National Camera's

SYNC MODULE

INSTRUCTION MANUAL

AN ACCESSORY FOR PHOTOGRAPHERS

A TEST INSTRUMENT FOR TECHNICIANS

CONTENTS

NATIONAL CAMERA'S SYNC MODULE

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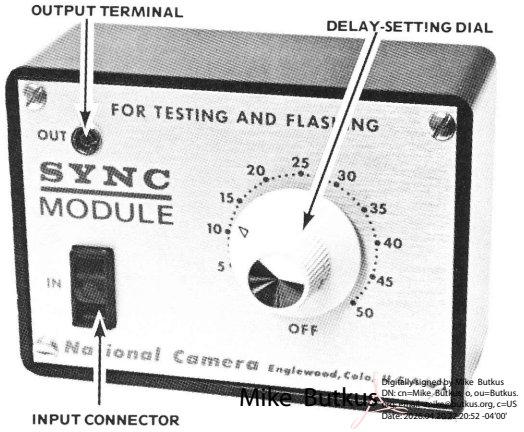

DELAY-SETTING DIAL

Serves both as the delay-setting dial and as the on/off switch. Turning the delay-setting dial clockwise to set the delay turns on the unit. Calibrated in milliseconds, the dial controls the time delay between the input signal and the firing of the flash. Leave the delay-setting dial in the 'OFF' position when you're not using the Sync Module to avoid battery drain.

INPUT CONNECTOR

Connect the sync cord of the camera you're testing or using here. The camera's contact closure provides the signal that activates the Sync Module. You can also plug a slave trigger into the input connector to fire the Sync Module with an electronic-flash unit. Or you can trigger the Sync Module with another Sync Module.

OUTPUT TERMINAL

Hook the sync cord from the electronic-flash unit here. The Sync Module then fires the flash unit after receiving the input signal at the input connector. According to the setting on the delay-setting dial, the Sync Module may fire the flash at the same time as it receives the input signal (0 ms setting) or up to 50 milliseconds after receiving the input signal.

POWER SUPPLY

The Sync Module uses a 9-volt battery. To reach the battery, remove the four screws on the instrument panel. Then, lift the circuit module out of the case.

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INTRODUCTION

The action-stopping ability of electronic flash lets us see things too fast for the unaided eye. A fast-moving subject illuminated by electronic flash appears frozen in position — its position at the instant of the flash. Your eye sees it that way and so does your camera.

With your Sync Module, you can now stop the action exactly where you want it — the instant it occurs or up to 50 milliseconds* later. And that's why the Sync Module serves both the technician and the photographer.

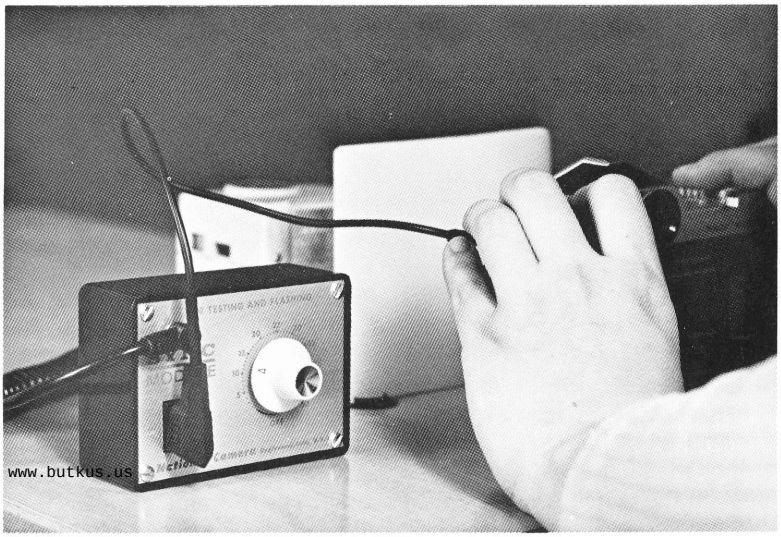
For the technician, the Sync Module is a compact instrument for testing flash synchronization and other shutter actions. All you must add is an electronic-flash unit. Any unit will do. You can then use the electronic-flash unit to illuminate the shutter you're testing. When illuminated by the electronic flash, the shutter appears stopped — frozen in motion at the instant the flash fires. So by changing the delay setting on the Sync Module, you can stop the action at any point during the shutter cycle.

For the photographer, the Sync Module makes possible unique stop-action effects on film. Normally, your shutter fires an electronic-flash unit when the blades (or curtains) reach the full-open position. But with the Sync Module, you can fire the flash after the shutter's contact closure. So you can freeze action when it occurs, after it starts, or even at any number of places during the event. You can even use several Sync Modules — as many as you want — to photograph an entire series of actions on one frame of film.

