

Installation and Use:

TCS TXM-27

Crystal Control for Arri 16-BL Camera

Basic Operation.

Select the **speed** with the rotary switch. Use 24 FPS unless there is a reason for using another speed. Make sure the slide switch is in the far left **1x** position. Moving this switch to the far right **2x** position will give double the selected speed. The **Phase** button is used in filming from a monitor, see below. The **Sync Alarm** will light if the camera is running off-speed.

To use an accessory Milliframe Controller, plug it into the MC socket at the top. A correction is required; set the Milliframe to 1.5x the desired speed. That is, for 25 FPS set it to 37.500. To enable the external controller, set the speed dial to **30, MC** and the slide switch to the center **MC** position.



Introduction.

The Tobin Cinema Systems TXM-27 gives crystal speed control of your Arri 16-BL camera if it is equipped with the Arri EMP or BLE “Universal” motor. Crystal speed control permits double-system sound filming with no connecting cable to the crystal-equipped sound recorder, and sound or silent filming without flicker under HMI or fluorescent lighting, or discharge-type street lights. The conventional HMI speeds included are 24 and 30 FPS (frames per second.) There are a total of 10 built-in crystal speeds. (If you have the 25:50 or 24:48 gear set you can also get 25 and 50 FPS by special settings, see below.)

The TXM-27 has two video related speeds built in, namely 23.976 and 29.970 FPS. These are used in filming for transfer to NTSC (USA system) video, along with audio that has been recorded on DAT, MiniDisc, Hi-Fi video tape, etc. that cannot be speed corrected during transfer. This will make the camera speed be equal to the film scanner speed of 23.976 or 29.970 FPS so the audio recorder is then working in real time, with no 0.1% speed pulldown being required. The 29.970 speed, and the Phase button, can also be used for filming from an NTSC video monitor or TV. The 24 speed and the Phase button are used for filming from special 24 FPS video monitors.

The TXM-27 also has a socket for external speed control, such as the TCS TMC Milliframe Controller. This optional accessory permits camera speed to be set in .00067 FPS (frame per second) increments for special uses such as for filming from a computer monitor with control of shutter bar. See below for the required correction to the TMC speed settings. The TMC2 Milliframe Controller with Counter can also be used but the footage counter will not advance. The TVC and TVCe Videoframe Controllers can not be used.

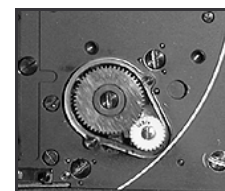
Preparation for Installation.

The required motor is the Arri BLE or EMP Universal motor. The TXM-27 will not work with the TCS CHT motor, the TCS TXM-25 crystal motor, or the old governor (BL reversing) or AC synchronous motors. The only motors that are compatible with the TXM-27 are those that run on DC power and do **not** have a reversing switch in the rear. The camera wiring and plugs, and the motor’s magnetic tachometer generator, must be intact.

There is a triple gang switch on the rear of the TXM-27 crystal control. This configures the unit for the **gear ratio** that is installed in the motor and camera. This must be set properly to get correct running speeds.

To get the correct running speeds, it is first necessary to determine which gear set is present. If you open the film compartment, you will see two gears behind a clear plastic window. They have been marked in various ways over the years, so the most positive system is to actually count the gear teeth on each. The plastic driving gear on the motor has 24 or 25 teeth; the metal driven gear has 48, 50 or 60 teeth.

The motor and control can be used with any standard gear set, either **24:50, 25:50 24:48** or **24:60**. (If a suitable gear set is not present, TCS can supply a newly manufactured 24:60 set. These must be installed as a pair; they will not mesh with any of the original gears.) The **switches**, located below center right rear of the crystal control, are set as follows according to the gear ratio that is present. Each switch is moved up for on, and down for off. These settings are also printed in white on the circuit board:



NOTE BEFORE PROCEEDING: The TXM-27 has circuitry that can be damaged by the thousands of volts of static electricity that your body, or plastic wrapping materials, can generate by friction in cold or dry weather.

Before handling the unit or making settings on the circuit board, ground yourself and the camera to prevent static charge accumulation. Static damage is not covered by your warranty.

