

Service Manual



This manual covers model:

LPS 301-305

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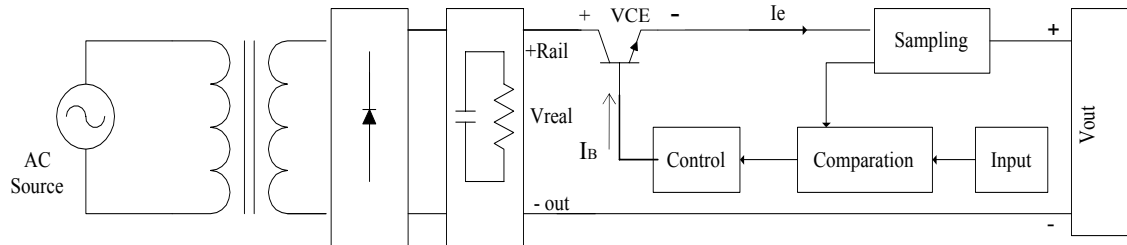
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Principle of Operation

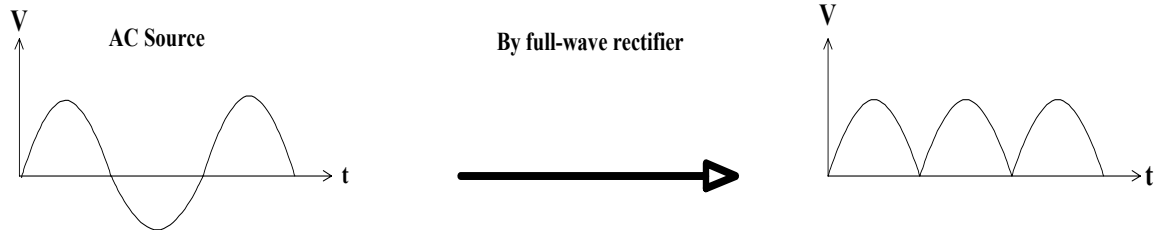
LPS 300 Series Block Diagram



Conversion of AC source to DC source is by a transformer, rectifiers and RC filters. Each model of LPS 300 series has individual voltage output by controlling V_{CE} .

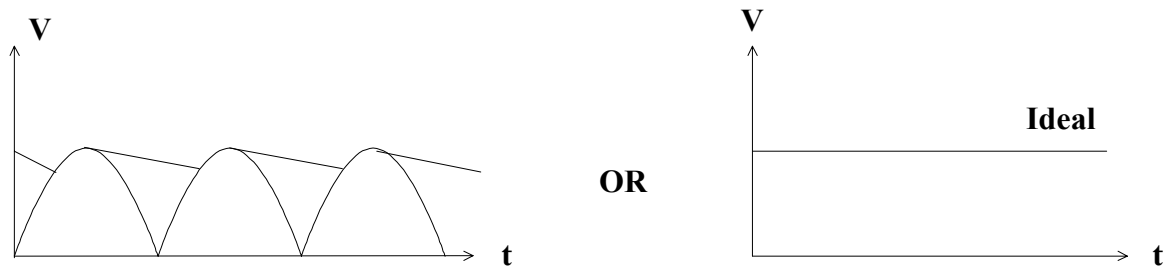
Description

Full-wave rectifier



Filtering

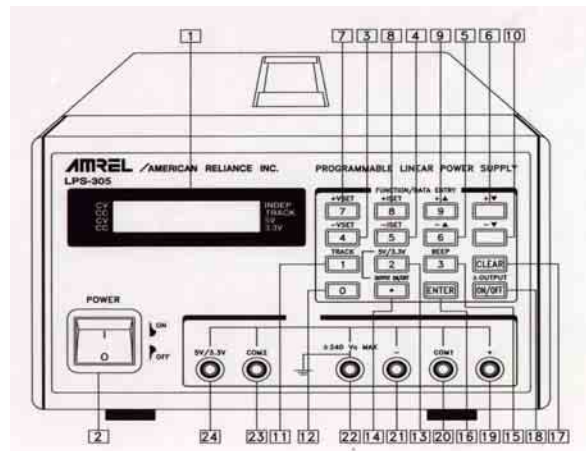
Pulsating DC voltage becomes smooth DC voltage by RC filtering



Digital to Analog Conversion

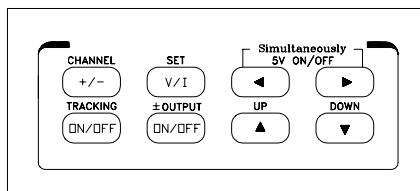
Key Pad Controls (LPS 305):

For data input and mode selection.



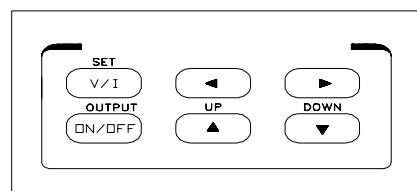
Key Pad Controls (LPS-304):

For data input and mode selection.



Key Pad Controls (LPS-301/302/303):

For data input and mode selection.

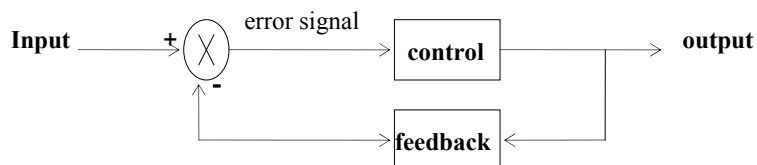


Toggle keypad on the above keyboards to get corresponding digital signal. The digital signal is converted to an analog signal by D/A converter IC 7541 to control output value on output terminals.

Sampling Circuit

- Voltage Sampling : Get voltage sampling from “+” (-) terminal and “COM” terminal.
- Current Sampling : Connect a very low resistor, called current shunt to generate voltage single ($V = IR$) on “+” (-) terminal and “COM” terminal.

Comparison Circuit

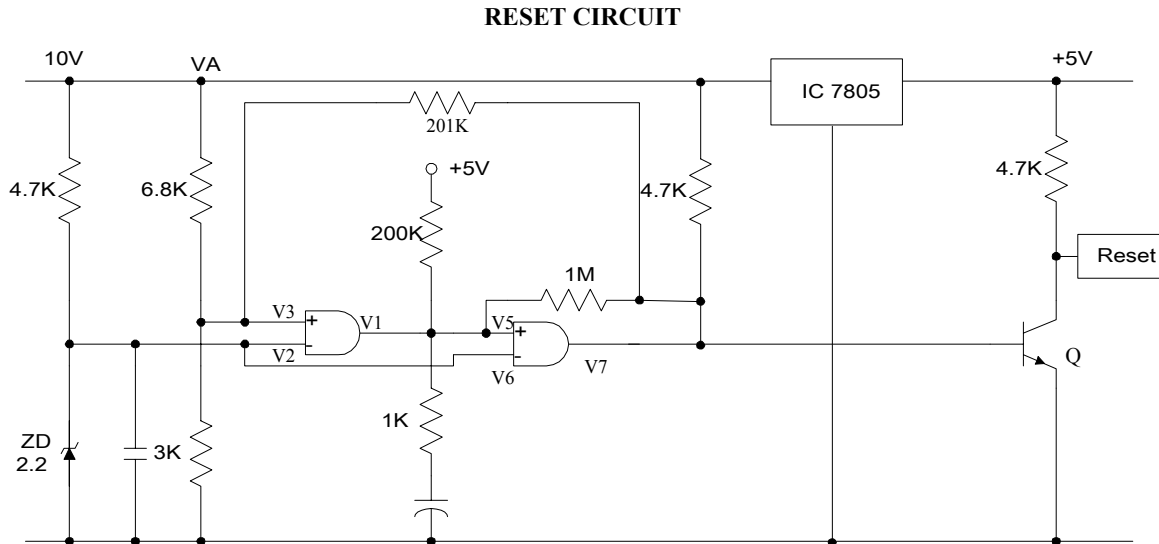


Referring to the above circuit, if the input signal is not equal to the output signal, the controller will make both input and output signals even. For example, if $V_{in} = 5V$ $V_{out} = 8V$, the I_b of transistor on control circuit will decrease, V_{CE} will increase, then V_{out} will decrease until $V_{out} = V_{in}$. ($V_{out} = V_{rail} - V_{CE}$)

The control circuit is consists of two stage transistor amplifiers, which control the I_b of the power transistor.

RESET SIGNAL

Provides a reset signal to CPU to ensure that the CPU will receive only “HI” or “LO” level.



Turn the unit on

a) When $V_A < 7.2V$ ($V_3 \times 3.0 \div (6.8 + 3.0) = 2.2V$ $V_3 \approx 7.2V$), $V_2 > V_3 \rightarrow V_1$ is in Lo level. $V_6 > V_5 \rightarrow V_7$

is in Lo level, The Reset signal is about 5V when the transistor (Q) is off and the CPU doesn't work.

b) When $V_A = 7.2V$, $V_3 > V_2 \rightarrow V_1$ Hi, $V_5 > V_6 \rightarrow V_7$ Hi the Reset signal is approximately 0V when the transistor (Q) is on. CPU and I/O processor will be enabled.

Turn the unit off

a) When $V_A > 7.2V$, $V_3 > V_2 \rightarrow V_1$ (Hi level), $V_5 > V_6 \rightarrow V_7$ (Hi level), the transistor (Q) is on, and the reset signal is in Lo level (0).

b) When $V_A < 7.2V$, $V_2 > V_3 \rightarrow V_1$ (Lo level), $V_6 > V_5 \rightarrow V_7$ (Lo level), the transistor (Q) is off, and the reset signal is in Hi level (1).

Remark : If LCD backlit is turned off, and the LCD display becomes dark, first check whether or not there is reset signal output. Sometimes, this is caused by IC7805 backward digital circuit taking up too much current consumption, which causes the point of V_A to be less than 7.2VDC.

Input Signal

1. Set voltage and current value through keyboard or RS232 interface.
2. CPU 80C31 (60C31) and I/O processor 8155 will decode and operate, and then put out the corresponding count to D/A converter IC7541.
3. Then IC7541 will convert digital signal into voltage signal. Following which, the IC4051, resistors, and capacitors form Data Hold Circuit which controls the DC signal.

For example

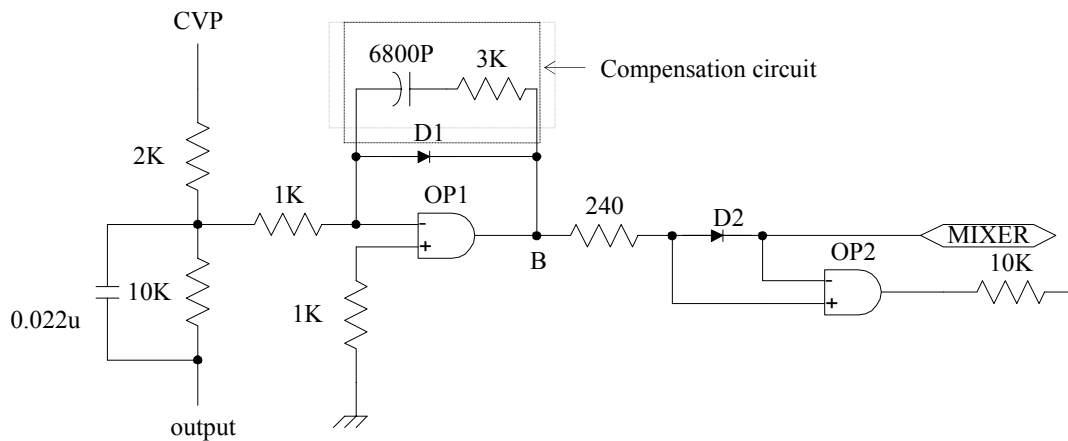
In calibration mode.

CVP (Constant Voltage Programming) V_{Lo} $\approx \pm 1.8 \sim 1.9$ Volts
CCP (Constant Current Programming) I_{Lo}

Please check the forward circuit if CVP/CCP is not close to 1.8 ~ 1.9 volts. Please check backward circuit if CVP/CCP is close to 1.8 ~ 1.9 volts.

Comparator Circuit

Compares the degree of difference between the default value on the front panel and output value on output terminals, and makes the values equal.



CVP Circuit

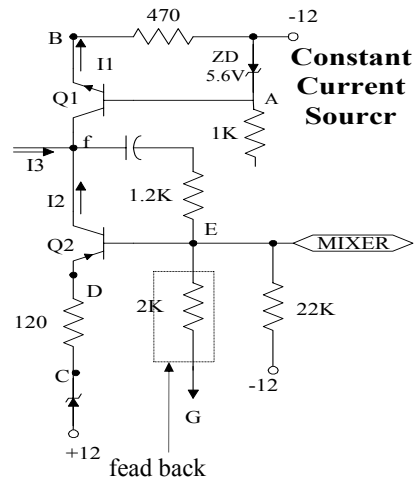
- (1) If CVP= 1V, output = - 5V, point A = 0V, output is in dynamic balance condition. D2 is in forward condition, OP2 is in CV mode.
- (2) When the closed loop is abnormal, output = 0V, point A is in “ + ” level, point B is in minus saturation voltage, $V_- = 0$, D1 is on, point B $\approx 0.6V$, D2 is in backward condition. OP2 is in CC mode.
- (3) When the closed loop is abnormal, output can't be controlled, V_{out} is at a very high level, point A is at a “ - ” level, point B is in plus saturation voltage, D2 is in forward condition and OP2 is in CV mode.

Remark : The above (1) is working properly. The above (2) & (3) closed loop are abnormal, but the problem is not fully caused by the comparator circuit.

