—

Tab. 11: con.15 encoder cable pin assignment, resolver

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 12: con.15 connector dimensions

Encoder cables – con.17 plug connectors

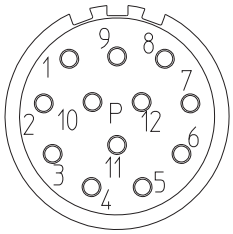
Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4/X140
	1	S3 Cos+	BK	YE	3
	2	S1 Cos–	RD	GN	11
	3	S4 Sin +	BU	WH	1
	4	S2 Sin–	YE	BN	9
	5	1TP1	BK	RD	7
	6	1TP2	WH	BU	14
	7	R2 Ref+	YEWH/ BKWH	GY	6
	8	R1 Ref–	RDWH	PK	2
	9	—	—	—	—
	10	—	—	—	—
	11	—	—	—	—
	12	—	—	—	—
	Housing	Shield	—	—	—

Tab. 13: con.17 encoder cable pin assignment, resolver

Length x [mm]	Diameter y [mm]
56	22

Tab. 14: con.17 connector dimensions

Encoder cables – con.23 plug connectors

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4/X140
	1	S3 Cos+	BK	YE	3
	2	S1 Cos–	RD	GN	11
	3	S4 Sin +	BU	WH	1
	4	S2 Sin–	YE	BN	9
	5	1TP1	BK	RD	—
	6	1TP2	WH	BU	—
	7	R2 Ref+	YEWH/ BKWH	GY	6
	8	R1 Ref–	RDWH	PK	2
	9	—	—	—	—
	10	—	—	—	—
	11	—	—	—	—
	12	—	—	—	—
	Housing	Shield	—	—	—

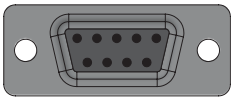
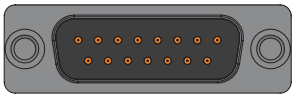
Tab. 15: con.23 encoder cable pin assignment, resolver

Length x [mm]	Diameter y [mm]
58	26

Tab. 16: con.23 dimensions

5.1.4.1.1 AP6 interface adapter (resolver)

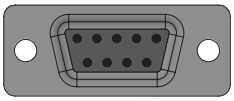
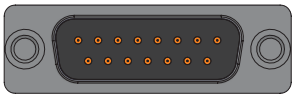
AP6A00 – Resolver (9-pin to 15-pin)

Socket[12]	Pin	Designation	Function	Pin	Connector[13]
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	—	—	—	1|2|3|4|5|6|7|8|9  10|11|12|13|14|15
	2	1TP1	—	—	
	3	S2 Sin–	Sin input reference potential	9	
	4	S1 Cos–	Cos input reference potential	11	
	5	R1 Ref–	Resolver excitation signal reference potential	2	
	6	1TP2	—	—	
	7	S4 Sin+	Sin input	1	
	8	S3 Cos+	Cos input	3	
	9	R2 Ref+	Resolver excitation signal	6	

Tab. 17: AP6A00 connection description for resolver (9-pin to 15-pin)

AP6A01 – Resolver and motor temperature sensor (9-pin to 15-pin)

Interface adapter with temperature sensor cores routed out on the side.

Socket[14]	Pin	Designation	Function	Pin	Connector[15]
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	—	—	—	1|2|3|4|5|6|7|8|9  10|11|12|13|14|15
	2	1TP1	Motor temperature sensor connection, if included in the encoder cable connector; routed out for the direct connection to terminal X2	—	
	3	S2 Sin–	Sin input reference potential	9	
	4	S1 Cos–	Cos input reference potential	11	
	5	R1 Ref–	Resolver excitation signal reference potential	2	
	6	1TP2	Motor temperature sensor connection, if included in the encoder cable connector; routed out for the direct connection to terminal X2	—	
	7	S4 Sin+	Sin input	1	
	8	S3 Cos+	Cos input	3	
	9	R2 Ref+	Resolver excitation signal	6	

Tab. 18: AP6A01 connection description for the resolver and motor temperature sensor (9-pin to 15-pin)

[12] View of 9-pin D-sub for connecting the SDS 4000-compatible resolver cable
[13] View of 15-pin D-sub for connecting to X140 of the RI6 terminal module or to X4 of the SC6 or SI6 drive controller
[14] View of 9-pin D-sub for connecting the SDS 4000-compatible resolver cable
[15] View of 15-pin D-sub for connecting to terminal X4 or X140

5.1.4.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Ultra-fine stranded wire made of bare Cu wires based on DIN VDE 0812. Single wire, 0.11 mm with a nominal cross-section of 0.14 and 0.25 mm². Internal structure twisted without tension.

Peak operating voltage

- Peak operating voltage (DIN VDE): pilot cores max. 350 V
- Voltage (UL/CSA): pilot cores max. 300 V

Test voltage

Core/core and core/shield: all cores 2000 V

Insulation resistance at 20 °C

Min. 100 MΩ × km

Limit temperature

Temperature range/ Operating mode	DIN VDE	UL/CSA
Not in motion	−50 °C to +90 °C	Up to +80 °C
In motion	−40 °C to +90 °C	Up to +80 °C

Max. tensile stress when being laid

50 N for each mm² of conductor cross-section

Smallest permissible bending radius

- Freely movable: 10 x d_{out}
- Permanently installed: 5 x d_{out}

Torsional stress

± 30°/m

Bending resistance

Trailable with 5 million bending cycles at a travel velocity of 180 m/min and an acceleration of 5 m/s² under optimum ambient conditions

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Resistance

- Oil resistant: very good in accordance with VDE 0282, part 10+HD 22.10
- Chemical: good against acids, bases, solvents, hydraulic fluids, etc.; more detailed information on request

Outer sheath

PUR (TMPU in accordance with DIN VDE 0282, part 10)

Banding

Fleece tape with overlapping

Core insulation

TPE-E

Core identification

Pair	Colors	
2 × 0.14	YE	GN
2 × 0.14	BN	WH
2 × 0.14	PK	GY
2 × 0.25	BU	RD

Sheath: color DESINA GREEN, similar to RAL 6018, imprinted with "STÖBER 44206"

Shield structure

- Shield: copper braiding, tin-plated
- Cover: ≥ 80%
- Pairs: with shielding film and braiding

Insulation material

Halogen-free, silicone-free, PWIS non-critical (PWIS = free of paint-wetting impairment substances)

Flammability

Combustion behavior: flame retarding and self-extinguishing in accordance with IEC 60322-1, CSA FT1 and UL FT1

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections and weights

Cable diameter	Description	Weight
Max. 11.4 mm	(3 × (2 × 0.14 mm²) + (2 × 0.25 mm²))	147 g/m

"(...)" = Shield

Design

UL/CSA (E172204)

Capacitance, inductance

Capacitance in accordance with VDE 0472 part 504 test type A; core/core[16]	
Pair 0.14 mm²	Max. 40 nF/km
Pair 0.25 mm²	Max. 50 nF/km

Capacitance in accordance with VDE 0472 part 504 test type B; core/remainder[17]	
Pair 0.14 mm²	Max. 300 nF/km
Pair 0.25 mm²	Max. 300 nF/km

Inductance based on EN 50289-1-12:2005; core/core	
Pair 0.14 mm²	Max. 800 µH/km
Pair 0.25 mm²	Max. 800 µH/km

[16] Details in accordance with EN 50289-1-5:2001 in preparation
[17] Details in accordance with EN 50289-1-5:2001 in preparation

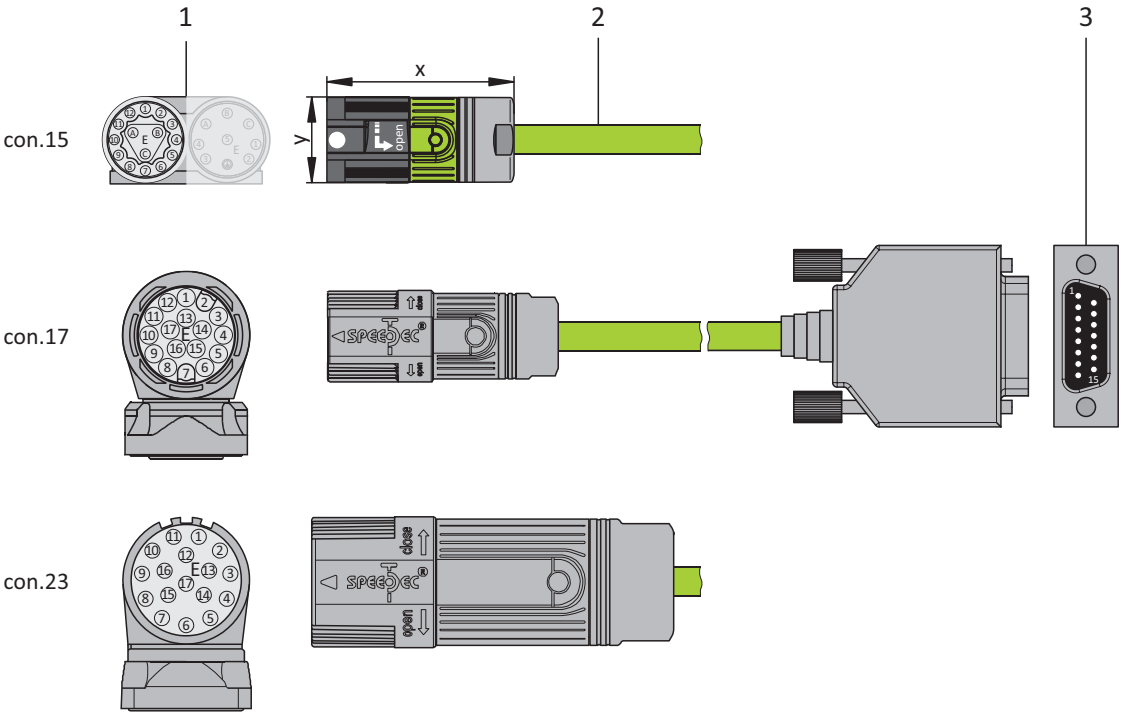
5.1.5 EnDat 2.1 sin/cos encoders

Suitable encoder cables are described below.

5.1.5.1 Connection description

Depending on the size of the motor plug connector, encoder cables are available in the following designs:

- Quick lock for con.15
- speedtec quick lock for con.17 and con.23



1: Plug connector
2: STOBER encoder cable
3: D-sub X140

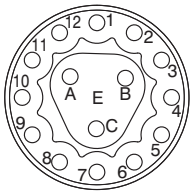
Information

Note that the cores for the temperature sensor in STOBER are routed in the power cable as standard. For motors that provide the temperature sensor at the encoder connection, you need an interface adapter to lead out the temperature sensor cores for connecting the cable to the drive controller.

Information

For connecting STOBER EnDat 2.1 sin/cos cables with a 15-pin D-sub connector to an integrated motor temperature sensor, you must use the AP6A02 interface adapter (ID No. 56523), available separately, to lead out the temperature sensor cores.

