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FINAL REPORT

MAGNETIC CONTROL ASSEMBLY

QUALIFICATION MODEL

NASA GSFC CONTRACT No. NAS 5-21867

I

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Report #90569

FINAL REPORT

MAGNETIC CONTROL ASSEMBLY

QUALIFICATION MODEL

NASA GSFC CONTRACT No. NAS 5-21867

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FINAL REPORT

MAGNETIC CONTROAL ASSEMBLY (MCA)

NASA, GSFC Contract NAS 5-21867

Report #90569

1.0 INTRODUCTION

1.1 Scope

This report summarizes the work accomplished under the NASA Contract NAS 5-21867 which resulted in building and qualifying the Magnetic Control Assembly (MCA) according to NASA Environmental Test Specification S-320-EN-1. This assembly consists of:

1. Control Logic Assembly (CLA)
2. Magnetometer probe

The MCA was designed as an add-on unit for certain existing components of the Nimbus or ERTS attitude control system. The acceptance electrical and environmental tests verified that the MCA is electrically, mechanically, and functionally compatible with the existing Nimbus or ERTS attitude control systems.

All major drawings and photographs are included in this report; procedures for manufacturing and inspections are outlined. A chronological list of events and fabrication summary is provided for the MCA.

1.2 Description of System

1.2.1 Description of Operation

The MCA system consists of three orthogonal electro-magnets (X, Y, and Z axes) capable of generating ±5000 pole-cm in each axis; a magnetometer probe capable of sensing external magnetic fields in the X, Y, and Z axes; and the control electronics. Inputs to the MCA are provided by the Control Logic Box and consist of the following:

1. Pitch error
2. Yaw error
3. Roll reaction wheels differential speed (It could accept Roll error also with slight modifications)

4. Pitch reaction wheel speed

5. Yaw reaction wheel speed

The magnetometer probe of the MCA measures the external magnetic fields of the satellite with respect to the X, Y, and Z axes of the satellite. Using these inputs the MCA computes the required drive signals and energizes the three orthogonal electro-magnets to generate the proper magnetic moments to decrease the satellite's position and rate errors as well as to continuously unload the reaction wheels.

1.2.2 Fine Control Mode

The ERTS orbits the earth at an altitude of 564 miles and each orbit takes 103.2 minutes. At this altitude, we can assume that the external magnetic B field is uniform and changing slowly. The maximum B field strength is about 0.4 gauss at this altitude.

Refer to Fig. 1. Assume that we have a magnetic field (B) pointing along the positive Y axis. A magnetic dipole will tend to align itself with the B field. The magnet (dipole moment M) in Fig. 1 points toward the minus Z axis. Since it wants to align itself with the B field, there exists a torque on the magnet along the X axis as shown in Fig. 1. In normal operation of the MCA in a satellite, a satellite position error in the X axis will require the Y axis electro-magnet acting on the Z axis magnetic field and Z axis electro-magnet acting on the Y axis magnetic field to correct it. The MCA computes the required strength (magnetic moment) of the electro-magnets using the measured strength of the external B field relative to the spacecraft and the position error and/or reaction wheel speeds of the satellite.

The MCA's vital function is to control the speeds of the reaction wheels in a satellite to reduce pneumatic gating in the normal operation mode. To correct the reaction wheel speeds in one axis, the MCA will energize the electro-magnet in the second axis in accordance with the magnetic B field in the third axis. For detailed

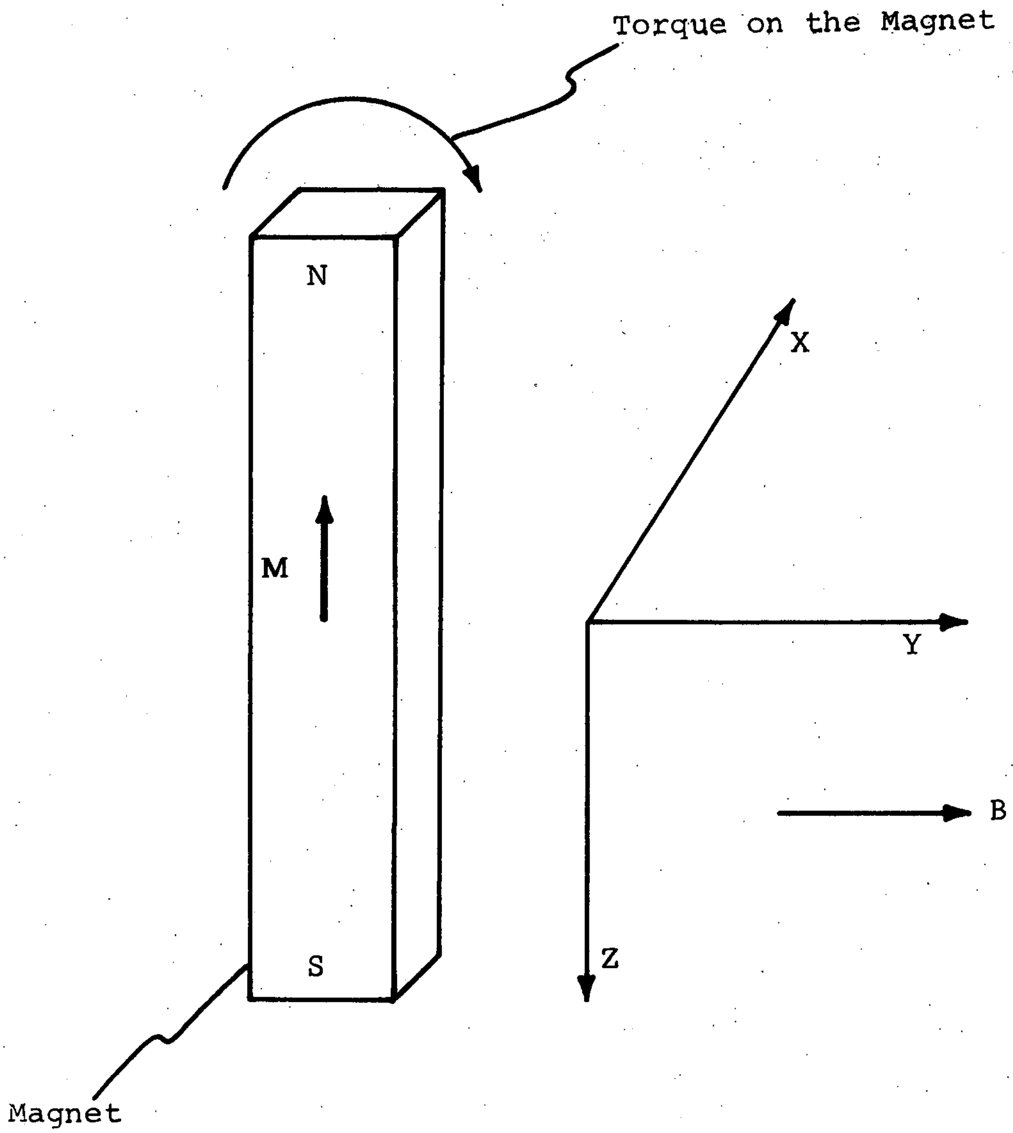


Figure 1

equations and simulations, see MCA's "Design Study Report" by A.C. Stickler, ITHACO, Inc. Report #90559.

1.2.3 Acquisition Mode

The MCA can be used for earth acquisition when the satellite is tumbling after separation from its booster. The acquisition principle is based upon the fact that in normal operation, when the satellite is stable, the external magnetic B field with respect to the satellite is almost constant at the speed the ERTS satellite is orbiting the earth (564 miles orbit height and 103.2 minutes per orbit.)

The derivative of the external magnetic B field, $\dot{B}$ is therefore close to zero. When the satellite is tumbling, the external B fields with respect to the satellite will be changing and their derivative $\dot{B}$ will no longer be zero. In the acquisition mode, the MCA will differentiate the B field input from its magnetometer probe and energize its magnets to create a torque to oppose the vehicle's rotation. Each electromagnet (X, Y, and Z) acts on the $\dot{B}$ of its own axis according to:

$$M_X = -K_1 \dot{B}_X$$

$$M_Y = -K_2 \dot{B}_Y$$

$$M_Z = -K_3 \dot{B}_Z$$

where M is the magnetic dipole moment of the electro-magnets, and K_1, K_2, K_3 are constants.

Example: Let us work in the rotation of a single plane. See Fig. 2

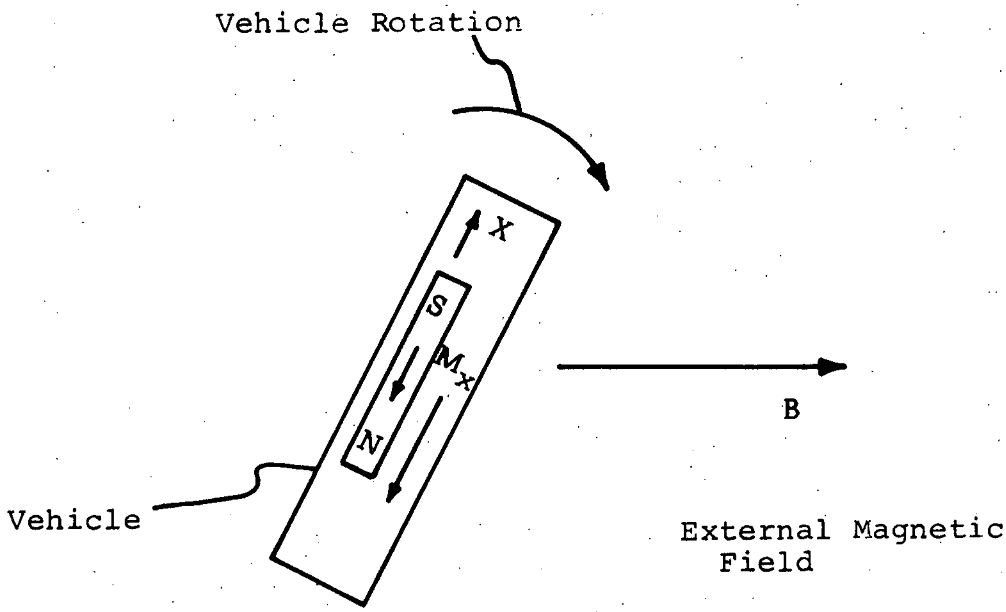


Figure 2

The vehical is tumbling in the direction shown, and there exists an external B field in the direction shown. $\dot{B}_X$ in that direction of rotation is increasing and therefore is positive. Thus according to the equation:

$$M_X = -K_1 \dot{B}_X$$

the X axis electro-magnet will be energized to point in the negative X axis direction as shown in Figure 2. This will create a torque opposite to the direction of the vehicle rotation. This torque will continue until the direction of the vehicle's X, Y, and Z axes with respect to the direction of the external B field (earth's magnetic field) is constant. The acquisition circuit can be commanded off to prevent interference during normal operation.

1.2.4 Operation with Failed Pitch Wheel

If the pitch wheel control fails with the wheel speed at zero, or any constant speed, the spacecraft attitude shall remain within one degree on all axes.

1.2.5 Example of Torque Generated

The Maximum magnetic field in the ERTS orbit is 0.4 gauss and the maximum magnetic moment of each electro-magnet is 5000 p-cm ($.37 \times 10^{-3}$ ft-lb/gauss).

The mass moment of inertia of the ERTS satellite is as follows:

$$I_{roll} = 367 \text{ slug ft}^2$$

$$I_{pitch} = 349 \text{ slug ft}^2$$

$$I_{yaw} = 154 \text{ slug ft}^2$$

The equations involved are:

$$\omega = \alpha t \qquad \text{eq. 1}$$

Angular velocity = angular acceleration times time

$$\bar{\Gamma} = \bar{M} \times \bar{B} \qquad \text{eq. 2}$$

Torque = magnetic moment across the magnetic flux density

and

$$\Gamma = I\alpha \qquad \text{eq. 3}$$

Torque = mass moment of inertia times angular acceleration

Let us say the satellite is tumbling around its yaw axis and the average useable external B field the MCA magnets can act on is .2 gauss and the average magnetic moment generated by the MCA is 500 p-cm or $.37 \times 10^{-3}$ ft-lb/gauss.

How fast can the MCA despin the ERTS satellite that is spinning around its yaw axis at the rate of one revolution per orbit?

$$\Gamma = M \times B = .37 \times 10^{-3} \times .20 \qquad \text{eq. 2}$$

$$\Gamma = I\alpha = 154 \cdot \alpha \qquad \text{eq. 3}$$

$$\alpha = \frac{M \times B}{I} = .4805 \times 10^{-6} \text{ rad/sec}^2 = .0765 \times 10^{-6} \text{ rev/sec}^2$$

$$\omega = \alpha t \qquad \text{eq. 1}$$

for one revolution per orbit

$$\omega = \frac{1}{6192} \text{ rev/sec} \quad \text{(one orbit takes 6192 sec)}$$

$$\omega = \alpha t \rightarrow \frac{1}{6192} = .0765 \times 10^{-6} \times t$$

or $t = 2.11 \times 10^{3}$ sec $\approx$ 35 min.

It will take the MCA approximately 35 minutes or about one third of an orbit to despin the ERTS satellite from an initial velocity of one revolution per orbit in its yaw axis. (This, of course, is a rough calculation, disregarding roll-yaw coupling, reaction wheels, efficiency factors, etc.) For detailed calculation, see ITHACO, Inc., MCA Design Study Report #90559 by A.C. Stickler.

2.0 PHYSICAL CHARACTERISTICS

2.1 Power

The MCA receives its power from a -24.5 volt power supply. Its average current consumption is 100 ma (2.45 watts). Its maximum power will not exceed 5 watts.

2.2 Weight

The total weight of the MCA and the probe is 7.66 pounds with the probe and its connecting wires taking up one pound out of the 7.66 pounds.

2.3 Size

The size of the magnetometer probe is 4.7" X 2.8" X 2.8". See ITHACO Drawing #C31512 in this report.

The size of the Control Logic Assembly of the MCA is roughly 7" X 7" X 7.625." See ITHACO Drawing D41114 in this report.

2.4 Available Moment

The maximum available magnetic moment is 5000 p-cm in each axis.

3.0 APPLICABLE DOCUMENTS

3.1 Publications

a) ITHACO Report No. 90474, "Progress on MCA and present Status," July 24, 1972, A.C. Stickler.

A report on the development of the MCA's control laws, implementation details, and recommendations for further work.

b) ITHACO Report No. 90496, "Status of Magnetic Compensation Assembly (MCA)," August 22, 1972, A.C. Stickler.

This report details the final form of the MCA control laws, details simulated system performance, and summarizes some of the more significant MCA characteristics.

c) ITHACO Report No. 90506, "MCA Signal Polarities and Mounting Information," Sept. 1, 1972, A.C. Stickler.

This report covers proper mounting orientation and coordinates.

d) ITHACO Report No. 90529, "Telemetry for Magnetic Compensation Assembly (MCA)," Sept. 15, 1972, A.C. Stickler to G. Branchflower.

This report requests the allocation of certain telemetry channels for the MCA.

e) ITHACO Report No. 90539, "Disturbance Torques and Parameters for ERTS/MCA Study," Sept. 26, 1972, A.C. Stickler.

This report details a new disturbance torque model to be used for ERTS/MCA simulation work.

f) ITHACO Report No. 90559, "Simulated ERTS Performance with the MCA," October 6, 1972, A.C. Stickler.

This report indicates probable ERTS performance with the MCA on board. The simulated performance reported here is based on an updated disturbance torque model (5) and supercedes performance predictions made in (2). A performance prediction considering the unexplained 44 μft-lbf yaw torque apparently experienced by ERTS A is also included.

g) Memo titled "Backup Magnetic Control System for Nimbus/ERTS," R.Z. Fowler & A.C. Stickler to Seymor Kant, Feb. 15, 1972.

This memo proposes and details the original concept of the MCA. It describes the proposed system, its modes of operation, major characteristics and control laws.

h) ITHACO Report No. 90420, "Performance of Nimbus/ERTS MCA," April 25, 1972, A.C. Stickler.

This report contains preliminary performance predictions.

i) ITHACO Report No. 90429, "Control Laws for Proposed MCA for Nimbus," May 5, 1972, A.C. Stickler.

This is a developmental report on MCA control laws.

j) ITHACO Report No. 90505, "MCA and Schonstedt's Magnetometer Mounting Orientations," August 30, 1972, R. Shen.

k) ITHACO Report No. 90506, "MCA Signal Polarities and Mounting Information," Sept. 1, 1972, A.C. Stickler.

l) ITHACO Report No. 90526, "Thermal Vacuum Test Plan for the Qualification Model MCA (MCA Prl)," Sept. 18, 1972, R. Shen.

m) ITHACO Report No. 90548, "Qualification Test Report MCA (Includes Vibration Test Plan and Vibration Levels)," October 5, 1972, R. Fleming.

B

3.2 Drawings

DRAWING TITLE	DRAWING NO.
Miscellaneous Drawings	
a. Major Assy	D41105-G1
b. Parts List for	D44105-G1(A)
c. Outline	D41114(A)
d. Block Diag.	F50030(B)
e. Pin Assign Diag	D41094(B)
f. Drawing Tree	B22039
g. Wire Diag. Harn	C31546
h. Assy Harn & P.L.	C31545-G1
i. Sensor Unit Outline	C31512-P1
j. Flow Plan	D41123
Pitch/Roll Module	
a. Elem Diag	C31514(E)
b. PWB Assy	D41101-G1(C)
c. Parts List for	D41101-G1(C)
d. PWB Detail	D41101-P1(B)
e. Module Assy	D41086-G1(A)
f. Parts List for	D41086-G1(A)
g. PWB Control	C88195-G1(A)
h. Frame	D41085-P1 & P2(A)
Control Module	
a. Elem Diag	F50027(A)
b. PWB Assy	D41098-G2
c. Parts List for	D41098-G2
d. PWB Detail	D41098-P1
e. Module Assy	C31532-G2
f. Parts List for	C31532-G2
g. PWB Control	D88188
h. Frame	D41107-P1
Power Supply Module	
a. Elem Diag	D41115(A)
b. PWB Assy	D41097-G2(A)
c. Parts List for	D41097-G2(A)
d. PWB Detail	D41097-P1(A)
e. Module Assy	C31531-G2
f. Parts List for	C31531-G2
g. PWB Control	C88189(A)
h. Frame	D41108-P1(A)

Yaw Module

a. Elem Diag	F50026(B)
b. PWB Assy	D41096-G1(A)
c. Parts List for	D41096-G1(A)
d. PWB Detail	D41096-P1
e. Module Assy	D41093-G1(A)
f. Parts List for	D41093-G1(A)
g. PWB Control	C88190
h. Frame	D41092-P1
i. Plate	C31511-P1
j. Cover	C31508-P1
k. Connector Assy	B22032-G1
l. Parts List for	B22032-G1
m. PWB Detail	B22032-P1

Spec Control, Selected & Altered Items

a. Transformer (S.C.)	C88118-P2(A)
b. Transistor (S.I.)	A86089-P1 & P2(A)
c. Screwlock (A.I.)	A86088-P1

Miscellaneous Mechanical Details

a. Base Plate	C31509-P1
b. Label, Module	A11183-P1
c. Shield	B21957-P1
d. Cover, Silkscreen	C31547-P1
e. Cover	C31458-P1
f. Cover, Basic	C31479-P1(B)
g. Label	A11270-P1
h. Spacer	A11149-P13
i. Dust Cover	A11218-P1, P5 & P6
j. Dust Cover, Basic	B21989-P1 & P2
k. Frame, Basic	D41017-P1(B)

Magnet & Magnetometer Module

a. Magnet Assy & P.L.	C31520-G1
b. Lamination	A11231-P1
c. Mounting Block	B21993-P1(A)
d. Control Mgt Mtr Module	SKC00352(A)
e. Frame	D41065-P1

4.0 CHRONOLOGICAL EVENTS

4.1 Planned Test Sequence

The Qualification Model MCA testing included in-process, acceptance, and environmental acceptance tests in accordance with GSFC Environmental Test Specification S-320-EN-1. The planned chronological sequence was as follows:

Card Tests: ITHACO, In Process Test Procedure (ITPS) at room temperature

System Trim test: ITHACO, In Process Test Procedure (ITPS) at room temperature

Acceptance test: System test at room temperature

Vibration test

Thermal Vacuum Test: -5°C and 50°C temperature cycles. Acceptance tests were performed during the temperature plateaus

All acceptance test data was compiled in a separate "Data Summary" section in this report. Tolerances for each result were specified. Any result not within the specified tolerance in the data summary was then discussed in ITHACO Problem Reports. Failures were reported on GSFC Malfunction Report forms.

4.2 Chronological Summary

Date	Event
8-25-72	Card fabrication completed
8-30-72	Card tests finished
9-1-72	Intercard harness fabrication completed
9-9-72	Finished pre-system test trim
9-14-72	Successfully completed system test, ATPS 1105. The roll and yaw electro-magnet leads were switched around for proper polarity.
9-25-72	Final assembly of MCA
9-27-72	Successfully completed vibration test ATPS 1106 at GSFC (ITHACO Report No. 90548, Qual Test for MCA)

10-6-72	Successfully completed Qual level Thermal Vacuum test ATPS 1107 (ITHACO Report No. 90526, Thermal Vac Test Plan).
10-10-72	MCA was taken apart for inspection after Environmental test. All parts were satis-tory.

5.0 PROBLEM REPORT SUMMARY

Report Number	Problem
11-101	The ±10 volt voltage regulation capacitors C10 and C15 on the A4 card were slightly stressed during a power turn on with no load attached to the ±10 volts. These are 22μf +15 volt capacitors (rated 20 volt peak voltage). When power was turned on with no load, they were stressed at 16.5 volts for a duration of about two minutes. The recommendation was use as is for this Qual Model. The C10 and C15 on the Elem Diagram of this report has been up-dated to 20V capacitors to be used on future flight cards.
11-102	A resistor R30 of the Yaw card was changed to give proper Telemetry gain voltage.
11-103	Due to a slight electrical offset, the MCA will unload the Yaw wheel speed to around +20 to 62RPM (depending on temperature) rather than to zero RPM. This does not present any problem.
11-104 and 11-105	The Q1 dual FETs of the Yaw card used a variable resistors are more sensitive to temperature than others. Thus at -5°C the Roll Magnet moment vs Pitch Wheel speed gain is increased by 21.8% (spec ±20%). Similarly at +50°C, the Roll magnet moment vs Yaw wheel speed gain is decreased by 25% (spec ±20%). A gain change of this order at extreme temperatures will not affect the MCA performance appreciably.

6.0 LOG BOOK SUMMARY

The Running Time of the MCA System as of 10-7-72 is 249 hours and 53 minutes.

The connector mate/demate history as of 10-12-72 is as shown below:

Card	Connector	Mated	Demated
A1	J1	8	8
A1	J1	5	5
A2	J1	7	7
A2	J2	3	3
A3	J2	1	1
A3	J3	6	6
A3	J4	5	5
A4	J1	6	6
A4	J2	5	5
A4	J3	6	6
A4	J4	7	7
A5	J1	8	8

7.0 MALFUNCTION REPORT (MR) SUMMARY MCA

MR No.	Card	Name	Description
D07183	15034	Power Supply	A short circuit was detected on a 2N2907A transistor from base to collector (the case). This was caused by a solder bridge formed during soldering of the device. This was an isolated occurance. Recent redesign of the Power Supply board to provide stress relief by means of off pad soldering will eliminate any future occurance on subsequent units.

