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(U) CONTRAVES GOERZ CORP PITTSBURGH PA 02 MAY 83
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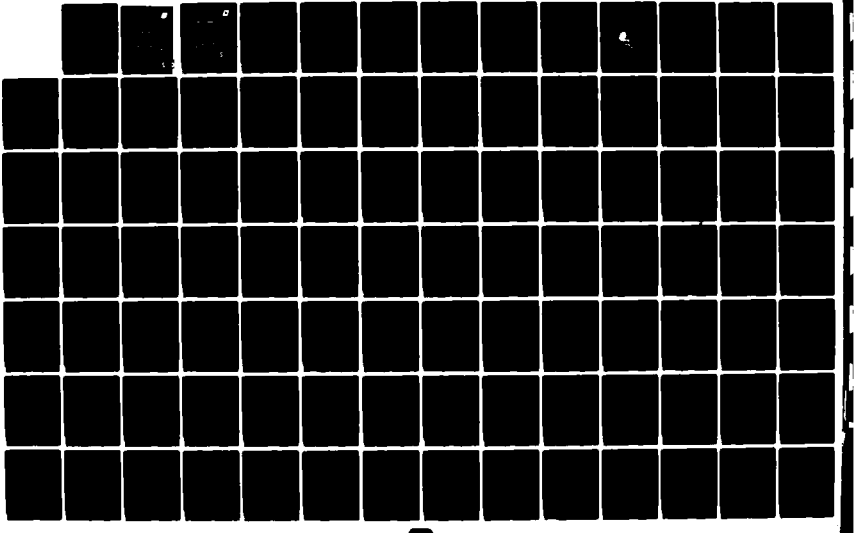

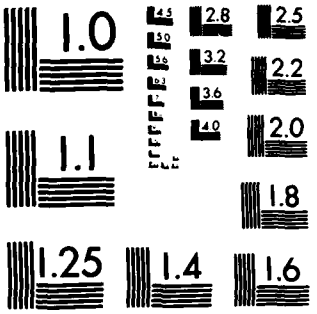

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U.S. Department of Transportation
United States Coast Guard

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TECHNICAL MANUAL FOR

MODEL 066 SEARCHLIGHT POSITIONER

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FOR

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1. GENERAL INFORMATION.

1.1. Introduction. This manual provides information for operation and maintenance of the Model 066, Two Axis Searchlight Positioner, designed and built by Contraves Goerz Corporation (CGC), 610 Epsilon Drive, Pittsburgh, Pennsylvania 15238.

1.1.1. Applicability. The Model 066 positioner supplied to the Night Vision Laboratory under Contract DAAK70-78-C-0136 was developed and built in accordance with U.S. Coast Guard Specification No. WMEC 443-2.

1.1.2. Associated equipment. The searchlight (AN/VSS-3A) and control box, purchased items, are factory mounted in the gimbal by CGC. See TM 11-5855-217-12-1 and TM 11-5855-217-35-1 for information about the AN/VSS-3A searchlight and control box.

1.2. General Description. The Model 066 Searchlight Positioner is a precise electromechanical device used to position a high intensity searchlight. The positioner is driven in the azimuth (AZ) axis, and in the elevation (EL) axis by direct drive DC torque motors. The positioner is shown in Figure 1.1.

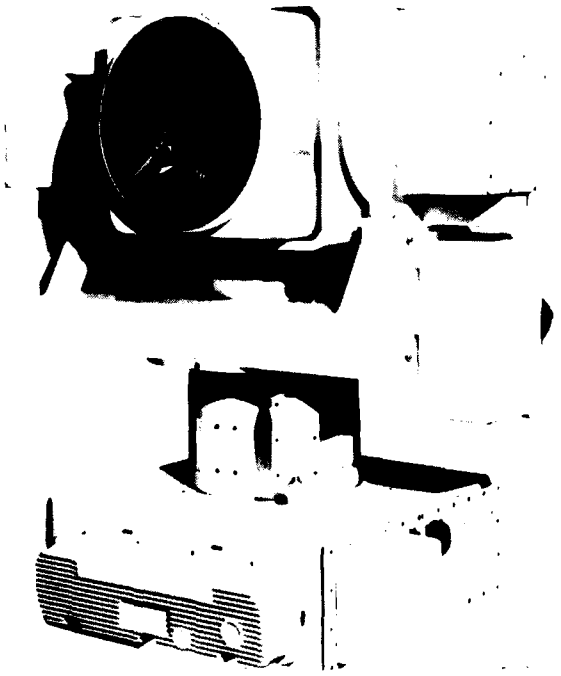


Figure 1.1 Model 066 Searchlight Positioner

1.2.1. Positioner configuration. The positioner can be broken down into four major sections by function:

a. AZ-EL mechanical drive package.

b. Electronic control system for AZ and EL drives.

c. Searchlight power, drive and control electronics.

d. Searchlight.

1.2.2. Position command signal inputs. The AZ and EL position commands are 400 Hz, three-phase synchro signals which control the output of a synchro transformer CT mounted in each axis. The CT outputs are demodulated, amplified and used to drive dc torque motors.

1.2.3. Position readout signals. A synchro transmitter CX mounted in each axis provides position readout signals to remote indicators.

1.2.4. Searchlight power, drive and control. The positioner houses the power supply used to ignite the searchlight. It also houses the electronics needed to control searchlight intensity and to operate the searchlight's infra-red filter. The searchlight can be operated from a control box mounted on the positioner or from a remote control panel.

1.2.5. AZ and EL limit switch operation. The azimuth limit switch circuitry functions in a slightly different manner than the elevation circuit. Elevation limits prevent travel in a particular direction once the limit in that direction is reached, however the axis can be driven back out of the limit. In azimuth the limit switch forces the searchlight into it's infra-red mode so as not to blind personnel and also allows a come-back circuit to function. This circuit drives the axis back thru zero to the other limit when the command signal goes beyond 180°.

1.3. Reference Data. Positioner specifications are listed in Table 1.1

1.4. Instrument and Manual Identification. This manual covers the Model 066 positioner which can be distinguished from the Model 066A by reference tc Figure 1.2.

The Model 066A positioner is described in a separate technical manual, procurement stock number CG-7610-01-GF2-0201.

1.5. Equipment Supplied. Equipment supplied is listed in Table 1.2

1.6. Equipment Required But Not Supplied. Equipment required but not supplied is listed in Table 1.3.

Table 1.1. Specifications

Payload Weight: 150 pounds
Power Requirements: 115 vac, 400 Hz, 3-phase, 15 amperes
Position Command Signal: 400 Hz, 3-phase synchro signal
Output Position Signal: 400 Hz, 3-phase synchro signal
Operating Temperature: -30° to $+65^{\circ}$C
Maximum Relative Humidity: 100%
Maximum Ice Loading: 4-1/2 lb/sq ft
Maximum Solar Radiation: 90 watts/sq ft
Axis Inertia: 18 in-lb/sq second
Physical Dimensions: 44 in. high, 43-3/8 in. wide, 24 in. deep
Weight: 600 lbs (with payload)
Maximum acceleration (both axis): 30°/sq second
Maximum velocity (both axis): 60°/second
Minimum velocity (both axis): 0.01°/second
Repeatability (both axis): $\pm 0.05^{\circ}$
Maximum drift (both axis): $\pm 0.05^{\circ}$/hr
Position accuracy (both axis): $\pm 0.1^{\circ}$
Maximum operational displacement: Azimuth axis $\pm 120^{\circ}$
Elevation axis -20° to $+55^{\circ}$
Mechanical Limits: Azimuth axis $\pm 125^{\circ}$
Elevation axis -25° to $+60^{\circ}$
Maximum Windspeed: Operating - 75 kn
Stowed - 100 kn

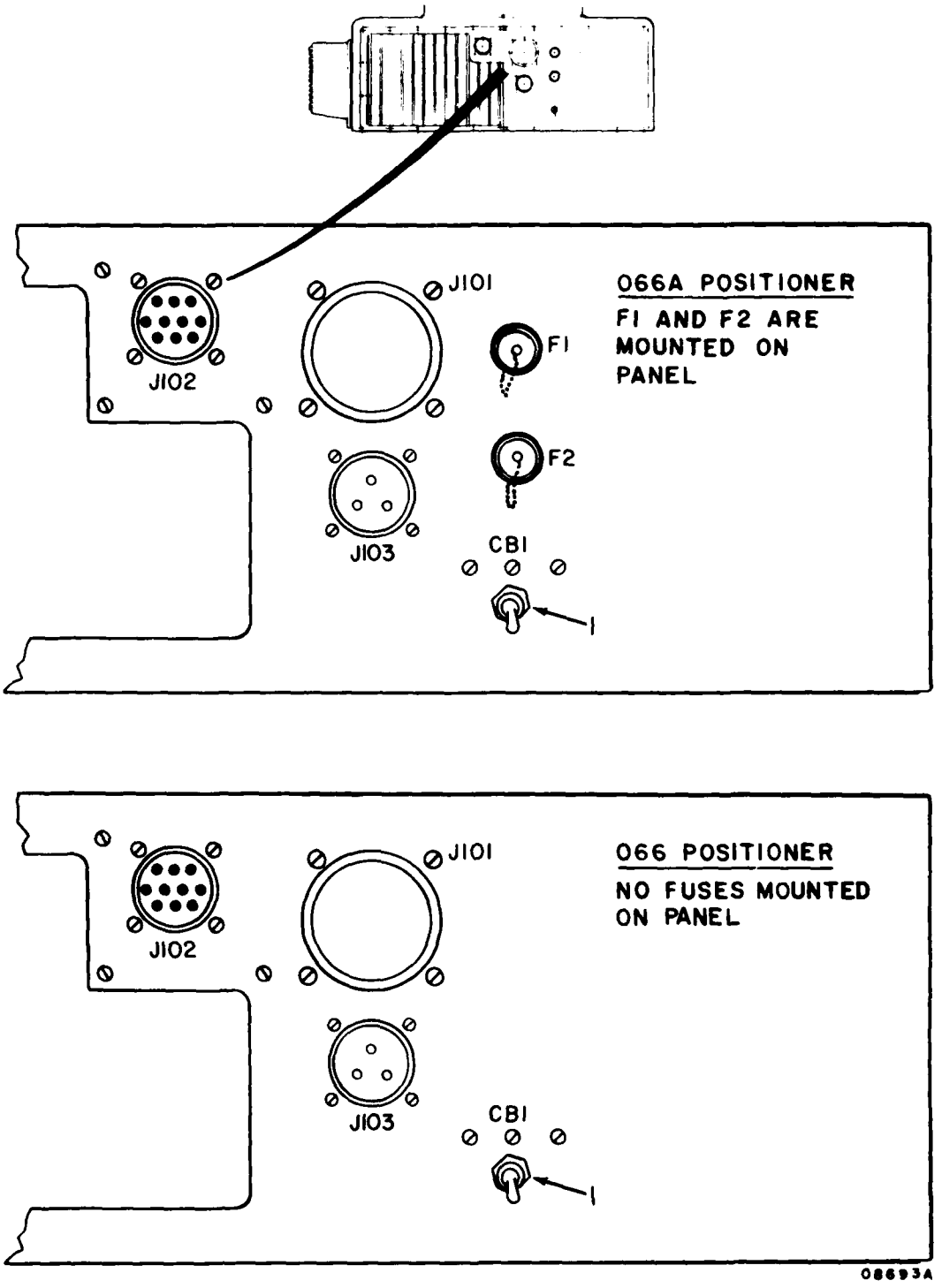


Figure 1.2. Searchlight Positioner, Model Identification

Table 1.2. Equipment Supplied

QUANTITY PER EQUIPMENT	NOMENCLATURE NAME	NOMENCLATURE DESIGNATION	OVERALL DIMENSIONS HEIGHT (Inches)	WIDTH (Inches)	DEPTH (Inches)	VOLUME (Cubic ft)	WEIGHT (Pounds)
1	Searchlight Positioner	Model 066*	44	43-3/8	24		450
1	Searchlight	AN/VSS-3A**	-	-	-		-
1	Searchlight Control Box	AN/VSS-3A**	-	-	-		-
1	Canvas Cover	066**	-	-	-	-	-
1	Extraction Tool	066**	-	-	-	-	-

*Designates CGC Part Number.
**See TM 11-5855-217-12-1 for searchlight data.

Table 1.3. Equipment Required But Not Supplied

QUANTITY PER EQUIPMENT	NOMENCLATURE NAME	NOMENCLATURE DESIGNATION	REQUIRED USE	REQUIRED CHARACTERISTICS
1	Extender Card	Vector PN 3690 or equivalent	Troubleshooting Testing and Alignment.	
1	Thickness gage		Locating Searchlight in gimbal.	3/32''
1	Connector	MS3106F22-19P	Installing Positioner.	
1	Connector	MS3106F22-2S	Installing Positioner.	
1	Connector	MS3106F36-15P	Installing Position.	
1	Multimeter, digital		Troubleshooting, Testing and Alignment	3 Digit
1	IR Detector	FJM FIND-R-SCOPE	Testing IR Mode	

1.7. Inquiries. Inquiries about the operation and maintenance of the positioner should be directed to:

Contraves Goerz Corporation
610 Epsilon Drive
Pittsburgh, Pennsylvania 15238
Attention: G. H. Group (412-782-7700)

1.8. Abbreviations. Table 1.4 is a table of abbreviations used in this manual.

Table 1.4. Abbreviations

AZ	Azimuth
CGC	Contraves Goerz Corporation
CR	Synchro Receiver
CT	Synchro Transformer
CX	Synchro Transmitter
EL	Elevation
Hz	Hertz (cycles per second)
PPS	Pulses per Second
VAC	Volts, Alternating Current
VDC	Volts, Direct Current

1.9. Safety Hazards. Note the following warnings:

WARNING

Dangerous voltages are present in this equipment. Both power supply voltages and synchro signals can cause serious electrical shock. Make sure that both power supply voltages and synchro signals are removed before disassembling this equipment.

WARNING

Avoid looking directly at the beam of light. Looking directly at the light can cause serious eye injury.

WARNING

Be very careful with the searchlight. The bulb is under high pressure and can cause serious personal injury if broken.

WARNING

Stand clear of the searchlight when disengaging stow pins. Certain electrical failures can cause the searchlight to ''run away'' causing serious personal injury.

WARNING

The searchlight, azimuth assembly and yoke-pillow block assembly are very heavy. Use two people to lift these assemblies to prevent personal injury.

WARNING

Liquid nitrogen, liquid freon, dry ice, and carbon dioxide fire extinguishers produce very low temperatures. These materials, and ojbects cooled with these materials, can cause serious burns.

WARNING

Stand clear when removing roll pin from stow lock assembly. The plunger is under spring tension and can cause serious personal injury if allowed to shoot out of the stow lock assembly.

WARNING

To prevent serious personal injury, both axes must be stowed during handling and installation of the positioner. When the positioner is stowed, each axis can move approximately one degree in both axes.

1.10. Handling CMOS Device. Note the following caution.

CAUTION

Printed circuit cards A5 and A6 contain CMOS devices which may be damaged by static electricity. Exercise care to protect CMOS devices from static discharge during unpacking, storage, handling, soldering or packing operations.

2. INSTALLATION.

2.1. Introduction. This chapter contains instructions for installation of the Model 066 Searchlight Positioner on the boatdeck.

2.2. Initial Inspection. The positioner is shipped in a crate completely assembled with the mounting screws for the deck and the searchlight in a plastic bag taped to the inside surface of the yoke. Packing lists of the equipment are included.

Check contents of the crate against packing slips. Inspect equipment for any sign of shipping damage.

WARNING

To prevent serious personal injury, both axes must be stowed during handling and installation of the positioner. When the positioner is stowed, each axis can move approximately one degree in both axes.

2.3. Mechanical Installation. As stated, the positioner is normally shipped completely assembled. The front of the positioner is defined on the base housing by the vertical cooling fins of the heat sink and the connectors.

2.3.1. Positioner mounting holes. Install the positioner on the deck with a hole pattern drilled and tapped to accept this particular base configuration, four holes, 1/2-20 x 1.0 inch deep in a hole pattern 18-1/2 x 22-1/2 (Figure 2-1).

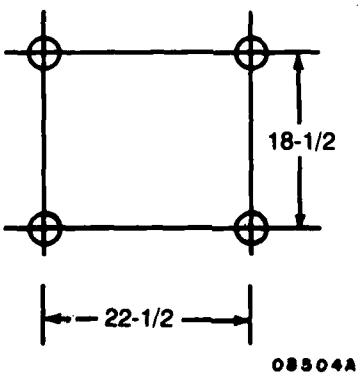


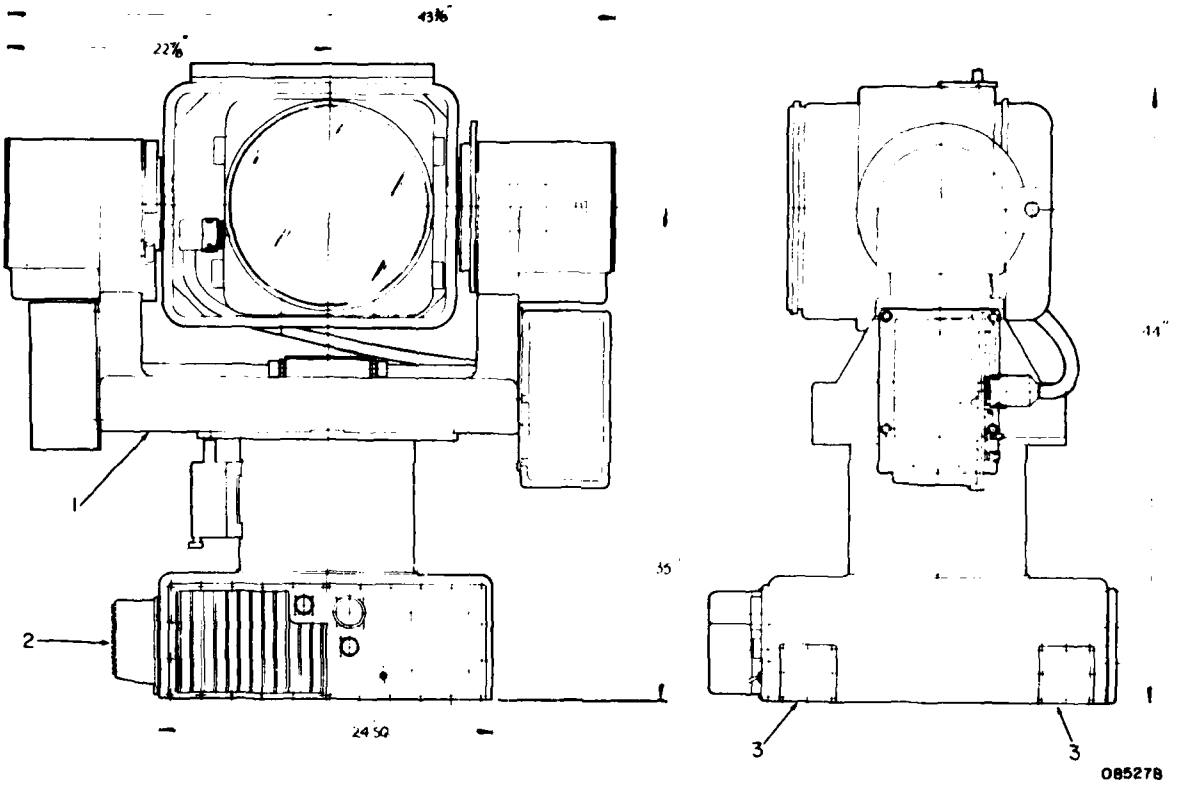
Figure 2.1. Mounting Hole Pattern for the Positioner.

2.3.2. Mounting the positioner. Mount the positioner as follows:

CAUTION

Do not hoist the positioner by the gimbal.

a. Hoist the positioner into place by nylon slings positioned under the horizontal member of yoke (1, Figure 2.2).



1. Horizontal Member of Yoke
2. Heat Exchanger Plenum Chamber
3. Small Covers

Figure 2.2. Positioner Installation Drawing

b. To install the searchlight on the deck, first remove the heat exchanger plenum chamber (2). This chamber has horizontal cooling fins and is on the left hand side of the base as you face the front of the searchlight.

c. Removing this chamber also releases the fan assembly and exposes the bolt holes. Remove both parts and lay them on top of the base. Remove two small covers (3) at the opposite (right) side of the base. This exposes a bolt hole at each corner. Align the base bolt holes and deck bolt holes; insert the four 1/2-20 capscrews provided and torque to 250 in-lbs.

d. Replace the covers. Be sure the gaskets are seated to make a good seal. Coat each of the screws with a reliable thread sealant. The entire positioner is sealed against moisture and particularly salt air. Failure to seal the base properly can cause premature failure of the electronic components.

2.4. Installing the Searchlight. Install the searchlight in the positioner as follows:

WARNING

Be very careful with the searchlight. The bulb is under high pressure and can cause serious personal injury if broken.

WARNING

The searchlight, azimuth assembly and yoke-pillow block assembly are very heavy. Use two people to lift these assemblies to prevent personal injury.

a. To install the searchlight, position the gimbal so that the machined surface with the slots is horizontal. Mount the searchlight onto this surface.

b. Once the searchlight is on the gimbal and before the bolts are inserted, slide the light to a position where the power cable can be connected. When the cable is connected, slide the searchlight until the bolt holes are aligned with the slots. Insert the bolts, but secure them only finger tight. Unstow the gimbal and rotate the searchlight to its highest elevation angle. Using a 3/32'' sheet metal gage, position the searchlight so that at the lowest point of its swing, it clears the cable distribution box by 3/32''. This places the searchlight in its optimum position. All of the mounts are factory balanced with the searchlights in this position. Even so, a change in the center of gravity between searchlights or a change in weight will cause an unbalance about the elevation axis. Should this occur, the search light will have to be repositioned. Reducing the clearance to less than 3/32'' will have no drastic consequences unless the searchlight is made to contact the cable distribution box.

CAUTION

Failure to balance the system about the elevation axis can cause a premature failure of the power amplifier that drives the elevation torque motor.

2.5. Electrical Installation. Electrical installation of the positioner consists of connecting the ship's mating cables to the connectors on the front of the electronic base, and performing a DC voltage test.

2.5.1. Connecting the ship's mating cables. The cables are shown on the overall schematic diagram (Figure 7.2). The functions of the three cables are as follows:

a. J101 provides connection to the AZ/EL synchro control transformers and transmitters.

b. J102 provides inputs to searchlight control cards and a Power On command signal.

c. J103 connects the 115 VAC, 3-phase, 400 Hz as the input power connector.

2.5.2. DC voltage test. After installation of the positioner on the ship and connection of the three connectors (J101, J102 and J103), remove P1 from J1 at the searchlight control box and attach a voltmeter across pins A and B of P1 with the Decrease Intensity Command on. If the voltage is less than 22 VDC or greater than 25 VDC, reverse any two of the three wire AC inputs on the ship side of P103. The voltage should be about 24 VDC with a Decrease Intensity Command present.

2.6. De-installation and Shipping. De-install and ship the positioner as follows:

a. Disconnect J101, J102 and J103 from positioner.

b. Remove heat exchanger plenum chamber (2, Figure 2.2) at the left side of the base.

c. Remove two small covers (3) at the opposite (right) side of the base.

d. Remove four 1/2 x 20 capscrews that fasten positioner to the deck.

e. Replace two small covers and heat exchanger plenum.

f. Hoist the positioner from the deck by nylon slings positioned under the horizontal member of the yoke (1).

g. Place the positioner in a shipping crate similar to that shown in Figure 2.3.

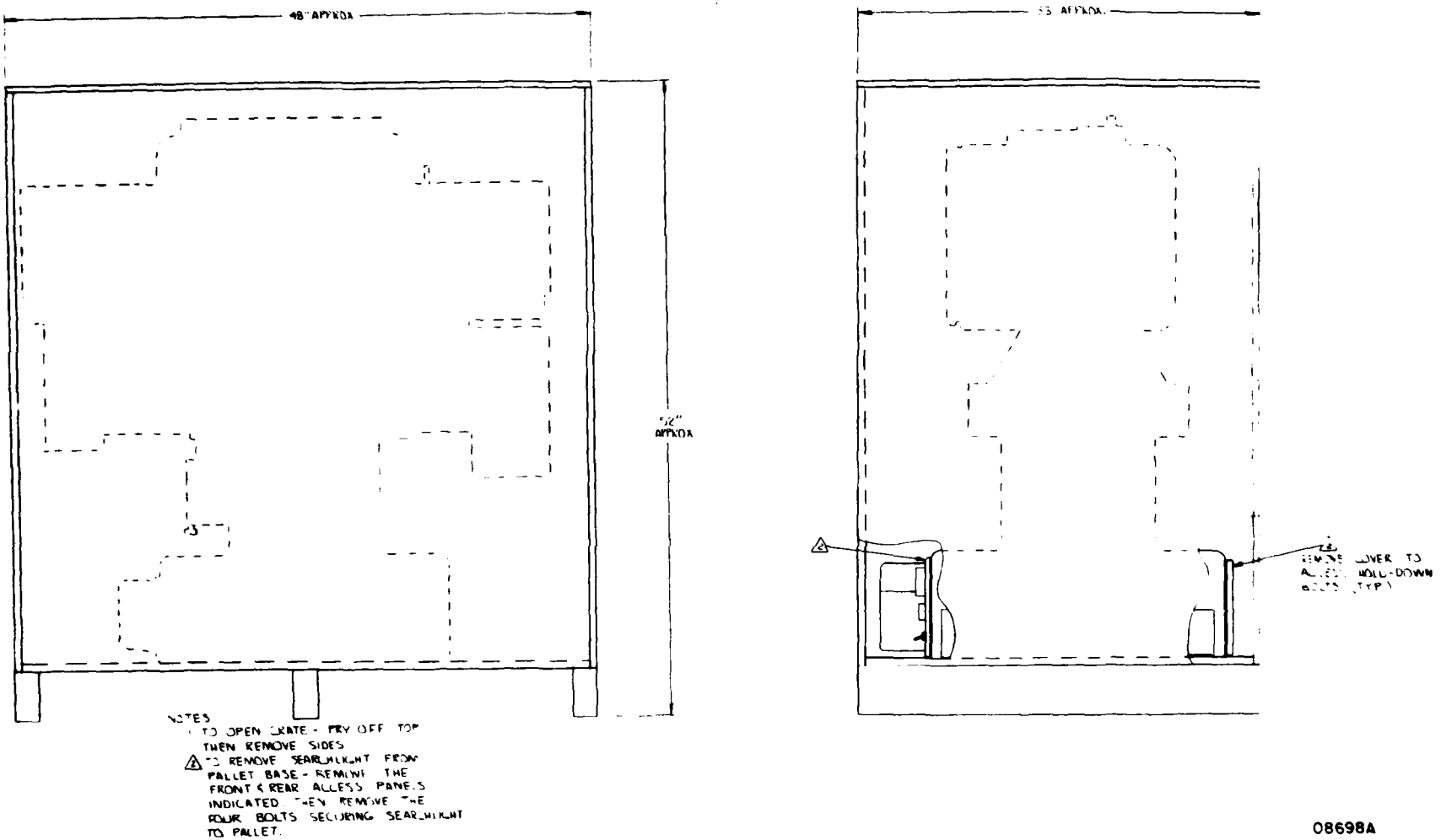


Figure 2.3. Positioner Shipping Crate

3. OPERATION.

3.1. Introduction. This chapter contains operating instructions for the Model 066, Two Axis Searchlight Positioner.

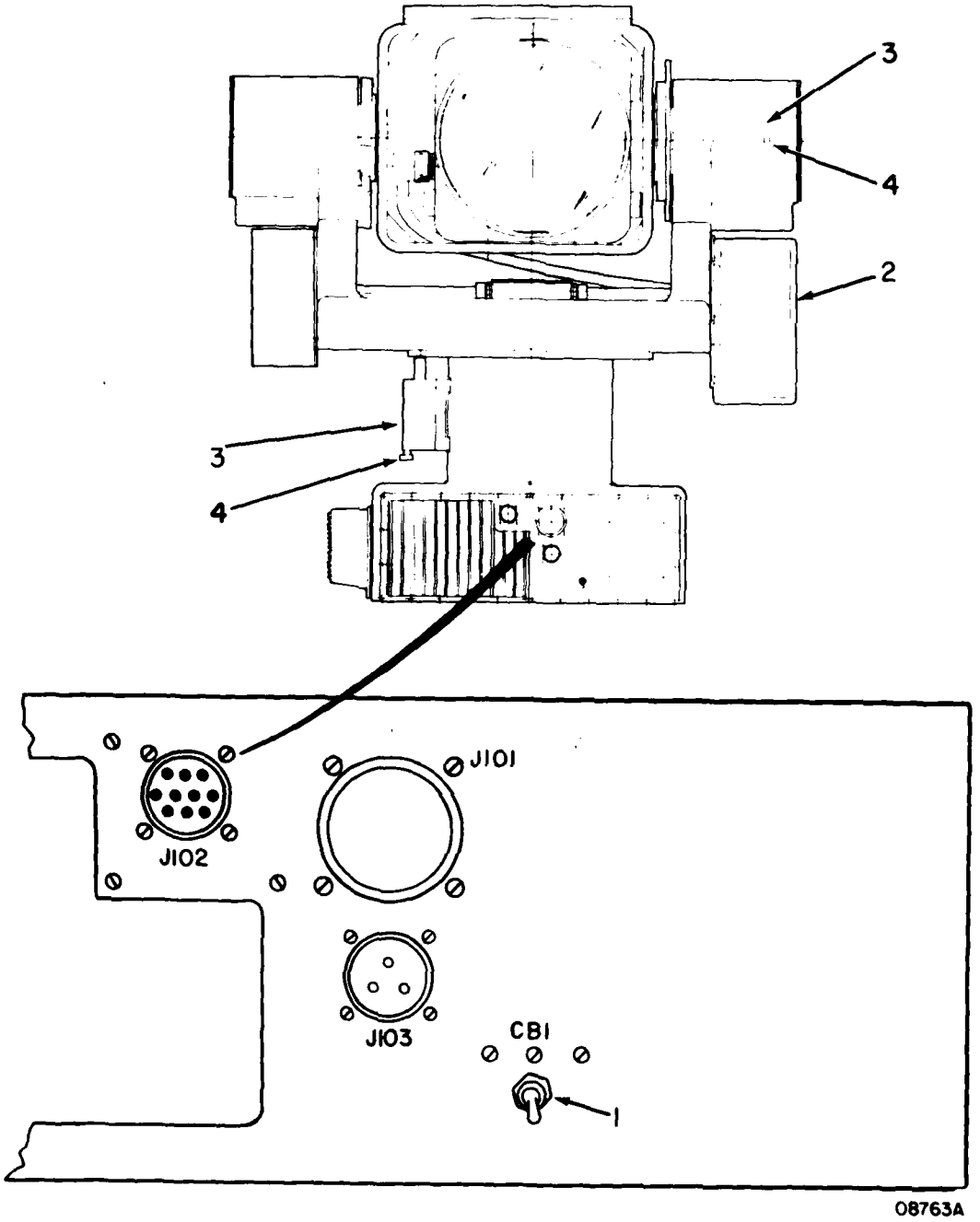
3.2. Electrical Operation. The only operator control located on the positioner is the main circuit breaker, CB1 (1, Figure 3.1) located on the front panel. In order to energize the positioner, turn CB1 to the ON position.

CAUTION

Engage the stow lock plunger and turn off the power when the positioner is not in use. This will prevent excess wear of the system.

3.3. Searchlight Control Box Operation. See TM 11-5855-217-12-1 for information about operation of the searchlight control box (2, Figure 3.1) mounted on the positioner.

3.4. Stow Lock Assembly, Manual Operation. Both axes can be manually stowed within ±1 degree from the zero position under a nonoperating condition. When the stow plunger is engaged (in the nonoperating mode), retract the plunger by turning the knurled knob on the stow lock assembly (3, Figure 3.1) in a clockwise direction until plunger is disengaged. To engage the plunger, turn the knurled knob fully counterclockwise and rotate the axis until the plunger drops into a hole in the caging disc.



1. Main Circuit Breaker
2. Searchlight Control Box
3. Stow Lock Assembly
4. Knurled Knob

Figure 3.1. Searchlight Positioner Operation

4. THEORY OF OPERATION.

4.1. Introduction. This chapter provides the theory of operation of the Model 066, Two Axis Searchlight Positioner.

4.2. Mechanical Configuration Description. The positioner (Figure 4.1) constitutes a two-axis elevation over azimuth configuration which provides two degrees of rotational freedom. The angular displacements of both axes are limited electrically as well as mechanically. The range on the elevation axis is +55 degrees to -20 degrees. The range of the azimuth axis is ±120 degrees from a nominal zero. Both axes can be manually stowed within ±1 degree from the zero position under a non-operating condition. There are additional stow positions for both azimuth and elevation. Azimuth may also be stowed at any 45 degree interval and elevation can be stowed at any 30 degree interval within the range of travel.

4.2.1. Elevation axis. The elevation axis provides a closed, 4-sided gimbal (1) for accepting the searchlight. The elevation gimbal is mounted between two concentrically aligned elevation shafts (2, Figure 4.1) which are supported by two pairs of preloaded angular contact ball bearings mounted in the pillow blocks (3 and 4).

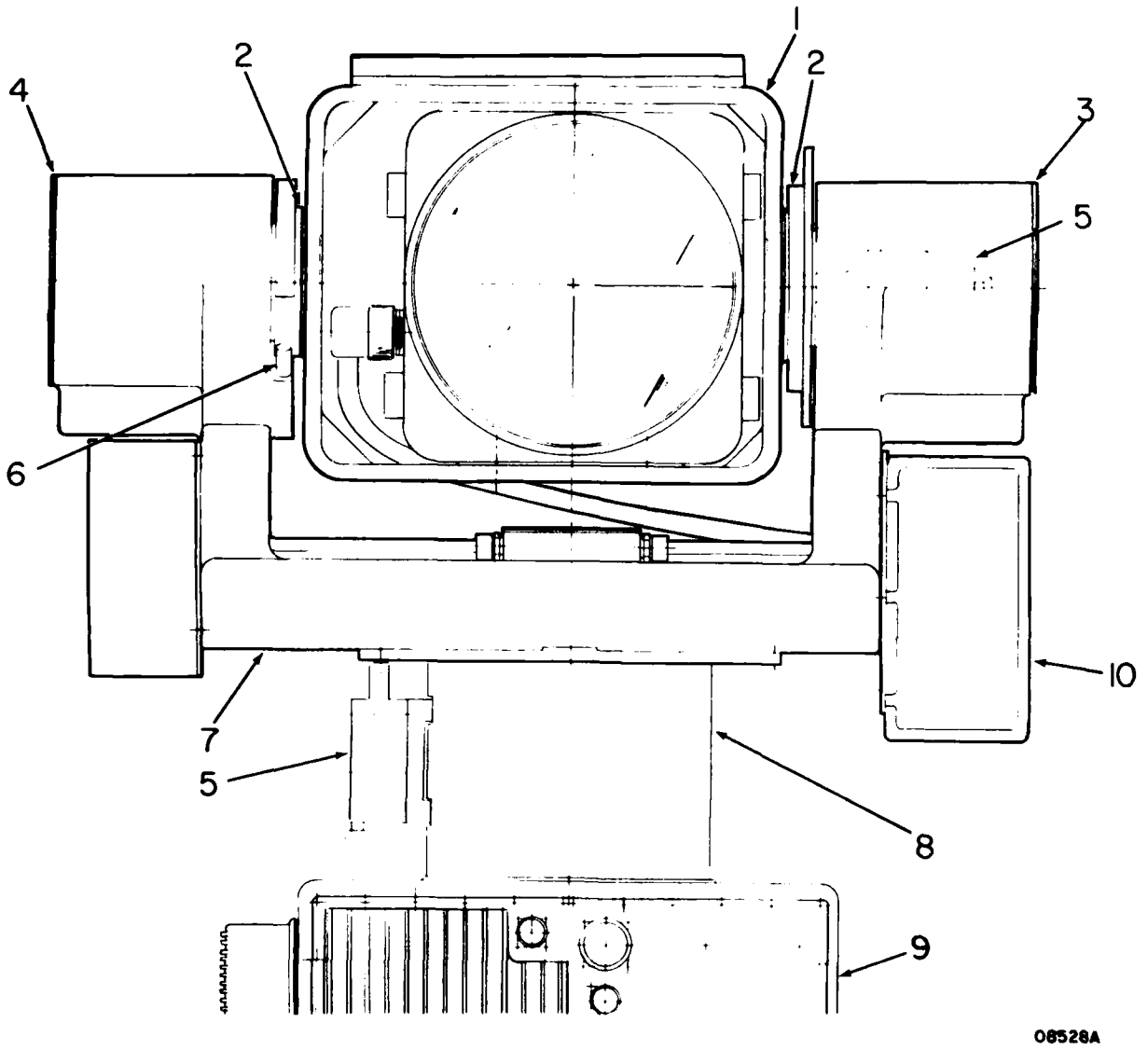
4.2.2. Pillow blocks. The drive side pillow block (3, Figure 4.1) houses a synchro transformer, a synchro transmitter, the elevation axis limit switches, and one set of preloaded bearings. The readout pillow block (4) houses only the opposing set of bearings and a 7 ft-lb direct drive torque motor. The elevation stow lock assembly (5) is mounted on the readout side pillow block. The elevation axis and stop assembly (6) is mounted on the drive side pillow block.

4.2.3. Azimuth yoke. The pillow blocks are supported by the azimuth yoke, (7, Figure 4.1) which is mounted to the azimuth shaft, which in turn is supported by a pair of angular contact ball bearings located in the azimuth drive housing (8). The azimuth housing also contains a 30 ft-lb torque motor, a synchro transformer, transmitter and the azimuth axis limit switches.

4.3. Electrical Configuration Description. The azimuth drive housing is mounted directly to the electronics base housing (9, Figure 4.1). The system cables are passed through the azimuth shaft in a cable twist arrangement to the base housing. Because of the large current required to drive the searchlight, 80 amps peak, the bore of the azimuth shaft is insulated with a plastic ıbe. This precludes that if the power cable should short out, it could not short the power supply to ground.

4.3.1. Control electronics. Positioner control electronics are contained in the card rack located in the electronics base. The cards contained in the card rack are:

a. A1 Deomdulator (AZ)
b. A2 Demodulator (EL)
c. A3 Input Amplifier and Notch Filter (AZ)
d. A4 Input Amplifier and Notch Filter (EL)
e. A5 Searchlight Control Card I
f. A6 Searchlight Control Card II



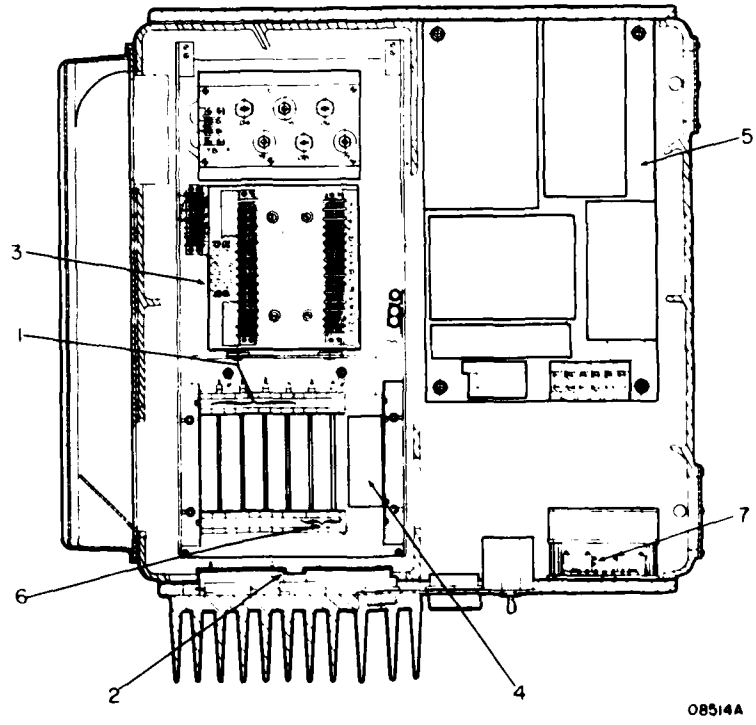
1. Elevation Gimbal
2. Elevation Shafts
3. Drive Side Pillow Block
4. Readout Side Pillow Block
5. Stow Lock Assembly
6. Elevation End Stop Assembly
7. Azimuth Yoke
8. Azimuth Drive Housing
9. Electronics Base Housing
10. Searchlight Control Box

Figure 4.1. Searchlight Positioner Mechanical Configuration

4.3.2. AZ-EL drive electronics. The drive electronics for the positioner are located in the electronics base. This system consists of four electronic printed circuit boards (1, Figure 4.2), a dual servo power amp assembly (2) and a three-phase power supply (3) which provides motor drive power and stores solenoid power. A ±15V, dc to dc converter (4) provides voltages for the operational amplifiers (op-amps) located on the printed circuit cards. The two synchro transformers, two power amplifiers, four printed circuit boards and two torque motors form two feedback servo control loops whose position commands come from remote three wire transmitters.

4.3.3. Searchlight control electronics. The searchlight power supply (5, Figure 4.2), located in the electronics base provides power to ignite the searchlight. In addition, two printed circuit cards (6) control turn on/turn off of the searchlight, searchlight intensity, and provide a control signal to position the serachlight's infra-red filter. Control of the searchlight may be done at a control box (10, Figure 4.1) mounted on the positioner or the searchlight may be controlled from a remote location.

4.4. AZ-EL Drive, Basic Block Diagram. Figure 7.1 is an illustration of the AZ-EL drive basic block diagram. Both the AZ and the EL servo loops function the same.



1. AZ-EL Drive Cards
2. Dual Servo Power Amplifier
3. Three-Phase Power Supply
4. DC-DC Converter
5. Searchlight Power Supply
6. Searchlight Control Cards
7. Isolation Assembly

Figure 4.2. Electronics Base Configuration

4.4.1. Synchro transformer operation. A position command, in the form of a 400 Hz, three-phase synchro signal goes to control transformer (CT). If the commanded position and the actual position are the same, there will be a zero volts position error signal and the motor will not drive. If the positioner is not at the commanded position, there will be an error signal generated by CT. The phase and the amplitude of the error signal depend upon the direction and the amount that the positioner must move in order to reach the commanded position.

4.4.2. Position readout signal. A synchro transmitter (CX) mounted on each axis provides a 400 Hz, three-phase position readout signal.

4.5. Printed Circuit Card Descriptions. The 400 Hz position error signal goes to the demodulator card. In the demodulator card, the phase of the position error signal is compared with the 400 Hz synchro excitation voltage and the amplitude of the position error signal is measured. A DC position error signal is generated. The polarity of the DC error signal depends upon the phase of the 400 Hz error signal and the amplitude of the DC error signal depends upon the amplitude of the 400 Hz error signal. The DC position error signal goes to the input amplifier and notch filter to be amplified and filtered. The amplified and filtered error signal goes to a servo power amplifier which drives a DC torque motor to move the positioner. As the positioner moves, the output of CT decreases until the positioner is at the commanded position and the output of CT once again returns to zero.

4.5.1. AZ demodulator (A1) and EL demodulator (A2) cards (Figure 7.3). The A1 and A2 cards are the same except for the value of R12. These cards provide a demodulated output signal corresponding to the position of the mount. The mount position is sensed by a synchro control transformer located on each axis. The synchro signal generates an output error voltage which is applied to the demodulator card on pins C and B.

4.5.1.1. Operation of IC1. IC1 is a differential input scaling amplifier whose gain is set to provide the correct ratio of error signal to reference voltage necessary to perform demodulation. The gain of IC1 is 0.1. The output of IC1 is AC coupled to the demodulator portion of the board (IC5 and IC7), to achieve complete DC isolation. The AC error signal is applied to the inputs of IC5 and IC7 simultaneously through R5 and R8.

4.5.1.2. Error signal demodulation. The function of IC5 and IC7 is to convert an amplitude modulated input signal to a DC output signal whose amplitude polarity is proportional to the phase and amplitude of the input signal. The output signal of IC5 (gain of 1) is inverted and applied to IC7 input through R11 via IC6-A contacts. IC7 is a summing amplifier. As a result of the above two signals being present at IC7 together, the gain characteristics (R12/R11 and R12/R8) cause the resultant output of IC7 to be the algebraic sum of the voltages applied via the contacts of IC6-A (analog switch), which are controlled by IC3 and IC4 to provide the required phase control for correct demodulation.

4.5.1.3. Phase control. IC3 is used to provide a variable phase lag at the given frequency of 400 Hz without influencing the amplitude of that signal. Basically, the circuit consists of an RC network (C9 and R22) and an op amp. With respect to the input signal on pin 14 of the PC card, this network presents a phase lag output signal at pin 6 of IC3 that influences the control of IC6 at the desired phase relationship between error signal and reference signal. IC4 is an open loop gain amplifier used to produce at its output a square wave signal at the same frequency and phase as its input.

4.5.1.4. Other circuit functions. R23 and CR1 provide voltage limiting of the signal from IC4 to 4.7V, the required level to energize IC6 (analog switch). IC2 is an active low pass filter that removes the remaining ac component from the demodulated signal, thereby leaving a resultant DC error signal on pin 4 of the PC card.

4.5.2. AZ input amplifier and notch filter card (A3) (Figure 7.6). This card provides the input to the drive section. The card may be divided into two sections:

a. Integrating compensator
b. Filter

4.5.2.1. Integrating compensator operation. The integrating compensator (IC1) has its feedback controlled by relay K1. The error signal which is input to the card on pin 8 is discriminated by IC6. For large error signals K1 is energized, thereby shorting C26. For small error signals, the relay is de-energized and the relay contacts are open, thus introducing a lead and integration into the loop.

4.5.2.2. Filter operation. IC2 provides a low pass filter and has a 3 dB attenuation at 20 Hz and a 40 dB/sec roll-off from thereon.

4.5.2.3. Other circuit functions. The final circuit on this card is controlled by the "Power On command" signal entering the card at pin E, which provides for the connection of the output signal of IC2 (TP6) to exit on pin 'C' of the card. When Power On command signal is high, the contacts of relay K2 are closed at pins 1 to 7. IC3 and IC5 are unused for this particular application.

4.5.3. EL input amplifier and notch filter card (A4) (Figure 7.9). This card's input and output signals are the same as for the azimuth (A3) card. In this case, no large step shorting relay (K1) is necessary because of the limited travel of the elevation axis. IC3 and IC5 are unused in this application.

4.5.4. Searchlight control card I (A5) (Figure 7.11). This card controls the intensity of the searchlight by varying the searchlight power supply output voltage through a control voltage generated by the card.

4.5.4.1. Intensity command signal (inputs). The command for an increase intensity enters the board at pin L and the decrease intensity signal enters the board at pin K. When a command signal enters this card, the free running multivibrator U11 is gated through U2-A/B, causing U4 and U5 to count up or down depending on whether an increase or decrease intensity command has to be initiated. The output of these counters is halted by the detection of the counter output state, detected by U3 and U6 at the counter extremes (to prevent roll over).

4.5.4.2. Digital to analog conversion. The digital signal is then presented to the digital to analog converter U8. This signal is buffered and scaled through U10 with an output on terminal Y of card A5. The signal level on terminal Y of A5 is 10V dc for full intensity and 8.56V for minimum intensity. The analog signal then goes to the searchlight control box to control searchlight intensity.

4.5.4.3. Other circuit functions. U1-A is a power on reset chip and outputs a Power On reset signal at pin 5 of card A5 after the system three-phase power is applied to the positioner. The receipt of a system power on signal provides +28V to the stow solenoids through relay contacts K1-1-2. This also causes the iterrogate signal to be output on pin J of the card.

4.5.5. Searchlight control card II (A6) (Figure 7.14). This card provides for signals to be presented to the Searchlight Control Box by the actuation of control logic on this card. Positioner signals are also processed on this control card to provide for the azimuth axis to move around to the opposite side of the field of view when a travel limit is reached.

4.5.5.1. Narrow/wide beam signal. The narrow/wide beam signal enters card A6 pins Z and 21 respectively. The presence of a 28V signal causes relay K5 or K6 to be energized and provides connection of the signal through pins Y, V, and X of the card to connector J2 on the Searchlight Control Box.

4.5.5.2. Mode and light on signals. Mode and light on command signals at 0-28 Volt levels are presented to card A6 on pins 17 and 14 respectively. These are hi levels and energize relays K3 and K13 to permit the transfer of signals through pins 18, 19, 20, T, and W of the card to J2 on the Searchlight Control Box.

4.5.5.3. AZ prelimit control of searchlight mode. If azimuth CW/CCW prelimit switches are activated, the Q output of U7 is forced high. This turns on transistor Q3 and energized relay K2. This causes K4 to de-energize, changing the command from white light to IR light. This signal goes to the searchlight control box via PC card pins 19, 20, and T and W of the card.

