27 Connecting to drive controllers of third-party manufacturers

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27.1   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 corresponding chapters of this catalog.

27.1.1   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.
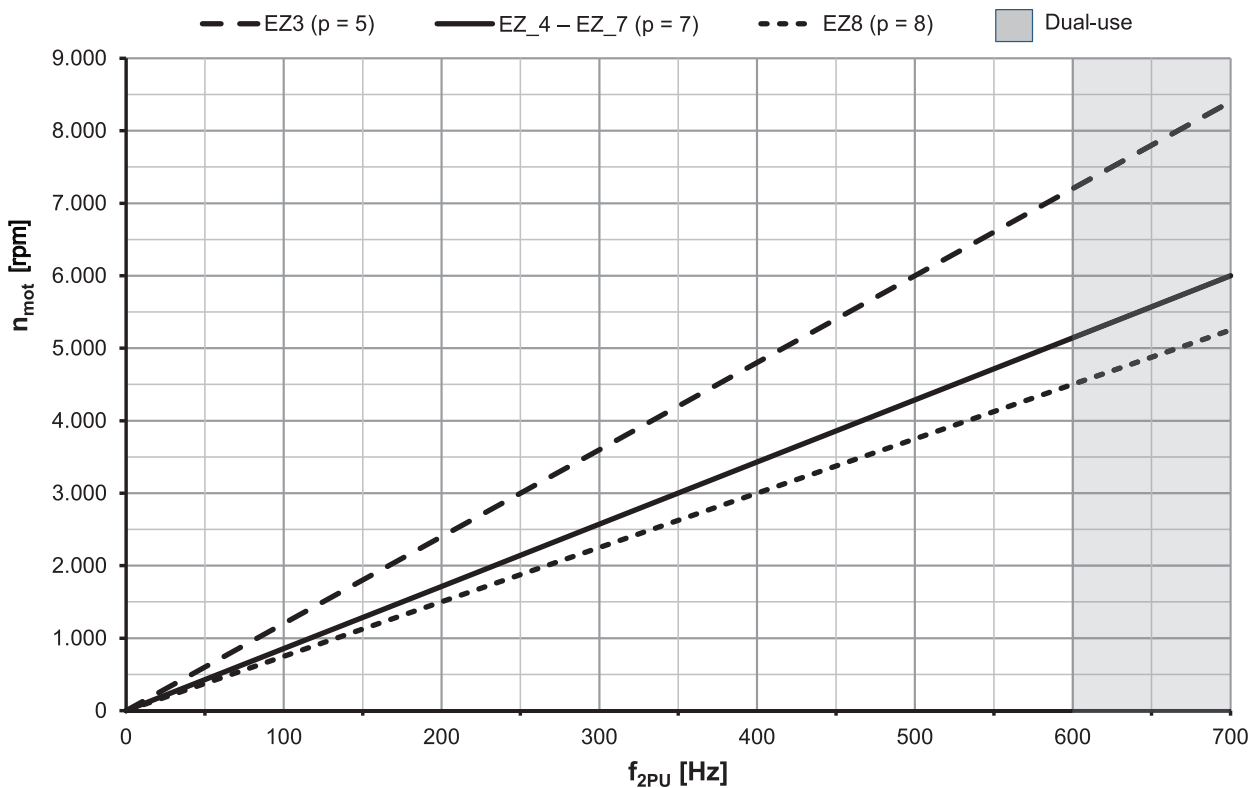

Fig. 1: Speed/frequency graph for EZ motors

27.1.2   Plug connectors

STOBER synchronous servo motors are equipped with angled, round plug connectors (INTERCONTEC brand) for power and encoder connection in the standard version. 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, turn the motor plug connectors accordingly. Details regarding the position of the plug connector for the forced ventilation unit can be found in the "Dimensional drawings" chapter.

