Home

The SEI Photometer

I am now offering a full service for the SEI, leds, rescaling, top chopping, calibration, repairs etc.
mail me: huw@huws.homelinux.org

The SEI Manual and the Accessories for Densitometry, an old advert and service manual

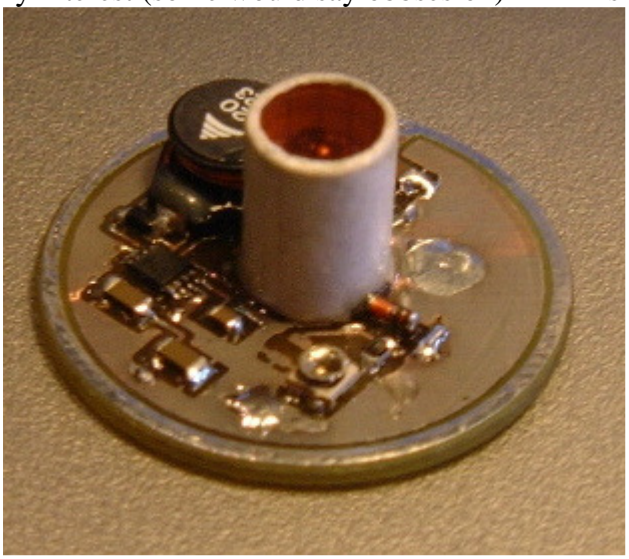
Photocell degredation
A few words about the degreadation of the photocell and how to fix it.

Simple calibration tests

Where to get bulbs for the SEI.
These bulbs and are not frosted, I have used one and it works perfectly without being frosted. They are MES (scerw in type) and the SEI bulb holder will need modifying a bit, just make shure the new lamp sticks up the same amount, if it is too high the photocell may be damaged.

From Farnell (.com) part 328285, you have to buy 10 but they take credit cards over the phone/web.

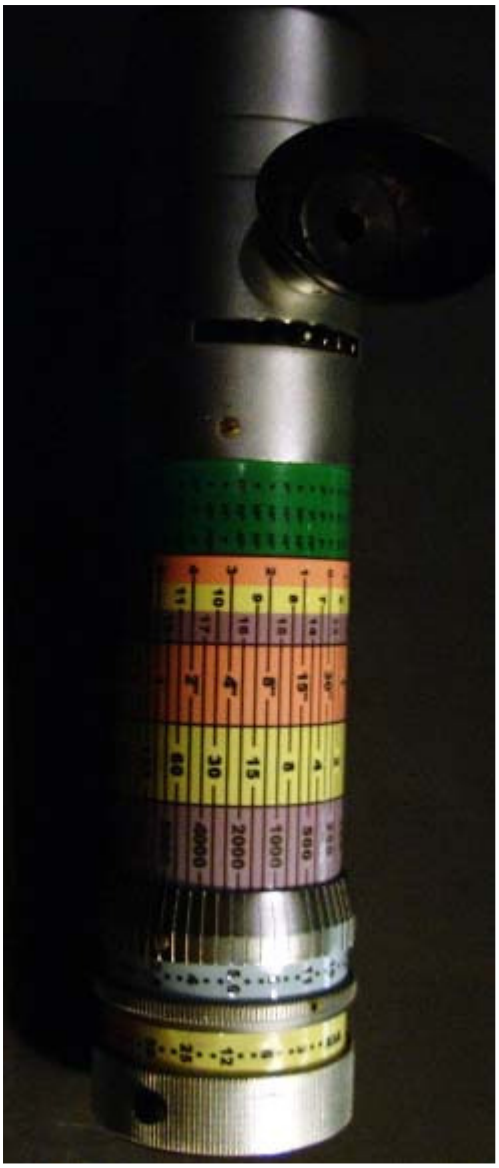
My interest (some would say obbsesion) in LEDs led (pun intended) me to this...



Prototype SEI LED

It just pops inside the photometer instead of the bulb tube, the cell is a bit loose but this doesn't matter. The circuit boosts the cell to 5V and the LED is adjusted using the potentiometer at the bottom to simulate the brightness of the original bulb, tungsten colour correction is done by the filter in the top of the tube. The original rheostat at the bottom is set to 'max', the circuit will keep a constant light output regardless of the state of the cell, unless it is flat. details here
Now for sale, mail me: huw@huws.homelinux.org

Sold some, so here are the SEI LED installation instructions



New scales on an old SEI.
Top green reciprocy failure tables
Middle LV scales
Bottom shutter speed in modern format

OK you purists, it has been done, no meter anymore.
This is real not 'photoshopped'.

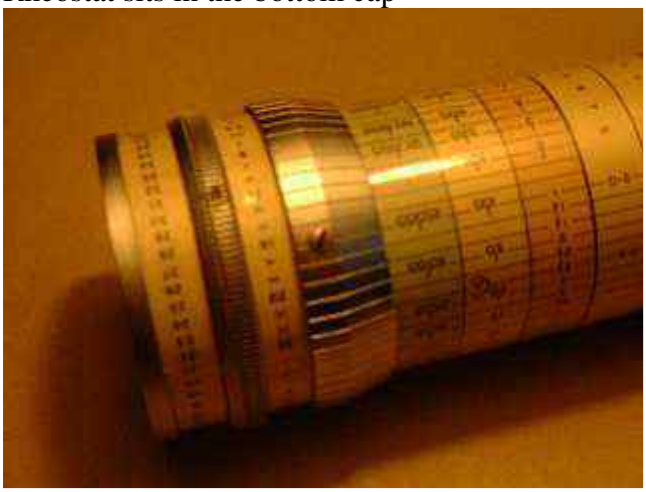
This is a few things about it and will get much bigger.

As an engineer and in good old Linux tradition 'read the source' so here are a few pics...

There it is!

The meter, used with rheostat on bottom to set the internal reference bulb brightness.

Bottom unscrewed, to change bulb or battery.
Rheostat sits in the bottom cap



Remove this screw and unscrew collar it is in.

