

# **Fundamentals**

**of**

# **Flash**

(Program Workbook)

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# The Fundamentals of Flash Presented by Steve Kozak

## The Basics of Flash Photography

**There are three things that you need to know when using a flash:**



- 1 - The guide number of your flash
- 2 - The correct flash sync for your camera
- 3 - The flash to subject distance.

**Guide Number:** The guide number of your flash is simply a rating of how *powerful* your flash is, when used at a particular ISO. You will find the Guide Number in the "specs" pages of your flash's instruction book.



## Flash Sync

**Flash Sync:** In order to use a manual flash, we also need to know the correct "flash sync" of the camera. This is the shutter speed that coordinates the flash with the shutter in the camera. Generally it 1/125, but it may vary from camera to camera. Certain shutters sync at all speeds. Be sure to check your camera manual to determine your camera's sync.

**Any time that you are using a flash, you must use the correct flash sync speed for your camera!**

Failure to use the correct flash sync may result in a portion - if not most of your photographs to be black. This occurs when the flash fires and the curtain mechanism in the camera has not had time to get fully opened. The flash fires and the curtain blocks a portion of the film leaving a "clear" area on the negative. This clear area on the negative creates the black area on the photograph!



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## Guide No. (GNo.) (ISO 100, in meters/feet)

### Normal Flash (Full Output) and Quick Flash (GNo.)

Flash Coverage (mm)	14	24	28	35	50	70	80	105
<b>Normal Flash (Full output)</b>	15/ 49.2	28/ 91.9	30/ 98.4	36/ 118.1	42/ 137.8	50/ 164	53/ 173.9	58/ 190.3
<b>Quick Flash</b>	Same as 1/2 to 1/6 manual flash output							

### Manual Flash (GNo.)

Flash Output	Flash Coverage (mm)							
	14	24	28	35	50	70	80	105
<b>1/1</b>	15/ 49.2	28/ 91.9	30/ 98.4	36/ 118.1	42/ 137.8	50/ 164	53/ 173.9	58/ 190.3
<b>1/2</b>	10.6/ 34.8	19.8/ 65	21.2/ 69.6	25.5/ 83.7	29.7/ 97.4	35.4/ 116.1	37.5/ 123	41/ 134.5
<b>1/4</b>	7.5/ 24.6	14/ 45.9	15/ 49.2	18/ 59.1	21/ 68.9	25/ 82	26.5/ 86.9	29/ 95.1
<b>1/8</b>	5.3/ 17.4	9.9/ 32.5	10.6/ 34.8	12.7/ 41.7	14.8/ 48.6	17.7/ 58.1	18.7/ 61.4	20.5/ 67.3
<b>1/16</b>	3.8/ 12.5	7/ 23	7.5/ 24.6	9/ 29.5	10.5/ 34.4	12.5/ 41	13.3/ 43.6	14.5/ 47.6
<b>1/32</b>	2.7/ 8.9	4.9/ 16.1	5.3/ 17.4	6.4/ 21	7.4/ 24.3	8.8/ 28.9	9.4/ 30.8	10.3/ 33.8
<b>1/64</b>	1.9/ 6.2	3.5/ 11.5	3.8/ 12.5	4.5/ 14.8	5.3/ 17.4	6.3/ 20.7	6.6/ 21.7	7.3/ 24
<b>1/128</b>	1.3/ 4.3	2.5/ 8.2	2.7/ 8.9	3.2/ 10.5	3.7/ 12.1	4.4/ 14.4	4.7/ 15.4	5.1/ 16.7

Guide number  
chart for  
Canon 600EX  
RT

### ■ Determining the aperture and flash output level in the Manual mode

In the Manual mode, use the guide number table and the following equation to calculate the aperture, flash output level, and shooting distance to obtain the correct exposure.

- The guide number (GN at ISO 100; m/ft) indicates the amount of light generated by the flash. The larger the number, the greater the flash output.

