Omega®
D5500

Auto CLS
Dichroic Lamphouse System

D5500 Chassis
(Cat. No. 407-900)

Auto CLS Dichroic Lamphouse
(Cat. No. 407-904)

Auto CLS Controller II
(Cat. No. 407-921)

Auto CLS Controller
(Cat. No. 407-911)

Auto CLS Translator/Controller
(Cat. No. 407-910)

Service Manual

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INTRODUCTION

This manual provides servicing and repair instructions for the D5500 Auto CLS Dichroic Lamphouse System, which includes the following components:

- D5500 Chassis, Catalog Number 407-900
- Auto CLS Dichroic Lamphouse, Catalog Number 407-904
- Auto CLS Controller, Catalog Number 407-911
- Auto CLS Controller II, Catalog Number 407-921
- Auto CLS Translator/Controller, Catalog Number 407910

Refer to the Instruction Manual, Publication Number 9-183-0686, for detailed information on equipment specifications, installation and operation.

The procedures and information provided herein are intended for use by qualified field service and shop personnel who have the expertise, equipment and facilities necessary to maintain, troubleshoot, repair and recalibrate this type of equipment. Unauthorized repairs made on the equipment within the equipment warranty period may void the Warranty if, in the opinion of the manufacturer, such repairs were incorrectly accomplished and/or resulted in additional equipment damage.

Section 1 of this manual provides functional circuit descriptions to support maintenance; Section 2 provides equipment adjustments and calibration; Section 3 covers equipment checkout, troubleshooting and repair; Section 4 includes equipment schematic diagrams as maintenance aids; and Section 5 provides information for ordering and parts identification.

SECTION 1 - SYSTEM OPERATION

GENERAL

This section describes the functional operation of the overall system, as well as functional descriptions of the lamphouse electronics, Auto CLS Controller and Auto CLS Translator/Controller. Refer to Section 4 for schematic diagrams of these components.

BASIC CLOSED LOOP SYSTEM, FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

As shown in figure 1-1, the basic closed loop system includes a CLS Controller console, power supply, cyan, magenta and yellow motor drives, C, M and Y dichroic filters, quartz-halogen enlarger lamp and color balance probe. Except for the controller console, all components are located within the lamphouse.

All filtration and exposure information is displayed and controlled at the CLS Controller. Cyan, magenta and yellow filtration, from 0 to 199 CC, is set into the system via the controller membrane switch panel and maintained automatically by a closed loop, which includes lamp DS2, dichroic filters and associated positioning drive motors, color balance probe and CLS Controller. A single ribbon cable assembly provides all signal and voltage interconnections between the controller and the lamphouse electronics.

Initial CC filtration values for the C, M and Y channels are selected at the controller panel and displayed on the associated three-digit color channel displays. Entering the selected values into the system microprocessor causes the C, M and Y drive channels to drive the dichroic filters to the appropriate position in the light path, as sensed by monitoring the respective channel outputs from the color balance probe. The probe outputs are constantly checked by the controller circuits to ensure that the proper color balance is maintained.

The 120-volt ac 50 or 60 Hz input power source is connected to the lamphouse and power supply via line filter J6 and plug P1. The power source is checked initially to determine if the line frequency is 50 or 60 Hz $\pm$5%.

The quartz-halogen lamp, DS2, is rated for operation at 82 volts ac, 200 watts. However, the lamp is operated at a reduced voltage of 78 volts ac during white light focusing mode to provide extended lamp life. The power supply also contains an RMS constant voltage regulator which stabilizes the lamp supply voltage to correct for line voltage fluctuations.

The light from DS2 is applied through a heat-absorbing glass filter to remove heat and color-degrading effects of IR radiation. The filtered light then enters the mixing chamber, via the dichroic filters, where the color balance of the light is constantly monitored through a port by the color balance probe assembly. This assembly includes three gallium arsenide phosphide photodetectors, red, blue and green filters and an IR filter. Each photodetector has an associated factory-adjusted offset control to balance the respective probe amplifier offset to a slightly positive value (2 to 20 mv).

The color probe sensor outputs are applied to the controller circuits and converted into equivalent CC values, shown in the color channel displays. Each channel also has a user-adjustable gain control. As a result of the closed loop action of the system, the sensor outputs are monitored for deviation from the desired CC values and corrections made automatically via the C, M and Y motors.

The controller also includes a line-frequency-controlled electronic timer which provides lamp exposure timing from .1 to 999 seconds, with the selected timing indicated on a three-digit front-panel displays.

The sequence of the translator controller panel functions is automatically programmed by the internal microprocessor circuits to guide the operator in entering the required system data, in the normal operating sequence. Front-panel switches illuminate as the operational sequence progresses.

The power supply also contains failure detection circuits to monitor cooling fan operation, enlarger lamp burn-out, improper installation of the mixing chamber and supply line frequency. In the event of a failure, the front-panel displays provide an error message and the controller inhibits the system from further operation until the situation is corrected.

The CLS Translator/Controller interfaces with the system in the same manner as the basic CLS Controller. However, the translator/controller can be programmed to accept up to 19 program memories, including density, color channel settings and exposure timing. On-easel density corrections are made by the density probe, connected to the console via J2.

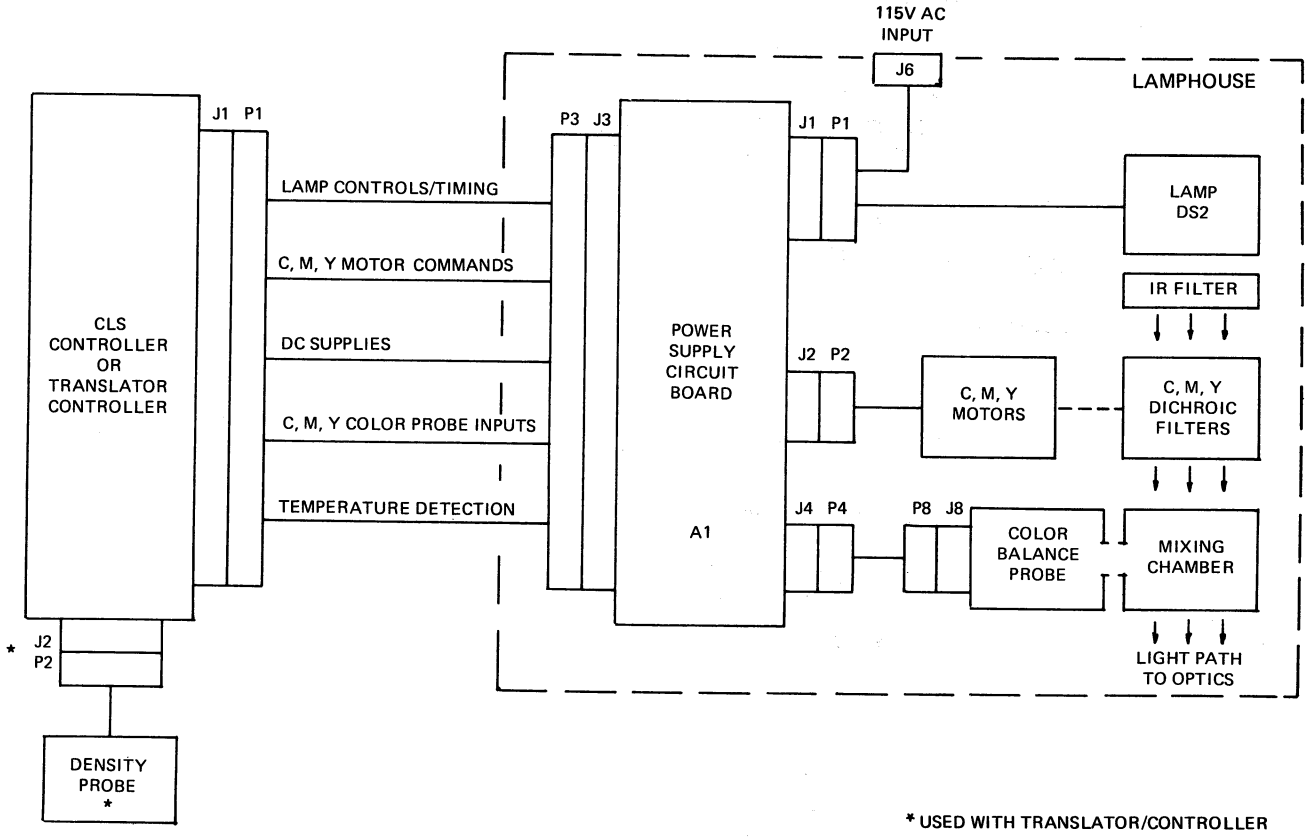


Figure 1-1. Basic Closed Loop System, Functional Block Diagram

LAMPHOUSE ELECTRONICS, FUNCTIONAL DESCRIPTION

Figure 1-2 is a functional block diagram of the lamphouse electronics; refer to figure 4-1 for a schematic diagram.

The lamphouse includes a circuit board, A1, which contains both regulated and unregulated dc supplies for the system; drive circuits for the cyan, magenta and yellow filter motors; and lamp voltage control and switches. Four connectors interface the lamphouse electronics with the associated controller (J3), input power supply circuits (J1), lamphouse motor drives (J2) and color balance probe (J4).

The 120v ac input is applied via line filter J6 and power ON-OFF switch S1 to the primary windings of power transformers T1 and T2 and to triac switch Q1. Transformers T1 and T2 supply the low-voltage ac input to the unregulated dc supplies and to the zero crossing detector. Three dc power supplies are included in A1: +5v dc unregulated from U1; +12v dc unregulated from U2; and +10v dc unregulated from CR2, CR3. The +12v dc supply is connected to the analog circuits in the controller via J3-20 and to +10v dc regulator VR2. The regulated +10v dc is applied to thermistor RT1, which monitors the lamphouse temperature and provides warning indications to the controller via J3-18 in the event of cooling fan failures. The +10v dc output is also supplied to the analog circuits in the controller via J3-22. The +10v dc output of CR2, CR3 provides operating voltages for the controller LED displays, via J3-15, -17.

The zero crossing detector, which receives +5v dc regulated from VR1 in the controller, monitors the sine-wave and provides an output pulse via U8 and U9 each time the ac signal crosses the zero point. As a result, the output pulses supplied at J3-10 are directly proportional to the frequency of the ac supply voltage and are processed by the controller circuits to prevent system operation on supply voltage frequencies which are not either 50 or 60 Hz $\pm$5%.

The lamp control circuits ensure that the lamp supply voltage is regulated to a nominal 78v ac during focus/white light mode (LAMP ON signal at J3-14), increasing to a nominal 82v ac during filter and expose mode (WHITE LIGHT ON signal at J3-9). Rms-to-dc converter U3 monitors a proportional current signal from the lamp supply circuit and functions as a constant-voltage stabilizer to regulate the lamp supply in the event of line voltage fluctuations by varying the triac "on" time. U10 and U11 are opto-isolators that connect the buffered lamp control signals to the ac line connected lamp control circuit. U10 turns the lamp on, while U11 reduces the lamp voltage by 5% during white light operation.

The lamp voltage is controlled by triac Q1, and the triac "on" time is determined by timing circuit U5. U4 controls the difference between high and low voltage. True rms converter U3 reads the lamp voltage and sets the turn-on time of the timer.

Resistor R10 and thermistor RT1 are used as a temperature-sensing circuit. RT1 is a positive temperature coefficient thermistor that has a very sharp "knee". When the temperature exceeds approximately 120 degrees C. the voltage across RT1 increases and the microprocessor in the controller shuts down the system and displays a "NO FAN" error message (or all "H`s").

The cyan, magenta and yellow drive channels are identical. Each channel receives either a forward or reverse input signal from the controller which drives the associated filter motor. The respective dichroic filters are driven to the proper position, as monitored via a feedback loop which is nulled out by the color balance probe and circuits within the controller.

The direction of motor rotation (M1, for example) is determined by the control voltage applied to P3-2 or P3-7. A control voltage at P3-2 initiates forward (downward) filter motion; while a control voltage at P3-7 causes a reverse (upward) filter motion. The circuit of U14 and U12 prevents the possibility of both directions being on at the same time, which would damage U15. All inputs are pulled low by resistor pack U13 to prevent operation of the motor circuits in the event of an open cable. U6, U15 and U21, on the controller circuit board (U19, U20 and U21, on the translator controller circuit board) are buffers for the motor control signals.

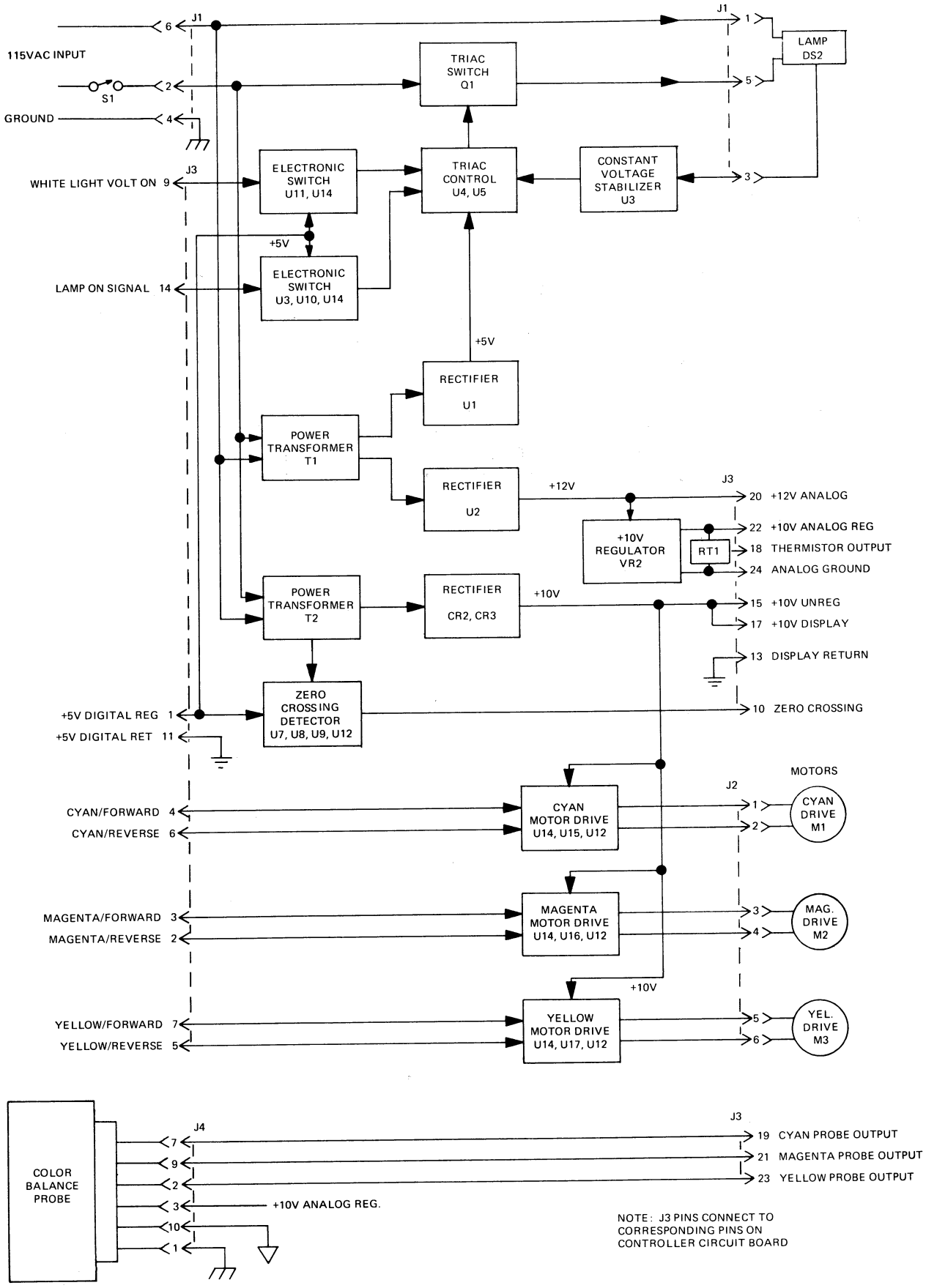


Figure 1-2. Lamphouse Electronics, Functional Block Diagram

CLS TRANSLATOR/CONTROLLER AND CLS CONTROLLER, CIRCUIT DESCRIPTIONS

The following circuit descriptions apply to both controllers; data which is peculiar to the translator/controller is included in parenthese ( ). Refer to the schematic diagrams for the CLS Controller and the CLS Translator/Controller, figures 4-1 through 4-4.

ANALOG SIGNAL PROCESSING CIRCUITS

The main component in the analog circuit is the multiplexed analog-to-digital converter, U1. The input from the sensors is applied to the A/D converter and the address supplied by the microprocessor determines which signal appears at the MUX output, pin 15. This signal is then applied to electronic switch U3 (U4) and then through amplifier U4 (U2) to the second switch input. The operational amplifier supplies a gain of 16. The control signal to pin 5 of the switch determines the gain, unity or 16, of the operational amplifier stage. The signal is then applied to the comparator input of the A/D converter, at pin 18. Regulator U2 provides the 5 volt voltage reference for the A/D converter. Input pin 6 to the A/D converter monitors the reset voltage of the keyboard/display controller U20 (U16) and the array recall of the NOVRAM memory, U17 (U22). The microprocessor does not initiate normal system operation until this voltage reaches at least 3 volts. The outputs of the photocells are supplied to respective operational amplifiers which are adjusted to a standard output of approximately 4 volts to the A/D converter when the lamp voltage is high and no filters are in the enlarger light path. The offset voltage is factory- or service-adjusted to about +20 millivolts to prevent errors since the A/D converter can only read positive voltages.

DISPLAY AND KEYBOARD CONTROL CIRCUITS

The 8279 keyboard/display IC, U20 (U16), automatically refreshes the display and multiplexes it and checks the keyboard for entries. The timing is controlled by the microprocessor via the clock input, pin 3, and by software. The four SL lines supply encoded digit select signals, from 1 to 16, which are decoded by U13 (U8) and select the proper digit through U12 and U14 (U7 and U9) digit drivers. The segment information is applied through buffers U6 and U11 to segment driver U10 (U6) and limiting resistor pack U9 (U5). The LED`s (on the translator/controller, also DS1, the MSD of the memory display) are the decimal points of the respective digit. The supply voltage for the displays is unregulated and controlled by Q1. Potentiometer R7 (R11) controls the bias, therefore varying the display brightness. The incandescent back lighting intensity is controlled by R8 (R12). The 8279 IC scans the keyboard between display refreshing by sending signals through U19 (U12) decoder and monitoring the eight return lines and the shift and control lines.

MICROPROCESSOR CONTROL SYSTEM

The microprocessor, U16, is the master control for the system. It receives instructions from two type 2716 EPROMS, U18 and U24. U23 is an address latch for the system. The address is also used to control the proper channel selection in the A/D converter. The basic timing of the

microprocessor is controlled by crystal Y1 at a frequency of 6 MHz. The exposure timing, however, is controlled by the ac line zero crossing signal which is used as the micro interrupt. The two output ports of the micro are used as follows:

Port 1-0: White light/filtered light signal
Port 1-1: Lamp on signal
Ports 1-2 through 1-7: Motor control
Ports 2-0 to 2-3: Address most significant bits
Port 2-4: Chip select for 8279 A/D converter and beep
Port 2-5: 8279 command line and beep
Port 2-6: NOVRAM memory select
Port 2-7: Store signal (only on translator/controller)

The bus, port 0, is the multiplexed data and address bus.

The beep signal is supplied via a single-shot multivibrator, U26 (U10). Non-volatile RAM (NOVRAM) U17 (U22) acts as a standard RAM except that on turn off (or when making a new program on the translator) the entire contents of the RAM are permanently stored and automatically recalled on turn-on.

SECTION 2 - ADJUSTMENT AND CALIBRATION

GENERAL

The system requires a minimum amount of maintenance-level adjustment and calibration. The only procedures that are required are: (a) adjustment of the lamp voltage regulator; (b) lens stage parallelism adjustments; and (c) mixing chamber sensor probe gain and offset adjustments.

TEST EQUIPMENT AND TOOLS REQUIRED

No special test equipment or tools are required for adjustment or calibration; a true rms meter or DVM is needed to adjust the lamp voltage. An adjustable level is required to perform the lens stage adjustments.

LAMP VOLTAGE ADJUSTMENT

a. Set power switch to OFF position.

b. Connect true rms meter across lamp DS2, between P1-5 and P1-3.

c. Set power switch to ON position, press FOCUS FILTER and observe meter reads 82 $\pm$0.1v ac after motors stop operating. If reading is out-of-tolerance, adjust potentiometer R2 (figure 3-3) to obtain correct reading.

d. Press FOCUS WHITE and verify that meter indicates 78 $\pm$2v ac.

e. Set power switch to OFF position and disconnect meter.

D5500 LENS STAGE ADJUSTMENT

The lens stage must be parallel to the film stage and to the baseboard for proper overall picture sharpness. A level is used to determine the film stage adjustment. Refer to the partial exploded view, figure 2-1, for location of indexed parts ( ) referenced in the following procedures.

CAUTION

Do not try to turn the knurled positioning screws while the associated setscrews are tight. Do not overtighten setscrews after adjustments are made.

a. Using an adjustable spirit level, place on baseboard and carefully adjust so that it reads level. All further leveling is with respect to the baseboard.

b. Check the level of the film stage with the adjustable level. If the film stage is not level, loosen the bolts securing the column and add shims as neccesary to obtain level.

c. Check the level of the lens stage (1) with the adjustable level. If necessary, adjust for left-to-right errors as described in paragraph d; or for front-to-back errors, as described in paragraph e.

d. Remove the lens and hold the level against the lens mounting plate. If the stage is out of alignment, adjust for left-to-right errors as follows:

1. Loosen the single allen head setscrew (2) in the rear of the lens stage (1) which holds the lens stage support (3) to the focusing assembly (4).

2. Adjust the two outside knurled screws (5) to level the lens stage (1). Note that both screws must be adjusted together. To tilt the lens stage to the right, for example, tighten the left screw, while loosening the right screw. Do not force the screws; just set screws snugly.

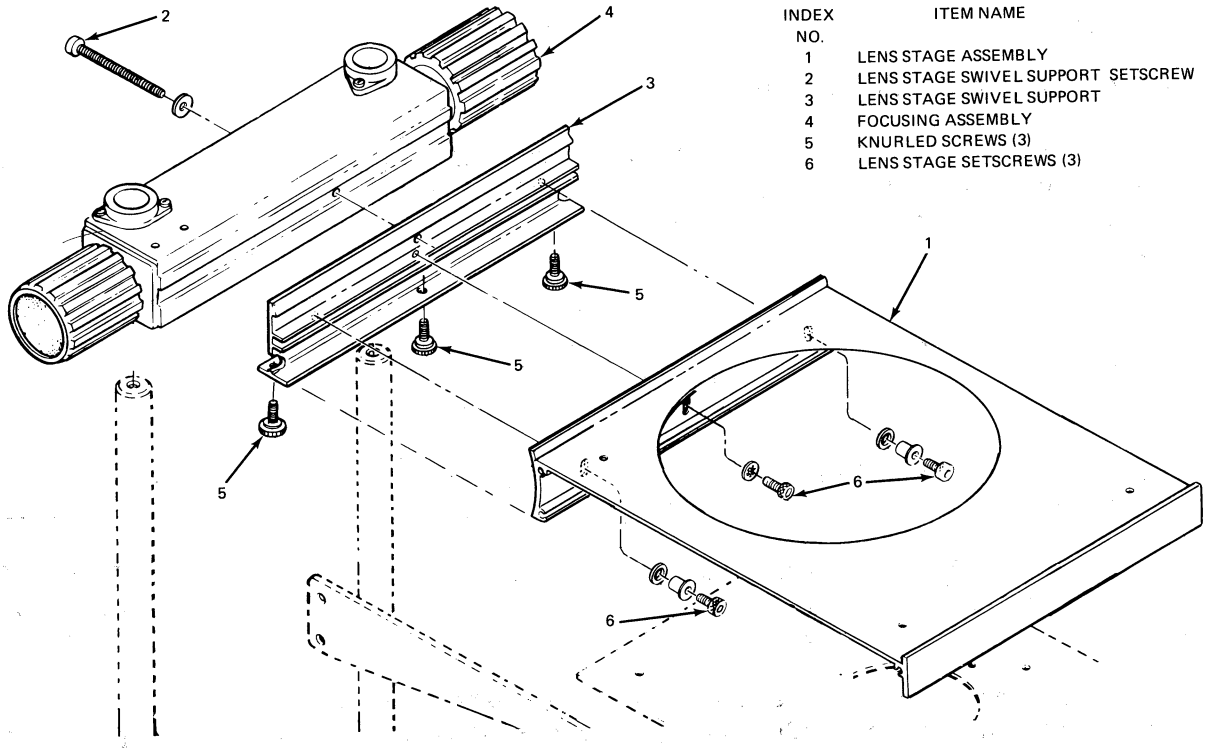
3. When the lens stage is level, left to right, tighten setscrew (2) while watching the level. If the level changes while the screw is being tightened, reset the adjustments, as necessary.

e. If the stage is out of alignment, front-to-back, adjust for errors as follows:

1. Loosen the three allen head setscrews (6) which hold the lens stage (1) to the lens stage swivel support (3).

2. To raise the front of the lens stage, tighten the center knurled screw (5) until the lens stage is level. To lower the front of the lens stage, loosen the screw. Maintain pressure on the front of the lens stage to keep the stage in contact with the screw.

