PLANET-B

NAG5-2918

FINAL REPORT

Technical Notes
and
Drawings

July 25, 1996

George R. Carignan
Space Physics Research Laboratory
University of Michigan
2455 Hayward St.
Ann Arbor MI 48109-2143

24-Aug-95

To: K. Arnett, B. Block, J. Eder, L. Frost, S. Battel

From: J. Maurer

Subj: Planet-B NMS FB ±75V Bias Transformer

The design of the transformer designated as T101 (061-0351) in the Filament/Bias module (061-0119) in the Planet-B NMS instrument was verified because of the differences from the GCMS and INMS instrument designs. A breadboard of a representation of the Hybrid 2301065, Bias Drive A driving a 2N3700 NPN transistor, with dual 75V secondaries, with loads, was used to test the circuit. See attached drawing 061-0356A.

The initial transformer design that was wound with bifilar secondaries was too unstable to test. The second 1408 transformer with a split bobbin and the feedback winding below the primary was also found to be unstable. (It was nearly impossible to keep the circuit from squeeging).

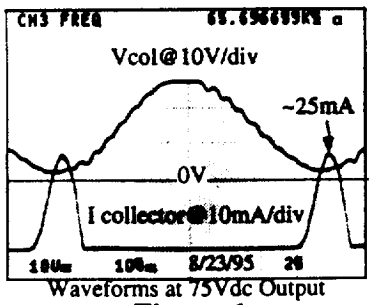
The third transformer tested was wound as shown on attached drawing 061-0351, Rev —, Date 24-Aug-95. This transformer has the feedback on the outside of the resonant winding. The primary goal of the design was to have as tight of magnetic coupling as possible to the resonant winding, and as loose of coupling as possible to the primary. Further, the circuit AC ground is connected to the winding at the feedback end of the secondary winding. See drawing.

This transformer proved to be very stable – it is virtually impossible to make this design squeg.

An emitter resistor (R129A) was added to this circuit, as referenced to the GCMS design, to protect Q102 from thermal runaway in the event of a turnon with a non-resonate circuit or load short. This was verified to protect Q102 for at least 30 seconds in the event of a short. Approximately 1% of the 41mW input power is lost in this protection resistor under normal operation.

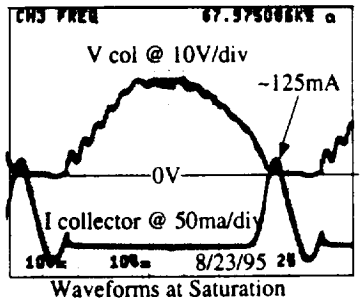
The circuit was verified to operate normally when a radiated Q102 (2N3700), (low Beta) transistor was substituted for the normal 2N3700. It should be noted that the monitored drive voltage went to approximately 2.7V with this low gain transistor.

Waveforms



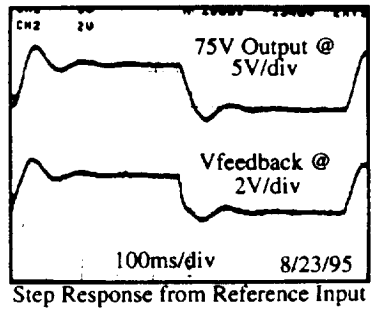
Waveforms at 75Vdc Output

Figure 1



Waveforms at Saturation

Figure 2



Step Response from Reference Input

Figure 3

Figure 1 shows the collector voltage and current at a controlled normal output of 75 volts. This is about 90% of maximum voltage output. The waveforms in Figure 2 are the same measurements, but with a maximum voltage output where the control loop overdrives the output transistor. Note the significantly greater current peak.

Figure 3 is the result of a small step applied to the input reference voltage. The ringing is due to the time constants that are designed into the hybrid that cannot be changed for this circuit.

TECHNICAL NOTES

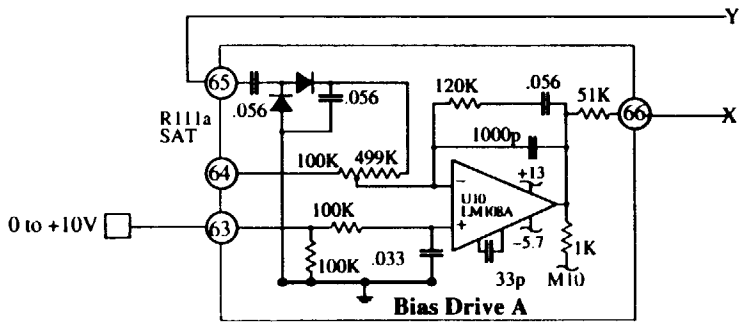
Measured Values

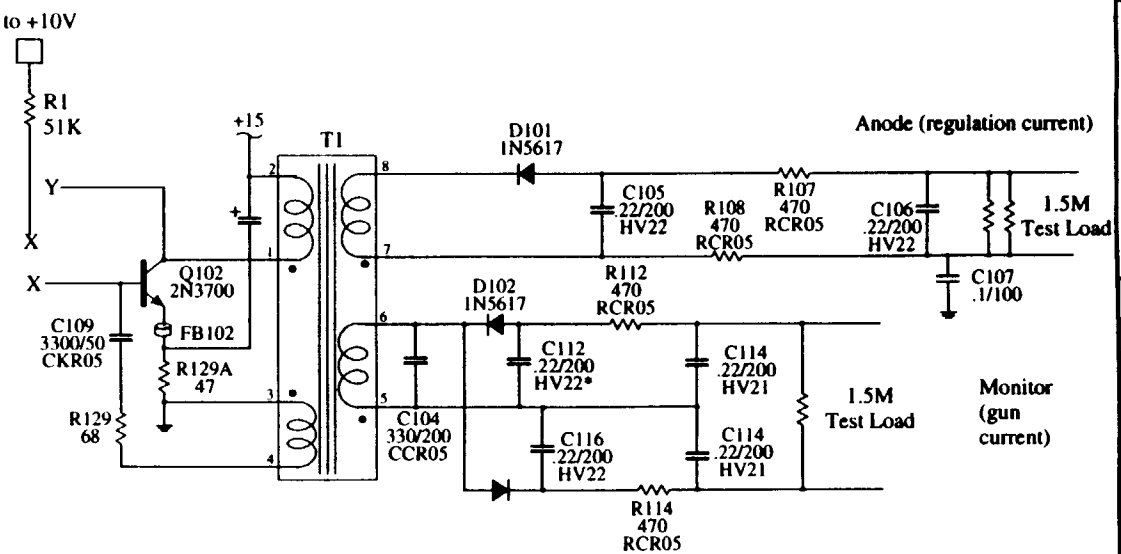
Frequency with 3300pF cap:	72KHz
Input Current at 15.0V	**2.73 mA**
Output voltage:	75V
Load Resistance:	1.5M (All windings)
Common Mode noise to gnd, 7-8:	**.03mv** AC RMS (Control/Anode)
Output noise, 7-8:	.8mv AC RMS
Common Mode noise to gnd, 5-6:	.2mv AC RMS (Monitor/Emission)

Attachments

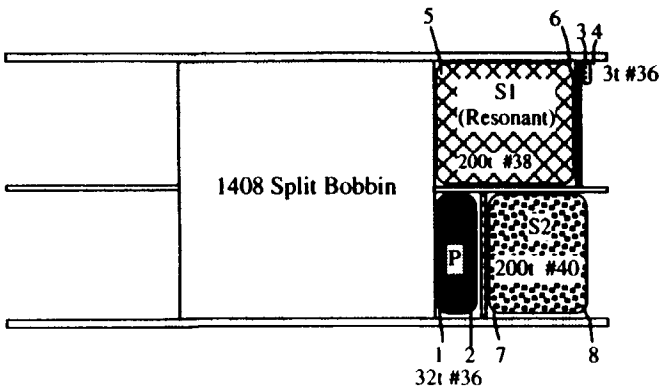
Dwg. 061-0356, Rev. A, 24-Aug-95, Pg. 5.38

Dwg. 061-0351, Rev. –, 24-Aug-95, Pg. 5.22





"A" Transformer Configuration



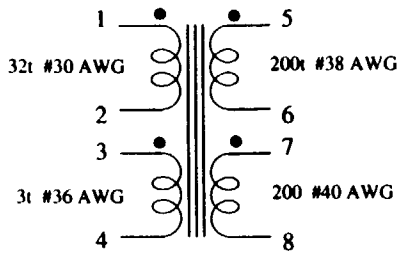
Space Physics Research Laboratory College of Engineering University of Michigan		FB ±75V Bias Test Oscillator Circuit Planet – B NMS			
061-NMS	0TK63	J0356A-Bias Test Osc A	061- 0356	A	

	24-Aug-95 JM
A	Not Released
–	03-Aug-95 O. Bayl
RELEASE	Not Released
DRAWN	copied 5-May-95 Jm
COG ENG	Maurer

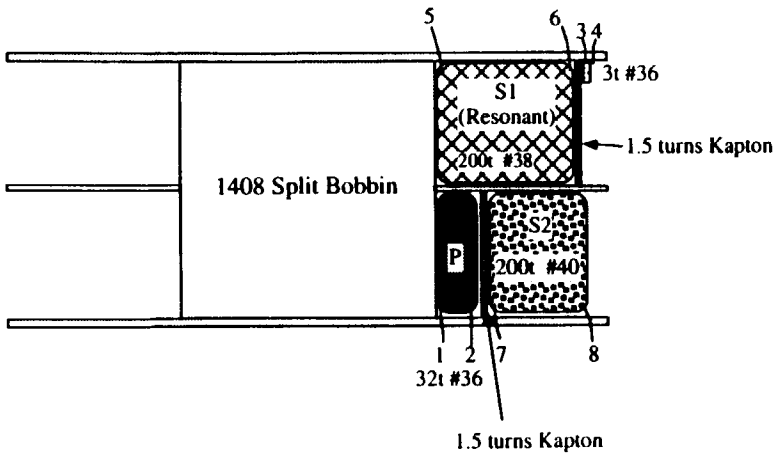
Printed: 8/24/95 12:56 PM

LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	1408PA250-3B7	Philips Magnetic Core
2	1	1408F1D	Philips Plastic Bobbin
3	AR	EPON 815/V140	Encapsulate



NOTES:



Space Physics Research Laboratory College of Engineering University of Michigan	FB +/-75V Bias Transformer Filament Bias Supply Planet B - NMS		
061-NMS	0TK63	J0351-FB +/-75 Bias Xfrm.	061- 0351

RELEASE	24-Aug-95 jm
DRAWN	Not Released
COG ENG	O. Bayl
	S. Bame/ K. Arnett

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Drawing Page 5.22

22-Aug-95

To: K. Arnett, B. Block, J. Eder, L. Frost

From: J. Maurer

Subj: Filament Current Transformer Phasing

Overview

The S/Ns EM1, EM2, and FM1 Filament/Bias (FB) module current transformers were assembled with the phasing such that the positive (monitored) output occurred during the non-modulated (non-controlled) portion of the 50 kHz AC input. The DC value of the current monitor was observed to make a significant change in the DC value for a change in the filament voltage.

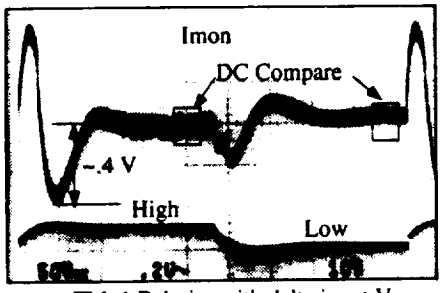
Measurements made on the GCMS KIWI breadboard unit confirmed that the breadboard had the same characteristics. When the phasing of the current transformer was reversed the voltage sensitivity was reduced by a factor of 4 or 5. Further, the negative voltage spike from the output of the current measurement circuit causing a shut down was approximately 1/2 as great when the phasing was reversed.

With either phasing the sensitivity to a change in the AC voltage and the unwanted spike can be significantly reduced by selecting the R101 trim resistor. With the "reversed" phasing the voltage sensitivity can be reduced to near zero.

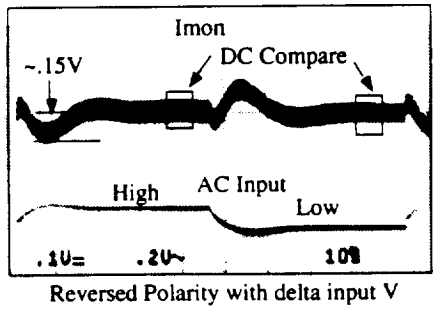
It was established that a change in the input AC power caused about the same effects as a change in the filament load voltage. A test procedure was established using a 5% modulation of the AC input voltage and monitoring the Imon output through the AMUX channel to select the best value for R101. The nominal value is about 18K which is approximately 20% greater than the sensitivity (positive) trim resistor.

Test Results

An unpotted, flight, filament magnetic assembly was used to verify the results from the KIWI magnetic assemblies. The following pictures were taken to illustrate typical waveforms.



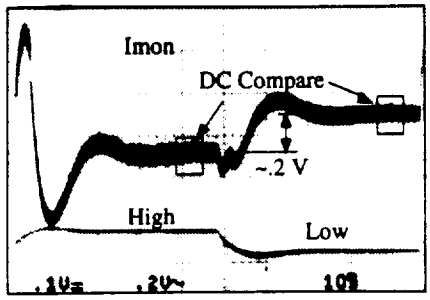
FM 1 Polarity with delta input V



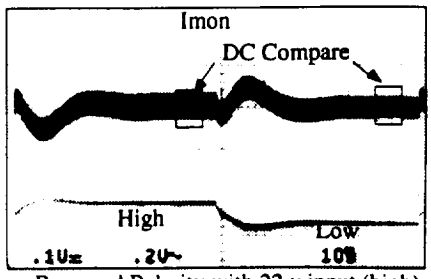
Reversed Polarity with delta input V

The above pictures show that the DC level shift with the "reversed" polarity is much less. Also that the spikes are significantly less in the "reversed" assembly. While an AC change of this magnitude is not expected in the finished system, the reduced sensitivity to noise spikes could prove to be significant.

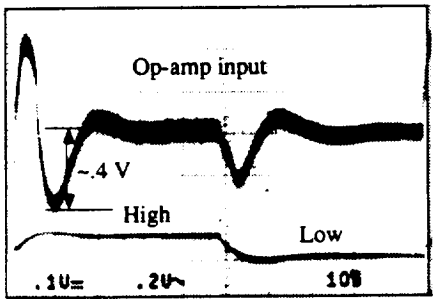
The current monitor is sensitive to the PWM off time. This is illustrated by changing the average AC input voltage. When the average AC input was increased by 1 volt, the sensitivities to a delta AC change is shown below.



FM 1 Polarity with 22 v input (high)

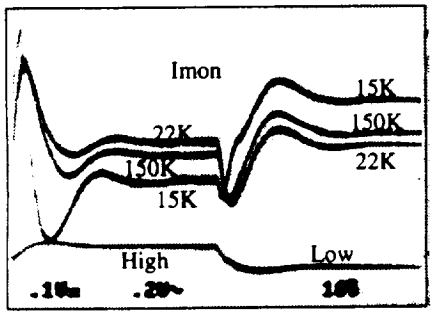


Reversed Polarity with 22 v input (high)



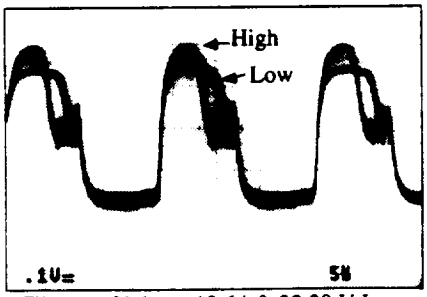
FM 1 Polarity input to op-amp

This picture was taken to show that the voltage through the coupling capacitor to the op-amp used to control the turnon current is the same as that measured on the plus side of the current monitor. The output of the AMUX was confirmed to be the same as these pictures except that the high frequency noise is filtered.



FM1 Polarity with delta R101 trim

This picture was taken as an aid in understanding the sensitivity to the R101 trim resistor. This resistor is a trim for the negative output of the Imon transformer. As can be seen if the R101 value is too low the voltage output is lower when the AC is high. If the trim value is too big of value, the voltage output is higher when the AC is high. It should be noted that this relationship is not linear and different AC deltas and average amplitudes will change the required value.

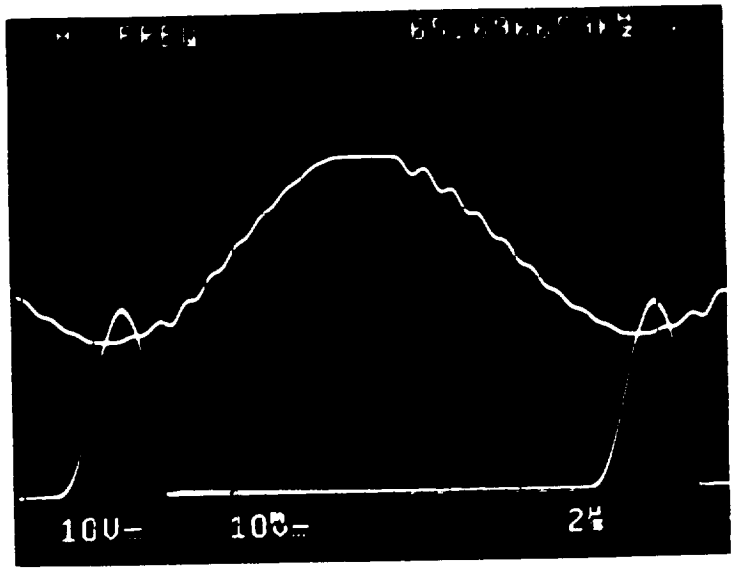


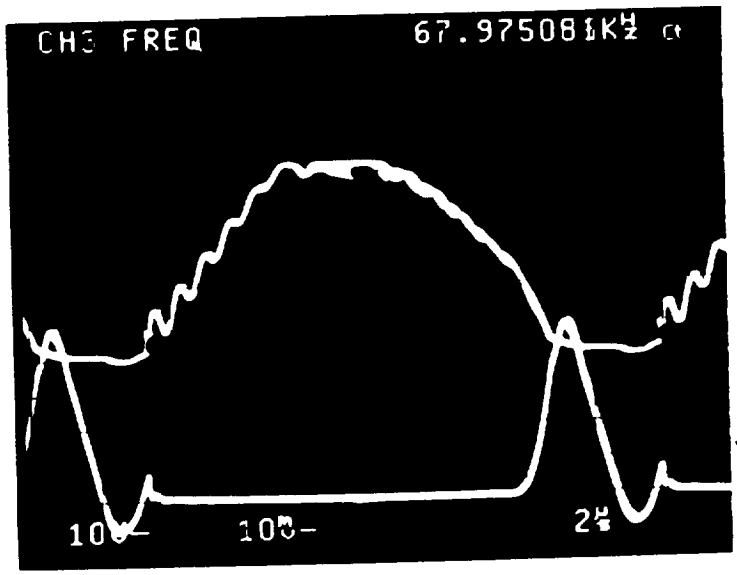
Filament Voltage 19.64 & 22.20 V Input

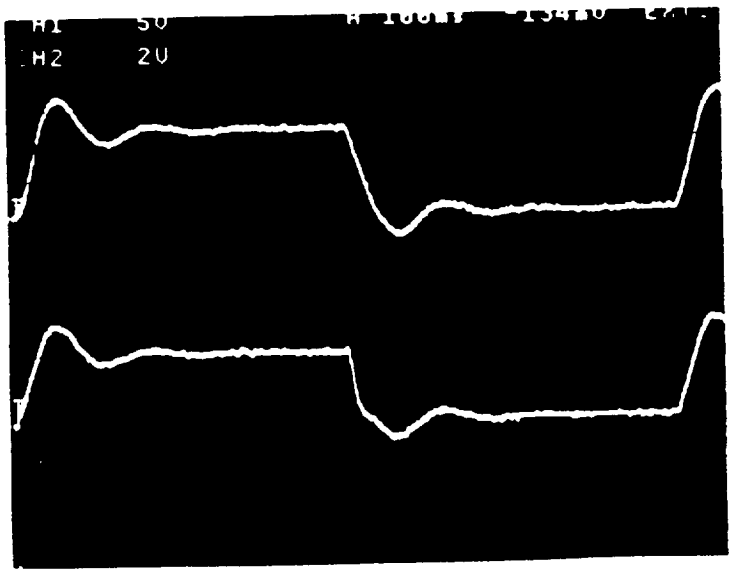
The AC amplitude was selected to cause an off time of 50% (of the positive or controlled half cycle), changing to about a 10% off time. This is consistent to the values selected and measured during the ion source tests at GSFC.

This picture shows the filament voltage change with the FM1 phasing and a 5% change in AC input.

061-3050







061-3051

THE UNIVERSITY OF MICHIGAN
SPACE PHYSICS RESEARCH LABORATORY
COLLEGE OF ENGINEERING
DEPARTMENT OF ATMOSPHERIC, OCEANIC AND SPACE SCIENCES

SPACE RESEARCH BUILDING
2455 HAYWARD STREET
ANN ARBOR, MICHIGAN 48109-2143

313-936-7775
313-763-5567 (FAX)
9102407554 (TELEX)

August 30, 1995

Mr. Steven H. Feng
Code 915.0
NASA Goddard Space Flight Center
Greenbelt, MD 20771

SUBJECT: Interface Requirements for Planet-B NMS RF/DC Supply

Dear Steve:

Please find enclosed a set of schematic drawings for the Control Board of the RF/DC Supply. We are building the breadboard version of the RF/DC to these prints. The interface to your digital logic is straightforward, as you can see.

The RF/DC Supply requires two sixteen-bit serial words to configure (these could be thirteen-bit words if you find that easier to implement). The AC word contains the twelve-bit AC amplitude code and a single bit denoting low or high frequency. The DC word contains the twelve-bit DC amplitude code. The thirteenth bit is ignored. The MSB of both AC and DC codes is shifted first. Each word is latched by a positive-going clock pulse on the appropriate enable line after each data word is shifted in. A low-going reset pulse loads zeroes into both the shift registers and latches. I would in principle send you a timing diagram, but I think that the interface is easy and the drawings speak for themselves.

To summarize:

AC Word

Bits 0 through 11 are AC amplitude data (MSB is bit 11);
Bit 12 is frequency datum (1=low frequency, 0= high frequency);
Bits 13 through 15 are not used (if sixteen bits are shifted);
Bit 15 is shifted first.

DC Word

Bits 0 through 11 are DC amplitude data (MSB is bit 11);
Bits 12 through 15 are not used (if sixteen bits are shifted);
Bit 15 is shifted first.

AC and DC Enables

Each data latch requires a positive-going enable after each data word is shifted into the input shift register.

Reset

A low level resets (and holds at reset) both the input shift registers and all data latches.

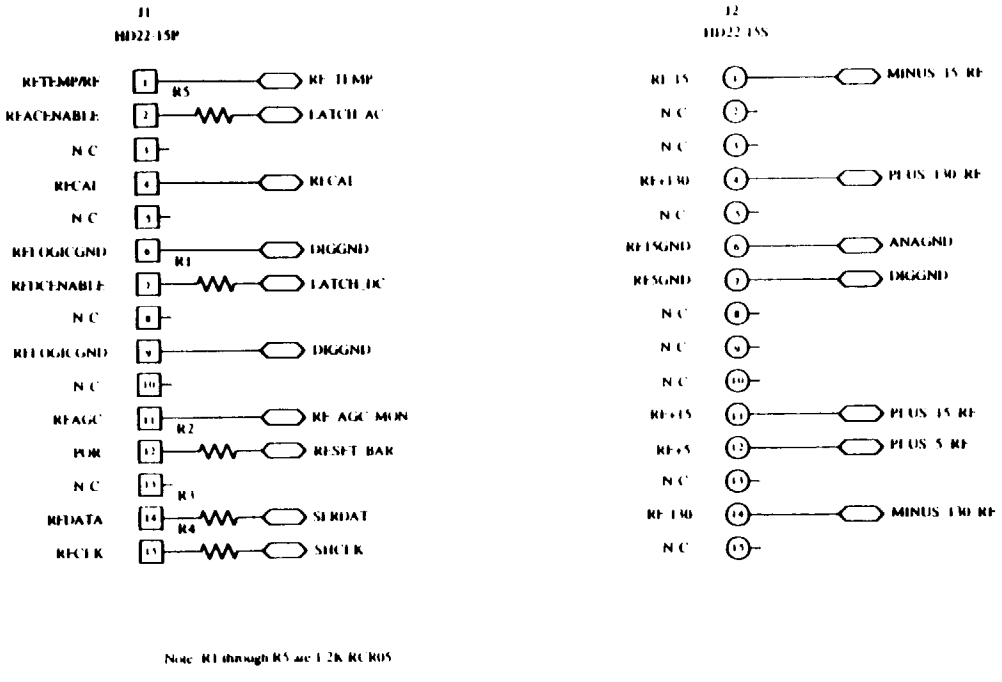
I hope this is sufficient to define the interface for you. Please do not hesitate to call if you have questions.

Best regards,

Bruce

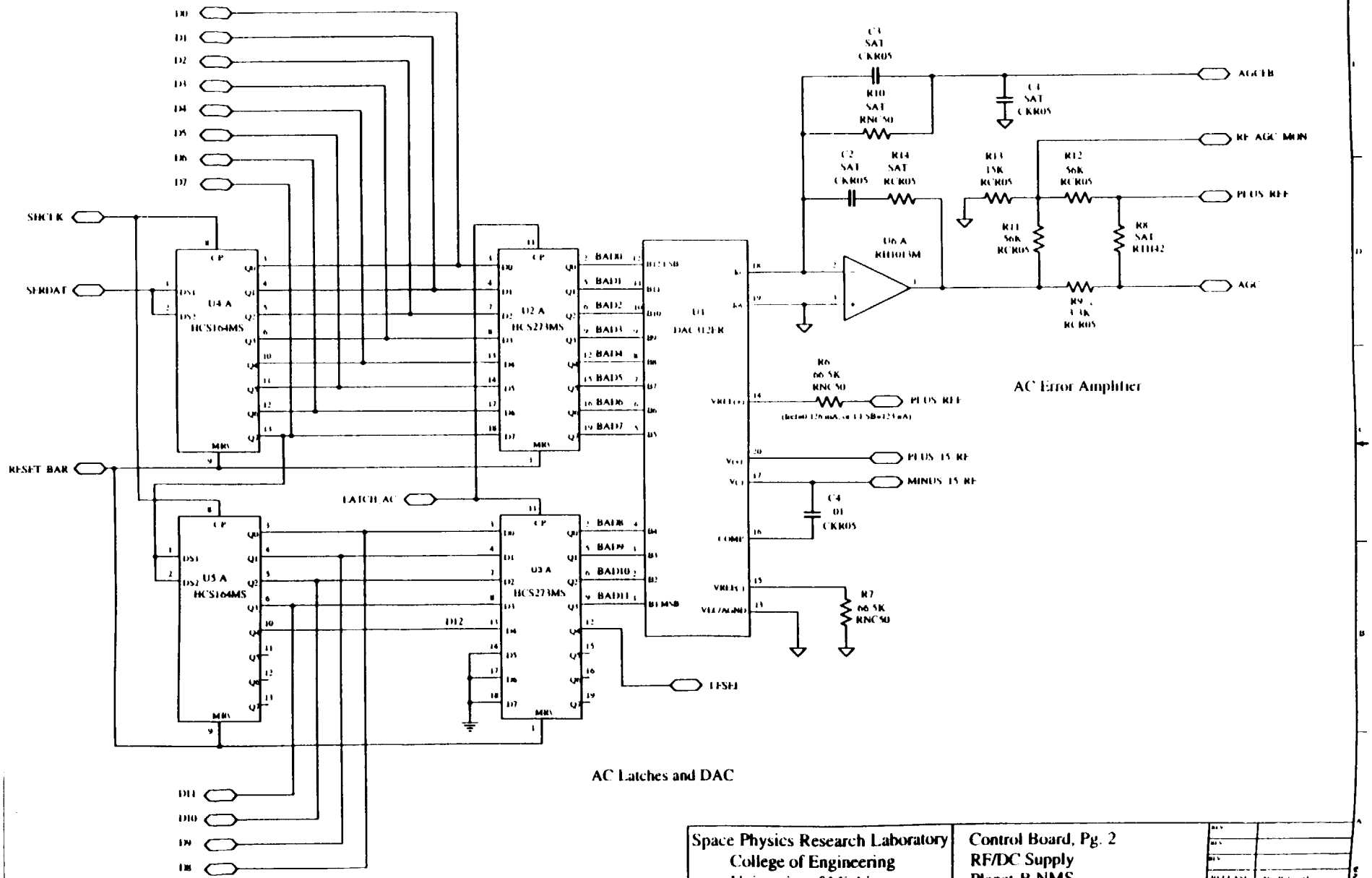
Bruce Block
Senior Engineer in Research

Enclosure

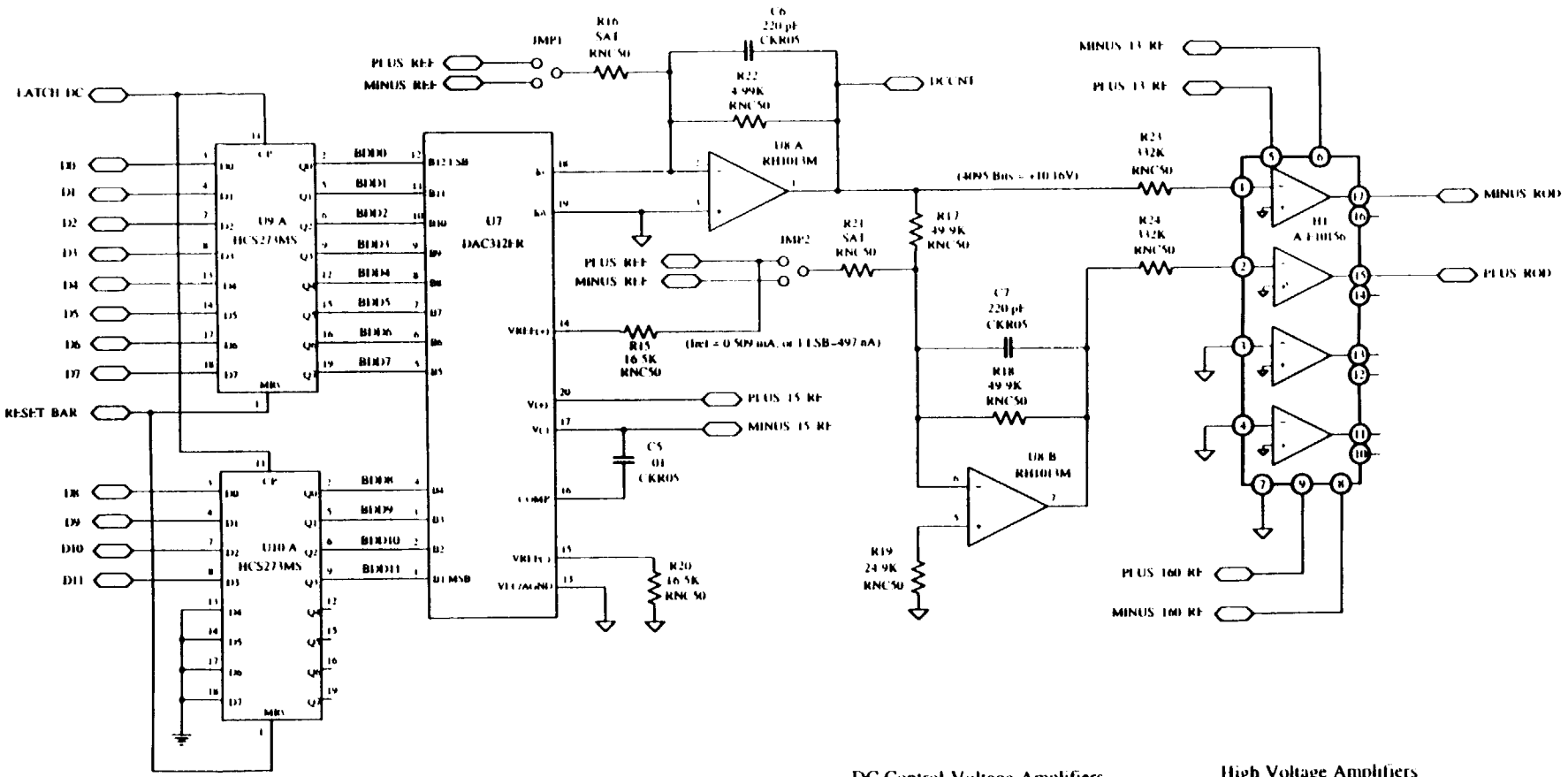


Note: R1 through R5 are 1.2k RC805

Space Physics Research Laboratory College of Engineering University of Michigan		Control Board, Pg. 1 RF/DC Supply Planet-B NMS		REV	
				REV	
				REV	
				RELEASED	04 Released
				DRAWN	24 Aug 95 BB
PROJECT Planet B - NMS	CAGE CODE 0TK63	DRAWING J0355.1A-RF/DC Ctrl, Pg. 1	CAGE DRAWING NUMBER 061-0355	REV A	CHECKED B. BECK



Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 2 RF/DC Supply Planet-B NMS			
Planet B - NMS	0TK63	J0355 2A-RF/DC Ctrl, Pg. 2	061-0355	A

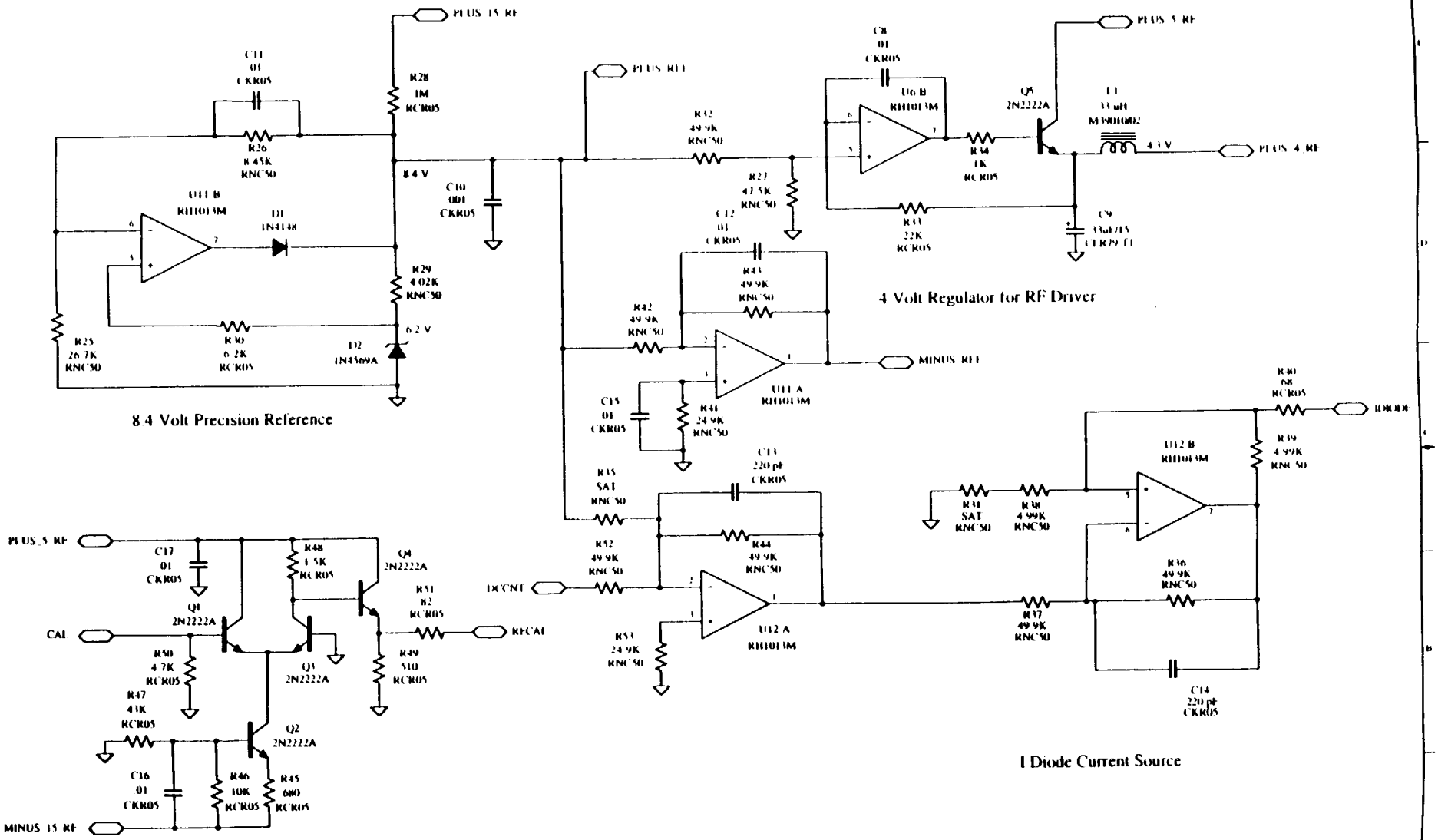


DC Latches and DAC

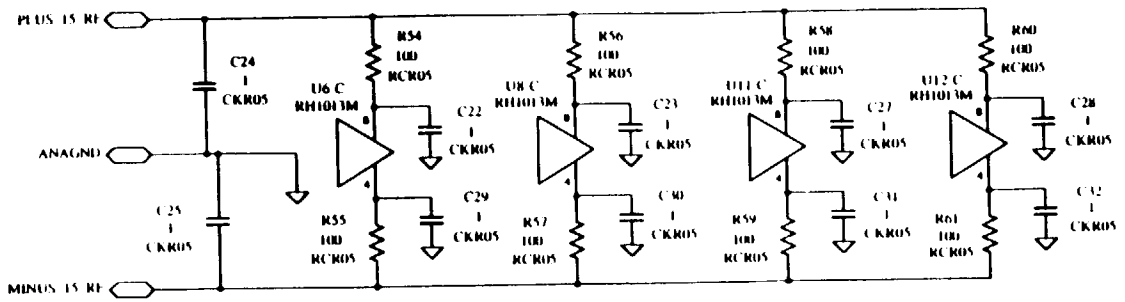
DC Control Voltage Amplifiers

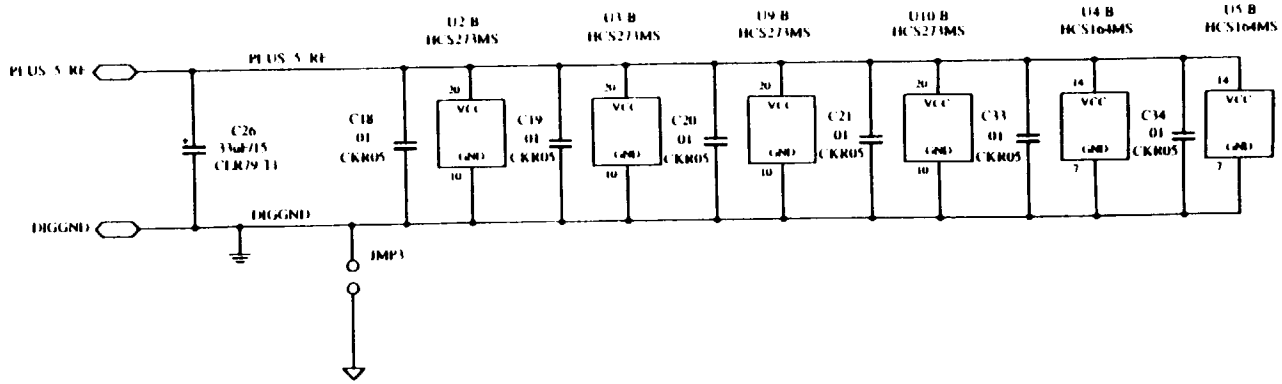
High Voltage Amplifiers

Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 3 RF/DC Supply Planet-B NMS			
Planet B - NMS	0TK63	J0355.2-RF/DC Ctrl, Pg. 3	061-0355	A



Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 4 RF/DC Supply Planet-B NMS			
Project: Planet B - NMS	Code Ident: 0TK63	Drawing: J0355 4A-RF/DC Ctrl, Pg. 4	Drawing Number: 061-0355	Rev: A
			RELEASED	Not Released
			DRAWN	24 Aug 95 BB
			CHECKED	B. BECK





Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 5 RF/DC Supply Planet-B NMS				
Project: Planet B - NMS	Page Name: 0TK63	Drawing Name: J0355 5A-RF/DC Ctrl, Pg. 5	Drawing Number: 061-0355	Rev: A	RELEASED: Neil Richard DRAWN: 24 Aug 95 CHECKED: B. Beck R

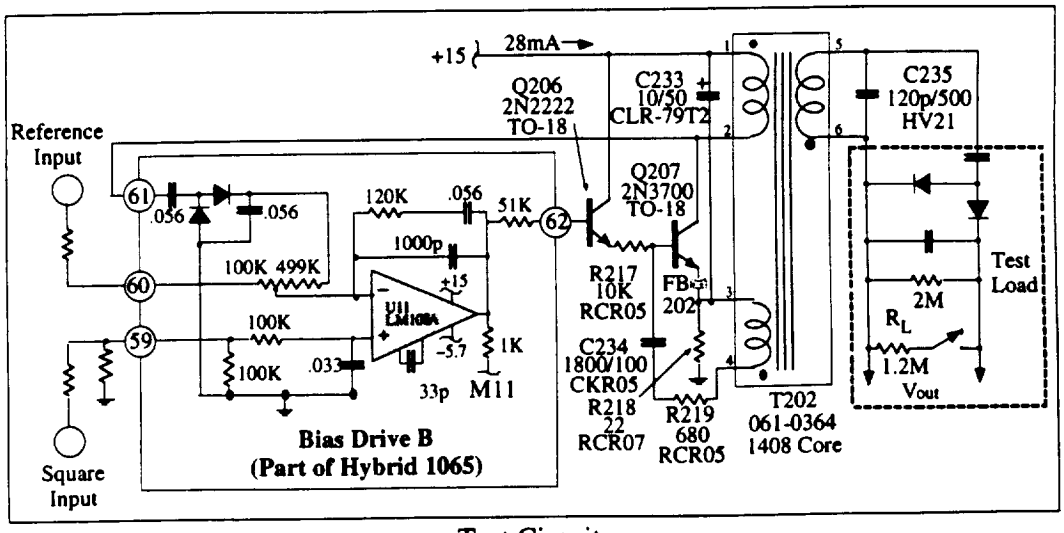
1-Sep-95

To: Planet-B NMS File:061-3052

From: J. Maurer

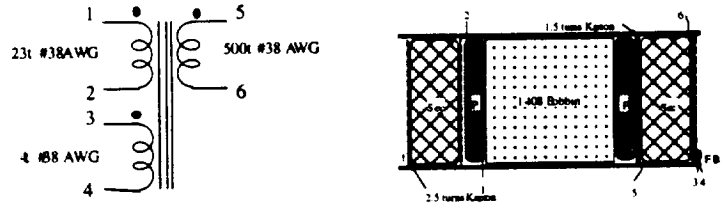
Subj. Planet-B EM HV Supply Circuit & Transformer Design

To verify the stability and circuit values the circuit below was used for test:



Test Circuit

The hybrid parts of the circuit were duplicated with discrete parts on the Vector Board. Two cores were wound for the tests. The final core design was wound as shown below. The following transformer specifications were copied from SPRL Dwg. 061-0364, Rev.–, Pg. 5.23.



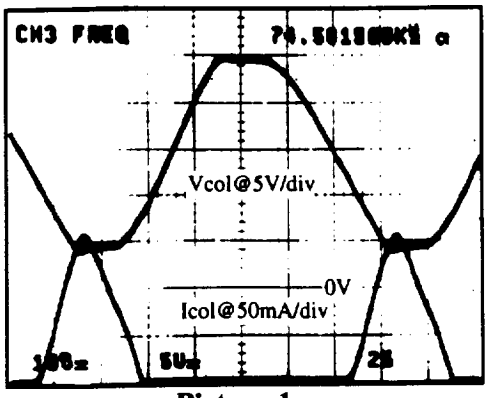
The placement of the feedback winding outside of the resonant secondary is very important to the stability of the resonant circuit. Not also that the AC low side of the secondary winding is next to the primary winding. The feedback winding covers such a small area of the resonant secondary that the increase in capacitance is very small.

To reduce the flux density and hence losses, the volts/turn was reduced from approximately 1 volt/turn to .6 volt/turn. To accommodate the additional turns the wire size was reduced form #30 to #38 on the primary. The secondary resonant current is approximately 20 mA peak. To keep the resonant frequency approximately 75 KHz, the core gap was changed from an A_L 250 core to an A_L 160 core. The resonant frequency is now approximately 77 KHz with a 120 pF resonating capacitor on the secondary.

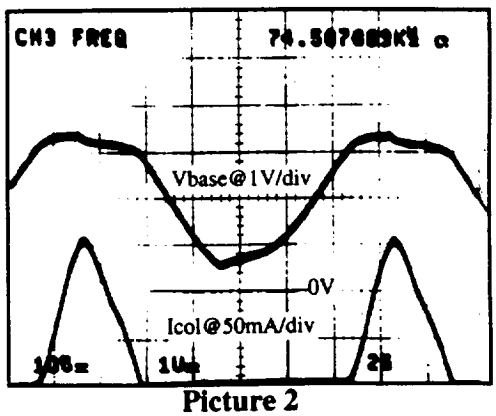
Not shown in the above picture is that the start and finish of the primary and secondary windings come from the same side of the core. i.e. There are no half turns that can cause a PCB current loop that could cause radiated noise.

The following pictures were taken with the circuit values shown on the preceding page. The collector and base voltage pictures were taken with the parallel resistor load. The is the nominal high load expected for two electron multipliers that have a 70 Meg load at 3000 volts.

Not the significant flattening of the curve because of the symmetrical rectifier load that clamps the peak. The sine shape could be improved by the use of a larger resonant capacitor. This would increase the overall power because of the resonant current in the #38 secondary wire.



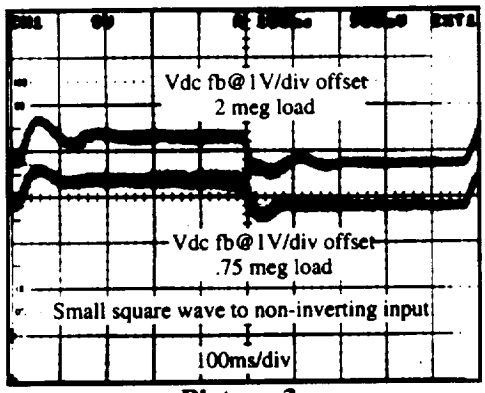
Picture 1



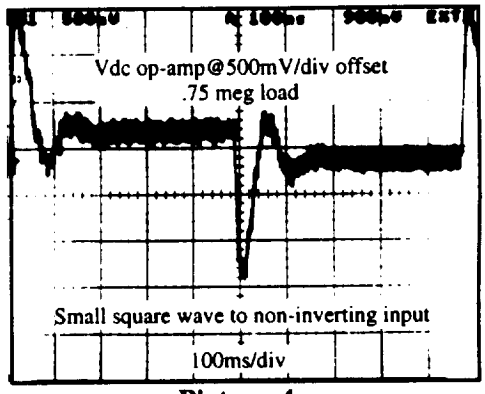
Picture 2

The following two pictures were taken to show the overall loop stability. This stability is significantly influenced by the magnetic design of the transformer. Picture 3 is a double exposure showing the rectified DC feedback voltage (inside the hybrid). This illustrates the difference of changing the load from 2 Meg to .75 Meg. The lighter load has more overshoot and tendency for ringing. At no load the circuit will squeg (oscillate). A 10 Meg DVM load will stabilize the circuit.

Picture 4 is the op-amp voltage with the .75 Meg load. This confirms that the op-amp tracks the DC feedback voltage. This picture can be duplicated on a finished PCB when the hybrid is used.



Picture 3



Picture 4

Summary

This circuit is stable at all reasonable loads. Without a load, circuit oscillations may be observed but will not cause any damage. No temperature tests were run since a flight type of voltage multiplier was not used in the circuit.

061-3054

Battel Engineering

AEROSPACE ENGINEERING AND MANAGEMENT SERVICES
10020 NORTH 58TH STREET
SCOTTSDALE, AZ 85253
(602) 991-9747 OFFICE
(602) 991-9748 FAX

September 12, 1995
BE/041/95/330

TELEFAX

To: **Bruce Block, SPRL** **cc. J. Maurer**

Fax #: **313-783-5567**

From: **S. J. Battel**

Page(s) Including Cover: 3

Subject: Lambda Advanced Analog Meeting Report

Message: Hi Bruce- I met with Mike Sullivan and his team at Lambda Advanced Analog (LAA) on Wednesday 9/6/95. The meeting was well supported and, overall, I believe that we came up with a viable plan for both the NRE activity and the flight build.

The primary goal of the meeting was to discuss potential design changes and develop both a plan and timeline for the NRE effort. The recommended plan is as follows:

1. No change will be made to the design to accommodate the 300 kHz switching frequency since the existing design is currently specified up to that value. Based on discussions with the LAA engineers, the frequency design margin is at least 10% with the main degradation factor above that limit being a gradual decrease in efficiency.

2. The overvoltage protection (OVP) will be removed by not installing the parts on the hybrid substrate. This will eliminate the potential OVP failure mode and open up a little room on the substrate to accommodate any size changes (not expected) to the magnetics.

3. The undervoltage lockout (UVL) circuit and auxiliary bias supply will be modified through part changes to support operation down to 15.00 volts (or at least 15.50 volts).

4. The transformer and output inductor turns ratio will be modified as and/or optimized to support operation down to 15.00 volts (or at least 15.50 volts) under our expected load and thermal conditions. Since changing the turns ratio results in discrete voltage steps, it was agreed that a slightly higher voltage on the +/-15 output (such as +/-15.25 volts) was preferable to a slightly lower one.

Please Call (602) 991-9747 if you do not receive all sheets

5. LAA will provide an SCD outline and support our preparation of a procurement specification with the goal of having a released specification in time for a flight order on 11/1.

6. As part of the NRE activity, LAA will produce a non-flight prototype (meeting form, fit and function) that will be furnished to SPRL for design validation in the 1/1/96 timeframe. Upon completion of testing, it was agreed that the unit would be temporarily returned to LAA for validation of test setups and test software.

In addition to the NRE activity schedule, QA options and cost were discussed.

1. The schedule for all activities was tentatively agreed to be as follows:

a) 10/1 Contract in place; Start NRE activity.

b) 11/1 SCD ready; Place flight order to allow procurement of long lead parts.

b) 12/1 Hold internal review meeting at LAA.

c) 1/1 Flight unit documentation changes complete; Deliver prototype unit to SPRL; Initiate flight manufacturing.

d) 2/1 Return prototype unit to LAA.

e) 4/1 Deliver flight units.

2. From a QA perspective, LAA builds all of their flight units to MIL-H-38534 Class K. This include element evaluation and can have local government QCI (Mike promised to get back to me regarding the specific agency) or GSFC inspection as required. We will need to discuss this further, but it is my belief that we are better off without government inspection. It may prove useful, however, to have Bob Savage of GSFC perform a pre-cap visual.

Qualification will be based on the 87 units already built and tested for INTELSAT since we agreed that the cost and schedule impact of a separate qualification effort could not be accommodated. Given this assumption, we worked hard to minimize the scope of the NRE activity such that the unit basic design, part choices and substate layout would not be changed.

3. The cost of the flight units will be $18,500 each in quantities of 1 to 4 or $14,400 each for quantities of 5 or greater. Mike called me yesterday with a ROM cost of $20,000 for the NRE activity.

CG1-3CEC

Battel Engineering

AEROSPACE ENGINEERING AND MANAGEMENT SERVICES
10020 NORTH 58TH STREET
SCOTTSDALE, AZ 85253
(602) 991-9747 OFFICE
(602) 991-9748 FAX

November 19, 1995

BE/041/95/389

TELEFAX

To: Bruce Block, SPRL **cc.** J. Maurer, K. Arnett

Fax #: 313-763-5567

From: S. J. Battel

Page(s) Including Cover: 8

Subject: Lambda Test Data

Message: Hi Bruce- Here is preliminary data from LAA for our configuration. Performance is better than what we had with the standard unit although not quite as good as we had hoped. A key concern is performance at very low currents on the +/- 15 volt lines. We will want to do some careful testing in this area when we get the prototype unit.

Dick says that they will be sealing up the proto unit next week and then doing some temperature testing. Dick will also take a crack at redlining the SCD to match what they have observed in the tests. They will be ready for a review on 12/14 as planned.

Best Regards, Steve

Please Call (602) 991-9747 if you do not

FAX COVER SHEET

LINEAR ADVANCED ANALOG INC.
2270 Martin Ave. Santa Clara, CA 95050 Ph: 408 988-4930 FAX: 408 988-2702

To: Steven J. Battel
Company: Battel Engineering
Phone: 602-991-9747
Fax: 602-991-9748

From: Dick Miller

Date: 16-Nov-95
Pages: 7 including this cover

Subject: Performance Curves for Type 8096 DC/DC Converter

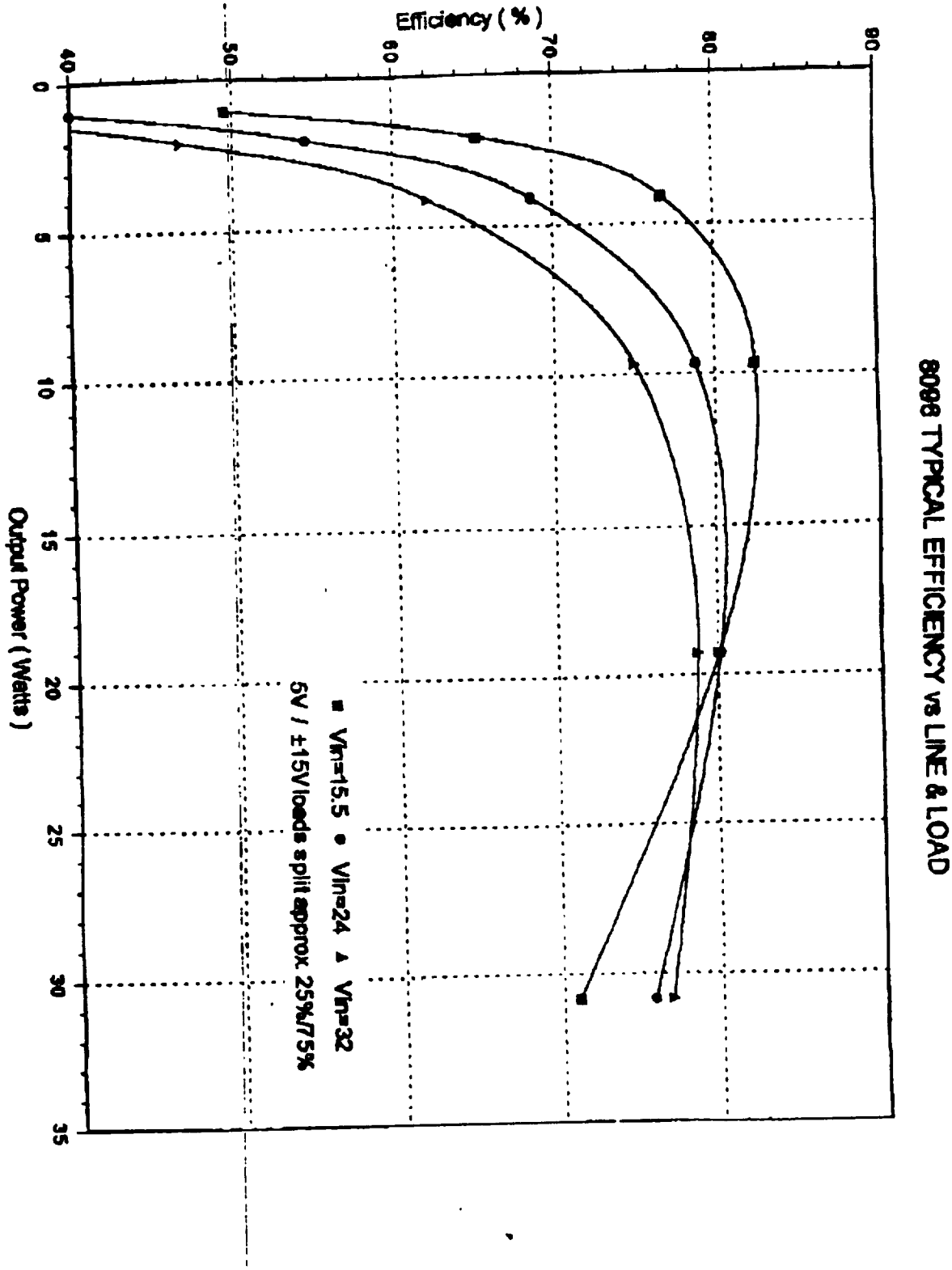
The following pages include a collection of performance plots generated from selected data accumulated by Steve Baker. These data (which include data points outside the specified operating range) will give you an idea about the general performance of the device. We believe it will do the job as intended.

However, because of limitations in the way the test limits were specified in the SCD, we would like to redefine the performance specifications to more closely reflect your requirements.

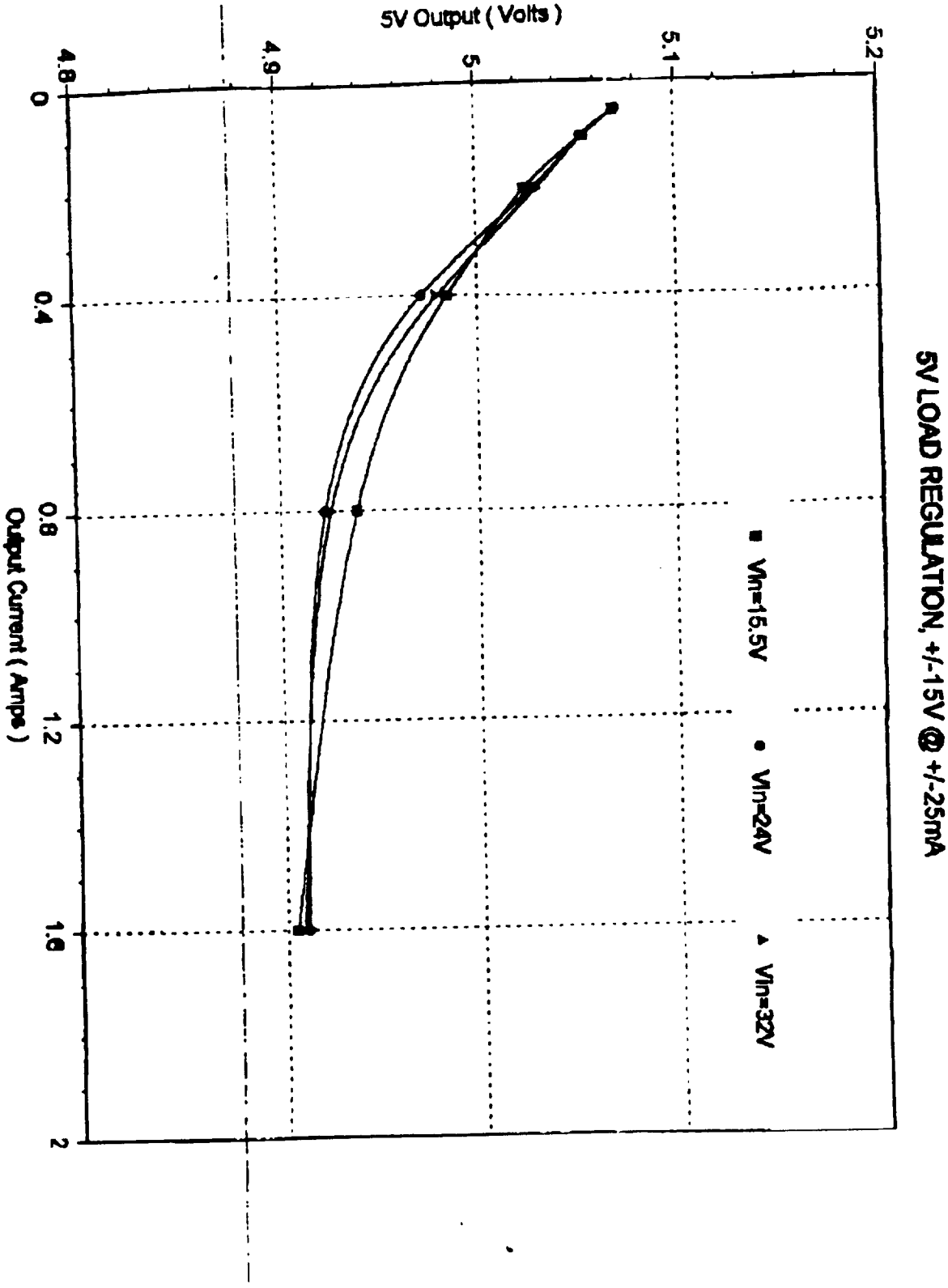
Inspection of the curves shows that as output loading gets very light, regulation rapidly deteriorates and some of the limits in the existing test table cannot be met over all the conditions specified. We do believe that the performance is consonant with your requirement and look for your concurrence on a redefinition.

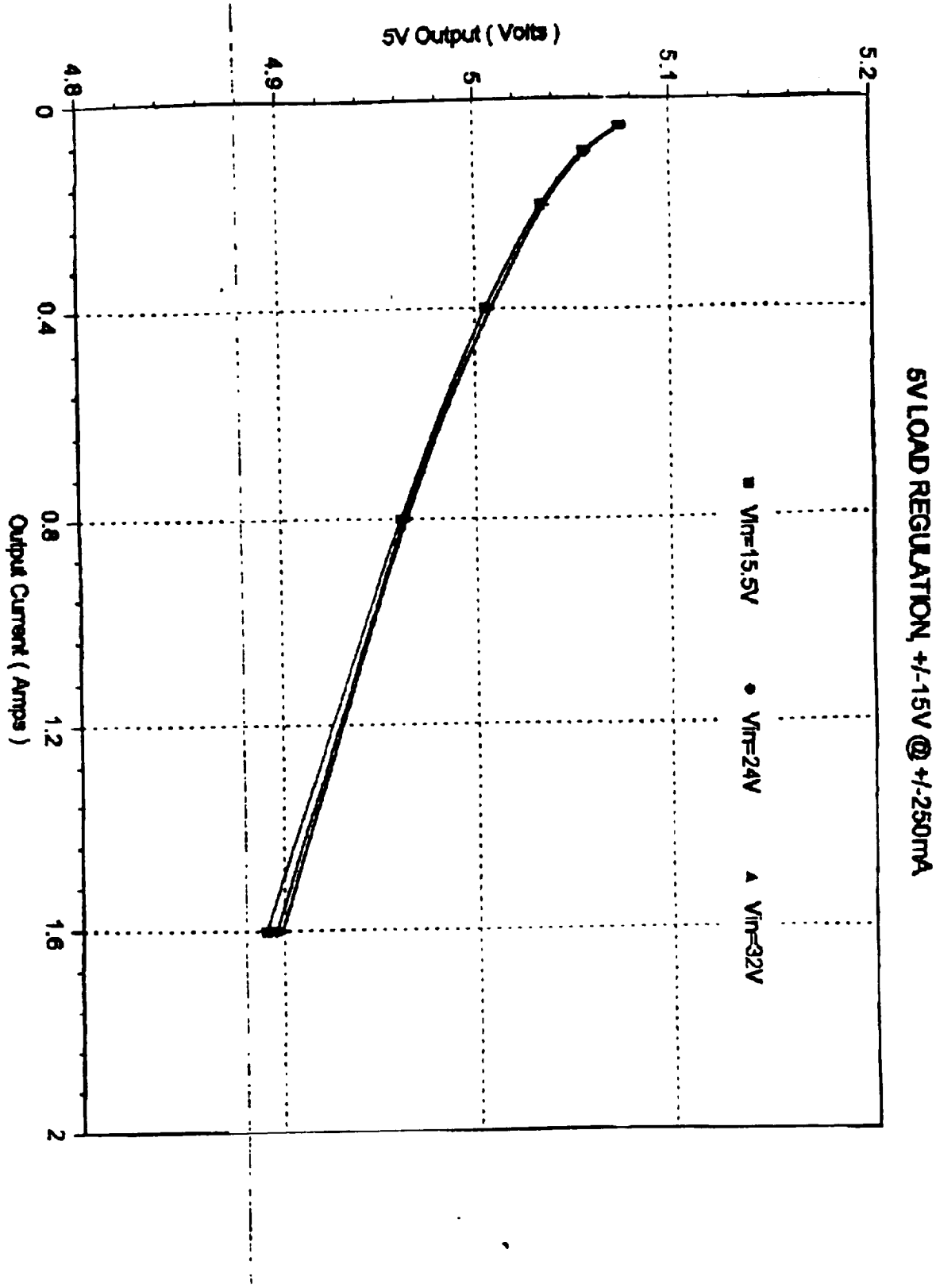
We'll talk after lunch.

