BRAUN

Hobby

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Dr. Gerhard Lander

ELECTRONIC FLASH UNIT

BRAUN-HOBBY

BH 100

MAX BRAUN - FRANCFORT ON THE MAIN / GERMANY

To my dear friend
Professor Dr. Harold E. Edgerton
Cambridge, Mass., USA,
the Pioneer of the modern Electronic Flash

Edition BH 100/I

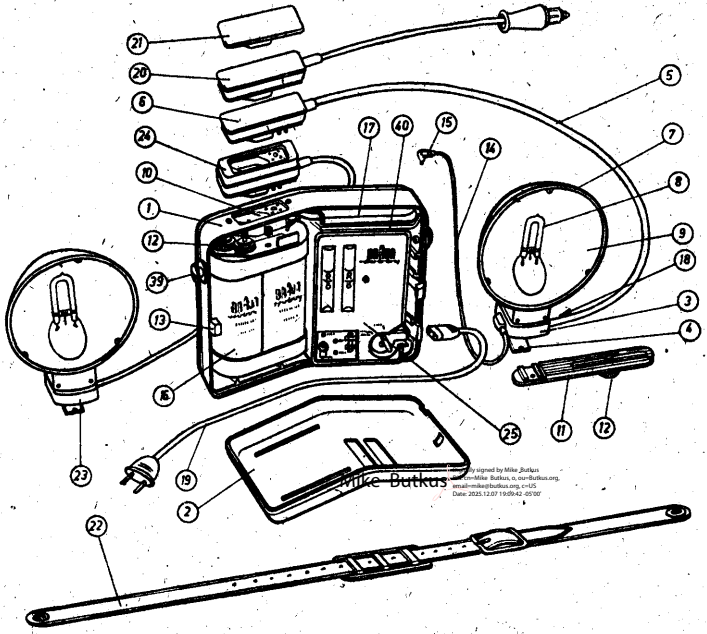
PREFACE

The history of the electronic flash dates back to the beginning of photography.

Essential elements of the structure of modern electronic flash units were existing even at that time, for instance, the storage capacitor in the form of the Leyden Jar with which Talbot generated flashes of light by spark discharges in 1851. The exposure times were very short and amounted to approximately one millionth of a second.

But progress continued steadily. At first, the shortest exposure time possible was interesting only for scientific photographs, and it was only in 1934, when the favourable properties of xenon gas as a filling agent for flash tubes were recognized. The road to the amateur unit was still far and depended on the solution of many tasks and problems. Now — weight, light output and its uniformity and duration, safety factors, design, and price had to be brought to an optimum in relation to each other.

This success was achieved in the construction of the electronic flash unit BRAUN HOBBY.



Description of Unit

The diagrams on the preceding and the following page show the main parts of BRAUN HOBBY with the nomenclature as it is used throughout this booklet.

1 Housing
2 Housing cover
3 Flash head
4 Flash head holder
5 Main cable
6 Main cable plug
7 Reflector
8 Flash tube
9 Plexiglass pane
10 Housing socket
11 Camera bracket
12 Camera screws
13 Locking spring
14 Shutter cable
15 Shutter cable plug
16 Flash capacitors
17 Safety cover
18 Flash head release
19 Power cable
20 Automobile charging cable
21 Protection plug
22 Carrying strap (detached)
23 Extension flash head
24 Adapter plug of extension flash head
25 Power supply pack (interchangeable)

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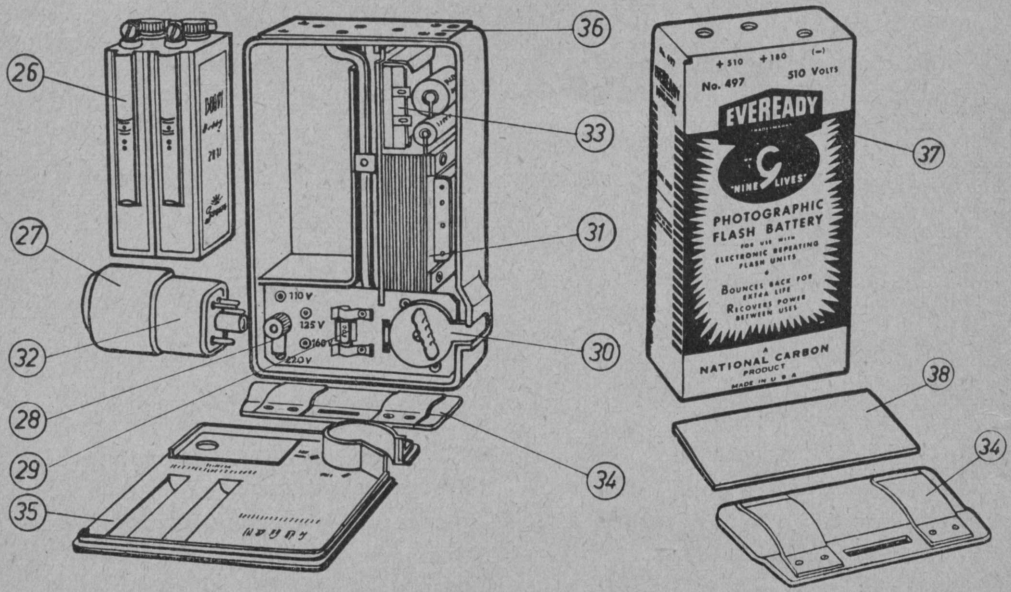
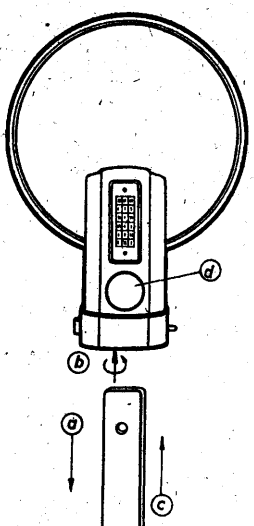


Description of Unit (cont'd)

26 Wet cell storage battery
27 Vibrator muffler
28 Voltage selector
29 Fuse
30 Converting switch (line current / storage battery)
31 Transformer
32 Vibrator
33 Rectifier
34 Spring plate
35 Cover
36 Contact plate
37 High voltage dry battery
38 Adapter plate
39 Fastening screws for carrying strap
40 Connecting plate

Handle your BRAUN HOBBY with care!



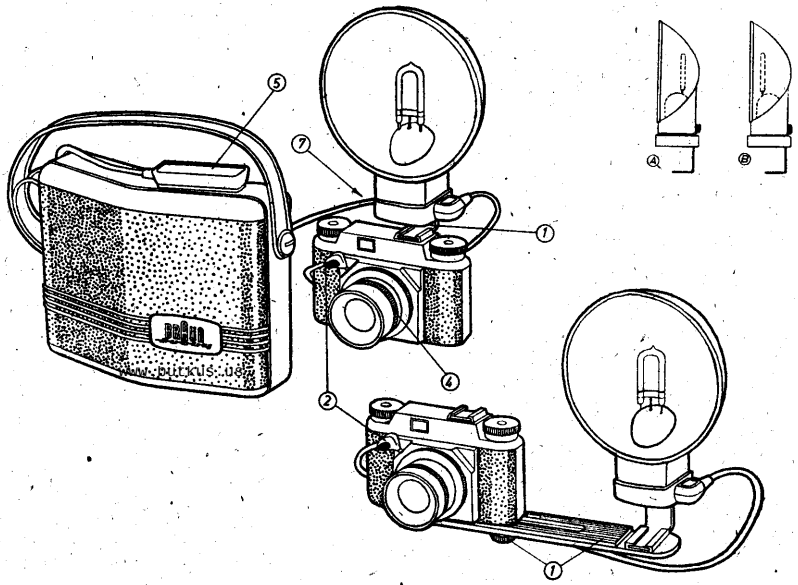
Flash operation

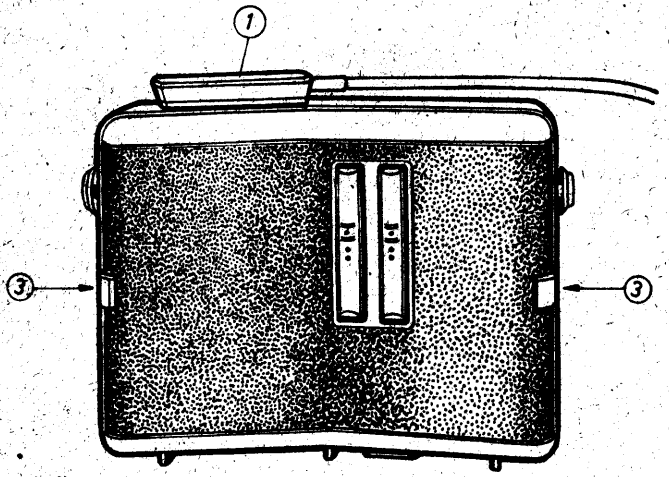
1. Slip flash head into accessory clip of camera or use camera bracket.
2. Plug shutter cord into synchronizer socket of camera.
3. Set synchro-lever of Camera (if existing) at X.
4. Prepare the camera for shooting:
   Focus the camera,
   Adjust the lens stop according to exposure table,
   Set the shutter speed: general setting $^1/_{100}$ ($^1/_{125}$) sec.
   With focal plane shutter cameras note special instructions.
5. Connect flash head plug with power pack.
6. When operating on alternating current, plug in power cable. Note correct voltage setting.
7. Turn switch on flash head down in direction of the red mark.
8. Wait until the ready light glows **(steady glow),** then make the exposure.
9. When operating with wet or dry batteries, switch off immediately.