3. Tighten the three setscrews (6) gradually and alternately while watching the level. If the level changes, repeat the procedure. Replace lens.



INDEX NO.	ITEM NAME
1	LENS STAGE ASSEMBLY
2	LENS STAGE SWIVEL SUPPORT SETSCREW
3	LENS STAGE SWIVEL SUPPORT
4	FOCUSING ASSEMBLY
5	KNURLED SCREWS (3)
6	LENS STAGE SETSCREWS (3)

Figure 2-1. Lens Stage Adjustments, Partial Exploded View

MIXING CHAMBER COLOR PROBE CALIBRATION

The mixing chamber color probe assembly, figure 2-2, has internal adjustments for setting gain and offset of each color channel. Gain checks and adjustments are performed during WHITE LIGHT mode, and the adjustments are accessible with the lamphouse panel removed; while offset adjustments are performed during READY PRINT mode and must be made with the probe removed from the mixing chamber to access the offset controls. Offset adjustments require the use of a breakout board to gain access to the circuit monitoring points; alternatively, if the controller has been disassembled, the test points can be accessed directly at the main lamphouse connector, J1.

The procedures require that color probe amplifiers gain is set first, then offset voltages are checked, or adjusted, as necessary. The gain adjustments affect the offset adjustments; however, the offset adjustments affect the gain adjustments only slightly, unless there is complete misalignment. If this is the condition, set the offset, adjust the gain and readjust the offset and gain, as necessary, until the correct values are obtained.

COLOR PROBE GAIN ADJUSTMENT

a. Set power switch to OFF position and remove lamphouse access panel.

b. Check that mixing chamber is properly seated.

c. Set power switch to ON position.

d. When motors stop operating, press WHITE, then press 0, on the data entry panel, to check probe calibration. The color displays should read as follows:

[ ][ ][0]	[ ][ ][0]	[ ][ ][0]
CYAN	MAGENTA	YELLOW

If the display readings are between 30 and -30 (acceptable), proceed to the Color Probe Offset Adjustment procedure;if the readings are outside this range, perform the sensor gain adjustment, as described in step e. Excessively positive readings will cause "AdJ" to be displayed. Excessively negative readings may cause the filter motors to attempt to drive the filters beyond the upper limit.

NOTE

Each gain adjustment is a multiturn potentiometer with no mechanical stops. If the end of rotation is reached, the shaft will continue to turn without changing the reading. Turn the control several turns in the opposite direction to vary the readings.

e. The C, M and Y sensor gain adjustments are located on the right side of the sensor assembly (figure 2-2). Adjust one channel at a time, using the yellow screwdriver supplied, adjusting clockwise (to increase) or counter-clockwise (to decrease), as necessary, until the readings for each channel are within a range of +10 to -10.

f. Set power switch to OFF position and replace lamphouse access panel, set power switch to ON position and return to normal operation.

COLOR PROBE OFFSET ADJUSTMENT

a. Set power switch to ON position, wait until motors stop operating, then press PRINT. Observe that DVM reads between 2 and 20 millivolts dc. Connect DVM across the magenta channel output, between P1-21/P8-9 (+ HI) and P1-24/P8-5 (- LO); and then across the output of the yellow channel, between P1-23/P8-2 (+ HI) and P1-24/P8-5 (- LO). If the channel outputs are not within the specified range, proceed to step b and adjust the respective offset control; if the correct readings are obtained, no adjustments are required.

b. The color probe, figure 2-2, is an integral part of the mixing chamber. To gain access to the offset adjustments, the probe must be removed from the mixing chamber. Set power switch to OFF, remove probe connector and remove mixing chamber with probe attached.

c. Remove four screws securing the cover to the top of the chamber; remove cover.

d. Slide front panel (with probe attached) upward out of chamber.

e. Remove three screws securing the probe to the panel and remove probe. Reattach connector to probe.

NOTE

The offset adjustments access holes are covered by a strip of black tape, which is removed and placed over the photocell ports to simulate a dark condition during calibration. After calibration, be sure to replace the tape over the offset adjustments access holes. Also, be sure to check that the probe gain is within tolerance before proceeding with the following procedures.

f. Connect breakout board between lamphouse and controller connector.

NOTE

When testing or adjusting the color probe as part of the lamphouse, do not allow the lamphouse bottom to be placed on any surface. There must be at least eight inches between the lamphouse bottom and the support surface, and the surface should be dark and non-reflecting. For best results, the lamphouse should remain on its normal operating chassis. The lamphouse access panel may be removed.

g. Connect DVM across the output of the cyan channel, between P1-19/P8-7 (+ HI) and P1-24/P8-5 (- LO).

h. Remove probe from mixing chamber and remove the black tape which covers the offset adjustment access holes. Place the tape over the light ports below the access hole to prevent the light from from reaching the photocells.

i. While observing the appropriate channel output on the DVM, adjust the respective offset control(s) for a reading of +10 millivolts (nominal setting).

j. Replace the tape over the control access holes and reinstall the probe on the mixing chamber.

k. Check that gain and offset readings are all within tolerance, repeat procedures, as necessary.

l. Set power switch to OFF position, disconnect breakout box and replace lamphouse cable.

m. Reassemble the probe and mixing chamber and install into lamphouse.

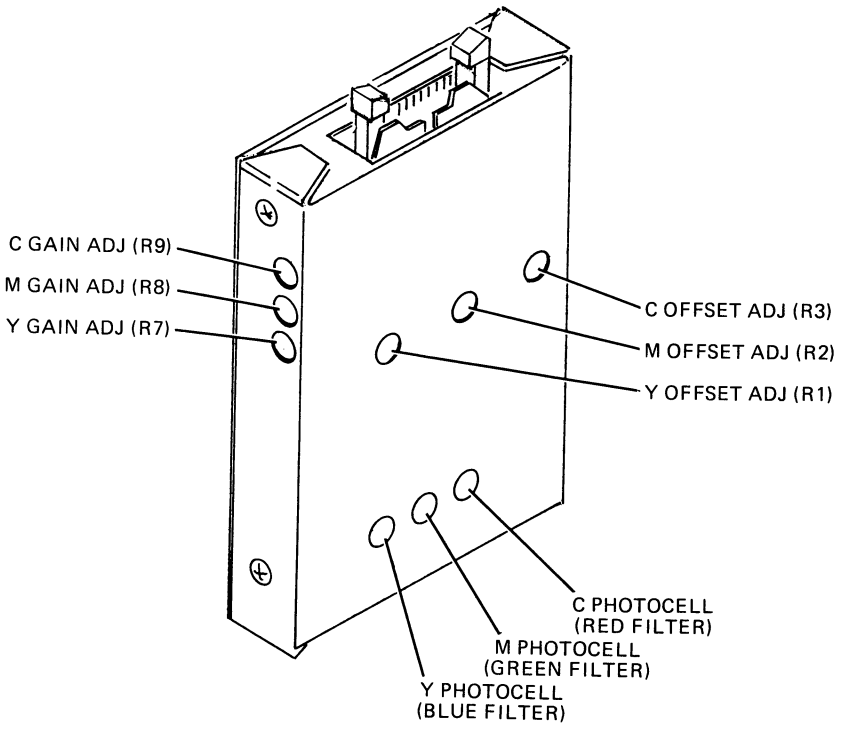


Figure 2-2. Location of Probe Assembly Adjustments

SECTION 3 - MAINTENANCE

GENERAL

This section includes instructions for troubleshooting, repair and checkout of the equipment. Good workmanship practices and proper use of test equipment is essential to ensure that the equipment is returned to proper operating condition. Follow troubleshooting suggestions and precautions whenever applicable.

TOOLS AND TEST EQUIPMENT REQUIRED

As a minimum, the following test equipment is required:

- Oscilloscope, dual-trace, for waveform analysis
- True RMS Digital Voltmeter for power supply checkout and circuit measurements
- Low-wattage soldering iron and desoldering equipment
- Frequency counter for clock and timing checks

CHECKOUT PROCEDURES

The system instruction manual provides general information on operation and use of the equipment. However, before performing troubleshooting or repair procedures, it is advisable to verify that equipment malfunctions are actually due to component failures, not the result of operator error or misinterpretation of operating instructions.

Perform the functional checkout procedures for the mixing chamber color probe (Section 2), Auto CLS Controller and the Auto CLS Translator/Controller, given in the following paragraphs, to determine whether the equipment is at fault. Note that these procedures should also be performed after repairs have been accomplished on the equipment and then represent minimum operating standards that the equipment must meet before it is returned to the user.

CLS CONTROLLER CHECKOUT PROCEDURE

a. Set power switch to ON position, note that "beep" sounds, fan operates and displays are all initially "8". After a short delay, the displays will show the last value used.

b. Adjust LED intensity via recessed front-panel DISPLAY control and observe that all display segments vary uniformly as the control is rotated between extremes. Return control to a normal setting.

c. Adjust legend lighting intensity via recessed front-panel LEGENDS control and observe that backlighting varies uniformly as the control is rotated between extremes. Return control to a normal setting.

d. Press WHITE LIGHT, TIME display blanks. Check density channel selection (d) by pressing CYAN and observe that cyan display changes from [ ][ ][0] to [d][ ][0]. Repeat for MAGENTA and YELLOW channels. Note that, as each channel is pressed, the display changes from [ ][ ][0] to [d][][0]. Press TIME to reset all channels to [ ][ ][0].

e. Press "0" (on numbered keyboard) and check mixing chamber color probe calibration. If the probe is calibrated precisely, each color display will show [ ][ ][0]. A reading between [-][3][0] and [ ][3][0] is acceptable. If out-of range readings are displayed, calibrate the mixing chamber probe as described in Section 2.

f. Press FILTER and observe that displays read the last values used.

g. Press TIME, "6", "0" and ENTER.

h. Press CYAN, "2", "4" and observe that CYAN displays [ ][2][4]. Press "3" and observe that the display "overflows", changing to [E]. Press ENTER and observe that nothing changes. Press any other channel and observe that CYAN display reverts to last valid reading. Press CYAN, "1", "2", "5" and ENTER. Observe that the CYAN display reads [1][2][5], the motors operate, and the display reads as follows:

[1][2][5]	[ ][ ][0]	[ ][ ][0]	[ ][6.][0]
CYAN	MAGENTA	YELLOW	TIME

i. Press MAGENTA, press and hold "up" key and observe that the MAGENTA display begins to increase at about 2 changes per second, increasing to about 5 changes per second after 5 changes. When the display reads [1][9][9] it resets to [ ][ ][ ] and repeats counting up. Press "down" key and observe that the display digits decrease, first slowly, then faster, until [0][0][0]. The display remains at this point and beep sounds. Press "8", "5", ENTER, and observe that display reads as follows:

[1][2][5]	[ ][8][5]	[ ][ ][0]	[ ][6.][0]
CYAN	MAGENTA	YELLOW	TIME

j. Press YELLOW, press "5", "5", ENTER, observe that YELLOW display reads [ ][5][5] and motors operate. Press READY-PRINT while motors are operating and observe that no change occurs. Pressing PRINT after the motors stop causes a beep sound, enlarger lamp extinguishes and display reads as follows:

[1][2][5]	[ ][8][5]	[ ][5][5]	[ ][6.][0]
CYAN	MAGENTA	YELLOW	TIME

k. While in READY-PRINT, press any channel key and note that only the TIME key beeps during this mode. Press "1", "2", "5" and observe that TIME display reads [1][2.][5]; press "0" and note that display reads [2][5][0]. Press TIME and note that display reverts to last valid reading, [ ][6.][0].

l. Press "3", "0", ENTER and note that display reads [ ][3.][0]. Press EXPOSE, time the exposure, observe that enlarger lamp illuminates and display counts down, by tenths, to 0, at which time the enlarger lamp extinguishes and the display returns to the original value. Press EXPOSE again and, during the exposure interval, check that the only keys that have an effect are the HOLD and CANCEL keys. Pressing HOLD extinguishes the lamp and "holds" the exposure time at the remaining interval; pressing cancel extinguishes the lamp and resets the TIME display. Note that the HOLD backlighting illuminates when this key is pressed. Press TIME again to complete the exposing cycle when in HOLD position.

m. Press TIME, "0","1", "0", "5", display reads [1][0][5], ENTER, then press EXPOSE. Note that TIME display counts down in seconds to 100, then counts down in tenths. Note that the beep sounds every second. Check the operation of the beeper switch (on the rear of the controller) by setting the switch OFF and noting that the beep sounds stop. Set switch back to ON. Check that HOLD and CANCEL keys function properly. Note that display reads as follows:

[1][2][5]	[ ][8][5]	[ ][5][5]	[1][0][5]
CYAN	MAGENTA	YELLOW	TIME

n. Press WHITE and note that motors operate. Press "0" after the motors stop and note that the color probe readings are displayed. Press FILTER and note that displays read as follows:

[1][2][5]	[ ][8][5]	[ ][5][5]	[1][0][5]
CYAN	MAGENTA	YELLOW	TIME

o. Press WHITE and, while motors operate, press PRINT; this key should have no effect. Press PRINT after motors stop; again, key should have no effect.

p. Press FILTER. ENTER "0" in CYAN, "50" in MAGENTA, "80" in YELLOW. Press PRINT, ENTER a time of 5.0 seconds and note that the displays read as follows:

[ ][ ][0]	[ ][5][0]	[ ][8][0]	[ ][5.][0]
CYAN	MAGENTA	YELLOW	TIME

q. Press WHITE and FILTER and observe that the display now reads as follows:

[ ][ ][0]	[ ][5][0]	[ ][8][0]	[ ][5.][0]
CYAN	MAGENTA	YELLOW	TIME

r. Set all channels to "0", ENTER CYAN "199" and wait for motors to stop. Note that the CYAN display value may change to a smaller value. Check each channel, in turn, to see what maximum filtration can be obtained. Each channel should be able to reach at least "170", with the other two channels at "0".

s. Press the foot switch (if supplied) and note that neither pedal has an effect. Press READY-PRINT, then press the FOCUS pedal of the foot switch. Observe that the enlarger lamp illuminates. Release the pedal and observe that the lamp extinguishes. Press the EXPOSE pedal and observe that the enlarger lamp illuminates for the timed interval. Release the EXPOSE pedal and note that the time continues to count down. Check that only HOLD and CANCEL have any effect during the exposure period.

t. Calibrate the system to a standard enlarger, as follows.

(1) Press FOCUS. While holding down CALIBRATE, press CANCEL. Note that system displays 0 filtration. ENTER desired filtration values and make a standard print.

(2) In PRINT mode, while holding down CALIBRATE, press HOLD.

(3) ENTER standard enlarger values on keypad.

(4) While holding down CALIBRATE, press ENTER. This calibrates the enlarger.

u. To check values in memory, while holding down CALIBRATE, press CYAN and note that displayed values represent the differences between your enlarger values and the standard enlarger values. These values should remain in memory even after the power is shut off.

v. Turn the equipment OFF. This completes the checkout procedure. If the equipment has passed the checkout satisfactorily, it is service-ready. If not, proceed to troubleshoot the equipment on the basis of the symptomatic trouble which was apparent when failure indications were obtained during the checkout.

CLS TRANSLATOR/CONTROLLER CHECKOUT PROCEDURE

a. Set power switch to ON position, note that "beep" sounds, fan operates and displays are all initially "8", except for the first MEMORY digit, which is a "1". After a short delay, the servo motors operate, the enlarger lamp lights, and the displays all blank out, except for the C, M and Y displays, which show [-][-][-]. When the servo motors stop, the lamp remain on and all displays are blank, except for the C, M and Y displays, which read as follows:

[ ][ ][0]	[ ][ ][0]	[ ][ ][0]
CYAN	MAGENTA	YELLOW

b. Adjust LED intensity via recessed front-panel DISPLAY control and observe that all display segments vary uniformly as the control is rotated between extremes. Return control to a normal setting.

c. Adjust legend lighting intensity via recessed front-panel LEGENDS control and observe that backlighting varies uniformly as the control is rotated between extremes. Return control to a normal setting.

d. Press CYAN and observe that cyan display changes from [ ][ ][0] to [ ][ ][-]. Repeat for MAGENTA and YELLOW channels. Note that, as each channel is pressed, the display changes from [ ][ ][0] to [ ][ ][-] and the displays on the other color channels change from [ ][ ][-] to [ ][ ][0]. The displays read as follows:

[ ][ ]	[ ][ ][ ]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[ ][ ][ ]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

e. Press DENSITY: a "beep" should sound and all color channels should display [ ][ ][0]. Press DENSITY again: no "beep" should be heard.

f. Press 0 and check mixing chamber color probe calibration. If the probe is calibrated correctly, each color display will show [ ][ ][0]. (A reading between [-][3][0] and [ ][3][0] is acceptable.) If out-of range readings are displayed, calibrate the mixing chamber probe as described in Section 2, then return to this step.

g. Press FOCUS-FILTER, observe that FOCUS-WHITE backlight extinguishes and FOCUS-FILTER and DENSITY backlights illuminate. The displays read as follows:

[ ][1]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[0][0.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

h. Press MEMORY. A beep should sound and the MEMORY backlight illuminates. The DENSITY backlight extinguishes, FOCUS FILTER backlight remains lit and the motors may operate. Display remains unchanged.

i. Check the operation of the digit keys. Press "1" and then "0" and observe that the display shows [1][0]. Sequentially press the "2" through "9" digit keys and observe that the "1" blanks out and the "0" changes to the selected key. Pressing the same key (other than "1") a second time will cause a beep sound but will not change the display; pressing the "1" a second time will change the display to [1][1].

j. Press "1" and ENTER. The motors may operate and the time display will change. The MEMORY backlight extinguishes, FOCUS FILTER remains lit and DENSITY backlight illuminates. The displays read as follows:

[ ][1]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[*][*][*]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

* Note that the TIME display always shows the last time entered previously for the selected program.

k. Press TIME and observe that it has no effect: TIME can be changed only in READY-PRINT. Press the other channels at random and observe that the pressed channel backlight illuminates and the remaining channel backlights extinguish.

l. Press DENSITY, press "6", "0", ENTER. The density display shows [ ][6][0] and the CYAN backlight illuminates. Press DENSITY again and press the "up" and "down" keys; there should be no change. Press CYAN and note that CYAN backlight illuminates.

m. Press "2", "4" and observe that CYAN displays [ ][2][4]. Press "3" and observe that the display "overflows", changing to [E]. Press ENTER and observe that nothing changes. Press any other channel and observe that CYAN display reverts to last valid reading and the most-recently pressed channel backlight illuminates. Press CYAN and "1", "2", "5", ENTER. Observe that the CYAN display reads [1][2][5] and the motors operate. The CYAN backlight extinguishes, the MAGENTA backlight illuminates and the TIME LSD decimal point lights and, after a while, flashes, then remains off. The display reads as follows:

[ ][1]	[ ][6][0]	[1][2][5]	[ ][ ][0]	[ ][ ][0]	[*][*][*.]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

n. Press and hold "up" key and observe that the MAGENTA display begins to increase at about 2 changes per second, increasing to about 5 changes per second after 5 changes. When the display reads [1][9][9] it resets to [ ][ ][0] and repeats counting up. Press "down" key and observe that display digits decrease, first slowly, then faster, until [ ][ ][0]. The display remains at this point and beep sounds. Whenever the "up" or "down" key is released, the servo motors drive to the selected filtration. Press "8", "5", and ENTER. Observe that the motors operate, MAGENTA backlight extinguishes and the YELLOW backlight illuminates. The display reads as follows:

[ ][1]	[ ][6][0]	[1][2][5]	[ ][8][5]	[ ][ ][0]	[*][*][*]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

NOTE

The display may change to [ ][H][I] when the "up" key is held depressed. This indicates that there is a value in memory which, when added to the display value, exceeds 199. Similarly, the display may indicate [ ][L][O] when the sum of the display and memory values is less than 0.

o. Press "5", "5", ENTER, observe that YELLOW display reads [5][5], motors operate, YELLOW backlight extinguishes and TIME backlight flashes (as an

indication that the density probe was not used). Try pressing READY-PRINT while the motors are operating and observe that no change occurs. Pressing READY-PRINT after the decimal point starts flashing causes a beep sound, the FOCUS-FILTER backlight extinguishes and the READY-PRINT backlight illuminates. The enlarger lamp extinguishes and the TIME backlght flashes. The display reads as follows:

[ ][1]	[ ][6][0]	[1][2][5]	[ ][8][5]	[ ][5][5]	[*][*][*]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

p. While in READY-PRINT, press any channel key and note that only the TIME key beeps during this mode. Press "1", "2", "5" and observe that TIME display reads [1][2.][5]; press "0" and note that display reads [2][5][0]. Press TIME and note that display reverts to the original value.

q. Press "3", "0", "0", ENTER and note that display reads [3][0.][0]. Press EXPOSE, time the exposure, observe that enlarger lamp illuminates and display counts down, by tenths, to 0, at which time the enlarger lamp extinguishes and the display returns to the original value. Press EXPOSE again and, during the exposure interval, check that the only keys that have an effect are the HOLD and CANCEL keys. Pressing HOLD extinguishes the lamp and "holds" the exposure time at the remaining interval; pressing cancel extinguishes the lamp and resets the TIME display. Note that the HOLD backlighting illuminates when this key is pressed. Press TIME again to complete the exposing cycle when in HOLD position.

r. Press TIME, press "0", then press "1", "0", "5", display reads [1][0][5], ENTER, then press EXPOSE. Note that TIME display counts down in seconds to 100, then counts down in tenths. Note that the beep sounds every second. Check the operation of the beeper switch (on the rear of the controller) by setting the switch OFF and noting that the beep sounds stop. Set switch back to ON. Check that HOLD and CANCEL keys function properly. Note that display reads as follows:

[ ][1]	[ ][6][0]	[1][2][5]	[ ][8][5]	[ ][5][5]	[1][0][5]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

s. Press READY-PRINT. Press and hold STORE, then press MEMORY. Release STORE and observe that display reads whatever values that may have been stored in memory. Check that the only key effective in this condition is FOCUS-WHITE which, when pressed, causes the motors to operate and the enlarger lamp to light. While the motors are operating, press FOCUS-FILTER, observe that the display shows the last entries, the motors stop for about one second, then continue operating. Press FOCUS-WHITE and "0" after the motors stop and the color probe readings will be displayed. Check that the color channels read between [-][1][0] and [ ][1][0]; if not, adjust the mixing chamber probe offsets as previously described. Press FOCUS-FILTER and note that displays read as follows:

[ ][1]	[ ][6][0]	[1][2][5]	[ ][8][5]	[ ][5][5]	[1][0][5]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

t. Press FOCUS-WHITE and, while motors are operating, press READY-PRINT; this key should have no effect. Press READY-PRINT again after motors stop; again, key should have no effect and lamp remains on. Note that all displays are blank, except C, M and Y, which show [ ][ ][0].

