

K1DM3 – Technical Note

Procedure

1. Introduction

This document is intended to cover replacement of the Renishaw LA11 readhead that is used as an absolute encoder for the Exlar deploy and retract actuator. This document will include the steps to remove and reinstall, as well as setting the readhead position on its mount, and also includes software recalibration. Please read the entire document before starting the replacement procedure.

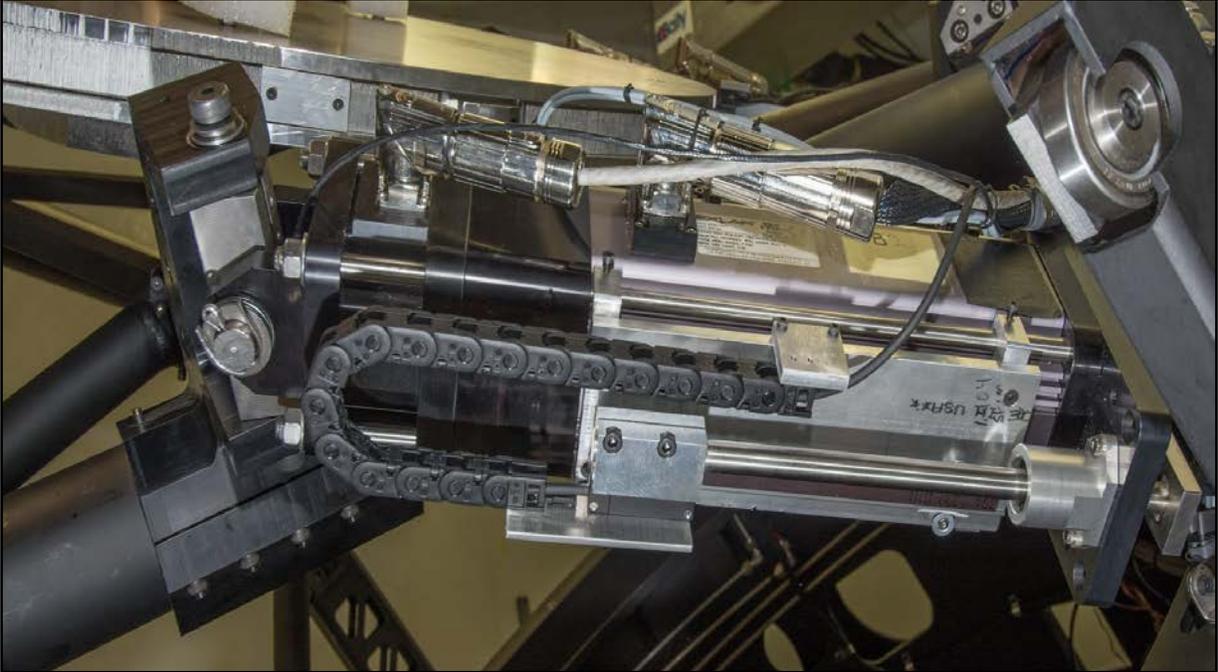


Figure 1 – Photograph of Exlar actuator with incorporated Renishaw LA11 absolute encoder (cover removed)

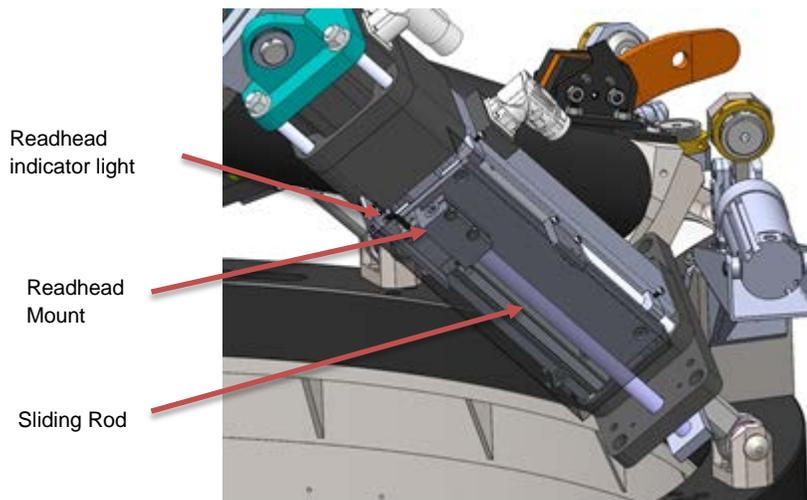


Figure 2 – CAD of Exlar actuator with incorporated Renishaw LA11 absolute encoder (cover transparent)

2. Inspection procedure

Remove the sheet metal cover to reveal the Renishaw absolute encoder as shown in Figure 1. Take care not to disturb the position of the swingarm, clamped in the V-blocks. Figure 2 shows the CAD representation of this assembly with various items labeled.

