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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Los Angeles, California 90025

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Technology in the Service of Creativity

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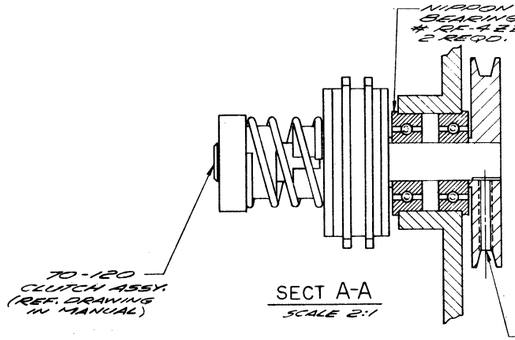
Date of Publication - July 22, 1974
September 18, 1975

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.

70-889

LET.	CHANGE	DATE



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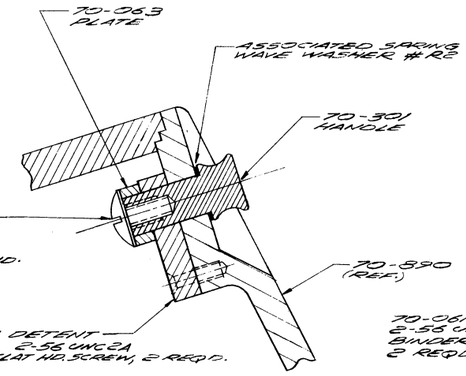

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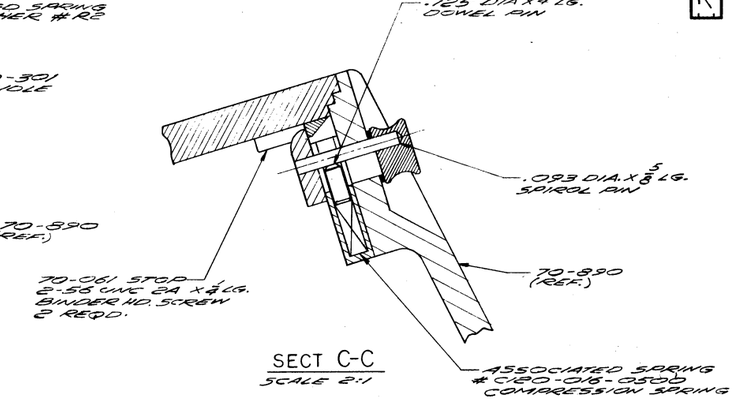

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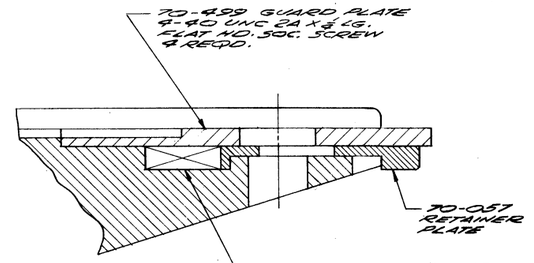

DETAIL D
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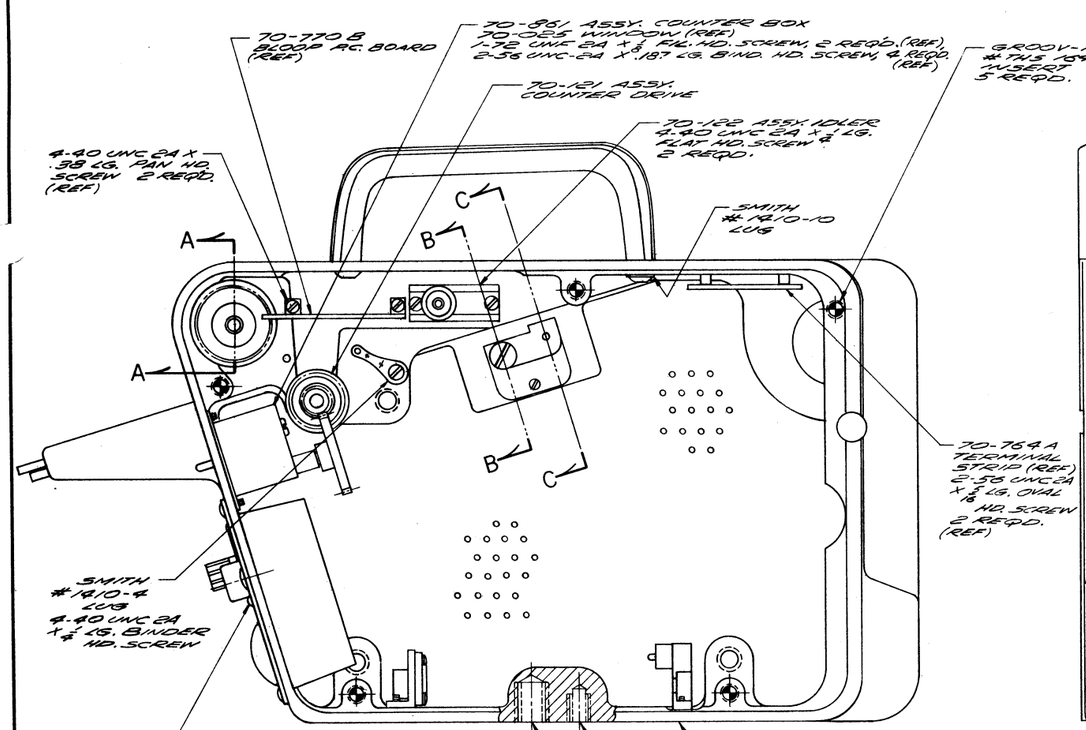

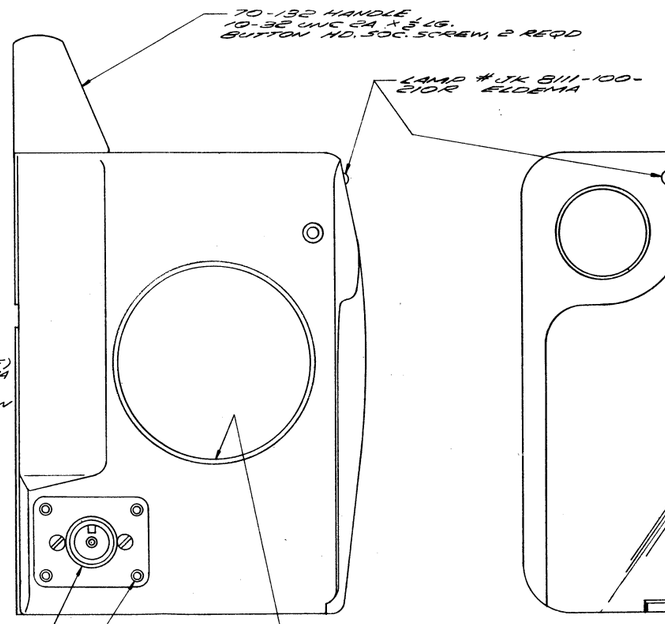

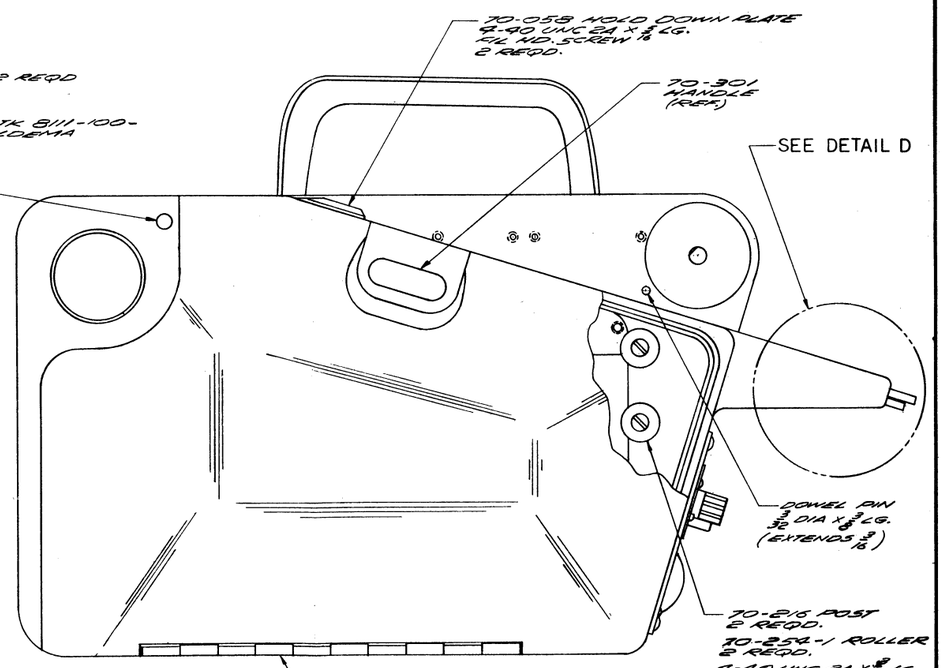

5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— 2 PL. DECIMALS ±.01, 3 PL. DECIMALS ±.005, FRACTIONAL ±1/64, ANGLES ±30', MACH. FINISH 63	cinema B products CORPORATION, Los Angeles, Calif. 90025	DRAWN BY · DORAME
			CHECKED BY
		TITLE: ASSEMBLY CAMERA BODY CP16R	APPROVED BY
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70-120

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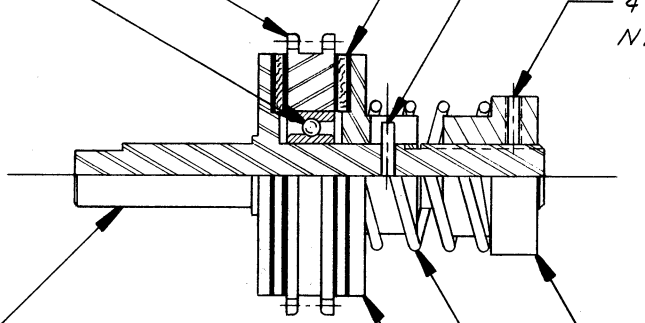

70-033 PULLY

NIPPON MINITURE BEARING # R1-814ZZA3L0-1.

70-041 CLUTCH FACING ASSEMBLY
LUBRICATE USING G.E. VERSILUBE G-322L

.062 DIA. X 7/16 LG. SPIROL PIN

4-40UNC-2A X 1/8 LG. SOC. HD. NYLON TIPPED SET SCREW.

70-029 SHAFT.

70-028 NUT, ADJUSTMENT.

ASSOCIATED SPRING # C600-045-1000

70-030 PRESSURE DISC.

5. FINISH:
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3. MATERIAL:
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NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:— FRACTIONAL ± 1/64
2 PL. DECIMALS ± .01 ANGLES ± 30'
3 PL. DECIMALS ± .005 MACH. FINISH 63

1		DATE 8-7-73
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cinema products CORPORATION
Los Angeles, Calif. 90025

TITLE
ASSEMBLY
CLUTCH
CP16

DRAWN BY	R. W. SAM
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APPROVED BY	
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70-120

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

Introduction

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

It includes specific trouble shooting information and general recommended maintenance procedures.

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 70-88

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 choke from crossbrace. Disconnect ground strap from motor assembly.

   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 sprocker shaft support bar.
9. Remove the four (4) #6-32 screws holding crossbrace to mid-rib and carefully remove.
10. Remove servo-amplifier curcuit board sfter removing top mounting screw and disconnecting plugs.

REFERRNCE 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.

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.

70-887

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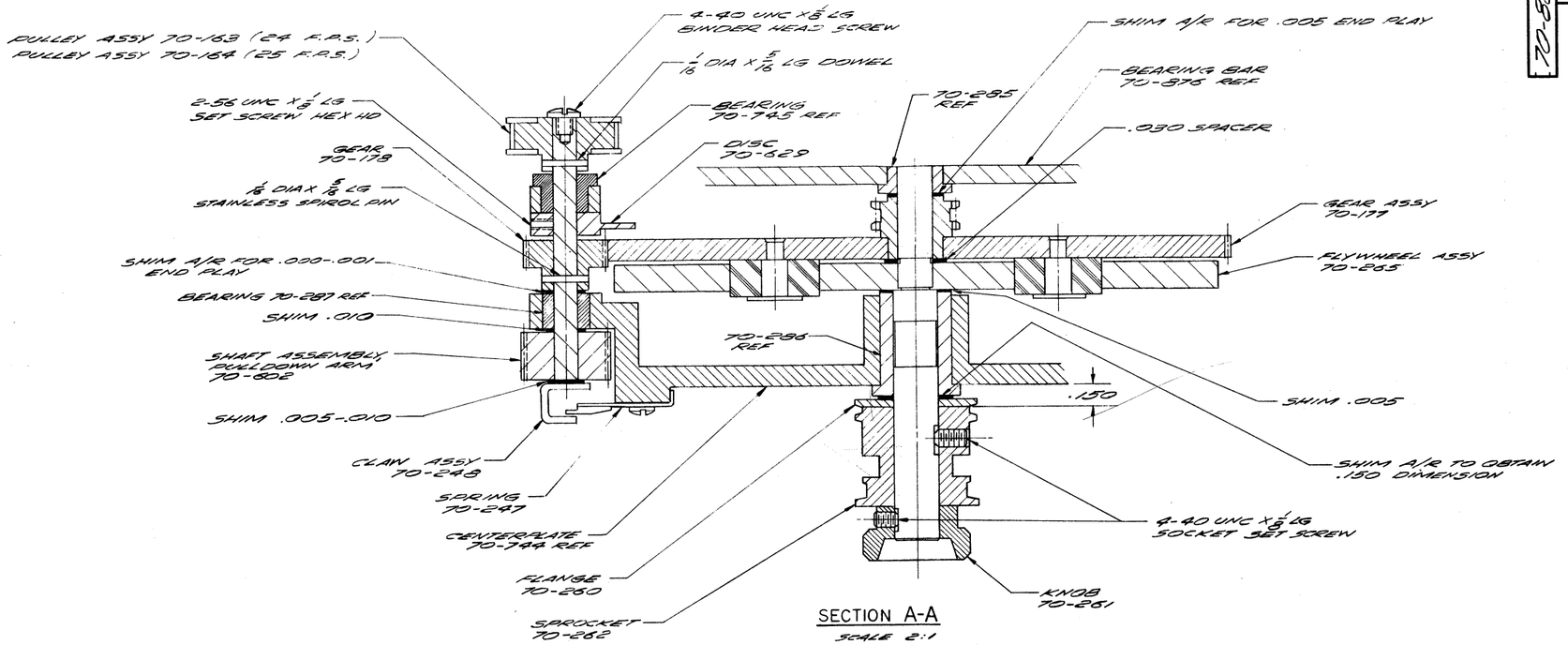

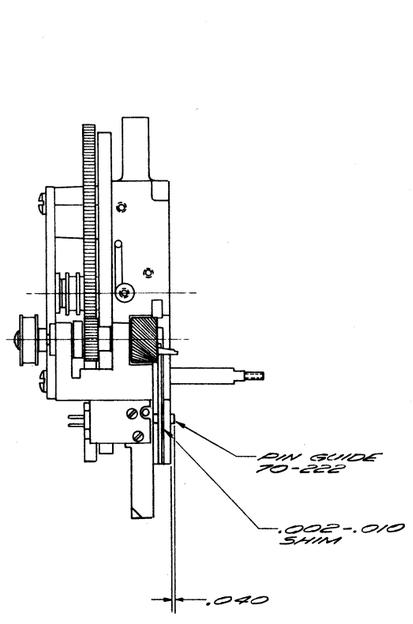

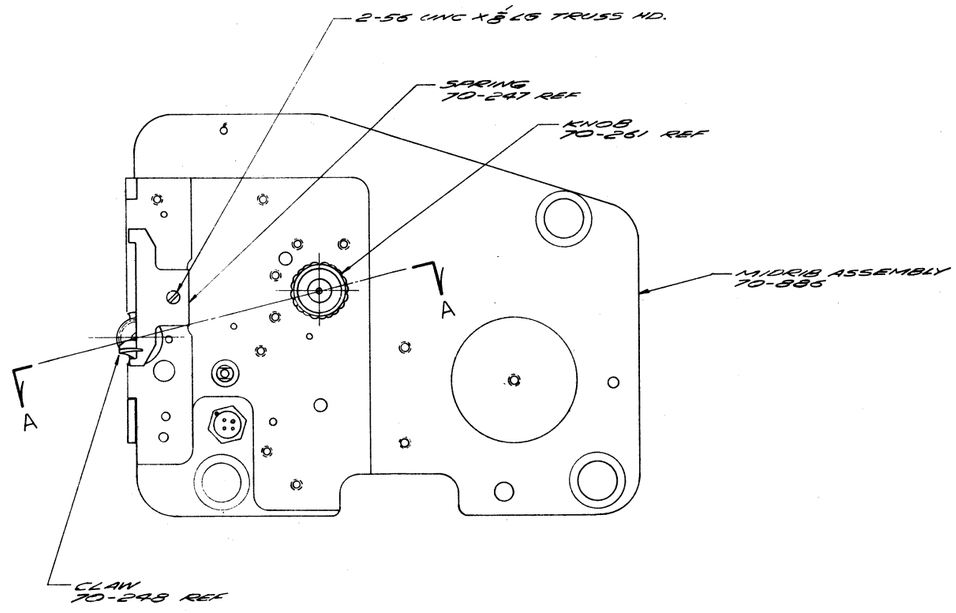

5. FINISH:
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		CHECKED BY:
		APPROVED BY:
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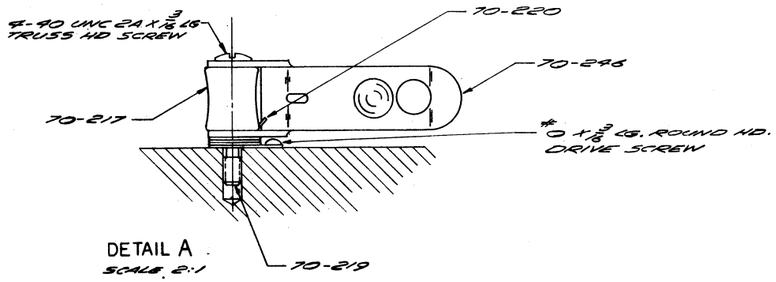

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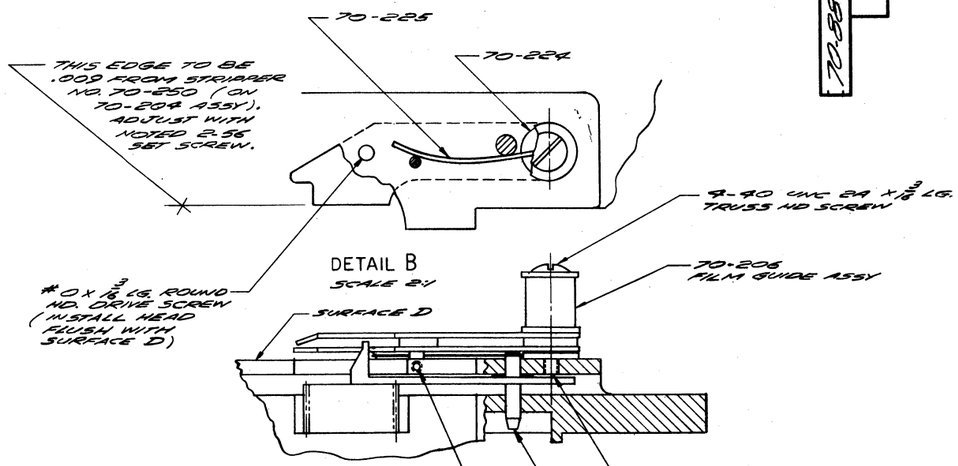

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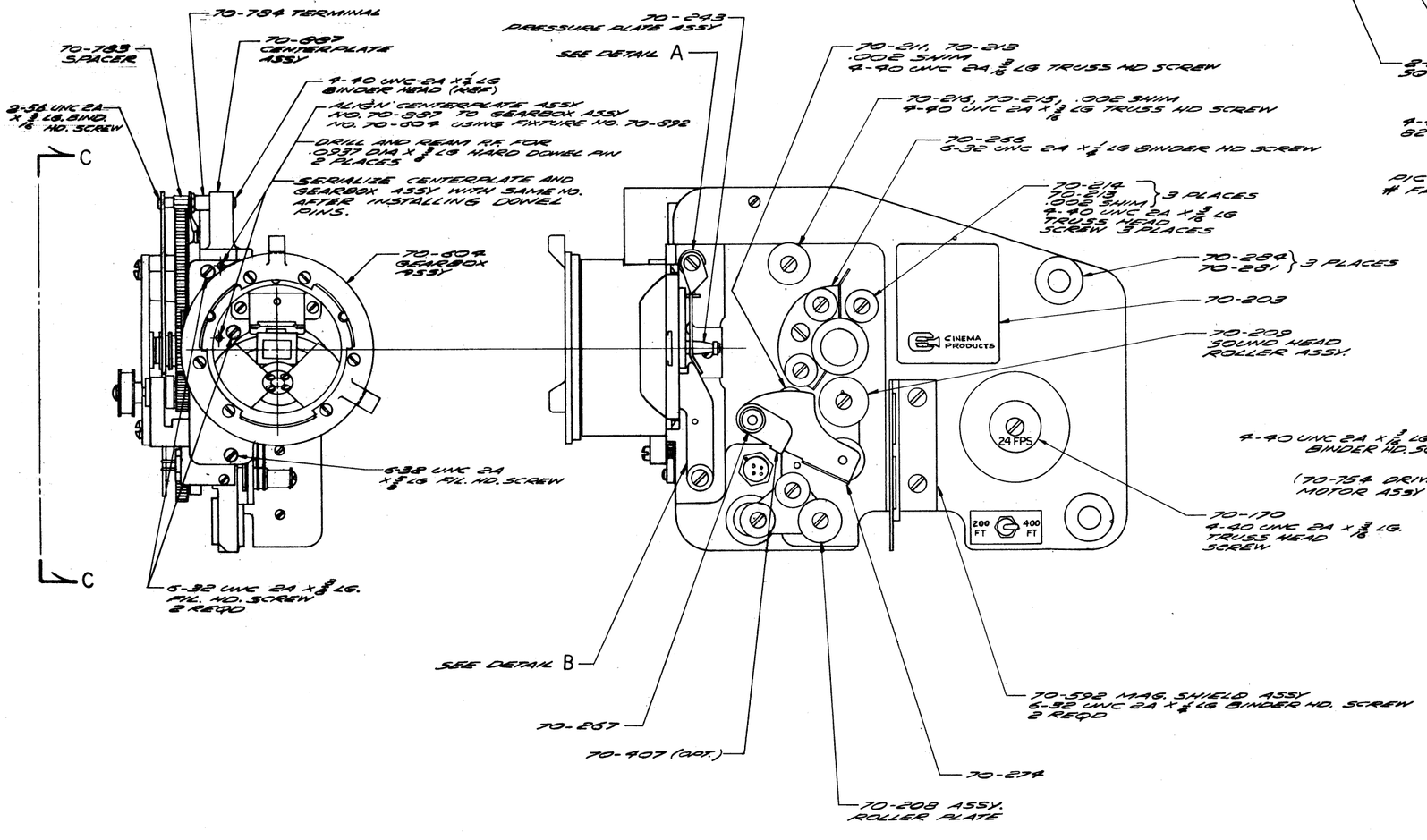

VIEW C-C

5. FINISH:
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70-791 A

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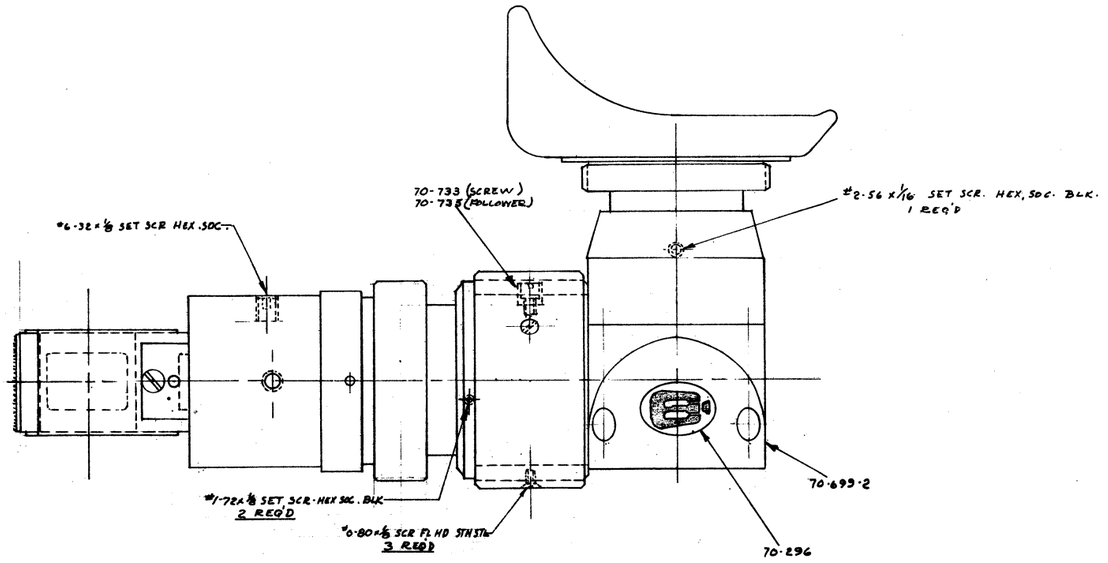

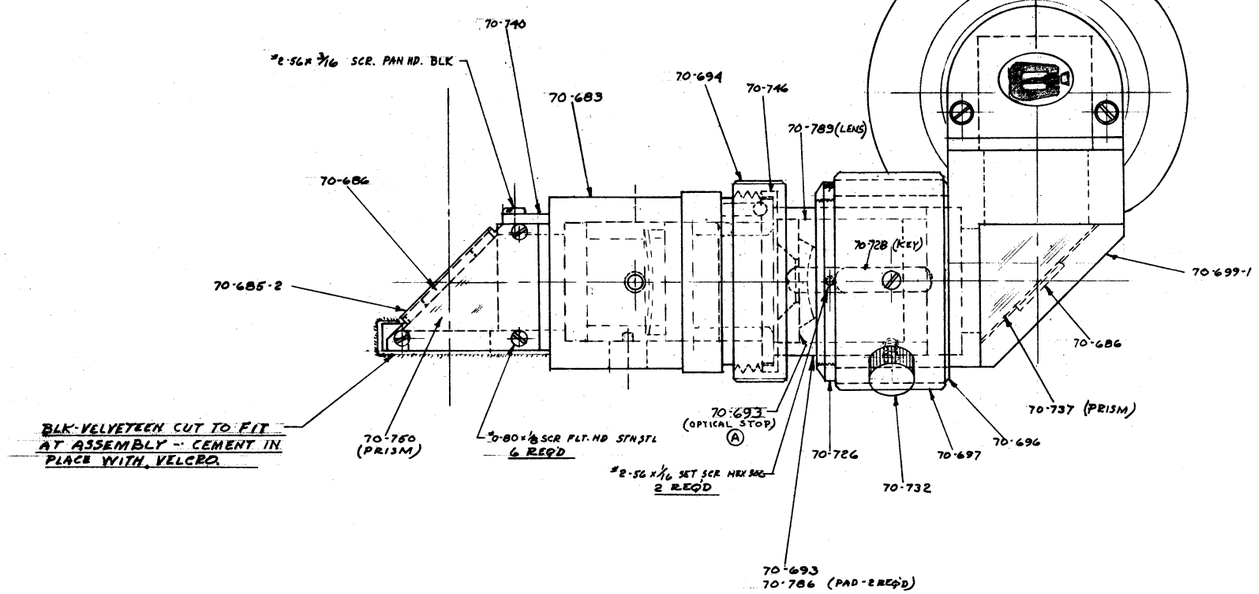

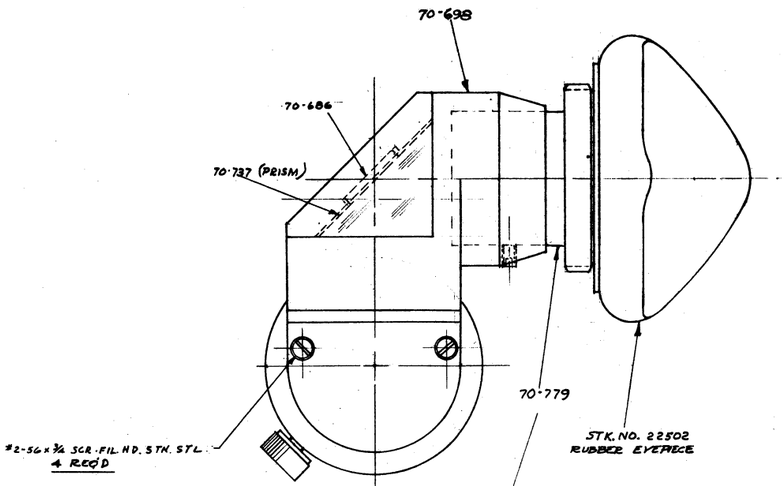

USE 70-727 TUBE AND 70-738 LENS UNTIL 70-779 PARTS ARE AVAILABLE.

5. FINISH:
4. HEAT TREAT:
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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.

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SEE APL 70-791

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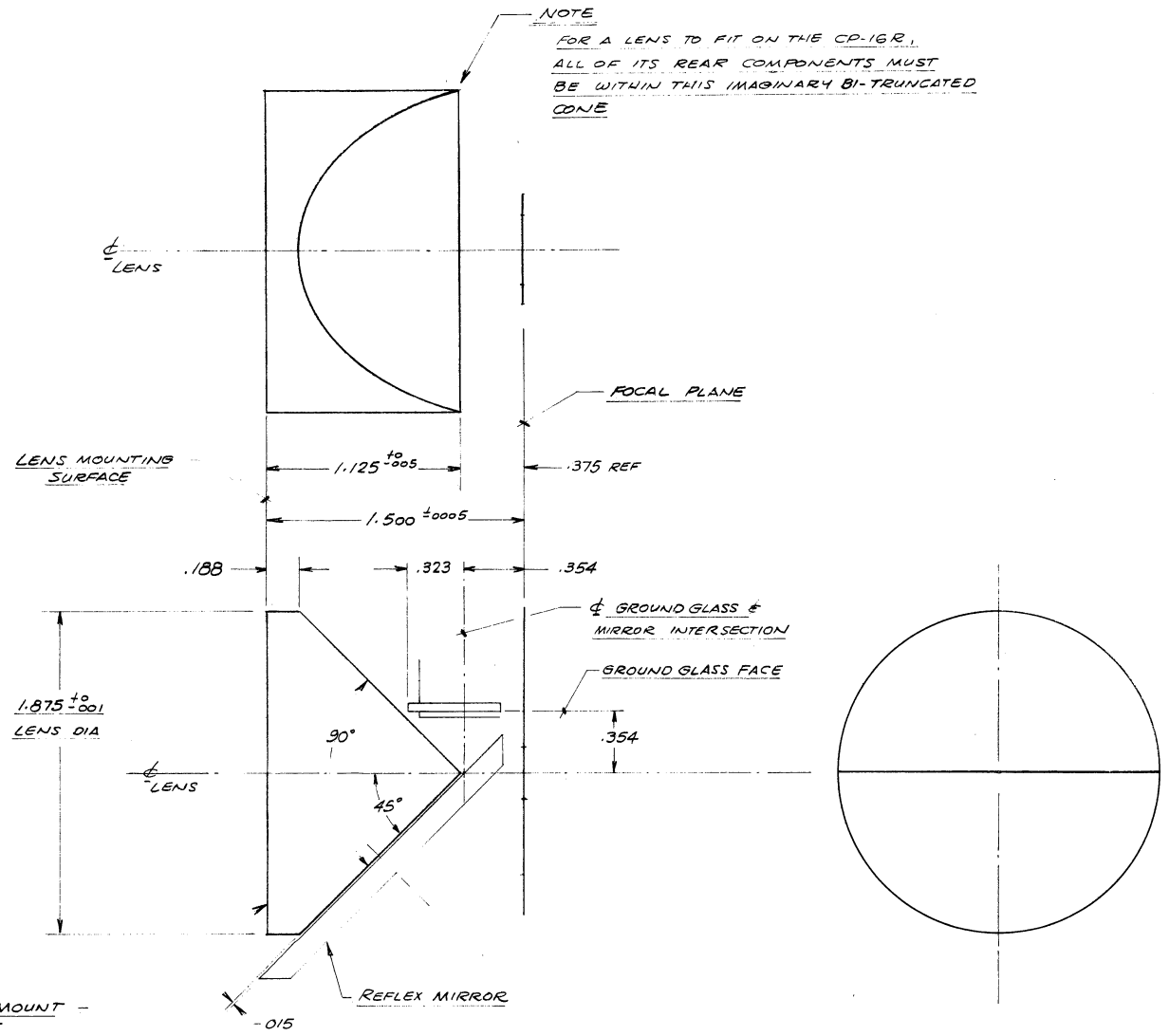

SIDE VIEW

REAR VIEW

70-587

SEE SHEET 2 FOR LENS MOUNT DETAIL

-.376
-.354
=.021

=.021 x .7071 = .0148

5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
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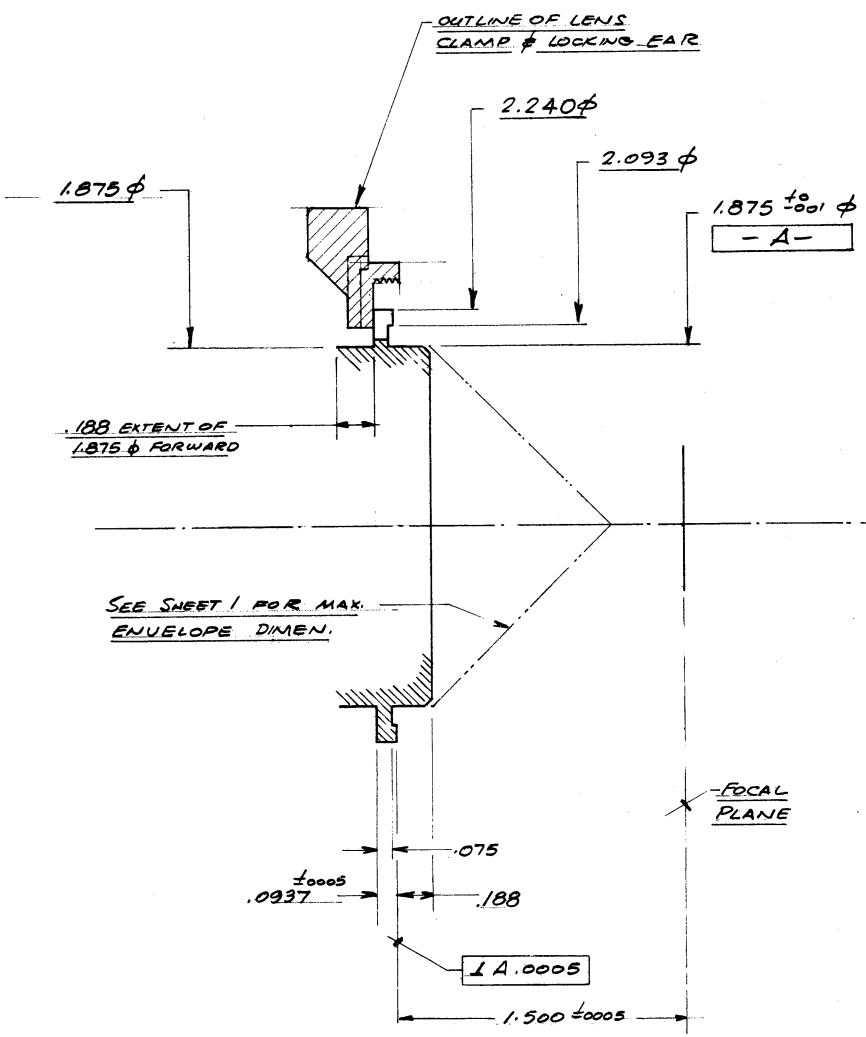
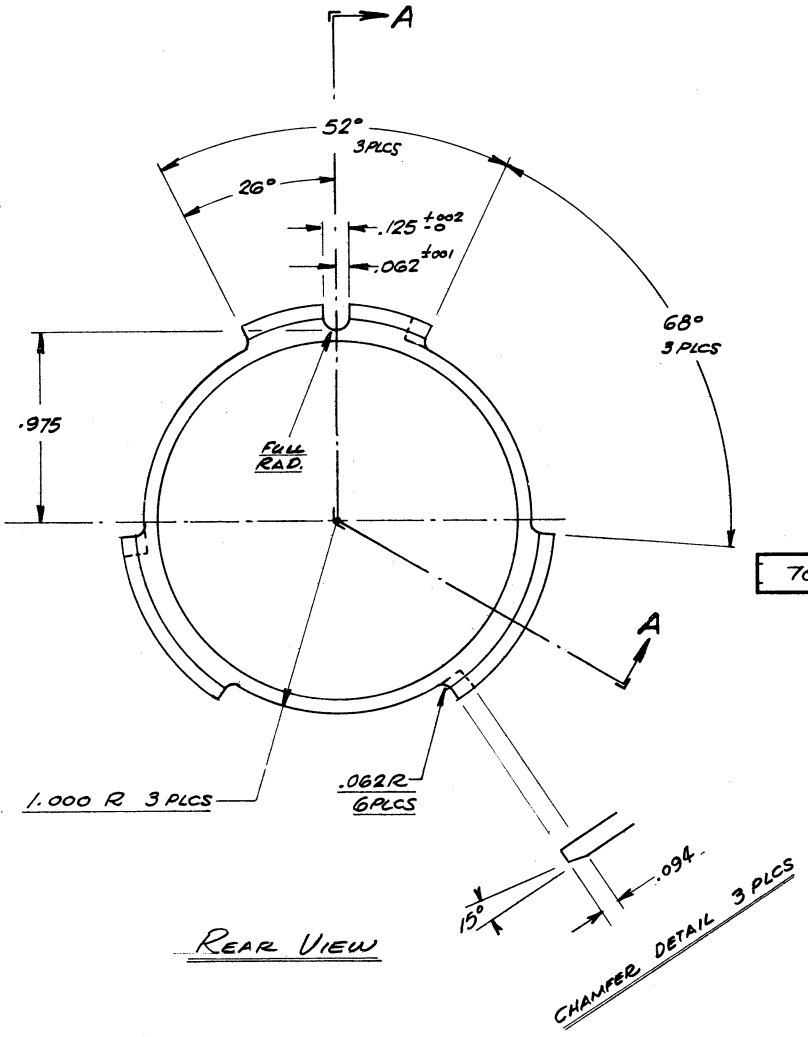


SIDE VIEW

SECTION AA



REAR VIEW

70-587

5. FINISH:
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		TITLE LENS MOUNT AND ENUELOPE - CP-16R
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REQD	NEXT ASSY.	SCALE 2x

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APPROVED BY	JURGENS
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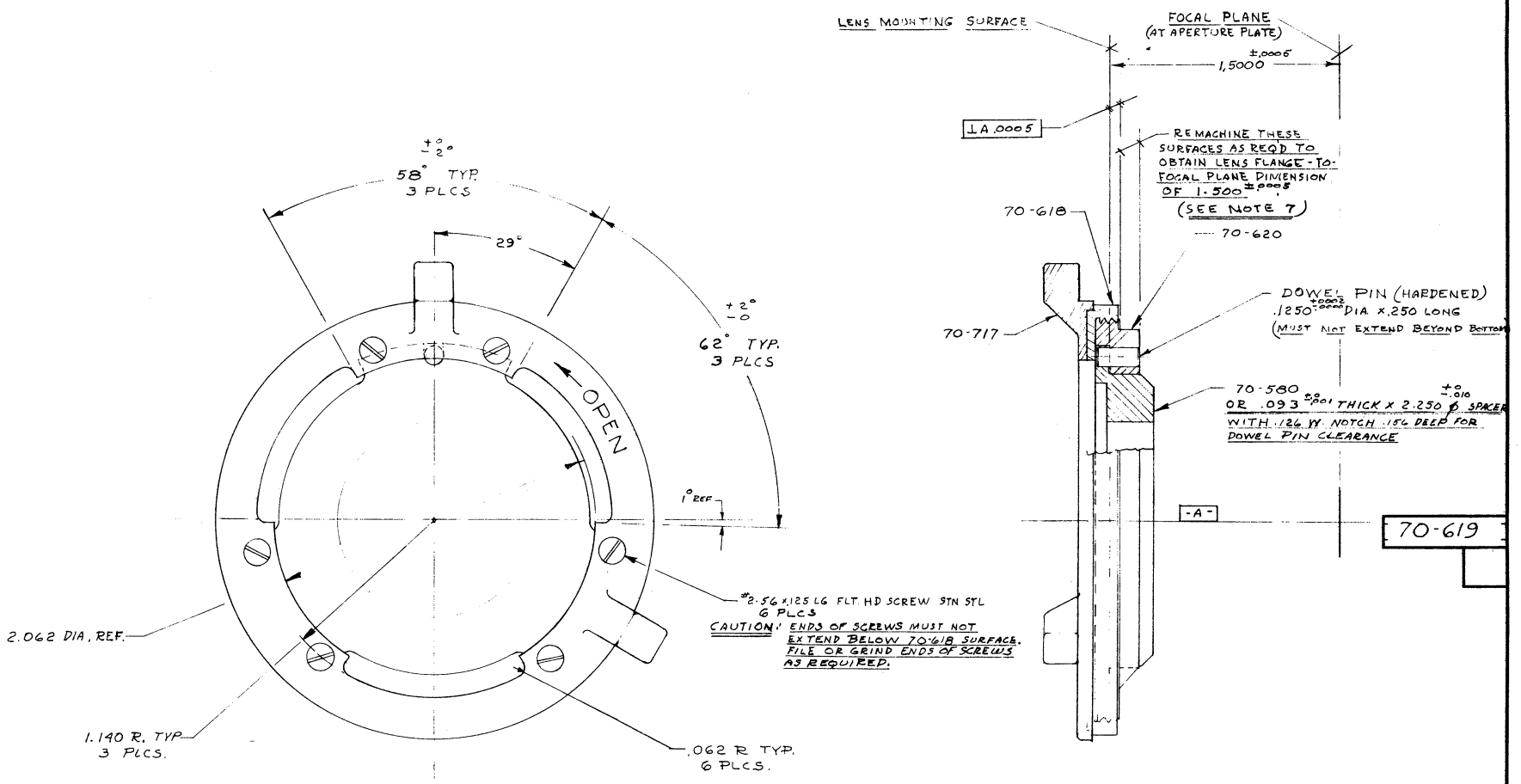

7. ASSEMBLE TO 70-603 GEARBOX WITH COMPLETED APERTURE PLATE ATTACHED. MEASURE FLANGE DEPTH AND REMACHINE SURFACES INDICATED ON LENS MOUNT RING 70-620 TO GIVE FLANGE DEPTH DIMENSION OF 1.5000 +.0005.
6. ASSEMBLE PARTS AS SHOWN USING CARE TO TIGHTEN LOCK RING 70-618 TO SECURELY SEAT LENS FLANGE 70-580 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.
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		TITLE ASSY LENS RING & LOCK RING CP 16 SMR
	DATE 11 MAY '73	DRAWN BY C.E Hurtle
	SCALE 2 X	CHECKED BY
REQD	NEXT ASSY.	APPROVED BY
1		C SIZE SHEET OF SHEETS
		70-619