In this manual, we'll describe the two worlds of the Sync Module — as a test instrument for the technician and as an accessory for the photographer.

* Special versions with delays up to 5 ms and .5 seconds are available on special order.

TESTING FLASH SYNCHRONIZATION



WHY TEST?

For maximum usable light from a flashbulb, the shutter of a camera must be synchronized with the light flash. But the peak amount of the light available from a flashbulb doesn't occur immediately. Rather, it's delayed several milliseconds after applying electrical energy to the flashbulb. So the shutter must have a corresponding delay — a delay between the contact closure that fires the flash and the actual release of the shutter. That gives the flashbulb a running start; the shutter waits until the flashbulb approaches its peak intensity before opening.

The shutter's delay is usually adjustable. Proper synchronization occurs when the delay permits the greatest amount of light available from the flashbulb to pass through the shutter.

WHAT IS PERFECT SYNC?

Ideally, the shutter should be open for the same number of milliseconds before the flashbulb reaches its peak brilliance as it is after this peak. For example, suppose a shutter delivering an accurate 1/100 second (half-open to half-closed time of 10 milliseconds) is to be perfectly synchronized with a flashbulb that takes 20 milliseconds to peak. The shutter should then reach its half-open point 15 milliseconds after the flash is first fired (5

milliseconds before the bulb peaks). And the blades should be half closed 5 milliseconds after the bulb reaches its peak.

SHUTTER HALF OPEN	BULB PEAK	SHUTTER HALF CLOSED
15 ms	20 ms	25 ms

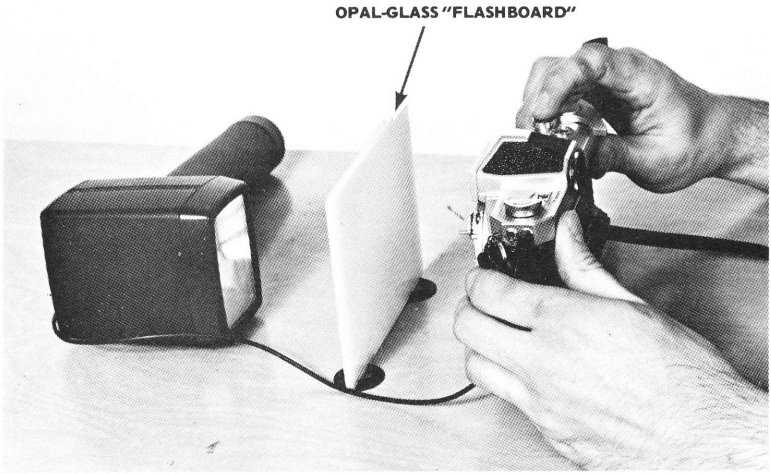
So obtaining ideal "M" synchronization over a wide range of speeds requires a change in delay time for each shutter-speed setting. A few shutters do indeed offer a variable M-sync delay. In some, changing the shutter speed automatically sets the M-sync delay time. In others, there's an external control to vary the time between contact closure and blade opening.

But most modern shutters deliver the same amount of delay regardless of the speed setting. The delay is generally adjusted to insure the shutter will be wide open when the flashbulb reaches its peak at the fastest shutter-speed setting. The remaining speeds then deliver acceptable (though not ideal) synchronization. If the shutter under test uses a high-speed spring for the fastest setting — and if there's no automatic compensation for the quicker blade opening — the delay adjustment must be compromised accordingly.

PRINCIPLE OF CHECKING SYNC DELAY WITH ELECTRONIC FLASH

By illuminating either shutter blades or curtains with electronic flash, you can see exactly where they are at the moment the flash fires. Suppose, for example, that you're checking a camera for proper "X" sync — here, the shutter should be fully open when the flash fires. One technique is to first hook an electronic-flash unit to the X-sync contacts. Then, release the shutter while looking through the focal-plane aperture at the electronic-flash unit.

CAUTION: When using this technique, be sure to somehow cut down the amount of light put out by the flash unit. Unshielded, the flash unit emits a blinding burst of light at such close distances. You can use a piece of opal glass, frosted plastic, or similar translucent material as we're doing in the illustration. Or you can simply wrap a handkerchief around the flash unit; use a couple of layers over the flashtube to cut down the light to an intensity you can look at comfortably.



CHECKING "X" SYNC WITH AN ELECTRONIC-FLASH UNIT

If the X-sync contacts are properly adjusted, you'll see the full shutter opening as a white splash of light. But if the X-sync contacts are out of adjustment, the opening will be partially blocked by the blades or curtains.

For example, say you're checking a focal-plane shutter. And the X-sync contacts close before the opening curtain completely clears the aperture. You'll then see the trailing edge of the opening curtain frozen in position. Or perhaps the contacts close after the closing curtain has been released. Then, you'll see the lead edge of the closing curtain in the focal-plane aperture.

