

AG 661

Absolute Angle Encoder



Contents

Chapter	Title	Page
1	Functional description and features of absolute angle encoders	3
2	Versions	4
3	Dimensional drawing	6
4	Characteristic data	17
5	Clock input circuit	18
6	Data format and delay time	19
7	Pinout	20
8	Accessories	21
9	Installation of AG 661 with expanding shaft and clamping ring flange	27

1. Functional description and features of absolute angle encoders

General

The absolute encoding process utilizes a number of time-parallel channels. Each step is defined by a unique combination of ABSOLUTE logic values each of which is stored as a code pattern on code discs in the absolute encoder. This makes it possible to obtain the absolute value whenever it is required.

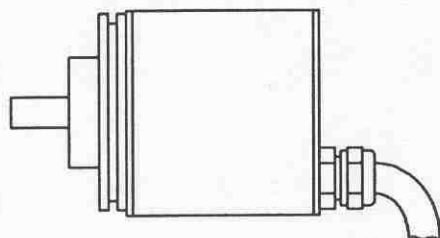
Since each step is defined by the code on the disc, there is no need to move to a reference point as in the case of the so-called incremental encoders.

The code discs are scanned by a wear-free, non-contacting, opto-electrical system and so these encoders are equally suitable for high speeds of rotation. The service life of these encoders is largely determined by the life of the ball bearings and of the gallium arsenide diodes that serve as light sources.

Rotations are measured by way of reduction gearing. The AG 661 can measure up to 4096 rotations with 4096 steps per rotation. The total resolution is thus 16.777.216 steps (4096 x 4096).

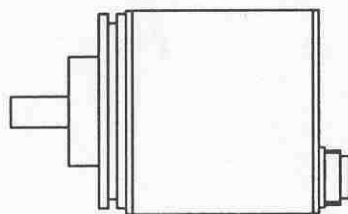
Main features:

- 3 shaft options: Standard shaft 6 mm x 10 mm
 Standard shaft 10 mm x 20 mm
 Expanding shaft 10 mm x 10 mm
- 3 flange options: Servo clamping flange
 Clamping-ring flange (Accessories)
 Servo flange
- 3 housing options: Cable exit axial
 7-pin connector on housing, axial
 12-pin connector on housing, axial or radial
- 4096 steps per rotation
- 4096 measurable rotations
- Power supply 10 V – 32 V
- Operating temperature range: 0° C ... + 55° C
 extended: – 20° C ... + 70° C
- Synchronous Serial Interface 

**AG 66101 – AG 66106**

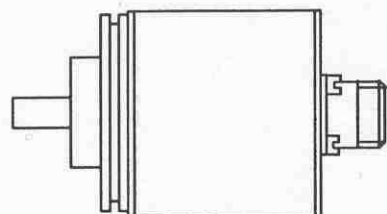
Shaft 10 mm x 20 mm
Servo clamping flange
Axial cable exit

see page 6

**AG 66107 – AG 66108**

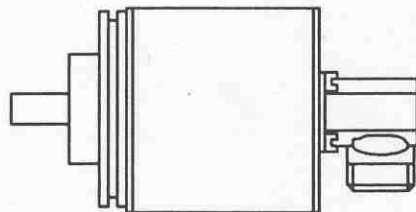
Shaft 10 mm x 20 mm
Servo clamping flange
7-pin connector (male) on
housing, axial

see page 8

**AG 66109 – AG 66110**

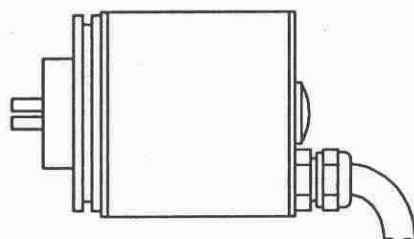
Shaft 10 mm x 20 mm
Servo clamping flange
12-pin connector (male) on
housing, axial

see page 9

**AG 66111 – AG 66112**

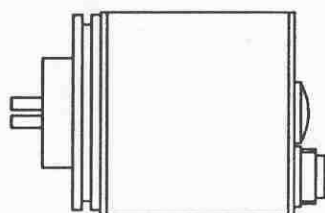
Shaft 10 mm x 20 mm
Servo clamping flange
12-pin connector (male) on
housing, radial

see page 10

**AG 66113 – AG 66118**

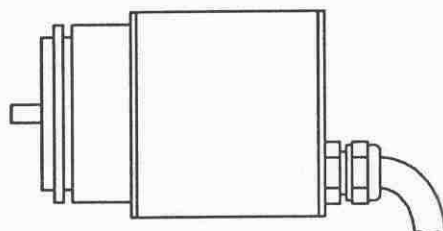
Expanding shaft 10 mm x 10 mm
 Servo clamping flange
 Axial cable exit

see page 11 and 12

**AG 66119 – AG 66120**

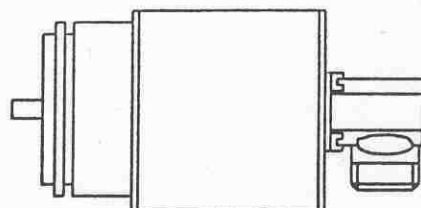
Expanding shaft 10 mm x 10 mm
 Servo clamping flange
 7-pin connector (male) on housing, axial

see page 13

**AG 66121 – AG 66124**

Shaft 6 mm x 10 mm
 Servo flange
 Axial cable exit

see page 14 and 15

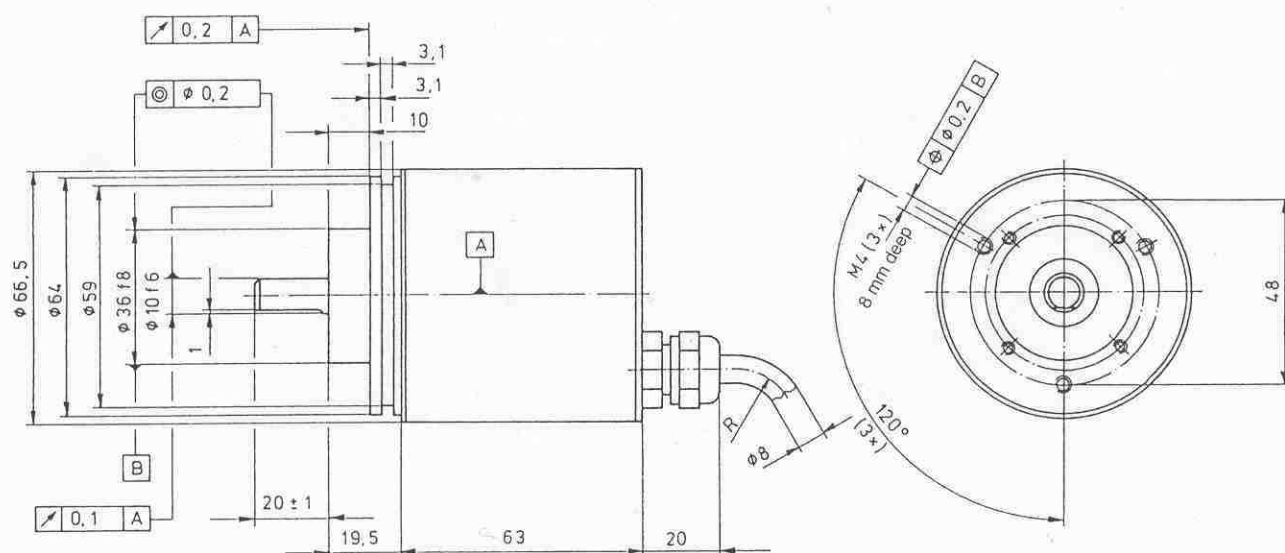
**AG 66125 – AG 66126**

Shaft 6 mm x 10 mm
 Servo flange
 12-pin connector (male) on housing, radial

see page 16

AG 661 01 – AG 661 06

- standard shaft 10 mm x 20 mm
- servo clamping flange
- axial cable exit
- cable length 150 cm
- protection IP 66