70-604

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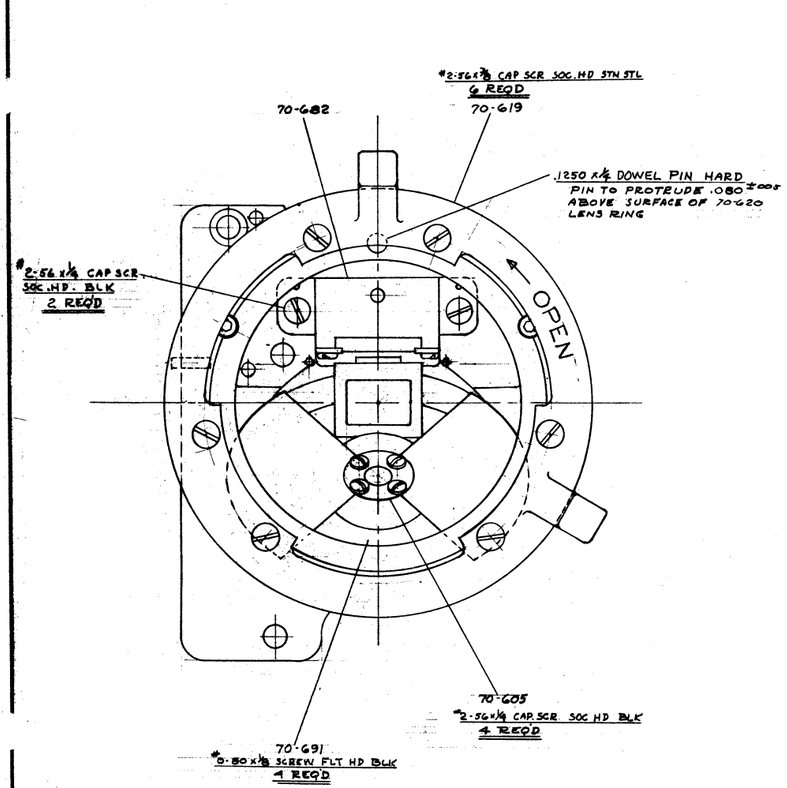
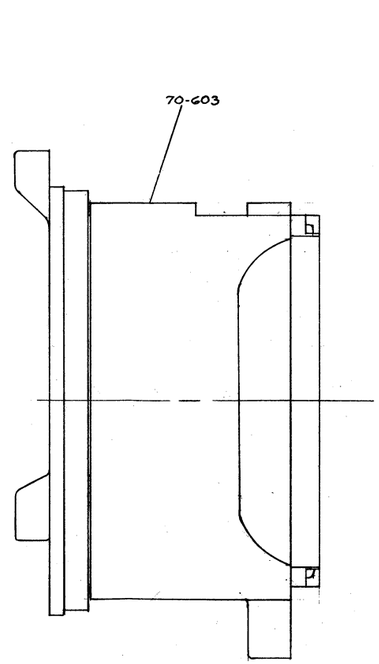
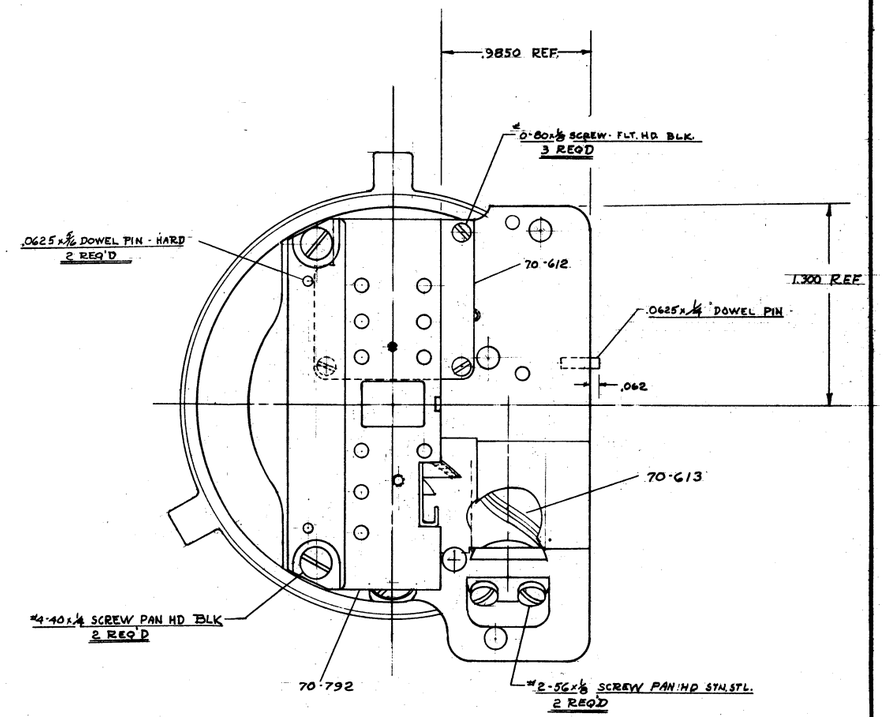
ASSEMBLY INSTRUCTIONS

1. INSTALL 70-612 REAR COVER ON 70-603 GEARBOX.
2. INSTALL 70-620 LENS RING (OF 70-619) TEMPORARILY ON GEARBOX.
3. PLACE APERTURE PLATE LOCATING FIXTURE ON LENS RING WITH RECTANGULAR TIP EXTENDING TOWARD REAR.
4. PLACE 70-792 APERTURE PLATE ON REAR OF GEARBOX WITH RECTANGULAR TIP OF FIXTURE EXTENDING THRU APERTURE OPENING AND INSTALL THE MOUNTING SCREWS LIGHTLY. INDICATE FILM GUIDING EDGE OF APERTURE PLATE AND ADJUST UNTIL IT IS PARALLEL WITH LONG MACHINED EDGE OF GEAR BOX WITHIN .0005 TIR.
5. TIGHTEN MOUNTING SCREWS AND RECHECK FOR PARALLELISM.
6. DRILL THRU DOWEL PIN PILOT HOLES INTO GEAR BOX USING #53 DRILL (.0595 ϕ)
7. FINISH REAM TO .0620 ϕ AND PRESS IN THE TWO .0625 ϕ x 5/16 DOWEL PINS
8. REMOVE 70-620 LENS RING
9. INSTALL IN FOLLOWING ORDER:
   a. 70-613 IDLER GEAR ASSEMBLY
   b. 70-605 MIRROR SHAFT ASSY - LESS MIRROR
   c. 70-691 COVER
   d. 70-682 GROUND GLASS MOUNT
   e. 70-620 LENS RING
10. USING SPECIAL "FEDERAL" DEPTH GAUGE (1.500 RANGE) CHECK DEPTH FROM LENS FLANGE MOUNTING SURFACE OF LENS RING TO FILM PLANE OF APERTURE PLATE. REQUIRED DEPTH IS $1.5000^{\pm.0005}$ (INITIAL MEASUREMENT SHOULD BE 1.5000 TO 1.5020.)
11. PLACE ASSEMBLY ON SPECIAL SUPPORTING FIXTURE (WITH APERTURE PLATE FACING UP), USING SURFACE GRINDER, GRIND BALLS IN APERTURE PLATE UNTIL $1.5000^{\pm.0005}$ FLANGE DEPTH IS OBTAINED
12. PRESS IN .1250 x 1/4 AND .0625 x 1/4 DOWEL PINS AS SHOWN.







5. FINISH:
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 3 PL. DECIMALS ±.005 FRACTIONAL ±1/64 ANGLES ±30' MACH. FINISH 63	cinema product CORPORATION Los Angeles, Calif. 90028	DRAWN BY GEH 12-28
			CHECKED BY
		TITLE GEARBOX ASS'Y	APPROVED BY
	1 DATE 26 FEB 74	CP16 SMR	D SIZE SHEET 1 OF 1 SHEETS
	REQD NEXT ASSY. SCALE 2 X		70-604

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 the (#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 (#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.

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.

Section V - This section describes the circuitry for the Exposure Control system which is an optional feature.

Section VI - This section describes the circuitry for the J-5 Zoom Control 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;

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.

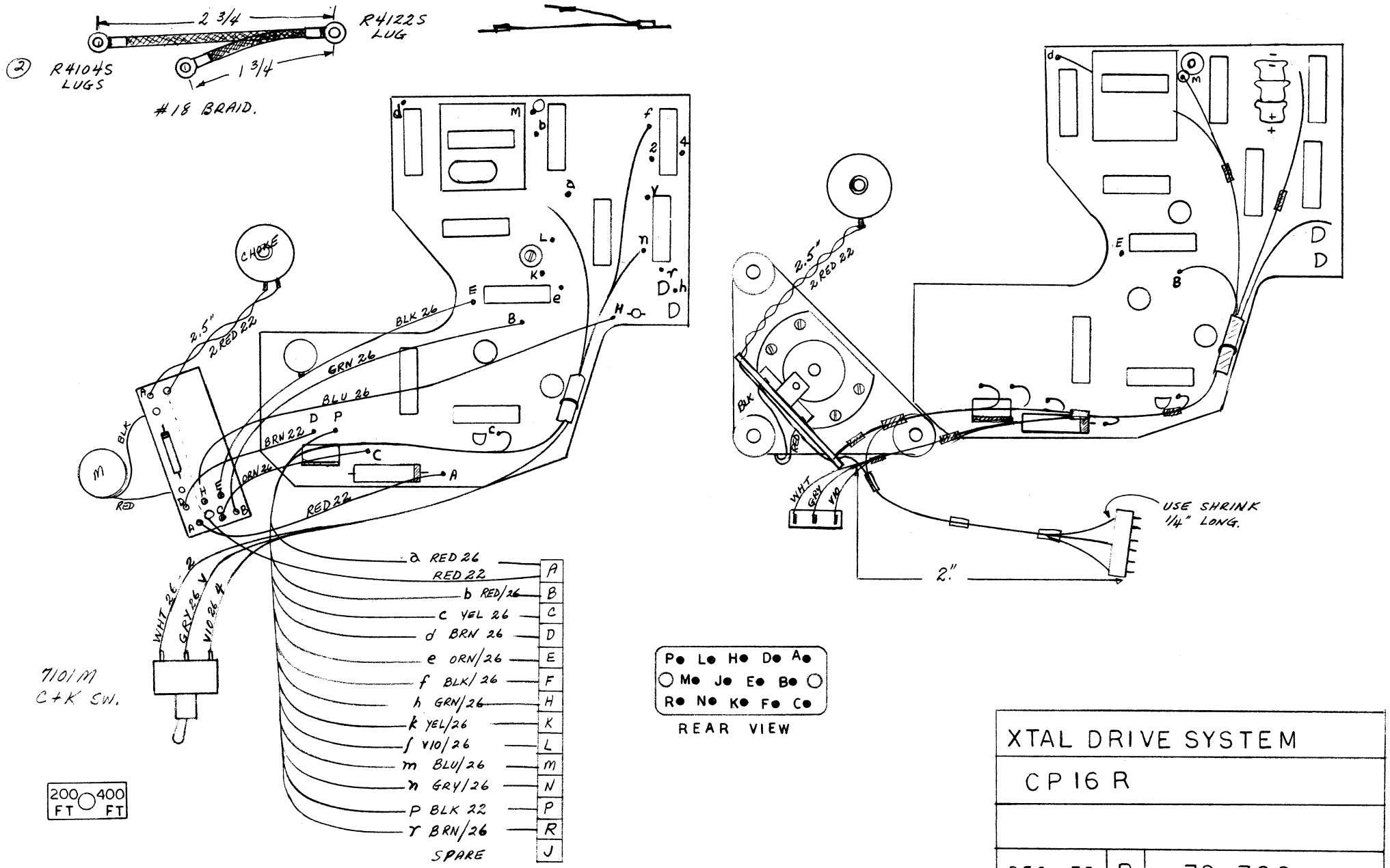
Changing the "Speed Select" switch to one of the "wild" speeds, converts the two gates at Q16 pins 8 through 13 into a multivibrator oscillator. The "Speed Select" switch along with the 9.53K ohm resistor and 1K ohm potentiometer form the resistive portion of an RC network that determines the oscillators 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.

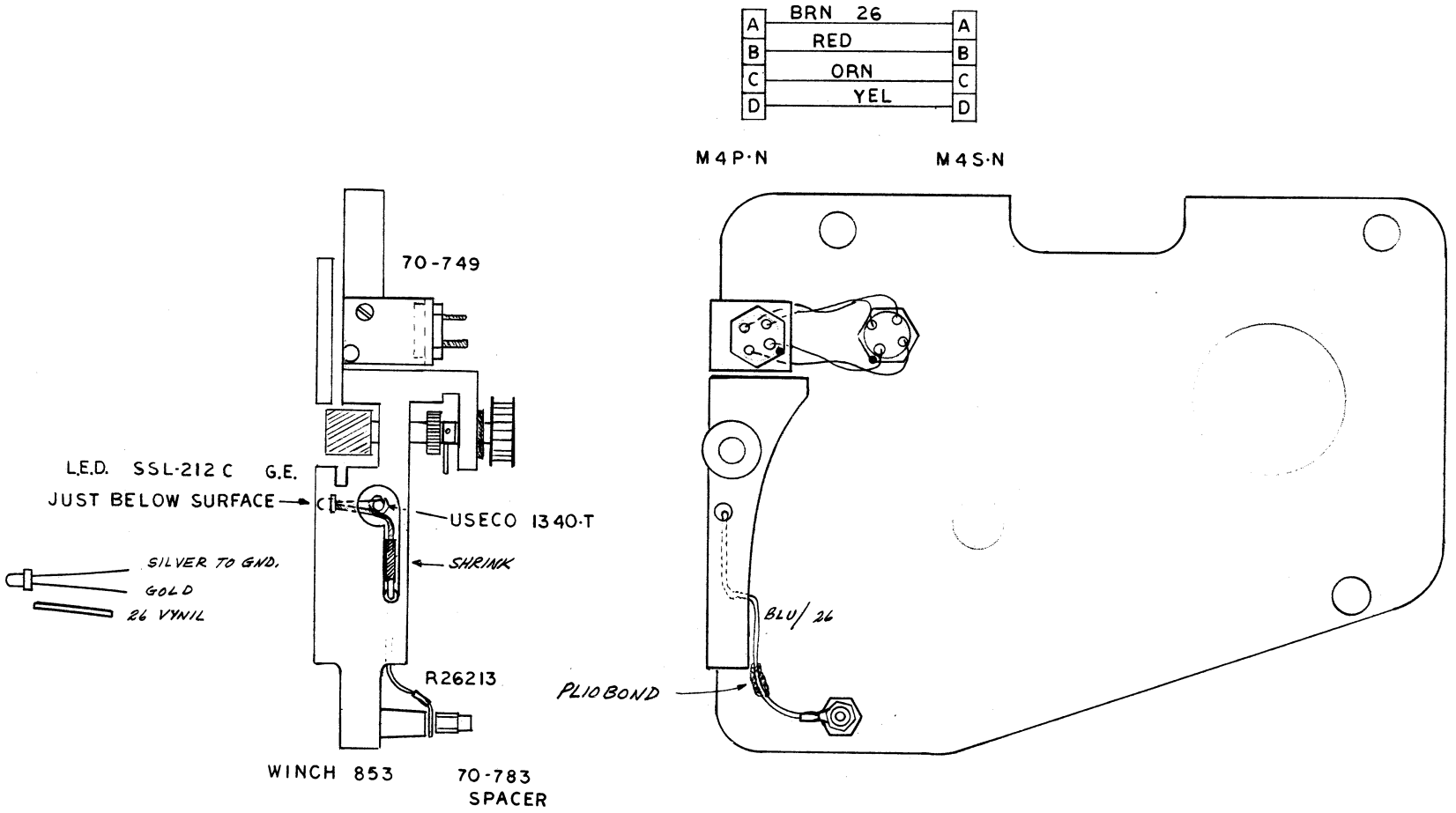
REFERENCE Optical Tachometer Circuitry

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

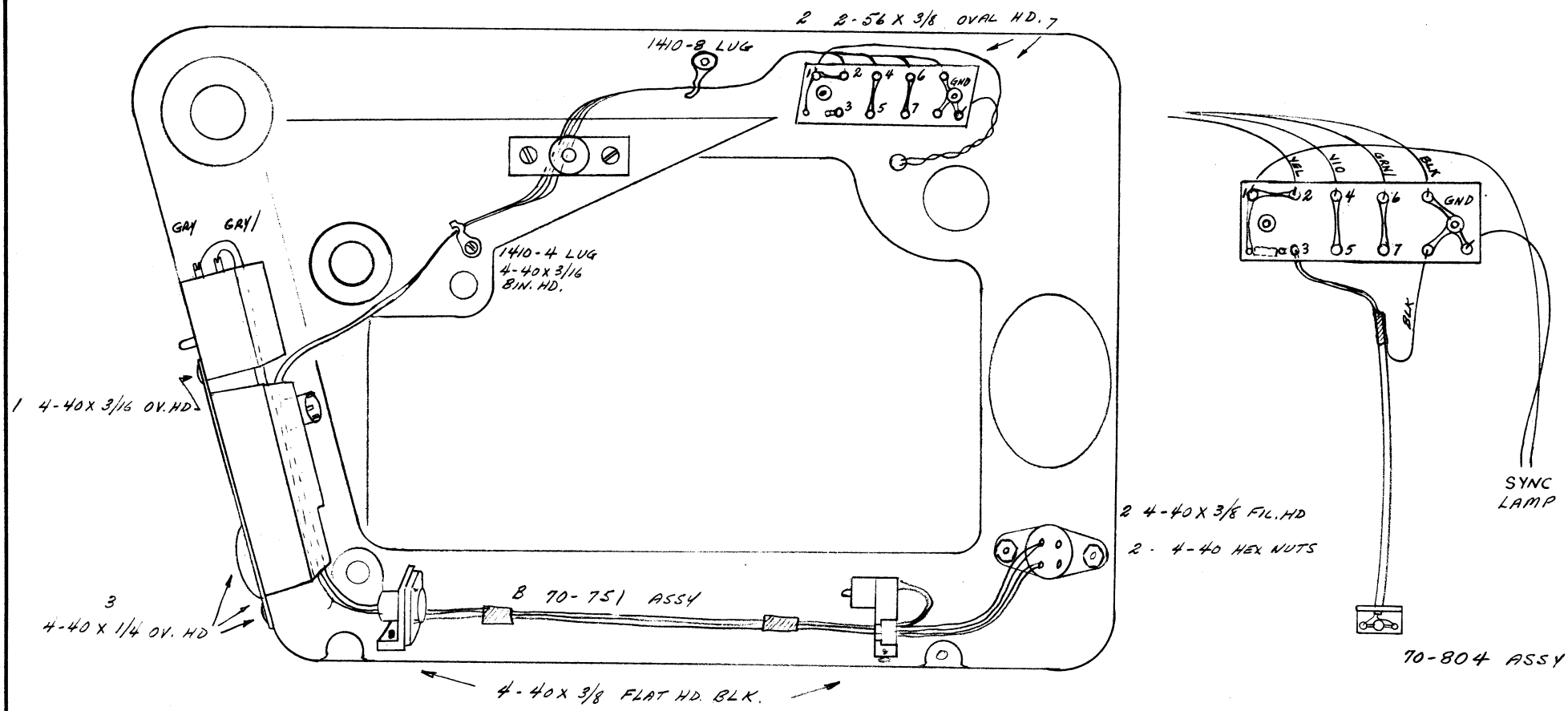


J.O. 6510

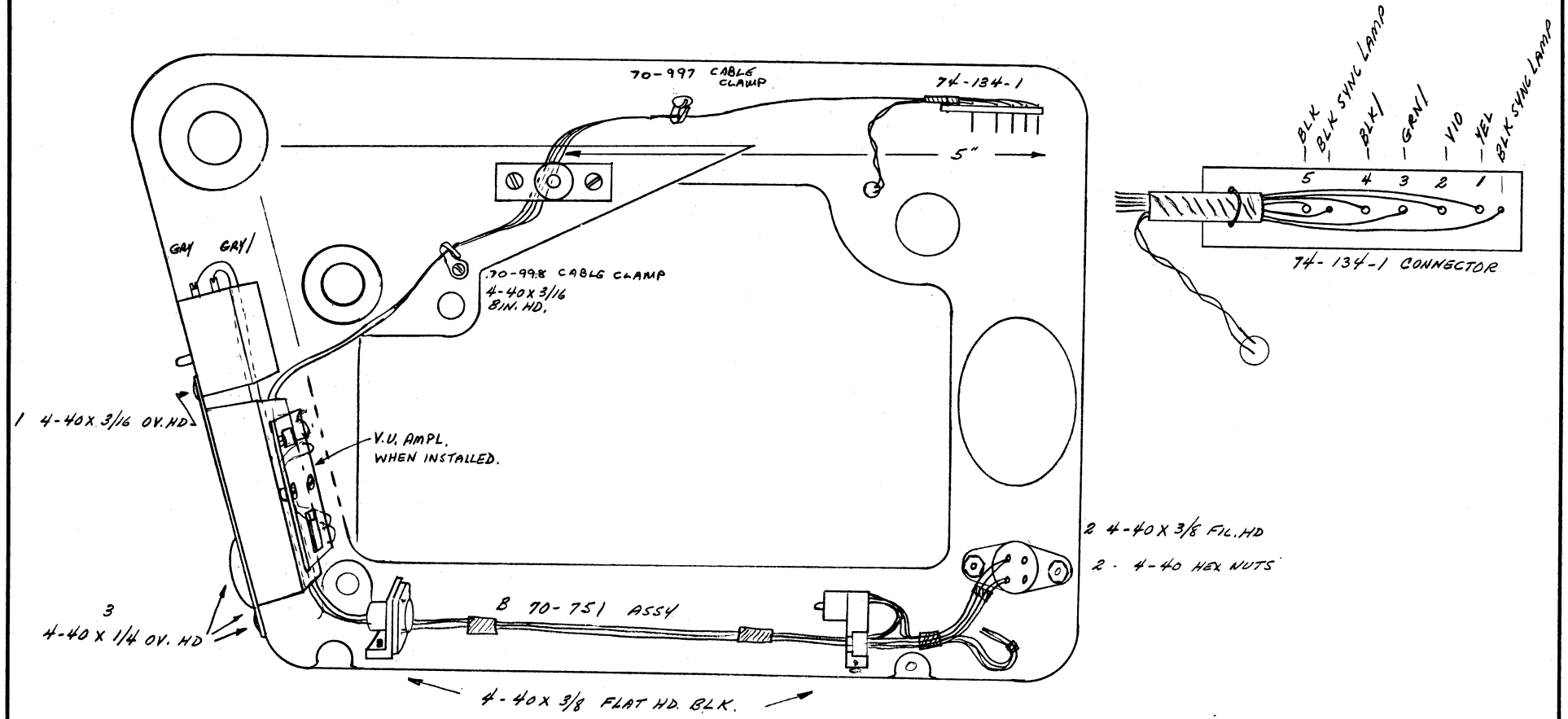
XTAL DRIVE SYSTEM		
CP 16 R		
DEC 73	B	70-760



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



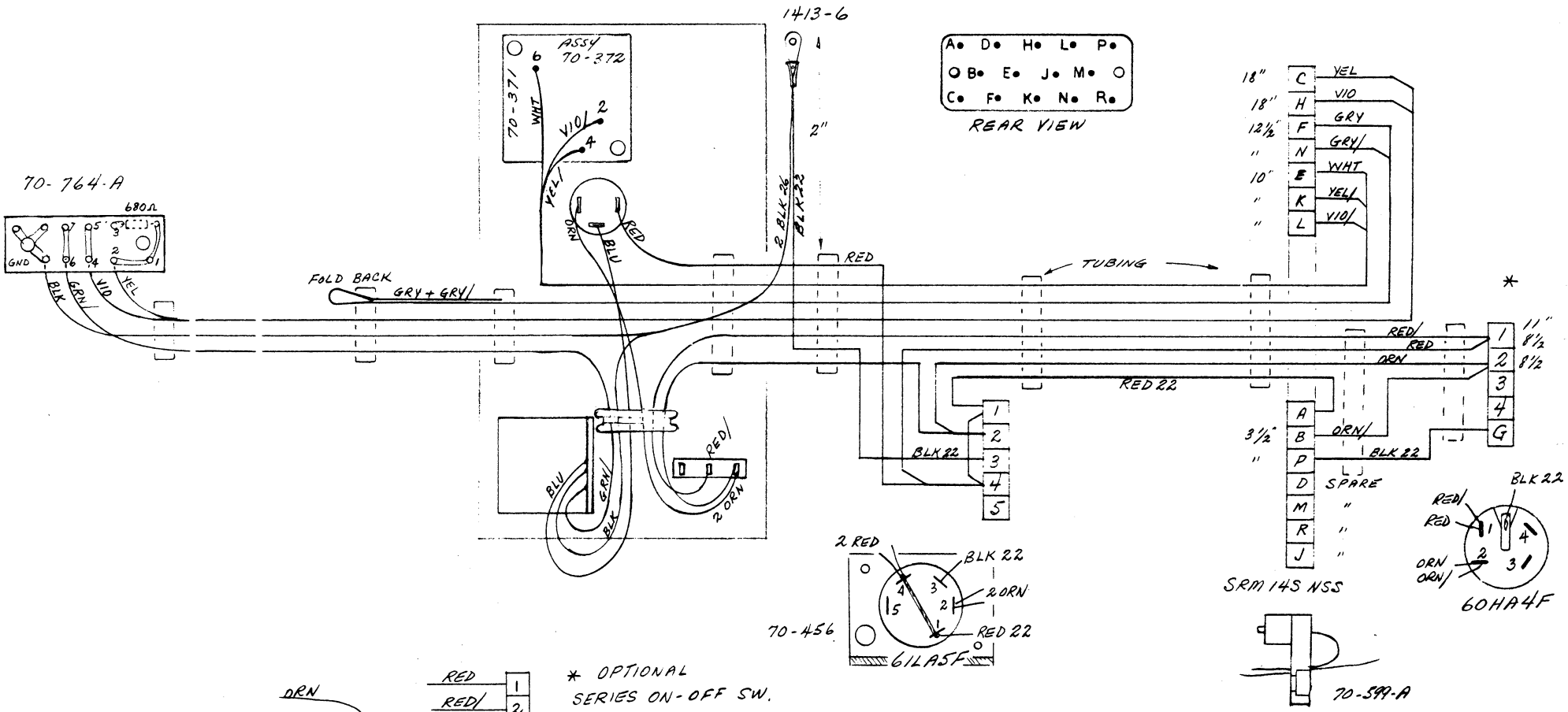
CINEMA PRODUCTS		
SCALE: NONE	APPROVED BY:	DRAWN BY J H
DATE: 5 - 74		REVISED
BODY WIRING CP16R		
B 70 - 805		DRAWING NUMBER



CINEMA PRODUCTS		
SCALE: NONE	~~APPROVED BY:~~ V.U. AMPL SHOWN	DRAWN BY J H
DATE: 10 -74		REVISED
BODY WIRING CP16R		
B 70 - 805 - C		DRAWING NUMBER

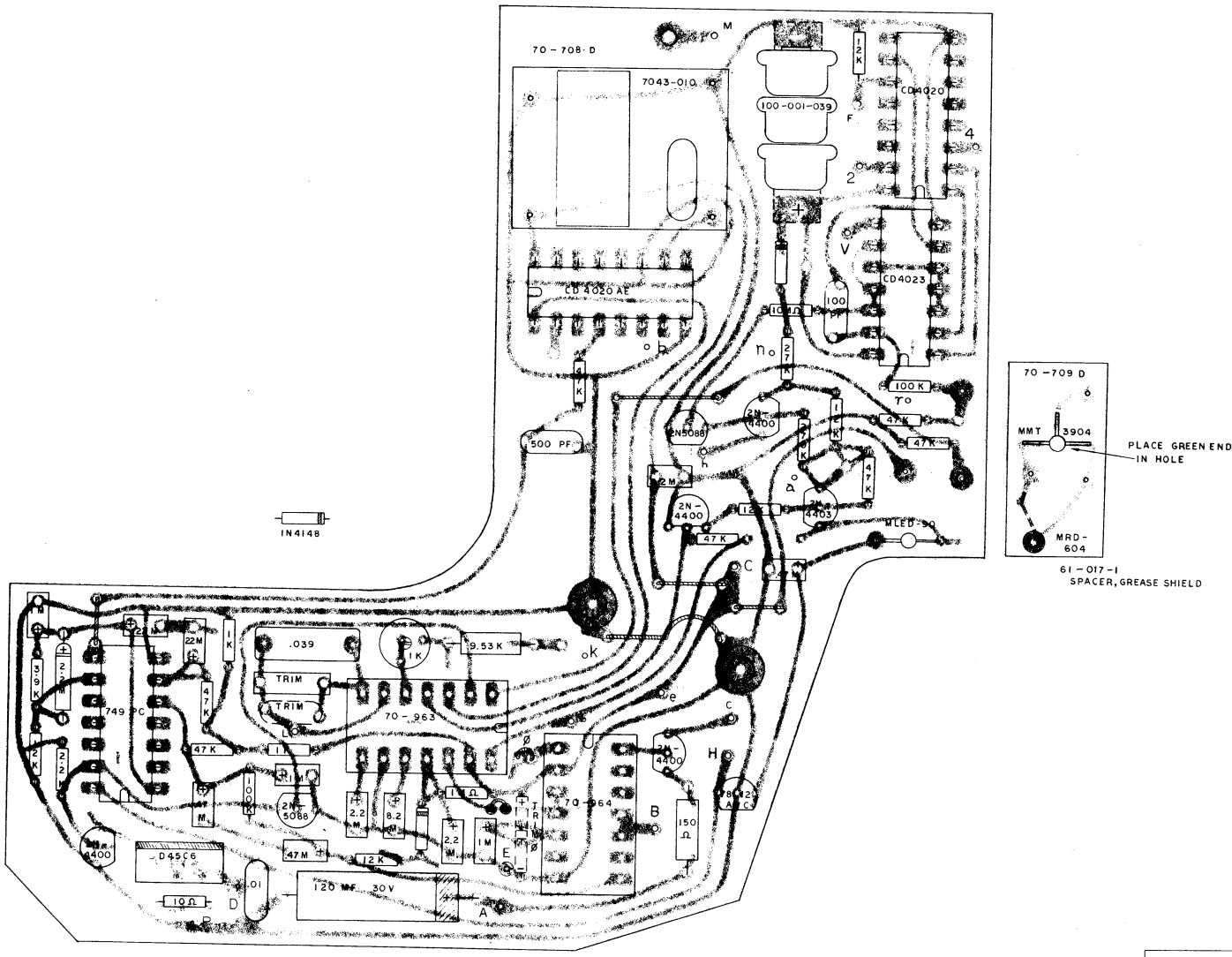
1 WIRE IS RED 22
2 WIRES ARE BLK 22
REMAINDER ARE 26 GA.

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 61A5F
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



61 - 017 - 1
SPACER, GREASE SHIELD

J O 6520
C P-16 R

CINEMA PRODUCTS	
P. C. BOARD ASSY.	
12-74	D 70 - 759 - F

(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

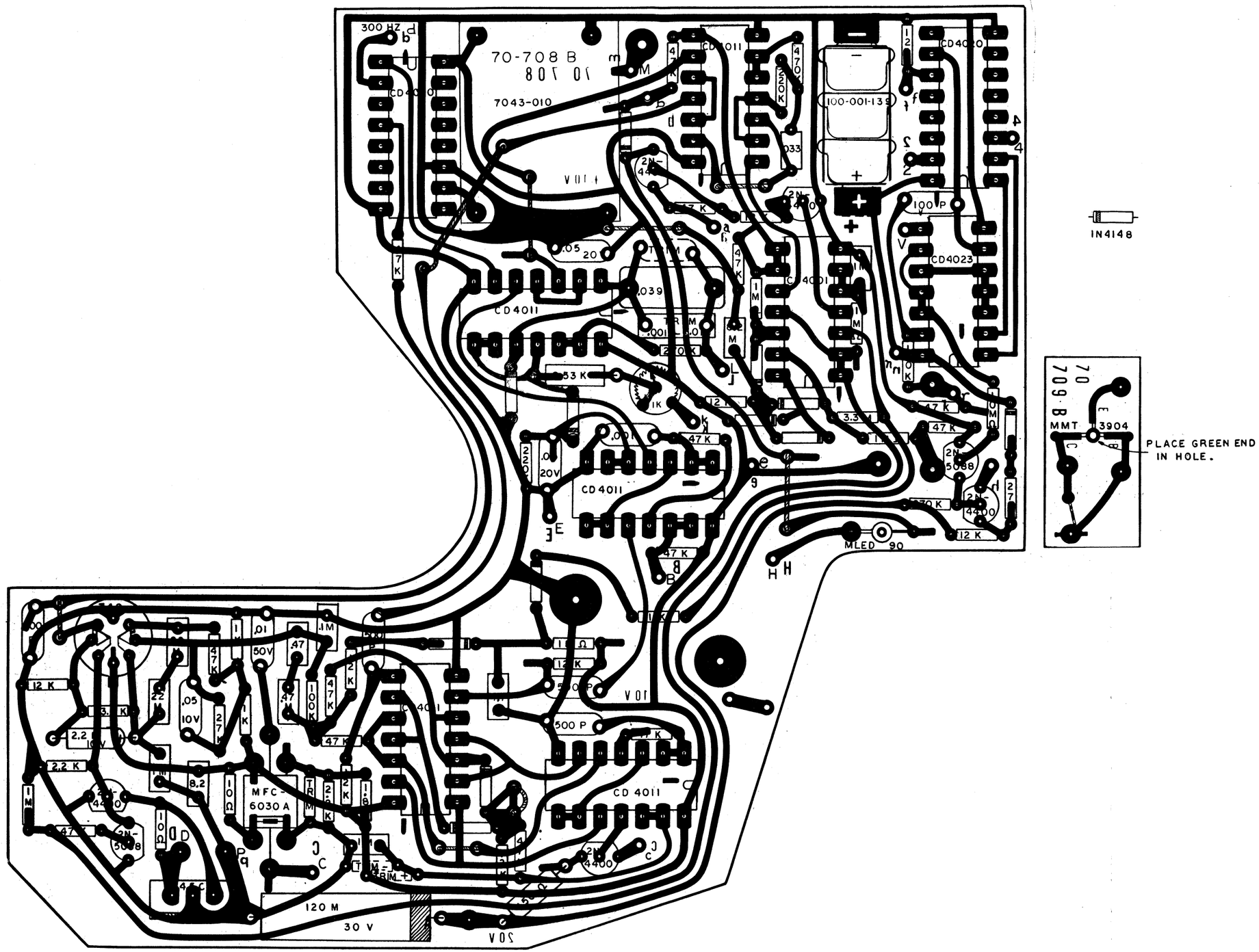
LOW FILM INDICATOR

REFERENCE Counter Power Supply

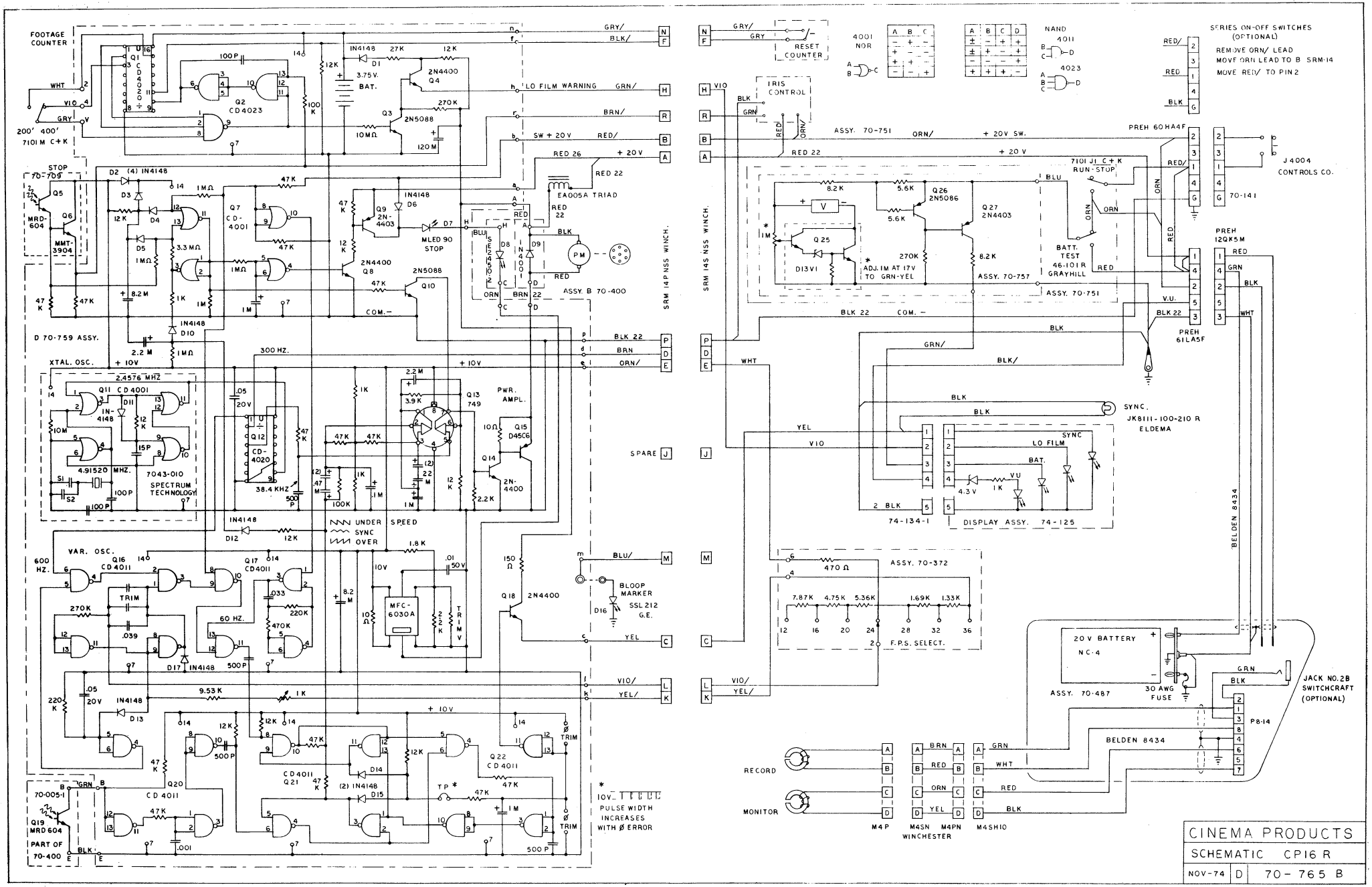
This circuit receives its power from a rechargeable 3.75 Nicad battery. The battery is recharged anytime the NC-4 battery is plugged into the camera. This battery alone will keep the circuit operating for well over one year.

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.



P. C. BOARD ASSY.	
CP-16R	
MAR 73	D 70-759-A


FOOTAGE COUNTER
RESET COUNTER
IRIS CONTROL
4001 NOR
NAND 4011
4023
SERIES ON-OFF SWITCHES (OPTIONAL)
REMOVE ORN/ LEAD
MOVE ORN LEAD TO B SRM-14
MOVE RED/ TO PIN 2
ASSY. 70-751
+ 20V SW.
+ 20 V
7101 J1 C+K RUN-STOP
BATT. TEST 46-101R GRAYHILL
ASSY. 70-757
ASSY. 70-751
J 4004 CONTROLS CO.
70-141
PREH 60HA4F
PREH 12QK5M
PREH 61LA5F
V.U.
SRM 14S NSS WINCH.
SRM 14P NSS WINCH.
BELDEN 8434
D 70-759 ASSY.
XTAL. OSC.
2.4576 MHZ
4.91520 MHZ.
7043-010 SPECTRUM TECHNOLOGY
38.4 KHZ
300 HZ.
+ 10V
PWR. AMPL.
UNDER SPEED
SYNC
OVER
VAR. OSC.
600 HZ.
60 HZ.
TRIM
MFC-6030A
BLOOP MARKER
SSL 212 G.E.
D16
SPARE
STOP
70-709
MRD-604
MMT-3904
EA005A TRIAD
MLED 90 STOP
ADJ. 1M AT 17V TO GRN-YEL
SYNC.
JK8111-100-210 R ELDEMA
LO FILM
BAT.
4.3V
74-134-1
DISPLAY ASSY. 74-125
ASSY. 70-372
470 Ω
F.P.S. SELECT.
20 V BATTERY
NC-4
ASSY. 70-487
30 AWG FUSE
JACK NO. 2B SWITCHCRAFT (OPTIONAL)
P8-14
BELDEN 8434
RECORD
MONITOR
M4P
M4SN WINCHESTER
M4PN
M4SHIO
70-005-1
Q19 MRD 604
PART OF 70-400
* 10V PULSE WIDTH INCREASES WITH Ø ERROR
CINEMA PRODUCTS
SCHEMATIC CP16 R
NOV-74 D 70-765 B

FOOTAGE COUNTER
Q1 CD4020
Q2 CD4023
WHT
OFF
V10
GRY
200' 400' 7103M C+K
100P
IN4148 27K 12K
D1 3.75V. BAT.
2N4400 Q4
LO FILM WARNING GRN/
BRN/
SW + 20V RED/
+ 20V
RED 26
RED 22
EA005A TRIAD
270K
Q3 2N5088
10MΩ
120M
1MΩ
STOP 70-705
D2 (4) IN4148
Q5 MRD-604
Q6 MMT-3904
D3 D4 D5
12K
3.3MΩ
Q7 CD-4001
27K
IN4148 D6
Q9 2N-4403
47K
12K
2N4400 Q8
MLED 90 STOP
D7
2N5088 Q10
D8 D9 IN4002
PM
RED
BLK
ASSY. B 70-400
ORN BRN 22
COM.–
8.2M
2.2M
IN4148 D10
D 70-759 ASSY. A TO F-1
XTAL. OSC.
+ 10V
300 HZ.
2.4576 MHZ
Q11 CD 4001
IN-4148 D11
10M
15P
4.91520 MHZ.
S1 S2
100P
70-346 SPECTRUM TECHNOLOGY
Q12 CD-4020
.05 20V
38.4 KHZ
500P
IN4148 D12
UNDER SPEED
SYNC
OVER
2.2M
3.9K
Q13 749
PWR. AMPL.
10Ω
Q15 D45C6
Q14 2N-4400
2.2K
(2) .47M
100K
.1M
(2) 22M
1M
SPARE J
VAR. OSC.
600 HZ.
Q16 CD 4011
Q17 CD4011
TRIM
270K
.039
.033
220K
470K
60 HZ.
D17 IN4148
500P
8.2M
MFC-6030A
2.2K
TRIM
150Ω
Q18 2N4400
BLOOP MARKER
SSL212 G.E.
D16
BLU/ M
YEL C
VIO/ L
YEL/ K
220K
.05 20V
IN4148 D13
9.53K
1K
+ 10V
Q20 CD 4011
Q21 CD4011
Q22 CD 4011
D14
(2) IN4148 D15
TP *
47K
1M
Ø TRIM
PART OF 70-400
70-005-1
Q19 MRD 604
GRN
BLK
.001
500P
* 10V PULSE WIDTH INCREASES WITH Ø ERROR
SRM 14P NSS WINCH.
SRM 14S NSS WINCH.

