THE PHOTO-ELECTRIC LIGHT METER IN PHOTOGRAPHY

An illustrated history from 1931-1970

by

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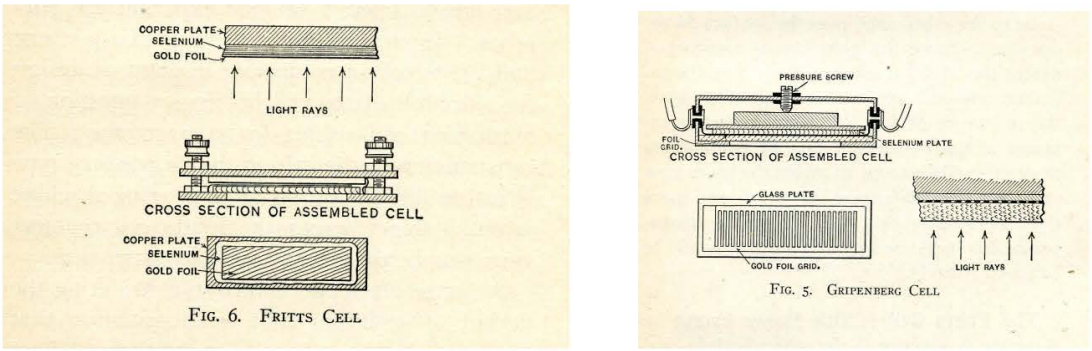
In 1839 Becquerel discovered that, when one of two electrodes that are immersed in a solution of a salt is exposed to light, a small electric current is generated. This effect can remarkably well be noticed when for example a silver electrode is immersed in a silver salt solution. Becquerel called this the "photo-electrical effect". He could not explain this effect; the mystery was resolved about 75 years later.
Based on this principle at the end of the 19th and at the beginning of the 20th century many research was done to develop a photo-electric cell that could generate an electric current when exposed to light.

In **1817** the Swedish chemist Berzelius isolates, what he thinks is, a new element. The properties of this element resemble strongly those of an earlier discovered element, Tellurium (= Greek for earth), so Berzelius gives this element the name Selenium(= Greek for moon). Together with Oxygen, Sulfur, Tellurium and Polonium it is in the same group of the periodic system. Selenium is acquired as a by-product in the production process of copper from copper-ore.

Around **1873** an assistant of Willoughby Smith, called May, discovered the change in resistance of a rod of Selenium when the light conditions changed. He was researching materials to be used in transatlantic cables for telegraphic purposes. During one of his measurements a cloud covered the sun and he noticed the change in resistance. The effect could easily be reproduced and this discovery was mentioned by Willoughby Smith on 12/2/1873 at a meeting of the Soc. of Telegraphic Engineers. This society was later called the Institution of Electrical Engineers.

Based on this discovery Werner von Siemens suggests in 1875 to construct a Photometer with the aid of a piece of selenium, a galvanometer and a battery.
At last a light sensitive element had been discovered, a "selenium resistor", that could be used in measuring the power of light. More important, it could be possible to measure the amount of light directly, without any comparative light source.

In **1877** Adams and Day in GB discover that a rod of crystallised selenium is capable of generating a small electric current <u>without</u> the aid of a battery. No external electric source was necessary. Some years later Fritts in New York discovers the same effect. He was not aware of the discovery of Adams and he patented his discovery.
Werner von Siemens constructs , having read Fritts experiments, some selenium cells with the same properties as the Fritts cell, and foresees a future for the industrial conversion of sunlight into electricity.



Some examples of early selenium cells

Brian Coe mentions in his book The Camera, 1978, an electrical light meter constructed by Vidal in Paris in **1888**. This is a meter after the same principle as Werner von Siemens described in 1875. In the "Traité Encyclopédique de Photographie"by C. Fabré, 1890, p 358, this meter is incidentally mentioned. Because of the great difference in spectral sensitivity between that selenium cell and the photographic plates at that time (the cell was very red- , the plates very blue sensitive) this meter couldn't be used..

Around **1888** Hallwachs describes the photoelectric effect of metals. In short: a metal that is exposed to light emits electrons. If these electrons can be caught in an electric circuit, you could measure the flow of the electrons, and this flow is dependent from the amount of light applied. So this effect could very well be used in measuring light as well.
Pioneers on this matter were **Elster & Geitel**, two German physicists. They constructed around 1900 a lot of photoelectric cells using different metals: sodium, potassium, calcium, caesium. The cell consisted of a glass bulb that was coated inside with a thin metal layer. In front of the layer a grid was placed. The tube was evacuated. A voltage (40-100V) was applied between the layer and the grid. If you exposed the cell to light, electrons were released from the metal layer and transported to the grid in the evacuated bulb. Hence a current could be measured by switching an amp meter in the circuit. Here below a few examples of those cells.

Some Elster&Geitel cells

Using these cells thus required an electr(on)ic circuit: a battery for generating a voltage between the anode and cathode, and a galvanometer to measure the generated current. In fact not a suitable instrument for the (amateur) photographer, but for use in a laboratory very well suited.

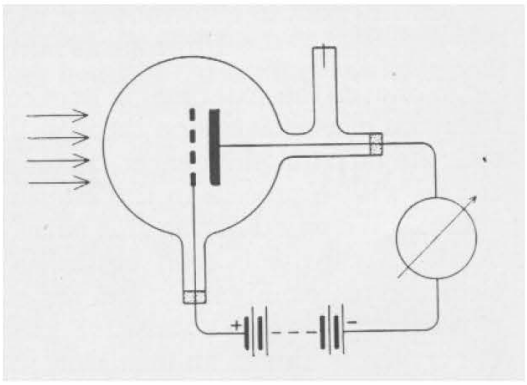


Diagram of an Elster & Geitel cell

An Elster & Geitel Photometer

In 1927 Dember and Bergmann (Germany) discover the light sensitive copper/copper oxyde cell. During the investigations on this cell the barrier effect is established, which means that a current can pass the copper/copper oxyde layer only in one direction. The cell finds immediately its use as a rectifier for alternating current. The light sensitive element is now further investigated and looks very promising. Its application in small light measuring devices looks great as the current generated by the

cell can be measured by a small sensitive galvanometer without the help of a battery. The Weston Instruments Co. in Newark, NJ, USA already applies for a patent in that direction by W.N. Goodwin.

In Berlin, **Bruno Lange**, working at the Kaiser Wilhelm Institut für Physik, is researching that barrier layer-cells as well and he had carried out some improvements to enhance the electric current of the cell. Knowing of the (not further developed) selenium cell he also applies these improvements on the older selenium cell.
In **1931** he succeeds in constructing a selenium cell that delivers much more voltage than a copper/copper oxide–cell. This cell can also be produced at a large scale with a very good quality control. Second good property of the cell is its spectral sensitivity: almost identical to the human eye and the panchromatic B&W film. The use of such a cell in a photographic light meter is quite simple. The only vulnerable part of the meter is the galvanometer. This cell is a revolution in photographic light-measuring.
Bruno Lange starts in 1934 his own company in designing and constructing devices equipped with photo-electric cells. He assembles the photocells, constructs photometers and analytical photometers. And he is a consultant for all big photocell and light meter manufacturers.

