

# Installing and Using the TCS TXM-21A Crystal Motor for Arri 2A, 2B, 2C

**1. Installation.** First detach the existing motor by removing the attaching screws and the idler gear, all of which will not be used with the TXM-21A.

Place the motor on a table. Gently engage the 35-tooth gear on the camera bottom with the matching interior gear in the motor. (This gear is very flexible owing to a universal joint, and may need to be helped into position with a small stick.) Turn the inching knob slightly while gently jiggling the camera to enable it to slip fully into place. Pass the two long screws through the motor up into the camera, and tighten the two screws.

Do not fully tighten the screws until you are sure the motor is flush against the camera, and the inching knob turns without binding.

**2. Powering.** The TXM-21A requires one or two sources of **12.6 volts DC**. A single 12-volt battery is used for normal speeds up to 25 FPS. A second 12-volt battery is added for speeds of 30 FPS and higher. The 4-pin male XLR receptacle of each uses standard wiring, that is with pin 1 negative (-) and pin 4 positive (+).

**Do not apply reversed polarity** to the first or second battery connection as this will cause damage to the motor and to connected accessories even with the run-stop switch turned off. Reverse polarity or overvoltage damage is not covered by your warranty.

When using a single 12 volt battery, the pins of the right-hand connector have 12 volts on them when the Run switch is on. **Do not short** these pins to the case or this will instantly blow the fuse and could cause other damage. Keep the slip-in plastic cap in place on this connector to prevent problems, when it is not in use.

If you want to use a **24 volt supply** that is tapped at 12 volts, connect it as follows: Connect the negative end to pin 1 of the left connector. Connect the 12 volt tap to pin 4 of the left connector. Wire the full 24 volts through an additional fuse holder and 5 amp fuse, to pin 4 of the right-hand connector, but plug it in only if running above 25 FPS. Be sure to label the plugs "Left" and "Right" to prevent confusion.

It is best to **not apply more voltage than needed**, as it will cause excess heating of the motor control components.

A **Fischer 11-pin** socket is found on the front. This supplies 12 volts DC for an accessory such as a zoom motor. It is not equipped for speed control; speed control is instead done through the socket on the side. The Fischer socket is protected by the main 5 Amp fuse.

**3. Maximum & Minimum speeds.** The highest speed included is 50 FPS (frames per second.) If your camera mechanism is worn and has play in the cam, however, you may not get a steady picture above 30 FPS (this is no fault of the motor.) We suggest not filming at speeds below 24 FPS for critical use as you may see some exposure non-uniformity. 12 FPS is not warranted to be usable for filming purposes and is included as a threading-check speed. Run tests to determine your personally acceptable range.

**4. Basic Operation.** The camera is started and stopped with the **"RUN - STOP"** rocker switch. The cooling fan still runs in STOP, and a Milliframe Controller, if connected, will draw a small standby power and other accessories can draw their normal current. The fan draws less than 0.1 amp and will take many days of filming, by itself, to drain a fully charged battery.

a. The speed of the TXM-21A is selected with the six-position rotary switch. The available speeds are (12,) 24, 25, 30, 40 and 50 FPS. If you change speed, remember to also change the lens aperture.

**60 Hz HMI** speeds are (12,) 24, 30 and 40 FPS.

**50 Hz HMI** speeds are 25 and 50 FPS.

b. When illumination is daylight or high-amperage tungsten lights, you can film at any speeds you like. Also, there is no harm in changing speed while running.

c. If the camera stops running with the viewfinder dark, use the camera's **inching knob** on the side. 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, and to flicker slightly when running below 24 FPS. An occasional slight flicker means the circuit is working hard to maintain sync, but has not actually lost sync.

**5. External Speed Control.** Connecting a TCS **"Milliframe Controller"** will automatically make it the reference for controlling the speed. Connection is by the RJ-12/RJ-45 socket on the Left side of the motor. The speed switch on the motor is totally inactive with an external reference, and can be left in any position. 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 about 1 to preferably 50 FPS (60 FPS with a high speed movement camera, and at your risk.) As previously mentioned, the best results may be obtained in the vicinity of 24 to 30 FPS; speeds below 24 FPS may have a flicker problem because of the Arri camera's odd frictional characteristic.

The Sync Alarm light will, however, not come on if a grossly excessive speed is called for that is beyond the range of the TXM-21A's PLL (phase locked loop) circuit. Normally this will not be experienced since a properly adjusted PLL is capable of a greater maximum speed than the motor itself. The TCS Milliframe Controller should receive power for at least a few seconds before the motor is started in order to stabilize its output. No standby switch is provided because of the small current drain of the Milliframe Controller, about 25-50 mA (.025-.050 Amp.)

