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SPELLMAN

INSTALLATION

AND OPERATING

MANUAL

DOUBLE WIDTH NIM SERIES

Models 301, 303, 305,310P, 313A, 313B, 315, 320N, 320P

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SECTION I GENERAL DESCRIPTION

1.1 PURPOSE OF EQUIPMENT

1.2 The NIM series consists of a family of regulated precision high voltage power supplies. Each model is housed in a standard AEC NIM module, high x2.7" wide, for insertion into a standard AEC NIM bin. The high stability and low noise inherent in the NIM series makes these units ideally suited as a high voltage source for sensitive nuclear detectors.

1.3 DESCRIPTION

1.4 There are nine models in the NIM series. The models 301, 303, 305, 310N, and 310P utilizes the ±12 V dc and ± 24V dc input power from the standard NIM bin connector. The models 313A, 315, 320N, 320P utilize 115/230V, 50-400Hz line input power.

1.5 The models 301, 303, 305, 310N, and 310P consist of a dc power supply which converts the ac line power to a low dc voltage, and a dc-dc converter which converts the low dc voltage to a high dc voltage.

1.6 The models 301,303,305,310N, and 310P utilize the ± 12V dc and ±24V dc input from the NIM bin as the input to the dc –dc converter. The circuitry in the NIM series that accomplishes these functions is more fully described in Section III of this manual.

1.7 All of the electronic circuitry is mounted on one plug- in printed circuit board and on the high voltage and chassis assembly. A NIM is a totally solid state, mechanically rugged and electrically reliable assembly. Conservatively rated components are utilized throughout. Correctly operated, it will perform over long periods of time with minimum maintenance and down time.

1.8 A NIM is a fully enclosed unit. INPUT POWER, the HIGH VOLTAGE OUTPUT connector, the REMOTE PROGRAMMING INPUT connector, and the LOCAL/REMOTE PROGRAM switch are accessible at the rear panel of the unit. The ON/OFF switch VOLTAGE CONTROL and LED indicator lights are on the front panel. The 115/230 LINE VOLTAGE selector switch (models 313A, 315, 320N, and 320P) is on the bottom panel.

1.9 SPECIFICATIONS

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	RIPPLE pk-pk	RESOLUTION & SETABILITY	INPUT POWER option
301	0 to ±1000	3 mA	1mV	200mV	A
303	0 to ±3000	1 mA	3mV	200mV	A
305	0 to ± 5000	500 uA	5 mV	200 mV	A
310N	0 to -10, 000	250 uA	20 mV	2 V	A
310P	0 to +10, 000	250 uA	20 mV	2 V	A
313A	0 to ±3000	10 mA	10 mV	200 mV	C
315	0 to ±5000	5 mA	25 mV	200 mV	C
320N	0 to -10, 000	2 mA	100 mV	2 V	C
320P	0 to +10, 000	2 mA	100 mV	2V	C

Input: A: ±12V dc @ 50 mA, ±24Vdc#@ 150 mA
C: 115/230V ±10%, 50-400 Hz. Line power cord furnished.

Regulation: 0.001% LINE, 0.002% LOAD

Stability: 0.01%/hr, 0.02%/8hrs.

Temp. Coeff: 50 ppm/ºC over the range 0 to 50ºC

HV Output Connector: SHV Panel Receptacle Kings 170-1 (all units except 10kV). Mating Connector (order separately) is SHV Plug Kings 1705-1.

10kV: SHV Panel Receptacle Kings 1064-1. Mating Connector (order separately) is 10kV Plug Kings 1065-1.

Accuracy:	0.25 % of dial reading plus 0.05% of maximum voltage.	Size:	2.7" W x 8.7" H x 9.7"D (69 x 221 x 246 mm)
Programming Connector:	BNC Receptacle (UG 290/U) Mating Connector (order separately) is NC Plug (UG 88/U).	Weight:	5.2 lbs (2.4 kg) Series 301 thru 310 10.2 lbs (4.6 kg) Series 313A thru 320, Add 2lbs for shipping.
Protection:	Short-circuit proof, arc protected		

CAUTION: THIS UNIT PRODUCES HAZARDOUS VOLTAGE. DO NOT APPLY LINE VOLTAGE INPUT UNLESS ADEQUATE GROUND IS CONNECTED TO THE POWER SUPPLY AND THE HIGH VOLTAGE OUTPUT HAS BEEN APPRIATELY CONNECTED.

SECTION II OPERATION

2.1 INPUT POWER

2.2 Models 313A, 315, 320N and 320P are provided with the standard three conductor ac line cord. A recessed switch on the bottom panel is used to select either 115 V or 230 V line voltage operation. **DO NOT OPERATE THE UNIT UNTIL IT IS DETERMINED THAT THE SELECTOR SWICTH IS SET FOR THE PROPER LINE VOLTAGE.**

2.3 Models 301, 303, 305, 310N and 310P utilize the $\pm$12 V dc and $\pm$ 24V dc input power provided thru the standard NIM bin power connector.

2.4 POLARITY

2.5 The models 301, 303, 305, 313A, and 315 are reversible polarity. A screwdriver operated POLARITY selector switch is located on the top of the instrument. The setting of the POLARITY switch is indicated by illumination of either the POSITIVE or NEGATIVE LED indicator on the front panel.

LINE INPUT POWER MUST BE TURNED OFF AND THE HIGH VOLTAGE OUTPUT SHOULD BE DISHARGED TO GROUND AT THE OUTPUT CONNECTOR BEFORE REVERSING POLARITY.

2.6 The models 310N, 310P, 320N, 320P have a fixed polarity output and cannot be reversed.

2.7 HIGH VOLTAGE OUTPUT

2.8 The HIGH VOLTAGE OUTPUT connector is located on the rear panel.

2.9 PROGRAMMING

2.10 PROGRAM switch on the rear panel selects either LOCAL or REMOTE programming of the output high voltage. When this switch is in the LOCAL position, the front panel controls determine the output voltage, independent of any programming input voltage. When this switch is in the REMOTE position, the front panel controls have no effect on the output voltage and need not, therefore, be returned to zero.