NOTE

Note that subsequent procedures which refer to the use of the probe must be performed under darkroom conditions. Stray light will cause the TIME display to read HI; insufficient light will cause the display to read LO.

u. Press FOCUS-FILTER, motors operate and last stored display appears. Press and hold STORE then press CANCEL. The MEMORY and DENSITY displays blank and the TIME display shows Pr (Probe). ENTER "0" in CYAN, "50" in MAGENTA, "80" in YELLOW. Place the density probe in the light path and momentarily activate the probe (a beep will sound at regular intervals while the probe is active). Note that TIME display changes to "P". Press READY-PRINT and note that lamp extinguishes. ENTER a time of 5.0 seconds and press PROGRAM. Note that the MEMORY and PROGRAM backlighting illuminates and that the displays read as follows:

[ ][ ]	[ ][ ][ ]	[ ][ ][0]	[ ][5][0]	[ ][8][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

v. Enter: PROGRAM "1", DENSITY "60", CYAN "0", MAGENTA "10", YELLOW "10". After this data has been entered, press and hold STORE and press ENTER. Observe that the PROGRAM backlighting extinguishes and the READY-PRINT backlighting illuminates. While pressing and holding STORE, press MEMORY. The display should read as follows:

[ ][1]	[ ][6][0]	[ ][ ][0]	[ ][4][0]	[ ][7][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

w. Press FOCUS-WHITE, FOCUS-FILTER and, while holding down STORE, press CANCEL. Enter: CYAN "150", MAGENTA "40", YELLOW "70", pressing ENTER after each data selection. Activate the density probe, press READY-PRINT, then press PROGRAM. Enter MEMORY "2", DENSITY "30", pressing ENTER after each selection. Attempt to ENTER CYAN "0" and observe that the display shows "E" because the difference between the original value and the new value must not exceed 128. ENTER CYAN "30". ENTER MAGENTA "180" and observe that display again shows "E". ENTER MAGENTA "50", YELLOW "10", TIME "5.0". While pressing and holding STORE, press ENTER. While pressing and holding STORE, press MEMORY. The display should read as follows:

[ ][2]	[ ][3][0]	[1][2][0]	[-][1][0]	[ ][6][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

Press FOCUS-WHITE, light remains on, motors operate and all displays blank, except C, M and y, which read [ ][ ][0].

x. Press FOCUS-FILTER and observe that the display now reads as follows:

[ ][2]	[ ][3][0]	[ ][3][0]	[ ][5][0]	[ ][1][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

y. While pressing and holding STORE, press CANCEL and observe that the display now reads as follows:

[ ][ ]	[ ][ ][ ]	[ ][3][0]	[ ][5][0]	[ ][1][0]	[P][r][.]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

z. Activate the density probe. Press READY-PRINT, press PROGRAM, ENTER: MEMORY "3", DENSITY "90", TIME "5.0". While pressing and holding STORE, press ENTER, while pressing and holding STORE, press MEMORY. The display should read as follows:

[ ][3]	[ ][9][0]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

Press FOCUS-WHITE, then FOCUS-FILTER.

aa. ENTER CYAN "199" and wait for motors to stop. Note that the CYAN display value may change to a smaller value. Check each channel, in turn, to see what maximum filtration can be obtained. Each channel should be able to reach at least "170". Reset each channel to the values noted in the previous step.

ab. Press MEMORY, "0", and ENTER. This is the process correction and is set to zero each time that the equipment is turned on. The displays must show all zeros and the last TIME used. Press any digit and any key, other than a channel, and observe that this has no effect. Press "up", observe that the DENSITY display increases to "19", reverts to "0", then increases again. Press "down" and observe that the DENSITY display decreases to "0", then to "-1", to "-19" and resets to "0". Press MEMORY, "3", ENTER and observe that the display shows the last value used, and the system is returned to normal operation. The display may appear as follows:

[ ][3]	[ ][9][0]	[ ][3][0]	[ ][5][0]	[ ][1][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

ac. ENTER CYAN, MAGENTA and YELLOW at "100"; ENTER DENSITY at "90". Activate the density probe and adjust the f stop until the TIME reading increases to about 200 seconds. Change DENSITY to "60" and observe that the TIME reading decreases to about one-half. Change DENSITY to to 30 and note that the TIME display further decreases to about one-half.

ad. ENTER YELLOW "0" and activate probe. The TIME display should decrease by less than 10%. ENTER CYAN "0" and activate probe. The TIME display should decrease by about 50%. Set MAGENTA to "0" and observe that the TIME display read 10% of the reading obtained when all filters were set to 100.

ae. Place a .3 ND filter over the probe aperture and probe again. Note that the TIME display should double ($\pm$10%). Remove filter and probe again; note that the TIME display returns to the original value ($\pm$5%).

af. Press the foot switch (if supplied) and note that neither pedal has an effect. Press READY-PRINT, then press the FOCUS pedal of the foot switch. Observe that the enlarger lamp illuminates. Release the pedal and observe that the lamp extinguishes. Press the EXPOSE pedal and observe that the enlarger lamp illuminates for the timed interval. Release the EXPOSE pedal

and note that the time continues to count down. Check that only HOLD and CANCEL have any effect during the exposure period.

ag. Turn the equipment OFF. Wait two minutes and turn the equipment ON. After the motors stop, press DENSITY and FOCUS-FILTER. The display should appear as follows:

[ ][1]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[0][0.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

ENTER "60" in DENSITY and observe that a TIME display value appears. ENTER "100" in each of the color channels. Press MEMORY, "0", ENTER and observe that the displays are all "0" except for the last TIME value. Press MEMORY, "1", ENTER. Press READY-PRINT and STORE MEMORY. The display values shown must be the same as those shown below for MEMORY [ ][1]. Press FOCUS-WHITE, FOCUS-FILTER, MEMORY, "2", ENTER, READY-PRINT, STORE MEMORY and verify that the program 2 values have not changed. Repeat for program 3.

[ ][1]	[ ][6][0]	[ ][ ][0]	[ ][4][0]	[ ][7][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

[ ][2]	[ ][3][0]	[1][2][0]	[-][1][0]	[ ][6][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

[ ][3]	[ ][9][0]	[ ][ ][0]	[ ][ ][0]	[ ][ ][0]	[ ][5.][0]
MEMORY	DENSITY	CYAN	MAGENTA	YELLOW	TIME

ah. Turn the equipment OFF. This completes the checkout procedure. If the equipment has passed the checkout satisfactorily, it is service-ready. If not, proceed to troubleshoot the equipment on the basis of the symptomatic trouble which was apparent when failure indications were obtained during the checkout.

TROUBLESHOOTING SUGGESTIONS AND METHODS

- Intermittent conditions, which can affect all or some functions, can be caused by defective probe wiring, broken or loose filter optics, defective internal unit cabling/wiring connections, dirty or oxidized switch contacts, or damaged circuit board wiring. These possible causes should be considered before conducting a detailed trouble analysis.

- Use a two-step approach to troubleshooting: first, use operational failure indications to sectionalize the trouble to a defective circuit board or functional circuit grouping; second, use detailed fault isolation/testing procedures to localize the trouble to a defective component. Although some troubles can be found by inspection, most failures that occur in equipment of this type must be found by checkout and test.

- Use visual inspections to locate faults without performing tests or measurements. Look for obvious failures, such as loose components, connections, and so on.

- Use operational tests to find the general location of the trouble. In many instances, the checkout procedures will help to identify the exact nature of the problem, or the problem area, and help to localize the fault to a circuit board or assembly.

- Use waveform analysis, voltage and resistance measurements to isolate the trouble to a defective circuit component.

Waveform Analysis - An oscilloscope is essential for checking the operation of digital circuits. Refer to the functional block diagrams and the schematic diagrams. Use digital troubleshooting techniques to follow gating and timing pulses through the stages until the fault is found.

CAUTION

Before using an ohmmeter to check in-circuit transistors or IC's, be sure to check that the open-circuit voltage across the test leads does not exceed 1.5 volts. Since the R X 1 range normally connects the ohmmeter internal battery directly in series with the test leads, the excessively-high current (50 ma or greater) can damage semiconductors. Note that the high resistance ranges may also be unsuitable. Use the R X 10 range, as necessary.

Resistance Measurements - To avoid damaging semiconductors or IC components, make resistance measurements only as necessary to check wiring and components.

Voltage Measurements - Use a digital voltmeter (DVM) or a high-impedance VTVM to check regulated supply voltages and variations in operational amplifier biasing/outputs. When measuring voltages, use tape or sleeving to insulate the entire test prod, except for the extreme tip. Accidental short circuits can damage transistors or IC's.

Semiconductor and IC Testing - When trouble has been traced to a stage, check input and output waveforms to verify that the suspected component is defective before making other tests. If the transistor or IC is hard-wired directly into the circuit, try to establish that the part is actually defective before unsoldering: semiconductor components are extremely susceptible to damage from soldering heat or lead flexing. Note that most IC`s are plugged in to hard-wired IC sockets. This simplifies removal and replacement for troubleshooting and repair.

GENERAL PARTS REPLACEMENT TECHNIQUES

Observe these precautions when replacing parts:

a. When soldering or unsoldering components, IC`s or transistor leads, solder quickly to allow the least amount of heat conduction. A vacuum desoldering tool is recommended for unsoldering of components. Avoid excessive heating and strain when unsoldering to prevent damage to circuit board wiring and through-hole connections. Whenever possible, use a heat sink (such as a long-nose pliers or test clip) between the solder joint and the part. Use approximately the same length and dress of leads as used originally.

b. Use a pencil-type soldering iron with a 25-watt maximum capacity for circuit board component replacement. If the soldering iron is used with an ac source, use an isolation transformer between the iron and the line. Check soldering iron for element-to-tip shorts before using. Do not use a soldering gun as damaging voltages can be induced into the components.

c. When replacing diodes or transistors, note the exact orientation of the part before it is removed. Replace the new part in the same position.

e. Front panel/keyboard is non-repairable and must be replace as a unit.

TROUBLESHOOTING CHART

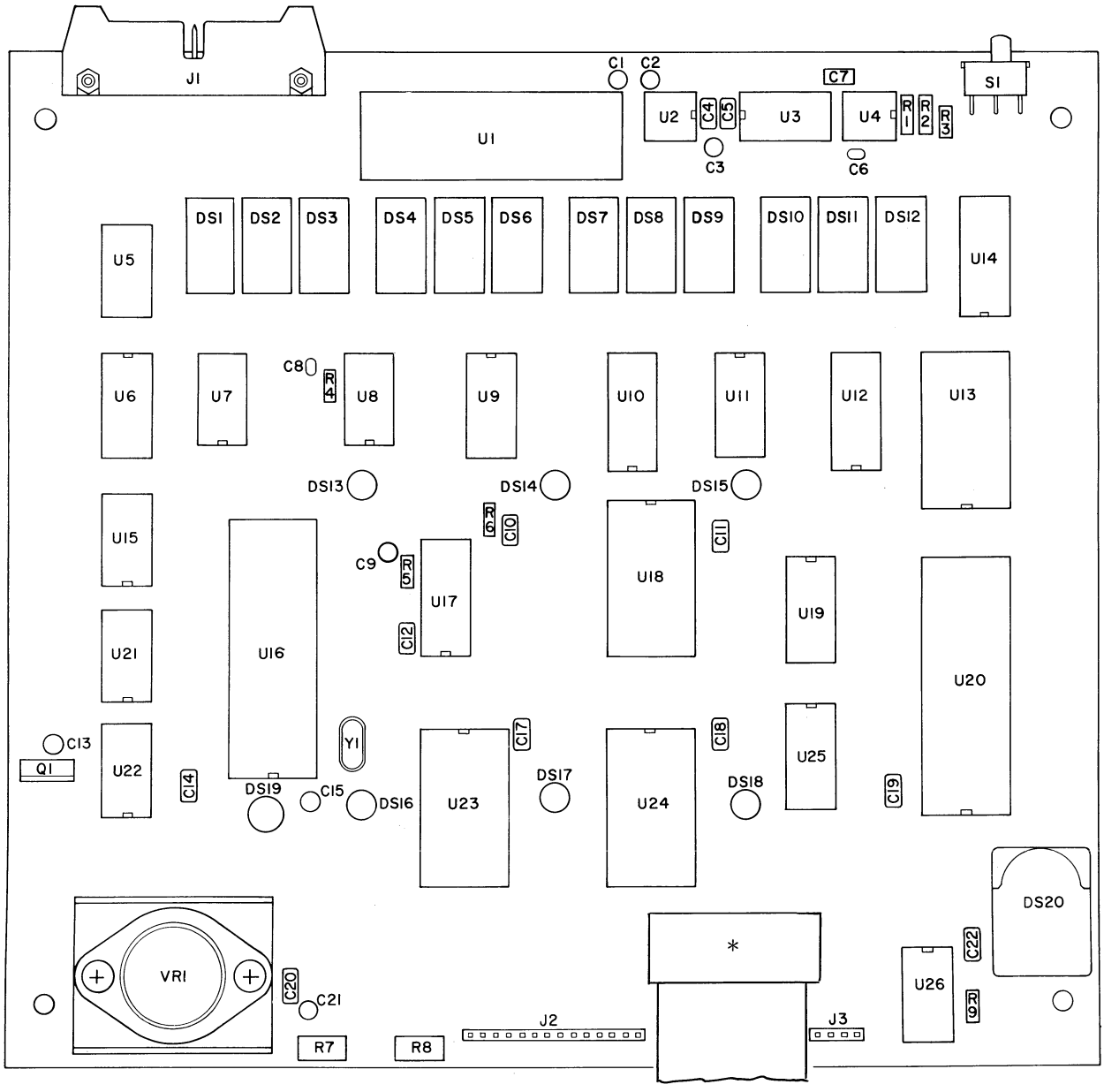
Table 3-1 provides step-by-step troubleshooting procedures based on symptoms observed during checkout procedures. Locate the "Trouble" which most closely resembles the observed malfunction, then check and/or replace the components listed in the corresponding "Corrective Action" column. Note that these procedures are intended only as an aid in localizing the malfunction to a defective stage or component grouping. Refer to the schematic and parts location diagrams for detailed circuit tracing and component locations.

Table 3-1. System Troubleshooting Chart

Trouble	Corrective Action
System does not turn on; fan does not operate.	Check line cord at male receptacle at rear of lamphouse; check defective power switch.
Fan operates; lamp does not light; display is blank.	Check ribbon-cable connector to translator/ controller or power supply.
Fan operates; lamp does not light; display is on.	Check lamp; change power supply.
System turns on but motors continue operating.	Check cable to sensor probe assembly; change sensor probe.
	Check for loose hub assembly on motor shaft; tighten as necessary.
	Check that mixing chamber is properly seated.
System functions properly but no beep is heard when key is pressed.	Check that audio switch is in ON position; replace 4001, 4011 IC`s.
Fan operates, lamp lights, but no display on translator/controller.	Check illumination controls; replace 2803, 8212 IC`s.
Keyboard locks up when key is pressed.	Change keyboard.
One or more keys are inoperative.	Change keyboard.
Display digits are incomplete.	Replace IC`s: 2716, ADC0816, CA3082, 4013, 8212, DG 387, REF02CP.
Half of the displays are off.	Replace 2981 IC.
Keyboard locks up in FOCUS mode.	Change MC14514, MC14556 IC`s.

Table 3-1. System Troubleshooting Chart (Continued)

Trouble	Corrective Action
Memory recall inoperative.	Change memory IC, X2201 or X2210.
Foot switch inoperative.	Check foot switch, connector.
Lamp keeps burning out.	Check power supply voltage setting; replace power supply.
One segment of LED display out.	Replace display.
One segment of all displays out.	Replace resistor pack, 2981, 3082, 2803 IC`s.
One filter does not move.	Check voltage on filter motor. If voltage is correct, replace motor.
Motor runs in one direction only.	Change 3082, 4001 IC`s; replace power supply.
One illumination lamp is off.	Replace lamp.
Sensor probe cannot be adjusted.	Replace probe.
Displays shows all "E`s".	Replace lamp.