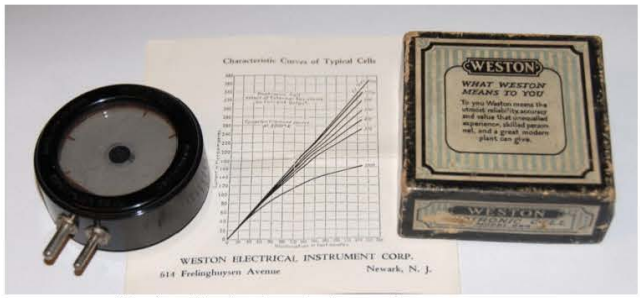
Many of the small companies that were producing electrical measuring devices, needed in building and repairing radio's, tried to take advantage from this new development and within a few years many different selenium light meters were produced. There was a world-wide economic depression, so anything you undertook could give you a profit.
The selenium cells for these meters were produced by a few specialised companies: **Elektrocell, Süddeutsche Apparaten Fabrik, Tungsram and Weston** .

Some selenium cells

The exposure meters

It is not quite clear who produced the first battery-less electrical exposure meter. The George Eastman House in Rochester, USA has in its collection a selenium cell meter made by Leonard **Westphalen**, Chicago. Further details unknown. Built in 1931, first adverts for sale appear in January 1932. The selenium cell is made by Weston and the galvanometer looks to be made by that company as well. This meter could be the first one.

Westphalen exposure meter



Weston Photronic selenium cell

Another early light meter is the Skinner light meter. This meter was built in 1932 by Skinner using Weston's Photronic cell and Weston's micro ammeter 301 to construct this device:

Front & back view of the Skinner meter

These early devices were a bit clumsy to handle and were mainly used in cine studios.

Most probably originating from the George Eastman House I acquired a list where chronologically the photo-electric exposure meters are mentioned that came into their possession from 1932-1937, so here below is an original historical overview.

EXPOSURE METERS (initial dates)

Makes & Models

1.	Westphalen Cine	Jan. 1932	26.	Tamiphot	June 1933
1a.	Rhamstine Electrophot 1st	April 1932	27.	Electrophot	Dec. 1935
2.	Weston Universal Type 1	Aug. 1932	28.	Prinsen	Nov. 1935
3.	Weston Cine	May 1933	29.	Ilford	Dec. 1935
4.	Metrophot	May 1933	30.	LePosémeter	Nov. 1935
5.	Ombrux	Sept. 1933	31.	Tempiphot	Dec. 1935
	Blendux		32.	Picoscop	Oct. 1935
	Photolux	March 1933	33.	New Photoscop	Feb. 1936
6.	Leicameter	Aug. 1933	34.	Helicon	Feb. 1936
7.	Photoscop	Sept. 1933	35.	Electro Bewi	Feb. 1936
8.	Weston Univ. Type II	Nov. 1933	36.	Sixtus	
9.	Electrophot	Aug. 1934	37.	Cimbrux	
10.	Electro Bewi	June 1934	38.	Avo	April 1936
11.	Tempophot	Nov. 1934	39.	Lux	May 1936
12.	Picoscop	Feb. 1935	40.	L.M.T. Exposurmeter	July 1936
13.	Zeiss "Helios"	March 1935	41.	Electrodrem	
14.	Ombrux for Leicas	April 1935	42.	Weston Cine Model	
15.	"Amato"	April 1935	43.	Dornlei	Feb. 1937
16.	Kino Metrophot	April 1935	44.	Excelsior	Feb. 1937
17.	Metrophot with foot	April 1935	45.	Sixtus for Leica	
18.	Avo	April 1935	46.	Sixtus for new Agfacolor	March 1937
19.	Leicameter 617 Type II	April 1935	47.	Cine Electrodrem	April 1937
20.	Pose metre	April 1935	48.	Majus	March 1937
21.	L'Exposemetre	Sept. 1935	49.	L'Exposemetre	May 1937
22.	Leicameter of 650 type	Sept. 1935	50.	Mini Photoscop	Aug. 1937
23.	Zeiss Contaflex	Sept. 1935	51.	New Model Ilford	July 1937
24.	Electrophot	June 1933	52.	Smethurst (Avo)	June 1937
25.	Amaphot	June 1933	53.	Temphphot	July 1937
			54.	Super Bewi	Aug. 1937
			55.	Ilford Model B	before Aug. 1937
			56.	Rex	Oct. 1937
			57.	Metrovick	Dec. 1937
			58.	General Electric	Dec. 1937

J.Th. Rhamstine, Detroit, USA

In 1932 Thomas Rhamstine, a manufacturer of all kind of electrical devices (radio's, gramophones, vehicle horns, etc.) in Detroit brings the "first" electrical light meter on the market, the Rhamstine Electrophot DH. The meter uses a light dependant resistor and is powered by 2 AA batteries. It is a very heavy device, intentionally meant to be used in the cine industry. Weight ca. 600 g, dim. 13x9x6cm3. Somewhat later a second model comes out, a square meter with a viewfinder, dim 10x10x3 cm3, weight ca 450 g. Still with a battery and a LDR.
Soon the LDR is replaced by a selenium cell, the use of a battery is cancelled. The knob to activate the circuit in the battery powered meter is not present any more on the selenium cell models.

1st model Rhamstine meter type DH 1932

2nd model Rhamstine Electrophot, with battery, beside without battery. The red button disappeared in the batteryless version.

Until 1940 Rhamstine presents some more models. From 1940 till 1945 they deliver work for the US-army. Some models of the small Electrophot were produced between 1945 and1948. Then Rhamstine steps out of his business and leaves Detroit, but his name remains connected to the first electrical exposuremeter.

Rhamstine model MSB

Super Electrophot

Some different models 10, 12, 14 of the small Electrophot

Weston Electrical Instruments Corp., Newark, NJ, USA

Weston was worldwide known for its outstanding precision electrical metering devices. They too were interested in making a good light meter. In 1929 there is a patent application for such a meter by Goodwin, one of the leading engineers at Weston. Weston understood that a good metering system should have a well standardized processing system at its base. Therefore they introduced together with their first selenium exposure meter a new sensitivity-system, the **Weston** scale. This Weston system was the base on which in 1942 the **ASA** –system was developed.

The first Weston meter was the 617, containing two selenium cells. A rather large device, dimensions 17x 6x3 cm3

The First Weston Photographic exposure meter, model 617

A second version, with only one cell came out a year later, the 617-2. In a row quickly after that followed the 627 Cinemeter, the 650 and the 819, the cine version of the 650.

617-2

627

650

819

For some top brands, Weston produced meters in a Weston case but with the 3rd party names (Leica, Bell & Howell, Bolex)

Left row the original Weston meters, on the right the 3rd-party equivalent of Bolex, Bell&Howell and Leitz

Most successful was Weston with the production of the Weston Masters series. From 1936/37 till 1965 a series of professional meters was produced, very sturdy meters. It is a bit strange, but in my collection there are more functioning pre-war than post-war Weston meters!

For the amateurs Weston also made meters, some with a special design. Weston Cadet, Weston 850 Junior Cine and 850 Junior, post–war Weston Direct Reading 853 and 854 and the Weston Pixie.
The Weston XM and Weston XM2 were meters from Japan. Anyone could order this meters with its own brand printed on. The Weston XM2 was sold in Germany as a Revue meter.

Weston 850 Junior

Weston Cadet

853 854

Pixie *Selenium XM* *CdS XM2*

The second big American producer of light meters was **General Electric**. From 1935 on they produced selenium light meters on behalf of the illumination-industry. With a simple additional piece provided with a calculator this meter was converted into a photographic light meter. Until the end of the 60-s they produced light meters, varying from the heavy, (semi)professional meters till small accessory-shoe meters and a number of special meters for Polaroid.