Encoder cables – con.15 plug connectors

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X140
	1	Sense U_2	BU	GNRD	12
	2	Sense GND	WH	GNBK	10
	3	U_2	BNGN	BNRD	4
	4	Clock+	VT	WHBK	8
	5	Clock–	YE	WHYE	15
	6	GND	WHGN	BNBU	2
	7	B+ (Sin+)	BUBK	RD	9
	8	B– (Sin–)	RDBK	OG	1
	9	Data+	GY	GY	5
	10	A+ (Cos+)	GNBK	GN	11
	11	A– (Cos–)	YEBK	YE	3
	12	Data–	PK	BU	13
	A	1TP2	WH	BNGY	14
	B	1TP1	BK	BNYE	7
	C	—	—	—	—
	Housing	Shield	—	—	—

Tab. 19: con.15 encoder cable pin assignment, EnDat 2.1 sin/cos

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 20: con.15 connector dimensions

Encoder cables – con.17 plug connectors

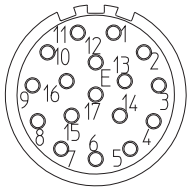
Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X140
	1	Sense U_2	BU	GNRD	12
	2	—	—	—	—
	3	—	—	—	—
	4	Sense GND	WH	GNBK	10
	5	1TP2	WH	BNGY	14
	6	1TP1	BK	BNYE	7
	7	U_2	BNGN	BNRD	4
	8	Clock+	VT	WHBK	8
	9	Clock–	YE	WHYE	15
	10	GND	WHGN	BNBU	2
	11	—	—	—	—
	12	B+ (Sin+)	BUBK	RD	9
	13	B– (Sin–)	RDBK	OG	1
	14	Data+	GY	GY	5
	15	A+ (Cos+)	GNBK	GN	11
	16	A– (Cos–)	YEBK	YE	3
	17	Data–	PK	BU	13
	Housing	Shield	—	—	—

Tab. 21: con.17 encoder cable pin assignment, EnDat 2.1 sin/cos

Length x [mm]	Diameter y [mm]
56	22

Tab. 22: con.17 connector dimensions

Encoder cables – con.23 plug connectors

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X140
	1	Sense U_2	BU	GNRD	12
	2	—	—	—	—
	3	—	—	—	—
	4	Sense GND	WH	GNBK	10
	5	1TP2	WH	BNGY	14
	6	1TP1	BK	BNYE	7
	7	U_2	BNGN	BNRD	4
	8	Clock+	VT	WHBK	8
	9	Clock–	YE	WHYE	15
	10	GND	WHGN	BNBU	2
	11	—	—	—	—
	12	B+ (Sin+)	BUBK	RD	9
	13	B– (Sin–)	RDBK	OG	1
	14	Data+	GY	GY	5
	15	A+ (Cos+)	GNBK	GN	11
	16	A– (Cos–)	YEBK	YE	3
	17	Data–	PK	BU	13
	Housing	Shield	—	—	—

Tab. 23: con.23 encoder cable pin assignment, EnDat 2.1 sin/cos

Length x [mm]	Diameter y [mm]
58	26

Tab. 24: con.23 dimensions

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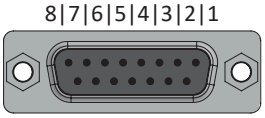
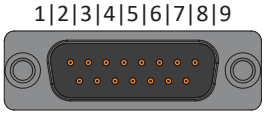
5.1.5.1.1 AP6 interface adapter (EnDat 2.1 sin/cos)

AP6A02 – EnDat 2.1 sin/cos encoder (15-pin to 15-pin)

Interface adapter with temperature sensor cores routed out on the side.

Socket[18]	Pin	Designation	Function	Pin	Connector[19]
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	B– (Sin–)	Sin input reference potential	1	1|2|3|4|5|6|7|8|9  10|11|12|13|14|15
	2	GND	Encoder supply reference potential	2	
	3	A– (Cos–)	Cos input reference potential	3	
	4	U_2	Encoder supply	4	
	5	Data+	Differential input for DATA	5	
	6	—	—	6	
	7	1TP1	Motor temperature sensor connection, if included in the encoder cable; routed out for the direct connection to X2	—	
	8	Clock+	Differential input for CLOCK	8	
	9	B+ (Sin+)	Sin input	9	
	10	Sense GND	Optional Sense connection for regulating the encoder supply	10	
	11	A+ (Cos+)	Cos input	11	
	12	Sense U_2	Sense signals for voltage excitation	12	
	13	Data–	Inverse differential input for DATA	13	
	14	1TP2	Motor temperature sensor connection, if included in the encoder cable; routed out for the direct connection to X2	—	
	15	Clock–	Inverse differential input for CLOCK	15	

Tab. 25: AP6A02 connection description for EnDat 2.1 sin/cos encoder and motor temperature sensor (15-pin to 15-pin)

[18] View of 15-pin D-sub for connecting the SDS 4000-compatible EnDat cable
[19] View of 15-pin D-sub for connecting to SD6, terminal X140 (RI6)

5.1.5.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Ultra-fine stranded wire made of bare Cu wires based on DIN VDE 0812. Single wire, Ø ≤ 0.11 mm with a nominal cross-section of 0.14 and 0.25 mm². Single wire, Ø ≤ 0.16 mm with a nominal cross-section of 0.34 mm². Internal structure twisted without tension.

Peak operating voltage

- Peak operating voltage (DIN VDE): pilot cores max. 100 V
- Voltage (UL/CSA): pilot cores max. 30 V

Test voltage

Core/core and core/shield: all cores 500 V

Insulation resistance at 20 °C

Min. 100 MΩ × km

Limit temperature

Temperature range/operating mode	DIN VDE	UL/CSA
Not in motion	−50 °C to +90 °C	Up to +80 °C
In motion	−40 °C to +90 °C	Up to +80 °C

Max. tensile stress when being laid

50 N for each mm² of conductor cross-section

Smallest permissible bending radius

- Freely movable: 10 x d_{out}
- Permanently installed: 5 x d_{out}

Torsional stress

± 30°/m

Bending resistance

Trailable with 5 million bending cycles at a travel velocity of 180 m/min and an acceleration of 5 m/s² under optimum ambient conditions

Resistance

- Oil resistant: very good in accordance with VDE 0282, part 10+HD 22.10
- Chemical: good against acids, bases, solvents, hydraulic fluids, etc.; more detailed information on request

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Outer sheath

PUR (TMPU in accordance with DIN VDE 0282, part 10)

Banding

Fleece tape with overlapping

Core insulation

TPE-E

Core identification

Pair	Colors	
2 × 0.14	GN	YE
2 × 0.14	RD	OG
2 × 0.14	BU	GY
2 × 0.14	WH/BK	WH/YE
2 × 0.25	GN/RD	GN/BK
2 × 0.25	BN/GN	BN/YE
2 × 0.34	BN/RD	BN/BU

Sheath: color DESINA GREEN, similar to RAL 6018, imprinted with "STÖBER 44207" without supplier article number

Shield structure

- Shield: copper braiding, tin-plated
- Pairs: copper braiding, tin-plated
- Cover: ≥ 80%

Insulation material

Halogen-free, silicone-free, PWIS non-critical (PWIS = free of paint-wetting impairment substances)

Flammability

Combustion behavior: flame retarding and self-extinguishing in accordance with IEC 60322-1, CSA FT1 and UL FT1

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections

Cable diameter	Description	Weight
Max. 13.0 mm	(2 x 2 x 0.25 mm² + 2 x 2 x 0.14 mm² + 2 x (2 x 0.14 mm²) + 2 x 0.34 mm²)	113 g/m

"(...)" = Shield

Design

UL/CSA (E172204)

Capacitance, inductance

Capacitance in accordance with VDE 0472 part 504 test type A; core/core[20]	
Pair 0.14 mm²	Max. 60 nF/km
Pair 0.25 mm²	Max. 110 nF/km
Pair 0.34 mm²	Max. 130 nF/km

Capacitance in accordance with VDE 0472 part 504 test type B; core/remainder[21]	
Pair 0.14 mm²	Max. 300 nF/km
Pair 0.25 mm²	Max. 300 nF/km
Pair 0.34 mm²	Max. 325 nF/km

Inductance based on EN 50289-1-12:2005; core/core	
Pair 0.14 mm²	Max. 650 µH/km
Pair 0.25 mm²	Max. 700 µH/km
Pair 0.34 mm²	Max. 700 µH/km

[20] Details in accordance with EN 50289-1-5:2001 in preparation
[21] Details in accordance with EN 50289-1-5:2001 in preparation

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5.1.6 HIPERFACE DSL encoders

Information

In combination with a HIPERFACE DSL encoder, you require hybrid cables which feature encoder communication and power transmission in a shared cable.

More detailed information on motor connection using hybrid cables can be found in the chapter One Cable Solution [▶ 84].

5.2 Determining the cable code for ready-made cables

The motor model, encoder model and encoder interface of the drive controller provide you with the cable code, which you in turn can use to determine the identification numbers of ready-made cables.

Information

Note that the cable codes used in this documentation are intended only to refer to the overview and selection tables within this manual. The cable codes are not part of the ordering process and are not printed on the cables.

5.2.1 Codes for EZ, EZHD, EZHP, EZS, EZM synchronous servo motors

The size of the motor plug connector of EZ, EZHD, EZM or EZS series synchronous servo motors depends on the motor size:

- con.15 for size 3 motors
- con.17 for size 4 or larger motors

The encoder interface for connecting the cable varies based on the encoder model and drive controller series.

Cables

Type		EnDat 2.1/2.2 digital		Resolver		EnDat 2.1 sin/cos	
		con.15	con.17	con.15	con.17	con.15	con.17
MDS 5000, SDS 5000, SD6	X4	SZ7	SZ2	—	—	—	—
	X140	—	—	SZ8	SZ1	SZ9	SZ3
SC6, SI6	X4	SZ7	SZ2	SZ8	SZ1	—	—

Tab. 26: Encoder cable codes for EZ, EZHD, EZM and EZS synchronous servo motors

Extension cables

Type	EnDat 2.1/2.2 digital		Resolver		EnDat 2.1 sin/cos	
	con.15	con.17	con.15	con.17	con.15	con.17
All series	SZ10	SZ5	SZ11	SZ4	SZ12	SZ13

Tab. 27: Extension cable codes for EZ, EZHD, EZM and EZS synchronous servo motors

5.2.2 Codes for ED, EK synchronous servo motors

ED and EK series synchronous servo motors are equipped with size con.23 motor plug connectors.

The encoder interface for connecting the cable varies based on the encoder model and drive controller series.

Cables

Type		EnDat 2.1/2.2 digital	Resolver	EnDat 2.1 sin/cos
		con.23	con.23	con.23
MDS 5000, SDS 5000, SD6	X4	SK4	—	—
	X140	—	SK2	SK1
SC6, SI6	X4	SK4	SK2	—

Tab. 28: Encoder cable codes for ED and EK synchronous servo motors

Extension cables

Type	EnDat 2.1/2.2 digital	Resolver	EnDat 2.1 sin/cos
	con.23	con.23	con.23
All series	SK9	SKF	SKG

Tab. 29: Extension cable codes for ED and EK synchronous servo motors

5.2.3 Codes for IE2, IE3 asynchronous motors

IE2 and IE3 series asynchronous motors are equipped with size con.23 motor plug connectors.

The available cables are connected to the X4 encoder interface of the drive controller.

Cables

Type		Incremental HTL	SSI
		con.23	con.23
FDS 5000	X4	SK0	—
MDS 5000, SDS 5000, SD6	X4	SK0	SK4
SC6, SI6	X4	SK0	SK4

Tab. 30: Encoder cable codes for IE2, IE3 asynchronous motors

Extension cables

Type	Incremental HTL	SSI
	con.23	con.23
All series	—	SK9

Tab. 31: Extension cable codes for IE2, IE3 asynchronous motors

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5.3 Ready-made encoder cables

The cable code provides you with the identification numbers for ready-made cables up to 100 m in length.

Information

Note that the maximum overall length of the cable and extension is 100 m.

EnDat 2.1/2.2 digital – Cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SZ7	con.15	56737	56738	56739	56740	56741	56742	56743	56744	56745	56746	56747	56748	56749	56750	56751	56752	56753	56754
SZ2	con.17	54781	54782	54783	54784	54785	54786	54787	54788	54789	54790	54791	54792	54793	54794	54795	54796	54797	54798
SK4	con.23	54430	54431	54432	54433	54434	54435	54436	54437	54438	54439	54440	54441	54442	54443	54444	54445	54446	54447

Tab. 32: Ready-made cables up to 100 m for EnDat 2.1/2.2 digital encoders

EnDat 2.1/2.2 digital – Extension cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SZ10	con.15	57640	57641	57642	57643	57644	57645	57646	57647	57648	57649	57650	57651	57652	57653	57654	57655	57656	57657
SZ5	con.17	53506	53507	53508	53509	53510	53511	53512	53513	53514	53515	53516	53517	53518	53519	53520	53521	53522	53523
SK9	con.23	54527	54528	54529	54530	54531	54532	54533	54534	54535	54536	54537	54538	54539	54540	54541	54542	54543	54544

Tab. 33: Ready-made extension cables up to 100 m for EnDat 2.1/2.2 digital encoders

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Incremental HTL – Cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SK0	con.23	54743	54744	54745	54746	54747	54748	54749	54750	54751	54752	54753	54754	54755	54756	54757	54758	54759	54760

Tab. 34: Ready-made cables up to 100 m for HTL incremental encoders

Resolver – Cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SZ8	con.15	56959	56960	56961	56962	56963	56964	56965	56966	56967	56968	56969	56970	56971	56972	56973	56974	56975	56976
SZ1	con.17	54817	54818	54819	54820	54821	54822	54823	54824	54825	54826	54827	54828	54829	54830	54831	54832	54833	54834
SK2	con.23	54184	54185	54186	54187	54188	54189	54190	54191	54192	54193	54194	54195	54196	54197	54198	54199	54200	54201