For the normal U.S.A. **24:50** gear set, turn on switch 3 and turn off 1 and 2.

For the normal European **25:50** or **24:48** gear set, turn on switches 1 and 2 and turn off 3.

For the **24:60** gear set, turn on switches 2 and 3 and turn off 1.

Installation.

First, using a 1/4" or 6mm flat blade screwdriver, remove the 16-BL original bloop panel on the back of the camera. Do this by first loosening all 4 corner screws completely from the camera's threaded holes; then grasp two kitty-corner (diagonally opposite) screws and pull out the panel. Remove the 4 screws the rest of the way by pulling outwards while turning with your fingers. Save these special screws, they will be re-used for mounting the TXM-27.

Install the 4 screws in the TXM-27 corner mounting holes. Place the unit in position and tighten the screws.

Insert the 9-pin Bendix/Amphenol 165-14 plug coming from the TXM-27 into the 165-15 receptacle on the rear of the camera. Proper **mating** is achieved by lining up the tang on the plug with the slot on the receptacle, at the same time as lining up the two lugs on the plug with the two bayonet slots on the receptacle. Push the plug on while turning the coupling ring, until it seats fully and locks in place.

NOTE: We recommend **leaving** this expensive and difficult to repair plug pair **connected at all times** to prevent damage by hurried or inexperienced camera assistants, and wearing it out from perpetual in-out cycles, even if it means modifying the camera carrying case to fit. Worn, dirty or broken pins will cause malfunction.

Power for the TXM-27 and the camera is now supplied through an industry standard "XLR" 4-pin male receptacle, with pin 1 negative (—) and pin 4 positive (+). This connector is rugged, inexpensive and connects easily without tricky alignments.

To verify that the gear ratio switches are correctly set, a television receiver can be used as a poor man's strobe. If you have U.S. television, run the camera at 29.970 FPS while aiming it at a TV broadcast, not a video tape, and you should get a stationary shutter bar. Do not use a computer monitor as their scan rates are not standardized.

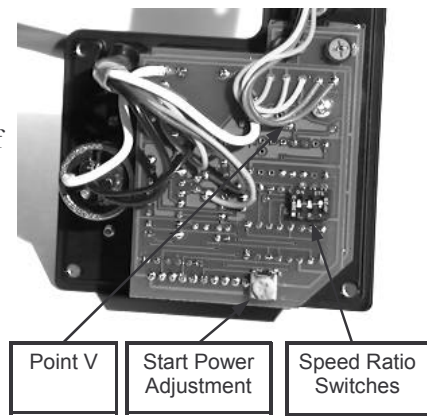
Possibly required **Start Power** adjustment: If the camera consistently starts up with a rush, at your usual speed, and takes a while to slow down to correct speed, the S (Start Power) pot (potentiometer) needs to be turned CCW (counter-clockwise.) If the camera consistently starts up underspeed, and takes a while to speed up to your usual speed, the S pot needs to be turned CW (clockwise.) The S pot is located at the bottom of the rear circuit board of the TXM-27. The initial average adjustment setting is about 1/3 of the way from CCW to CW. See the "For Technicians" section for a precise way of making this adjustment.

Detailed Operation.

The camera is started and stopped as before.

Crystal speed is selected with the 6-position rotary switch, and by the 3-position slide switch below it. The marked positions on the rotary switch show the speeds that will be obtained with the normal far left **1x** position of the slide switch. 24 FPS is generally used for sync-sound filming in the U.S. Special uses, with transfer to video, may call for the use of 23.976, 29.970 or 30 FPS instead. An old-time movie look can be had by filming at 18 FPS. Undercranking to increase the energy in an action sequence can be done at 21 FPS. There should be no harm in quickly switching the speed while running, but remember that a speed change calls for a corresponding lens aperture change, and the speed will take a few seconds to settle down.

The far right **2x** position of the slide switch multiplies all the speeds by 2. This switch setting is best changed by the use of a small-tip but not sharp tool such as a small screwdriver. The marked settings of 18, 21, 23.976 and 24 FPS will become instead the slow-motion speeds of 36, 42, 47.952 and 48 FPS. Do not use the 2x range with 29.970 or 30 as these speeds (59.940 and 60) are excessive for the camera, and could cause damage even if they can be reached. The speeds above 42 FPS may not be obtainable with the 24:60 gear set.



