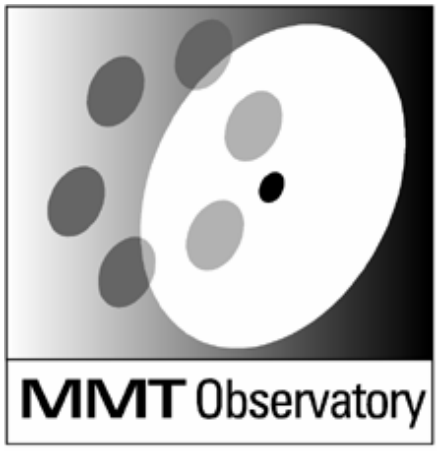
MMTO Conversion Technical Memorandum #98-3



Smithsonian Institution &
The University of Arizona®

6.5 m Instrument Rotator Performance

Goals and Specifications

D. Clark, S. Callahan, J.T. Williams

September 1998

Conversion Technical Memo #98-3
6.5 m Instrument Rotator
Performance Goals and Specifications*

Dusty Clark, Shawn Callahan, J.T. Williams
September 9, 1998

The following is an update of the original 6.5m Telescope Instrument Rotator Goals and Specifications, by J.T. Williams 2/20/92. It has been four years since the last major design effort for the system, and many changes have since been incorporated due to changes in the mirror cell and instrument configuration and design improvements in the drive system by MMTO Engineering.

Mechanical Requirements-

- Instrument mounting flange, 72 inches diameter bolt circle, at Z = -59.5 inches or 84 inches above floor, nominal. The plane of the mounting flange will be clear out to 85" diameter.
- Instrument mounting flange will support and rotate up to 3,000 lbs. with c.g. at Z = -109 inches or 49.5 inches aft of flange.
- The rotator assembly and its mounting will optimized for high stiffness, with a lowest resonant frequency goal greater than 15 Hz. Drive stiffness goal is 109 ft-lbs/radian.
- The rotator maximum flexure goal will maintain the instrument flange center of rotation on the mirror cell Z axis to 0.004 inches, and normal to the Z axis of the telescope to + 0.004 inches (tilt) at the edge of a 1 degree sky field, approximately 24 inches diameter. This corresponds to 0.1 arcsec of defocusing due to axial deformation.

Drive System Requirements-

- Rotator flange will be gear driven with multiple brush-type DC motors/pinions in a 'zero backlash' configuration, powered by PWM amplifiers selected with appropriate bus voltage/output current.
- Motor torque will provide for maximum instrument(s) loads with c.g. off-axis up to 10 inches, with a full complement of cables and hoses in the adjacent wrap-up system.
- Motor drive will be under computer control normally, with software settable velocity limits and rotator/instrument position angle limits.
- Rotator limits at ±180° nominal (due to cable-wrap and utility connections) will override both computer and manual operation.
- A manual remote paddle will be provided using hardware control with rotation direction, stop and on-off controls, for testing and default instrument mounting. In addition, a portable remote IO digital control with a full menu of velocity and position angle commands will be available at the rotator.

Servo System Performance Requirements-

- Maximum slew velocity will be software and hardware limited to 2 degrees per second (rotator), nominal. (Limited due to cable-wrap and utility connections).
- 'Tracking' velocity range will be ZERO to 1.3 degrees per second (sky @ 89°50' El), nominal.
- 'Tracking' resolution goal is 0.05 arcsec at the edge of a 1 degree sky field (f/5.27), or approximately 18 bits, over the angular velocity range 1.5 arcsec/second to 1.3 degrees/second (sky @ 89°50' El).
- 'Tracking' performance goal is 0.1 arcsec RMS at the edge of a 1 degree sky field.
- 'Pointing' accuracy goal is 0.5 arcsec RMS on the sky at the edge of a 1 degree field, dead reckoned from a fixed rotator position angle.
- 'Offset' accuracy goal is 0.2 arcsec over 10 degrees range of rotator position angle.
- 'Positioning' accuracy (repeatability) goal is 0.1 arcsec peak on the sky at the edge of a 1 degree sky field over a 10 degree range of rotator position angle.
- Servo bandwidth goal is 8 Hz or higher over the sky angular velocity range 1.5 arcsec/second to 1.3 degrees/second.

References:

Conversion Technical Memo 92-1, S. Groff "Instrument Rotator Control System
MMTO Internal Electronic Memo March 31, 1992, B. Russ

* **Supersedes:** Feb. 20, 1992 memo "6.5m Instrument Rotator Performance Goals and Specifications" – J.T. Williams