Tab. 35: Ready-made cables up to 100 m for resolvers

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Resolver – Extension cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SZ11	con.15	57658	57659	57660	57661	57662	57663	57664	57665	57666	57667	57668	57669	57670	57671	57672	57673	57674	57675
SZ4	con.17	55928	55929	55930	55931	55932	55933	55934	55935	55936	55937	55938	55939	55940	55941	55942	55943	55944	55945
SKF	con.23	54276	54277	54278	54279	54280	54281	54282	54283	54284	54285	54286	54287	54288	54289	54290	54291	54292	54293

Tab. 36: Ready-made extension cables up to 100 m for resolvers

EnDat 2.1 sin/cos – Cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SZ9	con.15	56977	56978	56979	56980	56981	56982	56983	56984	56985	56986	56987	56988	56989	56990	56991	56992	56993	56994
SZ3	con.17	54799	54800	54801	54802	54803	54804	54805	54806	54807	54808	54809	54810	54811	54812	54813	54814	54815	54816
SK1	con.23	54100	54101	54102	54103	54104	54105	54106	54107	54108	54109	54110	54111	54112	54113	54114	54115	54116	54117

Tab. 37: Ready-made cables up to 100 m for EnDat 2.1 sin/cos encoders

EnDat 2.1 sin/cos – Extension cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
SZ12	con.15	57676	57677	57678	57679	57680	57681	57682	57683	57684	57685	57686	57687	57688	57689	57690	57691	57692	57693
SZ13	con.17	57560	57561	57562	57563	57564	57565	57566	57567	57568	57569	57570	57571	57572	57573	57574	57575	57576	57577
SKG	con.23	54258	54259	54260	54261	54262	54263	54264	54265	54266	54267	54268	54269	54270	54271	54272	54273	54274	54275

Tab. 38: Ready-made extension cables up to 100 m for EnDat 2.1 sin/cos encoders

5.4 Service packs for encoder cables

If you would like to finish your cable yourself, you can find information in this chapter about available service packs. Our service packs contain the motor-side connector and the required contacts. To finish the contacts correctly, you require a suitable crimping tool for the respective contact type. More detailed information can be found in the enclosed assembly instructions.

Information

Be aware that the use of unsuitable cables or poorly made connections can cause subsequent damage. For this reason, we reserve the right to reject claims under the warranty in this case.

Type	con.15	con.17	con.23
EnDat 2.2 digital, 12-pin	57163	53791[a)]	55015
Incremental (HTL), 12-pin	—	—	55023
SSI, 12-pin	—	—	55023
Resolver, 12-pin	57164	53791[a)]	55023
EnDat 2.1 sin/cos, 15-pin (con.15), 17-pin (con.17/con.23)	57162	53790	55018

Tab. 39: Identification numbers of service packs for encoder cables

a) Service pack contains crimp contacts for both cable types.

5.5 Accessories

You can find information about the available accessories in the following chapters.

5.5.1 HTL-to-TTL adapter

HT6 HTL-to-TTL adapter

ID No. 56665
Adapter for SC6 and SI6 series drive controllers for level conversion from HTL signals to TTL signals.
It is used to connect an HTL differential incremental encoder to terminal X4 of the drive controller.

5.5.2 Interface adapters

AP6 interface adapters

The following variants are available:

AP6A00
ID No. 56498
Adapter X140 resolver, 9/15-pin.
Adapters for connecting resolver cables with a 9-pin D-sub connector.
SD6 series: Connection to the X140 encoder interface of the RI6 terminal module.
SC6 and SI6 series: Connection to X4 encoder interface.

AP6A01
ID No. 56522
Adapter X140 resolver, 9/15-pin with separate motor temperature sensor leads.
Adapters for connecting resolver cables with a 9-pin D-sub connector.
SD6 series: Connection to the X140 encoder interface of the RI6 terminal module.

AP6A02
ID No. 56523
Adapter X140 EnDat 2.1 sin/cos, 15/15-pin with separate motor temperature sensor leads.
Adapters for connecting EnDat 2.1 sin/cos cables with a 15-pin D-sub connector.
SD6 series: Connection to the X140 encoder interface of the RI6 terminal module.

5.5.3 Adapter cables

X50 adapter cable (SE6 option)

ID No. 56434
Connection cable for the X50 encoder interface of the SE6 safety module with open cable ends. 1.5 m.

5.5.4 Encoder battery module

Absolute Encoder Support AES

ID No. 55452
Battery module for buffering the supply voltage when using the EnDat 2.2 digital inductive encoder with battery-buffered multi-turn stage, for example EBI1135 or EBI135.
A battery is included.

Information

Note that a 15-pin extension cable between the socket and the AES may be necessary for the connection to the drive controller due to limited space.

- A commercially available shielded extension cable with a 15-pin D-sub connector and a length of ≤ 1 m can be used between the socket and the AES.

AES replacement battery

ID No. 55453
Replacement battery for AES battery module.

5.5.5 Encoder adapter box

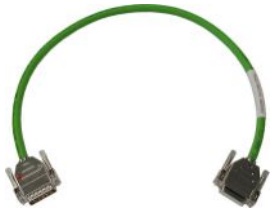
LA6A00 encoder adapter box

ID No. 56510
Interface adapter for differential TTL incremental signals and single-ended TTL hall sensor signals.
The adapter converts and transmits TTL signals from synchronous linear motors to the SD6 drive controller. A variable, internal interface converts the input signals appropriately for the STOBER standard interfaces.

X120 SSI/TTL connection cable

ID No. 49482
Cable for connecting the X120 TTL interface on the SD6 drive controller (on terminal module RI6 or XI6) with the X301 interface on the LA6 adapter box in order to transfer Hall sensor signals. 0.3 m.

LA6 / AX 5000 connection cable



Cable for connecting the X4 connection on the SD6 drive controller to X300 on the LA6 adapter box in order to transmit incremental encoder signals.

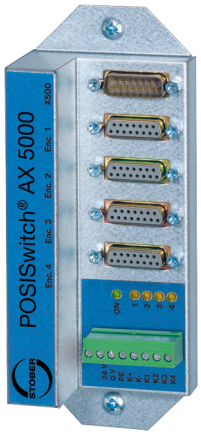
The following designs are available:

ID No. 45405: 0.5 m.

ID No. 45386: 2.5 m.

5.5.6 Axis switcher

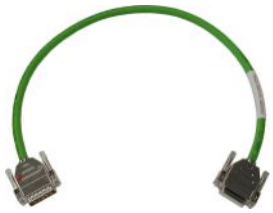
POSISwitch AX 5000 4-way axis switcher



ID No. 49578

Axis switcher for MDS 5000 and SDS 5000 series inverters.
Enables the operation of up to four synchronous servo motors on one inverter.

LA6 / AX 5000 connection cable



Cable to connect inverter and POSISwitch AX 5000 axis switcher.

The following versions are available:

ID No. 45405: 0.5 m.

ID No. 45386: 2.5 m.

6 Power cables

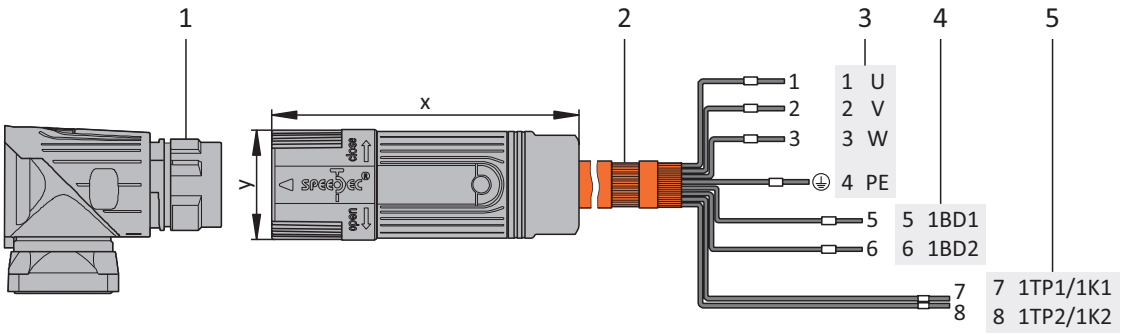
Synchronous servo motors and Lean motors from STOBER are equipped with plug connectors as standard, while asynchronous motors are equipped with terminal boxes.

STOBER provides suitable cables in various lengths, conductor cross-sections and connector sizes.

6.1 Connection description

Depending on the size of the motor plug connector, power cables are available in the following designs:

- Quick lock for con.15
- speedtec quick lock for con.23 and con.40
- Screw technology for con.58

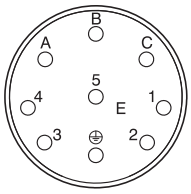


1: Plug connector
2: STOBER power cable, cable shield
3: Connection to terminal X20, motor
4: Connection of terminal X300/X5, brake
5: Connection to terminal X2, temperature sensor

Motor type	Connection	Size 0 to 2	Size 3
Synchronous servo motor, asynchronous motor	Without output choke	50 m, shielded	100 m, shielded
Synchronous servo motor, asynchronous motor	With output choke	100 m, shielded	—
Lean motor	Standard	50 m, shielded	50 m, shielded

Tab. 40: Maximum cable length of the power cable [m]

Power cables – con.15 plug connectors

Motor (1)				Cable (2)	Drive controller (3) – (5)		
Motor connection diagram	Pin	Designation	Int. motor core color	Core No./ Core color	Pin X20	Pin X300/X5	Pin X2
	A	1U1	BK	1	1	—	—
	B	1V1	BU	2	2	—	—
	C	1W1	RD	3	3	—	—
	1	1TP1/1K1[a)]	BK/RD/BN	7	—	—	7
	2	1TP2/1K2[a)]	WH	8	—	—	8
	3	1BD1	RD	5	—	5	—
	4	1BD2	BK	6	—	6	—
	5	—	—	—	—	—	—
	⏚	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

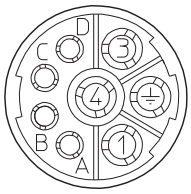
Tab. 41: con.15 power cable pin assignment

a) PTC/Pt1000/KTY

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 42: con.15 connector dimensions

Power cables – con.23 plug connectors

Motor (1)				Cable (2)	Drive controller (3) – (5)		
Motor connection diagram	Pin	Designation	Int. motor core color	Core No./ Core color	Pin X20	Pin X300/X5	Pin X2
	1	1U1	BK	1	1	—	—
	3	1V1	BU	2	2	—	—
	4	1W1	RD	3	3	—	—
	A	1BD1	RD	5	—	5	—
	B	1BD2	BK	6	—	6	—
	C	1TP1/1K1[a)]	BK/RD/BN	7	—	—	7
	D	1TP2/1K2[a)]	WH	8	—	—	8
	⏚	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

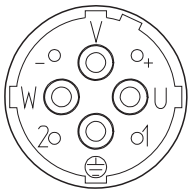
Tab. 43: con.23 power cable pin assignment

a) PTC/Pt1000/KTY

Length x [mm]	Diameter y [mm]
78	26

Tab. 44: con.23 connector dimensions

Power cables – con.40 plug connectors

Motor (1)				Cable (2)	Drive controller (3) – (5)		
Motor connection diagram	Pin	Designation	Int. motor core color	Core No./ Core color	Pin X20	Pin X300/X5	Pin X2
	U	1U1	BK	1	1	—	—
	V	1V1	BU	2	2	—	—
	W	1W1	RD	3	3	—	—
	+	1BD1	RD	5	—	5	—
	–	1BD2	BK	6	—	6	—
	1	1TP1/1K1[a)]	BK/RD/BN	7	—	—	7
	2	1TP2/1K2[a)]	WH	8	—	—	8
	⏚	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

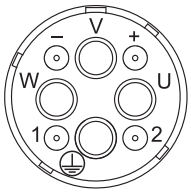
Tab. 45: con.40 power cable pin assignment

a) PTC/Pt1000/KTY

Length x [mm]	Diameter y [mm]
99	46

Tab. 46: con.40 connector dimensions

Power cables – con.58 plug connectors

Motor (1)				Cable (2)	Drive controller (3) – (5)		
Motor connection diagram	Pin	Designation	Int. motor core color	Core No./ Core color	Pin X20	Pin X300/X5	Pin X2
	U	1U1	BK	1	1	—	—
	V	1V1	BU	2	2	—	—
	W	1W1	RD	3	3	—	—
	+	1BD1	RD	5	—	5	—
	–	1BD2	BK	6	—	6	—
	1	1TP1/1K1[a)]	BK/RD/BN	7	—	—	7
	2	1TP2/1K2[a)]	WH	8	—	—	8
	⏚	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 47: con.58 power cable pin assignment

a) PTC/Pt1000/KTY

Length x [mm]	Diameter y [mm]
146	63.5

Tab. 48: con.58 connector dimensions

6.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Ultra-fine stranded wire made of bare Cu wires in accordance with VDE 0295 class 6, table 4, column 3. Internal structure stranded tension-free. The wire structure for conductors with 0.34 mm² is based on DIN VDE 0812.