The gear on top of the sleeve moves the two ND filters
the slot is for photocell electrical connexion

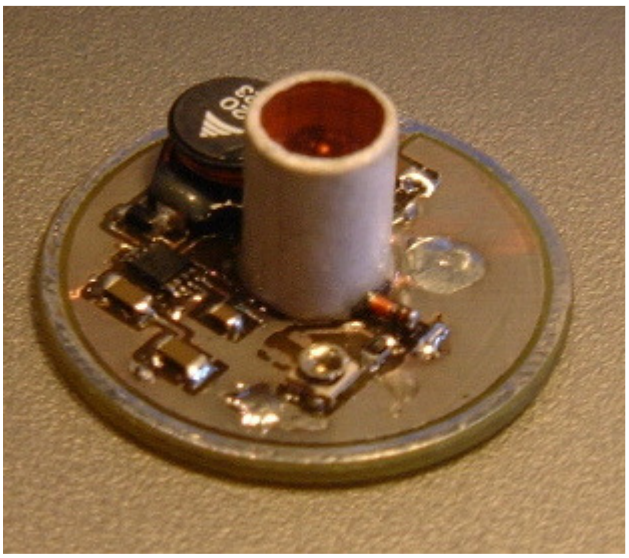
Remove 4 screws round the top section, one is covered in a wax seal.

Left, the two graduated ND filters to control the brightness 100:1 ratio. Right, lens to photometer cube and meter contact

The viewing telescope with hole to photometer cube and ND's for 100, 10000 & 1000000 ranges plus tungsten/daylight filters.

Home

The SEI LED replacement light source.



Yer bog standard SEI LED

vanity version with extra LED

I had a think.....
One white led filtered to about 3000K and for the deluxe version an extra (adjustable) led just to illuminate the photocell for the vain who want a working meter, there is only one of these in the whole world and it is owned by Roger Hicks.

For the filtering Lee filters had the solution and gave me a swatch of some 250 lighting filters, one turned out to be perfect. The LED comes from Marl, a bit pricey at 2UKP each but guaranteed colour temp. and quite bright, so bright the datasheet warns of eye damage!, distributed by Farnell.

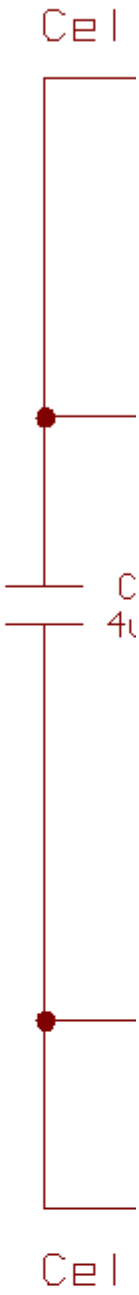
Temperature compensation
The LED has a negative (i.e. dimmer when hotter) temperature coefficient, so when it's sunny and hot you would overexpose (perfect!) a bit, the silicon diode (circuit D2) also has a negative coefficient and is put in series with current detecting resistor chain (circuit R1, 2 and P1) so the current rises with temperature. Tests using my freezer and oven at about -10C, 20C and +40C (that was quite hot to hold) revealed no measurable change at all. Certainly within the useable accuracy of the SEI (about 1/4 of a division of error when setting the match) thats about 1/12th stop (6%).
Interestingly my L-308 moved from f8.0 at 20C to f8.2 at -10C.

The electronics.....
A MAX1674 converts the 1.5V cell to 4-5V for the LED, the current through the LED controls the output and is temperature compensated by the silicon diode.

The MAX1674 circuit takes 40mA, this will give 450 hours using a 'D' cell. The fun bit is soldering the MAX1674, it's in a uMAX pack, the legs are on a 20thou (mils for the Americans, 0.5mm for the Europeans) pitch, thats a 10thou gap. I have three 1674s as samples from Maxim, they have survived de-re-soldering twice so far. The choke is a bit big for the current required but the 1674 has a 1A limit internaly, I will use the 1675 with a 500mA limit and a smaller choke for the next lot.
Assuming anybody wants one (or more).

To buy one of these hand built pieces of engineering joy, fully calibrated, mail me
huw@huws.homelinux.org

Circuit diagram for MKII


Cel
C
4u
Cel

Home

The photocell degrades with time, you can have one made for about 20UKP (Megatron do them) but as it is only a comparison there are two ways round this.

1) Re-mark the Standard Brightness point on the meter.

2) Reduce the series resistor in the meter housing.

I have done 2), replacing the fixed resistor with a pot.

And here it is.

The only problem with this is finding a standard light source to calibrate against. Calibration using test negatives is possible and would be fine for photographic applications of the SEI, but as it has a Foot Lambert scale it is nice to calibrate to that.

Standard Light Source.

(under construction in both senses, keep tuned to this station)

Home

ND filter test,

This checks the variable ND filters and the fixed ND filters for fading, it wouldn't work if filters got darker as they age, but they don't.

Set the meter to dimmest spot on the middle range, find an object that is that bright, set the meter to brightest spot on the low range, the object should match. The same is done for brightest spot on the middle range and dimmest spot on the high range.

Mine is within 1/2 a division (1/6th stop)

LAMP FOR THE EXTERNAL SUPPLY ADAPTOR
(Photometer Lamp)

The external supply adaptor and lamp (Figs. 8 and 9) take the place of the normal battery container and lamp used for exposure estimation. The adaptor consists of a machined metal barrel, closed at its upper end by a disc fitted with an aperture carrying a diffusing screen. Its lower end is threaded to carry the photometer lamp holder which in turn is mounted in an auxiliary base ring to fit the body of the photometer itself. This auxiliary base ring screws into the position on the photometer body normally taken by the 'operating ring' when the photometer is used for exposure estimation, and indeed the operating ring, with its push button switch screws into an outer cavity of the auxiliary base ring in which are situated the insulated contact and other terminal for the lamp circuit.

The leads to the lamp are brought in from two plugs through a hole in the auxiliary base ring, the lamp being operated by the push-button switch in the normal way.

The plugs for the photometer lamp circuit are used to connect the lamp and button switch with a two socket connector on the top of the transformer box. The sockets are themselves connected inside the transformer with the 6-volt output terminals of the transformer.

THE ILLUMINATOR LAMP AND ITS MOUNTING

The illuminator lamp is carried on a swivelling arm inside the illuminator. Its purpose is to illuminate the opal window in the top of the illuminator which is used as the platform of the densitometer. A lead screw terminating in a knob on the upper side of the transformer box, enables the distance of the densitometer lamp from the opal window to be adjusted so that the brightness of the opal window can be fixed at a convenient level and so that the zero of the relative density scale can be made to correspond with absolute zero density. The illuminator lamp is connected in parallel with the external supply adaptor (photometer) lamp. A switch on the top of the illuminator enables this lamp to be switched off.

The lamps employed are 6-volt, 6-watt, two-pole motor car side lamp bulbs with small bayonet cap fittings, Osram Reference No. 80.

