

18 Connecting to drive controllers of third-party manufacturers

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18.1 General notes

STOBER synchronous servo motors are designed for connection to STOBER drive controllers in the standard version. STOBER offers an extensive assortment of high-quality, trusted power and encoder connection cables for this purpose. However, STOBER synchronous servo motors can also be operated on drive controllers from third-party manufacturers. Notes and information for this purpose can be found in the following chapters. You can find all other information about STOBER synchronous servo motors in the chapter [\[17 \]](#).

18.1.1 Nominal data

Nominal data for synchronous servo motors specified in the selection tables of this catalog were calculated for connecting to STOBER drive controllers. Note that this nominal data may change when STOBER synchronous servo motors are connected to drive controllers of third-party manufacturers. The following drive controller plug connectors are determining factors here:

- f_{2PU}
- $f_{PWM,PU}$
- U_{ZK}
- Compensation of the field weakening range.

The maximum achievable speed of a synchronous servo motor depends on the number of pole pairs (p) of the synchronous servo motor and, if applicable, on the restriction of f_{2PU} by Regulation (EC) No. 428/2009 (EC Dual Use Regulation). Details are shown in the figure below.

Some encoders feature integrated temperature monitoring, the warning and switch-off thresholds of which may overlap with the corresponding values set for the thermal winding protection in the drive controller. In some cases, this may result in an instance where an encoder with internal temperature monitoring forces the motor to shut down, even before the motor has reached its nominal data.

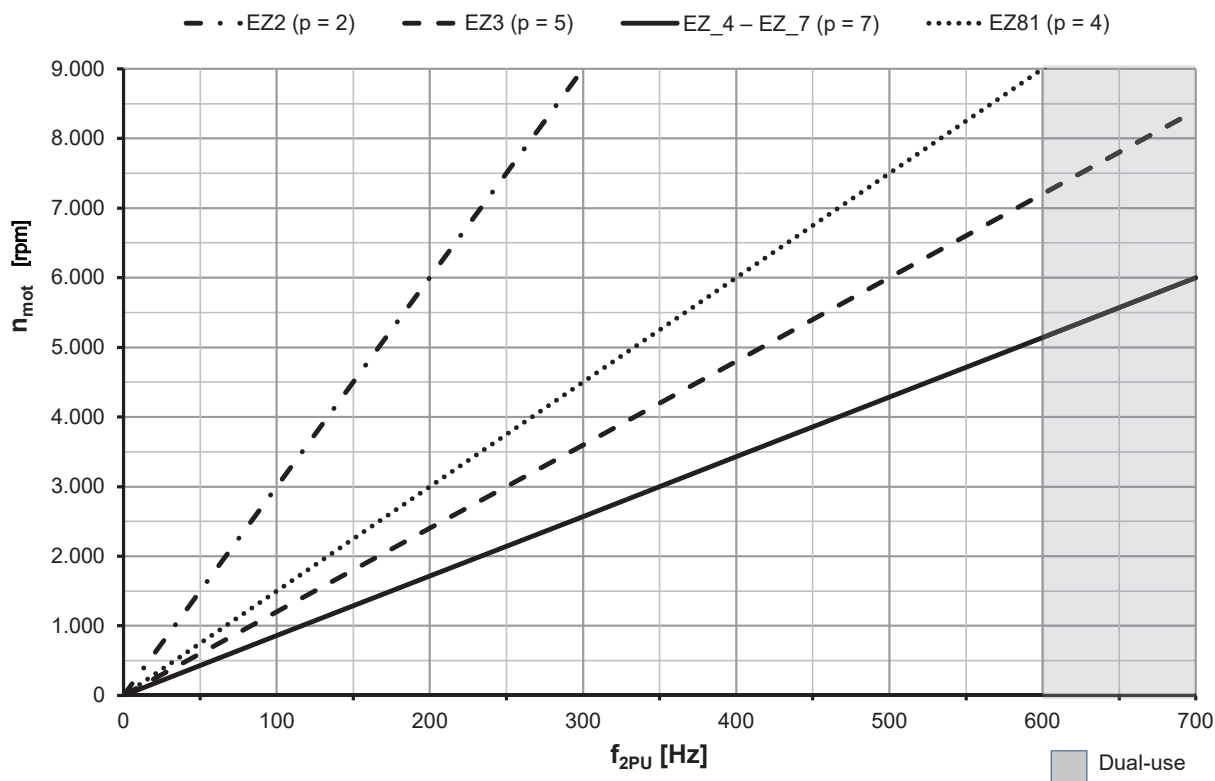


Fig. 1: Speed/frequency graph for EZ motors

18.1.2 Plug connectors (One Cable Solution)

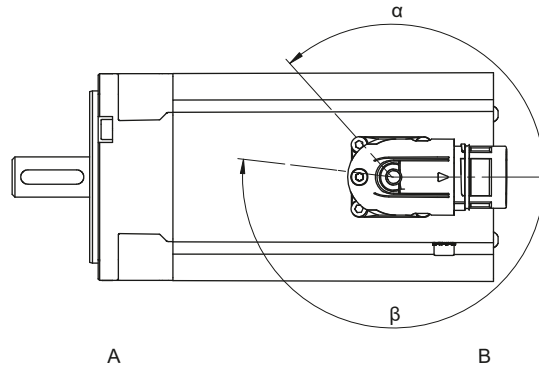
The One Cable Solution option is available for B&R, Control Techniques, Beckhoff, and Allen-Bradley drive controllers.

In the One Cable Solution design, the power and encoder lines are connected using a shared plug connector.

For motors with forced ventilation, avoid collisions between the motor connection cables and the plug connector of the forced ventilation unit. In the event of a collision, rotate the plug connectors of the motor by the required angle. Details on the position of the plug connector for the forced ventilation unit can be found in the chapter [\[17.4.5\]](#).

