



HEIDENHAIN



Product Information

SRP 5000

Angle Encoder Modules
with Integrated Drive Motor

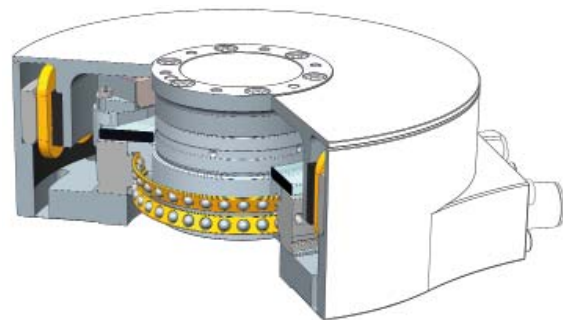
March 2017

Design and applications

Angle encoder modules from HEIDENHAIN are combinations of angle encoders and high-precision bearings that are optimally adjusted to each other. They are characterized by their high degree of measuring and bearing accuracy, their very high resolution, as well as optimum repeatability. The low starting torque permits smooth motions.

SRP angle encoder modules are additionally equipped with an integrated torque motor. They therefore combine a motor, precision bearing and encoder with very high accuracy in one compact system. The torque motor with its very low detent torque enables extraordinarily smooth motion control. Neither disruptive detent torques nor radial forces impair the high guideway accuracy of the bearing. Thanks to their design as completely specified and tested composite assemblies, handling and installation is very simple.

The SRP angle encoder modules are specially optimized for the stringent requirements of metrological applications. The very high resolution and excellent repeatability of the SRPs are decisive here—even at varying application temperatures. High motor torques and loads are not usually the focus of these applications.



Information on

- Angle encoders with integral bearing
 - HEIDENHAIN interface electronics
- is available upon request as well as on the Internet at www.heidenhain.de.



More Information:

- Detailed descriptions of the specifications and characteristics of the bearings and encoders can be found in the *Angle Encoder Modules* brochure, ID 1102713-xx.
- Comprehensive descriptions of all available interfaces as well as general electrical information is included in the *Interfaces* brochure, ID 1078628-xx.

This Product Information supersedes all previous editions, which thereby become invalid.

The basis for ordering from HEIDENHAIN is always the brochure edition valid when the order is made. Standards (ISO, EN, etc.) apply only where explicitly stated in the brochure.

Encoder characteristics

Encoder characteristics	<i>Incremental</i> SRP 5080	<i>Absolute</i> SRP 5010
Measuring standard	OPTODUR circular scale	DIADUR circular scale
Signal periods	30 000	16 384
System accuracy*	±2.5" or ±5"	
Position error per signal period	±0.23"	±0.40"
Repeatability	<i>From both directions: 0.3"</i>	<i>From both directions: 0.9"</i>
Position noise RMS	Typically ± 0.007"	Typically ± 0.020"
Interface	~ 1 V _{PP}	EnDat 2.2
Ordering designation	–	EnDat22
Position values/revolution	–	28 bits
Clock frequency Calculation time t _{cal}	–	≤ 16 MHz ≤ 5 μs
Reference marks	80 (distance-coded)	–
Cutoff frequency –3 dB	≥ 500 kHz	–
Electrical connection	1.5 m cable with D-sub connector (15-pin); interface electronics integrated in connector	1 m cable with M12 coupling (8-pin)
Cable length	≤ 30 m (with HEIDENHAIN cable)	
Voltage supply	DC 5 V ±0.25 V	DC 3.6 V to 14 V
Power consumption (max.)	5.25 V: ≤ 950 mW	3.6 V: ≤ 1.1 W 14 V: ≤ 1.3 W
Current consumption (typical)	175 mA (without load)	5 V: 140 mA (without load)