Control Circuit

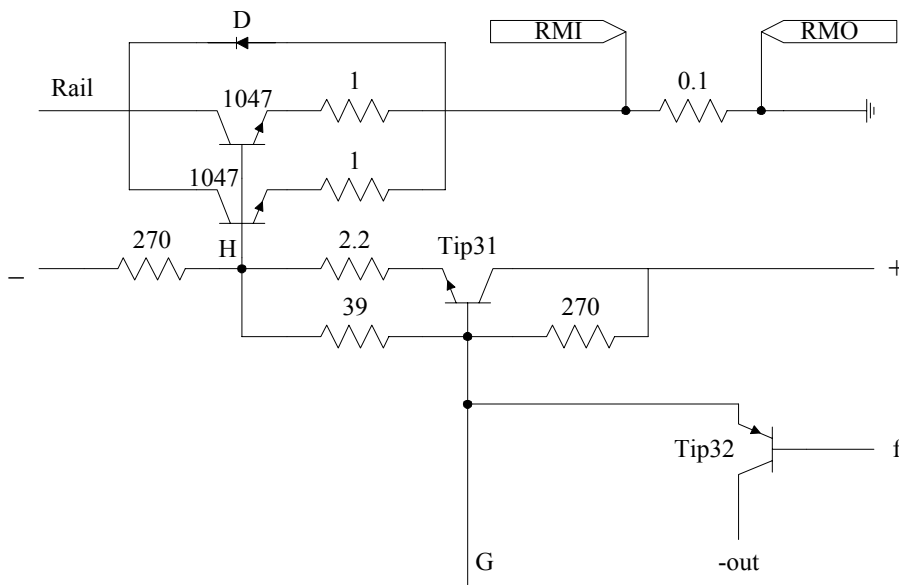
The control circuit contains the amplifier circuit, which is responsible for most problems associated with the LPS 300 series.

(-) $V_A = -12 + 5.6 = -6.4$
 $V_B = -6.4 - 0.7 = -7.1$
 $I_1 = (V_B - (-12)) / 470 = 10.4\text{mA (constant current)}$
 $I_3 + I_2 = I_1$
 If I_2 is higher, then I_3 will be lower (vice versa).
 $V_C = 12 - 5.6 = 6.4$
 $V_D = V_C - I_2 \times 120 = 6.4 - 10\text{m} \times 120 = 5.2$ ($I_2 \approx 10\text{m}$)
 $V_E = 5.2 - 0.7 = 4.5\text{V}$
 If $V_E \geq 5.5\text{V}$ or $\leq 3.5\text{V}$, check V_A, V_B, V_C and V_D to ensure they are correct. Additionally, check Q1 and Q2.
 If Q1 & Q2 is correct, check the forward circuit of



* Increase the resistor and capacitor between the collect and base on Q2 to reduce ripple.

(=)



Principles of Operation

This circuit is a transistor amplification circuit. Normally $V_G \approx 1.2\text{V}$; if $V_G \approx 0\text{V}$, then check the spike circuit for abnormalities in each operating voltage. If $V_G \gg 1.2\text{V}$, check the transistor # 1047, Tip31 and Tip32 to check for defects.

- * The purpose of the 1Ω resistor is to make the emission currents even, on the 2 transistors (#1047 or 817).
- * 1Ω resistor could be open if $V_f = 0.7\text{V}$, $V_H > 0.7\text{V}$ and $V_{out} = 0\text{V}$.

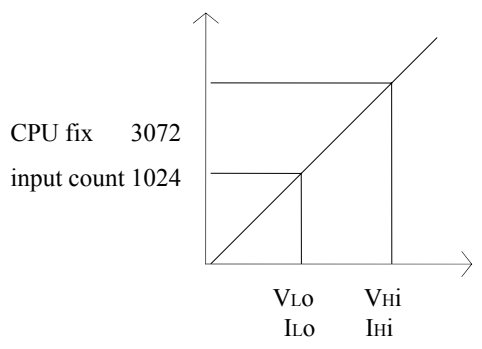
If transistor Tip31, Tip32 is defective, the following problems will result:

- a) 60 Hz ripple : It can be checked out by using scope setting on line frequency range.
- b) In calibration mode, if voltage is normal, but current output is abnormal. The Tip31 could be defective.

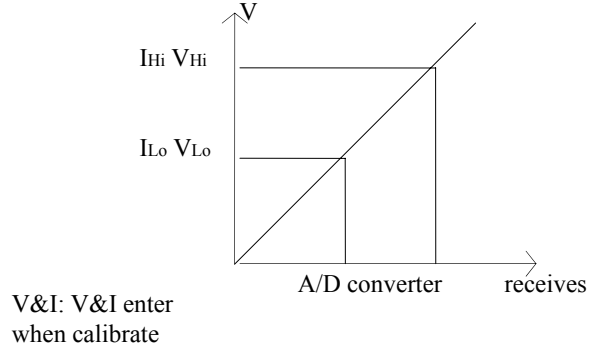
The control circuit is a part of the closed loop. If any components of the closed loop are defective, open or short, it will cause individual point of operation voltage drift throughout the closed loop.

Calibration Mode

If calibrated well, the accuracy of LPS 300 series is close to 4096 bit. Press “ ∇/I ” & “ ∇ ” (LPS301~LPS304); “8” & “ ∇ ” (LPS305) key simultaneously to enter the calibration mode, when the CPU 80C31 (60C31) is in low level, it sends 1/4 count to D/A converter IC7541. Then the D/A converter IC7541 receives 1024RC (or 1023), and generates the corresponding voltage. When the CPU is in Hi level, it will send 3/4 count to the D/A converter IC7541, which receives 3072D1 (or 3071), and again generates corresponding voltage. Thus, forming a proportional linearity between output value and CPU count, and storing it in EEPROM 93C46. Then, the internal controlling input voltage is followed by the proportional linearity when pressing the keypad.(see figure A)



(Figure A)

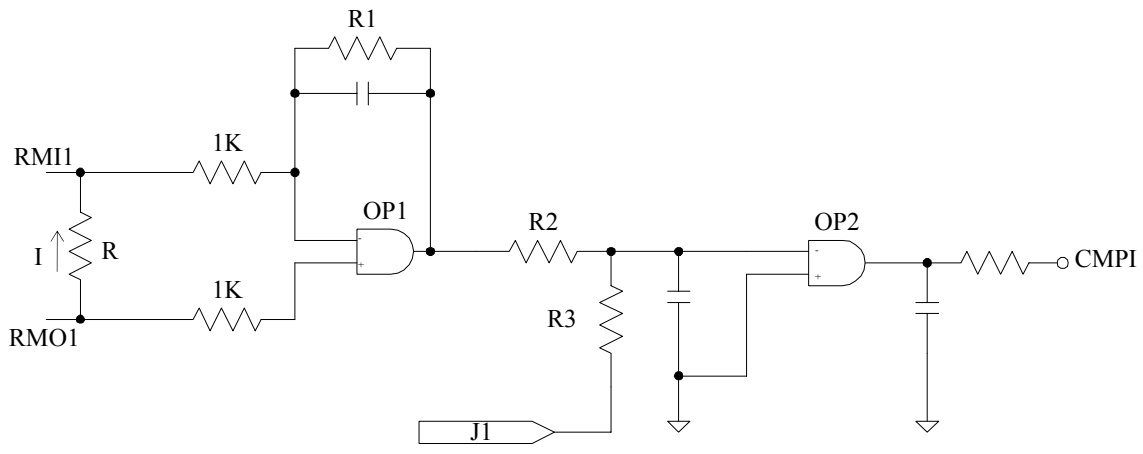


(Figure B)

When LPS is in calibration mode, both input voltage to D/A converter IC7541 and linearity in Readback circuit can be calibrated (see figure 3). Thus, check or compensate Readback circuit if readback value is inaccurate.

Read Back Circuit (Display)

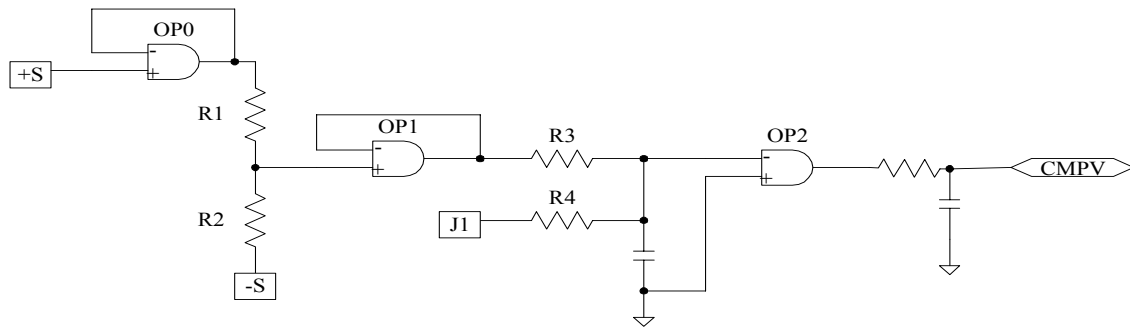
Readback I



When the output current flows through the current shunt (R), voltage will be generated on the resistor between RMI1 and RMO1. Inverted amplification of multiple occurs at IC OP1. Compare output voltage on OP1 and J1; a hi / lo level will then be generated at IC OP2. This status will generate a relative code which will be compared with the calibration code, and then produce output readings on the display.

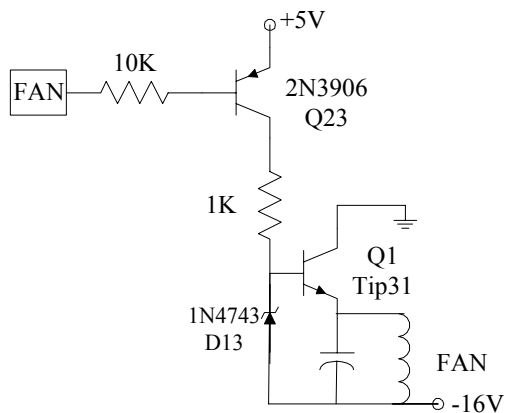
Remark : SAR (Successive Approximation Conversion).

Readback V



- OP1 function : To get high impedance between +S and - S points, make the load regulation very low.
- R1, R2, and OP1 function : Form sense output voltage and take sampling proportionally, compare with R3, R4, and J1, and get SAR action through OP2 output.
- The CMPV outputs Hi / Lo level, send Hi / Lo level to the optocoupler (4N35), readback the CPU and compare with calibration value, producing output readings on the display.

The Fan Circuit Diagram

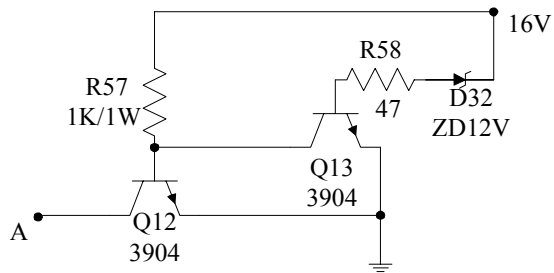


The principle of fan

The fan low level on → Q23 on → D13 break
down → Q1 on → Fan turn on

Remark : The fan power on or off is controlled by the CPU.

Spike Protection Circuit



Function : To avoid generating spike when the power supply is switched on and off continuously.

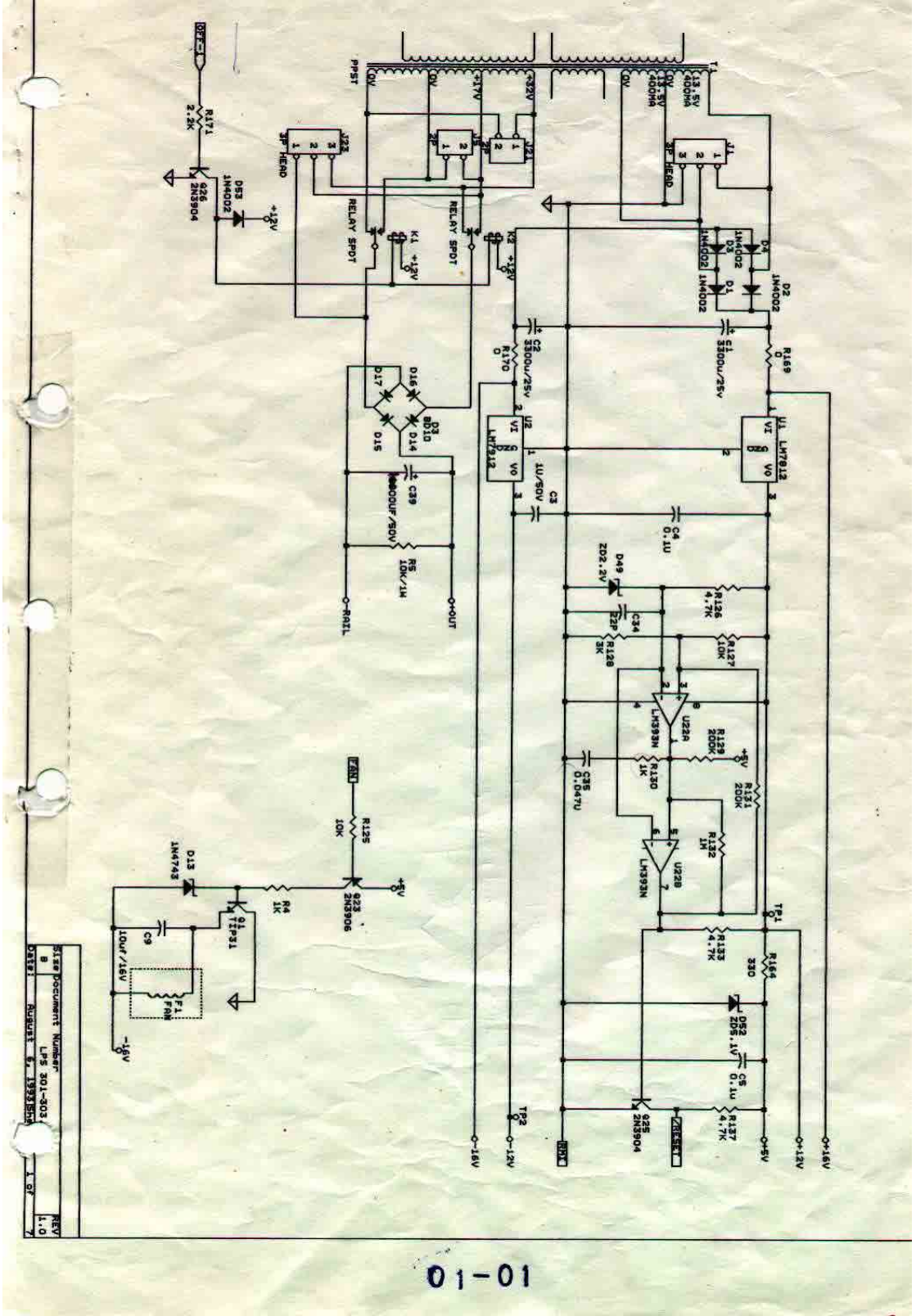
Principle :

1. When power is switched on, the input power 16V has not risen to 12.7V. Q13 is in off position, Q12 is on, point A is 0 volt; When the input power 16V has risen and exceeded 12.7V, Q13 turns on, Q12 turns off, point A is in stand by status and its voltage is about 1.2 ~ 1.4V.
2. When power is switched off, the input power 16V hasn't fallen down to 12.7V, Q13 turns on, Q12 turns off, point A is in stand by status ; when the input power 16V has fallen down to 12.7V below, Q12 turns on, Q13 turns off, point A is 0 volt.