### Guide number (ISO 100, m/ft)

Flash output level	Zoom-head position (mm)										
	*1	*2	14 <sup>o</sup>	17 <sup>o</sup>	24	28	35	50	70	85	105
M1/1	12.5/41	16/52	17/56	19/62	30/98	32/105	38/125	44/144	50/164	53/174	56/184
M1/2	8.8/29	11.3/37	12/39	13.4/44	21.2/70	22.6/74	26.9/88	31/102	35.4/116	37.5/123	40/131
M1/4	6.3/21	8.0/26	8.5/28	9.5/31	15.0/49	16/52	19/62	22/72	25/82	26.5/87	28/92
M1/8	4.4/14	5.7/19	6.0/20	6.7/22	10.6/35	11.3/37	13.4/44	15.6/51	17.7/58	18.7/61	19.8/65
M1/16	3.1/10	4.0/13	4.3/14	4.8/16	7.5/25	8.0/26	9.5/31	11/36	12.5/41	13.3/44	14/46
M1/32	2.2/7	2.8/9	3.0/10	3.4/11	5.3/17	6.0/20	6.7/22	7.8/26	8.8/29	9.4/31	9.9/32
M1/64	1.6/5	2.0/7	2.1/7	2.4/8	3.7/12	4.0/13	4.8/16	5.5/18	6.3/21	6.6/22	7.0/23
M1/128	1.1/4	1.4/5	1.5/5	1.7/6	2.6/8.5	2.8/9	3.4/11	3.9/13	4.4/14	4.7/15	4.9/16

- \*1 With the Nikon Diffusion Dome attached and the wide-flash adapter in place
- \*2 With the Nikon Diffusion Dome attached
- \*3 With the wide-flash adapter in place

Guide number  
chart for  
Nikon SB910

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### Calculating Exposure

The power of the flash determines the exposure in flash photography. Unlike non-flash photography, we do not really have a choice of f-stops and shutter speeds. The f-stops are going to be dictated by the flash output and the shutter speed is dictated by the camera's sync speed.

**We do not use "equivalent exposures" in flash photography.**

Let's work on finding the single correct exposure when using a manual flash. In the examples to follow, **It is assumed that the G# is expressed at 100ISO!**

To determine the correct exposure when using a flash in "manual" mode, use the following formula:

$$\mathbf{G\# / Flash\ to\ Subject\ Distance = F-stop}$$

For example, if it is given that: G# is 110 and the flash-to-subject distance equals 20 feet :

$$110 / 20 = F5.6 \text{ (rounded to the nearest stop)}$$

The correct exposure would be F5.6 and the shutter speed would be determined by the camera's sync. If your camera syncs at 1/60, then the exposure is F5.6 @ 1/60. If your camera syncs at 125, the exposure would be F5.6 @ 1/125.

**If the flash to subject distance changes to 5 feet, then:**

$$110 / 5 = F22$$

**If our G# is 60 and the distance is 20 feet, then:**

$$60 / 20 = F2.8$$

**At 5 feet, we get:**

$$60 / 5 = F11$$

Again, the shutter speed is a "given" based on the camera's sync.

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## Flash Set Up Check List

- Camera set to \_\_\_\_\_ mode
- Camera set to \_\_\_\_\_ ISO
- Shutter speed at \_\_\_\_\_
- Flash set to \_\_\_\_\_ mode
- Flash Zoom Head to \_\_\_\_\_ Zoom \_\_\_\_\_
- Flash ratio set to \_\_\_\_\_

### Using the “Inverse Square Law”

Cut distance in half --- stop down \_\_\_\_\_ stops

*Example:* If 10ft = F11, then 5ft = F \_\_\_\_\_

Double the distance --- open up \_\_\_\_\_ stops

*Example:* If 10ft = F11, then 20ft = F \_\_\_\_\_

The quality of light is determined by the \_\_\_\_\_ of the light source.  
On camera flash is \_\_\_\_\_ and \_\_\_\_\_!