Reflector setting from normal angle (A) to wide angle (B), and vice versa:

a) Loosen knurled screw (d), pull out angular flash head holder
b) Turn lower part of flash head for 180°
c) Insert flash head holder again
d) Tighten knurled screw

H a n d l e y o u r B R A U N H O B B Y w i t h c a r e !


5
7
1
4
2
1
A
B



Recharging the

Under all circumstances, not later than when the last ball sinks down, the battery must be recharged!

If the unit is not in use, at least every four weeks.

1. Main cable plug may be separated from power pack.

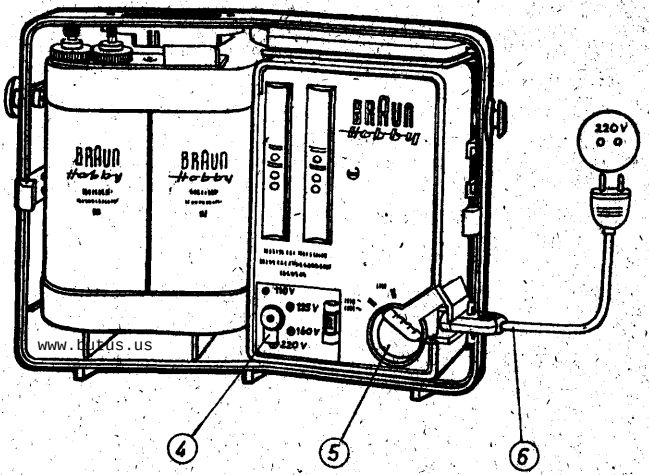
2. Check type and voltage of your power supply (the rating plate on the meter is positive proof).

   Charging with the built-in charger can be done only from an a-c outlet.

3. Take housing cover off. Push in both locking springs until the cover can be taken off. The cover should remain off during the charging process.

Storage Battery

4. Set voltage selector according to the **previously** identified voltage of your power supply.
5. Set converting switch (pull out and re-plug) to a-c power, and remove the small sliding cover from the side of the housing.
6. Connect power cable and plug this into wall outlet.
7. The charging is finished 3 or 4 hours after the black balls of the battery charge indicator have risen. When all three balls had been down, the average charging time is approx. 12 hours.



Detailed instructions for use

Remarks:

Synchronized flash means that with the release of the camera shutter, the built-in flash contact will automatically and at the precise time actuate the ignition of the flash. With the X-contact, the only one to be used for BRAUN HOBBY, it is the instant when the shutter is fully open. This is possible with all cameras having a synchro socket and which are defined as "synchronized" (or "fully synchronized"). Most cameras lacking the flash contact can at any time be synchronized (X-contact) for electronic flash units. Information can be obtained through your photo dealer or from the manufacturers of the shutters (Messrs. Friedr. Deckel, 7-13 Waakirchner Strasse, Munich 25, Germany; or Messrs. Alfred Gauthier, Calmbach/Enz, Schwarzwald, Germany). For cameras with focal plane shutters note special instructions.

A. FLASH OPERATION

1. Power Supply of BH 100

BH 100 is a convertible flash unit for operation from any household a-c outlet with voltages of 110, 125, 160, and 220 volts, 40—60 cycles; for operation with a wet cell storage battery independent of power lines; and for operation with a high voltage dry battery of 510 volts.

The power pack contains a power supply unit, which permits operation from a-c lines, or with a storage battery, as well as the recharging of the latter. If BRAUN HOBBY 100 was originally purchased for a-c operation only, it is possible to install the storage battery and the vibrator at a later date.

Please note: Connect blue cable to battery terminal with blue ⊖ mark, and

red cable to red ⊕ terminal. Push insulating hose back until cable clip is accessible.

The vibrator is keyed and can be plugged into its socket only when its nose is guided into the respective notch. The complete power supply pack can be exchanged for a high voltage dry battery without the use of tools. When operating the flash from the a-c line, the storage battery is recharged at the same time, and with the recharging process, the flash capacitors are reformed, i. e. their favourable properties — high capacity, little residual voltage, and small power losses — are preserved. When working with the high voltage dry battery, a special circuit, which is switched on automatically as the dry battery is inserted, is reforming the flash capacitors during periods of non-use. When the power supply pack is taken out, the capacitors are automatically discharged, so that there is no danger of contact voltages.

2. Preparations

The reflector can be adjusted to normal or wide angle coverage by turning the lower part of the flash head for 180°, after the angular flash head holder is pulled out. Generally, you will work with the normal setting (flash tube in the rear of the reflector). With wide angle illumination, the tube is in a position near the plexiglass pane. The longer arm of the flash head holder is pushed in more or less (height adjustment) and will be tightened in this position by the knurled screw. Now, the flash head can be slipped into the accessory clip of the camera.

If the camera has no accessory clip, the camera bracket supplied with the unit will be used. The bracket can be fastened to the camera with either the large (3/8") or small (1/4") threaded screw (which have a permanent place inside the power pack). Thus, together with the rubber coating, any camera will be held rigidly in place without shifting about.

The shutter cable which comes with the unit will fit all modern shutters.

Focal plane shutter cameras may require a synchro switch, or the special shutter cord supplied with the camera can be adjusted to fit the flash head of BRAUN HOBBY by the use of an adapter plug. These adapter plugs are available at photo shops.

With fully synchronized shutters, the synchro lever must be switched to the X-setting or the contact point, marked X, will be used. For selftimer shots with flash, the setting V may also be used.

Be careful not to place the shutter cable in front of the lens.

BH 100 is switched on with

a) a-c operation, by plugging the power cable into a wall outlet and by turning the switch on the flash head to the "On" position.

Note correct setting of voltage selector.

b) storage battery operation, by turning the switch on the flash head to the "On" position.

c) high voltage dry battery operation, by turning the switch on the flash head to the "On" position.

At the first flash of the ready light (visible in one of the side windows of the flash head) the unit is ready with about 70 % of its total output. The flickering of the ready light is then rapidly increasing until it practically becomes a steady glow: the full charge has been reached.

The flickering light is necessary when using high voltage batteries, since the voltage of the battery is falling off during the course of its service life, and because the frequency of the flicker gives you a notice when the battery has reached the end of its life.

Also when using wet storage batteries, the state of the battery charge can be judged by the frequency of the flicker.

With a-c operation, any under-voltage of the household current can be recognized.

3. Checking the Synchronization

This is generally not required with newer models of fully synchronized cameras. With older models, a test with the empty camera is recommended. To accomplish this, connect the flash with the synchro socket of your camera, open the diaphragm wide, set the shortest shutter speed, and open the camera back. Now look into the camera from the rear and fire a flash against a light wall (ceiling). If the synchronization is correct, you will see a clear, complete circle, which is the wide open diaphragm of your camera. Should you

not see this complete circle of light, but a star-like outline, it indicates that the shutter blades do not give the full diaphragm opening free at the time of the flash, and that at this shutter speed you cannot expect satisfactory results with the electronic flash. In such cases it is recommended to have the camera repaired. Turn to your photo dealer for advice. Should you want to make some exposures immediately, however, try a slower shutter speed after having checked that the flash hits the full opening.

With focal plane shutter cameras, only that instant can be utilized for the release of the electronic flash when the first curtain has cleared the entire frame of the film and before the second curtain starts to move. This condition is only given up to a certain shutter speed which generally may not be faster than 1/50 sec. For these cameras the respective instruction manuals indicate the possible shutter speed — the setting for electronic flash for release without delay (i. e. not relay-operated). For particular models note:

Alpa Alnea: Separate synchro socket for electronic flash built-in, up to 1/50 sec.

Contax: with Synchro-Switch 1366 for electronic flash, up to 1/50 sec., not faster.

Exakta: X-contact, up to 1/50 sec., not faster.

Exa: X-contact, up to 1/50 sec., not faster.

Leica: with red contact numbers: contact number 20 and 1/50 sec., or: contact number 0 and 1/25 sec.
with black contact numbers: contact number 2 and 1/30 sec.

Praktika: X-contact, up to 1/50 sec., not faster.

It should not be overlooked that with the Leica the so-called contact numbers must be set, with which the instant of contact within the shutter mechanism will be fixed.

With the Contax, the correct adjustment of the Synchro-Switch 1366 should be observed. The instructions for use, supplied by Zeiss-Ikon, inform you of the possibilities of setting and checking.

A synchronization test of these camera types can be made in a not too bright room, by putting a piece of unexposed film (most practical is a commercial or copying type film) into the camera, removing the lens and then firing a synchronized flash by means of the camera release. The reflector should be placed directly in front of the lens bayonet.

If the synchronization is correct, this piece of film, which must be looked at in dim light (not in direct sunlight), will show the entire frame with clearly defined outlines. Your photo dealer will be glad to assist you in making this test.

4. Flash as the Main Light Source

In the dark or under poor lighting conditions which are of no effect to the emulsion, besides the usual operations like focusing, etc., the following will be noted:

The lens opening (which with the short and fixed duration of the flash is the only factor deciding the exposure) will be set according to the exposure

table. In such cases, the shutter speed is rather unimportant (see page 57). With focal plane shutters (Alpa, Contax, Exakta, Exa, Hasselblad, Leica, Praktika, etc.), however, a maximum shutter speed (see above; approx. 1/50 sec.) must be observed.

For between-the-lens type shutters, a standard shutter setting of 1/100 (1/125) sec. is recommended. Although your camera may be equipped only with a simple shutter which is not capable of speeds faster than 1/50 sec., BRAUN HOBBY gives you a chance to "freeze" fast moving objects on your film. The flash duration of BRAUN HOBBY is approximately 1/1000 sec. and with it you can — as long as any extraneous light is dim enough — open entirely new fields for your camera. Even with cameras not synchronized, shots with 1/1000 sec. are possible if you employ the open-flash method. The procedure is as follows: **Open** the shutter (Time or Bulb), **fire** the flash with the flash head release, then **close** the shutter again.