GE Light meter and Exposure meter without hood. *Hood and complete Exposure meter DW47*

GE DW 48 *DW 49* *DW 58* *DW 68*

GE PR1 Trident *PR2 Guardian* *PR3 Golden Crown*

Some Mascot meters by GE

POLAROID

Edward Land introduced in 1948 the first Polaroid cameras. As the exposure for this type of film should be rather accurate each camera could be provided with a light meter.
The first meters were all produced by Gen. Electric, in the picture here below the bottom row.

In the 1950's Metrawatt produced the small meter , most left in the top row, the Polaroid 620 meter. The two adjacent meters were made by Gossen in the 1960's. All this meters were selenium-cell meters. The right one on the top row is the Polaroid 625, a CdS meter, powered by a small battery. It is a meter made in Japan in the 1970's, maker unknown.

De Jur produced from around 1940 a number of exposure meters with a special design, an oyster shell-shape. Sturdy meters, so good that the US-army had a batch produced for them. The colour was army (olive) green bakelite.

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The first light meter that Sekonic (Japan) brought out in 1949 was a 99,9% copy of this meter in the picture above the most right model on the middle row. Even the direction in which the ser # was printed was copied.

DeJur 5a & 5b, at right a 3rd party one, manuf. for Wards

DeJur 6a and the Dual Professional

DeJur LM 46A

GM Laboratories, Chicago produced from 1938 a number of small exposure meters, mainly for amateur use. Model names : GM, GM Junior, GM Standard, Skan, Skan de Luxe, Lutrix, Ranger. Possibly they produced for Argus the Argus Photar meter. The GM Standard was sold under the name Marvel for Sears Roebuck &Co, Sears later photographic products got the name "Tower" (called after the Sears Tower in Chicago)

From ltr, utd: GM Standard, GM Standard, GM Skan, Marvel(Sears), GM Standard mod B, GM Skan, GM Junior.

GM Lutrix

ltr Skan Ranger, Skan de Luxe 2x and Skan Quick

Spectra, a subsidiary company of Photoresearch made professional lightmeters for mainly the cine industry. It's obvious they based their models on an early Norwood meter. They are still in business. see http://www.spectracine.com/history.html

Products from Norwood went through Brockway to Spectra

Early Norwood and Spectra meters

Early Norwood -Brockway meters

The evolution from Norwood to Spectra

The evolution from Norwood to Spectra

Europe

<u>Prinsen, the Netherlands</u>

Prinsen was an engineer and pioneer in the field of the automatic diaphragm, triggered by a selenium cell. In 1935 he brought out his first selenium meter with a rather remarkable dial plate. The aperture #'s were printed on the hand that moved over a dial plate with shutter speed sectors. A perfect way of direct reading.

Prinsen, 1935

Prinsen, 1937-1939

rare red bodied meter *booster cell attached*

Based on the foregoing models Prinsen developed an oyster shape model. The Prinsen Directa was sold for a short time in France only

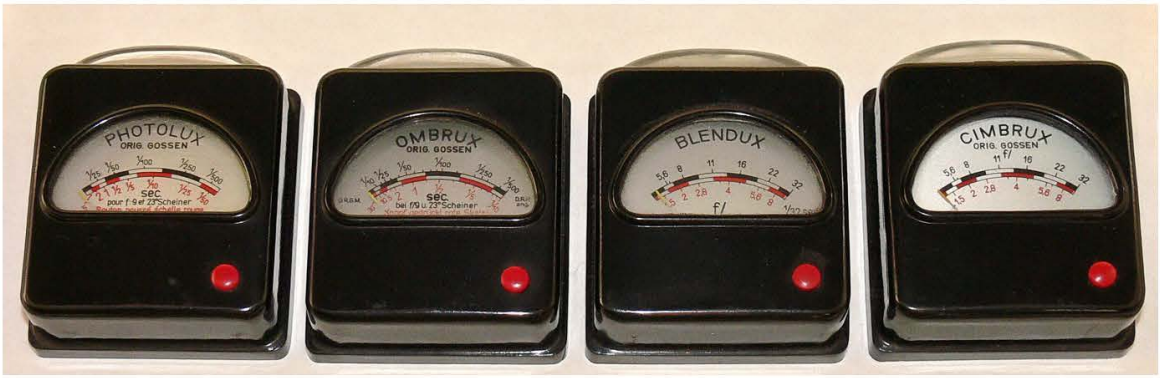
Prinsen Directa, Simson, Prinsen Super, Prinsen-Simson, Super Simson(2 ranges) and Prinsen Kelvina, 1950

The production of his meters stopped in 1960 when the competition of Japanese and German meters could not be beaten any more.

<u>Gossen,</u> Erlangen, Germany

Paul Gossen started in 1917 in Erlangen a small works for electric measuring devices. The upcoming radio-industry provided enough work for the controlling instruments. When around 1932 a reliable selenium cell entered the measuring industry, Paul Gossen directly saw the potential of an electric photometer. To be sure of a competitive price he ordered 100.000 selenium cells from Elektrocell in Berlin. The first meter, Photolux appeared in March 1932.

In September the name was changed into Ombrux. The Blendux and Cimbrux were the cineversions of this meter.



Photolux, Ombrux, Blendux en Cimbrux

In 1936 a smaller version entered the market, the Ombrux2. The readings from the first Ombrux were for a fixed emulsion sensitivity and diafragm. In the flap of the cover of the meter you could convert your reading to other values. The Ombrux2 had a direct reading system. Its close successor, the Sixtus came with minor changes. The cineversion was the Sixtus C and in 1948 slightly improved version the Sixtus2 appeared. They were produced until 1950. Sometimes Gossen made small series of meters with coloured case instead of the black bakelite case. The Sixtus with bakelite sliding cover was produced in a red version. There are examples known of the Sixtus (without cover) in a darkgreen and a darkbrown case.

Ombrux 2, Sixtus, Sixtus red and Sixtus C, all with slide.

Ombrux2, Sixtus en Sixtus2

The Sixtomat (to be described) came in a black housing, a small series of darkblue cases was made and I've even spotted a heavily damaged Sixtomat in a red case. The later Sixtomats were (almost) white, in the USA some gray models have been seen.

In 1950 Gossen came with the Sixtomat. This meter was a topseller for many years. The first models, in black case with a RVS sliding cover were only for direct light metering. The latter models, the Sixtomat x3 could be used for direct light metering, incident light metering and colour-temperature metering by means of an optical colour temperature meter.

As miniaturizing got popular, some smaller meters were produced. At first, the Sixti, an acc. shoe meter, also made for Kodak as Kodalux and for Sears as Tower meter. The smaller meters were the Sixtinette, Sixtino, Sixtry, Trisix, Sixon, Bisix, L.V.-Six

In 1960 Gossen presents as one of the first a meter with a CdS sensor, the Lunasix (its sensitivity was so high that it could measure a landscape illuminated by the moon, hence the name Lunasix).One disadvantage in respect to the selenium meter must be mentioned: the meter was battery dependent. By its high sensitivity and speed a wanted meter for the professional. The Sixtar is the second CdS meter in this range. The CdS sensors were faster than the selenium cell, but within some years a much faster sensor than the CdS resistor came available , the SBC, Silicon Blue Cell. The selenium cell is slowly abandoned, new names for old meters: Sixtomat electronic,Sixtus electronic, Polysix, Variosix, Sixtron (1968).