Getting the flash off the camera:

- Complete control of the flash and exposure
- \_\_\_\_\_ lighting
- Not bound by shooting \_\_\_\_\_
- Light control using modifiers (umbrellas, softboxes)
- Balance flash to \_\_\_\_\_

Control the output of your manual flash:

1.4 2 2.8 4 5.6 8 11 16 22 32  
(Large openings) (Small openings)

Closing the lens by one stop cuts the amount of light reaching the sensor in half. (1/2x)

Closing the lens by one stop ..... \_\_\_\_\_

Closing the lens by two stops .... \_\_\_\_\_

Closing the lens by three stops .... \_\_\_\_\_

Closing the lens by four stops..... \_\_\_\_\_

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### Advanced Flash Techniques

#### Fill Flash

When your subject is backlit, try using fill flash to add light to your subject. This helps to bring the exposure on the subject closer to the exposure of the background. This keeps the background from being too bright and washed out or your subject from being too dark and underexposed.

To use fill flash with a manual flash, read the meter for the background using the correct sync speed. For example, since your camera syncs at 1/125, then meter the background to find the F-stop that corresponds to 1/125. Then, read the flash meter to determine the F-stop.

Next, determine the output of your flash for a given distance. then reduce the power of the flash accordingly to get the correct exposure from the flash.

#### Example 1:

**The background reads F16 at 1/125. The flash output at 7.5 feet is F16. Set the flash 7.5 feet from the subject at full power to balance the subject to the background.**



**The background is F16 at 1/125**

Setting up the flash at 7.5 feet yields an output of F16 from the flash at full power. ( $11/7\text{ft} = \text{F16}$ )



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### Fill Flash

#### Example 2:

The background reads F5.6 at 1/125. The flash output at 10 feet is F11. Reduce the power of the flash to 1/4 power to reduce the flash output to F5.6.



The background measures  
F5.6 @ 1/125.

The flash output at 10ft is  
\_\_\_\_\_.

Reduce the power of the  
flash to \_\_\_\_\_  
to get an output of 5.6.

Where would the output  
setting of the flash be if the  
flash were set up at 5 ft?

\_\_\_\_\_



The background measures  
F4 at 1/125.

Where would the output  
setting of the flash be if the  
flash were set up at 10 ft?

\_\_\_\_\_

At 7 feet

\_\_\_\_\_



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### Bounce Flash:

Using "bounce flash" creates a much softer lighting and helps to eliminate distracting shadows. Bounce flash requires a room with relatively low ceilings - about 10 to 14 feet. The ceiling should be a light color, preferably white. This is important because you will be lighting your subject with the ceiling - not the flash. The color of the ceiling will be reflected in the overall color of the photograph.

To use bounce flash, calculate the distance from the flash to the ceiling, and add to it, the distance from the ceiling to the subject. Take that total distance and divide it into the guide number of your flash. The resulting number will be an F-stop. Finally, take that F-stop and "open up" the lens one or two additional stops. This is necessary because the ceiling does not efficiently return the light back down to the subject. Opening up this extra stop or two compensates for this loss of light. I suggest opening up one additional stop for lower, white ceilings and two additional stops for higher ceilings.

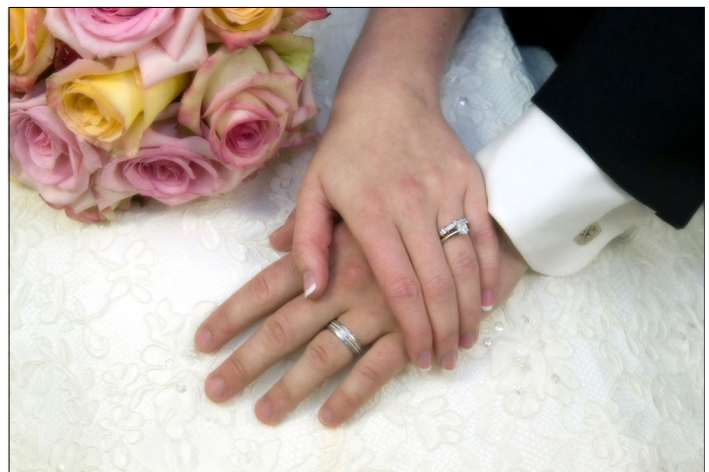
One of the "tricks" about using bounce flash is to know that light comes off of the ceiling at exactly the angle that it strikes the ceiling. What this means is that you want to angle the flash so that it strikes the ceiling at the halfway point between you and the subject. Pointing the flash straight up will mean that the light comes straight down - lighting yourself and not the subject. It is also possible to point the flash too far beyond the halfway point and therefore directing the light behind your subject. It takes a little practice.