After the flash, switch off immediately. **Unnecessary idle running of the power pack is a waste of power and will result in less flashes per battery charging.** If, for instance, the unit is running continuously without being flashed, the battery will be exhausted after approximately two hours, i. e. all coloured balls will have dropped down and the battery must be recharged immediately. If you avoid needless idle running, you have a supply of 60—80 flashes in the freshly charged storage battery.

5. Flash as Fill-in Light

(for instance, to open up shadows in back-lighted scenes, as side-light, and for special effects)

In all cases where you use the electronic flash in addition to the existing continuous-light, you have to balance both light sources in such a way as to gain the desired effect. Firm rules cannot be given for such situations. It will be noted that the light output of the flash can be influenced by the lens opening, but not by the shutter speed, since the flash duration of BRAUN HOBBY is shorter than the top shutter speed. However, the other effective light source (sunlight at backlighted shots, etc.) can be controlled by diaphragm **and** shutter speed. In such cases, it is best to start out from the requirements of the electronic flash and to select the lens opening necessary for full illumination, or for a special effect, from the exposure table. At this lens opening, the available light requires a certain shutter speed, which will be determined with the light meter and set accordingly. If you want one or the other light source to be prevailing, this can be achieved by the appropriate setting of diaphragm and shutter. Thus it is possible to make backlighted colour shots by filling-in foreground and shadows with the electronic flash, without changing the colour values of the subject. In a case like this, you can even use the flash as main light and the sun as fill-in, by employing the shortest shutter speed and a strongly prevailing front light of BRAUN HOBBY.

6. Flash Shots on Colour Film

Contrary to other artificial light sources, electronic flash requires daylight type colour film.

Because of the **different speeds** of the various types of colour film on the market now, it is recommended to determine the guide number by test shots and to apply this to the respective material.

The following values are recommended as a guide:

Agfacolor, positive transparency, daylight, symbol LUT:	guide ≒ 50—56
Agfacolor, negative film, daylight, symbol LNT:	guide ≒ 60—66
Gevacolor, positive transparency, daylight	guide ≒ 50—56
Gevacolor, negative film, daylight	guide ≒ 56—63
Kodachrome, positive transparency, daylight	guide ≒ 50—56
Ilfordcolor, positive transparency, daylight	guide ≒ 50—56
Anscocolor, positive transparency, daylight	guide ≒ 50—56

Side-lighted exposures render good modeling and have effects like sunlight. For these cases, your photo dealer or our service stations will supply a special shutter cord, available in lenghts of 3, 10, and 15 feet. Cords of other lengths upon request.

7. Exposure Table, Development

To measure the light output of electronic flash with a common light meter is impossible. A guide number or the exposure table on page 80 serve as a

guide for setting the camera. You will also find an exposure table on the flash head of BRAUN HOBBY, in order to have these important figures always handy. For the film speed most widely used (17/10 DIN = Europ. Sch. 27 = ASA 40), the ranges of full illumination are given for the respective lens openings. The following table gives guide numbers for various film speeds. For fine grain and normal development, ADOX films were processed with ADOX developers, Agfa films with Agfa developers, and Kodak films with Kodak developers.

Guide Numbers for Black-and-White Film

DIN	Europ. Sch.	ASA	Development		
			increased	normal	ultra-fine grain
14/10	24	20	115	92	82
17/10	27	40	165	132	119
21/10	31	100	230	185	165

RULE: When shifting from 17/10 to 14/10 DIN: use the next larger lens stop
When shifting from 17/10 to 21/10 DIN: use the next smaller lens stop
When shifting from increased
to normal development: use on half larger lens stop
When shifting from increased
to ultra-fine grain development: use the next larger lens stop

On page 73 you will find an international film speed rating table. The guide number tells you in a simple way which lens opening to use at a given subject-to-flash head distance. **To arrive at the exact lens opening, you only have to divide the guide number by the measured distance in feet.** For instance, the subject-to-flash distance is 20 feet. According to the table, a film with a speed of 17/10 DIN (or Europ. Sch. 27, or ASA 40) has a guide number of 165. This will give you a lens opening of: guide number divided by distance, i. e. 165 : 20 = f/8. Note, however, that the guide number gives only a rough estimate of the intensity of light at a certain distance. The reflections from walls, etc., which also influence the exposure, are not taken into consideration at all. This must be considered especially with colour shots, where the shadows may get an undesired tinge, resulting from reflected light. On the other hand, the latitude of photographic emulsions, at least of black-and-white film, is large enough to compensate for minor discrepancies. The guide number is not valid for close-ups under 6½ feet, and it is advisable to make a few test shots in such cases.

It is the light intensity of the subject which is important to photographic exposures, i. e. the quantity of light falling upon the square inch. The constructors of the BRAUN HOBBY reflector have made it possible that this quantity of light falling upon an area within the normal exposure angle and even exceeding it (see page 57) is extensively constant; i. e. a uniform illumination free of streaks.

But the subject-to-flash head distance decides upon which area the total

light output of the reflector is falling, and thus is responsible for the light intensity of the subject.

This explains also that when the light is falling upon a level subject at an oblique angle, which would be the case when using side-light, the full guide number cannot be employed. A guide may be given that the lens must be opened one full stop more, when the flash is coming from an angle of 35°. (This is the angle between the medium perpendicular of a level subject and the optical axis of the reflector, the so-called angle of incidence.)

The given guide numbers are based on the average reflection characteristics of medium-sized rooms, with light-coloured walls, dark floors, and white ceilings. Halls and large rooms require a full stop more exposure. Outdoors and in the dark, the lens should be opened for 1½ or 2 full stops more than given by the exposure table, since usually there will be no reflecting surfaces. **If your "flashed" film is to be developed at your photo shop, let the dealer know that the film has been exposed by electronic flash.**

If you do your own developing stick to your proven developer, but determine by tests how much increase in developing time is required. Electronic flash exposures tend to be flat and very soft in contrast. But this effect can be compensated for by over-development. Note the instruction sheet for your developer which usually contains an appropriate reference. An increased developing time of 30—50 % gives you well-balanced negatives. An increased graininess is not to be expected in the same ratio as with other exposures. The guide number depends on many variables, for instance:

1. Light transmitting quality of the lens.
   With two lenses of different manufacture, but of the same speed, or with any of two lenses closed down to the same lens stop, the light transmitting quality may be different.
2. Shutter tolerances are not too important for the flash (see page 56), but the effectiveness of the available ligth might be influenced by them.
3. Film speed tolerances of black-and-white film amount to one full lens stop, of colour film only to ½ stop.
4. The influences of developer, developing time, and temperature are known from normal exposures already.

In order to adapt your special working habits, camera type, lens, developer paper grade, etc., to electronic flash, it is recommended that you make your own standardization tests which will give you "your guide number".
Judge your test shots as follows:

Correct exposure (guide number): details in shadow areas, highlights not blocked up

(High intensity reciprocity failure prevents the latter, so that overexposures generally will not occur.)

Correct development: negatives of sufficient density and contrast to be readily printable on normal or hard papers.

Defect:	lack of density	use smaller guide number
	excessive density	use larger guide number
	lack of contrast	increase developing time
	excessive contrast	decrease developing time.

If on the same roll of film, you have shots exposed by daylight only and some only by flash, and you do not want to increase the developing time, look for information at the table on page 23. As a rule, if the type of developer is not known (if a processing lab is doing the work), and in order to obtain a uniform density on the entire roll, it is recommended, when "flashing", to open the lens for one stop more than obtained from the exposure table.

Two other methods to expose a roll of film alternately with daylight and flash allow the use of the given guide numbers. Those shots **without** flash must get **less** exposure time than normal by closing the lens down for about one stop. In this case, the developing time will be as for "flashed" film, i. e. 30—50 % longer than normal.

However, this method cannot be recommended for very constrasty subjects, back-lighted shots, for instance.

It is also possible to expose the daylight shots as usual, but to develop the film in fine grain developer not longer than 30 % over normal. This procedure, however which is the better of the two, cannot give you best results.

8. Continuous Operation

For several flash pictures taken in rapid succession, some limitations imposed by the load capacity of the flash tube, must be observed.

Just as the shutter will not stand to be cocked and tripped with 1/500 sec. at intervals of ½ second for a long period of time, the flash tube will not stand continuous flashing within the time limit required to charge the capacitors.

If it should be necessary for any reason to fire several flashes in rapid succession you can, of course, utilize the efficiency and short re-cycling time of BRAUN HOBBY. **When doing this, however, after no more than five consecutive flashes, you will have to pause for several minutes in order to give the flash tube a chance to cool off.**

Each gas discharge tube develops heat when the current surges through at the instant of the discharge. Since hereby the gas pressure is changed, all the other specific properties of the flash tube are changed, too. This applies to all types of flash tubes. Therefore, attention must be given, that the tube does not get too hot, and a pause to let it cool off must be provided.

The re-cycling time (the time from the last flash to readiness) is subject to variations insofar as the electrical components may show tolerance deviations. Furthermore, this time also depends on the state of the battery charge. When the unit is operated from the power line, voltage deviations will influence the re-cycling time.

A continuous operation with the high voltage dry battery is limited due to its specific properties. These batteries are built for temporary operation only and they recover strength during rest periods. A continued excessive use of the battery will shorten its service life by causing physical and chemical changes in the battery. Those photographers who shoot relatively long picture stories should remember this fact, and for such cases it is recommended to use alternately a second battery.