R = once only bending radius: 37,5 mm
continuous bending radius: 112,5 mm

Version

AG 661 01

Without connector at cable end
Temperature range 0° C ... + 55° C

AG 661 02

Without connector at cable end
Temperature range $-20^{\circ}\text{C} \dots +70^{\circ}\text{C}$

AG 661 03

7-pin B7 M3 (male) connector at cable end
Temperature range 0° C ... + 55° C

The mating B7 F3 (female) connector is not included and must be ordered separately.
(see Accessories, Page 26)

Version

AG 661 04

7-pin B7 M3 (male) connector at cable end
Temperature range -20°C ... $+70^{\circ}\text{C}$

The mating B7 F3 (female) connector is not included and
must be ordered separately.
(see Accessories, Page 26)

AG 661 05

12-pin C12 ML (male) connector at cable end
Temperature range 0°C ... $+55^{\circ}\text{C}$

The mating C12 FUR (female) connector is not included and
must be ordered separately.
(see Accessories, Page 26)

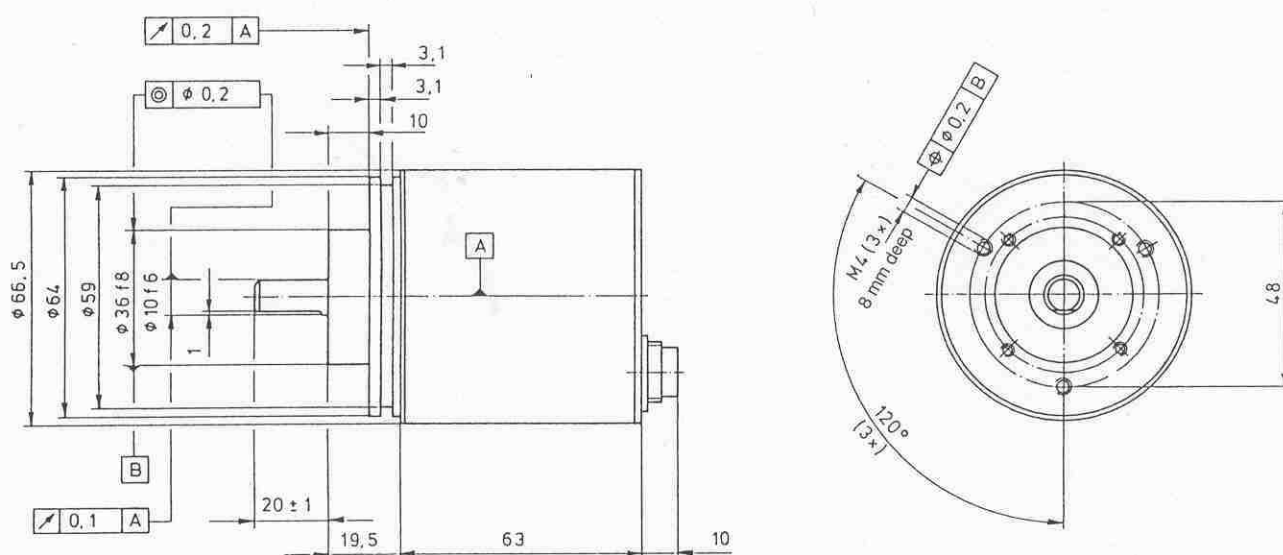
AG 661 06

12-pin C12 ML (male) connector at cable end
Temperature range -20°C ... $+70^{\circ}\text{C}$

The mating C12 FUR (female) connector is not included and
must be ordered separately.
(see Accessories, Page 26)

AG 661 07 – AG 661 08

- standard shaft 10 mm x 20 mm
- servo clamping flange
- 7-pin connector (male) on housing, axial
- protection IP 40 – IP 66 depending on female connector half

**Version****AG 661 07**

Temperature range 0° C ... + 55° C

The mating B7F3 or B7F4 (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

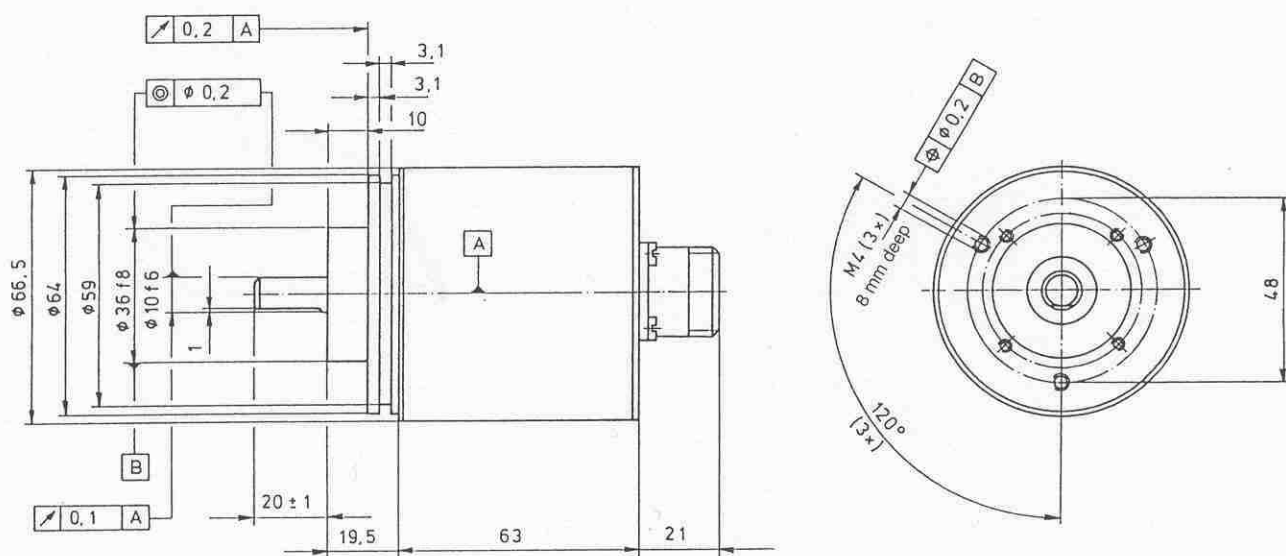
AG 661 08

Temperature range -20° C ... + 70° C

The mating B7F3 or B7F4 (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

AG 66109 – AG 66110

- standard shaft 10 mm x 20 mm
- servo clamping flange
- 12-pin connector (male) on housing, axial
- protection IP 65

