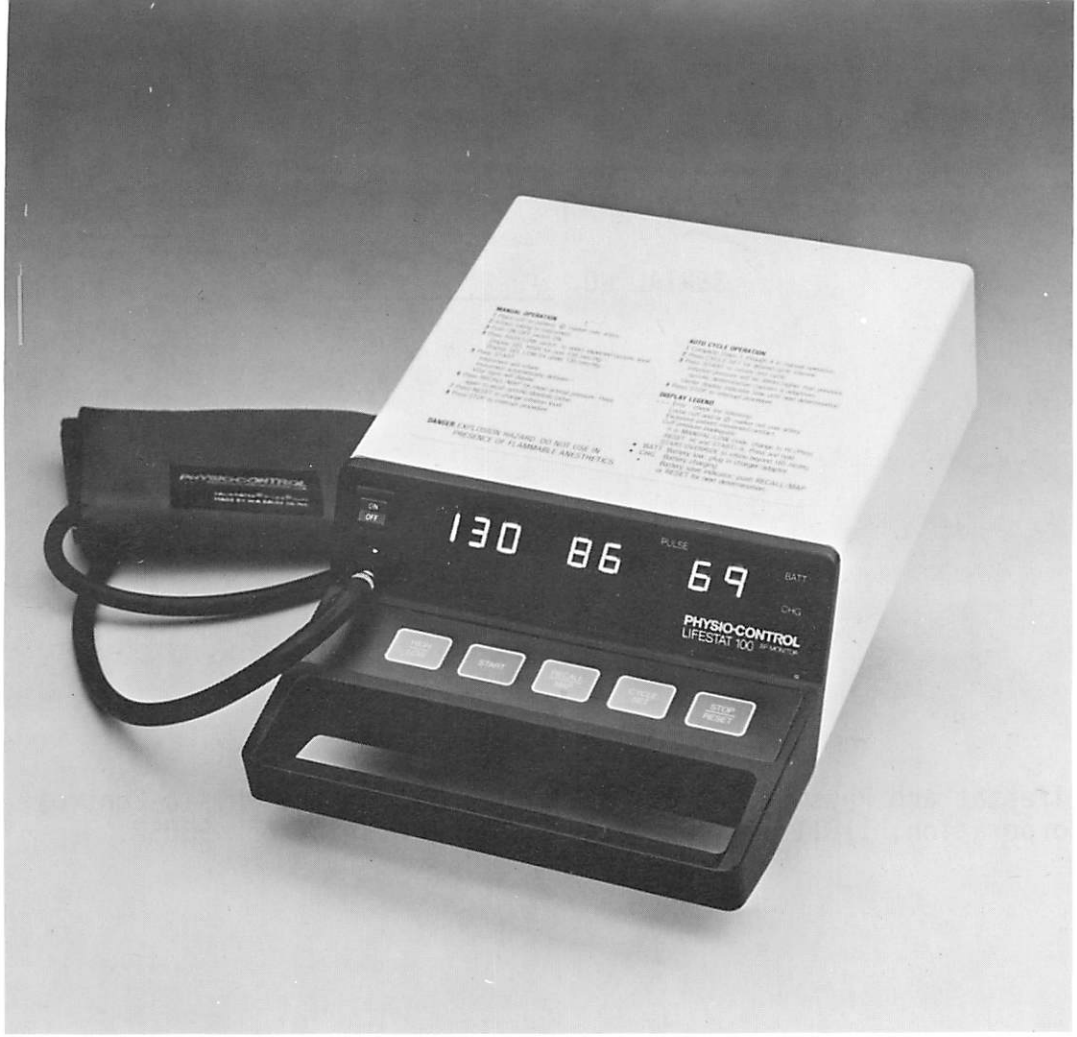

LIFESTAT™ 100

noninvasive blood pressure monitor

Operating and Service Manual

Manual No. 802610-00
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HOW TO USE THIS MANUAL.

Section I of the manual provides introductory information with GENERAL SPECIFICATIONS and CIRCUIT DESCRIPTIONS.

Section II familiarizes the user with OPERATION OF THE EQUIPMENT, identifies CONTROLS AND INDICATORS, provides a PERIODIC OPERATIONAL CHECKOUT, and gives simple OPERATOR MAINTENANCE INSTRUCTIONS. This section is not intended to instruct the operator in the clinical use of the instrument. A separate OPERATING INSTRUCTIONS booklet is provided for this purpose.

Section III provides FUNCTIONAL TEST AND CALIBRATION PROCEDURES and TROUBLE-SHOOTING guidance in the form of FAULT ISOLATION to major replaceable assemblies and SIGNATURE ANALYSIS.

Section IV consists of CORRECTIVE MAINTENANCE PROCEDURES and DISASSEMBLY INSTRUCTIONS.

Section V contains ILLUSTRATED PARTS LISTS with EXPLODED VIEWS or ASSEMBLY DRAWINGS to help identify replaceable parts by number and location.

Section VI is a folio of SCHEMATIC DRAWINGS which are updated periodically, as well as interconnect information.

SECTION 1
DESCRIPTION

1-1. SCOPE

This section provides a description of the circuits and general features of the Lifestat 100 Noninvasive Blood Pressure Monitor. This section is divided into three parts: Physical Description provides a general description of the LS 100 and lists specifications; Functional Description briefly describes the LS 100 circuitry at the functional block diagram level; Theory of Operation reviews the pneumatic system and provides detailed circuit descriptions at the schematic level of the LS 100 PCBs.

1-2. Physical Description.

The LS 100 (Figure 1-1) is a microprocessor-based, portable, blood pressure and pulse measurement device used for noninvasive determination of systolic/diastolic blood pressure, pulse rate, and mean arterial pressure. Systolic pressure, diastolic pressure and pulse rate are all displayed simultaneously on LED displays. Mean arterial pressure may be displayed via the RECALL/MAP switch when desired.

Additional product features include HIGH/LOW pressure selection for initial cuff inflation pressure and a CYCLE SET function for automatic blood pressure measurements at 2, 5, 10, 15 and 30 minute intervals. In addition, an adaptive algorithm is active during the automatic cycle mode that adjusts the initial cuff inflation pressure and the cuff deflation bleed rate based upon previously read information. By tailoring the initial inflation pressure and the cuff deflation rate to the specific patient, readings are obtained in a shorter time frame and higher accuracy is assured.

LS 100 measurements are based upon an oscillometric measurement technique which uses arterial pulsations acting against an inflated pressure cuff for blood pressure and pulse determimation. A standard single hose pressure cuff with a Luer fitting is used.

Power comes from either an internal battery or an external line-operated power supply/battery charger. The internal battery pack contains four rechargable, D-size, sealed lead-acid cells.

General specifications are given in Table 1-1.

FIGURE 1-1. LIFESTAT 100

TABLE 1-1

GENERAL SPECIFICATIONS

CHARACTERISTIC	QUANTITY OR SPECIFICATIONS
RANGE	45mmHg Diastolic to 280mmHg Systolic.
ACCURACY	± 5mmHg Mean ± 8mmHg standard deviation within the range of 60 to 180mmHg.
INFLATION RATE	Less than 80mmHg/sec.
DEFLATION RATE	-4mmHg ± 1mmHg.
OPERATING MODES	Manual and Automatic.
POWER SOURCE BATTERY	Rechargeable, 2.5AH, Sealed, lead-acid battery.
GENERAL	
• SIZE	7.90"W X 11.7"D X 3.5"H
• WEIGHT	7.5 pounds.
ENVIRONMENTAL	
• TEMPERATURE	5°C to 45°C (41°F to 113°F).
• RELATIVE HUMIDITY	0 to 85% (noncondensing).
• ATMOSPHERIC PRESSURE	500 to 775mmHg (-570 to +10,000ft).
• VIBRATION	MIL-STD-810C, method 514.2, procedure 8, Table 515.2-V1, Figure 514.2-6, curve 5 in all three axes.

1-3. Functional Description.

The following paragraphs contain a brief description of the LS 100 pneumatic system and electrical circuitry using Figure 1-2, LS 100 Functional Block Diagram.

The LS 100 contains pneumatic and electrical circuits. The pneumatic system consists of the pump, the Linear Bleed Servo Valve Assembly, and the Overpressure Switch. The pump inflates the patient cuff. The Linear Bleed Servo Valve Assembly deflates the cuff at controlled rates, implements auto-zeroing, and contains the pressure transducer. The Overpressure Switch causes rapid deflation if cuff pressure becomes excessive.

The LS 100 electronics are contained in two printed circuit boards, the System PCB and the Display PCB. The System PCB contains all of the machine controlling data processing electronics. The 146805 System Control Processor, U21, does the machine control processing, controls the analog-to-digital conversion of cuff, pulse, and servo error data, operates the pump, servo valve, beeper, and displays, and pre-processes the pulse and cuff data before passing it to the 6809 Blood Pressure Computation Processor, U37. The 6809 does all of the data processing involved in converting the cuff and pulse data into systolic, diastolic, and mean pressure and pulse rate measurements. The regulated power supplies are also generated on the System PCB.

Blood pressure determination is initiated when START is pressed on the Control Panel, causing the System Control Processor to turn on the pump and inflate the cuff. After the cuff is inflated, the servo valve opens and allows the pressure to bleed-down. During this bleed-down time the pressure transducer converts arterial pulsations into variations in an analog signal. The analog signal is conditioned into three separate signals: cuff, pulsatile, and servo error. The signals are multiplexed and converted into digital signals which are accepted by the System Control Processor.

Blood pressure and pulse rate are calculated by the Blood Pressure Computation Processor. When the System Control Processor contains blood pressure and pulse data it turns on the Blood Pressure Computation Processor, which then accepts the data from the System Control Processor. The data is processed and returned to the System Control Processor, which sends the results to the Display PCB.

The Display PCB contains all display drivers, displays, and the power switch.

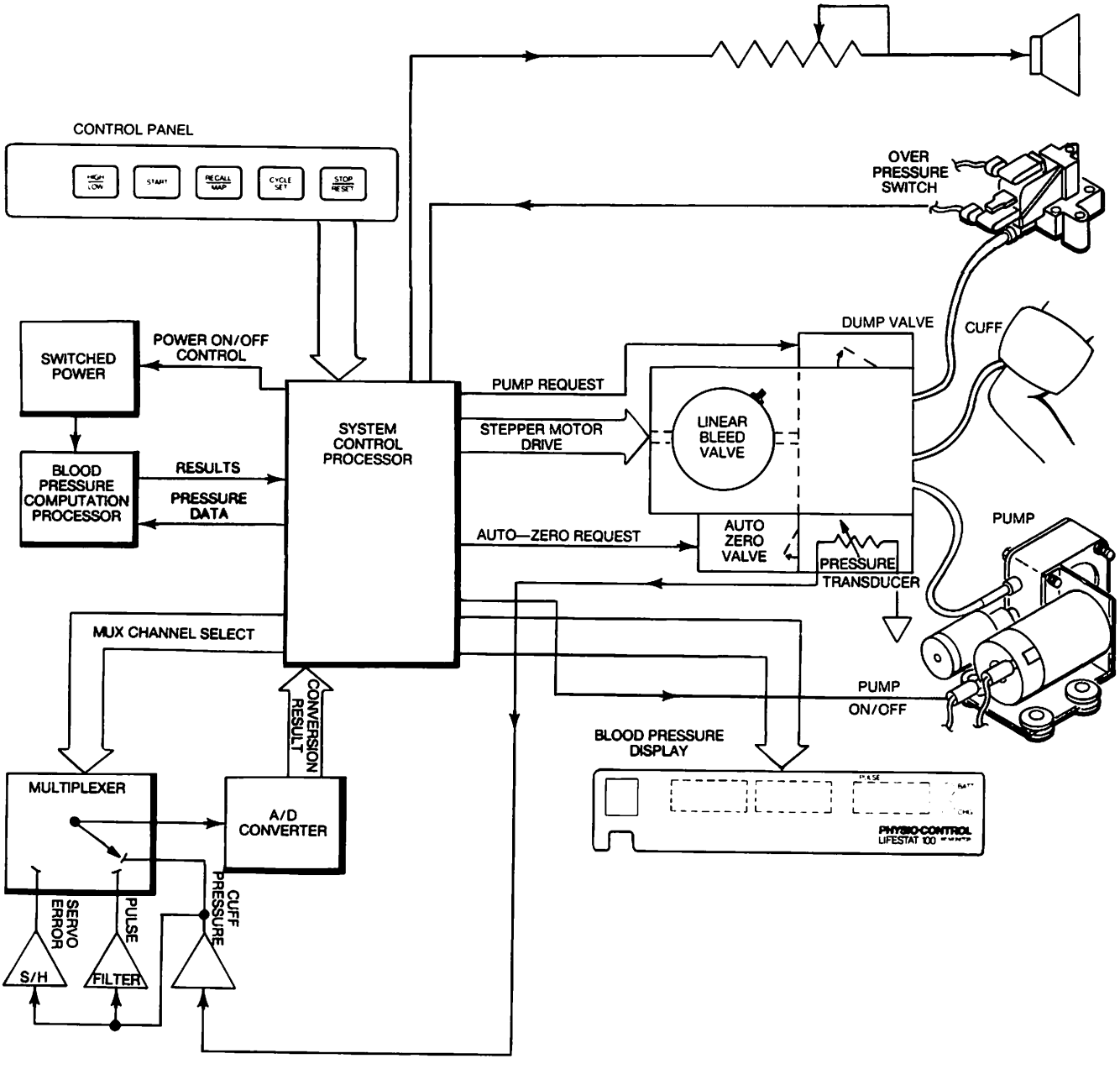

FIGURE 1-2. LS 100 FUNCTIONAL BLOCK DIAGRAM

1-4. Theory Of Operation.

The following paragraphs contain detailed descriptions of the LS 100 Pneumatic System PCB, Display PCB, and Battery Charger PCB.

1-5. Pneumatic System. The LS 100 pneumatic system is responsible for cuff inflation, cuff deflation at a linear rate, and sensing of raw pressure data. The pneumatic system also implements safeguards to prevent excessive cuff pressures and to ensure that high cuff pressures are not sustained for more than two minutes.

Figure 1-3 depicts the pneumatic system in simplified form. The system consists of the patient cuff, the pump assembly, the linear bleed servo valve, the overpressure switch, and all interconnecting tubes and tube fittings. The pump assembly, in turn, consists of the pump and the pump drive motor. The linear bleed servo valve comprises the servo valve itself, the dump valve, the auto zero valve, the manifold block, the stepper motor, and the pressure transducer.

Before the cuff is inflated, the dump valve is closed, the servo valve is nearly closed, and the auto zero valve is open. The open auto zero valve ensures that the initial or reference pressure in the manifold block is equal to atmospheric pressure. When the pump is enabled, the auto zero valve closes, sealing the system and permitting the cuff to inflate. As the cuff inflates, the pressure transducer inputs an analog signal to the System PCB proportional to the rising pressure. When the predetermined peak pressure is reached, the pump is disabled and bleed down begins.

Bleed down is accomplished by the needle-type servo valve, which is operated by the stepper motor. Under control of the 6805 microprocessor, the stepper motor opens the servo valve in metered increments to ensure a linear bleed rate. This linear bleed rate provides a predictable reference against which pulse-induced pressure variations are measured. The feedback necessary to maintain the linear rate is reported to the microprocessor in the form of the servo error signal. The microprocessor responds with a signal to the stepper motor to increase or decrease the servo valve aperture.

Cuff pressure is monitored by the overpressure switch as well as by the transducer. If pressure exceeds 320mmHg (approximately) the overpressure switch interrupts system power. This causes the dump valve to open, and the cuff rapidly deflates. A failsafe feature in the software will cause the dump valve to open in any event if cuff pressure is sustained for more than two minutes.

1-6. System PCB. The following paragraphs describe the functional circuits contained in the System PCB (Figure 6-1).

A. Analog Pressure Circuitry. The analog pressure circuitry on the System PCB acquires and conditions the data obtained from the cuff pressure transducer. The transducer signal is processed into three different signals, cuff pressure, pulsatile, and servo error, then multiplexed to an A/D converter circuit. The resulting digital

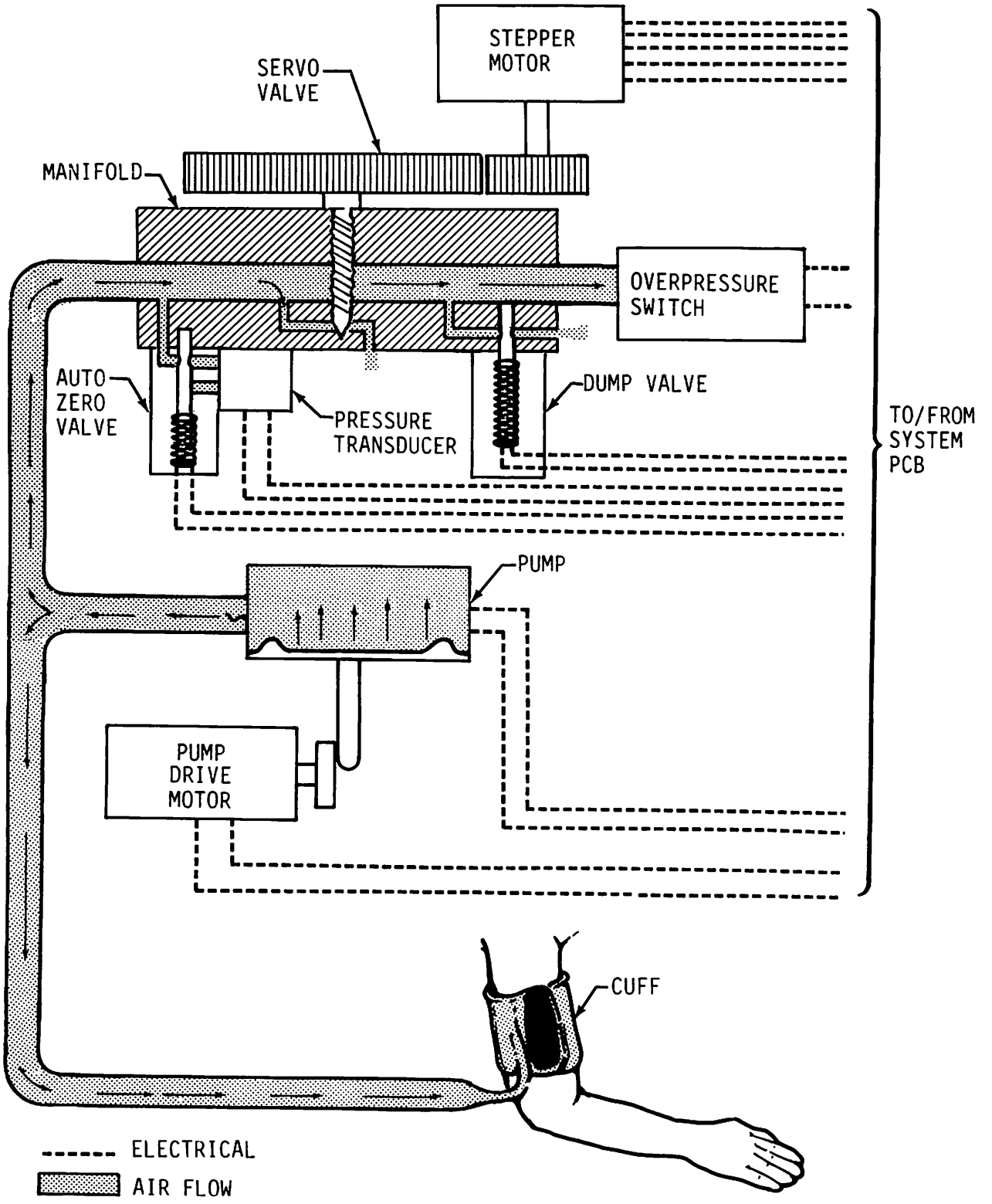

FIGURE 1-3. LS 100 PNEUMATIC SYSTEM

information is then applied to the System Control Processor for computation and display. The System Control Processor is also involved in two intermediate stages, pulse signal conditioning and A/D conversion.

1. Cuff Pressure. The pressure circuitry derives its input from a solid state pressure transducer. The differential amplifier formed by U1 has a gain of approximately 110 and an adjustable voltage offset provided by R12. Nominally, the offset provided at the output of U1-7 is -1 volt; less offset than this places the analog multiplexer, U4, in a nonlinear operating region. U2B is used to provide a low pass noise filter with a -3dB point at approximately 6.1Hz. The output U2B-7 represents the instantaneous cuff pressure.

2. Pulse. The pulse channel carries the pulsatile from the cuff. U2A and U2D are used to form a third-order high pass filter. The -3dB point of this filter can be shifted so the cutoff frequency moves from .5Hz to 3.0Hz. This is done under processor control with the analog switch, U7, by switching resistors in parallel with the frequency determining resistors R34, R25, and R37. This shift is done to allow this filter to recover quickly if there is a large cuff channel swing.

3. Servo Error. The servo error signal supplies the feedback required by the system control processor (U21) to provide closed loop control for the cuff bleed down. The servo error signal is generated by an op-amp of U2C, the sample and hold U8, and the op-amp U9. The op-amp U2C and analog switch U7 are used to form a single pole low pass filter whose -3dB point can be shifted from .5Hz to 2.0Hz, under processor control, for servo error channel fast recovery. U8 samples the instantaneous cuff pressure at intervals determined by the control processor. The instantaneous cuff pressure is subtracted from the sampled value and input to the analog multiplexer, U4. This provides a running measure of the cuff bleed rate.

4. A/D Conversion. The cuff pressure, pulse, and servo error, are multiplexed by U4, buffered by U5, and applied to an analog-to-digital converter circuit. The heart of the A/D circuit is U6, a multiplying digital-to-analog converter which receives 12-bit digital approximations from System Control Processor. These digital approximations are converted to an analog current and then compared to a second analog current representing the difference between the multiplexed signal input at U6-18 and a reference current input at U6-17. The result of this comparison is an error signal output at U6-1 which is proportional to the difference between the multiplexed analog signal and its digital approximation. This error signal is converted to a high or low TTL compatible signal for the System Control Processor. This error signal is amplified by a current-to-voltage translator, U42. U42 swings positive if the analog signal is higher than the approximation, negative if it is lower. Comparator U13 then converts these positive and negative swings to TTL high and low signal for output at System Control Processor.