Calibration

The S.E.I. exposure photometer is sufficiently accurate for most ordinary densitometry. If, however, density values are required to be compared with those obtained on different instruments to an accuracy of better than ± 0.04, the instrument should be calibrated against densities of known values. Strips of film carrying about 15 measured densities between 0 and 4 may be purchased from Ilford Limited.

ILFORD LIMITED · ILFORD · LONDON

SEIA/A50/S

Printed in England

Manufactured by SALFORD ELECTRICAL INSTRUMENTS LTD

Distributed by ILFORD LIMITED · ILFORD · LONDON

SEI

Photometer

—accessories for densitometry

Contents

S.E.I. Photometer accessories for densitometry

The S.E.I. Exposure Photometer is described fully in the Instruction Book supplied with the instrument. The present book describes accessories which provide a means for conveniently using the S.E.I. Photometer as a densitometer for transparencies and reflection images. Negatives and prints from miniature size upwards may be accommodated.

The Densitometer Accessories comprise :—

1. Densitometer Supplementary Lens Attachment, to focus the photometer on to the negative.
2. Densitometer Illuminator, containing transformer, 6-volt lamp, opal diffuser and cradle to support the photometer.

   WARNING : This apparatus must be used only with A.C. Main Electric Supply.
3. External Supply Adaptor, to convert the photometer to mains operation.

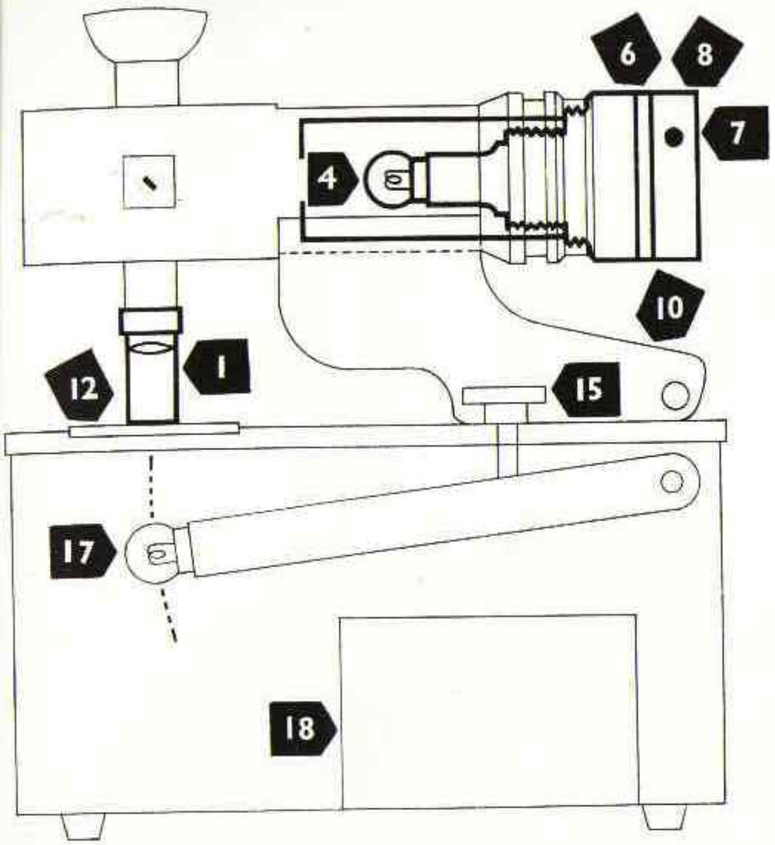
General arrangement

The general arrangement of the photometer and accessories is shown diagrammatically in Fig. 1, and their actual appearance in Fig. 2.

The photometer is mounted in a cradle on the *Illuminator* so that its telescope points at a white diffuser which forms a window in the top of the illuminator box. The diffuser is illuminated from inside the box by a small lamp whose distance from the diffuser can be varied ; thus the brightness of the diffuser can be adjusted. The telescope of the photometer is provided with a *Supplementary Lens Attachment* (Fig. 7) which carries a lens of such a power that the upper side of the diffuser can be focused in the eyepiece. This lens is mounted in the upper part of a small extension tube, blackened on the inside and provided at its lower end with a diaphragm having a small circular opening through which the diffuser is viewed. The tube of the supplementary attachment is provided at its lower end with a cut-away window for use in making density measurements of reflection images (see page 7). This window is provided with a sleeve by which it can be closed.

The *External Supply Adaptor* (Fig. 8) takes the place of the normal battery container and lamp used for exposure estimation. It consists of a tube to fit inside the body of the photometer and carries a lamp to illuminate the comparison ' spot ' of the photometer.

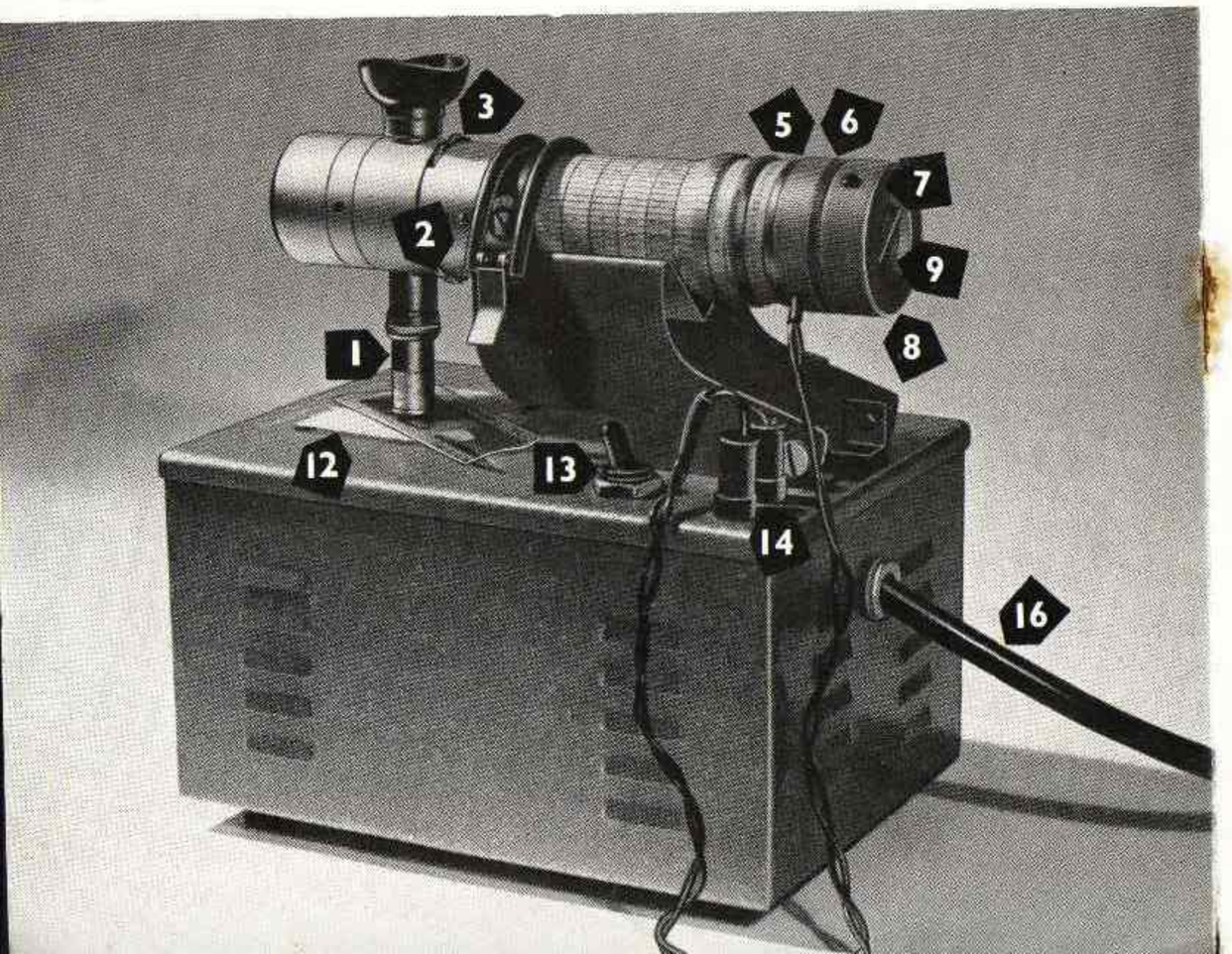
The two lamps are of the same type and wattage, 6-volt 6-watt. They are fed on parallel circuits from a small transformer which is mounted in



