AN-04 - Mechanical installation of DS Electric Encoders™

1. Summary

The DS encoders are semi-modular, i.e. the rotor and stator are separate but the rotor is captive inside the stator. The stator is fixed to the machine mounting surface by means of three special servo screws. In all encoders except for the **DS-58** the rotor is supported by a shoulder on the rotating shaft, it can be included in a chain that includes ball bearings flat spring etc. In applications where it is not economical for the machine builder to meet the recommended axial tolerance between the rotor and stator mounting surfaces, special compensation shims are available which are placed underneath the stator. In the **DS-58** the rotor clamped radially to the machine shaft by means of a supplied shaft clamp. Installation of the encoder thus involves the following steps:

1. Measuring the axial distance between the mounting shoulder and surface.
2. Selecting the compensation shims (if applicable)
3. Fixing the stator (housing) to the mounting surface.
4. Fixing the rotor to the shaft

The electrical integrity of the installation is validated as detailed in application note **AN-02** and consists of measuring the output signal amplitude and noise.

Note 1: In the **DS-37, DS-90,** and **DS-130** the encoder housing touches the machine mounting plate both **axially** and **radially** by three contact pads that are 120º apart. The pads are adjacent to three slots where the servo screws (supplied with the encoder) are engaged – see **Figure 1**.

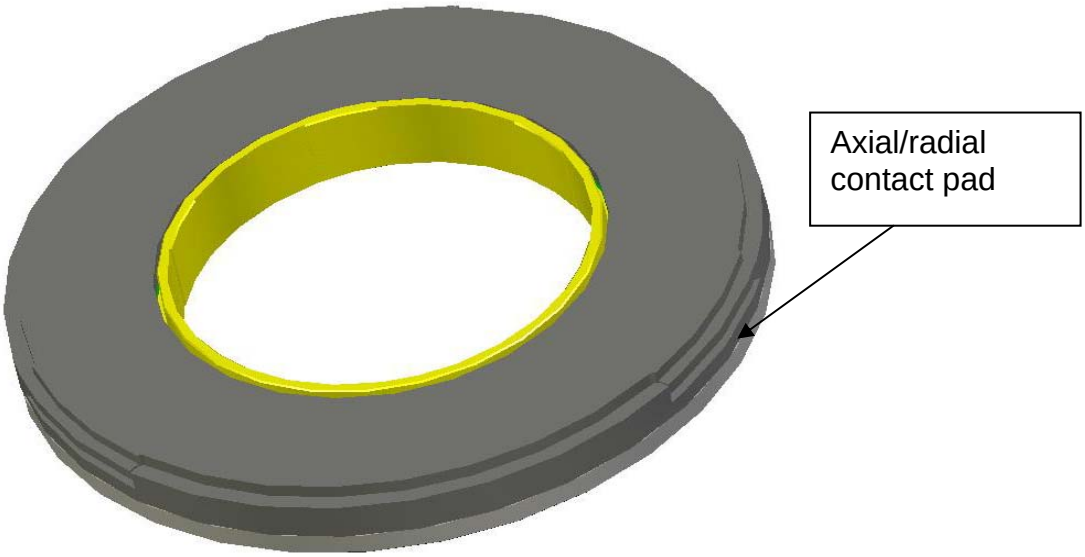

Figure 1

Note 2: In standard **DS** encoders the machine shaft should not be allowed to electrically float, since a floating shaft may pick up noise and couple it capacitively to the encoder. In most cased this is not an issue since the machine is usually grounded somehow and the exact nature of the shaft grounding is not critical. The DS-58 includes an internal protection that makes this precaution unnecessary. A similar protection can be customized for other **DS** encoders when system requirements justify.