* Connector used only in Model II

Figure 3-1. CLS Controller Circuit Board, Component Location

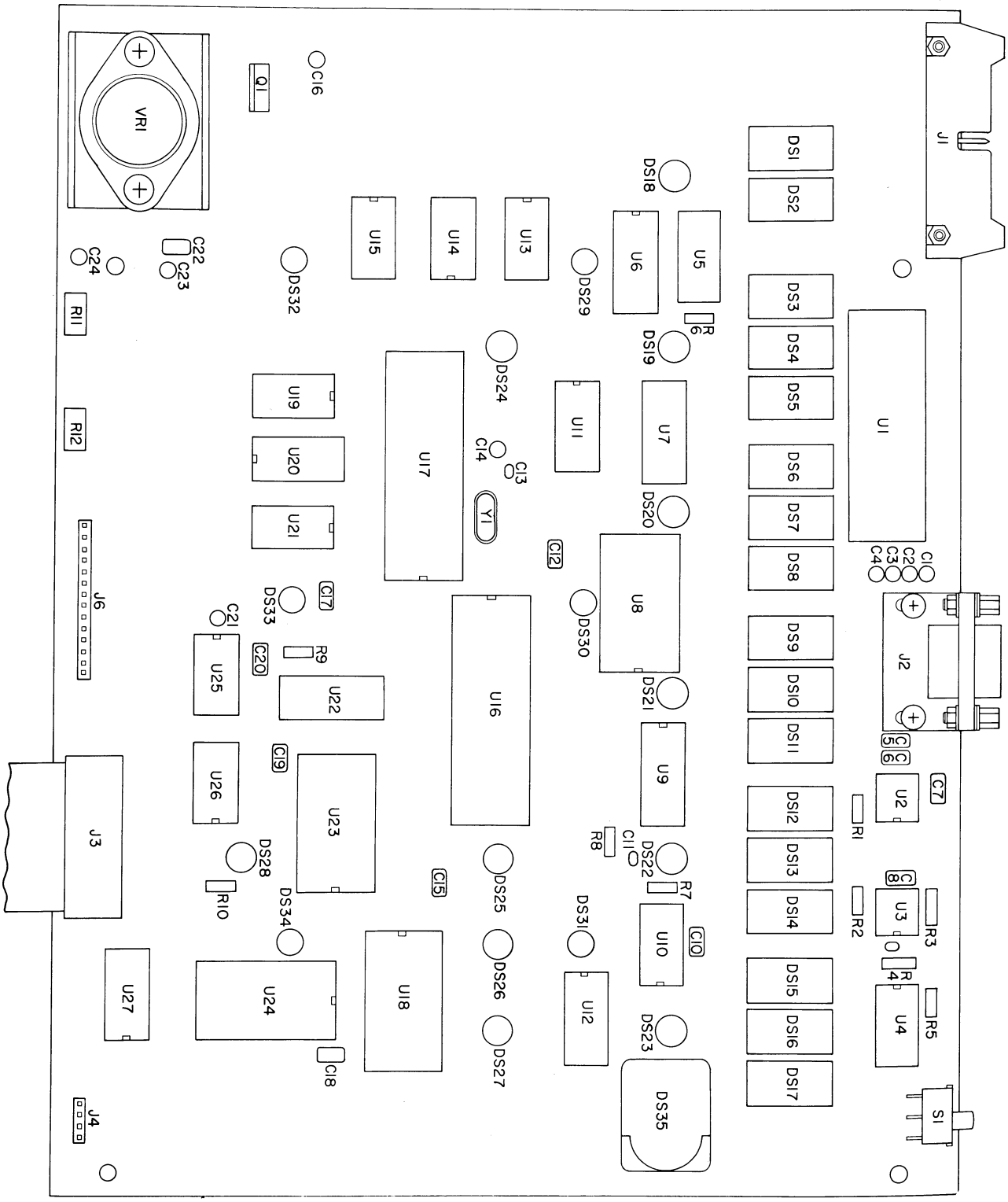


Figure 3-2. CLS Translator/Controller Circuit Board, Component Location

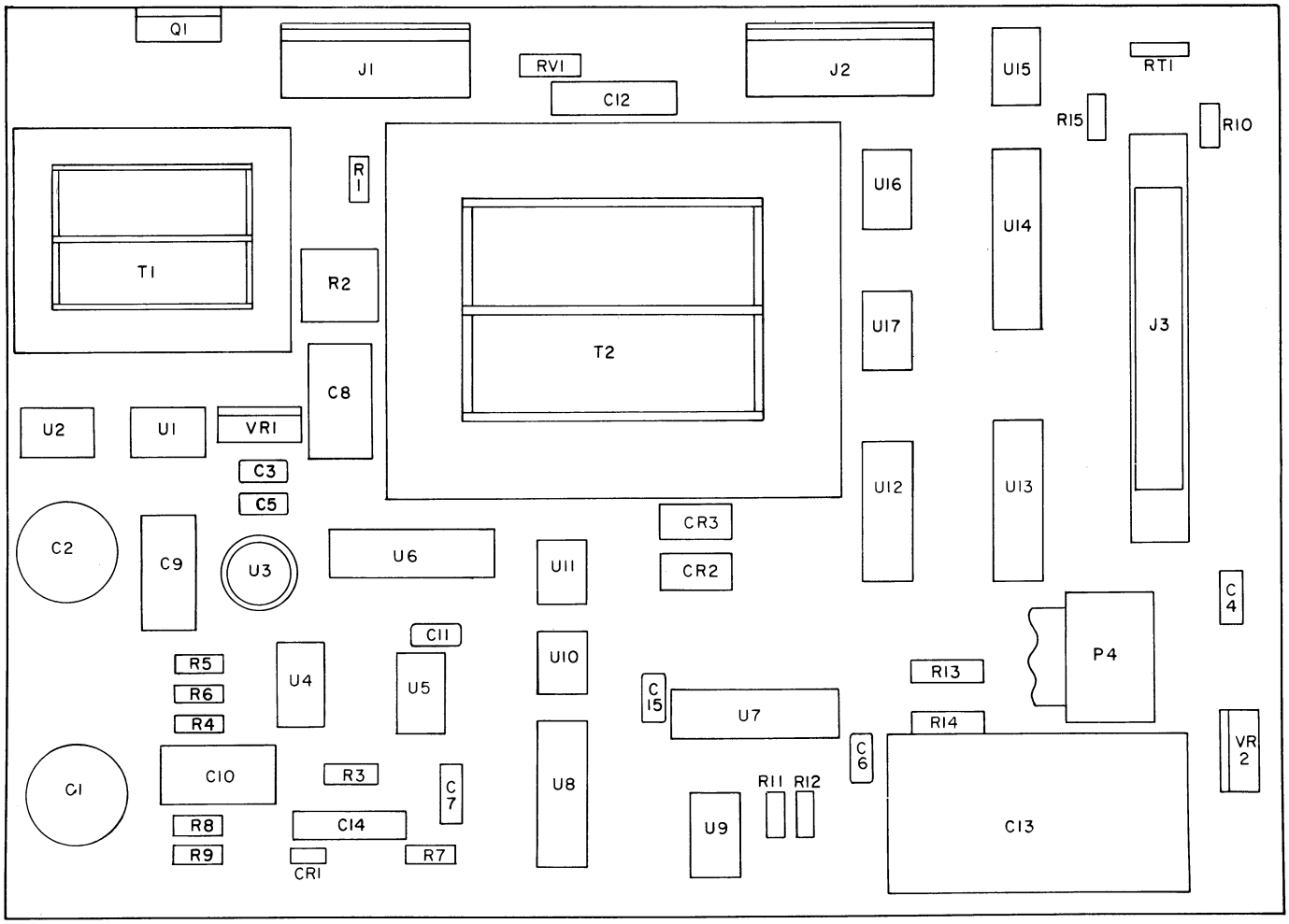


Figure 3-3. Power Supply Circuit Board, Component Location

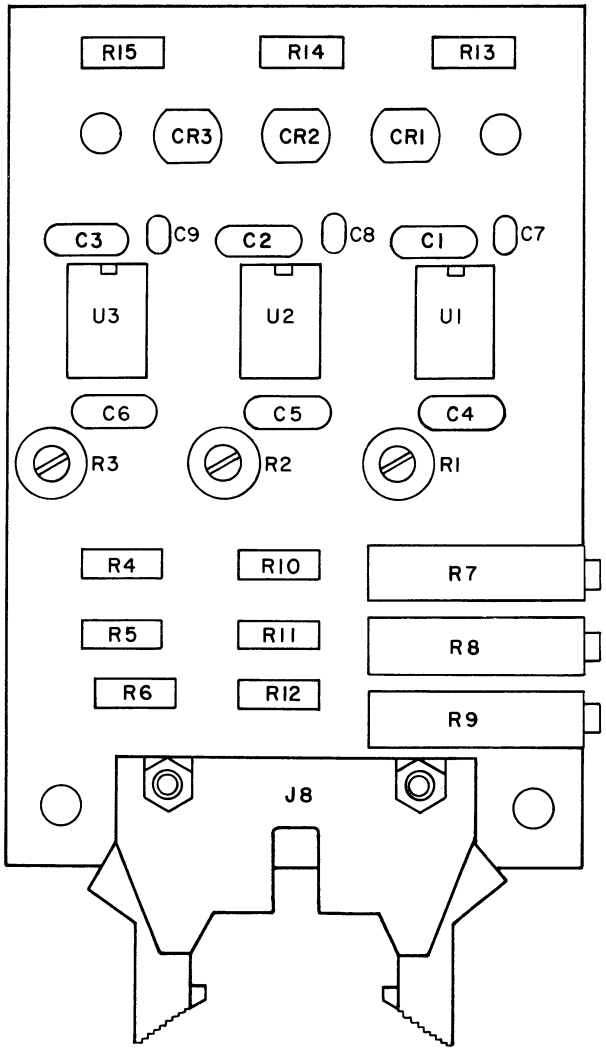


Figure 3-4. Color Balance Probe, Component Location

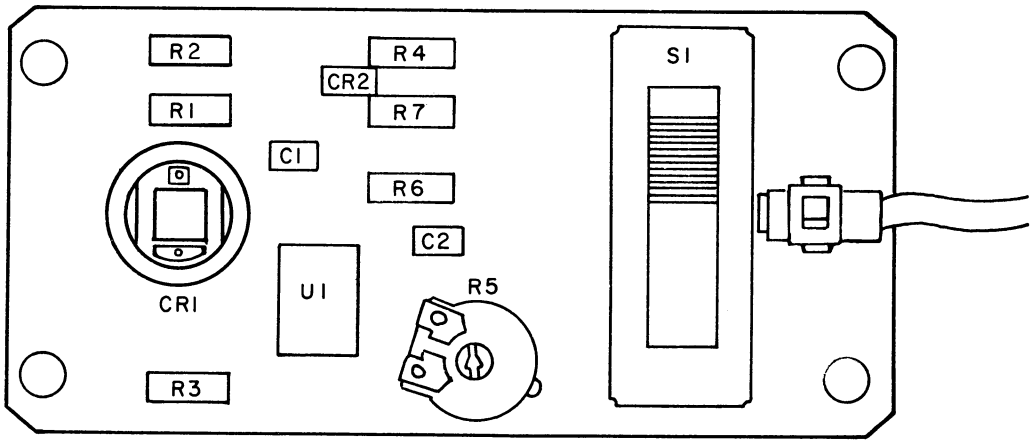


Figure 3-5. Density Probe Assembly, Component Location

SECTION 4 — DIAGRAMS

This section includes the following diagrams:

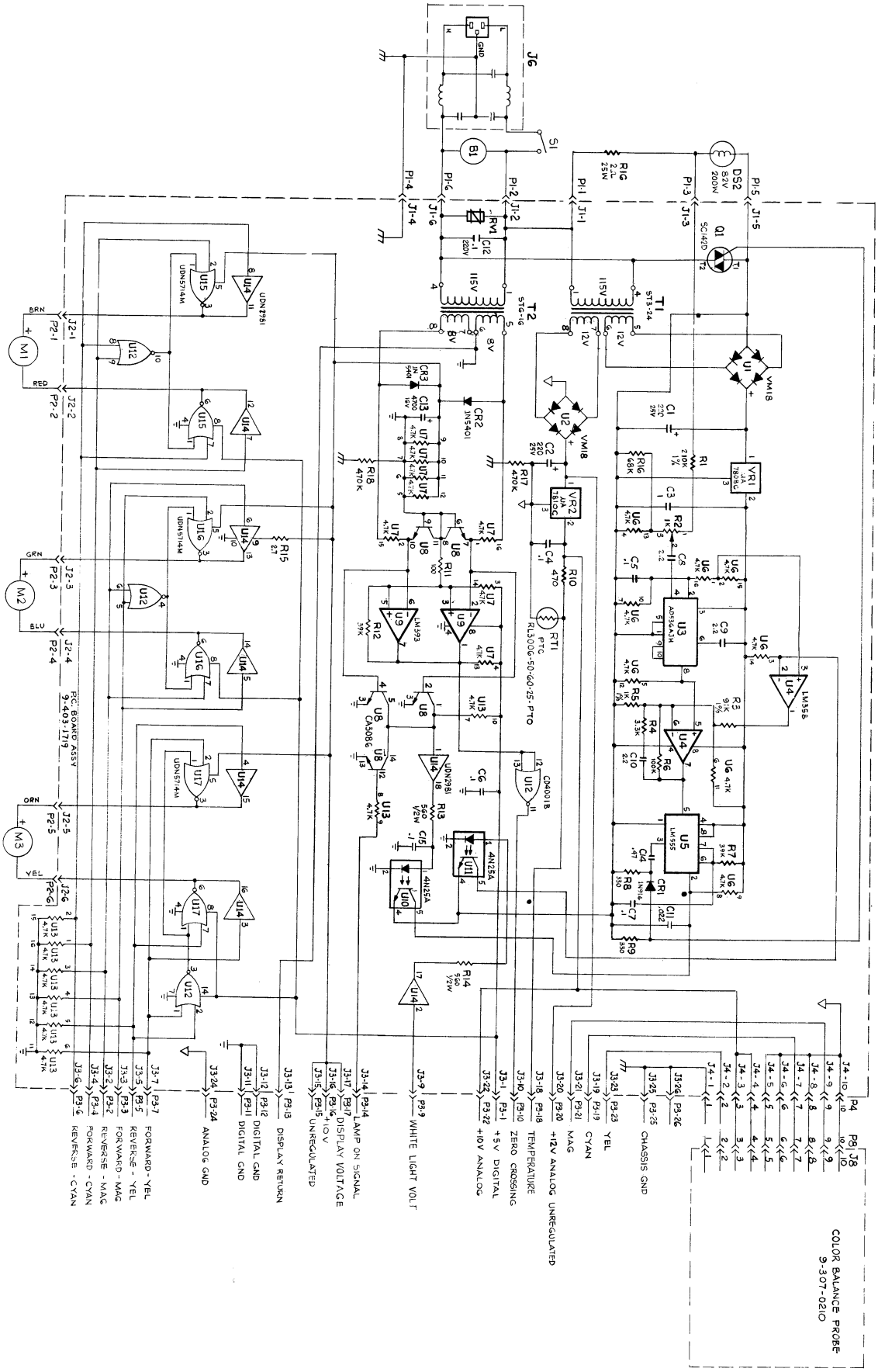
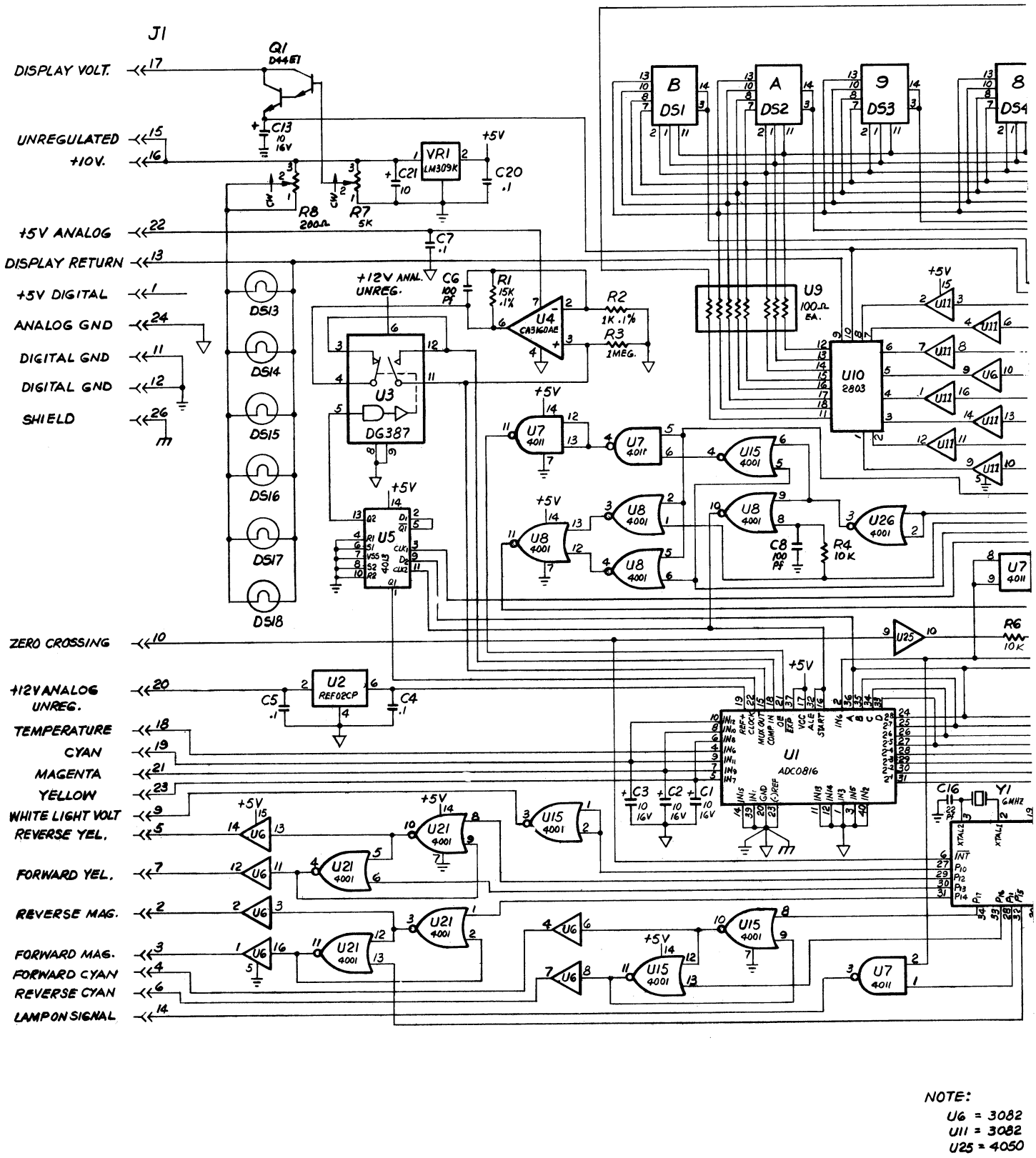
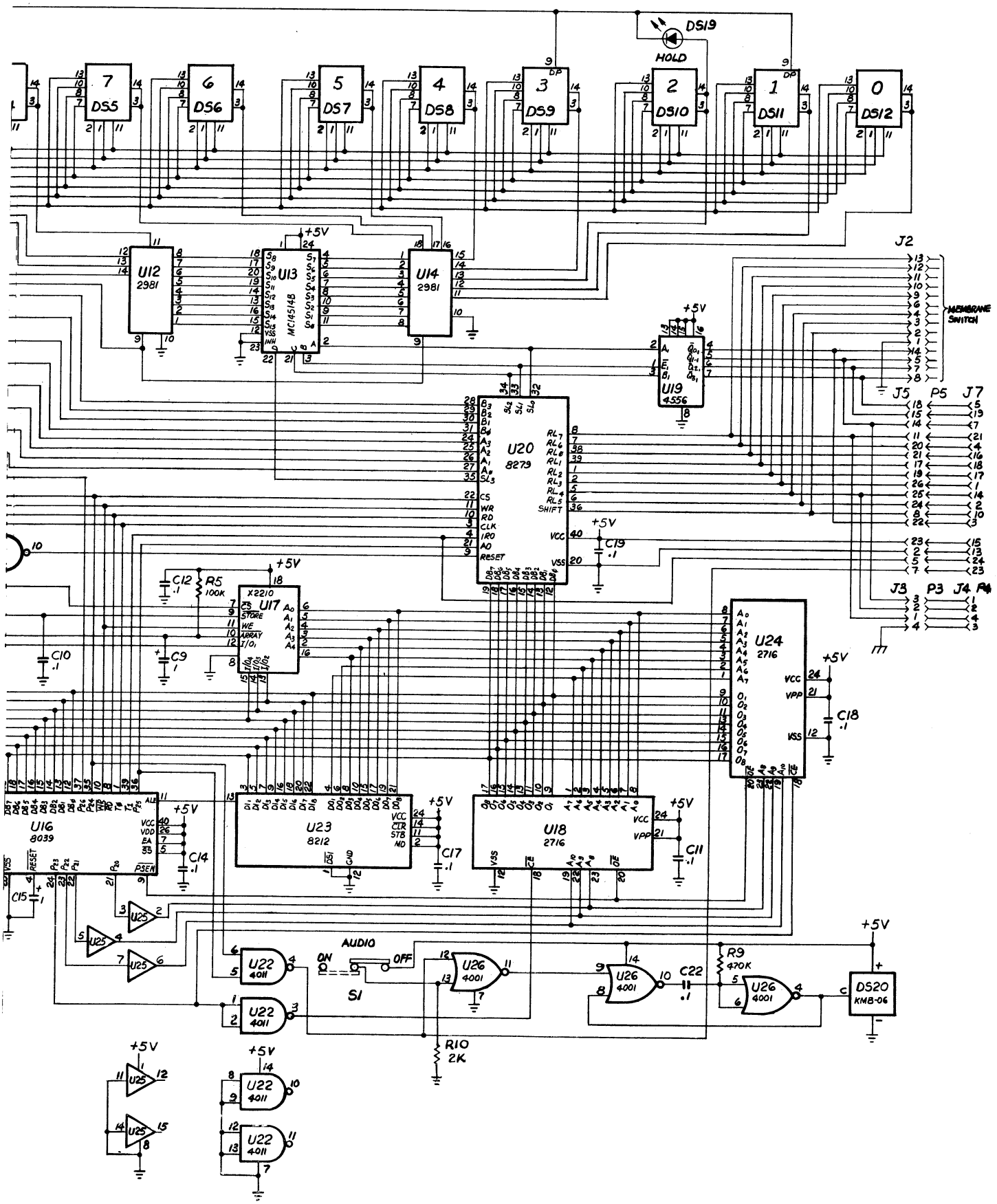


Figure 4-1. Power Supply, Schematic Diagram



NOTE:
U6 = 3082
U11 = 3082
U25 = 4050

Figure 4-2. CLS Controller,



Schematic Diagram

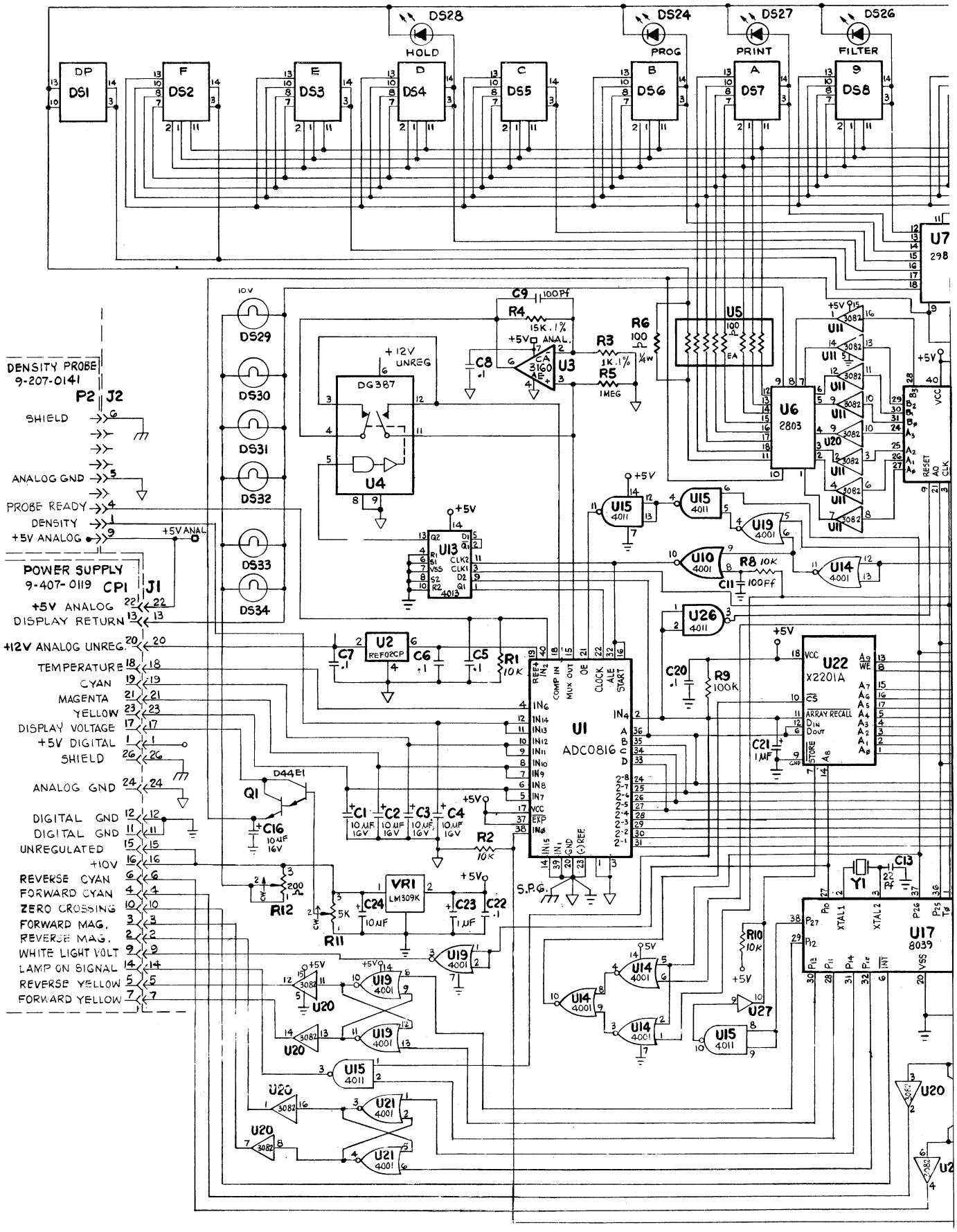
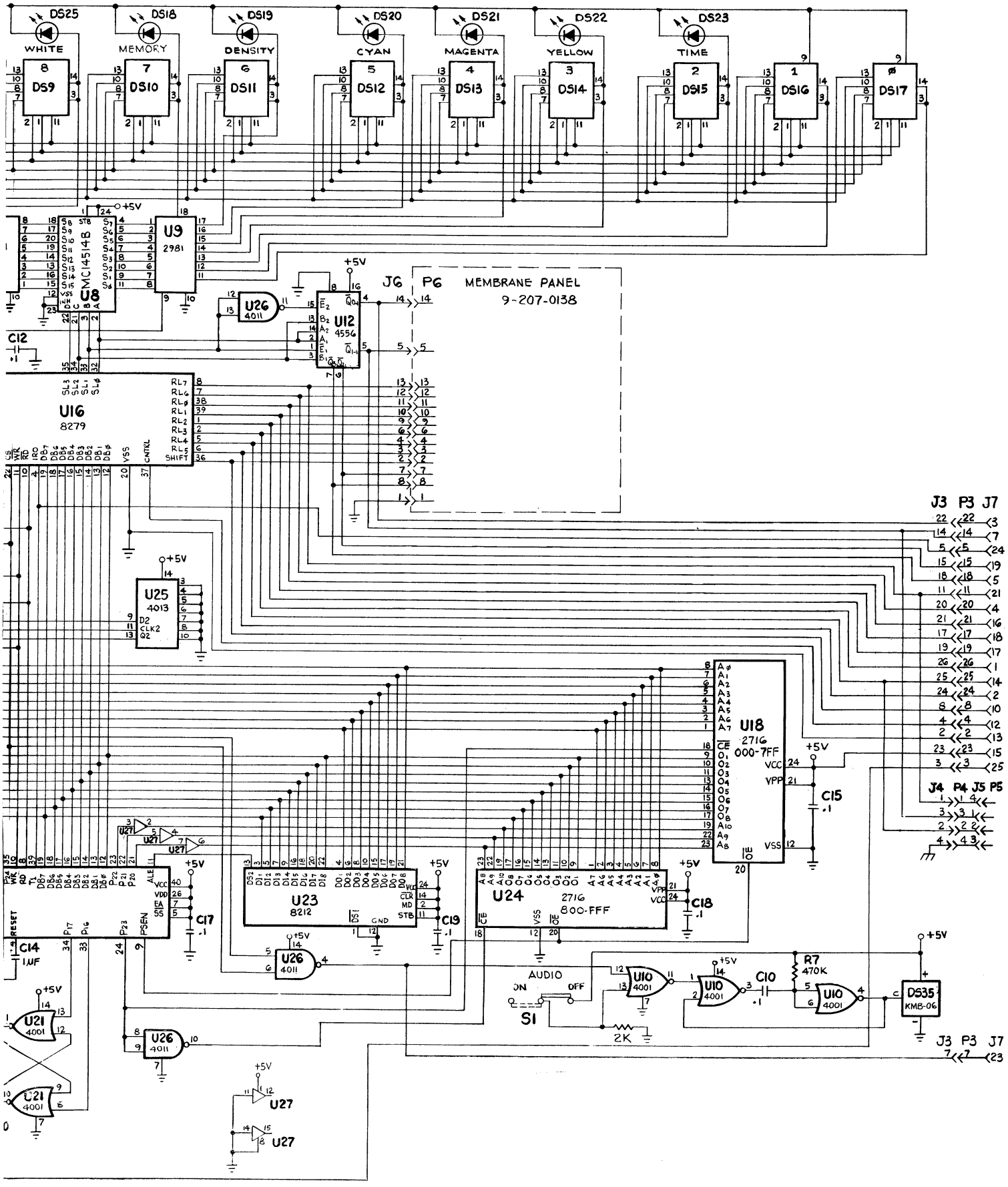


