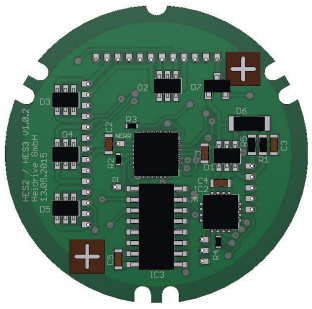
HES / HEM

Hall-Encoder

Features:

Magnetoresistive encoder series consisting of four basic versions with a resolution of 10 - 12 bit. Depending on model following interfaces are available:



- sin/cos output with 1 V_{PP} period per revolution
- SSI, BiSS C
- Incremental signals ABZ
- Commutation signals UVW

Type	Absolute encoders single-turn	Absolute encoders multi-turn, battery-backed		Incremental and/or commutation signals					
Variant	HES1-002	HEM1-001	HEM1-002	HES2-001	HES2-002	HES2-003	HES3-001	HES3-002	HES3-003
sin/cos 1 period / revolution	diff., 1.0 V_{pp} (only with braid wire X2)			-					
SSI	SSI diff., gray coded, 12 bit ST	BiSS diff., binary coded, 20 bit MT + 12 bit ST		SSI single ended, gray coded, 12 bit ST (only with connector X1)			-		
Incremental ABZ (line numbers)	-			diff. (256)	-	single ended (256)	diff. (256)		
Commutation UVW (pole number)	-			-	diff. 4 pole*	single ended 4 pole *	diff. 6 pole **	diff. 4 pole **	diff. 10 pole **
Connection options	braid wire X2 (standard), Connector X1 upon request						only braid wire X2 possible		
Temperature range	- 30 °C to + 125 °C with braid wire X2 - 30 °C to + 105 °C with connector X1								
Comment		without battery	with battery						

* 2- and 8- pole upon request
** other pole numbers upon request

Application:

- Rotor position detection for EC and BLDC motors
- Digital position sensor

Specifications

Electrical specifications

ESD-voltage (all pins)	2 kV
Power supply voltage V_{CC}	5.0 V_{DC} ± 10 %

Digital in- and outputs SSI / BiSS, ABZ, UVW		differential (RS422)	single ended (TTL)
Maximum frequency *		SSi: 4 MHz, BiSS C: 10 MHz	
Input voltage CLK+, CLK-	high	min. + 0.3 V diff	min. 2.0 V
	low	max. - 0.3 V diff	max. 0.8 V
Output voltage DATA+, DATA-, A+, A-,B+, B-, Z+, Z-, U+, U-, V+, V-, W+, W-	high	min. V_{CC} - 0.8 V	
	low	max. 0.8 V	
Output current (per output)		max. 50 mA	

* can be lower depending on the connection requirements.

Analog outputs sin und cos	1,0 V_{pp}
Amplitude sin+, sin-, cos+, cos-	0.25 V ± 20 %
Reference level	V_{CC} / 2 ± 20 %
Periods / revolution	1
Output current (per output)	max. 50 mA

Ambient conditions

Permitted operating temperature	- 30 °C to 105 °C with connector X1 - 30 °C to 125 °C with braid wire X2		
Permitted storage temperature	- 30 °C to 125 °C		
Permitted relative air humidity	15 to 85 % no condensation		
Protection class	IP00		
Permitted mechanical stress	sine-sweep 10 bis 150 Hz shock 6 ms	0.15 mm 150 m/s²	20 m/s²

Valid norms

Norm	Safety regulations according to EN 61010-1
	Electromagnetic compatibility to EN 61000-4-3
Galvanic isolated power supply required (SELV or PELV sources)	

Heidrive Encoder Single-/ Multiturn 1 (HES 1/HEM 1)

