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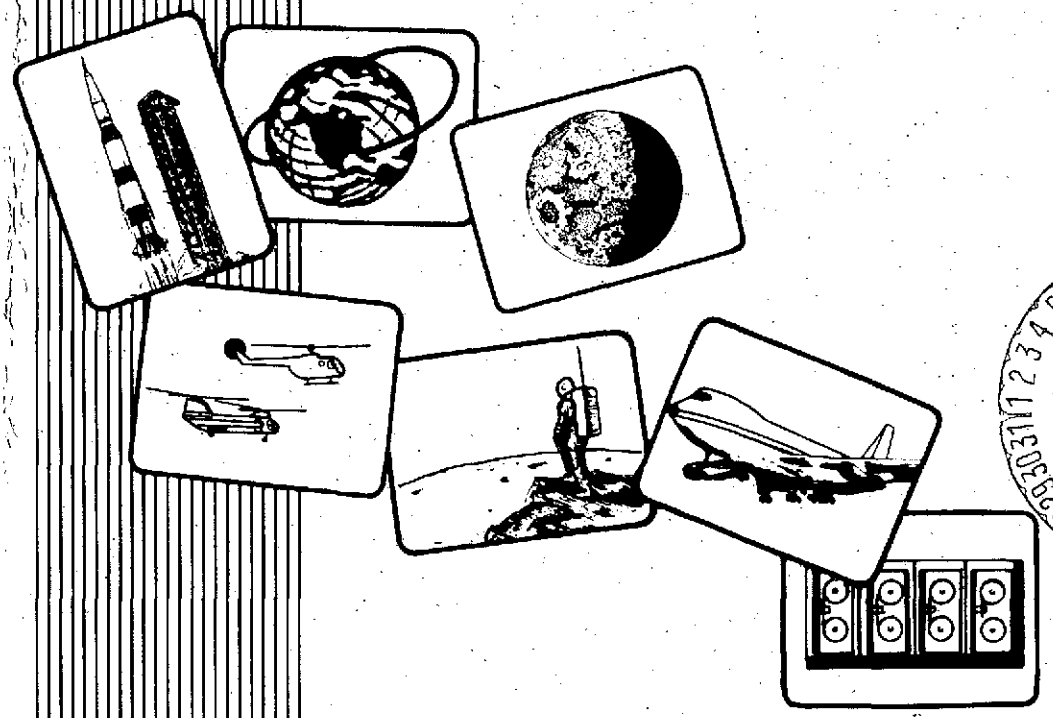
D2-118546-1

DYNAMIC DOCKING TEST SYSTEM (DDTS) ACTIVE TABLE FREQUENCY RESPONSE TEST RESULTS



THE BOEING COMPANY
HOUSTON, TEXAS

August 30, 1974

DOCUMENT NO. D2-118546-1

DYNAMIC DOCKING TEST SYSTEM (DDTS) ACTIVE TABLE FREQUENCY RESPONSE TEST RESULTS

Contract NAS 9-13136

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REVISIONS

REV. SYM	DESCRIPTION	DATE	APPROVED

Form HOU-3-1116 (LSB) Approved 11/67 AJT

ABSTRACT

This document presents the results of the frequency response test performed on the Dynamic Docking Test System (DDTS) active table. Sinusoidal displacement commands were applied to the table and the dynamic response determined from measured actuator responses and accelerometers mounted to the table and one actuator.

KEY WORDS

Docking Simulator
Dynamic Docking Test System (DDTS)
Frequency Response Test

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TABLE

REFERENCES

1. Boeing Document D2-118544-1, "Mathematical Model for the Simulation of Dynamic Docking Test System (DDTS) Active Table Motion," August 30, 1974.

2. Boeing Document D2-118544-2, "Dynamic Docking Test System (DDTS) Active Table Computer Program NASA Advanced Docking System (NADS)," August 30, 1974.

1.0 INTRODUCTION

The DDTS is a six-degree-of-freedom motion simulator developed to perform docking simulations using the USA and USSR docking hardware for the Apollo Soyuz Test Project. The simulator consists of a rigid structure supporting one set of docking hardware and active table to which the other set of docking hardware is attached as shown in Figure 1. The active table is a rigid structure supported by six hydraulic actuators. The motion of each actuator is controlled by an electronic control system which receives commands from equations of motion which provide the desired relative motions of the two spacecraft during docking.

Frequency response tests were conducted to determine the dynamic response of the active table to sinusoidal table motion commands. This document presents the results of these tests and compares them with analytical predictions provided by NASA Advanced Docking System (NADS), a computer program developed to model the dynamics of the active table in response to table motion commands. The mathematical model is derived in Reference 1, and the computer program is described in Reference 2.

2.0 INSTRUMENTATION

2.1 TABLE MOTION

Table displacements are determined by recording time-histories of the six actuator displacements measured by the linear potentiometers used in the displacement feedback of each actuator control system. These measured actuator lengths are then transformed to table displacements.

Simplified transformations from actuator lengths to table displacements are derived assuming small displacements about a nominal table position. Frequency response tests were run with no angular misalignments of the table; therefore, the Euler angles are zero. The inertial components of the actuator lengths at the reference position are then:

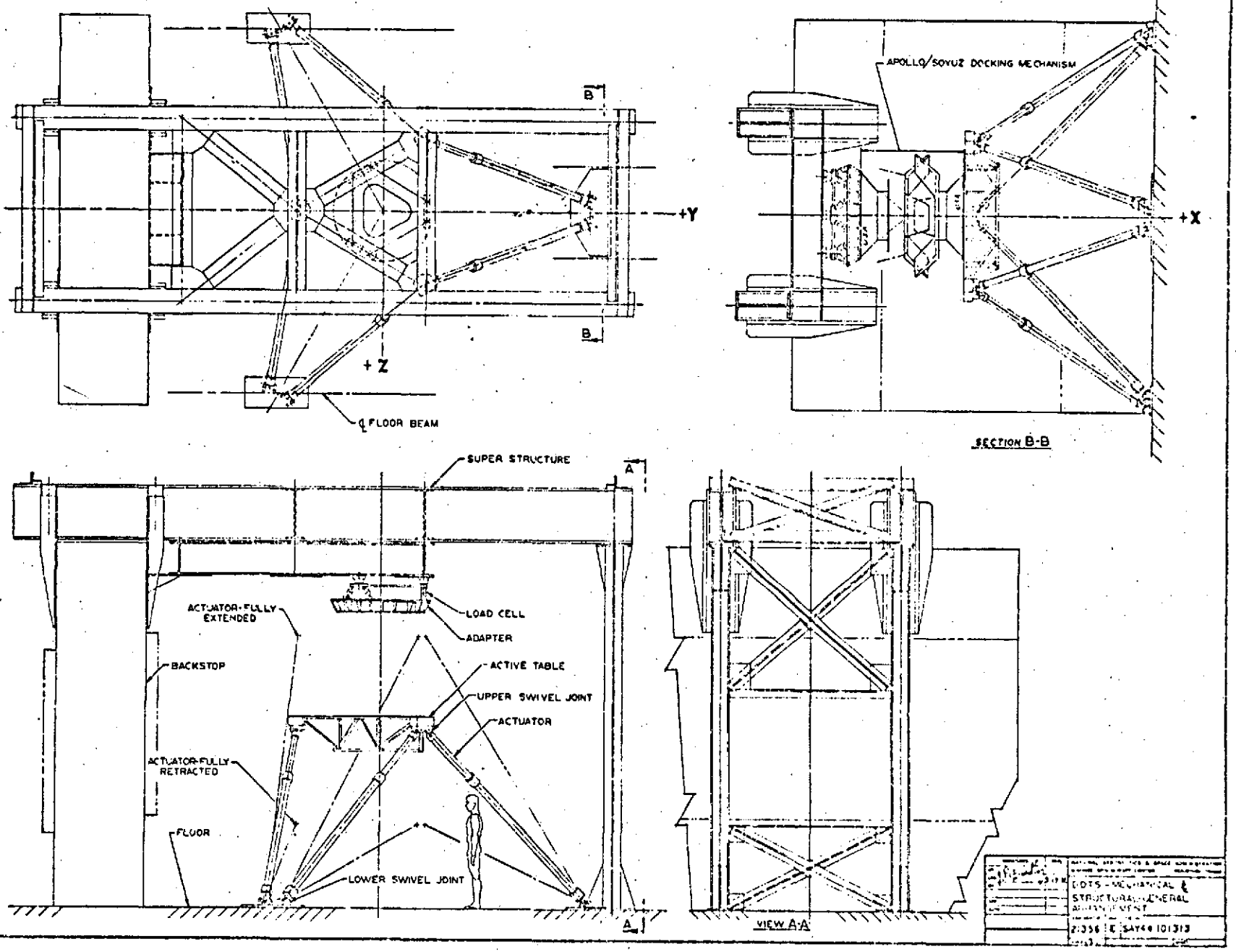


Figure 1. DDTS Simulator Facility

2.1 (Continued)

$$\begin{Bmatrix} r_{s_{x_i}} \\ r_{s_{y_i}} \\ r_{s_{z_i}} \end{Bmatrix} = \begin{Bmatrix} x_{I_o} \\ y_{I_o} \\ z_{I_o} \end{Bmatrix} + \begin{Bmatrix} r_{xa_i} \\ r_{ya_i} \\ r_{za_i} \end{Bmatrix} - \begin{Bmatrix} x_{f_i} \\ y_{f_i} \\ z_{f_i} \end{Bmatrix} \qquad (1)$$

where x_{I_o}, y_{I_o}, and z_{I_o} are the initial inertial positions of the table c.g.; r_{xa_i}, r_{ya_i}, r_{za_i}, are the x, y, z coordinates of the $i^{\underline{th}}$ table swivel joint with respect to the table c.g.; and x_{f_i}, y_{f_i}, z_{f_i} are the inertial coordinates of the floor swivel joints for the $i^{\underline{th}}$ actuator (see Figure 2).

Initial actuator lengths are then:

$$l_{o_i} = \sqrt{r_{s_{x_i}}^2 + r_{s_{y_i}}^2 + r_{s_{z_i}}^2} \qquad (2)$$

For geometry transformation purposes, it can be assumed that $r_{s_{x_i}}$, $r_{y_{s_i}}$, and l_{o_i} are constant. Incremental motions of the actuators can then be transformed to table motions. The transformation between table coordinates and inertial coordinates is unity.

In general:

$$\dot{l}_{p_i} = \left[r_{s_{x_i}} \dot{r}_{s_{x_i}} + r_{s_{y_i}} \dot{r}_{s_{y_i}} + r_{s_{z_i}} \dot{r}_{s_{z_i}} \right] / l_{p_i} \qquad (3)$$

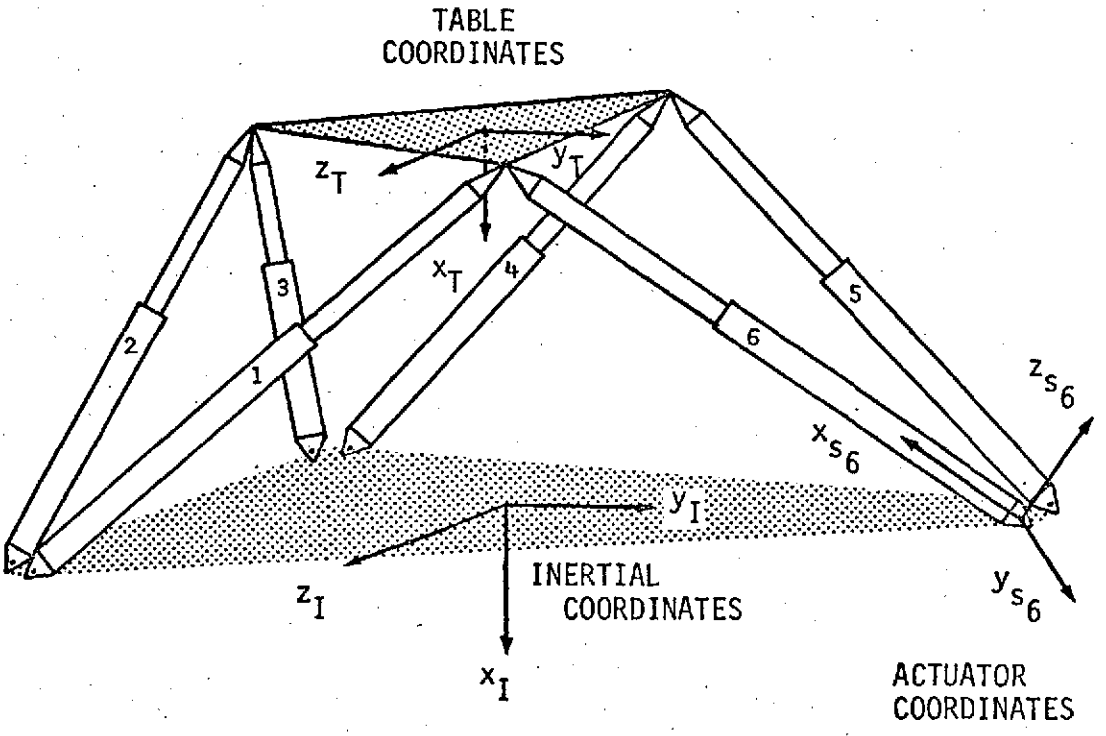


Figure 2. Active Table Coordinate Systems

2.1 (Continued)

but, if we let

$$\begin{Bmatrix} \dot{r}_{s_{x_i}} \\ \dot{r}_{s_{y_i}} \\ \dot{r}_{s_{z_i}} \end{Bmatrix} = \begin{Bmatrix} \dot{x}_T \\ \dot{y}_T \\ \dot{z}_T \end{Bmatrix} + \begin{bmatrix} 0 & -\omega_z & \omega_y \\ \omega_z & 0 & -\omega_x \\ -\omega_y & \omega_x & 0 \end{bmatrix} \begin{Bmatrix} r_{xa_i} \\ r_{ya_i} \\ r_{za_i} \end{Bmatrix} \tag{4}$$

where $\dot{x}_T$, $\dot{y}_T$, $\dot{z}_T$ are table translational velocities at any centerline reference point, and ω_x, ω_y, ω_z are table angular velocities.

A system of six equations (one for each actuator) and six unknowns ($\dot{x}_T$, $\dot{y}_T$, $\dot{z}_T$, ω_x, ω_y, ω_z) can be written and solved.

$$\left[A\right] \begin{Bmatrix} \dot{x}_T \\ \dot{y}_T \\ \dot{z}_T \\ \omega_x \\ \omega_y \\ \omega_z \end{Bmatrix} = \begin{Bmatrix} \dot{l}_1 \\ \dot{l}_2 \\ \dot{l}_3 \\ \dot{l}_4 \\ \dot{l}_5 \\ \dot{l}_6 \end{Bmatrix} \tag{5}$$

hence:

$$\begin{Bmatrix} \dot{x}_T \\ \dot{y}_T \\ \dot{z}_T \\ \omega_x \\ \omega_y \\ \omega_z \end{Bmatrix} = \left[A\right]^{-1} \begin{Bmatrix} \dot{l}_1 \\ \dot{l}_2 \\ \dot{l}_3 \\ \dot{l}_4 \\ \dot{l}_5 \\ \dot{l}_6 \end{Bmatrix} \tag{6}$$

2.1 (Continued)

The elements of the $i^{\underline{th}}$ row of the [A] matrix are:

$$A_{i1} = r_{s_{x_i}} / l_{o_i}$$

$$A_{i2} = r_{s_{y_i}} / l_{o_i}$$

$$A_{i3} = r_{s_{z_i}} / l_{o_i} \qquad (7)$$

$$A_{i4} = \left(-r_{s_{y_i}} r_{za_i} + r_{s_{z_i}} r_{ya_i}\right) / l_{o_i}$$

$$A_{i5} = \left(r_{s_{x_i}} r_{za_i} - r_{s_{z_i}} r_{xa_i}\right) / l_{o_i}$$

$$A_{i6} = \left(-r_{s_{x_i}} r_{ya_i} + r_{s_{y_i}} r_{xa_i}\right) / l_{o_i}$$

Likewise, the same transformation can be used to solve for incremental table displacements relative to its initial position.

$$\begin{Bmatrix} \Delta x_T \\ \Delta y_T \\ \Delta z_T \\ \Delta\theta_x \\ \Delta\theta_y \\ \Delta\theta_z \end{Bmatrix} = \left[A\right]^{-1} \begin{Bmatrix} l_1 - l_{o_1} \\ l_2 - l_{o_2} \\ l_3 - l_{o_3} \\ l_4 - l_{o_4} \\ l_5 - l_{o_5} \\ l_6 - l_{o_6} \end{Bmatrix} \qquad (8)$$

2.1 (Continued)

where:

$$\left.\begin{aligned} \Delta\theta_x &= \phi \\ \Delta\theta_y &= \theta \\ \Delta\theta_z &= \psi \end{aligned}\right\} \text{ Euler angles} \qquad (9)$$

2.2 ACCELERATIONS

Accelerometers were mounted to the active table and to one of the six hydraulic actuators. Figure 3 shows the location of the ten accelerometers available. One triaxial accelerometer is mounted to the active table truss structure and measures accelerations in the x, y, and z directions. A second triaxial accelerometer mounted to the table corner measures x, radial, and tangential accelerations. Actuator 6 accelerations are measured at the top of the cylinder in two orthogonal lateral directions and the axial direction. Actuator extension accelerations are measured by a Kistler servo accelerometer mounted to the upper end of the actuator piston.

The table on Page 9 shows the accelerometers recorded and those used as abort limit cues.

2.3 HYDRAULIC PRESSURES

Hydraulic pressure measurements were recorded on oscillograph recorders for each actuator. Due to recorder channel limitations, supply pressure measurements for all six actuators were measured while differential pressure measurements for actuators 1 through 5 were recorded. Differential pressures were obtained from the pressure feedback signals in the control system for each actuator.

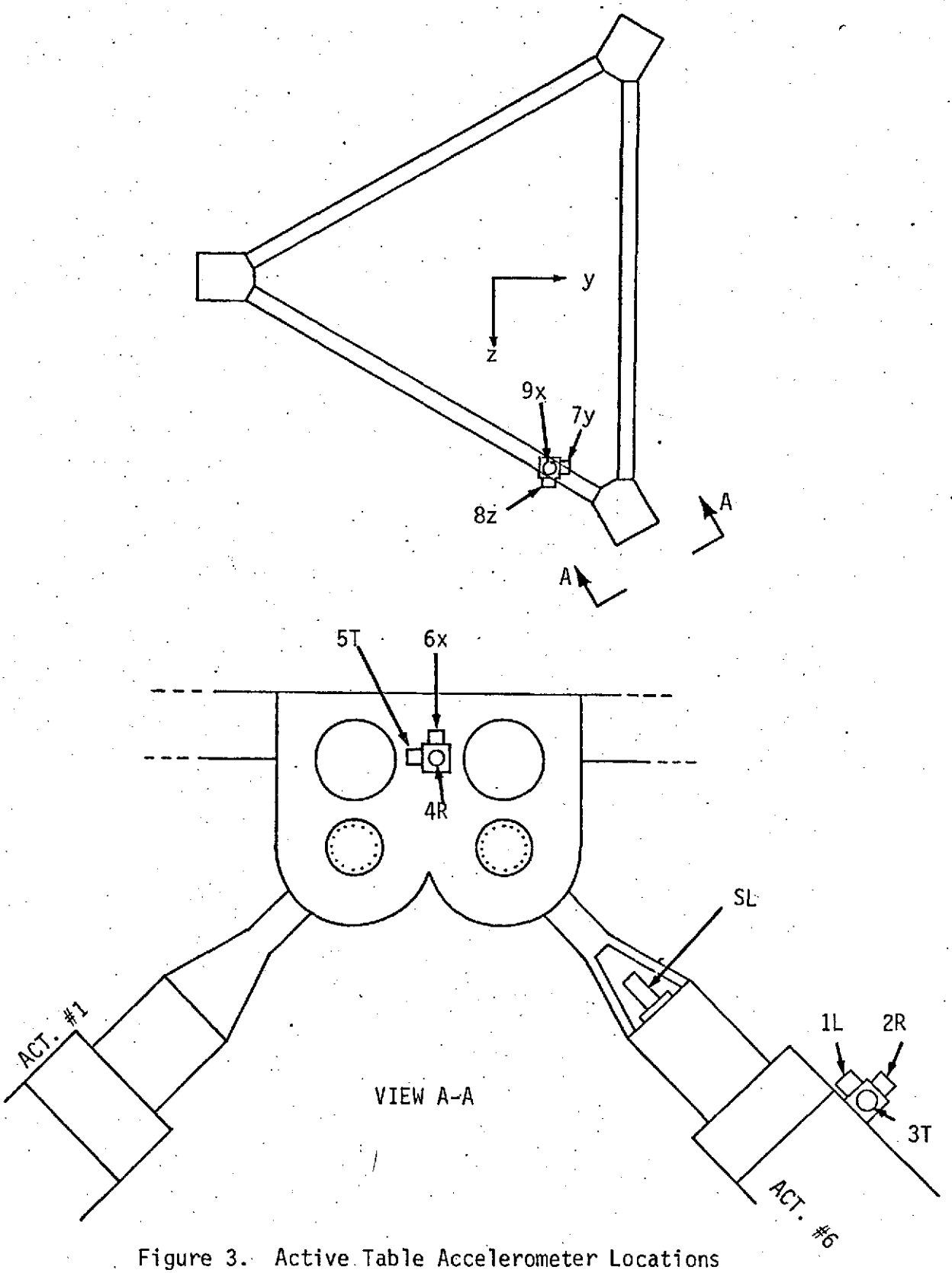


Figure 3. Active Table Accelerometer Locations

DDTS TABLE

FREQUENCY RESPONSE TEST ACCELEROMETERS

ACCEL. NO.	RECORD ON TAPE	USED AS ABORT LIMIT.	LIMIT ACCEL.
1L			
2R	X	X	±3.0 g
3T	X	X	±3.0 g
4R	X		
5T	X		
6X			
7Y	X	X	±3.0 g
8Z	X	X	±3.0 g
9X	X	X	±3.0 g
SL	X		

3.0 TEST INPUTS

The frequency response test was conducted with the table positioned on the simulator centerline with the actuators at mid-stroke ($x_{I_o} = 88.159$; $y_{I_o} = z_{I_o} = 0$). Sinusoidal table commands of 0.05 inch amplitude were used in each of the x, y, and z directions.

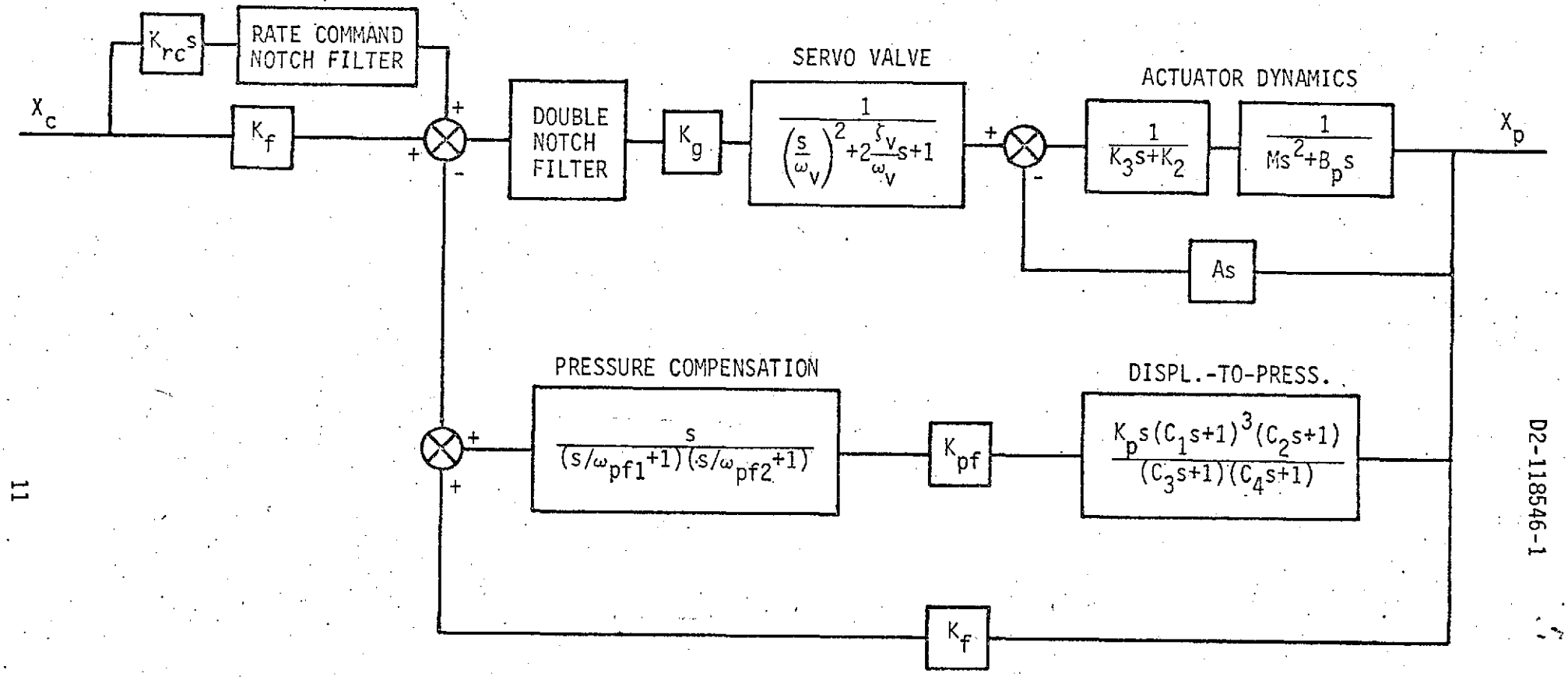
Commanded actuator lengths are determined from

$$\begin{Bmatrix} \Delta l_1 \\ \Delta l_2 \\ \Delta l_3 \\ \Delta l_4 \\ \Delta l_5 \\ \Delta l_6 \end{Bmatrix} = [A] \begin{Bmatrix} \Delta x_I \\ \Delta y_I \\ \Delta z_I \\ \Delta \theta_x \\ \Delta \theta_y \\ \Delta \theta_z \end{Bmatrix} \tag{10}$$

where the terms of the [A] matrix are defined in equation (7).

During docking simulations, each actuator receives a position command and a velocity command as indicated in the actuator control system block diagram shown in Figure 4. However, for the frequency response test, the rate command gain, K_{rc}, was set to zero because the automatic signal generator used in the test was not capable of generating a constant amplitude sine sweep position command and a corresponding rate command simultaneously.

To minimize the magnitudes of table and actuator responses and to reduce the wear and tear on the linear potentiometers, a .05 inch magnitude sinusoidal table position command signal was used. An automatic frequency sweeping signal generator was used to sweep from 1.0 Hz to 40 Hz in 1.0 Hz increments. Fifteen cycles of command signal were used at each frequency.



$$\text{RATE COMMAND NOTCH FILTER} = \frac{(s/\omega_c)^2+D_{cn}s+1}{(s/\omega_c)^2+D_{cd}s+1} \qquad K_3 = \frac{\text{Vol.}}{4\ \beta_e}$$

$$\text{DOUBLE NOTCH FILTER} = \frac{(s^2 + 51680.)(s^2 + 725690.)}{(s^2 + 533.3\ s + 51680.)(s^2 + 533.4\ s + 725690.)}$$

Figure 4. Single-Axis Servo Block Diagram

4.0 FREQUENCY RESPONSE PREDICTIONS

Frequency response characteristics of the table for position commands in the x, y, and z directions were obtained using NADS computer program (References 1 and 2). These predictions are shown in Figure 5. The table frequency response exhibits two resonances--one at the hydraulic resonant frequency ($\sim$ 30 Hz) and another which corresponds to the bending frequency of the actuators ($\sim$ 11 Hz). In the lateral directions, the hydraulic resonance occurs at approximately 22 Hz due to increased effective mass in the lateral direction.

Table and actuator acceleration predictions for each test were also obtained (Figures 6 and 7). Based on these acceleration predictions, a table and actuator acceleration limit of ±3.0 g was established to preclude possible damage to the table or actuators. Accelerometers on the table and actuator 6 (see Section 2.1) were monitored during the test, and an automatic abort capability was utilized.

5.0 TEST RESULTS

Frequency response tests were attempted in the x, y, and z directions. The first test (z-axis) was aborted automatically at 9 Hz due to measured accelerations exceeding the abort limit of 2.5 g. The abort limit was raised to 3.0 g, and the test was rerun. Again the test was automatically aborted at 9 Hz due to excessive accelerations.

It was apparent that the table possessed a resonant peak in the 10-15 Hz range which is higher in magnitude than predicted. Therefore, to prevent possible damage to the table, actuators, or potentiometers, the tests in the y and x directions were conducted using the same 3.0 g abort limit. The y-axis test was automatically aborted at 9 Hz, and the x-axis test was aborted at 11 Hz.

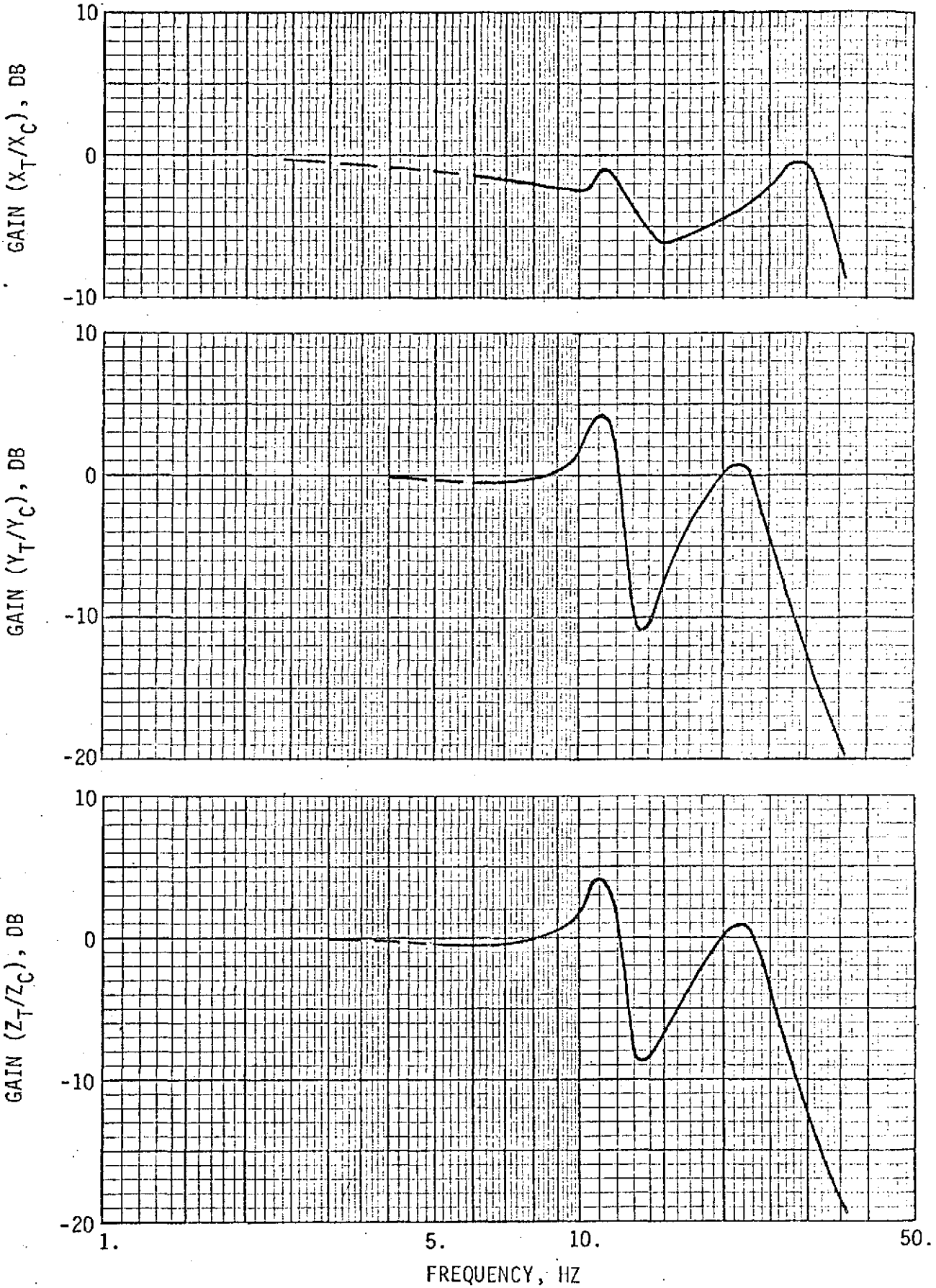


Figure 5. Table Displacement Prediction

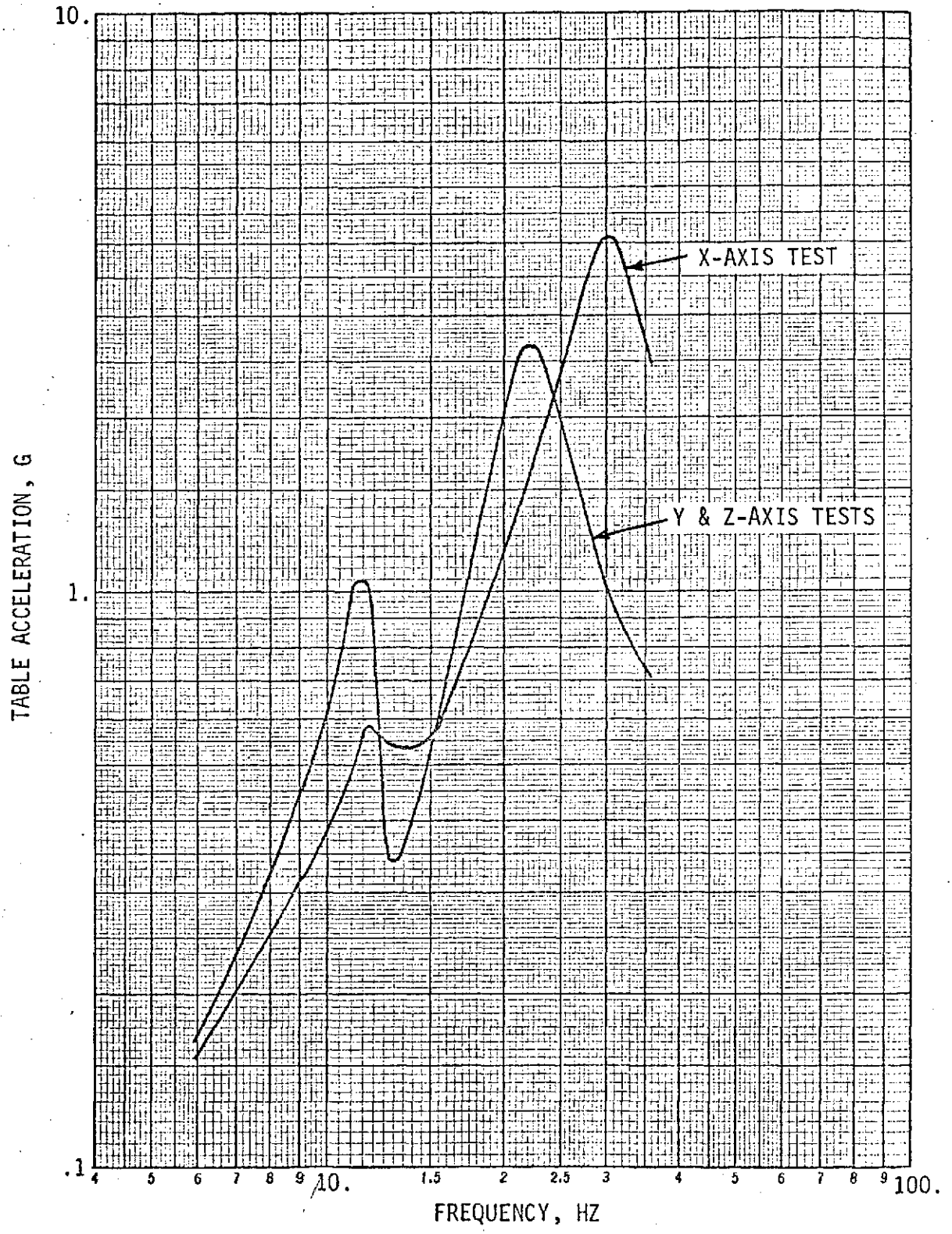


Figure 6. Table Acceleration Prediction

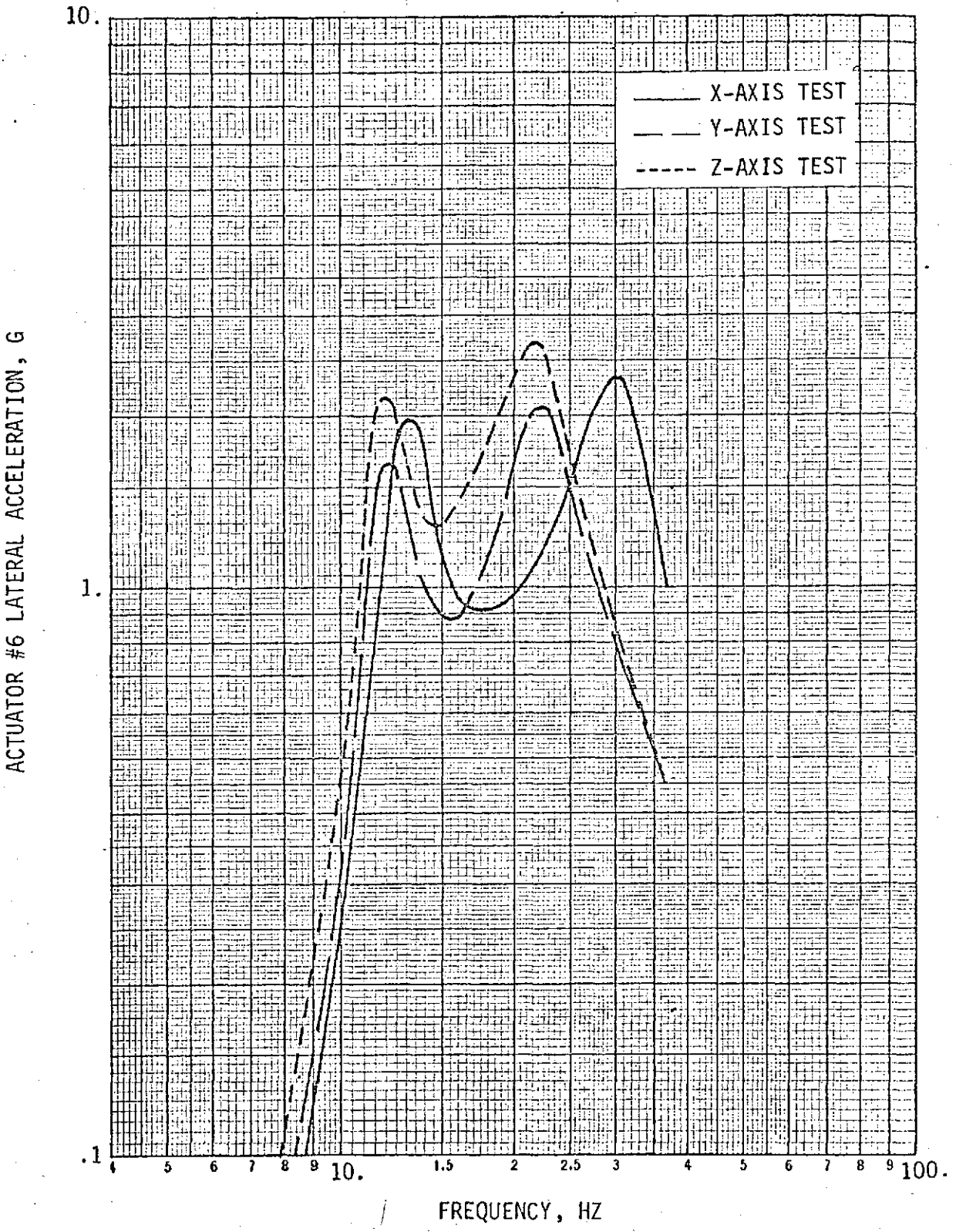


Figure 7. Actuator Acceleration Prediction

5.0 (Continued)

A comparison of frequency response test table motions with predicted table displacements is shown in Figure 8. A complete set of table motion frequency response test data is presented in the appendices. Measured table accelerations are compared with predicted table accelerations in Figure 9. Figure 10 compares measured actuator lateral accelerations at the upper end of actuator 6 cylinder with predicted actuator accelerations.

The cause of the higher dynamic responses has not been identified. Reducing the damping associated with actuator bending dynamics resulted in slightly higher analytical table dynamics, but could not account for the observed difference.

The analytical frequency response predictions show negligible coupling between table responses in the commanded direction and responses in the other directions. Test results show that the off-axis coupling was less than 30 percent of the commanded table motion at frequencies below 10 Hz. Test results shown in the appendices indicate that the coupling becomes more significant as the command frequency approaches the resonant frequency of the table.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The DDTS active table exhibits significantly higher dynamic characteristics than was predicted. It is recommended that further study be conducted to understand this discrepancy. This information is desirable so that the feasibility of utilizing the DDTS to perform other dynamic motion simulations and dynamic tests can be assessed.

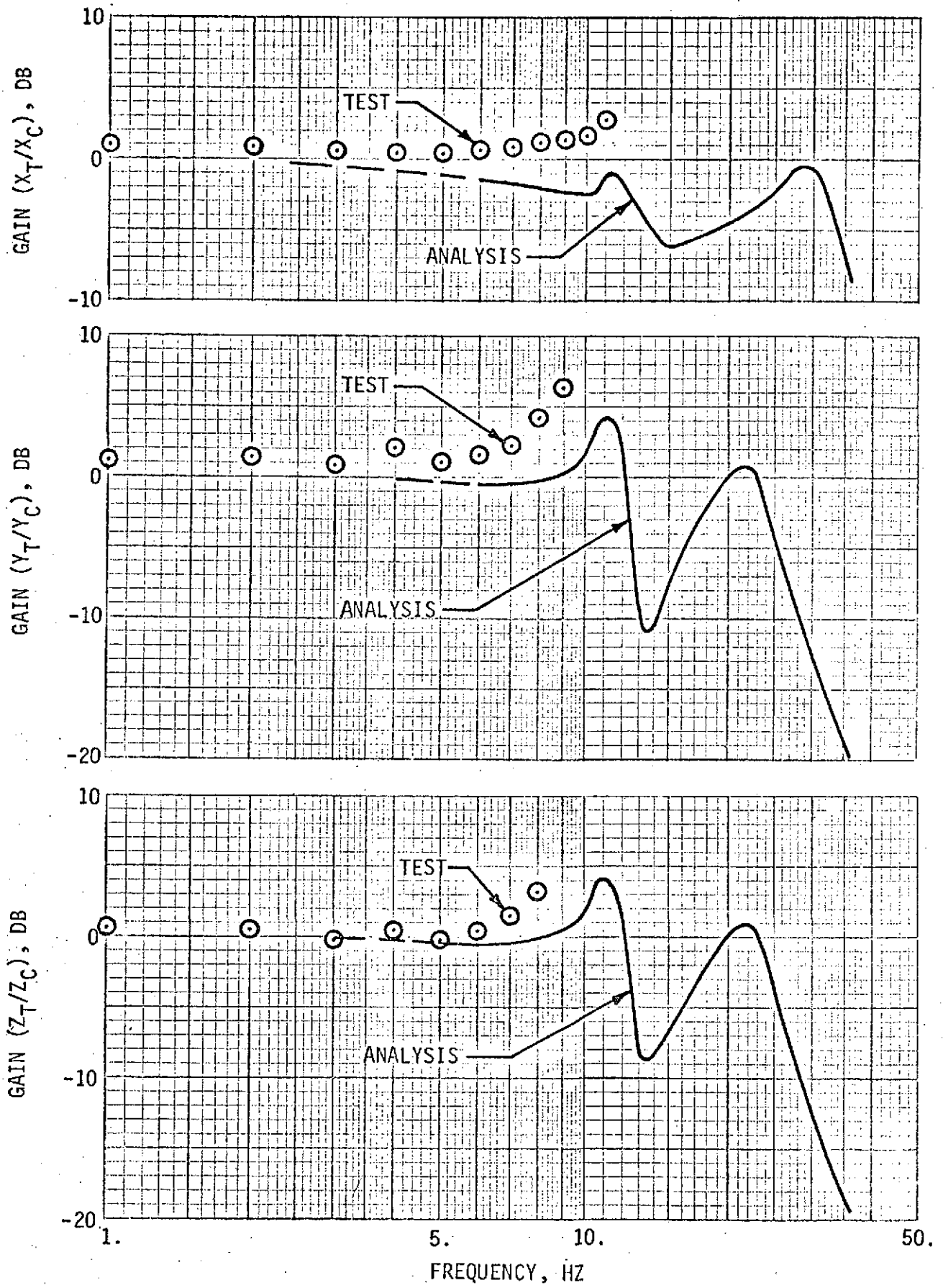


Figure 8. Table Displacement Frequency Response

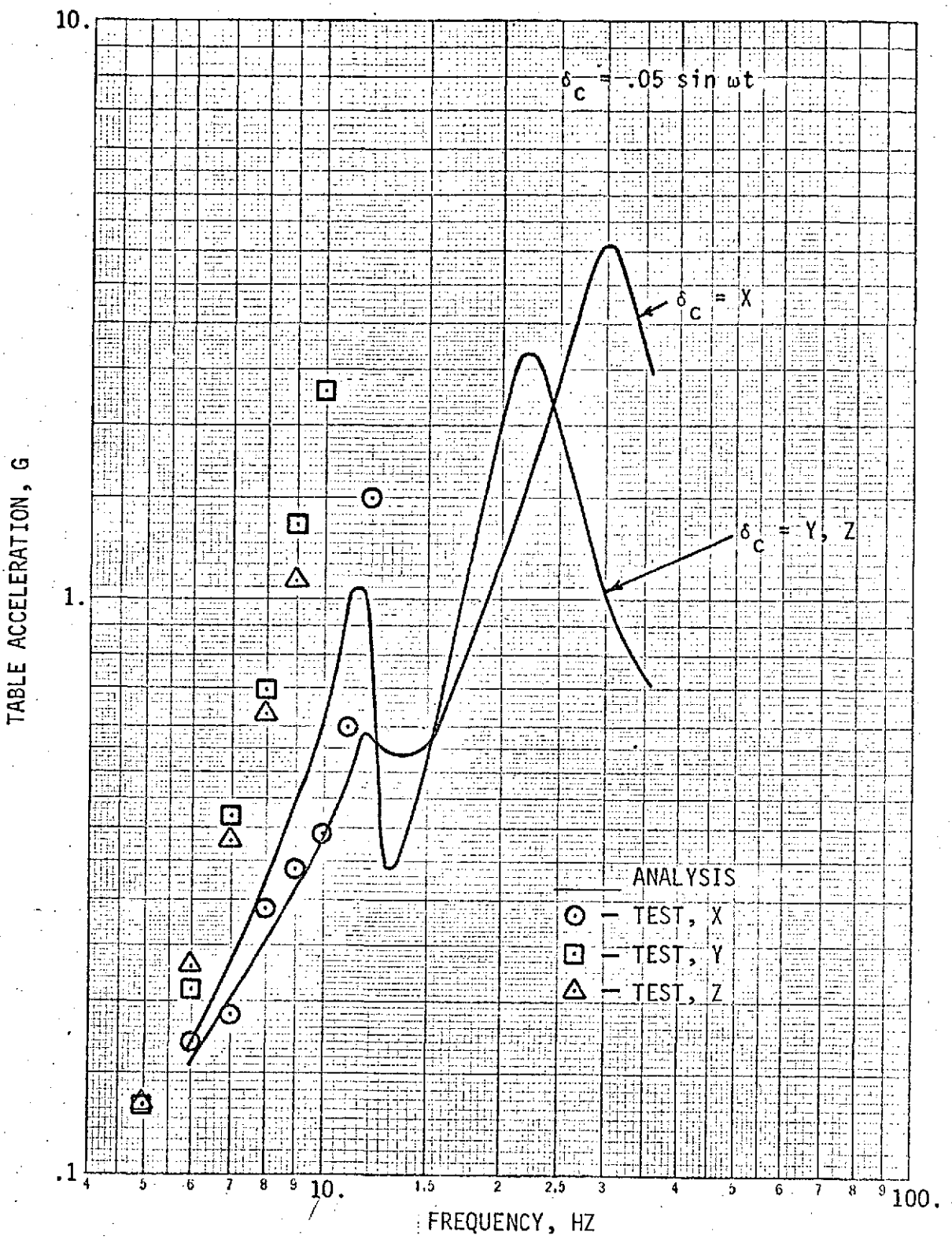


Figure 9. Table Accelerations, Frequency Response Test

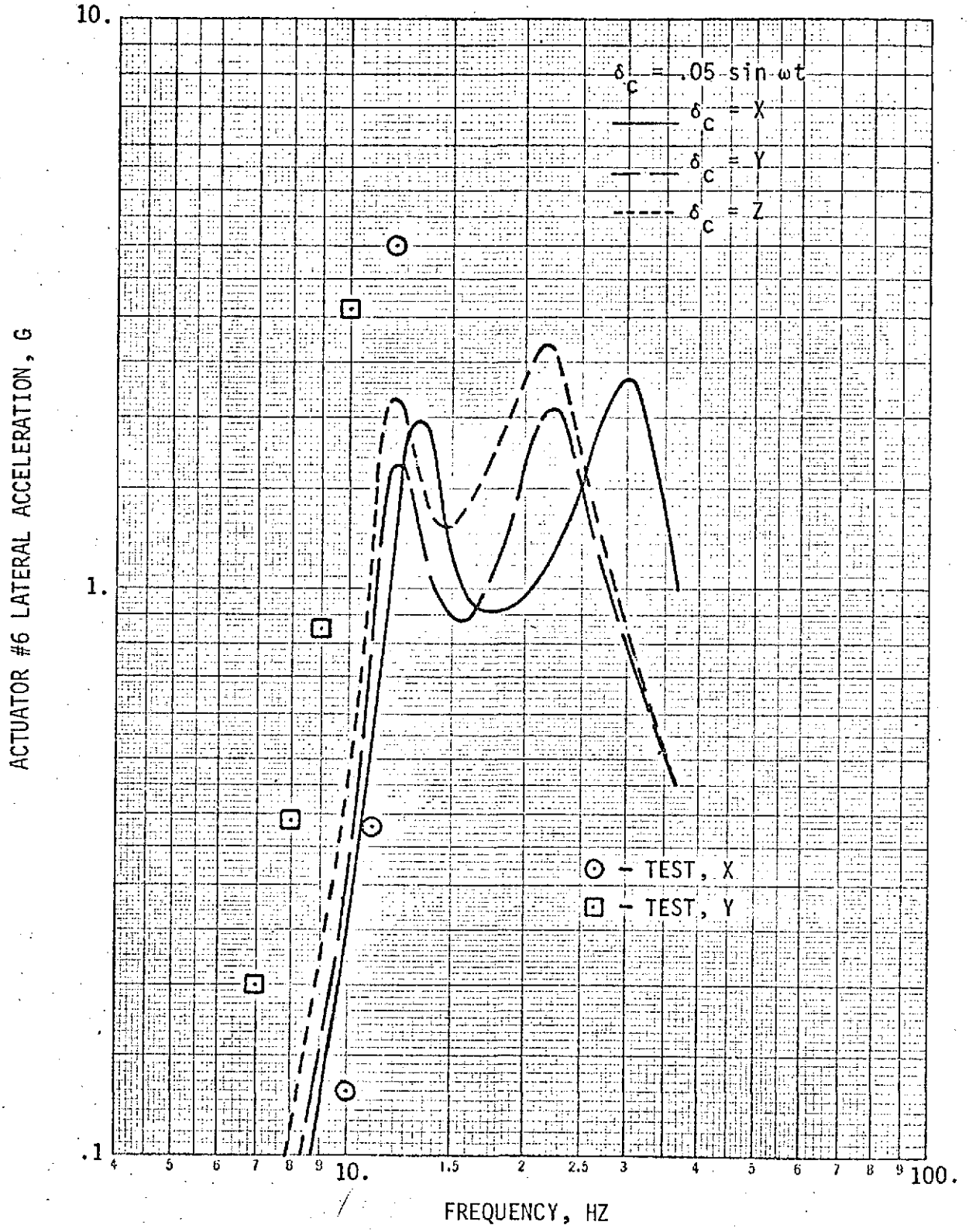


Figure 10. Actuator Accelerations, Frequency Response Test

APPENDIX A

TEST NO. 1 Z-AXIS

ODTS FREQUENCY RESPONSE TEST
SUMMARY OF INPUT INERTIAL CONDITIONS AND TRANSFORM MATRIX

FREQUENCY RESPONCE TEST 1

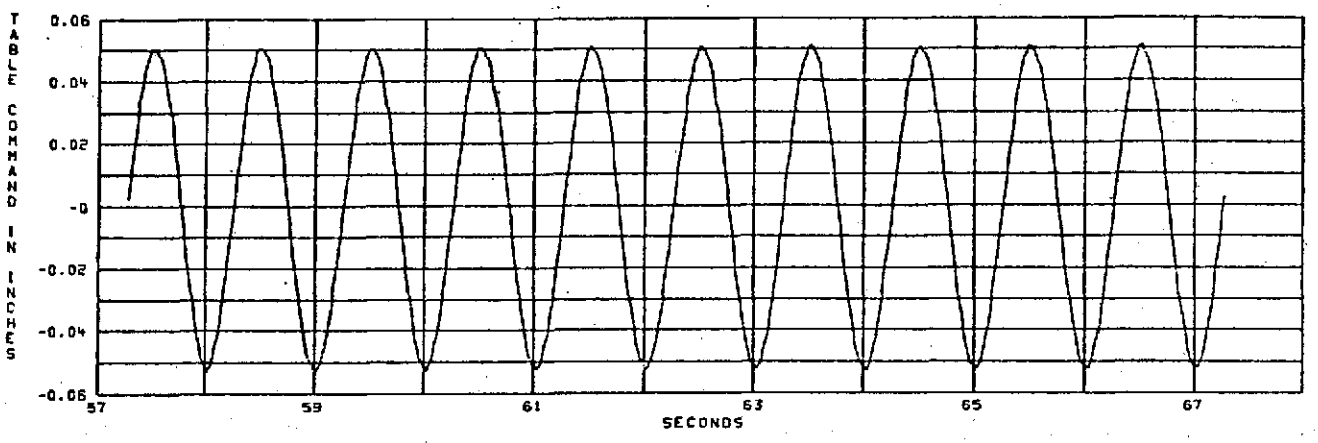
TEST DATE 3/08/74

	X	Y	Z
TABLE COORDINATES	88.159	.000	.000

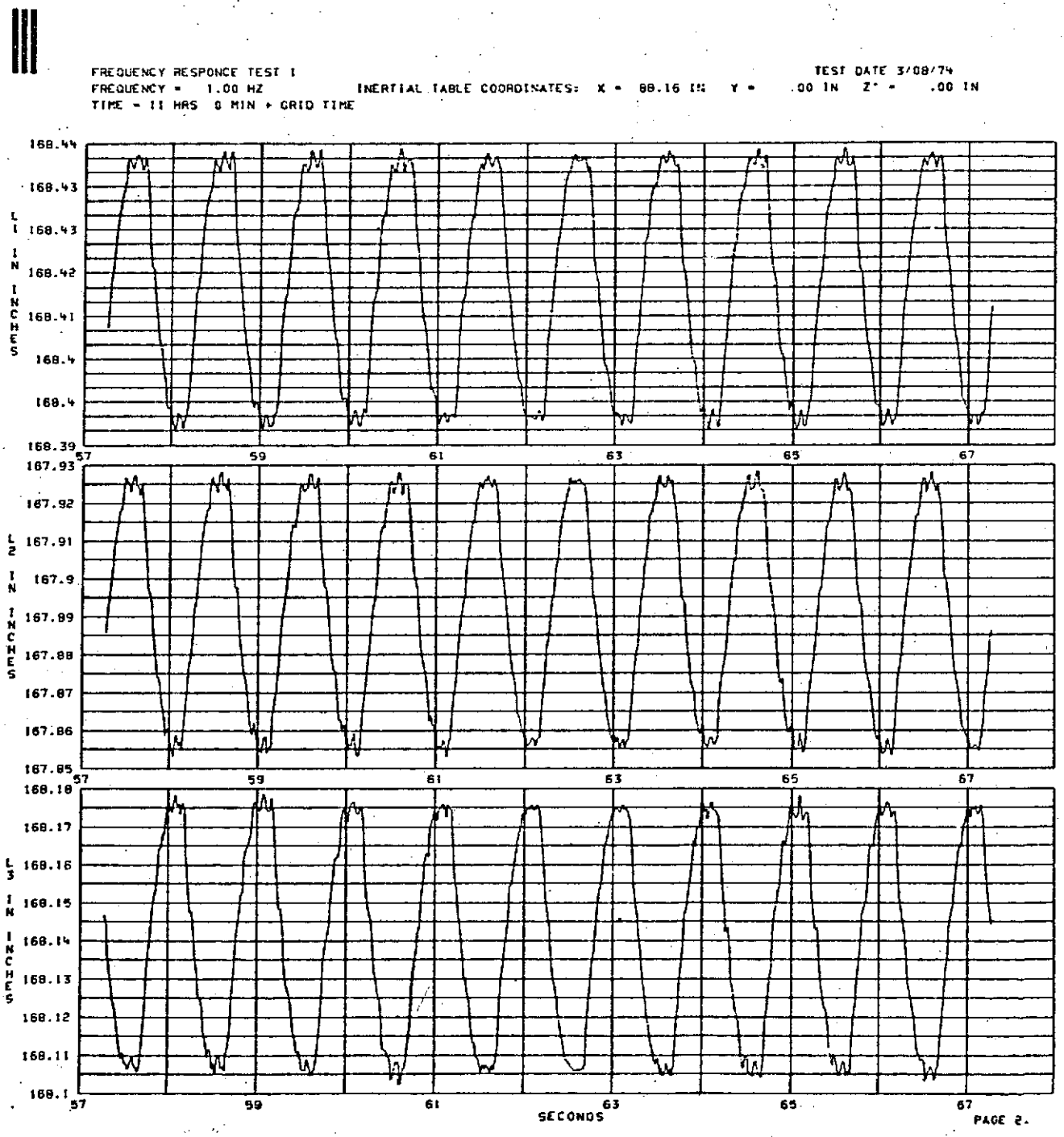
ACTUATOR	SERVO TABLE SWIVEL JOINTS X	Y	Z	FLOOR SWIVEL JOINTS X	Y	Z	COMPONENTS OF ACTUATOR LENGTH X	Y	Z	ACTUATOR LENGTH
1	.0000	25.1020	49.5000	210.4070	-64.3110	123.1780	-122.2480	89.4130	-73.6780	168.4272
2	.0000	-55.4190	3.0000	210.4290	-76.3800	116.1240	-122.2700	20.9610	-113.1240	167.8879
3	.0000	-55.4190	-3.0000	210.4220	-74.5730	-116.8190	-122.2630	19.1540	113.8190	168.1365
4	.0000	25.1020	-49.5000	210.4170	-62.4120	-123.6830	-122.2580	87.5140	74.1830	167.6569
5	.0000	30.2980	-46.5000	210.4100	138.4630	-5.9750	-122.2510	-108.1650	-40.5250	168.1881
6	.0000	30.2980	46.5000	210.3690	138.3890	8.0050	-122.2100	-108.0910	38.4950	167.6330

TRANSFORM MATRIX

-.227798+00	-.229422+00	-.228575+00	-.229554+00	-.228266+00	-.230510+00
.447118+00	-.236022-01	-.303266-01	.442709+00	-.416853+00	-.419525+00
-.222802+00	-.498159+00	.498501+00	.228740-00	-.276033+00	.268561+00
-.450573-02	.449077-02	-.449777-02	.448526-02	-.450071-02	.448595-02
-.648215-02	.145547-02	-.146094-02	.650505-02	.794358-02	-.796988-02
.543719-02	-.835884-02	-.833211-02	.544980-02	.288540-02	.291976-02


FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 0 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
57
59
61
63
65
67
SECONDS

PAGE 1.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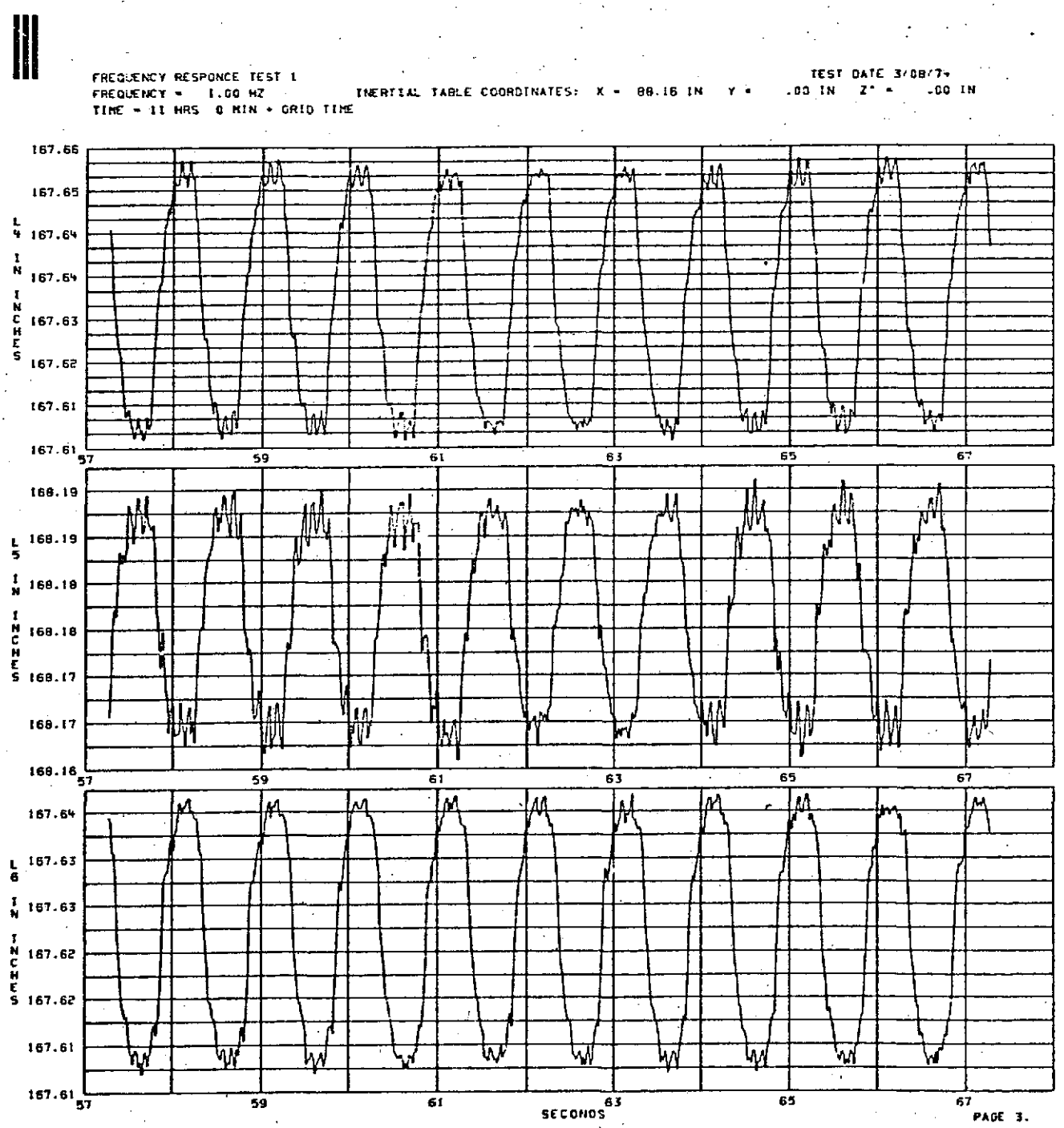
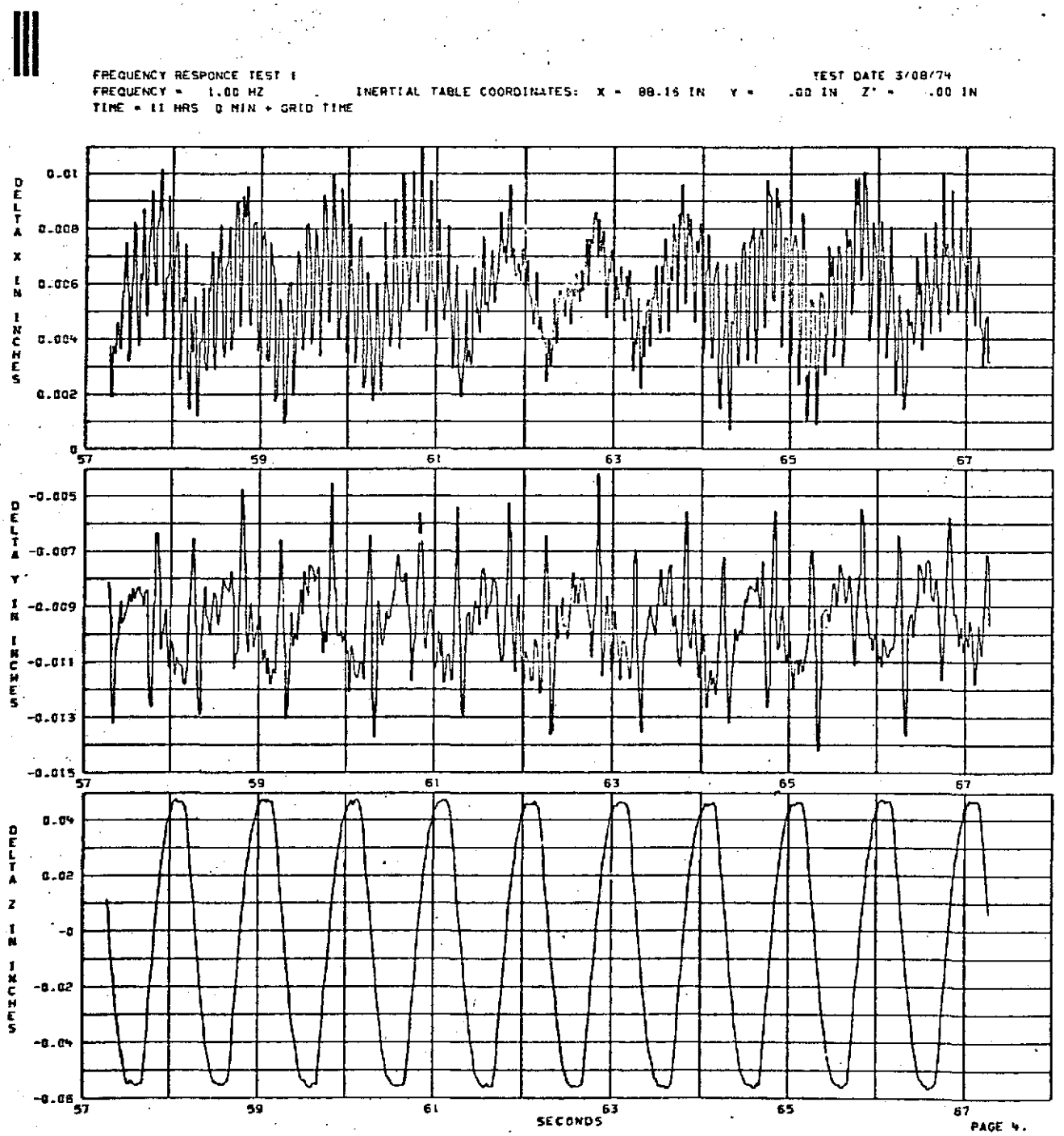
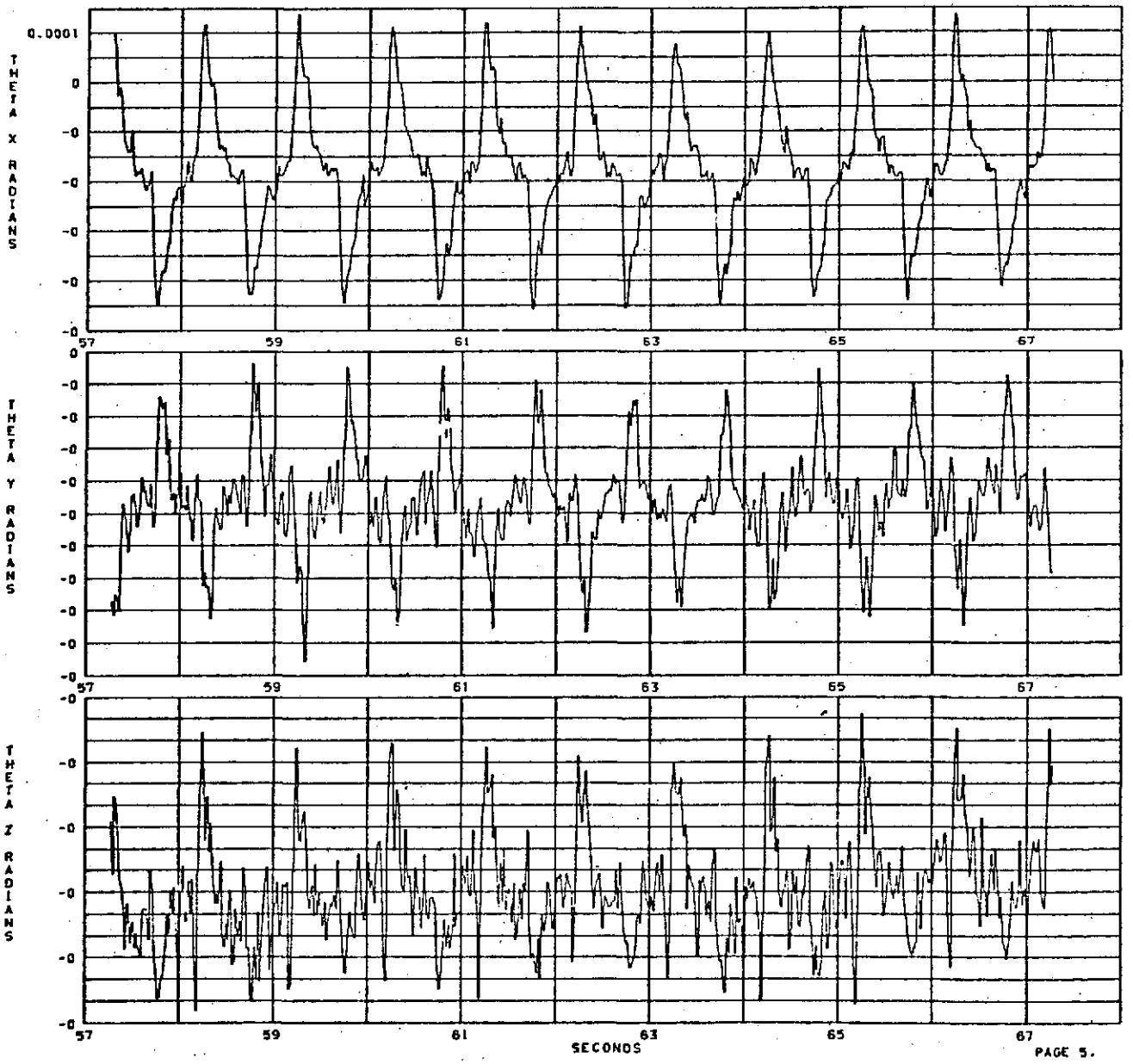
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 0 MIN + GRID TIME
TEST DATE 3/08/74
L1 IN INCHES
168.44
168.43
168.43
168.42
168.41
168.4
168.4
168.39
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
57
59
61
63
65
67
SECONDS
PAGE 2.


FREQUENCY RESPONCE TEST 1
FREQUENCY = 1.00 HZ
TIME = 11 HRS 0 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/7-
L4 IN INCHES
167.66
167.65
167.64
167.64
167.63
167.62
167.61
167.61
L5 IN INCHES
168.19
168.19
168.18
168.18
168.17
168.17
168.16
L6 IN INCHES
167.64
167.63
167.63
167.62
167.62
167.61
167.61
57
59
61
63
65
67
SECONDS
PAGE 3.


FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.15 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 0 MIN = GRID TIME
DELTA X IN INCHES
0.01
0.008
0.006
0.004
0.002
0
DELTA Y IN INCHES
-0.005
-0.007
-0.009
-0.011
-0.013
-0.015
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
57
59
61
63
65
67
SECONDS
PAGE 4.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TIME = 11 HRS 0 MIN + GRID TIME
0.0001
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THETA Y RADIANS
THETA Z RADIANS
57
59
61
63
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67
SECONDS
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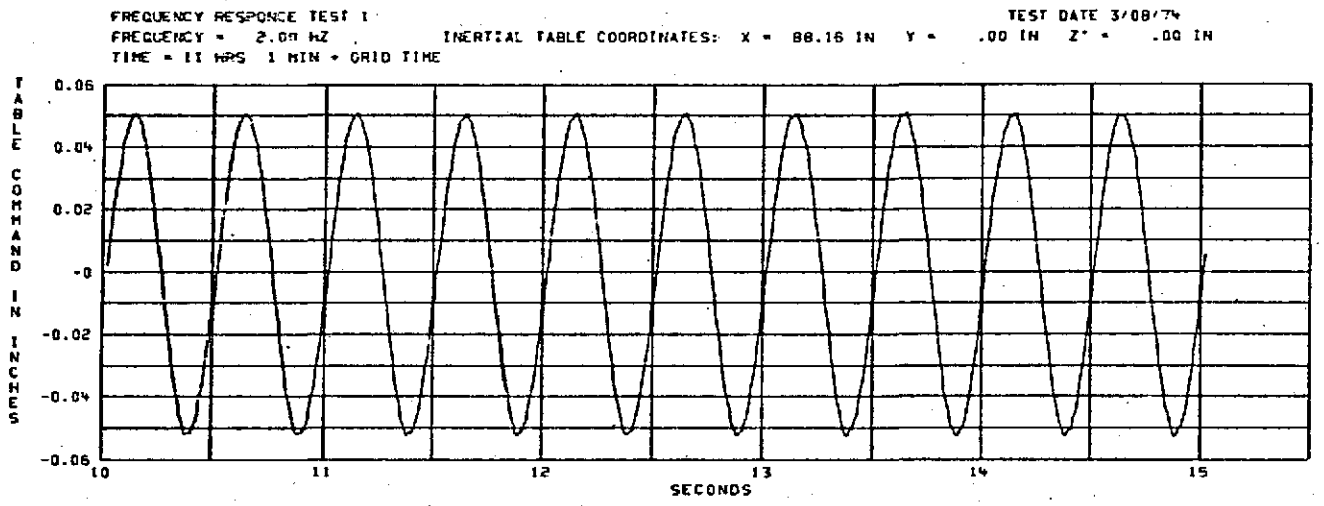
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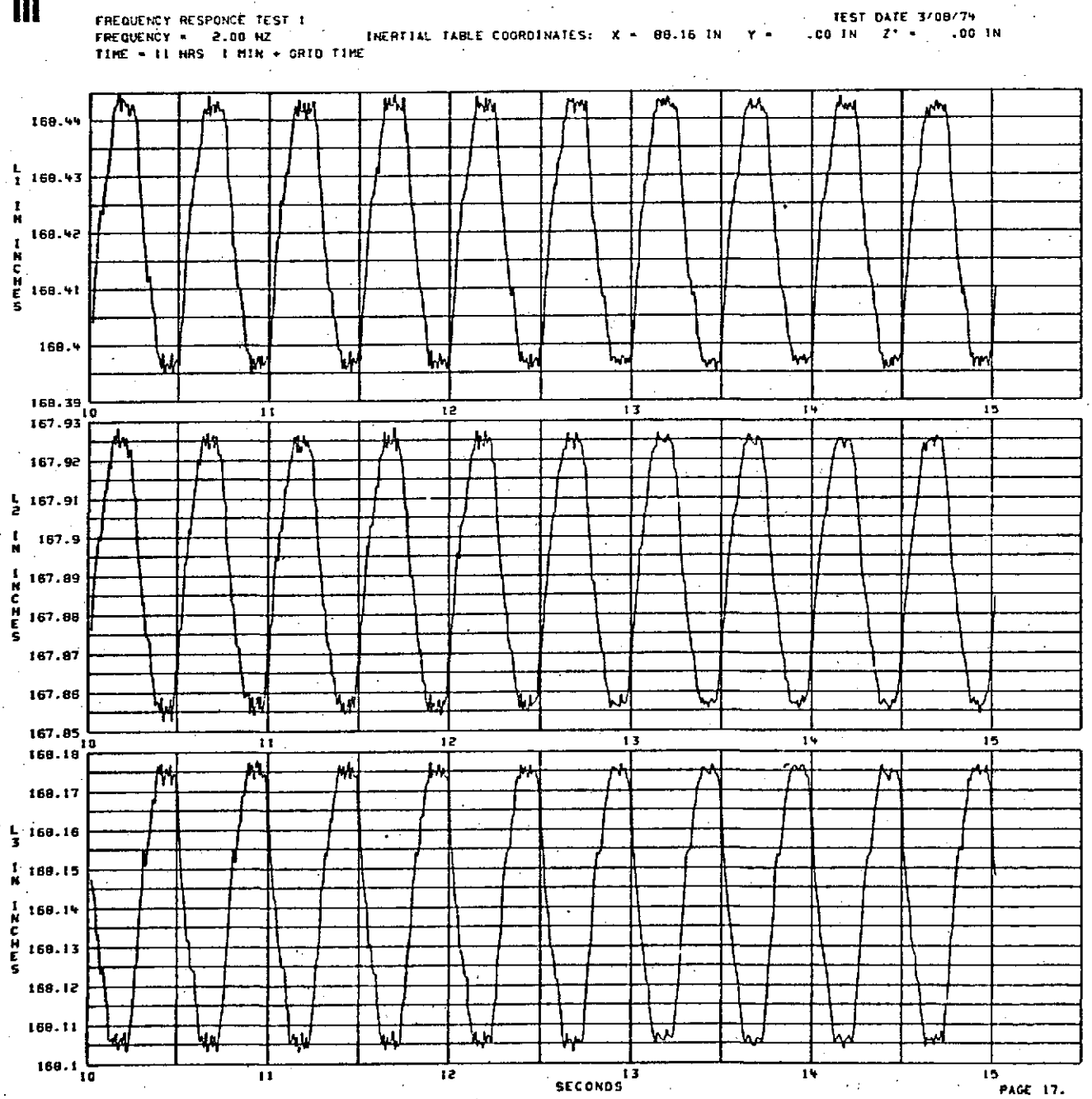
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
10
11
12
13
14
15
SECONDS

PAGE 18.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TEST DATE 3/08/74
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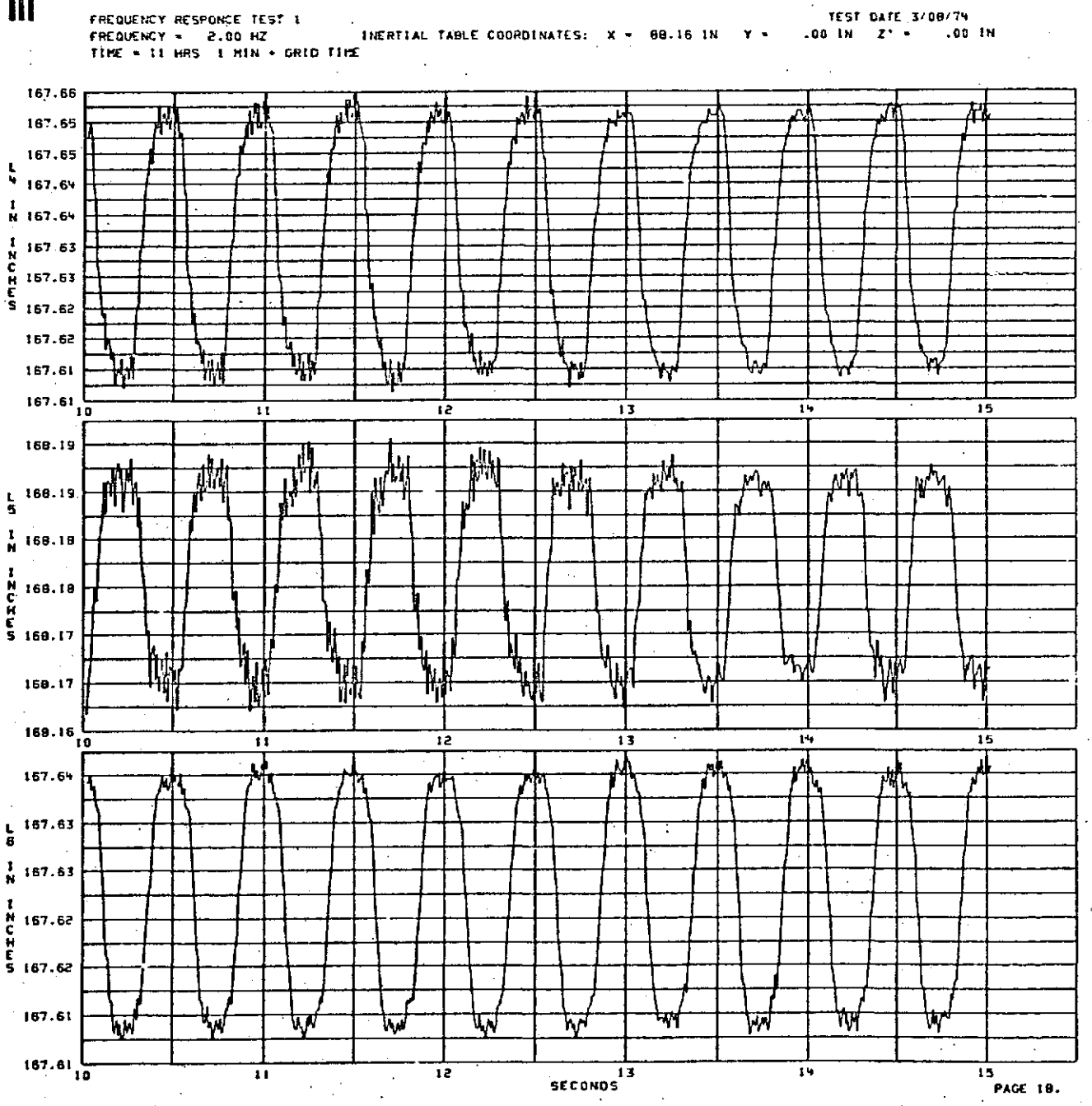
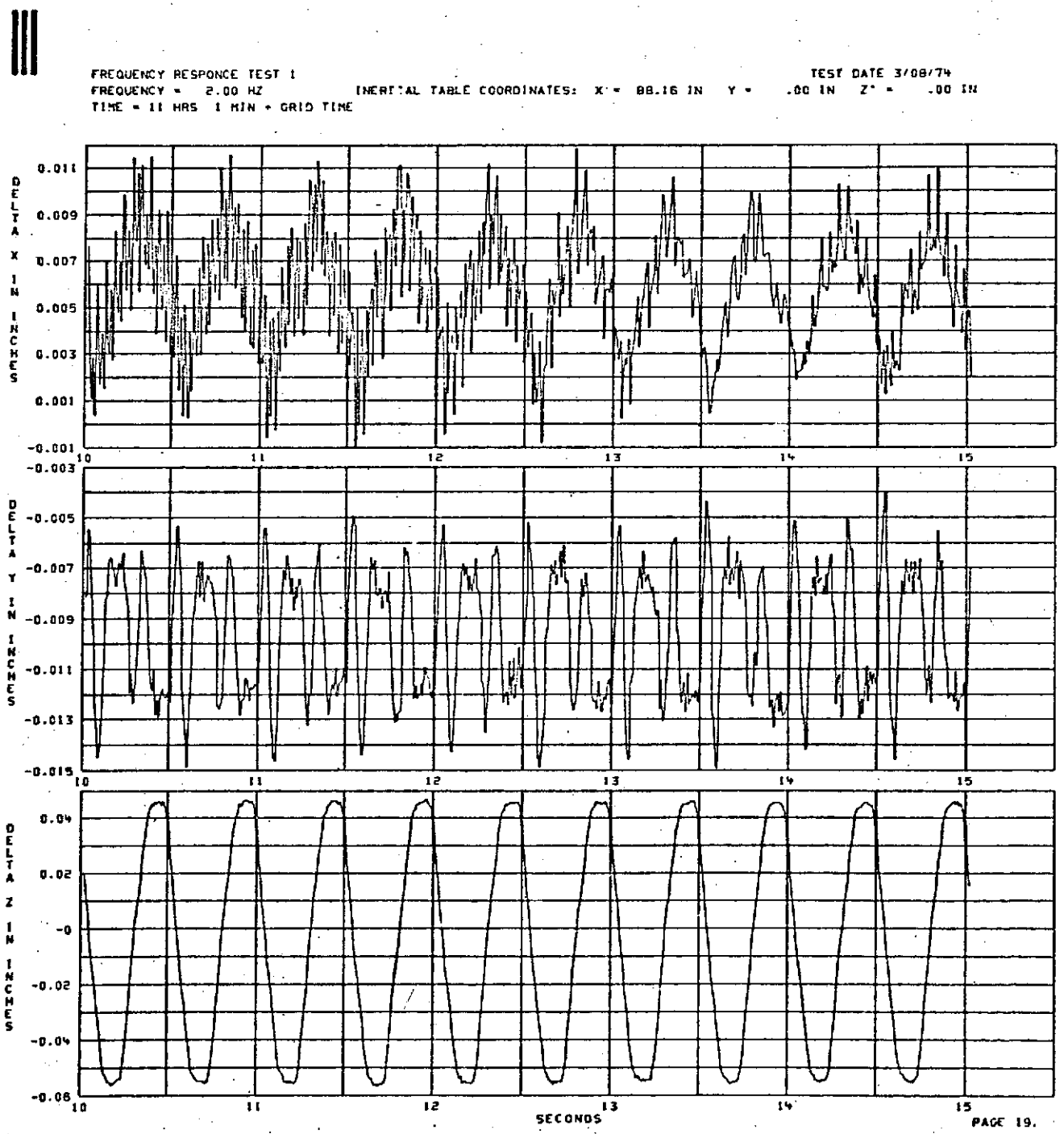
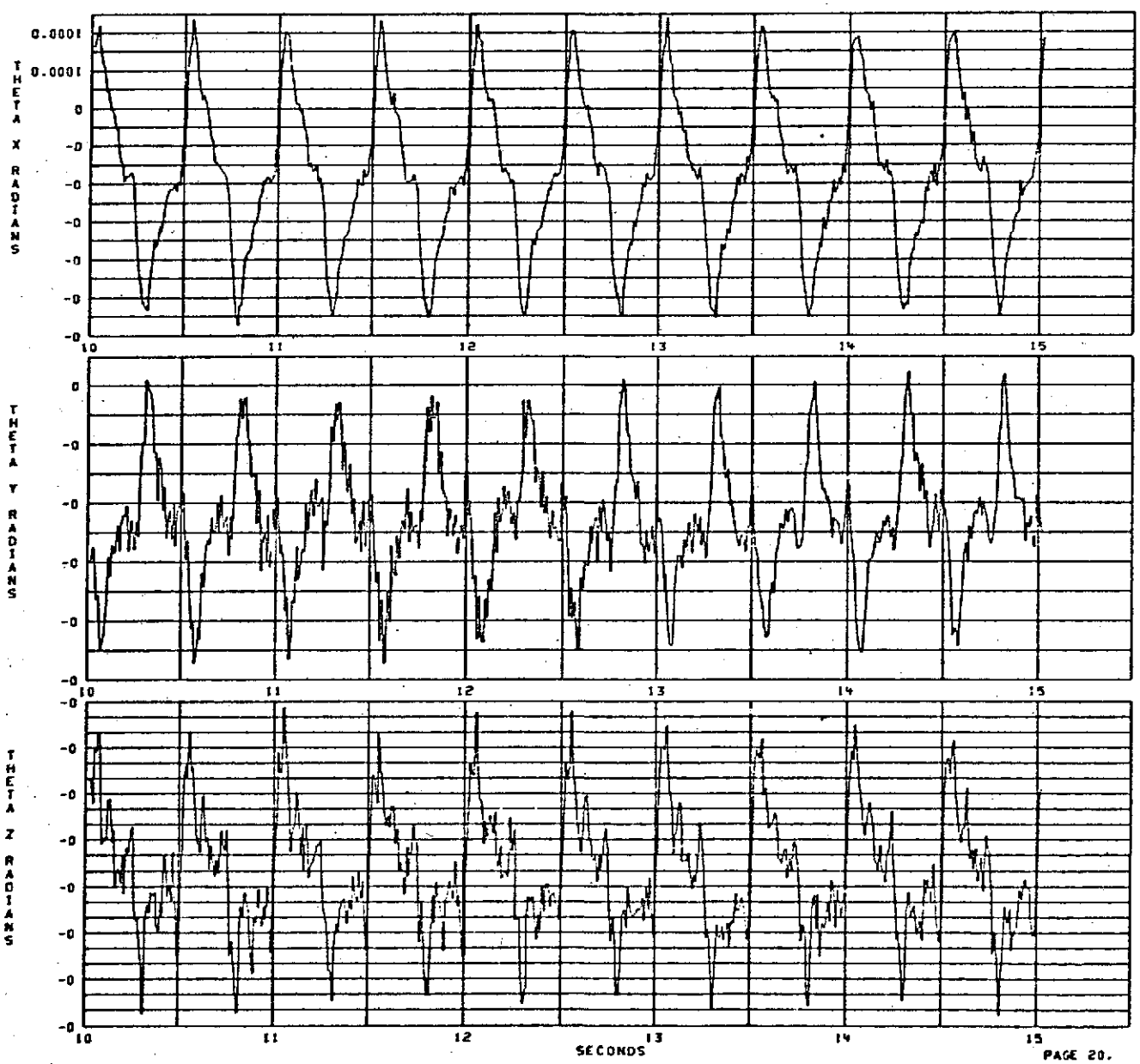
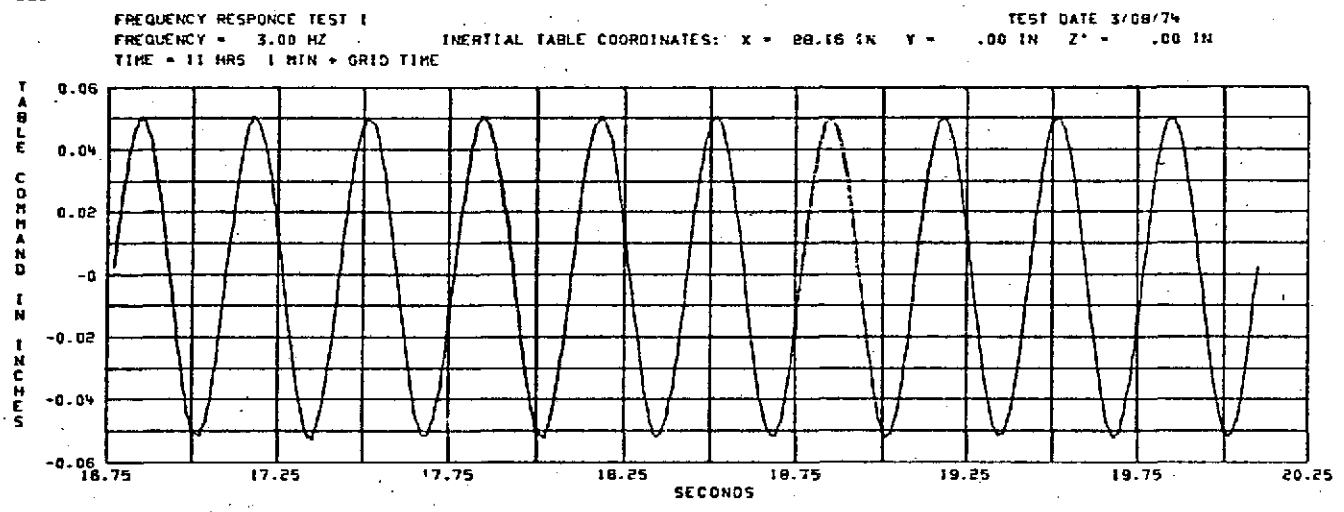
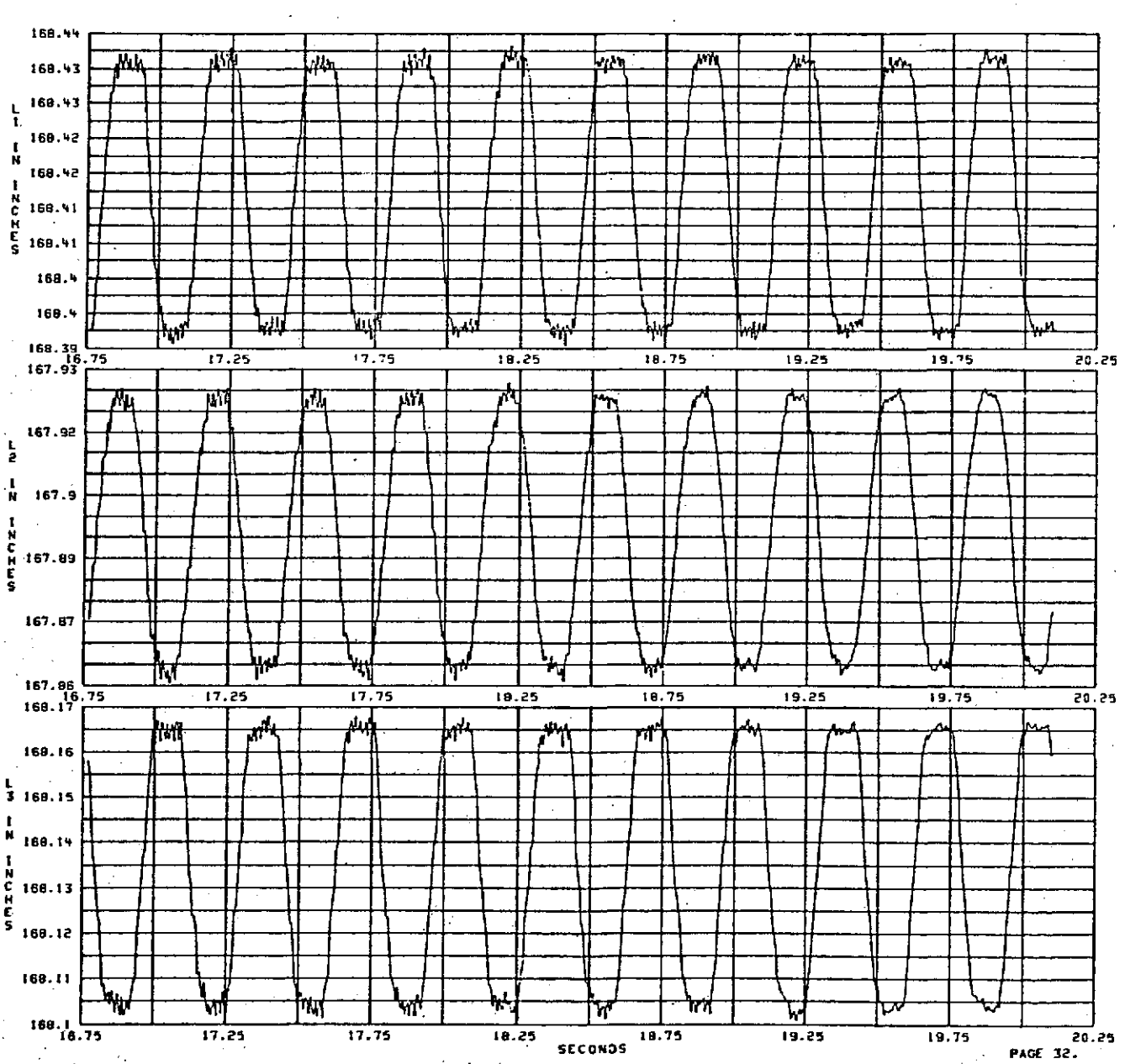
TIME = 11 HRS 1 MIN + GRID TIME
L1 IN INCHES
168.44
168.43
168.42
168.41
168.4
168.39
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
10
11
12
13
14
15
SECONDS
PAGE 17.

