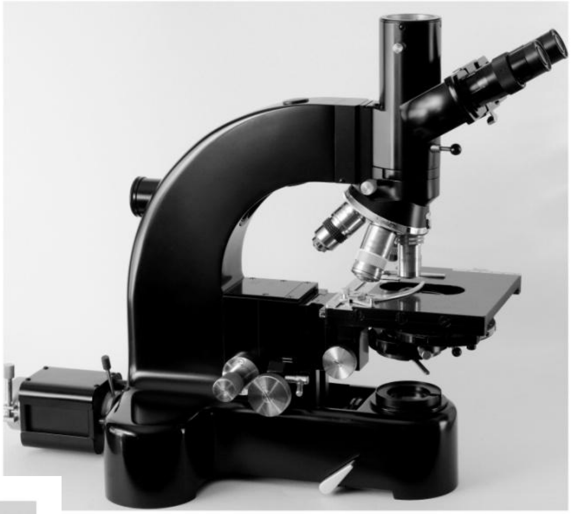
The Excellent Leitz Microscopes with Black Enamel Finish

3/10/2011

Normand Overney and Gregor Overney



The Excellent Leitz Microscopes with Black Enamel Finish

Normand Overney and Gregor Overney

This paper summarizes key features of several famous Leitz microscopes. Each of the microscopes comes in a beautiful black enamel finish.[1] All these magnificent instruments were developed sometime between 1937 and 1972.

Updated and revised 7th edition

Table of Contents

[1] We are not sure whether Leitz was using porcelain enamel (a substantially vitreous or glassy inorganic coating bonded to metal by fusion at a temperature above 800°F).

Acknowledgements

Important information for this work has been provided by many helpful microscopists from all around the globe. Many of them regularly contribute to several Internet forums and newsgroups about microscopy. Numerous brochures and manuals available at Gordon Couger's Web site [2], at Bernard Doudin's Web site [12] and kindly provided by Arthur Rosenfelder were crucial in answering some important questions.

The helpful comments by Howard Lynk [13], Brian Hall, John Field, and Rolf Beck are gratefully acknowledged.

The authors want to thank all readers for their interest in this little project.

Figure 1: Leitz Laborlux II with Leitz Berek condenser and rotating stage.

Introduction

Leitz (or Ernst Leitz GmbH Wetzlar) is one of the greatest names in microscopy.[2] Today, the company is part of LEICA Microsystems [1]. Leitz is a company with a great history. It started in 1849, when Carl Kellner (1826 – 1855) founded the "Optical Institute" at Wetzlar, Germany. A few years after his death, the company's name changed into the Leitz Works (Leitz Werke). Since 1869, Ernst Leitz (1843 – 1920) managed the company under his own name. – Over the following decades, Leitz produced very good microscopes. One of the authors (Gregor) tends to believe that this extreme devotion to quality was Leitz's major problem. After all, once a research group purchased the legendary Leitz Ortholux, they had no need to ever replace this unit. The Ortholux most likely outlasted the demands of the lengthiest research project and, if not abused, it should still be able to serve us well today. With the Orthoplan-Pol this situation did not get any better. The first Orthoplan[3] microscopes were built so well, the company actually lost money selling them. This is not exactly a business model that guarantees prosperity. – Sadly, all microscope makers have since learnt from this and made microscopes more "profitable".

Although the glorious time of the black research microscopes is not very well covered in Prof. J. Grehn's booklet entitled "Leitz-Microscopes for 125 Years" [3], it provides a solid introduction to the history of Leitz.

To illustrate the relation between a large selection of different models from the time period between 1937 and 1972, we have prepared the following overview (see Figure 2).

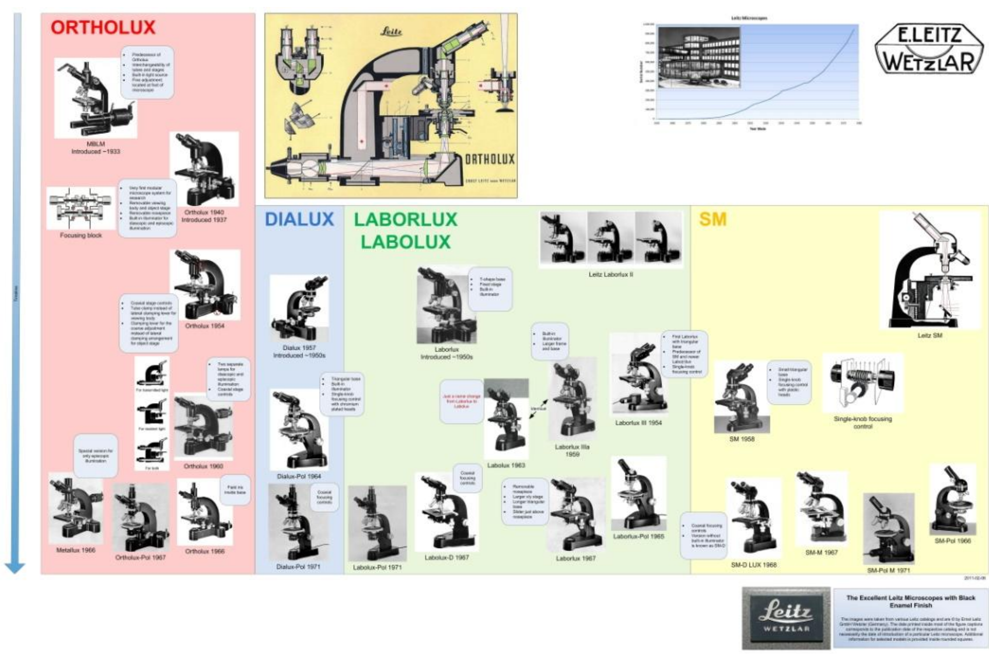


Figure 2: The excellent Leitz microscopes from the 30s, 40s, 50s, 60s, and early 70s. See last page for details.

---

[2] We limit ourselves to the Leitz microscopes. Leitz also produced other optical instruments (such as the famous Leitz cameras).

[3] Although one of the authors (Gregor) admires the quality of the Leitz Orthoplan, which has also been coated with a black enamel finish during its early introduction (see Leitz catalog #512-d27), we are not going to further discuss this magnificent microscope in this article. The Orthoplan was introduced in 1965.