Figure 4-3. CLS Translator/



Controller, Schematic Diagram

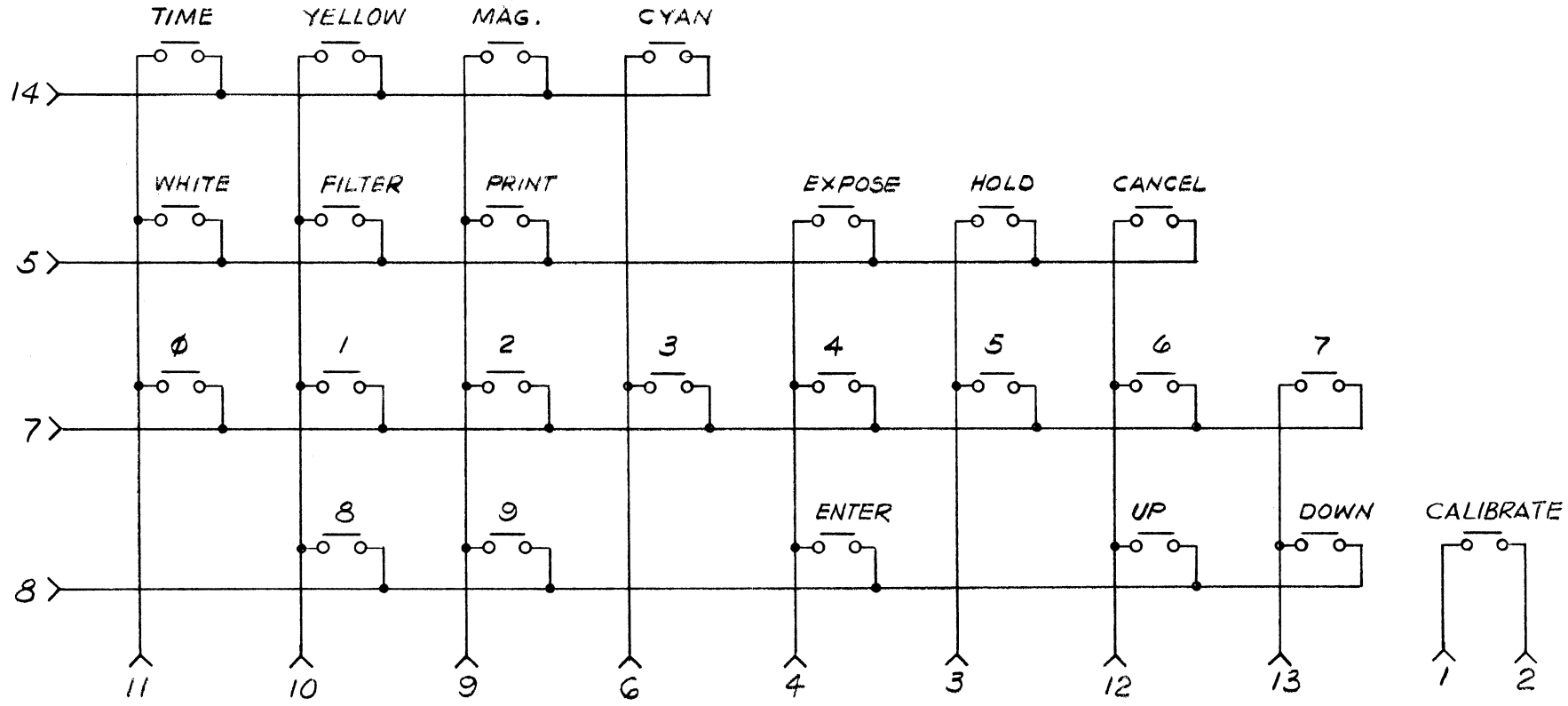


Figure 4-4. CLS Controller Front Panel, Schematic Diagram

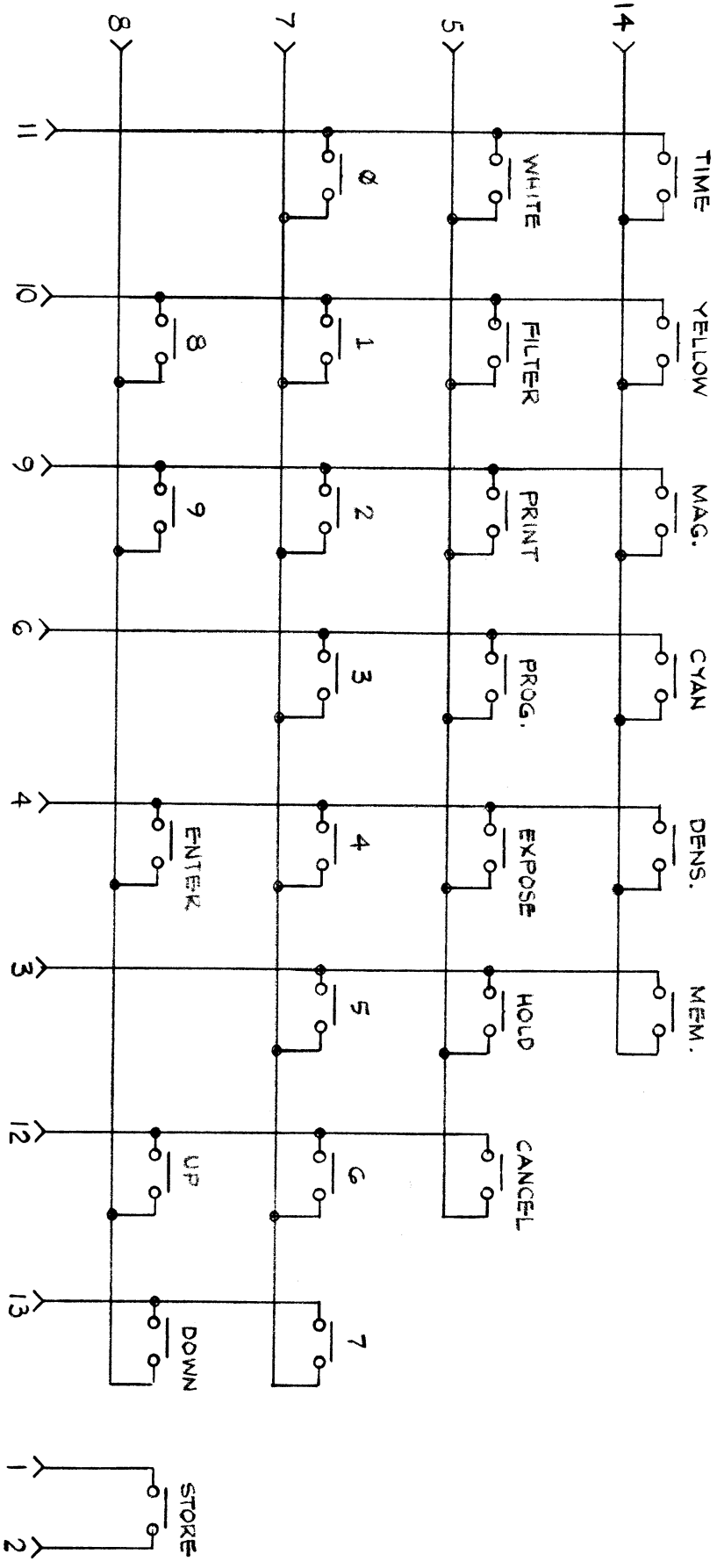


Figure 4-5. CLS Translator/Controller Front Panel, Schematic Diagram

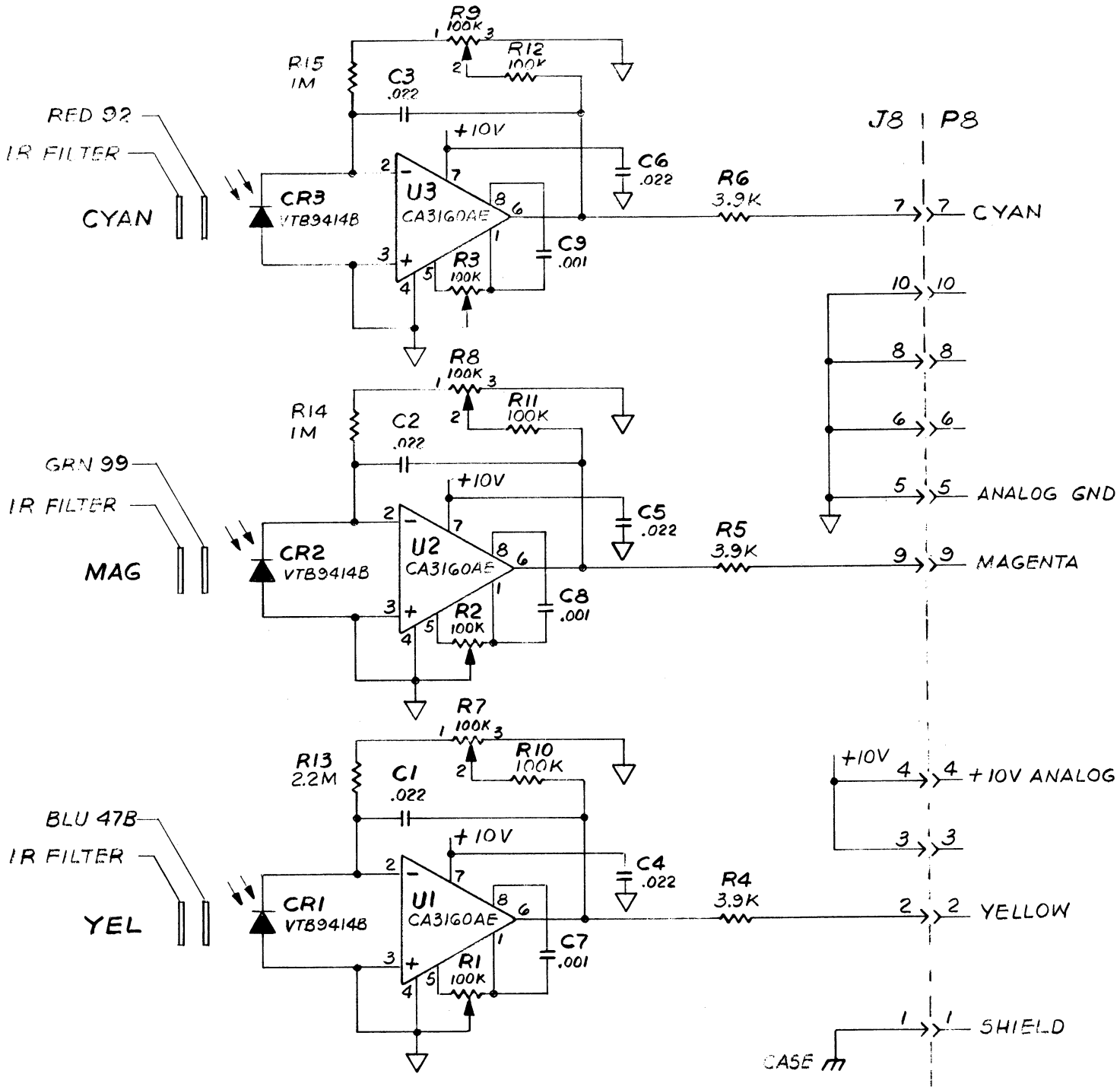


Figure 4-6. Color Balance Probe, Schematic Diagram

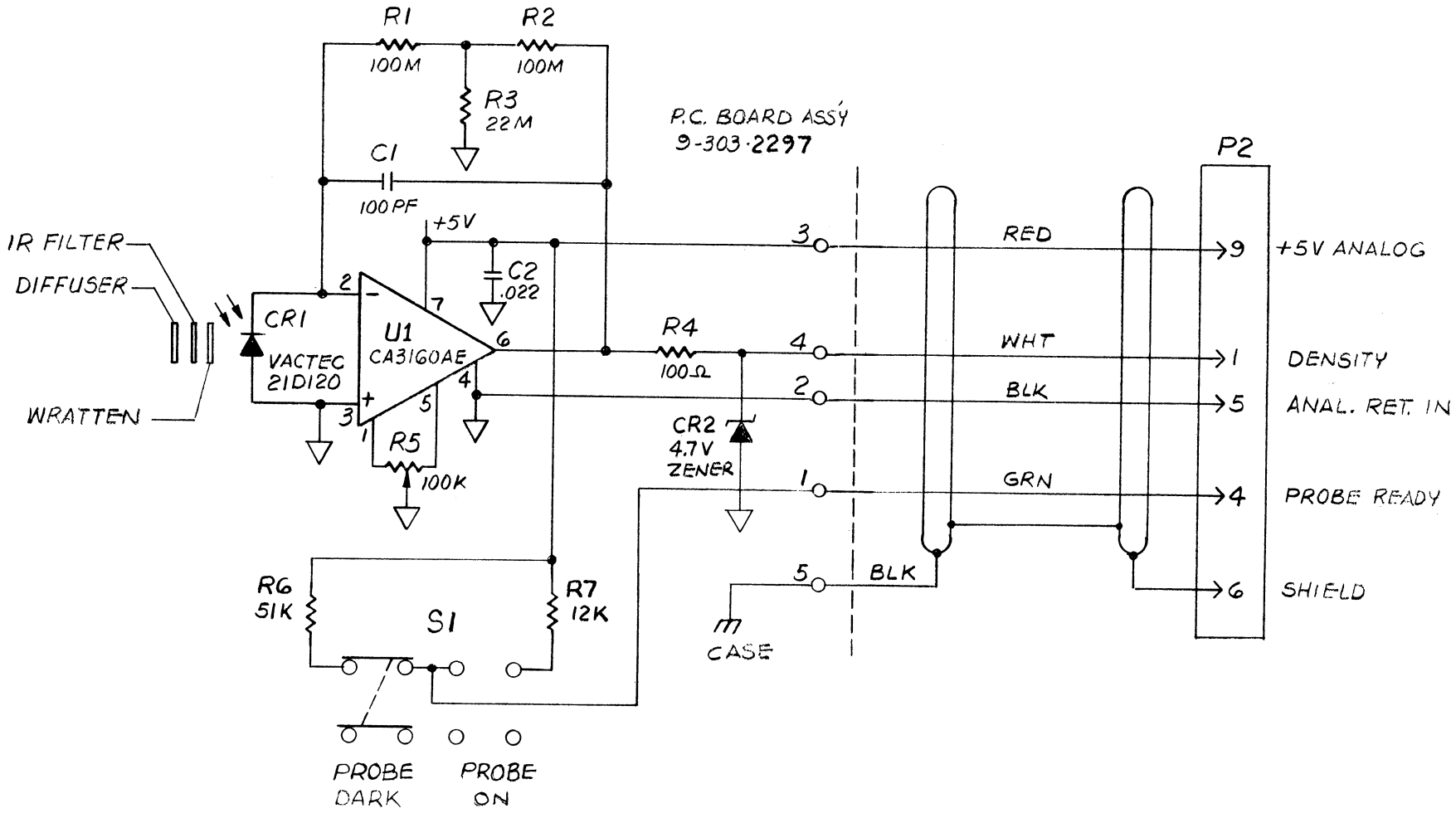


Figure 4-7. Density Probe, Schematic Diagram

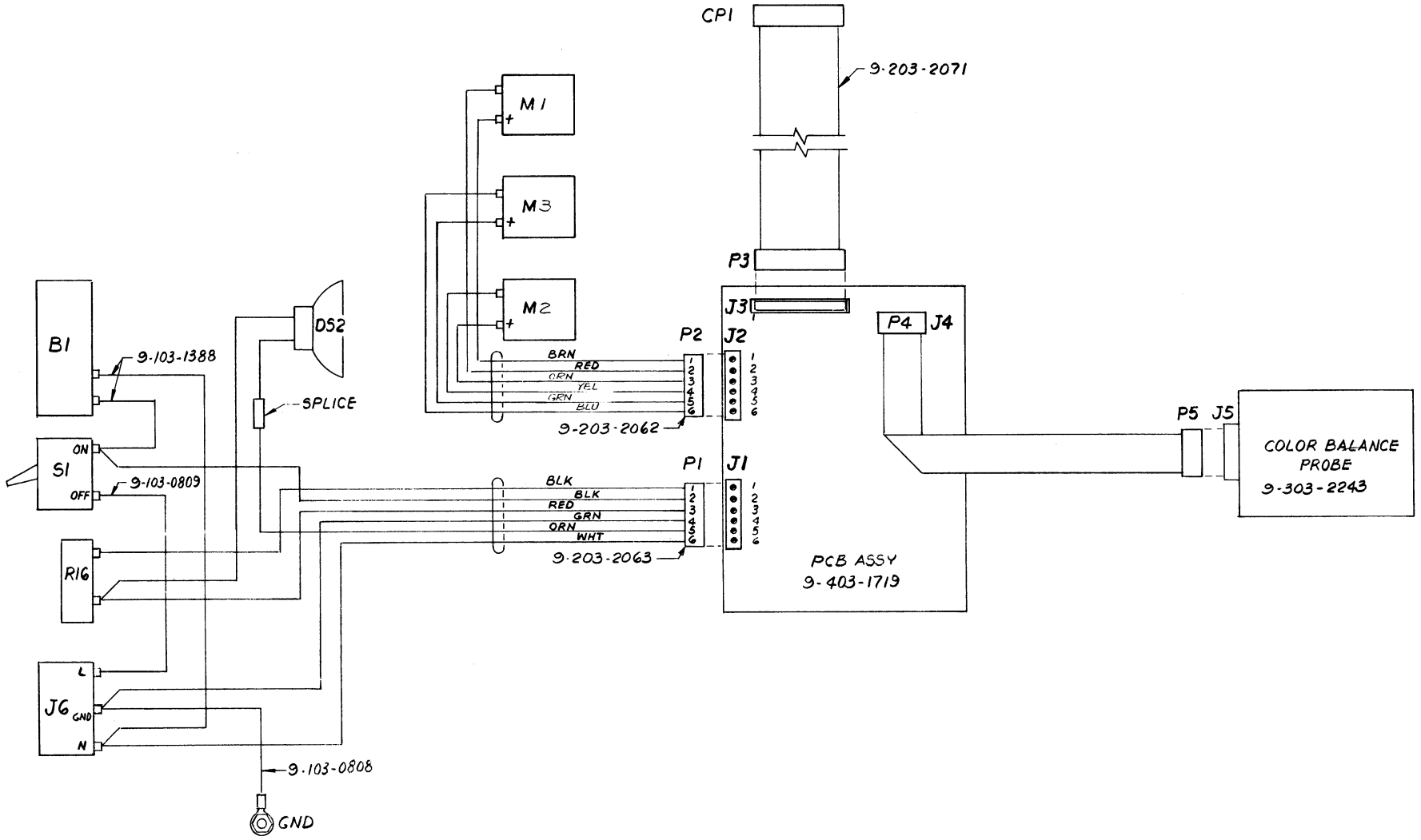


Figure 4-8. Lamphouse, Wiring Diagram

SECTION 5 - PARTS LIST

GENERAL

This section lists the replacement parts that may be required during repair of the equipment. Note that parts may be ordered from Omega Division, Berkey Marketing Companies, at the following locations:

New York - 25-20 Brooklyn-Queens Expressway, Woodside, N.Y. 11377

California - 3400 East 70th Street, Long Beach, California 90805

Canada - Berkey Photo (Canada, Ltd.), 70 Floral Parkway, Toronto, Canada M6L-261

When ordering parts, be sure to specify both the part name and part number. For electrical parts, also specify the reference designation.

Whenever electrical components or hardware items are obtained from sources other than Omega Division, be sure to use only parts of quality equal to those being replaced.

Figures 5-1 through 5-6 and respective parts lists, tables 5-1 through 5-6, identify the parts used in the equipment.

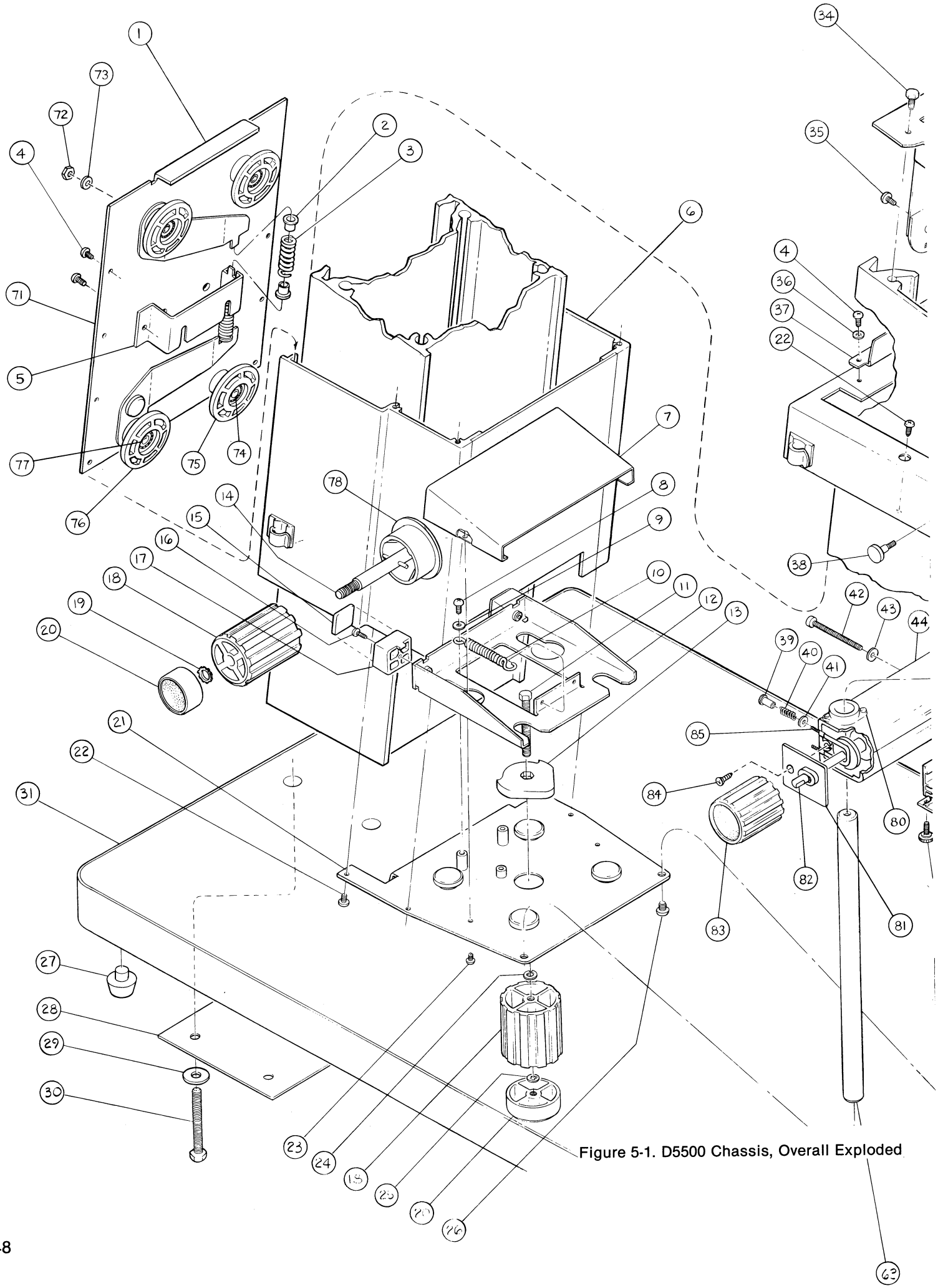
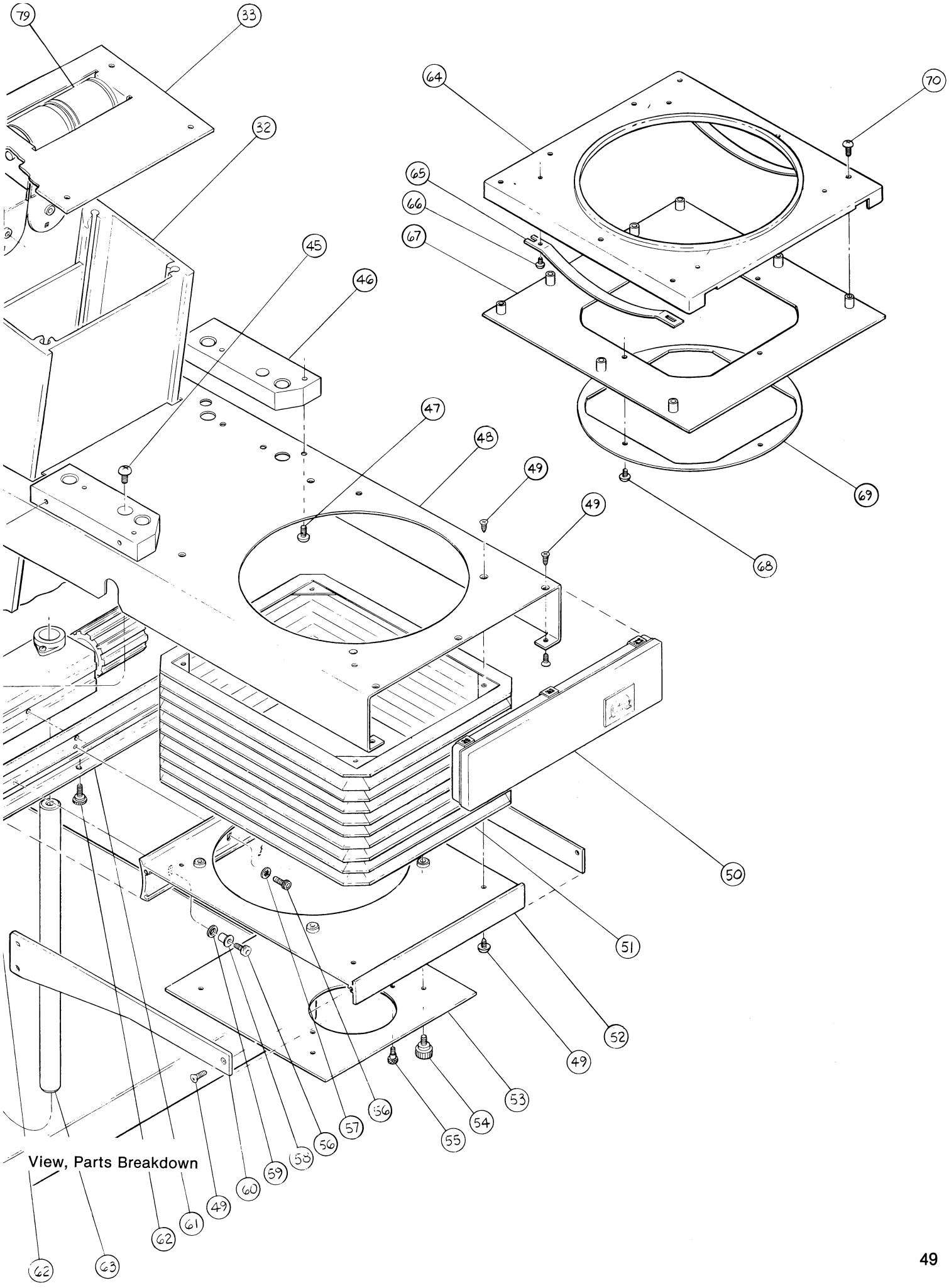