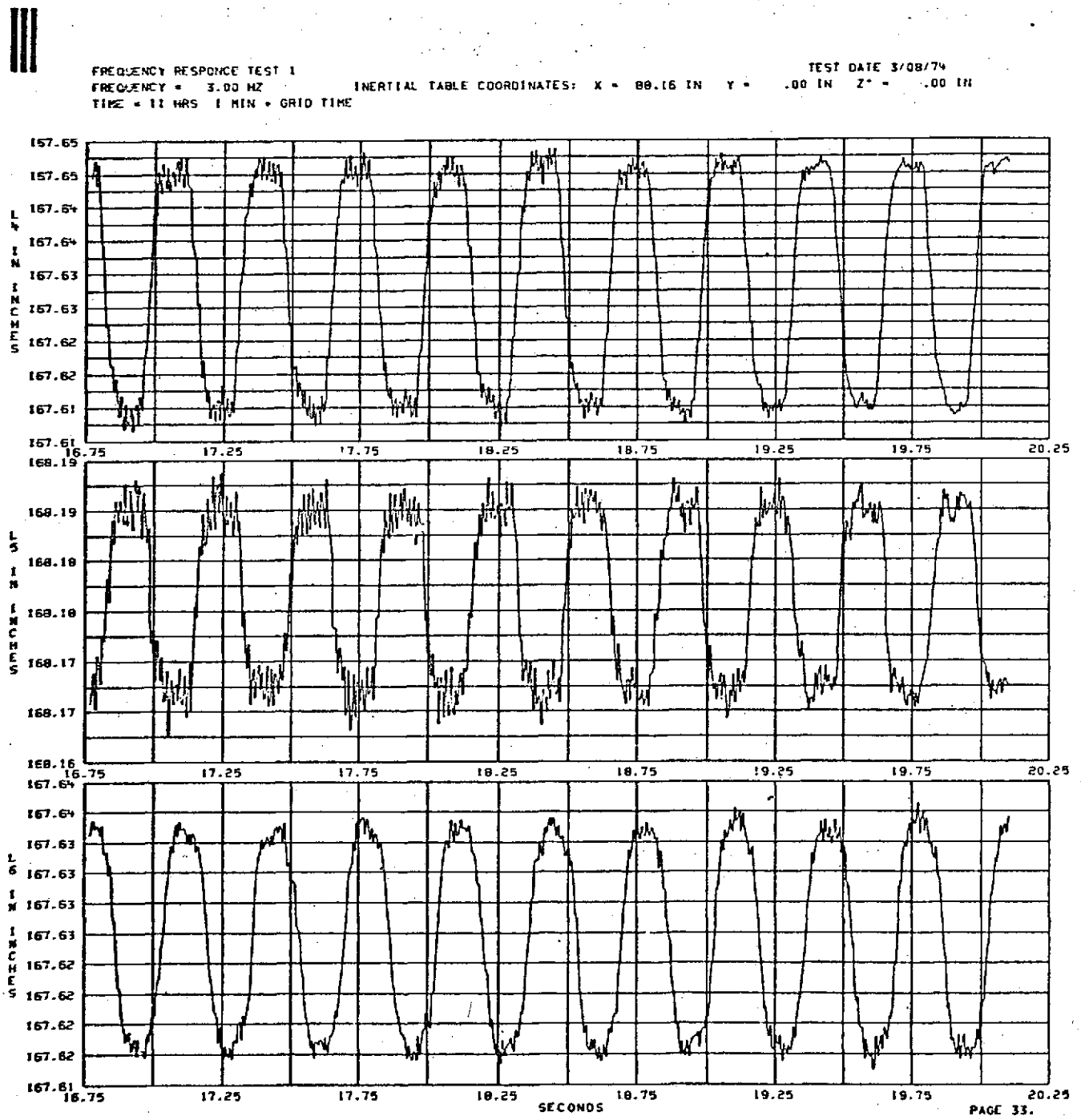

FREQUENCY RESPONSE TEST 1
FREQUENCY = 2.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 00.16 IN Y = .00 IN Z' = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
167.66
167.65
167.65
167.64
167.64
167.63
167.63
167.62
167.62
167.61
167.61
L5 IN INCHES
168.19
168.19
168.18
168.18
168.17
168.17
168.16
L8 IN INCHES
167.64
167.63
167.63
167.62
167.62
167.61
167.61
10
11
12
13
14
15
SECONDS
PAGE 18.

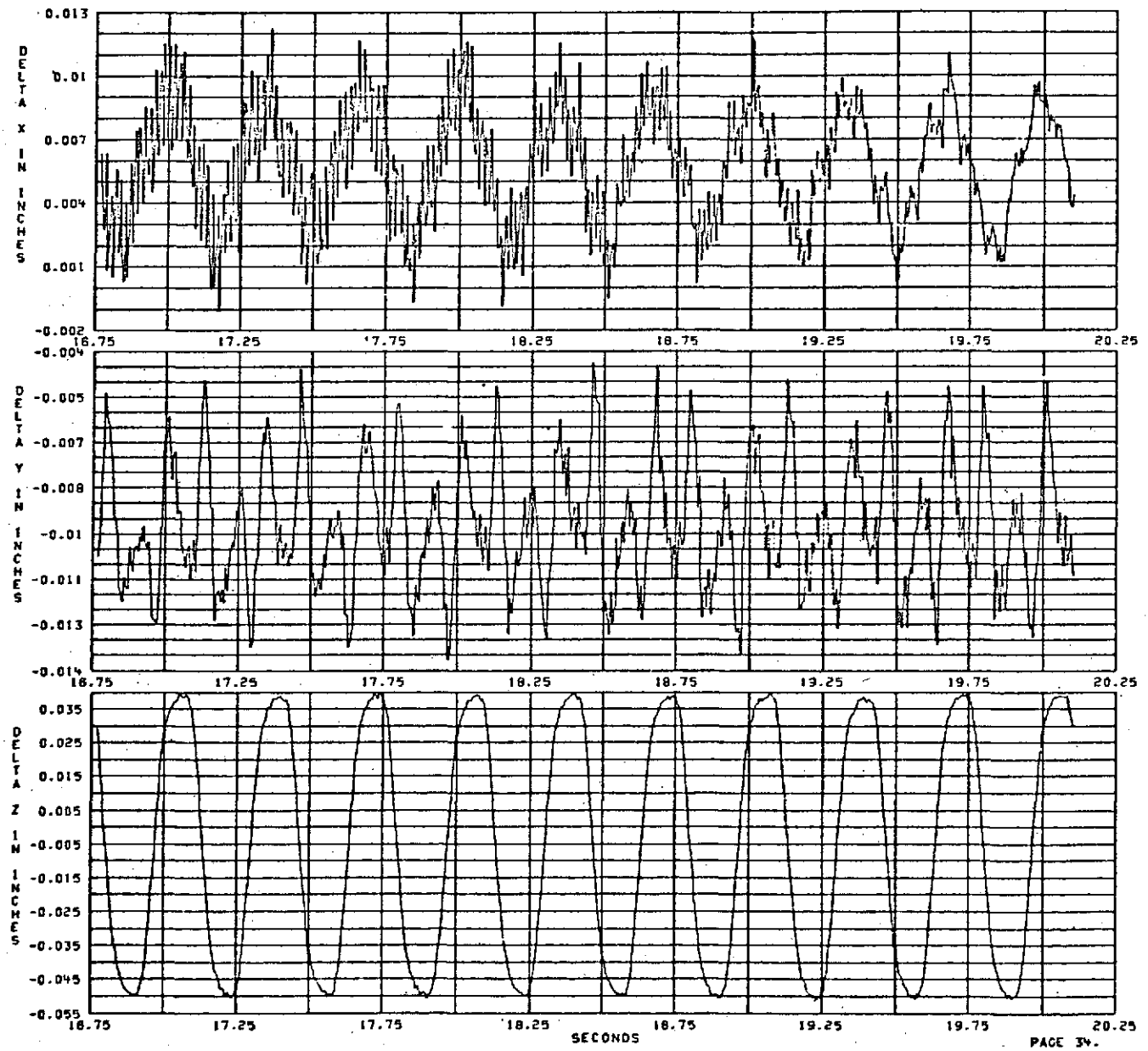

FREQUENCY RESPONCE TEST 1
FREQUENCY = 2.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X' = 88.16 IN Y = .00 IN Z' = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
DELTA Y IN INCHES
-0.003
-0.005
-0.007
-0.009
-0.011
-0.013
-0.015
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
10
11
12
13
14
15
SECONDS
PAGE 19.

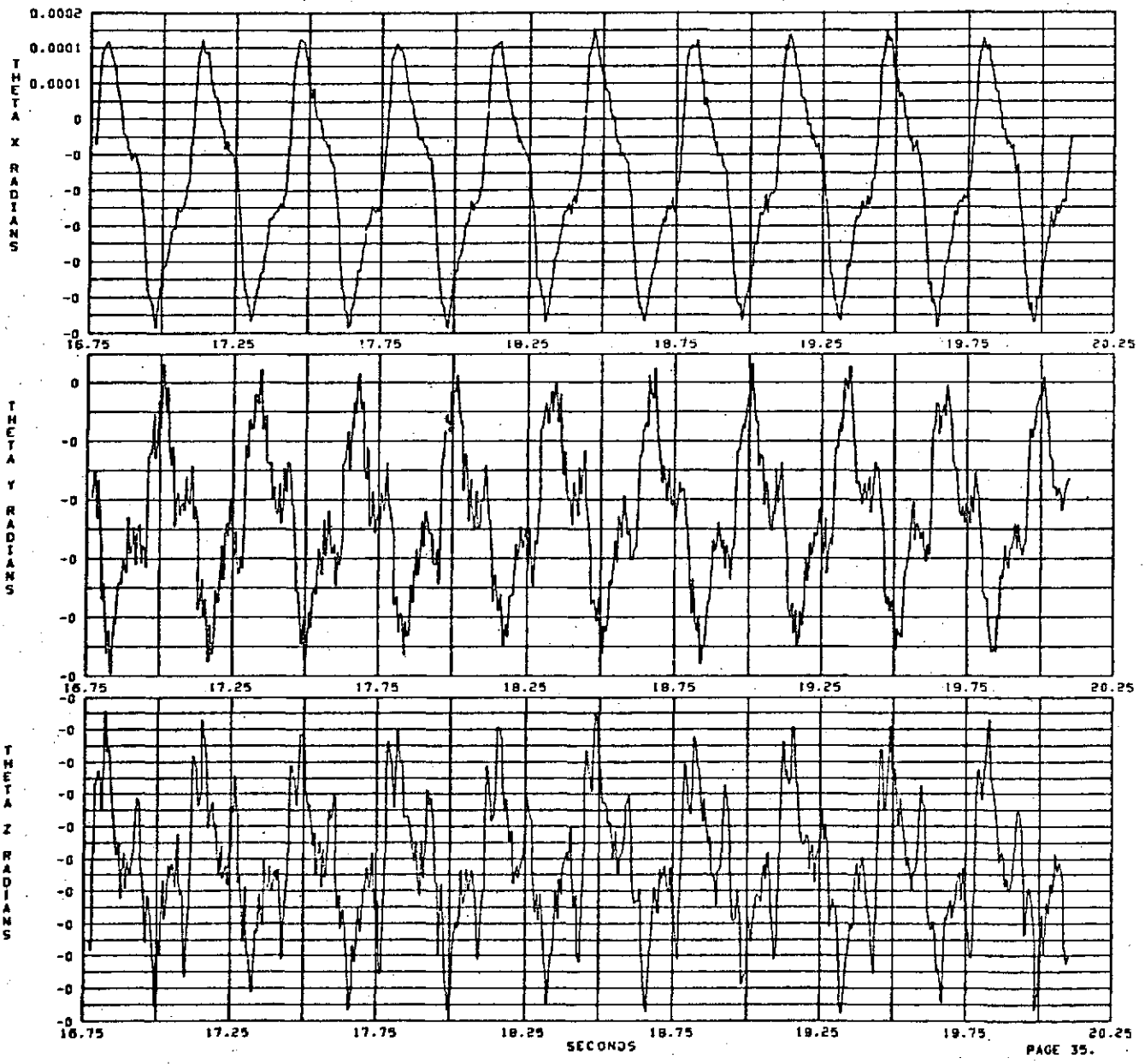

FREQUENCY RESPONCE TEST 1
FREQUENCY = 2.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
0.0001
10
11
12
13
14
15
SECONDS
PAGE 20.

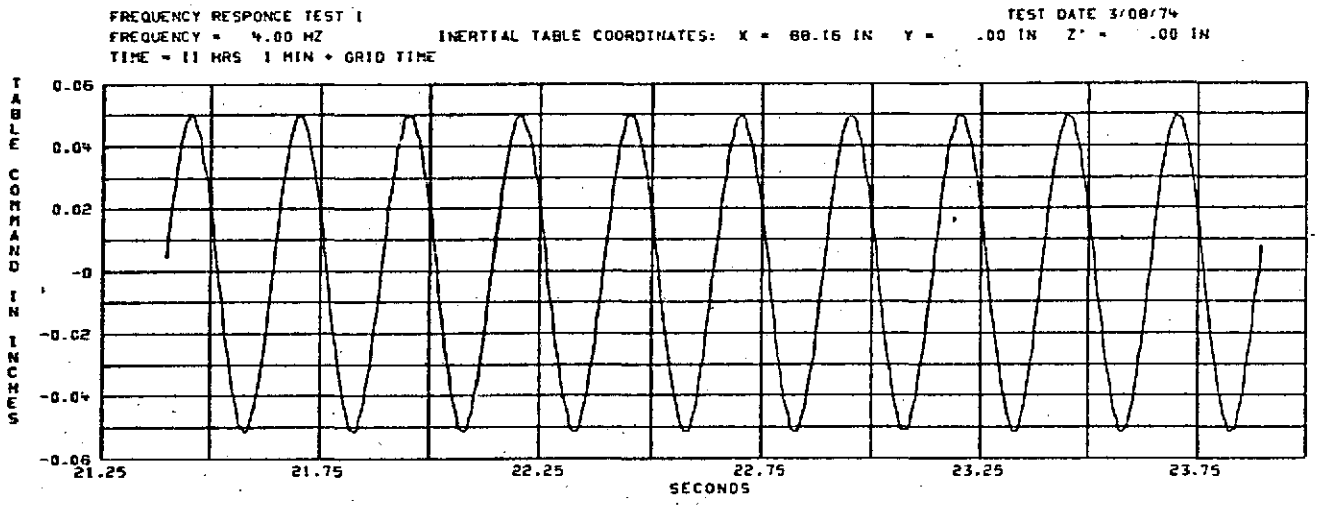

FREQUENCY RESPONCE TEST I
FREQUENCY = 3.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
16.75
17.25
17.75
18.25
18.75
19.25
19.75
20.25
SECONDS


FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
L1 IN INCHES
168.44
168.43
168.43
168.42
168.42
168.41
168.41
168.4
168.4
168.39
16.75
17.25
17.75
18.25
18.75
19.25
19.75
20.25
L2 IN INCHES
167.93
167.92
167.9
167.89
167.87
167.86
L3 IN INCHES
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
SECONDS
PAGE 32.

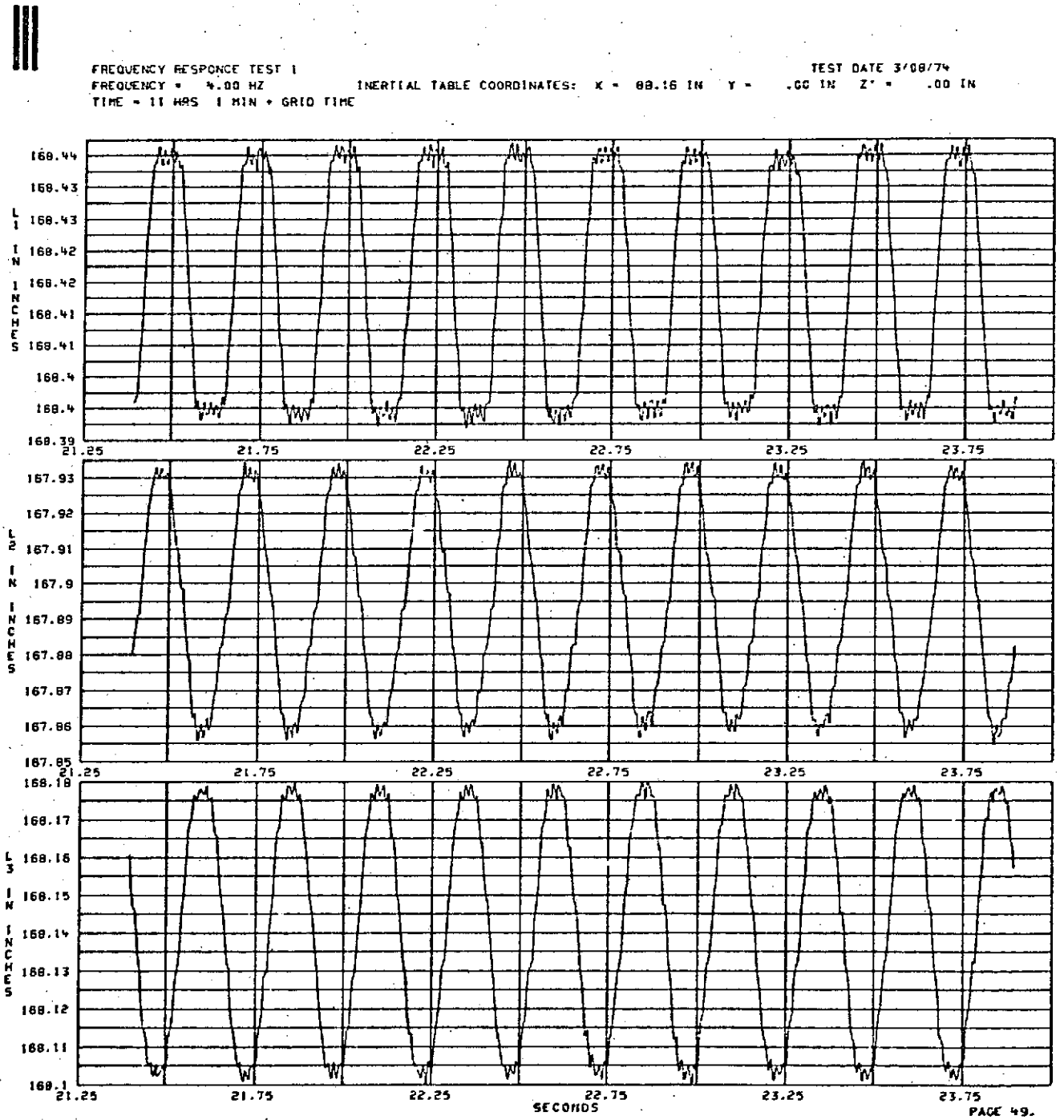

FREQUENCY RESPONCE TEST 1
FREQUENCY = 3.00 HZ
TIME = 11 HRS 1 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 80.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
L5 IN INCHES
L6 IN INCHES
SECONDS
PAGE 33.

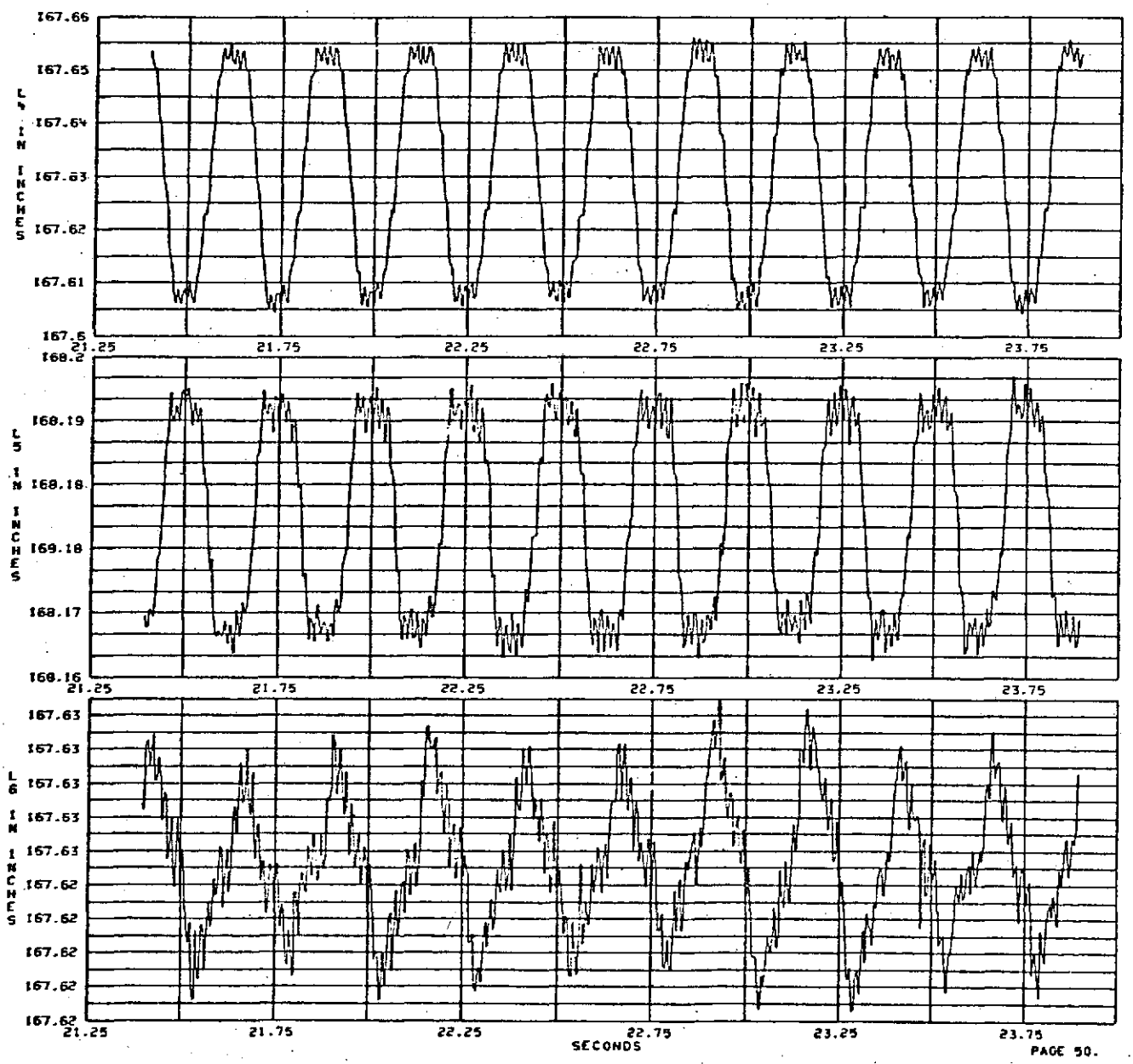

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN = GRID TIME
DELTA X IN INCHES
0.013
0.01
0.007
0.004
0.001
-0.002
DELTA Y IN INCHES
-0.004
-0.005
-0.007
-0.008
-0.01
-0.011
-0.013
-0.014
DELTA Z IN INCHES
0.035
0.025
0.015
0.005
-0.005
-0.015
-0.025
-0.035
-0.045
-0.055
16.75
17.25
17.75
18.25
18.75
19.25
19.75
20.25
SECONDS
PAGE 34.

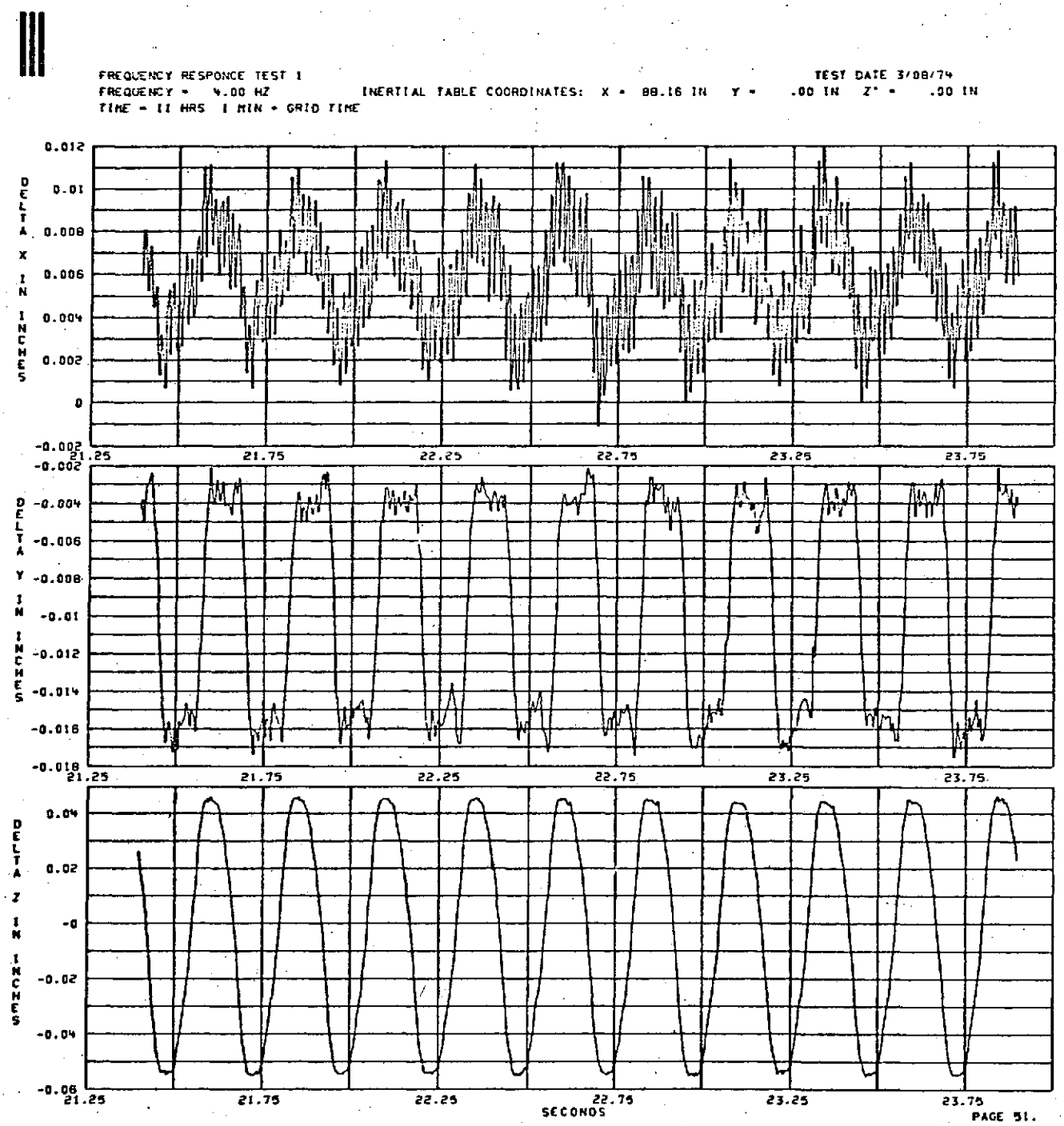

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0002
0.0001
0.0001
0
-0
16.75
17.25
17.75
18.25
18.75
19.25
19.75
20.25
SECONDS
PAGE 35.


FREQUENCY RESPONCE TEST 1
FREQUENCY = 4.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
21.25
21.75
22.25
22.75
23.25
23.75
SECONDS

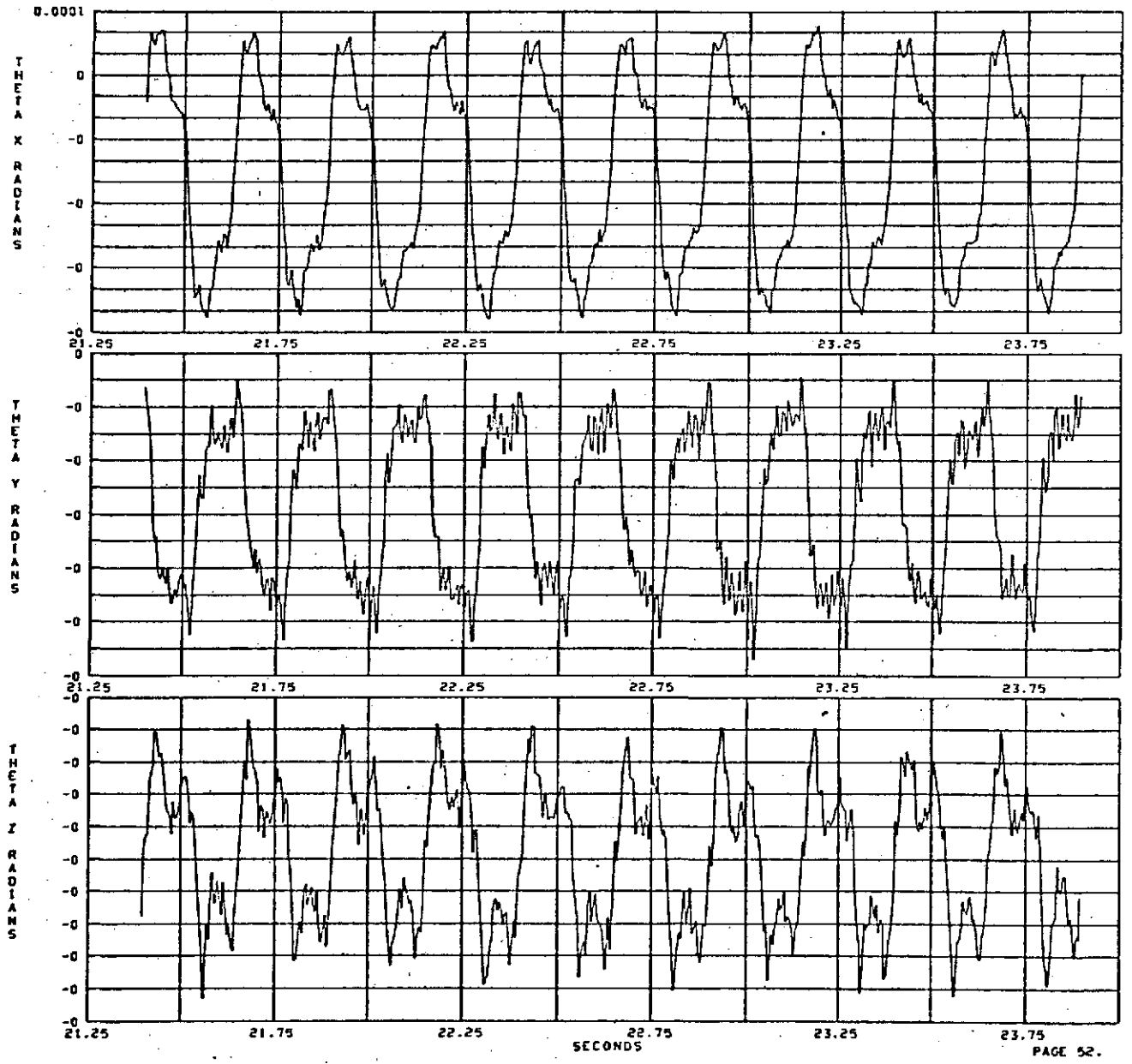
PAGE 48.


FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
L1 IN INCHES
168.44
168.43
168.43
168.42
168.42
168.41
168.41
168.4
168.4
168.39
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
21.25
21.75
22.25
22.75
23.25
23.75
SECONDS
PAGE 49.

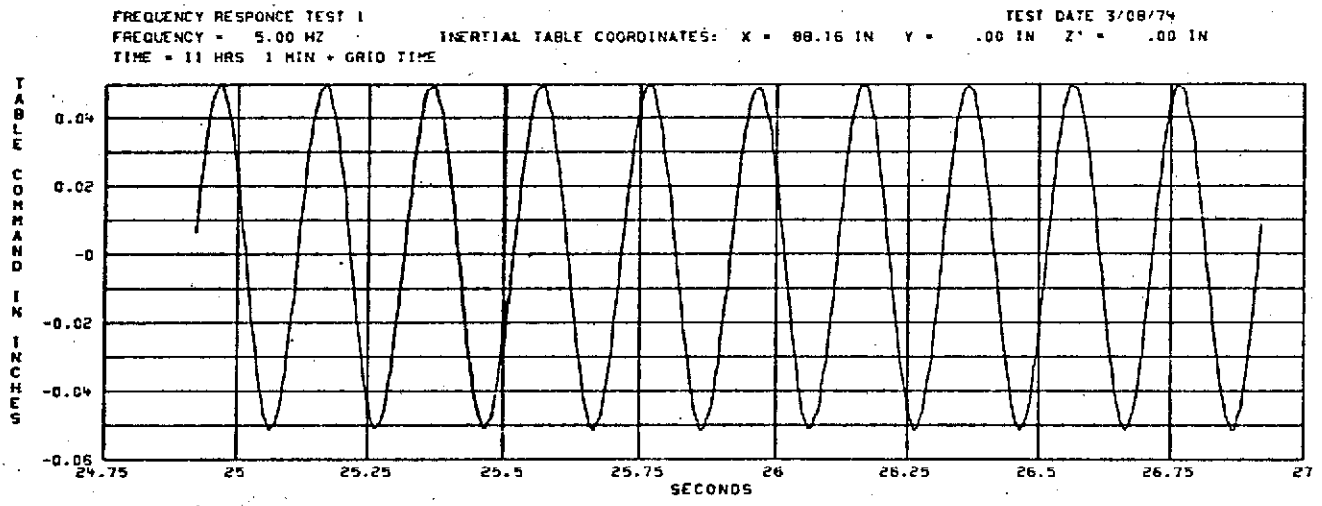

FREQUENCY RESPONCE TEST 1
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
TEST DATE 3/08/74
L4 IN INCHES
L5 IN INCHES
L6 IN INCHES
21.25
21.75
22.25
22.75
23.25
23.75
SECONDS
PAGE 50.

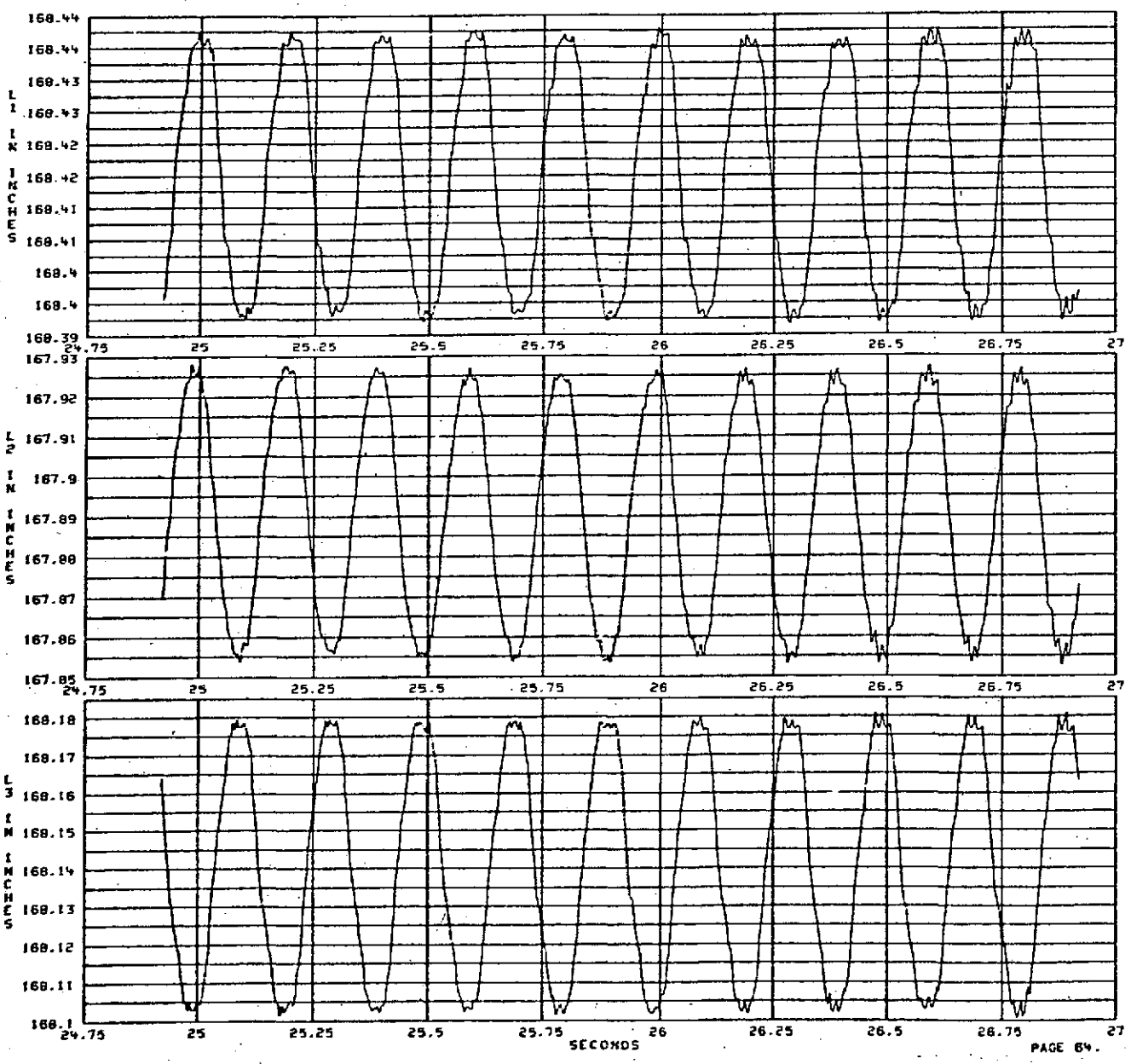

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN = GRID TIME
DELTA X IN INCHES
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
DELTA Y IN INCHES
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
21.25
21.75
22.25
22.75
23.25
23.75
SECONDS
PAGE 51.

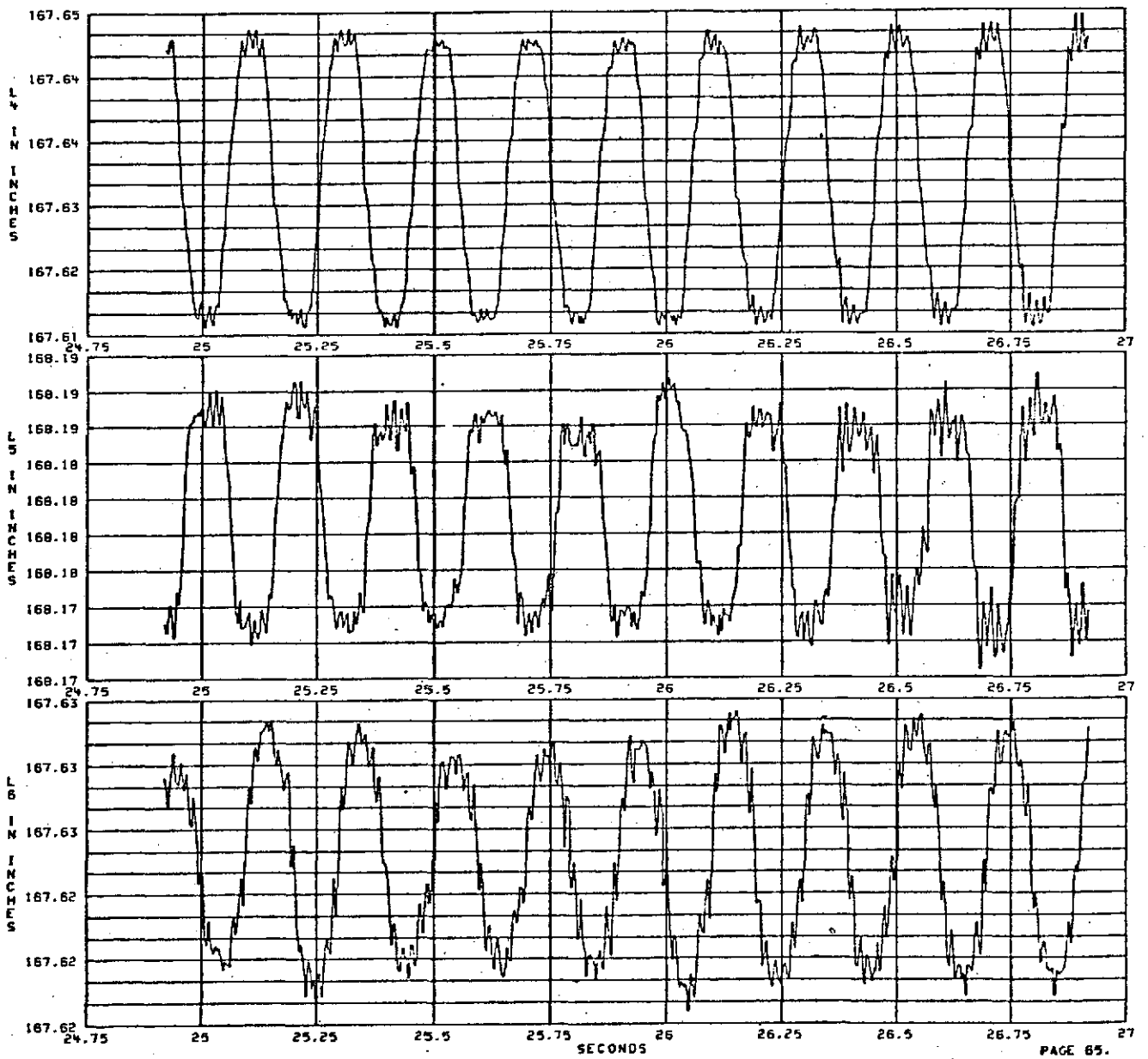
FREQUENCY RESPONCE TEST 1 TEST DATE 3/08/74
FREQUENCY = 4.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME

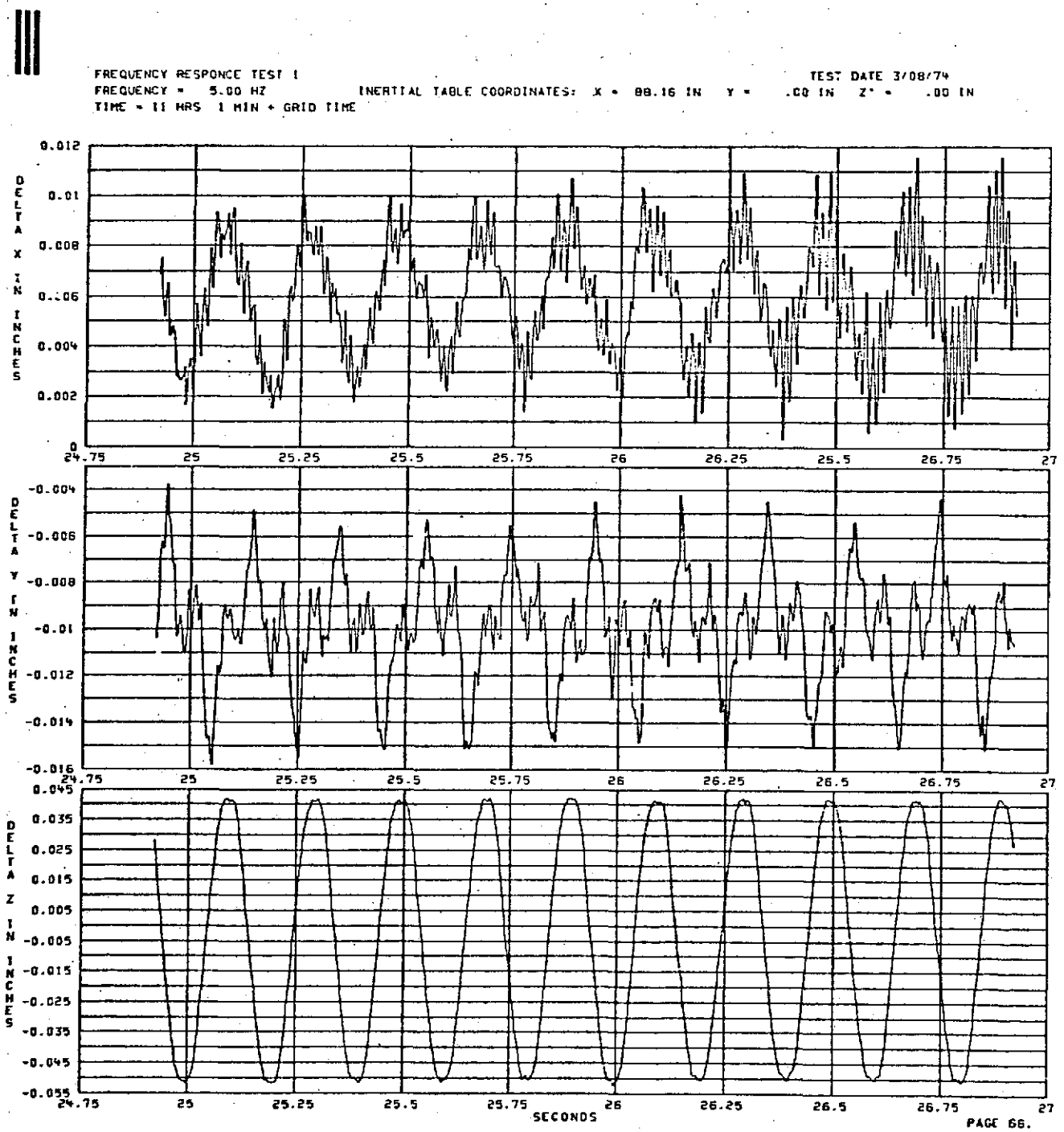


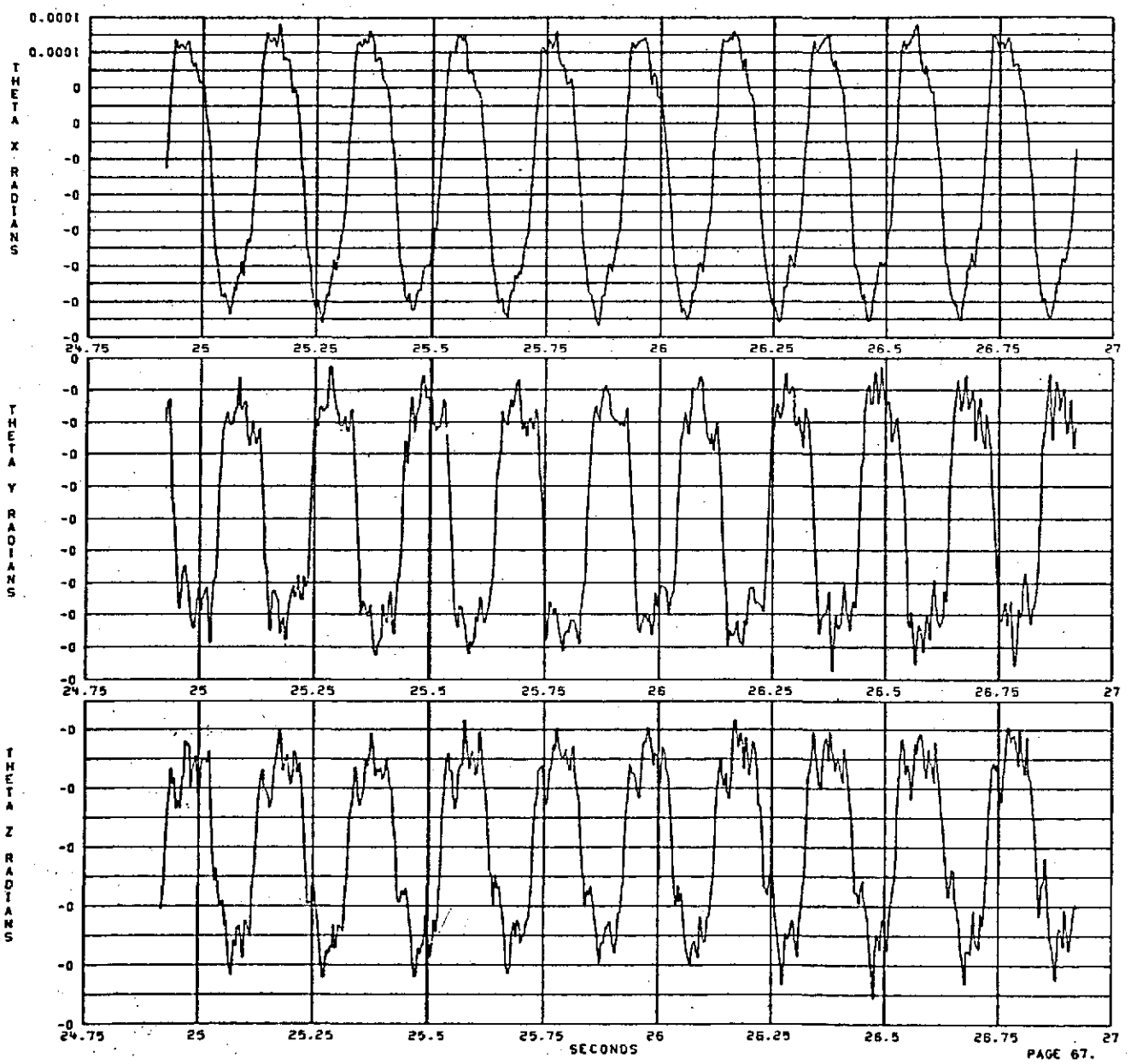
PAGE 52.

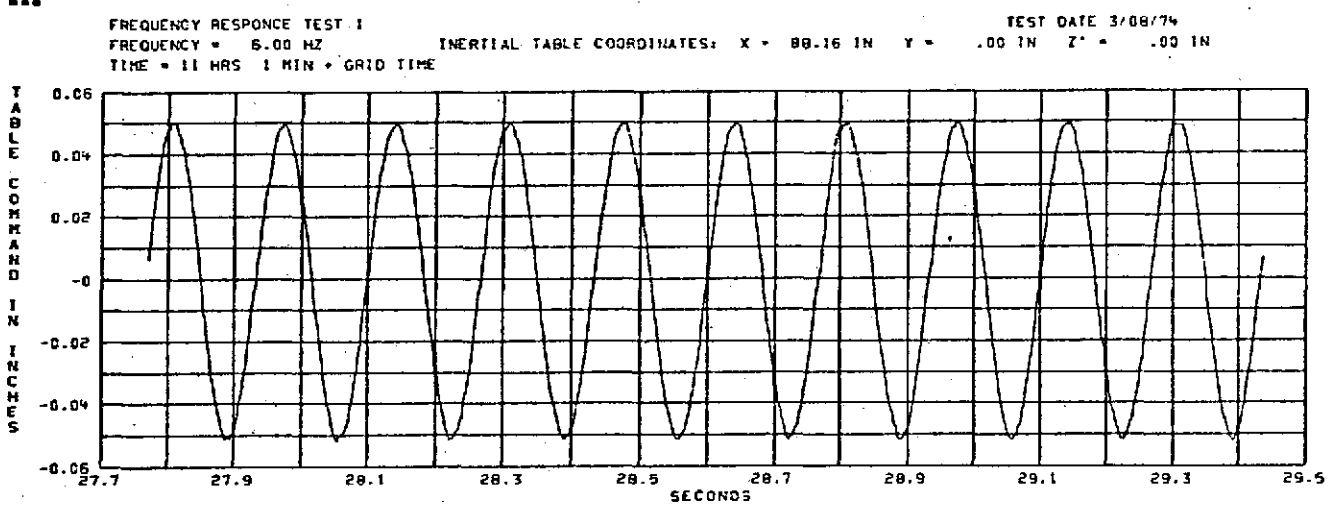

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z' = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
24.75
25
25.25
25.5
25.75
26
26.25
26.5
26.75
27
SECONDS


FREQUENCY RESPONCE TEST 1
FREQUENCY = 5.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.44
168.44
168.43
168.43
168.42
168.42
168.41
168.41
168.4
168.4
168.39
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
24.75
25
25.25
25.5
25.75
26
26.25
26.5
26.75
27
SECONDS
PAGE 64.

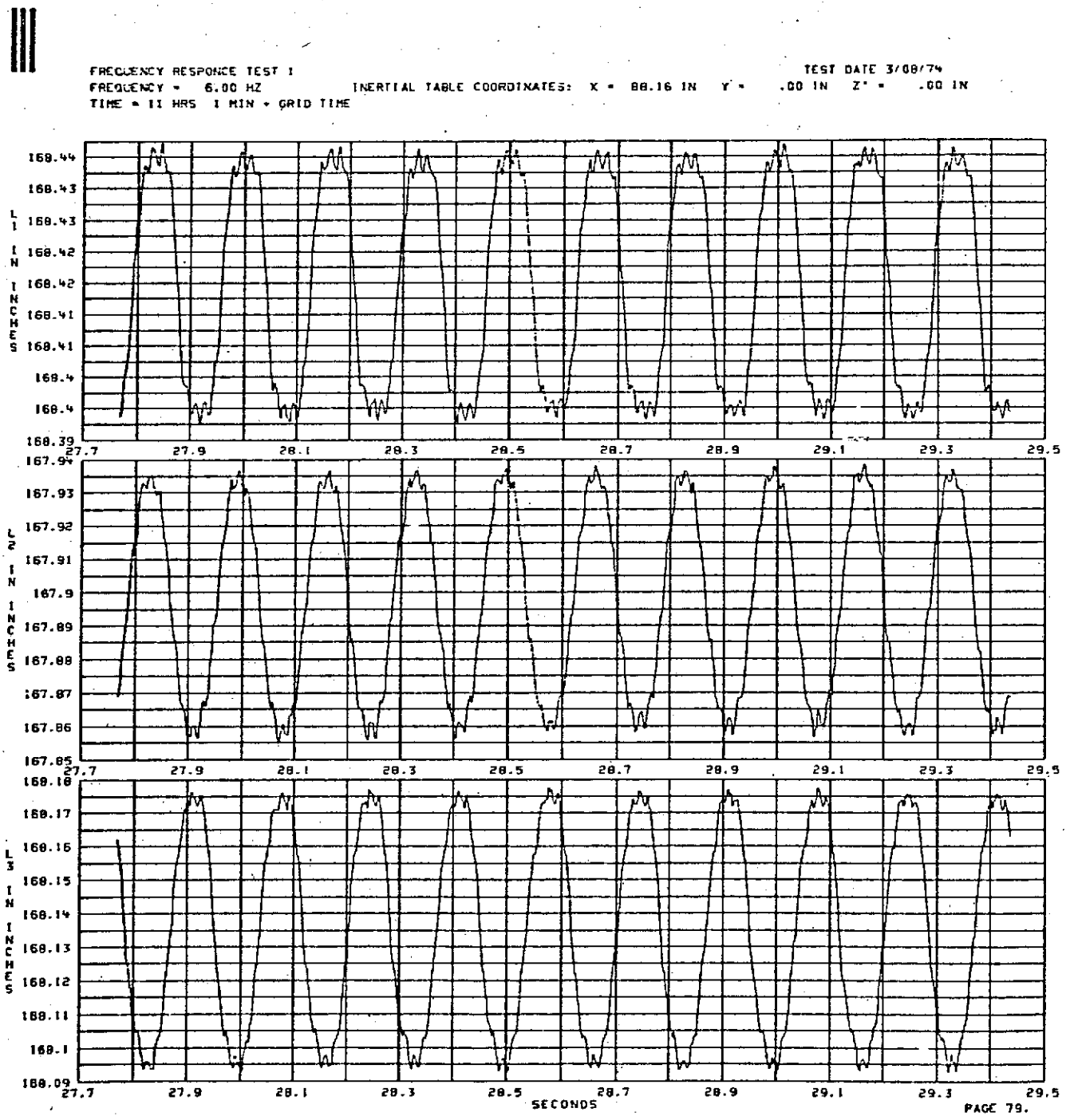

FREQUENCY RESPONCE TEST 1
FREQUENCY = 5.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
167.65
167.64
167.64
167.63
167.62
167.61
L5 IN INCHES
168.19
168.19
168.19
168.18
168.18
168.18
168.17
168.17
168.17
L6 IN INCHES
167.63
167.63
167.63
167.62
167.62
167.62
24.75
25
25.25
25.5
25.75
26
26.25
26.5
26.75
27
SECONDS

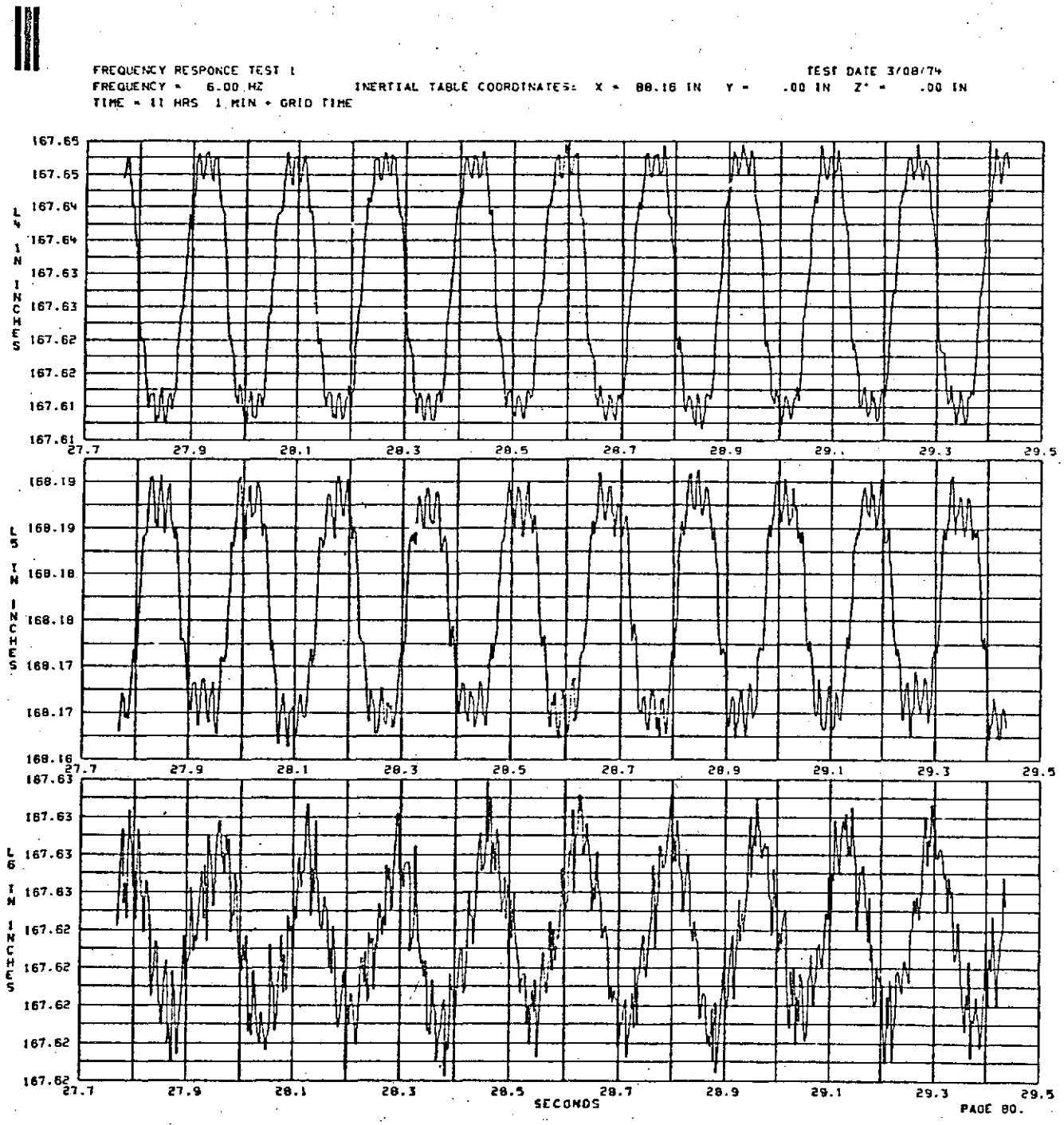

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
DELTA X IN INCHES
DELTA Y IN INCHES
DELTA Z IN INCHES
SECONDS
PAGE 66.

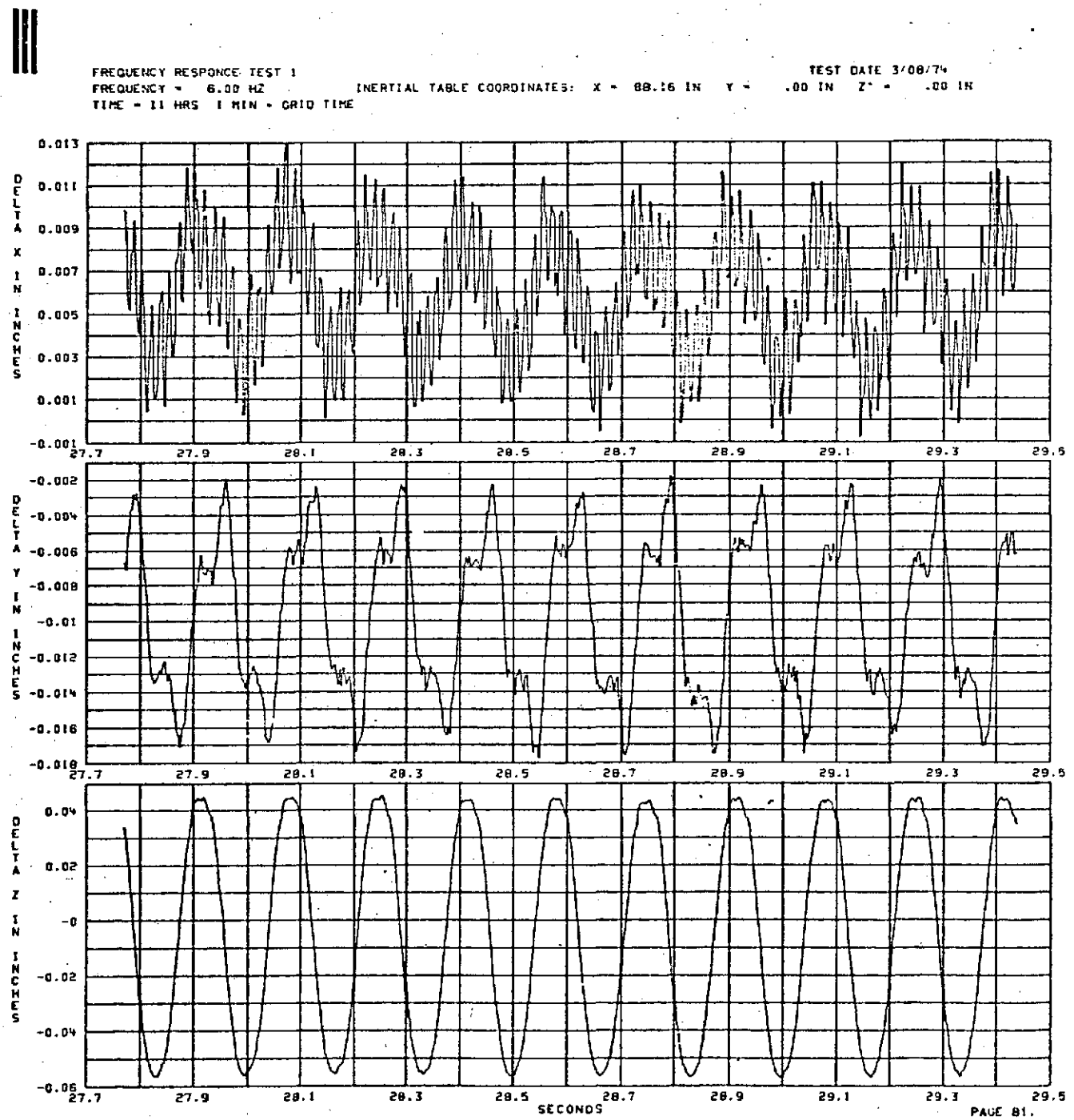

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
0.0001
0
-0
24.75
25
25.25
25.5
25.75
26
26.25
26.5
26.75
27
SECONDS
PAGE 67.

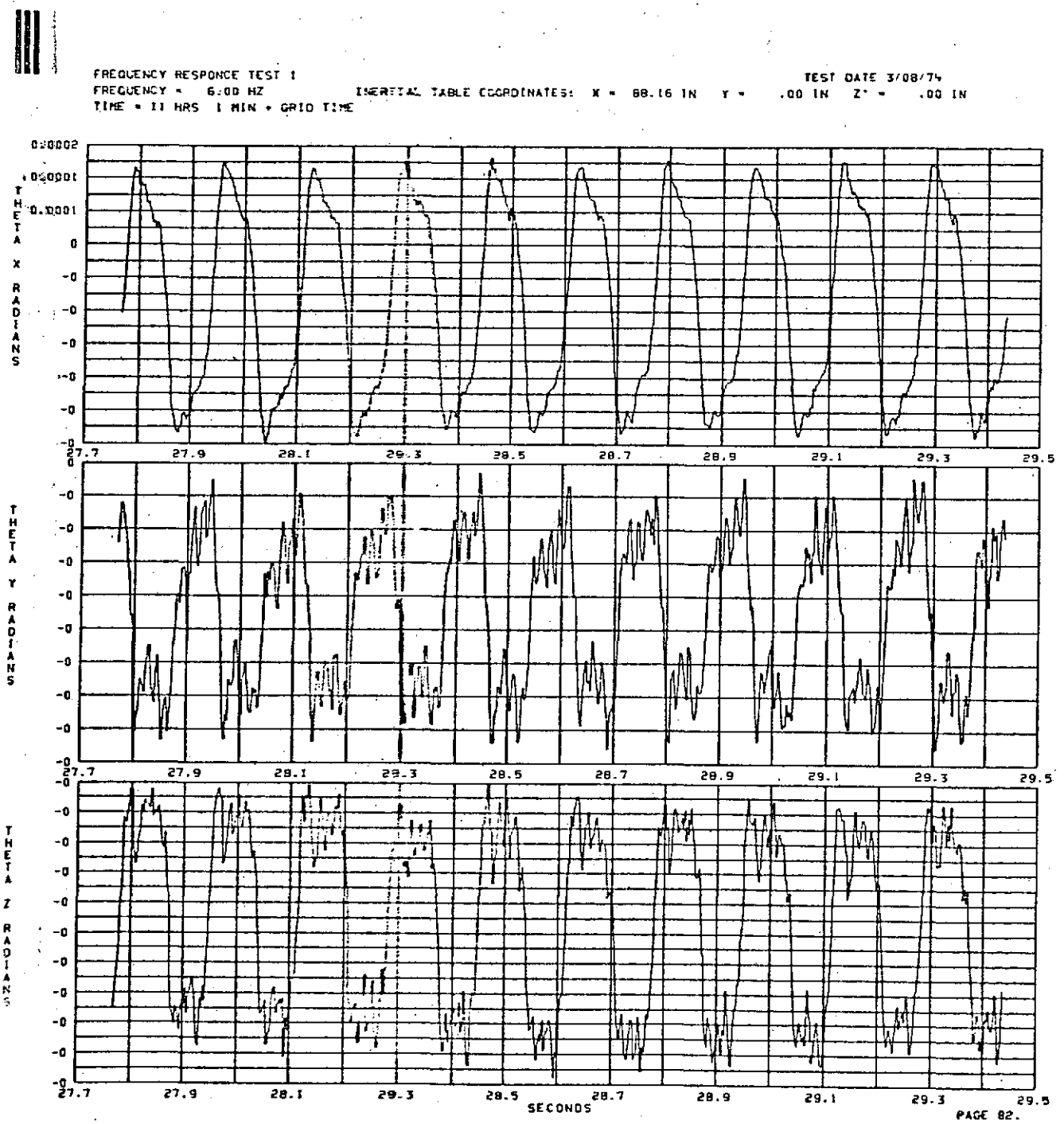

FREQUENCY RESPONCE TEST 1
FREQUENCY = 6.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
27.7
27.9
28.1
28.3
28.5
28.7
28.9
29.1
29.3
29.5
SECONDS

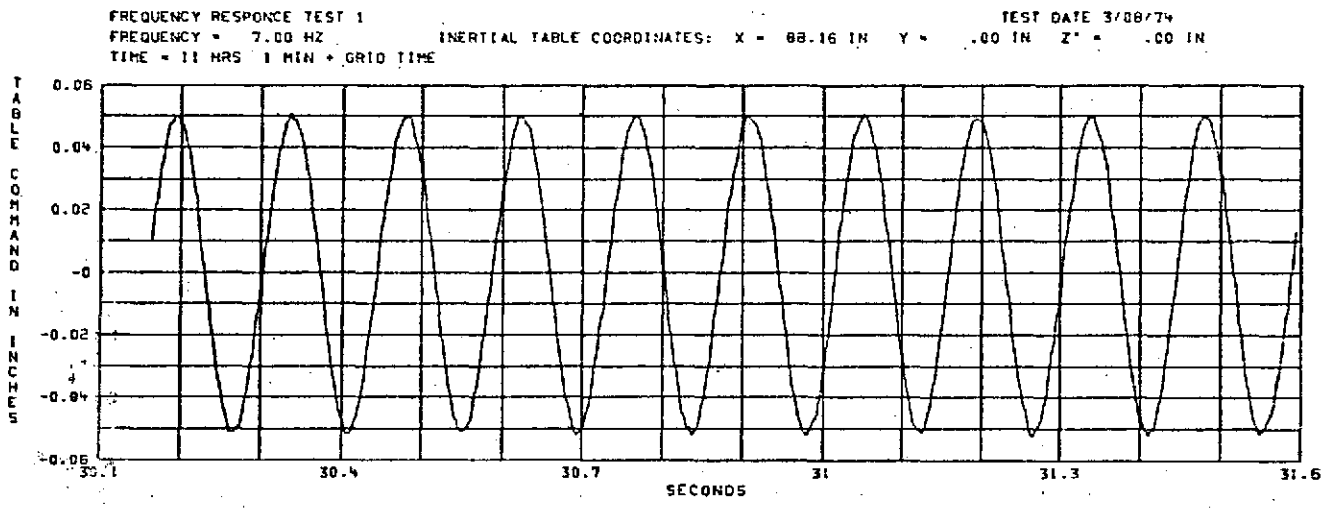
PAGE 78.

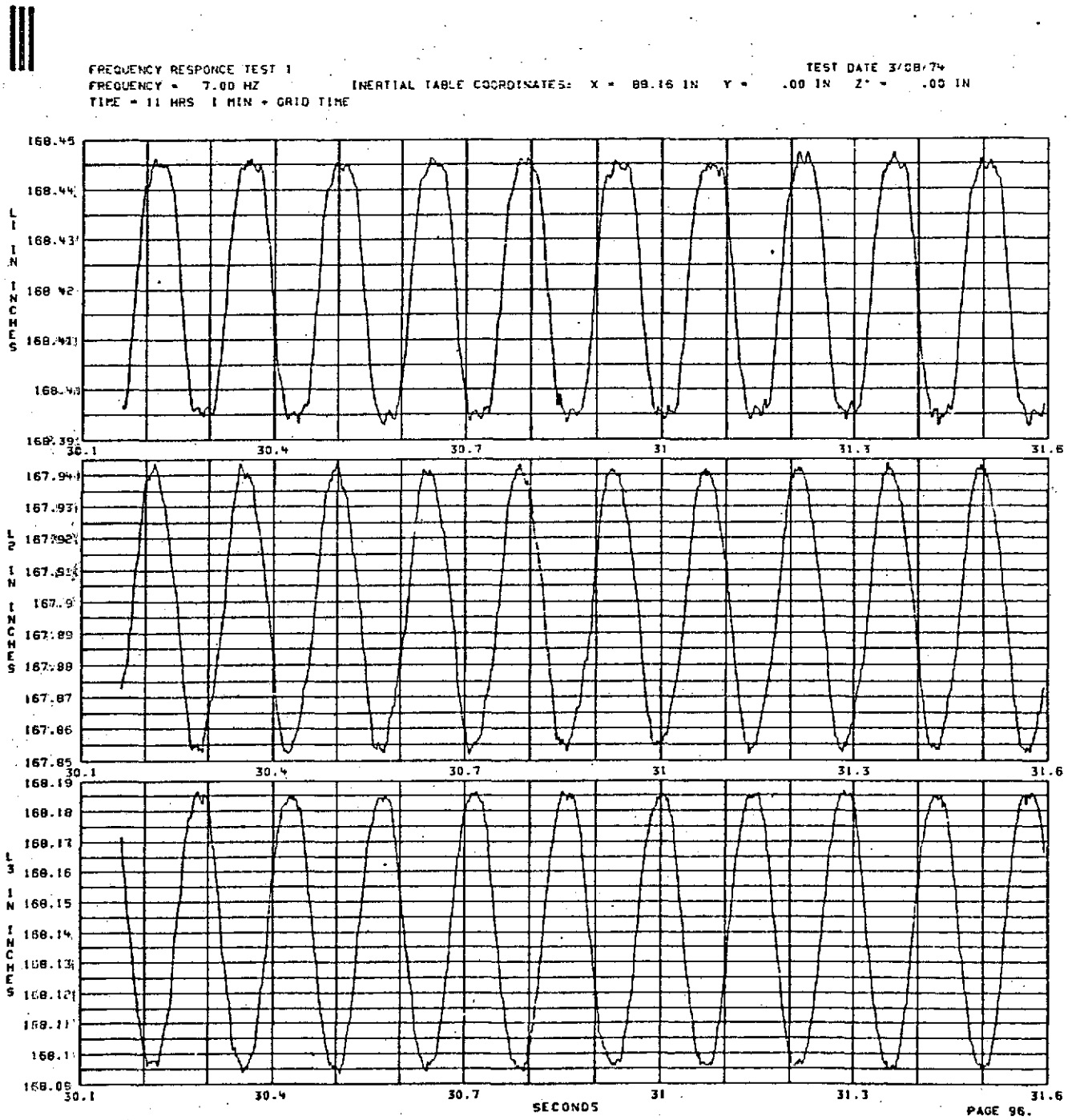

FREQUENCY RESPONCE TEST 1
FREQUENCY = 6.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.44
168.43
168.43
168.42
168.42
168.41
168.41
168.4
168.4
168.39
L2 IN INCHES
167.94
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
168.09
27.7
27.9
28.1
28.3
28.5
28.7
28.9
29.1
29.3
29.5
SECONDS
PAGE 79.

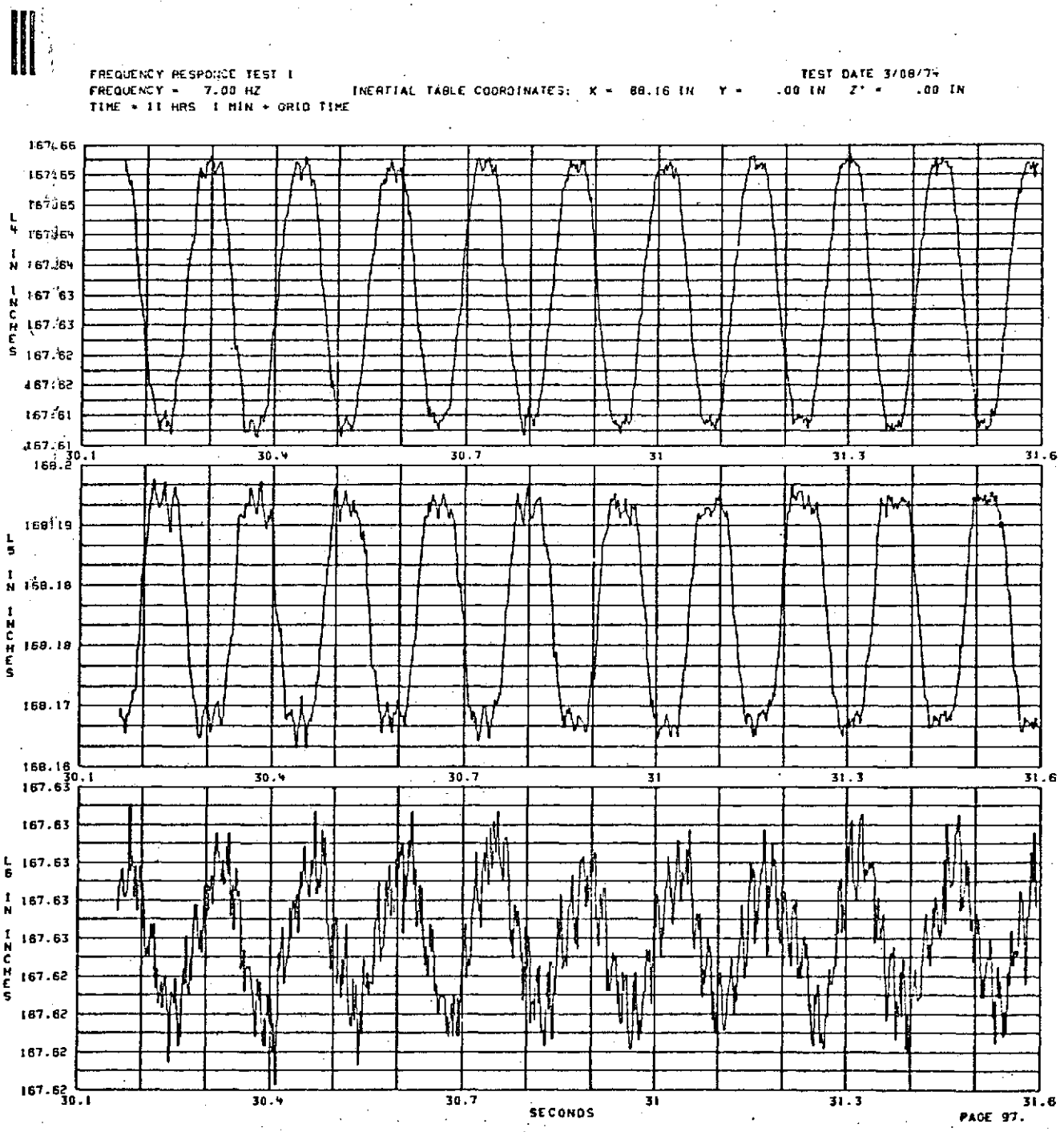

FREQUENCY RESPONCE TEST 1
FREQUENCY = 6.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
L5 IN INCHES
L6 IN INCHES
SECONDS
PAGE 80.

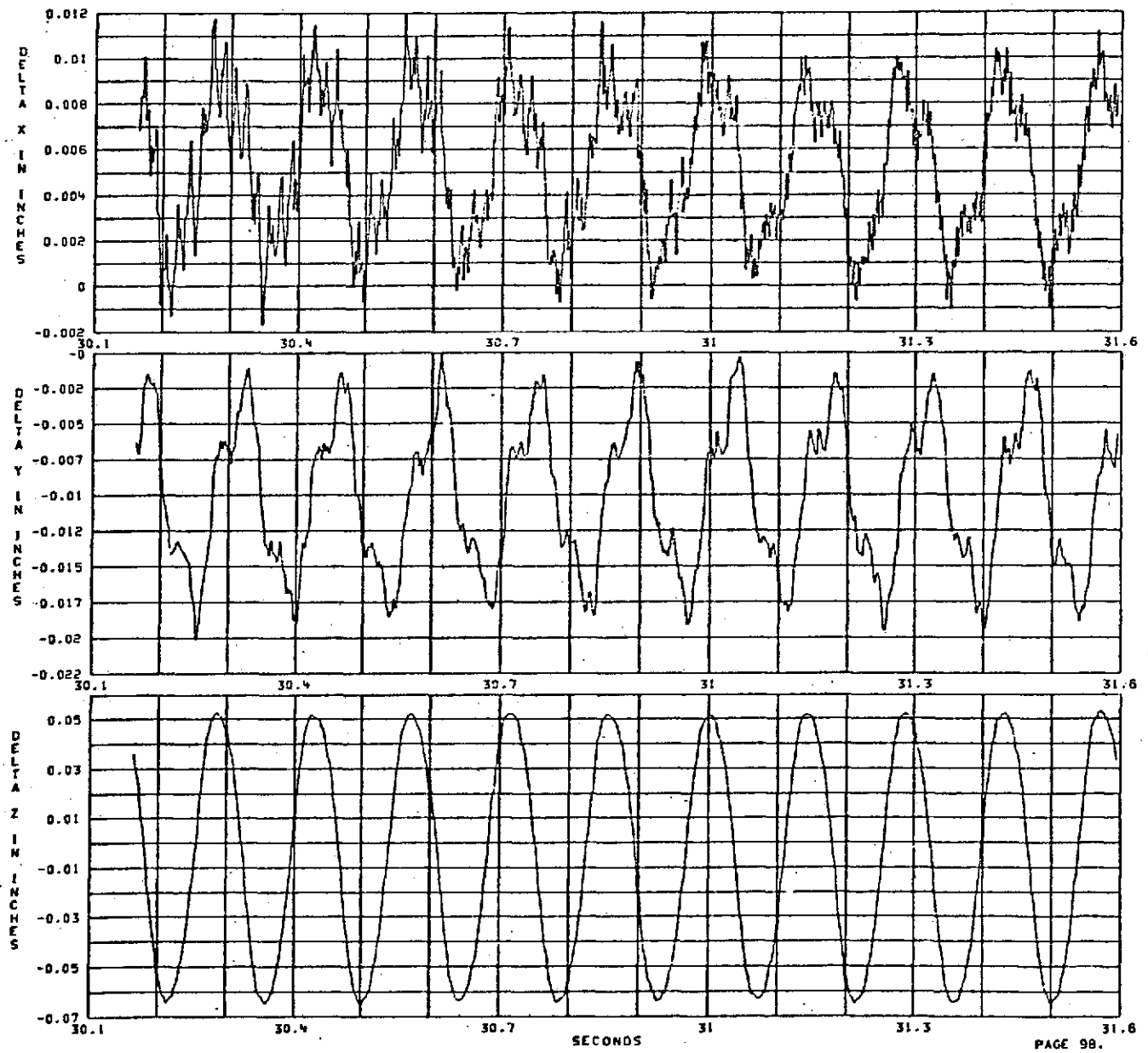

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN = GRID TIME
DELTA X IN INCHES
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
DELTA Y IN INCHES
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
27.7
27.9
28.1
28.3
28.5
28.7
28.9
29.1
29.3
29.5
SECONDS
PAGE 81.

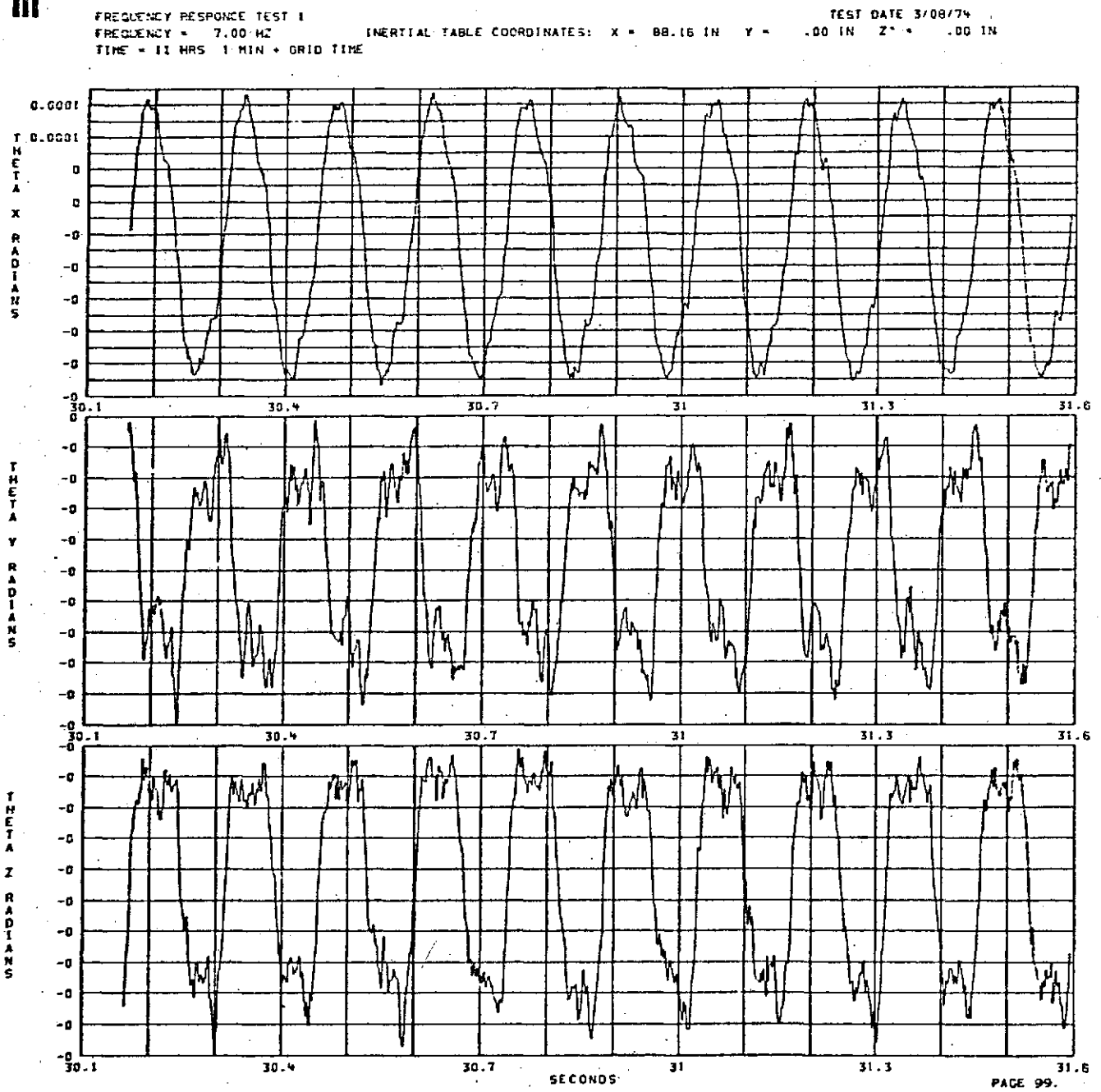

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN = GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
27.7
27.9
28.1
28.3
28.5
28.7
28.9
29.1
29.3
29.5
SECONDS
PAGE 82.

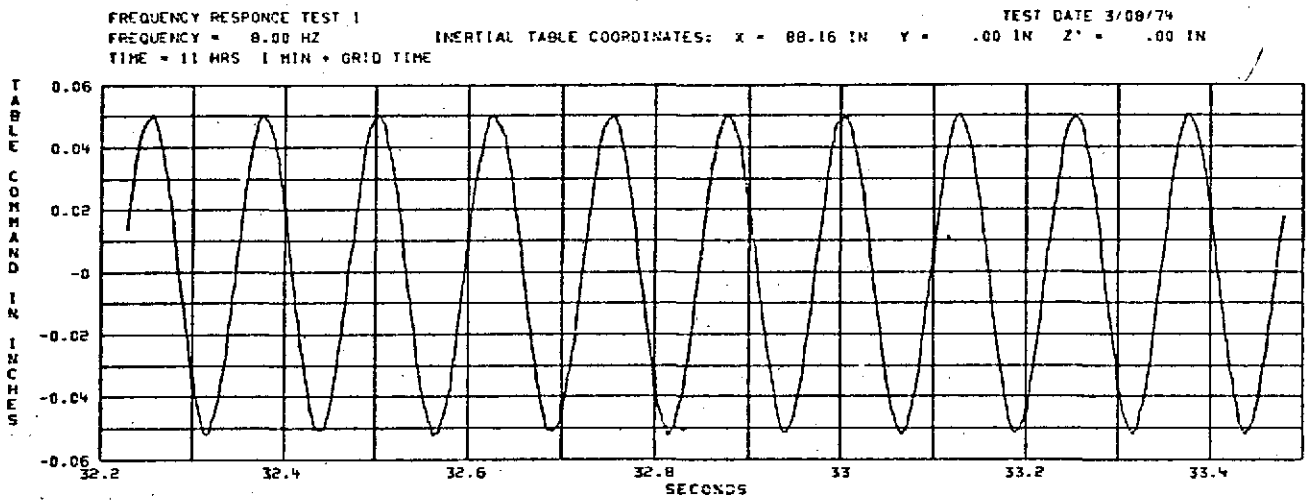

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
30.1
30.4
30.7
31
31.3
31.6
SECONDS

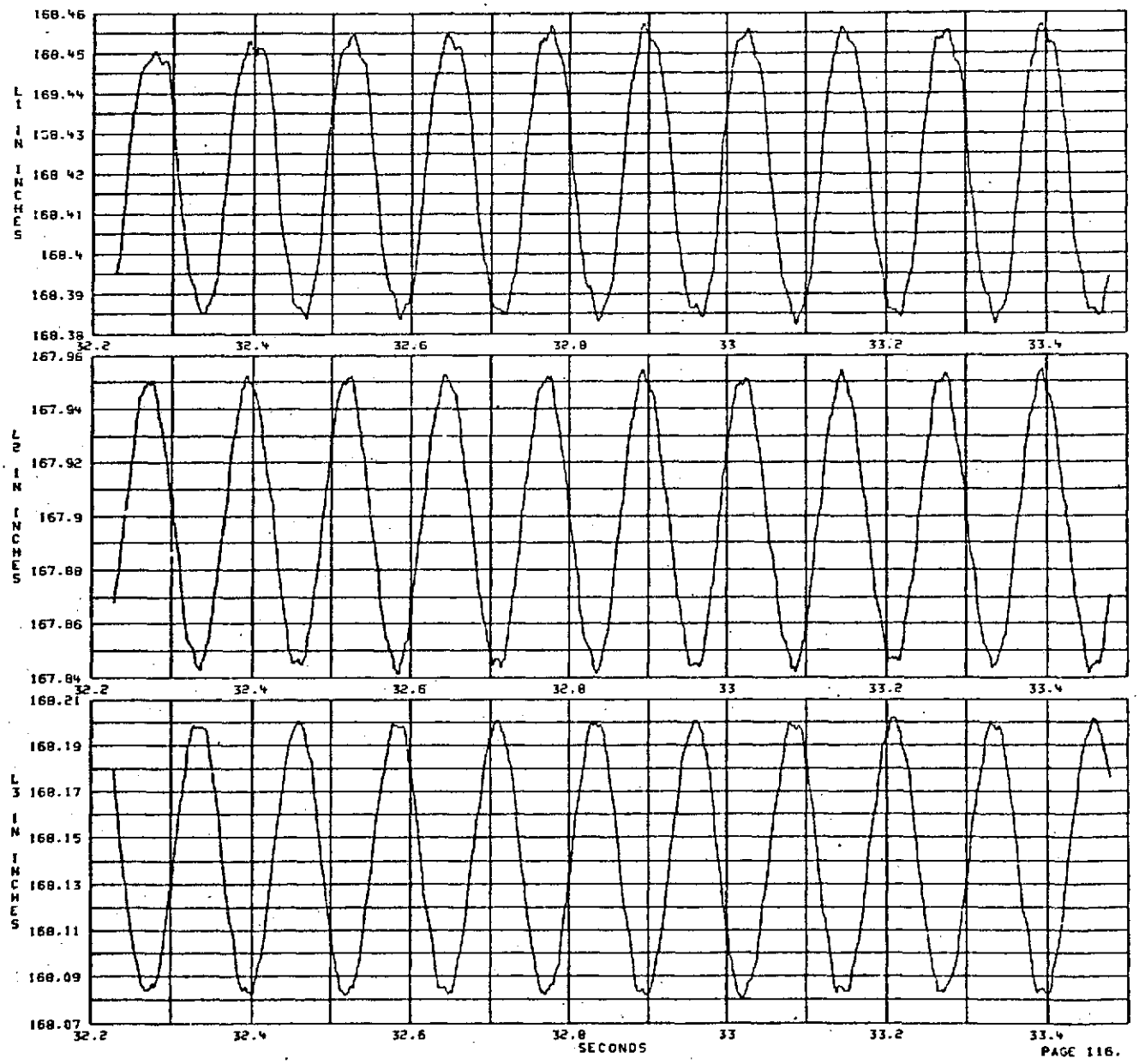

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN = GRID TIME
L1 IN INCHES
168.45
168.44
168.43
168.42
168.41
168.40
168.39
L2 IN INCHES
167.94
167.93
167.92
167.91
167.90
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.19
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.10
168.09
30.1
30.4
30.7
31
31.3
31.6
SECONDS
PAGE 96.

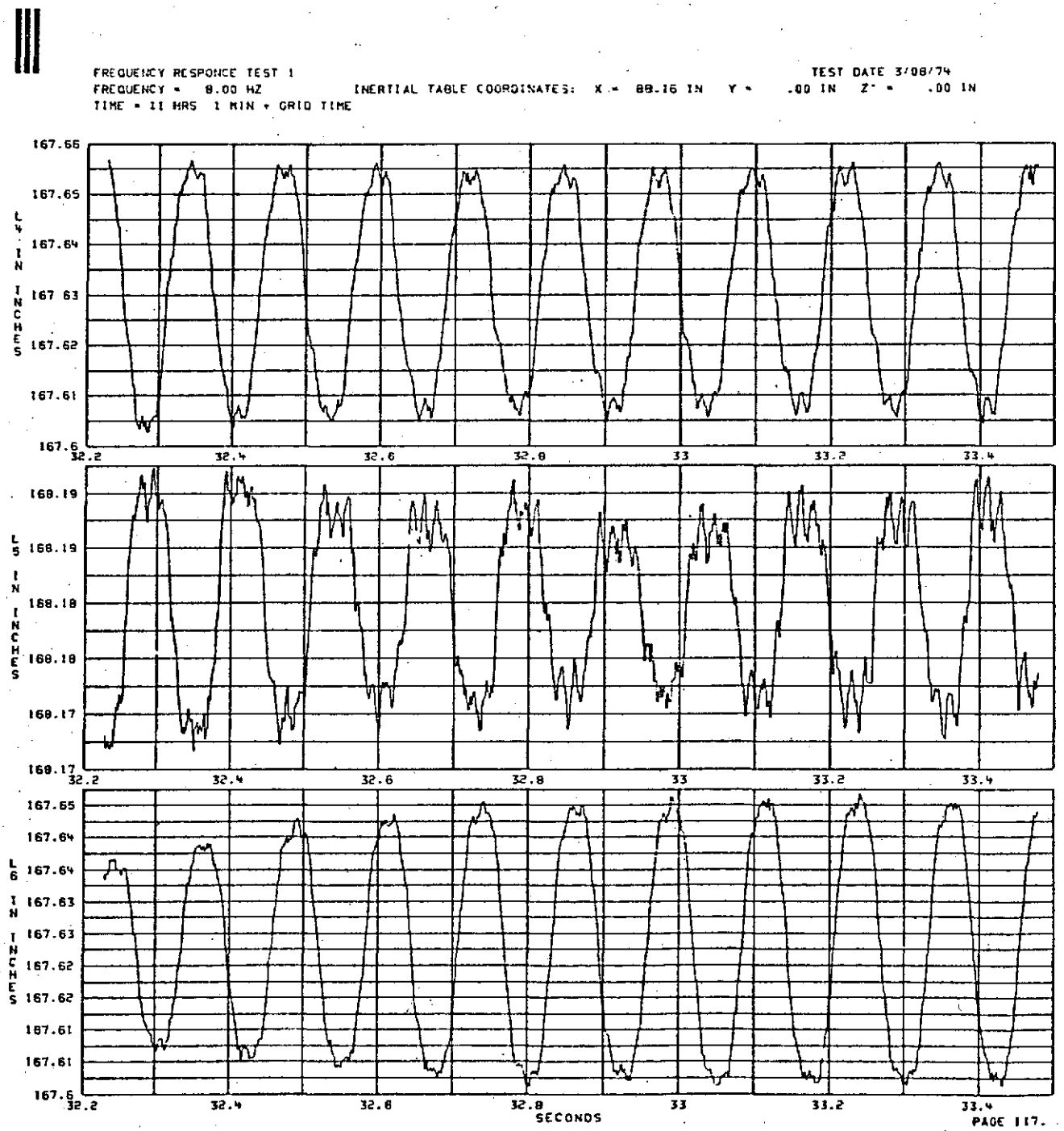

FREQUENCY RESPONSE TEST 1
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
L4 IN INCHES
167.66
167.65
167.65
167.64
167.64
167.63
167.63
167.62
167.62
167.61
167.61
L5 IN INCHES
168.2
168.19
168.18
168.18
168.17
168.16
L6 IN INCHES
167.63
167.63
167.63
167.63
167.63
167.62
167.62
167.62
30.1
30.4
30.7
31
31.3
31.6
SECONDS
PAGE 97.

