OPERATING INSTRUCTIONS for OPTICAL PRINTER K-104

K-104 R

INITIAL SET UP

To prepare Bolex Rex-4, Rex-5 (or SB) remove film and lenses and lock turret with plug or clamp. Allow spring motor to wind down then disengage by simultaneously swinging clutch lever from MOT to O and locking drive release back at M. Set film speed to 64ips (to minimize stress on governor). Secure to camera carriage using 3/8” threaded shaft provided.

Note position of 1:1 drive shaft—engraved red dot should be toward lens; advance to this position using camera rewind crank. Plug in projector and Printing Motor K203 or K200 to 115V 60Hz outlet. Set direction switch FWD, mode switch OFF (or SINGLE) and press once INDIV (or START) button to insure proper shaft position. Attach Printing Motor K203 to Bolex by carefully engaging universal drive shaft coupling with 1:1 shaft and locating three hand screws into threaded sockets. Do not overtighten. Turn mode switch to CONT and listen for smoothness of motor. If strain is indicated during cycle loosen hand screws and reposition motor until cycle is smooth then retighten. Turn direction switch OFF when not in use. Attach lens C-mount adaptor provided, to turret, bellows to adaptor and lens to bellows. (Note: see supplementary instructions for K103-2 set). For best operation optical printer should be mounted to solid work bench from underneath using 10-24 machine screws, in a relatively dust-free environment shaded from bright light.

CONTROLS

Printing motor. K203 is controlled by three switches—direction FWD, OFF and REV; mode CONT or OFF (SYNC); and INDIV. During printing operation direction switch must be FWD; Bolex cannot film in reverse. Direction switch should be turned OFF only when printing motor is at a halt. Mode switch determines whether camera shall operate synchronously (OFF) with the projector, or continuously (CONT) for filming freeze frame or for winding film through camera with variable shutter closed in FWD or REV. INDIV button either activates a single cycle in FWD or REV for printing or winding, or begins synchronous printing with projector.

K200 has same controls as K203 except mode is designated CONT and SINGLE and INDIV is designated START.

Projector motor. Direction determined by FWD OFF REV switch. Film is wound in either direction by depressing ADV button. Synchronous printing is halted by depressing and holding STOP button until cycle is complete. Longer lengths of film are wound in either direction by depressing activator slide retractor at rear of printing module.

Lamp. Standard lamp house uses PH113 50 watt photo enlarging lamp with condenser lenses for coverage of 8mm, Super 8, 16mm and 35mm slides. Variable voltage control adjusts lamp brightness from zero to maximum.

Quartz-halogen lamp house is blower cooled, with standard 300 watt ELH lamp. With variable voltage control on minimum turn main switch ON which activates blower, then raise lamp voltage to desired brightness. Turn main switch OFF which abruptly cuts lamp and blower, then turn variable voltage control to minimum for next use. Allow lamp to cool without disturbance before further use. Slide condenser unit forward for optical printing. Insert diffusion glass between lamp and projector film plane.

Counters. All counters add in forward, subtract in reverse operation. Printing Motor K203 has no built in frame counter, however accurately drives Bolex counter.

Image controls. Image size is established by tracking LENS carriage along optical axis; focus by tracking CAMERA carriage. Lock camera and lens carriages in place with handscrews located under carriages and at handwheel cranks. Image is aligned horizontally by tracking lens with horizontal adjustment handwheel and vertically with vertical adjustment handwheel. Lock horizontal adjustment with two handscrews; vertical adjustment spring stabilized.

ALIGNMENT AND INDEXING

Using lens carriage handwheels roughly center lens axis with camera aperture by eye and check approximate vertical alignment of projector by comparing the respective distances of projector and camera apertures to table top. Projector vertical adjustment handscrew and two set screws located at left rear. Square camera image plane by comparing a straightedge flushed against side of camera with chrome tracking rail. Adjust horizontal placement of camera with two set screws. For precise camera-projector alignment see “Alignment of camera and projector apertures on a common axis.”
WHEN THREADING THE FILM
PUSH FILM LIFTER UP
THROUGH THIS HOLE. USE
PIN OR SMALL SCREWDRIVER.

35 mm

16 mm

APERTURE PLATE

SPROCKET

FILMLIFTER PLATE

CONDENSER LENS

THREADING

Single film. Slide front of module forward. Thread film around sprockets and between aperture assembly. Feed from bottom with image reading correctly from front (and through viewfinder).

Bipack. Thread film separately as shown in diagram. For best results outside film should be of printstock pitch (.3000”). Inside film may be either print or camera (.2994") pitch. Place feed and takeup reels of outside film adjacent to those of inside film, coaxially.

