Using the TMC-55Aa Milliframe Controller

1. Introduction. The TMC-55Aa permits speed control of a compatible movie camera in .001 FPS (frame per second,) or *milliframe,* steps. This is done to enable filming at various rates under HMI discharge lamps, fluorescent lights, or metal-arc street lights without having a flicker in the film. It also enables filming with a video or computer monitor in the shot, eliminating the flickering or shutter bar that would otherwise result. It can just be used to provide traditional speeds that are not present on the camera's speed dial.

2. Connection. The unit plugs into compatible cameras that are equipped for external control, via either of two standard cables. The ***Fischer cable*** has an 11-pin Fischer plug to fit the Arri 35-BL, 16-SR High Speed and 16-SR cameras, the Arri 16-BL with Universal motor and TCS TXM-9/F crystal control unit, and other camera conversions that are compatible. The ***Tiny Tim cable*** has a 9-pin WPI Tiny Tim plug to fit most Aaton cameras, the Arri 16-S and 16-M equipped with the TCS TXM10-S crystal drive, the Bolex H-16 equipped with the TCS TXM10-B crystal drive, and other compatible cameras. The *DE-9 cable* fits the TXM-D motor for the Krasnogorsk K-3 camera. The output connector on the TMC-55Aa has a variety of signals available which may be of benefit in future camera adaptations.

3. General Operation. Turn the camera to "Standby" to furnish power to the unit. Dial in the desired speed with the pushwheel switches. Each digit is separately controlled, incremented with the top button and decremented with the bottom button. The decimal point will flash red until the selected speed is stable, at which time it becomes a steady green to advise you that it is safe to start the camera running; this should only take a second or two at normal speeds.

The light being green lets you know that the camera is correctly being told what speed to run; it is still necessary to check the camera's out of sync warning to ensure the speed is being achieved. Speeds up to 99.999 FPS are obtained with the pushwheel switches alone.

High Speed Filming is obtained by setting a speed of 79.999 or less in the pushwheel switches, and turning on the "+80" switch to add 80.000 FPS to the indicated reading. This enables speeds of up to 159.999 FPS to be obtained in .001 FPS steps. Do not exceed the camera's maximum speed rating or it may well be damaged. Setting high speeds can be inhibited as discussed in a later section.

Arri 16-SR High Speed cameras require only half as many pulses per frame and are made to run at the correct indicated speed as follows. Sit at a work area, grounding yourself and the unit to drain off static charge. Remove the 4 front corner screws and lift off the front panel. At the bottom of the front board you will see a jumper marked "Normal" and "16SR-HS." Remove the jumper from its right "Normal" position bridging the center and right pins of the header, and move it over one space so it is bridging the center and left pins in the "16SR-HS" position. Replace the front panel. (This change will only affect cameras using the Fischer or DE-9 cables.)

4. Filming Under HMI Lights. For shooting under discontinuous (flashing) illumination there are only certain speeds that will give flicker-free footage. Such sources include HMI lights, fluorescents, and discharge type street lights. On 60 Hz and 50 Hz current, these lights flash 120 or 100 times per second respectively. To get even exposure from one frame to the next there must be a whole number of flashes per frame. Safe speeds can be calculated by dividing the flashing rate by 1, 2, 3, 4, 5 and so on and for your convenience the range of HMI-safe speeds from 4 to 120 FPS is given on charts on the rear of the TMC-55Aa.

Doubly safe speeds can be calculated by dividing the flashing rate by an even number, such as 2, 4, 6, 8 and so on; these will be less affected by speed shifts in the camera and the location generators.

5. Filming From Video Monitors. For filming with an NTSC (U.S. system) TV set in the shot, the shutter bar can be immobilized by filming at 29.970 or 14.985 FPS. For PAL or SECAM monitors, use 25.000 or 12.500 FPS. For special 24 FPS video systems used in high-budget productions, film at 24.000 FPS. In general, the lower speed should be used if the monitor is large in the frame and minimum visibility of the scan lines is desired. Alternatively, if the video signal is fed through a "scan doubler" to eliminate interlace, all of the scan lines will be seen at the higher speed. For best results and greatest predictability the camera shutter should have opening and mirror segments that are both equal to 180°. If the video originates on a VCR that is running a bit off-speed, the filming rate may have to be altered slightly. When you start filming, push the "Phase" button to move the shutter bar to the bottom of the frame, and inform the director that he can command "Action!"