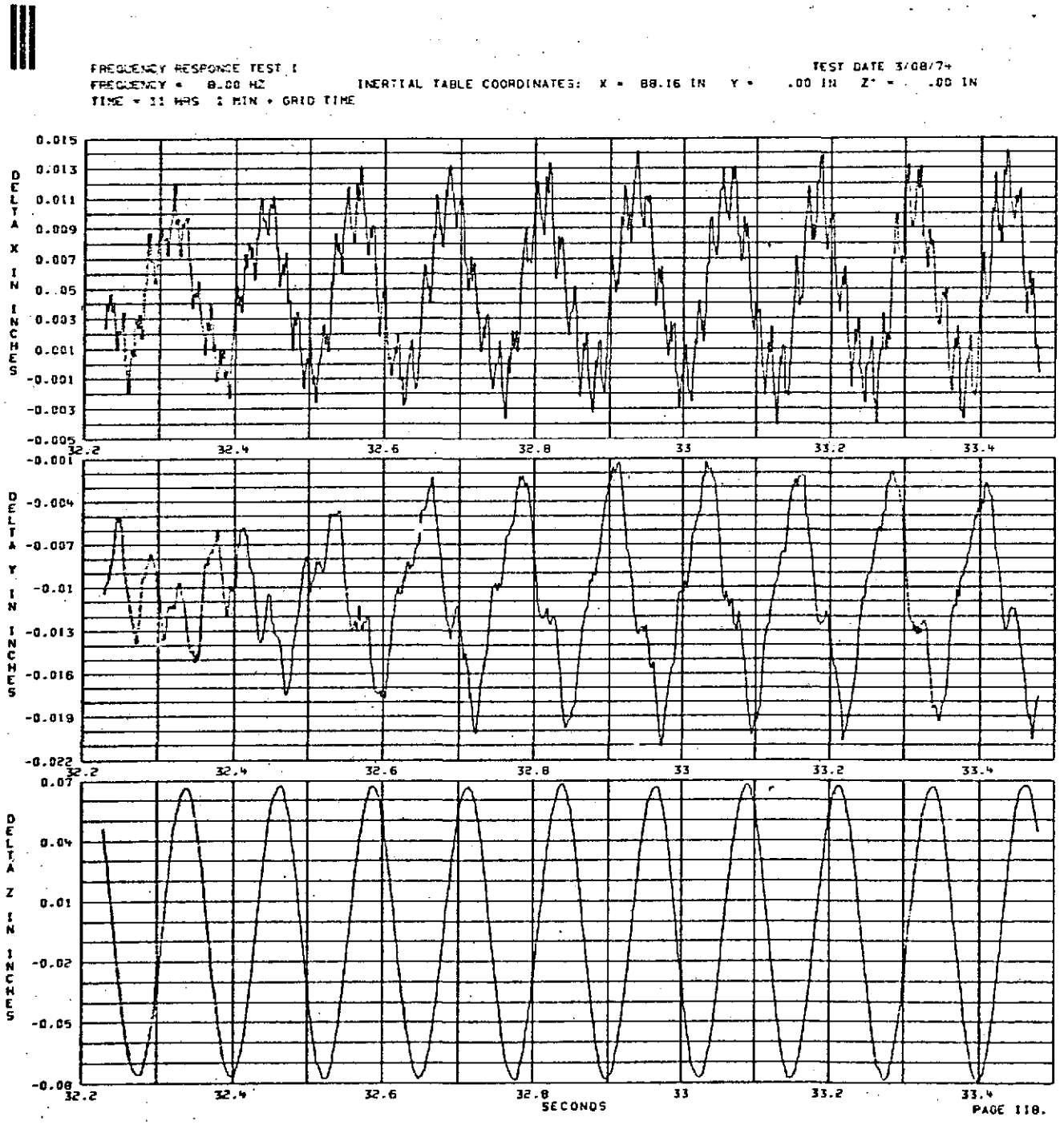

FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .30 IN
TIME = 11 HRS 1 MIN + GRID TIME
DELTA X IN INCHES
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
DELTA Y IN INCHES
-0
-0.002
-0.005
-0.007
-0.01
-0.012
-0.015
-0.017
-0.02
-0.022
DELTA Z IN INCHES
0.05
0.03
0.01
-0.01
-0.03
-0.05
-0.07
30.1
30.4
30.7
31
31.3
31.6
SECONDS
PAGE 98.


FREQUENCY RESPONCE TEST 1
FREQUENCY = 7.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
-0.0001
30.1
30.4
30.7
31
31.3
31.6
SECONDS
PAGE 99.


FREQUENCY RESPONCE TEST 1
TEST DATE 3/08/74
FREQUENCY = 8.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
32.2
32.4
32.6
32.8
33
33.2
33.4
SECONDS


FREQUENCY RESPONCE TEST 1
FREQUENCY = 8.00 HZ
INITIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 1 MIN + GRID TIME
TEST DATE 3/08/74
L1 IN INCHES
168.46
168.45
168.44
168.43
168.42
168.41
168.4
168.39
168.38
L2 IN INCHES
167.96
167.94
167.92
167.9
167.88
167.86
167.84
L3 IN INCHES
168.21
168.19
168.17
168.15
168.13
168.11
168.09
168.07
32.2
32.4
32.6
32.8
33
33.2
33.4
SECONDS
PAGE 116.

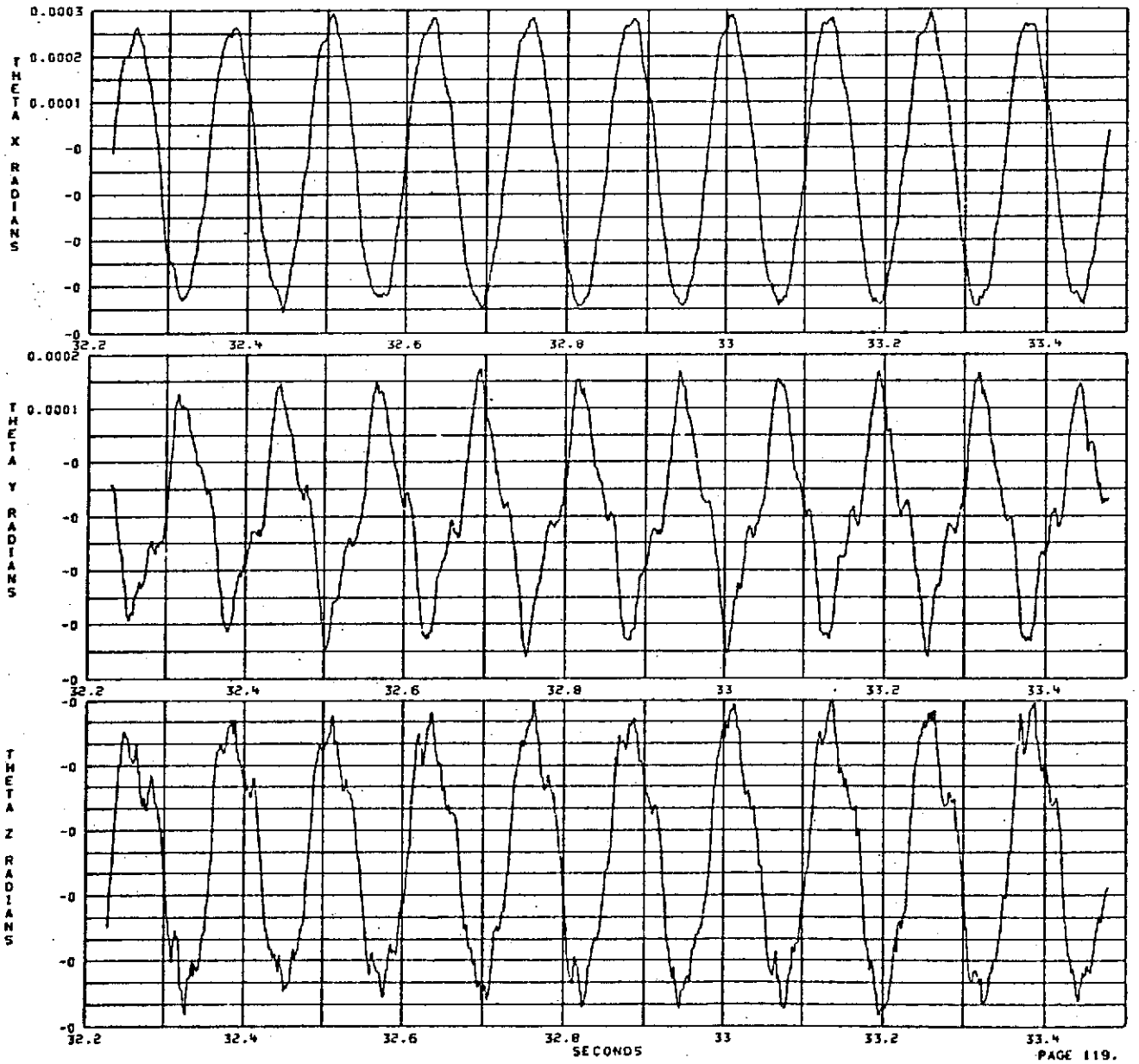

FREQUENCY RESPONCE TEST 1
FREQUENCY = 8.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
167.66
167.65
167.64
167 63
167.62
167.61
167.6
L5 IN INCHES
168.19
168.19
168.18
168.18
168.17
168.17
L6 IN INCHES
167.65
167.64
167.64
167.63
167.63
167.62
167.62
167.61
167.61
167.6
32.2
32.4
32.6
32.8
33
33.2
33.4
SECONDS
PAGE 117.


FREQUENCY RESPONSE TEST I
FREQUENCY = 8.00 HZ
TIME = 11 HRS 1 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
0.015
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
-0.003
-0.005
DELTA Y IN INCHES
-0.001
-0.004
-0.007
-0.01
-0.013
-0.016
-0.019
-0.022
DELTA Z IN INCHES
0.07
0.04
0.01
-0.02
-0.05
-0.08
32.2
32.4
32.6
32.8
33
33.2
33.4
SECONDS
PAGE 118.

FREQUENCY RESPONCE TEST 1
FREQUENCY = 8.00 HZ
TIME = 11 HRS 1 MIN = GRID TIME

INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN

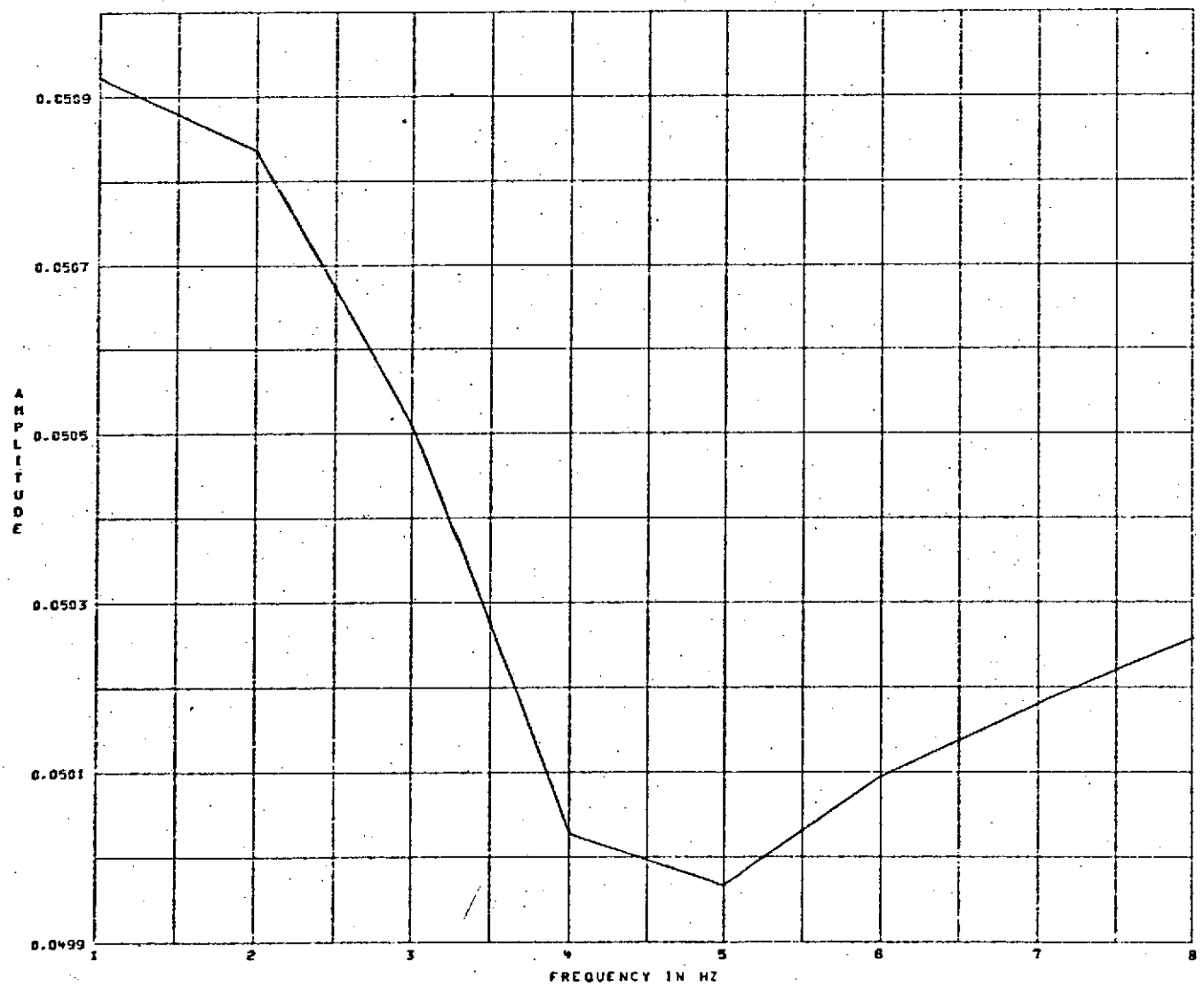
TEST DATE 3/08/74



PAGE 119.

FREQUENCY RESPONSE TEST 1
REFERENCE SENSOR - TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ HAS .100 HZ TO .800 HZ

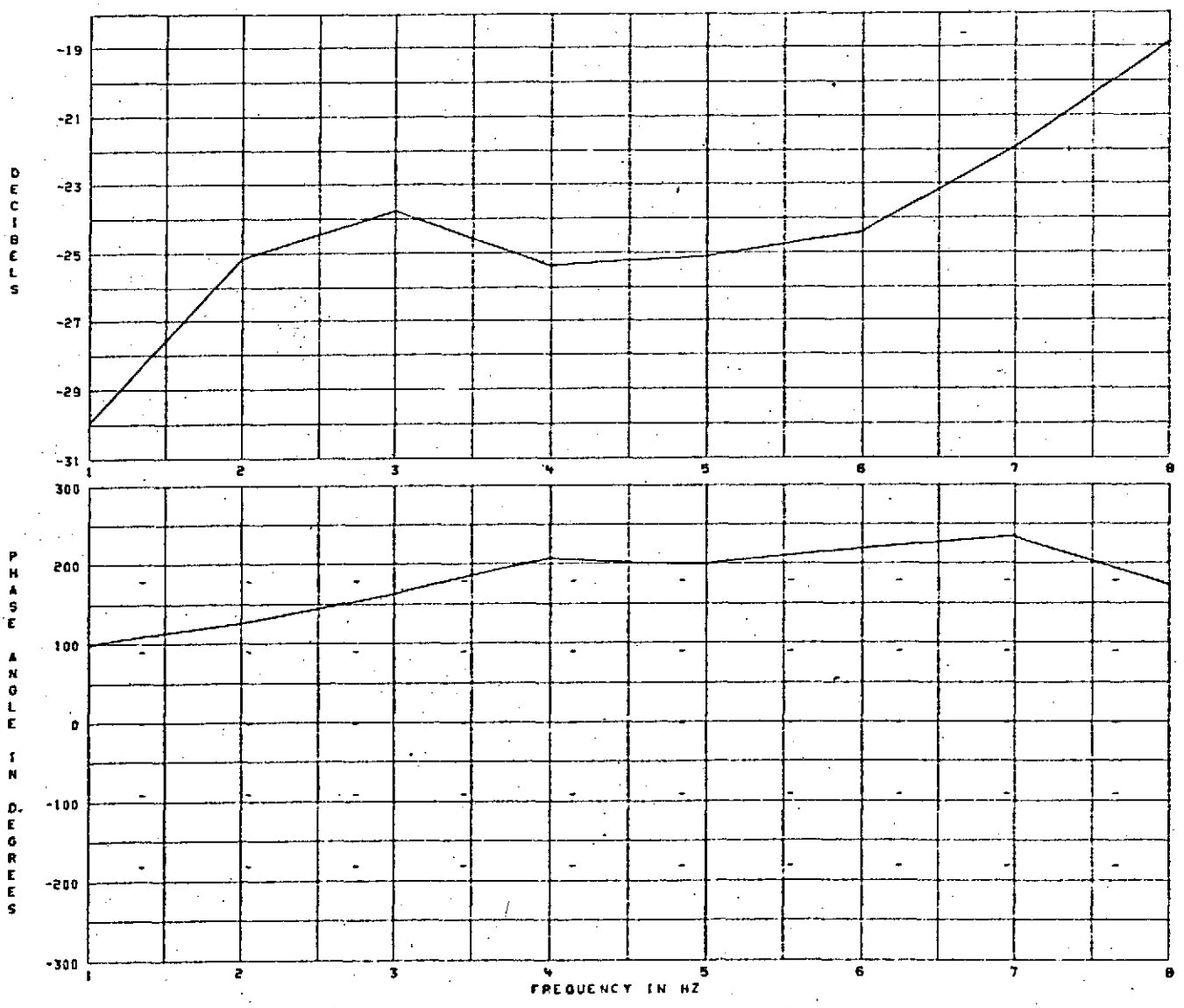
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.77 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 0.

FREQUENCY RESPONCE TEST 1
SENSOR -DELT X NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

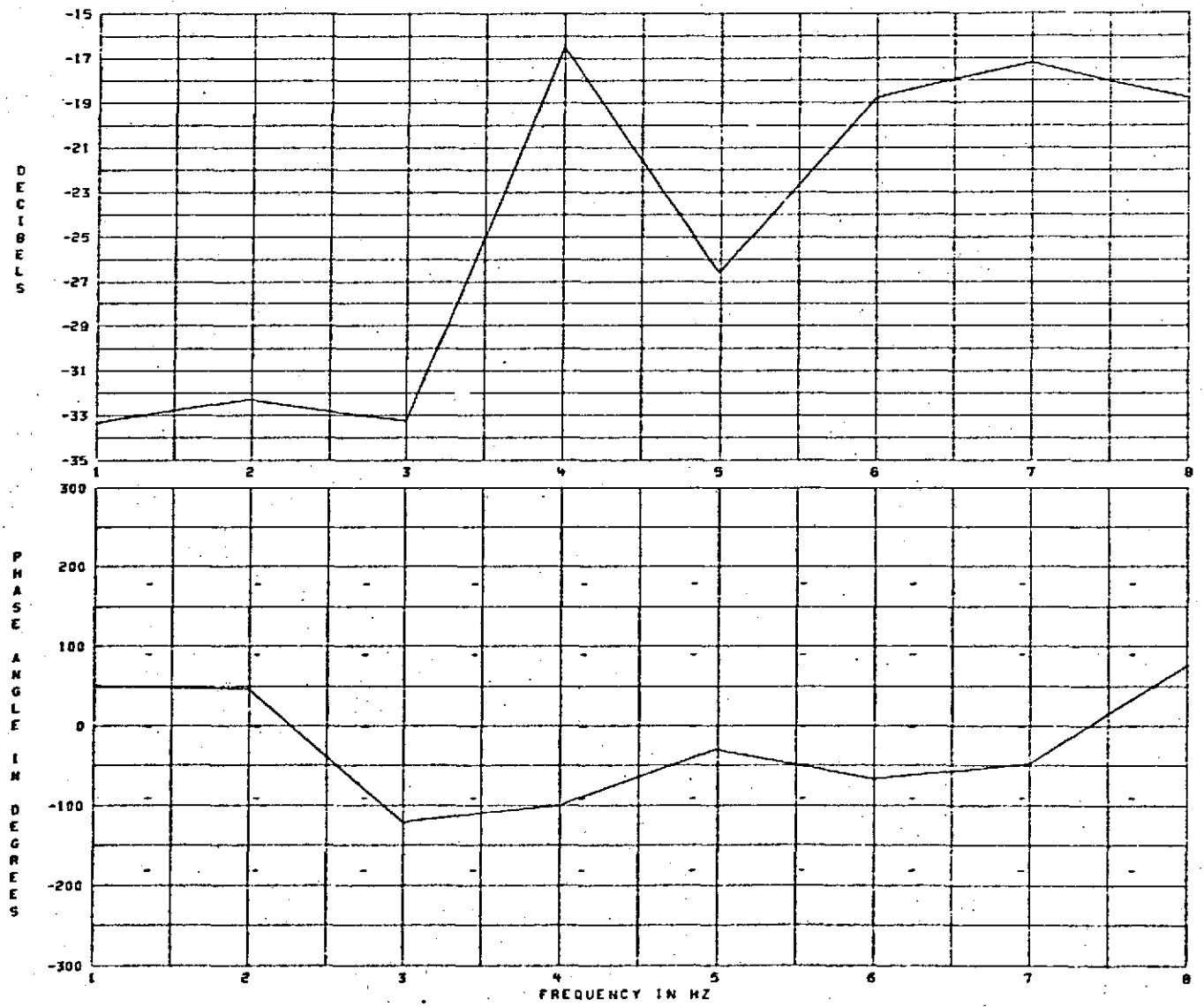
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.77 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 1.

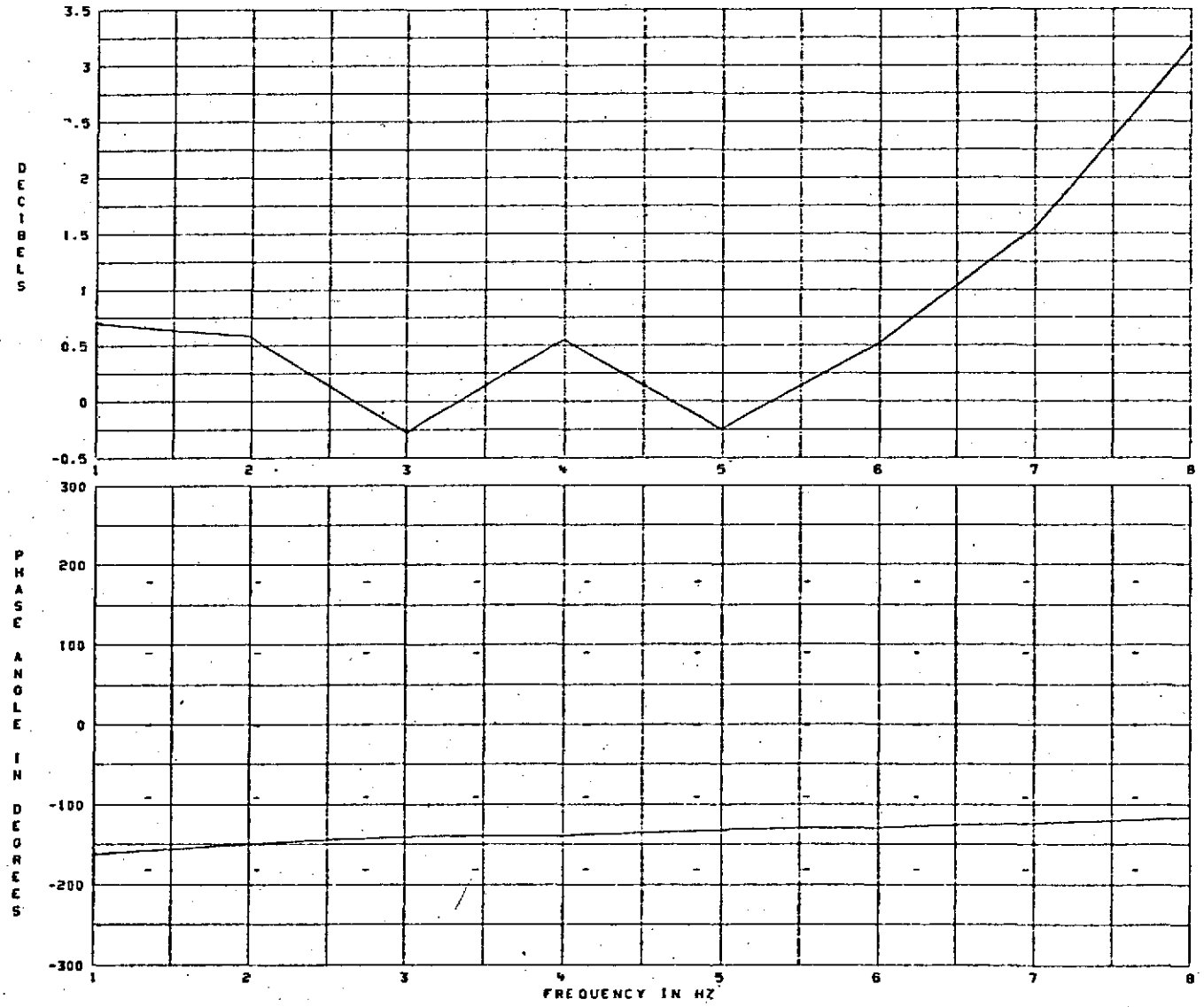
FREQUENCY RESPONCE TEST 1
SENSOR -DELT Y NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.77 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 2.

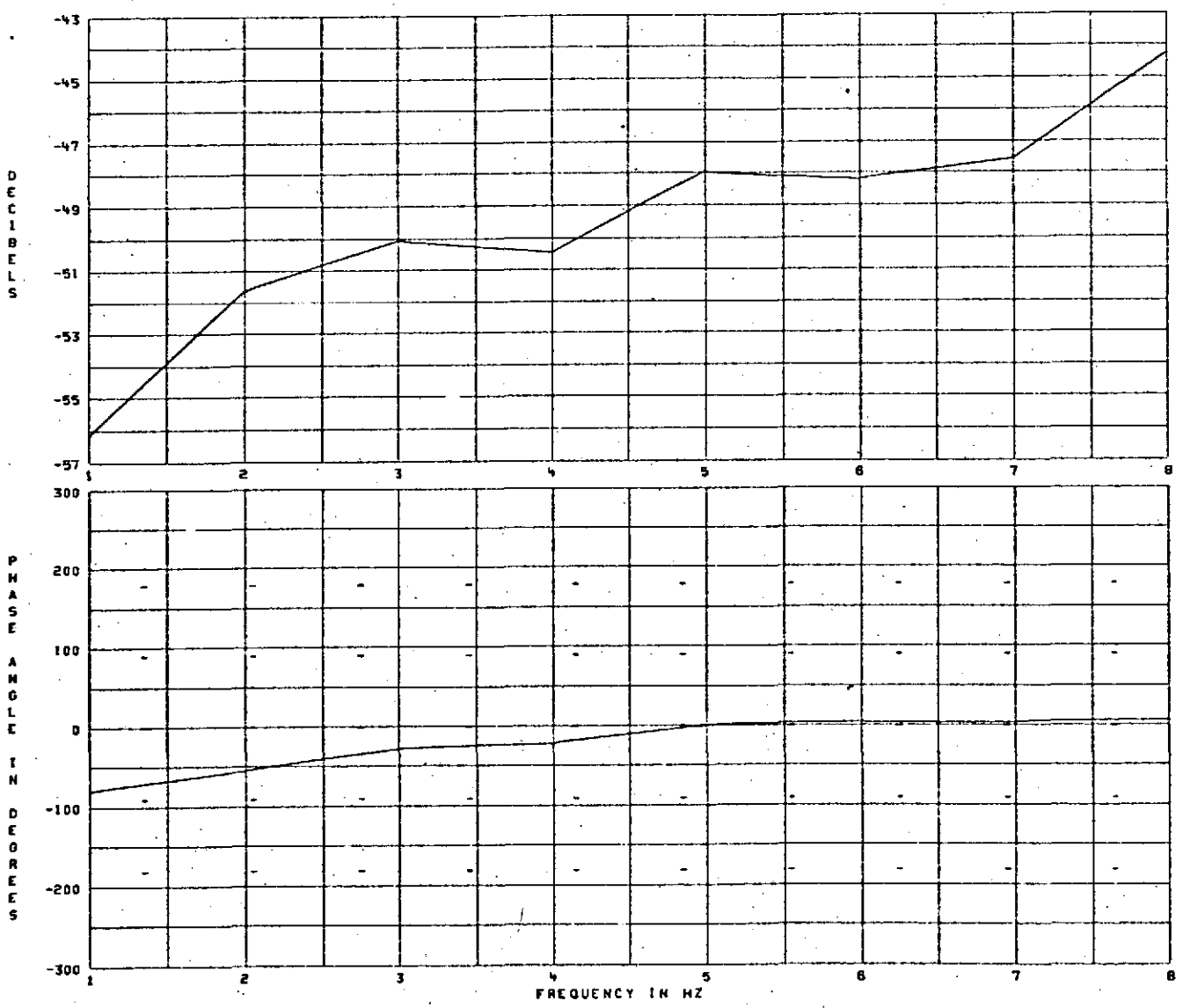
FREQUENCY RESPONCE TEST 1 DATE PROCESSED - 09APR74
SENSOR -DELT Z NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0 TOTAL PERIOD PROCESSED = 40.77 SEC
FIRST FREQUENCY = 1.00 HZ FREQUENCY INCREMENTS = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ



PAGE 3.

FREQUENCY RESPONCE TEST 1
SENSOR -XITETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

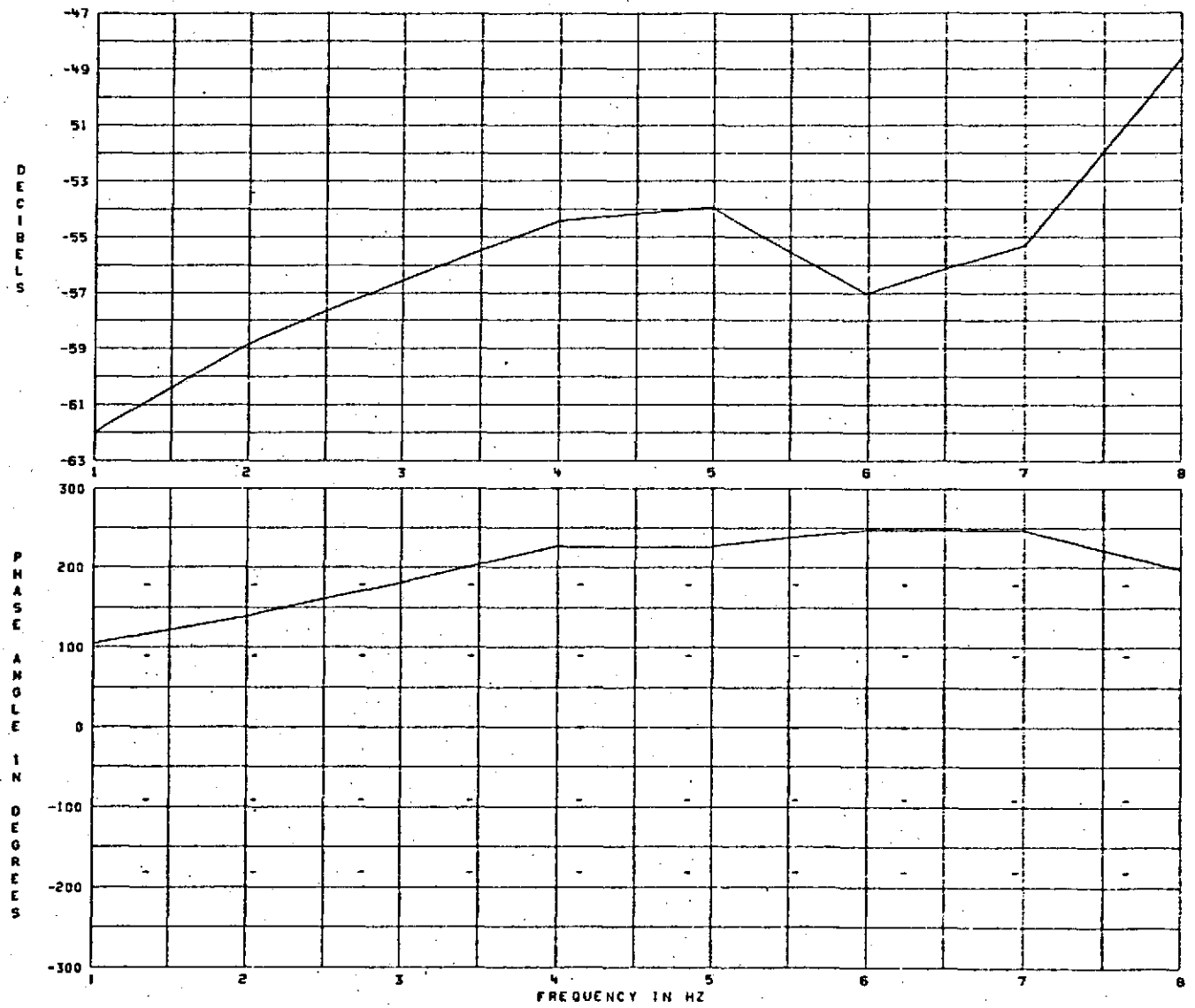
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.77 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 4.

FREQUENCY RESPONCE TEST 1
SENSOR -YTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS -.100 HZ TO .800 HZ

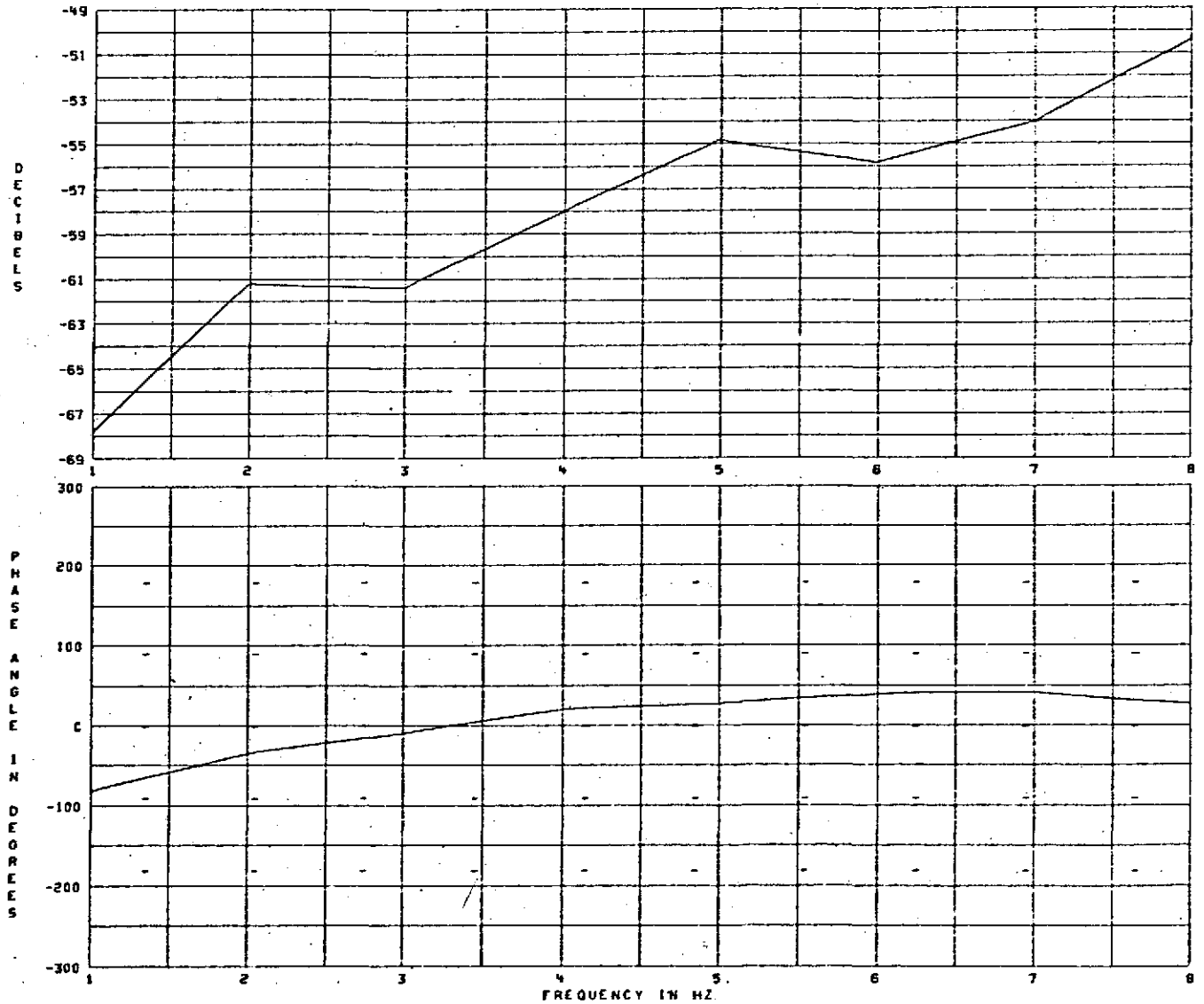
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.77 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 5.

FREQUENCY RESPONCE TEST I
SENSOR -ZTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.77 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 6.

APPENDIX B

TEST NO. 2 Z-AXIS

DOTS FREQUENCY RESPONSE TEST
SUMMARY OF INPUT INERTIAL CONDITIONS AND TRANSFORM MATRIX

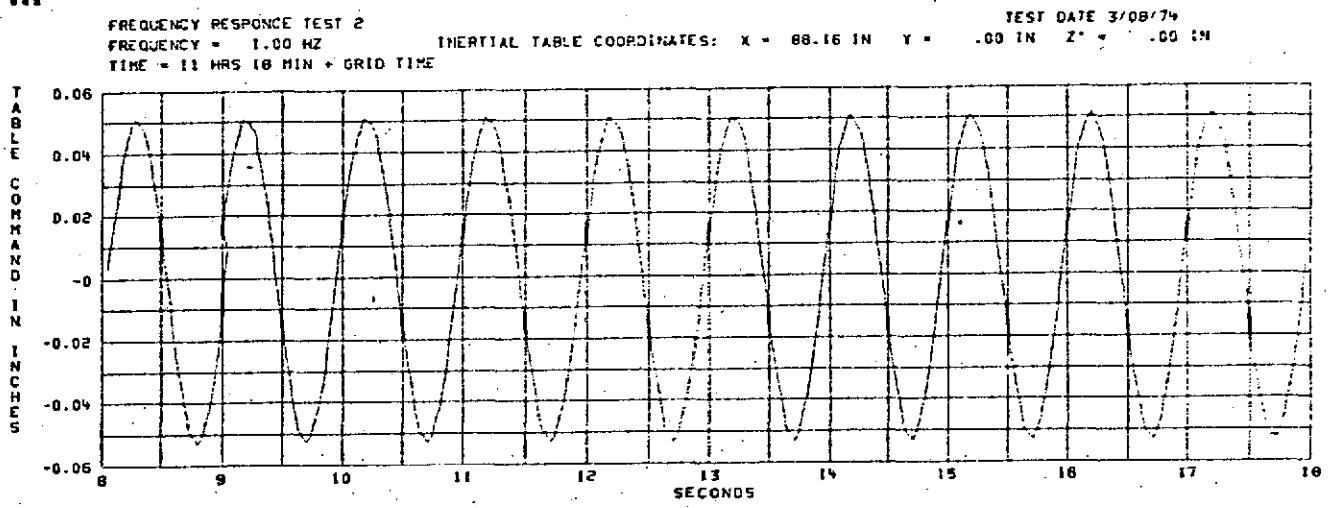
FREQUENCY RESPONCE TEST 2 — TEST DATE 3/08/74

	X	Y	Z
TABLE COORDINATES	88.159	.000	.000

ACTUATOR	SERVO TABLE SWIVEL JOINTS X	Y	Z	FLOOR SWIVEL JOINTS X	Y	Z	COMPONENTS OF ACTUATOR LENGTH X	Y	Z	ACTUATOR LENGTH
1	.0000	25.1020	49.5000	210.4070	-64.3110	123.1780	-122.2480	89.4130	-73.6780	168.4272
2	.0000	-55.4190	3.0000	210.4290	-76.3800	116.1240	-122.2700	20.9610	-113.1240	167.8879
3	.0000	-55.4190	-3.0000	210.4220	-74.5730	-116.8190	-122.2630	19.1540	113.8190	168.1365
4	.0000	25.1020	-49.5000	210.4170	-62.4120	-123.6830	-122.2580	87.5140	74.1830	167.6569
5	.0000	30.2980	-46.5000	210.4100	138.4630	-5.9750	-122.2510	-150.1650	-40.6250	168.1881
6	.0000	30.2980	46.5000	210.3690	138.3890	8.0050	-122.2100	-150.0910	38.4950	167.6330

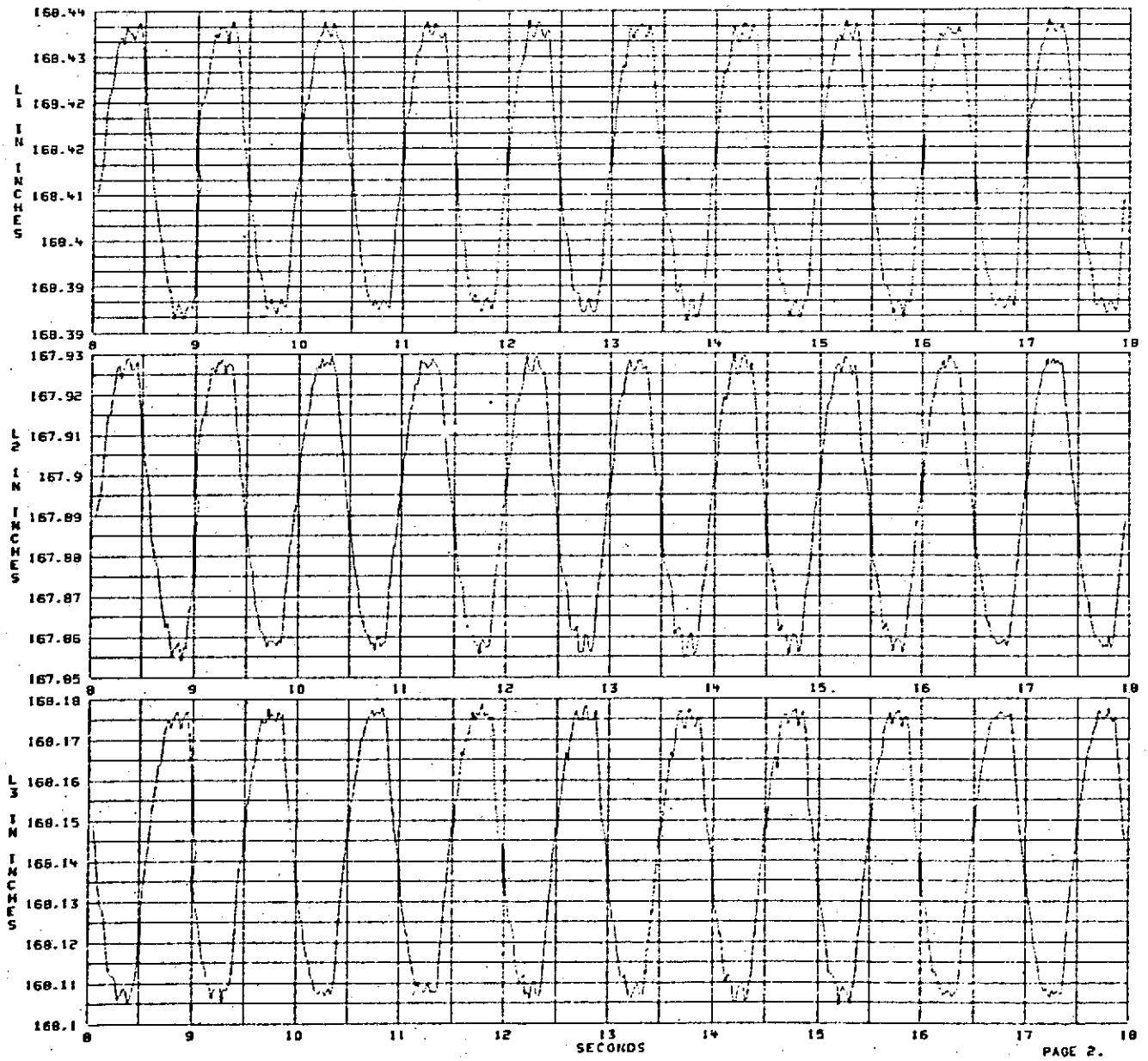
TRANSFORM MATRIX

-.227798+00	-.229422+00	-.228575+00	-.229554+00	-.228266+00	-.230510+00
.447118+00	-.236022-01	-.303266-01	.442709+00	-.416853+00	-.418525+00
-.222802+00	-.498159+00	.498501+00	.228740+00	-.275333+00	.268651+00
-.450573-02	.449077-02	-.449777-02	.448826-02	-.450071-02	.448595-02
-.648215-02	.145547-02	-.146094-02	.650505-02	.794358-02	-.796986-02
.543719-02	-.835984-02	-.833211-02	.544980-02	.268540-02	.291976-02

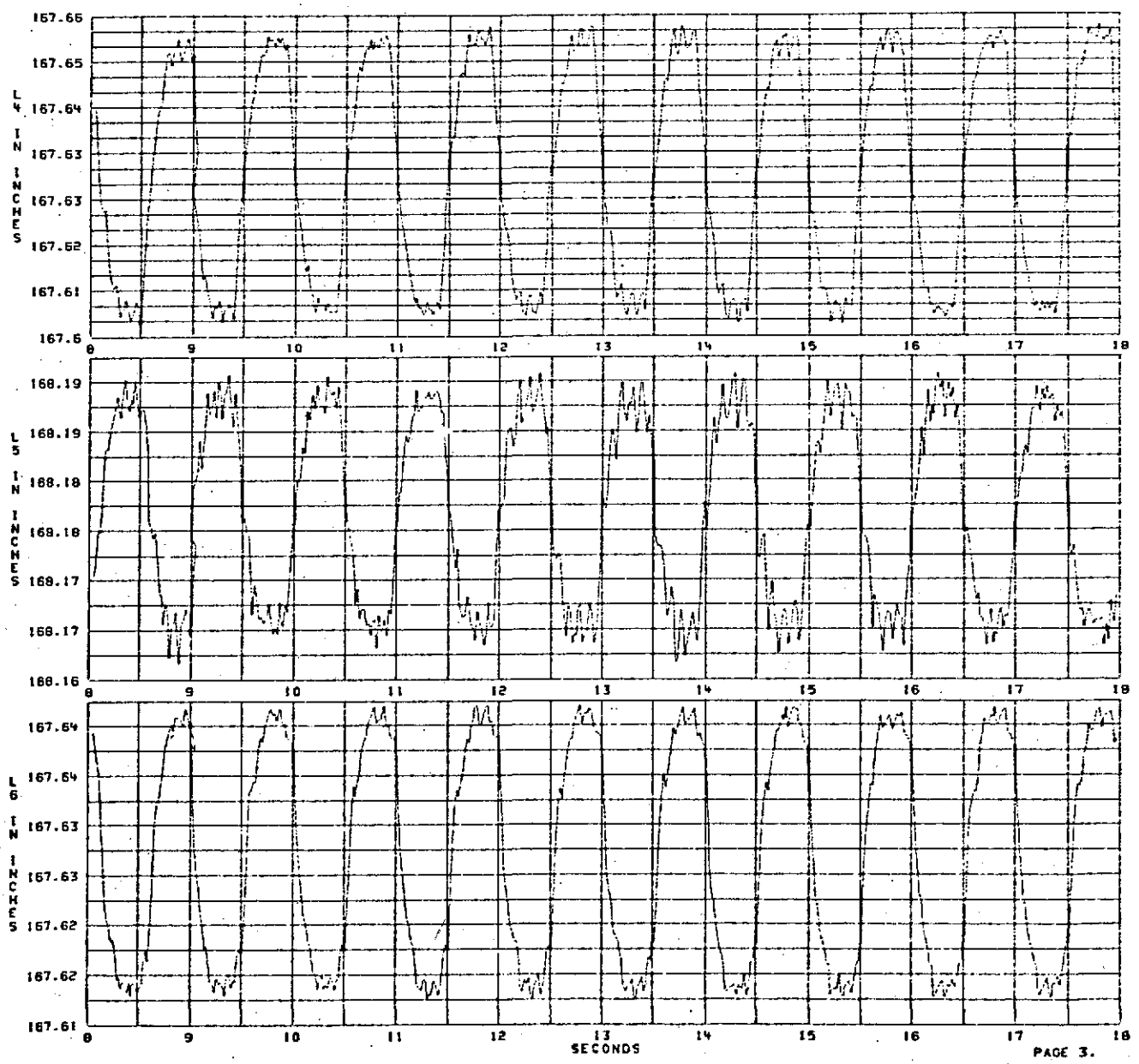

FREQUENCY RESPONCE TEST 2
FREQUENCY = 1.00 HZ
TIME = 11 HRS 18 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
8
9
10
11
12
13
14
15
16
17
18
SECONDS

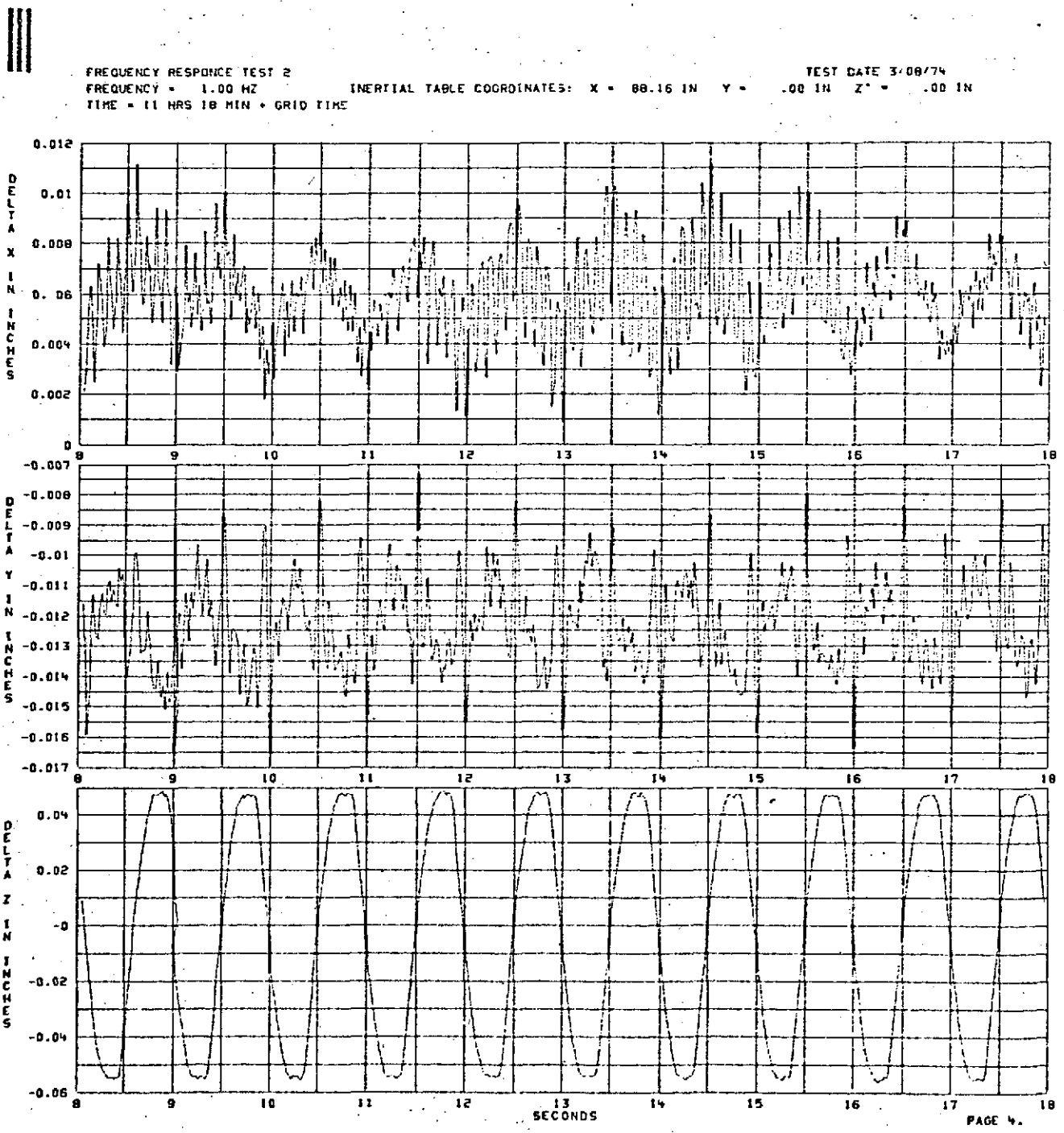
PAGE 1.

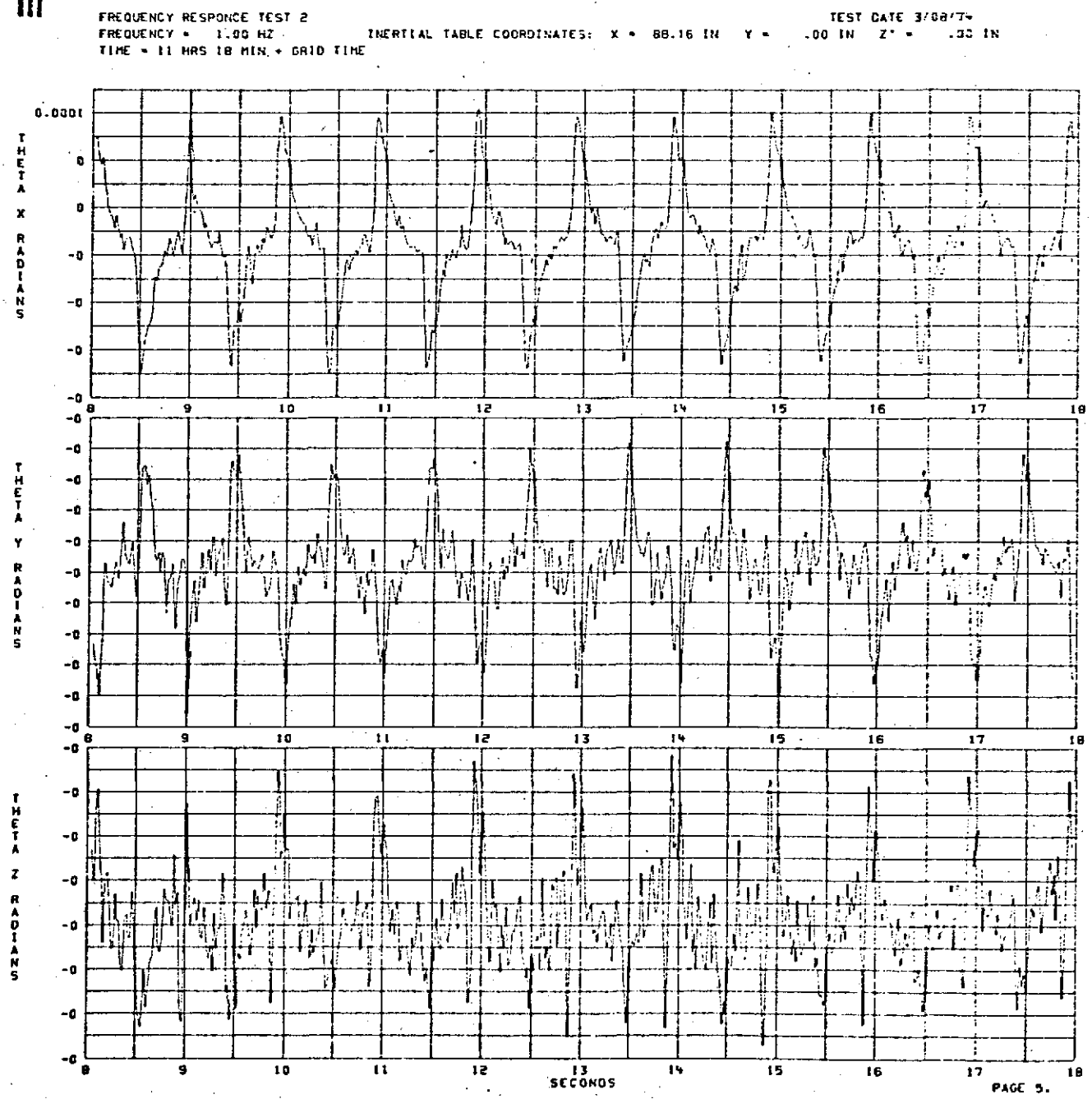
FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 1.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN +.GRID TIME

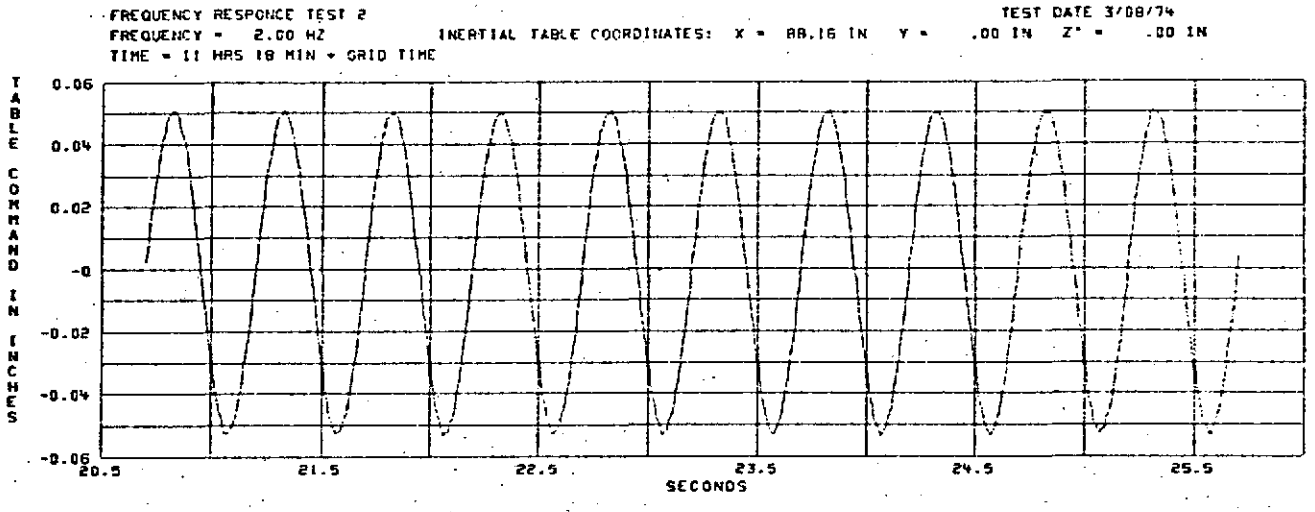


PAGE 2.

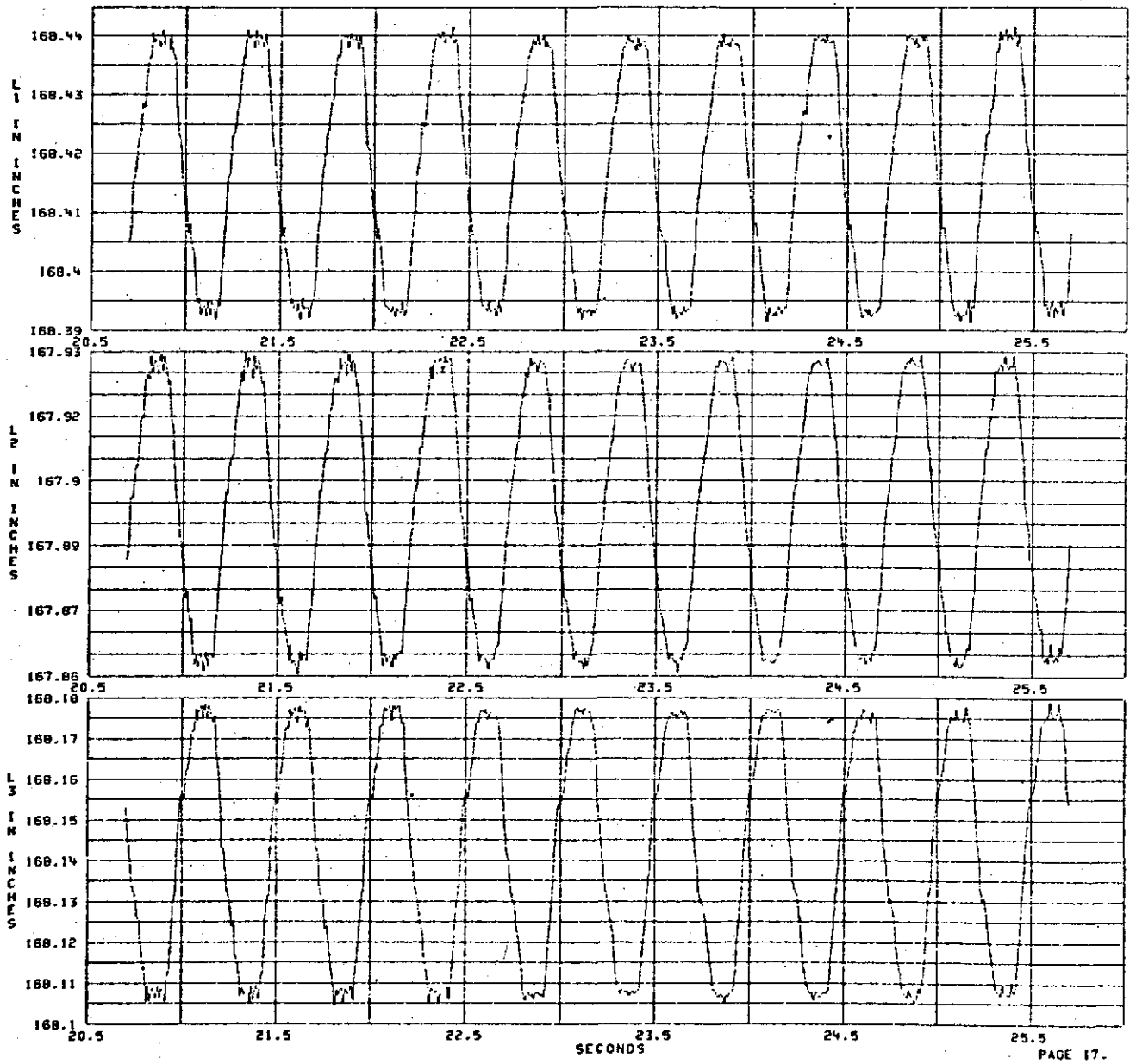

FREQUENCY RESPONCE TEST 2
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
TEST DATE 3/08/74
L4 IN INCHES
167.66
167.65
167.64
167.63
167.63
167.62
167.61
167.6
L5 IN INCHES
168.19
168.19
168.18
168.18
168.17
168.17
168.16
L6 IN INCHES
167.64
167.64
167.63
167.63
167.62
167.62
167.61
8 9 10 11 12 13 14 15 16 17 18
SECONDS
PAGE 3.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
DELTA X IN INCHES
0.012
0.01
0.008
0.006
0.004
0.002
0
DELTA Y IN INCHES
-0.007
-0.008
-0.009
-0.01
-0.011
-0.012
-0.013
-0.014
-0.015
-0.016
-0.017
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
8
9
10
11
12
13
14
15
16
17
18
SECONDS
PAGE 4.

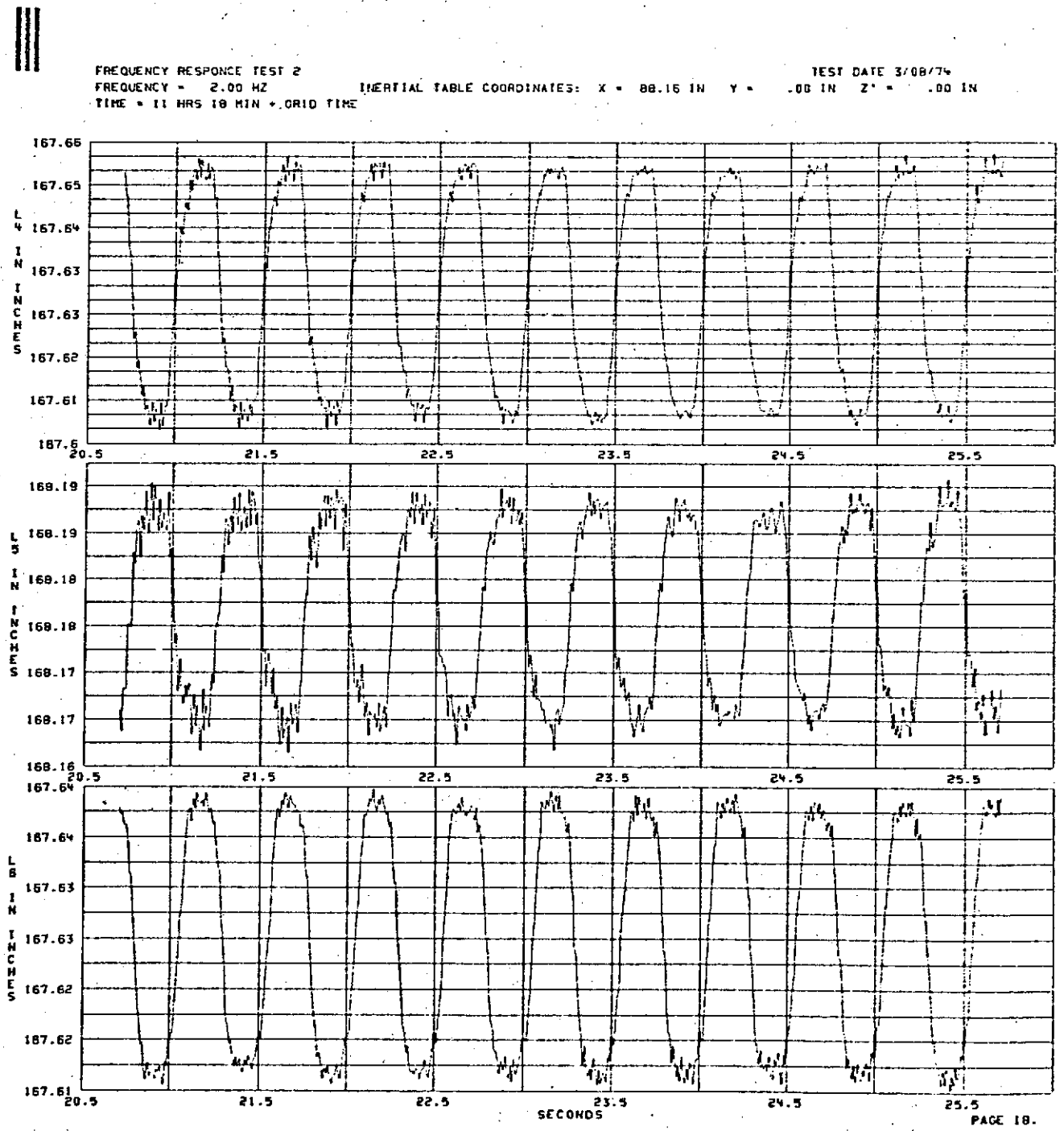

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN. = GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
8
9
10
11
12
13
14
15
16
17
18
SECONDS
PAGE 5.

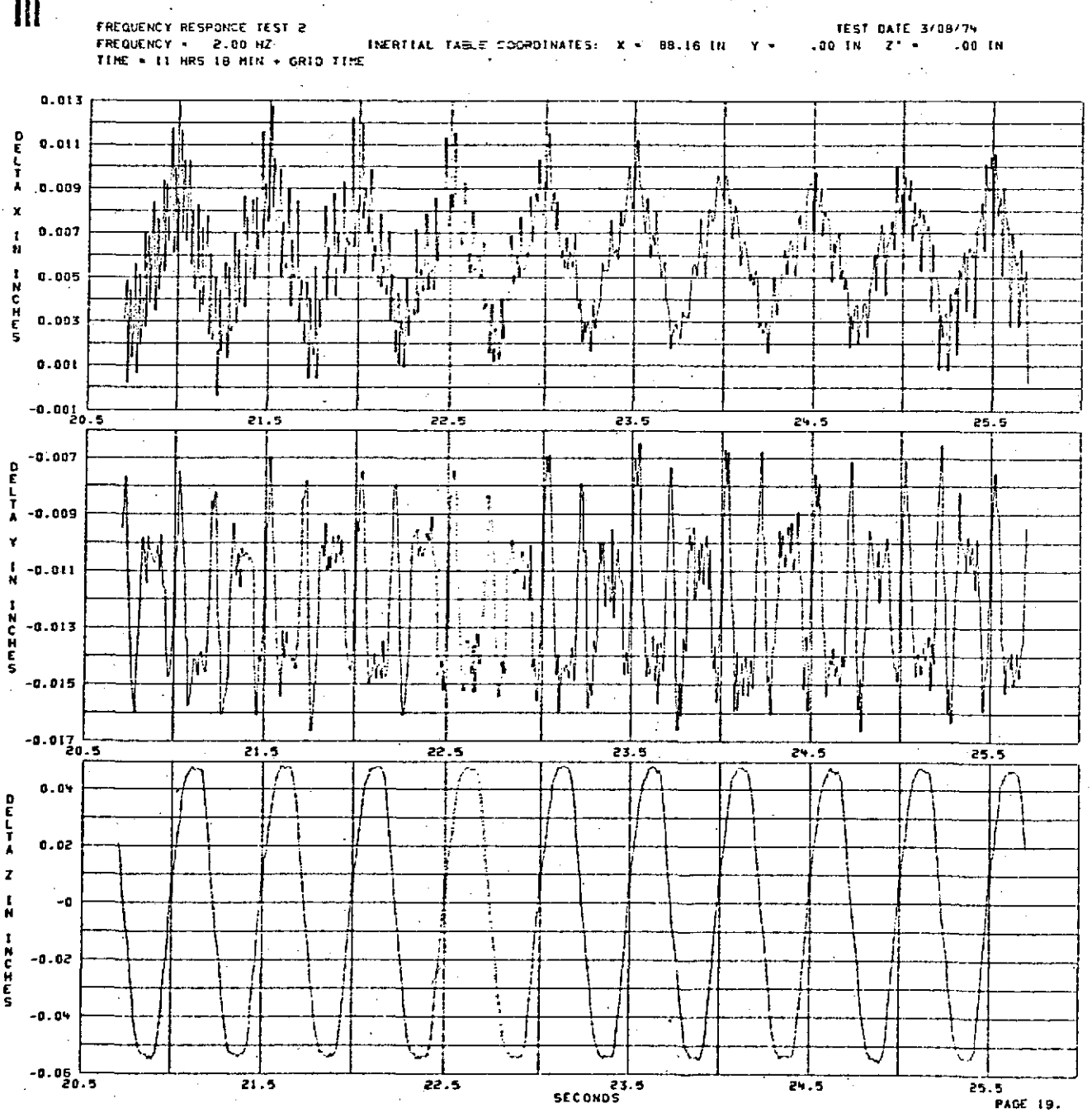

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
20.5
21.5
22.5
23.5
24.5
25.5
SECONDS

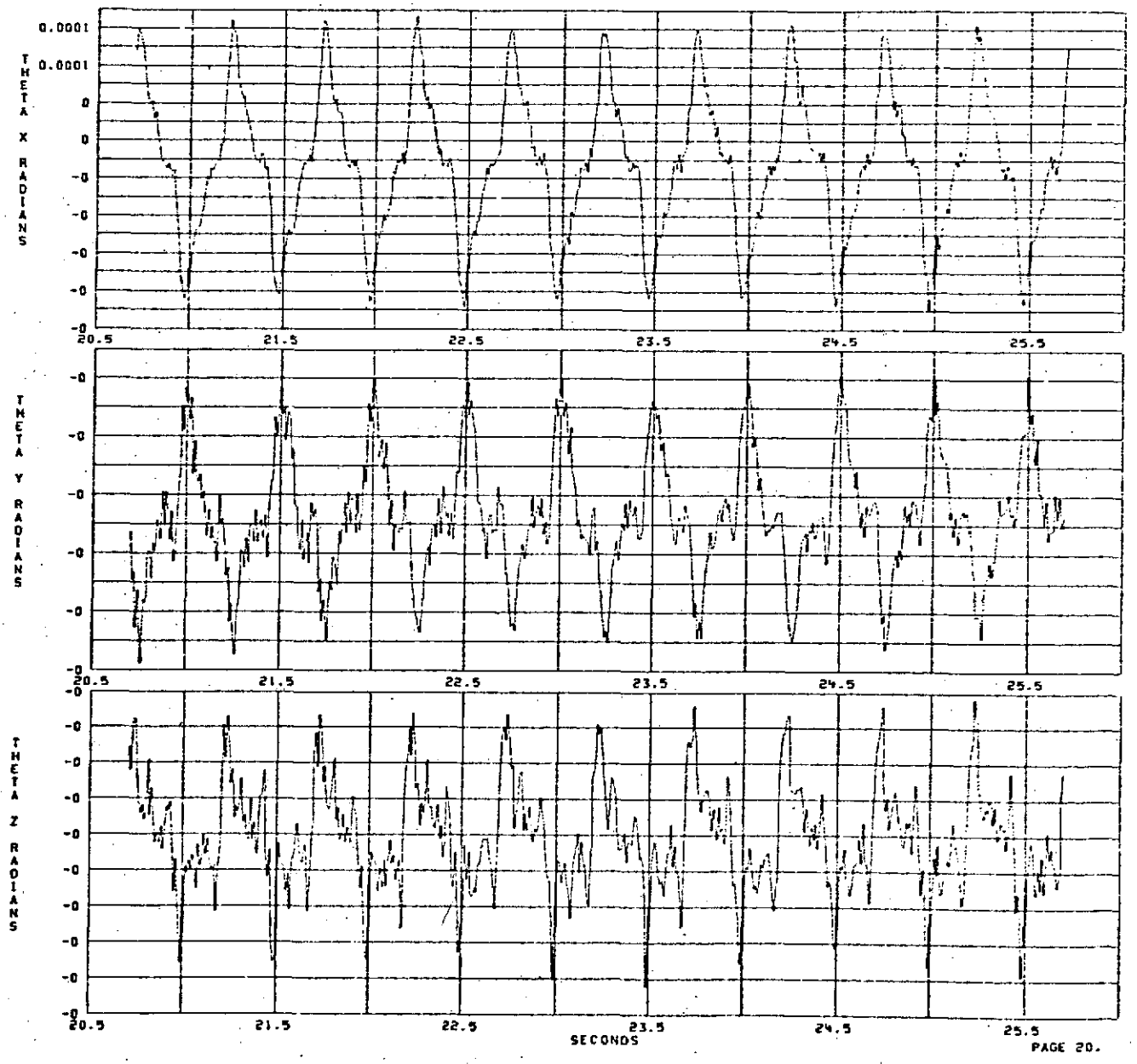
FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 2.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME

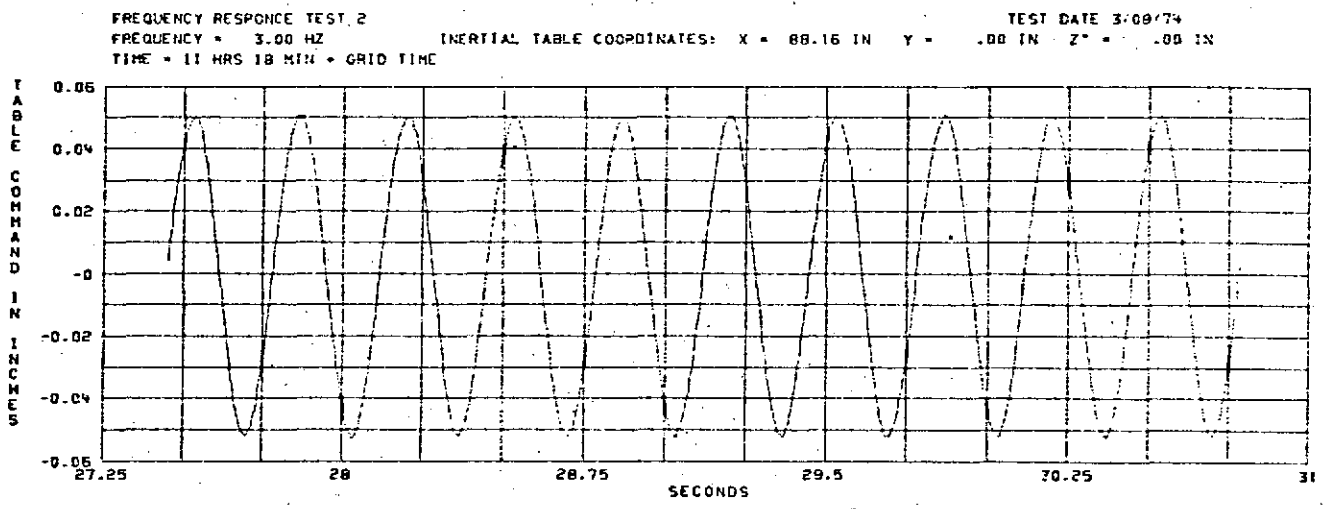


PAGE 17.

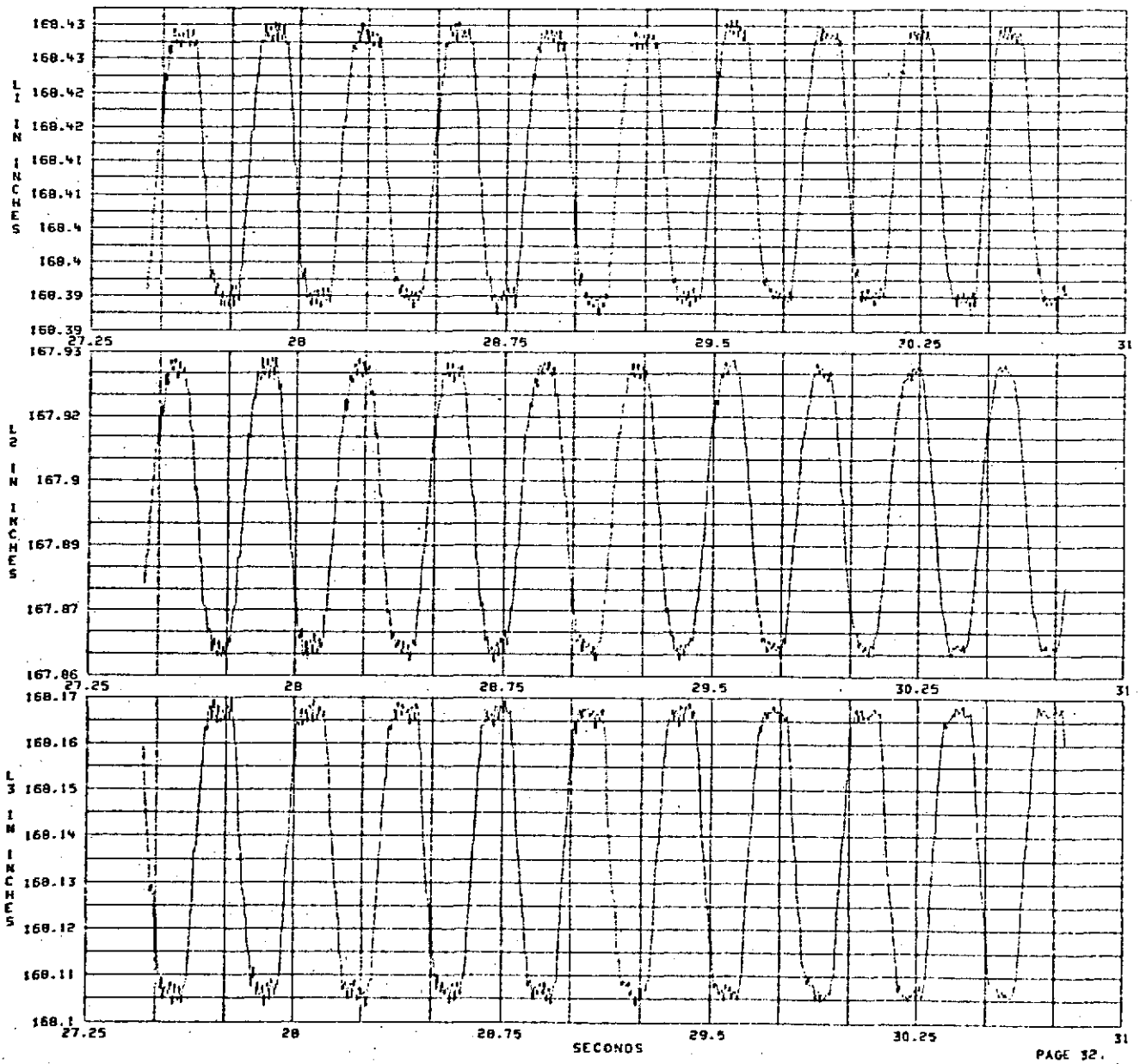

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN +.ORID TIME
L4 IN INCHES
167.66
167.65
167.64
167.63
167.63
167.62
167.61
167.6
L5 IN INCHES
168.19
168.19
168.18
168.18
168.17
168.17
168.16
L8 IN INCHES
167.64
167.64
167.63
167.63
167.62
167.62
167.61
20.5
21.5
22.5
23.5
24.5
25.5
SECONDS
PAGE 18.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
DELTA X IN INCHES
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
DELTA Y IN INCHES
-0.007
-0.009
-0.011
-0.013
-0.015
-0.017
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
20.5
21.5
22.5
23.5
24.5
25.5
SECONDS
PAGE 19.

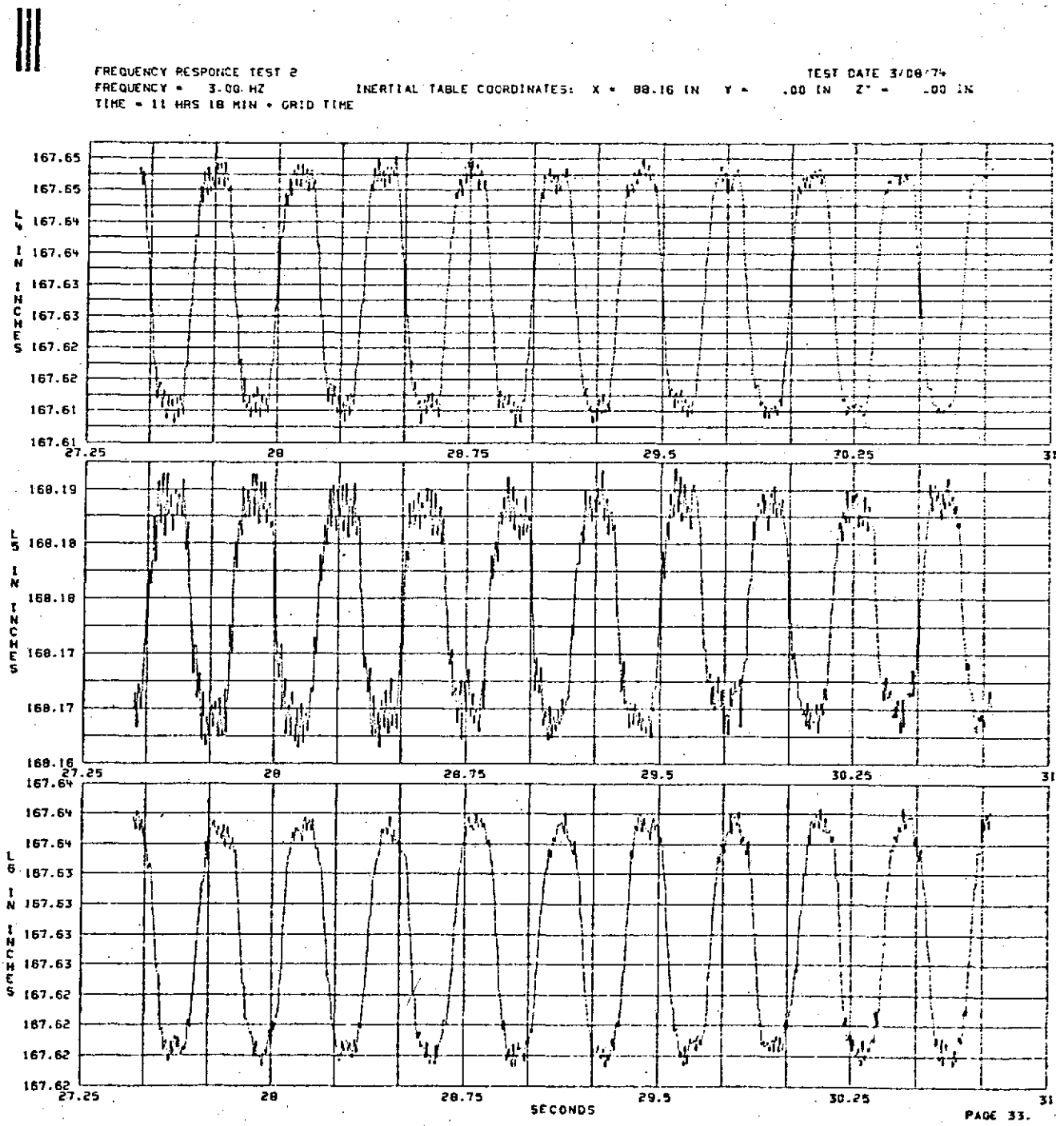

FREQUENCY RESPONCE TEST 2
FREQUENCY = 2.00 HZ
TIME = 11 HRS 18 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08-74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
0.0001
0
-0
20.5
21.5
22.5
23.5
24.5
25.5
SECONDS
PAGE 20.

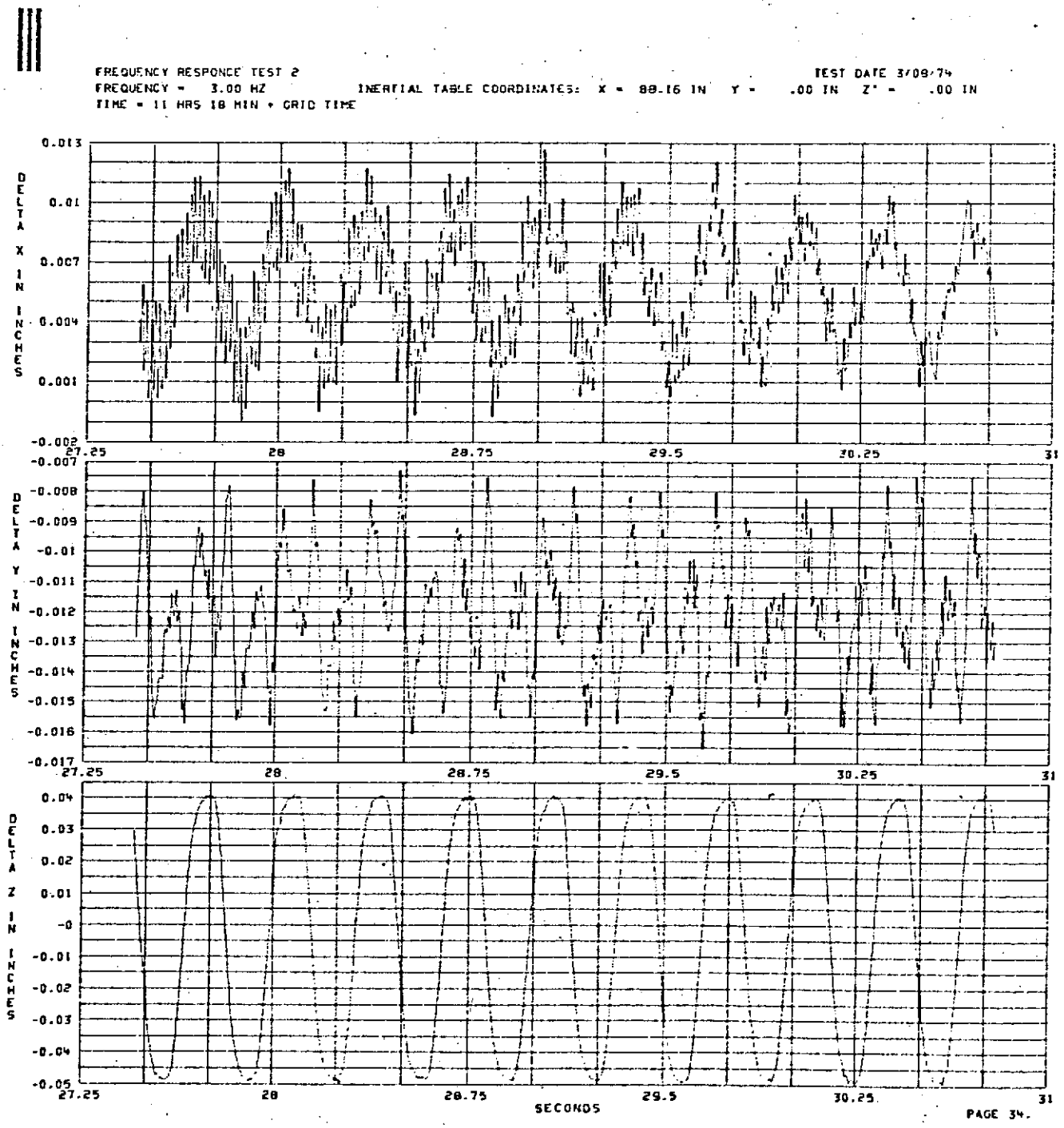

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
27.25
28
28.75
29.5
30.25
SECONDS

FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 3.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME

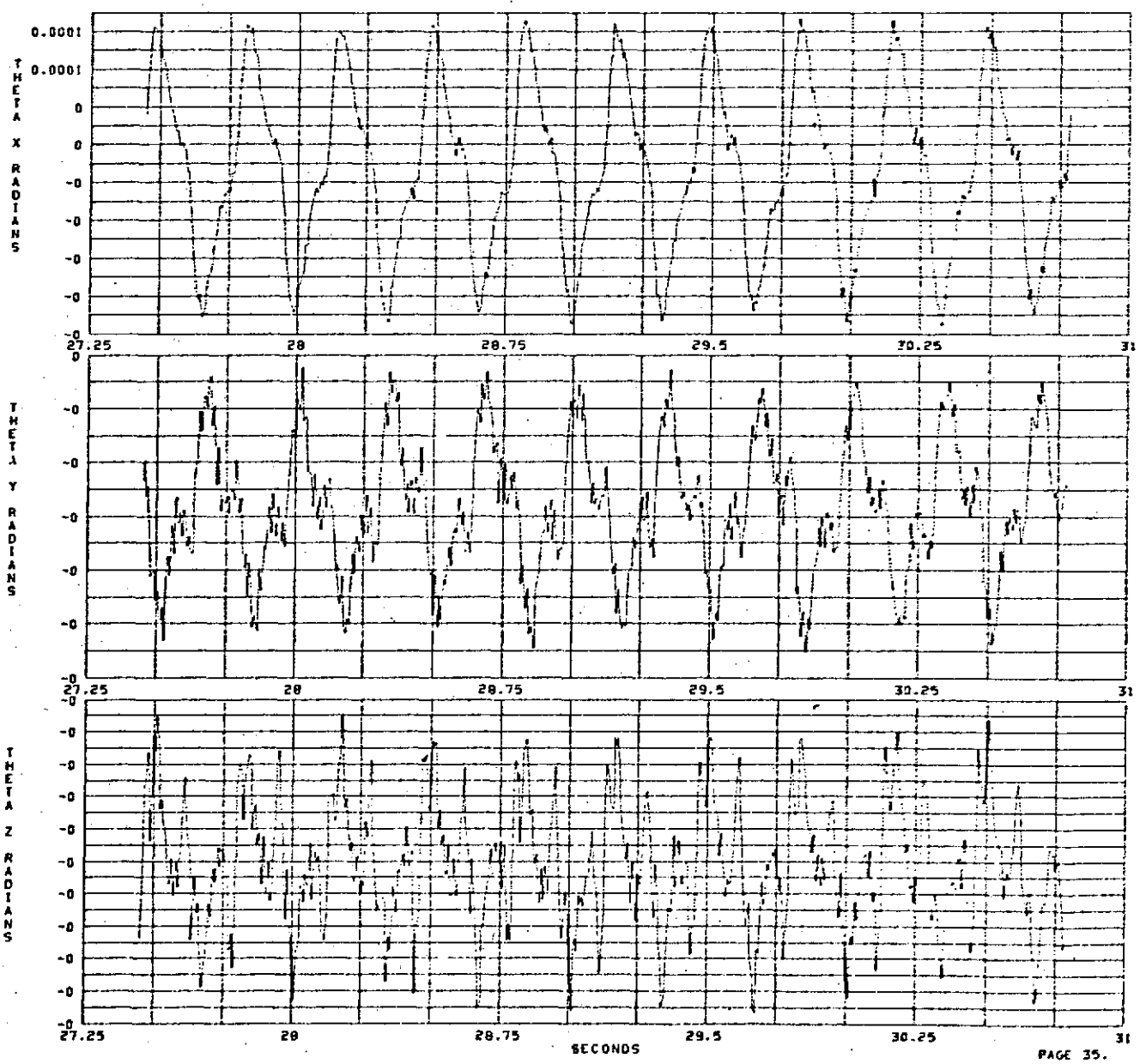


PAGE 32.

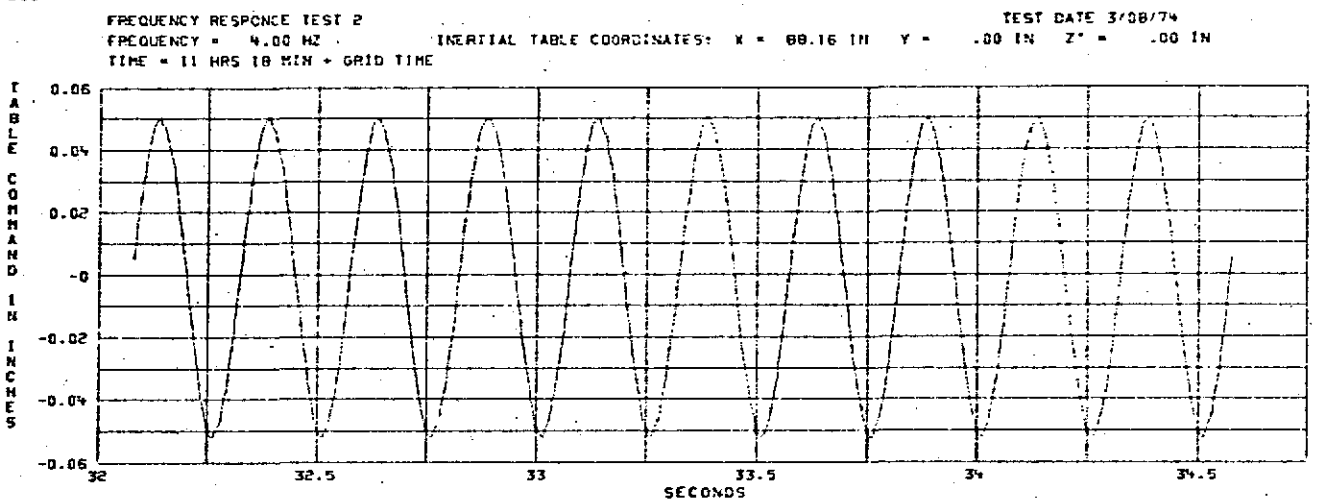

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
L4 IN INCHES
167.65
167.65
167.64
167.64
167.63
167.63
167.62
167.62
167.61
167.61
L5 IN INCHES
168.19
168.18
168.18
168.17
168.17
168.16
L6 IN INCHES
167.64
167.64
167.64
167.63
167.63
167.63
167.62
167.62
167.62
167.62
27.25
28
28.75
29.5
30.25
31
SECONDS
PAGE 33.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/09/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRIC TIME
DELTA X IN INCHES
0.013
0.01
0.007
0.004
0.001
-0.002
DELTA Y IN INCHES
-0.007
-0.008
-0.009
-0.01
-0.011
-0.012
-0.013
-0.014
-0.015
-0.016
-0.017
DELTA Z IN INCHES
0.04
0.03
0.02
0.01
-0
-0.01
-0.02
-0.03
-0.04
-0.05
27.25
28
28.75
29.5
30.25
31
SECONDS
PAGE 34.