First, it is suggested to inspect the status light of the readhead. Turn on the inner drum power if it is not on:

```
modify -s k1dm3 INNER24V=On
```

The status light indication colors are near the bottom of Figure 3. For completeness, the readhead status LED should be observed over the full range of Exlar actuator travel. Note: if the LED is solid on (not flashing), then the readhead is in communication with the Galil RIO, and the status will be in keywords **k1dm3saf.SE0** (Arm A) and **k1dm3saf.SE1** (Arm B):

```
gshow -s k1dm3saf SE0 SE1
```

The LA11 readhead position tolerances with respect to the magnetic scale are shown in Figure 3.

If the error occurs consistently on one portion of the scale, that portion of the scale should be checked as well. It should be inspected to look for magnetic bits that are clinging to the scale, they should be photographed and then removed if present. Another possibility is that the scale could have become demagnetized over some portion of the travel due to exposure to high intensity magnetism (unlikely).

If the readhead needs to be replaced, go to Section 3: *Before Replacing or Adjusting Readheads*.

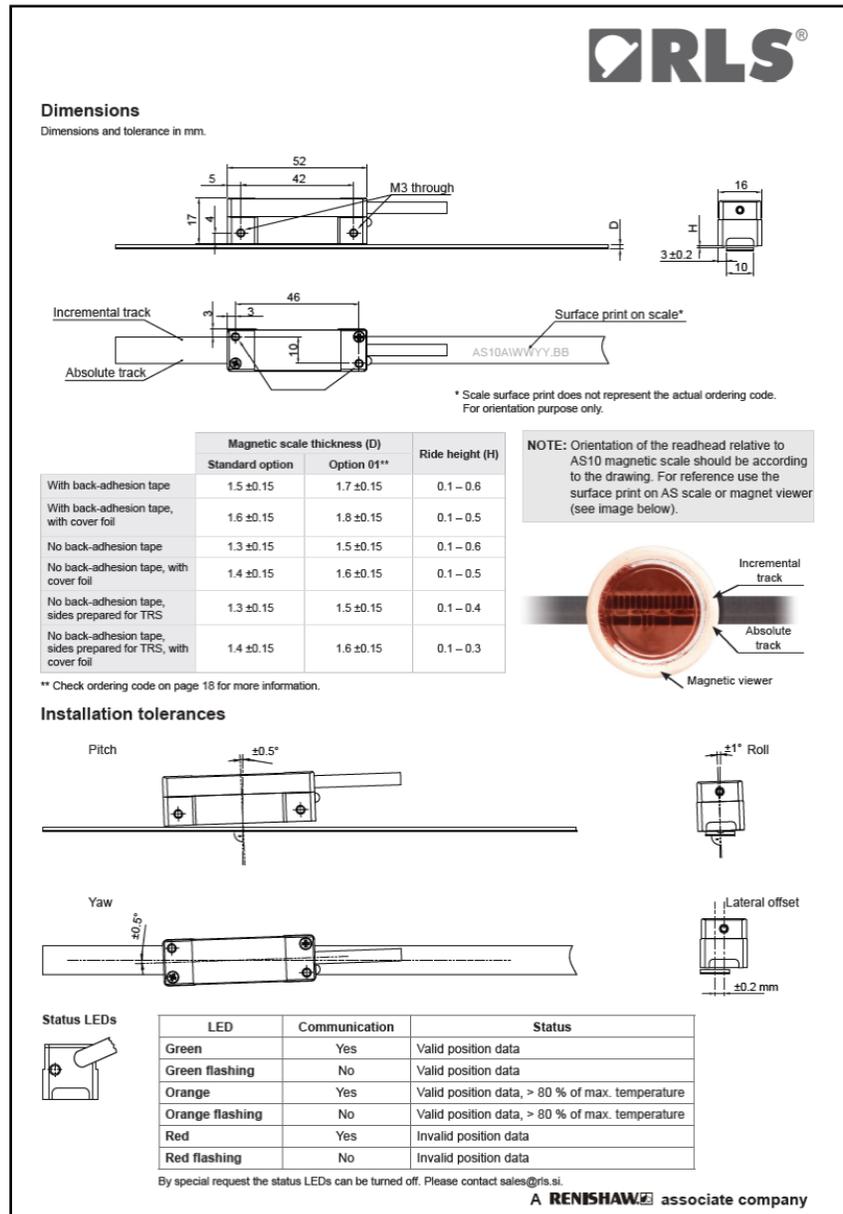


Figure 3 –Renishaw LA11 absolute encoder ride height specification and readhead Status LEDs