4.5.5.4. AZ prelimit circuitry. The azimuth demodulator output is input to the card on pin 7. When the magnitude of this signal corresponds to approximately 60° of position error and the proper azimuth prelimit is entered, pin 15 of flip-flop U6 is forced high. This energizes relay K9 and transfers the power amp input voltage from the azimuth input amp and notch filter card to either pin 7 or pin 14 of U1, depending upon which prelimt has been entered. This forces the mount to move out of the prelimit condition and thereby move towards the opposite end of travel in azimuth. Once in this mode of control, relay K9 is de-energized whenever the mount axis position error decreases below 180°. This allows the axis to be controlled by the azimuth input amp and notch filter card which is input on pin 16 of the card.

4.5.5.5. EL prelimit circuitry. The signal coming from the el input amp and notch filter card is a ±10V analog signal proportional to current in the elevation motor. This signal enters PC card pin H and exits card A6 via pin C, to the elevation power amplifier. Relay K7 and K8 are energized by the elevation down and up prelimit switch respectively. The activation of these limit switches causes the signal to the power amp to be unidirectional in polarity by inserting the diodes CR16 and CR15 in series with the output signal, pin C. This circuit permits the elevation axis to move up/down in a motion to go out of the limit condition once activated.

4.6. Stow Lock Operation. The stow lock assembly is activated by the System Power on signal entering card A5 pin 10, which energizes the coil on the stow solenoid and retracts the stow plunger from the hold down position.

4.7. Limit Switch Operation. Limit swtiches mounted on the azimuth and elevation axis provide the circuit information as to axis position.

4.7.1. AZ limit switches. The azimuth limit switches are set to approximately ±120° with respect to the azimuth zero position. When a limit switch is reached on the azimuth axis in the CW direction, S2 located on that axis is closed. The contacts control power amplifier input signals to permit the axis to move out of the limit condition, in a CCW direction. In the case where an azimuth CCW limit switch is reached, S3 located on that axis is closed. The contacts control power amplifier input signals to permit the axis to move out of the limit condition in a CW direction.

4.7.2. EL limit switches. The elevation limit switches are set at +55° and -20°. When a limit switch is reached in the +55° (positive from the horizon) angle, the power amplifier input signals permit the elevation axis to move down and out of the limit condition. When a limit switch is reached in the -20° (negative from the horizon) angle, the power amplifier input signals permit the elevation axis to move up and out of the limit condition.

4.8. Power Supplies Description. Three power supplies are present in the positioner.

4.8.1. Power supply, control electronics (3, Figure 4.2). The dc power needed to drive the motors and the P.C. cards come from a three-phase power supply consisting of a three-phase transformer rated for 23V @19A, a three-phase rectifier assembly, and a filter capacitor. The secondary side of the transformer is grounded to the base at a single point which ties all other grounds in the system together. This ''chassis'' ground is provided on one of the output connectors to tie to the ship's ground, minimizing current flow through the hull and thus preventing premature oxidation of the aluminum castings used in the mount and base. Three-phase power is activated via the base mounted circuit breaker CB1 which trips for an overload current. The dc power supply output feeds the servo power amplifier mounted on the electronics base.

4.8.2. DC to DC converter (4, Figure 4.2). The dc power supply also provides power to the DC to DC converter, a well regulated, low ripple, ±15 Volt supply used to power the op amps mounted on the PC cards.

4.8.3. Power supply, searchlight (5, Figure 4.2). Power for the light comes from a separate supply located in the electronics base. This supply consists of a motor driven auto transformer, a three-phase rectifier, a regulator board which drives the auto transformer's motor and other components shown in Figure 7.17. It supplies up to 28 volts at 60 amps and can tolerate a 150 amp current surge for three seconds. Three-phase power is applied to the searchlight power supply through the main circuit breaker CB1.

4.9. Power Amplifier Assembly Description (2, Figure 4.2). The power amp assembly consists of two epoxy incapsulated modules attached to a large, finned heat sink which provides the necessary cooling. The modules contain all the pre-drive and thermal shutoff circuitry, as well as the output transistor in a bridge-type, push-pull configuration.

CAUTION

Do not ground either output pin of power amplifier with test equipment leads or jumpers. Serious damage to the equipment will result.

Pins are provided for either voltage or current loop feedback and current limit across the output. At present, a current loop drive with 400 Hz bandwidth is sufficient to eliminate the L/R times constants of the motors, and the current limit is set to maximum of 12 amps dc. The heat sink is mounted to the base to provide external ambient air for cooling while maintaining the waterproof integrity of the base.

4.10. Isolation Assembly Description (7, Figure 4.2). The isolation assembly consists of two isolation transformers mounted in the electronics base. The purpose of the isolation assembly is to isolate the synchro reference signal from AC ground.

5. MAINTENANCE.

5.1. Introduction. This chapter provides maintenance instructions for the model 066 Searchlight Positioner.

5.1.1. The positioner will perform as required only if maintained properly.

a. After any maintenance, and especially when the positioner was disassembled, perform inspection as in paragraph 5.5, and test positioner operation as in paragraphs 5.6 through 5.8.

b. When disassembling the positioner, disassemble only to the extent necessary to make the repairs.

NOTE

The operators of the equipment should be familiar with both the theory of operation as well as the operating instructions for its use.

5.2. Mechanical Maintenance. Mechanical maintenance consists of cleaning and lubrication of the positioner.

5.2.1. Cleaning the positioner. It is important for the equipment to be kept clean. It is necessary to clean the positioner often because wind gusts might carry sand, dirt, and salt upon the equipment. Personnel responsible for cleaning shall inspect the positioner to determine the frequency and extent of cleaning. It is very important that salt deposited on the mount is washed off regularly. The mount is finished with durable epoxy paint. Pinholes in the paint finish are unavoidable, however, and will lead to corrosion if regular maintenance is not performed. Wash the positioner with fresh water and mild detergent. Wipe the equipment with a clean, dry, lintfree cloth when not exposed to sea air.

5.2.2. Lubricating the positioner. Lubrication is generally not required. The ball bearings used in both axles were lubricated for life at assembly. They will not need relubrication unless removed and degreased. This procedure is not recommended, but if necessary, grease the bearings with General Electric 6300 grease (versilube). Under normal conditions, the teflon seals keep out moisture and foreign matter such as dust and dirt.

5.3. Electrical Maintenance. Maintenance of the positioner electrical components consists of the following adjustment procedures:

WARNING

Dangerous voltages are present in this equipment. Both power supply voltages and synchro signals can cause serious electrical shock. Make sure that both power supply voltages and synchro signals are removed before disassembling this equipment.

5.3.1. Synchro transmitter orientation. The orientation of the synchro transmitters in the mount are adjusted at the factory to provide the following position readout at the control chassis:

5.3.1.1. The elevation axis readout indicates zero when the searchlight is parallel to the base (generally horizontal).

5.3.1.2. The azimuth axis readout indicates zero when the azimuth line of sight is lined up with the front surface of the base. The front surface of the base is the surface with the three connectors and the vertical cooling fins.

5.3.2. Synchro transmitter adjustment. The synchro transmitter may be repositioned to suit particular applications by following the given procedures.

5.3.2.1. Elevation axis synchro transmitter (118, Figure 5.7). The elevation axis synchro transmitter is located in the drive side pillow block. It is directly accessible by removing the pillow block cover (16). To adjust the transmitter, loosen the three clamp-down screws (708) slightly and turn the transmitter body by hand, as required. When the desired readout on the control chassis is achieved, retighten the clamp-down screws and replace the pillow block cover.

5.3.2.2. Azimuth axis synchro transmitter (116, Figure 5.4). The azimuth axis synchro transmitter is located in the azimuth drive housing. It is accessible by removing the larger cover (19) on the rear as one faces the instrument from the front. To adjust the transmitter, loosen the two clamp-down screws (711), slightly and turn the transmitter body by hand, as required. When the desired readout on the control chassis is achieved, retighten the clamp-down screws and replace the cover.

5.3.3. Limit switch adjustment. The limit switches of both axes are predjusted and need not be touched unless a different limit angle is required. The azimuth axis is adjusted to provide a travel of ±120 degrees before contact is made. The elevation axis is adjusted to provide -20 degrees to +55 degrees before contact is made. Both limit switches are adjustable cam switch assemblies - Precision Mechanism Corporation (PMC) type CS-402-4. Adjustment procedures follow in this section (Figure 5.1).

5.3.3.1. Limit switch locations. The elevation axis limit switch is located in the drive side pillow block (104, Figure 5.7). It is easily accessible by removing the pillow block cover (16). The azimuth axis limit switch (106, Figure 5.4) is located in the azimuth drive housing. It is reached by removing the two smaller covers (20) on the left side as one faces the instrument from the front.

5.3.3.2. Adjusting procedure. Follow the given procedures and see Figure 5.1 to adjust limit switches.

a. Follow procedure printed on end cap (Figure 5.1).

b. For switch closure angle "0" of 182° or less, wire to "Common" (C) and "Normally Open" (N.O.). Rotate adjusting screws according to instructions on end cap.

CAUTION

Do not overtighten adjusting screws.

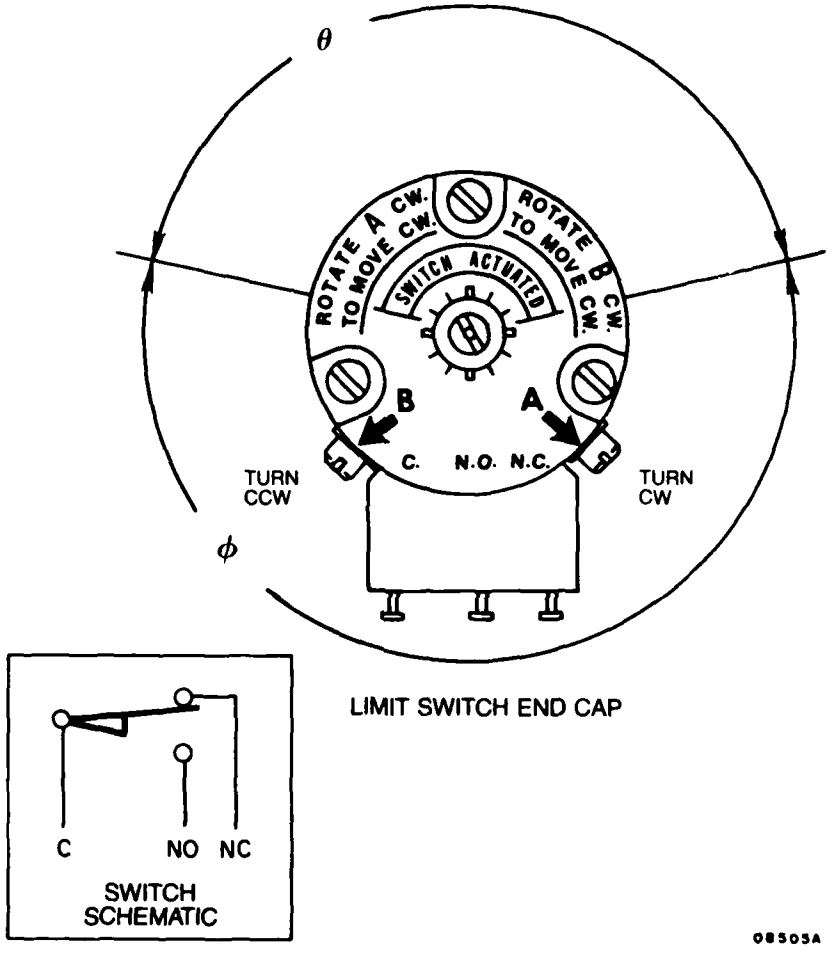


Figure 5.1. Limit Switch Adjustment

c. Switching angle ''0'' can be adjusted to zero. This results in switch non-actuation. Maintain a finite angle ''0'' when ''chasing'' an angle to a new position.

d. For switch closure angle ''0'' of 182° or greater, wire to ''Common'' and ''Normally Closed'' (NC). Adjust in (360° - 0) according to instructions on end cap.

CAUTION

Turn off circuit power before using an ohmmeter to test circuit.

e. The unit can be pre-adjusted to approximate settings on the printed dial at the end cap. Use an ohmmeter to note switch closure.

f. A final close trim of settings can be made after installation, even while the shaft is rotating.

CAUTION

End cap screws have internal stops at maximum and minimum. Do not over-tighten the adjusting screws.

5.3.4. Demodulator calibration. *Calibrate demodulator* cards (Figure 7.3) as follows:

CAUTION

Be sure power is off before removing or replacing PC cards, jumpers, connectors or components.

a. Open servo loops by removing input amplifier and notch filter cards (A3 and A4) from card rack.

b. Set the range on a voltmeter to 115 vac. Measure between pins C and B of the card.

c. Move axis until ac voltage from synchro control transformer is about 80 - 90 vac. Scale factor is input signal is 57.3 vac/90° of rotation.

d. Connect an oscilloscope between TP2 and TP6 (scope gnd). Adjust R22 until scope trace is as close to full wave rectification as possible (Table 5.1).

NOTE

Polarity of the waveform on TP2 may be positive or negative depending upon the position of the positioner.

e. Set meter range to 2.5 vac. Measure between TP1 and TP6 of A1 or A2.

f. Move axis until voltmeter reads 1 vac.

g. Set meter range to 10 vdc. Connect black lead (-) to TP6 and red lead (+) to TP3.

h. If you are adjusting the elevation axis, adjust R17 for a reading of 5 vdc ±0.1V.

i. If you are adjusting the azimuth axis, adjust R17 for a reading of 2 vdc ±0.1V.

5.3.5. AZ and EL input amp and notch filter cards balance pot adjustment (Figures 7.6 and 7.9).

CAUTION

Be sure all power is off before removing or replacing PC cards, jumpers, connectors or components.

a. Connect a multimeter to the output of IC1, test point TP5.

b. Connect clip lead jumper across C26 and clip lead from pin 8 of the card to ground.

c. Change multimeter scale to ±2.5V scale and adjust pot R1 until the meter reads under 100 mvdc.

d. Change multimeter scale to ±250 mv scale and adjust pot R1 until the meter reads under 5 mvdc.

e. Remove jumper from across C26 and from pin 8 of the card to ground.

5.3.6. Searchlight control card I (Figure 7.11) D/A converter adjustment.

a. Set multimeter range switch to 10VDC range.

b. Put the red lead (+) on pin Y of card A5 and put the black lead (-) on pin Z.

c. Connect pin 6 or pin F to pin L.

d. After 5 seconds, the meter should read +10VDC. If it does not, adjust R12 until the reading is obtained.

5.4. Circuit Test Points. Table 5.1 is a listing of circuit test points.

Table 5.1 Positioner Circuit Test Points

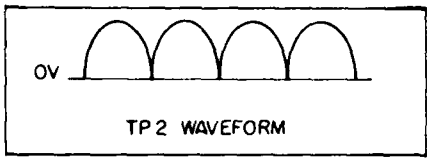
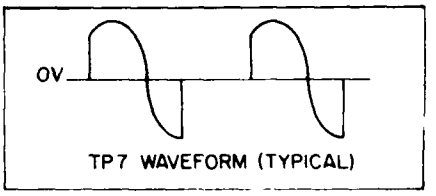
TEST POINT CARD	TEST POINT PIN OR TP	DESCRIPTION
A1 and A2	PIN (B) TO PIN (C)	400 Hz error signal. (57.3 vac/90° rotation, 90 vac max.)
	PIN (14)	400 Hz reference signal input. (90 vac)
	TP1	Scaled 400 Hz error signal. (0 to 2 vac)
	TP2	Demodulated error signal. May be + or - depending upon setting of positioner.  TP2 WAVEFORM
	TP3	Error signal output. (AZ 0 to ±5 vdc) (EL 0 to ±2 vdc)
	TP4	400 Hz reference signal. (12 vac)
	TP5	400 Hz square wave output. (4.7 VPP)
	TP6	Analog common.
	TP7	Input signal to demodulator IC7. (TYPICAL) This is a portion of a sine wave. Exact waveform depends upon the phase relationship between input and reference signals.  TP7 WAVEFORM (TYPICAL)
	TP8	+15 vdc
	TP9	-15 vdc
A3 and A4	TP5	Integrated error signal. For a small change in error signal, voltage at TP5 will ramp to + or -15 VDC fairly rapidly.
A3 and A4	TP6	Integrated filtered error signal. Integrated error signal with high frequency component removed.
	TP7	Not used.
	TP8	Not used on card A3. Same signal as TP6 on card A4.
A5	TP1	15V, 22 PPS square wave.
	TP2	"Stop up Count" logic signal. Normally 15V goes low to prevent counter (U4-U5) overflow.

Table 5.1 Positioner Circuit Test Points (Continued)

TEST POINT		DESCRIPTION
CARD	PIN OR TP	
	TP3	''Stop down Count'' logic signal. Normally 15V goes low to prevent counter (U4-U5) underflow.
	TP4	''Power on reset'' logic signal. Normally 15V goes low for 2 seconds when power is first supplied.
	TP5	D/A Converter output (0 to -10 vdc).
	TP6	Power common.
	TP7	Analog common.
	PIN (Y)	Searchlight intensity control output. +8.56 vdc for minimum intensity, +10 vdc for maximum intensity.
A6	TP1	+28V ''wide beam select'' logic signal.
	TP2	+28V ''narrow beam select'' logic signal.
	TP3	''Mode select'' logic signal. +28V selects ''WHITE'' light.
	TP4	AZ pre-limit logic signal. Normally +15V goes low on AZ pre-limit condition.
	TP5	AZ pre-limit signal normally low, goes to +15V on pre-limit condition.
	TP6	AZ pre-limit signal. Normally +15V goes low on AZ pre-limit condition.
	TP7	AZ pre-limit signal. Normally +15V goes low on AZ pre-limit condition.
	TP8	AZ pre-limit signal. Normally low goes to +15V on AZ pre-limit condition.

5.5. Inspecting the Positioner.

a. Make sure main power to the positioner is turned OFF, positioner is stowed.

b. Inspect positioner for physical defects such as cracked welds, dents, bends, corrosion and missing paint.

c. Inspect cables for worn or damaged insulation.

d. Inspect connectors for cracks or corrosion. Make sure cables are tightly connected to the positioner.

e. Remove front cover as in paragraph 5.10.1. Inspect for signs of leakage or for water in the base. If signs of leakage or water are found, go to the Troubleshooting Chart, Table 5.2, step No. 1.

f. Inspect screws and other fasteners for tightness; tighten as necessary.

g. Repair defects or replace defective parts as necessary.

5.6. Checking Position Readout.

a. Make sure searchlight is off.

b. With positioner stowed, turn power ON.

NOTE

When the positioner is stowed (stow plunger engaged) either axis can move approximately $\pm 1^{o}$.

c. Check position readout for both axis at remote indicators. If position readout is not $0^{o} \pm 1^{o}$, go to Table 5.2, step No. 2.

5.7. Testing Positioner Operation.

WARNING

Stand clear of the positioner when disengaging stow plunger. Certain electrical failures can cause the positioner to ''run away'' causing serious personal injury or equipment damage.

a. Disengage the stow plunger. If the positioner ''runs away'', turn off power at once, then go to Table 5.2, step No. 3.

b. Test positioner operation by slewing both axes from limit to limit, observing come back and light mode circuit functions (see paragraphs 4.5.5.3 and 4.5.5.4).

c. If the positioner does not move, go to Table 5.2, step No. 4.

d. If the positioner moves in one direction only, go to Table 5.2, step No. 5.

e. If the positioner moves erratically, go to Table 5.2, step No. 6.

f. Return the positioner to the 0°AZ/0°EL position and engage stow plunger.

5.8. Testing Searchlight Control.

WARNING

Avoid looking directly at the beam of light. Looking directly at the light can cause serious eye injury.

a. Turn on searchlight. If searchlight does not come on, go to Table 5.2, step No. 7.

b. Without changing lamp intensity setting, visually monitor lamp intensity for several minutes. If intensity varies, go to Table 5.2, step No. 8.

NOTE

As intensity of light changes, technician will also note an audible change in the sound of the fan mounted in the searchlight.

c. Adjust lamp intensity setting. If intensity does not increase or decrease as setting is changed, go to Table 5.2, step No. 9.

NOTE

Wide beam is wide and flat, narrow beam is circular.

d. Switch between "Wide Beam" and "Narrow Beam" modes. If the positioner does not enter wide beam or narrow beam mode, go to Table 5.2, step No. 10.

NOTE

The IR mode generates heat but no light. Use an IR detector to measure the presence of IR radiation.

e. Switch between "IR" and "white" modes. If the positioner does not enter IR or "white" mode, go to Table 5.2, step No. 11.

5.9. System Troubleshooting. Table 5.2 is a troubleshooting chart for the positioner. See paragraphs 5.5 through 5.8 for system inspection and testing procedures.

Table 5.2 System Troubleshooting Chart

ABNORMAL INDICATION			
STEP	INDICATION	PROBABLE CAUSE	CORRECTIVE MEASURES
1	Seals leaking, water in the pedestal	a. Seals loose or damaged	Adjust or replace seals as necessary.
		b. RTV seals under pedestal tieing searchlight power supply to base is loose or deformed	Tighten or replace seals as necessary.
		c. Heat exchanger gasket loose or damaged	Tighten or replace gasket as necessary.
		d. Connectors loose	Tighten connectors.
2	Position is inaccurate	a. Incorrect reference voltage or frequency	Check reference voltage and frequency. Correct problem.
		b. Hold down screws loose, allowing synchro transformer to rotate	Tighten screws.
		c. Synchro transformer or transmitter defective	Replace transformer or transmitter as required.
		d. Electronics circuits out of calibration or defective	Calibrate circuits, repair or replace as necessary.
		e. Remote indicator out of adjustment or defective	Adjust, repair or replace defective remote indicator as required.
3	Positioner runs away, loss of control	a. Power amplifier shorted	Correct short or replace amplifier as required.
		b. Azimuth pre-limit circuitry defective	Replace card A6 or limit switches as required.
		c. Synchro transformer defective	Replace transformer.
		d. ±15 volt power supply defective	Replace power supply.

Table 5.2 System Troubleshooting Chart (Continued)

ABNORMAL INDICATION		PROBABLE CAUSE	CORRECTIVE MEASURES
STEP	INDICATION		
4	Positioner does not move	a. Circuit breaker OFF	Turn on circuit breaker.
		b. Cables not connected	Connect cables.
		c. Cables or connectors corroded or defective	Clean, repair or replace cables as required.
		d. Caging plunger engaged	Disengage pins by hand.
		e. Synchro transformer defective	Replace transformer.
		f. Power amplifier shorted	Repair or replace amplifier as necessary.
		g. Power ''on'' relay not energized	Repair or replace as necessary.
		h. Card A3 or A4 defective	Replace A3 or A4.
		i. Relay protection diode on card A3 or A4 shorted	Replace diode.
		j. IC1 on A3 or A4 defective	Replace IC1.
		k. 18V zener diode on any card defective	Replace zener diode.
5	Positioner moves only in one direction	a. Power amplifier defective	Replace amplifier.
		b. Searchlight control card II defective	Replace searchlight control card II.
		c. Pre-limit diodes K7, K8, K10, K11 or relay defective	Replace diode or relay as necessary.
		d. Card A1 or A2 defective	Replace A1 or A2.

Table 5.2 System Troubleshooting Chart (Continued)

ABNORMAL INDICATION		PROBABLE CAUSE	CORRECTIVE MEASURES
STEP	INDICATION		
5	Positioner moves only in one direction (continued)	e. Q1 or IC6 on card A1 or A2 defective	Replace Q1 or IC6 as necessary.
		f. 18V zener diode on any card defective	Replace zener diode.
6	Positioner moves erratically	a. Corroded commutator or shorted motor winding	Repair or replace motor as required.
		b. Dirty bearing or seal	Clean or replace bearing or seal as necessary.
		c. Defective A1, A2, A3 or A4 card	Replace card.
		d. Zener diodes R17, R21, Z7 or Z8 on card A3 or A4 shorted	Replace zener diodes.
		e. C26 on card A3 and A4 or K1 on card A3 defective	Replace C25 or K1 as necessary.
7	Searchlight does not come on	a. Circuit breaker off.	Turn on circuit breaker.
		b. Power on switch off	Turn on power switch.
		c. Local control box in wrong state (LOC/REM switch in LOC, TEST switch in position 2 through 8)	Set switch to correct position.
		d. Local control box switch defective	Replace switch.
		e. Local control box fuse blown	Replace fuse.
		f. Lamp burned out	Replace lamp.

Table 5.2 System Troubleshooting Chart (Continued)

ABNORMAL INDICATION		PROBABLE CAUSE	CORRECTIVE MEASURES
STEP	INDICATION		
7	Searchlight does not come on (continued)	g. IR filter in place (heat and red glow present)	Replace defective card A6, repair or replace defective filter mechanism.
		h. Card A6 defective	Replace A6.
		i. Searchlight power supply defective	Repair or replace as necessary.
		j. Cable to control box loose, corroded, or defective	Tighten, clean or replace cable as required.
8	Searchlight intensity varies	a. Searchlight power supply hunting due to misadjusted chain tension	Adjust chain tension
		b. Card A5 defective	Replace A5.
		c. U7 on A5 noisy or defective	Replace U7 on A5.
		d. Searchlight bulb nearing the end of its life	Replace bulb.
		e. Card A5 defective	Replace A5.
9	Light does not increase or decrease intensity	a. Card A5 defective	Replace A5.
		b. K1, K3, or U8 on A5 defective	Replace K1, K3 or U8 as required.
		c. U10 defective	Replace U10.
		d. Searchlight power supply chain tensioner or motor locked up	Repair or replace tensioner or motor as required.
		e. Searchlight power supply drive resistors open	Replace resistors.

Table 5.2 System Troubleshooting Chart (Continued)

ABNORMAL INDICATION		PROBABLE CAUSE	CORRECTIVE MEASURES
STEP	INDICATION		
10	Searchlight does not enter WIDE BEAM or NARROW BEAM mode	a. Card A6 defective	Replace A6.
		b. K5 or K6 on A6 not working, CR19 or CR20 shorted	Repair or replace A6.
		c. Fuse on local control box blown	Replace fuse.
		d. Loose or dirty contacts in connector	Tighten contacts. Clean or replace connector.
11	Searchlight does not enter IR or WHITE mode	a. Positioner in pre-limit	Move positioner out of pre-limit.
		b. Card A6 defective	Replace A6.
		c. K3 or K4 not working. Q3 defective	Repair or replace A6.
		d. Searchlight is not functioning correctly	See searchlight manual, TM 11-5855-217-12-1.

5.10. Disassembling, Cleaning and Inspecting the Electronics Base. Disassemble, clean and inspect the electronics base as follows:

WARNING

Dangerous voltages are present in this equipment. Both power supply voltages and synchro signals can cause serious electrical shock. Make sure that both power supply voltages and synchro signals are removed before disassembling this equipment.

NOTE

In this, and in the following procedures disassemble the positioner only to the extent necessary to make the repair.

After any disassembly, be sure to check out the positioner as in paragraph 5.5 through 5.8 as necessary.

NOTE

To replace any gasket not called out in the drawings and parts list, cut out the gasket from a 1/16 inch thick sheet of neoprene.

5.10.1. Removing the printed circuit card rack plate.

a. Disconnect cables from connectors J101, J102 and J103 (107, 108, 109, Figure 5.2).

b. Remove 28 screws (712) and front cover (4). Do not remove heat sink (7) from cover.

c. Inspect gasket (37) under the cover. If gasket was damaged during cover removal, remove the gasket, scrape mating surfaces clean then install new gasket.

d. Move front cover aside to complete disassembly of the electronics base.

NOTE

To service printed circuit cards, use an extender card. Observe the correct placement of cards in the card rack plate.

e. Remove eight screws (735) and two power amplifier assemblies (132) from heat sink.

f. Remove two screws (706) at front of printed circuit card rack plate (13).

g. Remove screws (713), heat exchanger (26) and gasket (120). Inspect gasket as in step c.

h. Use a small angle screwdriver to remove center left screw (706) from plate.

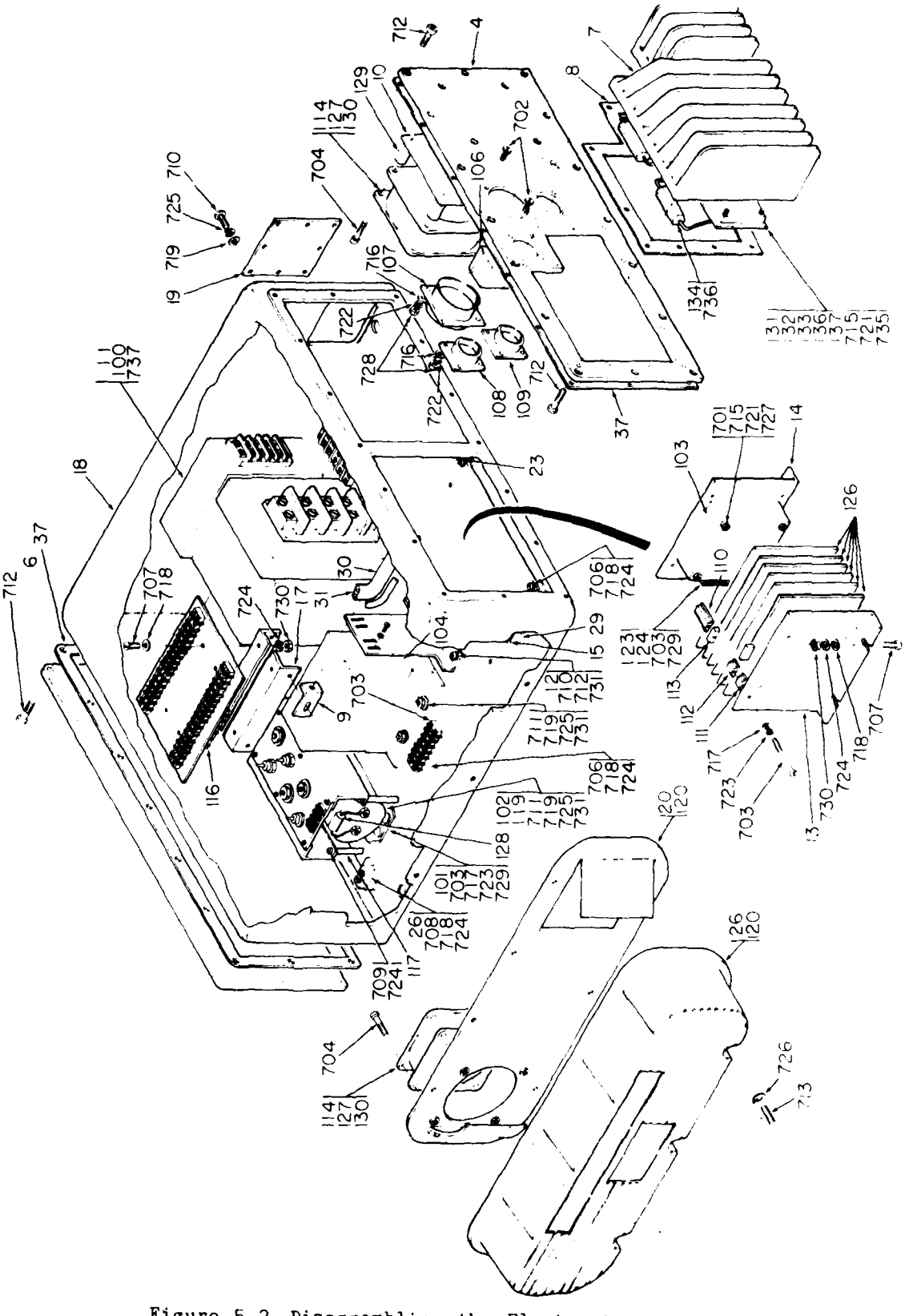


Figure 5.2. Disassembling the Electronics Base

i. Reaching in front of searchlight power supply (100), remove rear right screw from plate.

j. Slide plate forward to service plate mounted components.

5.10.2. Disconnecting and removing the printed circuit card rack plate from the electronics base.

CAUTION

Due to the time and difficulty involved in the unwiring and disconnecting the card rack plate, remove it only if necessary. Carefully mark each wire before disconnecting it. Connecting a wire to the wrong terminal can cause extensive equipment damage.

a. See the overall shematic diagram (Figure 7.2) for information about wiring the positioner.

b. Remove four screws (702, Figure 5.2) and nuts (728), and remove J102 (107) from the front cover (4).

c. Disconnect the wires on the load side of CB1 (106).

d. Disconnect the wires connected to pins 14, 8, J, C, and B of edge card connectors A1 and A2, pins X, V, Y, W, T, 18, 19 and 20 on edge card connector A6, and pins Y and Z on edge card connector A5. Save lengths of teflon tubing as wires are removed. Tubing will be reinstalled later.

CAUTION

Do not put excessive strain on the wires connected to the tabs of the three-phase diodes (3). The tabs are fragile and easily broken.

e. Remove the wires from terminal boards TB 101, and TB 102 so that plate can be removed. Be careful to preserve, as much as possible, the fanning shape of the wires.

f. Remove the wires from TB 110 (121).

g. Slide the printed circuit card rack plate forward and remove it from the electronics base.

5.10.3. Removing the searchlight power supply.

a. Remove 28 screws (712, Figure 5.2), and rear cover (6).

b. Inspect gasket (37) under cover. If gasket was damaged during cover removal, remove gasket, scrape mating surfaces clean, then install new gasket.

c. Remove four large screws (737) that fasten the searchlight power supply (100) to the electronics base. Two screws are at the front and two at the rear.

NOTE

The four searchlight power supply mounting screws have been fastened with screw thread compound and will be stiff and difficult to remove.

d. To service the searchlight power supply, slide it out the rear. This will allow access to the motor, chain tensioner and terminal board on the control card.

e. To remove the power supply from the electronics base, remove the two heavy power cables and the control input wires from the terminal board on the searchlight power supply. Slide the searchlight power supply to the rear and out of the electronics base.

5.10.4. Cleaning and inspecting the electronics base.

a. Use a vacuum cleaner with a soft bristle brush to clean the electronics base.

b. Clean all parts with a solvent that meets federal specification P-D-680.

c. Inspect all cables, wires, etc., for worn or damaged insulation. Make sure connectors and lugs are tightly fastened and not damaged or corroded.

d. Inspect soldered connections for tightness.

e. Inspect printed circuit cards for worn or damaged connectors or tracks. Make sure cards are not corroded.

f. Inpect printed circuit card components for signs of overheating. Make sure components are tightly soldered to cards.

g. Check for physical damage such as cracked welds, dents, bends, etc. Make sure all bolts, nuts and other parts are securely fastened.

h. Inspect plugs, jacks and connectors for worn or damaged pins, cracks or corrosion.

i. Inspect transformers for signs of overheating, a burned odor or for signs of varnish oozing out of the windings.

j. Repair defects and replace defective parts as necessary.

5.11. Assembling the Electronics Base. Assemble the electronics base as follows:

CAUTION

Be very careful to install wires correctly during assembly. Refer to the overall schematic diagram, Figure 7.2. Installing a wire in the wrong place can cause extensive equipment damage.

5.11.1. Installing the searchlight power supply.

a. Install searchlight power supply (100, Figure 5.2) in electronics base. Slide power supply as far forward as possible.

b. Install two heavy power cables and control input wires on terminal board mounted on power supply. Slide power supply back and line up mounting holes.

c. Apply screw thread compound (locktite) to four large power supply mounting screws (737). Install screws.

d. Install rear cover (6), gasket (37) and 28 screws (712).

5.11.2. Install the printed circuit card rack plate.

CAUTION

Be careful of the tabs of the three-phase diodes. These tabs are fragile and easily broken.

a. Connect wires to terminal boards TB101 and TB102 on printed circuit card rack plate (13, Figure 5.2).

CAUTION

Be careful to lay wire bundles in place. If they are not in place, they may contact ribbing on top of base casting, be damaged and short out. This can cause extensive equipment damage. As plate is being slid back, be careful not to put excessive strain on wires going to front cover and searchlight power supply.

b. Carefully lay the two wire bundles in place and slide the card rack plate back to line up the mounting holes.

c. Install teflon tubing removed in step 5.10.2d and connect wires to TB110 and edge card connectors of A1, A2, A5 and A6.

d. Connect wires to load side of CB1 (106).

e. Install J102 (107) in front cover (4) and install four screws (702) and nuts (728).

f. Install two front screws (706) at front of card rack plate but do not tighten.

g. Install two screws (706) at center of card rack plate. Tighten four screws.

h. Install two power amplifier assemblies (132) and eight screws (735).

i. Install heat exchanger (26), gasket (120), screws (713) and washers (726).

j. Install front cover (4) and gasket (37) with 28 screws (712).

k. Connect cables to connectors J101, J102 and J103 (107, 108 and 109).

5.12. Disassembling, Cleaning and Inspecting the Stow Lock Assembly.

a. Remove eight screws (704, Figure 5.3) and cover plate (7). Inspect gasket as in step 5.10.1.c.

b. Turn knob (103) to retract plunger (2).

CAUTION

Support the stow lock assembly by hand when removing mounting screws. If assembly is dropped, wires can pull out or break off.

c. Remove four socket head capscrews (703) that fasten stow lock assembly to positioner.

5.12.1. Removing the solenoid coil.

NOTE

When removing solenoid wires, do not let them slip into the casting. Use masking tape to keep wires outside until ready for installation.

a. Remove shrink tubing from solenoid coil (100, Figure 5.3) wire splices. Unsolder splices.

b. Loosen setscrew (102) in collar of adjusting shaft (3).

c. Use a 3/32 inch pin punch to remove roll pin (700) from collar.

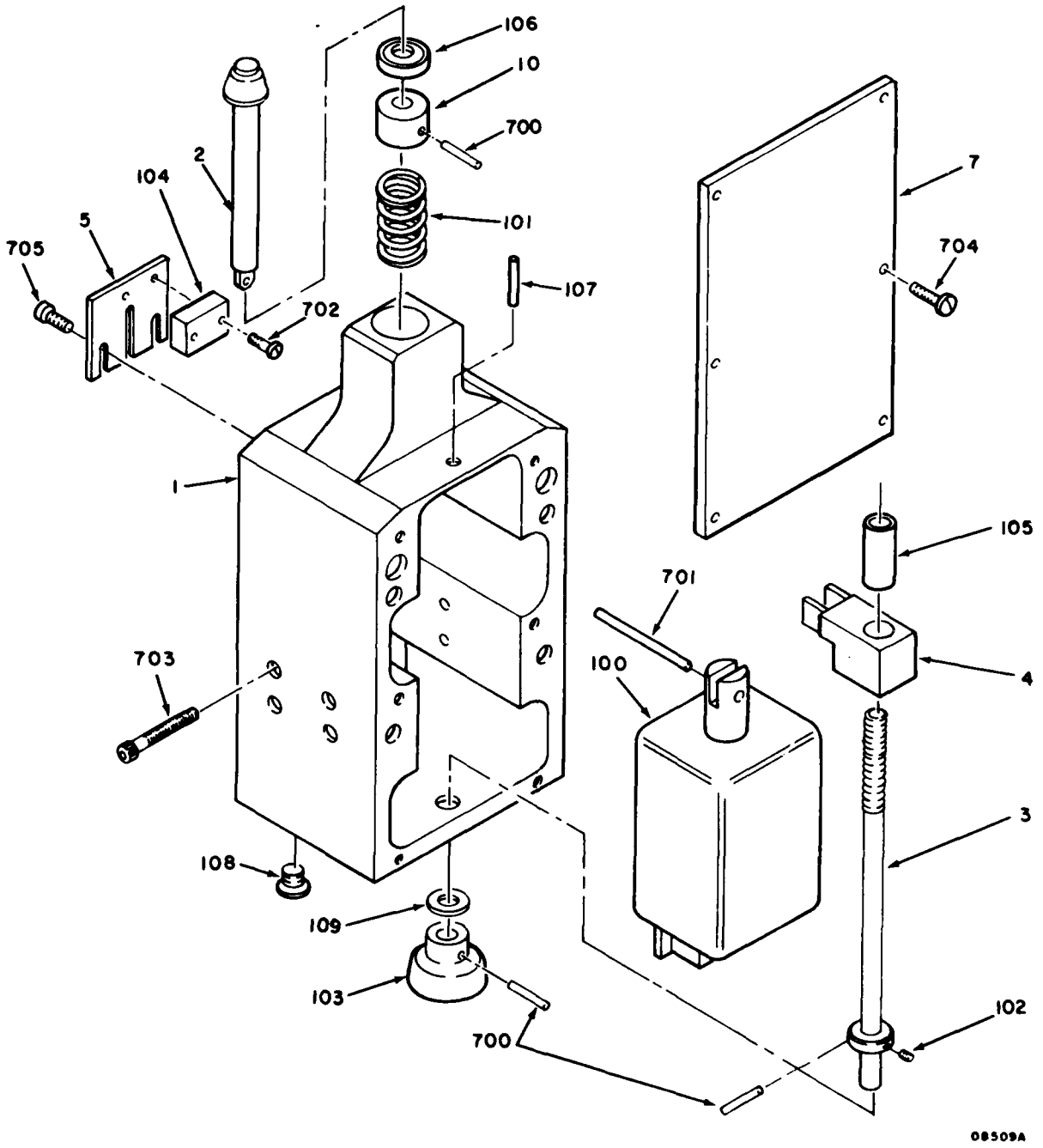


Figure 5.3. Stow Lock Assembly

d. Unscrew shaft from adjusting block (4). Remove shaft, collar and block from stow lock assembly.

WARNING

Stand clear when removing roll pin. Plunger is under spring tension and could cause serious personal injury if allowed to "shoot out" of stow lock assembly.

e. Hold plunger (2) and use a 3/32 inch pin punch to remove roll pin (701) that fastens plunger to solenoid.

f. Remove plunger with seal (106) and sleeve (10) attached, and remove spring (101) from stow lock assembly.

g. Remove six screws (703) that fasten solenoid to stow lock assembly. Remove solenoid.

5.12.2. Removing the stow lock assembly microswitch. Remove two screws (702, Figure 5.3) that fasten microswitch (104) to plate (5). Remove switch from stow lock assembly.

5.12.3. Cleaning and inspecting the stow lock assembly.

a. Clean all parts with a solvent that meets federal specification P-D-680.

b. Inspect mechanical parts for wear, cracks, corrosion, or other damage.

c. If it is necessary to replace seal (106), use a 3/32 inch pin punch to remove roll pin (700) from plunger sleeve (10). Remove sleeve and seal. Install new seal then install sleeve and roll pin on plunger.

CAUTION

Be sure power is removed from circuit before testing circuit with an ohmmeter.

d. Inspect the microswitch mounted on the bottom of solenoid (100), for wear, cracks or damaged switch buttons. Check switch with an ohmmeter.

e. Inspect solenoid for signs of overheating.

f. Inspect wires for wear or damaged insulation.

g. Repair defects or replace defective parts as necessary.

5.13. Assembling the Stow Lock Assembly.

a. Install microswitch (104, Figure 5.3) on plate (5) and install two screws (702).

b. Install solenoid (100) in stow lock assembly. Install six screws (703).

c. Install spring (101) in top of stow lock assembly.

d. Install plunger (2) with seal (106) and sleeve (10) attached. Hold plunger down and fit tongue at bottom into solenoid plunger groove.

e. Install roll pin (701) that fastens plunger to solenoid.

f. Install shaft (3) into stow lock assembly. Slip collar onto shaft and thread shaft into adjusting block (4).

g. Seat shaft into small hole at top of stow lock assembly housing (1). Make sure that adjusting block fingers are in place at top of solenoid plunger.

h. Install setscrew (102) and roll pin (700) in shaft collar.

i. Put a piece of shrink tubing on two solenoid wires. Solder wire splices. Shrink tubing.

j. Install stow lock assembly on positioner and install four screws that fasten stow lock assembly to positioner.

5.14. Disassembling, Cleaning and Inspecting the Azimuth Assembly.

NOTE

This assembly is complicated. Read the entire paragraph thoroughly before proceeding. Figure 5.4 shows the assembly upside down.

a. Remove the searchlight power supply and the printed circuit card rack as in paragraph 5.10.

b. Reach inside base casting and remove screw (705, Figure 5.4) and cable clamp (114). Use a mirror if necessary.

c. See the overall schematic diagram (Figure 7.2) for information about wiring the positioner.

CAUTION

Carefully mark each wire before disconnecting it. Connecting a wire to the wrong terminal can cause extensive equipment damage.

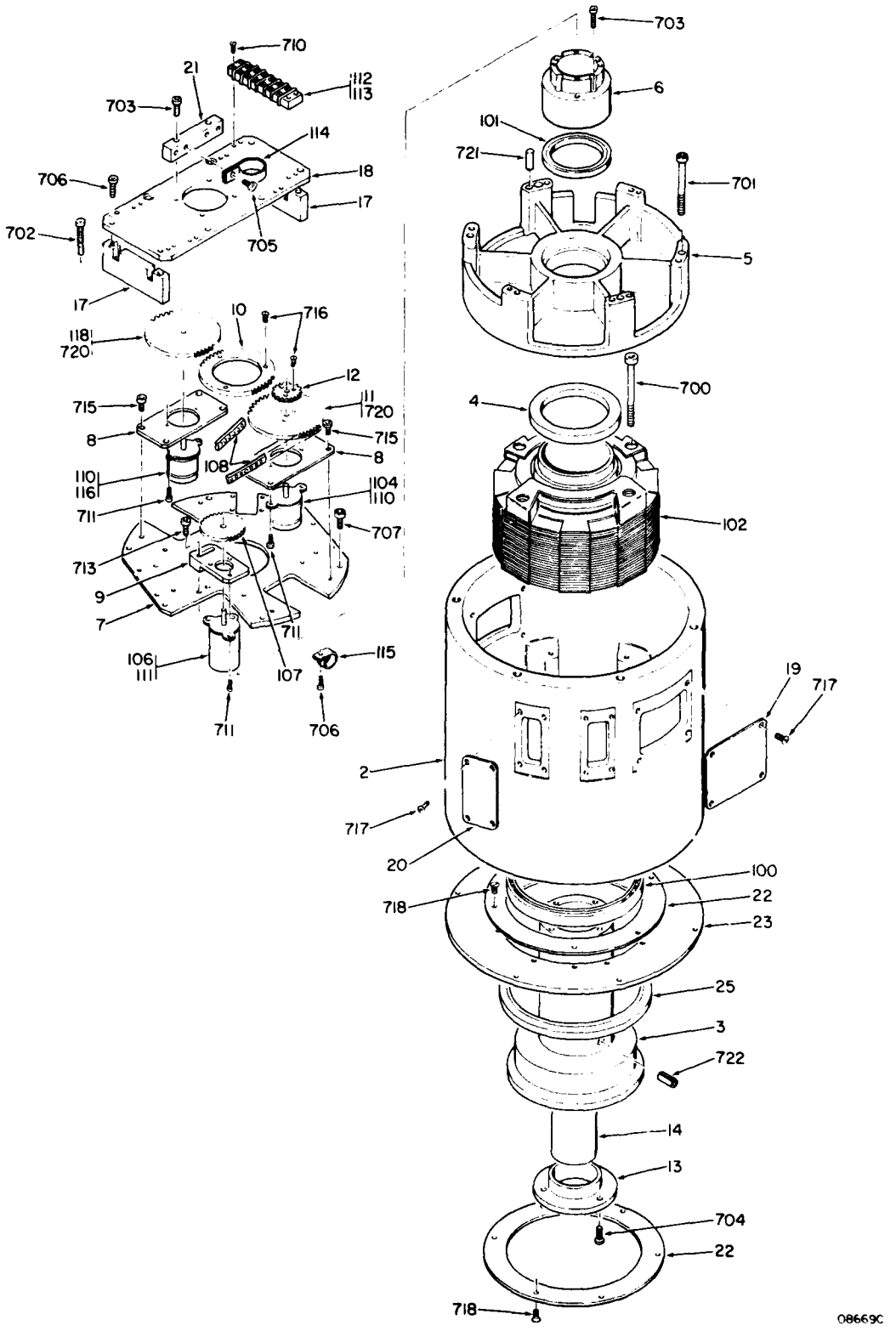


Figure 5.4. Azimuth Assembly

d. Remove wires from pins A, B, C, D, P, Q, R, and S of J101 (107, Figure 5.2) and from terminals 7 and 8 of TB113 (Figure 7.21) mounted on the isolation assembly. Keep the small pieces of teflon tubing to be used during assembly. Be sure to clean the solder cups of J101 to remove excess solder.

e. Wrap tape around the free end of the disconnected wires. Inspect base to make sure that wires can be pulled freely up through the azimuth shaft.

WARNING

Be very careful with the searchlight. The bult is under high pressure and could cause serious injury if broken. Use two people to lift the searchlight.

f. Remove the searchlight as in paragraph 2.3.

g. Remove screws (712, Figure 5.5), wire block cover (15) and its gasket.

h. Remove screws (712), and cable clamp (112).

i. Remove screws (711) and move wire block (14) aside exposing eight larger screws and azimuth shaft (3, Figure 5.4).

j. Uncage the axis, mark the orientation of the yoke with respect to the azimuth housing on the outer diameter of the yoke, then mark the orientation of the shaft with respect to the yoke on the inner diameter under the wire block.

k. Mark the orientation of the shaft and azimuth housing.

WARNING

To prevent personal injury, use two men to lift the yoke-pillow block assembly. It is very heavy.

l. Remove eight large screws and slowly lift the yoke-pillow block assembly with attached wire bundles off of the azimuth axis-base assembly. Do not let the azimuth shaft rotate with respect to the azimuth outer housing during this operation. When setting the assembly down, be careful not to pinch the wires under it.

