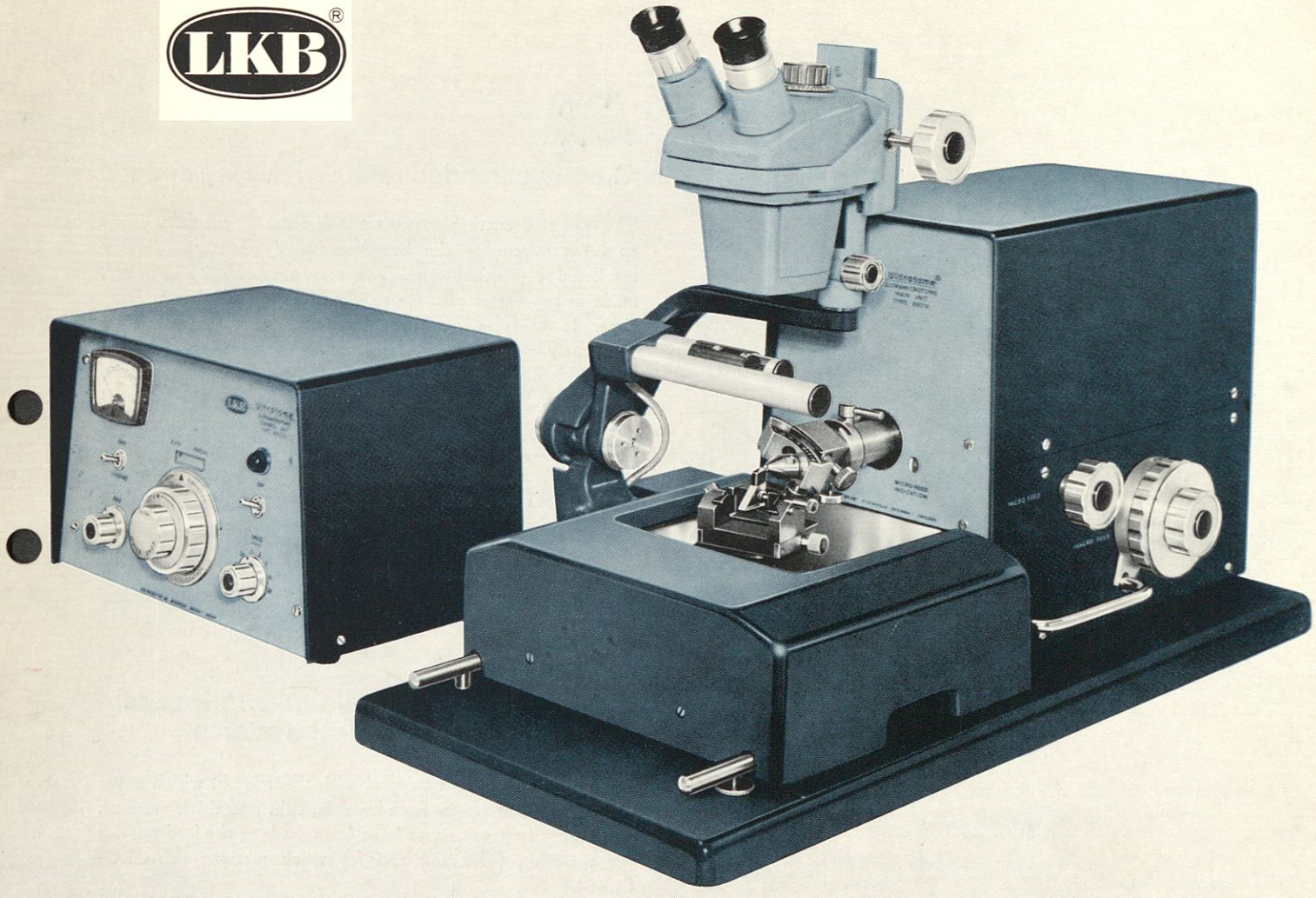


THE ULTROTOME® III

AN ALL NEW ULTRAMICROTOME FOR METHODICAL SECTIONING

A highly refined instrument combining precision and utmost convenience with unmatched versatility. **Important features:** ● Both very low and high cutting speeds ● Cutting cycle at 0.1 mm/sec. takes only 64 secs. with a full 6-mm cutting stroke ● Return stroke at all speeds takes a mere 0.4 sec. ● Exclusive knife edge evaluator based on an optical principle measures edge angle to ± 1° ● Long cutting stroke plus facility for evaluating angle and condition of knife edge permit sections 3 mm × 3 mm and larger to be cut ● Planetary gear now mounted on an improved Macrofeed mechanism facilitates taking sections of 1 μ or more serially ● Extremely stable thermal feed with range 50 Å — 1300 Å ● Unique accessory for mounting sections on EM grids ● Stereo-zoom microscope.