The Leitz Ortholux, Dialux and Laborlux of the Forties and Fifties

In 1937, the Leitz Ortholux microscope was introduced. It was a new type of instrument that offers a compact basic stand for research. This type of microscope is of high stability and is suitable for a comprehensive range of accessories. The research stand was designed to meet the highest standards in respect of performance and adaptability. The Ortholux is considered to be one of the finest microscopes of all times. It offers a built-in illuminating system for transmitted and incident light. The first version of the Ortholux has a built-in mirror that is flipped up and down to switch between episcopic and diascopic illumination. Only one lamp can be connected (see microscope on the left in Figure 3). Later versions of the Ortholux dropped this restriction and allowed two independent illumination sources to be connected to the scope. – Leitz Ortholux microscopes were sold until the 1970s. The later models were offered with a dark gray finish. A manual of this marvelous microscope can be obtained from Gordon Couger's Web site [4].

The early Leitz Dialux (sometimes referred to as "baby Ortholux**"**) from the 1950s has a T-shape base like the bigger Leitz Ortholux (see microscope in the middle of Figure 3). The viewing body is attached on top of the arm and not in front of it like on the Ortholux. A good article about this microscope has been published in Micscape Magazine [5].

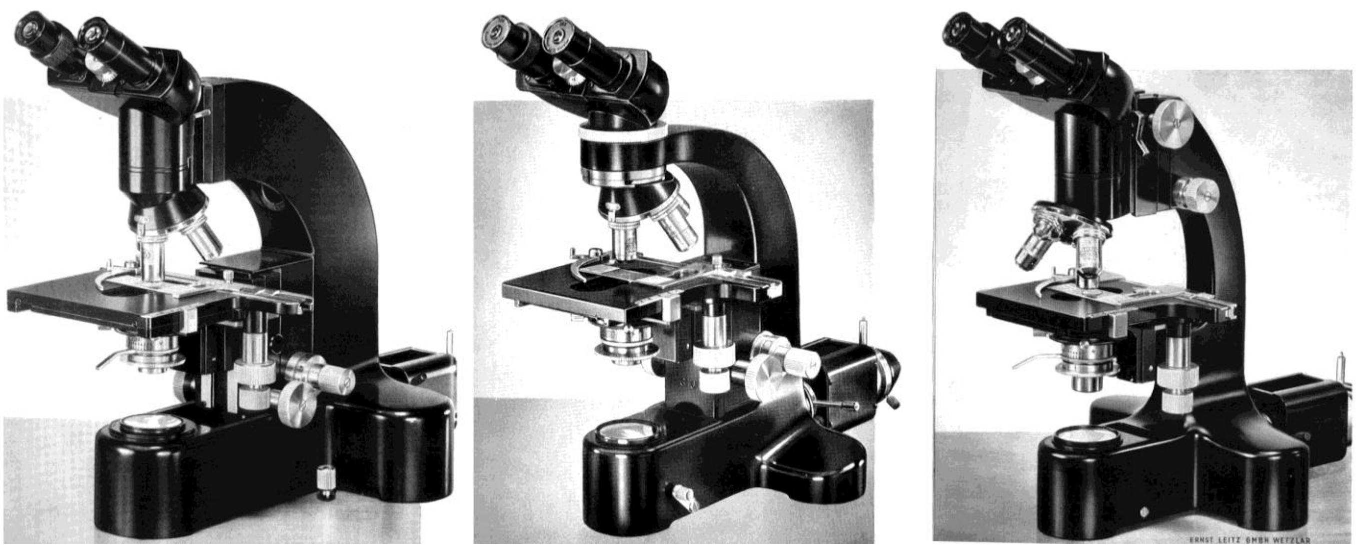


Figure 3: Leitz microscopes from the 1950s. From left to right: Ortholux, Dialux, Laborlux (since 1954 renamed Laborlux II). All these microscopes have a built-in illuminating system. They are equipped with a coarse focusing and micrometer screw with graduated drumhead (1 interval = 0.001 mm) [Copyright © Ernst Leitz GmbH Wetzlar].

Figure 4: Bayonet-type head attachment on Dialux stand [Copyright © Ernst Leitz GmbH Wetzlar].

Not commonly known, there was also a Leitz Laborlux from the early 50s with a T-shape base.[4] This frame has similarities with the early Dialux but comes with a fixed stage (see Figure 3). The viewing body of this Laborlux is identical to the one for the Ortholux. This early version of the Laborlux shares several components with the Leitz BS stand, which still has the horseshoe base (see microscope on left in Figure 5).[5] – Already in 1954, Leitz introduced the first microscope with a triangular base, the Leitz Laborlux III. Around the same time, Leitz renamed the Laborlux with the T-shape base Laborlux II. – The newer Leitz SM, which followed in 1958, and the improved Laborlux IIIa (1959) directly descended from the Laborlux III (see Figure 5).

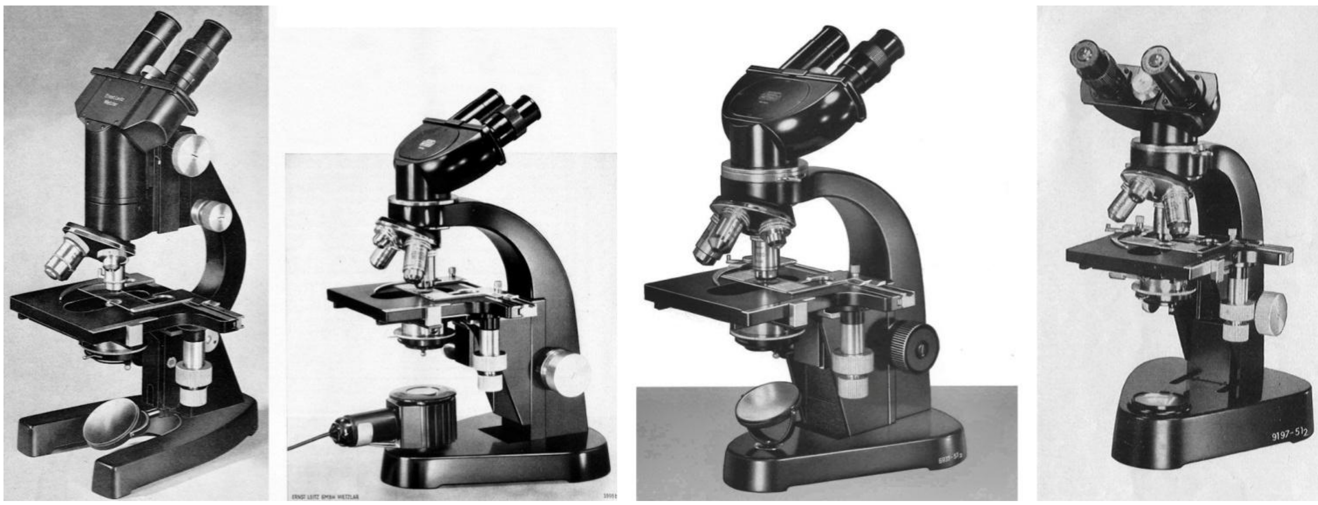


Figure 5: From left to right: Leitz BS 48/92K (1950), Laborlux III (1954), SM (1958), and Laborlux IIIa (1959). [Copyright © Ernst Leitz GmbH Wetzlar].

