



DLL Series IV 2-Axis ALM Lathe

■ Features

- Air-Bearing Stages
- Linear Motor Stage Drives
- Sub-Nanometer Position Resolution
- Full Aspheric Software
- Multi-Tool System
- Oscillating Tool Technology Option
- Air-Bearing Spindle
- Edge RADIUSING
- Lens Design Graphics
- Stable Granite Base on 4 Air Isolators
- DAC Script Language
- Hi-Speed Servo System
- Windows and DOS Operating Systems

■ Description

Each axis is driven by linear motors with position feedback from linear encoders with sub-nanometer resolution. The technology of the air-bearing slides eliminates air restrictor ports and provides ultra-smooth motion that translates to ultra-smooth surface finishes.

The lathe base is a 200 mm thick granite surface plate for accuracy and stability. The surface plate is mounted on 4 vibration isolators on a welded steel frame. The complete machine and electronics are housed in a single cabinet.

The Y axis is mounted directly to the granite and carries the spindle. The X slide is also mounted on the granite and precisely positioned at 90° to the Y slide. This machine geometry assures that machining loads are



well centered within the travel of the slides and that the spindle mounting is stiff and stable.

Multiple sets of tooling and a front surface gauging system are mounted on the X slide. The optional Oscillating Tool Technology (OTT) system can be added at the time of purchase or later to meet customer needs.

The lathe spindle is a carefully balanced, air-bearing high-frequency unit with programmable speeds of 0 to 10,000 rpm. A DC motor with encoder feedback provides torque at all speeds and the ability to synchronize with the OTT tooling.

■ Operation

It is recommended that all parts turned on the ALM Lathe be blocked. Special collet configurations are available upon request. The roughing natural diamond tool is used to remove the bulk of the material. As the finishing tool removes only a minimal amount of material, its edge (and life) is preserved.

All cuts are made by X or Y motion, or by XY interpolation. Any number of spheres and aspheric surfaces (front or back) can be turned. In addition, with the OTT option, the complete range of toric and atoric front and base curve surfaces can be turned. DAC has developed more than 40 algorithms that laboratories use to create their own special lens offerings. These include lenses that are spheres, aspheres, torics, atorics, bitorics, and keratoconus solutions for their clients. Because of the fine resolution, the surfaces require little or no polishing, depending on the material used and the manufacturer's process.

Edge radiusing is accomplished by utilizing a special tool with XY interpolation to produce the desired contour.

Typical contact lens base and front curves can be produced in 30 to 60 seconds, depending on geometry and material used. Very complex designs, such as crescent toric segmented bifocals, will take longer.

■ Operator–Machine Interaction

"Menu" type queries, on the color monitor screen, guide the user quickly through machine set-up, calibration, alignment, and tool replacement. The Windows-based software, along with our DAC Script Language (DSL), employs a subset of RS-274D machine language. This high-level programming language is easily understood by the user and is included in each lathe. Our Windows-based software gives the flexibility to interface with host computers and other Windows-based products, such as measuring equipment.

If all lens design parameters are known, the user simply enters the appropriate numbers using the keyboard. The machine calculates variables, such as junction thickness, after the entry of basic design factors. A display of a lens cross-section aids the user in the design process by

graphically presenting the actual design. The machine's computer automatically converts lens design specifications into the machine language program necessary to machine the desired part.

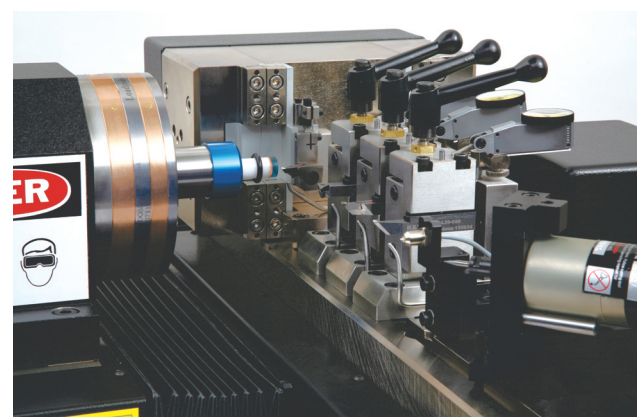
DAC software presents the laboratory with many, many options for the creation of lenses to meet the most demanding requirements.

■ Control System

The DAC Digital Motion Control (DMC) system is at the "heart" of all DAC Lathes. It is housed in the on-board computer, mounted with the servo amplifiers, in the base of the machine behind doors for easy access. Each axis is driven by a linear servo motor with linear encoder feedback.

Auxiliary functions such as actuating lights, vacuums, air blow-offs, autoloaders, etc., are controlled by outputs from the programmable logic control.

■ Tooling



Three tools are held in newly designed, micro-positioned holders that keep the tool parallel with spindle center.

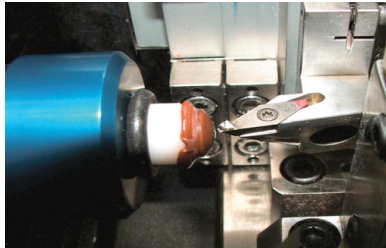
- Roughing/diametering tool
- Controlled waviness finish tool
- Edge radius tool

These robust tool holders are adjustable to accommodate a wide range of tool shank sizes.