3. Before Replacing or Adjusting Readheads

Recalibrating the absolute encoder with respect to the actuator is simple if and only if you ensure that the swingarm is clamped securely in the deployed position before proceeding, and that you record the absolute encoder values at this point. Steps:

3.1. Ensure swingarm is deployed and clamped.

3.2. Turn on power to the inner drum, if it is not on:

modify -s k1dm3 INNER24V=On

3.3. Verify that the safety dispatcher is receiving data, by checking that

k1dm3saf.LOOPSTATUS = OK

3.4. Record the k1dm3saf keywords **ENCODER0**, **ENCODER1**, **ARM_A_ENE**, **ARM_B_ENE**. This record the absolute encoder values, and the same values converted into motor encoder

units. If one of the encoders has failed, so that it is not reading correctly, you may have to simply assume that **ARM_x_ENE=0**.

- 3.5. Turn off power to the inner drum before proceeding to disconnect or cut any electrical cabling:

modify -s k1dm3 INNER24V=Off

4. Replacement of readhead procedure

- 4.1. *When carrying out the following steps, be careful to not disturb the position of the clamped swingarm in the V-blocks.*
- 4.2. Remove sheet metal cover
- 4.3. Measure from end surface of sliding rod to readhead mount, note the distance, try to duplicate this distance when re-installing new readhead to within approximately 0.010 inches
- 4.4. Unbutton igus chain
- 4.5. Clip any zip ties, cable wrap or anything else securing the readhead cable
- 4.6. Disconnect readhead cable from 9 pin mating connector that goes to Galil and free the cable so it is only attached to K1DM3 at the readhead
- 4.7. Unscrew the two socket head cap screws shown in Figure 4.

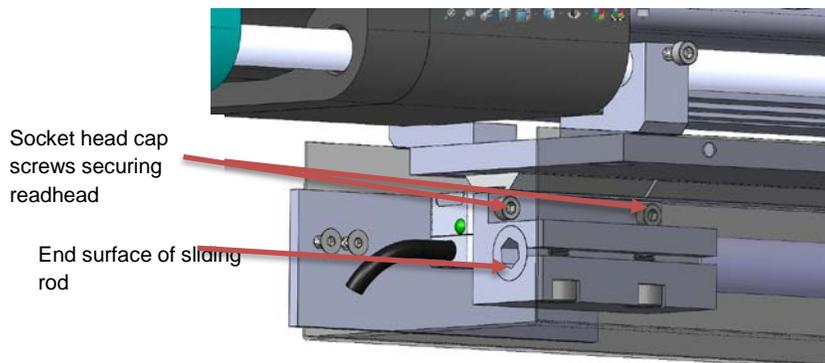


Figure 4 – Screws securing readhead

- 4.8. Remove the LA11 readhead
- 4.9. Use the same screws to re-secure the readhead
- 4.10. Use plastic shim stock to set the position of the readhead relative to the magnetic tape. Gap should be between 0.1mm and 0.4mm as indicated in Figure 3 (no back adhesion tape and track system option)
- 4.11. Tighten M3 socket head cap screws, first apply Loctite 222, tighten to approximately 8 in-lbs
- 4.12. Recheck gap to make sure it is as specified in Figure 3. May want to test at both ends of travel or view status light over full range of travel.

4.13. Reconnect DB9 connector, reapply wire wrap as originally found

5. Software calibration of new readhead

5.1. Turn on power to the inner drum:

```
modify -s k1dm3 INNER24V=On
```

5.2. Use the **k1dm3saf** keywords **SE0** and **SE1** to check that there are no active encoder warning or error codes from the readhead. The values will be **OK** if there are no problems.

5.3. Record the absolute encoder positions using **k1dm3saf** keywords **ENCODER0** and **ENCODER1**.

5.4. Determine the new zero-point offsets (in-V-block positions) for the adjusted or replaced readhead. The zero-point offsets of actuators A and B are stored in the fields labelled **Q0_VBLOCK** and **Q1_VBLOCK**, respectively, in the file *svn/kroot/kss/K1DM3/k1dm3saf/galil/safetyGalil.defs*. The new values are:

$$q0_vblock = ENCODER0 - 1.27 * ARM_A_ENE$$
$$q1_vblock = ENCODER1 - 1.27 * ARM_B_ENE$$

where the **ENCODERx** values are the newly-recorded values, and the **ARM_x_ENE** values are those from step 3.4.

Edit the *safetyGalil.defs* file, and change the entry for the changed readhead, ie one of:

```
Q0_VBLOCK = q0_vblock
```

```
Q1_VBLOCK = q1_vblock
```

substituting the values computed above.

5.5. Install the updated settings in the code burned into the Galil RIO, following the steps in Software User Guide Appendix B.

5.6. Confirm that the new **ARM_x_ENE** positions match the positions recorded earlier.

For questions:

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