Voltage

For cables 4 × 1.0 mm² to 4 × 4.0 mm²

- Nominal voltage (DIN VDE): power cores U_o/U = 0.6/1.0 kV
- Voltage (UL/CSA): power cores 1000 V
- Voltage (UL): pilot cores max. 300 V
- Voltage (CSA): pilot cores max. 1000 V

For cables 4 × 6.0 mm² to 4 × 25.0 mm²

- Nominal voltage (DIN VDE): power cores U_o/U = 0.6/1.0 kV
- Voltage (UL/CSA): power cores 1000 V
- Voltage (UL/CSA): pilot cores max. 1000 V

Test voltage

For cables 4 × 1.0 mm² to 4 × 4.0 mm²

- Core/core and core/shield: power cores 4000 V
- Core/core and core/shield: pilot cores 2000 V

For cables 4 × 6.0 mm² to 4 × 10.0 mm²

- Core/core and core/shield: power cores 4000 V
- Core/core and core/shield: pilot cores 4000 V

Current carrying capacity of power cores

Conductor cross-section A [mm²]	1.0	1.5	2.5	4.0	6.0	10.0	16.0	25.0
Nominal current $I_{N,CAB}$ [A]	12.5	15.0	20.0	28.3	35.8	49.2	66.7	90.0

Current carrying capacity of pilot cores – Brake and temperature sensor

Conductor cross-section A [mm²]	0.34 / AWG22	0.5	0.75	1.0	1.5
Nominal current $I_{N,CAB}$ [A]	1.5	5.0	9.0	12.5	15.0

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Insulation resistance at 20 °C

Min. 100 MΩ × km

Limit temperature

Temperature range/ Operating mode	DIN VDE	UL/CSA
Not in motion	−50 °C to +90 °C	Up to +80 °C
In motion	−40 °C to +90 °C	Up to +80 °C

Max. tensile stress when being laid

50 N for each mm² of conductor cross-section

Smallest permissible bending radius

- Freely movable: 10 x d_{out}
- Permanently installed: 5 × d_{out}; starting from 16 mm² = 7.5 × d_{out}

Torsional stress

± 30°/m

Bending resistance

Trailable with 5 million bending cycles at a travel velocity of 120 m/min and an acceleration of 5 m/s² under optimum ambient conditions

Resistance

- Oil resistant: very good in accordance with VDE 0282, part 10+HD 22.10
- Chemical: good against acids, bases, solvents, hydraulic fluids, etc.; more detailed information on request

Outer sheath

PUR (TMPU in accordance with DIN VDE 0282, part 10)

Banding

Fleece tape with overlapping

Core insulation

TPE-E

Marking

- Conductors: black with numbers printed in white (1; 2; 3; yellow/green for PE; (5; 6 thick pair); (7; 8 thin pair))
- Sheath: color based on DESINA, similar to RAL 2003 with additional imprint "STÖBER 49893" for 1.0 mm²; "STÖBER 44211" for 1.5 mm²; with imprint of cable manufacturer (not STÖBER) starting from 4 × 2.5 +... mm²

Shield coverage factor

Braiding min. 80% (Cu, tinned); control pairs with shielding film and braiding

Insulation material

Halogen-free, silicone-free, PWIS non-critical (PWIS = free of paint-wetting impairment substances)

Flammability

Combustion behavior: flame retarding and self-extinguishing in accordance with IEC 60322-1, CSA FT1 and UL FT1

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections and weights

Cable diameter	Description	Weights	ID No.
Max. 10.5 mm	(4 × 1.0 + (2 × 0.5) + (2 × 0.34)) mm²	0.159 kg/m	49893
Max. 12.7 mm	(4 × 1.5 + (2 × 1.0) + (2 × 0.50)) mm²	0.228 kg/m	44211
Max. 15.3 mm	(4 × 2.5 + 2 × (2 × 1.0)) mm²	0.321 kg/m	44210
Max. 16 mm	(4 × 4.0 + (2 × 1.0) + (2 × 0.75)) mm²	0.372 kg/m	45801
Max. 19.4 mm	(4 × 6.0 + (2 × 1.5) + (2 × 1.0)) mm²	0.58 kg/m	45802
Max. 23.5 mm	(4 × 10.0 + (2 × 1.5) + (2 × 1.0)) mm²	0.841 kg/m	45803
Max. 25.5 mm	(4 × 16.0 + 2 × (2 × 1.5)) mm²	1.29 kg/m	53178
Max. 28.8 mm	(4 × 25.0 + 2 x (2 × 1.5)) mm²	1.70 kg/m	53234

"(...)" = shield; other cross-sections on request

Design

UL/CSA (E172204)

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Capacitance, inductance

Capacitance in accordance with VDE 0472 part 504 test type A; conductor/conductor[22]	
Conductor cross-section 1.0 mm²:	
Conductors 1.0 mm²	Max. 45 nF/km
Pair 0.5 mm²	Max. 110 nF/km
Pair 0.34 mm²	Max. 70 nF/km
Conductor cross-section 1.5 mm²:	
Conductors 1.5 mm²	Max. 55 nF/km
Pair 1.0 mm²	Max. 70 nF/km
Pair 0.5 mm²	Max. 50 nF/km
Conductor cross-section 2.5 mm²:	
Conductors 2.5 mm²	Max. 65 nF/km
Pair 1.0 mm²	Max. 60 nF/km
Conductor cross-section 4.0 mm²:	
Conductors 4.0 mm²	Max. 60 nF/km
Pair 0.75 mm²	Max. 40 nF/km
Pair 1.0 mm²	Max. 45 nF/km
Conductor cross-section 6.0 mm²:	
Conductors 6.0 mm²	Max. 70 nF/km
Pair 1.0 mm²	Max. 35 nF/km
Pair 1.5 mm²	Max. 45 nF/km
Conductor cross-section 10.0 mm²:	
Conductors 10.0 mm²	Max. 75 nF/km
Pair 1.0 mm²	Max. 34 nF/km
Pair 1.5 mm²	Max. 45 nF/km
Conductor cross-section 16.0 mm²:	
Conductors 16.0 mm²	Max. 75 nF/km
Pair 1.5 mm²	Max. 35 nF/km
Conductor cross-section 25.0 mm²:	
Conductors 25.0 mm²	Values on request
Pair 1.5 mm²	Values on request

[22] Details in accordance with EN 50289-1-5:2001 in preparation

Capacitance in accordance with VDE 0472 part 504 test type B; conductor/remainder[23]	
Conductor cross-section 1.0 mm²:	
Conductors 1.0 mm²	Max. 250 nF/km
Pair 0.5 mm²	Max. 650 nF/km
Pair 0.34 mm²	Max. 600 nF/km
Conductor cross-section 1.5 mm²:	
Conductors 1.5 mm²	Max. 300 nF/km
Pair 1.0 mm²	Max. 550 nF/km
Pair 0.5 mm²	Max. 450 nF/km
Conductor cross-section 2.5 mm²:	
Conductors 2.5 mm²	Max. 325 nF/km
Pair 1.0 mm²	Max. 600 nF/km
Conductor cross-section 4.0 mm²:	
Conductors 4.0 mm²	Max. 260 nF/km
Pair 0.75 mm²	Max. 400 nF/km
Pair 1.0 mm²	Max. 550 nF/km
Conductor cross-section 6.0 mm²:	
Conductors 6.0 mm²	Max. 300 nF/km
Pair 1.0 mm²	Max. 350 nF/km
Pair 1.5 mm²	Max. 400 nF/km
Conductor cross-section 10.0 mm²:	
Conductors 10.0 mm²	Max. 350 nF/km
Pair 1.0 mm²	Max. 350 nF/km
Pair 1.5 mm²	Max. 400 nF/km
Conductor cross-section 16.0 mm²:	
Conductors 16.0 mm²	Max. 360 nF/km
Pair 1.5 mm²	Max. 350 nF/km
Conductor cross-section 25.0 mm²:	
Conductors 25.0 mm²	Values on request
Pair 1.5 mm²	Values on request

[23] Details in accordance with EN 50289-1-5:2001 in preparation

Inductance in accordance with EN 50289-1-12:2005; conductor/conductor[24]	
Conductor cross-section 1.0 mm²:	
Conductors 1.0 mm²	Max. 800 µH/km
Pair 0.5 mm²	Max. 600 µH/km
Pair 0.34 mm²	Max. 650 µH/km
Conductor cross-section 1.5 mm²:	
Conductors 1.5 mm²	Max. 700 µH/km
Pair 1.0 mm²	Max. 700 µH/km
Pair 0.5 mm²	Max. 650 µH/km
Conductor cross-section 2.5 mm²:	
Conductors 2.5 mm²	Max. 700 µH/km
Pair 1.0 mm²	Max. 650 µH/km
Conductor cross-section 4.0 mm²:	
Conductors 4.0 mm²	Max. 600 µH/km
Pair 0.75 mm²	Max. 650 µH/km
Pair 1.0 mm²	Max. 600 µH/km
Conductor cross-section 6.0 mm²:	
Conductors 6.0 mm²	Max. 650 µH/km
Pair 1.0 mm²	Max. 700 µH/km
Pair 1.5 mm²	Max. 650 µH/km
Conductor cross-section 10.0 mm²:	
Conductors 10.0 mm²	Max. 600 µH/km
Pair 1.0 mm²	Max. 700 µH/km
Pair 1.5 mm²	Max. 650 µH/km
Conductor cross-section 16.0 mm²:	
Conductors 16.0 mm²	Max. 570 µH/km
Pair 1.5 mm²	Max. 500 µH/km
Conductor cross-section 25.0 mm²:	
Conductors 25.0 mm²	Values on request
Pair 1.5 mm²	Values on request

[24] Details in accordance with EN 50289-1-5:2001 in preparation

6.3 Power cables for asynchronous motors

Proceed as follows:

- Determine the minimum cross-section of the cable based on the motor
- Check whether the minimum cross-section is sufficient for your application; adjust it if necessary
- The conductor cross-section then provides you with the identification numbers of the available non-terminated cables

6.3.1 Assignment of motor to minimum cross-section

Type	I_N [A]	1.5 mm²	4.0 mm²	6.0 mm²	10.0 mm²	16.0 mm²	25.0 mm²
D063K04	0.44	✓					
D063M04	0.65	✓					
D071K04	0.78	✓					
D071L04	1.06	✓					
D080K04	1.60	✓					
IE3D080L04	1.70	✓					
IE3D090S04	2.50	✓					
IE3D090LX04	3.40	✓					
IE3D100KX04	4.55	✓					
IE3D100LX04	6.35	✓					
IE3D112M04	7.90	✓					
IE3D132S04	12.0	✓					
IE3D132M04	14.50	✓					
IE3D160M04	21.0		✓				
IE3D160L04	28.0			✓			
IE3D180M04	34.50			✓			
IE3D180L04	40.50				✓		
IE3D200L04	54.50					✓	
IE3D225S04	67.0						✓
IE3D225M04	84.0						✓

Tab. 49: Assignment of asynchronous motor (4-pole) to minimum cross-section

Type	I_N [A]	1.5 mm²	4.0 mm²	6.0 mm²	10.0 mm²	16.0 mm²	25.0 mm²
D063K02	0.50	✓					
D063M02	0.74	✓					
D071K02	0.94	✓					
D071L02	1.32	✓					
IE3D080K02	1.65	✓					
IE3D080LX02	2.15	✓					
IE3D090S02	3.12	✓					
IE3D090L02	4.25	✓					
IE3D100L02	6.0	✓					
IE3D112M02	7.90	✓					

Tab. 50: Assignment of asynchronous motor (2-pole) to minimum cross-section

6.3.2 Checking the minimum cross-section for non-terminated power cables

STOBER offers cables with a minimum cross-section for the motors as standard. Depending on the application, however, larger conductor cross-sections may be required. For this reason, take into account the following points in addition for dimensioning the cable:

Nominal current I_N of the motor

For designing the cable, note the nominal current I_N of the motor.

