Camera Focus Mechanism Data Sheet

**General Description**
The MODS Camera Focus mechanism is required to precisely adjust the focus on the Maksutov-Schmidt science camera which has a depth of focus of ~25 microns for 10% increase in image diameter. The focus is adjusted by translating the spherical camera primary mirror parallel to the camera’s optical axis. The camera mirror is supported by a system of three parallelogram flexures which acting together restrict movements of the mirror to axial translation. The focus motion is naturally parallel to the camera mirror cell which is tilted by about 12 degrees relative to the camera optical axis. The two base vertices of the isosceles triangle have sprockets with 42 teeth and the top vertex has a sprocket with 40 teeth. This non-uniform gearing produces focus translation and a small rotation designed to minimize image motion during focus.

**Topology**
Continuous Linear

**Rendering of Camera Focus Asm.**
Rendering of a single Camera Focus Actuator

Drive Motor
Motor Type: Size 23 Step motor, 200 fullsteps per revolution, double-ended shaft
Part #: Superior # KML061F05 - D
Rated Current: 2.7 amps/phase parallel (RMS)
Rated Holding Torque: 170 in*oz
Rated Torque at operating Speed: ????

Motor Connection Diagram (for CW rotation viewed from motor front with positive command)
A Red/White (Pin13)
A Red  (Pin12)
B Black  (Pin11)
B Black/White  (Pin10)

Motor Controller Specifications
Manufacturer & Model: IMS MicroLYNX 7 (#MX-CS100-701)
Rated Current: 5amps RMS/phase, 7 amps peak/phase
Rated Voltage: 24 to 75 VDC
Daughterboards: None
**Motor Controller Settings**

- **MSEL = 10** 10 usteps/fullstep = 2000 microsteps/rev
- **MUNIT = 2000** sets units to (2000 usteps/rev) gives velocity and accelerations in rev/sec
- **MAC = 54** Acceleration Current = 54% = 3.8 amps peak
- **MRC = 54** Run Current = 2.7 amps RMS *1.4 = 3.8 amps peak (3.8/7 = 54%)
- **MHC = 0** Motor Hold Current is zero

- **ACLT=1** linear acceleration (default)
- **ACCL=DECL = 5** acceleration rate (rev/sec^2)
- **LDECL = 5** limit deceleration rate (rev/sec^2)

Overtravel at Limit = \( \text{ScrewPitch} \times \frac{\text{VM}^2}{2 \times \text{LDECL}} \) = 0.05 mm (pitch =0.5 mm and VM=1 rev/sec, LDECL=50 rev/sec^2)

Beware overtravel when seeking limits, must not decelerate hard into limits
Maximum Permitted Overtravel ~ 0.5 mm ~ 0.020"

- **VM= 1** running speed (rev/sec)
- **VM= 0.5** Homing speed to assert limits (rev/sec)

**Motor Controller I/O Connections**

- **Vpull:** not used
- **GND:** 24 volt Gnd
- **I/O 21:** CW LIMIT sensor (CW shaft rotation as viewed from motor front)
- **I/O 22:** CCW LIMIT sensor
- **I/O 23:** not used
- **I/O 24:** not used
- **I/O 25:** not used
- **I/O 26:** not used

**Input Sensors**

- **Model P&F # NJ0.8-5GM25-E**
- 5mm Inductive proximity sensor, Normally Open Sinking output (Type E0), 24 VDC supply
  Used for CW Limit, CCW limit, and HOME sensors

Connection for P&F E0 Sensors (3 wire)
- Brown +24 volts
- Blue 24 volt ground
- Black to input of controller

**Output Devices**

None

**Drive Mechanics**

The Camera Focus mechanism uses three linear screw drives operating in parallel to translate the camera mirror. The motion is guided by parallelogram flexures. The focus is actuated by three 1.0 mm pitch drive screws acting in parallel and synchronized through a “BERG” type timing belt. Because the mirror cell is not parallel to the optical axis of the camera, the top screw actuator has a slightly different drive ratio than the bottom two screws.

- **Position Datum:** Away from camera cell (CW End of Travel)
- **Range of Motion:** ~3.0 mm
Belt Reduction Ratio 42/21
Axis Resolution 2.5 microns per motor fullstep = (1mm)*(21/42)*(1/200)

Performance
Maximum Travel Time 6 seconds
Typical Travel Time for move of ~ 0.5mm 1 seconds
Position Repeatability ?? micron error
Position Hysteresis ?? micron

Software Notes
HOME Routine, Absolute Move routine with backlash compensation
See Front AGW software notes for details