[4] According to information kindly provided by Rolf Beck, who worked for Leitz and Leica for roughly half a century, the Leitz Laborlux II with a T-shape base was first sold in 1952.

[5] According to information kindly provided by John Field, Leitz sold a version that looks very similar to the Laborlux with T-shape base but has an uncovered mirror assembly in its base (open mirror). An image of this type of microscope with the "open mirror" can be found on page 114 in [17].

The Leitz Laborlux II

Leitz sold the Laborlux with T-shape base until the early 1970s. Since around 1954, it was known as Laborlux II. While most modern, research microscopes move the stage up and down for focusing, the Laborlux II keeps the stage in a fixed position. Therefore the specimen remains fixed. This has tremendous advantages for several key applications. In 1960s, Leitz sold heavy micromanipulators (see Figure 6 for a picture of the Laborlux II with two micromanipulators). These micromanipulators were not attached to the microscope's stage. They were fixed onto a heavy metal plate that also supported the entire microscope. For such a configuration to work properly, it is required that the specimen does not move when adjusting focus.

Other successful and often used designs include the attachment of the micromanipulators directly to the stage. However, connecting the manipulators to the object stage puts restrictions on the design of the micromanipulators. When looking at some of the newer inverted microscopes, such as the Nikon Eclipse TE2000, we find that focusing is accomplished via a "nosepiece up/down" movement. This ensures that the specimen's position is not changed during focusing. Conceptually, this is very similar to the Laborlux design. – The Leitz Laborlux of the early 1950s was a truly useful microscope.

Figure 6: A Laborlux II is shown with two Leitz micromanipulators. This picture is from a brochure published in 1966 [Copyright © Ernst Leitz GmbH Wetzlar]. The Laborlux II has a fixed object stage.

The Leitz Ortholux, Dialux, Labolux, Laborlux and SM of the Sixties and Early Seventies

The next two decades were rather busy for Leitz. Besides creating many different models, Leitz also started to work on the successor of the Ortholux, called the Orthoplan. During this time period, Leitz often switched back and forth between the model name “Laborlux” and “Labolux”. The reason for this switching back and forth is unclear.[6]

In 1963, Leitz announced the first Labolux. It was identical to the previously introduced Laborlux IIIa (see Figure 7).

Figure 7: Various Leitz microscopes with triangular base. From left to right: Labolux (1963) (identical to the Laborlux IIIa), Dialux-Pol (1964) with a single-knob focusing control, Laborlux-Pol (1965), Labolux-D (1967), and SM-D LUX. [Copyright © Ernst Leitz GmbH Wetzlar].

The following attributes can be used to distinguish various Leitz microscopes from this era (see Figure 2 for reference):

1) Base (T-shape base or triangular base)
2) Shape of triangular base (the late 60ties versions have a more elongated base, such as the Laborlux introduced in 1967)
3) Size of base (the SM type has a smaller base)
4) Size of stand (again, the SM type has a smaller stand)
5) Focusing mechanism (single-knob control or coaxial focusing knobs)
6) Removable nosepiece (such as the Laborlux 1967 and the Labolux-D 1967)
7) Slot for a slider above nosepiece (Labolux-D 1967)
8) Type of illuminator (built-in or external)

Many versions have built-in illuminators (such as the Dialux-Pol, Labolux-Pol, Labolux-D, and the Laborlux). While most SM stands have a separate lamp or mirror that sits on the base beneath the condenser, the SM-D LUX has a built-in illuminator (see the microscope on the right side in Figure 7). – Except a few microscopes (such as the Dialux-Pol, Labolux-Pol, SM-D, SM-D LUX, and the Labolux-D), all stands use a very cleverly engineered single-knob focusing control. With this single-knob control, coarse and fine focusing motions are

[6] While the name “**Labor**lux” makes much sense in the German language, it suggests a rather “laborious” experience in English.

combined in a single operating control. The knobs were either made out of a durable plastic or have chromium-plated focusing heads.[7] The others (like the Dialux-Pol, Labolux-Pol, SM-D, SM-D LUX, and the Labolux-D) have a coaxial fine focus assembly that resembles more closely the new style used on today's research stands. – The Labolux and Dialux frames are larger than the frame of the SM and also come with a larger mechanical stage.

In order to better understand the difference in height between the Labolux-D/Labolux and the SM-D/SM, we put a Labolux-D side by side with an SM-D stand (see Figure 8).

Figure 8: Side-by-side comparison between SM-D (left side) and Labolux-D (right side). The scale bar is in inch. Please note that both microscopes have the same focusing knobs.

For a successful identification of a microscope from this time period, one must consider the height of the frame and the length of the base. As a rule of thumb, if the height of the scope (including its triangular base but without the viewing body) is around **9½** inches, it is a SM-type microscope. But if it has the taller frame, which is around **11½** inches, it is most certainly not an SM, SM-M or SM-D but either a SM-D LUX, Dialux-Pol, Labolux-Pol, Labolux, Labolux-D or a "newer" Labo**r**lux.[8] To distinguish the SM-D LUX from the others, one measures the length of its base. The SM-D LUX has a base that is roughly **7½** inches long (compared to the ~**9** inches for the Labolux-D) (see Figure 8). – The type of focusing knob may further help in identifying the scope.

[7] The chromium-plated focusing head was an option available for all Leitz SM microscopes (except for the SM-D, which used a coaxial focusing control). It was standard on the Leitz Labolux stands (except Labolux-D).
[8] The exception to this rule is the Leitz Laborlux III (1954). It has a smaller stand that is very similar to the SM (see Figure 5, second microscope to the left).

The Dialux-Pol, Labolux-Pol, Labolux, Labolux-D, and "new" Laborlux have a removable nose piece that is slightly larger than the one of the SM-style microscopes (see Figure 9).

Figure 9: Removable nose piece of the Leitz Labolux-D.

Over several decades, even the famous Leitz Ortholux underwent several modifications. The later model of the Ortholux (produced since 1963) got equipped with a field iris in its base (see Figure 10).[9]

Figure 10: Leitz Ortholux from 1963 with Lamp Housing 250 and Heine phase contrast condenser.

[9] In the 1970s, the Ortholux was replaced by the Leitz Ortholux II, which is similar in appearance to the Orthoplan. For more information about the Orthoplan and Ortholux II see [15].

Since the late 50ties, the Leitz Ortholux received a separate light port for episcopic illumination (see Figure 11).

Figure 11: Leitz Ortholux with Leitz Aristophot. A 4x5" bellows camera is mounted to the Aristophot. A sleeve has been inserted into the light port for episcopic illumination.