N GRY/
F GRY
RESET COUNTER
4001 NOR
NAND 4011
4023
SERIES ON-OFF SWITCHES (OPTIONAL)
REMOVE ORN/ LEAD
MOVE ORN LEAD TO B SRM-14
MOVE RED/ TO PIN 2
H VIO
R BLK
B GRN
A
IRIS CONTROL
RED ORN/
ASSY. 70-751
ORN/ + 20V SW.
PREH 60HA4F
RED 22 + 20V
7101 J1 C+K RUN-STOP
BLU
8.2K 5.6K
Q26 2N5086
5.6K
Q27 2N4403
V
Q25
1M
D13V1
270K
8.2K
ADJ. 1M AT 17V TO GRN-YEL
ASSY. 70-757
BATT. TEST 46-101R GRAYHILL
ORN
RED/
RED
BRN/
BLK 22
PREH 61LA5F
J4004 CONTROLS CO.
70-141
PREH 12QK5M
RED
GRN
BLK
WHT
P WHT
D GRN/
E BLK/
COM. –
VU DISPLAY AMPL.
OUT IN
ASSY. A 70-996
SCHEM A 70-1007
BLK
YEL
V10
SYNC.
JK8111-100-210 R
ELDEMA
1.8K
SYNC
LO FILM
BAT.
VU
2 BLK
74-134-1
DISPLAY ASSY. 74-125
BELDEN 8434
ASSY. 70-372
470Ω
7.87K 4.75K 5.36K 1.69K 1.33K
12 16 20 24 28 32 36
2 F.P.S. SELECT.
20V BATTERY NC-4
ASSY. 70-487
30 AWG FUSE
JACK NO. 2B SWITCHCRAFT (OPTIONAL)
P8-14
BELDEN 8434
L VIO/
K YEL/
RECORD
MONITOR
M4P
M4SN WINCHESTER
M4PN
M4SH10
BRN RED ORN YEL
GRN WHT RED BLK

CINEMA PRODUCTS
SCHEMATIC CP16 R
3-75 | D | 70-765 D

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
6-75	F	7103M SW. IMΩ RES		JH	
6-75	G	400-A TACH.		JH	

70-760 ASSY.

SRM 14P NSS WINCH.

ASSY. 70-759 G&H
PC BOARD 70-708 D&E

FOOTAGE COUNTER

CD-4020-AE

CD 4023AE

CD 4001AE

XTAL OSC. 70-346 4.91520 MHZ.

CD-4020-AE ÷9

VCC NOR

VCC NAND

Q16 70-963 I/C

Q19 70-964 I/C

ACCEL. CKT.

UNDER ON SPEED OVER

OSC. FREQ.

PULSE WIDTH INCREASES WITH Ø ERROR

PART OF 70-400-A

STOP & COUNT

ASSY. 70-400-A

EA005A TRIAD

78L12-AWC 12 V REG.

7103M C&K

SPARE J

BLOOP MARKER

LLL-9-1 OPCOA

SRM 14S NSS WINCH.

IRIS CONTROL 74-102

COUNTER RESET

SERIES ON-OFF SWITCHES (OPTIONAL)
REMOVE ORN/ LEAD.
ORN LEAD TO B 14S.
MOVE RED/ TO PIN 2.

NOR 4001

NAND 4011 4023

60HA4F PREH

RUN-STOP 7101J1 C&K

46-101-R GRAYHILL

BAT. TEST

ASSY. 70-751

70-757

J 4004 CONTROLS CO.

70-141

61LA5F PREH 120K5M

V U DRIVER ASSY 70-996-B

MC1458-CP1

(3) IN4148

5.6V IN5232B

SYNC LAMP JK8111-100-210 R ELDEMA

74-134-1

DISPLAY ASSY. 74-125

20 V BAT. NC-4

30 AWG FUSE

ASSY 70-487

F.P.S. ASSY 70-372

MONITOR M4P M4SN M4PN M4SHIO WINCH.

BELDEN 8434

TOLERANCES (EXCEPT AS NOTED)	CINEMA PRODUCTS
DECIMAL ±	CP-16R
FRACTIONAL ±	TITLE SCHEMATIC
ANGULAR ±	DATE 6-75
SCALE	DRAWN BY J HILL
	APPROVED BY
	DRAWING NUMBER D 70-765-G

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.

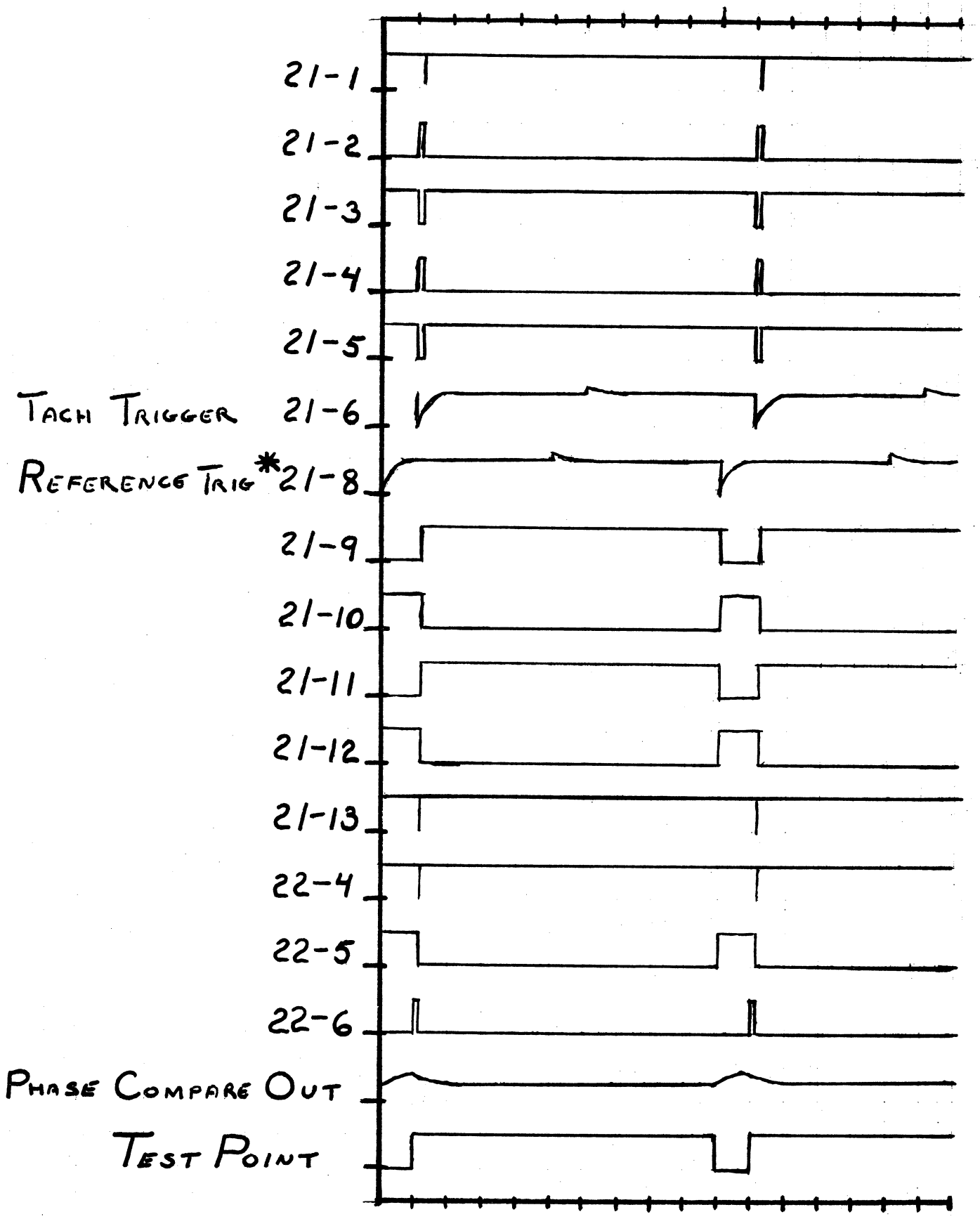
"Clap" occurs anytime the "Out of Sync" lamp is on. A positive voltage from the lamp passes through D3 to set the NAND gate Q29 pins 1 through 3 and turn on Q31. The clap output is now high. When the lamp turns off, "Clap" is held high until the .027 capacitor on Q29 pin 1 discharges below 5 volts. This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

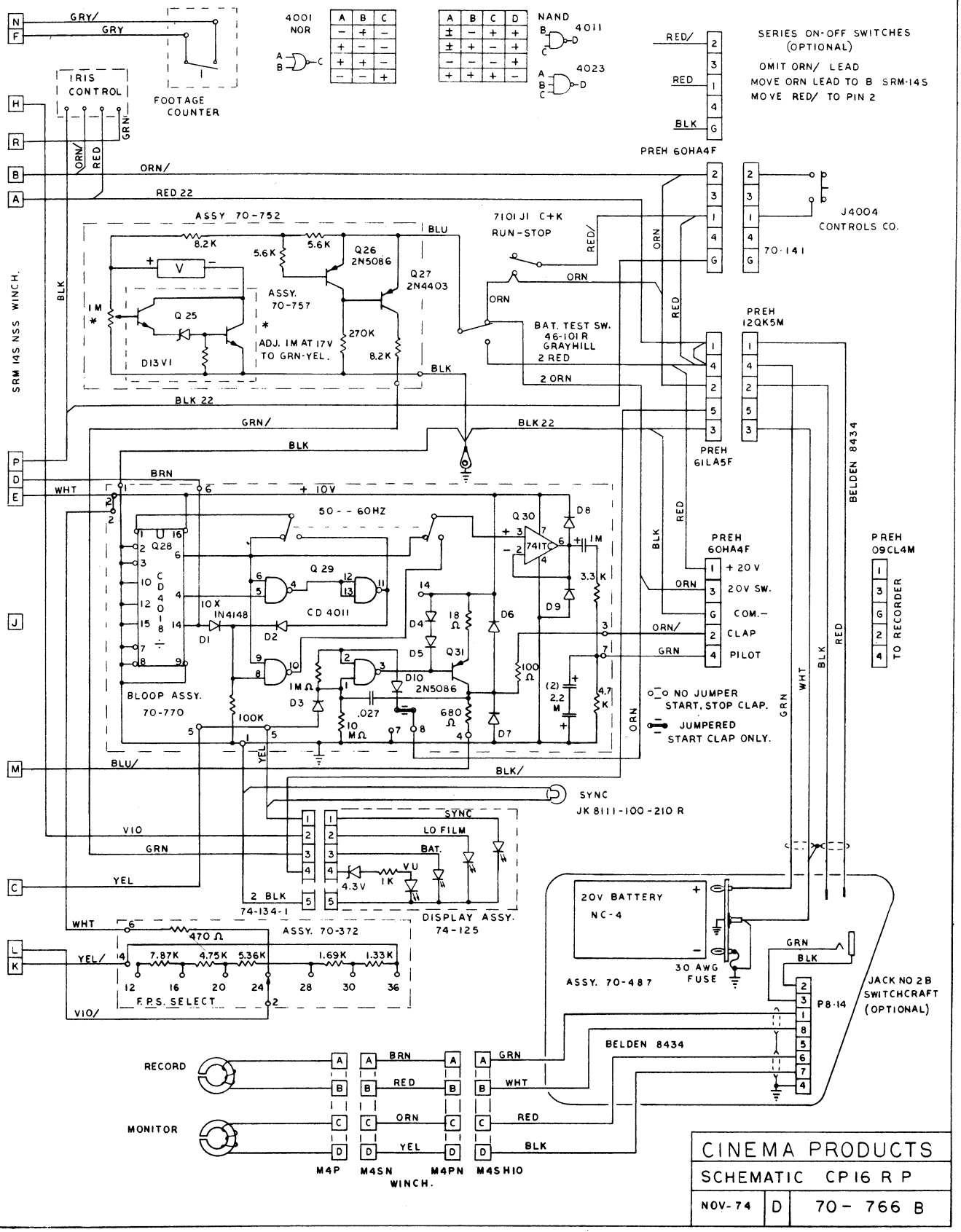
filtered into a sinewave.

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.

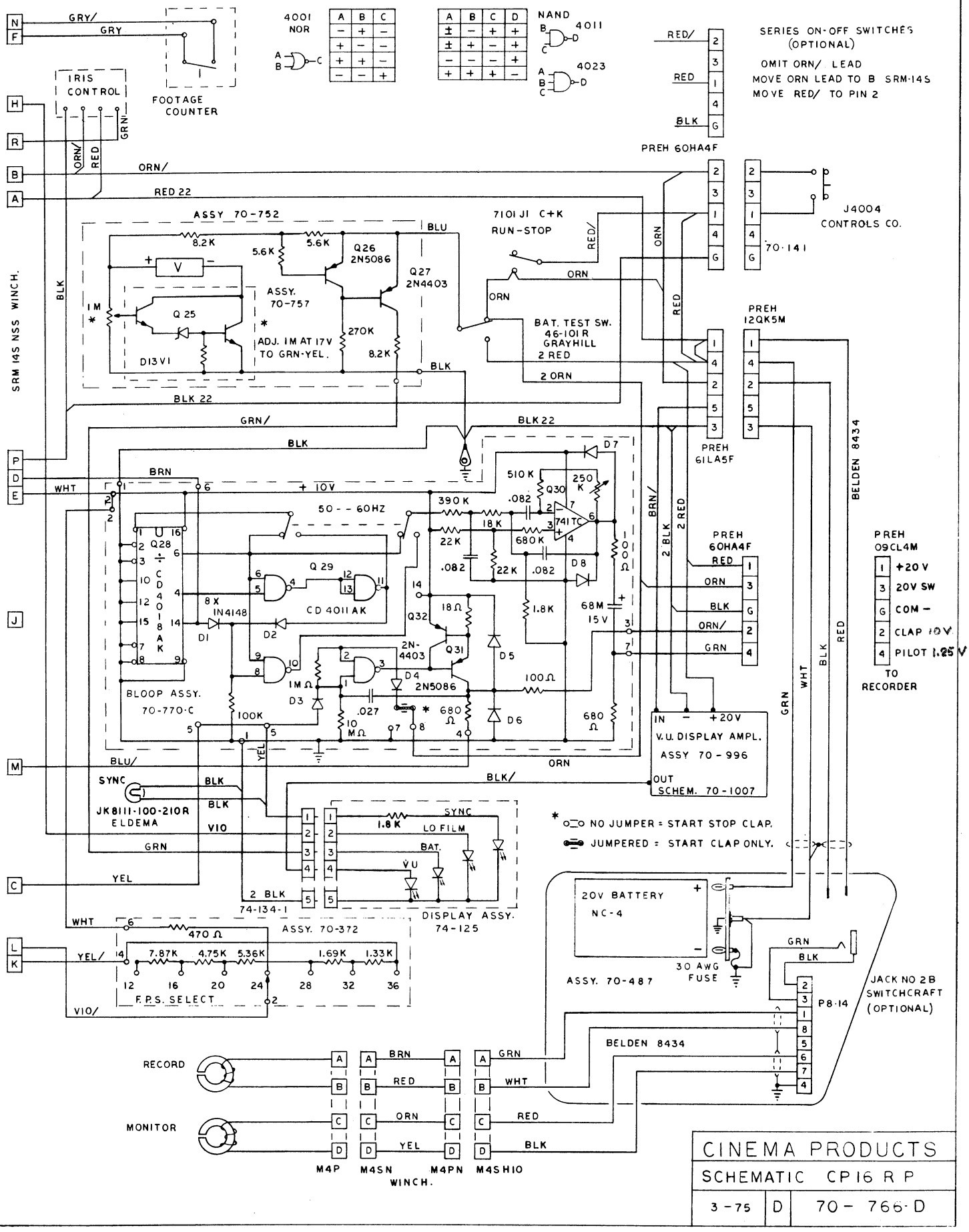
The square wave if buffered and filtered to produce a slow rise and fall square wave output.



*SYNC THE OSCILLOSCOPE TO THIS TRIGGER.



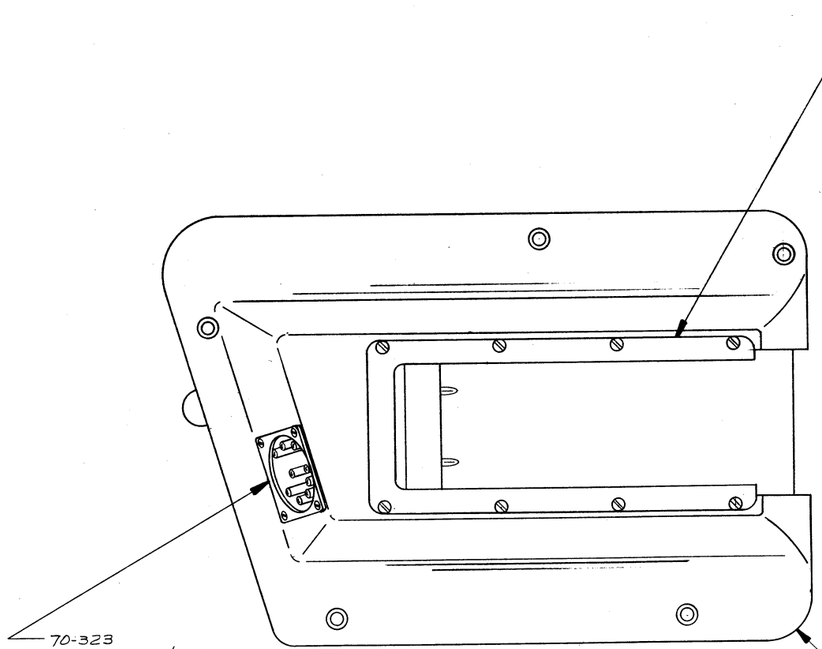
CINEMA PRODUCTS		
SCHEMATIC CP16 R P		
NOV-74	D	70 - 766 B



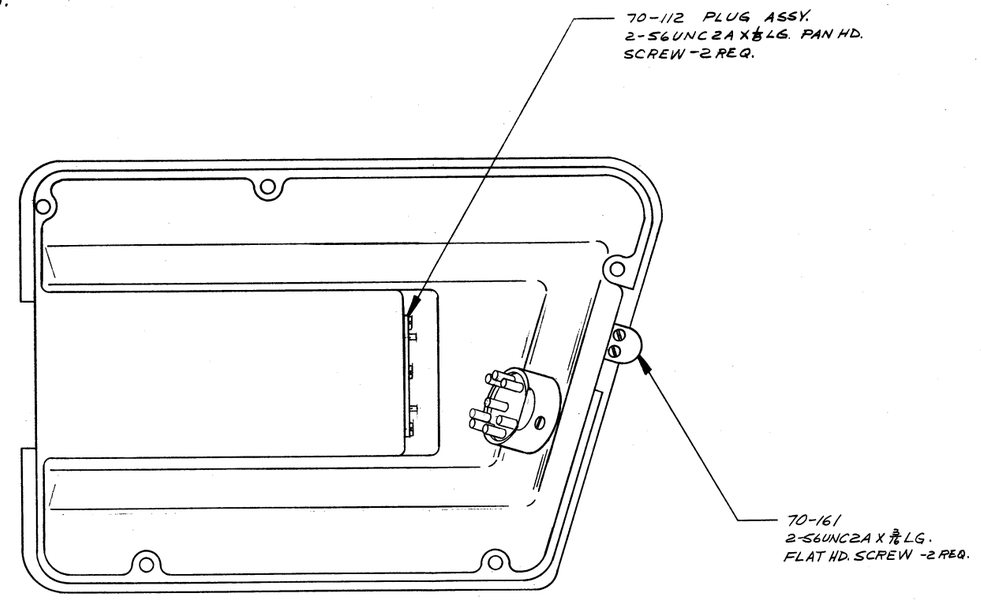
CINEMA PRODUCTS		
SCHEMATIC CP16 R P		
3-75	D	70-766-D

70-487

LET.	CHANGE	DATE



OUTSIDE-
PAINT- BLACK WRINKLE FINISH
ENTIRE SIDE EXCEPT BATTERY
BAY & 70-323.



INSIDE-
COAT WITH LORDCO # LDS-501
COVER WITH BARYFOL # 10.25 H.L.
BLANCHFORD CO. (D70-175 REF.)

5. FINISH:
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:- FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63		cinema products CORPORATION Los Angeles, Calif. 90025	DRAWN BY	RSAM
				CHECKED BY	
			TITLE ASSEMBLY REAR DOOR CP16	APPROVED BY	
	1	70-202 DATE 9-12-73		D SIZE	SHEET 1 OF 2 SHEETS
	REQD	NEXT ASSY. SCALE 1X		70-487	

SECTION V

EXPOSURE CONTROL SYSTEM

REFERENCE DRAWING: C74-203

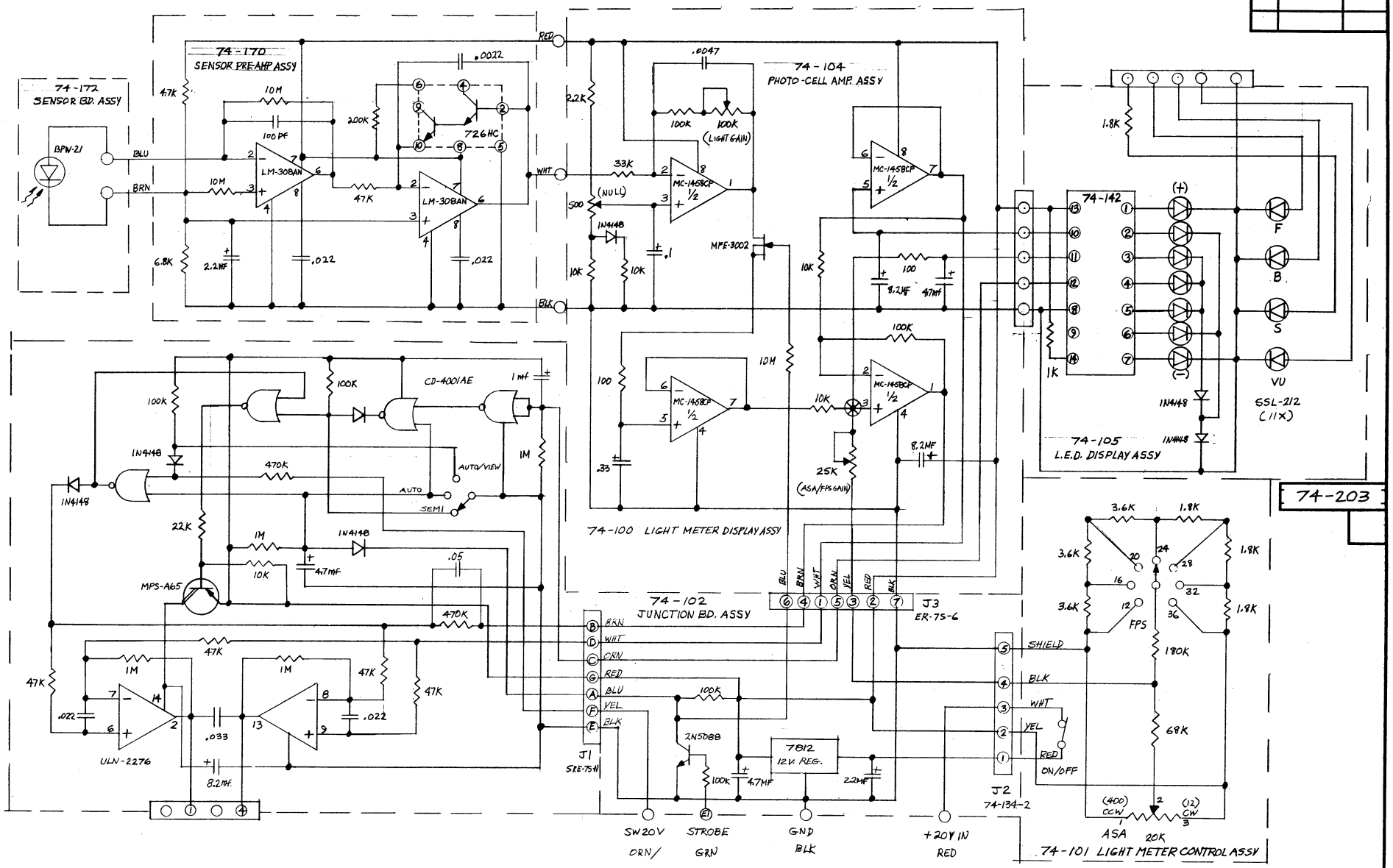
The exposure control is a behind-the-lens system utilizing a silicon light sensor for fast response at low light levels. The sensor is located on the fibre optic plate assy and shares light with the viewing optics. This is accomplished by a cube beam splitter located directly above the fibre optic plate. Approximately 20% of the light is directed to the sensor. No light is directed from the film.

The output of the sensor is linear over 6 decades of illumination. This output is amplified and processed through a temperature compensated log converter to give a DC step function directly proportional to light level. It is then amplified and fed to a sample and hold curcuit that is strobed by the shutter signal. The output of this curcuit is a DC level proportional to light, regardless of the output of the ASA/FPS controls and fed to the logic circuit which drives the L.E.D. Display.

The L.E. D. Display consists of 7 light emitting diodes located along the bottom edge of the fibre optic plate as seen through the viewfinder. The center diode displays a "0" which indicates system null or correct exposure. To the right of "0" are "+.5", "+1", and "+", which are $\frac{1}{2}$ stop increments. To the left are "-.5", "-1", and "-". The "+" and "-" serve as out of range indicators, i.e. "+" equals $1\frac{1}{2}$ stops or more overexposed; "-" equals $1\frac{1}{2}$ stops or more underexposed. The accuracy or deadband of null indication is

± 1/8 stop. The 1/8 stop is indicated when either "-.5" or "+.5" is illuminated simultaneously with "0".

LET.	CHANGE	DATE



REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025	DRAWN BY J Lacay CHECKED BY APPROVED BY
		TITLE SCHEMATIC - EXPOSURE CONTROL CP-16R	C SIZE SHEET OF SHEETS 74-203
	DATE 12 JULY 75		
	REQD NEXT ASSY. SCALE		

5. FINISH:
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.

SECTION VI

CIRCUIT DESCRIPTION FOR J-5 ZOOM CONTROL

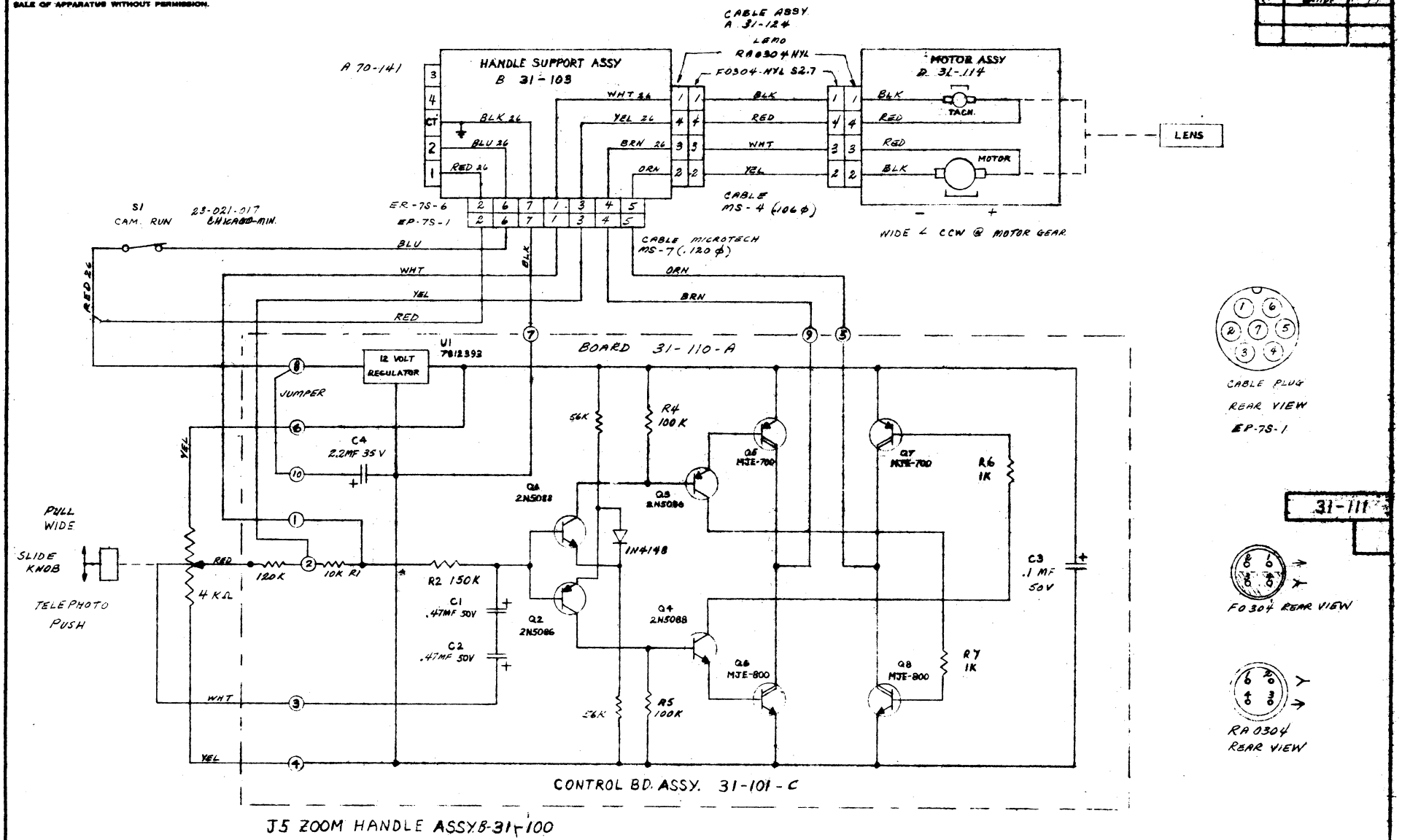
REFERENCE DRAWING: C70-111

This is a constant-on system. Any time a battery is in the camera the J-5 is drawing power. Without touching the zoom control, the circuit draws a nominal 6 ma (a fully charged battery would take four days to discharge at this rate). Zoom direction is controled electronically. No micro-switches to go out of adjustment. Also, this gives remarkably smooth control. The whole system (excluding motor) fits inside the camera hand grip. The small size and it's simplicity make it a very rugged accessory.

Circuit Description

The J-5 is basicly a simple complimentry drive amplifier with a single ended input control. An "off" dead band is accomplished with the silicon diode inserted between the two 56K resistors of the reference voltage divider. When the control line moves from the null point by the movement of the slide pot (zoom knob) either Q1 or Q2 turns on and in turn, it's respective complimentry set of drive transistors. Servo feedback is accomplished by a DC tach on the back of the zoom motor. This signal is mixed resistively to oppose the voltage derived from the slide pot to give a net voltage result at the control line to drive the motor at a steady rate.

LET.	CHANGE	DATE
A	ADDED SWITCH	11-74



31-111

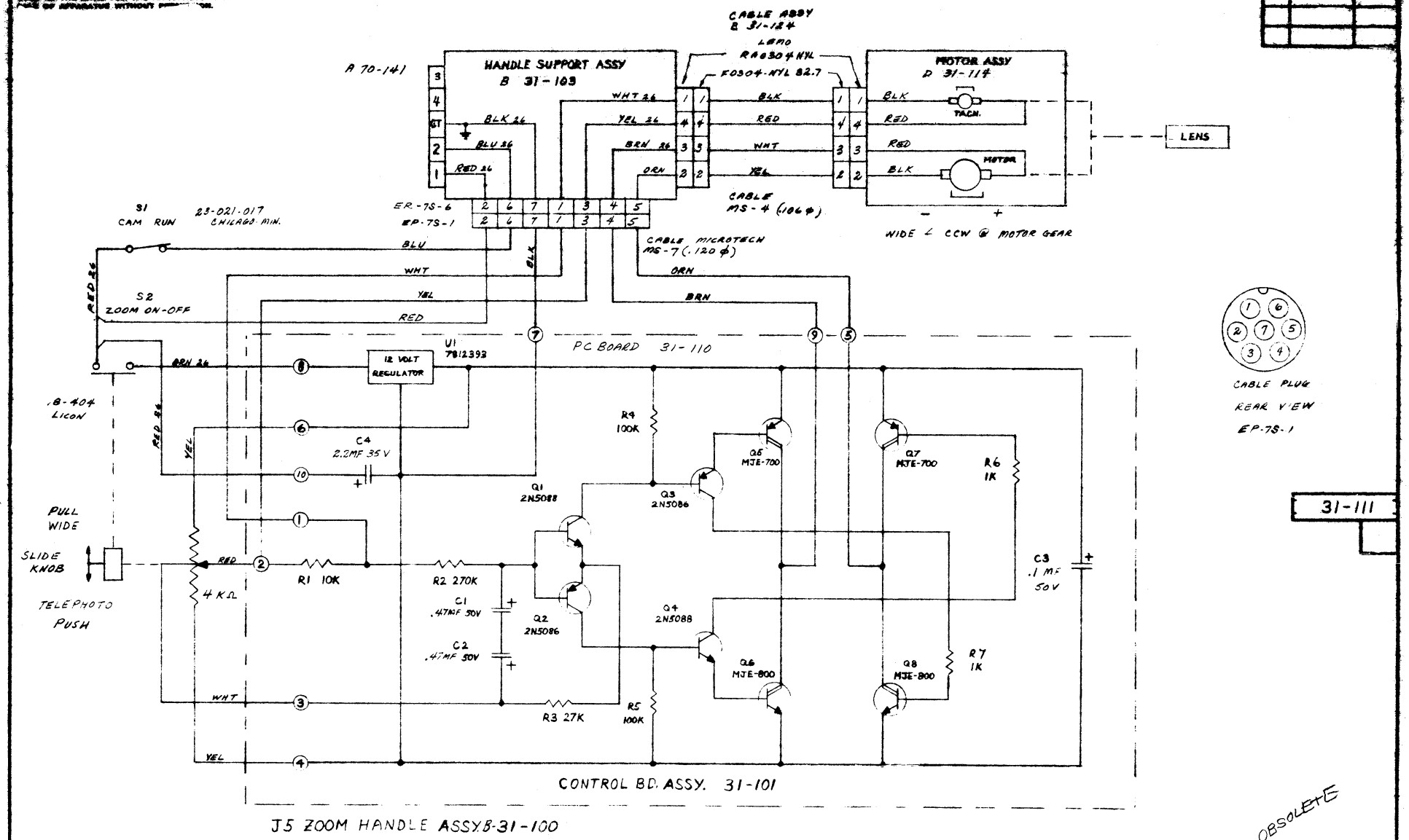
J5 ZOOM HANDLE ASSY B-31-100

HOLD FOR REF.

6. ALL RESISTORS ARE 1/8W 5%
5. FINISH:
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: FRACTIONAL ± 1/64; 2 PL. DECIMALS ± .01; ANGLES ± 30'; 3 PL. DECIMALS ± .005; MACH. FINISH 125	cinema products CORPORATION Los Angeles, Calif. 90065	DRAWN BY J Lacy
			CHECKED BY
		TITLE SCHEMATIC — J5 ZOOM CONTROL	APPROVED BY
	DATE 7 MAR 73		C SIZE — SHEET 1 OF 1 SHEETS
	NEXT ASSY. / SCALE		31-111

LET.	CHANGE	DATE



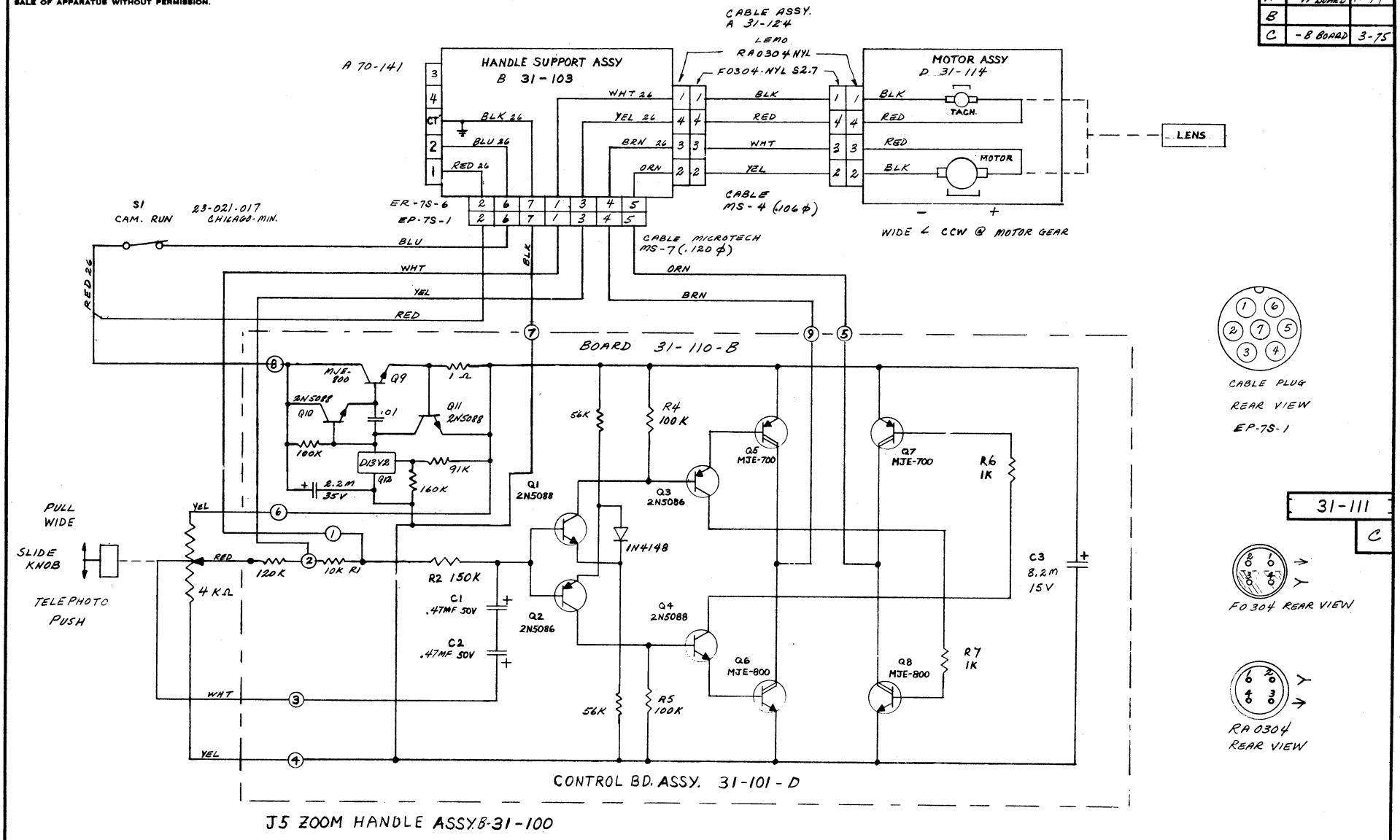
6. ALL RESISTORS ARE 1/8W 5%

5. FINISH:
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:— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90025
		DRAWN BY: J Leary
		CHECKED BY:
		APPROVED BY:
	DATE 7 MAR 73	C SIZE — SHEET 1 OF 1 SHEETS
DESIGN — NEXT ASSY. — SCALE		31-111

TITLE
SCHEMATIC —
J5 ZOOM CONTROL

LET.	CHANGE	DATE
A	SWITCH FROM -A BOARD	11-74
B		
C	-B BOARD	3-75



31-111 C

6. ALL RESISTORS ARE 1/8W 5%
5. FINISH:
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 3 PL. DECIMALS ±.005 FRACTIONAL ±1/64 ANGLES ±30' MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025
	DATE 7 MAR 73	TITLE SCHEMATIC — J5 ZOOM CONTROL
	REQD NEXT ASSY. SCALE	DRAWN BY J Levy; CHECKED BY; APPROVED BY; C SIZE; SHEET / OF / SHEETS; 31-111-C

Part III

CIRCUIT DESCRIPTION FOR CRYSTASOUND AMPLIFIER

Reference Drawing #D70-468 and D70-460

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.

DATE	SYM	REVISION RECORD	APPR.	DR.	CK.
	A	CHOKES ADDED			
3-73	B	MIC. INPUTS MODIF.		JH	
9-73	C	68/25 CAPS = 75M 50V		JH	

P.C. BOARD 70-447-E — 70-448 ASSY.

PLAY BACK

YEL/GRN — C — GRN — D

M4P-H — M4S-N — M4P-N — M4SH WINCH. — BELDEN 8434

RED — Z — BLK — Y

.0039 — L1 1.75 MH. — .0022 — .022 — 47K — 1K — 1K — 270 Ω — .33 M — 15M 10V

Q1 A 1/2 LM1303N — .0047 — .0033 — 470K

.47M — PLAYBACK — 5K — COM

10Ω — +150 M 15V

RECORD

ORN/BRN — A — BRN — B

GRN — W — WHT — V

3 HY. L2 — 3.3 M — RECORD TEST

10MH. L3 — 10 MH. L4 — .027 — 1.5K — 1K — .033

.0033 — L5 2.2 MH.

68 M 25 V — 3,4,5 10,11,12 — 8.2M 15V

Q3 LM380N — 33 P — .1M

150 M 15 V — +12V

47 K — 47 K — COM

S — YEL/ — GRY — K — INT. — MIXER — 22 K

4.7 M — 4.7 K — 47 K — GRN/ — N — 25 K — 2X 4.7 M

500 P — Q2 B 1/2 LM1303N — 270 P — M — 25 K — L

100 Ω — 150 Ω — 47 Ω — 8.2 M 15V — .01

60M 20V — b

500 P — e — SHIELD. — BLK

600 Ω LINE INPUT — 3501FP SWITCHCRAFT — .01 — 1K — MIC. 2 — 150 Ω INPUT

Q2 A 1/2 LM1303N — 500 P — 4.7K — J — 25 K — i — 270 P

100 Ω — 150Ω — 47 Ω — 8.2 M 15V — 150M 15V — .01 — 1K

60M 20V — a — SHIELD — RED — .01 — 1K — MIC. 1 — 150 Ω INPUT

BELDEN 9452 — CANNON XLR-3-50 RE-WORKED

EARPHONE 50 Ω — E — GRY/ — A — BLK — 500 P — JACK NO. 111 SWITCHCRAFT

BLU/ — 500 P — B — MIXER SIG. OUT — J — SHIELD

K — SHIELD

R — BRN — E — MIXER SIG. IN MANUAL

Q — BLK/ — F — MIXER SIG. IN AUTO

G — SHIELD

BENDIX PCO2W-12-10S

K1-B — P — BLU — F — WHT — PHONE VOL. — 25K — BLK

COM — BLK — C — COM. GND.

A — VIO/ — H — V.U. METER

T — ORN — A — MIXER A.G.C.

