

Built-On Absolute Encoder for 2AD Main Spindle Motors

Project Planning Manual

DOK-ENCODR-2AD*ABSOLUT-PRJ1-EN-P

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This documentation is used:

- To supply electrical data and mechanical dimensions of the mounted absolute encoder for 2AD main spindle motors of the 2AD 132, 2AD 160 and 2AD 180 series.
- To assist in the selection of the correct connectors and ready-made cables.
- To assist with type codes for ordering 2AD main spindle motors with mounted absolute encoders or absolute encoder mounting sets.
- It supplies steps on the correct procedures for replacing an absolute encoder.

Definition of the symbols used in this document



Danger:
Information on guidelines and prohibitions to prevent injury to personnel and damage to property.



Guidelines:
Texts marked with this symbol indicate special information.

Change procedures

Designation of documentation up to present edition	Release-date	Coments
9.568.020.4-00 EN/06.93	Jun/93	First Edition
DOK-ENCODR-2AD*ABSOLUT-PRJ1-EN-E1,44	Jul./97	First E-Dok

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Dept ENA (MR, FS)

AC main spindle drives with 2AD main spindle motors ...

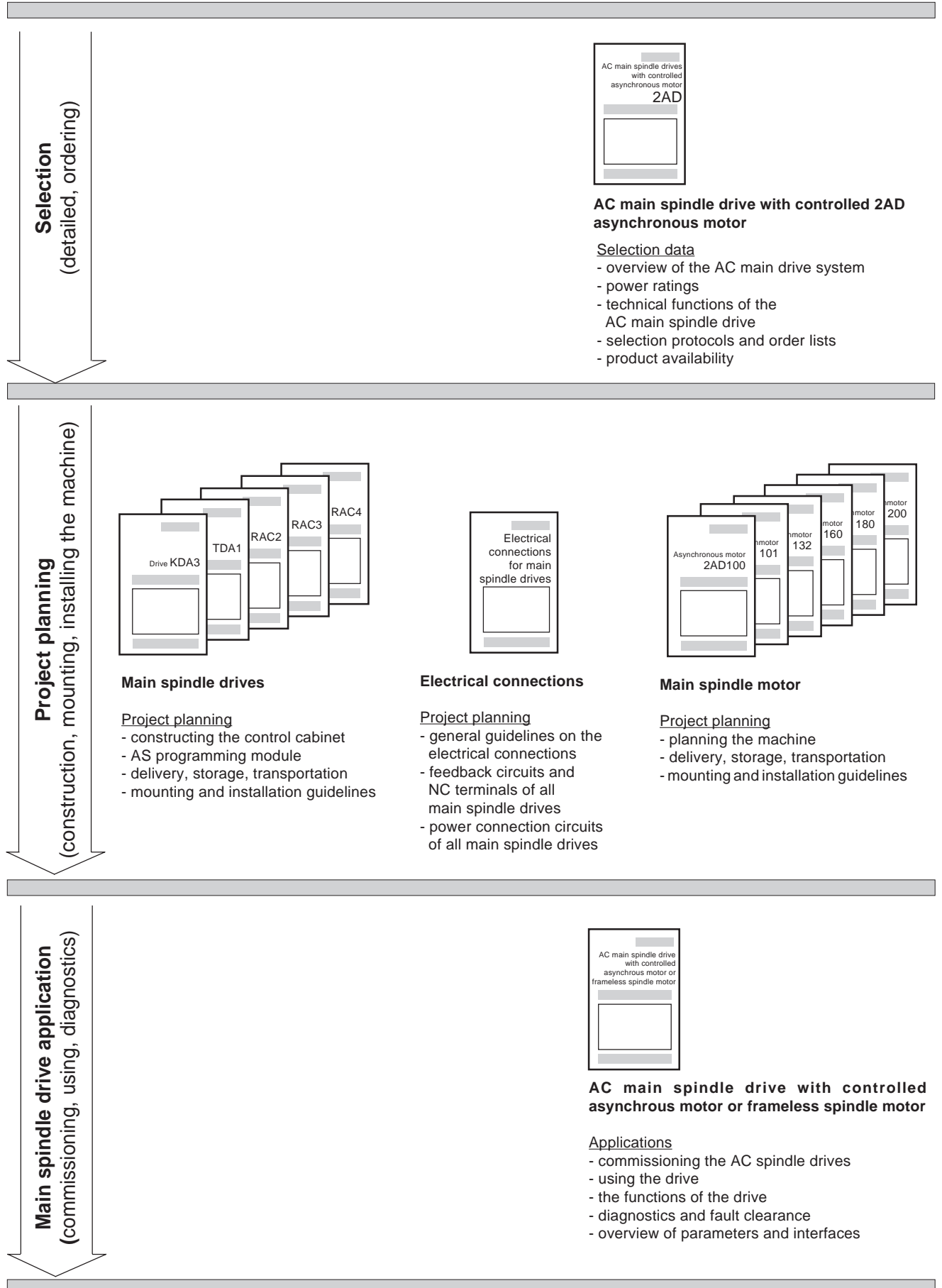


Figure 1: Documentation summary of "AC main spindle drives with 2AD main spindle motors and 1MB frameless spindle motor"

