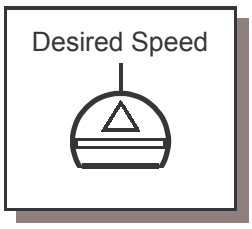
Installing and Using the TCS TXM-22 Crystal Motor for Arri 16-S, 16-M

1. Installation. First remove the existing motor by loosening the clamp, then pulling out the motor. **Clean** the front gold electrical contact and the front coupling ball on the TXM-22, the camera's electrical motor contact spring, and the inside of the camera's mating rubber coupling, with a cotton swab stick moistened with rubbing alcohol. Do not touch these components with your fingers. Install the TXM-22 by lining up the index pin with the slot in the camera, then push the motor fully in until the trim ring is flush against the body. Tighten the clamp.

2. Powering. The TXM-22 requires **12 volts DC** for the best results. Operation on 8 volts is not guaranteed. Make sure the correct DC polarity is applied; normally positive goes to the **Left** pin on the Arri-S original 2-pin socket, to **pin 1** on the Arri-M 3-pin socket (pin 3 —), and **pin 4** of cameras converted to have the standard XLR 4-pin socket (pin 1 —). The ultimate test is that when the run switch is on, positive voltage is found on the lower spring contact that connects to the front pin on the motor. If polarity is reversed, the motor may not be harmed but it will turn backwards at high speed, 50+ FPS. Do not attempt to use AC, or connect a battery charger.

3. Magazines. There should be no problem using the **16-M** 400' magazines as they are driven mechanically by the camera body. The **16-S** 400' magazine torque motors, however, are mostly designed for 8 volt operation. They must be converted for use on 12 volts to prevent overheating and burnout, and also to reduce electrical interference with the crystal drive motor.

4. Basic Operation. The camera is started and stopped as before with the camera's usual switch.



a. The **speed** of the TXM-22 is selected with the recessed rotary switch. Note that the **pointer or dot** is set towards the desired speed; do not align the screwdriver slot as this will give the wrong speeds. Available choices are 6, 12, 20, 24, 25, 30, 40 and 50 FPS (frames per second.) Certain speeds are HMI safe according to the power line (mains) frequency supplying the HMI lamps. For 60 Hz power, the safe speeds are 6, 12, 20, 24, 30 and 40 FPS. For 50 Hz mains, the safe speeds are 20, 25 and 50 FPS.

b. The **direction** is controlled by the recessed toggle switch to the right of, and below, the speed switch. Down is forward, and up is reverse. If using the Arri S with 400 foot magazine, be sure to **also** change the direction lever on the magazine.

c. If the camera stops running with the viewfinder dark, use the **Manual Advance** knob on the back of the motor. Turn it clockwise to restore the viewing position.

d. The **"Sync Alarm"** light will come on any time the motor is not running at the selected speed. It is normal for it to come on briefly at the beginning of a shot.

5. External Speed Control. Connecting a TCS Milliframe Controller will automatically make it the reference for controlling the speed. Connection is by the 3.5mm accessory socket on the rear of the motor. **IMPORTANT:** See the **note** below for the calculation of the speed to set on the Milliframe Controller switches. The speed switch on the motor should **also** be set to the approximate actual external speed in order to reach the external speed as quickly as possible. The "Sync Alarm" light on the motor will show whether the externally selected speed is being

maintained. External speeds should be kept within the range of 5 to 50 FPS.

NOTE: Setting the speed on the Milliframe Controller:

Using the usual simple, inexpensive 3.5mm cable you must set the speed switches to 60% (that is, 0.6 times) the desired speed. That is, for 29.970 FPS you set 29.970 x .6 = 17.982 on the Milliframe Controller. This is because the Milliframe Controller outputs a standard 100 pulses per frame, but the TXM-22 operates internally with 60 pulses per frame. Since the speed in this case is actually 29.970, to reach this speed as quickly as possible you will set this approximate speed also (i.e., 30) in the TXM-22 speed dial. Note that if using the TMC2 model with footage counter, the count will not advance with the TXM-22 as there is no frame pulse output from the motor to drive the counter.