2.11 LOCAL

2.12 With the PROGRAM switch set to local, the output voltage is read directly from the sum of the dial settings on the front panel. A continuous ten turn digital directly reads from 0 to 1000 volts with a resolution of 0.2 volts on all units in the NIM series except for the 10kV models.

2.13 A 500 volt selector switch, with up to nine steps positions as appropriate, is used on the models 303, 305, 313A, and 315.

2.14 The output voltage is the sum of the dial settings as described above. The polarity is as set by the polarity switch.

2.15 On the models 310N, 310P, 320N, 320P, the ten turn digital dial is used to vary output voltage from 0 to 10, 000 volts. Output voltage is 10 times the dial reading.

2.16 REMOTE

2.17 With the PROGRAM switch set to REMOTE, a 0 to –5 volts programming voltage input supplied to the BNC PROGRAM jack will linearly vary the output high voltage from zero to maximum volts. The polarity is as set by the POLARITY selector switch.

2.14.1 METER

2.14.2 The model 313A includes a front panel meter which provides a coarse indication of the output voltage. Precise output voltage settings are derived from the calibrated voltage controls dials.

SECTION III THEORY

3.1 FUNCTIONAL DESCRIPTION

3.2 The NIM series is basically a dc-dc converter which converts low voltage dc power to a high voltage dc output. This output voltage is high regulated and filtered and can be varied either by the front panel VOLTS controls or through the REMOTE PROGRAM input on the rear panel.

The input to the dc-dc converter is obtained from internal low voltage power supplies power by the ac line input in the models 313A, 315, 320N AND 320P (See figure 1 & 2), In the models 301,303,305, 310N, and 310P, the input to the dc- dc converter is obtained from $\pm$ 12 V dc and $\pm$ 24 V dc power supplies in the NIM bin (See Figure 3 & 4).

An oscillator determines the high frequency (approximately 20 kHz) at which all amplification, high voltage transformation, rectification, and filtering occurs, the amplification is a function of a control voltage which performs the function of control and regulation. A sample of the output voltage is compared against a reference voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed high voltage output.

3.3 CIRCUIT DESCRIPTION

3.4 In the models 313A, 315, 320N, and 320P, the input ac line is connected to the B+ (36V dc) supply and regulated +12 V low voltage power supplies. The B+ supply is a simple full wave bridge rectifier circuit. The regulated low power supply circuits ($\pm$ 12 V) are standard regulator IC circuits (IC 121 and 122) on PCB 100. The B+ supply is located on the chassis. In the models 303, 305, 310N, and 310P, the B+ supply and regulated negative voltages are obtained through the NIM bin power connector.

The output of the oscillator circuit (IC 102B) is amplified in the AGC integrated circuit, IC 105. The gain of the IC 105 is a function of the control voltage developed at the output of the amplifier IC 102A. The output of IC 105 drives the power transistors, Q1 and Q2.

The encapsulated high voltage assembly includes a high voltage power transformer, rectifier circuit, ripple filter, and sensing circuit. These are all critical custom designed and encapsulated components. It is recommended that trouble-shooting be avoided by personnel who are not thoroughly familiar with highly regulated high voltage techniques.

A sample of the high voltage dc output is fed to the sensing circuit and is compared to a referenced voltage. The sensing circuit consists of differential operational amplifier IC101. Output voltage control is obtained by varying the command voltage fed to IC102A. This command voltage is controlled by the front panel output VOLTS controls when the rear panel programming switch is in LOCAL position.

IC103A and potentiometer R11 (front panel VOLTS control) provide a continuous linear command variation appropriate for obtaining a 0 to 1000 voltage output (0 to 10, 000 voltage output for 10kV units). The front panel 500V control switch (not applicable in models 301, 310N, 310P, 320N, and 320P) provides incremental step changes in the command voltage appropriate for obtaining incremental output variations of 500V. IC103B sums the effect of the voltage controls.

IC104 and reference diode CR101 perform the generation, control and buffering of the –5V internal reference voltage.

SECTION IV MAINTANENCE

CAUTION: THIS UNIT PRODUCES HAZARDOUS VOLTAGE. DO NOT APPLY LINE VOLATGE INPUT UNLESS ADQUATE GROUND IS CONNETCED TO THE POWER SUPPLY AND THE HIGH VOLATGE OUTPUT HAS BEEN APPROPRIATELY CONNECTED.

4.1 TEST EQUIPMENT REQUIRED

4.2 The test equipment required to test and maintain a NIM series supply is listed as follows (equivalents may be used):

a. Oscilloscope
b. Digital or differential voltmeter
c. Variable autotransformer, General Radio Model W2
d. High impedance, high voltage 1000: 1 precision dc voltage divider
e. Capacitive coupled ac viewing circuit
f. High voltage load resistor rated for maximum voltage and current of the NIM supply
g. High voltage shorting stick

4.3 PREPARATION FOR MEASUREMENTS

4.4 Connect the HIGH VOLATGE OUPUT of the NIM supply to the high voltage terminal of the dc voltage divider and to the capacitor input of the ac viewing circuit. The low voltage terminal of the divider should be connected to the ground is connected to all instruments, viewing circuits and the MODEL NIM. After the ground has been checked, adequate safety precautions have been taken, and the output VOLTS controls set at zero, input power can be applied. For the NIM series 313, 315, 320N, and 320P, the ac input should be applied thru the variable auto transformer, which should be initially set for 115V or 230V output, as appropriate.

4.5 ADJUSTMENTS

4.6 With the VOLTS switch (where appropriate) set at zero, adjust the VOLTS dial to read 1000 volts (10, 000 volts for 10kV units). Adjust R172 on PCB 100 for output voltage of exactly 1000 volts (10, 0000 volts for 10kV units).

Readjust the VOLTS dial set to 10 volts (with the VOLTS switch still at zero). Adjust R171 for an output voltage of 10 volts. Set all front panel voltage controls for maximum output voltage and re- adjust r172 if necessary.

Adjustment is now complete. The following performance tests are used to determine that the unit meets all specifications.

4.7 PERFORMANCE TESTS

4.8 Check to assure that the procedures in Section 4.4 above have been followed.

Turn the front panel output VOLTS controls fully clockwise until the reading on the digital voltmeter indicates maximum output for the power supply.