Under control of a successive approximation software routine, System Control Processor utilizes the output of U8 to correct the digital input to U6. This is performed one bit at a time, beginning with the most significant bit. The bit is initially set to 1, and all other bits to zero. If the U13 output is low, indicating that the magnitude of the analog signal is smaller than the binary number, the MSB is reset. If the U13 output is high, the MSB remains set. The next lower bit is then set and the process is repeated until all bits are checked. The digital value input to U6 at the end of the cycle is accepted by the software as an accurate representation of the analog signal level.

The purpose of the reference current through U6-17 is to ensure that the result of the D/A conversion is equivalent to cuff pressure times .1mmHg. The voltage at U6-17 is adjusted at R20 to approximately 8.70 volts, giving nominal reference current of 870μA. This adjustment would give a valid voltage input range of 0 to -8.70V with a conversion factor of approximately 2.1mV per count.

B. Blood Pressure Computation Processor. U37 converts the cuff pulsatile pressure curve data into systolic, mean and diastolic blood pressure quantities which are transferred to the System Control Processor for display through the shared RAM. The processor and associated circuitry are based in U31 through U37.

U33 through U35 are read only memories (ROM) which contain the program for U37.

C. Power Supplies. The primary digital circuitry power supply in the LS 100 is VCC 1 which is regulated at +5V by U38. A secondary +5V (VCC2) is provided for the exclusive use of the blood pressure computation circuitry (U31-U37).

The System Control Processor controls the power to the Blood Pressure Computational Processor by turning on Q4 and Q5. When Q4 and Q5 are turned on, unregulated battery power is applied to voltage regulator U40 which delivers regulated +5V (VCC2) to U37 and associated circuitry. The analog pressure circuitry requires +12V and -12V to operate. These voltages are supplied by the DC to DC Converter which includes U10, U11, U12, Q1, Q2 and T1. Battery voltage is alternately switched across each half of the center tapped primary winding of T1 by transistors Q1 and Q2. The 60KHz switching frequency applied to Q1 and Q2 is controlled by a switching regulator U10 and timing components R46 and C17. The output of T1 is rectified by the full wave bridge rectifier CR1 and then filtered by C18 and C21. The output of the supply is regulated by positive and negative 12V regulators U11 and U12.

The outputs of the switching regulator have a deadtime between switching pulses to provide time for T1's magnetic field to deplete before the next pulse is applied. The minimum deadtime of 10% of the switching frequency is built into U10 but may be increased

externally through Pin 4. A logic output from the system control processor circuitry is applied to U10, pin 4. A logic high to U10, pin 4, corresponds to maximum deadtime (0% duty cycle), shutting off the analog pressure circuitry.

D. Beeper. The Piezo speaker X2 is sounded by providing a ground connection through CR10, CR9 or Q7. The three paths provide three different types of beeper response. A low level latched at U20, pin 9, produces a constant volume tone which is used as audio feedback for any front panel switch depressions. A low level at U20, pin 12, provides an adjustable volume tone, which sounds indicate a pulse detection. Q7 is turned on by the low battery detect, U39 Pin 7, which provides a low volume constant tone when the unit is in low battery shutdown, indicating that the unit should be turned off.

E. System Control Processor. The System Control Processor controls the Display, Pneumatic System, Blood Pressure Computation Processor, and performs A/D conversions. Included in this circuitry is program memory (U21), sense and communication latches (U14, 16-20), buffer/latches (U22, 24, and 29), oscillator (U15), reset circuit (U25), decoding logic (U26-28), and microprocessor (U21).

The resulting data from a blood pressure determination is displayed on nine seven-segment LED displays located on the Display PCB Assembly. The System Control Processor generates the code for a single digit and loads it into the latch U14, which pulls certain segment control lines high. The System Control Processor then enables the appropriate digit strobe line. These steps are then repeated for the next digits.

U21 controls the analog and the analog hardware through the processor's communication ports PA and PB. The data obtained from the analog circuitry is used to generate a curve of pulsatile pressure in the cuff vs. cuff pressure. This data is transferred to the BP Computation Processor (U37) for the actual calculation of the blood pressure through buffer U29 and transceiver U24. Servo error data is used to generate a linear bleed down. The six high order bits of COM Ø (U20) are used to control the bleed valve servo, the dump valve, and the auto-zero valve.

The dual one-shot, U25, provides timed resets for U21. At power-up the R-C of R69 and C22 at U25-A provides a trigger which causes one half of U25 to fire. The beginning of the pulse triggers the second half of the one-shot. The second pulse is roughly half the length of the first and is used to reset U21. Trigger input U25-11 is used to provide control panel resets by triggering only the second half of U25. The first pulse is routed to SENSE Ø (U16), input latch where it can be checked by the processor to determine whether the unit has just been turned on or whether it has been reset from the front panel.

U26 through U28 provide all of the address decoding for the System Control Processor and the logic for allocating the shared RAM usage between U21 and U37. The shared RAM in U31 is used to transfer data

collected by U21 to U37 for analysis. U28A and C are used to guarantee that U21 cannot access the shared RAM while U37 is active. The signals BA and BS must be high, indicating that U31 is in halt mode, before U21 gains access to the shared RAM. U26 is a Programmed Array Logic device which provides the required address decoding for the System Control Processor.

F. Low Battery Detection. U39B detects low battery voltage by comparing a divided down (approx. 1/4) battery voltage against a reference voltage provided by a resistive divider on VCC1. At power up the latch circuit around U39B is reset to provide the reference at U39, Pin 5. When the battery voltage falls below apprxomately 7.6V, U39, pin 7's, impedance goes high. R120 pulls U39, pins 3 and 5, above Vcc1 to provide a latched high level out to U29, pin 3, where the processor, U21, senses the low battery condition. The reference at U39, pin 5, is pulled to ground by U31, pin 11, when the pump is running to prevent noise from the pump triggering the low battery circuit.

G. Charge Detection. Battery charging is detected by sensing the charger input at the anode of CR6. When the input is increased above approximately 2.4V, a Darlington switch turns on the charge indicator.

1-7. Display PCB. The Display PCB (Figure 6-2) has nine seven segment displays, the charge and low battery status indicator and the drive electronics to support these displays. The display segment information and control is provided through J2 and J3 from the system control processor (U23) on the Systems board. Segment information delivered to the displays through J2, pins 4-10. The digit to be lighted is selected by information provided over J3-5 through J3-8 and J3-11 through J3-15.

A digit is strobed once every 1.1ms. The digit selection information is latched into U17 and U18, then the digit segment information is latched into U14 on the Systems board. The latch enable signal to U14 is inverted on the Display board by U3 and used to trigger the one-shot, U4. The output of U4 is used to enable the output of U14 for the required strobe time. The strobe time varies inversely with the battery supply voltage.

The constant current source is formed by G1 and R1. As the battery supply voltage increases, the current source provides a higher constant current, and the one-shot pulse becomes shorter.

The charge indicator LED and the low battery LED are supplied by the battery and are turned on through U2 by signals from J3, pins 3 and 4.

1-8. Battery Charger PCB. The Battery Charger PCB (Figures 1-4 and 6-6) is a stand alone unit that provides a regulated 9.8 volt input to LS 100. The charger electronics consists of a simple 30 volt center-tapped line transformer whose output is rectified (CR1) and fed to a switching regulator. The switching regulator is controlled by a TL494 pulse width modulator, U1. Constant current limiting is provided by resistor R3 in the ground return line. Current limiting takes place when the voltage at pin 15 is pulled below ground by the increasing current through R3. This occurs at approximately 1.8 amps.

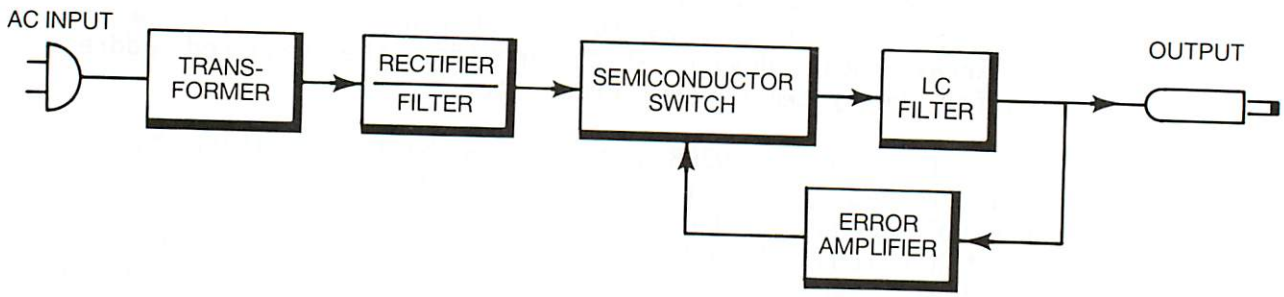

FIGURE 1-4. LS 100 BATTERY CHARGER BLOCK DIAGRAM

SECTION 2
OPERATION

2-1. GENERAL

This section familiarizes the technician with the LS 100 controls and indicators and provides periodic operational checkout and routine maintenance procedures.

2-2. CONTROLS AND INDICATORS

Figure 2-1 provides front and rear views of the LS 100. Table 2-1 identifies by name and function the controls and indicators shown in Figure 2-1.

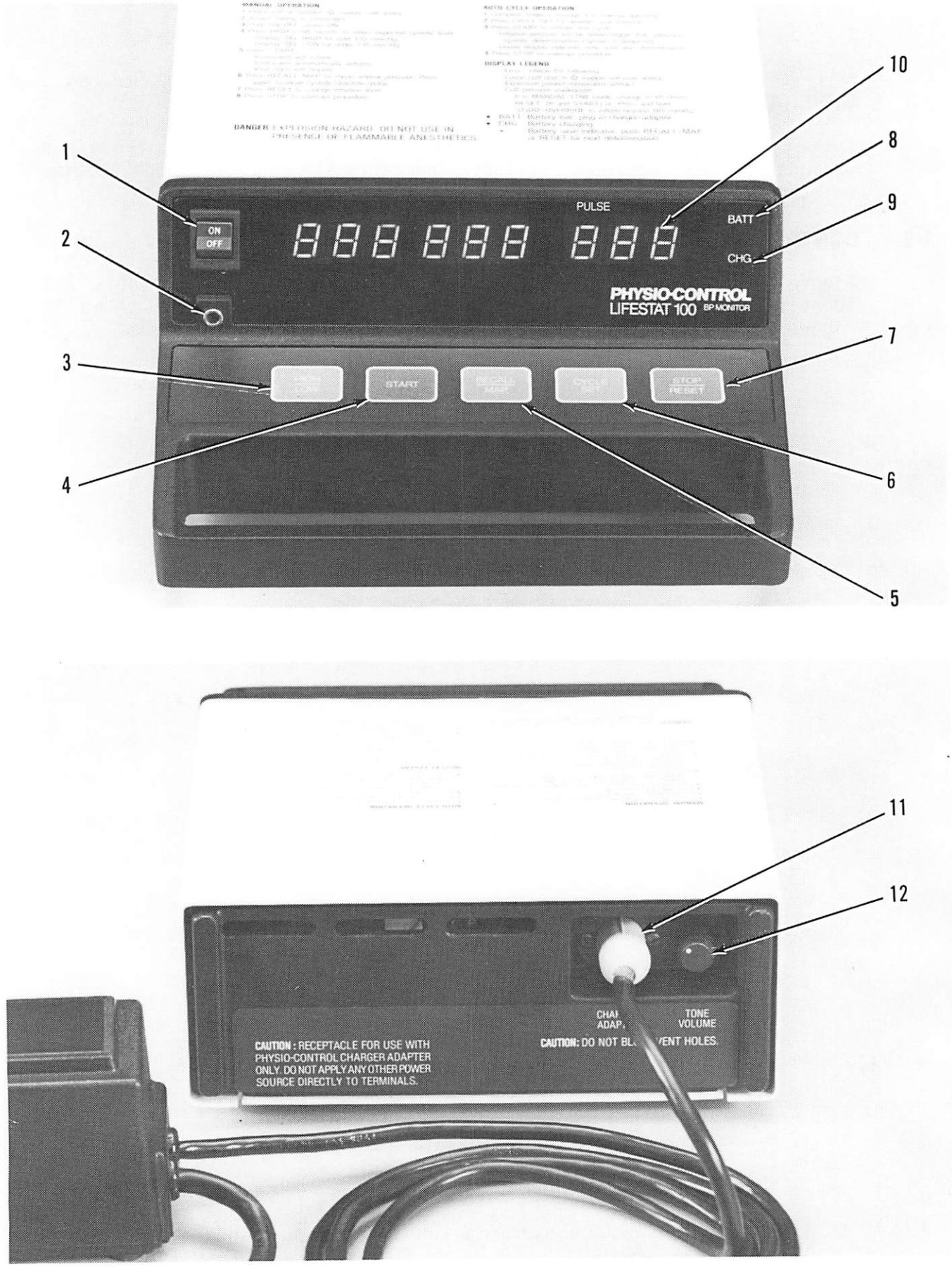

FIGURE 2-1. LS 100 CONTROLS AND INDICATORS

TABLE 2-1

CONTROLS AND INDICATORS

FIGURE KEY NO.	CONTROL OR INDICATOR	FUNCTION
1	ON/OFF	Rocker switch for main power control.
2	Cuff	Cuff tubing connector. Standard Luer fitting.
3	HIGH/LOW	Membrane switch for selection of high or low inflation mode. Use high for expected systolic pressure above 135mmHg. Use low for expected systolic pressure below 135mmHg.
4	START	Membrane switch to start cuff inflation. In high mode, inflates to approximately 220mmHg. In low mode, inflates to approximately 165mmHg. By continuous hold down of START switch, cuff can be inflated to any pressure up to 300mmHg maximum.
5	RECALL/MAP	Membrane switch for recall of last blood pressure and pulse reading, or Mean Arterial Pressure (M.A.P.) display. May be pressed as often as desired until instrument is turned off or reset.
6	CYCLE SET	Membrane switch for automatic pressure determinations at preset intervals. Initial reading is begun by depressing start button. May be set for 2, 5, 10, 15, or 30 minute cycles by continued pressure on switch.
7	STOP/RESET	Membrane switch to stop inflation at any time during procedure and immediately deflate the cuff pressure to less than 10mmHg within 10 seconds. Pressing switch will clear the previous readings from memory and reset the instrument into a select mode. Select mode allows the user to select high or low cuff pressure and select manual mode or one of the automatic cycle modes.

TABLE 2-1 (Continued)

CONTROLS AND INDICATORS

FIGURE KEY NO.	CONTROL OR INDICATOR	FUNCTION
8	BATT	Backlighting to indicate low battery charge. Instrument will not operate when battery power is low; must be connected to external power source for continued operation and charging.
9	CHG	Backlighting to indicate battery charging.
10	Digital Displays	The parameters displayed on the left-hand, center, and right-hand digital displays are variable. The following tabulation matches the contents of these displays to the conditions under which they appear.

CONDITION	LEFT-HAND DISPLAY	CENTER DISPLAY	RIGHT-HAND DISPLAY
A. Appears for approximately 5 seconds duration after power up.	"888"	"888"	"888"
B. Appears 5 seconds after power up, after STOP/RESET is pressed, or in place of "SEL. Lo" after HIGH/LOW is pressed.	"SEL."	"Hi"	-
C. Appears in place of "SEL. Hi" when HIGH/LOW is pressed.	"SEL."	"Lo"	-
D. Appears in place of "SEL. Hi -" or "SEL. Lo -" when CYCLE SET is pressed.	"SEL."	"Hi" or "Lo"	"C 2," "C 5," "C 10," "C 15," or "C 30"
E. Appears during cuff inflation.	"CUF"	Cuff pressure in mmHg (0-300).	"Hi" or "Lo"

TABLE 2-1 (Continued)

CONTROLS AND INDICATORS

FIGURE KEY NO.	CONTROL OR INDICATOR	FUNCTION
10.	Digital Displays (continued)	

CONDITION	LEFT-HAND DISPLAY	CENTER DISPLAY	RIGHT-HAND DISPLAY
F. Appears during cuff deflation.	"CUF"	Cuff pressure in mmHg (0-300).	"." (Flashes with beep for each pulse detected).
G. Appears when blood pressure is determined.	Systolic pressure in mmHg.	Diastolic pressure in mmHg.	Pulse in BPM.
H. Error rejection report - occurs when blood pressure reading is unsuccessful.	"---"	"---"	"---"
I. Appears after first blood pressure determination when RECALL/MAP is pressed.	"M.A.P."	Mean pressure in mmHg or "---".	-
J. Alternates with blood pressure determination display to show time remaining between BP cycles.	-	Time remaining in minutes and tenths of minutes.	"C 2," "C 5," "C 10," "C 15," or "C 30"

11	CHARGER ADAPTER	Socket for LS 100 Battery Charger. DO NOT CONNECT TO ANY OTHER POWER SOURCE.
12	TONE VOLUME	Control for changing volume of pulse tone.

2-3. PERIODIC OPERATIONAL CHECKOUT

The following tests are performed on the assembled unit and should be performed at regular intervals to ensure that the LS 100 is fully operational.

A. With unit disconnected from Battery Charger, turn power ON.

B. Verify that BATT does not come on. If BATT comes on, connect unit to Battery Charger and recharge battery before proceeding with test.

C. Verify that all three digital displays exhibit "888" for approximately 5 seconds after power up.

D. Verify that after five seconds "888" disappears from displays and "SEL. Hi" appears.

E. Place cuff snugly around arm with bladder centered over brachial artery. (For convenience, the cuff may be fastened around itself and slipped onto the arm like a sleeve.)

F. Press START. Verify that "CUF" appears and after it a pressure display rising rapidly to approximately 220mmHg as cuff inflates.

G. Verify that cuff bleeds down (descending pressure is displayed) and that a pulse light flashes periodically under PULSE, accompanied by a beep.

H. Verify that diastolic pressure, systolic pressure, and pulse determinations appear, respectively, on the left-hand, center, and right-hand digital displays. If "---" appears on each display, indicating error rejection, verify that cycle described in steps 6 and 7 is repeated automatically. If error rejection display persists, one of the following conditions may exist:

- Low cuff inflation pressure. Inflation must be at least 30mmHg above subject's systolic pressure to occlude artery. Even though cuff was inflated to set pressure it may have to be inflated higher by holding down the START button until the desired cuff inflation level is reached.

- Excessive subject movement, or external motion artifact, particularly muscle flex.

Refer to Operating Manual for additional information on error rejection. If conditions do not appear to warrant error rejection, unit is probably faulty. In this case, refer to Section 3 in this manual.

I. Press STOP/RESET. Verify that "SEL. Hi" appears.

J. Press HIGH/LOW. Verify that "SEL. Lo" appears. Repeat steps F, G, and H, verifying that cuff now inflates to approximately 165mmHg.

K. Press RECALL/MAP. Verify that "M.A.P." appears, followed by a digital value representing the mean arterial blood pressure from the last determination.

L. Press RECALL/MAP again and verify that diastolic, systolic, and pulse displays reappear.

M. Press STOP/RESET and verify that "SEL. Lo" appears. Press CYCLE SET and verify that "C 2" appears in the right-hand display. Successive presses of CYCLE SET should produce "C 5," "C 10," "C 15," "C 30," and blank.

N. Set cycle at "C 2" and repeat steps F, G, and H. When blood pressure determination display appears, verify that it alternates with a display of time remaining. (Time remaining should begin at approximately 1.0 minutes.)

O. Verify that when time remaining reaches zero, inflation cycle begins again automatically.

P. Perform the following pressure sensor calibration check.

1. Plug in Battery Charger and connect Battery Charger to LS 100.

2. Using a "T" tubing connector, attach a mercury (not aneroid) manometer to one arm of the "T". Connect the cuff to another arm of the "T" and connect the third arm of the "T" to the instrument. Make sure all fitting connections are airtight.

3. Wrap the cuff snugly around a solid object (an arm-sized glass bottle is good).

4. Turn instrument ON.

5. Simultaneously hold down HIGH/LOW and RECALL/MAP. While holding them down, use the other hand to press RESET. The word "tst" should appear. Then simulateously press START and CYCLE SET. "tst 2" should appear.

6. Press START. The pump will run until the unit displays 150mmHg. If more than 1mmHg difference is observed between the pressure displayed on the LS 100 and the pressure indicated on the manometer, proceed to Functional Test and Calibration, Section 3.

2-4. MAINTENANCE

The following routine maintenance recommendations will help ensure trouble-free operation of the LS 100 and should be observed by both operator and technician.

A. Internal Batteries. The internal batteries of the LS 100 are depleted electrolyte sealed lead-acid. The life expectancy of lead-acid batteries is dependent upon many variables, but the primary factors are temperature and use.

Optimum battery performance will occur when the unit is operated and charged at normal room temperatures. When unit is charging, ambient temperatures greater than 40°C may adversely *affect battery* life.

CAUTION

DO NOT DRAIN THE INTERNAL BATTERIES COMPLETELY. TO DO SO WILL CAUSE DAMAGE. TURN POWER OFF AND CONNECT TO AC POWER WHEN NOT IN USE.

Batteries will also perform best when kept as much as possible in the fully charged state. Completely discharging the batteries will damage them. When the LS 100 is not in use, connect the unit to the Battery Charger and ensure that the power switch is off. Use of the Battery Charger is also recommended for long periods of storage. If this is not possible, ensure that the batteries are fully charged when placed in storage and that ambient temperatures do not exceed 25°C.

B. Cuff Inflation Systems. Cuff inflation systems should be checked periodically for worn or damaged fittings, leaking bladder, or leaking tubing. Parts that are worn or defective should be repaired or replaced. These defects, if not corrected, will make it impossible to obtain accurate results and may result in repeated error signals.

C. Cuff Cleaning. After moving the latex inflation bag, the cuff may be machine or hand washed. Make sure the cuff is thoroughly rinsed and then allowed to air dry.

D. Care and Cleaning. Avoid dropping instrument or exposing to extremes of heat or cold which might damage electrical circuits. It should also be protected from exposure to water and spilled fluids.

Air circulation vents in instrument should not be obstructed by linen, clothing, or other devices when in use or plugged into Battery Charger.

The instrument should be cleaned with a mild soap and water. Use a damp sponge or towel to clean.

CAUTION

DO NOT IMMERSE ANY PART OF THIS INSTRUMENT IN WATER. DO NOT USE ALCOHOL OR KETONES (MEK, ACETONE, ETC.) TO CLEAN.