NOTE

When the yoke-pillow block assembly is removed, the azimuth seal is exposed. Keep this area clean.

m. Mark the orientation of the azimuth assembly with respect to the base.

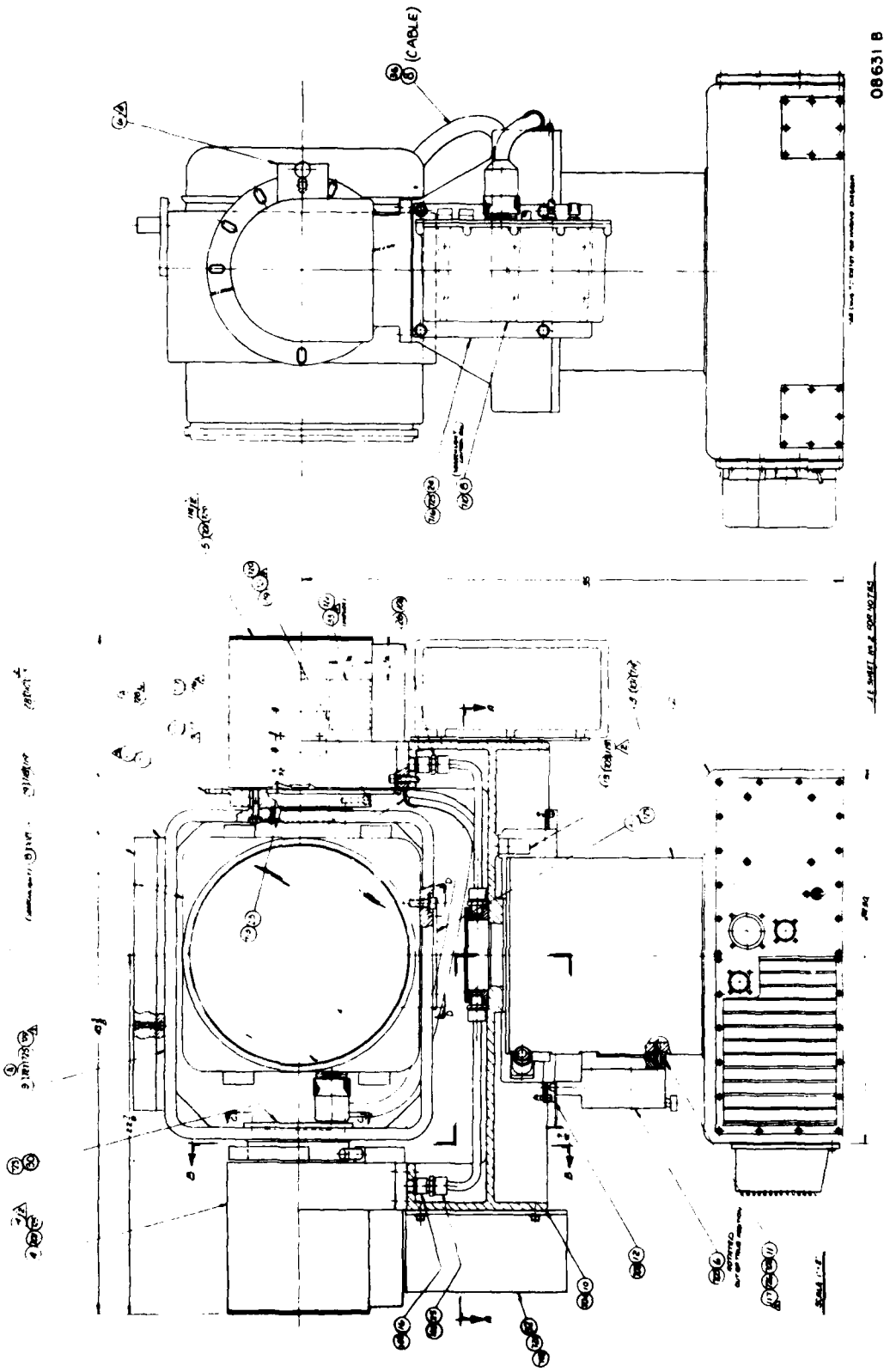


Figure 5.5 Searchlight Positioner Parts Location (sheet 1 of 2)

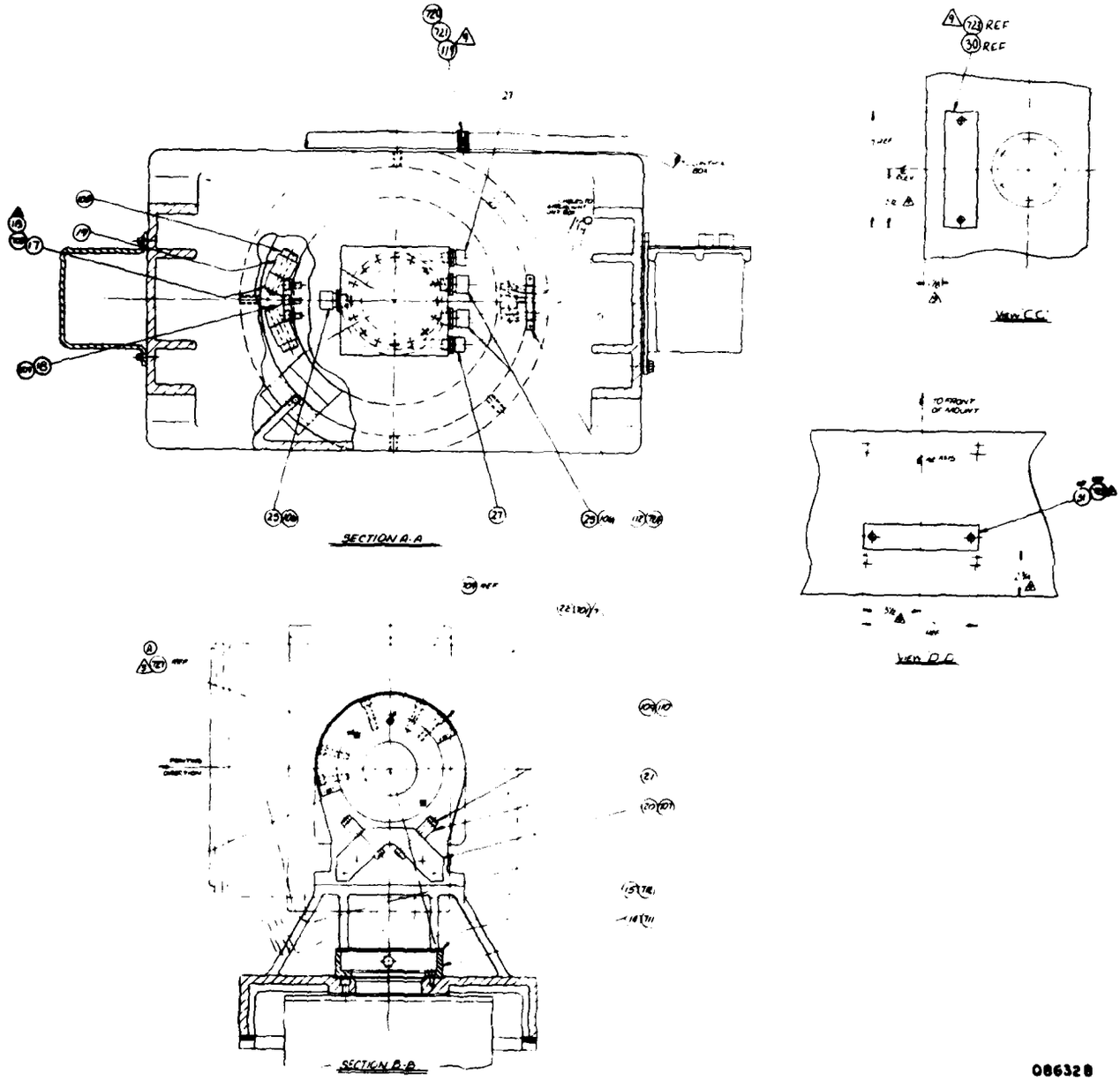


Figure 5.5 Searchlight Positioner Parts Location (Sheet 2)

n. From inside the base, remove six screws that fasten azimuth assembly to base.

WARNING

To prevent personal injury, use two men to lift azimuth assembly. It is very heavy.

o. Set the azimuth assembly, upside down, on a protected surface.

5.14.1. Removing synchro components.

CAUTION

Mark wires before removal. Connecting a wire to the wrong terminal can cause extensive equipment damage.

a. Disconnect wires of torque motor (102, Figure 5.4) from terminals 2 and 3 of TB103 (112) and unbundle them as far as possible.

b. Remove four screws (706) and move terminal block mounting plate (18) aside.

c. Carefully mark, within ±1 tooth, the orientation of the gear (10) mounted on azimuth shaft extension (6) with respect to the two synchro gears (118).

d. Loosen six screws (707) that fasten azimuth plate (7) to bearing housing (5).

e. Carefully lift the plate until gear mesh is broken. It may be necessary to loosen screws (715) that fasten synchro mounting plates (8) in order to break gear mesh.

f. Remove azimuth plate screws and remove azimuth plate from azimuth assembly.

5.14.2. Removing azimuth torque motor.

NOTE

This procedure is extremely difficult and time consuming. Perform this task only in dry-dock or at depot level maintenance.

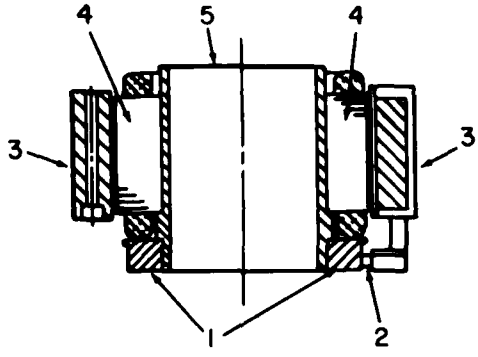
a. Remove four screws (703, Figure 5.4) that fasten azimuth shaft extension (6) to azimuth shaft (3). Remove extension.

b. Removing extension exposes bearing (101). Keep bearing clean and dry.

c. Mark orientation of bearing housing (5) with respect to azimuth housing (2).

d. Using a 10/32 inch bolt threaded into roll pins (721), remove pins and remove six screws (701) that fasten bearing housing to azimuth housing. Remove bearing housing and bearing, set it down, right side up, on a protected surface. It may be necessary to lift and rock the bearing housing to remove it.

e. Carefully remove brush blocks (1, Figure 5.6) and brushes (2) from between stator (3) and rotor (4).



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1. Brush Blocks
2. Brushes
3. Stator
4. Rotor
5. Azimuth Shaft

Figure 5.6. Torque Motor Cross Section

f. Put plastic shims (all the way around) between stator and rotor. Shims should be at least 4 inches long x 1 inch wide and fit snugly.

g. Loosen the small setscrew in retainer (4, Figure 5.3). Use a spanner wrench to rotate the retainer in a counterclockwise direction. Remove retainer from azimuth assembly.

h. Remove four screws (700) that fasten stator to housing (2). The stator should shift and wedge shims into the rotor. Lift both out together.

i. If the stator and rotor do not come out together, open the new motor box and without separating new stator and rotor, remove the keeper, the steel ring bolted to the stator.

CAUTION

Do not attempt this procedure without a keeper. The motor may lose its magnetism and be seriously damaged.

j. Fasten the keeper to the old stator and slowly wiggle the stator off the rotor using the shims for slides. *Do not remove the keeper from the stator* at this time.

k. The magnetic force will try to cock the stator and prevent removal, but it will come off slowly if enough force is applied and the force is applied straight up, not at an angle to the shaft.

WARNING

Liquid nitrogen, liquid freon, dry ice and CO_2 fire extinguishers produce very low temperatures. Handle with care. Remember that these substances, and objects that have been cooled with these substances, can cause serious ''burns''.

l. To remove the rotor, the shaft will have to be cooled to about 30^{o} below ambient (room) temperature with liquid nitrogen, liquid freon, dry ice or a carbon dioxide CO_2 fire extinguisher. Cool the shaft but not the rotor.

m. To cool the shaft, seal the top (*the bottom of the assembly as it now sits*) and pour or shoot in the coolant.

NOTE

The rotor will not rotate on the shaft until it has been moved up an inch or more. This is due to roll pin (722, Figure 5.4) which fits into a slot at the top of the rotor.

n. When the shaft has been cooled, remove the rotor. Due to the tight fit, removing the rotor will be a slow and difficult procedure, possible only if the shaft is kept cool enough, long enough.

o. When the rotor has been removed from the shaft, install it into the stator with the shims in place.

5.14.3. Completing disassembly of the azimuth assembly.

a. Turn the housing (2, Figure 5.4) over so that the top side is up.

b. Remove eight screws (718), seal cover (23), two seal retainers (22) and seal (103). They should come out as an assembly.

c. Turn the housing back over while carefully supporting the housing in three places so that shaft (3) is off the ground.

d. Using a rubber mallet or wooden block, tap on the shaft so that it pops down and free of the housing (2).

e. Remove bearing (100) from shaft.

5.14.4. Cleaning and inspecting the azimuth assembly.

a. Clean all parts with a solvent that meets federal specification P-D-680.

b. Inspect mechanical parts for wear, cracks, corrosion or other damage.

c. Inspect bearings for freedom of movement and signs of overheating.

d. Inspect electrical parts for cracks or signs of overheating.

e. Inspect wires for worn or damaged insulation.

f. Repair defects or replace defective parts as necessary.

5.15. Assembling the Azimuth Assembly.

a. Repack bearings and lubricate mating surfaces with silicone lubricant (Versalube) or equivalent.

b. Make sure bearings and motor are seated correctly before tightening holddown screws. Do not force items into place.

c. Make sure mating surfaces are free of dirt and grit before installing parts.

d. Cool shaft (3) as in steps 5.14.2.l and 5.14.2.m and install large bearing (100, Figure 5.4) over shaft.

e. Install shaft into housing making sure both races are seated.

f. Install seal (103), seal plate (23) and two seal retainers on shaft. Install eight screws (718) that fasten plate to housing.

g. Turn housing over and install motor (102) over shaft, aligning roll pin (722) with slot in hub.

h. Install four screws (700).

i. Apply thread compound to threads then install retainer (4). Make sure rotor is seated against shaft seat before tightening retainer with a pin punch. Tighten retainer setscrew.

j. Remove shims from between stator and rotor.

k. Install brush blocks (1, Figure 5.6) and motor wires, routing them through bearing housing (5, Figure 5.4) as this assembly is slipped over the shaft and aligned to its reference marks.

l. Install two pins (721) to locate bearing housing and install six screws (701) that fasten bearing housing to azimuth housing.

m. Make sure the outer race is still seated against the bearing housing, then install azimuth shaft extension (6) and four screws (703) that fasten azimuth shaft extension to azimuth shaft.

n. Install component mounting plate (7), carefully aligning the reference marks on the top of the shaft and housing and on the component gears themselves. Install screws (707) that fasten component plate to bearing housing. If a new synchro transformer (104) or transmitter (116) was installed, see paragraph 5.3 for adjustment procedures.

o. Take care during the gear meshing operation to minimize backlash at the high spots of the gear. Backlash adjustment is done by loosening the mounting plate (8) lining up the reference marks then rotating the housing while checking the play between the gears. At one point there should be no play while at another point there should be a small amount of play.

p. Move terminal board plate (18) back into position and install four screws (706) that fasten plate to component plate.

q. Install the azimuth assembly on the base, carefully lining up the reference marks. Install six screws that fasten assembly to base.

r. Install the yoke-pillow block assembly on the azimuth axis-base assembly, carefully passing the wires down through the azimuth assembly shaft. Carefully line up the reference marks. Install eight large screws that fasten the two assemblies together.

s. Move wire block (14, Figure 5.5) back into place and install screws (711) that fasten wire block.

t. Install cable clamp (112) and screws (724).

NOTE

Be sure to replace teflon tubing on wires before soldering wires to pins.

u. Connect wires to terminals 7 and 8 of TB113 (Figure 7.21) and to pins A, B, C, D, P, Q, R, and S of J101 (107, Figure 5.2).

v. Reach inside the base casting and install cable clamp (114, Figure 5.4) and screw (705).

w. Install the searchlight power supply and printed circuit card rack as in paragraph 5.11.

5.16. Disassembling, Cleaning and Inspecting Pillow Block Assemblies.

5.16.1. Disassembling the drive side (shock side) pillow block.

a. Remove 9 screws (709, Figure 5.7), cover (16) and gasket from pillow block.

b. Inspect gasket as in paragraph 5.10.1.c.

c. Carefully mark orientation of component gears (107 and 108) with respect to drive gear (11).

d. Loosen six screws (705) and two circular mounting plates (13).

e. Remove four screws (703) and component mounting plate (15).

f. Remove searchlight (8, Figure 5.5) from gimbal (9) as in paragraph 2.3.

g. Mark left side or right side of gimbal as viewed from the front.

h. Mark shaft to gimbal to pillow block housing orientation with marks on both sides of shaft.

i. Remove 2 roll pins (101) from each side of gimbal.

j. Support gimbal from the bottom to keep it horizontal when removing mounting screws.

k. Remove six screws from each side, around the inside diameter of the gimbal wall in a 1-4-2-5-3-6 sequence.

CAUTION

Be careful of machined shaft mounting surfaces. Remove gimbal by pulling straight out to prevent scoring or gouging.

l. If necessary, install eye bolts in the tapped holes in the pillow blocks and pull apart until gimbal can be removed.

m. Remove gimbal from positioner.

CAUTION

Do not loosen pillow block bolts unless directed to after consulting CGC.

n. Remove shaft (6, Figure 5.7) from the pillow block.

o. Remove four screws (710), seal retainer (3) and seal (109).

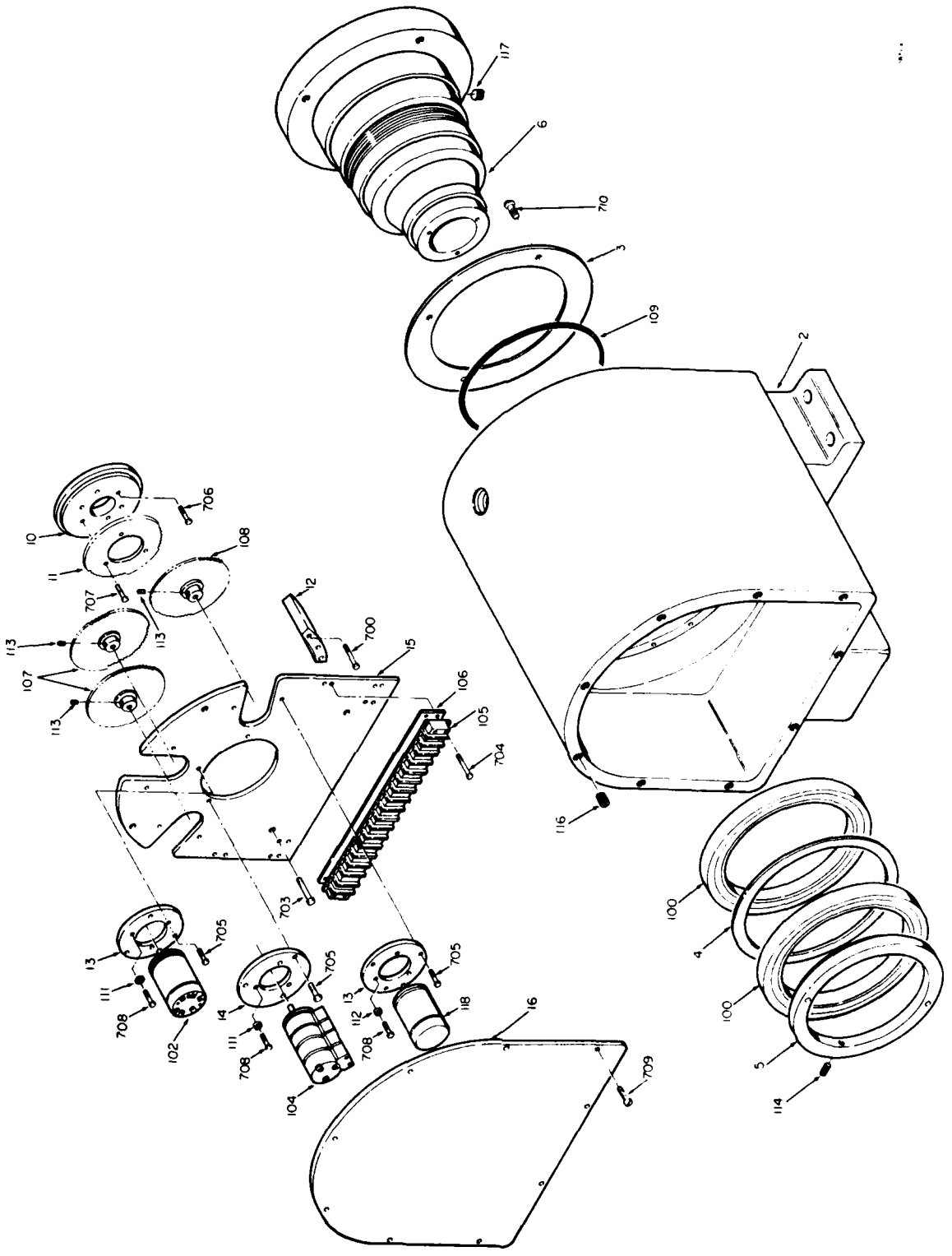

Figure 5.7. Drive Side (Shock Side) Pillow Block

CAUTION

Note position and location of bearings and spacers. Accuracy will be affected if they are not installed exactly as they were removed.

p. Loosen setscrew (114) and using a spanner wrench, turn counterclockwise to remove bearing retainer (5), bearing (100), spacer (4), and bearing (100).

5.16.2. Disassembling the readout side (caging side) pillow block.

a. Remove nine screws (706, Figure 5.8), cover (3) and gasket.

b. Inspect gasket as in paragraph 5.10.1.c.

c. Disconnect motor wires connected to TB7 (102).

d. Remove four screws (705) and component mounting plate (12).

e. Remove four screws (702) and motor retainer (14).

f. Remove brush blocks and brushes (1 and 2, Figure 5.6) from motor (107, Figure 5.8).

CAUTION

Do not remove rotor from stator without a keeper installed. The motor may lose magnetism and be seriously damaged.

g. Install plastic shim stock (all around) between stator and rotor (3 and 4, Figure 5.6).

h. Remove 6 screws (711, Figure 5.8) that fasten motor to pillow block.

i. Remove rotor and stator together.

j. If rotor and stator will not come out together, install a keeper on the stator, remove rotor, then stator.

k. Using Figure 5.8 as a reference, remove searchlight, gimbal and shaft from positioner as in steps 5.16.1.f through 5.16.1.n. Do not remove caging disk (4) from shaft except for replacement.

l. Remove four screws (703), seal retainer (5) and seal (101).

CAUTION

Note position and location of bearings and spacers. Accuracy will be affected if they are not installed exactly as they were removed.

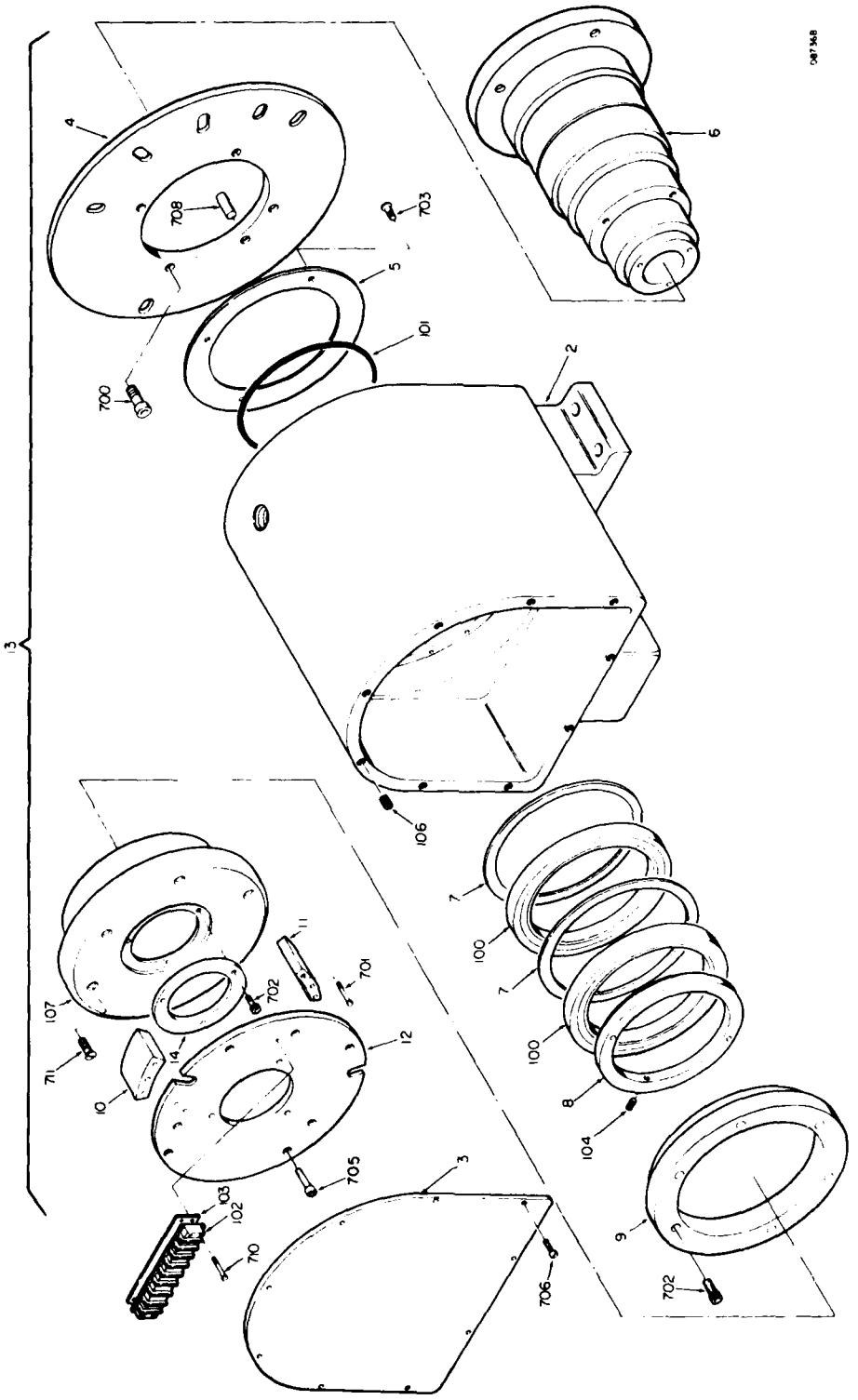

Figure 5.8. Readout Side (Caging Side) Pillow Block

m. Remove four screws (702) and bearing retainer (9).

n. Loosen setscrew (104) and using spanner wrench, turn counterclockwise to remove bearing retainer (8), bearing (100), spacer (7), bearing (100) and spacer (7).

5.16.3. Cleaning and inspecting pillow block assemblies.

a. Clean all parts with a solvent that meets Federal Specification P-D-680.

b. Inspect mechanical parts for wear, cracks, corrosion or other damage.

c. Inspect bearings for freedom of movement and signs of overheating.

d. Inspect electrical parts for cracks and signs of overheating.

e. Inspect wires for worn or damaged insulation.

f. Repair defects or replace defective parts as necessary.

5.17. Assembling Pillow Blocks.

a. Repack bearings and lubricate mating surfaces with General Electric G-300 grease (Versalube or equivalent).

b. Make sure mating surfaces are free of dirt and grit before installing parts.

5.17.1. Assembling drive side (shock side) pillow block.

CAUTION

Make sure bearings and spacers are seated properly before tightening bearing retainer to prevent damage to components.

a. Install bearing (100, Figure 5.7), spacer (4), bearing (100) and bearing retainer (5). Using a spanner wrench, turn clockwise until bearing retainer is tight. Tighten setscrew (114).

b. Install seal (109), seal retainer (3) and four screws (710).

c. Install shaft (6), lining up marks made in step 5.16.1.h. If both pillow blocks are being assembled, make sure both shafts are in place before installing gimbal.

d. If necessary, gently pull apart pillow blocks as in step 5.16.1.e.

e. Install gimbal (9, Figure 5.5) in positioner, lining up the marks made in step 5.16.1.h.

f. Install two roll pins (101) in each side of the positioner.

g. Install six screws in each side around the inner diameter of the gimbal wall. Tighten screws in a 1-4-2-5-3-6 sequence. Make sure the reference marks are lined up before tightening the screws.

h. Install searchlight as in paragraph 2.3.

i. Install component mounting plate (15, Figure 5.7) and four screws (703).

j. Line up reference marks made on gears (107 and 108) in step 5.16.1.b. Decrease backlash in each component separately at the high spots. Tighten circular mounting plates (13) when the gears are lined up.

k. Install cover (16), gasket (xx) and nine screws (709).

5.17.2. Assembling readout side (caging side) pillow block.

a. Install seal (101, Figure 5.8), seal retainer (5) and four screws (703).

CAUTION

Make sure bearings and spacers are seated properly before tightening bearing retainers to prevent damage to components.

b. Install spacer (7), bearing (100), spacer (7), bearing (100) and bearing retainer (8). Using a spanner wrench, turn clockwise until retainer is tight. Tighten setscrew (104).

c. Install bearing retainer (9) and four screws (702).

d. Using Figure 5.8 as a reference, install searchlight, gimbal and shaft in positioner as in steps 5.16.4.c through 5.16.4.h.

e. Install motor (107) on shaft (6). Install six screws (711) that fasten motor to pillow block. If keeper was installed, remove it at this time.

f. Remove shim stock from motor.

g. Install brush blocks and brushes (1 and 2, Figure 5.6) between rotor and stator.

h. Install motor retainer (14, Figure 5.8) and four screws (702).

i. Pass motor wires through a convenient slot in the component mounting plate and connect wires to correct terminals of TB7 (102).

j. Install component mounting plate (12) and four screws (705).

5.17.3. Completing assembly of the pillow block assemblies.

a. Check positioner operation as in paragraphs 5.6 through 5.8. If troubleshooting is required, see paragraph 5.9.

b. Install cover and nine screws (16 and 709, Figure 5.7) on drive side pillow block.

c. Install cover and nine screws (3 and 706, Figure 5.8) on readout side pillow block.

5.18. Adjustable Parts and Test Point Locations. Table 5.3 is a listing of POSITIONER ADJUSTABLE PARTS AND TEST POINTS. See paragraph 5.3 for adjustment procedures. See Table 5.2 for an explanation of circuit test points.

Table 5.3 Adjustable Parts and Test Points

Name	Location	Reference Designation	Schematic Figure Number	Schematic Location Index	Assembly Drawing Figure Number
IC-2 Gain	1A1A1	R17	7.3	4B	7.4
IC-3 Phase Shift	and 1A1A2	R22	7.3	2C	7.4
		TP1	7.3	2A	7.4
		TP2	7.3	5A	7.4
		TP3	7.3	4B	7.4
		TP4	7.3	2C	7.4
		TP5	7.3	4C	7.4
		TP6	7.3	2D	7.4
		TP7	7.3	4A	7.4
		TP8	7.3	2D	7.4
		TP9	7.3	2D	7.4
IC-1 Balance	1A1A3	R1	7.6	4B	7.7
		TP5	7.6	4B	7.7
		TP6	7.6	4B	7.7
		TP7	7.6	6B	7.7
IC-1 Balance	1A1A4	R1	7.9	4B	7.10
		TP5	7.9	4B	7.10
		TP6	7.9	5B	7.10
		TP7	7.9	6B	7.10
		TP8	7.9	5C	7.10
U-10 Adjust	1A1A5	R13	7.11	7E	7.12
		TP1	7.11	2A	7.12
		TP2	7.11	3C	7.12
		TP3	7.11	3C	7.12
		TP4	7.11	6A	7.12
		TP5	7.11	6D	7.12
		TP6	7.11	8C	7.12
		TP7	7.11	3D	7.12
	1A1A6	TP1	7.14	4D	7.15
		TP2	7.14	3E	7.15
		TP3	7.14	3C	7.15
		TP4	7.14	3B	7.15
		TP5	7.14	4B	7.15
		TP8	7.14	4B	7.15
AZ Synchro Transmitter	1A2	B2	7.2	4E (sheet 2)	x.xx
AZ Limit Switch	1A2	S1-S4	7.2	3B and 3C (sheet 2)	x.xx
EL Synchro Transmitter	1A3	B4	7.2	8E (sheet 2)	x.xx
EL Limit Switch	1A3	S5-S8	7.2	6B and 6C (sheet 2)	x.xx

6. PARTS.

6.1. Introduction. This chapter contains tables which provide descriptive data on electrical and mechanical parts of the positioner.

6.2. Table 6.1. Two-Axis Searchlight Positioner Reference Designations. This table contains a list of each major assembly or subassembly of the positioner. Page number, unit part number, assembly or subassembly name, and reference designation are given for each unit.

6.2.1. Page number. Page number refers to the page where that particular unit is broken down in the parts list, Table 6.2.

6.3. Table 6.2. Parts List. This table contains a list of electrical and mechanical parts of the positioner. A separate list for each assembly or subassembly is broken down into the piece-parts of that unit.

NOTE

In Table 6.1, names of major units are listed at the top of the page and are underlined. For example, on page 6.4, Model 066 Two-Axis Searchlight Positioner is the name of the major unit (the mainframe). The remaining entries on this page and the following two pages are piece-parts of the mainframe.

6.3.1. Ref symbol. This column lists the reference designation for each major unit and part.

6.3.1.1. Major units. The reference designation for major units is the designation found in Table 6.1.

6.3.1.2. Mechanical parts. For mechanical parts, the reference designation is the item number on the drawing of the major unit which contains the part. For example: on page , the elevation GIMBAL (REF SYMBOL "9") is item No. 9 on the Model 066, Two-Axis Searchlight Positioner Drawing (Figure 5.5).

6.3.1.3. Electrical parts. For electrical parts, the reference designation is the actual reference designation of the part as shown on the schematic. The item number of chassis mounted electrical is given (in parenthesis) in the description column.

NOTE

See the list of illustrations to find the drawing for major units. Generally, mechanical parts and mainframe electrical parts are illustrated in chapter 5; subassemblies such as printed circuit cards are illustrated in chapter 7.

6.3.2. Mfr or source. This column lists the FSCM (Federal Supply Code for Manufacturers) for each major unit and part. The FSCM is a number which identifies a particular manufacturer. See Table 6.3 for a list of manufacturers arranged in order of FSCM numbers.

6.3.3. Mfr's data. This column lists the manufacturer's part number for each major unit and part.

6.4. Table 6.3. List of Manufacturers. This table contains a list of manufacturers for each major unit or part listed in Table 6.2. Manufacturers are arranged in order of FSCM number. See paragraph 6.3.2. for an explanation of FSCM numbers.

TABLE 6.1. TWO AXIS SEARCHLIGHT POSITIONER, REFERENCE DESIGNATIONS

PAGE NUMBER	UNIT PART NUMBER	ASSEMBLY OR SUBASSEMBLY	REFERENCE DESIGNATIONS
	501195-1	Model 066 Two Axis Searchlight Positioner	1
	703731-1	Electronics Base Assembly	1A1
	703859-1	Azimuth Demodulator Card	1A1A1
	703859-2	Elevation Demodulator Card	1A1A2
	703732-1	Azimuth Input Amp and Notch Filter Card	1A1A3
	703732-2	Elevation Input Amp and Notch Filter Card	1A1A4
	703711-1	Searchlight Control Card I	1A1A5
	703712-1	Searchlight Control Card II	1A1A6
	704551-1	Diode Mounting Plate Assembly	1A1A7
	095-0343	Searchlight Power Supply	1A1A8
	703930-1	Cable Assembly, Power Supply to Control Box	1A1A9
	703936-1	Cable Assembly, Control Card to Control Box	1A1A10
	501192-1	Azimuth Assembly	1A2
	501193-1	Pillow Block Assembly, Drive Side	1A3
	501194-1	Pillow Block Assembly, Readout Side	1A4
	501086-1	Caging Assembly	1A5
	706071-1	Isolation Assembly	1A6

TABLE 6.2. PARTS LIST

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1	Model 66 Two Axis Searchlight Positioner	51261	501195-1
9	GIMBAL, Elevation (1 ea)	51261	108072-1
10	YOKE (1 ea)	51261	108073-1
11	ADAPTER, Caging Assembly (1 ea)	51261	108324-1
12	RING, Detent (1 ea)	51261	108149-1
13	STOP (1 ea)	51261	108147-1
14	BLOCK, Wire (1 ea)	51261	108321-1
15	COVER, Wire Block (1 ea)	51261	108323-1
16	ADAPTER, Fitting (2 ea)	51261	108346-1
17	BRACKET, Shock Mounting (1 ea)	51261	108148-1
18	SHAFT (2 ea)	51261	108146-1
19	SPRING, Rubber (2 ea)	51261	108071-4
20	BRACKET, Shock Mounting (1 ea)	51261	107779-2
21	SPRING, Rubber (2 ea)	51261	108071-3
22	BLOCK, Stop, Shock (1 ea)	51261	108062-1
23	COVER (2 ea)	51261	108331-1
24	ADAPTER, Control Box (1 ea)	51261	108325-1
25	CONNECTOR, Cord (4 ea)	51261	108427-1
26	CONNECTOR, Cord (1 ea)	51261	108427-2
27	CONNECTOR, Cord (2 ea)	41261	108427-3
28	PLATE, Mounting, Counterweight (1 ea)	51261	110635-1
29	COUNTERWEIGHT (1 ea)	51261	110634-1
30	COUNTERWEIGHT (1 ea)	51261	110931-1
31	WEIGHT, Trim (1 ea)	51261	110932-1
32	COUNTERWEIGHT, Azimuth (1 ea)	51261	110980-1
33	NAMEPLATE, Identification (1 ea)	51261	108000-1
101	PIN, Dowel, Pull Type, 5/56 Dia x 1-1/4 lg. (10-32 thd) (4 ea)	56878	5/16DX1-1/4LX10-32
102	WASHER, Flat, 3/4 OD x 0.386 ID x 3/32 thk SS (20 ea)	99862	CL-257
106	O-RING, Sealing (7 ea)	74545	205-09-001
107	RING, Retaining (2 ea)	79136	5100-50
108	COLLAR, Shaft, 1/2 ID (2 ea)	74445	8SS

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
109	COLLAR, Shaft, 5/16 ID (4 ea)	74445	5SS
110	SHAFT, Ground, 5/16 dia x 3-1/4 lg (2 ea)	16662	S5-32
111	WASHER, Flat, SS, 1/2 OD x 0.275 ID x 5/64 thk (4 ea)	99862	CL-255
112	CLAMP, Cable (1 ea)	84971	TA501-D4-.500
113	INSERT, Threaded 3/8-16 x 3/4 lg (2 ea)	01556	1185-6CN-0750
114	INSERT, Threaded, 3/8-16 x 9/16 lg (8 ea)	01556	1185-6CN-0562
115	INSERT, Threaded, 1/4-20 x 3/8 lg (6 ea)	01556	1185-4CN-0375
116	INSERT, Threaded, 1/4-20 x 1/4 lg (2 ea)	01556	1185-4CN-0250
117	INSERT, Threaded, 1/4-20 x 1/2 lg (2 ea)	01556	1185-4CN-0500
119	CLAMP, Loop Type, Cushioned (2 ea)	84971	TA716-D16
701	SCREW, CAP, Socket Head, 3/8-16 x 1-1/2 SS (19 ea)	51261	A3/8-16X1-1/2SS
702	SCREW, Cap, Socket Head, 1/2-20 x 1 SS (4 ea)	51261	A1/2-20X1.SS
703	SCREW, Cap, Socket Head, 3/8-16 x 1 SS (13 ea)	51261	A3/8-16X1SS
705	SCREW, Cap, Socket Head, 1/4-20 x 2-1/2 SS (8 ea)	51261	A1/4-20X2-1/2SS
706	SCREW, Cap, Socket Head, 1/4-20 x 1-1/2 SS (4 ea)	51261	A1/4-20X1-1/2SS
707	SCREW, Cap, Socket Head, 1/4-20 x 1-1/4 SS (4 ea)	51261	A1/4-20X1-1/4SS
708	SCREW, Cap, Socket Head, 1/4-20 x 3/4 SS (10 ea)	51261	A1/4-20X3/4SS
709	SCREW, Cap, Hex Head, 3/8-16 x 1-1/4 SS (16 ea)	51261	D3/8-16X1-1/4SS
710	SCREW, Cap, Flat Head Socket, 1/4-20 x 5/8 SS (12 ea)	51261	C1/4-20X5/8SS
711	SCREW, Cap, Socket Head, 1/4-20 x 1/2 SS (8 ea)	51261	A1/4-20X1/2SS
712	SCREW, Machine, Flat Head, Slotted, 8-32 x 1/2 SS (10 ea)	51261	F8-32X1/2SS
713	SCREW, Machine, Pan Head, Slotted, 8-32 x 3/4 SS (12 ea)	51261	G8-32X3/4SS
714	WASHER, Flat, 3/8 SS (32 ea)	51261	W3/8SS

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
715	WASHER, Flat, 1/2 SS (4 ea)	51261	W1/2SS
716	SCREW, Cap, Hex Head, 3/8-16 x 1 SS (4 ea)	51261	D5/8-16X1SS
717	SCREW, Cap, Socket Head, 1/4-20 x 2-1/4 SS (2 ea)	51261	A1/4-20X2-1/4SS
719	NUT, JAM, 1/4-20 SS (3 ea)	51261	JN1/4-20 SS
720	SCREW, Cap, Socket Head, 10-32 X 1/2 SS (2 ea)	51261	A10-32X1/2SS
721	WASHER, Flat, No. 10 SS (2 ea)	51261	W10SS
722	SCREW, Drive, No. 2 x 1/2 SS (4 ea)	51261	S2X1/2SS
723	SCREW, Cap, Flat Head, Socket, 10-32 x 3/4 SS (4 ea)	51261	C10-32X3/4SS
724	WASHER, Flat, 1/4 SS (4 ea)	51261	W1/4SS

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1	BASE ASSEMBLY, Electronics (figure 5.2)	51261	703731-1
A7	AMPLIFIER, Servo, dc (132)	28726	DCA-3000
A8	Same as A7 (132)		
C1	CAPACITOR, Computer Grade, 76,000 uF, 40 Vdc (102)	56289	36X7636040DF2A
C2	CAPACITOR, .47 uF, ± 10%, 135 Vac (127)	14752	910D1C474K
C3	Same as C2 (127)		
CB1	CIRCUIT BREAKER, 3 phase, 400 Hz, 15 amp (106)	81541	APGN666-1-42F-303
CR1	DIODE, MIL No. 1N5401 (124)	07263	1N5401
CR2	Same as D1 (124)		
CR3	Same as D1 (124)		
J101	CONNECTOR, Box Mounting (107)	96906	MS3102E36-1SS
J102	CONNECTOR, Box Mounting (108)	96906	MS3102E22-19S
J103	CONNECTOR, Box Mounting (109)	96906	MS3102E22-2P
R1	RESISTOR, 1K Ohms, 5%, 2 watt (128)	46555	OH1025
R2	RESISTOR, Wirewound, 15 Ohms, 50 watt (134)	91637	RH50
R3	Same as R2 (134)		
R4	RESISTOR, 330 Ohms, 5%, 114 watt (134)	44655	063315
R5	Same as R4 (136)		
R6	RESISTOR, 787 Ohms, 1%, 1/4 watt (137)	81349	RN55C7870F
R7	Same as R6 (137)		
T1	TRANSFORMER, 400 Hz, 3 Phase, High Current Current (104)	82858	27103
TB101	BOARD, TERMINAL, 16 Position (115)	75382	600-16
TB102	BOARD, TERMINAL, 16 Position (115)	75382	600-16
TB110	BOARD, TERMINAL, 5 Position (115)	75382	600-5
TB111	STRIP, Terminal, 4 Position (123)	83330	3004
TB112	BOARD, Terminal, 6 Position (121)	75382	600-6
VR1	RECTIFIER, Integrated bridge (101)	70857	VTH200
XA7	SOCKET, 52 pin (21)	28/26	240526.8
XA8	Same as XA7 (21)		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
XTB101	MARKER, terminal board, 16 positions (105)	75382	MS600-1-16-XP
XTB102	Same as XTB101 (105)		
XTB112	STRIP, Marker (135)	75382	MS600-6
3	PLATE, diode mounting assy	51261	704551
4	COVER, Front (1 ea)	51261	111053-1
5	PLATE, Mounting, Searchlight Control (1 ea)	51261	109292-1
6	COVER, Back (1 ea)	51261	111054-1
7	SINK, Heat, Power Amplifier (1 ea)	51261	111091-1
8	GASKET, Heat Sink (1 ea)	51261	111090-1
9	CLIP, Transformer (2 ea)	51261	111088-1
10	ISOLATION ASSEMBLY	51261	706071
11	PLUG, Power Supply Mounting (4 ea)	51261	111052-1
12	BRACKET, Transformer (1 ea)	51261	111089-1
13	BRACKET, Mounting, P.C. Card (1 ea)	51261	109235-1
14	BRACKET, Mounting, P.C. Card (1 ea)	51261	109235-2
15	RAIL, Guide (1 ea)	51261	109236-1
17	SUPPORT, Terminal Block (2 ea)	51261	109254
18	BASE MODIFICATION, Searchlight (1 ea)	51261	109272
19	PLATE, Cover (2 ea)	51261	109273
20	PLATE, Fan Mounting (Heat Exchanger) (1 ea)	51261	109274
23	RAIL, Guide (1 ea)	51261	109236-2
24	PLATE, Terminal Block Mounting (1 ea)	51261	109242
25	EXCHANGER, Heat (Modified) (1 ea)	51261	109489
26	BLOCK, Wedge (2 ea)	51261	109409
29	SPACER (8 ea)	51261	109465-2
37	GASKET, Base Cover (2 ea)	51261	109469-1
100	POWER SUPPLY, Searchlight	83008	095-0343
103	CONVERTER, Regulated, dc-dc (1 ea)	11352	9525-28-215
110	BAR, Mounting (4 ea)	18677	T-901-8.00
111	SPACER (24 ea)	18677	T-101-500
112	GUIDE, Printed Circuit Card (12 ea)	18677	T-311-60-T

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
113	SPACER, Stop (4 ea)	18677	T-910
114	FAN, Cooling, 115V, 400 Hz, 1 phase, 185 cfm, (2 ea)	82877	810DF
117	STANDOFF, Aluminum, 38 Dia x 2-1/4 lg (6 ea)	06540	8534-A0632
118	NUT, Self-Clinching (58 ea)	46384	CLS-632-2
119	CLAMP, Cable, Pro Grip (2 ea)	95987	3-7P
120	GASKET, Heat Exchanger (1 ea)	73165	VS30055R
122	JUMPER (Mount on TB112) (5 ea)	71785	140J-1
125	COVER, Valve (1 ea)	HOLLEY*	241-25
126	CONNECTOR, Printed Circuit Card Edge (6 ea)	05574	2VH22/1ANS
129	SPACER, Hex, Aluminum, 6-32 x 1-1/2 lg (4 ea)	91833	2213
130	GUARD, Fan (2 ea)	81041	6-182-039
131	WASHER, Nylon, No. 4 (8 ea)	83330	2514
700	SCREW, Machine, Slotted Pan Hd., 4-40 x 3/8 SS (8 ea)	51261	G4-40X3/8SS
701	SCREW, Machine, Slotted Pan Hd., 4-40 x 2-1/4 SS (4 ea)	51261	G4-40X2-1/4SS
702	SCREW, Machine, Slotted Pan Hd., 5-40 x 5/8 SS (12 ea)	51261	G5-40X5/8SS
703	SCREW, Machine, Slotted Pan Hd., 6-32 x 3/8 SS (38 ea)	51261	G6-32X3/8SS
704	SCREW, Cap, Socket Hd., 6-32 x 3/4 SS (8 ea)	51261	A6-32X3/4SS
705	SCREW, Machine, Slotted Pan Hd., 6-32 x 2 SS (8 ea)	51261	G6-32X2SS
706	SCREW, Machine, Slotted Pan Hd., 8-32 x 3/8 SS (2 ea)	51261	G8-32X3/8SS
707	SCREW, Machine, Slotted Pan Hd., 8-32 x 1/2 SS (8 ea)	51261	G8-32X1/2SS
708	SCREW, Machine, Slotted Pan Hd., 8-32 x 3/4 SS (4 ea)	51261	G8-32X3/4SS
709	SCREW, Cap, Socket Hd., 8-32 x 3/8 SS (6 ea)	51261	A8-32X3/8SS

*No code assigned. See Table 6.3 for address.