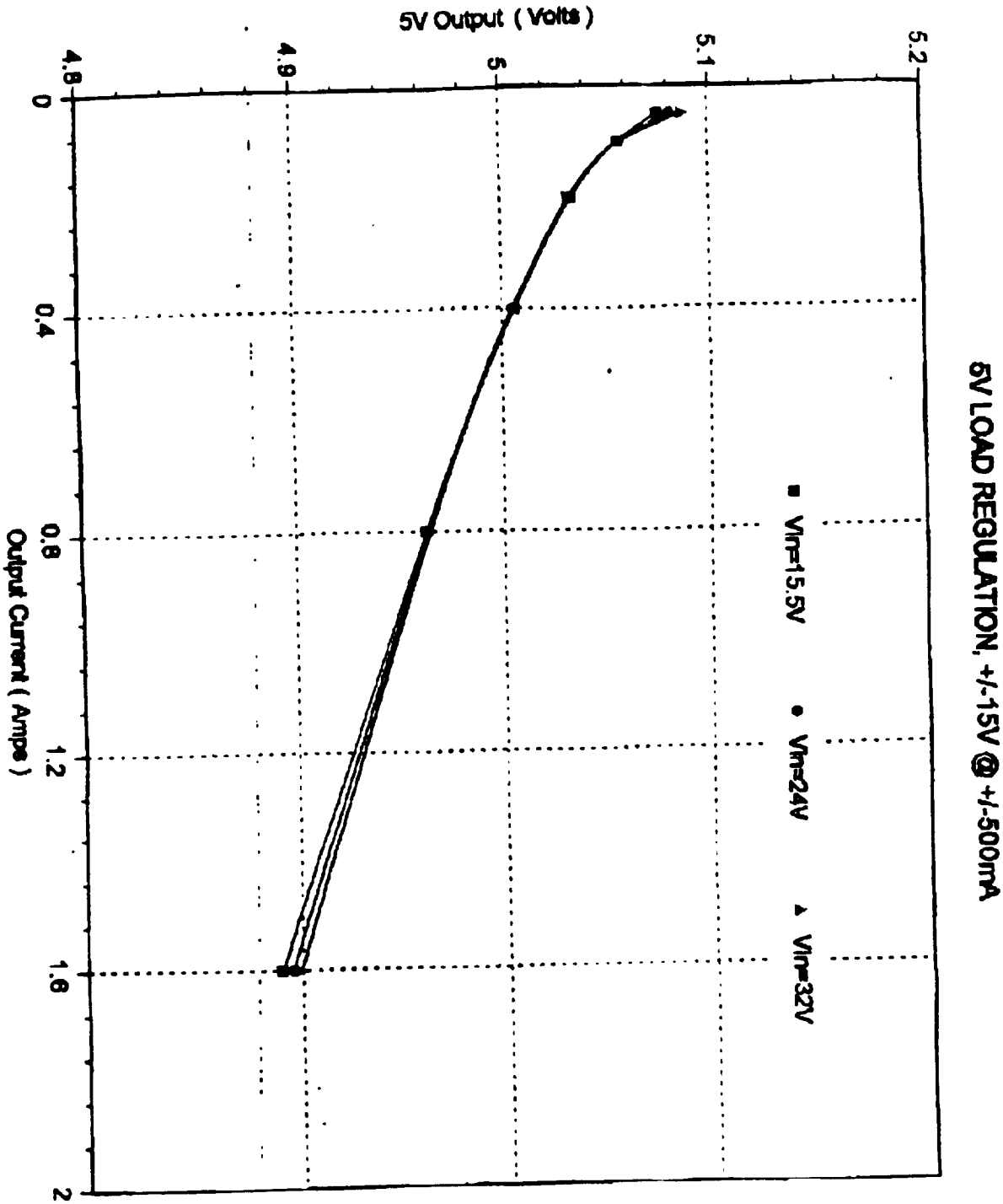
Dick

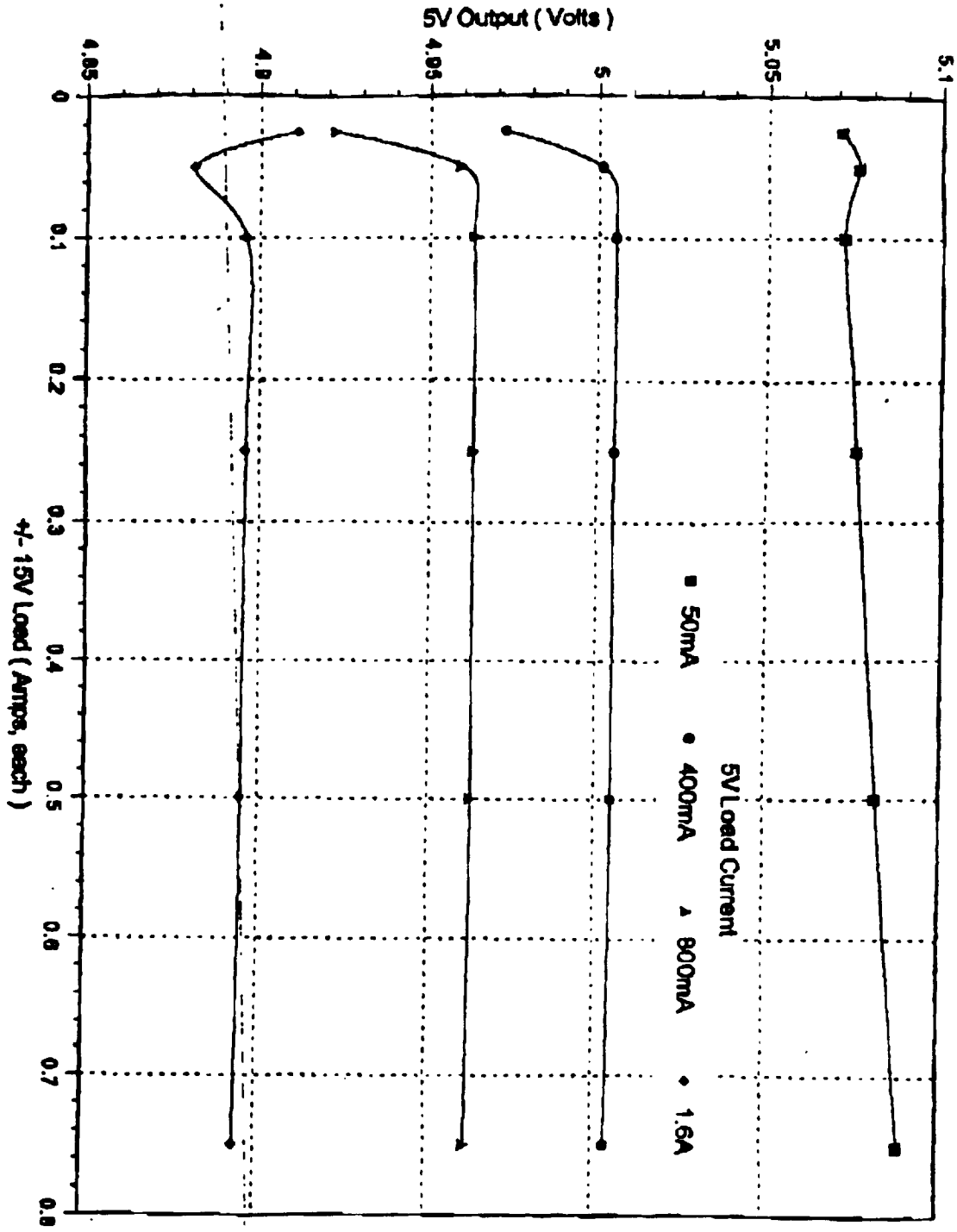


8098 TYPICAL EFFICIENCY vs LINE & LOAD

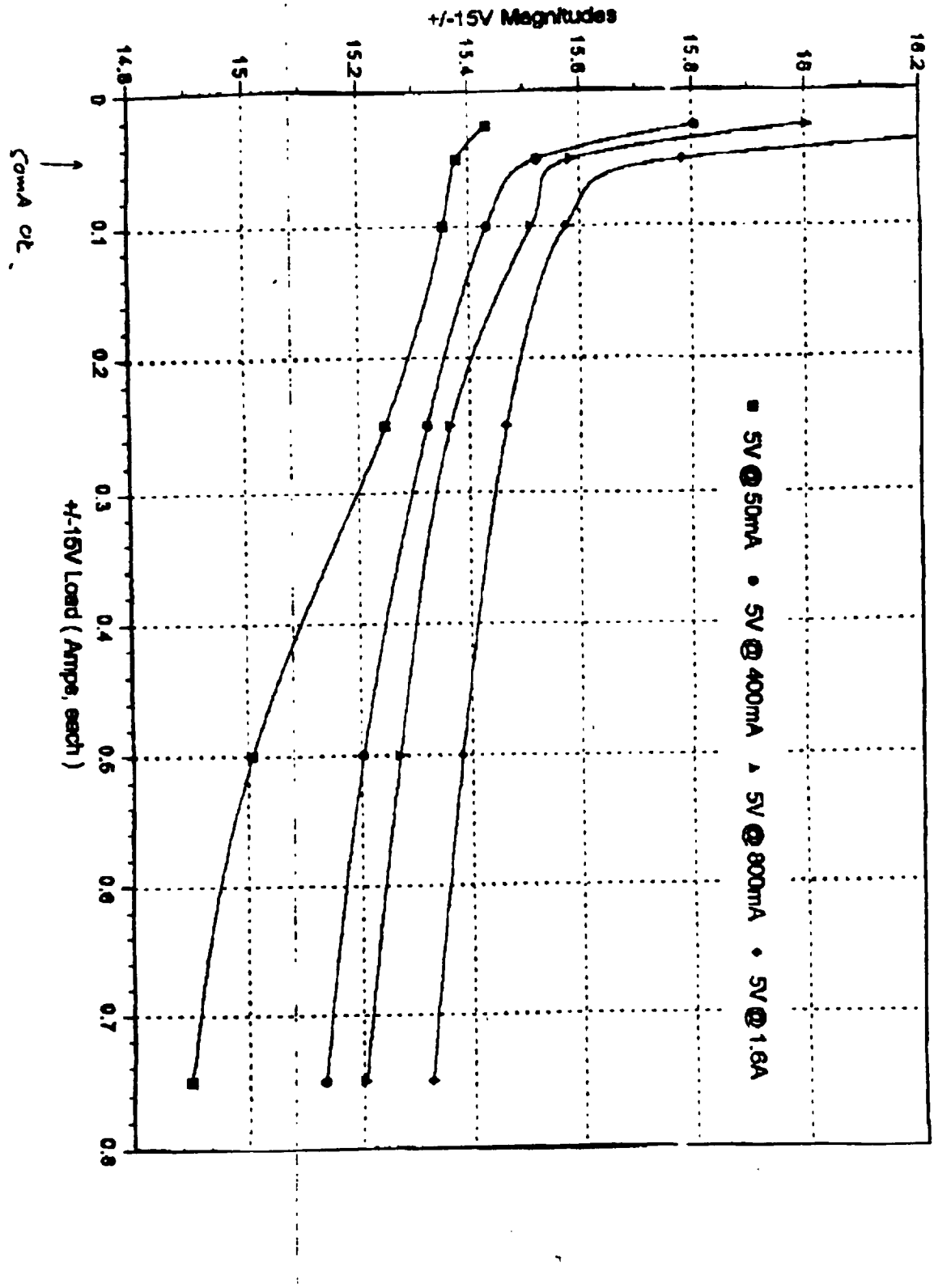

5V Output (Volts)
4.8
4.9
5
5.1
5.2
0
0.4
0.8
1.2
1.6
2
Output Current (Amps)
■ Vin=15.5V
● Vin=24V
▲ Vin=32V
5V LOAD REGULATION, +/-15V @ +/-25mA


5V Output (Volts)
4.8
4.9
5
5.1
5.2
0
0.4
0.8
1.2
1.6
2
Output Current (Amps)
■ Vin=15.5V
● Vin=24V
▲ Vin=32V
5V LOAD REGULATION, +/-15V @ +/-250mA

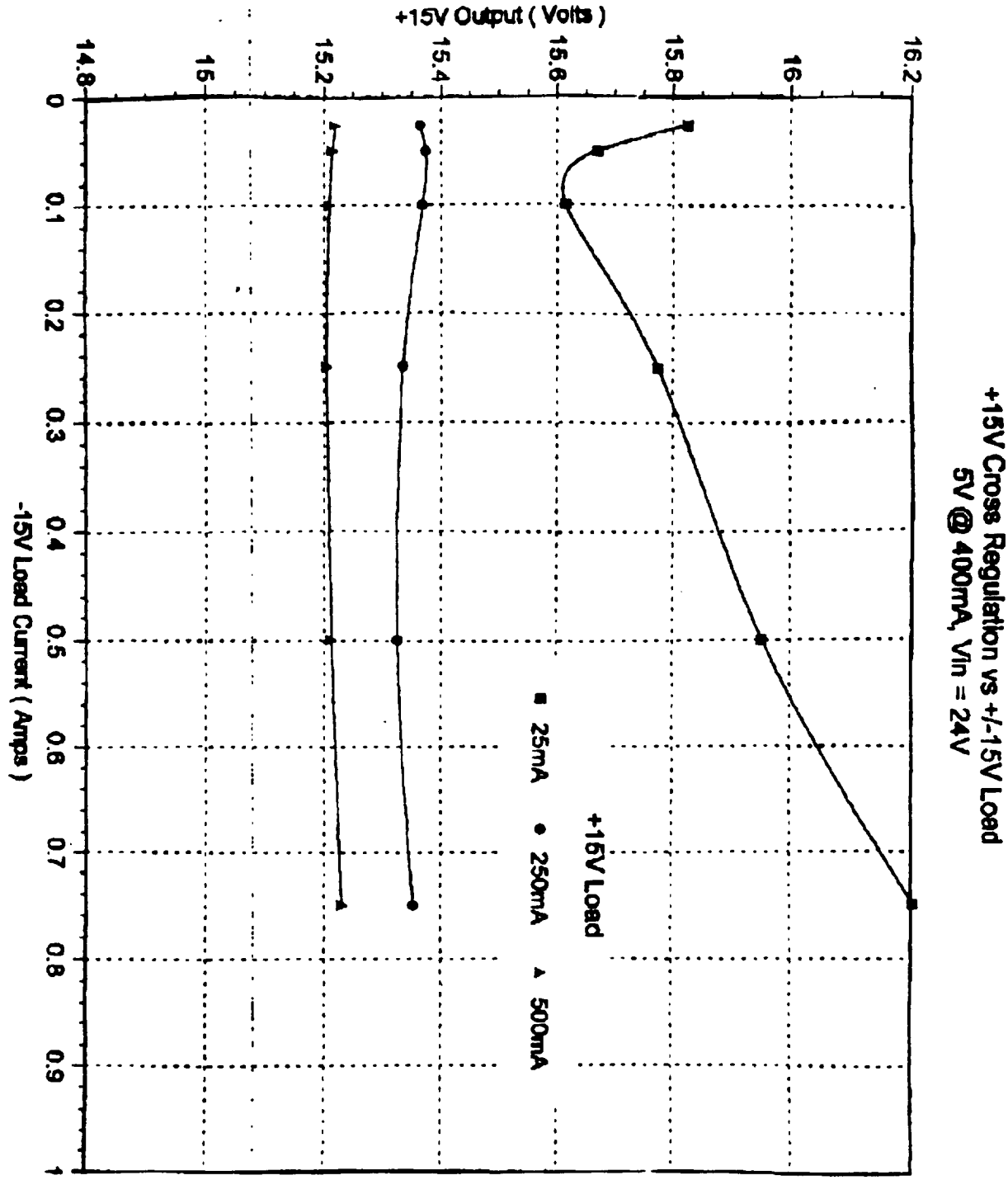

5V Output (Volts)
4.8
4.9
5
5.1
5.2
0
0.4
0.8
1.2
1.6
2
Output Current (Amps)
Vin=15.5V
Vin=24V
Vin=32V
5V LOAD REGULATION, +/-15V @ +/-500mA



5V CROSS REGULATION, Vin = 24V



+/-15V LOAD REGULATION, Vin = 24V


+15V Output (Volts)
14.8
15
15.2
15.4
15.6
15.8
16
16.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
-15V Load Current (Amps)
+15V Load
25mA
250mA
500mA
+15V Cross Regulation vs +/-15V Load
5V @ 400mA, Vin = 24V

061-3062

REVISION RECORD

REV LETTER	DESCRIPTION	APPROVED	DATE
A	ECO #12446, Initial Release	RM	22 Sep 95

Type 8096
Radiation Hardened
DC/DC Converter

Rev																		
Sheet																		

Revision Status Of Sheets																
Rev	A	A	A	A	A	A	A	A	A	A	A	A				
Sheet	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

LAMBDA ADVANCED ANALOG INC.

2270 Martin Avenue, Santa Clara CA 95050
408 988-4930 • FAX 408 988-2702

SOURCE CONTROL DRAWING

PREPARED BY: R. Miller
PURCH:
APPROVED BY:
DATE OF APPROVAL:

TITLE: Three Output, +5V, ±15.4V DC/DC Converter Hybrid, Radiation Hardened

DRAWING NO.: SCD 171558
REVISION LETTER: A
SIZE: A
CAGE CODE: 52467
SHEET 1 OF 12

DC/DC Converter, Hybrid
Three Output, +5Vdc, ±15.7Vdc
Radiation Hardened

1. Scope

1.1 Statement of scope. This specification covers the detail requirements for hybrid dc/dc converter microcircuits to be used for space applications.

2. Applicable Documents

2.1 Government documents. The following documents form a part of this specification to the extent specified herein. The revision in effect at the time of purchase order placement shall be the minimum revision acceptable.

Specifications

Military

MIL-H-38534	General Specifications for Hybrid Microcircuits
MIL-STD-883	Test Methods and Procedure for Microelectronics
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
MIL-STD-1772	Certification Requirements for Hybrid Microcircuit Facilities and Lines

3. Requirements

3.1 Item requirements. Microcircuits supplied to this drawing shall be in accordance with 1.2.2 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with non-compliant non-JAN devices" and shall meet all of the MIL-H-38534 class K requirements with the exceptions and additions specified herein. The quality assurance requirements shall be in accordance with MIL-H-38534 class K option 2 (end-of-line)

3.1.1 Absolute maximum ratings. Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

Input voltage range	-0.5 Vdc to +50 Vdc
Output power	internally limited to 52 W typical
Lead temperature (soldering, 10 seconds)	+300°C
Operating temperature range (case)	-55°C to +125°C
Storage temperature range (case)	-65°C to +135°C

3.2 Design and construction. The design and construction shall be as specified in MIL-H-38534 for class K with the exceptions and additions specified herein.

3.2.1 Case outline. The case outline shall be in accordance with figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified in table I.

3.2.3 Block diagram. The block diagram shall be as specified in figure 2.

3.2.4 Weight. The weight shall not exceed 120 grams.

3.2.5 Lead finish. The lead finish shall be finish A in accordance with MIL-H-38534.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table II and shall apply overt the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table IV. The electrical tests for each subgroup are described in table III.

3.5 Radiation hardness assurance (RHA). The RHA shall be in accordance MIL-H-39534 level R except with the additional requirements and exceptions specified herein.

a. The neutron fluence level shall be 3×10^{12} n/cm^2.
b. The transient ionizing dose shall be $\geq 1 \times 10^{11}$ rad (si)/s for survival.
c. Single event effects - The microcircuit shall be immune to single-event upset (SEU), latchup, and permanent damage (including burnout and gate rupture). The microcircuit is considered immune to single event effects if its linear energy transfer (LET) threshold is greater than 80 MeV-cm^2/mg.

3.6 Marking. Marking shall be in accordance with MIL-H-38534 except as specified herein. The part or identifying number (PIN) shall be as listed in table V and the following marking shall be included on each microcircuit as a minimum.

a. Index point or pin 1 identification.
b. PIN.
c. Lot identification code or date code.
d. Manufacturer's CAGE code, and loge, mark, name or other distinctive identification.
e. ESD identifier.
f. Serial number (see para. 3.6.1).

3.6.1 Serial number. Serial number shall be assigned in sequence and shall not be used more than once.

3.7 Line certification. Microcircuits supplied to this drawing shall be fabricated on a line certified in accordance with MIL-H-38534 to manufacture compliant hybrids.

4. Quality Assurance Provisions

4.1 Quality assurance provisions shall be in accordance with MIL-H-38534 class K option 2 with the exceptions and additions specified herein.

4.2 Screening. Screening shall be in accordance with MIL-H-38534 class K with the exceptions and additions specified herein. Screening shall be conducted on all devices prior to quality conformance inspection.

a. The minimum nondestructive bond pull limits shall be the value specified in method 2023 of MIL-STD-883.
b. Burn-in test, method 1015 of MIL-STD-883.
   1. Test condition C, steady state. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.
c. Interim and final electrical test parameters shall be as specified in table III.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 class K except as specified herein.

4.3.1 Group A inspection. Group A inspection shall be in accordance with MIL-H-38534 class K except as follows:

a. Tests shall be as specified in table IV herein.
b. Subgroups 7,8,9,10 and 11 shall be omitted.

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534 class K.

4.3.3 Group C inspection by similarity When specified in the purchase order, Group C inspection requirement shall be satisfied in its entirety by the application of similarity data from manufacturing lots of parts passing the group C criteria of MIL-H-38534 for class K. Such data shall be made available for inspection when requested.

4.3.4 Group E inspection by similarity. Similarity test data and analysis shall be used to meet the RHA requirements specified herein.

4.4 Data. A data review shall be performed against the following requirements prior to acceptance of the lot. The manufacturer shall create and maintain, as a minimum, with each lot of parts the following:

a. Completed assembly, screening, and qualification/QCI lot travelers.
b. Screening electrical test variables data, identified by serial number, for each device at each specified temperature. This includes devices which fail and are accountable in the PDA. PDA calculations or results are to be recorded on the traveler.
c. Group A variables data, identified by serial number.
d. Group B variables data, identified by serial number.
e. Catastrophic failure data and failure analysis results, if applicable.

5. Packaging

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

6.0 Notes

6.1 Intended use. Microcircuits conforming to this drawing are intended for use in radiation hard space level microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Approved sources of supply. The approved source(s) of supply shall be as shown table V.

Table I
Terminal Connections

Terminal Number	Terminal Symbol
1	+ V input
2	Input return
3	ENABLE
4	Sync
5	No connection
8	No connection
9	- 15 Vdc output
10	15 Vdc output return
11	+ 15 Vdc output
12	Chassis
13	+ 5 Vdc output
14	5 Vdc output return

Table II
Electrical Performance Characteristics

Parameter	Symbol	Conditions unless otherwise specified $-55°C \leq T_C \leq +125°C$, V_{IN}+24Vdc ±5%, C_L=0	Limit MIN	Limit MAX	Units
Output voltage accuracy	V_{OUT}	I_{OUT} = 350mAdc T_C = +25°C (main) I_{OUT} = 250mAdc T_C = +25°C (dual)	4.95 ±15.00	5.05 ±15.63	Vdc
Output power *Note 3*	P_{OUT}	15.5 Vdc< V_{IN} < 31Vdc	2	20	W
Output current *Note 3*	I_{OUT}	15.5 Vdc< V_{IN} < 31Vdc (main) (dual)	80 50	800 500	mAdc
Line regulation *Note 1*	VR_{LINE}	175 mAdc < I_{OUT} < 800 mAdc (main) 15.5 Vdc< V_{IN} < 31Vdc ±50 mAdc < I_{OUT} < ±500 mAdc (dual)	-15 -60	+15 +60	mV
Load regulation *Note 2*	VR_{LOAD}	175 mAdc < I_{OUT} < 800 mAdc (main) 15.5 Vdc< V_{IN} < 31Vdc ±50 mAdc < I_{OUT} < ±500 mAdc (dual)	-100 -250	+100 +250	mV
Cross regulation *Note 6*	VR_{CROSS}	15.5 Vdc< V_{IN} < 31Vdc (main) (dual)	-10 -250	+10 +250	mV
Total regulation	VR	All conditions of Line, Load, Cross Regulation, Aging, Temperature and Radiation (main) (dual)	4.85 14.5	5.15 16.5	V
Input current	I_{IN}	I_{OUT} = minimum rated, Pin 3 open Pin 3 shorted to pin 2 (disabled)		250 8	mA
Output ripple voltage *Note 4*	V_{RIP}	I_{OUT} = 800 mAdc (main), ±500 mAdc (dual)		100	mV_{p-p}
Input ripple current *Note 4*	I_{RIP}	I_{OUT} = 800 mAdc (main), ±500 mAdc (dual)		100	mA_{p-p}
Switching frequency	F_S	Sychronization input open. (pin 6)	225	275	kHz
Efficiency	Eff	I_{OUT} = 800 mAdc (main), ±500 mAdc (dual)	75		%
Enable Input open circuit voltage drive current (sink) voltage range			3.0 -0.5	5.0 100 50	V µA V
Synchronization Input frequency range pulse high level pulse low level pulse rise time pulse duty cycle		External clock signal on Sync. input (pin 4)	225 4.5 -0.5 40 20	310 10.0 0.25 80	Khz V V V/µS %
Power dissipation, load fault	P_D	Short circuit, any output		7.5	W

Table II
Electrical Performance Characteristics
(Continued)

Parameter	Symbol	Conditions unless otherwise specified -55°C ≤ T_C ≤ +125°C, V_{IN}=24Vdc ±5%, C_L=0	Limit MIN	Limit MAX	Units
Output response to step load changes *Notes 5, 9*	V_{TLD}	10% Load to/from 50% load	-200	200	mV_{PK}
		50% Load to/from 100% load	-200	200	
Recovery time from step load changes *Notes 9, 10*	T_{TLD}	10% Load to/from 50% load		200	µS
		50% Load to/from 100% load		200	
Output response to step line changes *Notes 8, 9*	V_{TLN}	I_{OUT} = 800 mAdc (main) V_{IN} = 15.5V to/from 31 V	-350	350	mV_{PK}
		I_{OUT} = ±500 mAdc (dual)	-1050	1050	
Recovery time from step line changes *Notes 8, 9, 11*	T_{TLN}	I_{OUT} = 800 mAdc (main) V_{IN} = 15.5V to/from 31 V		500	µS
		I_{OUT} = ±500 mAdc (dual)		500	
Turn on overshoot	V_{OS}	I_{OUT} = minimum and full rated (main)		500	mV
		(dual)		1500	
Turn on delay *Note 12*	T_{DLY}	I_{OUT} = minimum and full rated	5	20	mS
Capacitive load *Notes 7, 8*	CL	No effect on DC performance (main)		500	µF
		(dual)		100	
Isolation	ISO	500VDC Input to Output or any pin to case (except pin 12)	100		MΩ

Notes to Table II Electrical Performance Characteristics

1. Parameter measured from 24V to 15.5V or to 31V while loads remain fixed.
2. Parameter measured from nominal to minimum or maximum load conditions while line remains fixed.
3. Parameter verified by dynamic load regulation tests.
4. Guaranteed for a bandwidth of DC to 20Mhz. Tested using a 20Khz to 2Mhz bandwidth.
5. Load current is stepped for output under test while other outputs are fixed at half rated load.
6. Load current is fixed for output under test while other output loads are varied for any combination of minimum to maximum.
7. A capacitive load of any value from 0 to the specified maximum is permitted without comprise to DC performance. A capacitive load in excess of the maximum limit may interfere with the proper operation of the converter's short circuit protection, causing erratic behavior during turn on.
8. Parameter is tested as part of design characterization or after design or process changes. Thereafter, parameters are guaranteed to the limits specified in the table.
9. Load transient rate of change, dv/dt ≤ 2 A/µSec.
10. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1% of its steady state value.
11. Line transient rate of change, di/dt ≤ 50 V/µSec.
12. Turn on delay time is for either a step application of input power or a logical low to high transition on the inhibit pin (pin 3) while power is present at the input.

Table III
Group A Electrical Tests

Test	Symbol	Conditions unless otherwise specified $-55°C \leq T_C \leq +125°C$, V_{IN}+24Vdc ±5%, C_L=0	Group A Subgroups	Limit MIN	Limit MAX	Units
Output voltage accuracy	V_{OUT}	I_{OUT} = 350mAdc (main) I_{OUT} = ±250mAdc (dual)	1, 2, 3 1, 2, 3	4.95 ±15.00	5.05 ±15.63	V
Output power *Note 1*	P_{OUT}	V_{IN} = 15.5V, 24V, 31 V	1, 2, 3	2	20	W
Output current *Note 1*	I_{OUT}	V_{IN} = 15.5V, 24V, 31 V (main) (dual)	1, 2, 3 1, 2, 3	80 50	800 500	mA
Output regulation *Note 4*	VR	I_{OUT} = 175, 350, 800mAdc (main) V_{IN} = 15.5V, 24V, 31 V I_{OUT} = ±50, ±250, ±500mAdc (dual)	1, 2, 3 1, 2, 3	4.85 14.5	5.15 16.5	V
Input current	I_{IN}	I_{OUT} = minimum rated, Pin 3 open Pin 3 shorted to pin 2 (disabled)	1, 2, 3 1, 2, 3		250 8	mA
Output ripple *Note 2*	V_{RIP}	I_{OUT} = 800mA main, ±500mA dual	1, 2, 3		100	mV_{P-P}
Input ripple *Note 2*	I_{RIP}	I_{OUT} = 800mA main, ±500mA dual	1, 2, 3		100	mA_{P-P}
Switching frequency	F_S	Synchronization pin (pin 6) open	4, 5, 6	225	275	KHz
Efficiency	Eff	I_{OUT} = 800mA main, ±500mA dual	1, 2, 3	75		%
Power dissipation, load fault	P_D	Short circuit, any output	1, 2, 3		7.5	W
Output response to step load changes *Notes 3, 5*	V_{TL}	10% Load to/from 50% load 50% Load to/from 100% load	4, 5, 6 4, 5, 6	-200 -200	200 200	mV_{PK}
Recovery time from step load changes *Notes 5, 6*	T_{TL}	10% Load to/from 50% load 50% Load to/from 100% load	4, 5, 6 4, 5, 6		200 200	µS
Turn on overshoot	V_{OS}	I_{OUT} = minimum and full rated (main) (dual)	4, 5, 6 4, 5, 6		500 1500	mV
Turn on delay *Note 7*	T_{DLY}	I_{OUT} = minimum and full rated	4, 5, 6	5	20	mS
Isolation	ISO	500VDC Input to output or any pin to case (except pin 12)	1	100		MΩ

Notes to Table III Group A Electrical Tests

1. Parameter verified during dynamic load regulation tests.
2. Guaranteed for DC to 20 MHz bandwidth. Tested using a 20KHz to 2MHz bandwidth.
3. Load current is stepped for output under test while other outputs are fixed at half rated load.
4. Each output is measured for all combinations of line and load. Only the minimum and maximum readings for each output are recorded.
5. Load step transition time ≥ 10µS.
6. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1% of its steady state value.
7. Turn on delay time is for either a step application of input power or a logical low to high transition on the inhibit pin (pin 3) while power is present at the input.

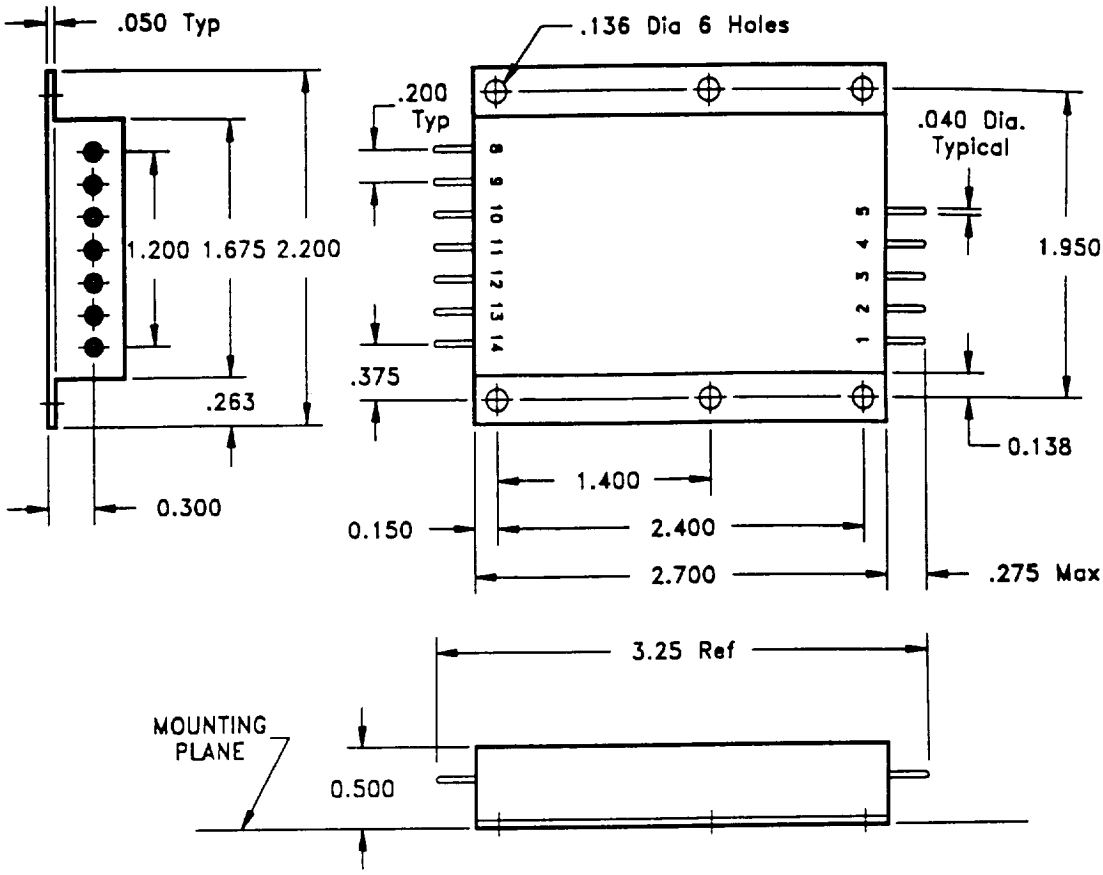
Table IV
Electrical Test Requirements.

MIL-H-38534 Test Requirements	Subgroups (in accordance with MIL-H-38534, group A test table)
Interim electrical parameters	1 (tests 1, 2, 3, 5, 7 & 8 of table III herein only)
Final electrical test parameters	1* 2, 3, 4, 5, 6
Group A test requirements	1 2, 3, 4, 5, 6
Group C end-point electrical parameters	1, 4
Group E end-point electrical parameters	1, 4

* PDA applies to subgroup 1.

Table V
Approved Sources of Supply

Manufacturer's CAGE code	Manufacturer's name and address
52467	Lambda Advanced Analog 2270 Martin Avenue Santa Clara, CA 95050-2781



Notes: Dimensions are in inches.
Unless otherwise specified, tolerances are

∠	= ± 2°
.XX	= ± .01
.XXX	= ± .005

Base Plate Flatness 0.003 maximum.

Figure 1.
Physical Outline

Size	Cage Code.	Drawing No.	Rev
A	52467	SCD 171558	A
Scale: NONE		Sheet 11 of 12	

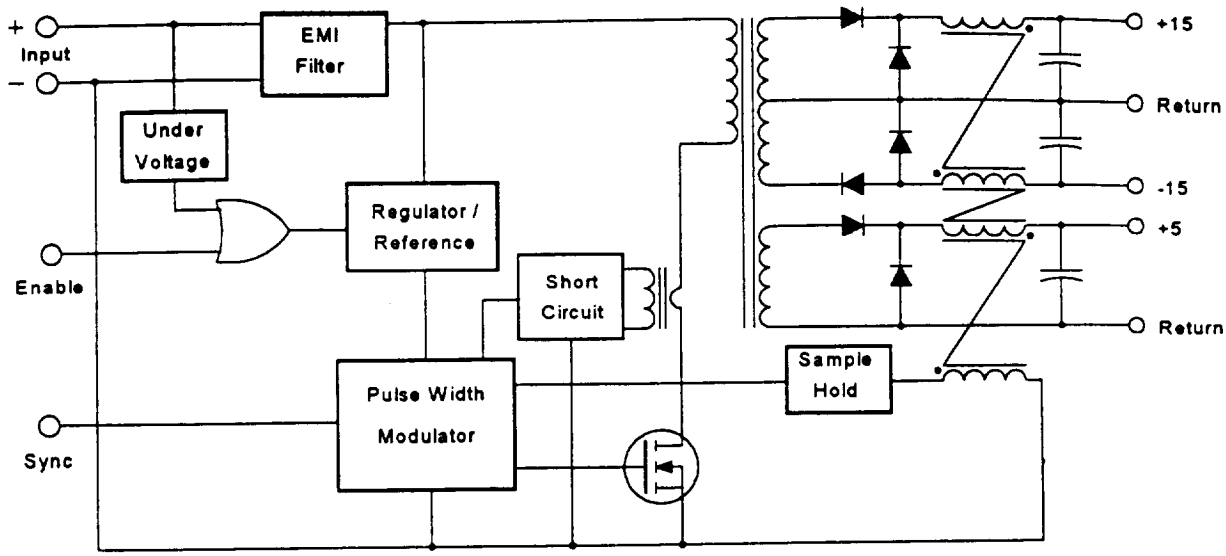
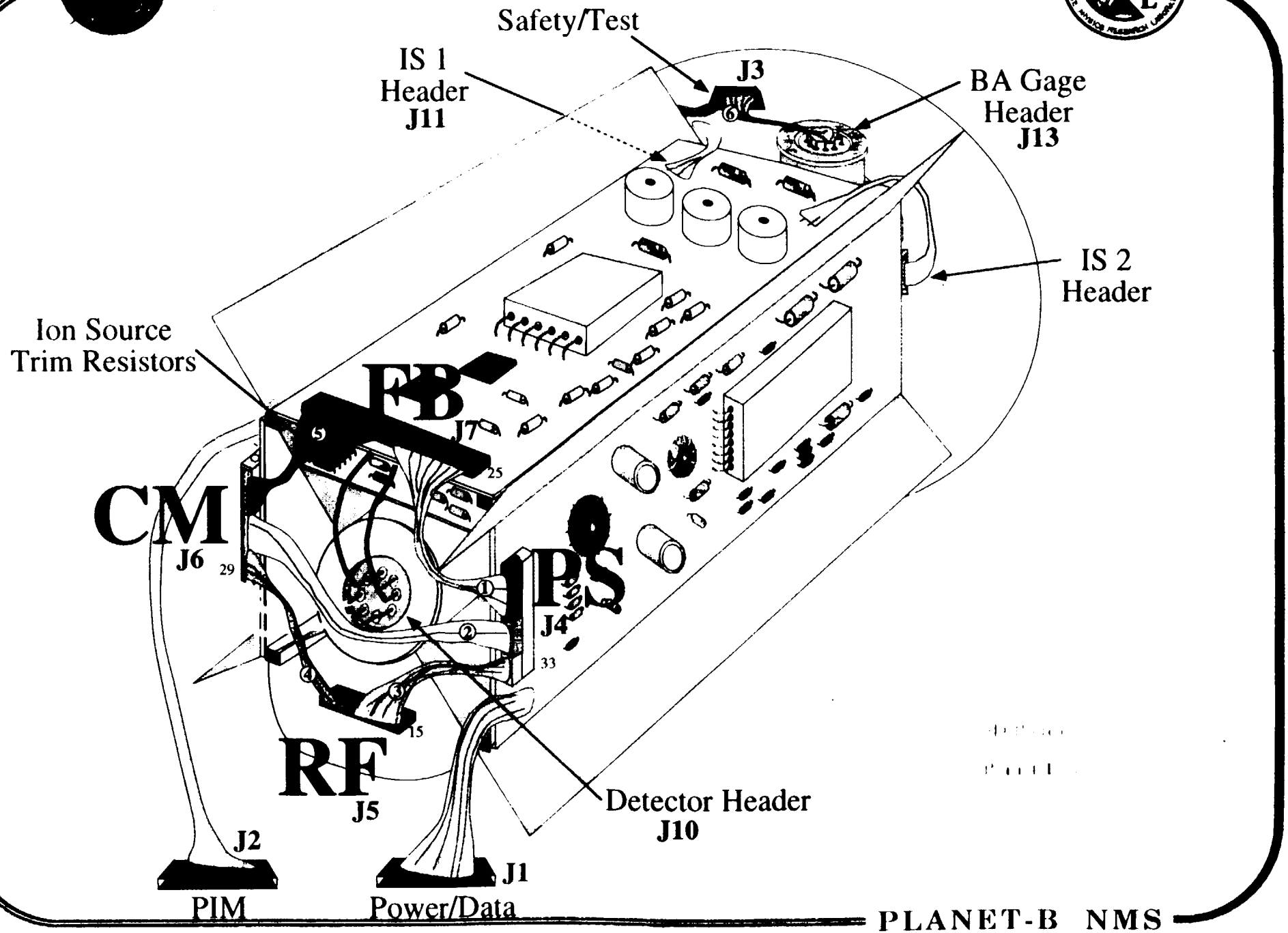


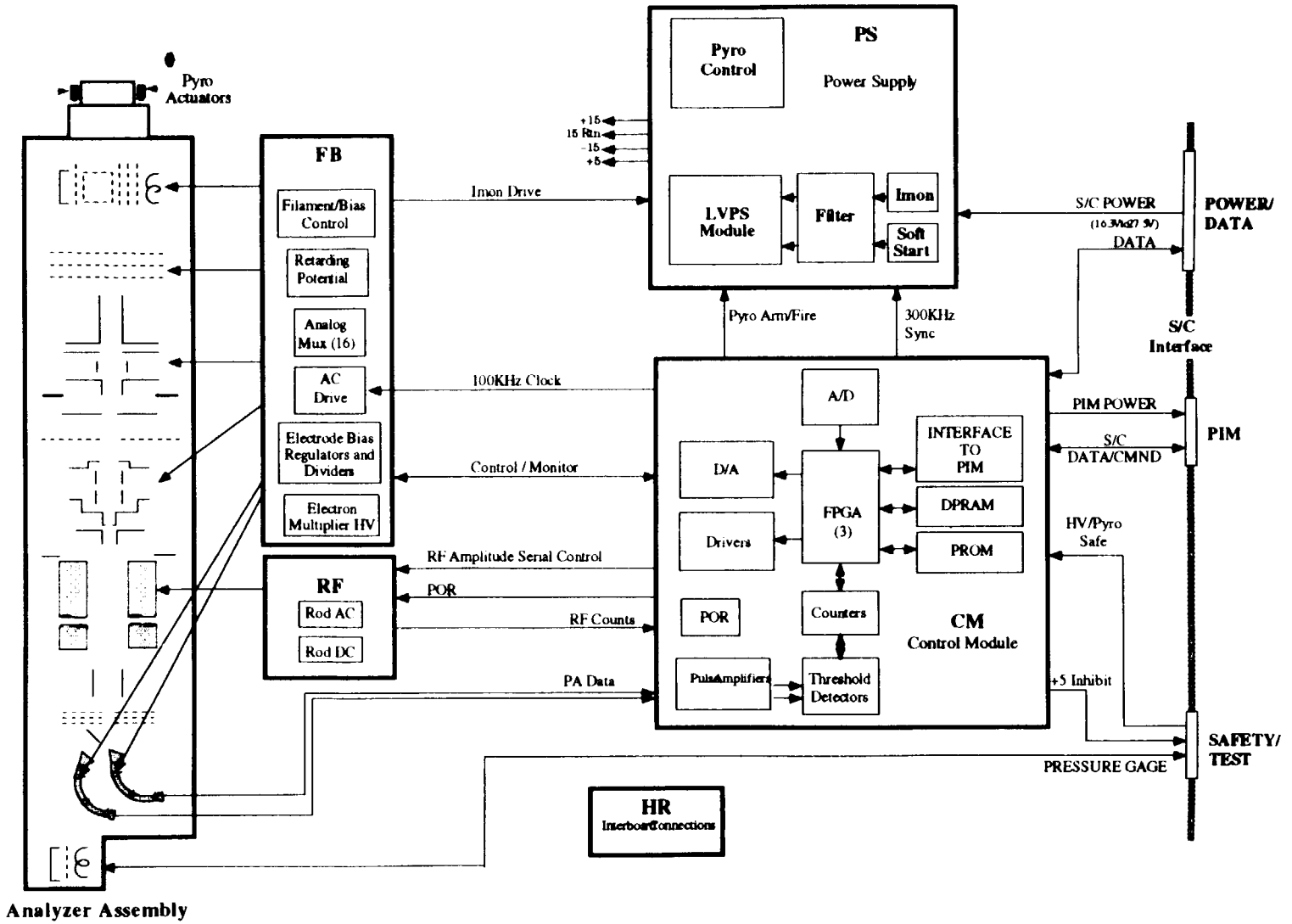
Figure 2.
Block Diagram

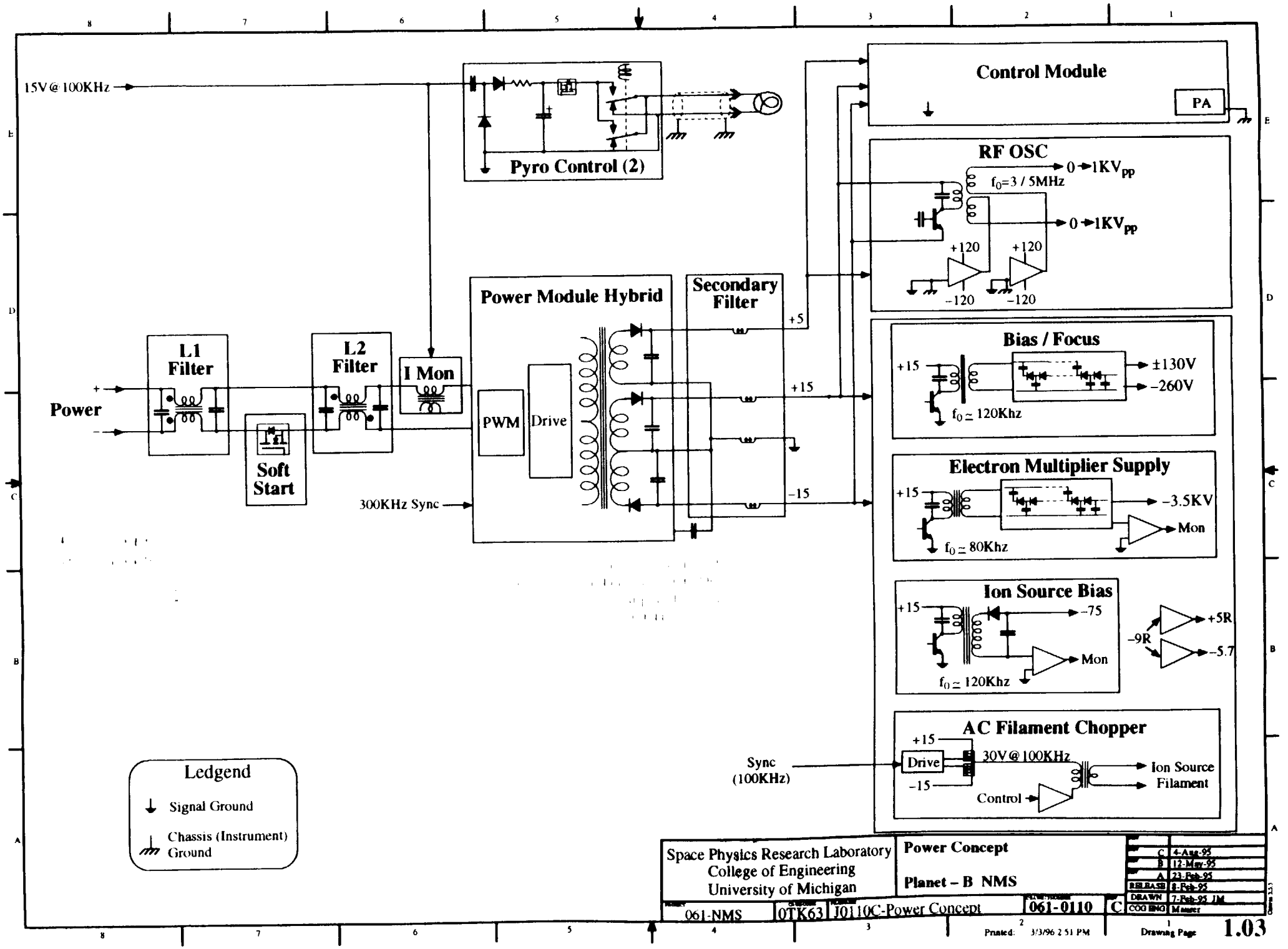
Size	Cage Code.	Drawing No.	Rev
A	52467	SCD 171558	A
Scale: NONE		Sheet 12 of 12	



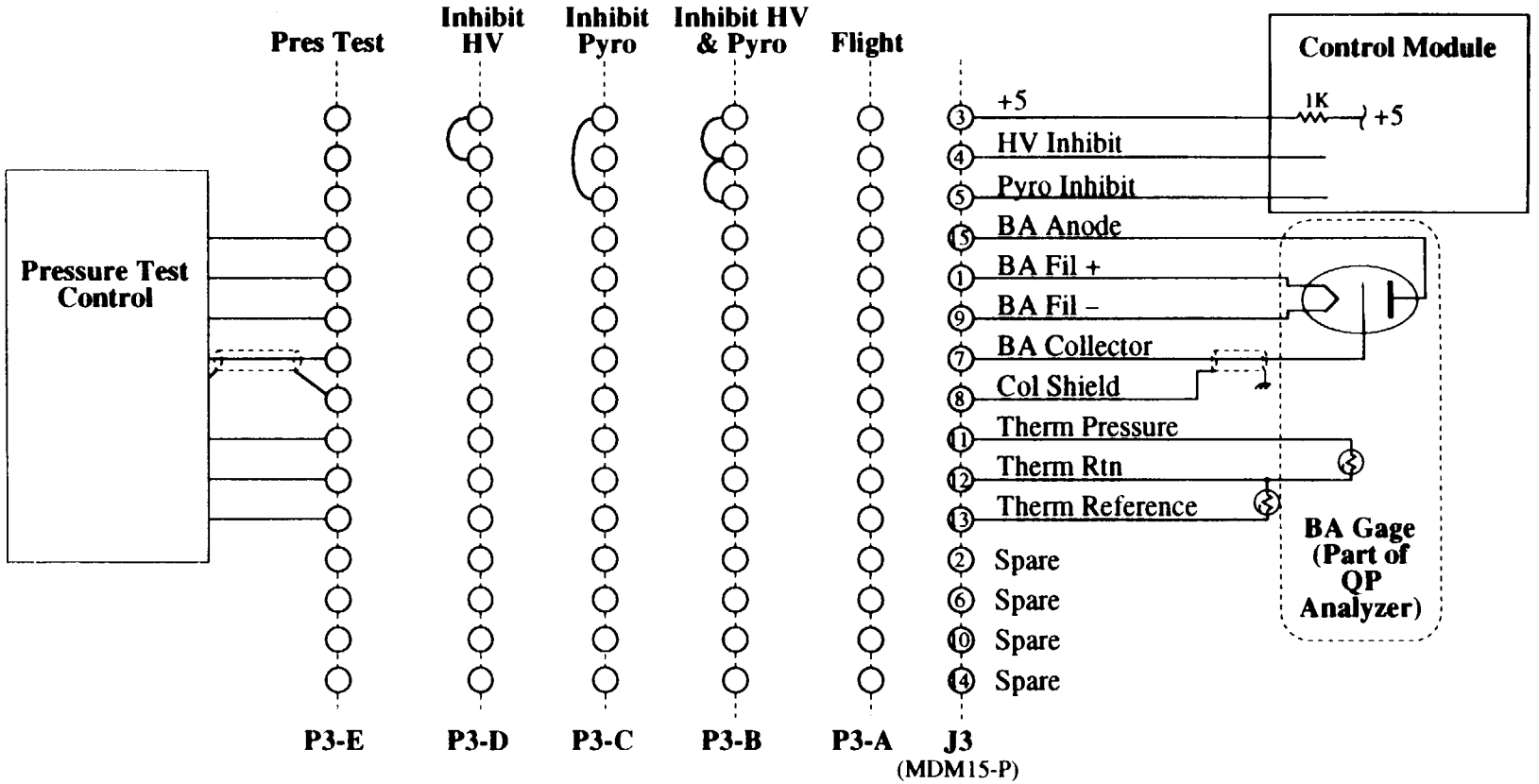
PLANET-B NMS

File: VG Planet B 3D pic


Pyro Actuators
FB
Filament/Bias Control
Retarding Potential
Analog Mux (16)
AC Drive
Electrode Bias Regulators and Dividers
Electron Multiplier HV
RF
Rod AC
Rod DC
Analyzer Assembly
Imon Drive
100KHz Clock
Control / Monitor
RF Amplitude Serial Control
POR
RF Counts
PA Data
PS
Pyro Control
Power Supply
+15
15 Rtn
-15
+5
LVPS Module
Filter
Imon
Soft Start
Pyro Arm/Fire
300KHz Sync
S/C POWER
DATA
POWER/ DATA
S/C Interface
A/D
D/A
Drivers
FPGA (3)
INTERFACE TO PIM
DPRAM
PROM
POR
Counters
PulsAmplifiers
Threshold Detectors
CM Control Module
PIM POWER
S/C DATA/CMND
PIM
HV/Pyro Safe
+5 Inhibit
SAFETY/ TEST
PRESSURE GAGE
HR
InterboardConnections

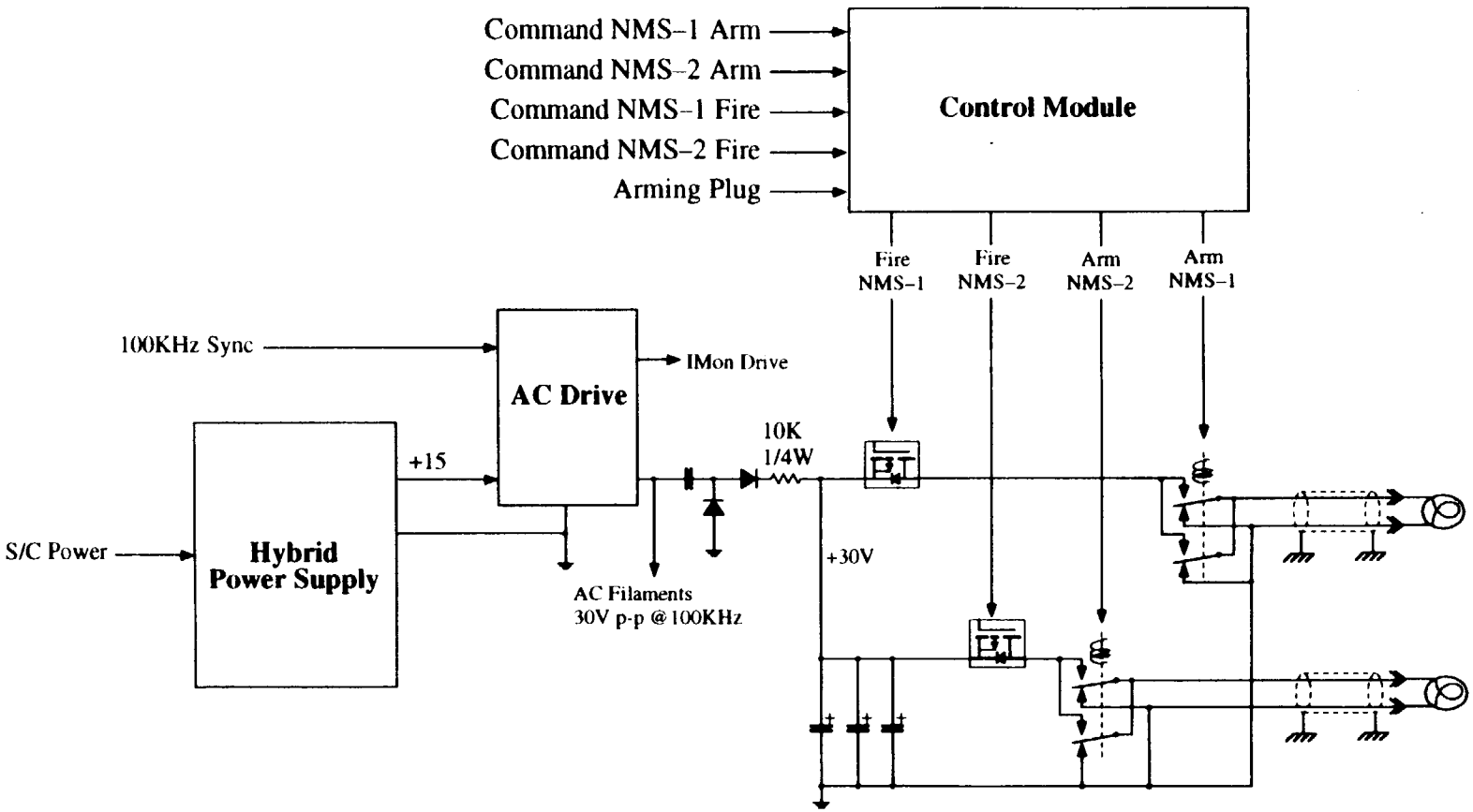

15V@100KHz
Pyro Control (2)
Control Module
PA
RF OSC
f_0=3 / 5MHz
0→1KV$_{pp}$
0→1KV$_{pp}$
+120
+120
-120
-120
Power
L1 Filter
L2 Filter
I Mon
Soft Start
Power Module Hybrid
PWM
Drive
300KHz Sync
Secondary Filter
+5
+15
-15
Bias / Focus
+15
±130V
-260V
$f_0 \simeq$ 120Khz
Electron Multiplier Supply
+15
-3.5KV
Mon
$f_0 \simeq$ 80Khz
Ion Source Bias
+15
-75
Mon
$f_0 \simeq$ 120Khz
-9R
+5R
-5.7
AC Filament Chopper
+15
Drive
-15
30V@100KHz
Ion Source Filament
Control
Sync (100KHz)
Ledgend
Signal Ground
Chassis (Instrument) Ground
Space Physics Research Laboratory
College of Engineering
University of Michigan
Power Concept
Planet – B NMS
061-NMS
0TK63
J0110C-Power Concept
061-0110
C
C 4-Aug-95
B 12-May-95
A 23-Feb-95
RELEASE 8-Feb-95
DRAWN 7-Feb-95 JM
COG ENG Master
Printed: 3/3/96 2:51 PM
Drawing Page
1.03

Optional Plugs



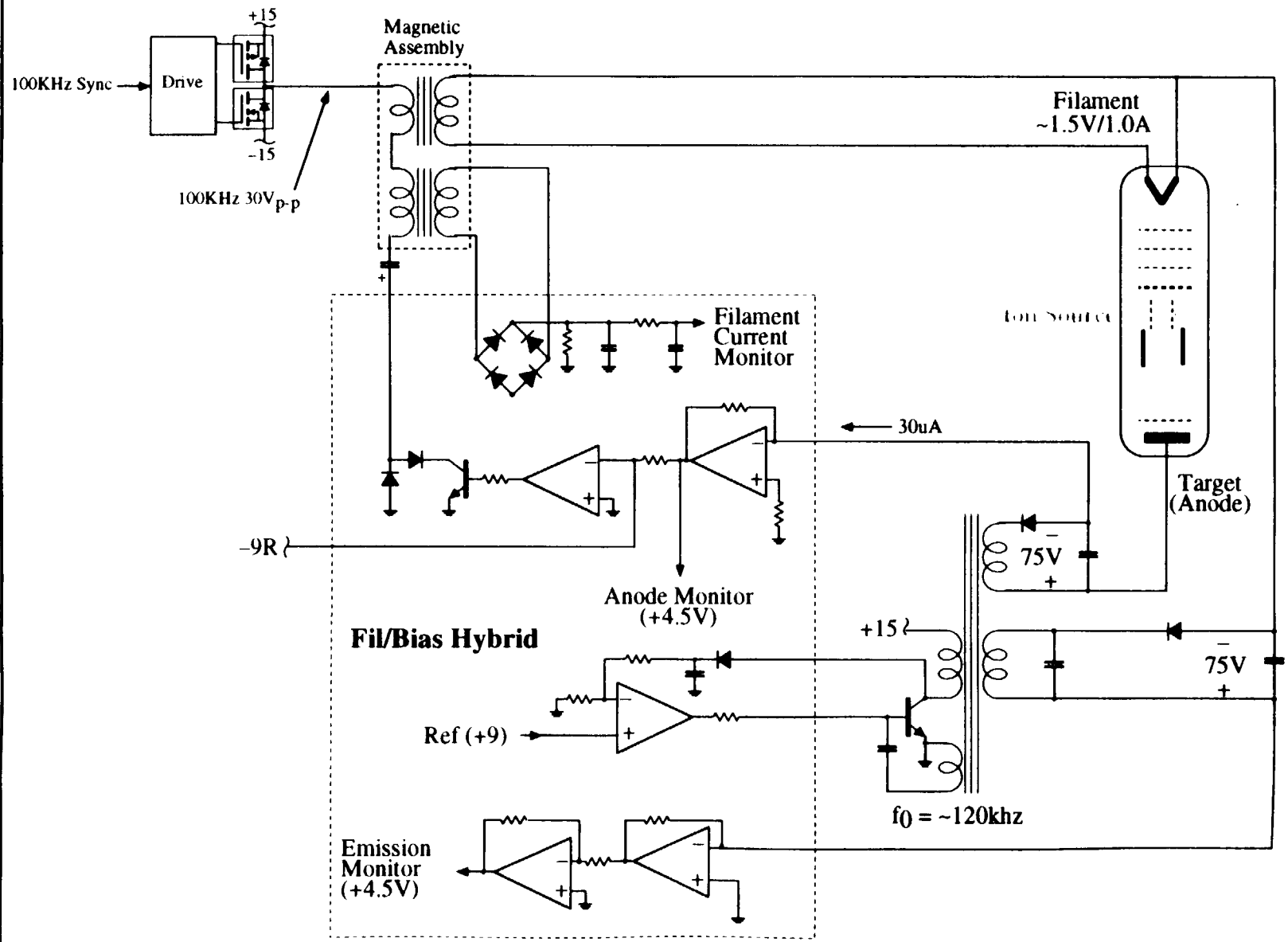
Space Physics Research Laboratory College of Engineering University of Michigan		Safe/Arm Concept Planet – B NMS			A 6-Sep-95 RELEASE 12-May-95
061-NMS	0TK63	J0121A-Safe/Arm Concept	061-0121	A	DRAWN 18-Apr-95 COG ENG Mauser