SECTION 3
TESTING, CALIBRATION AND TROUBLESHOOTING

3-1. GENERAL

This section will guide the user from routine, system-level test and calibration procedures to the identification of faulty circuits in the LS 100. Included are Functional Testing and Calibration, Troubleshooting Guide and Signature Analysis. Functional Testing and Calibration provide complete test and calibration procedures for the major circuits in the LS 100. The Troubleshooting Guide references malfunctions uncovered during the functional test to specific areas of probable fault. Signature Analysis provides a means for troubleshooting the digital circuits.

3-2. Test Equipment.

Test equipment suitable for the procedures in this section are listed in Table 3-1. Although specific, commercially available test instruments are recommended, other test equipment with equivalent specifications may be used.

TABLE 3-1

TEST EQUIPMENT REQUIRED

NOMENCLATURE	CHARACTERISTICS	MANUFACTURER
Digital Multimeter	4 1/2 Digit	Fluke 8050A
Variable Power Supply	15V @ 2A minimum	
Mercury Manometer	350mmHg ± 1mmHg minimum	
Signature Analyzer		Hewlett Packard 5004A
Standard Can (Aspirator bottle PCC #50973-02)	1/2 gallon or 1900 ml	Cole Parmer Instrument Co. Catalog TJ6080-20
Stethoscope (optional)		
Oscilloscope	Storage Capacity	Tektronix 5103

3-3. Test Setup. The procedures in this section require that the unit be in the test configuration, as shown in Figure 3-1. The test equipment connections are shown for use as required. To disassemble the unit to this level, refer to paragraph 4-3. Adjustment locations are shown in Figure 3-1.

3-4. FUNCTIONAL TEST AND CALIBRATION

This section provides a complete functional test and calibration procedure for the LS 100 and may be performed as routine periodic maintenance or as a first-level diagnostic procedure. If the unit fails to pass any of the tests in this procedure and the problem cannot be remedied by calibration, proceed to paragraph 3-5 or 3-6.

A. Power Supply, Charging System, and Powerup and Inflation Cycles.

1. Disconnect Power Supply/Battery Wire Harness at Molex connector.

2. Connect ammeter in series between positive lead of Variable Power Supply and the positive (red) wire of Power Supply/Battery Harness as shown in Figure 3-1.

3. Connect negative lead of the Variable Power Supply to the negative (black) wire of the Power Supply/Battery Harness (hereafter referred to as GND).

4. Set Variable Power Supply at 0Vdc, turn it on, and raise voltage to 10Vdc.

5. Turn on LS 100. Verify that BATT does not come on and that current drain is less than 800mA after "SEL. Hi" appears on Digital Displays. (If "ERR" appears after "888" disappears from Digital Displays, refer to Table 3-2, step 7.)

6. Measure and record voltage at U39-5, System PCB.

7. Lower Variable Power Supply voltage to 7.6 ± .2Vdc.

8. Measure voltage at U39-6 and adjust R93, System PCB, until voltage at U39-6 is equal to the voltage at U39-5.

9. Turn off LS 100 and raise the Variable Power Supply to 10Vdc.

10. Turn on LS 100 and slowly lower Variable Power Supply until BATT comes on. Verify that alarm sounds at the same time. Record Variable Power Supply voltage and turn LS 100 off.

11. Turn off Variable Power Supply and disconnect it.

12. Plug Variable Power Supply into CHARGER/ADAPTER jack on LS 100 rear panel and raise voltage to 9.6Vdc. (If a connector is not available, install Variable Power Supply between GND and input end of F1.) Turn on Variable Power Supply and LS 100 and verify that CHARGE comes on.

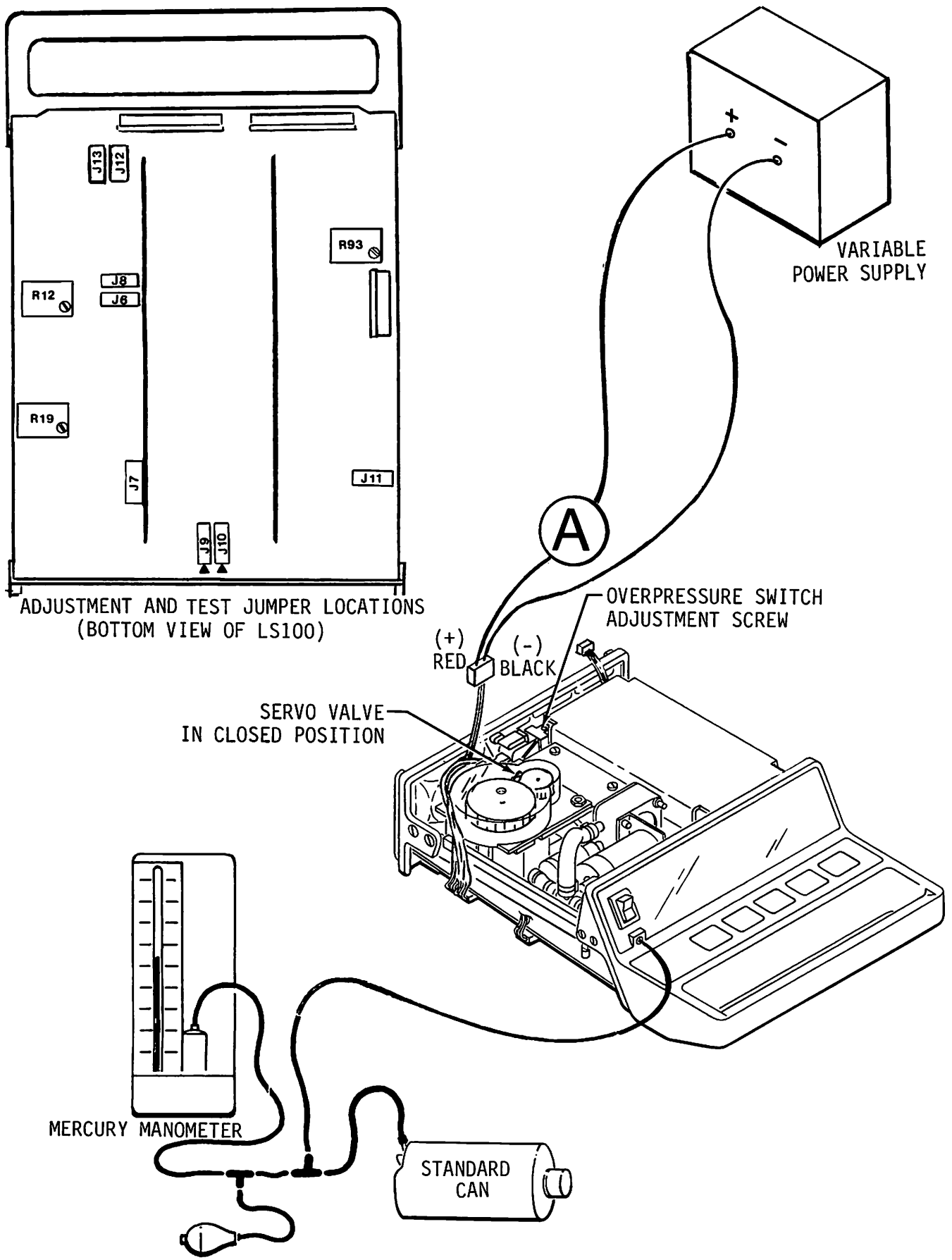

FIGURE 3-1. TEST CONFIGURATION

13. Turn off LS 100 and Variable Power Supply and install Battery Charger.

14. Turn on LS 100 and verify the following:

    a. Voltage at either end of F2 is 10Vdc.

    b. All digital displays show "888".

    c. Servo Valve as seen through clear plastic cover closes completely (large sprocketed wheel goes to extreme clockwise position), as shown in Figure 3-1.

    d. At approximately 5 seconds after power up, Digital Display changes to "SEL. Hi" and servo valve opens approximately 3/8".

15. Press START and verify the following:

    a. Servo valve closes.

    b. Pump starts.

16. Turn off LS 100 and reconnect Battery.

B. Self-Test Procedures. The LS 100 is equipped with test software that exercises the circuits in ways that facilitate diagnosis and calibration. To place the unit in the initial self-test mode, first press and hold HIGH/LOW and RECALL/MAP. Then, with a third finger, press STOP/RESET and verify that "tSt appears on the Digital Displays. The instrument is now ready for the following tests.

1. Test 1. Display System, Pump Assembly, Servo Valve, and Beeper.

    a. Using one or two "T" connectors as necessary, connect standard can, squeeze bulb, and manometer to Cuff fitting as shown in Figure 3-1.

    b. Place LS 100 in Test 1 mode by pressing HIGH/LOW and CYCLE SET simultaneously. Verify that "tSt 1" appears.

    c. Verify that all 7-segment displays count simultaneously from 0 to 9, and that all decimal points light when odd numbers are displayed. (The displays will blank briefly after all 9s are displayed.)

    d. Press START and verify that pump runs as long as switch is held down.

    e. Press HIGH/LOW and verify that servo valve closes. This can be verified by holding down both HIGH/LOW and START

switches and watching the manometer. If it pumps up with no air bleeding out of the servo valve, the valve has closed properly.

f. Press and hold RECALL/MAP and verify that beeper sounds loudly and that its volume is adjustable at rear panel TONE VOLUME knob.

g. Return to initial test mode by pressing CYCLE SET.

2. Test 2. Transducer Calibration and A/D Converter check.

a. Place LS 100 in Test 2 mode by simultaneously pressing START and CYCLE SET. Verify that "xxx PLS yyy" appears, with "xxx" being cuff pressure in mmHg and "yyy" the pulse rate channel.

b. Disconnect manometer and connect voltmeter between TP-1 and chassis ground.

c. Adjust R12 until voltmeter reads -1.00Vdc ± 1mV.

d. Reconnect manometer and press START. The pump will run until "xxx" reads 150mmHg and maintain this pressure.

e. Observe pressure shown on manometer and verify that it is 150mmHg ± 2mmHg. If not, adjust R19 as necessary. Pump-up cycle may be repeated by pressing START.

f. Press HIGH/LOW. Observe that "xxx rEF yyy" appears, with "xxx" being the raw cuff pressure and "yyy" twice the raw cuff pressure. Verify that "yyy" = "xxx" times 2, ± 2.

g. Return to initial test mode by pressing CYCLE SET.

3. Test 3. Pneumatic System Leakage Test.

a. Place LS 100 in Test 3 mode by simultaneously pressing RECALL/MAP and CYCLE SET. Verify that "150 0 0.00" appears. Press HIGH/LOW and verify that "150" changes to "250". The center and righthand displays show system pressure and elapsed bleed down time, respectively.

b. Press START. Pump will run until 250mmHg is reached. Pressure will then start to bleed down slowly with the elapsed time meter running. Verify that after 30 seconds, pressure is still greater than 210mmHg.

c. Press RECALL/MAP. This opens the servo valve. Wait until 3 decimal points in lefthand Digtal Display light, then press START. Pump will run until 250mmHg is reached, and timer will start again. Wait for 30 seconds and verify that manometer reads less than 170mmHg.

NOTE: This test checks the pneumatic system for leaks. A leak will cause a decrease in bleed down time. The specification given in this step is based on the test configuration as shown in Figure 3-1. Any deviation from this configuration will affect the bleed rate. Specifically, a test bottle of lesser volume will yield a shorter bleed down time. Actual bleed down time is less important that consistency of readings over time based on use of the same test bottle.

d. Return to initial test mode by pressing CYCLE SET.

4. Test 4. Test 4 is not used at this time.

5. Test 5. Analog Circuitry Check.

a. Turn off power and disconnect pressure transducer from System PCB at J13.

b. Place jumpers J12 and J13 in test position (short across pins 2 and 3). This replaces the transducer output with a square wave toggling at 6-second intervals. Pressing START will shorten the interval to 1 second. Pressing RECALL/MAP returns it to 6 seconds.

c. Turn power on and place LS 100 in initial test mode.

d. Place LS 100 in Test 5 mode by simultaneously pressing HIGH/LOW and CYCLE SET. Verify that "FiL xxx Lo" appears, with xxx representing the pulse rate channel.

e. Press HIGH/LOW several times in succession and verify that display toggles between "FiL xxx Lo" and "FiL xxx Hi".

f. Connect oscilloscope probe to TP1 (cuff channel output) and sync line to U1-7. Set oscilloscope to 1V, .2 seconds/division and trigger on positive edge.

g. Press START and verify that a waveform similar to that shown in Figure 3-2A is obtained. A perfectly square waveform is not acceptable.

h. Move oscilloscope probe to TP2 (pulse channel output) and press HIGH/LOW as necessary to obtain a "FiL xxx Lo" display.

i. Set sweep speed to 1 second/division. Set amplitude to 5V/division and press RECALL/MAP. Verify that waveform is similar to that shown in Figure 3-2B.

j. Set LS 100 display to "FiL tEr Hi" and return sweep speed to .2 seconds/division.

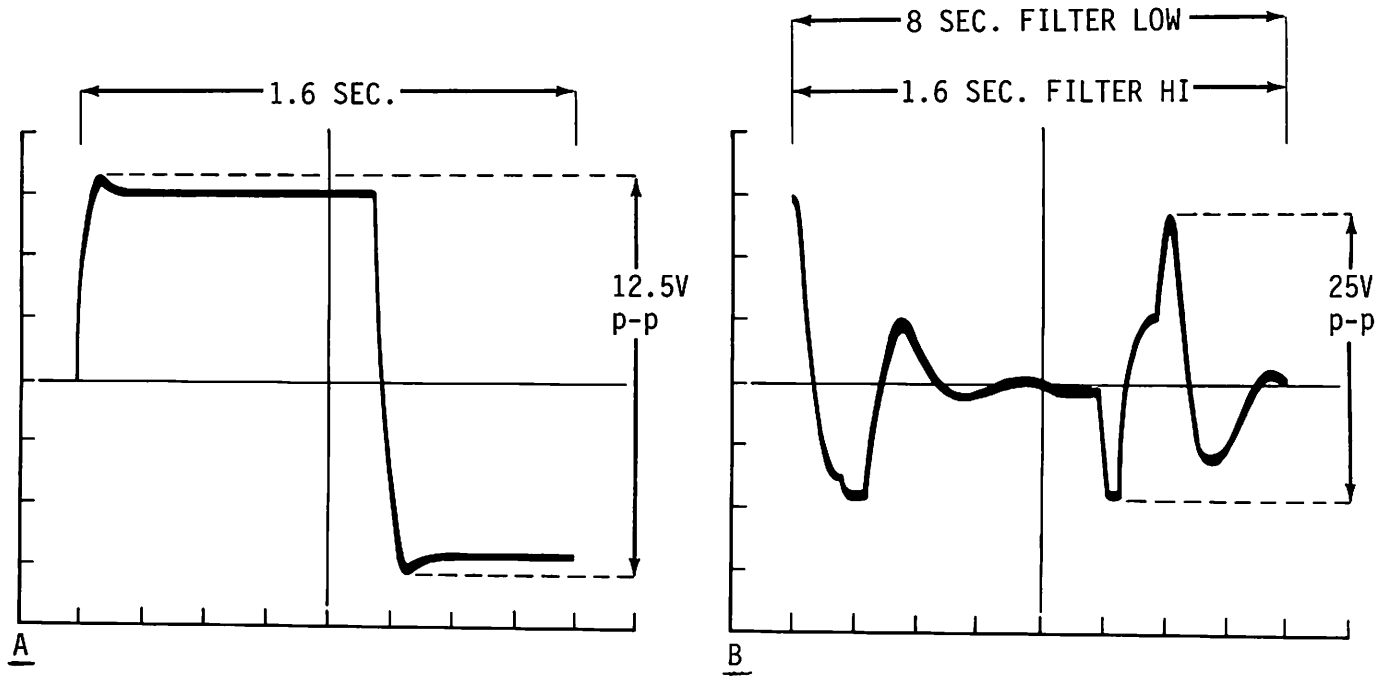

FIGURE 3-2. TEST 5 WAVEFORMS

k. Press START and verify that the waveform obtained resembles that shown in Figure 3-2B.

l. Return to initial test mode by pressing CYCLE SET.

6. Test 6. Overpressure Switch Calibration.

a. Place LS 100 in Test 6 mode by simultaneously pressing START and RECALL/MAP. Verify that "CUF HLD" appears, with the center display showing cuff pressure.

b. Press START. Verify that pump runs until 150mmHg is displayed and that this pressure is maintained.

c. Slowly and evenly increase pressure using squeeze bulb.

NOTE: The overpressure switch is very sensitive. A heavy hand on the bulb can trip it before the pressure display can respond. Because tripping of the overpressure switch shuts off power, the LS 100 will need to be powered up and returned to self test mode to repeat this procedure.

Verify that Overpressure Switch trips (the system bleeds down) at 320 ± 10mmHg. Adjust Overpressure Switch adjusting screw (Figure 3-1) as necessary.

C. Sphygmomanometer Test. (optional) This test compares the results of the LS 100 blood pressure determination to those of a conventional sphygmomanometer reading. The technician who is not skilled in the recognition of Korotkoff sounds should enlist the aid of a clinician.

1. Substitute patient cuff for Standard Can.

2. Wrap cuff around upper arm and initiate blood pressure determination cycle as detailed in paragraph 2-3.

3. Make a conventional blood pressure determination using stethoscope and manometer.

4. Verify that both diastolic and systolic blood pressure determinations displayed on LS 100 are within 8mmHg of conventional readings.

3-5. TROUBLESHOOTING

Table 3-2, Troubleshooting Guide, references failed tests in the Functional Test and Calibration Procedure to probable faults in the equipment. No attempt is made to cover all possible failure modes or all possible causes for the failure in question. The Troubleshooting Guide is intended only as a supplement to the technician's diagnostic skills and his or her use of the circuit descriptions and schematics provided in this manual.

TABLE 3-2

TROUBLESHOOTING GUIDE

SYMPTOM	PROCEDURE
POWER SUPPLY, CHARGING SYSTEM, AND POWER UP & INFLATION CYCLES	
1. BATT indicator comes on at 10Vdc input.	1. Adjust R93, System PCB, as per step 8, paragraph 3-4A. 2. If problem persists, suspect U39, System PCB, or U2, Display PCB.
2. Current through Power Supply/ Battery Harness exceeds 800mA.	1. Check for abnormally hot components, particularly regulators. 2. Check all regulator outputs (U3, 11, 12, 38, 40) for proper voltages. 3. Check power supply circuit (U10, Q1, Q2, R1).
3. Voltage at U39-6, System PCB, cannot be adjusted at R93 to match voltage at U39-5.	1. Check C34, System PCB, for short. 2. Check U39, System PCB.
4. Alarm does not sound when BATT indicator comes on.	1. Perform step 1., f., paragraph 3-4 B. If alarm does not sound, speaker is probably defective. If alarm sounds, check Q7 and CR13.
5. CHARGE indicator does not come on when Battery Charger is plugged in.	1. Check F1, U2, and DS11.
6. Battery Charger load voltage at F1, System PCB, is not to spec (9.8 ± .05Vdc) with unit on and Battery disconnected.	1. Check F1, Battery Charger PCB. If F1 is blown, suspect CR1. C2, 4, 5, or 6 may also be at fault. 2. Adjust R6, Battery Charger PCB. If correct voltage cannot be obtained, suspect U1.

TABLE 3-2 (Continued)

TROUBLESHOOTING GUIDE

SYMPTOM	PROCEDURE
7. Unit does not perform power up sequence as described in paragraph 3-4 A, step 14.	1. If "ERR 1" appears, a 6805 internal RAM failure is indicated. Refer to paragraph 3-6. 2. If "ERR 3" appears, a 6805 EPROM (U23) failure is indicated. Refer to paragraph 3-6. 3. If "ERR 4" appears, a 6809 RAM and/or EPROM failure is indicated. Refer to pargraph 3-6. 4. If "ERR 5" appears, 6809 is not responding to 6805 query. Refer to paragraph 3-6.
8. Unit does not respond to START command as described in paragraph 3-4 A, step 15.	1. Check Membrane switch. 2. Check U41 and associated components. 3. Check U20. 4. If problem persists, refer to paragraph 3-6.
SELF TEST PROCEDURES	
9. Test 1.	
a. Display segments missing.	1. If only one LED is affected, check LED. 2. If all LEDs are affected, check U1, RN1, and RN2, Display PCB. Check U14, System PCB.
b. Beeper does not sound when RECALL/MAP is pressed.	1. Check CR10 and R97, System PCB.

TABLE 3-2 (Continued)

TROUBLESHOOTING GUIDE

SYMPTOM	PROCEDURE
10. Test 2.	
a. -1.00Vdc ± 10mV cannot be obtained at TP1, System PCB, by adjusting R12.	1. Check U3 output for 10 ±.5 VDC. 2. Check pressure transducer. 3. Check U1.
b. Pressure displayed on LS 100 cannot be made to agree with manometer pressure by adjusting R19.	1. Check pressure transducer.
c. Multiple of cuff pressure ("yyy") does not equal twice cuff pressure.	1. Check U5B-7, System PCB for -2Vdc ±10mV. If -2Vdc ±10mV is not present, replace U5. 2. If U5B-7 is at -2Vdc ±10mV, suspect failure in A/D Converter (U4, U5, U6, U13, U42).
11. Test 3.	
a. System bleeds down too fast.	1. Check for leakage in servo valve, Overpressure Switch, pump, or internal or external tubing.
b. System bleeds down too slowly with Servo Valve open.	1. Check servo valve for improper adjustment or blockage.
12. Test 5.	
a. Display does not toggle between "FiL xxx Hi" and "FiL xxx Lo" when HIGH/LOW is pressed.	1. Check U7.
b. Cuff waveform does not conform to Figure 3-2A.	1. Check differential amplifier and low pass filter (U1, U2B, and associated components).

TABLE 3-2 (Continued)

TROUBLESHOOTING GUIDE

SYMPTOM	PROCEDURE
12. Test 5 (continued)	
c. Pulse waveform on lowpass filter setting does not conform to Figure 3-2B.	1. Check pulse channel filter (U2A, U2D, and associated components).
d. Pulse waveform on highpass filter setting does not conform to Figure 3-2B.	1. Check U7. 2. Check tolerances of R23, R26, R28, and R32.
13. Test 6.	
a. Overpressure Switch cannot be adjusted to trip at proper time.	1. Replace Overpressure Switch.

3-6. Signature Analysis.