Connect one end of the high voltage load resistor to ground and the other end to the shorting stick. Then, with the shorting stick, connect the load resistor across the HIGH VOLTAGE OUTPUT and observe the change in output voltage. During this no load to full load test. The digital voltmeter reading should not change by more than 0.002%.

With the load connected as above, observe the ac ripple voltage on the oscilloscope. The ripple should be less than the specified peak-to-peak ripple under this condition of full load and maximum output voltage.

For the models 313, 315, 320N, AND 320P, vary the autotransformer to produce ac line input change of $\pm$ 10% to the power supply and again observe the change in digital voltmeter reading. This change should be less than 0.001%.

Additional line and load regulation and ripple measurements may be performed at other voltage levels using the same procedure outline above. This should be usually necessary. Satisfactory test data at maximum output voltage and the full range of voltage control generally indicate that satisfactory test data will be obtained at all voltage levels, How ever full range testing is performed at the factory on each unit prior to shipment.

4.9 TROUBL-SHOOTING PROCEDURES

4.10 A NIM series High Voltage Power Supply consists of one easily replaceable plug in printed circuit board and a main chassis assembly, which includes the high voltage circuitry. The basic trouble-Shooting procedure consists of determining which of these assemblies is defective. Removal of the two side covers provides access to the printed circuit board and high voltage components. The printed circuit board is secured by a supporting bracket.

No further disassembly is required for trouble-shooting purposes. ONCE THE COVER HAS BEEN REMOVED EXTREME CAUTION MUST BE EXCERCISED AS POTENTIALLY DANGEROUS VOLTAGES ARE ACCESSIBLE. Make sure all test instruments are grounded, either to the high voltage connector shield or directly to the chassis, prior to the application of input power to the unit. The following procedures should then be followed.

4.11 For the models 313, 315, 320N, and 320P, remove PCB 100 from the unit. This leaves only the low voltage B+ and the unregulated $\pm$20 volt power supplies operable. Turn on ac line power and measure the dc voltage obtained at the positive terminal of capacitor C21 located above the power transformer. This voltage or capacitor is probably defective. If the B+ supply is operating properly, check for the unregulated $\pm$20Vdc output accessible at terminals 10 and 11 respectively of T-1. The $\pm$ voltages should be of equal magnitude to with 5% and within the range of 16 to 24 Vdc. If the magnitude and tracking are not within the range specified this circuitry is probably defective.

4.12 For the models 301, 303, 305, 310 and 310P, determine that the $\pm$12 Vdc and $\pm$24Vdc obtained from the NIM bin are operating properly.

4.13 If all the low voltage power supplies are operating properly, turn off input power, insert PCB 100, Turn all voltage controls to zero, follow the PREPARTION FOR MEASURMENT procedure outlined in Section 4.3, and turn the line power back ON.

If output voltage can be obtained, but the unit does not properly regulate or the front panel control does not operate properly, PCB 100 is probably defective.

If no output voltage is obtainable, test for ac drive to the base of transistor Q1 or Q2 located on the rear of the unit. If drive is present, the high voltage assembly or transistors Q1 and/or Q2 are probably defective.

The plug-in board, PCB100 can be repaired in the field or returned to the factory for repair or replacement. Spare boards which are completely assembled and tested can be obtained from the factory. Specify model number and serial number in all correspondence with factory. It is recommended that the entire unit be returned to the factory for the repair of the high voltage assembly.

Spellman High Voltage Electronics Corporation warrants this instrument to be free from defects in materials and workmanship for a period of one year from the original date of shipment. This warranty does not apply to equipment that has been subjected to misuse or which has been repaired or altered in any way by the user. Spellman High Voltage is responsible only for the cost of materials and labor to repair or replace FOB our factory products proved to be defective during the warranty period. We are not liable for consequential damages incurred due to failure of this equipment. No other warranty is expressed or implied. All products returned under warranty must be shipped prepaid to the factory with documentation describing the malfunction noted. It is recommended that the factory be notified prior to shipment. The equipment will be evaluated, repaired, or replaced and promptly returned if the warranty claims are substantiated. A nominal service charge will be made for unsubstantiated claims. Include Spellman High Voltage model number and serial number in all correspondence with the factory.

“ MANUAL MAY NOT REFLECT LATEST REVISIONS”

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THIS SECTION FOR: 315, 315 SERIES

THIS UNIT CONTROLS HAZARDOUS VOLTAGES. DO NOT APPLY INPUT POWER UNLESS ADEQUATE GROUNDING IS PROVIDED TO THE POWER SUPPLY AND THE HIGH VOLTAGE OUTPUT HAS BEEN PROPERLY CONNECTED.

THE DATA CONTAINED IN THIS MANUAL IS SUBJECT TO CHANGE WITHOUT NOTICE. WRITTEN PERMISSION FROM SPELLMAN HIGH VOLTAGE IS REQUIRED PRIOR TO THE REPRODUCTION OF ANY TECHNICAL DATA CONTAINED IN THIS MANUAL.

SECTION I: INTRODUCTION

1.1 PURPOSE OF EQUIPMENT

The NIM series consists of a family of regulated precision high voltage power supplies. Each model is housed in a standard AEC NIM module, high x2.7" wide, for insertion into a standard AEC NIM bin. The high stability and low noise inherent in the NIM series makes these units ideally suited as a high voltage source for sensitive nuclear detectors.

1.2 DESCRIPTION

Models 313B and 315 utilize 115/230V, 50-400Hz line input power.

All of the electronic circuitry is mounted on one plug- in printed circuit board and on the high voltage and chassis assembly. A NIM is a totally solid state, mechanically rugged and electrically reliable assembly. Conservatively rated components are utilized throughout. Correctly operated, it will perform over long periods of time with minimum maintenance and down time.

A NIM is a fully enclosed unit. INPUT POWER, the HIGH VOLTAGE OUTPUT connector, the REMOTE PROGRAMMING INPUT connector, and the LOCAL/REMOTE PROGRAM switch are accessible at the rear panel of the unit. The ON/OFF switch VOLTAGE CONTROL and LED indicator lights are on the front panel.
The 115/230 LINE VOLTAGE selector switch (model 313B, 315) is on the bottom panel.

