ARUN MICROELECTRONICS LTD

LTV UHV Translation Stages

USER INSTRUCTIONS Issue 1.3

These are general instructions for use with AML manipulators / gonoimeters.

SPECIFICATION

Specification	Unit	LTVL	LTVH
Travel	mm	50/100/150/200/250	50/100/150/200/250
Resolution in full step	µm	5	1
Maximum speed (with lubricated lead screw)	mm/s	15	4
Repeatability	µm	1	0.2
Load Capacity (Horizontal)	kg	20	20
Load moment	Nm	<5	<5
Axial load force @ 500Hz Iφ = 1A	kg	3	10
Backlash	µm	Negligible	Negligible
Roll, pitch & yaw (unloaded)	µrad	<25	<25
Roll, pitch & yaw compliance	µrad/Nm	33	33
Straightness of travel	µm	<1.3µm / 100mm	<1.3µm / 100mm
Stepper motor		D35.1	D35.1
Vacuum	mbar	$1x10^{-10}$	$1x10^{-10}$
Maximum operating temperature	°C	200	200
MTBF (5kg load, 30% duty cycle, lubricated lead screw)	hrs	15,000	10,000

HANDLING, UNPACKING, SHIPPING RESTRAINTS

The assembly should not be removed from the packaging until required for installation. Always use clean gloves.

Leadscrews, worm drives, and some gearing may be lubricated. While removing the covering from these, ensure that parts nearby are covered, to avoid transfer of lubricants.

Some mechanisms are shipped with temporary screws, brackets or other hardware fitted. These are normally identified with red paint or self-adhesive red labels.

LUBRICATION

Stages are supplied lubricated with Nyetorr 6300 UHV grease unless dry lubrication was specified when ordering.

INSTALLATION

The mechanism should be mounted on a flat surface through the fixing holes provided in the baseplate or adjustable feet. Mounting on standoff spacers is acceptable and may be preferable in order to compensate for an uneven surface. Take care not to distort the baseplate.

The mechanism does not require the mounting surface to act as a heat sink.

Do not remove or adjust any screws without understanding their function or consulting AML.
Take normal vacuum precautions, avoid creating trapped volumes when mounting the mechanism and avoid obstructing the pumping holes in the end faces of the motor.

Some AML mechanisms are supplied pre-wired to vacuum - compatible terminal blocks, connectors or feedthroughs. Others are supplied with the motor wiring secured only for transit.

The motor leads should be routed to the feedthrough in such a way that they cannot come into contact with the moving parts of the mechanism. Strain-relieve the wires if the motor moves relative to the feedthrough. Consult the Motor User Instructions for information on how to connect to the feedthrough and drive.

OPERATION

The mechanism should be run initially in air, so that the operation can easily be observed.

Since the moving parts for drive and guidance may not be conventionally lubricated, vibration and noise may be expected when the axes are moving. The coatings used on these parts have a much lower coefficient of friction in vacuum than in air. DLC-coatings may need baking to achieve optimum friction.

A small amount of radial movement of lead screws may be expected. The nut mounting arrangement compensates for this. Backlash on linear axes is controlled by constant-rate springs or anti-backlash nuts. Rotation axes use constant force sprung motors and/or anti-backlash gears. In both cases the backlash is small compared to the resolution. Where the motion was specified to have a vertical component these parts are not usually fitted.

AML DRIVES

SMD210 drives are recommended for use with these mechanisms and this will result in optimum mechanical and thermal management of the motor.

Acceleration and speed controls should be adjusted by experiment. Too high a speed or acceleration will result in loss of synchronism but a low speed may excite resonances. Resonances may be controlled by changing the step division mode. Choice of a large division ratio may limit the maximum slew speed available. Transient resonances during acceleration may often be avoided by a faster acceleration.

ALTERNATIVE DRIVES

Unipolar drives are unsuitable. If alternative bipolar drives are used the range and resolution of adjustment of phase currents may be less than with AML drives. The square root of the sum of the squares of the two phase currents applied to the motor must not exceed 1A at any time. Facilities to monitor the winding temperature of the motor and remove drive current when this exceeds 175°C must be provided. Ensure that the measuring circuit connected to the thermocouple is not affected by the electromagnetic environment inside the motor. Switchmode (or 'chopper') drives must have a chopping frequency of less than 22kHz. The phase current should be reduced when the motor is stationary for more than a few seconds. Ministepping is recommended for smooth operation only and not as a means of increasing resolution.

END STOPS

Axes may be driven to their mechanical limits where no vernier stops are fitted. No harm will result to the motor or mechanism. Several steps of lost motion may be expected in reversing off the end stop.

Precision vernier stops, which allow reference locations to be determined at one end with a range of uncertainty of two or three steps, may be fitted to these mechanisms. These usually consist of a radial or offset axial pin attached to the motor shaft, which meets a stop pin fitted to the carriage or moving part of the axis at the end of its travel. Because of the high gearing, the stop pin moves a large distance for each rotation of the motor shaft, ensuring that the pins meet and the motor stalls at a single, precise position.

If the position of the axis is unknown then the mechanism should be driven sufficient steps to ensure a complete traverse is taken toward the vernier stop. The position counter in the SMD210 may be recorded or preset to some convenient number when the motion is completed. All other locations may then be achieved by a single SMD210 command.

If precision vernier stops are approached with a step rate of more than 500Hz the pins will 'bounce' apart, causing an error. No damage will result. If it is necessary to slew to the stop at high speed then the carriage should subsequently be backed off a few steps before a final approach is made at slow speed to find the stop with the defined precision.

BAKEOUT

Baking at up to 175° Celsius is required for operation at UHV. Refer to the motor or SMD210 instructions for detailed information on bakeout.

Irreversible deterioration of the winding insulation will occur at 230° and the motor will subsequently produce large amounts of gas, even at lower temperatures.

TEMPERATURE RISE AND OUTGASSING IN VACUUM

Refer to the motor data sheet and AML Application Note 11 for information on estimating gas loads.

If the duty cycle of motion is relatively low this will result in the motor temperature stabilizing at about 50°C when the chamber wall is at 20°C. The average gas load from an adequately baked motor will be in the order of 1×10^{-8} mbar litre sec^{-1} under these conditions.