Figs. 1 and 2. *General arrangement*

Key to numbers :

1. *Supplementary lens attachment*
2. *Range shift disc*
3. *Colour matching disc*
4. *External supply adaptor*
5. *Base ring of external supply adaptor*
6. *Locking ring*
7. *Button switch*
8. *Operating ring*
9. *Rheostat control*
10. *Cradle*
12. *Diffuser*
13. *Switch for illuminator lamp*
14. *Plugs for photometer lamp supply*
15. *Zero adjusting screw*
16. *Mains lead*
17. *Illuminator lamp*
18. *Transformer*



the base of the illuminator. Any variations in mains voltage thus produce equal relative variations of output from the lamps; it is thus unnecessary to read and adjust the galvanometer in the photometer during the progress of densitometric work.

To set up the S.E.I. Photometer to measure densities of transparencies

1. Make sure that your electricity supply is A.C. 50 cycles/sec. Find out the nominal mains voltage. If the mains voltage is not 240 volts the connections to the illuminator transformer should be altered as described on page 9.

2. Mount and clamp the S.E.I. Photometer in the cradle of the illuminator so that the telescope points vertically downwards at about the centre of the diffuser. In this position the cradle should just occupy the scale space between the rotating end and the metal housing at the other end of the Photometer (Figs. 2 and 3).

3. Slip the supplementary lens attachment over the telescope. Note that the telescope lens itself should be pushed in as far as it will go and, for measuring the density of a transparency, the aperture in the side of the attachment must be closed by the sleeve provided (Fig. 2).

4. Set the knurled cradle stop screw so that the end of the supplementary attachment cannot accidently break the negative or diffuser window (Fig. 5).

5. Unscrew the operating ring at the end of the photometer (Fig. 2) and withdraw the battery container and lamp.

6. Insert the external supply adaptor to take the place of the battery container which you have just removed, and screw this adaptor into place (Fig. 6).

7. Screw the operating ring into the end of the adaptor, locking it with the ring provided (Fig. 2) so that the switch button is in a comfortable operating position.

8. Connect the two plugs from the adaptor to the sockets provided on the illuminator platform (Fig. 2).

9. Connect the illuminator mains lead (Fig. 2) to the supply point via a suitable earthing type (3-pin) plug.

The instrument is now ready for adjusting the zero.

