Using the TCS TXM-16 and TXM-16V

Crystal Controls for Bolex EBM-EL-ESM

Abbreviated Instructions

1. Plug the crystal into the camera.
2. Switch camera to **"SYNC"** or **"CRYS."**
3. Switch crystal to the desired speed.
4. Film away, ensuring that the "Alarm" stays dark.

The following gives additional detail for advanced and special uses:

Applications

The TXM-16 and TXM-16V are used for double-system sound filming with the Bolex EBM and EL cameras, and the ESM motor used with spring-wind cameras.

The **TXM-16** gives the traditional sound speeds of 24 FPS (frames per second) used in North America, and 25 FPS as standard in Europe and much of the world. In addition, after successful camera adjustment or modification it is also possible to film at the 30 FPS rate, which is popular for film that is to be transferred to U.S. NTSC video. The audio recorder such as a Nagra or cassette must be equipped with a crystal sync generator to record a pilot signal (a timing or speed reference) on the recorder's pilot or spare audio track. (Suitable crystal sync generators are also manufactured by TCS.) This tape is then resolved (i.e., transferred in sync) to 16mm perforated magnetic film, at the same speed as the picture, for editing.

It is also possible to have the sound on DAT (digital audio tape,) CD (compact disk,) or on Hi-Fi video tape such as 8mm, Hi-8, VHS, etc. Since these formats automatically record a control track that is locked to the same crystal on playback, acceptable sync can usually be maintained by simply re-recording to magnetic film without any special equipment. The magnetic film recorder is run at the same speed as the filming rate (24, 25 or 30) preferably locked to a crystal rather than the power line (mains) frequency, which can vary somewhat. Since general purpose sound equipment is not adjusted as accurately as equipment intended for sync sound use, the best sync will be obtained by playing the digital or Hi-Fi tape back on the same piece of equipment as was used in the field. The picture and sound rolls can then be edited to make film prints, or interlocked together for transfer to video.

The **TXM-16V** is primarily intended for generating footage that will just be transferred to U.S. NTSC video, and not be used for making film prints. The 23.976 and 29.970 FPS speeds are the exact speeds that a Rank or Bosch film scanner actually runs at when set to "24" and "29.97" respectively. Therefore, when filming at these speeds you are working in exact real time as far as the film scanner is concerned. Your audio can then be on DAT (digital audio tape,) CD (compact disk,) or on Hi-Fi video tape such as 8mm, Hi-8, VHS Hi-Fi, etc. This self-resolving audio can then be just played back without special equipment and re-recorded on the audio tracks of a professional video tape format. The start mark or clapstick can be lined up on two video tape machines, run together for editing. This eliminates the intermediate transfer to 16mm magnetic film, possibly saving cost and the loss of audio fidelity. This also permits keeping multiple channels of audio, which would usually be lost on magnetic film. It is also possible to film for eventual film release, by several possibly confusing options: **1**. Film at 23.976 FPS with audio on a Nagra or cassette recorder, using a 59.94 Hz crystal pilot frequency instead of 60. The tape can then be resolved to 16mm magnetic film with normal techniques and sync will be maintained. **2**. Film at 23.976 FPS with audio on a Nagra or cassette recorder, using a 60 Hz pilot frequency. In resolving, a 60.06 Hz reference frequency is used instead of 60. The disadvantage here is that 60.06 is not recognized as any sort of standard and crystals for this are rare. **3**. Film at 23.976 FPS. Record your audio on CD, Hi-Fi or DAT, and when re-recording run the magnetic film recorder at 23.976 FPS by feeding in a 59.94 Hz reference instead of 60. Not all magnetic film recorders are capable of this, however. **4**. In this case, dub from the digital audio to a Nagra tape while recording a 59.94 crystal pilot, then resolve that to 60 Hz to the mag film normally. (TCS makes crystal sync generators of 50 and 60, or 59.94, Hz and can make them up in a box for use on AC, or on batteries.)

In all cases, the differences above are mainly in how sound sync is maintained. For filming under conventional **HMI** lights, fluorescent lights, or discharge-type street lights the question of HMI compatibility arises. 24 and 30 FPS are HMI safe for lights operated on 60 Hz power. 25 FPS is safe for lights operated on 50 Hz power. 23.976 and 29.970 FPS are not HMI safe and a slow pulsation of exposure might be noticed. The remedy here is to use "flickerless" HMI lights, or else high-amperage tungsten light. Of course, when filming under daylight or high-amperage tungsten, any speed can be used at will anywhere in the world.

Connection and Operation

For the **EL** and **ESM**, simply plug the TXM-16 7-pin male Tuchel plug into the socket provided on the camera or motor.

Since the **EBM** has only a single 7-pin socket, plug the TXM-16's cable into the camera. Plug the switched power cable into the 7-pin female "**EBM Power**" socket on the TXM-16. However, if you are using the Power Grip with its internal battery, just plug the TXM-16 into the 7-pin female socket on the back of the Power Grip.

