

OP-99011

SDSS Technical Procedure

Procedure for Aligning Heidenhain Encoder Heads

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SCOPE

This procedure is applicable to work on the SDSS 2.5-meter telescope and describes the steps necessary to align a Heidenhain LIDA 18C or ERA 880C angle encoder scanning head with a LIDA steel scale tape.

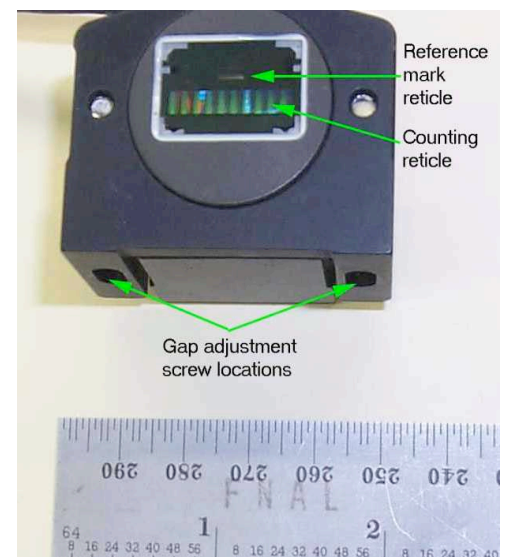
LIDA 18C scanning heads are used on the telescope alt/az fiducial system. ERA 880C scanning heads are used on the instrument rotator encoder system. Care should be taken when working with the scanning heads and tape to avoid scratching the surface of the scanning head reticle or tape. Scratches on these surfaces may cause degraded performance.

EQUIPMENT

Analog oscilloscope with real-time sweep
Heidenhain PWM-8 phase meter with 1V p-p and TTL input modules.

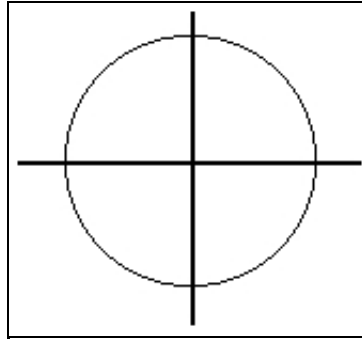
PROCEDURE

1. Mount the scanning head in its mounting bracket and physically align the scanning head with the encoded scale tape. The counting track on the tape should be aligned and parallel with the counting reticle on the face of the scanning head. The distance from the top edge of the scanning head to the top edge of the tape should be 17.4 mm (0.685"). The maximum vertical misalignment tolerance is +/- 0.76 mm (+/- 0.030").
2. Set the gap between the scanning head and the tape.
 1. The head-to-tape gap should be 0.8 mm (~0.031"). Use (4) 0.2 mm plastic shims to set the head spacing (also provided by Heidenhain).
 2. Place the shim stack between the scanning head and tape.
 3. Loosen the adjustment screws on head mounting bracket and slide the head toward the tape until the shim is LIGHTLY pinched between the scanning head and tape.