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

Turning ranges of plug connectors (EZ3 motors)
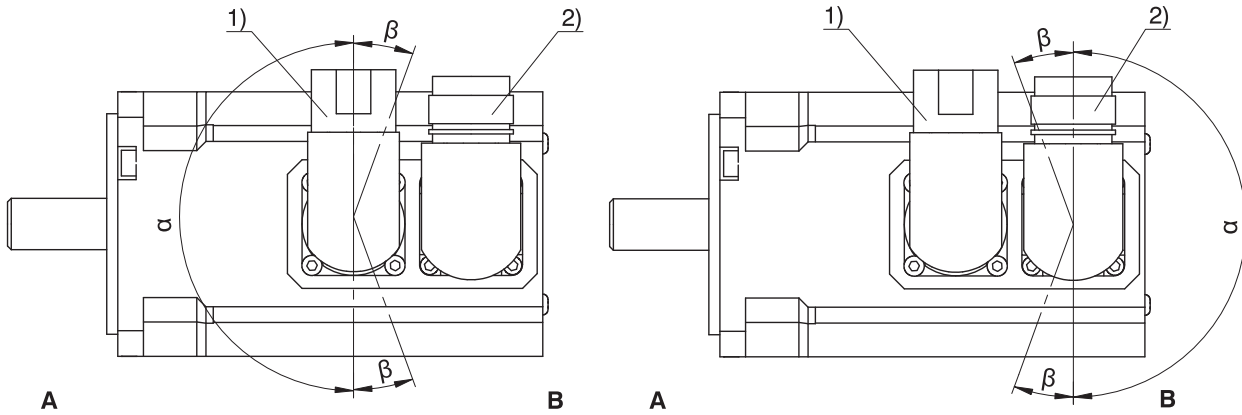
Turning ranges of plug connectors (motors EZ4 – EZ8, EZHD, EZHP, EZM, EZS)
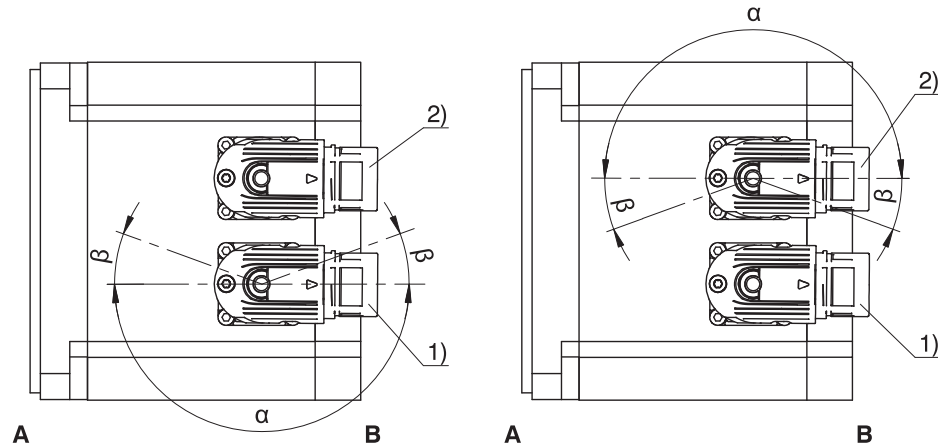
| 1 | Power plug connector | 2 | Encoder plug connector |
| A | Attachment or output side of the motor | B | Rear side of the motor |

Power plug connector features

Motor type	Size	Connection	Turning range	
			α	β
EZ3 – EZ5, EZ701, EZ703 EZHD_4, EZHD_5, EZHD_711 – EZHD_713 EZHP_5, EZHP_711 – EZHP_713 EZM, EZS	con.23	Quick lock	180°	20°
EZ705, EZ802, EZ803, EZ805U EZHD_715, EZHP_715	con.40	Quick lock	180°	20°
EZ805B	con.58	Screw thread[1]	0°	0°

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[1] Specify alignment on side A or B in the purchase order.

Encoder plug connector features

Motor type	Size	Connection	Turning range	
			α	β
EZ3 – EZ7, EZ802, EZ803, EZ805U EZHD, EZHP, EZM, EZS	con.23[2]	Quick lock	180°	20°
EZ805B	con.23[3]	Quick lock	180°	0°

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).

27.1.3 Connection cables

The plug connectors and connection assignment of STOBER synchronous servo motors are designed for connecting to drive controllers from third-party manufacturers in such 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 Rexroth cannot be used, STOBER offers suitable cables for this purpose. More detailed information is available from your STOBER customer consultant.
- Ensure that the cable quality and cable design is suitable for the ambient conditions at the installation location.

Electromagnetic compatibility (EMC)

Ensure compliance with statutory EMC requirements for the drive system at the installation location.

Connect the cable shields on both ends of the connection cable. Connect the grounding screw of the synchronous servo motor with the grounding at the installation location.

Power cables

Operation with unsuitable power cables may lead to inadmissibly high voltage peaks, which could damage the motor. For this reason, the capacitances and inductances must match the motor. Recommended values can be found in the table below.