2. Installing the DS-58

Proceed as follows:

1. Engage each servo screw in the mounting base of the stator until bottoming.
2. Unscrew slightly until the flat side of the cleat faces the stator.
3. Slide the DS-58 **Electric Encoder**™ onto the shaft until the stator bottoms in the mounting recess.
4. Tighten each servo screw with a torque of ~0.25Nm - make sure **all** cleats are engaged.
5. Adjust the axial position of the rotor on the shaft until the fine channel amplitude is 0.5V±10%. Alternatively, position the rotor within ±0.1mm of the center of its axial travel range.

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Although the encoder's accuracy and resolution are nearly unchanged over an axial rotor travel range of ± 0.3mm, the Fine-channel amplitude does change - see **Figure 2** and a deviation of the amplitude from the nominal 1V p-p might cause either saturation or loss of dynamic range in the A/D conversion. The correct rotor axial position can be validated by monitoring the Fine channel p-p amplitude while slowly rotating the shaft; it should be within 20% of the nominal value, which is typically equivalent to about ± 0.1 mm from the center nominal position.

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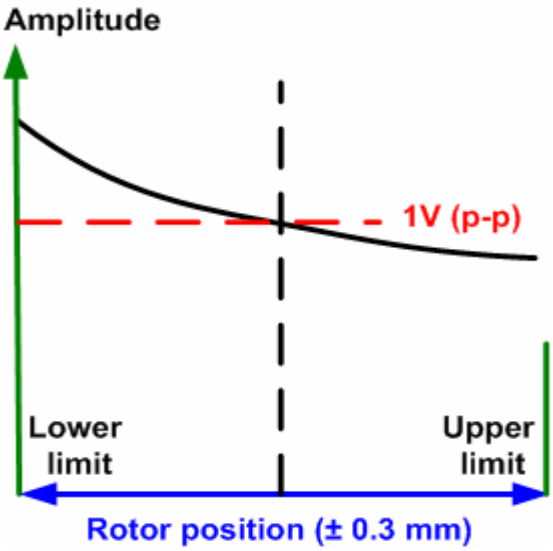
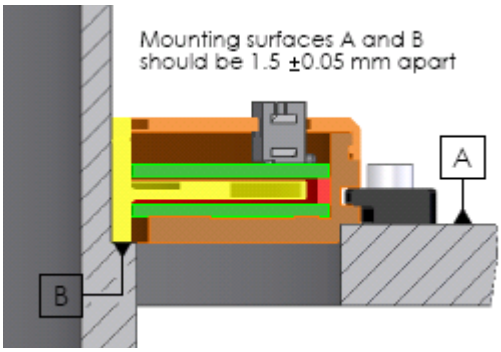


Figure 2

The rotor of the **DS-58** is secured to the shaft, after axial adjustment, by means of a supplied shaft clamp; the tightening torque of the shaft clamp screw should be ~0.25Nm

3. Installing the DS-37, DS-90 and DS-130

In these encoders there is no shaft clamp on the rotor, instead the rotor is supported by, and pressed against, a shoulder on the machine shaft. **Figure 3-a** shows the axial relationship between mounting surface **A** of the stator and mounting shoulder **B** of the rotor. The nominal axial distance **h** between these surfaces is 1.5mm with a tolerance of up to ±0.1mm. This tolerance is recommended even though **DS** encoders are tolerant to axial misalignment of the rotor up to ±0.2mm relative to the nominal position, where the rotor is in the center between transmitter and receiver plates. Except for Fine-channel amplitude variation, as in **Figure 2**, there would be an insignificant effect on the accuracy, and in fact accuracy improves as the rotor approaches the receiver plate (connector side). Since surfaces **A** and **B** are machined separately it may, depending on the specific system design, not easy to control axial tolerance build-up. In such applications it is recommended to decrease the axial separation **h** to, say 1.3mm and compensate for the balance by means of factory supplied shims as in **Figure 3-b**. The shims are available for each type of encoder and come with thicknesses of 0.1mm and 0.05mm**.**