8.0 VIBRATION AND THERMAL VACUUM TESTS

8.1 Vibration

The vibration levels for the MCA Control Logic Assembly and the Magnetometer Probe are shown in the tables on the following two pages. The vibration specifications are according to NASA's environmental test specification S-320-EN-1 (November, 1971). The MCA went through the vibration test successfully. (See ITHACO Report No. 90548 for details.)

MCA Control Logic Assembly
Vibration levels according to S-320-EN1, Nov. 1971

SINUSOIDAL

Frequency Range (cps)	Amplitude - "g" 0-to-Peak	
	Thrust Axis	Transverse Axes
5-40	8.0*	6.0*
40-200	10.0	18.0
200-2000	5.0	5.0

*Vibration limited to 1/2" double amplitude.
Sweep Rate: 1 octave/minute.

RANDOM

Direction	Frequency Range (cps)	Power Spectral Density (g^2/cps)	g-RMS
Thrust Axis	20-2000	0.09	13.4
Transverse Axes	20-2000	0.09	13.4

The duration of the test shall be 4 minutes in each direction -- 12 minutes total.

Magnetometer Probe
Vibration levels according to S-320-EN1, Nov. 1971

SINUSOIDAL

Frequency Range (cps)	Amplitude - "g" O-to-Peak	
	Thrust Axis	Transverse Axes
5-100	15.0*	15.0*
100-200	10.0	10.0
200-2000	5.0	5.0

*Vibration limited to 1/2" double amplitude.
Sweep Rate: 1 octave/minute.

RANDOM

Direction	Frequency Range (cps)	Power Spectral Density (g^2/cps)	g-RMS
Thrust Axis	20-2000	0.09	13.4
Transverse Axes	20-2000	0.09	13.4

The duration of the test shall be 4 minutes in each direction -- 12 minutes total.

8.2 Thermal Vacuum

The MCA CLA went through the Thermal Vacuum Test cycle successfully and the temperature cycle profile is according to the NASA specification S-320-EN-1. (See Figure 3) The vacuum level was 10^{-5} mm Hg or less.

The magnetometer probe was cycled between -20°C and 80°C at atmostpheric pressure as shown in Figure 3. The acceptance system test (ATPS 1105) for the MCA was run twice, once during the high temperature plateau and once during the low temperature plateau. (See Figure 3)

At the places where "*"'s are marked in Figure 3, the magnetometer probe received a fixed on off magnetic field to test the effect of temperature on the probe.

9.0 RELIABILITY AND QUALITY ASSURANCE (R&QA) SUMMARY

9.1 R&QA Plan

The MCA qualification unit, PR1, fabrication was controlled by procedures outline in the ITHACO Quality Control Manual ITHACO Report No. 90399 dated March 1972. The QC Manual meets the requirements of MIL-Q-9858A.

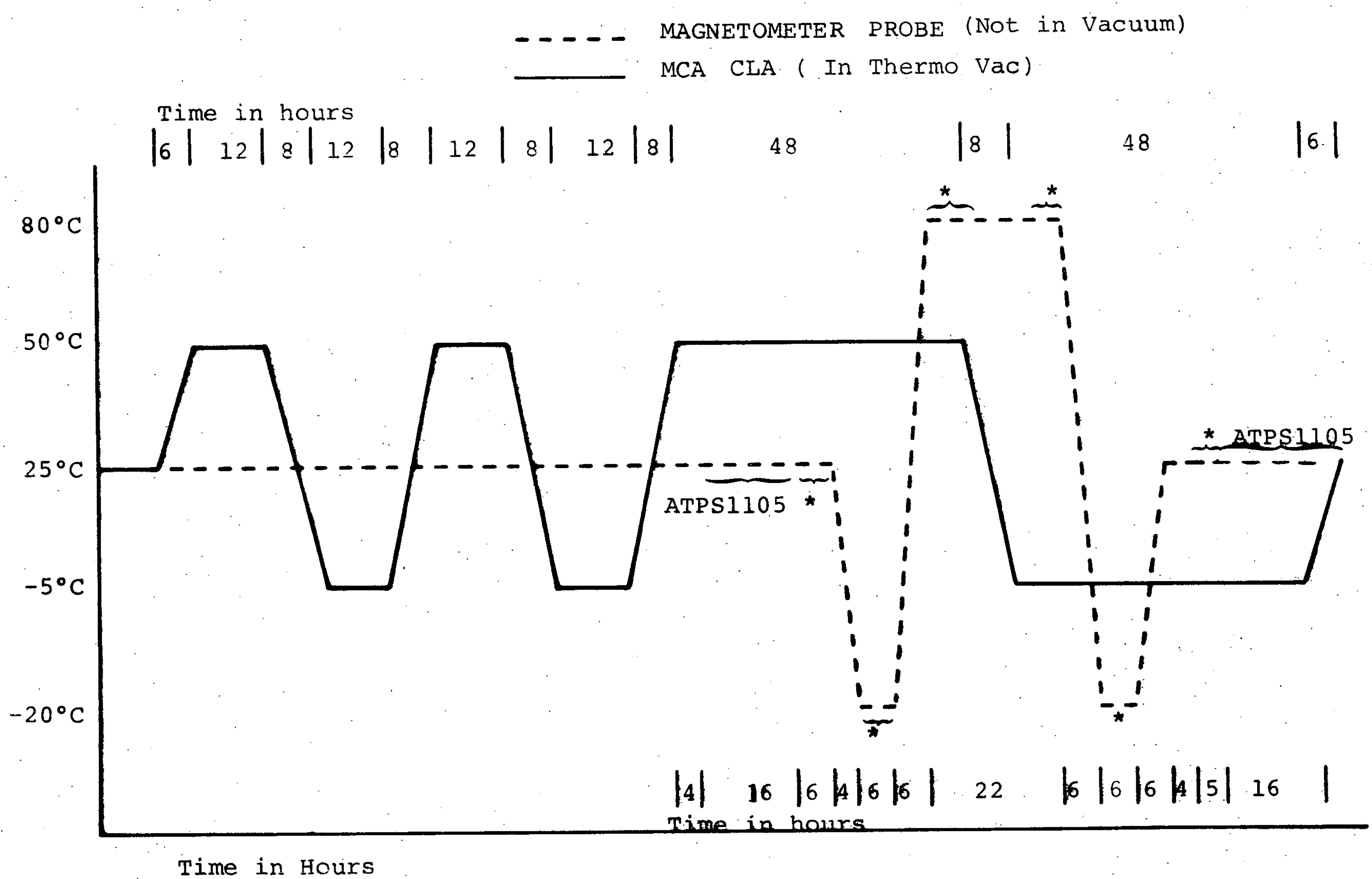
The primary functions served by Quality Assurance were incoming test and inspection, in process inspection, monitoring of acceptance and environmental testing, and data review and approval. Quality assurance also served on MRB actions and coordinated malfunction reporting.

9.2 Implementation

Control of materials and workmanship was performed in accordance with ITHACO Incoming Test and Inspection Procedures (ITPS 11 series), Manufacturing Operation Procedure, Space Systems (MOPS 30 series), and R&QA Procedures for Space Systems (RQPS 15 series) as per Flow Plan D41123.

The Triaxial Magnetometer C31512P1 S/N 15062 (Schonstedt Model SAM-63B-7) electronics module and probe was supplied by Schonstedt Instrument Company, Reston, Va. Control was by means of procurement document ITHACO Report No. 90362 and incoming inspection at ITHACO.

One Malfunction in the MCA CLA, a shorted JANTX 2N2907A in the Power Supply, was reported. Failure analysis revealed a solder bridge apparently formed during



MCA & MAGNETOMETERS TEMPERATURE TEST
PROFILE

*See Para 8.2

Fig. 3

installation of the device. Redesign of the printed wiring board to provide stress relief by means of off pad soldering will preclude recurrence.

9.3 Qualification

The MCA Qualification unit, MCA PR1, was subjected to Qualification Vibration levels as described in ITHACO Report #90548. The unit was also subjected to Qualification Thermal Vacuum as indicated in paragraph 8.2. A thorough visual examination performed subsequent to Qualification testing confirmed that no degradation had occurred.

Additional Environmental History on the Triaxial Magnetometer was supplied by Schonstedt in a letter from C. Upton to V. Selby dated Sept. 28, 1972.

10.0 FABRICATION SUMMARY

All P.C. boards were fabricated by ITHACO, Inc. All frames were made by Lansing Research Co. except for the A1 frame which was machined by Kolar's Machine shop. Covers were manufactured by Lansing Precision Tool Co.

During P.C. board assembly, MOPS 30.3 was revised to implement off pad soldering techniques. Two of the P.C. boards, Yaw card and A5 Pitch/Roll card, were fabricated to use off pad soldering but time did not permit a new layout of A3 Control card and A4 Power Supply card. These latter P.C. boards were assembled using off pad soldering on a standard board. This was done by cutting off transistor I.C. solder pads and bending the leads onto the runs and soldering. All feed through and component leads used as feed throughs were soldered off pad on the wire side, the same as transistor leads.

Frames and covers were iridited and painted at ITHACO and the frames were silk screened by Thompson Co. Cover markings were applied with press on lettering at ITHACO.

Harness fabrication was to MOPS 30.38 using 24 gauge wire Raychem specification #44 and Cannon Burgundy type connectors.

Magnet fabrication was per MOPS 30.40. The magnet material is Alloy 48, .014" thick, ground to size at Kolar's Machine shop, and heat treated to MOPS 30.25B at Owego Heat Treat, Inc. Fifteen layers of #30 Heavy Formvar magnet wires were used around each magnet.

11.0 SUBCONTRACTORS

Schonstedt Instrument Co. 1775 Wiehle Avenue Reston, Va. 22070	Magnetometer Probe and A2 card
Thompson Co. 85 Eldrege St. Binghamton, N.Y. 13900	Silk Screening
Owego Heat Treat, Inc. Marshland Rd. Appalachian, N.Y. 13732	Heat treating magnet laminations
Kolar's Machine Shop 407 Cliff Street Ithaca, N.Y. 14850	Grinding laminations
Lansing Research Co. 705 Willow Avenue Ithaca, N.Y. 14850	Machining Frames
Lansing Precision Tool Co. 1191 Warren Road Ithaca, N.Y. 14850	Machining Covers

12.0 CONFIGURED ARTICLE LIST

(See next page)

CONFIGURED ARTICLE LIST

PROGRAM MCA

COMPONENT MCA Qual

DATE 10-6-72

ITHACO INC
735 W. CLINTON ST.,
ITHACA, N.Y. 14850

INDENTURED ITEM NO.				NAME	PART NO.	SERIAL NO.	MRB	ECP	REMARKS
1	2	3	4						
1				Major Assy	D41105-G1	PR1			
	1			A1 Yaw Mod.	D41093-G1	15033			
	2			A2 Mag. Mod.	SKC00352	4493			
	3			A3 Cont. Mod.	C31532-G1	15035			
	4			A4 Pwr. Sup.	C31531-G1	15034			
	5			A5 Pitch/Roll	D41086-G1	15037			
	6			Harness Assy	C3154-G1				
	7			Cover	C31547-P1				
	8			Base Plate	C31509-P1				
	9			Shield	B21957-P1				
	10			Spacer	A11149-P13				
	11			Magnetometer Probe	C31512	15062			
	12			Magnets Yaw	C31520	15030			
	12			Magnets Roll	C31520	15028			
	12			Magnets Pitch	C31520	15029			

Report #90569
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13.0 DATA SUMMARY

See following pages:

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	XY PLOT NO.	ROOM	50°C	-5°C
Power	Current from -24V supply with inputs grounded	100 ±20ma				100ma	100ma	100ma
+10V		+10.0 ±5V				10.238	10.120V	10.243V
-10V		-10.0 ±5V				-10.285 V	-10.178 V	-10.271 V
Temp TLM	MCA CLA	Room =-1± .2V		A4J2-9		-1.037V		
		50°C =-.39±.08V		A4J2-9			-.349V	
		-5°C=-3.36±.7V		A4J2-9				-2.997V

PROCEDURE NO. ATPS 1105 S/N MCA DATE 10-18-72 PAGE 1

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	XY PLOT NO.	ROOM	50°C	-5°C
Power on TLM		-7.8 ±1V		A4J2-14		7.807	-7.870V	-7.855V
Power off TLM		0 ±5mV		A4J2-14		+1mV	+1mV	+1mV
Acquisition On TLM		-6.0 ±1V		A4J2-10		-6.481V	-6.436V	-6.470V
Acquisition Off TLM		0 ±5mV		A4J2-10		+1mV	0mV	-1mV
Roll Magnet	+Moment saturation 575 P-cm/V	+5000±1000p-cm		A1J1-12	6.5.2	-7.647 +4397p-cm	-7.827V +501 p-cm	-7.422V +4267p-cm
	-Moment saturation 575 p-cm/V	-5000±1000p-cm		A1J1-12	6.5.2	+8.526V -4902p-cm	+8.602V -4946p-cm	+8.431V -4848p-cm
Yaw Magnet	+Moment saturation 615 p-cm/V	+5000±1000p-cm		A1J1-4	6.5.15	-7.588V +4667p-cm	-7.744V +4763p-cm	-7.463V +4590p-cm
	-Moment saturation 615 p-cm/V	-5000±1000p-cm		A1J1-4	6.1.15	+8.499V -5227p-cm	+8.569 -5270p-cm	+8.430V -5184p-cm
Pitch Magnet	+Moment saturation 607 p-cm/V	+5000±1000p-cm		A1J1-10	6.5.22	-7.727V +4690p-cm	-7.898V +4794p-cm	-7.587 +4605p-cm
	-Moment saturation 607 p-cm/V	-5000±1000p-cm		A1J1-10	6.5.22	+8.561V -5197p-cm	+8.652V -5252p-cm	+8.469V -5141p-cm

PROCEDURE NO. ATPS1105 S/N MCA PR1 DATE 10-18-72 PAGE 2

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	XY Plot No.	ROOM	+50°C	-5°C
Offsets								
Mψ TLM for Mψ = 0		-3.7±.7V	A1J1-4	A1J1-3	6.5.17	-3.70V	-3.70V	-3.63V
M φTLM for Mφ = 0		-3.7±.7V	A1J1-12	A1J1-11	6.5.3	-3.70V	-3.86V	-3.67V
Mθ TLM for Mθ = 0		-3.7±.7V	A1J1-10	A1J1-9	6.5.10	-3.70V	-3.73V	-3.7V

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PROCEDURE NO. ATPS 1105 S/N MCA DATE 10-18-72 PAGE 3

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	XY PLOT	ROOM	50°C	-5°C
Offsets	Inputs not mentioned are at null							
Mψ Yaw Moment	+Bθ = +.1 gauss	±.68v		A1J1-4	6.5.36	.00volt	-.40v	.00v
	-Bθ = -.1 gauss	±.68v		"	6.5.35	.00v	-.65v	-.05v
	+Bϕ = +.25 gauss	±1.7v		"	6.5.21	-.1v	+1.5v	-.05v
	-Bϕ = -.1 gauss	±.68v		"	6.5.19	+.05v	-.30v	.00v
	-Bϕ = +.1 gauss	±.68v		"	6.5.20	-.05v	+.80v	-.05v
	Roll diff tach +75RPM	±.85v		"	6.5.34	.00v	-.55v	.00v
	Pitch θ = .75°	±.85v		"	6.5.15	.00v	-.20v	.00v
	Pitch wheel tach +75RPM	±.85v		"	6.5.16	.00v	+.07v	.00v
	All Inputs at null	±300mv		"	Offset Test	-18mv	-47mv	-20mv

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PROCEDURE NO. ATPS 1105 S/N MCAPR1 DATE 10-10-72 PAGE 4

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITHACO

ITH-200

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC		OUTPUT	XY PLOT	ROOM	50°C	-5°C
Offsets	Inputs not mentioned are at null							
Mφ Roll Moment	+Bθ = +.1 gauss	±68v		A1J1-12	6.5.33	-.45v	-.20v	-.40v
	-Bθ = -.1 gauss	±.68v		"	6.5.32	+.45v	-.90v*	+.05v
	+Bψ = +.25 gauss	±1.7v		"	6.5.5	.10 v	-.60v	.00v
	+Bψ = +.1 gauss	±.68v		"	6.5.6	.12 v	-.2v	.00v
	-Bψ = -.1 gauss	±.68v		"	6.5.7	.05v	+.43v	.00v
	Pitchθ = .75°	±.85v		"	6.5.1	.00v	+.10v	.00v
	Yaw wheel tach 75 RPM	±.85v		"	6.5.31	.00v	+.20v	.00v
	Yaw Rate $-.75\times10^{-3}$ deg/sec	±.85v		"	6.5.30	.00v	+.40v	+.05v
	All Inputs at null	±300mv		"	Offset Test	+8mv	-4mv	+8mv

* PR 11-103 C

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PROCEDURE NO. ATPS 1105 S/N MCA PR1 DATE 10-10-72 PAGE 5

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC		OUTPUT	XY PLOT	ROOM	50°C	-5°C
Offsets	Inputs not mentioned are at null			1				
Mθ Pitch Moment	+Bψ= -.25 gauss	±1.7v		A1J1-9	6.5.11	-.15v	+.15v	+.70v
	+Bψ= +.25 gauss	±1.7v		"	6.5.12	+.30v	+1.0v	+.00v
	-Bψ =							
	-Bϕ = +.1 gauss	± .68v		"	6.5.26	+.45v	+1.1v*	+.20v
	-Bϕ = +.25gauss	±1.7 v		"	6.5.27	+1.1v	+2.2v*	+.50v
	-Bϕ = -.25gauss	± 1.7 v		"	6.5.24	-1.0v	-1.0v	-.9v
	-Bϕ = -.1 gauss	± .68 v		"	6.5.25	-.40v	-.40v	-.5v
	Yaw wheel tach +75RPM	±.85 v		"	6.5.23	.0v	+.40v	-.05v
	Yaw wheel tach -75RPM	±.85 v		"	6.5.[illegible]	.0v	+.60v	-.08v
	Yaw Rate $-.75X10^{-3}$ deg/sec	±.85 v		"	6.5.22	.00v	-.15v	-.10v
	Roll wheels diff tach +75RPM	±.85 v		"	6.5.8	.00v	+.05v	+.50v
	Roll wheels diff tach -75RPM	±.85 v		"	6.5.9	.00v	+.20v	+.60v
	All Inputs at Null	±300mv		"	Offset Test	-25mv	+216mv	-102mv

* PR11-103 Rev B

PROCEDURE NO. ATPS 1105 S/N MCA PR1 DATE 10-10-72 PAGE 6

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	DATA SHEET	ROOM	50°C	-5°C
<u>Gain</u>								
Mφ vs Bψ	0.75° pitch	-5.12±1.0v/v	10v/ gauss	A1J1-12	XY-1	-5.18 V/V	-4.35 V/V	-5.55 V/V
	75 RPM pitch tach	+2.33± .6v/v			XY-2	+2.80 V/V	+2.35 V/V	+2.61 V/V
MφTLM vs Mφ		0.286± .02v/v	A1J1-12	A1J1-11	XY-3	+0.284 V/V	+.284 V/V	+.283 V/V
Mφ vs θ	Bψ= -0.25 gauss	171±30 v/v	A3J3-8	A1J1-12	XY-4	+200 V/V	+161 V/V	+192 V/V
Mφ vs δωθ	Bψ= + 0.25 gauss	67.7 ±13v/v	A3J3-4	A1J1-12	XY-5	+75 V/V	+63.5 V/V	+79 V/V
	Bψ = + 0.1 gauss	27.1 ±5 v/v			XY-6	+28.5 V/V	+25.0 V/V	+33.0 V/V*
	Bψ = - 0.1 gauss	-27.1 ±5 v/v			XY-7	-30.8 V/V	-27.2 V/V	-28.6 V/V
Mθ vs Bψ	75RPM diff tach	+1.2 ± .3v/v	10v/ gauss	A1J1-10	XY-8	+1.18 V/V	+1.41 V/V	+1.11 V/V
	-75 RPM diff tach	-1.2 ± .3 v/v			XY-9	-1.30 V/V	-1.0 V/V	-1.42 V/V
Mθ TLM vs Mθ		0.286± .02 v/v	A1J1-10	A1J1-9	XY-10	+.281 V/V	+.282 V/V	+.280 V/V
Mθ vs δωφ	Bψ = -0.25 gauss	-16.5 ±3.3 v/v	A3J3-1	A1J1-10	XY-11	-17.1 V/V	-16.1 V/V	-17.4 V/V
	Bψ = 0.25 gauss	16.5 ±3.3v/v			XY-12	+17.2 V/V	+16.4 V/V	+16.4 V/V
Yaw Acquisition	$\dot{B}$ >0, 2000p-cm Y=3.42v 0°C 25°C 45°C	0.272 ±.04v 0.235 ±.04v 0.204 ±.04v	1mgauss / sec-volt	A1J1-4	XY-13	+.241v	+.192v	+.308 V/V
	saturation 0°C 25°C 45°C	0.311 ±.05v 0.273 ±.04v 0.242 ±.04v				+.268v	+.226v	+.335v

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PROCEDURE NO. ATPS 1105 S/N MCA PR1 DATE 10-10-72 PAGE 7

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

*PR11-104

T R E N D   C H A R T

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	DATA SHEET	ROOM	50°C	-5°C
Yaw Acquisition	B < 0, 2000p-cm Y=3.42v 0°C	-0.272 ±.04v			XY-14			-.310 v
	25°C	-0.235 ±.04v				-.253 v		
	45°C	-0.204 ±.04v					-.190 v	
	saturation 0°C	-0.311 ±.05v						-.330 v
	25°C	-0.273 ±.04v				-.279 v		
	45°C	-0.242 ±.04v					-.225 v	
MΨ vs B φ	θ= 0.75°	+5.12 ±1.0v/v	10 v/ gauss	A1J1-4	XY-15	+5.10 v/v	+4.4 v/v	+5.56 v/v
	75 RPM pitch tach	-2.33 ± .6v/v			XY-16	-2.62 v/v	-2.25 v/v	-2.8 v/v
MΨTLM vs MΨ		0.286± .02v/v	A1J1-4	A1J1-3	XY-17	+.280 v/v	.280 v/v	.285 v/v
MΨ vs θ	Bφ = -0.25 gauss	-171 ±30 v/v	A3J3-8	A1J1-4	XY-18	-191.3 v/v	-160 v/v	-186 v/v
MΨ vs δωθ	Bφ = -0.1 gauss	+27.1± 5 v/v	A3J3-4	A1J1-4	XY-19	+28.9 v/v	+30 v/v	+29.2 v/v
	Bφ = 0.1 gauss	-27.1 ±5 v/v			XY-20	-29.0 v/v	-26 v/v	-28.6 v/v
	Bφ = 0.25 gauss	-67.7±13 v/v			XY-21	-74.4 v/v	-70 v/v	-75 v/v
M θvs Bφ	-0.00075°/sec yaw rate	+4.26± .9v/v	10v/ gauss	A1J1-10	XY-22	+4.57 v/v	+5.0 v/v	+4.3 v/v
	75 RPM yaw tach	-1.17± .3v/v			XY-23	-.766 v/v, +1.58 v/v	-.472 v/v, +1.82 v/v	-.90 v/v, +1.5 v/v
Mθvs Yaw Rate	Bφ = -0.25 gauss	-112±22v/v	A3J3-9	A1J1-10	XY-24	-116 v/v	-115 v/v	-115 v/v
Mθvs Yaw Tach	Bφ = -0.1 gauss	+7.07±1.4v/v	A3J3-5	A1J1-10	XY-25	+6.92 v/v	+7.3 v/v	+6.8 v/v
	Bφ = +0.1 gauss	-7.07±1.4v/v			XY-26	-7.42 v/v	-7.2 v/v	-6.9 v/v
	Bφ = +0.25 gauss	-17.7±3.5v/v			XY-27	-18.2 v/v	-17.8 v/v	-17.9 v/v