**Version****AG 661 09**

Temperature range 0° C ... + 55° C

The mating C12 FUR (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

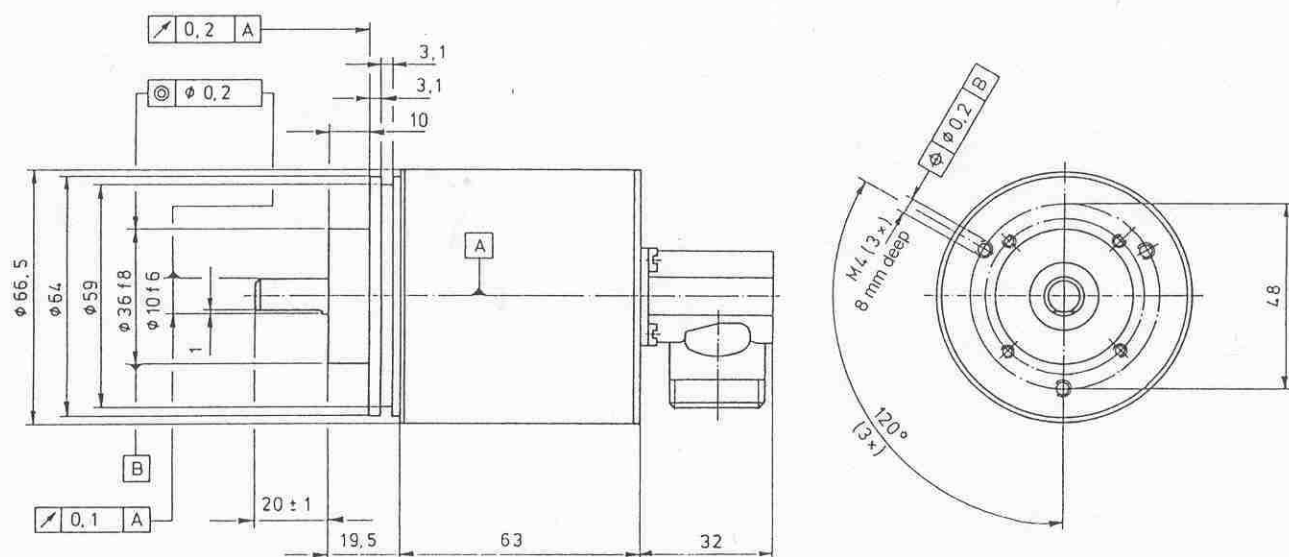
AG 661 10

Temperature range -20° C ... + 70° C

The mating C12 FUR (female) connector is not included and must be ordered separately.
(see Accessories, Page 26)

AG 661 11 – AG 661 12

- standard shaft 10 mm x 20 mm
- servo clamping flange
- 12-pin connector (male) on housing, radial
- protection IP 65

**Version****AG 661 11**

Temperature range 0° C ... + 55° C

The mating C12 FUR (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

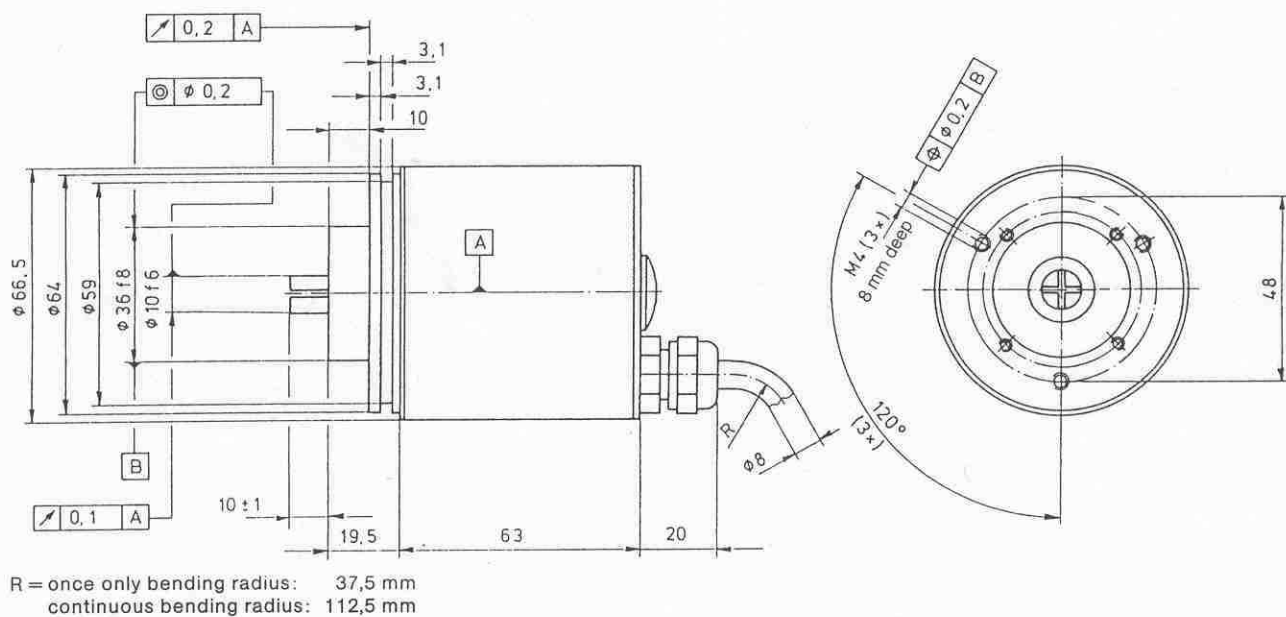
AG 661 12

Temperature range -20° C ... + 70° C

The mating C12 FUR (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

AG 661 13 – AG 661 18

- expanding shaft 10 mm x 10 mm
- servo clamping flange
- axial cable exit
- cable length 150 cm
- protection IP 66

**Version****AG 661 13**

Without connector at cable end
Temperature range 0° C ... + 55° C

AG 661 14

Without connector at cable end
Temperature range -20° C ... + 70° C

AG 661 15

7-pin B7 M3 (male) connector at cable end
Temperature range 0° C ... + 55° C

The mating B7 F3 (female) connector is not included
and must be ordered separately.
(see Accessories Page 26)

Version

AG 661 16

7-pin B7 M3 (male) connector at cable end
Temperature range -20°C ... $+70^{\circ}\text{C}$

The mating B7 F3 (female) connector is not included
and must be ordered separately.
(see Accessories Page 26)

AG 661 17

12-pin C12 ML (male) connector at cable end
Temperature range 0°C ... $+55^{\circ}\text{C}$

The mating C12 FUR (female) connector is not included
and must be ordered separately.
(see Accessories Page 26)

