

Activity B-1. The Electronic Flash Unit

Goal: To learn about the functions and care of an electronic flash unit

Prelab:

1. Read this entire activity before the lab period.
2. Look up the function of a *capacitor* (also called *condensor*).
3. Answer the online prelab questions (These are combined with the B-2 prelab questions.)
4. Prepare your lab journal in the usual way. Also list in your journal the 6 items given at the bottom of the last page of these instructions. You'll only need one sheet for this activity.

Equipment:

- Vivitar 283 flash unit
- 4 AA batteries and SB-4 AC adapter
- Modified PC cord (standard Vivitar 283 flash plug to RCA)
- Flash clamp

Some flash accessories that may be useful (but not essential) for the activities are described in Appendices B and C.

These activities are written under the assumption that the Vivitar 283 (or 285) flash unit is being used. While many flash units would suffice, the 283 and its cousin, the 285, are particularly suited to these activities. If a different flash unit is used, details relating to the architecture of the 283 will not apply in what follows. However, the fundamental methods of taking high-speed photographs and the general considerations relating to the flash unit will still apply.

This guidebook will not go into detail about how electronic flash units work. See footnote 1 on this page for a classic reference.

The Vivitar 283 flash unit with the SB-4 AC adapter and PC cord is shown in Figure 1. Use of the AC adapter is recommended to conserve batteries. Alternatively, one can use four rechargeable AA batteries. (Note that when using the SB-4 with the Vivitar 285, the AA batteries must also be used.) The 283 is a rugged unit, and handling it carefully will help it last a long time. One vulnerable part is the flash foot,



Figure 1. The Vivitar 283 electronic flash unit with SB-4 AC adapter and PC cord

¹ Harold E. Edgerton, *Electronic Flash, Strobe* (The MIT Press, Cambridge, MA, 1983).

which tends to break off easily. Another is the xenon flash tube. If the unit were dropped, a small crack in the tube would render the unit useless.

It's often handy to mount the flash unit on a special clamp with an adapter to receive the flash foot. See Figure 2. The jaws of the clamp can be secured to the edge of a table, and the flash foot can be slipped into the shoe on the handle of the clamp. The ball-and-socket on which the foot is mounted provides great flexibility in positioning the flash. Mount your flash unit into the shoe now. Before doing, make sure the locking lever on the back of the flash foot is unlocked. Then, after pushing the flash foot into the shoe, lock it in place. *Here's something important for increasing the lifetime of the ball-and-socket head:* Whenever repositioning the flash, hold it steady while loosening the thumbscrew on the ball-and-socket head. Reposition the flash and then tighten the thumbscrew. If you try to reposition the flash without loosening the thumbscrew, this will create excessive wear on the ball-and-socket joint. It costs about \$25 to replace one of these joints.



Figure 2. Clamp with ball and socket flash attachment

Note that with the Vivitar 283 the power switch doesn't function when using the AC adapter. The flash capacitor should begin to energize as soon as the adapter is plugged in. When the orange light on the back of the flash unit comes on, the capacitor is almost completely charged. Wait several seconds to provide extra time for charging. Now point the flash at a nearby object and push on either the orange light on the 283 or the red button on the foot of the 285 to discharge the flash.

There are other ways to discharge the flash. Plug the modified PC cord into the side of the 283 (or into the port on the foot of the 285). Be sure that the cord clicks securely into place. The main source of problems in using flash units is the cord. Use something metallic, such as a key or paper clip, to short across the terminals at the free end of the cord. Avoid directly touching the metal when doing this, because you could get a sting from the voltage across the terminals.

Now find two other metallic terminals that you can short across on the flash unit in order to discharge the flash unit. After you find them, show the instructor.

By shorting across the terminals, you are completing a trigger circuit within the flash unit that initiates the discharge of the main flash capacitor through the flash tube. Once started, the discharge proceeds to completion unless quenched by a means that will be discussed in the next activity. The voltage across the flash terminals is an important consideration when connecting the flash unit to external trigger circuits. For 283s made before 1984, the voltage is 200-300 V. This is typical of older flash units. Newer models are designed with low-voltage trigger circuits. For the newer 283s, this is less than 10 V.

Whenever you finish using the flash unit, it is a good idea to discharge the flash capacitor completely after the unit is turned off. To do this, first rotate the dial on the sensor module (labeled auto-thyristor) to M (for manual). Then discharge the unit.

In preparation for the next activity, it may be useful to see what's inside the flash unit. Figure 3 shows a disassembled Vivitar 283. Ask the instructor to see this unit up close. The main capacitor stores electrical energy for the flash discharge. The capacitor can remain charged even when the flash unit is open as in the diagram. Touching the capacitor contacts in this condition can be very dangerous. Therefore, opening up a flash unit should be left to someone who knows how to do so safely.

The power conversion circuit converts the input voltage from batteries or the SB-4 to that needed by the flash circuitry. The trigger input detects when the flash terminals have been closed and initiates the flash discharge. The input signal can come either from a PC cord or from the terminals on the flash foot.

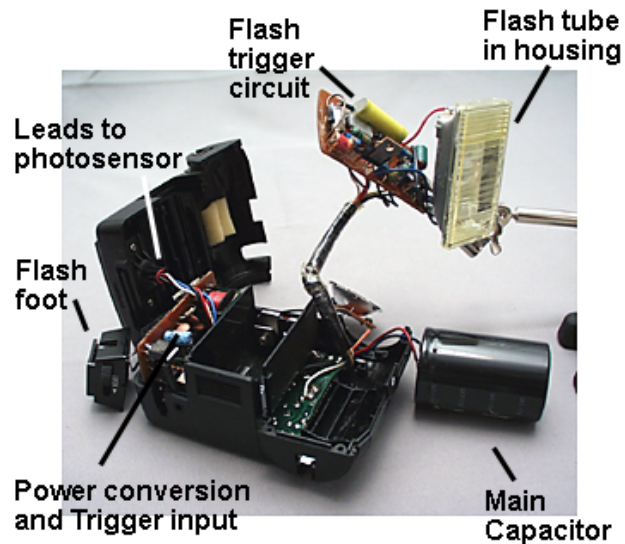


Figure 3. Disassembled Vivitar 283 flash unit

The trigger circuit steps up the voltage across the flash tube and sends a trigger pulse to the tube to start the breakdown of the xenon gas in the flash tube.

Note the leads from the photosensor, which is attached to the front housing of the flash unit. These leads go to a circuit that measures the intensity of light reflected from the subject and quenches the flash discharge when the right amount of light has been received for exposure of the subject. This function of this circuit, called the auto-exposure circuit, will be examined in the next activity.

In your lab book, check off that you've done the following. You may use the abbreviated labels in bold.

1. **Power up:** Powered the flash unit with both batteries and AC adapter, though not at the same time.
2. **Button discharge:** Discharged the flash using the orange ready light.
3. **Cord discharge:** Discharged the flash by shorting the end of the trigger cord.
4. **Mystery discharge:** Found two other metallic terminals that will discharge the flash.
5. **Power down and discharge:** Turned off the flash unit and discharged it completely.
6. **Dissection:** Examined the disassembled unit.