The Run-Stop switch on the TMC or TMC<sup>2</sup> Milliframe Controller might be usable for remote control of the camera. For this application, leave the motor Run switch turned on; when the Milliframe Controller is in the Stop position, the camera should be stopped and the Sync Alarm will light. (When stopped by remote control, the current drain is still 175 to 200 mA (.175-.200 Amp.)) Some motors might draw an additional current or even creep forward slowly when remotely stopped in this way. The TXM-21A has a digitally synthesized frame pulse output so it will actuate the footage counter in the TMC<sup>2</sup>.

For filming from a video or computer monitor, the speed of the external controller is set so as to get a stationary shutter bar. When you start filming the scene, push the controller's "Phase" button until the shutter bar is where you want it, such as at the bottom of the monitor's picture. Then the director can call "Action!"

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Note that the Arri Model 2A camera has a narrower shutter opening than the other models and will, therefore, give a wider shutter bar than is seen in the reflex finder.

## 6. Application Notes for sound filming:

a. Your Arri 2A-B-C is not a self-blinded 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 etc. where the performers are miming 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 also popular for film commercials that are to be transferred to U.S. 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. However, be careful about selecting this speed for theatrical length material, as many video standards conversion schemes assume that film is always shot at 24 FPS, so 30 FPS film may give odd artifacts.

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 35mm 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 audio equipment is not adjusted as accurately as equipment intended for double system sound, the best sync will be obtained by playing the digital or Hi-Fi tape back on the **same piece** of equipment (not just the same model) 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.

If the magnetic film recorder is omitted and the film and audio are transferred directly to video, be aware that NTSC film scanners actually run at 23.976 or 29.970 FPS and this difference must be taken into account to keep picture and audio in sync.

**7. Maintenance.** The TXM-21A has metal gears that should be lubricated once in a while to minimize wear and noise. The moving parts can be reached by detaching the camera and removing the 6 screws that hold the lid in place. With care, it should be possible to lubricate the drive train without removing the motor & gear block. Disassembly is definitely not recommended as this can lead to breaking or pinching wires, or damaging the encoder disc.

The **coupling** that engages the camera's drive gear can have its teeth brushed with a small amount of grease. This will reduce the chance of causing wear to the camera gear.

The **universal joint** should have a little grease packed into it; if it looks dry add some with a small stick.

The **gear teeth** should have a thin layer of grease painted on them with an "acid brush" or similar stiff brush. If the motor gear is hard to reach, greasing only the vertical-shaft gear will suffice. Turn the coupling by hand so you can reach all of the teeth.

The **sintered bronze & thrust bearings** should have about one drop of SAE 30 oil added to the shim washer(s) underneath the vertical-shaft gear. Running the motor slowly should draw it into place as needed.

Use a rag to mop up any excess oil and grease inside the TXM-21A case. Replace the lid and screws.

## 8. In Case of Difficulty.

**Fuse.** The TXM-21A has a 5 Amp GMA (5 x 20 mm) 32 Volt or higher standard fuse. It should blow in case of a film jam or other gross fault. The operator should, however, be alert and ready to turn off the power instantly in case of a film jam. The fuse may not act rapidly enough in every conceivable situation to prevent all possible damage to the motor and camera. It does not separately protect the second power input. Applying reversed polarity or overvoltage will cause damage to the motor electronics or connected accessories, even with the Run switch turned off, and possibly without blowing the fuse.

## 9. (for technicians)

**Milliframe Controller** connections. An RJ-12 6-conductor cable is used to connect to the Milliframe Controller. Pin 1 is +12 volts, pin 2 is open for internal crystal or ground for external reference, pin 3 is 5 volt 100 pulse per frame input, pin 4 is ground, pin 5 is 5 volt frame pulse output, and pin 6 is ground. Other accessories might use all 8 positions in the socket using an RJ-45 8-conductor cable. In this case, pin 1 is +5 volts low current, 2 is +12 volts, 3 is open for crystal or grounded for external, 4 is 100 PPF input, 5 is ground, 6 is frame pulse, 7 is ground, 8 is direct 0~5 volt input to speed control follower circuit for factory calibration and special uses. Ideally do not use an 8 conductor cable unless pin 8 actually needs to be connected, or the running speed can become erratic.

**Fischer** connections: Pin 11 is positive and pin 9 is negative. The other pins are not connected.

# Tobin Cinema Systems, Inc.

<http://www.tobincinemasystems.com>