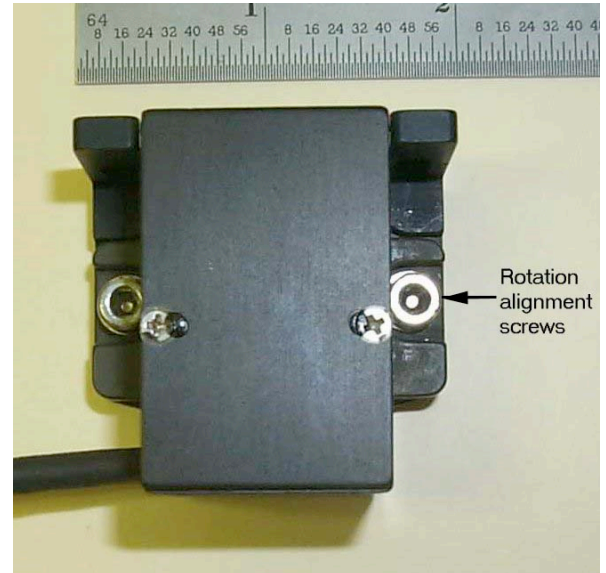


4. Tighten the adjustment screws on the mounting bracket to secure the head position.
 5. Carefully pull out the shim pack. Pull out the center one or two shims first, then pull out the shims in contact with the tape and scanning head. Removing the shims in this manner avoids scratching the tape or scanning head surfaces.
3. Rotate the scanning head within the mounting bracket to phase the counting track channels.
 1. For LIDA 18C and ERA 880C scanning heads, install the 1Vp-p module into the Heidenhain PWM-8 phase meter.
 2. Connect the cable from the scanning head directly into the input of the 1V module. Do not go through an interpolator.
 3. Connect BNC cables from the phase meter outputs A and B to the Ch. 1 and 2 inputs on the scope.
 4. Set the time scale on the scope to X-Y mode.
 5. Set the voltage scale on the scope to 0.2 volts/div for each input channel.
 6. Ground channels 1 and 2 on the scope and verify that the indicator is zeroed on the screen. Adjust as necessary, then set the X-input to channel 1 and the Y-input to channel 2.
 7. Set the phase meters output signals.
 1. On the phase meter, press *BNC*, *BNC A*, then the up-arrow until *A* appears in the *BNC A* window.
 2. On the phase meter, press *BNC*, *BNC B*, then the up-arrow until *B* appears in the *BNC B* window.
 8. Move the drive so the tape moves across the scanning head. A circular signal should appear on the scope as shown in Figure 1. Carefully loosen the rotational alignment screws on the scanning head mounting bracket and rotate the scanning head until the maximum circle size is obtained. At this point, the amplitude of the circle on the oscilloscope should be +/- 0.5V. The acceptable range is +/- 0.4 to 0.6V.

Figure 1. Lissajous signal on oscilloscope when scanning head is properly aligned with tape counting track.

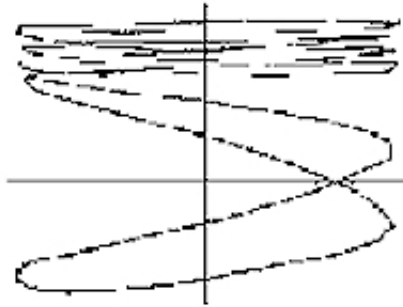


1. Once the maximum amplitude is achieved, gently tighten the rotation alignment screws. Move the tape across the scanning head and verify that the signal is still good.
2. Place the phase meter in counting mode and verify that the counts increase and decrease as the direction of rotation changes.



4. Check the phase and amplitude of the reference mark signal.
 1. Reset the phase meter output signals.
 1. On the phase meter, press *BNC*, *BNC A*, then the up-arrow until *A+B* appears in the *BNC A* window.
 2. On the phase meter, press *BNC*, *BNC B*, then the up-arrow until *R* appears in the *BNC B* window.
 2. Set the voltage scale on the oscilloscope to 0.2 volts/div.
 3. Move the drive so the tape moves across the scanning head. A horizontal line (slightly angled downward from left to right) should appear near the top of the oscilloscope as the tape passes across the scanning head. As a reference mark passes across the reference mark reticle of the scanning head, the signal on the scope will appear as either a loose figure 8 or a "V" rotated 90 degrees (ie, < or >). An example of the reference signal on the scope is shown in Figure 2.

Figure 2. Properly phased reference pulse signal on oscilloscope.



1. If the signal looks like a less-than sign (<), then the reference signal is out of phase with the counting signal. Loosen the rotational adjustment screws and rotate the head until the reference signal looks like a greater-than sign (>).
 2. If the reference pulse looks like a figure eight (8), the reference pulse is slightly out of phase. Rotate the head carefully until the reference signal tightens up and looks more like a greater-than sign (>).
 3. Once the reference pulse is properly phased, the apex of the (>) or the crossing point of the figure eight should occur at the 0 V horizontal line on the oscilloscope.
5. Verify reference mark indication on the Heidenhain phase meter.
1. With the proper looking signal on the oscilloscope, verify that the reference mark indicator flashes on the Heidenhain phase meter when a reference mark on the tape passes in front of the scanning head. If the indicator does not flash when the reference mark passes, then either the reference mark is not phased properly or the amplitude of the reference mark signal is too small.
 2. Verify that the reference mark signal is phased properly by repeating step 4.
 3. If the reference signal is phased properly, verify that the reference mark amplitude is correct. When the (>) occurs on the oscilloscope, the amplitude between the upper and lower arms of the V should be 0.4 to 0.6 V.
 1. If the amplitude is less than 0.4V, it is likely that the scanning head face is not parallel with the tape in the vertical direction. The gap between the scanning head and tape at the top edge of the tape may be larger than the gap at the bottom edge of the tape. To verify this, gently push the top of the scanning head toward the tape as the reference mark passes in front of the head. Pushing on the head will change the head-to-tape gap slightly. If the amplitude increases, then the head alignment needs to be adjusted.
 2. If the amplitude is greater than 0.6V, the gap between the scanning head and tape at the bottom edge of the tape may be larger than the gap at the top edge of the tape. To verify this, gently pull the top of the scanning head away from the tape as the reference mark passes in front of the head. If the amplitude decreases, then the head alignment needs to be adjusted.

4. If the magnitude needs to be adjusted, shim the scanning head mounting bracket to bring the head into parallel alignment with the tape.

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