6. Filming From Computer Monitors. This is a real no-man's land as each computer sub-model seems to drive its monitor at a different speed. Ideally use a photoelectric frequency meter to determine the ideal filming speed, or else run the camera without film while playing with the pushwheel switches to establish it. For the better quality non-interlaced monitors try the range of 25 to 46 FPS. For interlaced monitors try 12.5 to 23 FPS. The modern trend in newer IBM-compatible computers is towards a 75 Hz vertical refresh rate, implying a filming rate of 37.5 or 18.75 FPS. Use of the phase button is identical to that in section 5 above.

7. Filming For Video Transfer With Non-Resolvable Double System Audio. If you are planning to transfer your film to NTSC video, in conjunction with audio on DAT (digital audio tape) or on Hi-Fi video tape whose speed cannot be adjusted, this brings up a sync problem. The Rank or Bosch film scanner does not run at the expected 24 or 30 FPS, but instead at speeds referenced to the 59.94 Hz video rate. This makes the normal speeds become 23.976 and 29.970 FPS respectively, causing a 0.1% speed drift. The remedy is to film at the same exact rate that the film scanner runs at, thereby maintaining far better synchronization.

A creative possibility is to find out the available transfer speeds and film at them instead of at normal speeds. For example, if the available Rank can run at 16.03 FPS, you could film and transfer at this rate with double-system audio in perfect sync but with increased motion artifacts, namely more jerkiness than usual.

8. Filming With Certain Cameras. If your camera lacks a mirror shutter, or if its shutter

opening is much different from 180°, you may be able to film successfully from video or computer monitors using the following method. It is necessary to know your camera's exact shutter opening, and the vertical rate of the monitor. Use the following formula to calculate the filming rate that will minimize shutter bar by making an optical "splice" in a different place in each film frame, which may not be too visible if you are lucky and are filming at the maximum lens aperture. In this method the "Phase" button is not used as the vestiges of the shutter bar are in a different place in each frame anyway. The video frame rate is 29.970 for NTSC, 25 for PAL/SECAM and possibly 75 for newer computers.

$$\text{Filming Rate} = \frac{\text{Video Frame Rate} \times \text{Camera Shutter Opening}}{360°}$$

Thus, if you are filming from a U.S. TV set and your camera has a 131° shutter opening, you would film at 10.906 FPS to get all the scanning lines. If you would be satisfied with more visible scan lines, you could film at double that speed, or 21.812 FPS. In the case of a non-interlaced monitor you could not film at double speed or only half the picture height would be visible, rather than half of the lines but in the full height.

9. Setting The Speed Limit Jumpers. To avoid over-revving and damaging your camera, provision is made in the TMC-55Aa to limit the maximum speed to 99.999, 79.999 or 39.999 FPS. Speeds set in excess of the predetermined limit will be incorrect. For example, with a 39.999 limit if someone selects 49.999 the actual speed will become 9.999 instead, with no indication of the deviation other than looking at the camera's tachometer.

To proceed with setting a speed limit, observe the following. Sit down at the work area with the TMC-55Aa, and ground yourself and the unit to drain off any static charge. Remove the 4 panel screws and lift off the front panel. At the top of the upper circuit board you will find 3 jumpers, changed by pulling straight out and then re-installing one space to the left or right as directed below, bridging two of the three metal pins.

For no limit (159.999 FPS) all three jumpers should be to the right.
For 99.999 FPS (+80 switch inactive) move the top jumper to the left.
For 79.999 FPS move the top two jumpers to the left.
For 39.999 FPS all three jumpers should be on the left.
Reassemble the unit when done.

10. Additional Outputs. Pin assignments are as follows: Pin 6 is +, 5 & 9 are Ground. Other pins are 5 V CMOS logic, pulses per frame as shown: 1=25 PPF, 2=50PPF, 3=100PPF, 4=200PPF, 7=400PPF, 8=3200/1600PPF.