To get the maximum number of flashes from one battery, unnecessary long standby periods should be avoided. Also at times of non-use, the battery should remain in the power pack in order to keep the capacitors reformed. Before the battery is placed into the power pack, the flash capacitors should be reformed on the power line. To accomplish this, the unit will be connected to the power outlet for 20 to 30 minutes. Thereafter, about 10 flashes will be fired within 5 minutes. Now, put the dry battery immediately into its place. After the shelf life of the dry battery has expired (the ready light comes very late and flickers at long intervals), it can remain in the unit for another month to keep the capacitors reformed. Within this time, the old battery should be replaced by a new one. To reform the capacitors on the power line (as described above) is not necessary now. The best storage for spare batteries is provided in a refrigerator, in a dry, cool spot, between 32 and 40° F. (not in the deep freeze compartment!). After 6 months it will have lost only about 5 % of its power. Before use it should be exposed to normal room temperature for at least 6 hours, so that it will reach the operating temperature.

9. Synchronized Operation of Several Units

use of extension flash head

In order to obtain special light effects, for instance with portraits, nudes, colour and architectural shots — especially for professional work — the use of several BRAUN HOBBYs is recommended. For this purpose, you have to plug a "triple outlet" into the synchro contact of your camera. This outlet may be obtained through your photo dealer, or from Messrs. Gauthier, Calmbach/Enz, Germany. Up to three BRAUN HOBBYs can thus be connected which will flash simultaneously when the shutter is released.

It is also possible to connect one or more flash heads to one power pack. In this case, the total light output of the unit is about equally divided between the two, or more, flash heads. It will be practical to use one flash head as the main light and the other one as fill-in or to illuminate the background. For this purpose, the extension flash heads are provided with a 15 foot cable. With synchronized connection of several units over the triple outlet, there will be no overload on the shutter contacts. It is recommended, however, to refrain from a continuous operation of this kind with Compur and Synchro-Compur shutters, although even then the load on the shutter contacts in part considerably lower than with the use of only **one** flash unit of other manufacture. The combined use of BRAUN HOBBY with models of other make will be at your own risk!

It will be best to determine the lens opening to be used by a trial shot. The following information may serve as a guide:

If two BRAUN HOBBYs are used, one of which serves only as fill-in or for background illumination and does not contribute to the main light (with portraiture, for instance), the guide number remains unchanged and is computed on the basis of subject-to-front light distance. If both units are used as front light, so that their combined light output illuminates the same area, the subject will receive twice as much light, and the lens can be closed down one full stop.

Correspondingly, if **two** flash heads are connected to **one** power pack and only one is used as front light, while the other one serves as background illumination or fill-in, the lens must be opened one stop more than indicated by the exposure table. If both reflectors illuminate the same area, however, the values given in the exposure table remain unchanged.

B. RECHARGING THE STORAGE BATTERY

1. Battery Charge Indicator

On the back of the power pack, the battery charge indicators (three coloured balls) of the built-in storage battery can be seen. They are covered by the acidproof cover of the power supply unit, thus giving added protection from possible defects. It may happen that some balls will stick above the acid level. By tilting the unit you will get them floating again. The storage battery is a spill- and shockproof lead cell accumulator of 4 volts with a capacity of 2.4 ampere-hours. The manufacturer, the Firm Sonnenschein, gives

for their photo-flash batteries the following instructions, which are applicable if the battery was delivered in a dry state, and which should be given to the servicing station. Generally, your BRAUN HOBBY was delivered with a storage battery which was filled and recharged twice, so that you can skip the following paragraphs with the exception of "Maintenance after Preparation for Service".

a) Filling of battery:

Unscrew the vent caps. Fill battery with chemically pure sulphuric acid for storage batteries (specific gravity of 1.28) up to the lower mark. It is recommended to use the small "Sonnenschein" acid siphon KS.
After the filling, a pause from 2 to 3 hours is required. During this time, the acid level rises automatically to the upper mark.

b) Connecting the battery for charging:

The battery can only be charged with direct current. (BRAUN HOBBY, which is connected to the a-c line, provides the d-c by means of the built-in battery charger.) When connecting it, pay attention to the polarity. Like poles belong together. Connect the positive terminal of the battery with the positive terminal of the charging cable, and the negative terminal of the battery with the negative terminal of the charging cable.

c) Charging:

The charging is done with a maximum of 250 milliamperes. The charging will be continued until the voltage and the specific gravity of the acid have reached a constant value. Each fully charged cell has a voltage of 2.6 to 2.7; the specific gravity of the acid is 1,280. The increase of the specific gravity of the acid can be observed by the rising of the coloured balls. A sufficient charge is reached, when after the last ball (black) has risen, the charging is continued for 3 to 4 hours. The primary charging is usually finished after 10 to 12 hours.

d) **Acid level:**

Before the final adjustment of the correct acid level and the use of the battery, it is advisable to discharge the battery and recharge it immediately thereafter. Hereby, subsequent discrepancies of the acid level will be avoided.

e) **Discharging:**

The discharge will be done across a resistor with a maximum of 250 milliamperes. It is finished when all coloured balls have dropped down to the bottom.

f) **Recharging:**

The recharging is done as explained in par. c), above. It is finished after approximately 12 hours. After the completed charging, the acid level should have reached the upper mark. Surplus acid must be drawn out, missing acid must be replenished. Hereupon, threads and filling aperture will ce cleaned of acid residue with blotting paper and the vent caps will be screwed in. Now, the battery is ready for service.

g) **Checking for tightness:**

Any leakage appearing on vent caps or cover, which may have been caused by transportation damages, can easily be found when the battery, after completed filling and charging, is placed upside down for several hours on a clean support. Hereby, no leakage of acid or discolouration of the exterior lead parts should occur.

h) **Maintenance after preparation for service:**

The battery should be kept clean and dry at all times. The terminals will be cleaned, if necessary, and greased with an acid-free grease (Vaseline). During the further service, only **distilled water** will be used as replenishment. The acid is not exhausted and only the water evaporates. The **distilled water** will be added at the end of the recharging process, after the black ball has risen to the surface.

It must be refilled until the upper mark is reached. Now, continue the charging to secure a thorough blending of water and acid. Batteries which are not used after the charging, must always be recharged as soon as the lower ball is sinking; at least, however, every four weeks.

This storage battery was developed especially for electronic flash units. The dimensions and the weight were kept at a minimum, however, with regard to the highest possible efficiency.

In consideration of the electronic flash units, special attention was given to avoid damage by the leakage of acid (patented closing).

Instructions will be found on each cell. In addition, the following particulars are pointed out: A careful maintenance gives you a guaranty for the longest possible life of the storage battery. Therefore, it is important to keep it always fully charged.

To recognize the state of the charging, each cell is furnished with a side compartment containing three floating balls of different colours. The battery is fully charged when all three of the balls are floating in the upper part of the channel. (An overcharging should be avoided, it is harmful to the battery.) The middle and the upper ball show the state of the charging during operation. After the battery is about half discharged, the middle ball will sink. When the battery is completely discharged, the upper ball drops down also. At this state, the battery must be recharged immediately, since remaining in a discharged condition is detrimental to the storage battery. At the recharging, all balls will rise in reversed order. Should this

not be the case after an appropriate service time, it indicates that the service life of the battery comes to an end.

To keep the battery spill-proof (to avoid the leakage of acid), the correct acid level is important. For the control of the level, the float compartment contains two marks. The acid level should in no case exceed the upper mark.

Attention must be paid that all three balls of the indicator are floating at the surface at all times. **Even when you are not using the flash unit, the storage battery should be recharged as soon as one ball sinks, at the latest, however, every four weeks.** If this is observed, the battery will remain in a good electrical condition for a long time. The storage battery reaches its full capacity only after several chargings and dischargings. Thereafter, a fully charged battery will deliver approximately 60 to 80 flashes.

When the first ball starts to sink, you have approx. 50 flashes in reserve, when the second ball sinks, about 20. If you have to make numerous flash shots, you can go ahead until the last ball drops down. But if you then continue to flash, you will damage the storage battery. It will be absolutely necessary to recharge it immediately. In no case may it be left discharged any longer. BRAUN HOBBY is furnished with a built-in charger, so that it can be recharged quite easily. To accomplish this, the cover of the power pack is removed as shown on page 12. But first find out the type and voltage of your local power supply.

2. Charging on the A-C Power Line

Charging with the built-in charger can be done on a-c outlets only! For d-c power, a special charging cable is needed!

Since a direct current of approx. 250 milliamperes and of about 5 volts must pass through the battery for the charging, BRAUN HOBBY contains a transformer which reduces the available a-c voltage to the charging voltage.

This low voltage is then converted by a selenium rectifier and conducted into the battery.

The voltage selector in the power supply pack will be set according to the available line voltage. Thereafter, switch over the converting switch (line current/storage battery). Remove the small sliding cover from the side of the housing. Now, the power cable can be plugged in. As long as it is connected to the wall outlet, the storage battery is being charged and at the same time the flash capacitors are reformed.

Finish the charging by pulling the power cable out of the wall outlet, approximately 3 od 4 hours after the black balls of the charge indicator have risen to the surface. Thereafter, remove the power cable from the power supply pack and set the converting switch to storage battery operation. Put the small sliding cover back into its place at the side of the housing. The housing cover should stay off during the charging. The charging takes about 12 hours, or one night. To overcharge the storage battery is just as detrimental as leaving it unattended when discharged. The storage battery, besides the flash capacitor (see the respective paragraph), is the only element of the

unit which requires a certain degree of maintenance. This is very simple, however. In regards to replenishing distilled water, which becomes necessary from time to time, ask your photo dealer for advice.