Specifications

Variant	HES1-002	HEM1-001 *	HEM1-002	Upon request
SSI	SSI diff.	BiSS diff.		SSI / BiSS C
Coding	gray	binary		gray / binary
Multi-turn	-	20 bit / 1048576 revolution		4 / 8 / 12 / 16 / 20 / 24 / 32 bit
Single-turn	12 bit / 4096 increment			9 to 16 bit
Resolution	0.088° (12 bit)			-
Precision	typ. 0.5°			-
sin/cos differential	1.0 V_{pp}			-
Power supply voltage	5.0 V_{DC} ± 10 %			-
Current consumption (typ., without load)	25 mA	30 mA		-
With 120 Ohm load and SSI Data	65 mA	70 mA		-
With maximum load	175 mA	180 mA		-
Battery	-	without	with TLH-2450	-
Standby power	-	3.0 bis 5.5 V	-	-
Standby current	-	typ. 8 µA (3.6 V)	-	-
Max. speed	20000 min^{-1}			-

* Upon request

Connector X1 (upon request)

Molex Pico-Clasp 501331-1207

Pin	Function
X1.1	VCC
X1.2	n.c.
X1.3	CLK/
X1.4	CLK
X1.5	DATA/
X1.6	DATA
X1.7	Error (Open Collector)
X1.8	Encoder reset
X1.9	Preset multi-turn
X1.10	Intern
X1.11	Intern
X1.12	GND

Braid wire X2

PTFE-braid wire, AWG28

Pin	Function	Color
X2.1	CLK/	purple
X2.2	DATA/	green
X2.3	CLK	orange
X2.4	DATA	gray
X2.5	VCC	red
X2.6	GND	blue
X2.7	SIN	white
X2.8	SIN/	brown
X2.9	COS	pink
X2.10	COS/	black

Battery TLH-2450

Calculations consisting of informations from battery manufacturer

Ambient temperature	25 °C	45 °C	65 °C	85 °C
Life at 100 % battery operation *	4.8 years	4.3 years	3.7 years	3.0 years

* battery operation = encoder power supply is switched off

Further information for your application on request

Heidrive Encoder Singleturn 2 und 3 (HES 2 / 3)

Specifications

Variant	HES2-001	HES2-002	HES2-003	HES3-001	HES3-002	HES3-003	Upon request	
SSI	SSI single ended (only with connector X1)			-			SSI gray	BiSS binary
Coding	gray			-				
Single-turn	12 bit / 4096 increment			-			12 bit	
ABZ (line numbers)	diff. (256)	-	single ended (256)	diff. (256)			1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024	
UVW *	-	4 pole diff.	4 pole SE	6 pole diff.	4 pole diff.	10 pole diff.	HES2: 2/4/8 pole	HES3: any signal
Resolution	0.35° (10 bit)						-	
Precision	typ. 0.5°						-	
Power supply voltage	5.0 V_{DC} ± 10 %						-	
Current consumption (typ., without load)	25 mA			30 mA			-	
with 120 Ohm load on ABZ and UVW	150 mA			280 mA			-	
With maximum load	175 mA			330 mA			-	
Max. speed	20000 min^{-1}						-	

Alternative settings upon request
* at HES3 are optional output signals possible

Connector X1 (upon request)

Molex Pico-Clasp 501331-1207

	Function		
Pin	HES2-001	HES2-002	HES2-003
X1.1	V_{CC}		
X1.2	Intern		
X1.3	Intern		
X1.4	CLK		
X1.5	Z/	W	W
X1.6	DATA		
X1.7	B/	V	V
X1.8	A	U/	A
X1.9	B	V/	B
X1.10	Z	W/	Z
X1.11	A/	U	U
X1.12	GND		