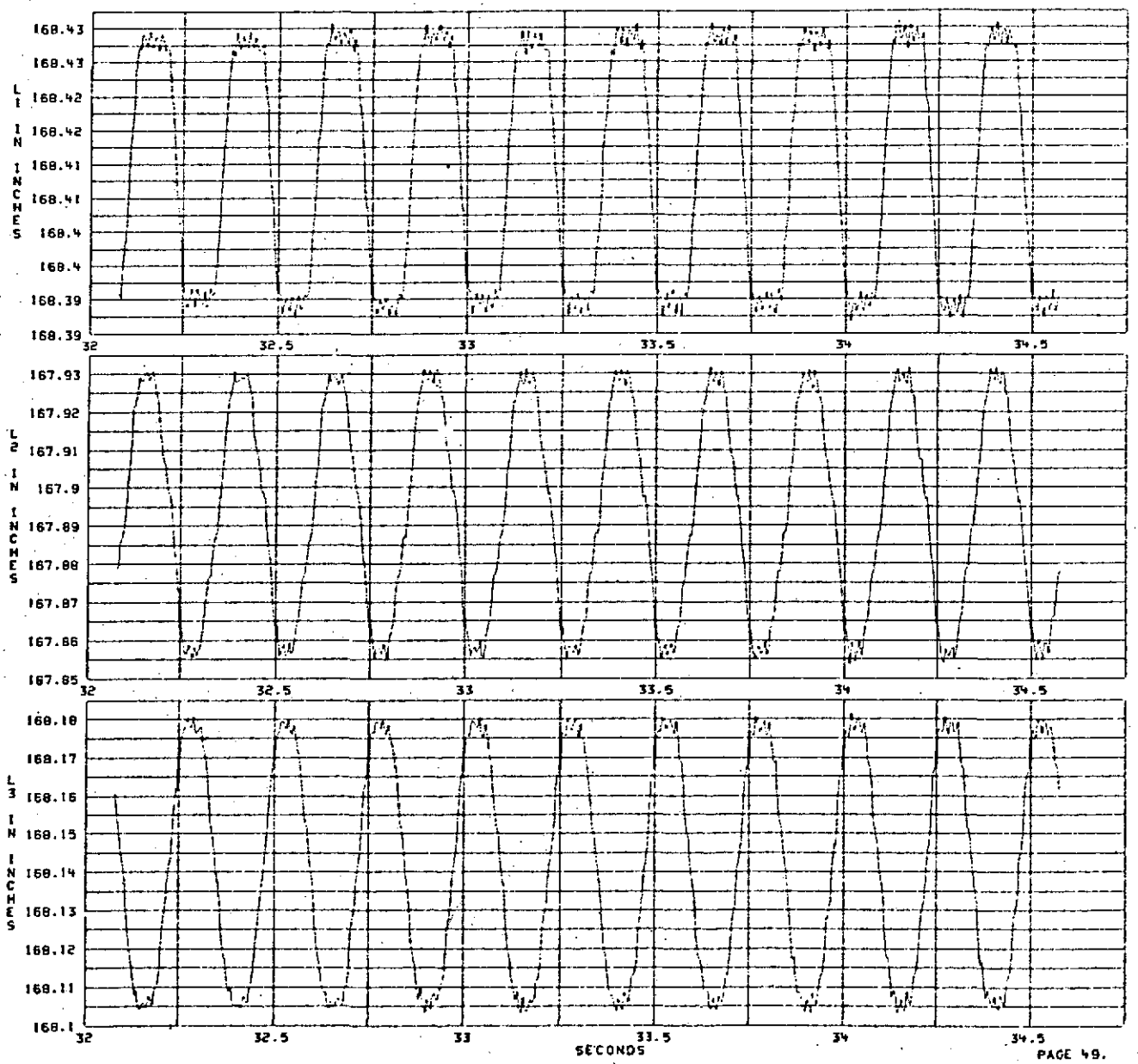
FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 3.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME



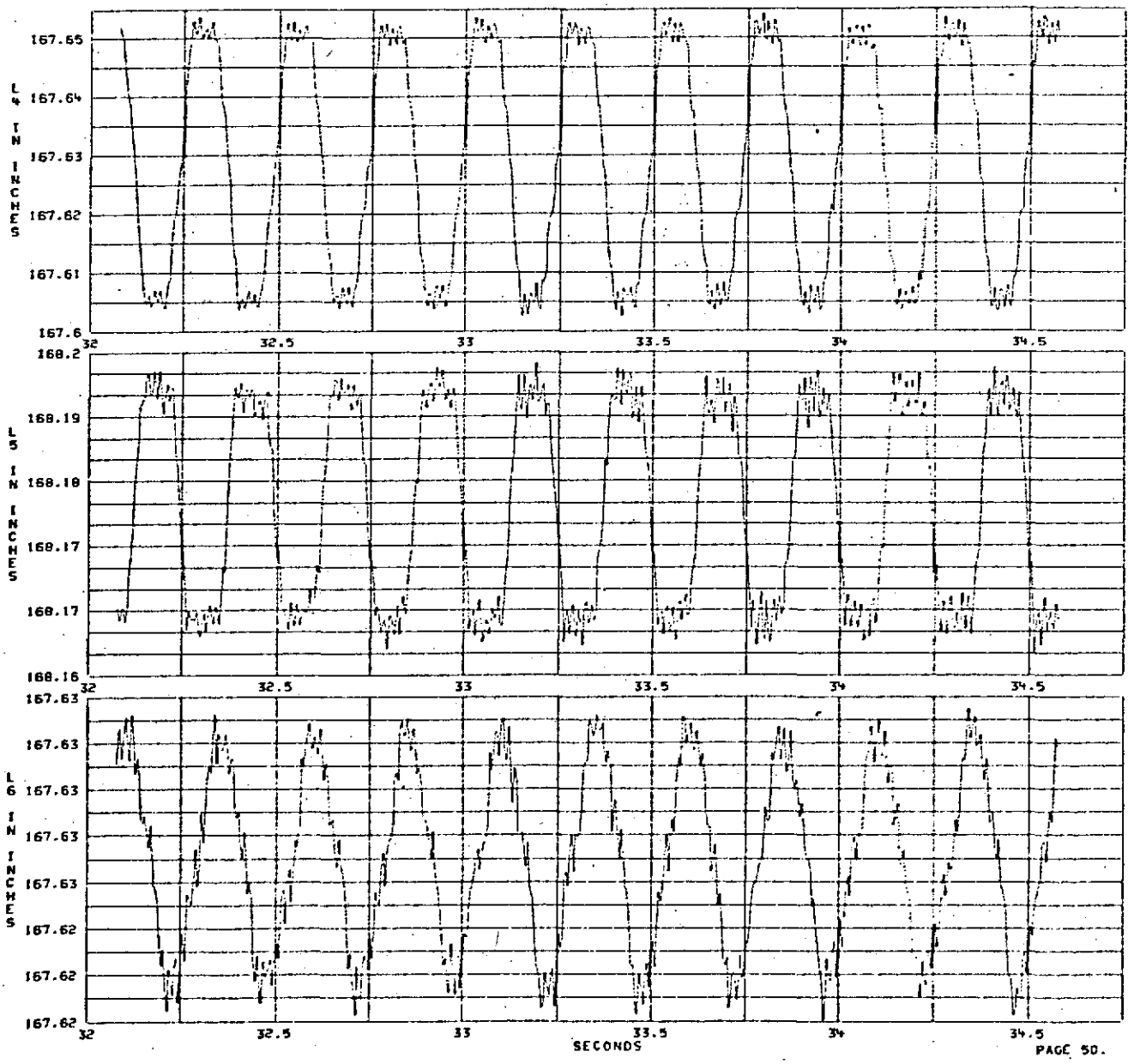
PAGE 35.

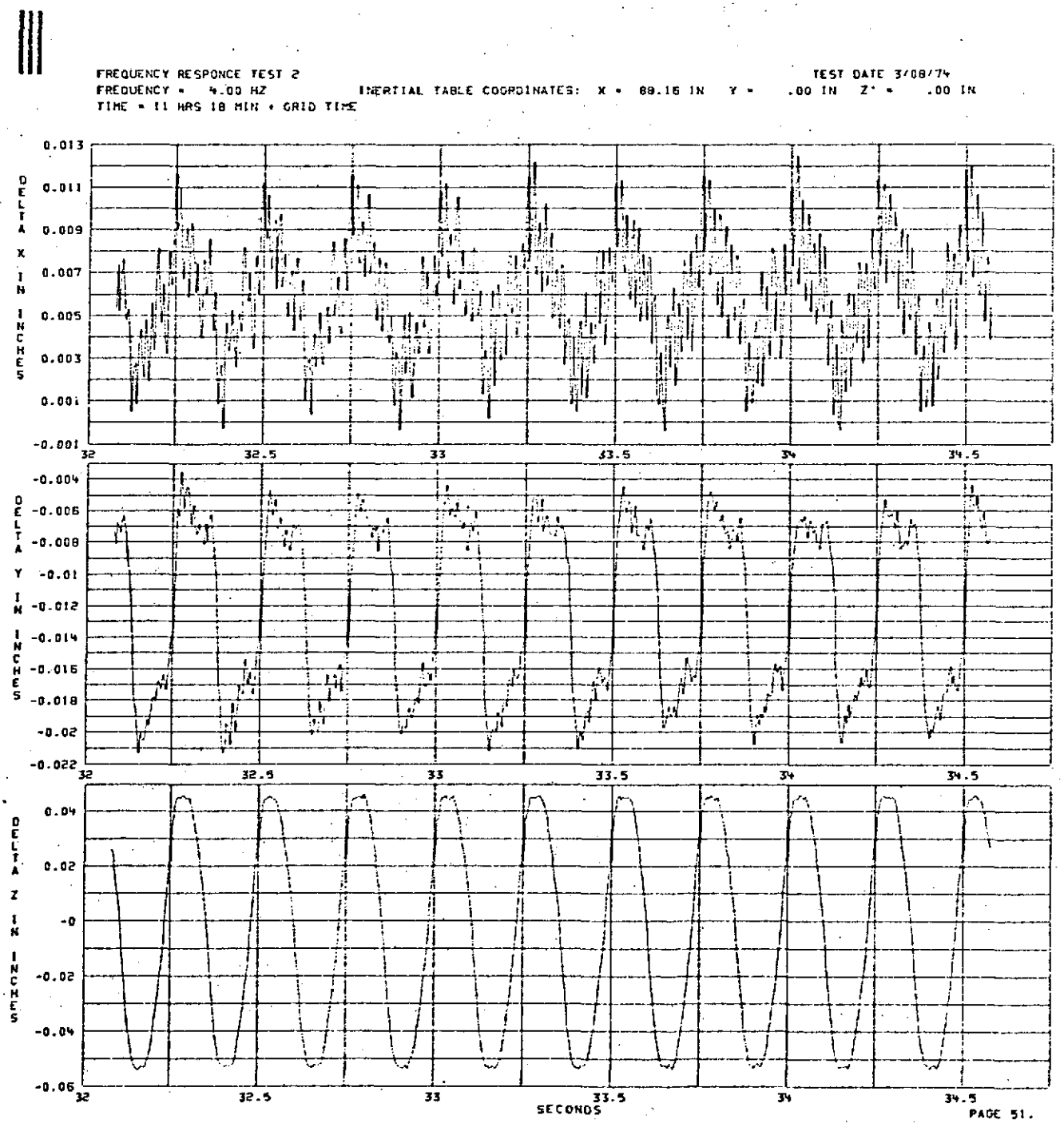

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
32
32.5
33
33.5
34
34.5
SECONDS

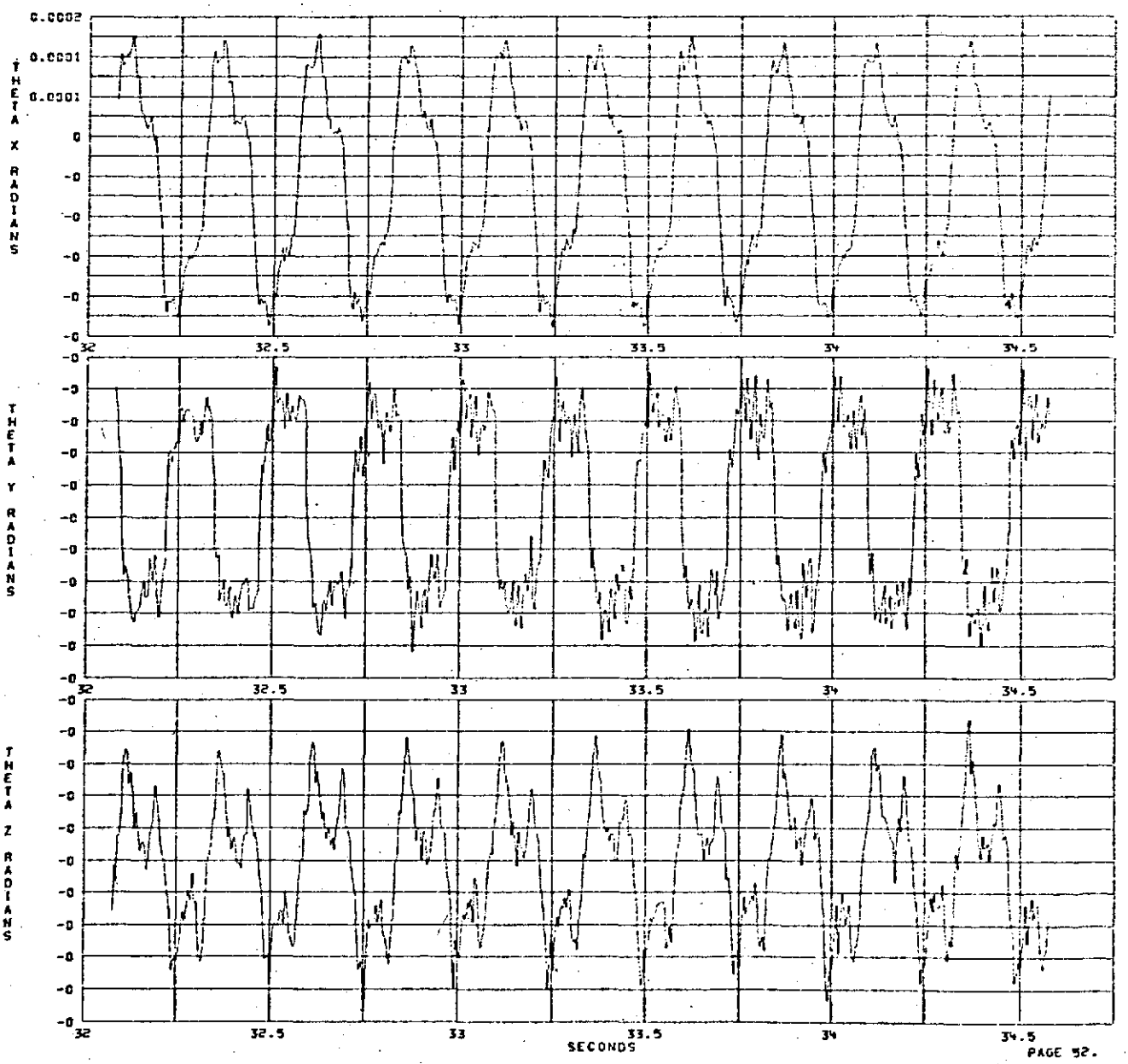
FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 4.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z' = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME

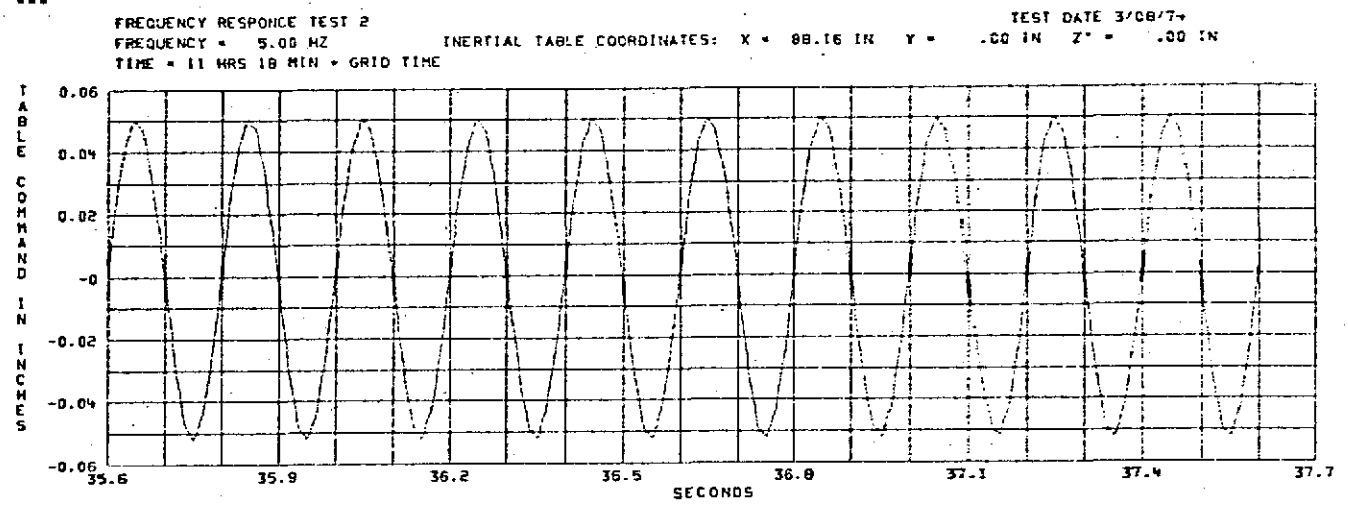


PAGE 49.

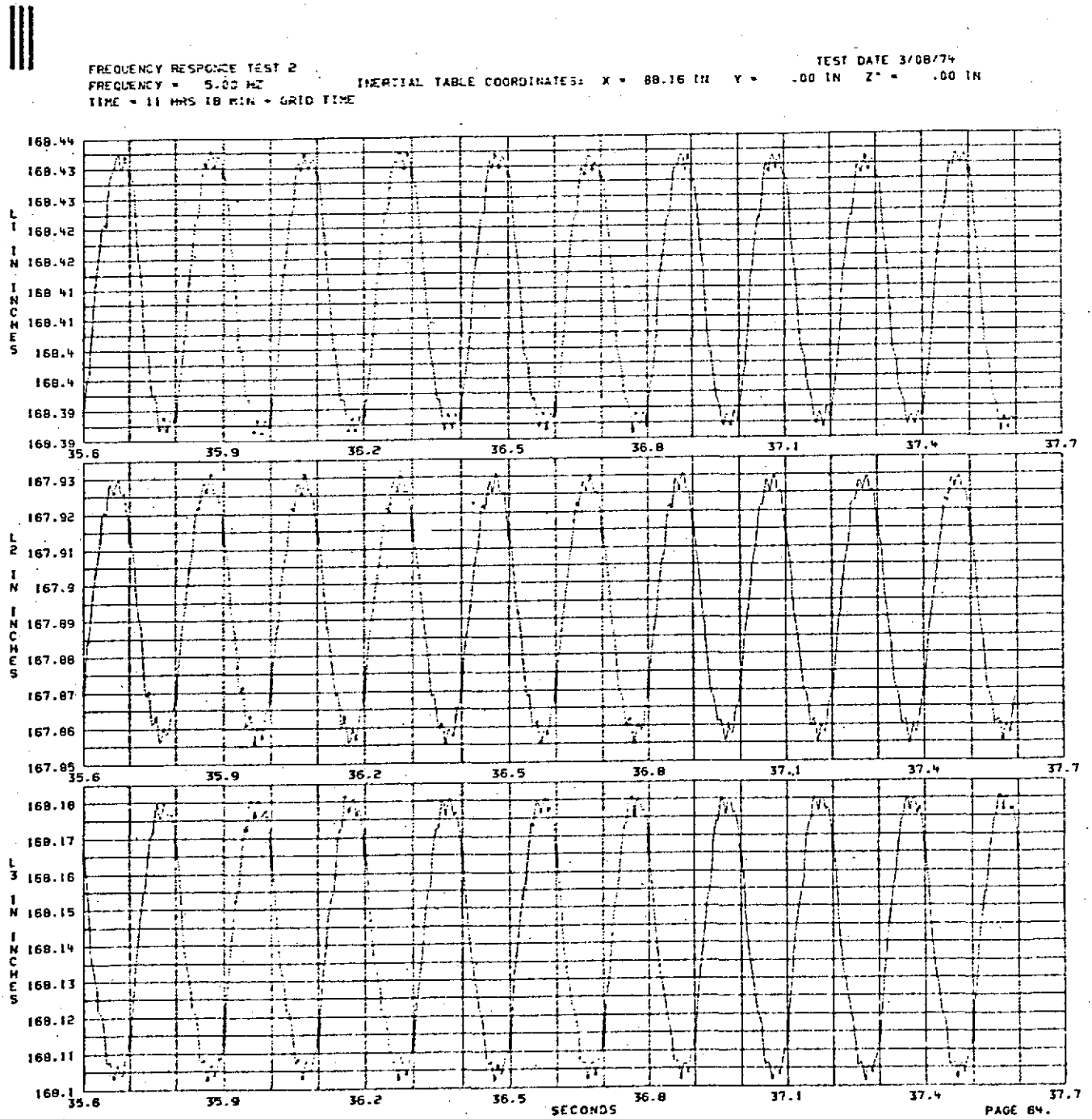

FREQUENCY RESPONCE TEST 2
FREQUENCY = 4.00 HZ
TIME = 11 HRS 18 MIN - GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
167.65
167.64
167.63
167.62
167.61
167.6
L5 IN INCHES
168.2
168.19
168.18
168.17
168.17
168.16
L6 IN INCHES
167.63
167.63
167.63
167.63
167.62
167.62
167.62
32
32.5
33
33.5
34
34.5
SECONDS
PAGE 50.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
DELTA X IN INCHES
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
DELTA Y IN INCHES
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
-0.02
-0.022
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
32
32.5
33
33.5
34
34.5
SECONDS
PAGE 51.

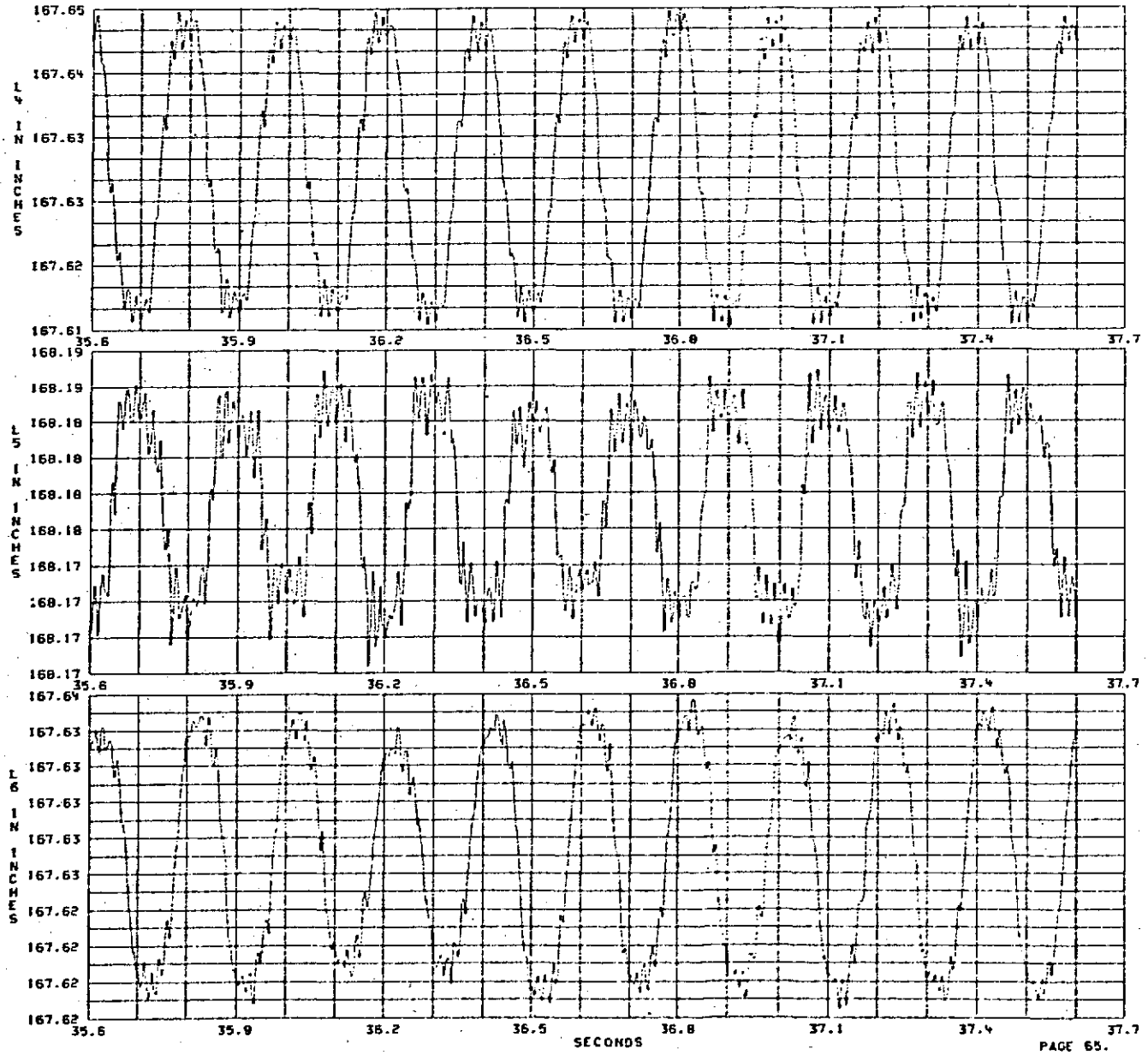

FREQUENCY RESPONCE TEST 2
TEST DATE 3/09/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0002
0.0001
0.0001
32
32.5
33
33.5
34
34.5
SECONDS
PAGE 52.


FREQUENCY RESPONCE TEST 2
FREQUENCY = 5.00 HZ
TIME = 11 HRS 18 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/7-
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
35.6
35.9
36.2
36.5
36.8
37.1
37.4
37.7
SECONDS

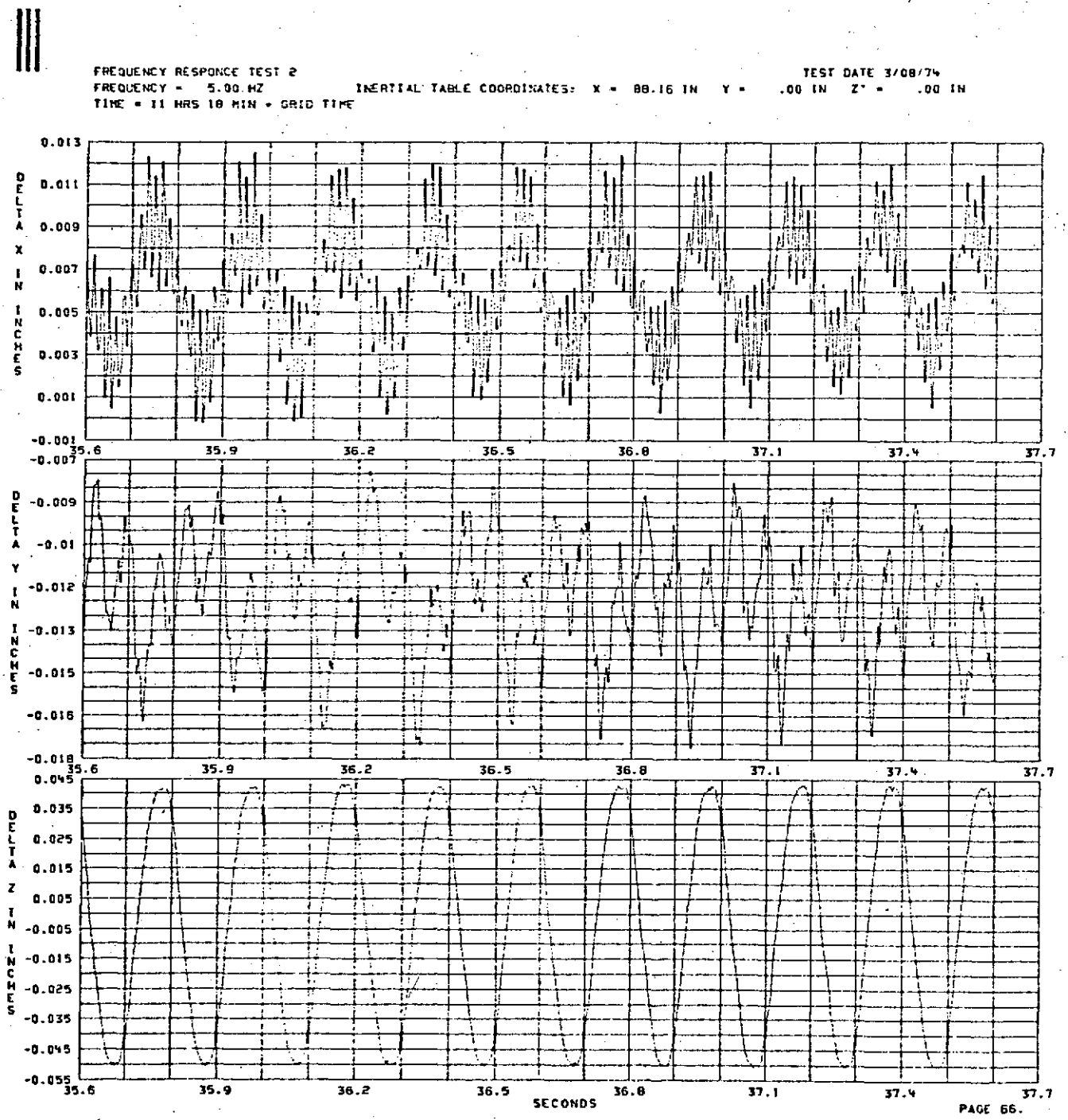
PAGE 63.

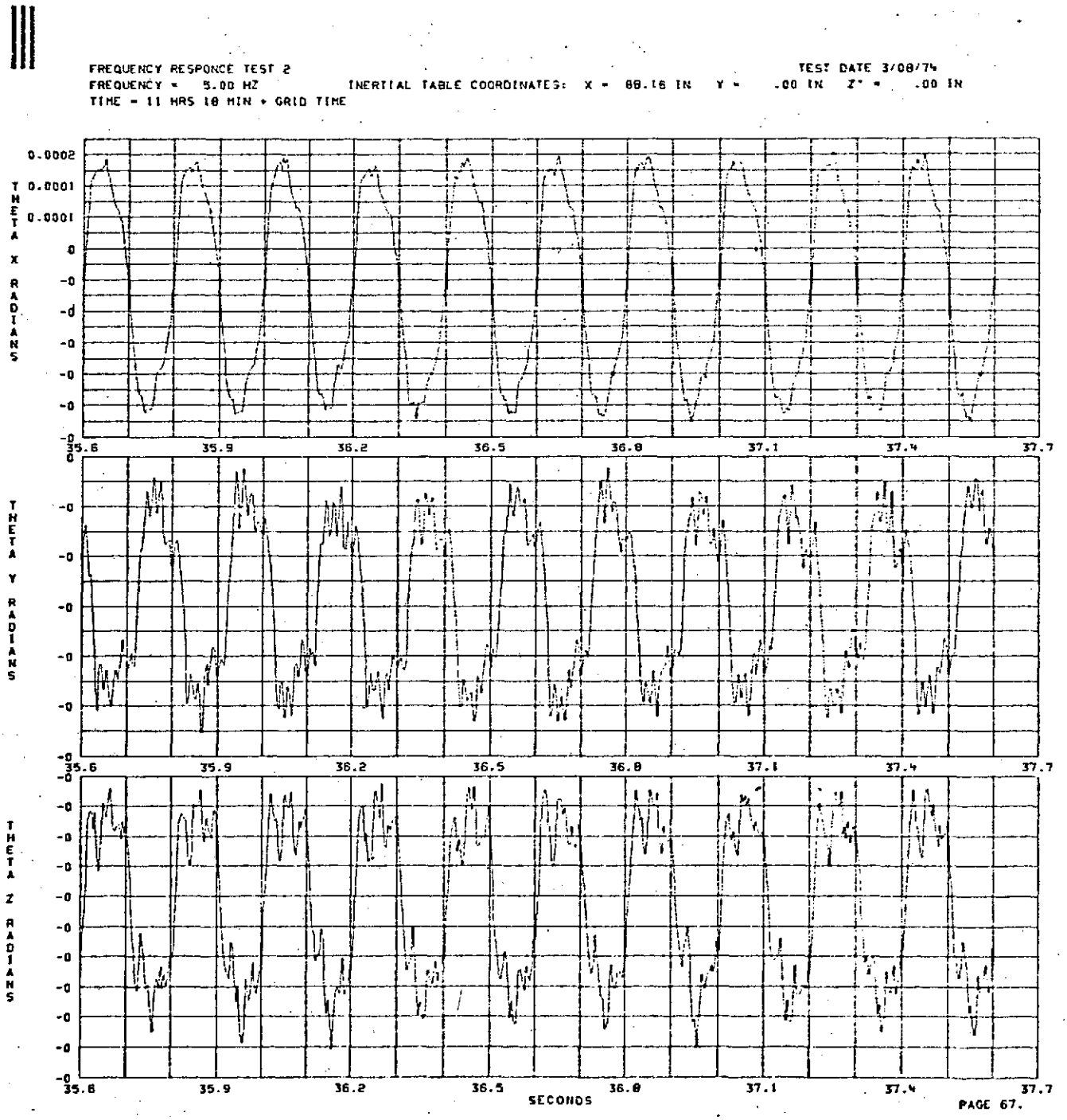

FREQUENCY RESPONSE TEST 2
FREQUENCY = 5.00 HZ
TIME = 11 HRS 18 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.44
168.43
168.43
168.42
168.42
168.41
168.4
168.4
168.39
169.39
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
169.18
169.17
169.16
169.15
169.14
169.13
169.12
169.11
169.1
35.6
35.9
36.2
36.5
36.8
37.1
37.4
37.7
SECONDS
PAGE 64.

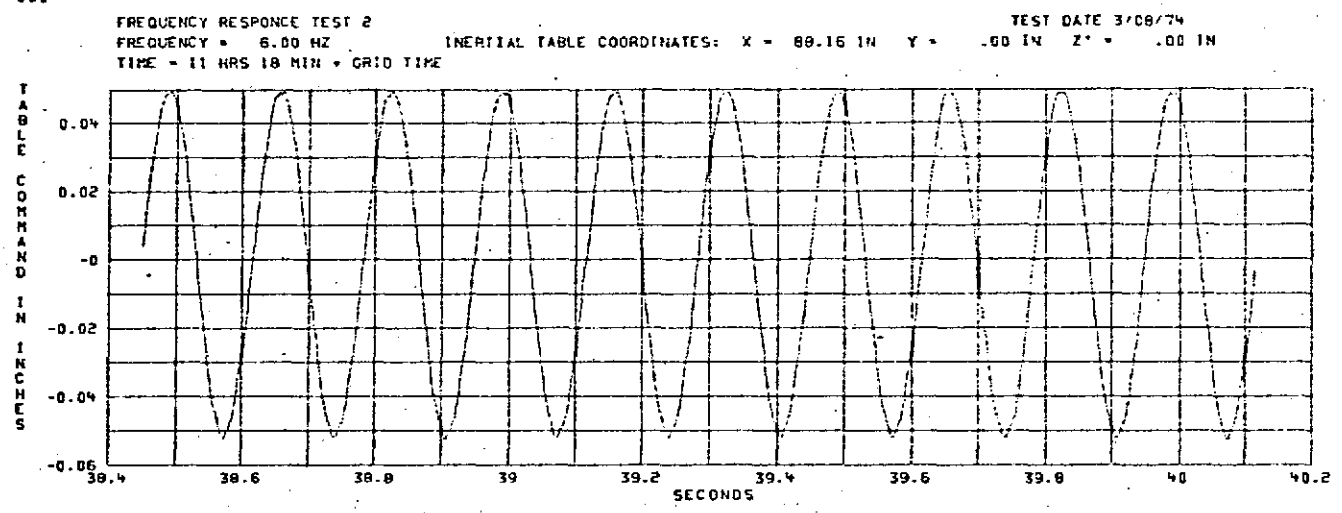
FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 5.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME



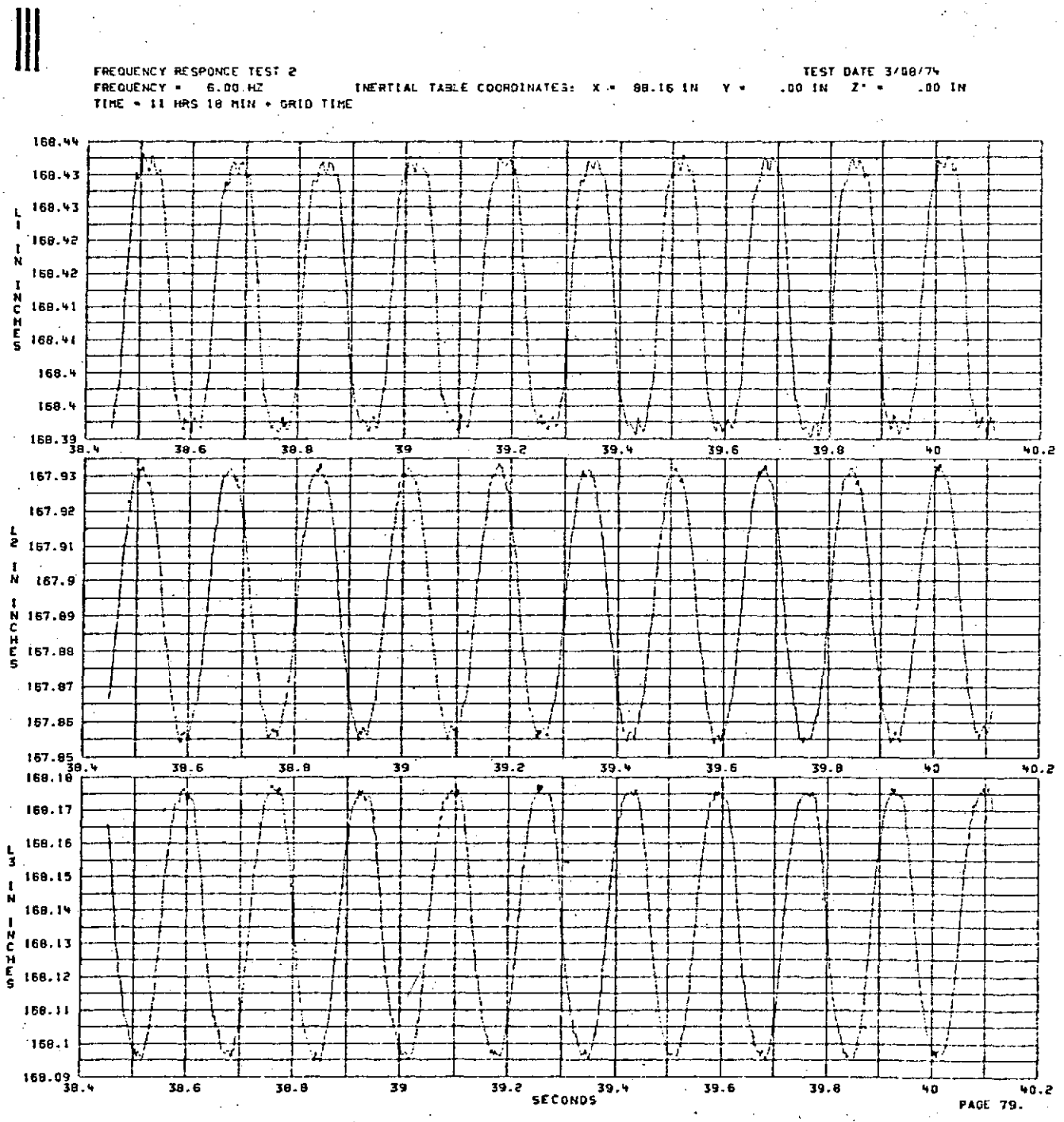
PAGE 65.

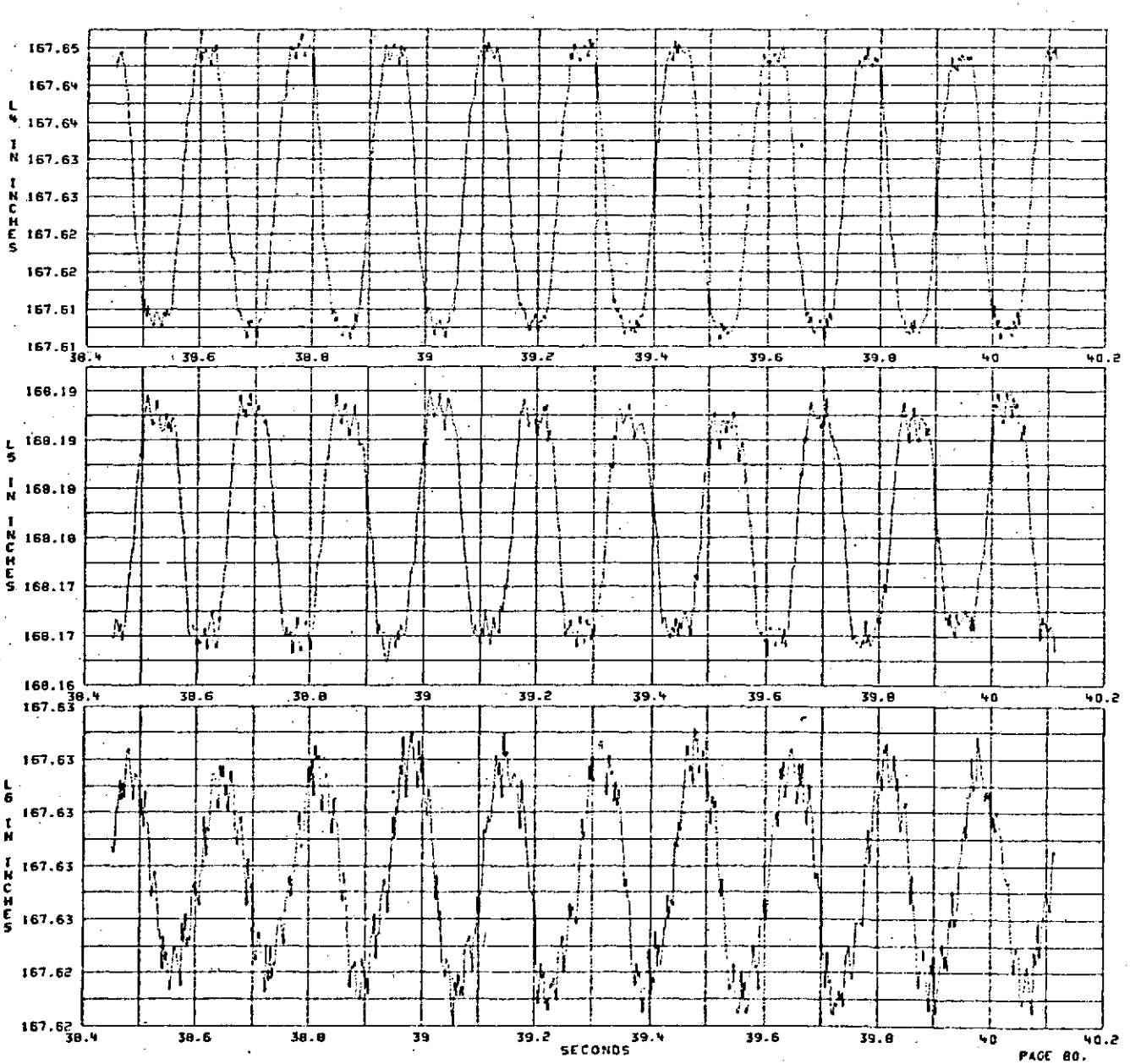

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 10 MIN - GRID TIME
DELTA X IN INCHES
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
DELTA Y IN INCHES
-0.007
-0.009
-0.01
-0.012
-0.013
-0.015
-0.016
-0.018
DELTA Z IN INCHES
0.045
0.035
0.025
0.015
0.005
-0.005
-0.015
-0.025
-0.035
-0.045
-0.055
35.6
35.9
36.2
36.5
36.8
37.1
37.4
37.7
SECONDS
PAGE 66.

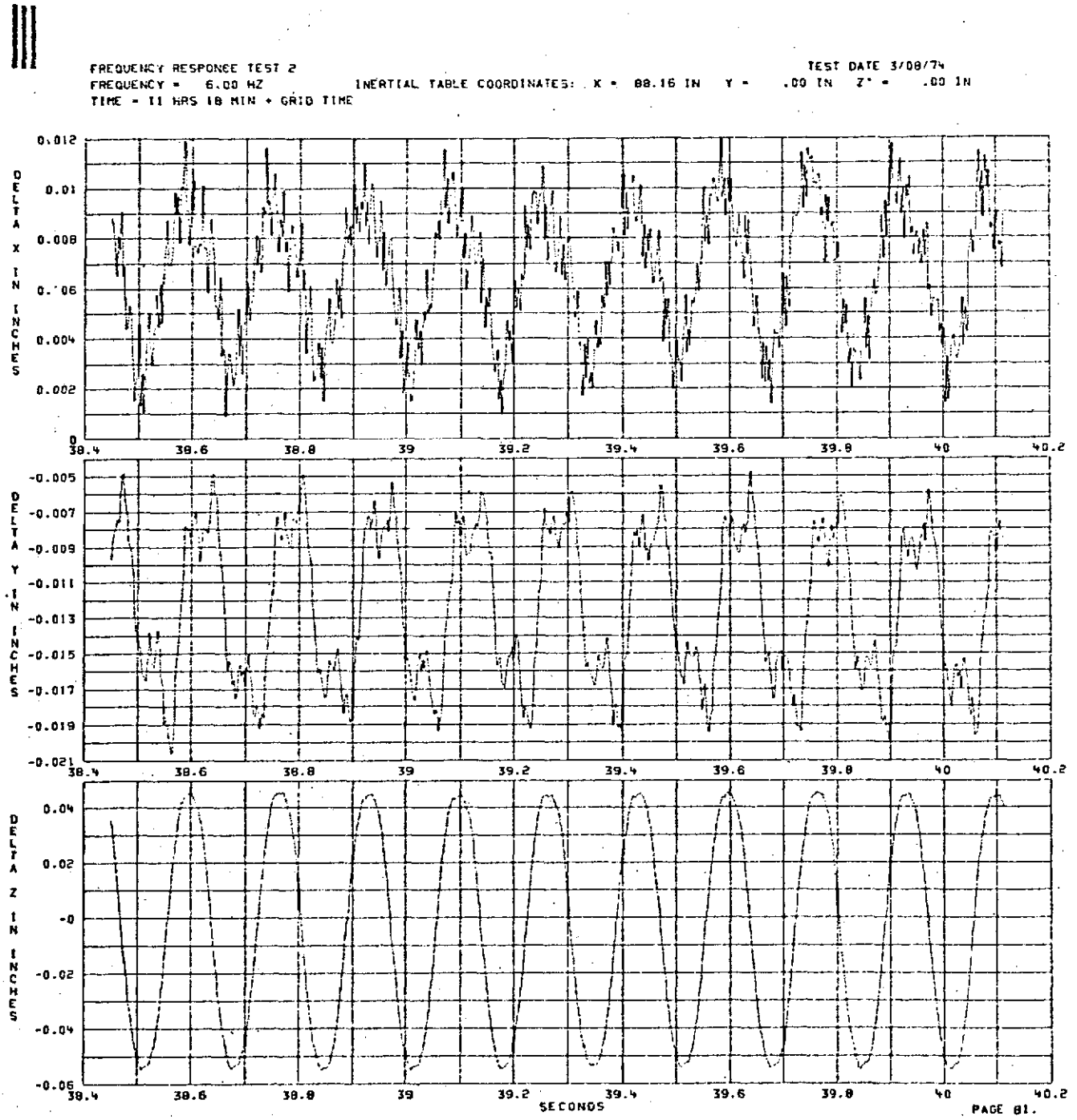

FREQUENCY RESPONCE TEST 2
FREQUENCY = 5.00 HZ
TIME = 11 HRS 10 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 80.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0002
0.0001
0.0001
35.6
35.9
36.2
36.5
36.8
37.1
37.4
37.7
SECONDS
PAGE 67.

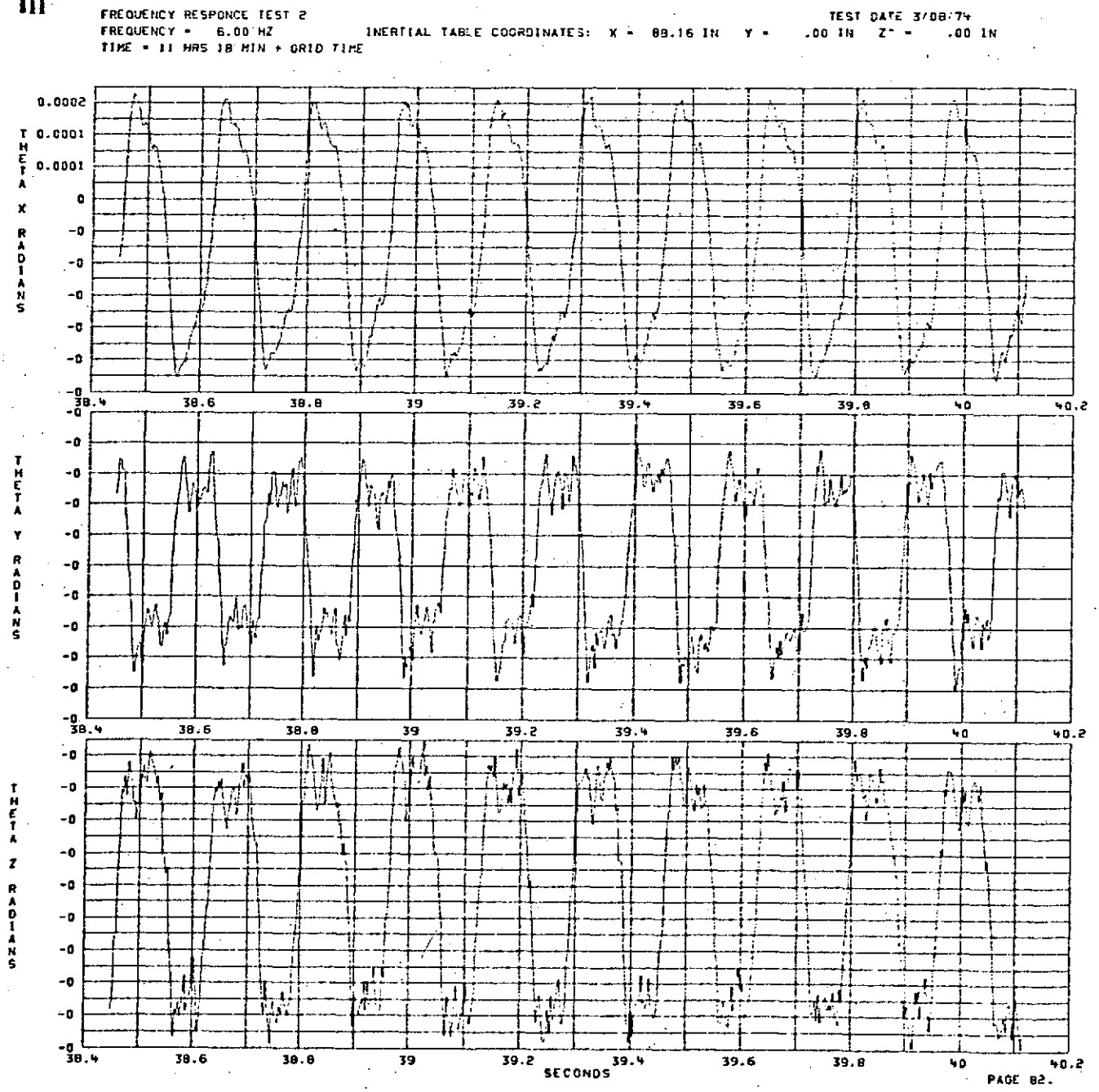

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 80.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
38.4
38.6
38.8
39
39.2
39.4
39.6
39.8
40
40.2
SECONDS

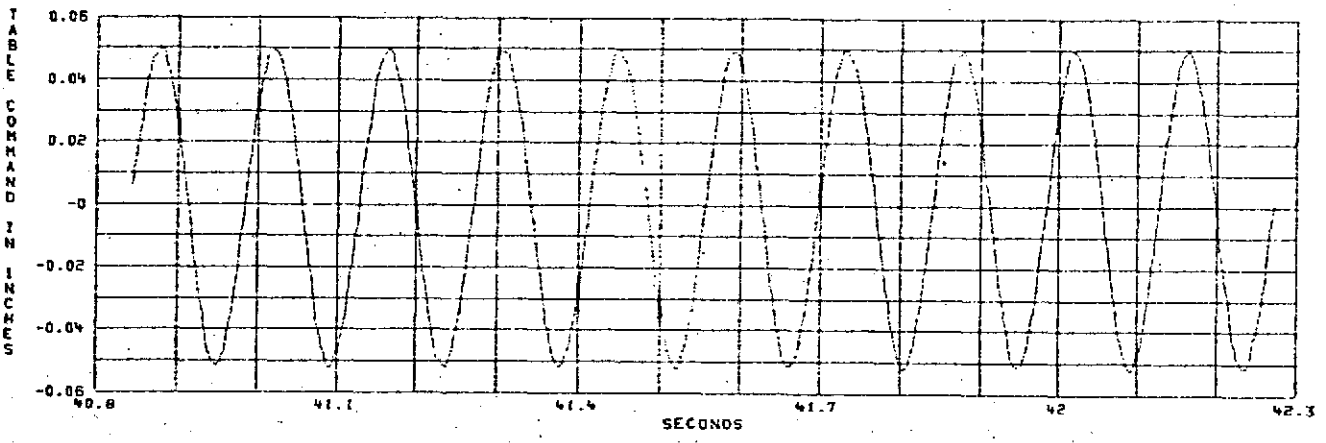
PAGE 78.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
L1 IN INCHES
168.44
168.43
168.43
168.42
168.42
168.41
168.41
168.4
168.4
168.39
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.18
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
168.09
38.4
38.6
38.8
39
39.2
39.4
39.6
39.8
40
40.2
SECONDS
PAGE 79.

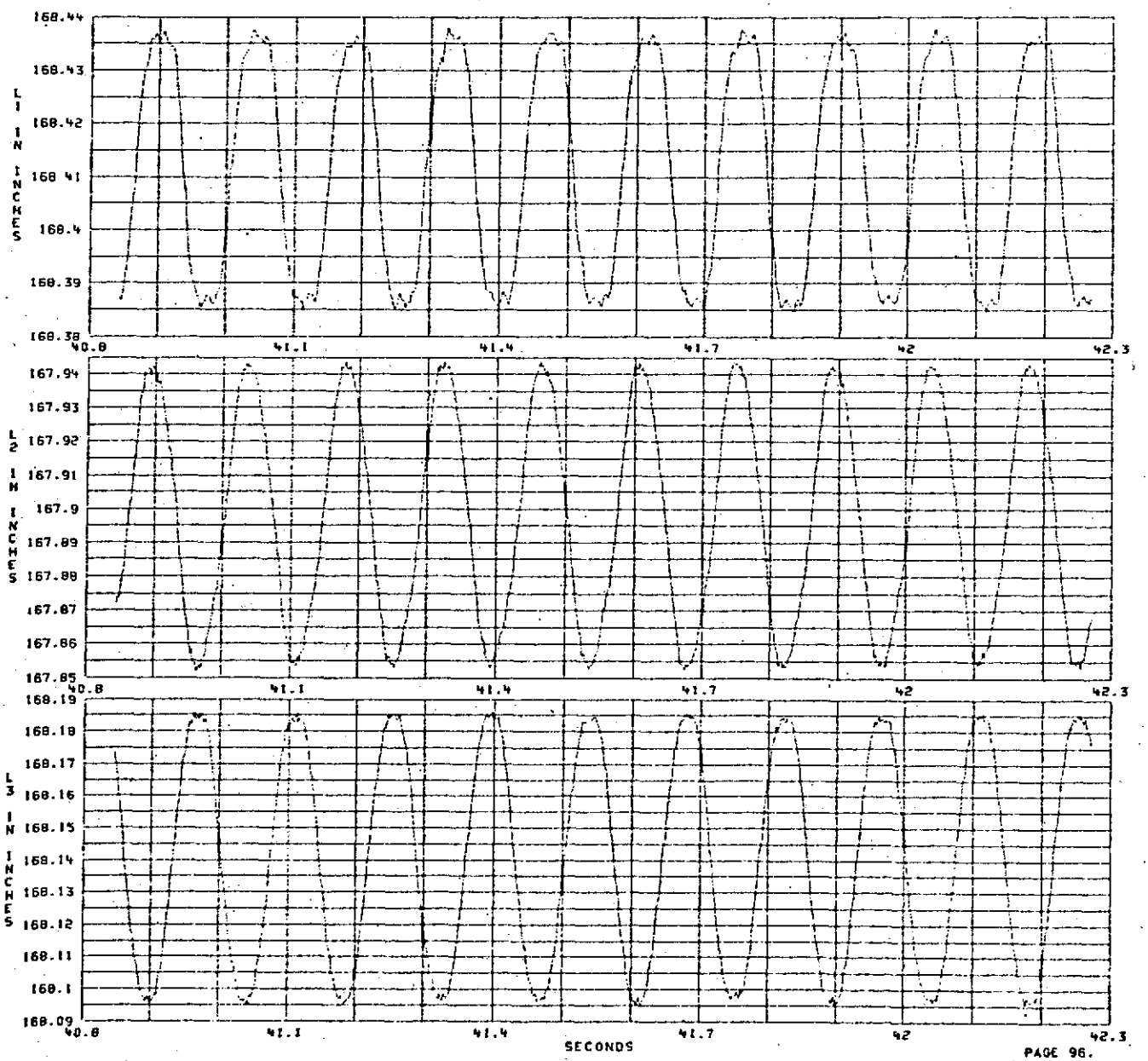

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
L4 IN INCHES
167.65
167.64
167.64
167.63
167.63
167.62
167.62
167.61
167.61
L5 IN INCHES
168.19
168.19
168.18
168.18
168.17
168.17
168.16
L6 IN INCHES
167.63
167.63
167.63
167.63
167.62
167.62
38.4
38.6
38.8
39
39.2
39.4
39.6
39.8
40
40.2
SECONDS
PAGE 80.


FREQUENCY RESPONSE TEST 2
FREQUENCY = 6.00 HZ
TIME = 11 HRS 18 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
0.012
0.01
0.008
0.006
0.004
0.002
0
DELTA Y IN INCHES
-0.005
-0.007
-0.009
-0.011
-0.013
-0.015
-0.017
-0.019
-0.021
DELTA Z IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
38.4
38.6
38.8
39
39.2
39.4
39.6
39.8
40
40.2
SECONDS
PAGE 81.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0002
0.0001
0.0001
0
-0
38.4
38.6
38.8
39
39.2
39.4
39.6
39.8
40
40.2
SECONDS
PAGE 82.

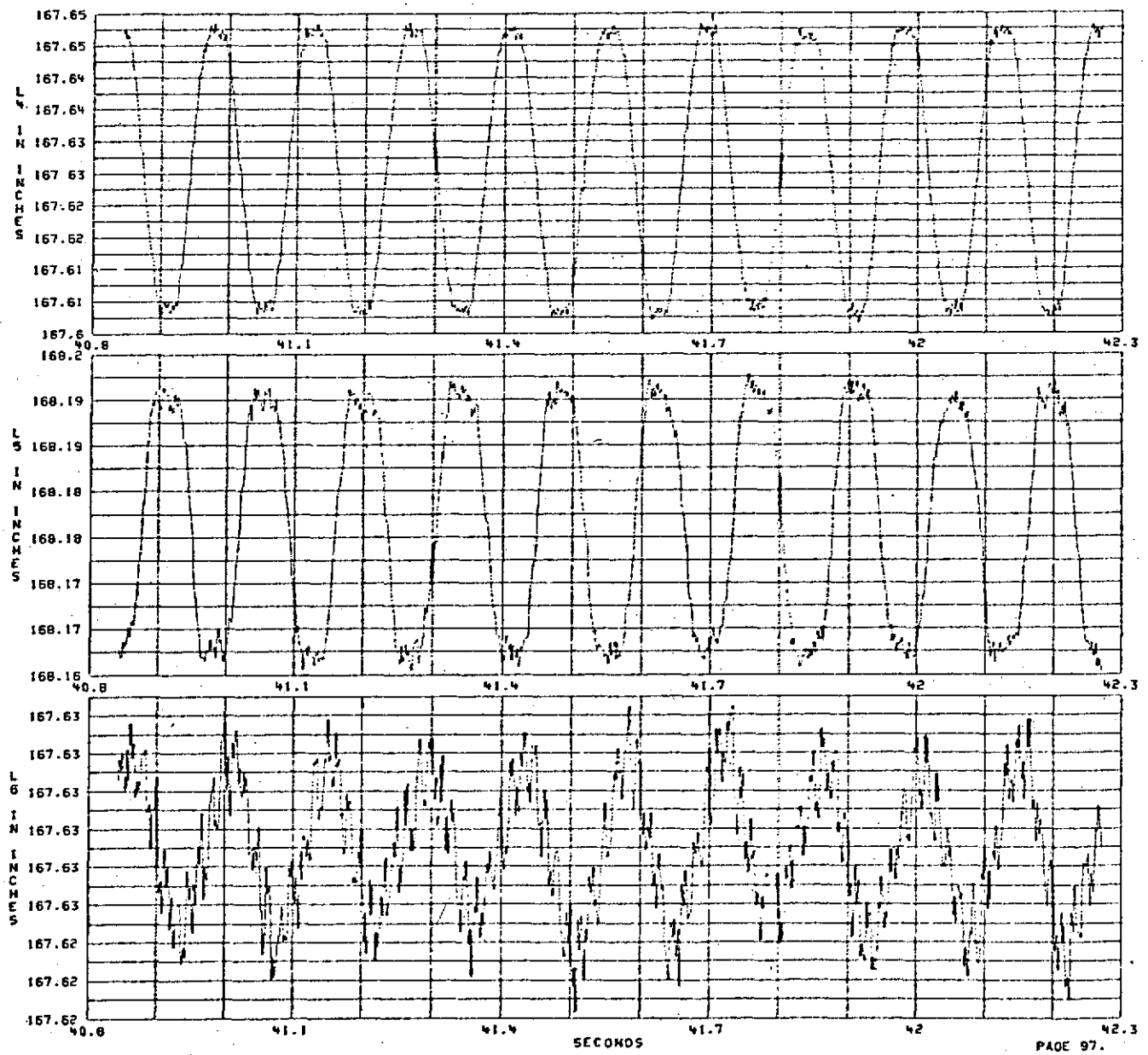

FREQUENCY RESPONCE TEST.2
FREQUENCY = 7.00 HZ
TIME = 11 HRS 18 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
40.8
41.1
41.4
41.7
42
42.3
SECONDS

FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 7.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME

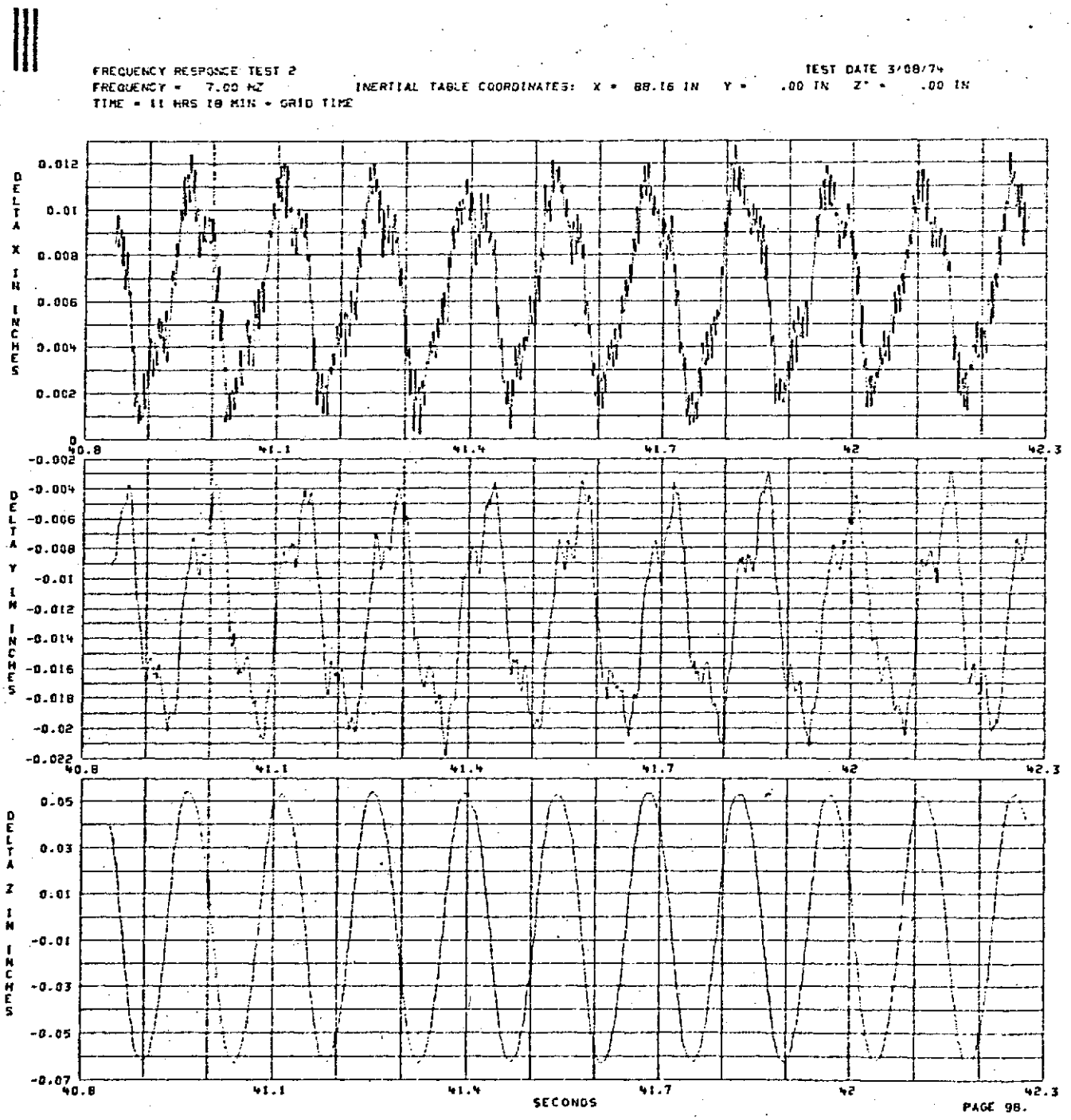


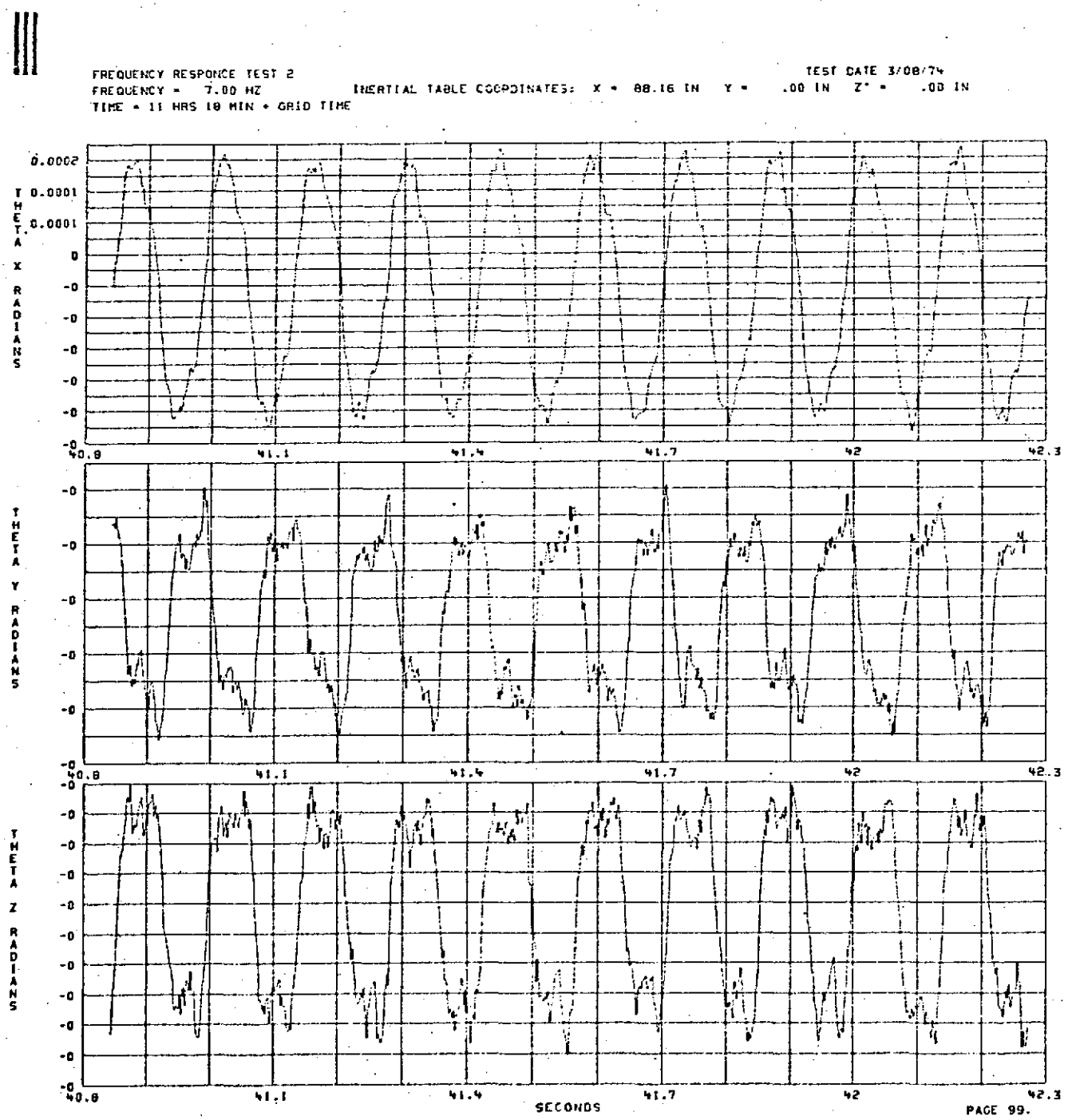
PAGE 96.

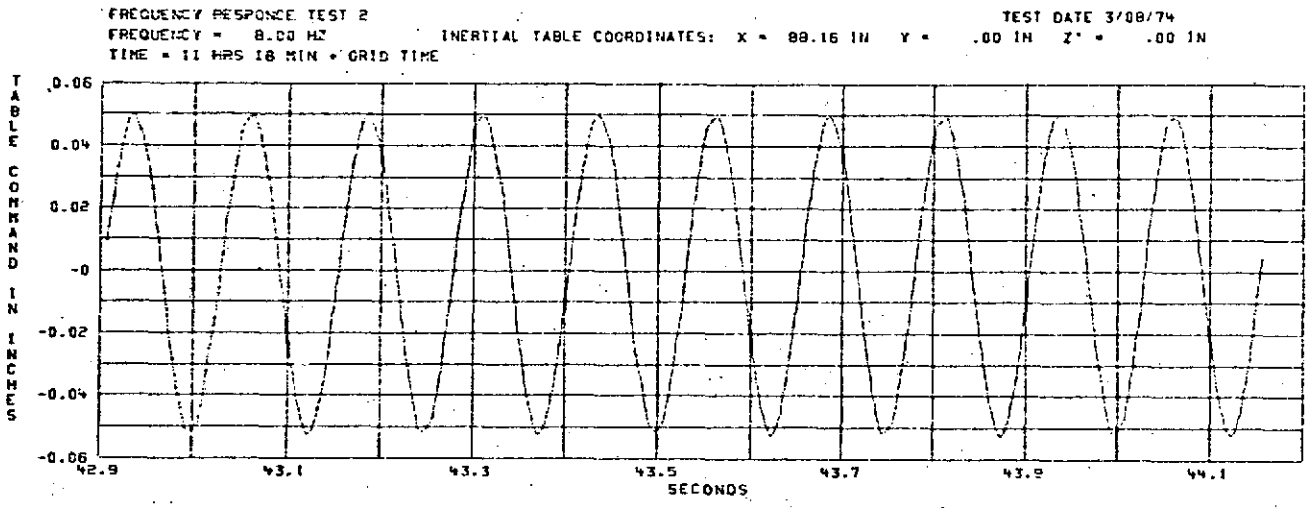
FREQUENCY RESPONCE TEST 2 TEST DATE 3/08/74
FREQUENCY = 7.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME



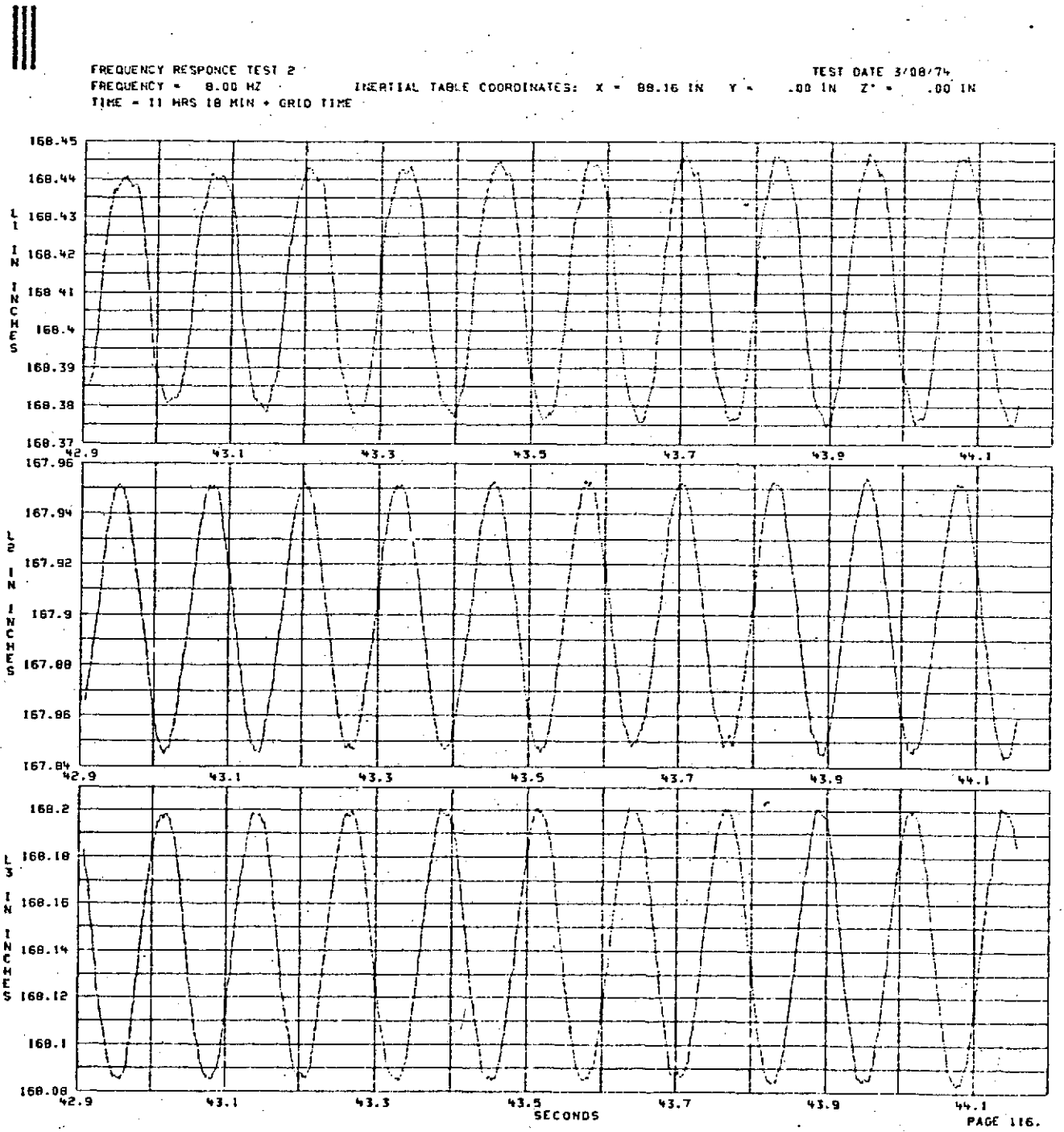
PAGE 97.

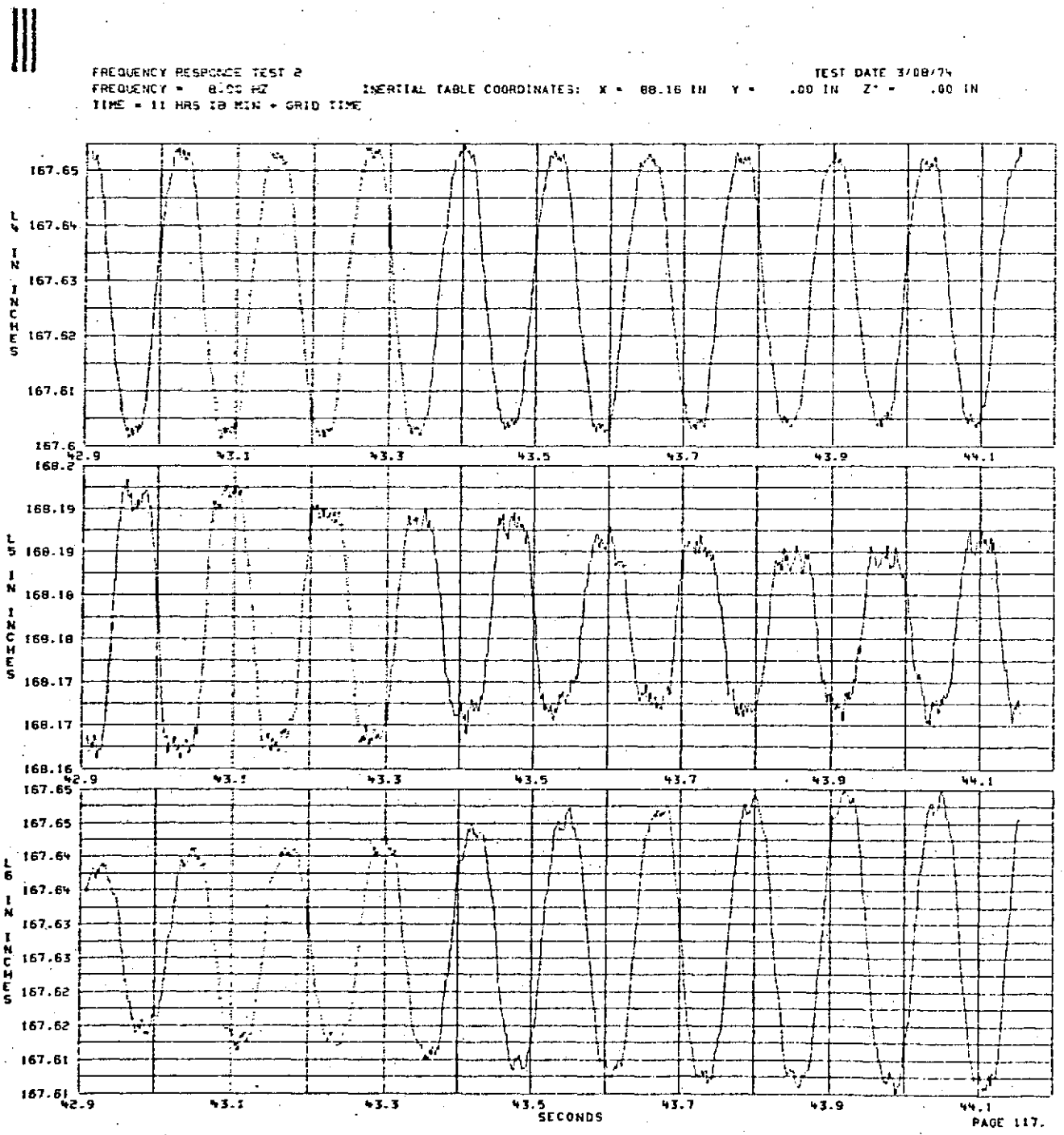

FREQUENCY RESPONSE TEST 2
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
DELTA X IN INCHES
0.012
0.01
0.008
0.006
0.004
0.002
0
40.8
41.1
41.4
41.7
42
42.3
DELTA Y IN INCHES
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
-0.02
-0.022
DELTA Z IN INCHES
0.05
0.03
0.01
-0.01
-0.03
-0.05
-0.07
SECONDS
PAGE 98.


FREQUENCY RESPONCE TEST 2
FREQUENCY = 7.00 HZ
TIME = 11 HRS 10 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0002
0.0001
0.0001
0
-0
40.8
41.1
41.4
41.7
42
42.3
SECONDS
PAGE 99.

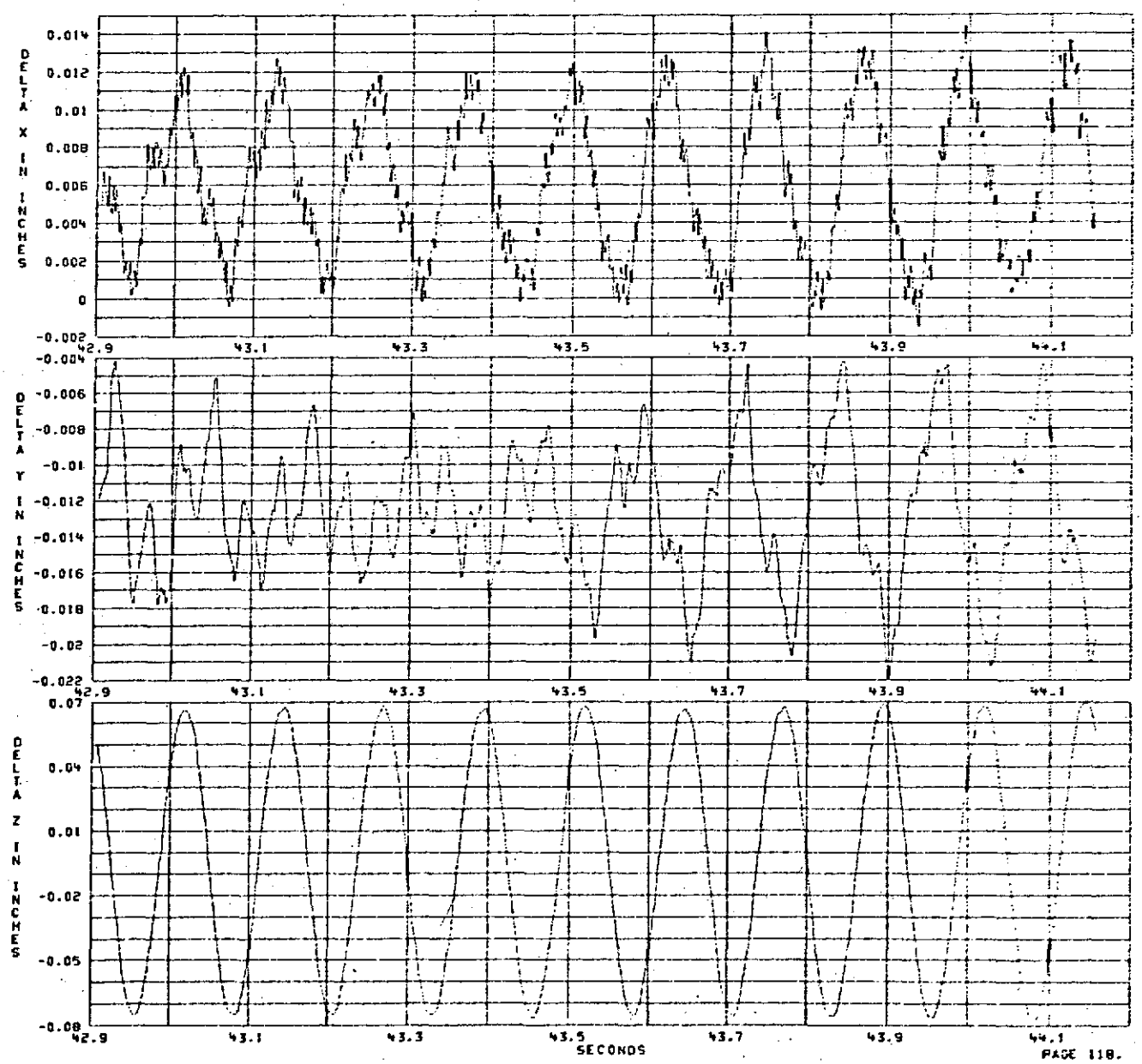

FREQUENCY RESPONCE TEST 2
TEST DATE 3/08/74
FREQUENCY = 8.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
42.9
43.1
43.3
43.5
43.7
43.9
44.1
SECONDS

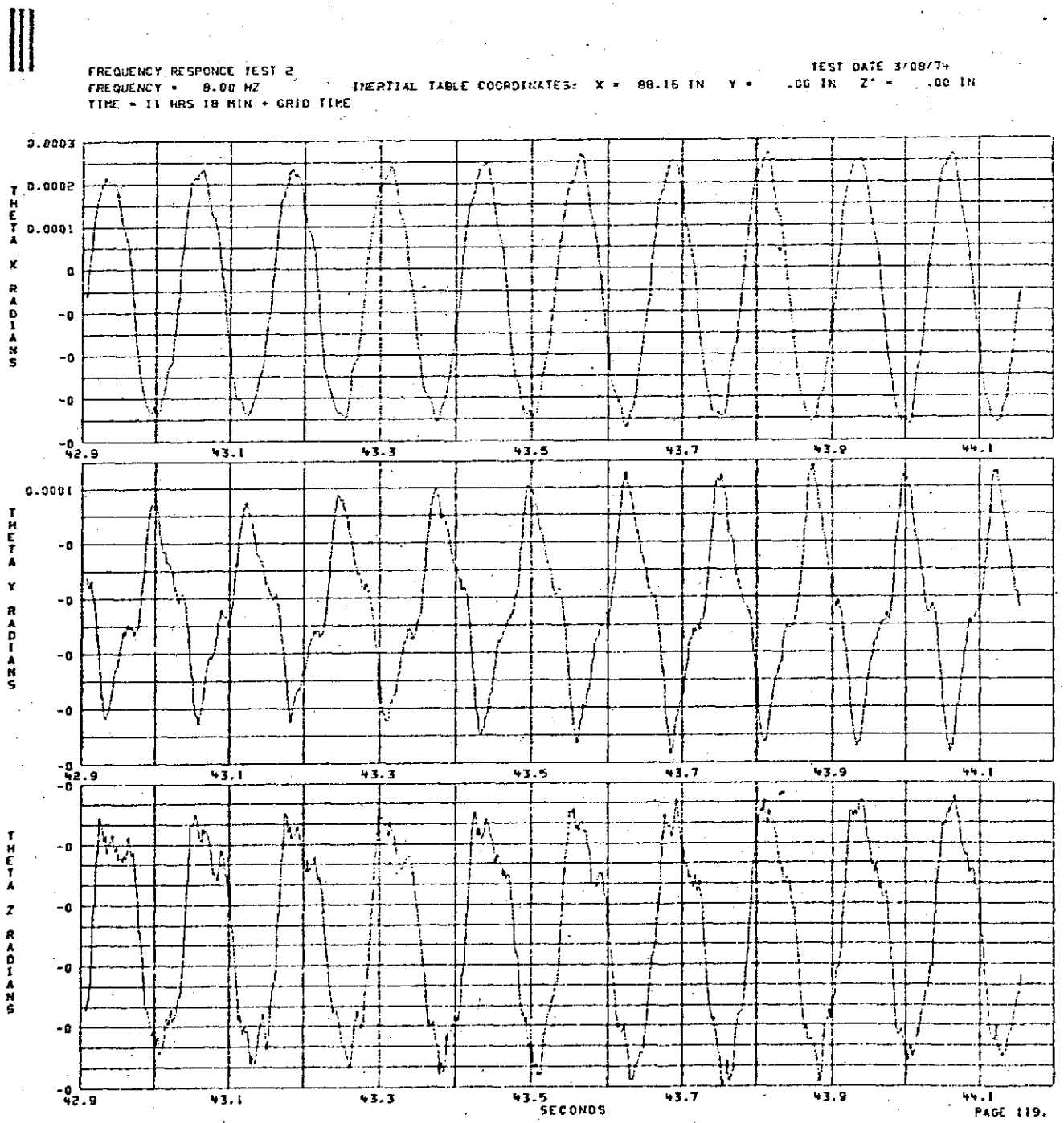
PAGE 115.


FREQUENCY RESPONCE TEST 2
FREQUENCY = 8.00 HZ
TIME = 11 HRS 18 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.45
168.44
168.43
168.42
168.41
168.4
168.39
168.38
168.37
L2 IN INCHES
167.96
167.94
167.92
167.9
167.88
167.86
167.84
L3 IN INCHES
168.2
168.18
168.16
168.14
168.12
168.1
168.08
42.9
43.1
43.3
43.5
43.7
43.9
44.1
SECONDS
PAGE 116.


FREQUENCY RESPONSE TEST 2
TEST DATE 3/08/74
FREQUENCY = 8.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
L4 IN INCHES
167.65
167.64
167.63
167.62
167.61
167.6
L5 IN INCHES
168.2
168.19
168.19
168.18
168.18
168.17
168.17
168.16
L6 IN INCHES
167.65
167.65
167.64
167.64
167.63
167.63
167.62
167.62
167.61
167.61
42.9
43.1
43.3
43.5
43.7
43.9
44.1
SECONDS

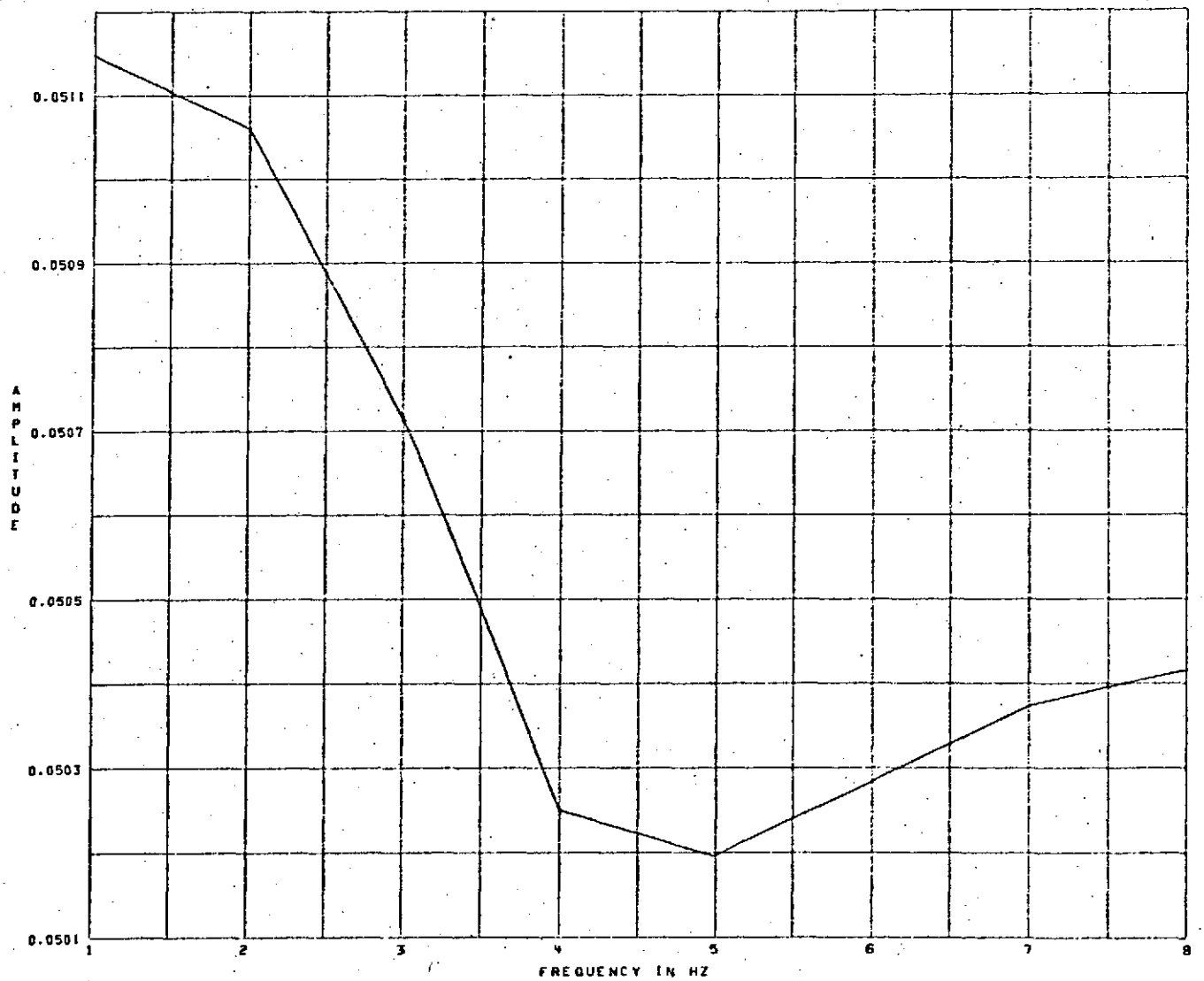
PAGE 117.


FREQUENCY RESPONCE TEST 2
TEST DATE 3/09/74
FREQUENCY = 8.00 HZ
INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 18 MIN = GRID TIME
DELTA X IN INCHES
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
DELTA Y IN INCHES
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
-0.02
-0.022
DELTA Z IN INCHES
0.07
0.04
0.01
-0.02
-0.05
-0.08
42.9
43.1
43.3
43.5
43.7
43.9
44.1
SECONDS
PAGE 118.


FREQUENCY RESPONCE TEST 2
FREQUENCY = 8.00 HZ
TIME = 11 HRS 18 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0003
0.0002
0.0001
0
-0
42.9
43.1
43.3
43.5
43.7
43.9
44.1
SECONDS
PAGE 119.

FREQUENCY RESPONSE TEST 2
REFERENCE SENSOR - TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 0.00 HZ WAS .100 HZ TO .800 HZ

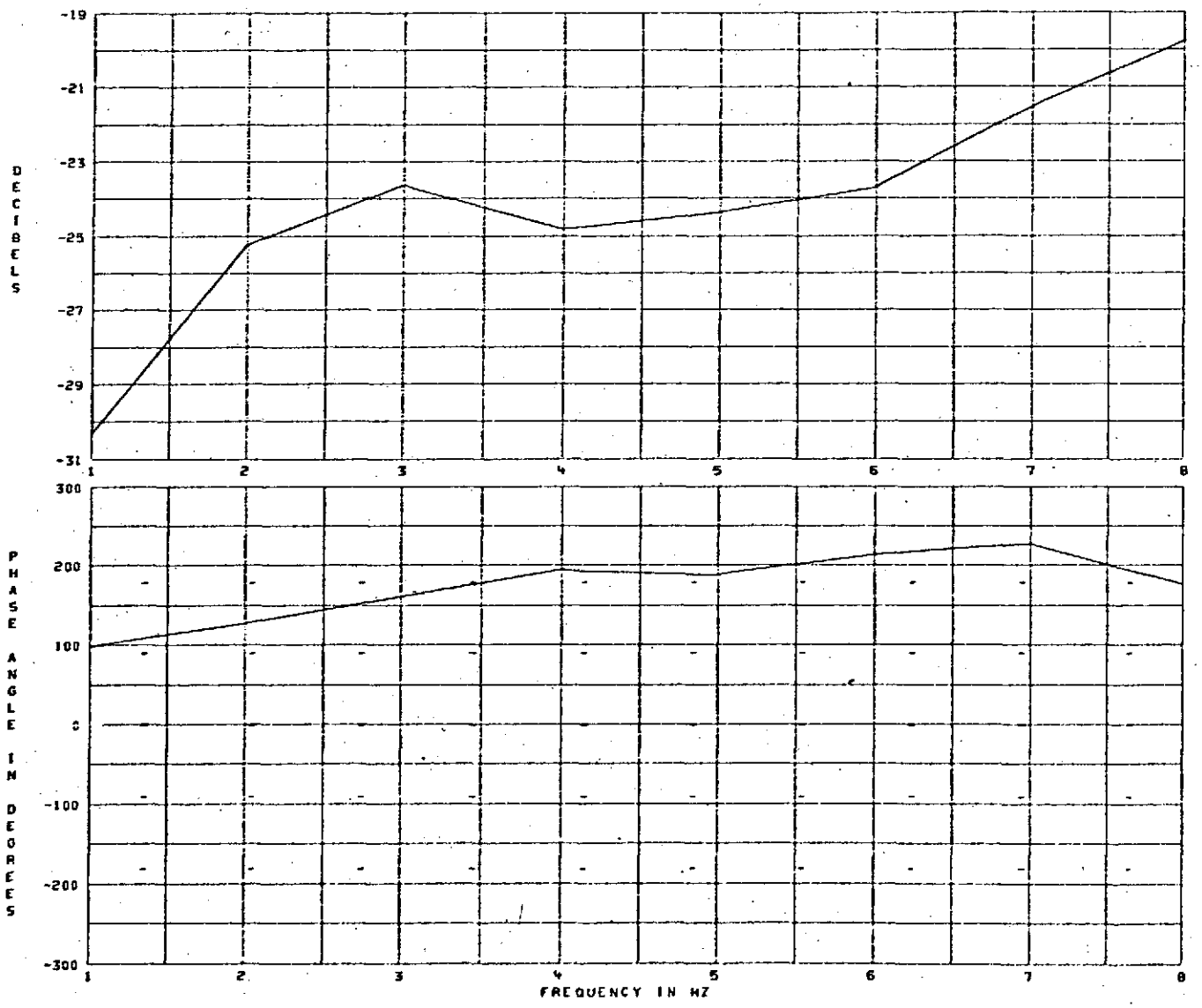
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.76 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 0.