1

Greatly extended range of cutting speeds

The range of cutting speeds extends from 20 mm/ down to 0.1 mm/sec. — the broadest found on any sently marketed ultramicrotome. The return stroke is, wever, made as rapidly as possible to eliminate unnecessary iting time. It takes a mere 0.4 sec. in all cases. At the most frequently used speed, 2 mm/sec., and all higher speeds, the whole cutting cycle is completed in 4 secs., while at the lowest speed (0.1 mm/sec.) only 64 secs. are required. Moreover, the part of the down stroke with constant speed is now 6 mm long, a feature which, together with the low cutting speeds, enables the Ultrotome III to produce sections of large area — 3 mm × 3 mm and more.

2

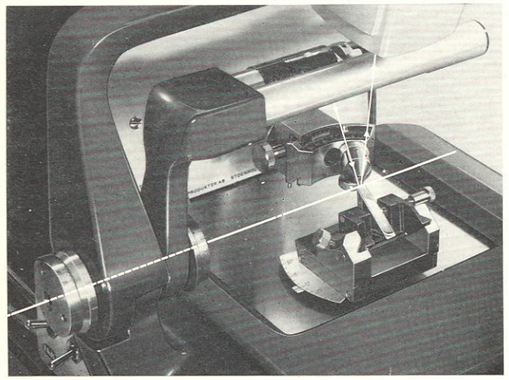
Feed — linear thermal and two independent manual mechanical systems

The Ultrotome III is equipped with three feeds, which cover respectively the ranges for ultrathin, thin and thick sections. Significant improvements have been made to the feed systems for ultrathin (Thermal) and for thick sections (MACRO-FEED).

The chief improvements affecting the thermal feed — still the most precise and reliable feed principle for ultrathin sectioning — are threefold:

Firstly, the specimen arm and heating system are designed to give **very rapid response;** no gradual change in section thickness from section to section occurs after reselecting the feed. Secondly, the return stroke is made as rapid as possible (0.4 sec.) to save waiting time. Thirdly, the metal in the specimen arm and holder has a very low coefficient of expansion. The last two features contribute to making the Ultrotome III especially insensitive to drafts and radiation from the sun, lamps, the operator or other causes of temperature fluctuations. The maximum thermal feed per section is 1300 Å, even during the shortest cutting cycle of 4 seconds.

The mechanical macrofeed shaft has now been fitted with a large planetary gear. This precision mechanism permits sections of 1 μ upwards to be taken serially. With a little practice silver sections may be obtained, reports one technician. With a total range of 15 mm it is more than adequate for any purpose and will be a boon to pathologists. The mechanism is independent of the mechanical microfeed, which covers a thickness range of 0.1 μ to 2 μ, as well as of the thermal feed (range 50 Å—1300 Å). Thus, the thermal feed does not need to be switched off when a thick section is to be taken with the manual feeds.



3

Unique Knife Edge Evaluator

The microscope stand of the 8800 is equipped with two angular scales, one on the arm of the microscope holder and the other on the lamp holder arm. Together with the microscope, the focussable lamp beam, the slit aperture, and the knife stage, these scales form a very effective facility for measuring the angle at the knife edge to an accuracy of 1°. Chips, imperfections, and contaminating particles on the cutting edge, as well as any variation of edge angle are clearly revealed by this method. Newly broken knives can be quickly evaluated and classed while a knife in use can be checked if a disturbance in even sectioning should arise.

Exact knowledge of the condition and edge angle of a glass knife is a necessary condition for **methodical ultramicrotomy** — the only sure and efficient means to satisfactory sectioning of difficult specimens without waste of time. Since no ultramicrotome will cut satisfactorily without an appropriate knife, the importance of this feature can hardly be overestimated. Especially valuable is it when one has to section materials which can only be cut with speeds and edge angles within a very narrow range.