Permitted current carrying capacity of the conductors

Observe the permitted carrying capacity of the cable depending on the ambient and usage conditions. The following standards describe this topic:

- General requirements for machine cabling: DIN EN 60204-1:2007-06
- Detailed information: DIN VDE 0298-4:2013-06

Cable length

Observe the cable length of the power and brake cores:

- The cable length of the power cores affects the possible short-circuit currents that have to be handled by the device protection
- The cable length of the brake cores can cause problems due to a voltage drop

Terminal specifications of the drive controller or output choke

The selected cable must be covered by the specification of the terminals of the drive controller or output choke; see the chapter Terminal specifications [▶ 97].

Plug connector size of the motor

Depending on the plug connector size of the motor, different power core cross-sections are available.

Information

Select a larger conductor cross-section if required by your application.

6.3.3 Non-terminated power cables

The cable diameter and description provide you with the identification numbers for non-terminated cables up to 100 m in length.

Non-terminated cables are available by the meter (whole meters). Indicate the desired cable length when placing your order.

Information

From an overall length of 50 m, you also require an output choke for drive controllers of sizes 0 to 2 in order to reduce interference pulses and protect the drive system. For drive controllers of sizes 0 to 2 with output chokes as well as drive controllers of size 3, the maximum overall length of the cable and extension is 100 m.

Cable diameter	Description	Weights	ID No.
Max. 10.5 mm	(4 × 1.0 + (2 × 0.5) + (2 × 0.34)) mm²	0.159 kg/m	49893
Max. 12.7 mm	(4 × 1.5 + (2 × 1.0) + (2 × 0.50)) mm²	0.228 kg/m	44211
Max. 15.3 mm	(4 × 2.5 + 2 × (2 × 1.0)) mm²	0.321 kg/m	44210
Max. 16 mm	(4 × 4.0 + (2 × 1.0) + (2 × 0.75)) mm²	0.372 kg/m	45801
Max. 19.4 mm	(4 × 6.0 + (2 × 1.5) + (2 × 1.0)) mm²	0.58 kg/m	45802
Max. 23.5 mm	(4 × 10.0 + (2 × 1.5) + (2 × 1.0)) mm²	0.841 kg/m	45803
Max. 25.5 mm	(4 × 16.0 + 2 × (2 × 1.5)) mm²	1.29 kg/m	53178
Max. 28.8 mm	(4 × 25.0 + 2 x (2 × 1.5)) mm²	1.70 kg/m	53234

Tab. 51: Non-terminated power cables up to 100 m

"(...)" = Shield

6.4 Power cables for synchronous motors

Proceed as follows:

- Determine the size of the plug connector and the minimum cross-section of the cable based on the motor
- Check whether the minimum cross-section is sufficient for your application; adjust it if necessary
- Determine the cable code based on the plug connector size and conductor cross-section, which you can use in turn to get the identification numbers of ready-made cables

6.4.1 Determining the cable code for ready-made cables in 3 steps

Information

Note that the cable codes used in this documentation are intended only to refer to the overview and selection tables within this manual. The cable codes are not part of the ordering process and are not printed on the cables.

6.4.1.1 Sizes for EZ, EZHD, EZHP, EZS, EZM synchronous servo motors

Determine the size of the plug connector and the minimum cross-section of the cable based on the motor.

EZ motors – IC 410 convection cooling

	n_N 2000 rpm			n_N 3000 rpm			n_N 4500 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZ301U	—	—	—	40	con.15	1.0	—	—	—	40	con.15	1.0
EZ302U	—	—	—	86	con.15	1.0	—	—	—	42	con.15	1.0
EZ303U	—	—	—	109	con.15	1.0	—	—	—	55	con.15	1.0
EZ401U	—	—	—	96	con.23	1.5	—	—	—	47	con.23	1.5
EZ402U	—	—	—	94	con.23	1.5	—	—	—	60	con.23	1.5
EZ404U	—	—	—	116	con.23	1.5	—	—	—	78	con.23	1.5
EZ501U	—	—	—	97	con.23	1.5	—	—	—	68	con.23	1.5
EZ502U	—	—	—	121	con.23	1.5	—	—	—	72	con.23	1.5
EZ503U	—	—	—	119	con.23	1.5	—	—	—	84	con.23	1.5
EZ505U	—	—	—	141	con.23	1.5	103	con.23	1.5	—	—	—
EZ701U	—	—	—	95	con.23	1.5	—	—	—	76	con.23	1.5
EZ702U	—	—	—	133	con.23	1.5	—	—	—	82	con.23	2.5
EZ703U	—	—	—	122	con.23	1.5	99	con.23	2.5	—	—	—
EZ705U	—	—	—	140	con.40	2.5	106	con.40	4.0	—	—	—
EZ802U	—	—	—	136	con.40	4.0	90	con.40	6.0	—	—	—
EZ803U	—	—	—	131	con.40	6.0	—	—	—	—	—	—
EZ805U	142	con.40	10.0	—	—	—	—	—	—	—	—	—

Tab. 52: Plug connector size and minimum cross-section, EZ synchronous servo motors with convection cooling

EZ motors – IC 416 forced ventilation

	n_N 2000 rpm			n_N 3000 rpm			n_N 4500 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZ401B	—	—	—	96	con.23	1.5	—	—	—	47	con.23	1.5
EZ402B	—	—	—	94	con.23	1.5	—	—	—	60	con.23	1.5
EZ404B	—	—	—	116	con.23	1.5	—	—	—	78	con.23	1.5
EZ501B	—	—	—	97	con.23	1.5	—	—	—	68	con.23	1.5
EZ502B	—	—	—	121	con.23	1.5	—	—	—	72	con.23	1.5
EZ503B	—	—	—	119	con.23	1.5	—	—	—	84	con.23	2.5
EZ505B	—	—	—	141	con.23	1.5	103	con.23	2.5	—	—	—
EZ701B	—	—	—	95	con.23	1.5	—	—	—	76	con.23	1.5
EZ702B	—	—	—	133	con.23	1.5	—	—	—	82	con.23	4.0
EZ703B	—	—	—	122	con.23	2.5	99	con.23	4.0	—	—	—
EZ705B	—	—	—	140	con.40	4.0	106	con.40	6.0	—	—	—
EZ802B	—	—	—	136	con.40	6.0	90	con.40	10.0	—	—	—
EZ803B	—	—	—	131	con.40	10.0	—	—	—	—	—	—
EZ805B	142	con.58	16.0	—	—	—	—	—	—	—	—	—

Tab. 53: Plug connector size and minimum cross-section, EZ synchronous servo motors with forced ventilation

EZHD motors – IC 410 convection cooling

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZHD0411U	96	con.23	1.5
EZHD0412U	94	con.23	1.5
EZHD0414U	116	con.23	1.5
EZHD0511U	97	con.23	1.5
EZHD0512U	121	con.23	1.5
EZHD0513U	119	con.23	1.5
EZHD0515U	141	con.23	1.5
EZHD0711U	95	con.23	1.5
EZHD0712U	133	con.23	1.5
EZHD0713U	122	con.23	2.5
EZHD0715U	140	con.40	4.0

Tab. 54: Plug connector size and minimum cross-section, EZHD synchronous servo motors with convection cooling

Assignment of EZHP motors – IC 410 convection cooling

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZHP_511U	97	con.23	1.5
EZHP_512U	121	con.23	1.5
EZHP_513U	119	con.23	1.5
EZHP_515U	141	con.23	1.5
EZHP_711U	95	con.23	1.5
EZHP_712U	133	con.23	1.5
EZHP_713U	122	con.23	2.5
EZHP_715U	140	con.40	4.0

Tab. 55: Plug connector size and minimum cross-section, EZHP synchronous servo motors with convection cooling

Assignment of EZS motors – IC 410 convection cooling

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZS501U	97	con.23	1.5
EZS502U	121	con.23	1.5
EZS503U	119	con.23	1.5
EZS701U	95	con.23	1.5
EZS702U	133	con.23	1.5
EZS703U	122	con.23	1.5

Tab. 56: Plug connector size and minimum cross-section, EZS synchronous servo motors with convection cooling

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Assignment of EZS motors – IC 416 forced ventilation

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZS501B	97	con.23	1.5
EZS502B	121	con.23	1.5
EZS503B	119	con.23	1.5
EZS701B	95	con.23	1.5
EZS702B	133	con.23	1.5
EZS703B	122	con.23	2.5

Tab. 57: Plug connector size and minimum cross-section, EZS synchronous servo motors with forced ventilation

Assignment of EZM motors – IC 410 convection cooling

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZM511U	97	con.23	1.5
EZM512U	121	con.23	1.5
EZM513U	119	con.23	1.5
EZM711U	95	con.23	1.5
EZM712U	133	con.23	1.5
EZM713U	122	con.23	1.5

Tab. 58: Plug connector size and minimum cross-section, EZM synchronous servo motors with convection cooling

6.4.1.2 Sizes for ED, EK synchronous servo motors

Determine the size of the plug connector and the minimum cross-section of the cable based on the motor.

ED motors – IC 410 convection cooling

	n_N 2000 rpm			n_N 3000 rpm			n_N = 4000/4200 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
ED212U	—	—	—	40	con.23	1.0	—	—	—	40	con.23	1.0
ED213U	—	—	—	40	con.23	1.0	—	—	—	40	con.23	1.0
ED302U	—	—	—	60	con.23	1.0	—	—	—	60	con.23	1.0
ED303U	—	—	—	110	con.23	1.0	—	—	—	60	con.23	1.0
ED401U	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED402U	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED403U	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED503U	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED505U	—	—	—	140	con.23	1.5	100	con.23	1.5	—	—	—
ED704U	210	con.23	1.5	140	con.23	1.5	100	con.23	2.5	—	—	—
ED706U	210	con.23	1.5	140	con.23	2.5	100	con.40	4.0	—	—	—
ED806U	—	—	—	140	con.40	6.0	100	con.40	10.0	—	—	—
ED808U	210	con.40	4.0	—	—	—	110	con.40	10.0	—	—	—

Tab. 59: Plug connector size and minimum cross-section, ED synchronous servo motors with convection cooling

ED motors – IC 416 forced ventilation

	n_N 2000 rpm			n_N 3000 rpm			n_N = 4000/4200 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
ED212B	—	—	—	—	—	—	—	—	—	—	—	—
ED213B	—	—	—	—	—	—	—	—	—	—	—	—
ED302B	—	—	—	—	—	—	—	—	—	—	—	—
ED303B	—	—	—	—	—	—	—	—	—	—	—	—
ED401B	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED402B	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED403B	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
ED503B	—	—	—	140	con.23	1.5	—	—	—	70	con.23	2.5
ED505B	—	—	—	140	con.23	1.5	100	con.23	2.5	—	—	—
ED704B	210	con.23	1.0	140	con.23	2.5	100	con.23	4.0	—	—	—
ED706B	210	con.23	2.5	140	con.23	4.0	100	con.40	6.0	—	—	—
ED806B	—	—	—	140	con.40	10.0	100	con.58	16.0	—	—	—
ED808B	210	con.40	10.0	—	—	—	110	con.58	25.0	—	—	—

Tab. 60: Plug connector size and minimum cross-section, ED synchronous servo motors with forced ventilation

EK motors – IC 410 convection cooling

	n_N 2000 rpm			n_N 3000 rpm			n_N = 4000/4200 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EK501U	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
EK502U	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
EK702U	210	con.23	1.5	140	con.23	1.5	—	—	—	—	—	—
EK703U	210	con.23	1.5	140	con.23	1.5	—	—	—	—	—	—
EK803U	—	—	—	140	con.23	2.5	—	—	—	—	—	—

Tab. 61: Plug connector size and minimum cross-section, EK synchronous servo motors with convection cooling

EK motors – IC 416 forced ventilation

	n_N 2000 rpm			n_N 3000 rpm			n_N = 4000/4200 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EK501B	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
EK502B	—	—	—	140	con.23	1.5	—	—	—	70	con.23	1.5
EK702B	210	con.23	1.5	140	con.23	1.5	—	—	—	—	—	—
EK703B	210	con.23	1.5	140	con.23	1.5	—	—	—	—	—	—
EK803B	—	—	—	140	con.23	4.0	—	—	—	—	—	—

Tab. 62: Plug connector size and minimum cross-section, EK synchronous servo motors with forced ventilation

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6.4.1.3 Sizes for LM Lean motors

Determine the size of the plug connector and the minimum cross-section of the cable based on the motor.