1.3 SPECIFICATIONS

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	RIPPLE pk-pk	RESOLUTION & SETABILITY	INPUT POWER option
313B	0 to ±3000	10 mA	10 mV	200 mV	C
315	0 to ±5000	5 mA	25 mV	200 mV	C

CAUTION: THIS UNIT PRODUCES HAZARDOUS VOLTAGE. DO NOT APPLY LINE VOLTAGE INPUT UNLESS ADEQUATE GROUND IS CONNECTED TO THE POWER SUPPLY AND THE HIGH VOLTAGE OUTPUT HAS BEEN APPRIATELY CONNECTED.

SECTION II OPERATION

2.1 INPUT POWER

Models 313B and 315are provided with the standard three conductor ac line cord. A recessed switch on the bottom panel is used to select either 115 V or 230 V line voltage operation. **DO NOT OPERATE THE UNIT UNTIL IT IS DETERMINED THAT THE SELECTOR SWICTH IS SET FOR THE PROPER LINE VOLTAGE.**

2.2 POLARITY

Models 313B and 315 are reversible polarity. A screwdriver operated POLARITY selector switch is located on the top of the instrument. The setting of the POLARITY switch is indicated by illumination of either the POSITIVE or NEGATIVE LED indicator on the front panel.

LINE INPUT POWER MUST BE TURNED OFF AND THE HIGH VOLTAGE OUTPUT SHOULD BE DISHARGED TO GROUND AT THE OUTPUT CONNECTOR BEFORE REVERSING POLARITY.

2.3 HIGH VOLTAGE OUTPUT

The HIGH VOLTAGE OUTPUT connector is located on the rear panel.

2.4 PROGRAMMING

PROGRAM switch on the rear panel selects either LOCAL or REMOTE programming of the output high voltage. When this switch is in the LOCAL position, the front panel controls determine the output voltage, independent of any programming input voltage. When this switch is in the REMOTE position, the front panel controls have no effect on the output voltage and need not, therefore, be returned to zero.

2.5 LOCAL

With the PROGRAM switch set to local, the output voltage is read directly from the sum of the dial settings on the front panel. A continuous ten turn digital directly reads from 0 to 1000 volts with a resolution of 0.2 volts on all units in the NIM series except for the 10kV models.

A 500 volt selector switch, with up to nine steps positions as appropriate, is used on the models 313B, and 315.

The output voltage is the sum of the dial settings as described above. The polarity is as set by the polarity switch.

2.6 REMOTE

With the PROGRAM switch set to REMOTE, a 0 to –5 volts programming voltage input supplied to the BNC PROGRAM jack will linearly vary the output high voltage from zero to maximum volts. The polarity is as set by the POLARITY selector switch.

2.7 METER

The model 313B includes a front panel meter which provides a coarse indication of the output voltage. Precise output voltage settings are derived from the calibrated voltage controls dials.

SECTION III. THEORY

3.1 FUNCTIONAL DESCRIPTION

The NIM series is basically a dc-dc converter which converts low voltage dc power to a high voltage dc output. This output voltage is high regulated and filtered and can be varied either by the front panel VOLTS controls or through the REMOTE PROGRAM input on the rear panel.

The input to the dc-dc converter is obtained from internal low voltage power supplies power by the ac line input in the models 313B and 315 (See figure 1 & 2).

An oscillator determines the high frequency (approximately 20 kHz) at which all amplification, high voltage transformation, rectification, and filtering occurs, the amplification is a function of a control voltage which performs the function of control and regulation. A sample of the output voltage is compared against a reference voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed high voltage output.

3.2 CIRCUIT DESCRIPTION

On the models 313B and 315 the input ac line is connected to the B+ (36V dc) supply and regulated +12 V low voltage power supplies. The B+ supply is a simple full wave bridge rectifier circuit. The regulated low power supply circuits ($\pm$ 12 V) are standard regulator IC circuits (IC 121 and 122) on PCB 100.

The output of the oscillator circuit (IC 102B) is amplified in the AGC integrated circuit, IC 105. The gain of the IC 105 is a function of the control voltage developed at the output of the amplifier IC 102A. The output of IC 105 drives the power transistors, Q1 and Q2.

The encapsulated high voltage assembly includes a high voltage power transformer, rectifier circuit, ripple filter, and sensing circuit. These are all critical custom designed and encapsulated components. It is recommended that trouble-shooting be avoided by personnel who are not thoroughly familiar with highly regulated high voltage techniques.

A sample of the high voltage dc output is fed to the sensing circuit and is compared to a

referenced voltage. The sensing circuit consists of differential operational amplifier IC101. Output voltage control is obtained by varying the command voltage fed to IC102A. This command voltage is controlled by the front panel output VOLTS controls when the rear panel programming switch is in LOCAL position.

IC103A and potentiometer R11 (front panel VOLTS control) provide a continuous linear command variation appropriate for obtaining a 0 to 1000 voltage output (0 to 10, 000 voltage output for 10kV units). The front panel 500V control provides incremental step changes in the command voltage appropriate for obtaining incremental output variations of 500V. IC103B sums the effect of the voltage controls.

IC104 and reference diode CR101 perform the generation, control and buffering of the –5V internal reference voltage.

SECTION IV. MAINTENANCE

CAUTION: THIS UNIT PRODUCES HAZARDOUS VOLTAGE. DO NOT APPLY LINE VOLATGE INPUT UNLESS ADQUATE GROUND IS CONNETCED TO THE POWER SUPPLY AND THE HIGH VOLATGE OUTPUT HAS BEEN APPROPRIATELY CONNECTED.

4.1 TEST EQUIPMENT REQUIRED

The test equipment required to test and maintains a NIM series supply is listed as follows (equivalents may be used):

a. Oscilloscope
b. Digital or differential voltmeter
c. Variable autotransformer, General Radio Model W2
d. High impedance, high voltage 1000: 1 precision dc voltage divider
e. Capacitive coupled ac viewing circuit
f. High voltage load resistor rated for maximum voltage and current of the NIM supply
g. High voltage shorting stick

4.2 PREPARATION FOR MEASUREMENTS

Connect the HIGH VOLATGE OUPUT of the NIM supply to the high voltage terminal of the dc voltage divider and to the capacitor input of the ac viewing circuit. The low voltage terminal of the divider should be connected to the ground is connected to all instruments, viewing circuits and the MODEL NIM. After the ground has been checked, adequate safety precautions have been taken, and the output VOLTS controls set at zero, input power can be applied. For the NIM series 313, and 315, the ac input should be applied thru the variable auto transformer, which should be initially set for 115V or 230V output, as appropriate.

