

Installation and use:

TTL Tobin Time Lapse Motor for Bolex H-16, H-8

NOTE: This motor requires that your camera have the 1:1 drive shaft.

The 1:1 shaft is found on cameras made since about 1965, including the H-16 Rex-4 serial number 210601 and higher; the H-16 M-4 serial number 214401 and higher; the H-16 S-4 serial number 221201 and higher; and the H-8 Rex-4 serial number 212401 and higher. All Rex-5, M-5, SB and SBM cameras have the 1:1 drive shaft. The 1:1 shaft is to the left of the film plane mark ϕ and above and to the right of the I-T selection knob.



Attaching the motor to the camera.

1A. First prepare the camera for motor attachment by following these steps. Also, if the headless filler screws are still installed in the motor mounting holes, remove and save them:

1. Turn the camera's **MOT** lever to **O** to disengage the clockwork spring. If excessive resistance is felt, push the camera's release button at the same time.
2. Remove the spring winding handle by hinging it over as if to wind the spring, but turn it *clockwise* instead of counter-clockwise. It has a left-hand thread and will unscrew. If it is stuck, add penetrating oil.
3. Set the speed dial to **64** or higher, fully clockwise.*
4. Lock the release slide in the **M** (lock-run) position to the left.
5. On H-16 Rex models with a variable shutter, remove the Rexofader if present, and lock the variable shutter in the **top** (fully open) **0** position.
6. It does not matter which position the I-T knob is set in; it has no effect with an external motor drive.

Warning: Failure to follow these steps can result in motor or camera damage, or inferior film. The motor's circuit protector, or automatic reset circuit breaker, may not act in time to prevent damage.

*Actually it makes little or no difference what speed is set on the camera speed dial for use with the TTL time lapse motor. The speed dial setting instruction must be followed for attaching other motors, however, so it is repeated here for consistency, in case the speed dial resetting is overlooked when switching to a different motor.

1B. Note that it is not possible to manually turn the output shaft of the TTL motor. This is because there is a 60:1 gear ratio between the internal motor and the shaft.

1. Observe that the camera 1:1 shaft has two different sizes in the two ends of the drive shaft pin. If possible, manually advance the camera mechanism with a rewind crank so the wider end of the pin, and the red dot, are uppermost or slightly clockwise. This is approximately the position the TTL motor stops in with normal settings. The 1:1 shaft is the one to the left of the film plane mark ϕ .

2. Lay the camera down on a soft surface, with the camera door side down.
3. Place the TTL drive shaft over the camera shaft so the camera's drive shaft pin aligns with the slots in the TTL drive shaft.



4. Rotate the entire motor as needed to get it into the normal mounting position.
5. Engage and tighten the three attaching screws just finger tight. It is not necessary or desirable to use a wrench as the motor driving torque is quite low at the TTL's operating speed, and over-tightening can damage the screws or the camera.

Powering.

The TTL requires 12.6 volts DC for operation. Current draw is quite low, suitable for long-term unattended operation on battery power. Connection is with the industry standard "XLR" type 4-pin male receptacle, and with the industry standard polarity of pin 1 negative (—) and pin 4 positive (+). Acceptable range is 11 to 14.4 volts.

Current drain between exposures is 15 mA (.015 Ampere.) During exposure the starting current is briefly 800 mA and average current drain is under 70 mA using the TTL motor alone. If accessories are used the current requirement will increase accordingly. Using a 7 AH (ampere-hour) lead-acid battery, you should be able to run 100 feet of 16mm film in time-lapse mode on a full battery charge if the interval is 5 minutes per frame or less.

To run from commercial AC power, a filtered and regulated DC power supply is required. For proper operation, the voltage must not sag below 11 volts with 800 mA drain, or rise above 14.4 volts with no load.

Controls and Connectors.

The main function switch is marked Rewind, Off, Normal and Wind.

Off means that no power is reaching the circuitry. The motor will stop in a random position if it was running at the time it was switched to Off.

Normal is used for intervalometer and animation. It will run the same speed and stop in the same position each time.

Wind is used to forward the film more rapidly than normal, for running off leader etc. This position can be used for continuous filming, bearing in mind that the speed, approximately 1.25 FPS, is not regulated and will vary with battery voltage, and that the camera will stop in a random position.

Rewind moves the film in reverse, for backing up the film for double exposures etc. It should not be used for filming since the Bolex uses a different claw in reverse, which can cause unsteadiness and a displaced frameline. The speed is the same as Wind, about 1.25 FPS. To rewind for a double exposure, cap the lens or close the variable shutter and back up the film a few frames more than wanted. Then go forward a few frames to the correct starting point, uncap the lens or open the shutter, and resume filming. Refer to the frame counter and your notes, to avoid confusion. Note that **Rewind cannot be used with the 400' magazine** as it will not run in reverse.

The **Time Lapse** knob selects the interval between exposures and is continuously variable.

The Minutes-Seconds switch selects **Seconds** when down in that position and **Minutes** when up in that position.

