AG 661
Absolute Angle Encoder

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 galium 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

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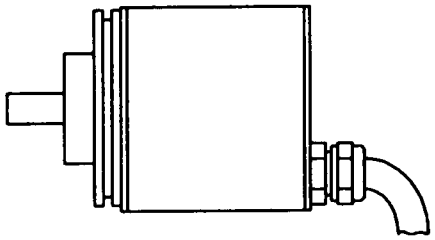
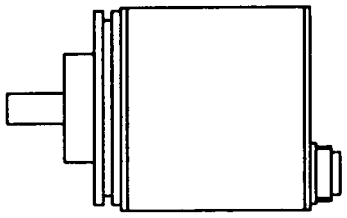
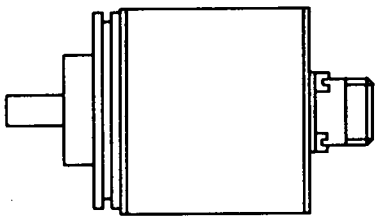
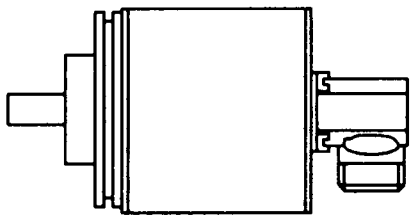
	**AG 66101 – AG 66106** Shaft 10 mm x 20 mm Servo clamping flange Axial cable exit see page 6
	**AG 66107 – AG 66108** Shaft 10 mm x 20 mm Servo clamping flange 7-pin connector (male) on housing, axial see page 8
	**AG 66109 – AG 66110** Shaft 10 mm x 20 mm Servo clamping flange 12-pin connector (male) 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

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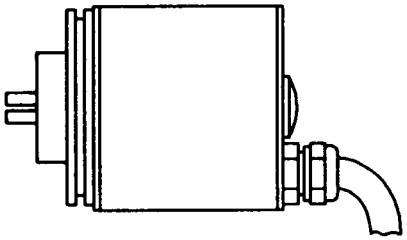
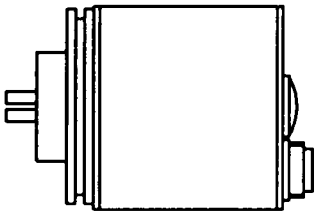
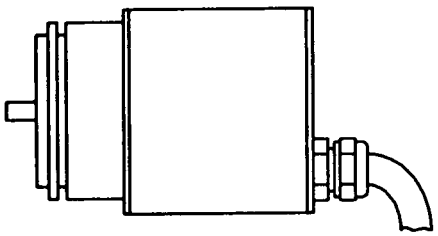
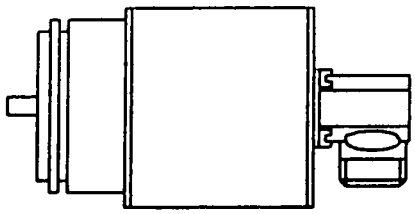
	**AG 66113 – AG 66118** Expanding shaft 10 mm x 10 mm Servo clamping flange Axial cable exit see page 11 and 12
	**AG 66119 – AG 66120** Expanding shaft 10 mm x 10 mm Servo clamping flange 7-pin connector (male) on housing, axial see page 13
	**AG 66121 – AG 66124** Shaft 6 mm x 10 mm Servo flange Axial 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