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
710	SCREW, Machine, Slotted Pan Hd., 10-32 x 3/8 SS (14 ea)	51261	G10-32X3/8SS
711	SCREW, Machine, Slotted Pan Hd., 10-32 x 1/2 SS (12 ea)	51261	G10-32X1/2SS
712	SCREW, Cap, Socket Hd., 10-32 x 5/8 SS (56 ea)	51261	A10-32X5/8SS
713	SCREW, Cap, Button Hd., Socket, 1/4-20 x 3/4 SS (7 ea)	51261	B1/4-20X3/4SS
714	BOLT, Hex Hd., 1/4-20 x 1 SS (4 ea)	51261	1/4-20X1SS
715	WASHER, Flat, No. 4 SS (12 ea)	51261	W4SS
716	WASHER, Flat, No. 5 SS (12 ea)	51261	W5SS
717	WASHER, Flat, No. 6 SS (46 ea)	51261	W6SS
718	WASHER, Flat, No. 8 SS (14 ea)	51261	W8SS
719	WASHER, Flat, No. 10 SS (26 ea)	51261	W10SS
720	WASHER, Flat, 1/4 SS (4 ea)	51261	W1/4SS
721	WASHER, Lock, No. 4 SS (12 ea)	51261	LW4SS
722	WASHER, Lock, No. 5 SS (12 ea)	51261	LW5SS
723	WASHER, Lock, No. 6 SS (56 ea)	51261	LW6SS
724	WASHER, Lock, No. 8 SS (22 ea)	51261	LW8SS
725	WASHER, Lock, No. 10 SS (82 ea)	51261	LW10SS
726	WASHER, Lock, 1/4 SS (11 ea)	51261	LW1/4SS
727	NUT, Hex, 4-40 SS (12 ea)	51261	N4-40SS
728	NUT, Hex, 5-40 SS (12 ea)	51261	N5-40SS
729	NUT, Hex, 6-32 SS (16 ea)	51261	N6-32SS
730	NUT, Hex, 8-32 SS (8 ea)	51261	N8-32SS
731	NUT, Hex, 10-32 SS (12 ea)	51261	N10-32SS
732	SCREW, Cap, Socket Hd., 1/4-20 x 3/4 SS (2 ea)	51261	A1/4-20-3/4SS
733	SCREW, Machine, Slotted Flat Hd., 6-32 SS (22 ea)	51261	F6-32SS
734	RIVET, Pop, 1/8 x 1/4, Aluminum (3 ea)	51261	R1/8X1/4A
735	SCREW, Machine, Slotted Pan Hd., 4-40 x 1-3/8 SS (8 ea)	51261	G4-40X1-3/8SS
736	SCREW, Machine, Slotted Pan Hd., 4-40 x 7/16 SS (4 ea)	51261	G4-40X7/16SS

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
737	SCREW, Cap, Socket Hd., 3/8-16 x 1 SS (4 ea)	51261	A3/8-16X1SS

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A1	DEMODULATOR CARD, Azimuth (Figure 7.4)	51261	703859-1
C1	CAPACITOR, 33 pF, 100V, Radial Lead Mil No. CK05BX330K	04222	CK05BX330K
C2	CAPACITOR, 1 uF, 100V, Metalized Polycarbonate	14752	650B1B105K
C3	Same as C1		
C4	CAPACITOR, 10 pF, 110V, Radial Lead Lead Mil No. CK05BX100K	04222	CK05BX100K
C5	Same as C1		
C6	CAPACITOR, .0082 uF, 100V, Metalized Polycarbonate	14752	650B1B822K
C7	CAPACITOR, 0.039 uF, 100V, Metalized Polycarbonate	14752	650B1B393K
C9	CAPACITOR, 1200 pF, 100V, Radial Lead Mil No. CK05BX122K	04222	CK05BX122K
C10	Same as C1		
C11	CAPACITOR, 15 uF, 20V, Tantallum Polatized	07088	T-212-B-156J-020-4-5
C12	Same as C11		
C13	CAPACITOR, 0.10 uF, ± 10%, 50V, Radial Lead Mil No. CK05BX104K	04222	CK05BX104K
C14	Same as C13		
C15	Same as C13		
C16	Same as C13		
C17	Same as C13		
C18	Same as C13		
C19	Same as C13		
C20	Same as C13		
C21	Same as C13		
C22	Same as C13		
C24	Same as C1		
C25	Same as C13		
C26	Same as C13		
CR1	DIODE, ZENER, 4.7V, 1 watt, Mil No. 1N4732	71468	1N4732

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
CR2	DIODE, ZENER, 18V, Mil No. 1N4746	04713	1N4746
CR3	Same as CR2		
CR4	DIODE, ZENER, 5.1V, 1 watt, Mil No. 1N4733	04713	1N4733
IC1	OPERATIONAL AMPLIFIER, 8 Lead, Metal Can	27014	LM101H
IC2	Same as IC1		
IC3	Same as IC1		
IC4	Same as IC1		
IC5	OPERATIONAL AMPLIFIER, 8 Lead, Metal Can	27014	LM108AH
IC6	SWITCH, Analog	34371	HI-201-2
IC7	Same as IC5		
L1	INDUCTOR, 82 mH	96906	MS90537-36
L2	Same as L1		
Q1	TRANSISTOR, NPN Silicon, Mil No. 2N2219	01295	2N2219
R1	RESISTOR, 100K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1003F	91637	RN55C1003F
R2	Same as R1		
R3	RESISTOR, 10K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1002	91637	RN55C1002
R4	Same as R3		
R5	Same as R1		
R6	Same as R1		
R7	RESISTOR, 499K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C4992	91637	RN55C4992
R8	Same as R7		
R9	RESISTOR, 2K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2001	91637	RN55C2001
R10	RESISTOR, 1K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1001	91637	RN55C1001
R11	RESISTOR, 24.9K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2492F	91637	RN55C2492F
R12	RESISTOR, 42.2K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C422F	91637	RN55C422F
R13	RESISTOR, 14.3K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1432	91637	RN55C1432

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
R14	Same as R1		
R15	Same as R1		
R16	RESISTOR, 500K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C5003	91637	RN55C5003
R17	POTENTIOMETER, 100K Ohms, Trimpot	80740	63X-R100K
R18	RESISTOR, 20K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2002	91637	RN55C2002
R19	Same as R3		
R20	Same as R3		
R21	Same as R3		
R22	Same as R17		
R23	Same as R9		
R24	RESISTOR, 510 Ohms, ± 5%, 1/4 watt, Composition	44655	OC5115
R25	RESISTOR, 200K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2003F	91637	RN55C2003F
R26	Same as R3		
TP1	TERMINAL, Solder, PC Turret	71279	160-1457-02-01-00
TP2	Same as TP1		
TP3	Same as TP1		
TP4	Same as TP1		
TP5	Same as TP1		
TP6	Same as TP1		
TP7	Same as TP1		
TP8	Same as TP1		
TP9	Same as TP1		
XIC1	SOCKET, SD Series, 8 Contacts	06776	SD-5178
XIC2	Same as XIC1		
XIC3	Same as XIC1		
XIC4	Same as XIC1		
XIC5	Same as XIC1		
XIC6	SOCKET, 16 Pin, DIP	06776	ICL-163-S6-G

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
XIC7	Same as XIC1		
XQ1	SOCKET, TRANSIPAD, SD/N Series, 3 contacts	13103	7717-5
137	EJECTOR, PC Card (1 ea)	18677	S-203

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A2	DEMODULATOR CARD, Elevation (Figure 7.4)	51261	703859-2
C1	CAPACITOR, 33 pF, 100V, Radial Lead, Mil No. CK05BX330K	04222	CK05BX220K
C2	CAPACITOR, 1 uF, 100V, Metalized Polycarbonate	14752	650B1B105K
C3	Same as C1		
C4	CAPACITOR, 10 pF, 100V, Radial Lead, Mil No. CK05BX100K	04222	CK05BX100K
C5	Same as C1		
C6	CAPACITOR, .0082 uF, 100V, Metalized Polycarbonate	14752	650B1B822K
C7	CAPACITOR, 0.039 uF, 100V, Metalized Polycarbonate	14752	650B1B393K
C9	CAPACITOR, 1200 pF, 100V, Radial Lead, Mil No. DK05BX122K	04222	CK05BX122K
C10	Same as C1		
C11	CAPACITOR, 15 uF, 20V, Tantallum Polarized	07088	T-212-B-156J-020-4-5
C12	Same as C11		
C13	CAPACITOR, 0.10 uF, ± 10%, 50V, Radial Lead, Mil No. CK05BX104K	04222	CK05BX104K
C14	Same as C13		
C15	Same as C13		
C16	Same as C13		
C17	Same as C13		
C18	Same as C13		
C19	Same as C13		
C20	Same as C13		
C21	Same as C13		
C22	Same as C13		
C24	Same as C1		
C25	Same as C13		
C26	Same as C13		
CR1	DIODE, ZENER, 4.7V, 1 watt, Mil No. 1N4732	71468	1N4732

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR	MFR'S
CR2	DIODE, ZENER, 18V, Mil No. 1N4746	04713	1N4746
CR3	Same as CR2		
CR4	DIODE, ZENER, 5.1V, 1 watt, Mil No.1N4733	04713	1N4733
IC1	OPERATIONAL AMPLIFIER, 8 Lead, Metal Can	27014	LM101H
IC2	Same as IC1		
IC3	Same as IC1		
IC4	Same as IC1		
IC5	OPERATIONAL AMPLIFIER, 8 Lead, Metal Can	27014	LM108AH
IC6	SWITCH, Analog	34371	H1-201-2
IC7	Same as IC5		
L1	INDUCTOR, 82 mH	96906	MS90537-36
L2	Same as L1		
Q1	TRANSISTOR, NPN Silicon, Mil No. 2N2219	01295	2N2219
R1	RESISTOR, 100K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1003F	91637	RN55C1003F
R2	Same as R1		
R3	RESISTOR, 10K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1002	91637	RN55C1002
R4	Same as R3		
R5	Same as R1		
R6	Same as R1		
R7	RESISTOR, 499K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C4992	91637	RN55C4992
R8	Same as R7		
R9	RESISTOR, 2K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2001	91637	RN55C2001
R10	RESISTOR, 1K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1001	91637	RN55C1001
R11	RESISTOR, 24.9K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2492F	91637	RN55C2492F
R12	RESISTOR, 100K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1003F	91637	RN55C1003F
R13	RESISTOR, 14.3K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C1432	91637	RN55C1432

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
R14	Same as R1		
R15	Same as R1		
R16	RESISTOR, 500K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C5003	91637	RN55C5003
R17	POTENTIOMETER, 100K Ohms, Trimpot	80740	63X-R100K
R18	RESISTOR, 20K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2002	91637	RN55C2002
R19	Same as R3		
R20	Same as R3		
R21	Same as R3		
R22	Same as R17		
R23	Same as R9		
R24	RESISTOR, 510 Ohms, ± 5%, 1/4 watt, Composition	44655	OC5115
R25	RESISTOR, 200K Ohms, ± 1%, 1/8 watt, Metal Film Mil No. RN55C2003F	91637	RN55C2003F
R26	Same as R3		
TP1	TERMINAL, Solder, PC Turret	71279	160-1457-02-01-00
TP2	Same as TP1		
TP3	Same as TP1		
TP4	Same as TP1		
TP5	Same as TP1		
TP6	Same as TP1		
TP7	Same as TP1		
TP8	Same as TP1		
TP9	Same as TP1		
XIC1	SOCKET, SD Series, 8 contacts	06776	SD-5178
XIC2	Same as XIC1		
XIC3	Same as XIC1		
XIC4	Same as XIC1		
XIC5	Same as XIC1		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
XIC6	SOCKET, 16 Pin, DIP	06776	ICL-163-S6-G
XIC7	Same as XIC1		
XQ1	SOCKET, TRANSIPAD SD/N Series, 3 contacts	13103	7717-5
137	EJECTOR, PC Card (1 ea)	18677	S-203

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A3	INPUT Amplifier and Notch Filter Card, Azimuth (Figure 7.7)	51261	703732-1
C3	Not used		
C5	Not used		
C7	CAPACITOR, 2 uF, ± 5%, 50V, 1/4 watt, Metalizer Polycarbonate	14752	650B1A205K
C7A	CAPACITOR, 10 uF, ± 10%, 50V, Metalized Polycarbonate	14752	650B1A106K
C8	CAPACITOR, 1 uF, ± 5%, 50V, Metalized Polycarbonate	14752	636A1A105J
C11	CAPACITOR, 47 uF, ± 5%, 50V, Metalized Polycarbonate	14752	652A1A473J
C12	Not Used		
C13	CAPACITOR, C13 is not used		
C13	DIODE, Silicone, 75V, Prv, 75 ma Mil No. 1N914B	34148	1N914B
C14	Same as C13		
C14	CAPACITOR C14 is not used		
C15	Not Used		
C22	Not Used		
C23	Not Used		
C24	Not Used		
C25	Not Used		
C26	CAPACITOR, 1.5 uF, ± 5%, 50V, Metalized Polycarbonate	14752	625B1A155J
C29	CAPACITOR, 10 uF, ± 20%, 25V, Tantalum	56289	199D106X0025CA1
C30	Same as C29		
IC1	OPERATIONAL AMPLIFIER	06665	OP-02J
IC2	Same as IC1		
IC3	Not Used		
IC5	Not Used		
IC6	Same as IC1		
K1	RELAY	94696	W172DIP-7
K2	RELAY	94696	W172DIP-8

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
R1	POTENTIOMETER, 10K Ohms	32997	3299X-1-103
R3	RESISTOR, 82K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC8235
R4	RESISTOR, 1K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OB1025
R9	RESISTOR, 17.4K Ohms, ± 1%, 1/8 watt, Precision Mil No. RN60C1742F	91637	RN60C1742F
R11	Same as R9		
R17	ZENER, Diode, 9.1V, ± 5%, 1 watt, Mil No. 1N4739A	34148	1N4739A
R18	RESISTOR, 100K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC1045
R20	RESISTOR, 390K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC3945
R21	Same as R17		
R22	RESISTOR, 11.3K Ohms, ± 1%, 1/8 watt, Precision Mil No. RN60C1132F	91637	RN60C1132F
R23	RESISTOR, 68K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC6835
R24	RESISTOR, 10K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC1035
R25	Same as R22		
R26	R26 not used, Install Jumper		
R28	RESISTOR R28 not used		
R28	Same as C13		
R29	Same as R18		
R29	RESISTOR R29 not used		
R30	Same as R18		
R30	RESISTOR R30 at Coordinates 68 not used		
R31	Same as C13		
R31	RESISTOR R31 not used		
R32	Not Used		
R37-R41	Not Used		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S
TP5	TERMINAL, Solder, PC Turret	71279	160-2034-02-01-00
TP6	Same as TP5		
TP7	Same as TP5		
TP8	Same as TP5		
XIC1	PAD, Transistor Mounting, 3/8 O.D., For 8 Pin TO-99 Can	13103	7717-8N
XIC2	Same as XIC1		
XIC6	Same as XIC1		
Z3	DIODE, ZENER 18V, ±5%, 1 watt, Mil No. 1N4746A	34148	1N4746A
Z4	Same as Z3		
Z7	DIODE, ZENER 2.4V, ±5%, 1 watt, Mil No. 1N4370A	34148	1N4370A
Z8	Same as Z7		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A4	INPUT Amplifier and Notch Filter Card, Elevation (Figure 7.10)	51261	703732-2
C3	Not Used		
C5	Not Used		
C7	CAPACITOR, 5 uF, ± 5%, 50V, 1/4 watt, Metalized Polycarbonate	14752	650DIA505J
C8	CAPACITOR, 1 uF, ± 5%, 50V, Metalized Polycarbonate	14752	636A1A105J
C11	CAPACITOR, 47 uF, ± 5%, 50V, Metalized Polycarbonate	14752	652A1A473J
C12	Not Used		
C13	Not Used		
C14	Not Used		
C15	Not Used		
C17	Not Used		
C26	Same as C8		
C29	CAPACITOR, 10 uF, ± 20%, 25V, Tantalum	56289	199D106X0025CA1
C30	Same as C29		
IC1	OPERATIONAL AMPLIFIER	06665	OP-02J
IC2	Same as IC1		
IC3	Not Used		
IC5	Not Used		
K2	RELAY	94696	W172DIP-8
R1	POTENTIOMETER, 10K Ohms	32997	3299X-1-103
R3	RESISTOR, 82K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC8235
R4	RESISTOR, 1K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OB1025
R17	ZENER, Diode, 9.1V, ± 5%. 1 watt, Mil No. 1N4739A	34148	1N4739A
R18	RESISTOR, 390K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC3945
R21	Same as R17		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
R22	RESISTOR, 11.3K Ohms, ± 1%, 1/8 watt, Precision Mil No. RN60C1132F	91637	RN60C1132F
R23	RESISTOR, 68K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC6835
R24	R24 not used, Install Jumper		
R25	Same as R22		
R26	R26 not used, Install Jumper		
R28	Not Used		
R29	Not Used		
R30	Not Used		
R31	Not Used		
R32	Not Used		
R37-R41	Not Used		
TP5	TERMINAL, Solder, PC Turret	71279	160-2034-02-01-00
TP6	Same as TP5		
TP7	Same as TP5		
TP8	Same as TP5		
XIC1	PAD, Transistor Mounting, 3/8 O.D., For 8 Pin TO-99 Can	13103	7717-8N
XIC2	Same as XIC1		
Z3	DIODE, ZENER 18V, ±5%, 1 watt, Mil No. 1N4746A	34148	1N4746A
Z4	Same as Z3		
Z5	DIODE, ZENER, 5.6V, ±5%, 1 watt, Mil No. 1N4734A	34148	1N4734A
Z6	Same as Z5		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A5	SEARCHLIGHT Control Card I (Figure 7.12)	51261	703711-1
C1	CAPACITOR, 4.5 uF, 50V, Metal Polycarbonate	14752	652A1A455K
C2	CAPACITOR, .01 uF, 50V, Metal Polycarbonate	14752	652A1A103K
C3	CAPACITOR, .1 uF, 50V, Metal Polycarbonate	14752	652A1A104K
C4	Same as C3		
C5	Same as C3		
C6	Same as C3		
C7	Same as C3		
C8	Same as C2		
C9	CAPACITOR, 15 uF, 20V, Tantalum, Polarized	07088	T-212-B-156J-020-A-5
C10	Same as C9		
C11	CAPACITOR, .15 uF, 50V, Metal Polycarbonate	14752	625A1A154K
C12	Same as C2		
CR1	DIODE, SILICON Mil No. 1N914B	04713	1N914B
CR2	DIODE, ZENER, 18V Mil No. 1N4746	04713	1N4746
CR3	Same as CR2		
K1	RELAY, DPDT	78290	FC-210-13
K2	RELAY K2 is not used		
K2, 1	RESISTOR, 120 Ohms, 1 watt, Carbon Composition	44655	0G1215
K3	RELAY, SPTD, To-5	11532	411D-26
K4	Same as K3		
K5	Same as K3		
R2	RESISTOR, 20K Ohms, ± 1%, Metal Film Mil No. RN60C200F	81349	RN60C200F
R3	Same as R2		
R4	RESISTOR, 1K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC1025
R5	Same as R4		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MRF OR SOURCE	MFR'S DATA
R6	RESISTOR, 9.1K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC9125
R7	RESISTOR, 6.2K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC6225
R8	RESISTOR, 2.49K Ohms, ± 1%, Metal Film Mil No. RN60C24R9F	81349	RN60C24R9F
R9	RESISTOR, 2.87K Ohms, ± 1%, Metal Film Mil No. RN60C2871F	81349	RN60C2871F
R10	RESISTOR, 5.11K Ohms, ± 1%, Metal Film Mil No. RC60C5111F	81349	RN60C5111F
R11	Same as R8		
R12	POTENTIOMETER, 50K Ohms	80740	63XR50K
R13	RESISTOR, 750K Ohms, ± 5%, Carbon Composition	44655	OE7535
R14	Same as R10		
R15	RESISTOR, 68K Ohms, ± 5%, 1/4 watt, Carbon Composition	44655	OC6825
TP1	TERMINAL, Solder, Turret PC	71279	160-1457-02-01-00
TP2	Same as TP1		
TP3	Same as TP1		
TP4	Same as TP1		
TP5	Same as TP1		
TP6	Same as TP1		
TP7	Same as TP1		
U1	ELIMINATOR, Bounce, Hex Contact	04713	MC14490EFL
U2	GATE, Triple 3-Input Nand	27014	MM54C10J
U3	GATE, 8-Input Nand	27014	MM54C30J
U4	COUNTER, Synchronous 4 Bit, Up/Down, Binary	27014	MM54C193J
U5	Same as U4		
U6	GATE, 3-Input OR	04713	MC14075BAL
U7	REFERENCE, ± 10V, Precision Voltage	06665	REF01J
U8	CONVERTER, 8 Bit, High Speed, Multiplying D/A	06665	DAC-08Q

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
U9	CONVERTER, DC/DC	13919	700
U10	AMPLIFIER, Transformer Coupled	13919	3451
U11	TIMER	27014	LM555
XK3	SPREADER	11532	192-67
XK4	Same as XK3		
XK5	Same as XK3		
130	EJECTOR, PC Card (1 ea)	18677	S-203

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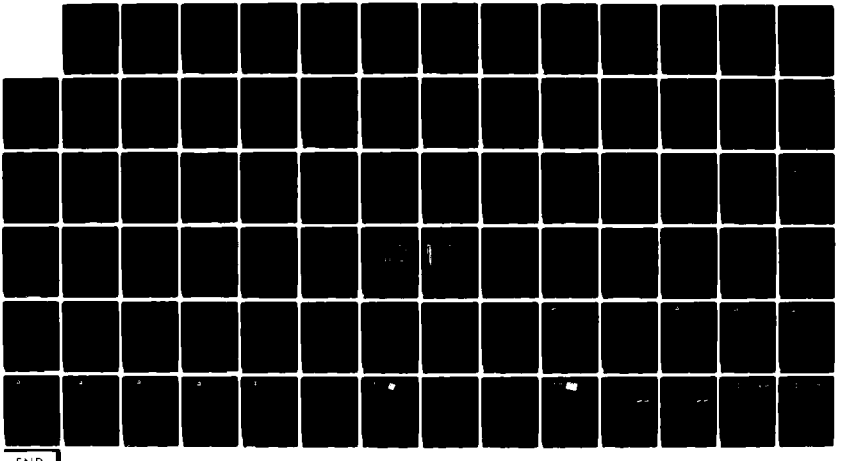

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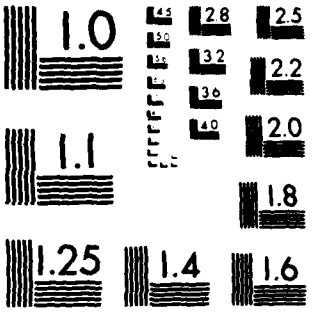

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TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A6	SEARCHLIGHT CONTROL CARD II (Figure 7.15)	51261	703712-1
C1	CAPACITOR, 33 uF, 35V, Solid Tantalum	07088	T330D336-035AS
C2	CAPACITOR, 0.1 uF	07088	C052K104M5R1CA
C3	Same as C2		
C4	Same as C2		
C5	Same as C1		
C6	Same as C2		
CR1	DIODE, Silicon, Mil No. 1N9143	04713	1N914B
CR2	Same as CR1		
CR3	Same as CR1		
CR4	Same as CR1		
CR5	DIODE, Zener, 18V, Mil No. 1N4746	04713	1N4746
CR6	Same as CR1		
CR7	Same as CR1		
CR8	Same as CR1		
CR9	Same as CR1		
CR10	Same as CR5		
CR11	Same as CR1		
CR12	Same as CR1		
CR13	Same as CR1		
CR14	Same as CR1		
CR15	Same as CR1		
CR16	Same as CR1		
CR17	Same as CR1		
CR18	Same as CR1		
CR19	Same as CR1		
CR20	Same as CR1		
CR21	Same as CR1		
CR22	Same as CR1		
CR23	Same as CR1		
CR24	Same as CR1		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
K1	RELAY, SPDT, TO5	11532	411D-26
K2	Same as K1		
K3	Same as K1		
K4	RELAY, DPDT, TO-S	11532	412D-26
K5	Same as K4		
K6	Same as K4		
K7	Same as K1		
K8	Same as K1		
K9	Same as K1		
K10	Same as K1		
K11	Same as K1		
K12	Same as K1		
K13	Same as K1		
Q1	POWER FET VMOS	17856	VN66AK
Q2	Same as Q1		
Q3	Same as Q1		
R3	POTENTIOMETER, 20K Ohms	80740	63XR20K
R4	Same as R3		
R5	Same as R3		
R6	Same as R3		
R7	Not Used		
R8	RESISTOR, 200K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC2045
R9	Same as R8		
R10	RESISTOR, 100K Ohms, ± 5%, 1/4 2 watt, Carbon	44655	OC1045
R11	RESISTOR, 5.1K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC5125
R12	Same as R11		
R13	Same as R11		
R14	Same as R11		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
R15	RESISTOR, 6.8K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC6825
R16	Same as R15		
R17	Same as R15		
R18	Same as R15		
R19	RESISTOR, 143K Ohms, ± 5%, 1/4 watt, Carbon, Mil No. RN60C1433F	81349	RN60C1433F
R20	Same as R19		
R21	RESISTOR, 51.1K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC5135
R22	Same as R21		
R23	RESISTOR, 88.7K Ohms, ± 5%, 1/4 watt, Carbon, Mil No. RN60C8872F	813497	RN60C8872F
R24	Same as R23		
R25	Same as R8		
R26	Same as R10		
R27	Same as R8		
R28	RESISTOR, 150K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC1545
R29	Same as R28		
R30	RESISTOR, 10K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC1035
R31	Same as R21		
R32	Same as R30		
R33	RESISTOR, 90.9K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC9135
R34	RESISTOR, 140K Ohms, ± 5%, 1/4 watt, Carbon, Mil No. RN60C1403F	81349	RN60C1403F
R35	RESISTOR, 33K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC3335
R36	RESISTOR, 2M Ohms, ± 5%, 1/4 watt, Carbon	44655	OC2055
R37	RESISTOR, 42K Ohms, ± 5%, 1/4 watt, Carbon	44655	OC4335
R38	Same as R21		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
R39	Same as R30		
R40	Same as R30		
R41	Same as R30		
R42	Same as R36		
R43	Same as R36		
TP1	TERMINAL, Solder, PC Turret	71279	160-1457-02-01-00
TP2	Same as TP1		
TP3	Same as TP1		
TP4	Same as TP1		
TP5	Same as TP1		
TP6	Same as TP1		
TP7	Same as TP1		
TP8	Same as TP1		
TP9	Same as TP1		
U1	QUAB, 741 OP Amp	27014	LM148
U2	Same as U1		
U3	Same as U1		
U4	MULTIVIBRATOR, Dual Monostable	27014	MM74221
U5	QUAD, 2-Input and Gate	27014	MM54C08
U6	DUAL JK FLIPFLOP, With Clear	27014	MM54C76
XK1	SPREADER, For 411D Relay	11532	192-67
XK2	Same as XK1		
XK3	Same as XK1		
XK4	SPREADER, For 412D Relay	11532	192-59
XK5	Same as XK4		
XK6	Same as XK4		
XK7	Same as XK1		
XK8	Same as XK1		
XK9	Same as XK1		
XK10	Same as XK1		
XK11	Same as XK1		

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
XK12	Same as XK1		
XK13	Same as XK1		
100	ELIMINATOR, Hex Contact Bounce (1 ea)	04713	MC14490EFL
101	FLIPFLOP, (1 ea)	27014	54C74J
114	EJECTOR, PC Card (1 ea)	18677	S-203

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A7	ASSEMBLY, Plate, Diode Mounting	51261	704551-1
CR4	DIODE, Power, Mil No. 1N1185 (100)	04713	1N1185
CR5	Same as CR4 (100)		
CR6	Same as CR4 (100)		
CR7	Same as CR4 (100)		
CR8	Same as CR4 (100)		
CR9	Same as CR4 (100)		
TB113	BLOCK, Terminal, Twin Screw, 2 Contact, 20 Amp (101)	71785	2-141
XTB113	STRIP, Marker (102)	71785	MS2-141
3	PLATE, Diode Mounting (1 ea)	51261	111079-1
4	BRACKET, Support, Diode Mounting Plate (2 ea)	51261	109252-1
5	WASHER, Mica, .001-.003 Thk, 1.00 CD x 0.255 ID (6 ea)	51261	54140-3
6	BUSHING, Shoulder, 0.625 OD x 0.260 ID (6 ea)	51261	54143-1
700	SCREW, Machine, Slotted Pan Hd., 4-40 x 7/16 (6 ea)	51261	G4-40X7/16
701	SCREW, Machine, Slotted Pan Hd., 6-32 x 3/4 (4 ea)	51261	G6-32X3/4
702	WASHER, Flat, No. 4 (6 ea)	51261	W4
703	WASHER, Flat, No. 6 (4 ea)	51261	W6
704	NUT, Hex, 4-40 (6 ea)	51261	N4-40
705	NUT, Hex, 6-32 (4 ea)	51261	N6-32
706	NUT, Hex, 1/4-28 (6 ea)	51261	N1/4-28

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
707	SCREW, Cap, Socket Hd., 10-24 x 5/8 S (6 ea)	91261	A10-24X5/8S
710	SCREW, Cap, Socket Hd., 6-32 x 1/2 S (16 ea)	91261	A6-32X1/2S
711	SCREW, Cap, Socket Hd., 4-40 x 3/3 S (9 ea)	91261	A4-40X3/8S
713	SCREW, Cap, Socket Hd., 10-32 x 7/8 S (2 ea)	91261	A10-32X7/8S
715	SCREW, Cap, Socket Hd., 8-32 x 1/2 S (8 ea)	91261	A8-32X1/2S
716	SCREW, Machine, Slotted Pan Hd., 4-40 x 3/8S (6 ea)	91261	G4-40X3/8S
717	SCREW, Machine, Slotted Hd., 10-24 x 5/8 SS (22 ea)	91261	G10-20X5/8SS
718	SCREW, Machine, Slotted Pan Hd., 6-32 x 1/4 SS (12 ea)	91261	G6-32X1/4SS
720	SETSCREW, Socket, Cup Point, 2-56 x 1/8 S (2 ea)	91261	K2-56X1/8S
721	PIN, Dowel, Pull Type, 10-32 Tap, 5-16-2 S(2 ea)	91261	DP5/16-2S
722	PIN, Roll, 1/4 x 5/8 S (1 ea)	91261	RP1/4X5/8S

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A8	SEARCHLIGHT Power Supply (Figure 7.18)	83008	095-0343
1	BEARING (2 ea)	71366	FL38-4
2	ROD, Tie (8 ea)	83088	651-1094
3	BLOCK, Terminal (1 ea)	71785	352-11-05-001
4	PIN, Spring (1 ea)	83008	512-1009
5	WASHER (1 ea)	83008	730-0596
6	SCREW, Socket Hd Shoulder (1 ea)	83008	595-0097
7	PIN, Spring (1 ea)	83008	512-1061
8	CHAIN, 1/4 Pitch, 13-1/4 in. lg (1 ea)	71041	25
9	HEAT SINK, Modified (1 ea)	83008	365-0094
10	RETAINER ASSEMBLY, Brush Holder (2 ea)	83008	808-0127
11	CONTACT ASSEMBLY (2 ea)	83008	841-0027
12	TRANSFORMER, Partial Range Variable (2 ea)	83008	033-8522
13	MOTOR (1 ea)	05106	33A2214-900
14	RESISTOR (4 ea)	09214	V47ZA7
16	BLOCK, Terminal (1 ea)	71785	356-31-03-001-3-152
17	BLOCK, Terminal (1 ea)	71785	355-31-04-001-4-542
18	TRANSFORMER, Isolated, Modified (1 ea)	83008	712-0617
19	STRIP, Terminal (1 ea)	71785	354-11-03-001
20	RECTIFIER (1 ea)	59993	1000HTIU3 Phase
15	BOARD, Regulator (1 ea)	83008	095-0348

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A9	CABLE ASSEMBLY, Power Supply to Control Box (Figure 7.24)	51261	703930-1
P1	CONNECTOR	96906	MS3108F32-5S
101	SLEEVING, Silicon Rubber, Black, 1/2 Dia (2 ea)	79074	H-C-1
102	SHIELD, Braided (2 ea)	92194	1232
103	CONDUCTOR, No. 3 (2 ea)	92194	6114
104	TERMINAL, Ring Torque, Solistrand (2 ea)	00779	320383

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A10	CABLE ASSEMBLY, Control Card I: to Control Box (Figure 7.23)	91261	703936-1
P2	CONNECTOR	96906	MS3108F18-1P
101	SLEEVING, Silicon Rubber, Black, 7/16 (1 ea)	79074	H-C-1
102	WIRE, No. 20 Gage (8 ea)	31924	P2111

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A1A11	CABLE ASSEMBLY, Control Box to Searchlight (Figure 7.22)	51261	
P4	CONNECTOR		MS3106F32-6P
	WIRE, No. 8 Gage (2 ea)	92194	
	WIRE, No. 12 Gage (3 ea)	92194	
	WIRE, No. 20 Gage (18 ea)	92194	

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A2	AZIMUTH ASSEMBLY, Model 066 (figure 5.4)	91261	501192-1
B1	TRANSFORMER, Synchro, 90V Input, 56.3V Output Mil No. M20708/ID-001 (104)	05402	CR90903024
B2	TRANSMITTER, Synchro, 115V Input, 90V Output, Mil No. M20708/R-001 (116)	05402	CR90913029
CR9	DIODE, Silicon, 5 volts-PRV, 1 Amp. (119)	04713	IN4001
M1	MOTOR, Torque, 30 ft.-lb. (102)	94259	R8409-03-D
S1	SWITCH, LIMIT, Adjustable Cam (106)	23934	CS-402-4
S2	Same as S1 (106)		
S3	Same as S1 (106)		
S4	Same as S1 (106)		
TB103	BOARD, Terminal (112)	75382	600A-10-XP
TB104	Same as TB103 (112)		
TB105	Same as TB103 (112)		
TB106	Same as TB103 (112)		
XTB103	STRIP, Marker, Mil No. MS600A-10-XP (113)	75382	MS600A-10-XP
2	HOUSING, Azimuth (1 ea)	91261	107136-1
3	SHAFT, Azimuth (1 ea)	91261	107206-1
4	RETAINER (1 ea)	91261	005-1068-31
5	HOUSING, Bearing (1 ea)	91261	107137-1
6	EXTENSION, Shafts Azimuth (1 ea)	91261	107155-1
7	PLATE, Mounting, Readout (1 ea)	91261	107110-1
8	PLATE, Mounting, Synchro/Resolver (2 ea)	91261	107123-2
9	PLATE, Mounting, Switch (1 ea)	91261	107125-1
10	GEAR, Drive, Modified (1 ea)	91261	900426-1
11	GEAR, Modified (1 ea)	91261	900425-1
12	PULLEY, Drive, Modified (1 ea)	91261	900424-1
13	FLANGE, Wire Guide (1 ea)	91261	109649-1
14	GUIDE, Wire (1 ea)	91261	109650-1
17	STANDOFF, Plate, Terminal Board (2 ea)	91261	107127-1
18	PLATE, Mounting, Terminal Board (1 ea)	91261	107122-1
19	COVER (2 ea)	91261	107152-1

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
20	COVER (2 ea)	91261	107152-2
21	MOUNT, Clamp (1 ea)	91261	107407-1
22	RETAINER, Seal (2 ea)	91261	107270-1
23	HOUSING, Seal (1 ea)	91261	107269-1
25	HOUSING, Azimuth (1 ea)	91261	107136-4
100	BEARING, Angular Contact (1 ea)	32828	KG060AR3
101	BEARING, Angular Contact (1 ea)	32828	KB030AR3
102	MOTOR, Torque, 30 ft. - lb. (1 ea)	94259	R8409-03-D
103	SEAL, Teflon, Spring Loaded, 7-1/4 I.D.	09055	305A-263A
107	PULLEY, "No Slip," Geared (1 ea)	00141	FC2-64
108	BELT, Drive, Positive "No Slip" (1 ea)	00141	FA-126
110	CLEAT, Motor Mounting (6 ea)	00141	L2-2
111	CLEAT, Motor Mounting (3 ea)	00141	L2-1
114	CLAMP, Cable (AR)	92194	
115	CLAMP, Cable (AR)	92194	
118	HUB ASSEMBLY, Solid (1 ea)	01351	101-171-HA1873
700	SCREW, Cap, Socket Hd., 1/4-20 x 3-1/2 S (4 ea)	91261	A1/4-20X3-1/2S
701	SCREW, Cap, Socket Hd., 1/4-20 x 3 S (6 ea)	91261	A1/4-20X3S
702	SCREW, Cap, Socket Hd. 10-32 x 1-1/4 S (4 ea)	91261	A10-32X1-1/4S
703	SCREW, Cap, Socket Hd., 10-32 x 1 S (6 ea)	91261	A10-32X1S
704	SCREW, Cap, Button Hd., Socket, 10-32 x 3/4 S (3 ea)	91261	B10-32X3/4S
705	SCREW, Cap Socket Hd., 10-32 x 5/8 S (1 ea)	91261	A10-32X5/8S
706	SCREW, Cap, Socket Hd., 10-32 x 1/2 S (8 ea)	91261	A10-32X1/2S

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A3	PILLOW BLOCK ASSEMBLY, Drive Side (figure 5.7)	91261	501193-1
B3	TRANSFORMER, Synchro, 90V Input 57.3V Output Mil No. M20708/ID-001 (102)	05402	CR90903024
B4	TRANSMITTER, Synchro, 115V Input, 90V Output Mil No. 20708/2C-001 (118)	05402	CR90913029
CR10	DIODE, silicon, 50 volts-PRV, 1 Amp. (119)	04713	IN4001
S5	SWITCH, LIMIT, Adjustable Cam (104)	23934	CS-402-4
S6	Same as S5 (104)		
S7	Same as S5 (104)		
S8	Same as S5 (104)		
TB108	BOARD, Terminal (105)	75382	600A-20
TB109	Same as TB108 (105)		
XTB108	STRIP, Marker, Mil No. MS600A-20XP (106)	75382	MS600A-20XP
XTB109	Same as XTB108 (106)		
2	BLOCK, Pillow (1 ea)	91261	107218-1
3	RETAINER, Seal (1 ea)	91261	107548-1
4	SPACER, Bearing (1 ea)	91261	107718-1
5	RETAINER, Bearing, Thd (1 ea)	91261	107722-1
6	SHAFT, Drive Side (1 ea)	91261	107731-1
10	ADAPTER, Gear (1 ea)	91261	107723-1
11	GEAR, Drive (1 ea)	91261	900461-1
12	STANDOFF (4 ea)	91261	107729-1
13	PLATE, Mounting, Synchro/Resolver (2 ea)	91261	107724-2
14	PLATE, Cam Switch Mounting (1 ea)	91261	107725-1
15	PLATE, Mounting, RD'T Components (1 ea)	91261	107732-1
16	COVER, Pillow Block (1 ea)	91261	107728-1
100	BEARING, Angular Contact (2 ea)	32828	KD045AR3

TABLE 6.6. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
107	HUB ASSEMBLY, Solid (2 ea)	01351	101-120/HA1873
108	HUB ASSEMBLY, Solid (1 ea)	01351	101-120/HA1248
109	SEAL, Teflon, Spring Loaded (1 ea)	09055	305A-251
111	CLEAT, Motor Mounting (6 ea)	00141	L2-2
112	CLEAT, Motor Mounting (3 ea)	00141	L2-1
113	SETSCREW, "No Mar", 2-56 x 5/32 (5 ea)	00141	CS-8
114	SETSCREW, "No Mar", 10-32 x 15/16 (1 ea)	00141	CS-13
116	INSERT, Threaded, 8-32 x 1/4 (9 ea)	01556	1185-2CN-0246
117	INSERT, Threaded, 3/8-16 x 9/16 (6 ea)	01556	1185-6CN-0562

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
700	SCREW, Cap, Socket Hd., 10-24 x 1-3/4 S (8 ea)	91261	A10-24X1-3/4S
703	SCREW, Cap, Socket Hd., 10-32 x 1/2 S (4 ea)	91261	A10-32X1/2S
704	SCREW, Cap, Socket Hd., 6-32 x 1/2 S (8 ea)	91261	A6-32X1/2S
705	SCREW, Cap, Socket Hd., 6-32 x 3/8 S (9 ea)	91261	A6-32X3/8S
706	SCREW, Cap, Socket Hd., 4-40 x 5/8 S (3 ea)	91261	A4-40X5/8S
707	SCREW, Cap, Socket Hd., 4-40 x 3/8 S (3 ea)	91261	A4-40X3/8S
708	SCREW, Cap, Socket Hd., 4-40 x 1/4 S (9 ea)	91261	A4-40X1/4S
709	SCREW, Machine, Slotted Pan Hd., 8-32 x 3/8 SS (9 ea)	91261	G8-32X3/8SS
710	SCREW, Machine, Slotted Pan Hd., 6-32 x 3/8 SS (6 ea)	91261	G6-32X3/8SS

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A4	PILLOW BLOCK ASSEMBLY, Readout Side (figure 5.8)	91261	501194-1
TB107	BOARD, Terminal (102)	75382	600A-12
XTB107	STRIP, Marker Mil No. MS600A-12-XP (103)	75382	MS600A-12-XP
M1	MOTOR, Torque, 7 ft.-lb. (107)	11384	T-5730-A
2	BLOCK, Pillow (1 ea)	91261	107218-2
3	COVER, Pillow Block (1 ea)	91261	107728-1
4	DISC, Caging (1 ea)	91261	108265-1
5	RETAINER, Seal (1 ea)	91261	107548-1
6	SHAFT, Readout Side (1 ea)	91261	107730-1
7	SPACER, Bearing (2 ea)	91261	107718-1
8	RETAINER, Bearing, Threaded (1 ea)	91261	107722-1
9	RETAINER, Bearing (1 ea)	91261	107719-1
10	STANDOFF (2 ea)	91261	107729-4
11	STANDOFF (2 ea)	91261	107729-3
12	PLATE, Mounting, Electrical Components (1 ea)	91261	107733-1
13	BLOCK, Pillow (1 ea)	91261	107218-1
14	RETAINER, Motor (1 ea)	91261	107720-1
100	BEARING, Angular Contact (2 ea)	32828	KD045AR3
101	SEAL, Teflon, Spring Loaded (1 ea)	09055	305A-251
104	SETSCREW, "No Mar", 10-32 x 15/64 (1 ea)	00141	CS-13
106	INSERT, Threaded, 8-32 x 1/4 (9 ea)	01556	1185-2CN-0246
700	SCREW, Cap, Socket Hd., 1/4-20 x 3/4 SS (6 ea)	91261	A1/4-20X3/4SS
701	SCREW, Cap, Socket Hd., 10-24 x S (8 ea)	91261	A10-24X
702	SCREW, Cap, Socket Hd., 10-24 x 5/8 S (8 ea)	91261	A10-24X5/8S
703	SCREW, Machine, Slotted Pan Hd., 6-32 x 3/8 SS (6 ea)	91261	G6-32X3/8SS
705	SCREW, Cap, Socket Hd., 10-32 x 1/2 S (4 ea)	91261	A10-32X1/2S

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
706	SCREW, Machine, Slotted Pan Hd., 8-32 x 3/8 SS (9 ea)	91261 91261	G8-32X3/8SS G8-32X3/8SS
708	PIN, Dowel, 1/4 x 1 SS (2 ea)	91261	DP1/4X1SS
710	SCREW, Cap, Socket Hd., 6-32 x 1/2 S (4 ea)	91261	A6-32X1/2S
711	SCREW, Machine, Slotted Flat Hd., 6-32 x 1-1/4 B (6 ea)	91261	F6-32X1-1/4B

TABLE 6.2 PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A5	CAGING ASSEMBLY (figure 5.3)	91261	501086-1
L1	SOLENOID (PS-75-24Vdc) (1 ea) (100)	28478	51073-83
S1	SWITCH, Subminiature, w/Actuator Leaf (1 ea) (104)	00685	111SM1-7
1	HOUSING, Caging (1 ea)	91261	107494-1
2	PLUNGER (1 ea)	91261	107495-1
3	SHAFT, Adjusting (1 ea)	91261	266-1054-1
4	BLOCK, Adjusting (1 ea)	91261	266-1051-1
5	PLATE, Switch Mounting (1 ea)	91261	107497-1
7	COVER (1 ea)	91261	107496-1
10	SLEEVE, Plunger (1 ea)	91261	109203-1
101	SPRING, Compression (1 ea)	70472	C0480-038-1500
102	SETSCREW, Collar (1 ea)	00141	C1-3
103	KNOB, Fastrol (1 ea)	01599	G-1N
105	INSERT, Threaded, 1/4-20 x 1/2 (1 ea)	01556	1185-4CN-0500
106	SEAL, Spring Ring (1 ea)	05939	SR-203-12-1
107	PIN, Dowel, 1/8 x 3/16 (1 ea)	00141	D5-187
108	SCREW, Nylon, Pan Hd., 1/4-20 x 1/4 (1 ea)	98343	Z11-N12-A4
109	WASHER, Nylon, 0.562 O.D. x 0.250 ID x 0.062 Thk (1 ea)	00141	YW-9
700	PIN, Roll, 3/32 x 1/2 SS (2 ea)	91261	RP3/32X1/2S
701	PIN, Roll, 3/32 x 1-1/8 S (1 ea)	91261	RP3/32X1-1/8S
702	SCREW, Machine, Slotted Pan Hd., 2-56 x 3/8 S (2 ea)	91261	G2-56X3/8S
703	SCREW, Cap, Socket Hd., 8-32 x 3/4 SS (6 ea)	91261	A8-32X3/4SS
704	SCREW, Machine, Slotted Pan Hd., 8-32 x 3/8 SS (6 ea)	91261	G8-32X3/8SS
705	SCREW, Machine, Slotted Pan Hd., 4-40 x 3/8 S (2 ea)	91261	G4-40X3/8S

TABLE 6.2. PARTS LIST (CONTINUED)

REF SYMBOL	NAME AND DESCRIPTION	MFR OR SOURCE	MFR'S DATA
1A6	Isolation Assembly (figure 7.21)	51261	706071-1
TB113	TERMINAL Board, 8 position (102)	75382	410-8
T1	TRANSFORMER, 400 HZ, 1:1 Turns Ratio (100)	32702	15E11OCT
T2	Same as T1 (100)		
103	MARKER Strip	75382	410-8-XP-2A
700	SCREW, Flat Head, 4-40 x 3/8 SS (4 ea)	51261	F4-40X3/8SS
701	SCREW, Flat Head, 4-40 x 1-1/2 SS (4 ea)	51261	F4-40X1-1/2SS
703	NUT, Hex, 4-40 SS (8 ea)	51261	N4-40SS
705	LOCKWASHER, 4-40 SS (8 ea)	51261	LW4-40SS

TABLE 6.3. LIST OF MANUFACTURERS

CODE	NAME AND ADDRESS
None Assgnd	Holley Replacement Part Div. P.O. Box 749 Warren, MI 48090
00141	Pic Design Corp. Sub. of Wells-Benrus Co. P.O. Box 335 Ridgefield, CT 06877
00685	Honeywell, Inc. Micro Switch - Farmer Electric 401 Elm St. Marlboro, MA 01752
00779	Amp, Inc. P.O. Box 3608 Harrisburg, PA 17105
01295	Texas Instruments, Inc. Semiconductor Group 13500 N. Central Expressway P.O. Box 225012 M/S 49 Dallas, TX 75265
01351	Dynamic Gear Co., Inc. 457i N.W. 8th Ave. P.O. Box 23610 Ft. Lauderdale, FL 33307
01556	Mite Corporation Heli-Coil Products Div. Shelter Rock Lane Danbury, CT 06810
01599	Reid Tool Supply Co. 2233 Temple St. Muskegon Heights, MI 49444
04222	AUX Ceramics Div. of AUX, Corp. 19th Ave. South P.O. Box 867 Myrtle Beach, SC 29577
04713	Motorola, Inc. Semiconductor Group 5005 E. McDowell Rd. Phoenix, AZ 85008
05106	Globe Industries, Inc. Electronics Div. Dayton, OH
05402	The Singer Co. Controls Div. Melrose Park, IL
05574	Viking Connectors, Inc. Sub. of Criton Corp. 21001 Nordhoff St. Chatsworth, CA 91311
05939	Fluorocarbon Co. Mechanical Seal Div. 10871 Kyle St. P.O. Box 520 Los Alamitos, CA 90720
06540	Mite Corp. Amatom Electronic Hardware Div. 446 Blake St. New Haven, CT 06515
06665	Precision Monolithics, Inc. Sub. of Bourns, Inc. 1500 Space Park Dr. Santa Clara, CA 95050
06776	Robinson Nugent, Inc. 800 E. 8th St. P.O. Box 470 New Albany, IN 47150
07088	Kelvin Electric Co. 5907 Noble Ave. Van Nuys, CA 91411
07263	Fairchild Camera and Instrument Corp., Semiconductor Div. Sub. of Schlumberger Ltd. North American Sales Stop 14-1053, 401 Ellis St. P.O. Drawer 7284 Mountain View, CA 94042
08127	Precision Mechanics Corporation 44 Brooklyn Ave. Westbury L.I. NY 11590
09055	Bal Seal Engineering Co. 620 W. Warner Ave. Santa Ana, CA 92707

TABLE 6.3. LIST OF MANUFACTURERS (CONTINUED)

