Alignment Mode

This document describes the Alignment Mode for BEI PSSC's nanoSeries® TRACKER absolute kit encoder. This mode can be entered by sending the alignment command (A1D38C17 hexadecimal) to the encoder. The encoder will then report the encoder alignment error in the lower 14 bits of the position (Bits 11-24) of the encoder data word. The upper 10 bits of the encoder position are still intact. The signal is generated using optical patterns, and thus is always available on the Encoder. When interfaced to BEI PSSC's Encoder Test Box, the Alignment Visualization Tool (see Figure 3) provides the means to align the encoder in the radial direction and to center the code disk. The user can also use the definitions below to interpret the signal for custom use. The use of Alignment Mode is subject to compliance with the appropriate Encoder Mechanical Interface Control Drawing. Without first meeting the ICD, the alignment signals cannot be guaranteed to meet the following specifications.

Signal Definition

- Radial Sensor — Encoder-generated signal representing relative readhead & disk radial alignment error
- This sensor consists of 14-bit signed integers representing a range of -0.004 to +0.003999 inches

Data Transmission Sequence, Alignment Mode

Table 1: Encoder Alignment Communications Format

BITS	CONTENTS	MEANING	
11-24	ALIGNMENT INDICATION	10 0000 0000 0000	-4.000 MILS
		00 0000 0000 0000	PERFECT ALIGNMENT
		01 1111 1111 1111	+3.999 MILS

Approved for general release

Radial Sensor

The radial sensor is sensitive to relative motion between the readhead and disk in the axis shown in Figure 1. This signal is unaffected by encoder calibration and exhibits outstanding linearity within the ±0.003 inch range (see Figure 2). The radial sensor provides an excellent means of centering the code disk, which is required to meet encoder accuracy performance.

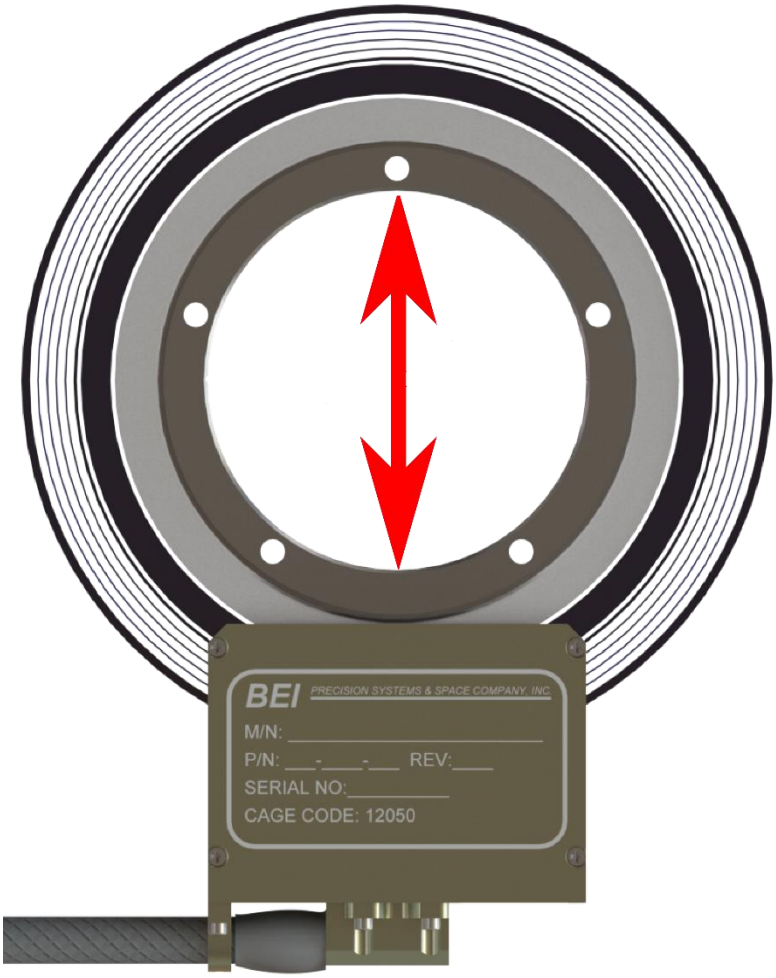

Figure 1: Radial Sensor Motion Orientation

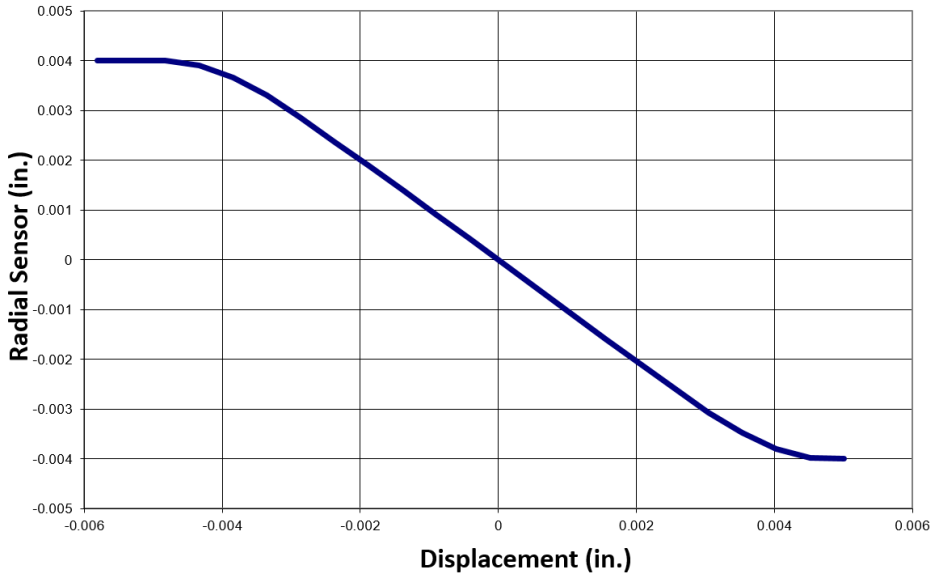

Figure 2: Radial Sensor Typical Linearity

Alignment Visualization Tool

The Alignment Visualization Tool (see Figure 3) is a customer interface GUI application that is activated when the encoder is placed into alignment mode. The tool displays a plot representing encoder shaft angle (x-axis) versus radial alignment error (y-axis). The plot ranges from -4 to +4 mils, and can be manually adjusted by entering new y-axis limits. Features include clearing the plot and an automatic adjustment mode that zooms to the limits of the radial sensor output. Zooming allows the user to incrementally center a code disk to a very high degree of precision.