4.3 ADJUSTMENTS

With the VOLTS switch (where appropriate) set at zero, adjust the VOLTS dial to read 1000 volts (10, 000 volts for 10kV units). Adjust R172 on PCB 100 for output voltage of exactly 1000 volts (10, 0000 volts for 10kV units).

Readjust the VOLTS dial set to 10 volts (with the VOLTS switch still at zero). Adjust R171 for an output voltage of 10 volts. Set all front panel voltage controls for maximum output voltage and re- adjust r172 if necessary.

Adjustment is now complete. The following performance tests are used to determine that the unit meets all specifications.

4.4 PERFORMANCE TESTS

Check to assure that the procedures in Section 4.4 above have been followed.

Turn the front panel output VOLTS controls fully clockwise until the reading on the digital voltmeter indicates maximum output for the power supply.

Connect one end of the high voltage load resistor to ground and the other end to the shorting stick. Then, with the shorting stick, connect the load resistor across the HIGH VOLTAGE OUTPUT and observe the change in output voltage. During this no load to full load test. The digital voltmeter reading should not change by more than 0.002%.

With the load connected as above, observe the ac ripple voltage on the oscilloscope. The ripple should be less than the specified peak-to-peak ripple under this condition of full load and maximum output voltage.

For the models 313 and 315 vary the autotransformer to produce ac line input change of ± 10% to the power supply and again observe the change in digital voltmeter reading. This change should be less than 0.001%.

Additional line and load regulation and ripple measurements may be performed at other voltage levels using the same procedure outline above. This should be usually necessary. Satisfactory test data at maximum output voltage and the full range of voltage control generally indicate that satisfactory test data will be obtained at all voltage levels, How ever full range testing is performed at the factory on each unit prior to shipment.

4.5 TROUBLE-SHOOTING PROCEDURES

A NIM series High Voltage Power Supply consists of one easily replaceable plug in printed circuit board and a main chassis assembly, which includes the high voltage circuitry. The basic trouble-Shooting procedure consists of determining which of these assemblies is defective. Removal of the two side covers provides access to the printed circuit board and high voltage components. The printed circuit board is secured by a supporting bracket.

No further disassembly is required for trouble-shooting purposes. ONCE THE COVER HAS BEEN REMOVED EXTREME CAUTION MUST BE EXCERCISED AS POTENTIALLY DANGEROUS VOLTAGES ARE ACCESSIBLE. Make sure all test instruments are grounded, either to the high voltage connector shield or directly to the chassis, prior to the application of input power to the unit. The following procedures should then be followed.

For the models 313 and 315 remove PCB 100 from the unit. This leaves only the low voltage B+ and the unregulated ±20 volt power supplies operable. Turn on ac line power and measure the dc voltage obtained at the positive terminal of capacitor C21 located above the power transformer. This voltage or capacitor is probably defective. If the B+ supply is operating properly, check for the unregulated ±20Vdc output accessible at terminals 10 and 11 respectively of T-1. The ± voltages should be of equal magnitude to with 5% and within the range of 16 to 24 Vdc. If the magnitude and tracking are not within the range specified this circuitry is probably defective.

If all the low voltage power supplies are operating properly, turn off input power, insert PCB 100, Turn all voltage controls to zero, follow the PREPARATION FOR MEASURMENT procedure outlined in Section 4.2, and turn the line power back ON.

If output voltage can be obtained, but the unit does not properly regulate or the front panel control does not operate properly, PCB 100 is probably defective.

If no output voltage is obtainable, test for ac drive to the base of transistor Q1 or Q2 located on the rear of the unit. If drive is present, the high voltage assembly or transistors Q1 and/or Q2 are probably defective.

The plug-in board, PCB100 can be repaired in the field or returned to the factory for repair or replacement. Spare boards which are completely assembled and tested can be obtained from the factory. Specify model number and serial number in all correspondence with factory. It is recommended that the entire unit be returned to the factory for the repair of the high voltage assembly.

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THIS SECTION FOR: 323 AND 325

SECTION I GENERAL DESCRIPTION

1.1 PURPOSE OF EQUIPMENT

The Spellman NIM Modules are precision high voltage power supplies, designed for use in sensitive nuclear detectors.

1.2 DESCRIPTION

Each unit converts applied power to a high voltage DC output. The high voltage output is high regulated and filtered. Polarity reversal is achieved by a screwdriver operated POLARITY selector switch. The output can be controlled by means of the front panel multi-turn potentiometer or via a remote analog signal. The front panel mounted LCD digital meter provides accurate monitoring of either the output voltage or current.

The power supply is housed in a standard AEC NIM dual width module powered from an 115/230Vac, 50-60 Hz single-phase line. Input power is applied via a captive line cord terminated with a standard NEMA male connector.

SECTION II. INSTALLATION

2.1 INSTALLATION

The NIM Series is a family of regulated high voltage power supplies that conform to AEC Standards for insertion into a NIM bin. Each unit is a double width module, secured by means of captive front panel screws. Input power is obtained from an 115/230Vac source via the captive line cord

A screwdriver operated POLARITY selector switch is located on the top of the instrument. The setting of the POLARITY switch is indicated by the illumination of either the POSITIVE or NEGATIVE LED indicator on the front panel when the unit is energized.

LINE INPUT POWER MUST BE TURNED OFF AND THE HIGH VOLTAGE SHOULD BE DISCHARGED TO GROUND AT THE OUTPUT CONNECTOR BEFORE REVERSING POLARITY.

Set the LOCAL/REMOTE switch on the rear panel to LOCAL if the front panel control is desired. If remote control operation is required, set the switch to REMOTE, and connect the programming signal input at the rear panel to the remote program connector. The high voltage output connector must be properly terminated before the power supply is turned on.

