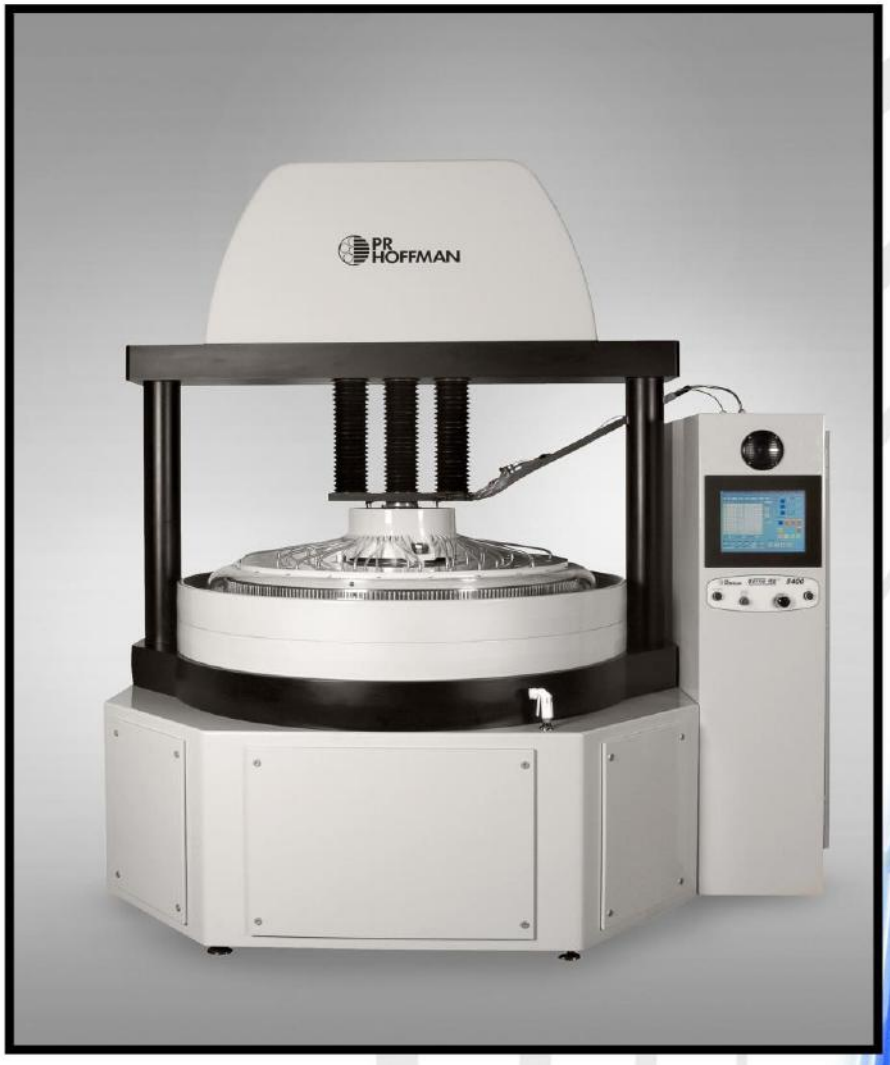
PR HOFFMAN
AMTECH GROUP



5400 SERIES

5400 Series
Double-sided Planetary
Lapping and Polishing Machine

1517 Commerce Avenue
Carlisle, PA 17015
www.prhoffman.com

Phone: 717-243-9900
FAX: 717-243-4542
Date: April 21, 2015

Servo RS™ 5400 Series

Double Side Planetary Lapping & Polishing Machine

The P.R. Hoffman **Servo RS** ™ 5400 Series double side lapping and polishing machine can be adapted to finish many different materials. The planetary action simultaneously removes equal amounts of material from both sides of the pieces. Precise, asymmetrical removal can also be programmed when needed. The **Servo RS** ™ 5400 planetary lapping and polishing machine can be modified to meet your processing requirements with the addition of a wide variety of optional accessories.