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PROCEDURE NO. ATPS 1105 S/N MCA PR1 DATE 10-10-72 PAGE 8

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITH-200

**PR11-103

TREND CHART

FUNCTION	TEST CONDITIONS	SPEC	INPUT	OUTPUT	DATA SHEET	ROOM	50°C	-5°C
Roll Acquisition	$\dot{B}$ >0, 2000p-cm Y = 3.42v 0°C	1.129± .17v	1mgauss / sec volt	A1J1-12	XY-28			+1.27v
	25°C	0.953± .14v				+.950v		
	45°C	0.812± .12v					+.73v	
	saturation 0°C	1.305± .20v						+1.39v
	25°C	1.129± .17v				+1.09v		
	45°C	0.988± .15v					+.88v	
	$\dot{B}$ <0, 2000p-cm Y = 3.42v 0°C	-1.129± .17v			XY-29			-1.26v
	25°C	-0.953± .14v				-.98v		
	45°C	-0.812± .12v					-.74v	
	saturation 0°C	-1.305± .20v						-1.37v
	25°C	-1.129± .17v				-1.10 v/v		
	45°C	-0.988± .15v					-.89 v/v	
Mφ vs Bθ	-0.00075°/sec Yaw rate	-4.26± .9v/v	10v/ gauss	A1J1-12	XY-30	-4.59 v/v	-4.7 v/v	-4.7 v/v
	75 RPM Yaw tach	+1.17±.3v/v			XY-31	+.736 / -1.554 v/v	+.45 v/v / -1.67	+.88 / -1.57 v/v
Mφvs Yaw Rate	Bθ = -0.1 gauss	+44.9±9v/v	A3J3-9	A1J1-12	XY-32	+46.2 v/v	+44.8 v/v*	+43.5 v/v
Mφvs yaw tach	Bθ = +0.1 gauss	+7.07±1.4v/v	A3J3-5	A1J1-12	XY-33	+6.3 v/v	+5.3 v/v**	+7.8 v/v
Mψ vs Bθ	75RPM Diff Tach	-1.20± .3 v/v	10v/ gauss	A1J1-4	XY-34	-1.23 v/v	-.97 v/v	-1.25 v/v
Mψvs Diff Tach	Bθ = -0.1 gauss	6.58±1.3 v/v	A3J3-1	A1J1-4	XY-35	6.78 v/v	+6.0 v/v	+6.4 v/v
	Bθ = 0.1 gauss	-6.58±1.3 v/v			XY-36	-6.24 v/v	-5.4 v/v	-6.5 v/v
Pitch Acquisition	$\dot{B}$> 0, 2000 p/m Y = 3.42v 0°C	1.082± .16v	1mgauss / sec-volt	A1J1-10	XY-37			+1.17v
	25°C	0.931± .14v				+.93v		
	45°C	0.810± .12v					+.71	

PROCEDURE NO. ATPS 1105 S/N MCA PR1 DATE 10-10-72 PAGE 9

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

TE-200

*PR11-103 **PR11-105

TREND CHART

FUNCTION	TEST CONDITIONS		SPEC			DATA SHEET	ROOM	50°C	-5°C
Pitch Acquisition	saturation	0°C	1.233± .18v			XY-37	+1.055v	+.85v	+1.26v
		25°C	1.082± .16v						
		45°C	0.961± .14v						
	B. < 0, 2000 p/m	0°C	-1.082± .16v			XY-38	-.94v	-.73v	-1.18v
	Y= -3.42v	25°C	-0.931± .14v						
		45°C	-0.810± .12V						
	saturation	0°C	-1.233± .18v				-1.040v	-.85v	-1.28v
		25°C	-1.082± .16v						
		45°C	-0.961± .14v						

PROCEDURE NO. ATPS1105 S/N MCA DATE 10-10-72 PAGE 10

COMPONENT MCA PERFORMED BY RS APPROVED BY RS

ITPS 1108, Para 6.1
ITHACO, Inc. Qual Model
MCA Electromagnets

Dipole moment vs voltage
post conformal coating

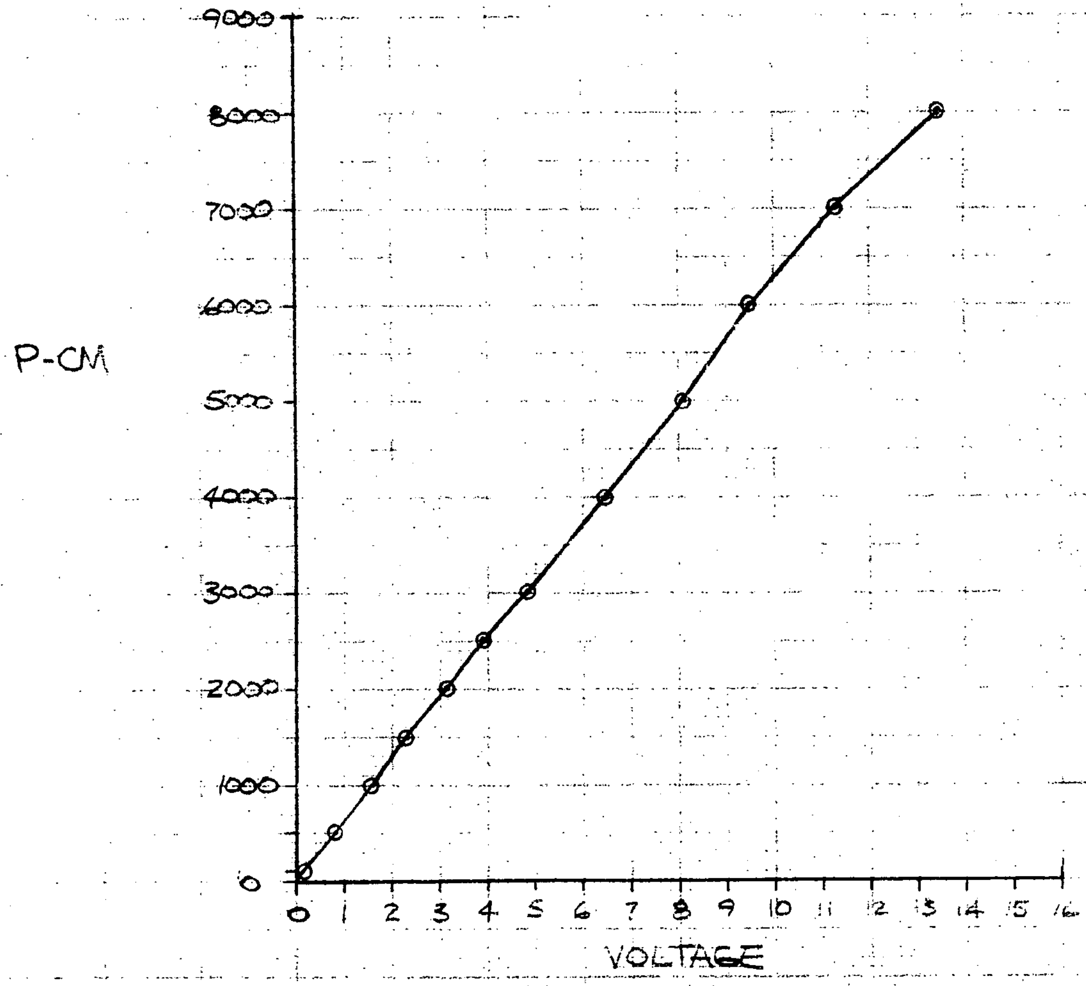
Axis YAW

S/N 15030

Date: 7-24-72

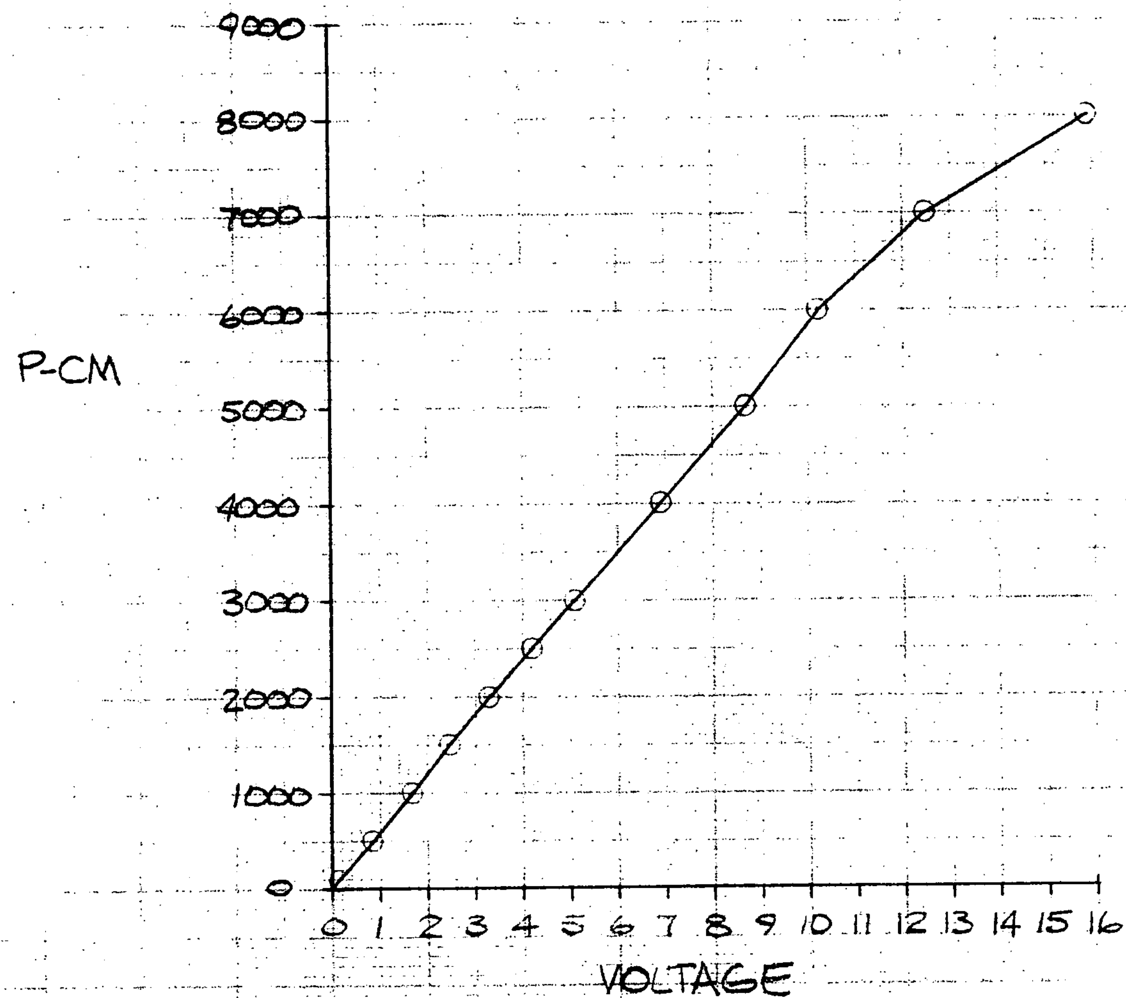
Temp: 22°C

Performed by: K. Kabelac



YAW

615 P-CM/V



ROLL

ITPS 1108, Para 6.1

ITHACO Inc. Qual Model

MCA Electromagnets

Dipole moment vs voltage

Post conformal coating

Axis ROLL

S/N 15028

Date: 7-24-72

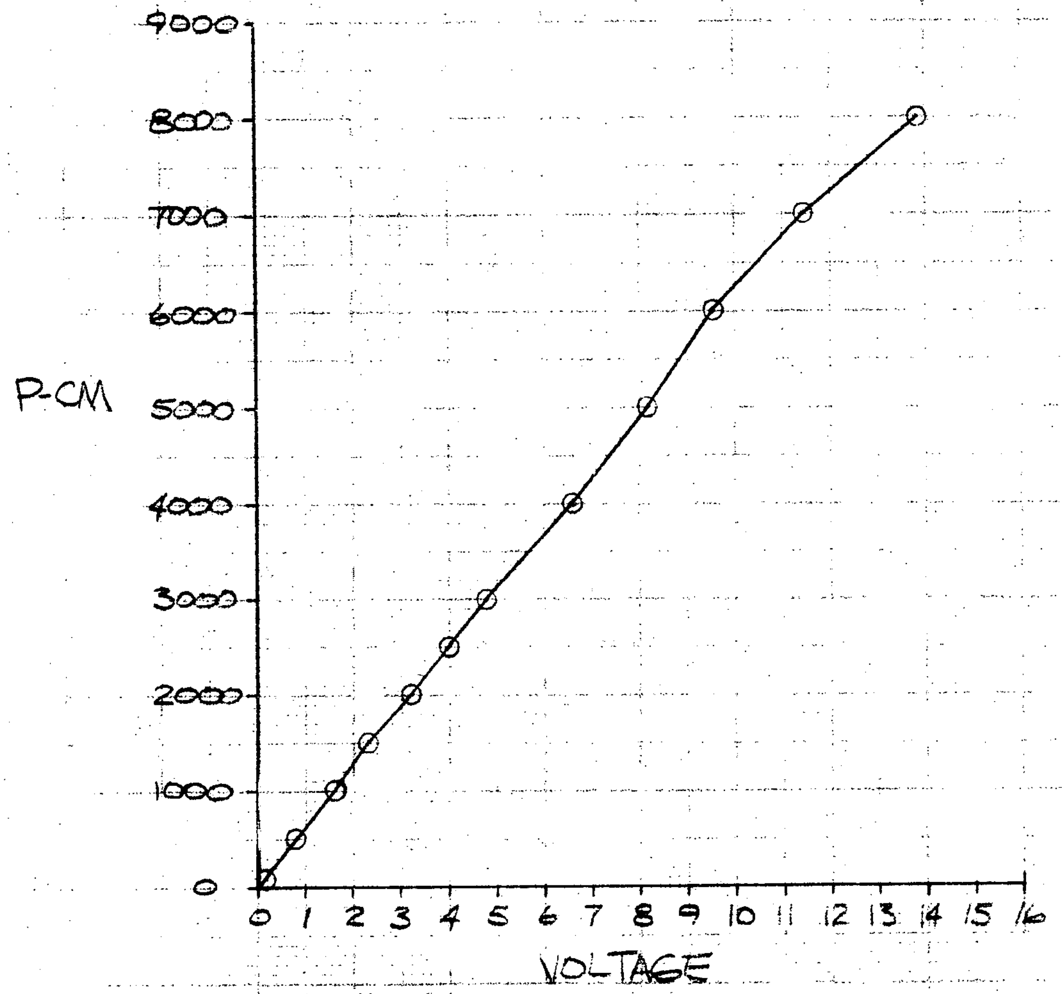
Temp: 22°C

Performed by: K. Kabelac

KS

12

575 P-cm/V



PITCH

ITPS 1108, Para 6.1
ITHACO, Inc. Qual Model
MCA Electromagnets

Dipole moment vs voltage
Post conformal coating

Axis PITCH

S/N 15029

Date: 7-24-72

Temp: 22°C

Performed by: K. Kabelac

RS

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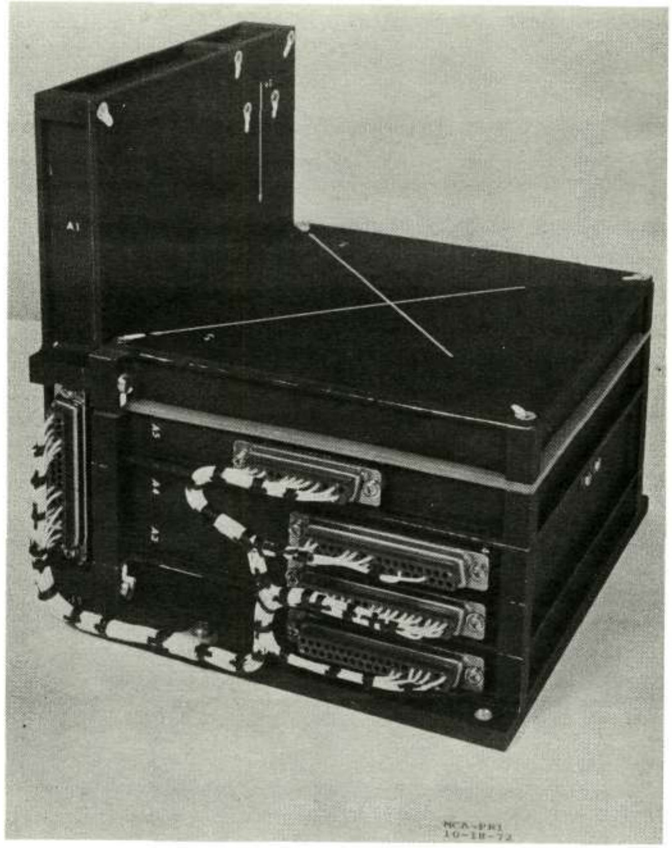
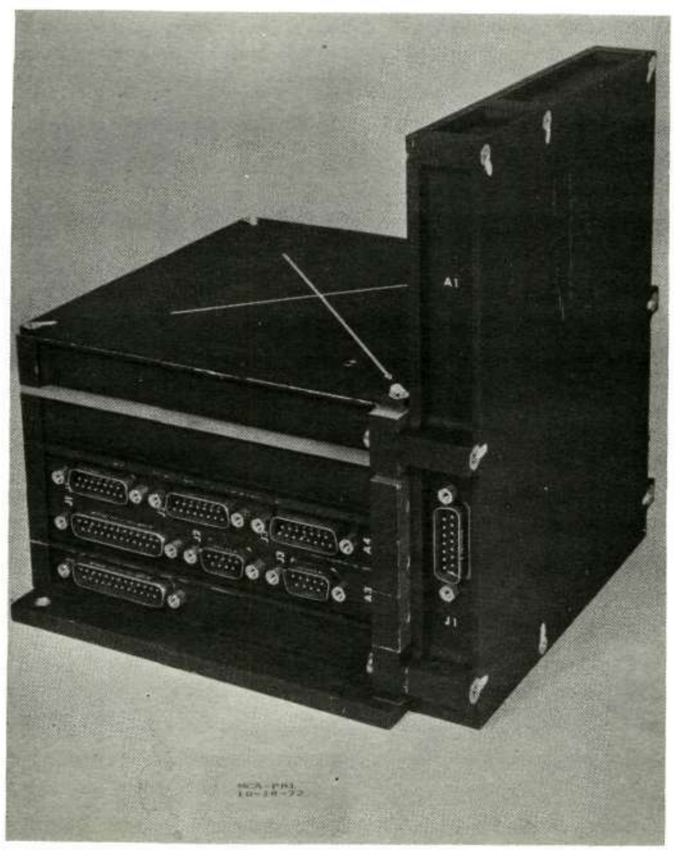
607 P-cm/V

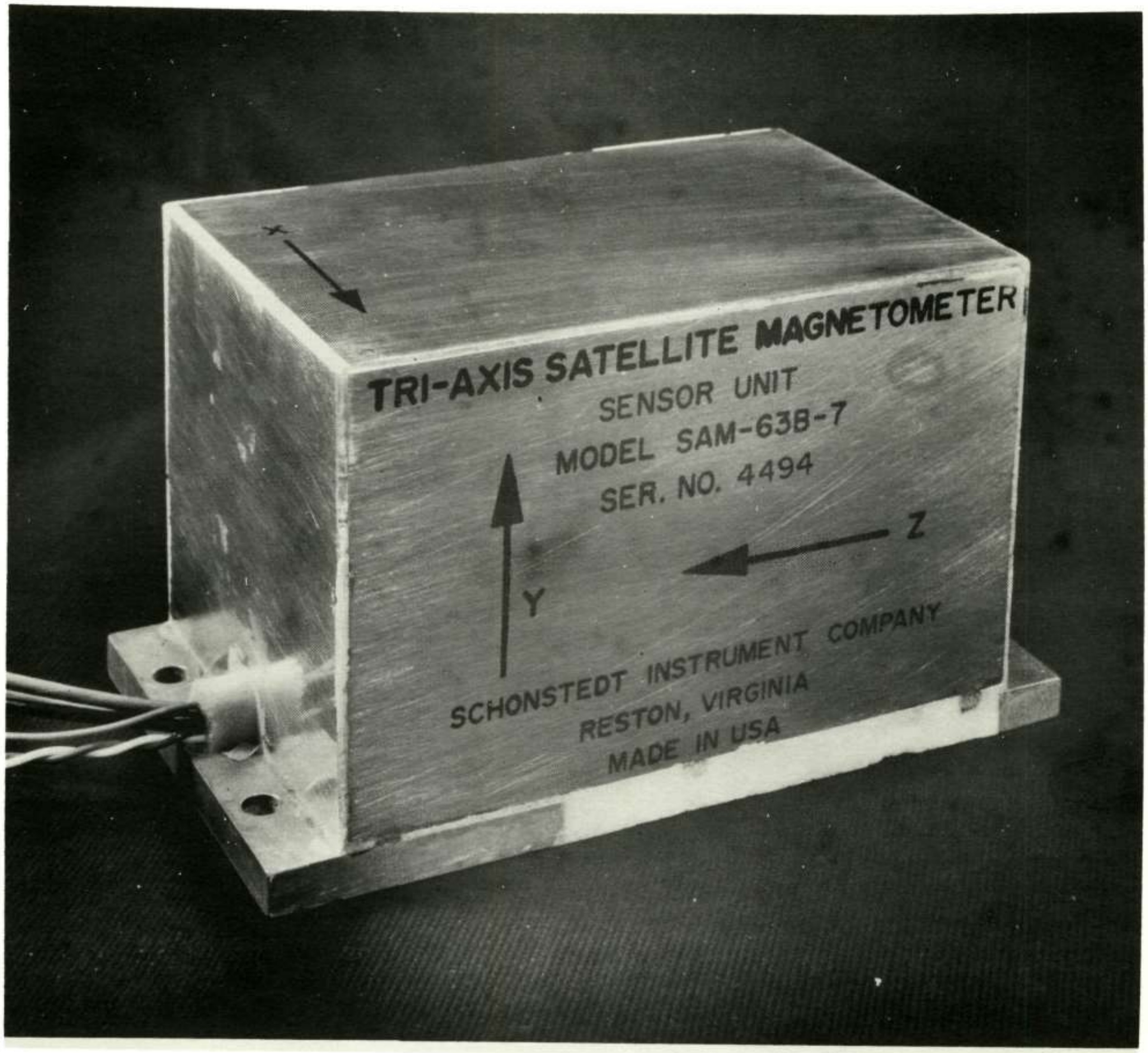
14.0 PHOTOS

See following pages:

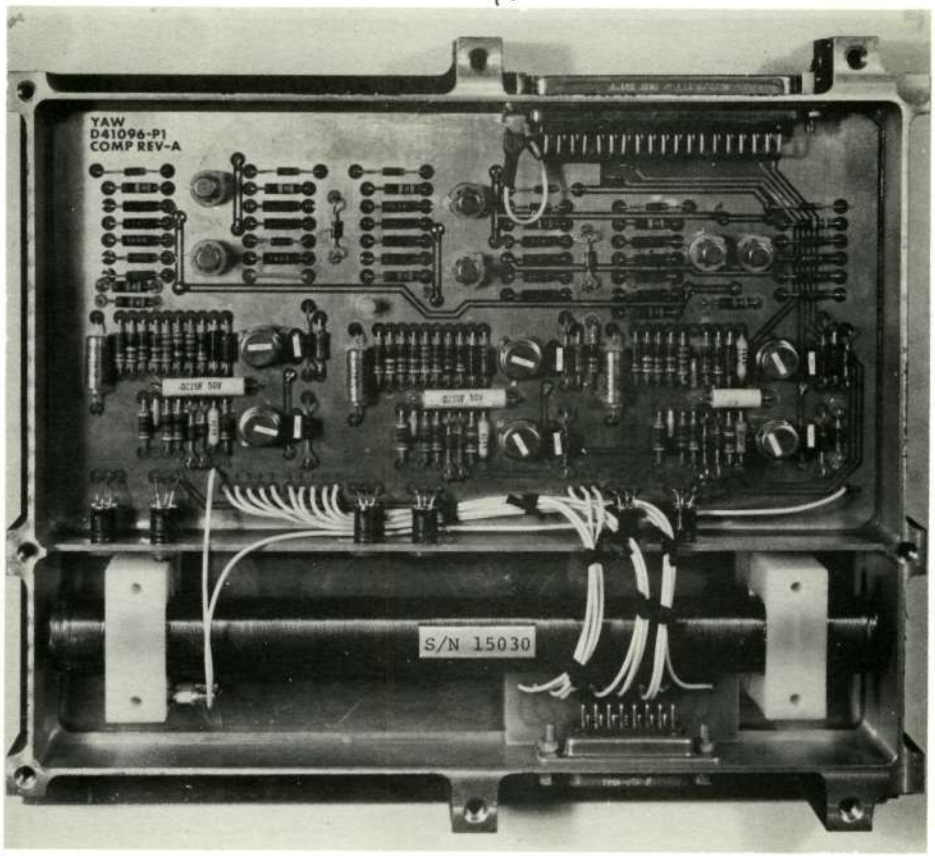


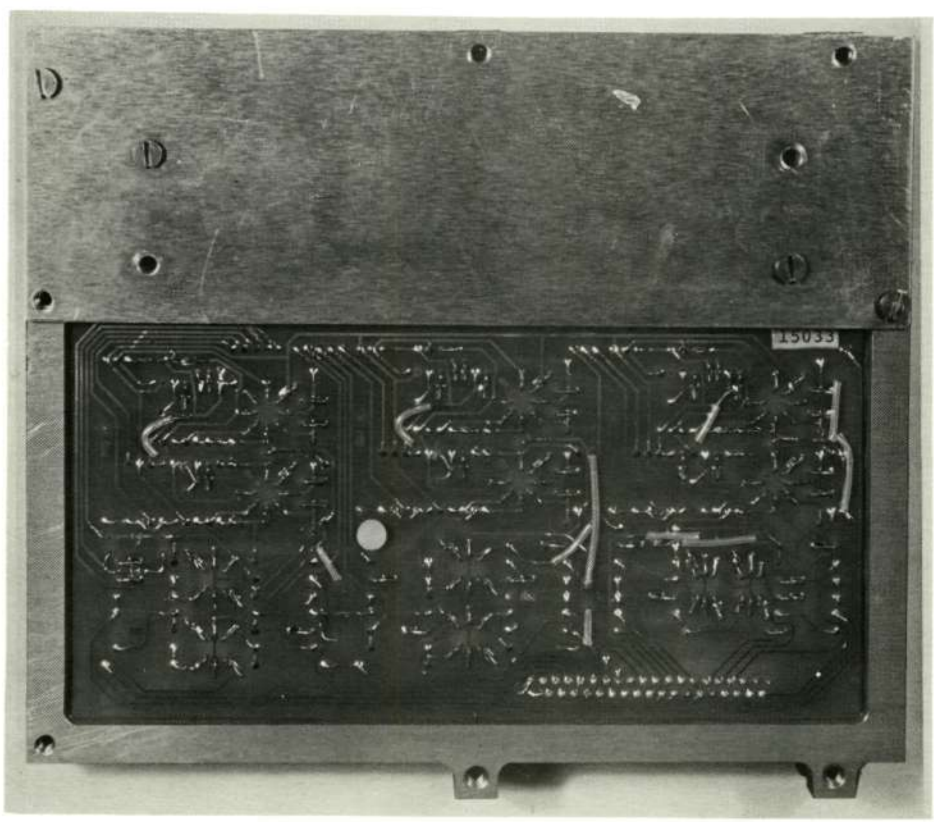


Control Logic Assembly of MCA P.R1

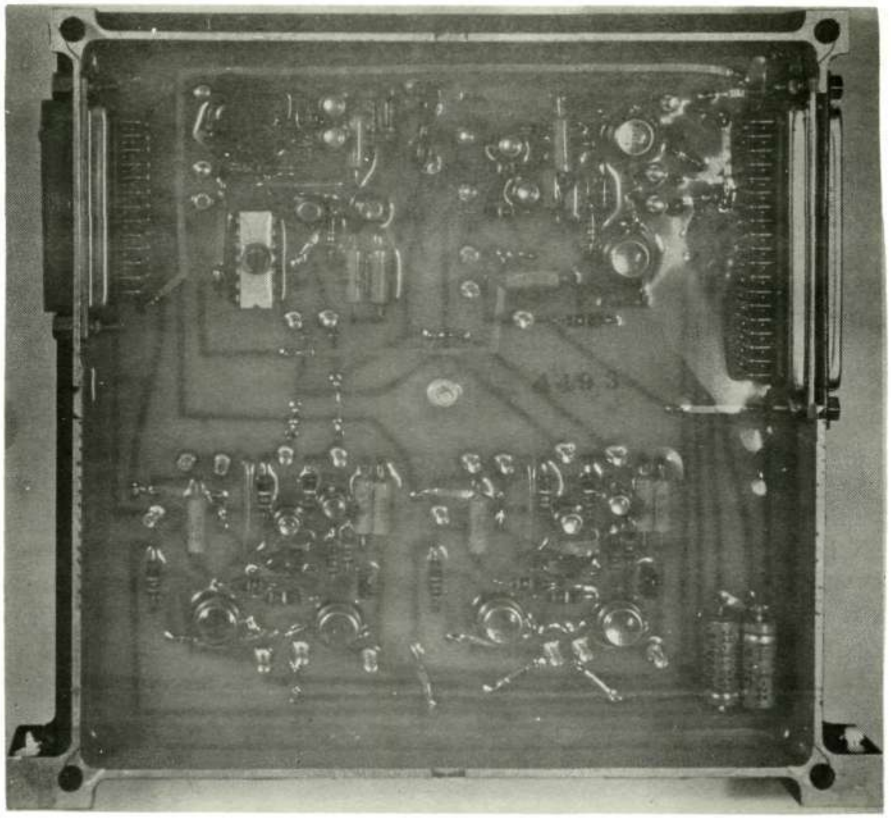


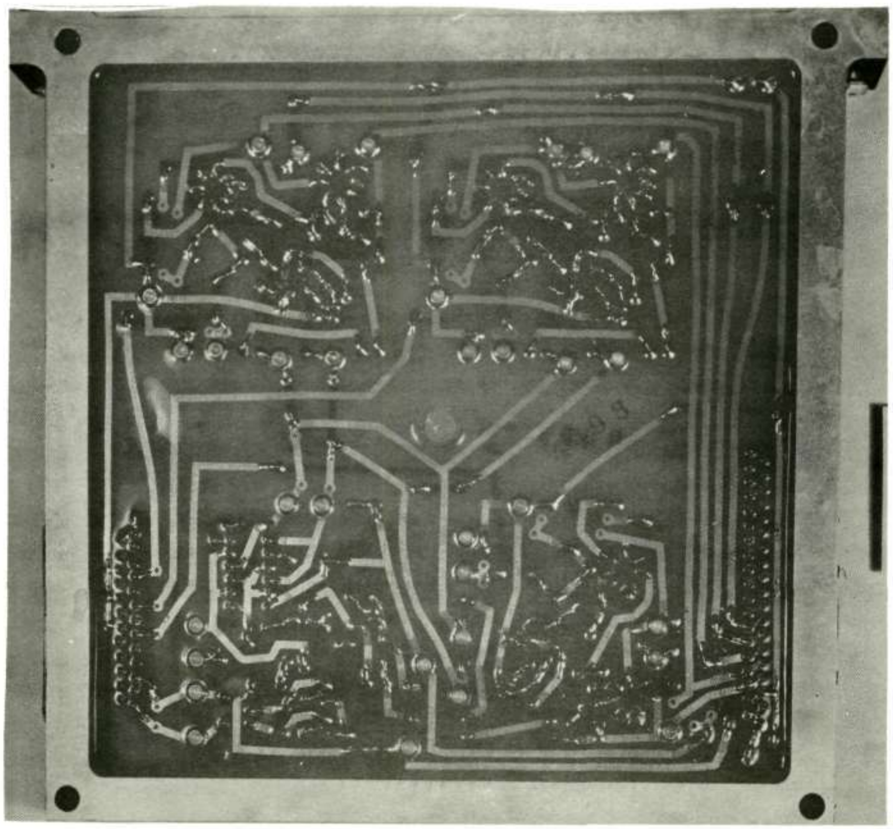
Magnetometer of MCA PR1 S/N 15062



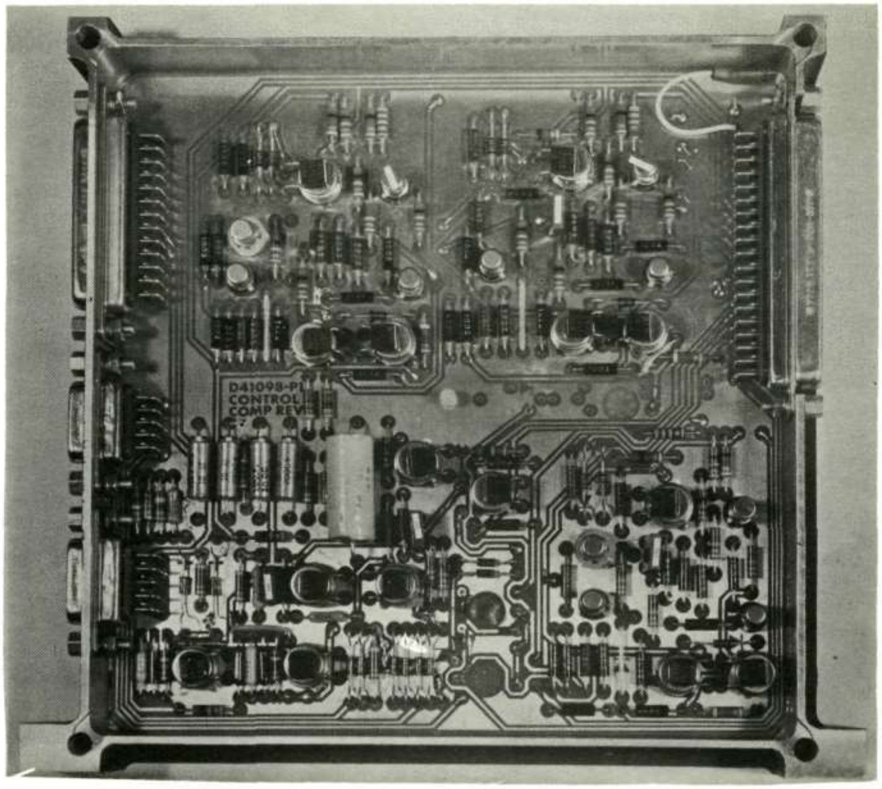


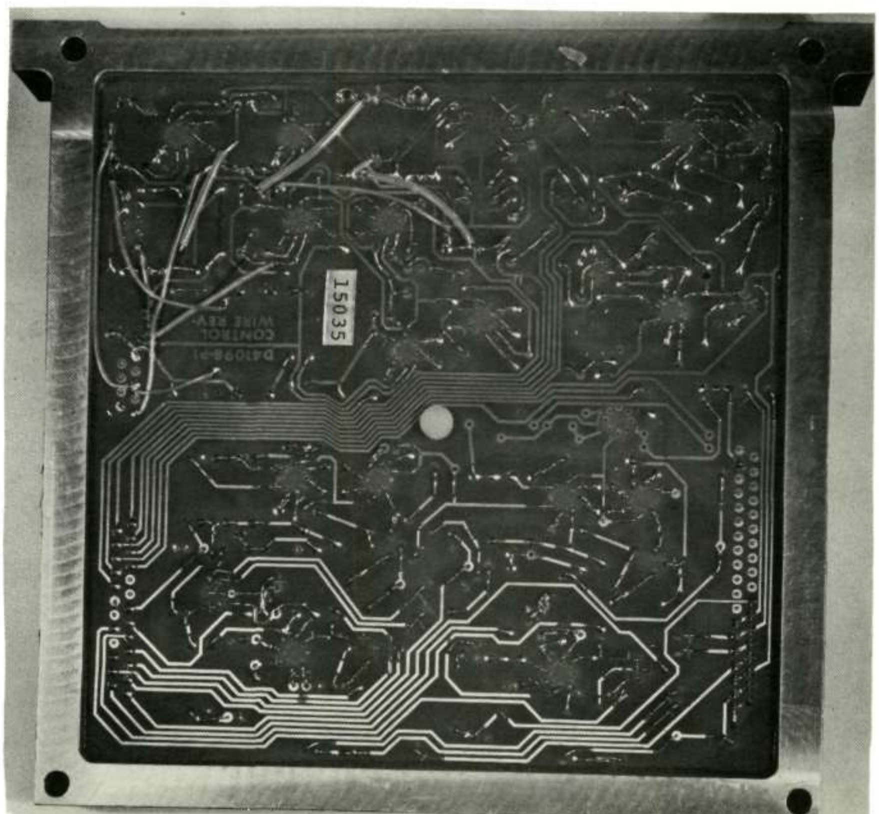
Yaw Card of MCA PR1 S/N 15033



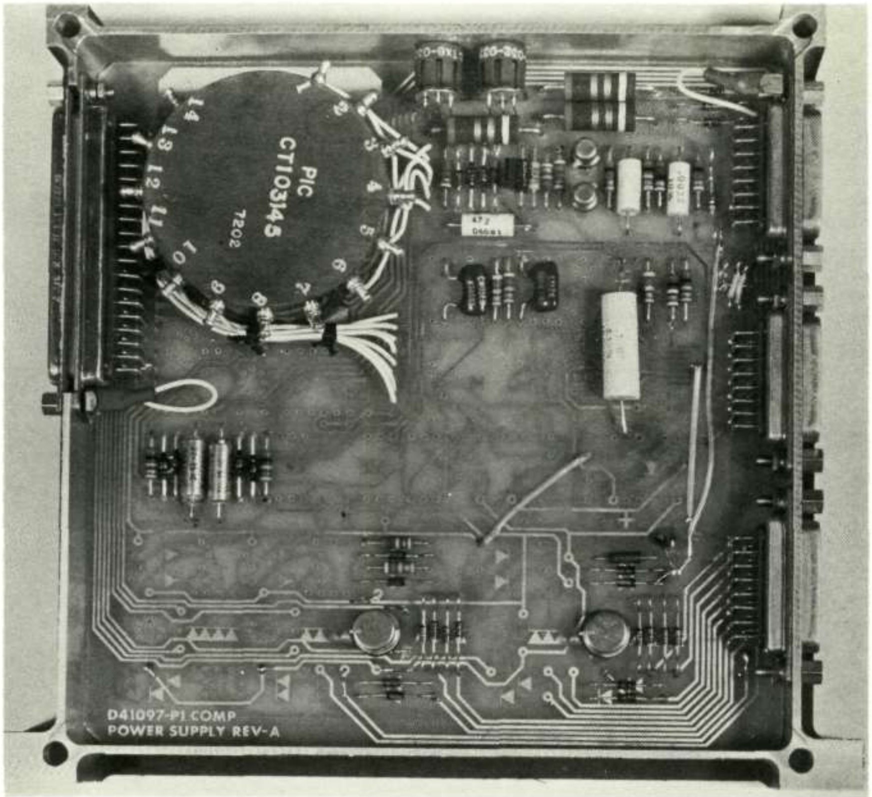


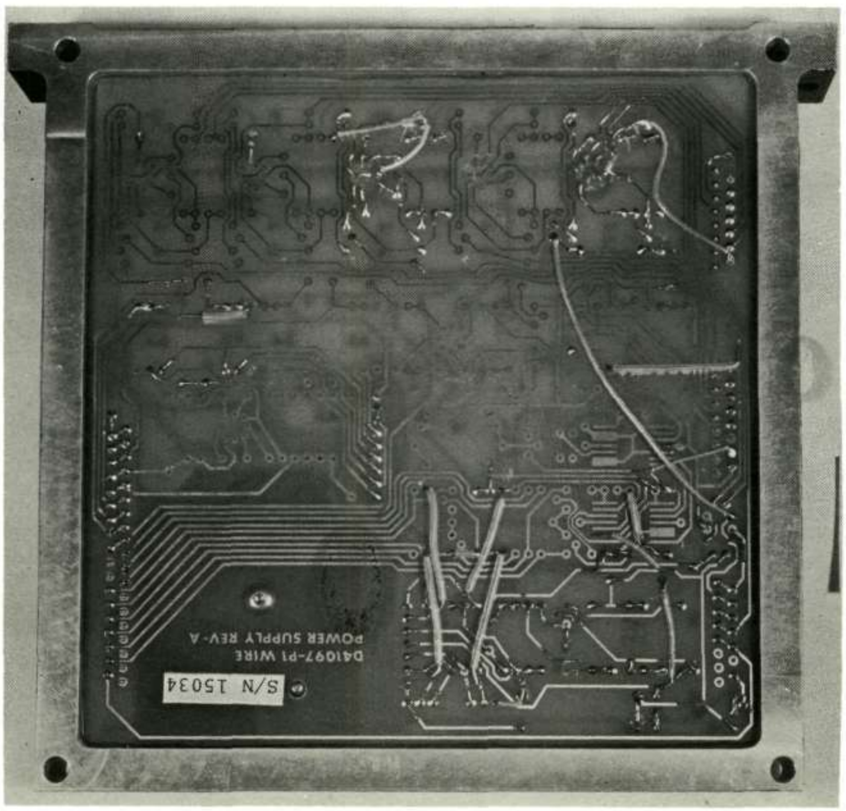
Magnetometer Electronics of MCA PR1 S/N 4493



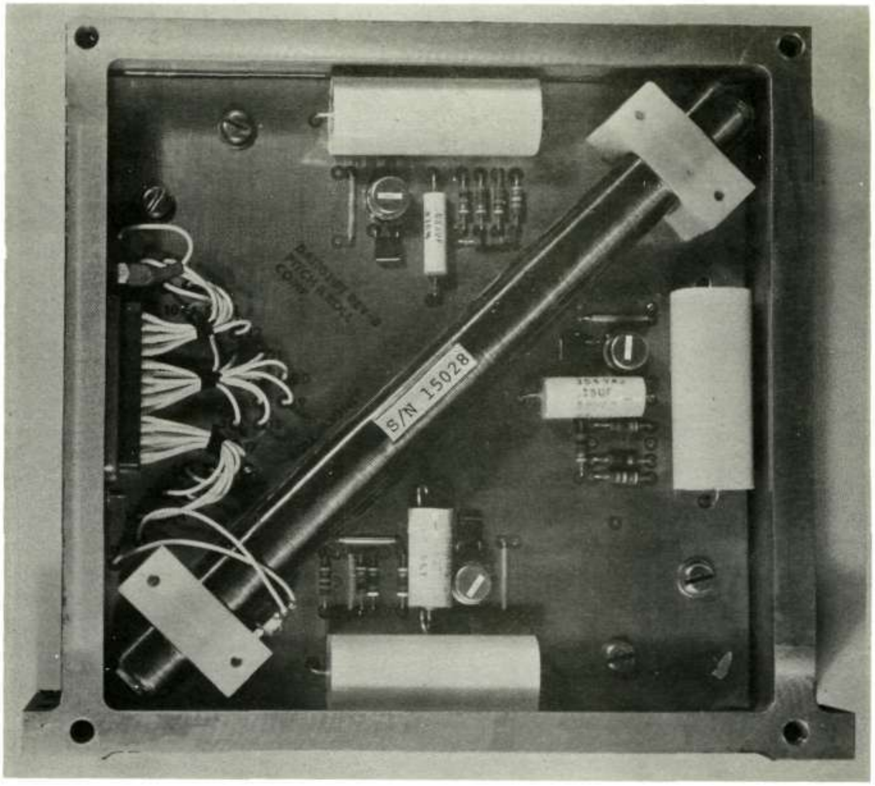


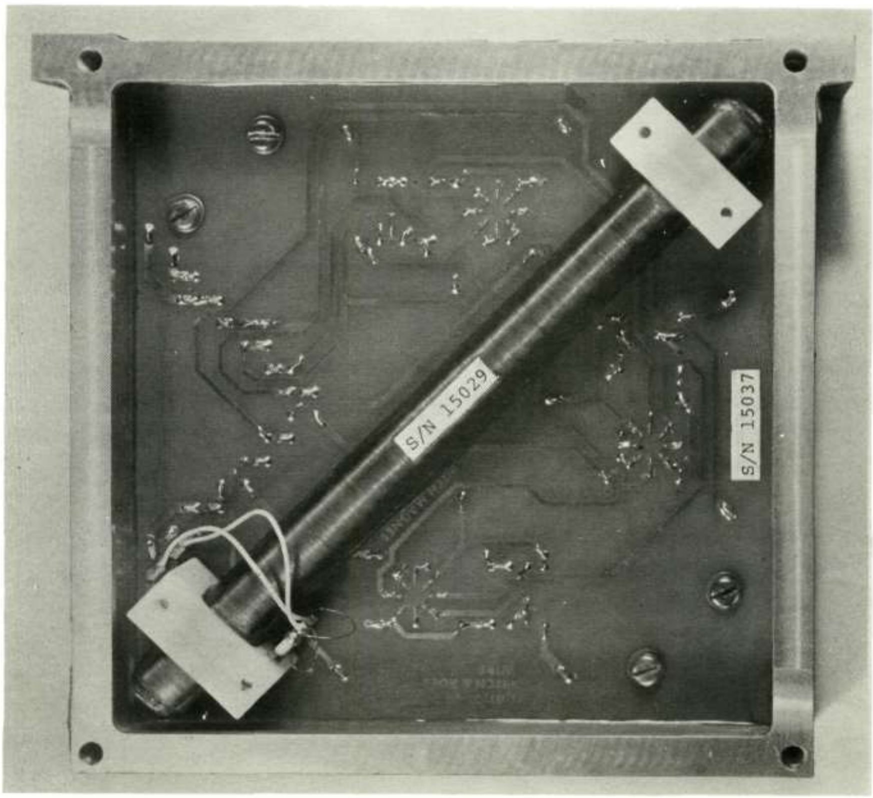
Control Card of MCA PR1 S/N 15035





Power Supply Card of MCA PR1 S/N 15034





Pitch and Roll Card of MCA PR1 S/N 15037

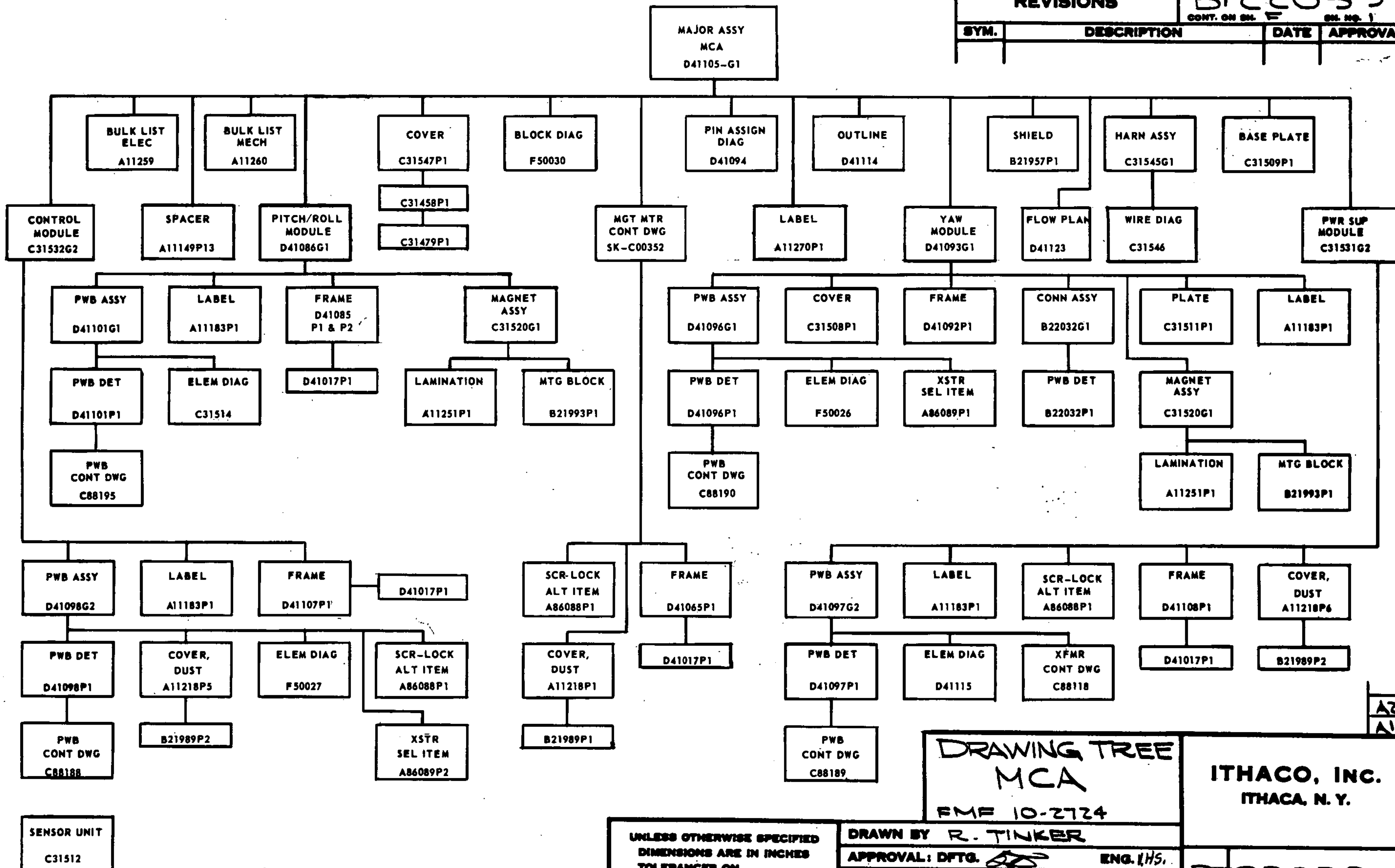
15.0 DRAWINGS

See following pages:

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVAL

B 22039
CONT. ON SH. F SH. NO. 1



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A27
A1

DRAWING TREE
MCA
FMF 10-2724

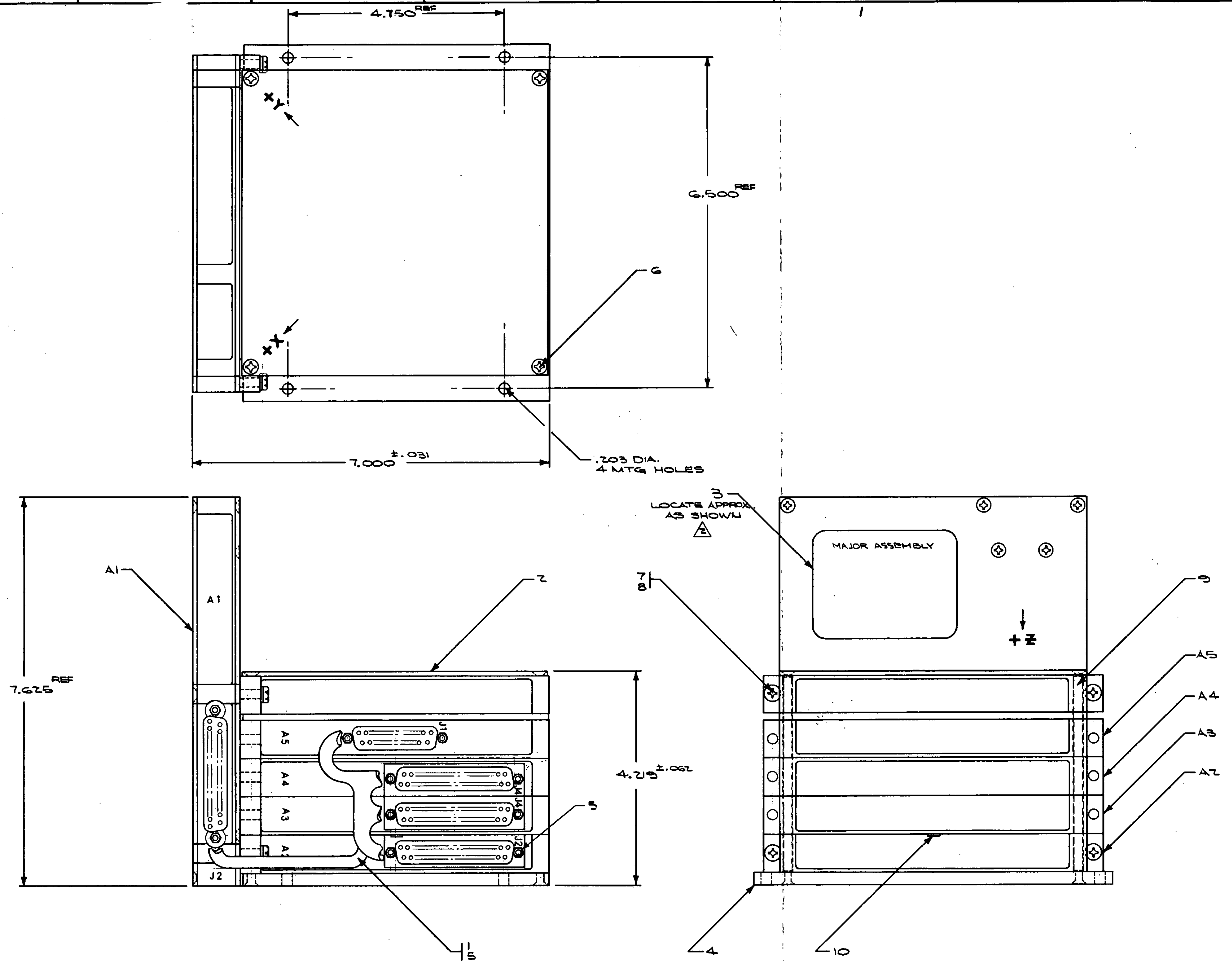
ITHACO, INC.
ITHACA, N. Y.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± DECIMALS ± ANGLES ±

DRAWN BY R. TINKER
APPROVAL: DFTG. [signature] ENG. LHS.
ISSUE DATE 2-17-72

B 22039
CONT. ON SH. F SH. NO. 1

ITH-22M



G1

NOTES

1. ASSEMBLE PER MOPS 30.37

2. TYPE IN GROUP & SERIAL NO.'S ON ITEM 3 (LABEL) PRIOR TO APPLYING TO A1 MODULE.

REVISIONS				D 41105
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
	A	13031		

SEE SEPARATE PARTS LIST

MAJOR ASSEMBLY
MCA

ITHACO, INC.
ITHACA, N. Y.

MAT'L:
FIN:
SCALE: 1/1

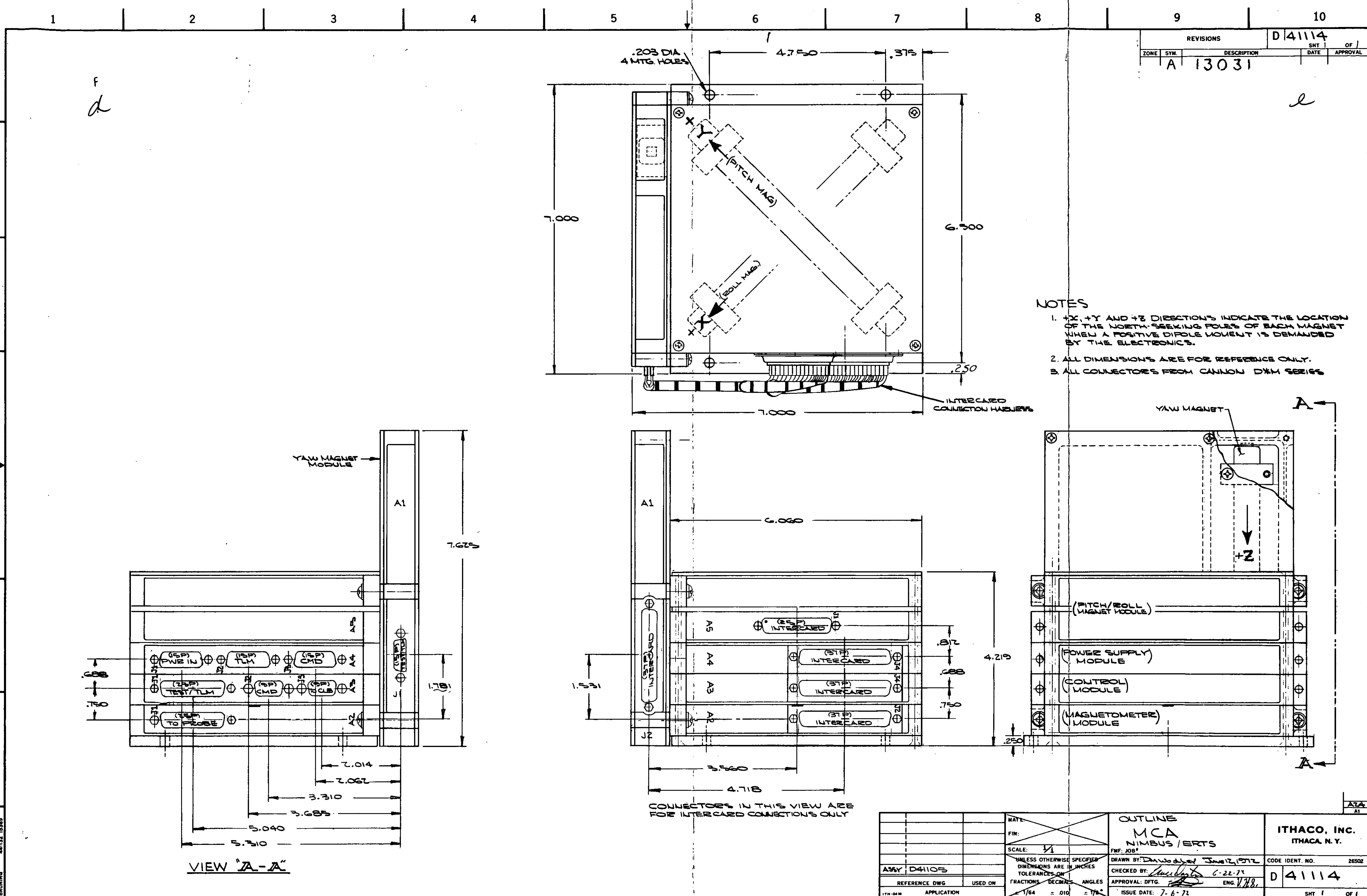
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ± .010 ANGLES ± 1/2°

REFERENCE DWG | USED ON
APPLICATION

FMF: JOB# 10-2774
DRAWN BY: [signature] June 26, 1972
CHECKED BY: [signature] 7-10-72
APPROVAL: DFTG. [signature] ENG. [signature]
ISSUE DATE: 7-17-72

CODE IDENT. NO. 26502
D 41105
SHT 1 OF 1

48-A 48-B 48-C



REVISIONS
D 41114
SHT 1 OF 1
ZONE
SYM.
DESCRIPTION
DATE
APPROVAL
A 13031
.203 DIA
4 MTG. HOLES
4.750
.375
7.000
6.500
+Y
(PITCH MAG)
(ROLL MAG)
+X
.250
INTERCARD
CONNECTION HARNESS
7.000
NOTES
1. +X, +Y AND +Z DIRECTIONS INDICATE THE LOCATION OF THE NORTH-SEEKING POLES OF EACH MAGNET WHEN A POSITIVE DIPOLE MOMENT IS DEMANDED BY THE ELECTRONICS.
2. ALL DIMENSIONS ARE FOR REFERENCE ONLY.
3. ALL CONNECTORS FROM CANNON D*M SERIES
YAW MAGNET
A
YAW MAGNET MODULE
A1
7.625
A5
(15P) PWR IN
(15P) TLM
(15P) CMD
A4
(25P) TEST/TLM
(9P) CMD
(9P) CLB
A3
(25P) TO PROBE
A2
.688
.750
1.781
J1
2.014
2.062
3.310
3.685
5.040
5.310
VIEW "A-A"
6.060
(25P) INTERCARD
(37P) INTERCARD
(37P) INTERCARD
(37P) INTERCARD
(37P) INTERCARD
.812
.688
.750
4.219
1.531
J2
3.560
4.718
CONNECTORS IN THIS VIEW ARE FOR INTERCARD CONNECTIONS ONLY
+Z
(PITCH/ROLL MAGNET MODULE)
(POWER SUPPLY MODULE)
(CONTROL MODULE)
(MAGNETOMETER MODULE)
.250
A
MAT'L
FIN:
SCALE: 1/1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
FRACTIONS ± 1/64
DECIMALS ± .010
ANGLES ± 1/2°
ASSY D41105
REFERENCE DWG
USED ON
APPLICATION
OUTLINE
MCA
NIMBUS / ERTS
DRAWN BY: June 12, 1972
CHECKED BY: 6-22-72
APPROVAL: DFTG.
ENG.
ISSUE DATE: 7-6-72
ITHACO, INC.
ITHACA, N.Y.
CODE IDENT. NO. 26502
D 41114
SHT 1 OF 1

49-A

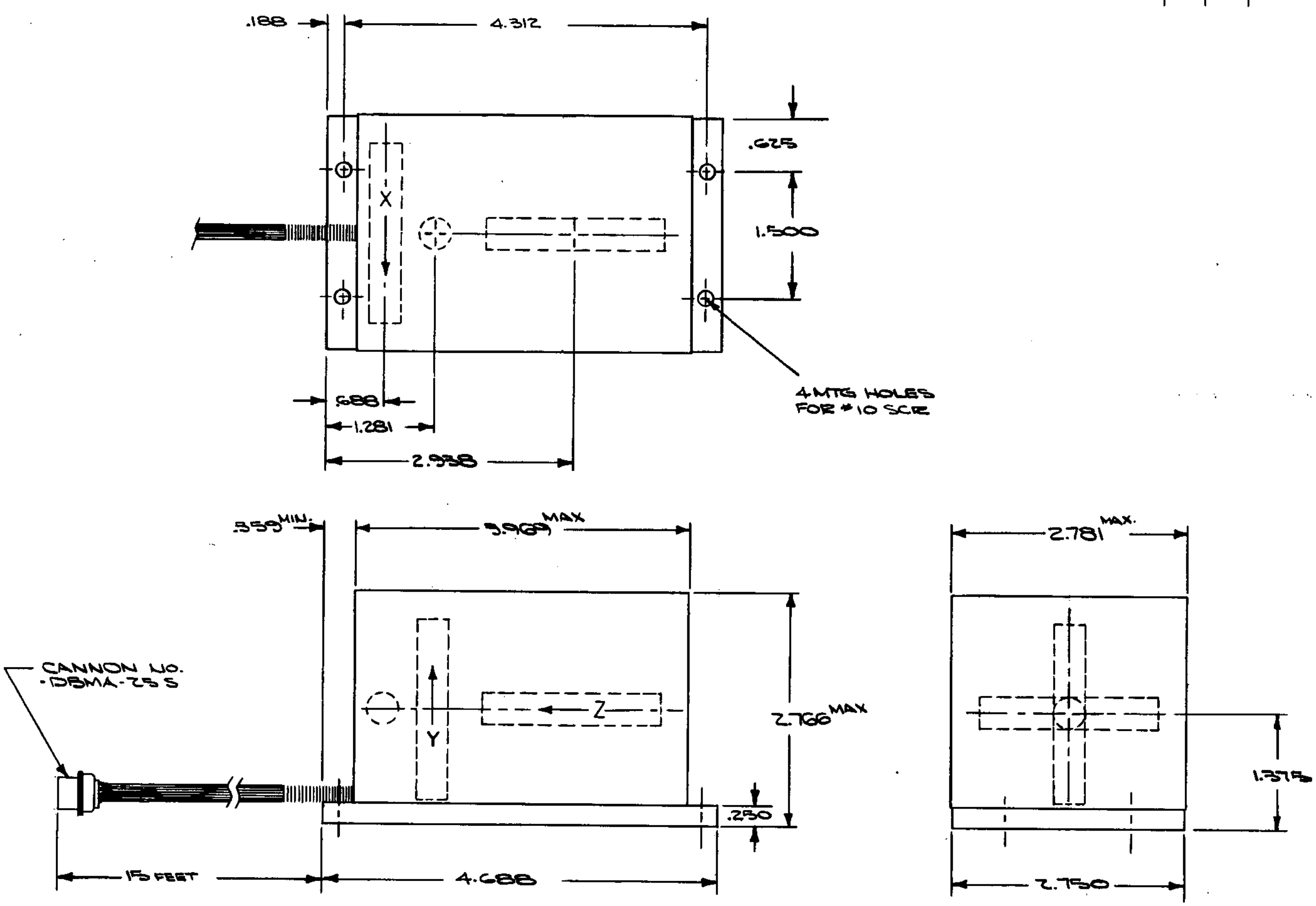
49-B

49-C

REVISIONS

ZONE	SYM.	DESCRIPTION	DATE	APPROVAL

C 31512 SHT 1 OF 1



(-P1) AS SHOWN

(-P2) SAME AS -P1 EXCEPT CONNECTOR IS CANNON # DBMA-25S-NMB1A106

SENSOR UNIT ASSEMBLY #SAM-63B-7

SCHONSTEDT INST. CO. RESTON, VA.

A2A A1

REFERENCE DWG	USED ON
ITH-23H	APPLICATION

MAT'L:
FIN:
SCALE: 1/1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON

FRACTIONS	DECIMALS	ANGLES
± 1/64	± .010	± 1/2°

OUTLINE SENSOR UNIT ASSEMBLY

FMF: JOB# 10-2724
DRAWN BY: [signature] 5-5-72
CHECKED BY: [signature] 6-20-72
APPROVAL: DFTG. [signature] ENG. V.A.S.
ISSUE DATE: 7-6-72

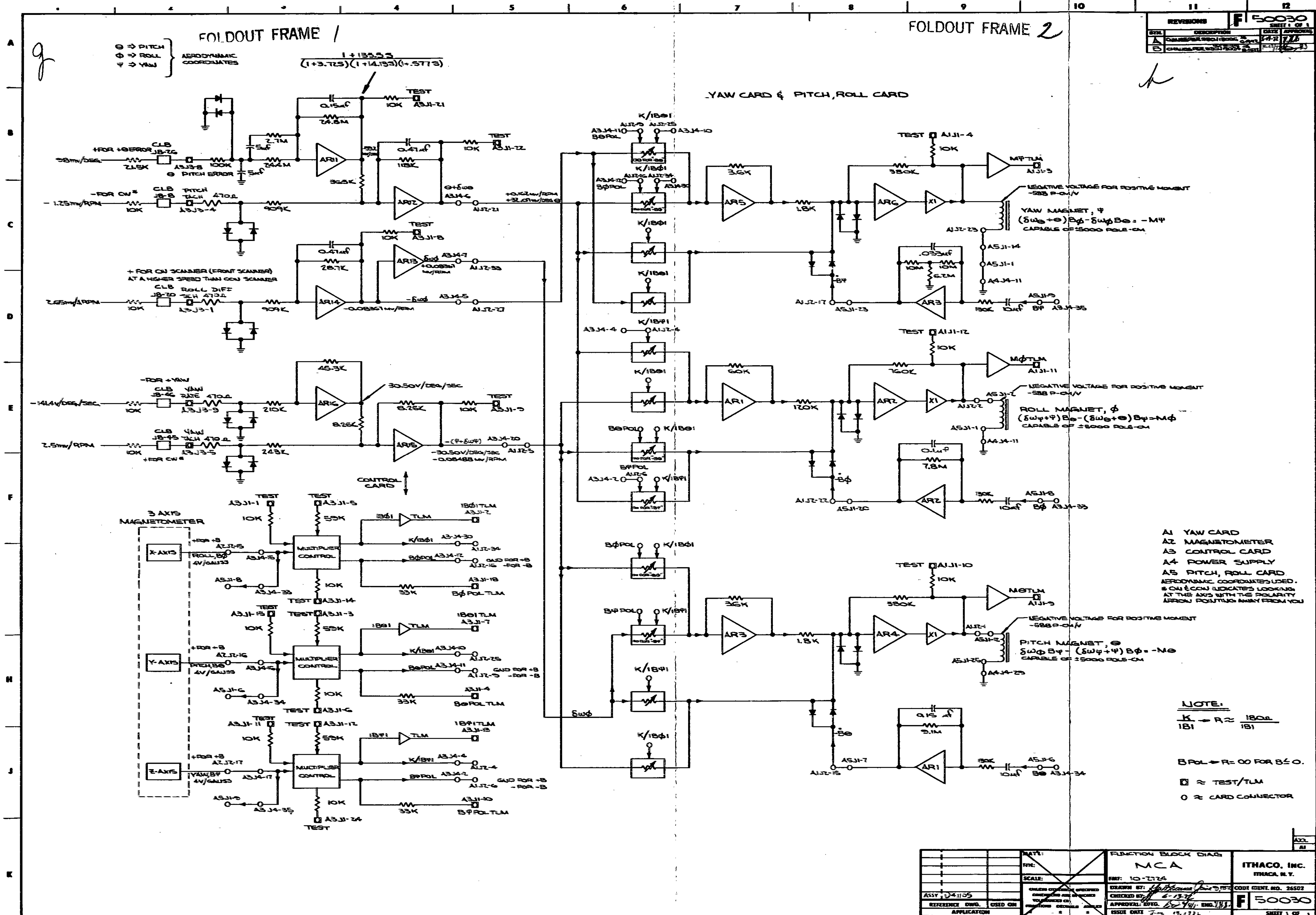
ITHACO, INC.
ITHACA, N. Y.