H — ORN/ — D — + 12 V

ON — A.G.C. — OFF

D1 IN4148 — .001

e — RED — d

Q5 — 82K — 2N4400 — 50 K — INC. V BIAS

.082 — 10K — 10 Ω — MFC-6030A — 470K — 15M 50 V — 1M — 15K

2N5191 — Q12 — BH-1058 — Q4 2N-5191

56 Ω — 10 Ω — TEST BIAS — .05 10V — 56 Ω — 2.2 K — 4.7 Ω — 15M 50V

COMP. 20 K — Q7 MFE 3002

+ 12 V

150 M 15V — 56 Ω — Q6 LM380N — 47K — 33 P — .1M

1K — 3,4,5 10,11,12 — 8.2M 15V

K1-B — F — WHT — P — BLU — PHONE VOL. — 25K — BLK — 1K — 56 Ω

U — RED — OFF ON — BIAS

PREH 12QK5M

B+ 1 — RED — OFF - ON — RED 22 — RED/ 26 — G — 4.7 Ω

SW. B+ 2 — BLK — C+K 7201S — 2 BRN/ 26 — Q

BAT. + 4 — GRN — .01 — 20 V BATTERY — NC 4

COM. 3 — WHT — BELDEN 8434 — 30 AWG FUSE

712-18 — K1-A — 680 Ω — 7812-393 — Q 8 — 12 V REG. — 15M 50V — 150M 15 V

COM BLK 22 — C

IN4148 — D2 — 10MEG. — 100 K — 6.8 K — .047

50 K — AGC

47K — Q9 2N4400 — 10 K — 15M 10V

4.7 K — 1M — .01M — 47 K — 47 K — Q1 B 1/2 LM1303N — 3K — 240 K

Q10 2N4400 — 56 Ω — 470 Ω

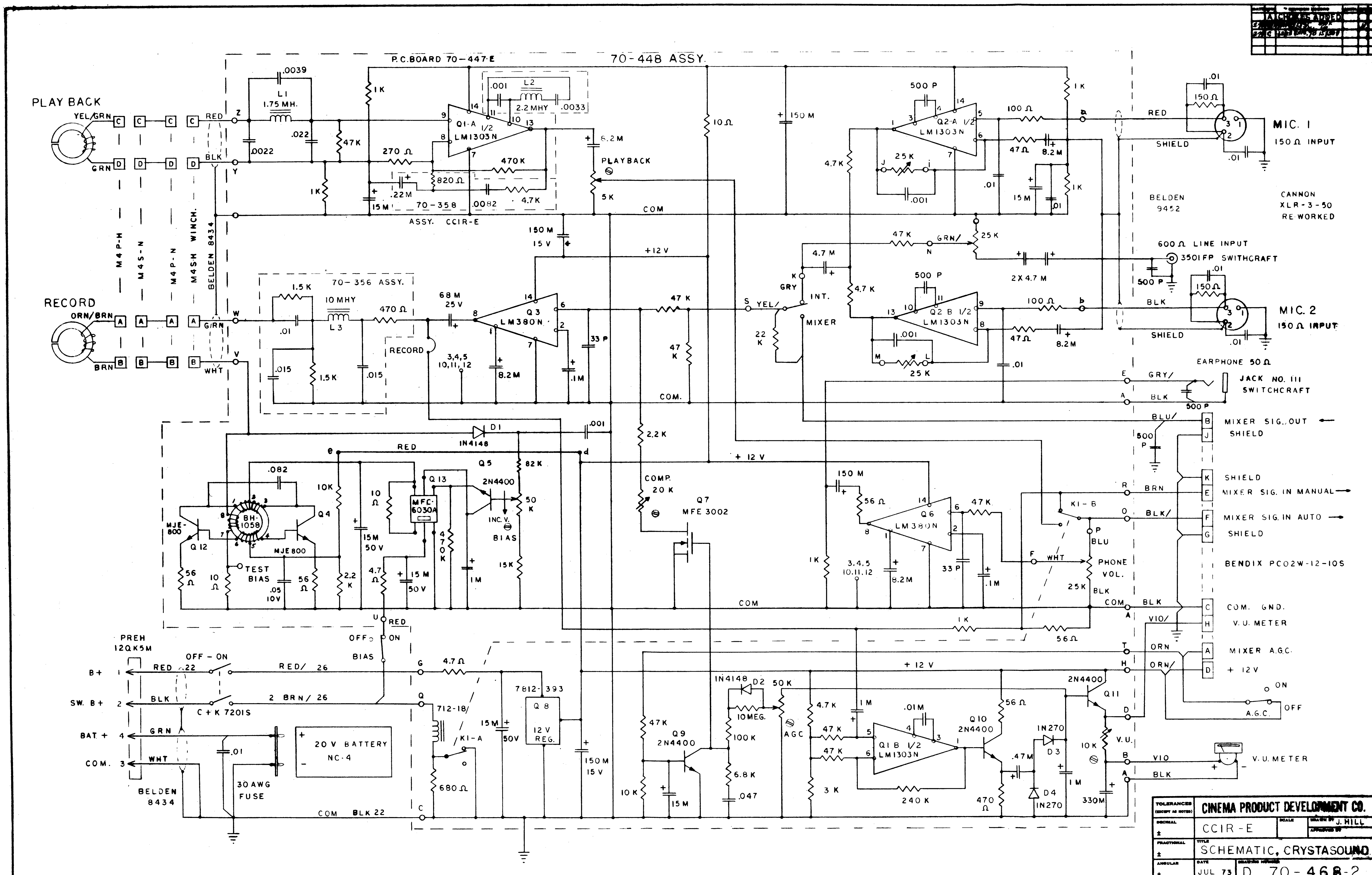
IN 270 — D3 — D4 IN270 — .47M — 1M — 330M 6V

2N4400 — Q11 — 10 K — V.U.

B — VIO — V.U. METER — + —

A — BLK

TOLERANCES (EXCEPT AS NOTED)	CINEMA PRODUCT DEVELOPMENT CO.		
DECIMAL ±	UNBALANCED INPUT	SCALE	DRAWN BY J. HILL
FRACTIONAL ±	TITLE SCHEMATIC, CRYSTASOUND		APPROVED BY
ANGULAR ±	DATE FEB 73	DRAWING NUMBER D 70-468-1-C	



P.C. BOARD 70-447-E
70-448 ASSY.
PLAY BACK
RECORD
M4P-H
M4S-N
M4P-N
M4SH WINCH.
BELDEN 8434
Q1-A 1/2 LM1303N
70-358 ASSY. CCIR-E
70-356 ASSY.
PLAYBACK
COM
+12 V
Q3 LM380N
RECORD
Q2-A 1/2 LM1303N
Q2 B 1/2 LM1303N
MIC. 1 150 Ω INPUT
MIC. 2 150 Ω INPUT
BELDEN 9452
CANNON XLR-3-50 RE-WORKED
600 Ω LINE INPUT
3501FP SWITCHCRAFT
EARPHONE 50 Ω
JACK NO. 111 SWITCHCRAFT
MIXER SIG. OUT
SHIELD
MIXER SIG. IN MANUAL
MIXER SIG. IN AUTO
BENDIX PC02W-12-10S
COM. GND.
V.U. METER
MIXER A.G.C.
+ 12 V
INT.
MIXER
COMP.
Q7 MFE 3002
Q6 LM380N
PHONE VOL.
K1-B
Q5 2N4400
Q13 MFC-6030A
INC. V. BIAS
Q4
Q12
MJE-800
MJE800
BH-1058
TEST BIAS
D1 1N4148
PREH 12QK5M
OFF - ON
B+
SW. B+
BAT. +
COM.
C + K 7201S
BELDEN 8434
30 AWG FUSE
20 V BATTERY NC-4
712-18
K1-A
7812-393 Q8 12 V REG.
Q9 2N4400
1N4148 D2
AGC
Q1 B 1/2 LM1303N
Q10 2N4400
Q11 2N4400
1N270 D3
D4 1N270
A.G.C.
V.U. METER
CINEMA PRODUCT DEVELOPMENT CO.
CCIR-E
J. HILL
SCHEMATIC, CRYSTASOUND
JUL 73
D 70-468-2

DATE	SYM	REVISION RECORD	AUTH.	DR.	ENG.
	A	CHOKES ADDED			
2-73	B	BIAS OSC. MOD		JH	
3-73	C	68/25 CAPS. TO 15/50 V			
5-74	D	CRYSTALINK + PW. CONNECTORS		JH	
6-74	G	150Ω MIC. IN TO BRD.		JH	
10-74	F	G - PC BOARD		JH	
2-75	F-1	V.U. SIG. VIO WIRE ADD		JH	
7-75	F-2	PWR. SW. WIRING CHANGED		JH	

P.C. BOARD 70-447-G

70-448 ASSY.

PLAY BACK

YEL/GRN C

GRN D

RED Z

BLK Y

RECORD

ORN/BRN A

BRN B

GRN W

WHT V

M4P-H — M4S-N — M4P-N — M4SH WINCH. — BELDEN 8434

L1 1.75 MH. .0039 .0022 .022 47K 1K 1K 270Ω .33 M 50V 15 M 10V .0047 Q1-A 1/2 LM1303N .0033 470K .47 M 50V PLAYBACK 5K COM

10Ω 150 M 15V +12V

3 HY. L2 3.3 M RECORD TEST L3 10 MH. L4 10 MH. .027 1.5K 1K .033 .0033 L5 2.2 MH. 68 M 25V 3,4,5 10,11,12 Q3 LM380N 8.2 M 15V .1M 50V 33 P 560 K f 47 K 2.2 K COM

500 P 4.7K 1K 100Ω 47Ω 8.2M 15V .01 50V 15M 10V .01 .001 25K Q2-A 1/2 LM1303N

MIC. 1 150Ω INPUT

CANNON XLR-3-50 RE-WORKED

47K GRN/ 25K 600Ω LINE INPUT 2X4.7M 25V 3501FP SWITCHCRAFT 500 P

4.7M K GRY INT. S YEL/ MIXER 22K 4.7K 500 P Q2-B 1/2 LM1303N .001 25K M L 100Ω 47Ω 8.2M 15V .01 50V

MIC. 2 150Ω INPUT

EARPHONE 50Ω E GRY/ A BLK 500 P JACK NO. 111 SWITCHCRAFT

BLU/ 500 P 1KV B J MIXER SIG. OUT SHIELD

PC02W-12-10S BENDIX

K SHIELD E MIXER SIG. IN MANUAL F MIXER SIG. IN AUTO G SHIELD

4 AUDIO OUT 3 +12V 1 COM. 2 V.U. METER LEMO RA 0304

C COM. GND. H V.U. METER A MIXER A.G.C. D +12V

ON A.G.C. OFF

V.U. 10K 500 P B VIO A BLK V.U. METER

e RED d 10K D1 IN4148 .001 Q5 82K .082 BH-1058 Q4 MJE-800 Q12 NJE800 61 KHz. ± 1 KHz. TEST BIAS .05 10V 56Ω 10Ω 56Ω 2.2K 10Ω MFC-6030A Q13 2N4400 50K INC. BIAS 15K 4.7Ω 15M 50V 470K 1M 50V 15M 50V

COMP. 20K Q7 MFE 3002 YEL 26

150 M 15V 56Ω Q6 LM380N 1K 3,4,5 10,11,12 8.2M 15V 33P .1M 50V 47K KI-B F WHT P BLU 25K BLK 56Ω

h COM U RED BLK 1K

V. U. SIG. 5 VIO/ 22 D

B+ 1 RED 22 C+K 7203S PWR-ON RED/ 26 G 4.7Ω

SW. B+ 2 BLK OFF AUTO-ON 2 BRN/ 26 Q

BAT + 4 GRN .01M .50V 30 AWG FUSE 20V BATTERY NC-4

COM. 3 WHT BELDEN 9434 COM BLK 22 C

PREH 12QK5M

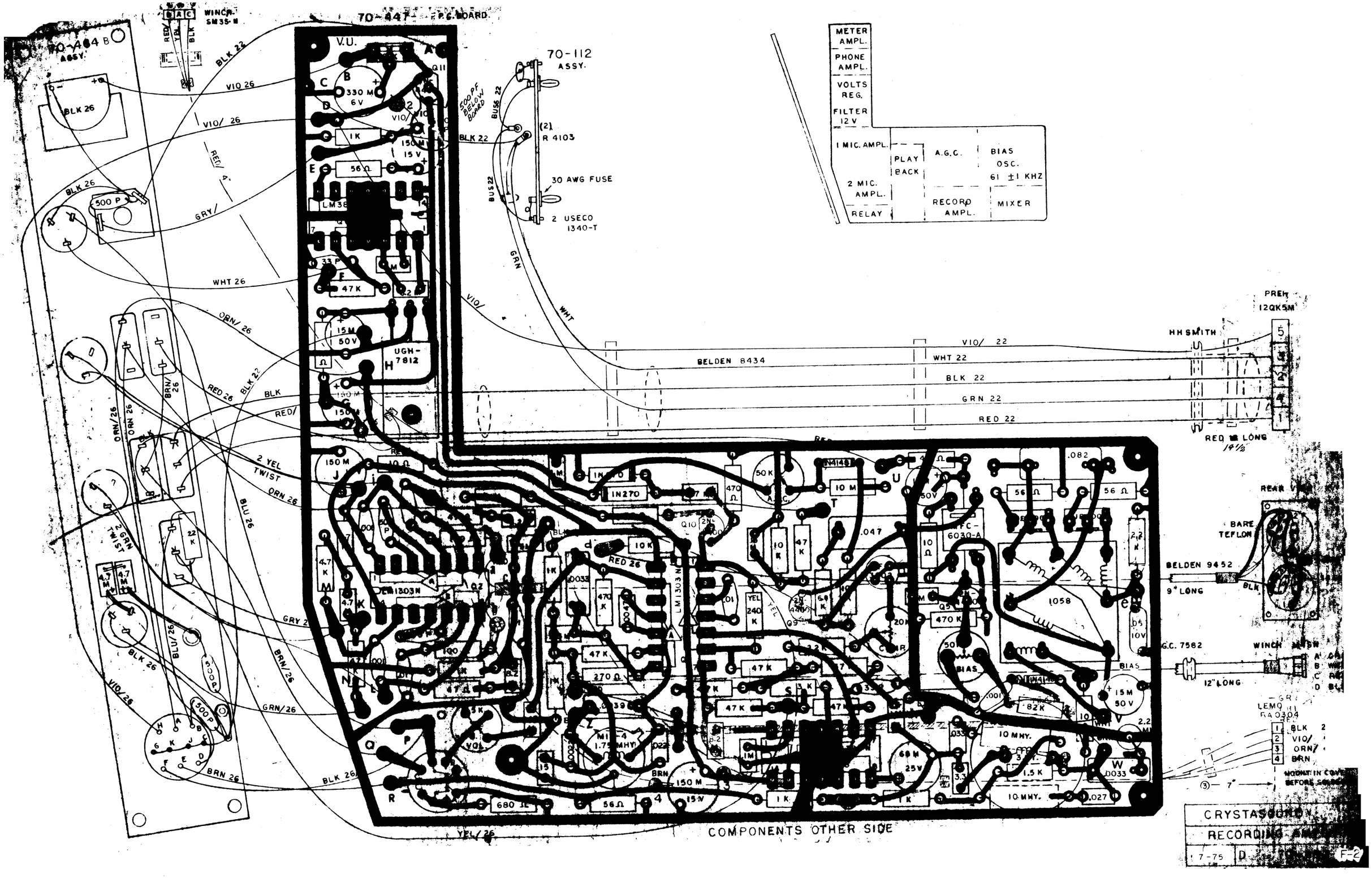
712-18/ KI-A 680Ω 15M 50V 7812-393 Q8 12V REG. 150M 15V

IN4148 D2 50K AGC 47K Q9 2N4400 10K 15M 10V 10MEG. 100K 6.8K .047 4.7K 1M 50V .01M 50V 47K 47K Q1-B 1/2 LM1303N 3K 240K Q10 2N4400 56Ω 470Ω IN270 D3 D4 IN270 .47M 2N4400 Q11 1M 330M 6V

+12V

YEL A SIGNAL RED/ B +20V BLK C COM CRYSTALINK SM3S-N WINCH.

TOLERANCES (EXCEPT AS NOTED)	CINEMA PRODUCT DEVELOPMENT CO.
DECIMAL ±	SCALE
FRACTIONAL ±	DRAWN BY J. HILL
ANGULAR ±	APPROVED BY
	TITLE: SCHEMATIC, CRYSTASOUND
	DATE: 7-75
	DRAWING NUMBER: D 70-468-F-2


70-447 P.C. BOARD
70-464 B ASSY.
WINCH SM35-M
V.U.
70-112 ASSY.
30 AWG FUSE
2 USECO 1340-T
METER AMPL.
PHONE AMPL.
VOLTS REG.
FILTER 12 V
1 MIC. AMPL.
2 MIC. AMPL.
RELAY
PLAY BACK
A.G.C.
BIAS OSC. 61 ±1 KHZ
RECORD AMPL.
MIXER
BELDEN 8434
V10/ 22
WHT 22
BLK 22
GRN 22
RED 22
HH SMITH
PREH 12QK5M
RED 18" LONG
14½
REAR VIEW
BARE TEFLON
BELDEN 9452
9" LONG
G.C. 7582
12" LONG
WINCH
LEMO
BLK
VIO/
ORN/
BRN
MOUNT IN CONSOLE BEFORE SOLDERING
COMPONENTS OTHER SIDE
CRYSTA SOUND
RECORDING AMP
7-75
D
F-2

1	PWR SWITCH CHANGED TO PWR ON-OFF W/O IND.

70-448 ASSY

70-447-6 P.C. BOARD.

70-464-B ASSY.

70-112 ASSY.

WINCH. SM35-N

B A C — COM SIG GND — RED YEL BLK

V.U.

BLK 22 · V10 26 · V10/ 26 · RED/ 4" · BLK 26 · GRY/ · WHT 26 · ORN/ 26 · BRN/ 26 · RED 26 · BLK 22 · RED/ · ORN/26 · 2 YEL TWIST · ORN 26 · BLU 26 · 2 GRN TWIST · BLU/26 · GRN/26 · VIO/26 · BRN 26 · BLK/26 · YEL/26

BUSS 22 · (2) R 4103 · 30 AWG FUSE · 2 USECO 1340-T

GRN · WHT · V10/

METER AMPL.			
PHONE AMPL.			
VOLTS REG.			
FILTER 12 V			
1 MIC. AMPL.	PLAY BACK	A.G.C.	BIAS OSC.
2 MIC. AMPL.		RECORD AMPL.	MIXER
RELAY			

PREH 12QK5M

2185 HH SMITH

BELDEN 8434	V10/ 22	5
	WHT 22	3
BELDEN 8434	BLK 22	2
	GRN 22	4
	RED 22	1

RED 14½ LONG

REAR VIEW

BLK/ GRN/ · TWIST 4 TURNS/IN. · BLK/ YEL/ · 9" LONG · 4148 · 18 GA.

G.C. 7582 · WINCH MOTOR · A GRN · B WHT · C RED · D BLK · 12" LONG

LEMO RA 0304

1 BLK · 2 VIO/ · 3 ORN/ · 4 BRN

MOUNT IN COVER BEFORE SOLDERING

③ — 7"

COMPONENTS OTHER SIDE

CRYSTASOUND

RECORDING AMPLIFIER

7-75 | D | 70-460-1

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.)

Effective Date: May 1, 1975

CP-16R AND CP-16R/A Cameras

REPLACEMENT PARTS AND COMPONENT MECHANICAL ASSEMBLIES

Order Code	Part Number for Reference only	Description	List Price
Reference Camera Body			
1Y100	70-142	Front on/off switch housing Assembly & front handle	$175.00
1Y101	70-136	Front Handle Only	60.00
1Y102	70-324	Front on/off Switch Housing Assembly	120.00
1Y103	70-139	Handle Lock Nut	5.00
1Y125	70-301	Handle, Door Latch Assembly	12.00
1Y126	70-063	Plate	8.50
1Y127	70-034	Detent Plate	15.00
1Y130	70-061	Stop	8.50
1Y136	70-254-1	Film Guide Roller	6.65
1Y137	70-216	Film Guide Post	8.60
1Y140	70-499	Magazine Latch Cover Plate	14.00
1Y141	70-057	Retainer Plate	20.00
1Y142	70-058	Magazine Hold Down Plate	8.50
1Y146	70-132	Camera Handle (Top)	12.00
1Y150	70-120	Clutch Assembly	120.00
1Y148	RF-4ZZRA	Clutch Bearing (Body)	4.00
1Y152	70 -100	Magazine Take-Up Pulley	12.00
1Y158	1600-045-100	Clutch, Spring	.80
1Y162	FA-144 (70-192)	Clutch Belt	11.75
1Y155	70-041	Facing Assembly	.75
1Y164	70-122	Idler Assembly	32.00
1Y170	70-121	Counter Drive Assembly	36.00
1Y1328	70-861	Transmitting Counter	60.00
1Y175	70-125	Counter Box Assembly	46.00
1Y176	70-016	Gear, Counter	15.00
1Y177	70-026	Counter	12.00
1Y179	70-027	Reset Button	1.00
Reference Control Panel Assembly - Drawing 70-751			
1Y1240	70-751	Control Panel Assembly includes: Control Panel Plate; Gasket; Escutcheon; Rate Switch Assembly; Battery Test Switch	

CP-16R AND CP-R/A CAMERAS

Order Code	Part Number for Reference Only	Description	List Price
1Y1240	70-751	(cont.) and Meter Assembly; On/Off Switch Assembly; Centerplate, Side Cover/Crystasound Connectors and Mounting Brackets; Front Switch Connector; Miscellaneous Hardware and Wiring Harness.	$250.00
1Y1245	70-752	Control Panel Ass'y (CP-16RP)	300.00
1Y1351	70-725	Plate, Control Panel	10.00
1Y1352	70-772	Gasket	1.00
1Y1359	70-723	Escutcheon (F.P.S.)	2.60
1Y1362	70-724	Knob, Speed Switch Assembly	1.00
1Y1365	C24C-02-038	Spring	.50
1Y1231	30-808-050	Speed (F.P.S.)Switch	8.50
1Y1243	70-372	P.C.-Board Assembly, Speed Switch	30.00
1Y1241	70-757	Battery Test Meter, Calibrated Assembly	20.00
1Y437	84	Meter	6.00
1Y439	70-031	Bracket, Battery Test Meter	5.80
1Y428	46-101-R	Battery Test Switch	3.60
1Y429	70-147	Guard, Battery Test Switch	3.80
1Y430	7101J-1	On/Off Switch	4.60
1Y432	7101J-1/7645-3	On/Off Switch and Bezel	6.00
1Y433	70-157	Guard, On/Off Switch	2.60
1Y1211	SRM-14S-NSS	Connector, Control Panel Assembly to Crystal Drive System	10.00
1Y426	60 HA 4F	Connector, Camera to Front Handgrip	3.40
1Y421	61 LA 5F	Connector, Camera to Side Cover or Crystasound	4.20
1Y1244	70-764-A	Terminal Board	8.00
Reference Centerplate (Mid-Rib) Assembly-Drawing 70-887			
1Y226	70-262	Sound Sprocket	66.00
1Y227	70-261	Knob Sound Sprocket	12.00
1Y228	70-260	Flange, Sound Sprocket	6.00
1Y229	70-265/70-263	Flywheel/Sprocket Shaft Assembly	80.00
1Y231	70-286	Bushing	7.60
1Y232	70-285	Bushing	7.60
1Y230	70-177	Sprocket Drive Gear (Large Gear)	95.00
1Y1402	70-876	Bearing Bar (Ref.)	(Ref.)

To order: Reference the designated order code, description and unit price.

Prices and specifications subject to change without notice.

Prices F.O.B. our plant Los Angeles, California.

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

Order Code	Part Number for Reference Only	Description	List Price
1Y237	70-178	Gear	$24.00
1Y1404	70-629	Disc	6.00
1Y1407	70-745	Bearing, Oilite	7.60
1Y239	70-287	Bearing, Oilite	7.60
1Y1409	70-602	Shaft Assembly, Pulldown Arm	45.00
1Y243	70-248	Transport Claw Assembly (Pulldown Arm and Pin)	64.00
1Y245	70-222	Guide Pin (Transport Claw Assembly)	5.00
1Y264	70-247	Edge Guide Spring	4.00
Reference Mid-Rib (Centerplate) Assembly-Drawing 70-888			
1Y260	70-206	Film Guide Assembly	38.00
1Y261	70-218	Post Film Guide	7.00
1Y263	70-225	Spring, Film Guide Assembly	1.40
1Y266	70-243	Pressure Plate Assembly	42.00
1Y267	70-246	Lever, Pressure Plate Assembly	5,50
1Y269	70-217	Roller, Pressure Plate Lever	1.00
1Y268	70-220	Spring, Pressure Plate Lever	3.20
1Y270	70-219	Post, Pressure Plate Lever	1.00
1Y264	70-247	Film Edge Guide Spring	4.00
1Y293	70-267	Knob, Sound Head, Dummy Roller	6.40
1Y299	70-407	Retractor Clip, Sound Head	3.00
1Y295	70-209	Dummy Sound Head Roller Assembly	60.00
1Y296	70-274	Retractor Clip, Dummy Roller	3.50
1Y302	70-456	Bracket, Connector Mount	7.00
1Y290	70-208	Roller Plate Assembly	36.00
1Y305	70-214	Post,Flangeless Roller	8.75
1Y306	70-213	Roller, Flangeless	8.60
1Y307	70-216	Post, Flanged Guide Roller	8.60
1Y308	70-215	Flanged Guide Roller	8.20
1Y309	70-266	Stripper Plate	6.00
1Y321	70-203	Film Threading Instruction Plate	1.25
1Y322	70-170	Frame Rate Indicator	1.75
1Y1418	70-965	Magnetic Shield Assembly	14.00
1Y1417	70-809	Spacer for Gel Filter Holders	2.00
1Y325	70-284	Grommet	.35
1Y326	70-281	Screw, Centerplate Mounting	6.40

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

Order Code	Part Number For Reference Only	Description	List Price
1Y1415	70-783	Spacer	$ 1.50
1Y1416	70-784	Terminal	1.50
1Y225	139T x 1/8	Drive Belt	4.50
Reference Gearbox Assembly-Drawing 70-604			
1Y1420	70-741	Mirror Shutter	280.00
1Y1422	70-605	Mirror Shaft Assembly (with mirror)	385.00
1Y1438		Mirror Shaft Assembly (without mirror)	200.00
1Y1434	70-743	Gear Assembly	140.00
1Y1421	70-606	Bushing Shaft	32.00
1Y1429	70-610	Screw	3.00
1Y1431	70-736	Thrust Washer	2.00
1Y1432	WO 242 006S	Spring Washer	.50
1Y1425	70-613	Idler Gear Assembly	100.00
1Y1427	70-616	Gear	48.00
1Y1428	70-617	Shaft	60.00
1Y1429	70-610	Screw	3.00
1Y1431	70-736	Thrust Washer	2.00
1Y1432	WO 242 006S	Spring Washer	.50
1Y1430	70-612	Rear Cover, Ground Glass	18.00
1Y1433	70-682	Ground Glass Mount Assembly	90.00
1Y1436	70-792	Aperture Plate Assembly	(Ref.)
Reference Lens Lock Ring Assembly-Drawing 70-619			
1Y1475	70-619	Lens Lock Ring Assembly	200.00
1Y1476	70-717	Handle	28.00
1Y1477	70-620	Lens Ring	(Ref.)
1Y1478	70-618	Lock Ring	(Ref.)
Reference Standard Viewer Assembly-Drawing 70-791			
1Y1503	70-683	Prism Mount	280.00
1Y1504	70-689	Lens	25.00
1Y1507	70-740	Bracket, LED Mounting	inquire
1Y1508	70-685-2	Retainer, Prism	4.50
1Y1509	70-686	Pad, Prism Retainer	1.00
1Y1512	70-694	Mounting Nut	24.00
1Y1513	70-746	Washer, Mounting Nut	1.00
1Y1516	70-789	Lens Assembly	100.00
1Y1517	70-693	Tube Mounting-Optical Stop	130.00
1Y1518	70-786	Pad, Optical Stop	2.00

To order: Reference the designated order code, description and Unit price.
Prices and specifications subject to change without notice.
Prices F.O.B. our plant Los Angeles, California.

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

Reference Standard Viewer Assembly-Drawing 70-791 (Cont'd)

Order Code	Part Number For Reference Only	Description	List Price
1Y1520	70-733	Screw	$ 3.00
1Y1521	70-735	Follower	5.00
1Y1522	70-728	Key	5.00
1Y1524	70-726	Lock Ring	20.00
1Y1525	70-732	Knob, Focus Adjust	3.00
1Y1528	70-737	Prism	32.00
1Y1531	70-699-1	Prism Retainer (lower)	50.00
1Y1532	70-699-2	Prism Retainer (upper)	50.00
1Y1537	70-779	Backlight Shutter Assembly (Dowser)	180.00
	70-696	Helix Sleeve	60.00
1R236	70-623-2	Fiber Optics Viewing Screen (Ground Glass)	80.00
1Y1539	70-698	Prism Housing	130.00
1Y1311	70-849	1.500" Gage	125.00
1Y1312	70-956	1.500" Master Block	75.00
1Y1306	70-878	Ground Glass Mirror	15.00
1Y1307	70-879	Aperture Mirror	20.00
1Y1308	70-884	Ground Glass Positioner	75.00
1Y1315	70-817-4	"Go/No Go" Lens Gage	100.00
1Y1320	NPN	Tool Kit	12.00
1Y1321	41-039	"C" Mount to "CP" Mount Adapter for Collimator	125.00
1Y1322	61-014	Flange Depth Gauge Fixture (1.875 Gage)	100.00
1Y1323	PT-102	1.875 Gage Contact Point	5.00*
1Y1324	70-1028	1.875 Master Block	75.00
1Y1325	70-1006	Aperture Flat Plate	20.00

* There is no charge when 1Y1311 is ordered

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.	875.00
1Y361	70-311	Drive Motor Assembly includes: C28775 Motor; Pulse Disc/Motor Pulley Assembly; Motor Plate Assembly.	125.00

To order: Reference the designated order code, description and unit price.

Prices and specifications subject to change without notice.

Prices F.O.B. our plant Los Angeles, California.

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

Drive Motor Assemblies and Components - Drawing 70-760 (Cont'd)

Order Code	Part Number For Reference Only	Description	List Price
1Y361	70-311	Drive Motor Assembly includes: C28775 Motor; Pulse Disc/Motor Pulley Assembly; Motor Plate; Wiring Harness.	125.00
1Y386	7043-010	Crystal Oscillator Assembly	150.00
1Y363	70-005-1/SE2450-2	LED Assembly	8.00
1Y362	70-005-1/MRD-604	Photo Transistor	8.00
Capacitors			
1Y115	DD101	110P	.75
1Y372	DD102	.001M-50V	.75
1Y371	DD501	500P	.75
1Y379	UK50-103	.01M-50V	1.40
1Y381	UK20-503	.05M-20V	1.50
1Y380	UK10-503	.05M-10V	1.40
1Y373	KR1W-50K	.1M-50V	2.25
1Y374	KR47W-50K	.47M-50V	2.50
1Y375	K1W-50K	1M-50V	2.25
1Y376	K8R2W15K	8.2M-15V	2.25
1Y377	K22W6K	22M-6V	2.25
1Y531	K4R7W25K	4.7M-25V	2.25
1Y539	CK05BX333K	.033M	1.80
1Y382	MTP127M030	120M-30V	8.25
1Y383	TAC225K010	2.2M-10V	2.25
1Y1608	CK05BX273K	Capacitor .027mf	1.40
1Y1609	CK05BX823K	Capacitor .082 mf	1.40
1YL233	K2R2W50K	Capacitor 2.2 mf	2.50
1Y533	K68E25K	Capacitor 68 mf	4.25
Integrated Circuit			
1Y1151	749PC	I.C.	10.00
1Y391	CD4020AE	I.C.	23.75
1Y1152	CD4001AE	I.C.	3.60
1Y392	CD4011AE	I.C.	3.85
1Y1153	CD4023AE	I.C.	3.80
1Y1154	D13V1	I.C.	1.80
1Y1610	CD4011AK	Integrated Circuit	12.00
1Y1611	CD4018AK	Integrated Circuit	26.00
1Y1601	MC1458CF	Integrated Circuit	3.00
1Y1602	741TC	Integrated Circuit	4.00
1Y1563	70-963	Hybrid Circuit	35.00
1Y1564	70-964	Hybrid Circuit	30.00

To order: Reference the designated order code, description and unit price.
Prices and specifications subject to change without notice.
Prices F.O.B. our plant Los Angeles, California.

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

Transistor

Order Code	Part Number For Reference Only	Description	List Price
1Y1166	2N4400	Transistor	$ 1.80
1Y397	2N4403	Transistor	3.25
1Y1167	2N5088	Transistor	2.20
1Y1168	2N5086	Transistor	2.00
1Y1169	MTT3904	Transistor	3.00
1Y1171	MRD-604	Transistor	5.00
1Y395	D45C6	Transistor	3.60

Potentiometers

1Y1186	62PR1K	Potentiometers	6.00
1Y1187	E086BC	Potentiometers	6.00

Diodes

1Y404	1N4148	Diodes	1.00
1Y1196	MLED90	Diodes	9.00
1Y405	1N4001	Diodes	1.60
1Y560	1N270	Diodes	1.85
1Y1603	SSL-212	LED Visible	2.00
1Y1604	MV-50	LED Visible	1.75
1Y1613	LLL9A-1	LED Visible (Bloop)	2.00

Choke

1Y408	EA-005A	Choke	20.00

Voltage Regulator

1Y412	MFC-6030-A	Voltage Regulator	4.85

Connectors

1Y1211	SRM-14S-NSS	Control Panel Assembly to Motor Drive System	10.00
1Y1213	SRM-14PNSS	Control Panel	9.00
1Y426	60 HA 4F	Camera to Front Handgrip	3.40
1Y421	61LA5F	Camera to Side Cover/ Amplifier	4.20
1Y447	SM3SN	Crystalink Connector (in amp)	8.50
1Y370	60 HA 4F (modified)	Pilot Tone Connector	5.50

Switches

1Y1231	NPN 30-808-050	FPS Rate (Control Panel)	8.50
1Y430	7101J-1	On/Off (Control Panel)	4.60
1Y432	7101J-1/7465-3	On/Off and Bezel (Control Panel)	6.00

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

Switches (Cont'd)

Order Code	Part Number For Reference Only	Description	List Price
1Y433	70-157	Guard On/Off (Control Panel)	2.60
1Y428	46-101-R	Battery Test (Control Panel)	3.60
1Y429	70-147	Guard Battery Test (Control Panel)	3.80
1Y434	J4004	On/Off Front	12.50
1Y1607	23-021-125	Switch, 50-60 HZ	6.00

Meter

1Y1241	70-757	Meter Calibration Assembly	20.00
1Y437	84	Battery Test Meter	6.00
1Y439	70-031	Bracket, Battery Meter	5.80

Hardware

1Y1256	70-764-A	Terminal Board (Sync Lamp)	8.00
1Y882	1413-6	Lug	
1Y580	2185	Grommet	.40

Battery

1Y1271	1100-001-139	Battery, Footage Counter	18.00

Capacitors

1Y373	KR1W50K	.1m-50V	2.25
1Y529	KR33W50K	.33M-50V	1.05
1Y374	KR47W50K	.47M-50V	2.50
1Y375	K1W50K	1M-50V	2.25
1Y530	K3R3W25K	3.3M-25V	4.50
1Y531	K4R7W25K	4.7M-25V	2.25
1Y376	K8R2W15K	8.2M-15V	2.25
1Y532	K15W10K	15M-10V	2.25
1Y378	K15E50K	15M-60V	4.25
1Y533	K68E25K	68M-25V	4.25
1Y534	K150E15K	150M-15V	4.25
1Y535	K330E6K	330M-6V	4.00
1Y525	65F10AA332	.0033M	1.60
1Y370	65F10AA392	.0039M	1.50
1Y526	65F12AA473	.047M	2.65
1Y527	65F13AC823	.082M	1.80
1Y538	CK05BX222K	.0022M	1.20
1Y540	CK05BX472K	.0047M	2.20
1Y536	CK05BX223K	.022M	1.80
1Y537	CK05BX272K	.027M	2.40
1Y539	CK05BX333K	.033M	1.80
1Y528	DD 330	33P	1.80

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

Order Code	Part Number For Reference Only	Description	List Price
1Y371	DD 500	500P	.75
1Y372	DD 102	.001M	.75
1Y379	UK50103	.01M-50V	1.40
1Y380	UK10503	.05M-10V	1.40
Integrated Circuits			
1Y544	LM1303N	I.C.	8.50
1Y545	LM380N	I.C.	8.50
Transistors			
1Y548	MJE800	Transistor	4.65
1Y396	2N4400	Transistor	2.00
1Y549	MFE-3002	Transistor	
Potentiometers			
1Y400	53-1-1-503	50 ohm Pot.	4.00
1Y552	53-1-1-502	50 ohm Pot.	
1Y553	53-1-1-203	20 ohm Pot.	6.00
1Y554	E086BC/10K	10 ohm Pot.	1.20
1Y556	25K ohm	Potentiometer Rework (70-442-2)	4.00
Diodes			
1Y560	1N270	Diode	1.85
1Y404	1N4148	Diode	1.00
Voltage Regulators			
1Y412	MFC-6030A	V.R.	4.85
1Y569	UGH-7812 393	V.R.	
Relay			
1Y570	712-18	Relay	4.00
Transformer			
1Y573	BH1058	Transformer	18.00
Hardware			
1Y576	1340T	Terminal Standoff	.30
1Y579	7582	Grommet	.40
1Y580	2185	Grommet	.40
1Y583	9452	Cable (nine inches)	1.00
1Y585	R4103	Lug	.20
1Y578	S 048-4	Bristol Key	
Connectors			
1Y590	3501FP	Phono Connector	.60
1Y591	111	Jack	.60
1Y592	70-454-1	Connector	12.00
1Y593	70-459	Microphone Connector Assembly	28.00
1Y594	70-112	Battery Plug Assembly	3.60

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

Order Code	Part Number For Reference Only	Description	List Price
Switches			
1Y597	7101M	Switch (Bias; Mode)	4.40
1Y598	7101S	Switch (AGC)	4.40
1Y599	7201S	Switch (Amplifier on/off)	5.00
Mechanical Parts			
1Y477	70-161	Guard	3.00
1Y478	70-010	Cover, Battery Compartment	6.25
1Y483	70-309	Cover	(Ref.)
1Y603	70-431	Bracket Mount; VU Meter	6.00
1Y606	70-446	Shield	24.00
1Y610	70-457	Knob	6.20
1Y611	70-433	Plate	12.80
1Y612	70-458	Stud, Panel Mount	2.40
1Y613	70-444	Plate, Light Trap	2.65
1Y614	70-426	Face Panel	7.25
1Y616	70-363	Shield Bias Oscillator	3.20
Replacement Parts Auxiliary Side Cover			
1Y475	70-323	Connector, Modification	4.00
1Y476	70-112	Plug Assembly	3.60
1Y477	80-161	Guard	3.00
1Y478	70-010	Cover Battery	6.25
1Y479	M4SH	Connector; To Record System	4.50
1Y480	12QK5M	Connector; Power to Body	2.00
1Y481	8434	Cable	1.00
1Y482	R4142SF	Lug, Red	.30
1Y483	70-309	Cover (Reference Only)	(Ref.)
PLC-4 Magazine			
1Y751	88-011	Light Trap	6.50
1Y750	88-024	Toe	3.00
1Y757	88-006	Knob	1.25
1Y762	88-012	Hub	24.00
1Y761	88-018	Roller Plate	12.50
1Y753	88-021	Shaft	4.40
1Y754	83-181	Screw	.40
1Y760	88-022	Spring Roller	9.00
1Y759	88-023	Fixed Roller	6.00
1Y756	88-020	Guide Roller	3.00
1Y752	88-001	Pulley	7.35
1G190	70-055	Stud	2.50
1G192	88-052	Core Adapters	9.00
1Y770	88-064	Housing, assembled	78.00
1Y771	88-059(-1 Front -2 Rear)	Door Assembly, Less hinge	42.00
1Y772	88-027	Hinge	35.00
1Y769	NPN	Update Kit for PLC-4 Latches	N/C

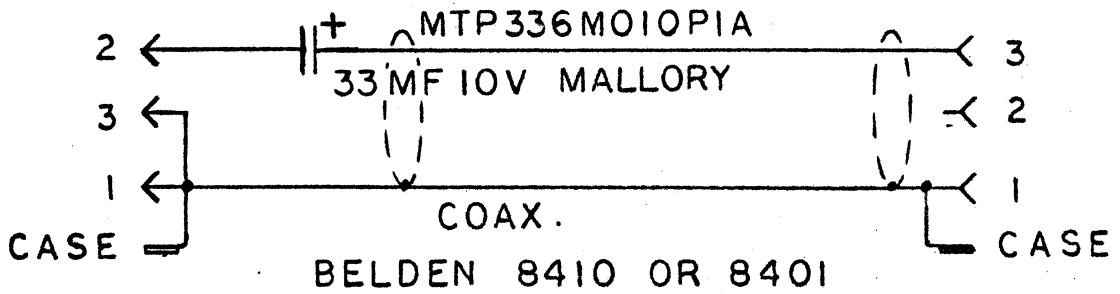
COLLIMATION OF GROUND GLASS
CP-16R WITH INFORMATION DISPLAY

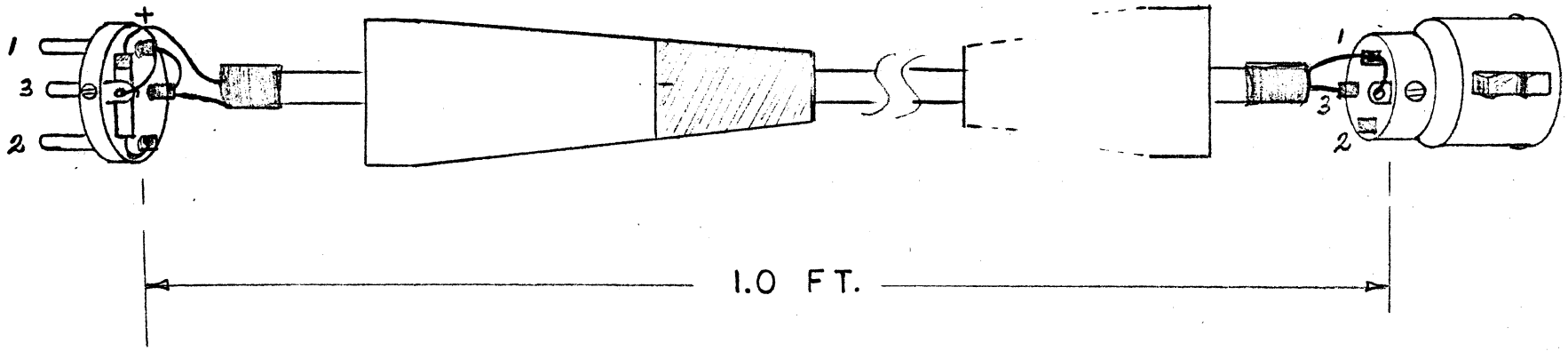
1. Remove information display coverplate.
2. Remove eyepiece and beamsplitter.
3. Remove information display P.C. board.
4. Rotate mirror shutter to open (non-viewing position).
5. Remove ground glass from holder.
6. Place 70-878 ground glass mirror in ground glass holder.
7. Remove pressure plate.
8. Place 70-879 aperture mirror in position.
9. Loosen screws on ground glass holder and move the holder all the way up and snug up the screws. NOTE: Do not tighten the screws, the holder may need adjustment.
10. Place lens on camera, focus to ' ' and wide open at 25mm.
11. Place 70- fixture on camera. The fixture fits the information display opening.
12. Place camera on collimator.
13. Check aperture mirror focus. NOTE: The aperture mirror is a reference and must be in focus.
14. Rotate mirror shutter to viewing position.
15. Check ground glass focus.
16. Tap the plunger on the fixture (lightly with a 2 oz hammer until the ground glass is in focus).
17. Turn the threading knob through several cycles to insure that focus of aperture mirror and ground glass mirror are identical.
18. Tighten screws on ground glass holder.
19. Recheck focus mirrors.
20. Remove fixture.
21. Replace information display P.C. board.
22. Replace beamsplitter and eyepiece.
23. Replace information display coverplate.
24. Replace ground glass in holder.
25. Replace pressure plate.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.