In 1956 Gossen presents the Sixticolour, a selenium meter for colour temperature measuring. This meter remained for a long time in production. Cases were in white, black and later gray plastic. From all the electrical- lightmeter-producers, Gossen is the longest surviving name.

Metrawatt, Nuremburg, Germany

Metrawatt was a company founded by Siegfried Guggenheimer in 1912. Guggenheimer started his company bearing his own name. As he was Jewish, he had to rename his company in 1933 by command of the Nazi regime. He chose for Metrawatt being the new name. The logo of the firm was changed from SG enclosed in a regular octagon to MW in a regular octagon.

Logo before 1933

Logo after 1933

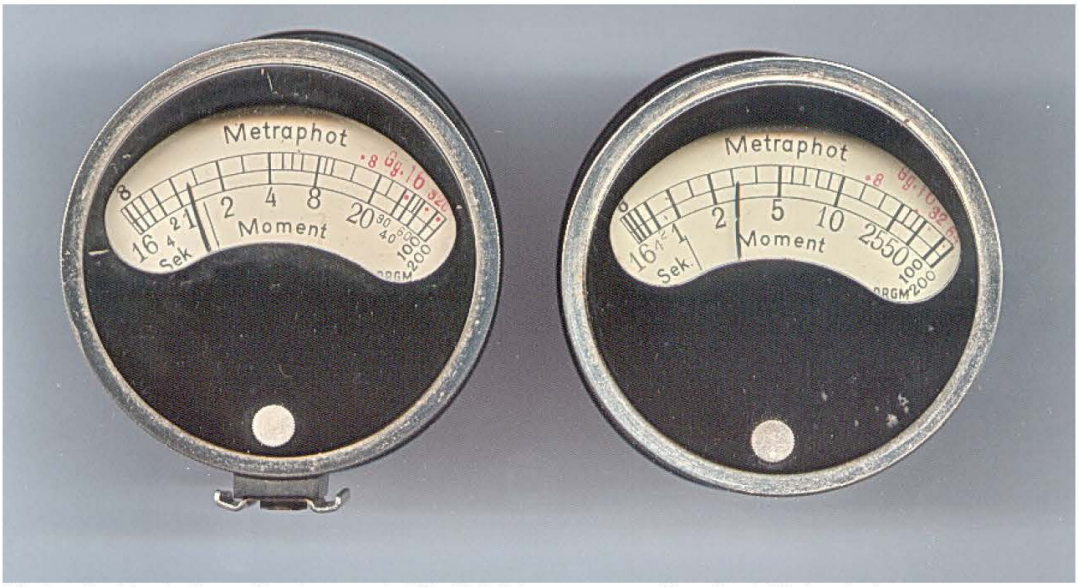
The first light meter that was brought out was a photometer for illuminating purposes in 1932, bearing the SG logo.

The first version of the photographic exposure meter had the name Metrophot printed on. The later versions all had the name Metraphot. This meter was, in achieving a direct reading, reasonably advanced: at the side of the selenium cell you had to point out the film sensitivity; the diaphragm to be used had to be set at that side as well by means of a real diaphragm. From the other side of the meter you could read the shutter speed. A sliding sunshade, that narrowed the measuring angle, completed the meter. This meter resembled very much a meter that Weston had patented, but that never went into production.
The model names were indicated by their longest shutter speed. So the first models got 4, later models 8 ; the models with 16 seconds were about 1cm thicker than the lower numbered models.

A cine version was also available, be it for a very short time. Here you had to set the film sensitivity and the recording speed in frames/sec. The stop to be used could be read at the front of the meter. This meter is very rare!

Standard Metraphot *Metraphot Kino*

For Leica a special model with a foot for an acc. shoe was made. The timescale at the front was different from the regular models.



Metraphot for Leica with shoe and diff. dialplate *Standard Metraphot*

Very soon newer models were presented: Tempophot, its successor Tempiphot, where an extra seleniumcell could be plugged in to improve sensitivity, followed by the Horvex, with that same feature, and a simpler meter called EOS (after the goddess of daybreak) .

The Tempophot, Tempiphot and Horvex meters were also available with an adapted shutter speed scale for Leica cameras and in 1939, in cooperation with Leitz, an acc. shoe meter for the Leica, the LC 60 is produced. Several models were available until 1950.

6 models of the LC60 from l. to r. 1939-1950

After WWII the production continues, new models are added to the range: Horvex2, Horvex3, a range of acc. shoe meters called Metraphot. Directly diverted from the Metraphot3 is the Polaroid 620.
For the Argus Co., AnnArbor, Mi, Metrawatt produced some Argus photometers, directly derived from the Horvex2 models. For financial reasons Argus moved to a Japanese manufacturer for their acc. shoe meters.

Some Metraphot , Leicameter abd a Metraphot Cine meter

Metraphot 2&3 , Leicameter 2 & 3, Metraphot Cine and Polaroid 620 meters

Horvex 2&3, Argus L3 and a Metrawatt Lux meter

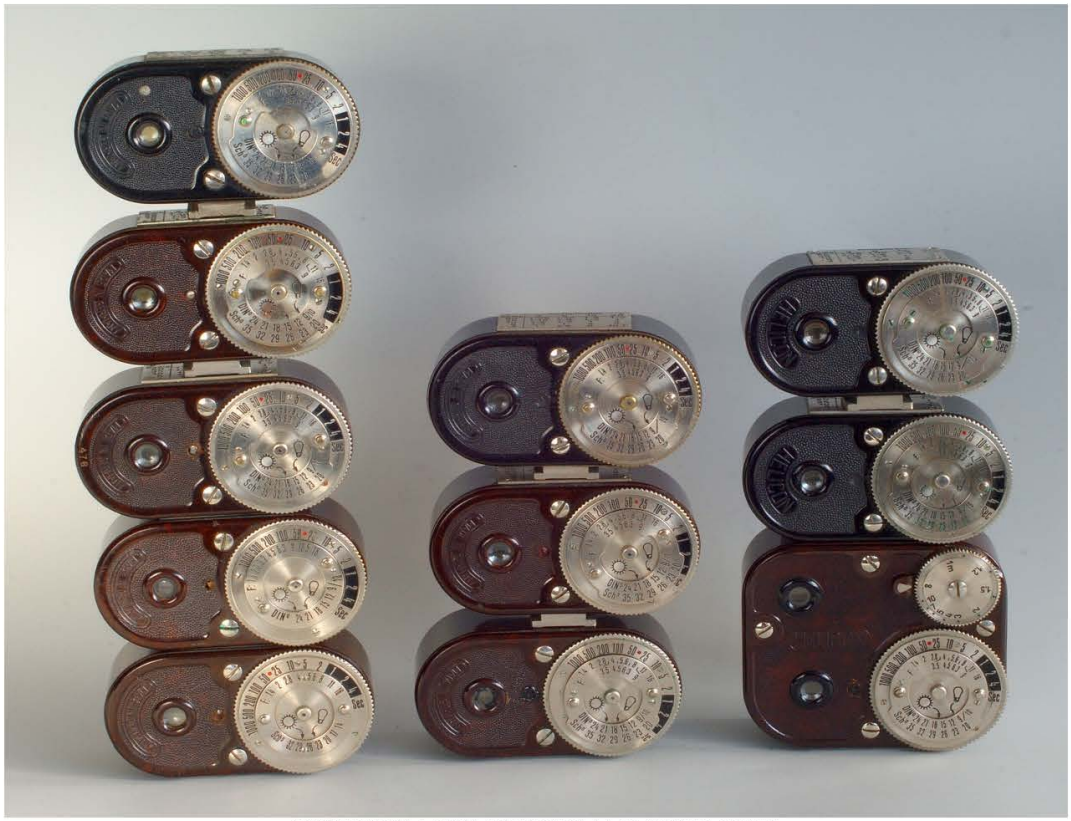
For several German camera builders Metrawatt supplied the(to be built-in) exposure meters.