3. Charging on the D-C Power Line

Because of the built-in transformer, the charging cannot be done on a d-c outlet, since direct current cannot be transformed. If you have only direct current at your home, the normally furnished power cable cannot be employed and the DC charging cable must be used. The ⊕ marking should light up. If this is done directly from the d-c outlet, the available voltage must be reduced to the charging voltage by a resistor. This charging method can only be recommended, however, when no a-c outlet is available, since it is very uneconomical. It would be preferable to charge the battery in the office, or any other place, where you have access to alternating current.

The plug of the d-c charging cable contains a socket to which a table lamp, serving as resistor, will be connected. The correct polarity of charging cable and wall outlet must be observed. The ⊕ marking should light up. If this is not the case, reverse the charging cable plug. Only then will the charging cable be connected to the power pack.

When the battery is charged on direct current, the power pack must remain closed, and the cover will under no circumstances be taken off as long as the charging cable is connected to the outlet, since contact voltages may occur.

Further will be noted that the table lamp should have a 25 watt bulb when using 110 volt d-c, and a 60 watt bulb when using 220 volt d-c.

Deviations to a higher wattage are detrimental to the storage battery, while deviations to a lower wattage will prolong the charging time.

4. Charging in an Automobile

To accomplish this, the charging plug of the automobile charging cable, which can be obtained through BRAUN service stations, is plugged into the housing socket of BRAUN HOBBY. The automobile plug is then connected to the 6 volt motor car battery. For 12 volt car batteries request special cable. Use the power outlet of your car, generally by pulling out the cigar lighter. The charging is finished as described above.

5. Fuse

The power supply pack contains a fine-wire fuse (300 milliamperes, medium delay action) for the protection of the transformer. It will blow upon the inadvertent connection to direct current, or an a-c power line of higher voltage than at which the voltage selector is set. The fuse may be easily exchanged after unscrewing the cover plate. Only a fuse of 5 x 20 mm, 300 ma, medium delay action, may be used.

6. Maintenance of the Flash Capacitors

If the flash unit had not been in use for a longer period of time, it is absolutely necessary to reform the electrolytic capacitors from time to time, i. e. to

preserve their electrical properties. BRAUN HOBBY has been constructed in such a way that this process is to a great degree performed automatically. With storage battery operation the electrolytic capacitors are automatically reformed at the periodic recharging of the storage battery, except when the charging is done with direct current or in an automobile. With high voltage dry battery operation, a special circuit performs the reforming process, as long as the dry battery is not taken out of the power pack.

With a-c operation, the regular reforming of the capacitors can be disregarded, since in this case it will not be at the expense of the number of flashes from wet or dry battery. Only the re-cycling time will be somewhat longer, which remains within reasonable limits, however.

This can be avoided by connecting the unit for 20 minutes to an a-c power outlet every four weeks. Hereafter, 10 flashes at intervals of 30 seconds should be fired.

If your BRAUN HOBBY has not been used for a long period of time, the capacitors should be reformed before any wet or dry battery operation. Otherwise, a fraction of the energy is wasted for the reforming process. Please observe the following rule, especially when using high voltage dry batteries:

Period of non-use without built-in dry battery	Reforming time
1 day	10 minutes
1 week	20 minutes
6 months	12 hours

Subsequently, fire 15 to 20 flashes at 90-second intervals and insert the dry battery immediately thereafter.

C. TRANSPORT OF THE FLASH UNIT

When you are on a journey with the BRAUN HOBBY, it is advisable to fasten the flash head at he power pack, in order to have one single unit which can be slung from the shoulder. To accomplish this, insert the **shorter** arm of the flash head holder into the flash head, and put the longer arm of the flash head holder into the fastening device on the bottom of the power pack. It is recommended to secure the main cable under the buckle of the carrying strap and not to coil it anywhere, in order to keep the unit ready for shooting.

BRAUN HOBBY is supplied with a protection plug, which will cover the housing socket in cases where power pack and flash head are carried separately, to prevent the penetration of rain, snow, and dust.

Useful knowledge from theory and practice

1. Flash Tube and Concept of Colour Temperature (Degree Kelvin)

For electronic flash units, a tube filled with a rare-element gas (usually xenon, with an admixture of other rare gases) is utilized, through which a current of a very high voltage is surging. This causes the gas content to glow intensely and briefly and thus a brilliant flash of light is emitted.

The current is drawn from a capacitor which is discharged through the flash tube in a surge, so that the entire process occurs in a very short time. The light emitted at this discharge is especially suited for photographic exposures on black-and-white and on daylight colour film, since it has essentially the same spectral composition as "mean sunlight".

For the characterization of the spectral similarity of two different light sources, the concept of colour temperature of the illuminant or light source is used. This conception is explained by the following.

To arrive at statements about the radiation qualities of various substances at high temperatures (temperature radiation), in physical science a substance is used whose radiation properties can be represented as generally authentic in different wave lengths and of which theoretical deductions can be made without depending on the matter of the substance. — Within the visible range, the wave lengths of different colours are between 400 and 800 mμ. One mμ (pronounced millimew) is the symbol for a length of .000,001 millimetre.

This substance is the so-called "black body" which is absorbing all radiation falling upon it. For practical use, it will not be sufficient to have a substance which appears black to the eye, but which is still reflecting a part of the radiation that strikes it. Moreover, our eyes cannot judge the absorbing powers (the blackness) within the range of invisible wave lengths. The black body is made by using a hollow space with opaque walls which contains a small opening. A ray of light falling into the hollow space is reflected many times from its walls (which additionally may be blackened) and each time a large part of its energy is absorbed. If the absorbing power of the inner wall is 95 %, for instance, after the first reflection only 5 % of the total energy will be left. After the second reflection it will only be 5 % of these 5 %, or 2.5 ‰. Should the ray come out of the opening after repeated reflections, its energy will be so small that it may be neglected and we can speak of a total absorption, even disregarding to a great extent the substance of the body. (Make a test by drilling a hole into a cigar box and painting it black inside and out. In any case, the opening will be blacker than its surrounding area.)

If the black body is heated to a high temperature, by means of an electric heating coil, the opening mentioned above will radiate and it is possible to measure or calculate (Planck's formula) the spectral distribution of the radiation at different temperature. Thus the desired radiation standard is obtained to which the other illuminants (also our flash tube) can be brought into relation. Herewith, it is sufficient to use one single figure to indicate

the spectral radiation properties of the black body, viz., its temperature, which is stated in degrees Kelvin (° K). This temperature scale is a continuation of the centigrade scale, but having no negative values, since the zero point is fixed at — 273° Centigrade (i. e. absolute zero, precisely — 273.15° C.). Therefore, 0° C. are + 273° K.; — 20° C. are + 253° Kelvin, and the boiling point of water under normal pressure is at + 373° Kelvin (+ 100° C.).

A given light source generally has not the same spectral distribution of its radiation as the black body. But if this distribution is measured and recorded, a curve is obtained within the visible range (interesting us in this respect only) which may be compared with one of those of the black body, and a curve will be found that coincides approximately with the given light source. The radiation curve of the black body thus selected is valid for a certain temperature T (° Kelvin) of the black body. This value of the temperature is taken over and designated as the colour temperature T of the given light source, even disregarding its actual temperature.

Therefore, one single number will be stated for the given light source (not the black body) which will adequately characterize its spectral properties. How far the approximate coincidence of the spectral curves is selected, cannot be exactly fixed. For measurements, the intensity within the red (approx. 700 mμ) and the green (520 mμ) range are usually compared with those of the black body. It would be senseless, to state the colour tem-

perature when the radiation deviates extensively from that of the black body, for instance, with selective light sources (sodium discharge lamp).

For daylight, as the main light source for photographic exposures, the following colour temperature values (according to Taylor) can be given:

Direct sunlight	5,000 — 5,800° Kelvin
Daylight, i. e. sun on clear sky	5,700 — 6,500° Kelvin
Daylight at overcast sky	6,700 — 7,000° Kelvin
Daylight from clear blue sky (according to Bouma)	14,000 — 50,000° Kelvin
As "mean sunlight" may be given	5,200 — 5,800° Kelvin

In order to gain the same colour effect with an object, illuminated consecutively by two different light sources, and for the correct rendering of colour on colour film, the spectral distribution of the two light sources must adequately coincide, and the colour film must correspond to this spectral distribution.

With the colour temperature as defined above, an equivalent is given with which to check the coincidence.

The colour temperature of BRAUN HOBBY is 5,600° Kelvin, which closely approximates that of sunlight, so that the colour impressions of the subject correspond to those with sunlight, which is of importance for the translation into correct shades of gray on black-and-white film. With colour film, only the daylight type is to be used, which is balanced to the colour temperature of the daylight (Agfa-Color daylight film to 5,500° Kelvin).

From these explanations it can be concluded that exposures with mixed light on daylight type colour films are very well possible. That means that you can shoot in daylight and use the flash of BRAUN HOBBY to open up shadows, or use it for any special effect desired. Mixed light of electronic flash and other artificial light sources (for instance, room light — the colour temperature of incandescent lamps is between 2,500 and 2,800° Kelvin) on daylight colour film will result in off-balance colours. This can be avoided, however, if the electronic flash is sufficiently prevailing, by using the fastest shutter speed, so that the room light will not appreciably contribute to the exposure.

For practical use, it is important to know that with high colour temperatures, there is a shift of the colour impression towards blue, and with low colour temperatures, towards red.