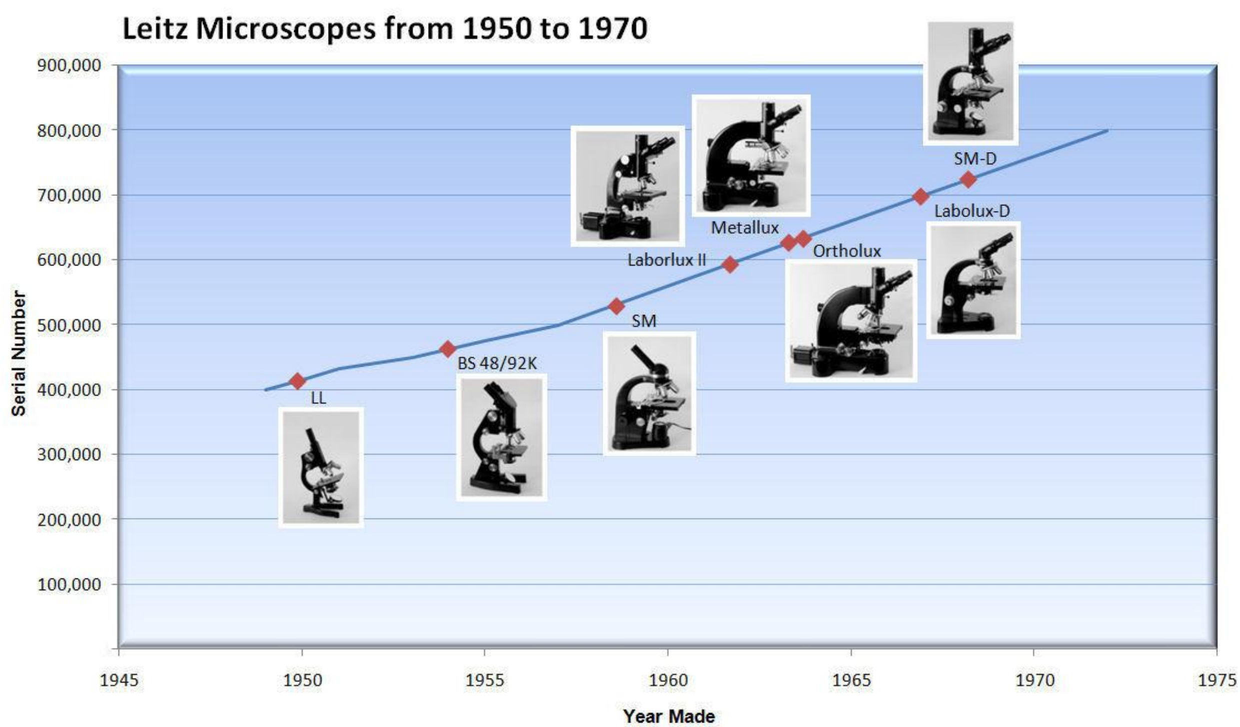
The mechanical tube length for all these older Leitz microscopes is 170 mm. This makes many optical components interchangeable. Additionally, several mechanical parts can be shared.[10]

[10] However, this "compatibility" has its limits. There are numerous reports that the mount of the viewing body can be different between various Labolux and SM stands. While the authors have only found attachments with a circular collar for the SM and Labolux, information about a bayonet-type head attachment is reported (see section "Parts and Accessories" in [10]). So far, we have only seen this bayonet-type attachment on a Dialux 1 (see Figure 4).

Historical Snapshot of Selected Leitz Microscopes between 1930 and 1977

Over 125 years (between 1849 and 1977), Leitz produced more than one million microscopes. The multitude of different configurations is astounding. During this entire time period, every microscope got carefully labeled with a unique serial number. The following is a snapshot of the very long list of serial numbers and year of production (from [3]). This time period covers the peak of the excellent black microscopes made by Leitz.

Serial Number	Year Made
300,000	1930
350,000	1941
400,000	1949
475,000	1955
500,000	1957
600,000	1962
700,000	1967
800,000	1972
950,000	1977



A more complete list of serial numbers can be found in [14].

Over the last couple of years, the authors' collection of Leitz microscopes from this time period grew to eight beautiful scopes; all of them are fully functional and are still in use today. These microscopes are truly built to last. Perfect optical components are combined with the best mechanical parts. (See Figure 12 for an image of four selected microscopes.)

Figure 12: From left to right: Leitz monocular student microscope LL, Leitz SM with illuminator, Leitz SM-D (coaxial focusing assembly) with Leitz Berek condenser, Leitz Ortholux with trinocular viewing body and Leitz PHACO #402a condenser.

Starting already in the 1930s, Leitz created the most impressive collection of microscopes, which led to the true microscope system known as the Ortholux. While other makers of this time period focused more on specialized microscopes, an Ortholux could be configured to suit someone's special needs. Today, all major microscope makers have adopted this approach. An important part of the marvelous microscope systems by Leitz were excellent objectives, such as the Leitz apochromatic objectives (see Figure 13).

Figure 13: Leitz APO 40x NA 0.95 objective with correction collar. This is one of the many Leitz objectives produced during this time period.

Compatibility with Newer Objectives

Compatibility with newer Leitz and non-Leitz objectives is of great importance to the microscopist using these older microscopes.

During the glory days of the "black" microscope stands, Leitz offered objectives with two different parfocal distances. The older objectives use a 37 mm parfocal distance ("short barrel") while the newer ones were designed for a 45 mm parfocal distance. In order to combine the two different types on the same nose piece (objective turret), Leitz offered special adapters called PLEZY and FLU-PLEZY.

In 1976, with the introduction of the Leitz Dialux 20, Leitz adopted German Standard Commission DIN 58887 [6]. DIN 58887 recommends a mechanical tube length (TL) of 160 mm. The Leitz Inter-Office Memorandum [7] clearly states that in most cases objectives designed for a mechanical tube length of 160 mm can successfully be used on the older Leitz microscopes, which use a 170 mm mechanical tube length. Of course, the oculars designed for a 170 mm tube length must be used in all cases. In a nutshell, the reason for this backward compatibility is the fact that the older Leitz microscopes use an optical tube length (or image distance) of 152 mm, which is just 2 mm longer than the one proposed by DIN 58887 (150 mm). (See Figure 14 for details.)