Figure 5-1. D5500 Chassis, Overall Exploded



View, Parts Breakdown

Table 5-1. D5500 Chassis, Parts List

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-1-		D5500 CHASSIS		
5-1-1	9-411-1368	. BACK PLATE	1	
5-1-2	9-035-1102-45	. BUSHING	4	
5-1-3	9-035-7871-44	. SPRING, COMPRESSION, 6000 O.D.	2	
5-1-4	9-035-7126-18	. SCREW, SELF-TAPPING, NO. 10X3/8	10	
5-1-5	9-211-1738	. NEGATOR BRACKET	1	
5-1-6	9-303-2225	. WRAPAROUND	1	
5-1-7	9-311-1400	. COVER	1	
5-1-8	9-035-7002-38	. SCREW, MACHINE, 8-32X1/4	2	
5-1-9	9-035-9312-82	. WASHER, FLAT, NO. 8	2	
5-1-10	9-035-7871-43	. SPRING, EXT	2	
5-1-11	9-035-7037-69	. SCREW, HEX HD, 1/4-20X2-7/8	1	
5-1-12	9-311-1398	. SLIDE BRAKE	1	
5-1-13	9-301-0234	. CAM BRAKE	1	
5-1-14	9-303-2256	. SHAFT ASSY	1	
5-1-15	9-145-0350	. BRAKE PAD	2	
5-1-16	9-035-7002-24	. SCREW, MACHINE, 8-32X1/2	2	
5-1-17	9-301-0240	. BRAKE PAD, SUPPORT	2	
5-1-18	9-301-0206	. KNOB	3	
5-1-19	9-035-9316-54	. WASHER, LOCK, 1/4	2	
5-1-20	9-203-2046	. END KNOB ASSY	3	
5-1-21	9-303-2259	. BRAKE PLATE ASSY	1	
5-1-22	9-035-7126-35	. SCREW, SELF-TAPPING, NO. 10X1/2	4	
5-1-23	9-035-7120-33	. SCREW, SELF-TAPPING, NO. 4X1/4	2	
5-1-24	9-035-9318-51	. WASHER, SPRING, 1/4	1	
5-1-25	9-035-9316-54	. WASHER, LOCK, 1/4	1	
5-1-26	9-035-6032-16	. SCREW, MACHINE 1/4-20X1/2	1	
5-1-27	9-245-0122	. FOOT	4	
5-1-28	9-211-1776	. PLATE	1	
5-1-29	9-035-9312-58	. WASHER, FLAT, 5/16	4	
5-1-30	9-035-7055-74	. NUT, HEXAGON, 5/16-18	4	
5-1-31	9-312-0247	. BASEBOARD	1	
5-1-32	9-330-0106-30	. COLUMN	1	
5-1-33	9-303-2260	. NEGATOR ASSY	1	
5-1-34	9-035-7126-35	. SCREW, HEX HD, 5/16-18X3/4	4	
5-1-35	9-035-7012-08	. SCREW, MACHINE, 10-32X1/4	2	
5-1-36	9-035-9316-41	. WASHER, LOCK, NO. 10	2	
5-1-37	9-211-1774	. BRACKET, STOP	1	
5-1-38	9-203-2069-02	. KNOB ASSY	4	
5-1-39	9-151-3667	. ADJUSTMENT NUT	4	
5-1-40	9-122-0397	. SPRING	4	
5-1-41	9-035-9313-41	. WASHER, FLAT	4	
5-1-42	9-035-6905-74	. SCREW, SOCKET HD, 10-32X2	1	
5-1-43	9-035-9312-68	. WASHER, NO. 10	1	
5-1-44	9-330-0096	. HOUSING (FOCUSING)	1	
5-1-45	9-035-7032-16	. SCREW, MACHINE, 1/4-20X1/2	4	
5-1-46	9-261-0855	. MOUNTING BLOCK	2	
5-1-47	9-035-7012-37	. SCREW, MACHINE 10-32X5/8	4	

Table 5-1. D5500 Chassis, Parts List (cont)

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-1-48	9-430-0036	. FILM STAGE	1	
5-1-49	9-035-7123-17	. SCREW, SELF-TAPPING, NO. 6X1/2	19	
5-1-50	9-303-2258	. COVER, FILM STAGE ASSY	1	
5-1-51	9-303-2292-01	. BELLOWS ASSY	1	
5-1-52	9-303-2253	. LENS STAGE ASSY	1	
5-1-53	9-311-1370	. LENS MOUNTING PLATE	1	
5-1-54	9-151-3641	. THUMBSCREW	4	
5-1-55	9-151-0081-01	. SCREW, KNURLED SHOULDER	2	
5-1-56	9-035-7015-19	. SCREW, HEX HD, 10-32X3/8	3	
5-1-57	9-035-9316-41	. WASHER, LOCK, NO. 10	1	
5-1-58	9-101-1703	. BUSHING, FLANGED	2	
5-1-59	9-035-9318-51	. WASHER, SPRING	2	
5-1-60	9-211-1748-01	. SIDE PLATE, LEFT	1	
5-1-61	9-203-2081	. LENS STAGE ASSY (SWIVEL)	1	
5-1-62	9-203-2069-01	. KNOB ASSY	3	
5-1-63	9-251-0456	. ROD, FOCUS	2	
5-1-64	9-405-0276	. HOUSING, NEGATIVE CARRIER	1	
5-1-65	9-290-0048	. SPRING	2	
5-1-66	9-035-6962-03	. SCREW, MACHINE, 4-40X1/8	4	
5-1-67	9-303-2662-01,2	. CARRIAGE HOUSING ASSY, BOTTOM	1	
5-1-68	9-035-6962-96	. SCREW, MACHINE, 4-40X3/16	4	
5-1-69	9-311-1391-01	. LOCATING RING	1	
5-1-70	9-035-6962-21	. SCREW, MACHINE, 4-40X7/16	8	
5-1-71	9-403-1696	. BACK PLATE ASSY	1	
5-1-72	9-035-5492-62	. NUT, HEXAGON	4	
5-1-73	9-035-9316-51	. WASHER	4	
5-1-74	9-203-2060	. SHAFT ASSY, RIGHT SIDE	2	
5-1-75	9-301-0228-01	. WHEEL, RIGHT SIDE	2	
5-1-76	9-301-0228-02	. WHEEL, LEFT SIDE	2	
5-1-77	9-203-2059	. SHAFT ASSY, LEFT SIDE	2	
5-1-78	9-401-0130	. BUSHING, ECCENTRIC	2	
5-1-79	9-290-6044	. NEGATOR SPRING	2	
5-1-80	9-201-0386	. BUSHING	4	
5-1-81	9-301-0210	. END CAP	2	
5-1-82	9-203-2057	. FOCUS SHAFT ASSY	1	
5-1-83	9-203-2085	. KNOB ASSY	2	
5-1-84	9-035-7123-09	. SCREW, SELF-TAPPING, NO. 6X5/16	2	
5-1-85	9-151-3642	. TENSION SCREW	2	

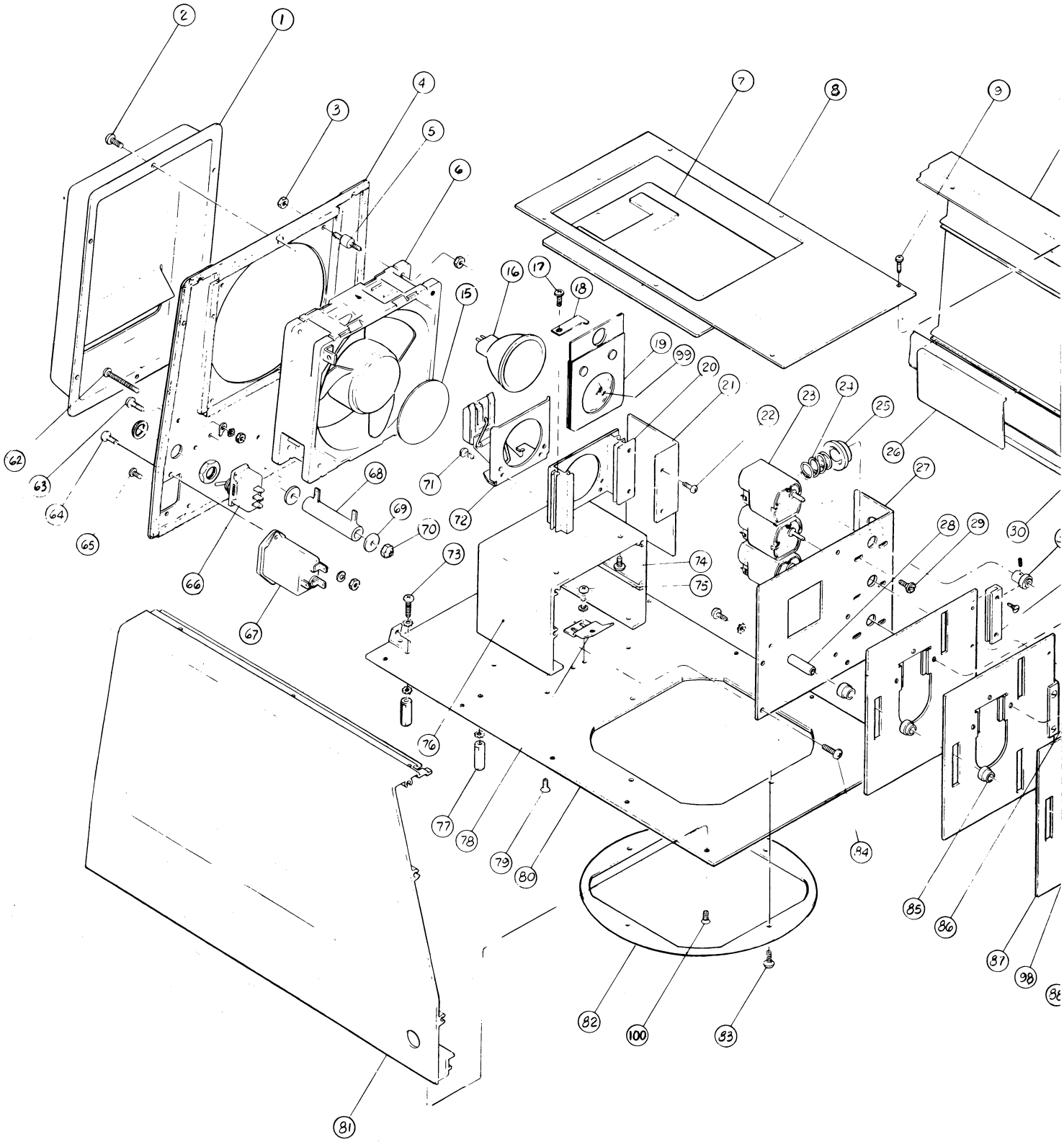
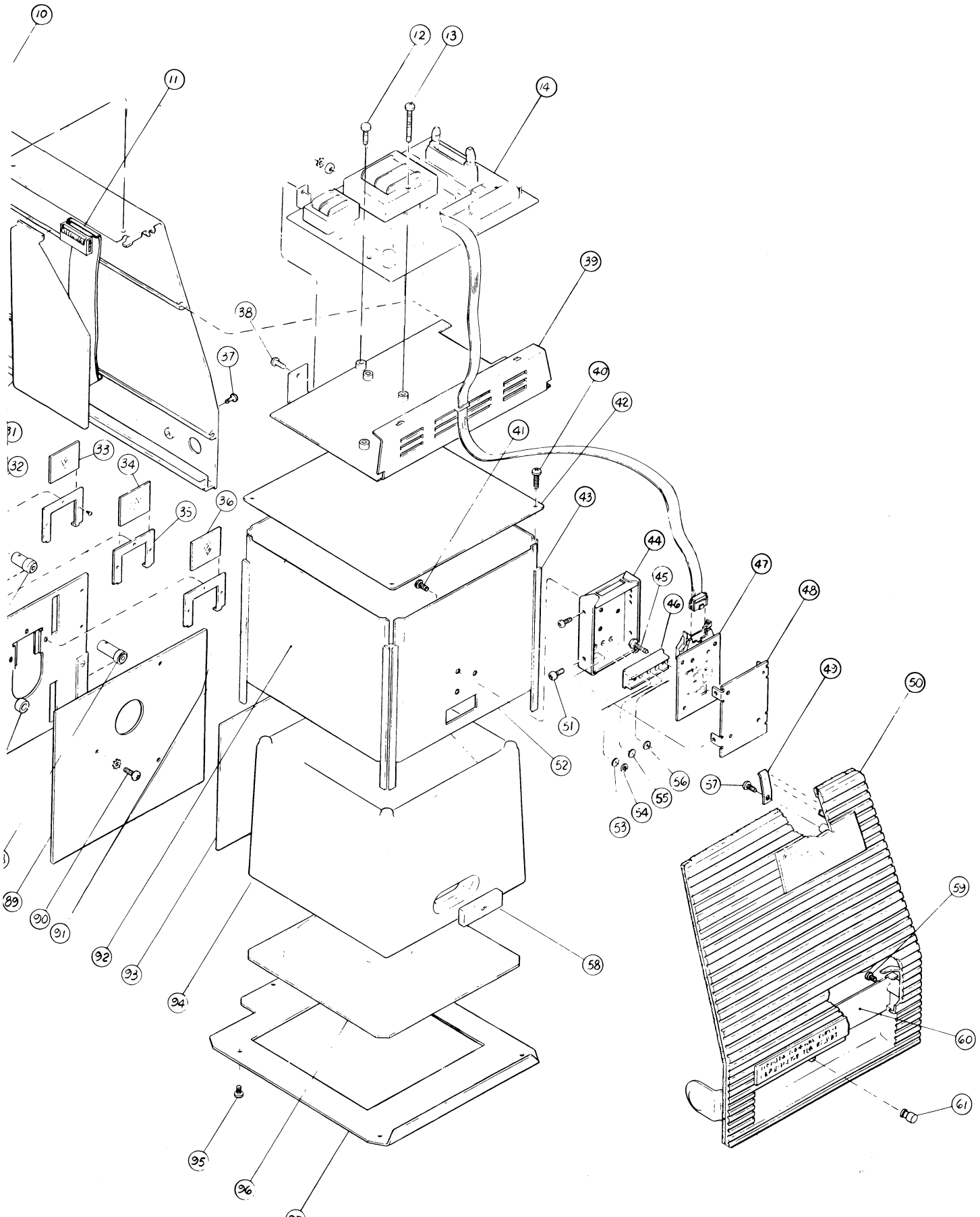


Figure 5-1a. D5500 Lamphouse, Overall



Exploded View, Parts Breakdown

Table 5-1a. D5500 Lamphouse, Parts List

Item	Part Number	Description	Qty.
1.	9-301-0235	Cover Exhaust	1
2.	9-035-7123-06	Self Tapping Screw #6 x 1/4 Black	6
3.	9-035-5492-48	Nut Hex 8-32	8
4.	9-411-1372-30	Rear Plate	1
5.	9-122-0412	Shock Absorber	4
6.	9-035-0660-41	Fan	1
7.	9-203-2070	Lid Assembly	1
8.	9-311-1365	Top Plate	1
9.	9-035-7123-16	Self Tapping Screw #6 x 1/2 Black	6
10.	9-303-2275	Side Enclosure Assembly, Right Hand	1
11.	9-203-2071	Cable Assembly	1
12.	9-035-6962-10	Screw 4-40 x 1/4	3
13.	9-035-6962-61	Screw 4-40 x 3/8 Black	2
14.	9-403-1719	Power Supply PC Board Assembly	1
15.	9-145-0353	Shield Reflector	1
16.	9-224-0014	Lamp 82V 200W	1
17.	9-035-6962-02	Screw 4-40 x 1/8 Black	1
18.	9-111-2030	Retainer	1
19.	9-203-2055	Heat Absorbing Glass Assembly	1
20.	9-230-0294	Guide	1
21.	9-245-0129	Shield	1
22.	9-035-7120-16	Self Tapping Screw #4 x 1/4	2
23.	9-222-0128	Motor	3
24.	9-035-7871-46	Compression Spring	3
25.	9-201-0410	Spring Housing	3
26.	9-211-1777-01	Retainer	1
27.	9-311-1366	Motor Plate	1
28.	9-251-0451	Stud	3
29.	9-251-0458	Shoulder Screw	6
30.	9-211-1777-02	Retainer	1
31.	9-203-2068-03	Hub Assembly	1
32.	9-201-0389	Guide	3
33.	9-221-0119	Filter, Cyan	1
34.	9-221-0121	Filter, Yellow	1
35.	9-111-2026	Filter Frame	3
36.	9-221-0120	Filter, Magenta	1
37.	9-035-7012-08	Screw 10-32 x 1/4 Black	2
38.	9-035-6962-10	Screw 4-40 x 1/4	1
39.	9-203-2053	PCB Holder Assembly	1
40.	9-035-7120-16	Self Tapping Screw #4 x 1/4	4
41.	9-035-6962-02	Screw 4-40 x 1/8	3
42.	9-211-1771	Cover	1
43.	9-230-0299	Extrusion	4
44.	9-211-1758-30	Cover	1
45.	9-035-6962-19	Screw 4-40 x 3/8	2
46.	9-201-0392	Filter Holder	1
47.	9-303-2282	PCB Assembly	1
48.	9-203-2054	Plate Assembly	1
49.	9-190-0304	Spring	2
50.	9-401-0132-30	Lamphouse Door	1
51.	9-035-6962-02	Screw 4-40 x 1/8	4
52.	9-311-1402-30	Side Plate	1
53.	9-121-0134	Filter, Red	1

Table 5-1a. D5500 Lamphouse, Parts List (cont)

Item	Part Number	Description	Qty.
54.	9-035-3039-48	Retaining Ring	3
55.	9-121-0135	Filter, Green	1
56.	9-121-0136	Filter, Blue	1
57.	9-035-7122-08	Self Tapping Screw #6 x 5/16 Black	2
58.	9-101-1702	Diffuser	1
59.	9-035-7122-08	Self Tapping Screw #6 x 5/16 Black	2
60.	9-211-2502	Baffle, Light	1
61.	9-035-4950-17	Lens Red .280 OD	1
62.	9-035-6992-91	Screw 6-32 x 2½ Black	1
63.	9-035-6992-19	Screw 6-32 x 3/8 Black	1
64.	9-035-6962-19	Screw 4-40 x 3/8 Black	2
65.	9-035-6962-02	Self Tapping Screw #6 x 5/16 Black	8
66.	9-035-8269-74	Switch	1
67.	9-035-2349-22	Plug, Line Filter	1
68.	9-035-6536-07	Resistor 2 Ohms 25 Watt	1
69.	9-151-0436	Washer, Fiber	2
70.	9-035-5496-34	Nut 6-32 Self Locking	1
71.	9-035-7120-16	Self Tapping Screw #4 x 1/4	2
72.	9-035-7591-10	Socket	1
73.	9-035-7012-21	Screw 10-32 x 3/8 Black	4
74.	9-035-7122-13	Self Tapping Screw #6 x 5/16	2
75.	9-035-6962-03	Screw 4-40 x 1/8 Black	2
76.	9-230-0301	Bracket	1
77.	9-151-3639	Post	4
78.	9-190-0307	Spring	1
79.	9-035-7123-09	Self Tapping Screw #6x5/16 Undercut Flat Head Black	10
80.	9-303-2266	Bottom Plate Assembly	1
81.	9-430-0038-01	Side Enclosure	1
82.	9-311-1391-02	Locating Ring	1
83.	9-035-6961-12	Screw #4-40 x 1/4 Black	4
84.	9-035-7122-13	Self Tapping Screw #6 x 5/16	4
85.	9-201-0387	Roller	9
86.	9-203-2068-02	Hub Assembly	1
87.	9-311-1367	Filter Plate	3
88.	9-203-2068-01	Hub Assembly	1
89.	9-211-2500	Aperture Plate	1
90.	9-035-6992-10	Screw 6-32 x 1/4	3
91.	9-311-1402-02	Side Plate	2
92.	9-311-1402-01	Side Plate	2
93.	9-201-0414	Shield	1
94.	9-401-0143-03	4x5 Mixing Chamber	1
95.	9-035-7120-84	Self Tapping Screw #4x9/32 Undercut Flat Head	4
96.	9-301-0227	Diffuser	1
97.	9-311-1401-03	Base	1
98.	9-201-0388	Roller Front	3
99.	9-121-0069	Heat Absorbing Glass (IR)	1
100.	9-035-6991-12	Screw 6/32 x 1/4 Flat Head	4
101.	9-303-2243	Color Probe Assembly (consists of: 44, 45, 46, 47, 48, 51, 53, 54, 55, 56)	1
102.	9-303-2247	Door Assembly (consists of: 49, 50, 57, 59, 60, 61)	1