* Please select when ordering

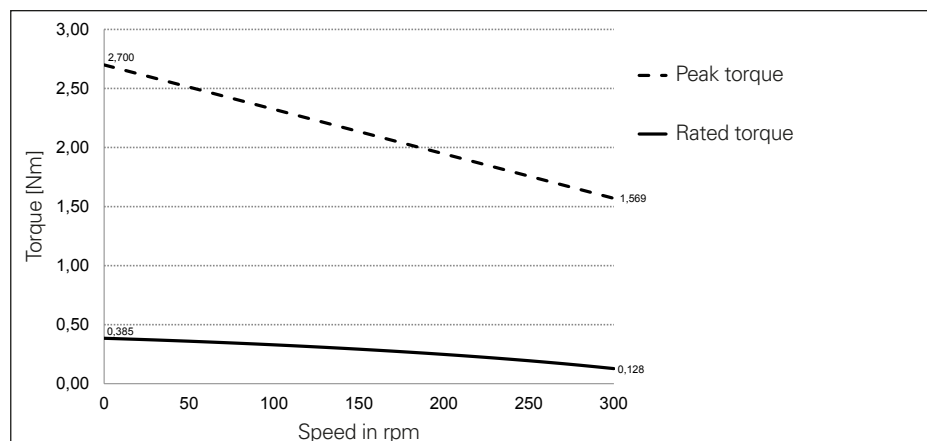
Motor characteristics

Mounting situation

All provided motor characteristics apply for the following mounting situation:

- Ambient temperature 20 °C
- Coil temperature 40 °C
- Stator screwed to steel plate with
 - o Total surface 0.016 m²
 - o Specific heat capacity of 460 J/kgK (at 20 °C)
 - o Specific thermal conductivity 30 W/mK (at 20 °C)

Motor characteristics	
Peak torque	2.70 Nm
Rated torque	0.385 Nm
Stall torque	0.253 Nm
Standstill speed	0.013 rpm
Maximum speed	300 rpm
Torque constant	0.668 Nm/A _{rms}
Back-electromotive force constant	0.397 V _{rms} /(rad/s)
Motor constant	0.181 Nm/√W
Electrical resistance R ₂₀ (at 20 °C)	9.06 Ω
Electrical inductance	2.42 mH
Maximum current	4.24 A _{rms}
Rated current	0.688 A _{rms}
Stall current	0.487 A _{rms}
Max. rated power loss	6.94 W
Max. DC-link voltage	DC 48 V
Number of poles	20
Max. detent torque	< 0.2 % of rated torque
Electrical connection	
Connection	M12 (4 pin, male)
Cable diameter	∅ 7.0 mm
Cable length	≤ 5 m
Number of phases	3



Torque characteristic at 48 V DC

Bearing properties

Bearing properties	
Shaft	Hollow through shaft D = 32 mm
Max. permissible axial load ²⁾	200 N (load centered)
Max. permissible radial load ²⁾	60 N
Max. permissible breakdown torque ²⁾	2.5 Nm
Contact stiffness	<i>Axial:</i> 303 N/μm <i>Radial:</i> 181 N/μm (values calculated)
Resistance to tilt	102 Nm/mrad (value calculated)
Mechanically perm. speed	300 rpm
Moment of friction	≤ 0.025 Nm
Starting torque	≤ 0.015 Nm
Max. transferable shaft torque ²⁾	2 Nm
Moment of inertia of rotor	$1.16 \cdot 10^{-3} \text{ kgm}^2$
Radial guideway accuracy	Measured at distance h = 55 mm: ≤ 0.20 μm (without load)
Non-reproducible radial guideway accuracy	Measured at distance h = 55 mm: ≤ 0.35 μm (without load)
Axial guideway accuracy	≤ ±0.2 μm
Axial shaft runout*	≤ 5 μm or ≤ 1 μm
Wobble of the axis	0.7"
Vibration 55 Hz to 2000 Hz Shock 6 ms	≤ 20 m/s ² (EN 60 068-2-6) ≤ 100 m/s ² (EN 60 068-2-27) (without load)
Protection EN 60529 ¹⁾	IP40
Operating temperature Storage temperature	0 °C to 30 °C 0 °C to 50 °C
Relative air humidity	≤ 75 % without condensation
Application height	< 2000 m
Mass	1.82 kg (without cable or connector)