SWITCHCRAFT A3M

SWITCHCRAFT A3F





TOLERANCES (EXCEPT AS NOTED)	CINEMA PRODUCTS.		
DECIMAL ±		SCALE NONE	DRAWN BY J H APPROVED BY
FRACTIONAL ±	TITLE MICROPHONE ADAPTER CABLE FOR UNBALANCED INPUT.		
ANGULAR ±	DATE APR 73	DRAWING NUMBER A 70 — 327	

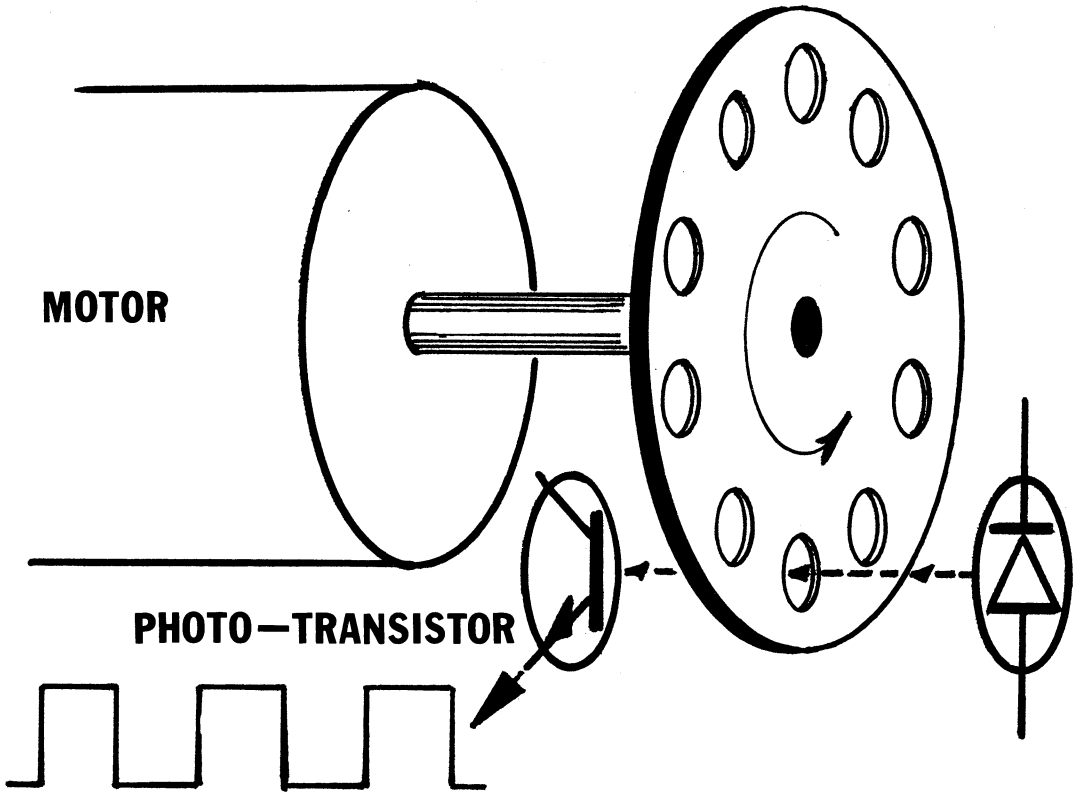
$$24 \frac{FR}{SEC} \times 60 \frac{SEC}{MIN} = 1440 \frac{FR}{MIN} = \underline{1440 \frac{REV}{MIN}}$$

$$25 \frac{FR}{SEC} \times 60 \frac{SEC}{MIN} = 1500 \frac{FR}{MIN} = \underline{1500 \frac{REV}{MIN}}$$

$$1440 \frac{REV}{MIN} \times 2.5 = \underline{3600 \frac{REV}{MIN}}$$

$$1500 \frac{REV}{MIN} \times 2.4 = \underline{3600 \frac{REV}{MIN}}$$

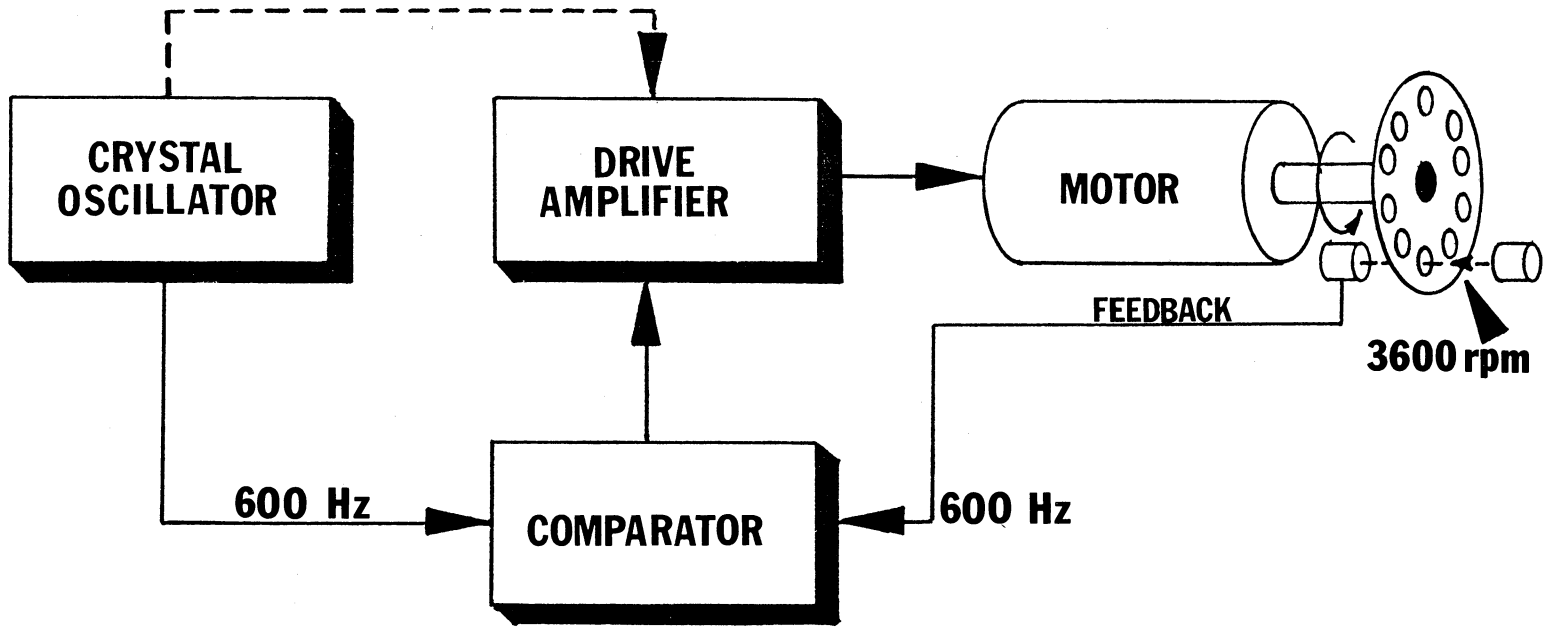
NUMBER:	TITLE:	DATE:	
	MOTOR SPEED MATH	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



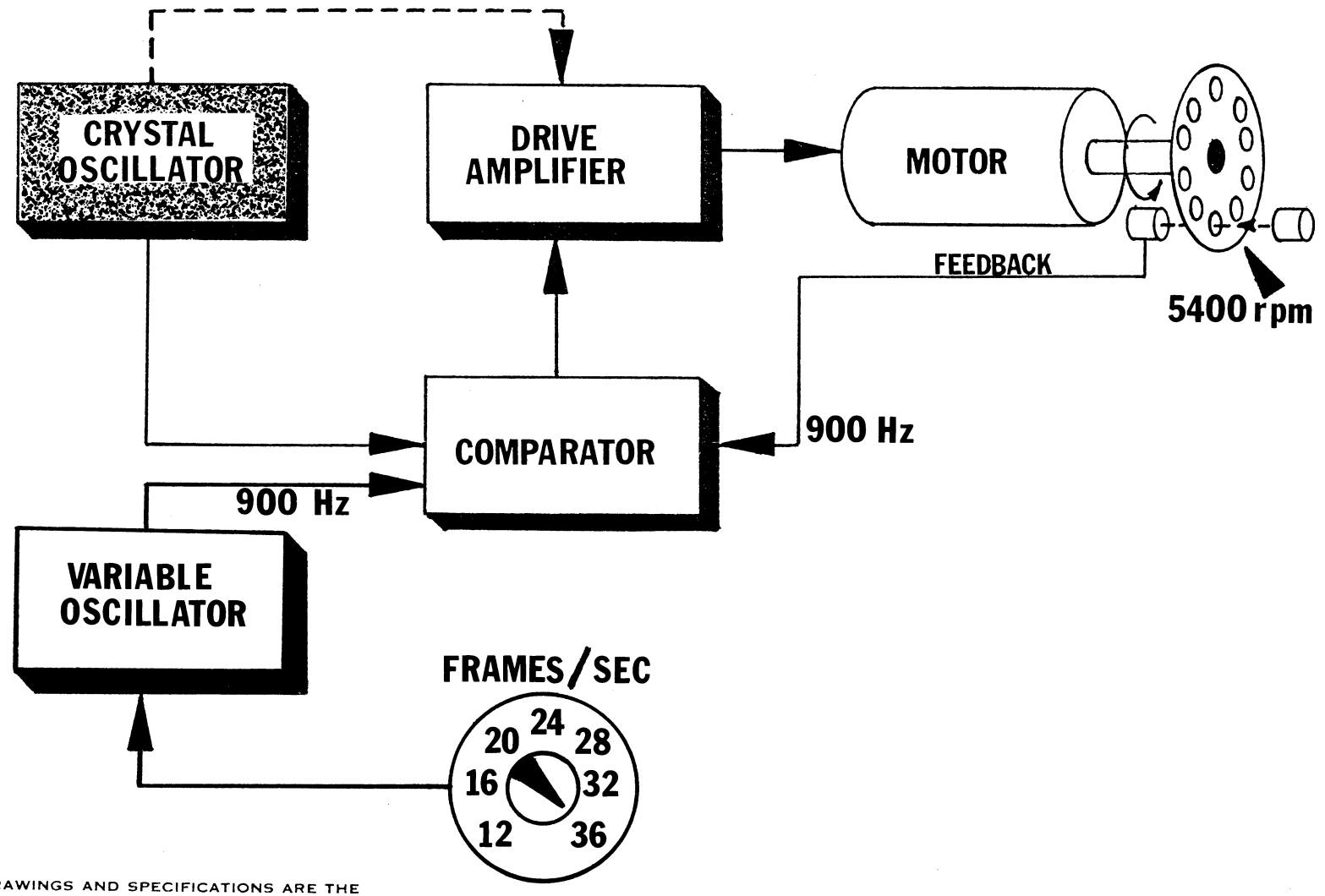
$$3600\frac{\text{rev}}{\text{min}} \div 60\frac{\text{sec}}{\text{min}} = 60\frac{\text{rev}}{\text{sec}}$$

$$60\frac{\text{rev}}{\text{sec}} \times 10 \text{ holes} = 600 \text{ Hz}$$

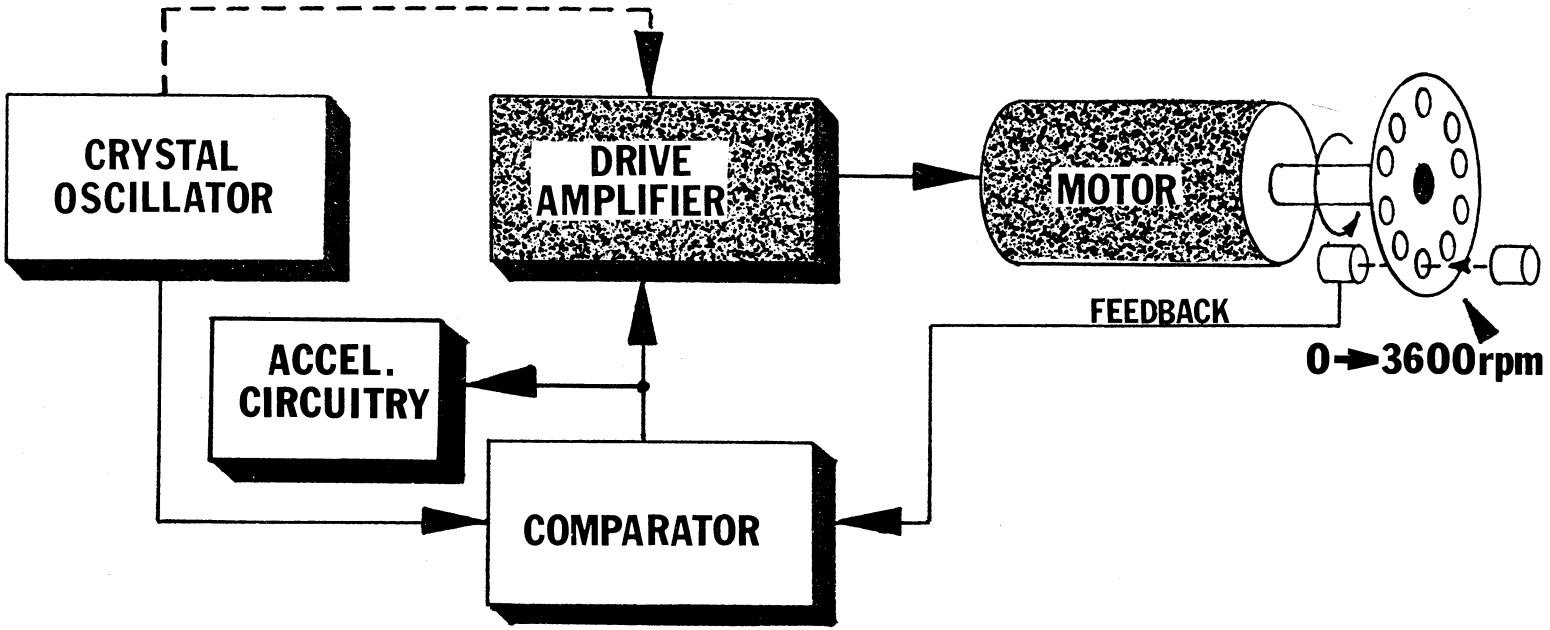
NUMBER:	TITLE:	DATE:	
	OPTICAL TACHOMETER	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



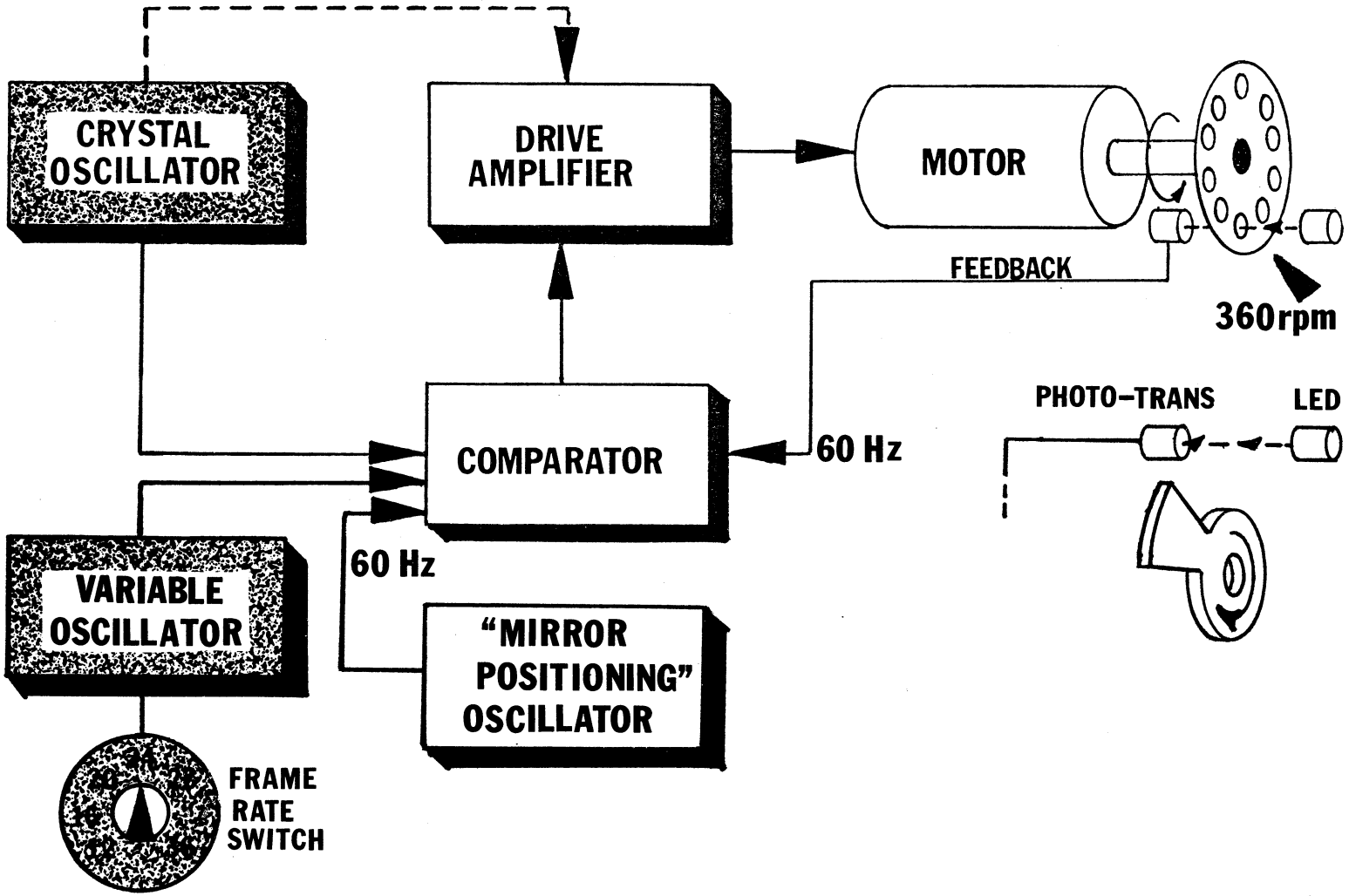
NUMBER:	TITLE:	DATE:	
	BASIC CRYSTAL DRIVE	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



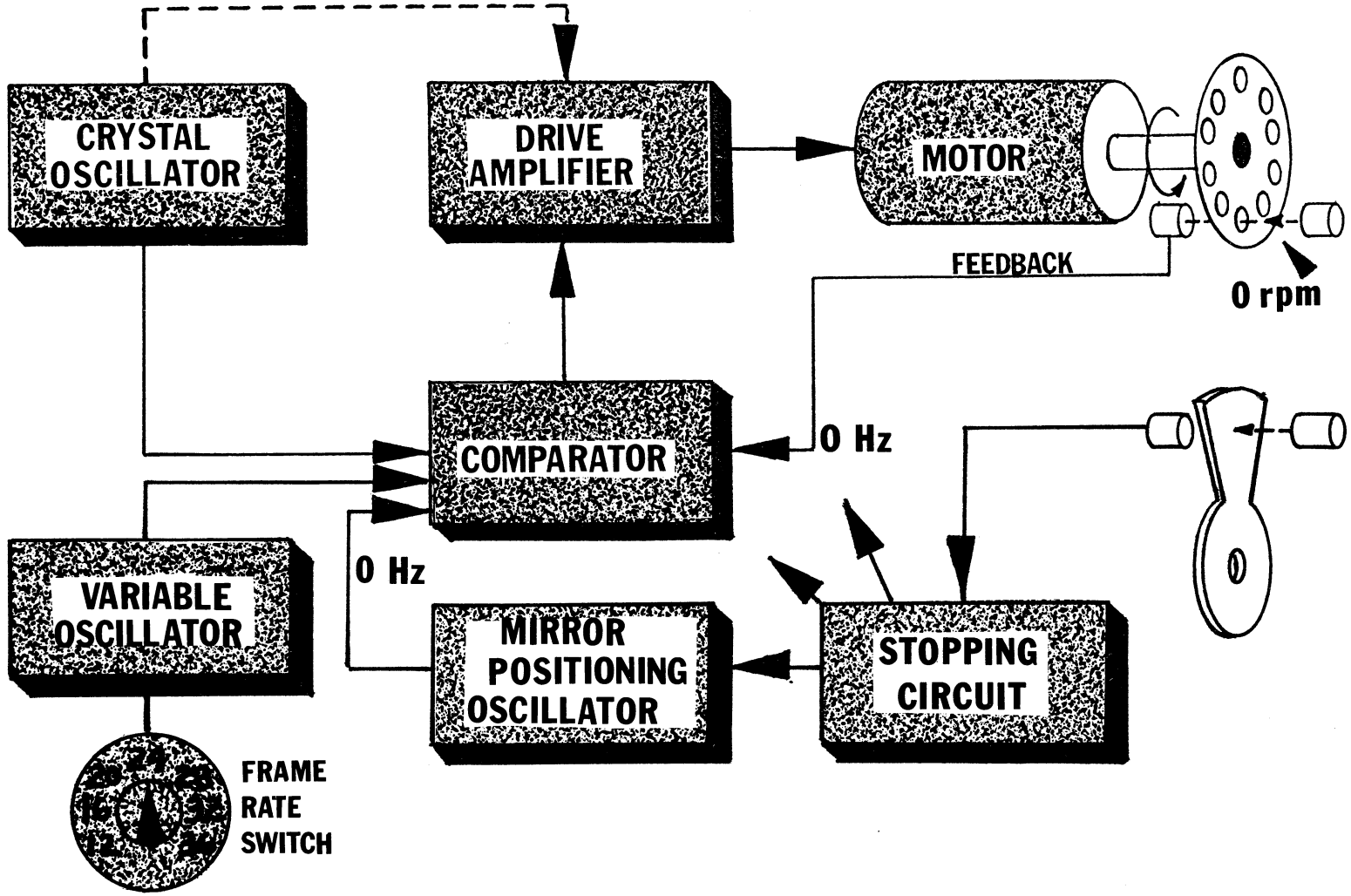
NUMBER:	TITLE:	DATE:	cinema products CORPORATION
	NON-CRYSTAL SPEEDS	8-75	
		DRAWN BY: MSP	Los Angeles, Calif. 90025



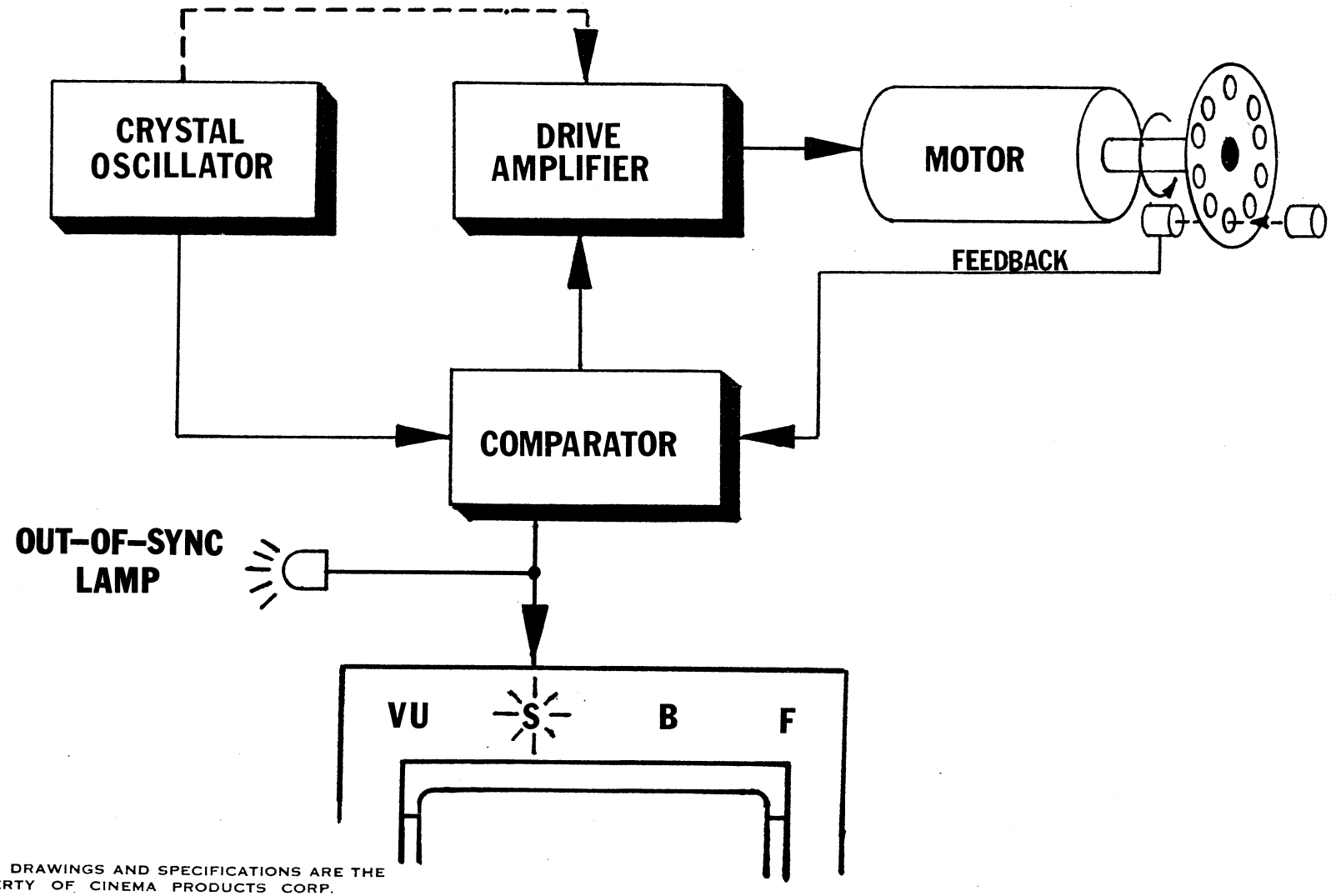
NUMBER:	TITLE:	DATE:	
	ACCELERATION CIRCUIT	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



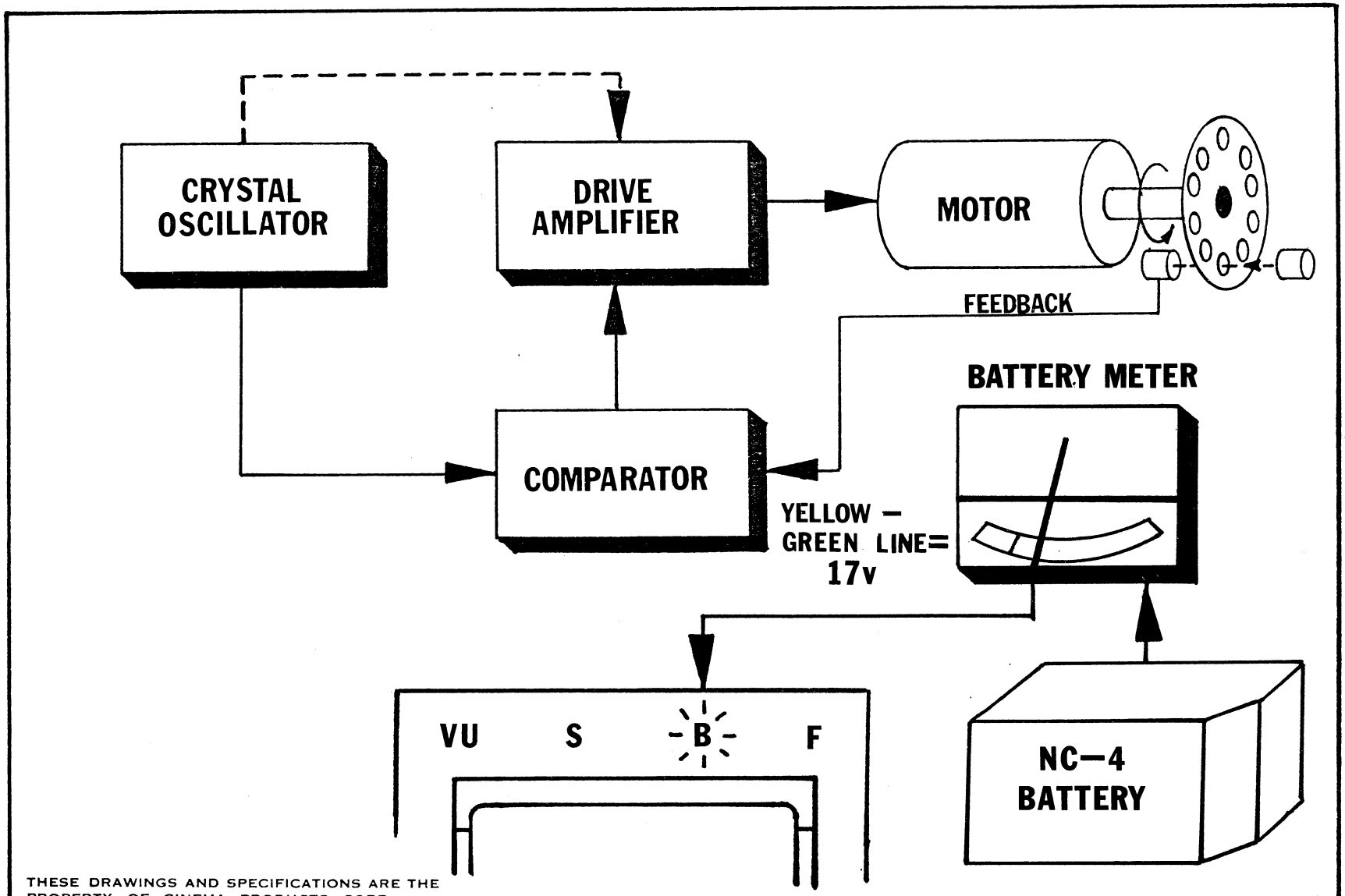
NUMBER:	TITLE:	DATE:	
	MIRROR POSITIONING	8-75	cinema products CORPORATION
		DRAWN BY: MGP	Los Angeles, Calif. 90025



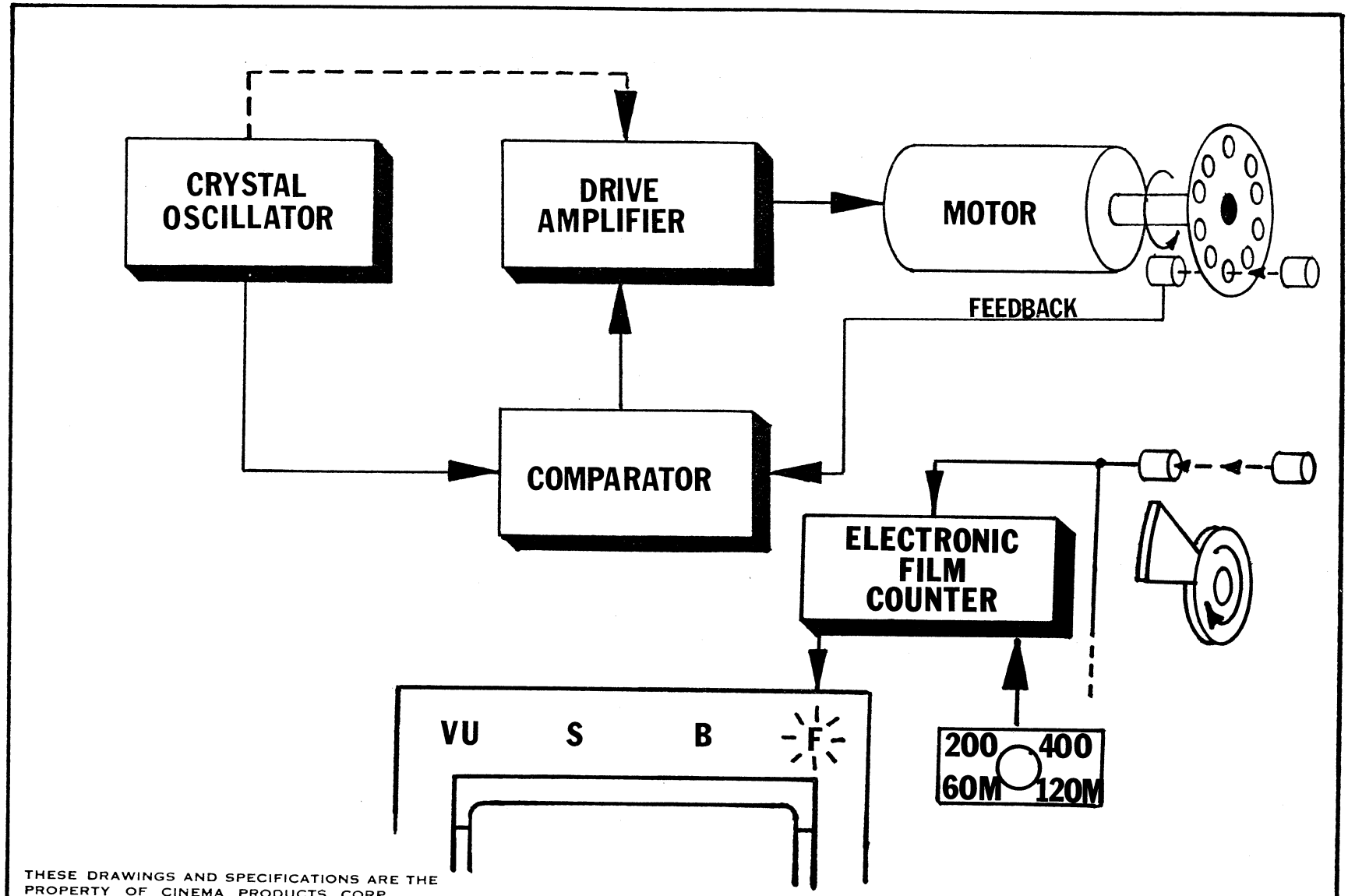
NUMBER:	TITLE:	DATE:	cinema products CORPORATION
	STOPPING CIRCUITS	8-75	
		DRAWN BY: MSP	Los Angeles, Calif. 90025



NUMBER:	TITLE:	DATE:	
	OUT-OF-SYNC WARNING	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



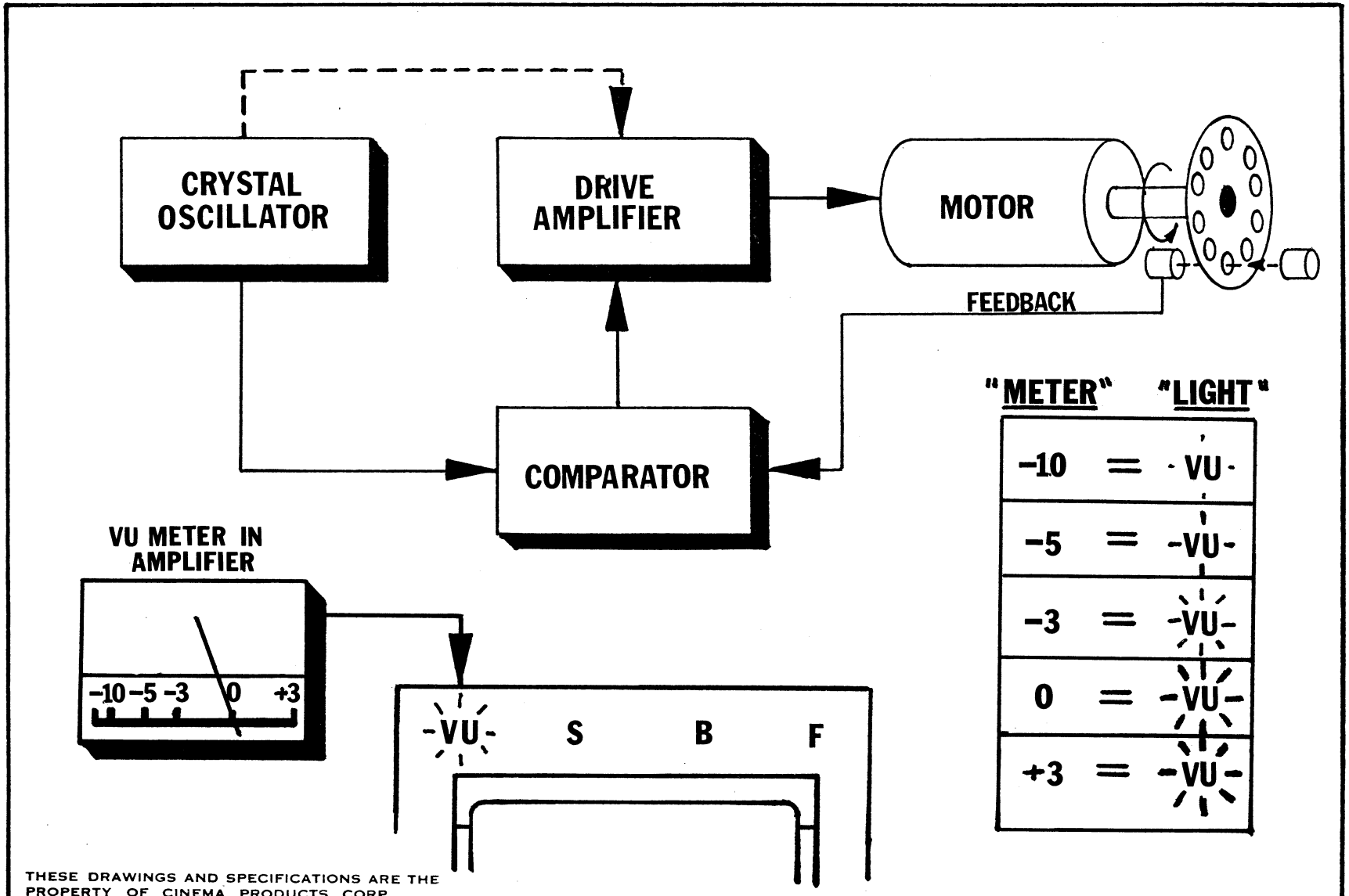
NUMBER:	TITLE:	DATE:	
	LOW-BATTERY WARNING	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



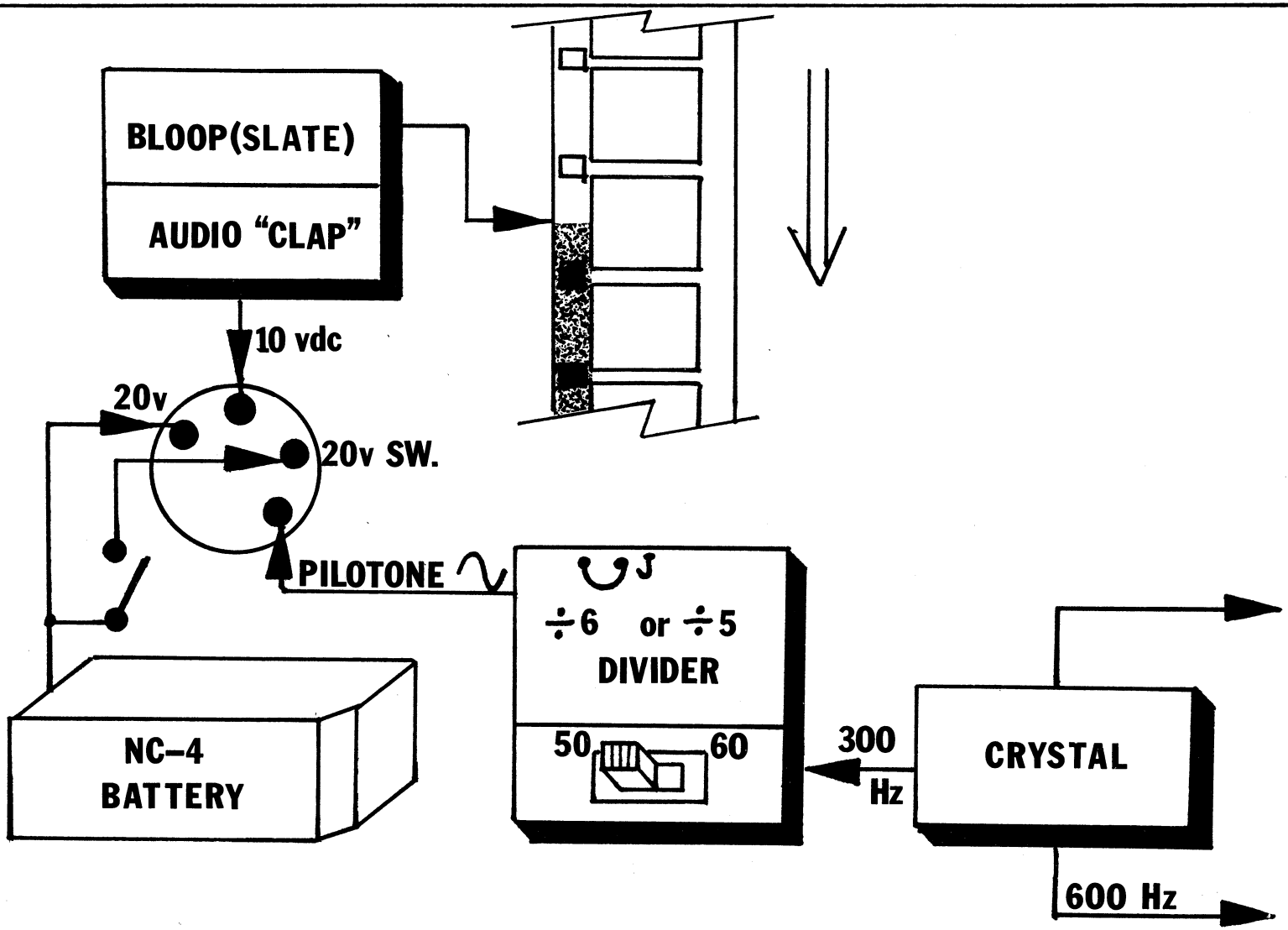
NUMBER:	TITLE:	DATE:	
	LOW-FILM WARNING	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025

SIZE OF LOAD	LOW FILM "F" WARNING AT	TIME AND FILM LEFT
400'	360'	2 MIN, 40'
120M	108M	2 MIN, 12M
200'	180'	1 MIN, 20'
60M	54M	1 MIN, 6M

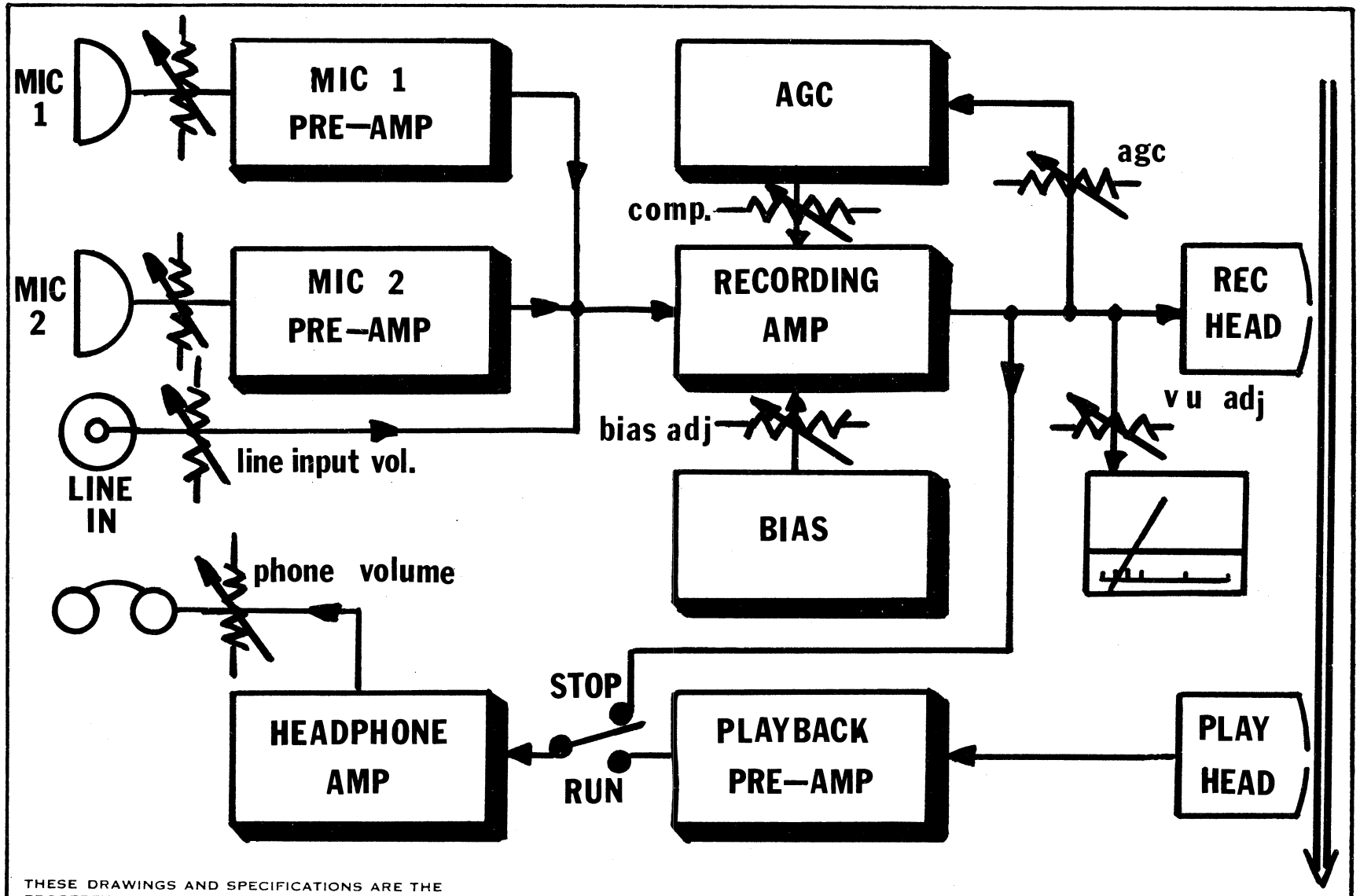
NUMBER:	TITLE:	DATE:	
	LOW FILM SIGNALS	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025



NUMBER:	TITLE:	DATE:	
	RECORD LEVEL WARNING	8-75	cinema products CORPORATION
		DRAWN BY: MSP	Los Angeles, Calif. 90025

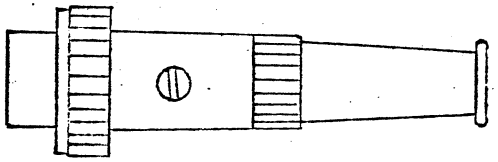


NUMBER:	TITLE:	DATE:	
	PILOTONE/BLOOP OPTION	8-75	cinema products CORPORATION
		DRAWN BY MSP	Los Angeles, Calif. 90025



NUMBER:	TITLE:	DATE: 8–75	cinema products CORPORATION
	CRYSTASOUND BLOCK DIAGRAM	DRAWN BY: MSP	Los Angeles, Calif. 90025

1	+ 20 V
2	CLAP
3	+ 20 V SW.
4	PILOT
G	COMMON



REAR VIEW

PARTS

1 09CL4M PREH CONNECTOR

1 WIRING SKETCH 70-877

09CL4M IS SWITCHCRAFT P/N

PILOT SIG. = 50 OR 60 HZ AT 1 VOLT R.M.S.