GENERAL DESCRIPTION

Weight:	Machine weight: 15,200 pounds (7,000 Kg)
Floor Space:	Left to Right: 106” [270cm] Front to Back: 74” [190cm] Height: 117" [300cm] Shipping Height: 100" [254cm]
Plates:	OD: 53.5" [1,359mm] ID: 17" [432mm] Track: 18.25" [464mm]
Carriers:	Number per Load: (5) 100 Tooth Sprocket Type Root Dia: 19.72" [501mm] Max. Part Circle: 19.21" [488mm]
Electric Utility:	Top Plate Drive: 20 HP (15 KW) D.C. Ring Gear Drive: 7.5 HP (5.6 KW) D.C. Center Gear Drive: 5 HP (3.75 KW) D.C. 480 VAC, 60 Hz, 3 phase, 50 amps 380 VAC, 50 Hz, 3 phase, 60 amps 208/230 VAC, 60 Hz, 3 phase, 100 amps (Optional)

STANDARD FEATURES

The ***Servo RS***™ machines have a touch screen display for editing the 14 step recipes. The parameters that are controlled in each of the 14 steps include:

Automatic Speed Calculation

Automatic Plate Flattening using High or Low Mode

Programmed Shutdown Sequence

Ramp Steps for both speed & load

Lap Steps, 999 minute each capability

Programmed Slurry or Coolant Flow

Programmed Flush Water Flow

Top Plate RPM

Ring Sprocket RPM (Auto or Manual)

Center Sprocket RPM (Auto or Manual)

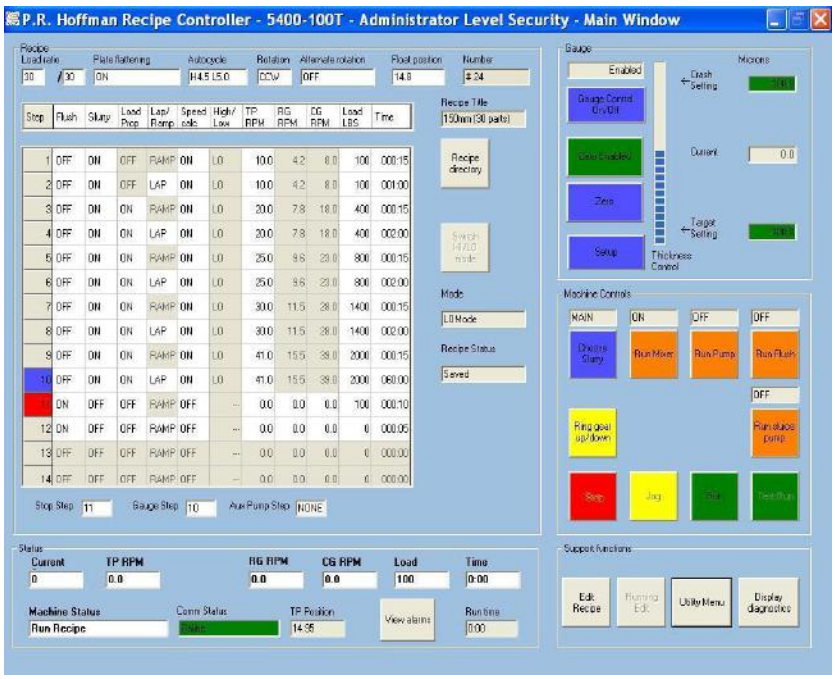
Load (Downforce on Parts)

Digital Gage Sizing Control (optional)

Digital "Crash Protection" (optional)

Timed Cycles (All Steps)