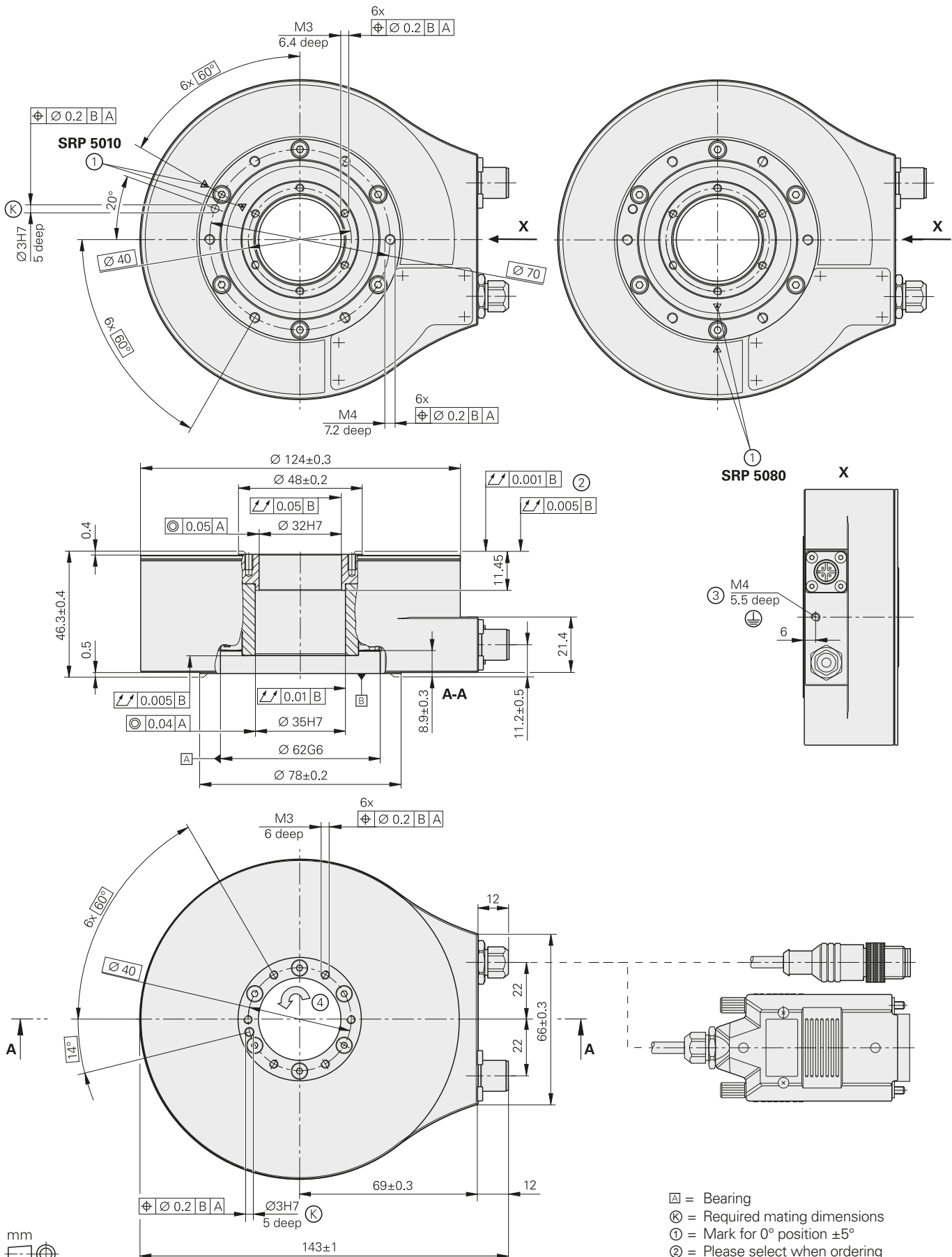
* Please select when ordering

¹⁾ When mounted

²⁾ Purely static load, without additional vibrations and shock

SRP 5010/SRP 5080

Dimensions

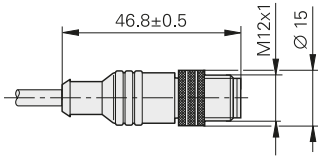


mm
 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ±0.2 mm

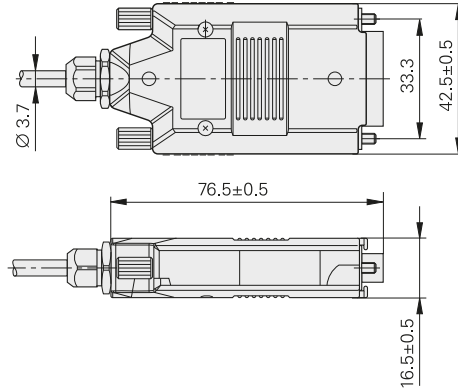
- ⊠ = Bearing
- ⊗ = Required mating dimensions
- ① = Mark for 0° position ±5°
- ② = Please select when ordering
- ③ = Protective conductor terminal
- ④ = Direction of shaft rotation for output signals as per the interface description