Drawing Page 1.06

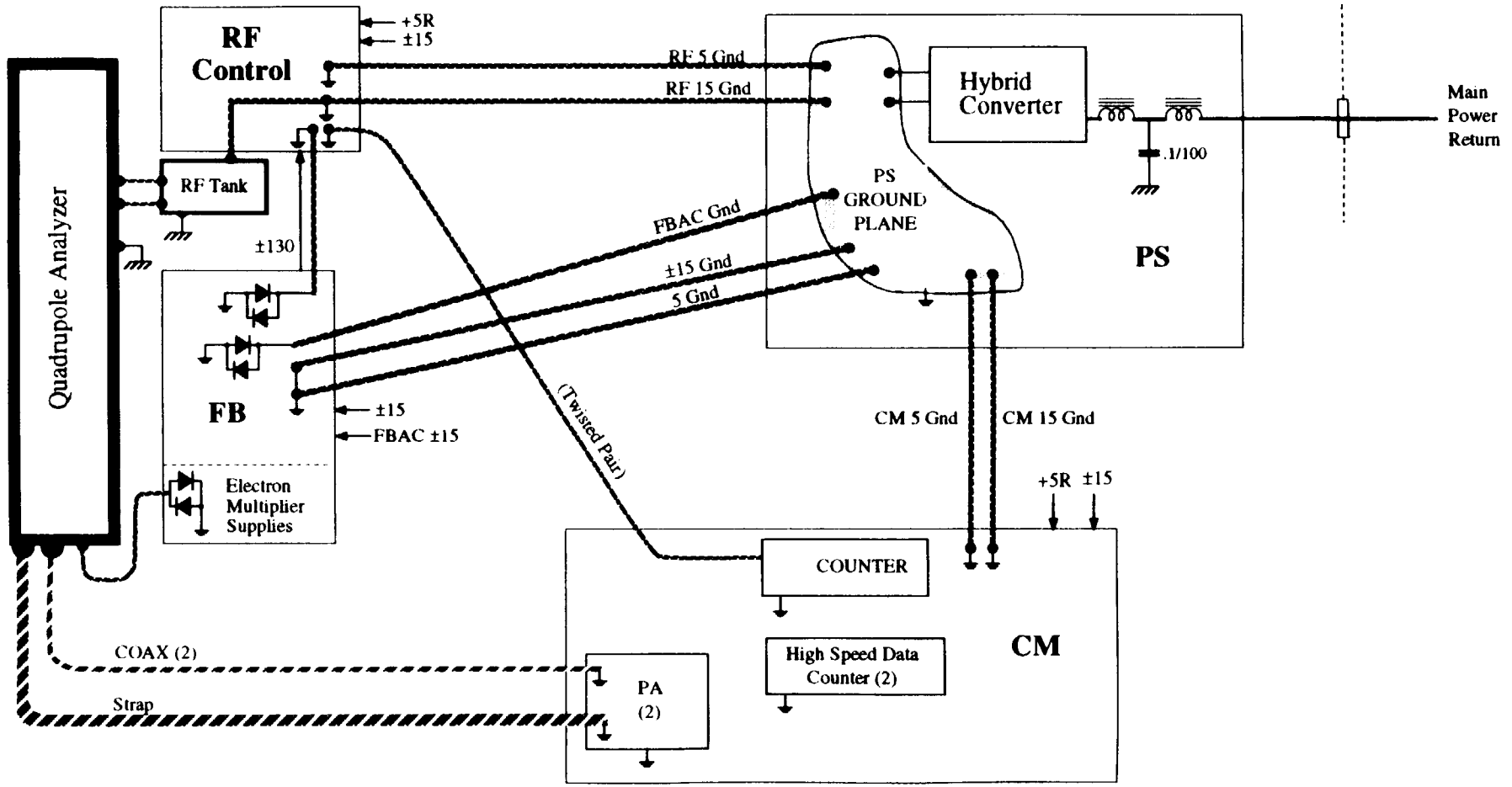


Capacitors:	FETs:	Relays:	Pyro Device:
Sprague	IR	Teledyne TO-5	IRECO Inc. BA31K7
M39006/22-0640	IRHF9130	412D-12	No Fire = 50 mA
140/60		M39016/15-129L	Recommended Fire = 1A
CLR79 T4			Resistance = 4 to 5 ohms

Space Physics Research Laboratory College of Engineering University of Michigan	Pyro Concept Planet-B NMS			B	4-Mar-96
				A	4-Apr-95
				RELEASE	12-May-95
				DRAWN	18-Apr-95 JM
061-NMS	0TK63	J0120B-Pyro Concept	061-0120	B	CODING



Space Physics Research Laboratory College of Engineering University of Michigan	**Filament Regulator Concept** **Planet – B**			A	27-Jul-95
				RELEASE	12-May-95
				DRAWN	5-Feb-95 JM
INMS/NAS53094	0TK63	J0112-Fil Reg Concept	061-0112	A	CODING Master



Legend

Connection to NMS **Instrument** Chassis

Connection to NMS **Secondary** Ground

Space Physics Research Laboratory College of Engineering University of Michigan	**Grounding Plan** **Planet – B NMS**			
061-NMS	0TK63	J0354-Grounding Plan	061-0354	–

RELEASE 11-Aug-95
DRAWN 11-Aug-95
CODING Master

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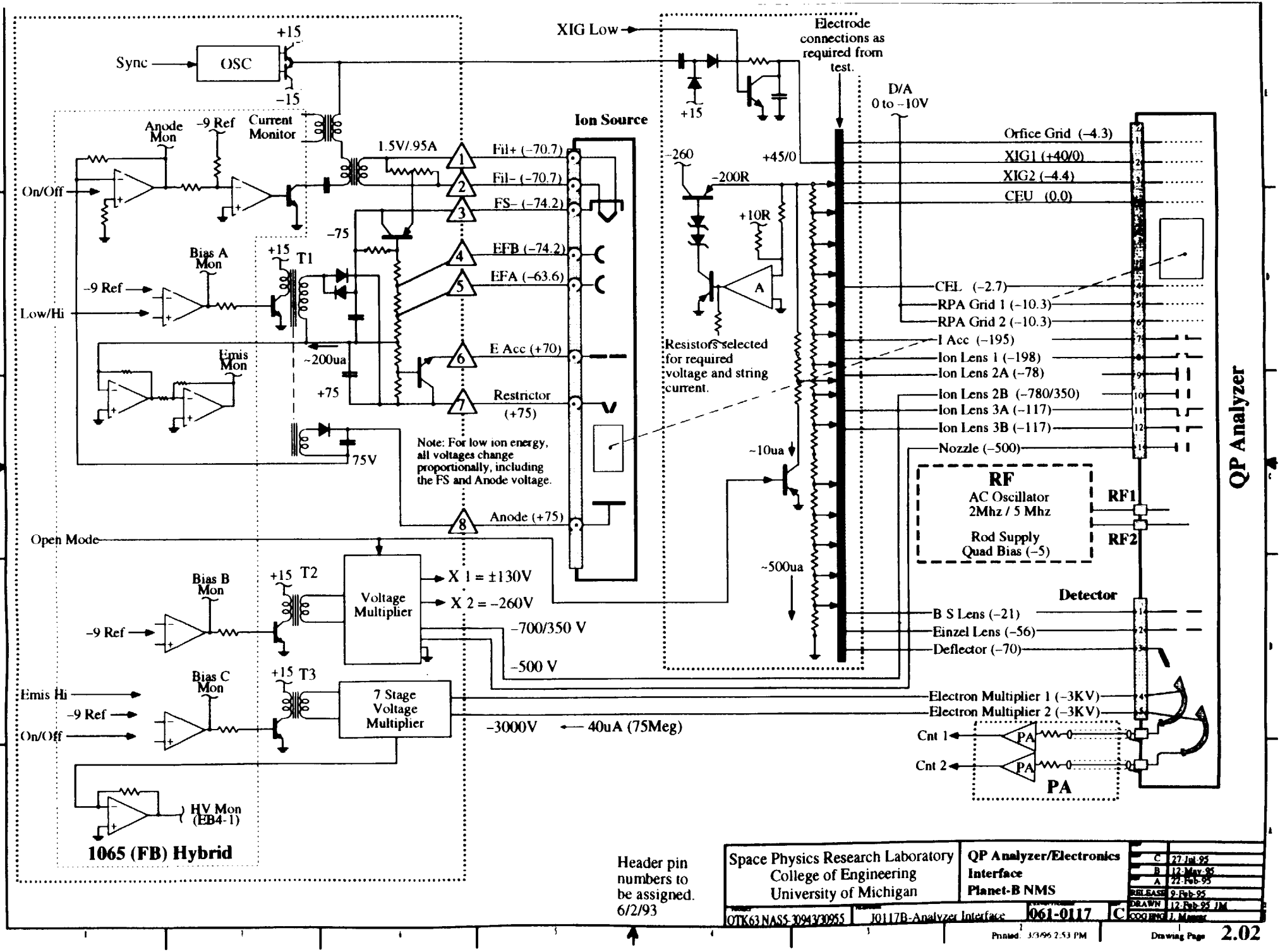
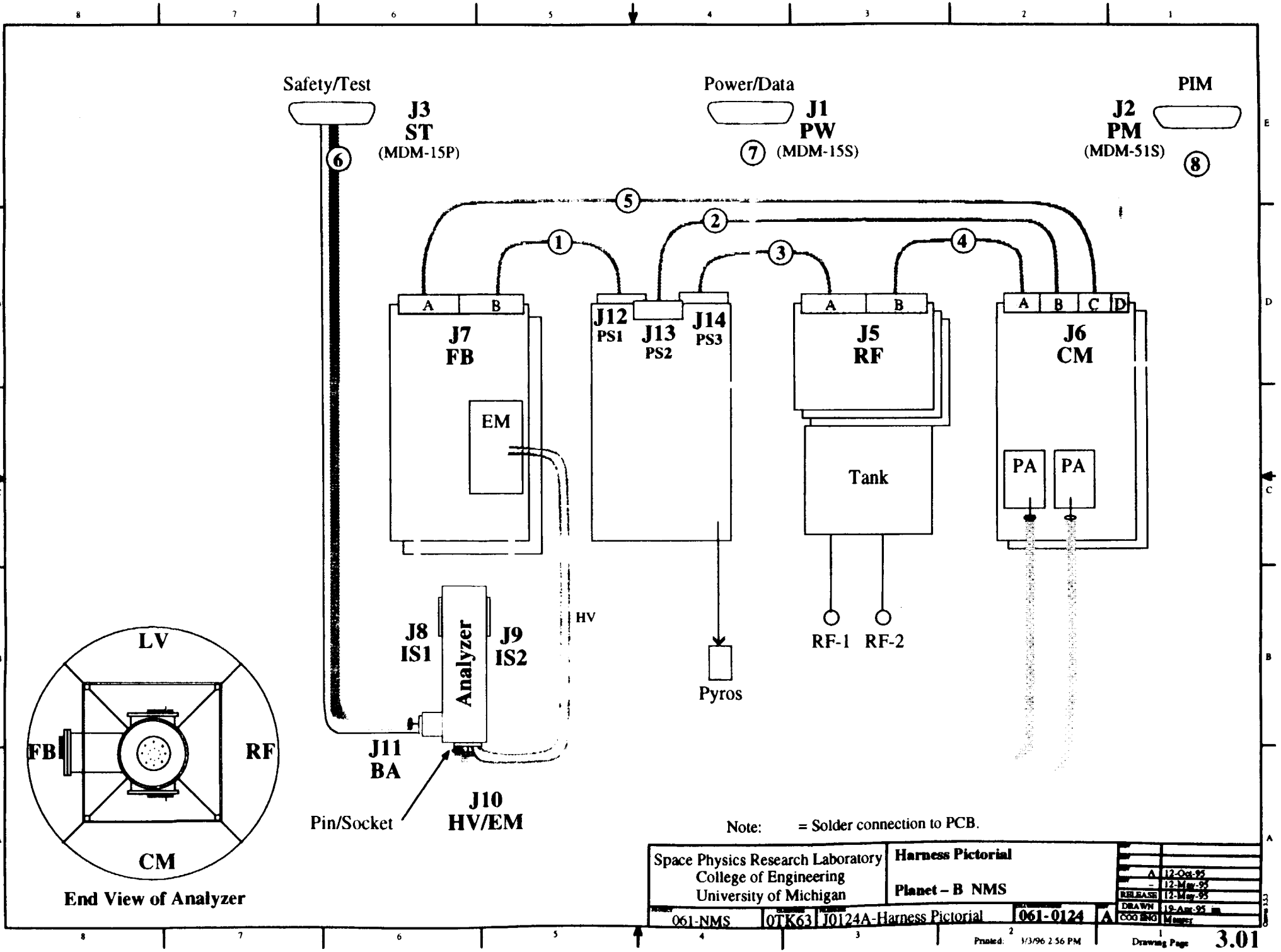
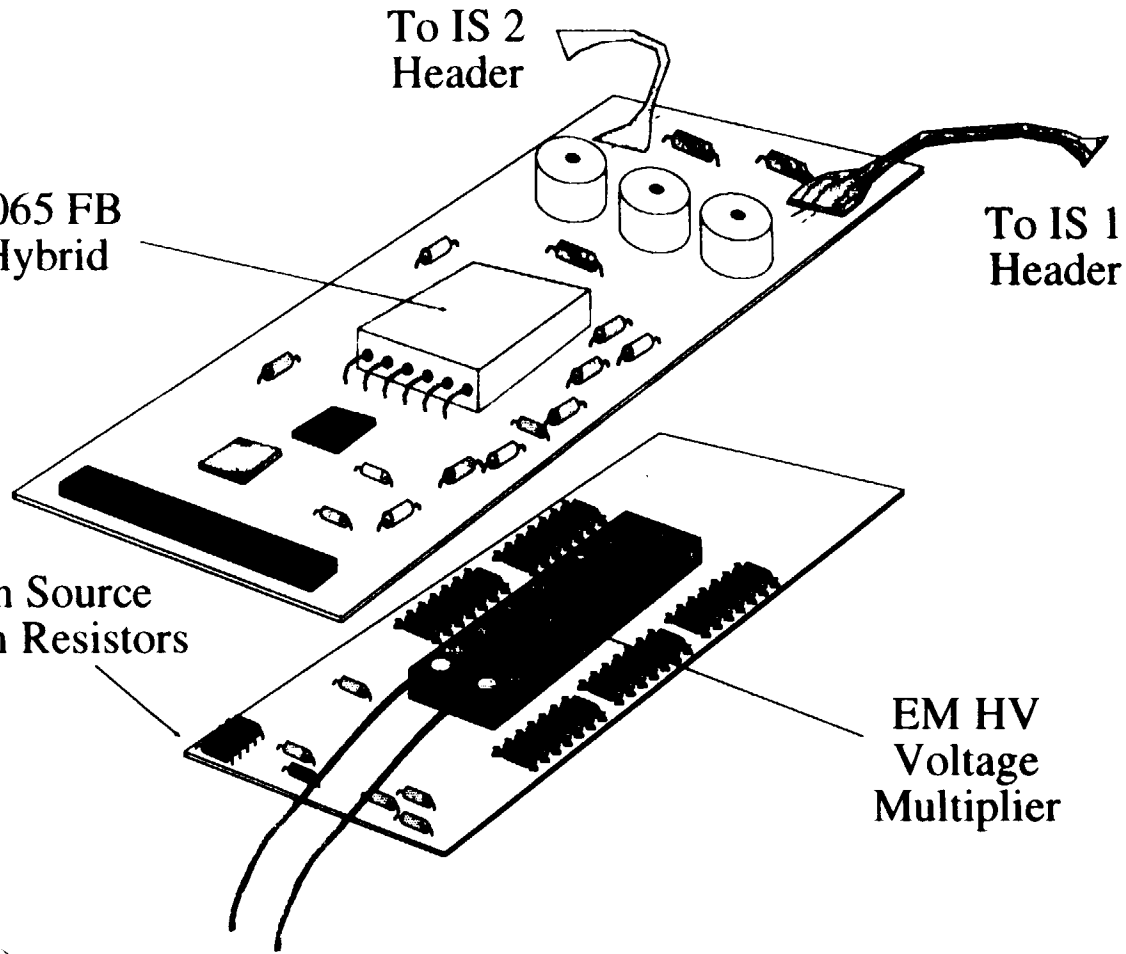
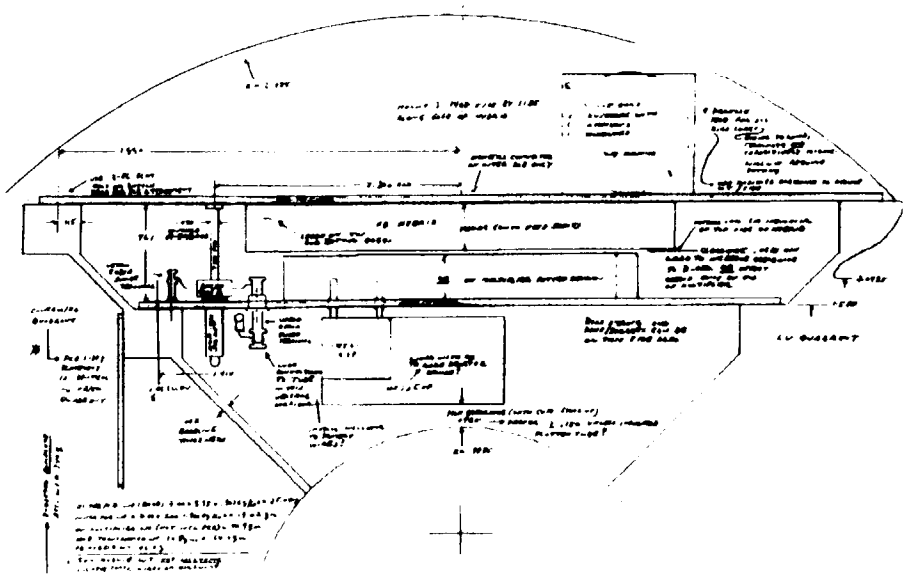
Drawing Page 1.13


Sync
OSC
+15
-15
XIG Low
Electrode connections as required from test.
D/A 0 to -10V
Ion Source
Anode Mon
-9 Ref
Current Monitor
1.5V/.95A
On/Off
Fil+ (-70.7)
Fil- (-70.7)
FS- (-74.2)
EFB (-74.2)
EFA (-63.6)
E Acc (+70)
Restrictor (+75)
Anode (+75)
-75
Bias A Mon
T1
Low/Hi
Emis Mon
~200ua
+75
75V
Note: For low ion energy, all voltages change proportionally, including the FS and Anode voltage.
-260
+45/0
-200R
+10R
A
Resistors selected for required voltage and string current.
~10ua
~500ua
Orfice Grid (-4.3)
XIG1 (+40/0)
XIG2 (-4.4)
CEU (0.0)
CEL (-2.7)
RPA Grid 1 (-10.3)
RPA Grid 2 (-10.3)
I Acc (-195)
Ion Lens 1 (-198)
Ion Lens 2A (-78)
Ion Lens 2B (-780/350)
Ion Lens 3A (-117)
Ion Lens 3B (-117)
Nozzle (-500)
RF
AC Oscillator 2Mhz / 5 Mhz
Rod Supply Quad Bias (-5)
RF1
RF2
QP Analyzer
Detector
B S Lens (-21)
Einzel Lens (-56)
Deflector (-70)
Open Mode
Bias B Mon
T2
Voltage Multiplier
X 1 = ±130V
X 2 = -260V
-700/350 V
-500 V
Bias C Mon
T3
7 Stage Voltage Multiplier
Emis Hi
-3000V
40uA (75Meg)
Electron Multiplier 1 (-3KV)
Electron Multiplier 2 (-3KV)
Cnt 1
Cnt 2
PA
HV Mon (EB4-1)
1065 (FB) Hybrid
Header pin numbers to be assigned. 6/2/93
Space Physics Research Laboratory
College of Engineering
University of Michigan
QP Analyzer/Electronics Interface
Planet-B NMS
C 27-Jul-95
B 12-May-95
A 22-Feb-95
RELEASED 9-Feb-95
DRAWN 12-Feb-95 JM
CHECKED J. Maurer
OTK63 NAS5-30943/30955
J0117B-Analyzer Interface
061-0117
C
Printed: 3/3/96 2:53 PM
Drawing Page 2.02


Safety/Test
J3
ST
(MDM-15P)
Power/Data
J1
PW
(MDM-15S)
PIM
J2
PM
(MDM-51S)
6
7
8
5
2
1
3
4
A
B
J7
FB
EM
J12
PS1
J13
PS2
J14
PS3
A
B
J5
RF
Tank
A
B
C
D
J6
CM
PA
PA
HV
J8
IS1
Analyzer
J9
IS2
J11
BA
J10
HV/EM
Pin/Socket
Pyros
RF-1
RF-2
LV
FB
RF
CM
End View of Analyzer
Note: = Solder connection to PCB.
Space Physics Research Laboratory
College of Engineering
University of Michigan
Harness Pictorial
Planet – B NMS
061-NMS
0TK63
J0124A-Harness Pictorial
061-0124
A
12-Oct-95
12-May-95
RELEASE
12-May-95
DRAWN
COG ENG
Printed: 3/3/96 2:56 PM
Drawing Page
3.01

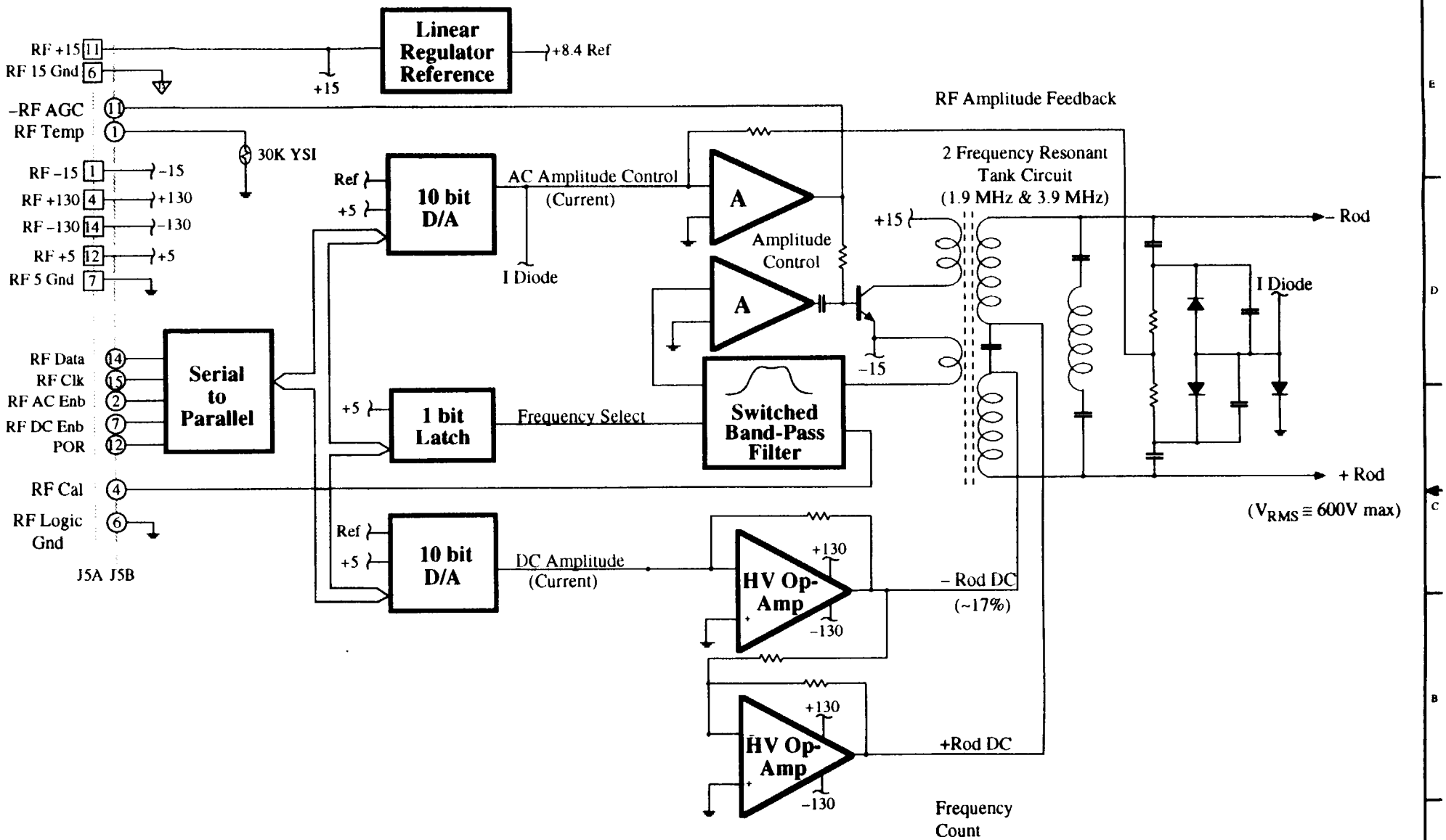




Space Physics Research Laboratory College of Engineering University of Michigan	FB Pictorial Plane B NMS				
061-NMS	0TK63	J0103A-FB Pictorial	061-0103	A	
				RELEASE	12-May-95 JM
				DRAWN	10-May-95 JM

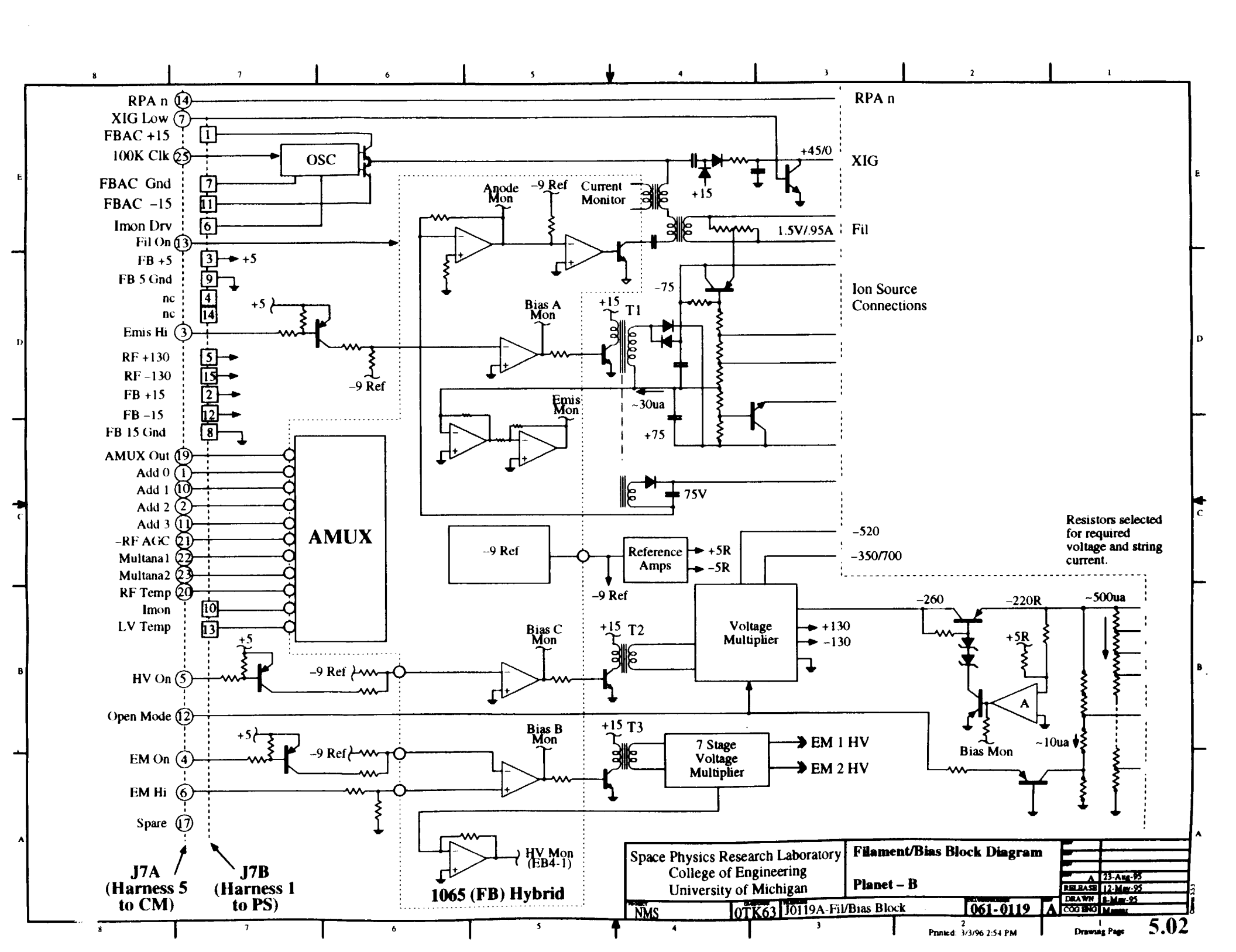
Printed 3/10/96 2:50 PM

Drawing Page 5.01



Space Physics Research Laboratory College of Engineering University of Michigan	RF Functional Block Diagram Planet – B NMS				
061-NMS	0TK63	J0141-RF Block	061-0141	A	RELEASE 12-May-95 DRAWN Copy 10-May-95 jm COG ENG Block

6.02


RPA n
XIG Low
FBAC +15
100K Clk
FBAC Gnd
FBAC -15
Imon Drv
Fil On
FB +5
FB 5 Gnd
nc
nc
Emis Hi
RF +130
RF -130
FB +15
FB -15
FB 15 Gnd
AMUX Out
Add 0
Add 1
Add 2
Add 3
-RF AGC
Multana1
Multana2
RF Temp
Imon
LV Temp
HV On
Open Mode
EM On
EM Hi
Spare
OSC
AMUX
+5
-9 Ref
Anode Mon
Current Monitor
+15
+45/0
1.5V/.95A
Fil
Ion Source Connections
-75
Bias A Mon
T1
~30ua
Emis Mon
+75
75V
-520
-350/700
Resistors selected for required voltage and string current.
Reference Amps
+5R
-5R
Bias C Mon
T2
Voltage Multiplier
+130
-130
-260
-220R
~500ua
Bias B Mon
T3
7 Stage Voltage Multiplier
EM 1 HV
EM 2 HV
Bias Mon
~10ua
HV Mon (EB4-1)
1065 (FB) Hybrid
J7A (Harness 5 to CM)
J7B (Harness 1 to PS)
Space Physics Research Laboratory
College of Engineering
University of Michigan
Filament/Bias Block Diagram
Planet – B
NMS
0TK63
J0119A-Fil/Bias Block
061-0119
A
23-Aug-95
12-Mar-95
8-Mar-95
Printed: 3/3/96 2:54 PM
Drawing Page
5.02

DRAWINGS

Planet–B

NMS

Electronic System Drawings

Release 2

4-Mar-96

File

Note: The EGSE is a separate book.

Planet-B NMS Electronic Drawing Index

Page	(061-) Dwg Num	Rev	Date	Dwg title
0.01	0099.1	–	7/27/95	NMS Drawing Index
0.02	0099.2	–	7/27/95	NMS Drawing Index
0.03	0143	A	10/13/95	Drawing Book Revision Record
1	**Overview & Concept Documents**			
1.01	0101	A	8/11/95	3D Pictorial
1.02	0100	C	8/11/95	Electrical Block Diagram
1.03	0110	C	8/4/95	Power Concept
1.04	0123	–	5/12/95	Data Flow Concept
1.05	0122	A	7/20/95	Command & Control Concept
1.06	0121	A	9/6/95	Safe/Arm Concept
1.07	0120	B	3/4/96	Pyro Concept
1.08	0114	B	8/23/95	Analog Mux Channels
1.09	0112	A	7/27/95	Fil Reg Concept
1.10	0113	–	5/12/95	Emis Bias Concept
1.11	0135	A	2/23/96	Power Estimate
1.12	0352	–	8/4/95	Data Packet Byte Assignment
1.13	0354	–	8/11/95	Grounding Plan
1.20	0380.0	–	2/15/96	Flight Parts Summary pg 1 of 7
1.21	0380.1	–	2/15/96	Flight Parts Summary pg 2 of 7
1.22	0380.2	–	2/15/96	Flight Parts Summary pg 3 of 7
1.23	0380.3	–	2/15/96	Flight Parts Summary pg 4 of 7
1.24	0380.4	–	2/15/96	Flight Parts Summary pg 5 of 7
1.25	0380.5	–	2/15/96	Flight Parts Summary pg 6 of 7
1.26	0380.6	–	2/15/96	Flight Parts Summary pg 7 of 7
1.50	0400	A	2/29/96	Mechanical End View
2	**QP – Quadrupole Electronic Interface**			
2.02	0117	C	7/27/95	Analyzer Electronic Interface
2.03	0115	–	5/12/95	Electrode Voltages
2.04	0413	–	3/6/96	Analyzer Interface Definition
3	**HR – Harness, Main & Header**			
3.01	0124	A	10/12/95	Harness Pictorial
3.02	0125	C	8/11/95	Harness Listing
3.03	0136	–	5/12/95	PIM Plug List
3.04	0150	–	5/26/95	Power Connector List
3.05	0338	A	2/27/96	Harness 1
3.06	0346	A	3/1/96	Harness 2
3.07	0339	A	3/1/96	Harness 3
3.08	0344	A	3/1/96	Harness 4
3.09	0345	A	3/1/96	Harness 5
3.10	0342	A	3/1/96	Harness 6
4	**PS – Power Supply Module**			
4.01	0102	–	5/12/95	PS Pictorial
4.02	0144	A	7/27/95	PS Block Diagram
4.03	0126.1	D	2/8/96	PS Schematic Drawing Pg 1
4.04	0126.2	D	2/8/96	PS Schematic Drawing Pg 2
4.05	0126.3	D	2/8/96	PS Schematic Drawing Pg 3
4.06	0127	D	2/8/96	PS Parts List Pg. 1
4.07	0127	D	2/8/96	PS Parts List Pg. 2
4.08	0128	D	2/8/96	PS Net List Pg. 1
4.09	0128	D	2/8/96	PS Net List Pg. 2
4.10	0128	D	2/8/96	PS Net List Pg. 3
4.20	0129	A	5/12/95	PS L1 Ass'y Detail
4.21	0130	B	7/5/95	PS L2 Ass'y Detail
4.22	0131	D	2/26/96	PS MA1 Pg 1 of 2
4.23	0131	D	2/26/96	PS MA1 Pg 2 of 2
4.24	0132	–	7/19/95	PS L3 Ass'y Detail
4.50	0139	A	2/28/96	PS PCB Outline
4.51	0374.0	A	2/7/96	PS PCB Drill and Trim
4.52	0374.1	–	2/7/96	PS PCB Layer 1
4.53	0374.2	–	2/7/96	PS PCB Layer 2
4.54	0374.3	–	2/7/96	PS PCB Layer 3
4.55	0374.4	–	2/7/96	PS PCB Layer 4
4.56	0376	A	2/1/96	PS Umbilical Support
4.57	0388	A	2/23/96	PS L1, L3 Cap
4.58	0393	A	2/26/96	PS MA1 Mounting Cap
4.59	0375	–	5/12/95	End View Layout– Preliminary
5	**FB – Fil/Bias & HV Module**			
5.01	0103	–	8/11/95	Fil/Bias Pictorial
5.02	0119	A	8/23/95	Fil/Bias Block Diagram
5.03	0133.1	–	8/30/95	FB PCB Schematic Pg 1 of 4
5.04	0133.2	–	8/30/95	FB PCB Schematic Pg 2 of 4
5.05	0133.3	–	8/30/95	FB PCB Schematic Pg 3 of 4
5.06	0133.4	–	8/30/95	FB PCB Schematic Pg 4 of 4
5.10	0357	–	8/30/95	FB PCB Parts List

Planet-B NMS Electronic Drawing Index

Page	(061-) Dwg Num	Rev	Date	Dwg title
5.11	0357	–	8/30/95	FB PCB Parts List
5.12	0357	–	8/30/95	FB PCB Parts List
5.13	0357	–	8/30/95	FB PCB Parts List
5.14	0357	–	8/30/95	FB PCB Parts List
5.15	0357	–	8/30/95	FB PCB Parts List
5.16	0357	–	8/30/95	FB PCB Parts List
5.20	0349	–	7/31/95	FB Filament/Current Transformer
5.21	0350	–	9/1/95	FB -780 Bias Transformer
5.22	0351	–	8/24/95	FB +/-75 Bias Transformer
5.23	0364	–	9/30/95	FB EM Transformer
5.40	0356	–	8/24/95	+/-75 Bias Test Oscillator Circuit
5.49	0396	A	2/29/96	FB Outer PCB Outline
5.50	0397	A	2/29/96	FB Inner PCB Outline
6	**RF – RF Module**			
6.01	0104	—	5/12/95	RF Pictorial
6.02	0141	A	8/23/95	RF Functional Block Diagram
6.04	0355.1	–	9/20/95	RF/DC Control, Pg. 1 of 5
6.05	0355.2	–	9/20/95	RF/DC Control, Pg. 2 of 5
6.06	0355.3	–	9/20/95	RF/DC Control, Pg. 3 of 5
6.07	0355.4	–	9/20/95	RF/DC Control, Pg. 4 of 5
6.08	0355.5	–	9/20/95	RF/DC Control, Pg. 5 of 5
6.09	0369	–	10/12/95	RF/DC RF Driver Bd.
6.10	0370	–	10/12/95	RF/DC AGC Bd.
6.11	0371	–	9/20/95	RF/DC Tank Comp.
6.13	0373	–	10/12/95	RF/DC TB Adapter Harness
6.48	0140	–	5/12/95	RF Outline — Preliminary
6.49	0398	A	2/29/96	RF Outer PCB Outline
6.50	0399	A	2/29/96	RF Inner PCB Outline
7	**CM – Control Module**			
7.02	0137	A	8/4/95	CM Functional Block (GSFC#????)
7.03	0142	C	9/5/95	CM Analog Interface
7.04	0404	–	2/20/96	CM Breadboard (bb.sch pg1)
7.05	0405	–	2/20/96	CM D/A Converter (dac08.sch)
7.06	0406	–	2/20/96	CM Pulse Amplifier Hybrid Pg4
7.07	0407	–	2/20/96	CM Memory Unit (mu.schPg 4)
7.08	0408	–	2/20/96	PIM Receivers/Drivers Pg 5
7.09	0409	–	2/20/96	Beef4 FPGA (beef4.sch)
7.10	0410	–	2/20/96	NMS Pulse Counters Pg 6
7.11	0411	–	2/20/96	ADC (adc.sch) Pg 8

Release 0, 12-May-95

Initial release of Planet-B, NMS, drawing book. Block and Concept drawings are difinitive, to the extent shown, but schematics are incomplete.

Release 0.1, 16-May-95

Revise pyro grounding and returns. Mod. voltage multiplier on FB.

Release 0.2 2-Jun-95

Revise MUX assignments, revise FB pins, add GSE drawing.

Release 0.3 12-Jun-95

Revise FB schematics & Pins, change HV multplier, redraw CM Block.

Release 0.4 20-Jun-95

Revise Imon, add harness #s to 3D pictorial, revise wire list and CM interface list, harness pictorial shows passthru for J1 data to CM, FB includes emitter follower for HV drive and added resistor for loop stability.

Release 0.5 27-Jul-95

Move Imon drive to FB. Revise FB AC drive circuit. Add XIG plus supply and control switch. Revise pyro voltage and circuit. Add socket type and temp pin assignments to 3 interface plugs. Significant revisions to PS and FB block diagrams.

Release 0.6 5-Aug-95

Add CMD and harness 6. Rev Block diagram to show 100 and 300 KHz sync. Add +5 Inhibit to several dwgs. Add ground legend. Add Data Packet assignment drawing.

Release 0.7 23-Aug-95

Many minor revisions. Harness drawings revised.

Release 0.8 6-Sep-95

CM interface pin assignment for Eng model. Safe/Arm plug pins assignment. Minor updates.

Release 0.9 5-Oct-95

Many FB changes to reflect breadboard status. RF drawings added.

Release 1.0 13-Oct-95

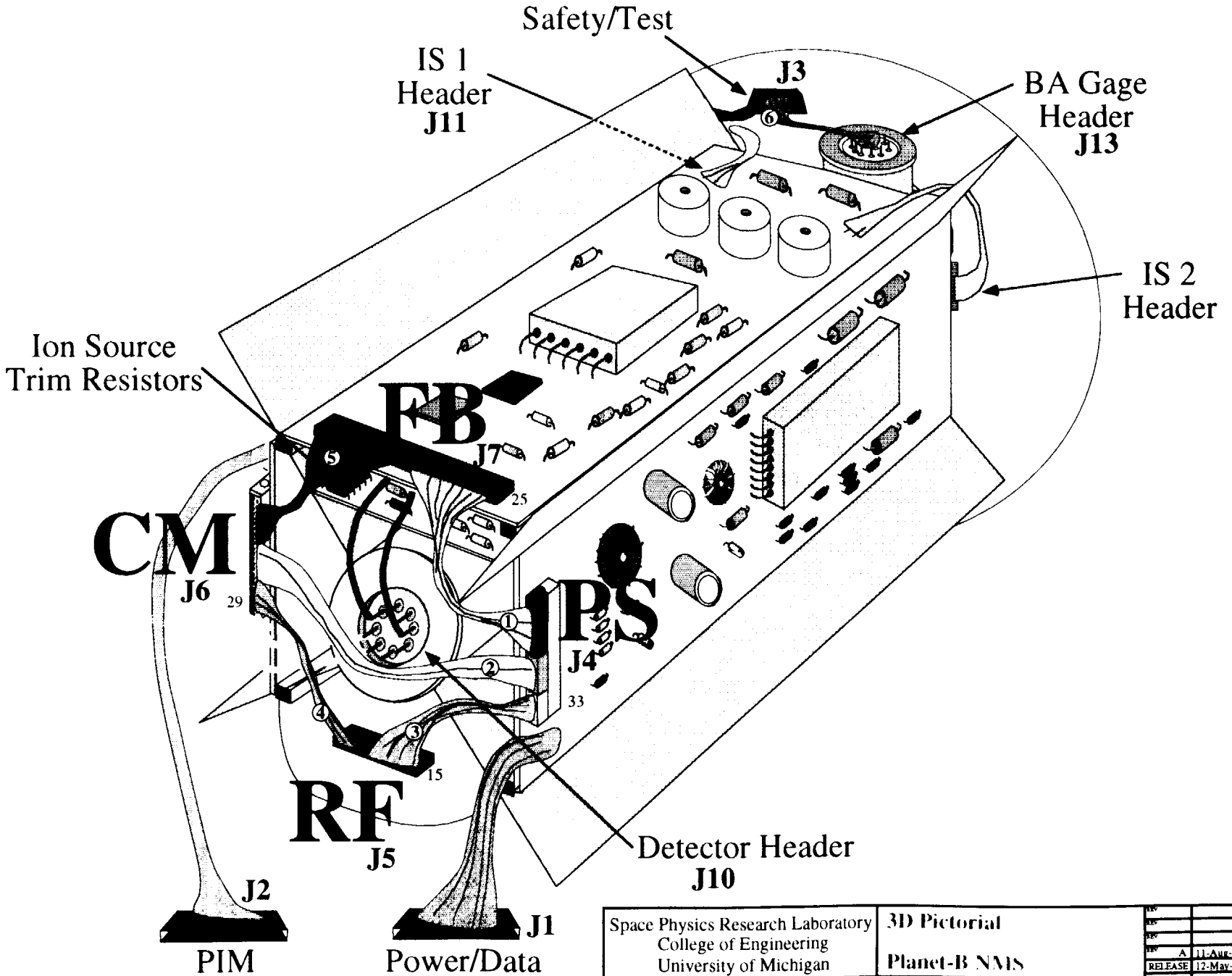
Updated most drawings to show a released date. This revision reflects the status of the finished breadboard unit as tested in Japan. Plugs reflect the BB types – not flight numbering.

Release 2.0 Feb-96

Released book for PDR. Proposed flight unit configuration. No effort made to show revision release date on individual drawings.

Communicate all errors, ommisions, or modifications to:
Bruce Block 313-764-7439, Bruce_Block@umich.edu
John Maurer 313-764-9463, John_Maurer@umich.edu
FTP to/from: JMAURER@SPRLC.SPRL.UMICH.EDU
E-Mail attachments in BINHEX4, or uuencode for
Microsoft WORD, EXCEL, PROJECTS & AutoCad, & Canvas

Section 1
Overview & Concept Documents



Space Physics Research Laboratory College of Engineering University of Michigan	3D Pictorial Planet-B NMS			REV	
				REV	
				REV	
				REV A	11-Aug-95
				RELEASE	12-May-95
061-NMS	0TK63	J0101A-Planet-B 3D	061-0101	A	DRAWN 10-May-95 JM COG ENG Maurer

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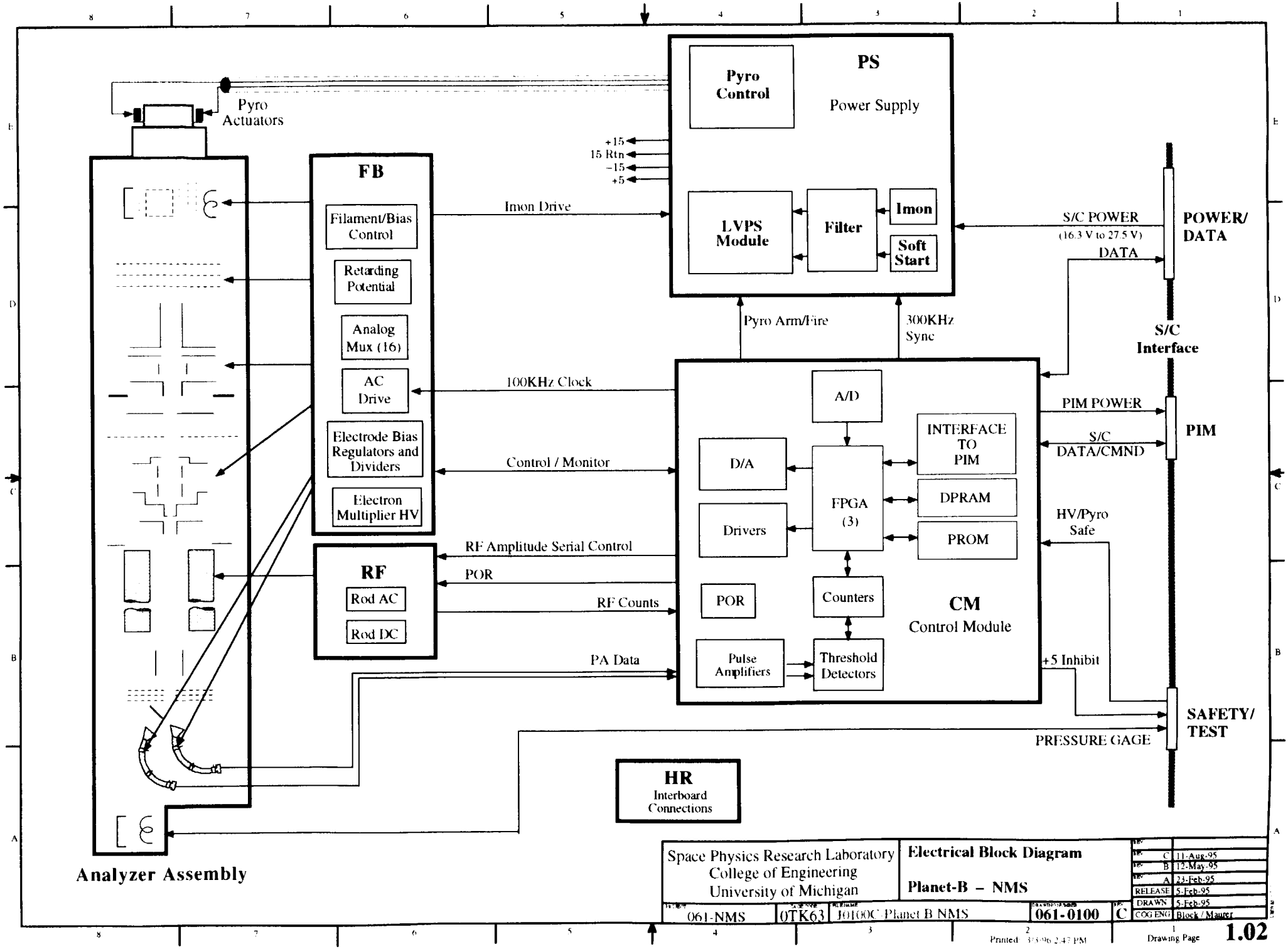
Drawing Page 1.01



Space Physics Research Laboratory College of Engineering University of Michigan	**Electrical Block Diagram** **Planet-B – NMS**

061-NMS	0TK63	J0100C Planet B NMS	061-0100	C

C	11-Aug-95
B	12-May-95
A	23-Feb-95
RELEASE	5-Feb-95
DRAWN	5-Feb-95
COG ENG	Block / Maurer

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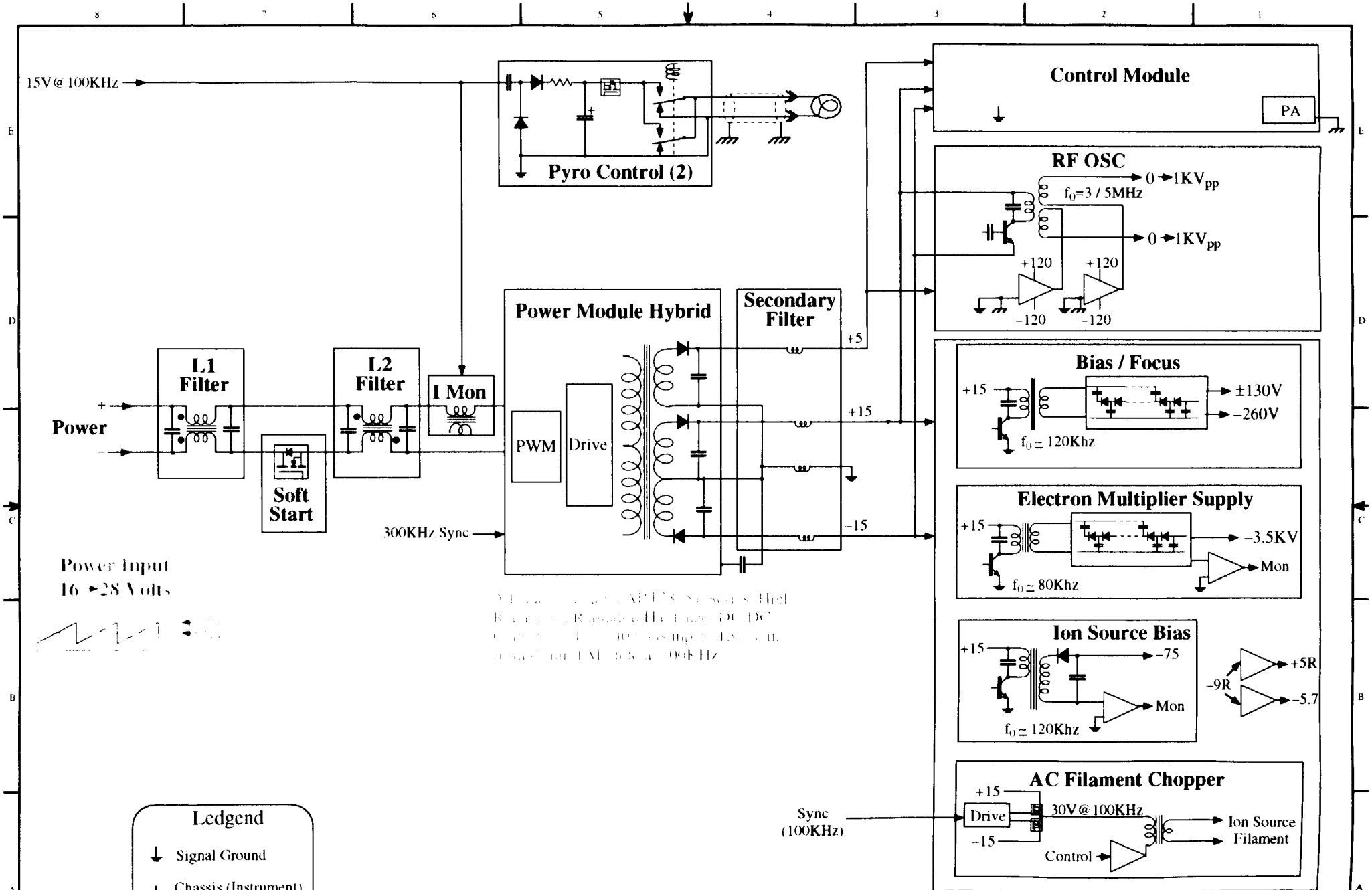
Drawing Page **1.02**



Space Physics Research Laboratory College of Engineering University of Michigan	**Power Concept** **Planet – B NMS**

061-NMS	0TK63	J0110C-Power Concept	061-0110	C	

REV		
C	4-Aug-95	
B	12-May-95	
A	23-Feb-95	
RELEASE	8-Feb-95	
DRAWN	7-Feb-95 JM	
COG ENG	Maurer	

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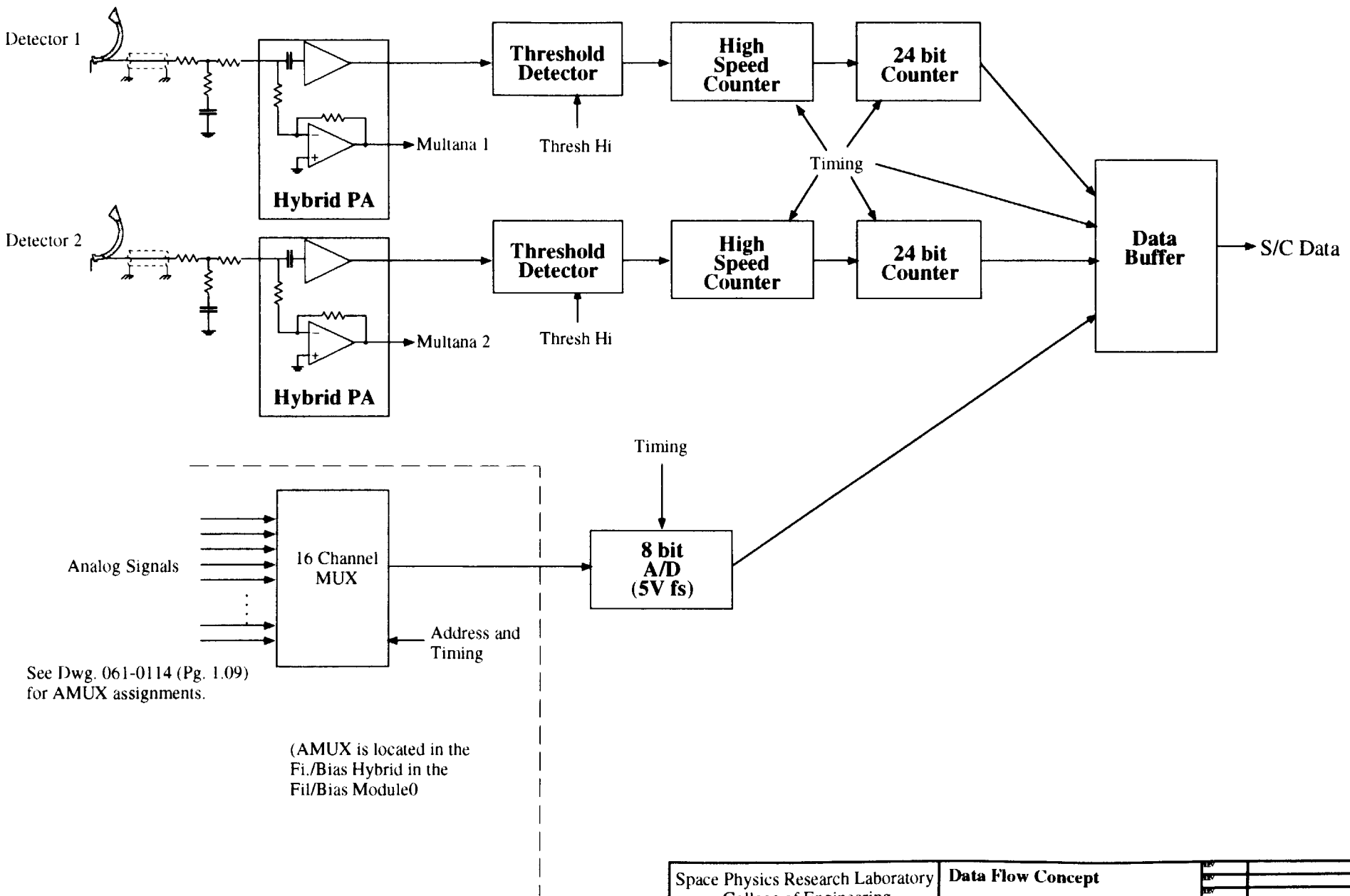
Drawing Page **1.03**



Space Physics Research Laboratory College of Engineering University of Michigan	**Data Flow Concept** **Planet – B NMS**			REV
				REV
				REV
				REV –
				RELEASE 12-May-95
061-NMS	0TK63	J0123-Data Flow Concept	**061-0123**	– DRAWN 18-Apr-95 COG ENG Maurer

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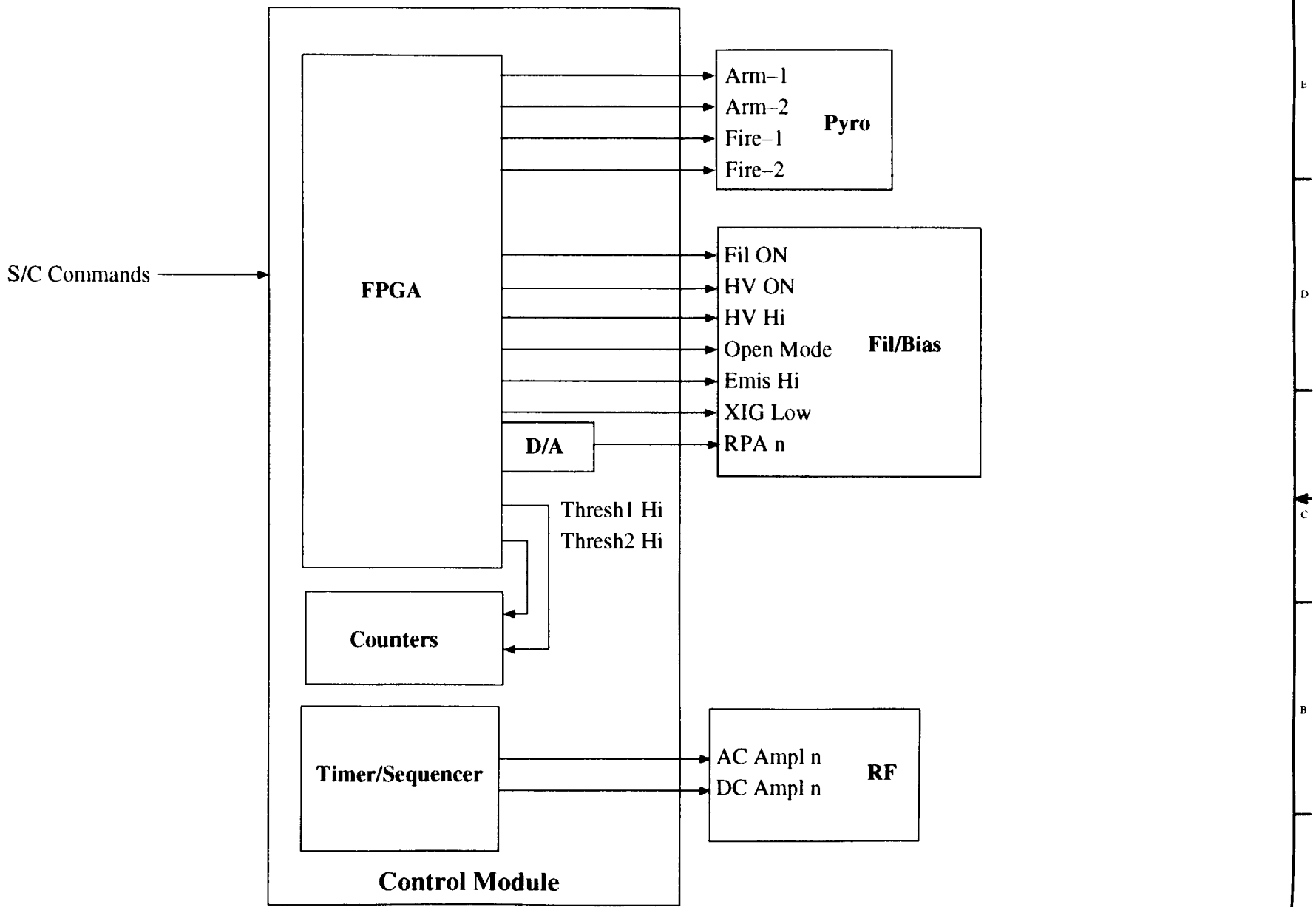
Drawing Page **1.04**



Space Physics Research Laboratory College of Engineering University of Michigan	**Command & Control Concept** **Planet – B NMS**			REV	
				REV	
				REV	
				A	20-Jul-95
				RELEASE	12-May-95
				DRAWN	18-Apr-95
061-NMS	0TK63	J0122A-Cmnd&Ctrl Concept	061-0122	COG ENG	Maurer

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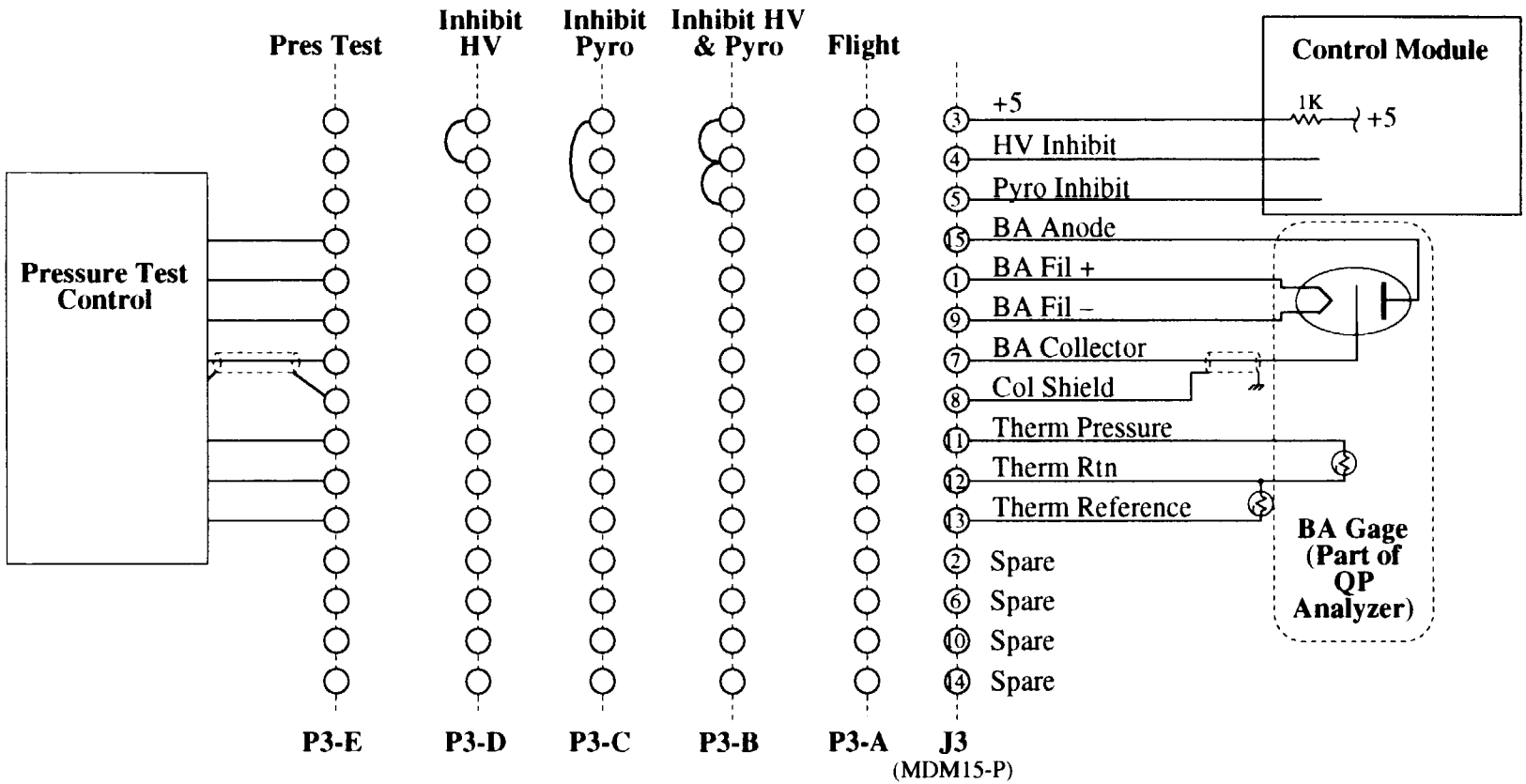
Drawing Page **1.05**

