INTERIM PROFESSIONAL

TECHNICAL MANUAL

CP-16R AND CP-16R/A

SOUND CAMERAS

SERVICING AND MAINTENANCE PROCEDURES

REPLACEMENT PARTS LISTS

ILLUSTRATED ASSEMBLY DRAWINGS

CINEMA PRODUCTS CORP.

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Technology in the Service of Creativity

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Editors Note: This manual is for professional technicians only. Camera owners who lack the necessary tools, are requested not to attempt repairs outlined in this book. A comprehensive operations, maintenance and repair manual for System CP-16 Cameras and Accessories will be published in Fall, 1974.

70-120

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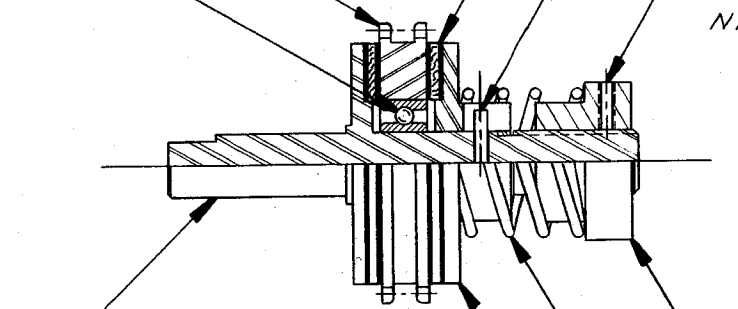

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2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS

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cinema products CORPORATION
Los Angeles, Calif. 90025

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INTERIM REPAIR INFORMATION FOR CP-16R AND CP-16R/A CAMERAS

Introduction

The following information is a basic disassembly manual for the CP-16R camera.

It does not include specific trouble shooting information or general recommended maintenance proceedures. However, as we intend to publish a comprehensive operations and maintenance manual, in Fall 1974, we are supplying you with these documents as an interim repair guide.

As always - do not hesitate to contact:

Mr. Derrick Whitehouse
Service Manager
Cinema Products Corp.

Part I

Part I is composed of the following Sections:

Section I - This section lists those areas that can be repaired without substantially dismantling the camera. For example, the front handle on/off switch can be repaired or replaced by removing the (4) screws holding the switch housing to the body.

Section II - This section explains the general procedural order of disassembly to dismantle a camera. For example, it is necessary to remove the battery,

the side cover or amplifier and the entire crystal drive system, to service the crystal drive P.C. board.

Section III - This section explains the specific procedural order of disassembly to dismantle a camera completely. Carefully read through the entire section before starting any work.

Section IV and V - These sections explain how to replace a mirror shutter and how to correctly collimate the ground glass and mirror shutter focal distances.

Section VI, VII and VIII - These sections explain mid-rib and viewing optics re-assembly procedures.

Section I

It is not necessary to completely dismantle a camera to repair or replace the following assemblies:

1. The viewfinder; the viewing optics
2. To replace the ground glass (for ground glass alignment procedures see Section V); mirror shutter.
3. To adjust the clutch tension
4. To replace or clean the pressure plate
5. To replace or clean the magazine quick release mechanism
6. The front handle and on/off switch housing

7. The door latch assembly

8. The footage counter

9. The film guide rollers

10. The control panel

In each case (listed above) remove or loosen only the necessary mounting hardware.

Section II

This is a general camera disassembly procedural outline only. It will help you determine roughly how much work is entailed in trouble shooting a particular area of the camera.

To repair the following:	Remove these corresponding assemblies in order of listing:
To repair battery	Remove battery
To repair side cover/amplifier, top handle or to install mike/ light bracket	Remove side cover/amplifier
To repair crystal drive system, motor only, or crystal drive board assembly	Remove entire motor drive system
To repair large drive gear	Remove large drive gear
*To repair viewfinder and viewing system	*Remove viewfinder and/or viewing optics
*To repair lens lock ring assembly	*Remove lens lock ring assembly

To repair mirror shutter/ gearbox assembly, film transport mechanism, body wiring, and to re-align ground glass	Remove mid-rib (camera movement plate assembly)

*Note: It is not necessary to remove side cover/amplifier and crystal drive system to remove viewfinder and viewing optics or lens lock ring assembly, but you must remove side cover/amplifier, crystal drive system, all viewing optics and lens lock ring assembly to remove mid-rib assembly.

Section III

This is a specific, step by step camera disassembly procedure outline. Read it thoroughly and follow the instructions carefully when disassembling a camera. Reference Drawings 70-887; 888; 604; 889.

REMOVAL OF MID-RIB FROM CAMERA BODY

REFERENCE the Battery Pack

1. Remove the battery pack.

REFERENCE the Viewfinder: Drawing 70-791.

2. Unscrew nut holding viewfinder and remove viewfinder from body of camera.
3. Remove the two (2) #6-32x½ socket head cap screws holding viewfinder mounting barrel to body and pull barrel out from its mounting hole in body sufficiently to expose screw holding bracket with light emitting diode wired into it.

4. Remove the screw and lift the bracket and diode up to free it from the opening in the barrel adjacent to the prism cover. Complete removal of barrel.

REFERENCE the Crystal Drive Assembly: Drawing 70-888

5. Remove Auxiliary Side Cover or Crystasound Amplifier by removing the five (5) #8-32 screws. Disconnect cables from connectors at lower section of camera body.
6. Remove the three (3) #8-32 screws holding motor assembly and remove motor assembly from the three mounting bosses. (Do not disconnect wires.)
7. Remove "toothed" belt from small pulley on main drive shaft.
8. Remove the two (2) #6-32 screws and spacers holding servo amplifier circuit board to sprocket shaft support bar.
9. Remove the two (2) #6-32 screws holding sprocket shaft support bar to mid-rib and carefully remove bar. (Gently pry off of dowel pins at ends adjacent to mounting screws.)
10. Remove servo-amplifier circuit board after removing top mounting screw and disconnecting plugs.

REFERENCE Large Gear: Drawing 80-887.

11. Rotate shaft clockwise by hand until front edge of small blade is pointing at center of shaft supporting large driven gear. Mark a line on large gear along edge of

small blade as a reference mark for re-assembly in same rotational relationship (use sharp pencil or scriber).

12. Rotate shaft until small blade is clear of large gear.
13. Carefully remove large gear and "blue" cog belt (counter and take-up drive belt).

REFERENCE Lens Lock Ring Assembly: Drawings 70-604; 70-619.

14. Remove camera lens lock not "stop" post.
15. Remove camera lens lock nut.
16. Remove six (6) #2-56 camera lens mount ring screws and remove mount ring.

REFERENCE Mid-Rib Assembly

17. Remove the three large mid-rib mounting screws.
18. Remove the two rollers and roller shafts mounted on camera body just below film opening for magazine.
19. Pull the upper portion of the mid-rib toward the door opening and then turn rear end of mid-rib toward opening. Pull assembly with twisting motion toward control panel end of camera until mirror housing is free of front end of camera body and remove mid-rib from body.

Section IV: Reference Drawing 70-604

REPLACEMENT OF MIRROR SHUTTER

1. Remove the four (4) #0-80 screws holding mirror to hub of mirror shaft and remove mirror from hub.

Note: To collimate installed mirror shutter, disassemble camera as outlined in Section III.

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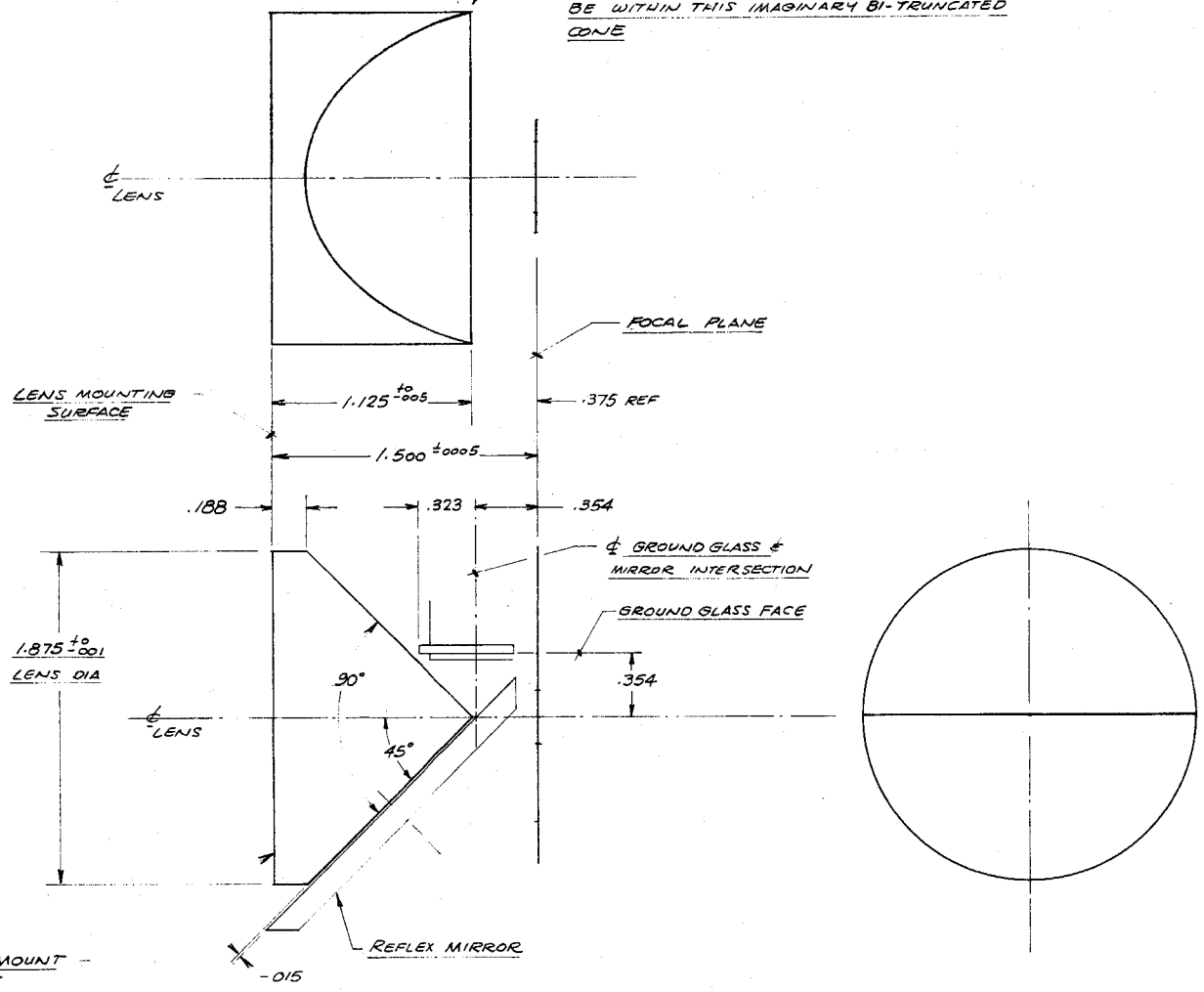