... and 1MB frameless spindle motors

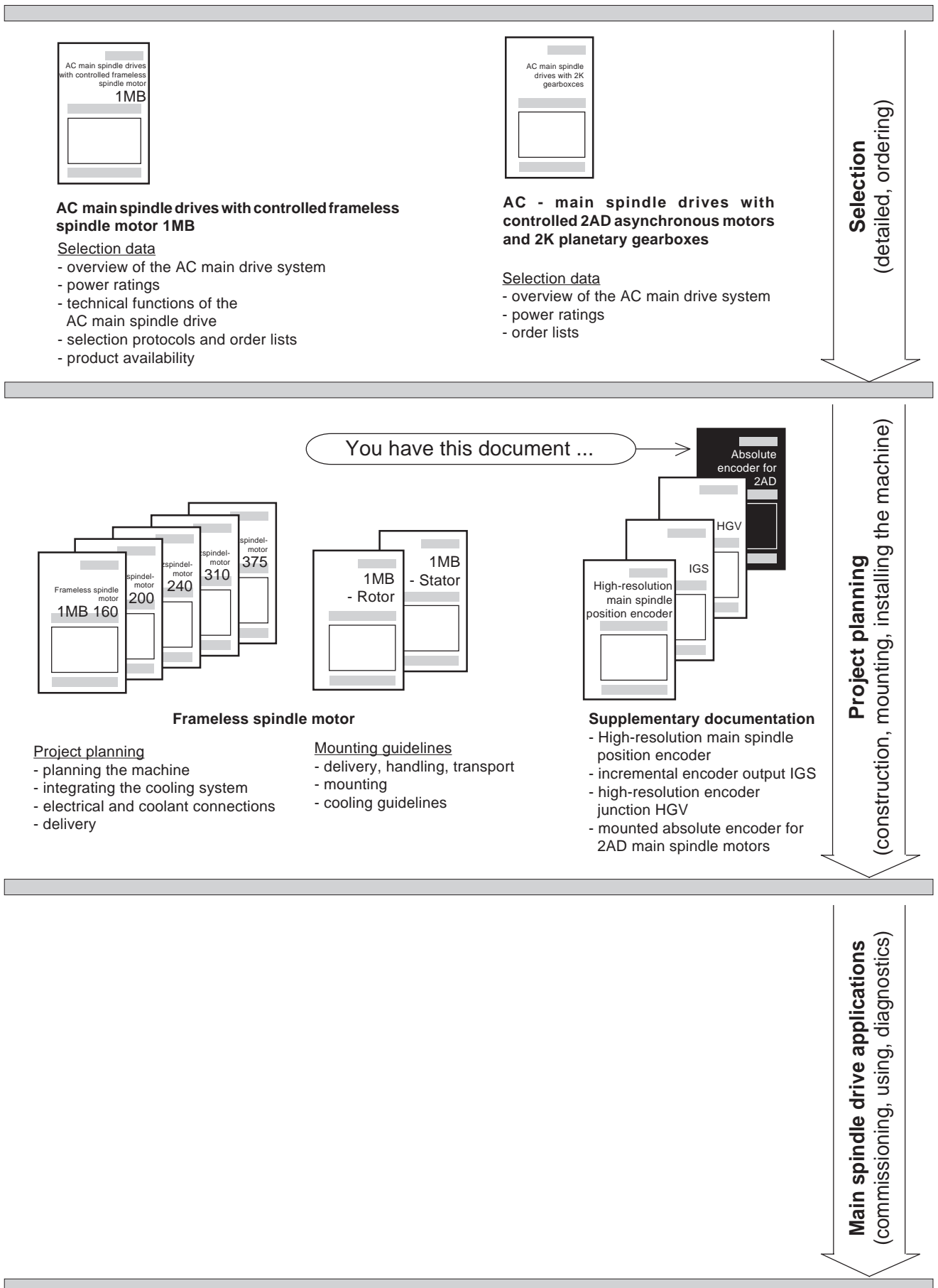


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1. Summary

While incremental encoders calculate changes in position by adding or subtracting increments in the control, absolute encoders supply an unequivocal (absolute) position value. These values are available even after an emergency stop or if the power is switched off. This eliminates the need for costly homing procedures of each individual axis. The current actual position value is immediately available even after an axis has been moved while no power was applied.