When checking a leaf-type shutter, you should see a clear aperture when the flash fires — a round circle of light. If the X-sync contacts are out of adjustment, you'll see the tips of the blades in the opening.

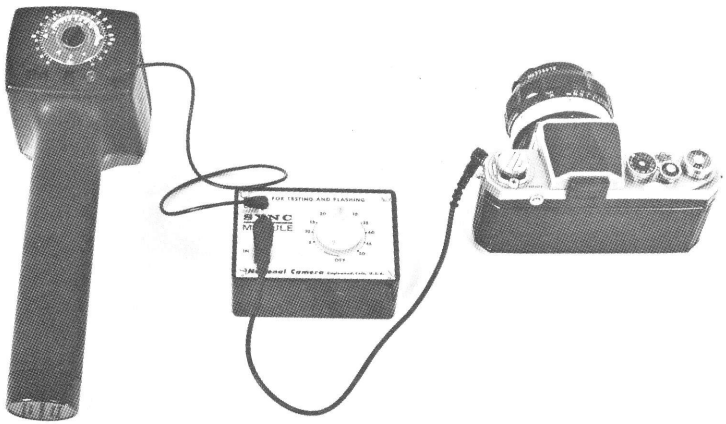
But what will you see if you're checking "M" sync? Here, the contacts close before the shutter starts to open. So you see nothing — the blades or curtains are still covering the aperture when the flash fires. What you now need is a system to delay the firing of the flash after the contact closure. And that's the function of the Sync Module.

SETTING UP THE SYNC MODULE AS A FLASH-SYNCHRONIZATION TESTER

The illustration below shows a technique very similar to that shown in the previous illustration. But now we're using the Sync Module to delay the firing of the electronic-flash unit.

TEST SETUP USING THE SYNC MODULE

You'll need two sync cords. Hook one sync cord from the shutter or camera you're testing to the input connector of the Sync Module. Hook the other sync cord from the output terminal of the Sync Module to the electronic-flash unit.



NOTE: You can use any electronic-flash unit for testing purposes. Especially ideal, however, is the automatic unit. The automatic flash unit cuts off when the light striking the opal glass or the focal-plane aperture bounces back to the unit's photosensor. As a result, you get a very brief pulse of light — and the briefer the light pulse, the greater the action-stopping ability.

Varying the delay setting as you trip the shutter allows you to see the entire shutter cycle. To illustrate the procedure, assume that you're checking a leaf-type shutter. And suppose that the M-sync contacts close 15 milliseconds before the shutter starts to open. So with the delay-setting dial of the Sync Module at 0 ms to 15 ms, you'll see no light through the shutter opening.

At a delay setting of 15 ms, the blades start to open. Then, you'll see a small opening at the center of the blades. Further, let's say that our sample shutter takes 2 ms to open. At a delay setting of 16 ms, then, you'll see the blades extending half way into the opening. And you'll see the full opening at a delay setting of 17 ms.

Continuing to increase the delay setting allows you to measure how long the blades stay open at the particular shutter-speed setting. We'll say that the shutter in our example stays open for 1 ms. Consequently, at a delay setting of 18 ms you'll still see the full opening. Then, at 18.5 ms, you'll see the tips of the blades entering the aperture. At 19 ms, the opening is once again half covered by the blades. And at 20 ms, you'll see the small opening at the center of the blades just before the shutter closes.

So you can measure the delay between contact closure and any point in the shutter's cycle. Also, you can measure blade-opening time, full-open time, and blade-closing time. These figures allow you to check shutter speeds:

1/2 opening time plus 1/2 closing time plus full-open time equals effective exposure.

When checking the "FP" or "M" flash-sync delay in a focal-plane shutter, you'll see a slit of light — the faster the shutter-speed setting, the narrower the slit. You can then measure the delay between contact closure and the shutter opening at any point across the focal-plane aperture. Typically, you'll see the slit at the opening side of the focal-plane aperture with a delay setting of 8 - 16 ms. Check focal-plane shutter speeds by noting the time for the opening to pass a particular point.

Test "X" sync in either a focal-plane or a leaf-type shutter by first setting the Sync Module to 0 ms (turn the delay-setting dial as far as it will go in a counterclockwise direction without turning off the unit). You should now see the full shutter opening, as previously described.

CHECKING FLASH-SYNC DELAY WITH A SOLENOID

To check a solenoid-synchronized shutter, use a power pack (battery pack) to both power the solenoid and trigger the Sync Module. Use a double-ended male cord to connect the power pack's output receptacle to the input connector of the Sync Module. Use the appropriate solenoid cord to connect the solenoid to the output receptacle of the power pack. Connect the flash unit used to illuminate the shutter blades to the output terminal of the Sync Module.