OPTICAL PRINTER MAINTENANCE

Cleaning. Frequently remove dirt and lose particles from module by swabbing entire film path with film cleaner/lubricant. Check more often if many splices pass through module.

Periodic lubrication (every 200 printing hours). Remove module from projector. Place a drop of sewing machine oil on each side of activator slide where it contacts two brass bearings. Slide should retract freely by hand and return smoothly under its own spring tension.

Open projector motor housing carefully by removing three screws. Using medium weight grease, lubricate outer ground surface of synchronizing cam and top and bottom drive gear teeth.

J-K CAMERA ENG. Inc. 5101 San Leandro St., Oakland, Calif. 94601 • (415) 534-9018
Set projector direction switch FWD, slide open gate of printing module and thread with film image suitable for reference such as SMPTE registration film or 12-field chart. Activate lamp house and increase brightness for focusing. Open camera and remove pressure pad, replacing with 90 degree prism. To open shutter for direct viewing of image set mode switch on CONT and jog direction switch between OFF and FWD. Focus image directly on prism using magnifier, lute or any lens to facilitate close viewing. Determine 1:1 image ratio as accurately as possible (this operation requires practice). For reference, each image plane to lens center distance will be twice lens focal length. Focus sharply and index positions on indicator rail and on lens and camera carriage handwheel cranks.

Now observe image through camera reflex viewfinder and carefully compare with actual image in film gate. Bolex viewfinders commonly mask image to same degree as picture will be cropped during projection.

LOADING

Except for reverse action printing, projector feeds from bottom (image reads correctly and appears right side up in camera viewfinder.) Tighten thumb nut securely. See threading diagram.

Load filmstock in camera using CONT mode on printing motor. To print frame for frame synchronously connect provided sync cable to sockets located on projector control panel and underneath printing motor. CAUTION: Contact of “live” plug with anything other than the intended socket may cause blown fuse or electrical shock. Never leave one end of sync cable unplugged.

To clear light path for printing of 35mm slides remove top and bottom hand screws from printing module and pull module straight away from projector body. Insert slide in slot retained by two leaf springs. When replacing module be sure slots in sprocket shafts engage with projector drive shafts. For maximum image quality place all filters either behind printing module in two inch filter holder or in one inch filter holder mounted on module.

SEQUENCE OF EVENTS

Set camera frame counter on ZERO and projector frame counter on ONE at first frame to be printed. With printing motor mode OFF (SYNC), direction FWD and projector direction FWD (or REV), press INDIV (or START) button on camera side, initiating the following sequence of events:

1. Camera exposes projector frame
2. Camera shutter closes
3. Camera and projector each advance one frame.

At the end of each cycle the camera frame counter shows the number of the last frame that was printed and the projector frame counter shows the number of the next frame to be printed.

To halt synchronous printing, press and hold the STOP button on the projector. By starting a sync run on the camera side and halting the run on the projector side the printer will always stop at the end of a complete cycle and proper sequence will be maintained.

Advancement and exposure of individual frames is accomplished by disconnecting both ends of sync cable or by switching non-functioning unit OFF. Press buttons gently to lessen danger of soft image.

TESTING

A full range of tests for standardizing filmstocks, exposures and color correction (rendition near as possible to original film) is recommended before critical work is done. Suggested initial test range for Ektachrome Commercial and Kodachrome type A films is 40-80 cyan plus 30-70 magenta with .3-.9 neutral density filter. Expose at f5.6 or f8, variable shutter fully open. Plus-X Reversal .6 - 1.2 neutral density at f5.6 or f8, shutter fully open. It is recommended that the 2B filter be used for all work, to absorb excess ultraviolet rays. Exposure time is .36 second with Printing Motor K203, .1 second with Printing Motor K200.

Set standard lamp house voltage at 100 or 105 volts; quartz-halogen lamp house at 30 to 50 volts. For very dense originals, when duplicating with slow print stock or with diffusion glass, use maximum quartz-halogen voltage.

OPTICAL PRINTING EFFECTS

Bipack the projector. Thread the module with the first film in the usual manner. Thread outside film onto sprockets but not under first pair of idler rollers. Place feed and takeup reels coaxially on spindles. For best results outside film should be printstock pitch (.3000") without regard to relative emulsion positions. If the lens is closed down several stops from maximum there is usually sufficient depth of field for both emulsions, even if bipack is base to base.
Multiple exposure. After initial exposure, close camera variable shutter and/or carefully replace lens cap. Rewind camera film using CONT and REV, several frames beyond ZERO, then FWD to ZERO. If camera film is to be rewound much more than about thirty feet, it is recommended that the film be removed (under darkroom conditions), rewound and replaced into the camera. This operation of course requires a sync reference at the head of the raw stock.