FREQUENCY RESPONSE TEST 2
SENSOR -DELT X NORMALIZED BY REFERENCE SENSOR -FA9COM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

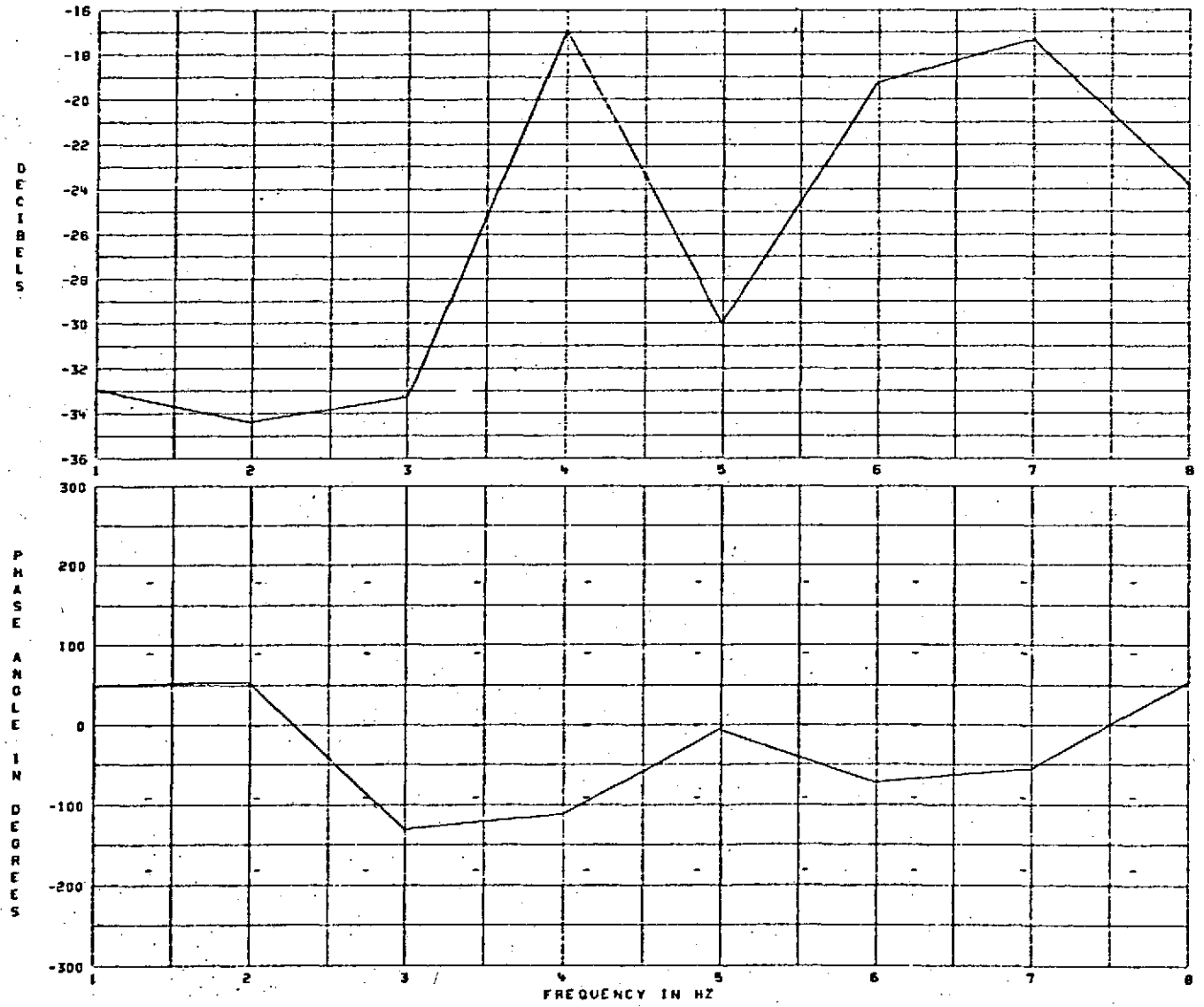
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.76 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 1.

FREQUENCY RESPONCE TEST 2
SENSOR -DELT Y . NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

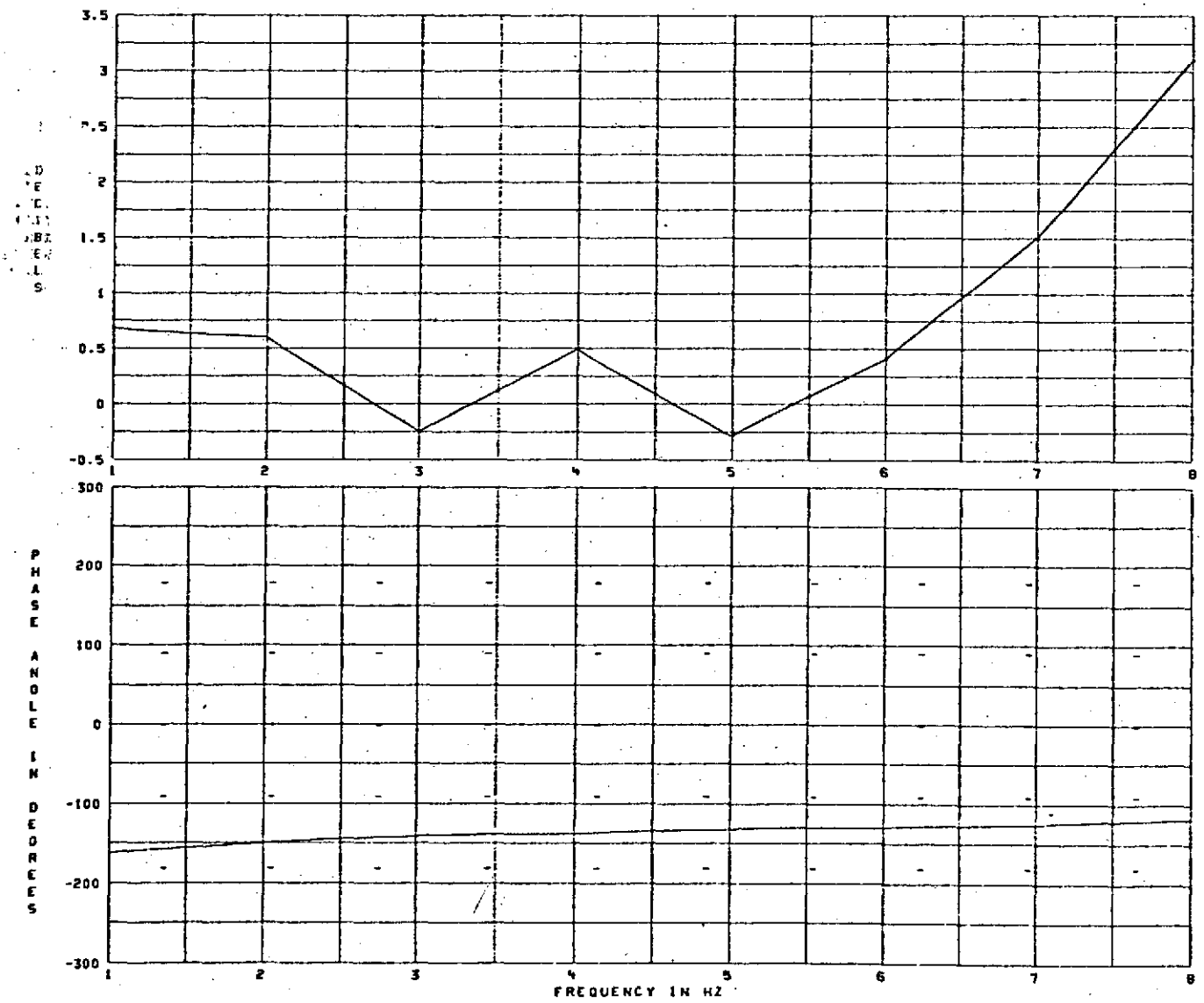
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.76 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 2.

FREQUENCY RESPONCE TEST 2
SENSOR -DELT Z NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.76 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 3.

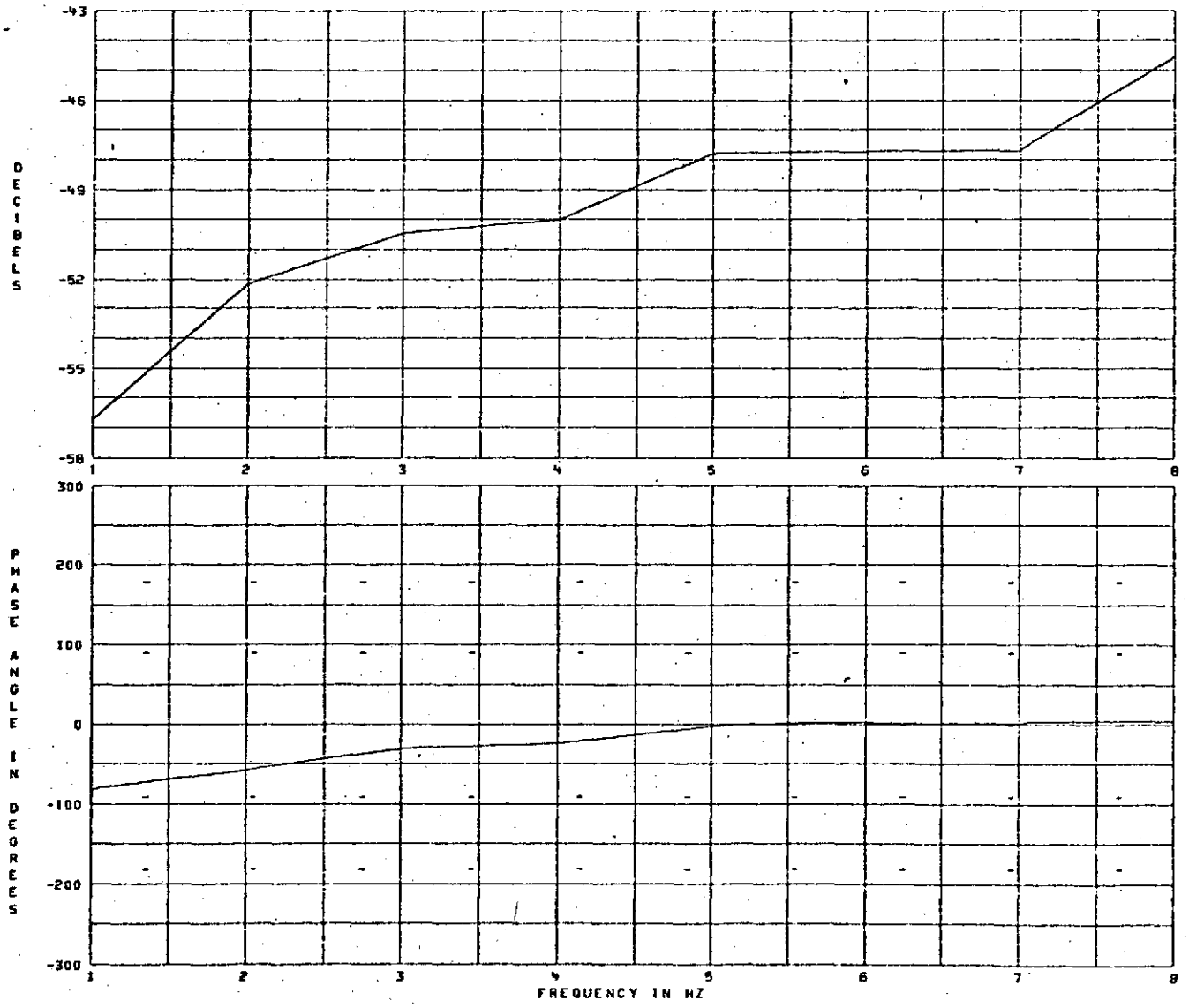
FREQUENCY RESPONCE TEST 2 — DATE PROCESSED - 09APR74

SENSOR -XTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM

TOTAL CYCLES PROCESSED = 0 — TOTAL PERIOD PROCESSED = 40.76 SEC

FIRST FREQUENCY = 1.00 HZ — FREQUENCY INCREMENTS = 1.00 HZ

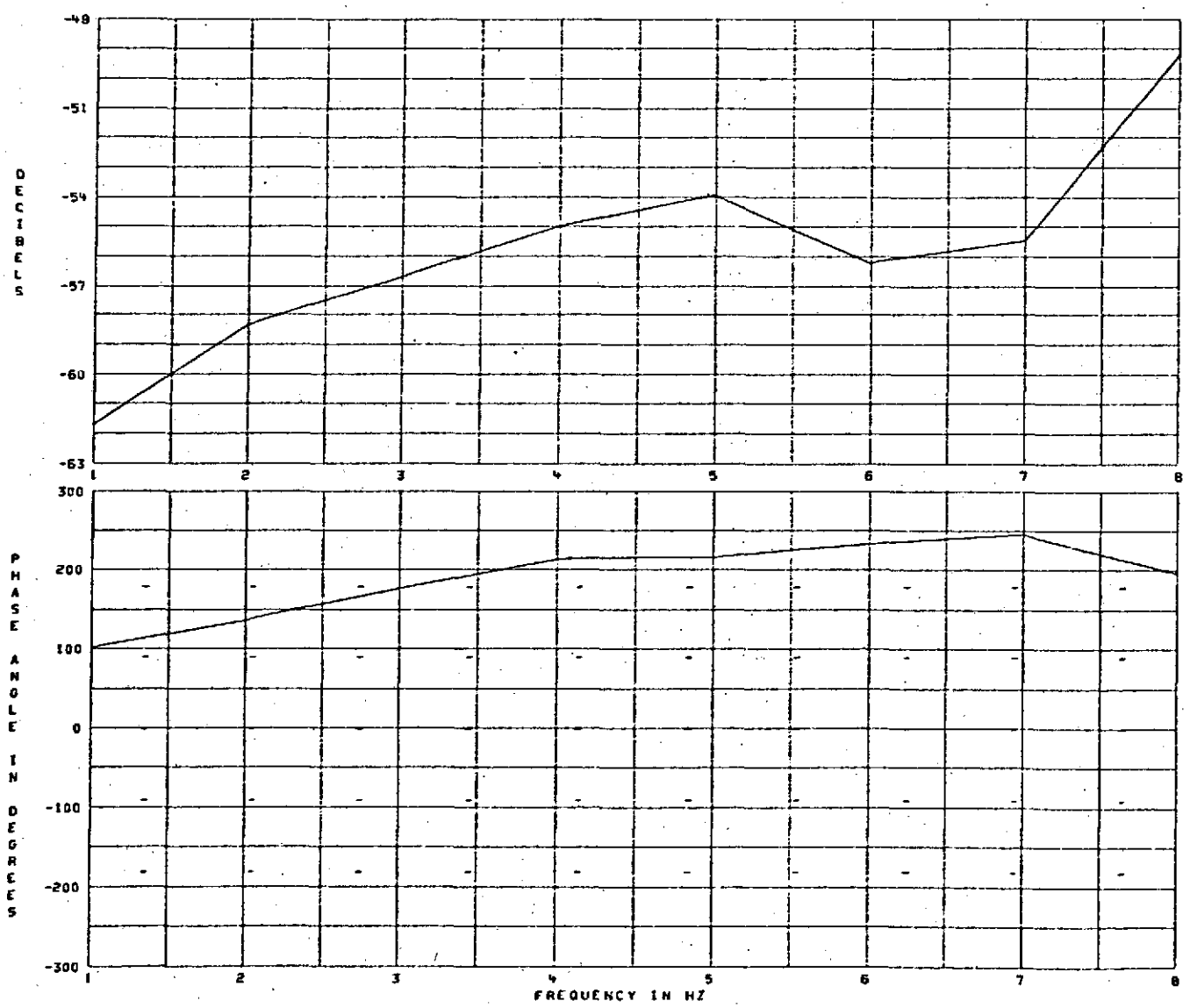
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ



PAGE 4.

FREQUENCY RESPONCE TEST 2
SENSOR -YTHETA NORMALIZED BY REFERENCE SENSOR -FABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

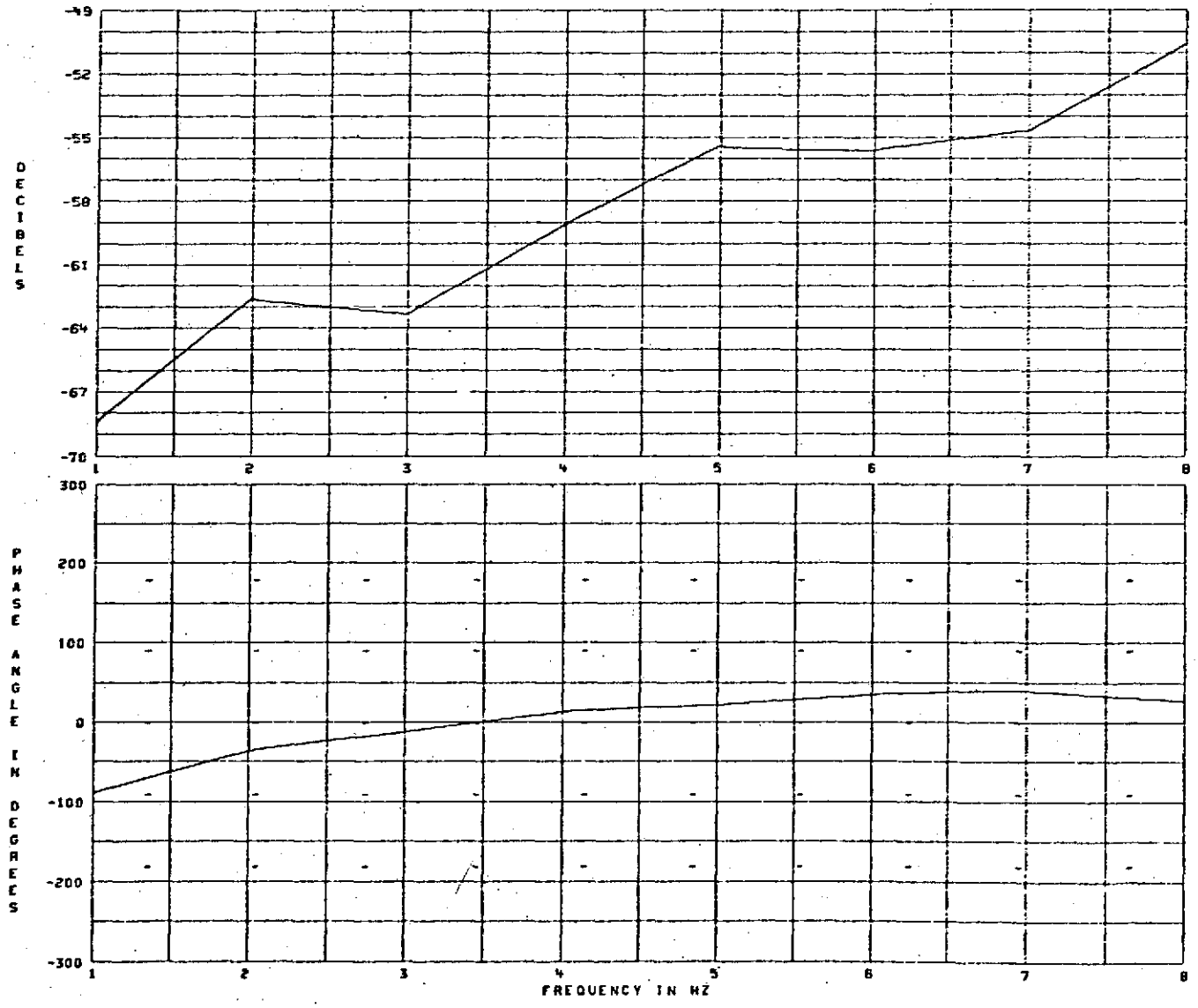
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.76 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 5.

FREQUENCY RESPONCE TEST 2
SENSOR -ZTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 8.00 HZ WAS .100 HZ TO .800 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 40.76 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 6.

APPENDIX C

TEST NO. 3 Y-AXIS

DDTS FREQUENCY RESPONSE TEST
SUMMARY OF INPUT INERTIAL CONDITIONS AND TRANSFORM MATRIX

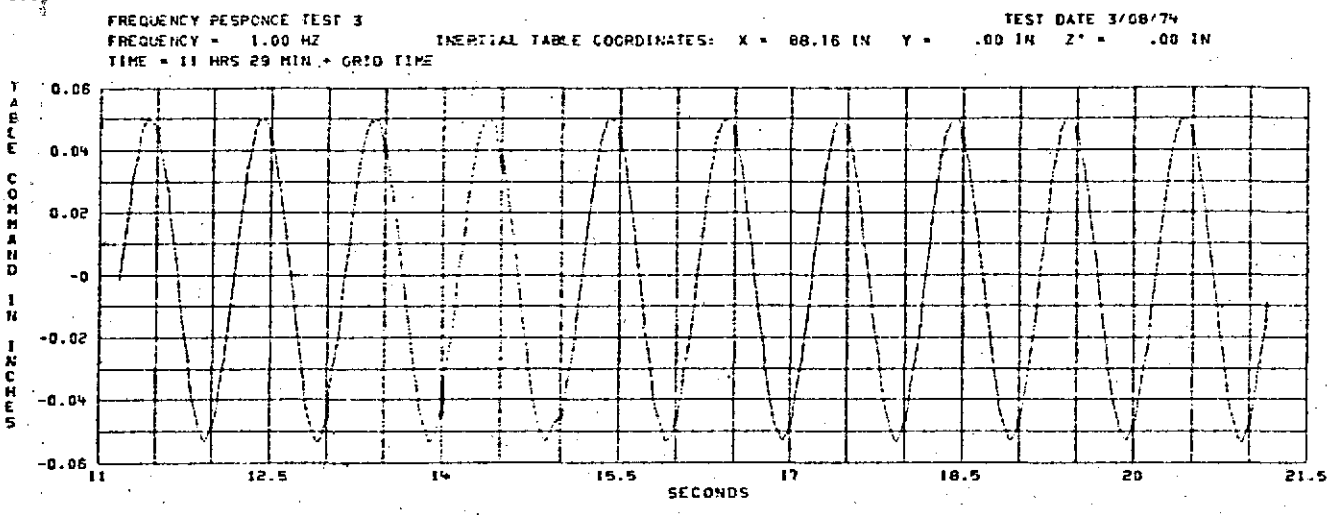
FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74

	X	Y	Z
TABLE COORDINATES	88.159	.000	.000

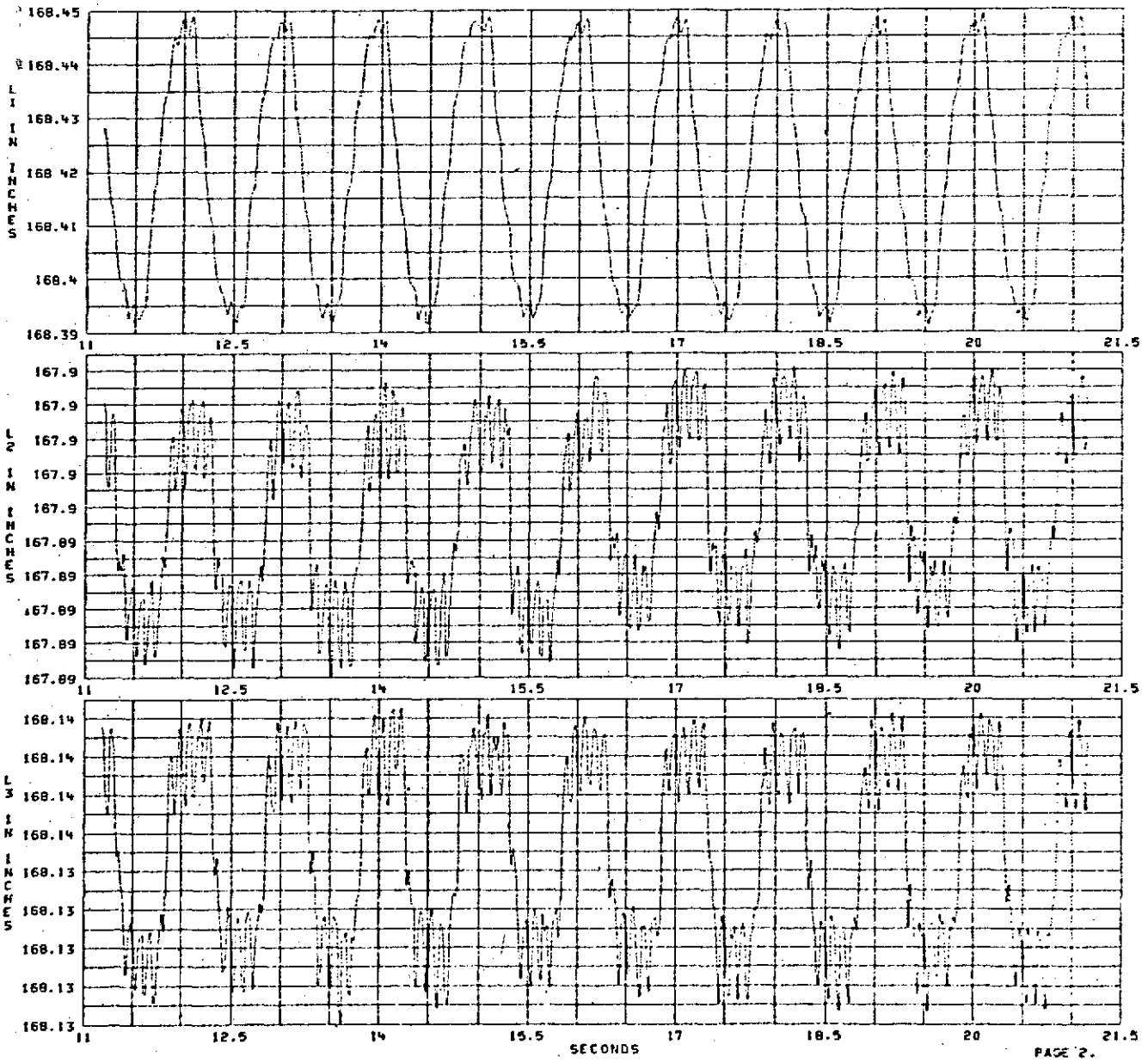
ACTUATOR	SERVO TABLE SWIVEL JOINTS X	Y	Z	FLOOR SWIVEL JOINTS X	Y	Z	COMPONENTS OF ACTUATOR LENGTH X	Y	Z	ACTUATOR LENGTH
1	.0000	25.1020	49.5000	210.4070	-64.3110	123.1780	-122.2480	89.4130	-73.6780	168.4272
2	.0000	-55.4190	3.0000	210.4290	-76.3800	116.1240	-122.2700	20.9610	-113.1240	167.6879
3	.0000	-55.4190	-3.0000	210.4220	-74.5730	-116.8190	-122.2630	19.1540	113.8190	168.1355
4	.0000	25.1020	-49.5000	210.4170	-62.4120	-123.6830	-122.2580	87.5140	74.1830	167.6569
5	.0000	30.2980	-46.5000	210.4100	138.4630	-5.9750	-122.2510	-108.1650	-40.5250	168.1881
6	.0000	30.2980	46.5000	210.3690	138.3890	8.0050	-122.2100	-108.0910	38.4950	167.6330

TRANSFORM MATRIX

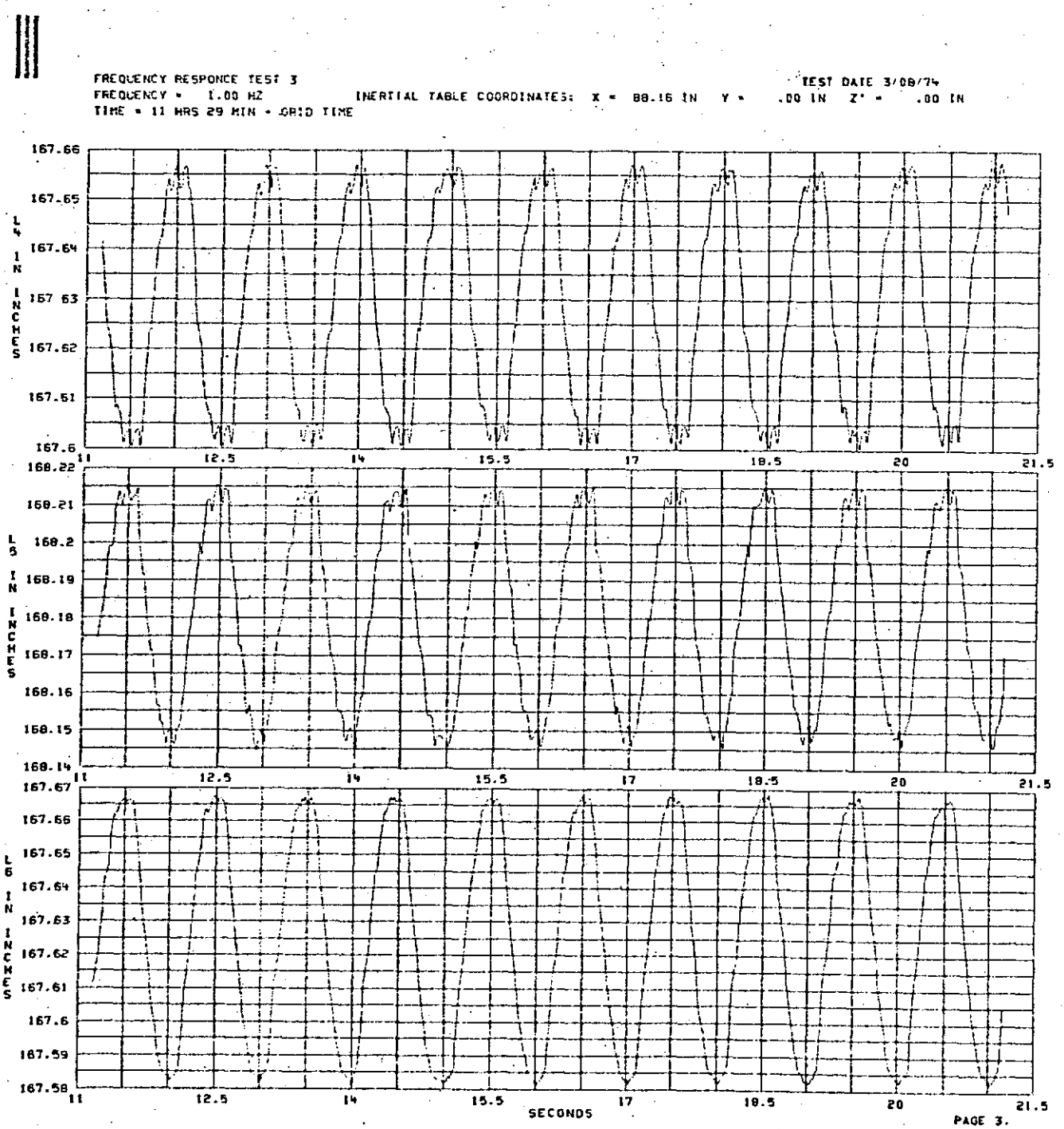
-.227798+00	-.229422+00	-.228575+00	-.229554+00	-.228266+00	-.230510+00
.447118+00	-.236022-01	-.303266-01	.442709+00	-.416853+00	-.418525+00
-.222802+00	-.498159+00	.498501+00	.228740+00	-.276033+00	.268561+00
-.450573-02	.449077-02	-.449777-02	.448626-02	-.450071-02	.448595-02
-.648215+02	.145547-02	-.146094-02	.650505-02	.794358-02	-.795988-02
.543719-02	-.835984-02	-.833211-02	.544980-02	.288540-02	.291976-02

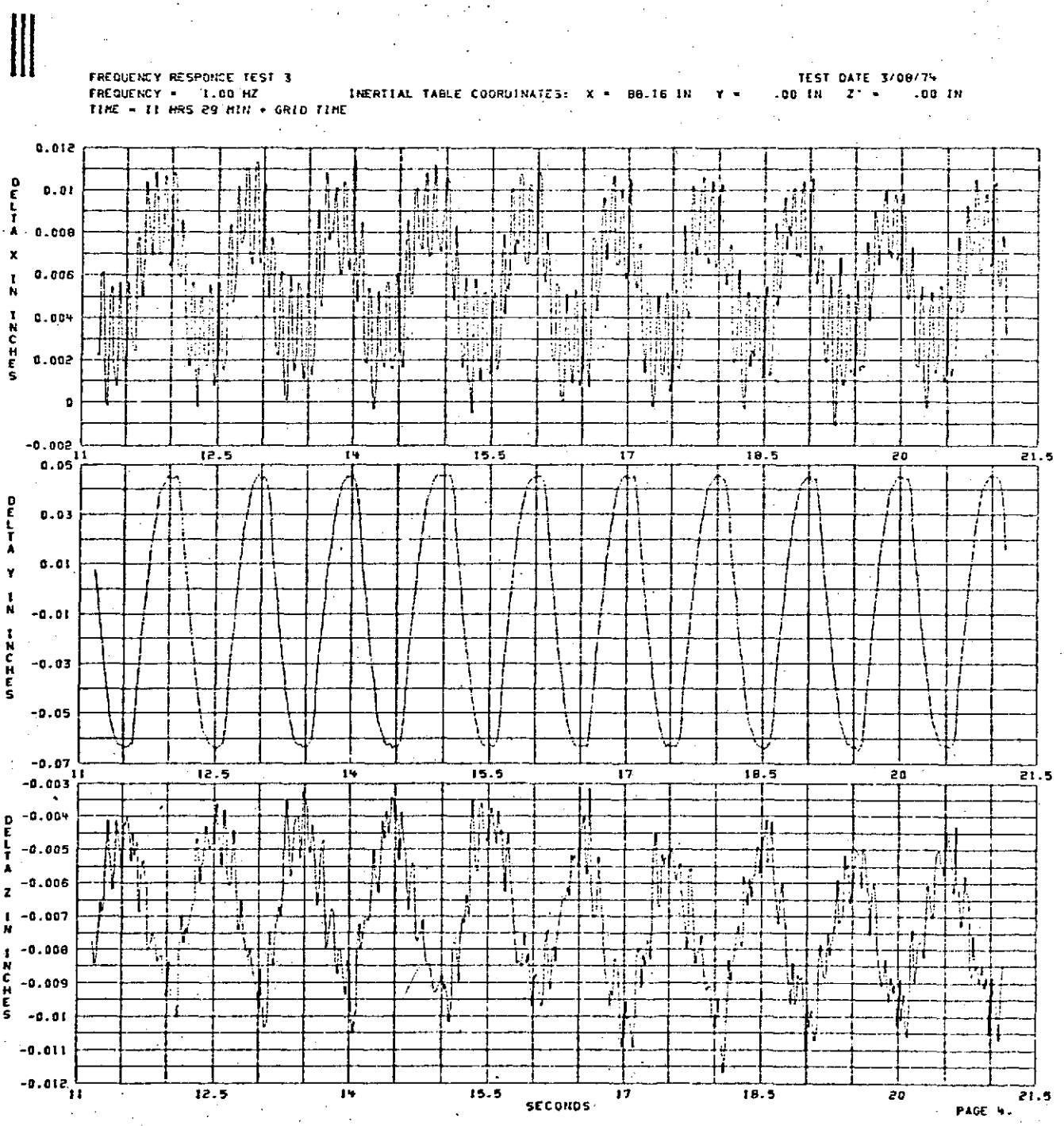

FREQUENCY PESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
11
12.5
14
15.5
17
18.5
20
21.5
SECONDS

FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 1.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME

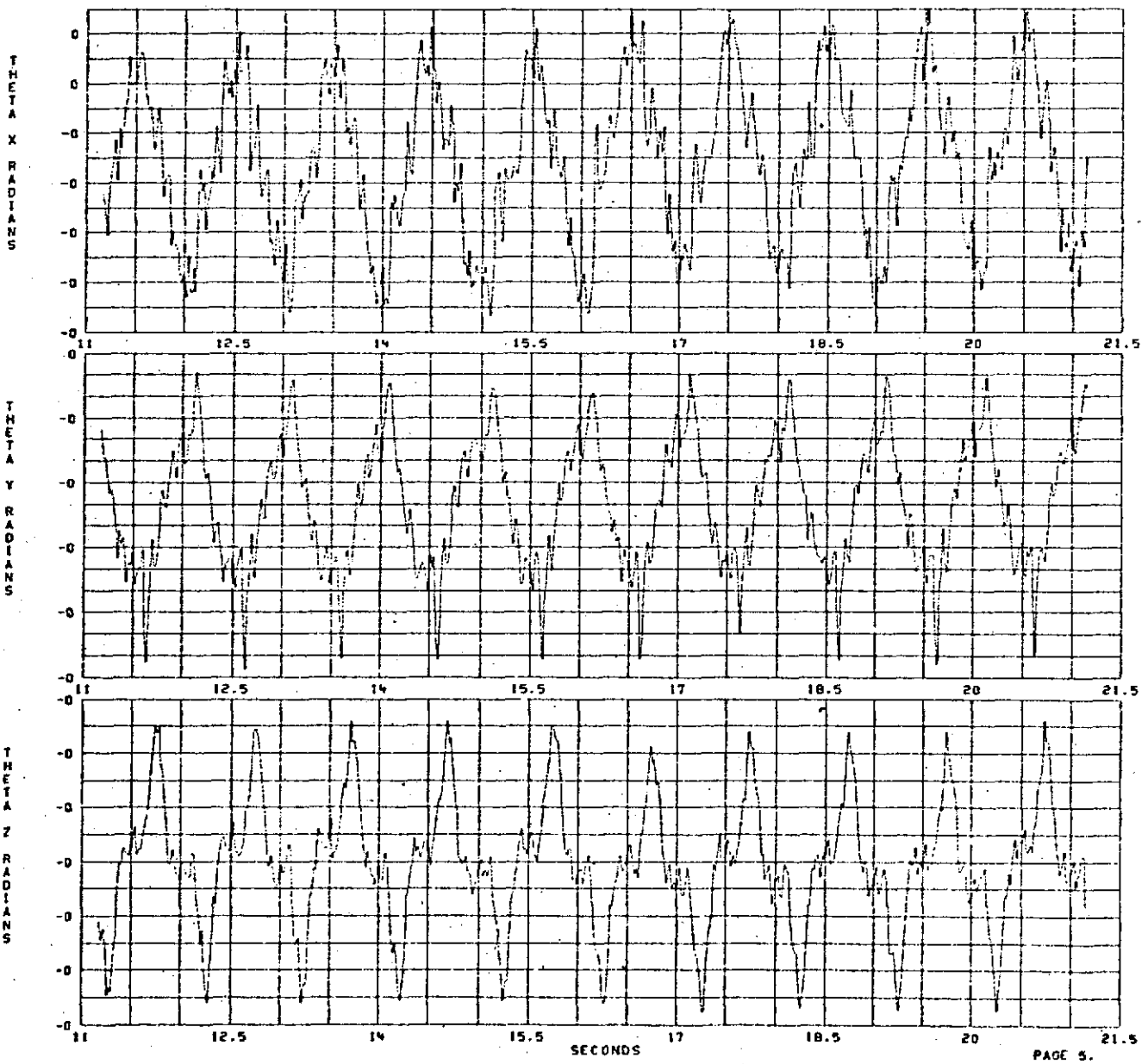


PAGE 2.

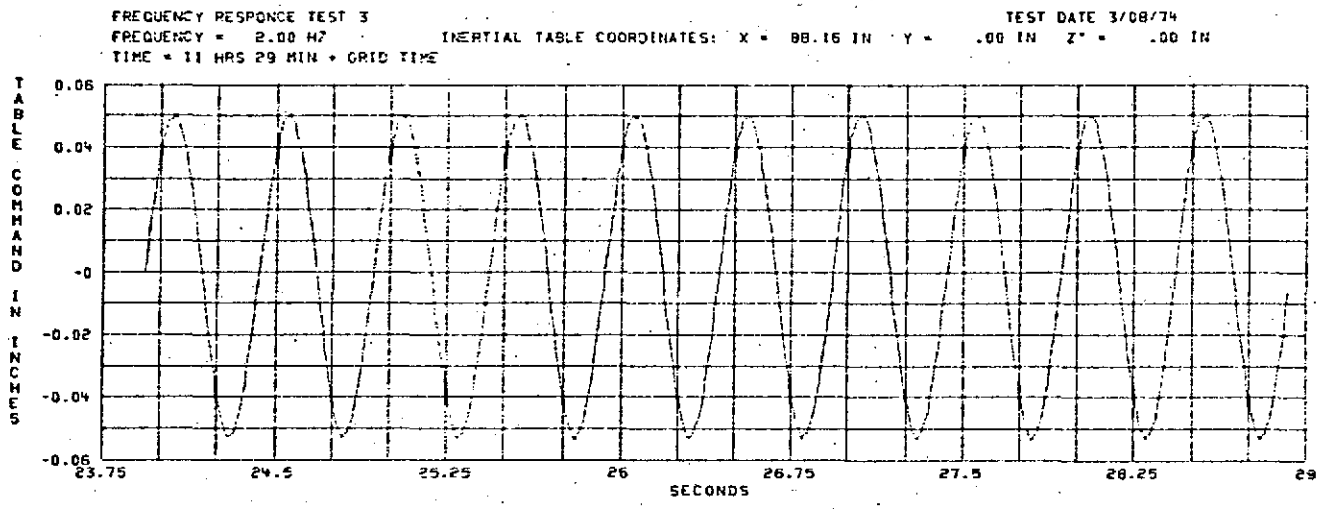

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z' = .00 IN
TIME = 11 HRS 29 MIN - GRID TIME
L4 IN INCHES
167.66
167.65
167.64
167 63
167.62
167.61
167.6
L5 IN INCHES
168.22
168.21
168.2
168.19
168.18
168.17
168.16
168.15
168.14
L6 IN INCHES
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
167.58
11
12.5
14
15.5
17
18.5
20
21.5
SECONDS
PAGE 3.

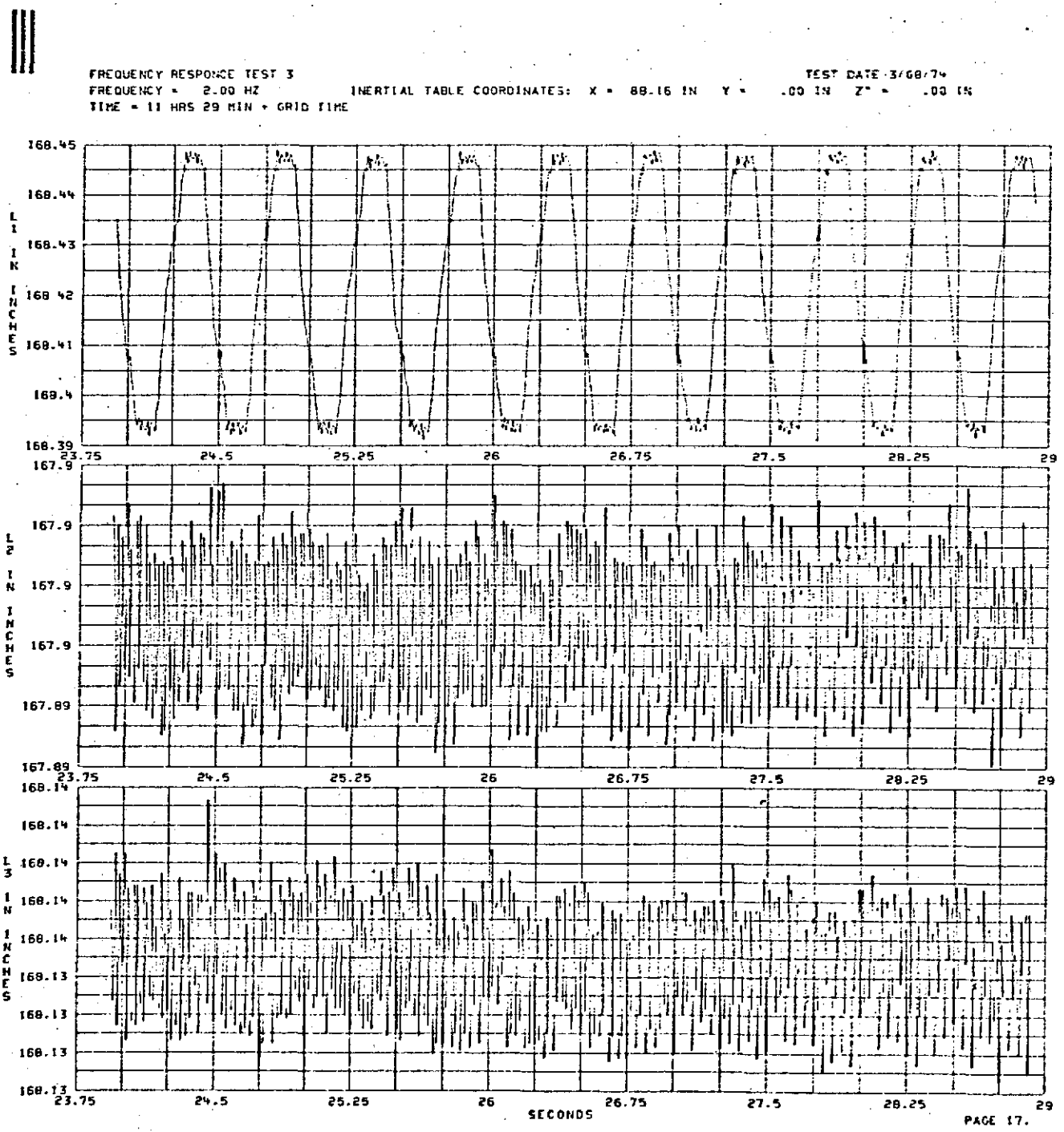

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
DELTA X IN INCHES
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
DELTA Y IN INCHES
0.05
0.03
0.01
-0.01
-0.03
-0.05
-0.07
DELTA Z IN INCHES
-0.003
-0.004
-0.005
-0.006
-0.007
-0.008
-0.009
-0.01
-0.011
-0.012
11
12.5
14
15.5
17
18.5
20
21.5
SECONDS
PAGE 4.

FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 1.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME

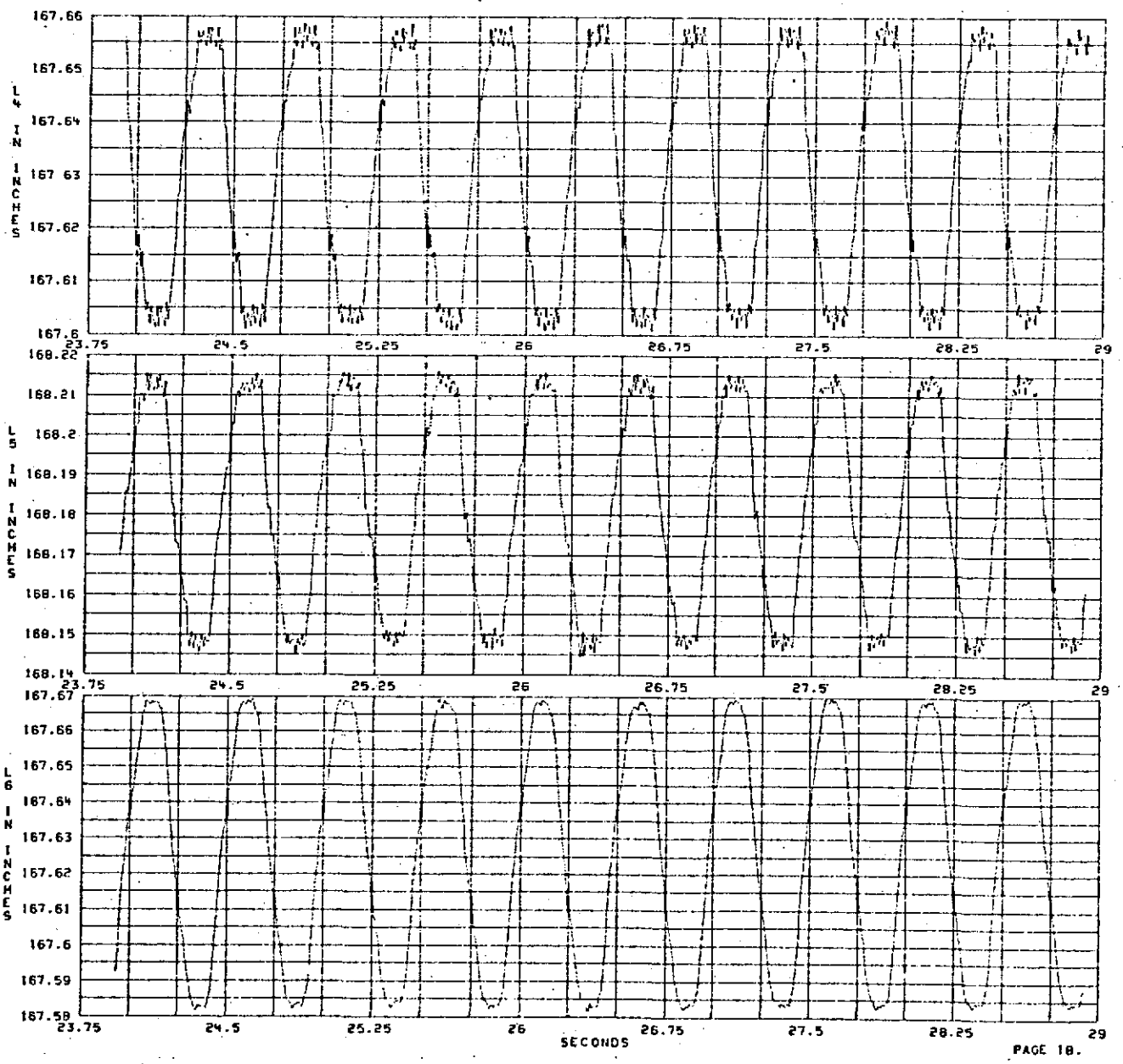


PAGE 5.

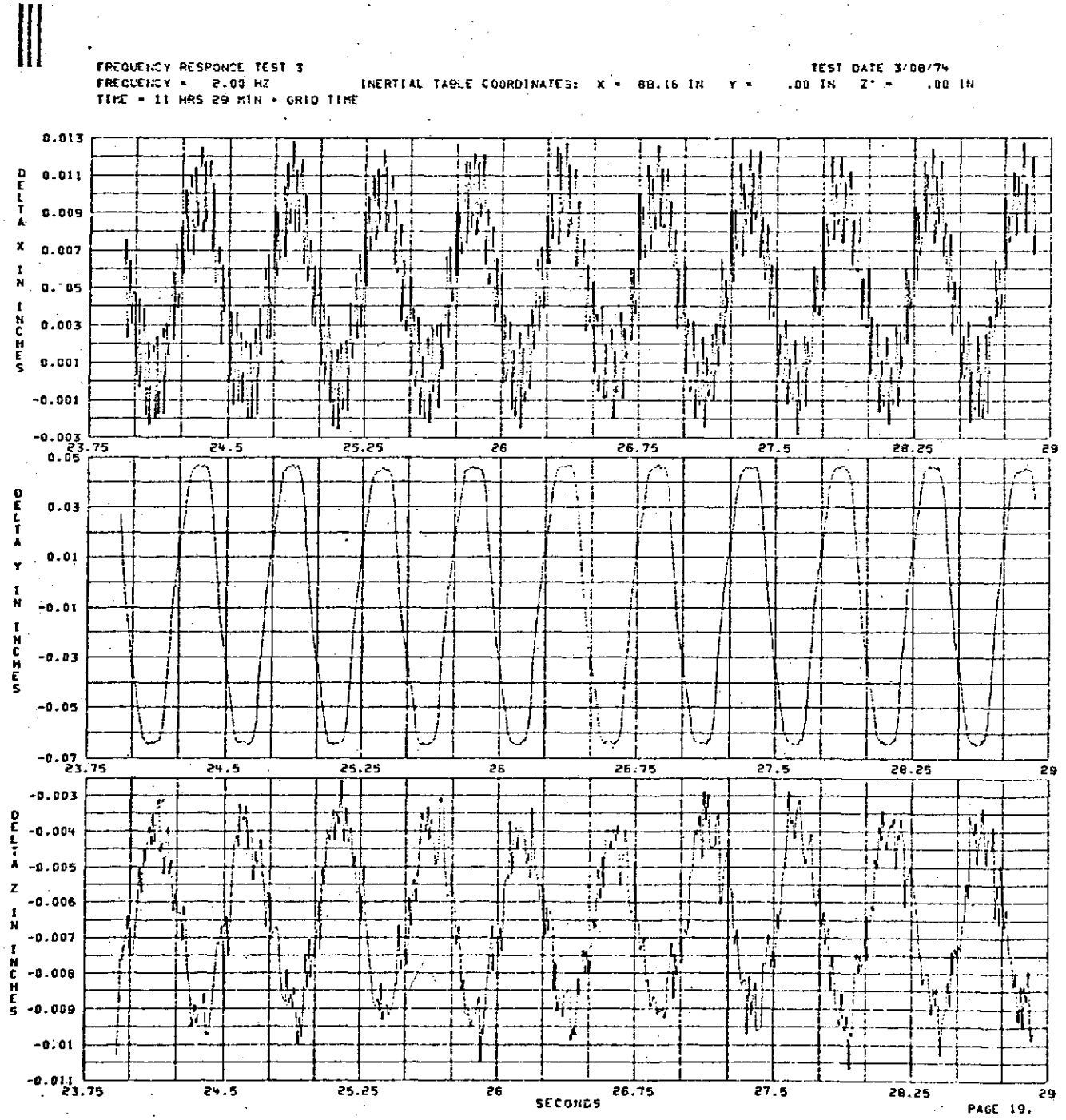

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
23.75
24.5
25.25
26
26.75
27.5
28.25
29
SECONDS

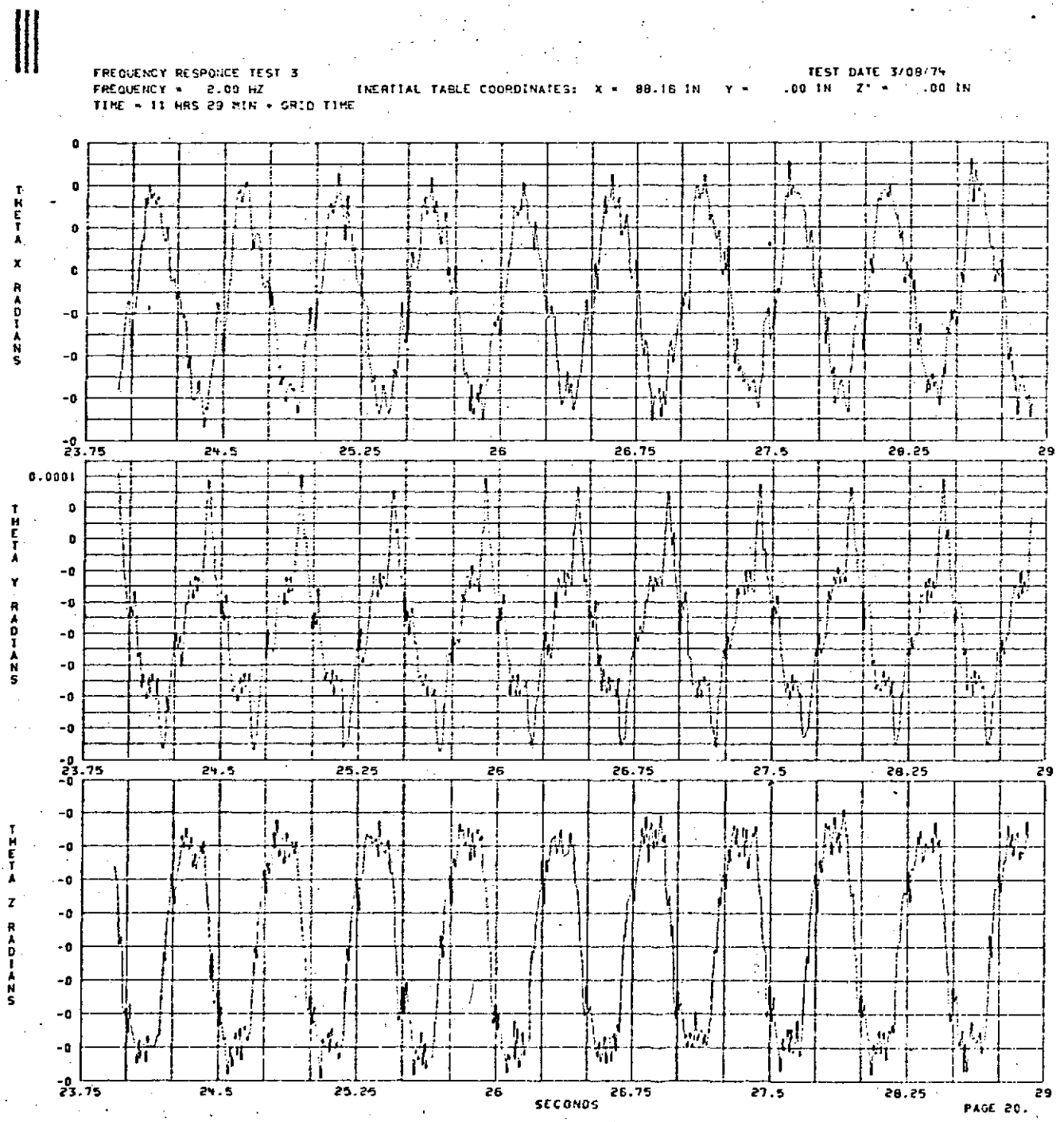

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
L1 IN INCHES
168.45
168.44
168.43
168.42
168.41
168.4
168.39
L2 IN INCHES
167.9
167.9
167.9
167.9
167.89
167.89
L3 IN INCHES
168.14
168.14
168.14
168.14
168.14
168.13
168.13
168.13
168.13
23.75
24.5
25.25
26
26.75
27.5
28.25
29
SECONDS
PAGE 17.

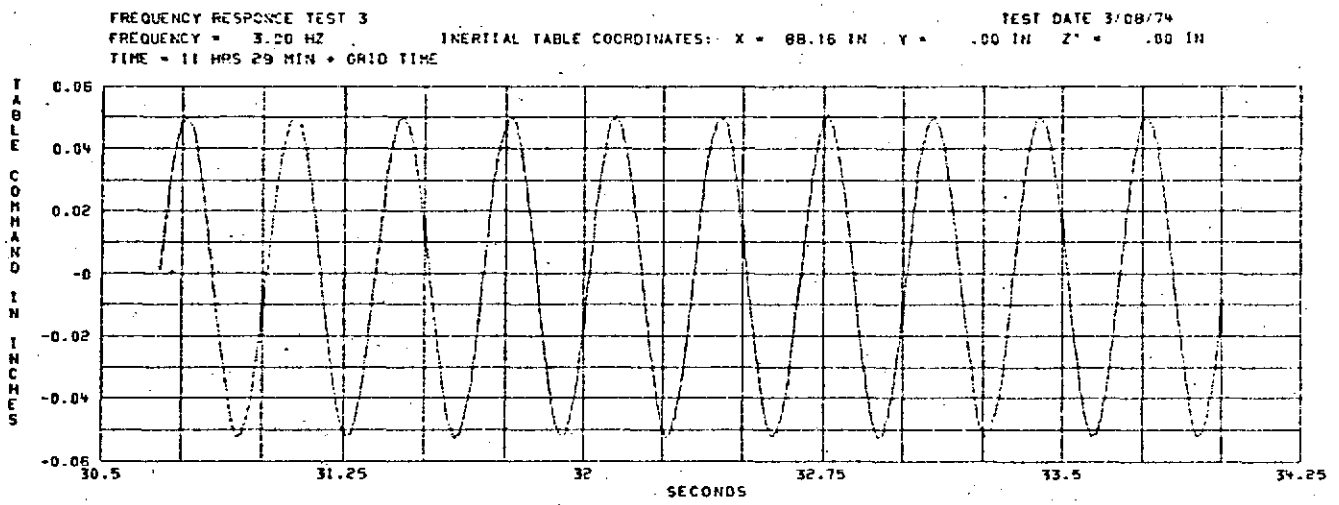
FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 2.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME

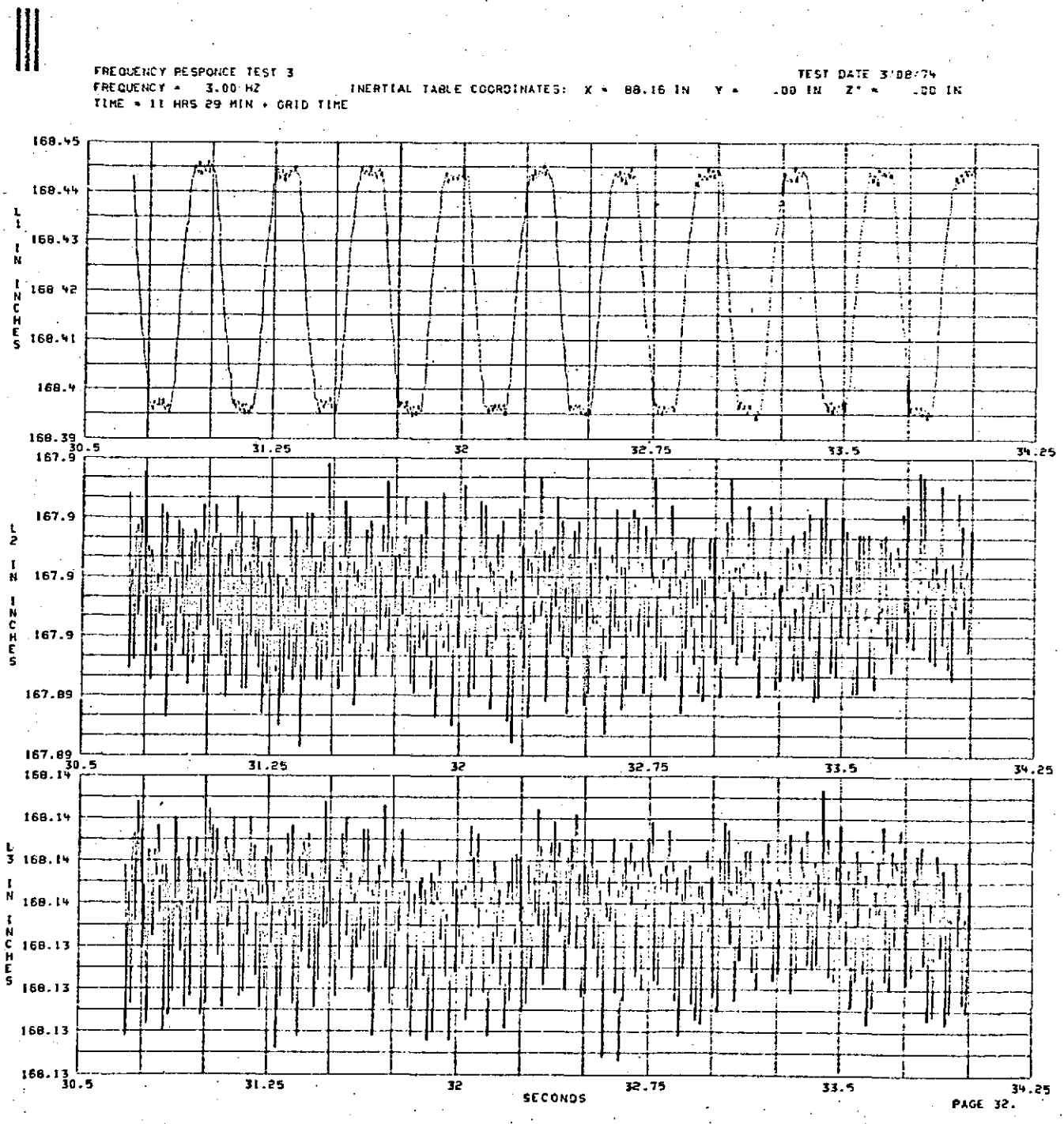


PAGE 18.

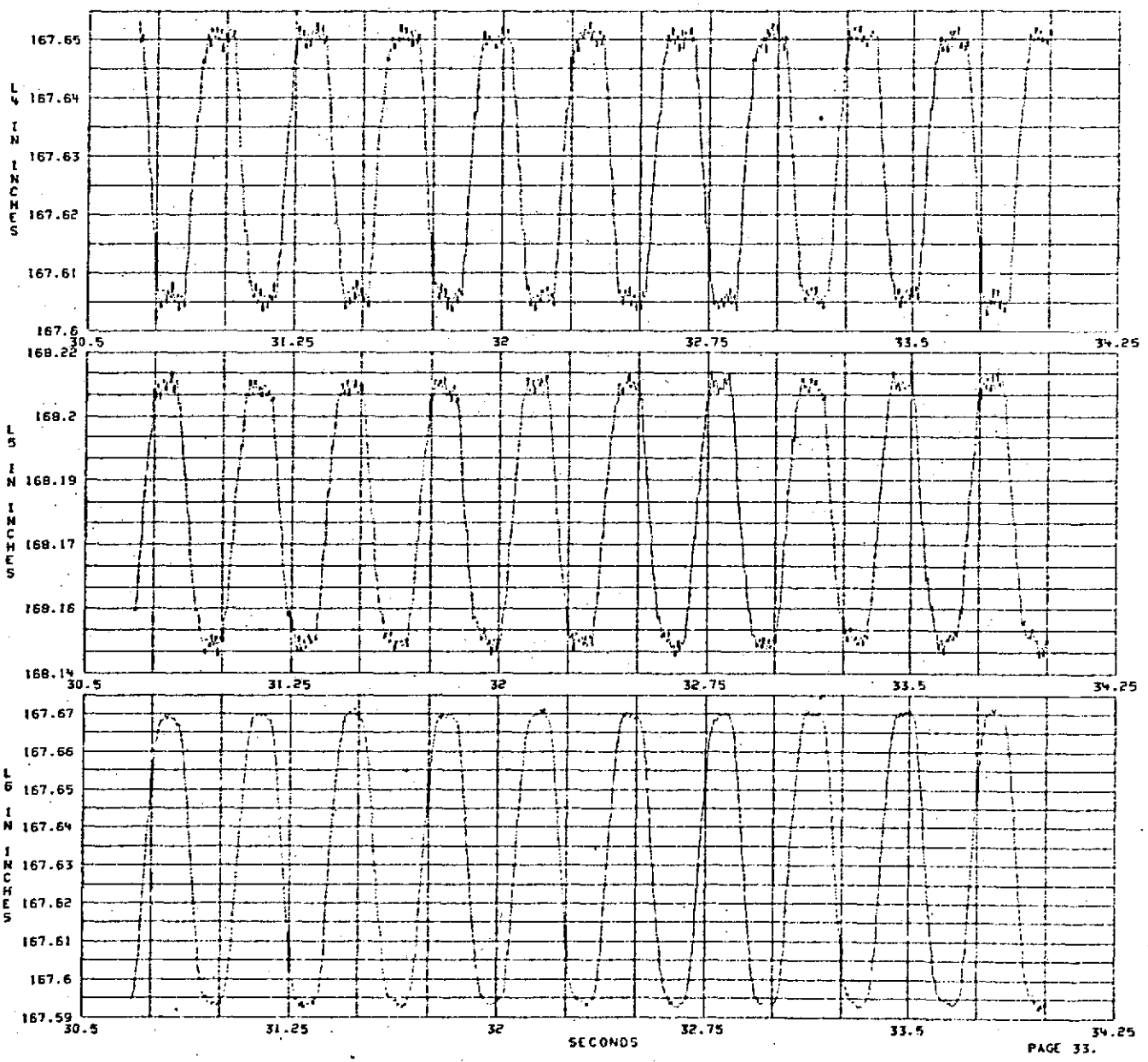

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
DELTA X IN INCHES
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
-0.003
DELTA Y IN INCHES
0.05
0.03
0.01
-0.01
-0.03
-0.05
-0.07
DELTA Z IN INCHES
-0.003
-0.004
-0.005
-0.006
-0.007
-0.008
-0.009
-0.01
-0.011
23.75
24.5
25.25
26
26.75
27.5
28.25
29
SECONDS
PAGE 19.


FREQUENCY RESPONCE TEST 3
FREQUENCY = 2.00 HZ
TIME = 11 HRS 29 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
23.75
24.5
25.25
26
26.75
27.5
28.25
29
SECONDS
PAGE 20.

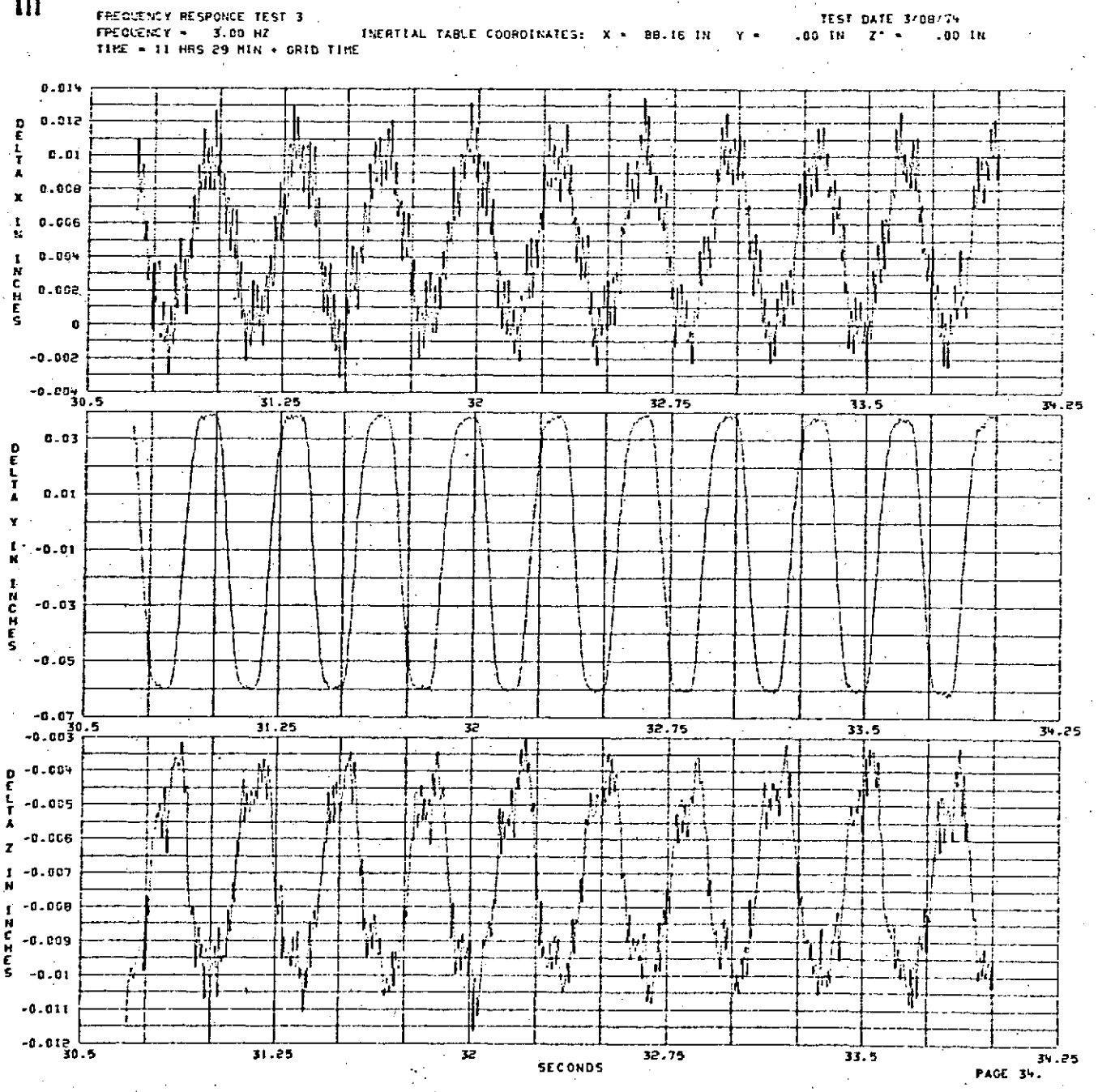

FREQUENCY RESPONSE TEST 3
TEST DATE 3/08/74
FREQUENCY = 3.20 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
30.5
31.25
32
32.75
33.5
34.25
SECONDS

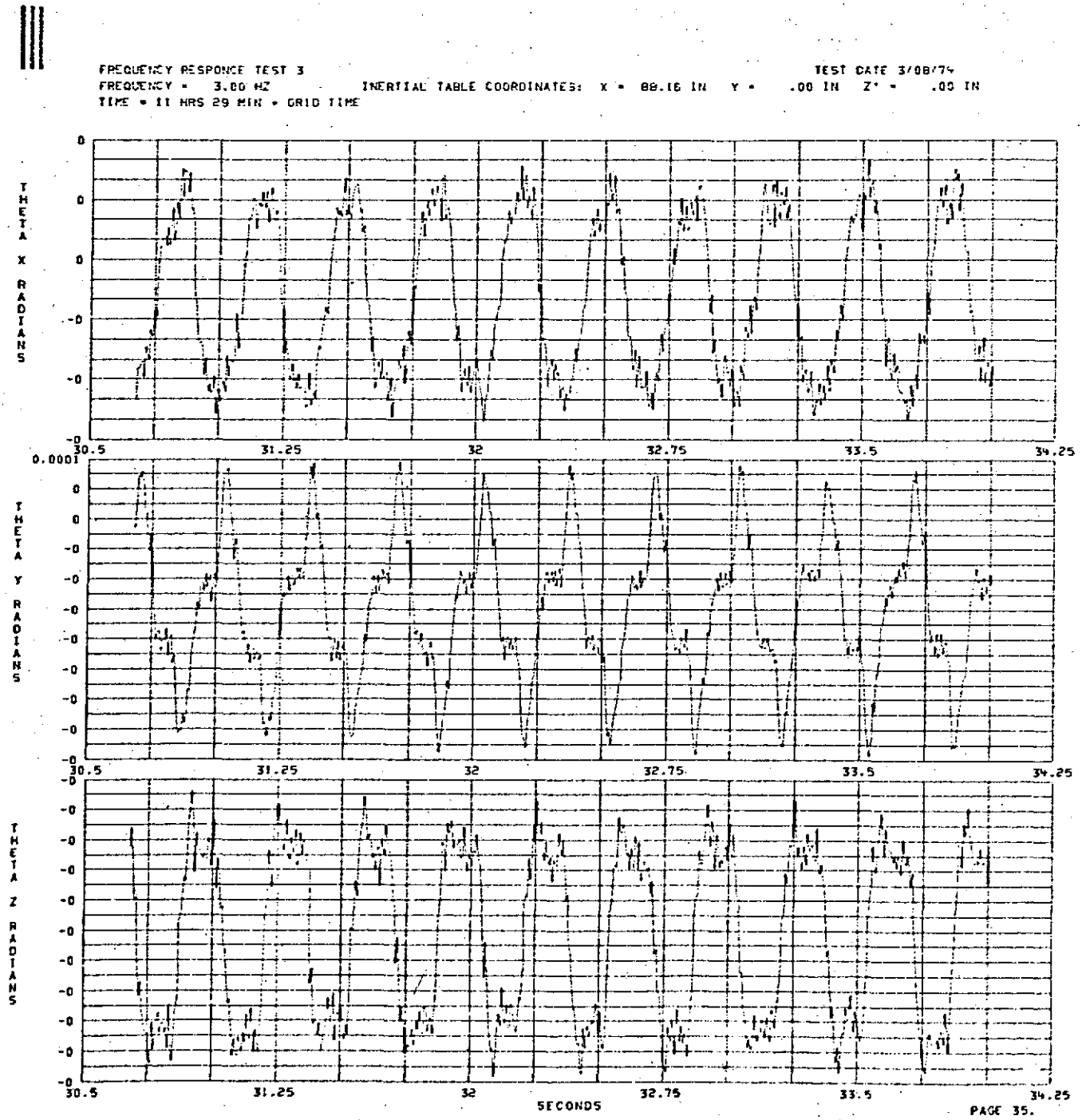

FREQUENCY RESPONCE TEST 3
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
L1 IN INCHES
168.45
168.44
168.43
168.42
168.41
168.4
168.39
L2 IN INCHES
167.9
167.9
167.9
167.89
167.89
L3 IN INCHES
168.14
168.14
168.14
168.13
168.13
168.13
30.5
31.25
32
32.75
33.5
34.25
SECONDS

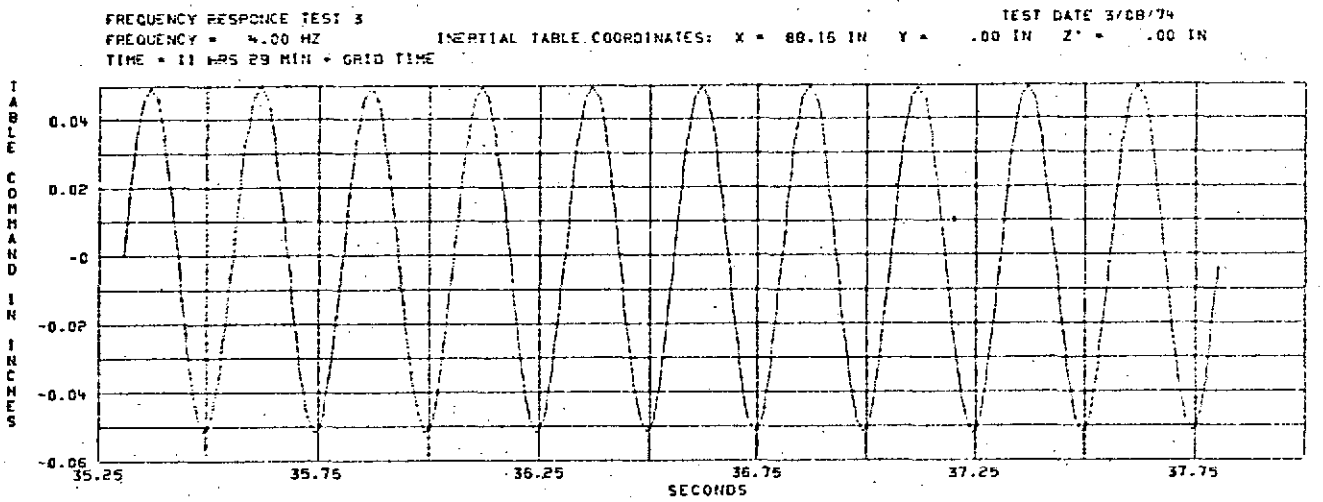
FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 3.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME

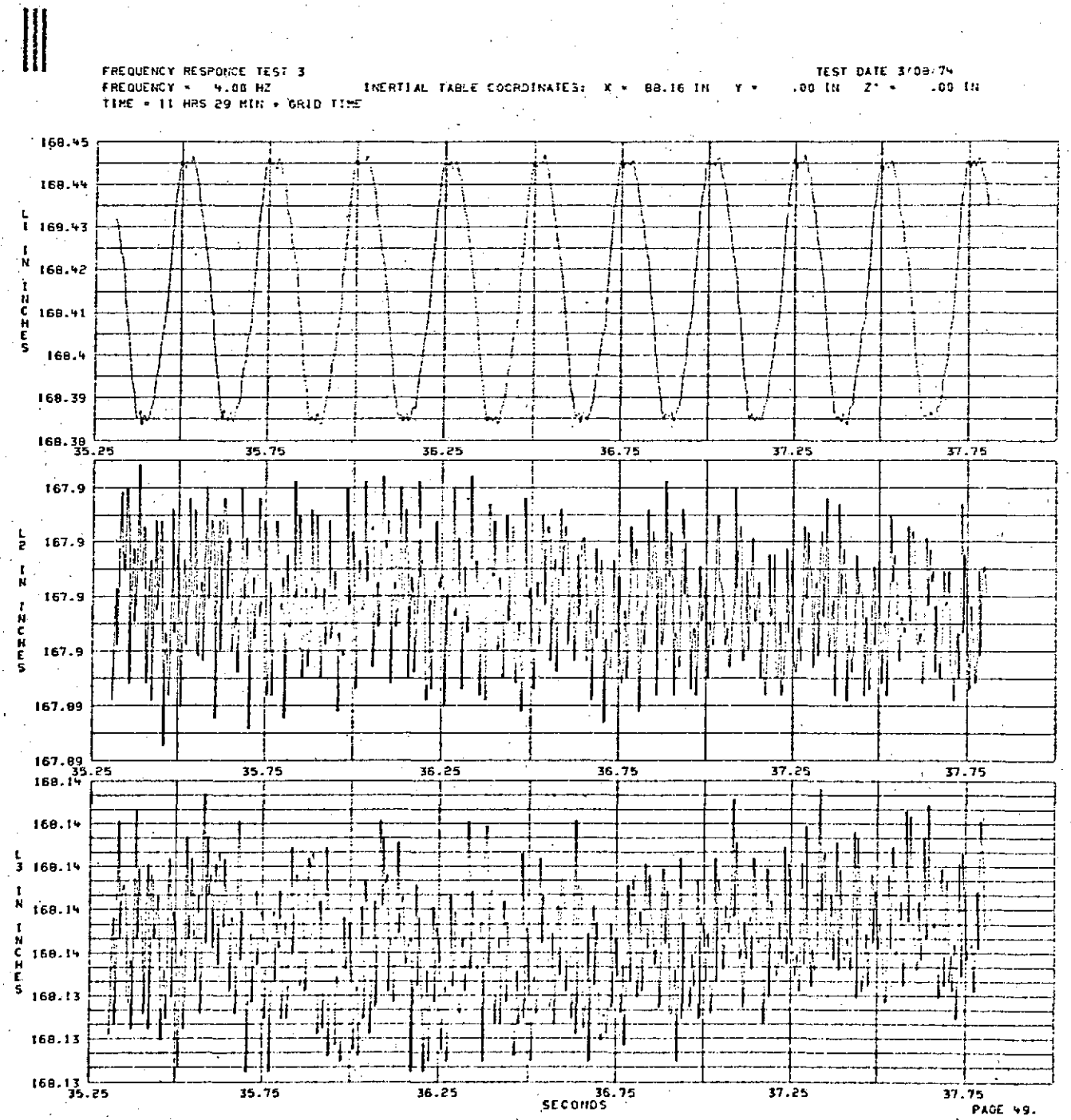


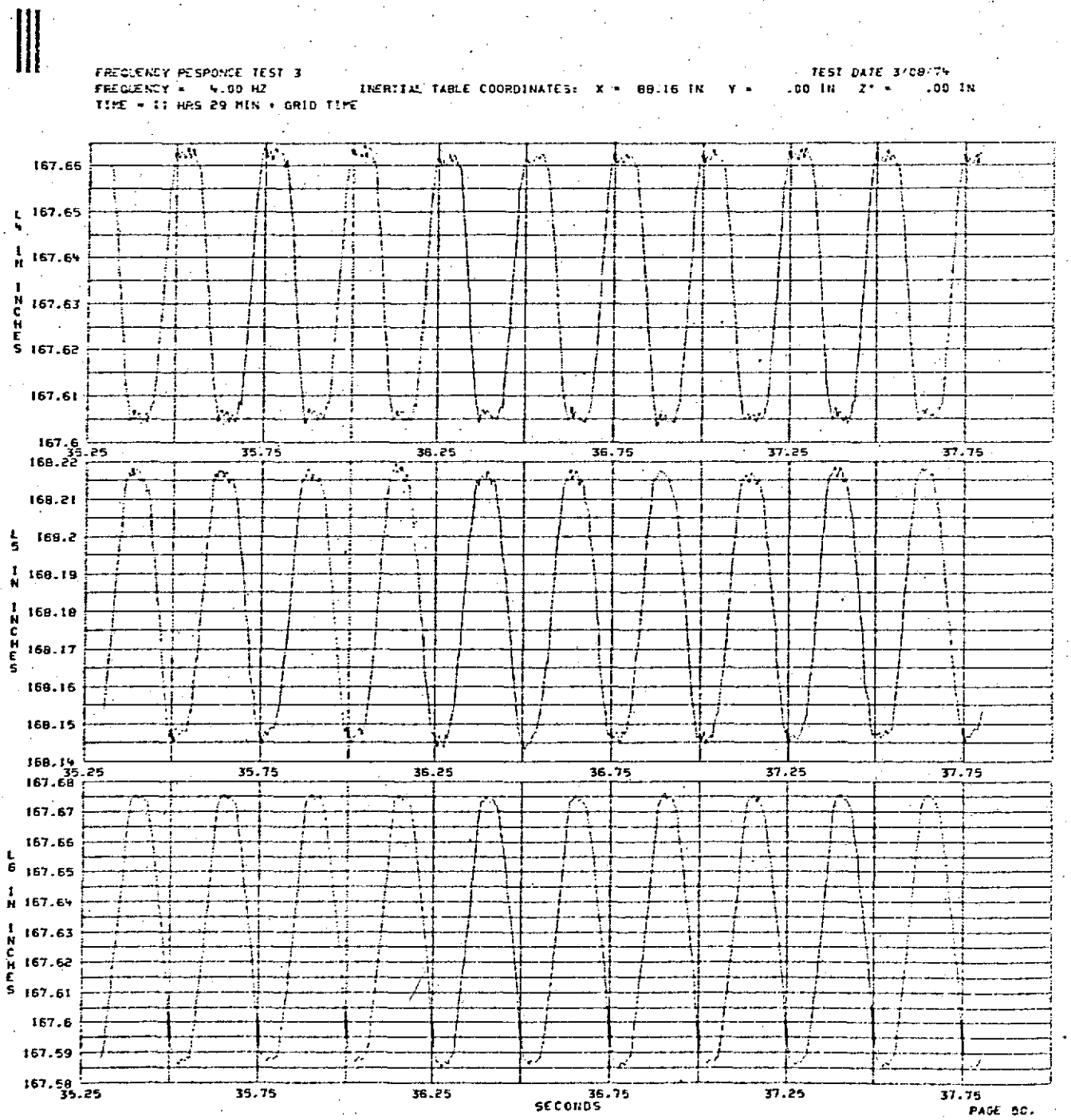
PAGE 33.

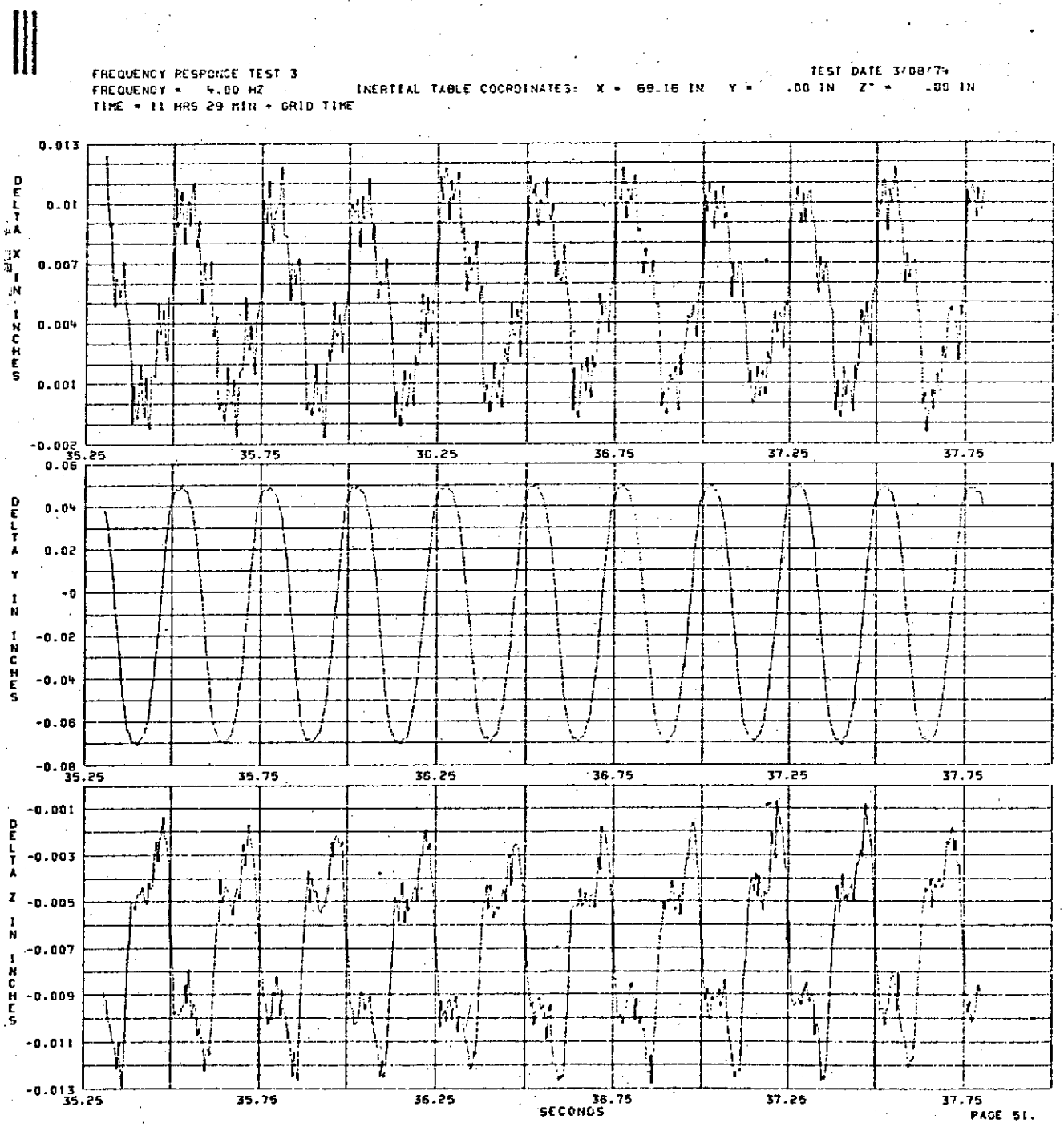

FREQUENCY RESPONCE TEST 3
FREQUENCY = 3.00 HZ
TIME = 11 HRS 29 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
DELTA Y IN INCHES
DELTA Z IN INCHES
SECONDS
PAGE 34.

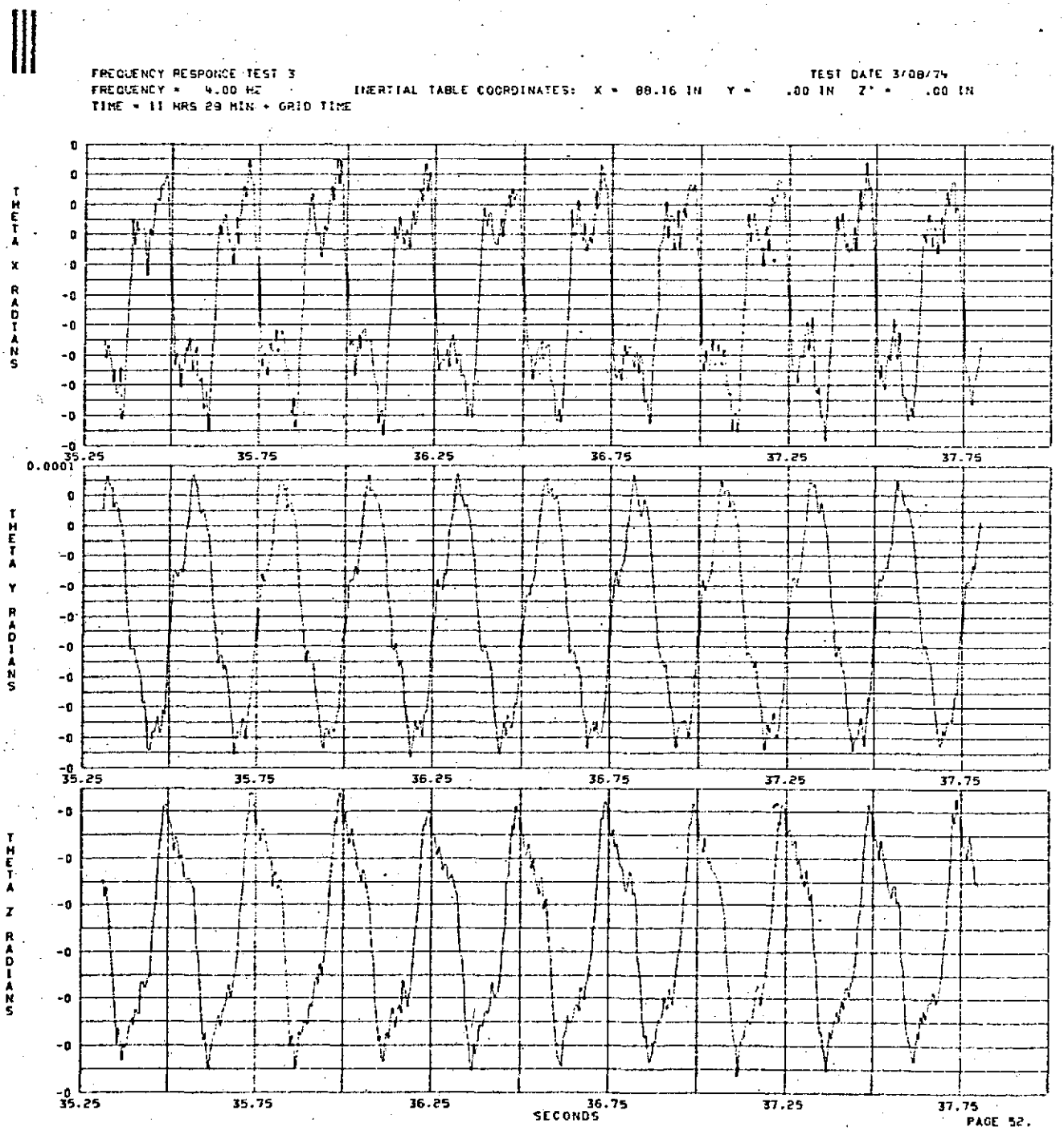

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
30.5
31.25
32
32.75
33.5
34.25
SECONDS
PAGE 35.

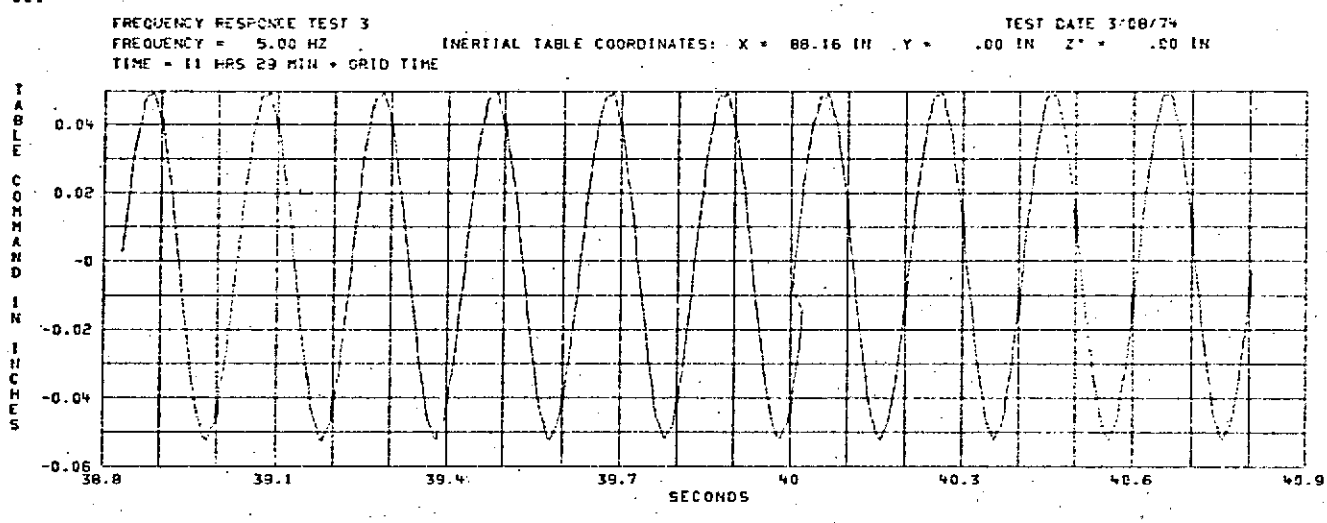

FREQUENCY RESPONCE TEST 3
FREQUENCY = 4.00 HZ
TIME = 11 HRS 29 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.15 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
35.25
35.75
36.25
36.75
37.25
37.75
SECONDS


FREQUENCY RESPONCE TEST 3
FREQUENCY = 4.00 HZ
TIME = 11 HRS 29 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.45
168.44
168.43
168.42
168.41
168.4
168.39
168.38
L2 IN INCHES
167.9
167.9
167.9
167.9
167.89
167.89
L3 IN INCHES
168.14
168.14
168.14
168.14
168.14
168.13
168.13
168.13
35.25
35.75
36.25
36.75
37.25
37.75
SECONDS
PAGE 49.


FREQUENCY RESPONCE TEST 3
FREQUENCY = 4.00 HZ
TIME = 11 HRS 29 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L4 IN INCHES
167.66
167.65
167.64
167.63
167.62
167.61
167.6
35.25
35.75
36.25
36.75
37.25
37.75
L5 IN INCHES
168.22
168.21
168.2
168.19
168.18
168.17
168.16
168.15
168.14
L6 IN INCHES
167.68
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
167.58
SECONDS
PAGE 80.