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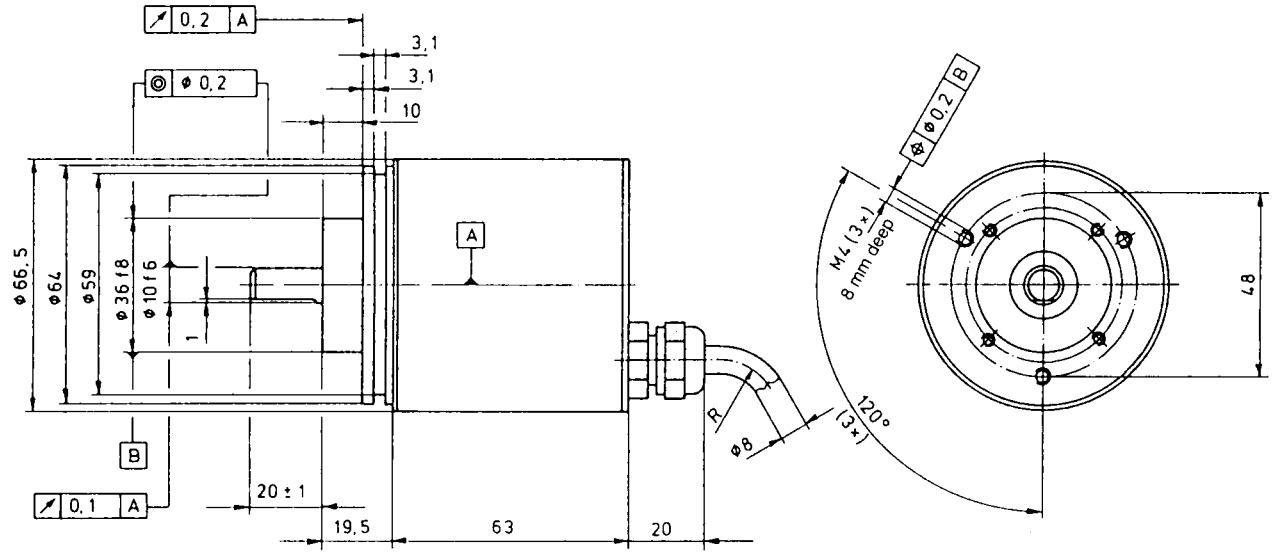
AG 661 01 – AG 661 06

- 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	Part no.
AG 661 01 Without connector at cable end Temperature range 0° C ... + 55° C	466 101 000 000
AG 661 02 Without connector at cable end Temperature range −20° C ... + 70° C	466 102 000 000
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)	466 103 000 000

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AG 661 Dimensional drawings and part numbers

Version	Part no.
AG 661 04 7-pin B7 M3 (male) connector at cable end Temperature range – 20° C ... + 70° C The mating B7 F3 (female) connector is not included and must be ordered separately. (see Accessories, Page 26)	466 104 000 000
AG 661 05 12-pin C12 ML (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)	466 105 000 000
AG 661 06 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)	466 106 000 000

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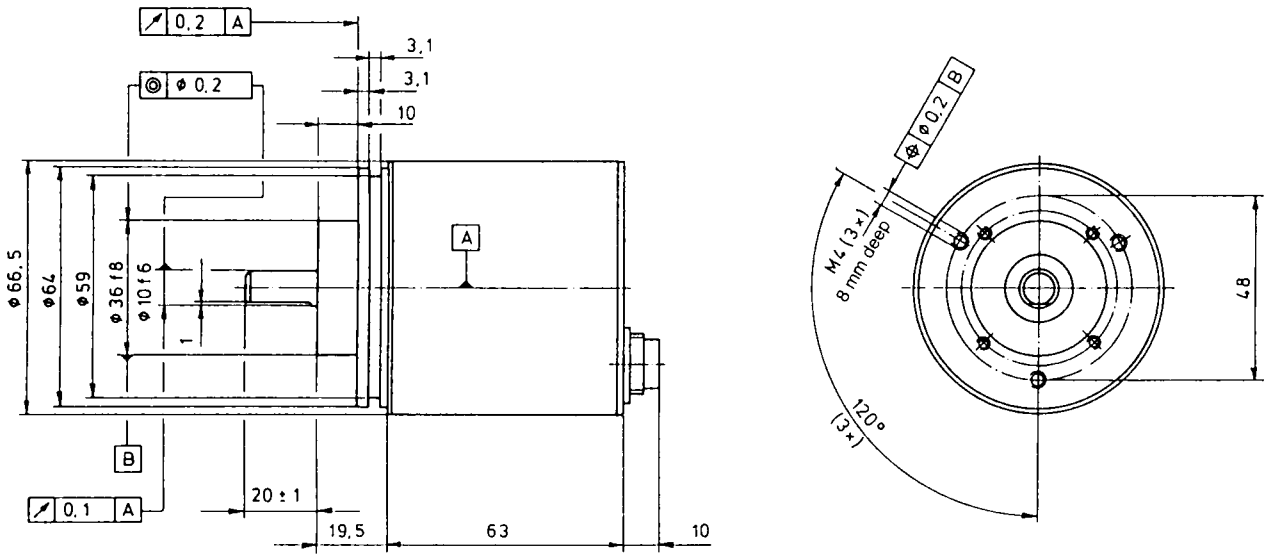
AG 661 Dimensional drawings and part numbers