4

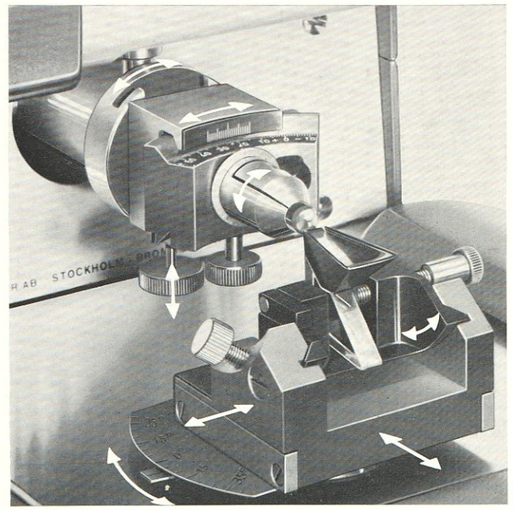
Universal Knife and Specimen Orientation

The great mechanical flexibility of two important parts — the knife stage and the specimen holder — allows the block and the knife to be oriented in **all** directions with respect to one another. This eliminates the need for special fixtures to hold the specimen during embedding and makes reembedding unnecessary.

So that the tilt of the block axis may be set at a known angle to the axis of the specimen arm, the sliding arc in the orientation head has been fitted with a vernier scale. The vertical position of the head itself is fixed by an adjustment screw under the specimen arm. Likewise the new cylindrical-type specimen holder is graduated in a full circle. This new holder is made of stainless steel and is even in other respects designed to give specially rigid support to the specimen block. It has been shown that cutting of sections with large area proceeds very smoothly with this fixture.

Cutting large sections demands utmost rigidity of also the knife edge. Reflecting this fact is the design of the knife stage with its three-point support having a wide freedom of movement. The stage may be rotated about a vertical axis up to 35° in either direction. Its position is indicated on the graduated plate.

These scales allow the operator to record his procedures in figures and to repeat them when the optimal conditions have been found. In other words, they permit **methodical sectioning** — the right way to get the most out of your instrument in the shortest possible time.

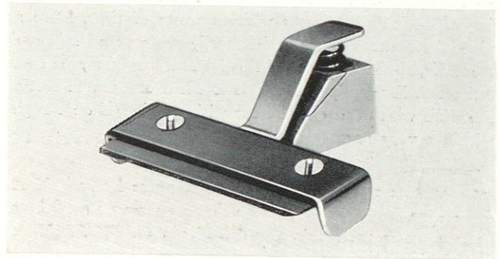


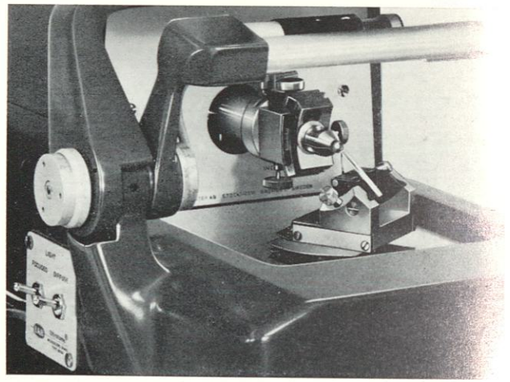
5

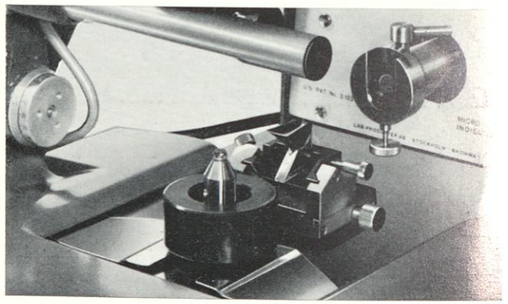
Specimen Trimming — two methods

Trimming the specimen in situ, that is, with the embedding clamped in the holder and the holder mounted on the specimen arm, is the most precise method of obtaining a regular tip and often the easiest. An ordinary glass knife is used, and the angular graduations on the flexible knife stage permit a pyramid with the exact shape and size desired to be formed. It will also have clean straight sides, so that the sections cut from it will float out with no trouble from the knife edge and hang together in a straight ribbon. Usually, it is not even necessary to remove the capsule from the block before trimming.

In case you wish to trim by hand, there is an additional holder for the trimming blade shaped to permit it to be gripped firmly either in one hand or in both. With these trimming aids, slicing off the whole tip accidentally, a not uncommon occurrence when trimming hard embeddings, is easy to avoid.