The flash unit should fire as you depress the test button of your power pack. Try holding the test button depressed and make sure the flash fires. If, however, the flash fires when you let up the test button, the polarity to the Sync Module is reversed. In that case, simply remove the plug at the input connector of the Sync Module. Turn the plug 180 degrees to change the polarity.

MEASURING CURTAIN-TRAVEL TIMES

The procedure for measuring curtain-travel time in a focal-plane shutter is very similar to that used in measuring flash-sync delay. All you're doing is checking the flash-sync delay measured at the starting point of the curtain travel and the flash-sync delay at the ending point. Subtracting the first figure from the second figure gives you the curtain-travel time.

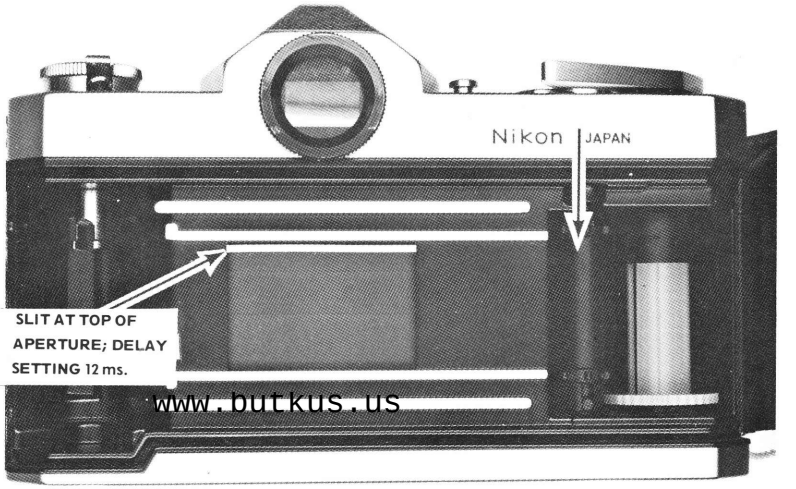
For example, the accompanying illustrations show typical results with a Copal Square shutter. Here, we're checking the flash-sync delay at the fastest shutter speed (1/1000 second in the Copal Square). The shutter's FP-sync terminal is hooked to the input connector of the Sync Module.

The curtains (blades) in the Copal Square travel from the top of the focal-plane aperture to the bottom. So in (A) of the illustration, we've adjusted the delay-setting dial until there's a slit of light at the top of the focal-plane aperture — 12 ms in our example. We've increased the delay setting in (B) until the slit is at the bottom of the focal-plane aperture — 20 ms in our example. Subtracting 12 ms from 20 ms gives us 8 ms, the edge-to-edge travel time.

There's only one problem with this technique — it's a little difficult to tell exactly when the slit of light enters the aperture and exactly when it reaches the end of the aperture. The width of the light slit further complicates interpretation.

For more precise travel-time measurements, you can use the National Camera Travel-Time Masks. There're two masks — one for vertically traveling shutters and one for horizontally traveling shutters. Each travel-time mask has two fine slits. All you have to do is measure the time for the curtains to reach the first slit and

then the time for the curtains to reach the second slit. The travel-time masks come with instructions and a list of proper travel times for several representative cameras.



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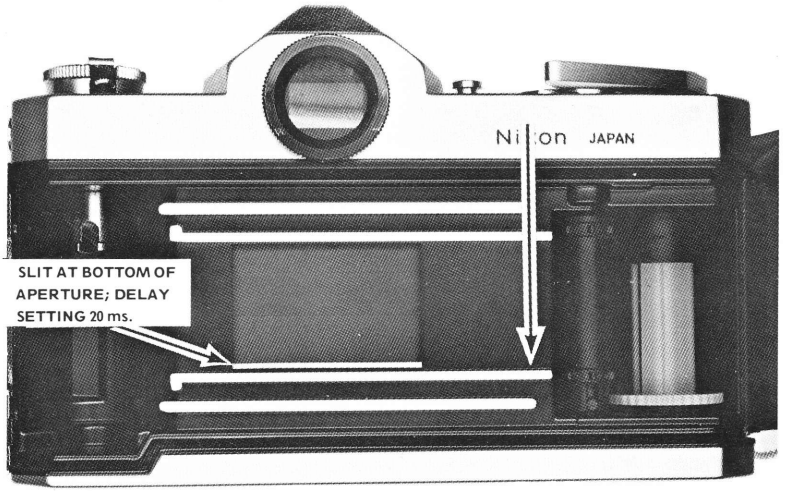