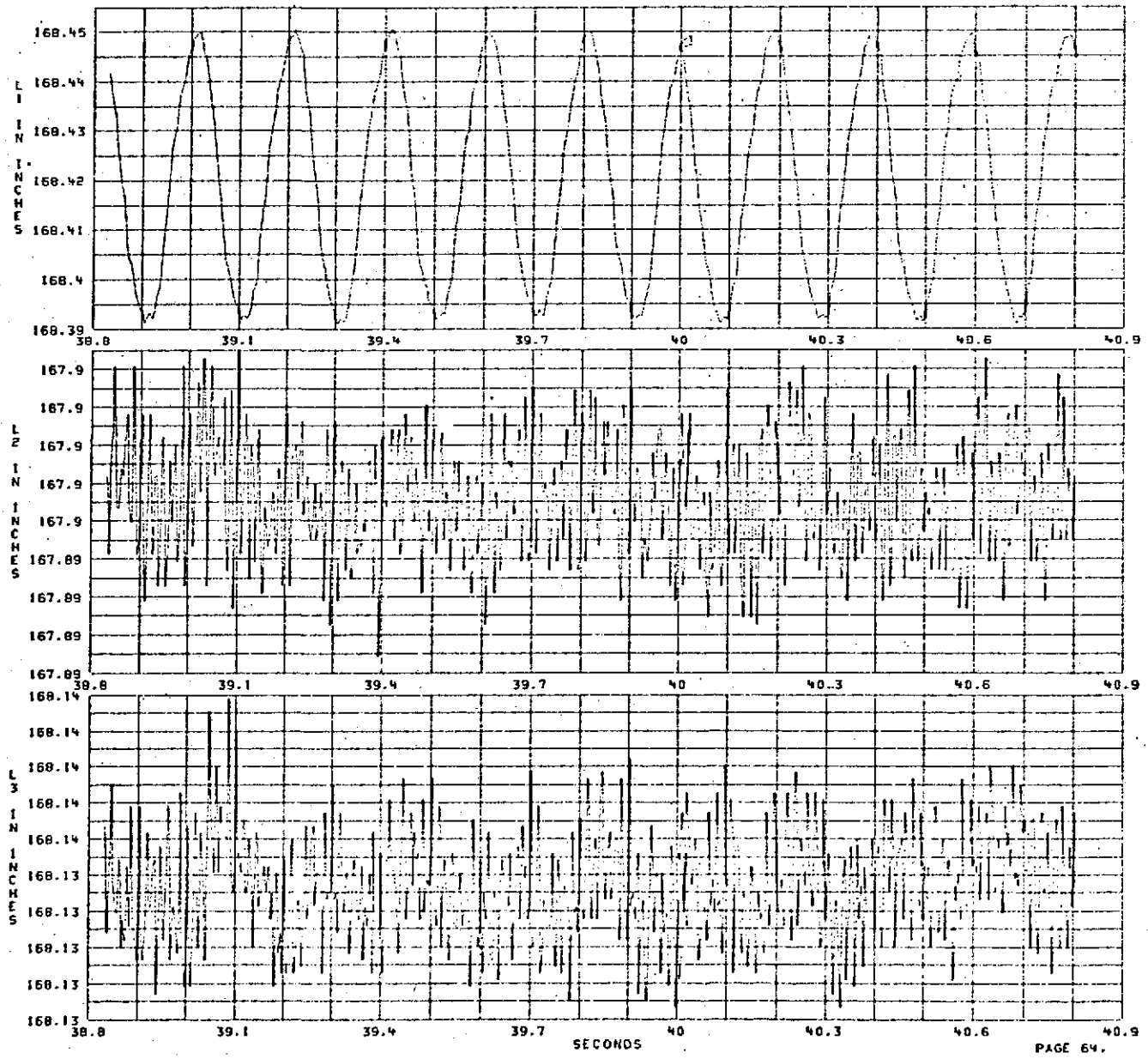

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 68.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
DELTA X IN INCHES
0.013
0.01
0.007
0.004
0.001
-0.002
DELTA Y IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
-0.08
DELTA Z IN INCHES
-0.001
-0.003
-0.005
-0.007
-0.009
-0.011
-0.013
35.25
35.75
36.25
36.75
37.25
37.75
SECONDS
PAGE 51.


FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
35.25
35.75
36.25
36.75
37.25
37.75
SECONDS
PAGE 52.

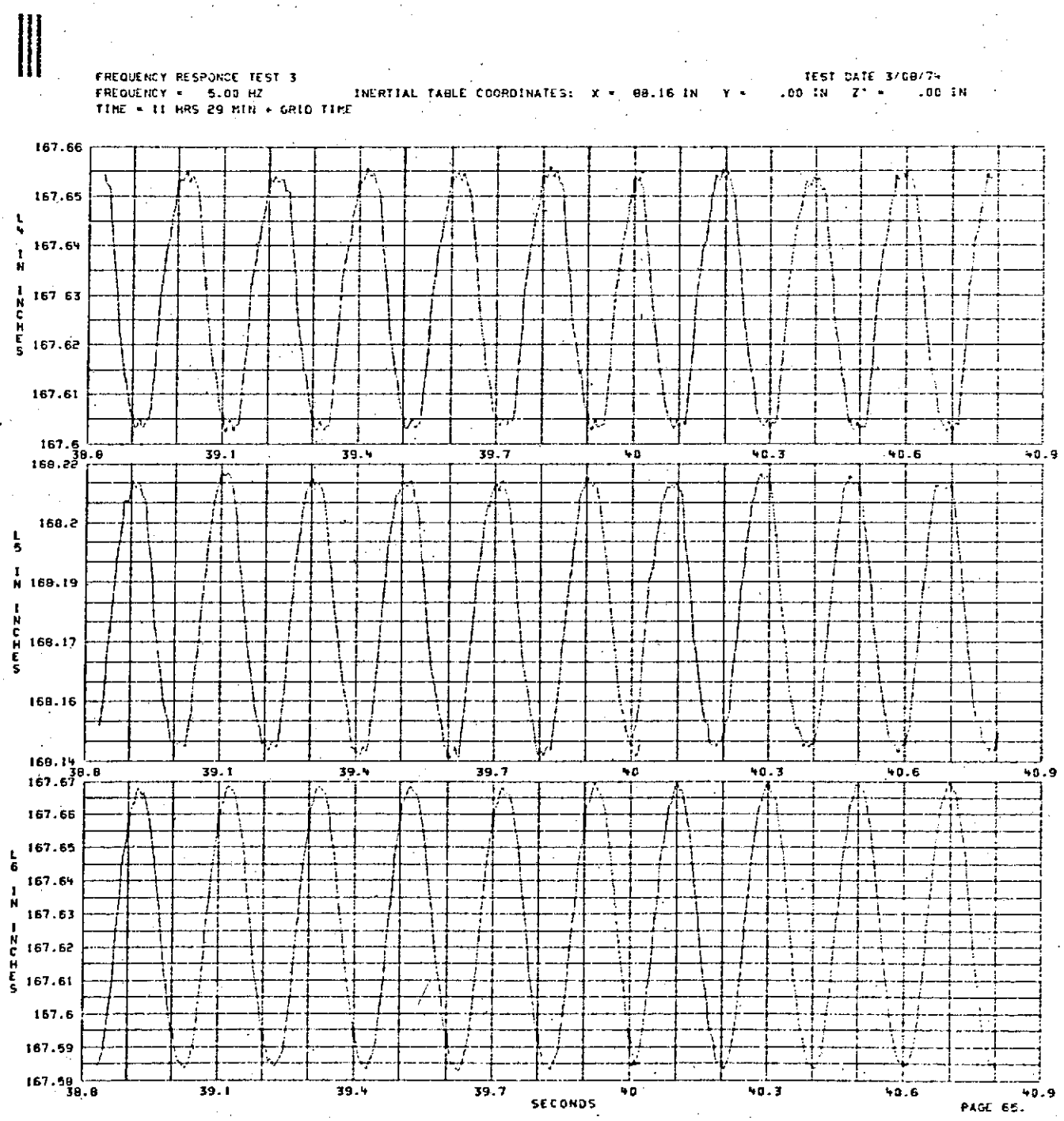

FREQUENCY RESPONSE TEST 3
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
38.8
39.1
39.4
39.7
40
40.3
40.6
40.9
SECONDS

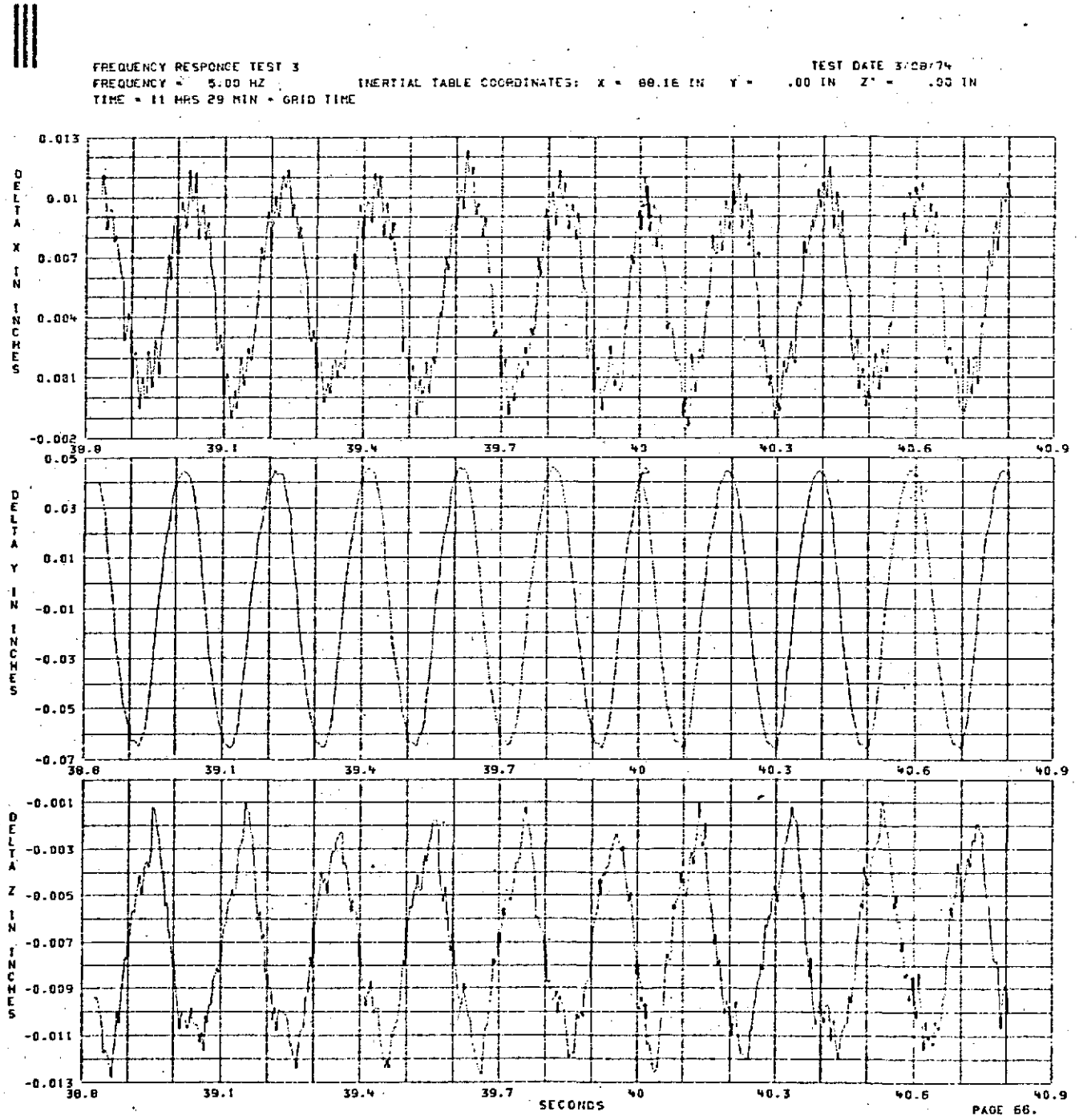
PAGE 63.

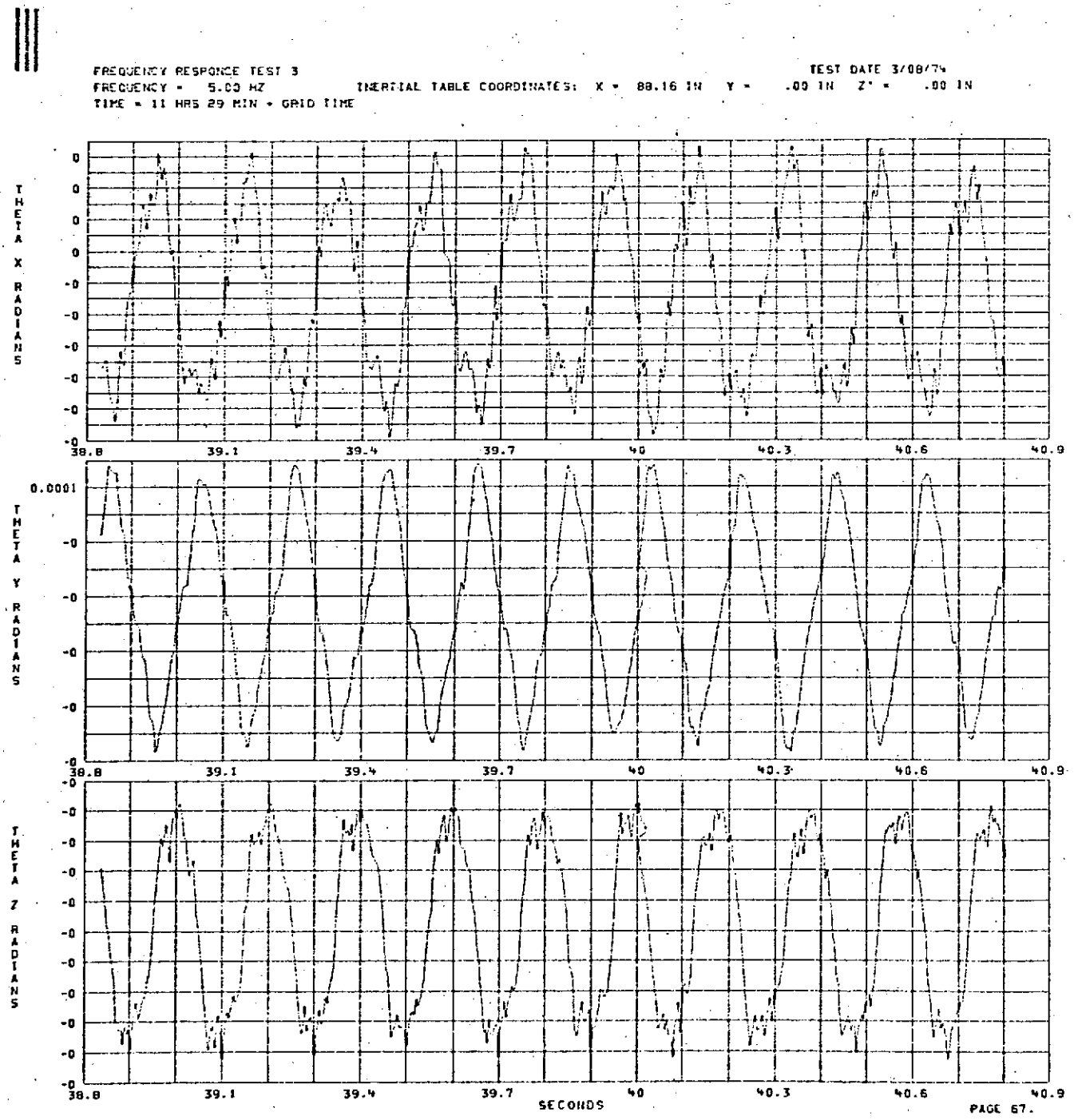
FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 5.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME

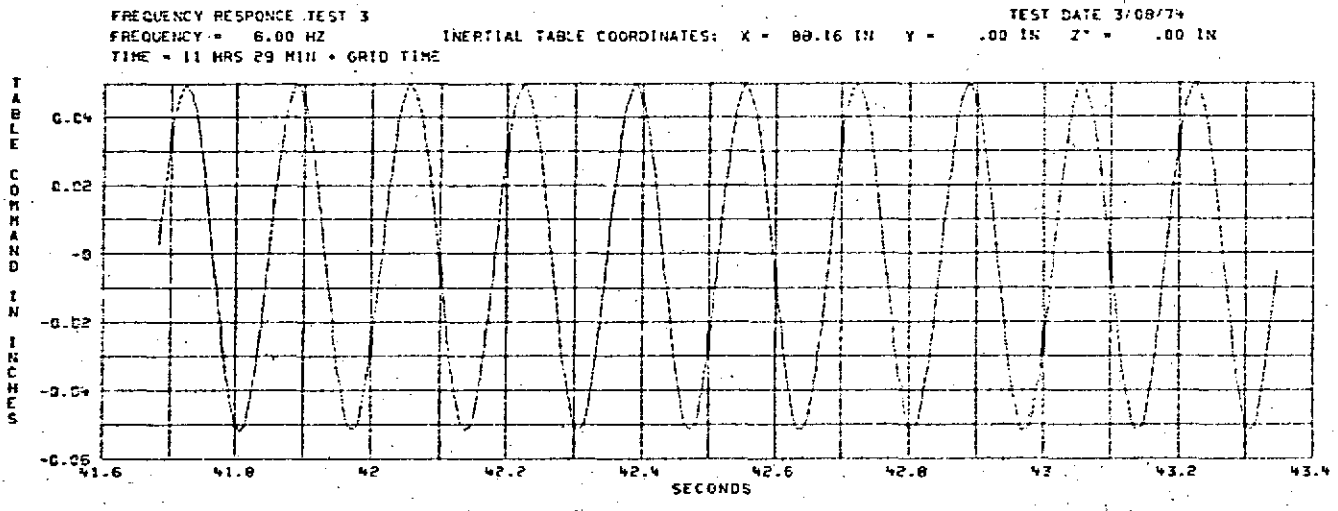


PAGE 64.

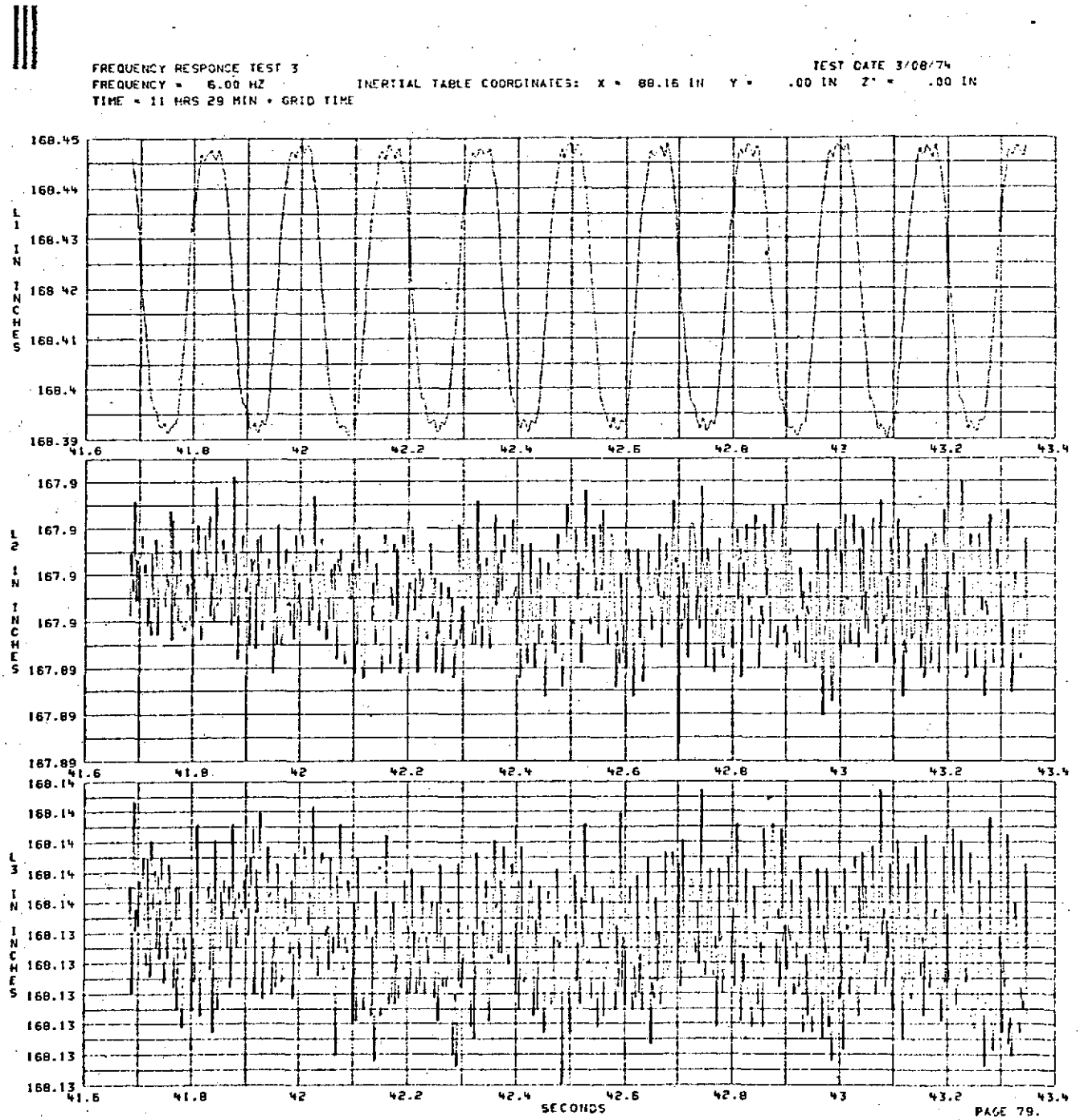

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
L4 IN INCHES
167.66
167.65
167.64
167.63
167.62
167.61
167.6
L5 IN INCHES
168.22
168.2
168.19
168.17
168.16
168.14
L6 IN INCHES
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
167.58
38.8
39.1
39.4
39.7
40
40.3
40.6
40.9
SECONDS
PAGE 65.

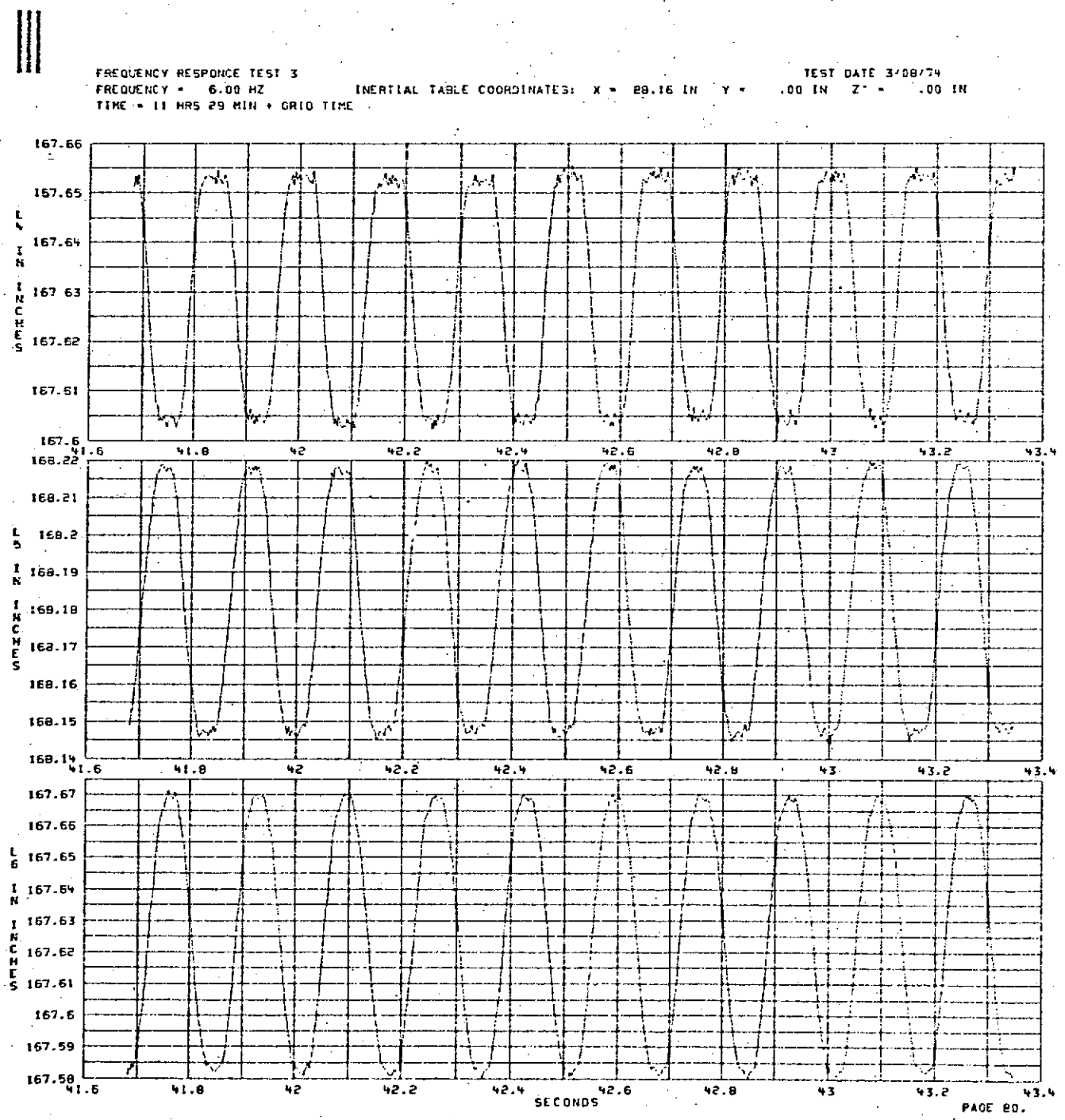

FREQUENCY RESPONCE TEST 3
TEST DATE 3/28/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.1E IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
DELTA X IN INCHES
0.013
0.01
0.007
0.004
0.001
-0.002
DELTA Y IN INCHES
0.05
0.03
0.01
-0.01
-0.03
-0.05
-0.07
DELTA Z IN INCHES
-0.001
-0.003
-0.005
-0.007
-0.009
-0.011
-0.013
38.8
39.1
39.4
39.7
40
40.3
40.6
40.9
SECONDS
PAGE 68.


FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
38.8
39.1
39.4
39.7
40
40.3
40.6
40.9
SECONDS
PAGE 67.

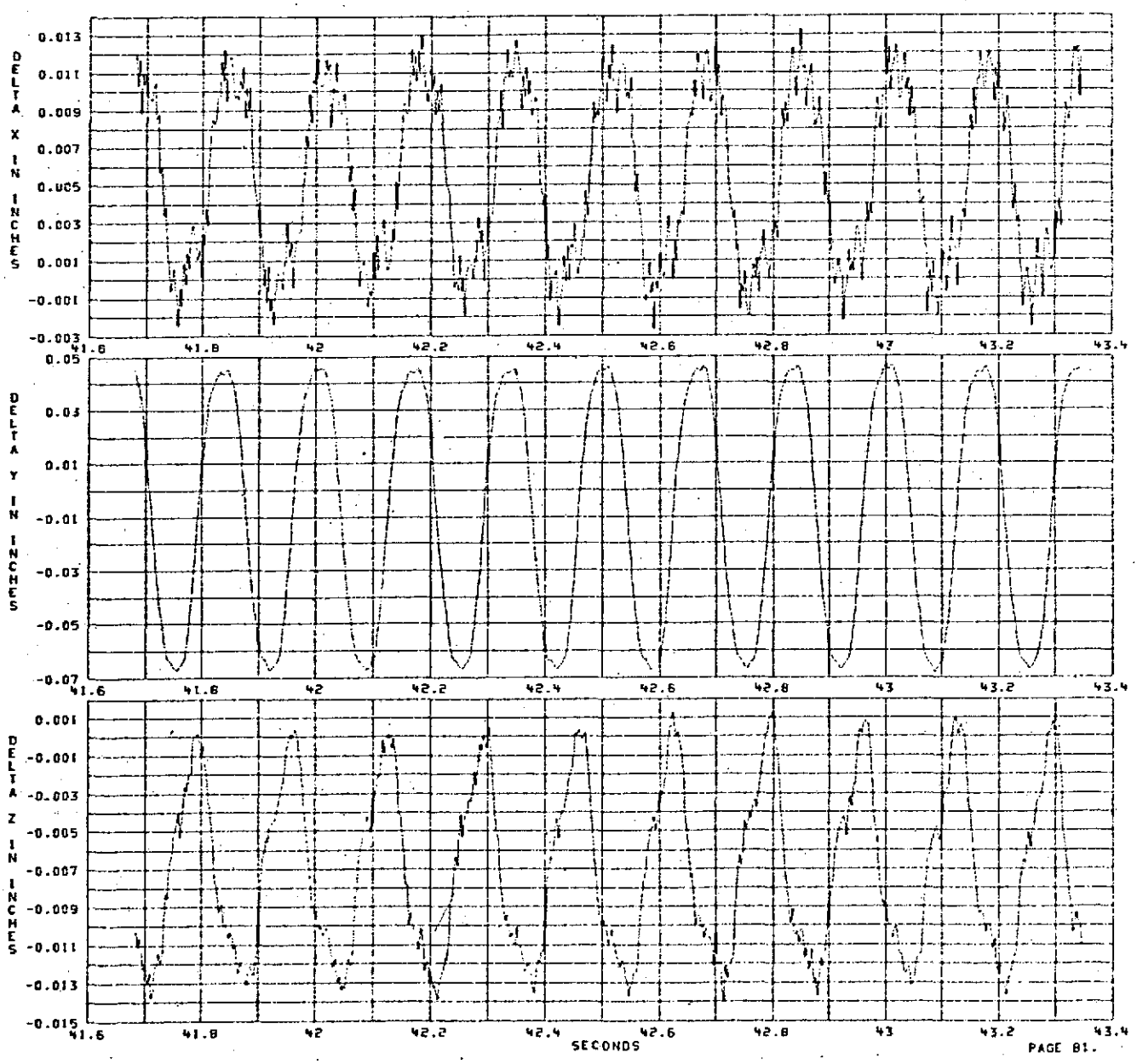

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 80.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
41.6
41.8
42
42.2
42.4
42.6
42.8
43
43.2
43.4
SECONDS

PAGE 78.

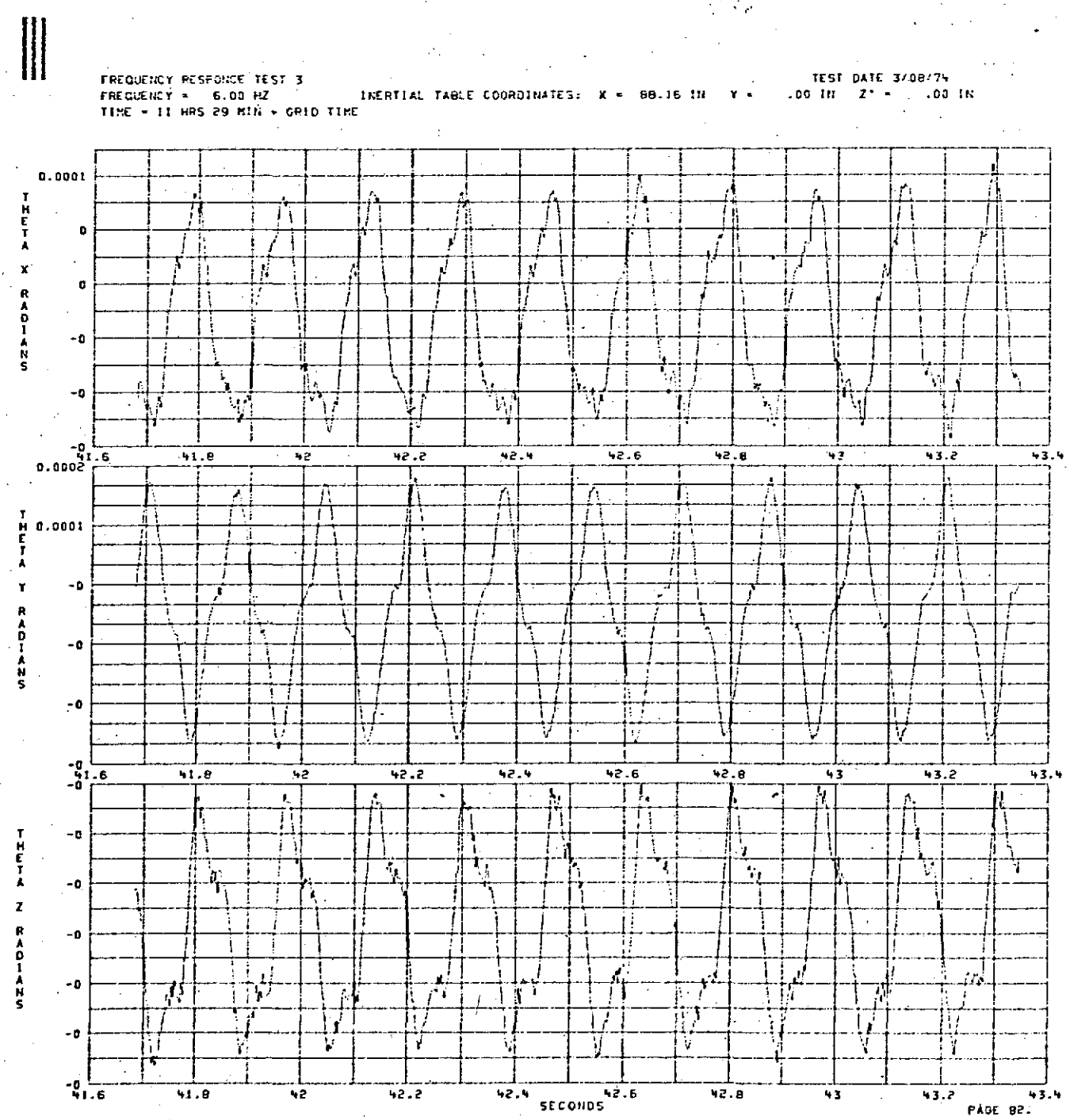

FREQUENCY RESPONSE TEST 3
FREQUENCY = 6.00 HZ
TIME = 11 HRS 29 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.45
168.44
168.43
168 42
168.41
168.4
168.39
L2 IN INCHES
167.9
167.9
167.9
167.89
167.89
167.89
L3 IN INCHES
168.14
168.14
168.14
168.14
168.14
168.13
168.13
168.13
168.13
168.13
41.6
41.8
42
42.2
42.4
42.6
42.8
43
43.2
43.4
SECONDS
PAGE 79.

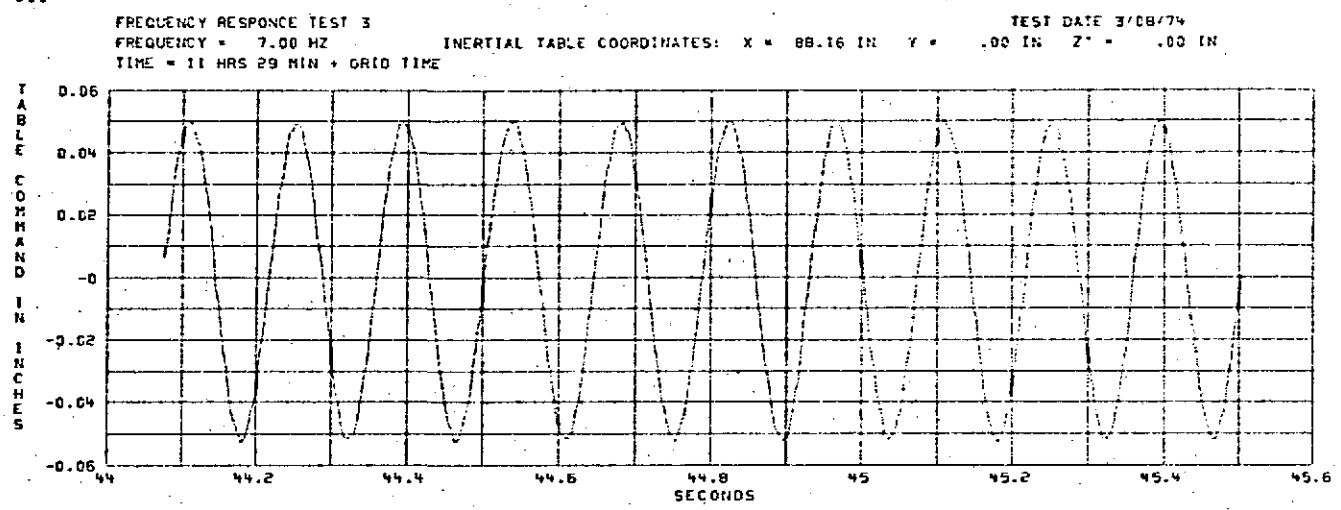

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
L4 IN INCHES
167.66
167.65
167.64
167.63
167.62
167.61
167.6
L5 IN INCHES
168.22
168.21
168.2
168.19
168.18
168.17
168.16
168.15
168.14
L6 IN INCHES
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
167.58
41.6
41.8
42
42.2
42.4
42.6
42.8
43
43.2
43.4
SECONDS
PAGE 80.

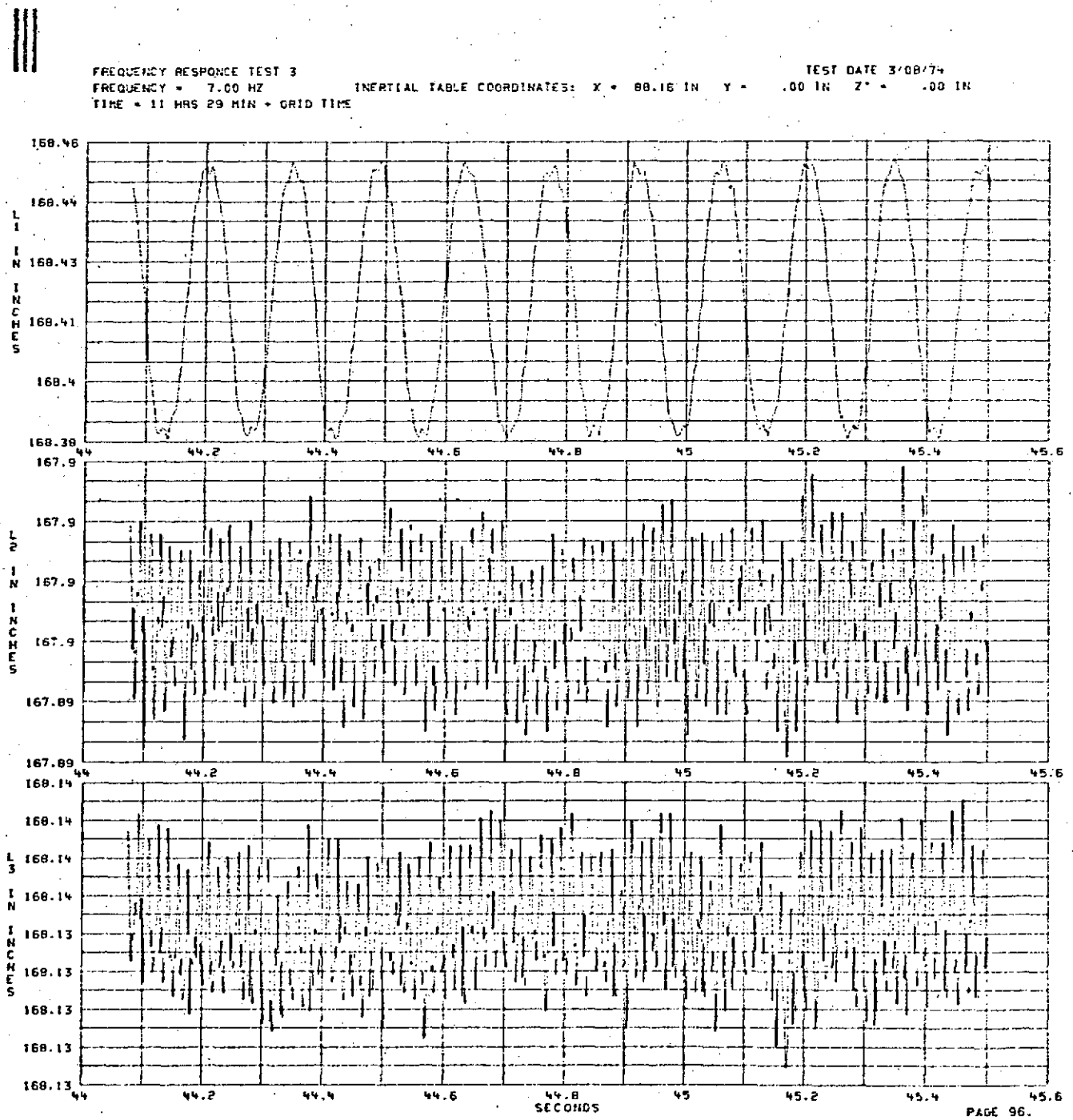
FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 6.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME

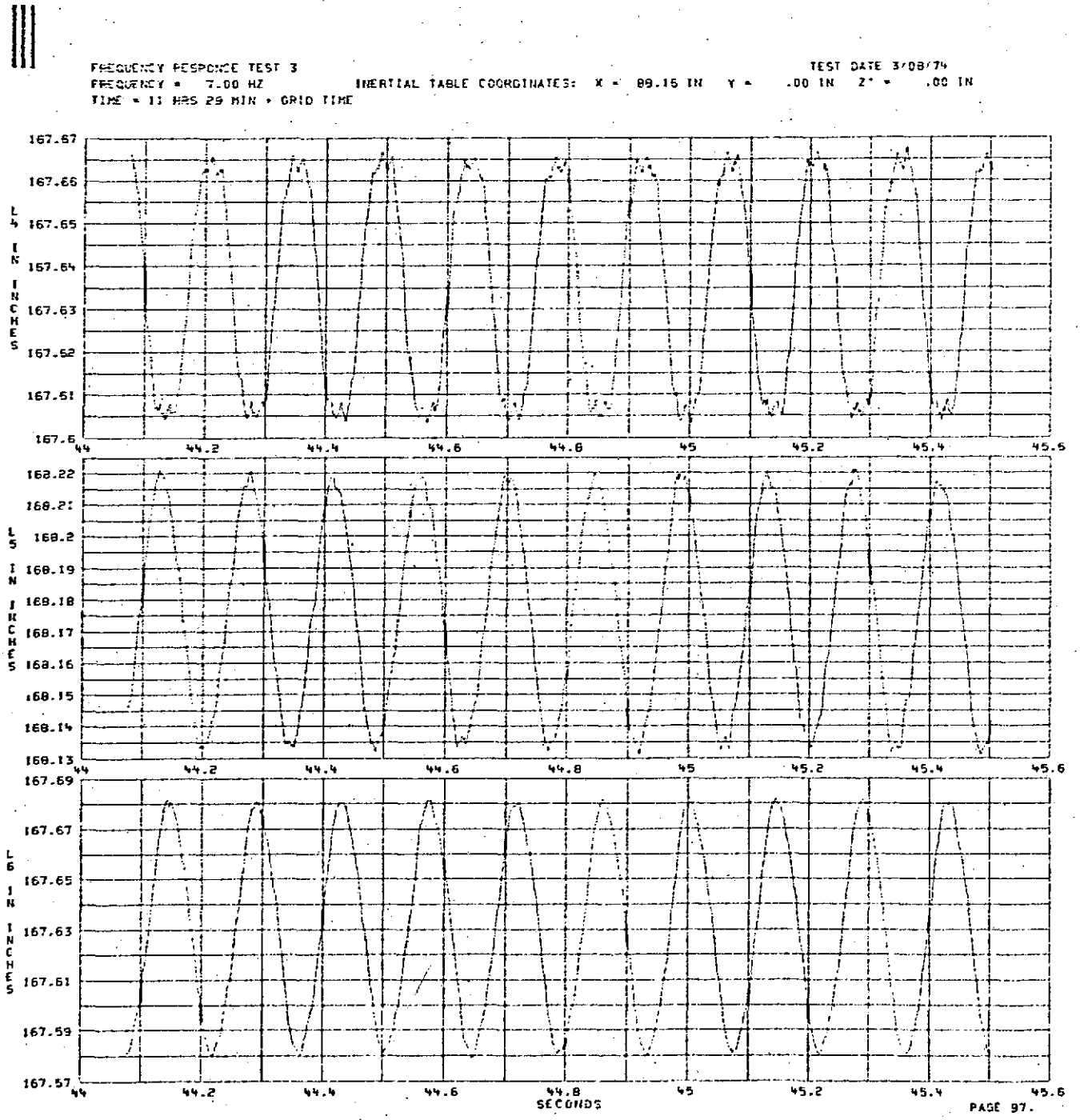


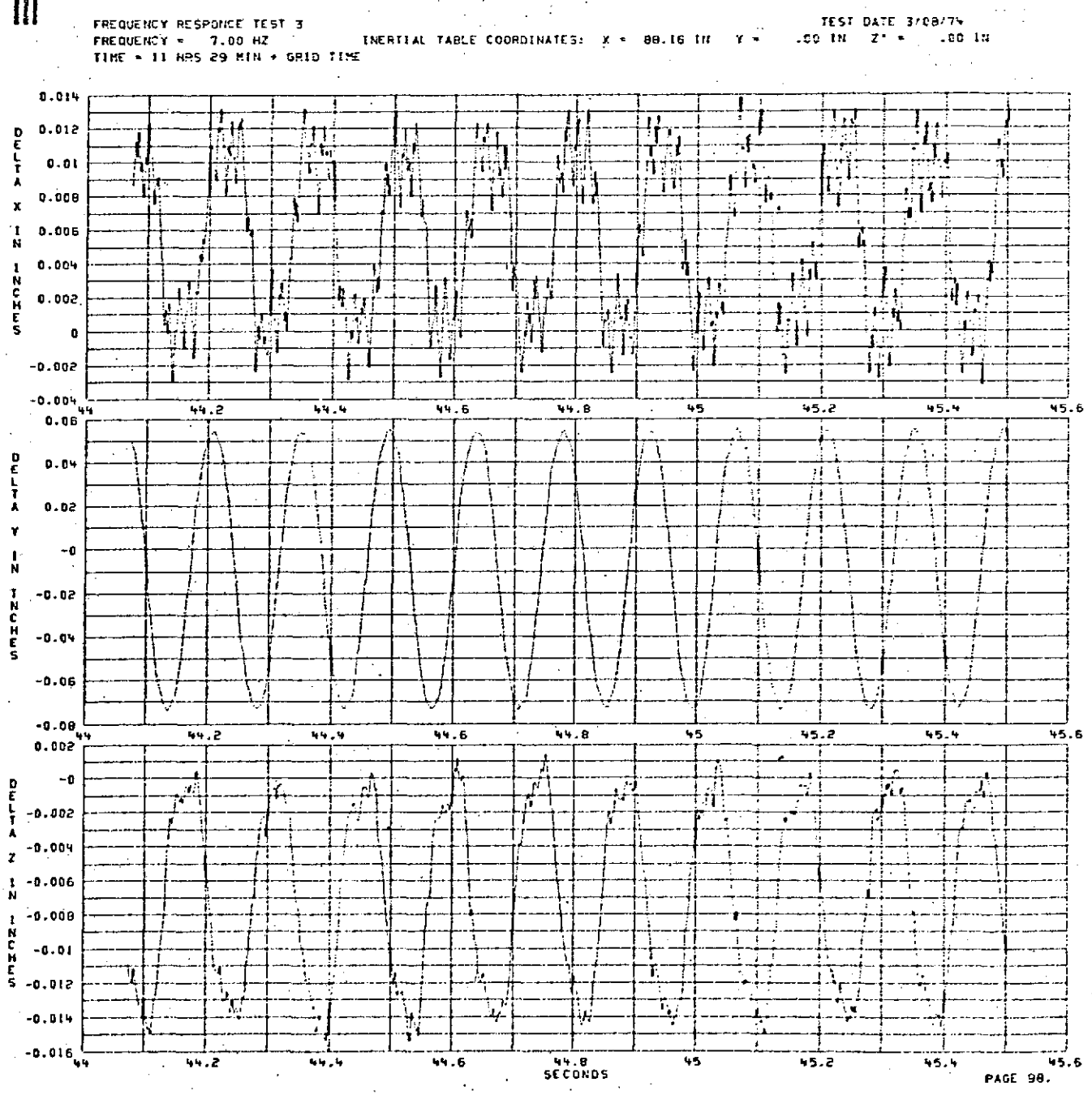
PAGE 81.


FREQUENCY RESPONCE TEST 3
FREQUENCY = 6.00 HZ
TIME = 11 HRS 29 MIN - GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0001
0.0002
-0
41.6
41.8
42
42.2
42.4
42.6
42.8
43
43.2
43.4
SECONDS
PAGE 82.


FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
44
44.2
44.4
44.6
44.8
45
45.2
45.4
45.6
SECONDS


FREQUENCY RESPONCE TEST 3
FREQUENCY = 7.00 HZ
TIME = 11 HRS 29 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.46
168.44
168.43
168.41
168.4
168.38
L2 IN INCHES
167.9
167.9
167.9
167.9
167.89
167.89
L3 IN INCHES
168.14
168.14
168.14
168.14
168.13
168.13
168.13
168.13
44
44.2
44.4
44.6
44.8
45
45.2
45.4
45.6
SECONDS
PAGE 96.

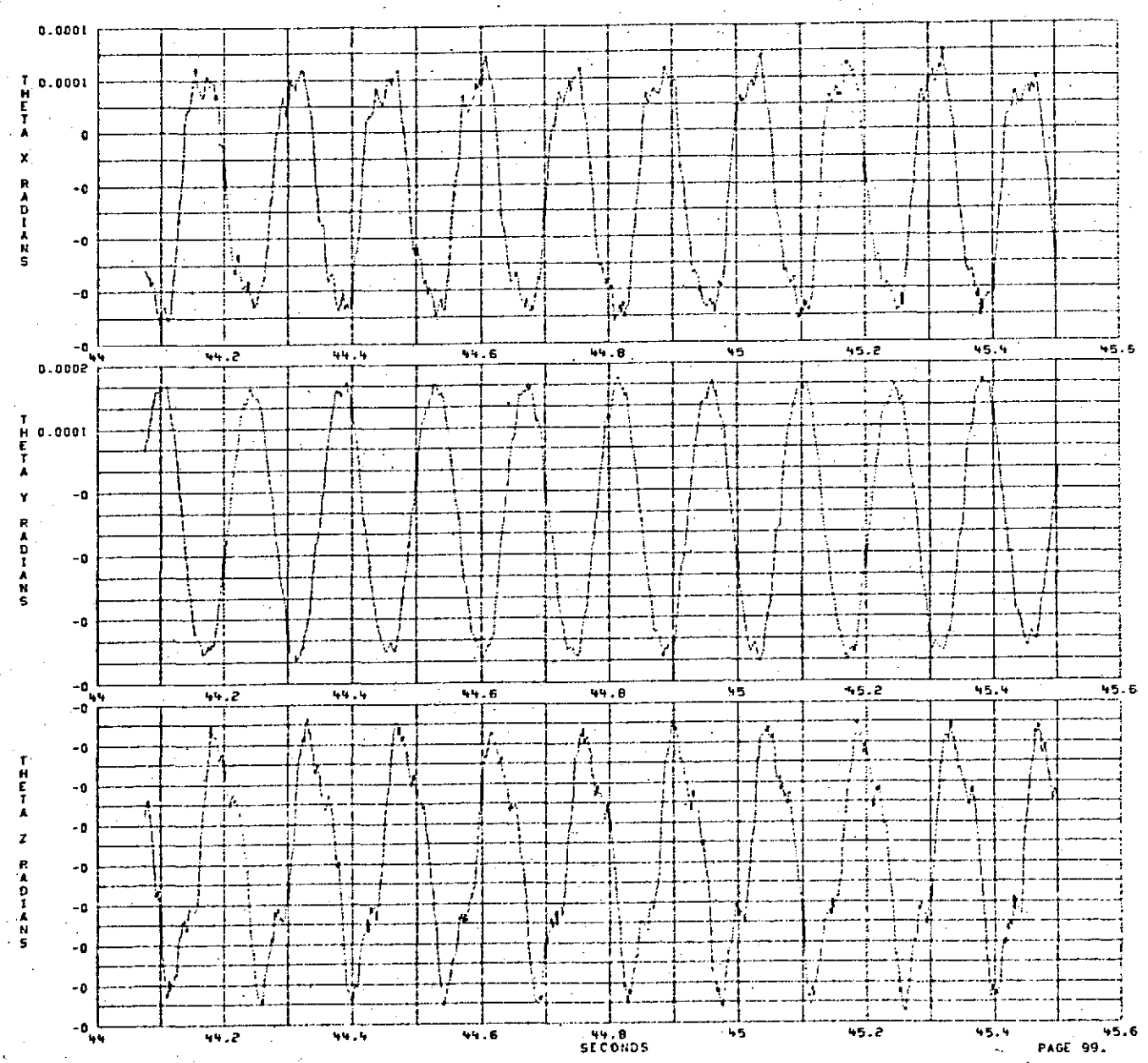

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 89.15 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN - GRID TIME
L4 IN INCHES
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
L5 IN INCHES
168.22
168.21
168.2
168.19
168.18
168.17
168.16
168.15
168.14
168.13
L6 IN INCHES
167.69
167.67
167.65
167.63
167.61
167.59
167.57
44
44.2
44.4
44.6
44.8
45
45.2
45.4
45.6
SECONDS
PAGE 97.


FREQUENCY RESPONCE TEST 3
FREQUENCY = 7.00 HZ
TIME = 11 HRS 29 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
DELTA Y IN INCHES
DELTA Z IN INCHES
SECONDS
PAGE 98.

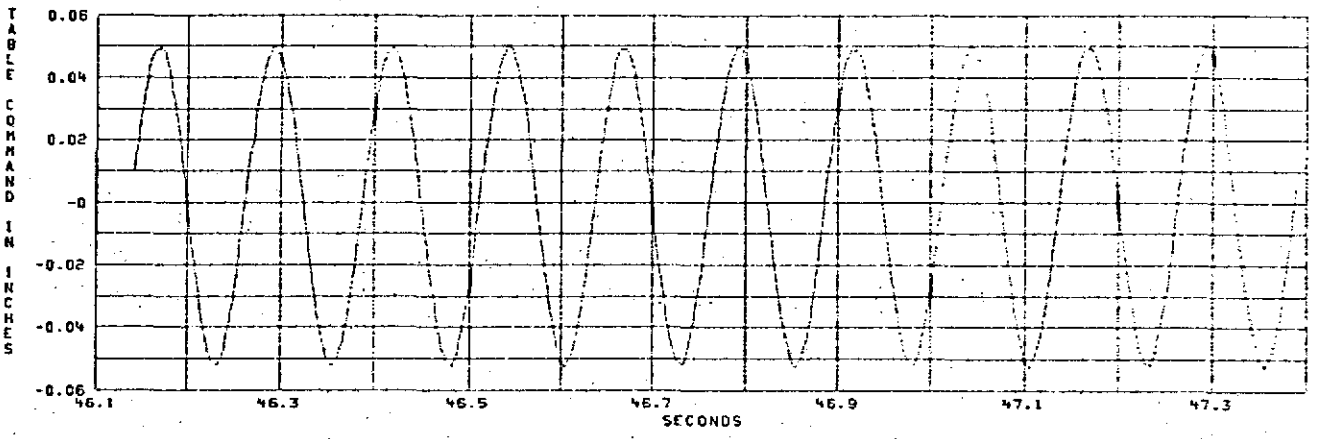
FREQUENCY RESPONCE TEST 3
FREQUENCY = 7.69 HZ
TIME = 11 HRS 29 MIN + GRID TIME

INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN

TEST DATE 3/08/74

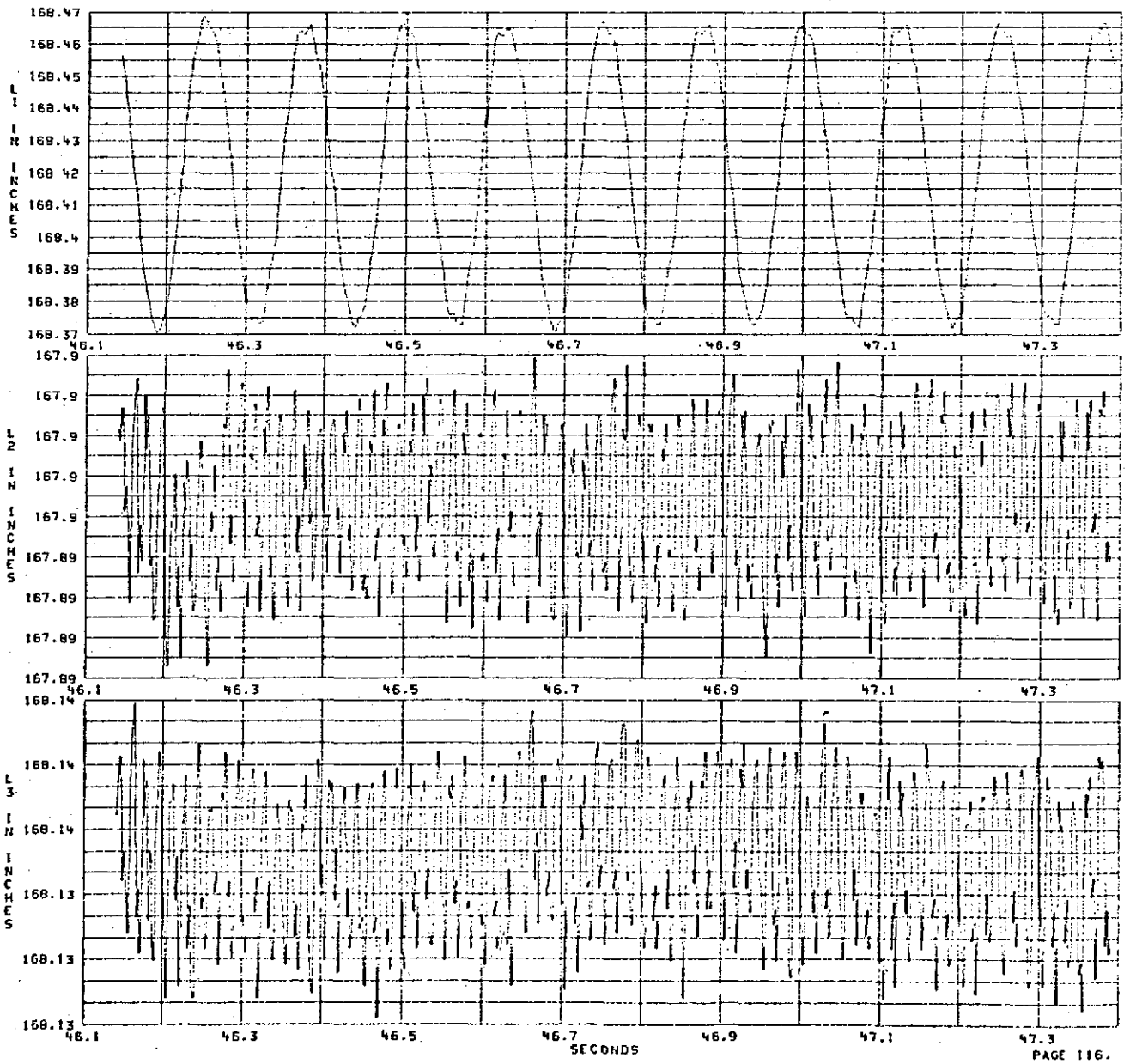


PAGE 99.

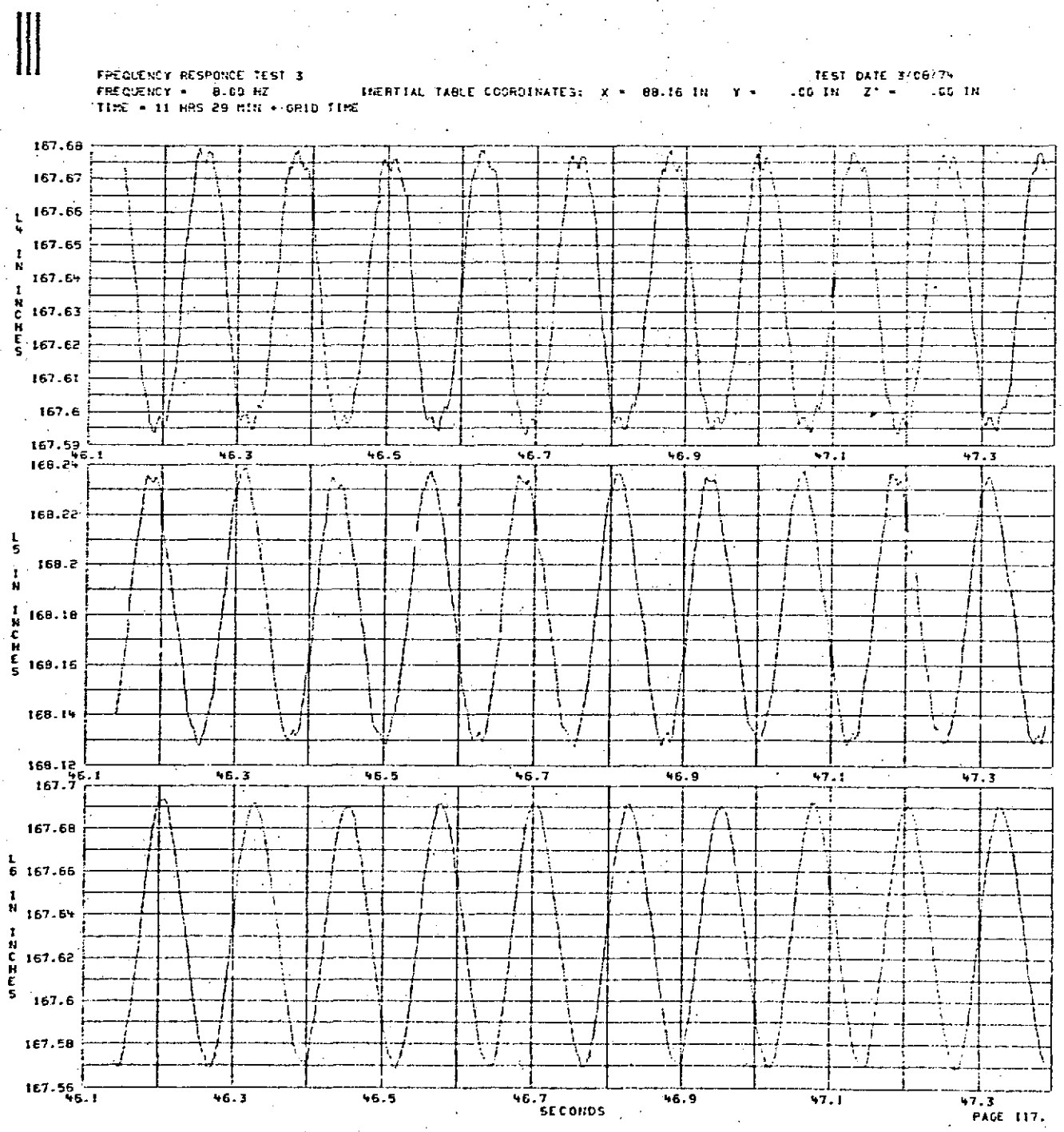

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 8.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
46.1
46.3
46.5
46.7
46.9
47.1
47.3
SECONDS

PAGE 115.

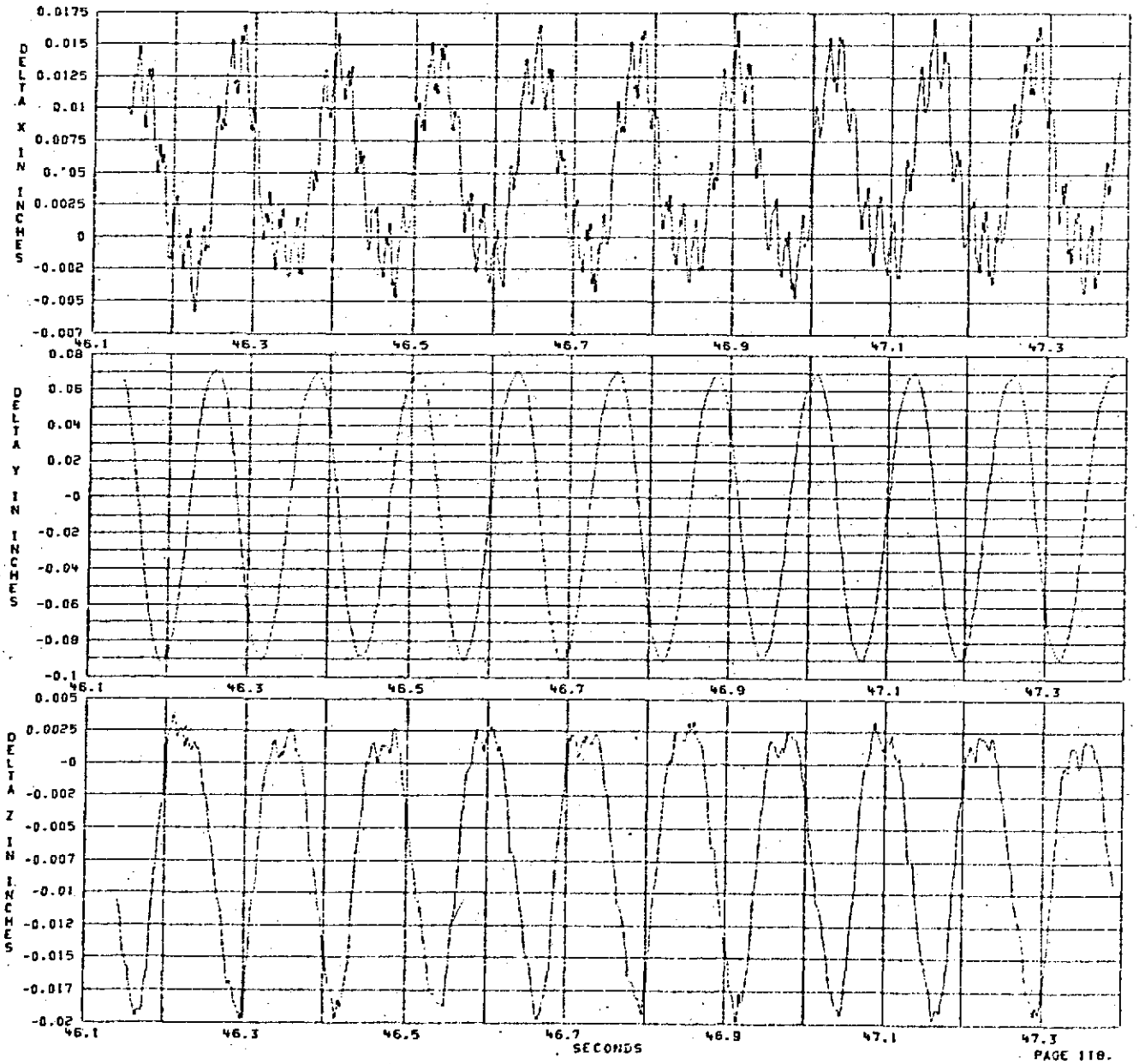
FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 8.00 HZ INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z' = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME



PAGE 116.

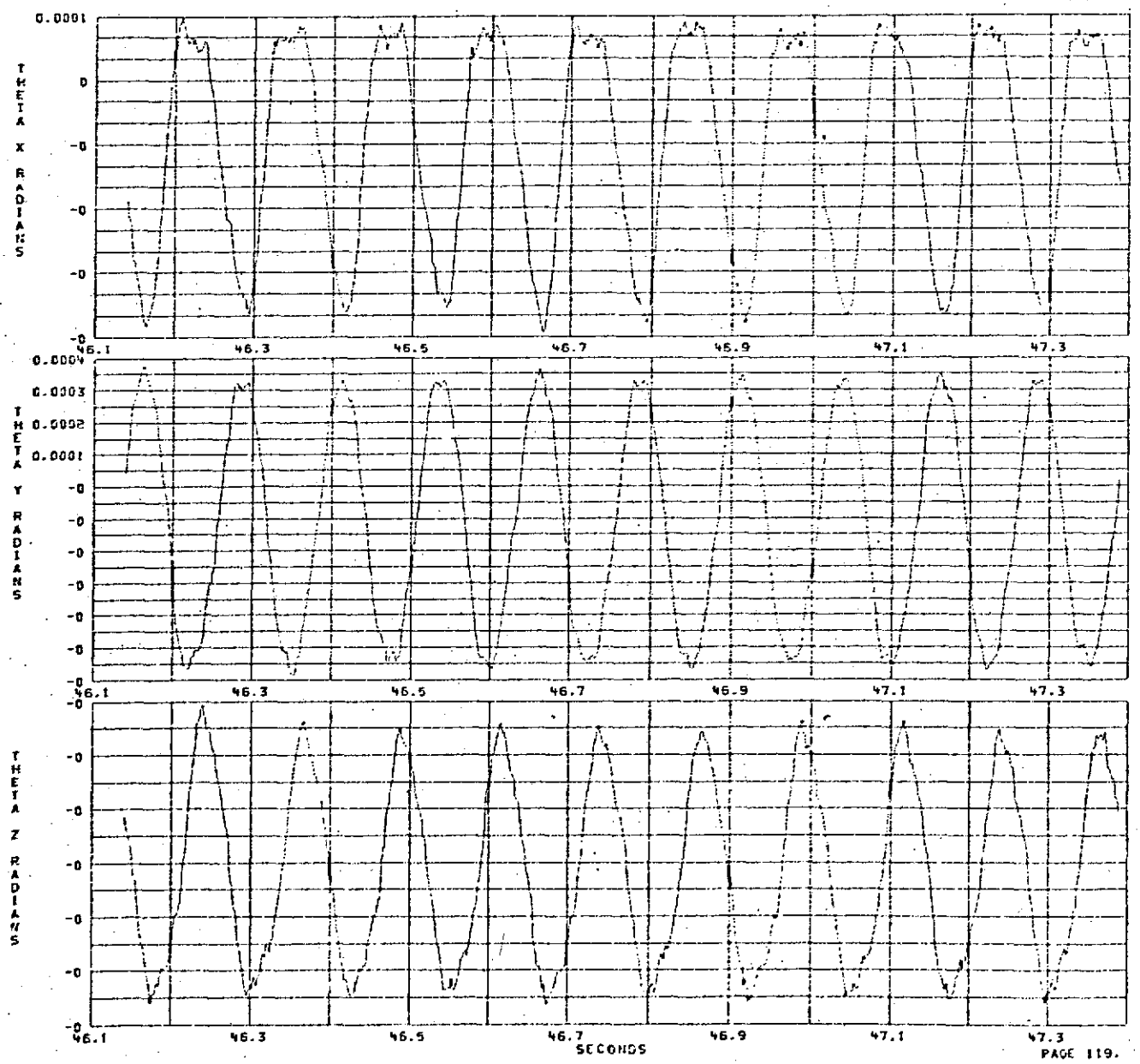

FREQUENCY RESPONCE TEST 3
TEST DATE 3/06/74
FREQUENCY = 8.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME
L4 IN INCHES
167.68
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
L5 IN INCHES
168.24
168.22
168.2
168.18
168.16
168.14
168.12
L6 IN INCHES
167.7
167.68
167.66
167.64
167.62
167.6
167.58
167.56
46.1
46.3
46.5
46.7
46.9
47.1
47.3
SECONDS
PAGE 117.

FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 8.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME

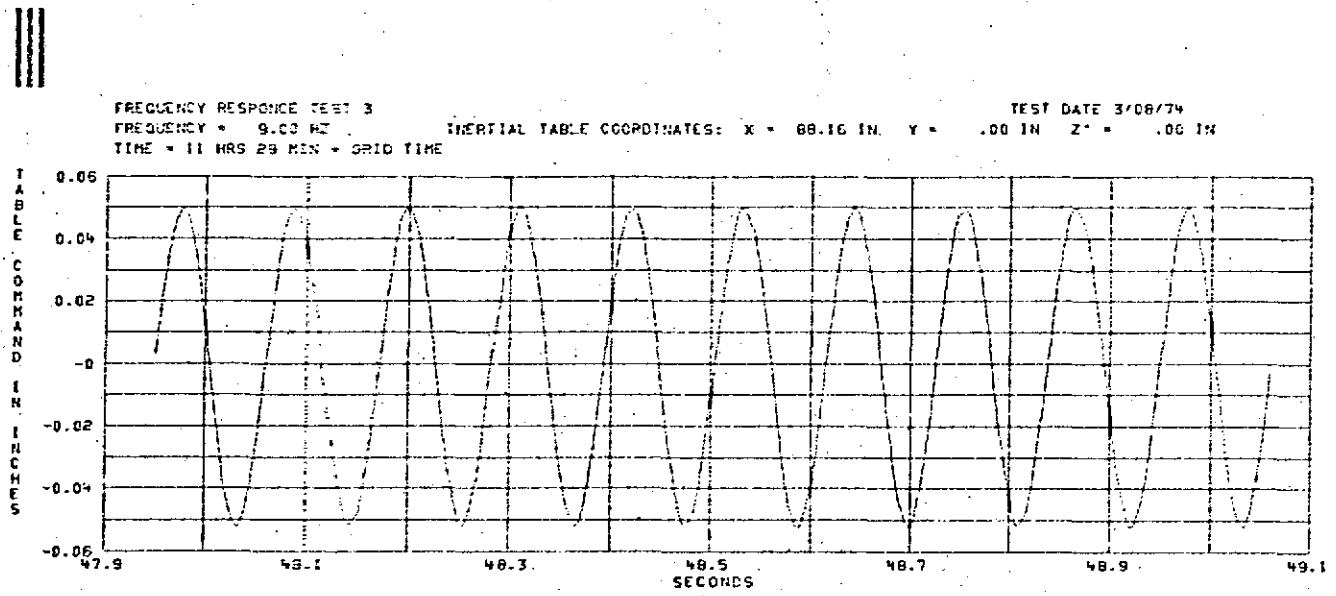


PAGE 118.

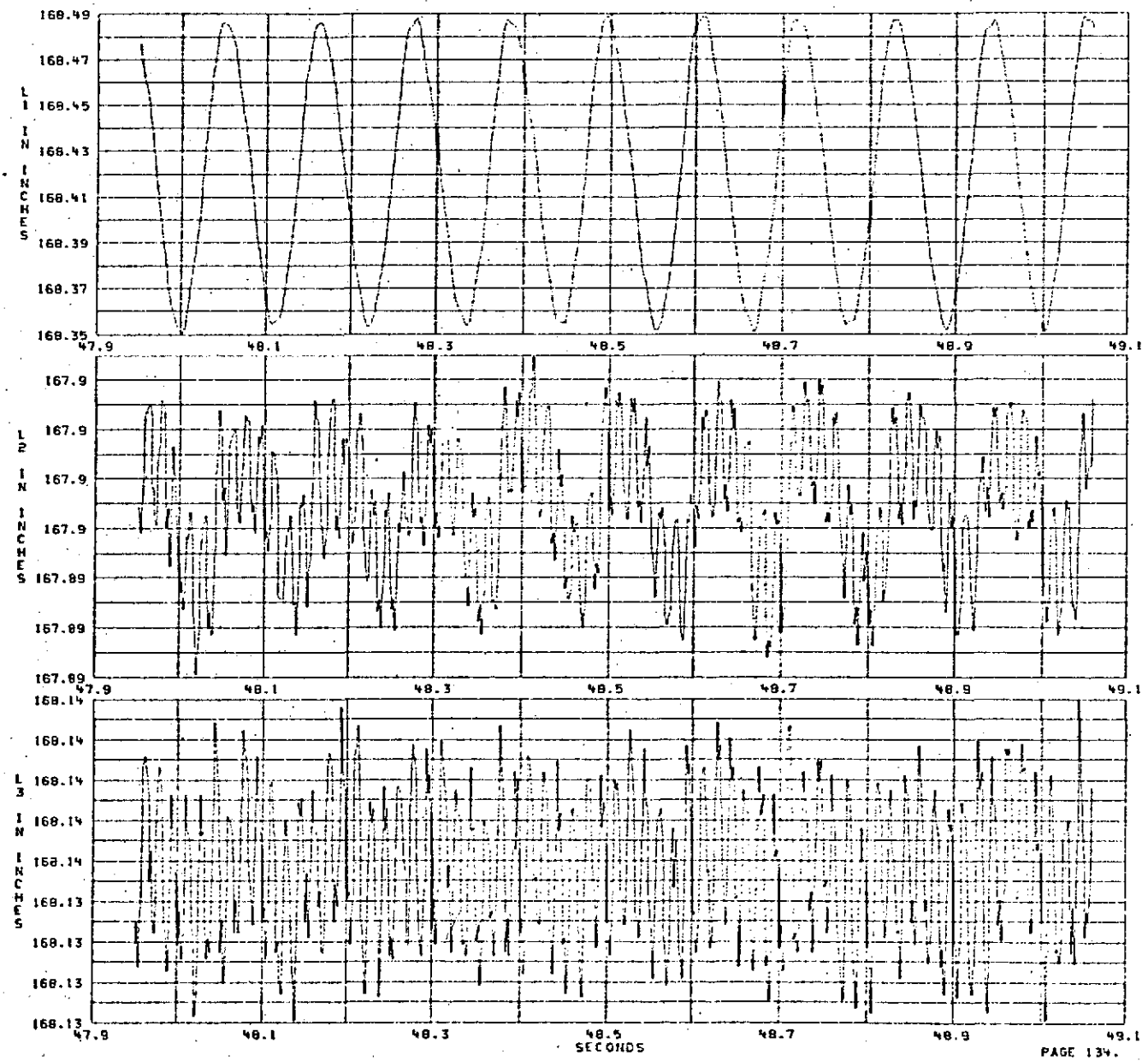
FREQUENCY RESPONCE TEST 3
FREQUENCY = 8.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN - GRID TIME
TEST DATE 3/08/74



PAGE 119.

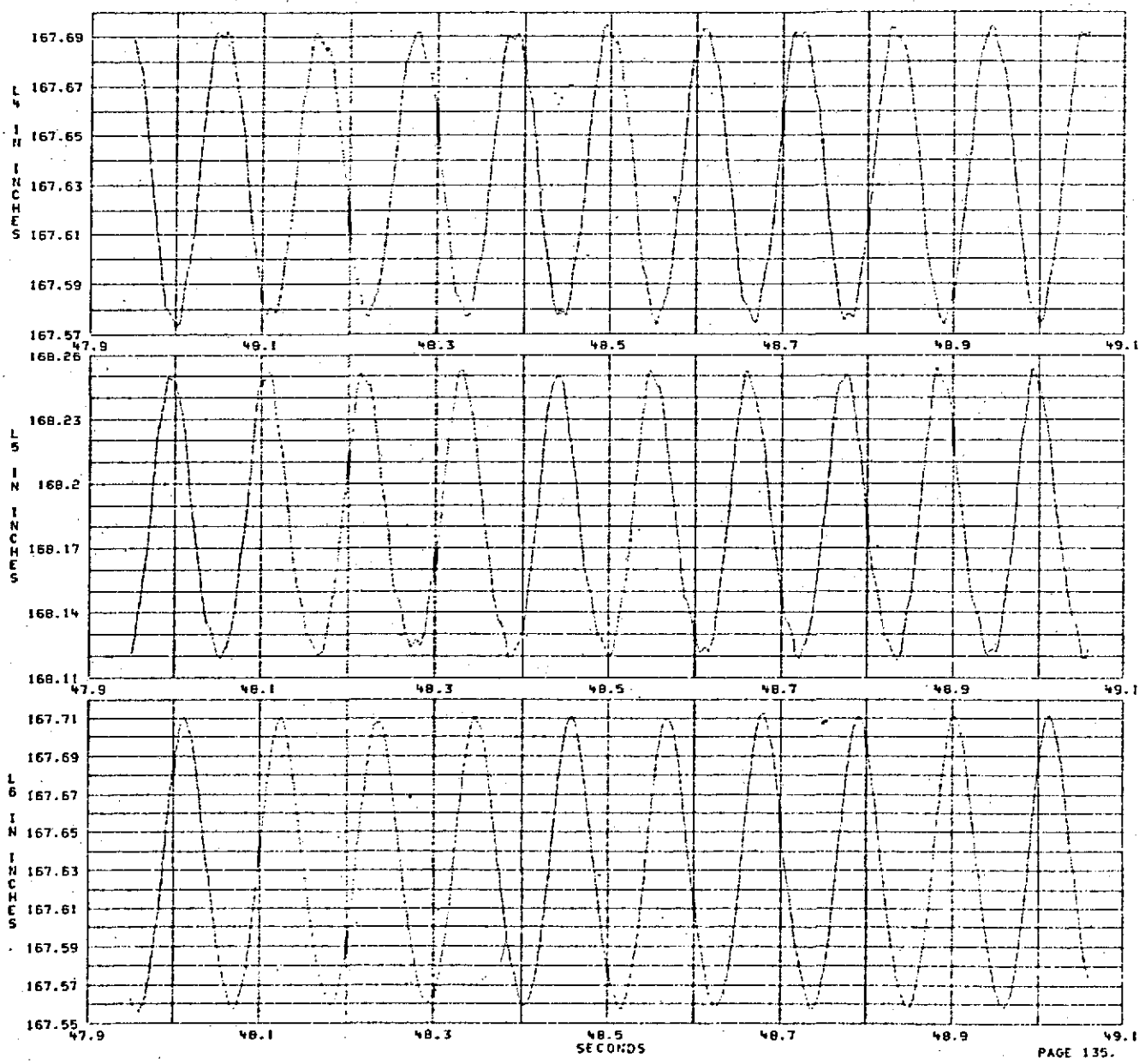

FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 9.03 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN. Y = .00 IN Z' = .06 IN
TIME = 11 HRS 29 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
47.9
48.1
48.3
48.5
48.7
48.9
49.1
SECONDS

FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 9.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN + GRID TIME

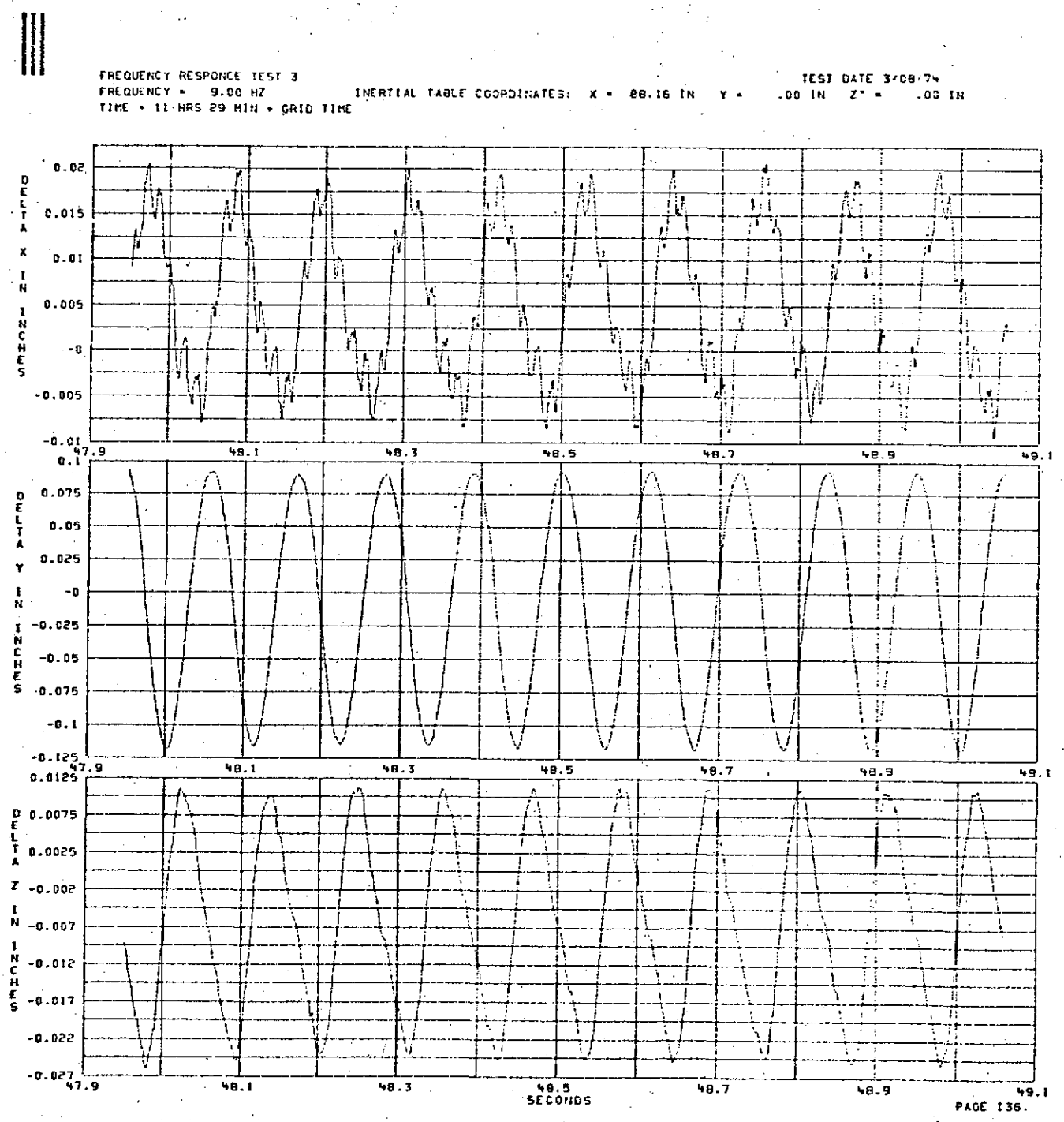


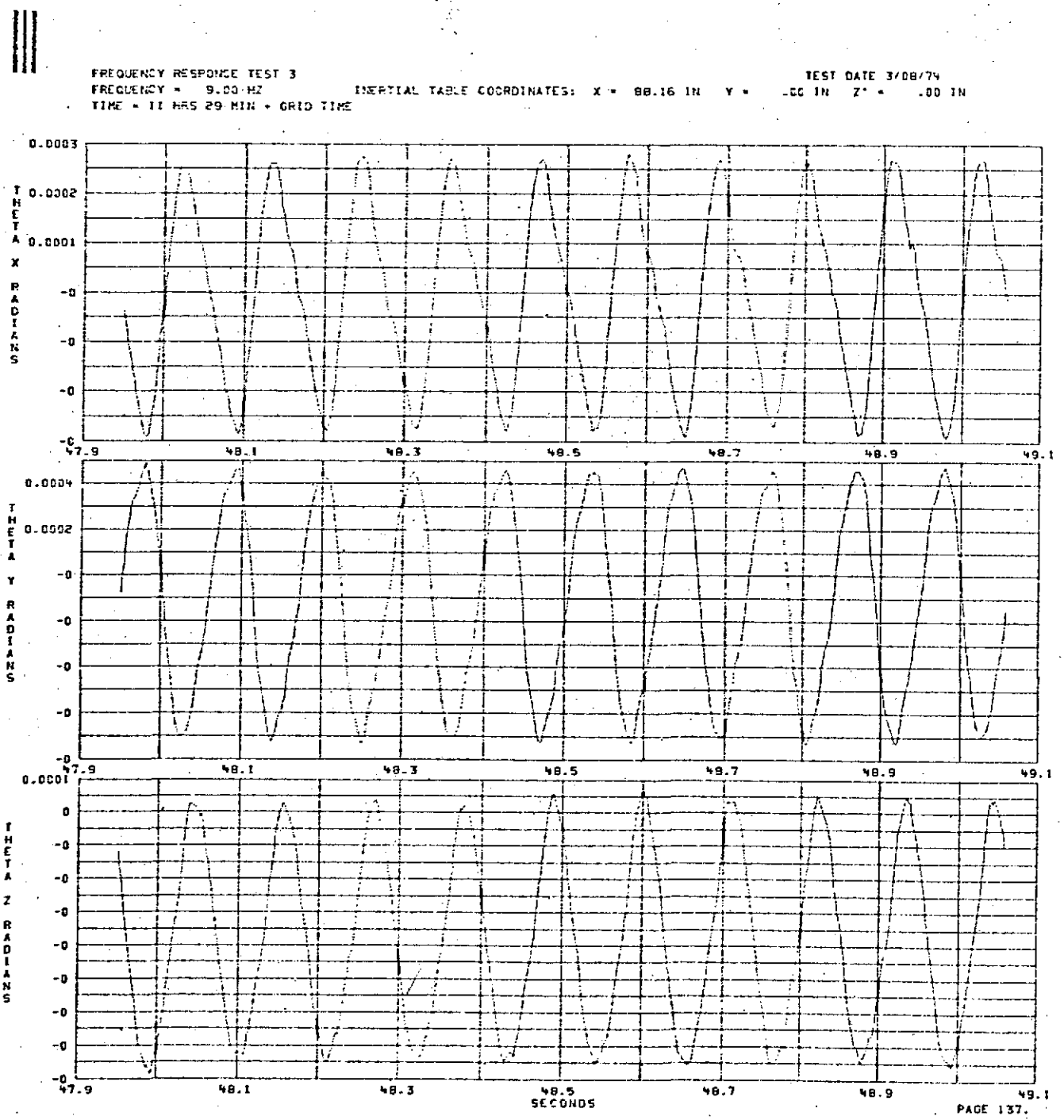
PAGE 134.

FREQUENCY RESPONCE TEST 3 TEST DATE 3/08/74
FREQUENCY = 9.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME



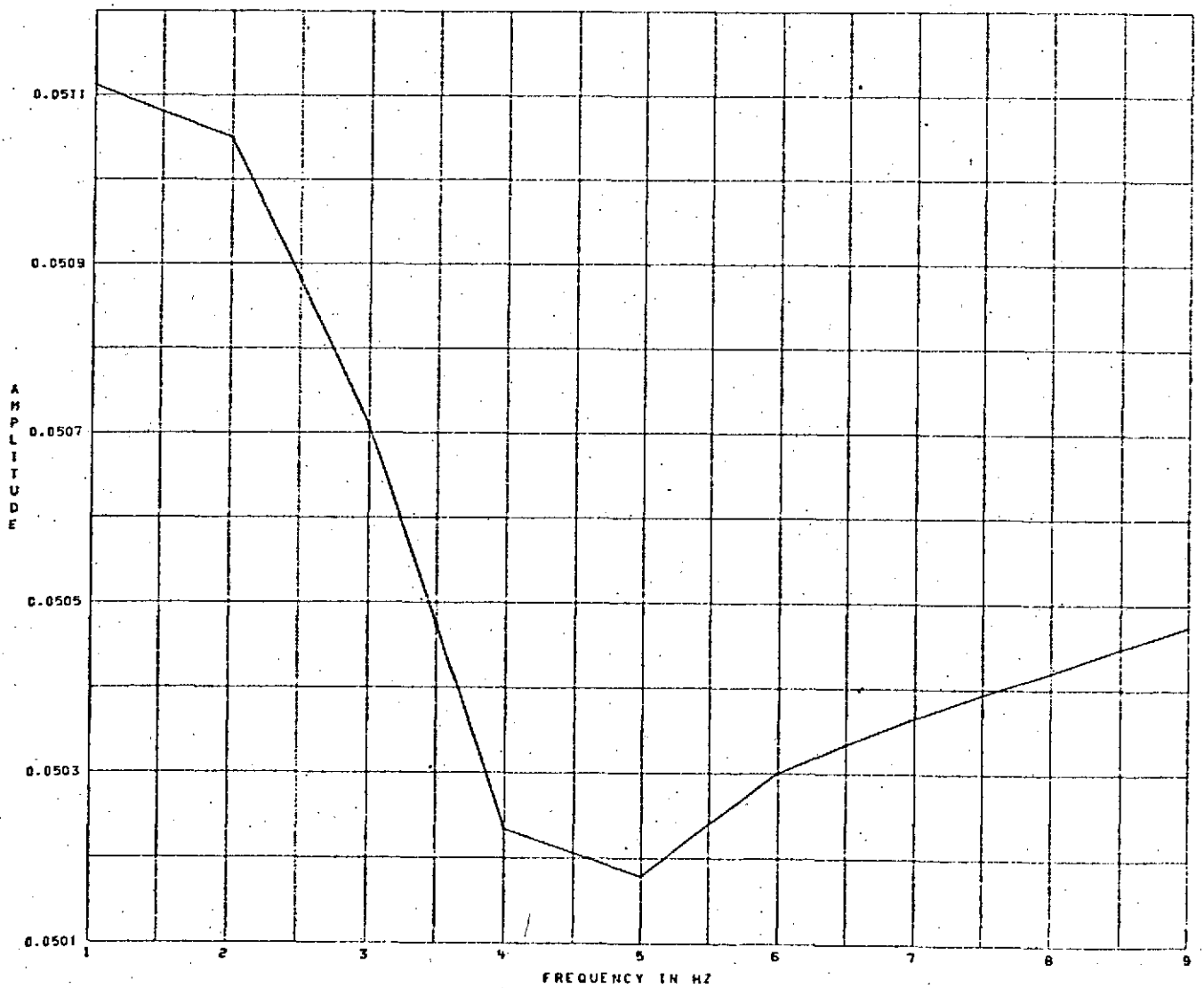
PAGE 135.


FREQUENCY RESPONCE TEST 3
FREQUENCY = 9.00 HZ
TIME = 11 HRS 29 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 00.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
0.02
0.015
0.01
0.005
-0
-0.005
-0.01
DELTA Y IN INCHES
0.1
0.075
0.05
0.025
-0
-0.025
-0.05
-0.075
-0.1
-0.125
DELTA Z IN INCHES
0.0125
0.0075
0.0025
-0.002
-0.007
-0.012
-0.017
-0.022
-0.027
47.9
48.1
48.3
48.5
48.7
48.9
49.1
SECONDS
PAGE 136.


FREQUENCY RESPONCE TEST 3
TEST DATE 3/08/74
FREQUENCY = 9.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 29 MIN = GRID TIME
THETA X RADIANS
0.0003
0.0002
0.0001
-0
-0
-0
-0
47.9
48.1
48.3
48.5
48.7
48.9
49.1
THETA Y RADIANS
0.0004
0.0002
-0
-0
-0
-0
-0
47.9
48.1
48.3
48.5
48.7
48.9
49.1
THETA Z RADIANS
0.0001
0
-0
-0
-0
-0
-0
-0
-0
47.9
48.1
48.3
48.5
48.7
48.9
49.1
SECONDS
PAGE 137.

FREQUENCY RESPONSE TEST 3
REFERENCE SENSOR - TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ

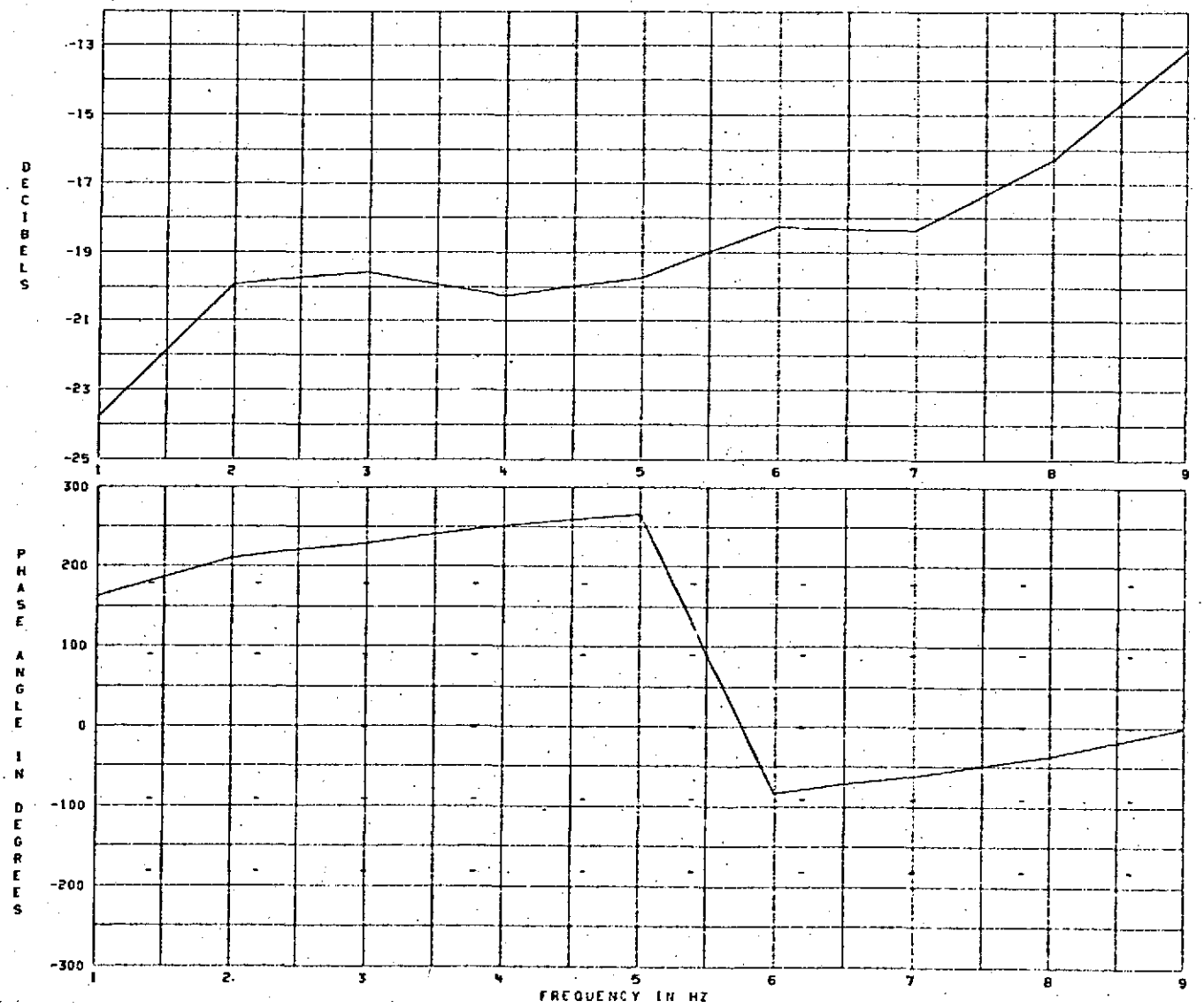
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 42.43 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 0.