SIDE VIEW

REAR VIEW

70-587

SEE SHEET 2 FOR LENS MOUNT DETAIL

.375 − .354 = .021 ; .021² + .7071² = .9148

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3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

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		TITLE LENS BORE ENVELOPE - CP-16R
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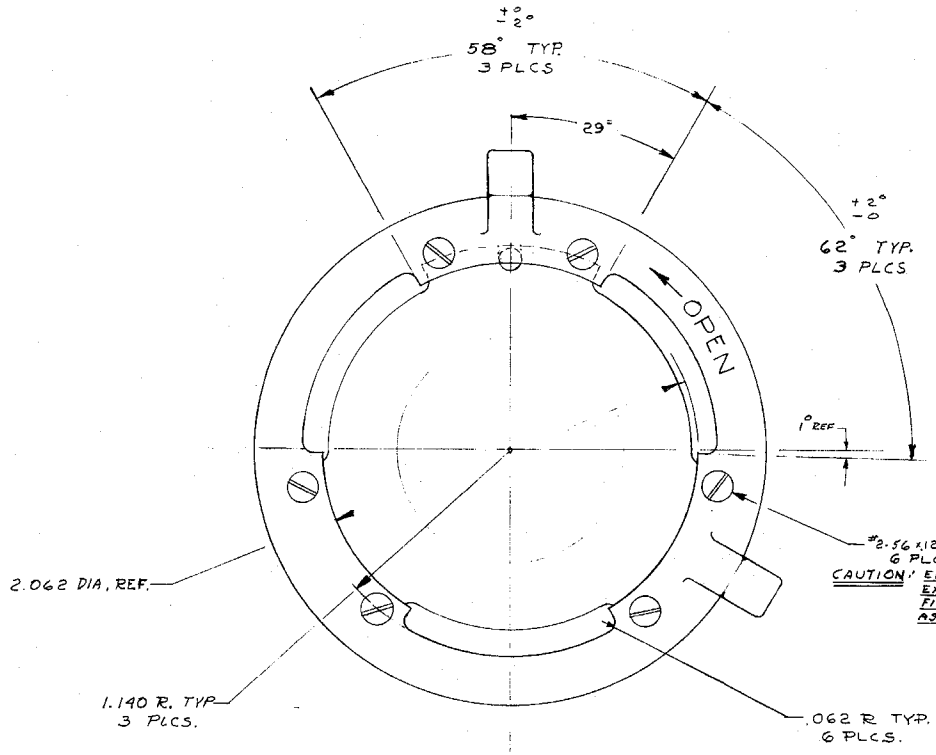

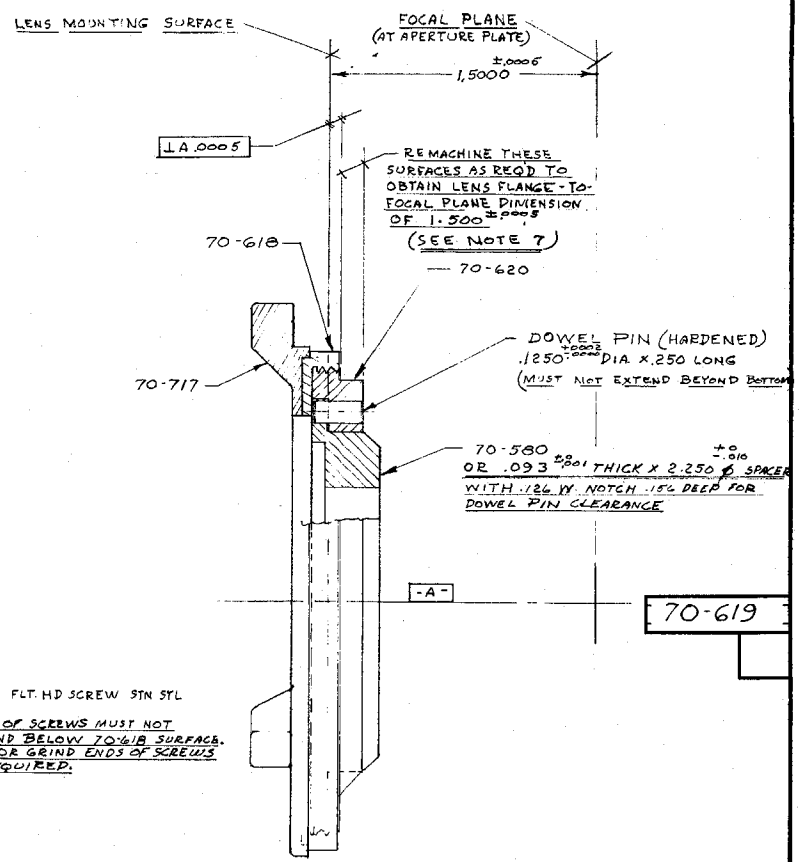

7. ASSEMBLE TO 70-603 GEARBOX WITH COMPLETED APERTURE PLATE ATTACHED. MEASURE FLANGE DEPTH AND REMACHINE SURFACES INDICATED ON LENS MOUNT RING 70-620 TO GIVE FLANGE DEPTH DIMENSION OF 1.5000 ±.0005
6. ASSEMBLE PARTS AS SHOWN USING CARE TO TIGHTEN LOCK RING 70-618 TO SECURELY SEAT LENS FLANGE 70-580 IN LENS RING 70-620. PLACE HANDLE 70-717 ON LOCK RING 70-618 AS SHOWN. MATCH DRILL AND TAP LOCK RING FOR #2-56 FLT.HD. SCREWS. ATTACH HANDLE TO LOCK RING, REMOVE FROM 70-620 & FINISH MACHINING 70-618. STOCK ASSEM (LESS 70-580) AS A SET. DO NOT REMOVE DOWEL PIN. (NUMBER EACH PART OF SET - WITH LAYOUT BLUE OR EQUIV. ON UNDER SIDE.)
5. FINISH: NUMBER SETS CONSECUTIVELY
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— 2 PL. DECIMALS ±.01 FRACTIONAL ±1/64 3 PL. DECIMALS ±.005 ANGLES ±30' MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025	DRAWN BY C.E.Hurtle
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2. Inspect hub and mounting surface of new mirror to make sure they are both clean.
3. Grasp new mirror at outside edges and place on hub with the four screw holes in line with the tapped holes in the hub.
4. Replace the four screws and gradually tighten screws alternately until all four are tight.

Section V

COLLIMATE GROUND GLASS AND MIRROR TO APERTURE POSITION

1. Rotate mirror in gearbox until blades are in horizontal position.
2. Carefully reinstall lens mount ring temporarily.
3. Remove ground glass from its mount in gear box and insert the mirror (CP Code Number 1Y1306 - same size as ground glass) with reflective surface facing downward.
4. Using suitable lens with collimator, check collimation of ground glass (via substituted mirror) with regard to aperture position (using the larger mirror - CP Code Number 1Y1307 - in film position at aperture opening).
5. If ground glass mount requires repositioning, insert positioning tool (CP Code Number 1Y1308) through opening in top of gear box with threaded hole in small block facing toward hole in center part of ground glass mount.

6. Thread short (#2-56x7/16 long) screw through hole in ground glass mount into threaded hole in small adjusting block (which is at end of shaft opposite knob).
7. Fasten top plate to top of gear box using longer (#2-56x5/16) screw.
8. Loosen slightly the two screws holding ground glass mount to gear box.
9. Using knob at end of adjusting tool adjust vertical position of ground glass mount until ground glass (via substituted mirror) is collimated with respect to mirror at film position at aperture.
10. Tighten ground glass mount screws.
11. Remove adjusting tool.
12. Reinstall ground glass.
13. Remove lens mount ring from gear box.

Section VI

REASSEMBLY OF MID-RIB

1. Reassemble mid-rib into camera body in reverse order from Section III.
2. Reassemble components to mid-rib.

Caution: Make sure small blade on drive shaft at front of mid-rib assembly is realigned with respect to mark made on large gear in step 11 of Sec-

tion III. This blade chops light for phototransistor control of position of rotating mirror to ensure reflex viewing when motor power is off.

Section VII

REASSEMBLY OF VIEWFINDER

1. Reassemble viewing optics and viewfinder in reverse order of removal from Section IV except do not attach the eye-piece portion of the viewfinder until completing Section VIII.

Section VIII: Reference Drawings 70-604; 70-791.

ALIGNMENT OF GROUND GLASS TO APERTURE

1. Remove film pressure plate.
2. Using a strip of cardboard, or other stiff material, prop pressure plate mounting arm up away from proximity to aperture opening.
3. Position a piece of white or light colored cardboard upright inside camera in line of sight of aperture and away from aperture opening sufficiently as to permit cardboard to be well lighted.
4. With camera setting so that the mirror and aperture opening may be viewed from the normal lens mount position, turn on

camera power and observe mirror and aperture with a 4 to 6 power viewing loupe or other suitable magnifier, maintaining line of sight as near as possible on the optical axis. The image of the lines of the ground glass will appear superimposed on the aperture opening.

5. If the image of the ground glass appears centered vertically with the aperture no adjustment is required.
6. If the image appears low, loosen slightly the #1-72 set screw (using the small set screw wrench provided) which is located about ¼ inch above the aperture opening on the film side of the aperture plate and in line with the rear edge of the ground glass. (To loosen turn wrench counter-clockwise.) Press ground glass in toward front end of set screw to remove clearance caused by turning screw with wrench.
7. Turn on camera power and recheck for proper alignment of ground glass image with aperture. Repeat step 6 if necessary.
8. If ground glass image is high with respect to aperture, turn set screw clockwise to cause image to lower and become aligned with aperture.
9. After completing ground glass alignment remove cardboard; replace film pressure plate and complete assembly of viewfinder to camera.

Introduction to Part II

The following information is a comprehensive circuit description of the CP-16R Crystal Drive System.

It does not include specific trouble shooting information or general recommended maintenance proceedures. However, as we intend to publish a comprehensive operations and maintenance manual, in Fall 1974, we are supplying you with these documents as an interim repair guide.

As always - do not hesitate to contact:

Mr.Derrick Whitehouse
Service Manager
Cinema Products Corp.

Part II

Part II is composed of the following Sections:

Section I - This section describes the power supply system for the camera.

Section II - This section details the Crystal Drive Circuit. Refer to schematic 70-765 B to graphically follow our electronic logic.

Section III - This section details the circuitry for the Low Film Indicator, which is an optional feature.

Section IV - This section details the circuitry for the "Auto-Slating System", which is an optional feature.