The cooperation with Leitz that started in 1939 lasted till the end of the Metrawatt company, when they were taken over , together with Gossen, by BCC. The production of exposure meters continued under the name Gossen.

Zeiss Ikon, Stuttgart, Germany

Zeiss Ikon presented as a camera builder their first selenium meter in 1935, the **Helios**, a meter in a maroon red bakelite case, with or without a foot for acc. shoe. The cell compartment was covered with a convex glass and contained two perpendicular plates that should effectuate a narrow measuring angle. A year later this meter was succeeded by a simpler model where the convex glass was replaced with a flat glass plate.
Most of the Helios meters have a DIN **and** Scheiner sensitivity scale. Zeiss produced small batches with only DIN or only Scheiner sensitivity scales.
The footed models were available in a black or maroon red bakelite housing.
Another year later the model was simplified again and lost its perpendicular plates in the cell compartment. The name was changed to **Helicon**, available only in a black bakelite housing, with or without foot.

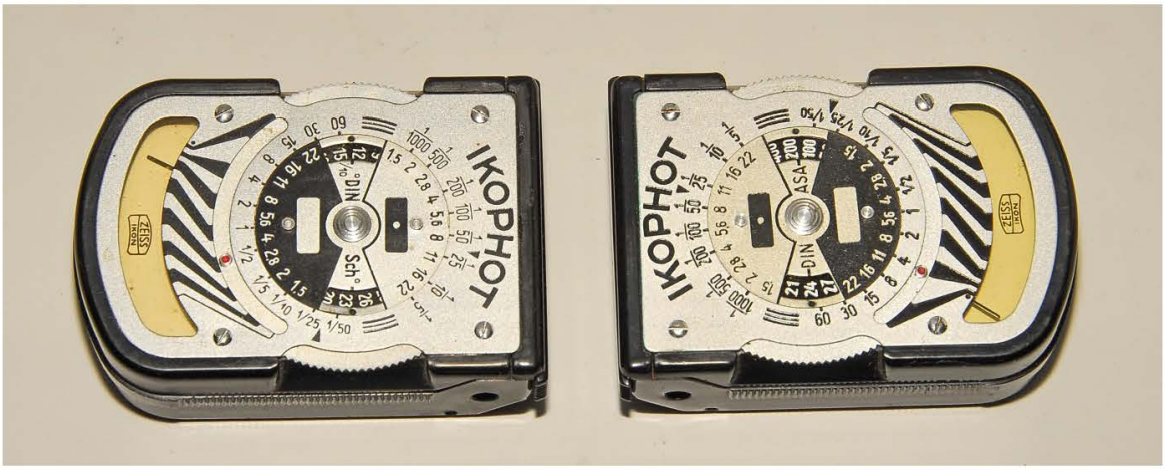
The Helicon appeared in 1937 also as an exposure meter combined with a rangefinder in a maroon red or black bakelite square case. There seem to exist footed models of this meter, but I never encountered one.



Different types of the Zeiss Helios and Helicon meters

Left pile: Helios 1935 models, middle pile the 1936 models and to the right the 1937 Helicon's

In 1940 a new model is launched, the Ikophot, model# 1328/1, in production till 1950. At first only with a DIN/Scheiner sensitivity scale, later with a DIN/ASA scale.



In 1951 the development of a new series of Ikophots was started that continued till 1965. All with a selenium cell.

Till 1971 some meters with a CdS cel were brought out, the sensitivity is much better, but the meter is now battery dependent. The production stopped after 1971.

Kiesewetter, Leipzig.

In Leipzig, Germany, the Excelsiorwerke-Kiesewetter Mess-Technik company still exists. Around 1933 they presented the Photoskop light meter. A different model than the existing ones, very nice design. Everybody wanted to profit from Gossen's success and the export to the US. In 1934 the succeeder was the Photoscop K, another special design, followed by the Picoskop, Kinoskop and Picoskop2, smaller and simpler versions of the Photoskop.

Photoskop

Photoskop K

Picoskop

Picoskop

Picoskop 2

Kinoskop

In 1937 a direct-reading meter, the Excelsior, comes out. For the USA the same model gets the name Mini-Photoscop. For Pathé a model with the name Pathex Kinor (cine version) is produced. A Leica version gets an A added to the name Excelsior. The only difference is an adapted range of shutter speeds.

Remarkable is the presence of two patent numbers on the dial plate of the Mini-Photoscop, one USA pat #, and one British pat #. Both #s are owned by J Bing USA, but were related to an optical light meter.
Possibly J Bing, who imported this meters to the USA, recommended Kiesewetter to put a pat # on the dial plate to prevent copying of this meter.

After WWII an Excelsior junior and an Excelsior 3 are produced.

After 1970 the production of exp. Meters by this company stops.

BEWI, Münich, Germany

Since 1919 Ernst Bertram runs together with Ludwig Leiner a small works of photographic equipment in Münich. In 1929 Leiner quits the company and the works are taken over by Paul Will. Bertram had developed an optical exposure meter that was sold for some years already. Ernst's brother Wilhelm, also working in the company as a designer had developed Bewi's first selenium meter, the Elektro Bewi, that was brought out in 1935. This meter had an added optical meter in case the light circumstances were so weak that the electrical meter gave no correct readings anymore.

In 1945 Will retires from the business and the Bertram brothers take over the company. The name is changed from Bewi into Bertram. In 1982 the company stops, until that moment still directed by Wilh. Bertram. They can look back to a series of original designed light meters: Elektro Bewi, Amateur, Chrolon, Chronos, Chrostar, Automat, -A, -B, -C, Boy, Piccollo, Piccollo II, Quick etc.

Rex Messinstrumentenbau GmbH, Erlangen, brought out since 1935 a number of meters with the name Rex.
Their first meter was a meter with a collapsible cell and two measuring ranges. Also available with Leica scales, stops as well as shutterspeeds.
After this one followed the Mini Rex, succeeded by the Novo Rex, a small meter with collapsible cell as well. The name of this little meter was changed to Novo Rix or Nuvo Rix for export models.
After 1945 a new series of MiniRex II models are produced, the black case is replaced by a coloured one or white with coloured paddings.

After the MiniRex L , the MiniRex III and the Rex 300 the production ends with a CdS meter, the Multirex.

Some MIni-Rex and a Rex 300 meter

Another firm in Bayern , **Weigand & Ehemann**, is starting in 1937 with the Actino lightmeter. This Actino meter exists in a lot of different versions; all have the same case, but the printing on the case or the dial scale exists in a number of varieties.
It is possible that Weigand also made the Balda Temeter for Balda in 1939. Only a few Temeters have shown up amongst collectors, possibly a lot of those meters were destroyed because of war-actions. Weigand continues after WWII with the Actino, Actino U and Actino S. A meter for acc.shoe is the Actino C, an identical model was made for Regula.

Weigand continues after WWII with the Actino, Actino U and Actino S. A meter for acc.shoe is the Actino C, an identical model was made for Regula.

In Leipzig **Joseph Dorn** starts in 1939 with the production of the Dornlei. In the USA this meter was sold as the Photrix.