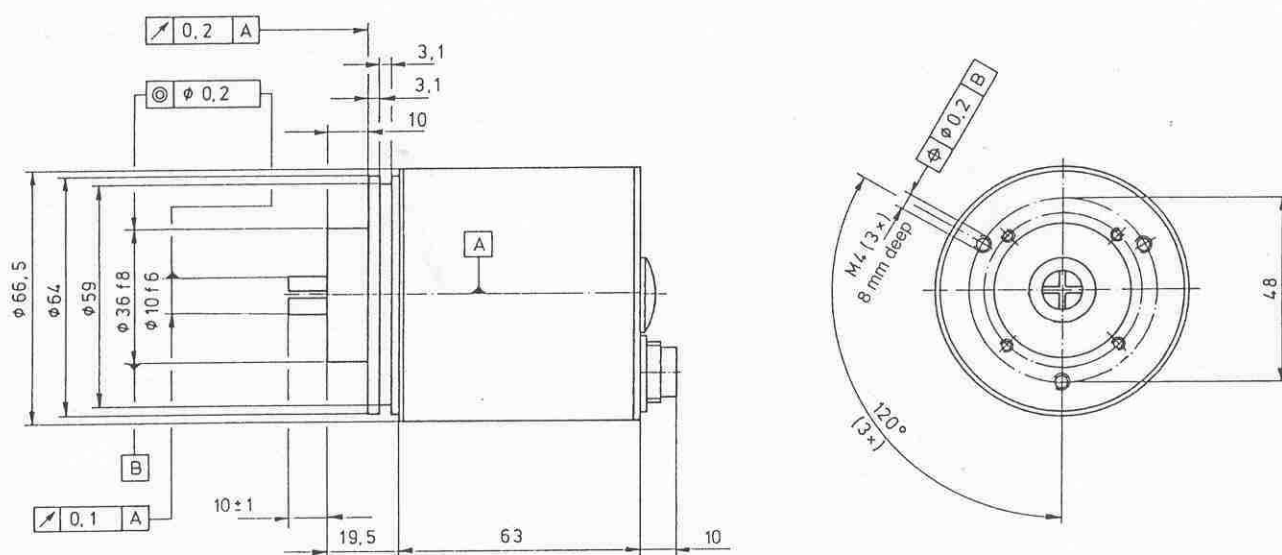
AG 661 18

12-pin C12 ML (male) connector at cable end
Temperature range -20°C ... $+70^{\circ}\text{C}$

The mating C12 FUR (female) connector is not included
and must be ordered separately.
(see Accessories Page 26)

AG 661 19 – AG 661 20

- expanding shaft 10 mm x 10 mm
- servo clamping flange
- 7-pin connector (male) on housing, axial
- protection IP 40 – IP 66 depending on female connector half

**Version****AG 661 19**

Temperature range 0° C ... + 55° C

The mating B7 F3 or B7 F4 (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

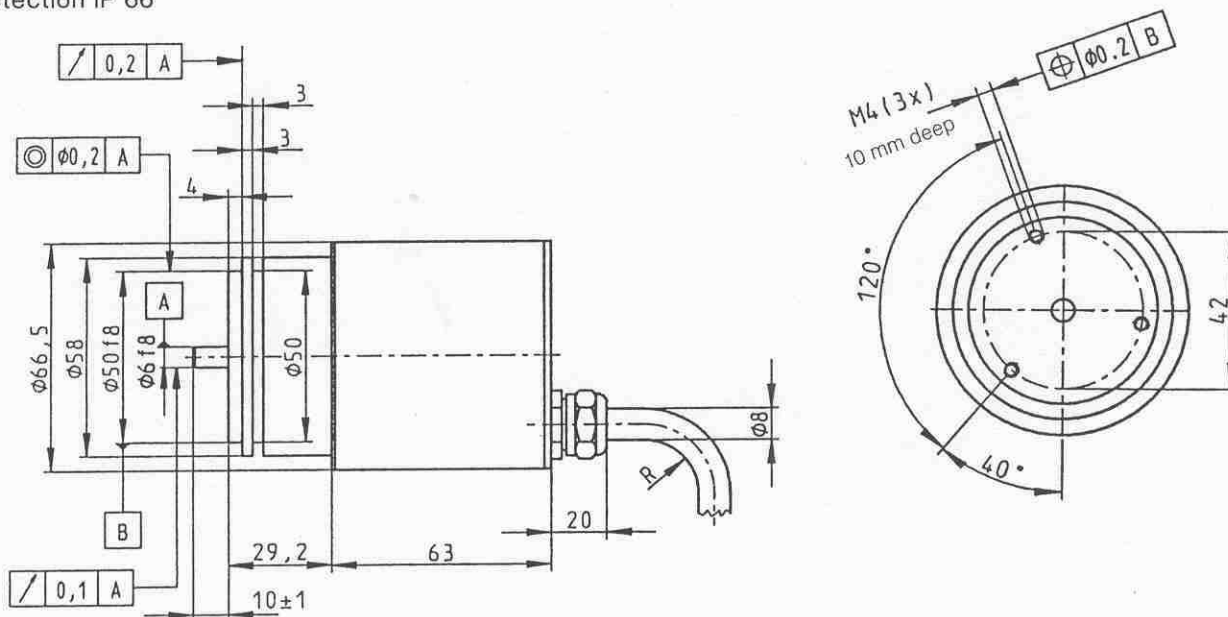
AG 661 20

Temperature range -20° C ... + 70° C

The mating B7 F3 or B7 F4 (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

AG 661 21 – AG 661 24

- standard shaft 6 mm x 10 mm
- servo flange
- axial cable exit
- cable length 150 cm
- protection IP 66



R = once only bending radius: 37,5 mm
 continuous bending radius: 112,5 mm

Version**AG 661 21**

Without connector at cable end
 Temperature range 0° C ... + 55° C

AG 661 22

Without connector at cable end
 Temperature range -20° C ... + 70° C

Version

AG 661 23

12-pin C12ML (male) connector at cable end
Temperature range 0° C ... + 55° C

The mating C12 FUR (female) connector is not included
and must be ordered separately.
(see Accessories Page 26)