There are two different types of rotary absolute encoders:

Single-turn encoder

Every angular position between 0° and 360° is assigned an absolute value.

Multiturn encoder

In addition to the absolute position in terms of the 360° , a multiturn encoder breaks up a definite number of revolutions assigning absolute values.

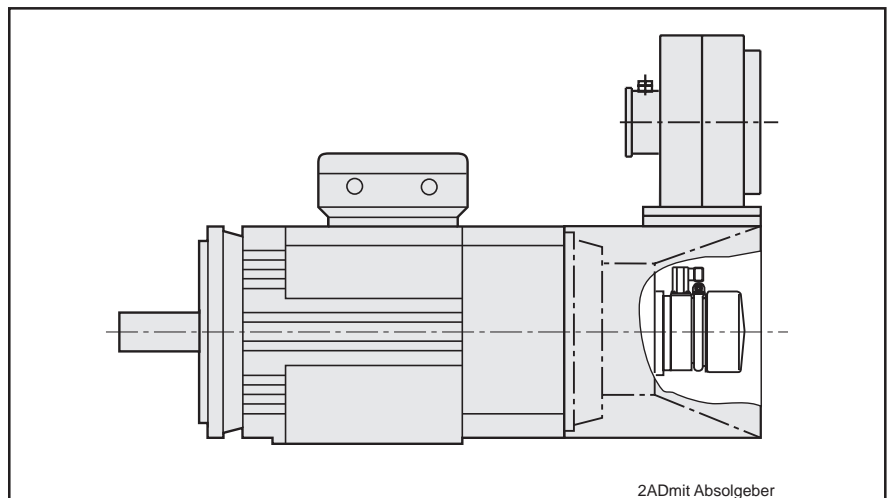


Figure 1.1: 2AD main spindle motor with mounted absolute encoder

2AD main spindle motor with mounted absolute encoder

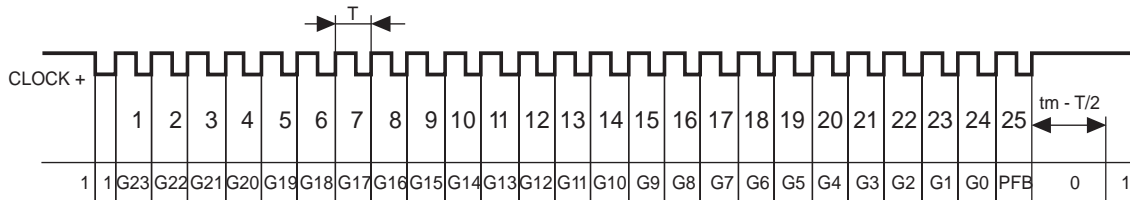
INDRAMAT 2AD main spindle motors are available in Design 3 (motor type code field "motor feedback") with mounted absolute encoder. This is the type most commonly ordered. Mounting sets are also available. A mounting set makes it possible to equip a 2AD main spindle motor with second shaft end with an absolute encoder. For reasons of dimensional precision, the encoders are completely assembled as a set with the flange needed for that motor size. In the event a replacement is necessary, the entire set must be replaced.

Primary features

- Multiturn encoder with a resolution of 24 bits, gray code, 4096 increments / 360° x 4096 revolutions
- synchronous serial interface
- fully insulated, robust construction
- plug connections, 12 pin
- complete protection against contact; protection against a jet of water (protection category is IP 65 after mounting)

2. Technical data

Supply voltage range:	DC 10 V...32 V, prot. against polarity reversal
Power consumption:	≤ 3 W
Sampling code:	gray code
Clockwise counting direction looking towards shaft:	rising
Transmission of data:	synchronous, serial
Serial data output:	driver as per EIA RS 422 protected against short-circuit
Mono stable output time t_m :	15 μ s < t_m < 25 μ s
Clock frequency:	200 kHz
Minimum clock brush:	30 μ s
Data format:	24 bit
Protection category when mounted:	IP 65

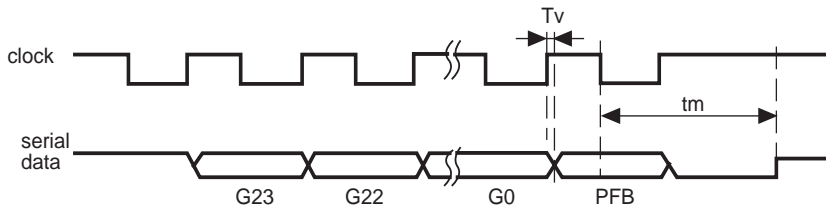


PFB = power failure bit
 T = duration of the clock signal
 t_m = mono stable output

Power failure bit:

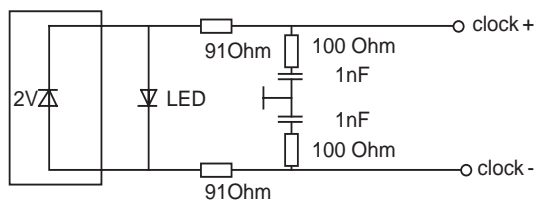
If breaks in the supply voltage (< 5 V) occur over a period longer than 100 μ s then the encoder data could be corrupted.