At a colour temperature of 5,500° Kelvin, the maximum of the spectral distribution curve is in the middle of the visible range, at approx. 530 mμ. The electronic flash tube is required to have, besides the above mentioned colour temperature of its light, an efficiency factor as high as possible and a long service life, during which its qualities of light should remain extensively constant. The efficiency factor of the flash tube is its total light output in relation to the electrical energy stored in the flash capacitor, and which is discharged through the gas content of the tube.

The flash tube of BRAUN HOBBY has a very long service life and it will retain its favourable qualities to the greatest extent. It must be provided, of course, that the flash tube is not overloaded, since it is capable to con-

vert only a certain maximum of electrical energy per flash and to give off only a certain number of immediately consecutive flashes. The flash tube of BRAUN HOBBY has a sufficient overload capacity, so that an earlier deterioration is not to be expected when these instructions are complied with. The only possible overload is caused by a continuous operation, as described on page 28. It will result in alterations on the glass and on the electrodes of the flash tube and thereby, any misuse can be recognized.

The structure of the tube, filled with rare-element gases, is similar to that of the fluorescent light tube. The fundamental difference, however, is that the gas pressure is higher and that the tube contains two cold electrodes, whereas a third electrode, in the form of a conducting foil, serves as the ignition. The electrical apparatus necessary for the generation of the flash current, is accommodated in the power pack. The tube does not flash when the operating voltage is applied, but must be ignited by a special ignition system (similar to the ignition coil in an automobile). This ignition system is built into the flash head.

2. Generation of the Operating Voltage

The low voltage of the storage battery (4 volts) is converted by a vibrator to an alternating current which in turn is stepped up by a transformer to a peak of approximately half of the operating voltage of the flash tube (510 volts), i. e. 255 volts. This secondary a-c voltage received from the transformer is rectified by a special circuit (see pages 62 and 63), which

contains a voltage doubler, and is then conducted to the flash capacitor whose task it is to store the electrical energy until the flash is fired and to supply the operating voltage for the tube.

With a-c operation, the line voltage is also stepped up by the transformer to half of the operating voltage, and then conducted to the same voltage doubler circuit as described above.

With dry battery operation, the operating voltages for flash tube and ignition system are drawn directly from the battery.

The ready light of the flash head has been adjusted in such a way that the first glow will occur at approximately 420 volts. Hereby, also the end of the service life of a dry battery can be recognized. When the voltage increases above 420 volts, the oscillating frequency will become so high that a steady glow will be seen. Now, the operating voltage is reached.

3. Ignition

The ignition of the electronic flash is done by conducting a short current surge of high voltage (about 12,000 volts) with a frequency of about 100 kilocycles to the ignition electrode. This is starting the discharge by ionizing the gas content. The generation of the high tension is done in a similar way to the ignition system of automobiles. But there is the following difference:

At the automobile, the current, coming from the battery and passing through the primary winding of the ignition coil, is at the instant of ignition briefly

interrupted by the circuit-breaker (located in the ignition distributor). The (magnetic) energy, generated by the current and stored in the iron core of the ignition coil, cannot disappear together with the interruption of the current, but will be compensated for by an inductive current surge. This produces in the secondary coil, consisting of many windings of fine wire, the high operating voltage of the spark plugs.

Principally, the same procedure could be applied to electronic flash units. The primary, interrupted current could be drawn from the battery. In this way, however, there are two main obstacles:

1. The ignition coil would become too bulky and too heavy.
2. The shutter contacts of the camera which close at the time of ignition would be useless.

Therefore, the method of the capacitor discharge through the primary winding of the ignition coil is to be preferred. A small condenser, which in the case of BRAUN HOBBY is charged to about 150 volts, stores the energy. This voltage is aquired by subdividing the operating voltage of the flash tube.

At the instant of ignition, this condenser (with an energy of approximately 2.25 mw/s = 2.25 thousandth watt/sec.) is discharged by the camera contact through the primary winding of the ignition coil. At suitable dimensions, there will be a fading high-frequency oscillation which generates in the secondary winding of the ignition coil a high tension of 12,000—15,000 volts, which will ionize the gas content of the flash tube, i. e. make it conductive to the current. As

a result, the proper flash current will start to flow through the main electrodes and the flash capacitor will be discharged.

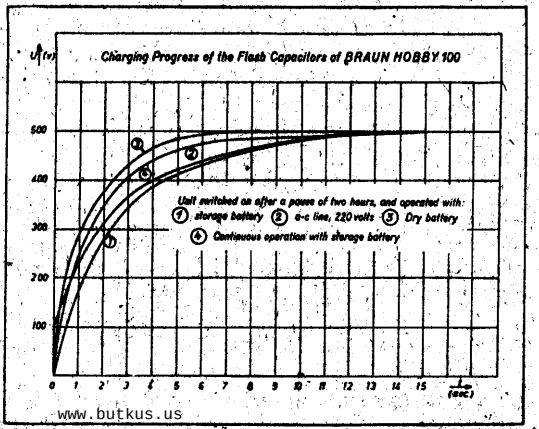
Not only will too high voltages damage the shutter contact, but also incorrect dimensions of ignition capacitor and ignition coil will cause an overload on the camera contact. The result will be a scorching of these small contact pieces and in some cases the contacts might even be welded together. The contact must then be taken out of the shutter and be replaced. With BRAUN HOBBY, the permissible peak load, as prescribed by the manufacturers of the shutters, is not exceeded in any way. By the use of most modern materials, the ferrites, an ignition system was built which incomparably preserves the shutter contact and which operates with the lowest ignition energy because it has no leakage. Furthermore, the ignition coil is impregnated to be absolutely tensionproof and has, because of its special structure, greatest safety against electric discharges.

Although the ignition requires a tension of about 10,000 volts, the shutter contact is operated only by the above mentioned low voltage of the ignition capacitor. This means a most careful treatment of the shutter contact which is, unfortunately, not provided by some other electronic flash units.

4. Operating Voltage and Readiness Indicator (Ready Light)

The charging of the flash capacitor occurs as follows: at the beginning the voltage is rising rapidly, but then it is progressively rising slower. This is due to the physical properties of all capacitor chargings, at which the

charging current is gradually decreasing as the secondary voltage is rising. It entails that the capacitor makes flashing possible within a few seconds, but that it will reach its terminal voltage, precisely speaking, only after an infinite period of time. In view of this physical condition, it is difficult to state



the charging time, because it would require a definition of the termination of the charging.

The graph shows how the charging of the flash capacitors occurs when BRAUN HOBBY is switched on. The unit is switched on at the 0 point. Curves 1 to 3 apply to a capacitor which is at the start completely discharged, as it will be when the unit is, on an average, at least two hours out of operation. Curve 4 applies when the unit was operating — after it was switched off, flashed, and switched on again. In the latter case, the flash capacitor has a starting voltage of about 100 volts. This is due to the fact that the flash tube has a residual voltage of this strength, at which the capacitor discharge is finished because a current passage below this voltage is not possible.

The curves are valid only for well-reformed flash capacitors. If the unit has not been in use for a longer period of time and if the periodical reforming of the capacitors has been neglected, it will take a longer time until the capacitors are fully charged and the ready light glows. This may take 30 seconds and longer, but it will happen only with the first flash. In such cases, you should let the unit run idle for about 15 minutes and thereby, the capacitors will be reformed as described on page 39.

Owing to a newly developed flash tube of a very long service life, BRAUN HOBBY has an exceptionally good light output. The statement of electrical energy in terms of watt/seconds is not a reliable measure for the photographically effective light output which is given by the guide number of the unit, and which is also influenced by the uniformity of the radiation within the larger or smaller illumination angle of the reflector.

5. Flash Capacitor

The flash capacitor of BRAUN HOBBY is particularly efficient. The following may be said of its construction:

In its original form, a capacitor (or condenser) consists usually of two conductive plates (electrodes) of a given size which are separated from each other by an insulating material (dielectric). You have probably seen the variable capacitor of your radio receiving set. Its capacity is generally (500 $\mu\mu$f (= 500 · 1/100,000 μf). This arrangement has the ability to store a certain charge of electricity which is conducted to and drawn from the capacitor by means of the electrode terminals. The capacity, which is measured in microfarads, increases, the larger the electrodes are and the closer they are moved together. BRAUN HOBBY employs a specifically designed type of capacitor, an electrolytic capacitor. One of the electrodes consists of a curled aluminum foil, the other one consists of electrolyte (a conductive liquid) in which the first is immersed. The insulation (dielectric) between the two is formed by a thin film of oxide (aluminum oxide), which is deposited on the aluminum electrode by electrochemical action.

Purity of aluminum foil and electrolyte, best workmanship, and a careful forming process are deciding the quality of a flash capacitor. The very thin film of aluminum-oxide, of a thickness of less than 1 μ, has to withstand highest electric field strengths without showing ruptures. At the operating voltage of 510 volts, this amounts to approximately 0.7 million volts per centimetre.

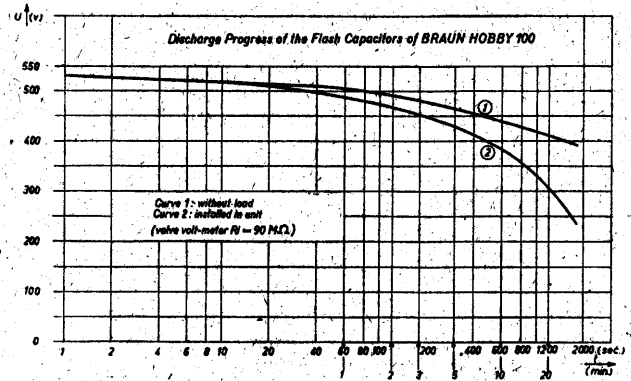
Because of their design, electrolytic capacitors have a residual charge which, in accordance with German Bureau of Standards = DIN 41331, may amount to 0.5 milliampere per microfarad and volt at 68° F. But flash capacitors must conform to substantially higher specifications. When the electrolytic capacitor has not been in use for some time, the film of aluminum-oxide will undergo some changes and it requires to be reformed. This will be done as described on page 38 "Maintenance of the Flash Capacitors", in order to reduce their residual charge to the especially low value of less than 1.5 milliampere, one of the advantages of the capacitors used for BRAUN HOBBY.