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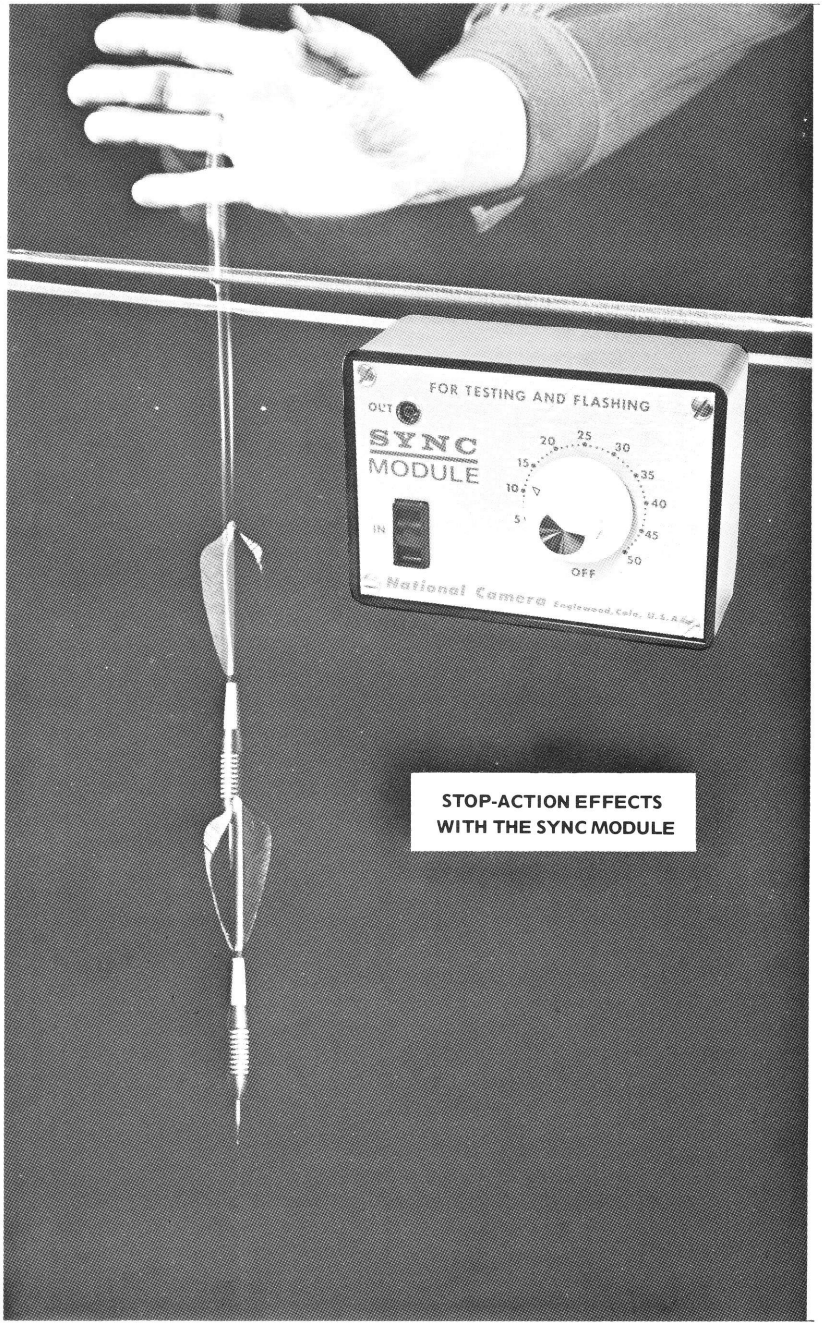
CURTAIN-TRAVEL TIME

20 ms – 12 ms EQUALS 8 ms EDGE- TO-EDGE.



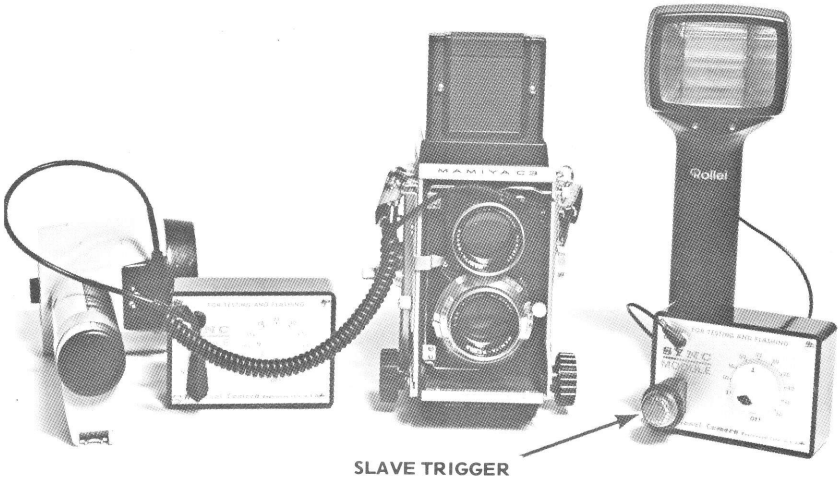
STOP-ACTION EFFECTS WITH THE SYNC MODULE

USING THE SYNC MODULE AS A PHOTOGRAPHIC ACCESSORY

As a photographic accessory, you can use the Sync Module to delay the firing of an electronic-flash unit. If you wish to expose a flash picture at some discrete time after an action, you can simply dial the delay into the Sync Module.