CIRCUIT DESCRIPTION OF THE CP-16 REFLEX CAMERA

Section I

POWER SUPPLY

REFERENCE the Battery

The NC-4 Battery is a 16 cell, rechargeable Nicad battery with a capacity of 550 ma/hr. The voltage range is from 17 tc 23 volts. The charge rate is approximately 55ma. This battery uses a piece of copper wire 28 AWG x 1.5 inch (.330mm x 38.1mm) as internal overload protection.

REFERENCE Battery Power Distribution

The negative side of the battery is connected to the main chassis ground through a fuse. This fuse is a 30 AWG x .75 inches (.254mm x 19mm) or longer copper wire. The positive side of the battery is wired directly to pin 4 of the 5 pin PREH connector. Chassis ground is also brought to this connector at pin 3. On the control panel side, the "+20" power is distributed to the drive system connector (14 pin Winchester), the handgrip power switch connector (4 pin PREH), and the pilot/clap connector (4 pin PREH). Battery power is also brought to the control panel power switch. Power from this switch is known as "switched +20" and is distributed to the same connectors as "+20".

REFERENCE "Battery Test" and "Battery Low Lamp" circuit

The D13V1 (3 lead I.C.) allows the meter to have an expanded scale, giving a range of 14 to 23 volts, instead of from 0 to 23 volts. This gives better resolution of the Battery charge level.

The meter circuit is normally connected to the "switched +20" line, but can be momentarily connected to the "+20" line by pressing the "Battery Test" switch, to check the battery charge level while the camera is not running.

Q26 (2N5086) in conjunction with the 5.6K ohm resistor which is in series with the meter circuit, senses meter current. Meter current is directly proportional to the battery charge level. The "Battery Low" circuit is designed to turn on the L.E.D. at approximately 17 volts (a "Yellow-Green" indication). As long as the voltage is above 17 volts, the current through the 5.6K ohm resistor will keep Q26 (2N5086) biased on. This in turn keeps Q27 (2N4403, the L.E.D. drive) off. As the battery level drops below 17 volts, Q26 shuts off and Q27 along with the "Battery Low" L.E.D. turn on.

REFERENCE Charging the Battery

The model NC-4 Battery Pack is charge by using model NCC-5 Battery Charger which is supplied with each

camera. Also available are model NCC-4 AC/DC Power Supply and Battery Charger which requires an additional Battery Charger Cable, and model MBC-6 Multi Charger (capable of charging six batteries simultaneously) which requires one Battery Charger Cable for each battery on charge. Required for each mode of charge is an AC Power Source, either 110 or 220 V.

REFERENCE AC Operation

Insert the Dummy Battery in the battery compartmant. Connect the NCC-4 Power Supply. The camera will operate from a 110 V or 220 V AC main

Connect the aforementioned Battery Charger Cable to the Dummy Battery to charge an NC-4 Battery Pack while the camera is operational from an AC main.

Section II

Reference Drawings 70-765; 70-759

THE DRIVE SYSTEM

REFERENCE Drive System Power

The Drive System utilizes three sources of power; "+20", "Switched +20" and an internally generated "+10" volts. "+10" is fed from the drive board through pin "E" (14 pin Winchester) as "Pilot/Slate" P.C. board power.

"+10" is generated by one of two ways; (1) by a MFC-6030A which must be trimmed to 10 volts, any time it is replaced. This is done by placing resistors in

parallel with the 2.2K ohm resistor which is near the MFC6030, or (2) by a F78L12AC which does not need calibration. Both I.C.'s have current limiting protection. The MFC-6030A limits at approximately 70 ma., and the F78L12AC at 120 ma. Power for the "+10" passes through the L.E.D.'s D7 and D8 before being distributed to the drive P.C. board. These L.E.D.'s are infra-red light sources for the "Optical Tachometer" and "Shutter Position" sensing circuits.

REFERENCE Drive Motor

This permanent magnet DC motor has a direct current armature winding resistance of 8 ohms. The motor operates at 3600 revolutions per minute (at 24 F.P.S.) with a torque output of more than 1.2 inch-ounces per 500 ma. With no load, the motor has an idle current of approximately 10 ma. Across the motor is D9 (1N4001) which acts as inductive kickback suppression to protect the "Drive Amplifier".

REFERENCE Drive Amplifier

Q14 (2N4400) and Q15 (D45C6) form a complimentary Darlington Power Amplifier. The circuit acts basically as an electronic switch between the motor and ground, turning on and off according to the signals at the base of Q14.

REFERENCE Motor Drive Modulator

The electronic switch is designed to turn on and off 38 thousand times per second. How long it stays on determines the amount of power to be delivered by the motor. This pulse-width modulation is accomplished by mixing a 38KHz, 2 volt P-P "sawtooth" waveform and "Controlled DC Level" inside a differential amplifier. A 5MV difference between the input lines will drive the output either to saturation or cutoff depending upon the polarity of the input. The sawtooth (pin 5 of Q13) is centered around a 5 volt DC level.

The "Controlled DC Level" (pin 6 of Q13) comes from the reference amplifier (pin 1 of Q13). It is a slowly changing voltage that determines how long the drive amp pulses are to be on. Example: assume that the "Controlled DC Level" is 4.5 volts. This means that one input of the differential amplifier is fixed at 4.5 volts. The other input will swing from 4 volts to 6 volts at the 38KHz sawtooth rate. Since the amplifier needs only a maximum of 5MV difference between the two signals, the output will be at cutoff during the time the sawtooth is swinging higher than 4.5 volts and in saturation while the sawtooth is below 4.5 volts. Notice that because of the shape of the sawtooth, the differential amplifier output will be

on 25% of the time and off 75%. The motor would be receiving one fourth of its total average power.

REFERENCE Frequency Generation Circuitry

The primary frequency generator is a temperature compensated crystal oscillator, operating at 4.91520MHz. It is divided by two to make 2.4576MHz before leaving the oscillator board, to further divided by Q12 (CD4020). The resulting frequencies are; 38.4KHz (pin 4) for the sawtooth generator (consisting of a 47K ohm resistor and a 500 picofarad cap), 600Hz (pin 1) as the reference for 24 F.P.S. operation and 300Hz (pin 2) which is sent to the pilot/clap board via pin "D" (14 pin Winchester). There is a secondary oscillator (Q17 pins 1 through 6) that generates 60Hz during camera shutdown. A stepped variable oscillator (Q16 pins 8 through 13) generates the reference frequencies for all the non-sync camera speeds. Frequencies are; 300Hz (12 F.P.S.), 400Hz (16 F.P.S.), 500Hz (20 F.P.S.), 700Hz (28 F.P.S.), 800Hz (32 F.P.S.), 900Hz (36 F.P.S.). The remaining signal sources are generated by the interruption of light beams to photo transistors. The first is the optical tachometer that generates 10 pulses for each revolution of the drive motor. The other is the shutter position sensor. It generates one pulse every time the shutter closes. This signal is fed to the

shut-down circuitry, low film indicator and to the light meter via pin "R" (14 pin Grayhill).

The basic active components in the primary and secondary oscillators are two COS/MOS type NAND gates looped to create positive feedback. Timing is achieved by the alternate charging and discharging of an RC network.

The crystal oscillator works in a similar manner, but it is not recommended to initiate repairs to the oscillator in the event of failure as this may effect the accuracy as a reference for 24 F.P.S.

The camera speed selection logic uses the control panel "Speed Select" switch, all of Q16 and pins 4-6 of Q20.

With the "Speed Select" switch in the 24 F.P.S. "Sync" position, the switch wiper arm is held electrically to +10v. This voltage level is fed to Q16 pins 12 and 13 via pin "L" (14 pin Winchester). With Q16 pins 12 ans 13 TRUE, the output pin 11 will be FALSE. This FALSE output is felt at Q16 pins 8 and 9 and back-biases D13. With Q16 pins 8 and 9 FALSE, the TRUE at pin 10 is passed on to Q16 pin 1 enabling the gate at Q16 pins 2 and 3. Any signal on pin 2 can now pass through. With D13 back-biased, any residual charge on the .05 microfarad cap (pins 5 and 6 of Q20) will be drained off by the 220K

ohm resistor to ground. When the charge level decreases below 5 volts, the gate at Q20 pins 5 and 6 will see this as FALSE and switch the output (pin 4) TRUE. This in turn enables the gate at Q16 pins 5 and 6. The primary frequency of 600Hz at Q16 pin 6 will be inverted and passed out pin 4 on to the gate at Q16 pins 2 and 3. This gate already enabled, allows the 600Hz to be re-inverted and brought out pin 3 to be presented to Q17 pin 9 of the "Shut-Down" circuitry.

Changing the "Speed Select" switch to one of the "wild" speeds, converts the two gates at Q16 pins 8 through 13 into a multivibrator oscillator. The "Speed Select" switch along with the 9.53K ohm resistor and 1K ohm potentiometer form the resistive portion of an RC network that determines the oscillators operating frequency. The .039 microfarad cap, along with its two trim capacitors, form the capacitive portion of the RC timing network. The multivibrator begins oscillation. This produces a signal at Q16 pin 1 and at D13. The first positive swing at Q16 pin 11, will quickly charge the capacitive network at Q20 pins 5 and 6 to a TRUE state making the output pin 4 FALSE. This gate will remain set as long as the multivibrator Q16 pins 8 through 13 oscillates. The FALSE output of Q20 pin 4

disables the gate at Q16 pins 5 and 6 preventing the 600Hz primary frequency from passing. With a FALSE at Q16 pin 5, the output, pin 4, must go TRUE enabling the gate at Q16 pins 1 and 3. Now the multivibrator output (Q16 pin 10) is inverted and passed out Q16 pin 3 to be presented to Q17 pin 9 of the "Shut Down" circuitry.

The "Shut Down" 60Hz multivibrator and its associative logic (all of Q17) allow the camera to seek at a relatively slow speed for a closed shutter. Pin 8 and pin 1 of Q17 sense when the "switched +20" line is FALSE. Q17 pin 8 will disable the gate at Q17 pins 8 and 9, preventing the signal at pin 9 from passing. This also makes the output (pin 10) TRUE, enabling the gate at Q17 pins 12 and 13. Q17 pin 1 goes TRUE because of gate Q7 pin 8 and 9. With Q17 pin 1 TRUE, the 60Hz multivibrator formed by Q17 pins 1 through 6 willoscillate. This signal is inverted and passed through the gate at Q17 pins 12 and 13. When the "switched +20" is TRUE, the 60Hz multivibrator is disabled, and the two gates Q17 pins 8 and 9 and Q17 pins 12 and 13 are enabled. This allows the signal at Q17 pin 9 to pass to the output Q17 pin 11.

REFERENCE Optical Tachometer Circuitry

The interrupted light beam produced by the motor tach-disc is sensed by the photo-transistor Q19

(MRD604). Q19 presents the electrical impulses to the gate at Q20 pins 12 and 13. All the COS/MOS type NAND gates in this circuit are being used as high gain amplifiers. The gate at Q20 pins 12 and 13 amplifies the electrical impulses to decrease the rise and fall times. The output from pin 11 is fed through a low pass filter to remove unwanted noise. The gates at Q20 pins 1 and 2 and Q20 pins 8 and 9 are used to further decrease the rise and fall times.