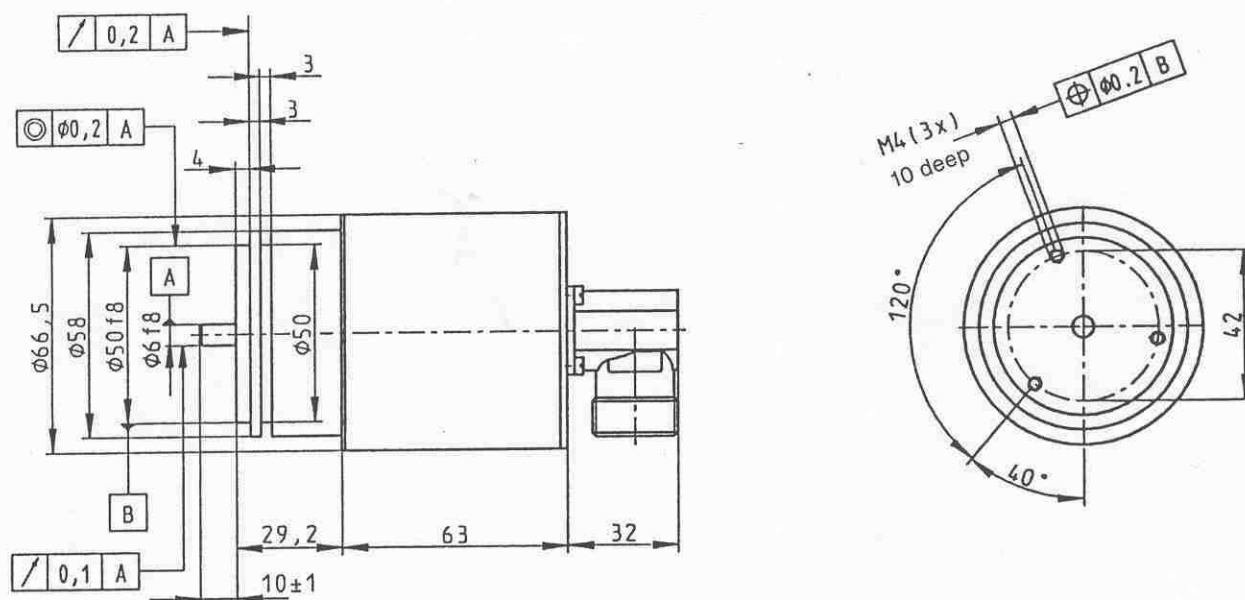
AG 661 24

12-pin C12 ML (male) connector at cable end
Temperature range -20° C ... + 70° C

The mating C12 FUR (female) connector is not included
and must be ordered separately.
(see Accessories Page 26)

AG 661 25 – AG 661 26

- shaft 6 mm x 10 mm
- servo flange
- 12-pin connector (male) on housing, radial
- protection IP 65

**Version****AG 661 25**

Temperature range 0° C ... + 55° C

The mating C12 FUR (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

AG 661 26

Temperature range -20° C ... + 70° C

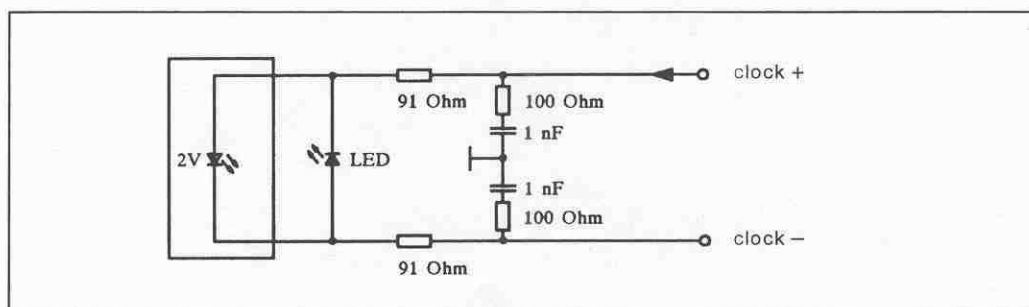
The mating C12 FUR (female) connector is not included and must be ordered separately.
(see Accessories Page 26)

Mechanical data	Max. permissible speed		6000	min^{-1}
	Permissible angular acceleration of rotor		10^5	rad/s^2
	Moment of inertia of rotor		45	gcm^2
	Max. starting torque at 25° C		1	Ncm
	Max. load on shaft			
	With standard shaft	axial	50	N
		radial	200	N
	With expanding shaft	axial	10	N
		radial	20	N
	Service life of ball bearings with 10 N axial load and 10 N radial load at 3000 rpm^{-1}		25000	h
	Vibration, sinusoidal 100 Hz		100	rad/s^2
	Radial impacts on the flange within 10 ms		300	rad/s^2
	Protection		See option concerned	
	Relative humidity		95	%
	Temperature range		See option concerned	
	Weight	approx.	0,4	kg

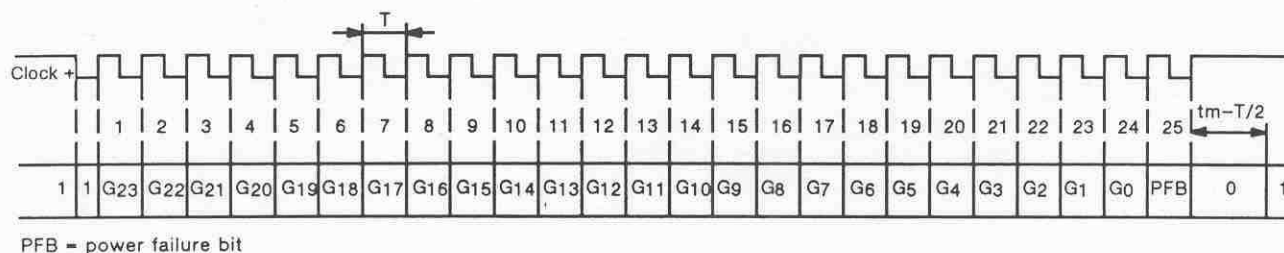
Electrical data	Max. step frequency		100	kHz
	Supply voltage		10 ... 32	V
	Max. power consumption		3,7	W
	Angular error		10^{-3}	rad
	Pick-up code		Gray single-step	
	Transmitters		GaAlAs diodes	
	MTBF		10^5	h

Electrical data	Data transmission	Synchronous, serial	
	Serial data output	Drivers to EIA RS 422, short-circuit proof	
	Serial clock input	Opto-couplers with antiparallel LEDs and recommended drivers to EIA RS 422	
	Monoflop time t_m	$15 < t_m < 25$	μs
	Minimum clock frequency	70	kHz
	Maximum clock frequency	1	MHz
	Recommended clock frequency	200	kHz
	Minimum interval between clock pulse trains T_p	30	μs

5. Clock input circuit (schematic diagram)



Data format

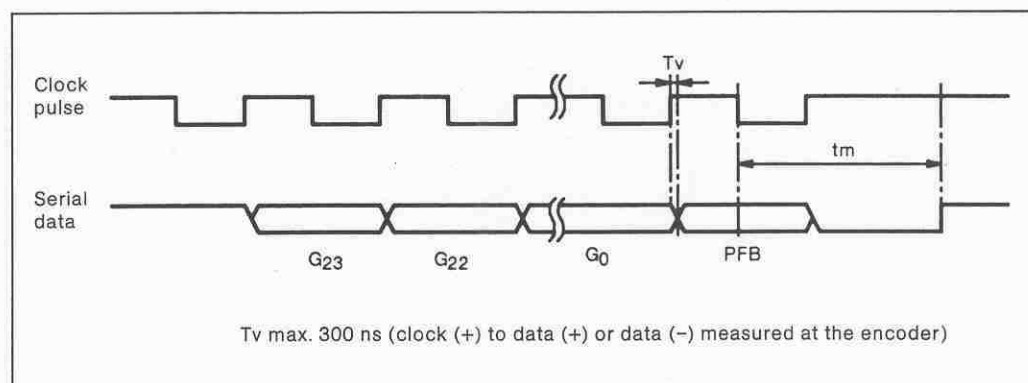


Power failure bit

If the power supply voltage should fall to below 5 V for more than 100 μ s, this could lead to the encoder transmitting incorrect information.

The power failure bit (PFB) causes the possibility of such an error to be indicated. A voltage comparator detects such a fall in voltage and sets the PFB to 1.