You can also chain together a group of Sync Modules for multiple-flash effects. One Sync Module then fires the next. Or you can trigger any number of Sync Modules using slave triggers. So it's possible to set up a series of flashes at equal or unequal intervals for a unique series of photographs or a stroboscopic record of a particular action.

The arrangement shown here provides two flashes at different delay times using a slave trigger. The camera fires one Sync Module and the first flash unit triggers the second Sync Module. You could get three flashes from the same two Sync Modules by firing the first flash unit with the camera; the Sync Modules would then fire the second and third flash units.



In photography, the Sync Module offers advantages over conventional stroboscopes or repeating flash units. Being able to select the delay setting allows you to precisely time repeating actions. Also, you can use the Sync Module with any electronic-flash unit. That may be an advantage when you need more light than a stroboscope can deliver. And by using an automatic electronic-flash unit, you have greater action-stopping ability at close flash-to-subject distances.

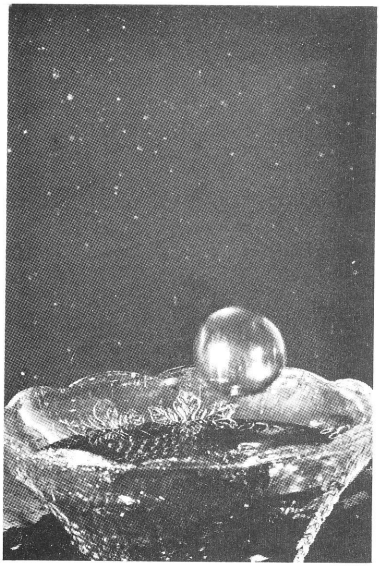
As an example, suppose that you wish to record the position of a moving object 30 ms after the action starts. You can use an external switch — a switch operated by the moving object — to trigger the Sync Module. So the Sync Module gets its input signal at the start of the action. It then fires the flash unit after the delay you've selected.

Depending on the object, a simple "normally open" switch may be all that's necessary; the object closes the switch to trigger the Sync Module at the start of the movement. Or you may require a more refined switch such as a photoelectric trigger. The moving object then actuates the photoelectric trigger by breaking a beam of light.

The series of photographs on the next page shows the effects of varying the delay setting. In the illustrations, we're simply dropping a ball into a bowl of water. As it falls, the ball breaks a beam of light to trigger the Sync Module through a photoelectric device.

In (A) of the series, the ball is just about to strike the surface of the water. The next illustration (B), taken with a slightly longer delay setting, shows the ball entering the water. And increasing the delay setting for the next two illustrations shows the difference in the resulting splashes.

Illustrations (E) and (F) show the same setup. But here we've added another flash unit to show the ball in two positions. A second Sync Module, triggered by a slave, fired the second flash. In these illustrations, we changed the delay setting of the second Sync Module to catch the ball in two positions — suspended in the air and entering the water.



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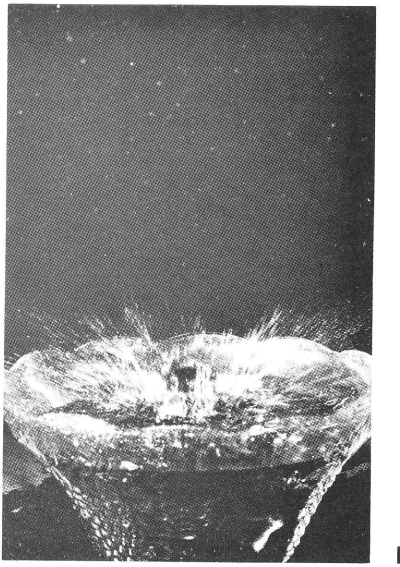

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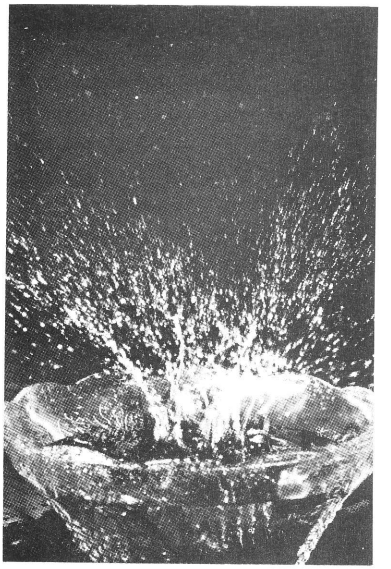