CLAP SIG = + 10 V WHEN ON AT 10 M.A.D.C.

+ 20 V ALWAYS ON

+ 20 V SW. ON WHEN CAMERA RUNNING.

TOLERANCES (EXCEPT AS NOTED)	CINEMA PRODUCTS		
DECIMAL ±	CP-16 R P	SCALE	DRAWN BY J HILL
			APPROVED BY
FRACTIONAL ±	TITLE PILOT CONNECTOR AND WIRING SKETCH KIT.		
ANGULAR ±	DATE MAY 74	DRAWING NUMBER A 70-877	

CP-16 Training Seminar Summary

The objective of this summary is to give a capsule review to accompany the printed block diagrams and figures. These diagrams and figures are identical to those used in seminar discussions.

The film transport claw pulls 1 frame of film down for each revolution of the gear to which it is attached. The mirror shutter is also synchronized with this same gear. The movement shaft that operates this gear directly is driven by a pulley which may changed for 24 FPS or 25 FPS crystal sync speed. The mathematics for deriving the motor speed given the basic frames per second requirements is shown in figure 1, "Motor Speed Math". The actual motor speed is the same regardless of crystal speed chosen.

The crystal oscillator in the CP-16 R yields a stable frequency output which can be processed electronically to do a number of different jobs simultaneously. The basic output frequency is 600 Hz(cycles per second) that maintains the frame rate at a perfect 24 or 25 FPS. Crystal controlled cameras and tape recorders need no connecting ("sync-pulse") cable to maintain perfect lip sync.

Referring to figure 2,"Optical Tachometer", this simplified drawing shows how a 600Hz waveform may be generated by infra-red light from a light-emitting-diode (LED) passing through 10 holes in a disc rotating at 3600 RPM striking a light sensative transistor. The 600 Hz "feedback" from the motor is sometimes called the tachometer.

Figure 3, "Basic Crystal Drive" depicts how the 600 Hz

from the crystal and the 600 Hz from the tachometer are evaluated in the "comparator" and then fed to the "drive amplifier" with the proper corrective signal. This speed corrective signal is modulated or mixed with another type of signal from the crystal and is converted into a series of variable width pulses which are then fed to the motor. Thus the closed control or servo loop is complete.

"The Acceleration Circuit" in figure 4 is the key to the smooth speed-up of the CP-16 R camera. The comparator's output signal is acted upon by the acceleration circuit to allow a gradual increase in speed until sync speed is acheived.

When frame rates other than crystal speed are called for the "variable oscillator" is called upon to deliver 300, 400, 500, 700, 800, or 900 Hz as selected by the control panel switch. These frequencies are then matched by feedback from the tachometer and cause the motor to deliver frame rates of 12, 16, 20, 28, 32, or 36 FPS respectively*. The 600 Hz from the crystal is de-energized as the shading in the diagram indicates. See figure 5, "Non-Crystal Speeds."

"Mirror Positioning" in figure 6 shows how the drive system slows down to a 60 Hz (2.4 FPS) rate by de-energizing both the crystal and the variable oscillators to cause the shutter to go slowly enough for the mirror to stop in the viewing position . The de-energizing of these circuits is caused by stopping the camera by using either the push-button or "STOP-RUN" switch.

*Using a 25 Fps pulley, the frame rates would be 12.5, 16.5, 21, 29, 33.5, and 37.5 respectively.

The "Stopping Circuit" figure 7 completes shutting off the entire camera once the mirror is in the viewing position. Another light sensative transistor and LED take care of the job by sensing a dark flag that blocks the LED's infra-red light when the mirror shutter reaches the viewing position.

The information display is a visual readout of vital camera functions. It is seen by the camera operator through the viewfinder, but does not in any way distract the operator by blocking any of the image.

The first information display function is the"Out-of-Sync Warning" in figure 8. This indicator operates together with the red lamp on the outside of the camera to tell the operator that the camera is not operating at the speed that has been selected. The signal for this function originates in the comparator. It is normal to see the out-of-sync warning as the camera is stopped or started.

The"Low Battery Warning" in figure 9 operates in conjunction with the battery meter on the control panel. The indicator in the viewfinder is designed to come on when the needle in the battery meter reaches the yellow-green line. The yellow-green line indicates enough battery charge to finish the take, but the battery should be changed before a long take is attempted.

The "Low Film Warning" indicator comes on to warn the operator that 10 per cent of his original film load is unexposed. The Low Film system features a long term memory that functions even when the battery is removed so your film

count is not lost until the counter is reset to zero by reseting the mechanical film counter above the control panel. The count originates from the same flag that causes the mirror to stop in the viewing position. The electronic film counter is "programmed" by setting the 200 - 400 ft. switch appropriately when threading that magazine for the first time. The switch is located in the film chamber of the camera. Figure 10, "Low Film Warning" gives the block diagram of the counter while figure 11, "Low Film Signals" gives the various indications possible. The indicator in the viewfinder will remain on as long as the camera battery is in the camera.

The "Record Level Warning"figure 12, gives a brightness proportional to the actual record level shown on the VU meter of the Crystasound amplifier. However, when a record level that could cause distortion occurs the indicator brightness jumps much higher than normal to alert the operator. The driver circuitry for the indicator is located behind the control panel of the camera.

The "Crystasound Block Diagram" figure 13, shows the basic roadmap of the amplifier. The diagram shows how the various inputs can be mixed and then fed to the record amplifier which is then acted upon by the AGC,if so desired, and the bias circuit. The control associated with the bias circuit(accessed by a hole in the side of the amplifier) must be adjusted periodically to compensate for head wear and emulsion differences. This control is "peaked" by recording a tone

and simultaneously listening through the headphones and adjusting the control slowly for the loudest possible tone.

The playback portion of the amplifier is provided for quality checking your recorded track at the time of recording. By switching the BIAS SWITCH OFF, a soundtrack may be played back without disturbing the original recording. When either of the camera run switches are engaged, the headphone amplifier automatically switches to the playback.

The amplifier, the Auxillary Side Cover (Silent Door), and the NC-4 Battery are provided with fuses. In both the amplifier and the side cover the fuse consists of .75 inches of #30 wire soldered between two posts on the battery connector board. The fuse itself is insulated with a piece of tubing, the spare wire provided is in a coil. Be sure to find the cause of the blown fuse before soldering a new one in.

The battery fuse is designed to withstand 50% more surge current than the amplifier fuse so there should seldom be a need for replacement. Fuse replacement is a factory procedure.

The "Pilotone/Bloop Option" figure 14 will provide a 50 or 60 Hz Pilotone and a 10 volt audio Clapstick to tape recorders so equipped. In addition, an edge marking slate (bloop) for the film that perfectly synchronizes with the clapstick is provided. The edge marker may be a "start only" or "start and stop" device depending on the user's needs. The Pilotone connector also features a 20 volt unswitched and a 20 volt switched outlet for possible remote control applications.

TECHNICAL MANUAL

CP-16R EXPOSURE CONTROL SYSTEM

SEMI-AND FULLY-AUTOMATIC

EVALUATION, ALIGNMENT AND REPAIR PROCEDURES

REPLACEMENT PARTS LIST

ILLUSTRATIONS

CINEMA PRODUCTS CORP.

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Technology in the Service of Creativity

(Revision 2 October 5, 1976)

CP-16R EXPOSURE CONTROL SYSTEM MANUAL
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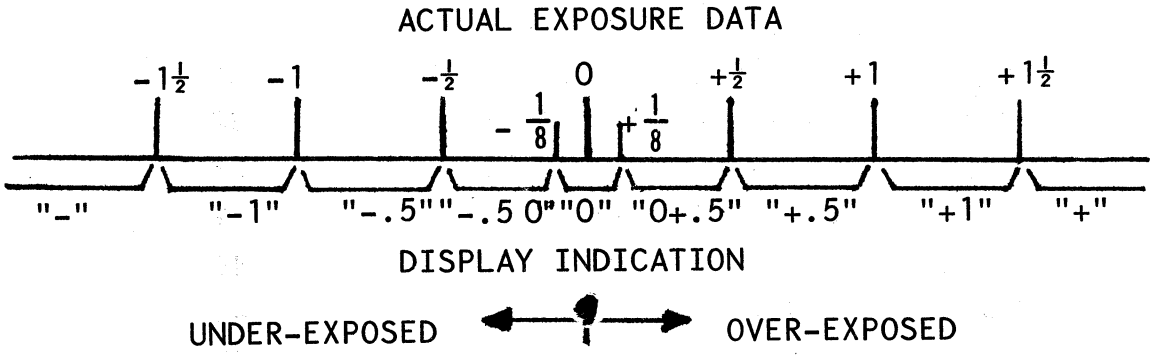
CP-16R SEMI AND FULLY AUTOMATIC EXPOSURE CONTROL SYSTEM

INTRODUCTION

The Exposure Control System is a behind-the-lens system using a silicon light sensor for fast response at low light levels. The sensor is located on the fiber optic viewing screen assembly and shares light with the viewing optics. This is accomplished by a cube beam splitter located directly above the fiber optic plate. Approximately 20% of the light is directed towards the sensor. No light is directed from the film.

The system is accurate over a wide range of illumination and is fully temperature compensated. Light measurements are taken only when the mirror shutter is in the viewing position of its rotary cycle. The ASA and FPS controls adjust the system for the particular film and frame rate being used.

The Exposure Display consists of 7 light emitting diodes (LED's) located along the bottom edge of the fiber optic plate as seen through the viewfinder. The center LED displays a "0" which indicates system null (correct exposure.) To the right of "0" are "+.5", "+1", and "+" which are $\frac{1}{2}$ stop increments. To the left are "-.5", "-1," and "-". The "+" and "-" indicate $1\frac{1}{2}$ stops or more over or under exposed respectively. The accuracy of the dead band or indication of null is $\pm 1/8$ stop.* The following diagram indicates how the display is interpreted.



When using the exposure control system the viewfinder dowser must be closed except when the eye is against it to prevent exposure errors due to light reaching the film and the sensor. When using behind the lens filters allow for the filter factor when setting the ASA control. Conversely when using filters in front of the lens, set the ASA control to the same ASA rating as the film.

Unless otherwise specified all references to FPS Control or Knob in this manual refer to the exposure system's FPS Control Knob not the camera's speed control knob located on the camera's rear control panel.

Further, all references to 24 FPS can be understood to mean 25 FPS for cameras whose Frame Rate is 25 FPS. The following table gives other Frame Rate equivalents:

Reference in Text & Exposure Control Markings	Interpretation for a 25FPS Camera
12	12.5
16	16.5
20	21
24	25
28	29
32	33.5
36	37.5

Since the exposure calculation difference between 24 FPS & 25 FPS is negligable no special instructions are required for 25 FPS cameras.

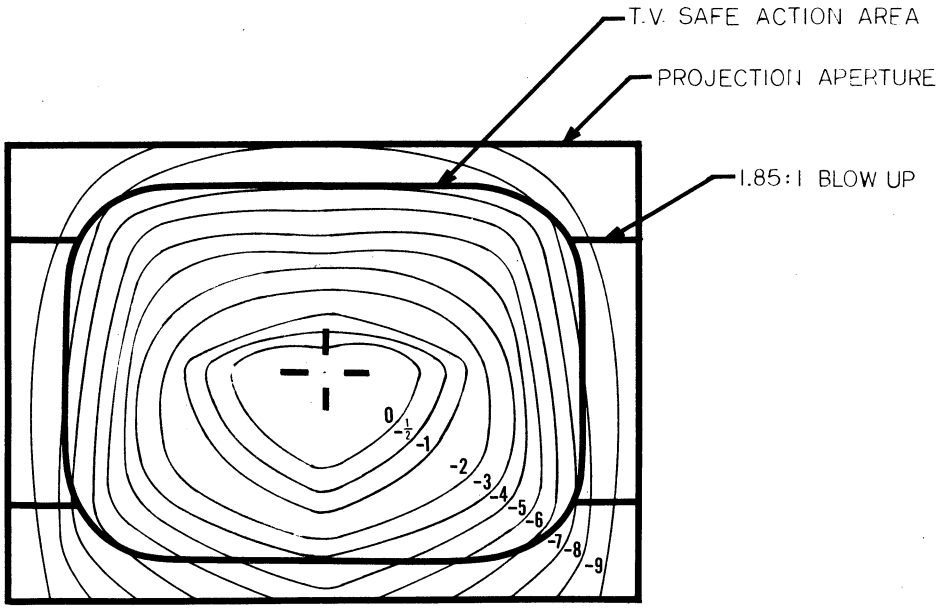
*This means a "0" indication is seen until the exposure is 1/8 stop from ideal. When this condition is reached the "+.5" or "-.5" indicator lights simultaneously with the "0".

CP-16R EXPOSURE SYSTEM WEIGHTING DIAGRAM

The accompanying diagram (below) represents the weighted response of the CP-16R Exposure Control System to images in the camera's picture area as seen on the fiber optic viewing screen.

The areas bounded by continuous lines represent values of uniform exposure control system weighting relative to the most sensitive region located at the center of the picture area. The numbers identifying these areas indicate the number of stops (t/or f/) that a particular area is de-weighted.

The exposure information displayed on the 7 LEDs (light emitting diodes)is most heavily influenced by the image appearing in the central high sensitivity region of the picture area. The foreground of the picture is moderately weighted to give an accurate exposure of picture elements nearer to the camera than the subject at the center of the picture area. The area which has the least influence on the exposure display is located at the very top of the picture area where a strong sky or other bright light source might override an otherwise accurate exposure of the subject. The balance of the picture area falls between these two extremes as indicated on the weighting diagram.



FIGURES REPRESENT STOPS RELATIVE TO CENTRAL AREA SENSITIVITY

CP-16R EXPOSURE CONTROL SYSTEM CIRCUIT DESCRIPTION

REFERENCE: 74-203 Schematic

SENSOR PREAMP ASSEMBLY, 74-170

Silicon Photodiode Sensor, D1, is operated in a forward bias mode into current amplifier and buffer, U1. Since the current through D1 is proportional to the light reaching it from the fiber optics viewing screen, the current through D1 and U1 doubles each time the light is increased by 1 stop. Likewise the current through D1 and U1 decreases by one-half each time the light is reduced by 1 stop. This current may be measured as a voltage from the Cathode of D1 (+ Lead) to Pin 6 of U1 (- Lead).

The log converter circuit, comprised of U2 and U3, converts the "doubling" and "halving" response to light of D1 and U1 to a uniformly increasing or decreasing voltage on the output (pin 6) of U2. U3 is used as a temperature compensated series diode pair in the feedback loop of amplifier U2. Voltmeter measurements taken from the cathode of D1 (- Lead) to pin 6 of U2 (+ Lead) will show an increase or decrease of approximately 50 millivolts when the light reaching the sensor increased or decreased by 1 stop respectively. Similarly, the same 50mV change can be measured from ground to pin 6 of U2 except that the voltage measured will be in the range between 7.5 to 8.5V.

This circuit board is powered by the 12 volt regulator VR1 located in junction assembly 74-102. Total current consumed by this circuit varies with temperature. At room temperature (70°F or 20°C) normal current for this circuit board is about 20mA at 12 volts.

LIGHT METER DISPLAY ASSEMBLY, 74-100

The display assembly consists of Photo-cell amplifier assembly, 74-104, and the LED display assembly, 74-105. These two circuit board assemblies are connected together by a permanent 5 circuit connector are then referred to as assembly 74-100. The assembly is located under the access cover plate on top of the camera.

U4A is an amplifier operating at a gain of approximately 5 to give approximately 250mV of change at pin 1 for an increase or decrease in light of 1 stop. The light gain trimpot, R 13, sets the gain of this stage. The null trimpot, R8, sets the correct operating point for U4A depending on the characteristics of D1 and the 74-170 Sensor Preamp assembly.

FET transistor, Q1, gates (conducts) the output of U4A to the sample and hold circuit U4B only when the mirror shutter is in the viewing position. Q1 is "on" only when the base of transistor Q2 (located in junction assembly 74-102) is low. T.P. "P" is a 12v. pulse equal to the camera's frame rate when the camera is running or a 12v. D.C. level when the camera is stopped in the viewing position.

This signal originates from the 70-760 crystal drive system assembly via pin R of the 14 pin connector.

Sample and hold circuit U4B operates at a gain of 1 (unity). Its output is a pure D.C. level which is proportional to light and is constant whether the camera is stopped or running. This output signal becomes the voltage against which the particular ASA and FPS settings are summed at summing test point, T.P. "S". The combined ASA and FPS settings produce a voltage the, summing point, which is proportional to the exposure requirements of the film. ASA/FPS trimpot, R20 calibrates the ASA/FPS voltage from the light meter control assembly, 74-101.

T.P. "S" is then filtered by R5 and C9 and applied to the summing input, pin 11, of Hybrid I.C., U6. U6 contains a resistive voltage divider that provides 1/2 of the supply voltage from the regulator. This reference voltage is used within U6 and is also used by the iris servo assembly, 74-103.

U5B provides a gain of 10 and buffers T.P"S" for later use in the iris servo assembly, 74-103.

U5A operates at unity gain and buffers T.P."R" (the reference voltage from U6) for later use in the iris servo assembly, 74-103.

Hybrid IC, U6 selects and operates the proper LED. U6 compares the voltage on pin 11, which represents the amount of light present summed against the particular ASA and FPS values selected to its internal voltage reference. On the basis of this comparison the proper LED or LEDS are lit. CR2 and CR3 are part of the LED selection circuit.

The light meter display assembly is powered by regulator VR1. Connection to VR1 and other exposure control components is made via P3. J5 connects LEDS 8 through 11 to the control panel circuits and crystal drive system.

JUNCTION ASSEMBLY, 74-102 AND LIGHT METER CONTROL ASSEMBLY, 74-101

Junction assembly, 74-102, interfaces all other assemblies of exposure control system and contains the strobe transistor Q2 (discussed in the previous section) and voltage regulator VR1. Connection is made to Pin R of the 70-760 crystal drive system, +20v battery, +20v "switched", and ground by solder connections to the camera body wiring harness.

The exposure control system power switch is located on the 74-101 light meter control assembly. This assembly also contains the FPS switch and the ASA control for adjusting the exposure control system to the particular frame rate and film speed. The FPS switch does not affect the camera's operating speed.

IRIS SERVO ASSEMBLY, 74-103

This assembly operates in three modes, which are discussed in the CP-16R Operation and Maintenance Manual.

When "Semi" is selected on S3, the null detect signal from U6 goes

low when a "0" is indicated by the exposure display. This signal is inverted by U7A and reinverted by U7B; however, the signal path stops here. CR4 and R34 assures the servo amplifier and motor won't receive any kind of "turn'on" signal.

When "AUTO" mode is selected the null detect signal via U7A and B is compared by U7C with a power on signal developed by U7D, R35 and CR5. Thus pin 11 of U7C is low only when it is necessary for the iris motor to operate the iris.

Q22 functions as a switch for the power to U8 and the iris motor. This conserves battery power when the iris motor is not being used; for example, when a null ("0") indication is displayed.

U8A and UB8 function as the servo amplifier which drives the iris servo motor, 74-156, only when a null is not detected. Assembly 74-100 produces buffered signals representing T.P."S" and T.P."R" which appear on pins B and D of P1. It is the relative polarity of these pins that controls the direction the motor will turn in the absense of a null signal. If T.P."S" is more positive than T.P."R", pins 6 and 8 of U8 will be more positive than pins 7 and 9. Thus, pin 13 will be more positive than pin 2. This condition will cause the motor to rotate CCW reducing the amount of light reaching the film. In the case of T.P."R" being more positive than T.P."S", pins 7 and 9 of U8 will be more positive than pins 6 and 8. Pin 2 will then be more positive than pin 13, and the motor will turn CW to increase the light reaching the film. In either case when null is reached power to U8 is cut-off by Q3.

When the "AUTO-VIEW" mode is selected all circuits operate as described previously as long as the camera runs. When the camera is turned off, pin 1 of U7D goes low and pin 2 gradually goes from low to high thus pin 3 stays high for a time and then goes low. While pin 3 is high U7C pin 13 is driven high. Since pin 12 is high also pin 11 goes low thus applying power to U8A and U8B via Q3. While pin 3 of U7D is high, pins 6 and 8 are driven positive regardless of light condition. The drives the servo motor CW to full aperture for viewing and focusing. Pin 3 eventually goes low (after 4 sec.) due to the time constant of R39 and C16. This will cut-off power to U8A and U8B and eliminate the drive signal from pin 3 to U7D. As long as the camera is stopped pin 2 of U7D cannot goe low thus preventing pin 11 of U7C from going low which would start the motor. When the camera is started operation as described in the "Auto" section is again established.

CP-16R EXPOSURE CONTROL SYSTEM TEST AND EVALUATION

INTRODUCTION

This Test & Evaluation procedure should be carried out when a malfunction or misalignment is suspected somewhere in the CP-16R Semi Automatic Exposure Control System. This procedure should also be carried out if any assemblies or components in the exposure control system have been replaced. Finally this procedure should be carried out only if all of the following equipment or equivalent is available and well calibrated. All references to FPS dial refer to the exposure control system's FPS dial unless otherwise specified.

EQUIPMENT REQUIRED

1. Light Value Standard (National Camera Comparalumen or equivalent unit to provide 120 foot-Lamberts of brightness.)
2. Lens of known accuracy (focal length approx. 28-30mm).

TEST & EVALUATION PROCEDURE FOR SEMI AUTOMATIC EXPOSURE CONTROL SYSTEMS.

1. Install a battery, lens on CP-16R camera.
2. If the camera has the fully automatic option, the MODE Control should now be set to "SEMI".
3. It is not necessary to have film in the CP-16R but if a magazine is not on the camera the magazine well cover plate should be put in place to prevent stray light from entering.
4. Make sure the mirror shutter is in the viewing position.
5. Using the recommended light source, point the camera lens to the left hand light window. Turn the standard on.
6. The camera's exposure controls should be set as follows: ASA dial to 50, FPS dial to 24.
7. Move the ON-OFF SWITCH to "ON". Let the system stabilize for 1 minute.
8. Set the lens iris to t/5.6. By adjusting the lens iris to either extreme it should be possible to make all lights in the exposure control system to operate sequentially.
9. Adjust the lens to t/5.6 the display as seen in the viewfinder should show "0" now, if the exposure control system is calibrated to factory specifications.

10. The iris should now be adjusted for an indication of "+1". The lens iris should now be at t/4. Set the lens iris for an indication of "-1". The lens iris should now be at t/8.
11. Set the ASA dial to 100 and adjust the lens iris for an "0" indication. The lens should now be at t/8. Set the ASA dial to 25. Readjust the lens iris for "0". The lens should now be at t/4.
12. Reset the lens iris to t/5.6, and the ASA to 50. Set the FPS dial to 36. Adjust the lens iris for a "0" indication. The lens iris should be between t/5.6 and t/4. Set the FPS dial to 12. Adjust the lens iris for "0". The lens iris should now be at t/8. Reset the FPS dial to 24, and lens iris to t/5.6.
13. The display should now show "0" again. Turn the camera motor on and observe the display. The "0" indication should remain. Turn the camera off. This completes the test & evaluation for semi-automatic exposure control systems. For fully automatic cameras continue with the following section.

TEST & EVALUATION PROCEDURE FOR FULLY AUTOMATIC EXPOSURE CONTROL SYSTEMS:

The following is a check of the fully automatic option. All previous functional tests must be OK before correct fully automatic operation is possible. This procedure assumes that the correct bracketry and iris servo motor has been mounted to the lens.

1. Set the mode selector to "AUTO".
2. Point the lens towards the left hand window of the light source. Set the ASA dial to 50 and the FPS dial to 24.
3. The iris motor should rotate the iris control ring of the lens to t/5.6 and then stop.
4. Set the ASA Knob to 100.
5. The iris motor should rotate the iris control ring to t/8.
6. Set the ASA Knob to 25.
7. The iris motor should rotate the iris control ring to t/4.
8. Set to ASA Knob to 50.
9. Set the FPS Knob to 36.
10. The iris motor should rotate the iris control ring to between t/5.6 and t/4.
11. Set the FPS Knob to 12.
12. The iris motor should rotate the iris control ring to t/8.
13. Set the FPS Knob to 24.
14. Set the "MODE" selector to "AUTO-VIEW".
15. Run the camera briefly and turn it off.
16. The iris motor should rotate the iris control ring to maximum aperture and then shut off.
17. Turn the camera on again.
18. The iris motor will now drive the iris control ring to t/5.6 assuming the lens is pointed towards the left hand window of the light source.
19. Repeat steps 2 through 13. The results must be the same as those reached previously.
20. This completes the Test & Evaluation.

CP-16R EXPOSURE SYSTEM MINOR ALIGNMENT

This procedure is to be followed only after perfroming step 9 of the CP-16R Exposure Control System Evaluation if the display, as seen through the viewfinder, does not show "0" at t/5.6 Another possible reason for carrying out this procedure would be reseting the Exposure Control System to match individual requirements or preferences requiring consistant under or over exposure. A much more convenient solution to this problem would be to use the ASA Knob to cause an intentional under or over exposure.

The first determination that must be made is how much correction is necessary or how much intentional over or under exposure is desired.

IMPORTANT: Corrections of more than 1 stop will undermine the potential accuracy of the exposure control system. Therefore do not attempt to correct the system more then 1 stop.

If the result of step 9 in the Exposure Control System Evaluation is a "+1", "+.5", "-.5" or "-1" on the display in the viewfinder then it is possible to make a minor correction. One of the following procedures should then be followed depending on your specific requirements. If the display shows "+" or "-", a minor correction is not possible. The exposure system may require comprehensive alignment and/or repair.

ADJUSTMENT TO FACTORY SPECIFICATIONS

1. Remove the battery.
2. Set controls as follows: ASA = 50, FPS=24 lens iris to t/5.6
3. Remove the camera's top access cover (5 screws)
4. Use a cotton swab dipped in acetone to soften any paint or glyptol on the NULL ADJUSTMENT TRIMPOT ONLY. See figure for location.
5. Install battery. Wait 1 minute for system to stabilize.
6. Use light value standard left hand window (as specified in the Test & Evaluation section). Reduce stray light reaching the lens by working in a low ambient light level. Use a dark lightproof cloth to cover the access opening to the adjustment controls.
7. While looking through the viewfinder adjust the null trimpot for an "0" indication.

8. Use a small amount of enamel paint to seal the adjustment.
9. Replace the camera's top access cover.

ADJUSTMENT TO NON-STANDARD SPECIFICATIONS

1. Follow steps 1 through 6 under ADJUSTMENT TO FACTORY SPECIFICATIONS.
2a. TO UNDER EXPOSE the film, look through the viewfinder and adjust the lens iris until the desired amount of under exposure is shown on the display (for example:"-.5" or "-1").
2b. TO OVER EXPOSE the film, look the viewfinder and adjust the lens iris until the desired amount of overexposure is shown on the display (for example "+.5" or "+1").
3. While looking through the viewfinder adjust the null trimpot for indication of "0".
4. Use a small amount of enamel paint to seal the trimpot adjustment.
5. Replace the camera's top access cover.

This completes the minor alignment. If the system still does not operate normally, comprehensive alignment and/or repair may be necessary. Refer to qualified service personnel for advice on these matters.

COMPREHENSIVE EXPOSURE CONTROL SYSTEM ALIGNMENT PROCEDURE

INTRODUCTION

This procedure provides detailed instructions to calibrate the CP16R Exposure Control System to factory specifications. First, the system will be checked for proper operations of all functions. Then the display module and Hybrid I.C. (74-142) will be evaluated. From this data alignment parameters to be used in the balance of the procedure will be established. After centering all alignment controls, the Light Gain Adjustment will be made to establish proper sensitivity to changes in light. After a preliminary null (calibration) adjustment the system will be set to respond properly to changes in film speed (ASA) and frame rate (FPS) as set by the user. The system is then given a final null (calibration) using a light value standard. After alignment the system will be fully tested and documented.

EQUIPMENT REQUIRED

1. Light value standard (National Camera Comparalumen or equivalent unit to provide 120 foot-Lamberts of brightness)
2. 1 stop Neutral density filter for above.
3. Digital Voltmeter (Fluke 8000A or equivalent)
4. Cinema Products test fixture (74-239) (NOTE: If test fixture 74-239 is not available a dark light proof blanket may be used to prevent stray light from entering the camera through the top access cover.)

DEFINITION OF NULL

Null refers to a reading of 0.000V ± .002V on the digital voltmeter as measured across test points R and S. Polarity of the voltage is not important. Obtaining a null is accomplished by varying the lens iris or the null trimpot as specified in the step by step instructions to reach a voltmeter reading of 0.000V ± .002V.

CAMERA PREPARATION AND BASIC TESTS

1. The camera's Auxillary Side Cover or Crystasound amplifier must be in place.

2. Remove the camera's top access cover plate.

3. Adjust the three screwdriver adjust controls (trim-pots) to mid rotation.

4. Install 74-239 test fixture. Make sure its movable contacts touch test points R and S. (If this fixture is not available use a dark light proof blanket to prevent stray light from entering the camera through the top access opening).

5. Verify that the ASA Knob may be rotated to reach all values from 12 to 400. The Knob may be loosened and repositioned on its shaft using a bristol wrench. (Red lines indicate 25-50-100-200-400).

6. Verify that the FPS Knob may be rotated to reach all seven positions. This Knob has internal indexing to prevent 360° rotation through unused switch positions.

7. Set ASA Knob to 50.

8. Set FPS Knob to 24.

9. Remove the body cavity cap or lens.

10. Install a fully charged NC-4 battery into its channel in the camera.

11. Turn the camera on and off briefly a few times to verify that the stopping position of the mirror shutter is correct. If the shutter consistantly stops in the wrong position, the shutter positioning flag (70-629) must be correctly positioned to prevent exposure control system alignment errors and operational problems.(Refer to CP-16R Technical Manual for correct positioning of the flag.)

12. Be sure fiber optics viewing screen is clean. (The Operation & Maintenance Manual has instructions for cleaning the fiber optic viewing screen on pg. 21)

13. Switch the exposure control system on and allow 1 minute for the system to stabilize.

14. Install a lens known to be accurate with respect to its t/stop markings.

15. Turn on the light source. Point the camera towards the left hand window if the Comparalumen is used. Reduce ambient stray light to minimum by working in subdued lighting.

16. Adjust the lens iris to obtain a "0" reading as seen in the viewfinder.

17. Verify the operation of the "+.5", "+1" and "+" indicators by adjusting the lens iris towards numerically smaller t/stops. "0" and "+.5", should operate simultaneously between "0" and "+.5" exclusive indications. "+1" and "+" indicators operate one at a time.

18. Similarly adjust the lens iris toward numerically larger t/stops

and verify the operation of "0", "-.5", "-1", and "-". These indicators operate in the same manner as outlined in step 17.

19. Return the lens iris to a position that gives a "0" indication.

20. Rotate the ASA Knob and verify that increasing the numerical ASA value causes some or all of the "+" indicators ("+.5", "+1" or "+") to light sequentially.

21. Return the ASA Knob to 50.

22. Rotate the FPS Knob to 12 and verify that some "+" indicators light sequentially.

23. Return the FPS Knob to 24.

24. Adjust the lens iris to a position that gives a "0" indication.

25. While looking through the viewfinder, turn the camera on. Observe that when the camera is operating in sync (out-of-sync lamp "S" not lit) at any speed, the "0" indication remains on. This verifies operation of the strobe circuit. Turn the camera off.

26. Test the voltage regulator and voltage divider by measuring between test point R and ground. This reading is to be 6.00V ± .30V.

27. This concludes the camera preparation and basic testing.

DERIVING THE "MEAN" AND "MEAN RANGE."

The MEAN and MEAN RANGE are values that are mathematically determined from exposure control system measurements. These measurements form the specifications which the exposure control system must meet throughout the alignment procedure. The MEAN and MEAN RANGE are different for every camera.

1. Install a battery and lens onto the camera.
2. Set ASA = 50.
3. Set FPS = 24.
4. Connect "+" lead of digital voltmeter to test point R and "-" lead to test point S. Use the 2 volt scale.
5. Adjust the lens iris to obtain a null reading .
6. While looking through the viewfinder adjust the lens <u>slowly</u> towards numerically smaller t/stop numbers. Note the reading shown on the voltmeter when "+1" <u>just</u> comes on. Record this reading on the test sheet on the line called +1: _____*
7. Similarly adjust the lens towards numerically larger t/stop numbers. Note the reading shown on the voltmeter when "-1" <u>just</u> comes on. Record this reading on the line called -1: _____

*Sample Test Sheet on Page 20.

8. These readings must be within the range of 215mV to 265mV. If these specs are not met the Hybrid I.C. should be replaced.
9. Calculate the MEAN by averaging these two readings . Example: If "+1" equals 238mV and "-1" equals 248mV, then the MEAN is $\frac{248 + 238}{2}$ = 243mV.
10. Calculate the upper MEAN RANGE adding 5% to the MEAN. Example: 243mV + 5% = 255mV.
11. Calculate the lower MEAN RANGE by subtracting 5% from the MEAN. Example: 243mV -5% = 231mV.
12. Thus the MEAN RANGE for this example only is 231mV to 255mV. Enter this on the test sheet. Of course the MEAN RANGE will be different for every camera.
13. This MEAN RANGE must be within the BOUNDARIES of 205mV to 275mV. If the MEAN RANGE exceeds one or both of these BOUNDARIES, the Hybrid IC must be replaced.
14. The MEAN and MEAN RANGE are now the specifications of the Display assembly to which the rest of the system will be adjusted.

LIGHT GAIN ADJUSTMENT PROCEDURE

I This procedure corrects the system's light gain to match the voltage response of the display assembly. To accomplish this, the 1 stop filter will alternately be removed and replaced in the light standard. Then appropriate adjustments will be made to the light gain trimpot to meet the MEAN and MEAN RANGE parameters already set. This procedure should be repeated many times to obtain the specifications. Do not expect to meet the specifications after only 1 or 2 repetitions.

II The specifications to be met are as follows: The voltage readings in steps 9 and 13 are to be equal to the MEAN. If this cannot be accomplished (which is the case many times) the readings in steps 9 and 13 must be within MEAN RANGE. It is preferrable, but not essential, that the readings be between the MEAN and the numerically larger limit of the MEAN RANGE.

1. Insert the 1 stop filter into the light source.
2. Set ASA = 50.
3. Set FPS = 24.
4. Rotate the lens iris to obtain a null.
5. Remove the filter.
6. Turn the light gain trimpot CCW just far enough to obtain a "+1" indication in the viewfinder. If necessary start from a full **CW position** because you must be turning the trimpot CCW to see the "+1" just turn on after the "+.5" goes out.
7. Adjust the lens iris to obtain a null.
8. Insert the one stop filter into the light source.
9. Read the voltmeter.
10. If the voltmeter reading is less than the MEAN, adjust the light gain trimpot CCW a small amount. If the voltmeter

reads more than the MEAN, adjust the light gain trimpot CW a small amount. In either case, ignore the voltmeter reading following the adjustment. The results of this adjustment will be seen when step 9 is repeated. In case the voltmeter reading is at the MEAN no adjustment is necessary at this time. In any case continue with step 11.

11. Adjust the lens iris to obtain a null.
12. Remove the 1 stop filter from the light source.
13. Read the voltmeter.
14. If the voltmeter reads less than the MEAN, turn the light gain trimpot CCW a small amount. If the voltmeter reads more than the MEAN turn the light gain trimpot CW a small amount. In either case ignore the voltmeter following the adjustment. The results of this adjustment will be seen when step 13 is repeated. If the voltmeter is at the MEAN no adjustment is necessary at this time. In any case continue to step 15.
15. Repeat steps 7 through 14 until specifications outlined in paragraph II under Light Gain Adjustment Procedure are met. If the specifications are met, continue with the PRELIMINARY NULL.

PRELIMINARY NULL

The preliminary null is done at this time because the light gain trimpot and null trimpot are somewhat interactive.

1. Set ASA = 50.
2. Set FPS = 24.
3. Lens iris to t/5.6.
4. Make sure no filter is in the light source and the viewfinder dowser is closed.
5. Read the voltmeter.Record or remember the reading, it will be important in step 7.
6. Adjust the null trimpot to obtain a null reading.
7. If the voltmeter reading in Step 5 was greater than half of the MEAN, Steps 7 through 15 in the light gain adjustment procedure should be repeated and any necessary adjustments made. If steps 7 through 15 were repeated, repeat steps 1 through 7 in this section until the reading in step 5 of this section is less than half of the' MEAN. If the READING was less than half of the MEAN continue with the ASA/FPS GAIN ADJUSTMENT PROCEDURE.

ASA/FPS GAIN ADJUSTMENT PROCEDURE

I. This procedure corrects the system's response to changes of film speed (ASA) or frame rate (FPS) to match the voltage response of the display assembly. To accomplish this the ASA Knob will be moved alternately between 100 and 50. Then appropriate adjustments to the ASA/FPS gain trimpot will be made to meet the MEAN and MEAN RANGE parameters already set.

This procedure should be repeated many times to obtain the specifications. Do not expect to meet the specifications after only 1 or 2 repetitions. Make sure no filter is in the light source and that the viewfinder dowser is closed.

II. The specifications to be met are as follows: The voltage readings in steps 9 and 13 are to be equal to the MEAN. If this cannot be accomplished (which is the case many times) the readings in steps 9 and 13 must be within the MEAN RANGE. It is preferrable, but not essential that the readings be between the MEAN and the numerically larger limit of the MEAN RANGE. All references to FPS Knob in this section are referring to the FPS Knob on the ASA/FPS Exposure Control System Control Panel, not the camera's speed control Knob.

1. Set ASA Knob to 100.
2. Set FPS Knob to 24.
3. Set the ASA/FPS gain trimpot to its full CW position.
4. Rotate the lens iris to obtain a null.
5. Set the ASA Knob to 50.
6. Adjust the ASA/FPS trimpot CCW to obtain a voltmeter reading equal to the MEAN.
7. Adjust the lens iris to obtain a null.
8. Set the ASA Knob to 100.
9. Read the voltmeter.
10. If the voltmeter reads less than the MEAN adjust the ASA/FPS trimpot CCW a small amount. If the voltmeter reads more than the MEAN, adjust the ASA/FPS trimpot CW a small amount. In either case ignore the voltmeter following the adjustment. The results of this adjustment will be seen when step 9 is repeated. In case the voltmeter is at the MEAN, no adjustment is necessary at this time. In any case continue with step 11.
11. Adjust the lens iris to obtain a null.
12. Set ASA Knob to 50.
13. Read the voltmeter.
14. If the voltmeter reads less than the MEAN adjust the ASA/FPS trimpot CCW a small amount. If the voltmeter reads more than the MEAN adjust the trimpot CW a small amount. In either case ignore the voltmeter following the adjustment. The results of the adjustment will be seen when Step 13 is repeated. In case the voltmeter reading is at the MEAN, no adjustment is necessary at this time. In any case continue with Step 15.
15. Repeat steps 7 through 15 until voltage readings in steps 9 & 13 meet the specifications outlined in Paragraph II under ASA/FPS GAIN ADJUSTMENT PROCEDURE.
16. Rotate the lens iris to obtain a null.
17. Set FPS Knob to 12.
18. Read the voltmeter.
19. A reading between the MEAN and 300mV is normal. If so continue with step 20. A "+1" should be seen in the viewfinder. If a smaller reading is necessary turn the ASA/FPS trimpot CCW a small amount. Since adjusting the ASA/FPS trimpot will affect the adjustments made in steps 7 through 15 a possible alternative for lowering the reading in step 18 would be to change the 200K 1/8w resistor in the ASA/FPS Control Assembly (74-101) to 220K 1/8w or 240K 1/8w. This will necessitate repeating steps 1 through 19 in the ASA/FPS GAIN ADJUSTMENT PROCEDURE.