The conductor cross-section of the power cable must be designed appropriately for the stall current of the motor. Details on this can be found in the table below.

Conductor cross-section [mm²]	1.0	1.5	2.5	4.0	6.0	10.0	16.0	25.0
Nominal current [A]	12.5	15.0	20.0	28.3	35.8	49.2	66.7	90.0
Maximum capacitance in accordance with test type A (core/core) [nF/km]	45	55	65	60	70	75	75	Values on request
Maximum capacitance in accordance with test type B (core/residual) [nF/km]	250	300	325	260	300	350	360	Values on request
Maximum inductance (core/core) [μH/km]	800	700	700	600	650	600	570	Values on request

Notes

- The maximum capacitance is specified in accordance with DIN VDE 0472-504. Specifications in accordance with EN 50289-1-5 in preparation.
- The maximum inductance is specified in accordance with EN 50289-1-12.

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[2] con.15 for connecting to B&R ACOPOSmulti with EnDat 2.2 Interface (drive controller type code GG).

[3] con.15 for connecting to B&R ACOPOSmulti with EnDat 2.2 Interface (drive controller type code GG).

Encoder cables

When operating with unsuitable encoder cables, encoder signals can no longer be transferred free of interference. Note the recommended values in the following table.

Signal shape	Digital		Sin-Cos			Resolver	
Conductor cross-section [mm²]	0.14	0.25	0.14	0.25	0.37	0.14	0.25
Maximum capacitance in accordance with test type A (core/core) [nF/km]	30	35	60	110	130	40	50
Maximum capacitance in accordance with test type B (core/remainder) [nF/km]	110	130	300	300	325	300	300
Maximum inductance (core/core) [µH/km]	800	800	650	700	700	800	800
Shielding type of cable	Tin-plated copper braiding						
Shielding type of conductor pairs	–		Tin-plated copper braiding			Film + braiding	
Cover	≥ 90 %		≥ 80 %			≥ 80 %	

Notes

- The maximum capacitance is specified in accordance with DIN VDE 0472-504. Specifications in accordance with EN 50289-1-5 in preparation.
- The maximum inductance is specified in accordance with EN 50289-1-12.

27.2 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 respective chapter of this catalog.

27.2.1 Encoders

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution
EQI 1131 FMA	M4	Inductive	4096	19 bit	524288
EQI 1131	Q6	Inductive	4096	19 bit	524288
EQN 1135 FMA	M3	Optical	4096	23 bit	8388608
EQN 1135	Q5	Optical	4096	23 bit	8388608
ECN 1123 FMA	M1	Optical	–	23 bit	8388608
ECN 1123	C7	Optical	–	23 bit	8388608
ECI 1118-G2	C5	Inductive	–	18 bit	262144

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution
ECI 119	C4	Inductive	–	19 bit	524288	Sin/Cos 32
EQN 1125 FMA	M2	Optical	4096	13 bit	8192	Sin/Cos 512
EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/Cos 512
ECN 1113 FMA	M0	Optical	–	13 bit	8192	Sin/Cos 512
ECN 1113	C6	Optical	–	13 bit	8192	Sin/Cos 512

Notes

- The encoder code is a part of the type designation of the motor.
- FMA = Version with fault exclusion for mechanical coupling.
- Encoders with EnDat 2.2 interface and in the FMA design are ready for operation as a one-encoder solution on a safety-related position measuring system with an EnDat 2.2 interface
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

27.2.2   Possible combinations with drive controllers

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

Drive controller		ACOPOS	ACOPOSmulti (with EnDat 2.1 interface)	ACOPOSmulti (with EnDat 2.2 interface)
Drive controller code		FG	FV	GG
Connection plan ID		442313	442444	442677
Encoder	Encoder code			
EQI 1131 FMA	M4	–	–	EZ, EZS
EQI 1131	Q6	–	–	EZ, EZS
EQN 1135 FMA	M3	–	–	EZ, EZS
EQN 1135	Q5	–	–	EZ, EZS
ECN 1123 FMA	M1	–	–	EZ, EZS
ECN 1123	C7	–	–	EZ, EZS
ECI 1118-G2	C5	–	–	EZ, EZS
ECI 119	C4	–	EZHD, EZHP, EZM	–
EQN 1125 FMA	M2	EZ, EZS	EZ, EZS	–
EQN 1125	Q4	EZ, EZS	EZ, EZS	–
ECN 1113 FMA	M0	–	EZ, EZS	–
ECN 1113	C6	–	EZ, EZS	–
Resolver	R0	EZ, EZS	EZ, EZS	–

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

27.2.3   Connection assignment of the power plug connector

The size and connection plan of the power plug connector depend on the size of the motor. The colors of the connecting wires inside the motor are specified in accordance with IEC 60757.