SECTION III. OPERATION

3.1 OPERATION

The operation of the power supplies is controlled and monitored by the meter, switches, indicators, and connectors located on the front and rear panels. Remote or local control operation can be selected and the operation fully monitored.

The models feature accurate local and remote output voltage control. The units are short circuit and arc protected along with a current limit circuit, which will fold back to approximately 50% of maximum when an output current greater than 120% of maximum is detected. The output voltage will automatically recover upon removal of the overload condition.

3.2 FRONT PANEL CONTROLS, METERS, AND INDICATORS

3.2.1 DIGITAL PANEL METER

The front panel LCD digital meter is switch selectable to display either output voltage or current.

3.2.2 ON/OFF SWITCH

The toggle switch provides ON/OFF control of the power supply.

3.2.3 HIGH VOLTAGE CONTROL

A multi-turn potentiometer and calibrated dial set the output voltage for the power supply in the local operating mode.

3.3 REAR PANEL SWITCH AND CONNECTORS

The rear panel contains the input power line cord, the high voltage output connector, remote control input connector, and the REMOTE/LOCAL control selector switch.

3.3.1 HIGH VOLTAGE OUTPUT CONNECTOR

The high voltage output connector for the high voltage power supply is located at the top of the rear panel. See section 1.4 for the appropriate output connector and mating connector part numbers.

3.3.2 REMOTE /LOCAL SWITCH

The toggle switch select remote or local mode of operation for the power supply.

3.3.3 REMOTE INPUT CONNECTOR

A BNC type connector is provided for remote control input. Input impedance is 2-mega ohms minimum. See section 1.4 for appropriate input connector and mating part numbers.

3.3.4 INPUT POWER CORD

A standard 115/230Vac source provides power via a captive 3-wire line cord terminated with a standard NEMA male connector. The unit is initially set for 115V line operation and is fused for 1 Ampere.

SECTION IV. THEORY OF OPERATION

4.1 GENERAL

The unit consists of a plug-in printed circuit board and an encapsulated high voltage assembly. The Schematic Block Diagram (DWG. 207467) clearly shows the interconnections and functions of all major assemblies and circuits. The control PC Board schematic, DWG. 207892, identifies all functions performed by the circuits contained on this assembly.

4.2 FUNCTIONAL DESCRIPTION

The high voltage power supply is basically a DC_DC converter, which converts low voltage DC power to a high voltage DC output. This output is highly regulated and filtered, and can be varied. The DC input to the converter is obtained from the internal low voltage power supplies powered by the ac line cord.

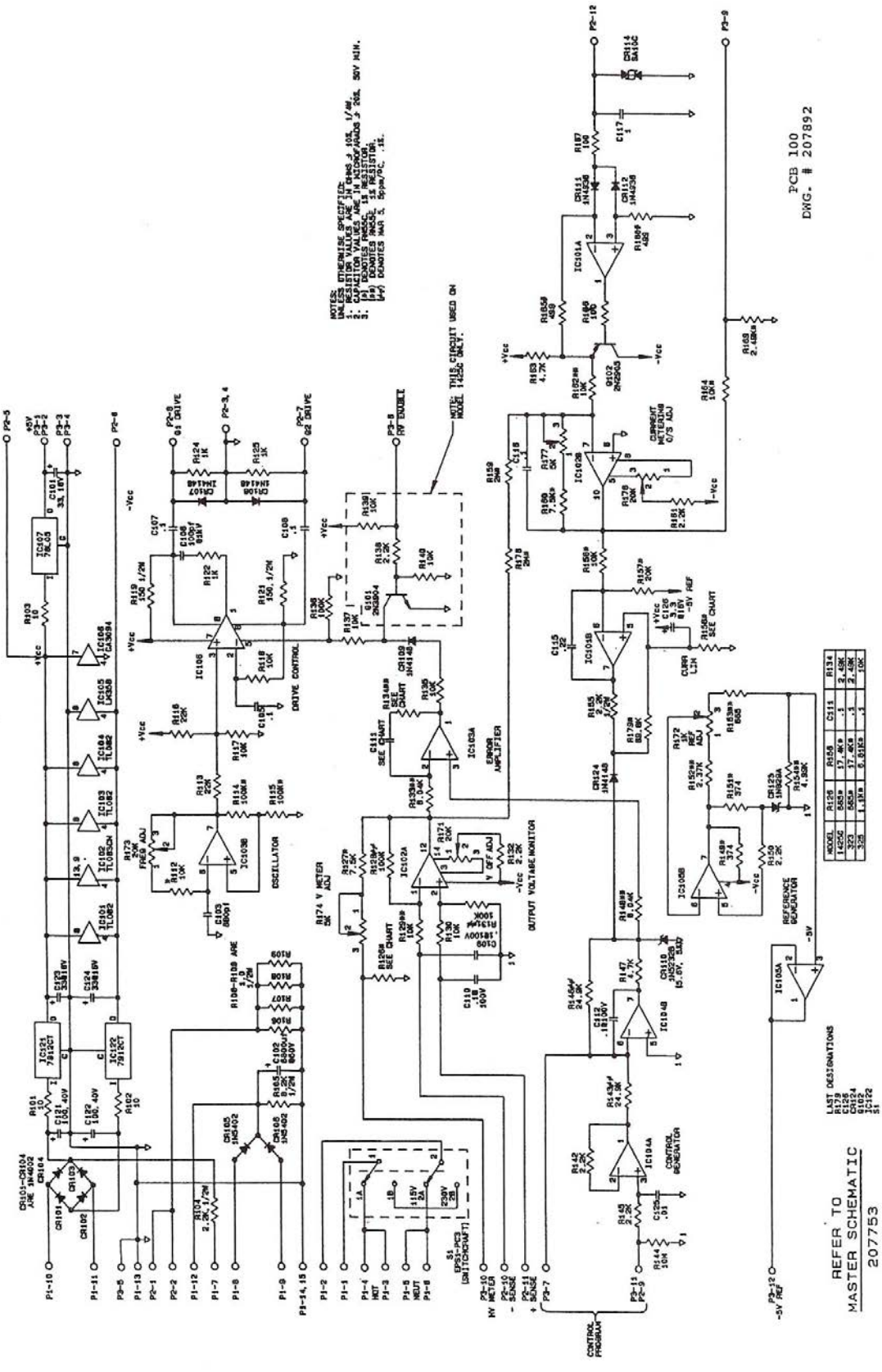
An internal oscillator determines the high frequency (approximately 20kHz) at which all amplification, high voltage transformation, rectification and filtering occurs. The amplification is controlled by a circuit, which performs the function of control and regulation.