Optical zoom. First see “Alignment of camera and projector apertures on a common axis.” Execute zoom by tracking lens carriage toward projector in equal increments, one frame at a time, one exposure per frame. Note that depth of focus will be maintained until image ratio approaches about 1.5:1, at which time focus becomes necessary (by tracking camera) for each increment. Exposure is not effected until around 2:1.

SOLID STATE SEQUENCER

Controls.
1. Power ON-OFF
2. START-STOP
3. Presetter function CAM-OFF-PROJ
4. Frame presetter
5. PRESET CLEAR
6. Mode MAN-PRESET ONLY-SKIP-STEP-ALT
7. CAMERA sequence
8. PROJECTOR sequence
9. SEQUENCE CLEAR

Modes.
MAN (manual) Disconnects all functions of control from printer.
PRESET ONLY Used in conjunction with presetter function to permit either camera or projector to run independently to a predetermined frame count.
STEP Camera prints each projector frame once EXCEPT: Camera sequence indicates how many times frame number that is indicated on projector sequence is to be printed.
ALT (alternate) Camera sequence indicates how many times frame number that is indicated on projector sequence is to be printed.
SKIP Camera prints each projector frame once EXCEPT: After number of frames indicated on camera sequence are printed, projector advances (no exposures) to frame indicated on projector sequence.

Sequential cycle is established by CAMERA and PROJECTOR sequence controls and by mode selector. Frame numbers indicated on sequence controls refer to frame number within sequential cycle and not to accumulated frame count.

Presetting sequence length. Set frame presetter to predetermined frame count. Set presetter function to CAM or PROJ as required. Press SEQUENCE CLEAR and PRESET CLEAR. Press START to initiate operation which will begin on camera side. To temporarily interrupt operation for exposure changes, etc., press STOP. To continue operation press START; sequencer will continue without loss of frame count.

To terminate operation before end of frame count indicated on frame presetter press STOP and PRESET CLEAR. After sequence is complete and terminated by presetter press STOP before attempting new settings.

Printing the preset sequence. Example: to duplicate film 100 frames in length shot at 24fps for projection at 18fps. Set frame presetter at 100 and presetter function at PROJ. Set CAMERA sequence at 3 and PROJECTOR sequence at 2. Set mode at SKIP. (Be sure projector and printing motors are both FWD.) Press SEQUENCE CLEAR and PRESET CLEAR. Press START to initiate sequence on camera side. To temporarily interrupt sequence at any point during the sequential cycle, press STOP. To continue operation with no break in cycle, press START; to continue same sequence at beginning of cycle (camera side first), press SEQUENCE CLEAR, then press START.

OPTICAL PRINTER K45A

The Aerial Image. Lens requirements: Prime optimum at 50-75mm f2. Aerial image optimum at 75-100mm f2 or 2.8.

1. Thread aerial image projector from top to bottom.
2. Thread prime projector with white leader, emulsion toward rear.
3. Align and focus the aerial image on white leader emulsion. Determine aerial image magnification by tracking aerial image lens carriage. Focus by tracking projector/lamp house carriage. Align image with vertical and horizontal lens adjustment handwheels.
4. Remove white leader and thread prime projector with subject film. Remove film from aerial image projector.
5. Align prime image and focus camera as in standard operation.
6. Replace film in aerial image projector.
7. Check aerial image focus through camera reflex viewfinder or 90° prism.
8. Control relative size and placement of aerial image with prime image using rear handwheels; control size and placement of composite using front handwheels.
9. Monitoring through 90° prism, close prime lens diaphragm two or three stops from maximum opening; close aerial image lens diaphragm from maximum to ascertain point at which vignetting occurs. Working with both lens diaphragms, determine optimum apertures by running visual and film tests. For best results place diffusion glass between lamp house and aerial image projector aperture.

Operational controls. Solid State Sequencer governs three components of the aerial image system in the same manner as two in the standard system; the projectors may operate in separate directions (or one OFF) however they are governed by the same sequence.

Single frame advance buttons for each projector component are located at the forward panel for initial monitoring purposes. Exposure time with 200 rpm printing motor .1 to .15 second.

When feeding from top to bottom in prime projector (e.g., reverse action printing) place primary takeup belt on lower takeup arm pulley first, then place transfer drive belt on outside pulley groove.