Readhead Alignment

The offset of the radial sensor sinusoid is equal to the readhead radial alignment error. In Figure 3, the readhead is approximately 2.25 mils too close. Moving the readhead away from the axis-of-rotation by this amount will yield perfect radial alignment.

Code Disk Centering

The code disk can be easily centered using the radial sensor and the Alignment Visualization Tool. Figure 3 shows an un-centered disk with approximately 2.5 mils peak-to-peak centering error. To begin centering, rotate the spindle until the instantaneous alignment error (active pixel in Alignment Mode) is at the bottom of the sinusoid. Lightly tap the code disk or hub towards the readhead until the active pixel is near the center of the sinusoid. Clearing the screen and rotating through another revolution will show the new disk-centering error. This process can be repeated until sufficient centering is achieved.

Key Points

- Radial sensor peak-to-peak value is equal to total indicated disk centering error
- Offset position of radial sensor signal equals readhead to axis-of-rotation radial alignment error

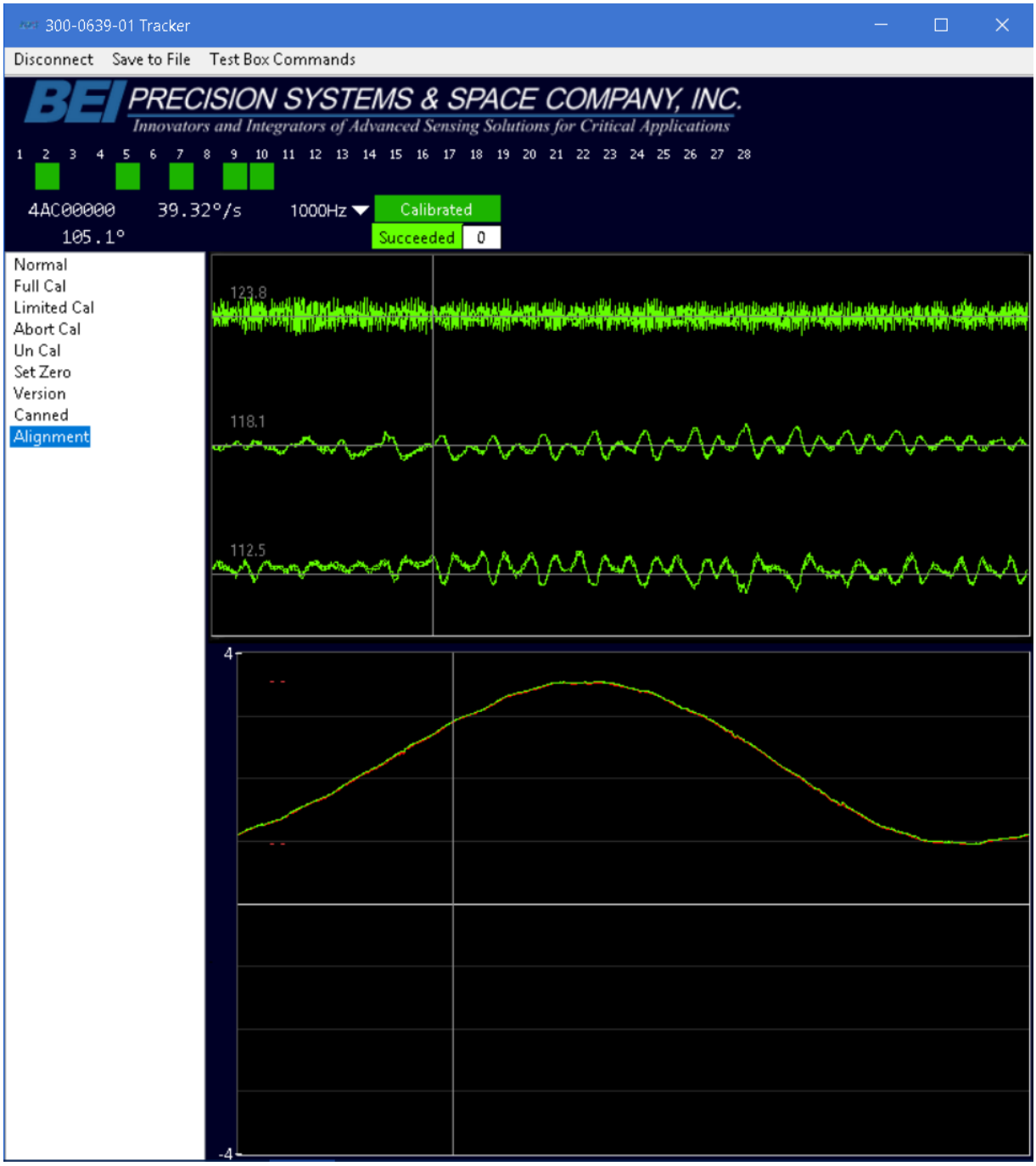

Figure 3: Alignment Visualization Tool & Radial Sensor