A Drill Marker is included for axis and diagnostic marking.

2-Axis ALM Options

■ Oscillating Tool Technology (OTT)



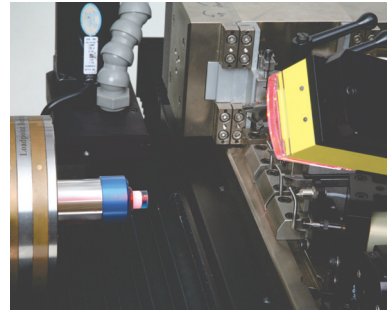
A Z' axis provides synchronized motion with the spindle to produce toric shapes. The oscillating tool has ± 1 mm travel. It holds a diamond

insert and is adjusted in the same vertical manner as the other three tools.

The OTT Option includes: (1) software to produce base curve torics in multiple zones, as required, plus toric optic zones in aspheres; and (2) software to produce front torics, bi-torics, spherical and crescent slab-offs, segmented bi-focals and prism ballast.

A Drill Marker is included for axis and diagnostic marking.

■ Reference Mark Locator

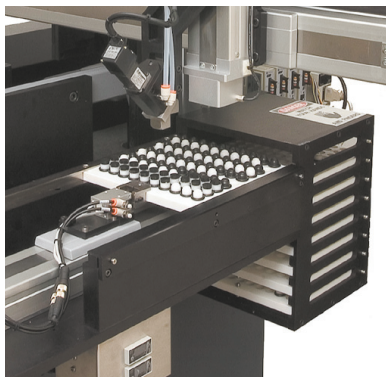


Recognizes scribes or contrasting marks on molds and lens blanks located in the spindle collet. Once recognized, this mark will be used as a reference point for turning the

desired lens design or geometry by the DAC ALM Lathe.

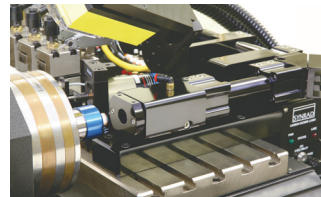
This option includes all recognition software for the locator system, the reference software link to the part program, the link to the DAC DMC III control system and required calibration routines.

■ Universal 1000 Autoloader



A 10-tray elevator system provides the ability to run up to 1,000 parts without stopping to reload, allowing "lights out" operation. Custom autoloading applications, such as molded parts, are available upon request.

■ Laser Etching



CO₂ laser with graphic and alphanumeric software for etching of identification and/or scribe marks on contact and intraocular lenses.

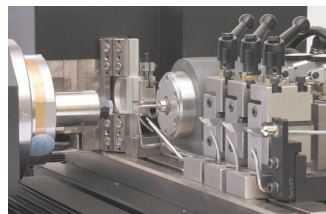


■ Environmental Chamber

Used in conjunction with cryogenic lathing applications, this enclosure keeps parts in the Universal 1000 elevator between 10° and 15°C (50–59°F).

Intraocular Lens Production Options

■ MLC Mill/Lathe Combination System



plan view of the IOL mounted on the X axis of the lathe.

The MLC is a combination machine designed for production of IOLs. The system is constructed on the DAC Series IV 2-Axis ALM Lathe and includes a mill system for milling the

The air-bearing, liquid-cooled spindle is mounted on the X axis and is programmable from 15,000 to 160,000 rpm.

The mill system features 3-axis control (X,Z,C), automatic Z-axis programming, continuous velocity control and provides the software capability to mill conic-shaped haptics.

Options:

- Oscillating Tool Technology (OTT)
- Air-cooled Environmental Chamber
- AMCC compatibility
- Focal Points Design Software compatible

■ Specifications

| | | |
|--------------------------------|--|---|
| Slides: | Linear slides are DC linear servo motor with linear encoder feedback | |
| Type: | X Air-bearing | Y Air-bearing |
| Travel: | 305 mm (12") | 203 mm (8") |
| Resolution: | Sub-Nanometer | Sub-Nanometer |
| Accuracy (incremental): | <i>Center Thickness</i> <i>Diameter</i> <i>Radius of Curvature</i> | ± 2.5 microns (0.0001") ± 5 microns (0.0002") ± 2.5 microns (0.0001") |
| Traverse rates: | 18 meters/minute (720 IPM) | |
| Spindles: | Air-bearing DC servo motor/encoder spindles—0 to 10,000 RPM with sub-degree resolution | |
| Collets: | Standard collet supplied with lathe—12.7 mm x 12.7 mm (0.5" x 0.5") with dead length stop Specials supplied if required | |
| Diamond tools: | A complete set of diamonds is supplied with each lathe | |

■ Installation Data

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|---------------------|---|---------------------|---|
| Power: | 208, 220, 230, 240 VAC, single phase, 50/60 Hz, 20 Amps | Vacuum: | User-furnished 58 mm (2.25") diameter manifold |
| Air: | 5 CFM @ 80 PSIG (9 m ³ /hr. @ 5.6 kg./cm ²) Clean, filtered, dry; supplied by user | Floor space: | 1,219 mm x 1,270 mm x 1,778 mm (48" x 50" x 70") |
| Temperature: | 68 to 74 degrees Fahrenheit | Weight: | <i>Floor</i> 1,089 kg. (2,400 lbs.) <i>Shipping</i> 1,225 kg. (2,700 lbs.) |

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