The power failure bit (PFB) indicates this error. A comparator is used in the event of a voltage break to set the PFB in the serial information to logical 1.

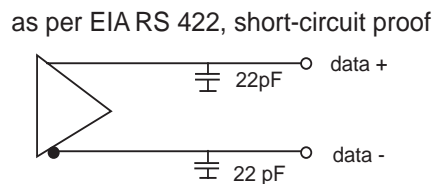


Delay time T_v : max. 300ns (clock (+) to data (+) or data (-), measured at the coder).

clock input circuit



data output circuit



TDAbsol

Figure 2.1: Mounted absolute encoder - technical data

3. Mechanical dimensions

3.1. Mounted absolute encoder mounted to a 2AD main spindle motor Mounting set AM 174 SG

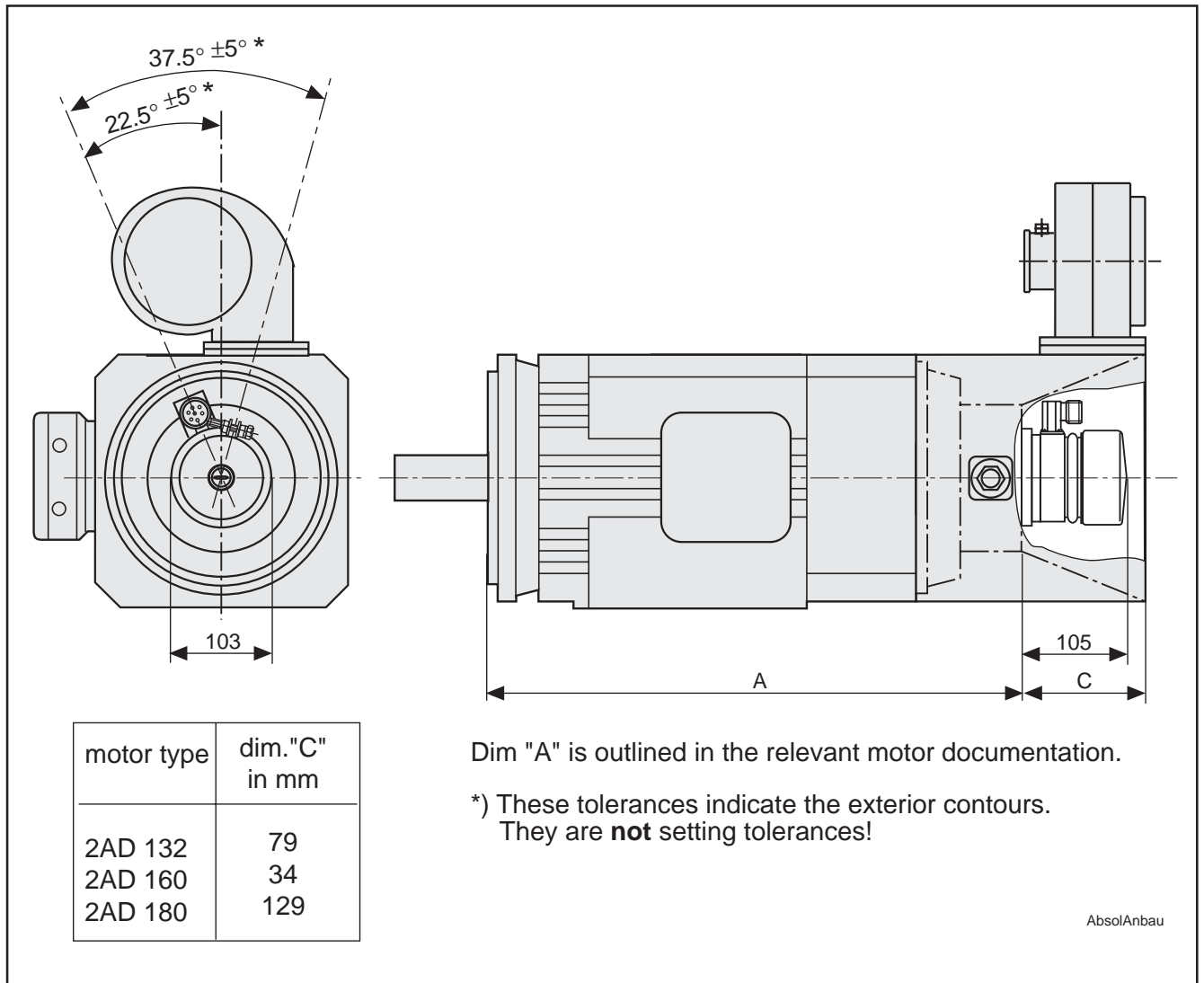


Figure 3.1: Absolute encoder mounting set AM 174 SG mounted to a 2AD asynchronous motor