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	Part no.
AG 661 07 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)	466 107 000 000
AG 661 08 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)	466 108 000 000

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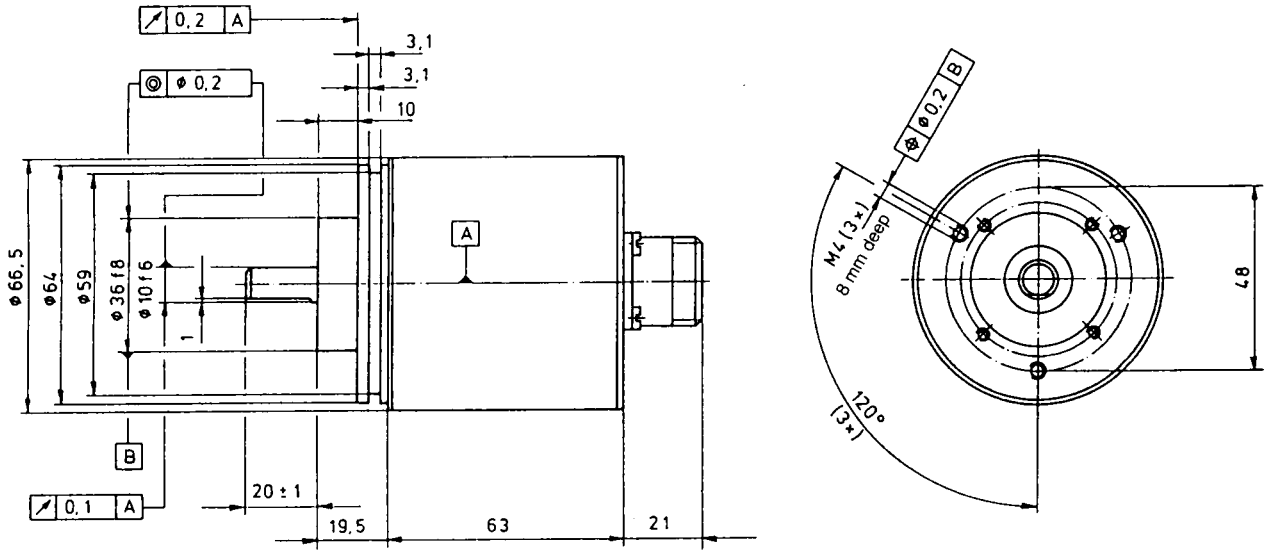
AG 661 Dimensional drawings and part numbers

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	Part no.
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)	466 109 000 000
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)	466 110 000 000

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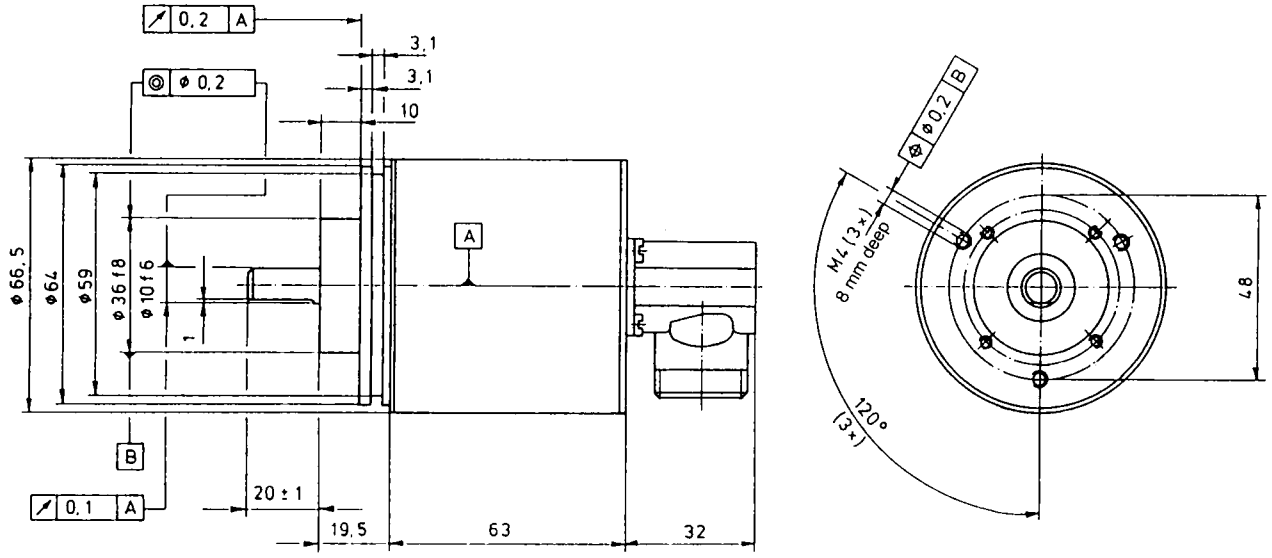
AG 661 Dimensional drawings and part numbers