Optional Plugs



Space Physics Research Laboratory College of Engineering University of Michigan	**Safe/Arm Concept** **Planet – B NMS**			REV	
				REV	
				REV	
				A	6-Sep-95
				RELEASE	12-May-95
061-NMS	0TK63	J0121A-Safe/Arm Concept	061-0121	A	DRAWN 18-Apr-95 gm COG ENG Maurer

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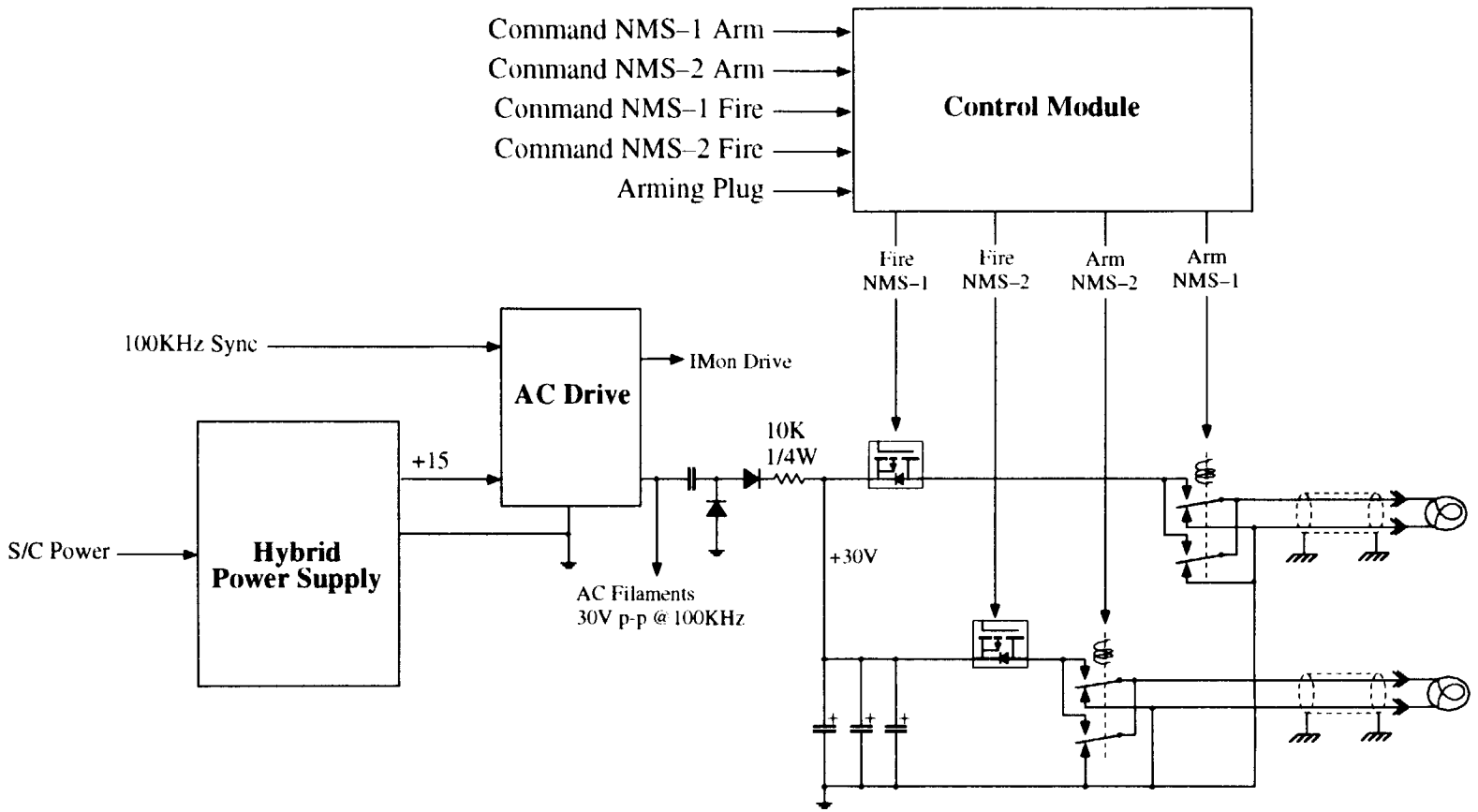
Drawing Page 1 **1.06**



Capacitors:	FETs:	Relays:	Pyro Device:
Sprague	IR	Teledyne TO-5	IRECO Inc. BA31K7
M39006/22-0640	IRHF9130	412D-12	No Fire = 50 mA
140/60		M39016/15-129L	Recommended Fire = 1A
CLR79 T4			Resistance = 4 to 5 ohms

Space Physics Research Laboratory College of Engineering University of Michigan	**Pyro Concept** **Planet-B NMS**			REV	
				REV B	4-Mar-96
				REV A	4-Aug-95
				RELEASE	12-May-95
				DRAWN	18-Apr-95 JM
061-NMS	0TK63	J0120B-Pyro Concept	061-0120	B	COG ENG Maurer

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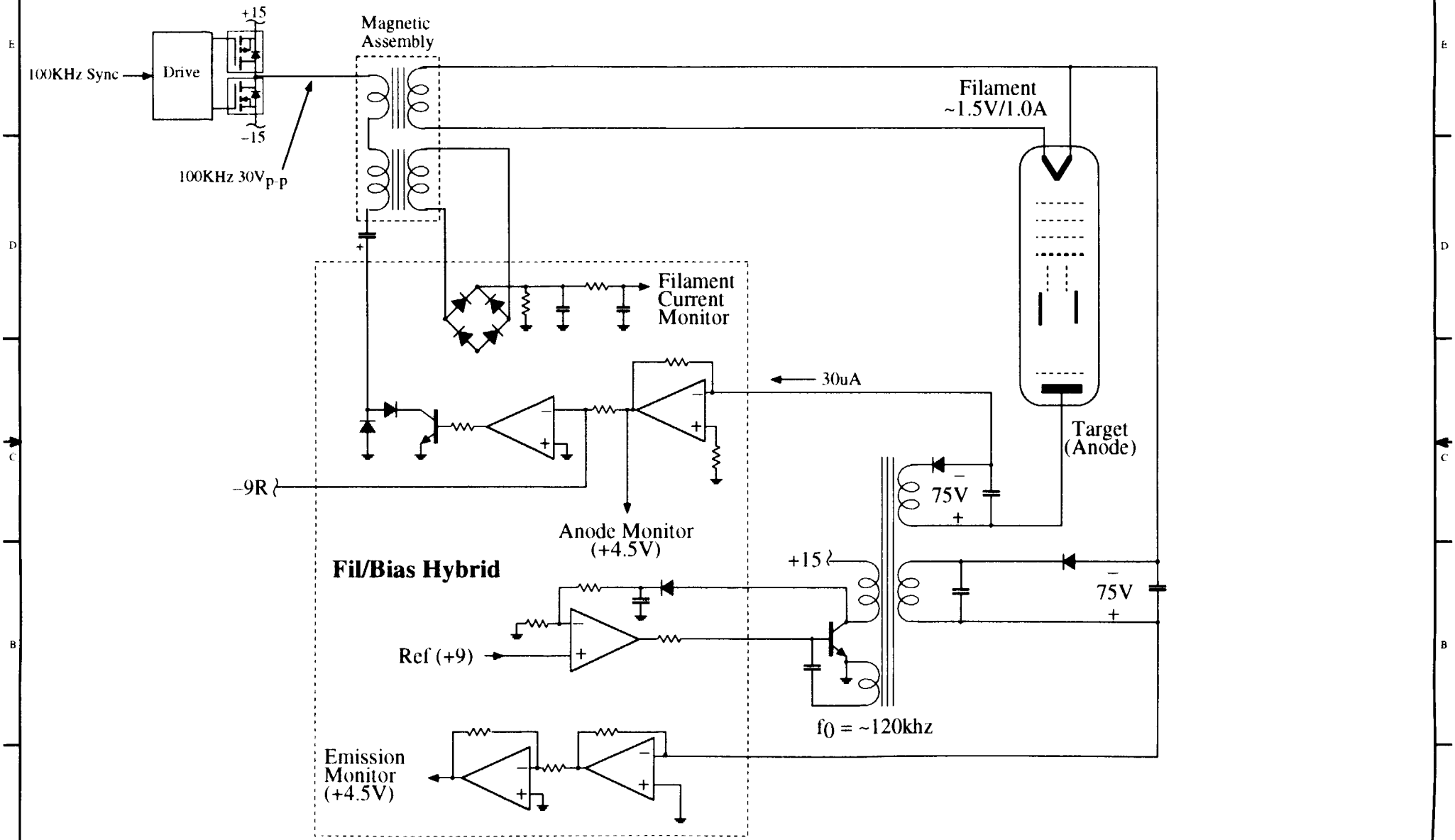
Drawing Page **1.07**

AMUX Channels in Fil/Bias Module

#	GCMS Function	Source	NMS	Type
1.	Anode 1	Int	Fil Anode	Inv curnt
2.	Anode 2	From RF	–RF AGC*	Inv curnt
3.	EB4 -2	Board	RF Temp	Non-inv curnt
4.	EB4 -1	Board	EM Mon	Non-inv curnt
5.	Fil I 1	Int	Fil I	Direct w/ 5limit
6.	Fil I 2	From LV	PS Temp	Direct w/ 5limit
7.	Fil Emis 2	Board	F/B Temp	Non-inv curnt
8.	Fil Emis 1	Int	Fil Emis	Non-inv curnt
9.	Bias A (-50 dual)	Int	Bias C Mon	Int AC rect
10.	Bias 1 (-70-1)	Int	Bias A Mon	Int AC rect
11.	Bias 2 (-70-2)	Int	Bias B Mon	Int AC rect
12.	Pressure 1	Board	Spare	Curnt w/ gain=100
13.	Bias Mon 3	Board	+5V mon	Direct
14.	Bias Mon 2	From LV	I Mon	Direct
15.	Spare Mon	From DC	Multana1	Direct
16.	Bias Mon 1	From DC	Multana2	Direct

12 is pressure mon with a gain of 100 – either inverting or not.



Space Physics Research Laboratory College of Engineering University of Michigan	**Filament Regulator Concept** **Planet – B**			REV	
				REV	
				REV	
				A	27-Jul-95
				RELEASE	12-May-95
INMS/NAS53094	0TK63	J0112-Fil Reg Concept	**061-0112**	DRAWN	5-Feb-95 JM
				COG ENG	Maurer

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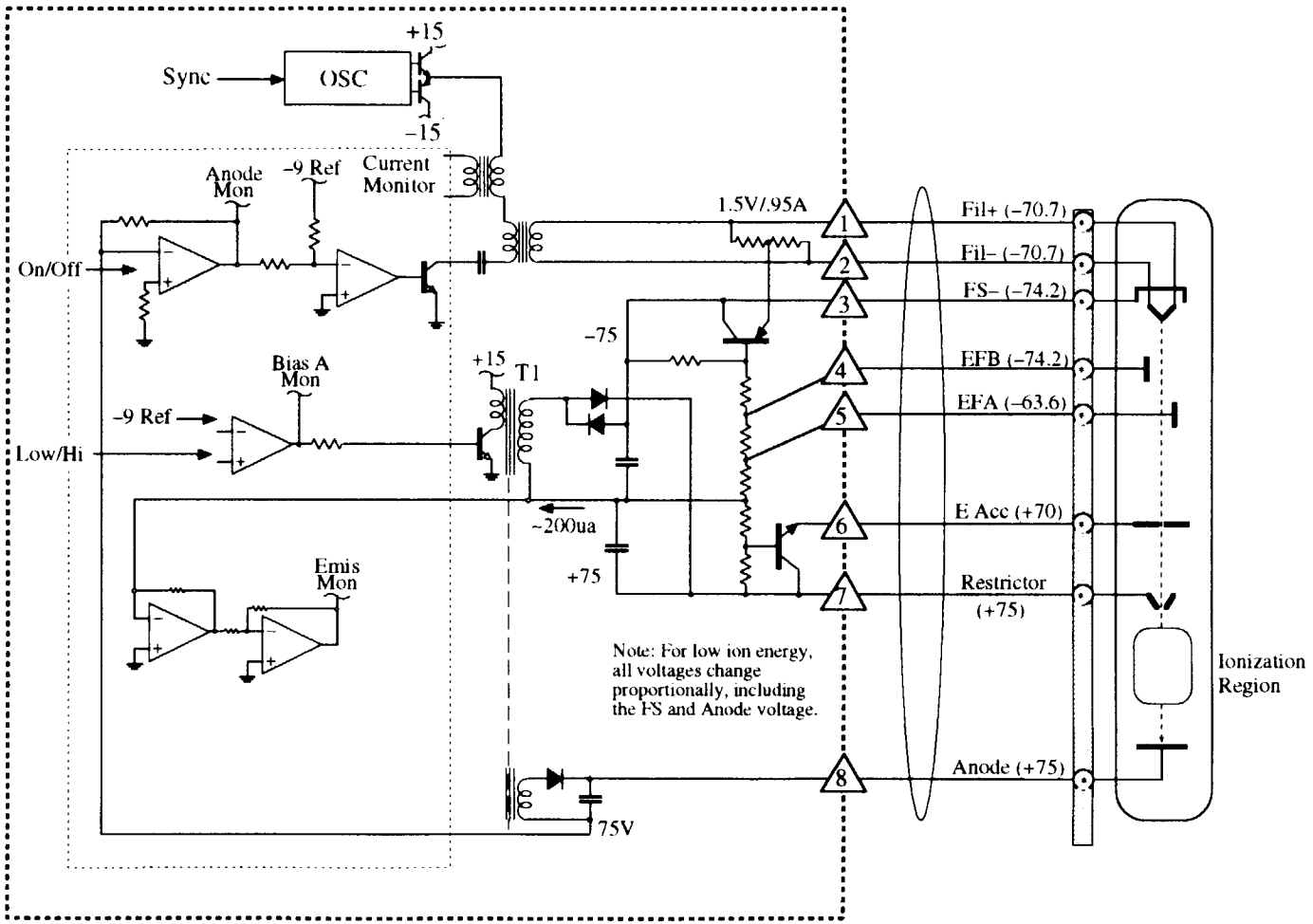
Drawing Page 1

1.09



Space Physics Research Laboratory College of Engineering University of Michigan	**Emission Bias Concept** **Planet – B**			REV
				REV
				REV
				REV
				RELEASE 12-May-95
				DRAWN 5-Feb-95
				COG ENG Maurer
INMS/NAS53094	0TK63	J0113-Emis Bias Concept	061-0113	REV

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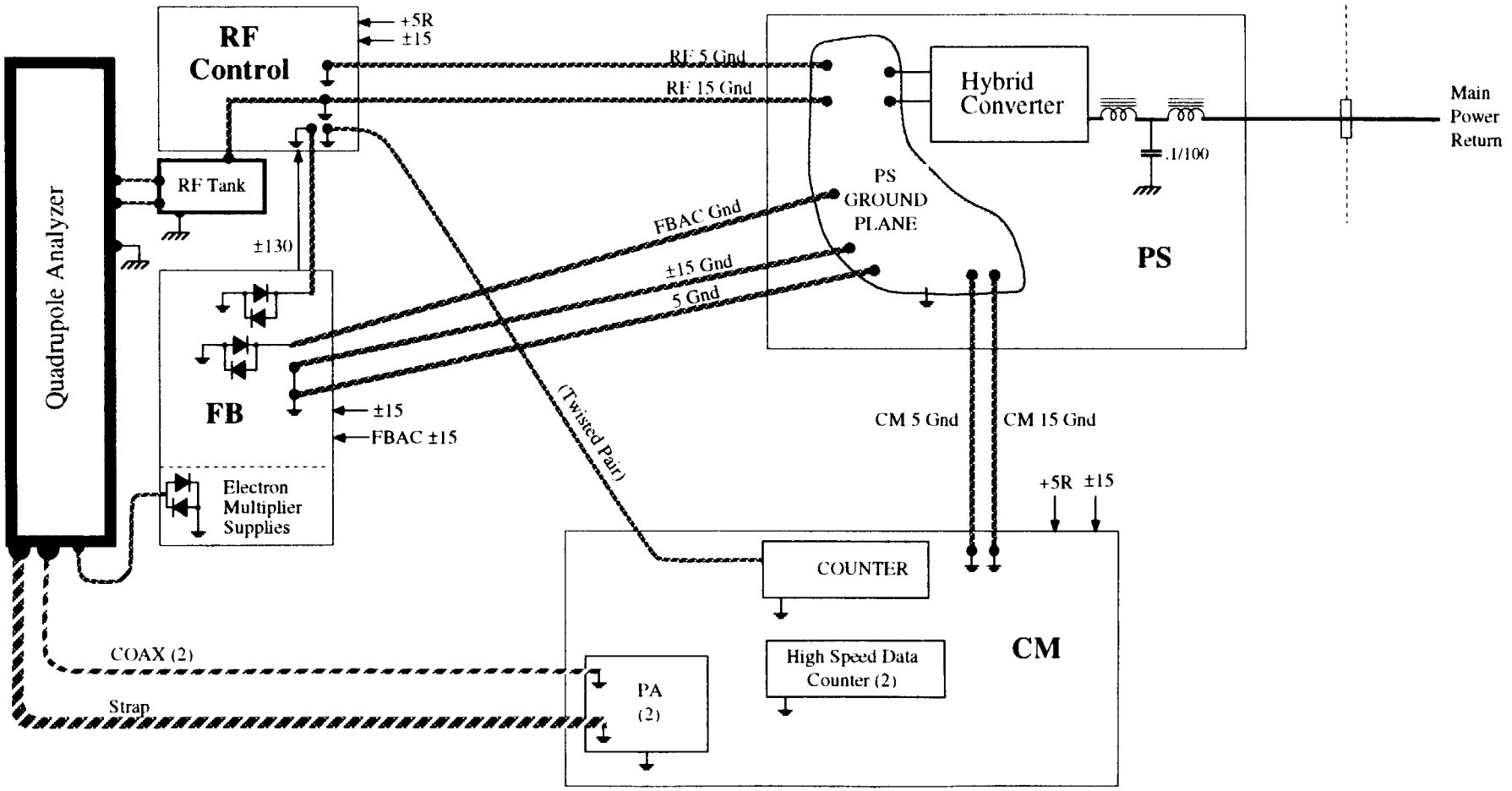
Drawing Page **1.10**

Load	Minimum mA 15	-15	5	Maximum mA 15	-15	5	Watts @72% Input @ 26V	mA Input @ 26V
RF	15	15	25	230	230	25	9.76	
Control Modul	10	10	100	10	10	100	1.11	
PA	2	25	25	2	25	25	0.74	
Elect. Bias	20	3		20	3		0.48	
Fil Bias	5	1		5	1		0.13	
EM HV	20	1		20	1		0.44	
Filament	0	0	5	75	75	5	3.16	
I mon	3	3		3	3		0.13	
PIM			100			130	0.90	
No PIM Load	75	58	155				**3.85**	**148**
Minimum	75	58	255				**4.54**	**175**
Max				365	348	285	**16.83**	**647**
Min current load Resistance	200	259	32					
Max current load Resistance				41	43	18		

FORMAT OF NMS MISSION DATA PACKET			
Data Address	**Description**	**# Bytes**	**Comments**
FA00 .. FA01	Frame Reference Word	2	Binary reference word (fixed 16-bit value, TBD)
FA02 .. F103	Frame Count	2	Count of packet output; increments on Packet Acknowlege
FA04 .. FA06	TI Time	3	Latched on the most recent Index Pulse (IP) after start of first integration period in the current packet
FA07 .. FA08	Phase Count	2	Latched at start of first integration period in the current packet
FA09 .. FA0A	Mem Check Address	2	Address of first memory block being output; increment by 1 each packet
FA0B .. FA1A	Mem Check Data	16	16 bytes of memory data starting at the address above
FA1B .. FA1C	RF Freq 1st	2	RF count sampled in first mass period of the current parcket
FA1D .. FA1E	RF Freq Last	2	RF count sampled in last mass period of the current parcket
FA1F .. FA20	Sequence Address	2	Memeory address of first step in sequence in the current packet
FA21 .. FA22	A Counts	2	Counts from Channel A, mass sample 1
FA23 .. FA24	B Counts	2	Counts from Channel B, mass sample 1
FA25 .. FA26	A Counts	2	Counts from Channel A, mass sample 2
FA27 .. FA28	B Counts	2	Counts from Channel B, mass sample 2
FA29 .. FA2A	A Counts	2	Counts from Channel A, mass sample 3
FA2B .. FA2C	B Counts	2	Counts from Channel B, mass sample 3
FA2D .. FA2E	A Counts	2	Counts from Channel A, mass sample 4
FA2F .. FA30	B Counts	2	Counts from Channel B, mass sample 4
FA31 .. FA32	Analog chan + value	2	4 bit Mux addr + 12 bit A/D sampled after 4th mass samples
FA33 .. FA34	A Counts	2	Counts from Channel A, mass sample 5
FA35 .. FA36	B Counts	2	Counts from Channel B, mass sample 5
FA37 .. FA38	A Counts	2	Counts from Channel A, mass sample 6
FA39 .. FA3A	B Counts	2	Counts from Channel B, mass sample 6
FA3B .. FA3C	A Counts	2	Counts from Channel A, mass sample 7
FA3D .. FA3E	B Counts	2	Counts from Channel B, mass sample 7
FA3F .. FA40	A Counts	2	Counts from Channel A, mass sample 8
FA41 .. FA42	B Counts	2	Counts from Channel B, mass sample 8
FA43 .. FA44	Analog chan + value	2	4 bit Mux addr + 12 bit A/D sampled after 8th mass samples
FA45 .. FA6A	Data of 2nd 8-Samples	38	Above block repeats nine more times
FA6B .. FA90	Data of 3rd 8-Samples	38	
FA91 .. FAB6	Data of 4th 8-Samples	38	
FAB7 .. FADC	Data of 5th 8-Samples	38	
FADD .. FB02	Data of 6th 8-Samples	38	
FB03 .. FB28	Data of 7th 8-Samples	38	
FB29 .. FB4E	Data of 8th 8-Samples	38	
FB4F .. FB74	Data of 9th 8-Samples	38	
FB75 .. FB9A	Data of 10th 8-Samples	38	
FB9B .. FBAF	Spare	21	
	TOTAL	**432**	Total 8-bit bytes in NMS packet. 1 NMS packet/sec at maximum data rate.



Legend

Connection to NMS **Instrument** Chassis

Connection to NMS **Secondary** Ground

Space Physics Research Laboratory College of Engineering University of Michigan	**Grounding Plan** **Planet – B NMS**			
061-NMS	0TK63	J0354-Grounding Plan	**061-0354**	–

RELEASE 11-Aug-95
DRAWN 11-Aug-95 jm
COG ENG Maurer

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Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
CAPACITORS																				
1000p/200 CKR05	M39014/01-1357	AVX	2	N	N	0	0	1			1	2	0	2	0.35	10	0	3.50	77	GCMS
220p/200 CKR05	M39014/01-1345	Kem	2	N	N	0	0	4			4	8	0	8	0.30	15	0	4.50	242	GCMS
47P/200 CKR05	M39014/01-1333	Kem	2	N	N	0	0	1			1	2	0	2	0.84	10	0	8.40	23	GCMS
.1/50 CKR05	M39014/01-1593	Kem	2	N	N	0	0	12			12	24	0	24	0.30	25	0	7.50	205	GCMS
4700P/100 CKR05	M39014/01-1569	Kem	2	N	N	0	0	2			2	4	0	4	0.54	20	0	10.80	20	GCMS
.01/100 CKR05	M39014/01-1575	Kem	2	N	N	9	0	17			26	52	0	52	0.30	70	0	21.00	80	GCMS
3900p/100 CKR05	M39014/01-1568	Kem	2	N	N	0	0	1			1	2	0	2	0.31	10	0	3.10	145	GCMS
3300/50 CKR05						0	1	0												
3300/100 CKR05						0	2	0												
.01/200 CKR06	M39014/02-1338	AVX	2	N	N	0	2	0			2	4	0	4	0.35	25	0	8.75	57	GCMS
.33/50 CKR06	M39014/02-1358	AVX	2	N	N	2	0	0			2	4	0	4	0.60	10	0	6.00	90	GCMS
.1/100 CKR06	M39014/02-1350	Kem	2	N	N	12	13	0			25	50	0	50	0.33	70	0	23.10	291	GCMS
330P/100 CCR05	CCR05CG331FS	Kem	1	N	N	0	0	0			0	0	0	0	1.37	10	0	13.70	50	GCMS
330/200 CCR05						0	1	0												
330/500 HV21						0	1	0												
33/15 CLR79	M39006/22-0505	SPG	1	N	N	0	2	2			4	8	0	8	8.92	15	0	133.80	11	GCMS
15/30 CLR79	M39006/22-0545	SPG	1	N	N	0	1	0			1	2	0	2	7.96	10	0	79.60	22	GCMS
10/50 CLR79	M39006/22-0565	SPG	1	N	N	0	2	0			2	4	0	4	7.96	10	0	79.60	36	GCMS
8.2/60 CLR79	M39006/22-0585	SPG	1	N	N	0	1	0			1	2	0	2	8.92	15	0	133.80	34	GCMS
47/35 CLR79						0	0	2												
56/75 CLR79	M39006/22-0617	SPG	1	N	N	1	0	0			1	2	0	2	12.65	10	0	126.50	35	GCMS
140/60 CLR79	M39006/22-0640	SPG	1	N	N	3	0	0			3	6	0	6	21.25	10	0	212.50	0	
17075 CLR79T2						0	1	0												
22/35 CSR21C						2	0	0												
22/35 CSR21D	M39003/09-0353	SPG	1	N	N	0	2	0			2	4	0	4	3.77	10	0	37.70	17	TOMS
220/10 CSR21D	M39003/09-0321	SPG	1	N	N	1	0	0			1	2	0	2	7.47	10	0	74.70	10	TOMS
.015/2KV HS20 NP	20HS20N825KMCS	KD	#014	N	N	0	0	0			0	0	0	0	88.71	20	0	1774.20	0	
.047/1KV HS20 NP	20HS20N825KMCS	KD	#014	N	N	0	0	0			0	0	0	0	88.71	10	0	887.10	0	
.082/500 HS20 NP	20HS20N825KMCS	KD	#014	N	N	0	0	0			0	0	0	0	88.71	15	0	1330.65	0	
.22/200 HV21	02HV21B224KMS	KD	#015	N	N	0	1	0			1	2	0	2	91.90	10	0	919.00	26	GCMS
.22/200 HV22						0	5	0												
.39/400V HV23	04HV23B394KMS	KD	#015	N	N	2	0	0			2	4	0	4	88.34	30	0	2650.20	14	GCMS
0.015/2KV HV23						0	7	0												
0.15/800 HV23						0	1	0												
0.047/1KV HV21						0	4	0												

Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
4700P/2KV HV21						0	12	0												
120/500 HV21						0	1	0												
0.082/500 HV20						0	4	0												
4700p/2KV NPO	05HS23N472KMS	KD	#014	N	N	0	0	0			0	0	0	0	61.11	30	0		0	
150P/300 CDR25	CDR25BP151DFSM	ATC	#012	N	N	0	0	2			2	4	0	4	20.01	10	0	200.10	12	GCMS
33 CDR25						0	0	2												
10P/500 CDR25	CDR25BP100EFSM	ATC	#012	N	N	0	0	4			4	8	0	8	11.09	12	0	133.08	10	GCMS
47P/50 CDR25	CDR25BP470EFSM	ATC	#012	N	N	0	0	0			0	0	0	0	11.09	10	0	110.90	11	GCMS
470 CDR25						0	0	1												
4700P/50 CDR25	CDR25BP472AFSM	ATC	#012	N	N	0	0	1			1	2	0	2	27.48	10	0	274.80	10	GCMS
4700/500 HS23						0	0	3												
4700/7.5 HS33						0	2	0												
CONNECTORS																				
RM252 20 Pin	RM252-20-311-55	AIR	Y	N	N	0	0	0			0	0	0	0	9.35	5	0	46.75	3	GCMS
RM222 20 Socket	RM222-20-211-55	AIR	Y	N	N	0	0	0	2	1	3	6	0	6	14.76	10	0	147.60	4	GCMS
RM252 30 Pin	RM252-30-311-55	AIR	Y	N	N	0	0	0			0	0	0	0	11.64	10	0	116.40	5	GCMS
RM222 30 Socket	RM222-30-211-55	AIR	Y	N	N	0	0	0	3	1	4	8	0	8	19.75	10	0	197.50	1	GCMS
RM252 50 Pin	RM252-50-311-55	AIR	Y	N	N	0	0	0			0	0	0	0	16.27	5	0	81.35	4	GCMS
RM222 50 Socket	RM222-50-211-55	AIR	Y	N	N	0	0	0	1	1	2	4	0	4	29.74	10	0	297.40	3	GCMS
AE11353	AE11353	Omt	Y	N	Y	0	0	0		1	1	2	0	2	19.11	10	0	191.10	2	GCMS
AE11354	AE11354	Omt	Y	N	Y	0	0	0		1	1	2	0	2	53.54	10	0	535.40	0	
AE11355	AE11355	Omt	Y	N	Y	0	0	0			0	0	0	0	12.35	5	0	61.75	0	
AE11356	AE11356	Omt	Y	N	Y	0	0	0		1	1	2	0	2	11.44	10	0	114.40	0	
AE11357	AE11357	Omt	Y	N	Y	0	0	0		1	1	2	0	2	23.36	10	0	233.60	0	
AE11358	AE11358	Omt	Y	N	Y	0	0	0	1	1	2	4	0	4	12.35	10	0	123.50	0	
AE11359	AE11359	Omt	Y	N	Y	0	0	0	2	1	3	6	0	6	46.36	10	0	463.60	0	
AE11497	AE11497	Omt	Y	N	Y	0	0	0	1		1	2	0	2	12.25	5	0	61.25	0	
AE11498	AE11498	Omt	Y	N	Y	0	0	0	1	1	2	4	0	4	10.25	10	0	102.50	0	
AE11499	AE11499	Omt	Y	N	Y	0	0	0	1	1	2	4	0	4	9.23	10	0	92.30	0	
AE???		Omt				0	2													
DIODES																				
1N5305	JANTXV1N5305	MS	1	N	N	1	0	0			1	2	5	7	3.74	10	0	37.40	0	
1N6318	JANTXV1N6318	MS	2	Y	N	0	1	0			1	2	5	7	1.89	10	0	18.90	0	

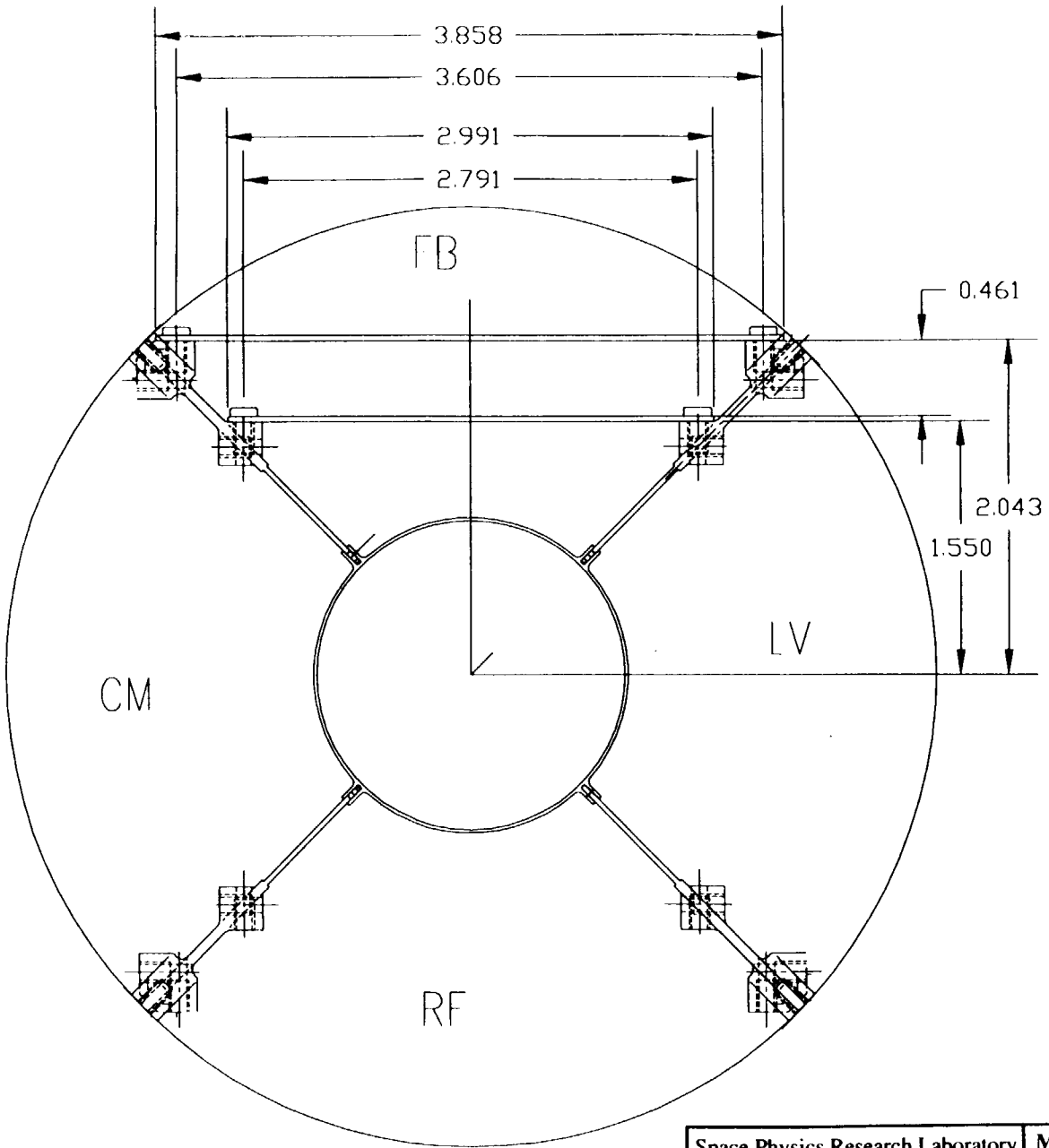
Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
1N4148-1	JANS1N4148-1	MS	1	N	N	1	10	1			12	18	5	23	32.81	25	0	820.25	13	GCMS
1N751A-1	JANTXV1N751A-1	MS	2	Y	N	0	1	0			1	2	5	7	47.88	10	0	478.80	32	GCMS
1N4995	JANTXV1N4995	MS	2	N	N	0	1	0			1	2	5	7	32.14	10	0	321.40	0	
1N5617	JANS1N5617	MS	1	N	N	0	2	0			2	4	5	9	25.38	12	0	304.56	15	GCMS
1N5711	JANTXV1N5711	HP	1	N	N	2	0	3			5	8	5	13	5.68	18	0	102.24	6	GCMS
1N5806	JANS1N5806	MS	1	N	N	5	0	0			5	8	5	13	41.42	15	0	621.30	45	GCMS
1N5811	JANS1N5811	MS	1	N	N	2	0	0			2	4	5	9	43.88	12	0	526.56	32	GCMS
1N4569A	JANS1N4569A	MS	1	N	N	0	0	1			1	2	5	7	26.11	12	0	313.32	0	
1N6320	JANS1N6320	MS	1	N	N	0	0	0			0	0	5	5	30.03	12	0	360.36	21	GCMS
1N6325	JANS1N6325	MS	1	N	N	1	0	0			1	2	5	7	30.03	12	0	360.36	9	GCMS
HRF30	G311P670-HRF30	SEM	#009	Y	S-311	0	28	0			28	42	5	47	27.44	40	0	1097.60	21	GCMS
1N754A	JANS1N754	MS	1	N	N	1	0	0			1	2	5	7	30.03	10	0	300.30	0	
HYBRID MICROCIRCUITS																				
ART2815/883	ART2815/883	AAD	#062	N	N	0	0	0			0	0	0	0	18000.00	3		54000.00	0	
A-E10156	A-E10156	Tel	NA	N	N	0	0	1			1	2	0	2	-	-		0.00	0	
A-E10198	A-E10198	Tel	NA	N	N	0	1	0			1	2	0	2	-	-		0.00	0	
A-E10935	A-E10935					0	0	1												
A-E10936	A-E10936					0	0	1												
A-E10937	A-E10937					0	0	1												
INDUCTORS																				
33 uH	M39010/03-A330JP	NYT	1	N	N	0	0	0			0	0	0	0	12.83	10	0	128.30	11	GCMS
33uH	M39010/02					0	0	1												
TRANSFORMERS																				
M21038	M21038/05-27	TRL	1	N	N	1	0	0			1	2	0	2	60.00	5	0	300.00	5	GCMS
RELAYS																				
412D-12	M39016/15-079P	TEL	#064	N	N	2	0	0			2	4	0	4	42.61	10	0	426.10	6	TOMS
TRANSISTORS																				
2N3632A						0	0	1												

Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
2N2222A	JANS2N2222A	Mot	1	N	N	0	2	7			9	14	5	19	42.20	25	0	1055.00	30	GCMS
2N2907A	JANS2N2907A	Mot	1	N	N	0	5	1			6	9	5	14	43.00	15	0	645.00	11	GCMS
2N3700	JANS2N3700	Mot	1	N	N	4	7	0			11	17	5	22	43.90	25	0	1097.50	35	GCMS
2N3866	5961012352202	Mot	2	Y	N	0	0	1			1	2	5	7	61.62	12	0	739.44	19	
SFT1192/5	SFT1192	SSDI	???	Y	N	0	4	0			4	6	5	11	10.37	15	0	155.55	0	
IRHF9130	IRHF9130	IR	#061	N	N	2	0	0			2	3	5	8	279.95	10	0	2799.50	0	
IRFM254	91-0072	IR	#001	N	N	1	0	0			1	2	5	7	418.47	10	0	4184.70	10	TOMS
AE11076	TBD	TBD	2	Y	N	0	0	0			0	0	5	5	53.78	10	0	537.80	0	
2N2369	JANTXV2N2369	Mot	2	Y	N	1	0	0			1	2	5	7	15.36	10	0	153.60	0	
RESISTORS																				
100 RCR05	RCR05G101JS	AB	1	N	N	1	0	8			9	18	0	18	0.60	50	0	30.00	0	TBD
1K RCR05	RCR05G102JS	AB	1	N	N	1	1	2			4	8	0	8	0.60	50	0	30.00	0	TBD
10K RCR05	RCR05G103JS	AB	1	N	N	4	3	4			11	22	0	22	0.60	50	0	30.00	0	TBD
100K RCR05	RCR05G104JS	AB	1	N	N	0	0	0			0	0	0	0	0.69	50	0	34.50	0	TBD
1M RCR05	RCR05G105JS	AB	1	N	N	0	1	1			2	4	0	4	0.69	50	0	34.50	0	TBD
1.2K RCR05	RCR05G122JS	AB	1	N	N	0	0	5			5	10	0	10	0.69	50	0	34.50	0	TBD
1.5K RCR05	RCR05G152JS	AB	1	N	N	0	0	2			2	4	0	4	0.25	50	0	12.50	0	TBD
150 RCR05	RCR05G151JS	AB	1	N	N	0	0	0			0	0	0	0	0.28	50	0	14.00	0	TBD
15K RCR05	RCR05G153JS	AB	1	N	N	2	1	0			3	6	0	6	0.28	50	0	14.00	0	TBD
20K RCR05	RCR05G203JS	AB	1	N	N	0	0	0			0	0	0	0	0.60	50	0	30.00	0	TBD
200K RCR05	RCR05G204JS	AB	1	N	N	0	0	0			0	0	0	0	0.69	50	0	34.50	0	TBD
2M RCR05	RCR05G205JS	AB	1	N	N	0	0	0			0	0	0	0	0.69	50	0	34.50	0	TBD
220 RCR05	RCR05G221JS	AB	1	N	N	0	0	1			1	2	0	2	0.69	50	0	34.50	0	TBD
2.2K RCR05	RCR05G222JS	AB	1	N	N	1	0	0			1	2	0	2	0.69	50	0	34.50	0	TBD
2.4KRCR05						0	0	1												
22K RCR05	RCR05G223JS	AB	1	N	N	0	0	1			1	2	0	2	0.69	50	0	34.50	0	TBD
2.7K RCR05	RCR05G272JS	AB	1	N	N	0	0	0			0	0	0	0	0.25	50	0	12.50	0	TBD
270K RCR05	RCR05G274JS	AB	1	N	N	0	0	0			0	0	0	0	0.69	50	0	34.50	0	TBD
33K RCR05	RCR05G273JS	AB	1	N	N	1	0	0			1	2	0	2	0.28	50	0	14.00	0	TBD
330 RCR05						0	0	1												
390K RCR05						0	0	1												
3.3K RCR05	RCR05G332JS	AB	1	N	N	0	0	1			1	2	0	2	0.25	50	0	12.50	0	TBD
3.6K RCR05						0	0	1												
4.7K RCR05	RCR05G472JS	AB	1	N	N	5	2	3			10	20	0	20	0.60	50	0	30.00	0	TBD
47 RCR05						0	1	0												

Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
470 RCR05	RCR05G471JS	AB	1	N	N	0	5	0			5	10	0	10	0.60	50	0	30.00	0	TBD
4.3K RCR05	RCR05G432JS	AB	1	N	N	0	0	0			0	0	0	0	0.60	50	0	30.00	0	TBD
43K RCR05	RCR05G433JS	AB	1	N	N	0	0	1			1	2	0	2	0.60	50	0	30.00	0	TBD
47K RCR05	RCR05G473JS	AB	1	N	N	5	4	0			9	18	0	18	0.60	50	0	30.00	0	TBD
330 RCR05						0	1	0												
510 RCR05	RCR05G511JS	AB	1	N	N	0	0	1			1	2	0	2	0.60	50	0	30.00	0	TBD
5.5KRCR05						0	0	1												
56K RCR05	RCR05G563JS	AB	1	N	N	0	0	0			0	0	0	0	0.28	50	0	14.00	0	TBD
620RCR05						0	0	1												
6.2K RCR05	RCR05G622JS	AB	1	N	N	0	0	1			1	2	0	2	0.69	50	0	34.50	0	TBD
68 RCR05	RCR05G680JS	AB	1	N	N	0	1	1			2	4	0	4	0.69	50	0	34.50	0	TBD
680 RCR05	RCR05G681JS	AB	1	N	N	0	2	2			4	8	0	8	0.48	50	0	24.00	0	TBD
7.5K RCR05	RCR05G752JS	AB	1	N	N	0	0	1			1	2	0	2	0.69	50	0	34.50	0	TBD
82 RCR05	RCR05G82RJS	AB	1	N	N	0	0	1			1	2	0	2	0.48	50	0	24.00	0	TBD
8.2K RCR05	RCR05G822JS	AB	1	N	N	0	0	1			1	2	0	2	0.48	50	0	24.00	0	TBD
9.1K RCR05	RCR05G912JS	AB	1	N	N	0	0	2			2	4	0	4	0.48	50	0	24.00	0	TBD
1K RCR07						0	2	0												
10K RCR07	RCR07G103JR	AB	2	N	N	2	2	0			4	8	0	8	0.17	50	0	8.50	0	TBD
2M RCR07	RCR07G205JR	AB	2	N	N	0	1	0			1	2	0	2	0.17	50	0	8.50	0	TBD
2.7 RCR07	RCR07G2R7JR	AB	2	N	N	1	0	0			1	2	0	2	0.17	50	0	8.50	0	TBD
47 RCR07						0	2	0												
100K RCR07	RCR07G104JR	AB	2	N	N	0	2	0			2	4	0	4	0.17	50	0	8.50	0	TBD
10 RCR07	RCR07G100JR	AB	2	N	N	0	0	0			0	0	0	0	0.17	50	0	8.50	0	TBD
51 RCR07	RCR07G510JR	AB	2	N	N	0	0	0			0	0	0	0	0.37	50	0	18.50	0	TBD
110 RCR07	RCR07G111JR	AB	2	N	N	2	0	0			2	4	0	4	0.37	50	0	18.50	0	TBD
499K RCR07						0	1	0												
110RNC50						0	1	0												
1.00K RNC50	RNC50J1001FS	Dal	1	N	N	0	0	0			0	0	0	0	0.24	50	0	12.00	0	TBD
10.0K RNC50	RNC50J1002FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
100K RNC50	RNC50J1003FS	Dal	1	N	N	1	2	2			5	10	0	10	0.59	50	0	29.50	0	TBD
120 RNC50						0	1	0												
110K RNC50						0	3	0												
12.1K RNC50	RNC50J1212FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
13.3K RNC50	RNC50J1332FS	Dal	1	N	N	0	2	0			2	4	0	4	0.59	50	0	29.50	0	TBD
47.5K RNC50	RNC50J4752FS	Dal	1	N	N	0	0	1			1	2	0	2	0.59	50	0	29.50	0	TBD
15.0K RNC50	RNC50J1502FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD

Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'd	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
150K RNC50	RNC50J1503FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
162K RNC50						0	1	0												
165K RNC50						1	0	0												
17.8K RNC50	RNC50J1782FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
1.78K RNC50						1	0	0												
1.87K RNC50	RNC50J1871FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
18.7K RNC50	RNC50J1872FS	Dal	1	N	N	0	3	0			3	6	0	6	0.59	50	0	29.50	0	TBD
20.0K RNC50	RNC50J2002FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
200K RNC50						0	1	0												
21.0K RNC50	RNC50J2102FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
22K RNC50						0	3													
24.9K RNC50	RNC50J2492FS	Dal	1	N	N	0	0	3			3	6	0	6	0.59	50	0	29.50	0	TBD
16.5K RNC50	RNC50J1652FS	Dal	1	N	N	0	0	2			2	4	0	4	0.24	50	0	12.00	0	TBD
2.67K RNC50	RNC50J2671FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
26.7K RNC50						0	0	1												
27K RNC50						0	1	0												
332K RNC50	RNC50J3323FS	Dal	1	N	N	0	0	2			2	4	0	4	1.76	50	0	88.00	0	TBD
402 RNC50	RNC50J4020FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
453 RNC50	RNC50J4530FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
499 RNC50	RNC50J4990FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
4.02K RNC50						0	0	1												
4.99K RNC50	RNC50J4991FS	Dal	1	N	N	0	0	3			3	6	0	6	0.59	50	0	29.50	0	TBD
49.9K RNC50	RNC50J4992FS	Dal	1	N	N	0	2	9			11	22	0	22	0.59	50	0	29.50	0	TBD
499K RNC50	RNC50J4993FS	Dal	1	N	N	0	2	0			2	4	0	4	1.10	50	0	55.00	0	TBD
56.2K RNC50	RNC50J5622FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
60.4K RNC50	RNC50J6042FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
68.1K RNC50	RNC50J6812FS	Dal	1	N	N	0	0	0			0	0	0	0	0.59	50	0	29.50	0	TBD
825 RNC50	RNC50J8250FS	Dal	1	N	N	0	0	0			0	0	0	0	0.28	50	0	14.00	0	TBD
8.45K RNC50						0	0	1												
90.9K RNC50	RNC50J9092FS	Dal	1	N	N	0	2	0			2	4	0	4	0.59	50	0	29.50	0	TBD
93.1K RNC50						0	1	0												
976K RNC50						0	1	0												
226K RNC55						0	1	0												
49.9K RNC55						0	0	2												
30K Thermistor	S-311-P-18-09T101	YSI	1	N	S-311	1	1	1			3	6	0	6	53.35	15	0	800.25	7	GCMS
5M MG660	G311P683 660-	Cad	1	N	S-311	0	1	?			###	####	0	###	16.50	10	0	165.00	15	GCMS
10M MG660	G311P683 660-	Cad	1	N	S-311	0	1	?			###	####	0	###	17.58	10	0	175.80	0	TBD

Value/Generic Pt	Part Number	Mfr.	Grade/ NSPAR	Re- Scrn.	SCD	PARTS BY DECK PS	FB	RF	MB	HR	Tot	Flight Parts Qty Req'	DPA Qty	Tot Qty	Price Each	Ord Qty	Data Chg	Total Cost	SPR Qty.	Stock Comment
50M MOX400						0	1	0												
MICROCIRCUITS																				
LT1013	RH1013M	LT	#019	N	Y	0	2	8			10	15	0	15	378.00	15	0	5670.00	18	GCMS
UC1709J/883BC	UC1709J/883BC	UNI	#060	N	N	0	1	0			1	2	0	2	23.90	10	0	239.00	0	
DAC-312	DAC312/883	AD	#059	N	Y	0	0	2			2	4	0	4	51.90	6	0	311.40	0	
54HCS164	54HCS164	Har	1	N	N	0	0	4			4	8	0	8	156.00	6	0	936.00	0	
54HCS273	54HCS273	NS	1	N	N	0	0	8			8	16	0	16	162.00	10	0	1620.00	0	
MISC.																				
Pin	09-8157-1-03	Con	NA	N	N	0	0	0			0	0	0	0	0.39	200	0	78.00	124	GCMS
Socket	1-332070-7	AMP	NA	N	N	0	0	0			0	0	0	0	0.11	2000	0	224.32	1245	GCMS
0-80 Lug Terminal	R26201	Hol	NA	N	N	0	0	0			0	0	0	0	0.05	1000	0	47.50	23	GCMS
2030 Terminal	2030B-45	USE	NA	N	N	0	0	0			0	0	0	0	0.15	2500	0	379.13	450	GCMS
2031 Terminal	2031B-45	USE	NA	N	N	0	55	21			76	152	0	152	0.12	1500	0	183.06	120	GCMS
2061 Terminal	2061B-45	USE	NA	N	N	8	15	0			23	46	0	46	0.21	1000	0	205.20	452	GCMS
1624 Terminal	1624-4-10	USE	NA	N	N	0	0	12			12	24	0	24	3.48	100	0	348.00	121	GCMS
1300Terminal						0	0	2												
1430Terminal						0	0	1												
Ferrite Bead	2673000101	FRT	NA	N	N	10	3	0			13	26	0	26	0.16	200	0	32.00	186	GCMS
															Parts Total :			**$97,278**		
															Materials Total			**$4,822**		
															Program Total			**$102,100**		



Space Physics Research Laboratory College of Engineering University of Michigan	**Mechanical End View** **Planet – B NMS**			REV	
				REV	
				REV	
				REV	
				RELEASE	29-Feb-96
				DRAWN	29-Feb-96 from ACAD
Planet B - 080249	0TK63	J0400A-Mech. End View	061-0400	A	Battel / Arnett

Printed: 02/29/96 08:34

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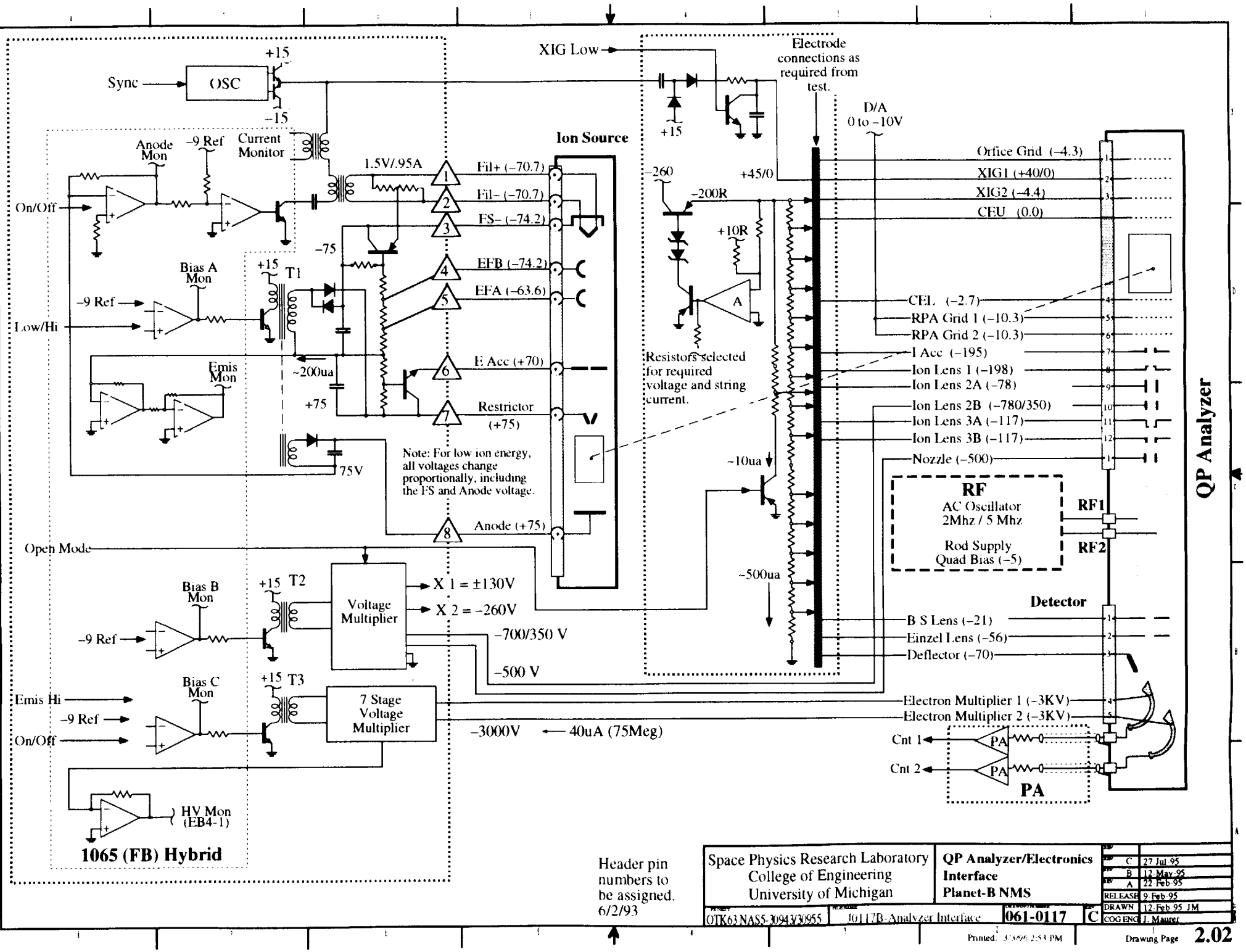
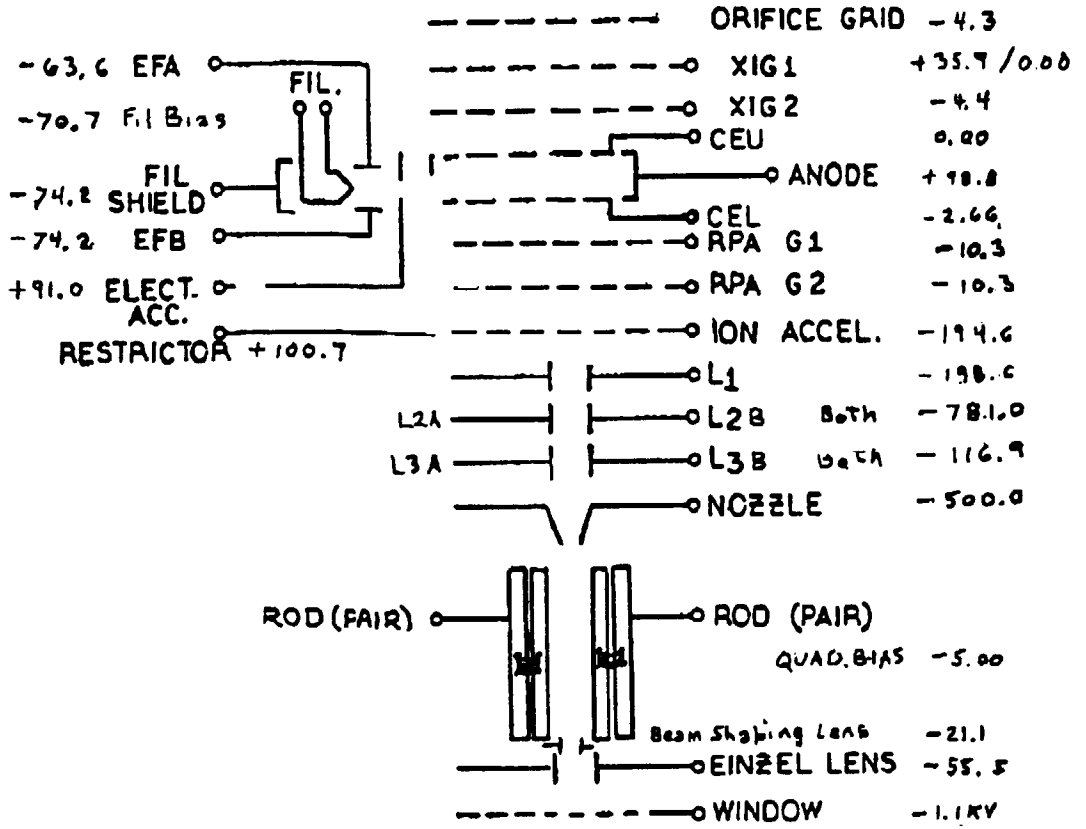
Section 2
QP - Quadrupole Electronic Interface


Sync
OSC
+15
-15
XIG Low
Electrode connections as required from test.
D/A 0 to -10V
Ion Source
Anode Mon
-9 Ref
Current Monitor
1.5V/.95A
On/Off
Fil+ (-70.7)
Fil- (-70.7)
FS- (-74.2)
EFB (-74.2)
EFA (-63.6)
E Acc (+70)
Restrictor (+75)
Anode (+75)
-75
Bias A Mon
T1
Low/Hi
Emis Mon
~200ua
+75
75V
Note: For low ion energy, all voltages change proportionally, including the FS and Anode voltage.
-260
+45/0
-200R
+10R
A
Resistors selected for required voltage and string current.
~10ua
~500ua
Orfice Grid (-4.3)
XIG1 (+40/0)
XIG2 (-4.4)
CEU (0.0)
CEL (-2.7)
RPA Grid 1 (-10.3)
RPA Grid 2 (-10.3)
I Acc (-195)
Ion Lens 1 (-198)
Ion Lens 2A (-78)
Ion Lens 2B (-780/350)
Ion Lens 3A (-117)
Ion Lens 3B (-117)
Nozzle (-500)
RF
AC Oscillator 2Mhz / 5 Mhz
Rod Supply Quad Bias (-5)
RF1
RF2
QP Analyzer
Open Mode
Bias B Mon
T2
Voltage Multiplier
X 1 = ±130V
X 2 = -260V
-700/350 V
-500 V
Detector
B S Lens (-21)
Einzel Lens (-56)
Deflector (-70)
Bias C Mon
T3
Emis Hi
7 Stage Voltage Multiplier
-3000V
40uA (75Meg)
Electron Multiplier 1 (-3KV)
Electron Multiplier 2 (-3KV)
Cnt 1
Cnt 2
PA
HV Mon (EB4-1)
1065 (FB) Hybrid
Header pin numbers to be assigned. 6/2/93
Space Physics Research Laboratory
College of Engineering
University of Michigan
QP Analyzer/Electronics Interface
Planet-B NMS
C 27 Jul 95
B 12 May 95
A 22 Feb 95
RELEASE 9 Feb 95
DRAWN 12 Feb 95 JM
COG ENG J. Maurer
OTK63 NAS5-30943/30955
f01178-Analyzer Interface
061-0117
C
Printed: 3/3/96 2:53 PM
Drawing Page 2.02

PV ONMS Electrode Voltages



Received 10-Feb-95 from H. Bentorm

Space Physics Research Laboratory College of Engineering University of Michigan	Quadrupole Electrode Voltages Planet – B		
INMS / NAS53094	0TK63	J0115-QP Electrodes	061-0115

RELEASE	12-May-95
DRAWN	11-Feb-95 ms
COG ENG	Maurer

Printed: 2/23/1996 02:09 PM

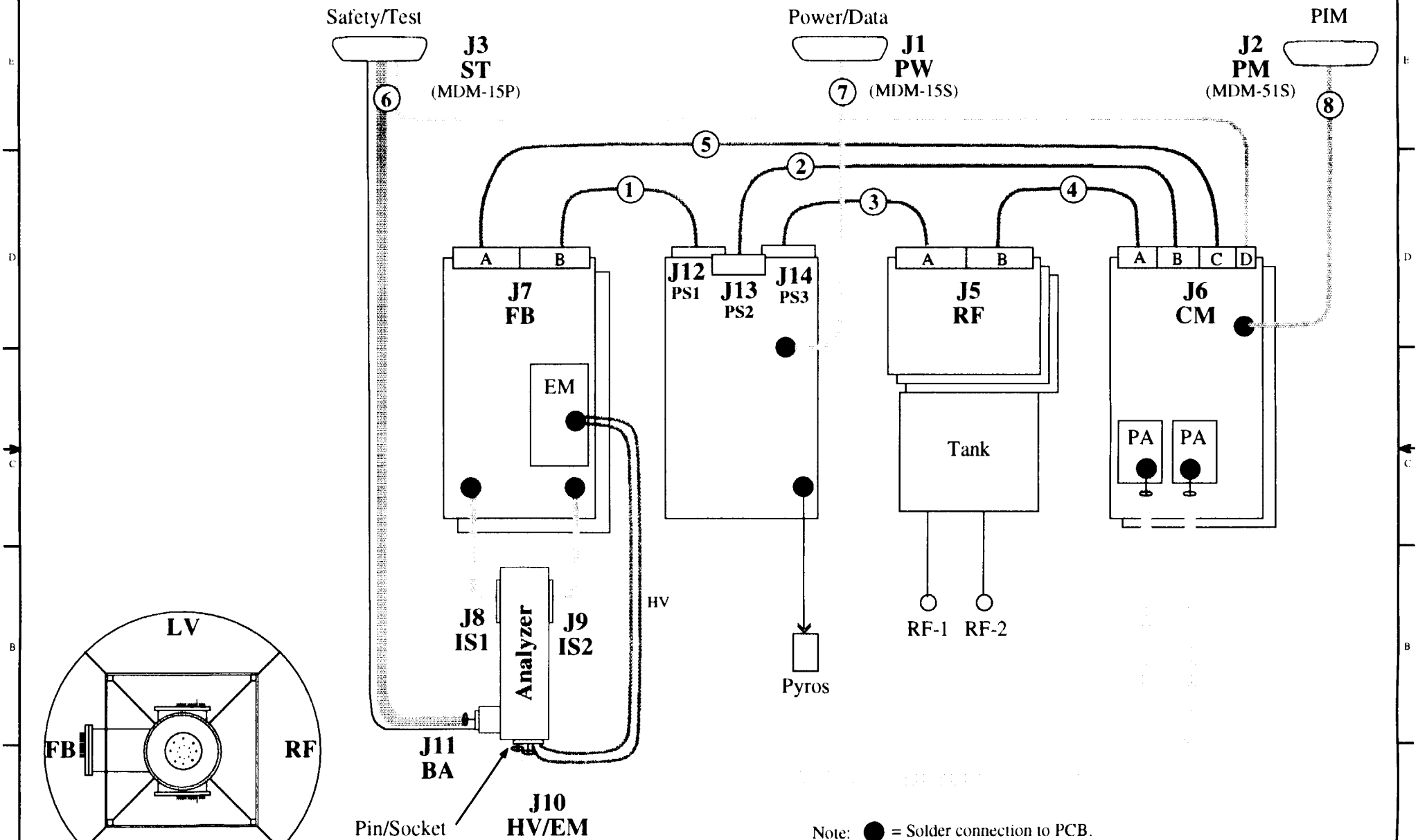
Drawing Page 2.03

Quadrupole Analyzer to Electronics Interface

Temp Pin #	QP Name	Design Voltage	Function	FB Pin #
1	Orfice Grid	-4.3	Fixed potential, TBS, from –200R divider	TBD
2	XIG1	+45/0	Voltage Doubler from ±15 AC with added +15 DC, or by XIG LOW cmd to –10.5V	TBD
3	XIG2	-4.4	Fixed potential, TBS, from –200R divider	TBD
4	CEU	0	Ground (from –200R divider)	TBD
5	CEL	-2.7	Fixed potential, TBS, from –200R divider	TBD
6	RPA Grid 1	–10.3/0to10	Fixed at –10(TBS), from –200R divider, or from RPA Value cmd 0 to +10, by Select cmd	TBD
7	RPA Grid 2	–10.3/0to10	Same as above (tied)	TBD
8	I acc	-195	Fixed potential, TBS, from –200R divider	TBD
9	Ion Lens 1	-198	Fixed potential, TBS, from –200R divider	TBD
10	Ion Lens 2A	-78	Fixed potential, TBS, from –200R divider	TBD
11	Ion Lens 2B	-780/350	–780(TBS), or –350(TBS) by Open Mode Cmd	TBD
12	Ion Lens 3A	-117	Fixed potential, TBS, from –200R divider	TBD
13	Ion Lens 3B	-117	Fixed potential, TBS, from –200R divider	TBD
14	Nozzle	-520	4x Voltage multipler tap from 130 Oscillator – not secondary regulated, and not adjustable.	TBD
15	B S Lens	-21	Fixed potential, TBS, from –200R divider	TBD
16	Einzel Lens	-56	Fixed potential, TBS, from –200R divider	TBD
17	Deflector	-70	Fixed potential, TBS, from –200R divider	TBD
18	EM 1	-3000	–3000 (TBS) volts from 7 stage voltage multiplier. 75 to 100 Meg load.	TBD
19	EM 2	-3000	–3000 (TBS) volts from 7 stage voltage multiplier. 75 to 100 Meg load.	TBD
20	EM Anode 1	0	Coax plug to 50 ohm coax to 3db impedance pad. ~35mV fs (clipping) pulse @14 ns wide.	(CM)
21	EM Anode 1	0	Coax plug to 50 ohm coax to 3db impedance pad. ~35mV fs (clipping) pulse @14 ns wide.	(CM)
22	Fil+	–70/-25	Fil AC at .95A/1.85V rms at 100KHz, referenced to to of fil bias string at –70(TBS), selected by Emis Hi Cmd, OR (NOT D/A!) –25(TBS). Current sum to Emis Mon	TBD
23	Fil–	–70/-25	Same	TBD
24	FS	-72/*	Voltage proportional to Fil. Current sum to Emis Mon	TBD
25	EFA	–74/*	Voltage proportional to Fil. Current sum to Emis Mon	TBD
26	EFB	–74/*	Voltage proportional to Fil. Current sum to Emis Mon	TBD
27	E Acc	70	Voltage proportional to Fil. Current sum to Emis Mon	TBD
28	Restrictor	75	Voltage proportional to Fil. Current sum to Emis Mon	TBD
29	Anode	75	Voltage proportional to Fil. Current sum to Anode Mon and regulates filament temperature.	TBD

*TBS = To Be Selected by resistor selection.