Assignment of LM Lean motors (nN = 3000 rpm)

	K_{EM} V/1000 rpm	Plug connector size	Minimum cross-section mm²
LM401	110	con.23	1.5
LM402	120	con.23	1.5
LM403	120	con.23	1.5
LM503	135	con.23	1.5
LM505	135	con.23	1.5
LM704	145	con.23	2.5
LM706	140	con.23	2.5

Tab. 63: Plug connector size and minimum cross-section, Lean motors

6.4.1.4 Checking the minimum cross-section

STOBER offers cables with a minimum cross-section for the motors as standard. Depending on the application, however, larger conductor cross-sections may be required. For this reason, take into account the following points in addition for dimensioning the cable:

Stall current I_0 of the motor

For designing the cable, note the stall current I_0 of the motor.

Permitted current carrying capacity of the conductors

Observe the permitted carrying capacity of the cable depending on the ambient and usage conditions. The following standards describe this topic:

- General requirements for machine cabling: DIN EN 60204-1:2007-06
- Detailed information: DIN VDE 0298-4:2013-06

Cable length

Observe the cable length of the power and brake cores:

- The cable length of the power cores affects the possible short-circuit currents that have to be handled by the device protection
- The cable length of the brake cores can cause problems due to a voltage drop

Terminal specifications of the drive controller or output choke

The selected cable must be covered by the specification of the terminals of the drive controller or output choke; see the chapter Terminal specifications [▶ 97].

Plug connector size of the motor

Depending on the plug connector size of the motor, different power core cross-sections are available.

Information

Select a larger conductor cross-section if required by your application.

6.4.1.5 Codes for EZ, EZHD, EZHP, EZS, EZM synchronous servo motors

The conductor cross-section of the cable and the drive controller series provide you with the cable code, which you in turn can use to determine the identification numbers of ready-made cables.

Cables for con.15

Cables	MDS 5000, SDS 5000, SD6	SC6, SI6
4 × 1.0 mm², 8-core	LS8	LSI6H

Tab. 64: Power cable codes for EZ, EZHD, EZHP, EZS and EZM synchronous servo motors, con.15

Extension cables for con.15

Extension cables	All series
4 × 1.0 mm², 8-core	LSY

Tab. 65: Extension cable codes for EZ, EZHD, EZM and EZS synchronous servo motors, con.15

Cables for con.23

Cables	MDS 5000, SDS 5000, SD6		SC6, SI6
	Size 0 to 2	Size 3	
4 × 1.5 mm², 8-core	LSF	—	LSI6B
4 × 2.5 mm², 8-core	LSG	LSG3	LSI6C
4 × 4.0 mm², 8-core	LSN1	LSN	LSI6D

Tab. 66: Power cable codes for EZ, EZHD, EZHP, EZS and EZM synchronous servo motors, con.23

Extensions for con.23

Extension cables	All series
4 × 1.0 mm², 8-core	LS9
4 × 1.5 mm², 8-core	LSP
4 × 2.5 mm², 8-core	LSR
4 × 4.0 mm², 8-core	LSX

Tab. 67: Extension cable codes for EZ, EZHD, EZHP, EZS and EZM synchronous servo motors, con.23

Cables for con.40

Cables	MDS 5000, SDS 5000, SD6		SC6, SI6
	Size 0 to 2	Size 3	
4 × 2.5 mm², 8-core	LSS	—	LSI6I
4 × 4.0 mm², 8-core	—	LSK	LSI6E
4 × 6.0 mm², 8-core	—	LSL	LSI6F
4 × 10.0 mm², 8-core	—	LSM	LSI6G

Tab. 68: Power cable codes for EZ, EZHD, EZHP, EZS and EZM synchronous servo motors, con.40

Extension cables for con.40

Extension cables	All series
4 × 2.5 mm², 8-core	LSSE
4 × 4.0 mm², 8-core	LSW
4 × 6.0 mm², 8-core	LSB
4 × 10.0 mm², 8-core	LSME

Tab. 69: Extension cable codes for EZ, EZHD, EZHP, EZS and EZM synchronous servo motors, con.40

Cables for con.58

	MDS 5000, SDS 5000, SD6
Cables	Size 3
4 × 16.0 mm², 8-core	LKY

Tab. 70: Power cable codes for EZ, EZHD, EZHP, EZS and EZM synchronous servo motors, con.58

6.4.1.6 Codes for ED, EK synchronous servo motors

The conductor cross-section of the cable and the drive controller series provide you with the cable code, which you in turn can use to determine the identification numbers of ready-made cables.

Cables for con.23

Cables	MDS 5000, SDS 5000, SD6		SC6, SI6
	Size 0 to 2	Size 3	
4 × 1.0 mm², 8-core	LSE	—	LSI6A
4 × 1.5 mm², 8-core	LSF	—	LSI6B
4 × 2.5 mm², 8-core	LSG	LSG3	LSI6C
4 × 4.0 mm², 8-core	LSN1	LSN	LSI6D

Tab. 71: Power cable codes for ED, EK synchronous servo motors, con.23

Extension cables for con.23

Cable extension	All series
4 × 1.0 mm², 8-core	LS9
4 × 1.5 mm², 8-core	LSP
4 × 2.5 mm², 8-core	LSR
4 × 4.0 mm², 8-core	LSX

Tab. 72: Extension cable codes for ED, EK synchronous servo motors, con.23

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Cables for con.40

Cables	MDS 5000, SDS 5000, SD6		SC6, SI6
	Size 0 to 2	Size 3	
4 × 2.5 mm², 8-core	LSS	—	LSI6I
4 × 4.0 mm², 8-core	—	LSK	LSI6E
4 × 6.0 mm², 8-core	—	LSL	LSI6F
4 × 10.0 mm², 8-core	—	LSM	LSI6G

Tab. 73: Power cable codes for ED, EK synchronous servo motors, con.40

Extension cables for con.40

Cables	All series
4 × 2.5 mm², 8-core	LSSE
4 × 4.0 mm², 8-core	LSW
4 × 6.0 mm², 8-core	LSB
4 × 10.0 mm², 8-core	LSME

Tab. 74: Extension cable codes for ED, EK synchronous servo motors, con.40

Cables for con.58

Cables	MDS 5000, SDS 5000, SD6
	Size 3
4 × 16.0 mm², 8-core	LKY
4 × 25.0 mm², 8-core	LKW

Tab. 75: Power cable codes for ED, EK synchronous servo motors, con.58

6.4.1.7 Codes for LM Lean motors

The conductor cross-section of the cable and the drive controller series provide you with the cable code, which you in turn can use to determine the identification numbers of ready-made cables.

Cables for con.23

Cables	SC6, SI6
4 × 1.5 mm², 8-core	LSI6B
4 × 2.5 mm², 8-core	LSI6C

Tab. 76: Power cable codes for LM Lean motors, con.23

Extension cables for con.23

Cable extension	SC6, SI6
4 × 1.5 mm², 8-core	LSP
4 × 2.5 mm², 8-core	LSR

Tab. 77: Extension cable codes for LM Lean motors, con.23

6.4.2 Ready-made power cables

The cable code provides you with the identification numbers for ready-made cables up to 100 m in length.

Information

From an overall length of 50 m, you also require an output choke for drive controllers of sizes 0 to 2 in order to reduce interference pulses and protect the drive system. For drive controllers of sizes 0 to 2 with output chokes as well as drive controllers of size 3, the maximum overall length of the cable and extension is 100 m.

Power cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
LS8	con.15	56755	56756	56757	56758	56759	56710	56711	56712	56713	56714	56715	56716	56717	56718	56719	56720	56721	56722
LSI6H	con.15	59174	59175	59176	59177	59178	59179	59180	59181	59182	59183	59184	59185	59186	59187	59188	59189	59190	59191
LSE	con.23	54312	54313	54314	54315	54316	54317	54318	54319	54320	54321	54322	54323	54324	54325	54326	54327	54328	54329
LSF	con.23	54338	54339	54340	54341	54342	54343	54344	54345	54346	54347	54348	54349	54350	54351	54352	54353	54354	54355
LSG	con.23	54363	54364	54365	54366	54367	54368	54369	54370	54371	54372	54373	54374	54375	54376	54377	54378	54379	54380
LSN1	con.23	57718	57719	57720	57721	57722	57723	57724	57725	57726	57727	57728	57729	57730	57731	57732	57733	57734	57735
LSG3	con.23	5050318	5050319	5050320	5050321	5050322	5050323	5050324	5050325	5050326	5050327	5050328	5050329	5050330	5050331	5050332	5050333	5050334	5050335
LSN	con.23	54383	54384	54385	54386	54387	54388	54389	54390	54391	54392	54393	54394	54395	54396	54397	54398	54399	54400
LSI6A	con.23	58500	58501	58502	58503	58504	58505	58506	58507	58508	58509	58510	58511	58512	58513	58514	58515	58516	58517
LSI6B	con.23	58518	58519	58520	58521	58522	58523	58524	58525	58526	58527	58528	58529	58530	58531	58532	58533	58534	58535
LSI6C	con.23	58536	58537	58538	58539	58540	58541	58542	58543	58544	58545	58546	58547	58548	58549	58550	58551	58552	58553
LSI6D	con.23	58554	58555	58556	58557	58558	58559	58560	58561	58562	58563	58564	58565	58566	58567	58568	58569	58570	58571
LSS	con.40	54671	54672	54673	54674	54675	54676	54677	54678	54679	54680	54681	54682	54683	54684	54685	54686	54687	54688

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Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
LSK	con.40	54473	54474	54475	54476	54477	54478	54479	54480	54481	54482	54483	54484	54485	54486	54487	54488	54489	54490
LSL	con.40	54491	54492	54493	54494	54495	54496	54497	54498	54499	54500	54501	54502	54503	54504	54505	54506	54507	54508
LSM	con.40	54509	54510	54511	54512	54513	54514	54515	54516	54517	54518	54519	54520	54521	54522	54523	54524	54525	54526
LSI6I	con.40	59210	59211	59212	59213	59214	59215	59216	59217	59218	59219	59220	59221	59222	59223	59224	59225	59226	59227
LSI6E	con.40	58572	58573	58574	58575	58576	58577	58578	58579	58580	58581	58582	58583	58584	58585	58586	58587	58588	58589
LSI6F	con.40	58590	58591	58592	58593	58594	58595	58596	58597	58598	58599	58600	58601	58602	58603	58604	58605	58606	58607
LSI6G	con.40	58608	58609	58610	58611	58612	58613	58614	58615	58616	58617	58618	58619	58620	58621	58622	58623	58624	58625
LKY	con.58	53910	53911	53912	53913	53914	53915	53916	53917	53918	53919	53920	53921	53922	53923	53924	53925	53926	53927
LKW	con.58	53928	53929	53930	53931	53932	53933	53934	53935	53936	53937	53938	53939	53940	53941	53942	53943	53944	53945

Tab. 78: Ready-made power cables up to 100 m

Extension cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
LSY	con.15	57578	57579	57580	57581	57582	57583	57584	57585	57586	57587	57588	57589	57590	57591	57592	57593	57594	57595
LS9	con.23	54599	54600	54601	54602	54603	54604	54605	54606	54607	54608	54609	54610	54611	54612	54613	54614	54615	54616
LSP	con.23	54563	54564	54565	54566	54567	54568	54569	54570	54571	54572	54573	54574	54575	54576	54577	54578	54579	54580
LSR	con.23	54581	54582	54583	54584	54585	54586	54587	54588	54589	54590	54591	54592	54593	54594	54595	54596	54597	54598
LSX	con.23	54545	54546	54547	54548	54549	54550	54551	54552	54553	54554	54555	54556	54557	54558	54559	54560	54561	54562
LSSE	con.40	57694	57695	57696	57697	57698	57699	57700	57701	57702	57703	57704	57705	57706	57707	57708	57709	57710	57711
LSW	con.40	56776	56777	56778	55038	—	—	—	—	—	—	—	—	—	—	—	—	—	—
LSB	con.40	56998	56999	—	59884	—	59311	—	—	—	—	—	—	—	—	—	—	—	—
LSME	con.40	58273	58274	58275	58276	58273	58274	58275	58276	58277	58278	58279	58280	58281	58282	58283	58284	58285	58286

Tab. 79: Ready-made extension cables for power cables up to 100 m

6.5 Service packs for power cables

If you would like to finish your cable yourself, you can find information in this chapter about available service packs. Our service packs contain the motor-side connector and the required contacts. To finish the contacts correctly, you require a suitable crimping tool for the respective contact type. More detailed information can be found in the enclosed assembly instructions.