CODE IDENT. NO. 26502
C 31512
SHT 1 OF 1

BRUNING 44-132 14930

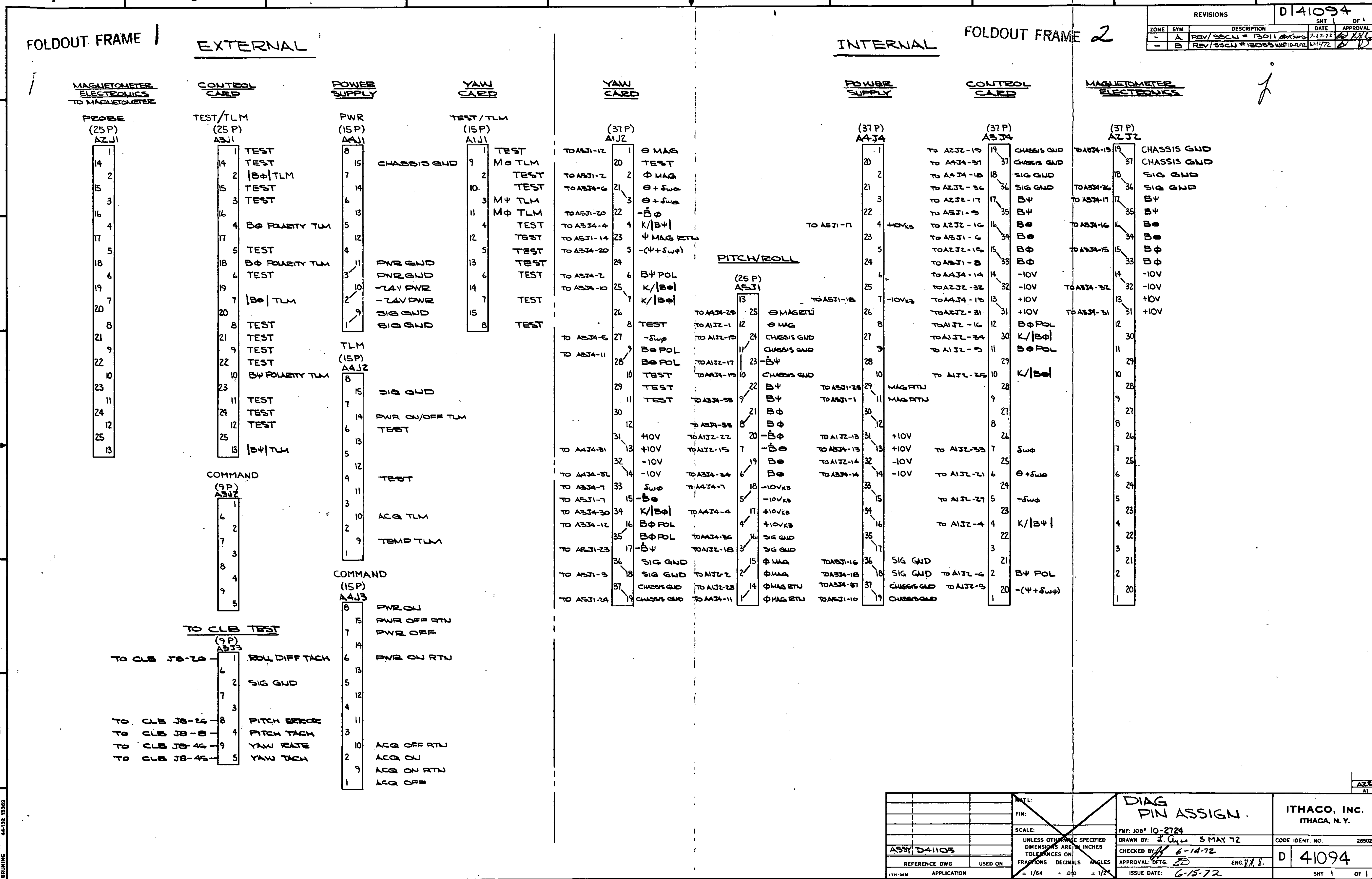
-50-

-51-A 51-B 51-C



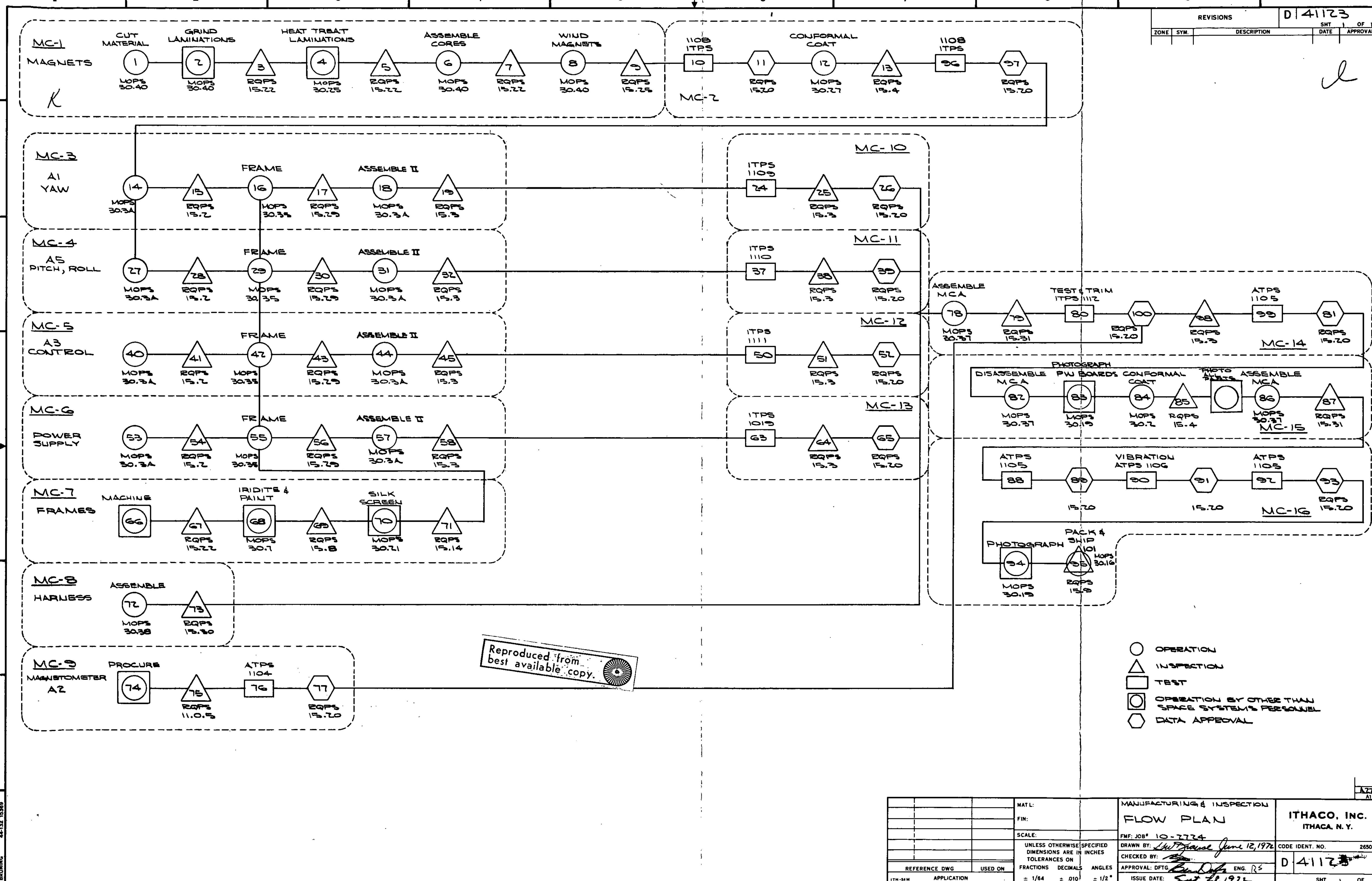
FOLDOUT FRAME 1
FOLDOUT FRAME 2
YAW CARD & PITCH, ROLL CARD
θ ⇒ PITCH
Φ ⇒ ROLL
Ψ ⇒ YAW
AERODYNAMIC COORDINATES
3 AXIS MAGNETOMETER
X-AXIS
Y-AXIS
Z-AXIS
MULTIPLIER CONTROL
CONTROL CARD
YAW MAGNET, Ψ
ROLL MAGNET, Φ
PITCH MAGNET, θ
NEGATIVE VOLTAGE FOR POSITIVE MOMENT
CAPABLE OF ±5000 POLE-CM
A1 YAW CARD
A2 MAGNETOMETER
A3 CONTROL CARD
A4 POWER SUPPLY
A5 PITCH, ROLL CARD
NOTE:
□ ≈ TEST/TLM
O ≈ CARD CONNECTOR
REVISIONS
FUNCTION BLOCK DIAG
MCA
ITHACO, INC.
ITHACA, N.Y.
F 50030

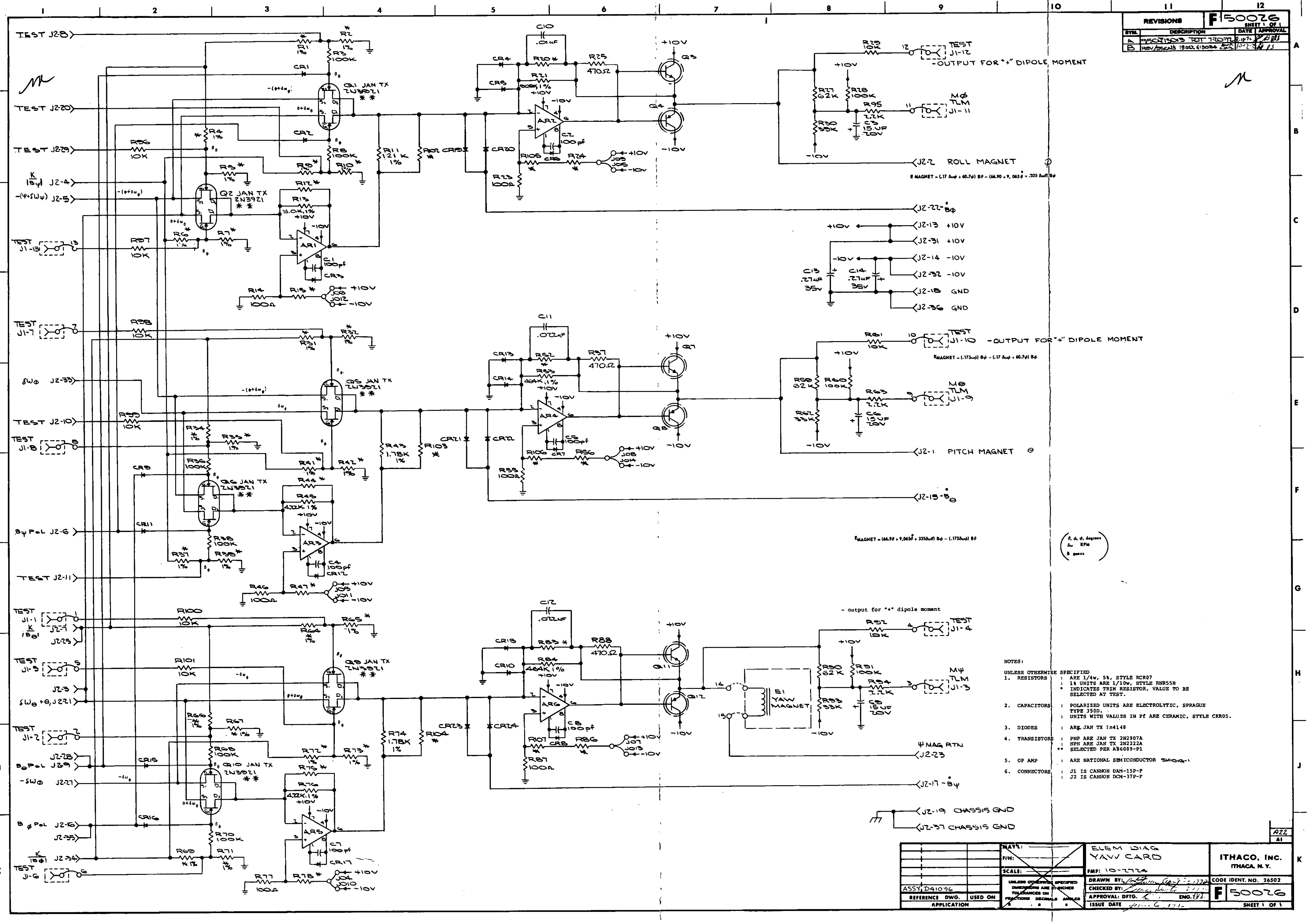
52-A 52-B 52-C



FOLDOUT FRAME 1
EXTERNAL
FOLDOUT FRAME 2
INTERNAL
MAGNETOMETER ELECTRONICS TO MAGNETOMETER PROBE (25 P) A2J1
CONTROL CARD TEST/TLM (25 P) A3J1
POWER SUPPLY PWR (15 P) A4J1
YAW CARD TEST/TLM (15 P) A1J1
YAW CARD (37 P) A1J2
PITCH/ROLL (25 P) A5J1
POWER SUPPLY (37 P) A4J4
CONTROL CARD (37 P) A3J4
MAGNETOMETER ELECTRONICS (37 P) A2J2
TLM (15 P) A4J2
COMMAND (9 P) A3J2
COMMAND (15 P) A4J3
TO CLB TEST (9 P) A3J3
TO CLB J8-20
TO CLB J8-26
TO CLB J8-8
TO CLB J8-46
TO CLB J8-45
ROLL DIFF TACH
SIG GND
PITCH ERROR
PITCH TACH
YAW RATE
YAW TACH
CHASSIS GND
PWR GND
-24V PWR
SIG GND
SIG GND
PWR ON/OFF TLM
TEST
ACQ TLM
TEMP TLM
PWR ON
PWR OFF RTN
PWR OFF
PWR ON RTN
ACQ OFF RTN
ACQ ON
ACQ ON RTN
ACQ OFF
REVISIONS
ZONE SYM DESCRIPTION DATE APPROVAL
– A REV/SSCN # 13011 7-27-72
– B REV/SSCN # 12088 10-12-72
DIAG PIN ASSIGN.
ITHACO, INC.
ITHACA, N. Y.
FMF: JOB# 10-2724
DRAWN BY: 5 MAY 72
CHECKED BY: 6-14-72
ISSUE DATE: 6-15-72
ASSY D41105
REFERENCE DWG
USED ON
APPLICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64 ± .010 ± 1/2°
CODE IDENT. NO. 26502
D 41094
SHT 1 OF 1

FOLDOUT FRAME 1 54-A 54-B 54C FOLDOUT FRAME 2



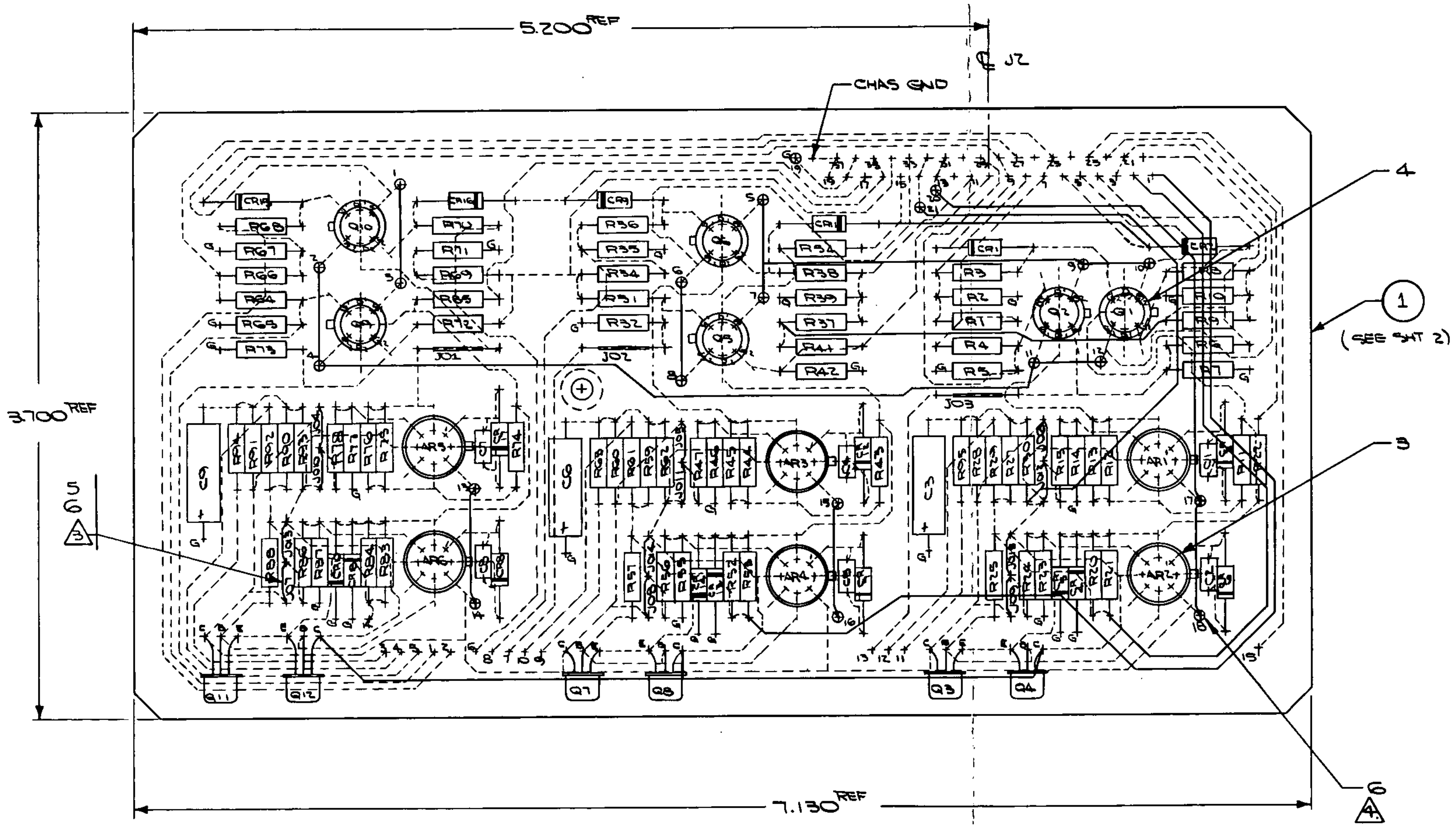

REVISIONS
F 50026
TEST J2-8
TEST J2-20
TEST J2-29
TEST J2-10
TEST J2-11
Q1 JAN TX 2N3921
Q2 JAN TX 2N3921
Q5 JAN TX 2N3921
Q6 JAN TX 2N3921
Q9 JAN TX 2N3921
Q10 JAN TX 2N3921
-OUTPUT FOR "+" DIPOLE MOMENT
ROLL MAGNET
PITCH MAGNET
E1 YAW MAGNET
ΨMAG RTN
J2-19 CHASSIS GND
J2-37 CHASSIS GND
- output for "+" dipole moment
NOTES:
UNLESS OTHERWISE SPECIFIED
1. RESISTORS : ARE 1/4w, 5%, STYLE RCR07
: 1% UNITS ARE 1/10w, STYLE RNR55H
* INDICATES TRIM RESISTOR, VALUE TO BE SELECTED AT TEST.
2. CAPACITORS : POLARIZED UNITS ARE ELECTROLYTIC, SPRAGUE TYPE 350D.
: UNITS WITH VALUES IN Pf ARE CERAMIC, STYLE CKR05.
3. DIODES : ARE JAN TX In4148
4. TRANSISTORS : PNP ARE JAN TX 2N2907A
: NPN ARE JAN TX 2N2222A
** SELECTED PER A86089-P1
5. OP AMP : ARE NATIONAL SEMICONDUCTOR
6. CONNECTORS : J1 IS CANNON DAM-15P-F
: J2 IS CANNON DCM-37P-F
ELEM DIAG
YAW CARD
FMF: 10-2724
ITHACO, INC.
ITHACA, N.Y.
CODE IDENT. NO. 26502
ASSY D41096
REFERENCE DWG.
USED ON
APPLICATION
DRAWN BY:
CHECKED BY:
APPROVAL: DFTG.
ENG.
ISSUE DATE
F 50026
SHEET 1 OF 1
A22
A1

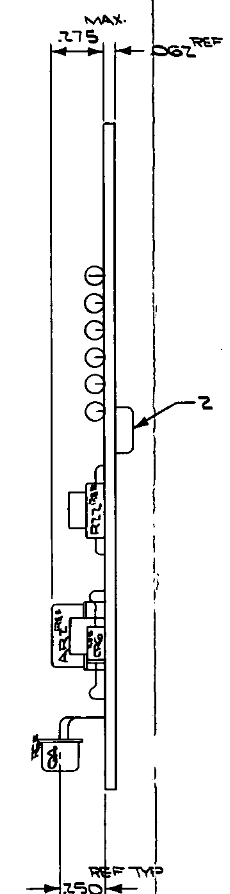
FOLDOUT FRAME 1 56-A

56-B

FOLDOUT FRAME 2 56-C

REVISIONS			D 41096 SHT 1 OF 2	
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
	A	RJT 7-20-72 SSCN# 13013	[illegible]	[illegible]





(G1)

NOTES:

1. ASSEMBLE PER MOPS 30.3.
2. SECURE LARGE COMPONENTS PER MSFC PROC 257.
3. (△) JUMPERS J04 THRU J015 OPTIONAL AT TEST.
   J04 THRU J09 TIE RES TO +10V
   J010 THRU J015 TIE RES TO -10V
4. (△) INTERFACIAL CONNECTIONS ARE TO BE MADE AT POINTS ⊕1 THRU ⊕21.

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
10	TEST	20	TEST	30	SPARE		
9	Bθ POL	19	CHAS GND	29	TEST		
8	TEST	18	SIG GND	28	Bθ POL		
7	TEST (K)	17	-Ḃψ	27	δωφ	37	CHAS GND
6	Bψ POL	16	Bφ POL	26	SPARE	36	SIG GND
5	-(ψ+δωψ)	15	-Bθ	25	TEST (K)	35	Bφ POL
4	TEST (K)	14	-10V	24	SPARE	34	TEST (K)
3	δωθ+θ,	13	+10V	23	YAW MAG RTN	33	δωφ
2	ROLL MAG	12	SPARE	22	-Ḃφ	32	-10V
1	PITCH MAG	11	TEST	21	δωθ+θ,	31	+10V

J2 PIN ASSIGNMENTS

REFERENCE DWG		USED ON
ASSY	D41093	
ELEM	F50026	
APPLICATION		

SEE SEPARATE PARTS LIST

MAT'L: | FIN: | SCALE: 2/1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .010 ANGLES ± 1/2°

ASSY, PRINTED WIRING BD

YAW CARD

FMF: JOB# 10-2724

REDRAWN BY: RJTINKER

CHECKED BY: [signature] 6-12-72

APPROVAL: DFTG. B. D. ENG. V. H. S.