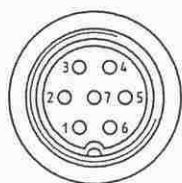
Delay time



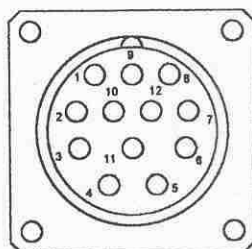
Pin 7-pin connector	12-pin connector	Signal	Colour of cores (for versions with cable exit)	Explanation
1	1	GND	Blue	Earth (ground) connection of encoder, galvanically isolated from the housing. The voltage source for GND is + Us.
2	2	Data (+)	White	Positive serial data output of differential line driver. A high level at this output gives logic 1 in positive logic.
3	10	Data (–)	Brown	Negative serial data output of differential line driver. A high level at this output gives logic 0 in positive logic.
4	3	Clock (+)	Yellow	Clock (+) together with Clock (–) forms a current loop. A current of 7 mA flowing in the direction of Clock (+) input gives logic 1 in positive logic.
5	11	Clock (–)	Lilac	Clock (–) together with Clock (+) forms a current loop. A current of 7 mA flowing in the direction of Clock (–) input gives logic 0 in positive logic.
6	5	CW/CCW V/R	Pink	This input programs the direction in which the encoder counts. A high level at this input causes the encoder to count upwards when the encoder is rotated clockwise as viewed looking at the drive shaft. If it is required that the encoder should count upwards when rotated counter-clockwise, then a low level (GND) must be applied to this connection.
7	8	Us	Red	Encoder supply voltage

Screen: On encoders with a cable exit the screen is connected to the connector housing.

Caution: Pins and cable leads not mentioned above must not be connected!



Pinout 7pol.

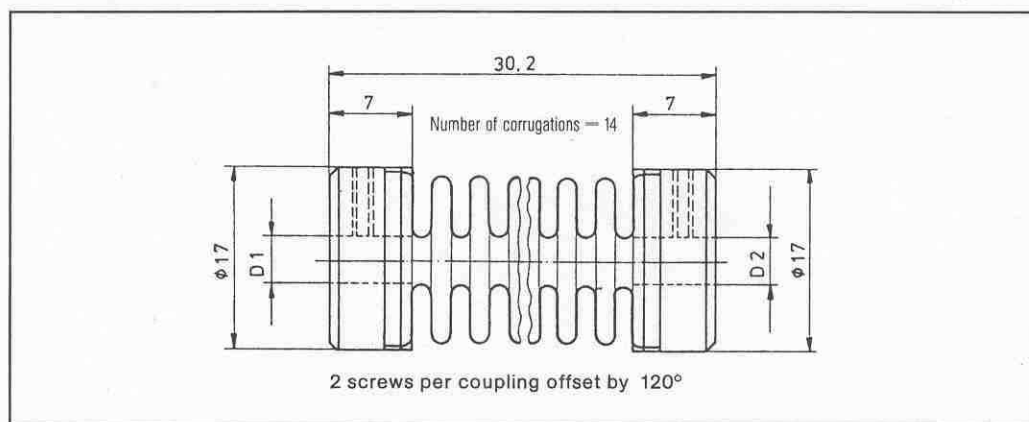


Pinout 12pol.

Adjusting tool	Adjusting tool EW 1 for adjusting the expanding shaft	Part no. 042 500 000 010
Cable	11-core cable Type LiYC11Y; 4 x 2 x 0,25 mm ² + 2 x 0,5 mm ² + 1 x 0,14 mm ²	Part no. 026 040 000 180
	12-core cable Type LiYC11Y suitable for use as trailing cable, with enhanced ability to withstand bending and torsional stress 4 x 2 x 0,25 mm ² + 3 x 0,5 mm ² + 1 x 0,14 mm ²	Part no. 026 040 000 350

Coupling SED 1450

For AG 661 with
10 mm standard shaft



Type	Dia. D1	Dia. D2	Part no.
1450/616	6	10	022 220 300 050
1450/1010	10	10	022 220 300 010
1450/1210	12	10	022 220 300 070

Technical data

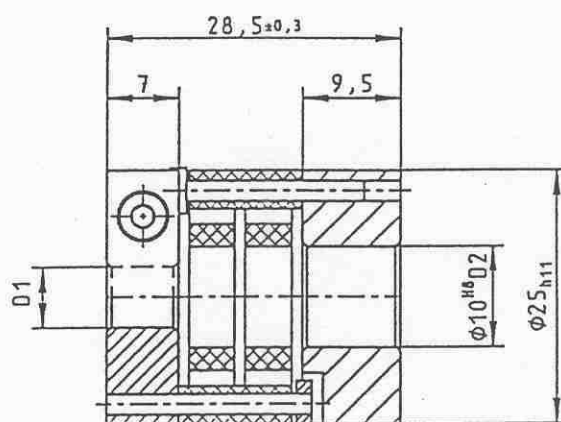
External diameter	17 mm
Length	30.2 mm
Max. torque	30 Ncm
Permissible shaft misalignment (radial)	± 0.4 mm
Permissible shaft misalignment (axial)	± 0.5 mm
Permissible angular misalignment	± 4 Degree
Permissible speed*	10000 min ⁻¹
Torsion constant	115 Ncm/Grad

* Based on a parallel misalignment of 0.5 mm and an angular misalignment of 8 degrees.

The coupling is torsionally stiff providing that as the maximum permitted torque is not exceeded.

Electrically Isolating coupling for encoders with a 10 mm expanding shaft, clamped on one side only.

CPS 9/2 S

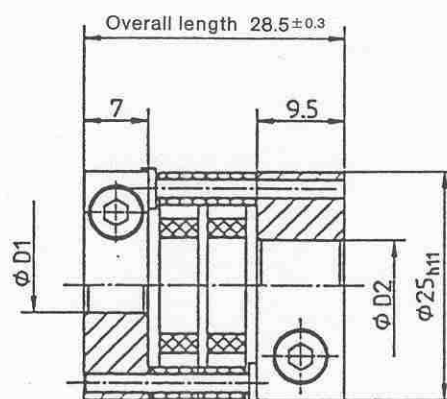


Type	Dia. D1	Dia. D2	Part no.
CPS 9/2 S 610	6 E9	10 H8	022 220 100 040
CPS 9/2 S 1010	10 E9	10 H8	022 220 100 060

Technical data

External diameter	25.4 mm max.
Length	28.5 mm
Clamping screws	M 2.5 / Ma 1.1 Nm
Nominal torque	2 Nm max.
Permissible shaft misalignment (radial)	± 0.5 mm
Permissible shaft misalignment (axial)	± 0.3 mm
Permissible angular misalignment	± 1 Degree
Torsional stiffness	55 Nm/rad
Permissible speed	15000 min ⁻¹

Electrically Isolating
coupling for encoders
with standard shaft,
clamped on both sides.