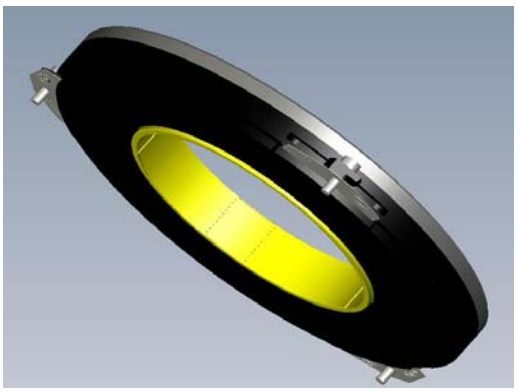


Figure 3 **(a)** **(b)**

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The mounting shoulder that supports the rotor can be integral with the shaft as in **Figure 3-a**; however, it may be, more practically, be implemented by machining a grove in the shaft and snapping a special thin section retainer ring as in **Figure 5-a** which is optionally included in the respective installation kit.

Figure 4 shows a gauge disc that can be included in the installation kit of the **DS-90** and the **DS-130**, it mountable on the shaft similar to the respective rotor and is used to facilitate the measurement of the actual axial separation between surfaces **A** and **B**. The measurement can be made by means of either a filler gauge between the stator mounting surface **A** and the bottom surface of the gauge disc. Alternatively, a caliper can be inserted into an access hole in the gauge and measure the axial distance between the gauge top surface and the mounting surface **A**.

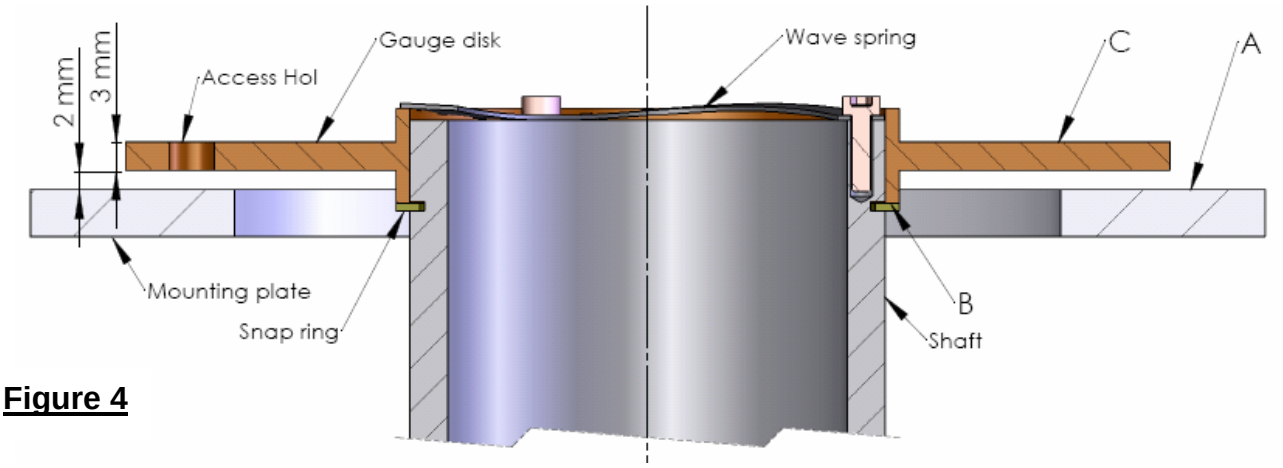

Figure 4

In **Figure 5-a** the rotor is mounted at the end of a tubular shaft and is secured axially by a flat wave-spring.