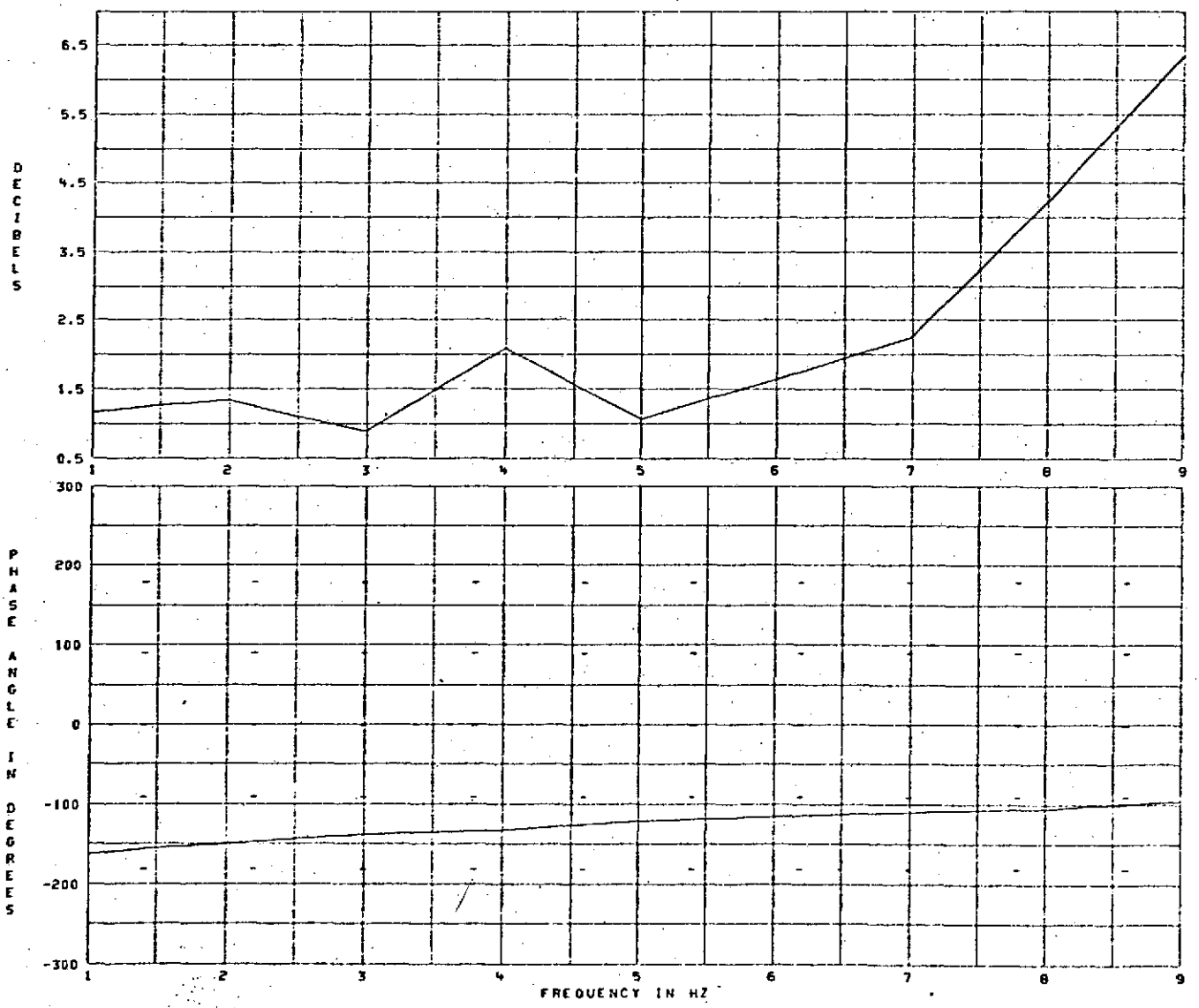
FREQUENCY RESPONCE TEST 3
SENSOR -DELT X NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 42.43 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 1.

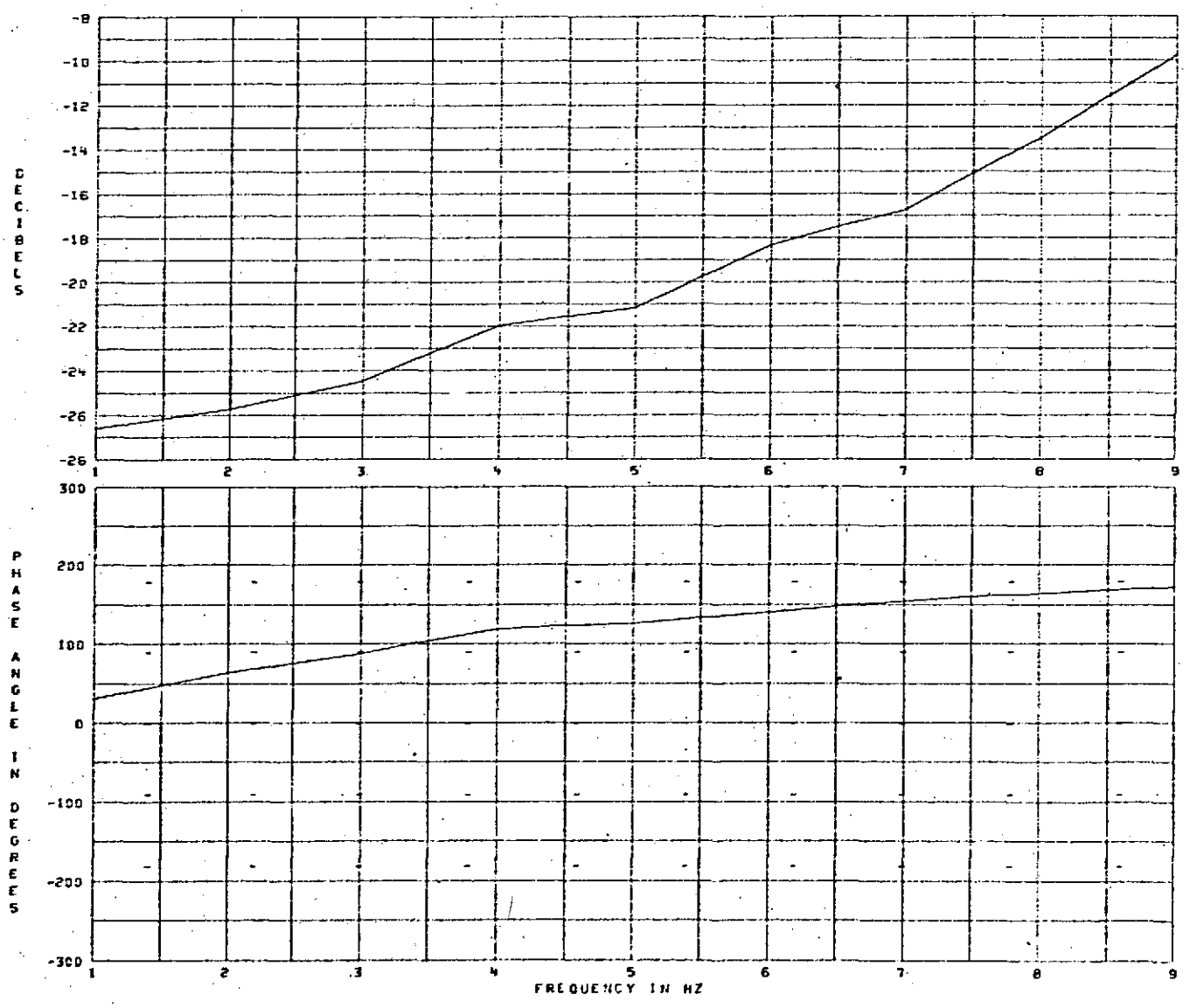
FREQUENCY RESPONCE TEST 3 DATE PROCESSED - 09APR74
SENSOR -DELT Y NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0 TOTAL PERIOD PROCESSED = 42.43 SEC
FIRST FREQUENCY = 1.00 HZ FREQUENCY INCREMENTS = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ



PAGE 2.

FREQUENCY RESPONCE TEST 3
SENSOR -DELT Z NORMALIZED BY REFERENCE SENSOR -TABCDM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ

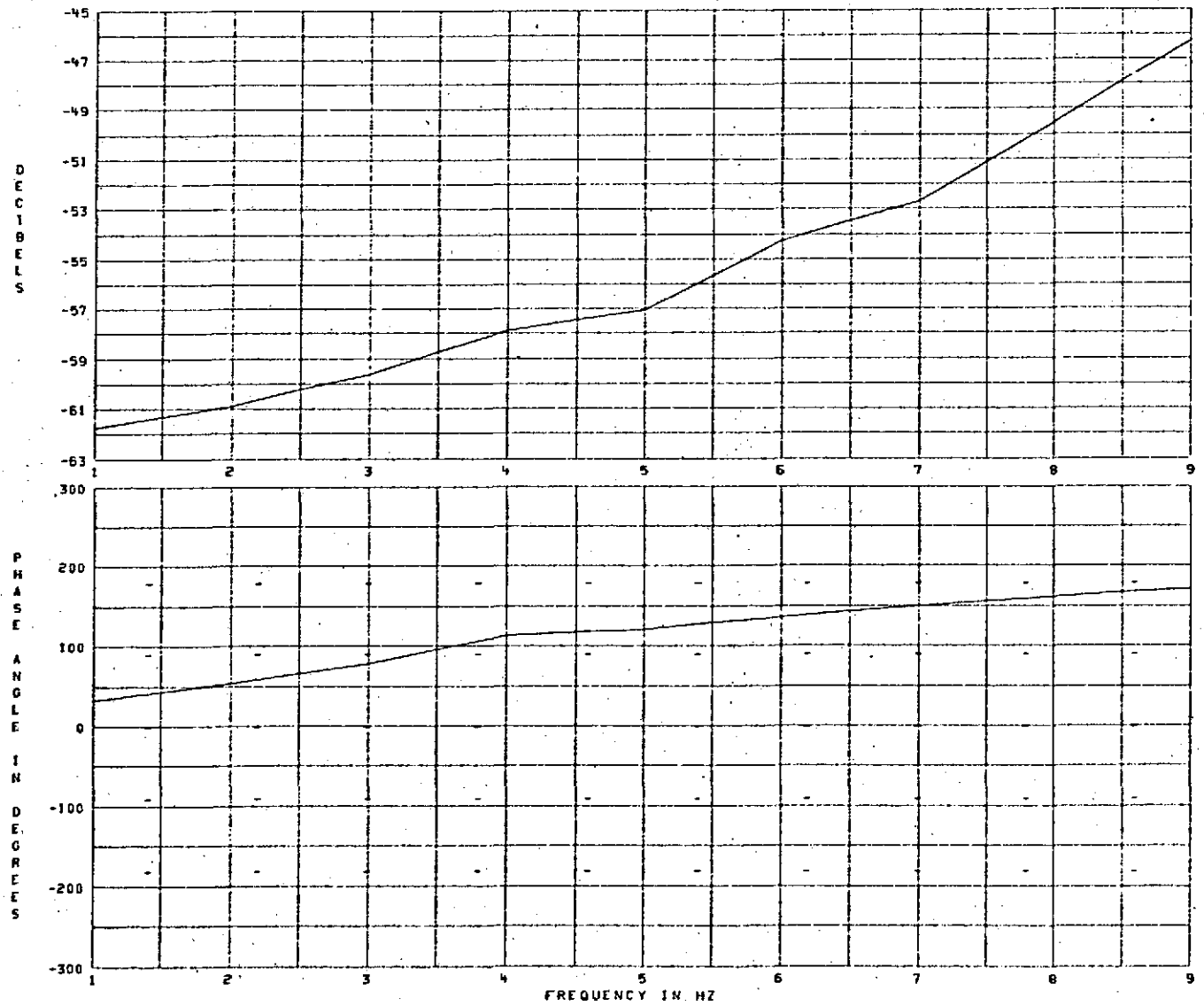
DATE PROCESSED - 05APR74
TOTAL PERIOD PROCESSED = 42.43 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 3.

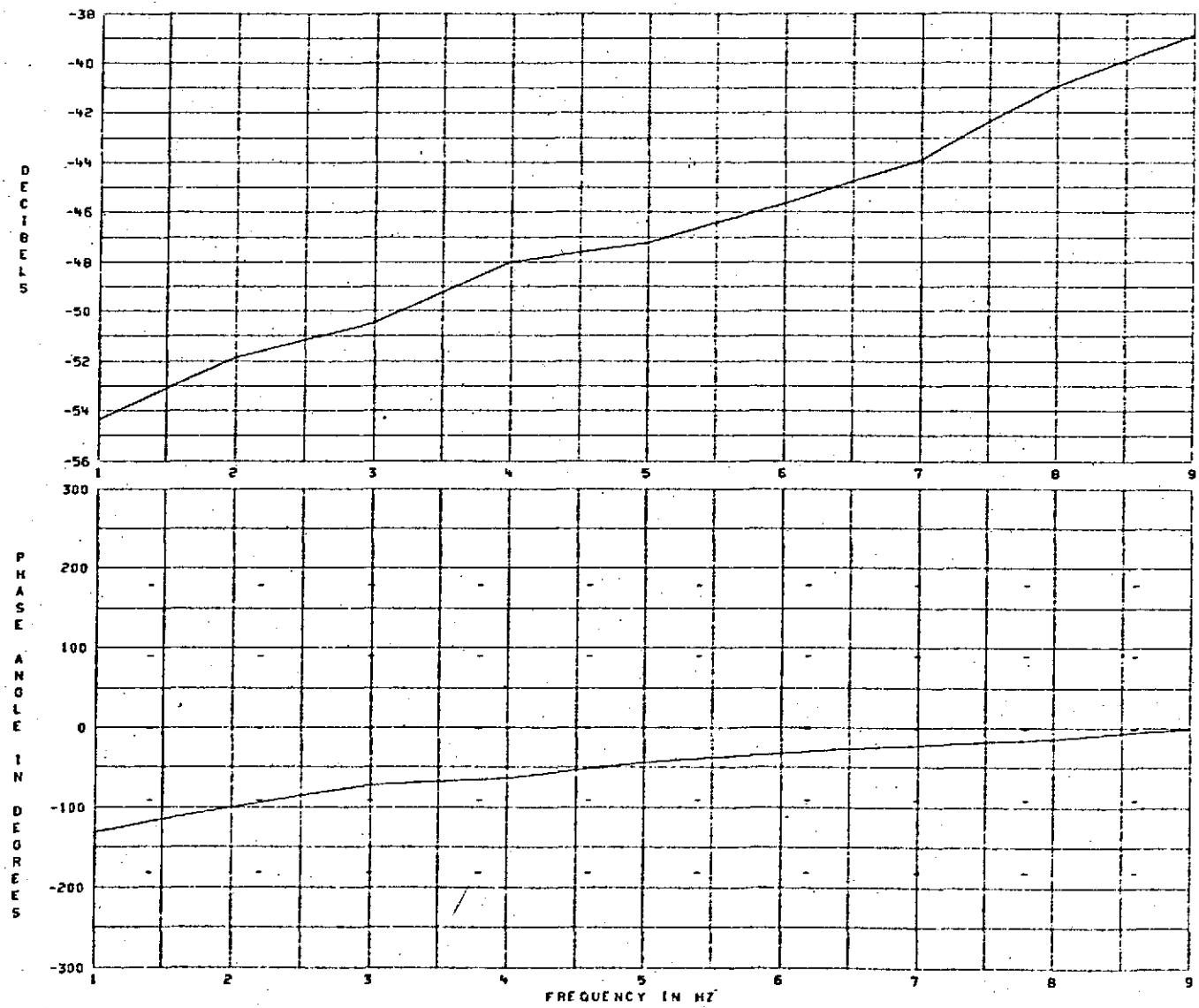
FREQUENCY RESPONCE TEST 3
SENSOR -XTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 42.43 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 4.

FREQUENCY RESPONCE TEST 3 DATE PROCESSED - 09APR74
SENSOR -YTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0 TOTAL PERIOD PROCESSED = 42.43 SEC
FIRST FREQUENCY = 1.00 HZ FREQUENCY INCREMENTS = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ



PAGE 5.

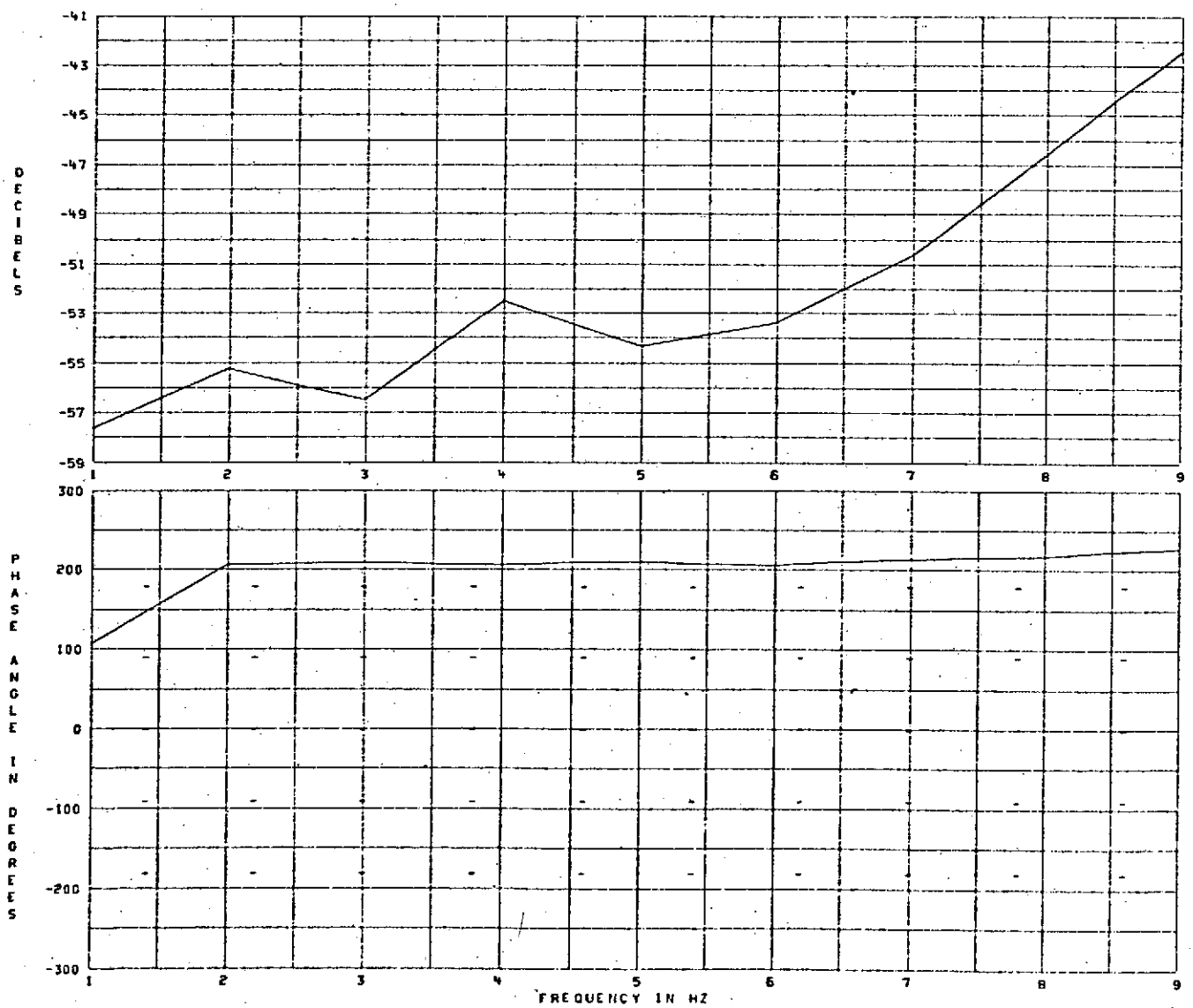
FREQUENCY RESPONCE TEST 3 — DATE PROCESSED - 09APR74

SENSOR -ZTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM

TOTAL CYCLES PROCESSED = 0 — TOTAL PERIOD PROCESSED = 42.43 SEC

FIRST FREQUENCY = 1.00 HZ — FREQUENCY INCREMENTS = 1.00 HZ

BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 9.00 HZ WAS .100 HZ TO .900 HZ



APPENDIX D

TEST NO. 4 X-AXIS

DDTS FREQUENCY RESPONSE TEST
SUMMARY OF INPUT INERTIAL CONDITIONS AND TRANSFORM MATRIX

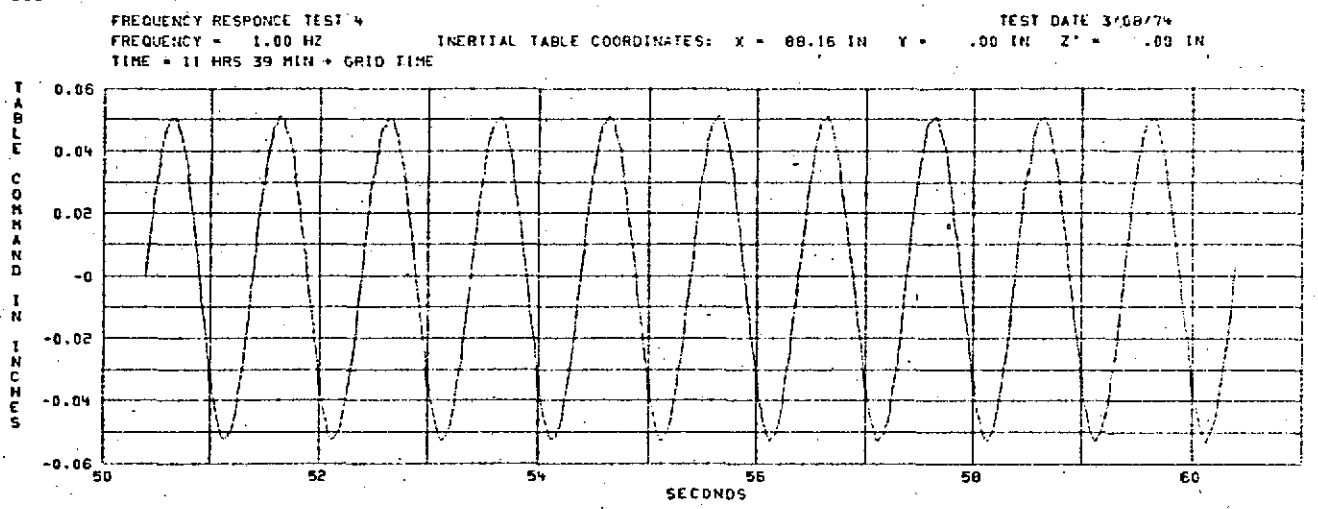
FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74

	X	Y	Z
TABLE COORDINATES	80.159	.000	.000

ACTUATOR	SERVO TABLE SWIVEL JOINTS X	Y	Z	FLOOR SWIVEL JOINTS X	Y	Z	COMPONENTS OF ACTUATOR LENGTH X	Y	Z	ACTUATOR LENGTH
1	.0000	25.1020	49.5000	210.4070	-64.3110	123.1780	-122.2480	89.4130	-73.6780	168.4272
2	.0000	-55.4190	3.0000	210.4290	-76.3800	116.1240	-122.2700	20.9610	-113.1240	167.8879
3	.0000	-55.4190	-3.0000	210.4220	-74.5730	-116.8190	-122.2630	19.1540	113.8190	168.1365
4	.0000	25.1020	-49.5000	210.4170	-62.4120	-123.6830	-122.2580	87.5140	74.1830	167.6569
5	.0000	30.2980	-46.5000	210.4100	138.4630	-5.9750	-122.2510	-108.1650	-40.5250	168.1891
6	.0000	30.2980	46.5000	210.3690	138.3890	8.0050	-122.2100	-108.0910	38.4950	167.6330

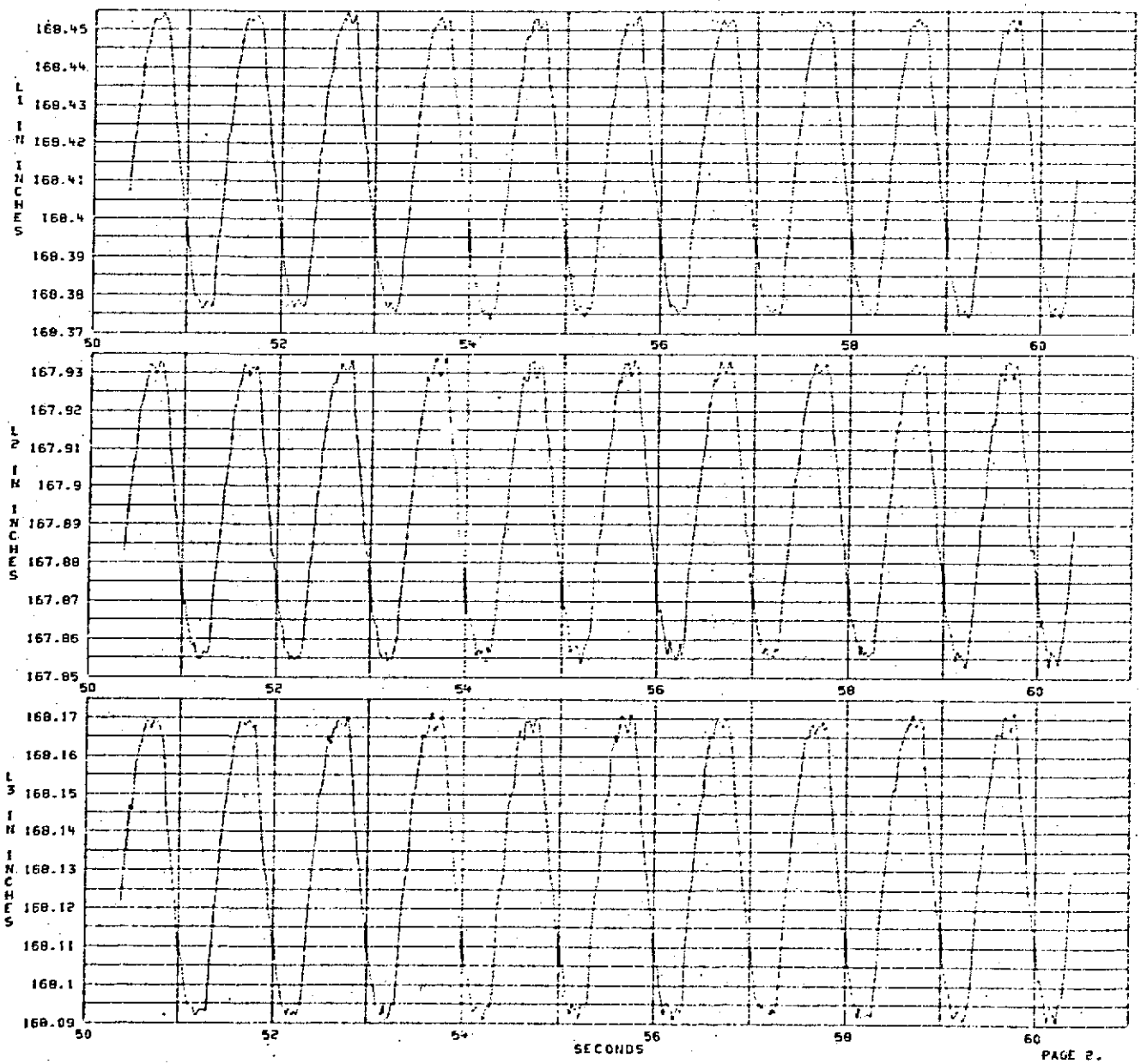
TRANSFORM MATRIX

-.227798+00	-.229422+00	-.228575+00	-.229554+00	-.228266+00	-.230510+00
.447118+00	-.236022-01	-.303266-01	.442709+00	-.416853+00	-.418525+00
-.222802+00	-.498159+00	.498501+00	.228740+00	-.276033+00	.269861+00
-.450573-02	.449077-02	-.449777-02	.448626-02	-.450071-02	.448595-02
-.648215-02	.145547-02	-.146094-02	.650505-02	.794358-02	-.796398-02
.543719-02	-.835084-02	-.833211-02	.544980-02	.288540-02	.281976-02


FREQUENCY RESPONCE TEST 4
FREQUENCY = 1.00 HZ
TIME = 11 HRS 39 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .09 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
50
52
54
56
58
60
SECONDS

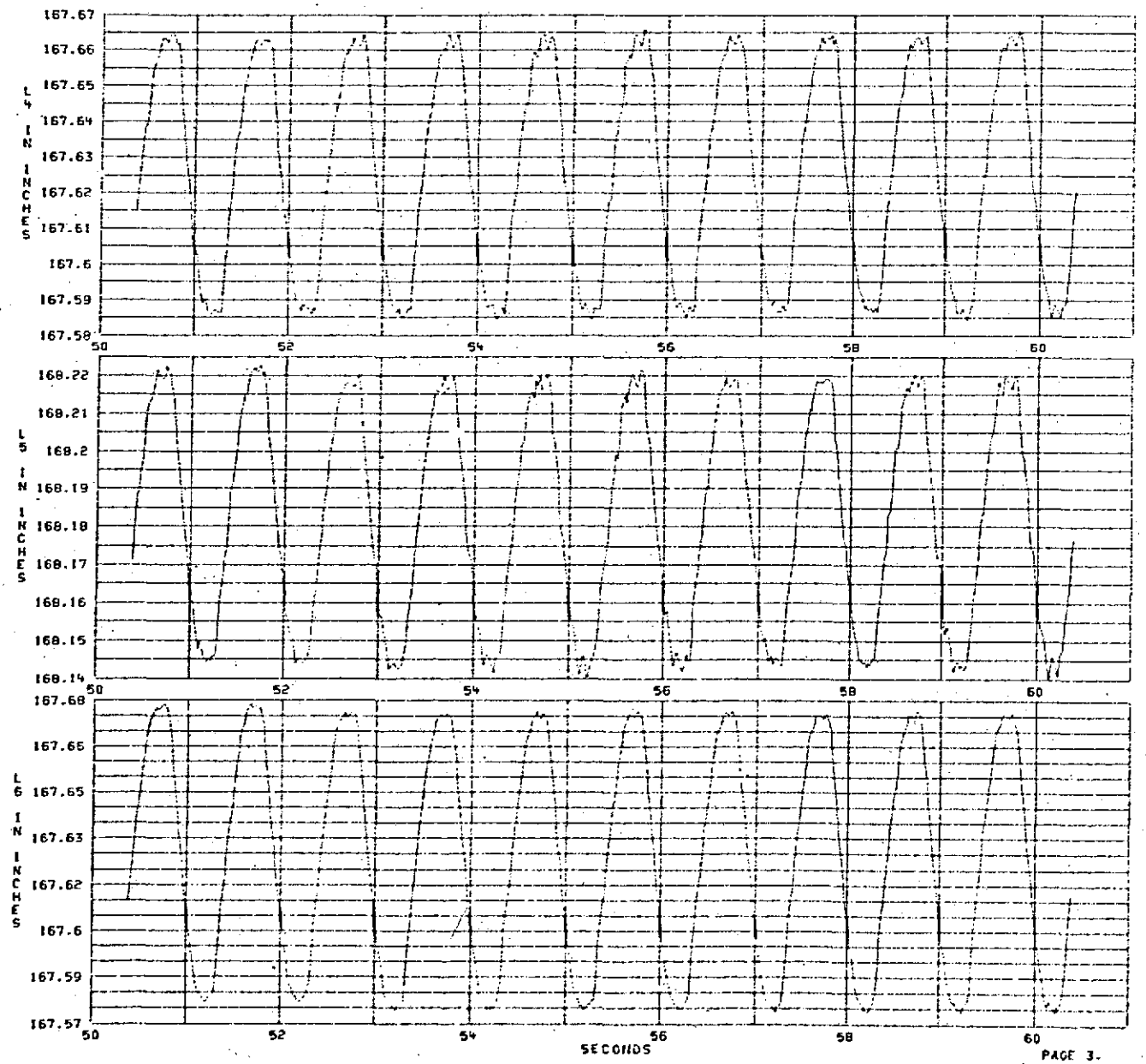
PAGE 1.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 1.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 39 MIN = GRID TIME

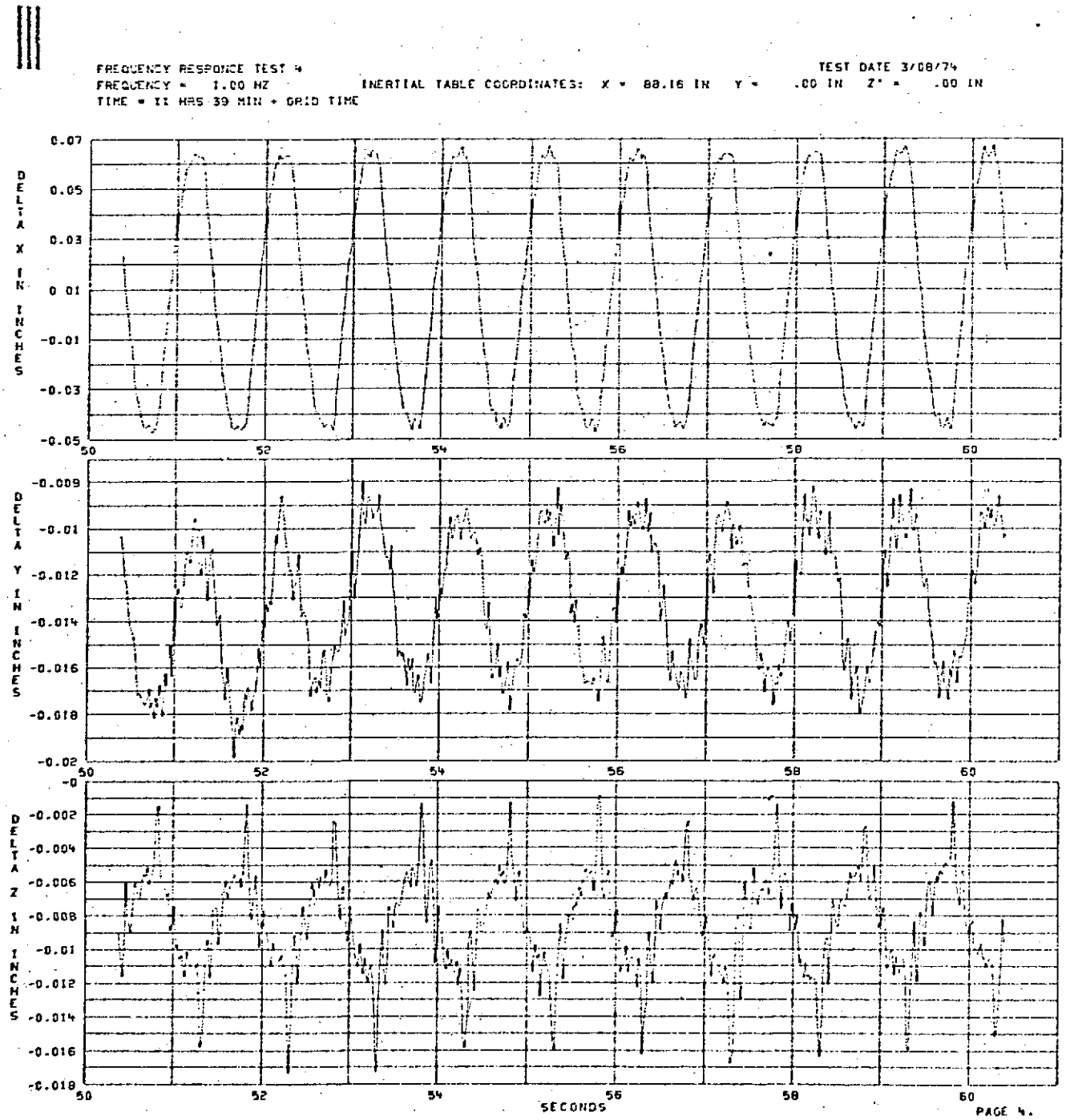


PAGE 2.

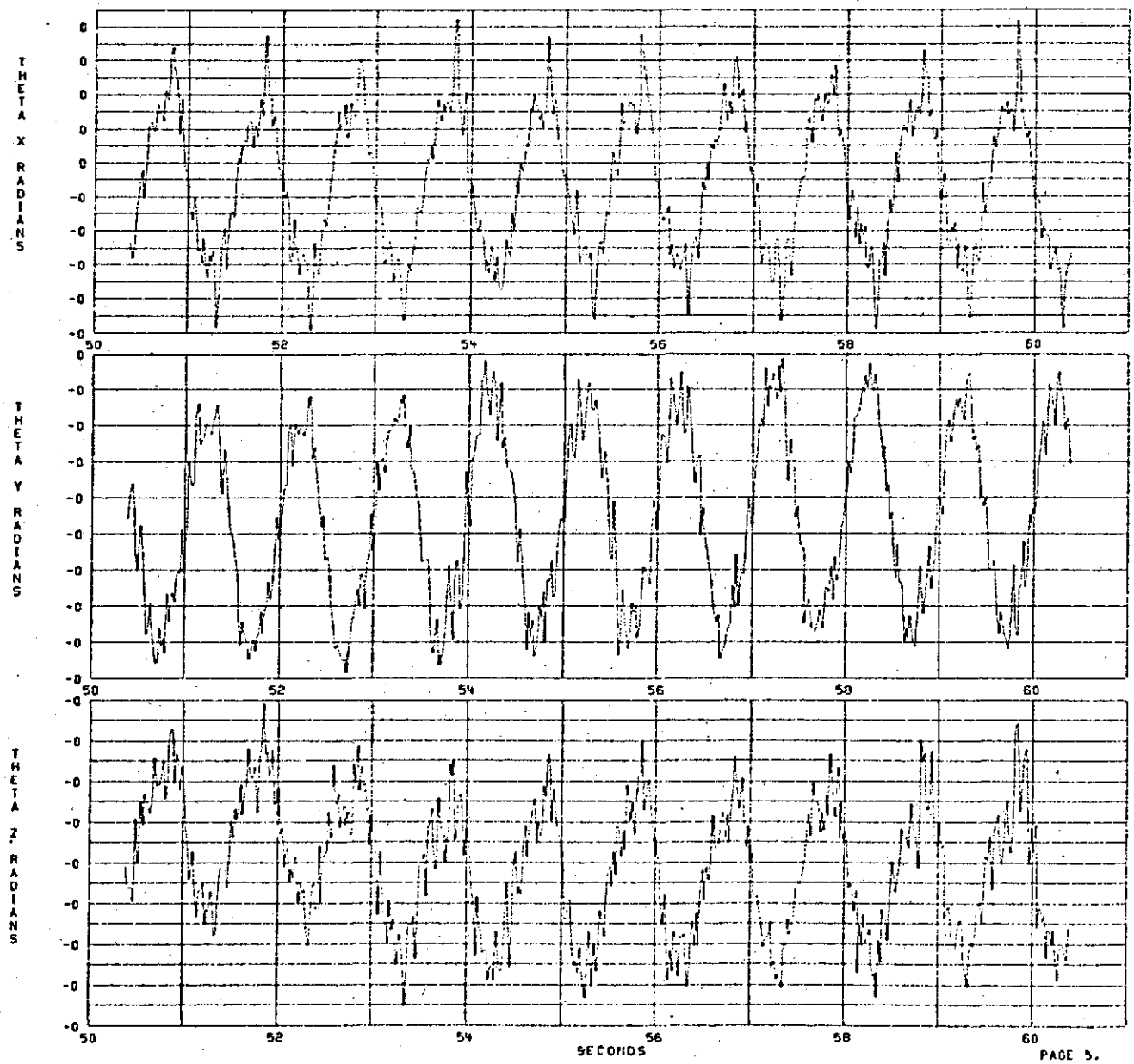
FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 1.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 39 MIN + GRID TIME



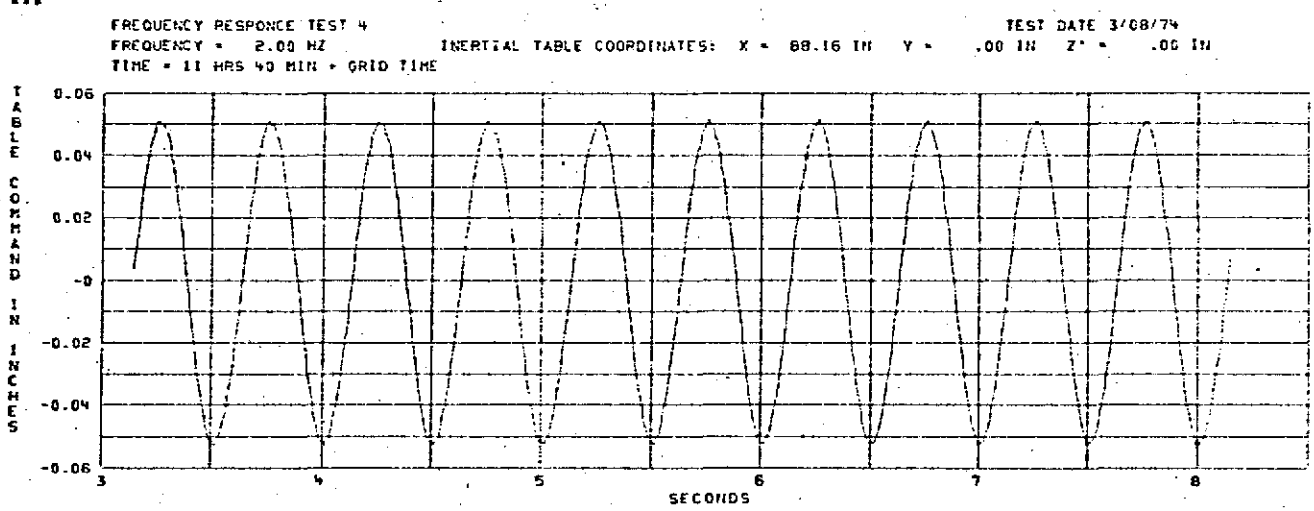
PAGE 3.


FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 1.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 39 MIN + GRID TIME
DELTA X IN INCHES
0.07
0.05
0.03
0 01
-0.01
-0.03
-0.05
DELTA Y IN INCHES
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
-0.02
DELTA Z IN INCHES
-0
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
50
52
54
56
58
60
SECONDS
PAGE 4.

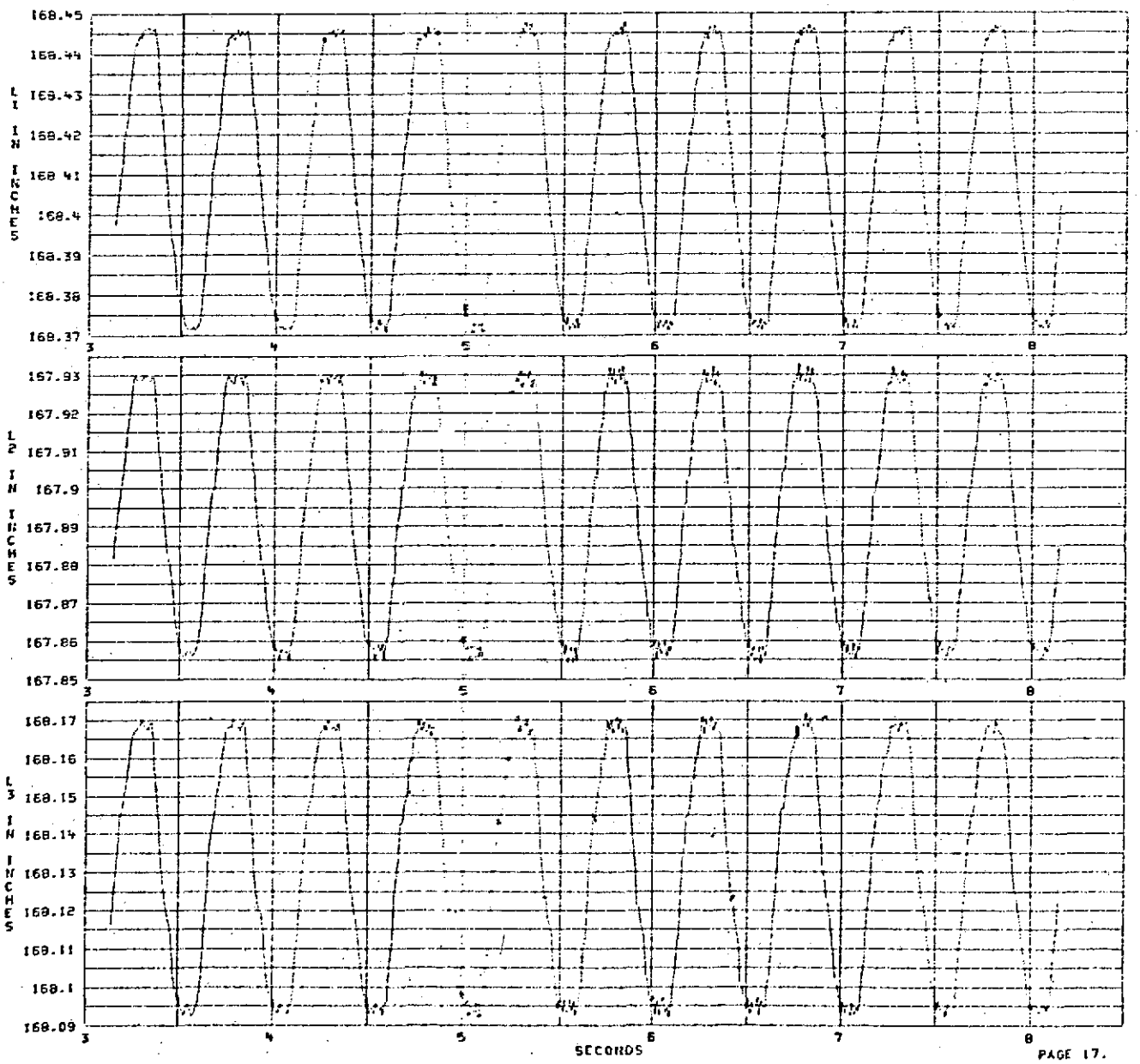
FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 1.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 39 MIN = GRID TIME



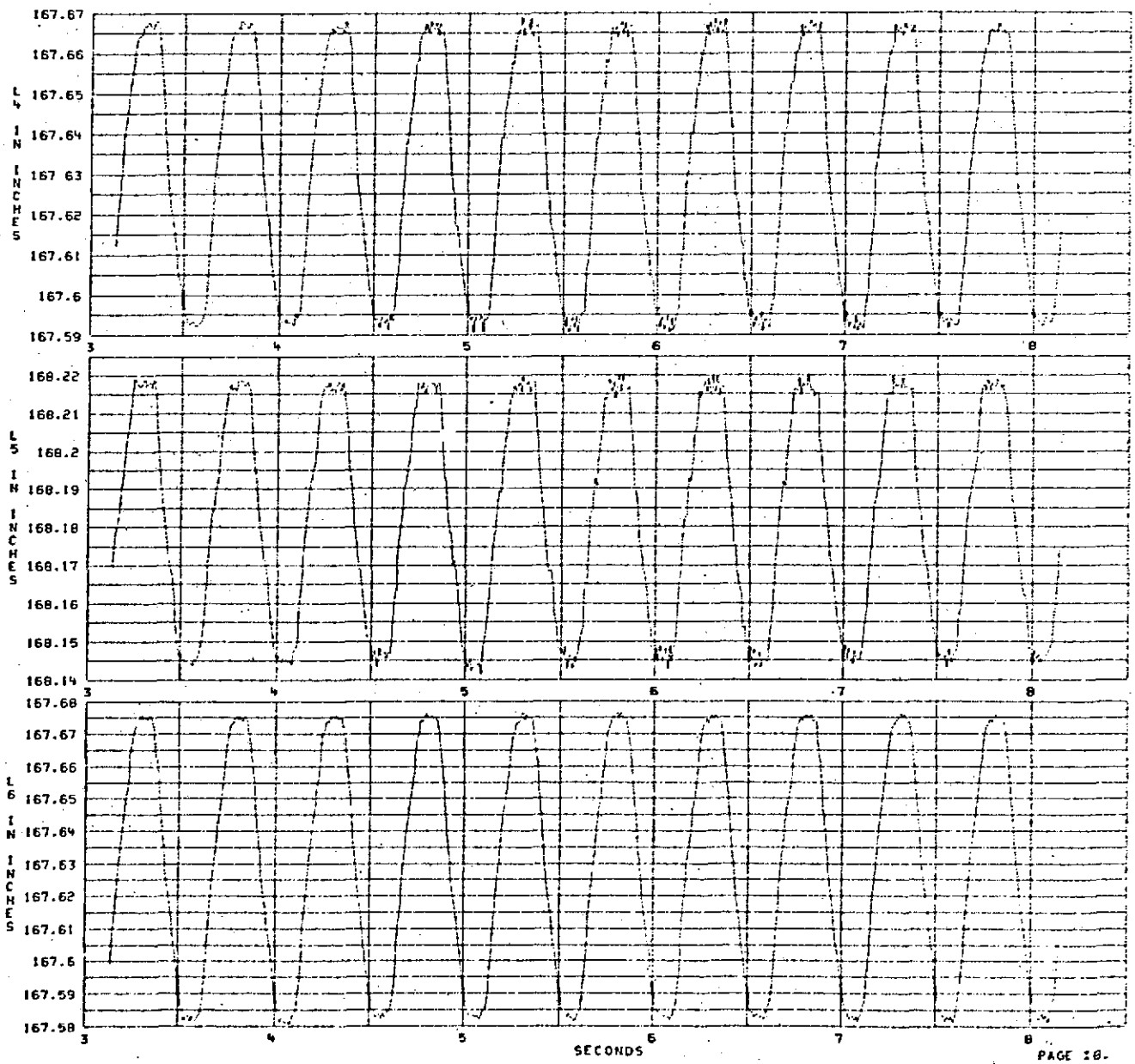
PAGE 5.


FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
3
4
5
6
7
8
SECONDS

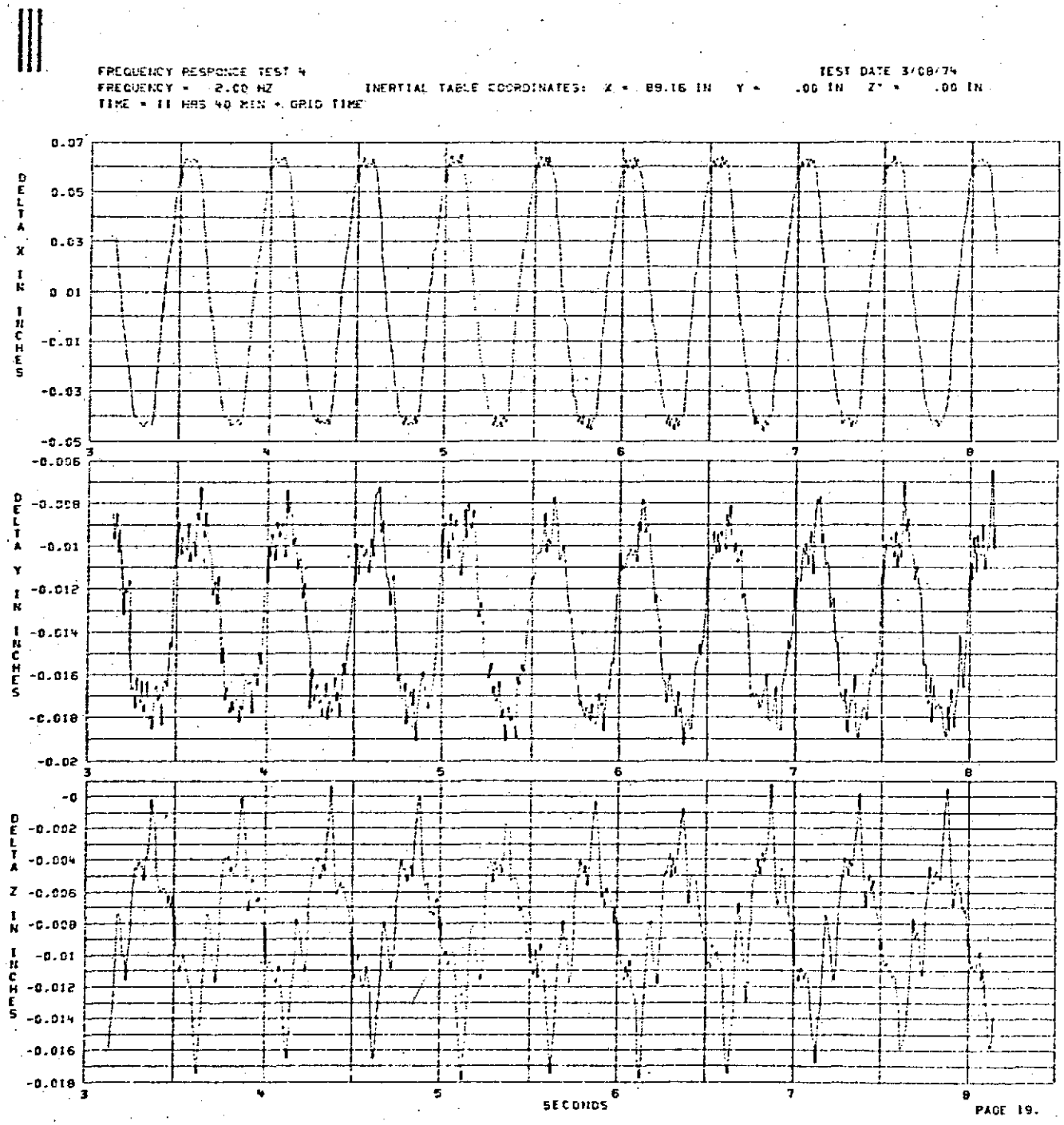
PAGE 16.


FREQUENCY RESPONCE TEST 4
FREQUENCY = 2.00 HZ
TIME = 11 HRS 40 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.45
168.44
168.43
168.42
168.41
168.4
168.39
168.38
168.37
L2 IN INCHES
167.93
167.92
167.91
167.9
167.89
167.88
167.87
167.86
167.85
L3 IN INCHES
168.17
168.16
168.15
168.14
168.13
168.12
168.11
168.1
168.09
3
4
5
6
7
8
SECONDS
PAGE 17.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 2.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



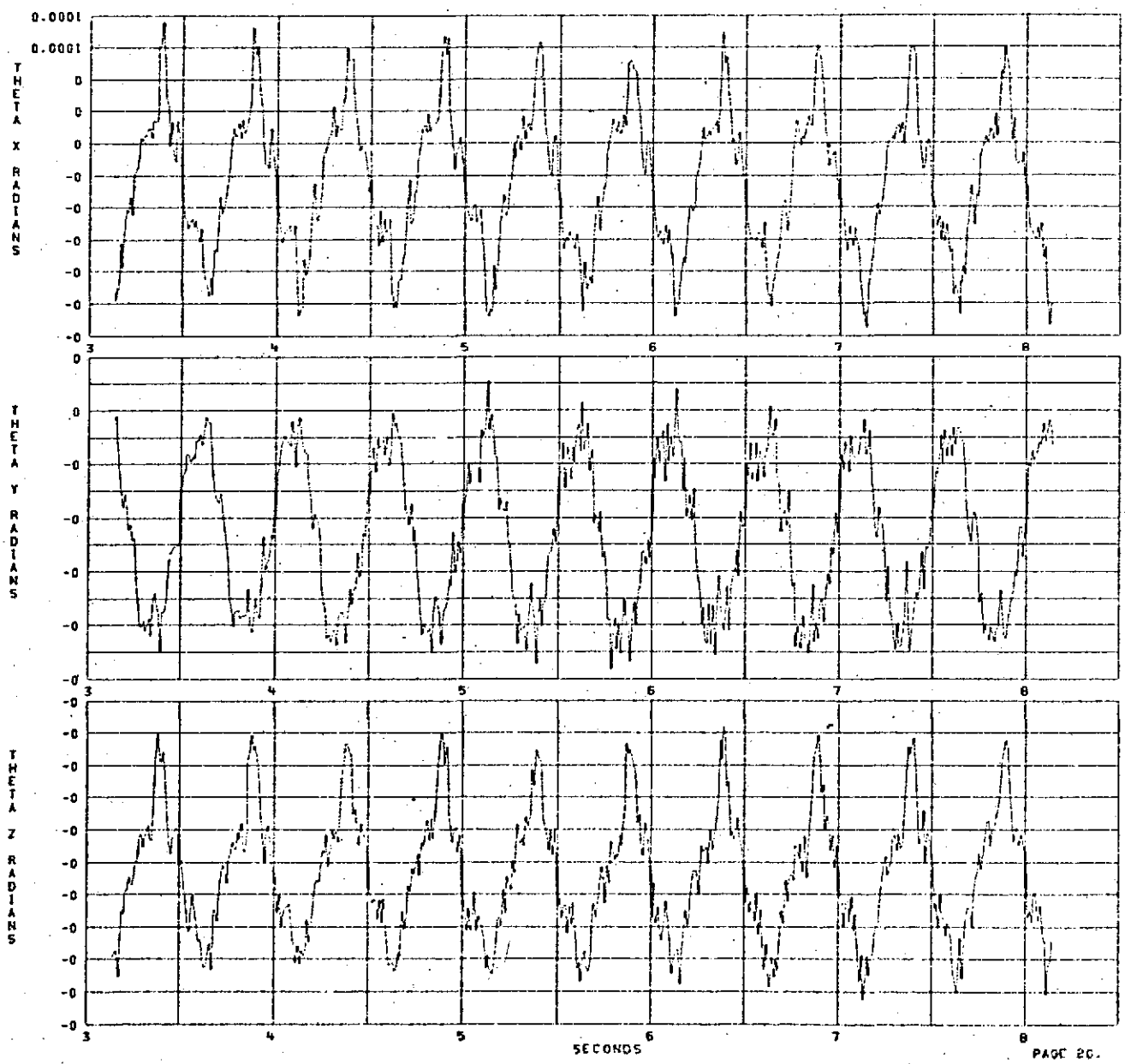
PAGE 18.


FREQUENCY RESPONSE TEST 4
TEST DATE 3/08/74
FREQUENCY = 2.00 HZ
INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
DELTA X IN INCHES
0.07
0.05
0.03
0 01
-0.01
-0.03
-0.05
DELTA Y IN INCHES
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
-0.02
DELTA Z IN INCHES
-0
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
3
4
5
6
7
8
SECONDS
PAGE 19.

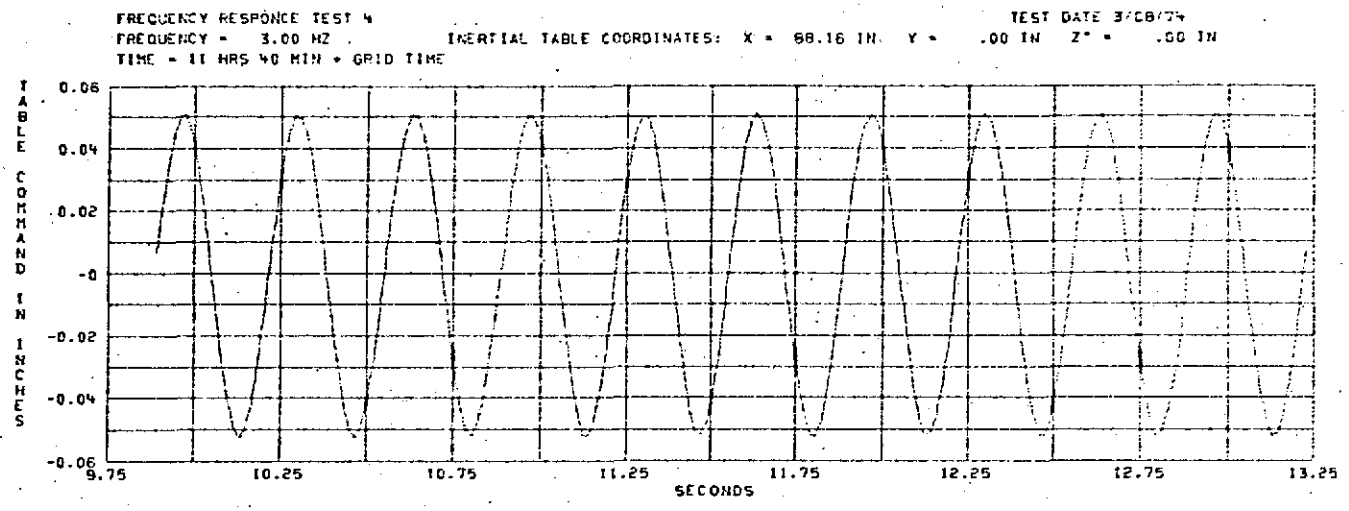
FREQUENCY RESPONCE TEST 4
FREQUENCY = 2.00 HZ
TIME = 11 HRS 40 MIN + GRID TIME

INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN

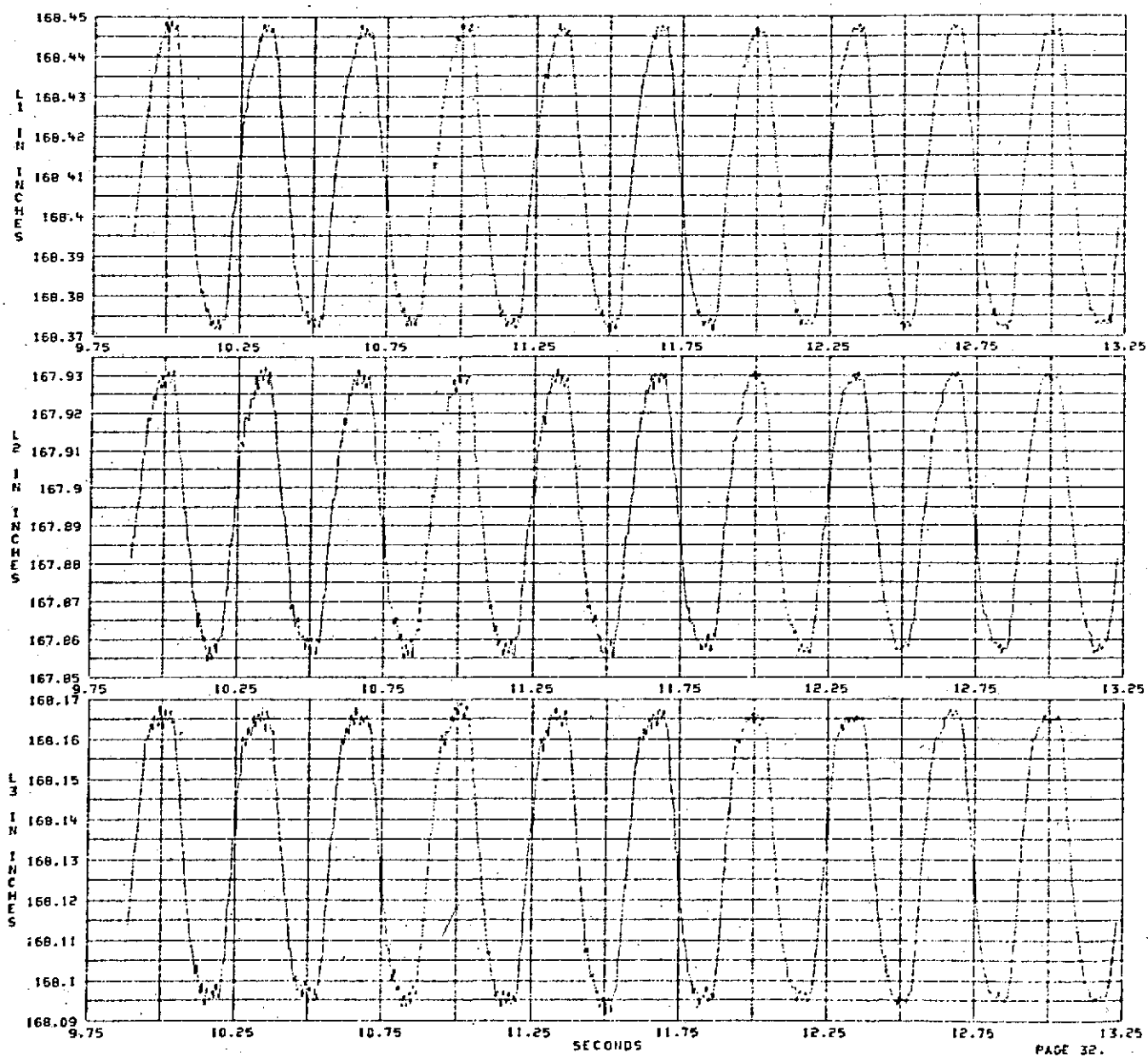
TEST DATE 3/08/74

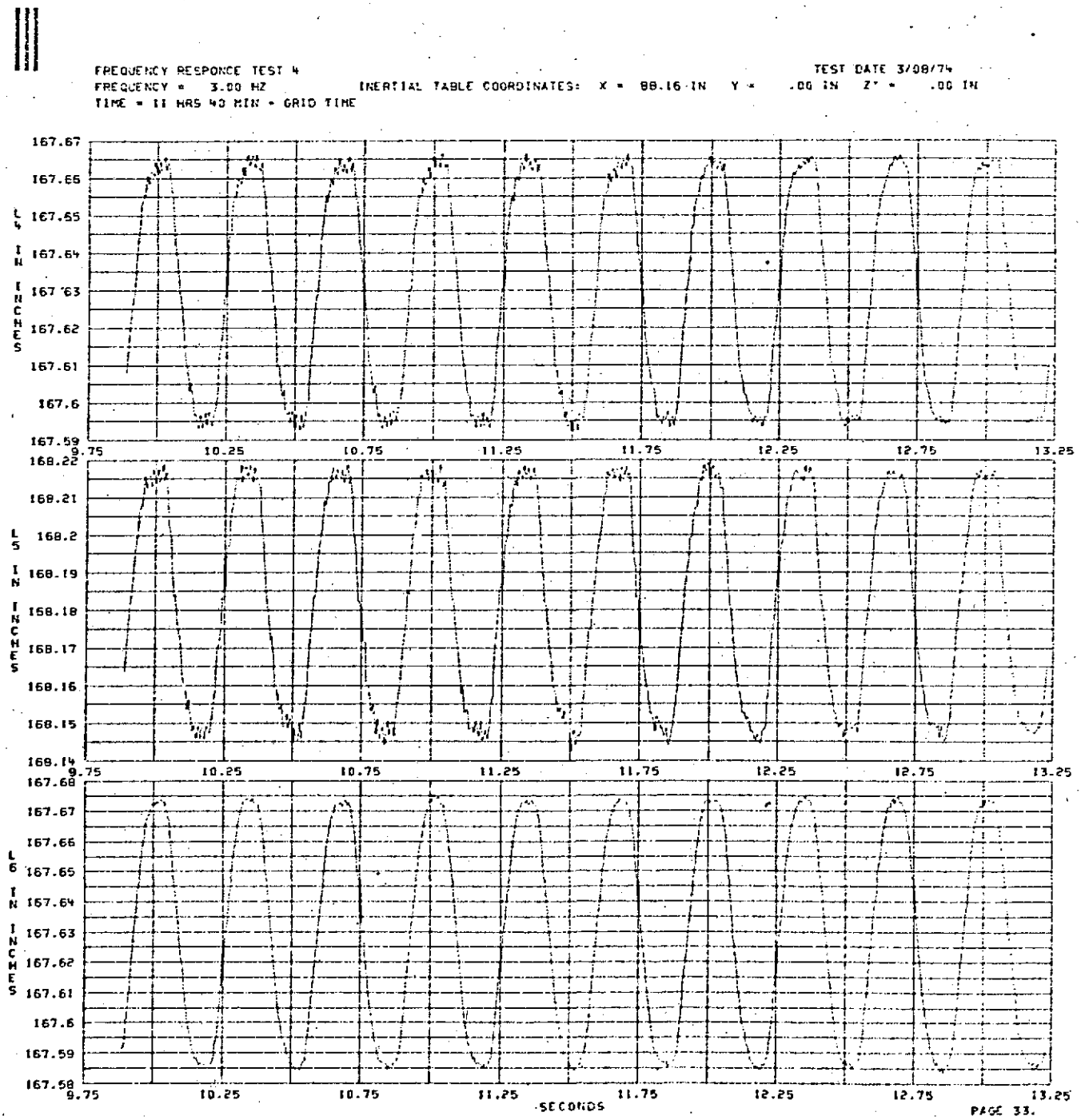


PAGE 20.

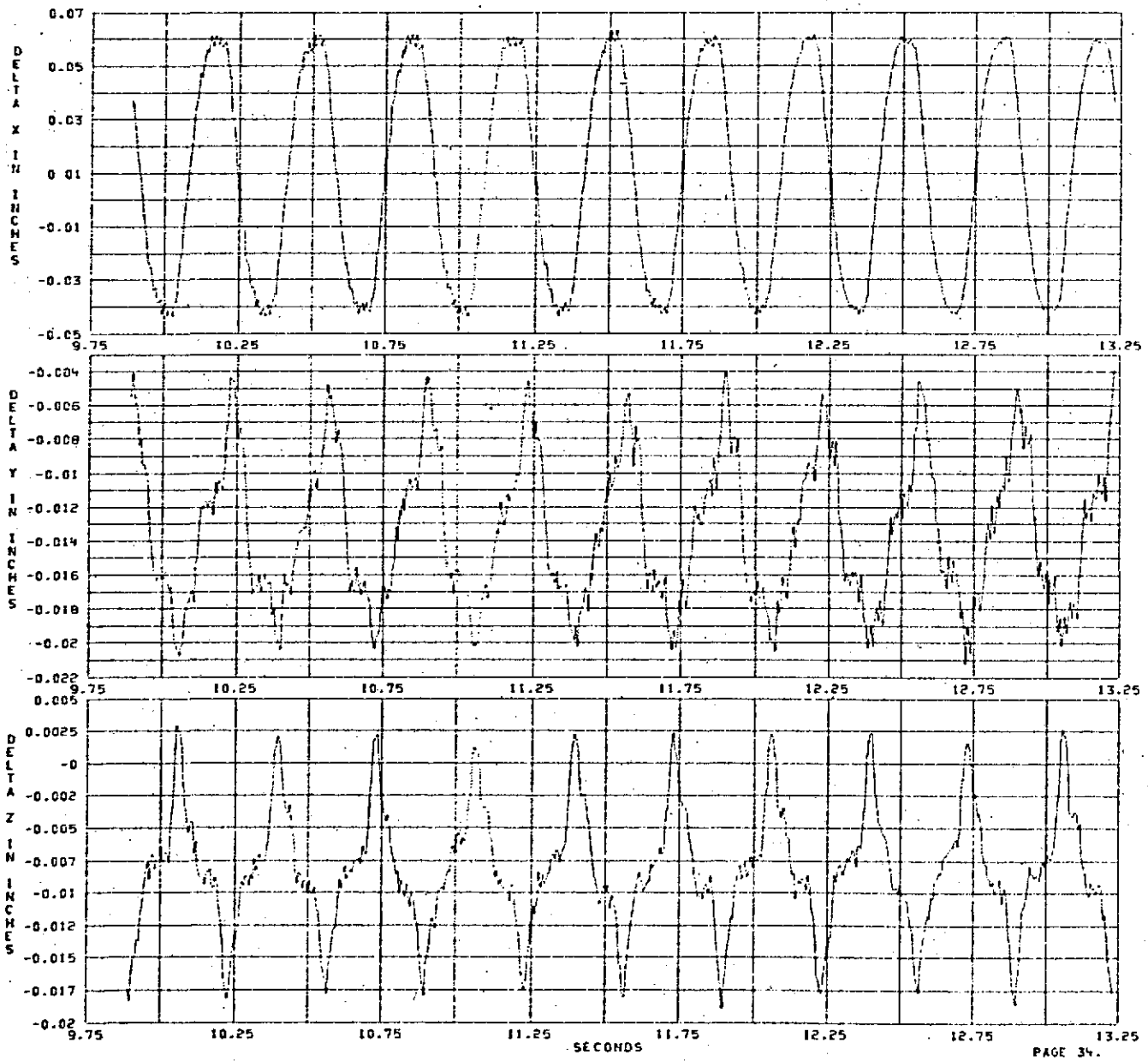

FREQUENCY RESPONCE TEST 4
TEST DATE 3/CB/74
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
9.75
10.25
10.75
11.25
11.75
12.25
12.75
13.25
SECONDS

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 3.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



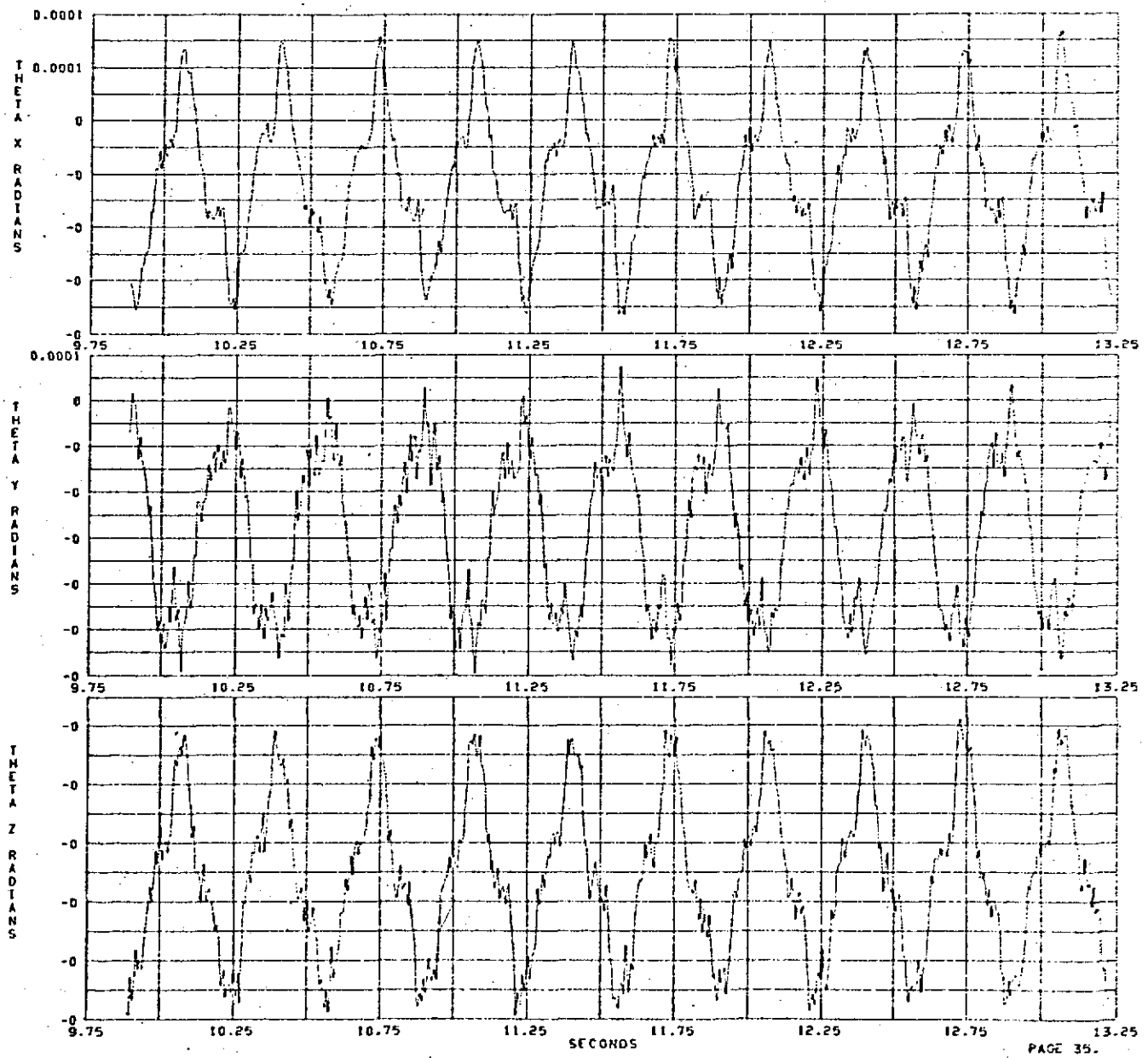

FREQUENCY RESPONCE TEST 4
FREQUENCY = 3.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
TEST DATE 3/08/74
L4 IN INCHES
L5 IN INCHES
L6 IN INCHES
9.75
10.25
10.75
11.25
11.75
12.25
12.75
13.25
SECONDS
PAGE 33.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 3.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME

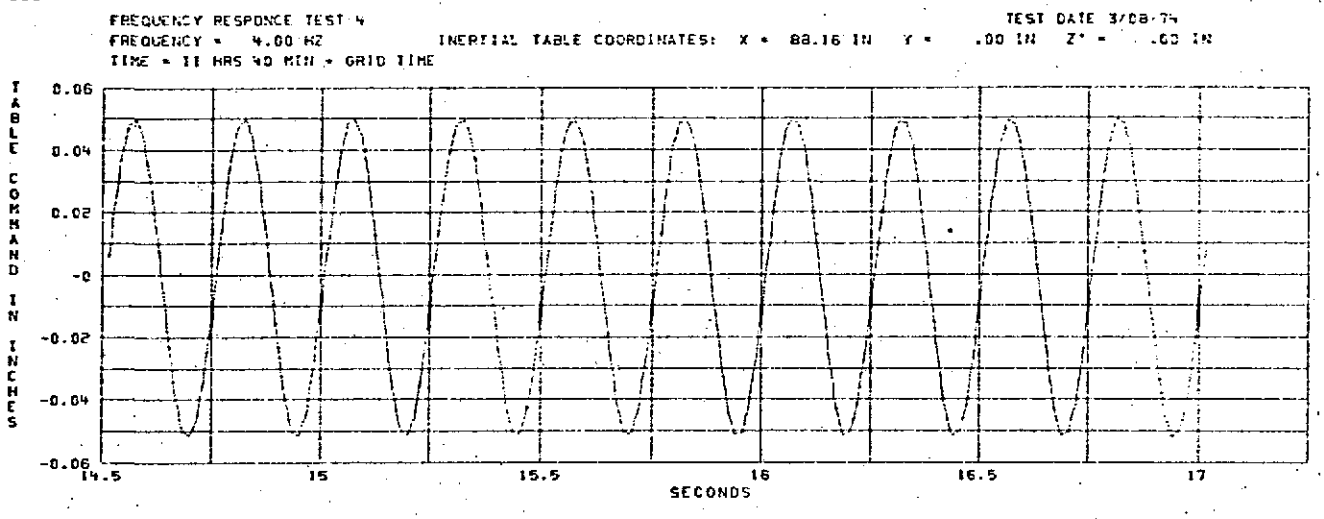


PAGE 34.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 3.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME

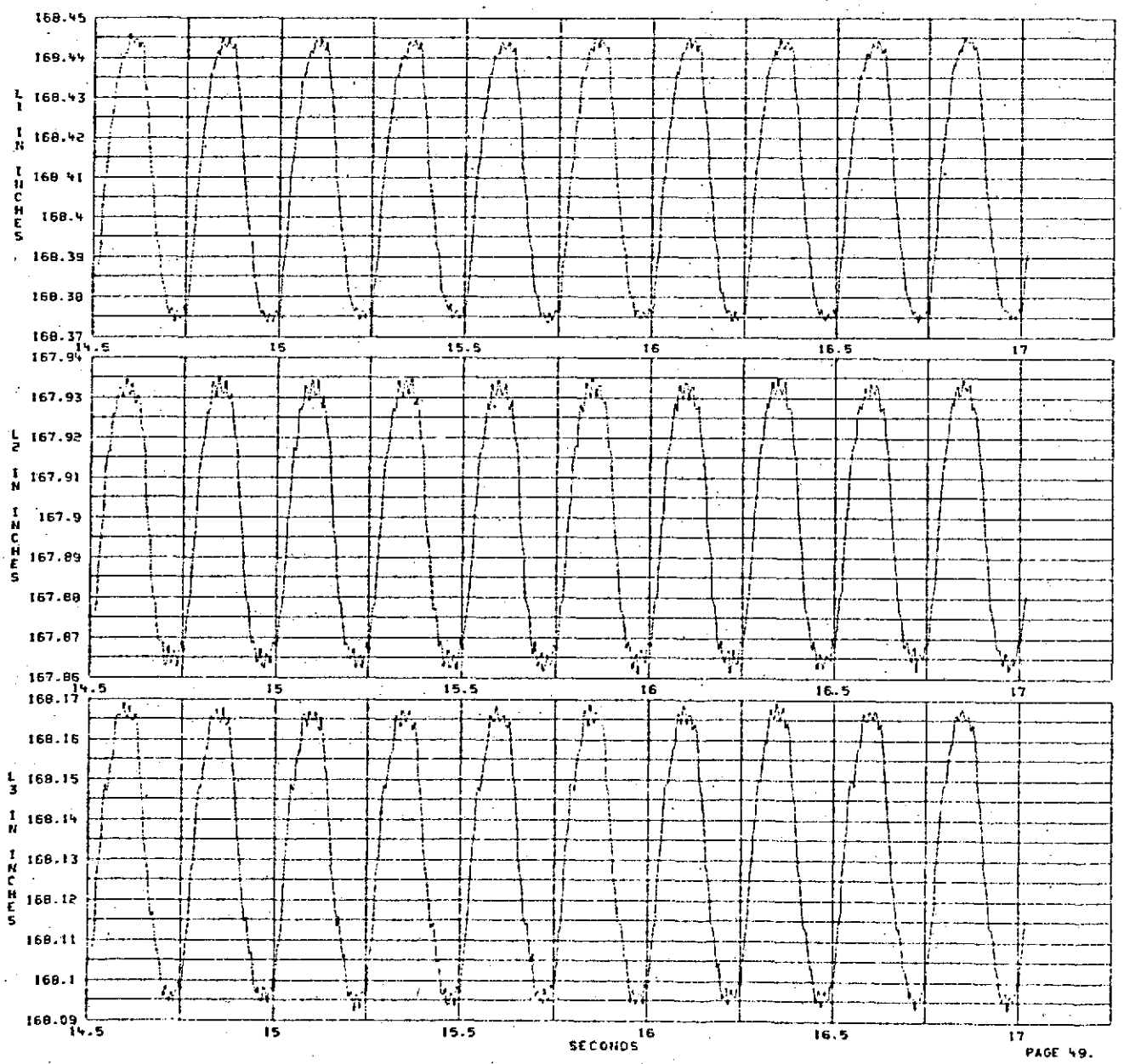


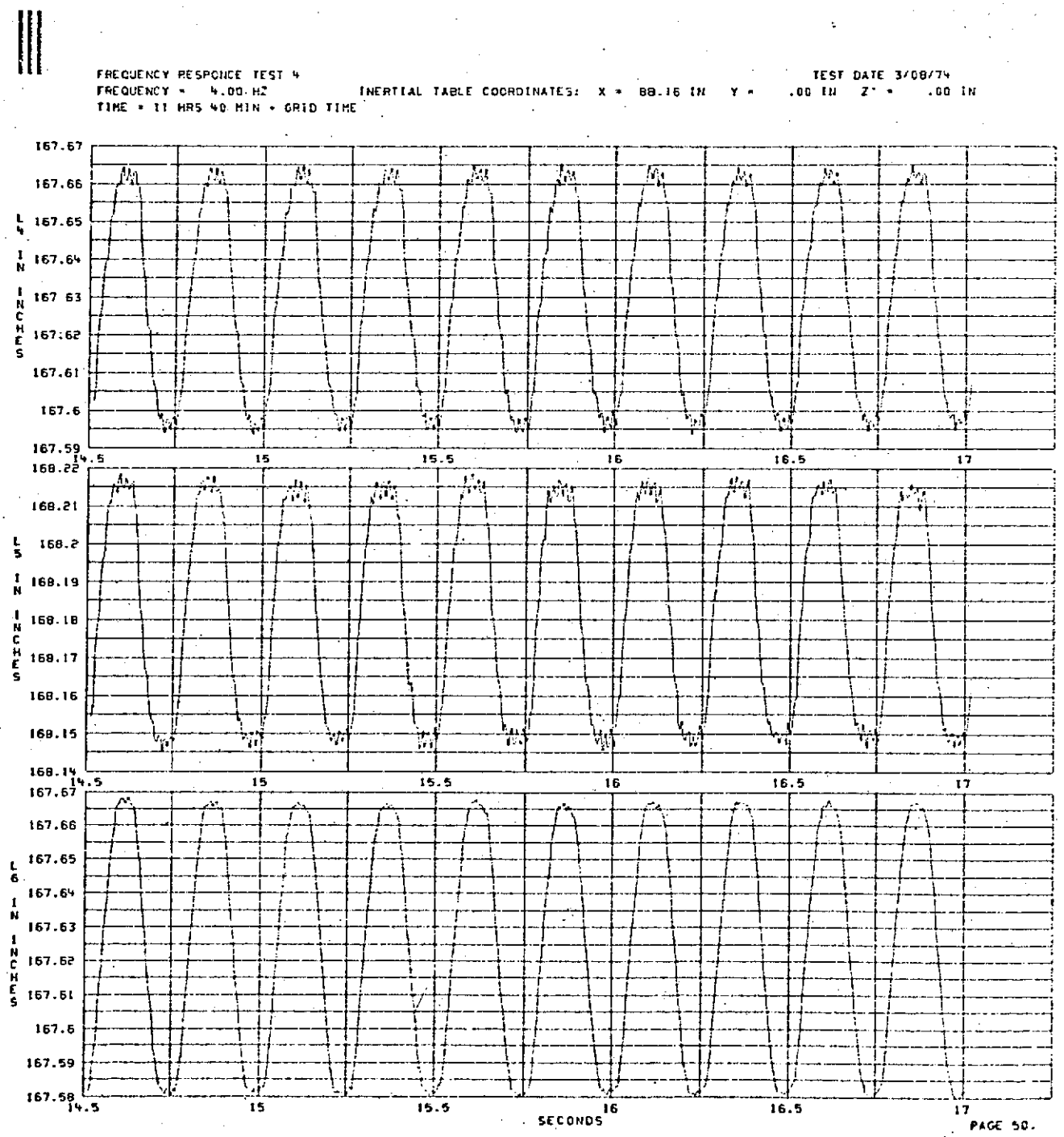
PAGE 35.

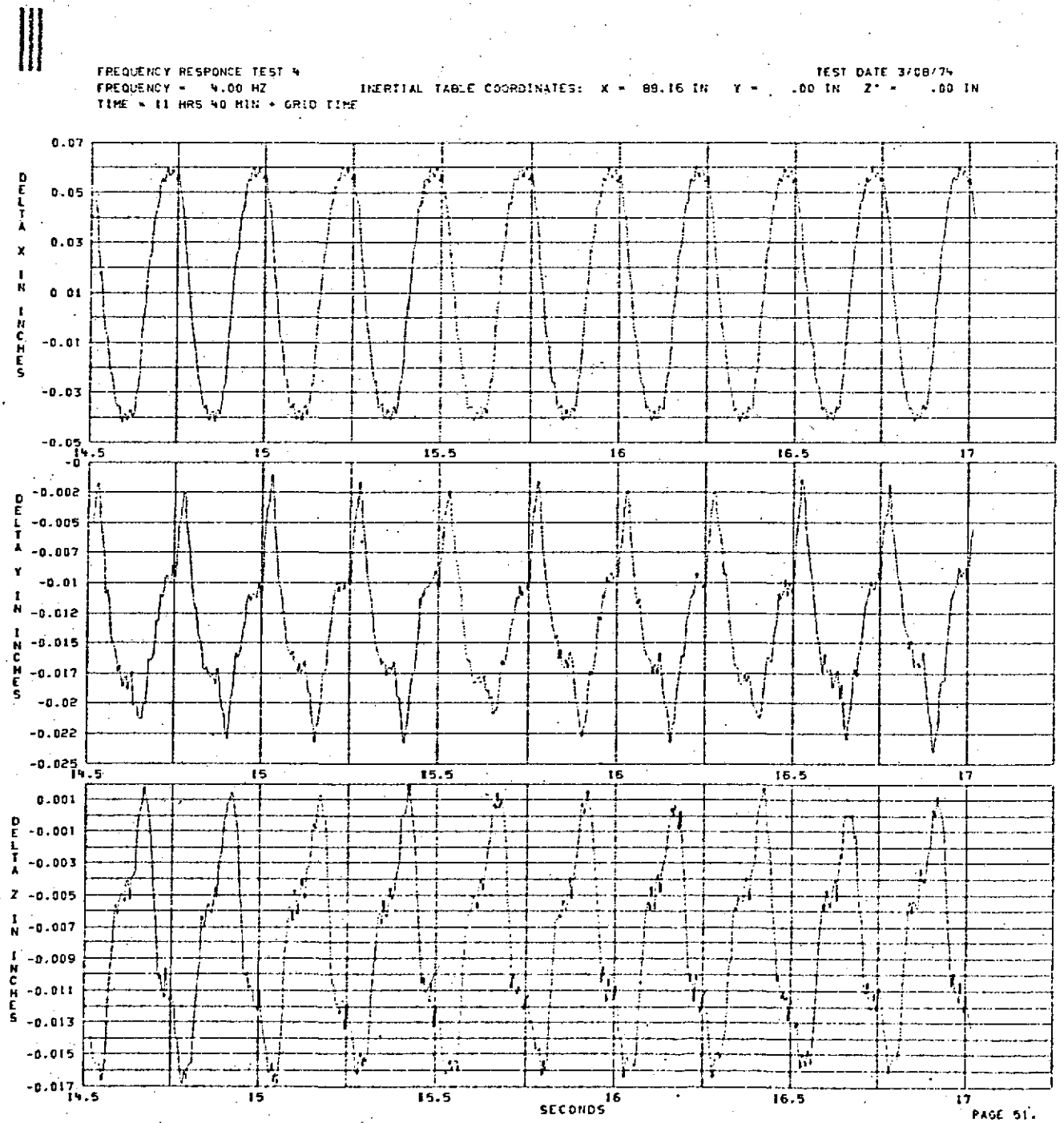

FREQUENCY RESPONCE TEST 4
FREQUENCY = 4.00 HZ
TIME = 11 HRS 40 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z' = .03 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
14.5
15
15.5
16
16.5
17
SECONDS

PAGE 48.

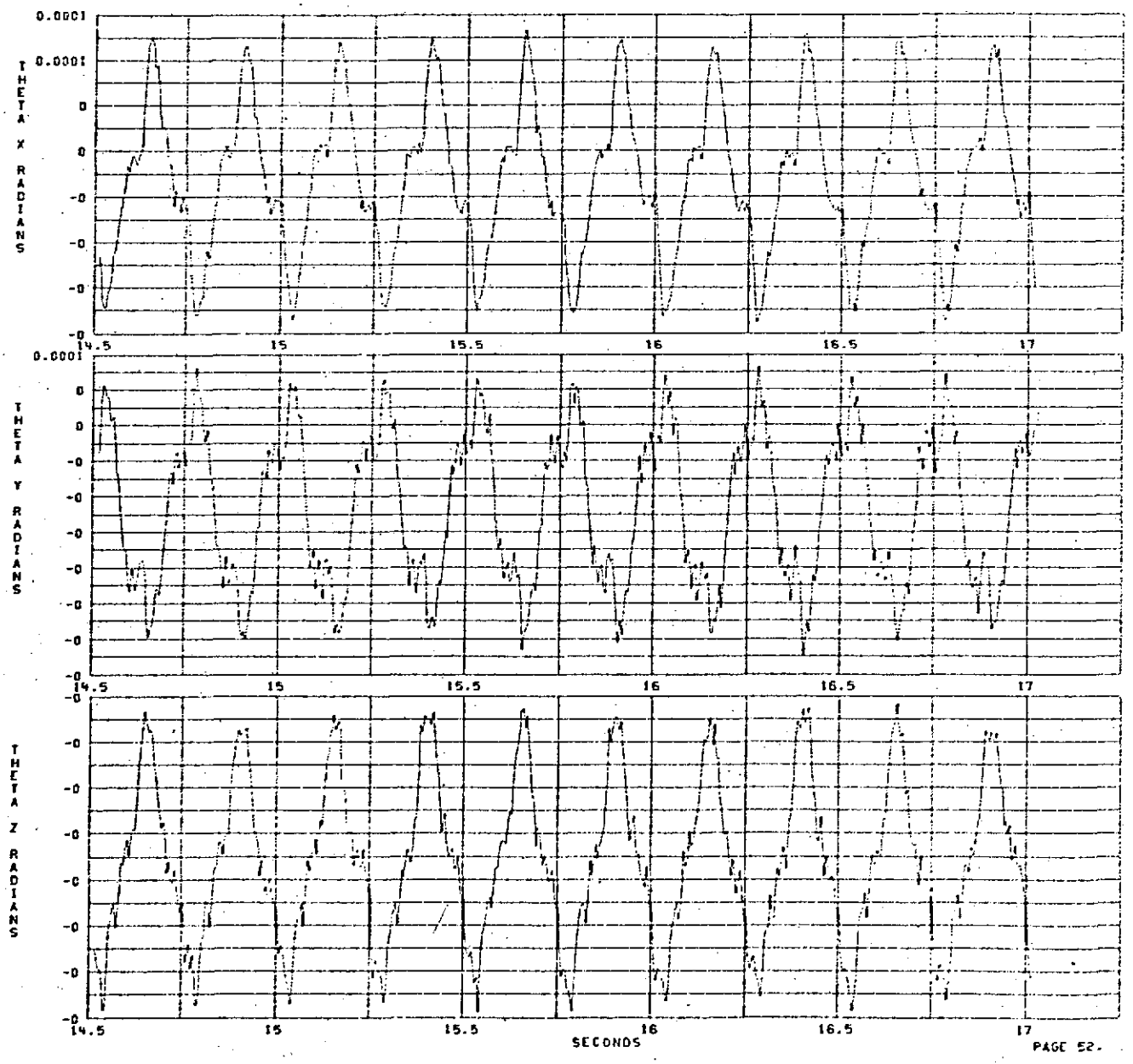
FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 4.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



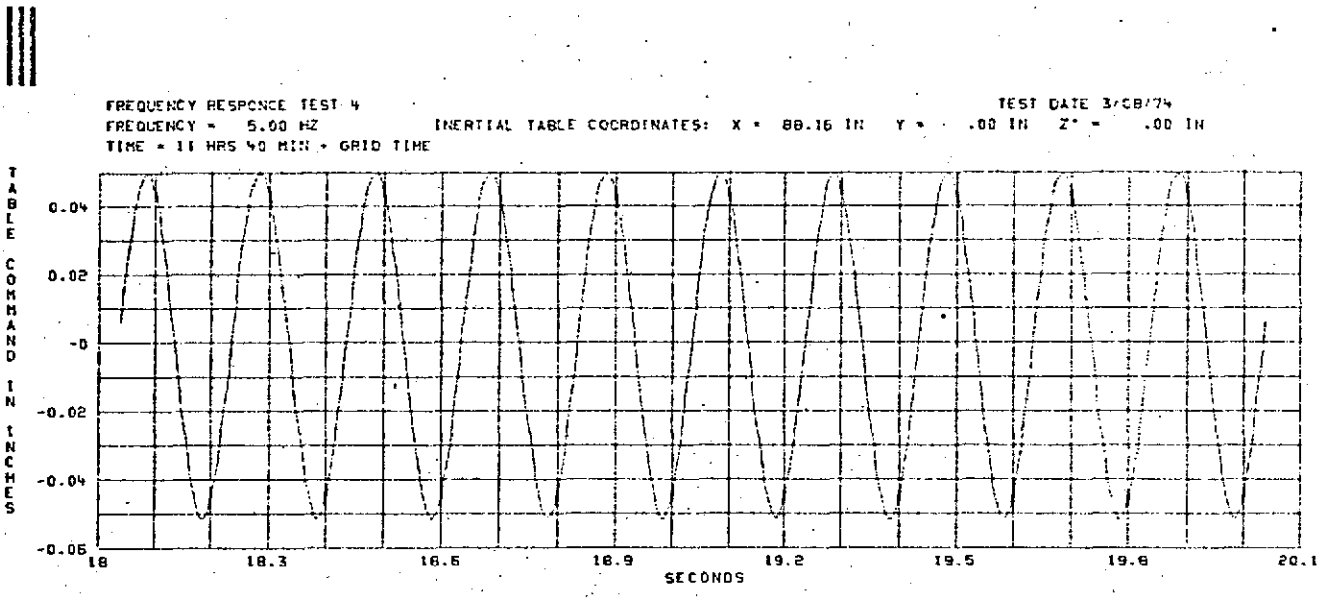

FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
L4 IN INCHES
L5 IN INCHES
L6 IN INCHES
SECONDS
PAGE 50.


FREQUENCY RESPONCE TEST 4
FREQUENCY = 4.00 HZ
INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
TEST DATE 3/08/74
DELTA X IN INCHES
DELTA Y IN INCHES
DELTA Z IN INCHES
SECONDS
PAGE 51.

