

Encoder Alignment for Keck Telescopes to Reduce Interpolator Error

NEW procedure subsequently created. This one is obsolete.

Introduction

This document describes the steps for carrying out an alignment of the rotary encoders.

Notes

The encoder heads will not all have the same amplitude signals but they should be set to the maximum amplitude you can get and still have the individual A and B signals close to equal amplitude.

Conceptualisation

Raise: Increase your head height vertically.

Lower: Opposite of raise.

In: Move head closer to tape (no tilt).

Out: Move head further away from tape.

Tilt Forward: Head becomes closer to the tape and vision is further down the tape.

Tilt Back: Opposite of tilt forward.

Tilt Left: Lean your head to the left and the head will rotate clockwise in your vision.

Tilt right: Opposite to tilt left.

Rotate Left: Look further left on the tape.

Rotate Right: Look further right on the tape.

PWM7 and Scope Setup

- PWM7 is inline between the encoder head and the interpolator (turn off power first). The PWM7 has two BNC outputs. Connect the left one to the scope Channel One and the right one to scope Channel Two.
- Setting One: PWM7 switches to analogue and dual waveform (rotating switch on second clockwise notch). Scope channels are set to DC input, high impedance, 0.5V per division, and a horizontal sweep that displays ~2 cycles of the waveform. The horizontal setting will change with telescope speed. Telescope axis at approximately 50-150 counts/millisecond.
- Setting Two: PWM7 switches to analogue and c-reference waveform (rotating switch on second clockwise notch). Scope channels are set to DC input, high impedance, 0.5V per division, and a horizontal sweep that displays ~2 cycles of the waveform. The horizontal setting will change with telescope speed. Telescope axis at approximately 500-1000 counts/millisecond.

- Setting Three: PWM7 switches to analogue and dual waveform (rotating switch on second clockwise notch). Scope channels are set to DC input, high impedance, 0.5V per division, and a horizontal sweep that displays ~2 cycles of the waveform. The horizontal setting will change with telescope speed. Telescope axis at approximately 1000 counts/millisecond. After the signal is visible on the scope change the scope to Lissajou mode. This will display a circle (perfect if the alignment is perfect) on the screen when setup properly.

Procedure

1. Check that the heads do not touch the tape*.
2. Check that the gaps on the left and the right side of the tape head are equal. Adjust by rotating right or left if necessary*.
3. (Setting One): Adjust the Raise/Lower motion to get the maximum sine wave for A and B channels.
4. (Setting One): Adjust the In/Out motion to get the maximum sine wave for A and B channels.
5. (Setting One): Adjust the tilt forward/back motion to get the maximum sine wave for A and B channels and to adjust A and B to be equal amplitude or as close as you can get.
6. (Setting Two): Check C reference mark for amplitude. You may have to compromise a bit on normal signal amplitude by adjusting the forward/back tilt if the C reference signal is not large enough.
7. (Setting Two): Adjust the tilt left/right to align the C reference phase. The C reference signal should correspond with the bottom edge of the sine wave (i.e. Both scope traces should dip at the same time). (Setting One): Monitor A and B amplitude to make sure amplitude stays high.
8. Repeat above steps at least one more time for best alignment.

*Because we have previously aligned the heads, these steps may be ok.