The following signature analysis procedures provide a means of diagnosing failures involving the LS 100's two microprocessors and/or their associated RAM, ROM, buffers, latches, decoders, and peripheral interface devices. The jumper arrangements specified for each signature analysis exercise the digital circuitry in essentially the same way it is exercised during the power up sequence. In signature analysis, however, the test routines continue to run as a closed loop so long as power is applied. It is then possible to obtain signatures representing recurrent signal patterns for verification purposes.

A. Signature Analysis, 6809.

1. RAM Test (U31 and U32).

a. Ensure that power is off.

b. Set jumper J9 to test position (pins 2 and 3), J10 to normal (pins 1 and 2).

c. Set START for rising edge and connect to TP7.

d. Set STOP for falling edge and connect to TP8.

e. Set CLOCK for falling edge and connect to TP10.

f. Connect probe to U37-7 (+5V).

g. Cycle ON/OFF switch and verify that signature is 42FF.

2. EPROM Test (U33, U34, U36).

   a. Place J9 in normal position and J10 in test position.

   b. Set START for rising edge and connect to TP6.

   c. Set STOP for falling edge and connect to TP8.

   d. Set CLOCK for falling edge and connecto to TP10.

   e. Turn power on and verify that signature is C349.

NOTE: The gate time for this test is approximately 9 seconds.

   f. Turn power off.

B. Signature Analysis, 6805.

1. RAM Test (microprocessor internal RAM).

   a. Return J10 to normal position (J6, J8, J9, J10, and J11 should be in normal position).

   b. Set START for falling edge and connect to TP4.

   c. Set STOP for rising edge and connect to TP4.

   d. Set CLOCK for falling edge and connect to TP9.

   e. Connect probe to U21-40 (+5V).

   f. Cycle ON/OFF switch and verify that signature at U21-40 is 5386.

2. EPROM Test (U23).

   a. Leave the Signature Analyzer set as before. Reposition J7 to the normal position and set J6 to the test position.

   b. Turn power on and verify that signtuare at U21-40 is 1CAU.

NOTE: The gate time for this test is approximately 5 seconds.

   c. Turn power off.

3. I/O Pattern Test.

   a. Leave the Signature Analyzer set as before and set both J6 and J7 to test position.

b. Turn on power and verify that signature at U21-40 (+5V) is 426A.

c. Verify the following signatures:

U21-1	426A	U21-11	FHP5	U21-21	108H	U21-31	C303
U21-2	426A	U21-12	8U8U	U21-22	FPU7	U21-32	U169
U21-3	55H5	U21-13	FHP5	U21-23	85U1	U21-33	0000
U21-4	426A	U21-14	8U8U	U21-24	9PF5	U21-34	0000
U21-5	7319	U21-15	0000	U21-25	390F	U21-35	C303
U21-6	0000	U21-16	0000	U21-26	9UAC	U21-36	U169
U21-7	FHP5	U21-17	9PUH	U21-27	3UPC	U21-37	426A
U21-8	8U8U	U21-18	H2U7	U21-28	2UFU	U21-38	----
U21-9	FHP5	U21-19	2P3C	U21-29	0000	U21-39	----
U21-10	8U8U	U21-29	0000	U21-30	U169	U21-40	426A

U22-2	0571	U26-12	0P60	U24-1	7319
U22-5	PU06	U26-13	UFFF	U24-19	CPA6
U22-6	04C9	U26-14	0000		
U22-9	2503	U26-15	0CA0		
U22-12	P22A	U26-16	4P6U		
U22-15	CA04	U26-17	4337		
U22-16	C08A	U26-18	9CF2		
U22-19	9H6C	U26-19	0000		

U18-1	0000	U17-1	0000	U19-1	426A	U20-1	0000
U18-2	HF2U	U17-2	7HHA	U19-3	0000	U20-2	6A5P
U18-5	U4F9	U17-5	7HHa			U20-5	P657
U18-6	1U8U	U17-6	7HHA			U20-6	F1FH
U18-9	C273	U17-9	7HHA			U20-9	3PUH
U18-11	4P6U	U17-11	4337			U20-11	0CA0
U18-12	H3H4	U17-12	3UC0			U20-12	3PUH
U18-15	FFFA	U17-15	3UC0			U20-15	1502
U18-16	426A	U17-16	3UC0			U20-16	A086
U18-19	3U00	U17-19	3UC0			U20-19	06A9

U14-11	9CF2	U16-1	426A	U36-1	7319	U28-10 UFFF
		U16-4	426A	U36-2	CPA6	
		U16-7	426A	U36-12	0000	
U7-3	U169	U16-8	426A	U36-18	CPA6	
		U16-11	426A	U36-21	CPA6	
		U16-13	426A	U36-22	7319	
		U16-14	426A	U36-24	426A	
		U16-17	U993			

d. Turn off power and reposition all test jumpers to normal position.

SECTION 4
MAINTENANCE

4-1. GENERAL

This section provides maintenance procedures for LS 100 and Battery Charger. Subsequent parts of the section are: Disassembly/Assembly Procedure, Inspection Techniques, Cleaning Techniques, Repair Techniques, and Preparation for Storage or Shipment.

4-2. WARRANTY

LIFESTAT 100 Noninvasive Blood Pressure Monitor is warranted against all defects in parts and workmanship for a period of 1 year from the date of delivery; cuff and tubing 90 days. Physio-Control will repair or replace any products which prove to be defective during the warranty period, provided proper use and maintenance procedures are followed as prescribed in the operating and service manual.

All defective products or components must be returned to Physio-Control or its authorized service center, with a detailed explanation of the failure. Transportation charges must be prepaid.

Service performed, by other than Physio-Control or its authorized agents may, at the discretion of Physio-Control, be cause to void this warranty.

No other party if authorized to make any other warranty or to assume any liability for Physio-Control products. No other warranty, either implied or in writing, will be recognized.

4-3. DISASSEMBLY/ASSEMBLY PROCEDURE (See Figures 4-1 and 5-1.)

The following procedures provide the most logical sequence of removing and installing the major components of the LS 100 and Battery Charger. Assembly is, for the most part, the opposite of disassembly, so only the disassembly procedures are provided. Special assembly notes are provided as required.

4-4. LS 100 Disassembly Procedure.

A. Case Removal.

1. Remove the four screws (3) that hold the case to the Bottom Plate, then slide the cover (1) off towards the rear of the instrument.

2. Remove four screws (5), eight washers (6) (7) and the Bottom Plate (4).

B. System PCB Assembly Removal. After performing Case Removal proceed as follows:

1. Disconnect Battery Pak (54) from the wire harness .
2. Disconnect cables from J1, J4 and J5 on the System PCB.
3. Remove three screws (13) from the System PCB heatsinks.
4. Remove two kepnuts (14) and carefully move the System PCB Assembly away from the chassis until the connector on J2 and J3 (15) are exposed. Disconnect the connectors from J2 and J3 (15).
5. Separate System PCB (12) from LS 100.

C. Front Panel Removal. After performing Case Removal proceed as follows:

1. Disconnect Battery Pak (54) from wire harness.
2. Remove the four screws (23) that hold the Front Panel to chassis.
3. Carefully move the Front Panel away from the chassis until J2 and J3 (15) of the System PCB Assembly are exposed. Disconnect J2 and J3 from the System PCB Assembly.
4. Cut the nylon wire tie that holds the Tubing Assembly (42) on the luer hose fitting (30). Pull the tubing off of the fitting.
5. Separate the Front Panel from the LS 100.

D. Display PCB Assembly Removal. After performing Case Removal, and Front Panel Removal proceed as follows:

1. Remove the two screws (28) and washers (29) that hold the Display PCB to the Front Panel.
2. Carefully move the Display PCB Assembly (26) away from the Front Panel until J1 is exposed. Disconnect the flex cable from J1.
3. Separate the Display PCB Assembly from the LS 100.

E. Battery Pak Removal. After performing Case Removal and Front Panel Removal proceed as follows:

1. Disconnect the Battery Pak (54) from the wire harness.
2. Remove the four screws (52) and washers (53) that hold the Bottom Cover to the chassis.
3. Separate the Battery Pak from the LS 100.

F. Pump Removal. After performing Case Removal, and Front Panel Removal proceed as follows:

1. Disconnect the pump motor cable. Cut the nylon wire tie that holds the Tubing Assembly (42) on the pump's output port. Pull the tubing off of the output port.

2. Remove the three screws (44) that hold the Pump Assembly to the chassis.

3. Separate the pump from the LS 100.

G. Servo Valve Assembly Removal. After performing Case Removal proceed as follows:

1. Disconnect the pump motor cable.

2. Cut the nylon wire tie holding the wire harness to the Servo Valve Assembly.

3. Cut the nylon wire tie that holds the Tubing Assembly (42) to the Servo Valve Assembly.

4. Remove the three screws (38) that hold the Servo Valve Assembly to the chassis. Two screws are located on the top side of the chassis the third screw is accessable through a hole in the System PCB Assembly on the bottom side of the instrument.

5. Raise the front side of the Servo Valve Assembly (37) up so the Tubing Set (42) is accessable. Pull the Tubing Assembly (42) off of the Servo Valve Assembly (37).

6. Cut the nylon wire tie that holds the tubing on the Overpressure Switch Assembly port of the Servo Valve Assembly. Pull the tubing off of the port.

7. Carefully lift the Servo Valve Assembly (37) until it and the transducer may be disconnected from the System PCB Assembly 12 .

H. Overpressure Switch Removal. After performing Case Removal and Servo Valve Assembly Removal proceed as follows:

1. Disconnect P3 and P4 from the Overpressure Switch (48).

2. Remove the two screws (49) and washers (50) that hold the Overpressure Switch to the chassis.

3. Separate the Overpressure Switch from the LS 100.

4-5. Battery Charger Disassembly Procedure. (See Figure 5-7)

A. Case Removal.

1. Remove one screw (2) and four feet (4) that hold the case to the chassis.

2. Slide case off the chassis away from the input and output cables.

B. Battery Charger PCB Removal. After performing Case Removal, proceed as follows:

1. Disconnect P1, P2, and P3 from the Battery Charger PCB Assy.

2. Remove four kepnuts (15) that hold the Battery Charger PCB to the chassis and lift the assembly out of the unit.

C. Transformer Assembly Removal. After performing Case Removal, proceed as follows:

1. Disconnect P1 and P2 from the Battery Charger PCB Assembly and cut the nylon wire ties that hold the cables to the chassis.

2. Remove two kepnuts (11) that hold the transformer to the chassis and lift the transformer from the Battery Charger.

4-6. Inspection Techniques.

A. Exterior Visual Inspections.

1. Visually inspect the entire LS 100 for wear, maintenance damage, corrosion, deterioration, and damage resulting from extreme temperature, or droppage.

B. Interior Visual Inspection.

1. Use a minimum of five-power magnification to check components, wiring, solder joints and printed circuit conductor patterns.

2. Inspect for the following conditions:

a. Check all connectors for loose, bent or corroded contact pins.

b. Check wires, harnesses and cables for signs of wear or deterioration.

c. Inspect sleeving and tubing for proper installation or evidence of damage.

d. Inspect components and their leads for security of mounting, deterioration or leakage.

e. Check terminals and connections for proper installation, faulty soldering, loss or wear.

f. Inspect printed circuit board surfaces for charring, cracking or brittleness.

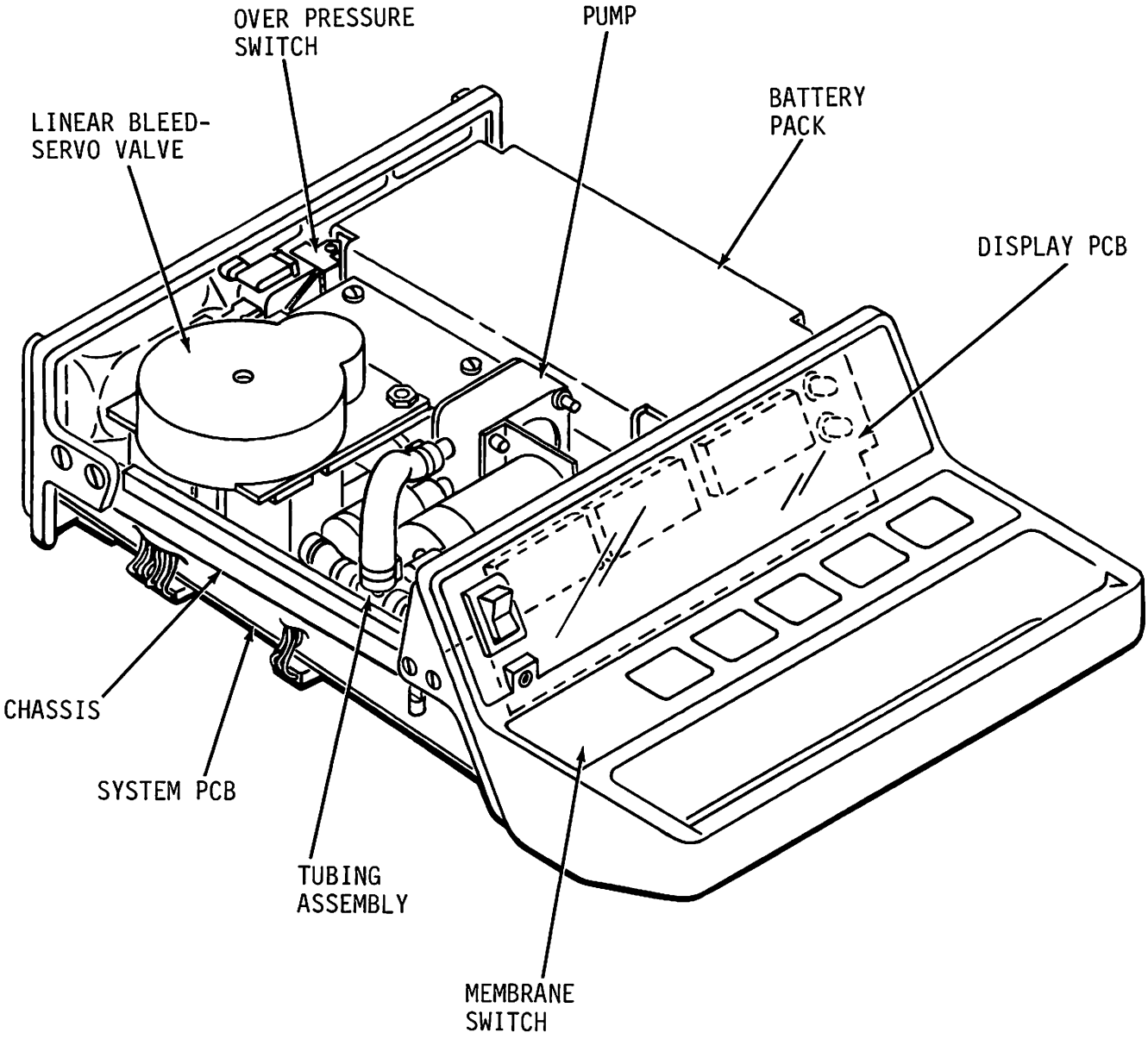

FIGURE 4-1. LS 100 MAJOR COMPONENT IDENTIFICATION

NOTE: Some degree of discoloration to the PCB surface may be expected due to continued exposure to operating temperatures of some of the components mounted theron.

g. Check identification nameplate and other decals for legibility.

h. Inspect chassis, covers and brackets for warping, bending, surface damage or missing hardware.

i. Check all screws and nuts for tightness or signs of stripped or cross-threaded threads.

j. Check for damaged traces on PCBs. Look for lifted conductors and inspect for breaks, scratches, nicks or pinholes.

k. Check for any other form of mechanical damage which may indicate a failure.

4-7. Cleaning Techniques.

A. General.

1. This section contains instructions for periodic cleaning of the LS 100 as a preventive maintenance measure and specific cleaning procedures to be conducted after disassembly and/or repair.

2. Parts having identical cleaning procedures are grouped under common headings.

3. No special tools are required.

B. List of Materials.

1. Cleaning Equipment.

a. Vacuum cleaner.

b. Nonmetallic, soft-bristle brush.

c. Clean, lint-free cloth.

d. Dry, low pressure compressed air (60 psi).

2. Cleaning Solvents.

a. Isopropyl alcohol, 99% pure (preferred solvent).

b. Ethyl alcohol, Fed-Std O-E-760, Grade 1, Class A or B.

c. Perchloroethylene.

NOTE: The above equipment and solvents are either standard shop commodities or are available from commercial sources.

C. Interior Cleaning.

WARNING

VENTILATE WORK AREA THOROUGHLY WHEN USING SOLVENTS. OBSERVE MANUFACTURERS' WARNINGS ON SOLVENT CONTAINERS WITH REGARD TO PERSONNEL SAFETY AND EMERGENCY FIRST AID. BE SURE FIRST AID EQUIPMENT IS AVAILABLE BEFORE USING CHEMICALS.

WARNING

OBSERVE SHOP SAFETY AND FIRE PRECAUTIONS. VENTILATE ALL WORK AREAS WHERE SOLVENTS ARE USED. STORE SOLVENTS AND SOLVENT SOAKED RAGS IN APPROVED CONTAINERS. REFER TO MANUFACTURERS' INSTRUCTIONS ON CONTAINERS FOR RECOMMENDED FIRE FIGHTING PROCEDURES AND NOTE THAT FIRE FIGHTING EQUIPMENT IS AVAILABLE.

1. Magnetics.

   Clean transformers and inductors with a dry nonmetallic soft-bristle brush.

CAUTION

DO NOT USE SOLVENTS TO CLEAN TRANSFORMERS OR INDUCTORS. THE CHEMCIAL ACTION OF SOLVENTS MAY REMOVE THE VARNISH FROM THE WIRE COILS, RENDERING THE COMPONENT USELESS. THE SOLVENT ALSO NEUTRALIZES THE ADHESIVE OF THE COVER TAPE, RESULTING IN EVENTUAL TAPE SEPARATION FROM THE WINDINGS.

2. Printed Circuit Boards.

CAUTION

SOME PRINTED CIRCUIT BOARD ASSEMBLIES IN THE LS 100 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. USE ELECTRO-STATIC SENSITIVE DEVICES (ESD'S) SPECIAL HANDLING PROCEDURES.

   a. Clean assembled parts with a vacuum cleaner or low pressure compressed air (60 psi).

   b. Prior to soldering, clean surfaces with nonmetallic, soft-bristle brush dipped in solvent.

   c. Dry with low pressure compressed air.

CAUTION

TAKE CARE WHEN CLEANING PRINTED CIRCUIT BOARDS THAT WIRES OR COMPONENT LEADS ARE NOT BENT BACK AND FORTH IN SUCH A MANNER TO WEAKEN THEM AND CAUSE THEM TO EVENTUALLY BREAK.

d. Remove excess solder from solder joints and chassis components after repairs.

3. Metallic and Plastic Parts.

a. Brush all surfaces and parts with a nonmetallic, soft-bristle brush.

b. Wipe metal surfaces with soft, nonabrasive cloth dampened with isopropyl alcohol.

CAUTION

DO NOT WIPE OVER SURFACES OF NAMEPLATES OR LABELS WITH ABRASIVE CLEANERS OR MATERIALS, AS THIS WILL EVENTUALLY WEAR AWAY THE NAMEPLATE INFORMATION.

CAUTION

DO NOT USE SOLVENTS TO CLEAN PLASTIC PARTS.

c. Dry clean surfaces with clean cloth.

d. Wipe surfaces of nameplates and labels with clean dry cloth.

D. Exterior Cleaning Procedures.

1. Case and Display. Use soap and water to clean external covers and line cord. Do not use alcohol, solvents, or cleaning solutions. These cleaning agents may damage the surfaces of the instrument.

4-8. Repair Techniques.

A. General.

1. Instructions contained in this section provide the information necessary to return the LS 100 unit and its subassemblies to serviceable condition.

2. Conduct the necessary level of disassembly and inspection to identify all areas requiring repair.

3. Before removing an assembly for repair or replacement, label each lead or draw a sketch showing the location of cables and wires.

B. List of Materials.

The following is a list of recommended materials, tools and chemicals to have available when conducting repair activities.

1. Crocus cloth, available from commercial sources.

2. Solder, activated rosin-core, tin-lead wire Sn 60 or Sn 63 Type R or RMA per Federal Specification QQ-S-571d.

3. Sleeving, silicone-treated fiberglass, Class HA1 or HC1 per MIL-I-3190 or equivalent.

4. 5-Minute Epoxy - Manufactured by Devcon Corporation, 59 Endicott Street, Danvers, Massachusetts, 01923.

5. Solder vacuum Part Number LTS13 - Manufactured by EDSYN Inc., 15954 Arminta Street, Van Nuys, California, 91406.

6. Isopropyl alcohol, 99% pure, available from commercial sources.

7. Trichloroethylene.

8. Acid brush and cotton swabs..

9. RTV Silicon Rubber, Sealant - General Electric RTV 102, White.

C. Repair Procedures.

NOTE: Repair procedures contained here are recommended only as an alternative to complete assembly replacement.

1. Do not attempt to straighten bent connector pins or chassis frame members unless the bending or warpage is slight. Parts damaged beyond this level should be replaced.

2. PCB installed components are normally nonrepairable and must be replaced when found faulty.

3. PCB Component Replacement.

   a. Replace all electronic components not meeting the requirements outlined in Testing and Calibration.

   b. Replace electrical wire as required with wire of same length, color and gage as that being replaced. Install the terminations identified on the applicable wire list.

   c. Remove excess solder from pad by wicking or vacuuming.

   d. Grasp the component with pliers and use a 60 watt soldering iron to remove components from circuit board, being careful not to lift solder pads.

CAUTION

WHEN INSTALLING COMPONENTS ON PRINTED CIRCUIT BOARD, REFER TO TRANSISTOR INDEXING, TAB POSITIONS, DIODE MARKINGS, CAPACITOR POLARITIES ILLUSTRATED IN THE REFERENCED IPL FIGURE.

e. Bend new component leads to fit mounting solder pads on PCB and trim leads to desired length. Be sure component is oriented in the proper polarity position and install it on the board, then solder in place.

NOTE: On heatsink mounted components, verify the isolation between the component tab and the heatsink with an ohmmeter before soldering the leads.

CAUTION

USE A HEAT SINK WHEN SOLDERING DIODES AND TRANSISTORS, AND USE A MINIMUM OF HEAT WHEN SOLDERING COMPONENTS TO PRINTED CIRCUIT BOARDS.

f. Clean residual flux from soldered areas with an acid brush and isopropyl alcohol then dry with compressed air.

g. Test before reassembly.