4. Electrical connections

4.1. Terminal diagram

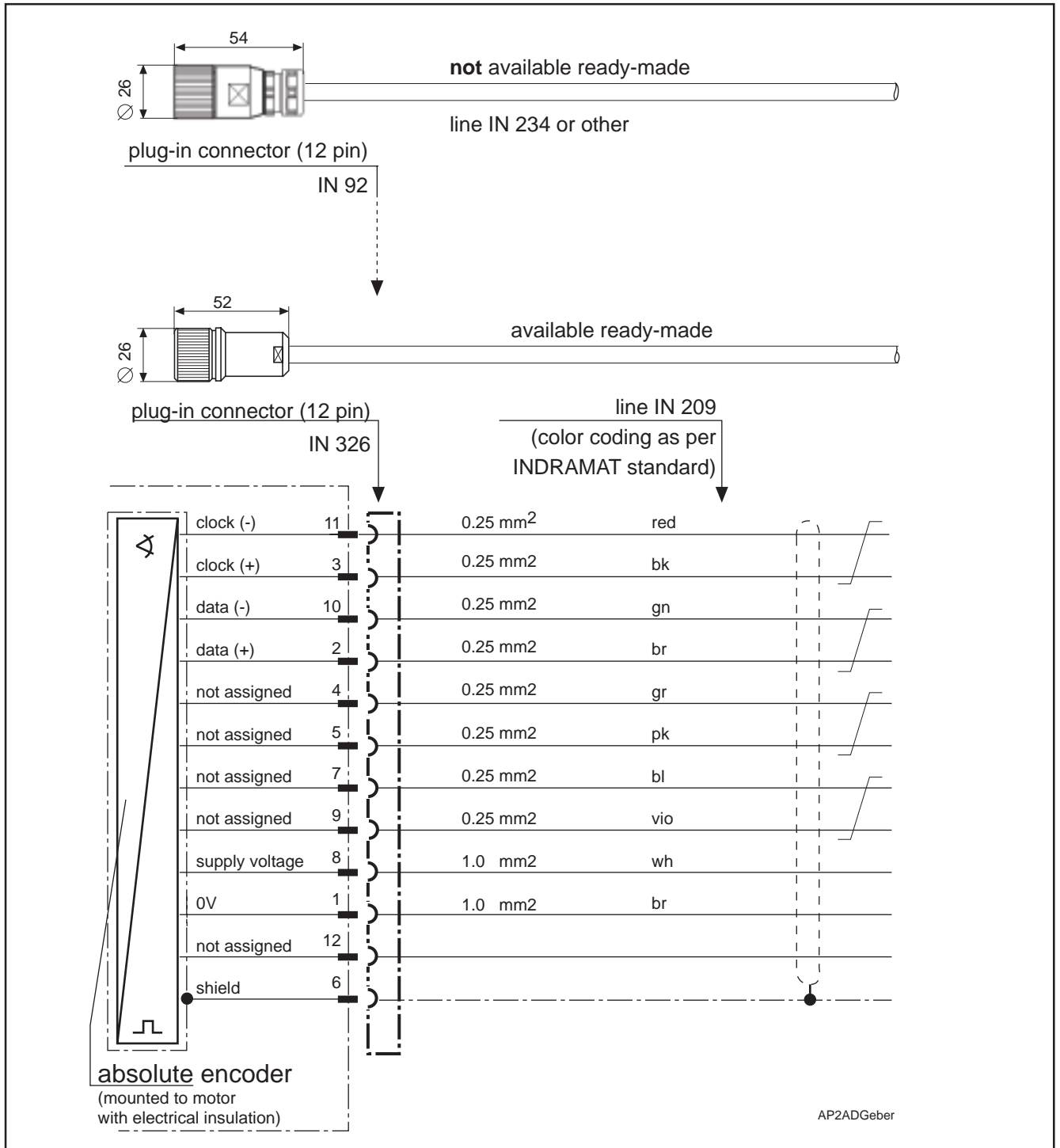


Figure 4.1: Absolute encoder terminal diagram



To maintain protection category IP 65, plug-in connector IN 326 may only be connected to line IN 209!

With other line types, protection category IP 65 is only possible if plug-in connector IN 92 is used.