CODE	NAME AND ADDRESS
09214	General Electric Co. Semiconductor Products Dept. Power Components Operation W. Genesee St. Auburn, NY 13021
11352	Tecnetics, Inc. 6287 Arapahoe Ave. P.O. Box 910 Boulder, CO 80302
11384	Inland Motor Div. of Kollmorgen Corp. 501 First St. Radford, VA 24141
13103	Thermalloy Co., Inc. 20121 W. Valley View Lane P.O. Box 340839 Dallas, TX 75234
13919	Burr-Brown Research Corp. 6730 S. Tucson Blvd. P.O. Box 11400 Tucson, AZ 85734
14752	Electro Cube, Inc. 1710 S. Del Mar Ave. San Gabriel, CA 91776
16662	Echlin Mfg. Co. Lift Parts Mfg. Co. Div. Chicago, IL
17856	Siliconix, Inc. 2201 Laurelwood Rd. Santa Clara, CA 95054
18677	Scanbe Mfg. Co. Division of Canoga Industries Sub. of Zero Corporation 3445 Fletcher Ave. El Monte, CA 91751
23934	Power/Mate Corp. 514 S. River St. Hackensack, NJ 07601
27014	National Semiconductor Corp. 2900 Semiconductor Dr. Santa Clara, CA 95051
28478	Deltrol Controls Div. Deltrol Corp. 2745 S. 19th St. Milwaukee, WI 53215
28726	Bulova Watch Co., Inc. Bulova Systems and Instruments Corp. Div., Green Acres Rd. W. P.O. Box 189 Valley Stream, NY 11582
31924	Pyttronic Industries, Inc. Montgomeryville Ind. Center 2 Stump Rd. Montgomeryville, PA 18936
32702	Abbott Power Corp. 7650 Stage Road Buena Park, CA 90621
32828	Keene Corp. Kaydon Bearing Div. 2860 McCracken St. Muskegon, MI 49443
32977	Accurate Tool and Gage 551 Crowther P.O. Box 39 Placentia, CA 92670
34148	Astro Mechanics, Inc. P.O. Box 9498-TR Austin, TX 78766
44655	Ohmite Mfg. Co. 3601 W. Howard St. Skokie, IL 60076
46384	Penn Engineering and Mfg. Corp. P.O. Box 311 Doylestown, PA 18901

TABLE 6.3. LIST OF MANUFACTURERS (CONTINUED)

CODE	NAME AND ADDRESS
51261	Contraves Goerz Corp. 610 Epsilon Dr. Pittsburgh, PA 15238
56289	Sprague Electric Co. 87 Marshall St. North Adams, MA 01247
56878	SPS Technologies, Inc. Highland Ave. Jenkintown, PA 19046
59993	International Rectifier Semiconductor Div. 233 Kansas St. El Segundo, CA 90245
70472	Barnes Group, Inc. 123 Main St. Bristol, CT 06010
71041	Incom International, Inc. Boston Gear Div., Inc. 14 Hayward St. Quincy, MA 02171
71279	Cambridge Thermionic Corp. 445 Concord Ave. Cambridge, MA 02138
71366	Eagle-Pitcher Industries, Inc. Bunting Brass and Bronze Div. 715 Spencer St. P.O. Box 407 Toledo, OH 43692
71468	ITT Cannon Electric Div. of International Telephone and Telegraph Corp. 10550 Talbert Ave. P.O. Box 8040 Fountain Valley, CA 92708
71785	TRW, Inc. TRW Cinch. Connectors Div. 1501 Morse Ave. Elk Grove Village, IL 60007
73165	FEL-PRO, Inc. Div. of Felt Products Mfg. Co. 7450 N. McCormick Skokie, IL 60076
74545	Hubbel Harvey, Inc. 584 Derby Milford Rd. Orange, CT 06477
75382	Kulka Electric Corp. Sub. of North American Philips Corp. 520 S. Fulton Ave. Mt. Vernon, NY 10551
78290	Struthers-Dunn, Inc. Lambs Rd. Pitman, NJ 08071
79074	Variflex Corp. 512 West Court St. Rome, NY 13440
79136	Waldes Kohinoor, Inc. 47-16 Austel Place Long Island City, NY 11101
80740	Beckman Instruments, Inc. 2500 Harbor Blvd. Fullerton, CA 92634
81041	Howard Industries Div. of MSL Industries, Inc. P.O. Box 287 Milford, IL 60953
81349	Military Specifications Promulgated by Military Departments/Agencies Under Authority of Defense Standardization Manual 4120-3M
81541	Airpax Electronics, Inc. Woods Rd. Cambridge, MD 21613
82858	NWL Transformers Rising Sun Rd. Bordentown, NJ 08505

TABLE 6.3. LIST OF MANUFACTURERS (CONTINUED)

CODE	NAME AND ADDRESS
82877	*Rotron, Inc.* Custom Div. 7 Hasbrouck Ln. Woodstock, NY 12498
83008	Staco Energy Products 301 Gaddis Blvd. Dayton, OH 45403
83330	Smith Herman H., Inc. 812 Snediker Ave. Brooklyn, NY 11207
84971	TA Mfg., Inc. Sub. of Criton Corp. 375 W. Arden Ave. P.O. Box 2500 Glendale, CA 91203
91637	Dale Electronics, Inc. P.O. Box 609 *Columbus, NE 68601*
91833	Keystone Electronics Corp. 49 Bleecker St. New York, NY 10012
92194	Alpha Wire Corp. 711 Lidgewood Ave. Elizabeth, NJ 07207
94259	Westinghouse Electric Corp. Bettis Atomic Power Laboratory P.O. Box 79 West Mifflin, PA 15122
94696	Magnecraft Electric Co. 5575 N. Lynch Ave. Chicago, IL 60630
95987	Weckesser Co., Inc. 4444 West Irving Park Rd. Chicago, IL 60641
96906	Military Standards Promulgated By Military Departments Under Authority of Defense Standardization, Manual 4120-3M
99862	Standard Spring and Mfg. Co., Inc. Brooklyn, NY

7. DIAGRAMS AND SCHEMATICS.

7.1. Introduction. This chapter contains the diagrams and schematics for the Model 066 Searchlight Positioner.

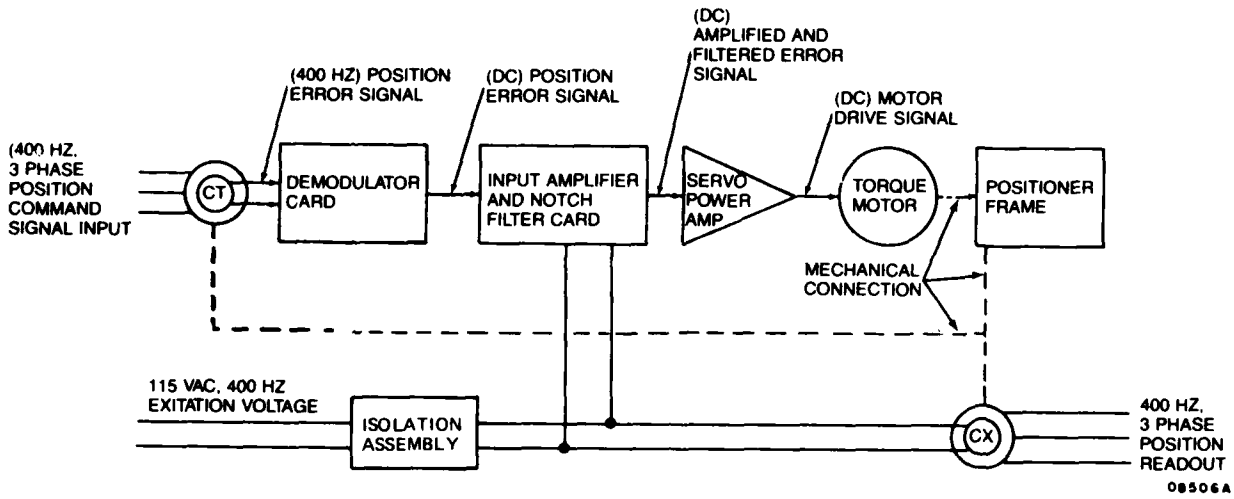
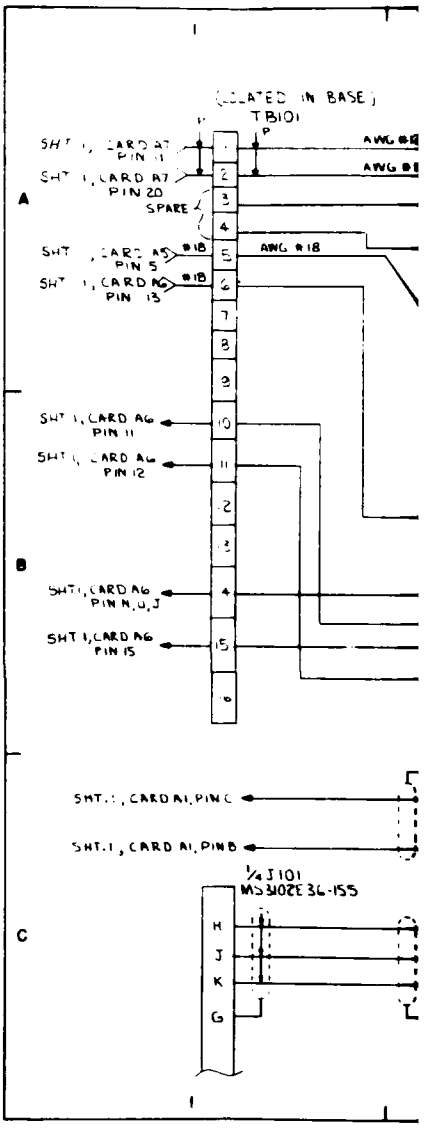


Figure 7.1. AZ-EL Basic Block Diagram

SCHEMATIC PARTS LOCATION INDEX

REF DESIG.	LOC.	REF DESIG.	LOC.
B1	2C	S4	2B
B3	4C	S5	4B
Caging Solenoid, AZ	2A	S6	4B
Caging Solenoid, EL	4A	S7	4B
CR10	4A	S8	4B
CR11	2A	TB101	1A
J101	1C	TB102	3A
J101	3C	TB103	2A
M1	2A	TB104	2B
M2	4A	TB105	2C
S1	2B	TB107	4A
S2	2B	TB108	4B
S3	2B		



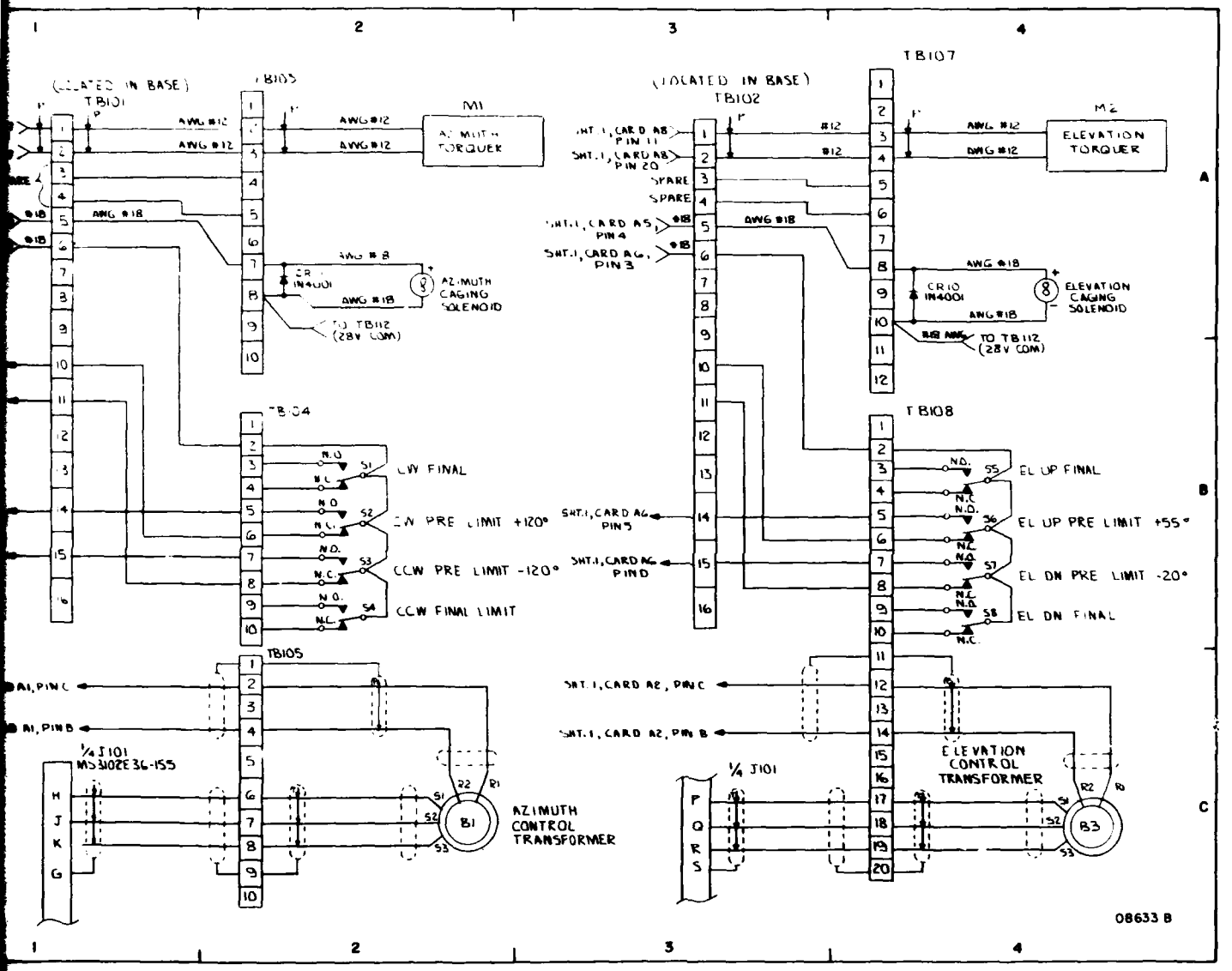


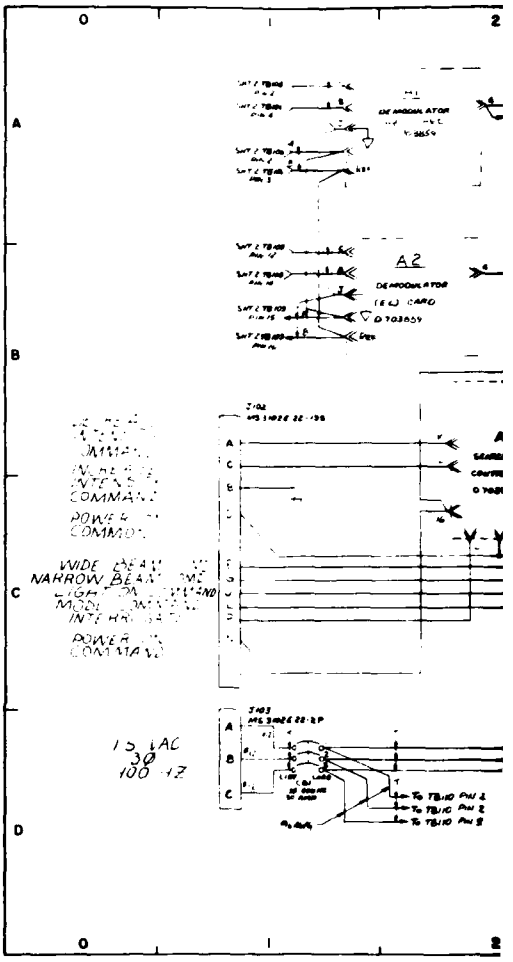
Figure 7.2. Overall Schematic Diagram

(Sheet 1 of 3)

2

SCHEMATIC PARTS LOCATION INDEX

REF DESIG.	LOC.	REF DESIG.	LOC.
A1	2A	J1	5C
A2	2B	J2	5C
A3	3A	J4	5C
A4	3B	J102	1B
A5	2C	J103	1D
A6	4C	PS1	4C
A7	4A	PS2	4C
A8	4B	P1	5C
CB1	1D	P2	5C
Control Box	5D	P4	5C
CR1	3D	R1	6A
CR2	3D	R2	4A
CR3	3D	R3	4A
CR4	6B	R4	4A
CR5	6B	R5	4A
CR6	6B	R6	4B
CR7	6B	R7	4B
CR8	6B	Searchlight	6C
CR9	6B	TB110	4A
C1	6B	TB111	3D
C2	5A	TB112	6A
C3	5B	TB113	6B
Fan #1	5B	T1	5B
Fan #2	5A		



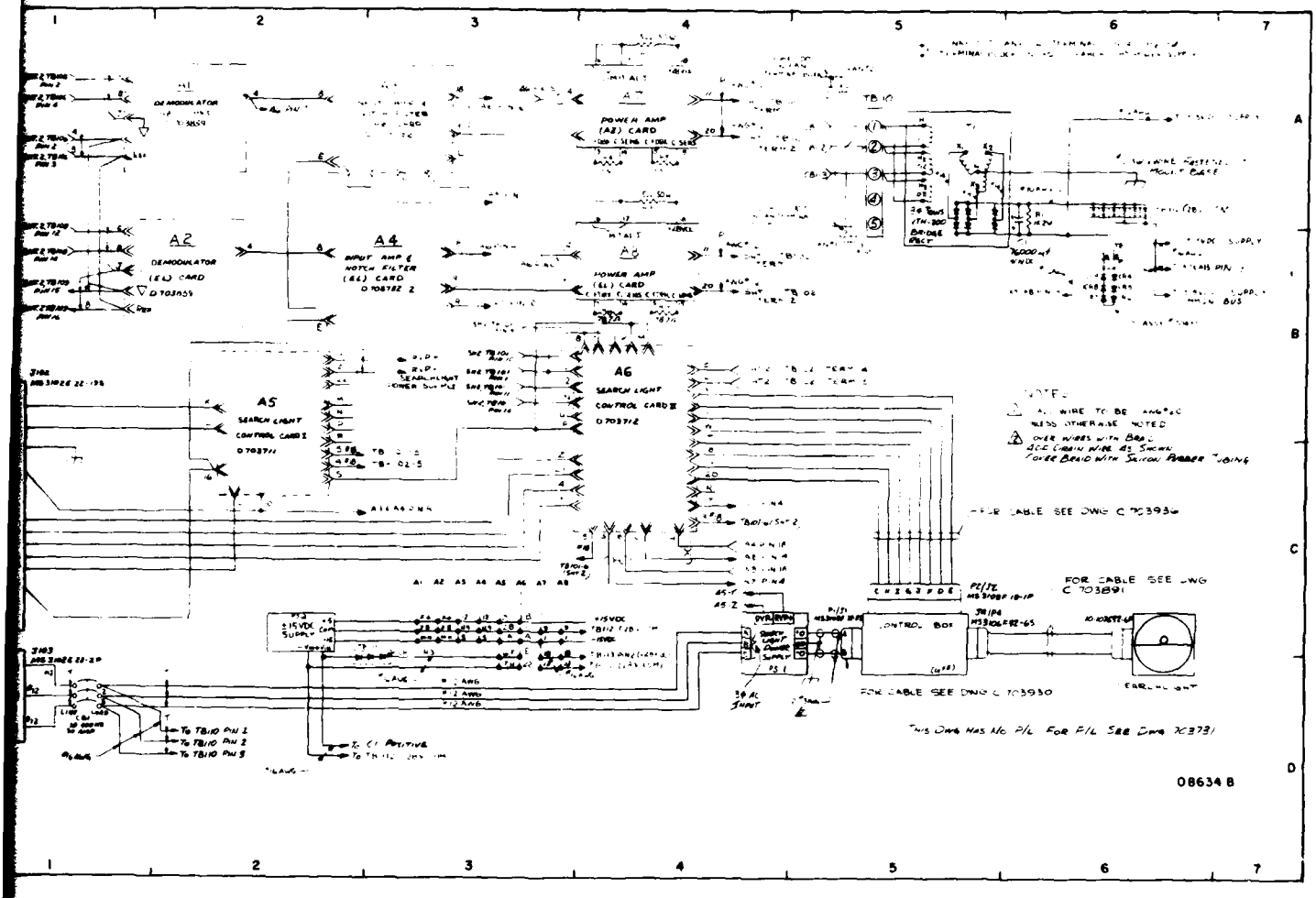
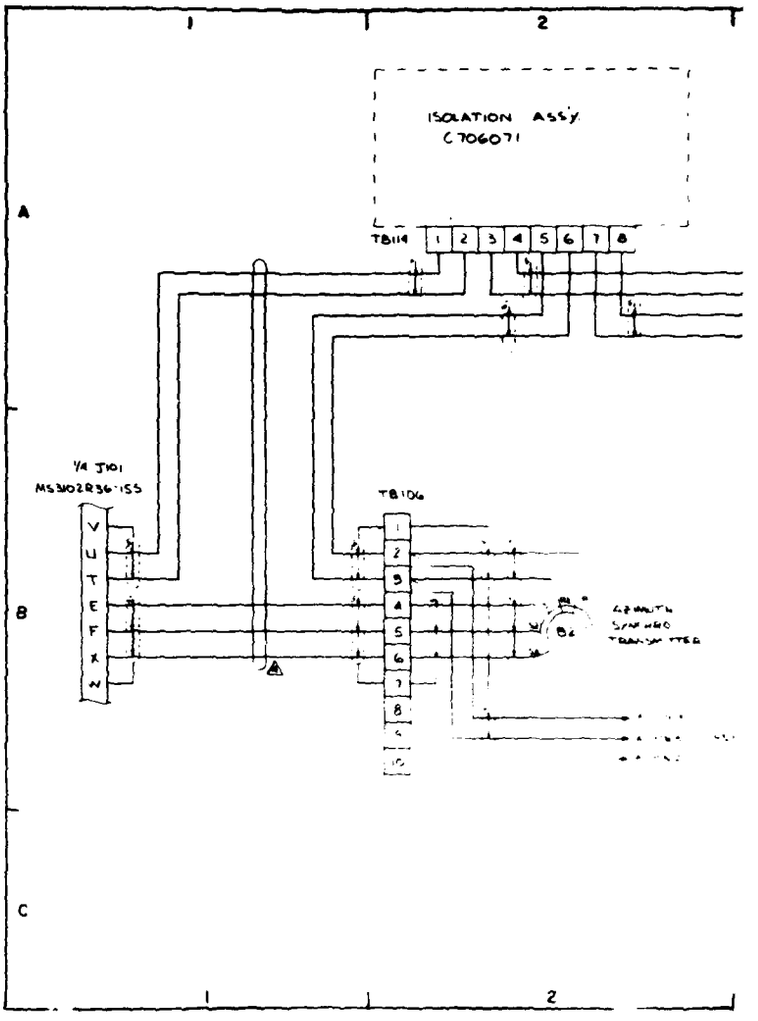


Figure 7.2. Overall Schematic Diagram

(Sheet 2)

SCHEMATIC PARTS LOCATION INDEX

REF DESIG.	LOC.
B2	2B
B4	4B
Isolation Assembly	2A
J101	1B
J101	3B
TB106	2B
TB109	4A
TB114	2A



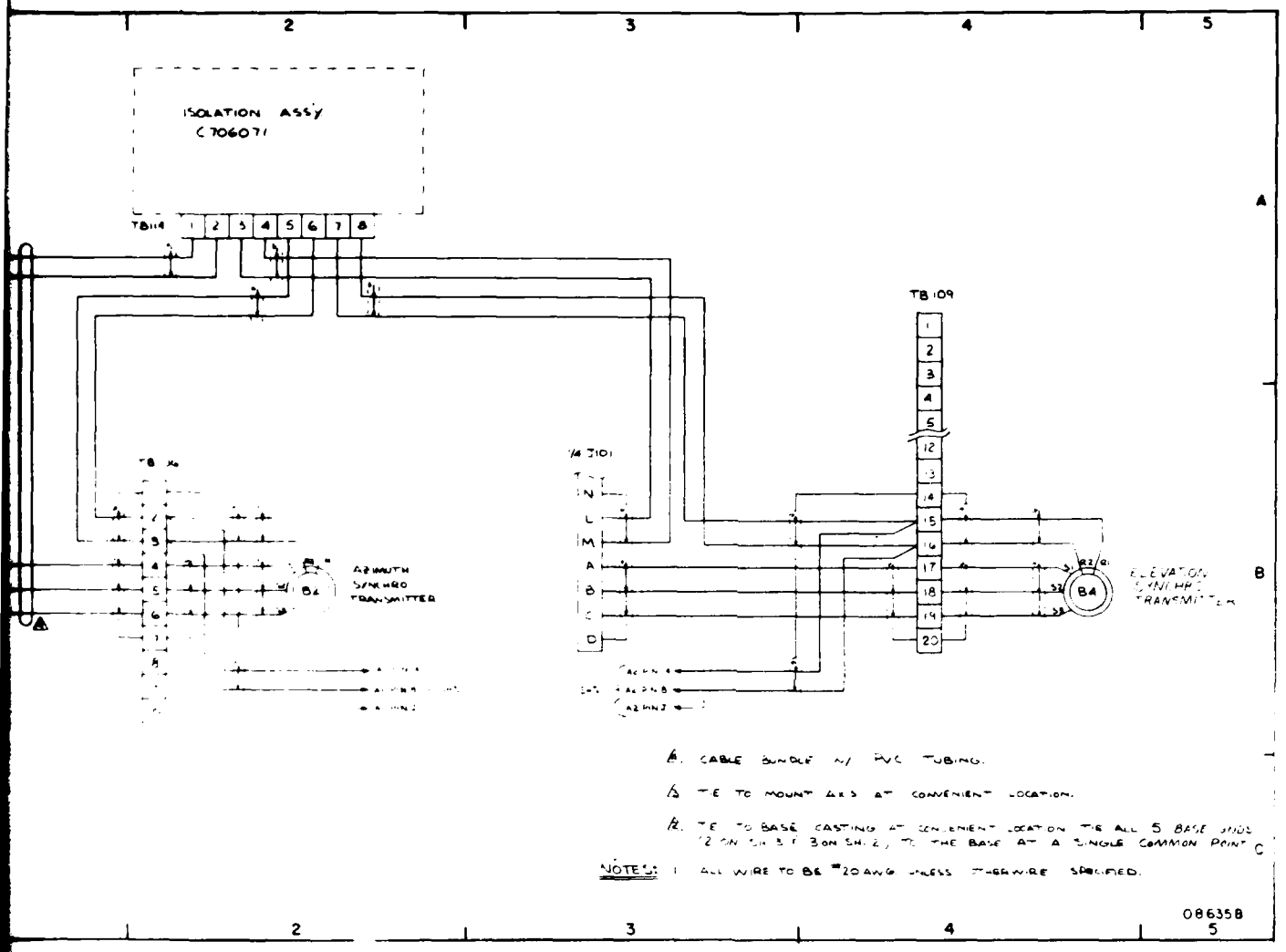


Figure 7.2. Overall Schematic Diagram
(Sheet 3)

SCHEMATIC PARTS LOCATION INDEX

NOTE*

AZ Demodulator Card is 1A1A1
EL Demodulator Card is 1A1A2

REF DESIG.	LOC.	REF DESIG.	LOC.	REF DESIG.	LOC.
1A1A1CR1	3C	1A1A1C23	2A	1A1A1R11	4B
1A1A1CR2	2D	1A1A1C24	4C	1A1A1R12	4A
1A1A1CR3	2D	1A1A1C25	3D	1A1A1R13	4B
1A1A1CR4	4D	1A1A1C26	3D	1A1A1R14	3B
1A1A1C1	2B	1A1A1IC1	2A	1A1A1R15	3B
1A1A1C2	2A	1A1A1IC2	4C	1A1A1R16	4B
1A1A1C3	3B	1A1A1IC3	2C	1A1A1R17	4B
1A1A1C4	4A	1A1A1IC4	3C	1A1A1R18	4C
1A1A1C5	4B	1A1A1IC5	3A	1A1A1R19	2C
1A1A1C6	4B	1A1A1IC6A	3A	1A1A1R20	2C
1A1A1C7	3C	1A1A1IC6B	4B	1A1A1R21	3C
1A1A1C9	2C	1A1A1IC7	4B	1A1A1R22	2D
1A1A1C10	2C	1A1A1L1	1D	1A1A1R23	3C
1A1A1C11	2D	1A1A1L2	1D	1A1A1R24	4D
1A1A1C12	2D	1A1A1Q1	3B	1A1A1R25	2C
1A1A1C13	3D	1A1A1R1	2A	1A1A1R26	2C
1A1A1C14	3D	1A1A1R2	2B	1A1A1TP1	2A
1A1A1C15	3D	1A1A1R3	2A	1A1A1TP2	5A
1A1A1C16	3D	1A1A1R4	2B	1A1A1TP3	4B
1A1A1C17	3D	1A1A1R5	3A	1A1A1TP4	2C
1A1A1C18	3D	1A1A1R6	3A	1A1A1TP5	4C
1A1A1C19	3D	1A1A1R7	3B	1A1A1TP6	2D
1A1A1C20	3D	1A1A1R8	4A	1A1A1TP7	4A
1A1A1C21	3D	1A1A1R9	3B	1A1A1TP8	2D
1A1A1C22	3D	1A1A1R10	3B	1A1A1TP9	2D

LOC.

4B
4A
4B
3B
3B
4B
4B
4C
2C
2C
3C
2D
3C
4D
2C
2C
2A
5A
4B
2C
4C
2D
4A
2D
2D

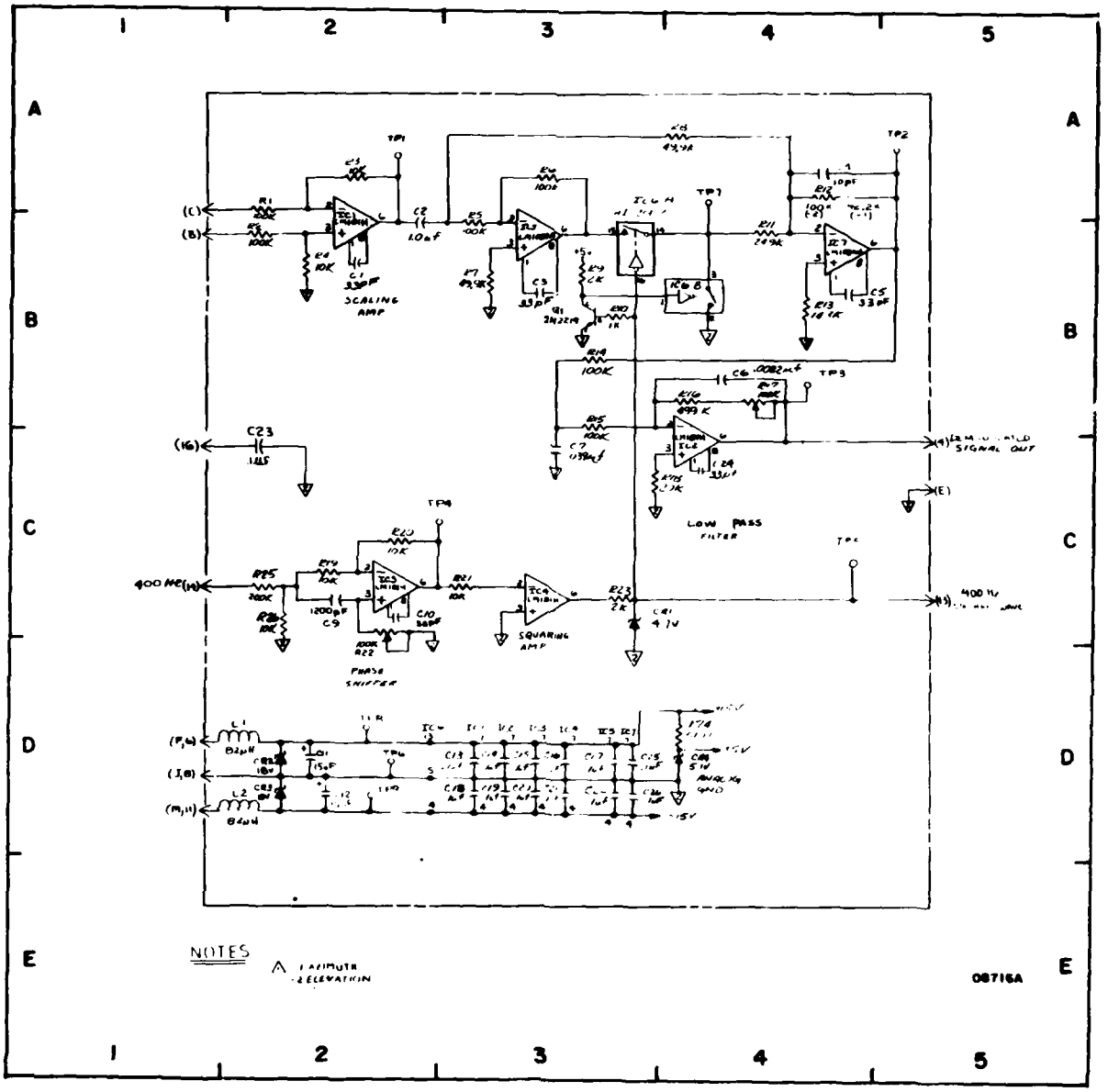


Figure 7.3. AZ Demodulator (A1) and EL Demodulator (A2) Schematic

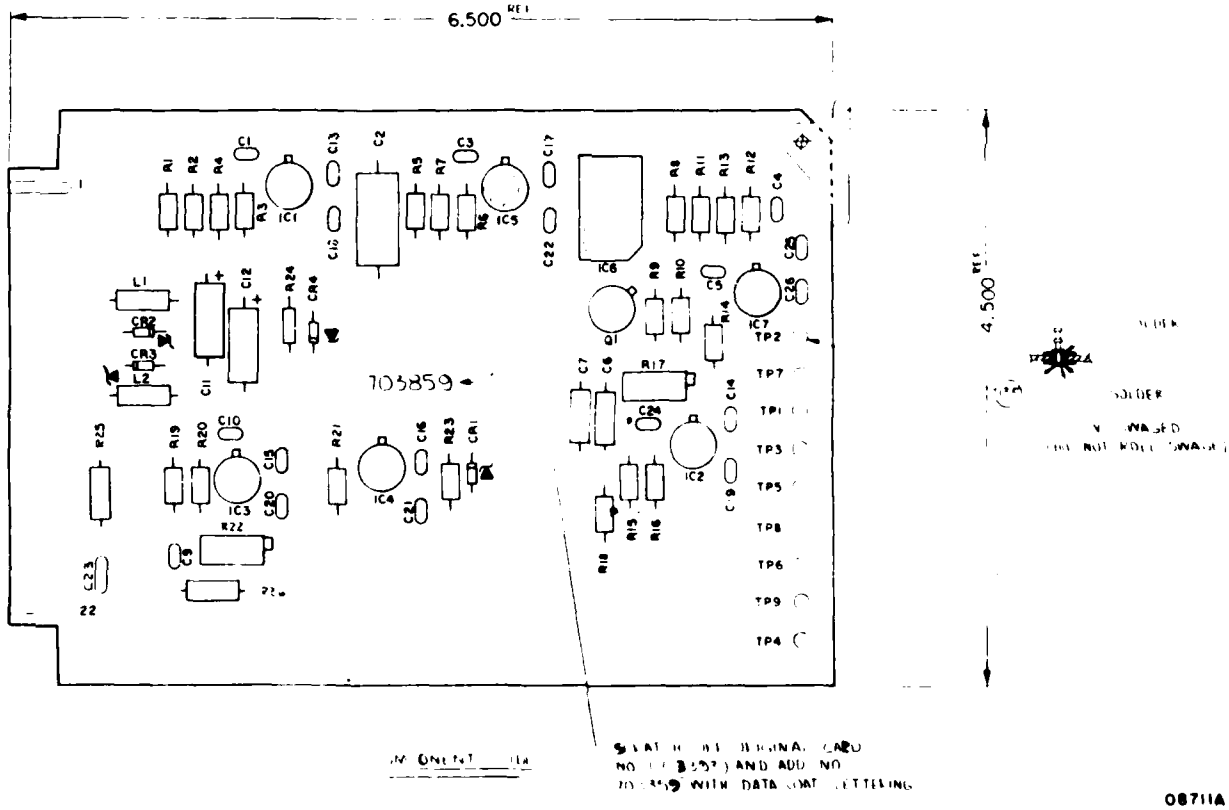
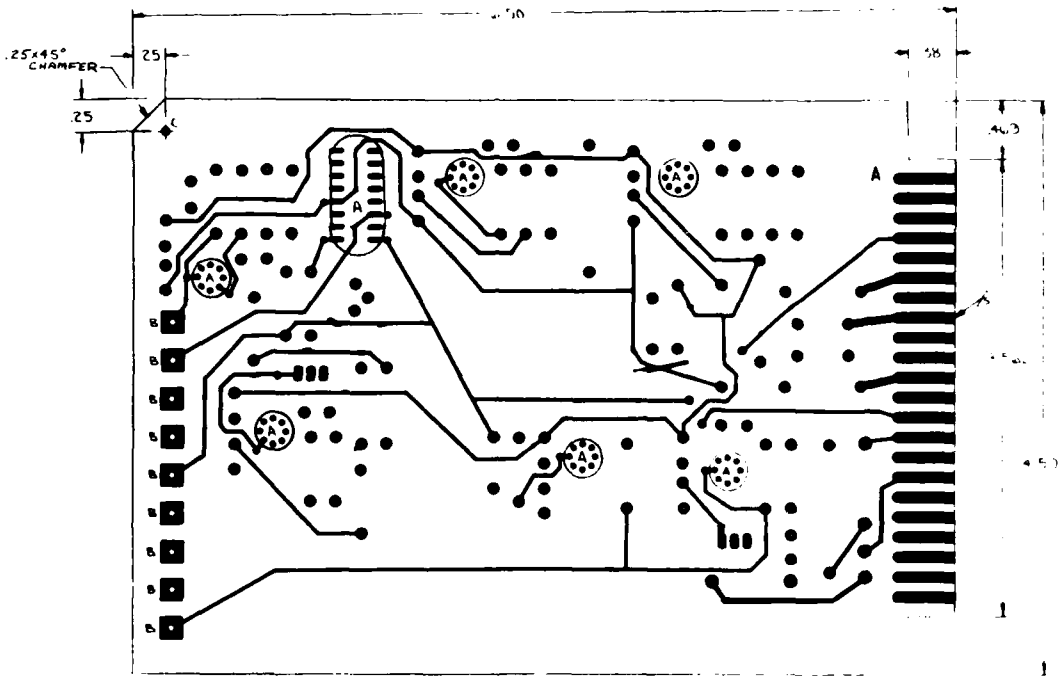


Figure 7.4. AZ Demodulator (A1) and EL Demodulator (A2) Assembly Drawing.



HOLE LEGEND

SYM	DRILL SIZE BEFORE PLATING	FIN. DIA. AFT. PLT.	QTY
A	NO. 57 DRILL (.043)	.037	648
UNMARKED	NO. 56 DRILL (.046)	.040	136
B	NO. 44 DRILL (.086)	.080	9
	1/8 DRILL (.125)	.119	1

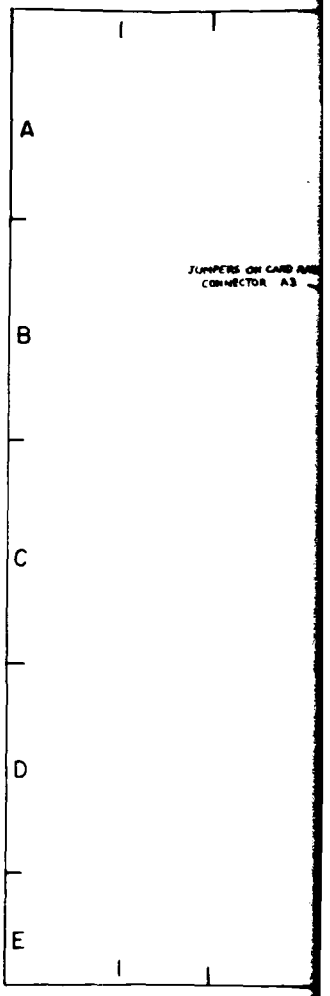
ALL DIA BASED ON .003 PLATING

NOTES:
1. MATERIAL - 1/16 THK. NEMA GRADE GID FIBERGLASS.
2. WEIGHT- 1 OZ. COPPER CLAD ON BOTH SIDES WITH AN ADDITIONAL 1 OZ. COPPER TO BE ELECTROPLATED ON.
3. TREATMENT- BRIGHT FINISH TIN-LEAD ELECTROPLATED FOR FOIL TRACES & PADS (EACH SIDE).
4. ALL HOLES TO BE PLATED THROUGH FINAL SIZE AS SHOWN IN HOLE LEGEND. ALL HOLES TO BE DRILLED FROM CKT SIDE.
5. GOLD FOIL CONNECTOR FINGERS TO BE GOLD OVER NICKEL ELECTROPLATE.

Figure 7.5. AZ Demodulator (A1) and EL Demodulator (A2) Printed Wiring.

PARTS LOCATION INDEX

REF DESIG.	LOC.
1A1A3C3	6B (Not Used)
1A1A3C5	6C (Not Used)
1A1A3C7	3B
1A1A3C7A	3A
1A1A3C8	4B
1A1A3C11	5B
1A1A3C12	5B (Not Used)
1A1A3C13	5B (Capacitor C13 Not Used)
1A1A3C13	4D
1A1A3C14	5B (Capacitor C14 Not Used)
1A1A3C14	5D
1A1A3C15	5B (Not Used)
1A1A3C22	6C (Not Used)
1A1A3C23	6C (Not Used)
1A1A3C24	6C (Not Used)
1A1A3C25	6C (Not Used)
1A1A3C26	4B
1A1A3C29	3D
1A1A3C30	3E
1A1A3IC1	4B
1A1A3IC2	5B
1A1A3IC3	6B (Not Used)
1A1A3IC5	6C (Not Used)
1A1A3IC6	4D
1A1A3K1	4A
1A1A3K2	4C
1A1A3R1	4B
1A1A3R3	3B
1A1A3R4	3B
1A1A3R9	5D
1A1A3R11	5D
1A1A3R17	4A
1A1A3R18	4B
1A1A3R20	4B
1A1A3R21	4A
1A1A3R22	4B
1A1A3R23	4B
1A1A3R24	4B
1A1A3R25	4B
1A1A3R26	5B
1A1A3R28	5B (Resistor R28 Not Used)
1A1A3R28	4D
1A1A3R29	5B (Resistor R29 Not Used)
1A1A3R29	4C
1A1A3R30	6B (Resistor R30 Not Used)
1A1A3R30	4D
1A1A3R31	6B (Resistor R31 Not Used)
1A1A3R31	5D
1A1A3R32	6B (Not Used)
1A1A3R37	6C (Not Used)
1A1A3R38	6C (Not Used)
1A1A3R39	6C (Not Used)
1A1A3R40	6C (Not Used)
1A1A3R41	6C (Not Used)
1A1A3TP5	4B
1A1A3TP6	5B
1A1A3TP7	6B
1A1A3Z3	3D
1A1A3Z4	3E
1A1A3Z7	4B
1A1A3Z8	4B