HMI Speeds. If you are filming under HMI or fluorescent lights, or discharge type street lights, it is necessary to use HMI compatible speeds to prevent flicker or pulsation in the film. This is because such lights actually flash 120 times per second, on 60 Hz power, and only a whole number of flashes per frame will give even exposure. There is a definite sequence of HMI compatible speeds, to wit: With **60 Hz** power, these are 30 and 24 FPS. Additional 60 Hz HMI speeds can be had by connecting the accessory Milliframe Controller. There are no built-in HMI speeds* for 50 Hz lights; these can be obtained with the accessory Milliframe Controller, (or see below if you have the 25:50 gear set.)

Daylight Speeds. If you are filming in daylight or with high-amperage tungsten lights, you can use any of the above speeds, or any external speed within the system's capabilities, at will.

(***25, 50 FPS Speeds.** Only if you have the 25:50 or 24:48 gear set, you can trick the TXM-27 into having the 25 and 50 FPS running speeds. To do this, set 24 FPS on the rotary switch, but set the small switches on the back of the rear circuit board to the 24:50 positions, that is with switch 3 on and 1 and 2 off. Mark the 24 position as 25 with easily removed tape, that will not damage the silk-screened markings on the TXM-27 panel. The 25 and 50 FPS speeds (selected with the 1x and 2x settings of the slide switch respectively) are HMI speeds for 50 Hz lamps. All the other speeds on the dial will be odd, 25/24 of the marked speeds, and not usable for sound or HMI filming. Restore the TXM-27 to normal before the next use.)

Sync Alarm. If the camera is not running at the selected speed, the red Sync Alarm light will show. It is normal for it to light or flicker each time you start the camera. Speeds around 24 FPS should lock into sync rapidly; those outside this range will take longer.

Filming From a Video Monitor. The TXM-27 has the correct speed, 29.970 FPS, plus the required Phase button built-in, for shooting from a conventional NTSC USA-system monitor. You can also film at 24 FPS from the special 24 FPS monitors used in higher-budget productions. For filming from a video monitor or TV, the speed of the controller is set first, so as to get a stationary shutter bar. (Note that 16-BL cameras may have a black stripe on the rotating reflex mirror that will give an extra, false shutter bar in the finder but not on the film. Usually the narrower of the two is the true shutter bar. This should be established by test.) When you start filming, push the TXM-27'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!" (Note that the Phase button on the TXM-27 will move the shutter bar downward, the opposite to what you may be used to with the TMC Milliframe Controller.)

External Speed Control. The TXM-27 has an MD-4 4-pin female Mini-DIN receptacle for connection of a compatible speed control such as the TCS TMC Milliframe Controller. This optional accessory permits control of running speed in .00067 FPS increments over the entire range of perhaps 15 to 50 FPS, or some 52,500 possible speeds. Such precision control is required when filming at strange speeds from a computer monitor, or just for filming at other desired speeds that do not appear on the TXM-27 dial.

To use the Milliframe Controller or other external signal, plug it into the MC socket at the top of the panel, with the plug's orientation mark towards the arrow marked on the panel. Change the rotary speed switch to the "**30, MC**" position and also change the slide switch to the center "**MC**" position. Note that a **speed correction** is required: Set the TMC pushwheel switches to exactly 1.5 times the actual desired speed. That is, for 25 FPS you would set the TMC to $25 \times 1.5 = 37.500$ FPS.

For filming from a computer monitor, the speed of the controller is set first, so as to get a stationary shutter bar. (Note that many 16-BL cameras may have a black stripe on the rotating reflex mirror that will give an extra, false shutter bar in the finder but not on the film. Usually the narrower of the two is the true shutter bar. This should be established by test.) If the monitor scan rate is not known, such as with an unfamiliar computer, the camera can be run without film while the speed is being determined. When you start actual filming, push the controller's or the TXM-27'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!" Note that the Phase button on the TMC will move the shutter bar down, while the Phase button on the TXM-27 will move it up.