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	Part no.
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)	466 111 000 000
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)	466 112 000 000

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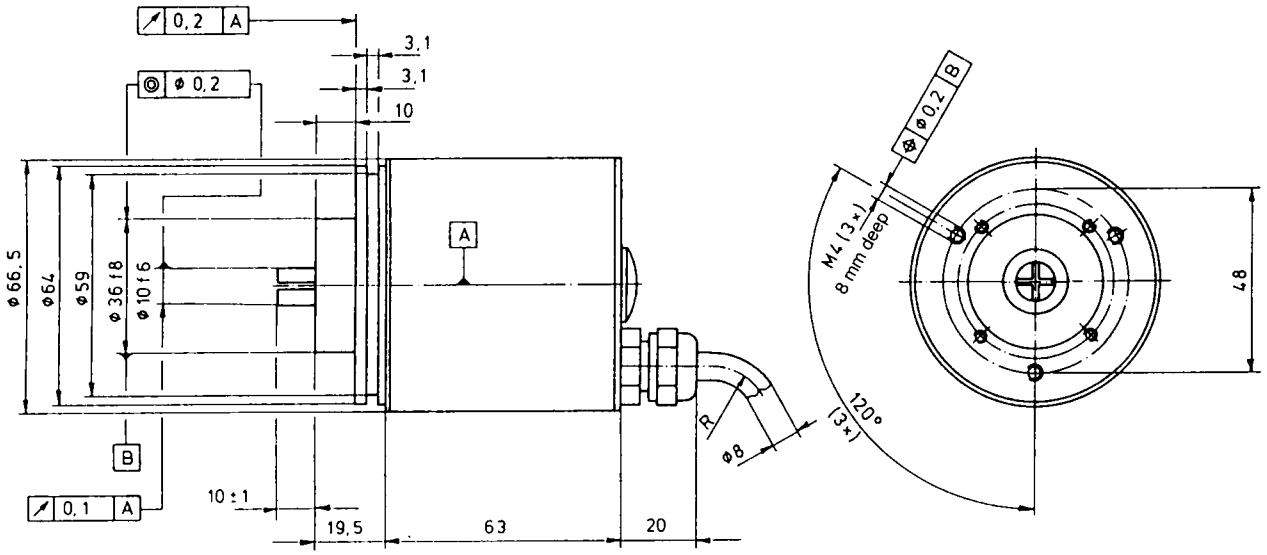
AG 661 Dimensional drawings and part numbers

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



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

Version	Part no.
AG 661 13 Without connector at cable end Temperature range 0° C ... + 55° C	466 113 000 000
AG 661 14 Without connector at cable end Temperature range – 20° C ... + 70° C	466 114 000 000
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)	466 115 000 000

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AG 661 Dimensional drawings and part numbers

Version	Part no.
AG 661 16 7-pin B7 M3 (male) connector at cable end Temperature range −20° C ... + 70° C The mating B7 F3 (female) connector is not included and must be ordered separately. (see Accessories Page 26)	466 116 000 000
AG 661 17 12-pin C12 ML (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)	466 117 000 000
AG 661 18 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)	466 118 000 000