Troubleshooting

Defective Phenomenon	Possible Reason	Examine Procedures
1. Fuse blows	<ul style="list-style-type: none"> a) In short - circuit between operating power and AC power source b) Transformer short c) Input filter capacitors defective 	<ul style="list-style-type: none"> a) Disconnect all operating power, then turn the unit on, the transformer is defective if fuse blows ; If fuse doesn't blow, connects individual operating power one by one to check which operating power is in short - circuit.
2. Still have output voltage when "output off" key is off ; High current is inaccurate.	<ul style="list-style-type: none"> OP offset voltage high 	<ul style="list-style-type: none"> Replace OP IC
3. The unit down	<ul style="list-style-type: none"> a) Reset signal doesn't output b) Digital IC current consumption large or short-circuit c) Data bus, Address bus short-circuit or open or high impedance circuit leakage d) LCD defective e) flat cable connecting to the LCD 	<ul style="list-style-type: none"> a) Check if reset signal outputs b) Touch digital ICs by hand to see which one is current consumption large c) Compare and check Data bus and Add. bus. d) Check the LCD display and cable to the LCD display.
4. Spike problem	<ul style="list-style-type: none"> Zenar diodes or transistors defective 	<ul style="list-style-type: none"> a) Check 2pcs of transistors and Zenar diode.
5. Readback inaccurate	<ul style="list-style-type: none"> a) A/D converter IC7541 open b) mon V, mon I, comp V, comp I circuit disorder. 	<ul style="list-style-type: none"> a) Check pin#4 ~ 15 of IC7541 by oscilloscope to see if there is any signal. b) Check mon V, mon I, comp V, and comp I circuit
6. Fan problems		<ul style="list-style-type: none"> a) Check operating voltage b) Check diode and 2pcs of transistors to see if they are defective c) Check the fan for defects or not.

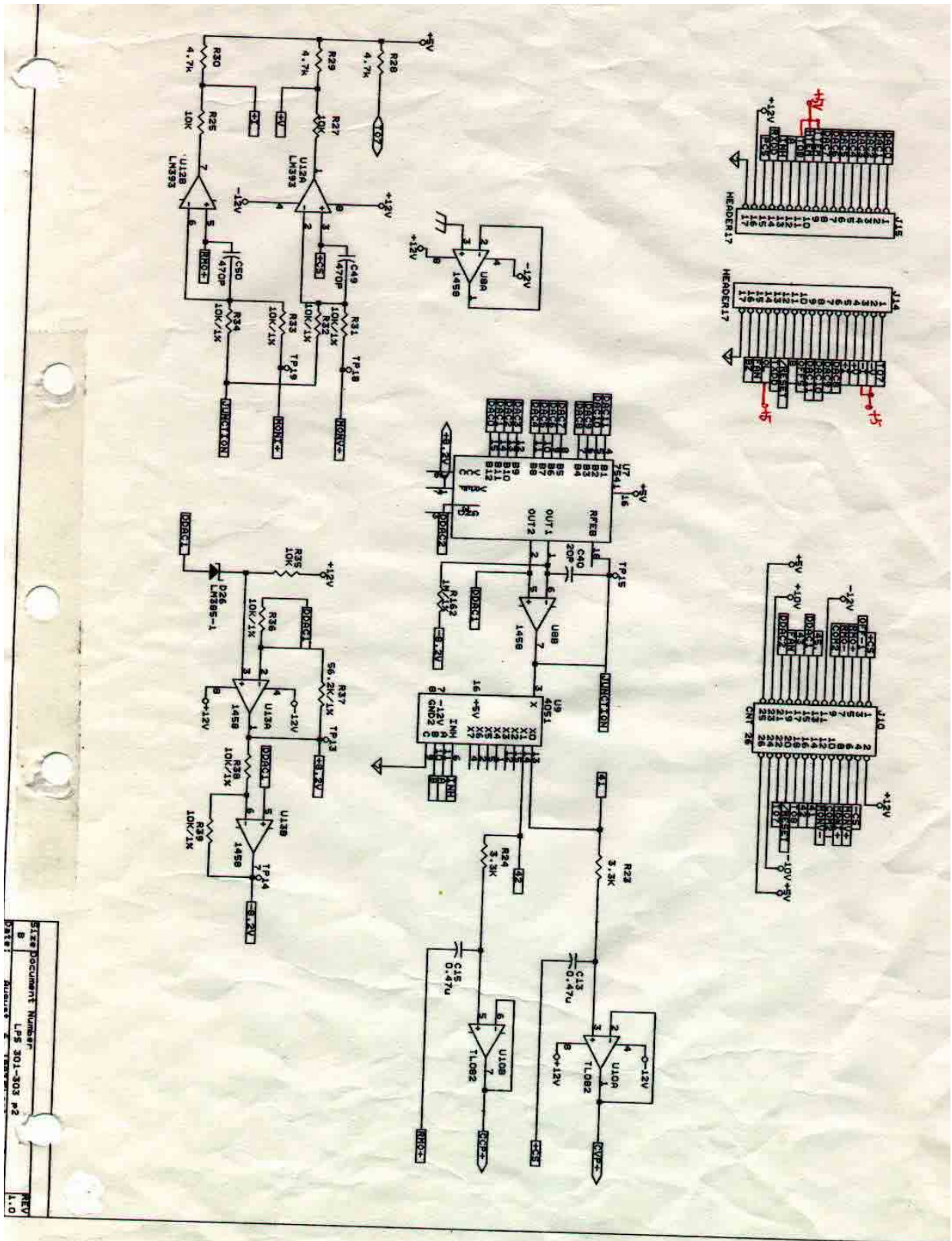
LPS 301 ~ 303 Circuit Diagrams (A)



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DATE	1993
NUMBER	5
OF	7
LPS DOCUMENT NUMBER LPS 301-303 LPS 301-303	

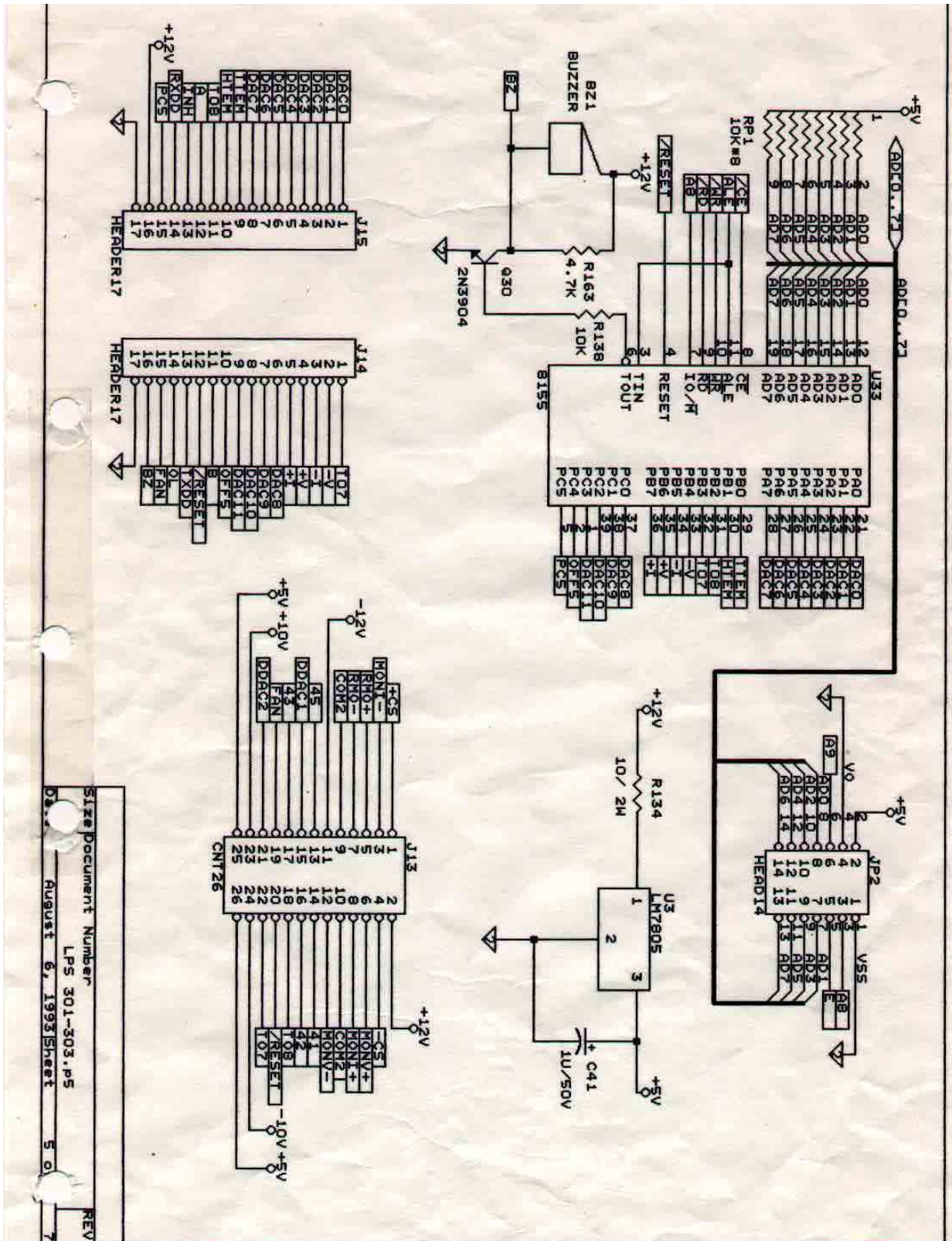
01-01

LPS301-303 Circuit Diagram (B)



01-02

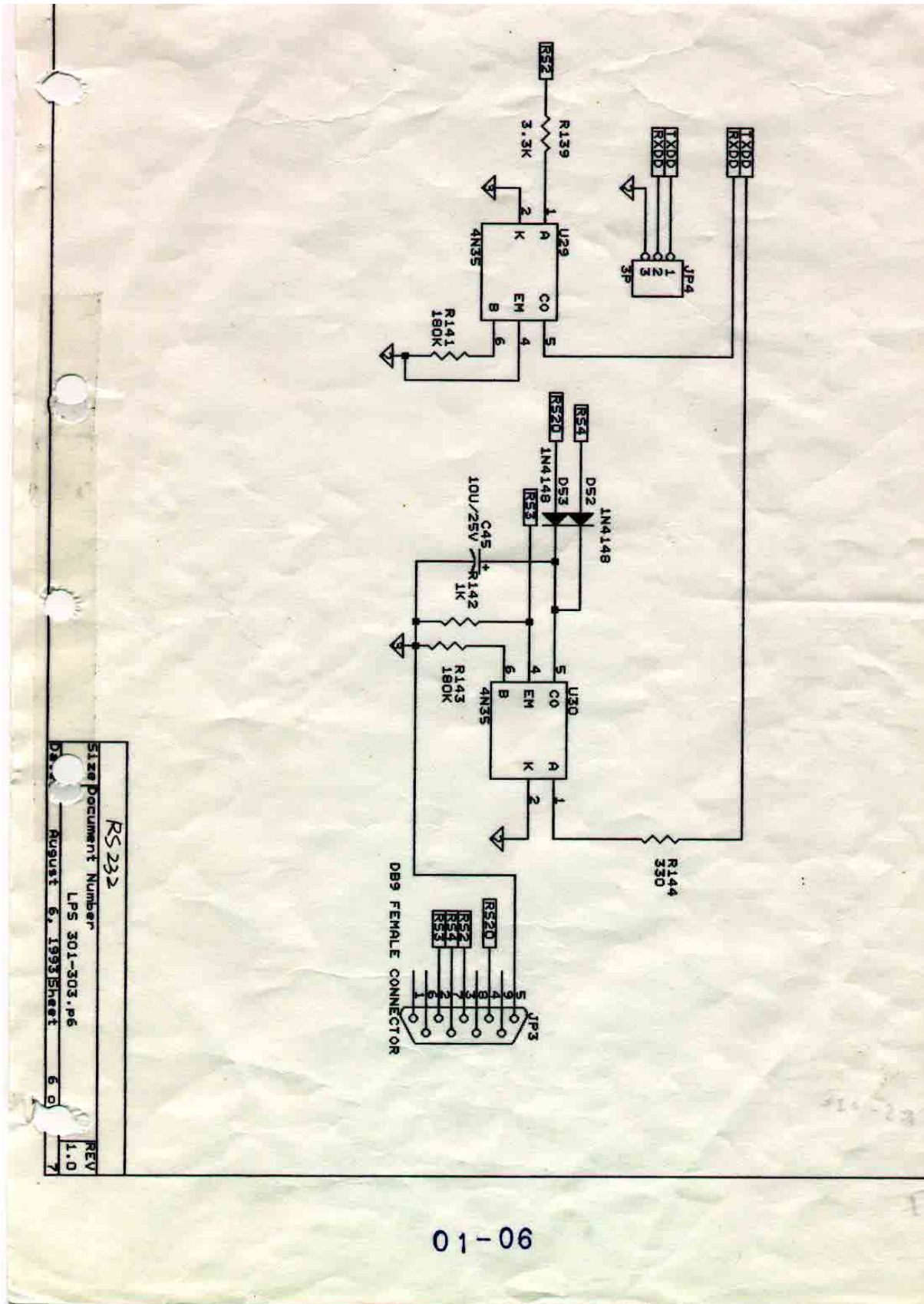
LPS301-303 Circuit Diagram (E)