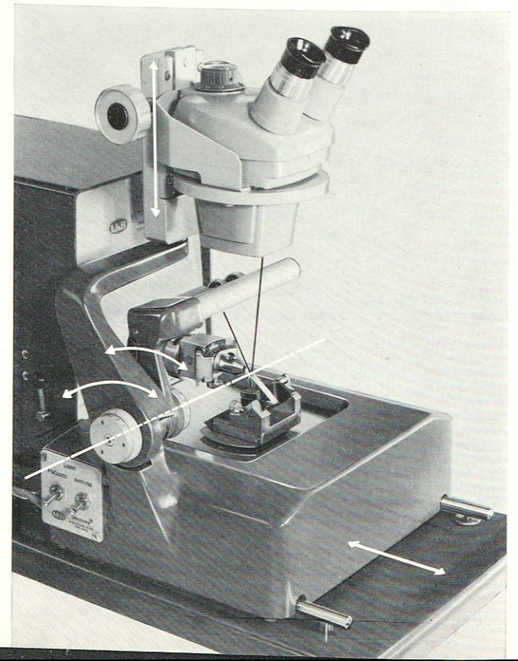




6

Improved Optical System

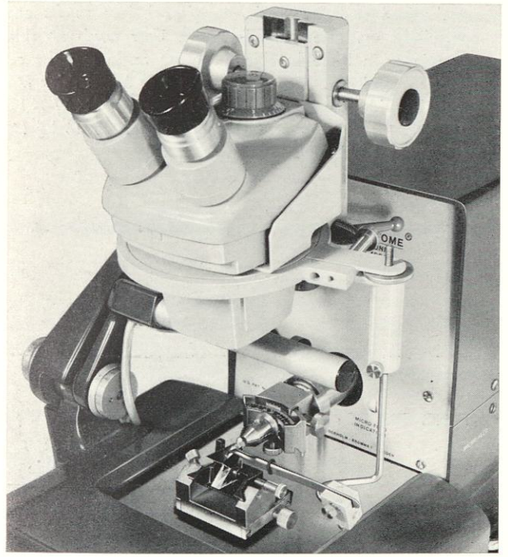
The microscope sold as standard for the Ultrotome III is a Bausch and Lomb stereo-zoom with a magnification range of 15—60 ×. It is mounted with a special holder on a sliding stand. The optical system is specifically designed for use during specimen trimming, knife inspection, measurement of the edge angle, following the progress of sectioning, and picking up the sections. The microscope stand with the dual illumination system and its switches and power cables may be lifted from the ultramicrotome and removed to another table, where, with the addition of a small transformer available, it may be used for other purposes. The rails on which the stand slides are equipped with a levelling screw to eliminate rocking which can arise from uneven working surfaces. All rotational adjustments of the microscope and light sources are centered on the cutting point. This construction in addition to the simplified and distinctive design of each control and its convenient placing enables an operator to carry out almost all the steps of ultramicrotomy with his or her eyes literally glued to the microscope, thus ensuring a continual and highly effective control of sectioning.



7

Section Collector

Included as a standard accessory on the new B.&L. stereo-zoom microscope, this simple device saves hours of valuable time during a workweek. Picking up sections on grids is no longer a finicky job. No endless teasing of sections so that they lie in the right place and properly stretched out. Now that you do not have to hold the grid, it is easy to manoeuvre the string of sections to the right place and with the other hand turn the focussing wheel. The sections will follow the grid up as the wheel is turned, and remain in focus. Even an unsteady hand finds this an easy job.

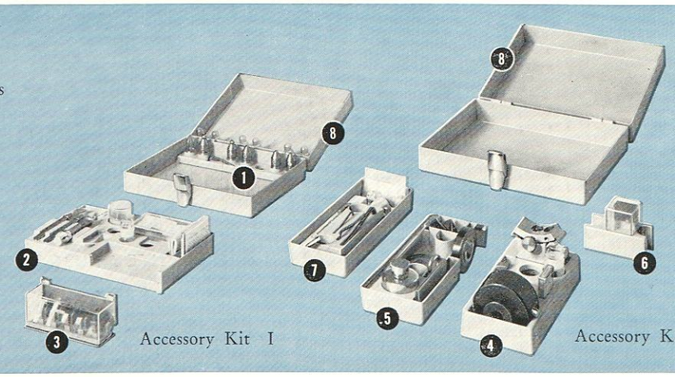


8

Comprehensive Range of Accessories

A full range of small accessories and supplies for ultramicrotomy are included with each Ultrotome III. They are packed in two small storage boxes containing removable trays. Each tray carries all the items needed for a particular aspect of ultramicrotomy. The tray with items for mounting the trough can thus be used at another place in the lab. than the tray with trimming equipment, both of which are contained in Accessory Kit II. If an additional B. & L. microscope with stand and a separate transformer is used, both these preparatory operations can be carried out away from the cutting unit, since all the accessories for sectioning are contained in Accessory Kit I.

