LP1210

TEN CHANNEL
LOOP POWER SUPPY

TECHNICAL MANUAL

870-12100

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LP-1210
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CONTENTS:

TABLES:

ILLUSTRATIONS:

LP-1210

TEN CHANNEL LOOP POWER SUPPLY

The LP1210 is a Ten Channel Loop Power Supply that may be used to convert MIL188/114 data to 120 VDC neutral loop data. The loop current of each channel may be set for either 20 or 60 milliamperes (Mark condition). Each of the ten channels includes optically isolated circuitry for MIL188-to-Loop and Loop-to-MIL-188 conversion, allowing use in a full duplex (FDX) send-receive system.

Electronic circuits for each channel are identical, each contained on a separate 4.5" x 6" plug-in circuit card. Each card includes 5 on-board LED indicators to assist in tracing system faults and maintenance of the LP-1210. Each card may be separately removed from the main chassis via a hinged door in the LP-1210 front panel. The low-voltage regulator plug-in circuit card also includes on-board LED indicators and may also be removed via the front panel door. A circuit extender PC card is included with each LP-1210 to further assist in maintenance.

The LP-1210 may be operated from main power lines of 115 or 230 VAC (rear panel switch), 50/60 Hz, drawing approximately 150 Watts. The main cabinet is rack-mounted with a 7" high x 19" wide front panel. The AC power switch, fuse, and pilot lamp are included on the front panel. The LP-1210 is 19" wide x 7" high x 17" deep and weighs 28 pounds.

An internal 100 CFM blower provides cooling for internal power resistors and transformers. Separate DB-25P rear-panel connectors are provided for each of the ten MIL-188-114 data I/O connections; a separate 6-terminal barrier strip is provided for each channel Loop In/Out connection.

The LP-1210 is designed for rugged service and has a calculated MTBF in excess of 100,000 hours (MIL-HDBK-217D) over the temperature range of 0 C to +50 C (operating) or -51 to +68.3 C (storage).

1.0 UNPACKING AND INSPECTION

Carefully inspect the packing carton and LP-1210 for shipping damage when unpacking. Any damage should be reported immediately to the shipping carrier. All claims must be made to the shipping carrier, not to HAL Communications. The following items are included in the shipping carton:

900-12100	LP-1210 Loop Power Supply
870-12100	LP-1210 Technical Manual
333-17250	AC Power Cord

2.0 INSTALLATION

Installation of the LP1210 involves three steps: (1) Make connections to the MIL-188-114 data device, (2) Make connections to the Loop device, and (3) Install the LP-1210 in the system rack. There are no internal option jumpers or internal switches to set in the LP-1210.

2.1 MIL-188-114 DATA CONNECTIONS

The LP-1210 is designed to convert MIL-188-114 data to ON/OFF neutral loop data. The voltages and currents for each data state are shown in Table 2.1.

TABLE 2.1
MIL-188-114 to LOOP DATA CONVERSION

SIGNAL	DB-25P Pin No.	STATE	MIL188	LOOP
SEND DATA to LOOP	2	MARK	-6 VDC	Loop Current ON (20 or 60 ma)
		SPACE	+6 VDC	Loop Current OFF (open loop)
RCVE DATA from LOOP	3	MARK	-6 VDC	Loop Current ON (10 to 100 ma)
		SPACE	+6 VDC	Loop Current OFF (I < 5 ma)

Note: The above MIL-188 polarities are in agreement with MIL-188-114 and are inverted from those of the older MIL-188C standard (MARK = +6VDC). MIL-188-114 polarity is, however, the same as EIA Standard RS-232C and the LP-1210 MIL-188-114 data connections may be used with common RS-232C data equipment. Different channel circuit cards are available from HAL Communications Corp. to support the older MIL-188C standard (+6V = MARK).

Connection to the LP-1210 MIL-188-114 port requires a cable-mounted DB-25S connector for each channel (pins = socket = female). The required connections are shown in Table 2.2.

TABLE 2.2
MIL-188-114 CONNECTIONS

DB-25 Pin	SIGNAL
1	CHASSIS GROUND (Cable Shield)
2	Send MIL-188-114 Data to Loop Circuit
3	Receive MIL-188-114 Data from Loop Circuit
4 - 6	No Connection
7	SIGNAL GROUND
8 - 25	No Connection

2.2 LOOP DATA CONNECTIONS

Each channel of the LP-1210 has a separate 6-terminal barrier strip for loop connections. These barrier strips use No. 6-32 screws and standard No. 6 solder-lug terminals may be used on each data wire. The protective cover should be installed over each barrier strip after all loop connections have been made. A separate optically isolated 2-wire loop connection is provided for send and receive data for each of the ten channels. The separate send and receive loops may be used individually for isolated full-duplex (FDX) loop circuits or series-connected for a 2 wire half-duplex (HDX) loop circuit.

2.2.1 LOOP OUT CIRCUIT

The LOOP OUT barrier connections present the neutral loop signals derived from the MIL-188-114 data input on pin 2 of the DB-25 connector. The polarity conversion is shown in Table 2.1. The LOOP OUT circuit of the LP-1210 includes a separate and ground-isolated internal 120 VDC loop power supply for <u>each</u> of the ten data channels. The closed-loop "Mark" state current is determined by internal current limiting resistors. Separate "+20" and "+60" screw barrier terminals are provided to choose the desired LOOP OUT Mark current. The same minus (-) terminal is used for both 20 and 60 ma loop output currents.

LOOP OUT connections are desiged to be directly connected to the receiving loop device - printer selector magnets, polar relay, or electronic loop sensing circuit. If a polarity sensitive loop device is used, be sure to observe the marked polarity of the LP-1210 LOOP OUT terminals.

CAUTION:

> The LP-1210 contains its own LOOP OUT 120 VDC power supply. Do NOT connect to an external device that ALSO contains a lopp power supply.

2.2.2 LOOP IN CIRCUIT

The LOOP IN barrier terminals accept neutral current-loop data and convert it into MIL-188-114 data that is then presented to pin 3 of the DB-25 connector. The current and corresponding MIL-188-114 voltages are shown in Table 2.1. The LOOP IN connection may be used to sense loop current from any loop circuit in which the Mark current (loop current ON) is between 10 and 100 ma. An exact current match or adjustment of the LP-1210 is not required for the LOOP IN circuit. The LOOP IN circuit is, however, <u>polarity sensitive</u> and care should be taken that the polarity of the incoming loop signal match the LP-1210 rear panel markings. Inadvertant reverse polarity connection will not damage the LP-1210, but <u>no data</u> will be presented to pin 3 of the DB-25 connector if the LOOP IN polarity is incorrect.

The LOOP IN circuit does <u>not</u> include a loop power supply within the LP-1210. Rather, the standard convention that loop current is supplied by the loop output device is followed. Connection of a loop output device that does not include a source of loop current will not damage the LP-1210 but no data will be translated and presented to pin 3 of the DB-25.