The internal power losses of the charged capacitor are so slight that it will take a long time to lose its entire charge. Consequently, after the unit is switched off without flashing when it was ready, the capacitor is carrying a high voltage for a long time, even though it is burdened by the ignition system of the flash head. The following graph shows the progress of this discharge:

Please note, therefore, that under no circumstances the capacitor should be touched without observing safety precautions, since it is holding considerable energies for a long time after it was charged!

The safest method is to remove the entire power supply unit from the power pack, whereby the flash capacitors will be completely discharged within a few seconds by means of an incorporated automatic safety switch. Another property of the electrolytic flash capacitor is its temperature-capacity relationship. The capacity is increasing when the outside temperature is rising,

and it is drecreasing when it falls. At an outside temperature of — 4° F., if the unit has been exposed to the cold for some time and has taken on the same temperature, the capacity is drecreasing for about 20-25 %. In this case, it



will be necessary to open the lens for one stop more than indicated in the exposure table.

The peak current load to which the flash capacitor is exposed when the flash is fired, is demonstrated below by some figures.

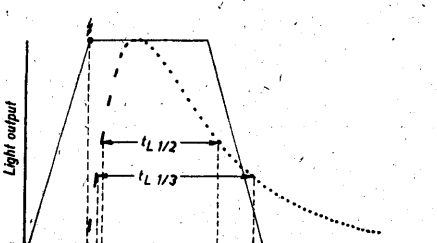
Immediately at the beginning of the current passage through the gas discharge tube, the capacitor supplies a peak current of about 350 amperes. To get an impression about the current strength, which reaches this peak tension only for fractions of milliseconds, and then goes back to zero within two milliseconds, the following comparison is given: Am normal houselamp of 75 watts carries at 220 volts a current of about 350 milliamperes. Only with a simultaneous use of 1,000 of these bulbs, the above mentioned 350 amperes would be consumed. These 350 amperes are flowing at a tension of 510 volts, which results in a peak output of about 180 kilowatts, corresponding to approximately 250 horse-powers.

These figures should not produce a wrong impression, however, and make you overlook the fact that this instantaneous power appears only at shortest periods of time and that, therefore, the energy will remain within its given, moderate limits.

6. Flash Curve

Occasionally, it is important for the photographer to know the duration and the characteristics of the flash discharge. When the light output is measured in relation to the time and this is represented by a curve (see graph, next page), the following will be noted: The release of the ignition system occurs at the 0 point. Soon thereafter, the light output will reach its peak, whereupon it will relatively slowly decrease and then disappear entirely. For the flash duration, a value was chosen which comprises most of the photographically effective

light output. The flash duration is considered to be the lapse of time from 1/2 of peak to 1/2 of the total light output. In order to obtain this flash



curve, an electronic flash-curve-indicator is used which marks the curve on the screen of a Braun's valve and which permits an immediate evaluation. In addition, time markings are introduced onto the screen to make exact measurements possible. The spacing of the time markings (from centre to centre) in the graph on this page amounts to 1/20,000 sec., therefore, the flash duration can ealisy be determined.

tf 1/2 = 0.95 millisec., tf 1/3 = 1.3 millisec.

Since the flash is photographically effective even after the end of the flash duration as defined above, it cannot be equalled with the exposure time. Therefore, efforts have been made lately to consider the flash duration to be from 1/3 of peak to 1/3 of peak. But even this value does not give us the true exposure time. If the flash duration is stated according to both of these definitions, the flash curve is adequately described, inasmuch as this gives us satisfactory information about the descent of the flash curve after the peak. To be exact, it is not true that the effectiveness of the flash on the photographic emulsion is shorter than the fastest speed of a modern shutter. With a flash duration of 1/1,000 sec., the flash is partly cut off by the closing shutter at 1/500 sec., which can easily be proved.

At a speed of 1/1,000 sec., the shutter of the MINOX camera permits the cut off of a still larger part of the descending light curve, and is therefore well suited for special problems.

Another important attribute can be derived from the flash curve: the ignition time, or the delay. This is the time-lag between the closing of the firing switch (marked 0) and the first passage of the curve through 1/2 of the peak light output. According to the above graph, this is approximately 1/9,000 sec. Consequently, BRAUN HOBBY is practically operating without delay.

7. Reflector

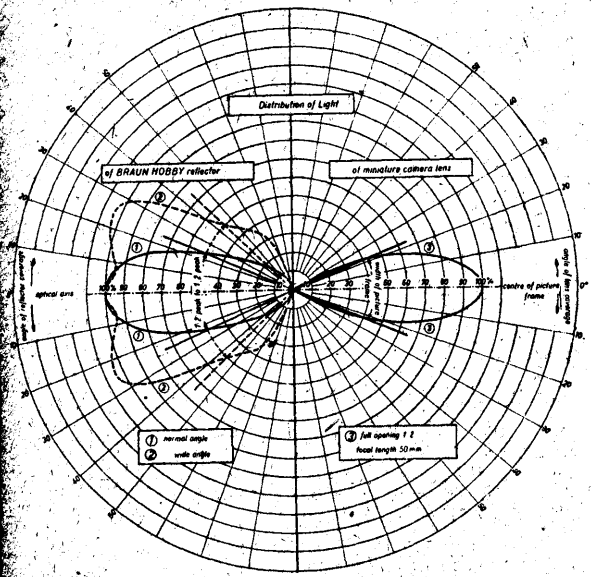
Among other factors is the guide number of a flash unit dependent upon the intensity of the flash, the structure and the shape of its reflector. Despite the

high guide number of BRAUN HOBBY, the distribution of light is so favourable that for the field covered by a lens of normal focal length, an even corner-to-corner illumination is provided. It is important, however, that the optical axes of reflector and lens run as close to each other as possible. If this is not the case, there will be a loss of light, resulting in a lower guide number or in an uneven illumination. The reflector has a coverage of more than 50 degrees, measured in a horizontal plane containing the optical axis, and gives by its newly developed surface structure an extremely soft and diffused light, so far unknown with electronic flash units.

When the reflector is set for wide angle coverage, it will cover an angle of more than 70 degrees, and the illumination within the coverage is so regulated that outside the centre the intensity of the illumination is again increased. The wide angle setting may also be chosen when it is important to obtain an even illumination with the use of high-speed lenses and a large lens opening, especially with colour photographs. These special illumination characteristics will partly compensate for the marginal loss of light, which is inherent to these lenses. This possibility exists only with this particular wide angle reflector which purposely creates an uneven distribution of light on the subject. The graph on next page shows the illumination characteristics of normal and wide angle coverage, as well as the correlation of the wide angle reflector with a lens opened up to f/2.

Since with the wide angle setting the available light output remains the same, but is distributed over a larger area, a lower illumination intensity on the

subject will result. The BRAUN HOBBY reflector has been so constructed that this is compensated for by using the next larger lens stop.



8. Vibrator and Storage Battery

The vibrator has to withstand the greatest mechanical load of all elements of the electronic flash unit.

It serves by the closing and opening of its pairs of primary contact pieces that the direct current is converted to a-c and can be stepped up to the operating voltage of the flash tube. The transformer, which can step up a-c only, is thereby furnished with the alternating current, which changes its direction in the primary winding 125 times per second and thus induces the higher voltage in the secondary winding and conducts it to the voltage doubler.

The vibrator is started by an extra drive coil which is switched on and off by the switch on the flash head. Its principle of drive is similar to that of the electric bell. Instead of the sine curve of alternating current of 50 cycles, there is, when the dimensions of the connections on the secondary coil of the transformer are accurate, a trapezoid alternating current, the curve of which is a decisive factor for the service life of the vibrator contacts. Especially when the unit is switched on, and before the flash capacitor has built up the counter tension, there are peak currents on the charging circuit of the low voltage side, which the storage battery must supply and which the vibrator must reliably convert. These peak currents cannot be measured with the usual inert indicating instruments, but must be determined by an oscillograph. In the case of BRAUN HOBBY, an instantaneous power of up to 25 amperes is conducted, while during standby periods without flashing, a continuous current of about 1 ampere is flowing.

This standby current covers the losses of switching points, the residual current of voltage doubler and flash capacitor, and drives the drive coil of the vibrator. If idle running is avoided as much as possible, the number of flashes which can be obtained from the storage battery is increased.

If this fact is observed, you will get 80 flashes out of one storage battery charging. This corresponds to a total running time of about 800 seconds. During this time, the pendulum of the vibrator has completed 125 x 800 = 100,000 oscillations and the contact pieces of the vibrator have made a total of 200,000 connections.

