

# Installing a TCS Crystal Drive on the Krasnogorsk-3

## *SEE THE DISCLAIMER AT THE END OF THIS DOCUMENT*

Before installation, we recommend running the camera with the clockwork spring and observing its speed constancy at 24 and 48 FPS. If the speed varies periodically, such as with every turn of the winding handle or of the film sprocket, it is probably not a good candidate for crystal motor adaptation as mechanical binding disturbances will tend to persist.

## Normal Conversion

TCS does not supply any hardware or tools. You will need three (3) #6-32 x 3/8" Allen cap screws, three (3) #6 lockwashers, about four #6 flat washers, one (1) 1/2" black Nylon hole plug, and one (1) drive coupling with two (2) setscrews, which can be fabricated from a 5/8" long metal or plastic rod, or heavy wall tubing, 5/16" in diameter, with a .1575" (4mm) bore down the center, increased to .165" at one end, and also at that end a .165" cutout through both walls .085" deep. The motor end is cross drilled and tapped through both walls for setscrews. A less critical installation adjustment (step 10 below) could result if you figure out some way of making a flexible coupling out of a rubber-like material.

1. Ensure there is no film in the camera. Run the mechanism until the spring is wound down. Unscrew the lens. **(Be careful in the following to protect the mirror shutter, optics and gears from damage or metal particles.)**

2. Carefully pry off the glued-on K-3 trim plate; it will be re-used. Remove the four screws holding on the front casting; one may be sealed in with a tar-like substance, which needs to be gouged out. Pull off the front casting and the stainless shim plate. Remove the release button and coil spring; these will not be re-used. File out the release button hole with a round file, and install a 1/2" black Nylon hole plug from the outside.

3. Partly dismantle the winding handle assembly by unscrewing the special screw in the center. Remove the winding handle; this cannot be left on as it will jam the mechanism when using the external drive. Reassemble.

4. Locate the helical worm gear that drives the governor worm; it also has lugs that engage the release slide. Temporarily remove the three screws that hold the assembly in place. Remove the screw from the center of the gear, and remove the gear itself; these will not be re-used. Temporarily remove the three screws and the outrigger bearing assembly of the governor worm. Remove the screw and spring, which will not be used, attached to the release slide; using a pliers, repeatedly and brutally wiggle the release slide up and down to induce metal fatigue at the narrow portion and break it off; be careful not to damage the fibre gear nearby.

5. Mark the body casting where the motor shaft will pass through, centered on the shaft that formerly held the worm gear. Make two marks 1/4" apart, equidistant from the original mark, perpendicular to the front of the casting, 1/4" long. While protecting the gears from metal dust, make a saw cut following each mark. With a pliers, break off the approximately 1/4" square piece of body casting, and also cut off the corresponding piece of leather. Temporarily install the stainless steel trim plate and mark it at the saw cuts. Either cut out a piece at that point, or using a milling machine remove about half of the thickness on the side towards the body.

6. Replace the two assemblies that were removed. Temporarily and lightly attach the motor drive coupling to the motor shaft. Remove the cover screws from the corners of the drive. Place the motor drive in the proper location so the large hole fits over the spring drive speed control knob, the base of the motor is parallel with the camera bottom, and the drive coupling engages with the lugs on the camera shaft that formerly held the gear. Mark through the three mounting holes in the motor drive (first applying white adhesive tape on the camera body will make the locations more visible.) Remove the crystal drive for drilling the mounting holes.

7. While protecting the camera mechanism from metal debris, drill holes clear through at the top and bottom using a suitable pilot hole for tapping #6-32. Drill the rear hole about 3/8" deep. Tap all three holes #6-32. (If you are metrified, this is about 3.5mm thread.)

8. Krasnogorsk bodies seen to date have a shaft that is not quite parallel to the camera base; also the body seems slightly indented where the lower mounting screw will be installed; consequently it is necessary to use #6 shim washers to remove the bulk of the misalignment. About one or two washers are needed between the bottom mounting hole and the camera; one or no washer is needed at the rear hole; and no washer is needed at the top hole. Install three screws and three lock washers from inside the motor drive, through the shim washers mentioned, and into the camera body. For now, leave the screws just barely loose enough to permit adjusting the position of the drive

needed at the top hole. Install three screws and three lock washers from inside the motor drive, through the shim washers mentioned, and into the camera body. For now, leave the screws just barely loose enough to permit adjusting the position of the drive, but not loose enough for it to move on its own.

9. Center the mirror on the viewing groundglass, loosen the drive coupling so it can be adjusted, and while keeping the mirror in position turn the motor shaft until the knob pointer is pointing up in the "View" position. Adjust the drive coupling for about .010" end play when the motor threading knob is pulled in and out. Tighten the setscrews.

10. Connect power to the drive and run it at the lowest available speed. Move the drive around very slightly, keeping its base parallel with the camera bottom, adjusting for the smoothest running and lowest current drain; this will coincide with the point where no continuous or intermittent drag or binding is felt when you turn the threading knob by hand. Tighten the mounting screws while monitoring camera performance; an increase in current drain (over 200 mA) means that the alignment or end play needs refinement. Readjust as necessary. A number of loosening, nudging a hair, and tightening cycles may be required to finally get the proper setting; this is normal.

11. Lock the setscrews and the mounting screw adjustments and lock washers in position with nail polish or other fast-drying paint or adhesive. Reassemble the crystal drive with the corner screws. Put less than a drop of oil where the coupling meets the camera drive shaft. Replace the shim plate and front casting. Replace the attaching screws (you can probably omit the tar!) and the trim plate and lens. Run the camera at all available speeds to make sure they are all functional. Check current drain for about 200 mA at 24 FPS without film.

## Perfectionist Installation

If the camera is disassembled anyway for some other reason, a lighter weight conversion with no unused parts to rattle around can be had by observing the following. A higher grade of camera repairperson and machinist is required, and service instructions would be helpful as putting it back together is trickier than taking it apart. We are still mystified by how the main plate can be re-installed in the body while holding back some spring-loaded parts that can't be reached any more when the plate is almost (but not far enough) back in place. Here are some general thoughts, but we are not confident enough to write step by step instructions:

A. Also remove the main spring, but keep the housing as its outer gear is needed to drive the takeup spool. You must be either well equipped with service manuals, factory training and the proper jigs, or else very foolish, to try to remove the **(nasty, sharp-edged, slippery with oily black graphite, tightly coiled up, wide, thick, stiff, unforgiving steel, ready to strike like a cobra or a demonic weed-whacker) spring**, as when it gets away from you it will violently and instantly whip around while unwinding to its approximate thirty foot length, possibly causing **personal injury** such as slicing off your head or other extremities, or cutting an extra doorway into your workshop. (We tried this once, survived, repented, and will never do it again.)

B. The spring-loaded ratchet pawls that prevent the spring housing from turning backwards are best removed as they serve no purpose after conversion and cause additional clicking noises while running, and if they stick they can cause flicker or loss of crystal sync.

C. The entire governor assembly can be removed from the inside, also the speed control dial and the release slide parts.

D. Many like to also remove the loop formers as they generally don't work anyway, and the high spring tension of the retractor button can deflect the camera lid enough to cause light leaks.

**DISCLAIMER:** The above instructions and suggestions are provided without charge as an aid to qualified and experienced technicians, who must decide for themselves if the instructions are correct, and if they are capable of doing the work. TCS will not be responsible for unsuccessful modification attempts by anyone. TCS does not install its motors in Krasnogorsk cameras.

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