Braid wire X2

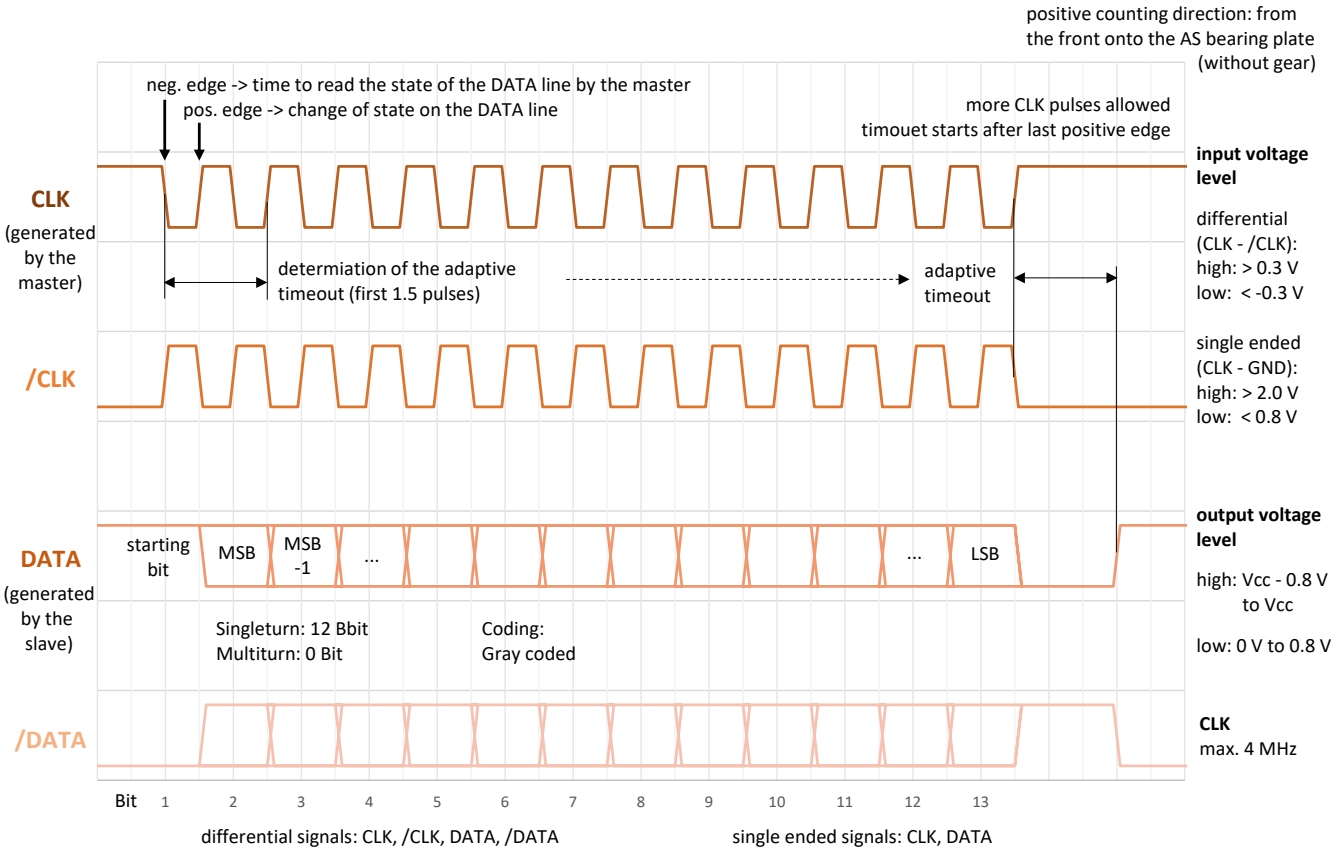
PTFE-braid wire, AWG28

		Function			
Pin	Color *	HES2-001	HES2-002	HES2-003	HES3
X2.1	brown	A/	U	U	A/
X2.2	black	B/	V	V	B/
X2.3	yellow	Z/	W	W	Z/
X2.4	white	A	U/	A	A
X2.5	pink	B	V/	B	B
X2.6	purple	Z	W/	Z	Z
X2.7	red	V_{CC}	V_{CC}	V_{CC}	V_{CC}
X2.8	blue	GND	GND	GND	GND
X2.9	white/green	-	-	-	U
X2.10	white/yellow	-	-	-	V
X2.11	white/gray	-	-	-	W
X2.12	white/pink	-	-	-	U/
X2.13	white/blue	-	-	-	V/
X2.14	white/red	-	-	-	W/

X2.9 to X2.14 only HES3 equiped
Braid wire approx. 200 mm long (not stripped)