The Normal-Long Exposure switch selects **Normal** exposure time, about 3/8 second, when down in that position and **Long Exposure** when up in that position. Use Normal unless shooting in very dim light. See the Exposure section. When you switch between positions the next frame may not be exposed correctly.

The **Animation** jack accepts a 3.5mm remote plug. Inserting the plug defeats the three previous controls and gives a fixed 3/8 second exposure, with frames exposed manually.

The **Accessory** jack is for connecting a torque motor for shooting 400 foot film lengths in the magazine, or for connecting a relay box for turning on exposure lights each time a frame is exposed, in Normal or Wind.

Film Loading.

Many Bolexes will probably be used for animation and time-lapse cinematography by owners of other cameras who have not used a Bolex before. This section is intended for them:

The Bolex has automatic threading when using the normal camera spools. To utilize this, you will remove the spool from the container in subdued light. Remove the camera lid. If you want to check the film gate for dirt and hairs, open the gate, unscrew the gate from the post and pull it out. Blow out the debris. Replace the gate and don't forget to close it fully. Remove the spool from its can or container. Place the spool on the upper spindle with the free film end hanging on the right, so it will unwind clockwise. If the leading end of the film has a point on it, trim it square with the little cutter inside the film compartment. (This is necessary to prevent the point from catching in the gate during automatic threading and causing a film jam.) Close the automatic loop formers by moving the lever down until it clicks. Run the motor in the "Wind" mode. Feed the leading end of the film into the upper sprocket. The film will follow the loop formers through the gate and then emerge from the lower sprocket. You can then push the button in the middle of the loop former lever so the loop formers will pop open. Observe that the upper and lower loops are present and not hitting anything. After enough film has emerged, stop the motor and insert the film end into the slot of the empty takeup spool. Wind the spool clockwise and pop it into place on the lower reel spindle. Replace the camera lid.

Cap or cover the lens to prevent confusion and wasted effort later, and run the motor for about another four feet until the footage counter reads "0." The film manufacturers have allowed for subdued-light loading and unloading by selling you an actual 109 feet of 16mm film on the nominal 100 foot spool. After the counter reaches "100," cap the lens again and run the camera for about another four feet until you hear the tail end of the film go through. Stop the motor, open the camera lid, place the full spool in the container, and send it off for processing. The now-empty supply spool becomes the takeup spool for the next load of film.

With the H-8 8mm camera, the film is turned over and run through once more, no more and no less, to expose both halves of the film. After processing it is slit to make 25 feet into 50, or 100 feet into 200. Each pass, you must have the light sensitive emulsion side facing towards the lens. The 25 foot spools have 33 feet of film, an extra 4 feet on each end.

Some causes of fogged film: Loading the camera in light that is not sufficiently subdued. Filming with the reflex finder blind open but with your eye not behind the eyepiece. Filming with no gelatin filter holder in place. Filming in Super-16 which is much more sensitive to edge fog and should be loaded and unloaded in even more

subdued light. Not running off enough film before you start shooting. Letting the camera stop with the shutter open in bright light when using the H-8 8mm camera, which can fog the opposite half of the film.

Time Lapse (Intervalometer) Operation.

In the Time Lapse mode, the TTL will automatically time the exposures over a very wide 1800:1 range. In the “Seconds” mode, the intervals are adjustable from under 2 up to about 60 seconds. In the “Minutes” mode, the intervals are multiplied by 64 to give a range of under 1 up to about 60 minutes. The speed dial has logarithmically spaced increments, for a wide (about 100:1) range on the dial. The timing for starting the next exposure is not begun until the previous frame is finished, to prevent missing frames when a short interval is chosen.

By default, with nothing plugged into the “Animation” socket, the TTL motor is in the Time Lapse mode. To run the camera, set the main function switch to “Normal.” It will automatically expose frames of film at the selected interval. The running speed is about .75 frame per second (FPS,) 45 frames per minute, or 32 times slower than normal 24 FPS filming. See the Exposure section for more information.

If you are shooting in very dim light, you can select the “Long Exposure” switch position. This will cause the camera to stop each time with the shutter open instead of closed. The exposure time becomes the interval between exposures, minus about one second. That is, if your interval is 6 seconds the exposure time will be 5 seconds. If your interval is 60 seconds, the exposure time will be 59 seconds. This is useful for very dim subjects such as stars or moonlit landscapes. Note that you **MUST NOT** change the interval dial or switch when filming the same subject and location, or else this will cause sudden exposure shifts or flicker in the film. See the note below about reciprocity failure correction.

Here are some starting points for experimenting with time lapse (or intervalometer) filming:

Sunsets	2 seconds at .75 FPS normal speed, or perhaps instead use the 1.25 FPS “Wind” speed. Use “Normal” exposure.
Clouds	4 to 7 seconds. Use “Normal” exposure.
Stars	45 to 60 seconds. Use “Long Exposure” setting.
Construction	60 minute intervals will make an entire day pass in one second, at 24 FPS. Use “Normal” exposure unless the light is very dim.
Surveillance	Use “Animation” mode with remote release. In case of suspicious behavior, you can film for 89 minutes on 100 feet of 16mm film and normally capture the entire event.
Various Subjects	Most fall in the range of 2 up to 30 seconds.