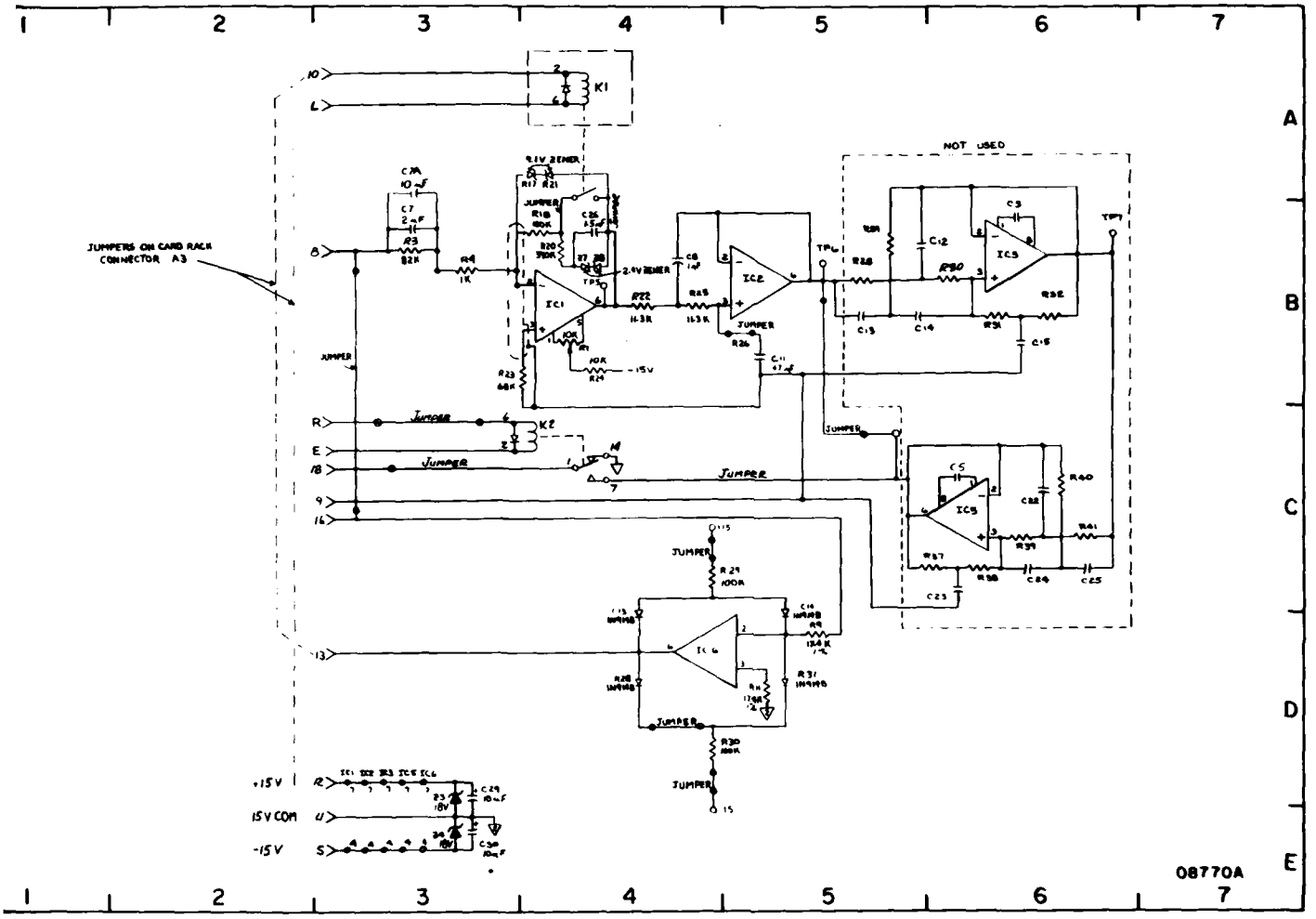


Figure 7.6. AZ Input Amplifier and Notch Filter (A3) Schematic

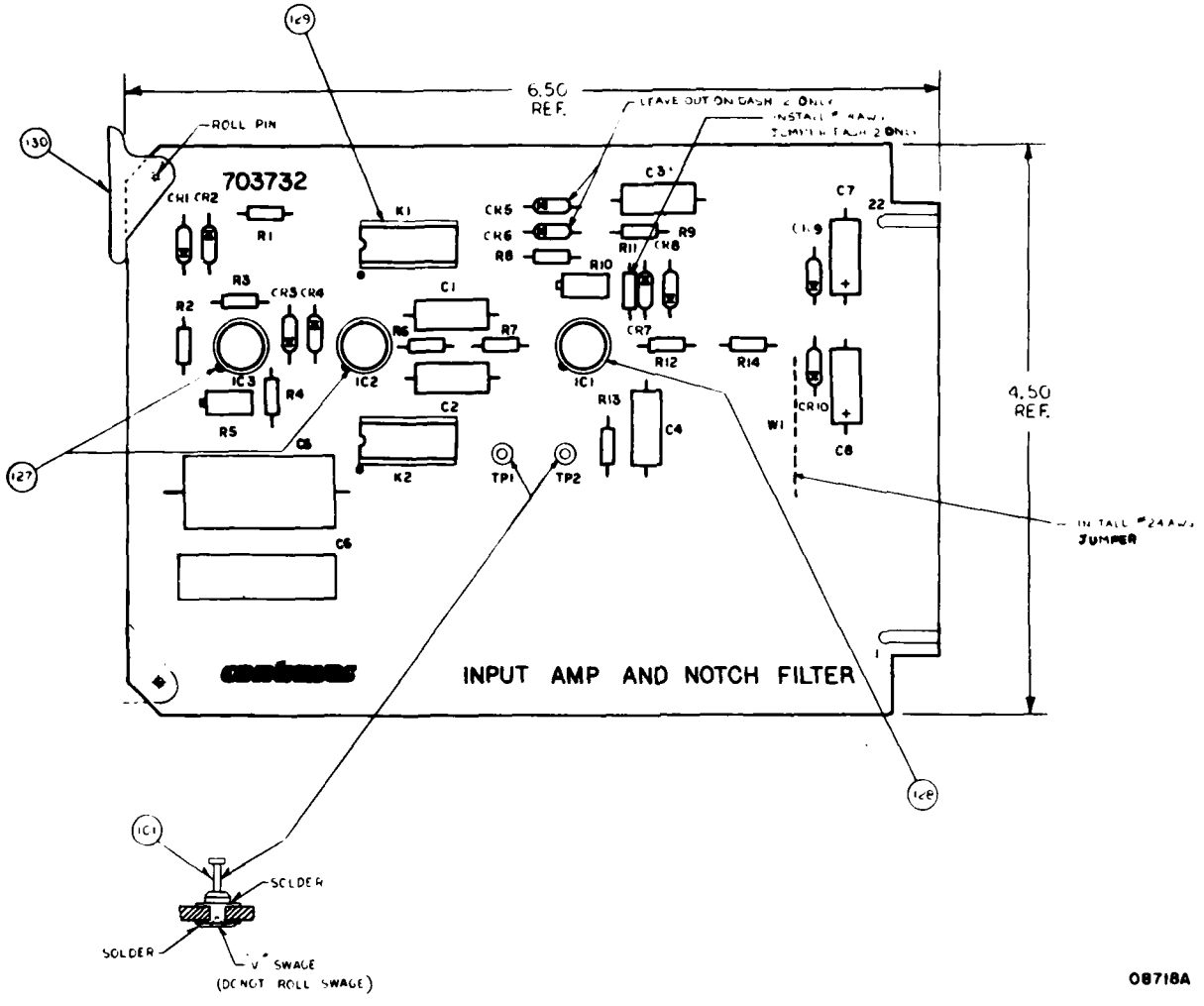


Figure 7.7. AZ Input Amplifier and Notch Filter (A3) Assembly Drawing

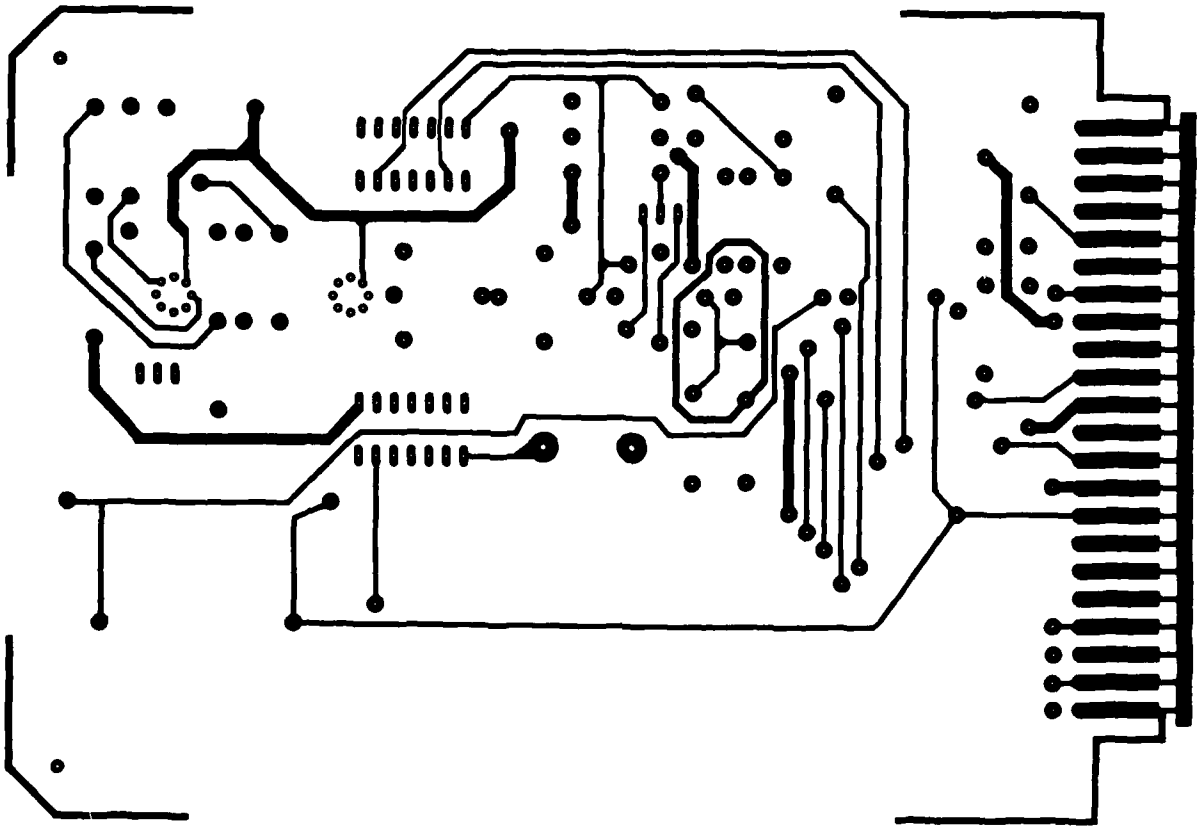
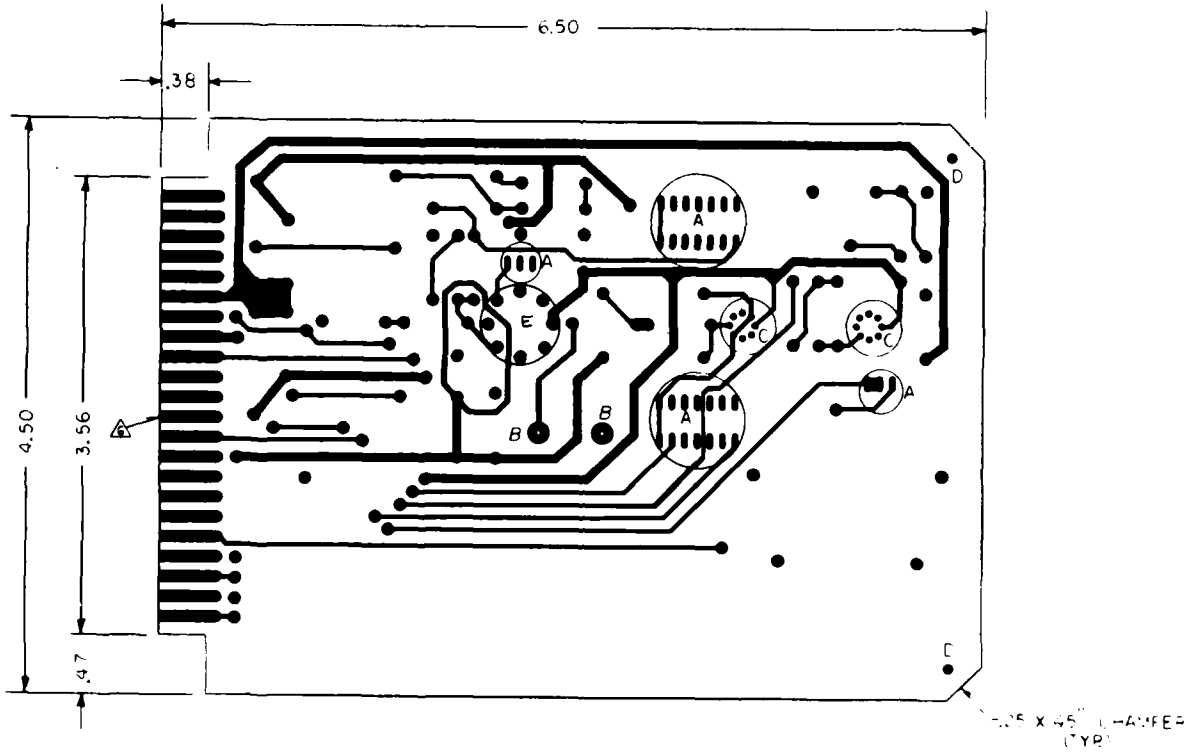


Figure 7.8. AZ Input Amplifier and Notch Filter (A3) and EL Input Amplifier and Notch Filter (A4) Printed Wiring.
(Sheet 1 of 2)



CIRCUIT SIDE

DRILL PLAN

HOLE LEGEND			
SYM	DRILL SIZE BEFORE PLATING	FIN DIA * F.T.H.	QTY
(NMR)	DRILL # 55 (.052)	.046	4
A	DRILL # 57 (.043)	.037	34
B	DRILL # 37 (.104)	.098	2
C	DRILL #63 (.037)	.031	29
D	DRILL 1/8 (.125)	.119	2
E	DRILL #53 (.0595)	.053	8

* FINAL DIA BASED ON .003 PLATING

7. TREATMENT TO BE BRIGHT FINISH TIN LEAD ELECTROPLATED FOR FOIL TRACES AND PADS (EACH SIDE)
6. CONTACT FINGERS TO BE GOLD PLATED (.000050) OVER NICKEL (.00050).
5. BOARD TO BE REFLOW SOLDERED.
4. FINISHED BOARD TO BE 2 oz COPPER AFTER PLATING.
3. BOARD MATERIAL TO BE 1/16" THICK FR4 NATURAL GREEN.
2. HOLE SIZES INDICATED ARE FINISHED DIAMETER AFTER PLATING.
1. ALL HOLES TO BE PLATED THRU.

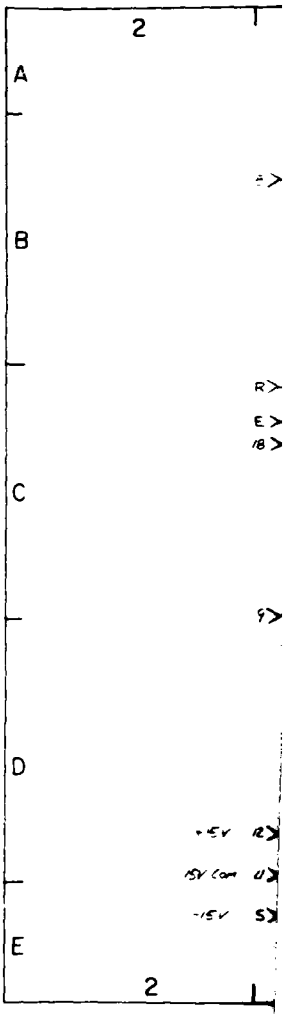
08706A

Figure 7.8. AZ Input Amplifier and Notch Filter (A3) and EL Input Amplifier and Notch Filter (A4) Printed Wiring.

(Sheet 2)

PARTS LOCATION INDEX

REF DESIG.	LOC.
1A1A4C3	6B (Not Used)
1A1A4C5	6C (Not Used)
1A1A4C7	3B
1A1A4C8	4B
1A1A4C11	5B
1A1A4C12	5B (Not Used)
1A1A4C13	5B (Capacitor C13 Not Used)
1A1A4C13	4D
1A1A4C14	5B (Capacitor C14 Not Used)
1A1A4C15	5B (Not Used)
1A1A4C22	6C (Not Used)
1A1A4C23	6C (Not Used)
1A1A4C24	6C (Not Used)
1A1A4C25	6C (Not Used)
1A1A4C26	4B
1A1A4C29	3D
1A1A4C30	3E
1A1A4IC1	4B
1A1A4IC2	5B
1A1A4IC3	6B (Not Used)
1A1A4IC5	6C (Not Used)
1A1A4K2	4C
1A1A4R1	4B
1A1A4R3	3B
1A1A4R4	3B
1A1A4R17	4A
1A1A4R18	4B
1A1A4R20	4B
1A1A4R21	4A
1A1A4R22	4B
1A1A4R23	4B
1A1A4R24	4B
1A1A4R25	4B
1A1A4R26	5B
1A1A4R28	5B (Resistor R28 Not Used)
1A1A4R28	4D
1A1A4R29	5B (Resistor R29 Not Used)
1A1A4R30	6B (Resistor R30 Not Used)
1A1A4R31	6B (Resistor R31 Not Used)
1A1A4R32	6B (Not Used)
1A1A4R37	6C (Not Used)
1A1A4R38	6C (Not Used)
1A1A4R39	6C (Not Used)
1A1A4R40	6C (Not Used)
1A1A4R41	6C (Not Used)
1A1A4TP5	4B
1A1A4TP6	5B
1A1A4TP7	6B
1A1A4Z3	3D
1A1A4Z4	3E
1A1A4Z7	4B
1A1A4Z8	4B



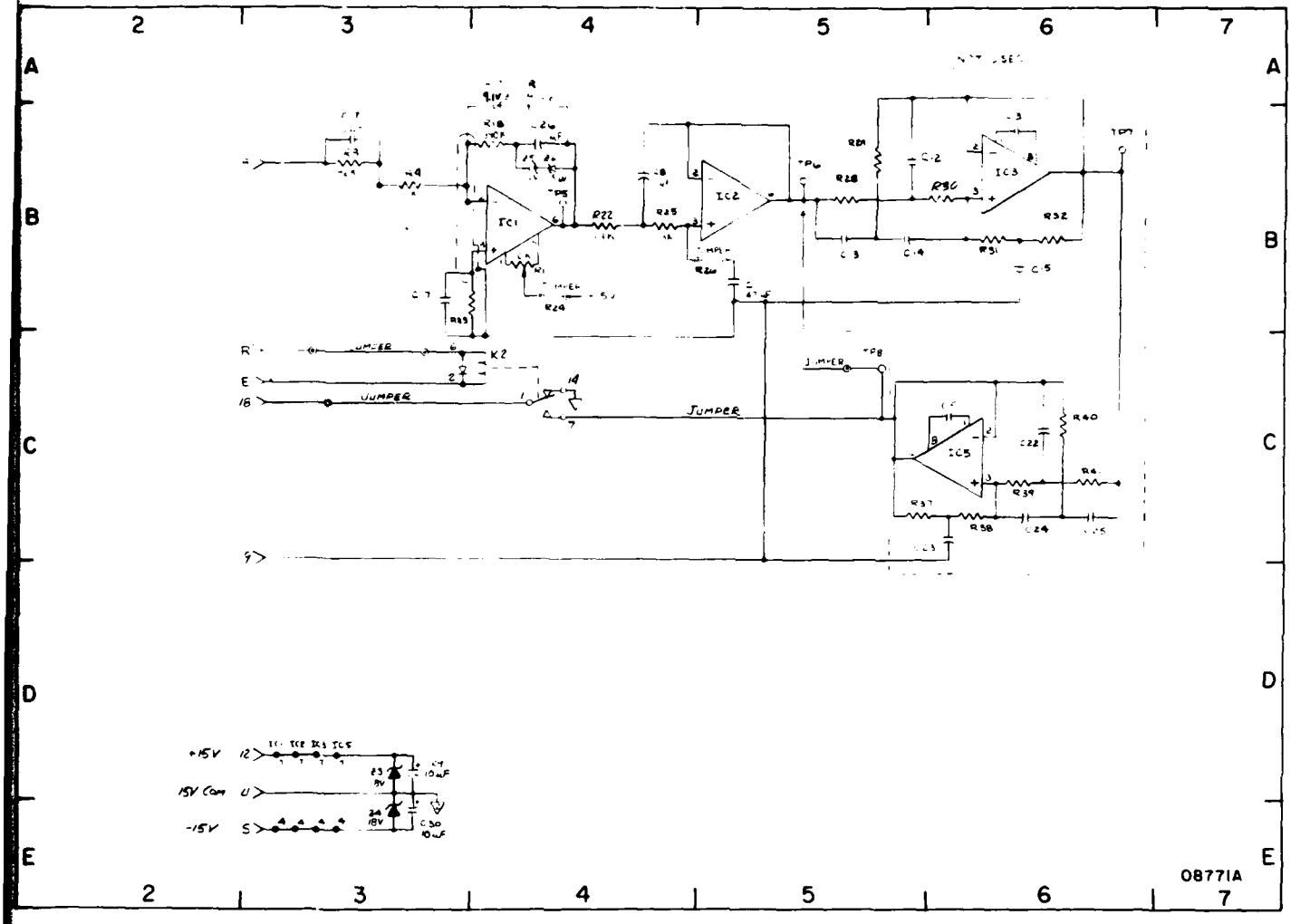


Figure 7.9. EL Input Amplifier and Notch Filter (A4) Schematic

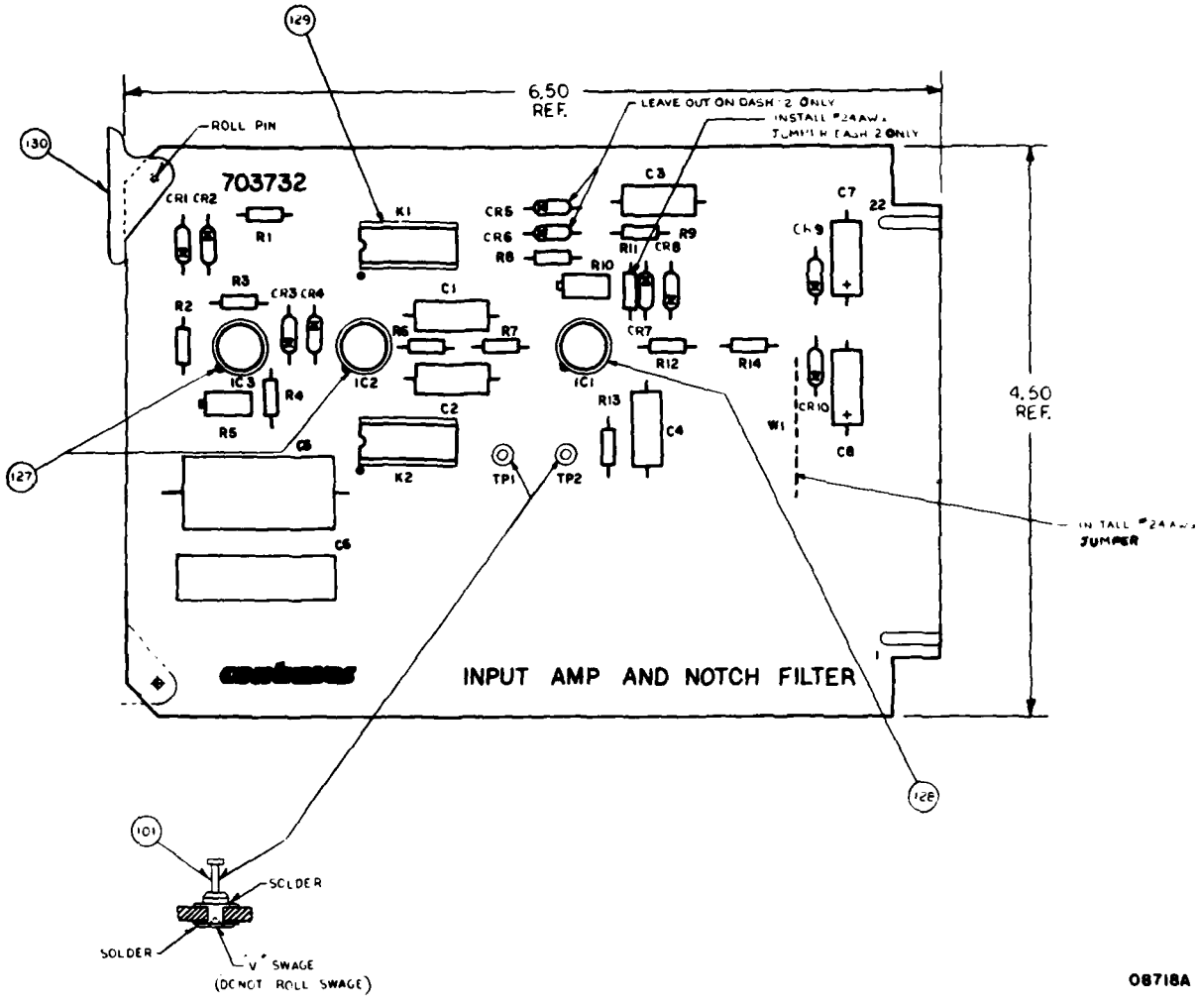
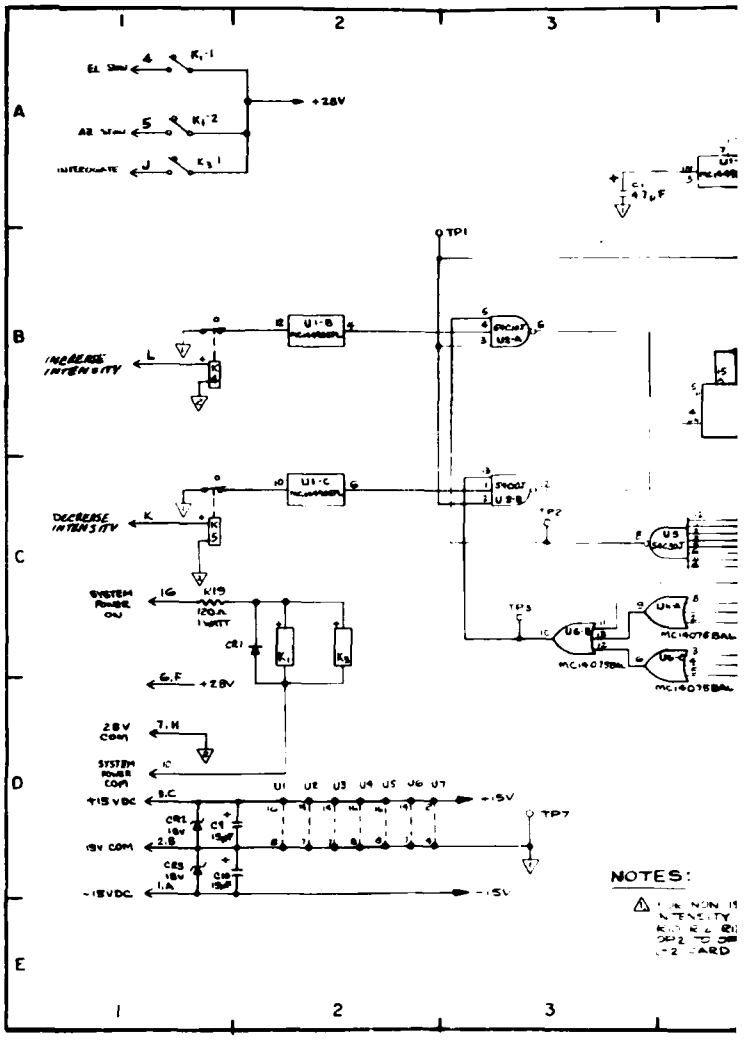


Figure 7.10. EL Input Amplifier and Notch Filter (A4) Assembly Drawing

PARTS LOCATION INDEX

REF DESIG.	LOC.	REF DESIG.	LOC.
1A1A5CR1	2C	1A1A5R9	7D
1A1A5CR2	1D	1A1A5R10	7D
1A1A5CR3	1D	1A1A5R11	7D
1A1A5C1	3A	1A1A5R12	7D
1A1A5C2	4A	1A1A5R13	7E
1A1A5C3	6D	1A1A5R14	6B
1A1A5C4	6D	1A1A5R15	6B
1A1A5C5	6D	1A1A5TP1	2A
1A1A5C6	5D	1A1A5TP2	3C
1A1A5C7	6C	1A1A5TP3	3C
1A1A5C8	6D	1A1A5TP4	6A
1A1A5C9	1D	1A1A5TP5	6D
1A1A5C10	1D	1A1A5TP6	8C
1A1A5C11	6B	1A1A5TP7	3D
1A1A5K1	2C	1A1A5U1-A	4A
1A1A5K1-1	1A	1A1A5U1-B	2B
1A1A5K1-2	1A	1A1A5U1-C	2C
1A1A5K2	2E	1A1A5U2-A	3B
1A1A5K2-1	1C	1A1A5U2-B	3C
1A1A5K3	2C	1A1A5U3	3C
1A1A5K3-1	1A	1A1A5U4	4B
1A1A5K4	1B	1A1A5U5	5B
1A1A5K5	1C	1A1A5U6-A	3C
1A1A5R1	3A	1A1A5U6-B	3C
1A1A5R2	5C	1A1A5U6-C	4C
1A1A5R3	6C	1A1A5U7	6C
1A1A5R4	5D	1A1A5U8	5D
1A1A5R5	6D	1A1A5U9	7C
1A1A5R6	6D	1A1A5U10	7D
1A1A5R7	6D	1A1A5U11	6B
1A1A5R8	7C		



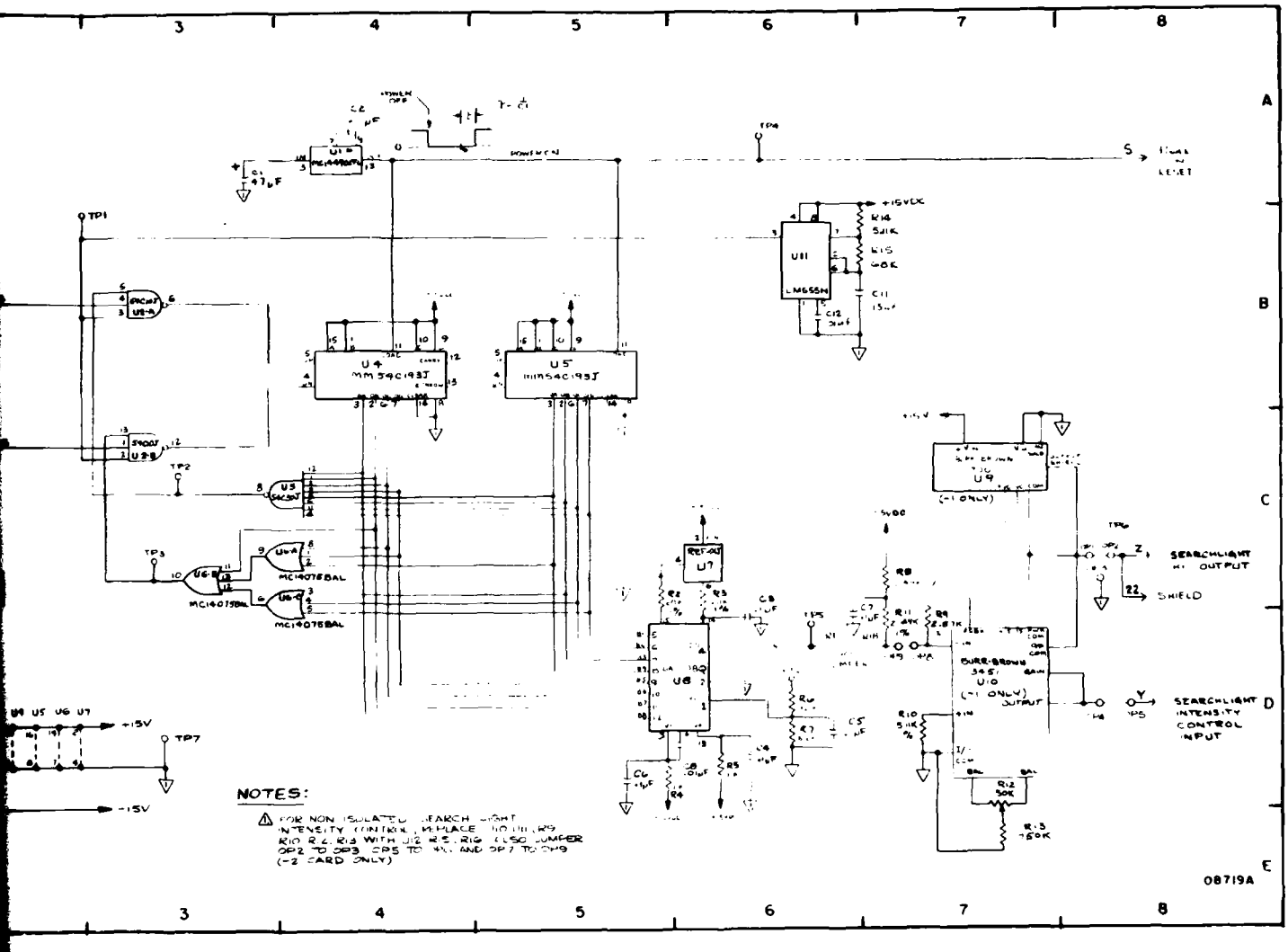
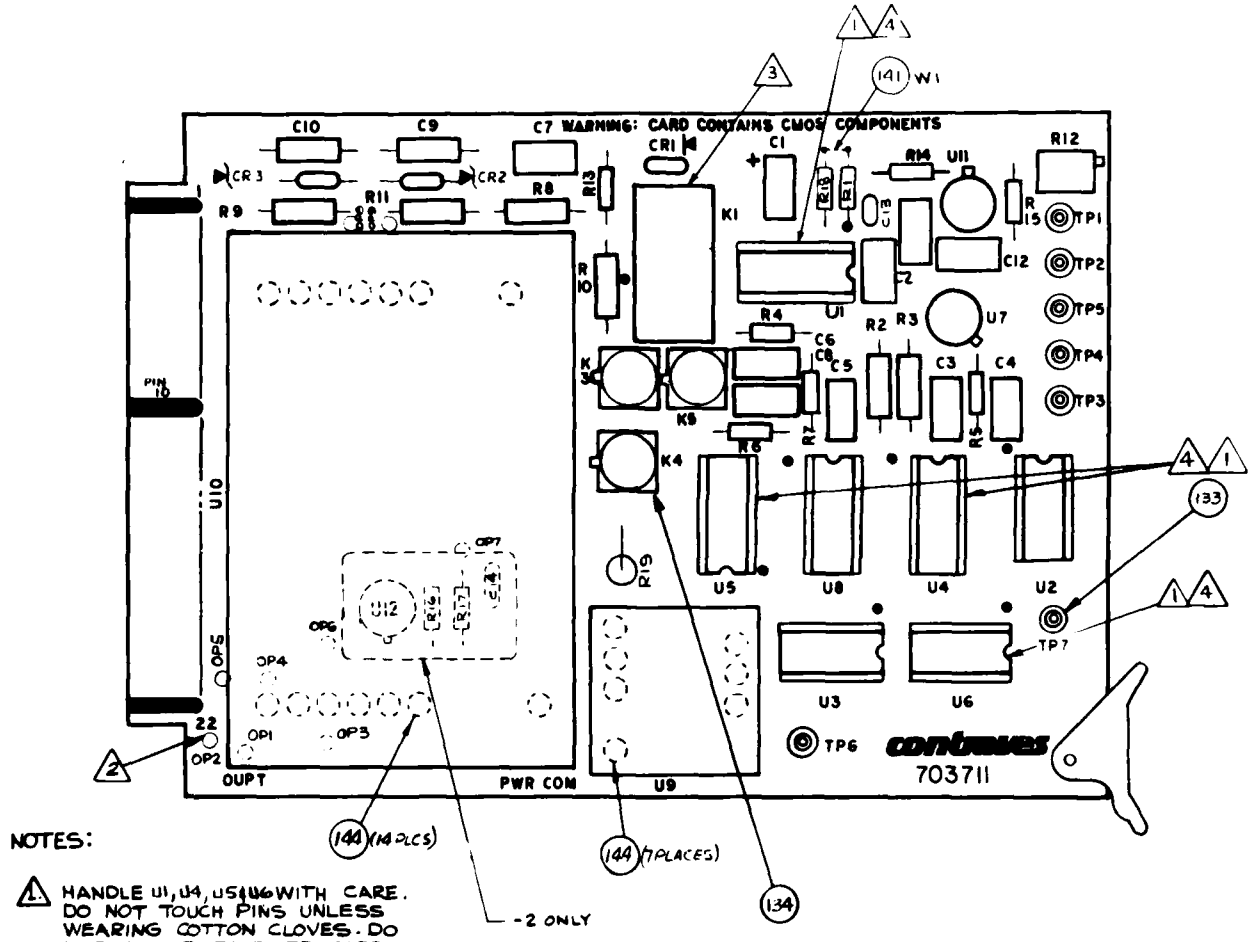


Figure 7.11. Searchlight Control Card I (A5) Schematic

2



NOTES:

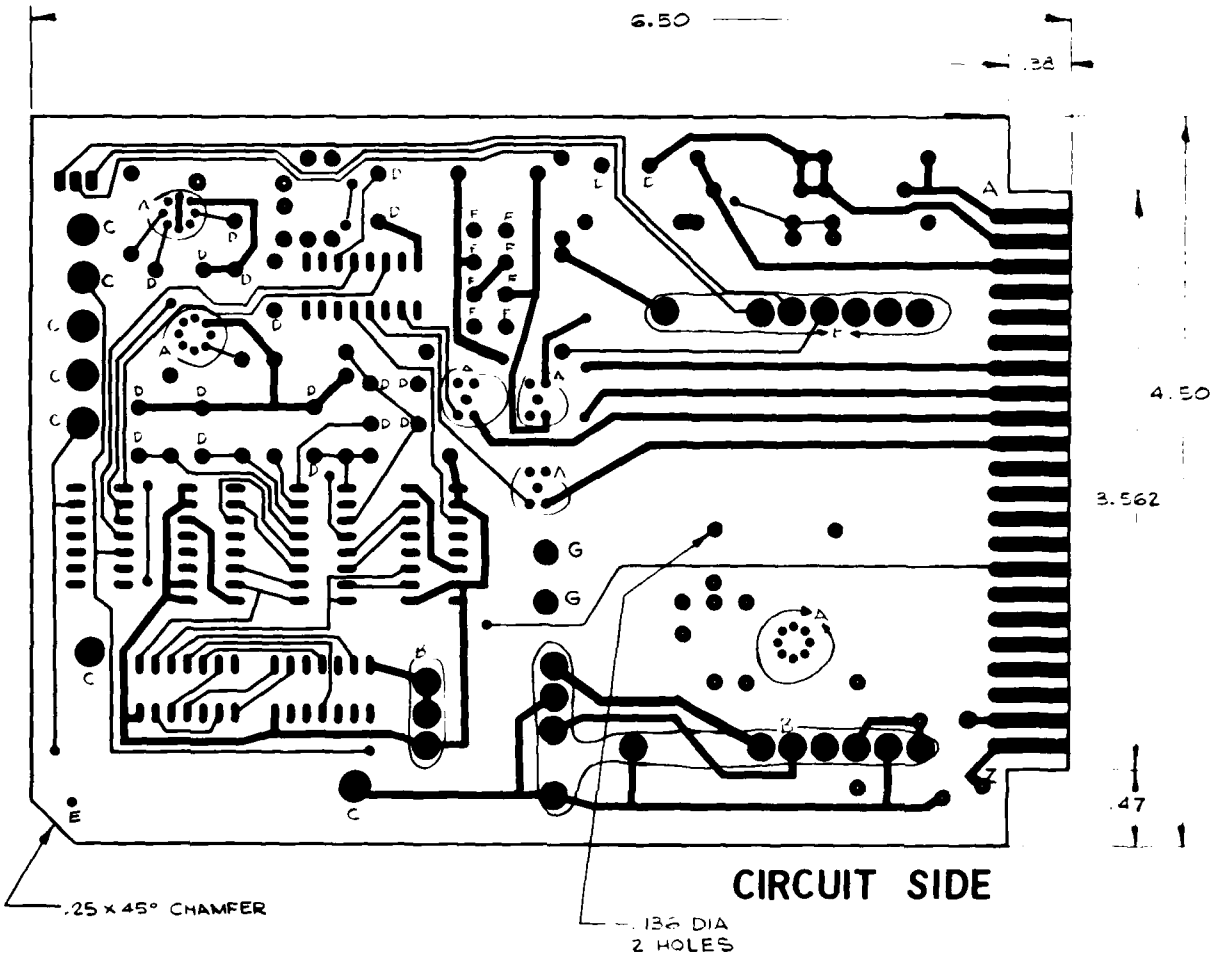
1. HANDLE U1, U4, U5 & U6 WITH CARE. DO NOT TOUCH PINS UNLESS WEARING COTTON GLOVES. DO NOT STORE FINISHED CARD IN PLASTIC BAG. GROUND ALL SOLDERING IRONS.
2. OPEN PADS (OP) TO BE JUMPERED PER TABLE 1
3. ADD TEFLON TAPE UNDER RELAY K1 TO INSULATE FROM CIRCUIT PATHS
4. WARNING: U1, U4, U5 & U6 MUST BE INSERTED ON AN ANTISTATIC BENCH

TABLE 1

FROM		-1	-2
OP2	TO	OP1	OP3
OP5	TO	OP4	OP6
OP9	TO	OP8	OP7

087204

Figure 7.12. Searchlight Control Card I (A5) Assembly Drawing.



HOLE LEGEND			
SYM	DRILL SIZE BEFORE PLATING	FIN DIA * PTH	QTY
UNMK	NO 57 DRILL (.043)	.037	186
A	NO 63 DRILL (.037)	.031	39
B	NO 47 DRILL (.079)	.098	21
C	NO 44 DRILL (.086)	.080	7
D	NO.55 DRILL (.052)	.046	20
E	1/8 DRILL (.125)	.119	1
F	NO.50 DRILL (.070)	.063	8
G	NO 54 DRILL (.055)	.049	2

NOTES:

1. ALL HOLES TO BE PLATED THRU.
2. HOLE SIZES INDICATED ARE FINISHED DIA AFTER PLATING
3. BOARD MATERIAL TO BE 1/16" THICK FR4 NATURAL GREEN.
4. FINISHED BOARD TO BE 2 OZ COPPER AFTER PLATING.
5. BOARD TO BE REFLOW SOLDERED.
6. CONTACT FINGERS TO BE GOLD PLATED (.000050) OVER NICKEL (.000050).
7. TREATMENT TO BE BRIGHT FINISH TIN LEAD ELECTRO-PLATED FOR FOIL TRACES AND PADS (BOTH SIDES)

08

Figure 7.13. Searchlight Control Card I (A5) Printed Wiring. (Sheet 1 of 2)

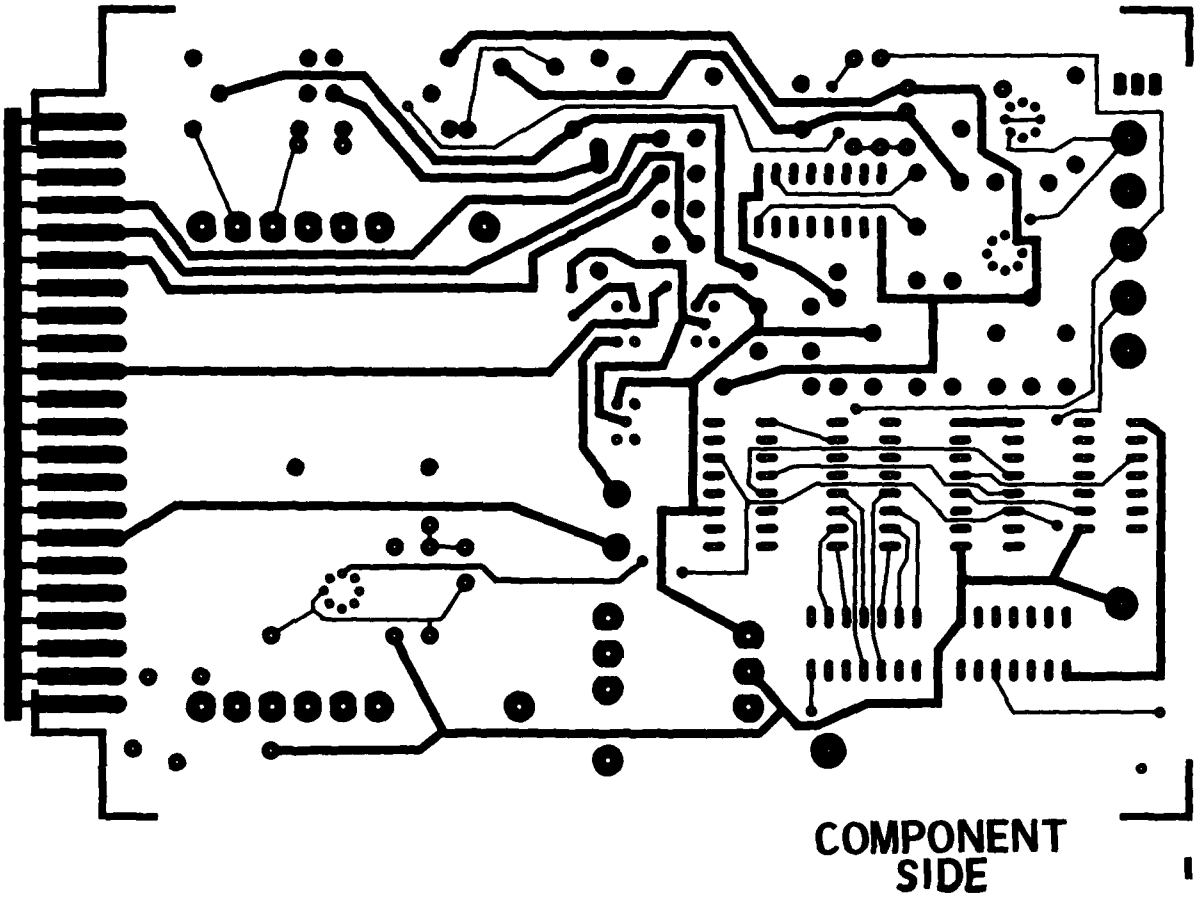
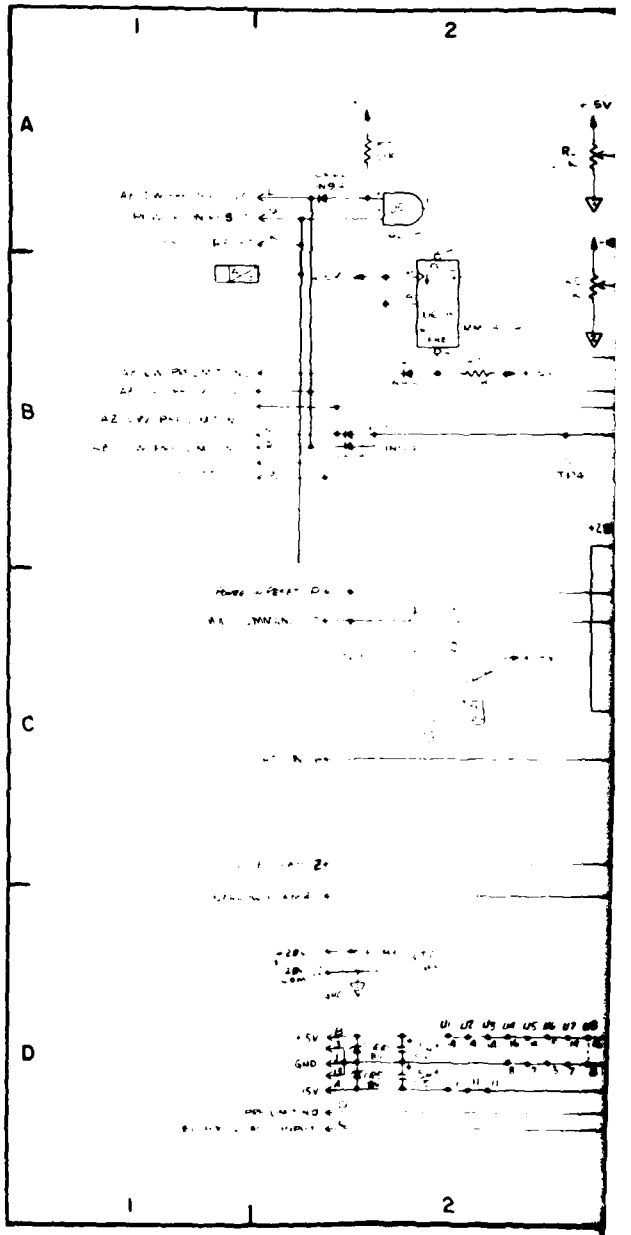


Figure 7.13. Searchlight Control
Card I (A5) Printed Wiring.
(Sheet 2)

SCHEMATIC PARTS LOCATION INDEX

REF DESIG.	LOC.	REF DESIG.	LOC.
1A1A6CR5	2D	1A1A6K12	3A
1A1A6CR10	2D	1A1A6K13	2C
1A1A6CR15	4B	1A1A6Q2	3B
1A1A6CR16	4B	1A1A6Q3	3B
1A1A6CR17	4A	1A1A6R5	2B
1A1A6CR18	4A	1A1A6R6	2A
1A1A6CR21	2B	1A1A6R30	2B
1A1A6CR22	2A	1A1A6R31	2A
1A1A6CR23	2B	1A1A6R40	2A
1A1A6CR24	2B	1A1A6R41	2B
1A1A6C1	2D	1A1A6TP1	3C
1A1A6C4	3B	1A1A6TP2	3D
1A1A6C5	2D	1A1A6TP3	2C
1A1A6K1	3B	1A1A6TP4	2B
1A1A6K2	3B	1A1A6TP5	3B
1A1A6K3	3C	1A1A6TP7	3B
1A1A6K4	3C	1A1A6TP8	3B
1A1A6K5	3D	1A1A6U1-C	3A
1A1A6K6	3D	1A1A6U5	2A
1A1A6K7	4B	1A1A6U6-A	2B
1A1A6K8	4B	1A1A6U7	3B
1A1A6K10	4A	1A1A6U8-A	3B
1A1A6K11	4A	1A1A6U8-B	3B



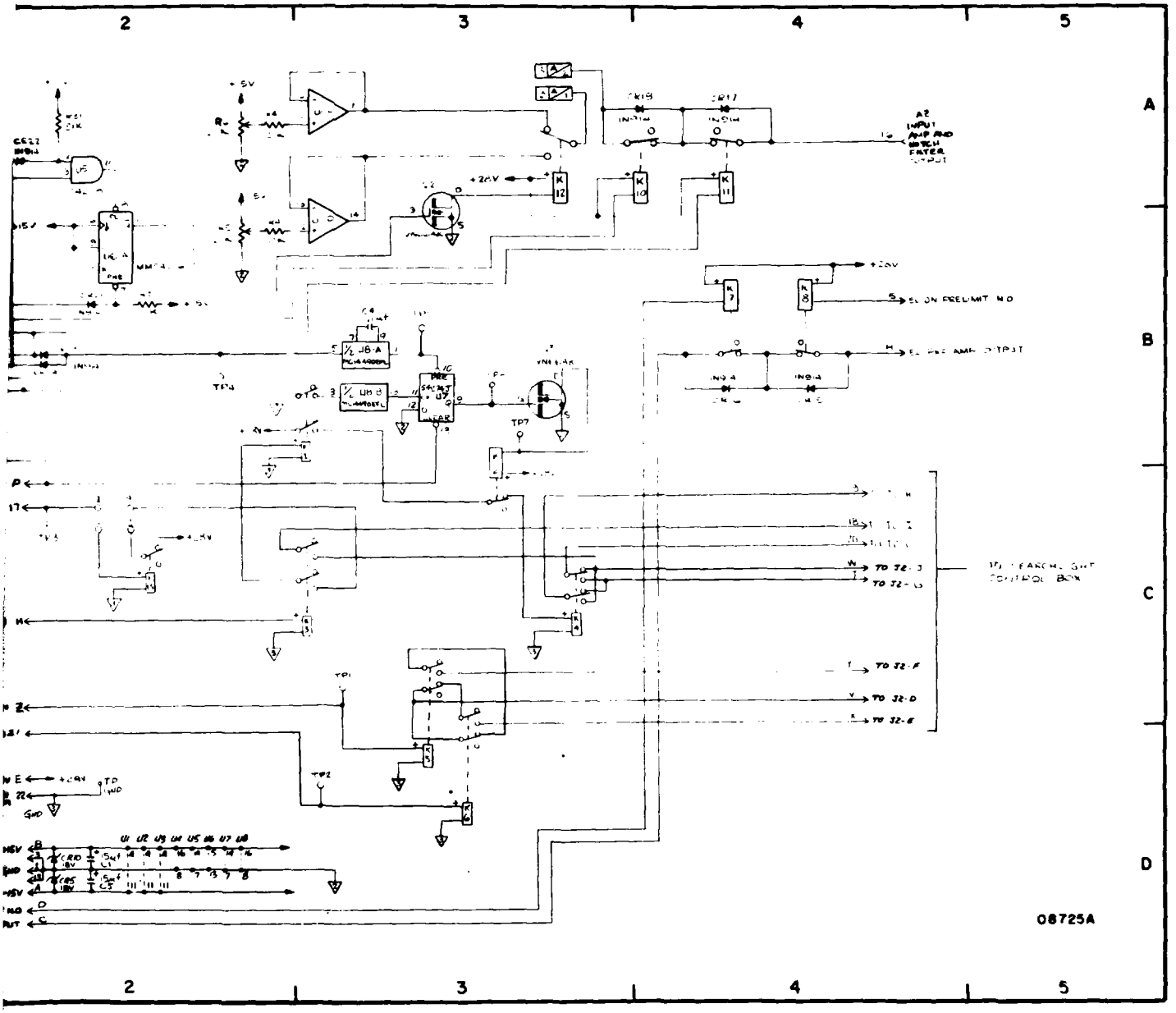
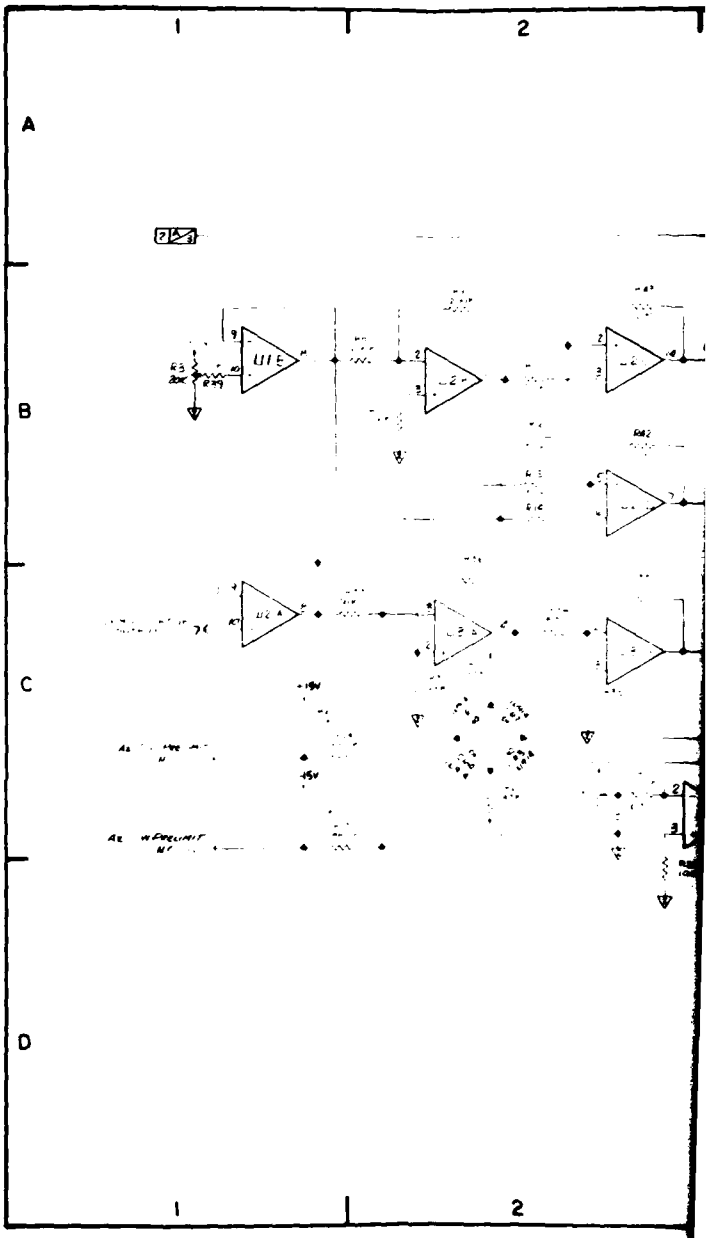