Dimensions of connecting elements

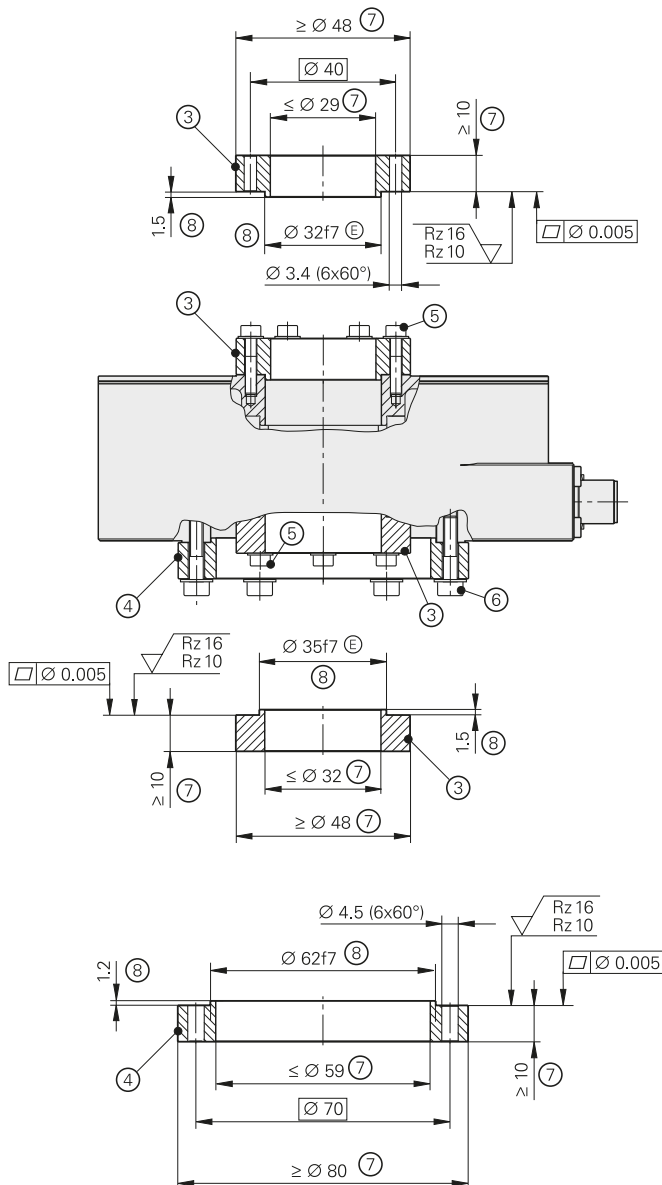
SRP 5010



SRP 5080



Required mating dimensions



- ③ = Rotor
- ④ = Stator
- ⑤ = Screw, ISO 4762 – M3 – 8.8. Materially bonding threadlocker required. Washer, ISO 7092 – 3 – 200HV tightening torque 1.1 Nm±0.05 Nm
- ⑥ = Screw, ISO 4762 – M4 – 8.8. Materially bonding threadlocker required. Washer, ISO 7092 – 4 – 200HV tightening torque 2.5 Nm±0.13 Nm
- ⑦ = Required mating dimensions for transfer of maximum permissible loads as per specifications
- ⑧ = Optional recommended mating dimensions

Information on the drive

Slotless torque motor

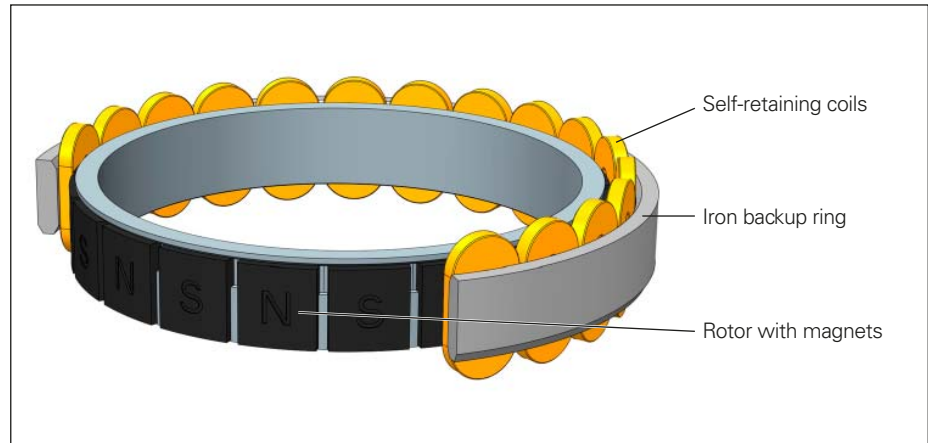
The motor, which was specially developed for the SRP angle measuring module, fulfills even the very highest requirements placed on high-precision rotary axes. The motor is free of detent and produces no disturbing influences on the high-accuracy bearing. This allows exceptionally uniform motion control and positioning accuracy.

A slotless, iron-core torque motor is used for the drive. This enables the motor to combine two opposing properties—high torque density and low detent torque. This form of motor does without the slots on classical designs. Instead, it uses self-retaining coils.

Thanks to the special design and the particularly symmetrical arrangement of all components, the rotor always faces a constant magnetic field over the entire rotation.

An iron backup ring allows a comparatively large torque. This brings the following characteristics:

- Extremely low detent torque
- No interfering lateral forces
- Medium torques
- High dynamics in controlled operation
- Low thermal power loss
- Compact dimensions



Slotless iron-core permanent-magnet-excited AC synchronous motor

Motor protection

For protection against thermal overload, suitable measures are required in the controller electronics, e.g. I^2t monitoring. Direct monitoring of the temperature by temperature sensors in the motor windings is not possible.

Operation with AccurET controllers

The AccurET position controllers are the perfect complement to the SRP angle encoder modules. Absolute peak performance can be achieved with regard to dynamics and position stability (see following page).

AccurET position controller

The compact AccurET position controllers cover a broad range of voltage and current. This greatly simplifies the integration of different servo motors in a machine.

Multiple position controllers connected to the same DC bus voltage can be supplied with one power supply. Each controller can drive two axes.

Since the position controllers do not require a mounting rack, the space required is dependent only on the number of axes to be controlled. Simplified power and communication cabling as well as the modular cooling unit facilitate the installation and maintenance of the machine.