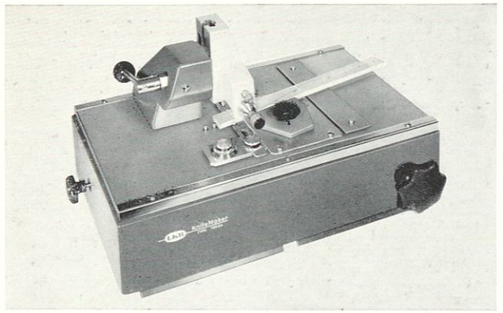
1. Stand with six specimen holders
2. Tray for sectioning work
3. Storage Box for glass knives
4. Specimen Trimming Tray
5. Tray for fitting trough onto knife
6. Tray for Diamond Knife Fixture.
7. Tray for tools and spare parts
8. Plastic Case



Accessory Kit I

Accessory Kit II

AUXILIARY EQUIPMENT



KnifeMaker LKB 7800A

A mechanized tool for producing glass knives to fit any commercially available ultramicrotome. User needs no skill or experience in knife breaking. Scoring angle may be set between 35° and 55°. Glass strips from 4 to 8 mm thick and up to 1 1/2″ wide are accommodated. Measures (L × W × H) 48 × 30 × 34 cm (19 × 12 × 13 1/2″) and weighs 16 kg (35 lbs). Detailed brochure available.

TECHNICAL SPECIFICATIONS

FEED:

1. Thermal feed for automatic cutting. Continuous range: 50—1300 Å per stroke. Dial on Control Unit indicates feed directly with compensation for period of cutting cycle. Thermal feed is linear with time within 10 % for at least 20 minutes.

2. Mechanical manual feed: two independent systems, operated from separate controls on righthand side of cutting unit.
a) MICROFEED obtained by turning smaller control, one full turn producing a feed of 1 μ ± 0.1 μ. Total feed: 15 μ. Suitable for taking occasional survey sections of thickness 0.1 μ — 2 μ during automatic or manual sectioning.
b) MACROFEED obtained with the large compound control. The large wheel is used chiefly for positioning the knife edge relative to the specimen block. For each full turn knife stage advances 0.5 mm. Total range is 15 mm.

The smaller control wheel, coupled to the larger by a planetary gear with 10:1 ratio, is fitted with a disc graduated in 50 divisions. One division is equivalent to a feed of 1 μ. Accuracy of MACROFEED is better than 10 % for each movement over 10 divisions or better than ± 0.25 μ for smaller movements. Suitable for taking thick sections for light microscopy, for mechanical trimming of embeddings mounted on the specimen arm, and for working down the cutting face.

COOLING:

Time required to cool specimen arm is proportional to the duration of thermal feed. No delay for cooling need arise provided the blower is always switched on as soon as automatic cutting is interrupted. The pause required for collecting sections in the trough suffices.

MODES OF OPERATION:

Automatic — Repeated sectioning, thermal feed.
Semi-automatic — Repeated sectioning, mechanical manual feed.
Manual — Remote manual control of specimen arm, manual specimen advance.

CUTTING SPEEDS:

	Speeds (mm/sec.)	Period of cutting cycle
During automatic operation	20, 10, 5 & 2	4 secs.
	1	8
	0.5	16
	0.2	32
	0.1	64
During manual operation	from standstill to ≈ 35 mm/sec.	Controlled entirely by operator
Instantaneous release (single stroke)	about 60 mm/sec.	Minimum 4 secs. Controlled by push button marked "Quick drop"

The tip of the mounted specimen moves at speeds constant to within ± 10 % of the set values, over a path extending from 3 mm above to 3 mm below the longitudinal axis of the specimen arm in the arrested position.