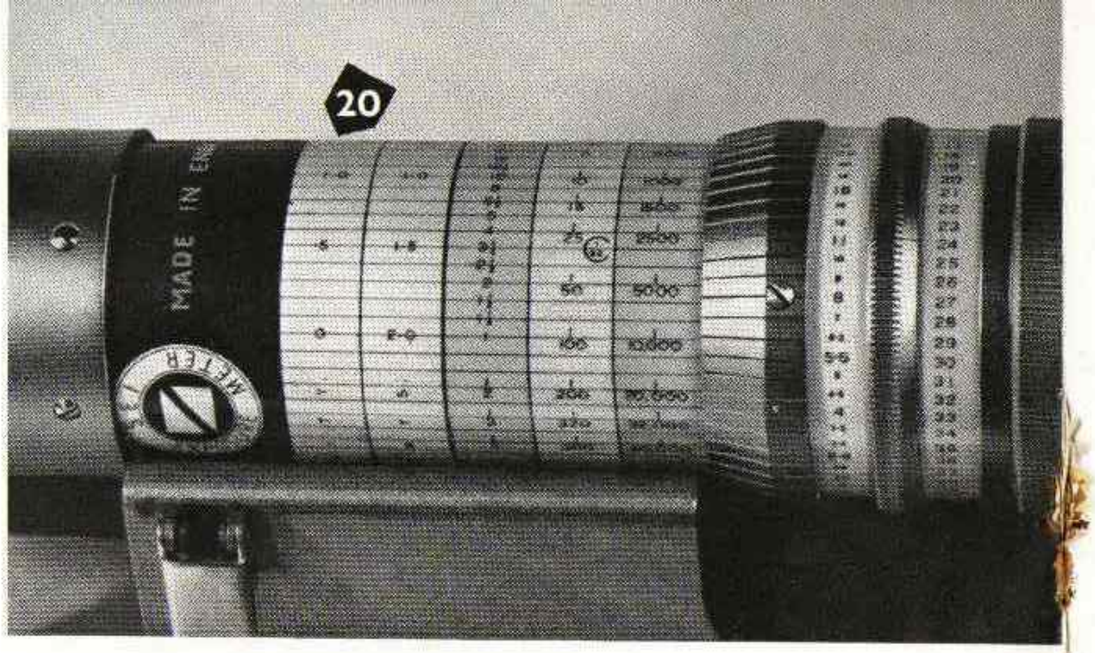
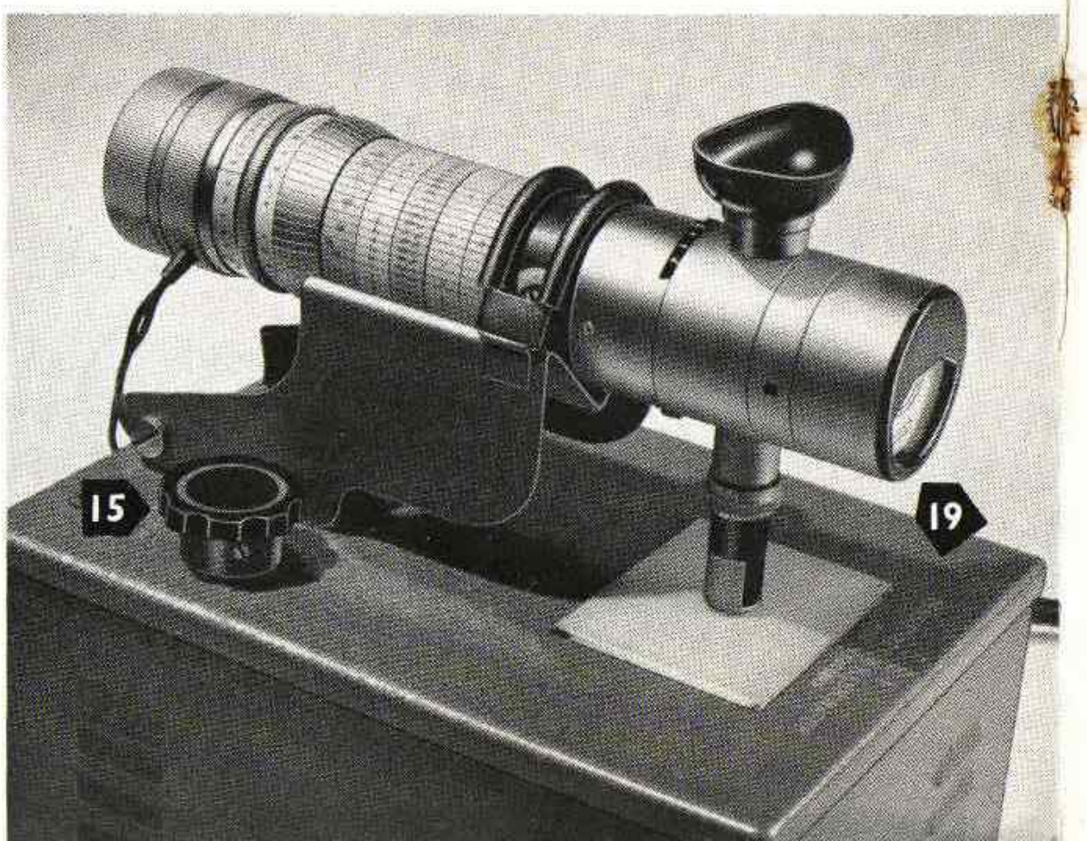


Fig. 3. *View of the Scales showing Relative Density Scale and reference mark screw. The instrument is shown recording a density value of* 0.23. *Arrow* (20) *points to Relative Density Scale*

Fig. 4. *View showing Zero Adjusting Screw* (15)



TO ADJUST THE ZERO

To enable the relative density scale of the photometer to be used as an absolute scale it is necessary to adjust the brightness of the illuminator. The procedure is as follows:—

10. Turn the operating ring of the photometer until the screw head in the graduated tapered ring corresponds with the zero of the relative density scale. This screw appears opposite 27° on the film speed scale and is in line with the reference mark of the photometer (Fig. 3).

11. Focus the eyepiece on the photometric spot.

12. Set the brightness range selector to the white index mark for densities between 0 and 2.0 (for higher densities, see 17 below), the colour-of-light corrector to the yellow index mark and the photometer rheostat control (Fig. 2) to about its mid position.

13. Look into the eyepiece, press the button switch in the operating ring and turn the densitometer zero adjusting screw (Fig. 3) until photometric balance is obtained.

Note: If the spot is yellower or whiter than the surrounding field, turn the rheostat control until colour balance has been restored. This must be done before the final zero brightness adjustment is made and should, as implied in 12 above, normally be obtained with the rheostat control at about its mid position. The needle of the photometer galvanometer (19, Fig. 4) should not be allowed to go over the end of the scale, but there is no need to use the red 'standard brightness' mark for this work.

TO MEASURE TRANSMISSION DENSITIES

14. Place the transparency, emulsion upwards, on the diffuser and arrange the part to be measured exactly under the aperture of the supplementary attachment (Fig. 2).

15. Look into the eyepiece and make any slight adjustment of the position of the negative which may be necessary to bring the image of the part to be studied over the photometric spot. The cradle stop screw may be used to assist in focusing the image of the negative, but it may sometimes be an advantage not to focus too sharply. Then press the switch button and rotate the operating ring until photometric balance is obtained.

16. Read the density from the relative density scale, using the line adjoining the screw mentioned in paragraph 10 as the reference mark.

17. For densities above 2.0, change to the 'red' range selector and proceed as above but adding 2.0 to the scale values then obtained.

Precautions to be taken in measuring transmission densities

The S.E.I. densitometer is intended to measure 'totally-diffuse densities'; that is to say, the density value should be that obtained when the image