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 LPS 301-303.P5
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 REV 7

01-05

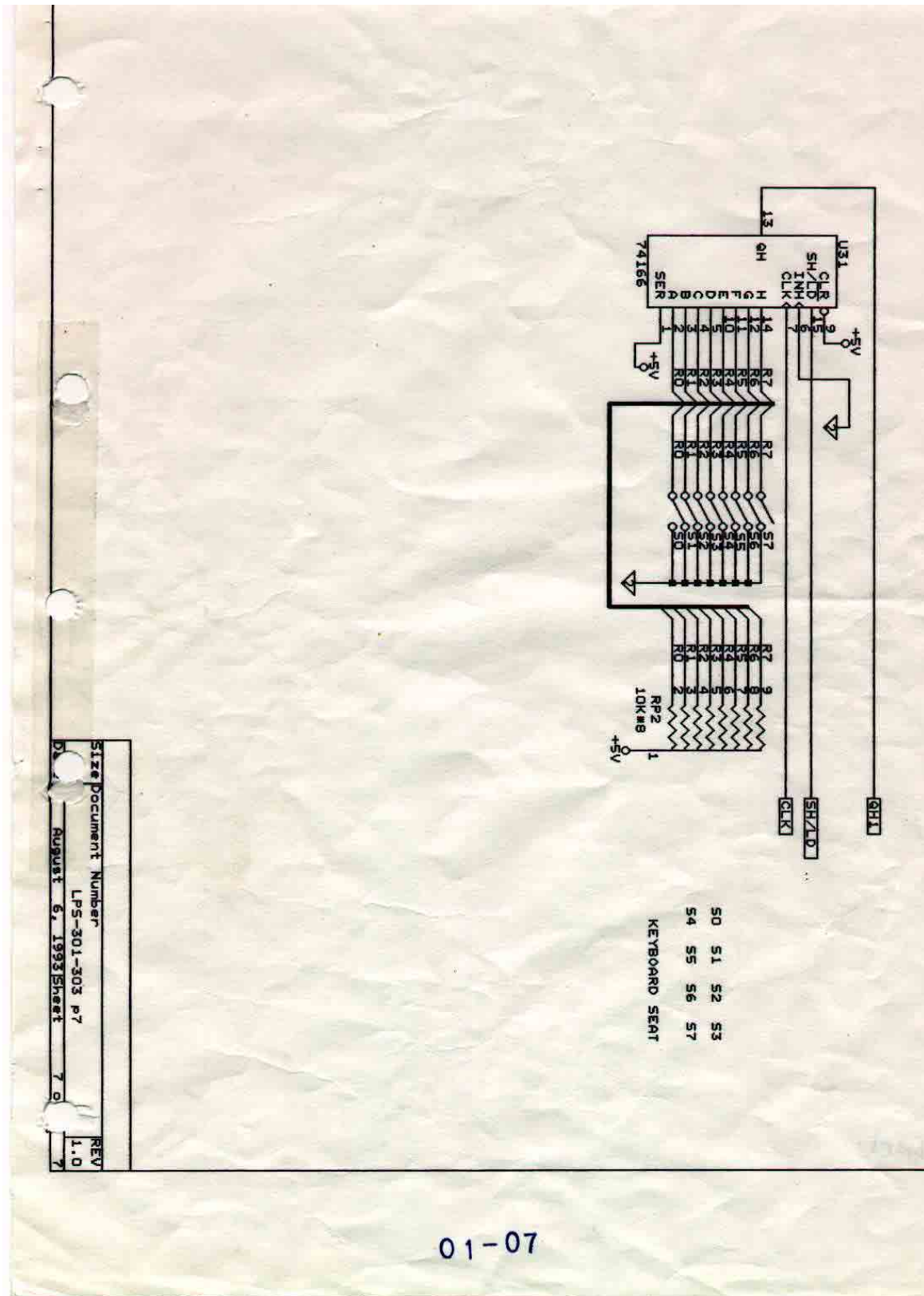
LPS301-303 Circuit Diagram (F)



RS232
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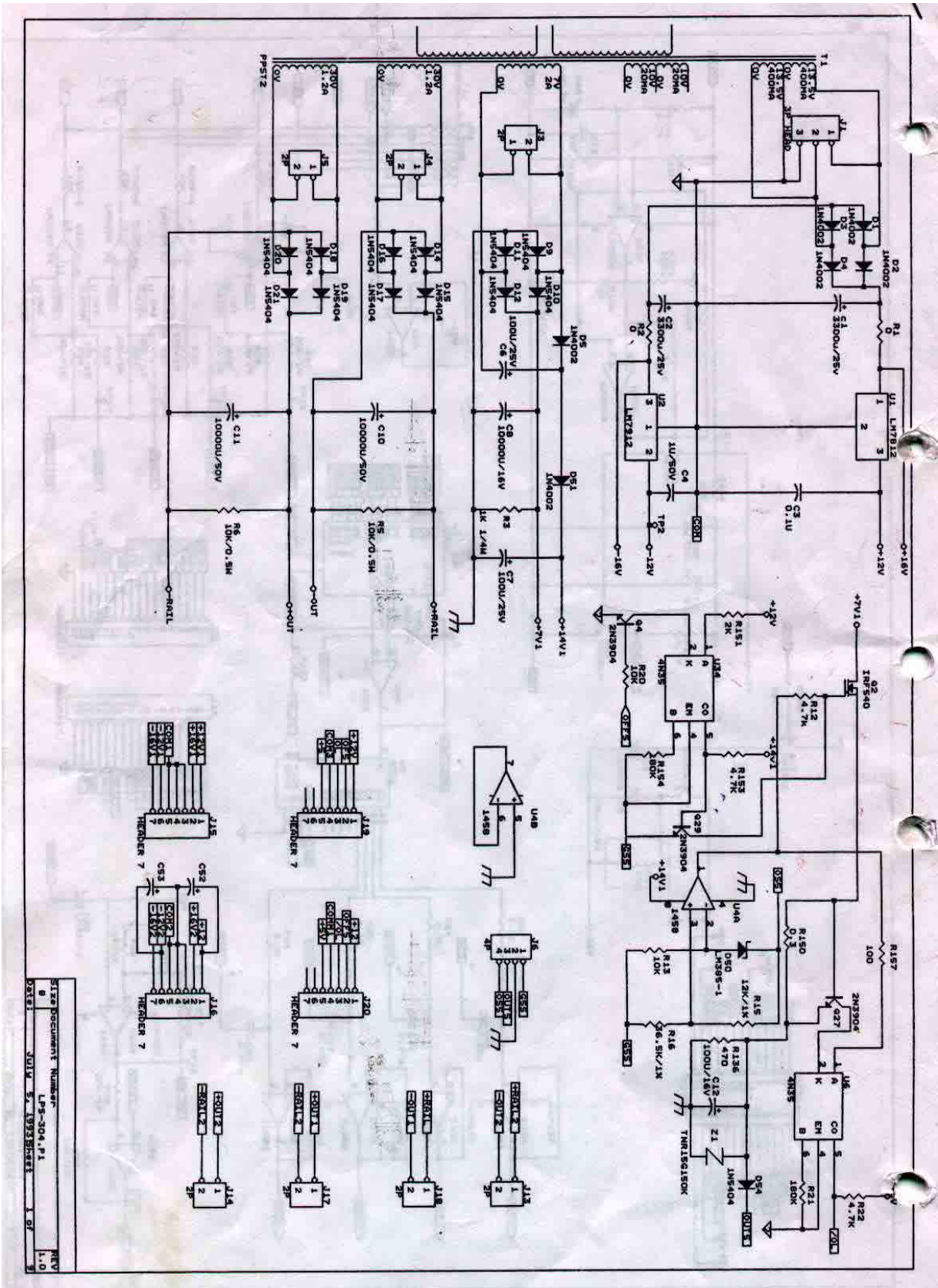
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LPS301~303 Circuit Diagram (G)