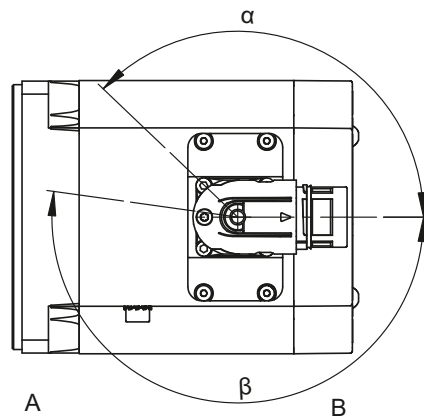
The figures represent the position of the plug connectors upon delivery.

Turning ranges of plug connectors (EZ2 – EZ3 motors)



A	Attachment or output side of the motor	B	Not output side
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Turning ranges of plug connectors (EZ4 – EZ7 motors)



A	Attachment or output side of the motor	B	Not output side
---	--	---	-----------------

Features of B&R/Beckhoff plug connectors

Motor type	Size	Connection	Turning range	
			α	β
EZ2 – EZ5, EZ701 – EZ703, EZ705U, EZ705B (n _N =3000 rpm)	con.23	Quick-lock	130°	190°

Features of Allen-Bradley plug connectors

Motor type	Size	Connection	Turning range	
			α	β
EZ3 – EZ5, EZ701 – EZ703, EZ705U (n _N =3000 rpm)	con.23	Quick-lock	130°	190°
EZ705U (n _N =4500 rpm), EZ705B, EZ813U	con.40	Quick-lock	130°	190°

Notes

- The number after "con." indicates the approximate external thread diameter of the plug connector in mm (for example, con.23 designates a plug connector with an external thread diameter of about 23 mm).

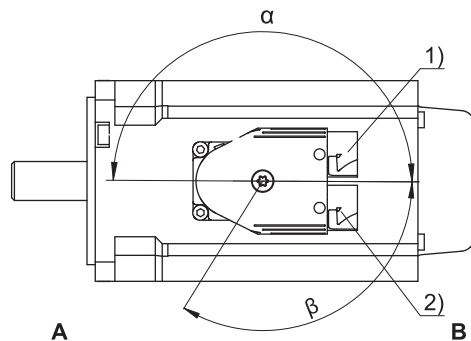
18.1.3 Plug connectors

In the standard version, STOBER synchronous servo motors are equipped with rotatable plug connectors¹ for power and encoder connections. You can find detailed technical information about the plug connectors at <http://www.intercontec.biz>.

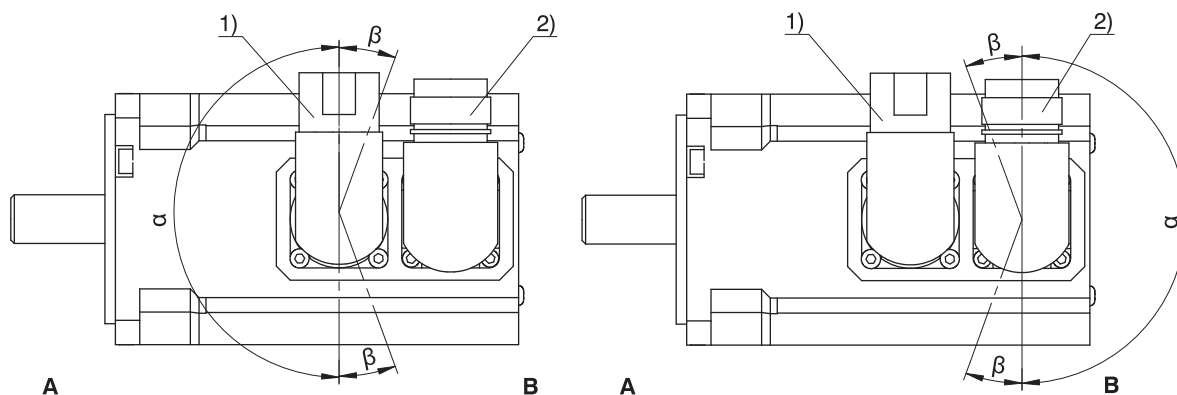
For motors with forced ventilation, avoid collisions between the motor connection cables and the plug connector of the forced ventilation unit. In the event of a collision, rotate the plug connectors of the motor by the required angle. Details on the position of the plug connector for the forced ventilation unit can be found in the chapter [► 17.4.6].

The figures represent the position of the plug connectors upon delivery.

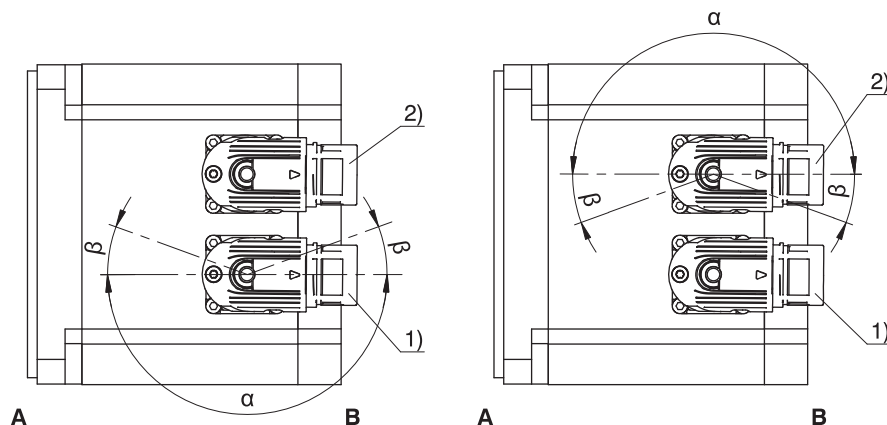
Turning ranges of con.15 ytec plug connectors (motors EZ2 – EZ3, EZ401, EZ402) for connection to B&R drive controllers (drive controller code GY)



Turning ranges of plug connectors (EZ2 – EZ3 motors)



Turning ranges of plug connectors (EZ4 – EZ8 motors)



1 Power plug connector

A Attachment or output side of the motor

2 Encoder plug connector

B Not output side

¹The connectors can be pivoted up to 10 times at a specific angle. They cannot be rotated repeatedly.