REFERENCE Phase-Compare and Sync-Alarm Circuitry

The square wave outputs from the reference oscilator (Q17 pin 11) and optical tachometer (Q20 pin 10) are fed into trigger forming networks. These networks consist of a 500 picofarad capacitor and a 12K ohm resistor to +10 volts. This results in 9 volt, negative going triggers that are referenced to +10 volts.

If the two triggers are coincident, the output from the "Phase-Compare" circuit (the line between the two 47K ohm resistors located at pins 3 and 10 of Q21) will be two very narrow pulses, one going positive, the other going negative from a 5 volt level. If the reference trigger starts to lead the optical tach trigger (ie. when the motor feels an increasing load) the positive going pulse becomes wider and the negative going pulse

disappears. The width of the positive going pulse is directly proportional to the number of degrees of phase error (the distance between two triggers is 360 degrees). If the optical tach triggers begin to lead the reference triggers, then the negative pulses become wider and the positive pulses disappear. This output is not normally seen because the leading filter network (100K ohm resistor, .1 microfarad cap and two .47 microfarad caps) integrates the pulses resulting in a varying D.C. level with a slight serration. The D.C. level will become greater than 5 volts with an increasing motor load, and less than 5 volts with a decreasing motor load.

The "Phase-Compare" circuit is basically two cross coupled latches consisting of Q21 pins 8 through 13 and Q21 pins 1 through 6. Delayed cross coupling is achieved by Q22 pins 1 through 10. Refer to the timing chart for the detailed analysis of the "Phase-Compare" circuit when the optical tachometer is lagging behind the reference by 10% (36 degrees).

The "out of sync" alarm senses the width of the pulse at the Test Point. The pulse width determines how much the 1 microfarad cap at Q22 pins 12 and 13 is discharged. The wider the pulse the greater will be the discharge. When the capacitor is discharged down to approximately

6 volts, the gate at Q22 pins 12 and 13 changes state turning on the emitter-follower Q18. Q18 drives two "Sync" lamps and D3 of the Pilot/Slate board via pin "C" (14 pin Winchester). The alarm is trimmed to trip at approximately a 40% pulse width.

REFERENCE Amplifier

A reference voltage of 5 volts, created by the two series 1K ohm resistors between +10 volts and ground, is fed to pin 3 of Q13. Q13 pins 2 and 3 form a differential amplification. Q13 pin 2 receives the leading filter network output and the difference between this signal and the reference is amplified. The duration of the difference primarily determines the maximum excursion of the output. This output becomes the "DC Level" for the Motor Drive Modulator.

REFERENCE Acceleration Control Circuit

The circuit consists of D10, D12, 12K ohm and 1 Meg resistors, along with the 2.2 microfarad cap. During initial start-up, the 2.2 microfarad capacitor receives most of its charging current from the "Phase Compare Output" line through D12 and the 12K ohm resistor. This forces the motor's acceleration rate to conform to the charging time constant of the 2.2 microfarad and 12K ohm combination. Once sync speed is achieved, the cap

continues to charge through the 1 Meg ohm resistor to back bias D12 to prevent any inadvertent loading during normal operation. The "Shut Down" logic will discharge the acceleration circuit through D10 any time "switched +20" is low and the "Shutter Position Detector" senses a closed shutter. This makes seeking a closed shutter smoother.

REFERENCE Shutter Position Detector

A paddle mounted on the film movement drive shaft, is adjusted to block the light to Q5 (MRD 604) whenever the shutter is closed. The emitter of Q5 drives Q6 (MMT 3904) an emitter follower. Signals from both of these transistors feed the "Shut Down" logic, low film indicator and, via pin "R" (14 pin Winchester), as a strobing pulse for the light meter circuit.

REFERENCE Shut Down Circuit

The "Shut Down" logic consists of Q7 and Q17. Q17 is the 60Hz oscilator and switching logic that has been covered in the section on "Frequency Generation Circuits". Q7 along with its associative circuitry provides the "Shut Down" sequence. It must provide control power during shut down, stop the drive motor when the shutter is closed, and turn off the control power to keep from discharging the battery. The whole sequence is iniatiated

by turning off the "switched +20". The "Shut Down" logic provides the board power during normal operation through Q9 (4403). D6 provides power only during start up intil Q9 can take over. Q9 and Q8 are held on by a FALSE at Q7 pins 5 and 6. This FALSE is the inversion of the "switched +20" through the NOR gate Q7 pins 12 and 13. When the "switched +20" goes off, the output remains FALSE by Q5 keeping pin 13 TRUE. Pin 13 goes FALSE when the shutter closes making the output pin 11 TRUE. The gate at Q7 pins 1 and 2 now discharges the "Acceleration Control Circuit" and aids in keeping Q7 pin 13 FALSE. Also, the output Q7 pin 11 inables Q10 which turns off the motor. The gate at Q7 pins 5 and 6 is a two second time delay. If, after two seconds the above situation has not changed, it will turn off the power to the control circuits. The 8.2 microfarad cap that has been charged by the +10 volts will briefly supply power to Q7 through D3 after the +10 volts turns off. D4 and D5 help keep any spurious signals from restarting the "Shut Down" circuit during the discharge of the 8.2 microfarad cap. The only battery load remaining, is the low current draw for charging the low film indicator's 3.75 volt battery supply.

Section III

LOW FILM INDICATOR

REFERENCE Counter Power Supply

This circuit receives its power from a rechargeable 3.75 Nicad battery. The battery is recharged anytime the NC-4 battery is plugged into the camera. This battery alone will keep the circuit operating for well over one year.

REFERENCE Counter Operation

The Low Film Indicator is reset any time the mechanical counter is cleared. When reset, the outputs Q1 pins 1,2,3, and 15 are low. The NAND gate (Q2 pins 1,2,8, and 9) receives these low outputs and in turn enables the gate at Q2 pins 10 through 13. Pulses from the "Shutter Position Detector" can now be received by the counter. During the count, the inputs (Q1 pins 1,2, and 8) will be going TRUE at various times. When all three inputs are TRUE at the same time, the output pin 9 will disable the gate at Q2 pins 11 through 13 and turn on the "Low Film" lamp. The counter can be set for 200 feet (7,168 frames) or 400 feet (14,336 frames) by selecting which of the three outputs from Q1 will be summed at the NAND gate Q2 pins 1,2,8, and 9.

Section IV

SLATING SYSTEM

REFERENCE Pilot/Clap Circuit

This circuit provides any peripheral equipment such as a recorder or transmitter with "+20" volts "switched +20" volts, ground, 50 or 60Hz pilot signal and "Start/Stop Clap" or Start Clap" only.

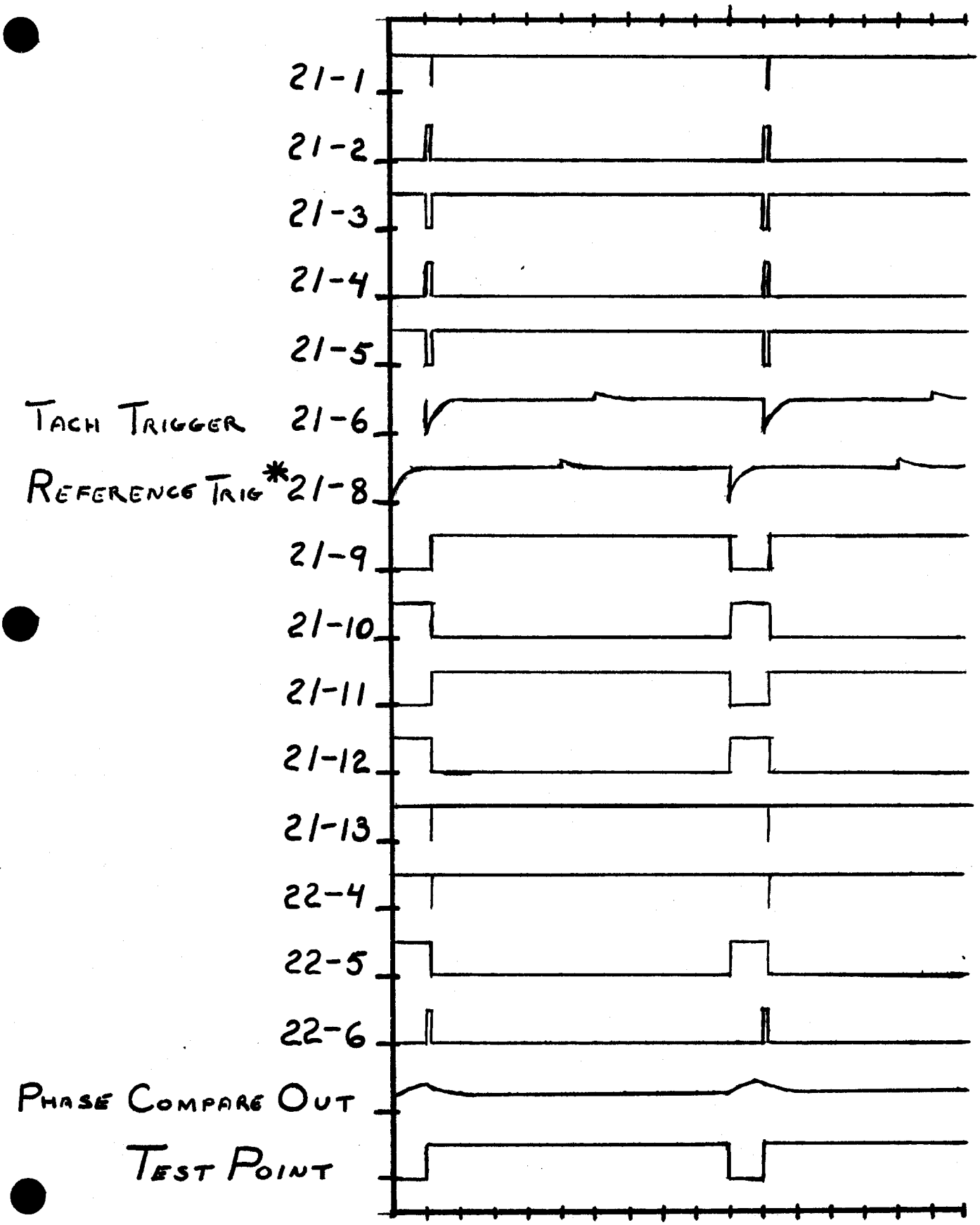
"Clap" occurs anytime the "Out of Sync" lamp is on. A positive voltage from the lamp passes through D3 to set the NAND gate Q29 pins 1 through 3 and turn on Q31. The clap output is now high. When the lamp turns off, "Clap" is held high until the .027 capacitor on Q29 pin 1 discharges below 5 volts. This delay insures the camera is running in sync. The "Clap" output also goes to the "Bloop" film marker.