KNIFE RETRACTION:

25—30 μ, independent of cutting speed. Knife edge returns to same position with an accuracy of ± 10 Å. Magnetic retraction is actuated when specimen leaves constant speed path on down stroke and not released until it passes upper limit of this path on return stroke.

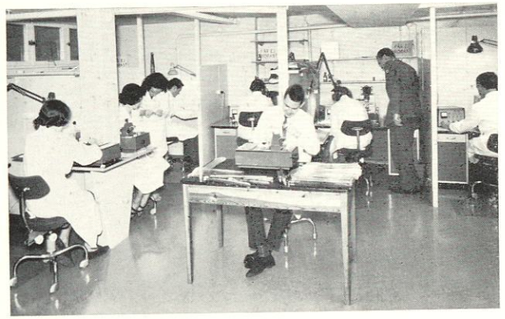
KNIFE ADJUSTMENTS:

(See drawing on page 3.)
Vertical: Set to fixed reference level.
Longitudinal: 15 mm (MACROFEED).
Horizontal Rotary: 360° around a vertical axis through the

APPLICATION SERVICE AND WORKSHOPS IN ULTRAMICROTOMY

T orps of highly-trained technical representatives and e engineers of the LKB sales organization as well as KB application laboratories are able to offer owners B equipment for ultramicrotomy free consultation of re qualified nature than any other manufacturer of icrotomes. Beyond this occasional advice, low-cost es in advanced ultramicrotomy are also arranged quite ularly.

The overwhelming interest in these courses makes it at present necessary to limit participants to those with a minimum of four months' experience with an Ultrotome. Particulars coming courses may be had by writing to us.



ng point. Graduations from 0 to 35° in each direction. ral: ± 7.5 mm.
: Up to 30° around a horizontal lateral axis through the ing point. Graduations enable clearance angle to be set rately between 0 and 20°.

KNIFE HOLDER:

ccommodates glass knives up to 10 mm thick or fixtures or metal or diamond knives.

GLASS KNIFE:

Recommended shape is an isosceles triangle broken from glass strips 25 mm wide. The knives are most efficiently broken with the LKB 7800 KnifeMaker. Its scoring angle can be set from 70° to 110° to an accuracy of 1°, so that a knife may be obtained with any scored angle (δ) between 35° and 55°. The edge angle (α) will always be slightly greater.

SPECIMEN HOLDER:

Available in six types, five types to accommodate specimen blocks cast in gelatin capsules of sizes 4 to 00 or in BEEM plastic capsules and one to accommodate flat embeddings up to 5 mm thick.

Type	B	D	E	F	G	K
Accept blocks from capsules	4	2 & 3	1	0	00 & BEEM	flat
Block diam.	4.8	5.6 & 5.2	6.3	7.2	8.0	—

The holders are of stainless steel and are graduated around the axis from 0 to 360° each 9° for easy orientation.

SPECIMEN ORIENTATION:

a) Specimen orientation head can be rotated 360° around its own axis (parallel to or coincident with the specimen arm's axis) and adjusted 10 mm vertically by a screw under the arm.
b) The sliding arc section carrying the specimen holder allows the axis of the specimen block to be positioned and fixed permanently at an angle of up to 47° with the axis of the specimen arm and orientation head. Accuracy ≈ 1/2°.
c) Specimen holder can be rotated around its axis, the axis of the block, from 0 to 360°. Graduations permit orientation to an accuracy of 3°.

MICROSCOPE:

Bausch & Lomb cycloptic stereo-zoom microscope with range of magnifying powers 15—60 ×. Includes special microscope holder which fits onto LKB's microscope stand. Free working distance between objective and focal point: 100 mm (4 inches).

ILLUMINATION:

Dual light source consisting of
a) Focussable beam from a 8-W, 6-V incandescent lamp.
b) Diffuse cold light from a 4-W fluorescent tube.

MICROSCOPE STAND:

Carries the dual light source on an adjustable arm and the microscope support on another. Both arms swing around the same horizontal axis and are fitted with angular scales used for measuring the knife angle. The stand slides on adjustable rails parallel to axis of specimen arm.

ELECTRICAL DATA:

The Ultrotome operates on 115, 130, 150, 220 or 240 volts, single phase, 50/60 cps. Power consumption is 75 watts. A voltage variation of ± 10 % is permissible.