A sample of the output high voltage is compared to a command voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed high voltage output. The output current is sensed, and over load condition will cause the output voltage to fold back to a safe level until the overload is removed.

SECTION V SERVICE AND REPAIR

5.1 GENERAL

The high voltage power supply should not require any maintenance or calibration. It is designed for reliable, trouble free operation. If any question should arise, contact Spellman's Customer Service Department for assistance or return authorization. Although adequate information is provided in the schematics included with this manual and in Section 4, it is suggested that the unit be returned to the factory if service should become necessary.


PCB 100
DWG. # 207892
REFER TO
MASTER SCHEMATIC
207753

INSTALLAION

AND

OPERATING

INSTRUCTION MANUAL

MODELS

323 and 325

WARNING

THIS UNIT CONTROLS HAZARDOUS VOLTAGES. DO NOT APPLY
INPUT POWER UNLESS ADEQUATE GROUNDING IS PROVIDED
TO THE POWER SUPPLY AND THE HIGH VOLTAGE
OUTPUT HAS BEEN PROPERLY CONNECTED.

WARRANTY

Spellman High Voltage warrants this instrument to be free from defects in material and workmanship for a period of one year from the date of shipment. This warranty does not apply to equipment that has been subjected to misuse or which has been repaired or altered in any way by the user. Spellman High Voltage is responsible only for the cost of materials and labor to repair or replace, FOB our factory, products proved to be defective during the warranty period. We are not liable for consequential damages incurred due to failure of this equipment. No other warranty is expressed or implied. All products returned under warranty must be shipped prepaid to the factory with documentation describing the malfunction noted. It is recommended that the factory be notified and a Return Authorization Number be obtained prior to shipment. The equipment will be evaluated, then repaired or replaced and promptly returned if the warranty claims are found to be substantiated. A nominal service charge will be made for any unsubstantiated claims. Included the Spellman High Voltage Model and Serial number in all correspondence with the factory.

THE DATA CONTAINED IN THIS MANUAL IS SUBJECT TO CHANGE WITHOUT NOTICE. WRITTEN PERMISSION FROM SPELLMAN HIGH VOLTAGE IS REQUIRED PRIOR TO THE REQUIRED PRIOR TO THE REPRODUCTION OF ANY TECHNICAL DATA CONTAINED IN THIS MANUAL. IM: 0007

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1.3 ELECTRICAL SPECIFICATIONS

Input Power:	115/230Vac +/-10%, 50 – 60Hz single phase	
Output Power:	Model 323	0 to 3000V @ 0 to 10mA
	Model 325	0 to 5000V @ 0 to 5 mA
Control:	Multi-turn precision potentiometer and indicator dial.	
Accuracy:	0.25% of setting plus 0.05% of maximum voltage plus resolution.	
Resolution:	The maximum voltage control error due to control resolution and reset ability is 6 volts.	
Programming:	0 to –5V corresponds to maximum output voltage via rear panel BNC connector. Program input impedance is 2 mega ohms minimum.	
Load Regulation:	0.002% for NL – FL and FL – NL	
Line Regulation	0.001% for a +/-10% line change	
Ripple:	Model 323	10mV peak-to –peak
	Model 325	25mV peak-to-peak
Temp Coeff:	50ppm/°C over the range of 0 to 50° C	

Stability:	.01%/hour, .02%/8hours after initial warm-up.
Meter Accuracy:	output voltage +/-0.5% of full scale plus 10V output current +/-0.5% of full scale plus 10*u*A
Protection:	Short circuit and arc protected, and current limiting

1.4 MECHANICAL SPECIFICATIONS

Size:	Double width standard NIM module. 2.7”W x 8.7”H x 9.7”D (69 x 221 x 246mm).
Weight:	11 pounds (5.0kg)
Connectors:	HV Output – Rear panel SHV connector. (Kings 1707-1 mates with 1705-1) Remote Programming – BNC connector. (UG 290/U mates with UG 88/U) (Mating connectors must be ordered separately)