Plug connector size con.23 (1)

Connection diagram	Pin	Connection	Color
	1	U phase	black
	3	W phase	red
	4	V phase	blue
	A	Temperature sensor +	
	B	Temperature sensor –	
	C	Brake +	red
	D	Brake –	black
	⏚	Grounding conductor	green-yellow

Plug connector size con.40 (1.5)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	1	Temperature sensor +	
	2	Temperature sensor –	
	⏚	Grounding conductor	green-yellow
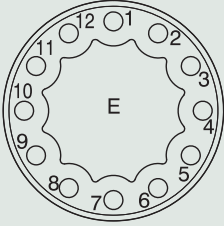
Plug connector size con.58 (3)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	−	Brake −	black
	1	Temperature sensor +	
	2	Temperature sensor −	
	⏚	Grounding conductor	green-yellow
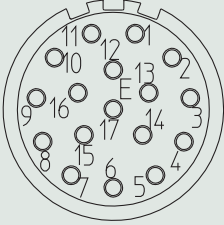
27.2.4   Connection assignment of the encoder plug connector

The size and connection assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor. The colors of the connecting wires inside the motor are specified in accordance with IEC 60757.

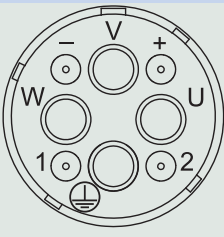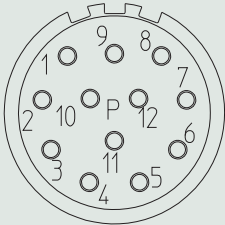**EnDat 2.2 digital encoder, plug connector size con.15**

Connection diagram	Pin	Connection	Color
	1	Up +	brown green
	2	Data +	grey
	3	Data −	pink
	4	Clock +	violet
	5	Clock −	yellow
	6		
	7	0 V GND	white green
	8		
	9		
	10		
	11		
	12		

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

Connection diagram	Pin	Connection	Color
	1	Up sense	blue
	2		
	3		
	4	0 V sense	white
	5		
	6		
	7	Up +	brown green
	8	Clock +	violet
	9	Clock −	yellow
	10	0 V GND	white green
	11		
	12	B + (Sin +)	blue black
	13	B − (Sin −)	red black
	14	Data +	grey
	15	A + (Cos +)	green black
	16	A − (Cos −)	yellow black
	17	Data −	pink

Resolver, plug connector size con.23

Connection diagram	Pin	Connection	Color
	1		
	2		
	3	S4 Sin +	blue
	4	S1 Cos −	red
	5	R2 Ref +	yellow white
	6		
	7	S2 Sin −	yellow
	8	S3 Cos +	black
	9	R1 Ref −	red white
	10		
	11		
	12		

27.3 Connection to Siemens 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 respective chapter of this catalog.

27.3.1 EIB 3392S interface

The EIB 3392S interface made by Heidenhain enables the connection of EnDat 2.2 encoders to Siemens SINAMICS S120 drive controllers using the powerful DRIVE-CLiQ system interface. STOBER offers the EIB 3392S interface with the ID 1250663-01. In this design, the connector and the terminal assignment on the EnDat 2.2 side are adapted to STOBER synchronous servo motors so that the interface can be connected and commissioned without additional work.

Advantages

- Support for all DRIVE-CLiQ interface options
- Compact and robust industrial design
- Easy, fast commissioning
- No space or wiring necessary in the control cabinet
- Because the DRIVE-CLiQ electronics are located outside of the motor, it is not necessary to reduce the performance data of the motor based on the temperature.

Features

Feature	Description
Surrounding temperature for operation	0 °C to 60 °C
Protection class	IP 65
Bending radius of the interface connection cable	75 mm, freely movable
	20 mm, permanently installed

The EIB 3392S interface is connected to the plug connector of the motor on the EnDat 2.2 side. On the DRIVE-CLiQ side, an original Siemens encoder cable with a length of up to 30 m can be connected.