Figure 7.14. Searchlight Control Card II (A6) Schematic
(Sheet 1 of 2)

SCHEMATIC PARTS LOCATION INDEX

REF DESIG.	LOC.	REF DESIG.	LOC.
1A1A5CR1	2C	1A1A5R21	1C
1A1A5CR2	2C	1A1A5R22	1C
1A1A5CR3	2C	1A1A5R23	1C
1A1A5CR4	2C	1A1A5R24	1C
1A1A5CR6	3B	1A1A5R25	2C
1A1A5CR7	3B	1A1A5R26	2D
1A1A5CR8	3B	1A1A5R27	2C
1A1A5CR9	3B	1A1A5R28	3B
1A1A5CR11	3C	1A1A5R29	3C
1A1A5CR12	3C	1A1A5R32	3B
1A1A5CR13	3C	1A1A5R33	2C
1A1A5CR14	3C	1A1A5R34	2C
1A1A5C2	4C	1A1A5R35	2C
1A1A5C3	3B	1A1A5R36	2C
1A1A5C6	3B	1A1A5R37	2C
1A1A5C7	2C	1A1A5R38	2C
1A1A5K9	4C	1A1A5R39	1B
1A1A5Q1	4C	1A1A5R42	2B
1A1A5R3	1B	1A1A5R43	2B
1A1A5R4	2C	1A1A5TP6	5C
1A1A5R8	2B	1A1A5U1-A	3C
1A1A5R9	2B	1A1A5U1-B	1B
1A1A5R10	2B	1A1A5U2-A	1C
1A1A5R11	2B	1A1A5U2-B	2B
1A1A5R12	2B	1A1A5U2-C	2B
1A1A5R13	2B	1A1A5U2-D	2B
1A1A5R14	2B	1A1A5U3-A	2C
1A1A5R15	3B	1A1A5U3-B	2C
1A1A5R16	3B	1A1A5U3-C	3C
1A1A5R17	3C	1A1A5U3-D	3C
1A1A5R18	3C	1A1A5U4	3B
1A1A5R19	2C	1A1A5U5	3B
1A1A5R20	2C	1A1A5U6-B	4C



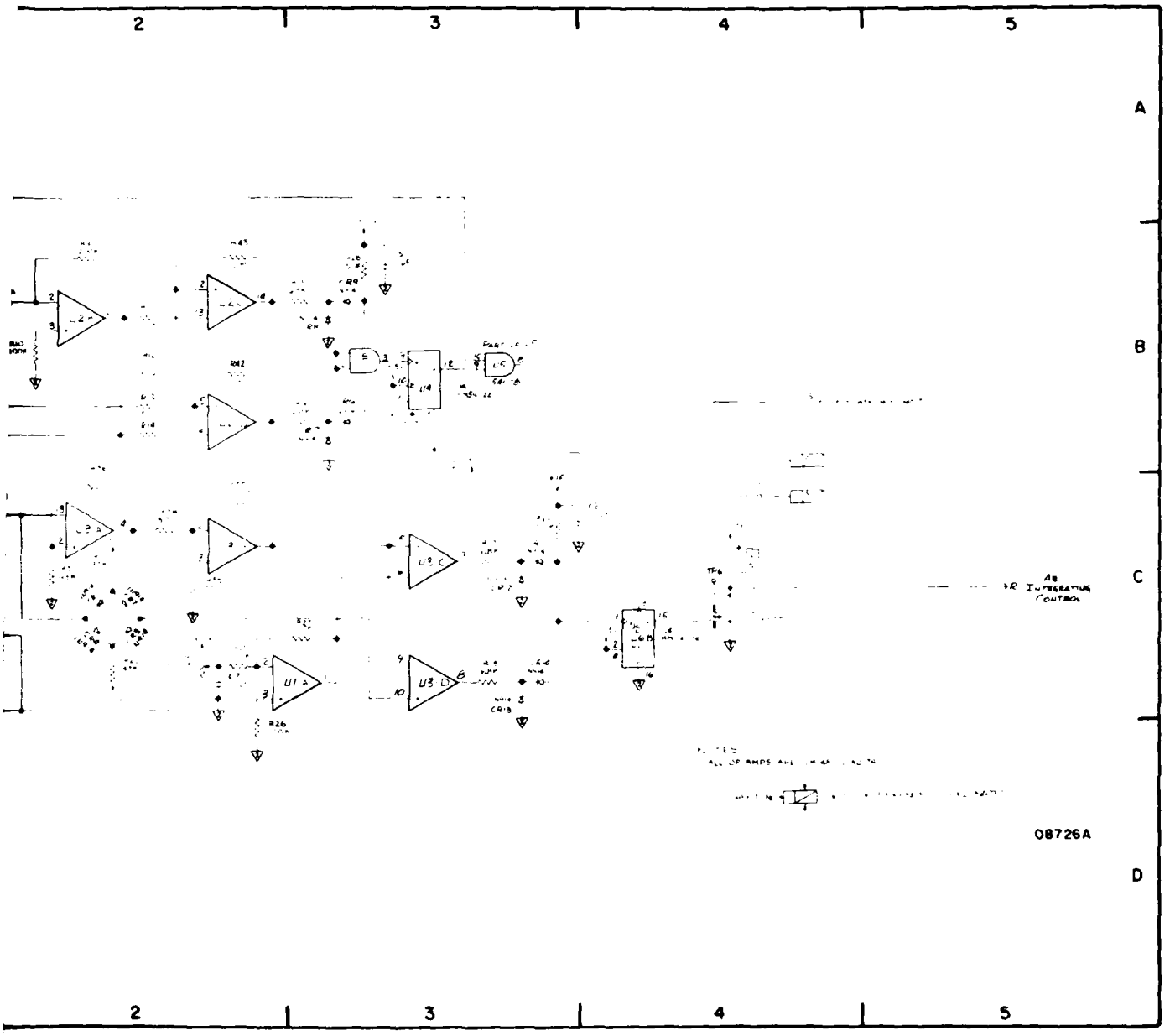
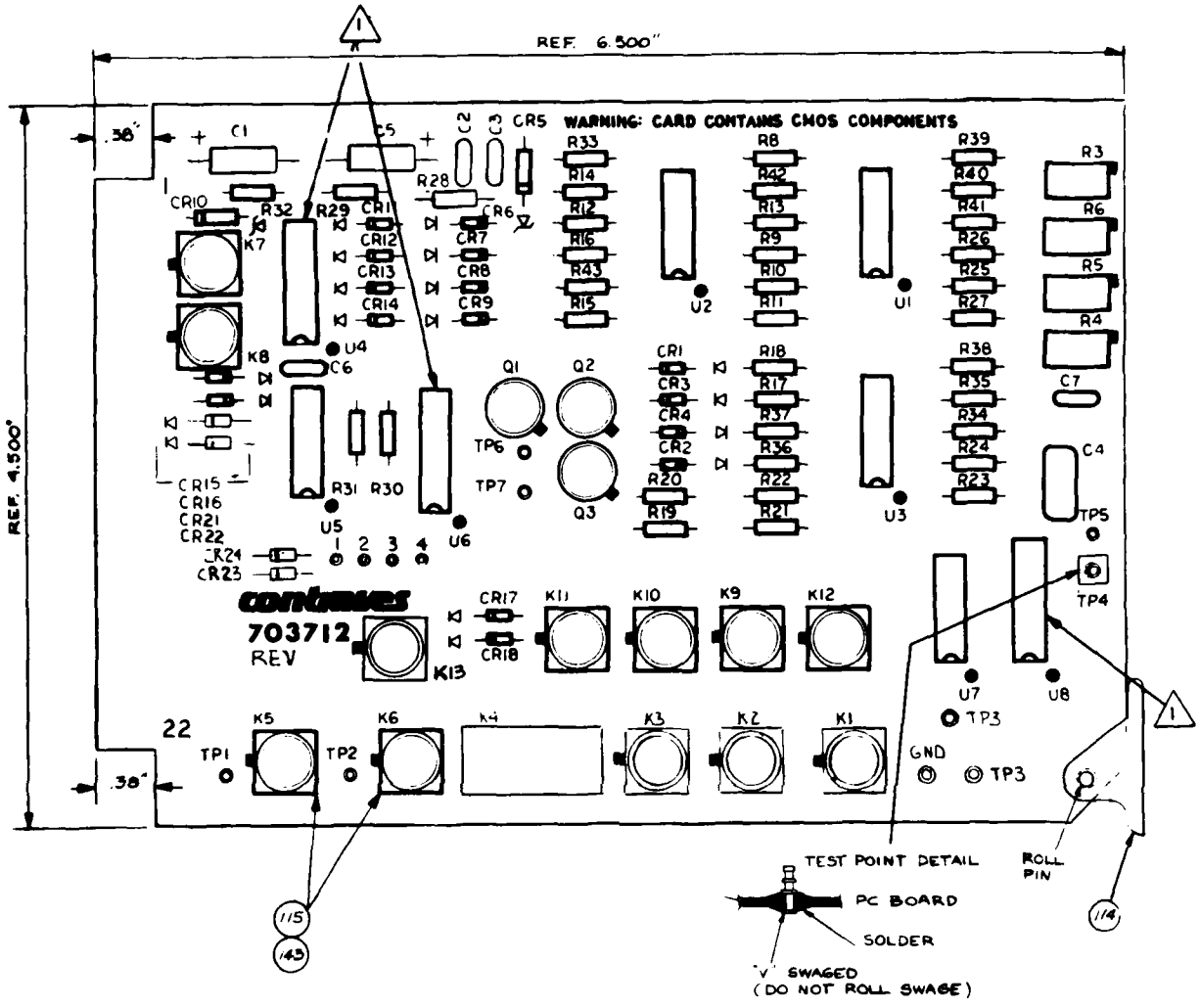


Figure 7.14. Searchlight Control Card II (A6) Schematic
(Sheet 2 of 2)



NOTES:

1. WARNING U4, U6 & U8 MUST BE INSERTED ON AN ANTISTATIC BOARD

NOTES

1. ALL ICS ARE CMOS, USE STATIC GUARD PROCEED FES.

08723A

Figure 7.15. Searchlight Control Card II (A5) Assembly Drawing.

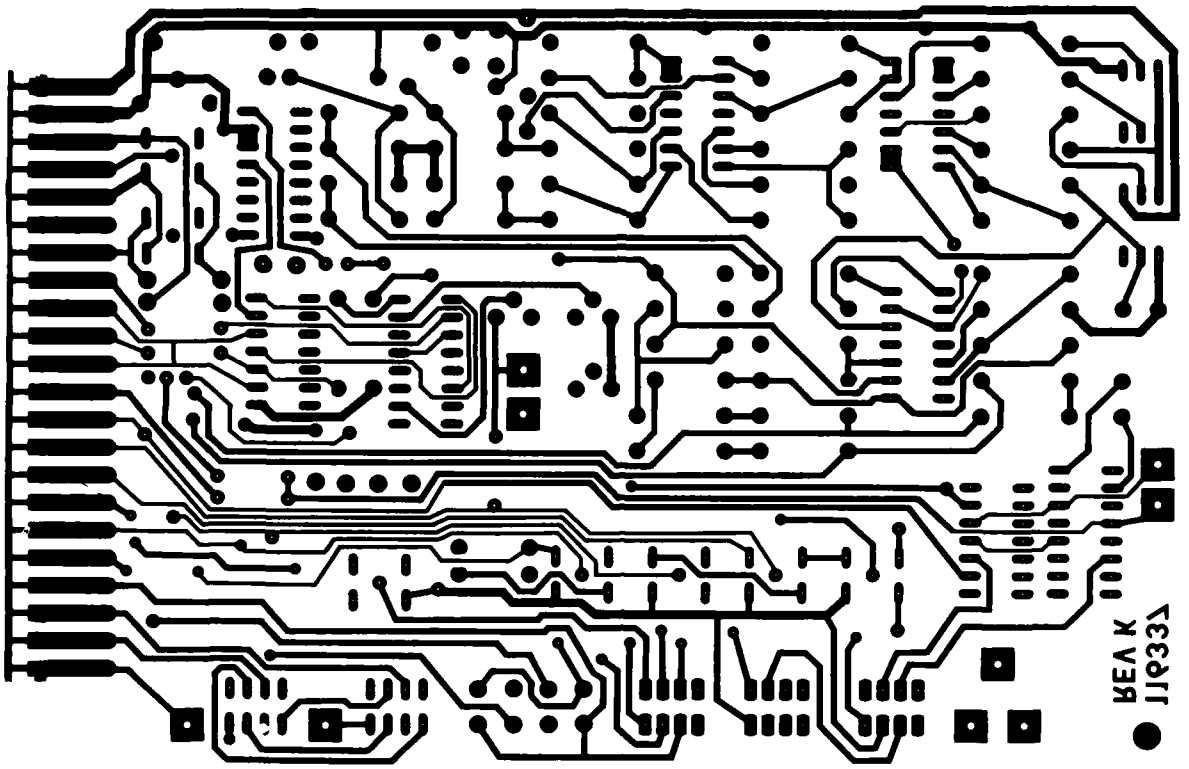
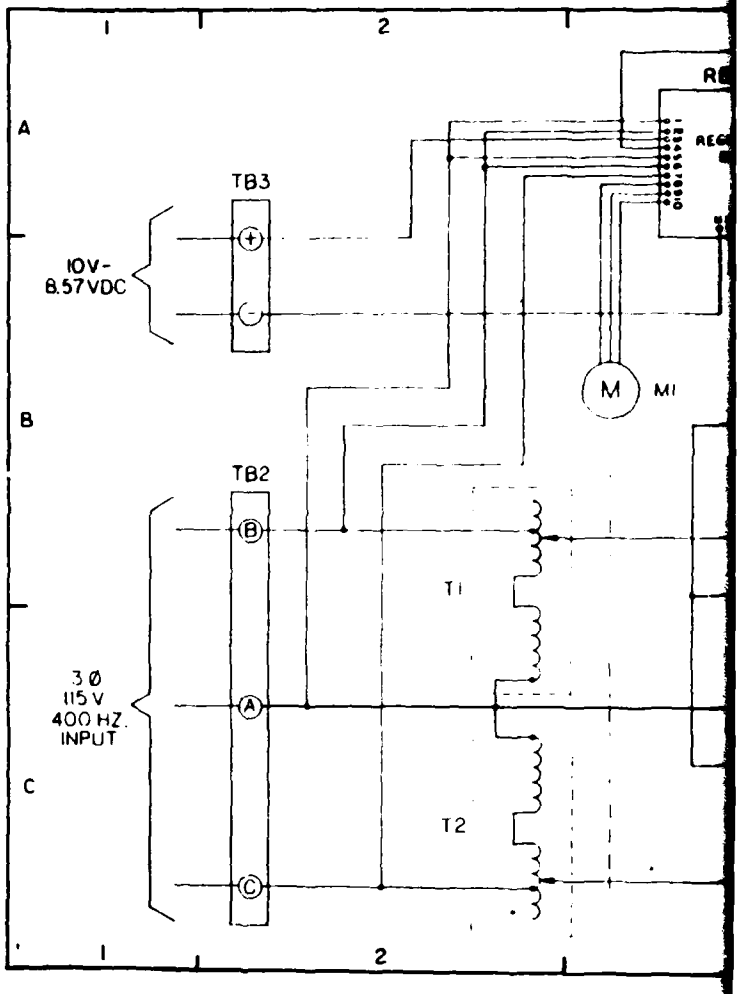


Figure 7.16. Searchlight Control
Card II (A6) Printed Wiring.

PARTS LOCATION INDEX

REF DESIG.	LOC.
CR1	3B
CR2	4B
CR3	4C
CR4	4B
CR5	4B
M1	3B
RB1	3A
TB1	4A
TB2	2B, 2C
T1	2B
T2	2C
T3	3B



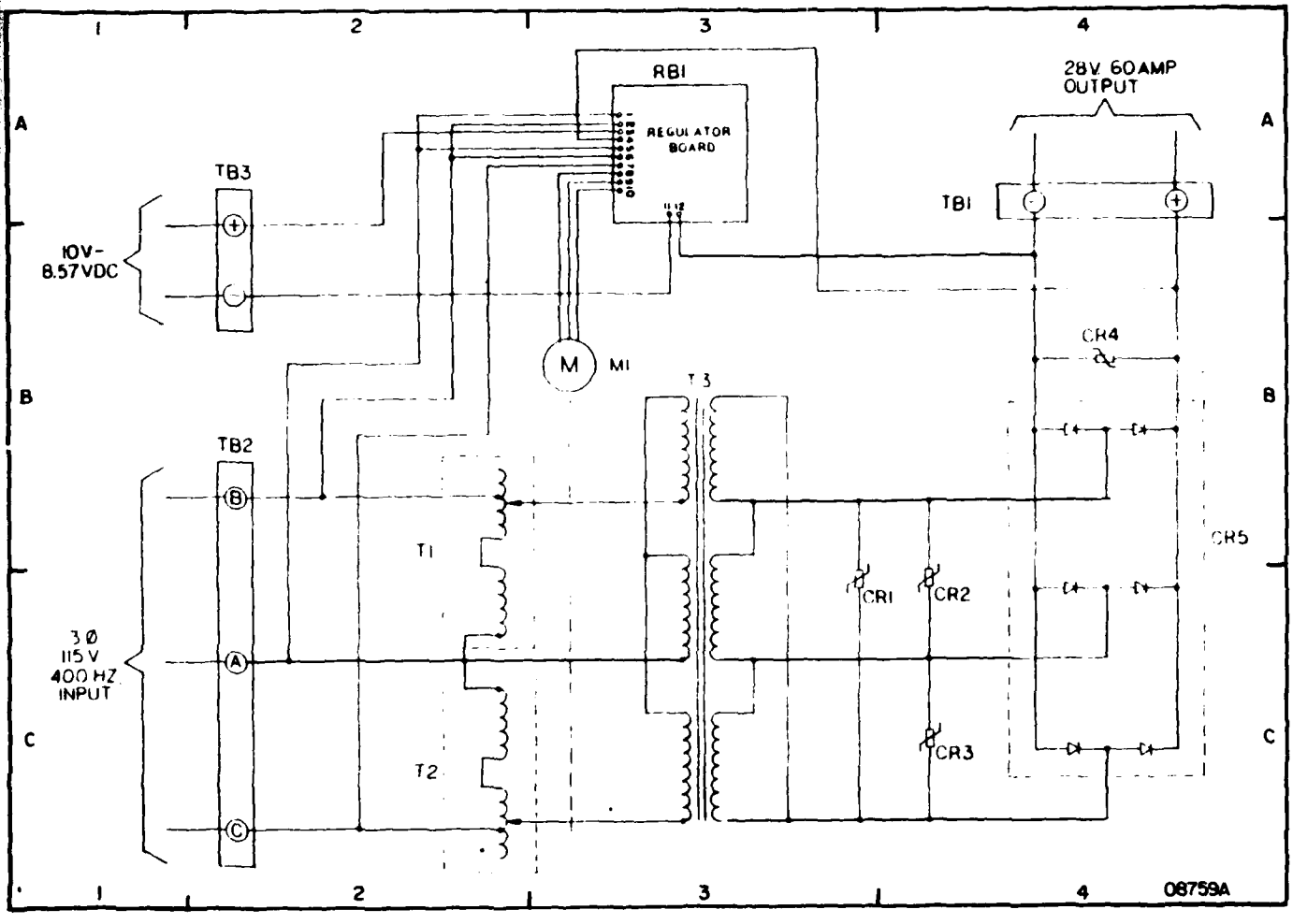


Figure 7.17. Searchlight Power Supply

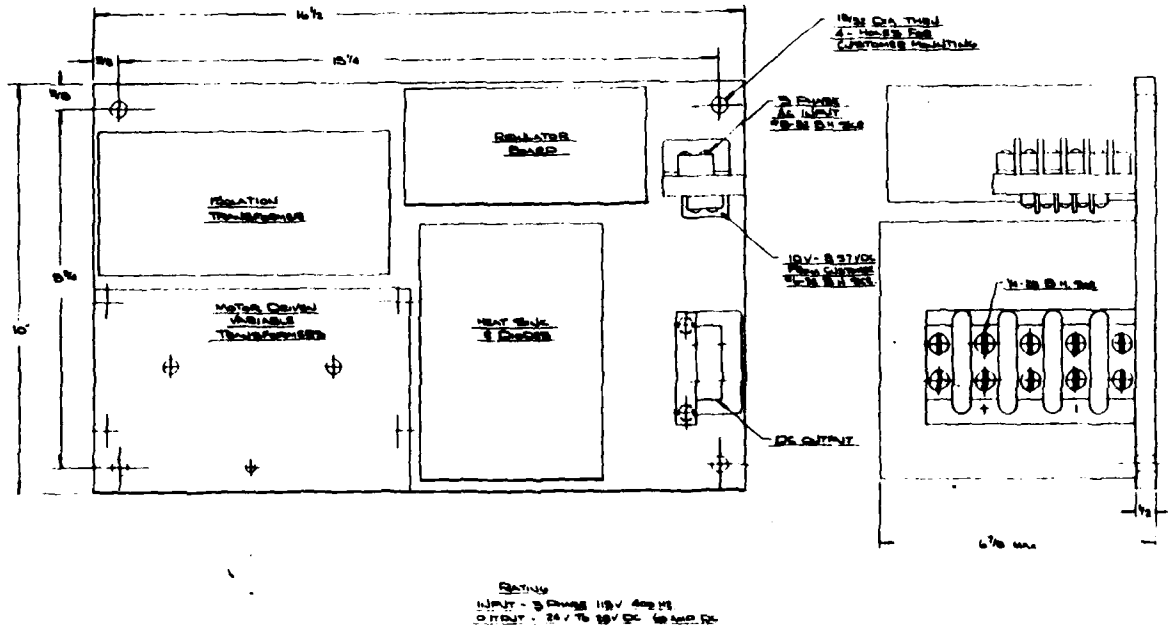
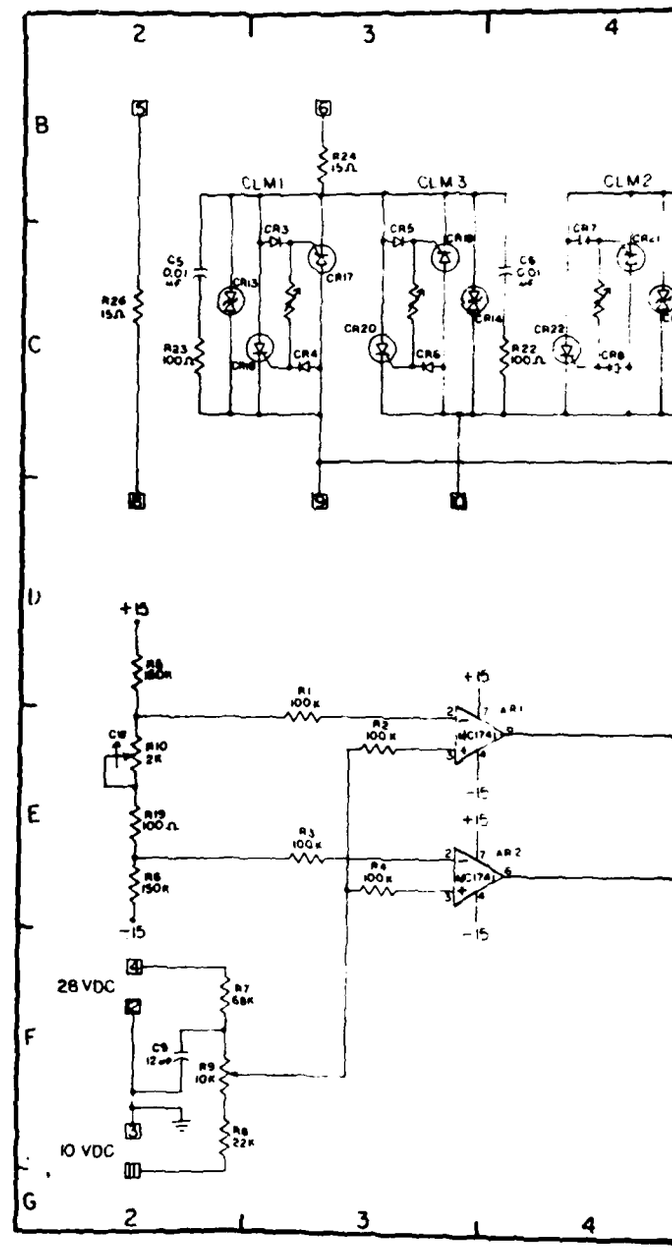


Figure 7.18. Searchlight Power Supply Assembly Drawing.

PARTS LOCATION INDEX

REF DESIG.	LOC.	REF DESIG.	LOC.
AR1	3E	C6	4C
AR2	3D	C7	4C
CLM1	5F	C8	5C
CLM2	5F	C9	2F
CLM3	5D	DS1	5D
CLM4	5D	DS2	5F
CR1	5E	Q1	5E
CR2	5E	Q2	5E
CR3	3C	R5	2D
CR4	3C	R6	2E
CR5	3C	R7	2F
CR6	3C	R8	2F
CR7	4C	R9	2F
CR8	4C	R10	2E
CR9	5C	R11	4E
CR10	5C	R12	4E
CR11	7B	R13	5D
CR12	7C	R14	5E
CR13	2C	R15	5E
CR14	3C	R16	5E
CR15	4C	R17	5D
CR16	5C	R18	5D
CR17	3C	R19	2E
CR18	3C	R20	5C
CR19	3C	R21	4C
CR20	3C	R22	4C
CR21	4C	R23	2C
CR22	4C	R24	3B
C1	7C	R25	5B
C2	7C	R26	2C
C3	8C	VR1	8B
C4	8C	VR2	7C
C5	2C		



Figu

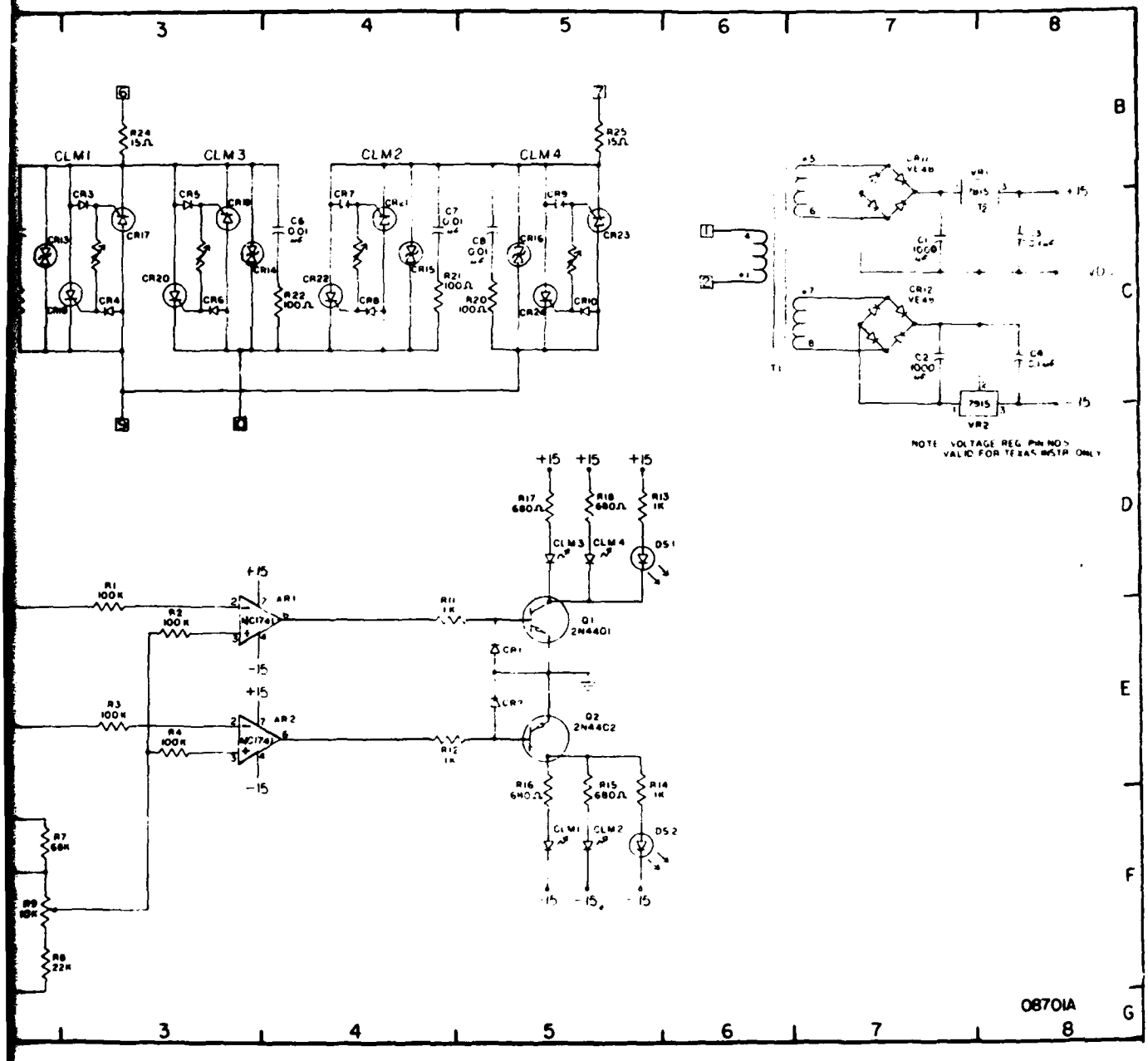
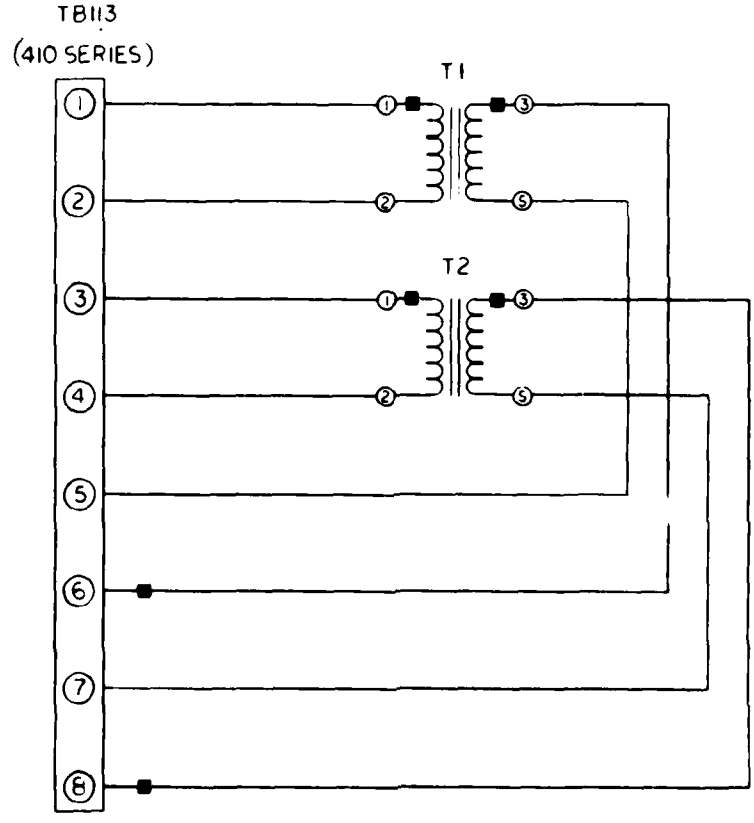


Figure 7.19. Searchlight Power Supply Regulator Board Schematic

2



2. ■ DENOTES IN-PHASE POINTS.

NOTES: 1. ALL WIRE #22 AWG.

Figure 7.20. Isolation Assembly Schematic.

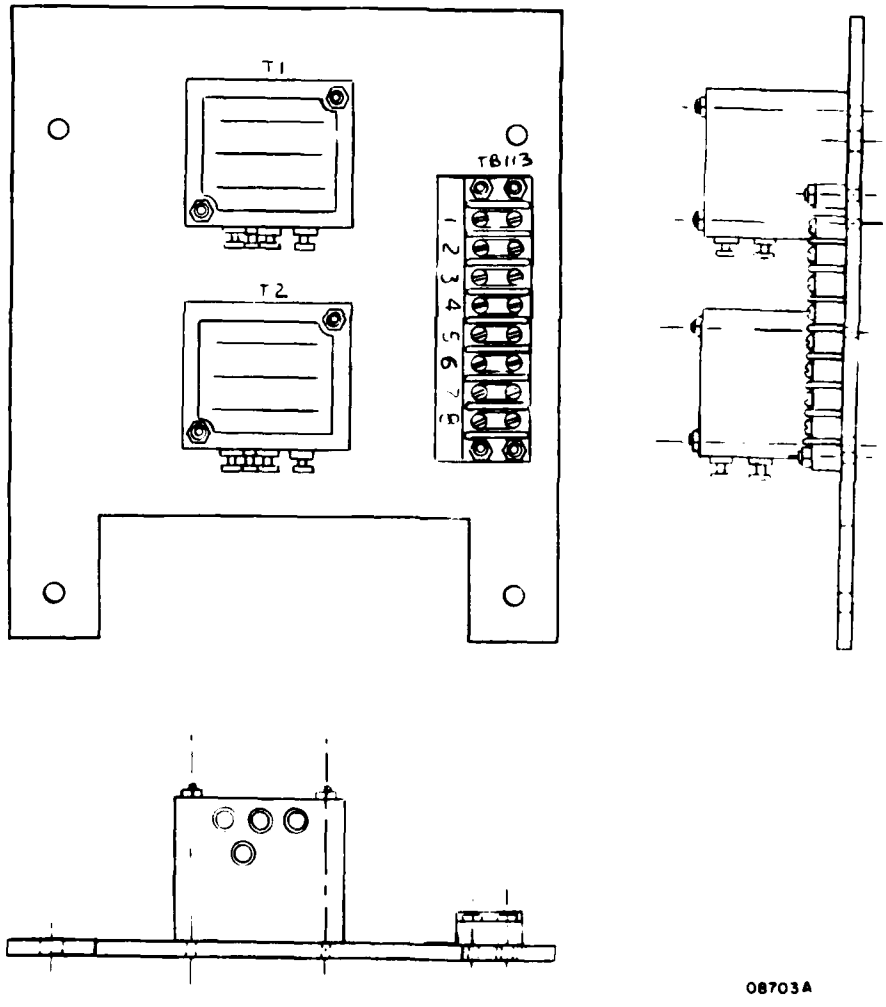


Figure 7.21. Isolation Assembly, Assembly Drawing.

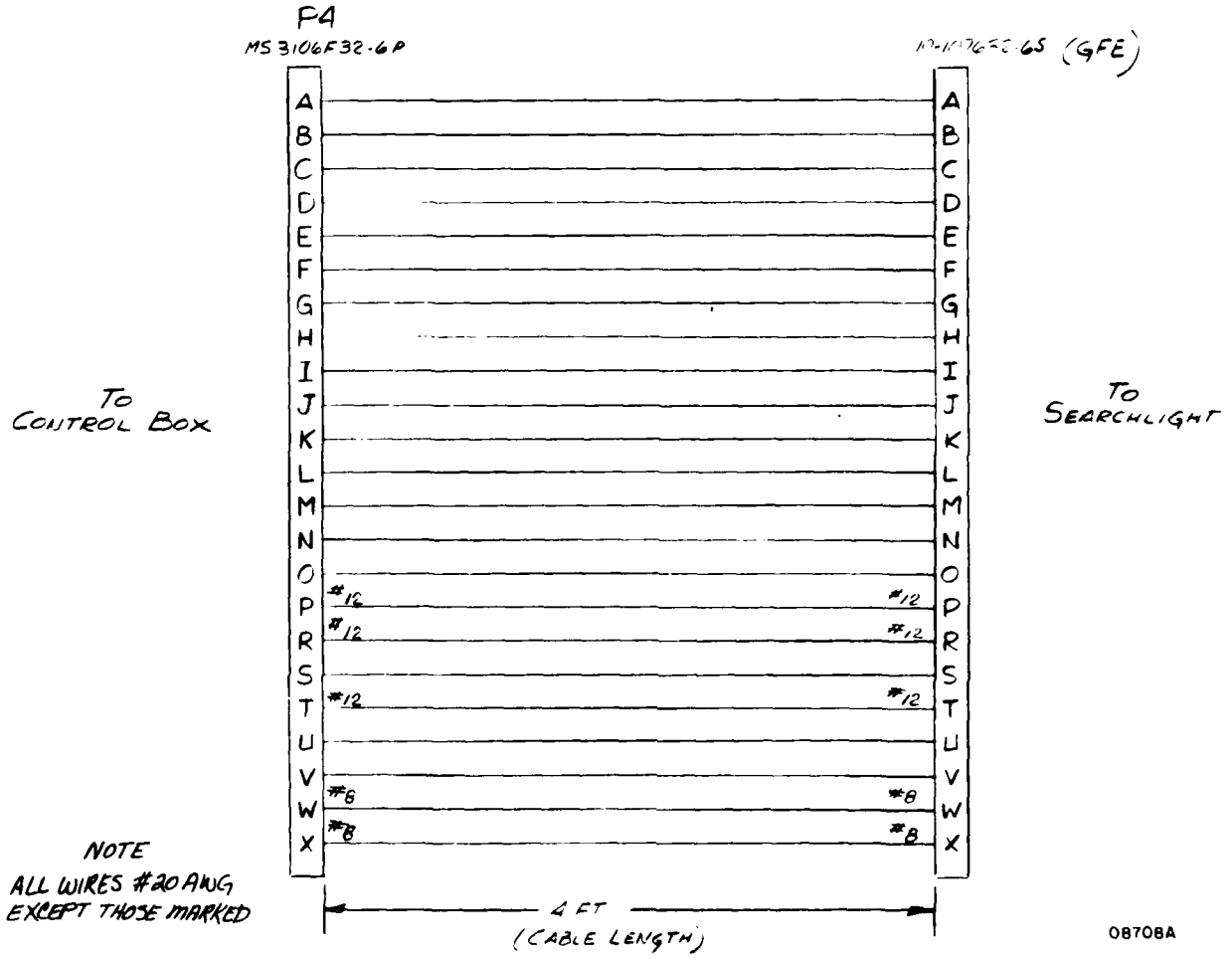


Figure 7.22. Control Box to Searchlight Wiring Diagram.

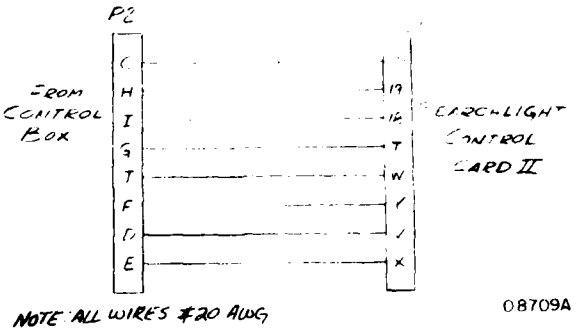


Figure 7.23. Searchlight Control Card II to Control Box Wiring Diagram

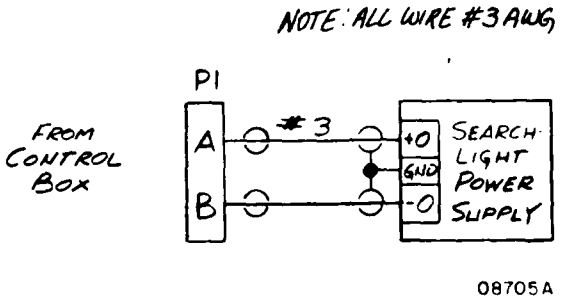


Figure 7.24. Power Supply to Control Box Wiring Diagram

National Semiconductor

Operational Amplifiers/Buffers

LM148, LM149 quad 741 op amps

LM148/LM248/LM348 quad 741 op amps
LM149/LM249/LM349 wide band decompensated ($A_{V(MIN)}$ = 5)

general description

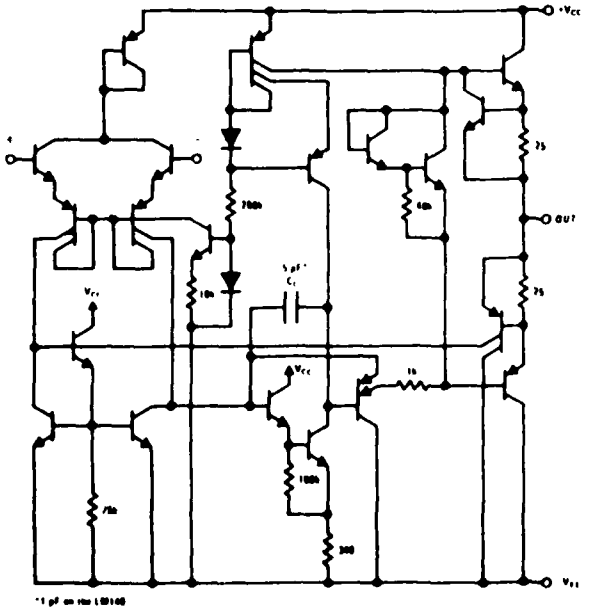
The LM148 series is a true quad 741. It consists of four independent, high gain, internally compensated, low power operational amplifiers which have been designed to provide functional characteristics identical to those of the familiar 741 operational amplifier. In addition the total supply current for all four amplifiers is comparable to the supply current of a single 741 type op amp. Other features include input offset currents and input bias current which are much less than those of a standard 741. Also, excellent isolation between amplifiers has been achieved by independently biasing each amplifier and using layout techniques which minimize thermal coupling. The LM149 series has the same features as the LM148 plus a gain bandwidth product of 4 MHz at a gain of 5 or greater.

The LM148 can be used anywhere multiple 741 or 1558 type amplifiers are being used and in applications where amplifier matching or high packing density is required

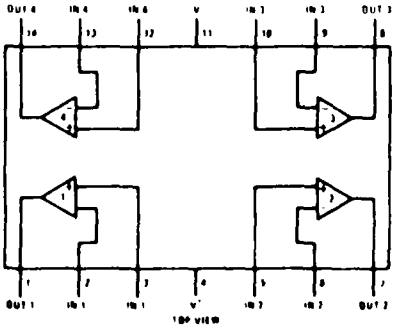
features

- 741 op amp operating characteristics
- Low supply current drain — 0.6 mA/Amplifier
- Class AB output stage—no crossover distortion
- Pin compatible with the LM124
- Low input offset voltage — 1 mV
- Low input offset current — 4 nA
- Low input bias current — 30 nA
- Gain bandwidth product
  - LM148 (unity gain) — 1.0 MHz
  - LM149 ($A_V \geq 5$) — 4 MHz
- High degree of isolation between amplifiers — 120 dB
- Overload protection for inputs and outputs

schematic and connection diagrams



Dual-In-Line and Flat Package



Order Number LM148D, LM248D, LM348D, LM149D, LM249D or LM349D
See NS Package D14E

Order Number LM248J, LM348J, LM249J or LM349J
See NS Package J14A

Order Number LM148F or LM149F
See NS Package F14A

Order Number LM348N or LM349N
See NS Package N14A

Figure 7.25. Integrated Circuit Devices.
(Sheet 1 of 19)

LM101/LM201, LM101A/LM201A/LM301A

National Semiconductor

Operational Amplifiers/Buffers

LM101/LM201, LM101A/LM201A/LM301A operational amplifiers

general description

The LM101 series are general purpose operational amplifiers which feature improved performance over industry standards like the LM709. Advanced processing techniques make possible an order of magnitude reduction in input currents, and a redesign of the biasing circuitry reduces the temperature drift of input current. Improved specifications include:

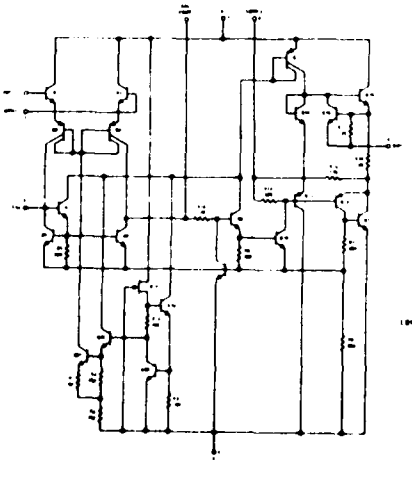
- Offset voltage 3 mV maximum over temperature (LM101A/LM201A)
- Input current 100 nA maximum over temperature (LM101A/LM201A)
- Offset current 20 nA maximum over temperature (LM101A/LM201A)
- Guaranteed drift characteristics
- Offsets guaranteed over entire common mode and supply voltage ranges
- Slew rate of 10V/μs as a summing amplifier

This amplifier offers many features which make its application nearly foolproof: overload protection on the input and output, no latch-up when the common mode range is exceeded, freedom from oscillations and compensation with a single 30 pF capacitor. It has advantages over internally compensated amplifiers in that the frequency compensation can be tailored to the particular application. For example, in low frequency circuits it can be overcompensated for increased stability margin. Or the compensation can be optimized to give more than a factor of ten improvement in high frequency performance for most applications.

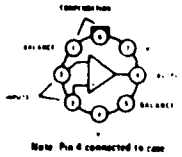
The LM101A series offers the features of the LM101, which makes its application nearly foolproof. In addition, the device provides better accuracy and lower noise in high impedance circuitry. The low input currents also make it particularly well suited for long interval integrators or timers, sample and hold circuits and low frequency waveform generators. Further, replacing circuits where matched transistor pairs buffer the inputs of conventional IC op amps, it can give lower offset voltage and drift at a lower cost.

The LM101/LM101A is guaranteed over a temperature range of −55°C to +125°C, the LM201A from −25°C to +85°C, and the LM201/LM301A from 0°C to +70°C.

schematic** and connection diagrams (Top Views)



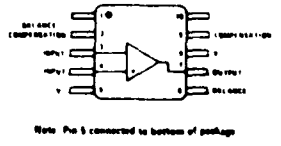
Metal Can Package



Note: Pin 4 connected to case

Order Number LM101H, LM201H, LM101AH, LM201AH or LM301AH
See NS Package H08C

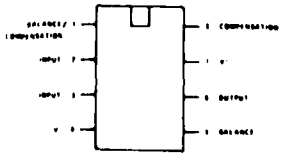
Flat Package



Note: Pin 5 connected to bottom of package

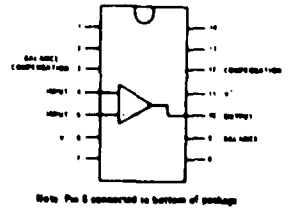
Order Number LM101F, LM201F, LM101AF or LM201AF
See NS Package F10A

Dual-In-Line Package



Order Number LM201J or LM301AJ
See NS Package J08A
Order Number LM301AN
See NS Package N08A

Dual-In-Line Package



Note: Pin 8 connected to bottom of package

Order Number LM101AD or LM201AD
See NS Package D14E
Order Number LM101AJ-14, LM201AJ-14, LM301AJ, LM101J-14 or LM201J-14
See NS Package J14A

**Pin connections shown are for metal can.

Figure 7.25. Integrated Circuit Devices.

(Sheet 2)

MM54C73/MM74C73 dual J-K flip-flops with clear
MM54C76/MM74C76 dual J-K flip-flops with clear and preset
MM54C107/MM74C107 dual J-K flip-flops with clear

general description

These dual J-K flip-flops are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement transistors. Each flip-flop has independent J, K, clock and clear inputs and Q and $\overline{Q}$ outputs. The MM54C76/MM74C76 flip flops also include preset inputs and are supplied in 16 pin packages. These flip flops are edge sensitive to the clock input and change state on the negative going transition of the clock pulses. Clear or preset is independent of the clock and is accomplished by a low level on the respective input.