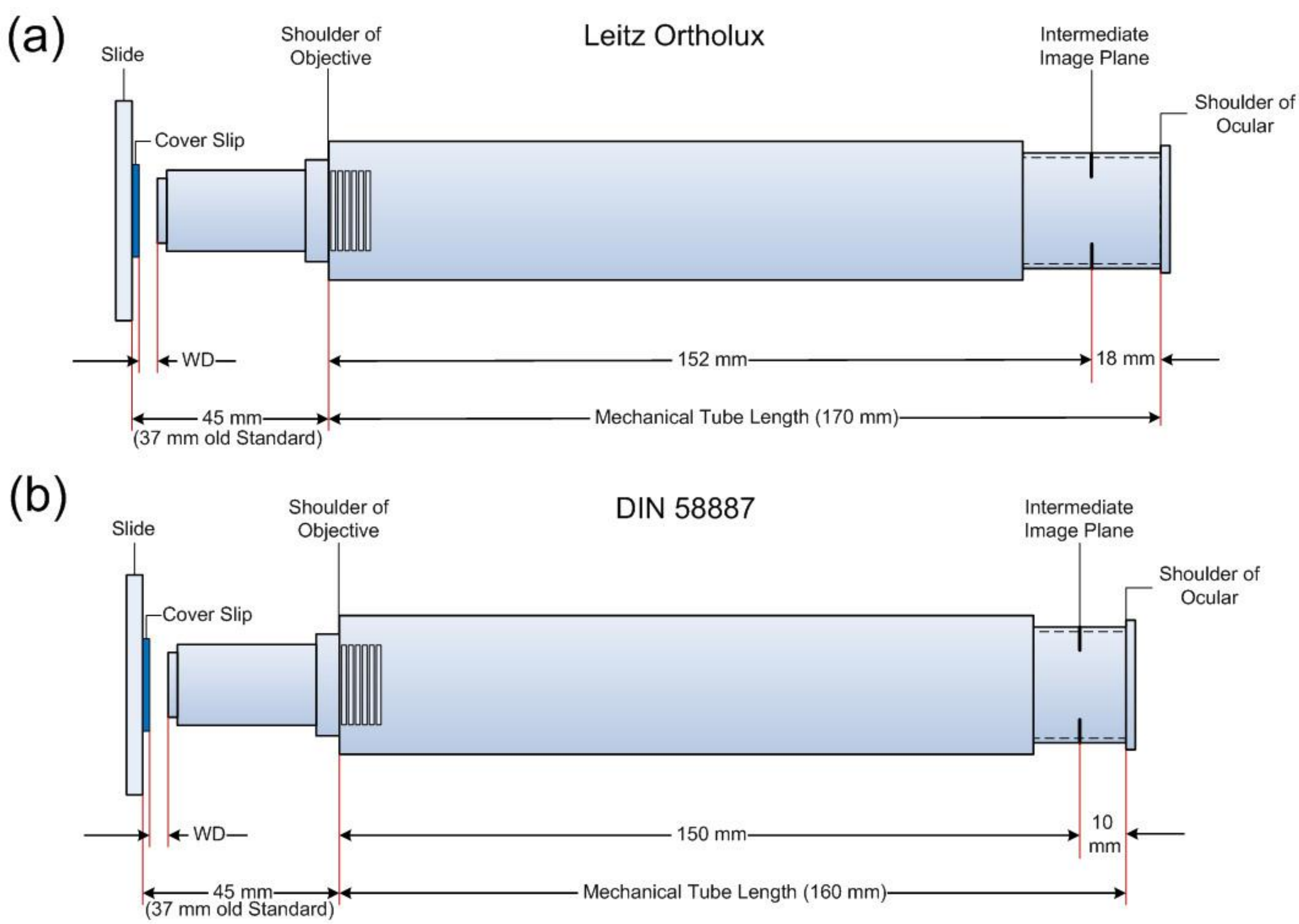


Figure 14: Dimensions for Leitz microscopes prior to 1976 (a) and for DIN 58887 (b).

For objectives with a magnification larger than 1:16, the 2 mm displacement of the intermediary image has no noticeable effect on image quality. Roger P. Loveland plotted the tolerance to tube length change versus objective NA in his excellent book about photomicrography [8]. Loveland concludes that the tolerance to change of tube length is affected only by the numerical aperture NA of the objective. Every dry lens with an NA of 0.80 or less should cope very well with a 2 mm difference in image distance. Even better, a difference of just 2 mm does not impact image formation when oil immersion objectives are used. The reason that Leitz does not recommend using objectives with a magnification of less than 1:16 is most likely due to the fact that one cannot maintain parfocality. If parfocality is not desired, even lower power objectives designed for a 160 mm TL could be used.

From the same Inter-Office Memorandum we can learn that newer oculars should <u>not</u> be used on older Leitz microscopes. Of course, when using an adjustable monocular viewing port, one may still be able to use newer oculars by appropriately reducing the mechanical tube length.

The authors are successfully using an Olympus S-PLAN 40x objective and several Leitz objectives that are corrected for a 160 mm mechanical tube length on these older microscopes.

The Leitz Condensers

One very important common feature of most advanced Leitz microscopes from this time period is the dovetail condenser holder. Each condenser for this type of mount has its own centering mechanism. Additionally, Leitz offered one that has a “sleeve mount”. The sleeve mount was often used on SM stands. The Berek and Heine condensers and the system 600, 400 and 700 are all designed for the dovetail mount.

Leitz Brightfield Condenser System 600

The condenser system 600 is based on a standard bottom part (No. 600), which is a centering convertible condenser. This bottom part consists of a condenser lens for low powers (up to NA 0.25), an aperture diaphragm and a mount for one condenser top. Leitz offered several condenser tops of various corrections, intercept lengths and apertures. The condenser top can be swung out of the beam path, as illustrated in Figure 15. The condenser system 600 is computed for a field diaphragm built into the stand of an Ortholux microscope. When used with a Laborlux or Labolux-D stand, an auxiliary condenser lens (adapter lens) is added to the bottom of the condenser (see Figure 15) in order to establish Köhler illumination on these stands.[11] The condenser top depicted in Figure 15 has an NA of 0.90 and is known as an Achromatic condenser top (Achr 0.90).

Figure 15: Leitz brightfield condenser 600 with Achromatic condenser top. An adapter lens for a Leitz Laborlux is shown in the right image.

[11] While most such adapter lenses are used to adjust for a shorter distance between field diaphragm and condenser, for the Leitz Orthoplan a special adapter lens is recommended to increase the illumination field for improved illumination.

Leitz Phase Contrast Condenser System 400 According to Zernike

Just like the condenser system 600, the system 400 is based on a bottom part with aperture diaphragm for brightfield illumination and with an interchangeable swing-out condenser top. The main difference is the newly introduced annular stop turret with a number of annular stops. All annular stops can be individually centered using special centering screws (see Figure 16). Again, an auxiliary condenser lens is required to use one of these condensers on a Laborlux or Labolux-D stand. An Achromatic phase contrast condenser bottom part 400a with a top 002 is shown in Figure 16. This configuration is also known as a 402a. The condenser top is identical to the one of the system 600.