ISSUE DATE: 7-10-72

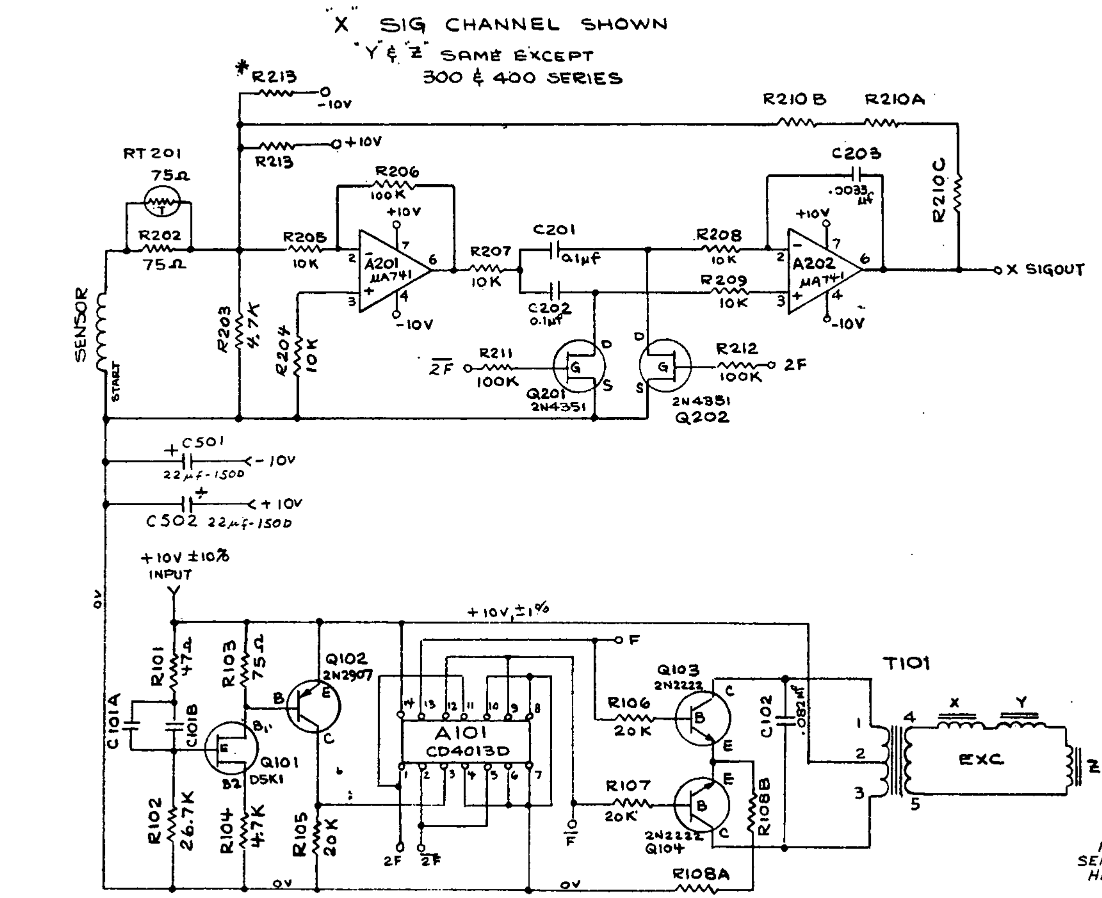
ITHACO, INC.
ITHACA, N. Y.

CODE IDENT. NO. 26502

D 41096

SHT 1 OF 2

BRUNING 44-132 15369



OSC PA

NOTES:

* ALTERNATE POSITION

A101			CD4013D	ICCD4013D	
T101			205309		
Q101			D5K1 (G.E.)		
Q102			2N2907	TC2N2907	
Q103			2N2222	TC2N2222	
Q104			2N2222	TC2N2222	
C101A			TEST	CDAP____	~910pf TOTAL
C101B			TEST	CDAP____	
C102			.082µf	CK06BX823K	
R101			47Ω	RAAC047	
R102			26.7K	RDLB2672	
R103			75Ω	RAAC075	
R104			4.7K	RDLB4701	
R105			20K	RAAC2002	
R106			20K	RAAC2002	
R107			20K	RAAC2002	
R108A			TEST	RDLB____	~100Ω TOTAL
R108B			TEST	RDLB____	
C501			22µf-150D-35v	CTAJ226	
C502			22µf-150D-35v		
A201	A301	A401	µA741		
A202	A302	A402	µA741		
Q201	Q301	Q401	2N4351	TC2N4351	
Q202	Q302	Q402	2N4351	TC2N4351	
C201	C301	Q401	0.1µf	CCEL104	
C202	C302	Q402	0.1µf	CCEL104	
C203	C303	Q403	.0033µf	CK05BX332M	
RT201	RT301	RT401	75Ω	T2V18E5	IN SENSOR HEAD
R202	R302	R402	75Ω	RDLB75.0	IN SENSOR HEAD
R203	R303	R403	4.7K	RDLB4701	
R204	R304	R404	10K	RAAC1002	
R205	R305	R405	10K	RAAC1002	
R206	R306	R406	100K	RAAC1003	
R207	R307	R407	10K	RAAC1002	
R208	R308	R408	10K	RAAC1002	
R209	R309	R409	10K	RAAC1002	
R210A	R310A	R410A	TEST	RDLB____	~2K TOTAL
R210B	R310B	R410B	TEST	RDLB____	
R210C	R310C	R410C	TEST	RDLB____	
R211	R311	R411	100K	RAAC1003	
R212	R312	R412	100K	RAAC1003	

-65-

SLD-1555	SAM-63B-7
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES REMOVE BURRS AND SHARP EDGES TOLERANCES ON FRACTIONS ± DECIMALS ± ANGLES ±

DO NOT SCALE THIS DRAWING

MATERIAL:

FINISH:

SPECIFICATIONS OF LATEST ISSUE APPLY

APPROVED 19

ELECTRICAL [illegible] 5-5-72
MECHANICAL
CHECKED
DRAWN FB 4-7-72

CIR DIAGRAM

SAM-63B-7

SCALE — | UNIT WT. | JOB ORDER

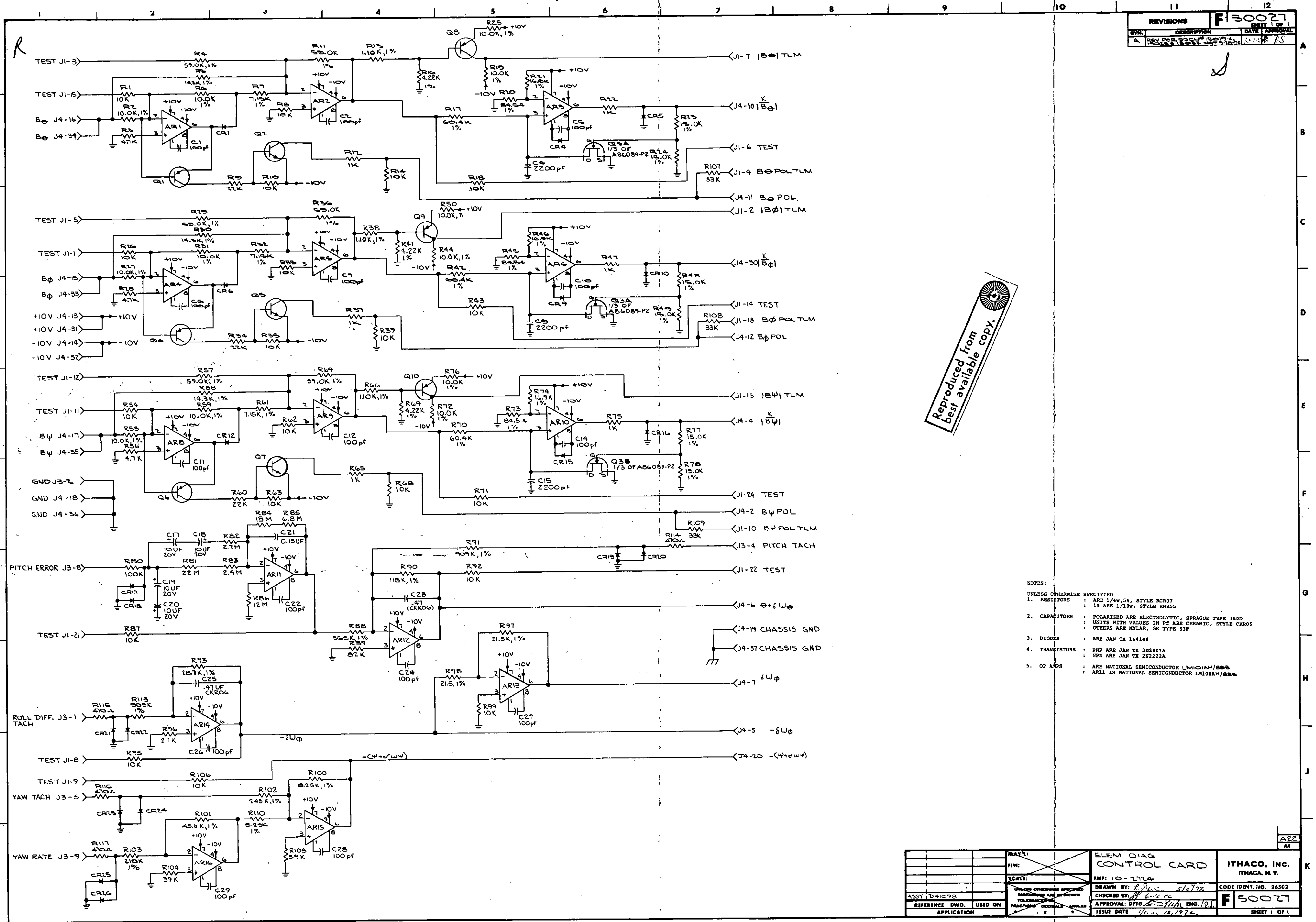
SCHONSTEDT INSTRUMENT CO.
Reston, Virginia

S.I. CO. DRAWING NUMBER 301016 | REV

58-A FOLDOUT FRAME 1

58-B

58-C FOLDOUT FRAME 2

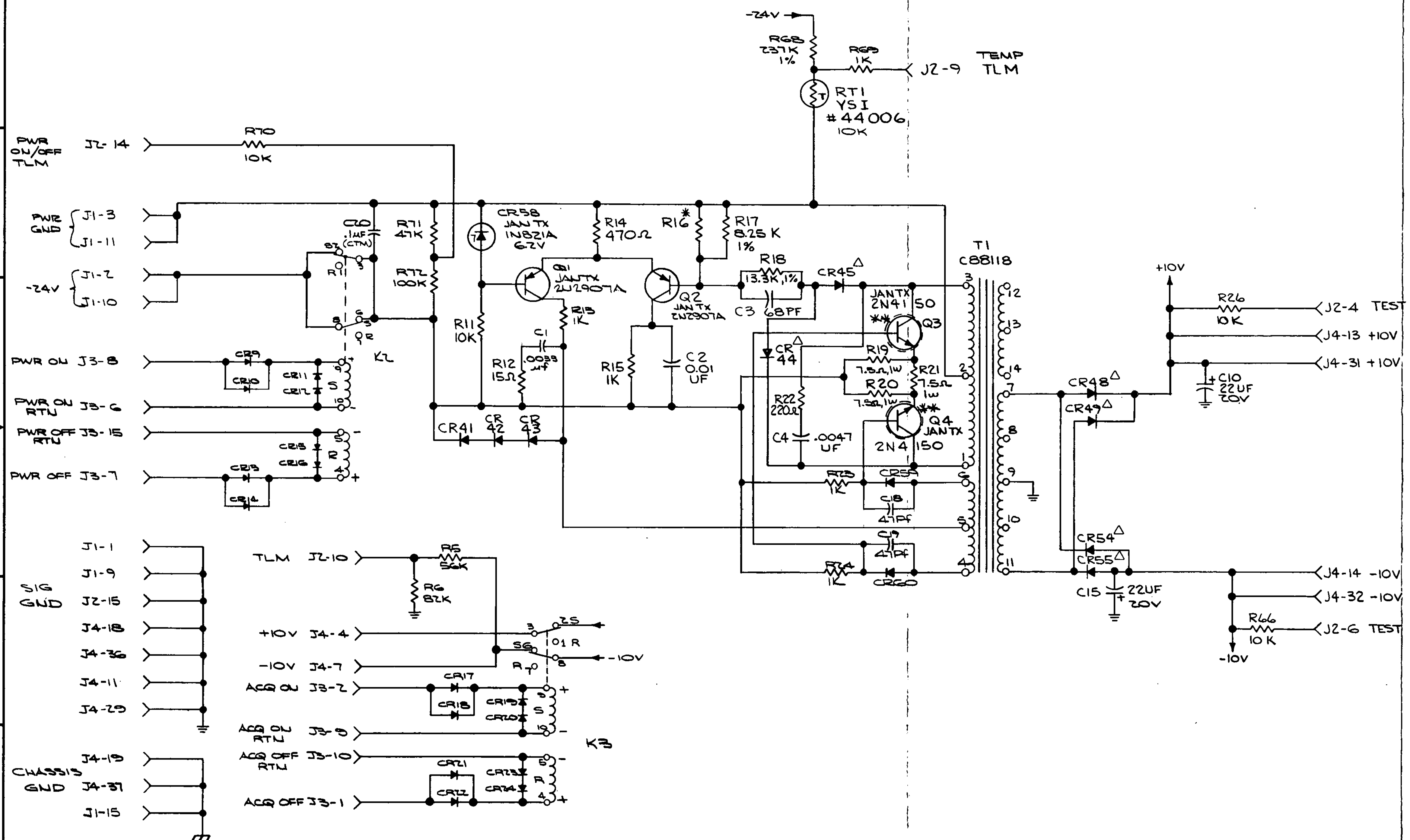


FOLDOUT FRAME 1 59-A

59-B

FOLDOUT FRAME 2 59-C

REVISIONS			D 41115	
			SHT 1 OF 1	
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
	A	REV PER SECN	10-5-72	



NOTES:

UNLESS OTHERWISE SPECIFIED

1. RESISTORS : ARE 1/4w, 5%, STYLE RCR07
   : 1% UNITS ARE 1/10w, STYLE RNR55H
   : 1w UNITS ARE 5% STYLE RCR32
   * INDICATES TRIM RESISTOR, VALUE TO BE SELECTED AT TEST.
2. CAPACITORS : POLARIZED UNITS ARE ELECTROLYTIC, SPRAGUE TYPE 350D
   : UNITS WITH VALUES IN Pf ARE CERAMIC, STYLE CKR05.
   : OTHERS ARE MYLAR, GE TYPE 63F.
3. DIODES : ARE JAN TX 1N4148
   : △ INDICATES UNITRODE UTX-220
4. CONNECTOR : J1,J2 & J3 ARE CANNON DAM-15PPNMBK56
   : J4 IS CANNON DCM-37PPNMBK56
5. ** INDICATES HEATSINK TO FRAME.

A22 A1 PS-3

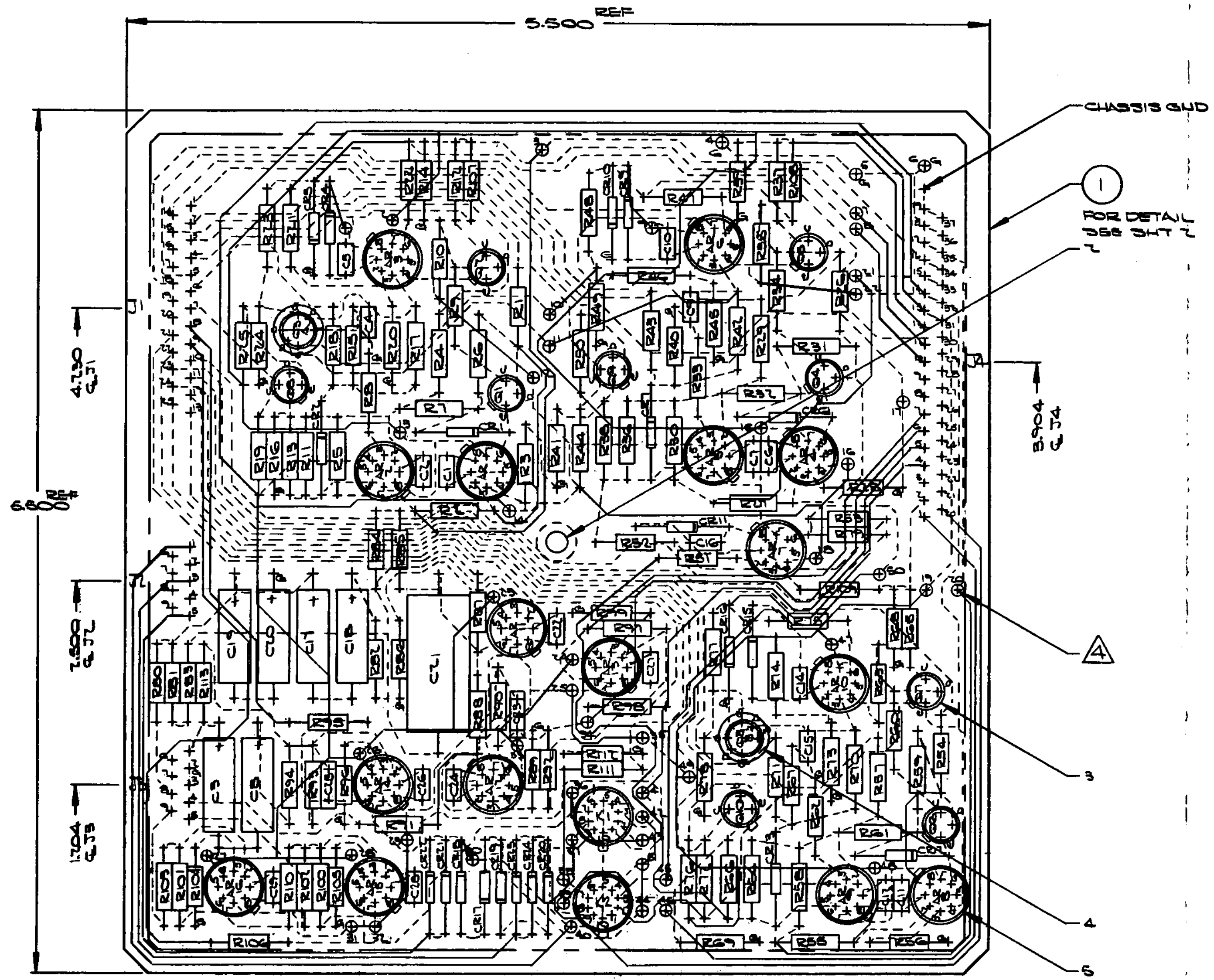
PWB ASBY D41181-G1	MCA	MAT'L: / FIN: / SCALE:	ELEM DIAG POWER SUPPLY	ITHACO, INC. ITHACA, N. Y.
REFERENCE DWG	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .010 ANGLES ± 1/2°	FMF: JOB# 10-2724	CODE IDENT. NO. 26502
ITH-24M APPLICATION			DRAWN BY: L. AYERS	D 41115
			CHECKED BY: SD 6-9-72	
			APPROVAL: DFTG 6/9/72 ENG. V.H.S.	
			ISSUE DATE: June 9, 1972	SHT 1 OF 1

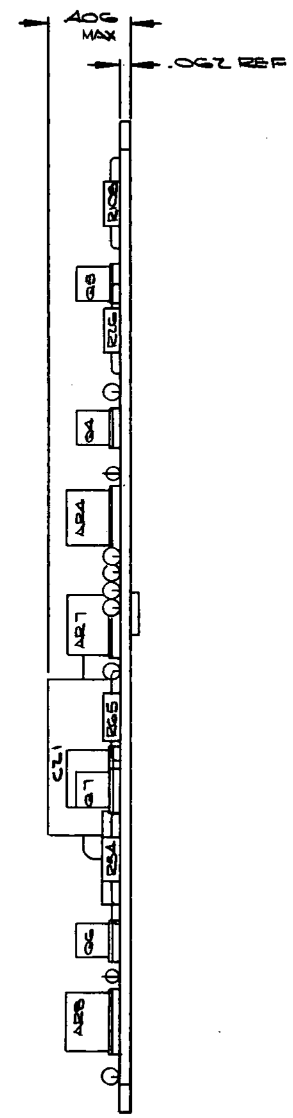
BRUNING 44-132 15369

FOLDOUT FRAME 1 60-A 60-B FOLDOUT FRAME 2 60-C

REVISIONS				
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL

D 41098 SHT 1 OF 2





NOTES, GENERAL:

1. FORM DIODE LEADS PER A10815
2. ASSEMBLE PER MOPS 80.5
3. SECURE LARGE COMPONENTS PER MSFC PROC 257
4. (△) AT POINTS 1⊕ THRU 51⊕, MAKE INTERFACIAL CONNECTIONS USING #24 AWG (.020 DIA) BUSS WIRE.

(G1) ASSEMBLY INACTIVE AUG 4, 1972
ASSEMBLE PER PARTS LIST D41098-G1
FOR ELEM DIAG SEE F50031

(G2) ASSEMBLY INACTIVE AUG 4, 1972 REPLACED BY D41098-G3
ASSEMBLE PER PARTS LIST D41098-G2
FOR ELEM DIAG SEE F50027

Reproduced from best available copy.

J1 PIN	FUNCTION	J1 PIN	FUNCTION	J1 PIN	FUNCTION	J2 PIN	FUNCTION	J3 PIN	FUNCTION	J4 PIN	FUNCTION	J4 PIN	FUNCTION	J4 PIN	FUNCTION	J4 PIN	FUNCTION
10	Bψ POL TLM	20	SPARE							10	K/1 Bα1	20	-(ψ+δωψ)	30	K/1 Bφ1		
9	TEST	19	SPARE			9	SPARE	9	YAW RATE	9	SPARE	19	CHAS GND	29	SPARE		
8	TEST	18	Bφ POL TLM			8	SPARE	8	PITCH ERR	8	SPARE	18	SIG GND	28	↑		
7	1 Bα 1 TLM	17	SPARE			7	SPARE	7	SPARE	7	δωφ	17	Bψ	27		37	CHAS GND
6	TEST	16	SPARE			6	SPARE	6	SPARE	6	α+δωα	16	Bα	26		36	SIG GND
5	TEST	15	TEST	25	MODE III TLM	6		5	YAW TACH	5	-δωα	15	Bφ	25		35	Bψ
4	Bα POL TLM	14	TEST	24	TEST	4	SPARE	4	PITCH TACH	4	K/1 Bψ1	14	-10V	24		34	Bα
3	TEST	13	1 Bψ 1 TLM	23	TEST	3		3	SPARE	3	SPARE	13	+10V	23		33	Bφ
2	1 Bφ 1 TLM	12	TEST	22	TEST	2	SPARE	2	SIG GND	2	Bψ POL	12	Bφ POL	22	↓	32	-10V
1	TEST	11	TEST	21	TEST	1		1	ROLL DIFF TACH	1	DISCRIM.	11	Bα POL	21	SPARE	31	+10V