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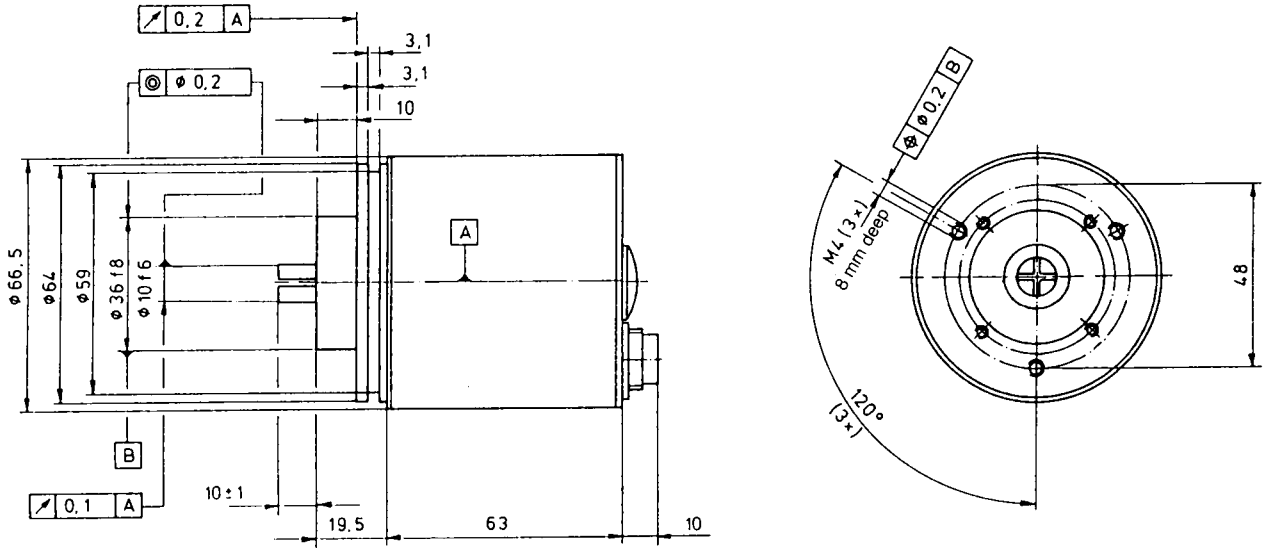
AG 661 Dimensional drawings and part numbers

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	Part no.
AG 661 19 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)	466 119 000 000
AG 661 20 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)	466 120 000 000

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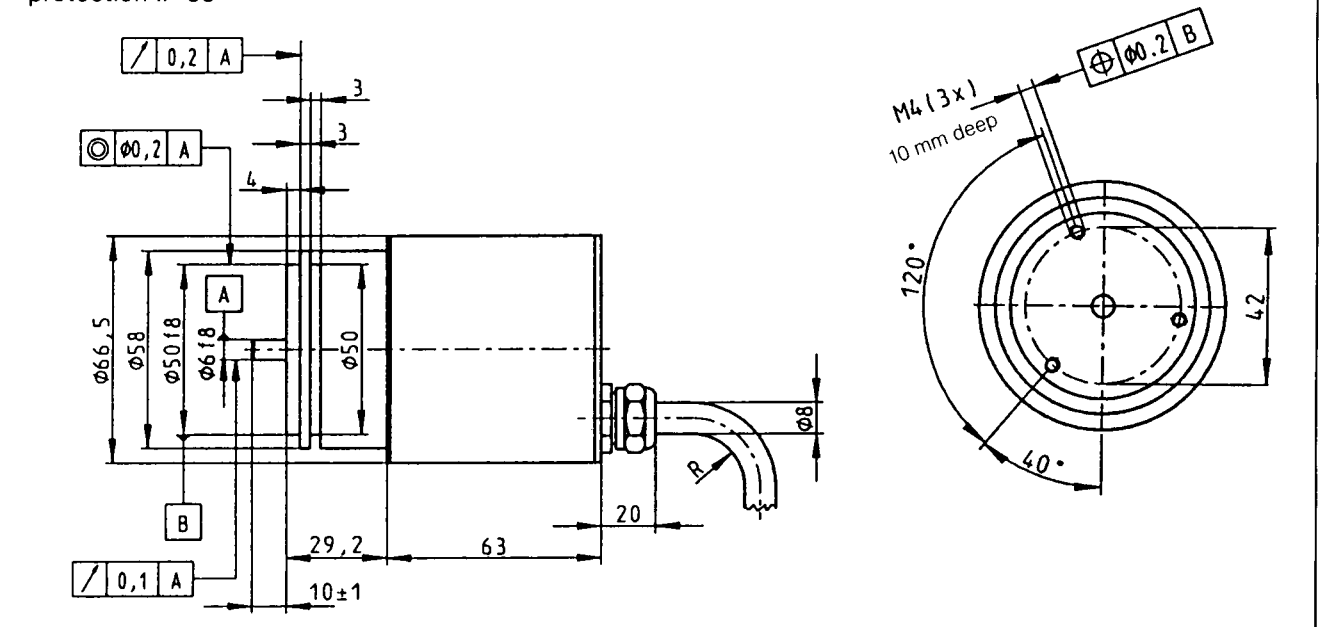
AG 661 Dimensional drawings and part numbers