CPS 9/2

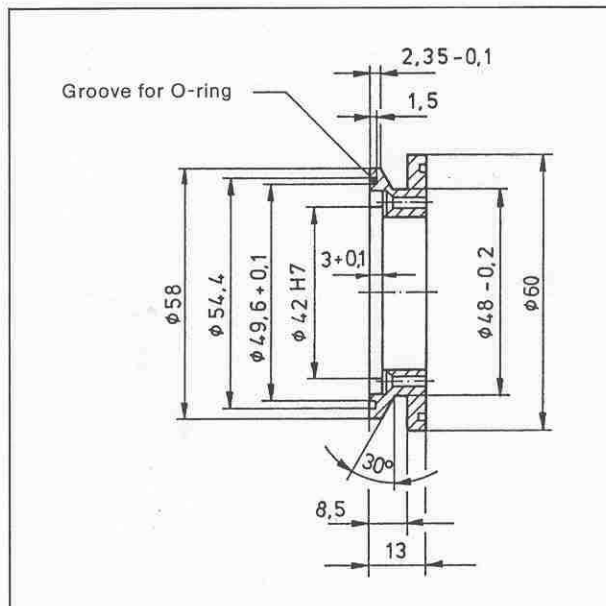
Type	Dia. D 1	Dia. D 2	Part no.
CPS 9/2 610	6 E9	10 E9	022 220 100 080
CPS 9/2 1010	10 E9	10 E9	022 220 100 090

Technical data

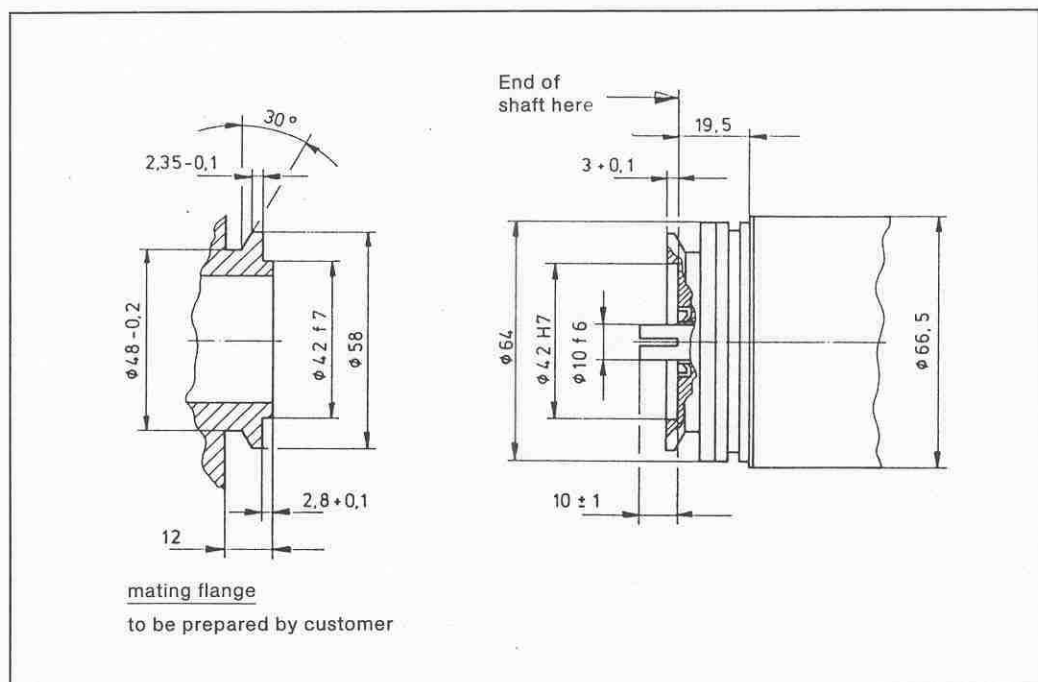
External diameter	25.4 mm max.
Length	28.5 mm
Clamping screws	M 3 / Ma 1.5 Nm
Nominal torque	2 Nm max.
Permissible shaft misalignment (radial)	± 0.5 mm
Permissible shaft misalignment (axial)	± 0.3 mm
Permissible angular misalignment	± 1 Degree
Torsional stiffness	55 Nm/rad
Permissible speed	15000 min ⁻¹

Clamping-ring flange

Part no.
81B 001 002 023



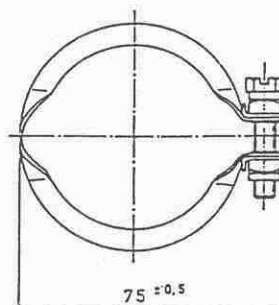
Mounting the encoder with the electrically insulating clamping-ring flange in conjunction with an insulating coupling ensures greater freedom from disturbances. This is particularly important in conjunction with brushless motors.



Clamping ring Norma 61

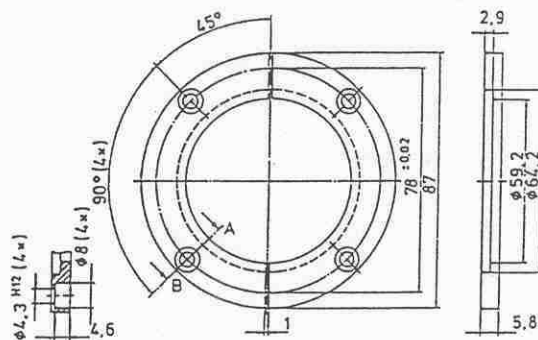
For AG 661 with
clamping-ring flange

Part no.
026 080 002 030

**Servo clamps SK 66**

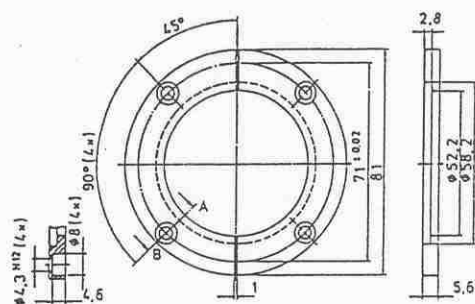
For AG 661 01...20
1 set = 2 servo clamps

Part no.
022 550 000 050

**Servo clamps SK 60**

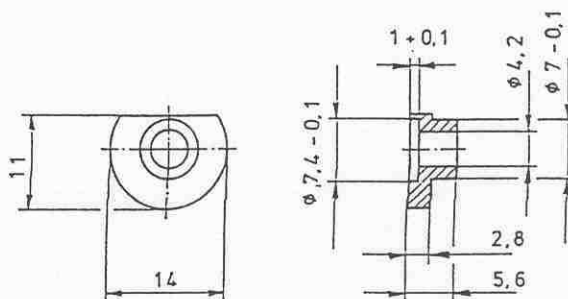
For AG 661 21...26
1 set = 2 servo clamps