Power plug connector features

Motor type	Size	Connection	Turning range	
			α	β
EZ2 – EZ3, EZ401, EZ402	con.15 ²	Quick-lock (ytec)	180°	140°
EZ2 – EZ5, EZ701 – EZ703	con.23	Quick-lock	180°	40°
EZ705, EZ8	con.40	Quick-lock	180°	40°

Encoder plug connector features

Motor type	Size	Connection	Turning range	
			α	β
EZ2 – EZ3, EZ401, EZ402	con.15 ³	Quick-lock (ytec)	180°	140°
EZ404, EZ5, EZ7, EZ8	con.15 ⁴	Quick-lock (itec)	180°	20°
EZ2 – EZ8	con.15 ⁵	Quick-lock (itec)	180°	20°
EZ2 – EZ8	con.23	Quick-lock	180°	20°

Notes

- In turning range β , the power or encoder plug connectors can be turned only if doing so does not cause them to collide.
- The number after "con." indicates the approximate external thread diameter of the plug connector in mm (for example, con.23 designates a plug connector with an external thread diameter of about 23 mm).
- With ytec plug connectors, the power and encoder plug connectors are mechanically connected and can only be turned together.

18.1.4 Connection cables

The plug connectors and terminal assignment of STÖBER synchronous servo motors are designed for connecting to drive controllers from third-party manufacturers in a way that allows you to connect the original cable of the respective manufacturer. Keep the following information regarding cable quality and design in mind.

- Because the original cable from Bosch cannot be used, STÖBER offers suitable cables for this purpose. More detailed information is available from your STÖBER customer consultant.
- Ensure that the cable quality and cable design is suitable for the ambient conditions at the installation location.

You can find more detailed information on our cables in the connection method manual, ID 443101.

Enter the ID of the manual in the Search term field at <http://www.stoeber.de/en/downloads/>.

² Only for connection to B&R ACOPOS P3 with EnDat 2.2 (drive controller code GY)

³ Only for connection to B&R ACOPOS P3 with EnDat 2.2 (drive controller code GY)

⁴ Only for connection to B&R ACOPOS P3 with EnDat 2.2 (drive controller code GY)

⁵ Only for connection to B&R ACOPOSmulti with EnDat 2.2 (drive controller code GG)

18.2 Connection to B&R drive controllers

This chapter contains the information for connecting STOBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STOBER drive controllers. You can find all other information about STOBER synchronous servo motors in the chapter [► 17].

STOBER has taken the following measures to minimize the effort of commissioning STOBER motors connected to B&R drive controllers and avoid errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- The electronic nameplate of the motor was designed to be compatible with the B&R controllers.
- Parameter lists are available on request at systemsupport@stoerber.de.

More information on commissioning EZ motors connected to B&R drive controllers can be found in the 443184_en document in the download area on the STOBER website.

18.2.1 Encoders

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EnDat 2.2 EQI 1131 Safety	S2	Inductive	4096	19 bit	524288	> 100	$\leq 15 \times 10^{-9}$
EnDat 2.2 EQN 1135 Safety	S3	Optical	4096	23 bit	8388608	> 100	$\leq 15 \times 10^{-9}$
EnDat 2.2 ECI 1118-G2	C5	Inductive	–	18 bit	262144	> 76	$\leq 1.5 \times 10^{-6}$

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	$\leq 2 \times 10^{-6}$
EnDat 2.1 ECI 1118-G3	C2	Inductive	–	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$
EnDat 2.1 EQI 1130-G3	Q2	Inductive	4096	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$

Notes

- The encoder code is a part of the type designation of the motor.
- Safety = Safety-related position measuring system for use in safety-oriented applications.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.2.2 Resolver

In this chapter, you can find detailed technical data for the resolver that can be installed as an encoder in a STOBER motor.

Feature	Description
Code	R0
Number of poles	2
Input voltage $U_{1\text{eff}}$	7 V $\pm$ 5%
Input frequency f_1	10 kHz
Output voltage $U_{z, S1-S3}$	$K_{tr} \cdot U_{R1-R2} \cdot \cos \theta$
Output voltage $U_{z, S2-S4}$	$K_{tr} \cdot U_{R1-R2} \cdot \sin \theta$
Transformation ratio K_{tr}	0.5 $\pm$ 5%
Electrical fault	± 10 arcmin
MTTF	> 100 years
PFH	$\leq 10^{-9}$

18.2.3 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER synchronous servo motors with drive controllers from B&R depending on the encoder model.

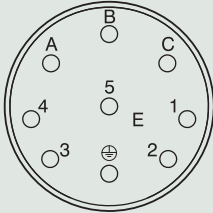
Drive controller		ACOPOS Standard EnDat 2.1/re-solver	ACOPOSmulti EnDat 2.1/re-solver	ACOPOSmulti EnDat 2.2	ACOPOS P3 EnDat 2.2	ACOPOS P3 OCS EnDat 2.2	ACOPOSmulti OCS EnDat 2.2
Drive controller code		FG	FV	GG	GY	GP	GV
Connection plan ID		442313	442444	442677	443095	443022	443092
Encoder	Encoder code						
EnDat 2.2 EQI 1131 Safety	S2	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 EQN 1135 Safety	S3	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 ECI 1118-G2	C5	–	–	EZ	EZ	–	–
EnDat 2.1 EQN 1125	Q4	EZ	EZ	–	–	–	–
EnDat 2.1 ECI 1118-G3	C2	–	EZ	–	–	–	–
EnDat 2.1 EQI 1130-G3	Q2	–	EZ	–	–	–	–
Resolvers	R0	EZ	EZ	–	–	–	–

The encoder and drive controller codes are a part of the type designation of the motor.