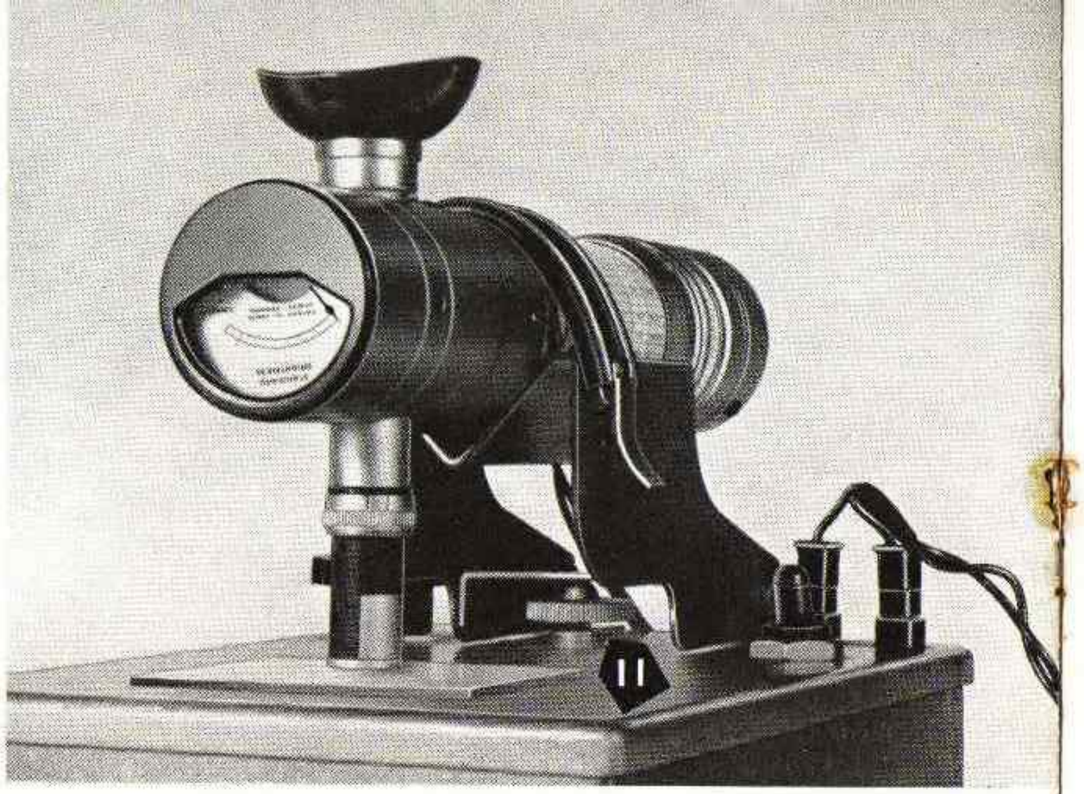
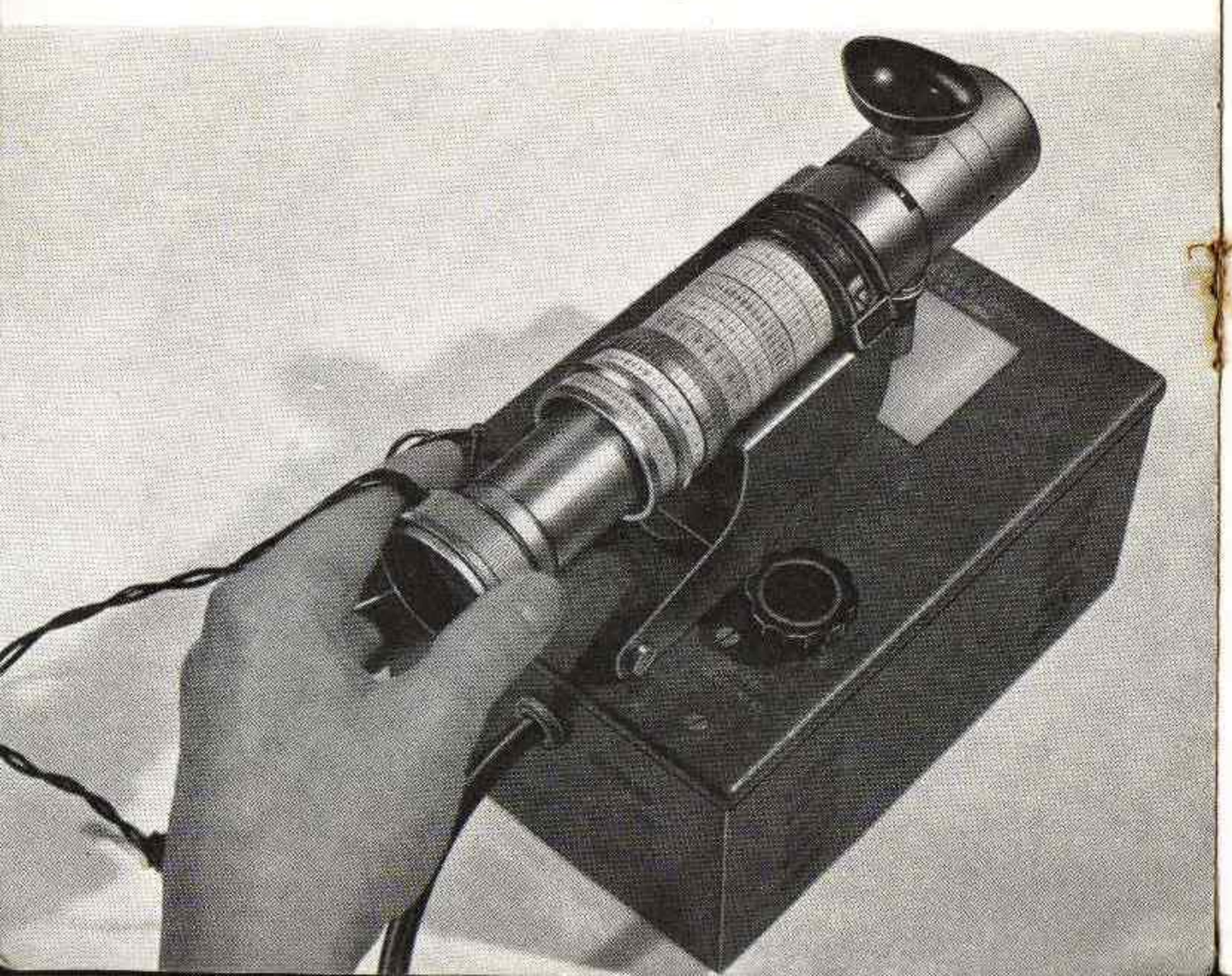


Fig. 5. *View showing Cradle Stop Screw* (11)

Fig. 6. *Inserting the External Supply Adaptor*



side of the negative is in contact with the diffusing window. If the instrument is used in a dimly lighted room and the diffuser window is masked down to a small aperture by means of a thin black mask placed under the negative and the negative itself is placed face downwards on the platform, these conditions are fulfilled. The aperture in the mask should be only sufficiently larger than the image of the photometer spot to ensure exclusion of any brighter surrounding area of negative. It has been found, however, that by placing the negative *face upwards* on the platform and the aperture of the supplementary attachment in contact with the negative, correct readings are obtained without masking provided the area to be measured covers the aperture. When these conditions are fulfilled, there is also no need to work in an inconveniently darkened room. It is for this reason that in paragraph 14 of the instructions it is advised that the negative be placed 'face upwards'.

For measuring densities which will not permit contact either with the diffuser or with the aperture, e.g. lantern slides with cover glasses, the diffuser must be masked and the room should be only dimly lighted.