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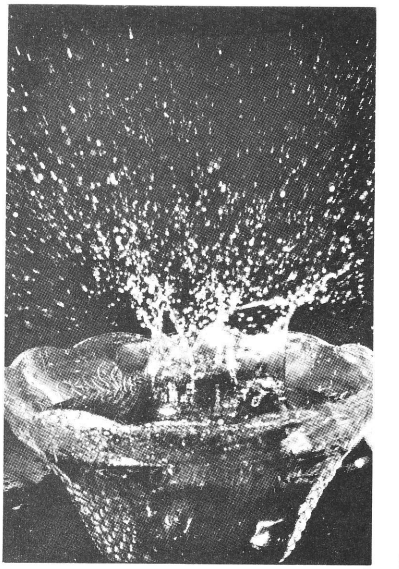

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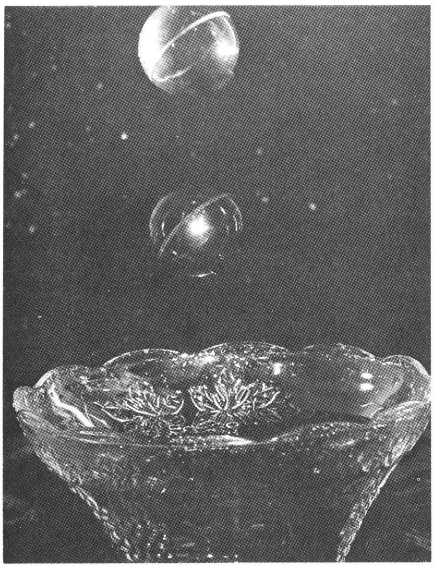

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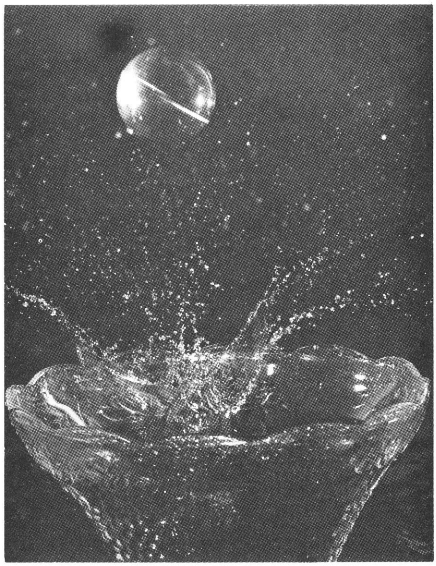

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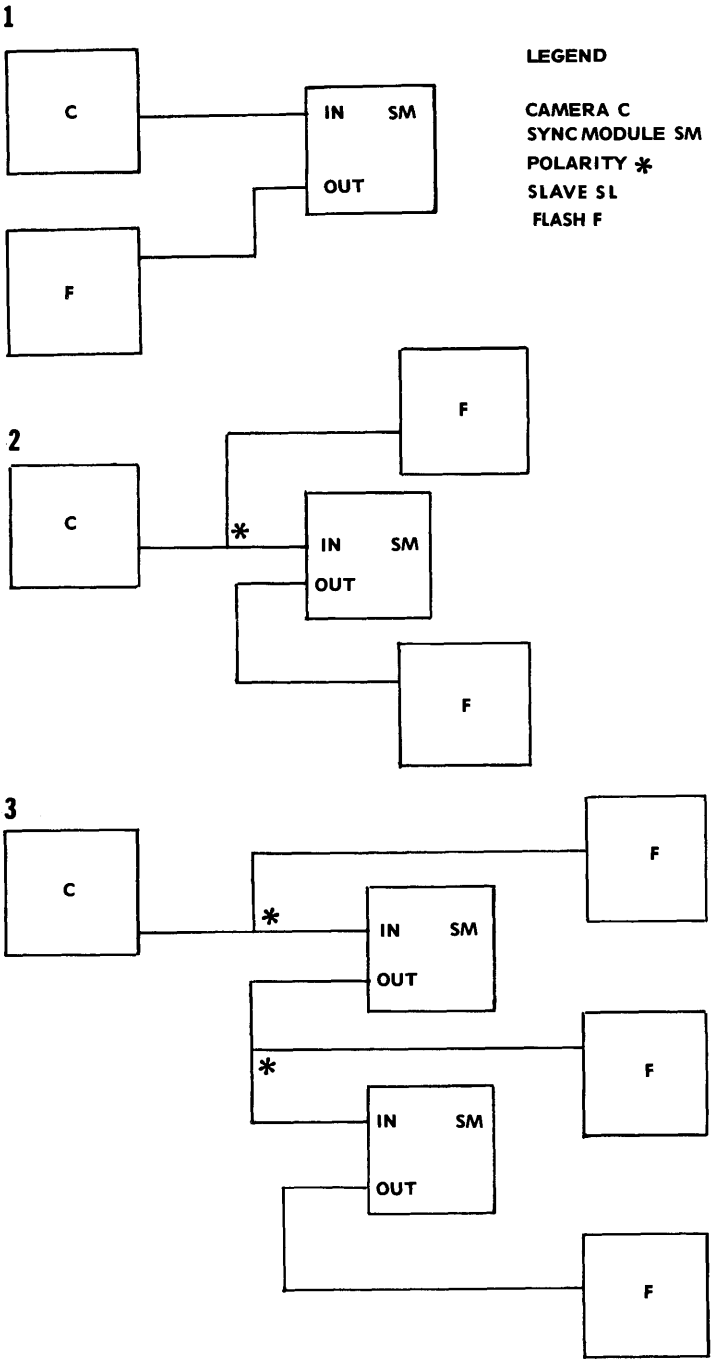
The setup we've described and illustrated is just one of many combinations you can use for multiple flash. By using a cube tap, for example, you can hook additional flash units to the input connector of the Sync Module. The following diagrams show several other possible combinations, starting with the simplest setup for a single delayed-flash exposure.