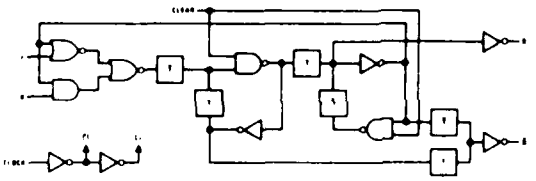
features

■ Supply voltage range	3V to 15V
■ Tenth power TTL compatible	drive 2 LPTTL loads
■ High noise immunity	0.45 V_{CC} (typ)
■ Low power	50 nW (typ)
■ Medium speed operation	10 MHz (typ) with 10V supply

applications

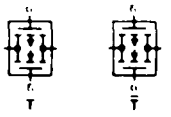
- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm systems
- Industrial electronics
- Remote metering
- Computers

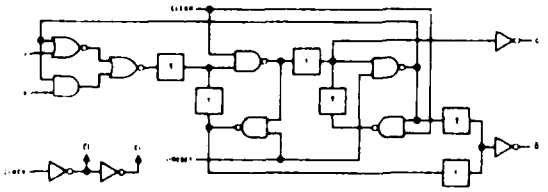
logic and connection diagrams



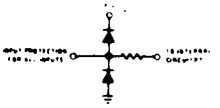
MM54C73/MM74C73 and MM54C107/MM74C107

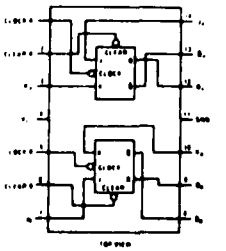
Transmission Gate



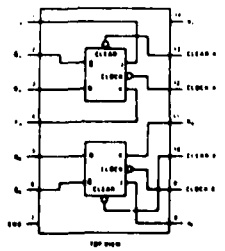


MM54C76/MM74C76

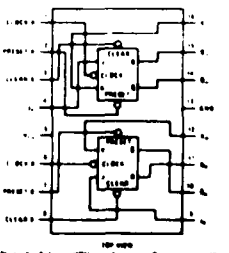




MM54C73/MM74C73



MM54C107/MM74C107



MM54C76/MM74C76

Figure 7.25. Integrated Circuit Devices.

(Sheet 3)

MM54C192/MM74C192 synchronous 4-bit up/down decade counter
MM54C193/MM74C193 synchronous 4-bit up/down binary counter

general description

These up/down counters are monolithic complementary MOS (CMOS) integrated circuits. The MM54C192 and MM74C192 are BCD counters. While the MM54C193 and MM74C193 are binary counters.

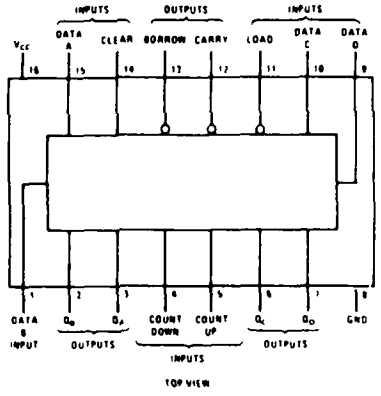
Counting up and counting down is performed by two count inputs, one being held high while the other is clocked. The outputs change on the positive going transition of this clock.

These counters feature preset inputs that are set when load is a logical "0" and a clear which forces all outputs to "0" when it is at logical "1". The counters also have carry and borrow outputs so that they can be cascaded using no external circuitry.

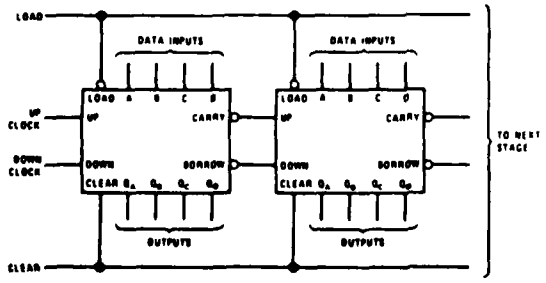
features

- High noise margin — 1V guaranteed
- Tenth power TTL compatible — drive 2 LPTTL loads
- Wide supply range — 3V to 15V
- Carry and borrow outputs for N bit cascading
- Asynchronous clear
- High noise immunity — 0.45 V_{CC} typ

connection diagram



cascading packages



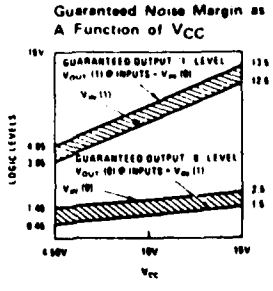


Figure 7.25. Integrated Circuit Devices.

(Sheet 4)

MM54C221/MM74C221 dual monostable multivibrator

general description

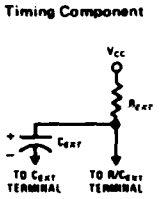
The MM54C221/MM74C221 dual monostable multivibrator is monolithic complementary MOS integrated circuit. Each multivibrator features a negative-transition-triggered input and a positive-transition-triggered input either of which can be used as an inhibit input, and a clear input.

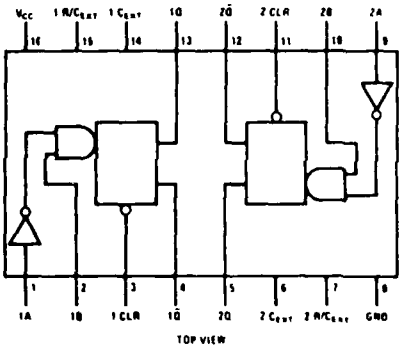
Once fired, the output pulses are independent of further transitions of the A and B inputs and are a function of the external timing components C_{EXT} and R_{EXT}. The pulse width is stable over a wide range of temperature and V_{CC}. Pulse stability will be limited by the accuracy of external timing components. The pulse width is approximately defined by the relationship $t_{W(OUT)} \approx C_{EXT}\ R_{EXT}$. For further information and applications, see AN-138.

features

■ Wide supply voltage range	4.5V to 15V
■ Guaranteed noise margin	1.0V
■ High noise immunity	0.45 V_{CC} typ
■ Low power	fan out of 2
TTL compatibility	driving 74L

connection diagrams





truth table

INPUTS			OUTPUTS	
CLEAR	A	B	Q	$\bar{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎎
H	↓	H	⎍	⎎

H = High level
L = Low level
↑ = Transition from low to high
↓ = Transition from high to low
⎍ = One high level pulse
⎎ = One low level pulse
X = Irrelevant

Figure 7.25. Integrated Circuit Devices.

(Sheet 5)

MM54C08/MM74C08 quad 2-input AND gate
MM54C86/MM74C86 quad 2-input EXCLUSIVE-OR gate

general description

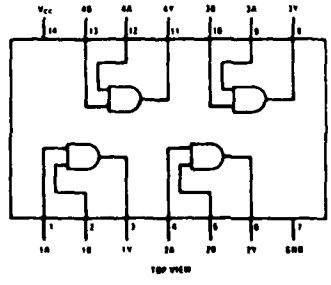
Employing complementary MOS (CMOS) transistors to achieve wide power supply operating range, low power consumption and high noise margin these gates provide basic functions used in the implementation of digital integrated circuit systems. The N and P-channel enchancement mode transistors provide a symmetrical circuit with output swing essentially equal to the supply voltage. No dc power other than that caused by leakage current is consumed during static condition. All inputs are protected from damage due to static discharge by diode clamps to V_{CC} and GND.

features

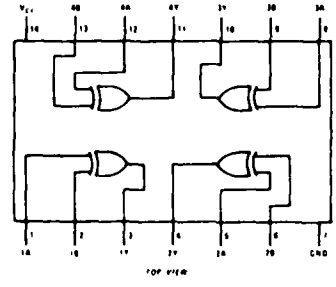
- Wide supply voltage range — 3.0V to 15V
- Guaranteed noise margin — 1.0V
- High noise immunity — 0.45 V_{CC} typ
- Low power TTL compatibility — fan out of 2 driving 74L
- Low power consumption — 10 nW/package typ
- The MM54C86/MM74C86 follows the MM54L86/MM74L86 pinout

connection diagrams

MM54C08/MM74C08



MM54C86/MM74C86



truth tables

MM54C08/MM74C08

INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

MM54C86/MM74C86

INPUTS		OUTPUTS
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

H = High Level L = Low Level

Figure 7.25. Integrated Circuit Devices.
(Sheet 6)

MM54C74/MM74C74 dual D flip-flop

general description

The MM54C74/MM74C74 dual D flip flop is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. Each flip flop has independent data, preset, clear and clock inputs and Q and $\overline{Q}$ outputs. The logic level present at the data input is transferred to the output during the positive going transition of the clock pulse. Preset or clear is independent of the clock and accomplished by a low level at the preset or clear input.

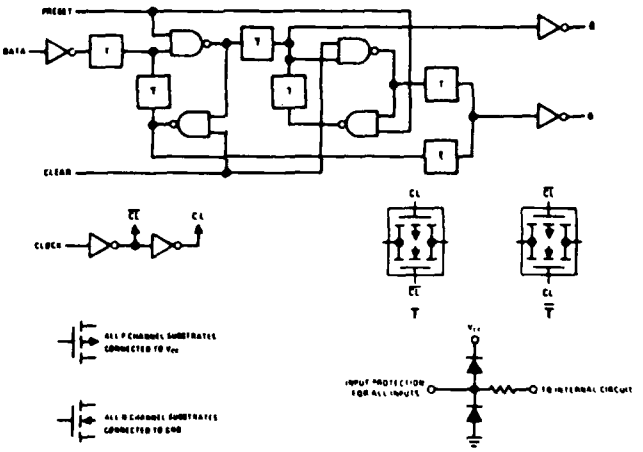
features

- Supply voltage range — 3V to 15V
- Tenth power TTL compatible — drive 2LPT^{2}L loads
- High noise immunity — 0.45 V_{CC} (typ)
- Low power — 50 nW (typ)
- Medium speed operation — 10 MHz (typ) with 10V supply

applications

- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm system
- Industrial electronics
- Remote metering
- Computers

logic and connection diagrams



truth table

Preset	Clear	Q_n	$\overline{Q}_n$
0	0	0	0
0	1	1	0
1	0	0	1
1	1	*Q_n	*$\overline{Q}_n$

*No change in output from previous state.

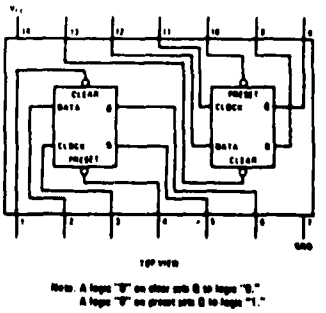


Figure 7.25. Integrated Circuit Devices.

(Sheet 7)

MM54C30/MM74C30 8-input NAND gate

general description

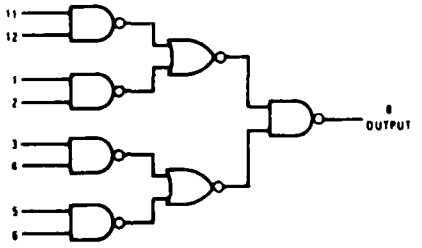
The logic gate employs complementary MOS (CMOS) to achieve wide power supply operating range, low power consumption and high noise immunity. Function and pin out compatibility with series 54/74 devices minimizes design time for those designers familiar with the standard 54/74 logic family

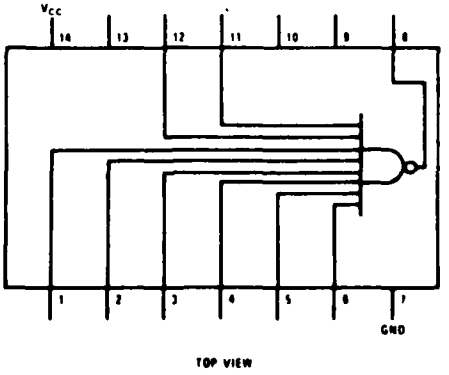
All inputs are protected from damage due to static discharge by diode clamps to V_{CC} and GND

features

■ Wide supply voltage range	3.0V to 15V
■ Guaranteed noise margin	1.0V
■ High noise immunity	0.45 V_{CC} typ
■ Low power TTL compatibility	fan out of 2 driving 74L

logic and connection diagrams





TOP VIEW

Figure 7.25. Integrated Circuit Devices.

(Sheet 8)

MM54C00/MM74C00 quad two-input NAND gate
MM54C02/MM74C02 quad two-input NOR gate
MM54C04/MM74C04 hex inverter
MM54C10/MM74C10 triple three-input NAND gate
MM54C20/MM74C20 dual four-input NAND gate

general description

These logic gates employ complementary MOS (CMOS) to achieve wide power supply operating range, low power consumption, high noise immunity and symmetric controlled rise and fall times. With features such as this the 54C/74C logic family is close to ideal for use in digital systems. Function and pin out compatibility with series 54/74 devices minimizes design time for those designers already familiar with the standard 54/74 logic family.

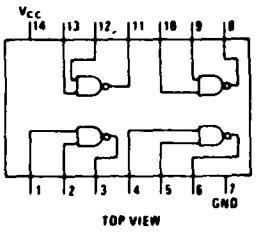
All inputs are protected from damage due to static discharge by diode clamps to V_{CC} and GND.

features

■ Wide supply voltage range	3.0V to 15V
■ Guaranteed noise margin	1.0V
■ High noise immunity	0.45 V_{CC} typ.
■ Low power consumption	10 nW/package typ
■ Low power TTL compatibility	fan out of 2 driving 74L

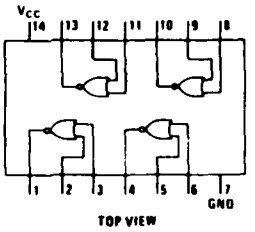
connection diagrams

MM54C00/MM74C00



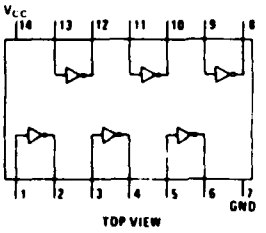
TOP VIEW

MM54C02/MM74C02



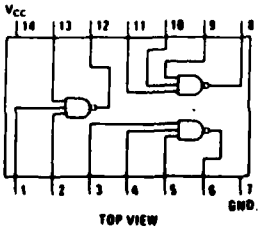
TOP VIEW

MM54C04/MM74C04



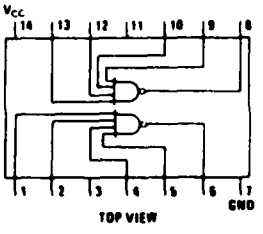
TOP VIEW

MM54C10/MM74C10



TOP VIEW

MM54C20/MM74C20



TOP VIEW

Figure 7.25. Integrated Circuit Devices.
(Sheet 9)

HARRIS SEMICONDUCTOR
A DIVISION OF HARRIS CORPORATION

HI-201

Quad SPST CMOS Analog Switch

FEATURES

- ANALOG VOLTAGE RANGE ±15V
- ANALOG CURRENT RANGE 80mA
- TURN-ON TIME 185ns
- LOW R_{ON} 65Ω
- LOW POWER DISSIPATION 15mW
- TTL/CMOS COMPATIBLE
- NO DIGITAL INPUT CURRENT SPIKE

APPLICATIONS

- HIGH FREQUENCY ANALOG SWITCHING
- SAMPLE AND HOLD CIRCUITS
- DIGITAL FILTERS
- OP AMP GAIN SWITCHING NETWORKS

DESCRIPTION

HI-201 is a monolithic device comprising four independently selectable SPST switches which feature fast switching speeds (185ns) combined with low power dissipation (15mW at 25°C). Each switch provides low "ON" resistance operation for input signal voltages up to the supply rails and for signal currents up to 80mA. Employing Dielectric Isolation and Complementary CMOS processing, HI-201 operates without any applications problems induced by latch-up or SCR-mode phenomena.

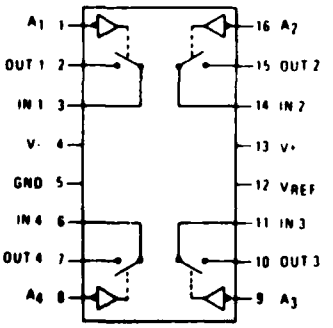
All devices provide break-before-make switching and are TTL and CMOS compatible for maximum application versatility. HI-201 is an ideal component for use in high frequency analog switching. Typical appliations include signal path switching, sample and hold circuit, digital filters and op amp gain switching networks.

HI-201 is available in a 16 lead dual-in-line package. HI-201-2 is specified from -55°C to +125°C while HI-201-5 operates from 0°C to +75°C. HI-201 is functionally and pin compatible with other available "200 series" switches.

PIN OUT

Package Code 4B

Top View



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow IC Handling Procedures specified on pg. 1-4.

FUNCTIONAL DIAGRAM

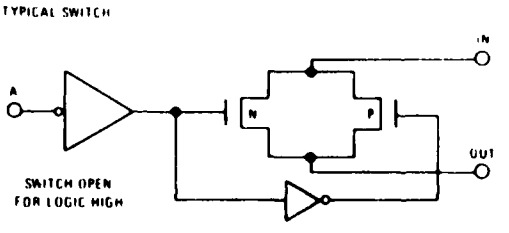


Figure 7.25. Integrated Circuit Devices.
(Sheet 10)

SPECIFICATIONS

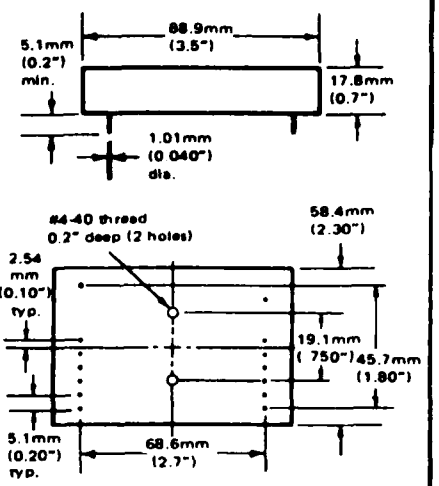
Typical at 25°C and ±15 Vdc unless otherwise noted.

ELECTRICAL

MODEL		3450	3451	3452/3455[6]
INPUT STAGE SPECIFICATIONS [1]				
Open Loop Gain	dB, Min.	94	88	94
Input Offset Voltage @ 25°C[4]	mV, Max.	±0.55	±20	±0.30
vs. Temp.	µV/°C Max	±1.0	±50	±5.0
vs. Supply	µV/V	±50	±50	±25
vs. Time	µV/mo	±10	±100	
Input Bias Current @ 25°C	Max	±50 nA	±25 pA	±20 pA
vs Temp	Max.	±0.5 nA/°C	doubles/10°C	
vs. Supply		±0.2 nA/V	±1 pA/V	
Input Offset Current @ 25°C		±30 nA Max	±2 pA	
vs Temp	Max.	±0.3 nA/°C	doubles/10°C	
vs Supply		±0.1 nA/V	±0.5 pA/V	
Input Impedance				
Differential		$10^7\Omega$	$10^{11}\Omega$	
Common Mode [2]		$5\times10^9\Omega$ ‖ 10pf	$10^{11}\Omega$ ‖ 10pf	
Input Noise				
Voltage, .01 Hz - 10 Hz	µV, p-p	0.8	2	4
10 Hz - 1 kHz	µV rms	1.2	3	2
Current, .01 Hz - 10 Hz	pA, p-p	30	0.3	0.3
10 Hz - 1 kHz	pA, rms	50	0.6	0.6
Input Voltage Range				
Common Mode [2] (operating)	V, Min.		±10	
Differential (w/o damage)	V, Min.		±15	
Common Mode [2] Rejection	dB @ 10V	100	80	90
Isolated Power Available				
Voltage		—	—	±15V +0 −10%
Current,	Max.	—	—	±10mA
Ripple @ 100 kHz		—	—	100 mV p-p
ISOLATION STAGE SPECIFICATIONS				
Gain (without trimming)[4]	1 V/V, tMax	±0.1%	±0.5 %	
vs. Temp.	ppM/°C Max	±10	±50	
Nonlinearity[7] @ ±10V	% Max/typ	±.005/±.0015	±0.025/±.005	±0.025/±.005
Frequency Response, -3 dB (See Fig. 9)		1.5 kHz	2.5 kHz	
Settling Time				
to 0.01%		5 msec		
to 0.1%		1 msec		
Isolation Impedance[3]		$10^{12}\Omega$ ‖ 16 pf		
Isolation Leakage Current at 240V/60Hz		2.5µA max[6]		
Isolation Mode[3] Rejection				
DC		160 dB Min		
60Hz		120 dB Min.		
Isolation[3] Voltage				
Rated, continuous, (min.)		±500 V Peak		±2000Vpk
Test voltage[5]		±2000V Peak		±5000Vpk[6]
Output Voltage		±10 V Min		
Output Current		±5 mA Min		
Output Impedance, DC		0.2 Ω		
Output Noise				
.01 Hz to 10 Hz		7 µV p-p		
10 Hz to 1 kHz		25 µV rms		
Output Offset Voltage @ 25°C[4]	mV, Max	±2	±5	±5
vs. Temp.		±100µV/°C Max		
vs. Supply		±500µV/V		
vs. Time		±100µV/Mo		
Input Power Requirements				
Voltage		±14 to ±16 VDC		
Current, quiescent		±30/±5 mA Max		
, full load, max		±35/-10mA		±55/-10mA[8]
TEMPERATURE RANGE				
Specification		-25°C to +85°C		
Storage		-55°C to +125°C		
Operating		-25°C to +85°C		

1) For 3450 and 3451 current drawn from FDBK pin must be ≤ 5mA. For 3452 the sum of the current drawn from FDBK pin and either "-V (Ref)" or "+V" pins (i.e., + or - isolated current) must be ≤ 11mA.
2) Common-mode parameters are measured at the +IN and -IN pins with respect to the I/P COM pin.
3) Isolation mode parameters are measured at the I/P COM pin with respect to the PWR COM pin and O/P COM pin.
4) Errors may be trimmed to zero.
5) All units 100% tested for 1µA max leakage current at test voltage.
6) The 3455 is identical to the 3452 except for two additional specifications. Each unit is tested to withstand a 2500V rms, 60 Hz sinewave common voltage (Ref. Dielectric Withstand Voltage, paragraph 31.11 of UL 544). Each unit is specified at a maximum leakage current of 2µA with 240V rms, 60 Hz common voltage (Ref. Leakage Current, paragraph 27.5 of UL 544).
7) Nonlinearity is specified to be the peak deviation from a best straight line expressed as a percent of peak-to-peak full scale output.
8) Includes fully loaded input power.

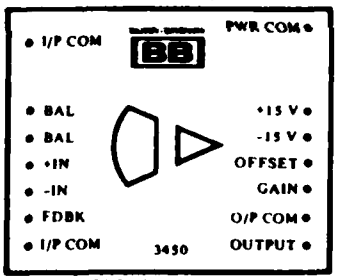
MECHANICAL



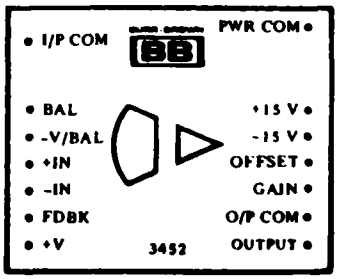
MATERIAL - Black Plastic
WEIGHT - 100g (3.5 oz)
PINS - Pin material and plating composition meet method 2003 (solderability) of Mil-Std-883 [except paragraph 3.2]
Mating Connector - 4400MC.

PIN CONNECTIONS

(TOP VIEW)



MODELS 3450 & 3451



MODEL 3452 & 3455

Figure 7.25. Integrated Circuit Devices.

(Sheet 11)

BURR-BROWN

700/700U

ISOLATED DC-TO-DC CONVERTER

FEATURES

- HIGH BREAKDOWN VOLTAGE 5000V PEAK
- LOW LEAKAGE CAPACITANCE ~3pF
- SHIELDED AND UNSHIELDED UNITS
- COMPLETELY SPECIFIED

BENEFITS

- HIGH VOLTAGE RATING PROTECTS EXPENSIVE INSTRUMENTATION
- LOW LEAKAGE CURRENT PROTECTS HUMAN LIFE
- EXCELLENT ISOLATION CMR IMPROVES SYSTEM PERFORMANCE
- SHIELDING PREVENTS ELECTROSTATIC AND EMI PROBLEMS

APPLICATIONS

- INDUSTRIAL PROCESS CONTROL
- MEDICAL INSTRUMENTATION
- TEST EQUIPMENT
- DATA ACQUISITION SYSTEMS

DESCRIPTION

The Model 700 converts a 10VDC to 18VDC input to a dual output of the same value as the input voltage. The internal hybrid integrated circuit reduces size and cost. A self-contained frequency stable 130kHz oscillator drives switching circuitry which is designed to minimize the common problem of spiking due to transformer saturation. Regulation and short circuit protection, if desired, can easily be added (see Figure 3). Models 700 and 700M have separate internal input and output shields. Models 700U and 700UM have no internal shields.

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Figure 7.25. Integrated Circuit Devices.

(Sheet 12)

CIRCUIT DESCRIPTION

The 3450,3451 and 3452 operate on the same principle, basically that of an operational amplifier followed by a high accuracy isolation stage (Figure 1a). The high accuracy of the isolation stage is achieved by use of a proprietary feedback technique in combination with high-stability components.

Isolated DC power for the input amplifier is provided by an internal DC-DC converter which derives its power from the external +15 Vdc supply.

Although a DC-DC converter and modulation techniques are used, the output noise is typically less than 1 mV (peak) as a result of careful design, internal filtering, and a shielded package. The frequency of this noise is approximately 100 kHz which makes it insignificant for many applications. Pulse width modulation minimizes pickup from adjacent units. The symbol shown in Figure 1b is used to represent the complete isolated operational amplifier.

The O/P COM pin must be connected to the PWR COM pin. Figure 10a shows the power supply connections and the optional offset and gain trims.

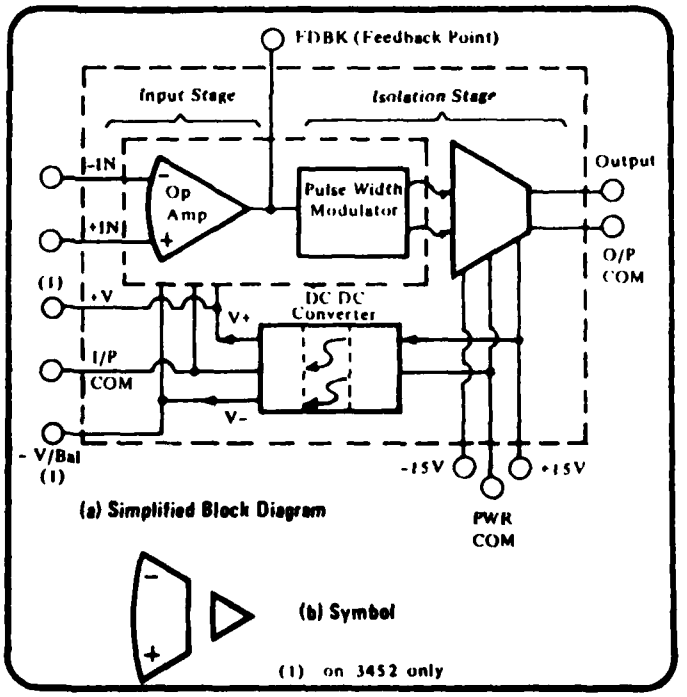


FIGURE 1. Block Diagram and Symbol

Figure 7.25. Integrated Circuit Devices.

(Sheet 13)

SPECIFICATIONS

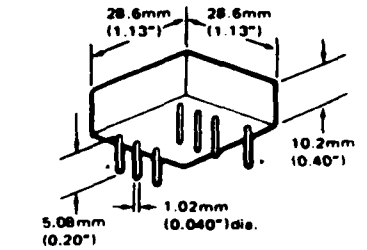
(Typical at 25°C with 15V supply unless otherwise noted.)

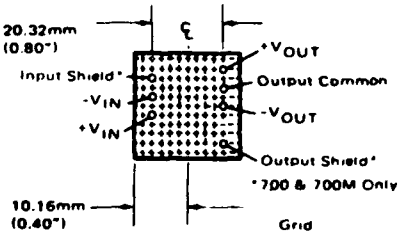
ELECTRICAL

MODEL	700/700M	700U/700UM
INPUT		
Voltage Range(1)	10V to 18V	
Current @ ±3 mA Load	20 mA	
Current @ ±30 mA Load	89 mA, max.	
Ripple Current @ ±3 mA Load	±3 mA, peak	
Ripple Current @ ±30 mA Load	±25 mA, peak	
ISOLATION(2)		
Voltage, Test, 5 sec. @ 60 Hz	4200Vp	5000Vp
Voltage, Continuous, derated	1500Vp	2000Vp
Impedance	10G Ω‖5 pF	10G Ω‖3 pF
Leakage Current @ 240V/60 Hz	1 µA, max.	1 µA, max.
OUTPUT		
V_{out} @ ±3 to ±30 mA Load	$\pm V_{in}$ with ±1V tolerance	
Operating Current total of both outputs	60 mA max.	
Safe Nondestructive Current at 25°C	120 mA max.	
Sensitivity to Input Voltage	1.08V/V	
Load Regulation	35 mV/mA	
Ripple Voltage @ ±3 mA Load	±15 mV, peak	
Ripple Voltage @ ±30 mA Load	±80 mV, peak max.	
Balance of +V and -V @ +I = -I	±20 mV	
TEMPERATURE RANGE		
Operating	-25°C to +85°C	
Storage	-55°C to +125°C	

NOTES: 1. Derate to 16V max between $+V_{in}$ and $-V_{in}$ above 70°C.
2. A medical grade unit is available which is 100% screened to Patient Connected Circuit requirements for the leakage current (par. 27.5) and dielectric withstand voltage (par. 31.11) of UL544. Specify 700M or 700UM.

MECHANICAL





Material Black Epoxy
Weight 22.67 gm (0.80 oz.) max
Grid: 2.50mm (0.10")
Pin: Pin material and plating composition conform to Method 2003 (solderability) of MIL-STD-883 (except paragraph 3.2)

NOTE Input and Output circuits have separate shields

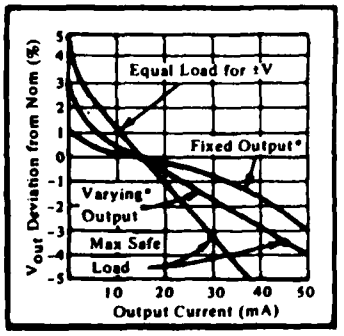


FIGURE 1. Load Regulation.

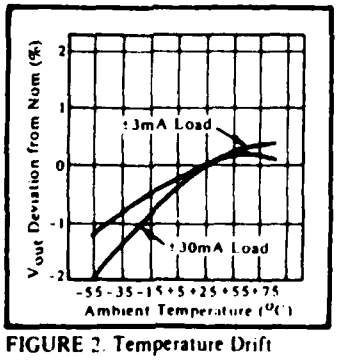


FIGURE 2. Temperature Drift

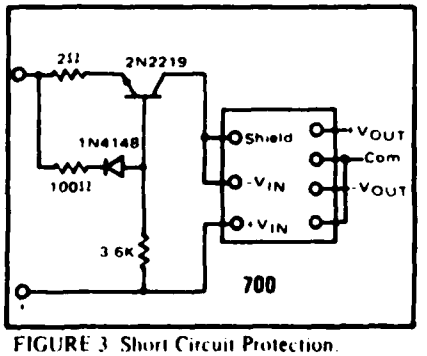


FIGURE 3. Short Circuit Protection.

*For one output with constant 15 mA load and varying current on other output.
(A minimum load of 3mA is recommended for each output)

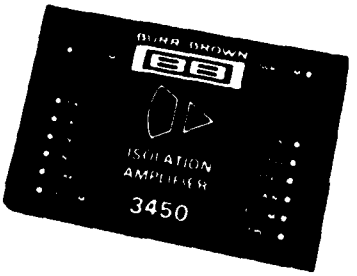
Use with Isolation Amplifiers:

When the Model 700/700U is used with isolation amplifiers such as the Burr-Brown 3650 and 3652 special attention should be given to current ratings to avoid over designing. Since the isolation amplifiers do not draw max. current simultaneously from the +V and -V Model 700/700U terminals, it is possible to drive more isolation amplifiers per Model 700/700U than one might initially expect. The Model 700/700U is capable of providing a total output current of 60 mA balanced or unbalanced between the two outputs. A minimum load of 3 mA is recommended for each output

The information in this publication has been carefully checked and is believed to be reliable, however, no responsibility is assumed for possible inaccuracies or omissions. Prices and specifications are subject to change without notice. No patent rights are granted to any of the circuits described herein.

Figure 7.25. Integrated Circuit Devices.

BURR-BROWN



3450
3451
3452
3455

Precision Linear ISOLATION AMPLIFIERS

FEATURES

- 2000V ISOLATION (3452)
- 160dB ISOLATION-MODE REJECTION
- DIFFERENTIAL INPUT
- 0.005% GUARANTEED GAIN LINEARITY (3450)
- 1μV/°C INPUT VOLTAGE DRIFT (3450)
- 20pA INPUT BIAS CURRENT (3452)
- PRECISION WIRE-WOUND RESISTORS FOR LONG TERM STABILITY
- LOW INTERFERENCE PICKUP-PW. MODULATION

DESCRIPTION

The Models 3450, 3451 and 3452 are operational amplifiers with the unique feature of having the output completely isolated from the input. This is accomplished by a high accuracy modulation/demodulation stage which isolates the input from the output by $10^{12}\Omega$ in parallel with 12 pF of coupling capacitance and provides gain linearity and stability far superior to that offered by ordinary isolation amplifiers.

These devices differ from other isolation amplifiers in several respects. They are true differential input operational amplifiers where as other commercially available isolation amplifiers are simple unity-gain isolators or are capable of a few fixed gains. Thus they can be connected in all of the common op amp feedback circuits such as summing, inverting, differentiating, etc.

The 3452 differs from the 3450 and 3451 in that it has higher isolation voltage (2000 volts vs 500 volts) and has isolated ± 15 Vdc power available at the input.

The 3450 and 3451 differ from each other primarily in their input stage characteristics. The 3450 has a low drift (1 μV/°C) bipolar transistor input stage while the 3451 has a low bias current (25 pA) FET transistor input stage. The 3455 is identical to the 3452 except for additional isolation specifications more well suited for medical applications

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Figure 7.25. Integrated Circuit Devices.

(Sheet 15)

MOTOROLA

MC14490

HEX CONTACT BOUNCE ELIMINATOR

The MC14490 is constructed with complementary MOS enhancement mode devices, and is used for the elimination of extraneous level changes that result when interfacing with mechanical contacts. The digital contact bounce eliminator circuit takes an input signal from a bouncing contact and generates a clean digital signal four clock periods after the input has stabilized. The bounce eliminator circuit will remove bounce on both the "make" and the "break" of a contact closure. The clock for operation of the MC14490 is derived from an internal R-C oscillator which requires only an external capacitor to adjust for the desired operating frequency (bounce delay). The clock may also be driven from an external clock source or the oscillator of another MC14490.

- Diode Protection on All Inputs
- Noise Immunity = 45% of V_{DD} Typical
- Six Debouncers per Package
- Internal Pullups on All Data Inputs
- Internal Oscillator (R-C), or External Clock Source
- TTL Compatible Data Inputs/Outputs
- Single Line Input, Debounces Both "Make" and "Break" Contacts
- Does Not Require "Form C" (Single Pole Double Throw) Input Signal
- Cascadable for Longer Time Delays
- Schmitt Trigger on Clock Input (Pin 7)
- Supply Voltage Range = 3.0 Vdc to 18 Vdc (MC14490EFL/FL/FP)
  = 3.0 Vdc to 6.0 Vdc (MC14490EVL/VL/VP)

CMOS LSI

(LOW-POWER COMPLEMENTARY MOS)

HEX CONTACT BOUNCE ELIMINATOR

L SUFFIX
CERAMIC PACKAGE
CASE 620

P SUFFIX
PLASTIC PACKAGE
CASE 648

ORDERING INFORMATION

MC14490

Suffix	Denotes
L	Ceramic Package
P	Plastic Package
F	Extended Operating Voltage Range (3V to 18V)
V	Limited Operating Voltage Range (3V to 6V)
Blank	Standard Operating Temperature Range (-40 to +85°C)
E	Extended Operating Temperature Range (-55 to +125°C)

BLOCK DIAGRAM

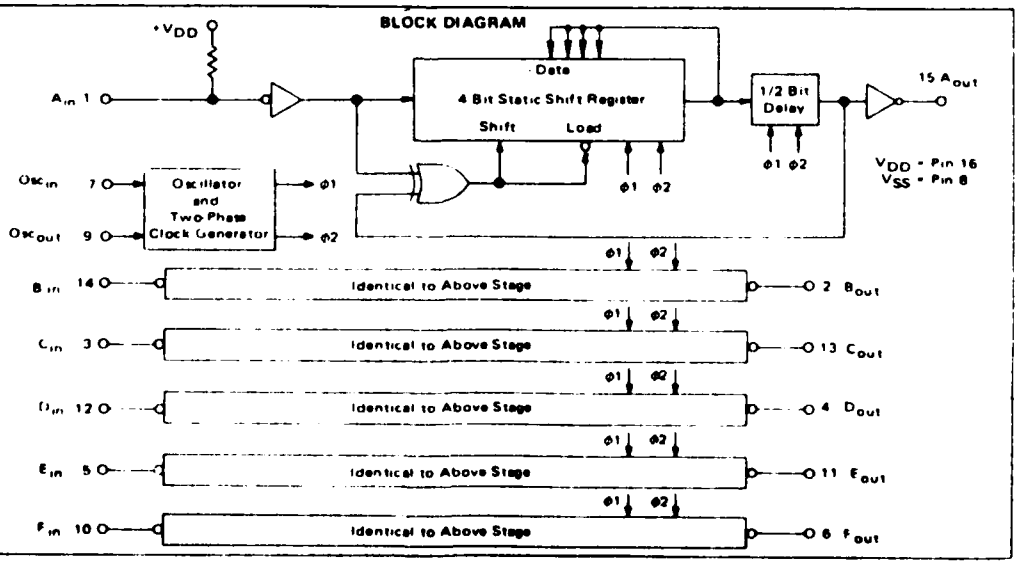


Figure 7.25. Integrated Circuit Devices.

(Sheet 16)

MOTOROLA

MC14075B

TRIPLE 3–INPUT "OR" GATE

The B Series logic gates are constructed with P and N channel enhancement mode devices in a single monolithic structure (Complementary MOS). Their primary use is where low power dissipation and/or high noise immunity is desired.

- Quiescent Current = 0.5 nA typ/pkg @ 5 Vdc
- Noise Immunity = 45% of V_{DD} typ
- Supply Voltage Range — 3.0 Vdc to 18 Vdc
- All Outputs Buffered
- Capable of Driving Two Low-power TTL Loads, One Low-power Schottky TTL Load or Two HTL Loads Over the Rated Temperature Range
- Double Diode Protection on All Inputs
- Pin-for-Pin Replacement for CD4075B

CMOS SSI

(LOW POWER COMPLEMENTARY MOS)

TRIPLE 3-INPUT "OR" GATE

L SUFFIX
CERAMIC PACKAGE
CASE 632

P SUFFIX
PLASTIC PACKAGE
CASE 646

ORDERING INFORMATION

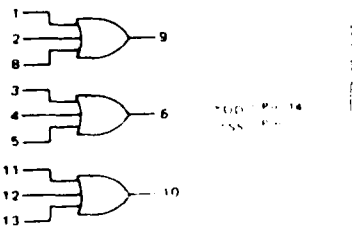
MC14XXXB — Suffix Denotes
- L Ceramic Package
- P Plastic Package
- A Extended Operating Temperature Range
- C Limited Operating Temperature Range

MAXIMUM RATINGS (Voltages referenced to V_{SS})

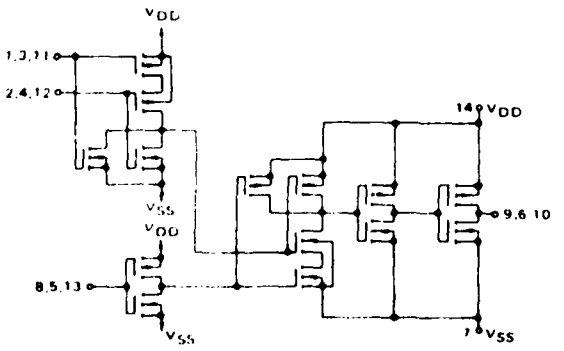
Rating	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	0.5 to +18	Vdc
Input Voltage, All Inputs	V_{in}	0.5 to V_{DD} +0.5	Vdc
DC Current Drain per Pin	I	10	mAdc
Operating Temperature Range — AL Device CL/CP Device	T_A	55 to +125 -40 to +85	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

See the MC14001B data sheet for complete characteristics for this device.

LOGIC DIAGRAM



CIRCUIT SCHEMATICS
(1/3 of Device Shown)



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation, it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \le (V_{in}$ or $V_{out}) \le V_{DD}$.

Unused inputs must always be tied to an *appropriate logic voltage level* (e.g., either V_{SS} or V_{DD}).

Figure 7.25. Integrated Circuit Devices.

(Sheet 17)

PMI®

DAC-08

8 BIT HIGH SPEED MULTIPLYING D/A CONVERTER

UNIVERSAL DIGITAL LOGIC INTERFACE

GENERAL DESCRIPTION

The DAC-08 series of 8 bit monolithic multiplying Digital-to-Analog Converters provide very high speed performance coupled with low cost and outstanding applications flexibility.

Advanced circuit design achieves 85 nsec settling times with very low "glitch" and at low power consumption. Monotonic multiplying performance is attained over a wide 40 to 1 reference current range. Matching to within 1 LSB between reference and full scale currents eliminates the need for full scale trimming in most applications. Direct interface to all popular logic families with full noise immunity is provided by the high swing, adjustable threshold logic inputs.

High voltage compliance dual complementary current outputs are provided, increasing versatility and enabling differential operation to effectively double the peak-to-peak output swing. In many applications, the outputs can be directly converted to voltage without the need for an external op amp.

All DAC-08 series models guarantee full 8 bit monotonicity, and nonlinearities as tight as ±0.1%over the entire operating temperature range are available. Device performance is essentially unchanged over the ±4.5V to ±18V power supply range, with 33 mW power consumption attainable at ±5V supplies.

FEATURES

- **Fast Settling Output Current** . . . . . 85 nsec
- **Full Scale Current Prematched to ±1 LSB**
- **Direct Interface to TTL, CMOS, ECL, HTL, PMOS**
- **Nonlinearity to ±0.1% Max Over Temp Range**
- **High Output Impedance and Compliance** . . −10V to +18V
- **Differential Current Outputs**
- **Wide Range Multiplying Capability** . . . . 1 MHz Bandwidth
- **Low FS Current Drift** . . . . . ±10ppm/°C
- **Wide Power Supply Range** . . . . . ±4.5V to ±18V
- **Low Power Consumption** . . . . . 33 mW @ ±5V
- **Low Cost**

The compact size and low power consumption make the DAC-08 attractive for portable and military/aerospace applications; devices processed to MIL-STD-883A, Level B are available.

DAC-08 applications include 8 bit, 1 μsec A/D converters, servo-motor and pen drivers, waveform generators, audio encoders and attenuators, analog meter drivers, programmable power supplies, CRT display drivers, high speed modems and other applications where low cost, high speed and complete input/output versatility are required.

EQUIVALENT CIRCUIT

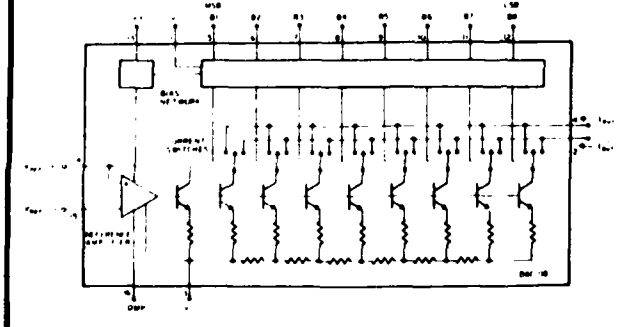
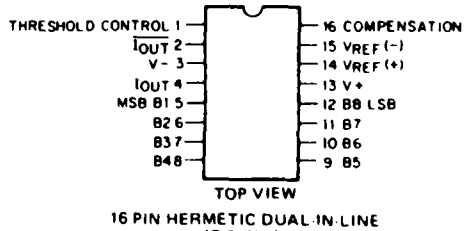


FIGURE 1

ORDERING INFORMATION AND PIN CONNECTION



TOP VIEW

16 PIN HERMETIC DUAL-IN-LINE
(Q-Suffix)

MODEL	TEMP RANGE	NONLINEARITY
DAC-08AQ	-55°/+125°C	·0 1%
DAC-08Q	-55°/+125°C	·0 19%
DAC-08HQ	0°/70°C	·0 1%
DAC-08EQ	0°/70°C	·0 19%
DAC-08CQ	0°/70°C	·0 39%

Military Temperature Range Devices
With MIL-STD-883A Class B Process ng

ORDER DAC-08-883-AQ
DAC-08-883-Q

Figure 7.25. Integrated Circuit Devices.

(Sheet 18)

OP-02

HIGH PERFORMANCE GENERAL PURPOSE OPERATIONAL AMPLIFIER

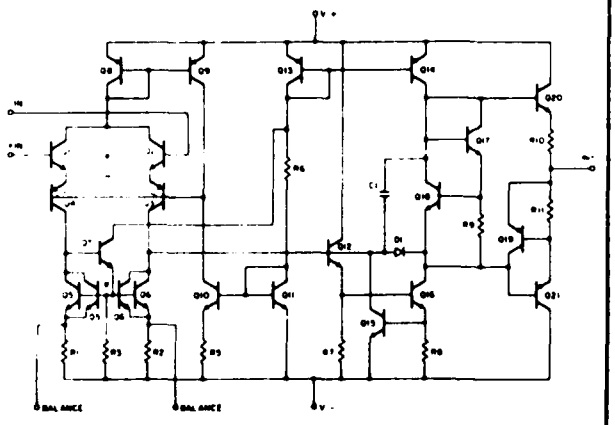
GENERAL DESCRIPTION

The OP-02 Series of High Performance General Purpose Operational Amplifiers provides significant improvements over industry-standard and "premium" 741 types while maintaining pin-for-pin compatibility, ease of application, and low cost. Key specifications, such as V_{OS}, I_{OS}, I_B, CMRR, PSRR and A_{VO}, are guaranteed over the full operating temperature range. Precision Monolithics' exclusive Silicon-Nitride "Triple Passivation" process eliminates "popcorn noise." A thermally-symmetrical input stage design provides low TCV_{OS}, TCI_{OS} and insensitivity to output load conditions. The OP-02 Series is ideal for upgrading existing designs where accuracy improvements are required and for eliminating special low drift or low noise selected types. OP-02's with MIL-STD-883 processing are available. For dual high performance matched general purpose operational amplifiers, refer to the OP-04 and OP-14 data sheets.

FEATURES

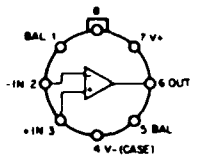
- Excellent D.C. Input Specifications
- Fits Standard 741 Socket
- Internally Compensated
- Low Noise . . . . . 0.65 μVp p Typ
- Low Drift (TCV_{OS}) . . . . . 8 μV/°C Max
- "Premium" 741 Replacement
- 0°C/+70°C and -55°C/+125°C Models
- MIL-STD-883 Processing Available
- Silicon-Nitride Passivation
- Low Cost

SIMPLIFIED SCHEMATIC

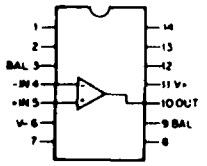


PIN CONNECTIONS AND ORDERING INFORMATION

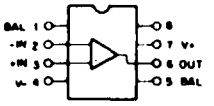
TOP VIEW



TO-99 (J-Suffix)
ORDER
OP-02AJ
OP-02J
OP-02EJ
OP-02CJ



14 PIN HERMETIC DIP (Y Suffix)
ORDER
OP-02AY
OP-02Y
OP-02EY
OP-02CY



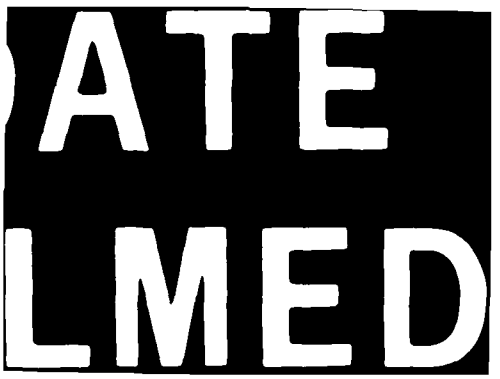
EPOXY 8 MINI DIP (P-Suffix)
ORDER
OP-02CP

Military Temperature Range Devices with MIL-STD-883A Class B Processing

ORDER OP02-883-AJ
OP02-883-AY
OP02-883-J
OP02-883-Y

Figure 7.25. Integrated Circuit Devices.

(Sheet 19)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