The EIB 3392S interface may only be connected to motors with a Pt1000 temperature sensor. The temperature sensor is connected to the EnDat 2.2 encoder inside the motor. The EIB 3392S interface transmits the values from the temperature sensor over the DRIVE-CLiQ interface unchanged.

The housing of the EIB 3392S must be attached at the installation location. A cable clip can be used for this purpose (see dimensional drawing).

Functional safety

Depending on the connected encoder and the downstream electronics, the EIB 3392S can be used in safety-oriented applications up to Safety Integrity Level (SIL) 2 in accordance with EN 61508-1 / EN 61800-5-2 or up to Category 3, PL d in accordance with EN ISO 13849-1.

The probability of a failure per hour (PFH) is 26×10^{-9} for an installation altitude ≤ 1000 m above sea level.

The EIB 3392S interface does not have any effect on the safe position that can be implemented by the motor encoder and the downstream electronics.

27.3.1.1 Dimensional drawing
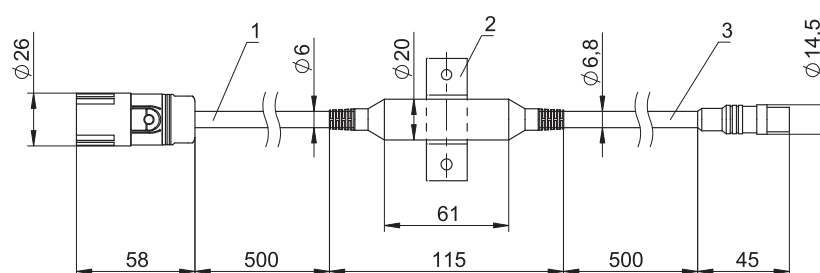
1	Black cable color (EnDat 2.2 side)	2	Cable clip (not included in the scope of delivery)
3	Green cable color (DRIVE-CLiQ side)		

27.3.1.2   Terminal assignment

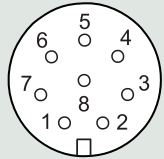| EnDat 2.2 side, con.23 plug connector			DRIVE-CLiQ side, M12 plug connector		
Connection diagram	Pin	Connection	Connection	Pin	Connection diagram
	1	Clock +	Up +	1	
	2			2	
	3		RXP	3	
	4		RXN	4	
	5	Data –	0 V GND	5	
	6	Data +	TXN	6	
	7		TXP	7	
	8	Clock –		8	
	9				
	10	0 V GND			
	11				
	12	Up +			

27.3.2   Encoders

Encoders with EnDat 2.2 interface

Encoders with an EnDat 2.2 interface can be connected to Siemens S120 drive controllers and operated using the EIB 3392S interface.

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution
EQI 1131 FMA	M4	Inductive	4096	19 bit	524288
EQI 1131	Q6	Inductive	4096	19 bit	524288
EQN 1135 FMA	M3	Optical	4096	23 bit	8388608
EQN 1135	Q5	Optical	4096	23 bit	8388608
ECN 1123 FMA	M1	Optical	–	23 bit	8388608
ECN 1123	C7	Optical	–	23 bit	8388608
ECI 119-G2	C9	Inductive	–	19 bit	524288

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	Periods per revolution
ECI 119	C4	Inductive	–	19 bit	524288	Sin/Cos 32
EQN 1125 FMA	M2	Optical	4096	13 bit	8192	Sin/Cos 512
EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/Cos 512
ECN 1113 FMA	M0	Optical	–	13 bit	8192	Sin/Cos 512
ECN 1113	C6	Optical	–	13 bit	8192	Sin/Cos 512

Notes

- The encoder code is a part of the type designation of the motor.
- FMA = Version with fault exclusion for mechanical coupling.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

27.3.3   Possible combinations with drive controllers

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

Encoders with an EnDat 2.2 interface can be connected to Siemens S120 drive controllers and operated using the EIB 3392S interface.
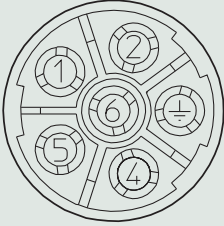
Drive controller		SINAMICS S120 (with EnDat 2.1 and resolver interface)	SINAMICS S120 (with DRIVE-CLiQ interface)
Drive controller code		FJ	GQ
Connection plan ID		442315	443049
Encoder	Encoder code		
EQI 1131 FMA	M4	–	EZ, EZS
EQI 1131	Q6	–	EZ, EZS
EQN 1135 FMA	M3	–	EZ, EZS
EQN 1135	Q5	–	EZ, EZS
ECN 1123 FMA	M1	–	EZ, EZS
ECN 1123	C7	–	EZ, EZS
ECI 119-G2	C9	–	EZHD, EZHP, EZM
ECI 119	C4	EZHD, EZHP, EZM	–
EQN 1125 FMA	M2	EZ, EZS	–
EQN 1125	Q4	EZ, EZS	–
ECN 1113 FMA	M0	EZ, EZS	–
ECN 1113	C6	EZ, EZS	–
Resolver	R0	EZ, EZS	–