At some future date, TCS may offer a conversion box to go inline between the Milliframe Controller and the TXM-22. If using this box, you would then set the actual desired speed on the Milliframe Controller's pushwheel switches.

6. Application Notes for sound filming:

a. Your Arri S or M is not a self-blimped quiet camera, so for successful sync sound filming you may need: a directional microphone and sound-absorbing walls; to use a blimp or barney indoors; to film outdoors at a distance; or to film through a window. Of course, to shoot a music video where the performers are miming (lip-syncing) to playback and no audio is being recorded, camera noise is not a problem.

b. Choice of filming speeds:

Traditional sound speeds are **24** FPS used in North America, and **25** FPS in Europe and much of the world. The **30** FPS rate is popular for film that is to be transferred to U.S. NTSC video, as it eliminates "judder," an irritating 12 Hz irregularity in the strobing of moving objects arising from the so-called "2-3 pulldown" for digitally converting 24 FPS film to 30 FPS 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,) MiniDisc, 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 **23.976** and **29.970** FPS speeds are the exact speeds that a Rank or Bosch NTSC film scanner actually runs at when set to "24" and "29.97" respectively. Therefore, when filming at these speeds, using the Milliframe Controller, you are working in exact real time as far as the film scanner is concerned, so audio on DAT, MiniDisc etc. should hold sync well.

7. In Case of Difficulty.

Fuse. The TXM-22 has a non-replaceable, automatically resetting PTC (positive temperature coefficient) thermistor "fuse." If more than about three times the normal current is drawn by the motor and accessory speed control for more than a few seconds, the PTC device will switch to a high temperature high resistance state that will prevent the motor from running or the sync alarm light from coming on. In this case, turn off the power switch, and let the unit cool for 5 or 10 minutes. Normal operation should then resume.

Running Backwards. If the motor turns at high speed the wrong way, your DC polarity is reversed and must be corrected. The fact that your original variable speed motor runs the right way means nothing as it is a wound-field type that will turn the same way with either polarity.

Sync Drift. If you suspect that proper sync is not being maintained, it is quickly verified by pointing the running camera at a TCS TSC Speed Checker. Alternatively, a TV receiver can be used as sort of a poor man's strobe. If you have a U.S. set, run the camera at 29.970 FPS with a Milliframe Controller and you should get a stationary shutter bar. (If you don't have the ability to run that speed, select 30 FPS instead; the shutter bar should move from bottom to top of the picture in about 16 seconds.) For European PAL or MESECAM receivers, run the motor at 25 FPS and you should see a stationary shutter bar.

If the bar is moving improperly, that is it is definitely crawling downwards with 29.970 or 25 FPS, or moving at the wrong rate at 30 FPS, this indicates that the camera is running slow. The most frequent cause of this is a slipping coupling between the motor and the camera. The TXM-22's coupling ball is machined to the same diameter as the original motors' couplings. Since most rubber cups have become loose with age and use, the diameter of the ball is increased at the factory by applying a piece of heat-shrink tubing. In case you are still getting slippage, first try cleaning the rubber and the motor ball with rubbing alcohol, avoiding fingerprints on either. If this does not work, try making the fit tighter by applying a second piece of 3/8" (10mm) heat-shrink tubing to the ball, and heating it to a shrink fit.

Conversely, if the ball diameter is too large to fit easily into the camera's rubber coupling, the heat-shrink tubing can be removed by slicing it with a knife.

A very slow movement of the shutter bar in either direction may be due to normal frequency tolerances in either the video source or the motor. The crystal frequency in the motor is best checked by removing the rear cover, connecting a frequency counter (with recent calibration) to the test point pin and ground, and while running adjusting the nearby trimmer capacitor for 9216.000 kHz ±30 Hz or ±3 ppm (parts per million.)

3.5mm Connections. In case the speed controller cable is damaged and needs repair, tell your technician that Sleeve is cable shield and circuit ground, Tip is +11~12 volts 50 mA (max.) power output, and Ring is 3~5 volts p-p 60 pulses per frame square wave input signal. Circuit ground is 0.6 volts above case ground owing to a polarity protection diode.

Tobin Cinema Systems, Inc.