4.2. Ready-made cables







Order designation of the ready-made position feedback cable	Type designations of the plug-in connector	Line	Cable end design
IKS 801/ . . .	IN 326 	IN 209	 with ferrules for connection to modular terminal
IKS 806/ . . .	IN 326 	IN 209	IN 327  with coupling unit for connection to plug-in connector IN 326 or IKS 801
IKS 724/ . . .	IN 326 	IN 209	IN 292  for connection to CLM

Figure 4.2: Available ready-made position feedback cables for the built-on absolute encoder

IN 209 - data

Cable diameter	8.8 mm
Bending radius, fixed routing	40 mm
Bending radius, flexible routing (more than 500,000 bending loads)	90 mm
Specific weight	0.102 kg/m
Chemical characteristics	absolute resistance to mineral oils and greases, hydrolysis resistant, silicone and halogen free
Permissible ambient temperature for operation and storage	-30°C to +80°C
Cable surface	poor adhesion, prevents sticking in drag chains
Maximum cable length	75 meters

Figure 4.3: IN 209 - technical data

4.3. Installation guidelines

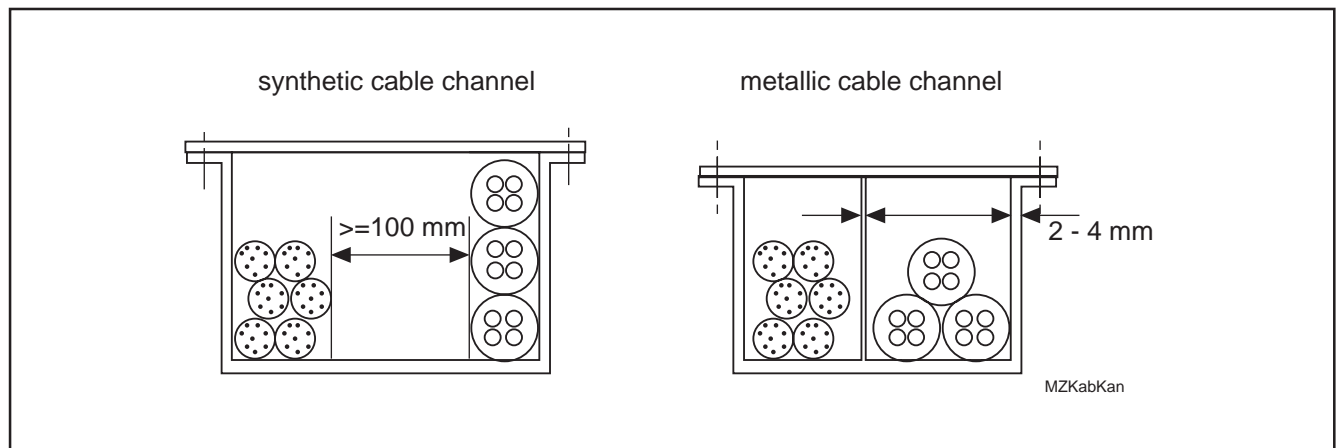


Figure 4.4: Examples of separate and shielded routing of motor power and feedback cables

Experiences with various industrial applications have demonstrated that installation is a significant factor. Please note the following guidelines to avoid emitting interference into feedback lines:

- Always use shielded lines for feedback lines. This is guaranteed, if INDRAMAT lines are used.
- Apply shield of feedback line in the plug-in connector to the NC!
- Do not apply the shield to the motor housing. (To avoid earth loops, the encoders are insulated, in contrast to the motors.)
- Maintain a minimum clearance of 100 mm if feedback and power cables are routed parallel, or use a metallic partition in the power cable (Figure 4.4).
- Do not remove or insert connectors with power on.
- Do not route the feedback lines in close proximity to high-frequency equipment, power transformers, chokes, motors and other machines with strong magnetic fields. Also do not route near high-voltage lines, otherwise interference could be coupled in.

5. Order information

5.1. Order information for a 2AD main spindle motor with built-on absolute encoder

Order 2AD main spindle motors with absolute encoders as follows:

Item 1

Ordering a 2AD main spindle motor with a second shaft end and a radial blower.

Example:

the text of the order
2AD132C-B05RB3-AS03-A 3 N1

Item 2

Ordering the absolute encoder

Example:

the text of the order
AM 174 SG

Item 3

Ordering the absolute encoder set for the 2AD asynchronous motor

Example:

the text of the order
**mounting set AM 174 SG for
 2AD132C-B05RB3-AS03-A3N1**

Item 4

Feedback connector and line or ready-made cable

Example:
 (see section 4.2)

the text of the order
**IN 326 and IN 209/(length)
 or IKS 801**

5.2. Ordering replacements parts for an absolute encoder mounting set

The mounting set of the absolute encoder can be ordered individually.

order designation:

the text of the order
AM 174 SG

A special tool is offered for mounting and setting (INDRAMAT part no. 243 044) see Figure 7.1. The tool must be ordered separately.

order designation

the text of the order
EW1

6. Procedures for setting home

Various procedures can be used to set the homing point.