Section 3
HR - Harness, Main & Header


Safety/Test
J3
ST
(MDM-15P)
Power/Data
J1
PW
(MDM-15S)
PIM
J2
PM
(MDM-51S)
6
7
8
5
2
1
3
4
A
B
J7
FB
J12
PS1
J13
PS2
J14
PS3
A
B
J5
RF
A
B
C
D
J6
CM
EM
Tank
PA
PA
J8
IS1
Analyzer
J9
IS2
HV
RF-1
RF-2
Pyros
J11
BA
J10
HV/EM
Pin/Socket
LV
FB
RF
CM
End View of Analyzer
Note: ● = Solder connection to PCB.
Space Physics Research Laboratory
College of Engineering
University of Michigan
Harness Pictorial
Planet – B NMS
061-NMS
0TK63
J0124A-Harness Pictorial
061-0124
A
DRAWN 19-Apr-95 jm
COG ENG Maurer
A 12-Oct-95
12-May-95
RELEASE 12-May-95
Printed
Drawing Page
3.01

Harness 1	P12		P7B
FB 15 Gnd	1	→	P7B-1
FB 5 Gnd	2	→	P7B-4
FB -15	3	→	P7B-3
FBAC -15a	4	→	P7B-10
FBAC -15b	5	→	P7B-10
FBAC Gnd	6	→	P7B-8
FBAC +15a	7	→	P7B-9
FBAC +15b	8	→	P7B-9
FB +15	9	→	P7B-2
FB +5a	10	→	P7B-5
FB +5b	11	→	P7B-5
Imon	12	→	P7B-11
LV Temp	13	→	P7B12
Imon Drv	14	→	P7B-13
FB +130	15	→	P7B-6
FB -130	16	→	P7B-7

Harness 2	P13		P6B
CM -15	1	→	P6B-3
CM +15	2	→	P6B-2
CM +5a	3	→	P6B-5
CM +5b	4	→	P6B-5
CM 5 Gnda	5	→	P6B-4
CM 5 Gndb	6	→	P6B-4
CM 15 Gnd	7	→	P6B-1
Fire-1	8	←	P6B-10
Arm-1	9	←	P6B-8
Arm-2	10	←	P6B-9
Fire-2	11	←	P6B-11
Index Pulse +	12	→	P6B-12
Index Pulse -	13	→	P6B-13
Phase Clock +	14	→	P6B-14
Phase Clock -	15	→	P6B-15
Guard Pulse +	16	→	P6B-16
Guard Pulse -	17	→	P6B-17
300K Sync/	18	←	P6B-7
300K Sync	19	←	P6B-6

Harness 3	P14		P5A
RF-130	1	→	P5A-14
RF+130	2	→	P5A-4
Spare	3	→	P5A-
RF +5a	4	→	P5A-12
RF +5b	5	→	P5A-12
RF +15a	6	→	P5A-11
RF +15b	7	→	P5A-11
RF +15c	8	→	P5A-11
RF +15d	9	→	P5A-11
RF -15a	10	→	P5A-1
RF -15b	11	→	P5A-1
RF -15c	12	→	P5A-1
RF -15d	13	→	P5A-1
RF 5 Gnd	14	→	P5A-7
RF 15 Gnd	15	→	P5A-6

Harness 4	P5B	P6A

RF Temp/RF	1	→	CMA-1
-RF AGC	11	→	CMA-2
RF Data	14	→	CMA-3
RF Clk	15	←	CMA-4
RF AC Enb	2	←	CMA-5
RF DC Enb	7	←	CMA-6
RF Cal	4	→	CMA-7
RF Logic Gnd	6	→	CMA-8
POR	12	←	CMA-9

Harness 5	P7A	P6C	
Emis Hi	3	←	CMC-1
Open Mode	12	←	CMC-2
AMUX Out	19	←	CMC-3
AMUX Add 0	1	←	CMC-4
AMUX Add 1	10	←	CMC-5
AMUX Add 2	2	←	CMC-6
AMUX Add 3	11	←	CMC-7
Fil On	13	←	CMC-8
EM On	4	←	CMC-9
EM Hi	6	←	CMC-10
RPA n	14	←	CMC-11
100K Clk	25	←	CMC-12
Spare	17	←	CMC-13
HV On	5	←	CMC-14
Multana 1	22	←	CMC-15
Multana 2	23	←	CMC-16
RF Temp/FB	20	←	CMC-17
-RF AGC	21	←	CMC-18
XIG Low	7	←	CMC-19

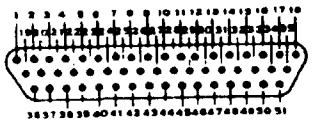
Harness 6	J3		CMD
+5 Inhibit	1	←	CMD-1
HV Inhibit	2	←	CMD-2
Pyro Inhibit	3	←	CMD-3
BA Anode	4	←	B/A-4
BA Fil+	5	←	B/A-5
BA Fil-	6	←	B/A-6
BA Collector	7	←	B/A-7
Col Shield	8	←	B/A-8
Therm Press	9	←	B/A-9
Therm Rtn	10	←	B/A-10
Threm Ref	11	←	B/A-11
Spare	12		
Spare	13		
Spare	14		
Spare	15		

Refer to Dwg. 061-0124, Pg. 3.01 for harness numbers and plug identification.

Table 6.1-1 User Inteface Connector pin assign

PIN No			SIGNAL NAME	I/O	NOTE	PIN No			SIGNAL NAME	I/O	NOTE
1						10			REQ ACK	O	
	19						28		TI DATA ENA	O	
		36						45	TI DATA	O	
2			TD15	O		11			REQ	I	
	20		TD14	O			29		TI LCK	I	
		37	TD13	O				46	TI CLK	I	
3			TD12	O		12					
	21		TD11	O			30				
		38	TD10	O				47			
4			TD9	O		13			RD7	I	
	22		TD8	O			31		RD6	I	
		39	TD7	O				48	RD5	I	
5			TD6	O		14			RD4	I	
	23		TD5	O			32		RD3	I	
		40	TD4	O				49	RD2	I	
6			TD3	O		15			RD1	I	
	24		TD2	O			33		RD0	I	
		41	TD1	O				50			
7			TD0	O		16					
	25		S1	O			34		+5V	I	
		42	S0	O				51			
8			ADRS STB	O		17			COM(2)	I	
	26		WR	O			35				
		43	RD	O							
9			MCRP	O		18					
	27		ON CMD	O							
		44	OFF CMD	O							

MDM-51 Plug



51 Contacts

From Planet-B, Data Handling System, User's Manual, 457 Pg. 6-1, Rev. 5 Scanned 5/9/95

Space Physics Research Laboratory College of Engineering University of Michigan	PIM Plug List Planet – B NMS		
PROJECT: 061-NMS	CAGE CODE: 0TK63	PRJ NAME: J0136-PIM Plug list	DRAWING NUMBER: 061-0136 REV: –
REV		RELEASE	12-May-95
REV		DRAWN	Scanned 9-May-95
REV		COG ENG	Maurer
REV			

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J1- Power/Data
MDM-15S

01- Shield Ground
02- Index Pulse +
03- Phase Clock +
04- Guard Pulse +
05- Not Used
06- Bus–1 (Power +)
07- Not Used
08- Not Used
09- Not Used
10- Index Pulse –
11- Phase Clock –
12- Guard Pulse –
13- Not Used
14- Com–1 Power Return
15- Not Used

Notes:
1- This pin assignment only applies to the Engineering Unit.

Space Physics Research Laboratory College of Engineering University of Michigan	NMS Power Connector List Planet – B NMS			REV REV REV REV RELEASE 26-May-95 DRAWN 26-May-95 jm COG ENG Maurer
PROJECT 061-NMS	CONFIG 0TK63	FILE NAME J0150-PowerPlug	DRAWING NUMBER 061-0150	REV –

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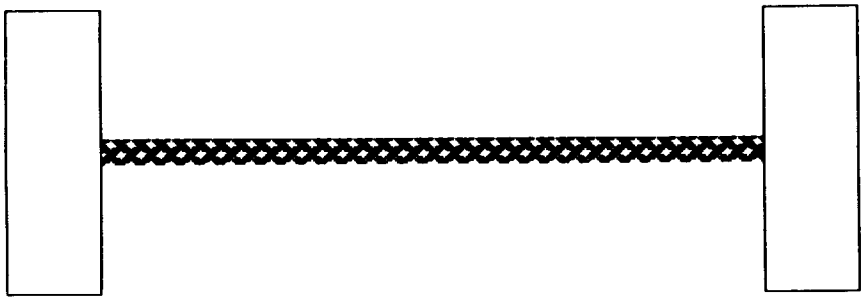
HARNESS 1

P12
TBD
OMNETICS

1	FB 15 GND
2	FB 5 GND
3	FB -15
4	FBAC -15
5	FBAC -15
6	FBAC GND
7	FB AC +15
8	FB AC +15
9	FB +15
10	FB +5
11	FB +5
12	IMON
13	LV TEMP
14	IMON DRV
15	FB +130
16	FB -130

PS



FB

J7B
TBD
OMNETICS

1	TBD
2	TBD
3	TBD
4	TBD
5	TBD
6	TBD
7	TBD
8	TBD
9	TBD
10	TBD
11	TBD
12	TBD
13	TBD
14	TBD
15	TBD
16	TBD

PRELIMINARY

Space Physics Research Laboratory College of Engineering University of Michigan		Harness 1 Planet – B NMS			
061-NMS	0TK63	J0338A-Harness	061-0338	A	

REV A	27-Feb-96 DC
RELEASE	18-Aug-95
DRAWN	26-Jul-95
CDG ENG	Arnett/Matthews

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Drawing Page 3.05

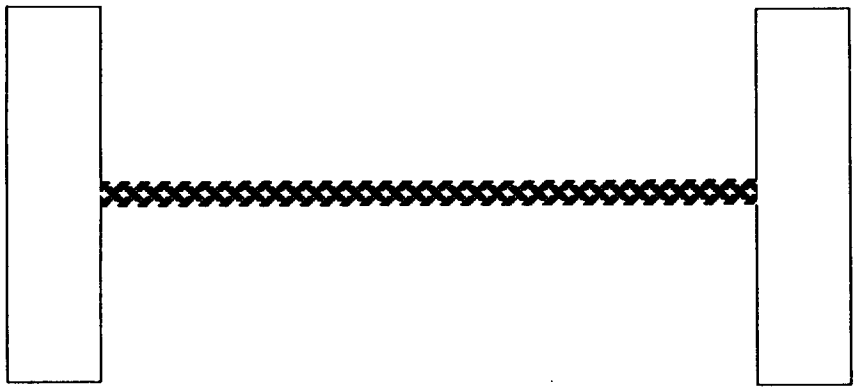
HARNESS 2

P13
TBD
OMNETICS

1	CM -15
2	CM +15
3	CM +5
4	CM +5
5	CM 5 GND
6	CM 5 GND
7	CM 15 GND
8	FIRE -1
9	ARM -1
10	ARM -2
11	FIRE -2
12	INDEX PULSE+
13	INDEX PULSE-
14	PHASE CLOCK+
15	PHASE CLOCK-
16	GUARD PULSE+
17	GUARD PULSE-
18	300K SYNC/
19	300K SYNC

PS

CM



PGB
TBD

TBD

PRELIMINARY

Space Physics Research Laboratory College of Engineering University of Michigan	Harness 2 Planet – B NMS			DRN	
				DRN	
				DRN	
				A	1-Mar-96 DC
				RELEASE	18-Aug-95
061-NMS	0TK63	J0346A-Harness 2	061- 0346	A	DRAWN 25-Jul-95
					ENG Arnett/Matthews

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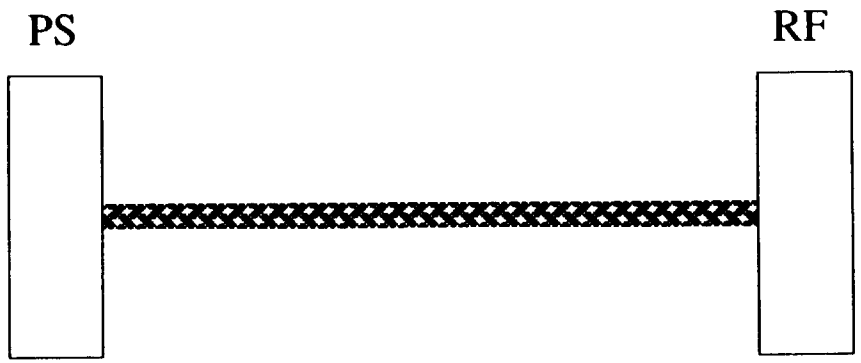
Drawing Page 3.06

HARNESS 3

P14
TBD
OMNETICS

1. RF -130
2. RF +130
3. SPARE
4. RF +5
5. RF +5
6. RF +15
7. RF +15
8. RF +15
9. RF +15
10. RF -15
11. RF -15
12. RF -15
13. RF -15
14. RF 5 GND
15. RF 15 GND



J5A
TBD

TBD

PRELIMINARY

Space Physics Research Laboratory College of Engineering University of Michigan	Harness 3 Planet – B NMS			DIV	
				DIV	
				DIV	
				A	1-Mar-96 DC
				RELEASE	18-Aug-95
				DRAWN	26-Jul-95
061-NMS	0TK63	J0339A-Harness 3	061-0339	A	ENG Arnett/Matthews

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HARNESS 4

P5B
TBD
OMNETICS

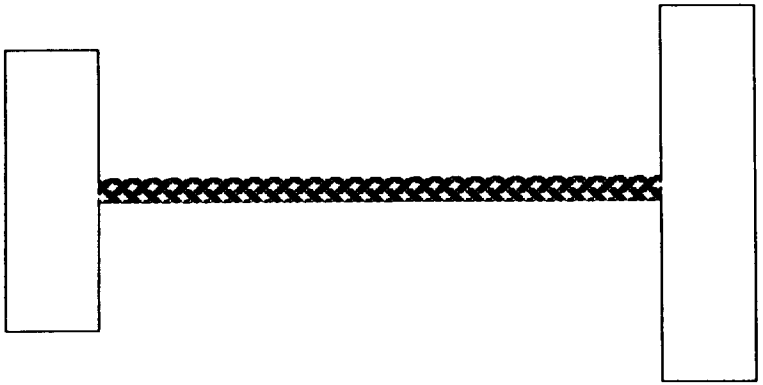
P6A

RF

CM

TBD

TBD



PRELIMINARY

Space Physics Research Laboratory College of Engineering University of Michigan	Harness 4 Planet – B NMS				
061-NMS	0TK63	J0344A-Harness 4	061- 0344	A	

A	1-Mar-96 DC
RELEASE	28-Aug-95
DRAWN	25-Jul-95
ENG	Arnett/Matthews

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Drawing Page 3.08

HARNESS 5

P7A
TBD
OMNETICS

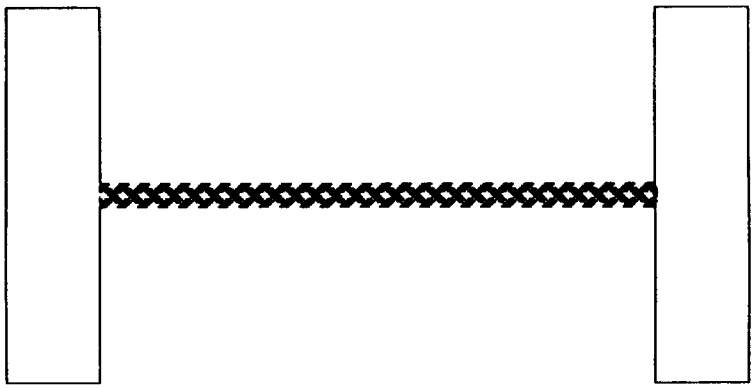
P6C

FB

CM

TBD

TBD



PRELIMINARY

Space Physics Research Laboratory College of Engineering University of Michigan	Harness 5 Planet – B NMS			REV	
				A	1-Mar-96 DC
				RELEASE	18-Aug-95
061-NMS	0TK63	J0345A-Harness 5	061- 0345	A	DRAWN 25-Jul-95
					ENG Arnett/Matthews

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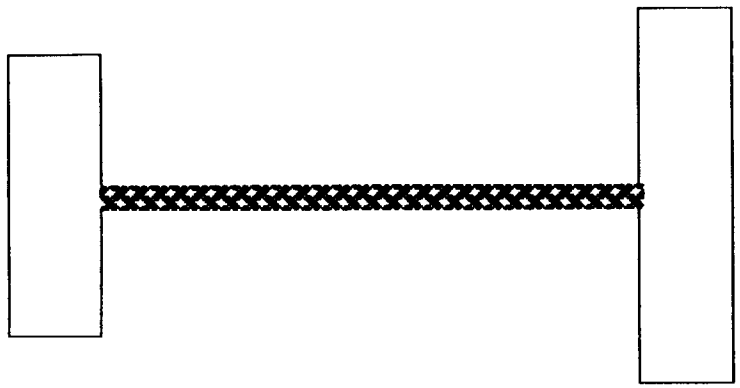
Drawing Page 3.09

HARNESS 6

J3

SAFETY/TEST
INTERFACE

TBD



TBD

PRELIMINARY

Space Physics Research Laboratory College of Engineering University of Michigan	Harness 6 Planet – B NMS			DRAWN	26-Jul-95
				ENG	Arnett/Matthews
061-NMS	0TK63	J0342A-Harness 6	061-0342	A	

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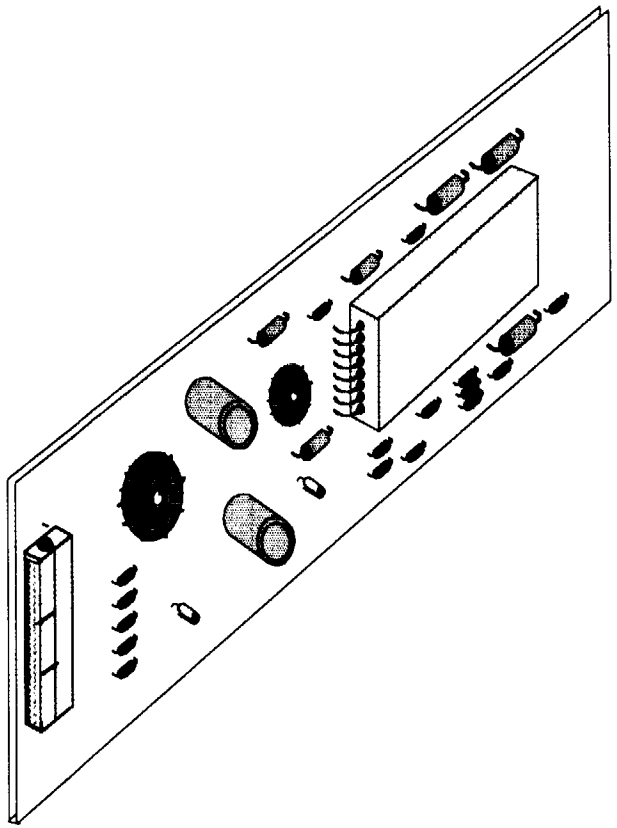
Drawing Page 3.10

Section 4
PS - Power Supply Module



Space Physics Research Laboratory College of Engineering University of Michigan		PS Pictorial Planet-B NMS		REV REV REV REV RELEASE 12-May-95 DRAWN 10-May-95 JM COG ENG Arnett
061-NMS	0TK63	J0102-PS Pictorial	061-0102	REV

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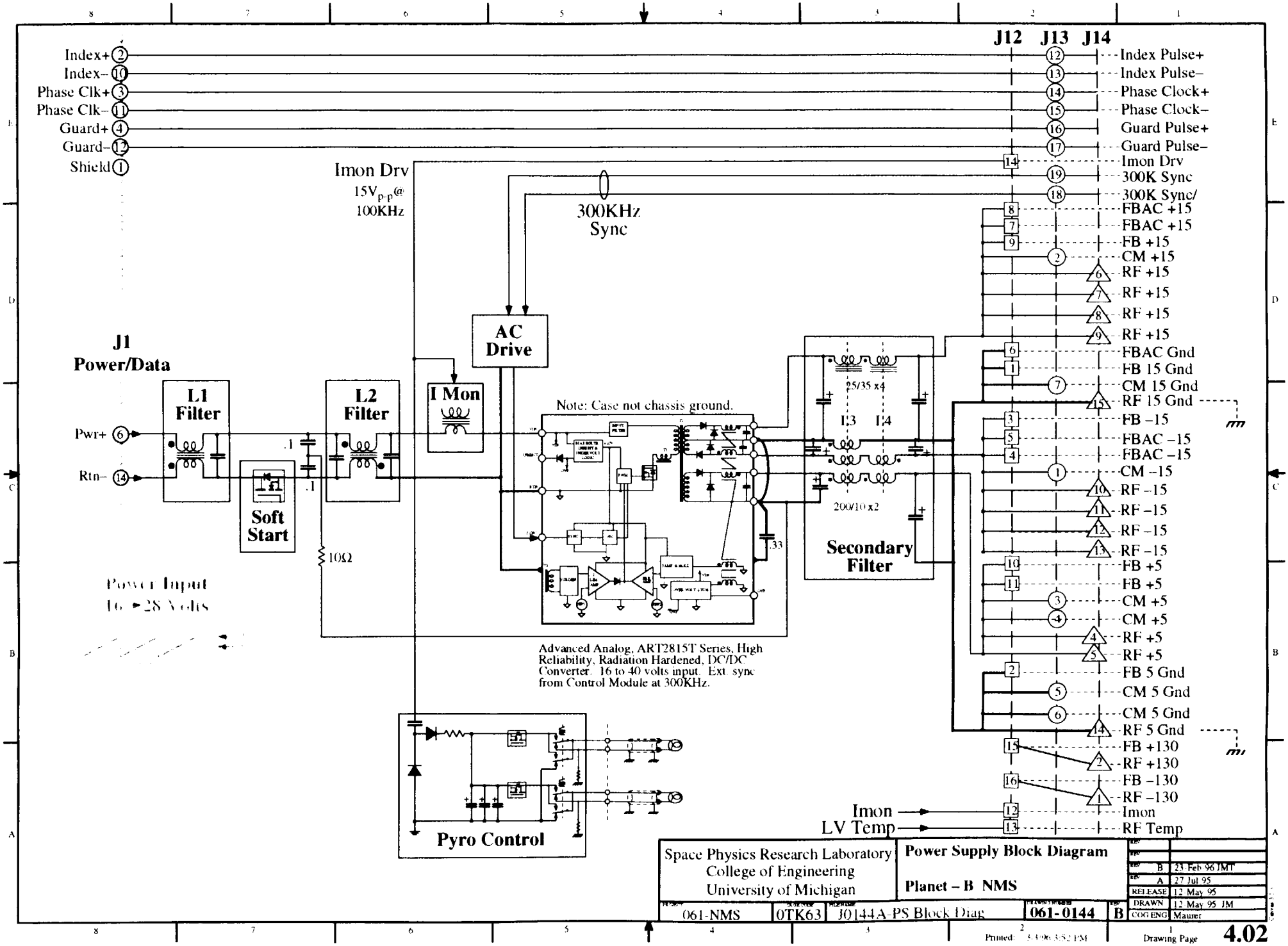
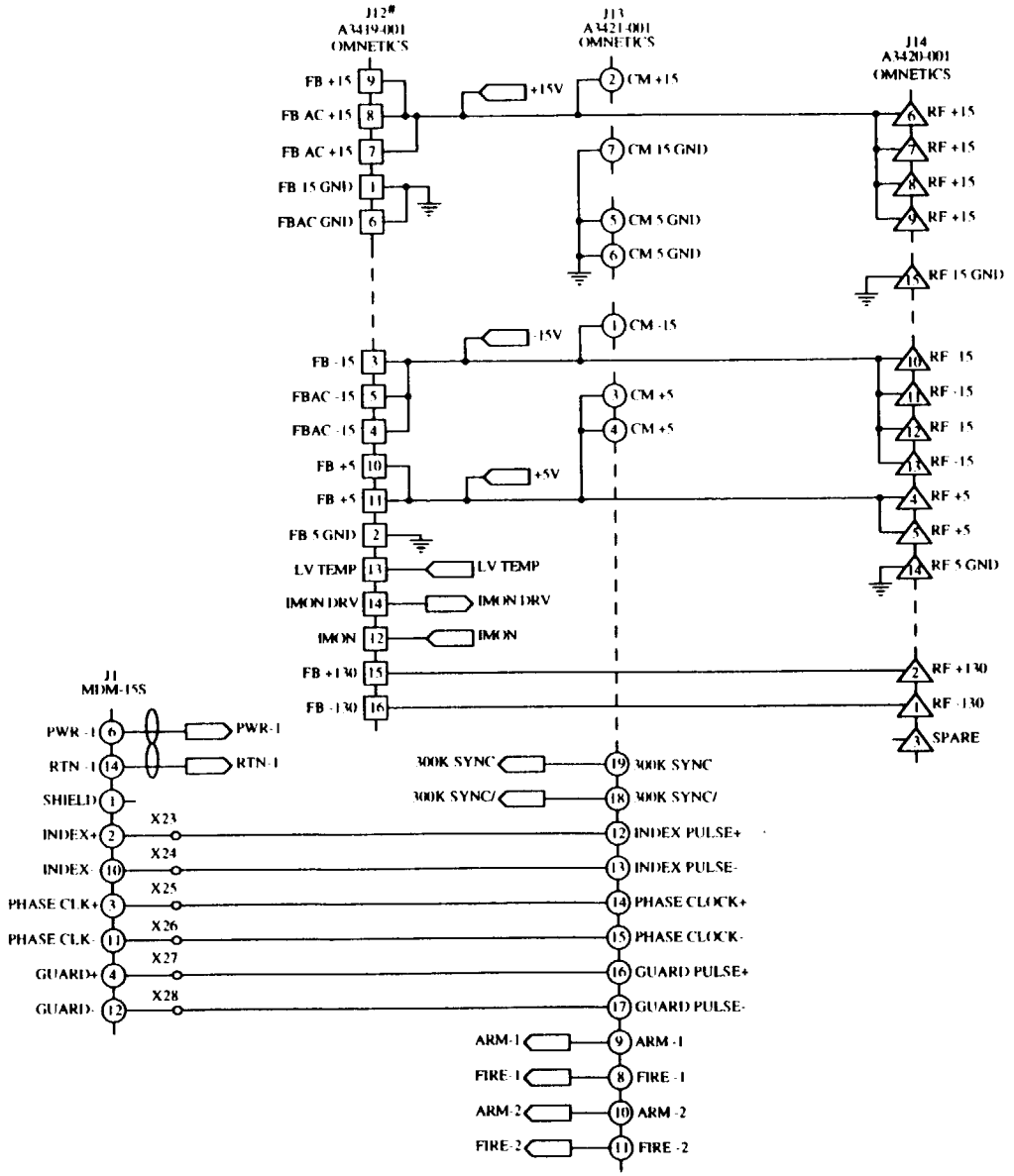
Drawing Page **4.01**


J12 J13 J14
Index+ 2
Index– 10
Phase Clk+ 3
Phase Clk– 11
Guard+ 4
Guard– 12
Shield 1
Index Pulse+
Index Pulse–
Phase Clock+
Phase Clock–
Guard Pulse+
Guard Pulse–
Imon Drv
300K Sync
300K Sync/
FBAC +15
FBAC +15
FB +15
CM +15
RF +15
RF +15
RF +15
RF +15
FBAC Gnd
FB 15 Gnd
CM 15 Gnd
RF 15 Gnd
FB –15
FBAC –15
FBAC –15
CM –15
RF –15
RF –15
RF –15
RF –15
FB +5
FB +5
CM +5
CM +5
RF +5
RF +5
FB 5 Gnd
CM 5 Gnd
CM 5 Gnd
RF 5 Gnd
FB +130
RF +130
FB –130
RF –130
Imon
RF Temp
Imon Drv
15Vp-p@
100KHz
300KHz
Sync
AC
Drive
J1
Power/Data
L1
Filter
L2
Filter
I Mon
Soft
Start
Pwr+ 6
Rtn– 14
.1
.1
10Ω
Power Input
16 to 28 Volts
Note: Case not chassis ground.
25/35 x4
I3 I4
200/10 x2
Secondary
Filter
.33
Advanced Analog, ART2815T Series, High Reliability, Radiation Hardened, DC/DC Converter. 16 to 40 volts input. Ext. sync from Control Module at 300KHz.
Pyro Control
Imon
LV Temp
Space Physics Research Laboratory
College of Engineering
University of Michigan
Power Supply Block Diagram
Planet – B NMS
061-NMS
0TK63
J0144A-PS Block Diag
061-0144
B
B 23 Feb 96 JMT
A 27 Jul 95
RELEASE 12 May 95
DRAWN 12 May 95 JM
COG ENG Maurer
Printed:
Drawing Page
4.02

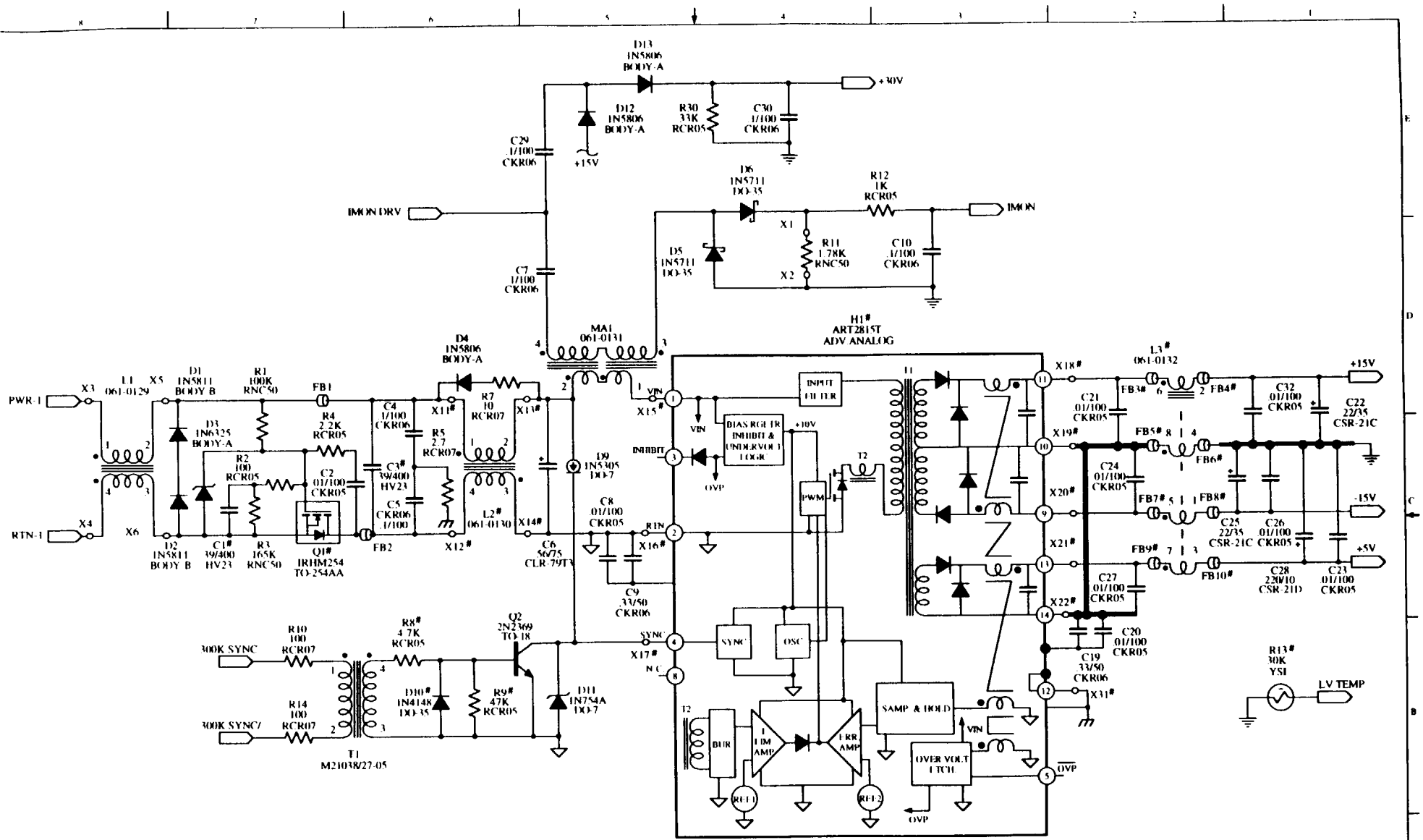


LAST USED: C34, D17, FB10, H1, J4, K2, L3, MA1, Q8, R30, T1, X31

Space Physics Research Laboratory College of Engineering University of Michigan	Schematic Diagram, Pg. 1 of 3 Power Supply Planet B - NMS		
PROJECT: Planet B - NMS	TAG# CODE: 0TK63	FILENAME: J0126.1-PS Schematic	DRAWING NUMBER: 061-0126 REV: D

REV	
REV D	8-Feb-96 D.Cumming
REV C	12-Oct-95 D.Cumming
RELEASE	10-Aug-95 O. Bayt
DRAWN	28-Apr-95 O. Bayt
COG'ENG	S. Battel/ K. Amen

4.03



NOTES:

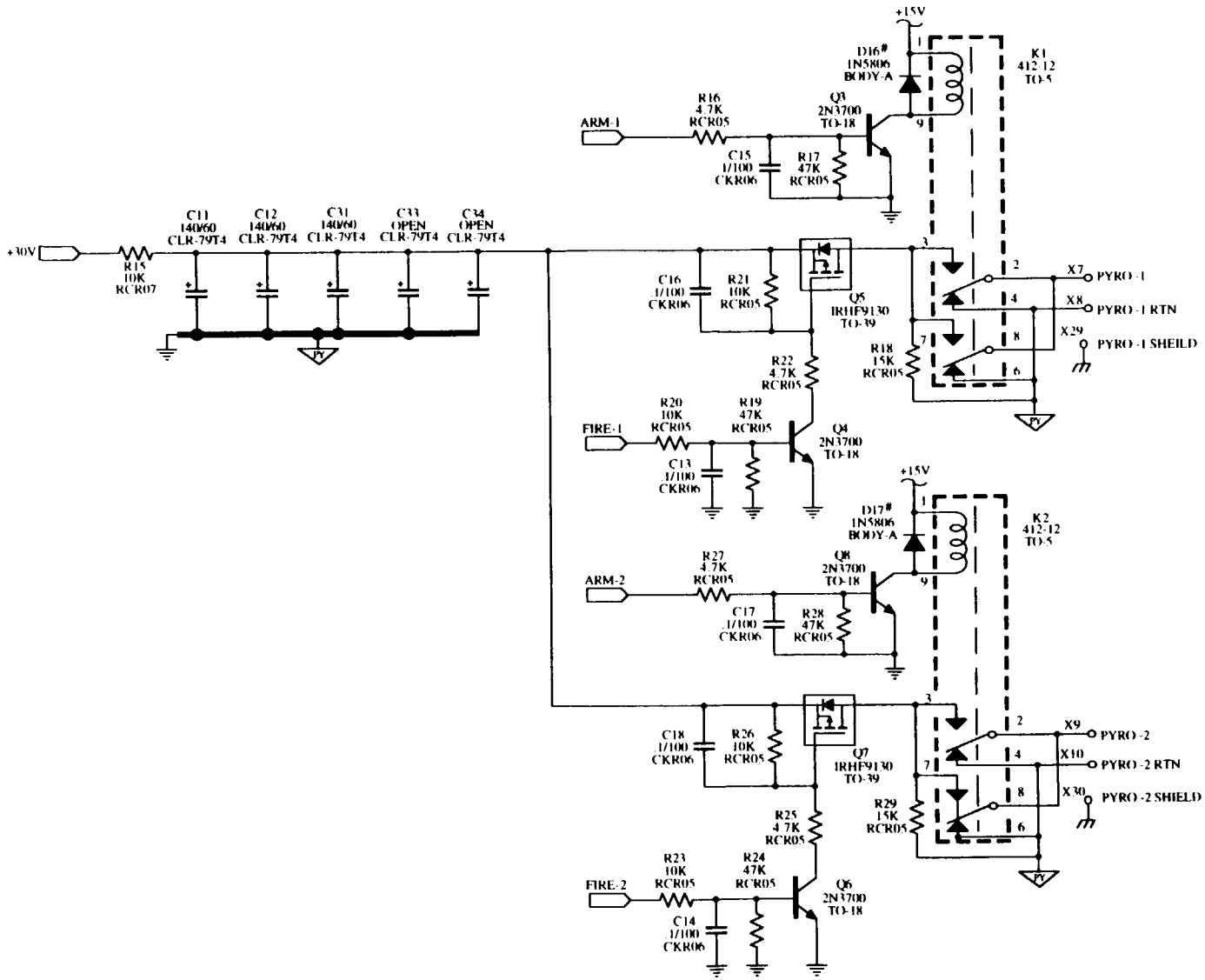
1) FB1 - FB10 ARE FB2673022401's.
2) O DENOTES TURRET -> TYPE 2031A USECO
3) # DENOTES TURRET MOUNTED ON TOP SIDE (LAYER 1) OF PCB ALL OTHER PARTS MOUNTED ON BOTTOM SIDE
4) REFER TO PARTS LIST 061-0127 FOR MANUFACTURING

Space Physics Research Laboratory College of Engineering University of Michigan	Schematic Diagram, Pg. 2 of 3 Power Supply Planet B - NMS

PROJECT	CAGE CODE	DRAWING NUMBER	REV
Planet B - NMS	0TK63	J0126.2-PS Schematic	061-0126 D

REV	
D	8-Feb-96 D.Cumming
C	12-Oct-95 D.Cumming
RELEASE	10-Aug-95 O. Bayt
DRAWN	28-Apr-95 O. Bayt
CODENG	S. Battel/ K. Amen

4.04



Space Physics Research Laboratory College of Engineering University of Michigan	Schematic Diagram, Pg. 3 of 3 Power Supply Planet B - NMS			
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	DRAWING NAME: J0126.3-PS Schematic	DRAWING NUMBER: 061-0126	REV: D

REV	
D	8-Feb-96 D Cumming
C	12-Oct-95 D Cumming
RELEASE	10-Aug-95 O. Bayi
DRAWN	28-Apr-95 O. Bayi
COG ENG	S. Bartel/ K. Arnett

Ref	Value	Info
C1	.39/400	HV23
C2	.01/100	CKR05
C3	.39/400	HV23
C4	.1/100	CKR06
C5	.1/100	CKR06
C6	56/75	CLR-79T3
C7	.1/100	CKR06
C8	.01/100	CKR05
C9	.33/50	CKR06
C10	.1/100	CKR06
C11	140/60	CLR-79T4
C12	140/60	CLR-79T4
C13	.1/100	CKR06
C14	.1/100	CKR06
C15	.1/100	CKR06
C16	.1/100	CKR06
C17	.1/100	CKR06
C18	.1/100	CKR06
C19	.33/50	CKR06
C20	.01/100	CKR05
C21	.01/100	CKR05
C22	22/35	CSR-21C
C23	.01/100	CKR05
C24	.01/100	CKR05
C25	22/35	CSR-21C
C26	.01/100	CKR05
C27	.01/100	CKR05
C28	220/10	CSR-21D
C29	.1/100	CKR06
C30	.1/100	CKR06
C31	140/60	CLR-79T4
C32	.01/100	CKR05
C33	OPEN	CLR-79T4
C34	OPEN	CLR-79T4
D1	1N5811	BODY-B
D2	1N5811	BODY-B
D3	1N6325	BODY-A
D4	1N5806	BODY-A
D5	1N5711	DO-35
D6	1N5711	DO-35
D9	1N5305	DO-7
D10	1N4148	DO-35
D11	1N754A	DO-7
D12	1N5806	BODY-A
D13	1N5806	BODY-A
D16	1N5806	BODY-A
D17	1N5806	BODY-A
FB1	FB2673022401	Ferrite Bead
FB2	FB2673022401	Ferrite Bead
FB3	FB2673022401	Ferrite Bead
FB4	FB2673022401	Ferrite Bead
FB5	FB2673022401	Ferrite Bead
FB6	FB2673022401	Ferrite Bead
FB7	FB2673022401	Ferrite Bead
FB8	FB2673022401	Ferrite Bead
FB9	FB2673022401	Ferrite Bead
FB10	FB2673022401	Ferrite Bead
H1	ART2815T	ADV.ANALOG
J1	MDM-15S	
J12	A3419-001	OMNETICS
J13	A3421-001	OMNETICS
J14	A3420-001	OMNETICS
K1	412-12	TO-5
K2	412-12	TO-5
L1		061-0129
L2		061-0130
L3		061-0132
MA1		061-0131
Q1	IRHM254	TO-254AA
Q2	2N2369	TO-18
Q3	2N3700	TO-18
Q4	2N3700	TO-18

Ref	Value	Info
Q5	IRHF9130	TO-39
Q6	2N3700	TO-18
Q7	IRHF9130	TO-39
Q8	2N3700	TO-18
R1	100K	RNC50
R2	100	RCR05
R3	165K	RNC50
R4	2.2K	RCR05
R5	2.7	RCR07
R7	10	RCR07
R8	4.7K	RCR05
R9	47K	RCR05
R10	100	RCR07
R11	1.78K	RNC50
R12	1K	RCR05
R13	30K	YSI
R14	100	RCR07
R15	10K	RCR07
R16	4.7K	RCR05
R17	47K	RCR05
R18	15K	RCR05
R19	47K	RCR05
R20	10K	RCR05
R21	10K	RCR05
R22	4.7K	RCR05
R23	10K	RCR05
R24	47K	RCR05
R25	4.7K	RCR05
R26	10K	RCR05
R27	4.7K	RCR05
R28	47K	RCR05
R29	15K	RCR05
R30	33K	RCR05
T1	M21038/27-05	
X1	2031A Useco	Turret
X2	2031A Useco	Turret
X3	2031A Useco	Turret
X4	2031A Useco	Turret
X5	2031A Useco	Turret
X6	2031A Useco	Turret
X7	2031A Useco	Turret
X8	2031A Useco	Turret
X9	2031A Useco	Turret
X10	2031A Useco	Turret
X11	2031A Useco	Turret
X12	2031A Useco	Turret
X13	2031A Useco	Turret
X14	2031A Useco	Turret
X15	2031A Useco	Turret
X16	2031A Useco	Turret
X17	2031A Useco	Turret
X18	2031A Useco	Turret
X19	2031A Useco	Turret
X20	2031A Useco	Turret
X21	2031A Useco	Turret
X22	2031A Useco	Turret
X23	2031A Useco	Turret
X24	2031A Useco	Turret
X25	2031A Useco	Turret
X26	2031A Useco	Turret
X27	2031A Useco	Turret
X28	2031A Useco	Turret
X29	2031A Useco	Turret
X30	2031A Useco	Turret
X31	2031A Useco	Turret

Extracted Thursday, February 08, 1996 02:28 PM

+5V		
	C23	2
	C28	1
	FB10	1
	J12	10
	J12	11
	J13	3
	J13	4
	J14	4
	J14	5
+15V		
	C22	1
	C32	1
	D12	2
	D16	1
	D17	1
	FB4	1
	J12	7
	J12	8
	J12	9
	J13	2
	J14	6
	J14	7
	J14	8
	J14	9
	K1	1
	K2	1
+30V		
	C30	1
	D13	1
	R15	1
	R30	2
-15V		
	C25	2
	C26	2
	FB8	1
	J12	3
	J12	4
	J12	5
	J13	1
	J14	10
	J14	11
	J14	12
	J14	13
15 RTN		
	C19	1
	C20	1
	C21	2
	C24	1
	C27	2
	FB5	2
	X19	1
	X22	1
300K SYNC		
	J13	19
	R10	1
300K SYNC/		
	J13	18
	R14	1
ARM-1		
	J13	9
	R16	1
ARM-2		
	J13	10
	R27	1
CHAS		
	H1	65
	R5	2
	X29	2
	X30	2
	X31	1
FIRE-1		
	J13	8
	R20	1
FIRE-2		
	J13	11
	R23	1
GND		
	C10	1
	C22	2
	C23	1
	C25	1
	C26	1
	C28	2
	C30	2
	C32	2
	D5	2
	FB6	1
	J12	1
	J12	2
	J12	6
	J13	5
	J13	6
	J13	7
	J14	14
	J14	15
	R13	2
	R30	1
	X2	2
IMON		
	C10	2
	J12	12
	R12	1
IMON DRV		
	C7	2
	C29	1
	J12	14
LV TEMP		
	J12	13
	R13	1
N:1		
	J12	16
	J14	1
N:2		
	J12	15
	J14	2
N:3		
	J1	2
	X23	2
N:4		
	J13	12
	X23	1
N:5		
	J1	10
	X24	2
N:6		
	J13	13
	X24	1
N:7		
	J1	3
	X25	2
N:8		
	J13	14
	X25	1
N:9		
	J1	11
	X26	2
N:10		
	J13	15
	X26	1
N:11		
	J13	16
	X27	1
N:12		
	J1	4
	X27	2
N:13		
	J1	12
	X28	2
N:14		
	J13	17
	X28	1
N:15		
	C7	1
	MA1	4
N:16		
	D5	1
	D6	2
	MA1	3
N:17		

	C29	2
	D12	1
	D13	2
N:18		
	C19	2
	C20	2
	H1	95
N:19		
	C8	2
	C9	2
	H1	48
N:20		
	D6	1
	R12	2
	X1	1
N:21		
	C3	1
	C4	1
	D4	1
	FB1	1
	X11	2
N:22		
	C1	1
	R2	1
	R3	1
N:23		
	D3	1
	Q1	2
	R1	2
	R2	2
	R4	1
N:24		
	D1	2
	D2	1
N:25		
	C2	1
	R4	2
N:26		
	C2	2
	FB2	2
	Q1	1
N:27		
	C4	2
	C5	1
	R5	1
N:28		
	D4	2
	R7	1
N:29		
	C6	1
	D9	2
	MA1	2
	R7	2
	X13	1
N:30		
	MA1	1
	X15	2
N:31		
	C1	2
	D2	2
	D3	2
	Q1	3
	R3	2
	X6	1
N:32		
	R8	1
	T1	4
N:33		
	D10	1
	Q2	2
	R8	2
	R9	1
N:34		
	H1	1
	X15	1
N:35		
	D9	1
	D11	1
	Q2	1
	X17	2
N:36		
	R10	2
	T1	1
N:37		
	R11	1
	X1	2
N:38		
	H1	12
	X31	2
N:39		
	R11	2
	X2	1
N:40		
	C27	1
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	X21	1
N:41		
	R14	2
	T1	2
N:42		
	C24	2
	FB7	2
	X20	1
N:43		
	C21	1
	FB3	2
	X18	1
N:44		
	D1	1
	FB1	2
	R1	1
	X5	1
N:45		
	C3	2
	C5	2
	FB2	1
	X12	2
N:46		
	FB6	2
	L3	4
N:47		
	FB5	1
	L3	8
N:48		
	FB3	1
	L3	6
N:49		
	FB7	1
	L3	5
N:50		
	FB4	2
	L3	2
N:51		
	FB9	1
	L3	7
N:52		
	FB8	2
	L3	1
N:53		
	FB10	2
	L3	3
N:54		
	L1	1
	X3	1
N:55		
	L1	4
	X4	1
N:56		
	L1	2
	X5	2
N:57		
	L1	3
	X6	2
N:58		
	L2	1
	X11	1
N:59		
	L2	4
	X12	1
N:60		

	L2	3
	X14	2
N:61		
	L2	2
	X13	2
N:62		
	H1	2
	X16	1
N:63		
	H1	4
	X17	1
N:64		
	H1	11
	X18	2
N:65		
	H1	10
	X19	2
N:66		
	H1	9
	X20	2
N:67		
	H1	13
	X21	2
N:68		
	H1	14
	X22	2
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	K1	2
	K1	8
	X7	2
N:70		
	C18	2
	Q7	2
	R25	1
	R26	2
N:71		
	Q6	1
	R25	2
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	C14	1
	Q6	2
	R23	2
	R24	1
N:73		
	C17	1
	Q8	2
	R27	2
	R28	1
N:74		
	D17	2
	K2	9
	Q8	1
N:75		
	K2	2
	K2	8
	X9	2
N:76		
	C11	1
	C12	1
	C16	1
	C18	1
	C31	1
	C33	1
	C34	1
	Q5	3
	Q7	3
	R15	2
	R21	1
	R26	1
N:77		
	C16	2
	Q5	2
	R21	2
	R22	1
N:78		
	Q4	1
	R22	2
N:79		
	C13	1
	Q4	2
	R19	1
	R20	2
N:80		
	C15	1
	Q3	2
	R16	2
	R17	1
N:81		
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	K1	9
	Q3	1
N:82		
	K1	3
	K1	7
	Q5	1
	R18	1
N:83		
	C11	2
	C12	2
	C13	2
	C14	2
	C15	2
	C17	2
	C31	2
	C33	2
	C34	2
	K1	4
	K1	6
	K2	3
	K2	4
	K2	6
	Q3	3
	Q4	3
	Q6	3
	Q7	1
	Q8	3
	R17	2
	R18	2
	R19	2
	R24	2
	R28	2
	R29	1
	R29	2
	X8	2
	X10	2
PWR RTN		
	C6	2
	C8	1
	C9	1
	D10	2
	D11	2
	Q2	3
	R9	2
	T1	3
	X14	1
	X16	2
PWR-1		
	J1	6
	X3	2
RTN-1		
	J1	14
	X4	2

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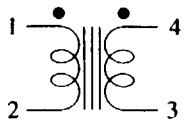
10:54

LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	204T250-3C81	Philips/ Ferroxcube Toroid
2	AR	B2222512	#22 AWG Bifilar Magnet Wire
3	AR	3M Scotchcast 235	Encapsulant



NOTES:

1) Wind one full layer of #22 AWG bifilar wire on 204T250-3C81 core (~ 14 turns). DO NOT cross finish leads over start leads.

2) • denotes phasing.

3) Refer to Special Assembly Procedure 061-0389 for Flight Hardware Assembly.

Space Physics Research Laboratory College of Engineering University of Michigan	L1 Assembly Detail Power Supply Planet – B NMS				
061-NMS	0TK63	J0129B-PS L1 Ass'y Detail	061-0129	B	

B	26-Feb-96 JMT
RELEASE	12-May-95 O. Bayl
DRAWN	08-May-95 O. Bayl
COG ENG	S. Battel/ K. Arnett

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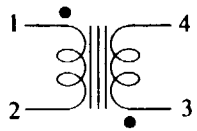
Drawing Page 4.20

LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	A-390134-2	Arnold MPP Core
2	AR	B2222512	#22AWG Bifilar Magnet Wire
3	AR	3M Scotchcast 235	Encapsulant



NOTES:

1) Wind 30 turns of #22 AWG bifilar wire on A-390134-2 core. DO NOT cross finish leads over start leads.

2) • denotes phasing.

3) Refer to Special Assembly Procedure 061-0390 for Flight Hardware Assembly.

Space Physics Research Laboratory College of Engineering University of Michigan	**L2 Assembly Detail** **Power Supply** **Planet – B NMS**			REV	
				REV	
				REV C	26-Feb-96 JMT
				REV B	05-Jul-95 O. Bayi
				RELEASE	12-May-95 O. Bayi
				DRAWN	08-May-95 O. Bayi
PROJECT 061-NMS	CODE IDENT 0TK63	FILE NAME J0130C-PS L2 Ass'y Detail	DRAWING NUMBER 061-0130	REV C	COG ENG S. Battel/ K. Arnett

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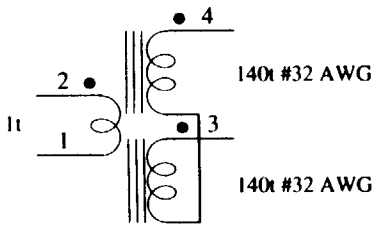
Drawing Page **4.21**

LIST OF MATERIALS

Item	QTY	P/N	Description
1	2	50402-1E	Magnetics Toroid
2	AR	HAPT-32	#32AWG Magnet Wire
3	AR	3M Scotchcast 235	Encapsulant
4	1	061-0131-1	Robison Potting Shell, Modified
5	1	061-0131-2	G10 Insulator
6	1	061-0131-3	G10 Spacer
7	1		Screw, #2-56 x 3/16" Philips 100° FH
8	AR	QPL	#22AWG Solid Bus Wire, Tinned
9	AR	3M 1838B/A	Scotchweld Epoxy
10	AR	Rapid Seal	Latex Sealant
11	AR	QQ-S-571E	Solder
12	AR	EN-11A/B	Conathane Potting

WINDING DETAIL:

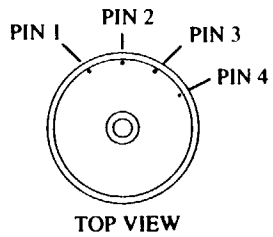


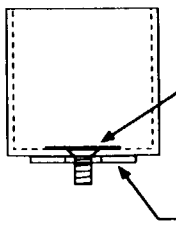
1) Wind 140 turns of #32 AWG bifilar wire, stack wound on each 50402-1E Magnetics core.

2) 2 cores are stacked with common 1 turn primary. Stack up so M and H supplies add.

3) Refer to Special Assembly Procedure 061-0391 for Flight Hardware Assembly.

ASSEMBLY DETAIL:





Space Physics Research Laboratory College of Engineering University of Michigan	**MA1 Ass'y Detail, Page 1 of 2** **Power Supply** **Planet – B NMS**	REV D	26-Feb-96
		REV C	16-Oct-95
		REV B	05-Jul-95 O. Bayl
		RELEASE	12-May-95 O. Bayl
		DRAWN	08-May-95 O. Bayl
061-NMS / 0TK63 / J0131.1-PS MA1	061-0131.1 D	COG ENG	S. Battel/ K. Arnett

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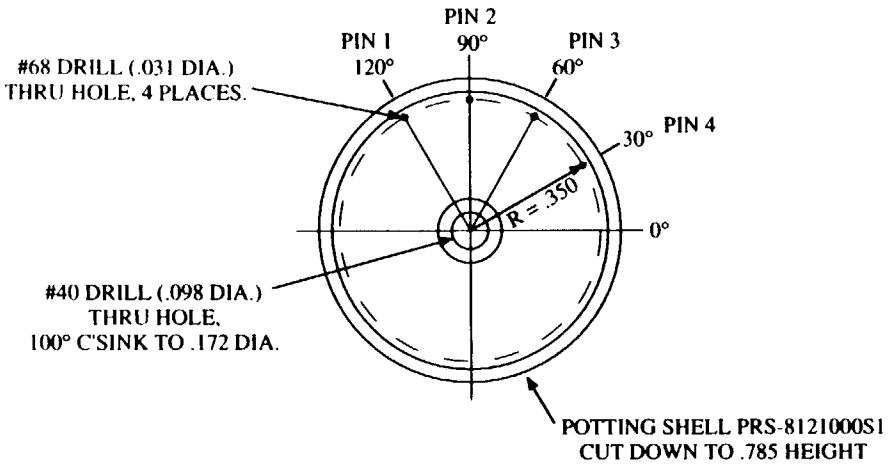
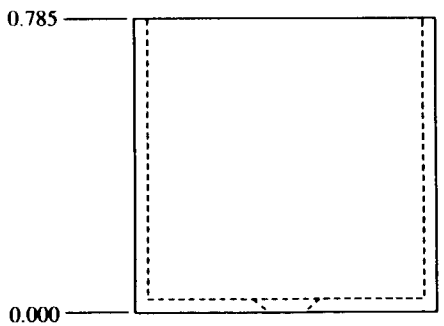
LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	PRS-8121000S1	Robison Potting Shell
2	1		G10, .40 Dia., .010 Thick
3	1		G10, .560 Dia., .032 Thick
4	1		#11 Drill
5	1		#40 Drill
6	1		#68 Drill





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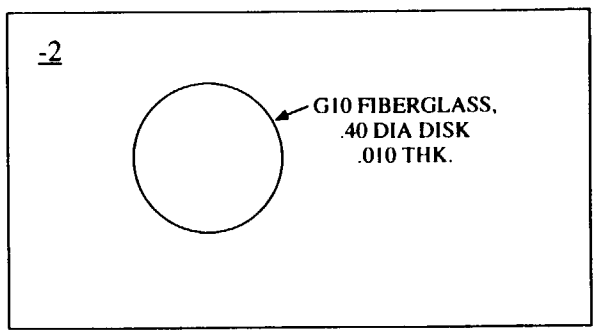

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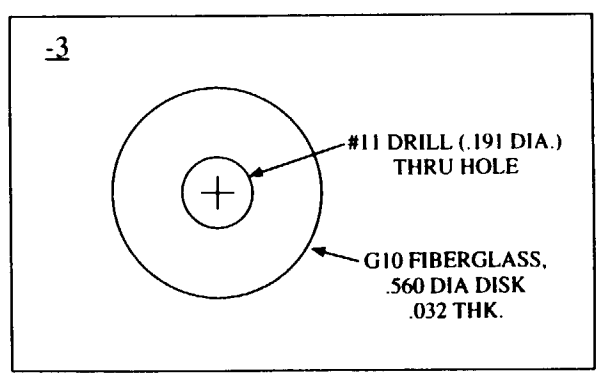

Space Physics Research Laboratory College of Engineering University of Michigan	MA1 Ass'y Detail, Page 2 of 2 Power Supply Planet – B NMS

061-NMS	0TK63	J0131.2-PS MA1	061-0131.2	D

REV	
D	26-Feb-96
C	16-Oct-95
B	05-Jul-95 O. Bayl
RELEASE	12-May-95 O. Bayl
DRAWN	08-May-95 O. Bayl
COG ENG	S. Bame/ K. Arnett

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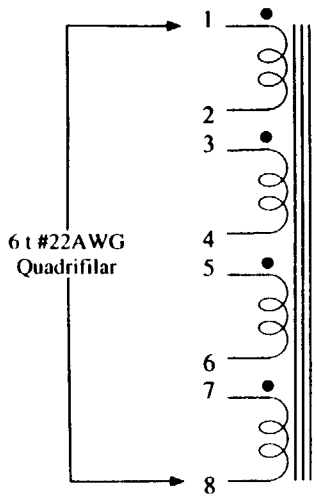
Drawing Page 4.23

LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	204T250-3C81	Feroxcube Core
2	AR	HAPT-22	#22 AWG Magnet Wire
3	AR	3M Scotchcast 235	Encapsulant



NOTES:

1) Wind 6 turns of #22 AWG Quadrifilar wire (single layer) on Feroxcube core 204T250-3C81. DO NOT cross finish leads over start leads.

2) • denotes phasing.

3) Refer to Special Assembly Procedure 061-0389 for Flight Hardware Assembly.