The "Pilot" signal comes from dividing 300Hz (pin "D" 14 pin Winchester) by 5 (60Hz) or by 6 (50Hz). Q28 is a programable decade divider. Feeding back an output or combination of outputs to the reset line (Q28 pin 1) determines what number it will divide the frequency (300Hz) coming in pin 14. In the 50Hz position, the output from pin 6 feeds directly to the "Pilot" output driver. The 50Hz is a symmetrical or 50% square wave that is easily

filtered into a sinewave.

In the 60Hz position the output from Q28 will not be symmetrical, therefore, timing logic is necessary to achieve a symmetrical square wave. Q29 pins 4 through 13 consist of three NAND gates. Pins 5,6, and 9 receive the normal outputs from Q28 so that a divide by 5 operation is performed. Pin 8 of Q29 mixes a portion of 300Hz with the divide by 5 output to achieve symmetry.

The square wave if buffered and filtered to produce a slow rise and fall square wave output.



*SYNC THE OSCILLOSCOPE TO THIS TRIGGER.

Part III

CIRCUIT DESCRIPTION FOR CRYSTASOUND AMPLIFIER

Reference Drawing #D70-468 (See Crystasound Recording System, Technical Manual)

Power Supply

The NC-4 battery supplies 20 volts to pins #3 and 4 of the 12QK5M connector, which feeds the 20 volts to the camera control panel.

When the amplifier is switched on, 20 volts B is received through pin #1 of the 12QK5M connector (from the camera control panel) to the voltage regulator I.C. Q8. The voltage regulator Q8 supplies a regulated 12 volts to the amplifier B line. The relay K1 is only energized when the camera is switched on. The switchable 20 volts to relay K1 is received from pin #2 of the 12QK5M connector, via the amplifier on/off switch. The switchable 20 volts is also supplied to the amplifier bias circuit via the bias on/off switch.

Bias Oscillator

The bias oscillator circuit is composed of a toroidal transformer and a pair of transistors Q4 and Q12 (Q4 and Q12 are 2N5191s or in later models MFE800s). The drive voltage is supplied by a MFC-6030A voltage regulator whose output is controlled by transistor Q5.

Pin #7 of the toroidal transformer is connected to a bias test point. The bias test point should read approximately 70 millivolts, and is adjustable via the 50K ohm bias potentiometer.

Microphone Amplifiers

There are two 150 ohm balanced line mic inputs, which are fed to each half of I.C. Q2 respectively. Q2 is a LM1303N I.C. which is two amplifiers in one package, the gain of which is controlled by two 25K ohm controls (mic 1 and 2) respectively and are located on the control panel. The outputs of Q2 are at pins #1 and 3 respectively and are fed through the int/mixer switch to Q3 I.C. pin #6.

Record Amplifier

The record amplifier is a LM380N I.C. Q3, the input of which is pin #6. The input source to Q3 is via the internal/mixer switch. The internal switch position is the summing point for the two outputs from Q2 and a 600 ohm line input. (The level of the 600 ohm line input is controlled by a 25K ohm control located on the control panel). The mixer position is connected to pin B of the mixer connector. The mixer switch position is also bypassed by a 22 K ohm resistor to enable the operation of our Sennheiser Pre-Amp with the switch in the internal position so that the standard mic inputs can be used at the same time. The output of Q3 is at pin #8 and is fed through a equalizing network to the record head. The output of Q3 at pin #8 is also fed to the A.G.C. circuit Q1 and the earphone amplifier Q6. The earphone amplifier input is pin #8 of Q6 and its gain is controlled by a 25K ohm control marked "phone vol" located on the control panel.

Circuit Description for Crystasound Amplifier continued.

Playback Amplifier

The output from the playback head is fed through a low pass filter and bias trap to pins #8 and 9 of I.C. LM1303N Q1. The output of Q3 is at pin #13 and goes to the playback pot located on the P.C. board. The output from the playback pot is fed to pin #6 of Q6 via K1-B relay contacts and through a 25K ohm "phone vol" control located on the control panel. The output of Q6 is at pin #8 and goes to the earphone jack (50 ohm impedance).

AGC Circuit and VU Meter Circuit

Q1 is a LM1303N and one half of it is the AGC and VU meter amplifier. The output from the record amplifier Q3 pin #8 is fed to the input of Q1 at pin #5. (AGC and VU meter amplifier). The output of Q1 is at pin #1 and is buffered by a transistor Q10. The coupling capacitor and the two 1N270 diodes rectify the output of Q10 and the signal is filtered by the capacitor on the base of Q11. Q11 buffers the DC signal to drive the VU meter. The rectified DC signal at the base of Q11 goes to the 50K ohm AGC pot. The resistor diode network on the arm of the pot sets the attack and release time of the AGC circuit. This DC signal controls the FET Q7 which acts as a voltage control resistor, shunting the input of Q3 pin #6. The 20K ohm compression pot sets the dynamic range of the AGC circuit in the AGC off switch position. Q9 and its associated circuitry clamps the FET Q7 off.

CRYSTASOUND AMPLIFIER TROUBLE SHOOTING

A. Will not record, yet monitors ok with camera off.

This condition will be caused by the absence of Bias current which could be caused by the following:

1. Bad record/play back head assmebly. This can be proved by changing the head assembly.
2. Bias switch open circuit. Check for 20 volts on both sides of bias switch.
3. 4.7 ohm resistor open circuit between point "U" and MFC-6030A.
4. No B+ output from MFC-6030A to pin 2 of BH 1058 transformer.
5. Open circuit BH 1058 transformer. Continuaty check with record/playback head disconnected.
6. Bad Q4, 5 or 12.
7. Open circuit cable or connector between points "W" or "V" on P.C. Board to record/playback head.
8. Bad capacitor .082 MFD between points 1 and 3 on BH 1058 transformer.

CRYSTASOUND AMPLIFIER TROUBLE SHOOTING

B. Will not record and no monitor with camera off or on also V.U. meter does not register.

1. First check that this condition exists in the line input as well as both mic inputs. If ok through the line input yet will not work with mics see "C" below.
2. Check that the int/mixer switch is in the internal position.
3. Open circuit int/mixer switch (check for continuity between points "K" and "S" on P.C. Board).

C. Will not record through one or both mic inputs yet is ok through the line input.

1. First make sure that the mics being used are balanced line mics as unbalanced line mics will not work unless an adaptor patch cord is used.
2. Check that mic is ok by substituting mic.
3. Bad I.C. Q2. (Check with a scope at pins 1 and/or 13 for output with a mic or oscillator connected at the mic inputs).

D. Amplifier is completely dead yet camera runs ok.

1. With the amplifier power on/off switch in the on position check continuity through switch with a meter.
2. 4.7 ohm resistor open circuit. (Check for continuity from on/off switch to the voltage regulator Q8 7812).
3. Bad voltage regulator Q8. (Check with a meter for 12 volts B+ at point "D" or "E" on P.C. Board).

E. Play back monitor level is low yet monitor level is good with camera off.

1. Adjust playback level potentiometer so that the playback level is the same as the monitor level when the camera is off. (The Bias control should be peaked out before this adjustment is made).
2. Bad playback head. (Substitute record/playback head assembly should be installed and step 1 above repeated).

F. No playback monitor level yet recorded film is good.

1. Bad playback head. (Substitute record/playback head assembly should be tried and E.1 above repeated).

2. Bad I.C. QI. (With a scope check for output at pin 13 of QI).
3. Open circuit K1-B relay contacts. (Check for continuity with a meter).

G. No earphone output in playback or monitor mode.

1. Check head set by substitution.
2. Bad I.C. Q6. (Check input pin 6 and output pin 8 with a scope).
3. Open circuit between points "F" and "P" to phone volume control.

H. No A.G.C. or V.U. Meter indication.

1. Bad I.C. QI. (Check with a scope input and output at pins 5 and 1).
2. Bad transistor Q10 or Q11 (check with scope.)

CP-16R AND CP-16R/A CAMERAS

REPLACEMENT PARTS AND COMPONENT MECHANICAL ASSEMBLIES

Order Code	Part Number For Reference Only	Description
Reference Camera Body - Drawing 70-889		
1Y100	70-142	Front on/off Switch Housing Assembly and Front Handle
1Y101	70-136	Front Handle Only
1Y102	70-324	Front on/off Switch Housing Assembly
1Y103	70-139	Handle Lock Nut
1Y125	70-301	Handle, Door Latch Assembly
1Y126	70-063	Plate
1Y127	70-034	Detent Plate
1Y130	70-061	Stop
1Y136	70-254-1	Film Guide Roller
1Y137	70-216	Film Guide Post
1Y140	70-499	Magazine Latch Cover Plate
1Y141	70-057	Retainer Plate
1Y142	70-058	Magazine Hold Down Plate
1Y146	70-132	Camera Handle (Top)
1Y150	70-120	Clutch Assembly
1Y148	RF-4ZZRA	Clutch Bearing (Body)
1Y152	70-100	Magazine Take-Up Pulley
1Y158	1600-045-100	Clutch, Spring
1Y162	FA-144	Clutch Belt
1Y164	70-122	Idler Assembly
1Y170	70-121	Counter Drive Assembly
1Y175	70-125	Counter Box Assembly
1Y176	70-016	Gear, Counter
1Y177	70-026	Counter
1Y179	70-027	Reset Button
Reference Control Panel Assembly - Drawing 70-751		
1Y1240	70-751	Control Panel Assembly includes: Control Panel Plate; Gasket; Escutcheon; Rate Switch Assembly;

Order Code	Part Number For Reference Only	Description
1Y1240	70-751	(cont.) Battery Test Switch and Meter Assembly; On/Off Switch Assembly; Centerplate, Side Cover/Crystasound Connectors and Mounting Brackets; Front Switch Connector; Miscellaneous Hardware and Wiring Harness.
1Y1351	70-725	Plate, Control Panel
1Y1352	70-772	Gasket
1Y1359	70-723	Escutcheon (F.P.S.)
1Y1362	70-724	Knob, Speed Switch Assembly
1Y1365	C24C-02-038	Spring
1Y1231	30-000-003	Speed (F.P.S.) Switch
1Y1243	70-372	P.C.-Board Assembly, Speed Switch
1Y1241	70-757	Battery Test Meter, Calibrated Assembly
1Y437	84	Meter
1Y439	70-031	Bracket, Battery Test Meter
1Y428	46-101-R	Battery Test Switch
1Y429	70-147	Guard, Battery Test Switch
1Y430	7101J-1	On/off Switch
1Y432	NPN	On/off Switch and Bezel
1Y433	70-157	Guard, on/off Switch
1Y1211	SRM-14S-NSS	Connector, Control Panel Assembly to Crystal Drive System
1Y426	60 HA 4F	Connector, Camera to Front Handgrip
1Y421	61 LA 5F	Connector, Camera to Side Cover or Crystasound
1Y1244	70-764-A	Terminal Board