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
cintinuous bending radius: 112,5 mm

Version	Part no.
AG 661 21 Without connector at cable end Temperature range 0° C ... + 55° C	466 121 000 000
AG 661 22 Without connector at cable end Temperature range –20° C ... + 70° C	466 122 000 000

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AG 661 Dimensional drawings and part numbers

Version	Part no.
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)	466 123 000 000
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)	466 124 000 000

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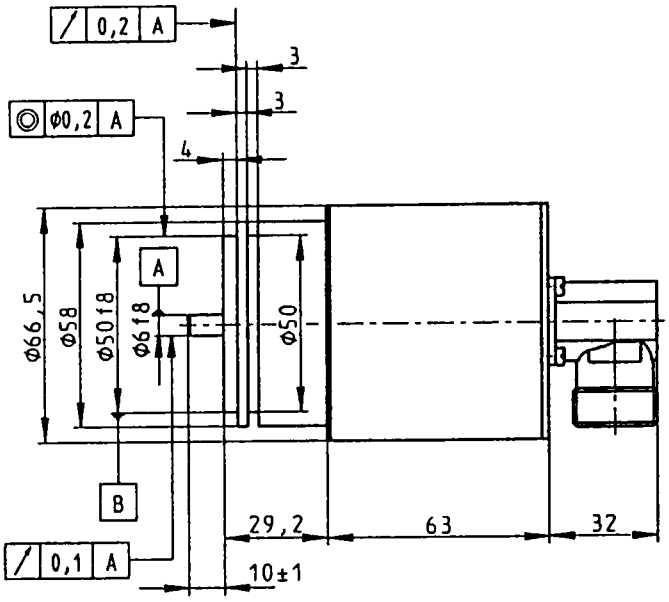
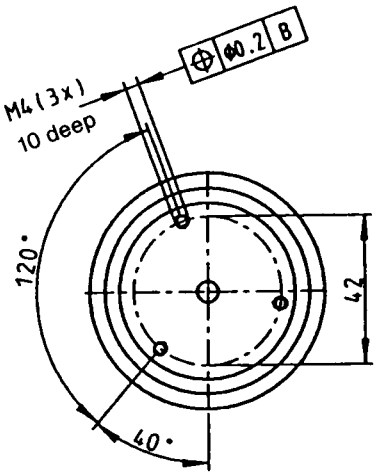
AG 661 Dimensional drawings and part numbers

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	Part no.
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)	466 125 000 000
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)	466 126 000 000