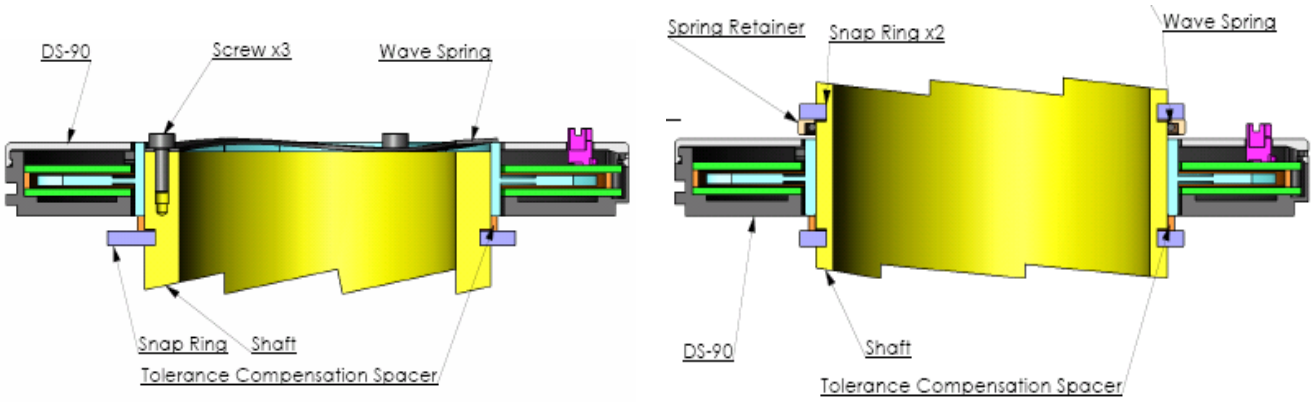

Figure 5 **(a)** **(b)**

Figure 5-b illustrates an encoder mounted on a shaft that extends upward, the axial rotor loading is provided by a flat spring that is held by means of a second retaining ring.

4. Installation kit parts

The following parts can be ordered to facilitate the **DS-90** and **DS-130** mounting:

1. Axial spacing gauge (Figure 4)
2. Flat wave spring (Figure 5-a)
3. Wire wave spring and retainer (Figure 5-b)
4. Retainer ring (Figure 5-a and 5-b)

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5. Installing the DS-25

The **DS-25** stator (housing) can be secured to the mounting recess by means of three M1.6 screws, the screws should penetrate 1.5 mm into the housing, and excessive screw penetration will **damage** the encoder! Alternatively, the **DS-25** stator can be secured by pushing down its top side by 3 servo screws on a 29.4 mm circle as in **Figure 7**.

Note that unlike the **DS-37**, **DS-90**, and **DS-130** where the rotor ends are flush with the housing top and bottom surfaces, in the **DS-25** the rotor ends are recessed by 1.5mm on both sides. Thus, the shoulder on the shaft (7mm diameter) on which the rotor leans can be included inside the housing and minimize the axial length of the encoder in space-tight applications.

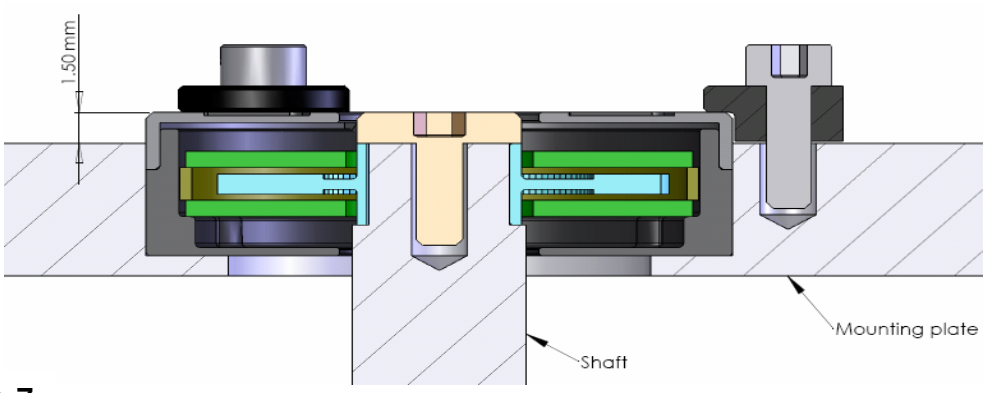

Figure 7

(April 7, 2007)

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