Reference Centerplate (Mid-Rib) Assembly-Drawing 70-887

1Y226	70-262	Sound Sprocket
1Y271	70-261	Knob Sound Sprocket
1Y228	70-260	Flange, Sound Sprocket

CP-16R AND CP-16R/A CAMERAS

Order Code	Part Number For Reference Only	Description
1Y229	70-265/70-263	Flywheel/Sprocket Shaft Assembly
1Y231	70-286	Bushing
1Y232	70-285	Bushing
1Y230	70-177	Sprocket Drive Gear (Large Gear)
1Y1402	70-876	Bearing Bar (Ref.)
1Y237	70-178	Gear
1Y1404	70-629	Disc
1Y1407	70-745	Bearing, Oilite
1Y239	70-287	Bearing , Oilite
1Y1409	70-602	Shaft Assembly, Pulldown Arm
1Y243	70-248	Transport Claw Assembly (Pulldown Arm and Pin)
1Y245	70-222	Guide Pin (Transport Claw Assembly)
1Y264	70-247	Edge Guide Spring
Reference Mid-Rib (Centerplate) Assembly-Drawing 70-888		
1Y260	70-206	Film Guide Assembly
1Y261	70-218	Post Film Guide
1Y263	70-225	Spring, Film Guide Assembly
1Y266	70-243	Pressure Plate Assembly
1Y267	70-246	Lever, Pressure Plate Assembly
1Y269	70-217	Roller, Pressure Plate Lever
1Y268	70-220	Spring, Pressure Plate Lever
1Y270	70-219	Post, Pressure Plate Lever
1Y264	70-247	Film Edge Guide Spring
1Y293	70-267	Knob, Sound Head, Dummy Roller
1Y299	70-407	Retractor Clip, Sound Head
1Y295	70-209	Dummy Sound Head Roller Assembly
1Y296	70-274	Retractor Clip, Dummy Roller
1Y302	70-456	Bracket, Connector Mount

CP-16R AND CP-16R/A CAMERAS

Order Code	Part Number For Reference Only	Decription
1Y290	70-208	Roller Plate Assembly
1Y305	70-214	Post
1Y306	70-213	Roller
1Y307	70-216	Post, Flanged Guide Roller
1Y308	70-215	Flanged Guide Roller
1Y309	70-266	Stripper Plate
1Y321	70-203	Film Threading Instruction Plate
1Y322	70-170	Frame Rate Indicator
1Y323	70-592	Magnetic Shield Assembly
1Y324	70-467	Spacer for Gel Filker Holders
1Y325	70-284	Grommet
1Y326	70-281	Screw, Centerplate Mounting
1Y1415	70-783	Spacer
1Y1416	70-784	Terminal
1Y225	139T x 1/8	Drive Belt
Reference Gearbox Assembly-Drawing 70-604		
1Y1420	70-741	Mirror Shutter
1Y1421	70-606	Bushing
1Y1422	70-605	Mirror Shaft Assembly
1Y1425	70-613	Idler Gear Assembly
1Y1430	70-612	Rear Cover, Ground Glass
1Y1433	70-682	Ground Glass Mount Assembly
1Y1436	70-792	Aperture Plate Assembly
Reference Lens Lock Ring Assembly-Drawing 70-619		
1Y1475	70-619	Lens Lock Ring Assembly
1Y1476	70-717	Handle
1Y1477	70-620	Lens Ring
1Y1478	70-618	Lock Ring
1Y1479	70-580	Flange

CP-16R AND CP-16R/A CAMERAS

Order Code	Part Number For Reference Only	Description
Reference Standard Viewer Assembly-Drawing 70-791		
1Y1503	70-683	Prism Mount
1Y1504	70-689	Lens
1Y1507	70-740	Bracket, LED Mounting
1Y1508	70-685-2	Retainer, Prism
1Y1509	70-686	Pad, Prism Retainer
1Y1512	70-694	Mounting Nut
1Y1513	70-746	Washer, Mounting Nut
1Y1516	70-789	Lens Assembly
1Y1517	70-693	Optical Stop
1Y1518	70-786	Pad, Optical Stop
1Y520	70-733	Screw
1Y521	70-735	Follower
1Y522	70-728	Key
1Y524	70-726	Lock Ring
1Y525	70-732	Knob, Focus Adjust
1Y528	70-737	Prism
1Y531	70-699-1	Prism Retainer (Lower)
1Y532	70-699-2	Prism Retainer (Upper)
1Y537	70-779	Backlight Shutter Assembly (Dowser)

CP-16R AND CP-16R/A CAMERA

Recommended Tools and Fixtures

Order Code	Part Number (For Reference)	Description	List Price
1Y1311	70-849	1.500" Gage	$125.00
1Y1312	NPN	1.500" Master Block	75.00
1Y1306	70-878	Ground Glass Mirror	15.00
1Y1307	70-879	Aperture Mirror	20.00
1Y1308	NPN	Ground Glass Positioner	75.00
1Y1315	70-817-4	"Go/No Go" Lens Gage	150.00

REPLACEMENT PARTS CP-16R CAMERA

Electronic Components and Assemblies

Order Code	Part Number For Reference Only	Description
Drive Motor Assemblies and Components - Drawing 70-760		
1Y1101	70-760	Crystal Drive System includes: Servo Drive Board Assembly; Choke; Connector; Lugs; Motor Assembly; Optical Tach Assembly.
1Y361	70-311	Drive Motor Assembly includes: C28775 Motor; Pulse Disc/Motor Pulley Assembly; Motor Plate; Wiring Harness.
1Y386	7043-010	Crystal Oscillator Assembly
1Y363	70-005-1/ SE2450-2	LED Assembly
1Y362	70-005-1/ MRD-604	Photo Transistor
Capacitors		
1Y1115	DD101	100P
1Y372	DD102	.001M-50V
1Y371	DD501	500P
1Y379	UK50-103	.01M-50V
1Y381	UK20-503	.05M-20V
1Y380	UK10-503	.05M-10V
1Y373	KR1W-50K	.1M-50V
1Y374	KR47W-50K	.47M-50V
1Y375	K1W-50K	1M-50V
1Y376	K8R2W15K	8.2M-15V

REPLACEMENT PARTS CP-16R CAMERA

Order Code	Part Number For Reference Only	Description
Capacitors (cont.) - Drawing 70-759		
1Y377	K22W6K	22M-6V
1Y531	K4R7W25K	4.7M-25V
1Y539	CK05BX333K	.033M
1Y382	MTP127M030	120M-30V
1Y383	TAC225K010	2.2M-10V
1Y1116	65F10Ac102	.001M
1Y1117	65F10AC103	.01M
1Y1118	65F10AC122	.0012M
1Y1119	65F10AC152	.0015M
1Y1120	65F10AC182	.0018M
1Y1121	65F10AC222	.0022 M
1Y1122	65F10AC272	.0027M
1Y1123	65F10AC332	.0033M
1Y1124	65F10AA472	.0047M
1Y1125	65F10AA562	.0056M
1Y1126	65F10AA682	.0068M
1Y1127	65F10AA822	.0082M
1Y1128	65F12AC393	.039M
Integrated Circuit - Drawing 70-765		
1Y1151	749PC	I.C.
1Y391	CD4020 AE	I.C.

REPLACEMENT PARTS CP-16R CAMERA

Order Code	Part Number For Reference Only	Description
Integrated Circuit (cont.)		
1Y1152	CD4001 AE	I.C.
1Y392	CD4011 AE	I.C.
1Y1153	CD4023 AE	I.C.
1Y1154	D13V1	I.C.
Transistor		
1Y1166	2N4400	Transistor
1Y397	2N4403	Transistor
1Y1167	2N5088	Transistor
1Y1168	2N5086	Transistor
1Y1169	MTT3904	Transistor
1Y1171	MRD-604	Transistor
Potentiometers		
1Y1186	62PR1K	Potentiometers
1Y1187	E086BC	Potentiometers
Diodes		
1Y404	1N4148	Diodes
1Y1196	MLED90	Diodes
1Y405	1N4001	Diodes
1Y1197	D4566	Diodes
Choke		
1Y408	EA-005A	Choke

REPLACEMENT PARTS CP-16R CAMERA

Order Code	Part Number For Reference Only	Description
Voltage Regulator		
1Y412	MFC-6030-A	Voltage Regulator
Connectors		
1Y1211	SRM-14S-NSS	Control Panel Assembly to Motor Drive System
1Y1213	SRM-14PNSS	Motor Drive System to Control Panel
1Y426	60 HA 4F	Camera to Front Handgrip
1Y421	61LA5F	Camera to Side Cover/Amplifier
Switches		
1Y1231	NPN 30-000-003	FPS Rate (Control Panel)
1Y430	7101J-1	On/Off (Control Panel)
1Y432	NPN	On/Off and Bezel (Control Panel)
1Y433	70-157	Guard On/Off (Control Panel)
1Y428	46-101-R	Battery Test (Control Panel)
1Y429	70-147	Guard Battery Test (Control Panel)
1Y434	J4004	On/Off Front
Meter		
1Y1241	70-757	Meter Calibration Assembly
528-77 1Y437	84	Battery Test Meter
1Y439	70-031	Bracket, Battery Meter
Hardware		
1Y1256	70-764	Terminal Board (Sync Lamp)
1Y882	1413-6	Lug
1Y580	2185	Grommet

REPLACEMENT PARTS CRYSTASOUND AMPLIFIER

Electronic Components and Assemblies

Order Code	Part Number For Reference Only	Description
Capacitors		
1Y373	KR1W50K	.1M-50V
1Y529	KR33W50K	.33M-50V
1Y374	KR47W50K	.47M-50V
1Y375	K1W50K	1M-50V
1Y530	K3R3W25K	3.3M-25V
1Y531	K4R7W25K	4.7M-25V
1Y376	K8R2W15K	8.2M-15V
1Y532	K15W10K	15M-10V
1Y378	K15E50K	15M-60V
1Y533	K68E25K	68M-25V
1Y534	K150E15K	150M-15V
1Y535	K330E6K	330M-6V
1Y525	65F10AA332	.0033M
1Y370	65F10AA392	.0039M
1Y526	65F12AA473	.047M
1Y527	65F13AC823	.082M
1Y538	CK05BX222K	.0022M
1Y540	CK05BX472K	.0047M
1Y536	CK05BX223K	.022M
1Y537	Ck05BX273K	.027M
1Y539	CK05BX333K	.033M
1Y528	DD 330	33P
1Y371	DD 500	500P
1Y372	DD102	.001M
1Y379	UK50103	.01M-50V
1Y380	UK10503	.05M-10V
Integrated Circuits		
1Y544	LM1303N	I.C.
1Y545	LM380N	I.C.
Transistors		
1Y548	MJE800	Transistor
1Y396	2N4400	Transistor
1Y549	MFE-3002	Transistor
Potentiometers		
1Y400	53-1-1-503	50 ohm Pot.
1Y552	53-1-1-502	50 ohm Pot.