Space Physics Research Laboratory College of Engineering University of Michigan		L3 Assembly Detail Power Supply Planet – B NMS			
061-NMS	0TK63	J0132B-PS L3 Ass'y Detail	061-0132	B	

B	26-Feb-96 JMT
RELEASE	19-Jul-95 O. Bayi
DRAWN	13-Jul-95 O. Bayi
COG ENG	S. Bantel/ K. Arnett

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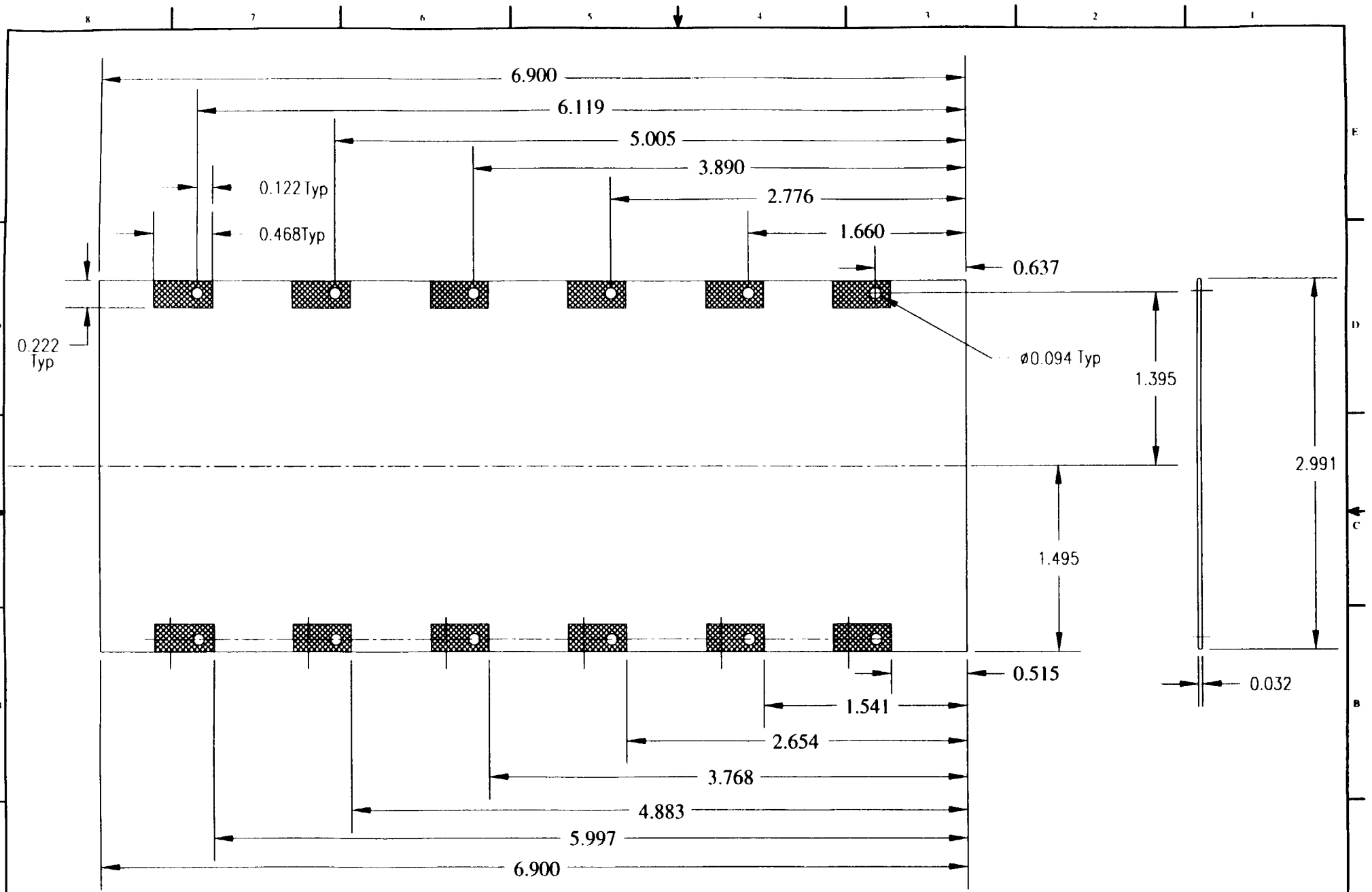
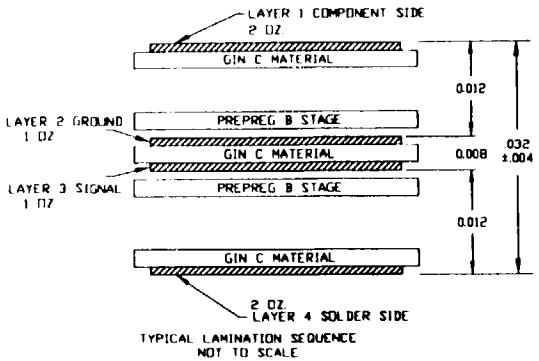


Space Physics Research Laboratory College of Engineering University of Michigan	**PCB Outline** **PS** **Planet – B NMS**			REV	
				REV	
				REV	
				REV A	28-Feb-96
				RELEASE	12-May-95
				DRAWN	Scan 10-May-95 jm
Planet B - 080249	0TK63	J0139A-PS PCB Outline	061-0139	A	COG ENG Battel



TYPICAL LAMINATION SEQUENCE
NOT TO SCALE

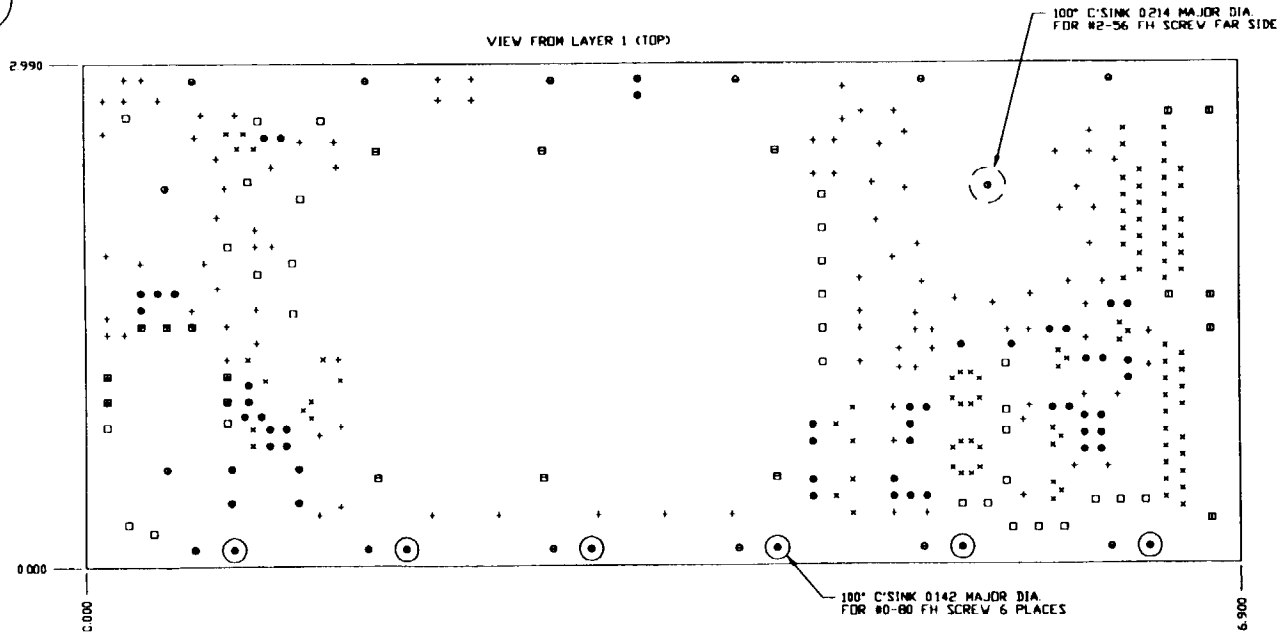
TOTAL HOLES: 320

SYMBOL	•	×	+	□	■	●	⊡	◆	◈	⊟
FINISHED HOLE SIZE	.028	.032	.037	.046	.052	.064	.070	.094	.096	.166
HOLE TYPE	PLATED	PLATED	PLATED	PLATED	PLATED	NON PLATED	NON PLATED	PLATED	NON PLATED	PLATED
QTY	50	97	102	31	7	6	6	12	3	7
TOOL CODE	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10

NOTES!

1. REFER TO GENERAL MANUFACTURING SPECIFICATION #A-E10586B FOR MATERIAL CALL OUTS, COUPON, TESTING, AND REQUIRED DELIVERY DATA PACKAGE.
2. FINISH ALL COPPER EXCEPT CONNECTOR CONTACTS. TO BE PLATED WITH ELECTRO-DEPOSITED TIN-LEAD
3. ALL PLATED THRU HOLES SHALL BE PLATED WITH A MINIMUM OF .001 INCH THICK COPPER. HOLE DIMENSIONS APPLY AFTER PLATING THRU.
4. MATERIAL: 2 OZ. COPPER LAYERS 1 & 4
   1 OZ. COPPER LAYERS 2 & 3
5. BOARD EDGE ROUTING EXPOSED COPPER OKAY
6. SEE 7777.NCD FILE FOR HOLE LOCATION
7. LAYERS TO BE SPACED AS INDICATED. TWO CORE AND FOIL LAMINATION SEQUENCE OKAY.

0
BD
NCD



UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM ENDING IN ±.030 ANGULAR DIM
DIM ENDING 000 ±.005 ±30 MIN.

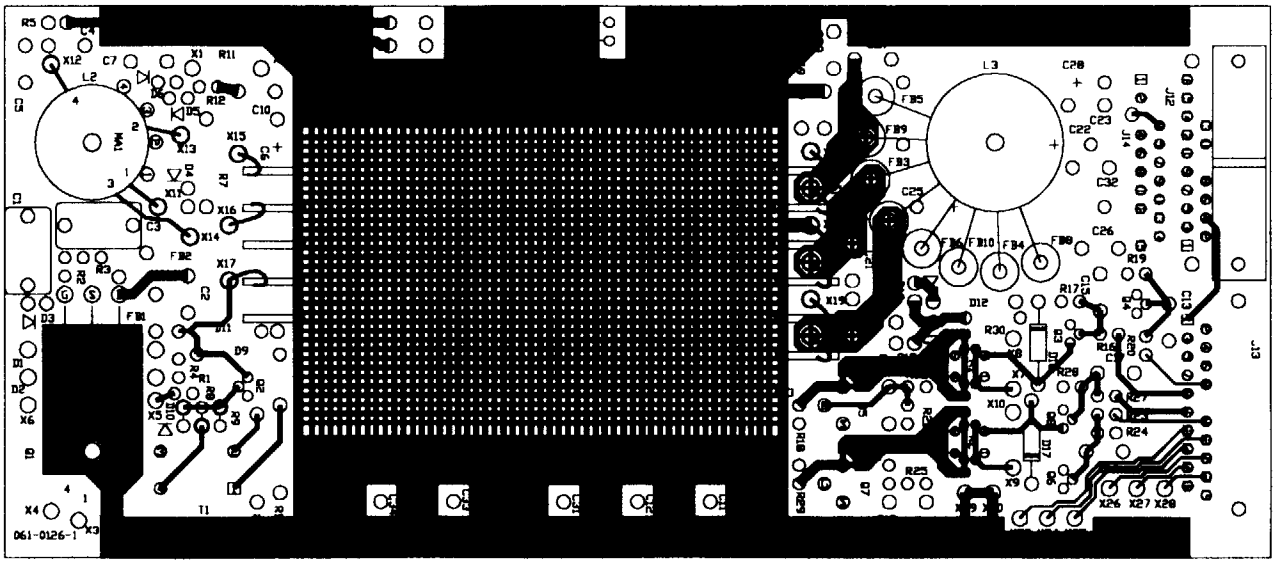
		061-0126			Printed Circuit Board		
L.H.	R.H.	PART NO.	L.H.	R.H.	NAME	SIZE	DESCRIPTION
NO REQ'D			DASH NO.			MATERIAL	

Space Physics Research Laboratory
College of Engineering
University of Michigan

PCB Drill and Trim
PS
Planet B - NMS

PROJECT	PARTITION	FILE NAME	DRAWING NUMBER	REV
Planet B - 080249	0TK63	J0374.0A-PS PCB D&T	061-0374.0	A

RELEASE	Not Released
DRAWN	7-Feb-96 EDSI
CYG ENG	Arnett/Battel



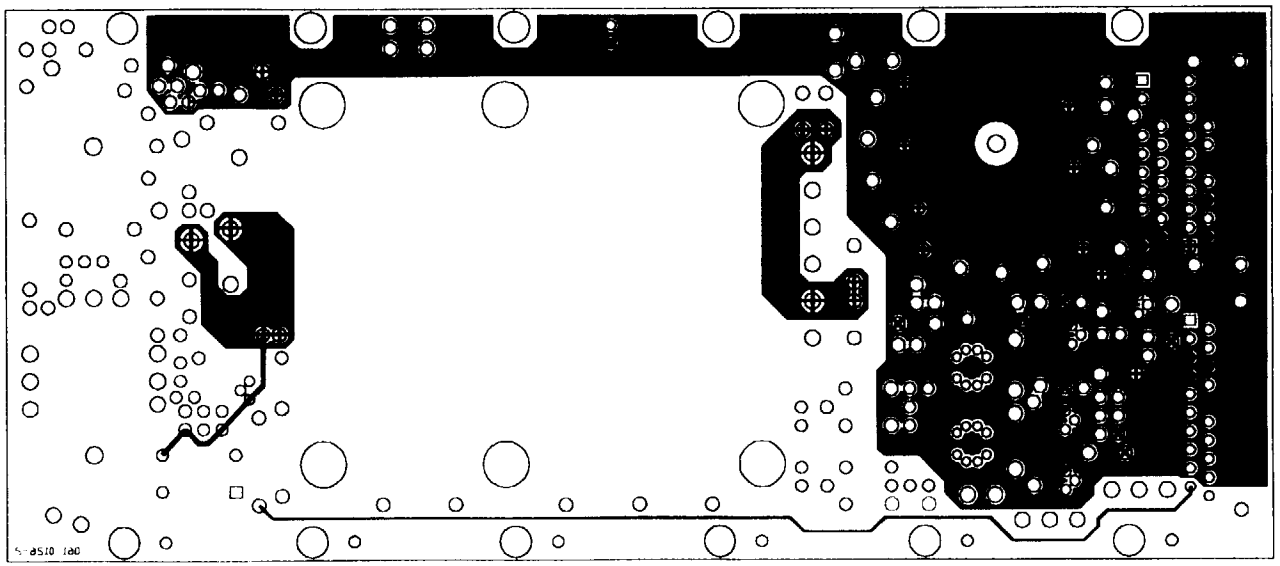
PRELIMINARY

		061-0126			Printed Circuit Board		
L.H. NO. REQ'D	R.H. NO. REQ'D	PART NO	L.H. DASH NO	R.H. DASH NO	NAME	SIZE	DESCRIPTION
						MATERIAL	

Space Physics Research Laboratory College of Engineering University of Michigan	PCB Layer 1 PS Planet B - NMS

Planet B - 080249	0TK63	J0374.1A-PS PCB Lyr 1	061-0374.1	A	RELEASE: Not Released DRAWN: 7-Feb-96 EDSI COG ENG: Arnett / Battel

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM. ENDING .00 ± 030 ANGULAR DIM. ± 30 MIN.
DIM. ENDING .000 ± 005

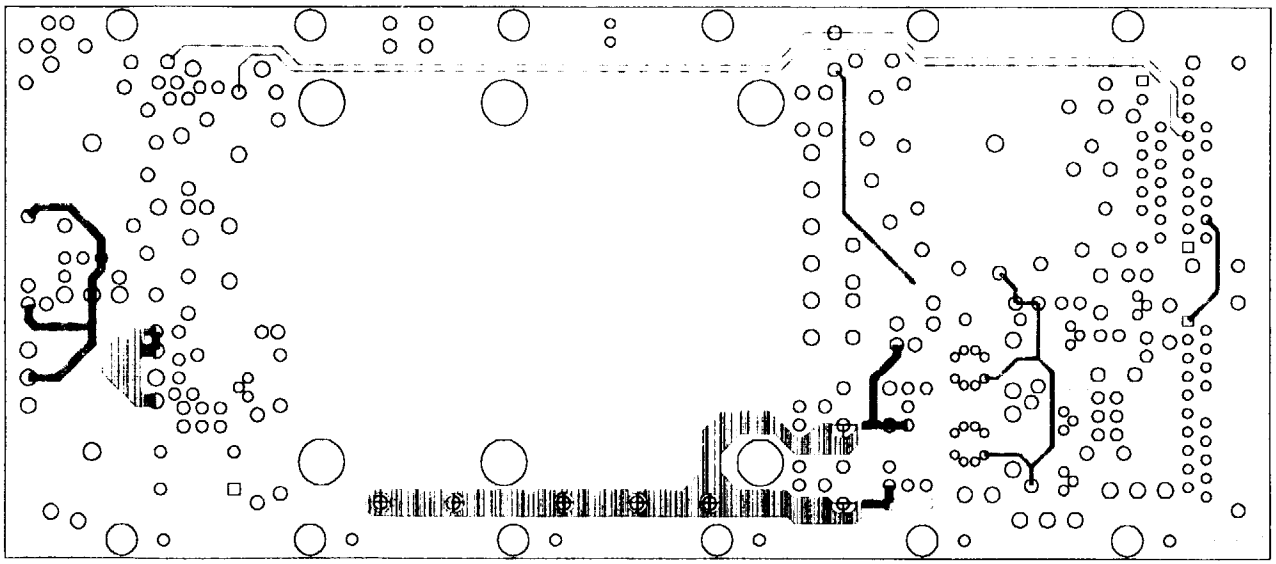


PRELIMINARY

		061-0126			Printed Circuit Board		
L.H.	R.H.	PART NO.	L.H.	R.H.	NAME	SIZE	DESCRIPTION
NO. REQ'D			DASH NO.			MATERIAL	

Space Physics Research Laboratory College of Engineering University of Michigan	PCB Layer 2 PS Planet B - NMS		
PROJECT: Planet B - 080249	PCB CODE: 0TK63	MCAD FILE: J0374.2A-PS PCB Lyr 2	DRAWING NUMBER: 061-0374.2
REV: A	RELEASE: Not Released	DRAWN: 7-Feb-96 EDS!	COG ENG: Arnett / Battel

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE
DIM. ENDING .00 ±.030 ANGULAR DIM.
DIM. ENDING .000 ±.005 ±30 MIN.



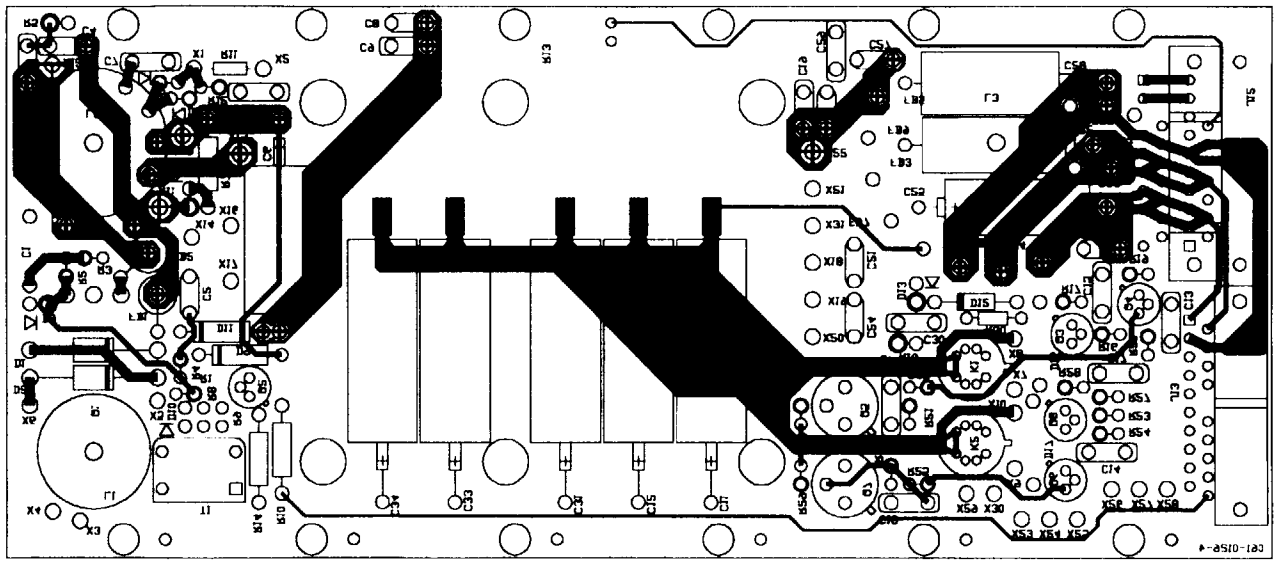
PRELIMINARY

		061-0126			Printed Circuit Board		
L.H.	R.H.	PART NO	L.H.	R.H.	NAME	SIZE	DESCRIPTION
NO. REQ'D.			DASH NO			MATERIAL	

Space Physics Research Laboratory College of Engineering University of Michigan	PCB Layer 3 PS Planet B - NMS		
PROJECT: Planet B - 080249	SCALE: 0TK63	DRAWING NAME: J0374.3A.PS PCB Lyr 3	DRAWING NUMBER: 061-0374.3 REV: A

RELEASE	Not Released
DRAWN	7-Feb-96 EDS
COG ENG	Arnett/Battel

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM. ENDING .00 ± .030 ANGULAR DIM. ± 30 MIN.
DIM. ENDING .000 ± .005



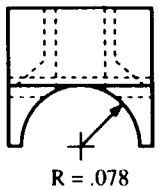
PRELIMINARY

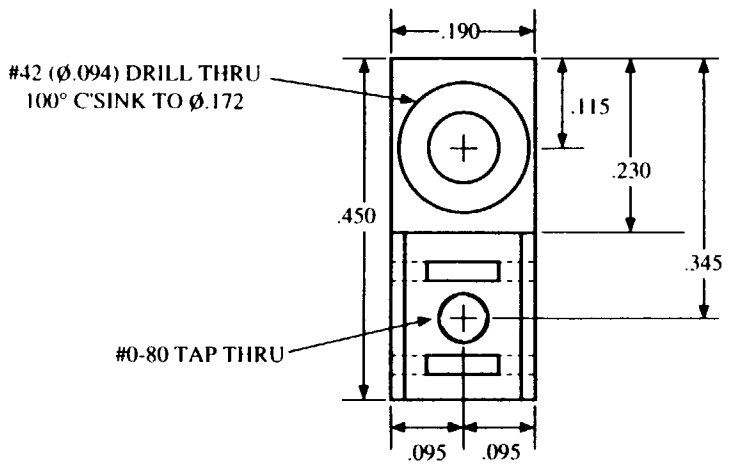
		061-0126			Printed Circuit Board		
L.H.	R.H.	PART NO.	L.H.	R.H.	NAME	SIZE	DESCRIPTION
NO. REQ'D			DASH NO.			MATERIAL	

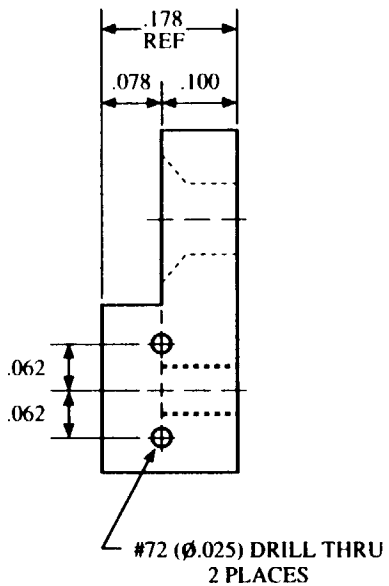
Space Physics Research Laboratory College of Engineering University of Michigan	PCB Layer 4 PS Planet B - NMS			
PROJECT: Planet B - 080249	CAGE CODE: 0TK63	DRAWING NUMBER: J0374.3A-PS PCB Lyr 4	061-0374.4	REV: A

RELEASE	Not Released
DRAWN	7-Feb-96 EDSI
COG ENG	Arnett / Battel

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM. ENDING .00 ±.030 ANGULAR DIM
DIM. ENDING .000 ±.005 ±30 MIN.





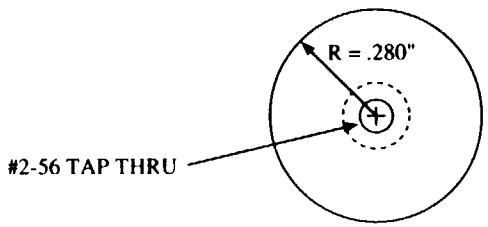


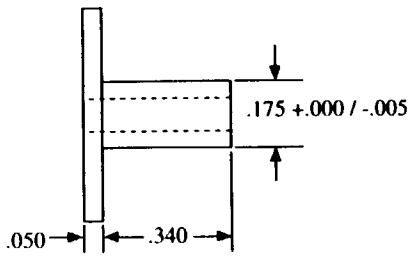
NOTE: BREAK ALL CORNERS

6		061-0376			UMBILICAL SUPPORT	.178 x .19 x .45	WHITE DELRIN
L.H.	R.H.	PART NO.	L.H.	R.H.	NAME	SIZE	DESCRIPTION
NO. REQ'D			DASH NO.			MATERIAL	

Space Physics Research Laboratory College of Engineering University of Michigan	Umbilical Support PS Assembly Planet B - NMS			REV
				REV
				REV
				REV
				RELEASE: 1-Feb-96
PROJECT: Planet B - 080249	CAGE CODE: 0TK63	FILE NAME: J0376-PS Umb. Support	DRAWING NO.: 061-0376	REV: A
				DRAWN: 31-Jan-96 K. Arnett
				COG ENG: Arnett / Battel

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM ENDING .00 ± .030 ANGULAR DIM.
DIM ENDING .000 ± .005 ±30 MIN.





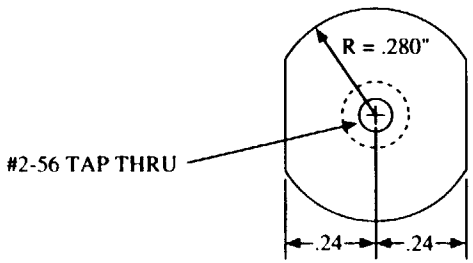
2		061-0388			INDUCTOR CAP	.280 Dia x .390	WHITE DELRIN
L. H. / R. H. / NO. REQ'D		PART NO.	L. H. / R. H.	DASH NO.	NAME	SIZE	DESCRIPTION
						MATERIAL	

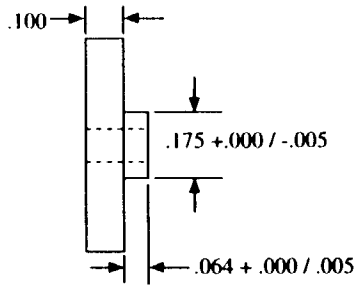
Space Physics Research Laboratory College of Engineering University of Michigan	L1, L3 Cap Power Supply Planet B - NMS

PROJECT	CAGE CODE	PART NAME	DRAWING NO.	REV	REV / REV / REV / REV
Planet B - 080249	0TK63	J0388-PS L1,L3 Cap	061-0388	A	RELEASE 23-Feb-96 DRAWN 23-Feb-96 KA COG ENG K. Ament

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM. ENDING .00 ±.030 ANGULAR DIM
DIM. ENDING .000 ±.005 ±30 MIN.

DRAWING PAGE 4.57



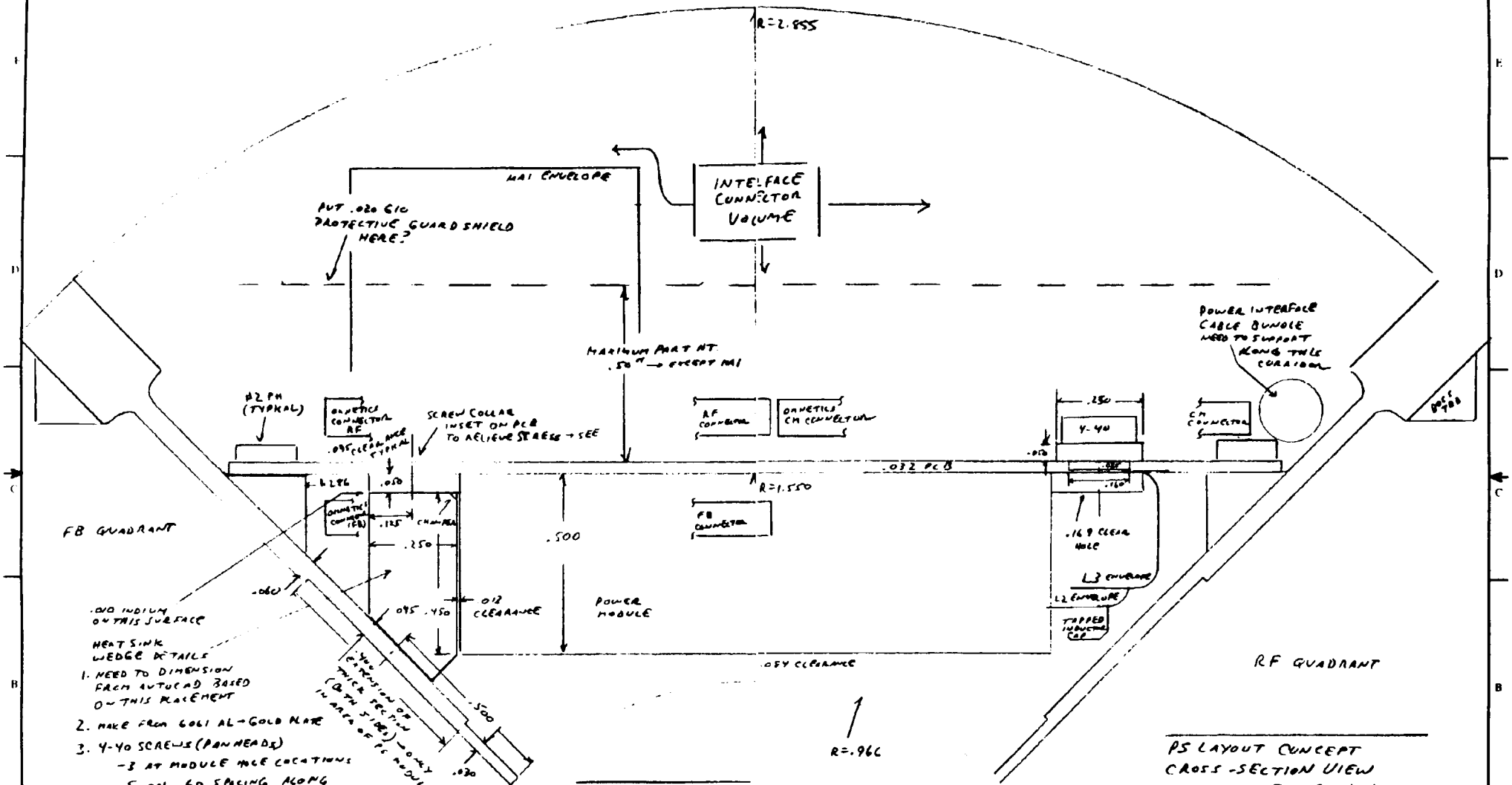


1		061-0393			MA1 MOUNTING CAP	.280 Dia x .164	WHITE DELRIN
L. H. NO. REQ'D.	R. H.	PART NO.	L. H. DASH NO.	R. H.	NAME	SIZE	DESCRIPTION / MATERIAL

Space Physics Research Laboratory College of Engineering University of Michigan	MA1 Mounting Cap Power Supply Planet B - NMS			REV
				RELEASE: 26-Feb-96
				DRAWN: 26-Feb-96 KA
PROJECT: Planet B - 080249	CAGE CODE: 0TK63	PART NAME: J0393-PS MA1 Mtg Cap	DRAWING NUMBER: 061-0393	REV: A
				COG ENG: K. Arnett

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIM. ENDING .00 ±.030 ANGULAR DIM.
DIM. ENDING .000 ±.005 ±30 MIN.

DRAWING PAGE: 4.58



Space Physics Research Laboratory College of Engineering University of Michigan		PS Layout End View Preliminary Planet – B NMS		DRN	
				DRN	
				DRN	
				–	16-Oct-95
				RELEASE	Not Released
061-NMS	0TK63	J0375-PS End View - Prelim	061-00375	DRAWN	Battel - Scan 16-Oct-95
				COG ENG	Arnett / Battel

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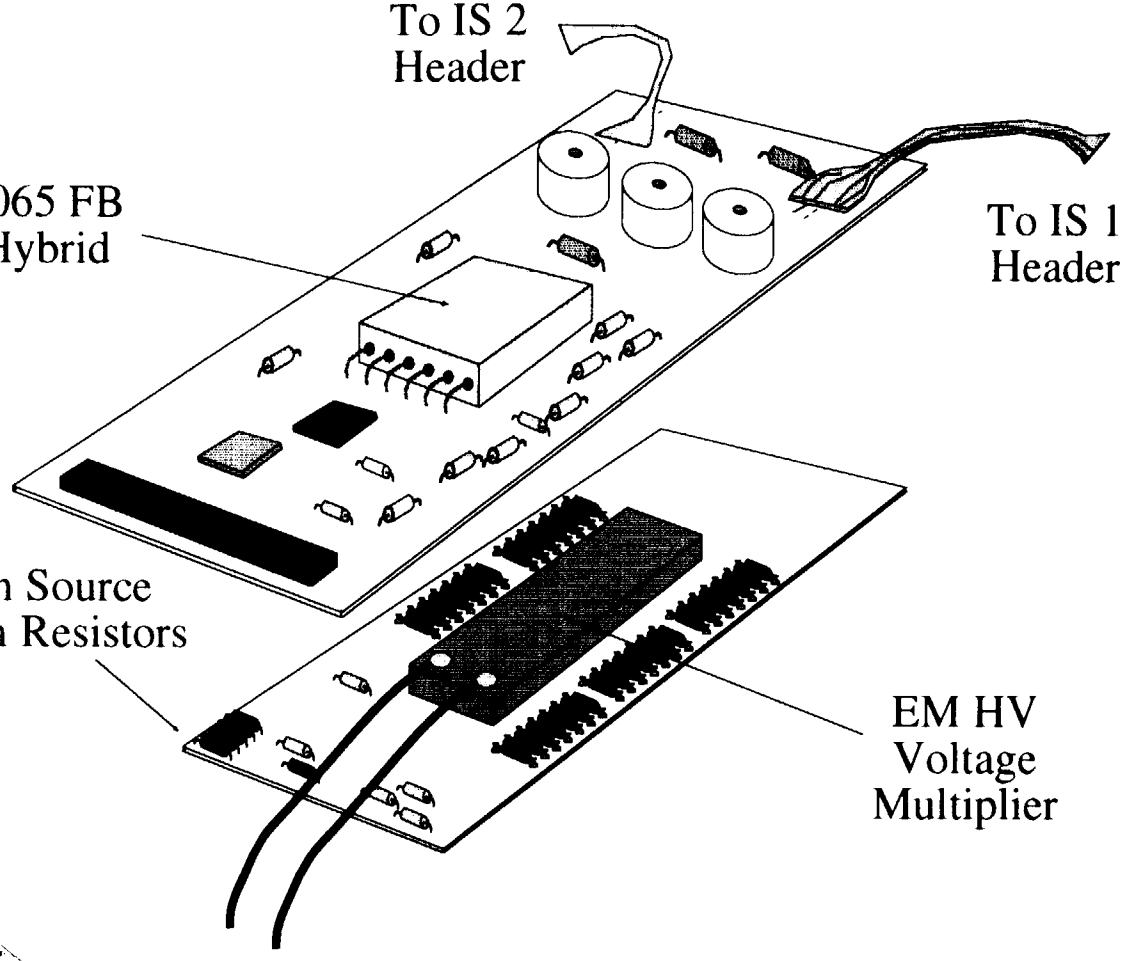
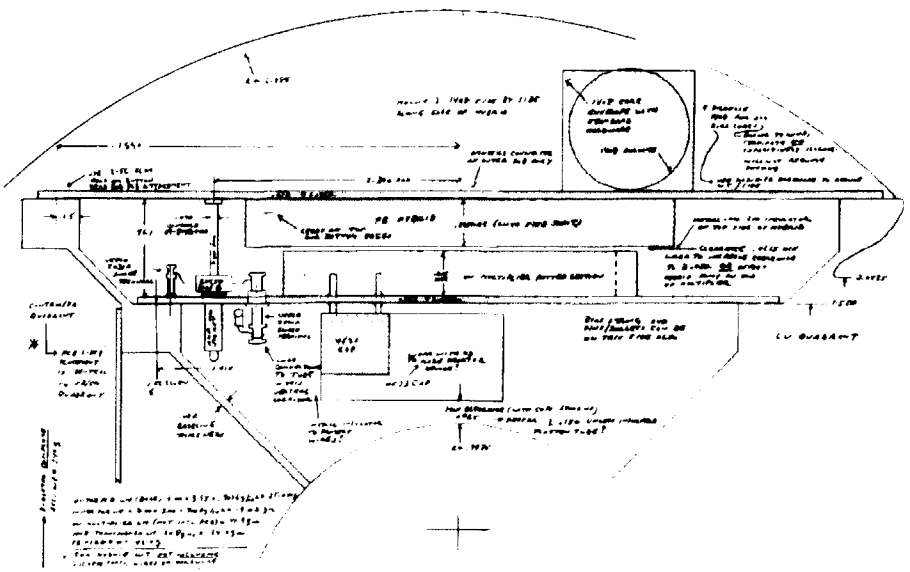
Section 5
FB - Fil/Bias & HV Module





Space Physics Research Laboratory College of Engineering University of Michigan	FB Pictorial Planet-B NMS			REV	
				REV	
				REV	
				A	11-Aug-95 JM
				RELEASE	12-May-95 JM
				DRAWN	10-May-95 JM
				COG ENG	Maurer
061-NMS	0TK63	J0103A-FB Pictorial	061-0103	A	

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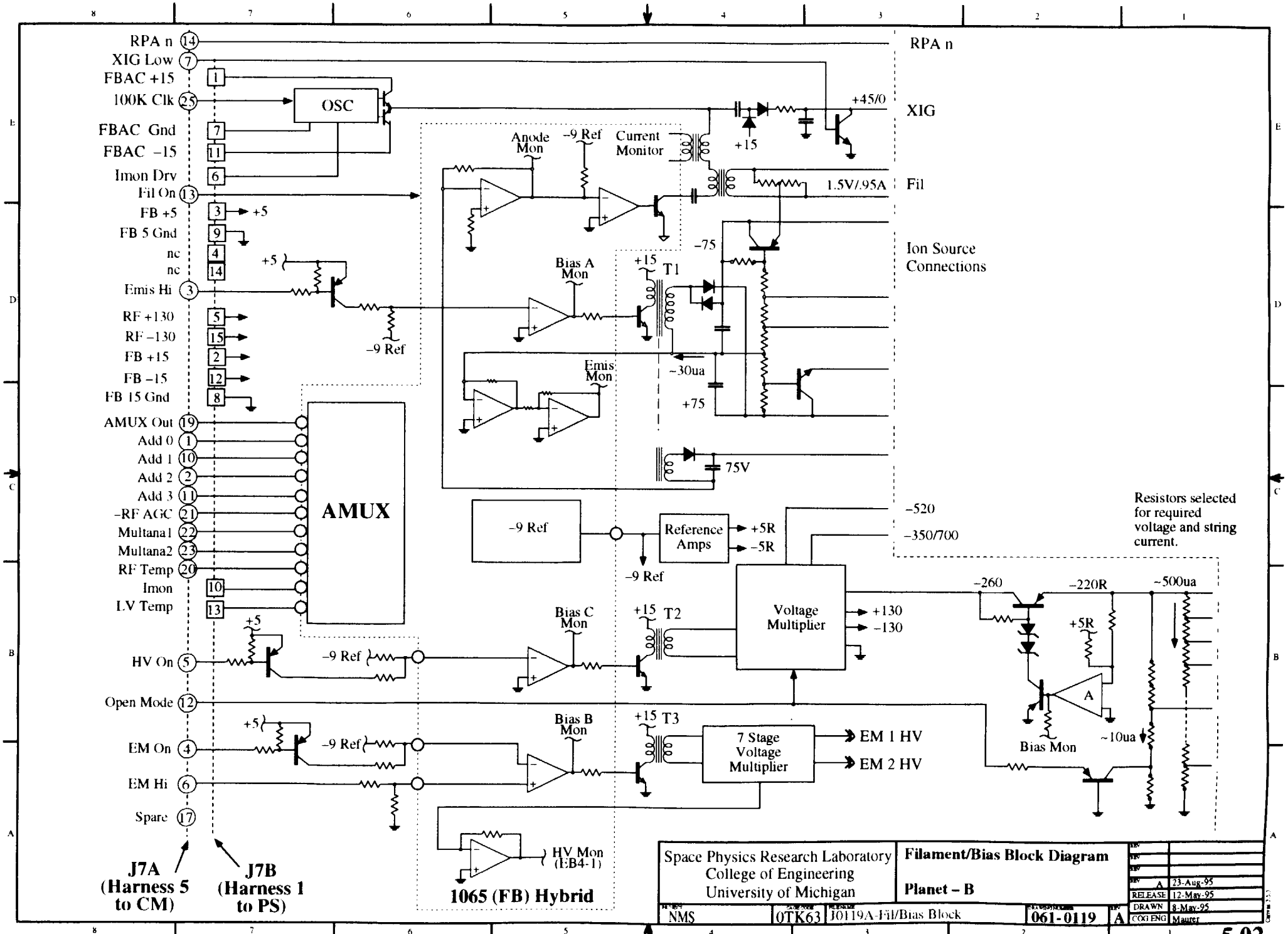
Drawing Page **5.01**



Space Physics Research Laboratory College of Engineering University of Michigan	**Filament/Bias Block Diagram** **Planet – B**				
NMS	0TK63	J0119A-Fil/Bias Block	061-0119	A	COG ENG Maurer

REV A 23-Aug-95 | RELEASE 12-May-95 | DRAWN 8-May-95

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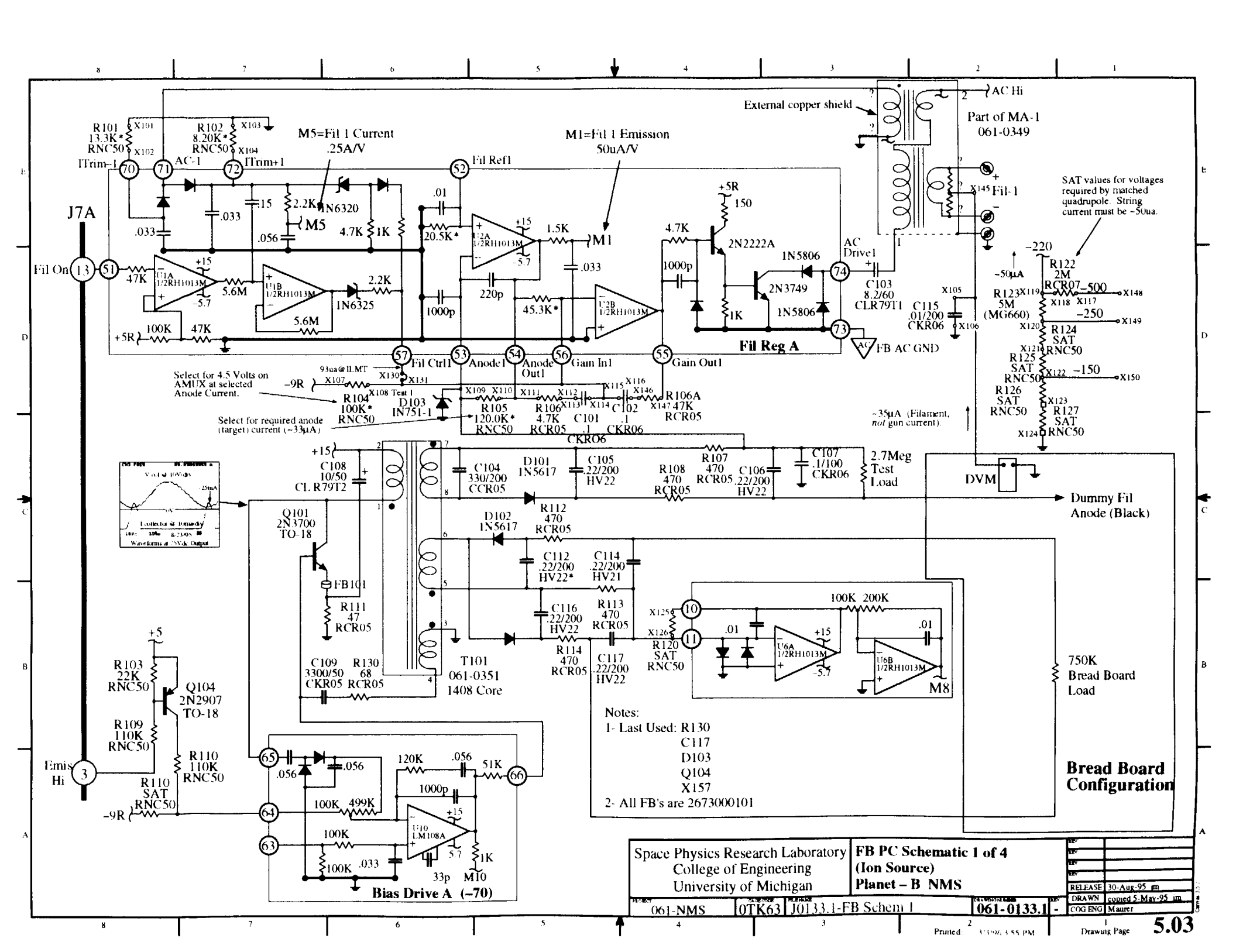
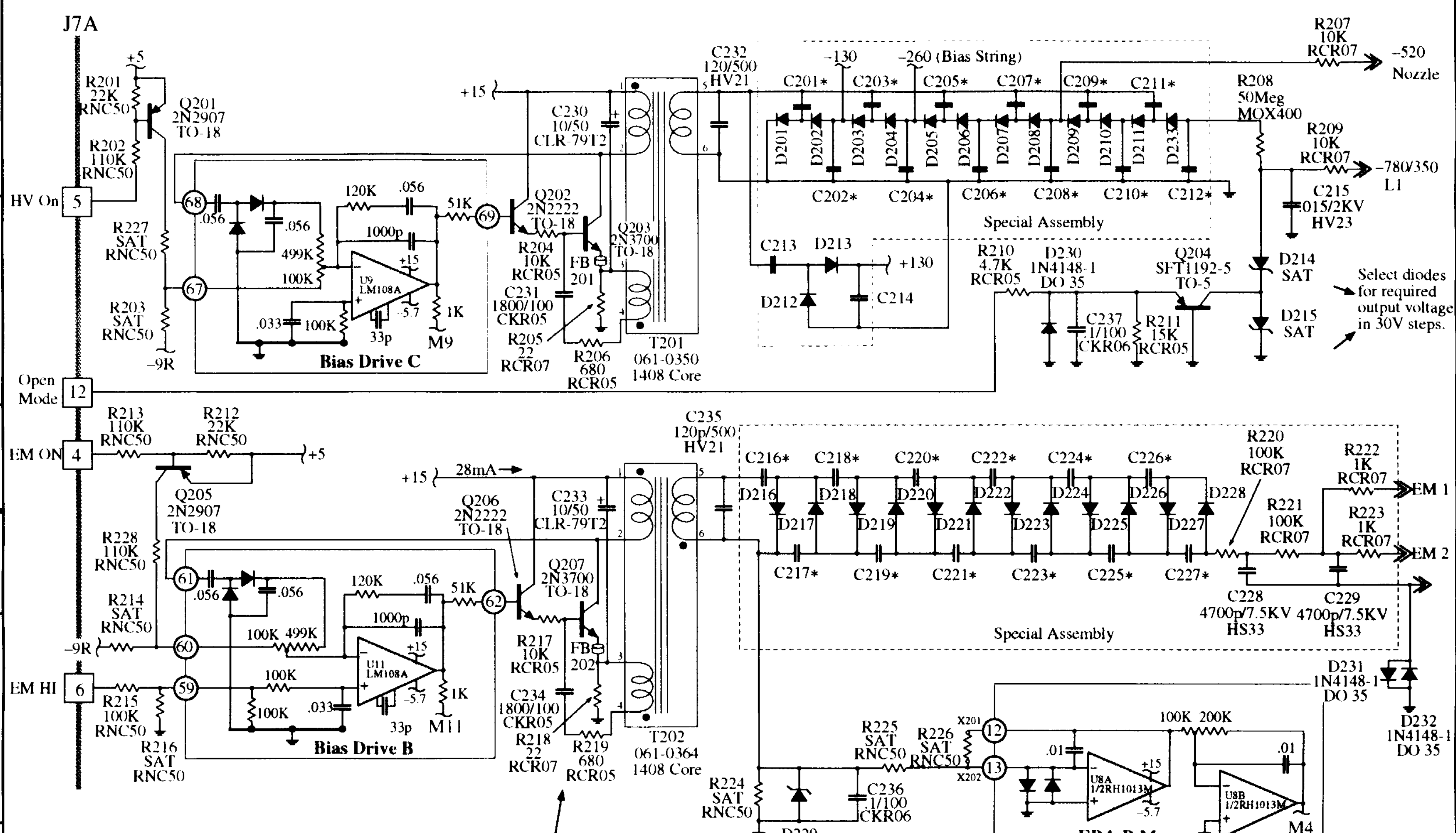
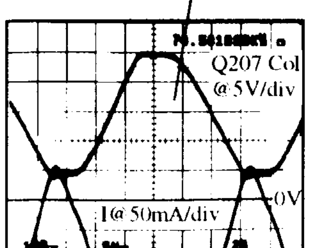
Drawing Page **5.02**


J7A
Fil On
13
51
47K
U1A 1/2RH1013M
+15
-5.7
5.6M
U1B 1/2RH1013M
1N6325
2.2K
100K
47K
+5R
R101 13.3K* RNC50
R102 8.20K* RNC50
X101
X102
X103
X104
ITrim-1
ITrim+1
70
71
72
AC-1
.033
.15
2.2K
1N6320
M5
.056
4.7K
1K
M5=Fil 1 Current
.25A/V
M1=Fil 1 Emission
50uA/V
Fil Ref1
52
.01
20.5K*
U2A 1/2RH1013M
+15
-5.7
1.5K
M1
.033
220p
1000p
45.3K*
U2B 1/2RH1013M
External copper shield
AC Hi
Part of MA-1
061-0349
X145
Fil-1
+5R
150
4.7K
2N2222A
1N5806
1000p
2N3749
1K
1N5806
74
73
AC Drive1
C103 8.2/60 CLR79T1
C115 .01/200 CKR06
X105
X106
FB AC GND
SAT values for voltages required by matched quadrupole. String current must be -50ua.
-220
~50µA
R122 2M RCR07-500
R123 5M (MG660)
X119
X118
X117
X148
-250
X120
X149
R124 SAT RNC50
X121
R125 SAT RNC50
X122
-150
X150
R126 SAT RNC50
X123
R127 SAT RNC50
X124
57
Fil Ctrl1
53
Anode1
54
Anode Out1
56
Gain In1
55
Gain Out1
Fil Reg A
93ua@ILMT
X130
X131
Select for 4.5 Volts on AMUX at selected Anode Current.
-9R
X107
X108 Test 1
R104 100K* RNC50
D103 IN751-1
X109
X110
R105 120.0K* RNC50
X111
X112
R106 4.7K RCR05
X113
X114
C101 .1 CKR06
X115
X116
C102 .1 CKR06
X146
X147
R106A 47K RCR05
Select for required anode (target) current (~33µA)
~35µA (Filament, not gun current).
DVM
+15
C108 10/50 CLR79T2
C104 330/200 CCR05
D101 IN5617
C105 .22/200 HV22
R108 470 RCR05
R107 470 RCR05
C106 .22/200 HV22
C107 .1/100 CKR06
2.7Meg Test Load
Dummy Fil Anode (Black)
D102 IN5617
R112 470 RCR05
Q101 2N3700 TO-18
FB101
R111 47 RCR05
C112 .22/200 HV22*
C114 .22/200 HV21
C116 .22/200 HV22
R113 470 RCR05
R114 470 RCR05
C117 .22/200 HV22
C109 3300/50 CKR05
R130 68 RCR05
T101 061-0351 1408 Core
X125
X126
10
11
R120 SAT RNC50
100K 200K
.01
U6A 1/2RH1013M
+15
-5.7
U6B 1/2RH1013M
M8
750K Bread Board Load
+5
R103 22K RNC50
Q104 2N2907 TO-18
R109 110K RNC50
R110 110K RNC50
R110 SAT RNC50
Emis Hi
3
-9R
65
64
63
66
.056
120K
51K
1000p
100K 499K
100K
100K
.033
U10 LM108A
+15
5.7
1K
33p
M10
Bias Drive A (-70)
Notes:
1- Last Used: R130
C117
D103
Q104
X157
2- All FB's are 2673000101
Bread Board Configuration
Space Physics Research Laboratory
College of Engineering
University of Michigan
FB PC Schematic 1 of 4
(Ion Source)
Planet – B NMS
061-NMS
0TK63
J0133.1-FB Schem 1
061-0133.1
-
RELEASE 30-Aug-95 gn
DRAWN copied 5-May-95 im
COG ENG Maurer
Printed
Drawing Page
5.03


J7A
HV On 5
Open Mode 12
EM ON 4
EM HI 6
R201 22K RNC50
R202 110K RNC50
Q201 2N2907 TO-18
R227 SAT RNC50
R203 SAT RNC50
-9R
+5
68
67
69
.056
.056
120K
.056
1000p
499K
100K
U9 LM108A
+15
-5.7
.033
100K
33p
1K
M9
51K
Bias Drive C
+15
Q202 2N2222 TO-18
R204 10K RCR05
C231 1800/100 CKR05
R205 22 RCR07
FB 201
Q203 2N3700 TO-18
R206 680 RCR05
C230 10/50 CLR-79T2
T201 061-0350 1408 Core
C232 120/500 HV21
-130
-260 (Bias String)
C201* C203* C205* C207* C209* C211*
D201 D202 D203 D204 D205 D206 D207 D208 D209 D210 D211 D233
C202* C204* C206* C208* C210* C212*
Special Assembly
C213 D213 D212 C214 +130
R207 10K RCR07
-520 Nozzle
R208 50Meg MOX400
R209 10K RCR07
-780/350 L1
C215 .015/2KV HV23
R210 4.7K RCR05
D230 1N4148-1 DO 35
C237 1/100 CKR06
R211 15K RCR05
Q204 SFT1192-5 TO-5
D214 SAT
D215 SAT
Select diodes for required output voltage in 30V steps.
R213 110K RNC50
R212 22K RNC50
+5
Q205 2N2907 TO-18
R228 110K RNC50
R214 SAT RNC50
-9R
R215 100K RNC50
R216 SAT RNC50
61 60 59 62
.056 .056
100K 499K
100K
100K
.033
U11 LM108A
33p
1K
M11
Bias Drive B
120K .056 1000p 51K
+15 28mA
Q206 2N2222 TO-18
R217 10K RCR05
C234 1800/100 CKR05
R218 22 RCR07
FB 202
Q207 2N3700 TO-18
R219 680 RCR05
C233 10/50 CLR-79T2
T202 061-0364 1408 Core
C235 120p/500 HV21
C216* C218* C220* C222* C224* C226*
D216 D217 D218 D219 D220 D221 D222 D223 D224 D225 D226 D227 D228
C217* C219* C221* C223* C225* C227*
Special Assembly
R220 100K RCR07
R221 100K RCR07
R222 1K RCR07
R223 1K RCR07
EM 1
EM 2
C228 4700p/7.5KV HS33
C229 4700p/7.5KV HS33
D231 1N4148-1 DO 35
D232 1N4148-1 DO 35
R224 SAT RNC50
D229 1N6318 DO-35
C236 1/100 CKR06
R225 SAT RNC50
R226 SAT RNC50
X201 X202
12 13
.01
U8A 1/2RH1013M
+15 -5.7
100K 200K
.01
U8B 1/2RH1013M
M4
EB4-B Mon



Notes:
1- Last Use: C237, D234, R228,Q207, X202
2- All diodes are F30 unless otherwise marked.
3- All FBs are 2673000101.
4- HV connection ≫ tbd.
5- [ ] designates a part of hybrid 2301065.
6- * HV Capacitor Values: 4700p/2KV C216 thru C227
.082/500 C201 thru C204
.047/1KV C205 thru C208
.015/2KV C209 thru C214

Space Physics Research Laboratory
College of Engineering
University of Michigan

FB PC Schematic 2 of 4
(HV Circuits)
Planet – B NMS

RELEASE	30 Aug 95 jm
DRAWN	copied 5 May 95 jm
COG ENG	Maurer

061-NMS | 0TK63 | J0133.2-FB Schem 2 | 061-0133.2 | -

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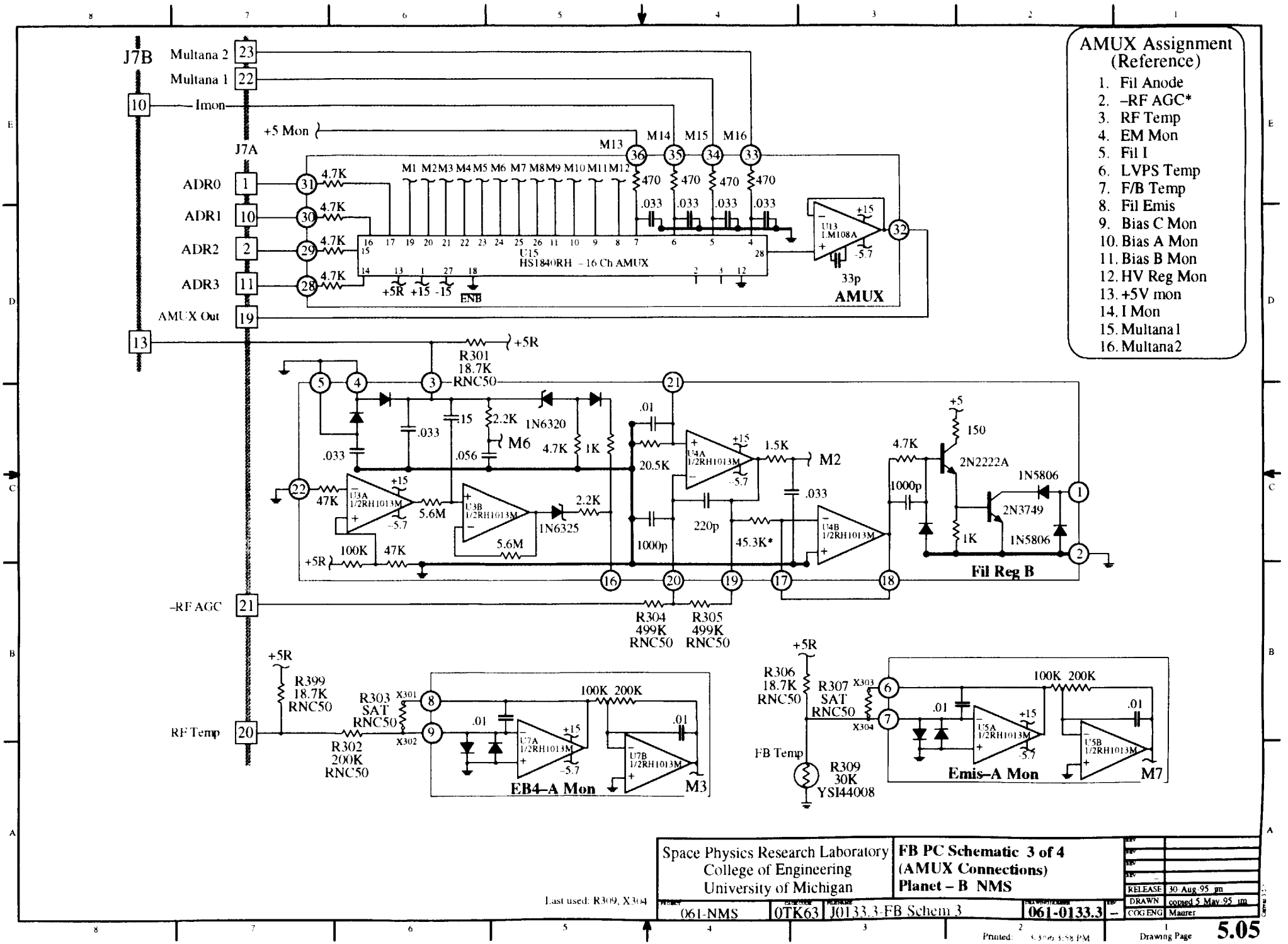
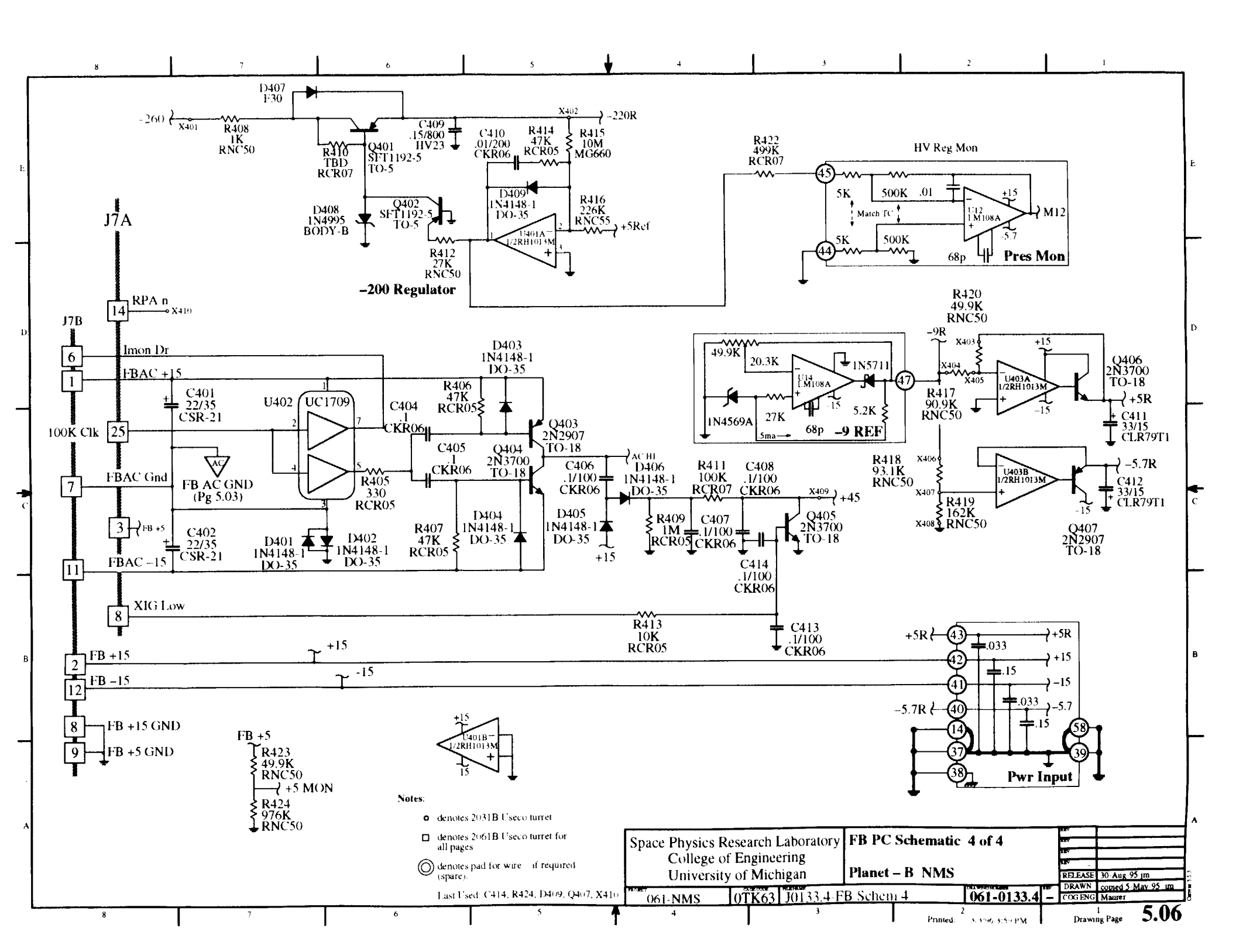
Drawing Page 5.04


AMUX Assignment (Reference)
1. Fil Anode
2. –RF AGC*
3. RF Temp
4. EM Mon
5. Fil I
6. LVPS Temp
7. F/B Temp
8. Fil Emis
9. Bias C Mon
10. Bias A Mon
11. Bias B Mon
12. HV Reg Mon
13. +5V mon
14. I Mon
15. Multana1
16. Multana2
J7B
Multana 2
Multana 1
Imon
+5 Mon
J7A
ADR0
ADR1
ADR2
ADR3
AMUX Out
U15
HS1840RH – 16 Ch AMUX
AMUX
33p
+5R
R301
18.7K
RNC50
Fil Reg B
–RF AGC
R304
499K
RNC50
R305
499K
RNC50
RF Temp
R399
18.7K
RNC50
R303
SAT
RNC50
R302
200K
RNC50
EB4–A Mon
R306
18.7K
RNC50
R307
SAT
RNC50
FB Temp
R309
30K
YSI44008
Emis–A Mon
Space Physics Research Laboratory
College of Engineering
University of Michigan
FB PC Schematic 3 of 4
(AMUX Connections)
Planet – B NMS
Last used: R309, X304
061-NMS
0TK63
J0133.3-FB Schem 3
061-0133.3
RELEASE 30 Aug 95 jm
DRAWN copied 5 May 95 jm
COG ENG Maurer
Drawing Page
5.05