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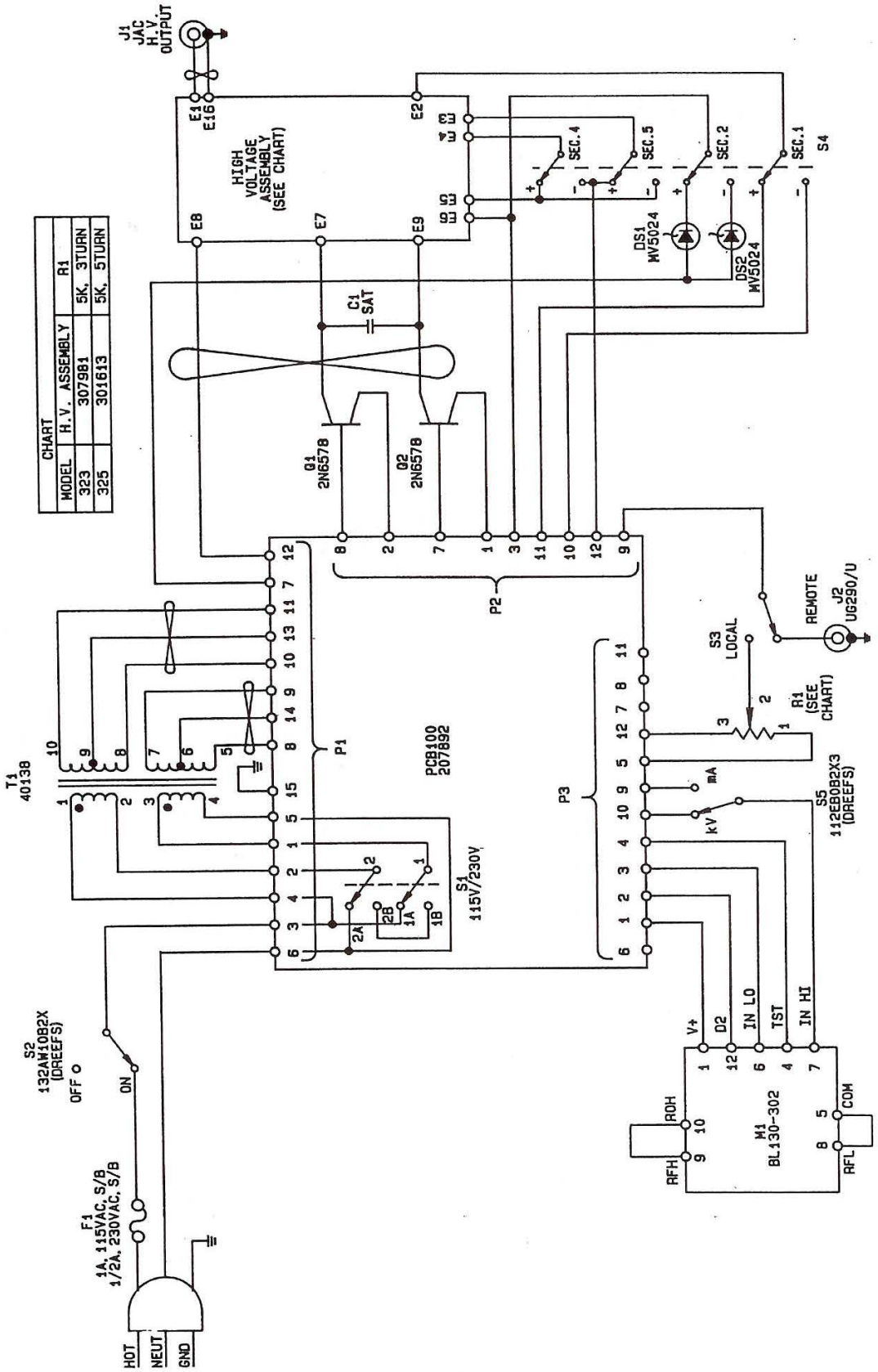
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SECTION V SERVICE AND REPAIR

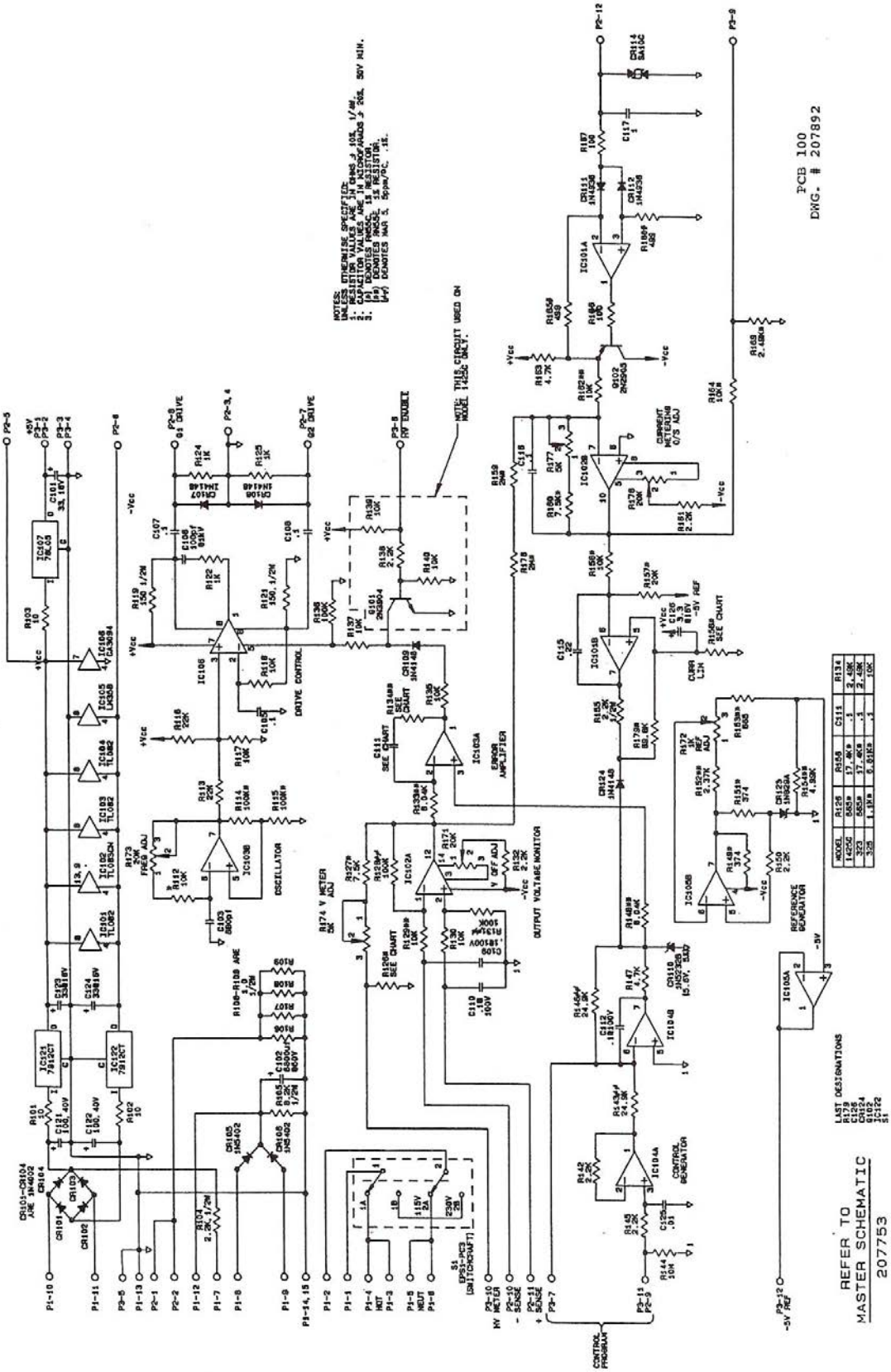
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880509
HSB



SCHEMATIC BLOCK DIAGRAM
DWG. # 207467


PCB 100
DWG. # 207892
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