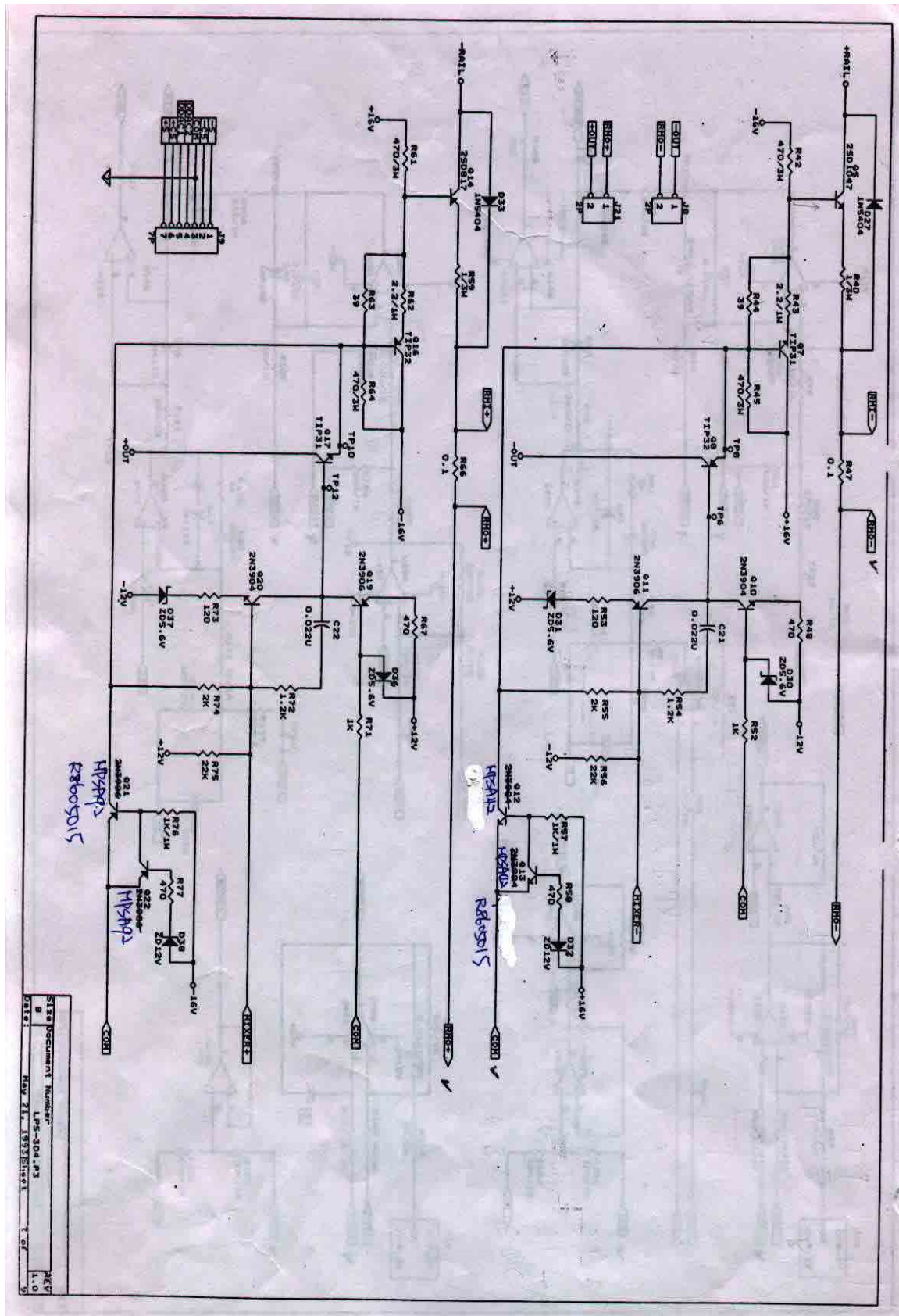


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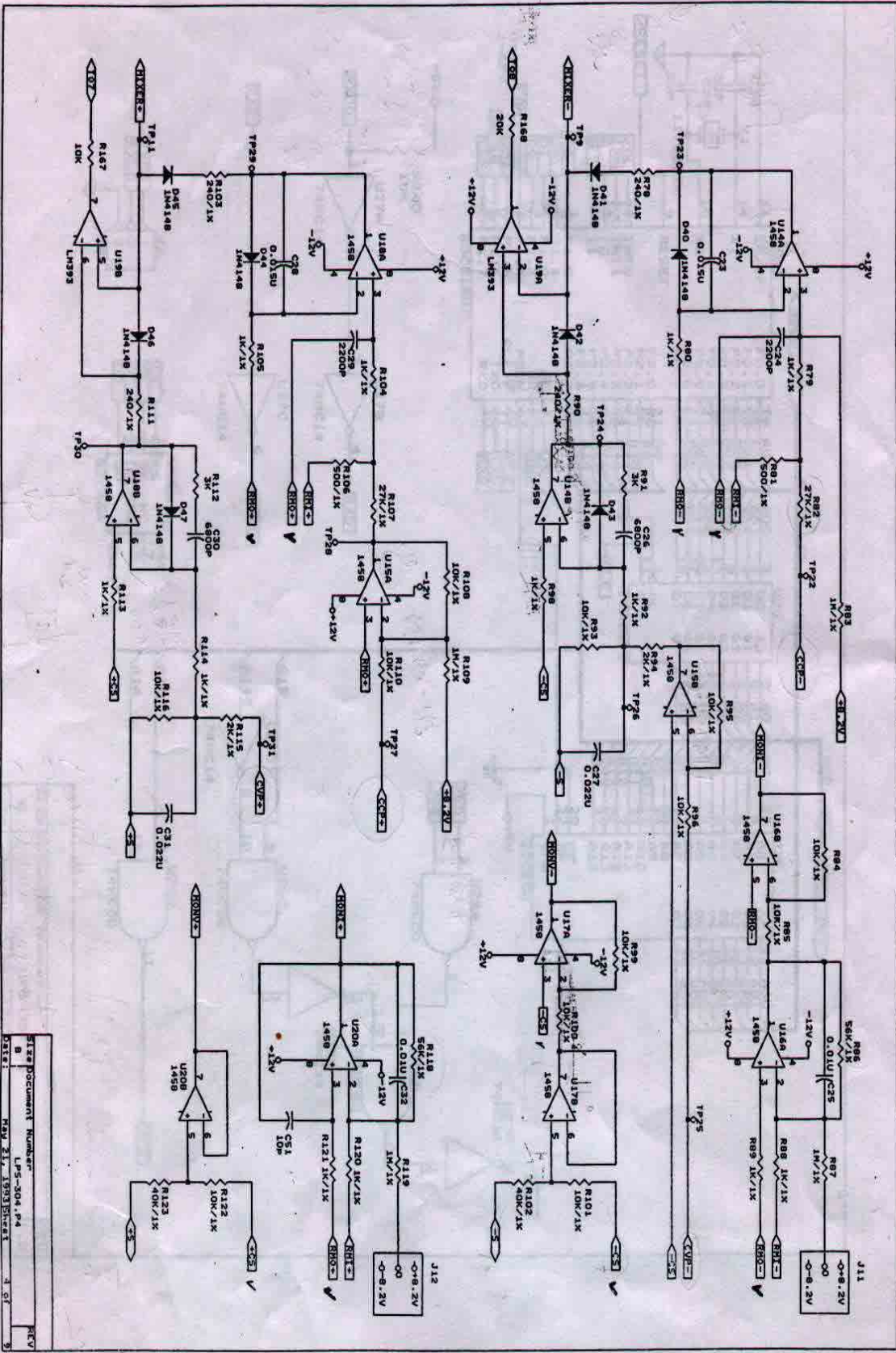
LPS304 Circuit Diagram (A)



LPS304 Circuit Diagram (C)

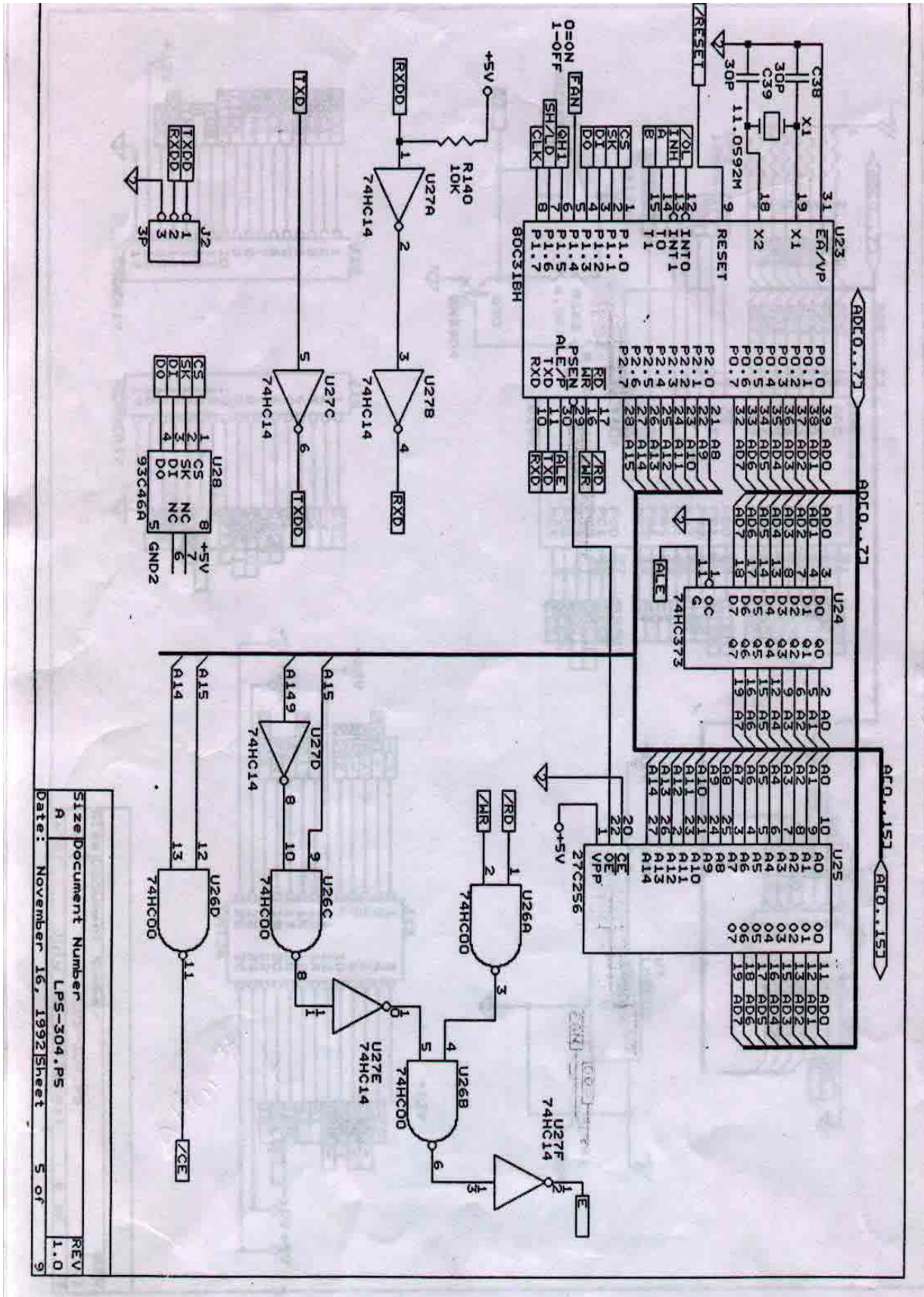


LPS304 Circuit Diagram (D)



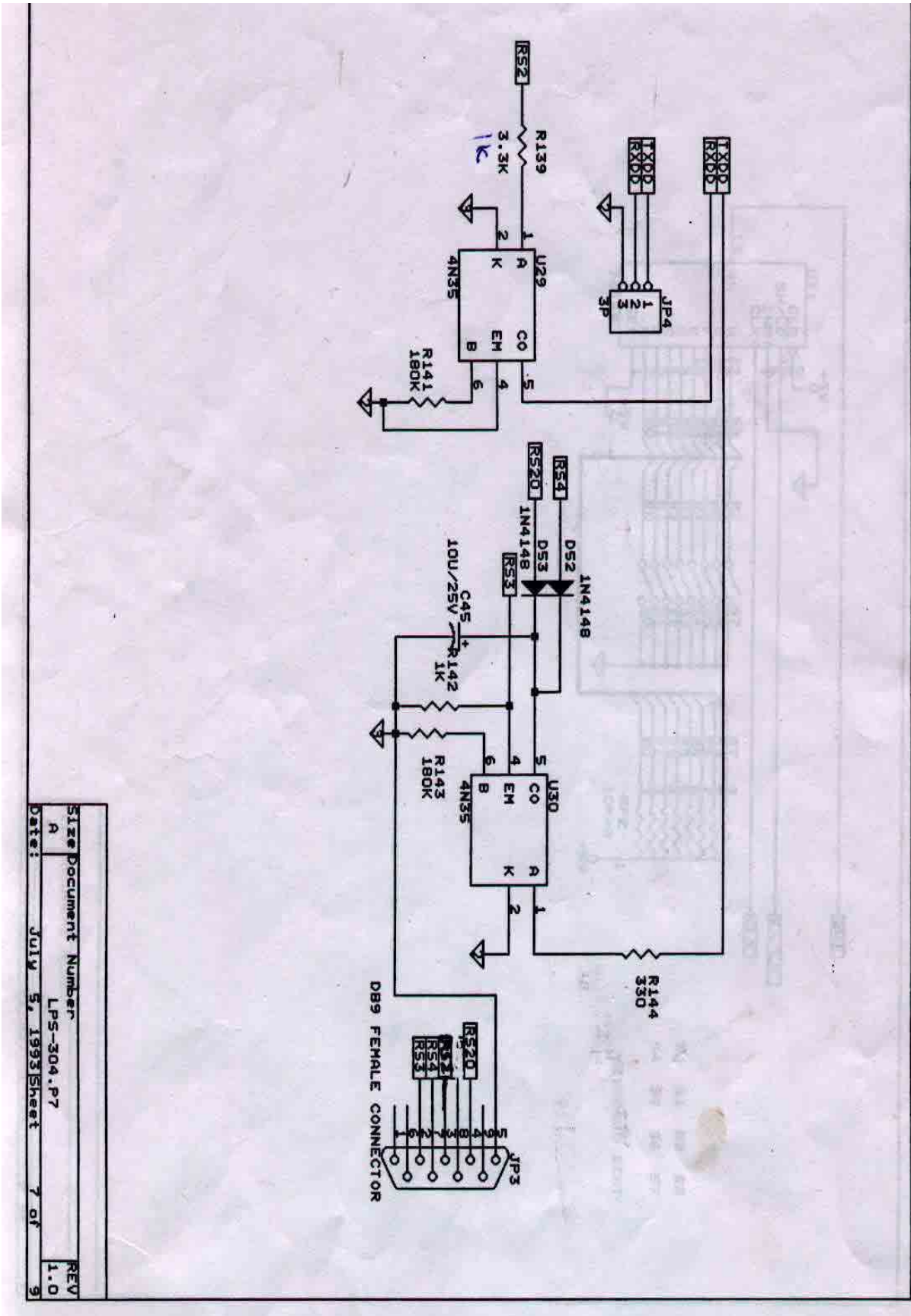
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REV	30	1593

LPS304 Circuit Diagram (E)