Information

Be aware that the use of unsuitable cables or poorly made connections can cause subsequent damage. For this reason, we reserve the right to reject claims under the warranty in this case.

Type	con.15	con.23	con.40	con.58
4 × 1.0 mm², 9-pin	57161	—	—	—
4 × 1.5 mm² to 4 × 2.5 mm², 8-pin	—	55016	—	—
4 × 2.5 mm² to 4 × 4.0 mm², 8-pin	—	55020	—	—
4 × 2.5 mm² to 4 × 4.0 mm², 8-pin	—	—	58729	—
4 × 6.0 mm² to 4 × 10.0 mm², 8-pin	—	—	55021	—
4 × 16.0 mm², 8-pin	—	—	—	57030

Tab. 80: Identification numbers of service packs for power cables

6.6 Accessories

You can find information about the available accessories in the following chapters.

6.6.1 TEP output choke

Output chokes are required from a cable length > 50 m for drive controllers of sizes 0 to 2.

Information

The following technical data only applies to a rotating magnetic field frequency of 200 Hz. For example, this rotating magnetic field frequency is achieved with a motor with 4 pole pairs and a nominal speed of 3000 rpm. Always observe the specified derating for higher rotating magnetic field frequencies. Also observe the relationship with the clock frequency.

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Properties

Specification	TEP3720-0ES41	TEP3820-0CS41	TEP4020-0RS41
ID No.	53188	53189	53190
Voltage range	3 × 0 to 480 V_{AC}		
Frequency range	0 – 200 Hz		
Nominal current $I_{N,MF}$ at 4 kHz	4 A	17.5 A	38 A
Nominal current $I_{N,MF}$ at 8 kHz	3.3 A	15.2 A	30.4 A
Max. permitted motor cable length with output choke	100 m		
Max. surrounding temperature $\vartheta_{amb,max}$	40 °C		
Protection class	IP00		
Winding losses	11 W	29 W	61 W
Iron losses	25 W	16 W	33 W
Connection	Screw terminal		
Max. conductor cross-section	10 mm²		
UL Recognized Component (CAN; USA)	Yes		
Test symbols	c UL us CE		

Tab. 81: TEP specification

More information on chokes can be found in the manuals of the drive controllers; see the chapter Detailed information [▶ 96].

7 One Cable Solution

STOBER synchronous servo motors are equipped with plug connectors as standard.

STOBER provides suitable cables in various lengths, conductor cross-sections and connector sizes.

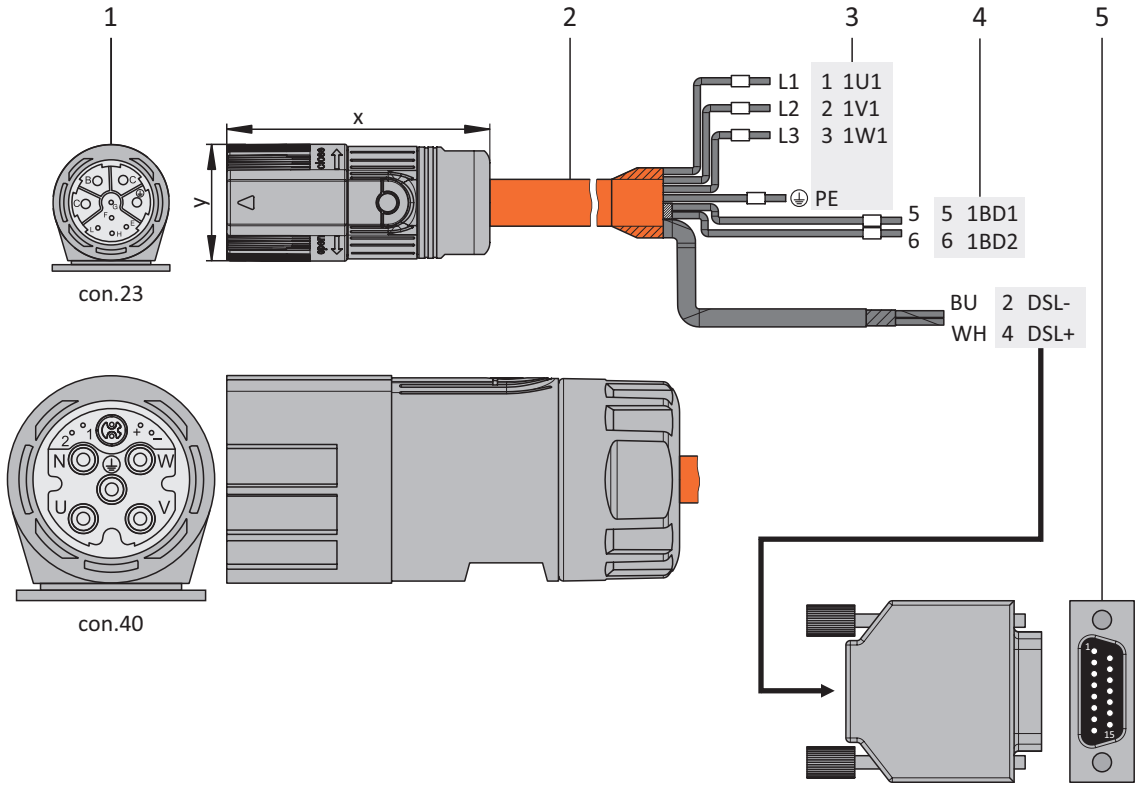
A motor connection as a One Cable Solution (OCS) combined with a HIPERFACE DSL encoder requires hybrid cables which feature encoder communication and power transmission in a shared cable.

Information

For connecting as a One Cable Solution, use exclusively hybrid cables from STOBER. The use of unsuitable cables or poorly made connections can cause subsequent damage. For this reason, we reserve the right to reject claims under the warranty in this case.

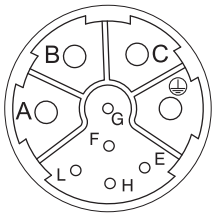
7.1 Connection description

The hybrid cables are available in plug connector sizes con.23 and con.40 with a speedtec quick lock.



1: Plug connector
2: STOBER hybrid cable
3: Connection to terminal X20, motor
4: Connection to terminal X2, brake supply
5: D-sub X4

Hybrid cables – con.23 plug connectors

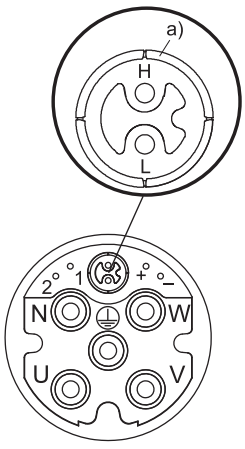
Motor (1)				Cable (2)	Drive controller (3) – (5)		
Connection diagram	Pin	Designation	Core color	Core No./ Core color	Pin X20	Pin X2	Pin X4
	A	1U1	BK	L1	1	—	—
	B	1V1	BU	L2	2	—	—
	C	1W1	RD	L3	3	—	—
	E	DSL–	GN	BU	—	—	2
	F	DSL shield	—	—	—	—	Connector
	G	1BD1	RD	5	—	5	—
	H	DSL+	GY	WH	—	—	4
	L	1BD2	BK	6	—	6	—
	⏚	PE	GNYE	GNYE	4	—	
	Housing	Shield	—	—	Shield contact	—	—

Tab. 82: con.23 hybrid cable pin assignment

Length x [mm]	Diameter y [mm]
78	26

Tab. 83: con.23 connector dimensions

Hybrid cables – con.40 plug connectors

Motor (1)				Cable (2)	Drive controller (3) – (5)		
Connection diagram	Pin	Designation	Core color	Core No./ core color	Pin X20	Pin X2	Pin X4
	U	1U1	BK	L1	1	—	—
	V	1V1	BU	L2	2	—	—
	W	1W1	RD	L3	3	—	—
	N	—	—	—	—	—	—
	+	1BD1	RD	5	—	5	—
	–	1BD2	BK	6	—	6	—
	F	—	—	—	—	—	—
	G	—	—	—	—	—	—
	H	DSL+	GY	WH	—	—	4
	L	DSL–	GN	BU	—	—	2
	⏚	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 84: con.40 hybrid cable pin assignment

a) Coaxial shield to which the DSL shield is connected.

Length x [mm]	Diameter y [mm]
99	46

Tab. 85: con.40 connector dimensions

7.2 Technical data

IP protection class of the plug connectors

The plug connectors meet the IP 66/67 protection class (in accordance with IEC 60529). This information applies if both parts of the plug connector are connected together properly. Plug connectors have to be protected against environmental factors that affect functionality (dust, moisture, etc.) in accordance with the type approval laws.

Conductor construction

Bare copper, term. 6 in accordance with DIN EN 60228. PP drag chain cable in accordance with UL758 (AWM) style 21223 (sheath) and style 10492 (core).

Voltage

- Nominal voltage (DIN/VDE): power cores U_0/U 600 V/1000 V
- Nominal voltage (DIN/VDE): pilot cores U_0/U 600 V/1000 V
- Voltage (UL/CSA): 1000 V_{AC}

Current carrying capacity of power cores

Conductor cross-section A [mm²]	1.5	2.5
Nominal current $I_{N,CAB}$ [A]	15.0	20.0

Current carrying capacity of pilot cores – Brake and temperature sensor

Conductor cross-section A [mm²]	0.34 / AWG22	0.75
Nominal current $I_{N,CAB}$ [A]	1.5	9.0

Test voltage (50 Hz)

- Power cores: 4000 V, 5 min.
- Pilot cores: 3000 V, 1 min.

Insulation resistance

Min. 500 MΩ × km

Temperature range

- Free to move: −20 °C to +80 °C
- Permanently installed: −40 °C to +80 °C
- Moving in the drag chain, under mechanical load: −20 °C to +60 °C

Smallest permissible bending radius

- Free to move: 7 x d_{out}

- Permanently installed: 5 x d_{out}

Bending resistance

Min. 5 million cycles

Travel velocity

Max. 240 m/min

Acceleration

- Max. 30 m/s² to 5 m travel path
- Max. 15 m/s² to 10 m travel path
- Max. 5 m/s² to 20 m travel path

Resistance and other properties

- Oil-resistant in accordance with DIN EN 60811-404
- Halogen-free in accordance with DIN VDE 0472 T.815
- Silicone-free
- CFC-free

Outer sheath

PUR

Core insulation

PP

Marking

- Power cores:
  Core 1: black with imprint U/L1/C/L+
  Core 2: black with imprint V/L2
  Core 3: black with imprint W/L3/D/L–
- Pilot cores:
  Pair 1: Black with the numbers 5 + 6
  Pair 2: White and blue
- Sheath: Orange (similar to RAL 2003)
- Grounding conductor: Green-yellow

Shielding

- Core shielding of the pilot cores in pairs with tin-plated copper braid, optical coverage ≥ 85% and metallized plastic non-woven fabric for DSL pair
- Complete shielding of tin-plated Cu braid, optical coverage ≥ 85%

Flammability

Flame-resistant in accordance with IEC 60332-1-2, UL758 cable flame test

RoHS conformity

Free of hazardous substances according to the RoHS-2 2011/65/EU Directive

Conductor cross-sections

Cable diameter	Description
Max. 13.5 mm	(4G 1.5 + (2 x 0.75) C + (2 x AWG22) C2Y) C
Max. 15.0 mm	(4G 2.5 + (2 x 1.0) C + (2 x AWG22) C2Y) C

"(...)" = Shield

7.3 Determining the cable code for ready-made cables in 3 steps

Information

Note that the cable codes used in this documentation are intended only to refer to the overview and selection tables within this manual. The cable codes are not part of the ordering process and are not printed on the cables.

7.3.1 Sizes for EZ, EZS synchronous servo motors

Determine the size of the plug connector and the minimum cross-section of the cable based on the motor.