2.2.3 FDX (4-WIRE) LOOP CONNECTION

A typical 4-wire, full-duplex (FDX) data connection to the LP-1210 is shown in Figure 2.1. Note that two data wires connect between LP-1210 LOOP OUT terminals and the loop receiving device; two <u>additional</u> data wires connect between LP-1210 LOOP IN and the loop transmit device. Use of shielded cable(s) is recommended and the shield(s) should be connected to the LP-1210 chassis ground terminal provided.

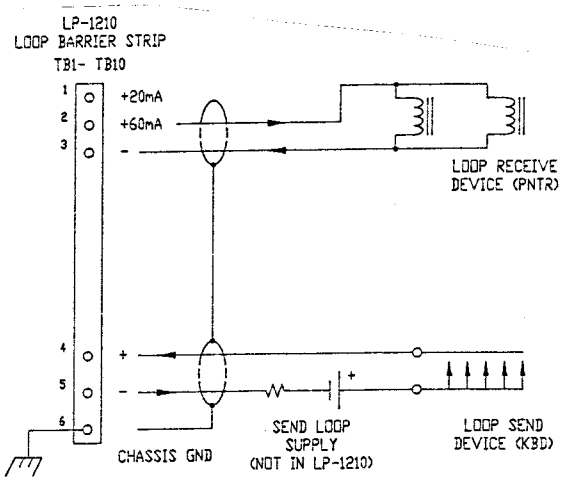

FIGURE 2.1 FDX (4-WIRE) LOOP CONNECTION

2.2.4 HDX (2-WIRE) LOOP CONNECTION

The LP-1210 may also be used in a two-wire, half-duplex (HDX) data system. In this case, the LOOP OUT and LOOP IN terminal of the LP-1210 are connected in series and the two data wires are then connected between the positive terminal of LOOP IN and the positive terminal of LOOP OUT (+20 or +60 ma as required). A jumper is connected between -LOOP IN and - LOOP OUT terminals. Use of shielded cable is highly recommended with the shield connected to the LP-1210 chassis ground barrier terminal. The HDX connection is shown in Figure 2.2.

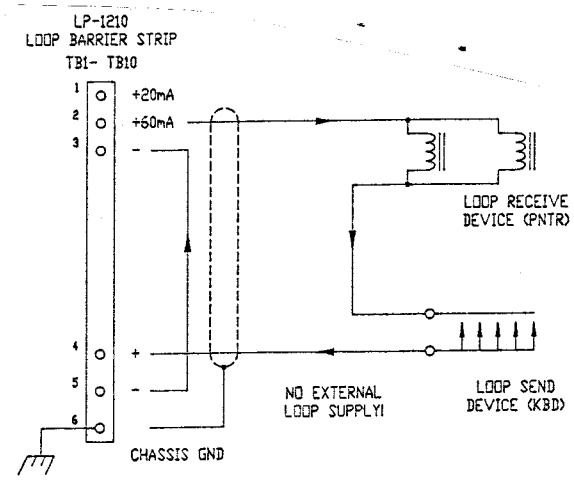

FIGURE 2.2 HDX (2-WIRE) LOOP CONNECTION

NOTE: This series connection <u>must</u> be observed for proper HDX operation.

The loop device must also be series connected in the HDX loop, observing current flow requirements if the loop device is also polarity sensitive. Note that the HDX connection gives a local-echo of loop data. Data sent into pin 2 of the DB-25 is converted to a loop signal, output to LOOP OUT, echoed back through the LOOP IN terminal, and converted back to MIL-188-114 receive data on pin 3 of the DB-25. Therefore, the MIL-188-114 device connected to the DB-25 may either be a FDX or HDX device, but must be configured for no local echo.

2.3 SYSTEM INSTALLATION

2.3.1 MOUNTING AND COOLING

The LP-1210 requires 7 inches of rack panel height. Forced air cooling of the LP-1210 is provided by its internal blower. Air flow enters at the left side of the LP-1210 cabinet and exits on the right side (transverse air flow, parallel to the front panel surface). Therefore, placement of heat-generating devices above or below the LP-1210 is not critical. However, air flow at the sides of the rack enclosure is required. The normal 1.5 to 2 inch side clearance of standard equipment racks is more than adequate to assure sufficient cooling of the LP-1210. If multiple LP-1210 units are vertically mounted (one above the other) and used in a very warm environment, it is recommended that additional ventillation fans be installed in the equipment rack to assure a continuous flow of cooling air. Each LP-1210 dissipates a maximum of 150 Watts (all ten channels set for 60 ma LOOP OUT current). A 100 CFM blower is used in each LP-1210. For continuous duty operation, the air temperature into each LP-1210 must be at or below +50 degrees Celcius.

2.3.2 AC POWER CONNECTION

The LP-1210 is provided with a standard non-captive 115 VAC power cord with an IEC320 female socket on the LP-1210 end and a NEMA 5-15P male plug on the AC power end (U.S. standard "U-ground" plug). This cord may be used directly for all 115 VAC power systems. When using 115 VAC power, be sure to set the rear panel AC switch to "115" position (switch toggle down). Incorrect setting of the switch to the "230" position will not damage the LP-1210, but will cause improper operation.

If the LP-1210 is to be connected to 230 VAC power systems, be sure to first set the power switch to "230" before connecting the AC power cord.

CAUTION: Incorrect setting of the "115" / "230" rear panel switch when connecting to 230 VAC will cause damage to the LP-1210! Be sure this switch is set to "230" before connecting to a 230 VAC source of AC power.

2.3.3 SYSTEM GROUND

A separate 6-32 ground screw terminal is provided on the LP-1210 rear panel. Use a heavy wire or flat shield braid to connect this terminal to the rack cabinet and then to the communications system safety ground system.

2.3.4 RFI CONSIDERATIONS

The LP-1210 uses no internal oscillators or clocks, does not radiate RFI signals, and is not subject to FCC Part 15 regulations for incidental radiating devices. The LP-1210 is contained in a shielded enclosure and is not susceptable to reasonable RFI levels from external devices. RFI susceptability is minimized when the rear panel ground terminal and shielded cables are connected as described in previous sections of this Chapter.

3. TESTING

Testing of the LP-1210 only requires verification that MIL-188-114 and loop circuit polarities match those shown in Table 2.1. Separate MARK/SPACE LED indicators are provided on each channel circuit board to assist in this verification.

CAUTION: The following steps involve operation of the LP-1210 with the front panel hinged door in the open position. Voltages up to 120 VDC are present on each of the channel circuit cards. DO NOT INSERT FINGERS OR TOOLS INTO THE CARD FRAME WHILE AC POWER IS TURNED ON.