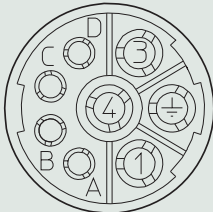
18.2.4 Connection assignment of the power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

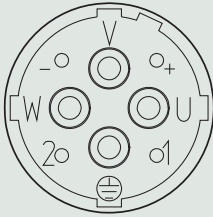
Plug connector size con.15

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	1	1TP1 (temperature sensor +)
	2	1TP2 (temperature sensor –)
	3	1BD1 (brake +)
	4	1BD2 (brake –)
	5	
		PE (grounding conductor)

Plug connector size con.23

Connection diagram	Pin	Connection
	1	1U1 (U phase)
	3	1W1 (W phase)
	4	1V1 (V phase)
	A	1TP1 (temperature sensor +)
	B	1TP2 (temperature sensor –)
	C	1BD1 (brake +)
	D	1BD2 (brake –)
		PE (grounding conductor)

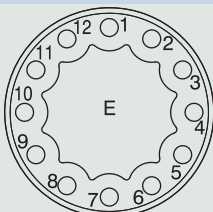
Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	1BD1 (brake +)
	-	1BD2 (brake -)
	1	1TP1 (temperature sensor +)
	2	1TP2 (temperature sensor -)
		PE (grounding conductor)

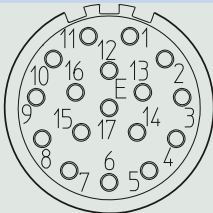
18.2.5 Connection assignment of the encoder plug connector

The size and terminal assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor.

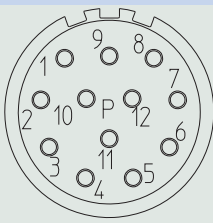
EnDat 2.2 digital encoder, plug connector size con.15

Connection diagram	Pin	Connection
	1	Up +
	2	Data +
	3	Data -
	4	Clock +
	5	Clock -
	6	
	7	0 V GND
	8	
	9	
	10	
	11	
	12	

EnDat 2.1 encoder with sin/cos incremental signals, plug connector size con.23

Connection diagram	Pin	Connection
	1	Up sense
	2	
	3	
	4	0 V sense
	5	
	6	
	7	Up +
	8	Clock +
	9	Clock -
	10	0 V GND
	11	
	12	B + (Sin +)
	13	B - (Sin -)
	14	Data +
	15	A + (Cos +)
	16	A - (Cos -)
	17	Data -

Resolver, plug connector size con.23

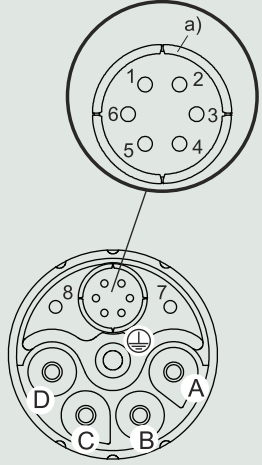
Connection diagram	Pin	Connection
	1	
	2	
	3	S4 Sin +
	4	S1 Cos –
	5	R2 Ref +
	6	
	7	S2 Sin –
	8	S3 Cos +
	9	R1 Ref –
	10	
	11	
	12	

18.2.6 Terminal assignment for plug connectors (One Cable Solution)

In the One Cable Solution design, the power and encoder lines are connected using a shared plug connector.

The temperature sensor of the motor is connected to the encoder internally. The measured values from the temperature sensor are transmitted via the log of the encoder.

Plug connector size con.23

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	D	
	1	Up +
	2	0 V GND
	3	Data +
	4	Data –
	5	Clock +
	6	Clock –
	7	1BD2 (brake –)
	8	1BD1 (brake +)
	⊕	PE (grounding conductor)
a) Coaxial shield to which the shield of the encoder cores is connected		

18.3 Connection to Control Techniques drive controllers

This chapter contains the information for connecting STOBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STOBER drive controllers. You can find all other information about STOBER synchronous servo motors in the chapter [► 17].

STOBER has taken the following measures to minimize the effort of commissioning STOBER motors connected to Control Techniques drive controllers and avoid errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- Parameter lists are available on request at systemsupport@stoerber.de.

18.3.1 Encoder

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EnDat 2.2 EQI 1131 Safety	S2	Inductive	4096	19 bit	524288	> 100	$\leq 15 \times 10^{-9}$
EnDat 2.2 EQN 1135 Safety	S3	Optical	4096	23 bit	8388608	> 100	$\leq 15 \times 10^{-9}$

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	$\leq 2 \times 10^{-6}$
EnDat 2.1 ECI 1118-G3	C2	Inductive	—	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$
EnDat 2.1 EQI 1130-G3	Q2	Inductive	4096	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$

Notes

- The encoder code is a part of the type designation of the motor.
- Safety = Safety-related position measuring system for use in safety-oriented applications.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.3.2 Resolver

In this chapter, you can find detailed technical data for the resolver that can be installed as an encoder in a STOBER motor.

Feature	Description
Code	R0
Number of poles	2
Input voltage $U_{1\text{eff}}$	7 V $\pm$ 5%
Input frequency f_1	10 kHz
Output voltage $U_{2,S1-S3}$	$K_{tr} \cdot U_{R1-R2} \cdot \cos \theta$
Output voltage $U_{2,S2-S4}$	$K_{tr} \cdot U_{R1-R2} \cdot \sin \theta$
Transformation ratio K_{tr}	0.5 $\pm$ 5%
Electrical fault	± 10 arcmin
MTTF	> 100 years
PFH	$\leq 10^{-9}$

18.3.3 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER synchronous servo motors with drive controllers from Control Techniques depending on the encoder model.