4. Repair Of Damaged Or Defective Trace. A damaged trace may be a complete break or scratches, nicks, or pinholes which reduce the cross-sectional area of the conductor beyond original design specifications (See Figure 4-2).

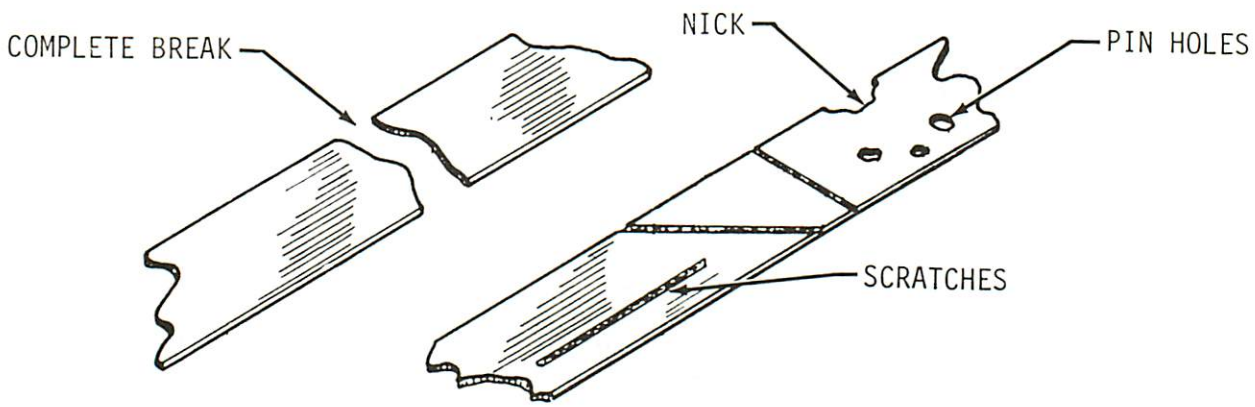

FIGURE 4-2. TYPICAL PRINTED WIRING DAMAGE

NOTE: Repair should be limited to two repairs per board. The damaged section of the conductor should not exceed five times the conductor width.

a. Clean both sides of break in conductor, at least 1/4 inch on each side, with a rubber eraser, then clean with an acid brush and isopropyl alcohol.

b. Cut a piece of 22 or 24 gage solid, tinned copper wire a minimum of 1/4 inch longer than the break. The wire may optionally be flattened by placing it between smooth metal plates and pressing with a bench vise.

c. Hold the wire on the centerline of the conductor, across the break, and solder in place (See Figure 4-3).

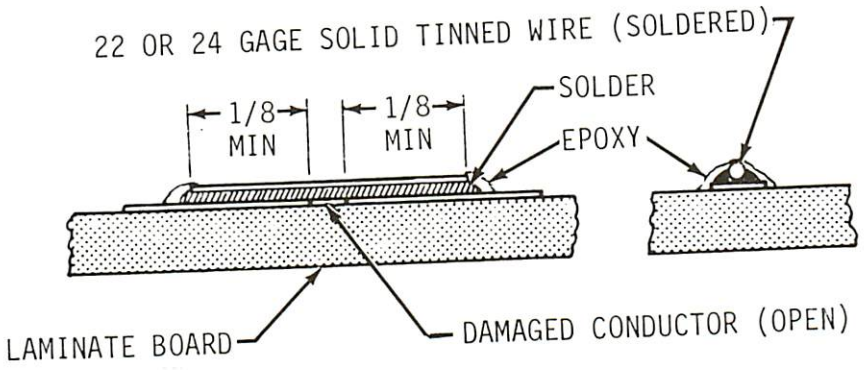

FIGURE 4-3. REPAIRING DAMAGED CONDUCTOR

d. Remove solder flux with cloth dampened with isopropyl alcohol and dry with compressed air.

e. Flow a small amount of 5-minute epoxy cement over the entire repair and allow to dry at room temperature for 15 minutes.

5. Repairing Lifted Conductors. A lifted conductor is present when a portion of the conductor is separated from the PC board surface, but is not broken (See Figure 4-4).

a. Rinse area to be repaired with isopropyl alcohol and dry with compressed air. Be sure that underside of lifted conductor is clean and remove any obstacles which prevent the lifted conductor from making total contact with the substrate surface.

b. Apply 5-minute epoxy to surface of lifted conductor and to a distance of at least 1/8 inch in all directions from the damaged area.

c. Dry at room temperature for one hour.

FIGURE

NOTE: The length of the lifted conductor which is repairable shall not exceed one half the length of the conductor path between two terminal areas or one half inch, whichever is smaller. See dimension X in Figure 4-4.

6. Cover and Case Repair/Replacement. Cover and case repair should be attempted only if the damage is minor; otherwise the damaged part should be replaced. Minor damage is damage that does not effect the structural integrity of the case.

NOTE: Do not attempt to straighten severe bends or to repair severely cracked case halves. Should any damage of this nature be present, replace defective part.

a. Replacement.

1. Replace all cross- or strip-threaded items.

2. If restoration does not return damaged parts to a serviceable condition, then the damaged parts should be replaced.

b. Repair.

1. Remove all traces of grease, dirt or other foreign matter from the damaged area with isopropyl alcohol.

2. Apply trichloroethylene along the line where the pieces meet with a cotton swab.

3. If the joint being repaired is closed, such as a crack, clamping is not necessary; however, if a separate piece is being rejoined that will not hold itself together then clamping is necessary. Allow either joint to set for 24 hours before reassembly.

4. Should surfaces be nicked, scratched or burred, the damaged area can be refinished as follows:

5. Using crocus cloth, work burrs or nicks down to the level of the surrounding area.

6. Brush apply a coat of matching color model paint to the repaired surface.

4-9. Preparation for Storage or Shipment.

It is recommended that the original shipping box and packing for the [illegible] for later use in storage or shipment.

SECTION 5
ILLUSTRATED PARTS LISTS

5-1. GENERAL

This section provides the illustrated parts breakdown and describes the parts used in the LS 100 instrument. Table 5-1 lists the Assembly Drawings and Parts Lists.

5-2 Parts Lists.

1. **FIG-ITEM.** This column contains the figure number of the illustrated assembly and the assigned item number or reference designation of each part.

2. **PART NUMBER.** Physio-Control Corporation (PCC) part number or other part number as specified is contained in this column for each part listed.

3. **DESCRIPTION.** This column contains the nomenclature and descriptive information for each part listed. Electrostatic Sensitive Devices (ESDs) are identified in this column by this symbol 

. Special handling of PCB assemblies containing ESDs is required.

4. **USE CODE.** This column contains an alphabetical code which indicates configuration differences. Consult the first entry in the parts list for code effectivity.

5. **QTY.** This column lists the total quantity of parts for each particular assembly. The abbreviation "REF" (reference) indicates that the part has been listed for reference purposes.

5-3. Part Ordering. Some parts may be purchased locally. When ordering from Physio-Control Corporation, give the instrument model and serial number. Include part number, reference designation, and description. Different parts may be substituted by Physio-Control to reflect modifications and improvements of instrument circuitry.

TABLE 5-1

LS 100 ASSEMBLY DRAWINGS AND PARTS LISTS

DRAWING NO.	NOMENCLATURE	FIGURE NO.
802602	LS 100 FINAL ASSEMBLY	5-1
802581	SYSTEM PCB ASSEMBLY	5-2
802579	DISPLAY PCB ASSEMBLY	5-3
802688	SERVO/PUMP HARNESS ASSEMBLY	5-4
802650	POWER SUPPLY-BATTERY HARNESS ASSEMBLY	5-5
802630	PUMP ASSEMBLY	5-6
802606	BATTERY CHARGER FINAL ASSEMBLY	5-7
802595	BATTERY CHARGER PCB ASSEMBLY	5-8
802668	BATTERY CHARGER TRANSFORMER ASSEMBLY	5-9

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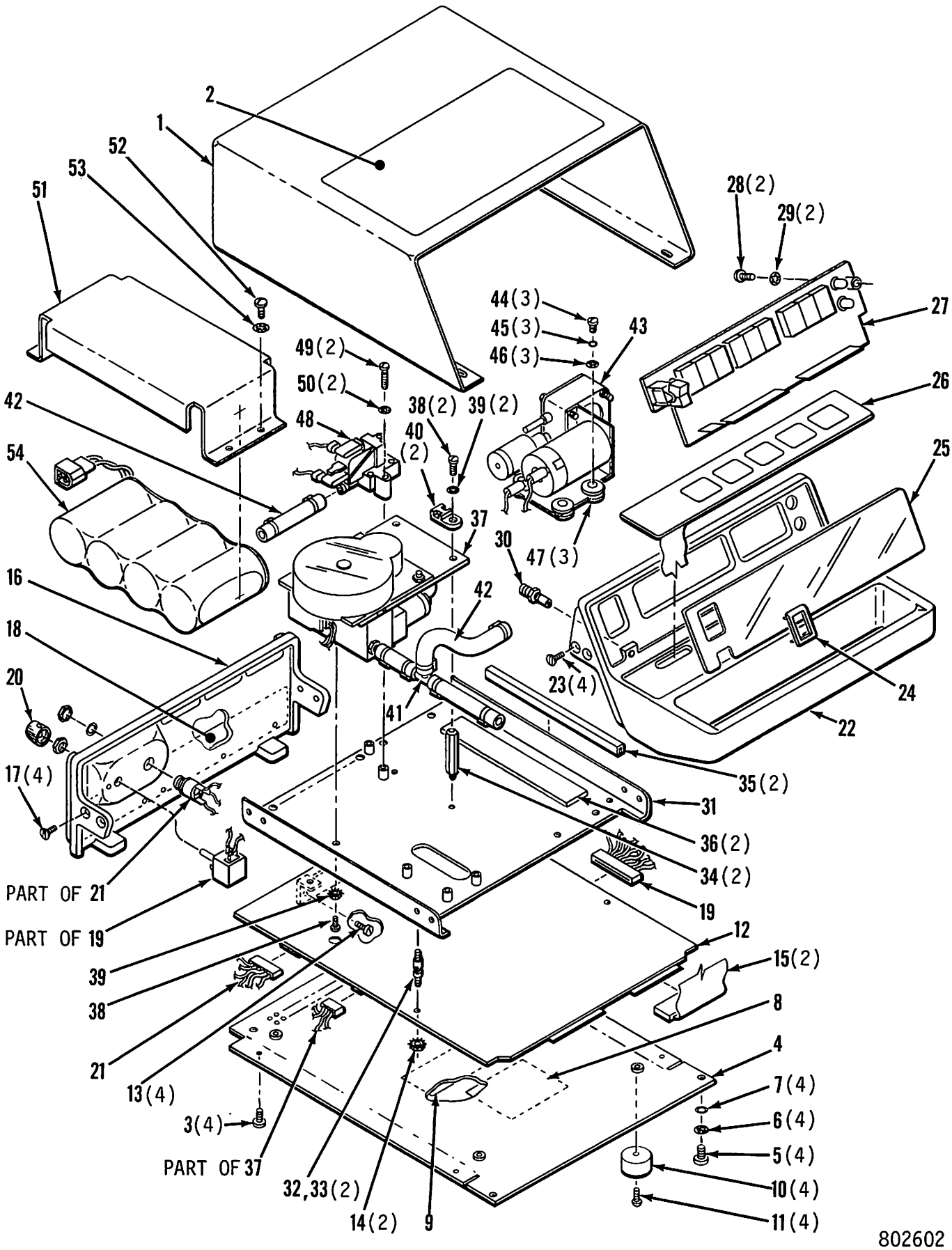


FIGURE 5-1. LS 100 FINAL ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-1	802602-00	LS 100 FINAL ASSY		REF
1	802622-00	. COVER, Top		1
2	802521-00	. LABEL, Operating Instructions		1
3	200476-760	. SCREW, Pan Head, 4-40 X .25L		4
4	802621-00	. PLATE, Bottom		1
5	200476-793	. SCREW, Pan Head, 6-32 X .312L		4
6	90-04014	. WASHER, Lock, #6		4
7	90-04064	. WASHER, Flat, #6		4
		---*---		
8	800897-01	. LABEL, Serial Number		1
9	01-50318-08	. LABEL, Caution		1
10	201245-000	. FOOT, Mounting With Washer, #8		4
		---Attaching Parts		
11	200476-761	. SCREW, Pan Head, 4-40 X .312L		4
12	802581-01	. SYSTEM PCB ASSY (See Figure 5-2)		1
13	200476-760	. SCREW, Pan Head, 4-40 X .25L		4
14	201199-033	. KEPNUT, 4-40		2
		---*---		
15	802664-00	. RIBBON CABLE, Display/System		2
16	802574-00	. REAR PANEL		1
		---Attaching Parts		
17	200478-792	. SCREW, Flat Head, 6-32 X .25L		4
		---*---		
18	802499-00	. LABEL, Rear Panel		1
19	802688-00	. SERVO/PUMP WIRE HARNESS ASSY (See Figure 5-4)		1
20	200141-002	. KNOB, Volume Adjust		1
21	802650-00	. POWER SUPPLY/BATT. WIRE HARNESS ASSY (See Figure 5-5)		1
22	802573-00	. FRONT PANEL		1
		---Attaching Parts		
23	200478-792	. SCREW, Flat Head, 6-32 X .25L		4
		---*---		
24	201546-000	. FRAME, Bezel/ON/OFF Switch		1
25	802625-00	. WINDOW, Display		1
26	802591-00	. SWITCH, Membrane, Front Panel		1
27	802579-00	. DISPLAY PCB ASSY (See Figure 5-3)		1
28	200476-762	. SCREW, Pan Head, 4-40 X .375L		2
29	90-04005	. WASHER, Lock, #4		2
		---*---		
30	802155-00	. FITTING, Hose, Luer, Taper		1
31	802624-00	. CHASSIS		1
32	201421-128	. STANDOFF, Hinged, 4-40		2
33	201199-033	. KEPNUT, 4-40		2
34	201118-314	. SPACER, Hex, 6-32		2
35	201605-001	. GROMMET, Continuous, Nylon		A/R
36	200318-003	. TAPE, Adhesive, Black Sponge		A/R
37	802290-01	. SERVO VALVE-LINEAR BLEED ASSY		1
		---Attaching Parts		
38	200476-793	. SCREW, Pan Head, 6-32 X .312L		3
39	90-04014	. WASHER, Lock, #6		3
40	90-10034	. FASTENER, Cable Tie Mount (One Not Shown)		2
		---*---		
41	201461-000	. FITTING, Luer, Tee, Male		1
42	201489-000	. TUBING, Vinyl		A/R
43	802630-00	. PUMP ASSY		1
		---Attaching Parts		
44	200476-824	. SCREW, Pan Head, 8-32 X .25L		3
45	90-04017	. WASHER, Lock, #8		3
46	90-04016	. WASHER, Flat, #8		3
47	90-10056	. GROMMET, Rubber		3
		---*---		
48	201379-000	. SWITCH, Pressure Sensing, SPDT		1
		---Attaching Parts		

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-1				
49	200476-804	. SCREW, Pan Head, 4-40 X 1.0L		2
50	90-04005	. WASHER, Lock, #4, I.T.		
		---*---		
51	802623-00	. COVER, Battery Pack		1
		---Attaching Parts		
52	200476-793	. SCREW, Pan Head, 6-32 X .312L		4
53	90-04014	. WASHER, Lock, #6, I.T.		4
		---*---		
54	802564-00	. BATTERY PACK		1

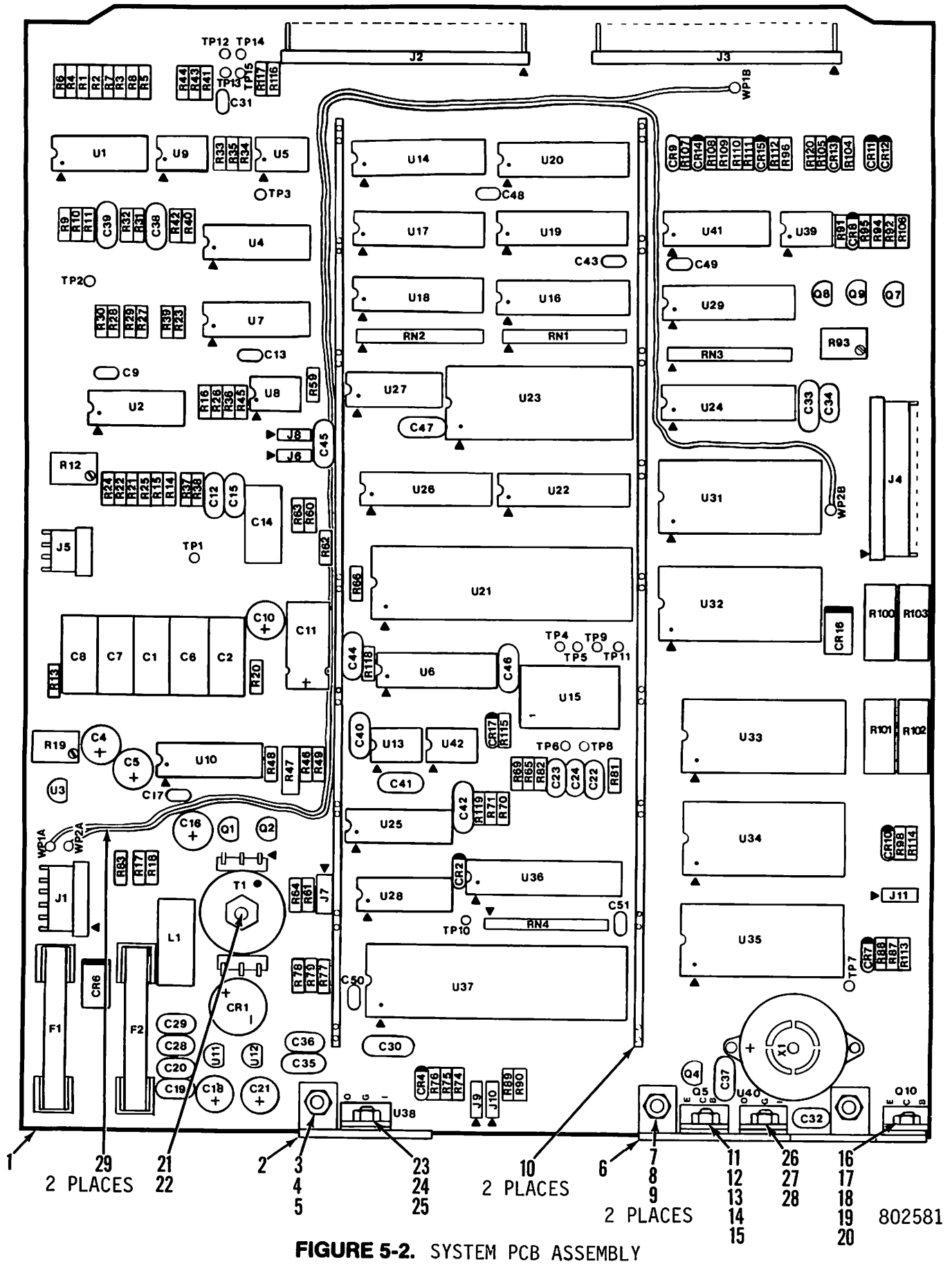


FIGURE 5-2. SYSTEM PCB ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-2	802581-01	SYSTEM PCB ASSY		REF
1	802580-02	. SYSTEM PCB		1
2	802627-01	. BRACKET, Support		1
		---Attaching Parts		
3	200476-760	. SCREW, 4-40 X .25L		1
4	90-04061	. WASHER, Lock, #4		1
5	201199-100	. NUT, Hex, 4-40		1
		---*---		
6	802631-01	. BRACKET, Support		1
		---Attaching Parts		
7	200476-760	. SCREW, 4-40 X .25L		2
8	90-04061	. WASHER, Lock, #4		2
9	201199-100	. NUT, Hex, 4-40		2
		---*---		
10	201526-000	. BUS BAR, High Capacitance		2
C1	200744-013	. CAPACITOR, 47uF/50V, 5%		5
C2	200744-009	. CAPACITOR, .22uF/50V, 5%		1
C4,5	200701-021	. CAPACITOR, Electrolytic, 10uF/35V, 100%		3
C6-8		. (Same as C1)		
C9	200893-008	. CAPACITOR, 680pF/50V, 10%		1
C10		. (Same as C4)		
C11	200204-041	. CAPACITOR, Electrolytic, 47uF/25V, 20%		1
C12	200893-234	. CAPACITOR, .1uF/50V, 20%		15
C13	200893-015	. CAPACITOR, 2700pF/50V, 10%		1
C14		. (Same as C1)		
C15		. (Same as C12)		
C16	200701-006	. CAPACITOR, Electrolytic, 33uF/16V, 100%		1
C17	200901-034	. CAPACITOR, 1000pF/50V, 5%		1
C18	200701-013	. CAPACITOR, Electrolytic, 22uF/25V, 100%		2
C19,20		. (Same as C12)		
C21		. (Same as C18)		
C22-24		. (Same as C12)		
C28,29		. (Same as C12)		
C30	200893-046	. CAPACITOR, 1uF/50V, 10%		2
C31	200893-022	. CAPACITOR, .01uF/50V, 10%		6
C32		. (Same as C12)		
C33		. (Same as C30)		
C34	200893-040	. CAPACITOR, .33uF/50V, 10%		1
C35	200893-038	. CAPACITOR, .22uF/50V, 10%		2
C36		. (Same as C12)		
C37		. (Same as C35)		
C38-41		. (Same as C12)		
C42	200274-005	. CAPACITOR, Mica, 10pF/500V, 5%		1
C43		. (Same as C31)		
C44-47	200264-022	. CAPACITOR, .47uF/50V, 20%		4
C48-51		. (Same as C31)		
CR1	801167-02	. DIODE, Bridge, VM28, 1A/400V		1
CR2	802302-01	. DIODE, Schottky, 1N5712, 35mA/20V		2
CR4	801159-00	. DIODE, Schottky, 1A/20V		3
CR6	201391-005	. DIODE, Schottky, SB380		1
CR7-10	200971-000	. DIODE, Switching, 1N914B, PIV75		7
CR11,12		. (Same as CR4)		
CR13-15		. (Same as CR7)		
CR16	200083-003	. DIODE, Schottky, 1N5820, 3A/100V		1
CR17		. (Same as CR2)		
F1	200256-149	. FUSE, Slow, 3A/250V		1
F2	200256-145	. FUSE, Slow, 2A/250V		1
J1	200534-031	. CONNECTOR, Plug, 6 Contact		1
J2,3	201542-019	. CONNECTOR, Plug, 20 Contact		2
J4	200534-038	. CONNECTOR, Plug, 13 Contact, Lock		1
J5	200534-029	. CONNECTOR, Plug, 4 Contact, Lock		1
J6-11	200396-036	. CONNECTOR, Plug, 3 Contact		6