The encoder and drive controller codes are a part of the type designation of the motor.
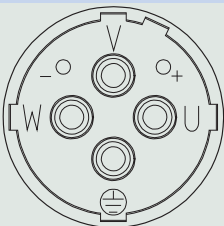
27.3.4   Connection assignment of the power plug connector

The size and connection plan of the power plug connector depend on the size of the motor. The colors of the connecting wires inside the motor are specified in accordance with IEC 60757.

Plug connector size con.23 (1)

Connection diagram	Pin	Connection	Color
	1	U phase	black
	2	V phase	blue
	4	Brake +	red
	5	Brake –	black
	6	W phase	red
	⏚	Grounding conductor	green-yellow

Plug connector size con.40 (1.5)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	⏚	Grounding conductor	green-yellow

27.3.5   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.23

Encoders with an EnDat 2.2 interface can be connected to Siemens S120 drive controllers and operated using the EIB 3392S interface.

Connection diagram	Pin	Connection	Color
	1	Clock +	violet
	2		
	3		
	4		
	5	Data −	pink
	6	Data +	grey
	7		
	8	Clock −	yellow
	9		
	10	0 V GND	white green
	11		
	12	Up +	brown green

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

Connection diagram	Pin	Connection	Color
	1	A + (Cos +)	green black
	2	A − (Cos −)	yellow black
	3	Data +	grey
	4		
	5	Clock +	violet
	6		
	7	0 V GND	white green
	8	Temperature sensor +	black/brown
	9	Temperature sensor −	white/white
	10	Up +	brown green
	11	B + (Sin +)	blue black
	12	B − (Sin −)	red black
	13	Data −	pink
	14	Clock −	yellow
	15	0 V sense	white
	16	Up sense	blue
	17		

Resolver, plug connector size con.23

Connection diagram	Pin	Connection	Color
	1	S4 Sin +	blue
	2	S2 Sin −	yellow
	3		
	4		
	5		
	6		
	7	R1 Ref −	red white
	8	Temperature sensor +	black/brown
	9	Temperature sensor −	white/white
	10	R2 Ref +	yellow white
	11	S3 Cos +	black
	12	S1 Cos −	red

27.4   Connection to Kollmorgen 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 respective chapter of this catalog.

27.4.1   Encoders

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolu-tion	Position values per revolution	Periods per rev-olution
ECI 119	C4	Inductive	–	19 bit	524288	Sin/Cos 32
EQN 1125 FMA	M2	Optical	4096	13 bit	8192	Sin/Cos 512
EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/Cos 512

Notes

- The encoder code is a part of the type designation of the motor.
- FMA = Version with fault exclusion for mechanical coupling.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

27.4.2   Possible combinations with drive controllers

The following table shows the possible combinations of STOBER synchronous servo motors with drive con-
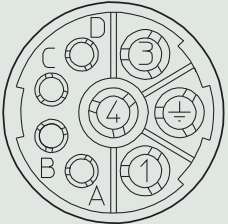trollers from Kollmorgen depending on the encoder model.

Drive controller		Servostar S300/S400/S600/S700
Drive controller code		FE
Connection plan ID		442311
Encoder	**Encoder code**	
ECI 119	C4	EZHD, EZHP, EZM
EQN 1125 FMA	M2	EZ, EZS
EQN 1125	Q4	EZ, EZS
Resolver	R0	EZ, EZS

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

27.4.3   Connection assignment of the power plug connector

The size and connection plan of the power plug connector depend on the size of the motor. The colors of
the connecting wires inside the motor are specified in accordance with IEC 60757.