A second model developed by him was the Prix, a small square meter with a lid that covered the top and the cell. Only e few meters survived with this bakelite flip, the construction was too weak.

All the Prix meters produced after this one had to go without a flip. After WWII Dorn moved to Neustadt a/d Weinstrasse where until 1970 a lot of other meters were produced. The Prixim, Primat,Prixcolour, Colourprix, Pric Perfect. Some of Dorn's meters were sold with another brand name.

After WWII East-Germany is also a source of (cheap) selenium light meters. **Werra** comes with a series of meters, all in almost the same shape but in a variety of colours: black, red ,olive-green, cream-coloured, in a metal cover or a leather cover. An accessory filter, that could be connected to the front of the selenium cell, could serve as colour temp. meter.

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Weimarlux is the name for some meters that were mainly sold in East Germany

The **Zeiss** Co, from Jena also produces a meter in two different clours, one in black plastic and one in green plastic. The latter model gets a transformation into a Jena meter by applying some transfer stickers to have the name ZEISS disappear.

From VEB a small, but surprising meter is the Iris. Two ranges, achieved by applying a gray filter, a very original solution. No hand, but a turning scale-plate. Available in black or in a rarer white case.

United Kingdom

As one of the oldest manufacturers of photographic equipment **Ilford** presents its first selenium meter in 1936. It was produced for them by the AVO measuring instruments Co., and resembled the first AVO exposure meter.

AVO had shown its first lightmeter In 1935, followed in 1937 with a smaller one and in 1938 with the AVO-Smethurst incident light meter. Soon after that all professional meters adapted the incident light measuring method.

To the left the first AVO meter, the white ring below the selector knob was soon replaced by a black one

The different AVO meters. Bottom right is a lux meter; its left neighbour is a prototype for photographic purposes, that is derived from that model. On top of that one the AVO-Smethurst meter for incident light measuring.

Other English manufacturers were in the first place **Sangamo-Weston**, a subsidiary company of Weston , USA. The Weston Master I came out in 1938 in the USA. The first British Master I was produced in 1947, shortly after the W. Master II was introduced in the USA. The British W. Master could be distinguished from its American equivalent by the white dial-plate. In 1952 the British Master II left the factory, a few years later followed by the Master III.
The Weston Master IV and V, totally redesigned in respect to the WM III, were exclusively produced in the UK.

The Weston Euro Master was a slightly modificated Master V.

Metrovick, London produced a small lightmeter, the M&V around 1940. The calculator was sewn onto the flap of the etui. Sooner or later that would come off. A version for Cine and one for Leica were available.

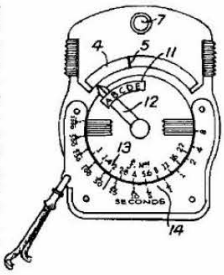
Around 1950 a newly designed meter was brought out that could be used without its etui, the Metrovick Hunter.

The General Electric. Co. came in 1947 with a circular selenium exposure meter. They had already made some lux-meters in the past, this was a special design. It was the only meter for photography they made although they applied for a patent on another meter already in 1935

458,695. Photo - electric exposure meters. GENERAL ELECTRIC CO., Ltd., Magnet House, Kingsway, London, and BANNER, E. H. W., c/o Salford Electrical Instruments, Ltd., Silk Street, Salford, Lancashire. July 23, 1935, No. 20921. [Class 98 (i)]

The meter is provided with a calculator having scales of plate-speeds, exposure times, and apertures, one scale being fixed and the others carried by a movable member mounted so that any mark on one of them can be moved into register with the pointer of an indicating instrument connected to the cell, the other scale then moving over the fixed scale. The scales are subdivided so that equal steps correspond to doubling of the exposure and the indicating instrument is constructed with a logarithmic characteristic by suitably shaping the poles and/or core. In the form shown, the pointer 5 of the instrument is visible in a window 4 at the rear. A scale 14 of exposure times is fixed to the casing and a disc bearing scales of apertures 13 and plate-speeds 11 is pivoted thereon. A pointer 12 is movable over the scale 11. In use the pointer 12 is set to the selected plate-speed and the disc then rotated to bring the pointer into register with the pointer 5. The casing has an aperture provided with a grid so that the angle of the light incident on the cell is limited. A viewing hole 7 is provided to enable the meter to be directed at the object.

FIG. 1.



CHUM is the name of a small meter that was produced by I.& A. Gosling. It was a 100 % copy of the German Prix from Joseph Dorn. First meters appeared in 1946, being marketed till around 1950.
One version comes with the name Swift.

Pullin, another manufacturer of optical devices comes with a light meter that can be connected to a strap to be worn on the wrist, a feature some meters from Bertram had as well. Around 1955.

FRANCE

Only one big company was active in electric measuring devices, **Chauvin-Arnoux**. In 1935 their first selenium meter is set onto the market, the model 161. 3similar models follow and in 1937 a small meter is introduced, Le Gousset (= vest-pocket).

After 1945 a larger edition of le Gousset is produced, the CA mod 64, followed by the Cellophot some years later and the PoseLux in 1955. A mall meter for an acc. shoe and meters to be built into French cameras complete their production .


POSE-LUX
CHAUVIN
ARNOUX
1/60


ASA

LMT

LMT stands for : Le Materiel Telephonique. It is a subsidiary company of the American Bell Telephone Manufacturing Company. They also tried to get into the meter market.
Their first model, the 3001A is a straightforward copy of the Weston 627 lightmeter. In the manual and on the meter a LMT sensitivity scale is mentioned. Nowhere to trace in literature. In a latter manual of another LMT meter this LMT scale appears to be equal to the Weston scale. How do you mean: copying?

A second from LMT , the 3002A looks to be copied as well from a Weston meter, the 650. To distract the view the dimensions have changed a bit. This meter contains a selenium cell that has a diameter of around 8 cm, one of the largest found in exposuremeters. Bruno Lange, who perfected the selenium cell had established that the optimum size for a selenium cell is a diameter of around 4 cm. To gain sensitivity it is wiser to switch some smaller cells in serial connection to obtain the same effective surface.

After this meter 3 meters with a more original design followed, the last, LMT 3005 was produced around 1950.

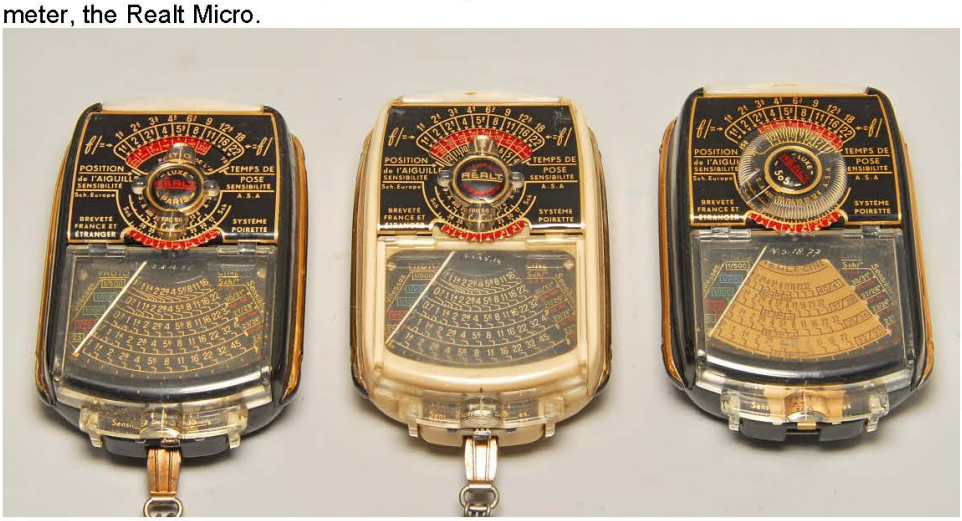
All LMT meters in front of a shop display.