PARTS LIST

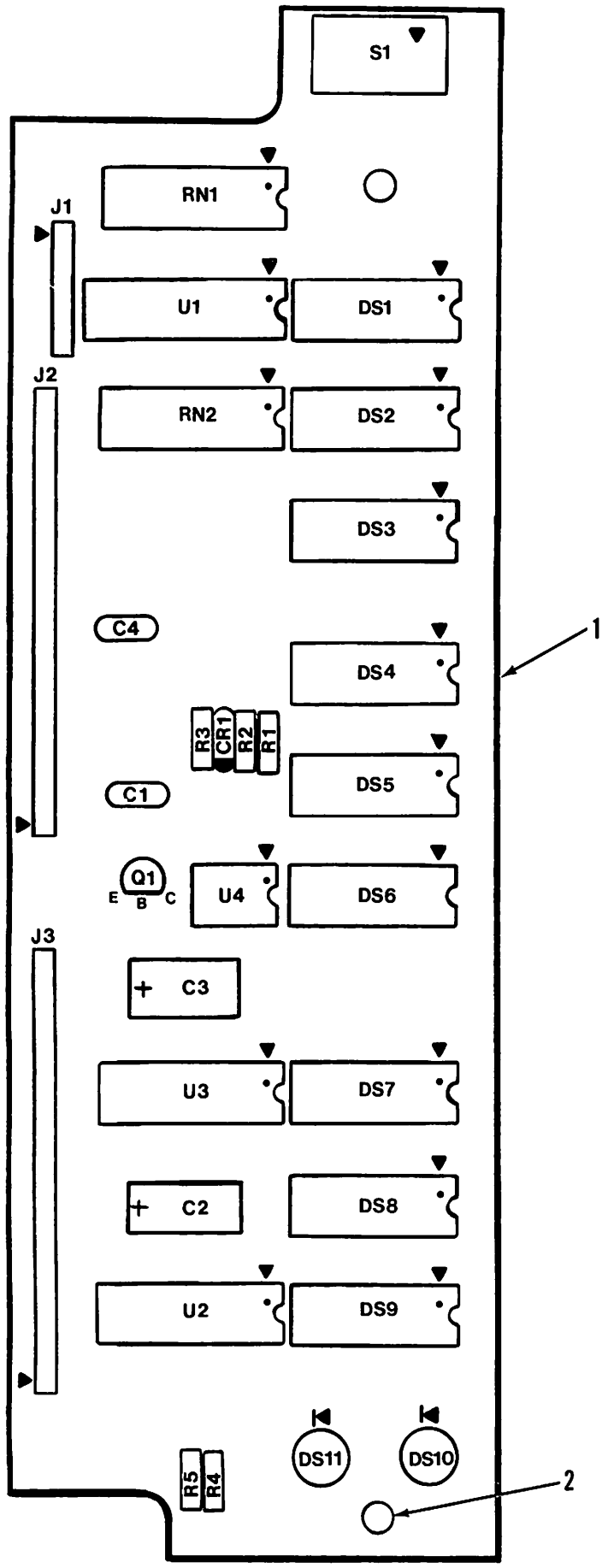
FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-2				
L1	200833-013	. INDUCTOR, RF, 500uH, 500mA, 25%		1
Q1,2	801186-00	. TRANSISTOR, PN2222A, NPN		2
Q4	801507-01	. TRANSISTOR, 2N3904, NPN		4
Q5	801175-00	. TRANSISTOR, D45H11, PNP		1
		---Attaching Parts		
11	200478-760	. SCREW, Flat Head, 4-40		1
12	90-09227	. INSULATOR, Silpad		1
13	200431-849	. WASHER, Shoulder, Nylon, #4		1
14	90-04061	. WASHER, Lock #4		1
15	201199-100	. NUT, Hex, 4-40		1
		---*---		
Q7-9		. (Same as Q4)		
Q10	802303-01	. TRANSISTOR, TIP116, PNP		1
		---Attaching Parts		
16	200478-760	. SCREW, Flat Head, 4-40		1
17	90-09227	. INSULATOR, Silpad		1
18	200431-849	. WASHER, Shoulder, Nylon, #4		1
19	90-04061	. WASHER, Lock, #4		1
20	201199-100	. NUT, Hex, 4-40		1
		---*---		
R1	200054-384	. RESISTOR, 100K, 1/8W, 1%, RN55C		14
R2	200054-218	. RESISTOR, 1.82K, 1/8W, 1%, RN55C		1
R3-9		. (Same as R1)		
R10,11	200054-355	. RESISTOR, 49.9K, 1/8W, 1%, RN55C		4
R12	200527-028	. POTENTIOMETER, 10K, 1/2W, 10%, Multi-Turn		1
R13	200470-080	. RESISTOR, 2.2K, 1/4W, 5%		4
R14,15	200054-374	. RESISTOR, 78.7K, 1/8W, 1%, RN55C		2
R16	200054-403	. RESISTOR, 158K, 1/8W, 1%, RN55C		1
R17	200054-282	. RESISTOR, 8.66K, 1/8W, 1%, RN55C		1
R18	200054-202	. RESISTOR, 1.24K, 1/8W, 1%, RN55C		1
R19	200527-027	. POTENTIOMETER, 5K, 1/2W, 10%, Multi-Turn		2
R20	200054-136	. RESISTOR, 255, 1/8W, 1%, RN55C		1
R21	200054-463	. RESISTOR, 665K, 1/8W, 1%, RN55C		3
R22	200054-264	. RESISTOR, 5.62K, 1/8W, 1%, RN55C		1
R23	200054-397	. RESISTOR, 137K, 1/8W, 1%		3
R24		. (Same as R1)		
R25		. (Same as R21)		
R26		. (Same as R23)		
R27		. (Same as R21)		
R28		. (Same as R1)		
R29		. (Same as R23)		
R30		. (Same as R1)		
R31	200054-353	. RESISTOR, 47.5K, 1/8W, 1%, RN55C		1
R32	200054-279	. RESISTOR, 8.06K, 1/8W, 1%, RN55C		1
R33,34		. (Same as R1)		
R35		. (Same as R10)		
R36	200054-305	. RESISTOR, 15K, 1/8W, 1%, RN55C		1
R37	200054-338	. RESISTOR, 33.2K, 1/8W, 1%, RN55C		1
R38	200054-210	. RESISTOR, 1.5K, 1/8W, 1%, RN55C		1
R39	200054-317	. RESISTOR, 20K, 1/8W, 1%, RN55C		1
R40,41	200054-263	. RESISTOR, 5.49K, 1/8W, 1%, RN55C		2
R42	200054-430	. RESISTOR, 301K, 1/8W, 1%, RN55C		1
R43	200054-445	. RESISTOR, 432K, 1/8W, 1%, RN55C		1
R44	200054-479	. RESISTOR, 976K, 1/8W, 1%, RN55C		1
R45	200470-096	. RESISTOR, 10K, 1/4W, 5%		5
R46	200470-100	. RESISTOR, 15K, 1/4W, 5%		1
R47	200471-060	. RESISTOR, 330, 1/2W, 5%		1
R48,49	200470-065	. RESISTOR, 510, 1/4W, 5%		2
R59	200470-072	. RESISTOR, 1K, 1/4W, 5%		6
R60,61	200470-102	. RESISTOR, 18K, 1/4W, 5%		2

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-2				
R62-64		. (Same as R59)		
R65,66	200470-088	. RESISTOR, 4.7K, 1/4W, 5%		10
R69		. (Same as R45)		
R70	200470-132	. RESISTOR, 330K, 1/4W, 5%		1
R71	200470-124	. RESISTOR, 150K, 1/4W, 5%		1
R74,75		. (Same as R65)		
R76	200470-104	. RESISTOR, 22K, 1/4W, 5%		1
R77-79		. (Same as R65)		
R81,82		. (Same as R65)		
R83		. (Same as R59)		
R87	200470-084	. RESISTOR, 3.3K, 1/4W, 5%		4
R88	200470-112	. RESISTOR, 47K, 1/4W, 5%		4
R89		. (Same as R59)		
R90	200470-058	. RESISTOR, 270, 1/4W, 5%		1
R91		. (Same as R10)		
R92	200470-107	. RESISTOR, 30K, 1/4W, 5%		1
R93		. (Same as R19)		
R94		. (Same as R45)		
R95	200054-342	. RESISTOR, 36.5K, 1/8W, 1%, RN55C		1
R96		. (Same as R13)		
R98	200470-064	. RESISTOR, 470, 1/4W, 5%		1
R100-103	200676-020	. RESISTOR, 39, 3W, 5%		4
R104		. (Same as R65)		
R105		. (Same as R88)		
R106		. (Same as R13)		
R107		. (Same as R87)		
R108		. (Same as R88)		
R109	200470-067	. RESISTOR, 620, 1/4W, 5%		1
R110		. (Same as R13)		
R111		. (Same as R87)		
R112		. (Same as R88)		
R113		. (Same as R45)		
R114	200470-103	. RESISTOR, 20K, 1/4W, 5%		1
R115		. (Same as R87)		
R116		. (Same as R1)		
R117	200054-193	. RESISTOR, 1K, 1/8W, 1%, RN55C		1
R118	200470-048	. RESISTOR, 100, 1/4W, 5%		1
R119		. (Same as R37)		
R120		. (Same As R45)		
RN1-4	200425-011	. RESISTOR NETWORK, SIP, 9 X 4.7K, .20W, 2%		4
T1	802615-00	. TRANSFORMER, Low Power Invertor		1
		---Attaching Parts		
21	NO NUMBER	. SCREW, Nylon, 4-40 X .750		1
22	NO NUMBER	. NUT, Nylon, 4-40		1
		---*---		
TP1-15	801959-00	. TERMINAL, Test Point		15
U1,2	801149-00	. I.C., Lin., Op-Amp, TL064— ATTENTION		2
U3	801142-01	. I.C., Lin., Volt. Reg, LN317LZ		1
U4	802312-00	. I.C., Dig., CMOS, Multiplexer, 7501— ATTENTION		1
U5	801152-00	. I.C., Lin., Op-Amp, LF353— ATTENTION		1
U6	801194-00	. I.C., Inf., CMOS, D/A, 7541— ATTENTION		1
U7	802313-00	. I.C., Inf., CMOS, Multiplexer, 7510D1JN— ATTENTION		1
U8	802315-00	. I.C., Lin., Sample/Hold, LF398N		1
U9	801148-00	. I.C., Lin., Op-Amp, LF355N— ATTENTION		2
U10	801229-00	. I.C., Lin., Volt. Reg., TL494CN		1
U11	801143-02	. I.C., Lin., Reg., 78L12		1
U12	802471-02	. I.C., Lin., Reg., 79L12		1
U13	802314-01	. I.C., Lin., Comparator, LM311N		1
U14	802310-00	. I.C., Dig., HCMOS, Octal Latch, 74HC373— ATTENTION		8
U15	201545-000	. I.C., Crystal Oscillator, Hybrid, 5MHz		1
U16-20		. (Same as U14)		
U21	802328-00	. I.C., Dig., CMOS, Microprocessor, MC146805E2— ATTENTION		1
U22		. (Same as U14)		

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-2				
U23	802694-100	. I.C., EPROM, Control Software, 2764 ATTENTION		1
U24	802324-00	. I.C., Dig., Octal Bus Transceiver, 74LS245		1
U25	802331-00	. I.C., Dig., CMOS, Multivibrator, MC14538 ATTENTION		1
U26	802568-101	. I.C., Dig., PAL10H8		1
U27	801126-00	. I.C., Dig., Buffer/Inverter, 74LS04		1
U28	801130-00	. I.C., NAND Gate, 74LS00		1
U29		. (Same as U14)		
U31,32	802330-01	. I.C., Dig., CMOS, 2K X 8 RAM, MPD446 ATTENTION		2
U33	802693-100	. I.C., EPROM, Blood Pressure Software, 2532 ATTENTION		1
U34	802693-200	. I.C., EPROM, Blood Pressure Software, 2532		1
U35	802693-300	. I.C., EPROM, Blood Pressure Sotfware, 2532 ATTENTION		1
U36	802568-201	. I.C., Dig., PAL 12L10		1
U37	802337-01	. I.C., Dig., NMOS, Microprocessor, MC68A09 ATTENTION		1
U38	802332-00	. I.C., Lin., Volt. Reg., +5V, LM340T-5		2
		---Attaching Parts		
23	200478-760	. SCREW, Flat Head, 4-40		1
24	90-04061	. WASHER, Lock, #4		1
25	201199-100	. NUT, Hex, 4-40		1
		---*---		
U39	801193-00	. I.C., Lin., Comparator, LN393		1
U40		. (Same as U38)		
		---Attaching Parts		
26	200478-760	. SCREW, Flat Head, 4-40		
27	90-04061	. WASHER, Lock, #4		
28	201199-100	. NUT, Hex, 4-40		
		---*---		
U41	201387-000	. I.C., Linear, Transistor Array, 2003		1
U42		. (Same as U9)		
X1	201490-000	. TRANSDUCER, Piezoelectric		1
XF1,2	201345-001	. FUSEHOLDER (Used with F1,2), Retainer		4
XU2	200907-019	. SOCKET, I.C., DIP, 14 Contact		3
XU4	200907-020	. SOCKET, I.C., DIP, 16 Contact		6
XU6	200907-021	. SOCKET, I.C., DIP, 18 Contact		1
XU7		. (Same as XU4)		
XU8	200907-018	. SOCKET, I.C., DIP, 8 Contact		3
XU10		. (Same as XU4)		
XU13		. (Same as XU8)		
XU16-19	200907-022	. SOCKET, I.C., DIP, 20 Contact		8
XU21	200907-026	. SOCKET, I.C., DIP, 40 Contact		2
XU22		. (Same as XU16)		
XU23	200907-025	. SOCKET, I.C., DIP, 28 Contact		1
XU24		. (Same as XU16)		
XU25		. (Same as XU4)		
XU26		. (Same as XU16)		
XU27,28		. (Same as XU2)		
XU29		. (Same as XU16)		
XU31-35	200907-024	. SOCKET, I.C., DIP, 24 Contact		5
XU36		. (Same as XU4 & XU8)		
XU37		. (Same as XU21)		
XU39		. (Same as XU8)		
XU41		. (Same as XU4)		
29	201267-000	. WIRE, bus, vinyl, #8 Blk		A/R

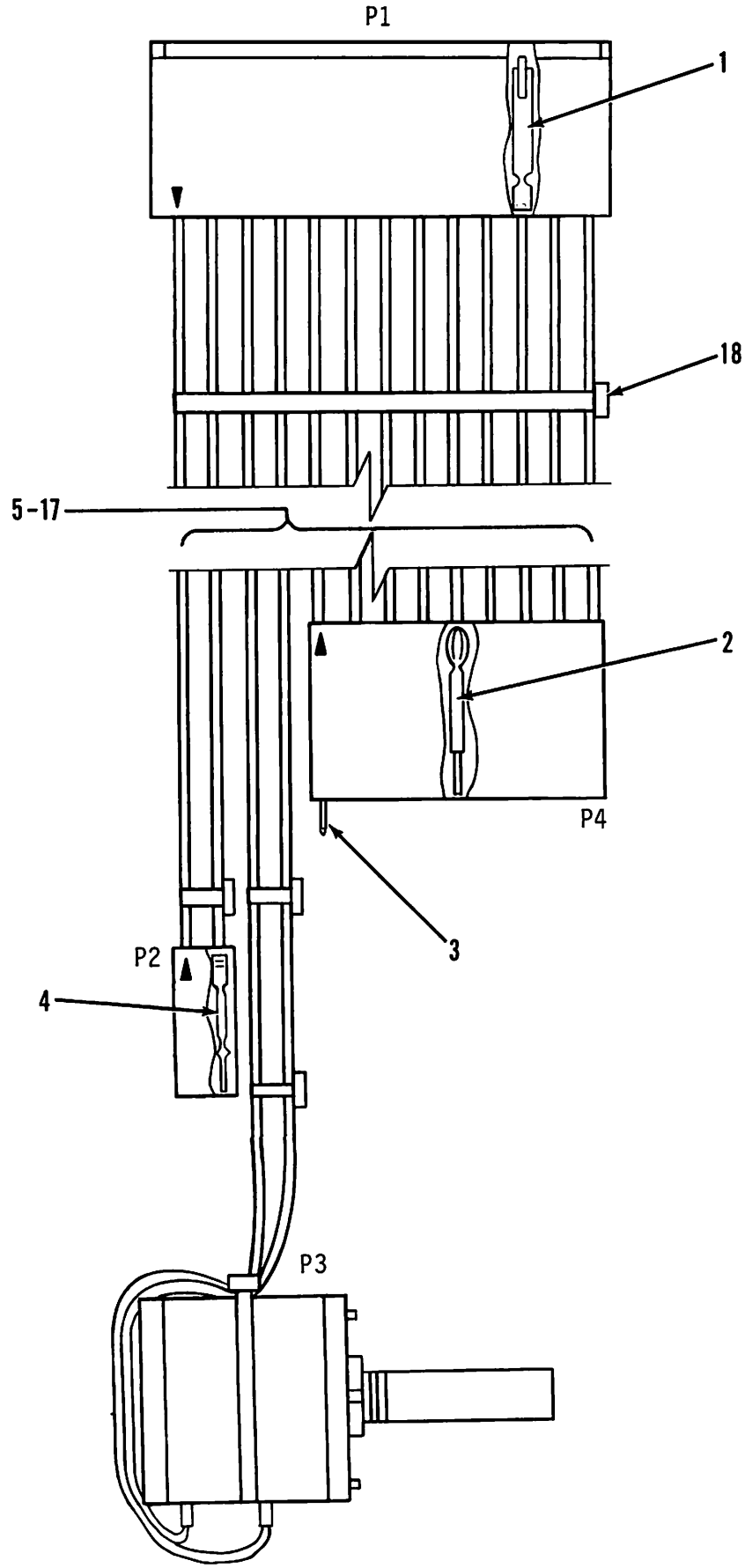


802579

FIGURE 5-3. DISPLAY PCB ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-3	802579-00	DISPLAY PCB ASSY		REF
1	802578-01	. DISPLAY PCB		1
C1	200901-054	. CAPACITOR, .047uF/50V, 10%		1
C2,3	200204-050	. CAPACITOR, Electrolytic, 10uF/35V, 50%		2
C4	200901-046	. CAPACITOR, .01uF/50V, 5%		1
CR1	200971-000	. DIODE, Switching, 1N914B, PIV 75		1
DS1-9	201571-000	. LED, Numeric, 7 Segment, Red		9
DS10-11	200491-000	. LED, Red, 2.2V		2
J1	200396-039	. CONNECTOR, Header, 6 Contact		1
J2,3	200396-307	. CONNECTOR, Header, 20 Contact		2
Q1	200883-001	. TRANSISTOR, 2N3906, PNP		1
R1	200054-271	. RESISTOR, 6.65K 1/8W, 1%		1
R2,3	200470-088	. RESISTOR, 4.7K, 1/4W, 5%		2
R4	200470-066	. RESISTOR, 560, 1/4W, 5%		1
R5	200470-069	. RESISTOR, 750, 1/4W, 5%		1
RN1	200043-056	. RESISTOR NETWORK, 8 X 4.7K, 1.5W, 2%		1
RN2	200043-008	. RESISTOR NETWORK, 8 X 47K, 1.5W, 2%		1
S1	802616-00	. SWITCH, Power On/Off		1
U1	802309-000	. I.C., Lin., Driver, UDN2981A		1
U2,3	201387-000	. I.C., Lin., Transistor Array, ULN2003		2
U4	801139-00	. I.C., Dig., Timer, NE555		1
XDS1-9	200907-019	. SOCKET, LED, 14 Contact		9
XDS10,11	201124-540	. SPACER, Round, Fiber, #6		2
XU1	200907-021	. SOCKET, I.C., 18 Contact		1
XU2,3	200907-020	. SOCKET, I.C., 16 Contact		2
XU4	200907-018	. SOCKET, I.C., 8 Contact		1
2	200655-003	. STANDOFF, Rnd, Swage		2