3.1 LP1210 FINAL TEST PROCEDURE

The following is the final test procedure used by HAL Communications to test each LP-1210 Loop Power Supply. The procedure to test Channel 1 is described in detail and the test is repeated for each of the ten channels.

Equipment required:

Fluke 77 Multimeter
Data Terminal (full duplex 75 baud)
Jumper Lead

1) Turn on LP-1210 and verify power light comes on.

2) Connect the data terminal to the LP-1210. Set the terminal for 75 baud Ascii.

3) Connect the LOOP OUT - and LOOP IN - terminals together.

4) Connect the multimeter between LOOP OUT + (60 ma) and LOOP OUT - terminals. Set the multimeter for DC Amps, 300 ma range.

5) Turn the LP-1210 AC POWER on and measure the 60 ma loop current.
   Limit = 60 ma $\pm$ 10 ma

6) Turn AC power OFF and jumper LOOP OUT + (60 ma) to LOOP IN +. Turn power ON and send 75 baud data from the data terminal to the LP-1210. Verify that the data is echoed properly at the terminal.

7) Turn the LP-1210 off, disconnect the jumper between LOOP OUT + (60 ma) and LOOP IN +, and connect the meter between LOOP OUT + (20 ma) and LOOP OUT - terminals.

8) Turn the LP-1210 on and measure the 20 ma loop current.
   Limit = 20ma $\pm$ 6 ma

9) Turn AC power OFF and jumper LOOP OUT + (20 ma) to LOOP IN +. Turn power ON and send 75 baud data from the data terminal to the LP-1210. Verify that the data is echoed properly at the terminal.

10) Turn power OFF and remove all jumpers from the LOOP connections. Turn power ON and measure the open circuit voltage between LOOP OUT + (20 or 60 ma) and LOOP OUT - screw terminals.
Limit = 110 to 170 VDC

11) Disconnect the data terminal from the LP-1210. Apply -5.0 vdc to Pin 2 of the DB-5 connector and verify that the HV, OUTPUT MARK and INPUT MARK LED's are ON and the OUTPUT SPACE and INPUT SPACE LED's are OFF. Measure Voltage between Pin 3 and 7 of the DB-25.
LIMIT = -5.0 v $\pm$1.0v

12) Apply +5.0 vdc to Pin 2 of the DB-25 connector and verify that the OUTPUT SPACE and INPUT SPACE LED's are ON and the OUTPUT MARK and INPUT MARK LED's are OFF. Measure Voltage between Pin 3 and 7 of DB-25.
LIMIT = +5.0 v $\pm$1.0v

13) Repeat the same procedure for the rest of the channels.

CHECK OFF:

TEP	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10
1	---	---	---	---	---	---	---	---	---	----
2	---	---	---	---	---	---	---	---	---	----
3	---	---	---	---	---	---	---	---	---	----
4	---	---	---	---	---	---	---	---	---	----
5	---	---	---	---	---	---	---	---	---	----
6	---	---	---	---	---	---	---	---	---	----
7	---	---	---	---	---	---	---	---	---	----
8	---	---	---	---	---	---	---	---	---	----
9	---	---	---	---	---	---	---	---	---	----
10	---	---	---	---	---	---	---	---	---	----
11	---	---	---	---	---	---	---	---	---	----
12	---	---	---	---	---	---	---	---	---	----

3.2 OPERATIONAL TESTING

The operation of each channel of the LP-1210 may be tested at any time by observing the flashing of the 5 LED's on each channel circuit card. The five LED's provide the information shown below in Table 3.1.

TABLE 3.1
CHANNEL CARD LED INDICATORS

LED	FUNCTION	ON	OFF
HV	Check output of 120 VDC Supply	120V OK	Defective 120V supply
OUTPUT MARK	Test continuity of output loop current.	OUTPUT LOOP OK	No flash = open OUTPUT LOOP.
OUTPUT SPACE	Test operation of MIL-188-114 data receiver.	MIL188 Rcvr OK	No flash = bad MIL188 INPUT data
INPUT MARK	Test continuity of input loop current.	INPUT LOOP OK	No flash = open INPUT LOOP
INPUT SPACE	Test operation of MIL-188-114 data transmitter.	MIL188 Xmtr OK	No flash = bad MIL188 OUTPUT data

Note that the "MARK" LED's verify correct operation of the loop side of the LP-1210 data interface and the "SPACE" LED's verify correct operation of the MIL-188-114 data receiver/transmitter circuit. Under conditions of normal data flow, the MARK and SPACE LED's will therefore flash alternately when all connections are correct and the LP-1210 is functioning. Failure of either MARK LED indicates a loop circuit failure; failure of a SPACE LED indicates a MIL-188-114 interface failure. Failure of the "HV" LED to illuminate indicates a 120 VDC power supply failure in that channel of the LP-1210.

4. LP-1210 OPERATION AND PERIODIC MAINTENANCE

After the connections of Chapter 2 and the tests of Chapter 3 have been sucessfully made, operation of the LP-1210 requires only that the power switch be turned ON and that data of the proper format be provided to each channel in use. Proper LP-1210 operation may be periodically verified by opening the front panel access door and observing the 5 LED indicators on each channel circuit card.

Periodic maintenance requires only that the operator periodically check to see that the test LED's for each channel indicate correct operation as outlined in Section 3.2.

If the LP-1210 is used in a high dust and humidty environment, it is recommended that each circuit board be periodically removed and accumulated dust be brushed from the circuit board. If the circuit boards are found to be excesively dirty, it is also recommended that the LP-1210 be removed from the equipment rack, the top cover removed, and the internal cabinet parts also be thoroughly cleaned. A vacuum-cleaner is recommended to remove any accumulated dust from inside the cabinet, assisted by use of a small soft-bristle brush. The blower is self lubricated and should require no additional lubrication.

CAUTION:

TO AVOID A SERIOUS ELECTRICAL SHOCK, BE SURE TO (1) DISCONNECT AC POWER FROM THE LP-1210 AND (2) TURN OFF ALL EXTERNAL LOOP SENDING DEVICES AND THEIR POWER SUPPLIES BEFORE REMOVING ANY CIRCUIT BOARDS FOR CLEANING OF BEFORE OPENING THE CABINET FOR CLEANING.

5. CIRCUIT DESCRIPTION

Refer to the block diagram in Figure 5.2 and the schematic diagrams of Figures 5.2, 5.4, and 5.6 for the following discussion.

The LP-1210 is made up of ten identical channels of MIL-188-114 to DC Loop data converters. Electronic circuitry of each data channel is contained on a separate plug-in circuit card. Low voltage power (+8 VDC and -8 VDC) is provided by an 11th plug-in circuit card. An extender circuit card is provided in the 12th slot of the plug-in card frame. All plug-in cards may be accessed through a hinge-down front panel door for easy maintenance. All cards are inserted with the components facing to the right side of the front panel. Each plug-in card and its mating socket are keyed so that a card may not be installed upside down or in an incorrect location. Power transformers, loop current-limiting resistors, I/O connectors, and a ventilation blower are contained within the LP-1210 cabinet.