1st procedure

Set the zero point of the absolute encoder to the mechanical homing point.

- set the main spindle drive to the homing point (jog mode)
- connect the control unit to the absolute encoder
- remove the absolute encoder - motor shaft connection (special setting tool, part no.: 243 044)
- turn the absolute encoder to the zero point; evaluation by the control unit
- test run

2nd procedure

Set the end of the measuring range of the absolute encoder to the mechanical axis end position.

- run the mechanics to the end position
- connect the absolute encoder to the control unit
- remove the absolute encoder - motor shaft connection (setting tool, part no.: 243 044)
- turn the absolute encoder to the relevant end position
- re-connect absolute encoder - motor shaft
- test run

3rd procedure

Electronic shifting of the zero point in the control unit (depends on the control unit)

- the absolute encoder remains clamped to the motor
- the drive is connected to the mechanics
- drive is moved to homing point (jog mode)
- the absolute value of the encoder is read in and interpreted by the control unit as a zero point

7. Encoder replacement



The absolute encoders which INDRAMAT mounts are high-quality measuring systems developed for rugged operations on production machines. The careful mounting of the complete mounting set will guarantee trouble-free and continuous operation.

The encoders are replaced on site as one complete unit.

Do not use harsh cleansers for cleaning the units.

The encoder may only be operated if the filler plugs are firmly screwed into place (10) (any contamination by dirt can cause the encoder to break down).

Required tools

Hexagon socket key, angular, SW 3

Hexagon socket key, straight, SW 4

Torque key 0 to 5 Nm

Screwdriver

Setting tool, part no. 243 044 (11)



Risk of accident from uncontrolled axis movements!

Switch servo motor off before working on the absolute encoder.

Pull or insert encoder connector only when power is off.