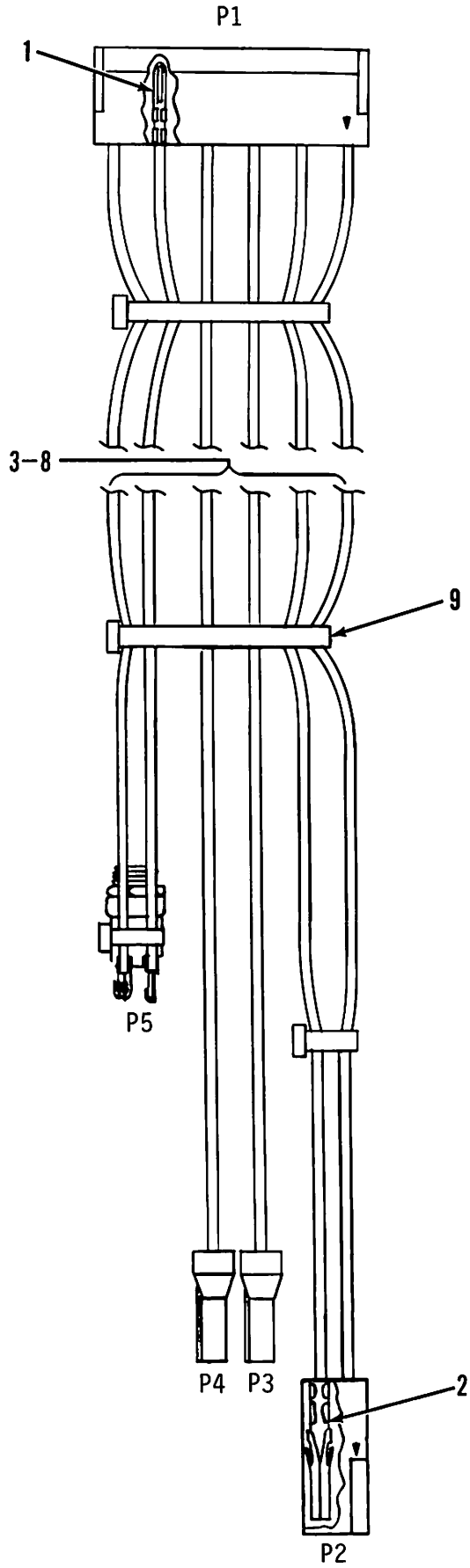


802688

FIGURE 5-4. SERVO/PUMP HARNESS ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-4	802688-00	SERVO/PUMP HARNESS ASSY		REF
P1	200419-030	. CONNECTOR, Receptacle, 13 Contact		1
P2	200825-001	. CONNECTOR, Polarized Lock Plug, 2 Contact		1
P3	201584-000	. POTENTIOMETER, 5K, 1 Turn		1
P4	200389-008	. CONNECTOR, Receptacle, 9 Contact		1
1	200390-001	. TERMINAL, Crimp, 22-30, Loose		13
2	200979-115	. TERMINAL, Crimp, 22-26, Reel		8
3	201485-004	. TERMINAL, Crimp, 22-26, Loose		1
4	200853-001	. TERMINAL, Crimp, 18-24, Loose		2
5	200357-108	. WIRE, Stranded, 22 AWG, CSA, White		A/R
6	200357-109	. WIRE, Stranded, 22 AWG, CSA, Black		A/R
7	200357-110	. WIRE, Stranded, 22 AWG, CSA, Red		A/R
8	200357-111	. WIRE, Stranded, 22 AWG, CSA, Green		A/R
9	200357-112	. WIRE, Stranded, 22 AWG, CSA, Yellow		A/R
10	200357-113	. WIRE, Stranded, 22 AWG, CSA, Blue		A/R
11	200357-114	. WIRE, Stranded, 22 AWG, CSA, Brown		A/R
12	200357-115	. WIRE, Stranded, 22 AWG, CSA, Orange		A/R
13	200357-116	. WIRE, Stranded, 22 AWG, CSA, Gray		A/R
14	200357-117	. WIRE, Stranded, 22 AWG, CSA, Violet		A/R
15	200357-118	. WIRE, Stranded, 22 AWG, CSA, White/Black		A/R
16	200357-119	. WIRE, Stranded, 22 AWG, CSA, White/Red		A/R
17	200357-120	. WIRE, Stranded, 22 AWG, CSA, White/Green		A/R
18	200536-09	. RETAINER, Cable Tie, Nylon, 3.50L X .080W		8

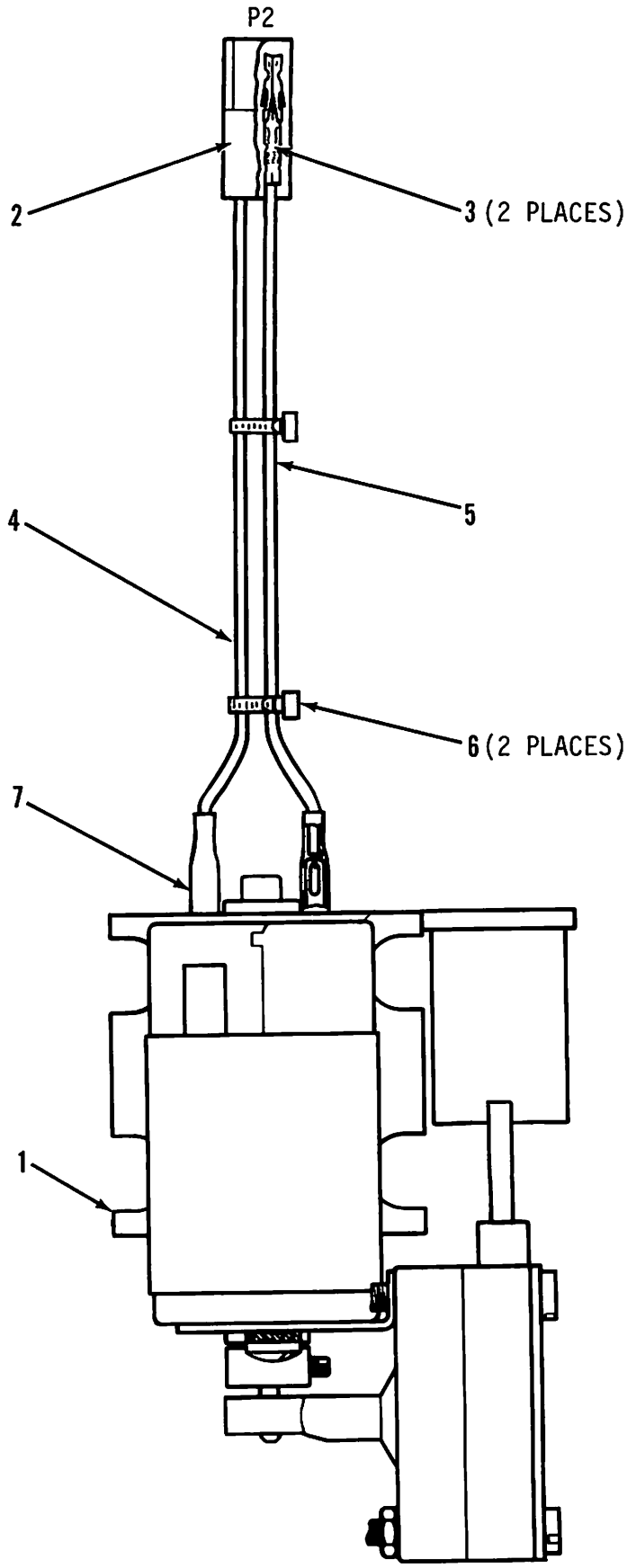


802650

FIGURE 5-5. POWER SUPPLY/BATTERY HARNESS ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-5	802650-00	POWER SUPPLY/BATTERY HARNESS ASSY		REF
P1	200419-023	. CONNECTOR, Receptacle, Lock, 6 Contact		1
P2	200824-001	. CONNECTOR, Receptacle, Polarized, Lock, 2 Contact		1
P3,4	200514-006	. TERMINAL, 90° Receptacle, 22-18 AWG		2
P5	201585-000	. JACK, Power, 5A, 12V		1
1	200390-001	. TERMINAL, Socket, Crimp, 22-30, Loose		6
2	200894-001	. TERMINAL, Socket, Crimp, 18-24, Loose		2
3	200357-082	. WIRE, Stranded, 20 AWG, CSA, Black		A/R
4	200357-083	. WIRE, Stranded, 20 AWG, CSA, Red		A/R
5	200357-108	. WIRE, Stranded, 22 AWG, CSA, White		A/R
6	200357-111	. WIRE, Stranded, 22 AWG, CSA, Green		A/R
7	200357-112	. WIRE, Stranded, 22 AWG, CSA, Yellow		A/R
8	200357-113	. WIRE, Stranded, 22 AWG, CSA, Blue		A/R
9	200536-009	. RETAINER, Cable Tie, 4.06L		3

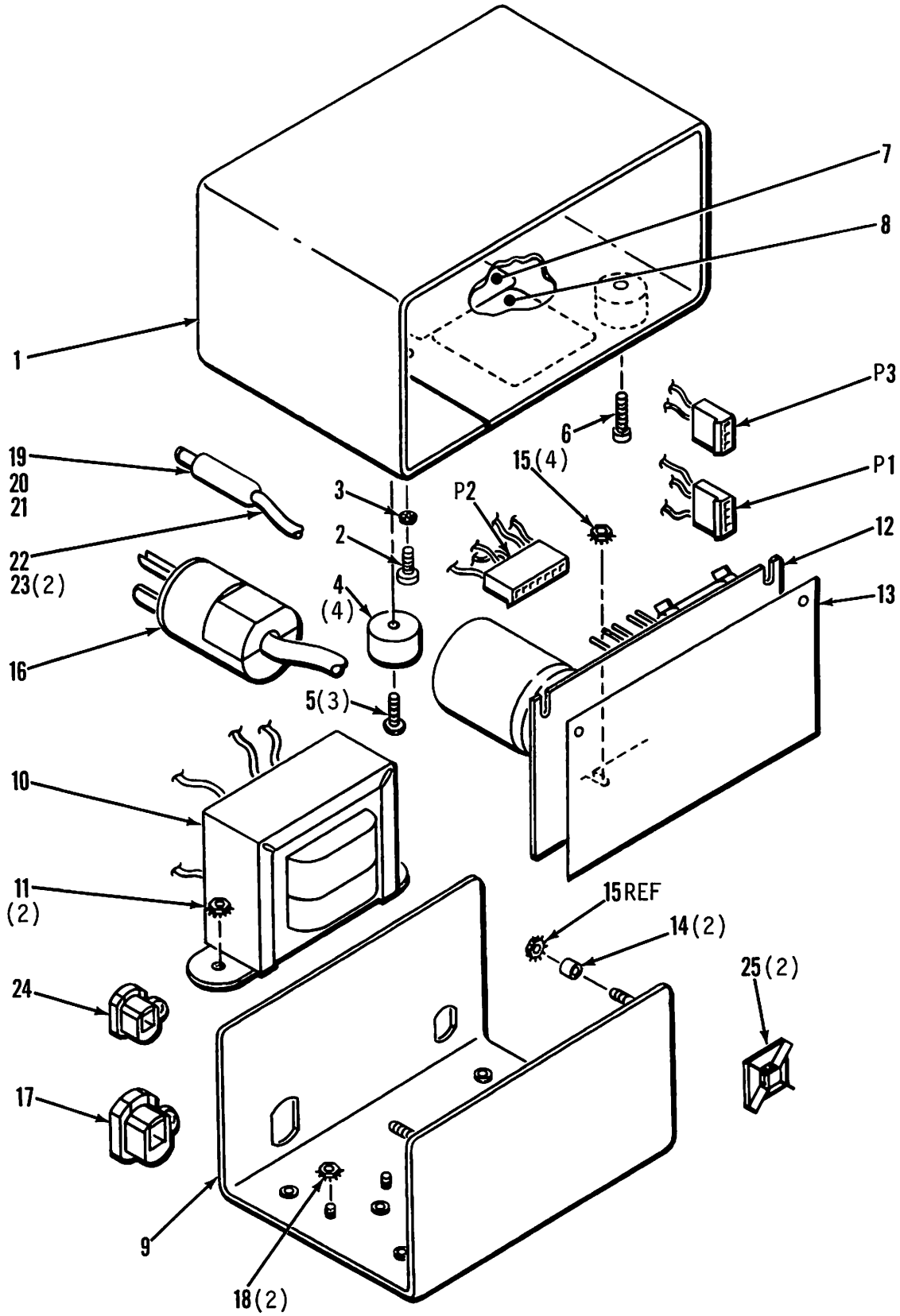


802630

FIGURE 5-6. PUMP ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-6	802630-00	PUMP ASSY		REF
1	802628-00	. BRACKET, Pump Mounting		1
2	200824-001	. CONNECTOR, Receptacle, Polarized Lock, 2 Contact		1
3	200894-001	. TERMINAL, Crimp, 18-24, Loose		2
4	200357-108	. WIRE, Stranded, 22 AWG, CSA, White		A/R
5	200357-109	. WIRE, Stranded, 22 AWG, CSA, Black		A/R
6	200536-008	. RETAINER, Cable Tie, Nylon, 5.5L		2
7	200283-003	. TUBING, Heatshrink, Red		A/R

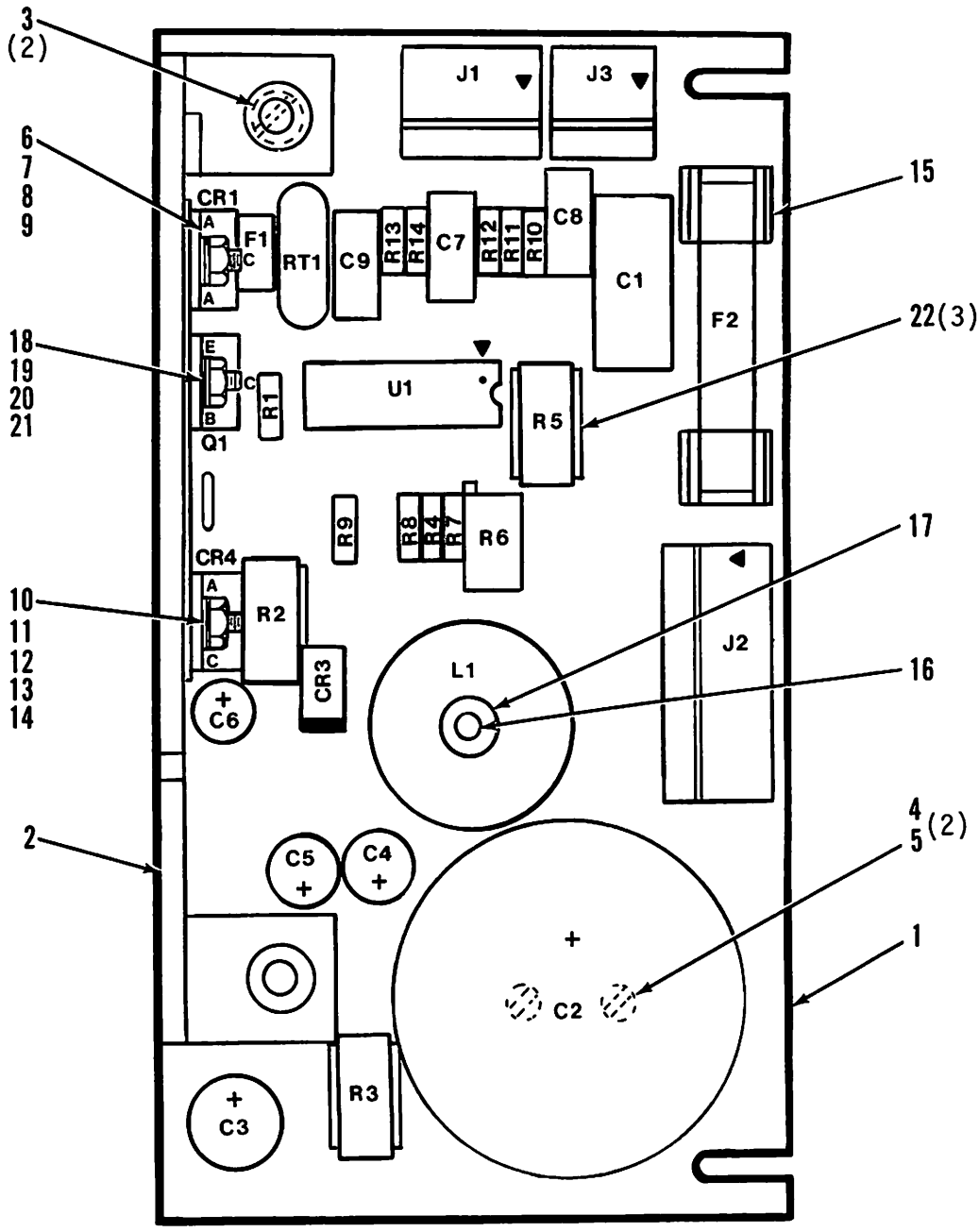


802606

FIGURE 5-7. BATTERY CHARGER FINAL ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-7	802606-00	BATTERY CHARGER FINAL ASSY		REF
1	802613-00	COVER		1
		---Attaching Parts		
2	200476-764	. SCREW, Pan Head, 4-40 X .500L		1
3	90-04005	. WASHER, Lock, #4, I.T.		1
		---*---		
4	201245-000	. FOOT, Mounting, With Washer		4
		---Attaching Parts		
5	200476-764	. SCREW, Pan Head, 4-40 X .500L		3
6	200476-765	. SCREW, Pan Head, 4-40 X .562L		1
		---*---		
7	800897-01	. LABEL, Serial Number		1
8	01-50318-08	. LABEL, Caution, Shock, English		1
9	802612-00	. CHASSIS		1
10	802668-00	. TRANSFORMER ASSEMBLY (See Figure 5-9)		1
		---Attaching Parts		
11	90-03019	. KEPNUT, Hex, 4-40		2
		---*---		
P1		. . (Part Of 10)		1
P2		. . (Part Of 10)		1
P3	200277-001	. CONNECTOR, Receptacle, 3 Contact		1
12	802595-00	. PCB ASSEMBLY, BATTERY CHARGER (See Figure 5-8)		1
		---Attaching Parts		
13	802954-00	. SHIELD, Nomex, Aramide 410		1
14	201124-511	. SPACER, Round Fiber, #4 X .187L		2
15	90-03019	. KEPNUT, Hex, 4-40		4
		---*---		
16	800445-10	. POWER CORD ASSY		1
		---Attaching Parts		
17	200050-020	. BUSHING, Strain Relief, Nylon		1
18	90-03021	. KEPNUT, Hex, 6-32		2
		---*---		
19	802687-00	. OUTPUT CABLE ASSEMBLY		1
20	201586-000	. . PLUG, Power		1
21	802963-00	. . SHIELD, Nomex		1
22	201618-000	. . CABLE, Unshielded, 2 Conductor, 20 AWG, Stranded		A/R
23	200390-016	. . TERMINAL, Socket, Crimp, 18-24		2
		---Attaching Parts		
24	200050-012	. BUSHING, Strain Relief, Nylon		1
25	90-10055	. RETAINR-CABLE Tie, Nylon		2



802595

FIGURE 5-8. BATTERY CHARGER PCB ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-8	802595-00	BATTERY CHARGER PCB ASSY		REF
1	802594-01	. BATTERY CHARGER PCB		1
2	802662-01	. HEATSINK		1
		---Attaching Parts		
3	200476-537	. SCREW, Pan Head, 4-40 X .312L		2
		---*---		
C1	201216-013	. CAPACITOR, .10uF/250V, 20%		1
C2	200100-132	. CAPACITOR, Electrolytic, 9000uF/25V, +75%		1
		---Attaching Parts		
4	200476-132	. SCREW, Pan Head, 10-32 X .250L		2
5	90-04046	. WASHER, Lock, ET, #10		2
		---*---		
C4,5	200701-013	. CAPACITOR, Electrolytic, 22uF/25V, 100%		2
C6	200205-046	. CAPACITOR, Electrolytic, 22uF/50V, 10%		1
C7,8	200966-003	. CAPACITOR, .10uF/100V, 5%		2
C9	200966-014	. CAPACITOR, .01uF/250V, 5%		1
CR1	201320-001	. DIODE, Fast Recovery, 16A, PIV100		1
		---Attaching Parts		
6	200478-538	. SCREW, Flat Head, 4-40 X .375L		1
7	200431-849	. WASHER, Shoulder, #4		1
8	90-04061	. WASHER, Lock, #4		1
9	201199-100	. NUT, Hex, 4-40 X .188W		1
		. ---*---		
CR3	200103-003	. DIODE, Zener, ICTE-12		1
CR4	802656-02	. DIODE, Schottky, VSK64, 6A		1
		---Attaching Parts		
10	200478-538	. SCREW, Flat Head, 4-40 X .375L		1
11	802632-00	. INSULATOR, Heatsink Silpad		1
12	200431-849	. WASHER, Shoulder, #4		1
13	90-04061	. WASHER, Lock, #4		1
14	201199-100	. NUT, Hex, 4-40 X .188W		1
		---*---		
F1	201167-010	. FUSE, Fast, 3A/125V		1
F2	200256-138	. FUSE, Slow, .8A/250V		1
		---Attaching Parts		
15	201345-001	. RETAINER-CLIP, Fuseholder, 3AG		2
		---*---		
J1	200096-002	. CONNECTOR, Plug, Lock, 4 Contact		1
J2	200096-005	. CONNECTOR, Plug, Lock, 7 Contact		1
J3	200096-001	. CONNECTOR, Plug, Lock, 3 Contact		1
L1	800908-00	. INDUCTOR, Toroid, 300$H, 3A		1
		---Attaching Parts		
16	201111-040	. SCREW, Binding Head, Nylon, 4-40 X .500L		1
17	200681-028	. RETAINER, Toroid		1
		---*---		
Q1	801175-00	. TRANSISTOR, D45H11, PNP		1
		---Attaching Parts		
18	200478-538	. SCREW, Flat Head, 4-40 X .325L		1
19	200431-049	. WASHER, Shoulder, #4		1
20	90-04061	. WASHER, Lock, #4		1
21	201199-100	. NUT, Hex, 4-40		1
R1	200470-040	. RESISTOR, 47, 1/4W, 5%		1
R2	200676-029	. RESISTOR, 100, 3W, 5%		1
R3	200270-000	. RESISTOR, .10, 2W, 5%		1

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-8				
R4	200054-147	. RESISTOR, 332, 1/8W, 1%		1
R5	200270-080	. RESISTOR, 220, 2W, 5%		1
R6	200527-012	. POTENTIOMETER, 50K, 1/2W, 10%, Multi-turn		1
R7	200470-096	. RESISTOR, 10K, 1/4W, 5%		1
R8	200054-085	. RESISTOR, 9.31K, 1/8W, 1%		1
R9	200470-054	. RESISTOR, 180, 1/4W, 5%		1
R10	200470-092	. RESISTOR, 6.8K, 1/4W, 5%		1
R11	200470-128	. RESISTOR, 220K, 1/4W, 5%		1
R12	200470-072	. RESISTOR, 1K, 1/4W, 5%		1
R13	200470-080	. RESISTOR, 2.2K, 1/4W, 5%		1
R14	200470-144	. RESISTOR, 1M, 1/4W, 5%		1
22	90-09089	. INSULATOR, Cradle Mount (Used with R2,3,5)		3
RT1	200486-003	. THERMISTOR, Surge, 2A, 5 Ohm		1
U1	801229-02	. I.C., Linear, Switching, Volt. Reg., TL494		1
XU1	200675-002	. SOCKET, I.C., DIP, 16 Contact		1