5.1 CHANNEL CARDS (Figures 5.2 and 5.3)

Most of the LP-1210 circuitry is contained on the ten channel cards. All channel cards are identical and interchangeable. The operation of a typical channel will be described. The data flow convention used in all LP-1210 documentation refers to the LP-1210 itself. Thus a MIL-188-114 data input is data flowing <u>from</u> the MIL188 device <u>into</u> the LP-1210. A LOOP OUTPUT circuit describes loop data flowing <u>from</u> the LP-1210 <u>to</u> an external loop receiver device.

Each channel card has a separate and isolated 120 VDC loop power supply. The AC transformer for this supply is located on the LP-1210 chassis and connected to each plug-in card through edge connector pins A1, A2, and A3. The AC output of the transformer is rectified in the full-wave bridge of D1, D2, D3, and D4 and then filtered by C1. Resistor R1 and LED DS1 provide a safety bleeder load for the 120V power supply and a test indicator that the supply is operational. The positive output of the 120 VDC supply is connected to loop keying transistors Q1 - Q3 and the negative to the loop output through the OUTPUT MARK indicator (DS1). This indicator is ON when ever current flows in the 120 V loop output circuit (loop MARK condition). Resistor R5 and capacitor C5 provide suppression of voltage transients that may be produced if a high-inductance device is connected to the loop circuit output (a TTY machine selector magnet, for example). Pins A5 (plus) and A6 (minus) are the keyed loop output connections on the plug-in card. Total loop current is set by power resistors external to the plug-in channel card.

MIL-188-114 data from the rear panel DB-25 connector is passed to pins A8 and A9 of the plug-in card edge connector. Data from the MIL-188-114 device passes into pin A8 of the plug-in card to operational amplifier U3a where it is level detected, inverted, and applied to optical isolator U1. The optical isolator internal LED and test LED DS1 (OUTPUT SPACE) are turned ON during a MIL-188-114 input SPACE condition (input at A8 = +6V). This also results in current flow through the output transistor of U1, turning OFF the Darlington-connected loop keying transistors Q1, Q2, and Q3. In a similar manner, a MIL-188-114 MARK input (-6V to pin A8) will result in U1 turning OFF, forcing the loop keyer circuit ON, and completing the conduction path between the 120 VDC positive terminal and pin A5 of the plug-in card.

Note that the loop keying circuit is polarity sensitive and only a neutral loop connection may be used with the LP-1210 OUTPUT LOOP circuit. Also, the LP-1210 contains its own internal 120 VDC 20/60 ma, OUTPUT LOOP power supply and the unit should not be connected to a loop circuit that also contains a loop power supply. Such a connection will result in damage to the LP-1210 OUTPUT LOOP circuitry.

Loop data from an external loop data generator is connected to pins A20 and A21 of the plug-in card. Note that this connection is polarity sensitive (positive to pin A20). Either a neutral or polar loop device may be connected to the INPUT LOOP circuit, but it must be connected such that a positive current flow is provided into pin A20 during the MARK state. Reverse connection to the INPUT LOOP will not damage the LP-1210 but data will not be detected correctly.

Resistor R17 and capacitor C11 provide transient protection for the INPUT LOOP circuitry. Diode D5 prevents reverse input loop current flow through the detection circuitry. Positive loop current flow is detected by D6, limited by D7, and passed to optical isolator U2 through the INPUT MARK indicator DS5. Indicator DS5 is therefore ON whenever a MARK current flow condition exists in the INPUT loop circuit.

An input loop MARK condition therefore turns the output transistor of U2 ON, forcing a low voltage condition at U3b pin 5, the positve input of the MIL-188-114 output driver. A +6V output is therefore presented to pin A9 of the plug-in card and wired to pin 3 of the rear panel DB-25 connector. MIL-188-114 output data also drives indicator DS4 to provide test indication of an INPUT LOOP SPACE condition.

All components of the channel card are chosen to maximize reliability; resistors are derated to 25% of their standard commercial ratings and ceramic, JAN-rated semiconductors are used throughout.

5.2 LOW VOLTAGE POWER SUPPLY (Figures 5.4 and 5.5)

Low voltage DC power for the LP-1210 channel cards is provided by the LOW VOLTAGE POWER SUPPLY plug-in card, installed in the slot to the right of the Channel 1 I/O card. As in the case of the channel cards, the AC power transformer for the low voltage supplies is located on the LP-1210 chassis and the low voltage AC output is connected to pins A16, A17, and A18 of the plug-in card connector. Diodes D1, D2, D3, and D4 are a full-wave bridge that provides positive and negative voltage outputs to filter capacitors C4/C5 (positive) and C3/C1 (negative). The filtered DC is then regulated to +8V by VR2 and -8V by VR1. LED's DS1 and DS2 provide test indicators that the low voltage power supply is functioning properly. The low voltage power supply card provides +8VDC and -8VDC to each of the ten channel cards.

5.3 LP-1210 CHASSIS (Figures 5.6 and 5.7)

The LP-1210 chassis includes the circuit card rack for the ten channel cards and low voltage power supply card, AC power transformers, power OUTPUT LOOP current limiting resistors, rear panel I/O connectors, and front panel AC power controls. A 12th slot is included in the plug-in card assembly for storage of the circuit card extender.

AC power for the 120 VDC loop power supply on each channel card is supplied by HAL tranformer A1481A. Each A1481A transformer provides 120 VAC for two LP-1210 channel cards. Thus, transformer T1 powers channels 1 and 2, T2 channels 3 and 4, etc. AC power for the low voltage power supply card is provided by transformer T6. The 5 loop power transformers have dual primary windings which are connected so that either 115 or 230 VAC power lines may be used, selected by switch S2. The blower motor, B1, and low voltage transformer primary (T6) are also connected so that they may be used on either 115 or 230 VAC power lines. All AC power to the LP-1210 passes through power line filter J22, DPDT front panel power switch S1, and front panel fuse F1. Power ON condition is indicated by pilot lamp I1, connected to the +8V output of the low voltage power supply.

The positive LOOP OUTPUT terminal of each channel card (pin A5) is connected to two power resistors, R1 (2K) and R2 (4K) in channel 1. (R3 and R4 for channel 2, R5 and R6 for channel 3, etc.) If a 60 ma, OUTPUT LOOP current is desired, the positive loop connection is made to OUTPUT LOOP barrier strip terminal 1. The 120 VDC loop voltage is thus impressed across only R1 and the closed-loop current is set to 60 ma. For 20 ma OUTPUT LOOP operation, barrier terminal 2 is used and the 120VDC is pressed across R1 in series with R2, a total of 6,000 ohms, giving a closed-loop current of 20 ma. The negative connection for the OUTPUT LOOP is to barrier terminal 3 in either case. INPUT LOOP signals are connected to barrier terminals 4 and 5 which are wired to channel card pins A20 and A21. As discussed in Section 5.1, polarity of the OUTPUT and INPUT connections is critical and care should be taken that LP-1210 polarities match those of the external loop data devices.