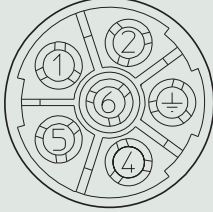
Drive controller		Unidrive EnDat 2.1/Resolver	Digitax OCS EnDat 2.2
Drive controller code		GE	HH
Connection plan ID		442555	443177
Encoder	Encoder code		
EnDat 2.2 EQI 1131 Safety	S2	–	EZ
EnDat 2.2 EQN 1135 Safety	S3	–	EZ
EnDat 2.1 EQN 1125	Q4	EZ	–
EnDat 2.1 ECI 1118-G3	C2	EZ	–
EnDat 2.1 EQI 1130-G3	Q2	EZ	–
Resolvers	R0	EZ	–

The encoder and drive controller codes are a part of the type designation of the motor.

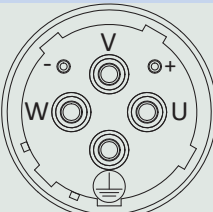
18.3.4 Terminal assignment of the power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

Plug connector size con.23

Connection diagram	Pin	Connection
	1	1U1 (U phase)
	2	1V1 (V phase)
	4	1W1 (W phase)
	5	1BD1 (brake +)
	6	1BD2 (brake –)
		PE (grounding conductor)

Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	1BD1 (brake +)
	–	1BD2 (brake –)
		PE (grounding conductor)

18.3.5 Terminal assignment of the encoder plug connector

The size and terminal assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor.

EnDat 2.1 encoder with sin/cos incremental signals, plug connector size con.23

Connection diagram	Pin	Connection
	1	1TP1 (temperature sensor +)
	2	1TP2 (temperature sensor -)
	3	
	4	
	5	
	6	
	7	
	8	Clock +
	9	Clock -
	10	A + (Cos +)
	11	Data +
	12	Data -
	13	A - (Cos -)
	14	B + (Sin +)
	15	B - (Sin -)
	16	Up +
	17	0 V GND

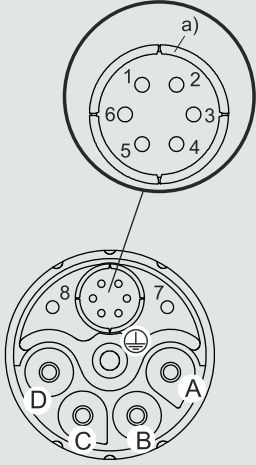
Resolver, plug connector size con.23

Connection diagram	Pin	Connection
	1	R2 Ref +
	2	R1 Ref -
	3	S3 Cos +
	4	S1 Cos -
	5	S4 Sin +
	6	S2 Sin -
	7	1TP1 (temperature sensor +)
	8	1TP2 (temperature sensor -)
	9	
	10	
	11	
	12	

18.3.6 Terminal assignment for plug connectors (One Cable Solution)

In the One Cable Solution design, the power and encoder lines are connected using a shared plug connector. The temperature sensor of the motor is connected to the encoder internally. The measured values from the temperature sensor are transmitted via the log of the encoder.

Plug connector size con.23

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	D	
	1	Up +
	2	0 V GND
	3	Data +
	4	Data -
	5	Clock +
	6	Clock -
	7	1BD2 (brake -)
	8	1BD1 (brake +)
		PE (grounding conductor)
a) Coaxial shield to which the shield of the encoder cores is connected		

18.4 Connection to Siemens drive controllers

This chapter contains the information for connecting STÖBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STÖBER drive controllers. You can find all other information about STÖBER synchronous servo motors in the chapter [► 17].

STÖBER has taken the following measures to minimize the effort of commissioning STÖBER motors connected to SINAMICS S120 drive controllers and avoid errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- Parameter lists are available on request at systemsupport@stoerber.de.

More information on commissioning EZ motors connected to SINAMICS S120 drive controllers can be found in the 443232_en document in the download area on the STÖBER website.

18.4.1 Encoders

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	$\leq 2 \times 10^{-6}$

Notes

- The encoder code is a part of the type designation of the motor.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.4.2 Resolver

In this chapter, you can find detailed technical data for the resolver that can be installed as an encoder in a STÖBER motor.

Feature	Description
Code	R0
Number of poles	2
Input voltage U_{1eff}	7 V $\pm$ 5%
Input frequency f_1	10 kHz
Output voltage $U_{z,S1-S3}$	$K_{tr} \cdot U_{R1-R2} \cdot \cos \theta$
Output voltage $U_{z,S2-S4}$	$K_{tr} \cdot U_{R1-R2} \cdot \sin \theta$
Transformation ratio K_{tr}	0.5 $\pm$ 5%
Electrical fault	± 10 arcmin
MTTF	> 100 years
PFH	$\leq 10^{-9}$

18.4.3 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER synchronous servo motors with drive controllers from Siemens depending on the encoder model.

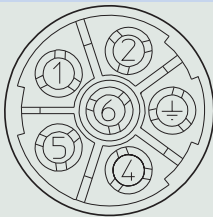
Drive controller		SINAMICS S120 EnDat 2.1/resolver
Drive controller code		FJ
Connection plan ID		442315
Encoder	Encoder code	
EnDat 2.1 EQN 1125	Q4	EZ
Resolvers	R0	EZ

The encoder and drive controller codes are a part of the type designation of the motor.

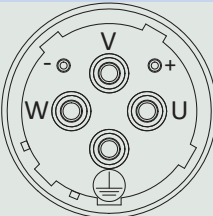
18.4.4 Connection assignment of the power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

Plug connector size con.23

Connection diagram	Pin	Connection
	1	1U1 (U phase)
	2	1V1 (V phase)
	4	1BD1 (brake +)
	5	1BD2 (brake –)
	6	1W1 (W phase)
		PE (grounding conductor)

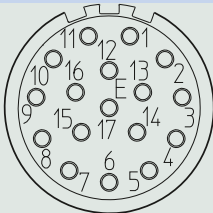
Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	1BD1 (brake +)
	-	1BD2 (brake –)
		PE (grounding conductor)

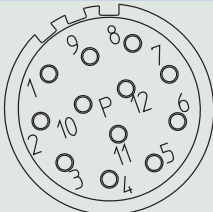
18.4.5 Connection assignment of the encoder plug connector

The size and terminal assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor.