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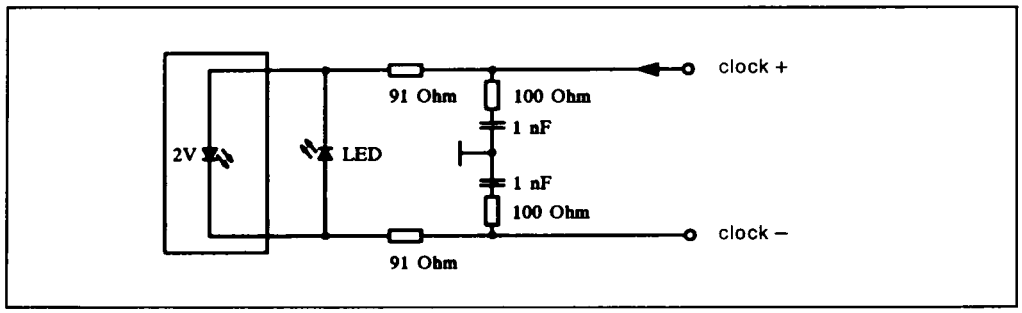
AG 661 4. Characteristic data

Mechanical data	Max. permissible speed		6000	rpm^{-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	ms^{-2}
	Radial impacts on the flange within 10 ms		300	ms^{-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 tm	15< tm <25	µs
	Minimum clock frequency	70	kHz
	Maximum clock frequency	1	MHz
	Recommended clock frequency	200	kHz
	Minimum interval between clock pulse trains Tp	30	µs

5. Clock input circuit (schematic diagram)



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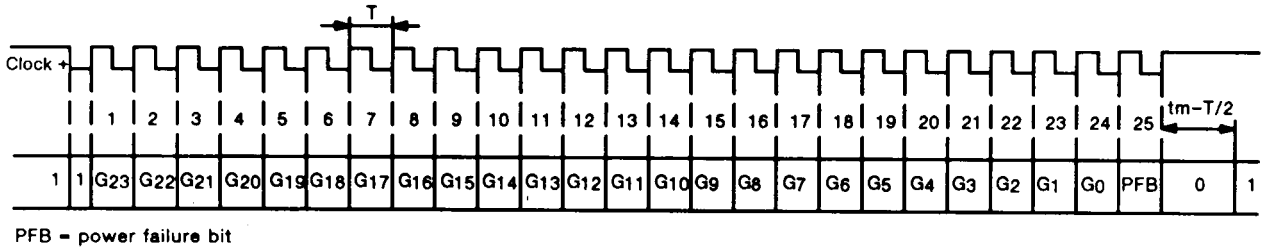
Data format

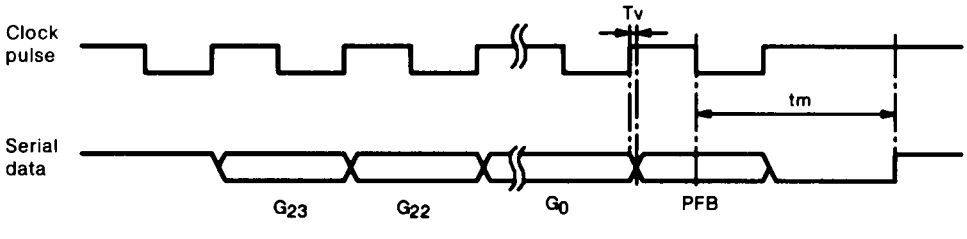


PFB = power failure bit

Power failure bit

If the power supply voltage should fall to below 5 V for more than 100 µs, 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



Tv max. 300 ns (clock (+) to data (+) or data (−) measured at the encoder)

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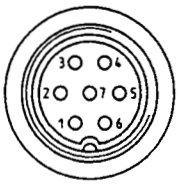
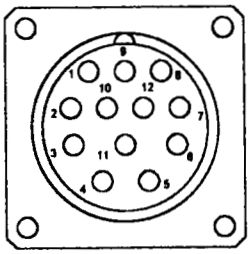
Pin 7-pin connector	12-pin connector	**Signal**	**Colour of cores** (for versions with cable exit)	**Explanation**
1	1	GND	Blue	Earth (ground) connection of encoder, galvanically isolated from the housing. The voltage source for GND is + Us.
2	2	Data (+)	White	Positive serial data output of differential 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 / $\overline{\text{CCW}}$ V / $\overline{\text{R}}$	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 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 connecter housing.

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



Pinout 7pol.



Pinout 12pol.