MIL-188-114 connections are made to DB-25P connectors J1 through J10 and passed directly to the proper channel card for processing as discussed in Section 5.1. Only pins 1, 2, 3, and 7 of these DB-25 connectors are used by the LP-1210.

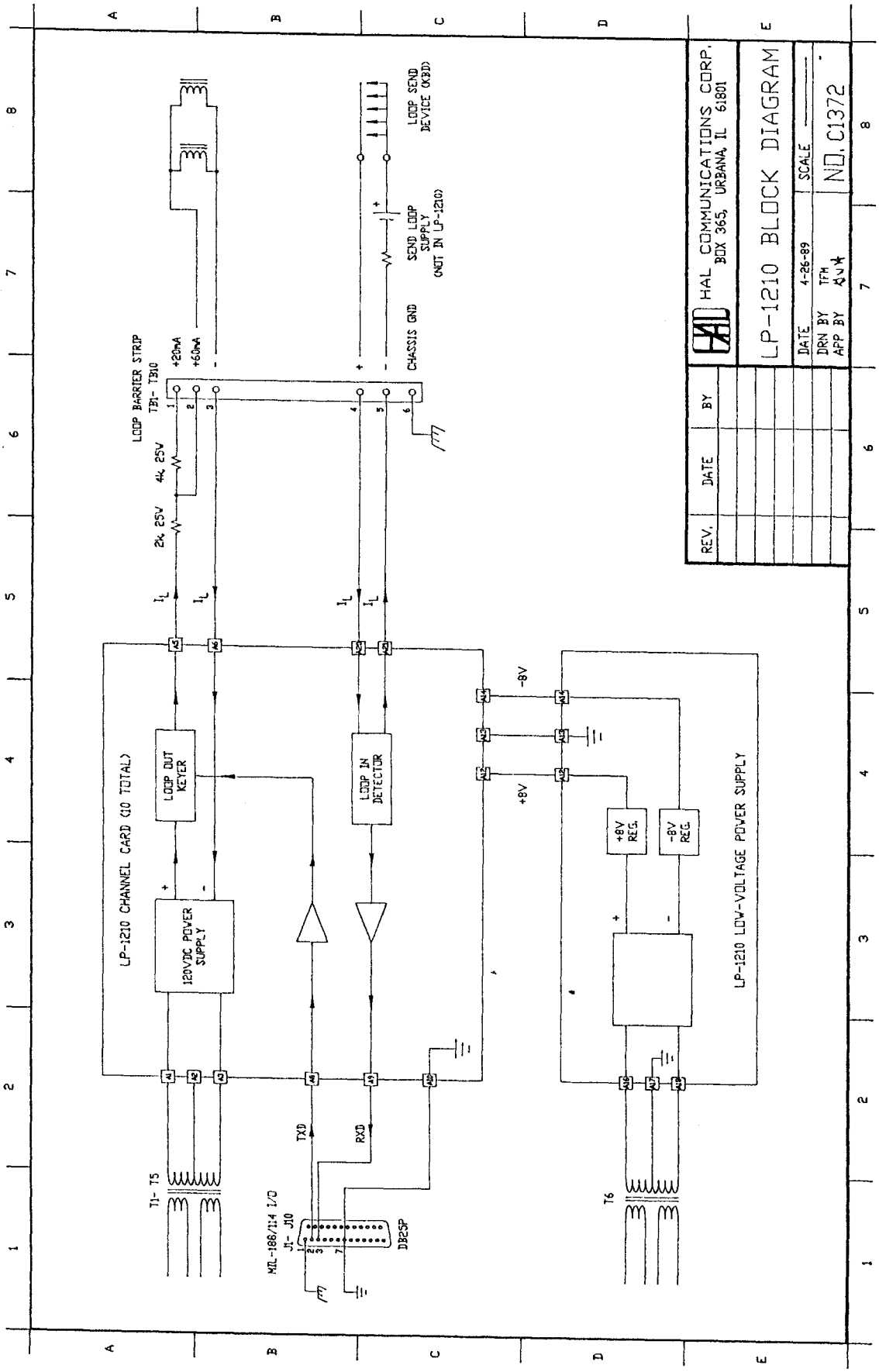

Figure 5.1 LP1210 BLOCK DIAGRAM

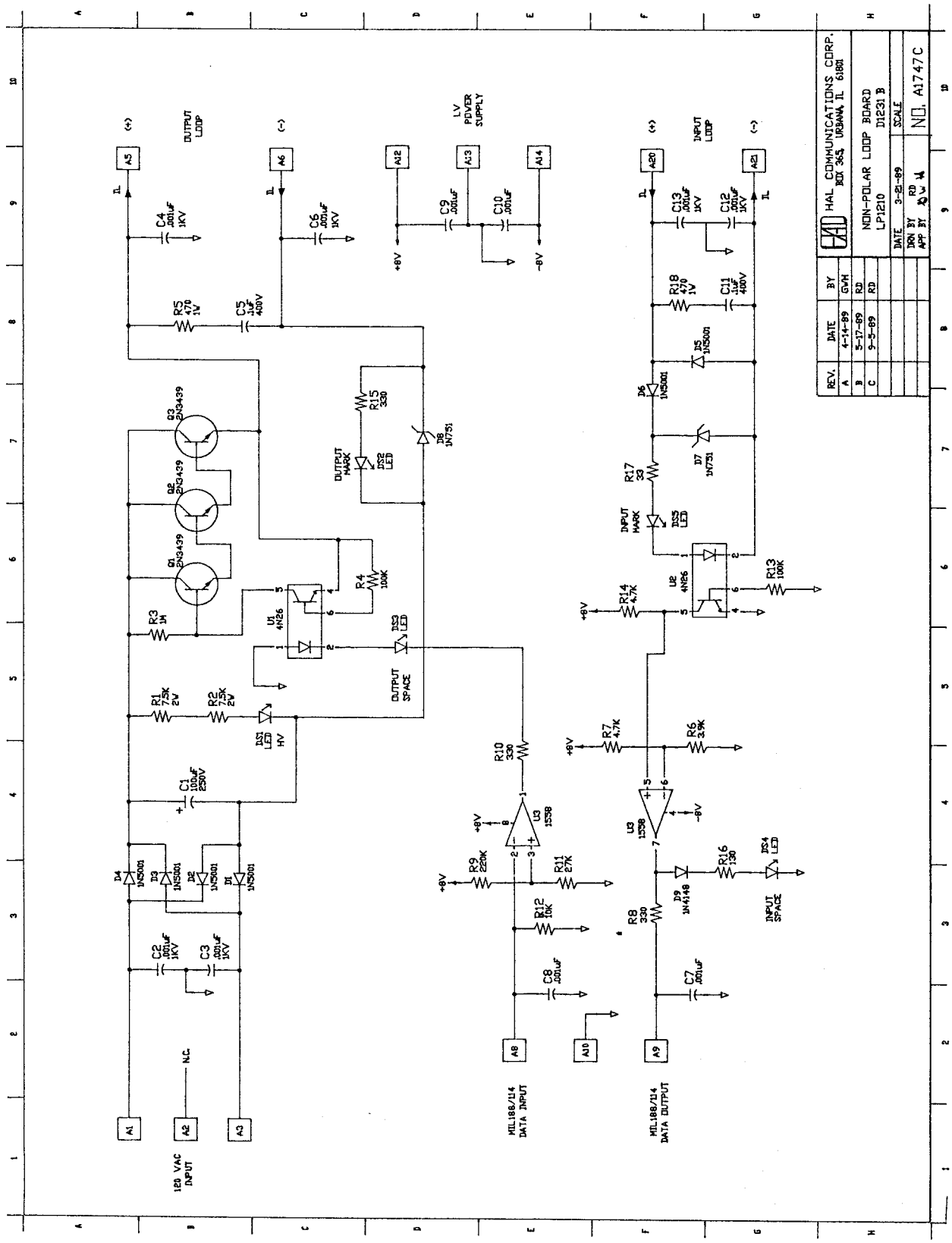

Figure 5.2 LP-1210 CHANNEL CARD SCHEMATIC

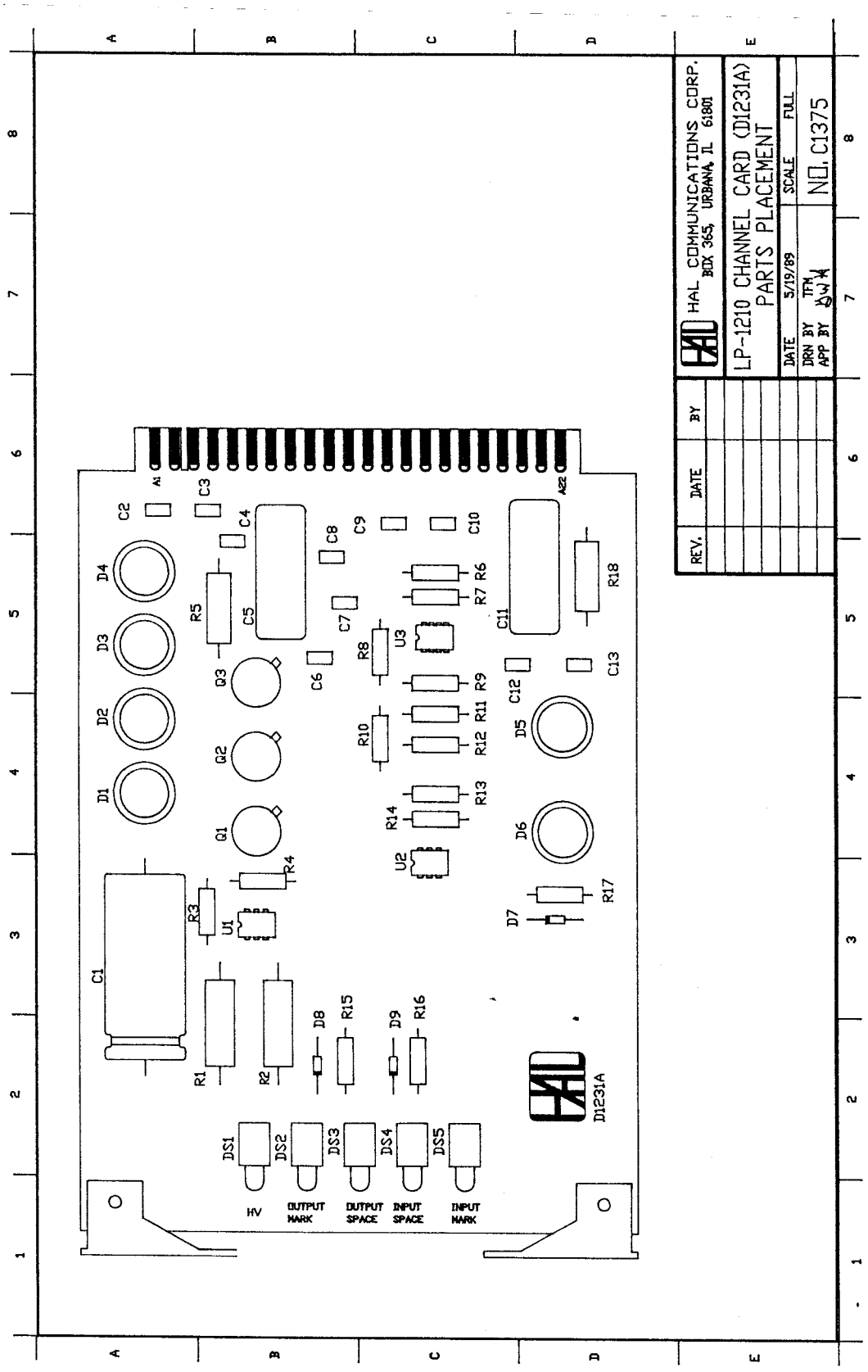

Figure 5.3 LP-1210 CHANNEL CARD PARTS PLACEMENT

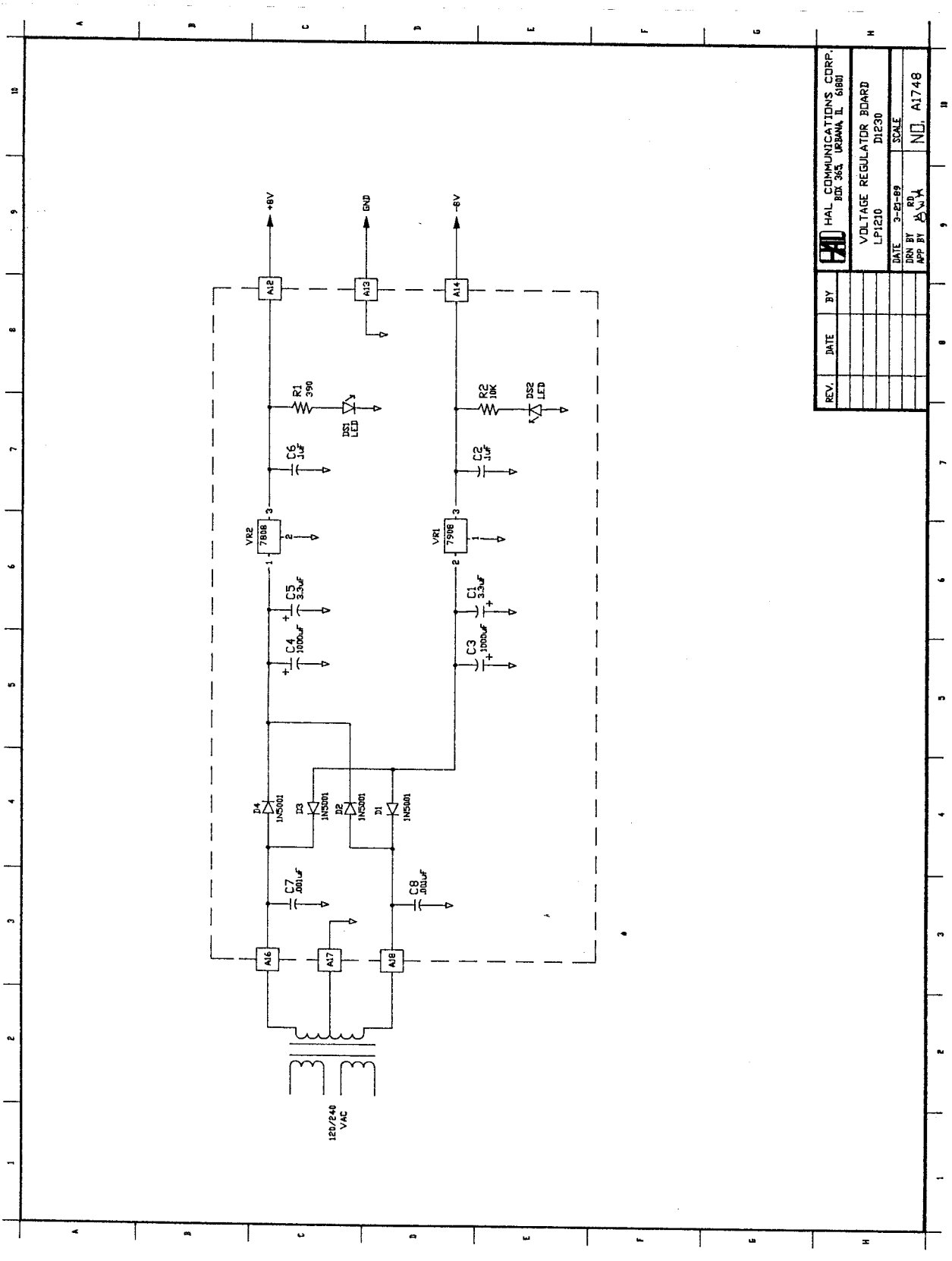

Figure 5.4 LP12100 LOW VOLTAGE POWER SUPPLY SCHEMATIC

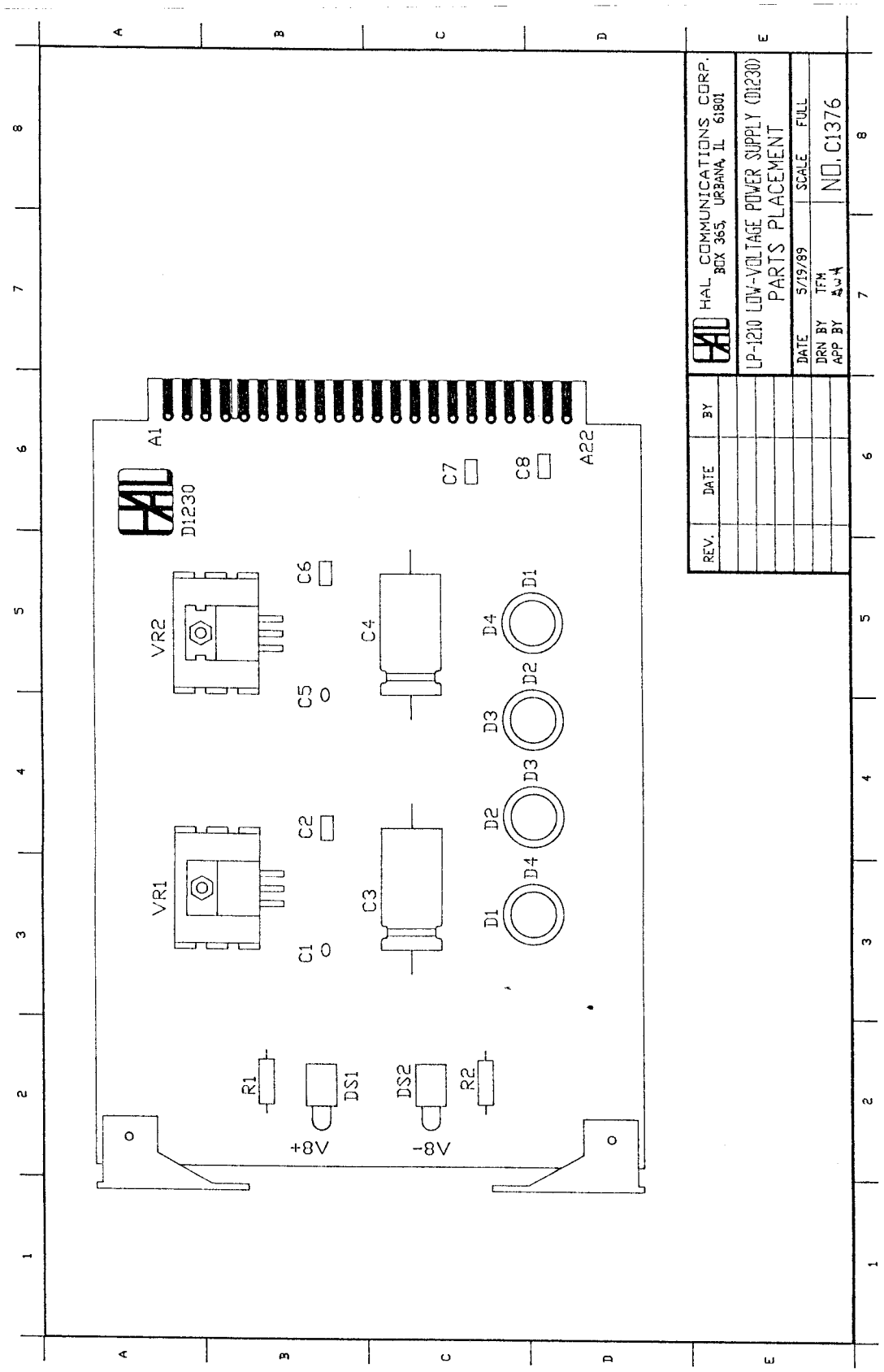

Figure 5.5 LOW VOLTAGE POWER SUPPLY PARTS PLACEMENT

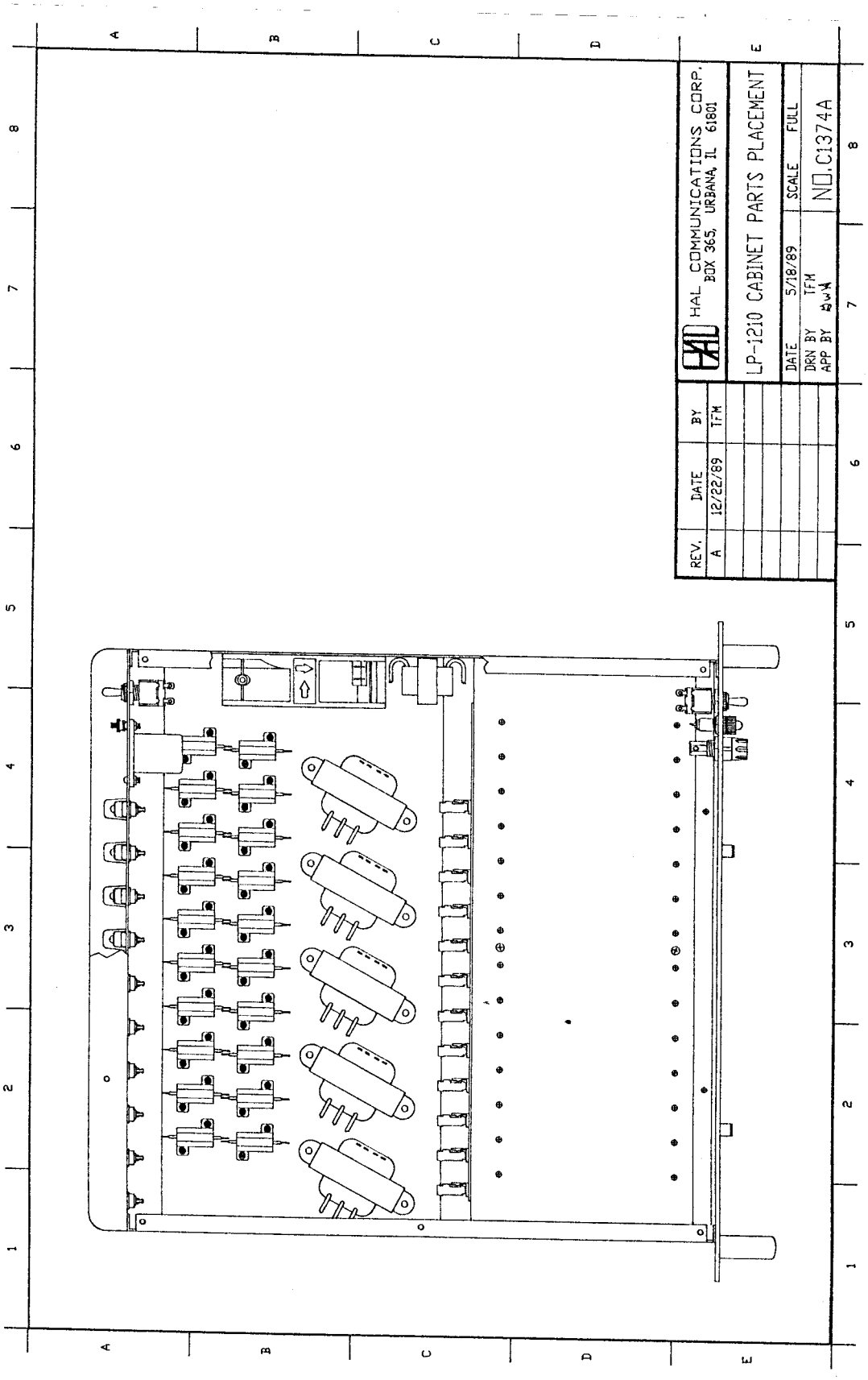

Figure 5.7 LP-1210 CABINET PARTS PLACEMENT

6.0 LP-1210 SPECIFICATIONS

NUMBER OF CHANNELS:	10, isolated
LOW-LEVEL DATA:	MIL-188-114 MARK = -6 VDC SPACE = +6 VDC Connector = DB-25P Input to LP-1210 = Pin 2 Output from LP-1210 = Pin 3 Data Rate = 75 baud