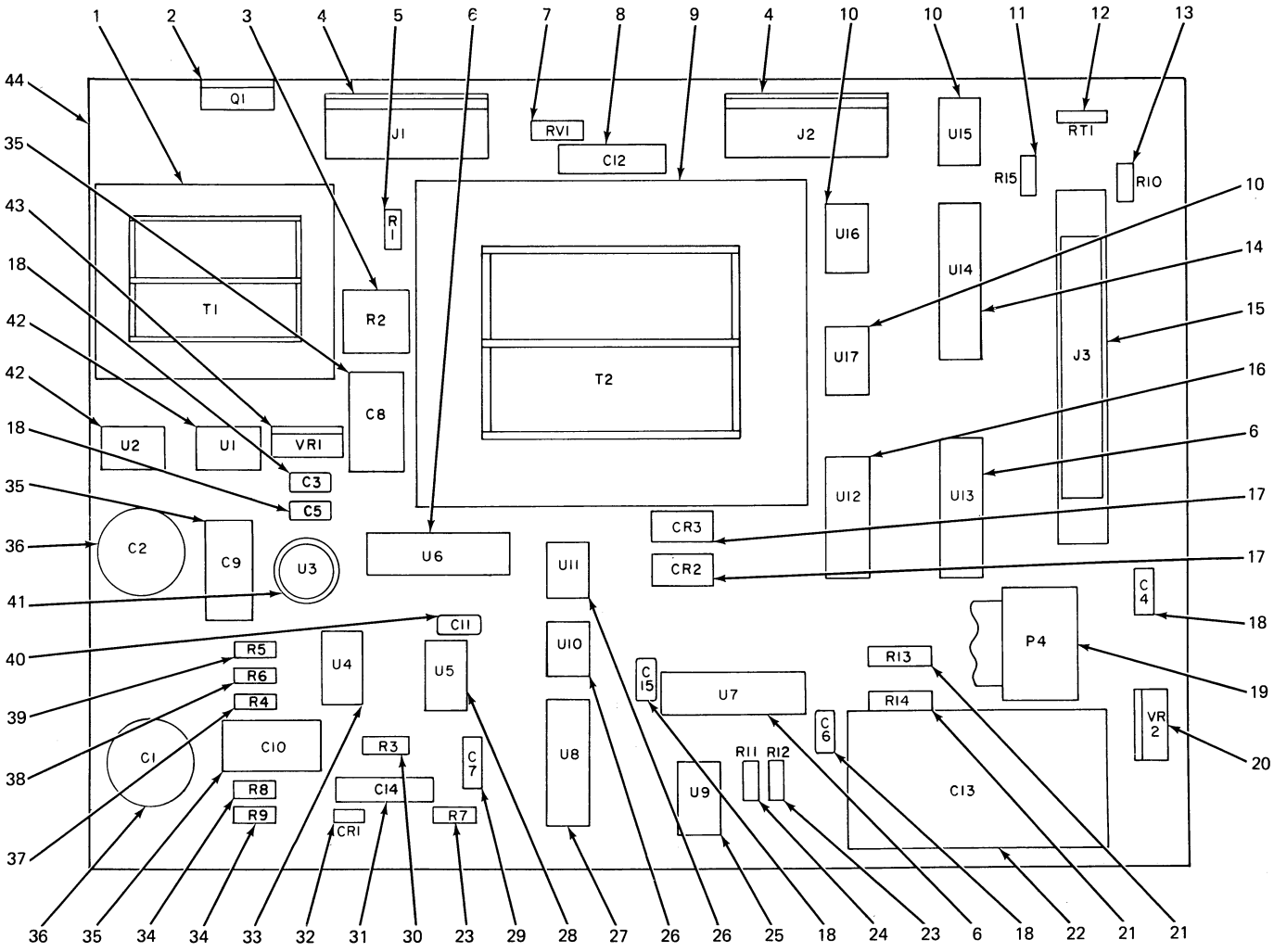


Figure 5-2. Power Supply Circuit Board Assembly, Parts Breakdown

Table 5-2. Power Supply Circuit Board Assembly, Parts List

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-2-	9-403-1719	POWER SUPPLY CIRCUIT BOARD ASSY	1	
5-2-1	9-035-8840-79	. TRANSFORMER, ST3-34	1	T1
5-2-2	9-035-7270-45	. TRIAC, SC142D	1	Q1
5-2-3	9-035-6251-07	. RESISTOR, VAR, 1K	1	R2
5-2-4	9-035-2364-89	. CONNECTOR, 6 PIN	2	J1, J2
5-2-5	9-035-6514-63	. RESISTOR, FXD, 210K, 1/4W, 1%	1	R1
5-2-6	9-035-6525-15	. RESISTOR NETWORK, 4.7K	3	U6, U7, U13
5-2-7	9-035-6528-06	. VARISTOR	1	RV1
5-2-8	9-035-1281-40	. CAPACITOR, 0.1MFD, 220V	1	C12
5-2-9	9-035-8840-80	. TRANSFORMER, ST6-16	1	T2
5-2-10	9-035-7282-34	. INTEGRATED CIRCUIT, UDN5714M	3	U15, U16, U17
5-2-11	9-035-6489-01	. RESISTOR, FXD, 2.7OHM, 1/4W, 5%	1	R15
5-2-12	9-035-6526-02	. THERMISTOR	1	RT1
5-2-13	9-035-6489-47	. RESISTOR, FXD, 220OHM, 1/4W, 5%	1	R10
5-2-14	9-035-7282-33	. INTEGRATED CIRCUIT, UDN2918A	1	U14
5-2-15	9-035-2365-02	. CONNECTOR, 26 PIN	1	J3
5-2-16	9-035-7282-26	. INTEGRATED CIRCUIT, CD40018	1	U12
5-2-17	9-035-7266-76	. RECTIFIER, IN5401	2	CR2, CR3
5-2-18	9-035-1272-60	. CAPACITOR, 0.1MFD, 50V	5	C3-C6, C15
5-2-19	9-103-1379	. CONNECTOR ASSY	1	P4
5-2-20	9-035-7282-16	. VOLTAGE REGULATOR, 7805C	1	VR2
5-2-21	9-035-6490-57	. RESISTOR, FXD, 560OHM, 1/2W, 5%	2	R13, R14
5-2-22	9-035-1275-97	. CAPACITOR, 4700MFD, 16V	1	C13
5-2-23	9-035-6487-02	. RESISTOR, FXD, 39K, 1/4W. 5%	2	R7, R12
5-2-24	9-035-6489-39	. RESISTOR, FXD, 100OHM, 1/4W, 5%	1	R11
5-2-25	9-035-7281-30	. INTEGRATED CIRCUIT, LM393N	1	U9
5-2-26	9-035-7274-05	. OPTO ISOLATOR, 4N25A	2	U10, U11
5-5-27	9-035-7282-14	. INTEGRATED CIRCUIT, CA3086	1	U8
5-2-28	9-035-7281-28	. INTEGRATED CIRCUIT, LM555	1	U5
5-2-29	9-035-1281-12	. CAPACITOR, 0.1MFD, 100V	1	C7
5-2-30	9-035-6514-61	. RESISTOR, FXD, 91K, 1/4W, 1%	1	R3
5-2-31	9-035-1281-31	. CAPACITOR, 0.47MFD, 100V	1	C14
5-2-32	9-035-7266-52	. DIODE, 1N914	1	CR1
5-2-33	9-035-7282-05	. INTEGRATED CIRCUIT, LM358N	1	U4
5-2-34	9-035-6489-51	. RESISTOR, FXD, 330OHM, 1/4W, 5%	2	R8, R9
5-2-35	9-035-1281-27	. CAPACITOR, 2.2MFD, 100V	3	C8, C9, C10
5-2-36	9-035-1275-74	. CAPACITOR, 220MFD, 25V	2	C1, C2
5-2-37	9-035-6489-75	. RESISTOR, FXD, 3.3K, 1/4W, 5%	1	R4
5-2-38	9-035-6487-12	. RESISTOR, FXD, 100K, 1/4W, 5%	1	R6
5-2-39	9-035-6514-35	. RESISTOR, FXD, 1K, 1/4W, 1%	1	R5
5-2-40	9-035-1272-59	. CAPACITOR, 0.022MFD, 50V	1	C11
5-2-41	9-035-7282-17	. INTEGRATED CIRCUIT, AD536AJH	1	U3
5-2-42	9-035-7266-75	. RECTIFIER, VM18	2	U1, U2
5-2-43	9-035-7282-15	. VOLTAGE REGULATOR, 7808C	1	VR1
5-2-44	9-322-0160	. CIRCUIT BOARD, BLANK	1	

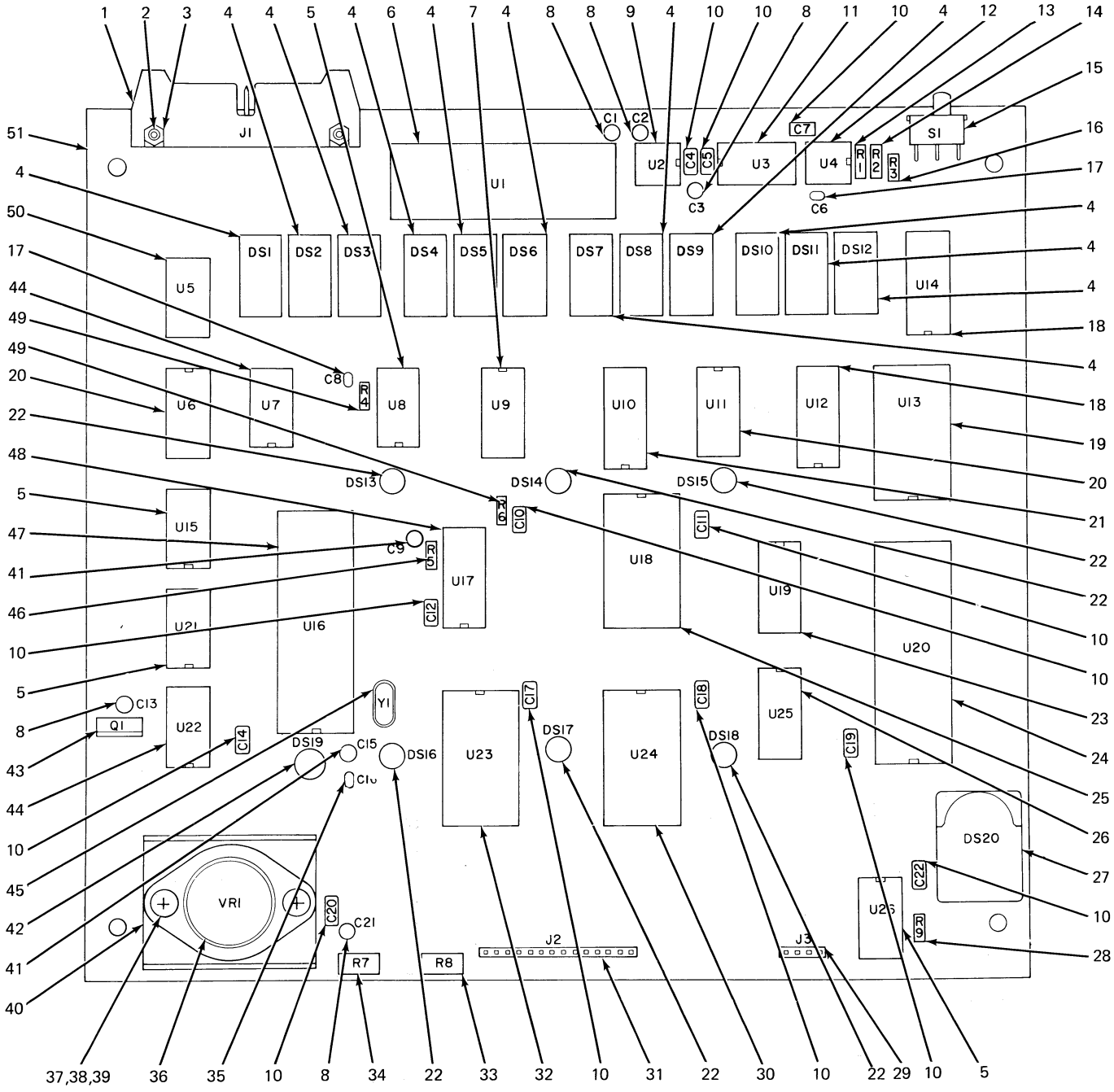


Figure 5-3. CLS Controller, Circuit Board Assembly, Parts Breakdown

Table 5-3. CLS Controller, Circuit Board Assembly, Parts List

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-3-	9-403-1756	CLS CONTROLLER CIRCUIT BOARD ASSY	1	
5-3-1	9-035-2365-01	. CONNECTOR, 26 PIN	1	J1
5-3-2	9-035-6932-32	. SCREW, MACHINE, 2-56X3/8	2	
5-3-3	9-035-5492-11	. NUT, HEXAGON, 2-56	2	
5-3-4	9-035-4693-10	. LED DISPLAY	12	DS1-DS12
5-3-5	9-035-7882-26	. INTEGRATED CIRCUIT, CD4001BE	4	U8, U15, U21, U26
5-3-6	9-035-7282-23	. INTEGRATED CIRCUIT, ADC0816	1	U1
5-3-7	9-035-6525-07	. RESISTOR NETWORK, 1000HM	1	U9
5-3-8	9-035-1285-50	. CAPACITOR, 10MFD, 16V	5	C1-C3, C13, C21
5-3-9	9-035-7282-28	. INTEGRATED CIRCUIT, REF02CP	1	U2
5-3-10	9-035-1272-60	. CAPACITOR, 1MFD, 50V	12	C4, C5, C7, C10, C11, C12, C14, C17-C20, C22
5-3-11	9-035-7282-32	. INTEGRATED CIRCUIT, DG387CJ	1	U3
5-3-12	9-035-7282-12	. INTEGRATED CIRCUIT, CA3160AE	1	U4
5-3-13	9-035-6513-12	. RESISTOR, FXD, 15K, 1/4W, .1%	1	R1
5-3-14	9-035-6513-11	. RESISTOR, FXD, 1K, 1/4W, .1%	1	R2
5-3-15	9-035-8266-27	. SWITCH, SLIDE	1	S1
5-3-16	9-035-6487-36	. RESISTOR, FXD, 1MEG, 1/4W, 5%	1	R3
5-3-17	9-035-1272-49	. CAPACITOR, 100PF, 50V	2	C6, C8
5-3-18	9-035-7282-33	. INTEGRATED CIRCUIT, UDN2981A	2	U12, U14
5-3-19	9-035-7282-31	. INTEGRATED CIRCUIT, CD4514BE	1	U13
5-3-20	9-035-7282-36	. INTEGRATED CIRCUIT, CA3082	2	U6, U11
5-3-21	9-035-7282-29	. INTEGRATED CIRCUIT, ULN2803A	1	U10
5-3-22	9-035-4687-17	. LAMP, 7344PS	6	DS13-DS18
5-3-23	9-035-7281-69	. INTEGRATED CIRCUIT, MC145568CP	1	U19
5-3-24	9-035-7282-20	. INTEGRATED CIRCUIT, 8279	1	U20
5-3-25	9-122-0407	. INTEGRATED CIRCUIT, PROM 2716	1	U18
5-3-26	9-035-7282-35	. INTEGRATED CIRCUIT, CD4050BE	1	U25
5-3-27	9-035-7652-05	. BUZZER, KMB-06	1	DS20
5-3-28	9-035-6487-28	. RESISTOR, FXD, 470K, 1/4W, 5%	1	R9
5-3-29	9-035-2364-97	. CONNECTOR, 4 PIN	1	J3
5-3-30	9-122-0406	. INTEGRATED SWITCH, PROM 2716	1	U24
5-3-31	9-035-2364-98	. CONNECTOR, 14 PIN	1	J2
5-3-32	9-035-7282-22	. INTEGRATED CIRCUIT, 8212	1	U23
5-3-33	9-035-6251-06	. RESISTOR, VAR, 2000HM, 1/2W	1	R8
5-3-34	9-035-6251-48	. RESISTOR, VAR, 5K, 1/2W	1	R7
5-3-35	9-035-1272-55	. CAPACITOR, 22PF, 50V	1	C16
5-3-36	9-035-7282-27	. INTEGRATED CIRCUIT, LM309K	1	VR1
5-3-37	9-035-6992-18	. SCREW, MACHINE, 6-32X3/8	2	
5-3-38	9-035-9316-34	. WASHER, LOCK, NO. 6	2	
5-3-39	9-035-5492-45	. NUT, HEXAGON, 6-32	2	
5-3-40	9-035-3920-13	. HEAT SINK	1	
5-3-41	9-035-1285-21	. CAPACITOR, 1MFD, 35V	2	C9, C15
5-3-42	9-035-4692-10	. LED, RED	1	DS19

Table 5-3. CLS Controller, Circuit Board Assembly, Parts List (cont)

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-3-43	9-035-7272-55	. TRANSISTOR, D44E1	1	Q1
5-3-44	9-035-7281-22	. INTEGRATED CIRCUIT, 4011	2	U7, U22
5-3-45	9-035-2680-03	. CRYSTAL	1	Y1
5-3-46	9-035-6487-12	. RESISTOR, FXD, 100K, 1/4W, 5%	1	R5
5-3-47	9-035-7282-19	. INTEGRATED CIRCUIT, 8039	1	U16
5-3-48	9-035-7282-37	. INTEGRATED CIRCUIT, X2210-30	1	U17
5-3-49	9-035-6489-87	. RESISTOR, FXD, 10K, 1/4W, 5%	2	R4, R6
5-3-50	9-035-7282-25	. INTEGRATED CIRCUIT, CD4013BE	1	U5
5-3-51	9-422-0108	. CIRCUIT BOARD, BLANK	1	

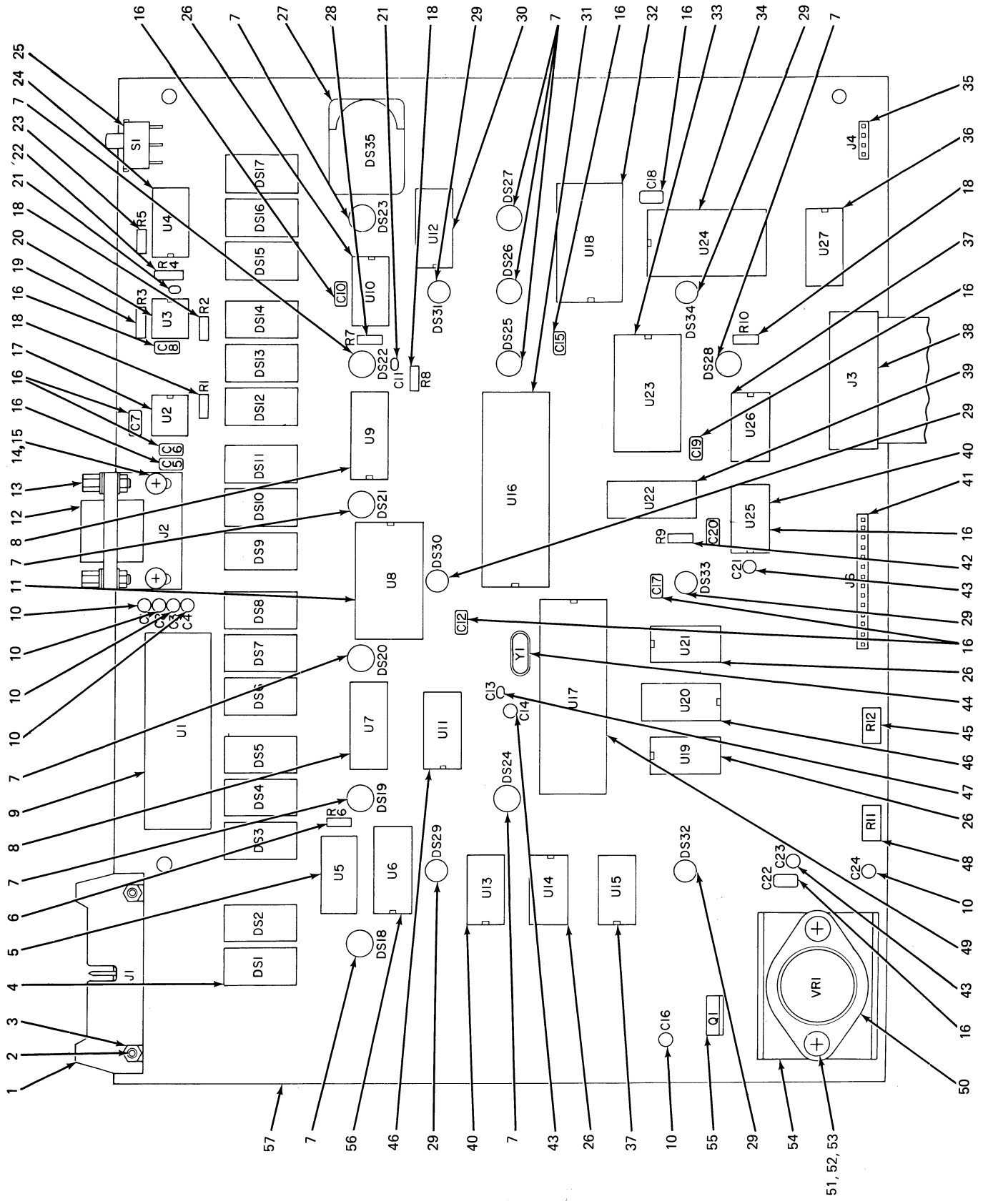


Figure 5-4. CLS Translator/Controller, Circuit Board Assembly, Parts Breakdown

Table 5-4. CLS Translator/Controller, Circuit Board Assembly, Parts List

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-4-	9-403-1756	CLS TRANSLATOR/CONTROLLER CIRCUIT BOARD ASSY	1	
5-4-1	9-035-2365-01	. CONNECTOR, 26 PIN	1	J1
5-4-2	9-035-6932-32	. SCREW, MACHINE, 2-56X3/8	2	
5-4-3	9-035-5492-11	. NUT, HEXAGON, 2-56	2	
5-4-4	9-035-4693-10	. LED DISPLAY	17	DS1-DS17
5-4-5	9-035-6525-07	. RESISTOR NETWORK, 1000HM	1	U5
5-4-6	9-035-6489-39	. RESISTOR, FXD, 1000HM, 1/4W, 5%	1	R6
5-4-7	9-035-4692-10	. LED, RED	11	DS18-DS28
5-4-8	9-035-7282-33	. INTEGRATED CIRCUIT, UDN2981A	2	U7, U9
5-4-9	9-035-7282-23	. INTEGRATED CIRCUIT, ADCD816	1	U1
5-4-10	9-035-1285-50	. CAPACITOR, 10MFD, 16V	6	C1-C4, C16, C24
5-4-11	9-035-7282-31	. INTEGRATED CIRCUIT, CD4514BE	1	U8
5-4-12	9-035-2364-92	. CONNECTOR, DEP9SCA	1	J2
5-4-13	9-035-2346-02	. SCREWLOCK, FEMALE	1	
5-4-14	9-035-6962-55	. SCREW, MACHINE, 4-40X5/16	2	
5-4-15	9-035-5492-19	. NUT, HEXAGON, 4-40	2	
5-4-16	9-035-1272-60	. CAPACITOR, 0.1MFD, 50V	12	C5-C8, C10, C12, C15, C17-C20, C22
5-4-17	9-035-7282-28	. INTEGRATED CIRCUIT, REF02CP	1	U2
5-4-18	9-035-6489-87	. RESISTOR, FXD, 10K, 1.4W, 5%	4	R1, R2, R8, R10
5-4-19	9-035-6513-11	. RESISTOR, FXD, 1K, 1/4W, .1%	1	R3
5-4-20	9-035-7282-12	. INTEGRATED CIRCUIT, CA3160AE	1	U3
5-4-21	9-035-1272-49	. CAPACITOR, 100PF, 50V	2	C9. C11
5-4-22	9-035-6513-12	. RESISTOR, FXD, 15K, 1/4W, 5%	1	R4
5-4-23	9-035-6487-36	. RESISTOR, FXD, 1MEG, 1/4W, 5%	1	R5
5-4-24	9-035-7282-32	. INTEGRATED CIRCUIT, DG387CJ	1	U4
5-4-25	9-035-8266-27	. SWITCH, SLIDE	1	S1
5-4-26	9-035-7282-26	. INTEGRATED CIRCUIT, CD4001BE	4	U10, U14, U19, U21
5-4-27	9-035-7652-05	. BUZZER, KMB-06	1	DS35
5-4-28	9-035-6487-28	. RESISTOR, FXD, 470K, 1/4W, 5%	1	R7
5-4-29	9-035-4687-17	. LAMP, 7344PS	6	DS29-DS34
5-4-30	9-035-7281-69	. INTEGRATED CIRCUIT, MC14556BCP	1	U12
5-4-31	9-035-7282-20	. INTEGRATED CIRCUIT, 8279	1	U16
5-4-32	9-122-0404	. INTEGRATED CIRCUIT, PROM, 2716	1	U18
5-4-33	9-035-7282-22	. INTEGRATED CIRCUIT, 8212	1	U23
5-4-34	9-122-0405	. INTEGRATED CIRCUIT, PROM, 2716	1	U24
5-4-35	9-035-2364-97	. CONNECTOR, 4 PIN	1	J4
5-4-36	9-035-7282-35	. INTEGRATED CIRCUIT, CD4050BE	1	U27
5-4-37	9-035-7281-22	. INTEGRATED CIRCUIT, 4011	2	U15, U26
5-4-38	9-203-2067	. CABLE ASSY	1	J3
5-4-39	9-035-7282-24	. INTEGRATED CIRCUIT	1	U22
5-4-40	9-035-7282-25	. INTEGRATED CIRCUIT, CD40138E	2	U13, U25
5-4-41	9-035-2364-98	. CONNECTOR, 14 PIN	1	J6