Animation Photography.

This operation mode is entered by plugging in the remote release switch. This causes a number of internal changes, including automatically setting the “Normal” exposure mode and disconnecting the timer.

Make a single exposure by briefly tapping the remote switch. If you hold the switch down, the motor will continue to run. This is useful for doing a “freeze frame” as additional filming in continuous running will have the same exposure as actual single frames. Use the camera’s frame counter to keep track of things. You can back up the film for multiple exposures by using the “Rewind” position on the main function switch. The cable provided is 3 feet long, and it can be extended by using a 3.5mm microphone extension cable.

Correcting Exposure.

The TTL runs at .75 FPS in the Animation mode, or in Time Lapse mode with the “Normal” exposure position, regardless of the interval between exposures. This is 32 times slower than normal filming at 24 FPS.

The physical exposure time is 1/2 of a second at .75 FPS. To get the same exposure at .75 FPS as you would at 24 FPS, you need to either close down the lens aperture by **5 stops**, or insert a **1.5 ND** (neutral density) filter in the light path.

For setting your light meter, remember that the reflex Bolex Rex, SB and SBM cameras have a physical exposure time of 1/66 second at 24 FPS, and the light diverted to the reflex finder makes the exposure setting equivalent to about 1/85 second. At .75 FPS the effective exposure time is 3/8 of a second, which is 32 times longer. Since few movie light meters show an FPS rate of 40 FPS (which would give the same exposure with the average camera as a Bolex Rex gives at 24 FPS,) it is often necessary to fudge on the meter’s ASA speed setting.

A. If you are using ASA 100 film in your Bolex, you could set 64 ASA in your light meter, setting it also to 24 FPS (1/50 second assumed) and get good exposure. If you then insert a **1.50 ND** filter in the light path, the exposure should now be correct at the .75 FPS speed of the TTL motor. If you can not find a 1.50ND filter, correct the meter's ASA setting as follows if using ASA 100 film: If **1.0 ND**, set ASA 200. If **2.0 ND**, set ASA 20.

B. Another possibility is to pretend you are using a much higher film sensitivity than reality, to allow for the filming rate difference. If you are using ASA 100 film in your Bolex, you could enter a film ASA rating of 2000 and 1/50 second, and directly read the required aperture for actually filming at .75 FPS with the TTL motor. This will work best in rather dim light.

It is preferable to use **ND** (Neutral Density) filters instead of stopping down the lens to very small openings. This is because a lens used at a very small opening, say smaller than (i.e., a bigger number than) F/11 will usually give a loss of sharpness and contrast owing to light diffraction effects.

You can film from a mixed assortment of **video and computer monitors** with the TTL. The long exposure time will minimize the flicker and roll bar by exposing each frame of video many times. For this to work you will have to slow down the computer program by some 32 times so it will come out the right speed on the film.

With very **long exposure times**, over one second, the sensitivity of the film becomes less because of an effect called "reciprocity failure." Consult the film's data sheet for specifics. With many films, if the light meter calls for a 10 second exposure per frame, you will need to actually give 30. If the meter calls for 30 seconds, you will need to actually give 150. This correction is not needed if you can increase the intensity of light reaching the film instead of the duration, to make the indicated exposure time less than one second. That is, use more light or a larger (smaller number) F stop.

In Case of Difficulty.

If the motor runs in the **wrong direction** in Wind or Rewind, and does not run at all in Normal, your DC polarity is reversed. Swap the connections to the battery.

If the **circuit protector** trips, which will only occur in case of major failure or abuse, it will reset itself if you turn off the power and let it cool for a few minutes. Normal operation should then resume.

If the **torque motor** is not getting enough voltage to take up film tightly enough in the 400 foot magazine, your technician can remove the TTL cover and install the shorting jumper at the top of the circuit board so that it is linking the two pins. Use care as the drive shaft and spring will fall out when the unit is disassembled. The voltage is restored to its original setting by installing the jumper on only one pin, not linking the two. Reassembly of the motor takes patience as the drive parts and four captive screws must all be correctly aligned at the same time.

A very few early Bolex type 4 (Rex-4 etc.) cameras may have left the factory with a **drive pin** lacking the wide and narrow coding. In this case, you will have to attach the TTL and then verify, by turning the lens turret and looking in the film gate, that the motor is stopping in the correct position, that is with the shutter closed in Normal, and open in Long Exposure.

Tricky **remote control** hint if needed: Use a 3-conductor "stereo" shielded 3.5mm cable. Use two switches at the other end. Linking Ring to Sleeve will switch from Time Lapse to Animation mode. Linking Tip to Sleeve will then run the camera for either single frames or continuous run.

The **accessory jack** has pins 1 and 4 negative (—) and 2 and 3 positive (+) at about 8 volts when running.

NOTE: Do not modify the TTL, such as by adding a relay to the built-in microswitch, as this point in the circuit is not designed to supply more than logic switching current. This will cause improper operation, could damage parts, and will void your warranty.

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