For crystal sync sound filming, you must switch the camera to "**SYNC**" or "**CRYS**" (depending on the model.) Run the camera. The sync "**Alarm**" should initially light, and then go out. A bright light indicates a stopped camera, bad cable, or damaged quartz crystal. If it lights more dimly or flashes, then sync is not being maintained. This could be caused by a film jam, weak battery, defective camera or cable, attempting 29.970 or 30 speeds before adjustment or conversion, or most often by the camera dial not being at the proper setting. You can preview this effect by switching the camera to a specific speed, such as 18 or 32. The crystal circuitry senses the errors but has no actual control over the camera in these positions and the "Alarm" light will come on.

>When you are finished, remember to switch the camera back.

For conventional filming, use 24 FPS in North America and 25 FPS in Europe. For transfer to NTSC video, several speeds could be used depending on your equipment and techniques, and the available sound and video facilities; speeds of 29.970 and 30 FPS give reduced "judder" for smoother motion. Refer to the Applications section above.

video, several speeds could be used depending on your equipment and techniques, and the available sound and video facilities; speeds of 29.970 and 30 FPS give reduced “judder” for smoother motion. Refer to the Applications section above.

On the **TXM-16**, set 24 FPS by moving the top switch left to the “24” position. The bottom switch then has no effect, and can be on 25 or 30. For 25 FPS, move the top and bottom switches right. For 30 FPS, move the top switch right and the bottom switch left.

On the **TXM-16V**, move the switch to the left position for 23.976 FPS. Move the switch to the right position for 29.970 FPS.

At the beginning of each shot, use a clapstick that can be seen by the running camera and heard by the running recorder’s microphone, to establish a starting point. To minimize confusion later, also write the scene and take number on the clapstick, and announce it verbally. These steps should eliminate guesswork in proper synchronization. Film editing and sound mixing steps are beyond the scope of these instructions and you should refer to the books and courses on the subject.

Your Bolex is not a self-blimped quiet camera, so a technique involving a blimp or barney, filming at a distance or through a window, the use of directional or lavalier microphones, etc. may be called for.

Camera Adjustment for 29.970 and 30 FPS Filming

Your Bolex was probably factory adjusted so that it is only willing to run in the range of about 22 to 27 FPS in the “SYNC” or “CRYS” mode. Some Bolex cameras and motors can be re-adjusted to enable crystal filming at 29.970 and 30 FPS by adjusting pot P6 on the EBM and ESM, and pot P103 on the EL. Because of part tolerances, many cameras may not be adjustable to include these speeds and a resistor substitution may be needed. Changing this 5¢ part entails camera disassembly and you may wish to contemplate whether the benefits outweigh the labor cost and time involved. There may be little cost however if it is done at the same time as cleaning, lubrication and adjustment of the camera.

We are not in a position to guarantee whether any particular camera can be simply re-adjusted or will require disassembly. We will not be responsible for improperly done conversions, inadequate or incorrect instructions by us, voided warranties, or any direct or consequential problems.

After adjustment or modification your camera should be used only within the range of speeds for which it has been modified; at other speeds the crystal control unit may no longer be able to reliably pull the camera into sync.

Instructions for your technician: First remove a panel or cover as required for adjustment access. On the camera’s 7-pin Tuchel socket, connect a 1 kΩ resistor from pin 1 to pin 4 (a piece of wire could be used, but a resistor prevents damaging the camera in case of connecting to the wrong pins.) Run the camera, and with an insulated tool adjust pot P6 on the EBM or ESM, or pot P103 on the EL, so the camera is running at or just above 32 FPS, judged by using a strobe light, or by a stopwatch timing the footage dial (32 FPS is 48 feet per minute.) The adjustment can be confirmed by removing the resistor, connecting a TXM-8, TXM-16 or TXM-16V crystal, loading film, and checking that the sync “Alarm” light stays dark while running at all crystal speed settings. The adjustment can be further confirmed by connecting an oscilloscope to socket pin 1 and ground, and observing that the duty cycle of the control signal does not approach 0% or 100% too closely at any crystal speed. If the speed cannot be reached by adjustment, ask the customer if you are to proceed. If so, disassemble the camera and increase the value of the resistor in series with the pot: resistor R34 (120 kΩ) on the EBM or ESM, or R135 (82 or 100 kΩ) on the EL. As a starting point, try raising the value by about 20% (from 82 to 100, 100 to 120, and 120 to 150 kΩ.) Then see if the adjustment can be made.

If the camera balks at running in sync at all crystal speeds, at a compromise setting, it may be necessary to mark the adjusting pot for 24/25 and for 30, and instruct the camera owner to change the setting when switching between the crystal speed ranges.

Other Information

There are no user adjustments or user-replaceable parts inside the TXM-16 and TXM-16V. Refer all servicing to qualified personnel.

The crystal can be recalibrated if necessary by connecting a frequency counter to the test point on the lower board, and to ground. Adjust the trimmer capacitor on the lower board, accessible through a hole in the upper board, for 6144.000 kHz on the TXM-16 and 6137.862 kHz on the TXM-16V, ±20 Hz, while connected to a camera receiving normal 12 volts DC.