Plug connector size con.23 (1)

Connection diagram	Pin	Connection	Color
	1	U phase	black
	3	W phase	red
	4	V phase	blue
	A	Brake +	red
	B	Brake –	black
	C		
	D		
	⏚	Grounding conductor	green-yellow

Plug connector size con.40 (1.5)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	1		
	2		
	⏚	Grounding conductor	green-yellow

Plug connector size con.58 (3)

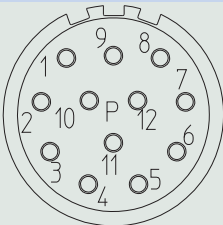| Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	1		
	2		
	⏚	Grounding conductor	green-yellow

27.4.4 Connection assignment of the encoder plug connector

The size and connection 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	Color
	1	B – (Sin –)	red black
	2	0 V GND	white green
	3	A – (Cos –)	yellow black
	4	Up +	brown green
	5	Data +	grey
	6		
	7	Temperature sensor +	black/brown
	8	Clock +	violet
	9	B + (Sin +)	blue black
	10	0 V sense	white
	11	A + (Cos +)	green black
	12	Up sense	blue
	13	Data –	pink
	14	Temperature sensor –	white/white
	15	Clock –	yellow
	16		
	17		

Resolver, plug connector size con.23

Connection diagram	Pin	Connection	Color
	1		
	2	Temperature sensor +	black/brown
	3	S4 Sin +	blue
	4	S1 Cos −	red
	5	R2 Ref +	yellow white
	6	Temperature sensor −	white/white
	7	S2 Sin −	yellow
	8	S3 Cos +	black
	9	R1 Ref −	red white
	10		
	11		
	12		

27.5   Connection to Bosch Rexroth 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 respective chapter of this catalog.

27.5.1   Encoders

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolu-tion	Position values per revolution	Periods per rev-olution
ECI 119	C4	Inductive	–	19 bit	524288	Sin/Cos 32
EQN 1125 FMA	M2	Optical	4096	13 bit	8192	Sin/Cos 512
EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/Cos 512
ECN 1113 FMA	M0	Optical	–	13 bit	8192	Sin/Cos 512
ECN 1113	C6	Optical	–	13 bit	8192	Sin/Cos 512

Encoders with HIPERFACE interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolu-tion	Position values per revolution	Periods per rev-olution
SKM36	H1	Optical	4096	–	–	Sin/Cos 128

Notes

- The encoder code is a part of the type designation of the motor.
- FMA = Version with fault exclusion for mechanical coupling.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

27.5.2   Possible combinations with drive controllers

The following table shows the possible combinations of STOBER synchronous servo motors with drive controllers from Bosch Rexroth depending on the encoder model.
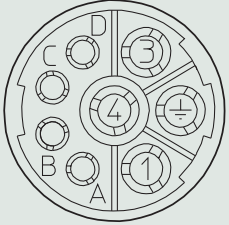
Drive controller		IndraDrive C/Cs	IndraDrive Mi	IndraDrive C/Cs
Drive controller code		FW	FW	GH
DC link voltage U_{ZK}		540 V	540 V	310 V
Connection plan ID		442445	442445	442678
Encoder	**Encoder code**			
ECI 119	C4	EZHD, EZHP, EZM	–	EZHD, EZHP, EZM
EQN 1125 FMA	M2	EZ, EZS	–	EZ, EZS
EQN 1125	Q4	EZ, EZS	–	EZ, EZS
ECN 1113 FMA	M0	EZ, EZS	–	EZ, EZS
ECN 1113	C6	EZ, EZS	–	EZ, EZS
SKM36	H1	–	EZ, EZS	–

The encoder and drive controller codes are a part of the type designation of the motor.
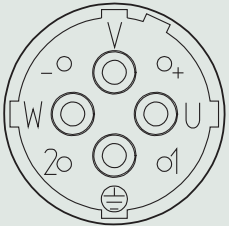
27.5.3   Connection assignment of the power plug connector

The size and connection plan of the power plug connector depend on the size of the motor. The colors of the connecting wires inside the motor are specified in accordance with IEC 60757.
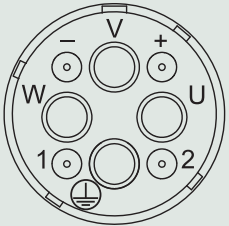
Plug connector size con.23 (1)

Connection diagram	Pin	Connection	Color
	1	U phase	black
	3	V phase	blue
	4	W phase	red
	A	Brake +	red
	B	Brake –	black
	C	Temperature sensor +	
	D	Temperature sensor –	
	⏚	Grounding conductor	green-yellow

Plug connector size con.40 (1.5)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	1	Temperature sensor +	
	2	Temperature sensor –	
	⏚	Grounding conductor	green-yellow

Plug connector size con.58 (3)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	1	Temperature sensor +	
	2	Temperature sensor –	
	⏚	Grounding conductor	green-yellow

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27.5.4   Connection assignment of the encoder plug connector

The size and connection assignment of the encoder plug connectors depend on the model of encoder installed and the size of the motor. The colors of the connecting wires inside the motor are specified in accordance with IEC 60757.