No frame pulse output is provided, so the TMC2 Milliframe Controller can be used, but its footage counter will not advance. The Run-Stop switch on the TMC and TMC2 is not active with the TXM-27 and can be left in either position.

Depending on your particular camera setup, the camera may not run smoothly below 18 FPS. If you are using the 24:60 gear set, the camera may not be able to run above 42 FPS. In any case, Arri does not recommend running the camera above 50 FPS, corresponding to a TMC pushwheel switch setting of 75.000. Speeds in the vicinity of 24 FPS should be reached rapidly; higher or lower speeds will take a little longer.

The external controller is supplied 12 volt power continuously as long as the battery cable is connected. Because the TCS TMC Milliframe Controller draws such little power (25 mA), and to simplify operation, no standby switch is provided. Do not connect controllers that draw more than 100 mA (0.1 Amp) or this will overload and possibly damage the circuit board wiring.

When you have finished with the accessory, unplug it and move the TXM-27 slide switch back to the far left **1x** position, and the rotary switch to the desired speed.

Short Circuit Protection.

A short in the camera wiring, which sometimes occurs in the body or more likely by pinched wires inside the handgrip, will generally melt and burn much of the camera and crystal wiring if unprotected, leading to a difficult and expensive repair. A new PTC (positive temperature coefficient) device in the TXM-27, similar to a circuit breaker, should prevent this damage. If more than about 10 amperes flows into the power socket, several times the normal current, the PTC will change to a high resistance state and shut down operation in seconds, limiting the current to a fraction of its initial value to protect the wiring. To reset, remove the power by disconnecting the power cable and letting the PTC cool back down for perhaps 5 or 10 minutes. During this time, you need to find and correct the short so you can resume filming.

For Technicians.

S (Start Power) adjustment: The S setting must be made with the aid of a VTVM or DVM with a high (10-11 M Ω) input resistance. To make this adjustment, thread the camera with film in the magazine and set the speed to that used most often, typically **24 FPS** and **x1**. Remove the power cable and the rear panel, supporting it so that nothing inside can short out to metal such as the camera body. Connect the voltmeter Black (negative) lead to shiny metal on the TXM-27 panel or camera body. Set the range to read 0-5 or 0-20 volts DC. Connect the power carefully, using the same battery and power cable that will be in use. Run the camera, and after the Sync Alarm light goes out, measure the voltage at point **V**, towards the top of the rear circuit board, below the bottom of the **V** at the nearest solder pad. This reading, approximately 1.7 volts, will fluctuate according to the speed correction that is being applied to keep the camera running in sync, and will depend on the motor model and the gear ratio. Remember a good average of this voltage. Move the meter probe to measure the voltage at the center (wiper) terminal of the **S** pot at the bottom of the board. Adjust the S pot so about this same remembered voltage appears there. Disconnect the leads and power and re-assemble the TXM-27 panel to the camera.

The TXM-27 **speeds** can be calibrated over a small range by the trimmer capacitors at the top of the front board. Connect a frequency counter of known accuracy to the TP (test point) and ground. With the speed switch set to 23.976 or 29.970 FPS, adjust the right-hand trimmer cap for 9.206792 MHz \pm 30 Hz. With the speed switch set to any other even speed such as 24 or 30, adjust the left-hand trimmer cap for 9.216000 MHz \pm 30 Hz. Repeat the adjustments as often as necessary, as they will interact. The running speed of the camera may malfunction while the counter is connected; this should be disregarded, or else set the slide switch to the center MC position so the camera will not actually run.

The **MC** (Milliframe Controller) socket has pins 1 and 2 and the shell grounded, pin 3 is +12 volts through 22 Ω , and pin 4 is the signal reference input, 5V p-p CMOS logic. Using the 30 FPS (or 29.970 FPS) setting of the speed dial, a standard 3200 PPF (pulses per frame) input signal needs to be increased by 1.5x to get the required speed. See the operating instructions above.

For people who like to do things the hard way: Other TXM-27 speed settings than 29.970 or 30 FPS can be used with an external Milliframe Controller. However, the required MC corrections are mostly not round numbers and are harder to remember. At 24 or 23.976, multiply by 1.875. At 21, multiply by 2.1428. At 18, multiply by 2.5.

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