J1 PIN ASSIGNMENTS — J2 PIN ASSIGN. — J3 PIN ASSIGN. — J4 PIN ASSIGNMENTS

BRUNING 44-132 15369

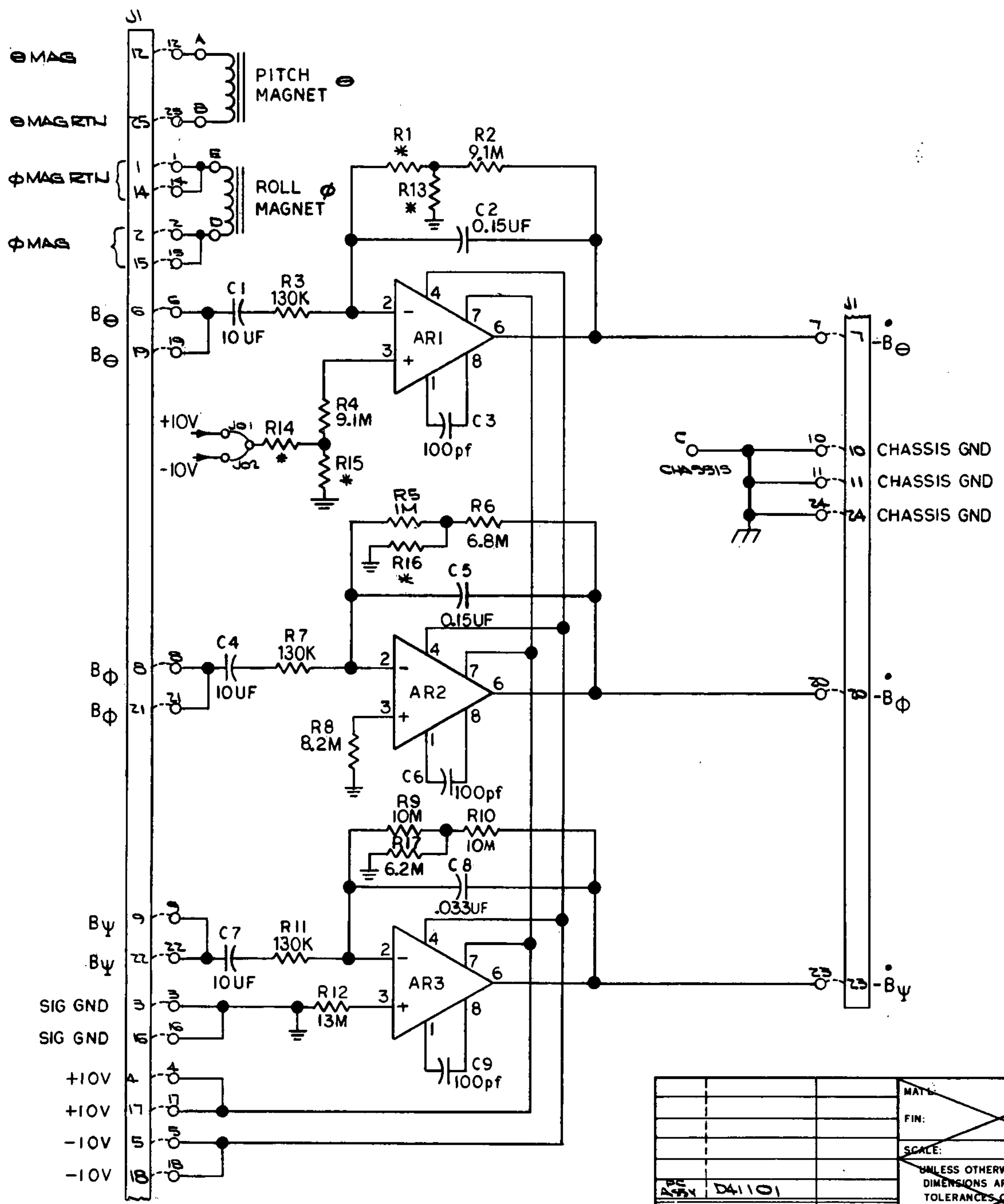
SEE SEPARATE PARTS LIST(S)

ASSY C31552	REFERENCE DWG / USED ON / APPLICATION
MAT'L:	FIN:
SCALE: 2/1	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64, DECIMALS ± .010, ANGLES ± 1/2°
ASSY, PRINTED WIRING BD - CONTROL CARD	ITHACO, INC. ITHACA, N.Y.
FMF: JOB# 10-2724	CODE IDENT. NO. 26502
DRAWN BY: J. GOGGART 6-12-72	D 41098
CHECKED BY: [signature] 6-14-72	
APPROVAL: DFTG. [initials] ENG. [initials]	
ISSUE DATE: 7-7-72	SHT 1 OF 2

ITH-24M A25 A1 C-1

ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
	A	CHANGE PER SSCN 13004	6-8-72	
	B	CHANGE PER SSCN 13006	6-19-72	
	C	CHANGE PER SSCN 13015	7-21-72	
	D	CHANGE PER SSCN 13026	9-4-72	
	E	REV PER SSCN 13025	10-27-72	

REVISIONS — C 31514 SHT 1 OF 1



NOTES

UNLESS OTHERWISE SPECIFIED:

1. RESISTOR ARE 1/4W, 5%, STYLE RCR07
   * INDICATES TRIM RESISTOR, VALUE TO BE SELECTED AT TEST
3. OP AMP: ARE NATIONAL SEMICONDUCTOR LM108AH/883
4. CAPACITORS:
   VALUES IN pf ARE CERAMIC, STYLE CKR05, OTHERS ARE MYLAR, GE TYPE 63F; C1, C4, C7 ARE ELECTROCUBE NO. 625B1B106J, POLYCARBONATE, ± 5%.
5. "JO" INDICATES JUMPERS

PC ASSY	D41101
REFERENCE DWG	USED ON
APPLICATION	

MAT'L:
FIN:
SCALE:

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON

FRACTIONS	DECIMALS	ANGLES
± 1/64	± .010	± 1/2°

ELEM DIAGRAM
PITCH, ROLL - CARD

FMF: JOB# 10-2724

DRAWN BY: L. Ayers 5/8/72

CHECKED BY: 5-12-72

APPROVAL: DFTG. ENG.

ISSUE DATE: May 23, 1972

ITHACO, INC.
ITHACA, N. Y.

CODE IDENT. NO. 26502

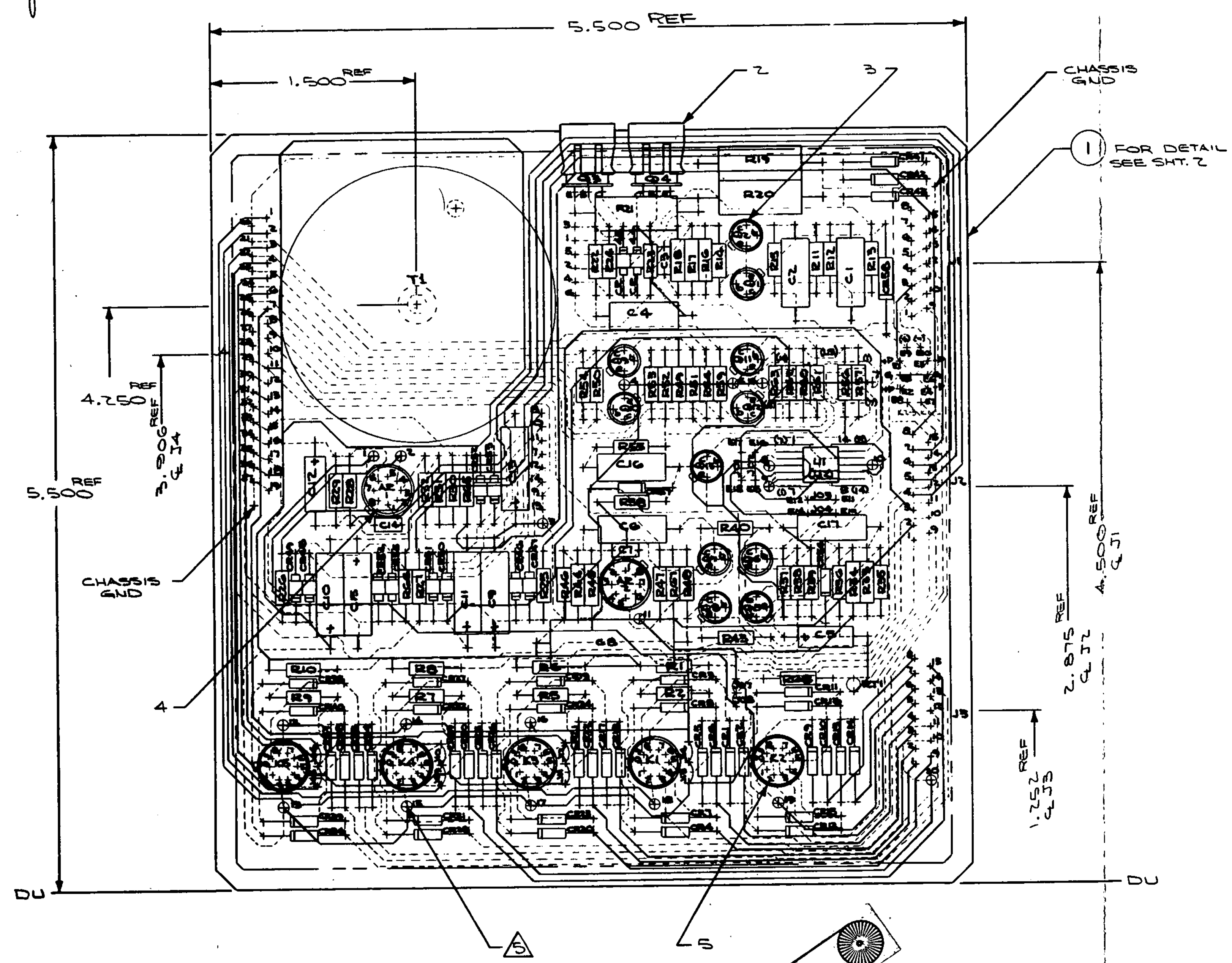
C 31514

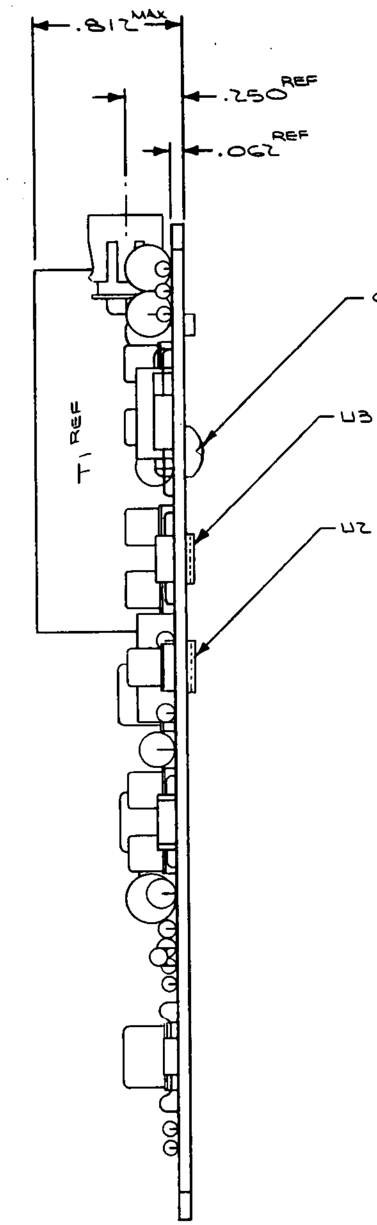
SHT 1 OF 1

BRUNING 44-132 14930

REVISIONS				
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
	A	REV PER 35501:B001	7-1-72	

D 41097 SHT 1 OF 2





NOTES, GENERAL

1. FORM DIODE LEADS PER A10315
2. ASSEMBLE PER MOPS 30.3
3. SECURE LARGE COMPONENTS PER MSFC PROC 257
4. ASSEMBLE HEAT SINK XSTRS USING FRAME JIG #78037
5. (△) AT POINTS 1 ⊕ THRU 20 ⊕, MAKE INTERFACIAL CONNECTIONS USING #24 AWG (.020 DIA) BUSS WIRE.

(G1) ASSEMBLY,
ASSEMBLE PER PARTS LIST D41097-G1.
FOR ELEM DIAG SEE F50028

(G2) ASSEMBLY,
ASSEMBLE PER PARTS LIST D41097-G2
FOR ELEM DIAG SEE D41115.

J4 ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
10	RAMP	20		30	+5V PWR		
9	TEST	19	CHAS GND	29	SIG GND		
8	TEST	18	SIG GND	28			
7	-10V	17	+45V	27		37	CHAS GND
6	-10V	16	+5V REF	26	TEST	36	SIG GND
5	-10V	15	-5V REF	25	$\overline{\phi A}$	35	+45V
4	+10V	14	-10V	24	ϕ A	34	+5V REF
3	+10V	13	+10V	23	TEST	33	-5V REF
2	+10V	12	+5V PWR	22	$\overline{\phi B}$	32	-10V
1		11	SIG GND	21	ϕ B	31	+10V

J3 ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION
10			
9			
8	PWR ON		
7	PWR OFF		
6	PWR ON/OFF RTN		
5		15	
4		14	
3		13	
2		12	
1		11	

J2 ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION
10	TLM		
9	TEMP TLM		
8	TEST		
7	TEST		
6	TEST		
5	TEST	15	SIG GND
4	TEST	14	
3	TEST	13	
2	TEST	12	TLM
1	TLM	11	TLM

J1 ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION
10	-PWR		
9	SIG GND		
8			
7			
6			
5		15	CHAS GND
4		14	
3	+ PWR	13	
2	- PWR	12	
1	SIG GND	11	+ PWR

SEE SEPARATE PARTS LIST(S)

ASSY C31531	
REFERENCE DWG	USED ON
APPLICATION	

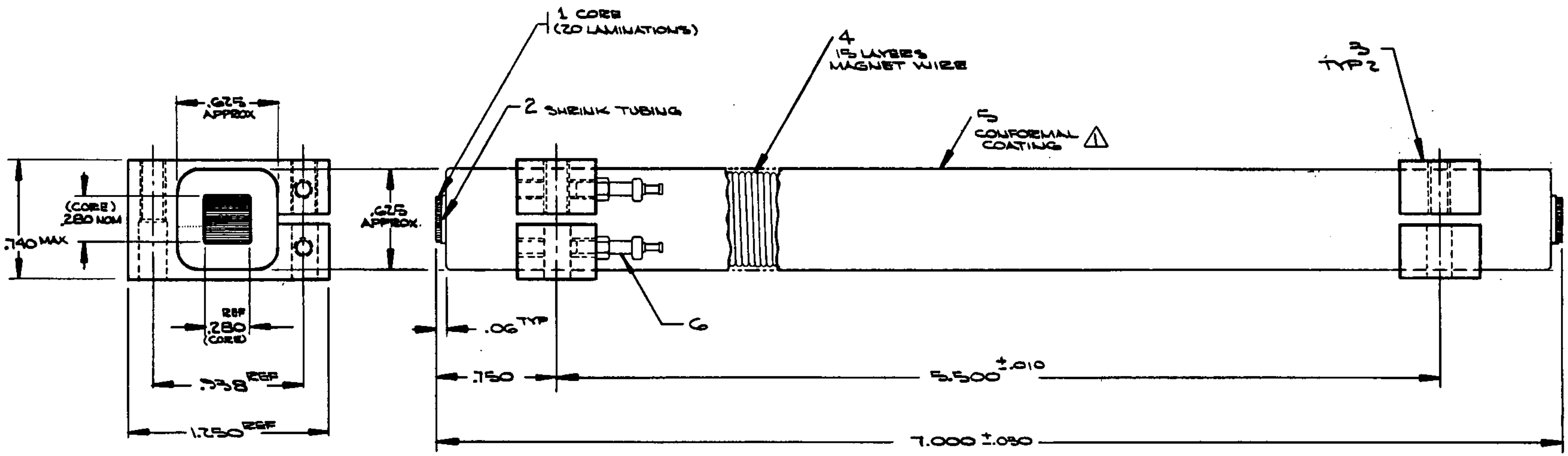
MAT'L:
FIN:
SCALE: 2/1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ± .010 ANGLES ± 1/2°

ASSY, PRINTED WIRING BD - POWER SUPPLY
FMF: JOB# 10-2724
DRAWN BY: J. GOSART 4-72
CHECKED BY:
APPROVAL: DFTG. ENG.
ISSUE DATE: June 12, 1972

ITHACO, INC.
ITHACA, N. Y.
CODE IDENT. NO. 26502
D 41097
SHT 1 OF 2

REVISIONS				
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
3C	A	REV PER ECN 18026	10-17-72	RS

C 31520 SHT 1 OF 1



G1

NOTES:

1. ASSEMBLE & CONFORMAL COAT PER MOPS 30.40
2. ASSEMBLE ITEM 3 (MOUNTING BLOCKS) USING FIXTURE 78058

ITEM NO.	QTY REQD	CODE IDENT.	PART NO. OR IDENTIFYING NO.	DESCRIPTION	MATERIAL	SPECIFICATION
6	2		CAMBION #2256-1	TERMINAL, INS.		
5	AR		HYSOL PC-22	CONFORMAL COATING		
4	AR		#30 HEAVY FORMBAR	MAGNET WIRE		
3	2		B21993-P1	MOUNTING BLOCK		
2	AR		RAYCHEM	SHRINK TUBING	KYNAR	
1	20		A11231-P1	LAMINATE		
	G1		PARTS LIST			

REFERENCE DWG		USED ON
ASSY	D41086	PITCH/ROLL MODULE
ASSY	D41095	YAW MODULE

APPLICATION

MAT'L: FIN: SEE NOTES AND PARTS LIST

SCALE: 2/1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ±2°

ASSY "7" MAGNET"

FMF JOB# 10-2724

DRAWN BY: [signature] June 2, 1972

CHECKED BY: [signature] June 8, 1972

APPROVAL DFTG. [signature] ENG. V.H.B.

ISSUE DATE June 15, 1972

ITHACO, INC. ITHACA, N. Y.

CODE IDENT. NO. 26502

C 31520

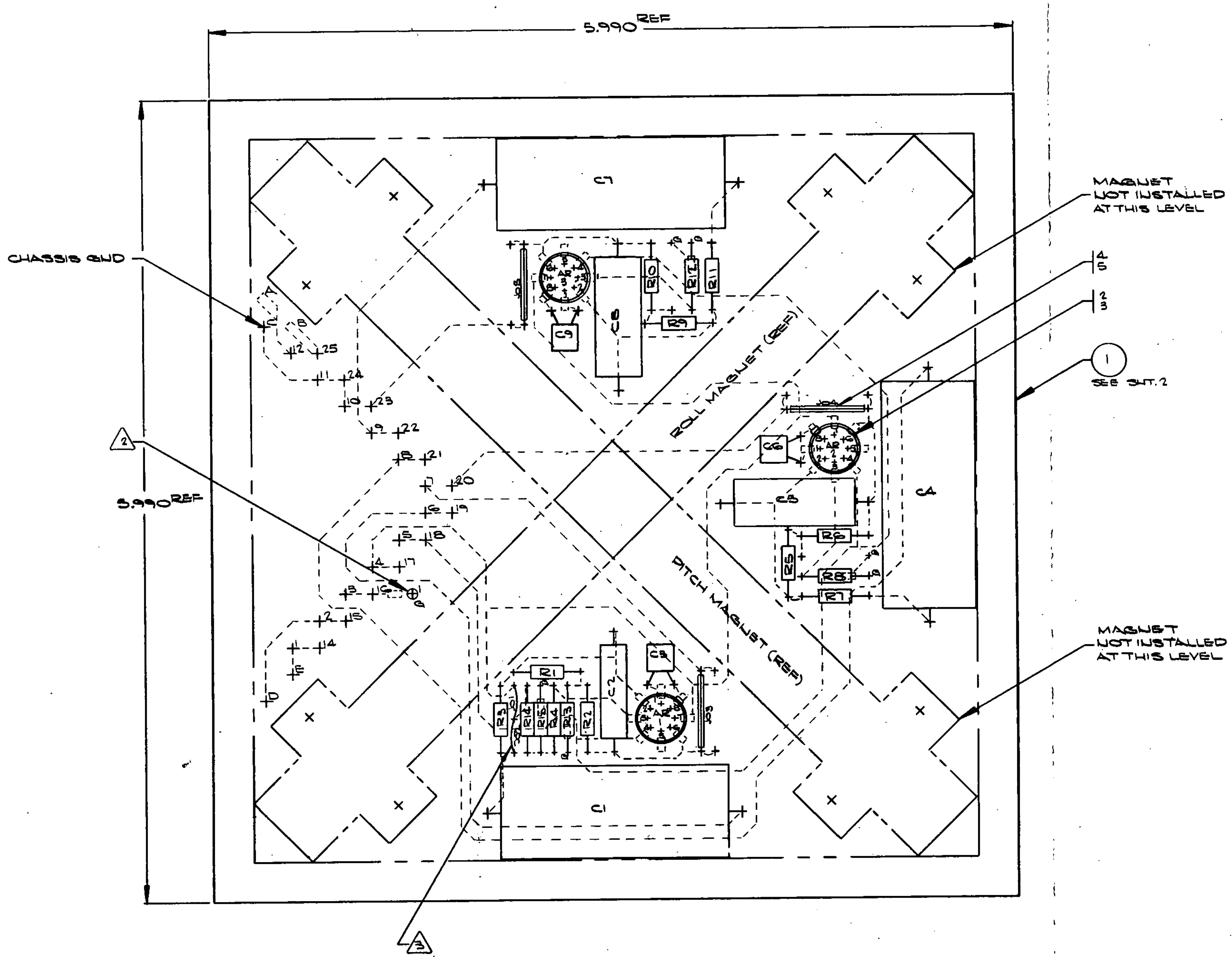
SHT 1 OF 1

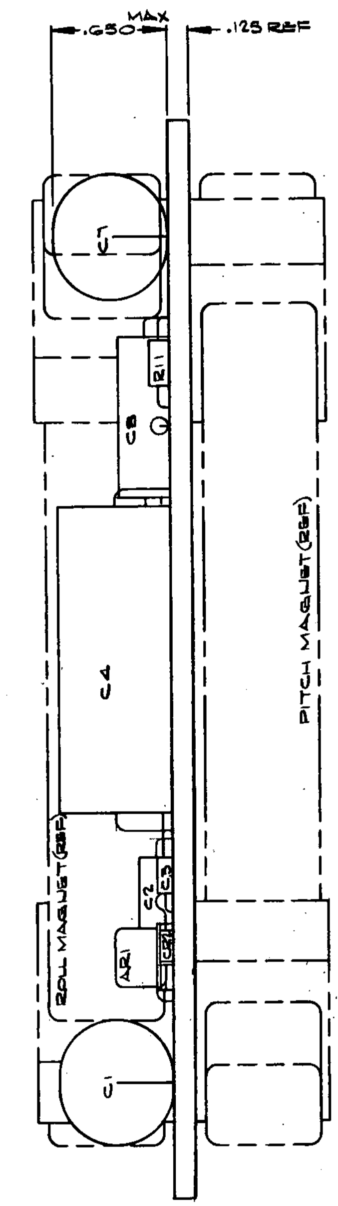
BRUNING 44-132 14930

-63-

64-A FOLDOUT FRAME 1 64-B FOLDOUT FRAME 2 64-C

REVISIONS			D 41101 SHT 1 OF 2	
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL
	A	REV. & RED. SSCN 13006 JS 6-28-72	7-6-72	VHS
	B	REV PER SSCN 13015 JS 7-18-72	7-21-72	V.H.S.
	C	REV PER SSCN 13020 JS 8-11-72	9-4-72	





(G1) INACTIVE FOR NEW DESIGN AFTER SEPT. 11, 1972 USE D41101-G2

NOTES:

1. ASSEMBLE PER MOPS 30.3
2. (△2) AT POINT 10 MAKE INTERFACIAL CONNECTION PER FIGURE 8 OF MOPS 30.5
3. (△3) FOR +10V TO R14 INSTALL J01 ONLY
   FOR -10V TO R14 INSTALL J02 ONLY

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
9	BΨ	18	-10V		
8	BΦ	17	+10V		
7	-B°Θ	16	SIG GND	25	ΘMAG RTN
6	BΘ	15	ΦMAG	24	CHAS GND
5	-10V	14	ΦMAG RTN	23	-B°Ψ
4	+10V	13	SPARE	22	BΨ
3	SIG GND	12	ΘMAG	21	BΦ
2	ΦMAG	11	CHAS GND	20	-B°Φ
1	ΦMAG RTN	10	CHAS GND	19	BΘ

J1 PIN ASSIGNMENTS

SEE SEPARATE PARTS LIST

ASSY	D41086	
ELEM	C31514	
REFERENCE DWG		USED ON
ITH-24M	APPLICATION	

MAT'L: — FIN: —
SCALE: 2/1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .010 ANGLES ± 1/2°

ASSY, PRINTED WIRING BD. — PITCH & ROLL
FMF: JOB# 10-2724
DRAWN BY: J. GOSART 6-22-72
CHECKED BY:
APPROVAL: DFTG. J. LONG ENG. V.H.S.
ISSUE DATE: JUNE 5, 1972

A25 A1 P/R-1
ITHACO, INC.
ITHACA, N. Y.
CODE IDENT. NO. 26502
D 41101
SHT 1 OF 2

BRUNING 44-132 15369