EZ motors – IC 410 convection cooling

	n_N 3000 rpm			n_N 4500 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZ301U	40	con.23	1.5	—	—	—	40	con.23	1.5
EZ302U	86	con.23	1.5	—	—	—	42	con.23	1.5
EZ303U	109	con.23	1.5	—	—	—	55	con.23	1.5
EZ401U	96	con.23	1.5	—	—	—	47	con.23	1.5
EZ402U	94	con.23	1.5	—	—	—	60	con.23	1.5
EZ404U	116	con.23	1.5	—	—	—	78	con.23	1.5
EZ501U	97	con.23	1.5	—	—	—	68	con.23	1.5
EZ502U	121	con.23	1.5	—	—	—	72	con.23	1.5
EZ503U	119	con.23	1.5	—	—	—	84	con.23	1.5
EZ505U	141	con.23	1.5	103	con.23	1.5	—	—	—
EZ701U	95	con.23	1.5	—	—	—	76	con.23	1.5
EZ702U	133	con.23	1.5	—	—	—	82	con.23	2.5
EZ703U	122	con.23	1.5	99	con.23	2.5	—	—	—
EZ705U	140	con.40	2.5	—	—	—	—	—	—

Tab. 86: Plug connector size and minimum cross-section, EZ synchronous servo motors with convection cooling

EZ motors – IC 416 forced ventilation

	n_N 3000 rpm			n_N 4500 rpm			n_N 6000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZ401B	96	con.23	1.5	—	—	—	47	con.23	1.5
EZ402B	94	con.23	1.5	—	—	—	60	con.23	1.5
EZ404B	116	con.23	1.5	—	—	—	78	con.23	1.5
EZ501B	97	con.23	1.5	—	—	—	68	con.23	1.5
EZ502B	121	con.23	1.5	—	—	—	72	con.23	1.5
EZ503B	119	con.23	1.5	—	—	—	84	con.23	2.5
EZ505B	141	con.23	1.5	103	con.23	1.5	—	—	—
EZ701B	95	con.23	1.5	—	—	—	76	con.23	1.5
EZ702B	133	con.23	1.5	—	—	—	—	—	—
EZ703B	122	con.23	2.5	99	—	—	—	—	—

Tab. 87: Plug connector size and minimum cross-section, EZ synchronous servo motors with forced ventilation

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Assignment of EZS motors – IC 410 convection cooling

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZS501U	97	con.23	1.5
EZS502U	121	con.23	1.5
EZS503U	119	con.23	1.5
EZS701U	95	con.23	1.5
EZS702U	133	con.23	1.5
EZS703U	122	con.23	1.5

Tab. 88: Plug connector size and minimum cross-section, EZS synchronous servo motors with convection cooling

Assignment of EZS motors – IC 416 forced ventilation

	n_N 3000 rpm		
	K_{EM} V/1000 rpm	Plug con. size	Minimum cross-section mm²
EZS501B	97	con.23	1.5
EZS502B	121	con.23	1.5
EZS503B	119	con.23	1.5
EZS701B	95	con.23	1.5
EZS702B	133	con.23	1.5
EZS703B	122	con.23	2.5

Tab. 89: Plug connector size and minimum cross-section, EZS synchronous servo motors with forced ventilation

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7.3.2 Checking the minimum cross-section

STOBER offers cables with a minimum cross-section for the motors as standard. Depending on the application, however, larger conductor cross-sections may be required. For this reason, take into account the following points in addition for dimensioning the cable:

Stall current I_0 of the motor

For designing the cable, note the stall current I_0 of the motor.

Permitted current carrying capacity of the conductors

Observe the permitted carrying capacity of the cable depending on the ambient and usage conditions. The following standards describe this topic:

- General requirements for machine cabling: DIN EN 60204-1:2007-06
- Detailed information: DIN VDE 0298-4:2013-06

Cable length

Observe the cable length of the power and brake cores:

- The cable length of the power cores affects the possible short-circuit currents that have to be handled by the device protection
- The cable length of the brake cores can cause problems due to a voltage drop

Terminal specifications of the drive controller or output choke

The selected cable must be covered by the specification of the terminals of the drive controller or output choke; see the chapter Terminal specifications [▶ 97].

Plug connector size of the motor

Depending on the plug connector size of the motor, different power core cross-sections are available.

Information

Select a larger conductor cross-section if required by your application.

7.3.3 Codes for EZ, EZS synchronous servo motors

The conductor cross-section of the cable and the drive controller series provide you with the cable code, which you in turn can use to determine the identification numbers of ready-made cables.

Information

STOBER offers a suitable hybrid adapter cable for connecting the output choke to the drive controller.

Cables for con.23

Cables	SC6, SI6
4 × 1.5 mm², 8-core	HK2B
4 × 2.5 mm², 8-core	HK2C

Tab. 90: Hybrid cable codes for EZ and EZS synchronous servo motors, con.23

Extension cables for con.23

Extension cables	SC6, SI6
4 × 1.5 mm², 8-core	HV2B
4 × 2.5 mm², 8-core	HV2C

Tab. 91: Extension cable codes for EZ and EZS synchronous servo motors, con.23

Cables for con.40

Cables	SC6, SI6
4 × 2.5 mm², 8-core	HK3C

Tab. 92: Hybrid cable codes for EZ and EZS synchronous servo motors, con.40

Extension cables for con.40

Extension cables	SC6, SI6
4 × 2.5 mm², 8-core	HV3C

Tab. 93: Extension cable codes for EZ and EZS synchronous servo motors, con.40

Hybrid adapter cables for the choke connection

Cables	SC6, SI6
4 × 1.5 mm², 8-core	HA0B

Tab. 94: Hybrid adapter cable codes for the choke connection

7.4 Ready-made hybrid cables

The cable code provides you with the identification numbers for ready-made cables up to 100 m in length.

Information

From an overall length of 50 m, you also require an output choke for drive controllers of sizes 0 to 2 in order to reduce interference pulses and protect the drive system. For drive controllers of sizes 0 to 2 with output chokes as well as drive controllers of size 3, the maximum overall length of the cable and extension is 100 m.

Information

STOBER offers a suitable hybrid adapter cable for connecting the output choke to the drive controller.

Hybrid cables

Code	Size	Line length [m]																	
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90	100
HK2B	con.23	59166	59167	59352	59168	59353	59354	59355	59356	59357	59358	59359	59360	59361	58746	59362	59363	59364	58747
HK2C	con.23	59365	59366	59367	59368	59369	59370	59371	59372	59373	59374	59375	59376	59377	59378	59379	59380	59381	59382
HK3C	con.40	59401	59402	59403	59404	59405	59406	59407	59408	59409	59410	59411	59412	59413	59414	59415	59416	59417	59418

Tab. 95: Ready-made hybrid cables up to 100 m

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Extension cables

Extension cables for hybrid cables are only permitted up to a maximum length of 90 m.

Code	Size	Line length [m]																
		2.5	5	7.5	10	12.5	15	18	20	25	30	35	40	50	60	70	80	90
HV2B	con.23	59506	59507	59508	59509	59510	59511	59512	59513	59514	59515	59516	59517	59518	59519	59520	59521	59522
HV2C	con.23	59523	59524	59525	59526	59527	59528	59529	59530	59531	59532	59533	59534	59535	59536	59537	59538	59539
HV3C	con.40	59557	59558	59559	59560	59561	59562	59563	59564	59565	59566	59567	59568	59569	59570	59571	59572	59573

Tab. 96: Ready-made extension cables for hybrid cables up to 90 m

Hybrid adapter cables

Code	Size	Line length [m]			
		2	2.5	3	3.5
HA0B	—				

Tab. 97: Hybrid adapter cables up to 3.5 m for the choke connection

8 Appendix

8.1 Detailed information

Motor connection plans and current document versions of the drive controllers manuals can be found at http://www.stoeber.de/en/downloads/.

If you do not know the ID of the motor connection plan, first select the desired language of the document as well as "connection plan" as the download type for the search to limit the search results. Then enter the drive controller series (e.g. "SD6") or the motor type (e.g. "EZ") in the search field.

In the following table, you can find the IDs for the drive controllers manuals of the 5th and 6th generation:

Device/Software	Documentation	Contents	ID
FDS 5000 frequency inverter	Configuration manual	Technical data, installation and connection	442269
MDS 5000 servo inverter	Configuration manual	Technical data, installation and connection	442273
SDS 5000 servo inverter	Configuration manual	Technical data, installation and connection	442277
drive controller SC6	Manual	System setup, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442790
Multi-axis drive system with SI6 and PS6	Manual	System setup, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442728
drive controller SD6	Manual	System setup, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442426

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8.2 Terminal specifications

The cores for the motor temperature sensor and brake in the power cable are tailored for STOBER of drive controllers with end sleeves with collars and an insulation stripping length of 10 mm.

The requirements for terminal X20 for the motor connection depend on the series and size of the drive controller. You can find more information in the following chapters.

8.2.1 MDS 5000 servo inverter – X20

The maximum conductor cross-section of the end sleeves with collars as well as the required insulation stripping length for the motor connection to terminal X20 can be found in the following table.

Type	Conductor cross-section, insulation stripping length
MDS 5007A	2.5 mm², 10 mm
MDS 5008A	
MDS 5015A	
MDS 5040A	4 mm², 12–15 mm
MDS 5075A	
MDS 5110A	10 mm², 18 mm
MDS 5150A	
MDS 5220A	35 mm², 18 mm
MDS 5370A	
MDS 5450A	

Tab. 98: MDS 5000 servo inverter, X20 motor connection terminal specification

8.2.2 SDS 5000 servo inverter – X20

The maximum conductor cross-section of the end sleeves with collars as well as the required insulation stripping length for the motor connection to terminal X20 can be found in the following table.

Type	Max. conductor cross-section / insulation stripping length
SDS 5007A	2.5 mm², 10 mm
SDS 5008A	
SDS 5015A	
SDS 5040A	4 mm², 12–15 mm
SDS 5075A	
SDS 5110A	10 mm², 18 mm
SDS 5150A	
SDS 5220A	35 mm², 18 mm
SDS 5370A	
SDS 5450A	

Tab. 99: SDS 5000 servo inverter, X20 motor connection terminal specification

8.2.3 SD6 drive controllers – X20

The maximum conductor cross-section of the end sleeves with collars as well as the required insulation stripping length for the motor connection to terminal X20 can be found in the following table.

Type	Conductor cross-section / insulation stripping length
SD6A02	2.5 mm², 10 mm
SD6A04	
SD6A06	
SD6A14	4 mm², 12–15 mm
SD6A16	
SD6A24	10 mm², 18 mm
SD6A26	
SD6A34	35 mm², 18 mm
SD6A36	
SD6A38	

Tab. 100: SD6 drive controllers, X20 motor connection terminal specification

8.2.4 SC6 drive controllers – X20

The maximum conductor cross-section of the end sleeves with collars as well as the required insulation stripping length for the motor connection to terminal X20 can be found in the following table.

Type	Conductor cross-section / insulation stripping length
SC6A062	2.5 mm², 10 mm
SC6A162	4 mm², 12–15 mm
SC6A261	10 mm², 18 mm

Tab. 101: SC6 drive controllers, X20 motor connection terminal specification

8.2.5 SI6 drive controllers – X20

The maximum conductor cross-section of the end sleeves with collars as well as the required insulation stripping length for the motor connection to terminal X20 can be found in the following table.

Type	Conductor cross-section / insulation stripping length
SI6A061	2.5 mm², 10 mm
SI6A062	
SI6A161	4 mm², 12–15 mm
SI6A162	
SI6A261	10 mm², 18 mm
SI6A262	
SI6A361	

Tab. 102: SI6 drive controllers, X20 motor connection terminal specification

8.3 Formula symbols

Symbol	Unit	Explanation
$\Delta\vartheta$	K	Temperature difference
d_{out}	mm	Outer diameter
I_0	A	Stall current
$I_{N,CAB}$	A	Nominal current of the cable
$I_{N,MF}$	A	Nominal current of the choke or motor filter
K_{EM}	V/1000 rpm	Voltage constant: Peak value of the induced motor voltage at a speed of 1000 rpm and a winding temperature $\Delta\vartheta$ = 100 K (tolerance ±10%)
M_N	Nm	Nominal torque of the motor
n_N	rpm	Nominal speed: The speed for which the nominal torque M_N is specified

9 Contact

9.1 Consultation, service and address

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Glossary

DC link discharge

Process that causes the DC link capacitors to discharge. Requirements for the discharge process: The power grid supply is disconnected and no energy flows back from the motor to the device.

DC link discharge time

Time until the DC link capacitors are discharged enough that the device can be worked on safely.

Output choke

This type of choke is used to reduce high-frequency currents on electric lines and thus increase the interference immunity and availability of drive systems. They reduce current peaks caused by line capacitance at the power output of the drive controller. They make long power cables possible, increase the motor service life and reduce harmonic currents.

Self-discharge

Passive running process that causes the capacitors to discharge even when no electrical load is connected.

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