REPLACEMENT PARTS CRYSTASOUND AMPLIFIER

Order Code	Part Number For Reference Only	Description
Potentiometers (cont.)		
1Y553	53-1-1-203	20 ohm Pot.
1Y554	E086BC/10K	10 ohm Pot.
1Y556	25K ohm	Potentiometer Rework (70-442-2)
Diodes		
1Y560	1N270	Diode
1Y404	1N4148	Diode
Voltage Regulators		
1Y412	MFC-6030A	V.R.
1Y569	UGH-7812 393	V.R.
Relay		
1Y570	712-18	Relay
Transformer		
1Y573	BH1058	Transformer
Hardware		
1Y576	1340T	Terminal Standoff
1Y579	7582	Grommet
1Y580	2185	Grommet
1Y583	9452	Cable (nine inches)
1Y585	R4103	Lug
1Y578	S 048-4	Bristol Key
Connectors		
1Y590	3501FP	Phono Connector
1Y591	111	Jack
1Y592	70-454-1	Connector
1Y593	70-459	Microphone Connector Assembly
1Y594	70-112	Battery Pulg Assembly
Switches		
1Y597	7101M	Switch (Bias; Mode)
1Y598	7101S	Switch (AGC)
1Y599	7201S	Switch (Amplifier on/off)
	Mechanical Parts	
1Y477	70-161	Guard

REPLACEMENT PARTS CRYSTASOUND AMPLIFIER

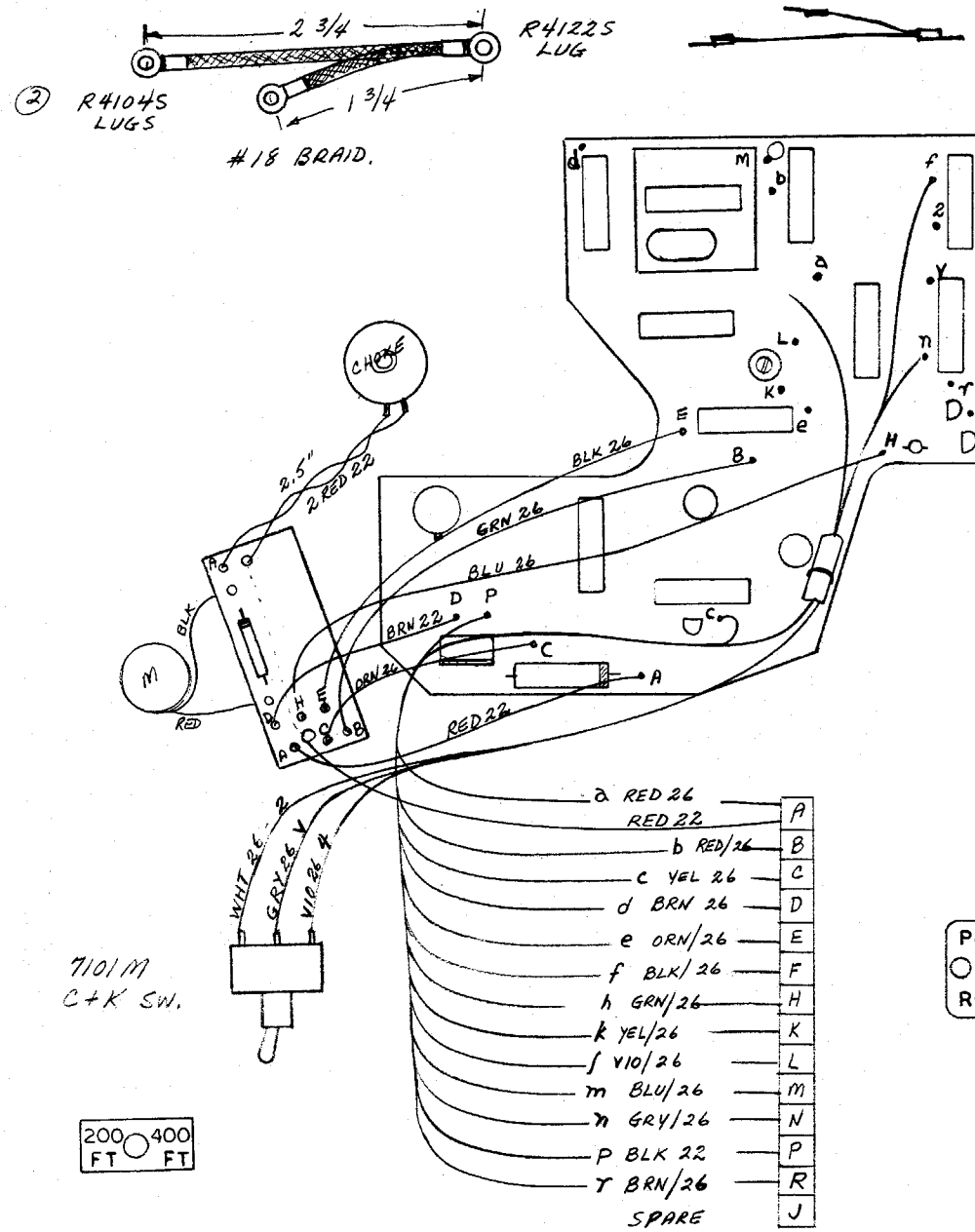
Order Code	Part Number For Reference Only	Description
1Y478	70-010	Cover, Battery Compartment
1Y483	70-309	Cover
1Y603	70-431	Bracket Mount;VU Meter
1Y606	70-446	Shield
1Y610	70-457	Knob
1Y611	70-433	Plate
1Y612	70-458	Stud, Panel Mount
1Y613	70-444	Plate, Light Trap
1Y614	70-426	Face Panel
1Y616	70-363	Shield Bias Oscillator

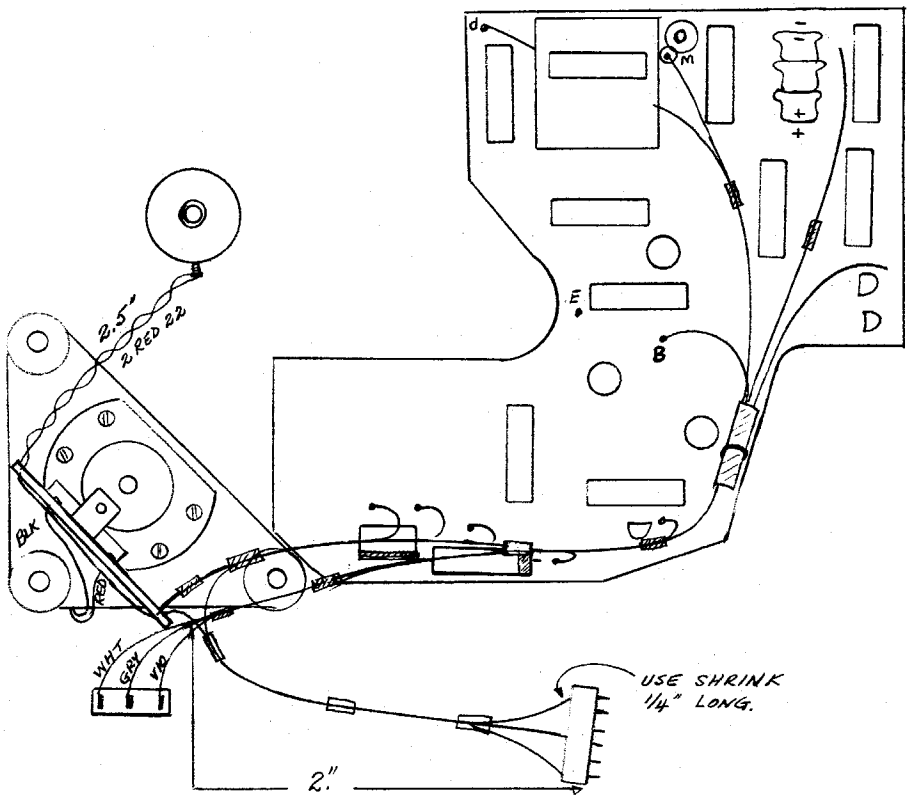
REPLACEMENT PARTS AUXILIARY SIDE COVER

1Y475	70-323	Connector, Modification
1Y476	70-112	Plug Assembly
1Y477	80-161	Guard
1Y478	70-010	Cover Battery
1Y479	M4SH	Connector; To Record System
1Y480	12QK5M	Connector; Power to Body
1Y481	8434	Cable
1Y482	R4142SF	Lug, Red
1Y483	70-309	Cover (Reference Only)

REPLACEMENT PARTS PLC-4 MAGAZINE

Order Code	Part Number For Reference Only	Description
1Y751	88-011	Light Trap
1Y750	88-021	Toe
1Y757	88-065	Knob
1Y762	88-012	Hub
1Y761	88-018	Roller Plate
1Y753	88-021	Shaft
1Y754	83-181	Screw
1Y760	88-022	Spring Roller
1Y759	88-023	Fixed Roller
1Y756	88-020	Guide Roller
1Y752	88-001	Pulley
1G190	70-055	Stud
1G192	88-052	Core Adapters