Figure 16: Leitz phase contrast condenser 402a with centering screws, green filter and phase centering telescope.

The Leitz Heine Phase Contrast Condenser

Just a few years after Zeiss (around 1949), Leitz introduced a different implementation of a phase contrast setup, which is commonly referred to as Phase Contrast illumination after Heine (see Figure 17). Hermann Heine (1883 – 1966) who joined Leitz in 1908 invented this marvelous design. Its basic principles are identical to the Zernike type phase contrast (see previous paragraph). The only major difference is that the Heine setup does not contain a phase plate in the front focal plane of the condenser but contains a movable mirror that produces a hollow light cone of adjustable radius. By operating a control knob on the condenser, it offers the possibility of continually changing the illumination from brightfield, phase contrast to darkfield while observing the specimen. Of course, there is a phase annulus located at a conjugated aperture plane inside each objective. Through the vertical adjustment of the mirror component via the control knob, the numerical aperture of the Heine condenser changes from 0.25 to 0.70 (without screw-on immersion cap) and 0.50 to 1.40 (with screw-on immersion cap). The Heine phase contrast objectives are labeled 'Pv' and use a 37 mm parfocal distance.

Figure 17: Heine phase contrast condenser with Heine phase contrast objectives and phase centering telescope.

Heine objectives for positive phase contrast with the designation '**n**' are supplied with a phase ring of normal absorption (75% +/- 5%). Objectives with a higher absorption (88% +/- 2%) are designated '**h**' and are recommended where the difference in refractive index between the structure to be observed and the surrounding field is very small.

The authors are using the following six Heine objectives: Pv 10/0.25 'h', Pv 25/0.50 'n', Pv APO L 40/0.70 'n', Pv APO L 40/0.70 'h', Pv FL Oil 70/1.15 'n', and Pv APO Oil 90/1.15 'h'. In order to accomplish darkfield illumination with the 70/1.15 and 90/1.15 objectives, a screw-on immersion cap is mounted on top of the Heine condenser.

Leitz Dedicated Darkground (Darkfield) Condensers

For the dovetail mount, Leitz offered two darkground condensers, the D 0.80 and the D 1.20-1.40. The D 0.80 was also available for the sleeve mount. Figure 18 shows two darkground condensers with dovetail change. The immersion darkground condenser D 1.20-1.40 is designed for work with oil immersion at high to very high magnification. It produces a light cone with an NA between 1.20 and 1.40. Every objective with an NA of less than 1.10 can be used for proper darkfield illumination. The darkground condenser D 0.80 is used for dry objectives with an NA of less than 0.70.

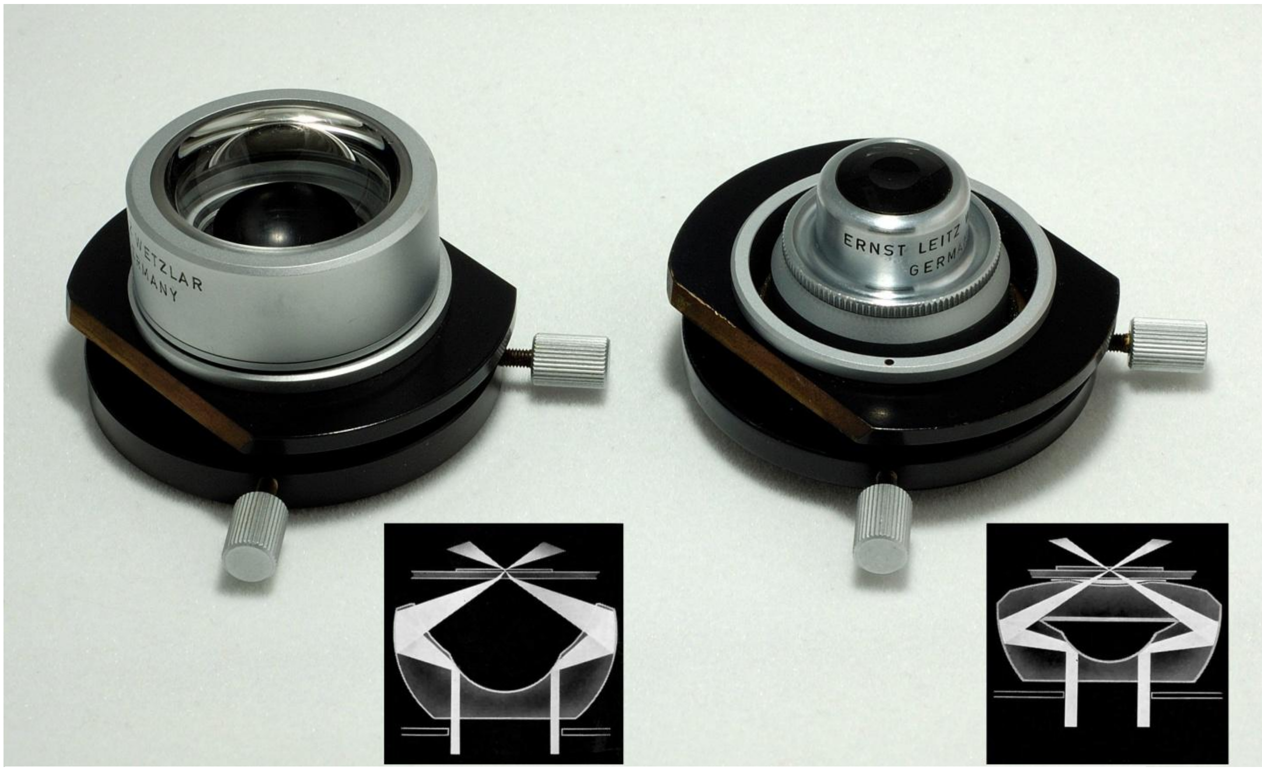


Figure 18: Leitz darkground condensers D 0.80 (left) and D 1.20-1.40 (right). The optical path is illustrated in the two insets. The insets are Copyright © Ernst Leitz GmbH Wetzlar.

These darkground condensers are also known as Cardioid condensers. This type of condenser is not trivial to operate and the following steps must be taken when working successfully with this unit:

1. The object slide should be between 0.9 and 1.1 mm thick and the cover glass should be as near 0.17mm as possible
2. Use immersion oil between condenser and slide (only D 1.20–1.40)
3. Clean surfaces of slide carefully
4. Do not expect too much performance when using thick samples
5. Avoid slides made out of glass with many fluorescent impurities
6. Use centering screws to center condenser for optimal darkfield illumination
7. Do not use an objective with an NA of more than 1.10
8. Do not use an objective with less than 10x magnification

The Leitz Berek Condenser

Figure 19: Famous Leitz Berek two-diaphragm condenser.