EnDat 2.1 encoder with sin/cos incremental signals, plug connector size con.23

Connection diagram	Pin	Connection
	1	A + (Cos +)
	2	A - (Cos -)
	3	Data +
	4	
	5	Clock +
	6	
	7	0 V GND
	8	1TP1 (temperature sensor +)
	9	1TP2 (temperature sensor -)
	10	Up +
	11	B + (Sin +)
	12	B - (Sin -)
	13	Data -
	14	Clock -
	15	0 V sense
	16	Up sense
	17	

Resolver, plug connector size con.23

Connection diagram	Pin	Connection
	1	S4 Sin +
	2	S2 Sin -
	3	
	4	
	5	
	6	
	7	R1 Ref -
	8	1TP1 (temperature sensor +)
	9	1TP2 (temperature sensor -)
	10	R2 Ref +
	11	S3 Cos +
	12	S1 Cos -

18.5 Connection to Kollmorgen drive controllers

This chapter contains the information for connecting STÖBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STÖBER drive controllers. You can find all other information about STÖBER synchronous servo motors in the chapter [17].

STÖBER has taken the following measures to minimize the effort of commissioning STÖBER motors connected to Kollmorgen drive controllers and avoid errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- Parameter lists are available on request at systemsupport@stoerber.de.

More information on commissioning EZ motors connected to Kollmorgen drive controllers can be found in the 443236_en document in the download area on the STÖBER website.

18.5.1 Encoders

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EnDat 2.2 EQI 1131 Safety	S2	Inductive	4096	19 bit	524288	> 100	$\leq 15 \times 10^{-9}$

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	$\leq 2 \times 10^{-6}$

Notes

- The encoder code is a part of the type designation of the motor.
- Safety = Safety-related position measuring system for use in safety-oriented applications.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.5.2 Resolver

In this chapter, you can find detailed technical data for the resolver that can be installed as an encoder in a STÖBER motor.

Feature	Description
Code	R0
Number of poles	2
Input voltage U_{1eff}	7 V $\pm$ 5%
Input frequency f_1	10 kHz
Output voltage $U_{2,S1-S3}$	$K_{tr} \cdot U_{R1-R2} \cdot \cos \theta$
Output voltage $U_{2,S2-S4}$	$K_{tr} \cdot U_{R1-R2} \cdot \sin \theta$
Transformation ratio K_{tr}	0.5 $\pm$ 5%
Electrical fault	± 10 arcmin
MTTF	> 100 years
PFH	$\leq 10^{-9}$

18.5.3 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER synchronous servo motors with drive controllers from Kollmorgen depending on the encoder model.

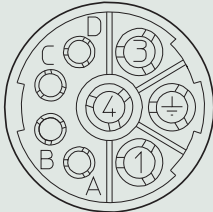
Drive controller		Servostar S300-700
Drive controller code		FE
Connection plan ID		442311
Encoder	Encoder code	
EnDat 2.2 EQI 1131 Safety	S2	EZ
EnDat 2.1 EQN 1125	Q4	EZ
Resolvers	R0	EZ

The encoder and drive controller codes are a part of the type designation of the motor.

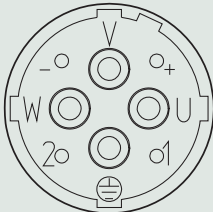
18.5.4 Connection assignment of the power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

Plug connector size con.23

Connection diagram	Pin	Connection
	1	1U1 (U phase)
	3	1W1 (W phase)
	4	1V1 (V phase)
	A	1BD1 (brake +)
	B	1BD2 (brake –)
	C	
	D	
		PE (grounding conductor)

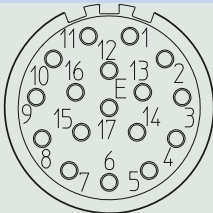
Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	1BD1 (brake +)
	-	1BD2 (brake –)
	1	
	2	
		PE (grounding conductor)

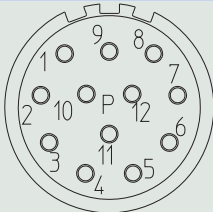
18.5.5 Connection assignment of the encoder plug connector

The size and terminal assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor.

EnDat 2.1 encoder with sin/cos incremental signals, plug connector size con.23

Connection diagram	Pin	Connection
	1	B – (Sin –)
	2	0 V GND
	3	A – (Cos –)
	4	Up +
	5	Data +
	6	
	7	1TP1 (temperature sensor +)
	8	Clock +
	9	B + (Sin +)
	10	0 V sense
	11	A + (Cos +)
	12	Up sense
	13	Data –
	14	1TP2 (temperature sensor -)
	15	Clock –
	16	
	17	

Resolver, plug connector size con.23

Connection diagram	Pin	Connection
	1	
	2	1TP1 (temperature sensor +)
	3	S4 Sin +
	4	S3 Cos +
	5	R2 Ref +
	6	1TP2 (temperature sensor -)
	7	S2 Sin –
	8	S1 Cos –
	9	R1 Ref –
	10	
	11	
	12	

18.6 Connection to Bosch drive controllers

This chapter contains the information for connecting STÖBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STÖBER drive controllers. You can find all other information about STÖBER synchronous servo motors in the chapter [\[► 17\]](#).

STÖBER has taken the following measures to minimize the effort of commissioning STÖBER motors connected to IndraDrive C/Cs drive controllers and avoid errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- Parameter lists are available on request at systemsupport@stoerber.de.

More information on commissioning EZ motors connected to IndraDrive C/Cs drive controllers can be found in the 443235_en document in the download area on the STÖBER website.