The Belgian branche of LMT, BTM (**B**ell **T**elephone **M**anufacturing Company) also brought out a lightmeter, exactly the same as the LMT 3003, except that the initials LMT were replaced by BMT, to be seen on above picture utmost right.

Realt

In 1949 REALT shows its first lightmeter. The patents of this meter were all assigned to a Mr. Poirret. His name returns in the “Systeme Poirret” that was mentioned in the instructions for use. The Systeme Poirret directed to this feature: the dial plate had to be changed if another sensitivity had to be set. The advantage was nothing else had to be set, so you had direct readings.

Models: Realt Photo Cadran, Realt Luxe, Realt Luxe 505, Belisa , Ile de France and an acc. shoe meter, the Realt Micro.



Another company that produced some remarkable (and rare) meters is **Guerpillon**, three models are produced between 1949 and 1958. The second model came in a gray or a black housing. The 3rd model is very rare.

Guerlux 1

Guerlux 1 “luxus” model

Guerlux II gray

Guerlux II black

Guerlux III

Two meters named **Luminox** are introduced in 1948. They look to be copied from the Ikophot meter. A second model is brought out some years later and in 1954 an almost identical meter with the name Inox is sold in France.

Luminox 's and Inox

When we continue our travel through Europe we arrive in Italy, **Milano** where a company called **ICE** brings out a nice lightmeter, the **Multilux**, around 1960.

A cine-version, the Kinelux was also available in an underwater housing for diving, where separate sensitivity scales had to be inserted to obtain a direct reading.

In neighbour country **Switzerland** near Zurich an optical instrumentwork **WEKA** can be found. Several different meters are produced. At first the **colour temperature** meters by **Rebikoff**, very nice design, from 1950-1960 three different versions are produced.

Dimitri Rebikoff was a genius. In the 1950's he was occupied with building and designing electronic flashes and underwater apparatus. In 1951 he publishes a booklet about electronic flashes: "Photo Flash électronique". That Rebikoff was a man with vision can be deducted from the last chapter in this booklet, entitled: ***Photography in the year 2000****. Here he predicts the use of very small cameras with miniflashes by almost everyone, to be used at almost any opportunity. At the same time he predicts the use of telephone lines for transporting images and the storage of pictures on magnetic layers. A clear seeer! At the end of the 1950's he moves to the USA and continues working on underwater photography and the development of small submarines.*

From the Weka works two other meters appear; the SwissLux (a second model with minor changes is called SwissLux 2) and the Fotomatic, a meter with a rotating dial scale.

Austria

From Austria many lightmeters saw the light! Dr. EmilMayer, a lawyer, companyname DREM, started in 1925 a work in photographic accessories. Amongst those accessories an optical lightmeter, the Justophot. Thanks to a friend of him who had settled in the USA, his products were introduced in the USA and were soon sold all over the world. In 1936 he produces his first electric meter, the Electrodrem.

A curious design, but understandable. As the basis of the meter he used the tube of an optical meter with its original scales. On top of the tube he placed the electric eye, the selenium cell, where one used to see through the tube. The hand points at a letter on the scale, and on the outside of the tube the shutter speed and stop can be read.

Two years later a meter with a more common design appears, the Drem Electric.
Austria had been taken over by Hitler and hence the meters should be provided with a text: Deutsches Erzeugnis or Made in Germany. Mayer was Jewish and refused to live under this regime. In 1938 he committed suicide. It meant the end of Drem.

Another Austrian firm was AKG, **A**kustische- und **K**ino- Geräte GmbH, Wien who in 1953 brings out a meter called AKALUX. A year later, another firm from Vienna, the **El**ektro-und **F**einmechanischer

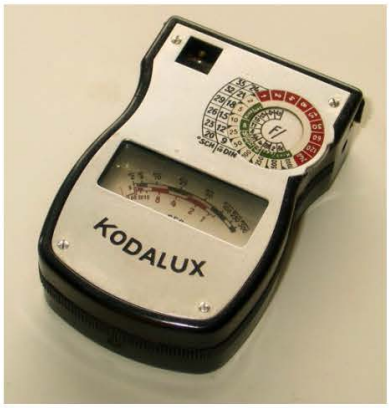
Apparatebau GmbH presents the Elfa spezial L20, a meter that is almost identical to the Akalux. A second Elfa model follows soon thereafter, it is their last model.

Hungary has a lightmeter industry as well, be it a very small one. Two brands are known:

Riszdorfer produced a meter with with a viewfinder, the Superlux, the setting dials look to be copied straight away from the Gossen Sixtus meter.

Also produced with the name Kodalux written on it, and as a version for the Leica, than it's called the Superlux L, to be recognized by its aperture numbers and shutter speeds and the letter L on the dial.

60. Belichtungsmesser GAMMAFOT und sein Konstrukteur *Dr. Vajta*
The GAMMAFOT exposure meter and its designer *Dr. Vajta*



The Gammafot meter is produced for the Hungarian Gamma cameras.

Second company is **EKM**, they produced the Rotolux, a meter with a rotating dial scale. White case, you could choose from a blue, black, green or red scale.

Czechoslovakia had at least one leading company producing lightmeters, **Metra Blanska**. Between 1950 and 1970 four different models are produced with the very exciting names Metra1, Metra2, Metra 3 and Metra 4.

Metra 1

Metra 2

More eastwards we arrive in the **USSR**. Until 1995 rarely meters from the USSR were seen in the western countries. The first Russian meters were sold in the West by the Poland tradesman who calculated themselves rich with this eastern treasures as they called it on the international fairs. Prices dropped within a few years and nowadays at every fair the Russian meters are abundant.

Leningrad is the mark most widely seen, meter names from Leningrad1 to Leningrad 10

Leningrad 1

Leningrad 2

A **Moskwa** meter is not seen so often, and a **Kiev** meter is even rarer.

Kiev meter

Kiev meter with higher sensitivity

FED produced a heavy circular meter. The date of production is not certain, but well informed Russian collectors mention 1939.

Sverdlovsk is a brand that started production at the end of the 60's. These meters were too young to be a part of my collection, they all were battery-dependent meters.

And a very nice example of an early Russian professional exposure meter made in 1952 at the MKIP factory in Moscow.

Selenium Light Meter, swiveling head, bakelite body. Iris diafragm as the early Metraphot's had.

JAPAN

Japan has always been known in our western world as "famous copiers". In the world of the exposure meters that is no exception: the first photo-electric exposure meter was a (modified) copy of the German Tempophot meter, originally made in 1935 by Metrawatt. It was manufactured by SIBAURA DENKI K.K. in 1936. This company is todays TOSHIBA. This MAZDA Exposure Meter is using the N.S.G.(NIHON SHASINN GAKKAI) sensitivity system. This original Japanese standard was enacted in 1935 and was used only for a short time.

*Metrawatt **Tempophot** to the left and Sibaura **Mazda** meter to the right.*

SEIKO was the second company to produce an electric light meter in Japan. It was an almost perfect copy of the DeJur mod 50A (produced around 1945) that was brought out in 1949 as the Sekonic L-1 meter, most probably as the result of the American support in boosting the Japanese economy after WW II.