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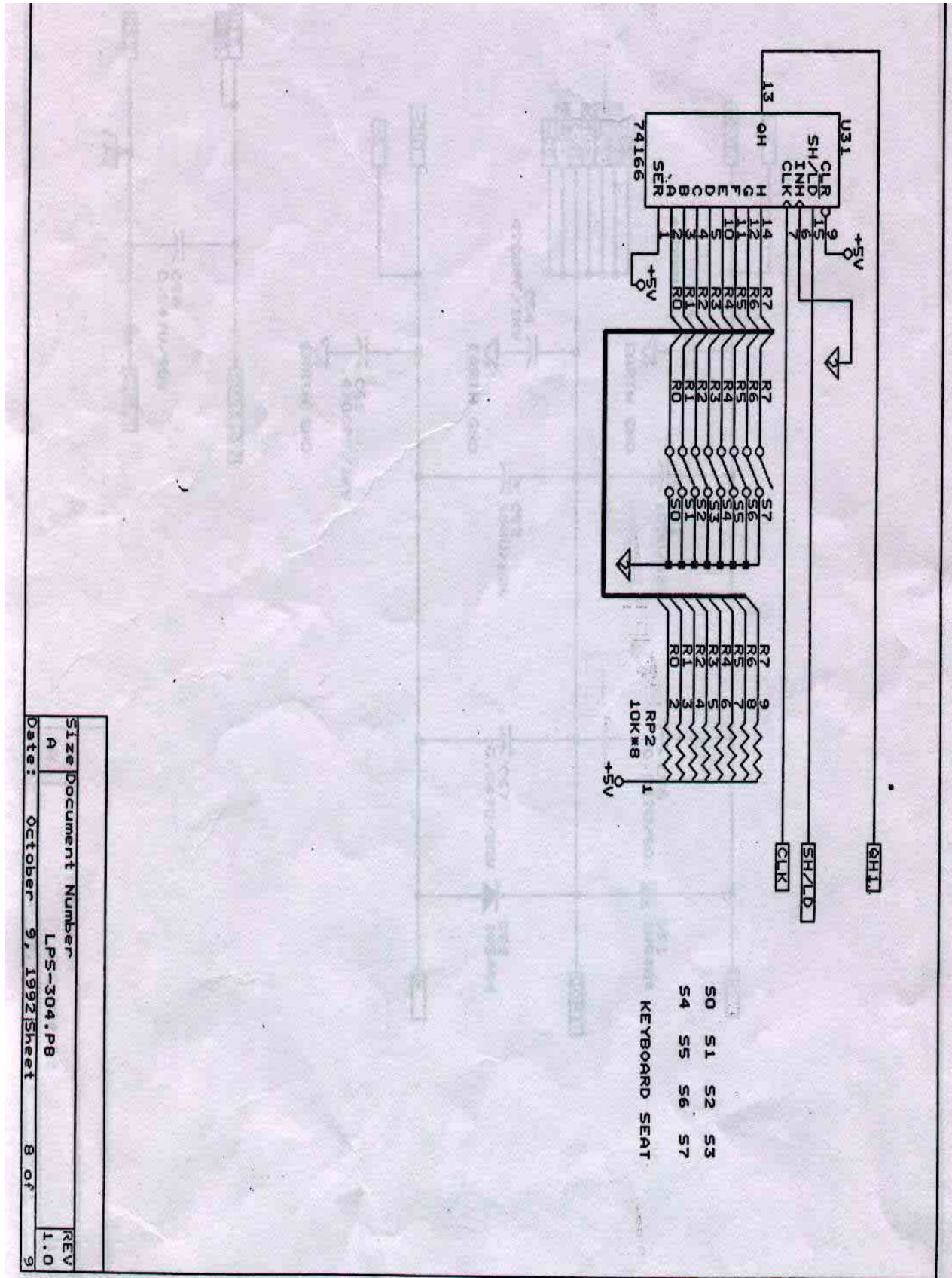
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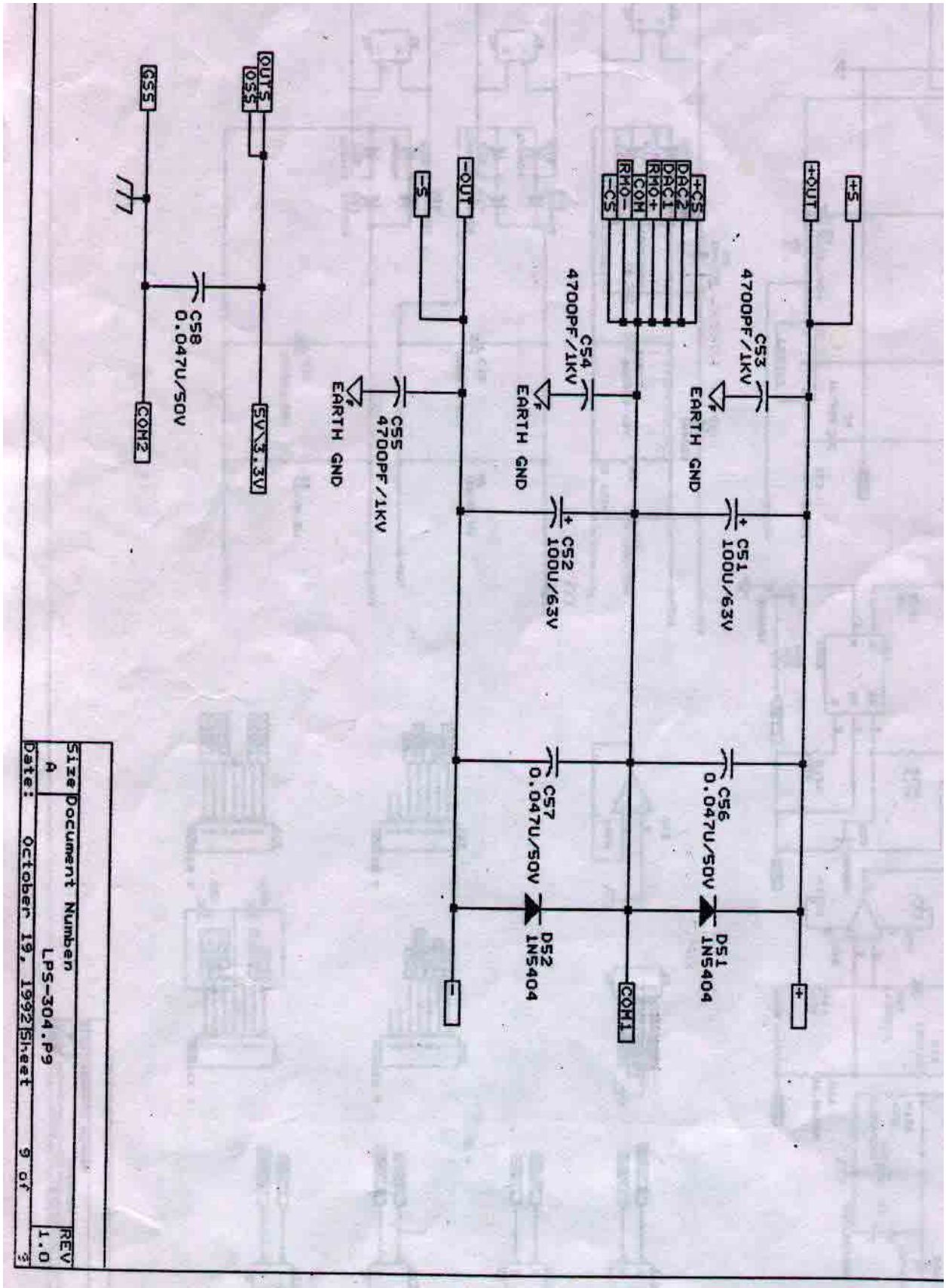
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LPS304 Circuit Diagram (G)

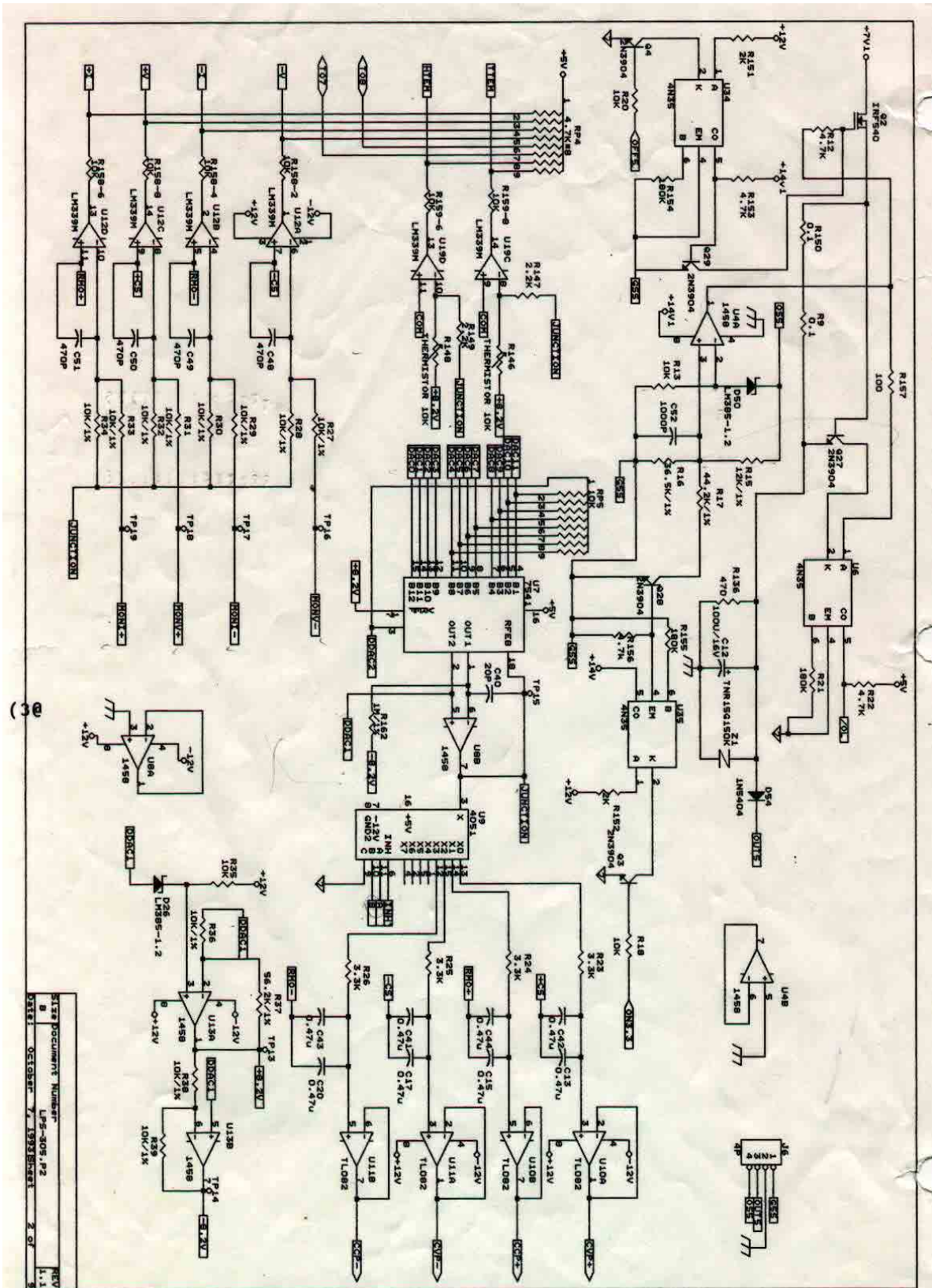
LPS304 Circuit Diagram (H)



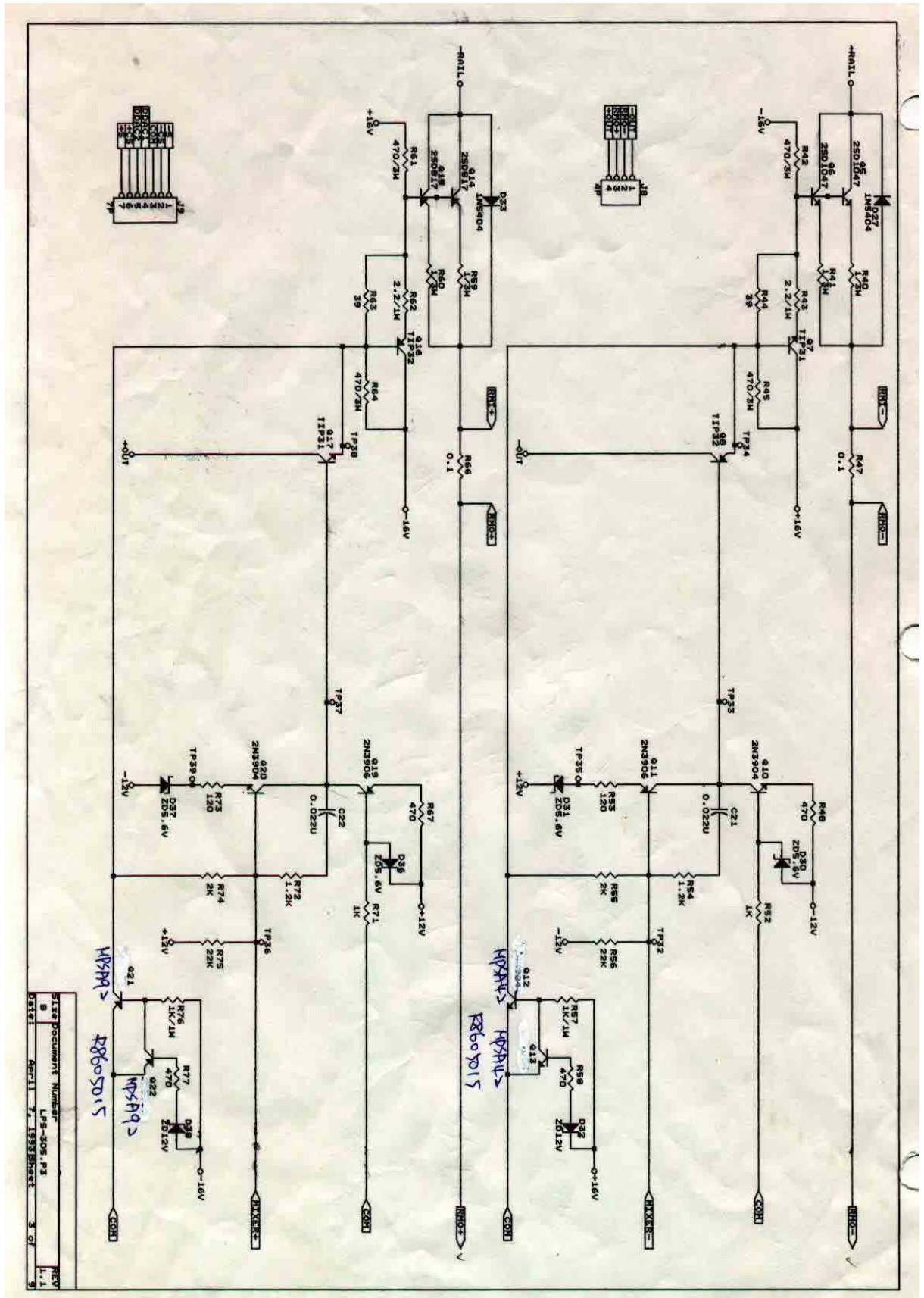
LPS304 Circuit Diagram (I)