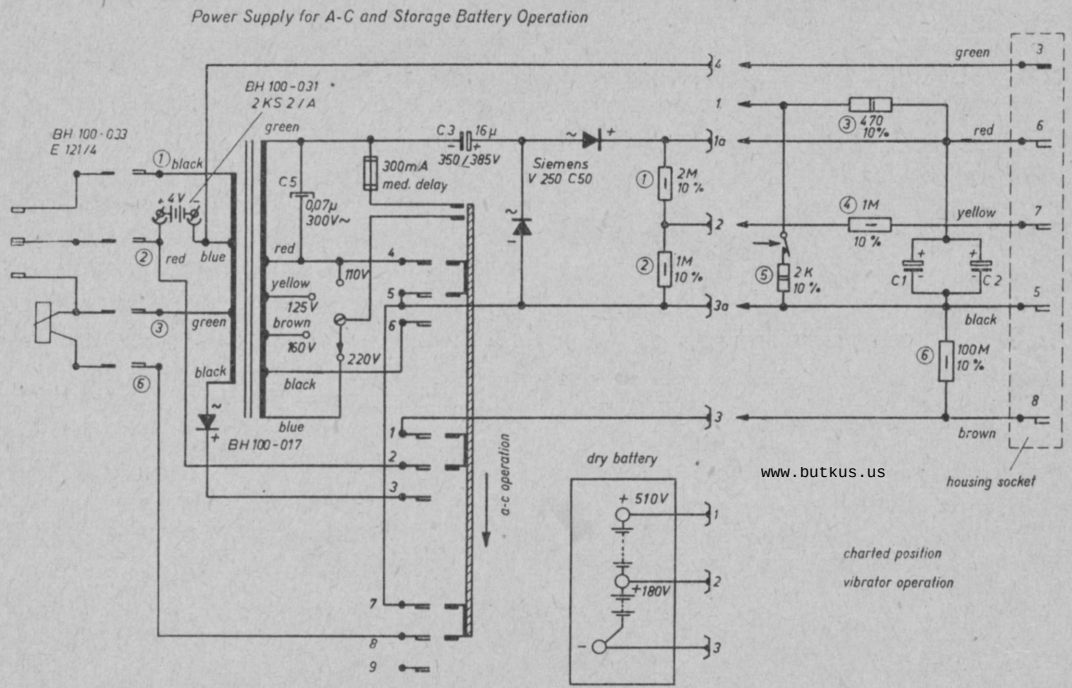
9. Schematic Diagramm of BRAUN HOBBY, Battery Charger

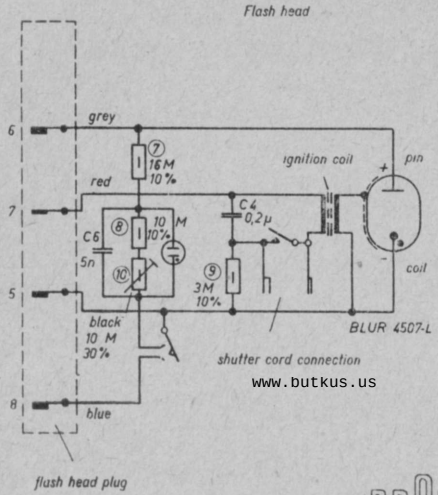
The schematic diagram of BRAUN HOBBY includes besides the circuit the most important parts with their order numbers, the contact numbers of the multiple-plug connection, the connecting plate, the switch socket, and the vibrator.

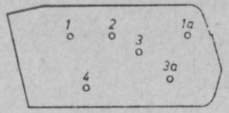
For a better understanding of the circuit, the preceding paragraphs should be noted, especially "Generation of the Operating Voltage" and "Ignition". Bypassing the transformer, the storage battery can de charged on the car battery with a special automobile charging cable. In this case, the charging current is reduced to its minimum strength by a built-in resistor.

The charging can also be done from a d-c line by utilizing a special charging cable, available as accessory. With this, the necessary resistance is furnished by the interconnection of a table lamp with a prescribed wattage (see "Charging of Storage Battery"). A small glow lamp contained in the plug indicates correct polarity.

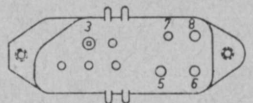
It must be mentioned, however, that the charging from a d-c outlet is an inefficient method, since it has to be done with the simultaneous and useless burning of an incandescent lamp. Therefore, charging from an a-c outlet or from the car battery is to be preferred.


Power Supply for A-C and Storage Battery Operation
BH 100-033
E 121/4
BH 100-031
2 KS 2/A
BH 100-017
4 V
black
red
blue
green
black
blue
C 5
0,07µ
300V~
300mA
med. delay
C 3
16µ
350/385V
Siemens
V 250 C50
110V
125V
160V
220V
yellow
brown
black
a-c operation
dry battery
+ 510V
+180V
2M 10 %
1M 10 %
2K 10 %
470 10 %
1M 10 %
100M 10 %
C 1
C 2
green
red
yellow
black
brown
housing socket
charted position
vibrator operation
www.butkus.us

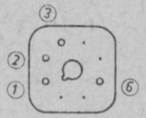




connecting plate (top view)



housing socket (bottom view)



vibrator (bottom view)

switch socket (bottom view)

BRAUN hobby

electronic flash unit
BH 100

1/2 W

2 W

K = Kiloohm
M = Megohm
n = nF
µ = µF

Trouble location

1. **Power pack does not start working when unit is switched on, because ...**

   main cable plug is not firmly connected to power pack.

   Make positive connection.

   storage battery is completely discharged.

   Recharge storage battery immediately in accordance with instructions.

   storage battery is not yet filled.

   Have battery filled.
   Note directions on storage battery and on instruction sheet.

   storage battery is not, or incorrectly, connected.

   Check in battery chamber. Red cable to positive terminal, blue cable to negative terminal! Colour of cable must correspond to colour of battery terminal (very important!!!).

   the unit has a defect which cannot be determined.

   Turn the flash unit over to your photo dealer.

2. **Ready light does not glow, because ...**

   power pack does not start working (no humming sound).

   See paragraph 1, above.

with a-c operation, the setting of voltage selector is incorrect.

Adjust to correct voltage setting. Exchange fuse, if necessary.

with high voltage dry battery operation, the battery is dead.

Replace dry battery, note pages 28 and 29.

main cable between power pack and flash head is defective.

Stop using the flash unit and have main cable exchanged immediately

there is a defect in the flash head.

Do not break the seal, or the guaranty will be void. Take the unit to your photo dealer, who can test the flash head on another power pack. He can locate the trouble positively and can correct it.

3. **Glowing of ready light is retarded and it flickers at long intervals, because ...**

storage battery is almost completely discharged.

Recharge storage battery immediately according to instructions.

terminals of storage battery are oxidized.

Take battery out. Terminals must be cleaned with a wire brush and greased (Vaseline). Reconnect storage battery correctly.

setting of voltage selector was incorrect (too high).

Adjust to correct voltage setting.

dry battery has reached the end of its service life.

Note pages 28 and 29.

there is a defect in power pack or flash head.

Have your photo dealer test the unit with another flash head, in order to locate the trouble and to correct it.

the flash unit was not in use for a long period of time.

Reform flash capacitors. See page 39.

4. **The unit does not flash, because ...**

a mistake in the operation has been made.

Correct this. For instance, connect shutter cord with synchro socket of camera, etc. Observe instructions for use.

the storage battery is so much exhausted that there is not sufficient power for a flash.

Recharge storage battery!

the dry battery is so weak that there is not sufficient power for a flash.
Note page 17.

shutter cord is ruptured.
This defect will be found if the flash can be fired with the flash head release, but not by inserting the tip of a pencil into the shutter cord plug. Have it repaired by your photo dealer.

flash tube has been damaged.
Have flash tube exchanged by your photo dealer.

shutter contact of camera is defective.
A defect of the shutter contact will be found if the flash can be fired with the flash head release as well as by inserting the tip of a pencil into the shutter cord plug, but not when the shutter cord is plugged into the synchro socket of the camera and the shutter is tripped. If this defect is discovered, turn your camera over to a repair shop.

5. **The storage battery does not charge, because ...**

the charging cable is not connected to the power pack.
Make connections.

line voltage does not correspond to voltage setting on unit.

Follow instructions for use closely.

fuse is blown out.

This happens if the unit is connected to direct current with the a-c charging cable, or when the charging is done from the 220 volt power line with the voltage selector on 110 volts. Exchange fuse in power pack.

6. **The flash pictures were not exposed correctly, because ...**

a mistake in the operation has been made.

Avoid this mistake (for instance, set camera synchro lever to X), observe instructions for use.

exposure table was used incorrectly (for instance, camera was loaded with film of 17/10 DIN (Europ. Sch. 27, ASA 40) rating, but exposure was based on 21/10 DIN (Europ. Sch. 31, ASA 100).

Note film speed!

the unit was not given enough time for a full capacitor charge.

The exposure table is not valid before the ready light glows.

the flash does not hit the full shutter opening.

Check synchronization in accordance with instructions on page 17.

the flash curve was partly cut off by an extreme shutter speed.

Note page 55.

the shutter speed of a focal plane shutter camera was too fast.

Observe maximum shutter speed prescribed by the manufacturer of your camera (see page 18).

wide angle setting of reflector was used in connection with guide number for normal angle setting.

TABLE OF CONTENTS

Exposure Table

Lens Opening = Guide Number : Distance (in feet)

Film Speed Rating	Guide Number
14/10 DIN (Europ. Sch. 24, ASA 20)	115
17/10 DIN (Europ. Sch. 27, ASA 40)	165
21/10 DIN (Europ. Sch. 31, ASA 100)	230
Colour Film *	50—60

Lens Opening (f/Stop)	Distance in Feet for Film Speed Rating of: 14/10	17/10	21/10	Colour
1.5	72½	99	132	33
2	56	82½	105½	24½
2.8	39½	56	82½	18
4	29½	39½	56	13
5.6	20	29½	39½	8
8	15	20	29½	6½
11	10	15	20	—
16	6½	10	15	—
22	—	6½	8	—

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* Note page 22!