If you have the chance to watch photojournalist on the news while they are shooting using bounce flash, you will notice that some will have a white notecard attached to the flash with rubber band. This card helps to redirect some of the light towards the subject with a bit more efficiency than just bouncing the flash off the ceiling. This also helps to add light to the subject's eyes and fill-in some of the shadows on the face that are created from the light coming off the ceiling.

The image at right was taken with bounce flash in a room with 12 foot, white acoustical tile ceilings which meant I would open up two stops on my bounce flash exposure.

The flash distance up to the ceiling and back down was 15 feet.

My exposure was \_\_\_\_\_ at 1/125.





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### Dragging the Shutter

You can take flash photographs at shutter speeds that are slower than the flash sync. For example, if your shutter syncs at 1/125, you can also use 1/60, 1/30, 1/15, 1/8 and so on. This is called dragging the shutter. Dragging the shutter allows you to record some of the ambient light along with the flash exposure.

To do this, figure your F-stop for the flash exposure. Then, read the meter at that F-stop to determine the corresponding shutter speed at that F-stop. Set camera to the corresponding shutter speed.

For Example: A room meters F2.8 at 1/30. Let's assume you are going to shoot your flash at F5.6. Shooting at F5.6 at 1/60(or your given sync) creates a properly exposed subject but the room appears very dark. Meter the room exposure at F5.6 and the shutter speed drops to 1/8. (Remember "equivalent exposures" from the Basic Class?) Now, take the photograph at F5.6 at 1/8 and you will have a well exposed subject and also record the lighting in the room. You will need a tripod at these slow shutter speeds and a subject that is not moving about.



The background measured F2.8 at 1/15.

My flash was 10 feet away.

At full power, my flash output is F \_\_\_\_\_.

To get my flash to fire at F2.8, I had to set the power output setting to \_\_\_\_\_.

My shutter speed at left was 1/125.



What shutter speed did I use to balance my flash to the background? \_\_\_\_\_

My final settings on the camera were: F \_\_\_\_ @ \_\_\_\_\_. My flash was at \_\_\_\_\_ power.

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### Flash Worksheet (Assume G#110 at 100 ISO and 1/1 unless otherwise stated)

1. What is the correct exposure when the flash to subject distance is:

Flash Power	A. 5ft @1/1 _____	Flash Power	@1/2 _____	Flash Power	@1/4 _____	Flash Power	@1/8 _____
	B. 20ft @1/1 _____		@1/2 _____		@1/4 _____		@1/8 _____
	C. 7ft @1/1 _____		@1/2 _____		@1/4 _____		@1/8 _____
	D. 10ft @1/1 _____		@1/2 _____		@1/4 _____		@1/8 _____
	E. 15ft @1/1 _____		@1/2 _____		@1/4 _____		@1/8 _____

2. How many stops are represented by:

1/8 \_\_\_\_\_ 1/32 \_\_\_\_\_ 1/4 \_\_\_\_\_ 1/16 \_\_\_\_\_ 1/2 \_\_\_\_\_ 1/64 \_\_\_\_\_

3. What is:

1/8 of F11 \_\_\_\_\_ 1/4 of F22 \_\_\_\_\_ 1/32 of F16 \_\_\_\_\_

4. What ratio setting would be required to fire the flash at F4 when the flash distance is:

A. 5ft \_\_\_\_\_ B. 20ft \_\_\_\_\_ C. 7ft \_\_\_\_\_  
 D. 10ft \_\_\_\_\_ E. 15ft \_\_\_\_\_

5. The subject measures F4 and the background measures F11. The flash is 5 feet from the subject. What are your settings?

A. Set the F-stop to: \_\_\_\_\_ B. Set the flash to: \_\_\_\_\_

6. You are photographing a bride on the center aisle. The flash is 7 feet away. You want to use F4. The background reads F8 @1/2. What are your settings?