7. Encoder replacement

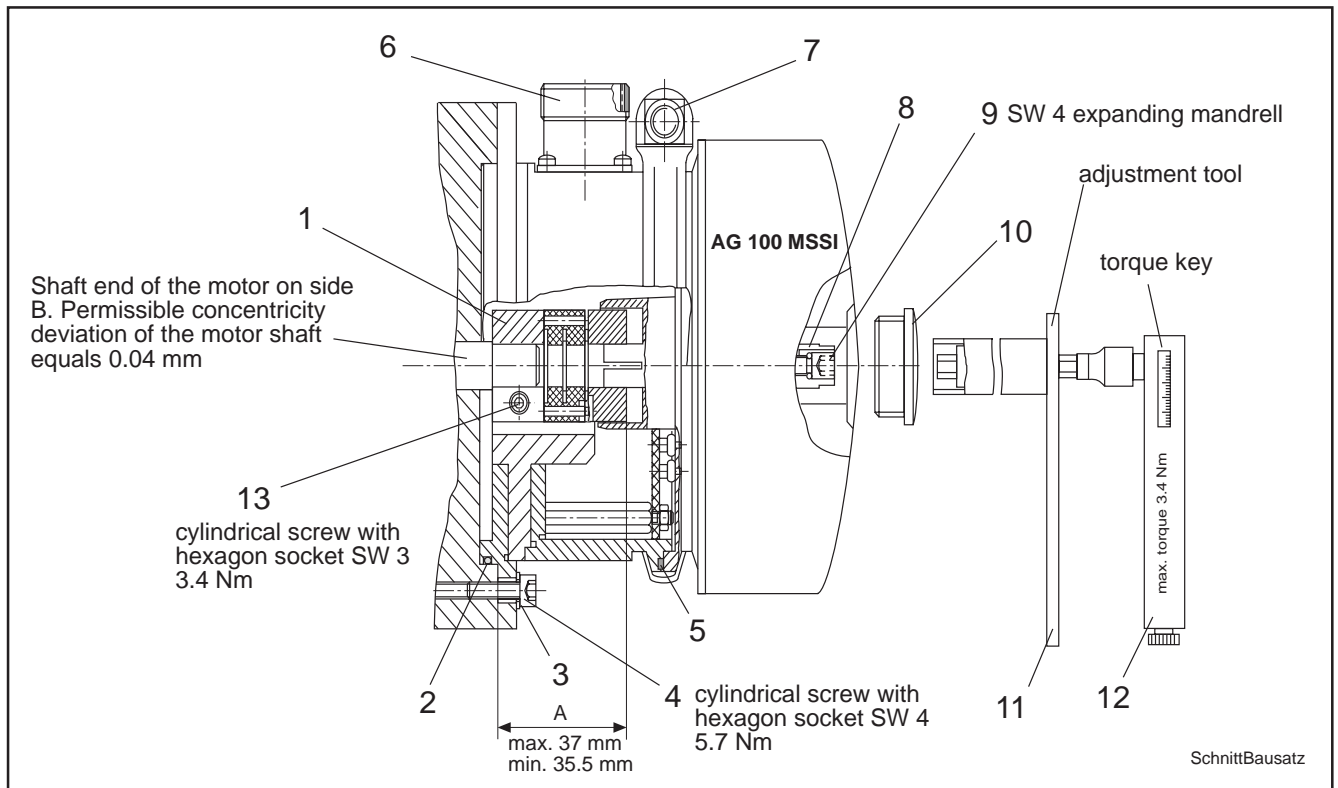


Figure 7.1: Cross-section drawing of absolute encoder mounting set AM 174 SG

Removing the absolute encoder

1. Screw filler plug (10) out of the encoder housing.
2. Place setting tool (11) on expanding mandrel (8) and hold firmly in this position.
3. Using a hexagon socket screw (SW4) pull the expanding mandrel (9) out with approximately six revolutions!

Do not twist the setting tool during this procedure!

The coupling and the encoder expanding mandrel are now separated.

4. Remove the four screws (4) (SW3) and carefully pull the entire encoder set out. The coupling remains firmly clamped to the motor shaft.
5. If necessary when replacing the coupling, remove the coupling clamped onto the motor shaft after the cylindrical screw has been removed (13).

Preparing the encoder for mounting

1. Carefully remove the replacement unit out of its packaging.
2. Remove filler plugs (10) on the encoder housing.
3. Check to see whether the expanding shaft (8) is unloaded.
4. It must be possible to slightly move the coupling on the expanding shaft (9). If not, place and hold firmly the setting tool onto the hexagon socket of the expanding shaft. Now, turn the expanding mandrel (9) with a hexagon socket screw (SW4) to the left for six full rotations. The expanding shaft is now unloaded.

These are the pre-requisites for a correct mounting of the replacement unit.

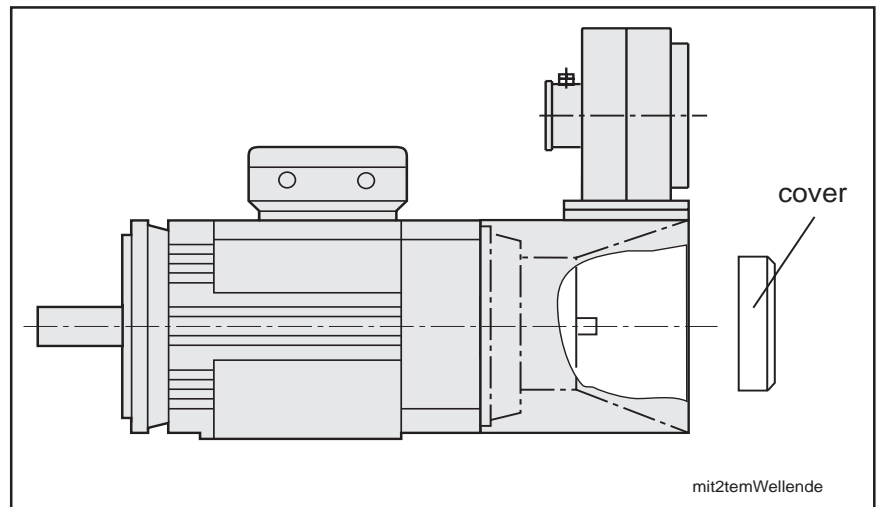


Figure 7.2: 2AD main spindle motor with second shaft end

Mounting the new encoder

1. Remove the cover on shaft end of side B (if one is mounted)
2. Push coupling (1) onto the second shaft end
3. Dimension "A" (set distance of flange surface to the end of the coupling, see Figure 7.1)
4. Tighten screw (13) with 3.4 Nm
5. Check whether O ring (2) is mounted to unit
6. Set the mounting set carefully, and without tipping, onto the motor. Feed the expanding shaft (8) into the coupling at the same time.
7. Turn connector (6) so that the angle as depicted Figure 3.1 is given
8. Fix mounting set into place using the four screws with sealing rings (4). Tightening torque: 5.7 Nm.
9. Place setting tool (11) onto expanding shaft (8). Hold the setting tool firmly in this position.
10. Tighten expanding mandrel (9) using torque key. Tightening torque: 3.4 Nm
11. Screw filler plug (10) into encoder housing
12. Insert connector
13. Switch power on
14. Switch drive on and check encoder function
15. Run a homing procedure