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Date: October 19, 1992 Sheet		3
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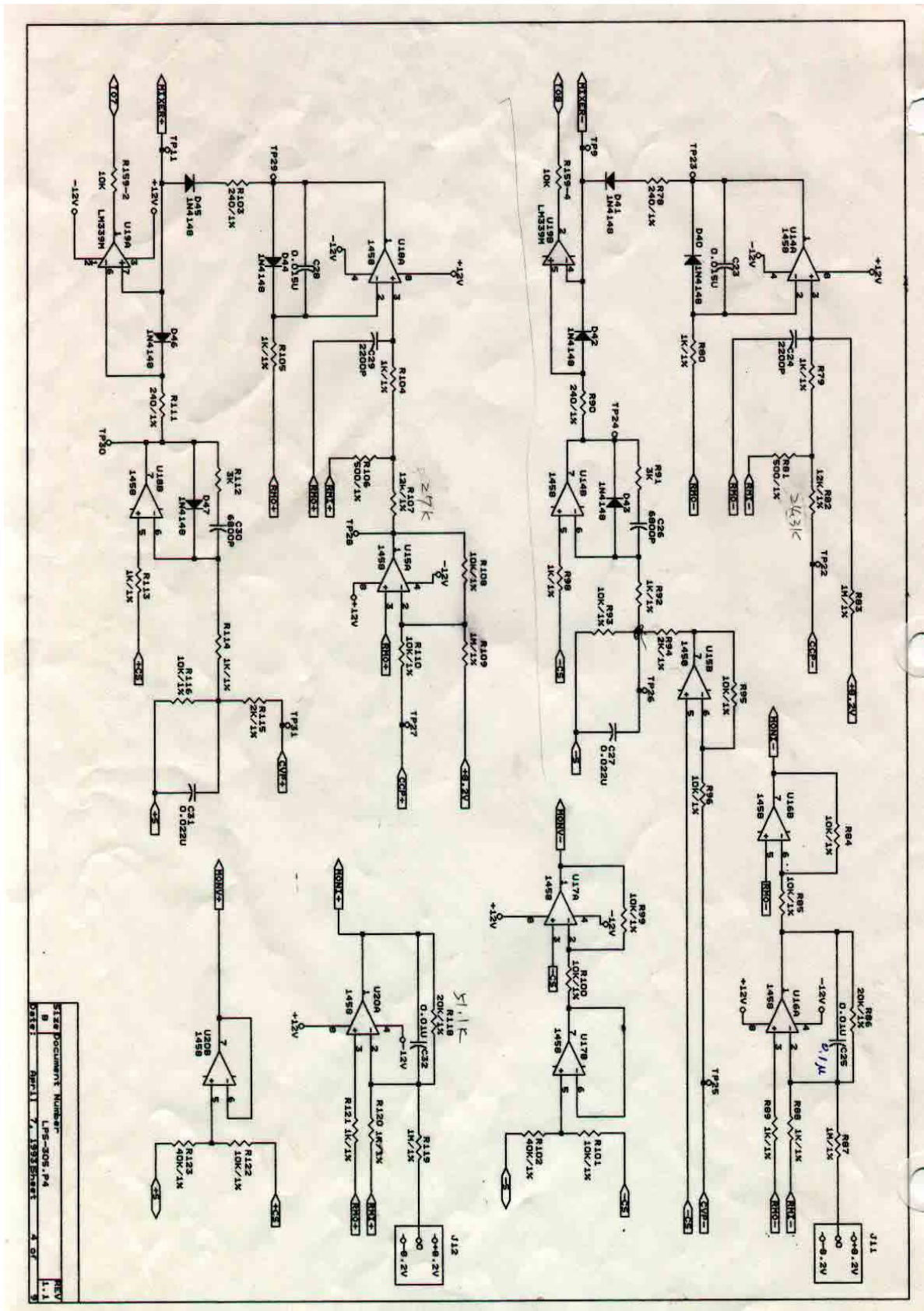


LPS305 Circuit Diagram (B)

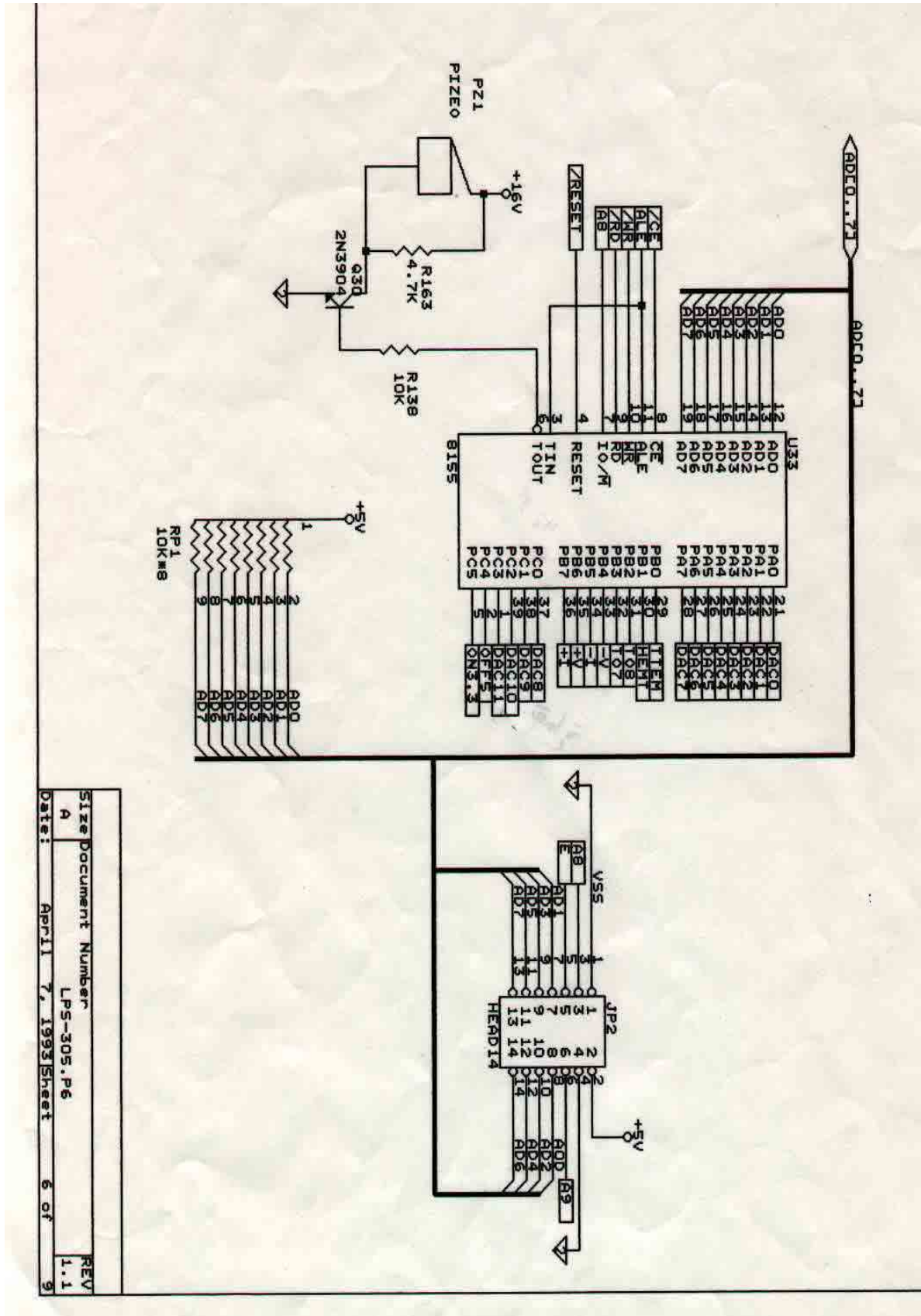


LPS305 Circuit Diagram (C)

LPS305 Circuit Diagram (D)

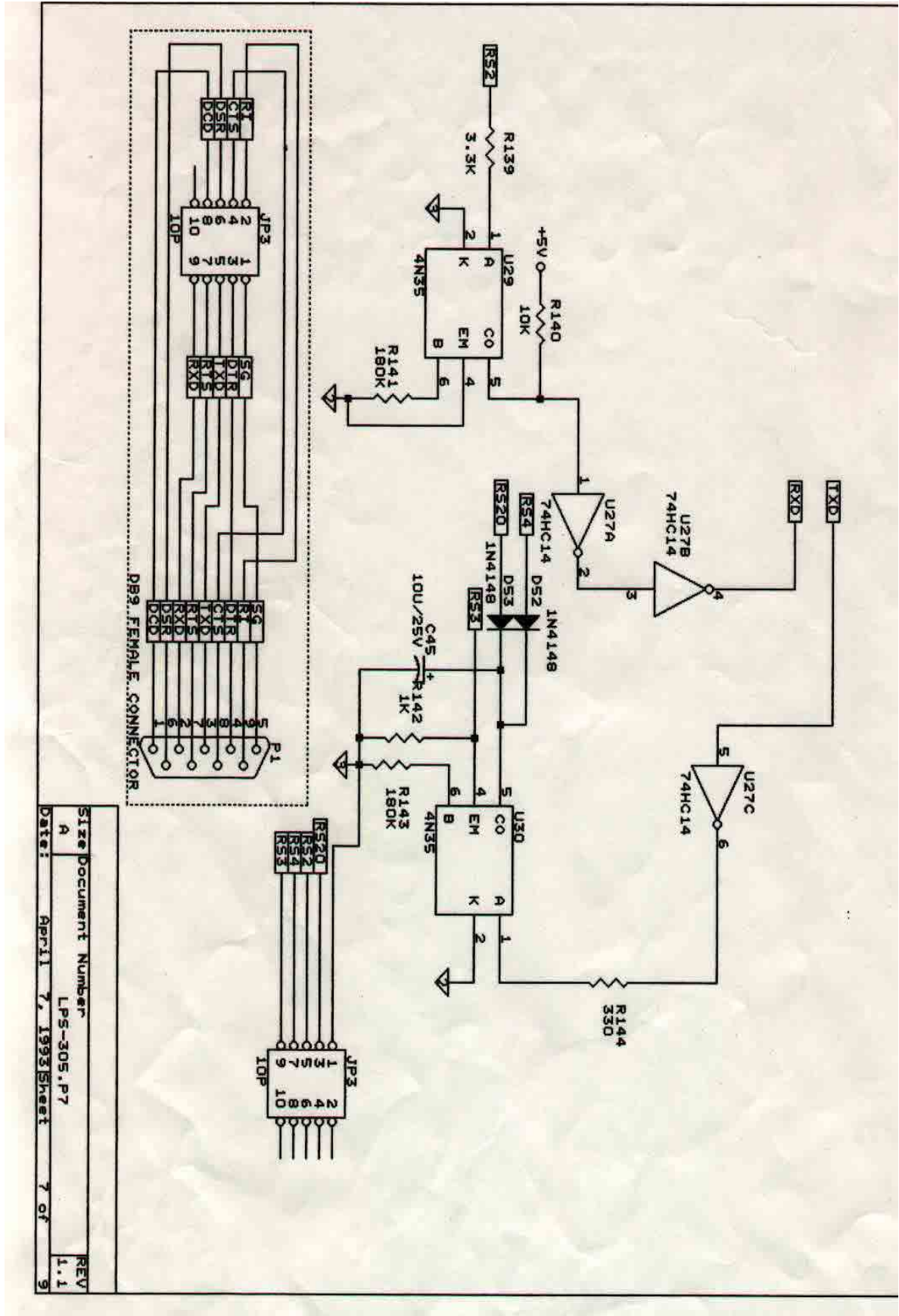


LPS305 Circuit Diagram (F)



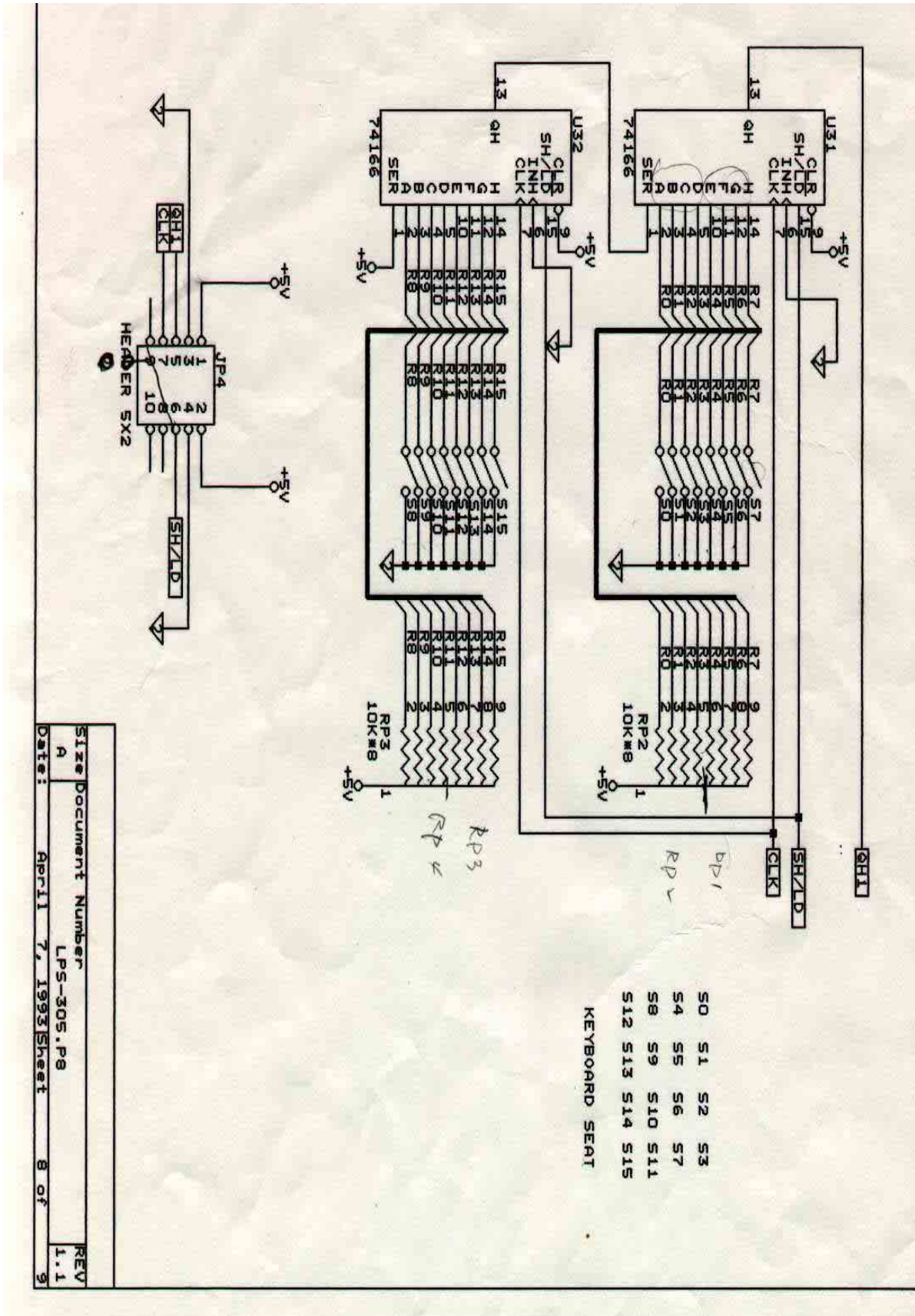
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LPS305 Circuit Diagram (G)