The values of density obtained with this instrument from negatives which are neutral grey in colour will be directly applicable to contact printing. They will not, without further experiment, give correct printing values for negatives which are to be used for projection printing.

Measurement of reflection density

For measuring reflection densities of prints the lamp within the illuminator is switched off and the paper print to be measured is placed face up under the aperture of the supplementary attachment. The illumination must now be provided by means of an external lamp arranged so that it can shine at an angle of about 45° to the surface of the paper through the side aperture of the supplementary attachment (Fig. 7). This aperture is uncovered by turning the sleeve provided.

Although it is possible to adjust the position of the external lamp so that the white of the fixed out paper gives photometric balance when the relative density scale reads zero, it is more convenient to fix the position of the lamp relative to the photometer and obtain balance by turning the operating ring of the photometer. The photometer reading obtained with the instrument so set must be taken as the zero position and all subsequent readings must be measured from this point.

To obtain the best out of the apparatus for reflection density work, it is best to use a lamp like that used in the adaptor (6-volt 6-watt). This must be fed by a parallel circuit tapped from the same plugs as used for the adaptor.

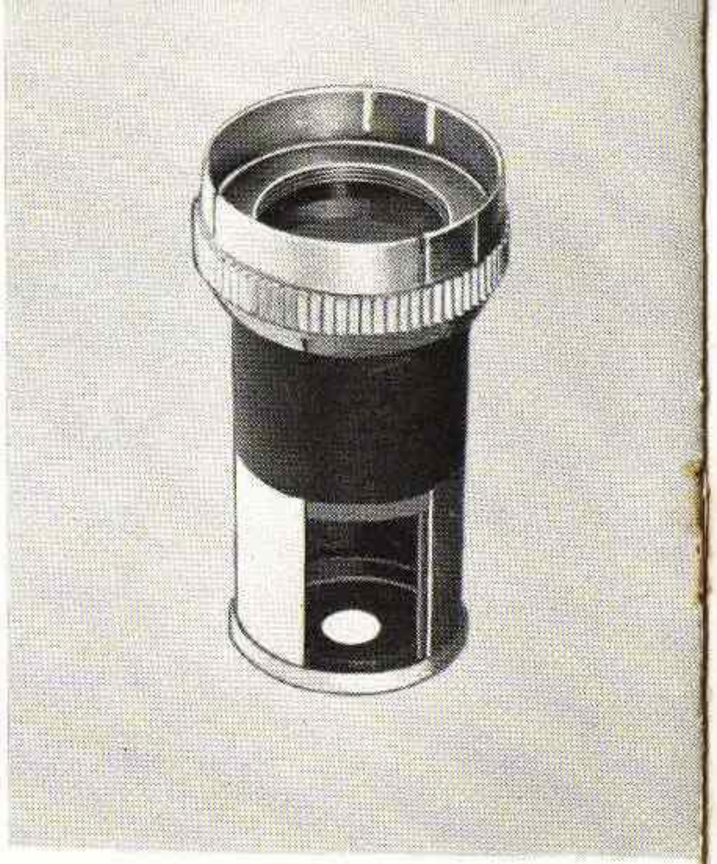
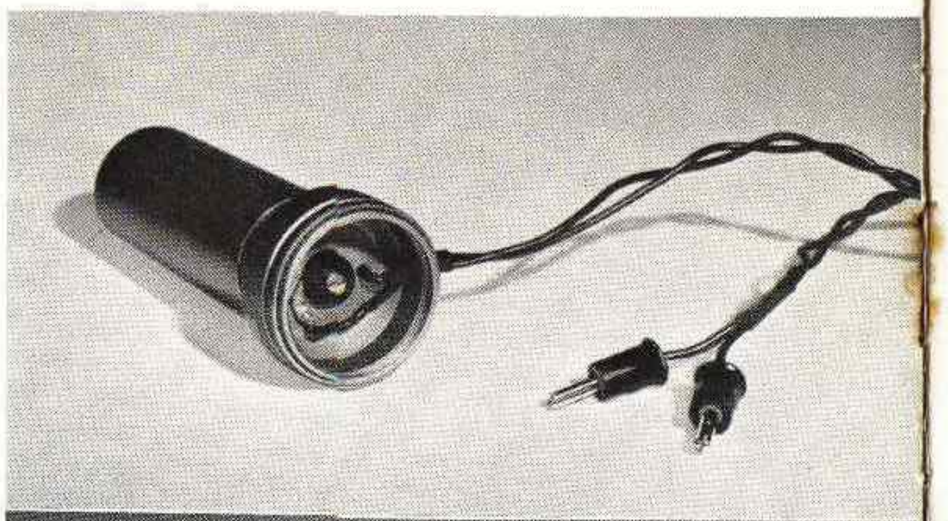


Fig. 7. *Supplementary Lens Attachment, about twice actual size, showing side window open as it would be for reflection density work*

Fig. 8. *External Supply Adaptor*

Fig. 9. *Barrel of External Supply Adaptor removed to show lamp*



Electrical connections and maintenance

Connection to A.C. mains is provided by a length of 3-core flex carrying the usual earthing wire. This flex is led through one end of the illuminator and held by a rubber fairlead ring (Fig. 2). The instrument is sent out connected for a 240 volt A.C. 50 cycle circuit. If the available voltage is other than this, the red and black wires must be moved and soldered to the appropriate connectors on the transformer panel.

TRANSFORMER PANEL

To get at the transformer panel, give a half turn anticlockwise to the slot-headed fastening clamp on the bottom of the box and lift off the top of the box. It will be necessary to push the main supply lead inwards in order to lift the lid of the box far enough to get at the transformer panel.

The instrument as supplied is wired for 240V A.C. as shown in Fig. 10.

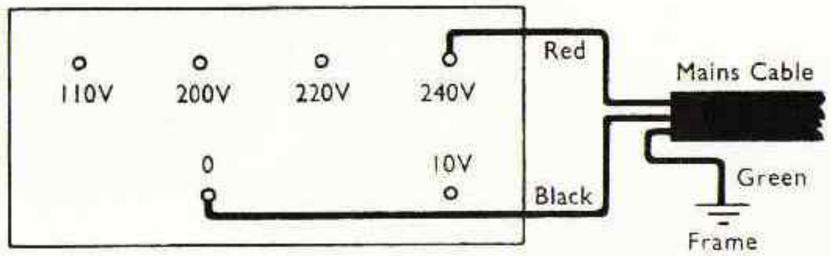


Fig. 10. Transformer panel wired for 240V A.C.