SPACE REQUIREMENTS (L × B × H):

Main Unit with microscope and baseplate: 40 × 69 × 51 cm max. (15 7/8″ × 27 1/2″ × 20 1/8″).
Control Unit: 34 × 22 × 22 cm (13 7/8″ × 8 5/8″ × 8 5/8″).
Table: 130 × 75 × 67 cm (52″ × 30″ × 26 3/4″).

ORDERING INFORMATION

LKB 8800A-NM ULTROTOME III Ultramicrotome with

a) linear thermal feed for ultrathin sectioning and two independent mechanical manual feeds for cutting thin and thick sections respectively;
b) extra wide range of cutting speeds (20—0.1 mm/sec.);
c) facilities for automatic, electronically controlled serial sectioning, for cutting single sections at set speed, and for remote manual control of cutting at any speed up to 35 mm/sec. and with mechanical feed from 0.1 μ upwards;
d) and sliding microscope stand equipped with a dual light source and a knife edge evaluator. Microscope not included.

The package comprises

8801 Main Unit;
8802 Control Unit;
8809 Base Plate;
8810 Microscope Stand with dual light source and angular scales for knife edge evaluation;
4812A Damping Cushions (4 pcs);
4813A Plastic Dust Cover for Main Unit;
4814A Plastic Dust Cover for Control Unit;
I—8800 Instruction Manual;
8815 Accessory Kit I in plastic case containing items used during sectioning,
a) a removable Stand carrying six Specimen Holders each with protective hood;
b) a removable Tray carrying a Storage Box for glass knives, two pairs of Forceps, hypodermic Syringe with needle, Grid Box, Lens Tissues, two glass Vials, etc.

8816 Accessory Kit II in plastic case containing four removable trays,
a) carrying items used during specimen trimming: Specimen Orientation Head 8836-1, Trimming Stand, Holder for Trimming Knife, Schick razor blades (3 pcs), Silver Gillette blades (pkt of 5), and 15 ml glass Vial;
b) for items used for fitting the trough to the glass knife: two metal troughs, two rolls of black plastic tape, pair of scissors, spatula, dental wax, and spirit lamp;
c) for diamond knife fixture with protective hood (fixture and hood are optional);
d) for spare parts and tools, such as Allen wrenches, fuses, incandescent bulb, fluorescent tube and glow-discharge starter.

LKB 8804 **Bausch & Lomb Cycloptic Stereo-Zoom Microscope** with range of magnifying powers 15—60 ×, including Section Collector 8850 B/L and special Microscope Holder 8806 with rack and pinion to fit Microscope Stands 8810 and 4810A.

LKB 8800A Same as 8800A-NM but including also Bausch & Lomb Microscope 8804 as described above.

LKB 4806A **Articulated Ultramicrotomy Table** with Formica covered top and linoleum covered sides, 4 damping cushions, and plastic sandbags for ballast (sand not included).

LKB 7800A **KnifeMaker** with glass cutter and breaking tool combined in one unit for producing glass knives used in ultramicrotomy.

LKB 8818 **Set of 30 graduated Specimen Holders 8840** of stainless steel, with protective caps. Carried on 5 separate Stands 8823 each accommodating 6 Holders and contained in Plastic Case 8820. (State in your order the quantity of each size required.)

LKB 4838A **Diamond Knife Fixture.**

A complete list of accessories, operating supplies and spare parts will be sent on request. Additional accessories are constantly in development and are announced as soon as available.
Information supplied in this brochure is subject to alteration in detail without notice.

RECOMMENDED INITIAL EQUIPMENT

Quantity	Cat. No.	Item	Weights (kg)		Dimensions of Packing Case (cm)
			Net	Gross	
1	8800A-NM	ULTROTOME III Ultramicrotome	97	130	main unit: 80 × 45 × 51 optical unit: 53 × 34 × 25
1	8804	Bausch & Lomb Cycloptic Stereo-zoom Microscope	4	6	25 × 21 × 20
1	8818	Set of 30 stainless steel Specimen Holders 8840 in plastic case (type and quantity according to customer's need)	4	4.5	25 × 24 × 90
1	4806A	Ultramicrotomy Table	88	115	142 × 83 × 50
1	7800A	KnifeMaker	24.8	26	51 × 36 × 39

LKB-PRODUKTER AB, P.O.Box 76, Stockholm-Bromma 1, Sweden

Subsidiaries for Sales and Service in Washington, London and the Hauge

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