18.6.1 Encoders

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	$\leq 2 \times 10^{-6}$
EnDat 2.1 ECI 1118-G3	C2	Inductive	–	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$
EnDat 2.1 EQI 1130-G3	Q2	Inductive	4096	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$

Encoders with HIPERFACE interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
SKM36	H1	Optical	4096	12 bit	4096	Sin/cos 128	> 100	$\leq 5.4 \times 10^{-7}$

Notes

- The encoder code is a part of the type designation of the motor.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.6.2 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER synchronous servo motors with drive controllers from Bosch depending on the encoder model.

Drive controller		IndraDrive C/Cs
Drive controller code		FW
Connection plan ID		442445
Encoder	Encoder code	
EnDat 2.1 EQN 1125	Q4	EZ
EnDat 2.1 ECI 1118-G3	C2	EZ
EnDat 2.1 EQI 1130-G3	Q2	EZ
SKM36	H1	EZ

The encoder and drive controller codes are a part of the type designation of the motor.

18.6.3 Connection assignment of the power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

Plug connector size con.23

Connection diagram	Pin	Connection
	1	1U1 (U phase)
	3	1V1 (V phase)
	4	1W1 (W phase)
	A	1BD1 (brake +)
	B	1BD2 (brake –)
	C	1TP1 (temperature sensor +)
	D	1TP2 (temperature sensor –)
	⏏	PE (grounding conductor)

Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	1BD1 (brake +)
	–	1BD2 (brake –)
	1	1TP1 (temperature sensor +)
	2	1TP2 (temperature sensor –)
	⏏	PE (grounding conductor)

18.7 Connection to Beckhoff drive controllers

This chapter contains the information for connecting STÖBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STÖBER drive controllers. You can find all other information about STÖBER synchronous servo motors in the chapter [\[► 17\]](#).

STÖBER has taken the following measures to minimize the effort of commissioning STÖBER motors connected to AX5000 and AX8000 drive controllers and avoiding errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- Parameter lists are available on request at systemsupport@stoerber.de.

More information on commissioning EZ motors connected to Beckhoff drive controllers can be found in the 443185_en document in the download area on the STÖBER website.

18.7.1 Encoders

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EnDat 2.2 EQI 1131 Safety	S2	Inductive	4096	19 bit	524288	> 100	$\leq 15 \times 10^{-9}$
EnDat 2.2 EQN 1135 Safety	S3	Optical	4096	23 bit	8388608	> 100	$\leq 15 \times 10^{-9}$

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution	MTTF [years]	PFH [h]
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	$\leq 2 \times 10^{-6}$
EnDat 2.1 EQI 1130-G3	Q2	Inductive	4096	18 bit	262144	Sin/cos 16	> 100	$\leq 6 \times 10^{-7}$

Encoders with HIPERFACE DSL interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EDM35	H6	Optical	4096	20 bit	1048576	> 100	$\leq 31 \times 10^{-9}$

Notes

- The encoder code is a part of the type designation of the motor.
- Safety = Safety-related position measuring system for use in safety-oriented applications.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.7.2 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER synchronous servo motors with drive controllers from Beckhoff depending on the encoder model.

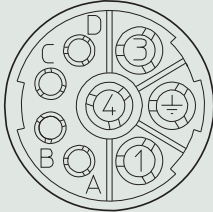
Drive controller		AX5000 8-pin ⁶ EnDat 2.1	AX8000/5000 OCS 9-pin ⁷ HIPERFACE DSL	AX5000 9-pin ⁸ EnDat 2.1	AX8000 9-pin ⁹ EnDat 2.2
Drive controller code		FM	HK	HN	HO
Connection plan ID		442318	443393	443451	443452
Encoder	Encoder code				
EnDat 2.2 EQI 1131 Safety	S2				EZ
EnDat 2.2 EQN 1135 Safety	S3				EZ
EnDat 2.1 EQN 1125	Q4	EZ		EZ	
EnDat 2.1 EQI 1130- G3	Q2			EZ	
EDM35	H6		EZ		

The encoder and drive controller codes are a part of the type designation of the motor.

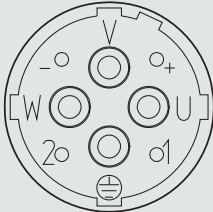
18.7.3 Terminal assignment of 8-pin power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

Plug connector size con.23

Connection diagram	Pin	Connection
	1	1U1 (U phase)
	3	1W1 (W phase)
	4	1V1 (V phase)
	A	1BD1 (brake +)
	B	1BD2 (brake –)
	C	1TP1 (temperature sensor +)
	D	1TP2 (temperature sensor –)
	⊕	PE (grounding conductor)

Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	1BD1 (brake +)
	-	1BD2 (brake –)
	1	1TP1 (temperature sensor +)
	2	1TP2 (temperature sensor –)
	⊕	PE (grounding conductor)

⁶ Design of the power connector

⁷ Design of the power connector

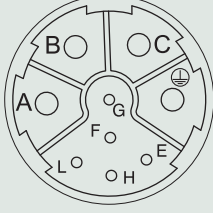
⁸ Design of the power connector

⁹ Design of the power connector

18.7.4 Terminal assignment of 9-pin power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

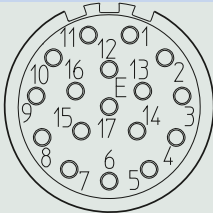
Plug connector size con.23

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	E	1TP2 (temperature sensor -)
	F	
	G	1BD1 (brake +)
	H	1TP1 (temperature sensor +)
	L	1BD2 (brake -)
	PE	PE (grounding conductor)

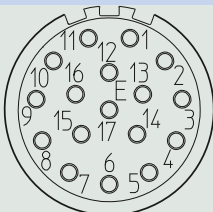
18.7.5 Connection assignment of the encoder plug connector

The size and terminal assignment of the encoder plug connectors depend on the type of encoder installed and the size of the motor.