Note: Before using sequence controls, insure START STOP is at STOP; press SEQUENCE CLEAR and PRESET CLEAR.

## TROUBLE SHOOTING

<table>
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<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Remedy</th>
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</thead>
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<tr>
<td>A Printing motor sounds strained or uneven</td>
<td>Motor not properly aligned with camera 1:1 shaft</td>
<td>K203: Loosen three hand screws, reposition motor until cycle smooth and retighten. K200: Loosen camera from underneath, reposition or shim camera until cycle smooth and retighten.</td>
</tr>
<tr>
<td>B Synchronous operations runs wild</td>
<td>1. Camera mode on CONT 2. Camera on REV 3. Projector activator slice in down position 4. Film original contains damaged or torn perforations or bad splices</td>
<td>1. Switch to OFF (SYNC) 2. Switch to FWD 3. Release by pressing lock 4. Repair perforations and/or splices</td>
</tr>
<tr>
<td>C Film in projector runs continuously without registering</td>
<td>1. Film original damaged 2. Film original badly shrunked</td>
<td>1. See above 2. Attempt to print one frame at a time by disconnecting sync cable 3. Transpose film layers of bipack</td>
</tr>
<tr>
<td>D Projector damages or destroys film original</td>
<td>Module improperly threaded</td>
<td>See threading diagram</td>
</tr>
<tr>
<td>E Film original is burned</td>
<td>1. Takeup belt not connected 2. Takeup belt connected improperly</td>
<td>1. Give a half twist and replace on takeup spindle</td>
</tr>
<tr>
<td>F Processed reversal film is black (or negative film clear)</td>
<td>Camera variable shutter closed</td>
<td>1. See B above</td>
</tr>
<tr>
<td>G Processed film has consistent slurred, indiscernible image</td>
<td>1. Camera and projector not properly synchronized 2. Camera 1:1 shaft 180° out of position</td>
<td>2. Read paragraph 2 under Initial Set Up; Check for proper shaft position by observing image through 90° prism. When camera completes cycle shutter should be closed</td>
</tr>
</tbody>
</table>
H Processed film has occasional slurred frames
   1. Bad splices, torn or shrunk perforations went through projector
   2. Multiple exposure improperly executed
   3. Quartz-halogen lamp house not centered with projector or has canted axis
   4. Light path interrupted during printing
   5. Line voltage dropped substantially during printing
I Processed film image has spots, dark areas or inconsistent brightness
   1. Bolex viewfinder prism dusty or dirty
   2. Bolex filter dirty or bent
   3. Open turret exposing beamsplitter prism, swing out and clean
   4. Place all filters between light source and film original
   5a. Realign lamp house
   5b. Insert diffusion glass between lamp and projector
   5c. Run lamp through a voltage regulator
   5d. Run lamp at higher voltage
   5e. Unplug refrigerator or other heavy appliances during printing

ALIGNMENT OF CAMERA AND PROJECTOR APERTURES ON A COMMON AXIS

VERTICAL:
1. Establish exact 1:1 image via prism in camera gate using suitable calibrated film. Mark positions of camera and lens carriages and of camera and lens carriage handwheel cranks.
2. Track lens toward projector about 1 1/8" or more (with 50mm lens) and camera away from projector until image is in focus on prism. Mark these positions 2:1 ratio (approx.)
3. Loosen two projector set screws but keep snug. Note new vertical image center.
4. Correct error in vertical image center by about half using projector adjustment handcrew located under projector base.
5. Track camera and lens carriages back to original 1:1 positions. Reframe image to exact 1:1 using lens vertical adjustment handwheel.
6. Track camera and lens to 2:1 positions.
7. Repeat steps 4, 5 and 6 until image remains vertically centered throughout 1:1 to 2:1 range. Tighten projector set screws.

HORIZONTAL:
1. Proceed as in steps 1 and 2 above. Loosen threaded shaft under camera carriage but keep snug.
2. INCREASE error in horizontal image center by about half using forward camera adjustment screw; adjust rear screw same amount. (Check accuracy of image plane axis by comparing level straightedge flushed against side of camera body, with edge of tracking rail. Make corrections with rear adjustment screw.)
3. Track camera and lens carriages back to original 1:1 positions. Reframe image to exact 1:1 using lens horizontal adjustment handwheel.
4. Track camera and lens to 2:1 positions.
5. Repeat steps 2, 3 and 4 until image remains horizontally centered throughout 1:1 to 2:1 range. Tighten threaded shaft.

Camera and projector axes are now in line for center zoom. Off center zoom can be set up using same method.