LOOP DATA:	120 VDC, Neutral Current Loop Isolated from ground and other signals. MARK = loop current ON SPACE = loop current OFF OUTPUT LOOP = 20 or 60 ma INPUT LOOP = 10 to 100 ma Connector = 6-position barrier terminal strip. Data Rate = 75 baud
AC POWER:	115 or 230 VAC (rear panel switch selected) 60 Hz, 120 Watts 50 Hz, 155 Watts Connector = IEC320, Filtered Fuse = 3AG, 2A SB
MECHANICAL:	7" high x 19" wide rack panel 7" x 19" x 17" over-all size 28 lbs net, 35 lbs shipping Rack-mounting front panel with circuit card access door.
ENVIRONMENT:	Operating: 0 to 50 degrees C Storage: -51 to +68.3 C Shock: to 15g MTBF: 100,000 hours calculated (MIL-HDBK-217D)

LIMITED WARRANTY

HAL Communications Corp. of Urbana, Illinois, hereby warrants to the purchaser that the product herein described shall be free from defects in materials and workmanship, and from failure of operation from ordinary use, for a period of one year from the date of sale to the purchaser.

In the event of a defect in materials or workmanship during the warranty period, HAL Communications Corp. will, at its own expense, repair the defective unit and replace any defective parts. Cost of shipping the unit to HAL Communications Corp. as well as costs of removal and reinstallation of the unit shall be paid by the purchaser. HAL Communications Corp. will pay the shipping costs incurred in returning the unit to the purchaser.

To obtain warranty service, the customer should:

1. Notify, as soon as possible, the Customer Service Department of HAL Communications Corp., Box 365, Urbana, Illinois, 61801, of the existence of a possible defect.

2. At the time of notification, identify the serial number, and the possible defect.

3. HAL Communications will issue a Return Authorization Number at this time.

4. Return the unit, freight prepaid. Include in the shipping carton a reference to the Return Authorization Number and a brief description of the problem.

Correct installation, use, maintenance, and repair are essential for proper performance of this product. The purchaser should carefully read the equipment manual. The purchaser will be billed for labor and shipping charges on any unit determined by HAL to be in working order when received for repair.

This warranty does not apply to any defect which HAL Communications Corp. determines is due to any of the following:

1. Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts;

2. Misuse, abuse, neglect, improper installation, or improper operation (including operation without a proper safety ground connection);

3. Accidental or intentional damage.

All implied warranties are limited in duration to a period of one year from the date of purchase by the original retail purchaser. HAL Communications Corp. disclaims any liability for incidental or consequential damages arising out of the use of, or inability to use, this product. This warranty gives you specific legal rights, but there may be additional rights.