D407 F30
-260
X401
R408 1K RNC50
Q401 SFT1192-5 TO-5
R410 TBD RCR07
C409 .15/800 HV23
C410 .01/200 CKR06
R414 47K RCR05
R415 10M MG660
X402
-220R
D408 1N4995 BODY-B
Q402 SFT1192-5 TO-5
R412 27K RNC50
D409 1N4148-1 DO-35
R416 226K RNC55
+5Ref
-200 Regulator
R422 499K RCR07
HV Reg Mon
45
5K
500K .01
Match TC
U12 1/2RH1013M
M12
44
5K
500K
68p
Pres Mon
J7A
J7B
14
RPA n
X410
6
Imon Dr
1
FBAC +15
25
100K Clk
7
FBAC Gnd
3
FB +5
11
FBAC -15
8
XIG Low
2
FB +15
12
FB -15
8
FB +15 GND
9
FB +5 GND
C401 22/35 CSR-21
C402 22/35 CSR-21
FB AC GND (Pg 5.03)
U402 UC1709
C404 .1 CKR06
C405 .1 CKR06
R405 330 RCR05
R406 47K RCR05
R407 47K RCR05
D401 1N4148-1 DO-35
D402 1N4148-1 DO-35
D403 1N4148-1 DO-35
D404 1N4148-1 DO-35
D405 1N4148-1 DO-35
D406 1N4148-1 DO-35
Q403 2N2907 TO-18
Q404 2N3700 TO-18
Q405 2N3700 TO-18
C406 .1/100 CKR06
AC HI
+15
R409 1M RCR05
R411 100K RCR07
C407 .1/100 CKR06
C408 .1/100 CKR06
C414 .1/100 CKR06
X409
+45
R413 10K RCR05
C413 .1/100 CKR06
49.9K
20.3K
U14 LM108A
1N5711
47
1N4569A
27K
.5ma
68p
-9 REF
5.2K
R420 49.9K RNC50
-9R
X403
X404
X405
U403A 1/2RH1013M
R417 90.9K RNC50
Q406 2N3700 TO-18
+5R
C411 33/15 CLR79T1
R418 93.1K RNC50
X406
X407
X408
R419 162K RNC50
U403B 1/2RH1013M
-5.7R
C412 33/15 CLR79T1
Q407 2N2907 TO-18
+5R
43
.033
+15
42
.15
-15
41
.033
-5.7R
40
-5.7
.15
14
58
37
39
38
Pwr Input
FB +5
R423 49.9K RNC50
+5 MON
R424 976K RNC50
+15
U401B 1/2RH1013M
-15
Notes:
denotes 2031B Useco turret
denotes 2061B Useco turret for all pages
denotes pad for wire if required (spare).
Last Used: C414, R424, D409, Q407, X410
Space Physics Research Laboratory
College of Engineering
University of Michigan
FB PC Schematic 4 of 4
Planet – B NMS
061-NMS
0TK63
J0133.4-FB Schem 4
061-0133.4
–
REV
REV
REV
REV
RELEASE 30 Aug 95 jm
DRAWN copied 5 May 95 jm
COG ENG Maurer
Printed:
Drawing Page
5.06

Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
C101	.1/100	CKR06							
C102	.1/100	CKR06							
C103	8.2/60	CLR79T1							
C104	330/200	CCR05							
C105	.22/200	HV22							
C106	.22/200	HV22							
C107	.1/100	CKR06							
C108	17075	CLR79T2							
C109	3300/50	CKR05							
C112	.22/200	HV22							
C113	.1/100	CKR06							
C114	.22/200	HV21							
C115	.01/200	CKR06							
C116	.22/200	HV22							
C117	.22/200	HV22							
C201	.082/500	HV20							
C202	.082/500	HV20							
C203	.082/500	HV20							
C204	.082/500	HV20							
C205	.047/1KV	HV21							
C206	.047/1KV	HV21							
C207	.047/1KV	HV21							
C208	.047/1KV	HV21							
C209	.015/2KV	HV23							
C210	.015/2KV	HV23							
C211	.015/2KV	HV23							
C212	.015/2KV	HV23							
C213	.015/2KV	HV23							
C214	.015/2KV	HV23							
C215	.015/2KV	HV23							
C216	4700P/2KV	HV21							
C217	4700P/2KV	HV21							
C218	4700P/2KV	HV21							
C219	4700P/2KV	HV21							
C220	4700P/2KV	HV21							
C221	4700P/2KV	HV21							
C222	4700P/2KV	HV21							
C223	4700P/2KV	HV21							
C224	4700P/2KV	HV21							
C225	4700P/2KV	HV21							
C226	4700P/2KV	HV21							
C227	4700P/2KV	HV21							
C228	4700P/7.5KV	HS33							

Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
C229	4700P/7.5KV	HS33							
C230	10/50V	CLR-79T2							
C231	3300/100	CKR05							
C232	120/500	HV21							
C233	10/50V	CLR-79T2							
C234	3300/100	CKR05							
C235	330/500	HV21							
C236	.1/100	CKR06							
C237	.1/100	CKR06							
C401	22/35	CSR-21							
C402	22/35	CSR-21							
C403	15/30	CLR79T1							
C404	.1/100	CKR06							
C405	.1/100	CKR06							
C406	.1/100	CKR06							
C407	.1/100	CKR06							
C408	.1/100	CKR06							
C409	.15/800	HV23							
C410	.01/200	CKR06							
C411	33/15	CLR79T1							
C412	33/15	CLR79T1							
C413	.1/100	CKR06							
C414	.1/100	CKR06							
D101	1N5617	BODY-A							
D102	1N5617	BODY-A							
D103	1N751-1	DO-35							
D201	F30	F30							
D202	F30	F30							
D203	F30	F30							
D204	F30	F30							
D205	F30	F30							
D206	F30	F30							
D207	F30	F30							
D208	F30	F30							
D209	F30	F30							
D210	F30	F30							
D211	F30	F30							
D212	F30	F30							
D213	F30	F30							
D214	SAT								
D215	SAT								
D216	F30	F30							
D217	F30	F30							

Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
D218	F30	F30							
D219	F30	F30							
D220	F30	F30							
D221	F30	F30							
D222	F30	F30							
D223	F30	F30							
D224	F30	F30							
D225	F30	F30							
D226	F30	F30							
D227	F30	F30							
D228	F30	F30							
D229	1N6318	DO-35							
D230	1N4148-1	DO-35							
D231	1N4148-1	DO-35							
D232	1N4148-1	DO-35							
D233	F30	F30							
D401	1N4148-1	DO-35							
D402	1N4148-1	DO-35							
D403	1N4148-1	DO-35							
D404	1N4148-1	DO-35							
D405	1N4148-1	DO-35							
D406	1N4148-1	DO-35							
D407	F30	F30							
D408	1N4995	BODY-B							
D409	1N4148-1	DO-35							
FB101	2673000101	Ferrite Bead							
FB201	2673000101	Ferrite Bead							
FB202	2673000101	Ferrite Bead							
H101	AE10198								
J7A		OMNETICS							
J7B		OMNETICS							
MA1	061-0349	Mag. Assembly							
Q101	2N3700	TO-18							
Q102	SFT1192-5	TO-5							
Q103	2N3700	TO-18							
Q104	2N2907	TO-18							
Q201	2N2907	TO-18							
Q202	2N2222	TO-18							
Q203	2N3700	TO-18							
Q204	SFT1192-5	TO-5							
Q205	2N2907	TO-18							
Q206	2N2222	TO-18							
Q207	2N3700	TO-18							

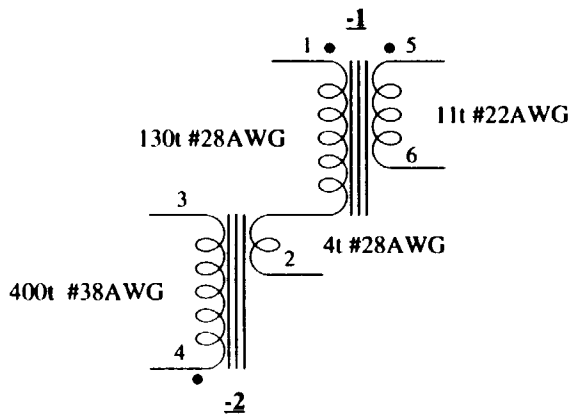
Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
Q401	SFT1192-5	TO-5							
Q402	SFT1192-5	TO-5							
Q403	2N2907	TO-18							
Q404	2N3700	TO-18							
Q405	2N3700	TO-18							
Q406	2N3700	TO-18							
Q407	2N2907	TO-18							
R101	13.3K*	RNC50							
R102	13.3K*	RNC50							
R103	22K	RNC50							
R104	100K	RNC50							
R105	120.0*	RNC50							
R106	4.7K	RCR05							
R106A	47K	RCR05							
R107	470	RCR05							
R108	470	RCR05							
R109	110K	RNC50							
R110	SAT	RNC50							
R111	47	RCR05							
R112	470	RCR05							
R113	470	RCR05							
R114	470	RCR05							
R115	SAT	RNC50							
R116	SAT	RNC50							
R117	SAT	RNC50							
R118	SAT	RNC50							
R119	SAT	RNC50							
R120	SAT	RNC50							
R122	2M	RCR07							
R123	5M	MG660							
R124	SAT	RNC50							
R125	SAT	RNC50							
R126	SAT	RNC50							
R127	SAT	RNC50							
R128	SAT	RNC50							
R129	SAT	RNC50							
R130	68.00	RCR05							
R201	22K	RNC50							
R202	110K	RNC50							
R203	SAT	RNC50							
R204	10K	RCR05							
R205	47	RCR07							
R206	680	RCR05							

Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
R207	10K	RCR07							
R208	50M	MOX400							
R209	10K	RCR07							
R210	4.7K	RCR05							
R211	15K	RCR05							
R212	22K	RNC50							
R213	110	RNC50							
R214	SAT	RNC50							
R215	100K	RNC50							
R216	SAT	RNC50							
R217	10K	RCR05							
R218	47	RCR07							
R219	680	RCR05							
R220	100K	RCR07							
R221	100K	RCR07							
R222	1K	RCR07							
R223	1K	RCR07							
R224	SAT	RNC50							
R225	SAT	RNC50							
R226	SAT	RNC50							
R227	SAT	RNC50							
R228	110K	RNC50							
R301	18.7K	RNC50							
R302	200K	RNC50							
R303	SAT	RNC50							
R304	499K	RNC50							
R305	499K	RNC50							
R306	18.7K	RNC50							
R307	SAT	RNC50							
R308	18.7K	RNC50							
R309	30K	YSI44008							
R405	330	RCR05							
R406	47K	RCR05							
R407	47K	RCR05							
R408	1K	RCR05							
R409	1M	RCR05							
R410	TBD	RCR07							
R411	100K	RCR07							
R412	27K	RNC50							
R413	10K	RCR05							
R414	47K	RCR05							
R415	10M	MG660							
R416	226K	RNC55							

Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
R417	90.9K	RNC50							
R418	93.1K	RNC50							
R419	162K	RNC50							
R420	49.9K	RNC50							
R422	499K	RCR07							
R423	49.9K	RNC50							
R424	976K	RNC50							
T101	061-0351	1408 Core							
T201	061-0350	1408 Core							
T202	061-0364	1408 Core							
U401	1/2RH1013M	8-DIP							
U402	UC1709	8-DIP							
U403	1/2RH1013M	8-DIP							
X101	2031B Useco	Turret							
X102	2031B Useco	Turret							
X103	2031B Useco	Turret							
X104	2031B Useco	Turret							
X105	2031B Useco	Turret							
X106	2031B Useco	Turret							
X107	2031B Useco	Turret							
X108	2031B Useco	Turret							
X109	2031B Useco	Turret							
X110	2031B Useco	Turret							
X111	2031B Useco	Turret							
X112	2031B Useco	Turret							
X113	2031B Useco	Turret							
X114	2031B Useco	Turret							
X115	2031B Useco	Turret							
X116	2031B Useco	Turret							
X117	2031B Useco	Turret							
X118	2031B Useco	Turret							
X119	2031B Useco	Turret							
X120	2031B Useco	Turret							
X121	2031B Useco	Turret							
X122	2031B Useco	Turret							
X123	2061B Useco	Turret							
X124	2061B Useco	Turret							
X125	2031B Useco	Turret							
X126	2031B Useco	Turret							
X130	2031B Useco	Turret							
X131	2031B Useco	Turret							
X132	2061B Useco	Turret							
X133	2061B Useco	Turret							

Ref	Value	Comment	Part Number	Mfg	Ven	PO	Cost	Date Code	S/N
X134	2061B Useco	Turret							
X135	2061B Useco	Turret							
X136	2061B Useco	Turret							
X137	2061B Useco	Turret							
X138	2061B Useco	Turret							
X139	2061B Useco	Turret							
X140	2061B Useco	Turret							
X141	2061B Useco	Turret							
X142	2061B Useco	Turret							
X143	2061B Useco	Turret							
X144	2061B Useco	Turret							
X145	2031B Useco	Turret							
X146	2031B Useco	Turret							
X147	2031B Useco	Turret							
X148	2031B Useco	Turret							
X149	2031B Useco	Turret							
X150	2031B Useco	Turret							
X151	2031B Useco	Turret							
X152	2031B Useco	Turret							
X153	2031B Useco	Turret							
X154	2031B Useco	Turret							
X155	2031B Useco	Turret							
X156	2031B Useco	Turret							
X157	2031B Useco	Turret							
X201	2031B Useco	Turret							
X202	2031B Useco	Turret							
X301	2031B Useco	Turret							
X302	2031B Useco	Turret							
X303	2031B Useco	Turret							
X304	2031B Useco	Turret							
X401	2031B Useco	Turret							
X402	2031B Useco	Turret							
X403	2031B Useco	Turret							
X404	2031B Useco	Turret							
X405	2031B Useco	Turret							
X406	2031B Useco	Turret							
X407	2031B Useco	Turret							
X408	2031B Useco	Turret							
X409	2031B Useco	Turret							
X410	2031B Useco	Turret							

WINDING INSTRUCTIONS



LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	768T188-3F3	Philips/Ferroxcube Toroid
2	1	TBD	Robert Hadley Tape Wound Core
3	AR	HAPT-22	#22AWG Magnet Wire
4	AR	HAPT-28	#28AWG Magnet Wire
5	AR	EPON 815/Z	Encapsulate
6	AR	EC2850FT/CAT 9	Epoxy (Black)

Notes:

1) Core -1 is Philips/Ferroxcube 768T188-3F3. Core -2 is Magnetics 80550-1/4D, prewound by Robert Hadley.

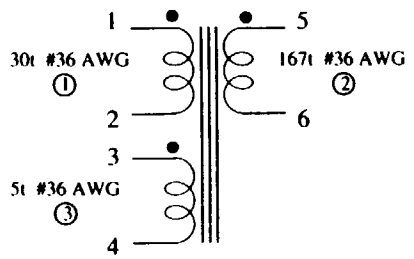
2) All windings in same direction around core.

Space Physics Research Laboratory College of Engineering University of Michigan	Filament/Current Transformers Filament Bias Supply Huygens - GCMS		
061-NMS	0TK63	J0349-Fil/Bias AC Trans	061-0349

RELEASE	31-Jul-95 O. Bayl
DRAWN	O. Bayl
TOG	Arnett/Bantel

LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	1408PA250-3B7	Philips Magnetic Core
2	1	1408F1D	Philips Plastic Bobbin
3	AR	EPON 815/V140	Encapsulate

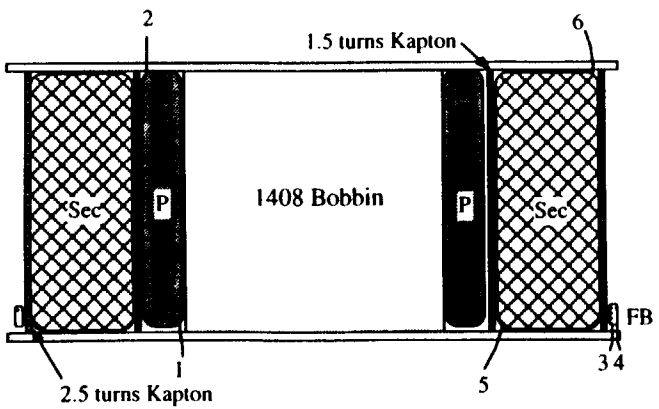


NOTES:

1) ○ denotes winding order.

2) • denotes phasing.

3) 1.5 layers of Kapton tape between 1 and 2.
   2.5 layers of Kapton tape between 2 and 3.



Space Physics Research Laboratory College of Engineering University of Michigan		FB -780 Bias Transformer Filament Bias Supply Planet – B NMS		REV	
				REV	
				REV	
				REV	
				RELEASE	1-Sep-95 jm
061-NMS	0TK63	J0350-FB -780 Bias Xfrm.	061-0350	DRAWN	O. Bayi
				COG ENG	S. Battel/ K. Arnett

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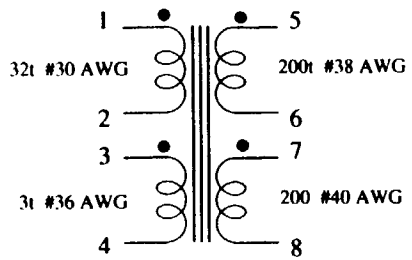
LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	1408PA250-3B7	Philips Magnetic Core
2	1	1408F1D	Philips Plastic Bobbin
3	AR	EPON 815/V140	Encapsulate



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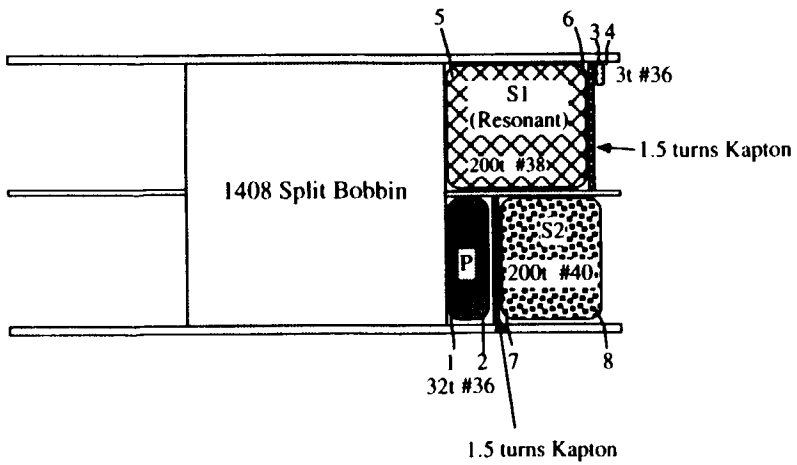

Space Physics Research Laboratory College of Engineering University of Michigan		**FB +/-75V Bias Transformer** **Filament Bias Supply** **Planet B - NMS**	
061-NMS	0TK63	J0351-FB +/-75 Bias Xfrm.	061-0351

REV	
REV	
REV	
REV	
RELEASE	24-Aug-95 jm
DRAWN	O. Bayi
COG ENG	S. Battel/ K. Arnett

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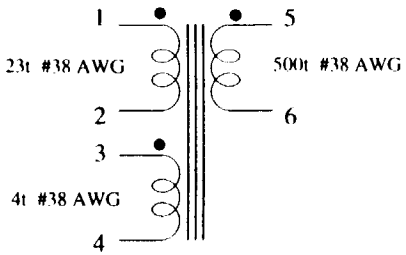
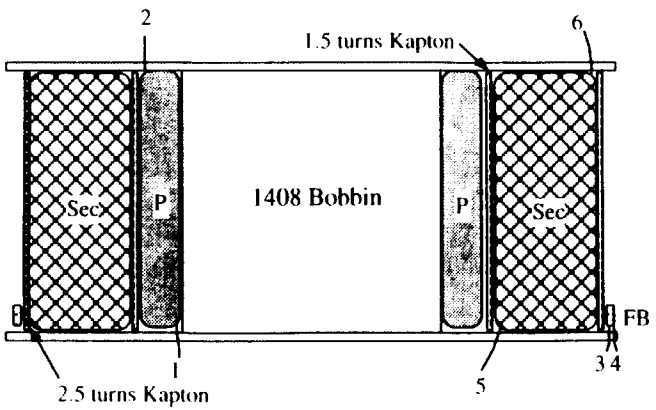
LIST OF MATERIALS

Item	QTY	P/N	Description
1	1	1408PA160-3B7	Philips Magnetic Core
2	1	1408F1D	Philips Plastic Bobbin
3	AR	EPON 815/V140	Encapsulate



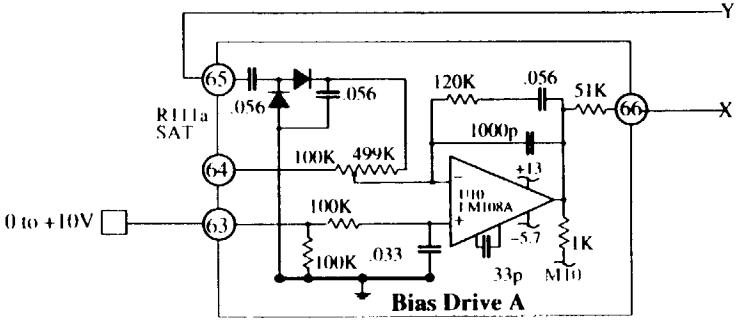


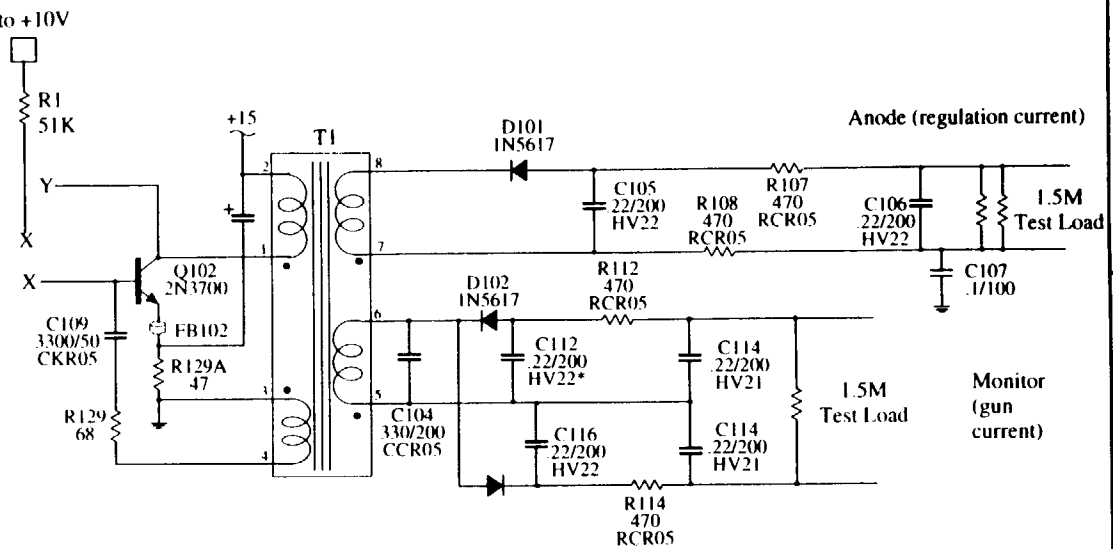
Space Physics Research Laboratory College of Engineering University of Michigan	**FB EM Transformer** **Planet – B NMS**		
061-NMS	0TK63	J0364-FB EM Transformer	**061-0364**

REV	
REV	
REV	
REV	
RELEASE	30-Sep-95 jm
DRAWN	copied 5-May-95 jm
COG ENG	Maurer

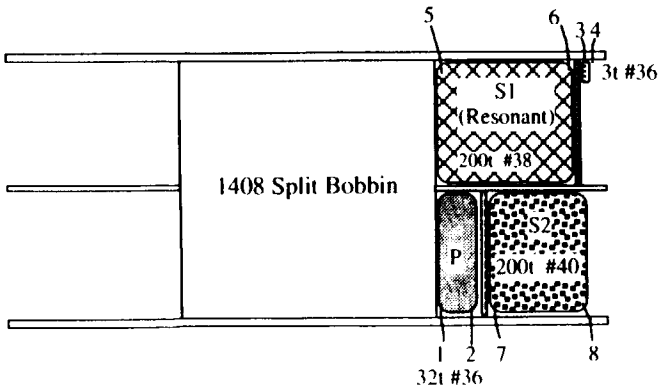
Printed: 3/31/1996 12:28 PM

Drawing Page **5.23**





"A" Transformer Configuration



Space Physics Research Laboratory College of Engineering University of Michigan	FB ±75V Bias Test Oscillator Circuit Planet – B NMS			DR	
				DR	
				DR	
				DR A	24-Aug-95 JM
				RELEASE	03-Aug-95 O. Bayi
				DRAWN	copied 5-May-95 jm
				COG ENG	Maurer
061-NMS	0TK63	J0356A-Bias Test Osc A	061-0356	A	

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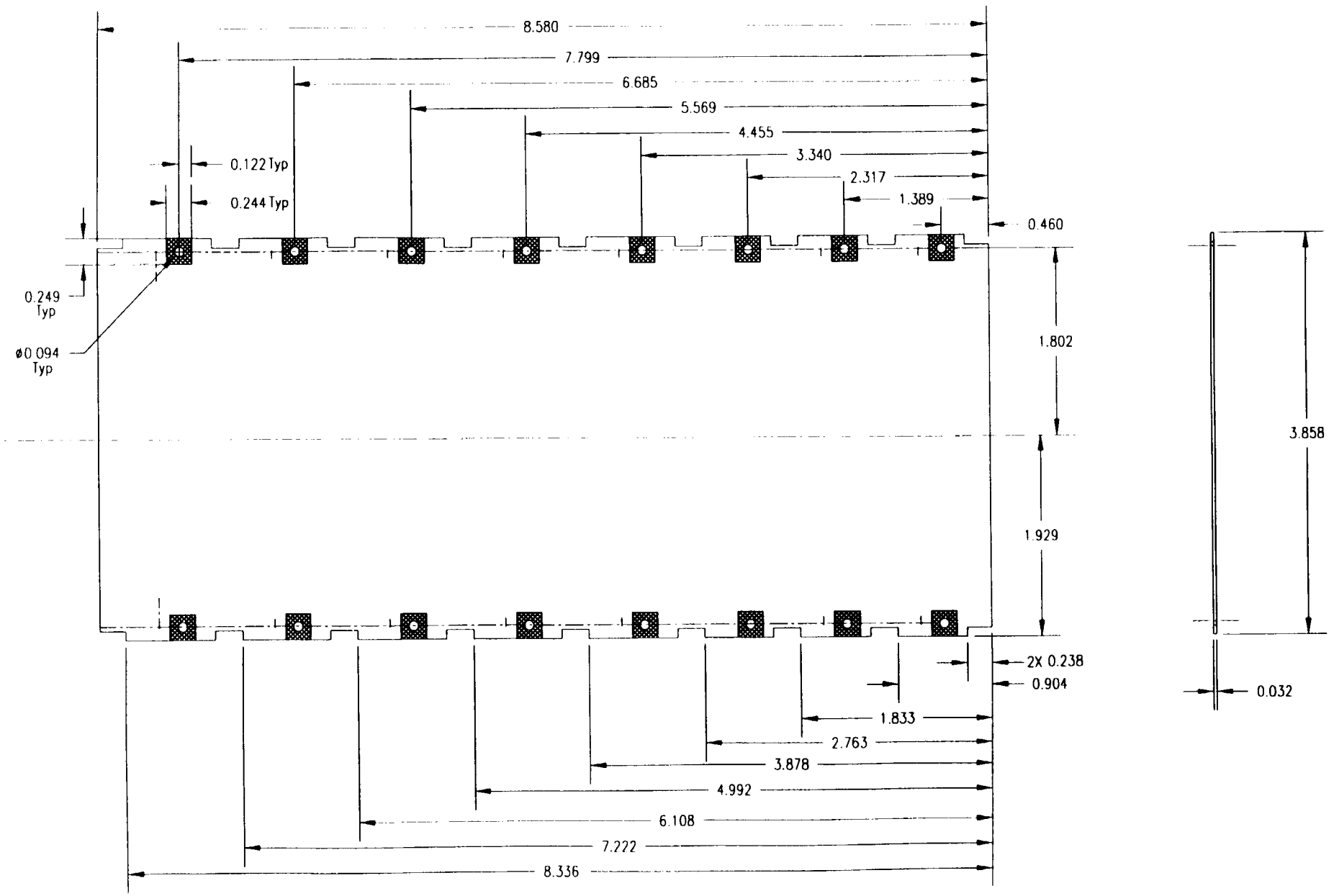
Drawing Page 5.40



Space Physics Research Laboratory College of Engineering University of Michigan	**Outer PCB Outline** **FB** **Planet – B NMS**				RELEASE: 29-Feb-96 DRAWN: 29-Feb-96 from ACAD COG ENG: Battel / Arnett
Planet B - 080249	0TK63	J0396A-FB Outer PCB	061-0396	A	

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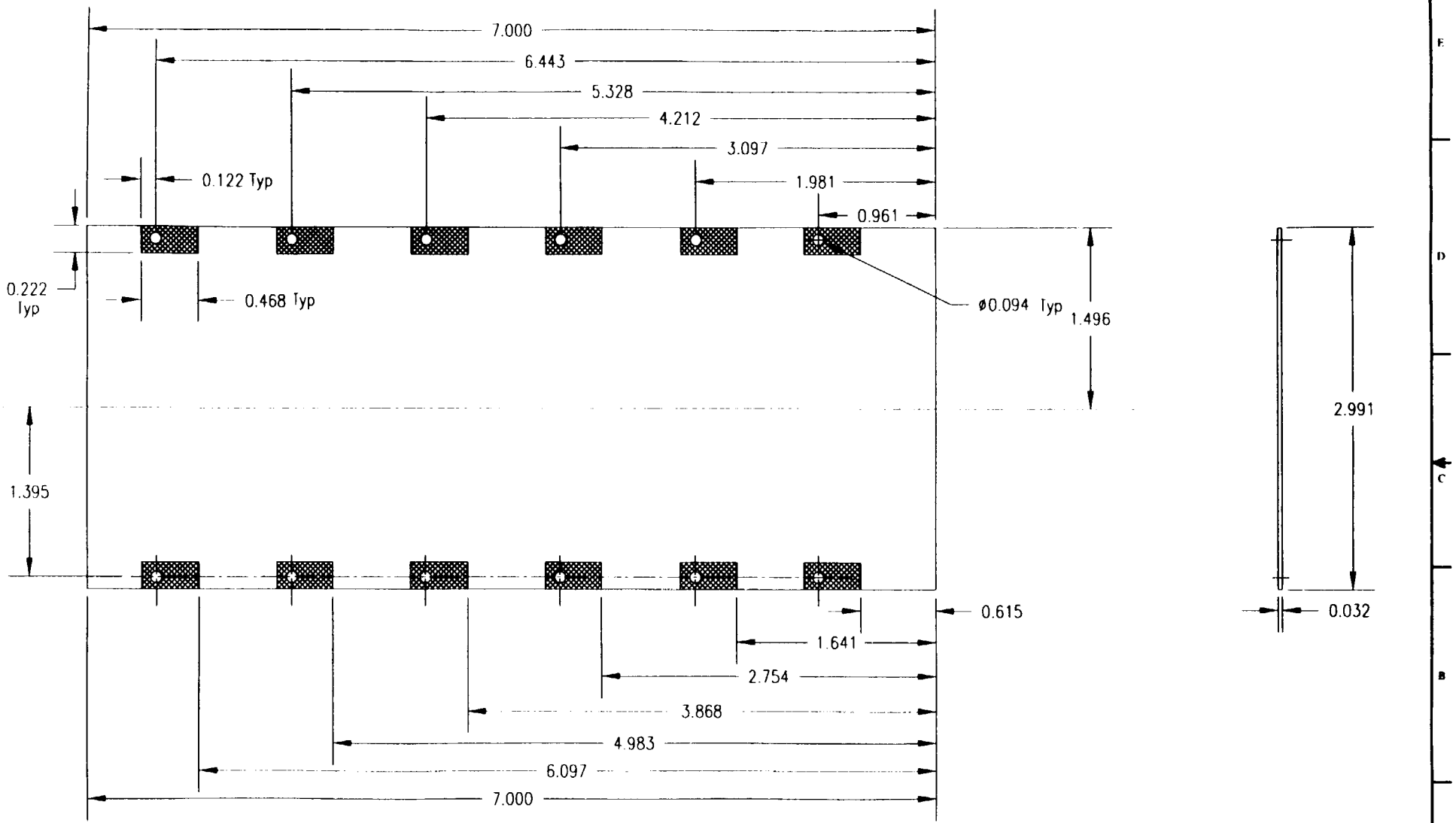
Drawing Page **5.49**



Space Physics Research Laboratory College of Engineering University of Michigan	**Inner PCB Outline** **FB** **Planet – B NMS**			
Planet B - 080249	0TK63	J0397A-FB Inner PCB Outline	**061- 0397**	A

RELEASE	29-Feb-96
DRAWN	29-Feb-96 from ACAD
COG ENG	Battel / Anett

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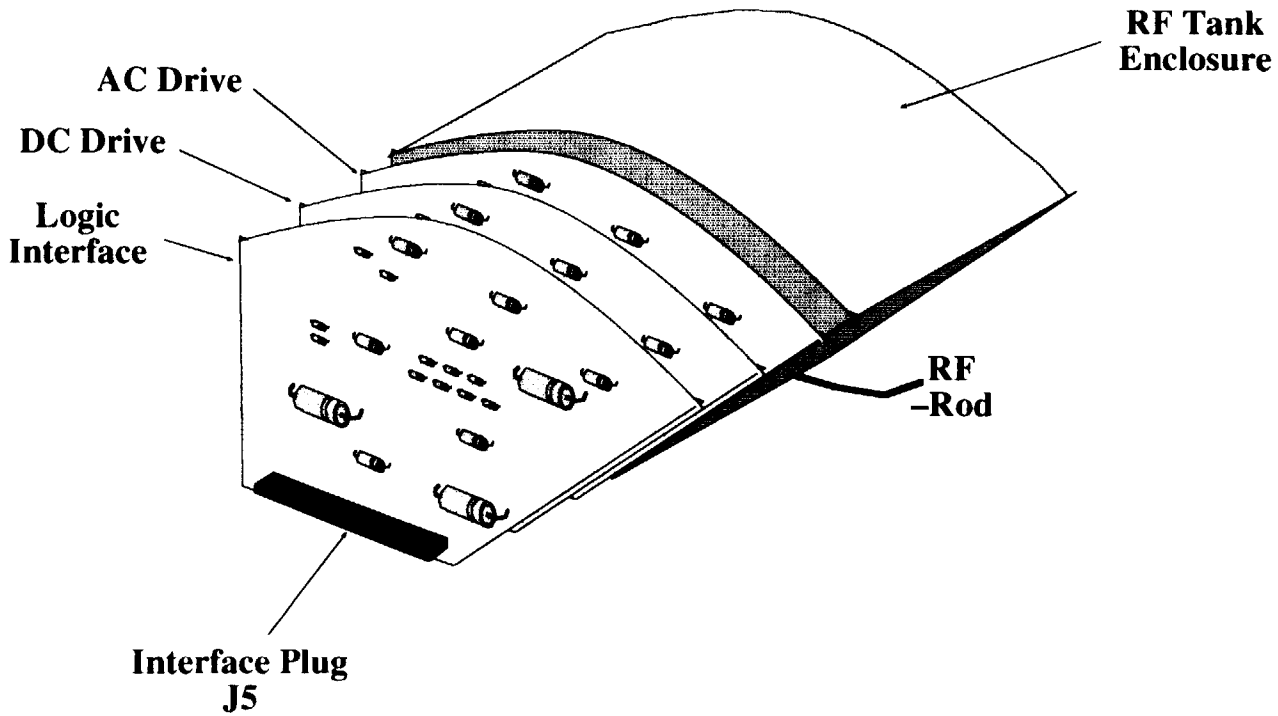
Section 6
RF - RF Module



Space Physics Research Laboratory College of Engineering University of Michigan	RF Pictorial Planet-B NMS			REV	
				REV	
				REV	
				REV	
				RELEASE	12-May-95
061-NMS	0TK63	J0104-RF Pictorial	061-0104	DRAWN	10-May-95 JM
				COG ENG	Maurer

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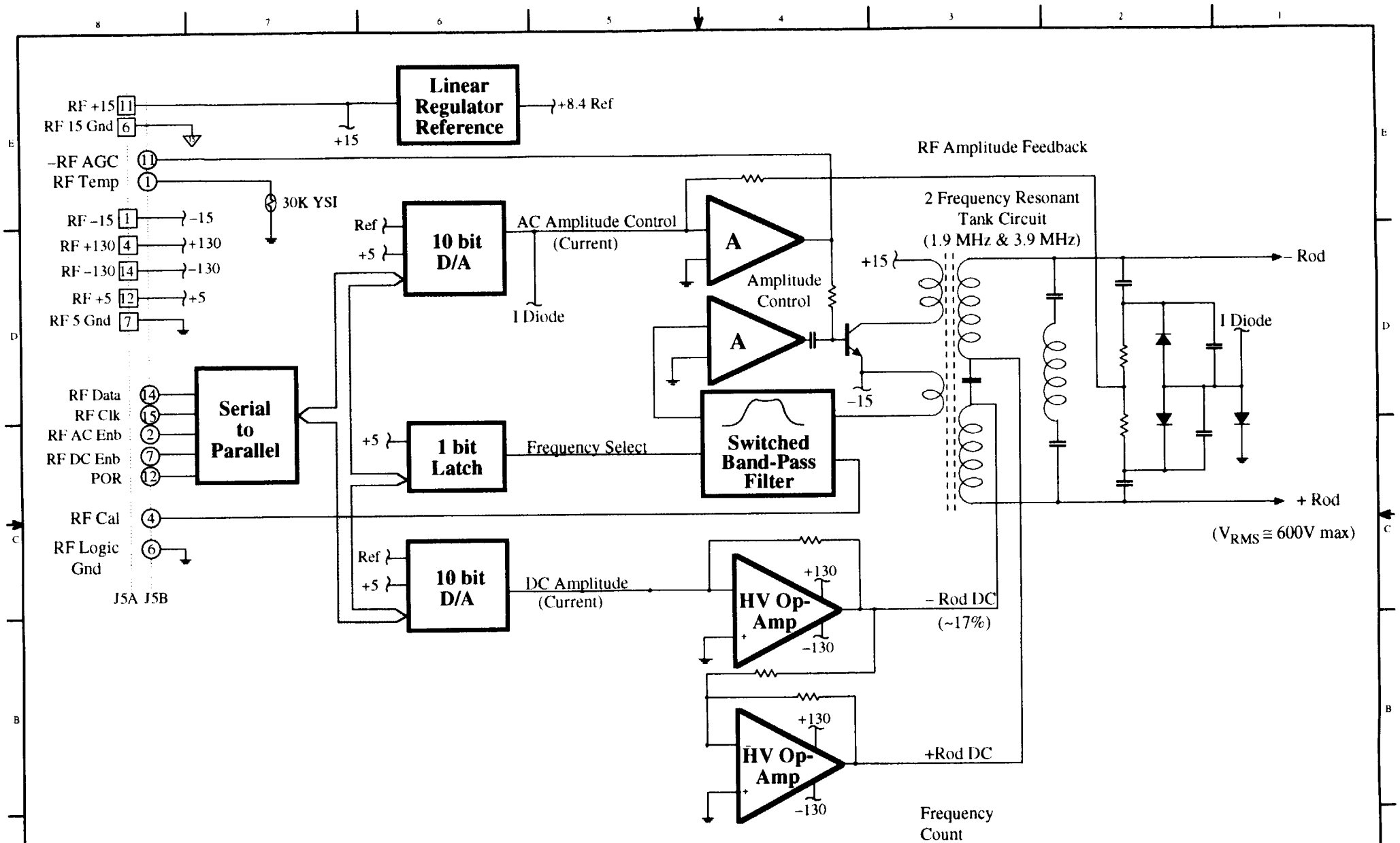
Drawing Page 6.01



Space Physics Research Laboratory College of Engineering University of Michigan	RF Functional Block Diagram Planet – B NMS			REV A	23-Aug-95
				RELEASE	12-May-95
				DRAWN	Copy 10-May-95 jm
061-NMS	0TK63	J0141-RF Block	061-0141	A	COG ENG Block

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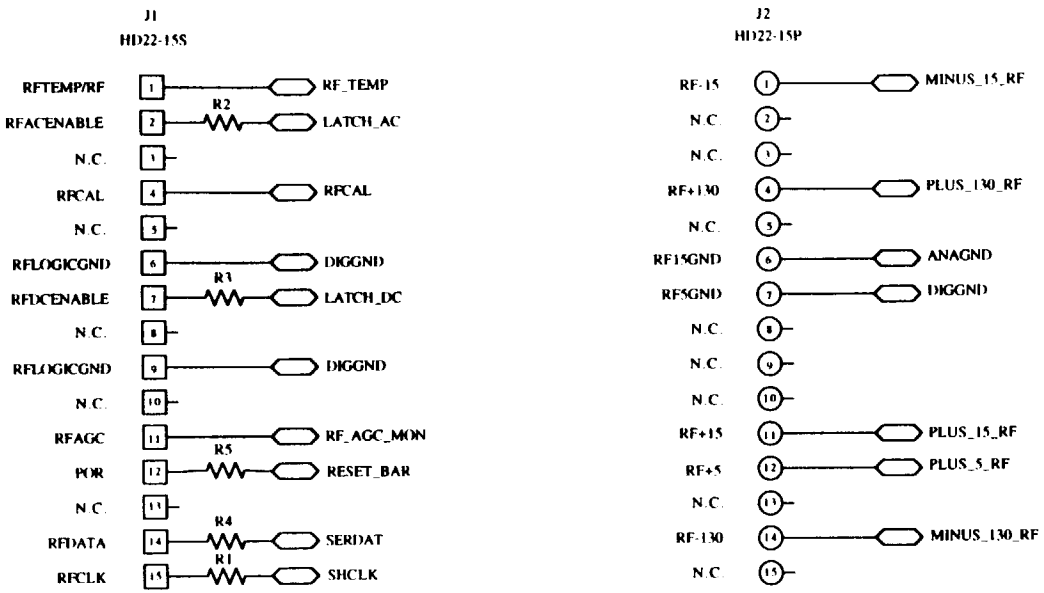
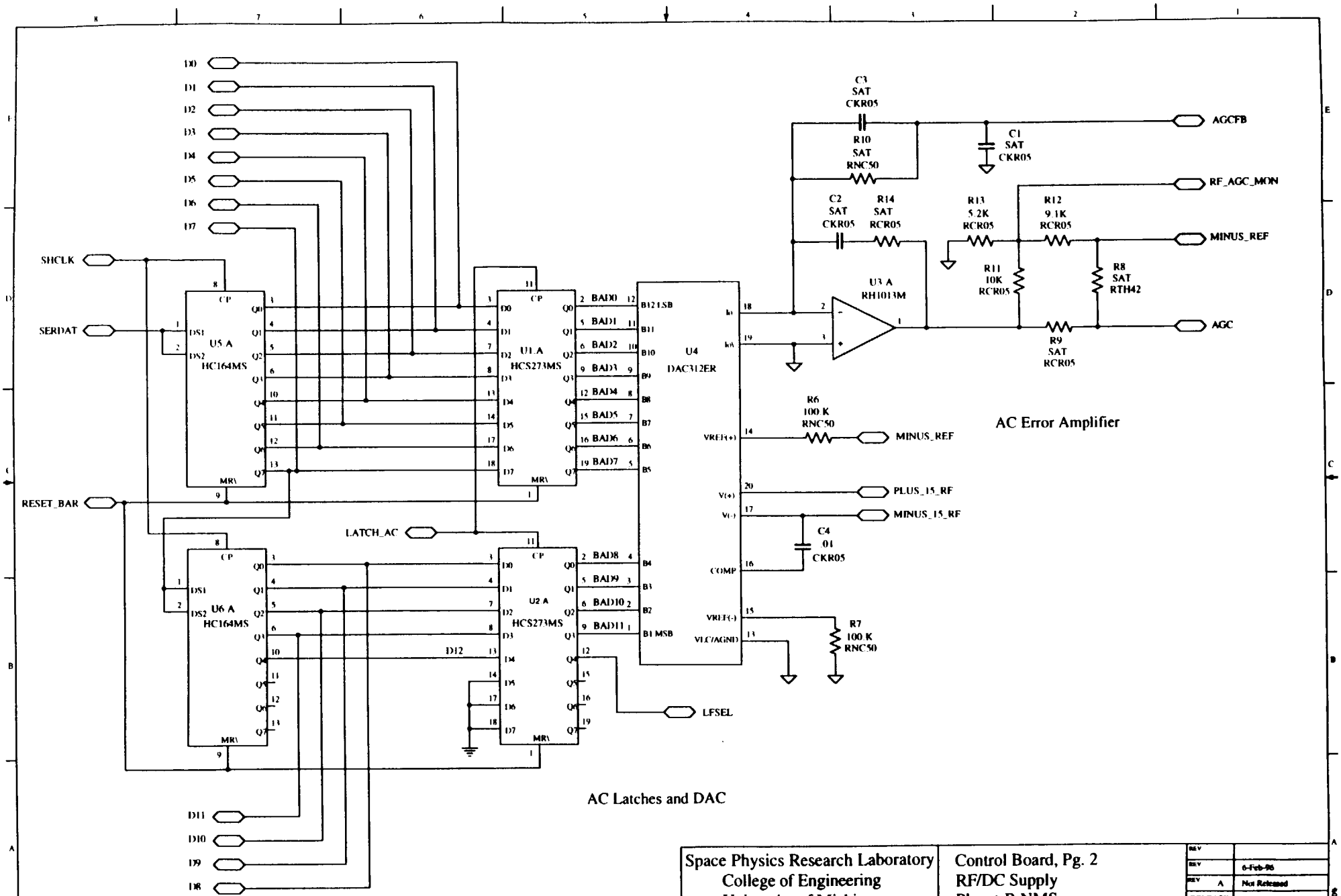
1 Drawing Page

6.02



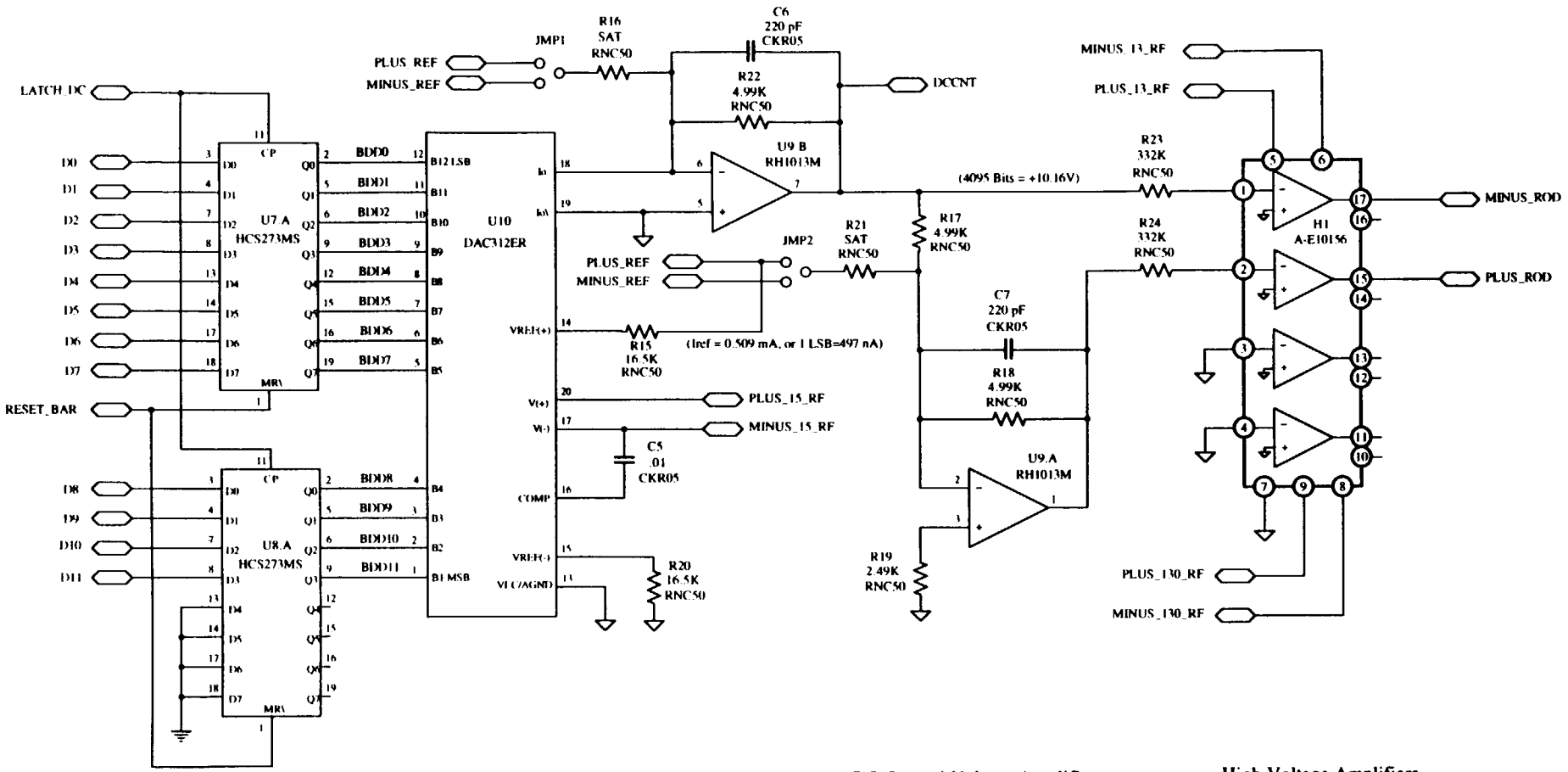
Note: R1 through R5 are 1.2K RCR05.

Space Physics Research Laboratory College of Engineering University of Michigan		Control Board, Pg. 1 RF/DC Supply Planet-B NMS		REV	
				REV	6-Feb-96
				REV A	Not Released
				RELEASE	20-Sept-95
				DRAWN	24-Aug-95 BB
				COG ENG	B. BLOCK
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	PROGRAM: J0355.1A-RF/DC Ctrl, Pg. 1	DRAWING NUMBER: 061-0355	REV: A	



Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 2 RF/DC Supply Planet-B NMS	REV	
		REV	6-Feb-96
		REV A	Not Released
		RELEASE	20-Sept-95
		DRAWN	24-Aug-95 BB
		COG ENG	B BLOCK

PROJECT	CAGE CODE	RELEASE	DRAWING NUMBER	REV
Planet B - NMS	0TK63	J0355.2A-RF/DC Ctrl, Pg. 2	061-0355	A



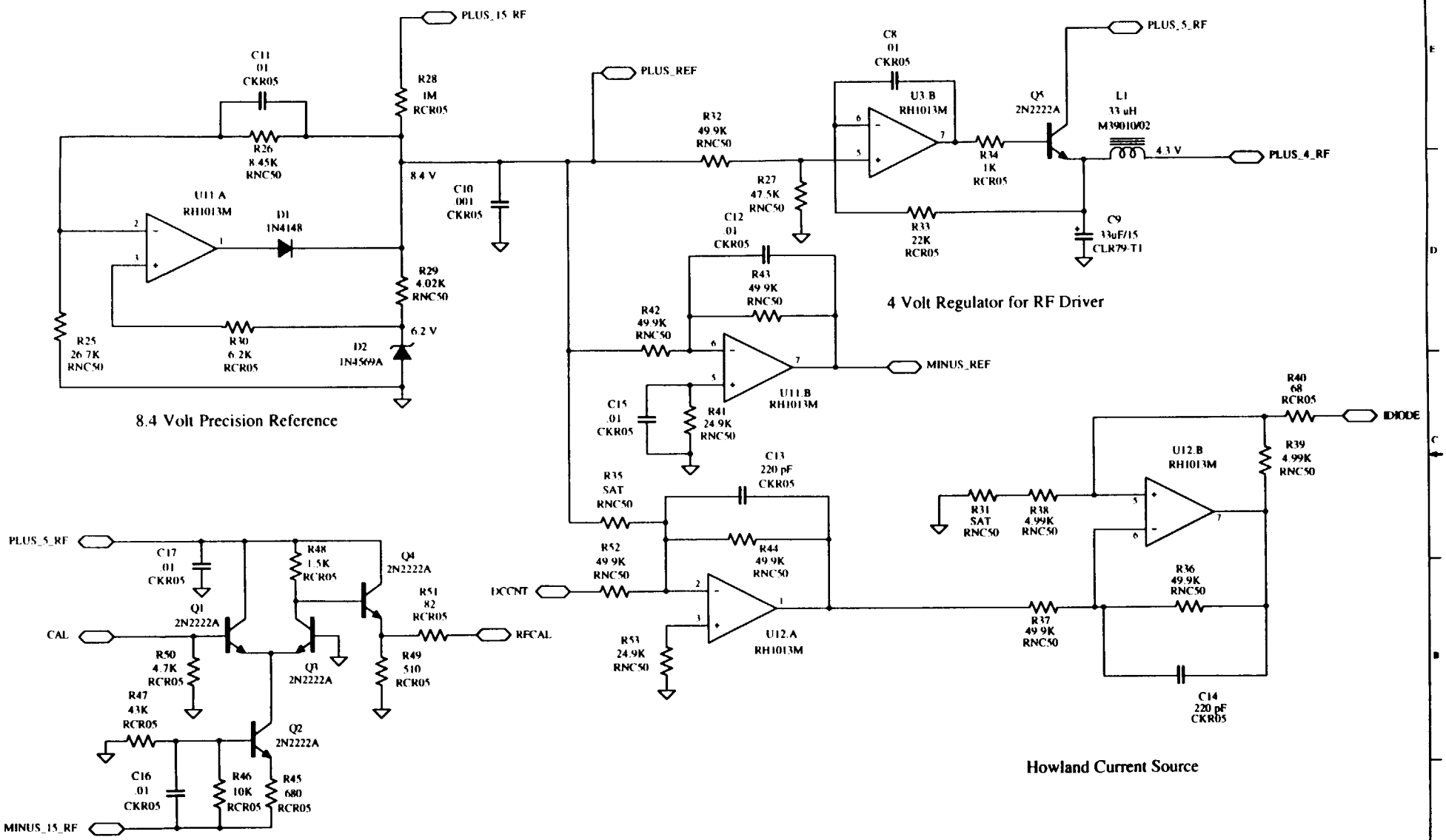
DC Latches and DAC

DC Control Voltage Amplifiers

High Voltage Amplifiers

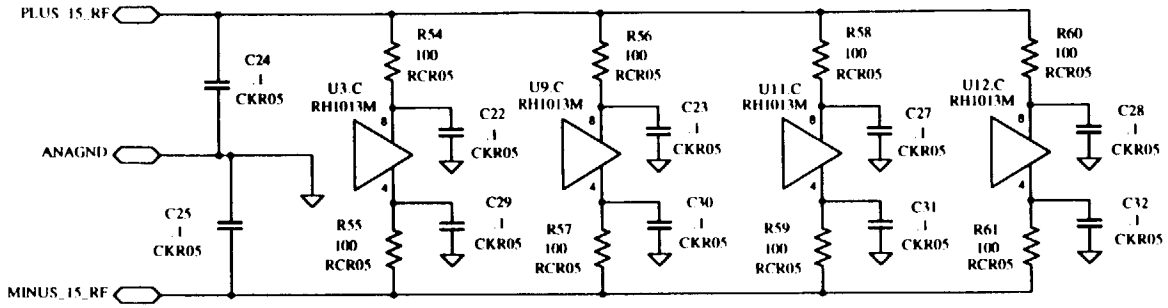
Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 3 RF/DC Supply Planet-B NMS	REV	
		REV	6-Feb-96
		REV A	Not Released
		RELEASE	20-Sept-95
		DRAWN	24-AUG-95 BB
		COG ENG	B. BLOCK

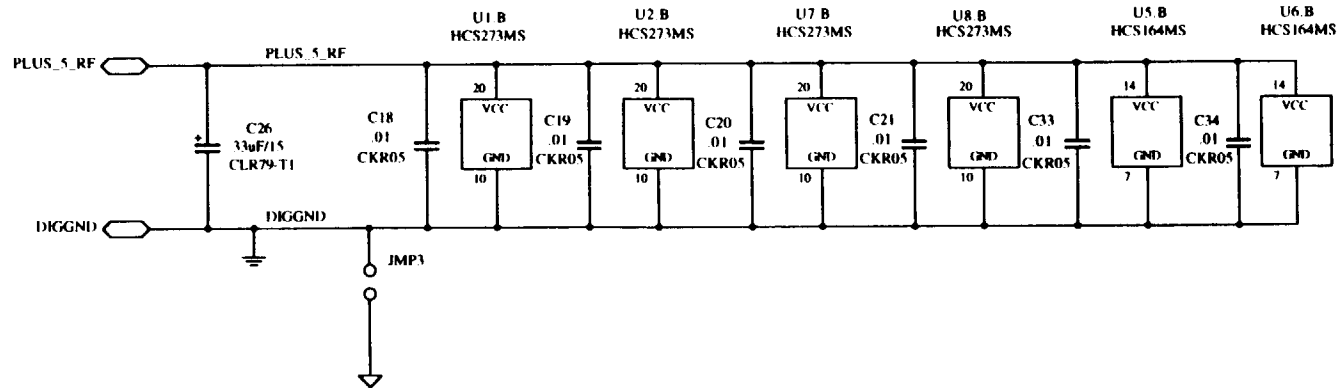
PROJECT	CAGE CODE	RELEASE	DRAWING NUMBER	REV
Planet B - NMS	0TK63	J0355.2A-RF/DC Ctrl, Pg. 3	061-0355	A



Space Physics Research Laboratory College of Engineering University of Michigan		Control Board, Pg. 4 RF/DC Supply Planet-B NMS		REV	
				REV	6-Feb-96
				REV A	Not Released
				RELEASE	20-Sept-95
				DRAWN	24-Aug-95 BB
				COG ENG	B. BLOCK
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	RELEASE: J0355.4A-RF/DC Ctrl, Pg. 4	DRAWING NUMBER: 061-0355	REV: A	

6.07



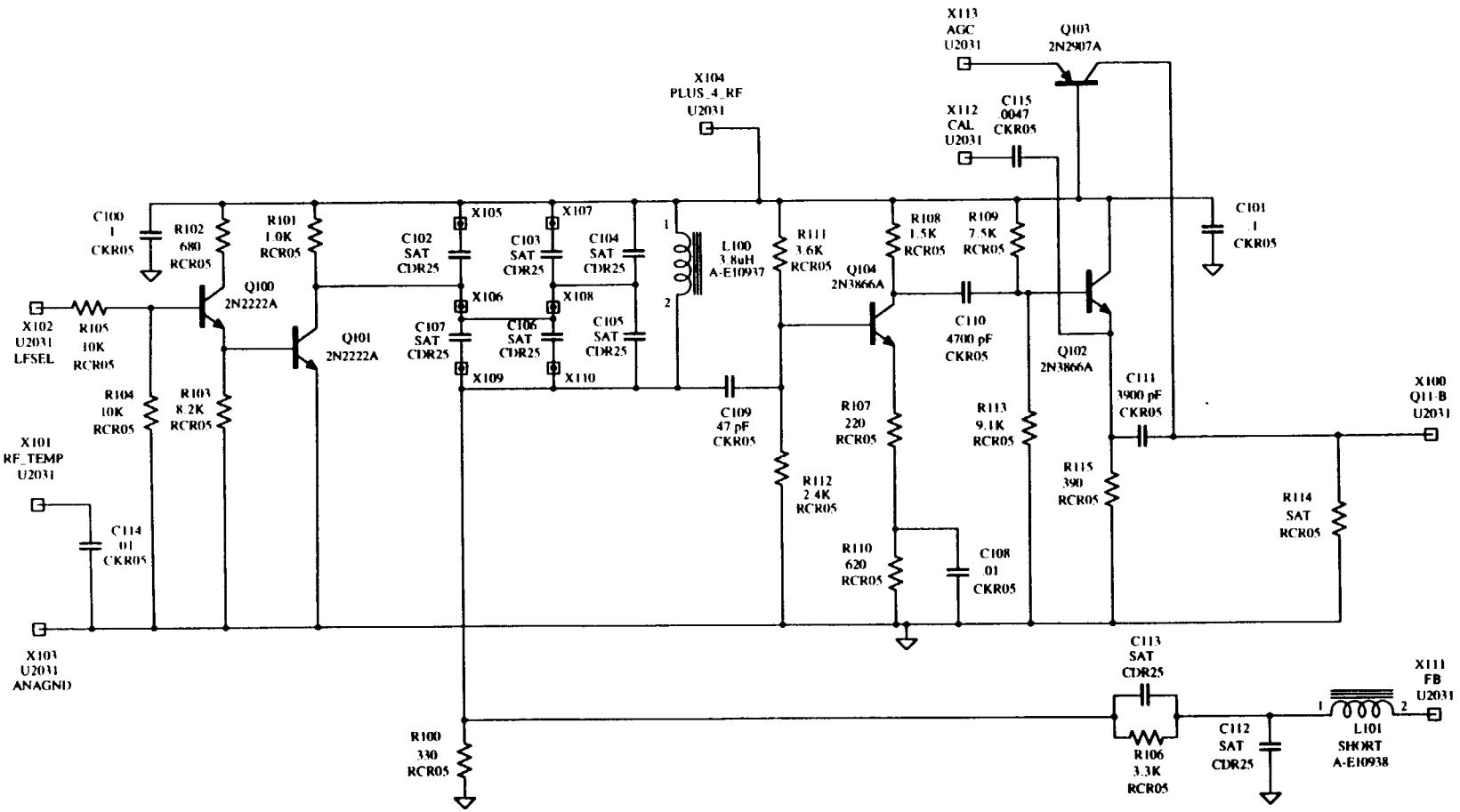


Space Physics Research Laboratory College of Engineering University of Michigan	Control Board, Pg. 5 RF/DC Supply Planet-B NMS

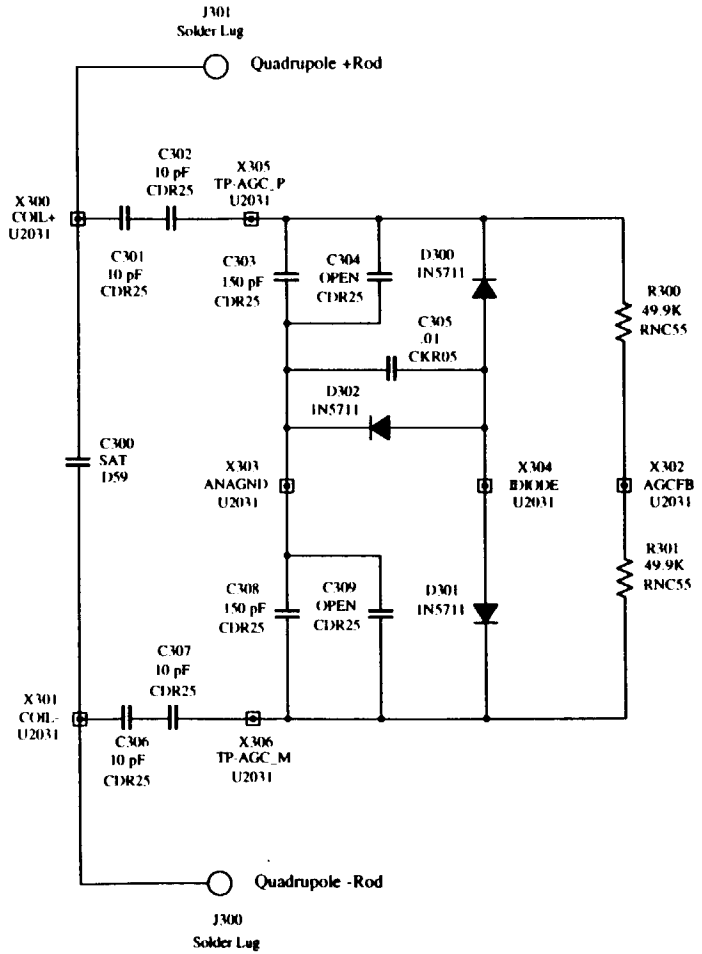
PROJECT	CAGE CODE	FILENAME	DRAWING NUMBER	REV
Planet B - NMS	0TK63	J0355.5A-RF/DC Ctrl, Pg. 5	061-0355	A

REV	
REV	6-Feb-96
REV A	Not Released
RELEASE	20-Sept-95
DRAWN	24-Aug-95
COG ENG	B. BLOCK

6.08



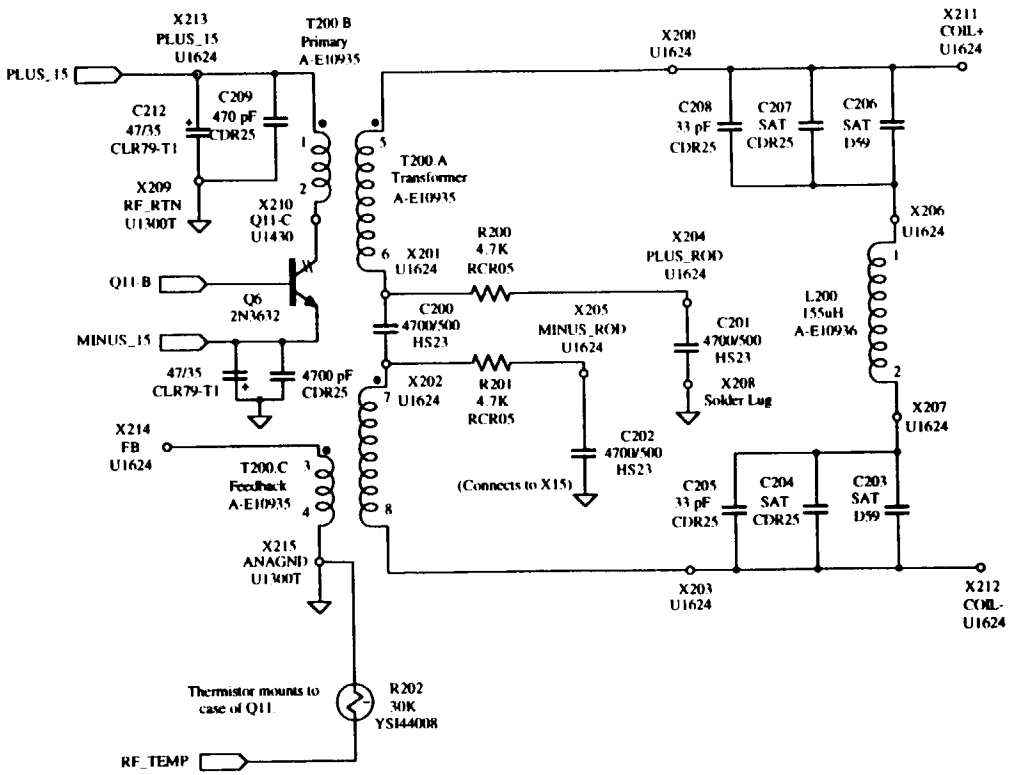
Space Physics Research Laboratory College of Engineering University of Michigan	RF/DC Driver Board RF/DC Supply Planet-B NMS	REV	
		REV	7-Feb-96
		REV A	Not Released
		RELEASE	12-Oct-95
		DRAWN	9/11/95 BB
		COG ENG	B.Block
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	RELEASE: J0369A RF/DC RF Driver Bd	DRAWING NUMBER: 061-0369 REV: A



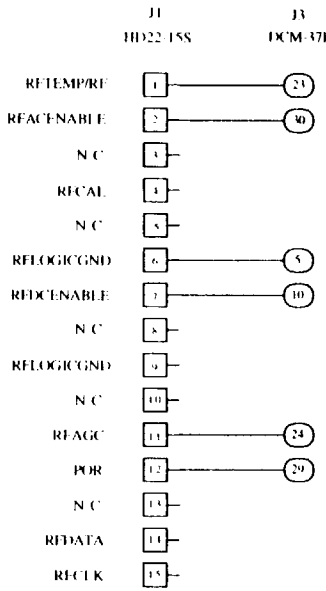
Notes:

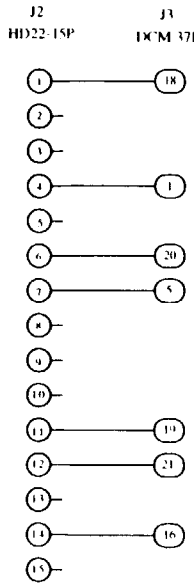
1. C47, C48, C49, C50 and C52, C53, C54, C55 must be selected and matched per procedure TBS.