Before using the instrument on other A.C. voltages the connections of the mains lead on the panel must be altered. The connections in each case should be as shown in the following table.

A.C. supply voltage	Terminals for mains lead connections		
	Red	Black	Green
110V	110V	0V	Frame
120V	110V	10V	Frame
200V	200V	0V	Frame
210V	200V	10V	Frame
220V	220V	0V	Frame
230V	220V	10V	Frame
240V	240V	0V	Frame
250V	240V	10V	Frame

Working conversion table between speed systems.

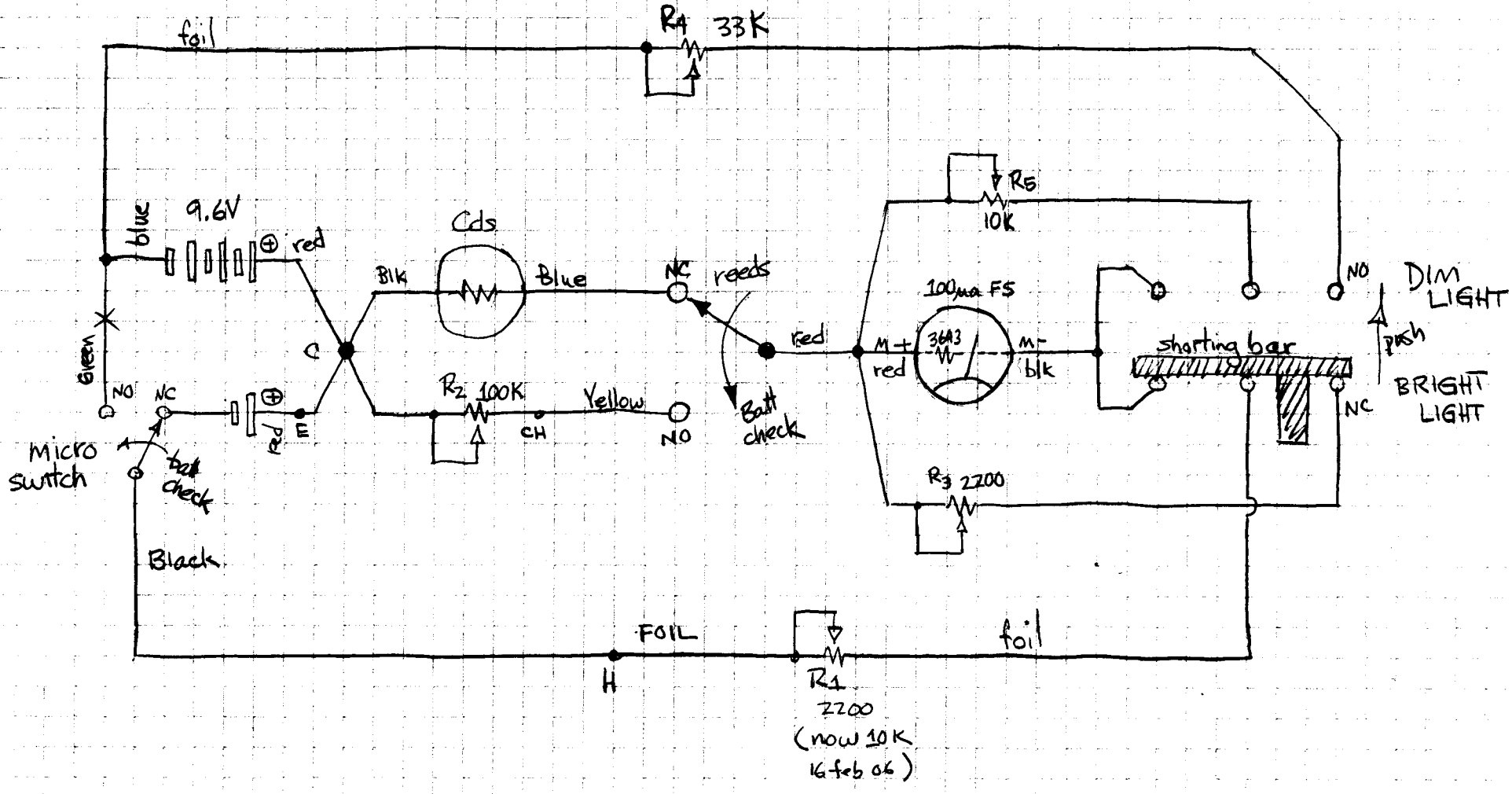
Relative Speed	Ilford Group	B.S.I. Ilford Scheiner	American Scheiner	DIN/10	British H & D	A.S.A. G.E. Weston	Wellcome*
		16°	11°	6°	80	3	2/3
1	A	17°	12°	7°	100	4	1/2
		18°	13°	8°	125	5	—
		19°	14°	9°	160	6	1/3
2	B	20°	15°	10°	200	8	1/4
		21°	16°	11°	250	10	—
		22°	17°	12°	320	12	1/6
4	C	23°	18°	13°	400	16	1/8
		24°	19°	14°	500	20	—
		25°	20°	15°	640	25	1/12
8	D	26°	21°	16°	800	32	1/16
		27°	22°	17°	1000	40	—
		28°	23°	18°	1250	50	1/24
16	E	29°	24°	19°	1600	64	1/32
		30°	25°	20°	2000	80	—
		31°	26°	21°	2500	100	1/48
32	F	32°	27°	22°	3200	125	1/64
		33°	28°	23°	4000	160	—
		34°	29°	24°	5000	200	1/96
64	G	35°	30°	25°	6400	250	1/128
		36°	31°	26°	8000	320	—
		37°	32°	27°	10000	400	1/192
128	H	38°	33°	28°	12500	500	1/256
		39°	34°	29°	16000	650	—

Keytone corrections

(Applicable to the *white* film speed index mark only).

Reflectance of keytone matched%	Typical keytones	Keytone correction to basic film speed
100	Magnesium carbonate block (' Standard White ') Fresh snow Sunset cloud fringes (not too near to sun)*	Nominal B.S. logarithmic exposure index number
80	White blotting paper Matt white card Clean white paint	+1°
65	Slightly weathered white paint	+2°
50	Old weathered white paint	+3°
40		+4°
30	Normal face tone (diffuse highlight)	+5°
25		+6°
20	Bronzed face tone (diffuse highlight)	+7°

Asahi Spotmeter K Redrawn 16 FEB 06



Cds cell ≈ 10K for f16 @ ISA in bright sun

Meter 100μa full scale, $R_m \approx 3643\ \Omega$