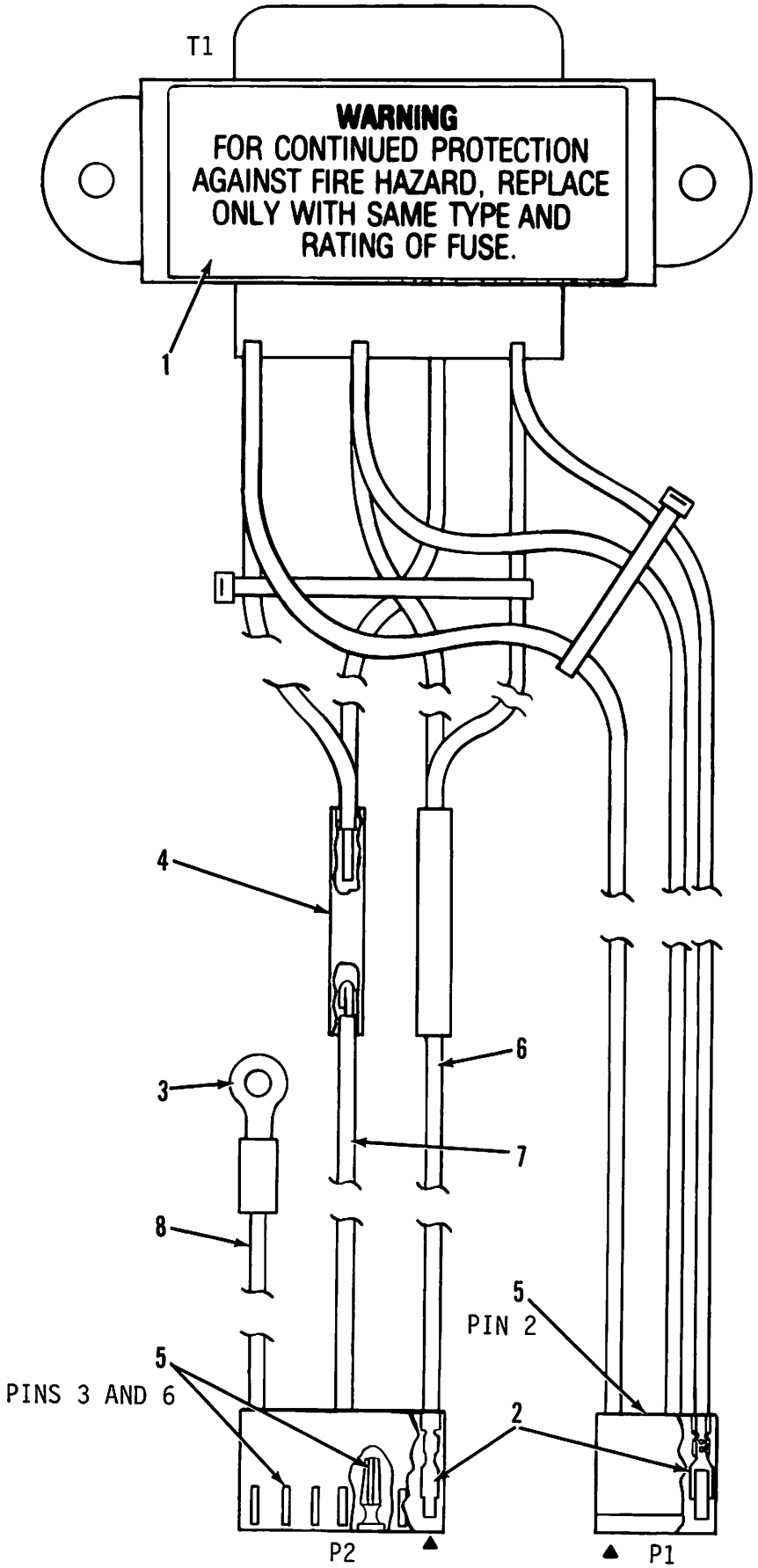


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FIGURE 5-9. BATTERY CHARGER TRANSFORMER ASSEMBLY

PARTS LIST

FIG-ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	USE CODE	QTY
5-9	802668-00	BATTERY CHARGER TRANSFORMER ASSEMBLY		REF
P1	200277-002	. CONNECTOR, Receptacle, Housing, 4 Contact		1
P2	200277-005	. CONNECTOR, Receptacle, Housing, 7 Contact		1
T1	802669-00	. TRANSFORMER, Line, Split Primary		1
1	801362-03	. LABEL, Warning Fuse		1
2	200390-016	. TERMINAL, Socket, Crimp, 18-24, Chain		6
3	200276-212	. TERMINAL, Lug, Ring Tongue, 22-16, 1/4		1
4	90-10002	. TERMINAL, Splice, Window, Blue, 16, 14A		2
5	200169-000	. KEY, Connector Polarizing		3
6	200357-088	. WIRE, Stranded, 20AWG, CSA, Orange		A/R
7	200357-087	. WIRE, Stranded, 20AWG, CSA, Brown		A/R
8	200357-084	. WIRE, Stranded, 20AWG, CSA, Green		A/R

SECTION 6
SCHEMATICS

6-1. GENERAL

This section provides the schematic drawings for the LS 100. Table 6-1 lists the schematics contained.

NOTE: The schematics in this section are typical and may differ slightly from the user's configuration.

TABLE 6-1

LS 100 SCHEMATIC DRAWINGS

DRAWING NO.	NOMENCLATURE	FIGURE NO.
802581	SYSTEM PCB SCHEMATIC	6-1
802579	DISPLAY PCB SCHEMATIC	6-2
802688	SERVO/PUMP HARNESS SCHEMATIC	6-3
802650	POWER SUPPLY/BATTERY HARNESS SCHEMATIC	6-4
802664	DISPLAY/SYSTEM HARNESS SCHEMATIC	6-5
802602	LS 100 INTERCONNECT DIAGRAM	6-6
802595	BATTERY CHARGER PCB SCHEMATIC	6-7
802668	BATTERY CHARGER TRANSFORMER SCHEMATIC	6-8
802606	BATTERY CHARGER INTERCONNECT DIAGRAM	6-9

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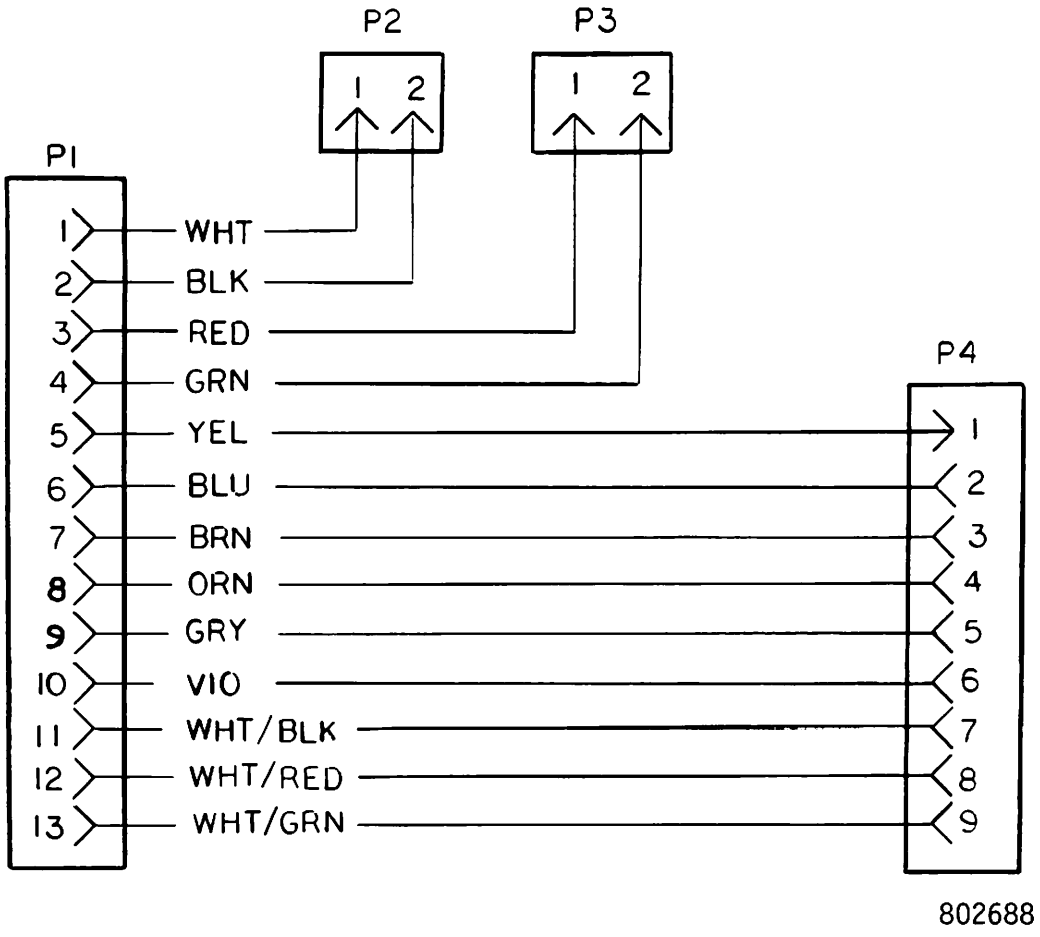

FIGURE 6-3. SERVO/PUMP HARNESS SCHEMATIC

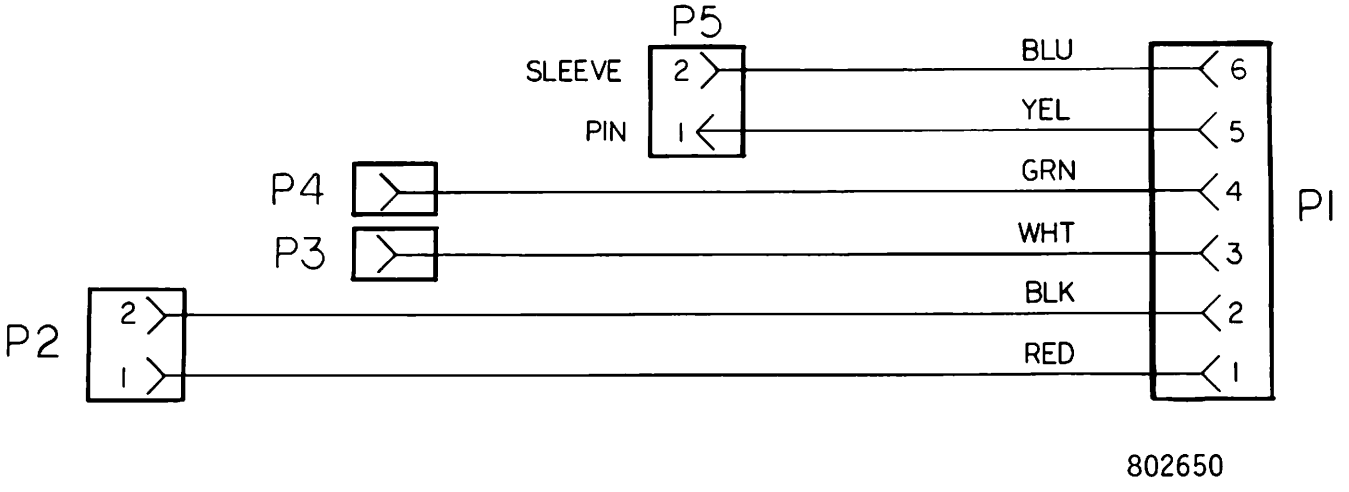

FIGURE 6-4. POWER SUPPLY/BATTERY HARNESS SCHEMATIC

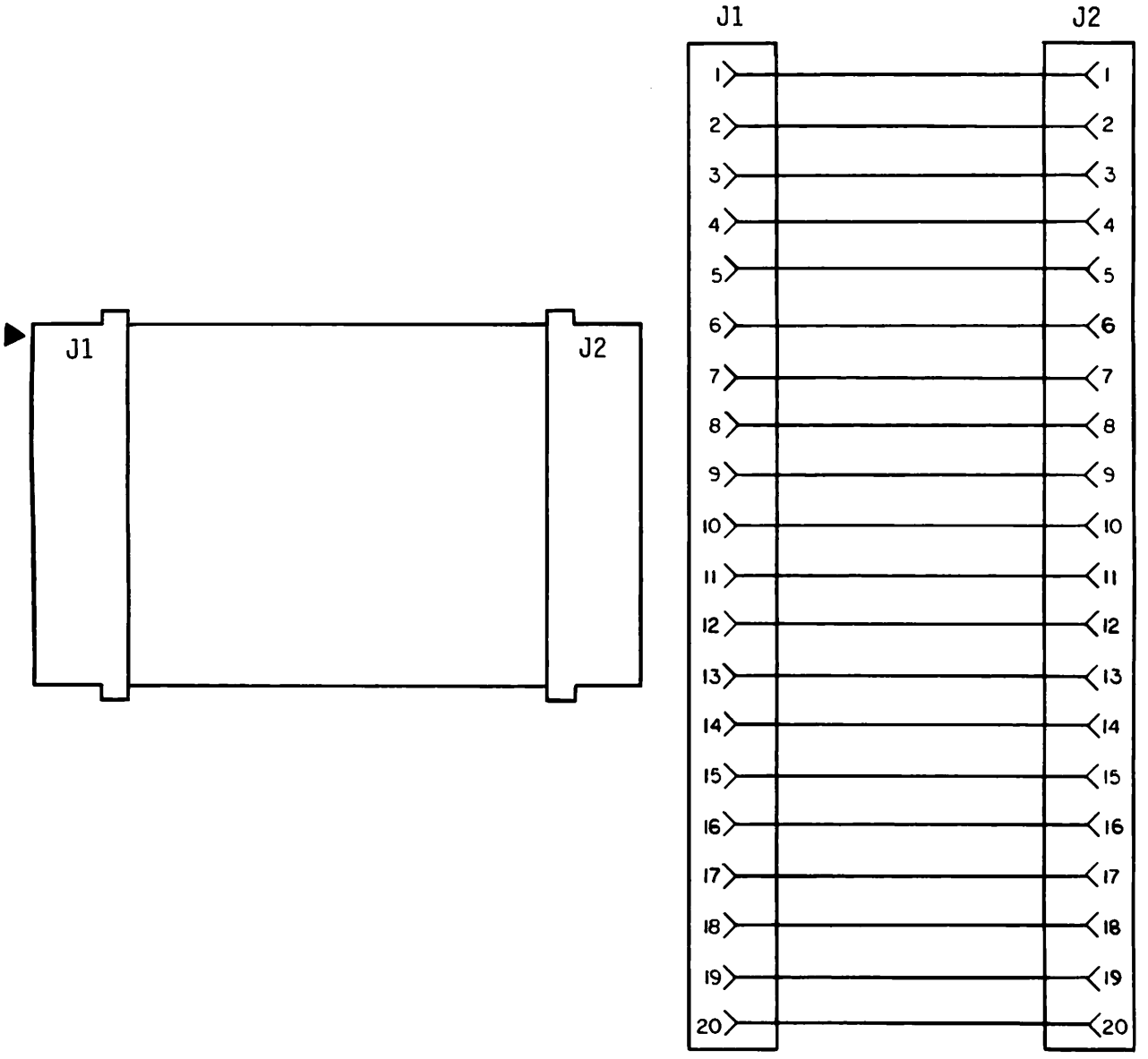

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FIGURE 6-5. DISPLAY/SYSTEM HARNESS SCHEMATIC

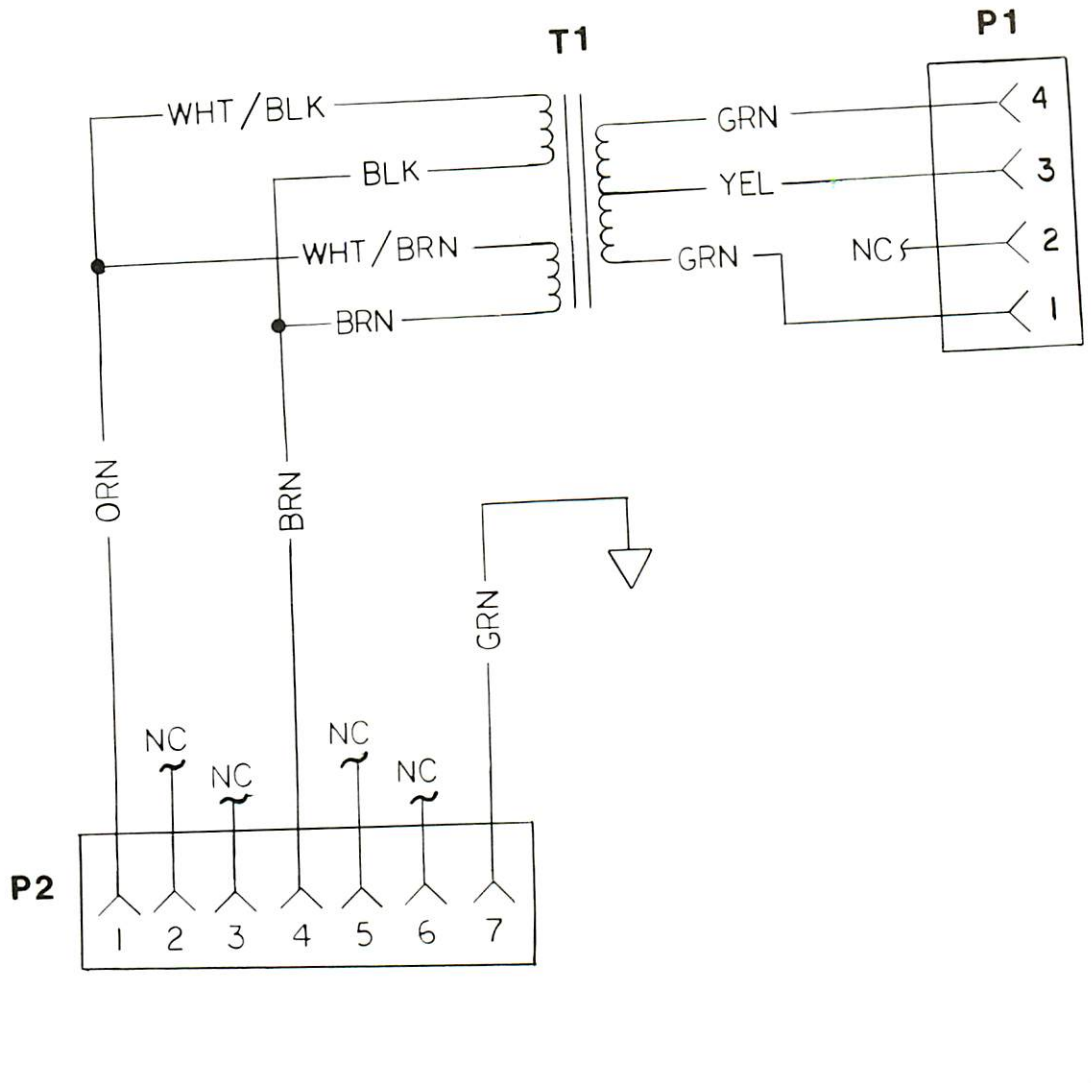
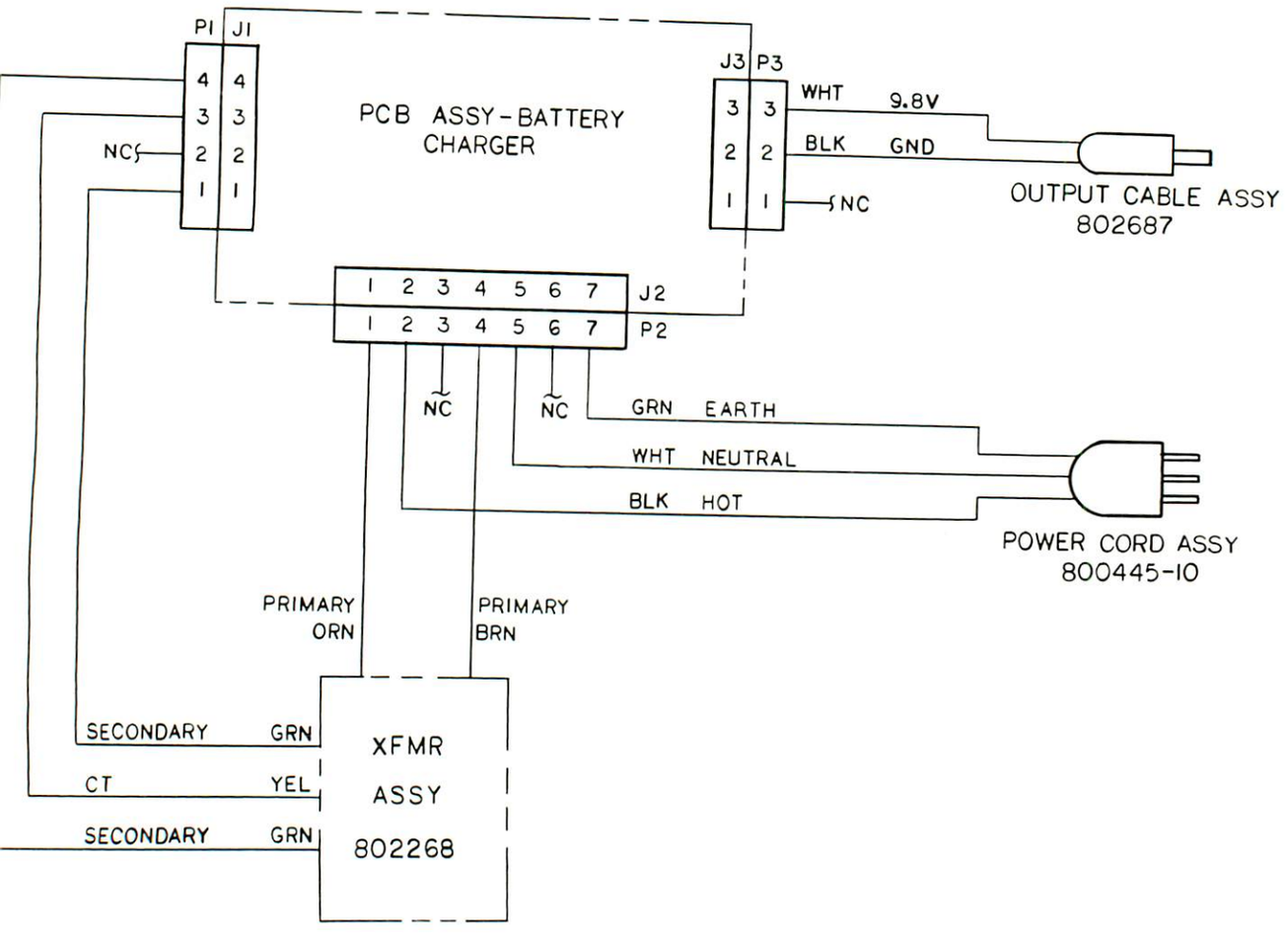


FIGURE 6-8. BATTERY CHARGER WIRING DIAGRAM



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INTERCONNECT DIAGRAM