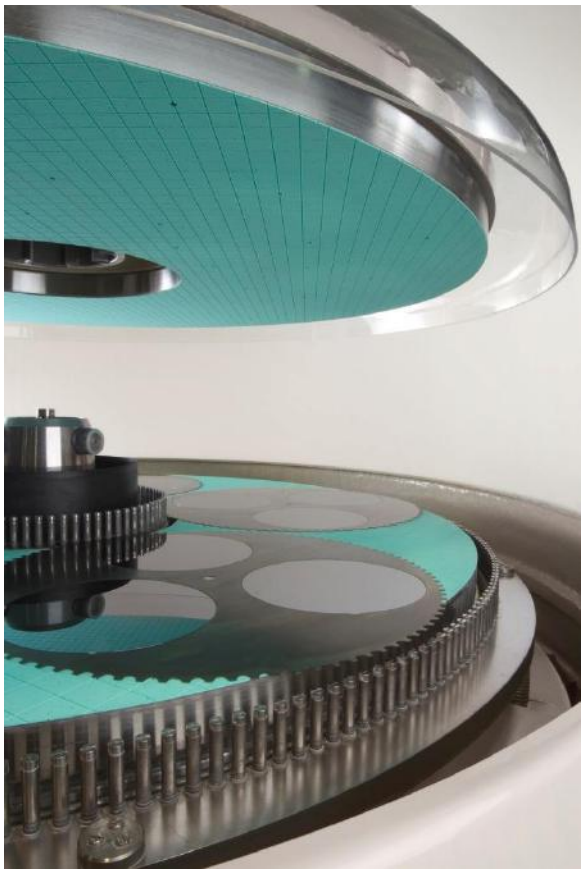
Hour Meter with Alarm



Servo RS™ Main Recipe Screen

- The speeds of the top plate, ring sprocket and center sprocket can be programmed to ramp to a desired RPM over a period as long as 3:00 minutes.
- If an asymmetrical top to bottom removal ratio is required, the ***Servo RS***™ series is easily programmed for ratios as high as 50:1. This technology allows removal of material from one side of a substrate while minimally affecting the opposite side of the product.
- Automatic slurry feed system with a DC variable flow peristaltic pump and a DC variable speed propeller style mixer.
- Two-hand controls for raising and lowering the top plate.
- Cast iron smooth lapping plates.
- Stainless steel ring and center sprockets with pin drive.
- Cast iron top and bottom support plates with stainless steel hardware. Top subplate includes stainless steel slurry inserts and quick disconnects.
- Complete, detailed machine instruction manual stored on machine's Windows® PC and accessible through the touch screen.

Controls:



The machine operation is computer-controlled. Unlimited recipes with 14 steps each can be stored, allowing processes for different products to be changed quickly.

The controller governs all of the process operations. Ring sprocket, center sprocket and top plate speeds and direction as well as acceleration and deceleration ramping are controlled functions. Speed changes can be coordinated to avoid abrupt changes and shock to the parts.

The top plate downforce is controlled by a servo driven ball screw. The controller constantly adjusts the downforce based on feedback from a load cell that is mounted on the top plate drive shaft. This control loop allows precise control of downforce on the parts. The lapping force range is from 25 to 2,200 pounds (11 to 1,000 Kg). Changes are made gradually through the servo motor. This same motor is used to raise and lower the top plate.

A variable speed peristaltic pump feeds slurry or coolant to the process. The pump controls are fully-integrated into the operator panel and are activated within the process recipe steps.

The recipe is selected and the program is displayed and controlled on a touch screen supported by Windows®. During operation, the touch screen presents information to the operator on the progress of the process such as recipe step, speeds and top plate weight. The programming is done through various edit icons displayed on the touch screen. The 5400, as delivered, is fully programmed for process control and for lapping plate or polishing pad conditioning. Additional programs, customized for your application, can be written and altered easily.

The top plate is raised and lowered with two-hand push buttons.

Construction:

Our machine design philosophy includes the use of heavy gauge materials. The rugged machine construction will withstand harsh environments and provide a stable platform for producing flat and parallel parts.

The plate and sub-plate designs include extra thickness to help prevent distortion from heat and force, resulting in a flatter lapping or polishing surface for making high-quality parts.

The Model 5400 machine employs a 3-way motion control design using a non-rotating bottom plate, which is useful for most free and fixed-abrasive processes as well as for very thin and fragile processes.

The Model 5400 machine design employs stainless steel hardware and polymer coatings, which protects parts exposed to process fluids against corrosion and makes cleaning easier.

Drives:

The rotating elements on the Model 5400 are driven by independent, advanced D.C. velocity-servo brushless motors coupled with cycloidal speed reducers, which offer an exceptional level of precise, seamless and efficient control for handling fragile parts. This high level of control greatly reduces the stress on the carrier teeth and the edges of the parts. The brushless D.C. motors provide accurate digital speed feedback to their controllers and to the control display panel. The torque output over the full speed range is far superior to that of an A.C. motor drive. The Model 5400 machine design uses the ***Servo RS***™ control platform, which is industry-proven for more than two decades.

Automatic Plate Flatness Control:

Flatness of the top and bottom plates is controlled during the processing cycle by automatically changing the relative speeds of the ring and center sprockets. Typical plate flatness is held within 0.0003 inches [8 microns] over the entire plate surface.

Slurry System:

The Model 5400 controls are integrated with a variable-speed peristaltic pump, which feeds slurry or coolant to a distribution ring on the top plate. A variable-speed, remote-controlled propeller-style mixer is specially designed to gently agitate shear-sensitive slurries.