SSi signal

SSI diagram

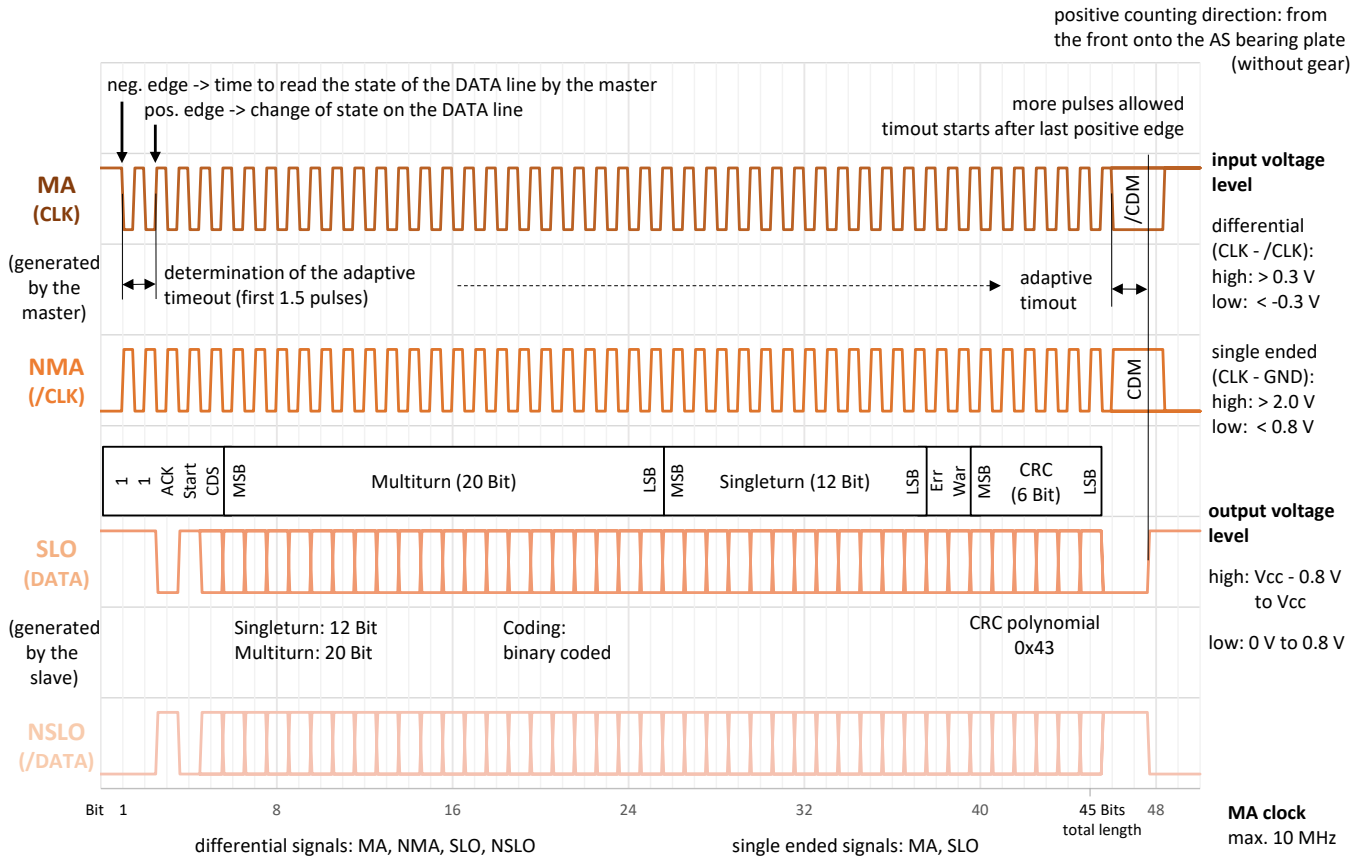


SSI signals

CLK	Clock signal, generated by the master
/CLK	Inverted CLK signal, used for differential transmission
DATA	Response of the encoder with the angular value, synchronous with the CLK signal of the master
/DATA	Inverted DATA signal, used for differential transmission
Startbit	First bit to be read, always high
MSB	Most significant bit
LSB	Least significant bit
adaptive timeout	The duration of the timeout is determined by the time from the first negative edge of the CLK signal to its second positive edge. After expiration of the duration of the timeout, the internal shift register of the encoder is set to 0 again. Starts with the last positive edge of the CLK signal.

