



Precision Flatness Gauges · Monochromatic Light Unit Optical Flats · Polishing Stand · Hand Lapping/Polishing Plates

Precision Flatness Gauges

All Lapmaster precision flat lapping machines are of the "ring lapping" type. This design permits high standards of flatness to be routinely achieved by careful adjustment of the lateral position of the cast iron conditioning rings on the annular lap plate track.

To consistently achieve successful results it is essential to periodically assess the flatness of the lap plate. As well as giving a spot check at the time of testing, the results of a series of checks, if recorded, will form a log and allow analysis of trends, providing information for correctional measures to be made if required ie: adjustment of the conditioning ring positions.

There are several methods of testing, for example a monochromatic light and optical flat can be used to set up an interference pattern. This technique requires that the surface to be tested is reasonably reflective, so in most cases after lapping and cleaning, a hand polishing operation must be carried out. This check can be carried out on the component itself, or on a special test plug made of brass, which can run along with a batch of parts.

Full details of this technique can be found by referring to the Bulletin "Measuring Flatness with Lapmaster Monochromatic Lights and Optical Flats". (Copies available on request.)

The benefit of the Lapmaster flatness gauge is that it allows direct reading of the flatness of the lap plate itself once it has been cleaned. It also eliminates the need for a hand polishing stage, which is particularly beneficial when large components are being processed.



The gauge is of the spherometer type having a dial test indicator mounted in the centre of a cast iron body. The gauge rests on three feet, which are fitted with hardened steel ball anvils. (These are screwed in and can be replaced should they wear after prolonged usage.)

A choice of metric or Imperial versions is offered, with resolutions of 2 microns and 0.0001" respectively. This means that the resolution of the flatness gauge with interpolation is 1 micron over 237mm or 0.00005" over 9.33" (equivalent to one sodium light band

over 71mm/2.8"). The gauge is zeroed prior to use by setting it on a master flat so that all three feet and the anvil of the dial gauge are on the same plane, and the dial gauge bezel or the adjustable foot are then adjusted to set the indicator to zero. Each gauge comes complete with a hardened steel master flat, lapped and polished to a flatness better than 0.3 micron/0.000012", and a sturdy wooden box which houses both when not in use.

Two sizes of gauge are available as follows:

Nominal 5"	Metric version	X91000006
Nominal 5"	Imperial version	X91000102

This size is suitable for use with Model 15 bench mounted machines.

Nominal 9"	Metric version	X91000003
Nominal 9"	Imperial version	X91000103

This size is suitable for use with the Model 24, 36, 48, and 56.

Polishing Stand

For flatness assessment the surface being examined must be sufficiently shiny so that light will be reflected back through the optical flat. If the component is to be checked after a polishing operation, or after the lapping process if it is very hard material, then it will have sufficient reflectivity so that no further polishing is needed. However for the majority of work the lapped surface must be lightly polished. As this stage does not require much time it is conveniently carried out manually, using a figure of eight motion. The Lapmaster polishing stand used for this, can be loaded with a roll of abrasive paper, clamped taut to prevent the edges of the work from being rounded, and situated on a bench near to the lapping machine.



When worn the roll can be adjusted to present a new section of paper.

Polishing stand complete with roll of grade 4/0 polishing paper
Part No. X91090000.

Monochromatic Light Unit

In order to obtain precise measurement and contrasting fringe patterns when using optical flats to assess the flatness of processed components, the field of view must be illuminated with monochromatic light - that is, light in which the rays have virtually the same wavelength.