End of Cycle Flush:

Flush water control is also fully-integrated into the process controller for rinsing the slurry from the parts, normally during the final process steps. The flush function is also useful for polishing pad dressing and cleaning processes using brush carriers. Two hand held sprayers complement the automatic flush system, and can be used for cleaning the machine.

Retractable Ring Sprocket:

When processing is complete and the top plate is raised, the ring sprocket can be lowered below the level of the bottom plate. After first removing the carriers, thin, fragile parts are slid off the edge of the plate without damage.

Pad Punch:

A PVC backer plate and pad punch are supplied for 5400 polishers. After pads are applied, the punch is inserted through each of the slurry holes to punch through the pad against the backer plate. This method provides a clean, perfectly aligned slurry hole in the pad.

Carriers:

The 5400 holds five 100 tooth carriers (work holders) with a maximum part circle of 19.2” [488mm].

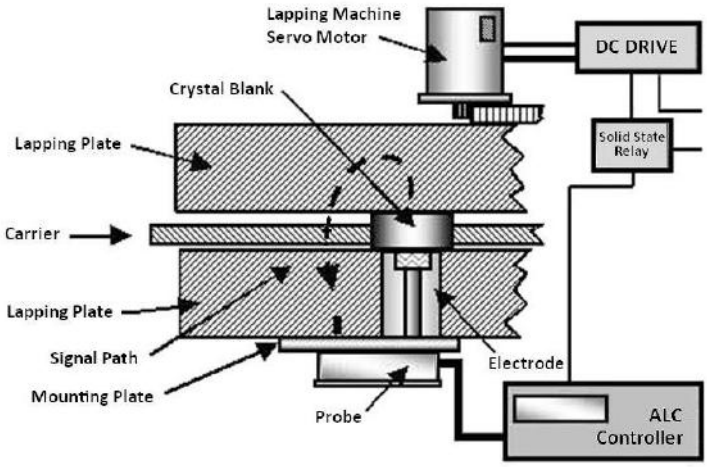
Set-Up, Training and Support:

All machines include set-up, operator and maintenance training. The normal set-up allowance is one week, including travel time. Continuing support is then provided by telephone, e-mail or teleconference. Remote diagnostics can also be initiated through the machine’s personal computer via the internet.

OPTIONAL EQUIPMENT

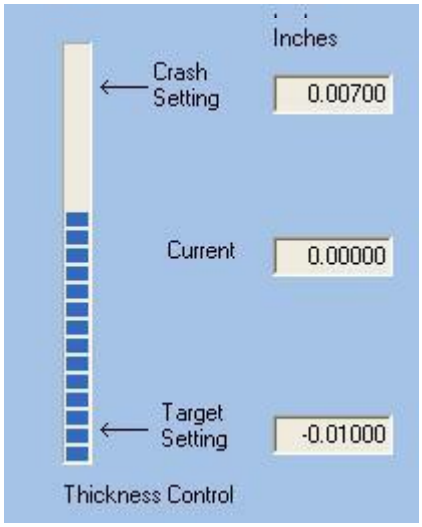
Automatic Sizing Control:

The automatic sizing control system measures parts up to .065" [1.65 mm] thick. A piezo electric quartz crystal is loaded in the center of a carrier and processed along with the parts. As the quartz is lapped, its resonant frequency increases and is monitored by an electrode inserted into the bottom plate. When the crystal resonates at the frequency preset on the ALC, the machine is stopped.



Digital Sizing Control:

The digital gauge sizing device is fully-integrated into the Windows® PC. This device approximates the thickness of the parts being processed by direct measurement of the distance between the plates. The digital gauge probe is mounted inside the top plate assembly, and makes contact with a tungsten-carbide anvil mounted on the machine center shaft. The gauge can be adjusted to account for slurry fluid boundary layer and for plate wear. The operator presets the amount of material to be removed on the touch screen control in inches, microns or millimeters. The gauge device then shuts the machine off when this amount of material is removed. Typically, this gauge can be used to process parts to tolerances of +/-0.0002" [0.005mm] or better.



Part Out of Carrier and Crash Protection:

Used on machines configured as polishers, this option will automatically sense a "crash" and terminate the polishing cycle. If parts are improperly loaded into the carriers during machine loading, the machine will not start the processing cycle and a caution message will be displayed.