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

This connection assignment only applies to the IndraDrive C/Cs drive controller.

Connection diagram	Pin	Connection	Color
	1	Up sense	blue
	2		
	3		
	4	0 V sense	white
	5		
	6		
	7	Up +	brown green
	8	Clock +	violet
	9	Clock −	yellow
	10	0 V GND	white green
	11		
	12	B + (Sin +)	blue black
	13	B − (Sin −)	red black
	14	Data +	grey
	15	A + (Cos +)	green black
	16	A − (Cos −)	yellow black
	17	Data −	pink

Hiperface encoder, plug connector size con.23

Connection diagram	Pin	Connection	Color
	1	Us	red
	2	0 V GND	blue
	3	REFSIN	brown
	4	REFCOS	black
	5	Data +	grey
	6	Data −	green
	7	+ SIN	white
	8	+ COS	pink
	9		
	10		
	11		
	12		

27.6   Connection to Beckhoff 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 respective chapter of this catalog.

27.6.1   Encoders

Encoders with EnDat 2.1 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolu-tion	Position values per revolution	Periods per rev-olution
ECI 119	C4	Inductive	–	19 bit	524288	Sin/Cos 32
EQN 1125 FMA	M2	Optical	4096	13 bit	8192	Sin/Cos 512
EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/Cos 512
ECN 1113 FMA	M0	Optical	–	13 bit	8192	Sin/Cos 512
ECN 1113	C6	Optical	–	13 bit	8192	Sin/Cos 512

Notes

- The encoder code is a part of the type designation of the motor.
- FMA = Version with fault exclusion for mechanical coupling.
- Multiple revolutions of the motor shaft can be recorded only using multi-turn encoders.

27.6.2   Possible combinations with drive controllers

The following table shows the possible combinations of STOBER synchronous servo motors with drive controllers from Beckhoff depending on the encoder model.
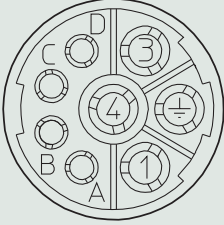
Drive controller		AX5000
Drive controller code		FM
Connection plan ID		442318
Encoder	**Encoder code**	
ECI 119	C4	EZHD, EZHP, EZM
EQN 1125 FMA	M2	EZ, EZS
EQN 1125	Q4	EZ, EZS
ECN 1113 FMA	M0	EZ, EZS
ECN 1113	C6	EZ, EZS

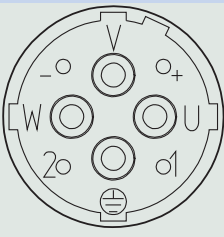The encoder and drive controller codes are a part of the type designation of the motor.

27.6.3   Connection assignment of the power plug connector

The size and connection plan of the power plug connector depend on the size of the motor. The colors of the connecting wires inside the motor are specified in accordance with IEC 60757.

Plug connector size con.23 (1)

Connection diagram	Pin	Connection	Color
	1	U phase	black
	3	W phase	red
	4	V phase	blue
	A	Brake +	red
	B	Brake –	black
	C	Temperature sensor +	
	D	Temperature sensor –	
	⏚	Grounding conductor	green-yellow

Plug connector size con.40 (1.5)

Connection diagram	Pin	Connection	Color
	U	U phase	black
	V	V phase	blue
	W	W phase	red
	+	Brake +	red
	–	Brake –	black
	1	Temperature sensor +	
	2	Temperature sensor –	
	⏚	Grounding conductor	green-yellow

27.6.4   Connection assignment of the encoder plug connector

The size and connection 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	Color
	1	B – (Sin –)	red black
	2	0 V GND	white green
	3	A – (Cos –)	yellow black
	4	Up +	brown green
	5	Data +	grey
	6		
	7		
	8	Clock +	violet
	9	B + (Sin +)	blue black
	10	0 V sense	white
	11	A + (Cos +)	green black
	12	Up sense	blue
	13	Data –	pink
	14		
	15	Clock –	yellow
	16		
	17		