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 core 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.

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 respective chapter of this catalog.

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.

18.2.1 Encoders

Encoders with EnDat 2.2 interface

Encoder model	Code	Measuring method	Recordable revolutions	Resolution	Position values per revolution	MTTF [years]	PHF [h]
EnDat 2.2 EQI 1131 FMA	M4	Inductive	4096	19 bit	524288	> 100	≤ 15 × 10^{-9}
EnDat 2.2 EQI 1131	Q6	Inductive	4096	19 bit	524288	> 100	≤ 15 × 10^{-9}
EnDat 2.2 EQN 1135 FMA	M3	Optical	4096	23 bit	8388608	> 100	≤ 15 × 10^{-9}
EnDat 2.2 EQN 1135	Q5	Optical	4096	23 bit	8388608	> 100	≤ 15 × 10^{-9}
EnDat 2.2 ECN 1123 FMA	M1	Optical	–	23 bit	8388608	> 100	≤ 15 × 10^{-9}
EnDat 2.2 ECN 1123	C7	Optical	–	23 bit	8388608	> 100	≤ 15 × 10^{-9}
EnDat 2.2 ECI 1118-G2	C5	Inductive	–	18 bit	262144	> 76	≤ 1.5 × 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]	PHF [h]
EnDat 2.1 EQN 1125 FMA	M2	Optical	4096	13 bit	8192	Sin/cos 512	> 57	≤ 2 × 10^{-6}
EnDat 2.1 EQN 1125	Q4	Optical	4096	13 bit	8192	Sin/cos 512	> 57	≤ 2 × 10^{-6}
EnDat 2.1 ECN 1113 FMA	M0	Optical	–	13 bit	8192	Sin/cos 512	> 57	≤ 2 × 10^{-6}
EnDat 2.1 ECN 1113	C6	Optical	–	13 bit	8192	Sin/cos 512	> 57	≤ 2 × 10^{-6}

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.

18.2.2 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.

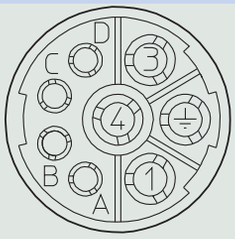
Drive controller		ACOPOS	ACOPOSmulti (EnDat 2.1)	ACOPOSmulti (EnDat 2.2)	ACOPOS P3 (EnDat 2.2)	ACOPOS P3 OCS (EnDat 2.2)	ACOPOSmulti OCS (EnDat 2.2)
Drive controller code		FG	FV	GG	GY	GP	GV
Connection plan ID		442313	442444	442677	443095	443022	443092
Encoder	**Encoder code**						
EnDat 2.2 EQI 1131 FMA	M4	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 EQI 1131	Q6	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 EQN 1135 FMA	M3	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 EQN 1135	Q5	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 ECN 1123 FMA	M1	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 ECN 1123	C7	–	–	EZ	EZ	EZ	EZ
EnDat 2.2 ECI 1118-G2	C5	–	–	EZ	EZ	–	–
EnDat 2.1 EQN 1125 FMA	M2	EZ	EZ	–	–	–	–
EnDat 2.1 EQN 1125	Q4	EZ	EZ	–	–	–	–
EnDat 2.1 ECN 1113 FMA	M0	–	EZ	–	–	–	–
EnDat 2.1 ECN 1113	C6	–	EZ	–	–	–	–
Resolver	R0	EZ	EZ	–	–	–	–

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

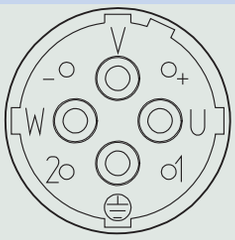
18.2.3 Connection assignment of the power plug connector

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

Connection diagram	Pin	Connection	Color
	1	U phase	BK
	3	W phase	RD
	4	V phase	BU
	A	Temperature sensor +	
	B	Temperature sensor –	
	C	Brake +	RD
	D	Brake –	BK
	⏚	Grounding conductor	GNYE

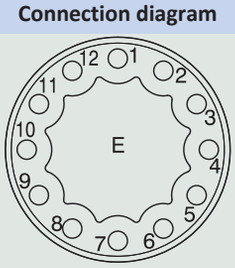
Plug connector size con.40 (1.5)

Connection diagram	Pin	Connection	Color
	U	U phase	BK
	V	V phase	BU
	W	W phase	RD
	+	Brake +	RD
	–	Brake –	BK
	1	Temperature sensor +	
	2	Temperature sensor –	
	⏚	Grounding conductor	GNYE

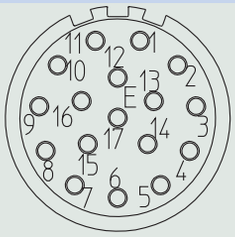
18.2.4 Connection assignment of the encoder plug connector

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.

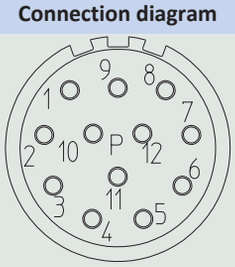
EnDat 2.2 digital encoder, plug connector size con.15

Connection diagram	Pin	Connection	Color
	1	Up +	BNGN
	2	Data +	GY
	3	Data –	PK
	4	Clock +	VT
	5	Clock –	YE
	6		
	7	0 V GND	WHGN
	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	BU
	2		
	3		
	4	0 V sense	WH
	5		
	6		
	7	Up +	BNGN
	8	Clock +	VT
	9	Clock –	YE
	10	0 V GND	WHGN
	11		
	12	B + (Sin +)	BUBK
	13	B – (Sin –)	RDBK
	14	Data +	GY
	15	A + (Cos +)	GNBK
	16	A – (Cos –)	YEBK
	17	Data –	PK

Resolver, plug connector size con.23

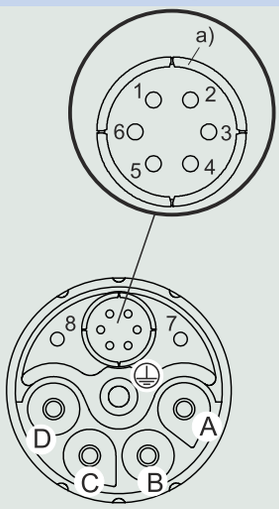
Connection diagram	Pin	Connection	Color
	1		
	2		
	3	S4 Sin +	BU
	4	S1 Cos –	RD
	5	R2 Ref +	YEWH
	6		
	7	S2 Sin –	YE
	8	S3 Cos +	BK
	9	R1 Ref –	RDWH
	10		
	11		
	12		

18.2.5 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 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	Color
	A	U phase	black
	B	V phase	blue
	C	W phase	red
	D		
	1	Up +	browngreen
	2	0 V GND	whitegreen
	3	Data +	grey
	4	Data –	pink
	5	Clock +	violet
	6	Clock –	yellow
	7	Brake –	
	8	Brake +	
	⏚	Grounding conductor	green-yellow

a) Coaxial shield to which the shield of the encoder cores is connected