Table 5-4. CLS Translator/Controller, Circuit Board Assembly, Parts List (cont)

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-4-42	9-035-6487-12	. RESISTOR, FXD, 100K, 1/4W, 5%	1	R9
5-4-43	9-035-1285-21	. CAPACITOR, 1MFD, 35V	3	C14, C21, C23
5-4-44	9-035-2680-03	. CRYSTAL	1	Y1
5-4-45	9-035-6251-06	. RESISTOR, VAR, 200OHM, .5W	1	R12
5-4-46	9-035-7282-36	. INTEGRATED CIRCUIT, CA3082	2	U11, U20
5-4-47	9-035-1272-55	. CAPACITOR, 22PF, 50V	1	C13
5-4-48	9-035-6251-48	. RESISTOR, VAR, 5K, .5W	1	R11
5-4-49	9-035-7282-19	. INTEGRATED CIRCUIT, 8039	1	U17
5-4-50	9-035-7282-27	. INTEGRATED CIRCUIT, LM309K	1	VR1
5-4-51	9-035-6992-18	. SCREW, MACHINE, 6-32X3/8	2	
5-4-52	9-035-9316-34	. LOCAKWASHER, NO. 6	2	
5-4-53	9-035-5492-45	. NUT, HEXAGON	2	
5-4-54	9-035-3920-13	. HEAT SINK	1	
5-4-55	9-035-7272-55	. TRANSISTOR, D44E1	1	Q1
5-4-56	9-035-7282-29	. INTEGRATED CIRCUIT, ULN2803A	1	U6
5-4-57	9-422-0106	. CIRCUIT BOARD, BLANK	1	

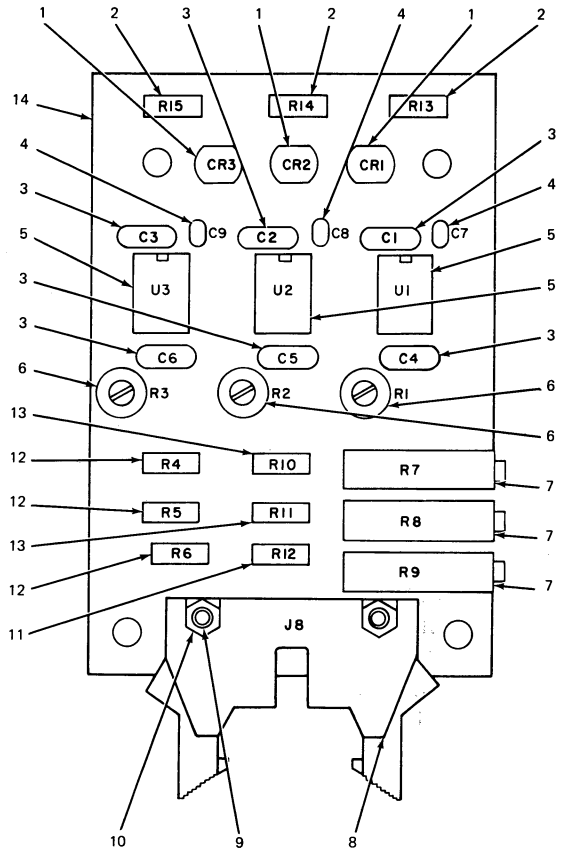


Table 5-5. Color Balance Probe Circuit Board Assembly, Parts Breakdown

Table 5-5. Color Balance Probe Circuit Board Assembly, Parts List

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-5-	9-303-2232	COLOR BALANCE PROBE CIRCUIT BOARD ASSY	1	
5-5-1	9-035-7280-20	. PHOTOCELL	3	CR1-CR3
5-5-2	9-035-6487-12	. RESISTOR, FXD, 100K, 1/4W	3	R13-R15
5-5-3	9-035-1272-59	. CAPACITOR, .022MFD, 50V	6	C1-C6
5-5-4	9-035-1272-45	. CAPACITOR, .001MFD, 50V	3	C7-C9
5-5-5	9-035-7282-12	. INTEGRATED CIRCUIT, CA3160AE	3	U1-U3
5-5-6	9-035-6251-58	. RESISTOR, VAR, 100K	3	R1-R3
5-5-7	9-035-6251-73	. RESISTOR, VAR, 100K	3	R7-R9
5-5-8	9-035-2365-14	. CONNECTOR	1	J8
5-5-9	9-035-6932-32	. SCREW, MACHINE, 2-56X3/8	2	
5-5-10	9-035-5492-11	. NUT, HEXAGON, 2-56	2	
5-5-11	9-035-6487-41	. RESISTOR, FXD, 1.6MEG, 1/4W	1	R12
5-5-12	9-035-6489-39	. RESISTOR, FXD, 1000HM, 1/4W	3	R4-R6
5-5-13	9-035-6487-44	. RESISTOR, FXD, 2.2MEG, 1/4W	2	R10, R11
5-5-14	9-322-0171	. CIRCUIT BOARD, BLANK	1	

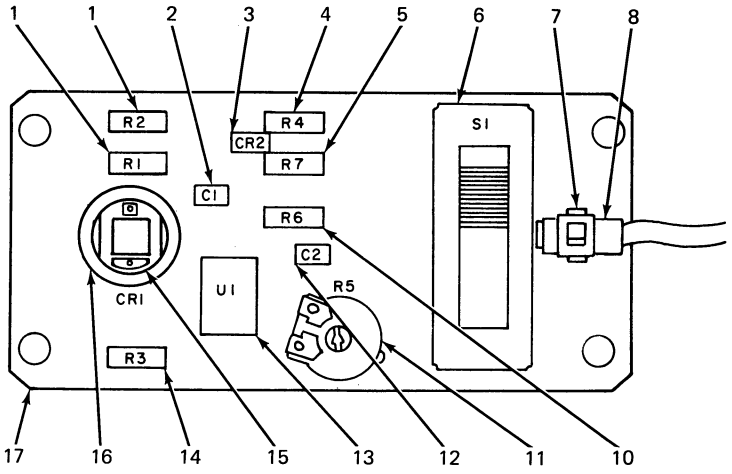


Table 5-6. Density Probe Circuit Board Assembly, Parts Breakdown

Figure 5-6. Density Probe Circuit Board Assembly, Parts List

Figure and Index No.	Part Number	Description	Qty	Reference Designation
5-6-	9-303-2297	DENSITY PROBE CIRCUIT BOARD ASSY	1	
5-6-1	9-035-6487-88	. RESISTOR, FXD, 100MEG, 1/4W, 5%	2	R1, R2
5-6-2	9-035-1272-49	. CAPACITOR, 100PF, 50V	1	C1
5-6-3	9-035-7262-21	. ZENER DIODE, 1N750	1	CR2
5-6-4	9-035-6489-39	. RESISTOR, FXD, 1000HM, 1/4W, 5%	1	R4
5-6-5	9-035-6489-89	. RESISTOR, FXD, 12K, 1/4W, 5%	1	R7
5-6-6	9-122-0418	. SWITCH, SLIDE	1	S1
5-6-7	9-035-2346-08	. CABLE CLAMP	1	
5-6-8	9-035-8466-73	. FERRULE	1	
5-6-9	9-203-2051	. CONNECTOR AND CABLE ASSY	1	
5-6-10	9-035-6487-05	. RESISTOR, FXD, 51K, 1/4W, 5%	1	R6
5-6-11	9-035-6251-62	. RESISTOR, VAR, 100K	1	R5
5-6-12	9-035-1272-59	. CAPACITOR, .022MFD, 50V	1	C2
5-6-13	9-035-7282-12	. INTEGRATED CIRCUIT, CA3160AE	1	U1
5-6-14	9-035-6487-68	. RESISTOR, FXD, 22MEG, 1/4W, 5%	1	R3
5-6-15	9-222-0682	. PHOTOCELL	1	CR1
5-6-16	9-101-1707	. HOLDER, PHOTOCELL	1	
5-6-17	9-322-0172	. CIRCUIT BOARD, BLANK	1	

APPENDIX A

SERVICE MODIFICATIONS

INTRODUCTION

This Appendix contains instructions for the inspection and update of the D5500 Chassis, Catalog Number 407-900. Inspection and rework can be accomplished on-site by removing the lamphouse and cassette at the outset.

NOTE

Date codes on boxed goods date-coded higher than 1013 need NOT be inspected.

TOOLS AND SUPPLIES REQUIRED

The following tools and supplies are required to accomplish the rework instructions contained in this Appendix:

(a) Phillips #1 screwdriver
(b) Phillips #2 screwdriver
(c) 3/8" flat blade screwdriver
(d) 5/16" box or open-end wrench
(e) 1/2" box or open-end wrench
(f) #10 (5/32") Allen key
(g) Lubricant, part number 9-035-4980-08
(h) Lens stage alignment fixture
(i) Penlight
(j) Shim, .010 inch
(k) Locktite, part number 9-035-0050-05

MATERIALS REQUIRED

The following replacement material is required:

(a) Bellows Assembly, part number 9-303-2292-01
(b) Lens Stage Swivel Assembly, part number 9-203-2081
(c) Focus Knob Assembly, part number 9-203-2085-02
(d) Focus Knob Assembly Setscrews, part number 9-035-7009-49
(e) Focus Rod, part number 9-251-0456
(f) Focus Roller Assembly, part number 9-303-2254
(g) Packaging Label, part number 9-306-0284

BELLOWS ASSEMBLY REWORK

The D5500 Bellows Assembly supplied in the kit can be installed easily with the use of a Phillips screwdriver. Both the upper and the lower frames incorporated into the rectangular-shaped bellows have four pre-punched holes in each frame corresponding to the mounting holes in the film stage and lens stage of the enlarger. Note that the frames are loosely held in place by the folds in the bellows; care should be taken to keep them in place when installing the bellows. New bellows are designed to allow full compression with minimal tension on the focusing movement of the enlarger. It is not

recommended that you overtighten the four knurled adjustment knobs to the rear of the focusing block to keep the focusing movement from slipping. The movement should be smooth to the touch, but tight enough to maintain focusing at all magnifications.

Bellows Check - Look into the film/lens assembly opening and check to see if there is a bellows frame (B). If there is a bellows frame, no replacement is required. If there is no frame, the bellows must be replaced, as described in the following paragraph.

Procedure - Refer to figure A-1 and proceed as follows:

a. Turn the carriage lock handle on the chassis to the "lock" position.

b. Remove the lamphouse and lens turret or lens plate and negative carrier cassette.

c. Using a Phillips screwdriver, remove the four self-tapping flat head screws which secure the bellows to the film stage; remove the four self-tapping screws holding the bottom of the bellows to the lens stage. DO NOT DISCARD THESE SCREWS - they will be used in reassembling the new bellows.

NOTE

If metal plates are cemented to the bellows on the enlarger, these plates are not required for use with the replacement bellows. Discard the old bellows with the cemented plates.

d. Hold the replacement bellows to the underside surface of the film stage with one hand and line up the bellows frame holes with the holes on the film stage. Insert one of the flat self-tapping screws removed earlier into any one of the four holes in the film stage and loosely tighten the screw; install the remaining three screws to attach the bellows then securely tighten all screws. DO NOT OVERTIGHTEN SCREWS - threaded holes may be damaged.

e. Follow the same procedure to attach the bottom of the bellows to the lens stage.

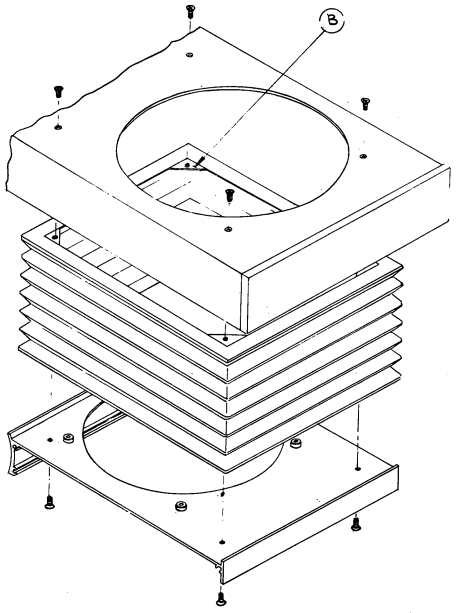


Figure A-1. Rework of Bellows Assembly

LENS STAGE SWIVEL PRESS NUT

Press Nut Check - Using a #10 (5/32") Allen key, remove the center socket head screw and lock washer (C, figure A-1) from the lens stage. (Note that later versions use a 5/16" slotted head hex screw.) With a small penlight, check to see if the hole above (which has the front end of the screw in it) is surrounded by steel or black paint. If it is steel, the part is up to date and does not require replacement; however, if it is black, the lens stage swivel requires replacement, as described in the following paragraph.

Lens Stage Swivel Replacement - Proceed as follows:

a. Remove the remaining two socket head screws and washers.
b. Remove the long socket head screw and flat washer from the rear of the focus roller assembly (E).
c. Replace the old assembly with the new assembly, part number 9-203-2081.
d. Install the long socket head screw and flat washer (E); tighten the screw.
e. Install the three socket head short screws and washers (C) in the front of the lens stage (snug, but not tight).
f. Using the alignment fixture, align the lens stage and tighten the three short socket head screws; do not overtighten. (If the alignment fixture is not available, perform the lens stage alignment procedures provided earlier in this manual.)
g. Lower bellows and remove the alignment fixture. This completes the replacement procedure. (Retain replaced items for factory instructions.)

FOCUS ROD

Focus Rod Check - Check the focus rod as follows:

a. Extend the bellows approximately eight inches.
b. Visually inspect and feel the top of the rod (near the film stage) for a scored focus rod.
c. If the focus rod is not scored, the focus rods are acceptable and no further action is required. However, if the focus rods are damaged, replace the focus rods and the Focus Roller Assembly, part number 9-303-2254, as described in the following paragraph.

Focus Rod and Focus Roller Assembly Replacement - Proceed as follows:

a. Loosen (but do not remove) the tension nuts (F, figure A-1) for both focus rods, located on the focus roller assembly.
b. Remove the four Phillips head screws (G) on top and bottom of the focus rods.
c. Pull the two focus rods forward past the brake locking plate.
d. Collapse the bellows to full compression.
e. Pull the defective rod(s) out.

NOTE

If the rod does not go through the bushing, then lift the bellows and remove it from the opposite direction. This is due to some flaring at one end of the rod, on some rods.

f. Remove the long socket head screw (E) and washer from the rear of the focus roller assembly; this will release the focus swivel and bellows.

g. Remove the old focus roller assemblt and replace with the new assembly.

h. Install the new rods through the focus roller assembly over the rollers and through the bushing. Check rod ends for flaring and ensure that non-flared ends are inserted first.

i. With the bellows collapsed, set the focus rods back into position between the brake plate and the film stage.

j. Install the four Phillips screws (G) loosely.

k. With the bellows fully compressed, tighten the two screws in the film stage.

l. Fully extend the bellows and tighten the two screws on the brake plate.

m. Readjust the tension nuts (F) and check that the bellows moves smoothly throughout its complete range.

n. Check the alignment of the lens stage and align, if necessary. This completes the replacement procedure. (Retain replaced items for factory instructions.)

TENSION SCREW LUBRICATION AND KNOB REPLACEMENT

NOTE

If a focus rod is damaged, also replace the focus roller assembly.

a. Remove both focus knobs by prying them off (old type knobs) with a flat blade screwdriver.

b. Remove each end cap by removing the small Phillips head screw located in the end cap of the focus roller assembly.

c. Inspect the tension screw (U-bolt) for lubricant. Inspect the focus roller shaft for physical damage under the tension screw.

d. If sufficient lubricant is present and the focus shaft is in good condition, no further action is required.

e. If the lubricant is missing, lubricate the shaft generously on the open side of the tension screw on the focus shaft with lubricant, part number 9-035-4980-08.

f. If the focus shaft is damaged, replace the focus roller assembly as described in the previous paragraph.

g. Reinstall the end caps and install the small Phillips screws.

h. With the focus knob setscrew out, apply a small drop of Locktite to the thread. Insert into the focus knob and begin threading it into the knob bushing. Install the focus knob on the focus shaft (setscrew to rest on flat of focus shaft), adjust position, and turn the knob setscrew until it is tight on the focus shaft. This completes lubrication and knob replacement/ inspection.

BACKPLATE SUBASSEMBLY CHECKS

Refer to figure A-2 and proceed as follows:

a. Raise the chassis to the top of the column.

b. Remove four top bolts (A) using 1/2" box wrench, or wrench supplied with the chassis.

c. Remove the film/lens stage from the column.

d. Retain the hardware for later re-installation of the film stage to the column.

e. Loosen the negator plates via the two access holes in the back plate. Use a #2 Phillips screwdriver and loosen the screw no more than 1-1/2 turns.

f. Grasp the negator spring and pull the clamp off the negator bracket and then move the spring in the direction to release it. Do this for both springs; this releases the negator assembly.

g. Remove the negator assembly from the chassis assembly.

h. Inspect the four rollers for:

1 - Straightness
2 - Visible damage (scored, worn, nicked, etc.)
3 - Clearance (0.010 in. clearance, min.)
4 - Looseness (plastic rollers are tight on bearings)

i. Inspect the back plate for flatness. It should be flat to within 0.015 inches.

j. Check that spring levers move freely and do not have excessive play.

k. Replace Back Plate Assemby, part number 9-403-1696 if it does not meet the requirements outlined in steps d, e or f.

l. If the requirements of d, e and f are met, place the negator assembly back into position. Grasp one of the negator springs, making sure that the tab is facing correctly on the clamp, pull it forward and onto the appropriate slot. Repeat for the second negator spring.

m. Hold the negator spring clamps straight and tighten the clamp via the screw access holes in the back plate; repeat for other spring. This completes the inspection.

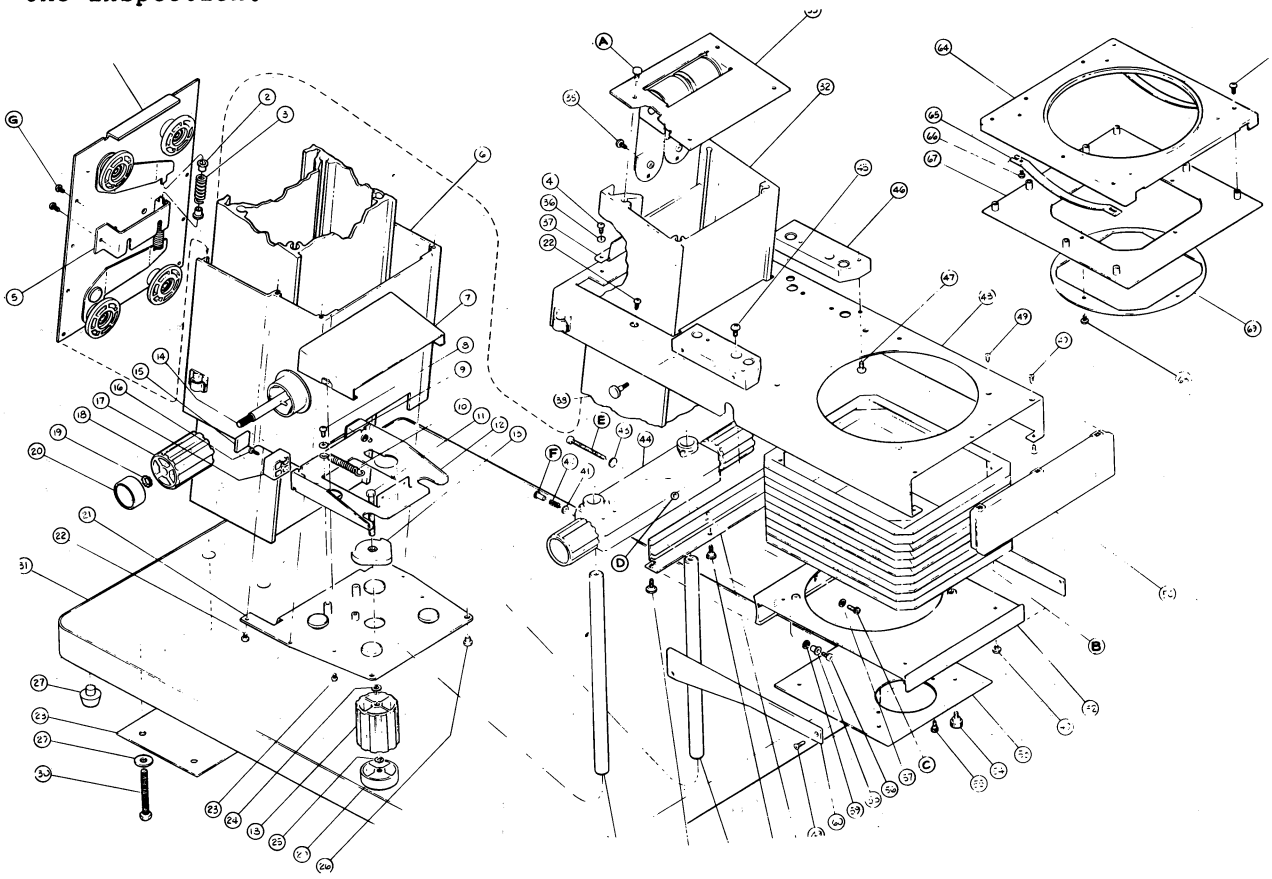


Figure A-2. Disassembly for Rework

LAMPHOUSE CHECKS

a. Check motor bushings for tightness and wear. Setscrews must be #4; replace as required.

b. Check IR filter and filter holder. Install clip to hold IR filter in position, if required.

c. Check that color probe is latest configuration. Series resistors R4, R5 and R6 must be 3.91K ohms each. Feedback resistors R10, R11 and R12 must be 100K each. R13 should be 2.2 megohms; and R14 should be 1 megohm. Update as required. Readjust gain and offset nulls after updates are completed.

d. Check that power supply ground return resistors R17 and R18 are 470K ohms. Check that R16 is 68K ohms, C15 is 0.1 mfd, 50 wvdc, C11 is .22 mfd, 50 wvdc, R1 is 210K ohms $\pm$1%, R2 is a 1K ohm potentiometer. Update as required.

e. Check analog regulator. If regulator is 5v dc, color probe must be removable from mixing chamber.

NOTE

Update power supply to 10 volt configuration only if a complete system of lamphouse and controller is being updated.

f. Power supply update requires the following, in addition to steps d and e:

1 - Change analog regulator VR2 to type 7810C, 10v dc.
2 - Change resistor R10 (temperature sensing circuit) to 470 ohms.
3 - Color probe must be attached permanently to mixing chamber.
4 - Color probe gain and nulls must be readjusted.

AUTO CLS CONTROLLER

a. Check for latest EPROMS and replace, if necessary.

b. Check beeper circuit and update, if required.

TRANSLATOR CONTROLLER

a. Check for latest EPROMS and replace, if necessary.

b. Check beeper circuit and update, if required.

c. Check for time LSD decimal point connection. Connect DP, pin 9, to the other decimal points.

d. Check that XICOR memory is type X2001A; replace if it is not an "A" revision. Make the latest ECO circuit changes.

e. Check that latest density probe is used. If old probe is present, power supply must be updated to 10v dc and probe must be replaced with new probe.

REPACKAGING

Once the inspection has been completed on finished goods, the outside package label has to be replaced with a label that contains a red "D" on "D"5500, part number 9-306-0284.

Omega Division
BERKEY MARKETING COMPANIES
25-20 Brooklyn-Queens Expwy. West, Woodside, NY 11377 • (212) 932-4040
3400 East 70th Street, Long Beach, CA 90805 • (213) 774-6405

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