EnDat 2.2 digital encoder, plug connector size con.23

Connection diagram	Pin	Connection
	1	
	2	0 V GND
	3	
	4	Up +
	5	Data +
	6	
	7	
	8	Clock +
	9	
	10	0 V sense
	11	
	12	Up sense
	13	Data -
	14	
	15	Clock -
	16	
	17	

EnDat 2.1 encoder with sin/cos incremental signals, plug connector size con.23

Connection diagram	Pin	Connection
	1	B – (Sin –)
	2	0 V GND
	3	A – (Cos –)
	4	Up +
	5	Data +
	6	
	7	
	8	Clock +
	9	B + (Sin +)
	10	0 V sense
	11	A + (Cos +)
	12	Up sense
	13	Data –
	14	
	15	Clock –
	16	
	17	

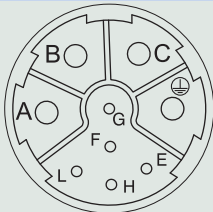
18.7.6 Terminal assignment for plug connectors (One Cable Solution)

In the One Cable Solution design, the power and encoder lines are connected using a shared plug connector.

The size of the plug connector depends on the size of the motor.

The temperature sensor of the motor is connected to the encoder internally. The measured values from the temperature sensor are transmitted via the log of the encoder.

Plug connector size con.23

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	E	DSL– (L)
	F	DSL shield
	G	1BD1
	H	DSL+ (H)
	L	1BD2
		PE (grounding conductor)

18.8 Connection to Allen-Bradley drive controllers

This chapter contains the information for connecting STOBER synchronous servo motors to drive controllers of the above-named manufacturer which differs from connecting to STOBER drive controllers. You can find all other information about STOBER synchronous servo motors in the chapter [\[► 17\]](#).

The STOBER EZ geared motors can be parameterized to Kinetix 5500/5700/6500 drive controllers fully automatically. EZ motors without an attached gearbox and other STOBER series are excluded.

STOBER has taken the following measures to minimize the effort of commissioning STOBER motors connected to Allen-Bradley drive controllers and avoid errors during parameterization:

- The commutation offset of the motor was set so that calibration by the customer is not necessary.
- The electronic nameplate of the motor was designed to be compatible with the Kinetix 5500/5700/6500.
- STOBER tests the motor connected to Allen-Bradley drive controllers before delivery to the customer.
- Parameter lists are available on request at systemsupport@stoerber.de.

More information on commissioning EZ motors connected to Allen-Bradley drive controllers can be found in the 443244_en document in the download area on the STOBER website.

18.8.1 Encoders

Information

The safety functionality of the encoders cannot be used in combination with Allen-Bradley drive controllers because, for applications with safety functionality, Allen-Bradley only permits its own motors.

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EnDat 2.2 EQN 1135 Safety	S3	Optical	4096	23 bit	8388608	> 100	$\leq 15 \times 10^{-9}$

Encoders with HIPERFACE DSL interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PFH [h]
EDM35	H6	Optical	4096	20 bit	1048576	> 100	$\leq 31 \times 10^{-9}$

Notes

- The encoder code is a part of the type designation of the motor.
- Safety = Safety-related position measuring system for use in safety-oriented applications.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

18.8.2 Possible combinations with drive controllers

The following table shows the possible combinations of STÖBER motors and geared motors with drive controllers from Allen-Bradley depending on the encoder model.

Information					
		KINETIX 5500 OCS	KINETIX 5700 OCS	KINETIX 5700	KINETIX 6500
		HIPERFACE DSL	HIPERFACE DSL	EnDat 2.2	EnDat 2.2
Drive controller code		HB	GD	HA	GC
Connection plan ID		443169	442449	443096	442448
Encoder	Encoder code				
EnDat 2.2 EQN	S3	–	–	EZ	EZ
1135 Safety					
EDM35	H6	EZ	EZ	–	–

The encoder and drive controller codes are a part of the type designation of the motor.

18.8.3 Terminal assignment of the power plug connector

The size and connection diagram of the power plug connector depend on the size of the motor.

Plug connector size con.23

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	F	MBRK + (1BD1)
	G	MBRK – (1BD2)
	E	
	H	
	L	
	⏏	PE (grounding conductor)

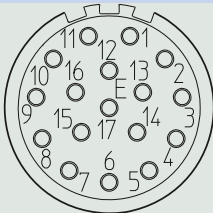
Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	+	MBRK + (1BD1)
	–	MBRK – (1BD2)
	1	
	2	
	⏏	PE (grounding conductor)

18.8.4 Terminal assignment of the encoder plug connector

The size and terminal assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor.

EnDat 2.2 digital encoder, plug connector size con.23

Connection diagram	Pin	Connection
	1	
	2	
	3	
	4	
	5	DATA +
	6	DATA –
	7	CLK + (Clock +)
	8	CLK – (Clock –)
	9	EPWR_5V (Up +)
	10	ECOM (0 V)
	11	
	12	
	13	TS + (1TP1)
	14	TS – (1TP2)
	15	
	16	
	17	

18.8.5 Terminal assignment for plug connectors (One Cable Solution)

In the One Cable Solution design, the power and encoder lines are connected using a shared plug connector.

The size of the plug connector depends on the size of the motor.

The temperature sensor of the motor is connected to the encoder internally. The measured values from the temperature sensor are transmitted via the log of the encoder.

Plug connector size con.23

Connection diagram	Pin	Connection
	A	1U1 (U phase)
	B	1V1 (V phase)
	C	1W1 (W phase)
	E	DATA + (DSL +)
	F	MBRK + (1BD1)
	G	MBRK - (1BD2)
	H	DATA - (DSL -)
	L	
		PE (grounding conductor)

Plug connector size con.40

Connection diagram	Pin	Connection
	U	1U1 (U phase)
	V	1V1 (V phase)
	W	1W1 (W phase)
	N	
	+	
	-	
	1	MBRK + (1BD1)
	2	MBRK - (1BD2)
	H	DATA - (DSL -)
	L	DATA + (DSL +)
		PE (grounding conductor)

a) Coaxial shield to which the DSL shield is connected