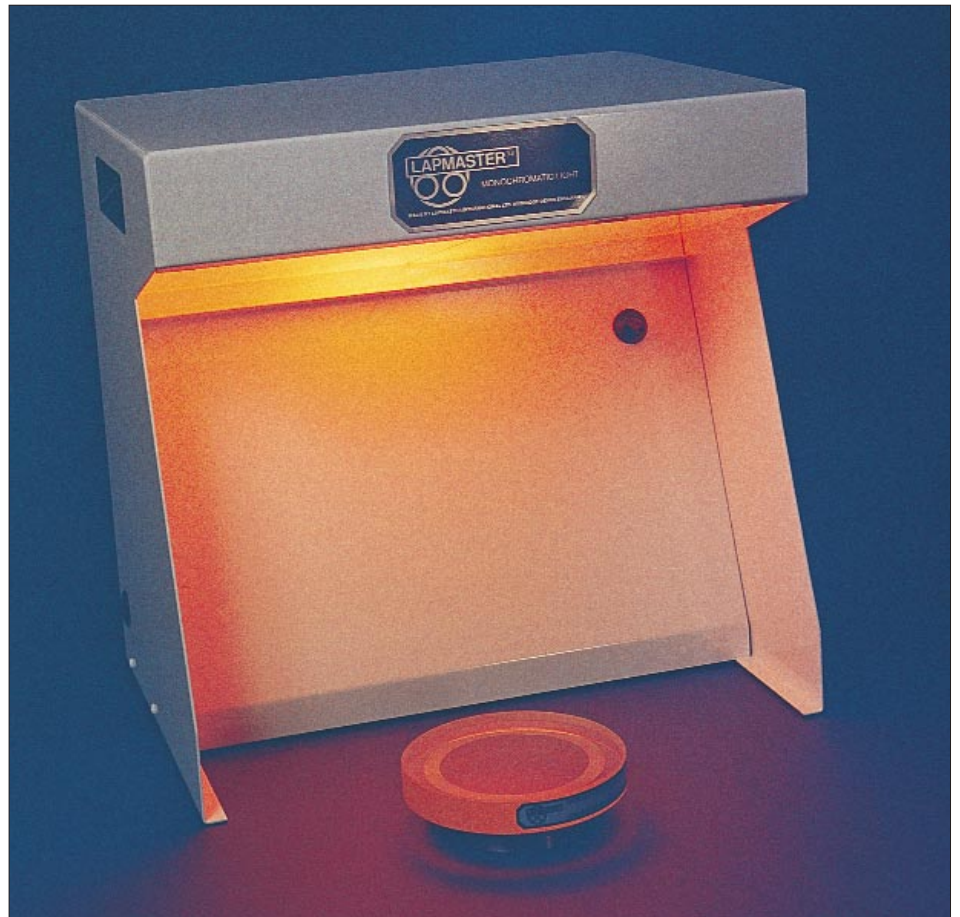
The new Lapmaster monochromatic light unit uses a standard commercial 18W low pressure sodium SOX lamp which gives very economic running costs and a long operating life.

The effective monochromatic wavelength is 5896A, so $\lambda/2$ is approximately 0.3 microns.

In front of the bulb is an opalescent diffusing screen with a straight line engraved across its face. By suitable adjustment of the flat, work and eye position, the reflection of the engraved line provides a straightness reference with which the bands can be compared.

For more details of this technique and interpretation of fringe patterns, please refer to the Bulletin "Measuring Flatness with Lapmaster Monochromatic Lights and Optical Flats."

Units can be offered to suit the following single phase power supplies:



Part No.	X04080300	220/240V 1Ph 50Hz
Part No.	X04080304	220/240V 1Ph 60Hz
Part No.	X04080301	110V 1Ph 50Hz
Part No.	X04080305	110V 1Ph 60Hz

Spare Part No. L0258008 Replacement Sodium SOX Lamp.

Optical Flats

Lapmaster optical flats are test reference or proof flats used in the measurement of plane or nearly plane specular surfaces in conjunction with a monochromatic light source.

A transparent distortion free material is needed for an optical flat, and Lapmaster use only Zerodur¹, a glass ceramic material with ideal properties for this application. The standard grade of Zerodur is specified which has a mean linear coefficient of thermal expansion in the range 0 to 50°C of less than $0 \pm 0.15 \times 10^{-6}/K$. This together with its exceptional long term longitudinal stability leads to its superiority over other optical materials used for flats. The diameter to thickness ratio is always $\leq 7:1$ for mechanical stability.