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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:

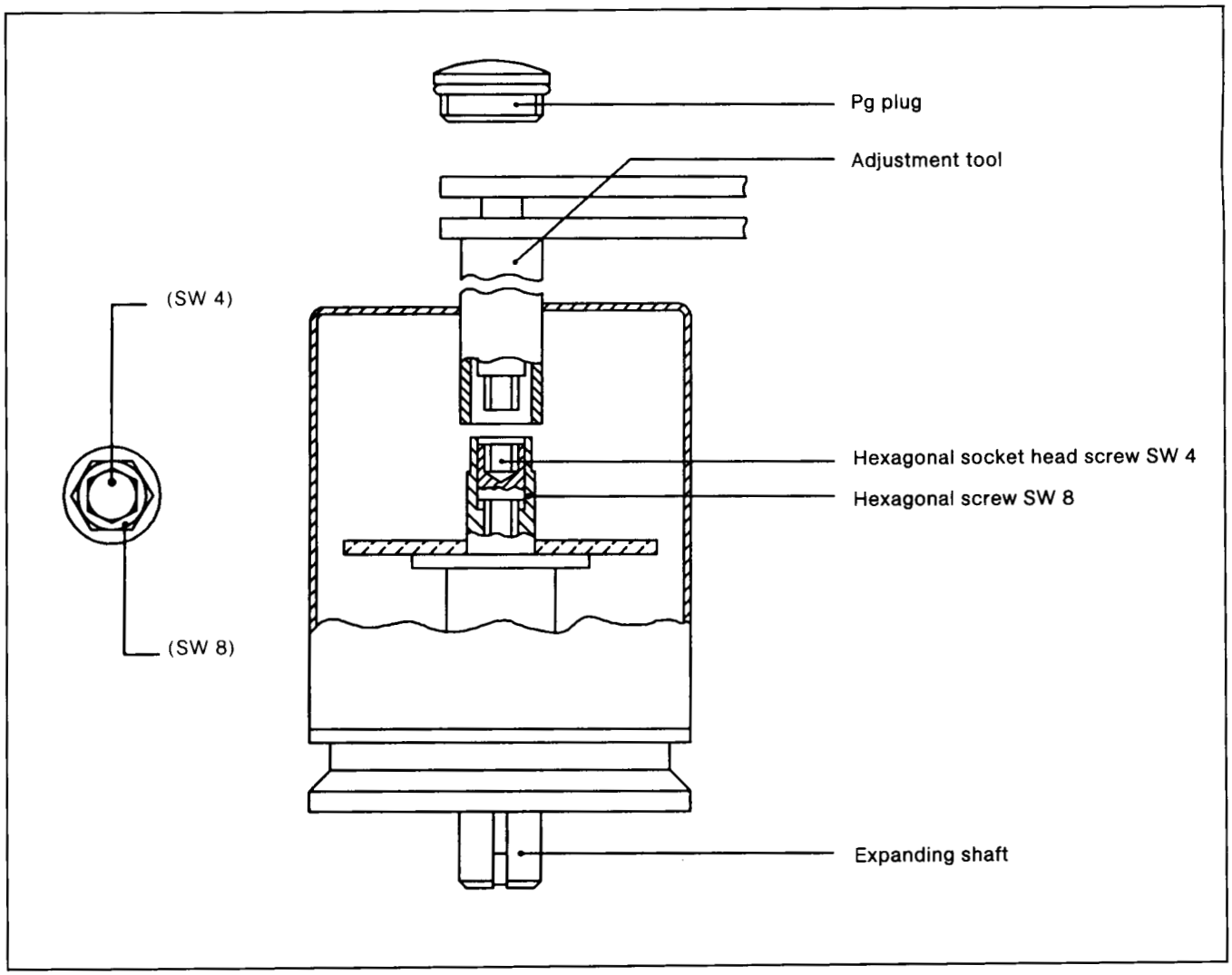
1. A positive connection can be achieved between the drive shaft and the coupling without the need for any set screws or grub screws within the coupling.
2. If the shaft diameter is reduced by loosening the screw, the encoder shaft can be easily set to the required position.

Remove Pg plug in the encoder housing. The drive shaft can be easily secured to the coupling by using an M 4 key and an M 8 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).

AG 661

Installation of AG 661 with expanding shaft and clamping ring flange



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