Serration Option on Standard Class 40 Cast Iron Plates:

Serrated standard class 40 cast iron plates are for large parts, to reduce hydroplaning.

Serrated Ductile Martensite Lapping Plates Option (replaces standard smooth cast iron plates):

These specially-formulated and heat treated lapping plates are used for lapping silicon wafers with fine-grade slurry. The fine grain structure produces scratch-free lapping.

Cast Iron/Stainless Steel Polishing Plates Option (replaces standard smooth cast iron plates):

These plates provide the thermal stability of cast iron along with corrosion-free plate edges at a lower cost. The design consists of cast iron polishing plates w/ stainless steel slurry inserts and stainless steel cladding on the ID and OD of the plates.

Stainless Steel Polishing Plates Option (replaces standard smooth cast iron plates):

Used when maximum corrosion protection is required.

Stainless Steel Roller Pins:

Roller pins provide smooth transition of power to the carrier teeth, resulting in smoother running polish recipes. The rollers reduce wear on the carrier teeth.

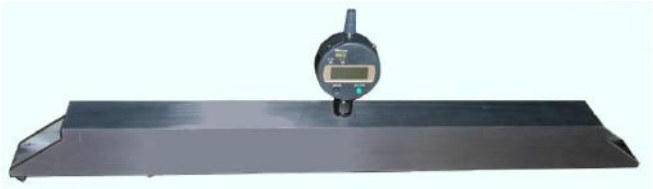
Polishing Plate Cooling / Heating Option:

Special top and bottom subplates provide passages for re-circulating cooled or heated water. This aids in maintaining consistent processing temperature. Water is directed through a special rotary union joint to the top subplate, providing a closed circuit flow. The non-rotating bottom plate has a direct connection for the water flow.

Water Cooling / Heating System:

A self contained chiller / heater system can be provided for maintaining coolant temperature for water cooled / heated plates.

Lapping Plate Flatness Gauge:



The lap plate flatness measuring gauge comes complete with a digital indicator and protective case. Regular checking of cast iron lapping plate flatness with this gauge will allow determination of when reconditioning of the plates is needed before part flatness and parallelism tolerances deteriorate. This option is recommended with the first lapping machine purchase. A granite reference flat is also available**.**

Boost Transformer Kit with Wiring Panel:

Booster transformers for converting 208 VAC or 230 VAC, 3 phase building power to 480 VAC / 3 phase power. **NOTE: Required option** if 480 VAC is not available.

Conditioning Sprockets:

A set of rigid dressing sprockets is used to remove irregularities on lap plate surfaces such as scratches or rust deposits, and to flatten the plates as necessary. These sprockets are available in Class 40 cast iron or ductile Martensite. Commonly used in sets of four.

Carriers (workholders):

Carriers are manufactured of spring steel, Lamitex™, phenolic, Lexan®, and PVC. Workholes of any size and shape are available. Other materials are available on request.

Brush Carriers for Polishing Pads:

Brush carriers with scrubbing bristles are used with a water flush to clean and restore glazed polishing pads. Brush carriers are commonly used in sets of four.

Diamond Conditioning Carriers for Polishing Pads:

Each conditioning carrier assembly consists of a PVC carrier that holds a precision, diamond-electroplated stainless steel wheel that spans across the entire plate track width. The diamond coating is flat and uniformly applied to both sides of the wheel. The diamond conditioning carriers are used to break-in and planarize new polishing pads and to re-condition glazed polishing pads. The diamond conditioning carriers are commonly used in sets of four.

Warranty:

All processing machines are warranted by Seller to be free from defects in materials and workmanship for a period of one year after the date of shipment by Seller. Seller's warranty of processing machines covers parts only, does not cover labor, and does not cover any machine which has been abused, misused or negligently operated or maintained. If Buyer notifies Seller in writing within ten days after discovery of a defect during the warranty period only, and if such defect appears in Seller's sole judgment to be a defect in material and workmanship attributable to Seller, Seller will make such repair or replacement to correct such defects as Seller in its sole judgment shall deem appropriate. The above warranties supersede all warranties of merchantability or fitness for a particular purpose. There are no warranties, express or implied, which extend beyond the warranties contained herein.

The foregoing remedy shall be Buyer's sole and exclusive remedy against Seller. Broken or faulty parts must be returned to P.R. Hoffman for inspection and new or repaired parts will be returned.