Preparation of the highly specular flat surfaces is carried out in our own optical polishing facility using our latest Lapmaster 48 air bearing optical polishing machine. Both single and double sided flats are available.

All flats are checked against our master flat which is calibrated regularly by the National Physical Laboratory at Teddington, UK and are supplied with an inspection certificate. A sturdy storage box ensures safe keeping of the flat when not in use.

Two standards of accuracy are available:

1/4 light band $\lambda/8$

1/10 light band $\lambda/20$

Where λ is the monochromatic wavelength (sodium source). A range of sizes is offered, please refer to the adjacent table.

Zerodur¹ is a registered trademark of Schott Glaswerke, Mainz.



Nominal Diameter	Description	Part No. Single Sided	Part No. Double Sided
25mm	1/4 lightband accuracy	X91071025	X91072025
	1/10 lightband accuracy	X91081025	X91082025
50mm	1/4 lightband accuracy	X91071050	X91072050
	1/10 lightband accuracy	X91081050	X91082050
75mm	1/4 lightband accuracy	X91071075	X91072075
	1/10 lightband accuracy	X91081075	X91082075
100mm	1/4 lightband accuracy	X91071100	X91072100
	1/10 lightband accuracy	X91081100	X91082100
125mm	1/4 lightband accuracy	X91071125	X91072125
	1/10 lightband accuracy	X91081125	X91082125
150mm	1/4 lightband accuracy	X91071150	X91072150
	1/10 lightband accuracy	X91081150	X91082150
200mm	1/4 lightband accuracy	X91071200	X91072200
	1/10 lightband accuracy	X91081200	X91082200
250mm	1/4 lightband accuracy	X91071250	X91072250
	1/10 lightband accuracy	X91081250	X91082250
300mm	1/4 lightband accuracy	X91071300	X91072300
	1/10 lightband accuracy	X91081300	X91082300

Annular flats with a cut-out hole are available, to permit the checking of surfaces where a protrusion extends above the plane of work. Prices will be quoted on request.

Lapmaster also offer a repolishing service of optical flats clouded by usage, or recalibration only if required with issue of new certification.



Lapmaster Hand Lapping Plates

Lapmaster hand lapping plates are suitable for laboratory, tool room or maintenance workshop and can be used for lapping parts to extreme flatness in low volumes.

These plates are made from high quality low porosity grey cast iron (Grade 300 to BS1452) and are usually serrated with a square cross-hatched pattern. Solid (Unserrated) hand lapping plates are available for use with very small workpieces.

They are used with an abrasive grit, applied in paste form to give a uniform dull matt finish on a wide variety of metallic and non-metallic materials.

Three sizes of plate are available:

Hand Lapping Plates

6" (150mm)	diameter, serrated:	X00003753
6" (150mm)	diameter, solid:	X00003754
12" (300mm)	diameter, serrated:	X00003751
12" (300mm)	diameter, solid:	X00003752
18" (457mm)	diameter, serrated:	X04550002
18" (457mm)	diameter, solid:	X04550001

Lapmaster Soft-Metal Alloy Hand Polishing Plates

Lapmaster alloy polishing plates are for use with diamond abrasives, either in paste or spray form, to produce polished surfaces on components.

The plate is made of a lead-based whitemetal conforming to BS3332/F. This is a lead-tin-antimony alloy with traces of other metals and is an ideal soft metal matrix for diamond grains.

A small charging block used to load the soft metal surface with the diamond abrasive is provided.

This is an essential step in preparing the lap plate prior to polishing.

Two sizes of plate are available:

Hand Polishing Plates

6" (150mm)	diameter, solid:	X00003756
12" (300mm)	diameter, solid:	X00003755

Plates are only available in solid format. Diamond hand polishing on this type of lap does not require serrations.



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