20. Set the FPS Knob to 36.
21. Read the voltmeter.
22. A reading between half of the MEAN and 150mV is normal. The "-.5" should be seen in the viewfinder. If this reading is over 150mV see recommendations in step 19.
23. The following table gives approx. voltmeter readings and display indications for other FPS positions.

FPS" POSITION	DISPLAY			VOLTAGE READING
36	-.5			See step 22
32	-.5	0		Approx. 2/3 of voltage in step 22
28	-.5	0		Approx. 1/3 of voltage in step 22
24		0		Null
20		0	+.5	Approx. 1/3 of voltage in step 19
16			+.5	Approx. 2/3 of voltage in step 19
12			+1	See step 19

24. If the specifications of paragraph II, step 19 & 22 cannot all be met, use a compromise setting of the ASA/FPS trimpot. The compromise setting should favor the accuracy of the ASA Knob (steps 1 through 15) rather than the FPS Knob (Steps 19, 22, and 23). If the specifications are met continue the FINAL NULL ADJUSTMENT.

FINAL NULL ADJUSTMENT

1. Set ASA Knob to 50.
2. Set FPS Knob to 24.
3. Set lens iris to t/5.6.
4. Make sure no filter is in the light source and the viewfinder dowser is closed.
5. If the camera has a TVT 144° shutter set ASA Knob to midway between 50 and 64. If in doubt about the shutter opening, contact the factory.
6. Read the voltmeter. Record or remember the reading.
7. If the reading is less than the MEAN continue to step 8. If this reading is more than the MEAN, the Light Gain Adjustment procedure must be repeated until the reading in step 6 is less than the MEAN. If the Light Gain Adjustment Procedure is repeated ASA/FPS Gain Adjustment Procedure should be repeated also. However, it is not likely any adjustments to the ASA/FPS Gain trimpot will be necessary.
8. Adjust the null trimpot for a null reading.
9. The alignment procedure is now completed.

ALIGNMENT EVALUATION and DOCUMENTATION

1. Set ASA Knob to 50.
2. Set FPS Knob to 24.
3. Adjust lens iris to t/22.
4. Read the voltmeter.
5. Record this voltage reading on the line t/22: _____.
6. Repeat steps 3,4, and 5 for the other t/stops on the lens.
7. The differences between all adjacent readings (for example:t/16 and t/11) should be added and then averaged.
8. This average should be within the MEAN RANGE or less than 5% greater.
9. Set the lens iris to t/5.6.
10. Set ASA Knob to 400.
11. Read the voltmeter.
12. Record this reading on the line 400: _____.
13. Repeat steps 10, 11, and 12 for ASA values of 200, 100, 50, 25, & 12.
14. Calculate the differences between adjacent readings (for example: ASA 400-ASA 200), add these differences and then average.
15. This average should be within the MEAN RANGE or less than 5% greater.
16. Set the ASA Knob to 50.
17. Set the FPS Knob to 36.
18. Read the voltmeter.
19. Record this reading on line 36: _____.
20. Repeat steps 17, 18, and 19 for all other FPS positions.
21. Calculate the differences between adjacent FPS readings (for example: 24 FPS-20 FPS).
22. Add the differences for 36-32, 32-28 and 28-24 FPS.
23. This sum should be between 1/2 of the MEAN and 150mV.
24. Add the differences between 24-20, 20-16, and 16-12 FPS.
25. This sum should be between the MEAN and 300mV.
26. This completes the Alignment Evaluation and Documentation.
27. Temporarily remove the camera battery.
28. Remove the test fixture from the top of the camera.
29. Loosen, but do not remove, the 3 screws holding the display assembly.
30. Replace the camera battery.
31. Slightly adjust the display board while looking through the viewfinder for best focus and centering relative to the viewing screen.
32. Remove the camera battery.
33. Tighten the 3 screws.
34. Use quick drying enamel paint to seal the 3 trimpots and the 3 mounting screws for the display assembly.
35. Replace the cameras top access cover.
36. Remove the lens.
37. Replace the camera's lens mount dust cover.
38. This completes the comprehensive alignment of the exposure control system.

39. If the camera has the optional fully automatic iris control and servo motor, see the checkout procedure found elsewhere in this manual. No alignment or calibration is necessary.

CINEMA PRODUCTS
EXPOSURE SYSTEM CHECKOUT

NOTE: In all tests, "+" lead to T.P. "R", "-" lead to T.P. "S".
All readings are in m V.D.C.

CAMERA # SAMPLE Technician MSP
HYBRID: "+1" 238 "-1" 248
MEAN = 243 Range 231 - 255

t - Stops:	Reading	Difference
t/22 =	1018	
		252
t/16 =	766	
		274
t/11 =	492	
		213
t/8 =	279	
		279
t/5.6 =	0	
		255
t/4 =	255	
		238
t/2.8=	493	
		225
t/2 =	718	
TOTAL =	1736 ÷ 7 =	248

ASA:	Reading	Difference
400 =	753	
		270
200 =	483	
		241
100 =	242	
		242
50 =	0	
		242
25 =	242	
		213
12 =	455	
TOTAL =	1208 ÷ 5 =	242

FRAME RATE:	Reading	Difference	Total
36 fps =	132		
		45	
32 fps =	87		
		43	132
28 fps =	44		
		44	
24 fps =	0		
		102	
20 fps =	102		275
		86	
16 fps =	188		
		87	
12 fps =	275		

CAMERA # _____ Technician _____
HYBRID: "+1" _____ "-1" _____
MEAN = _____ Range _____

t - Stops:	Reading	Difference
t/22 =		
t/16 =		
t/11 =		
t/8 =		
t/5.6 =		
t/4 =		
t/2.8=		
t/2 =		
TOTAL =	÷ 7 =	

ASA:	Reading	Difference
400 =		
200 =		
100 =		
50 =		
25 =		
12 =		
TOTAL =	÷ 5 =	

FRAME RATE:	Reading	Difference	Total
36 fps =			
32 fps =			
28 fps =			
24 fps =			
20 fps =			
16 fps =			
12 fps =			

CP-16R EXPOSURE CONTROL SYSTEM
KEY VOLTAGE READINGS

Due to the System's unique design and application, some voltages are somewhat meaningless and/or inaccessable for measuring. The voltages provided here should be adequate for trouble shooting. All voltages are measured using a 10 meg-ohm input D.C. voltmeter (digital or conventional) Minus (-) lead grounded. Controls are as follows:

ASA = 50
FPS = 24
Power Switch in "ON" position
Mode Switch in "SEMI" position
Light Conditions adjusted so an "0" indication is seen in the viewfinder. Most voltages vary with light conditions.
Camera is not running, reflex mirror/shutter in viewing position.

Voltages which are meaningless or inaccessable are marked ( ).

Voltages marked * are D.C. when the camera is stopped and a 24Hz or 25Hz pulse when the camera is running.

74-100, Light Meter Display Assembly

U4:
Pin #1 = 5.57
#2 = ( )
#3 = 7.79
#4 = 0
#5 = 5.55
#6 = 5.55
#7 = 5.55
#8 =11.80
T.P."S" = 5.86
T.P."P" =11.68
Red Pin Plug = 11.80
Black Pin Plug = 0
White Pin Plug = Depends on alignment and individual components. Normal Range 7.5 - 8.5 Voltage increased with increasing light.

U5:
Pin #1 = 6.05
#2 = 5.86
#3 = 5.86
#4 = 0
#5 = 5.86
#6 = 5.86
#7 = 5.86
#8 =11.80
T.P."R" = 5.86

U6:
Pin #1 = ( )
#2 = ( )
#3 = ( )
#4 = ( )
#5 = ( )
#6 = ( )
#7 = ( )
#8 = 0
#9 = NC
#10 = 5.86
#11 = 5.86
#12 = 0.30
#13 =11.80
#14 = 3.78

74-187, Sensor Assembly.

Blu Pin Plug = ( )
Brn Pin Plug = ~7.00 ± 5%

74-102, Junction Assembly

J1:
Pin #A = 11.68
#B = 6.05
#C = 0.30
#D = 5.86
#E = 0
#F = 0
#G = 11.80

J2:
Pin #1 = 20.
#2 = 11.80
#3 = 20.
#4 = 6.21
#5 = 0

J3
Pin #1 = 5.86
#2 = 11.80
#3 = 6.21
#4 = 6.05
#5 = 0.30
*#6 = 11.68
#7 = 0

CP-16R EXPOSURE CONTROL SYSTEM MANUAL
ASSEMBLY REMOVAL AND REPLACEMENT INSTRUCTIONS.

To remove any assembly, it is first necessary to remove the camera's auxillary side cover or amplifier. After replacing any assembly follow exposure control system test and evaluation procedure found elsewhere in this manual.

DISPLAY ASSEMBLY, 74-100

To Remove:

1. Disconnect the 7 contact gold plug at Junction Assembly, 74-102, by loosening the locking collar and pulling the plug out by grasping the plug body, not the wire.
2. Remove the camera's top access cover. This cover fits tightly so push from the inside rather than prying from the outside.
3. Remove the three small wires (red, white and black) by pulling straight up on the pin plugs.
4. Remove three screws indicated in diagram 74-100.
5. Pull the Display Assembly straight up gently.

To Replace:

1. Reverse above procedure noting that when tightening the screws removed in step 3, some adjustment of the circuit board is possible for best focus and centering of the LEDS visible in the viewfinder.
2. Use case so that the wire going to the Junction Assembly does not interfere with any moving parts.

SENSOR PREAMP ASSEMBLY, 74-170

To Remove:

1. Remove Display Assembly, 74-100.
2. In the lens bore ("gear box" or "rotary mirror housing") unplug the blue and brown pin plugs from the Sensor Assembly, 74-187, pulling straight out gently using long nose pliers.
3. Remove the 2 black 6-32 socket head screws holding viewfinder tube in the camera.
4. Do not twist the viewfinder tube. Pull it straight out of the camera body.
5. Remove 2 screws holding pre-amp assembly in place.
6. Remove the assembly.

To Replace:

1. Reverse the above procedure.

ASA/FPS LIGHT METER CONTROL ASSEMBLY, 74-101

To Remove:

1. Remove the 7 contact gold plug at Junction Assembly, 74-102,

by loosening the locking-collar and then pulling the plug out by the plug body, not the wire.
2. Remove the 5 contact plug connecting the light meter control panel with the Junction Assembly by pulling it straight out evenly.
3. Remove the 5 screws holding the assembly from outside the camera body.
4. Remove the assembly.

To Replace:

1. Reverse the above procedure.

FULLY AUTOMATIC IRIS CONTROL, 74-103

To Remove:

1. Remove the 7 contact gold plug at Junction Assembly, 74-102, by loosening the locking collar and then pulling the plug out by the plug body, not the wire.
2. Remove the 5 contact plug connecting the light meter control panel with the Junction Assembly by pulling it straight out evenly.
3. Remove the green 7 contact plug. Use long nose pliers and pull evenly but gently on the exposed studs. Do not pull on the cable or small wires.
4. Remove the 4 screws holding the control panel of the Iris Control Assembly.
5. Carefully remove the unit by pulling the green plug past the foam block. (It may be necessary to cut the block loose and reglue it upon replacement of the assembly.)

To Replace:

1. Reverse the above procedure.

JUNCTION ASSEMBLY, 74-102

To Remove:

1. Follow steps 1, 2, and 3 from the preceding procedure.
2. Remove two flat head screws holding the assembly from outside the camera body.
3. Pull the assembly out of the camera body.
4. Unsolder the 4 wires that connect to the wiring harness. Note the location and colors of the wires for easy replacement.
5. Remove the assembly.

To Replace:

1. Reverse the above procedure.
2. Be very careful that none of the small wires interfere with any moving parts such as the large gear. Be cautious of pinching any wires.

SENSOR ASSEMBLY, 74-187

To Remove:

1. Unplug the blue and brown wires by pulling the attached pin plugs straight out using long nose pliers.
2. Remove only the 2 small upper screws which go through the circuit board. It is important not to distrub the other two (painted) small screws. If these are removed the minor re-alignment procedure must be followed.
3. Remove the assembly.

To Replace:

1. Reverse the above procedure.

CP-16R EXPOSURE CONTROL SYSTEM PARTS LIST

To order replacement parts, please reference the part number, description, and price as listed. Part numbers and/or descriptions in parentheses ( ) denote alternate value or application as specified. Prices are FOB, Los Angeles and are subject to change. All resistors, 1/8w, 5%.

Reference Drawing: 74-101, Light Meter Control Assembly

KEY #	PART #	QTY	DESCRIPTION	LIST PRICE EACH
R24	74-145	1	Potentiometer, 20K, ASA	32.00
S1	SWT-076900	1	Switch, slide, ON-OFF	4.00
P2	74-134-2	1	Connector Assembly	10.00
--	MSC-098800	5	Connector plug, 3203-3-03, (part of P.2)	.75
--	CBL-015100	6"	Cable, 4 conductor, shielded, (used on P.2)	2.50/ft.
--	70-986	1	Gasket	.75
--	74-113	1	Control panel	48.00
--	74-143	1	Dress panel	7.50
--	74-144	1	Stop washer	1.00
--	74-190	1	Dial, ASA	5.00
--	74-191	1	Dial, FPS	5.00
--	MSC-082400	1	O-Ring, 000-6	.50

Reference Drawing: 74-102, Junction Assembly

R22,R23	RES-056500	2	Resistor, 100K	.50
C12	CAP-022800	1	Capacitor, 2.2mf,35v, T330A225K035AS	2.25
C13	CAP-023300	1	Capacitor, 4.7mf,25v, T330A475K025AS	2.25
Q2	SMC-063300	1	Transistor, 2N5088	2.20
VR1	SMC-071650	1	Voltage regulator, 12v, 7812UC	10.00
J1	CON-032550	1	Connector, SRE-7S-N	12.50
J2	MSC-096450	5	Connector, Jack, 450-3394-02-03	1.20
J3	CON-033500	1	Connector, ER-7S-6	18.00
--	74-127	1	Mount, Connector	12.00
--	74-128	1	Mount, Assembly	19.00

Reference Drawing: 74-104, Photo-Cell AMP Assembly

Top Assembly: 74-100

R7	RES-050950	1	Resistor, 2.7K	.50
R8	POT-042800	1	Potentiometer, 500Ω, NULL, 62PR500	6.00
R9,R10				
R14,R19	RES-053600	4	Resistor, 10K	.50
R11	RES-055300	1	Resistor, 33K	.50
R12,R21	RES-056500	2	Resistor, 100K	.50
R13	POT-041150	1	Potentiometer, 100K, Light gain, 62PR100K	6.00
R15,R17	RES-045900	2	Resistor, 100Ω	.50
R18	RES-059900	1	Resistor, 10MEG	.50
R20	POT-042175	1	Potentiometer, 25K, ASA/FPS Gain 62PR25K	6.00

KEY #	PART #	QTY	DESCRIPTION	LIST PRICE EACH
C6	CAP-021750	1	Capacitor, .1mf, 50v, T330A104K050AS	2.25
C7	CAP-019000	1	Capacitor, .0047mf, 50v, CK05BX472K	2.00
C8,C11	CAP-023600	2	Capacitor, 8.2mf, 15v, T330A825K015AS	2.25
C9	CAP-023300	1	Capacitor, 4.7mf, 25v, T330A475K025AS	2.25
C10	CAP-022200	1	Capacitor, .33mf, 50v. T330A334K050AS	2.25
Q1	SMC-060400	1	Transistor, FET, MFE-3002	8.00
U4,U5	SMC-068800	2	I.C., Dual OP-AMP, MC-1458-CPI	5.00
CR1	SMC-064200	1	Diode, IN4148	1.00
P3	31-165	1	Cable Assembly	55.00
--	74-148	1	Connector, circuit board	12.50
--	MSC-090600	3	Connector jack,3703-01-03	.75

Reference Drawing: 74-105, LED Display Assembly

Top Assembly: 74-100

R16	RES-049400	1	Resistor, 1K	.50
R48	RES-050400	1	Resistor, 1.8K	.50
U6	74-142	1	I.C., Hybrid	75.00
CR2, CR3	SMC-064200	2	Diode, IN4148	1.00
LED1-11	SMC-063500	11	LED,RED, 5082-4101	2.00
LED1-11	(SSL-212)	11	(LED,RED, Early Version)	5.00
J5	MSC-090600	5	Connector jack	.75
--	74-137	1	Photo mask	3.50
--	74-205	1	Holder, LED	16.00
--	(74-150)	1	(Holder, LED, Early Version)	50.00
--	74-209	1	Mask	16.00
--	(74-151)	1	(Mask, Early Version)	18.00
--	(74-185)	1	(Spacer, Early Version)	16.00

Reference Drawing: 74-120 Amplifier Board, Iris Servo

Top Assembly: 74-103

R41,R43, R45,R46	RES-055600	4	Resistor, 47K	.50
R42,R44	RES-059300	2	Resistor, 1MEG	.50
C18,C21	CAP-020500	2	Capacitor, .022mf, 50v, CK05BX223K	2.75
C19	CAP-020700	1	Capacitor, .033mf, 50v, CK05BX333K	2.75
C20	CAP-023600	1	Capacitor, 8.2mf, 15v, T330A825K015AS	2.75
U8	SMC-067050	1	I.C., Dual Power AMP,ULN2277P	15.00
--	CON-034750	1	Connector plug, 460-3202-02-03	.75
--	MSC-090600	1	Connector jack, 3703-01-03	.75

Reference Drawing: 74-121 Control Board, Iris Servo

Top Assembly: 74-103

R18	RES-054700	1	Resistor, 22K	.50
R33,R39	RES-059300	2	Resistor, 1MEG	.50

KEY #	PART #	QTY	DESCRIPTION	LIST PRICE EACH
R34,R35	RES-056500	2	Resistor, 100K	.50
R36,R47	RES-058350	2	Resistor, 470K	.50
R37	RES-049400	1	Resistor, 1K	.50
R40	RES-053600	1	Resistor, 10K	.50
C14	CAP-022550	1	Capacitor, 1.0mf, 50v, T330A105K035AS	2.25
C15	CAP-023600	1	Capacitor, 8.2mf, 15v, T330A825K015AS	2.25
C16	CAP-023300	1	Capacitor, 4.7mf, 25v, T330A475K025AS	2.25
C17	CAP-021050	1	Capacitor, .047mf, 50v, CK05BX473K	1.75
Q3	SMC-063000	1	Transistor, MPS-A65	2.00
U7	SMC-060200	1	I.C., CD-4001AE, Quad Nor	3.60
CR4-CR9	SMC-064200	6	Diode, IN4148	1.00
S3	SWT-077600	1	Switch, Rotary, 30-808-050 MODE	8.50
P1	CON-032510	1	Connector, SRE-7P-N	12.50
--	MS-7	A/R	Cable, 7 conductor, shielded	4.00/ft.
--	MSC-106225	4	Stand-Off, 350-2188-09-07	.75
--	MSC-090470	1	Grommet, GOB-2101	.75
--	MSC-090460	1	Solder Terminal, #101	.25
Reference Drawing:	None (Final Assembly of 74-103 Iris Servo)			
--	74-195	1	Dress panel	24.00
--	74-109	1	Rear cover	18.00
--	74-196	3	Stand Off	1.50
--	70-598	1	Knob	15.00
--	74-116	1	Panel	25.00
J4	CON-035500	1	Connector, RA0304NYL, Motor	13.00
--	CON-034750	1	Connector plug, 460-3202-02-03	1.20
--	MSC-096450	1	Connector jack, 450-3394-02-03	.75
Reference Drawing:	31-114 Iris Control Motor Assembly			
Top Assembly:	74-156			
--	CON-035500	1	Connector, RA0304NYL	13.00
--	MOT-039830	1	Motor 050/0055/05/3/1670:1	85.00
--	MOT-039840	1	Gear box 050/0055/05/3/1670:1	40.00
--	31-115	1	Clamp, Motor, Eccentric	30.00
--	31-139	1	End bell	25.00
--	31-140	1	Clutch face, Inner	36.00
--	31-141	1	Pinion	45.00
--	31-142	1	Clutch face, Outer	18.00
--	31-143-1	A/R	Shim, .005"	.75
--	31-143-2	A/R	Shim, .010"	.75
--	31-143-3	A/R	Shim, .025"	.75
--	31-144	2	Clutch washer	.75
--	31-145	3	Clutch key	4.50
--	31-146	1	Connector housing	25.00
--	31-148	1	Cap	10.00
--	31-180	1	Neoprene seal	1.50
--	31-179	1	Foam cushion	1.50
--	31-178	1	Shield, Lead	2.00
--	70-088	1	Logo	.85
--	74-153	1	Motor housing	34.00
--	74-154	1	Key	15.00
--	74-155	1	Drive spindle	65.00
--	MSC-082750	1	Spring washer, F1004-007	.75
--	MSC-102700	1	Retaining ring, 5304-25	.75

Reference Drawing: 74-174 ASA/FPS Board Assembly

Top Assembly: 74-101

KEY #	PART #	QTY	DESCRIPTION	LIST PRICE EACH
R25,R26, R27	RES-051500	3	Resistor, 3.6K	.50
R28,R29, R30	RES-050400	3	Resistor, 1.8K	.50
R31	RES-057100	1	Resistor, 200K	.50
R31	(RES-057200)	1	(Resistor, 220K)	.50
R31	(NPN)	1	(Resistor, 240K)	.50
R32	RES-056050	1	Resistor, 68K	.50
S2	SWT-077600	1	Switch, Rotary, 30-808-050, FPS	8.50

Reference Drawing: 74-186 Beam Splitter Mount Assembly

--	70-624	2	Rail, ground glass	5.00
--	74-175	1	Mount, beam splitter	85.00
--	74-178	1	Frame, field lens	35.00
--	74-225	1	Frame, fiber optics	20.00
--	74-187	1	Detector assembly	125.00
--	74-188	1	Beamsplitter assembly	100.00
--	74-189	1	Field lens assembly	90.00

Reference Drawing: 74-187 Detector Assembly

Top Assembly: 74-186

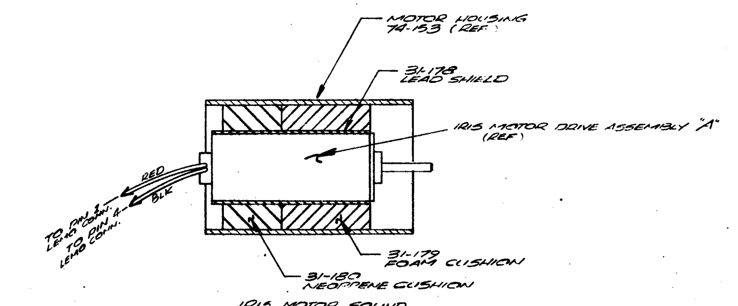
D1	SMC-061550	1	Light sensor, Silicon, BPW-15	15.00
--	MSC-090600	2	Connector jack	.75
--	74-182	1	Holder	34.00
--	74-183	1	Retainer	8.00
--	74-211	2	Pin	3.00
--	74-212	2	Spring	4.50
--	MSC-081950	1	Lens, 5 x 5.6mm, 11.0005	15.00
--	74-172	1	Sensor board assembly	48.00

Reference Drawing: 74-170 Preamp Assembly

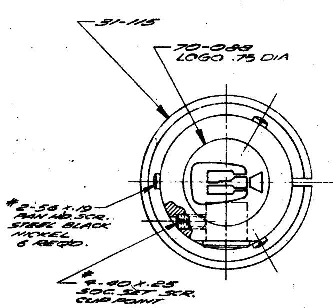
R1	RES-052100	1	Resistor, 4.7k	.50
R2	RES-052750	1	Resistor, 6.8k	.50
R3, R4	RES-059900	2	Resistor, 10MEG	.50
R5	RES-055600	1	Resistor, 47k	.50
R6	RES-057100	1	Resistor, 200k	.50
C1	CAP-022800	1	Capacitor, 2.2MF, T330A225K035AS	2.25
C2	CAP-017400	1	Capacitor, 100PF, DD101	.75
C3, C4	CAP-020500	2	Capacitor, .022MF, CK05BX223K	2.25
C5	CAP-018500	1	Capacitor, .0022MF, CK05BX222K	2.75
U1, U2	SMC-067160	2	I.C., LM308AN	20.00
U3	SMC-069970	1	I.C., 726HC	20.00
--	CON-035375	5	Connector Plug, 460-3202-01-03	1.20
--	74-152	1	Bracket	12.00

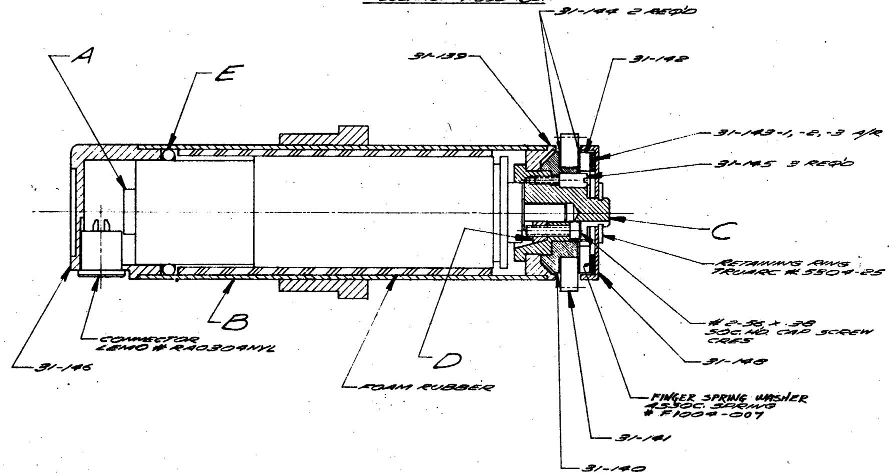
31-114 H

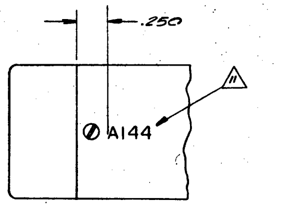
LET.	CHANGE	DATE
B	REDRAWN	6-19-74
C	[illegible]	10-[illegible]
D	SEE ECO	[illegible]
E	SEE ECO	[illegible]
F	SEE ECO	[illegible]
G	SEE ECO	[illegible]
H	SEE ECO	[illegible]



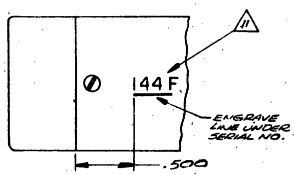
IRIS MOTOR SOUND INSULATION ASSEMBLY







IRIS MOTOR



J-5 ZOOM MOTOR

11 ENGRAVE SERIAL # FOLLOWED BY (SEE TABLE) ON SIDE OF HOUSING USING 8 PT. HIGH CHARACTERS.

10. SELECT SHIMS FROM 31-143-1, 2, 3 AND COMPLETE ASSY.

9. FROM THIS CALCULATE SHIMMING REQD AS FOLLOWS;
   SHIM THICKNESS IN .001 = ADDITIONAL TORQUE REQD / .66

8. MEASURE OUTPUT TORQUE AND SUBTRACT FROM 20 OZ-IN. (FOR 74-156)

7. ASSEMBLE REMAINDER OF PARTS LEAVING OUT 31-143-1, 2, 3

6. ASSEMBLE 31-139, 31-140 AND 31-145 THEN POSITION 31-137 OR 74-155 AXIALLY SO THAT MOTOR TURNS FREELY AND TIGHTEN SCREW IN 31-137 OR 74-155. CEMENT "O" RING OR NEOPRENE TO MOTOR AND HOUSING USING PERMABOND.

5. PLACE 31-137 OR 74-155 ON MOTOR SHAFT.

4. ASSEMBLE PARTS #31-137 AND 31-138 OR 74-155 AND 74-154 LOOSELY USING #2-56 x .38 CAP SCR.

3. WRAP FOAM RUBBER AROUND MOTOR AND SLIP INTO HOUSING 31-147 OR 74-153 FACE OF MOTOR SHOULD BE .38 BELOW FACE OF HOUSING. (USE FOAM NO. 31-179 ON IRIS MOTOR.

2. PLACE "O" RING #2-211 N219-70 ON MOTOR 31-151 OR 31-166. (USE NEOPRENE (31-180) AND PERMBOND ON IRIS CONTROL MOTOR)

1. WRAP LEAD SHIELD NO. 31-178 OVER MOTOR (IRIS MOTOR ONLY) AND TAPE IN PLACE

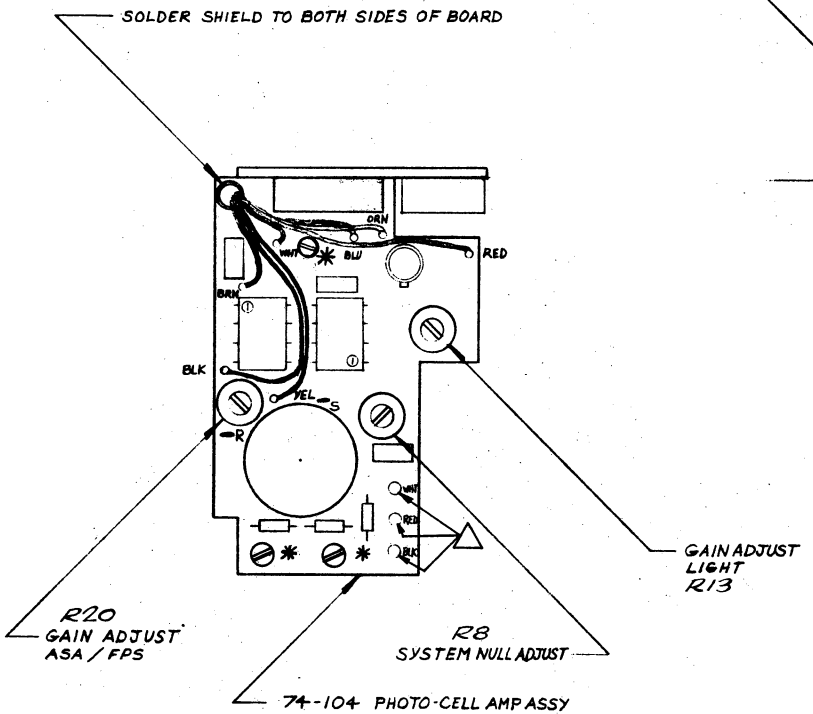
ACCEPTABLE NOISE LEVEL	TORQUE @ 8 V.D.C.	A.P.L.	SERIAL NO. FOLLOWED BY LETTER	USEAGE	A DRIVE ASSEMBLY	B MOTOR HOUSING	C DRIVE SPINDLE	D KEY	E SEAL
27 DB @ 8 V.D.C.	18 / 24	31-114	F	J5 ZOOM MOTOR HIGH SPEED	31-151	31-147	31-137	31-138	PARKER O-RING 2-117 N219-70
27 DB @ 8 V.D.C.	18 / 24	31-167	S	J5 ZOOM MOTOR LOW SPEED	31-166	31-147	31-137	31-138	PARKER O-RING 2-117 N219-70
27 DB @ 4 V.D.C.	12 / 16	74-156	"A" PRECEDES SERIAL NO.	IRIS CONTROL MOTOR	050/0055 + 05/3 1670:1 MOTOR AND GEAR HD	74-153	74-155	74-154	NEOPRENE .25 THK

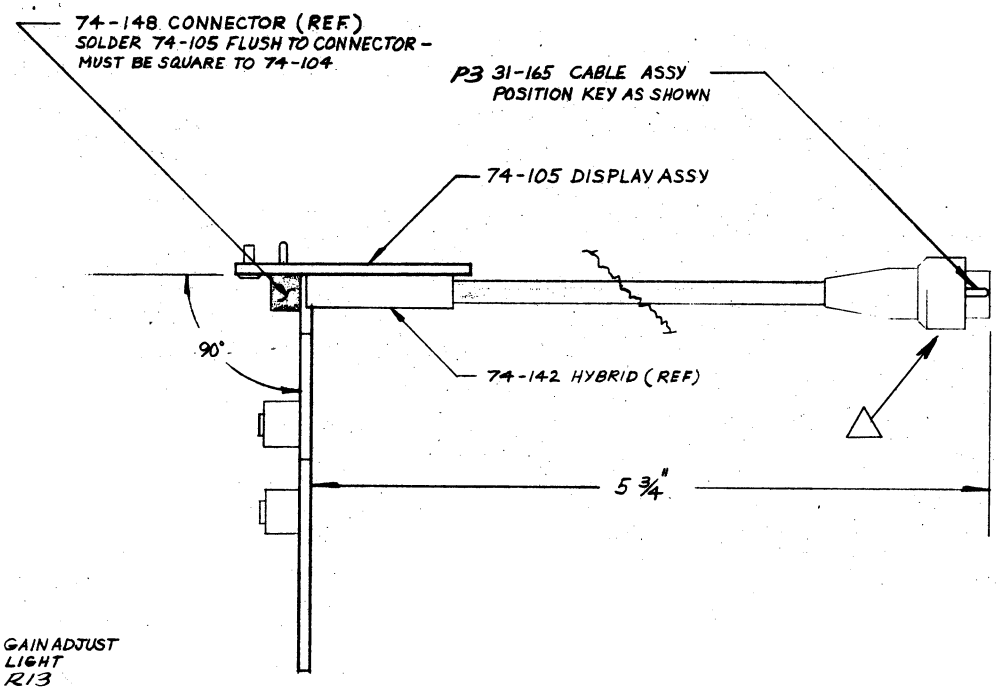
PAGE 29

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

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES:— 2 PL. DECIMALS ±.01, 3 PL. DECIMALS ±.005, FRACTIONAL ±1/64, ANGLES ±30', MACH. FINISH 63	cinema products corporation, Los Angeles, Calif.	DRAWN BY: Dorme	CHECKED BY:
	1 / DATE 6-17-74	TITLE: ZOOM MOTOR ASSEMBLY J5 ZOOM CONTROL AND IRIS CONTROL	APPROVED BY: a. o. [illegible]	D SIZE, SHEET 1 OF 1 SHEETS
	REQD / NEXT ASSY. / SCALE 2:1		31-114	

LET.	CHANGE	DATE
A	RELEASED	28 AUG 75





TO REMOVE ASSEMBLY:
REMOVE ONLY 3 SCREWS
MARKED *. UNPLUG WIRES
AT POINTS MARKED △ 4 PLACES

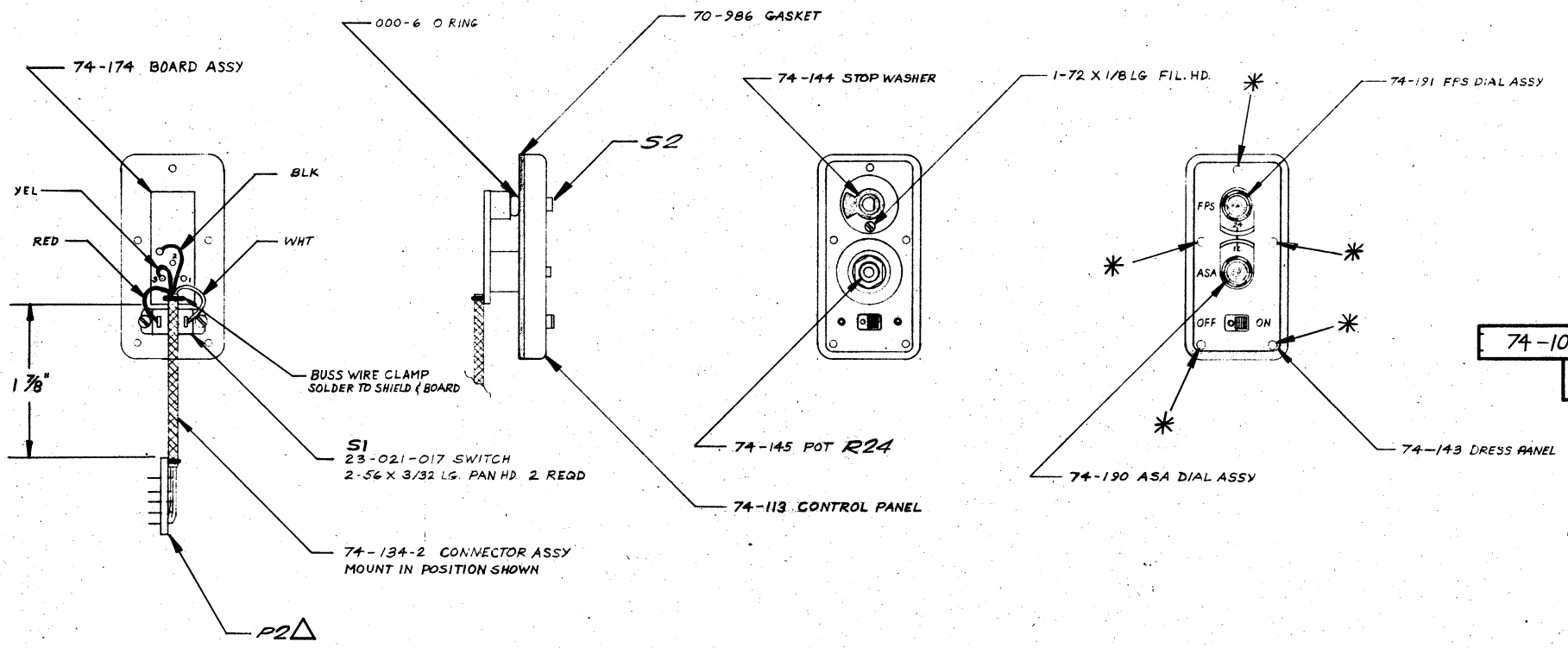
74-100
A

PAGE 30

5. FINISH:
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:- FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90025	DRAWN BY J Lacey
			CHECKED BY
			APPROVED BY
	1 70-966	TITLE LIGHT METER DISPLAY ASSY	C SIZE
	1 70-895 DATE 28 AUG 75	CP-16R	SHEET OF SHEETS
	REQD NEXT ASSY. SCALE 2X		74-100

LET.	CHANGE	DATE
B	RELEASED	25AUG75



TO REMOVE ASSEMBLY:
REMOVE 5 SCREWS MARKED ✱, UNPLUG CABLE MARKED △

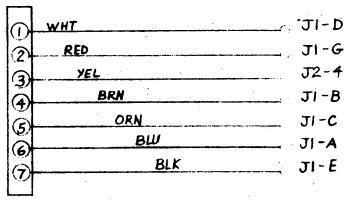
74-101
B

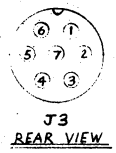
PAGE 31

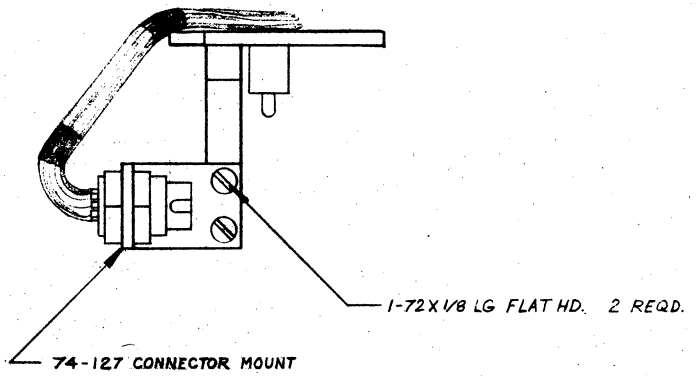
5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

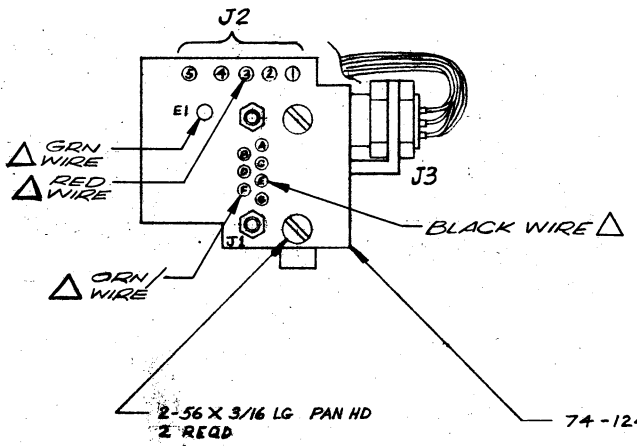
REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63		cinema B products CORPORATION Los Angeles, Calif. 90025	DRAWN BY J Lacey
				CHECKED BY
			TITLE	APPROVED BY
	1 70-966		LIGHT METER CONTROL ASSY	C SIZE SHEET OF SHEETS
	1 70-895	DATE 25 AUG 75	CP-16R	74-101
	REQD NEXT ASSY.	SCALE FULL		

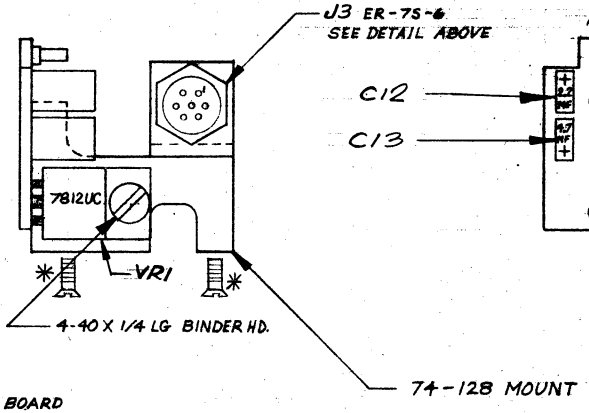
LET.	CHANGE	DATE
A	RELEASED	21 AUG 75

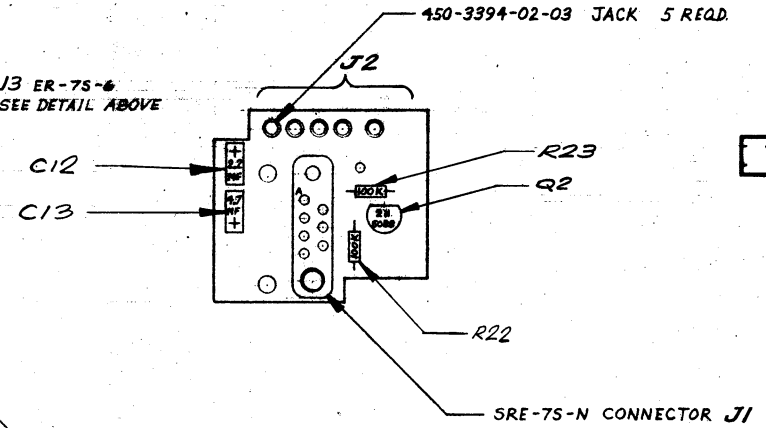












74-102
A

TO REMOVE ASSEMBLY:
REMOVE TWO SCREWS FROM THE BOTTOM OF THE CAMERA BODY MARKED *.
UNSOLDER 4 WIRES MARKED △

5. FINISH:
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.

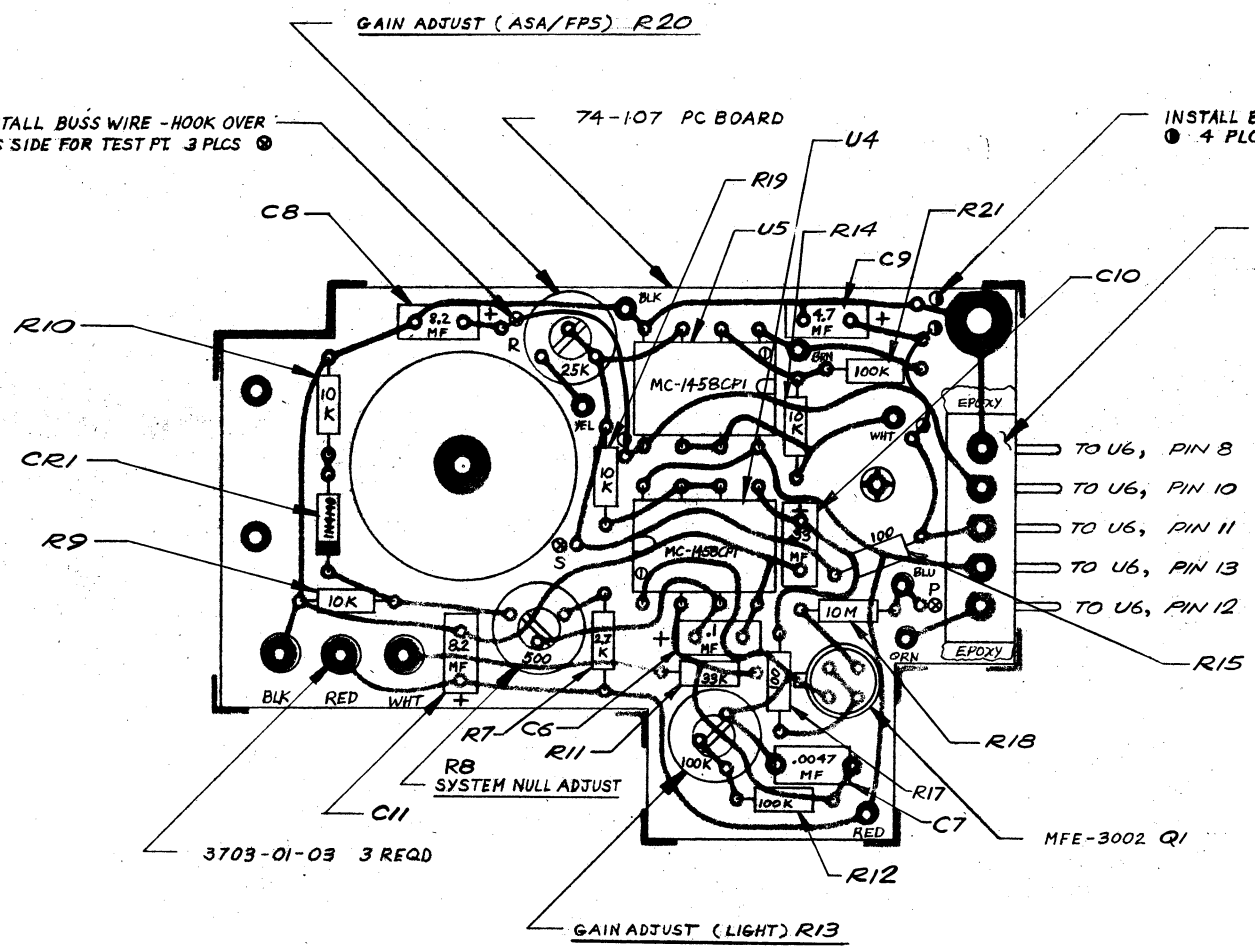
REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES— 2 PL. DECIMALS ±.01 3 PL. DECIMALS ±.005 FRACTIONAL ±1/64 ANGLES ±30' MACH. FINISH 63		
	1	70-966	
	1	70-895	DATE 21 AUG 75
	REQD	NEXT ASSY.	SCALE 2X

cinema B products CORPORATION
Los Angeles, Calif. 90025

TITLE
JUNCTION BD. ASSY
EXP. CONTROL
CP-16R

DRAWN BY	J Lacey
CHECKED BY	
APPROVED BY	
C SIZE	SHEET OF SHEETS
74-102	

	CHANGE	DATE
A	RELEASED	27AUG75
B	REV. J.L.	15OCT75



74-104
B

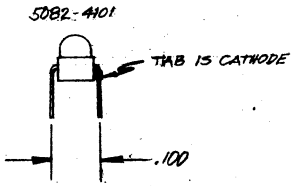
PAGE 33

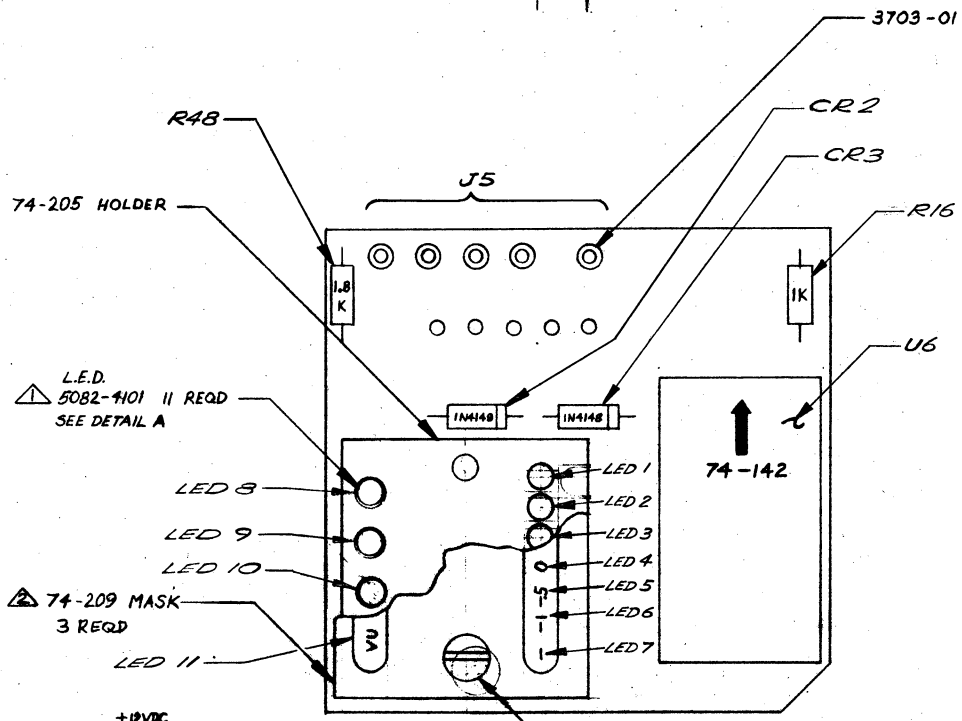
5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010
MACHINED FILLETS .003-.005 R.