Part no.
022 550 000 060

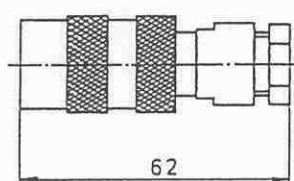
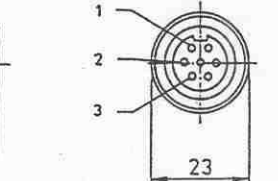
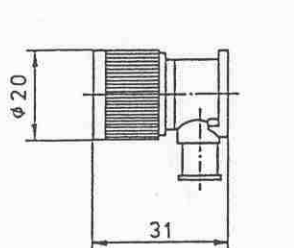
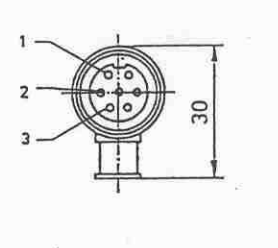
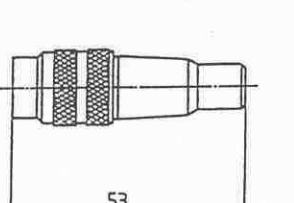
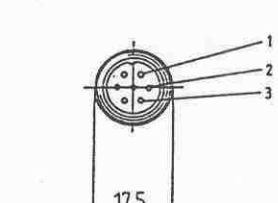
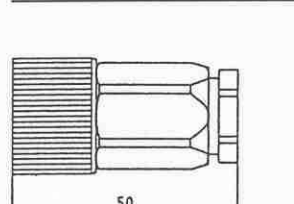
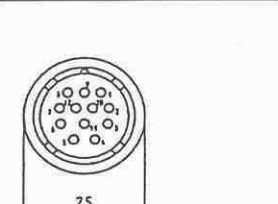
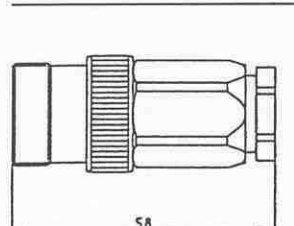
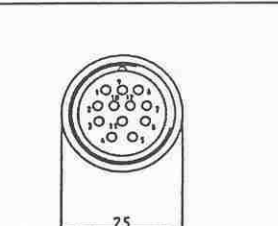
**Servo clamps SK 99**

1 set = 3 servo clamps

Part no.
022 550 000 030



Connectors

	 Pinout	7-pin screw-on connector B7F3 (female) Protection IP 66 Part no. 026 020 200 200
	 Pinout	7-pin screw-on connector B7F4 (female) Protection IP 40 Part no. 026 020 200 660
	 Pinout	7-pin circular connector B7M3 (male) Protection IP 40 Part no. 026 020 200 420
	 Pinout	12-pin screw-on connector C12 FUR (female) Protection IP 65 Part no. 026 020 200 700
	 Pinout	12-pin circular connector C12 ML (female) Protection IP 65 Part no. 026 020 200 210

9. Installation of AG 661 with expanding shaft and clamping ring flange

The installation of optical encoders by using an expanding shaft and clamping ring flange was pioneered by Stegmann and is protected under patent number DE 3427709C1 and registered design number G 8422363.4.

Features:

- **cost-effective and simple installation**
- **easy position setting**
- **compact**
- **the coupling housing no longer has to be opened in order to secure the coupling**

It works like a collet chuck. The drive shaft is split and contains a conical mandrel. The split part of the shaft is expanded by turning a screw located in the centre of the shaft.

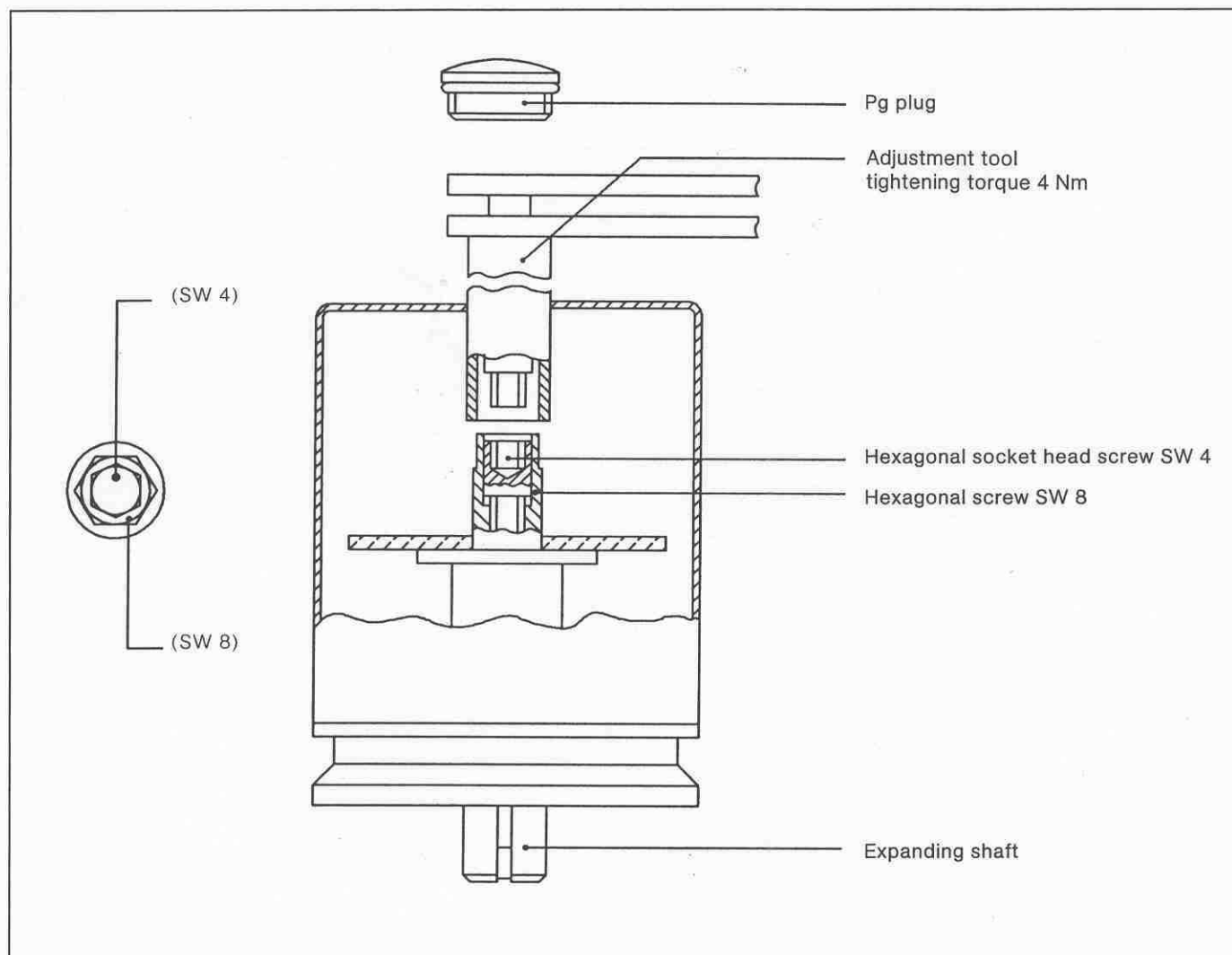
This system has two advantages:

1. A positive connection can be achieved between the drive shaft and the coupling without the need for any set screws or grub screws within the coupling.
2. If the shaft diameter is reduced by loosening the screw, the encoder shaft can be easily set to the required position.

Remove Pg plug in the encoder housing. The drive shaft can be easily secured to the coupling by using an M4 key and an M8 hexagonal socket wrench. This is done by holding the shaft still with the 8 mm socket wrench and turning the 4 mm key clockwise. Recommended tightening torque 4Nm. By turning the key anti-clockwise, the connection is loosened. The shaft can then easily be turned to the required position with the 8 mm socket wrench.

Position setting can be achieved using any commercially available tools or with the Stegmann adjusting tool (see Accessories page 21).

Installation of AG 661 with expanding shaft and clamping ring flange



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