Notice that in some circumstances you must observe the proper polarity of a connection. If the polarity is incorrect for a slave trigger or an auxiliary flash, it may prevent the flash from firing; or it may prevent the Sync Module from triggering. In that case, simply unplug the slave or the auxiliary flash and reverse the connection.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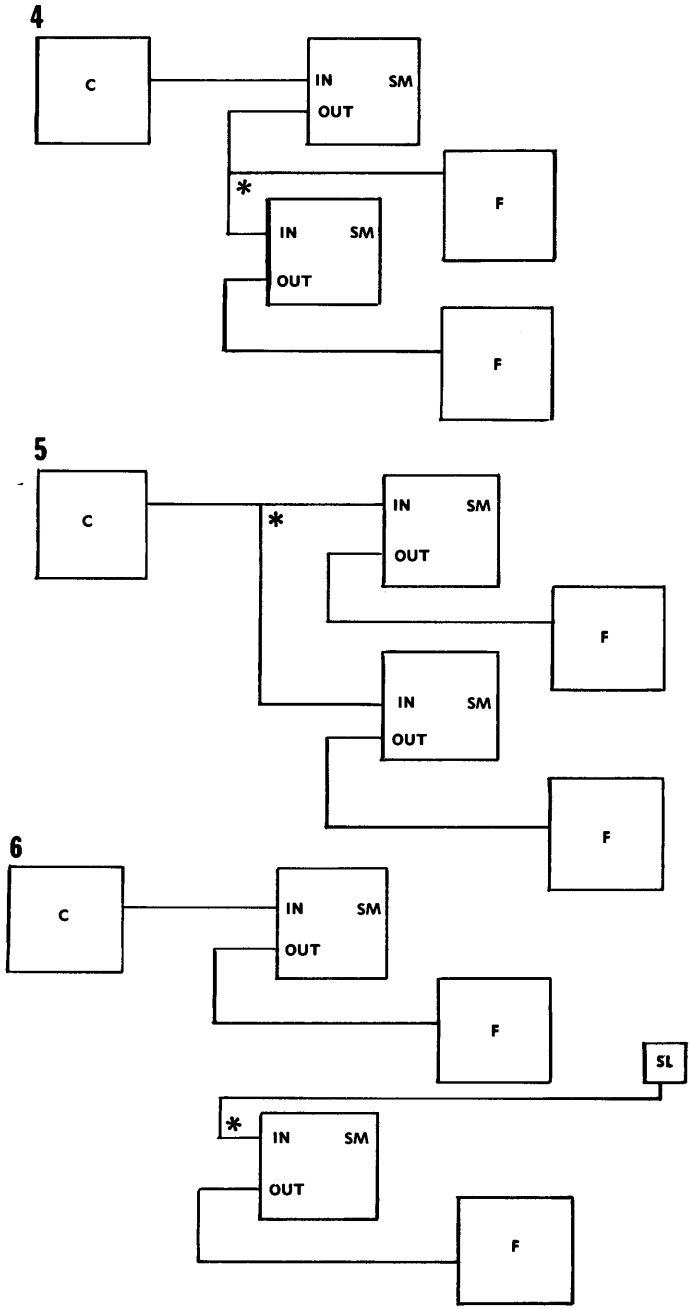
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