Further information on the AccurET position controllers is available on request as well as on the Internet at www.etel.ch

AccurET Modular 48:

The AccurET Modular 48 controller is available in two versions. One version permits the installation of an optional board, such as the UltimET motion controller or the I/O board.



AccurET VHP 48:

Controller with a high-speed encoder input and specific power output stage for very demanding applications with regard to speed stability and position accuracy.


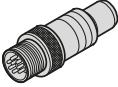





	AccurET Modular 48		AccurET VHP 48	
DC-link voltage	DC 48 V			
Number of axes	2			
Continuous current rms	2.5 A	5 A	1.5 A	5 A
Peak current rms	5 A	10 A	3 A	10 A
Supply voltage	DC 15 V to 48 V			
Current consumption rms	10 A			
PWM frequency	10 kHz, 20 kHz		–	
Encoder input	1 V _{PP} (2048-fold interpolation) TTL EnDat 2.1 and EnDat 2.2		1 V _{PP} (up to 65 536-fold interpolation) TTL EnDat 2.1 and EnDat 2.2	
Interfaces	USB 2.0 (for configuration) ETEL real-time bus Ethernet (TCP/IP)			
Digital I/O	4/2 per axis		4/4 per axis	
Fast digital I/O	6/4 for both axes			
Analog I/O	With additional expansion board		4/4 for both axes	

Electrical connection

Pin assignment


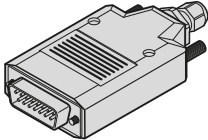
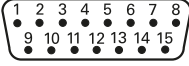


SRP 5010 EnDat 2.2

								
	1	2	3	4	5	6	7	8
	Sensor 0V	Sensor U_P	DATA	DATA	0V	CLOCK	CLOCK	U_P
	White	Blue	Gray	Pink	White/Green	Yellow	Violet	Brown/Green

Cable shield connected to housing; **U_P** = Power supply voltage

Sensor: The sensor line is connected in the encoder with the corresponding power line.

SRP 5080 1V_{PP}

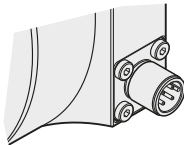
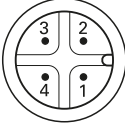
															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	A+	0V	B+	U_P	/	/	R-	/	A-	Sensor 0V	B-	Sensor U_P	/	R+	/
	Brown	White/Green	Gray	Brown/Green	/	Yellow/Black	Black	Green/Black	Green	White	Pink	Blue	Violet	Red	/



Cable shield connected to housing; **U_P** = Power supply voltage

Sensor: The sensor line is connected in the encoder with the corresponding power line.




Vacant pins or wires must not be used.

SRP 50x0

					
	1	2	3	4	
	Phase 1	Phase 2	Phase 3	GND	

				
	1	2	3	4
	Phase 1	Phase 2	Phase 3	GND
	White	Brown	Green	Yellow

Cable for direct connection to AccurET position controller

Motor connection cable $\varnothing 7 \text{ mm } (4 \cdot 0.5 \text{ mm}^2)$		
With one connector M12 connector (female), 4-pin		1140842-xx
Adapter cable for 1 Vpp $\varnothing 6 \text{ mm } [6(2 \cdot 0.19 \text{ mm}^2)]$		
Complete D-sub connector (female), 15-pin and D-sub connector (male), 15-pin		1159446-xx
Adapter cable for EnDat 2.2 $\varnothing 6 \text{ mm } [2(2 \cdot 0.09 \text{ mm}^2) + 2(2 \cdot 0.14 \text{ mm}^2)]$		
Complete M12 connector (female), 8-pin and D-sub connector (male), 15-pin		1165032-xx

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

☎ +49 8669 31-0

FAX +49 8669 32-5061

E-mail: info@heidenhain.de

www.heidenhain.de

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More Information:

Comply with the information in the following documents to ensure the correct and intended operation of the encoder:

- Brochure: *Angle Encoder Modules* 1102713-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Operating Instructions 1192465-xx