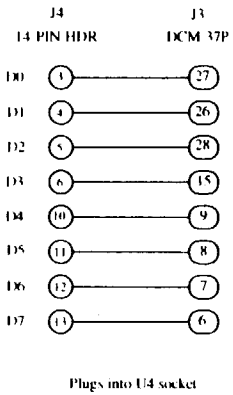
Space Physics Research Laboratory College of Engineering University of Michigan	AGC Board RF/DC Supply Planet-B NMS			REV	
				REV	
				REV A	6-Feb-96
				RELEASE	12-Oct-95
				DRAWN	11-Sep-95
				COG ENG	B Block
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	FILENAME: J0370A-RF/DC AGC Bd.	DRAWING NUMBER: 061-0370	REV: A	



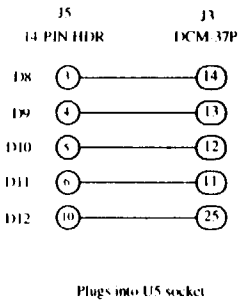
Space Physics Research Laboratory College of Engineering University of Michigan	Tank Compartment RF/DC Supply Planet-B NMS			REV	
				REV	6-Feb-96
				REV A	Not Released
				RELEASE	20-Sept-95
				DRAWN	9-11-95 BB
				COG ENG	B.Block
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	PROGRAM: J0371A RF/DC Tank Comp.	DRAWING NUMBER: 061-0371	REV: A	





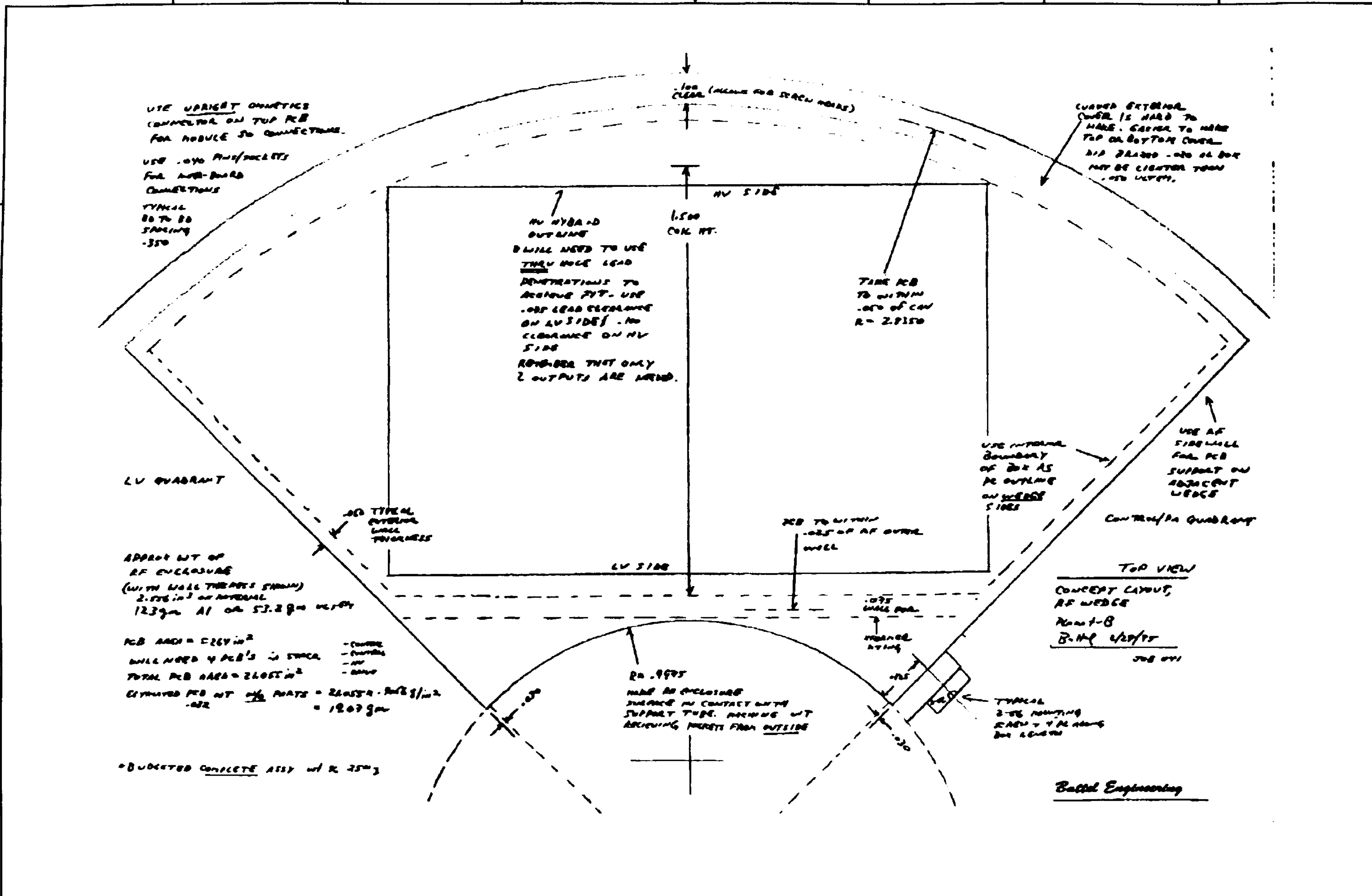


Plugs into U4 socket



Plugs into U5 socket

Space Physics Research Laboratory College of Engineering University of Michigan		Test Box Adapter Harness RF/DC Supply Planet-B NMS		REV	
				REV	
				REV	
				RELEASE	12-Oct-95
				DRAWN	12-Sept-95
PROJECT: Planet B - NMS	CAGE CODE: 0TK63	DESIGNER: J0373 RF/DC BB Harness	DRAWING NUMBER: 061- 0373	REV: -	COG ENG: B. BLOCK



Space Physics Research Laboratory College of Engineering University of Michigan	RF Outline Planet – B NMS	RELEASE 12-May-95 DRAWN Scan 10-May-95 im COG ENG Battel
Planet B - 080249 · 0TK63 · J0140-RF Outline	061-0140	–

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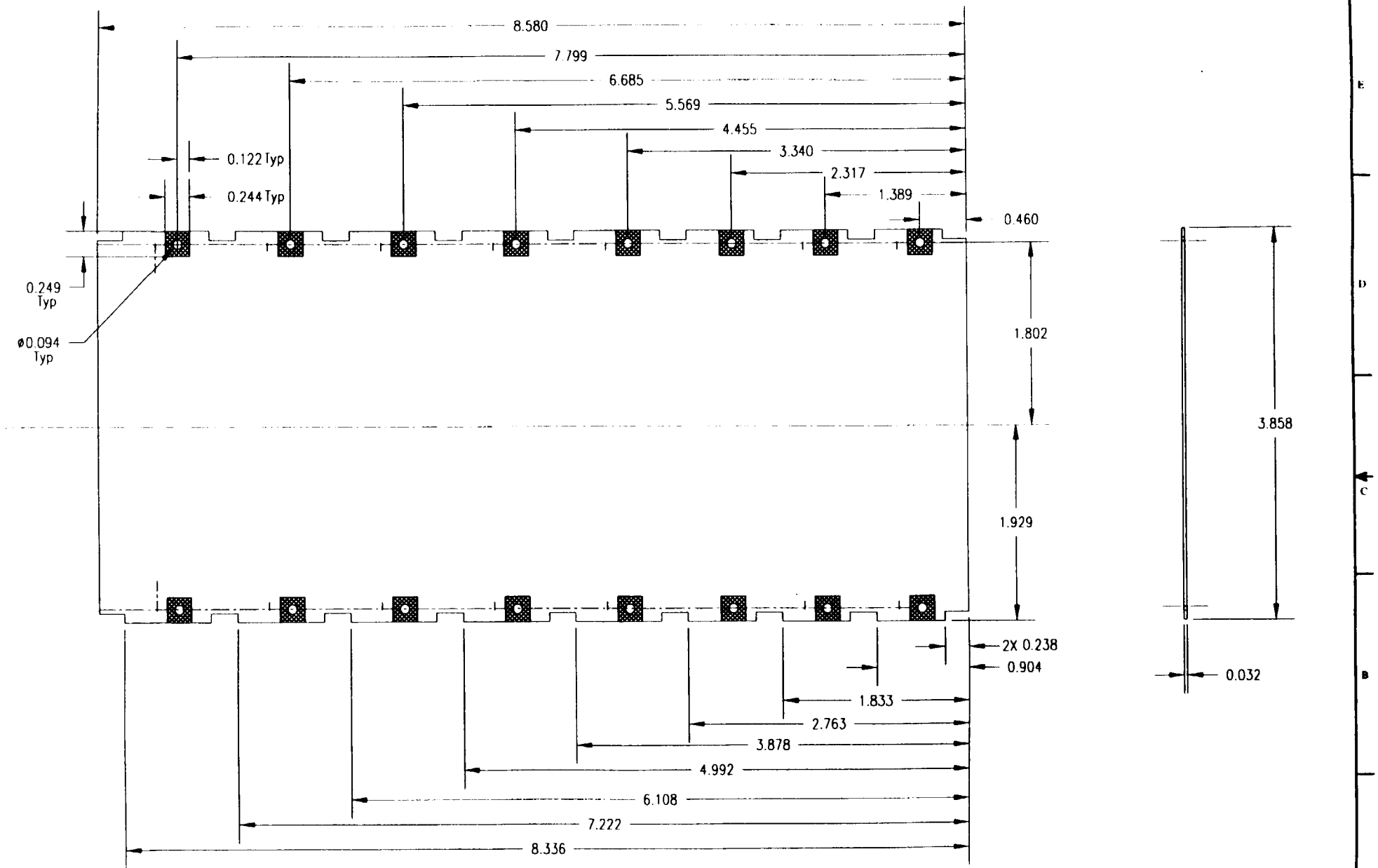
Drawing Page 6.48



Space Physics Research Laboratory College of Engineering University of Michigan	Outer PCB Outline RF Planet – B NMS				
Planet B - 080249	0TK63	J0398A-RF Outline	061-0398	A	RELEASE: 29-Feb-96 DRAWN: 29-Feb-96 from ACAD CUG ENG: Battel / Arnett

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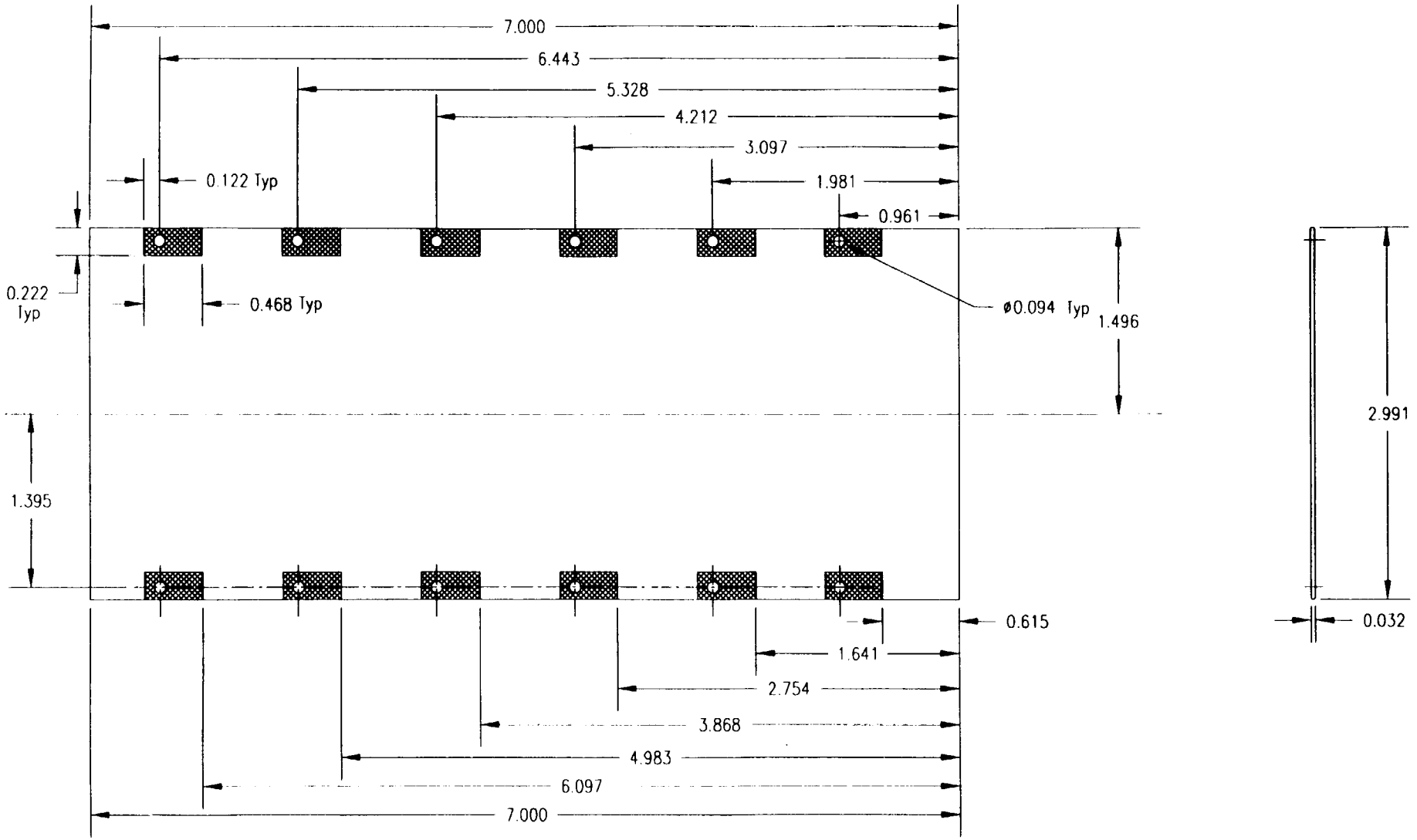

Space Physics Research Laboratory College of Engineering University of Michigan		Inner PCB Outline RF Planet – B NMS			REL'EASE: 29-Feb-96
Planet B - 080249	0TK63	J0399A-RF Outline	061-0399	A	DRAWN: 29-Feb-96 from ACAD CUG ENG: Battel / Arneti

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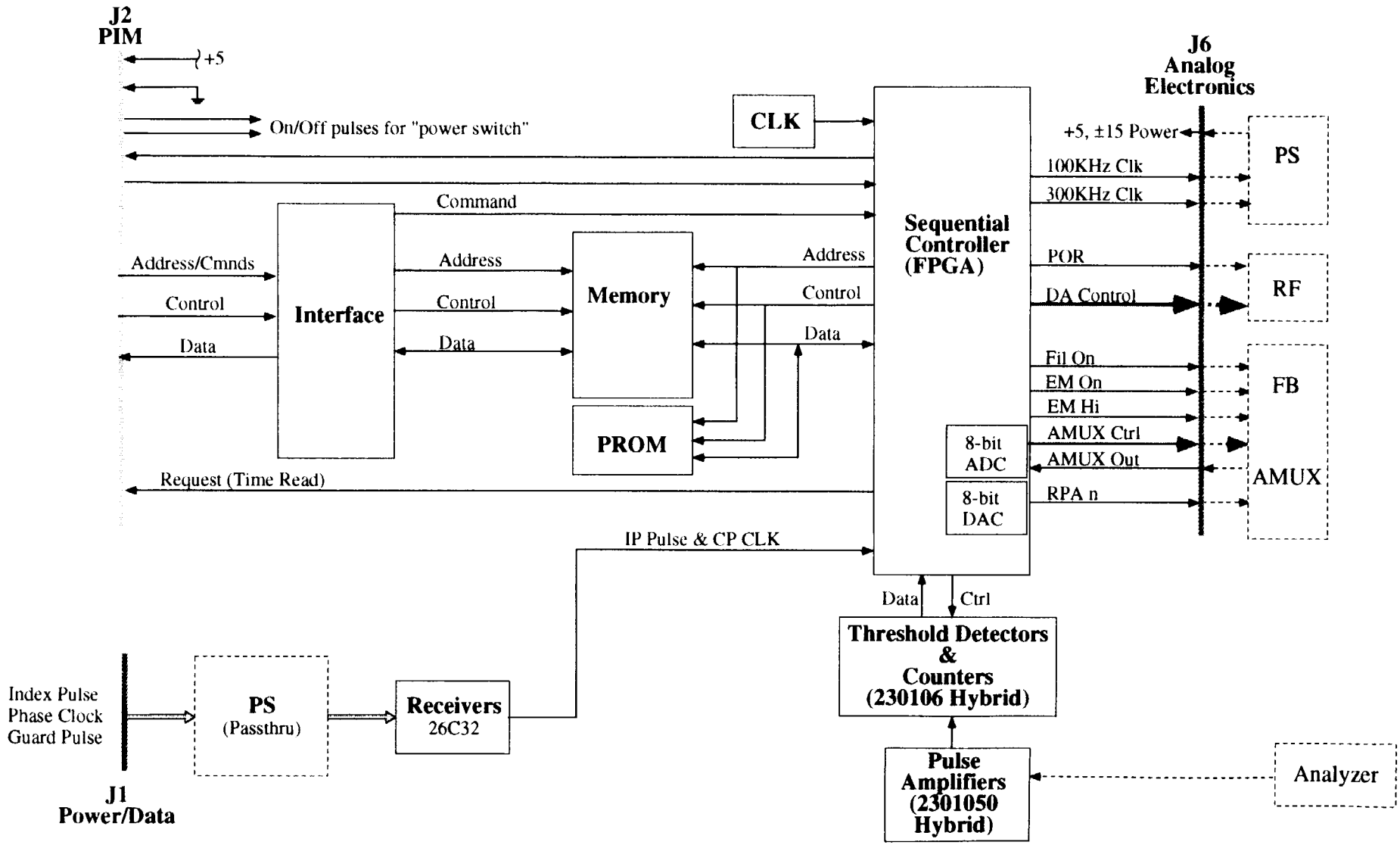
Section 7
CM - Control Module



NASA Goddard Space Flight Center	Control Module Functional Block Diagram Planet – B NMS			REV	
				REV	
				REV	
				REV A	4-Aug-95
				RELEASE	12-May-95
061-NMS		J0137A-CM Block	061-0137	A DRAWN	6/12/95 jm
				COG ENG	Frost

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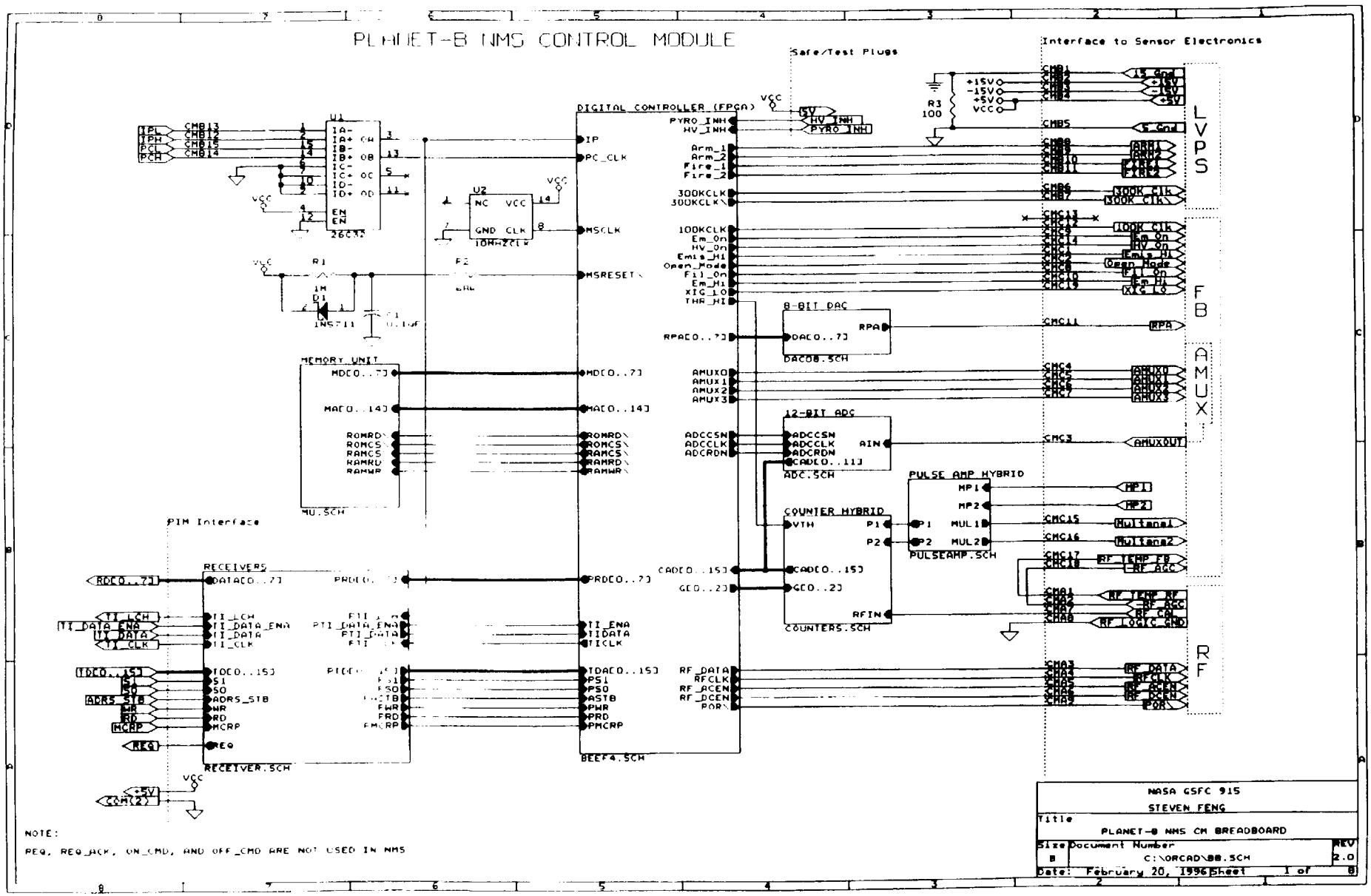
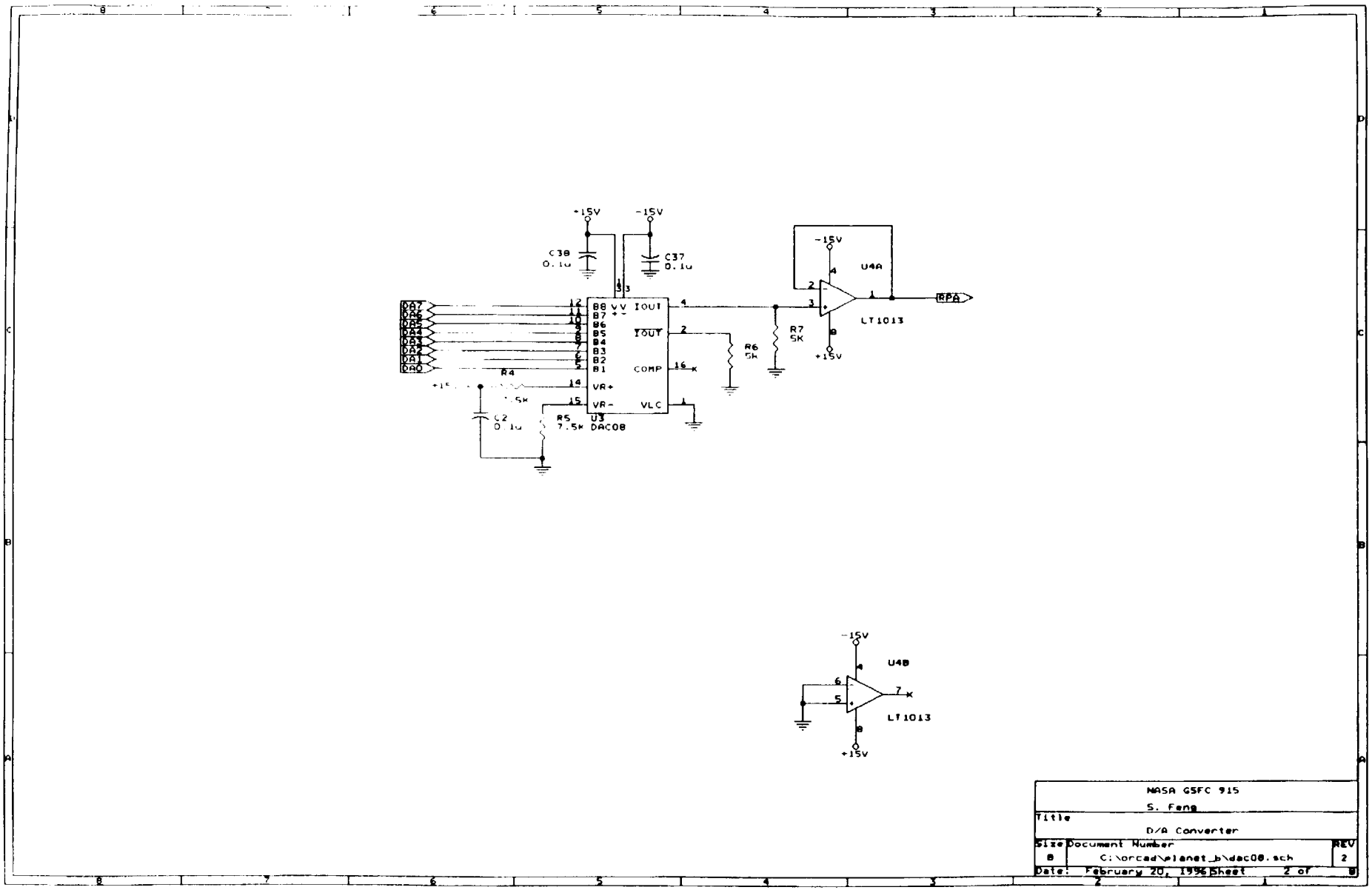
Drawing Page

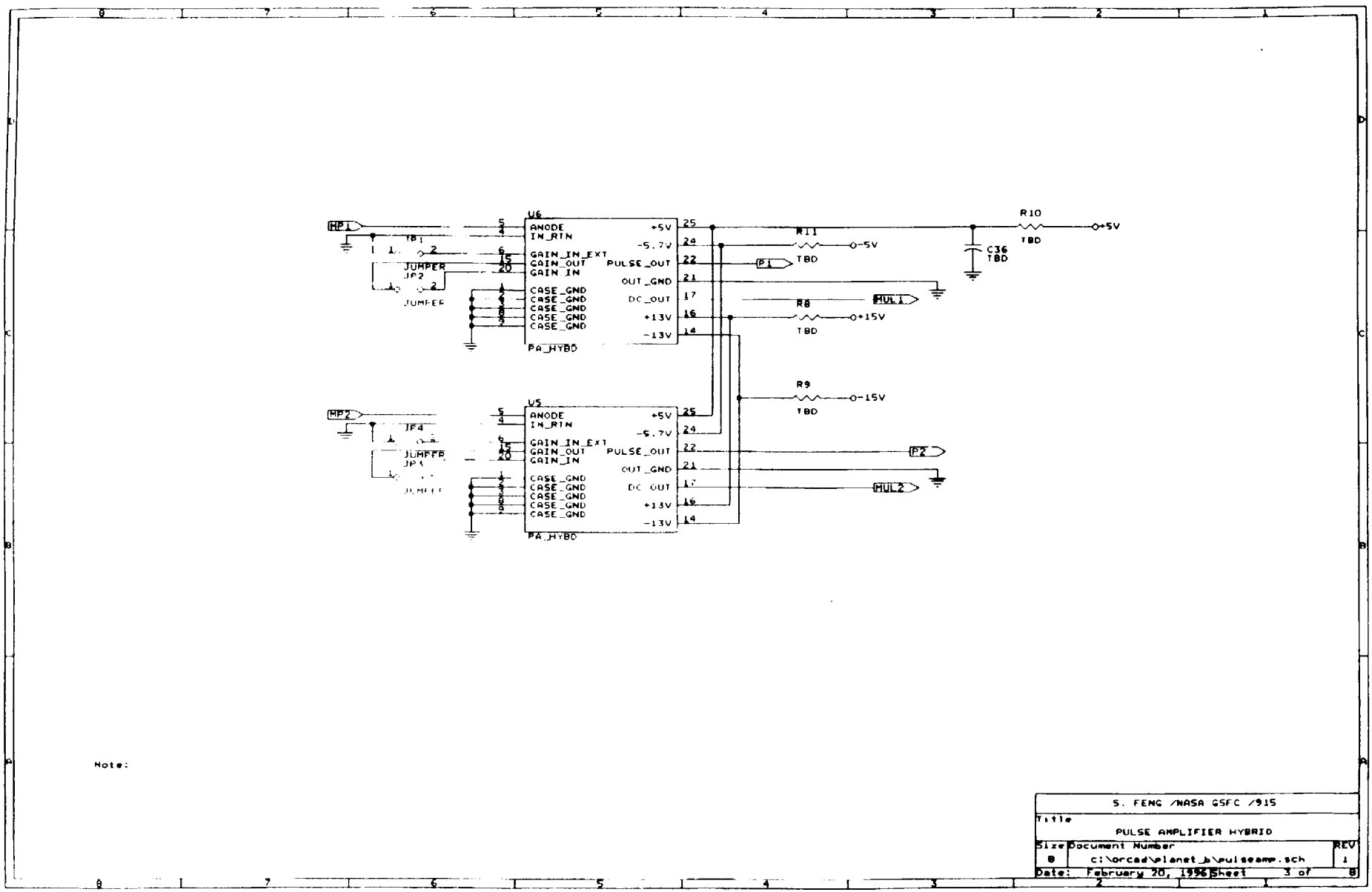
7.02

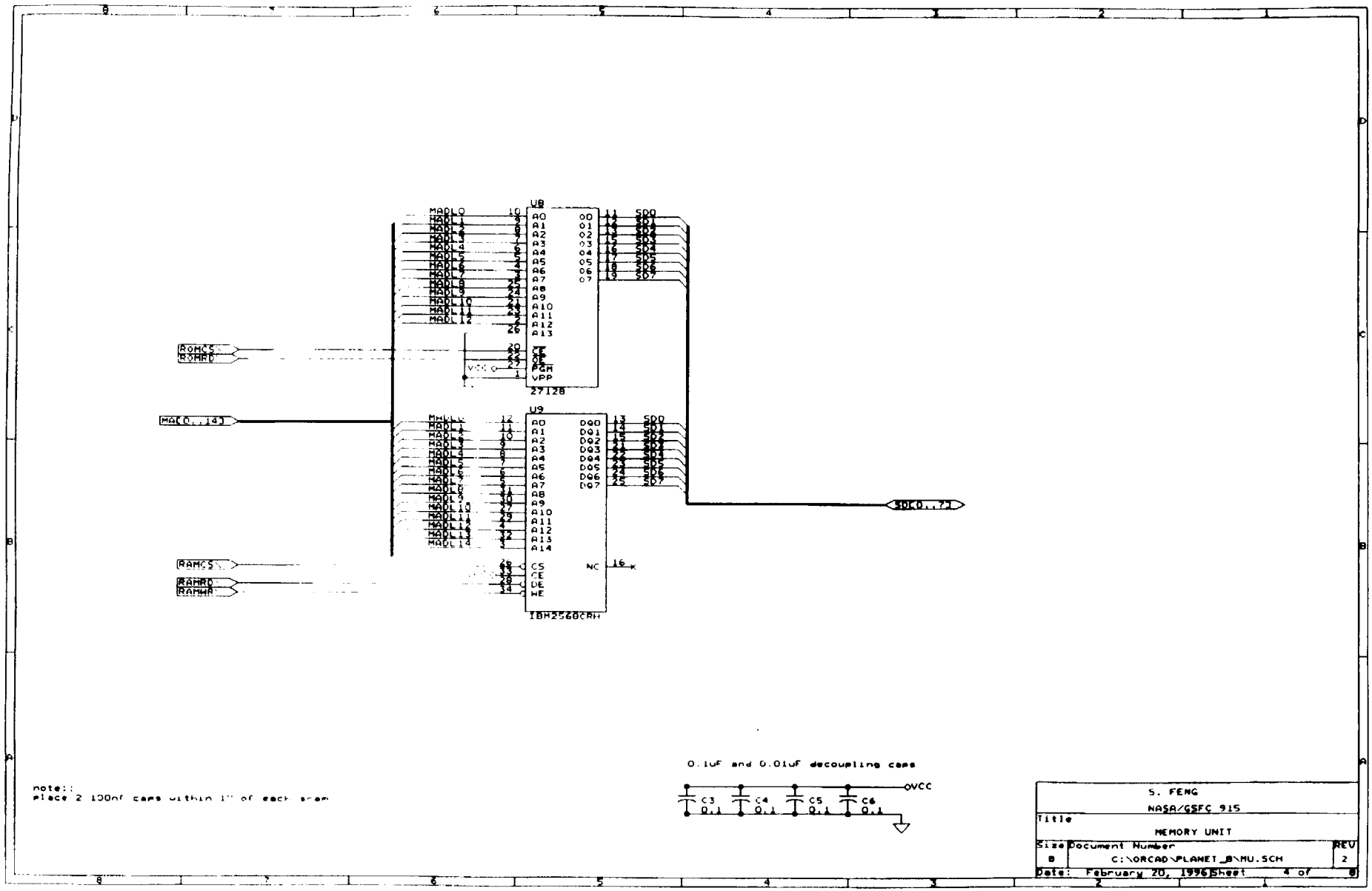
Name	Description	CM Plug		Desttination
Harness 4		**Flite**	**VME 2**	*
RF Temp/RF	RF thermistor temperature from RF to CM as passthru to FB.	CMA-1	C17	RFB-1
-RF AGC	RF AGC monitor voltage. 0 to -5V. Passthru from RF to FB	CMA-2	C18	RFB-11
RF Data	Serial data for RF amplitude and rod DC.	CMA-3	C1	RFB-14
RF Clk	Clock for RF amplitide data.	CMA-4	C2	RFB-15
RF AC Enable	Enable for rod AC amplitude data.	CMA-5	C3	RFB-2
RF DC Enable	Enable for rod DC amplitude data.	CMA-6	C4	RFB-7
RF Cal	Logic level, RF frequency, to CM counter. Twisted Pair.	CMA-7	C5 Tw	RFB-4
RF Logic Gnd	RF digital ground. Twisted Pair.	CMA-8	C6 Tw	RFB-6
POR/	Power on reset not from CM to reset RF serial IF and latch. Signal high true. (A low signal causes reset).	CMA-9	C7	RFB-12
RF Logic Gnd	RF digital ground.	CMA-10	C8	RFB-9
Harness 2				
CM 15 Gnd	15 power return for CM	CMB-1	B32	LVB-16
CM +15	+15 power for CM	CMB-2	A32	LVB-7
CM -15	-15 power for CM	CMB-3	C32	LVB-24
CM 5 Gnu	5 power return. 5 and 15 gnds NOT connected in CM.	CMB-4	B30	LVB-15
CM +5	+5 power for CM	CMB-5	A30	LVB-6
300K Sync	300KHz sync for main converter. Balanced pulse xfmr load. Twisted Pair.	CMB-6	A1 Tw	LVB-3
300K Sync/	300KHz return. Balanced, differential, input. Twisted Pair.	CMB-7	A2 Tw	LVB-13
Arm-1	+5 logic, true, to HOLD, the pyro arming relay #1 on before fire. A S/C command of Disarm-1 must be sent to turn off this signal after firing.	CMB-8	A4	LVB-5
Arm-2	+5 logic, true, to HOLD, the pyro arming relay #2 on before fire. A S/C command of Disarm-2 must be sent to turn off this signal after firing.	CMB-9	A5	LVB-23
Fire-1	+5 V logic, true, to fire pyro #1. Must be executed AFTER the Arm-1 cmnd. S/C cmnd of Unfire-1 must be sent after the Disarm-1 cmnd.	CMB-10	A6	LVB-9
Fire-2	+5 V logic, true, to fire pyro #2. Must be executed AFTER the Arm-2 command. S/C cmnd of Unfire-2 must be sent after the Disarm-2 cmnd.	CMB-11	A7	LVB-18
Index Pulse +	Sun detect pulse from S/C. NMS latches clock into TM word for angle of attack reference. Balanced pair.	CMB-12	A8	LVB-1
Index Pulse ı	Return wire of balanced pair.	CMB-13	A9	LVB-10
Phase Clock +	Clock of counts between Index Pulses. ~8000 between Index Pulses. Balanced Pair.	CMB-14	A11	LVB-11
Phase Clock _	Return wire of balanced pair.	CMB-15	A12	LVB-19
Guard Pulse +	Pulse from Topside Sounder via S/C. Pulse true before output pulse. Not used in NMS as of 1-Jul-95. Balanced pair.	CMB-16	A14	LVB-2
Guard Pulse -	Return wire of balanced pair.	CMB-17	A15	LVB-12
Harness 5				
Emis Hi	+5V logic signal, true, to hold, ionization voltage at hi (70V).	CMC-1	B1	FBA-3
Open Mode	+5V logic signal, true, to hold, open mode (lower, 2 ion focus voltages).	CMC-2	B2	FBA-12
AMUX Out	AMUX output to 8?-bit D/A. -.040V to +5.08V. Overload (fault) from -15V to +15V.	CMC-3	B3	FBA-19
AMUX Add 0	AMUX address 0. See Pg. 1.08, Dwg. 061-0114, for MUX assignment.	CMC-4	B4	FBA-1
AMUX Add 1	AMUX address 1.	CMC-5	B5	FBA-10
AMUX Add 2	AMUX address 2.	CMC-6	B6	FBA-2
AMUX Add 3	AMUX address 3.	CMC-7	B7	FBA-11
Fil On	+5 V logic signal, true, to hold, filament on.	CMC-8	B8	FBA-13
EM On	+5 V logic signal, true, to hold, EM on.	CMC-9	B9	FBA-4
EM Hi	+5 V logic signal, true, to hold, EM to 200V higher, when EM is ON.	CMC-10	B10	FBA-6
RPA n	Analog voltage, -10V to +10V, from 8-bit D/A, to apply RPA voltage directly to RPA grid. Rev 3/5/96	CMC-11	B11	FBA-14
100K Clk	100KHz clock for FB AC drive. FPGA drive to UC1709 load.	CMC-12	B20	FBA-25
Spare		CMC-13	B21	FBA-17
HV On	+5 V logic signal, true, to hold, HV Bias Voltages ON. This signal false if Safe/Arm plug, P3 "Inhibit HV", plug is installed.	CMC-14	B12	FBA-5
Multana 1	EM analog voltage from PA #1 to FB AMUX input.	CMC-15	B14	FBA-22
Multana 2	EM analog voltage from PA #2 to FB AMUX input.	CMC-16	B15	FBA-23
RF Temp/FB	RF thermistor temperature from RF, to FB, as passthru, from RF.	CMC-17	B17	FBA-20
-RF AGC	RF AGC monitor voltage. 0 to ı5V. Passthru to FB.	CMC-18	B18	FBA-21
XIG Low	+5 V logic signal, true, to hold, XIG low (0 volts), by command. False sets XIG at ~+45V (normal).	CMC-19	B13	FBA-7
Harness 6			**VME 3**	
Plus 5	Plus 5 volts to Safe/Arm connector for pull-up of inhibits.	S/T-1	A1	CMD-1
HV Inhibit	When pulled high, HV (both 500 and EMs) are are logically held off.	S/T-2	B1	CMD-2
Pyro Inhibit	When pulled high, the pyro signals are inhibited.	S/T-3	C1	CMD-3

*Note 5/11/95: Pin assignments are placeholders only. Pin numbers will be assigned during PCB layout.


PLANET-B NMS CONTROL MODULE
Safe/Test Plugs
Interface to Sensor Electronics
DIGITAL CONTROLLER (FPGA)
MEMORY UNIT
MU.SCH
PIM Interface
RECEIVERS
RECEIVER.SCH
8-BIT DAC
DAC08.SCH
12-BIT ADC
ADC.SCH
COUNTER HYBRID
COUNTERS.SCH
PULSE AMP HYBRID
PULSEAMP.SCH
BEEP4.SCH
LVPS
FB
AMUX
RF
NOTE:
REQ, REQ_ACK, ON_CMD, AND OFF_CMD ARE NOT USED IN NMS
NASA GSFC 915
STEVEN FENG
PLANET-B NMS CM BREADBOARD
C:\ORCAD\BB.SCH
February 20, 1996


+15V
-15V
C38
0.1u
C37
0.1u
U4A
LT1013
RPA
R7
5K
R6
5K
DA7
DA6
DA5
DA4
DA3
DA2
DA1
DA0
B8
B7
B6
B5
B4
B3
B2
B1
VV
IOUT
IOUT
COMP
VR+
VR-
VLC
R4
C2
0.1u
R5
7.5K
U3
DAC08
U4B
LT1013
NASA GSFC 915
S. Feng
Title
D/A Converter
Size
B
Document Number
C:\orcad\planet_b\dac08.sch
REV
2
Date: February 20, 1996
Sheet 2 of 8


U6
ANODE
IN_RTN
GAIN_IN_EXT
GAIN_OUT
GAIN_IN
CASE_GND
CASE_GND
CASE_GND
CASE_GND
CASE_GND
+5V
-5.7V
PULSE_OUT
OUT_GND
DC_OUT
+13V
-13V
PA_HYBD
MP1
TB1
JUMPER
JP2
JUMPER
R10
TBD
+5V
R11
TBD
-5V
C36
TBD
P1
R8
TBD
+15V
MUL1
R9
TBD
-15V
U5
MP2
JP4
JUMPER
JP1
P2
MUL2
Note:
S. FENG /NASA GSFC /915
Title
PULSE AMPLIFIER HYBRID
Size
B
Document Number
c:\orcad\planet_b\pulseamp.sch
REV
1
Date: February 20, 1996
Sheet 3 of 8


U8
27128
U9
IBM25608CRH
MA[0..14]
ROMCS
ROMRD
RAMCS
RAMRD
RAMWR
SD[0..7]
note::
place 2 100nf caps within 1" of each ram
0.1uF and 0.01uF decoupling caps
VCC
C3 0.1
C4 0.1
C5 0.1
C6 0.1
S. FENG
NASA/GSFC 915
Title
MEMORY UNIT
Size B
Document Number
C:\ORCAD\PLANET_B\MU.SCH
REV 2
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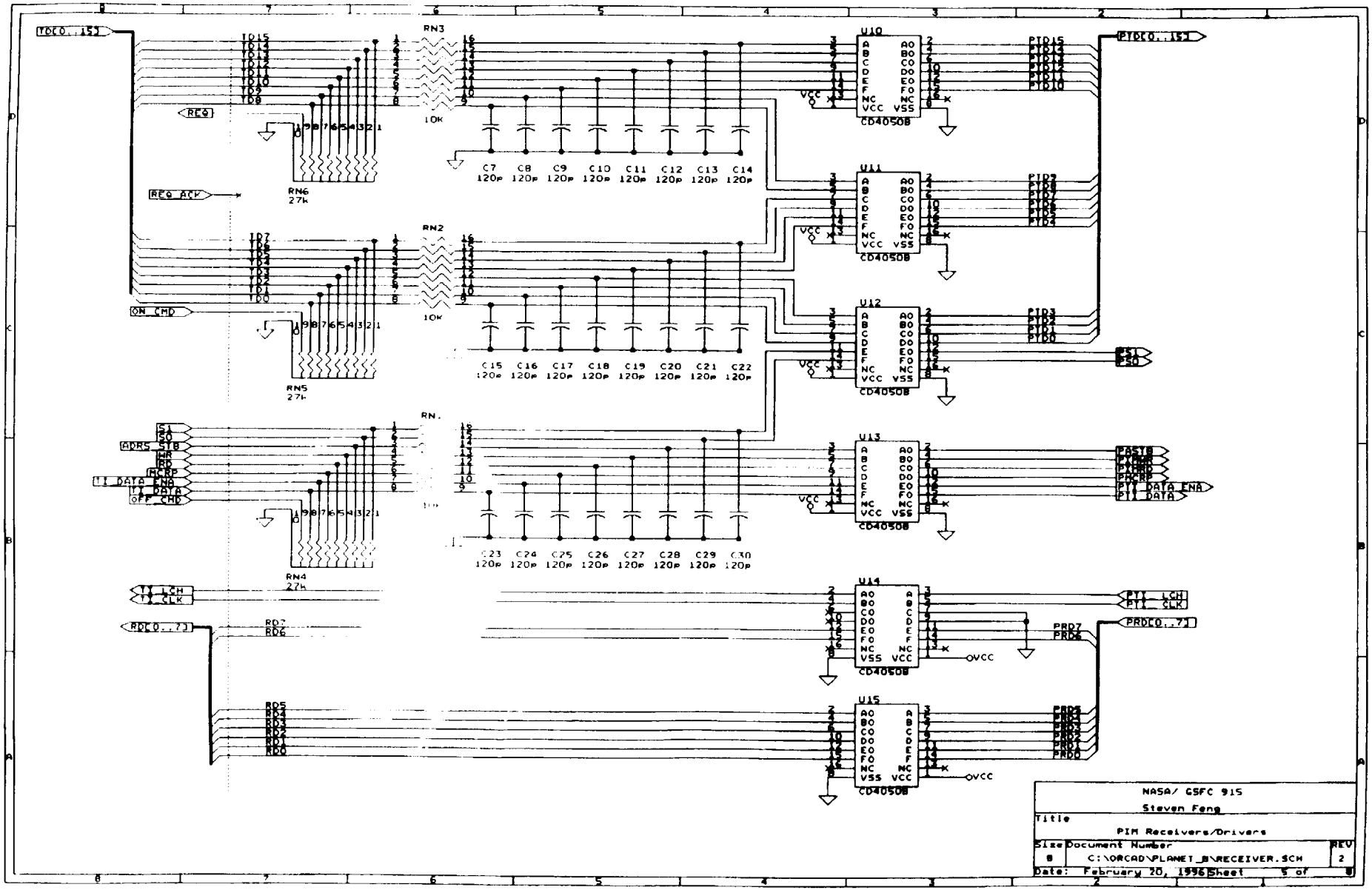
PDCO..15
RN3
10K
RD0
RD15
REQ
RN6
27K
C7 C8 C9 C10 C11 C12 C13 C14
120p
U10
CD4050B
PID15
REQ_ACK
RN2
RD7
RD0
ON_CMD
RN5
27K
C15 C16 C17 C18 C19 C20 C21 C22
U11
PID7
U12
PID3
PID0
RN.
ADRS
STB
WR
RD
MCRP
ENA
DATA
OFF_CMD
RN4
27K
C23 C24 C25 C26 C27 C28 C29 C30
U13
PTI_DATA_ENA
PTI_DATA
PTI_LCH
PTI_CLK
RDCO..7
RD7
RD6
RD5
RD4
RD3
RD2
RD1
RD0
U14
U15
PRD7
PRD6
PRD5
PRD4
PRD3
PRD2
PRD1
PRD0
PRDCO..7
VCC
NASA/ GSFC 915
Steven Feng
Title
PIM Receivers/Drivers
Size B
Document Number
C:\ORCAD\PLANET_B\RECEIVER.SCH
REV 2
Date: February 20, 1996
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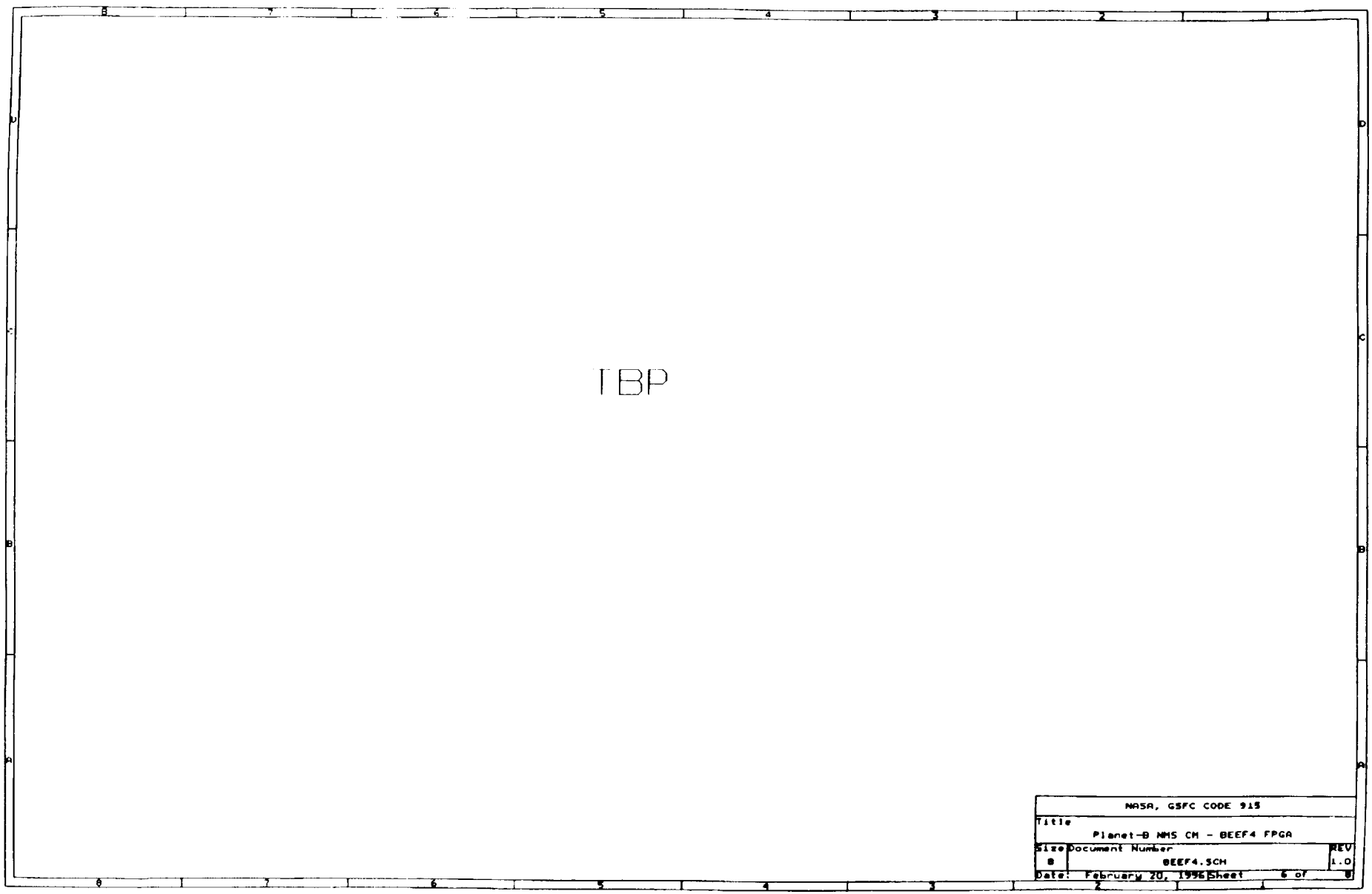
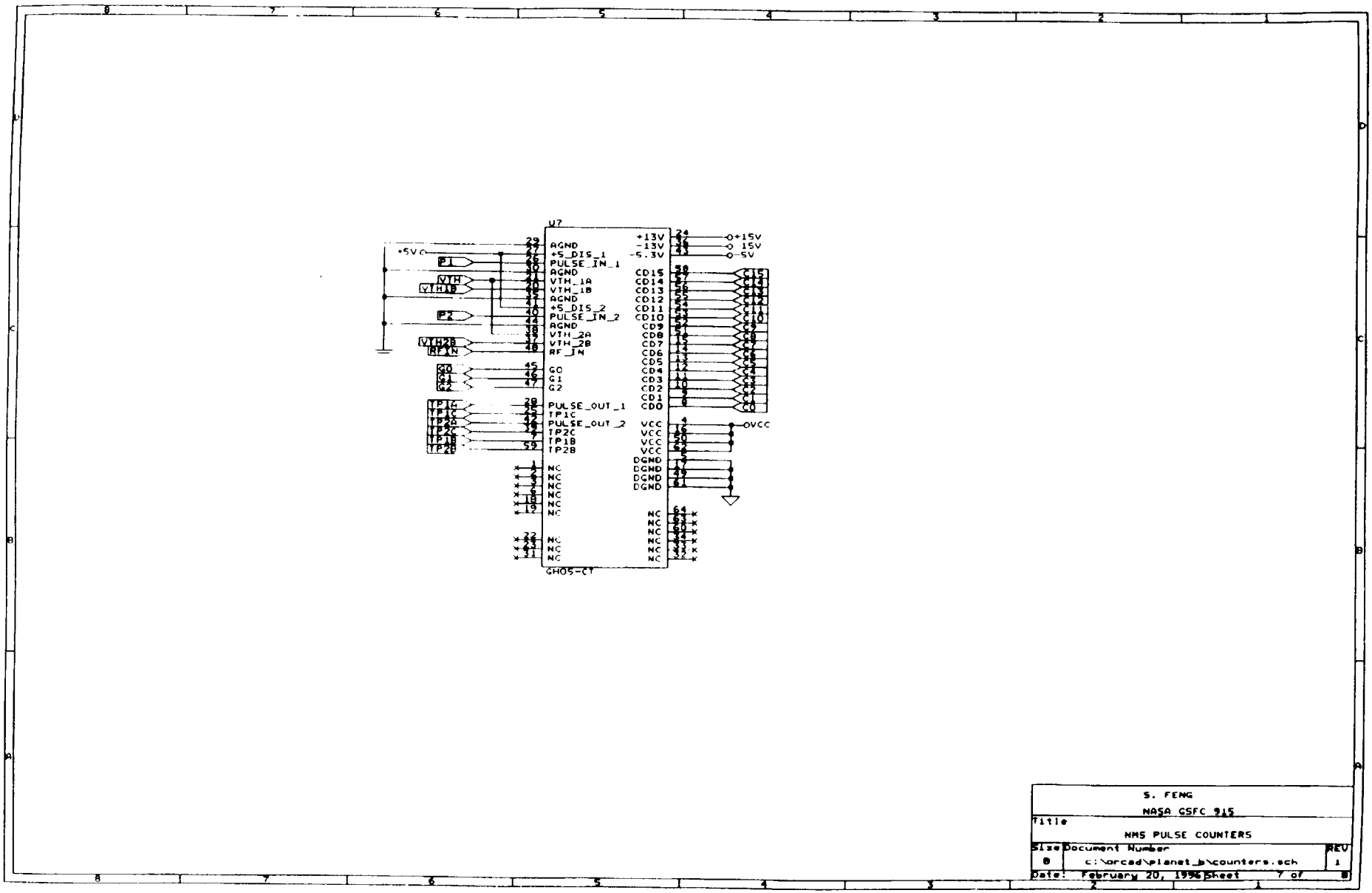

TBP
NASA, GSFC CODE 915
Title
Planet-B NMS CM - BEEF4 FPGA
Size
B
Document Number
BEEF4.SCH
REV
1.0
Date: February 20, 1996 Sheet 6 of 8


U7
AGND
+5_DIS_1
PULSE_IN_1
AGND
VTH_1A
VTH_1B
AGND
+5_DIS_2
PULSE_IN_2
AGND
VTH_2A
VTH_2B
RF_IN
G0
G1
G2
PULSE_OUT_1
TP1C
PULSE_OUT_2
TP2C
TP1B
TP2B
+13V
-13V
-5.3V
CD15
CD14
CD13
CD12
CD11
CD10
CD9
CD8
CD7
CD6
CD5
CD4
CD3
CD2
CD1
CD0
VCC
DGND
NC
GHOS-CT
+5VC
P1
VTH
VTH1B
P2
VTH2B
RF1N
TP1C
TP2C
TP1B
TP2B
+15V
15V
-5V
OVCC
S. FENG
NASA GSFC 915
Title
NMS PULSE COUNTERS
Size
B
Document Number
c:\orcad\planet_b\counters.sch
REV
1
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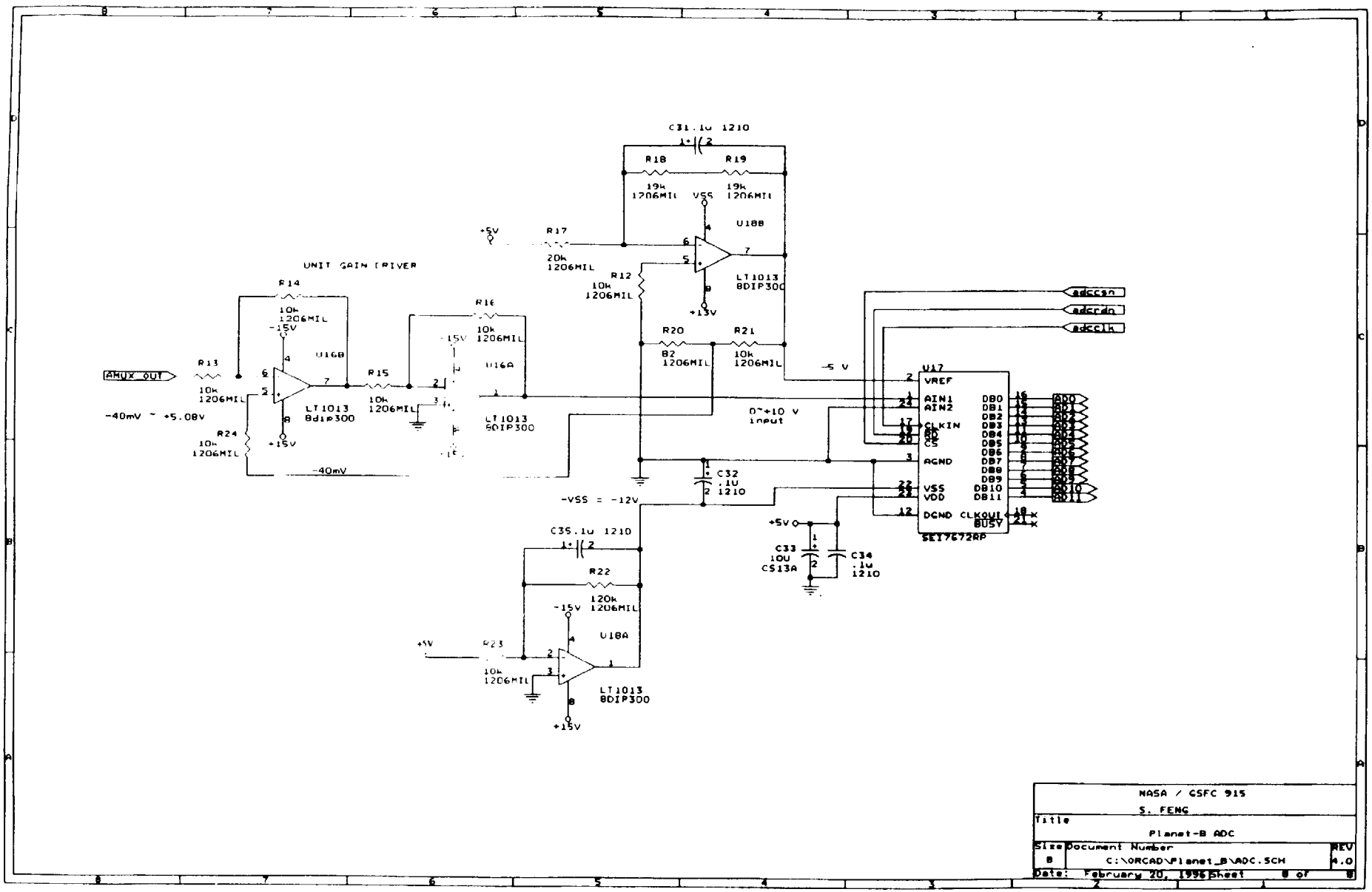
C31.1u 1210
R18
R19
19k 1206MIL
19k 1206MIL
VSS
U18B
+5V
R17
20k 1206MIL
R12
10k 1206MIL
LT1013 8DIP300
+15V
UNIT GAIN DRIVER
R14
10k 1206MIL
-15V
U16B
R16
10k 1206MIL
-15V
U16A
AMUX_OUT
R13
10k 1206MIL
-40mV ~ +5.08V
LT1013 8dip300
R15
10k 1206MIL
R24
10k 1206MIL
+15V
-40mV
LT1013 8DIP300
R20
82 1206MIL
R21
10k 1206MIL
-5 V
0~+10 V input
adccsn
adcrdn
adcclk
U17
VREF
AIN1
AIN2
CLKIN
RD
WR
CS
AGND
VSS
VDD
DGND
CLKOUT
BUSY
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DB8
DB9
DB10
DB11
SEI7672BP
C32 .1U 1210
-VSS = -12V
+5V
C33 10U CS13A
C34 .1u 1210
C35.1u 1210
R22
120k 1206MIL
-15V
U18A
+5V
R23
10k 1206MIL
LT1013 8DIP300
+15V
NASA / GSFC 915
S. FENG
Title
Planet-B ADC
Size B
Document Number
C:\ORCAD\Planet_B\ADC.SCH
REV 4.0
Date: February 20, 1996
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