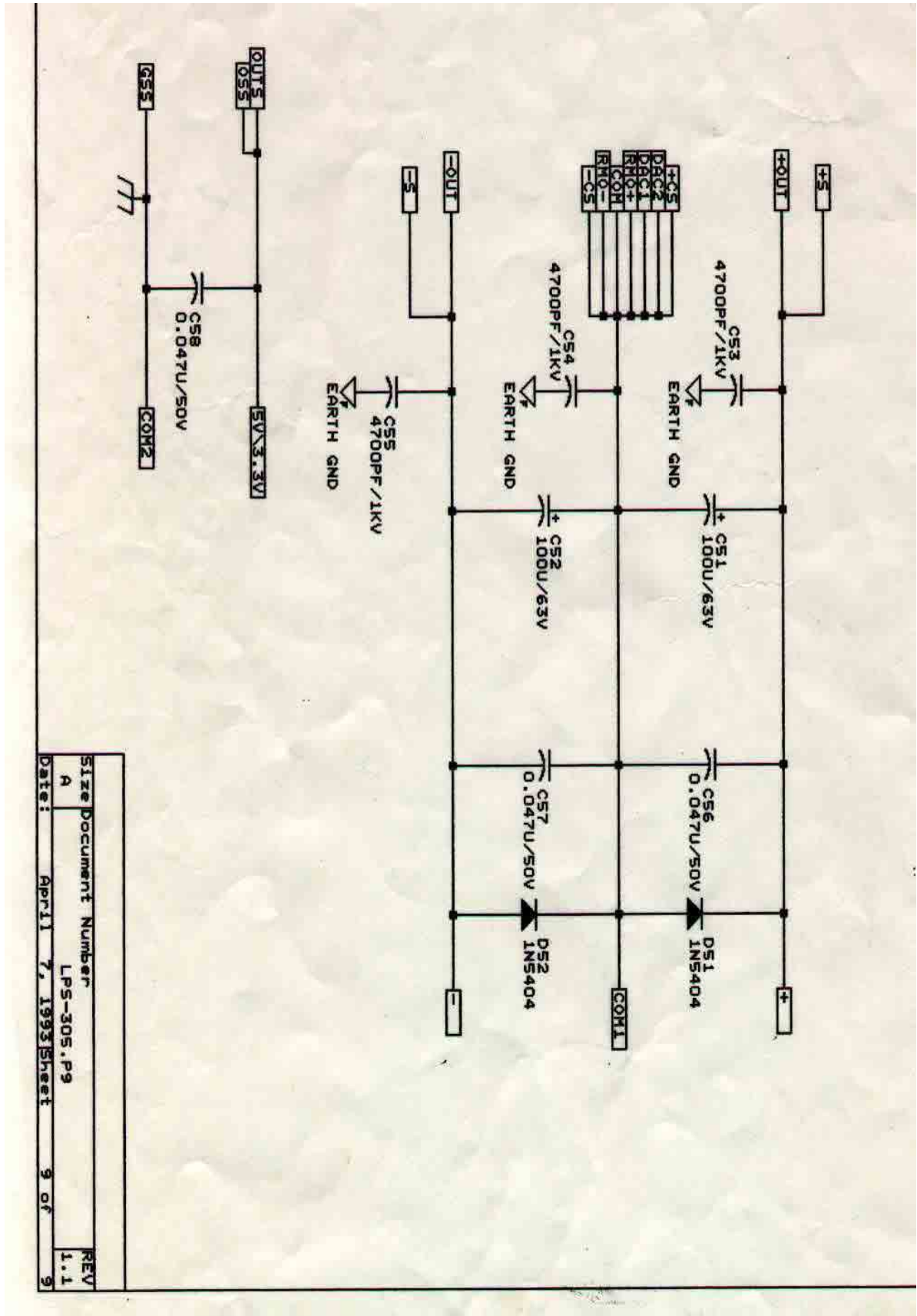
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A	LPS-305.P7	1.1
Date:	April 7, 1993	Sheet 7 of 9

LPS305 Circuit Diagram (H)



Size Document Number LPS-305.P8 REV 1.1
 A
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LPS305 Circuit Diagram (I)





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A	LPS-305.P9	1.1
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Calibration procedures

Equipment needed for calibration: DMM, such as Fluke model 45 or HP 3478A

For LPS301~304

Step 1: Simultaneously press  and  keys to enter calibration mode.

Step 2: Measure the DC voltage from the positive channel output terminals (+ and COM1) with DMM, and then use the arrow keys to enter the measured voltage value as the +V Lo.

Step 3. Repeat step 2. Enter the measured value as +V Hi.

Step 4. Measure the DC current from positive channel output terminals with the DMM and enter the measured current value as +I Lo.

Step 5. Repeat step 4. Enter the measured value as +I Hi.

(For LPS-304 Only)

Step 6. Measure the DC voltage from negative channel output terminals (- and COM1) with the DMM, and enter the measured value as -V Lo.

Step 7. Repeat step 6. Enter the measured value as -V Hi.

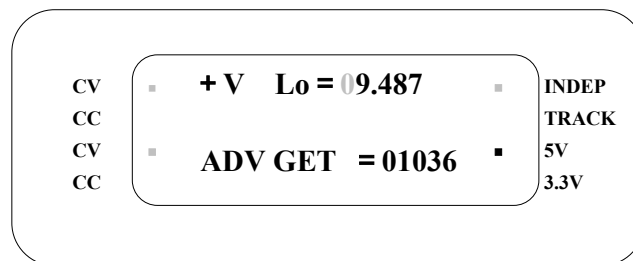
Step 8. Measure the DC current from negative channel output terminals with the DMM and enter the measured current value as -I Lo.

Step 9. Repeat step 4. Enter the measured value as -I Hi. Calibration is completed.

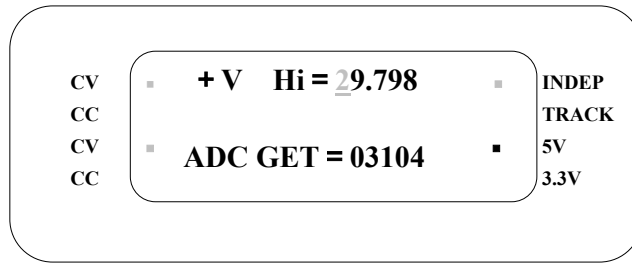
NOTE: If **Error #0002** appear on the LCD after inputting calibration parameters, please make sure all the calibration parameters are correct and then re-enter them again.

For LPS 305

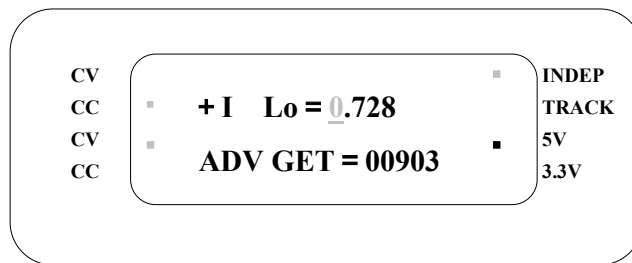
Step 1 : Simultaneously press the “ 8 ” and the “ - ▼ ” keys on the Keypad and the following message will appear on the LCD:



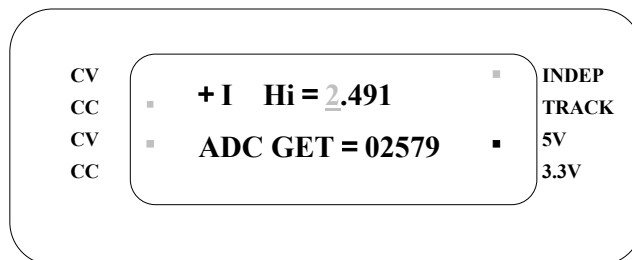
Step 2 : Measure the DC voltage from the + output terminals (+ and COM1) with the DMM and keyin the measured value (i.e. if the DMM shows 9.487V then keyin 9.487) followed by the “ ENTER ” key. The following message will then appear on the LCD:



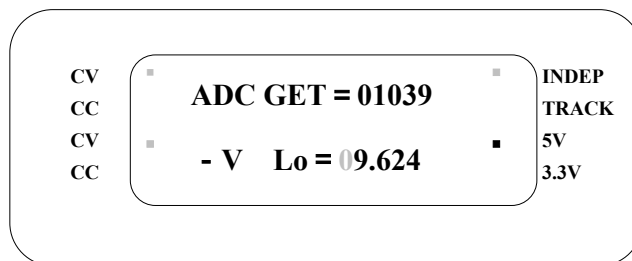
Step 3 : Repeat step 2. Keyin the measured value (i.e. if the DMM shows 29.798V then keyin 29.798) followed by the “ ENTER ” key. The following message will then appear on the LCD:



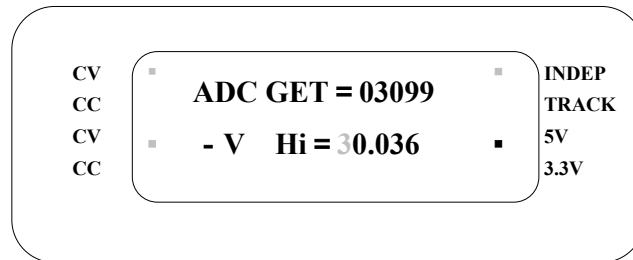
Step 4 : Measure the DC current from +output terminals (+ and COM1) with the DMM and keyin the value (i.e. if the DMM shows 0.728A, then keyin 0.728) followed by the “ ENTER ” key. The following message will then appear on the LCD:



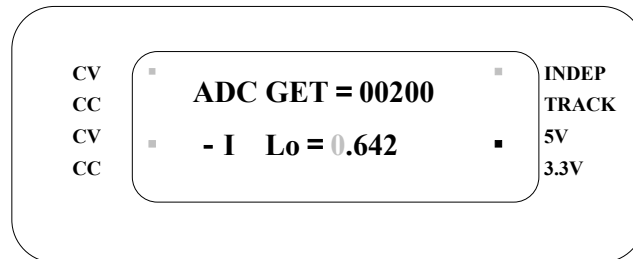
Step 5 : Repeat step 4. Keyin the measured value (i.e.if the DMM shows 2.491A then keyin 2.491) followed by the “ ENTER ” key. The following message will then appear on the LCD:



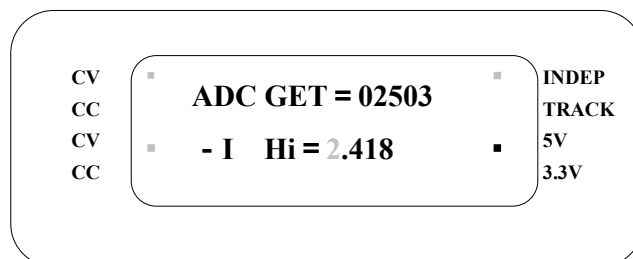
Step 6 : Measure the DC voltage from -output terminals (- and COM1) with the DMM and keyin the measured value (i.e. if the DMM shows 9.624V then keyin 9.624) followed by the “ ENTER ” key. The following message will then appear on the LCD:



Step 7 : Repeat step 6. Keyin the measured value (i.e. if the DMM shows 30.036V, then keyin 30.036) followed by the “ ENTER ” key. The following message will then appear on the LCD:

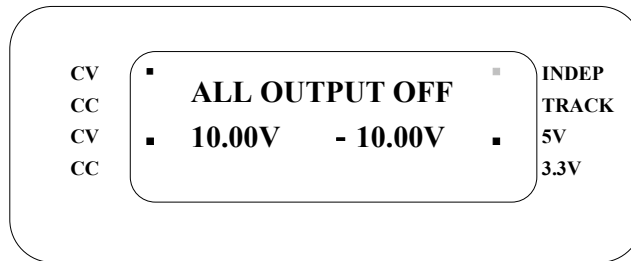
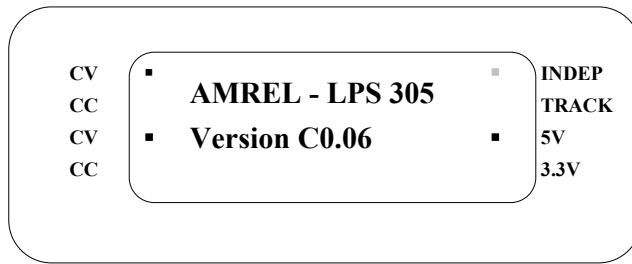


Step 8 : Measure the DC current from -output terminals (- and COM1) with the DMM and keyin the measured value (i.e. if the DMM shows 0.642A then keyin 0.642) followed by the “ ENTER ” key. The following message will then appear on the LCD:



Step 9 : Repeat step 8. Keyin the measured value (I.e. if the DMM shows 2.418A, then keyin 2.418) followed

by the “ENTER” key. The following message will then appear on the LCD:



RS232 Installation

For LPS301~304

1. Connect the cable to the connector on the board of front panel.
2. Turn the instrument on. The display will show

AMREL LPS302
Version 1.xx

3. Turn the power SW on.
When the display shows

AMREL LPS302
Version 1.xx

Immediately press 4 Keys simultaneously.

The display will show

AMREL LPS302
Version 1.xxR

The “ R ” means the instrument with RS232 interface.