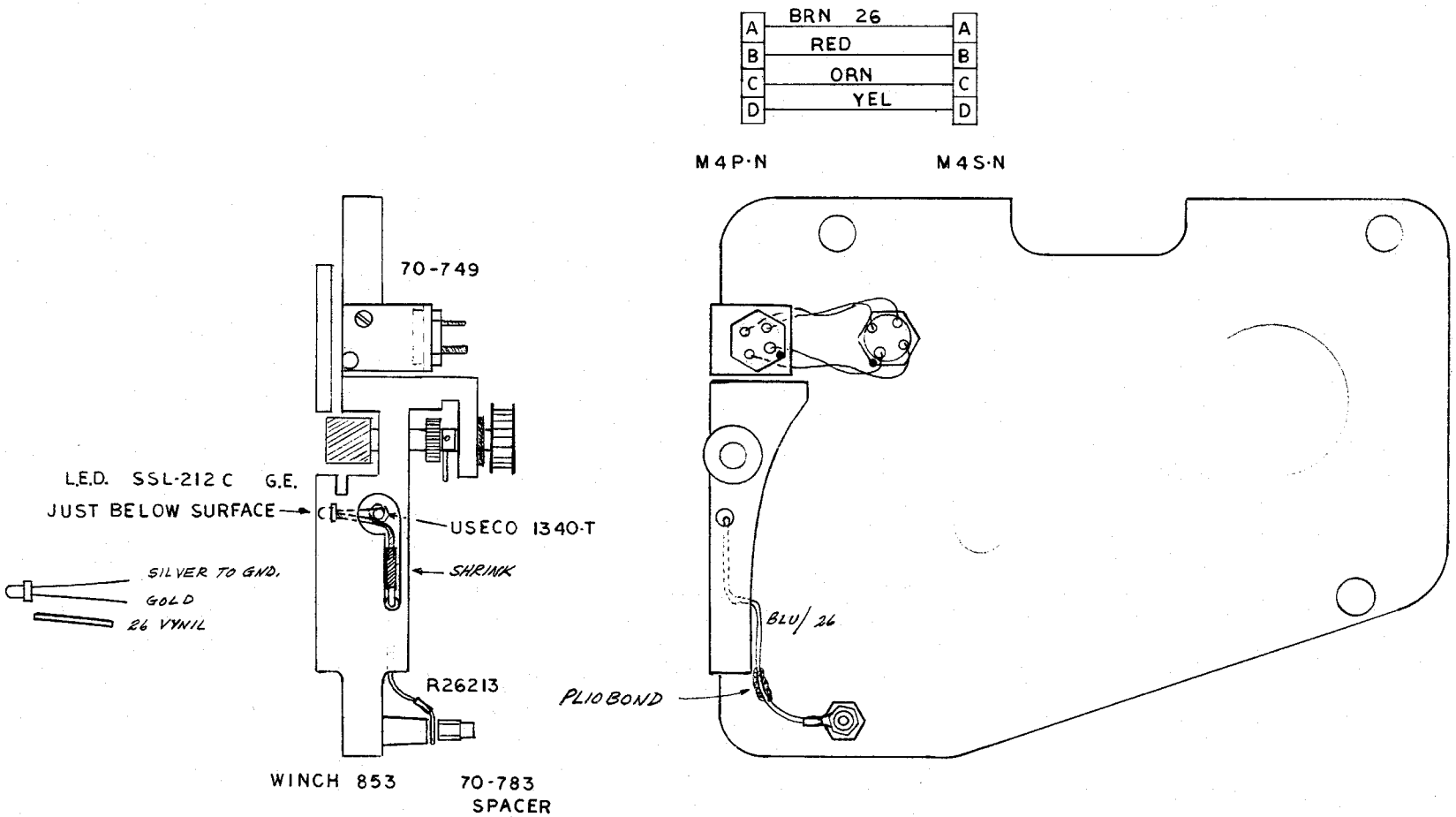
7101M
C+K SW.

200 FT ○ 400 FT

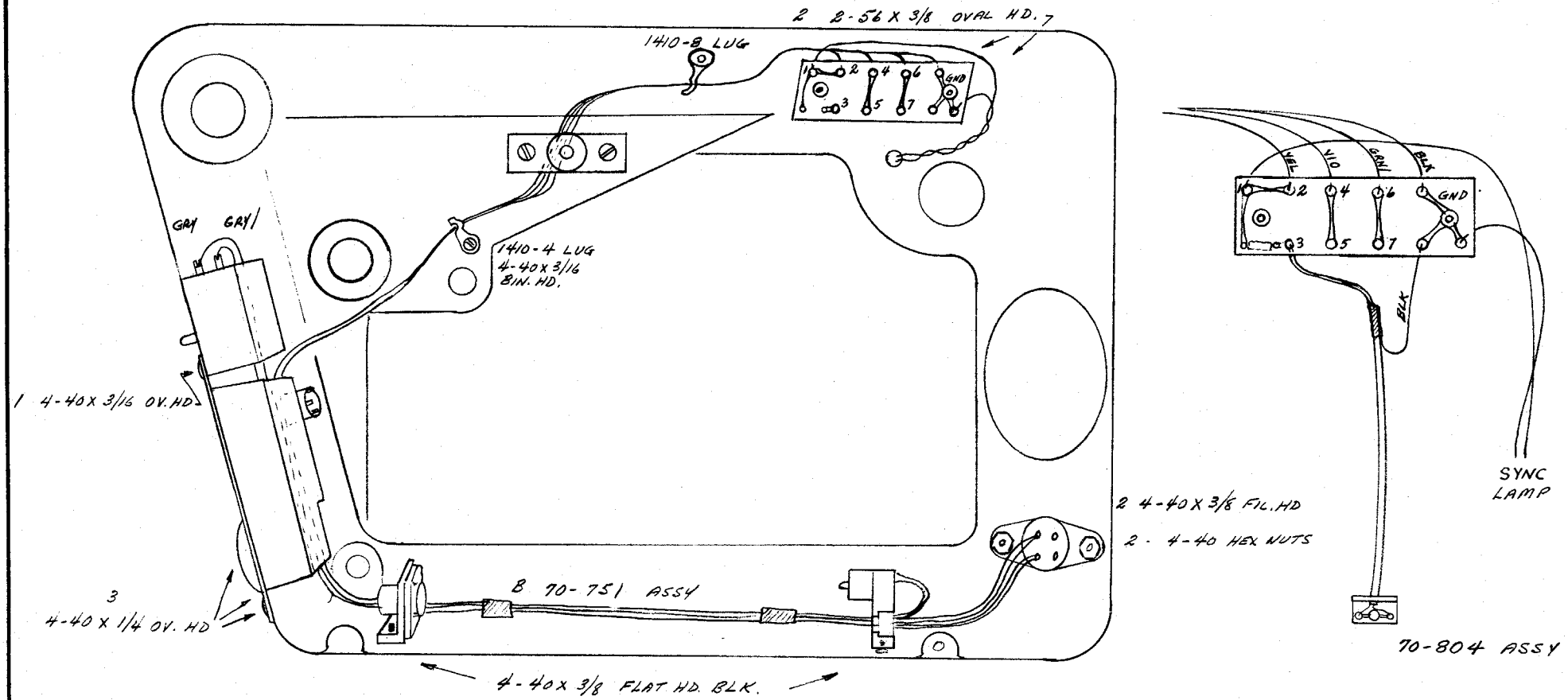
P● L● H● D● A●
○ M● J● E● B● ○
R● N● K● F● C●
REAR VIEW

J.O. 6510

XTAL DRIVE SYSTEM		
CP 16 R		
DEC 73	B	70-760



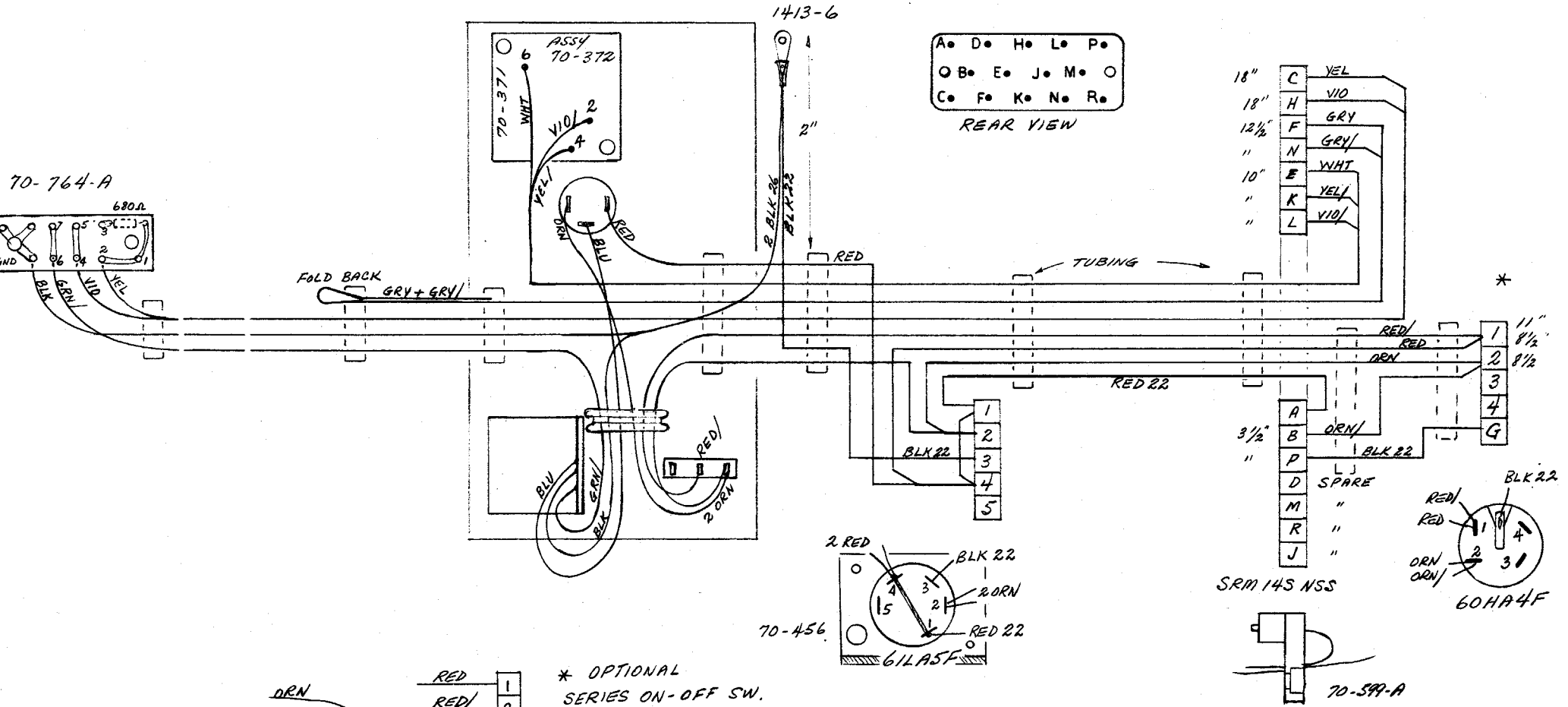
MID-RIB WIRING	
CP-16 R	
5-74	B 70-802

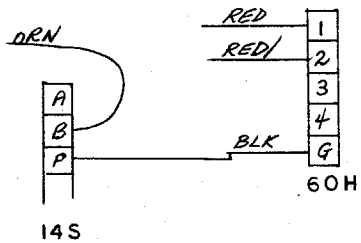


CINEMA PRODUCTS		
SCALE: NONE	APPROVED BY:	DRAWN BY J H
DATE: 5 -74		REVISED
BODY WIRING CP16R		
B 70 - 805		DRAWING NUMBER

1 WIRE IS RED 22
2 WIRES ARE BLK 22
REMAINDER ARE 26 GA.

① PLUG 14 PIN CONNECTOR ONTO JIG AND WIRE FIRST
② MOUNT ON BRACKET 70-599-C, FASTEN IN PLACE.
③ WIRE 60HA4F NEXT, THEN 61LA5F
PLACE TUBING WHERE SHOWN.





* OPTIONAL
SERIES ON-OFF SW.
OMIT ORN/
ORN TO B - 14S
RED/ TO PIN 2

CONTROL PANEL ASSY.		
CP 16 R		
DEC 73	B	70 - 751