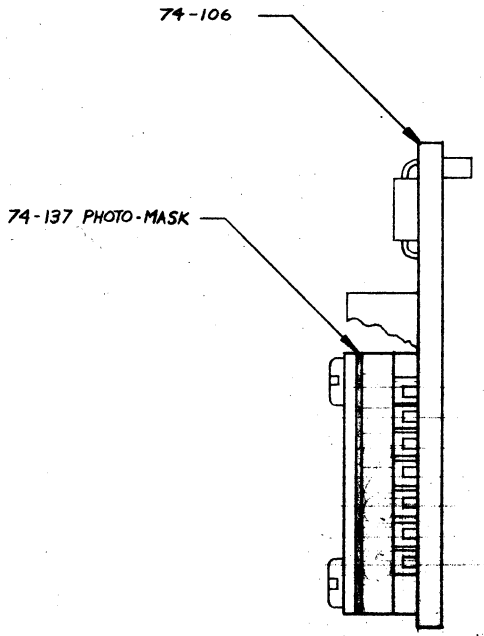
REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ±30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025	DRAWN BY J Lacey
			CHECKED BY
		TITLE PHOTO-CELL AMPLIFIER ASSY CP-16R	APPROVED BY
	1 74-100 DATE 27AUG75		C SIZE SHEET / OF / SHEETS
	NEXT ASSY SCALE 4X		74-104

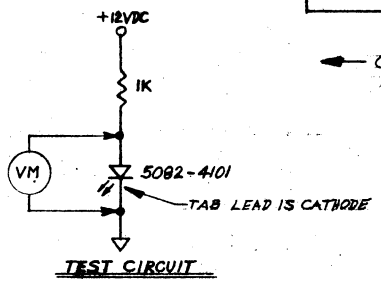
LTR.	CHANGE	DATE
B	RELEASED	27AUG75
C	REVISED	22OCT75
D	SEE ECO	7 JUL 76

DETAIL A 11 PLCS









TEST CIRCUIT

74-105 D

PAGE 34

⚠2 INSTALL (2) 74-209 BELOW PHOTO-MASK; (1) ABOVE

⚠1 5082-4101 L.E.D'S MUST BE SORTED ACCORDING TO FWD VOLTAGE DROP MEASURED AT 10MA. L.E.D'S USED IN EXPOSURE DISPLAY (DETAIL A) TO BE WITHIN 300 MV OF EACH OTHER. - SEE TEST CIRCUIT.

5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.

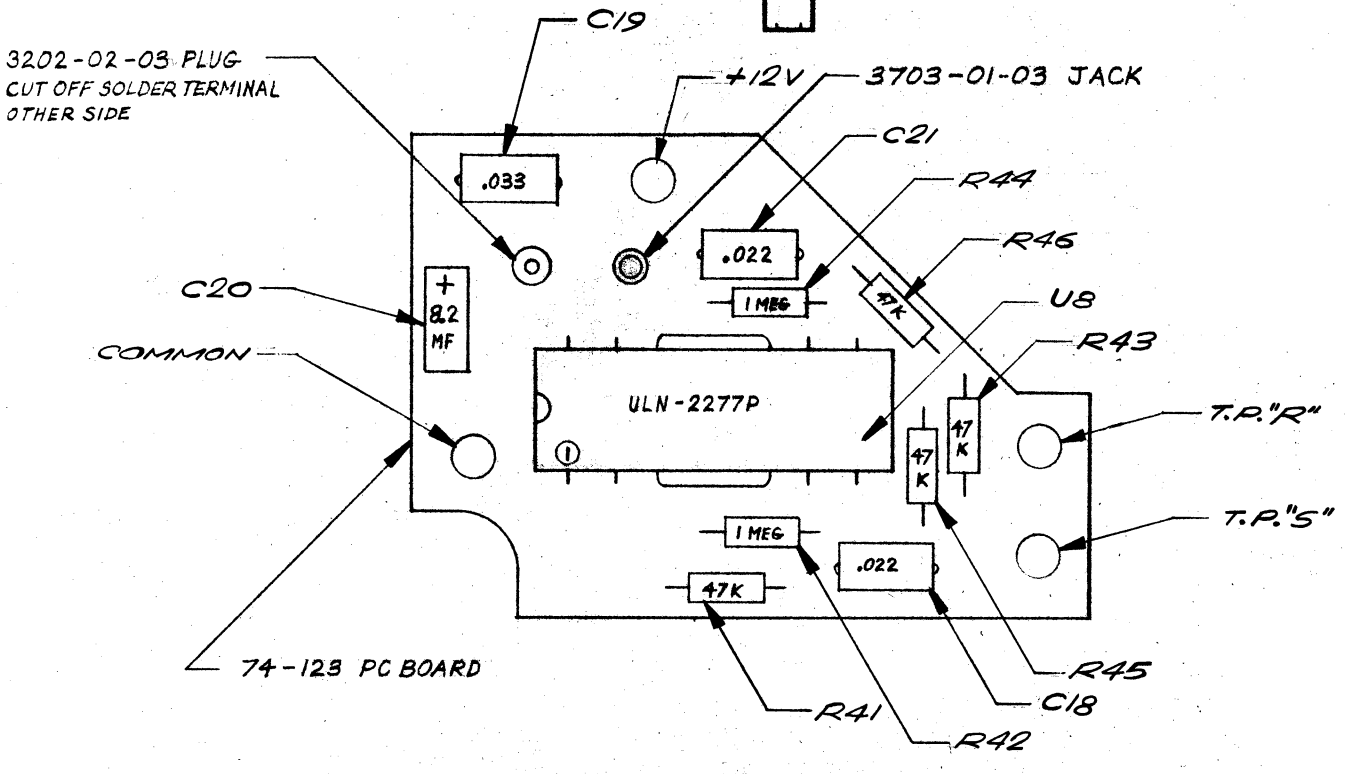
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES— 2 PL. DECIMALS ± .01 3 PL. DECIMALS ± .005 FRACTIONAL ± 1/64 ANGLES ± 30' MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90025	DRAWN BY J Lacey
			CHECKED BY
		TITLE L.E.D. DISPLAY ASSY EXP. CONTROL CP-16R	APPROVED BY
	1 74-100 DATE 27 AUG 75		C SIZE SHEET 1 OF 1 SHEETS
	REQD NEXT ASSY. SCALE 4X		74-105

REV D

74-120 A

LET.	CHANGE	DATE
A	RELEASED	10 SEP 75

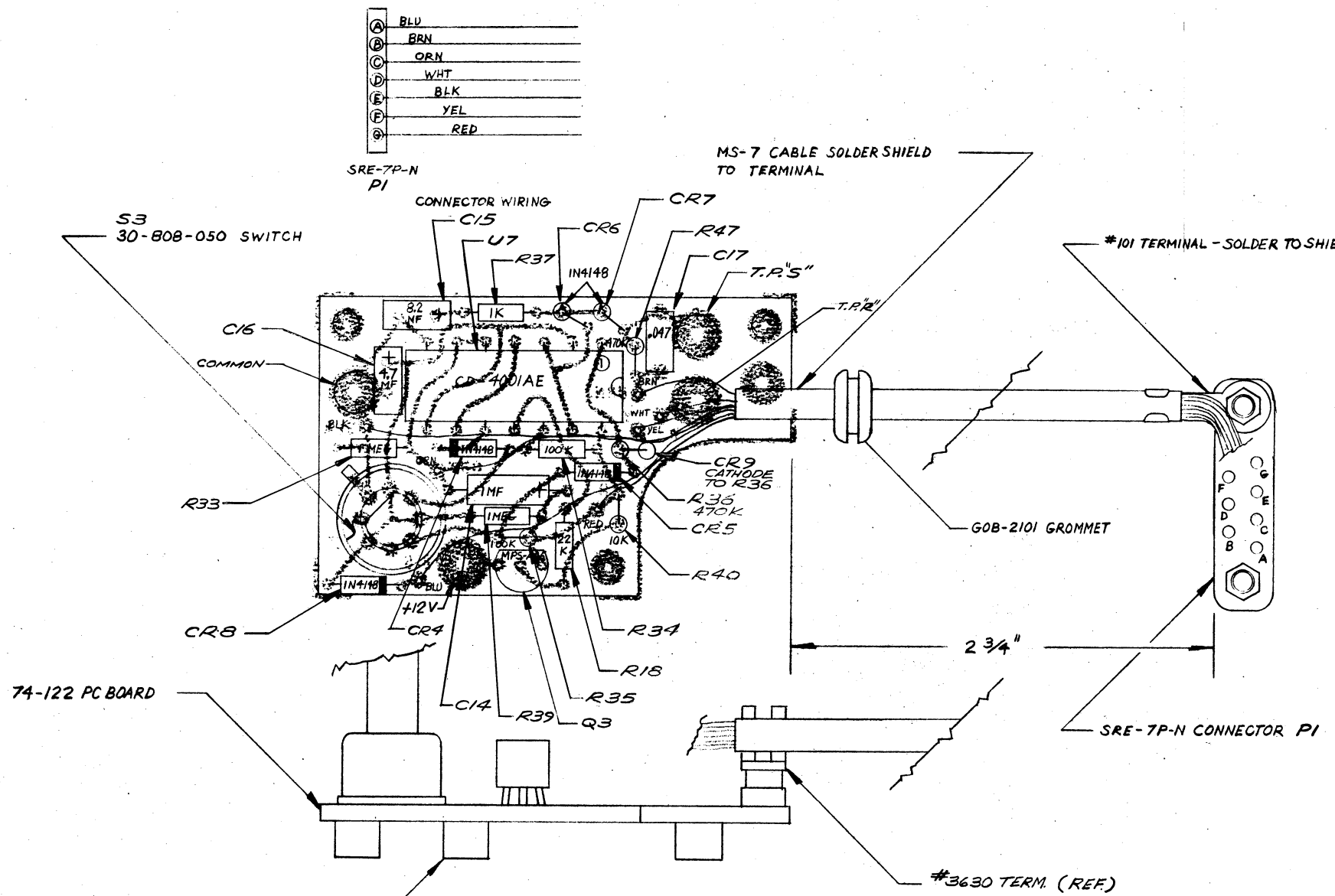


5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:- FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90025	DRAWN BY J Lacey CHECKED BY APPROVED BY
	1 74-103 DATE 10 SEP 75 REQD NEXT ASSY. SCALE 4X	TITLE AMPLIFIER BOARD ASSY IRIS SERVO CP-16R	B SIZE SHEET OF SHEETS 74-120

REV A

LTR	CHANGE	DATE
A	RELEASED	10 SEP 75
B	REVISED & REDRAWN	5 NOV 75



74-121 B

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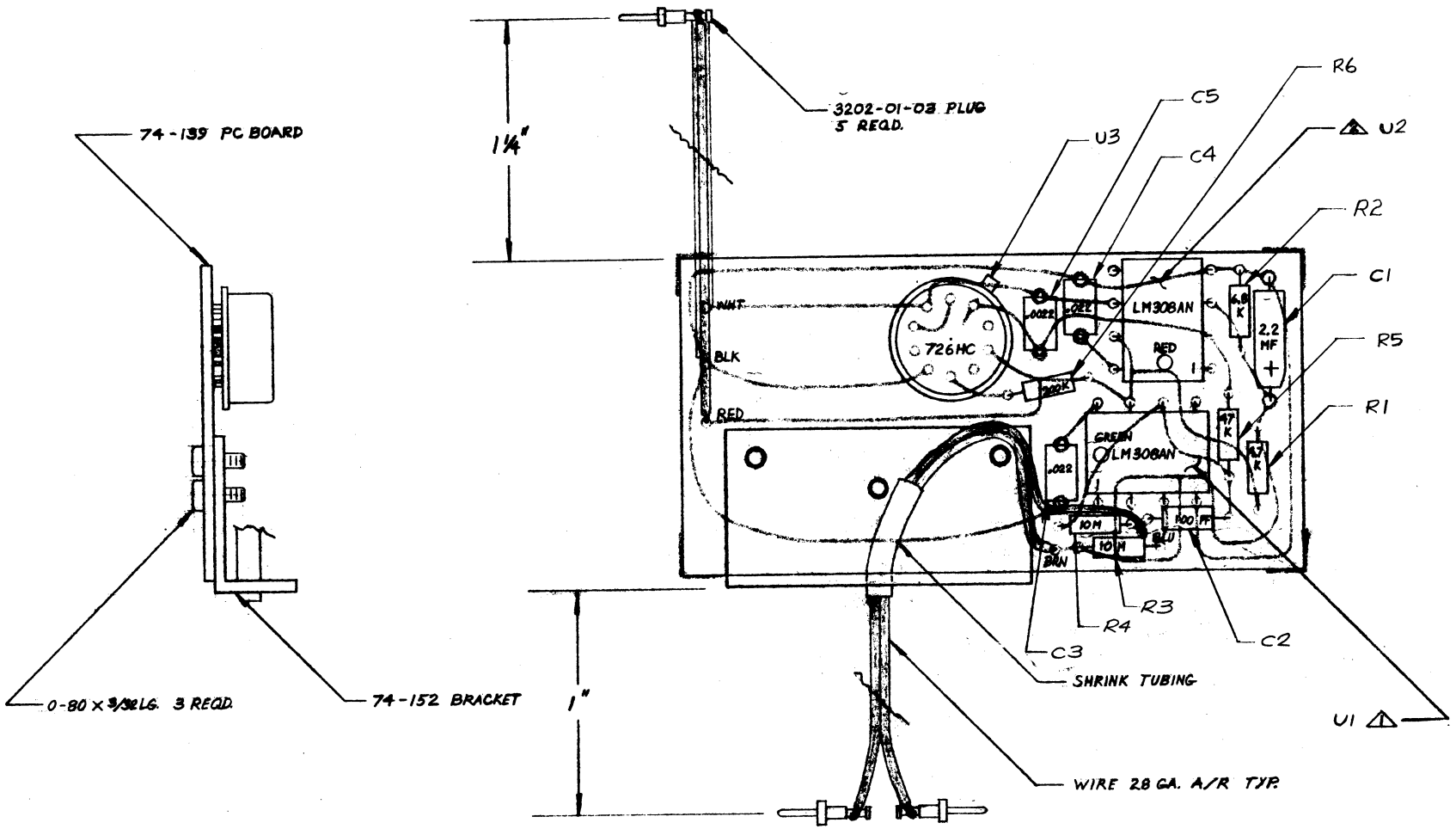
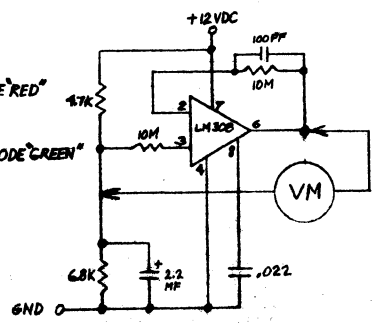
5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:- FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90066	DRAWN BY J Lacey
			CHECKED BY
		TITLE CONTROL BOARD ASSY IRIS SERVO CP-16R	APPROVED BY
	1 74-103 DATE 10 SEP 75		C SIZE SHEET OF SHEETS
	REQD NEXT ASSY. SCALE 4X		74-121

LT	CHANGE	DATE
B	RELEASED	27AUG75
C	REV. J.L.	22OCT75



74-170
C



TEST CIRCUIT

⚠ OFF-SET VOLTAGE TO BE 5 MV. OR LESS - COLOR CODE "RED" TEST BEFORE INSTALLATION - SEE TEST CIRCUIT

⚠ OFF-SET VOLTAGE TO BE 2 MV. OR LESS - COLOR CODE "GREEN" TEST BEFORE INSTALLATION - SEE TEST CIRCUIT

5 FINISH
4 HEAT TREAT
3 MATERIAL
2 CONCENTRICITY CON T I R
BREAK SHARP EDGE .005 MAX
MACHINED FILLETS .020 MAX R
UNLESS OTHERWISE SPECIFIED

cinema products
Los Angeles, Calif.

J Lacey

SENSOR PRE-AMP ASSY
CP-IGR

SIZE	DWG NO	REV
C	74-170	

SCALE 4 X

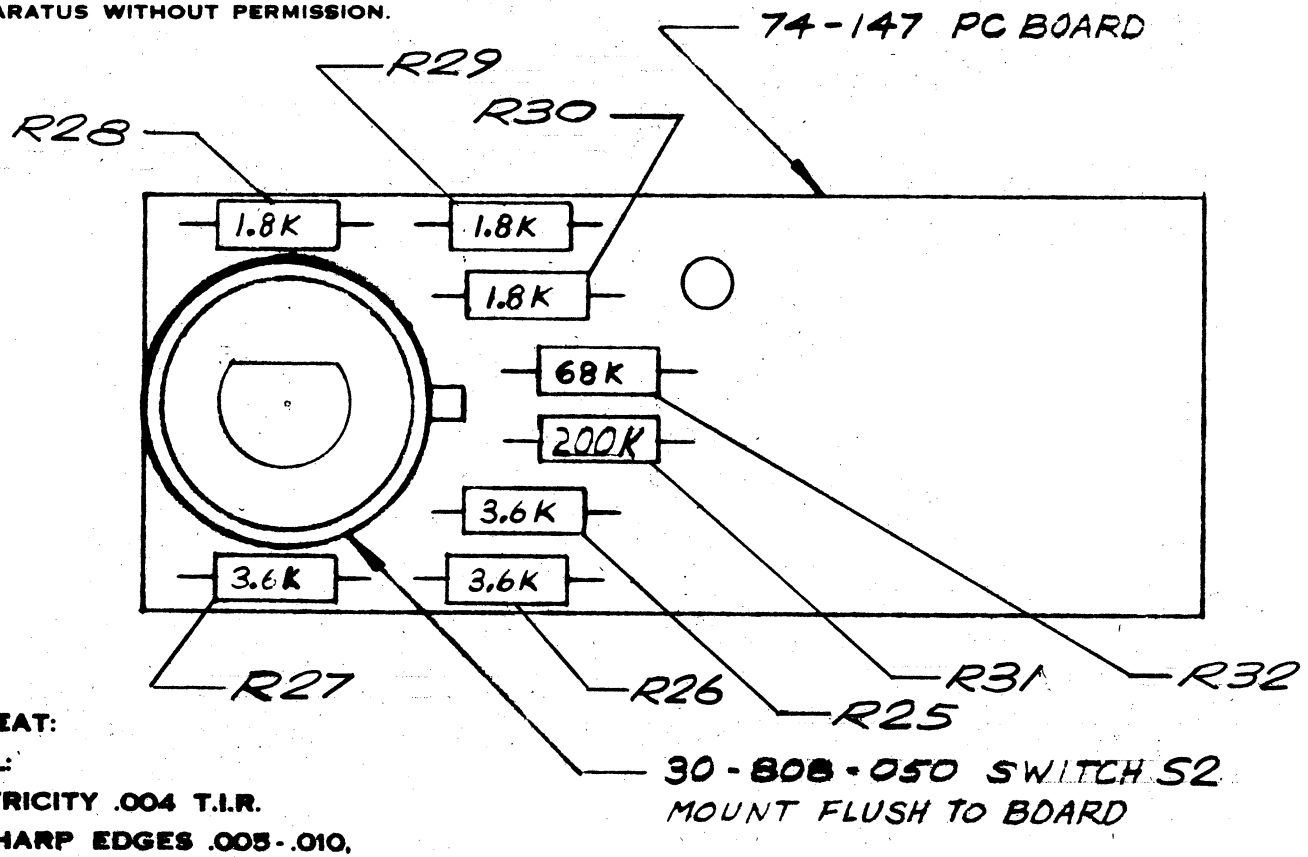
QTY	PART NO	DESCRIPTION
1	74-210	

DATE 27 AUG 75

SHEET 1 OF 1 SHEETS

74-170

LET.	CHANGE	DATE
A	RELEASED	21 AUG 75
B	SEE ECO	3-22-76

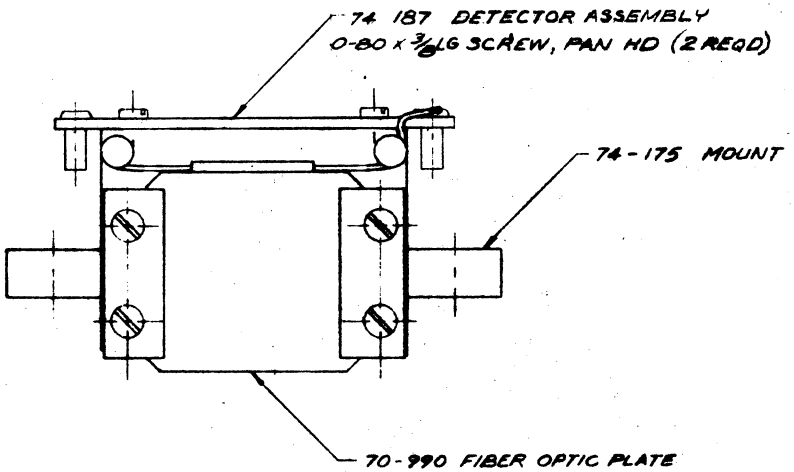


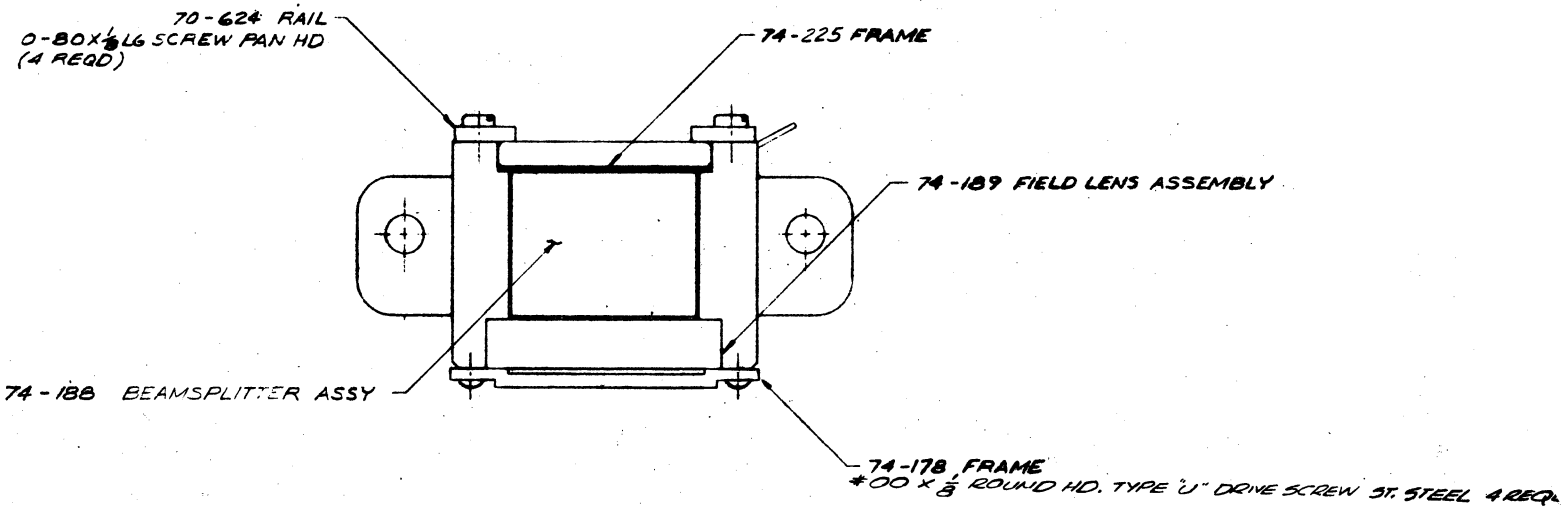
5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010, MACHINED FILLETS .003-.005 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— FRACTIONAL ±1/64 2 PL. DECIMALS ±.01 ANGLES ±30' 3 PL. DECIMALS ±.005 MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025
		TITLE ASA/FPS BOARD ASSY EXP. CONTROL CP-16R
	1 74-101 DATE 21 AUG 75 REQD NEXT ASSY. SCALE 4X	DRAWN BY J. Lacey CHECKED BY APPROVED BY A SIZE SHEET OF SHEETS 74-174

REV A

LTR.	CHANGE	DATE
A	ADD PART PROJECTION	10/76 75
B	SEE ECO	DEC 29, 1975





74-186
B

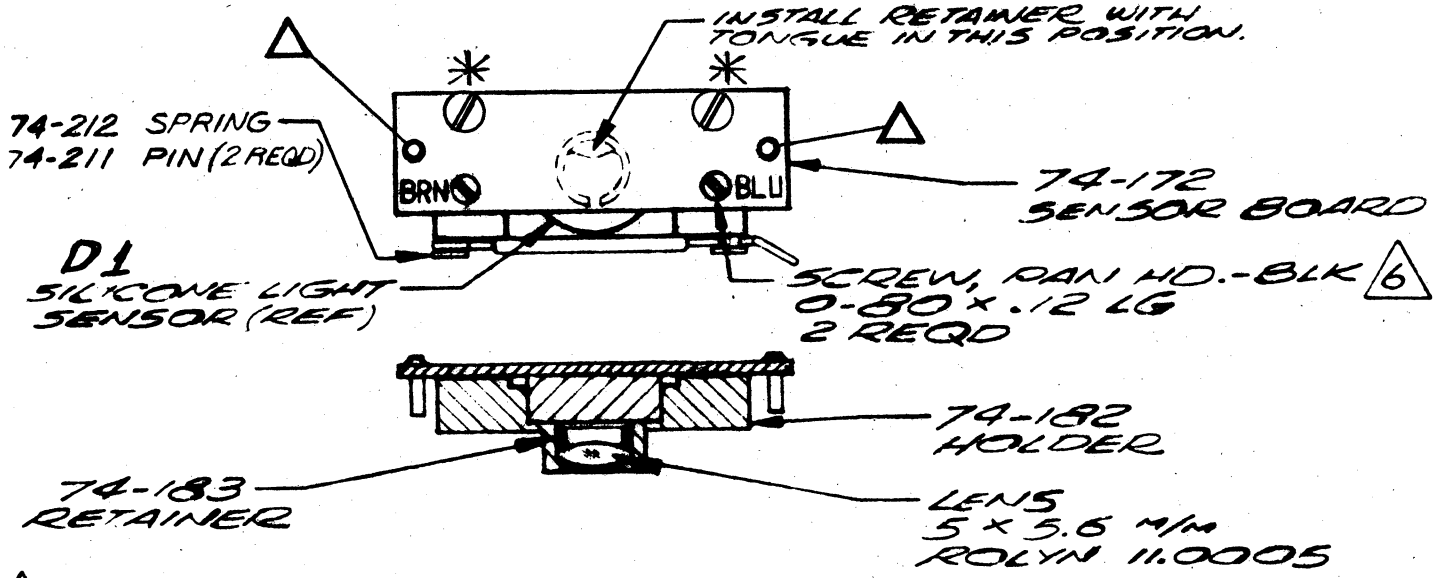
PAGE 39

5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .008-.010.
MACHINED FILLETS .003-.008 R.
NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90025
	70-604 DATE NOV 6 75	TITLE BEAMSPLITTER MOUNT ASSY-EXP CONTROL CP-16R
	NEXT ASSY. SCALE 4=1	SIZE C SHEET OF SHEETS 74-186

DRAWN BY
CHECKED BY
APPROVED BY

LET.	CHANGE	DATE
A	REL FOR DESIGN	OCT 7 1975
B	SEE ECO	NOV 5 75



6 POSITION SILICONE LIGHT SENSOR PROPERLY THEN TIGHTEN 0-80 SCREWS AND LOCK SCREWS IN PLACE WITH GLYPTOL.

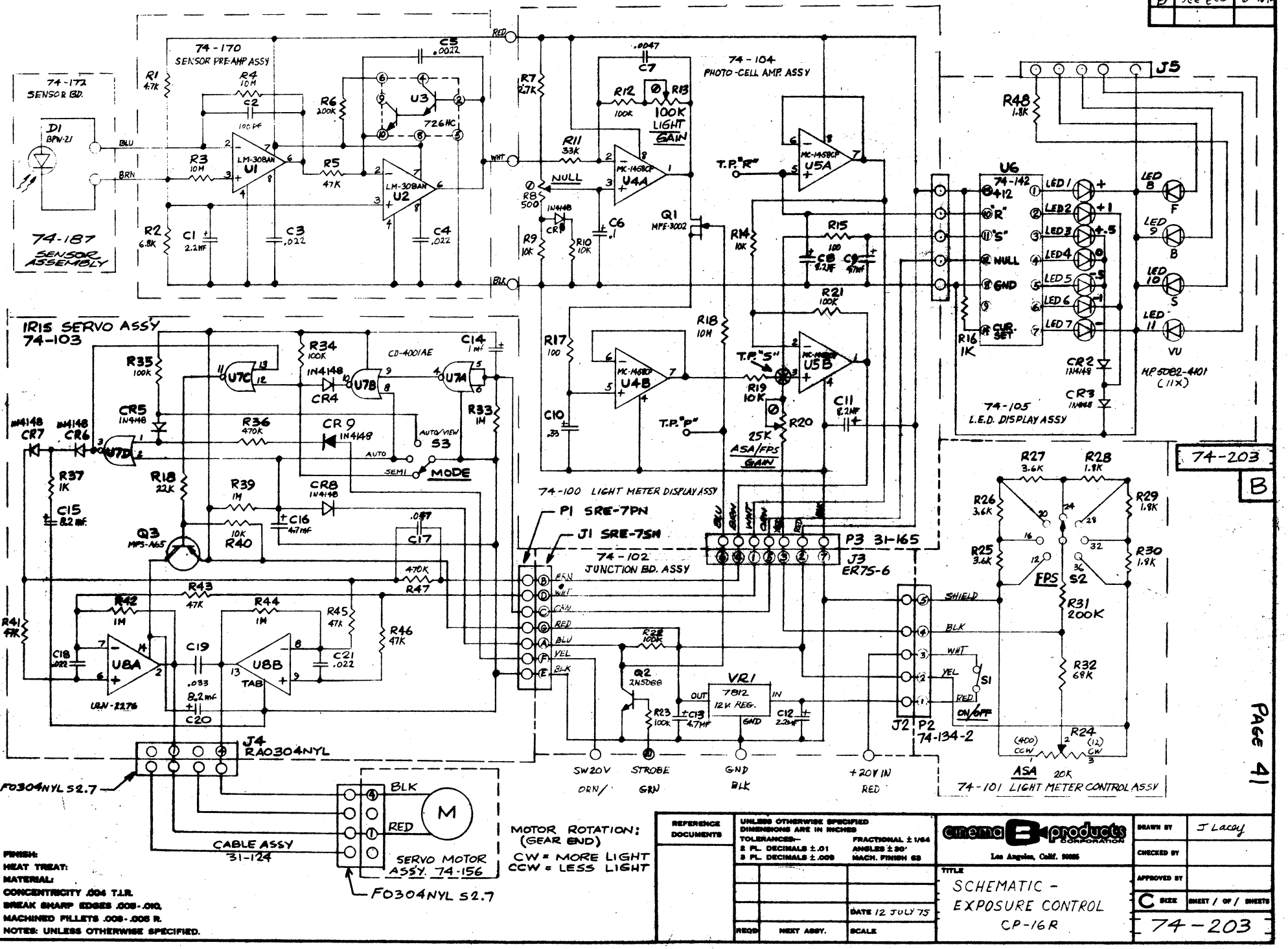
5. FINISH:
4. HEAT TREAT:
3. MATERIAL:
2. CONCENTRICITY .004 T.I.R.
1. BREAK SHARP EDGES .005-.010,
   MACHINED FILLETS .003-.005 R.
   NOTES: UNLESS OTHERWISE SPECIFIED.

TO REMOVE ASSEMBLY:
REMOVE 2 SCREWS MARKED *. UNPLUG 2 WIRES AT △

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025
		TITLE DETECTOR ASSEMBLY EXPOSURE CONTROL CR16R
	74-186 DATE OCT. 6, 1975	
	REQD NEXT ASSY. SCALE 2:1	

DRAWN BY	DOLLMES
CHECKED BY	
APPROVED BY	
A SIZE	SHEET 1 OF 1 SHEETS
74-187	

LET.	CHANGE	DATE
A	REV JL	3 NOV 75
B	SEE ECO	6-16-76

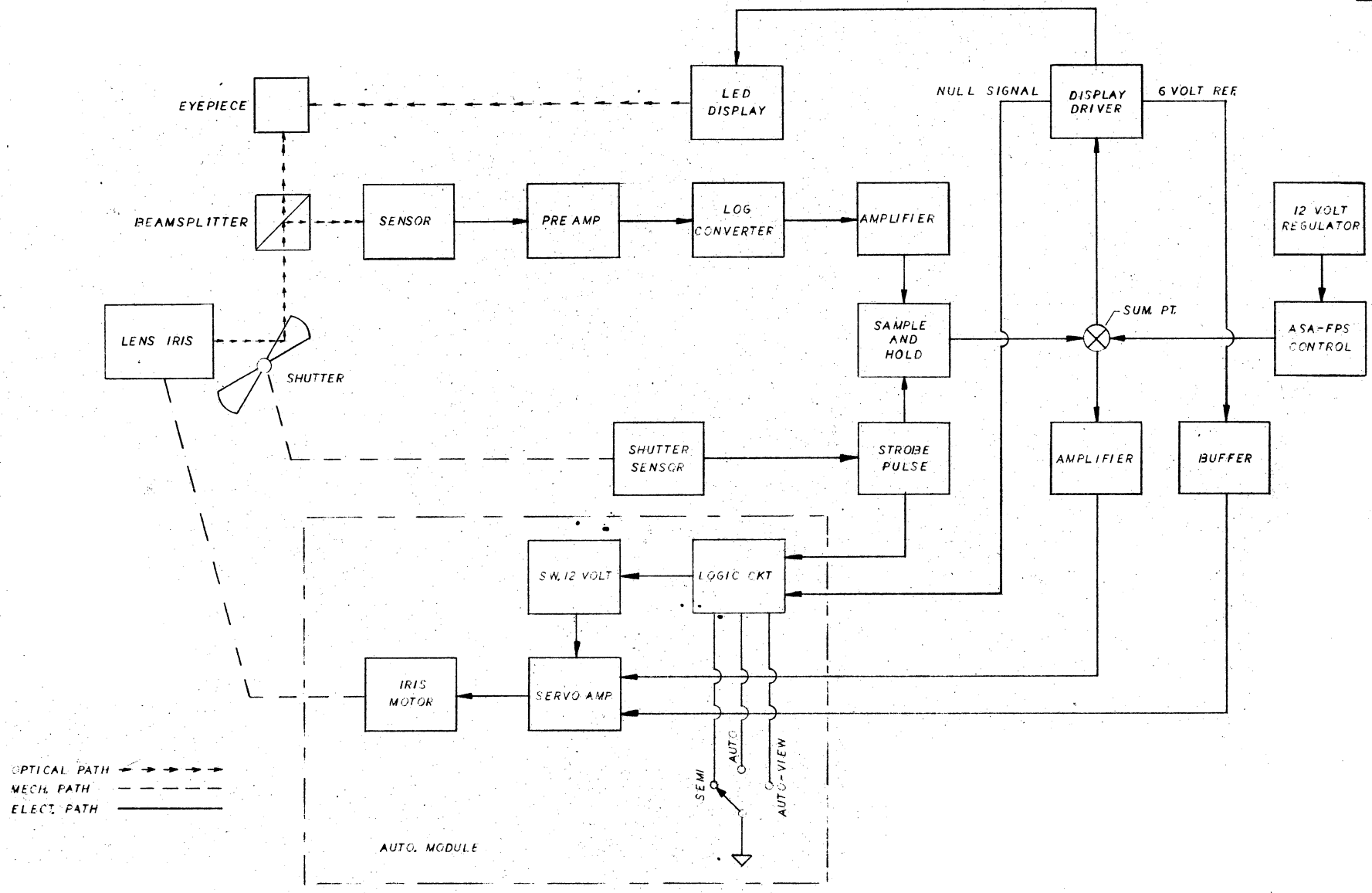


1. BREAK SHARP EDGES .008-.010, MACHINED FILLETS .008-.006 R.
2. CONCENTRICITY .004 T.I.R.
3. MATERIAL:
4. HEAT TREAT:
5. FINISH:

NOTES: UNLESS OTHERWISE SPECIFIED.

REFERENCE DOCUMENTS	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES:— FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema B products CORPORATION Los Angeles, Calif. 90025
		DRAWN BY: J Lacoy
		CHECKED BY:
		APPROVED BY:
	DATE 12 JULY 75	C SIZE — SHEET / OF / SHEETS
REQD	NEXT ASSY. SCALE	TITLE: SCHEMATIC - EXPOSURE CONTROL CP-16R
		74-203

LET.	CHANGE	DATE



74-204

5. FINISH:
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:- FRACTIONAL ± 1/64 2 PL. DECIMALS ± .01 ANGLES ± 30' 3 PL. DECIMALS ± .005 MACH. FINISH 63	cinema products CORPORATION Los Angeles, Calif. 90025
		TITLE BLOCK DIAGRAM - EXPOSURE CONTROL CP-16R
	DATE 18 SEP. 75	
REQD NEXT ASSY.	SCALE	

DRAWN BY	J Lacey
CHECKED BY	
APPROVED BY	
C SIZE	SHEET OF SHEETS
74-204	