Sekonic's SEC, deJur's Mod50A and Sekonic's AEC exposure meters

In 1950 the Sekonic Perfect mod I appears, designed and developed by Sekonic, followed in 1952 by the Sekonic L II. Then comes the Sekonic Perfect mod II, followed by the Sekonic L II-2, the Sekonic L III, the Sekonic L V and the Sekonic L3b.

All these models are look-a-likes of the American Weston Master models. Seiko wanted to reach the professional market, so they attached a label to the front reading : Sekonic Professional (L III) and Sekonic New Professional for the L V. After the LV an improved version of the LIII is released, the L3b, the label has disappeared. The LIII, L3b and the LV all had the same metal case.

In this early period of production a colour temperature meter is released as well, the CT-2 (1954).

Around 1957 Sekonic comes with the L VI, a nice,small meter, simple to handle, perfect for the amateur. This meter comes in different versions, with and without the typename “Leader” on the dialplate.

Sekonic L VI

Sekonic L8 and amplific. cell

The L7 is a small meter as well, not so successful as the L8. This meter, the L8, had a slot to attach an amplifier to extend the metering range. Sekonic gets a big order from Hanimex (Australia) to produce for them the Hanimex-Sekonic.
Sekonic tries to be innovative and comes in 1955 with a small meter for acc. shoe.

Metrawatt has also produced smaller meters and now the competition starts. But how far can you go: a meter has to remain readable, so the limit is set how far you can minimize.

In 1962 Sekonic brings out the Micro-Leader L 96. This meter has a light sensitive resistor (CdS-cell) as the light sensitive element. A battery is needed. Because the meter can measure light of extreme weakness the dial plate is covered with fluorescent paint so a declination of the hand can be noticed. A small lamp can be attached to the meter to read the scales in this darkness. A knob on the side of the meter fixes the declination of the hand when pushed.

As I mentioned before: Sekonic wanted to reach the professionals. I have to conclude that they succeeded, they are still in the business of lightmetering, together with their German competitor Gossen.

From Japanese sources I've learned that there were two manufacturers of exposure meters: Sekonic and Waltz. The Waltz company was taken over in the early 1960's by Copal, and a few years later Sekonic was bought in as well. Copal kept producing exposure meters under the Sekonic name, as it was a well established one already.

From the meters in my collection can be seen that there are a lot of identical meters, but they have different names. I think that if you were a wholeseller you could have any type of meter produced with the name you wanted printed on. That indicates that there were only one or two big manufacturers of exposure meters.

Look at these meters below:

and at the little acc. shoe meters: all the same body but a different coat.

I mentioned before Japan's copying behaviour. That is reflected in the light meters from Walz as well. They copied the GE PR1 and a Weston Master 2 .

SAMOCA

Samoca's first meter was a downsized copy of the DeJur50 meter. Their second meter a copy of the Weston Master 1. They had to learn it anyhow. But soon their self confidence was so strong they started their own designs, that were altered very soon to feed the market with "new models".

1st version of the 1st Samoca acc.shoe meter

and the 2nd version of that meter.

Rough Weston Master 1 copies

A very neat Samoca Automat meter

Samoca V meter

WALZ

Above some Walz meters. Number 4 in the row is the Walz Etalon meter, aside two Etalon meters. The connection between Walz and Etalon is unknown, only the plant where they were produced looks to have the same name: CDK

Identical Walz, Sunscope (USA) and Etalon meters


Comet


Compact
TIME

Unittic


EXPOSURE METER
UNITTIC
RAIEN DENKEI CO.
LIGHT


UNITTIC
Closed
LIGHT
TIME


UNITTIC
DIN
Polaroid
Light Value


UNITTIC
LVS
ASA
DIN
Polaroid


ASA


UNITTIC
DIN
INDEX

Australia

Even in Australia selenium meters were produced. From one plant, the **Palec** Elecrical Pty. Ltd from Sydney three consecutive models were produced starting around 1950 and ending in 1960, the Palec 1, 2 and 3.

Palec model1

Palec model2

Palec model3

The **Hanimex** company, established in 1947 by Jack Dieter Hannes in Sydney, 24 years of age at that time, expanded to a big trading company in electronic and photographic devices. They started selling slide projectors, and added photographic equipment to their selling business. They did not produce equipment, but bought it mainly in Japan. The first light meter they sold was the Hanimex Sekonic (L8), but the later models they sold can't be traced back to a producer because of the non-transparent Japanese lightmeterindustry.
Hannes died in 2005 in Switzerland, aged 81.

Colour temperature meters.

When the colour emulsions around 1937 came out the need of a colour temperature meter for a professional was felt. Here at first a short , simple explanation of colour temperature:
If you decrease the voltage of an incandescent lamp by means of a regulator you will clearly notice the change in colour of the emitted light by the lamp: it gets more red. If you increase the voltage the lamp gets brighter, more white. It's all dependant of the temperature of the glow-spiral in the lamp.
The Colour temperature of white light is defined as the colour of the light that is emitted by a black body that is heated to a certain temperature.
Below a scheme how that temperature effects the colour. The temperature is given in degrees Kelvin (i.e. degrees Celsius+ 273). Sunlight has on midday a colour temperature of about 5500K.

The colour-emulsions were made for a special col. temp. If you would expose a film for 5500K inside the house at the light of an ordinary incandescent lamp you would notice that that resulted in pictures with an orange shade, the light was too yellow.
For an exact colour-representation colour-correction filters could be used. Especially in the cinema industry a common help.

One of the first colour temperature meters was an optical one by Kodak from around 1937.

Harrison also made an optical colour temperature correction meter, in combination with a set of correction filters.

A selenium meter could also be used as a colour temperature meter if you attached a device that lets you measure the light through a red filter, followed by a measurement through a blue filter. From the difference in the readings the colour temperature could be calculated.
An accessory device, shown here below, was made by Harrison as well for the Weston Master and the GE exposure meters.

In a special colour temperature meter the amount of shift to the blue or red side gives you an easy indication of the right colour temperature.

Gossen started making this meters around 1952, the **Kelvilux**, followed in 1956 by the Sixticolor

Kelvilux

Sixticolor

Around 1950 Prinsen (NL) shows his **Kelvina**, derived from the Prinsen-Simson exposure meter

Prinsen Kelvina

and from the USA the **Ashcraft** meter could be ordered.

Sekonic shows in 1954 its **CT-2** meter (CT stands for colour temperature)

and **Rebikoff** his beautiful meters around 1955.

Walz (Japan) makes a Colour Meter in 1960,

as do **EEL**

and **Megatron** in the UK

and **LIFA** in Germany.

LIFA even combined a colour temperature meter and a selenium meter, the **LIFA Colourlux**. (shown in the middle of the picture above). The **Colourlux Baby** was a single colour temperature meter. LIFA also delivered sets of colour correction filters to be used with their meters.

This history is by far not complete yet. There always show up meters that weren't advertised or described in literature. But with the help of some other avid collectors I'll try to keep up with the latest findings.

I wish to thank Tom Meyer (CH), Richard Holzman (USA), Jean-Yves Moulinier (F) and Pere Pons Thomas (ES) for their most helpful and contributing discussions that made this piece of light metering history as reliable as possible.

This article was originally written in 2007 on request of the Dutch Fotografica Collectors Club at its 30th anniversary. All pictures are, except from a few, from meters in my collection.

Delft, Netherlands
Revised version
March 2014.