Our favorite condenser is the Berek two-diaphragm bright field condenser (No. 76) (depicted in Figure 19).

This condenser is named after Dr. Max Berek (1886 – 1949) who was one of the most famous scientists working for Leitz. Max Berek became famous for his contributions to the field of polarization microscopy.

This condenser is an Achromat, swing-out type model with an NA of 0.95. The top lens elements can be moved out of the optical path to create a more even illumination for low power objectives. An optional oil immersion top is available to increase the NA to 1.40. – It is a joy to use this condenser on every older Leitz stand that provides the appropriate condenser mount. With only some minor adjustments, it is possible to establish an almost perfect Köhler illumination with any regular desk lamp. First, one needs to properly center this condenser and move the lamp into a position where its bulb appears focused in the back focal plane of the objective. Second, after adjusting the field iris, which is built into the condenser, one is able to enjoy a perfectly evenly illuminated specimen. This condenser is its weight worth in gold. – It is not clear to the authors why nowadays such an elegant condenser design is no longer manufactured.

Leitz also offered the polarizing condenser system 700. For the sleeve mount, there are several special condensers available, such as the two-lens Abbe condenser with an NA of 1.20 (condenser No. 66), which is very commonly found on Leitz SM stands.

Digital Photomicrography using the Leitz Ortholux

Of great interest is the suitability of these older Leitz microscopes for digital photomicrography, which is photography through the microscope using a digital image sensor. One of the best stands for this task is indeed the Leitz Ortholux microscope (see Figure 20).

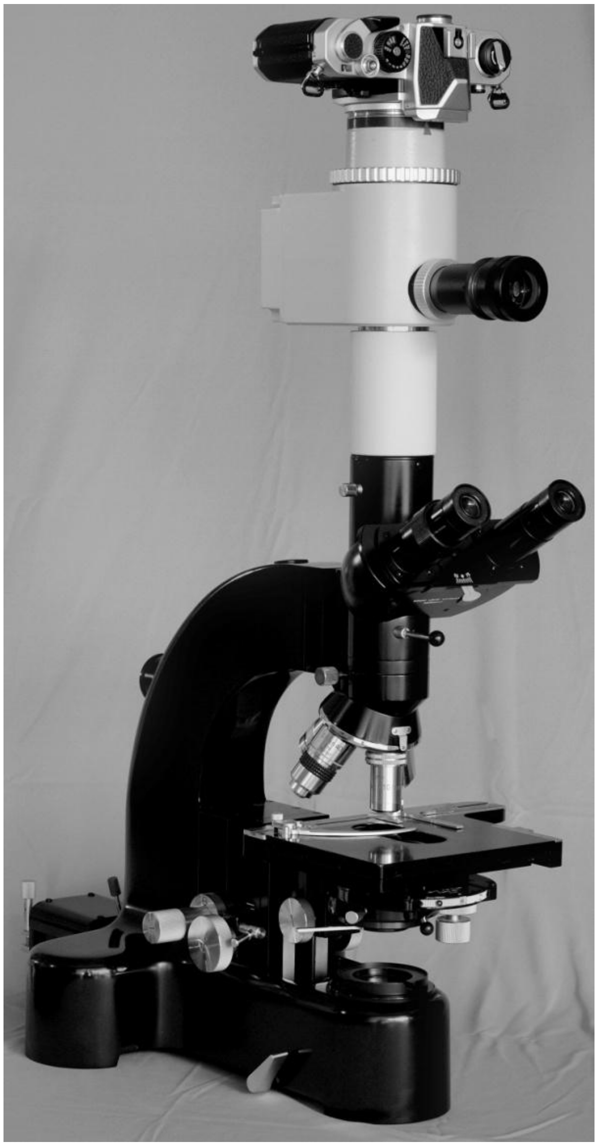


Figure 20: Leitz Ortholux with Nikon AFX camera system and Nikon FM SLR camera. For this picture, a Nikon FM is used instead of a DSLR. An Olympus NFK 2.5x photo eyepiece is used. It is added with a custom adapter in such a way as to capture the intermediary image produced by the objective.

The trinocular viewing body of the Leitz Ortholux microscope provides an ISO 38 mm port for today's modern photo adapters/couplers. The older Leitz microscopes use the ocular to complete the correction for lens aberrations, which are only partially handled inside the objective. Mainly lateral chromatic aberration (also known as chromatic difference in magnification = CDM) is not fully corrected inside the older Leitz objectives. A compensating ocular or photo relay lens is required for fully correcting CDM. The details are well explained in the literature. A good starting point is R. P. Loveland's great two volumes [9], which are very highly recommended.

One of the authors is using a legacy Nikon AFX camera system with the AFX-II controller and an Olympus NFK 2.5x photo eyepiece. Of course, there are many other ways to connect a digital camera to such a microscope. Another good approach is to connect a Nikon Coolpix 990 with a Leitz Periplan ocular to the photo port. But in this case, it has to be ensured that the Periplan ocular picks up the intermediate image at the correct location. And last but not least, by using monochromatic illumination, one can directly project the intermediate image onto the image sensor using a 1x C-mount adapter that is directly connected to the 38 mm ISO port of the trinocular viewing body. This type of setup is particularly useful for IR photomicrography and video microscopy using a deep red filter (such as Wratten 89B -> 720nm).

Conclusions

It is overwhelming to see all these different models that Leitz produced from 1937 to 1972 (see Figure 2). We did not even mention special versions of Leitz microscopes, such as the Leitz Panphot. We also did not include the famous Orthoplan microscope. – One of the most puzzling aspects of this investigation was the almost random assignment of “Laborlux” and “Labolux”. At one time, Leitz did not seem to bother updating the image in their catalogs but just renamed the Laborlux IIIa (1959) into Labolux (1963).

The Leitz SM, Laborlux, Labolux, Dialux, and Ortholux are truly remarkable microscopes. – The Ortholux is a perfectly suitable platform for digital photomicrography. All these older instruments are still very capable of the highest quality work. – At reasonable cost, there is no brand-new equipment that can compete with the quality of these Leitz microscopes.

More information about Leitz microscopes can also be found on Greg McHone’s very informative Web site [10]. An interesting article about the Leitz Orthoplan microscope was written by Mike Andre [11]. John Field wrote a detailed article about the Leitz Ortholux [16]. Wolfgang Lehmann dedicated an entire Web site to the Leitz Ortholux microscope [18]. Last but not least, the authors also want to mention Rolf Beck’s booklet “Die Leitz-Werke in Wetzlar”, which contains some very interesting archive photographs [17].

References

[1] LEICA Microsystems maintains a Web site at http://www.leica-microsystems.com/.

[2] G. Couger, Science-Info.org at http://science-info.net/index.html.