BiSS signal

BiSS diagram

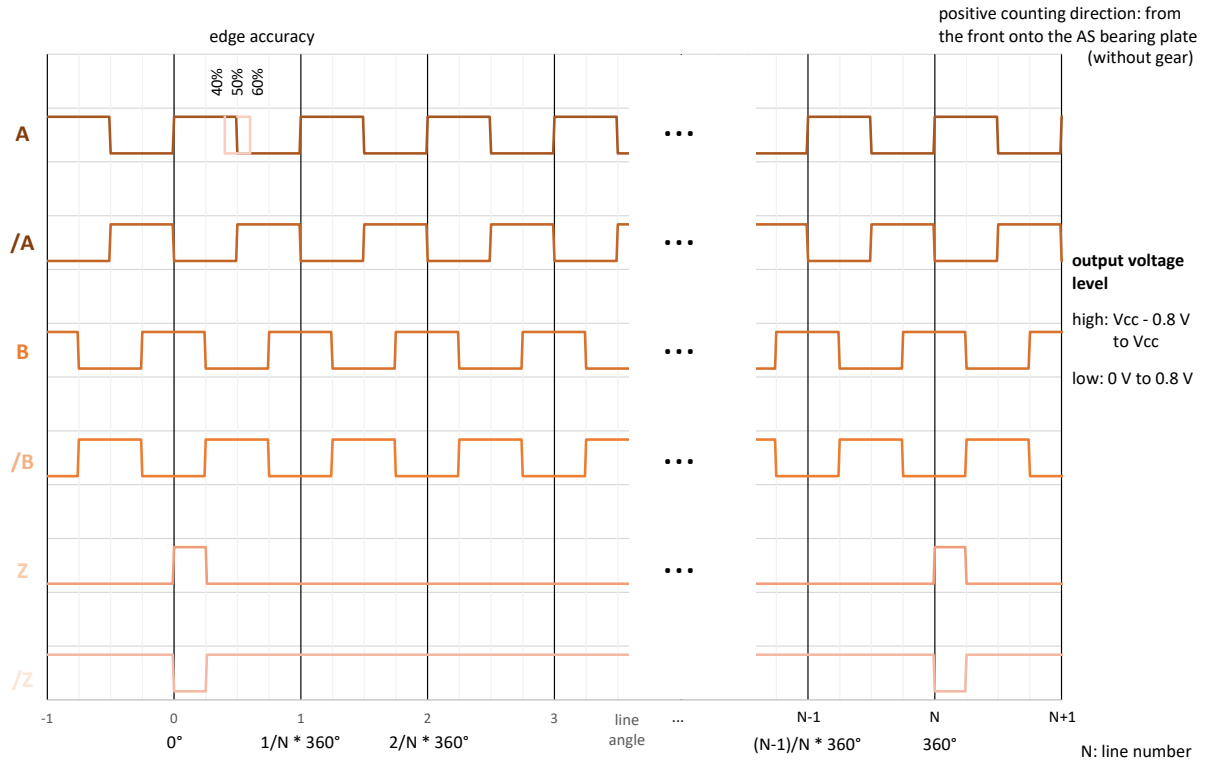


BiSS signals

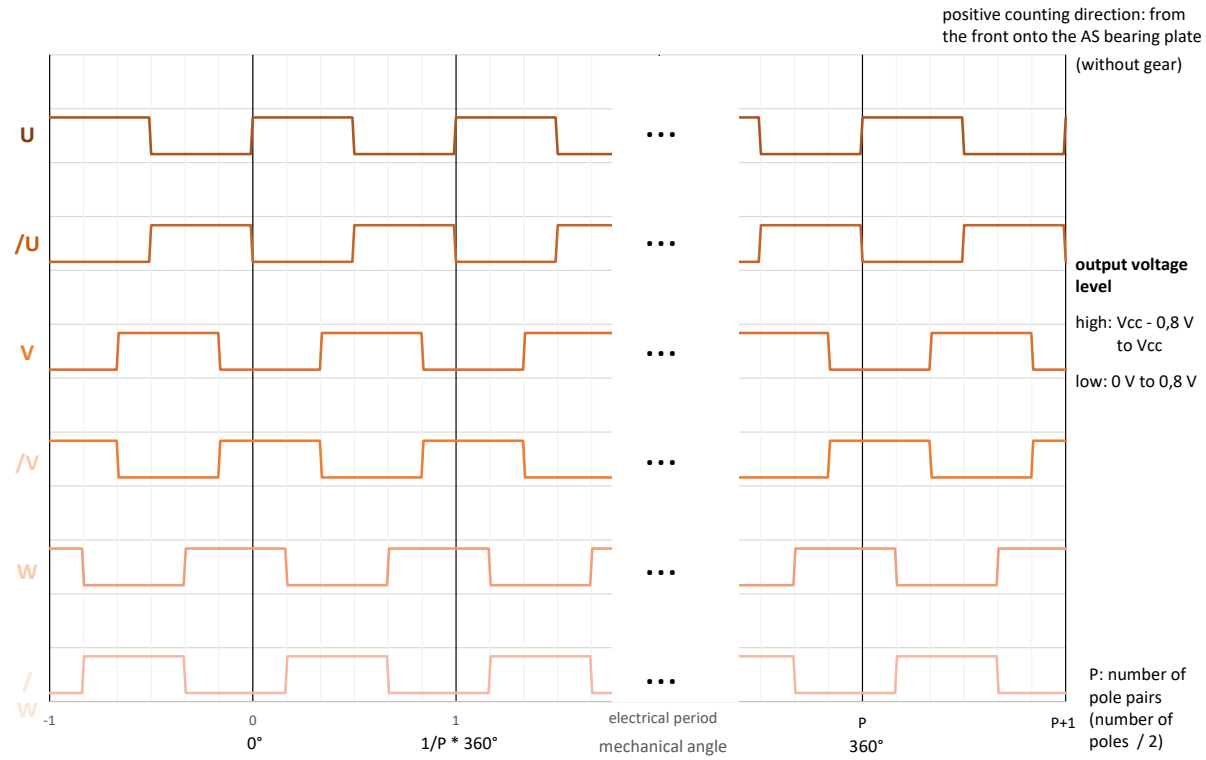
MA	Clock-Signal, signal generated by the master for clock-synchronous polling of the angular value (corresponds to CLK for SSI)
NMA	Inverted MA signal, used for differential transmission (corresponds to /CLK for SSI)
SLO	"Slave Out, data package containing, among other things, the angular value, response of the encoder to the MA signal, synchronous with the MA signal of the master (corresponds to DATA for SSI)"
NSLO	Inverted SLO signal, used for differential transmission (corresponds to /DATA for SSI)
CDM	Control Data Master, one bit per frame can be transmitted from the master to the encoder. The bit is the state of the SLO line at the moment of the timeout. The bits are composed to a BiSS command.
ACK	Acknowledge. Response of the encoder that the transmission is ready. SLO changes from high to low on readiness.
Start	Startbit. SLO state is always high.
CDS	Control Data Slave. Response of the slave to the CDM.
MSB	Most significant bit
LSB	Least significant bit
Err	Error bit. High: encoder in error state. Low: The encoder does not show any error.
Warn	Warning bit. High: encoder shows a warning. Low: encoder shows no warning.
CRC	Cyclic Redundancy Check with polynom 0x43. Serves to monitor the transmitted data.
adaptive timeout	The duration of the timeout is determined by the time from the first negative edge of the MA signal to its second positive edge. After expiration of the duration of the timeout, the internal shift register of the encoder is set to 0 again. Starts with the last positive edge of the MA signal.

ABZ signal, UVW signal

ABZ diagram



UVW diagram



Technical data subject to change! Last changes: 04/2022

Heidrive GmbH
Starenstraße 23
93309 Kelheim

Tel. 09441/707-0
Fax 09441/707-259

info@heidrive.de
www.heidrive.com