A. Set the F-stop to: \_\_\_\_\_ B. Set the shutter to: \_\_\_\_\_  
 C. Set the flash to: \_\_\_\_\_

7. You are photographing a group in a room with 12 ft ceilings with bounce flash. The distance up and down is about 15 feet. What is the exposure? \_\_\_\_\_

8. What is the correct exposure at 400 ISO when the flash to subject distance is:

F-Stop	Flash Power	F-Stop	Flash Power
A. 20ft _____	@ _____	B. 5ft _____	@ _____
C. 15ft _____	@ _____	D. 10ft _____	@ _____
E. 7ft _____	@ _____		

9. You are using 400 ISO. The flash is 15 feet away. You want to shoot at F4. What are your flash settings?

10. You are using 400 ISO. The flash is 5 feet away. You want to shoot at F4. What are your flash settings?

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### Flash Worksheet (Assume G#110 at 100 ISO and 1/1 unless otherwise stated)

1. What is the correct exposure when the flash to subject distance is:

- |   |  |  |                                       |
|---|--|--|---------------------------------------|
| A. 5ft <sup>Flash Power</sup> @1/1 <u>F22</u> | @1/2 <sup>Flash Power</sup> <u>F16</u> | @1/4 <sup>Flash Power</sup> <u>F11</u> | @1/8 <sup>Flash Power</sup> <u>F8</u> |
| B. 20ft @1/1 <u>F5.6</u>                      | @1/2 <u>F4</u>                         | @1/4 <u>F2.8</u>                       | @1/8 <u>F2</u>                        |
| C. 7ft @1/1 <u>F16</u>                        | @1/2 <u>F11</u>                        | @1/4 <u>F8</u>                         | @1/8 <u>F5.6</u>                      |
| D. 10ft @1/1 <u>F11</u>                       | @1/2 <u>F8</u>                         | @1/4 <u>F5.6</u>                       | @1/8 <u>F4</u>                        |
| E. 15ft @1/1 <u>F8</u>                        | @1/2 <u>F5.6</u>                       | @1/4 <u>F4</u>                         | @1/8 <u>F2.8</u>                      |

2. How many stops are represented by:

- 1/8 3 1/32 5 1/4 2 1/16 4 1/2 1 1/64 6

3. What is:

- 1/8 of F11 F4 1/4 of F22 F11 1/32 of F16 F2.8

4. What ratio setting would be required to fire the flash at F4 when the flash distance is:

- A. 5ft 1/32 B. 20ft 1/2 C. 7ft 1/16  
 D. 10ft 1/8 E. 15ft 1/4

5. The subject measures F4 and the background measures F11. The flash is 5 feet from the subject. What are your settings?

- A. Set the F-stop to: F11 B. Set the flash to: 1/4

6. You are photographing a bride on the center aisle. The flash is 7 feet away. You want to use F4. The background reads F8 @1/2. What are your settings?

- A. Set the F-stop to: F4 B. Set the shutter to: 1/8  
 C. Set the flash to: 1/16

7. You are photographing a group in a room with 12 ft ceilings with bounce flash. The distance up and down is about 15 feet. What is the exposure? F4

8. What is the correct exposure at 400 ISO when the flash to subject distance is:

- |   |  |
|---|--|
| A. 20ft <sup>F-Stop</sup> <u>F5.6</u> @ <sup>Flash Power</sup> <u>1/4</u> | B. 5ft <sup>F-Stop</sup> <u>F22</u> @ <sup>Flash Power</sup> <u>1/4</u>  |
| C. 15ft <sup>F-Stop</sup> <u>F8</u> @ <sup>Flash Power</sup> <u>1/4</u>   | D. 10ft <sup>F-Stop</sup> <u>F11</u> @ <sup>Flash Power</sup> <u>1/4</u> |
| E. 7ft <sup>F-Stop</sup> <u>F16</u> @ <sup>Flash Power</sup> <u>1/4</u>   |  |

9. You are using 400 ISO. The flash is 15 feet away. You want to shoot at F4. What is your flash setting? 1/16 power

10. You are using 400 ISO. The flash is 5 feet away. You want to shoot at F4. What is your flash setting? 1/128 power