[3] J. Grehn, Leitz-Microscopes for 125 Years, English edition, E. Leitz, Inc. Rockleigh, N.J. 07647 (1977).

[4] Manual for the Leitz Ortholux at http://www.science-info.net/docs/leitz/Leitz-Ortholux-Manual.pdf.

[5] P. James, The Leitz Dialux 1 – The poor man's Ortholux? Micscape Magazine January 2006, http://www.microscopy-uk.org.uk/mag/artjan06/pjleitz.html.

[6] DIN 58887 recommends: mechanical tube length = 160 mm, intermediate image of the eyepiece = 10 mm, distance of the objective image = 150 mm, and matching distance = 37 mm, and later 45 mm.

[7] Leitz Inter-Office Memorandum (available at http://www.science-info.net/docs/leitz/Leitz-160mm-Memo.pdf) from September 30, 1976 entitled "160 mm Mechanical Tube Length".

[8] R. P. Loveland, p. 59, Figure 2-2 "Tolerance to tube length change versus objective NA." in Photomicrography – A Comprehensive Treatise, Volume 1, John Wiley & Sons, Inc. (1970).

[9] R. P. Loveland, Photomicrography – A Comprehensive Treatise, Volume 1 and 2, John Wiley & Sons, Inc. (1970).

[10] Greg McHone's informative Web site about "Ernst Leitz Wetzlar Microscopes" at http://earth2geologists.net/Microscopes/LeitzScopes.htm.

[11] Mike Andre, Leitz Orthoplan – Universal Largefield Research Microscope, Micscape Magazine, May 2006, available at http://www.microscopy-uk.org.uk/mag/artmay06/ma-orthoplan.html.

[12] Bernard Doudin's extensive list of Leitz catalogs and manuals at http://microscope.database.free.fr/Welcome.html.

[13] Howard Lynk maintains a Web site about the Leitz Ortholux at http://www.blackortholux.com.

[14] An extensive list of serial numbers of Leitz microscopes is available on Greg McHone's Web site at http://earth2geologists.net/Microscopes/documents/ErnstLeitzMicroscopeSerialNumbers.pdf.

*[15] N. Overney and G. Overney, The Leitz Orthoplan and Ortholux II Research Microscopes, Micscape Magazine **168** (2009) available at http://www.microscopy-uk.org.uk/mag/artoct09/go-leitz-ortho.html.*

[16] John Field, The Leitz Ortholux Microscope: A Study and Celebration, The Journal of the Microscope Historical Society, Vol. 15, No. 2 & 3, Summer/Winter 2007.

[17] Rolf Beck, Die Leitz-Werke in Wetzlar, Reihe Archivbilder, Sutton Verlag GmbH, Erfurt (1999).

[18] Wolfgang Lehmann's beautifully designed Web site dedicated to the Leitz Ortholux microscope at http://www.leitz-ortholux.de.

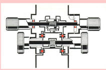
Timeline

ORTHOLUX

- Predecessor of Ortholux
- Interchangeability of tubes and stages
- Built-in light source
- Fine adjustment located at foot of microscope

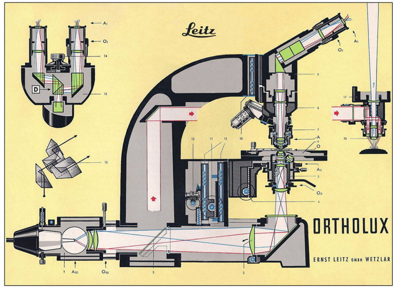
MBLM
Introduced ~1933

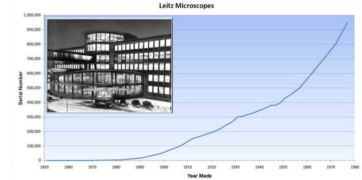
Ortholux 1940
Introduced 1937



Focusing block

- Very first modular microscope system for research
- Removable viewing body and object stage
- Removable nosepiece
- Built-in illuminator for diascopic and episcopic illumination





E.LEITZ WETZLAR

Ortholux 1954

- Coaxial stage controls
- Tube clamp instead of lateral clamping lever for viewing body
- Clamping lever for the coarse adjustment instead of lateral clamping arrangement for object stage

- Two separate lamps for diascopic and episcopic illumination
- Coaxial stage controls

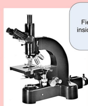
Ortholux 1960

Special version for only episcopic illumination

Metallux 1966

Ortholux-Pol 1967

Field iris inside base



Ortholux 1966

DIALUX

Dialux 1957
Introduced ~1950s

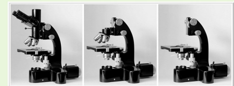
- Triangular base
- Built-in illuminator
- Single-knob focusing control with chromium plated heads

Dialux-Pol 1964

Coaxial focusing controls

Dialux-Pol 1971

LABORLUX LABOLUX



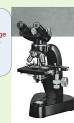
Leitz Laborlux II

- T-shape base
- Fixed stage
- Built-in illuminator

Laborlux
Introduced ~1950s

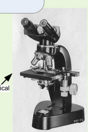
- Built-in illuminator
- Larger frame and base

Just a name change from Laborlux to Labolux

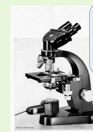


Labolux 1963

Identical

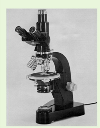


Laborlux IIIa
1959



- First Laborlux with triangular base
- Predecessor of SM and newer Labo(r)lux
- Single-knob focusing control

Laborlux III 1954

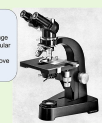


Labolux-Pol 1971

Coaxial focusing controls

Labolux-D 1967

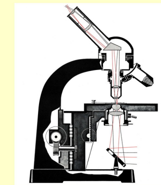
- Removable nosepiece
- Larger x/y stage
- Longer triangular base
- Slider just above nosepiece



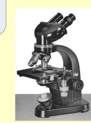
Laborlux 1967

Laborlux-Pol 1965

SM

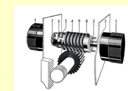


Leitz SM



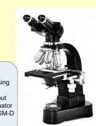
SM 1958

- Small triangular base
- Single-knob focusing control with plastic heads



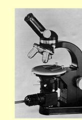
Single-knob focusing control

- Coaxial focusing controls
- Version without built-in illuminator is known as SM-D



SM-D LUX 1968

SM-M 1967



SM-Pol M 1971

SM-Pol 1966

2011-02-06

The Excellent Leitz Microscopes with Black Enamel Finish

The images were taken from various Leitz catalogs and are © by Ernst Leitz GmbH Wetzlar (Germany). The date printed inside most of the figure captions corresponds to the publication date of the respective catalog and is not necessarily the date of introduction of a particular Leitz microscope. Additional information for selected models is provided inside rounded squares.