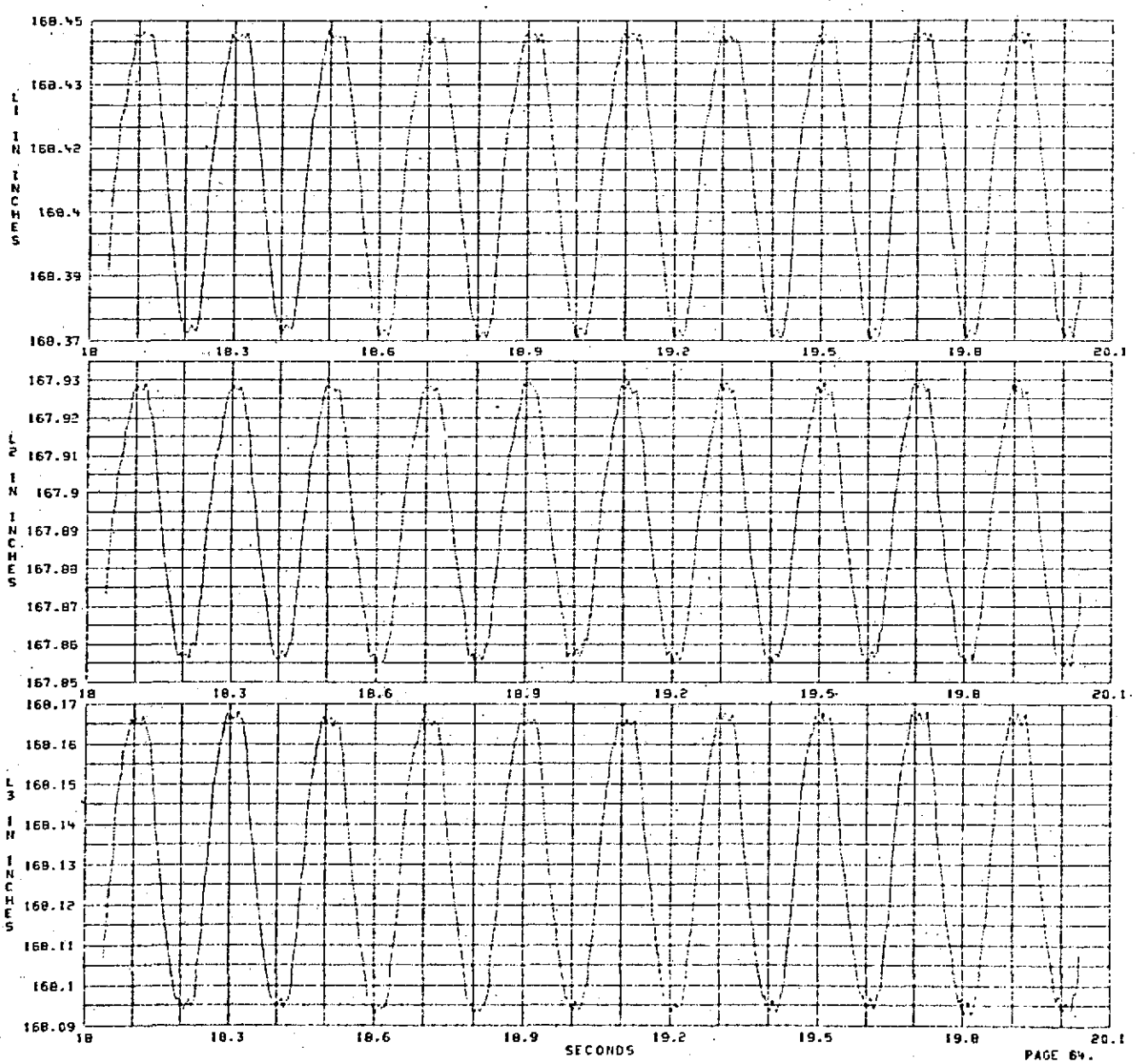
FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 4.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME



PAGE 52.

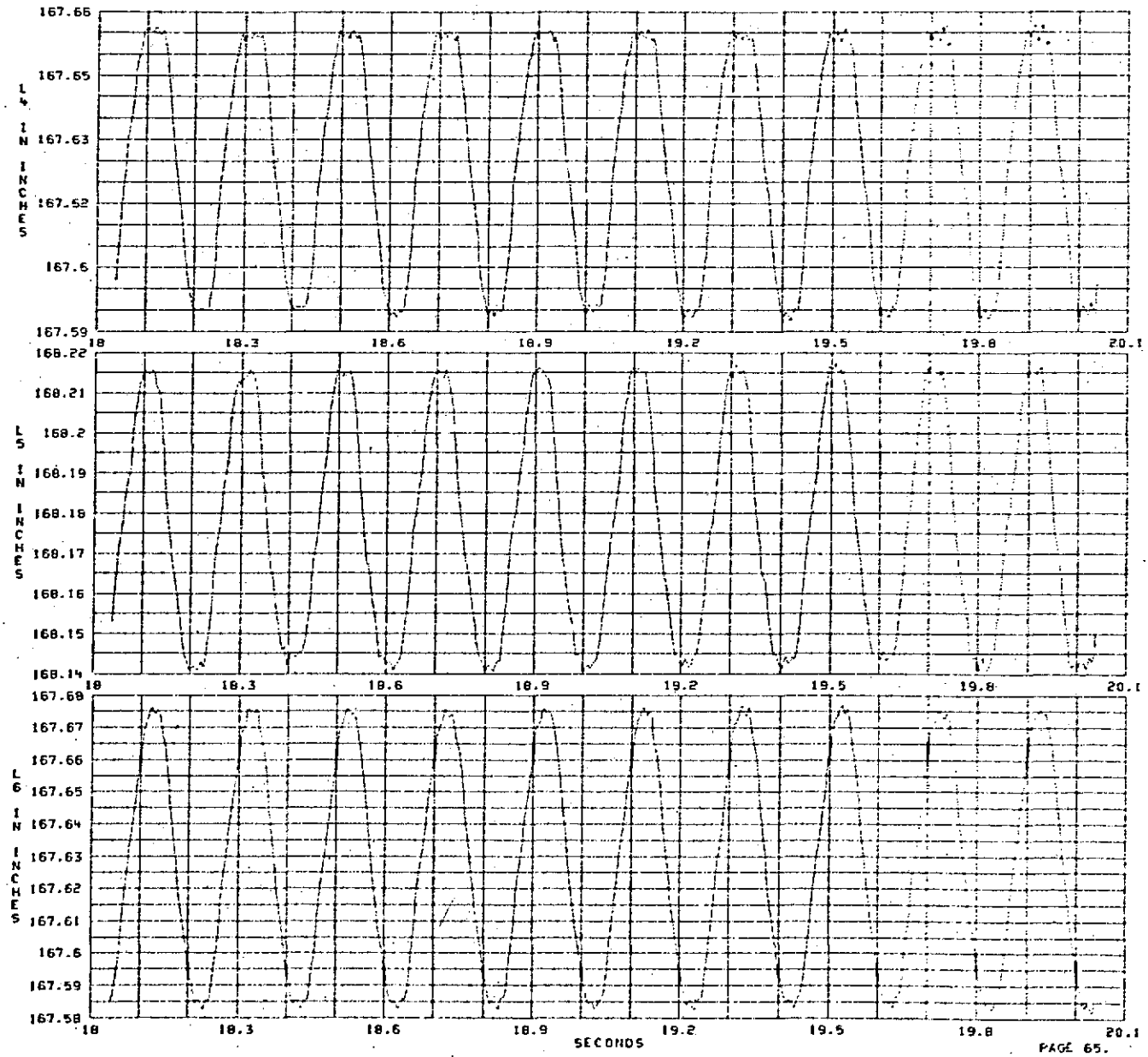

FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 5.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.04
0.02
-0
-0.02
-0.04
-0.06
18
18.3
18.6
18.9
19.2
19.5
19.8
20.1
SECONDS

FREQUENCY RESPONCE TEST 4 TEST DATE 3/09/74
FREQUENCY = 5.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



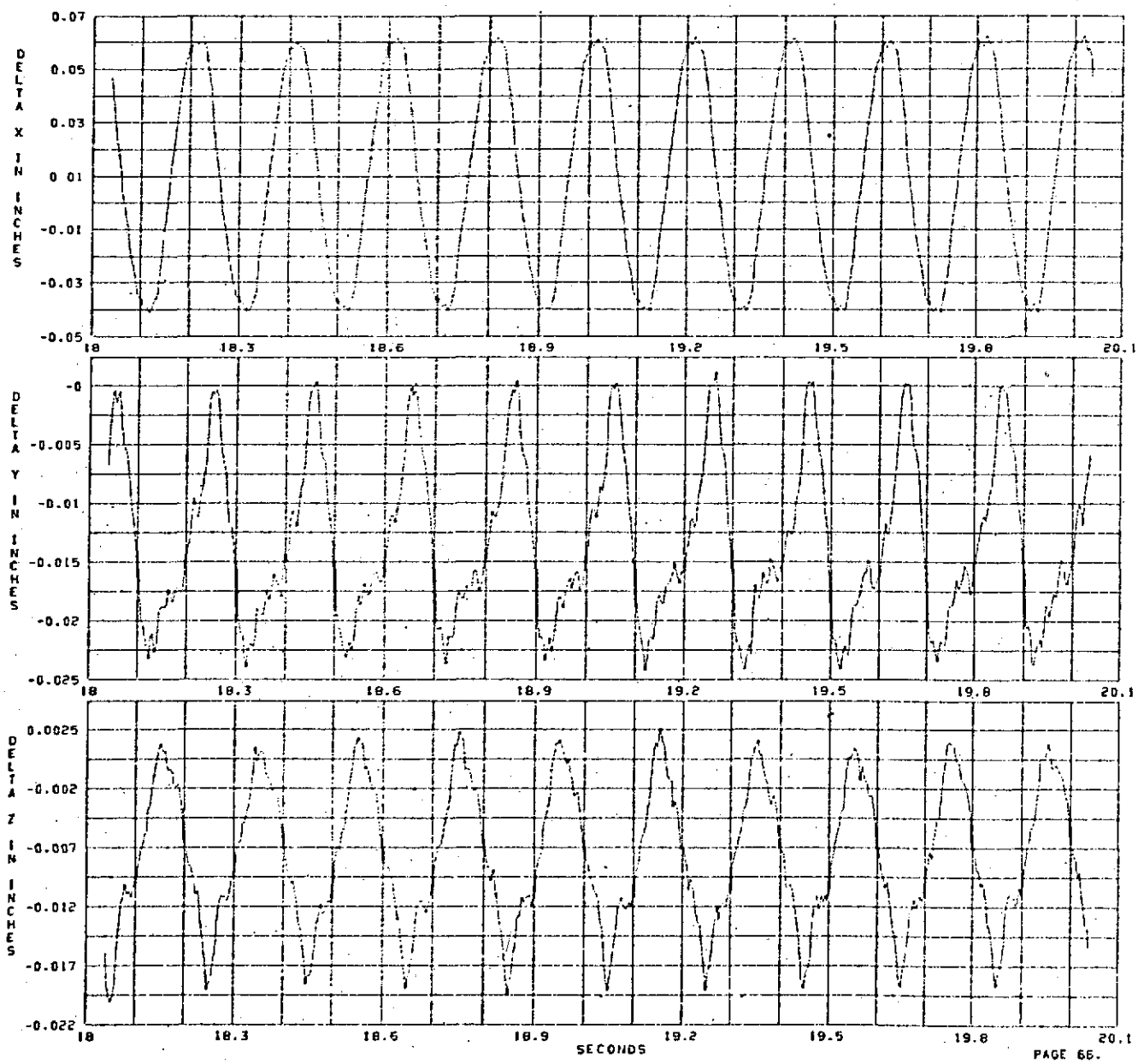
PAGE 64.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/09/7[illegible]
FREQUENCY = 5.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME



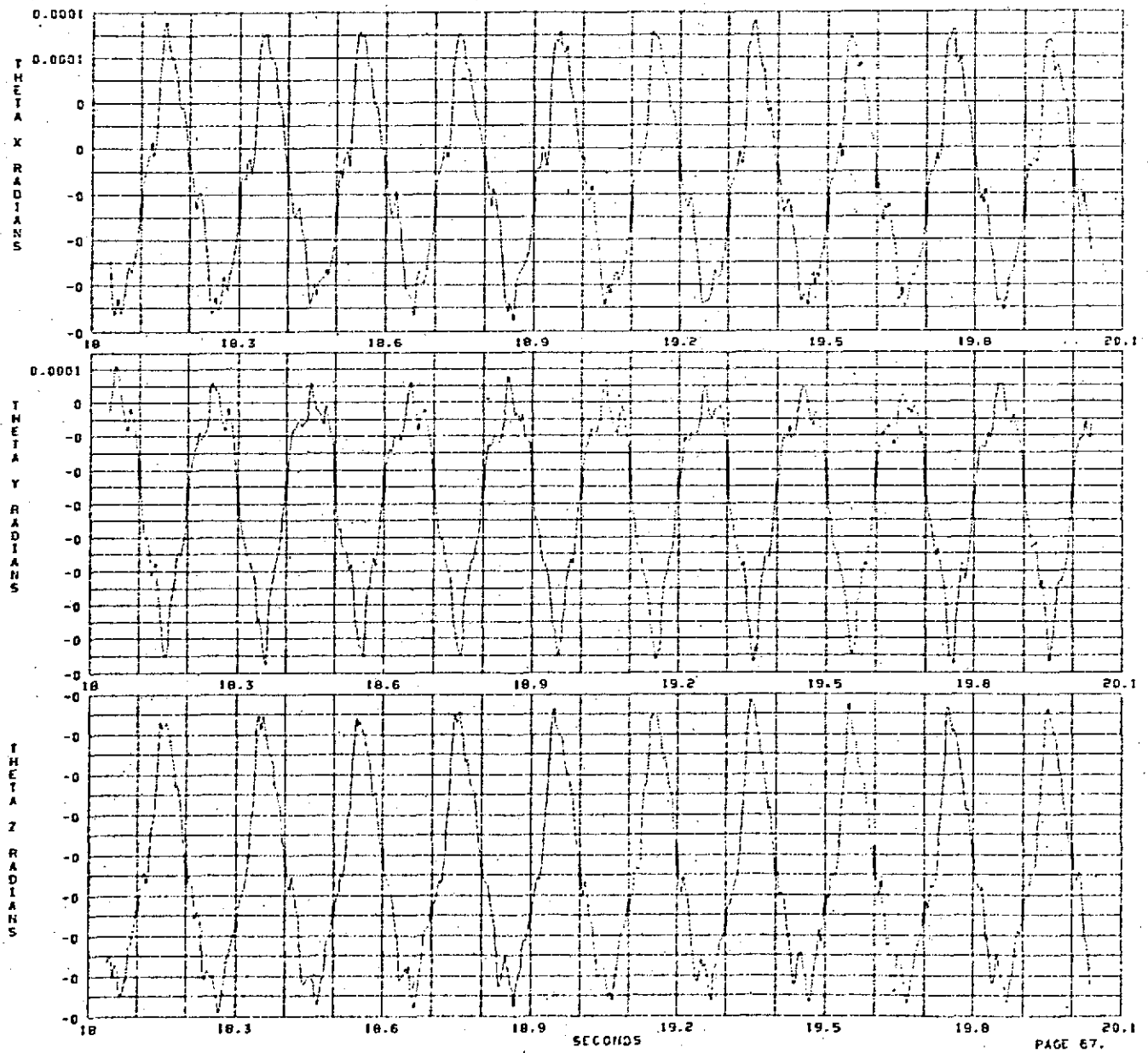
PAGE 65.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 5.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME

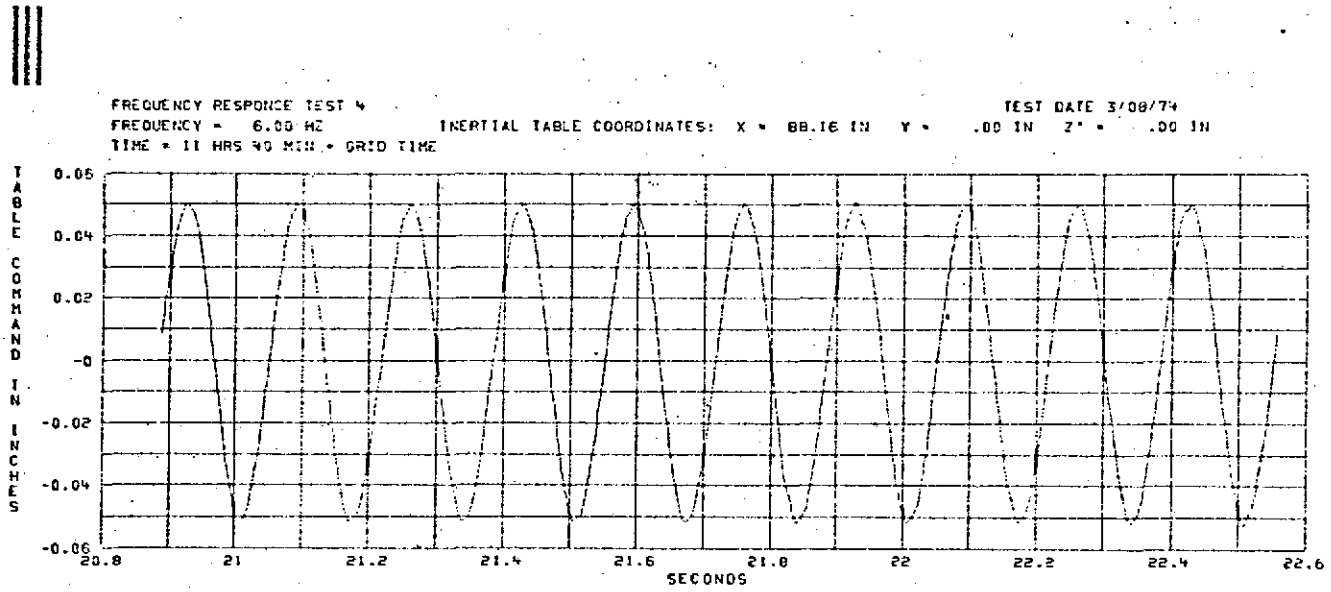


PAGE 66.

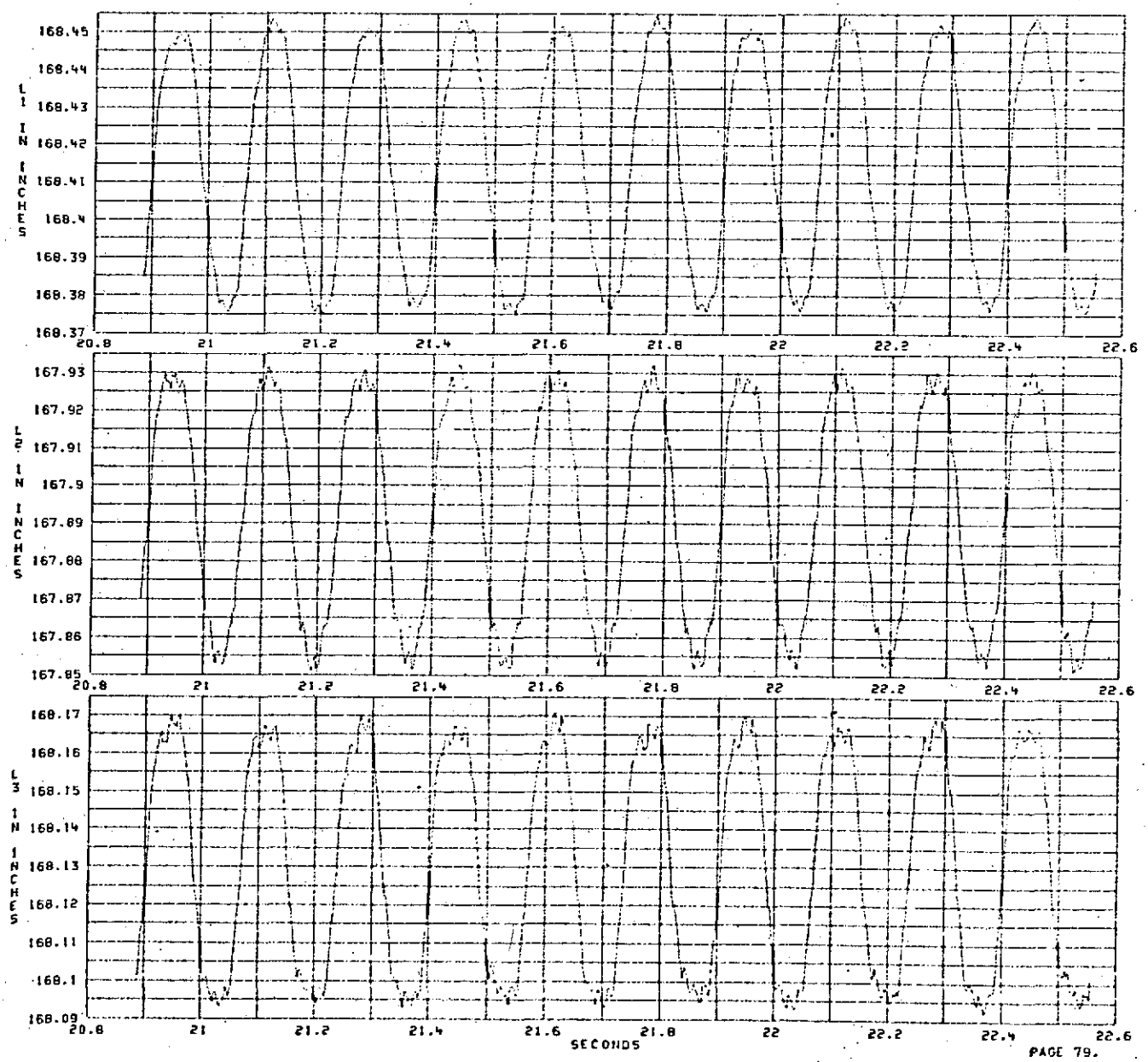
FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 5.00 HZ INERTIAL TABLE COORDINATES: X = 68.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



PAGE 67.

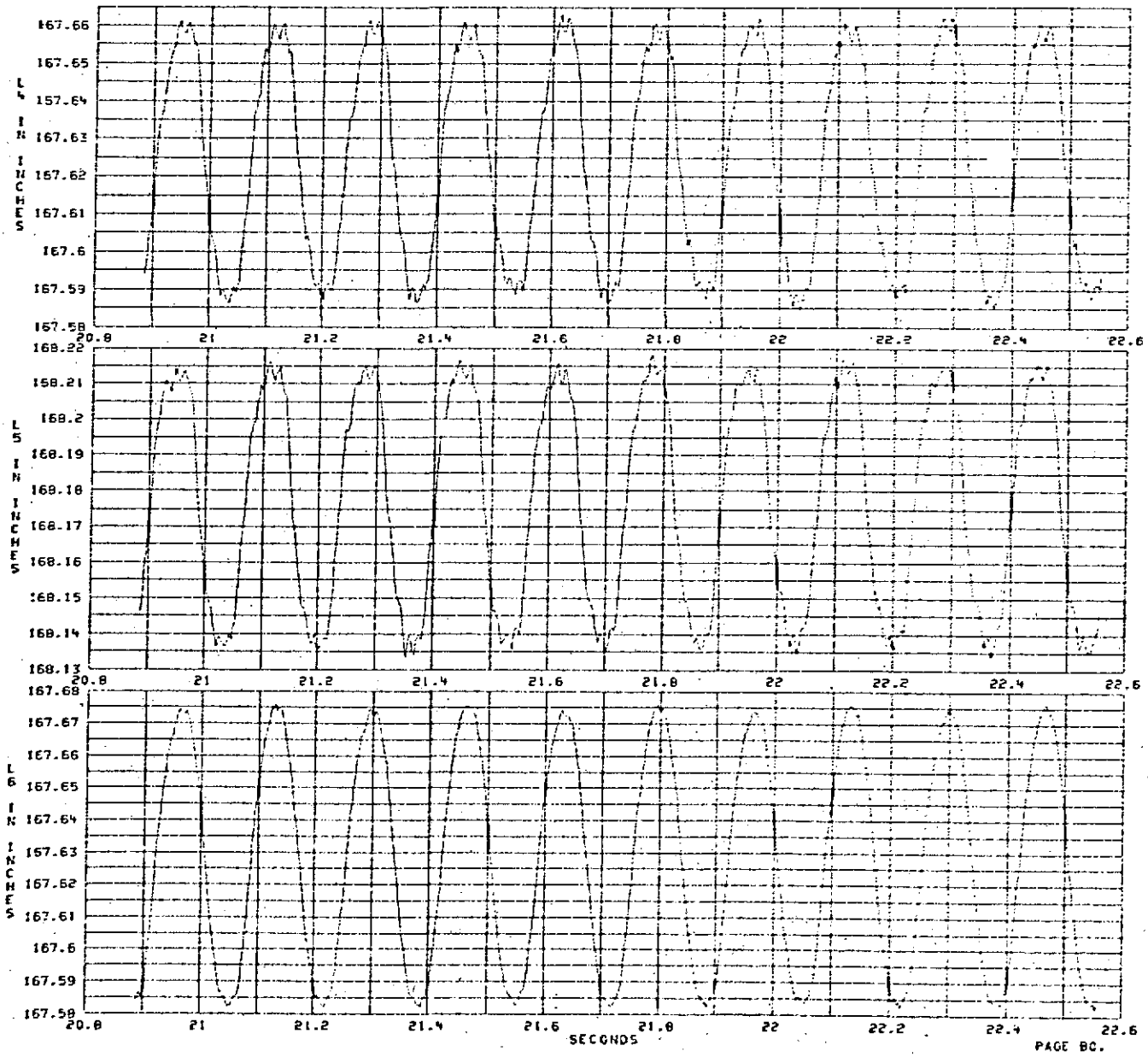

FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 6.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN. + GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
20.8
21
21.2
21.4
21.6
21.8
22
22.2
22.4
22.6
SECONDS

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 6.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME



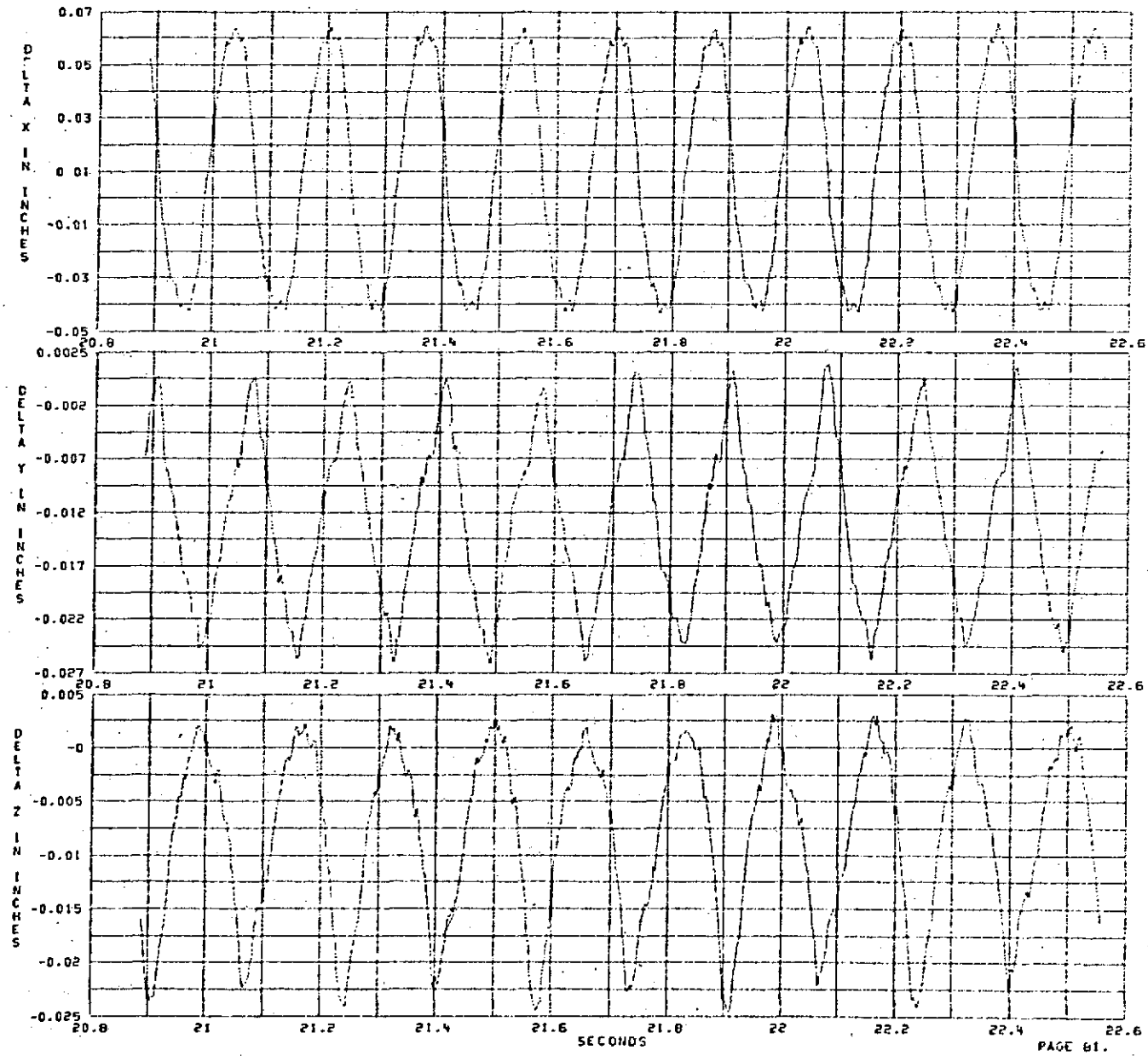
PAGE 79.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 6.00 HZ INERTIAL TABLE COORDINATES: X = 00.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



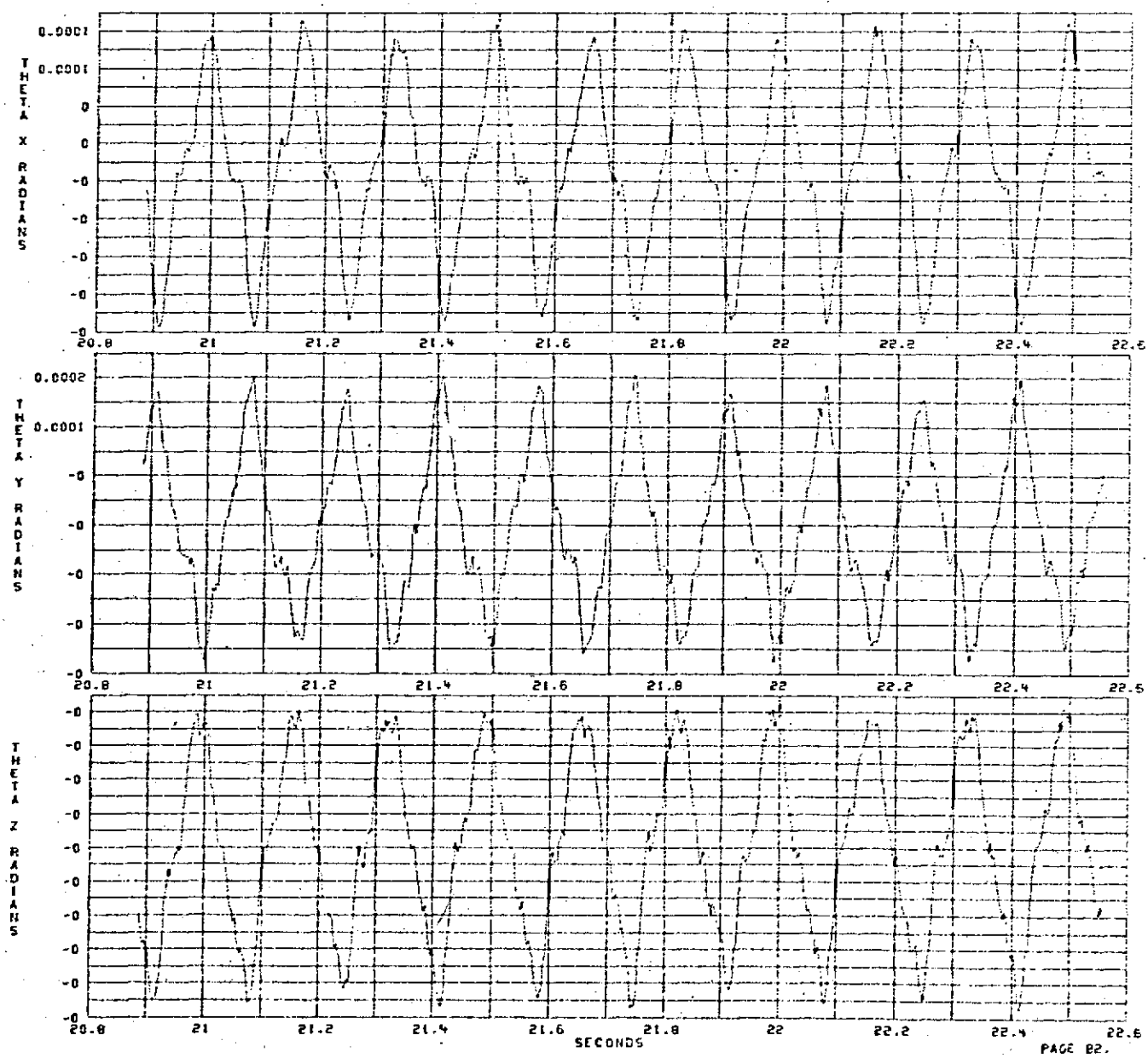
PAGE BC.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 6.00 HZ INERTIAL TABLE COSRDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME

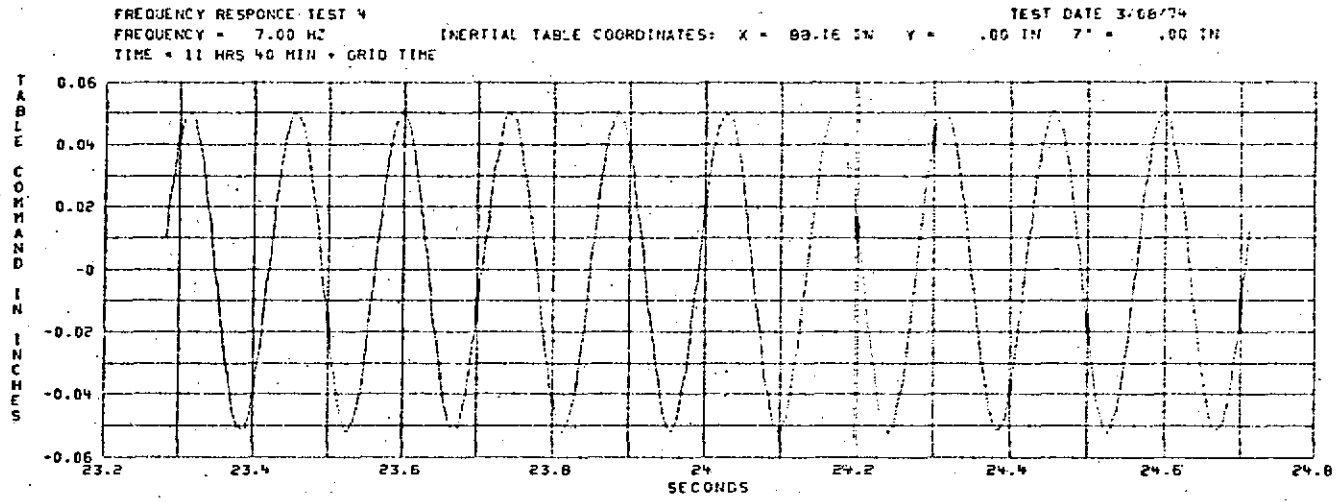


PAGE 81.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/09/74
FREQUENCY = 6.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME



PAGE B2.

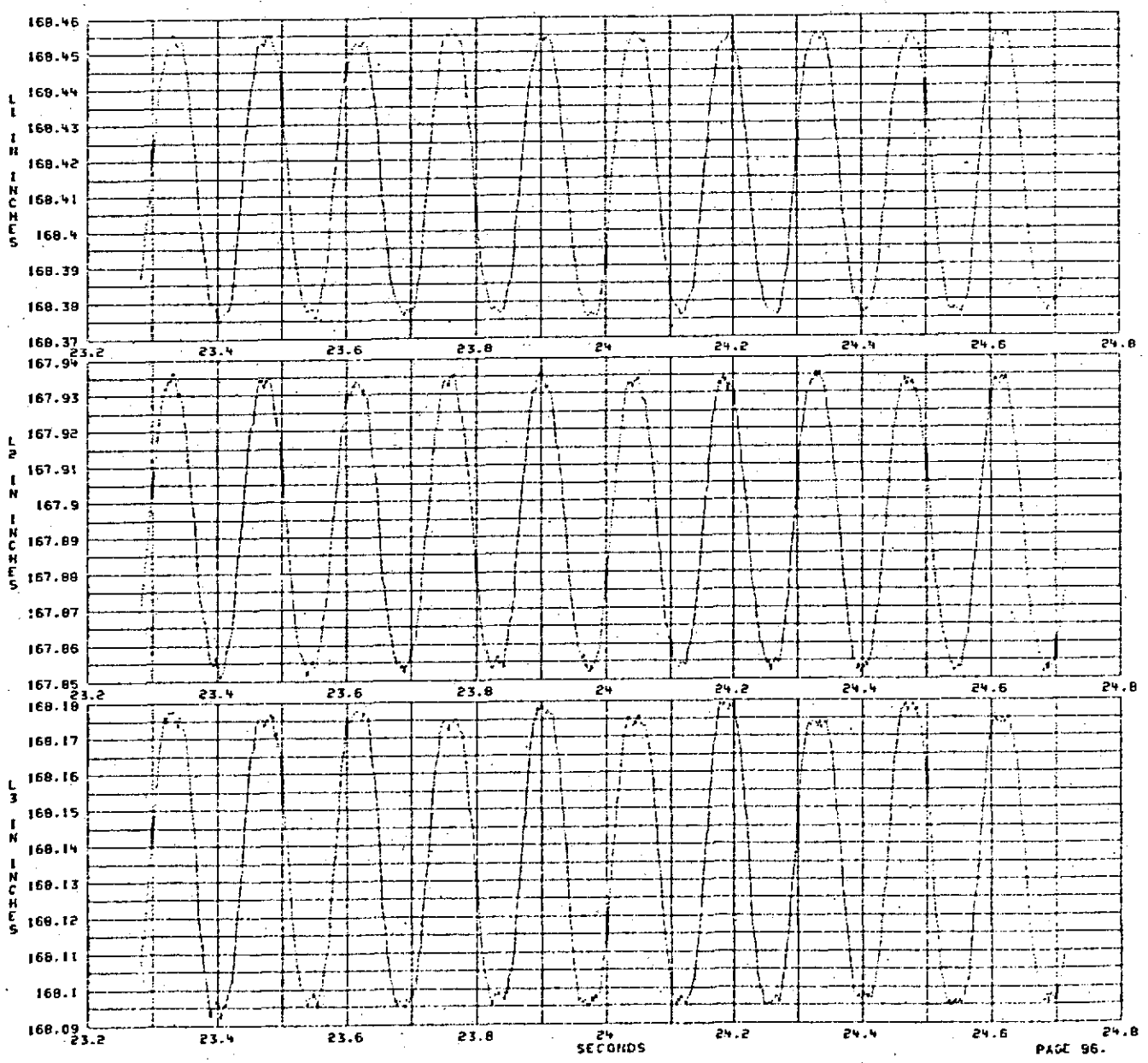

FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 80.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
23.2
23.4
23.6
23.8
24
24.2
24.4
24.6
24.8
SECONDS

PAGE 95.

FREQUENCY RESPONCE TEST 4
FREQUENCY = 7.00 HZ
TIME = 11 HRS 40 MIN = GRID TIME

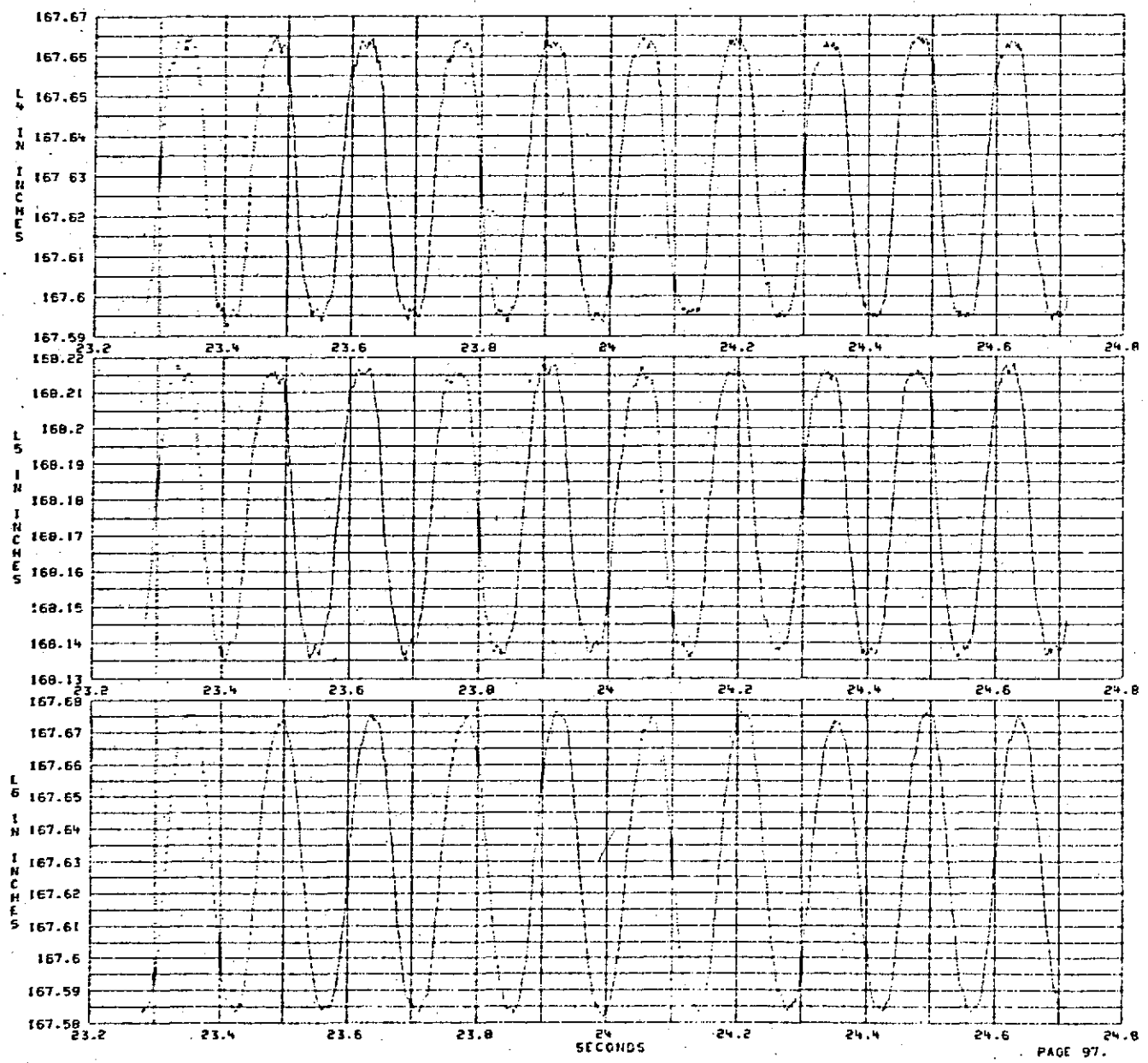
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN

TEST DATE 3/08/74



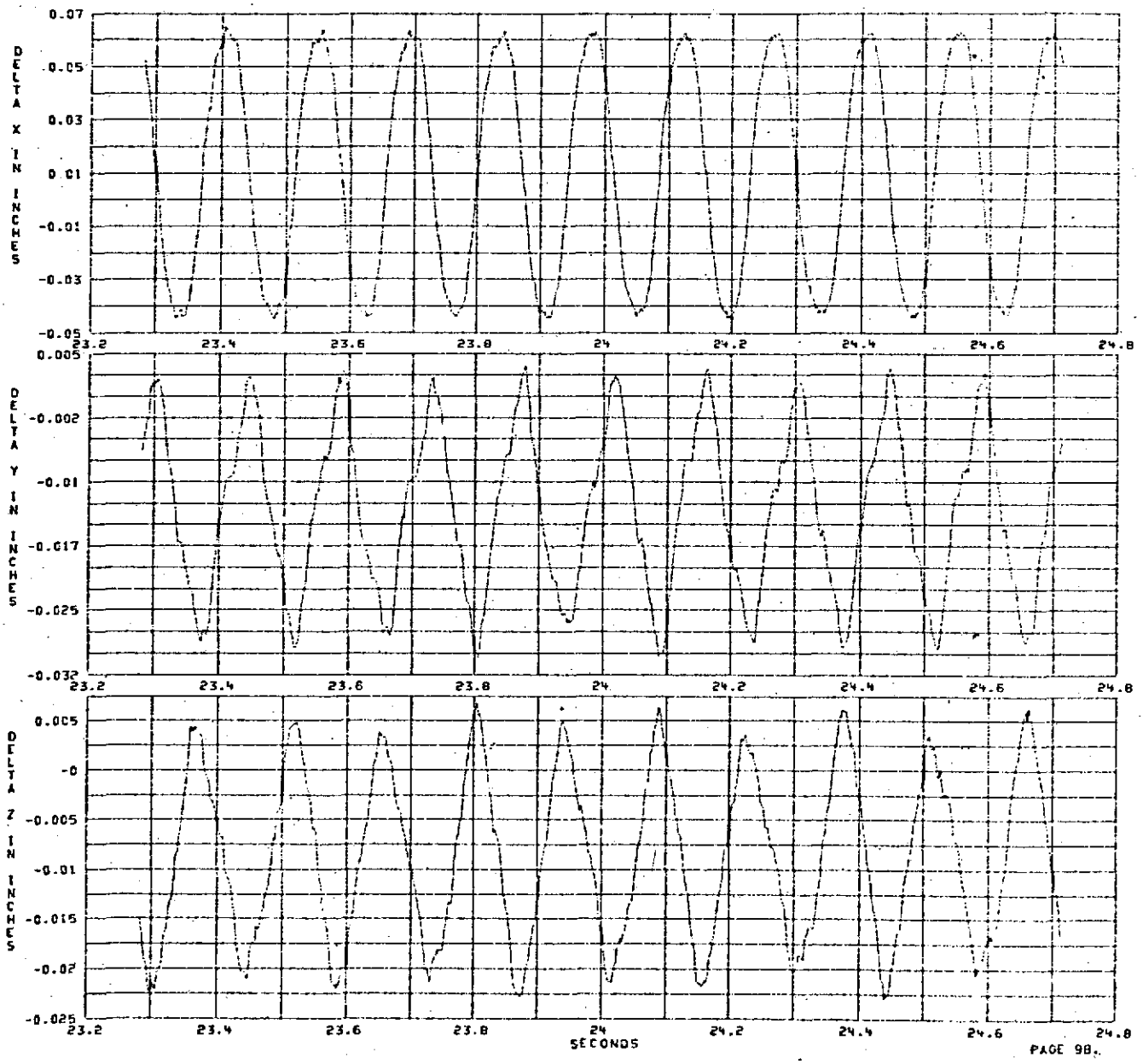
PAGE 96.

FREQUENCY RESPONSE TEST 4 TEST DATE 3/08/74
FREQUENCY = 7.00 HZ INERTIAL TABLE COORDINATES: X = 00.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME

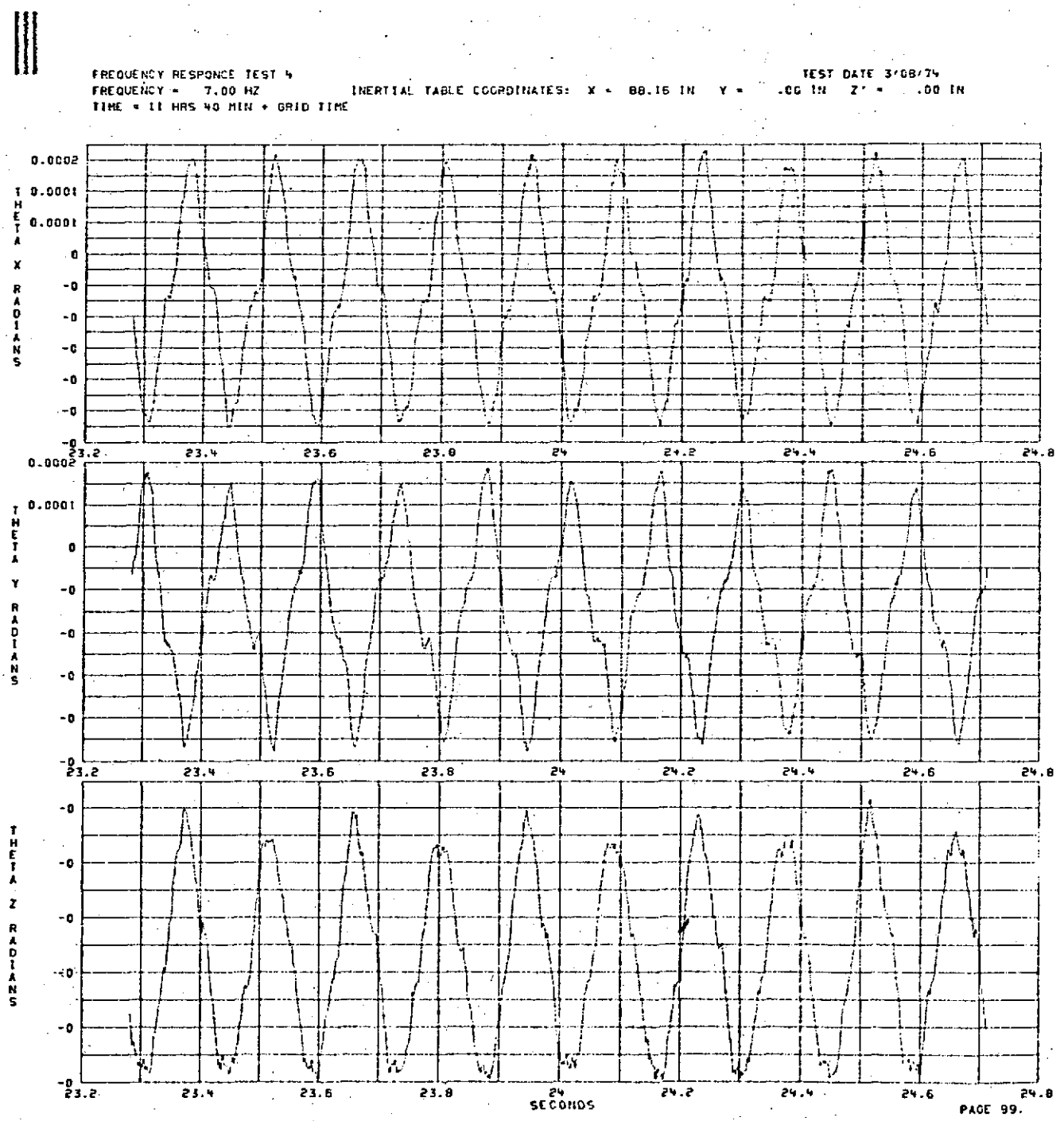


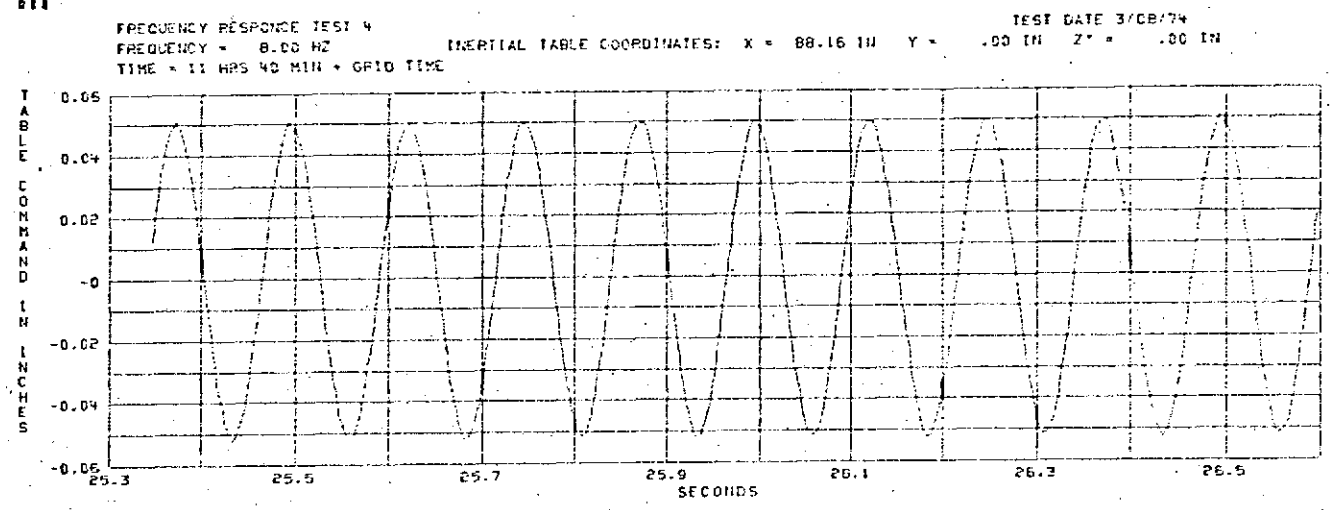
PAGE 97.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 7.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME



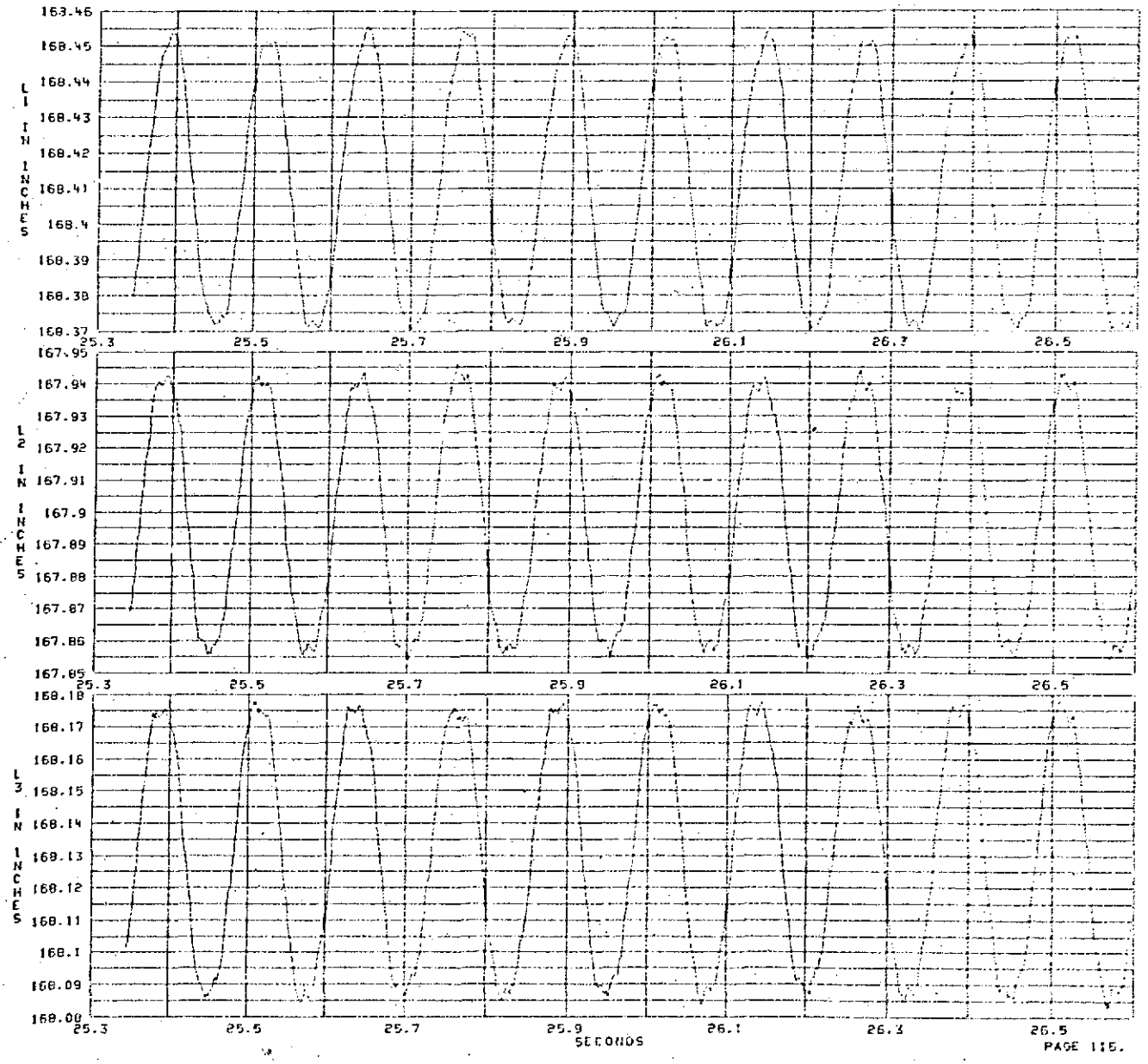
PAGE 98.


FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 7.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
0.0002
0.0001
0
-0
23.2
23.4
23.6
23.8
24
24.2
24.4
24.6
24.8
SECONDS
PAGE 99.



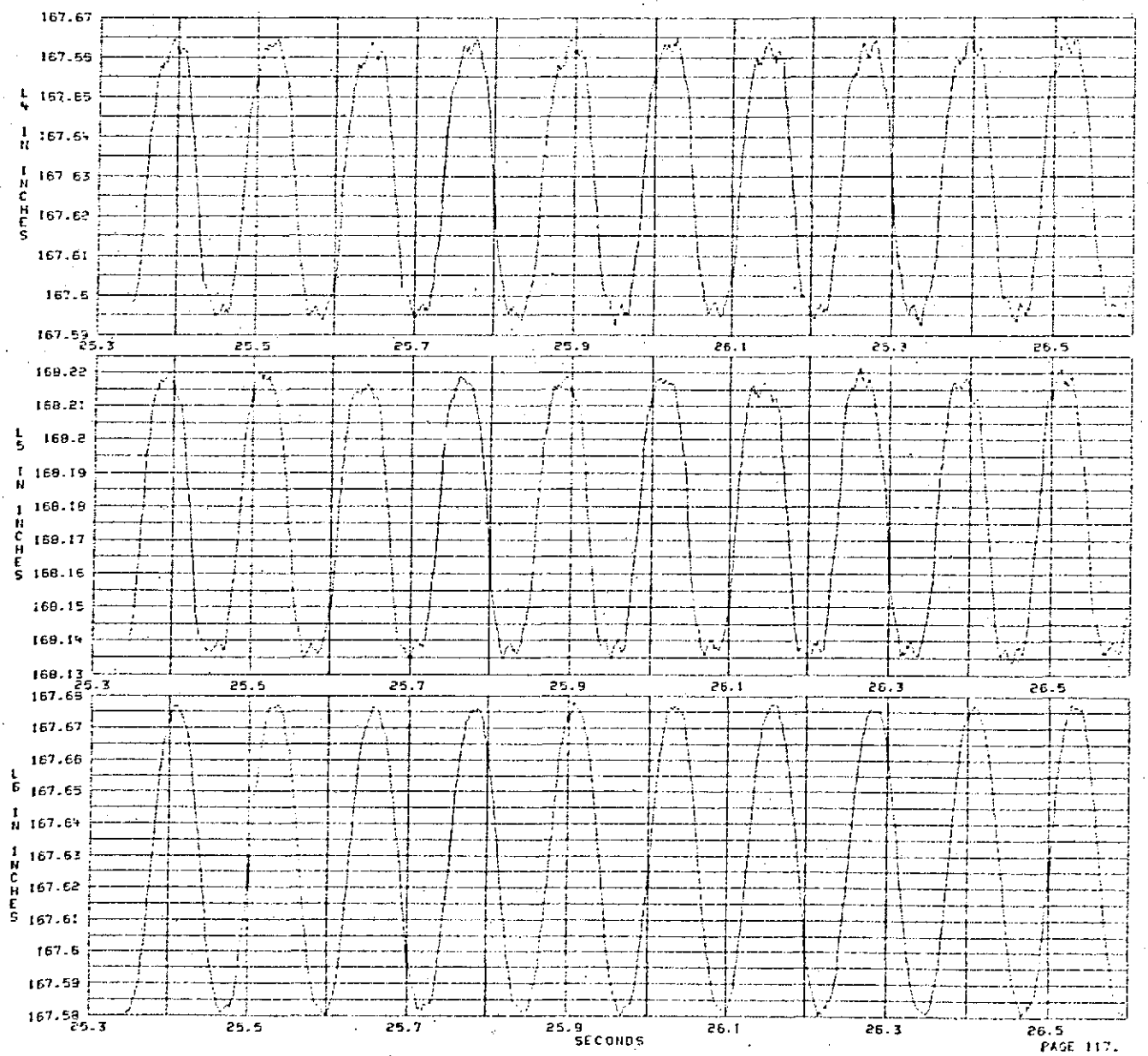
PAGE 115.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/28/74
FREQUENCY = 8.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME

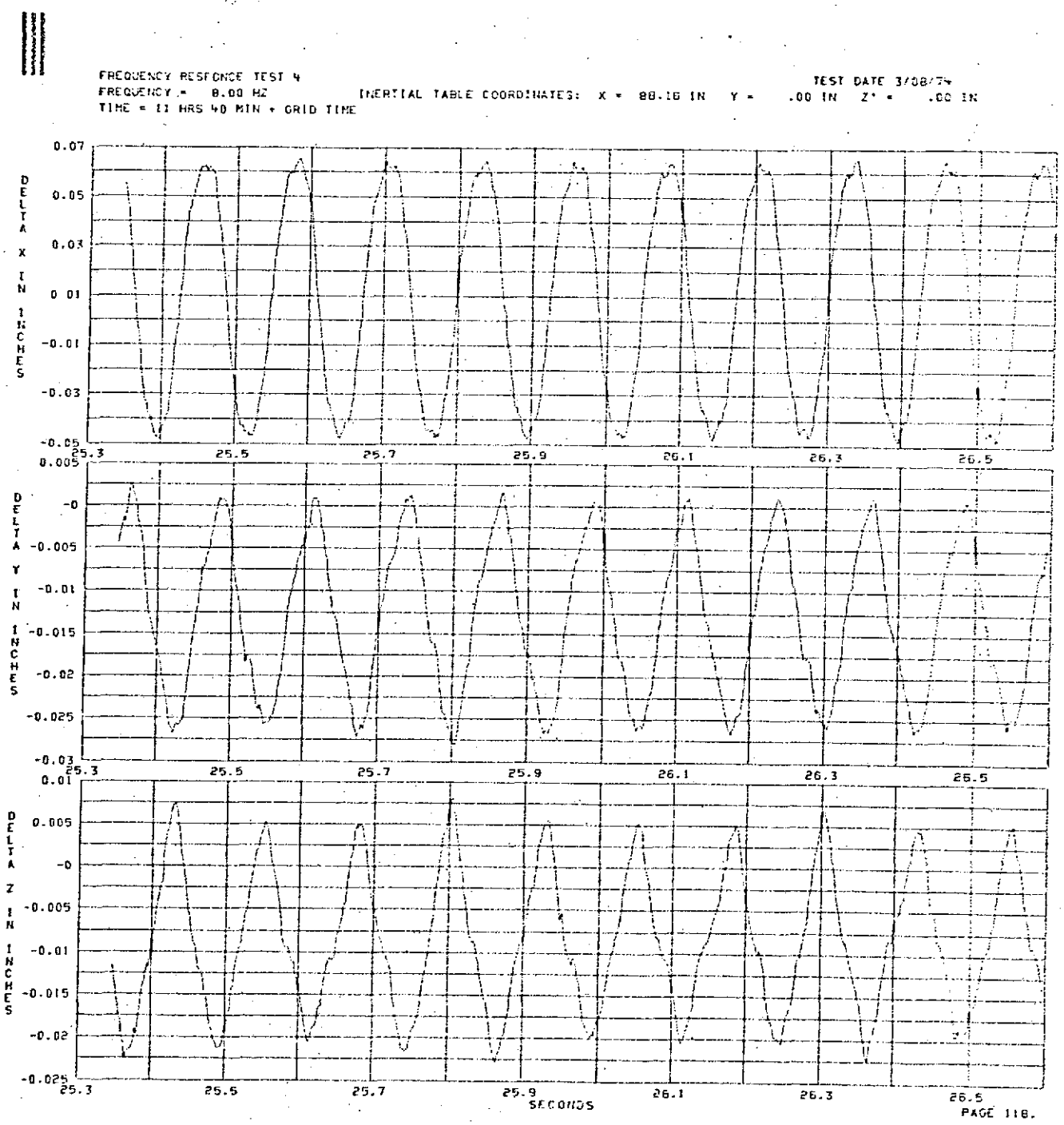


PAGE 115.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 8.55 HZ INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME



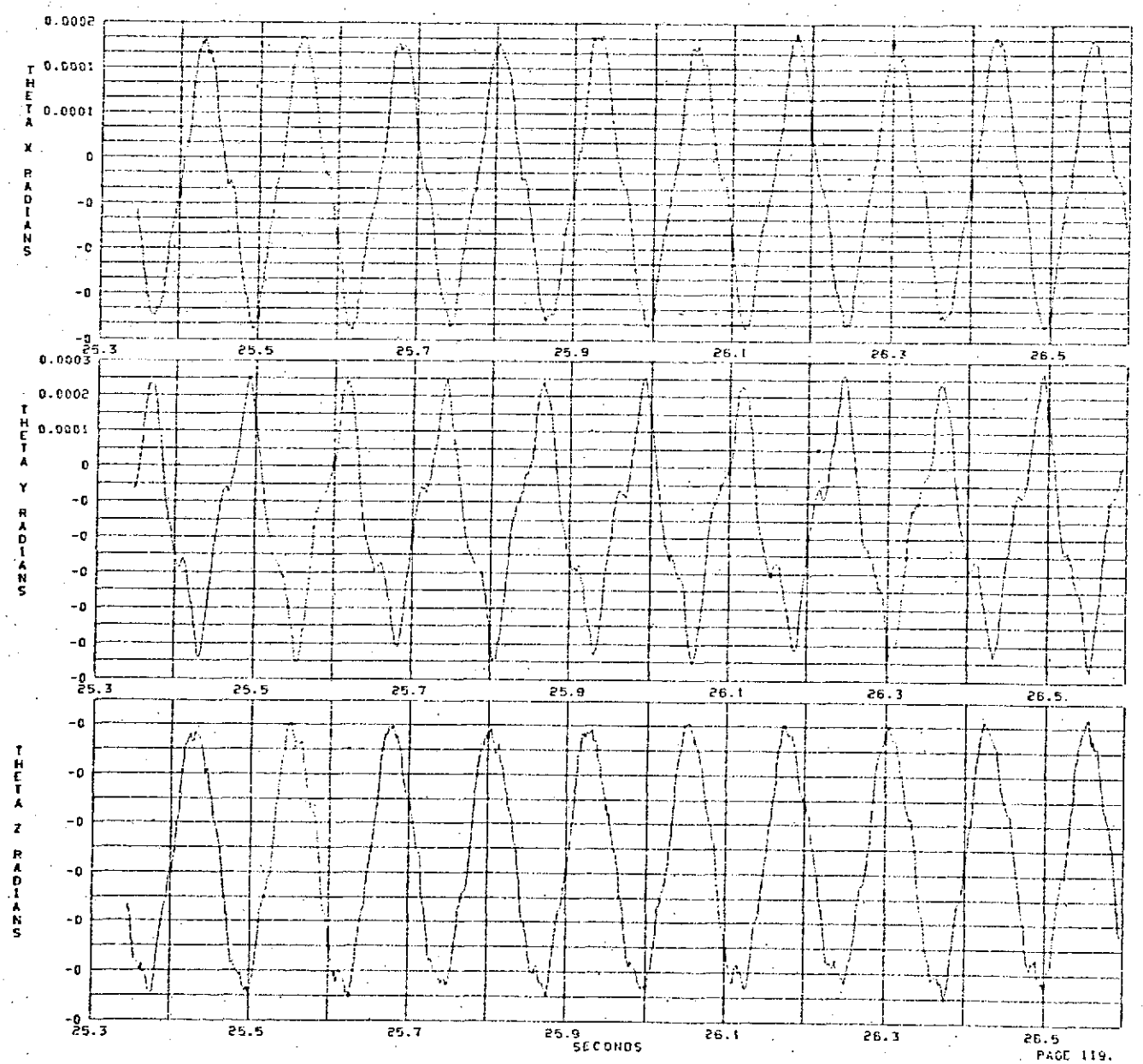
PAGE 117.


FREQUENCY RESPONCE TEST 4
FREQUENCY = 8.00 HZ
TIME = 11 HRS 40 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/7
DELTA X IN INCHES
0.07
0.05
0.03
0.01
-0.01
-0.03
-0.05
DELTA Y IN INCHES
0.005
-0
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
DELTA Z IN INCHES
0.01
0.005
-0
-0.005
-0.01
-0.015
-0.02
-0.025
25.3
25.5
25.7
25.9
26.1
26.3
26.5
SECONDS
PAGE 118.

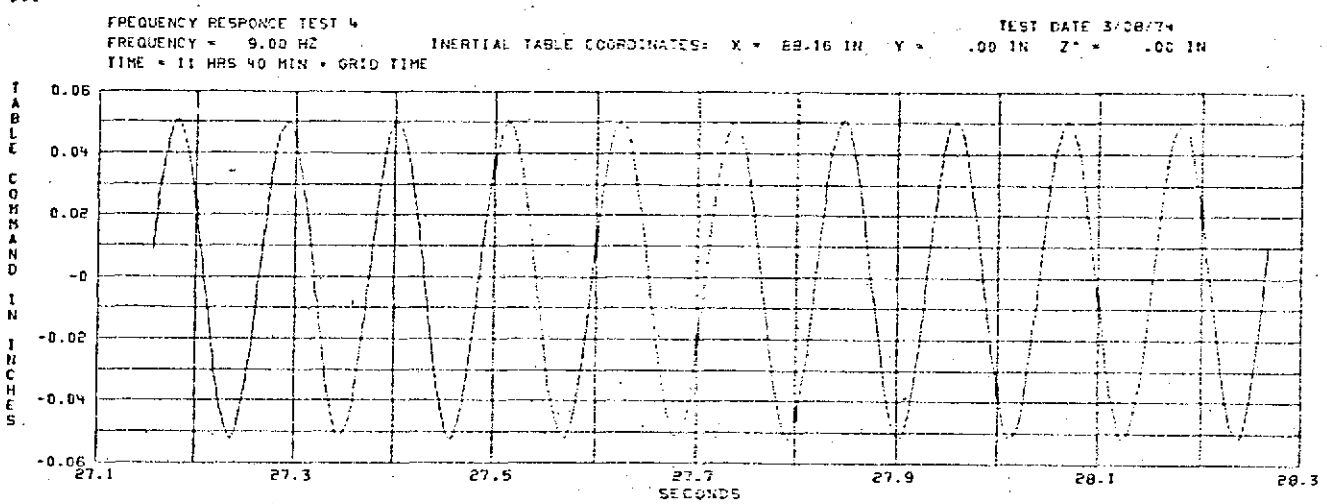
FREQUENCY RESPONCE TEST 4
FREQUENCY = 8.00 HZ
TIME = 11 HRS 40 MIN - GRID TIME

INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN

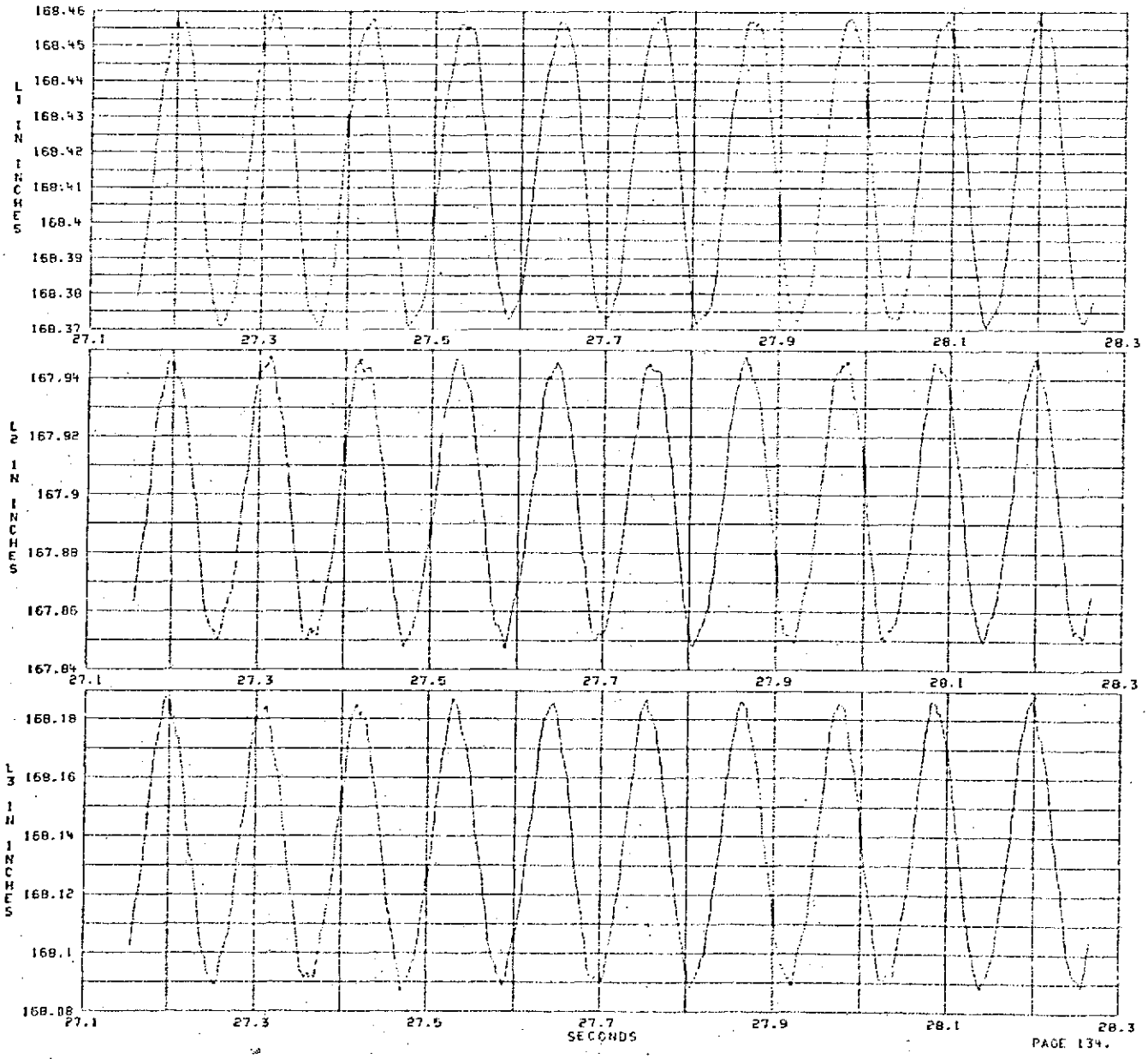
TEST DATE 3/08/74



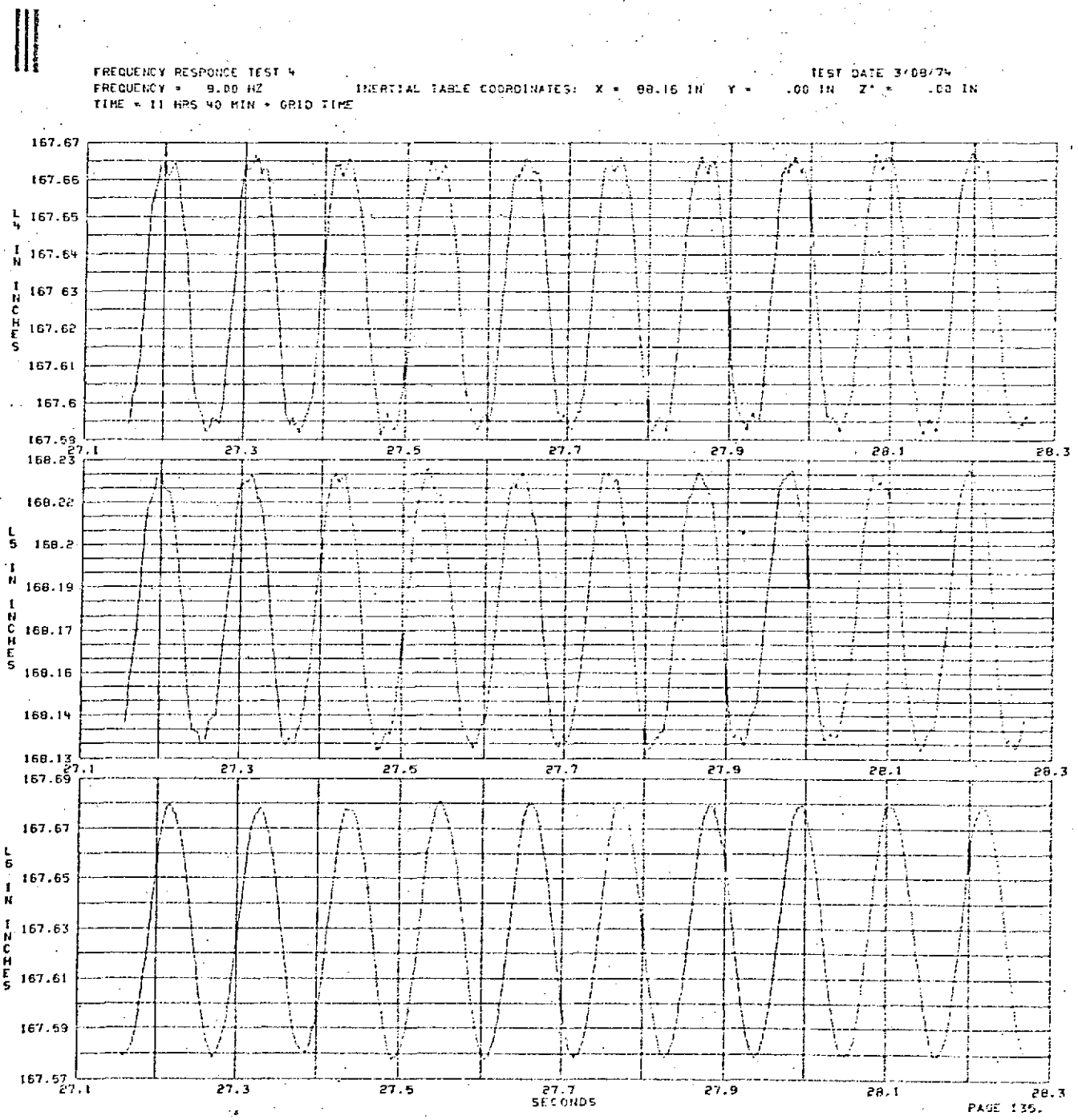
PAGE 119.

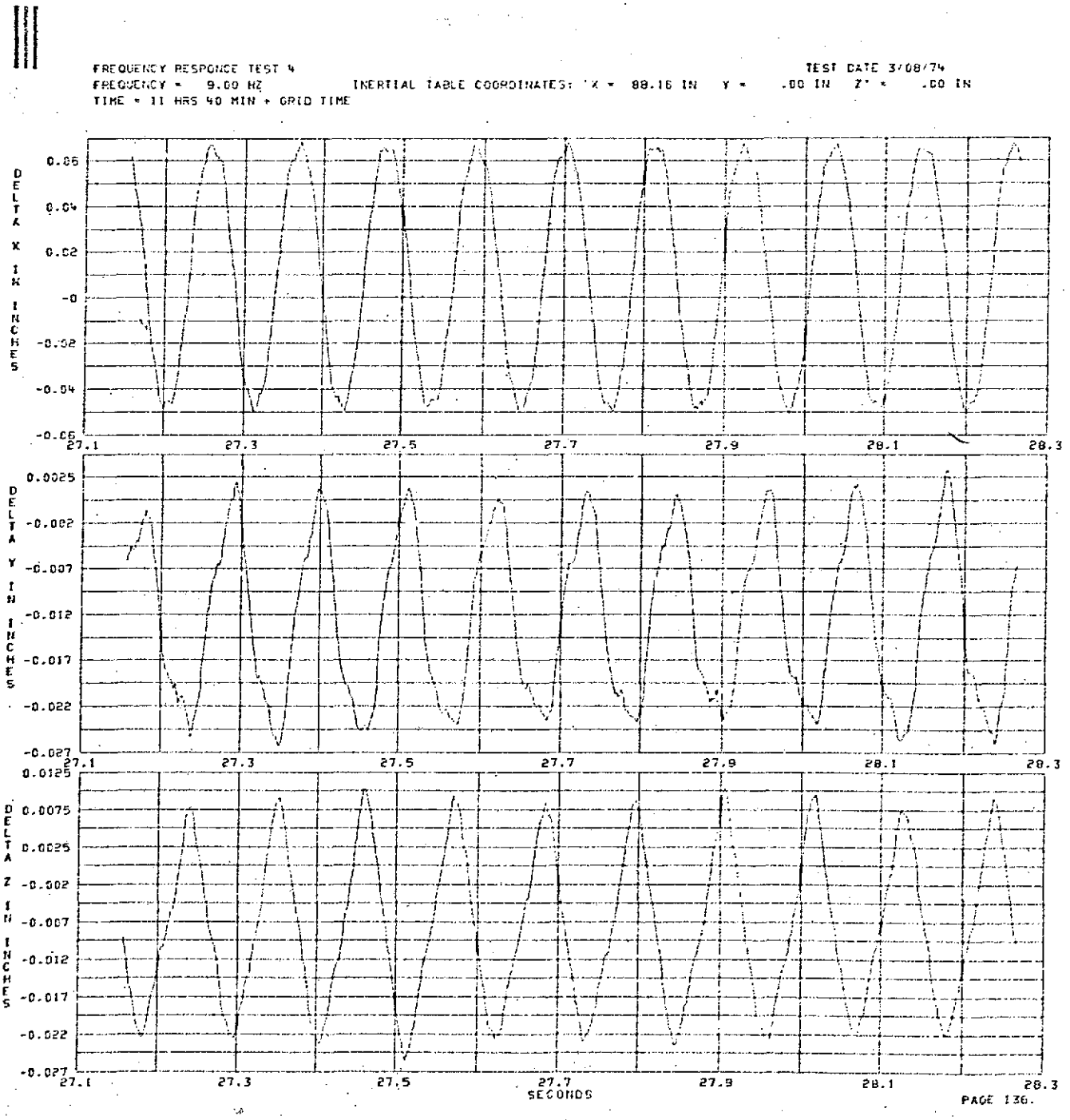

FREQUENCY RESPONCE TEST 4
FREQUENCY = 9.00 HZ
TIME = 11 HRS 40 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
27.1
27.3
27.5
27.7
27.9
28.1
28.3
SECONDS

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 9.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN - GRID TIME

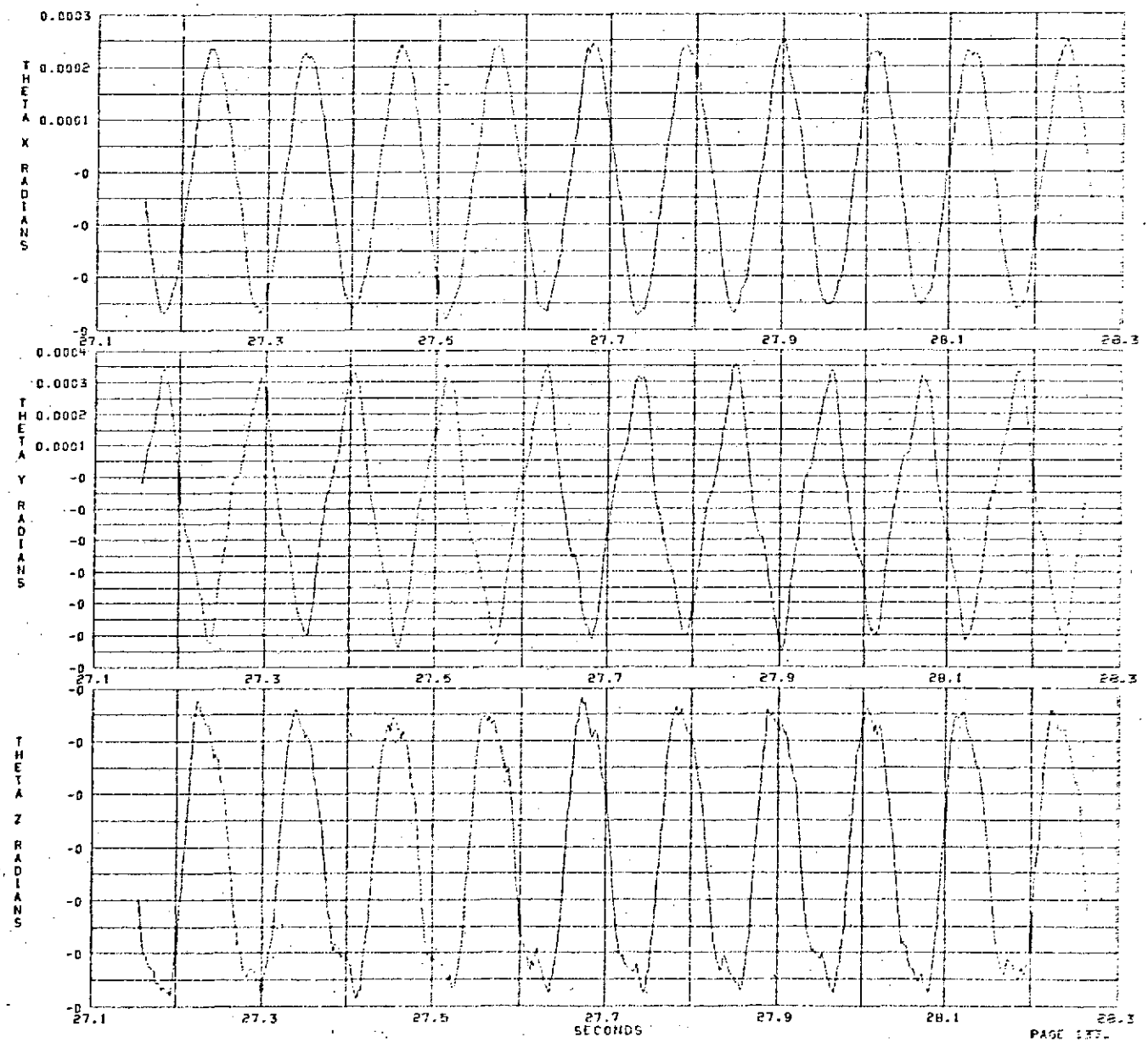


PAGE 134.

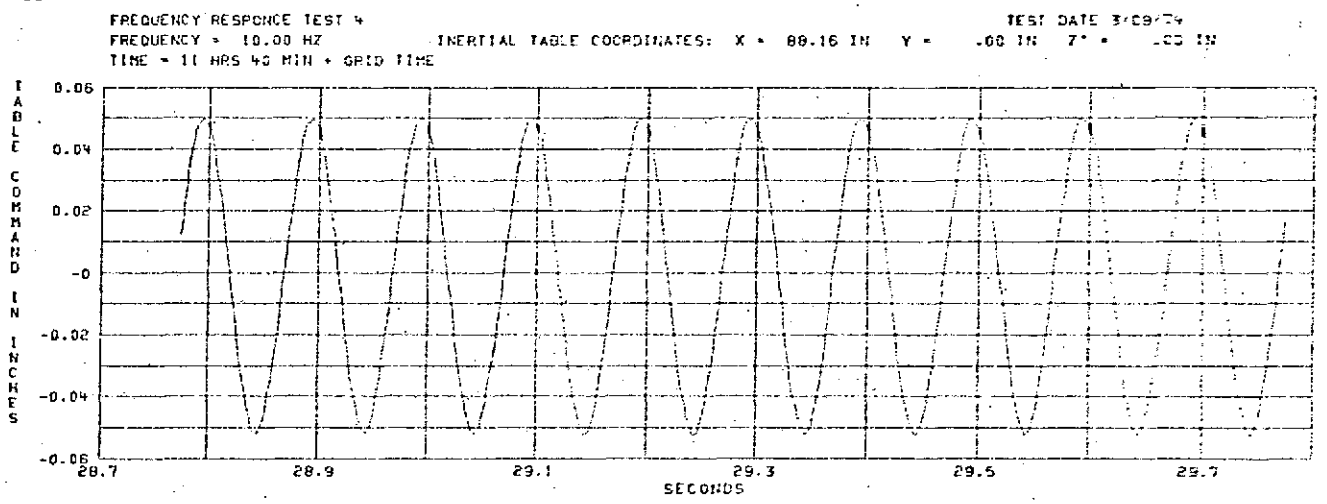

FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 9.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
L4 IN INCHES
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
L5 IN INCHES
168.23
168.22
168.2
168.19
168.17
168.16
168.14
168.13
L6 IN INCHES
167.69
167.67
167.65
167.63
167.61
167.59
167.57
27.1
27.3
27.5
27.7
27.9
28.1
28.3
SECONDS
PAGE 135.


FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 9.00 HZ
INERTIAL TABLE COORDINATES: 'X = 88.16 IN Y = .00 IN Z' = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME
DELTA X IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
DELTA Y IN INCHES
0.0025
-0.002
-0.007
-0.012
-0.017
-0.022
-0.027
DELTA Z IN INCHES
0.0125
0.0075
0.0025
-0.002
-0.007
-0.012
-0.017
-0.022
-0.027
27.1
27.3
27.5
27.7
27.9
28.1
28.3
SECONDS
PAGE 136.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 9.60 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .05 IN
TIME = 11 HRS 40 MIN + GRID TIME

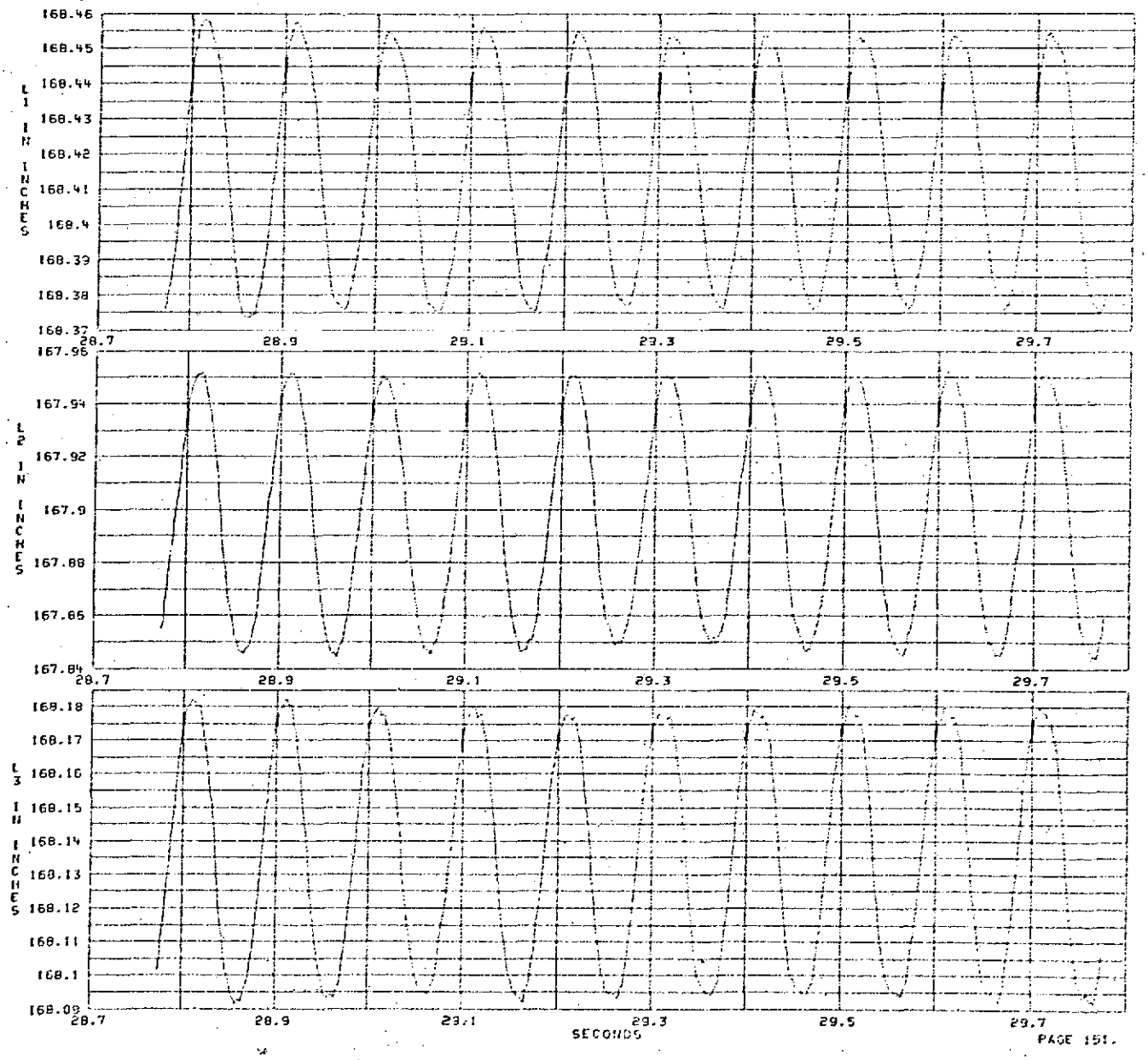


PAGE [illegible]

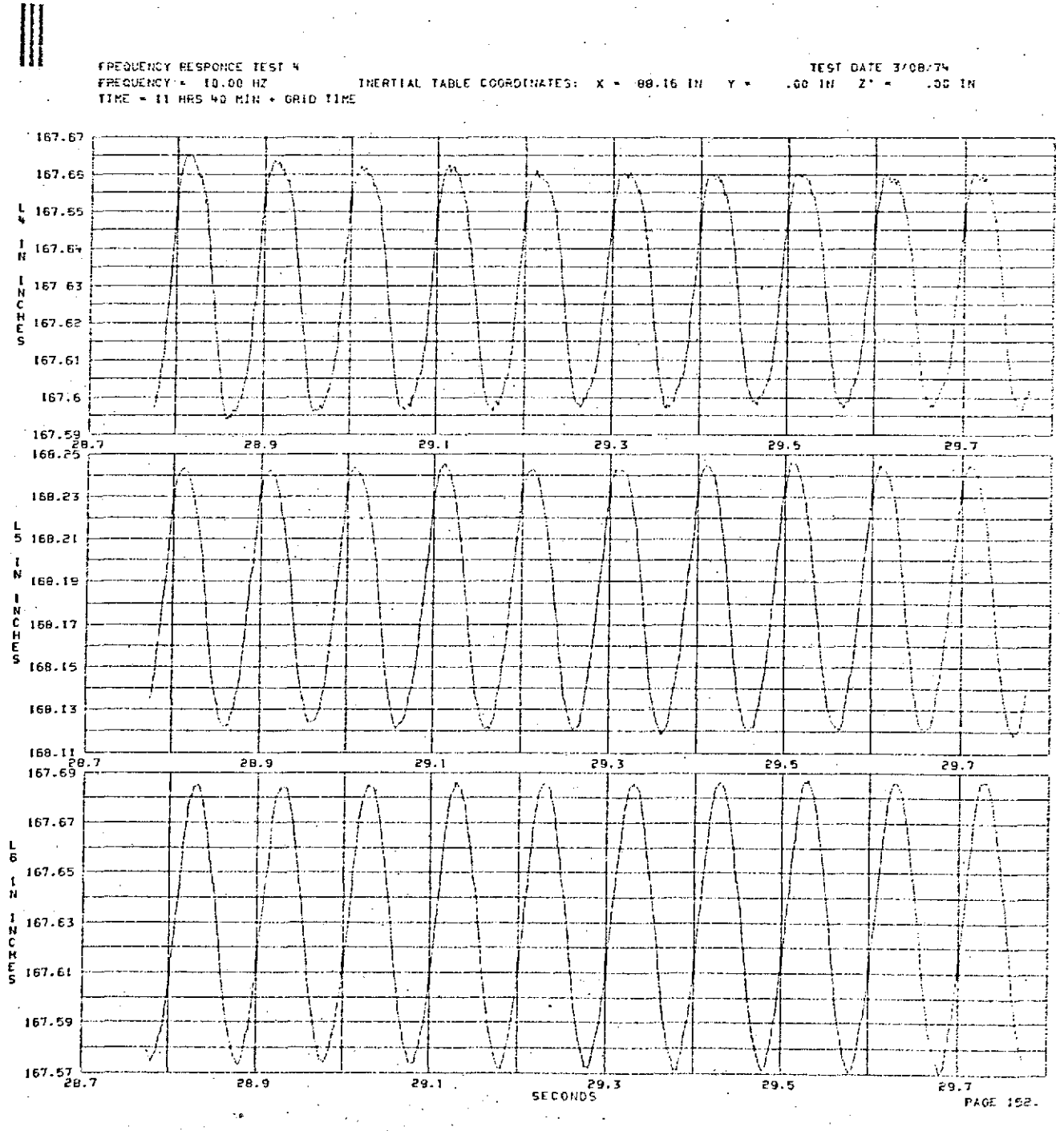

FREQUENCY RESPONCE TEST 4
FREQUENCY = 10.00 HZ
TIME = 11 HRS 43 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
28.7
28.9
29.1
29.3
29.5
29.7
SECONDS

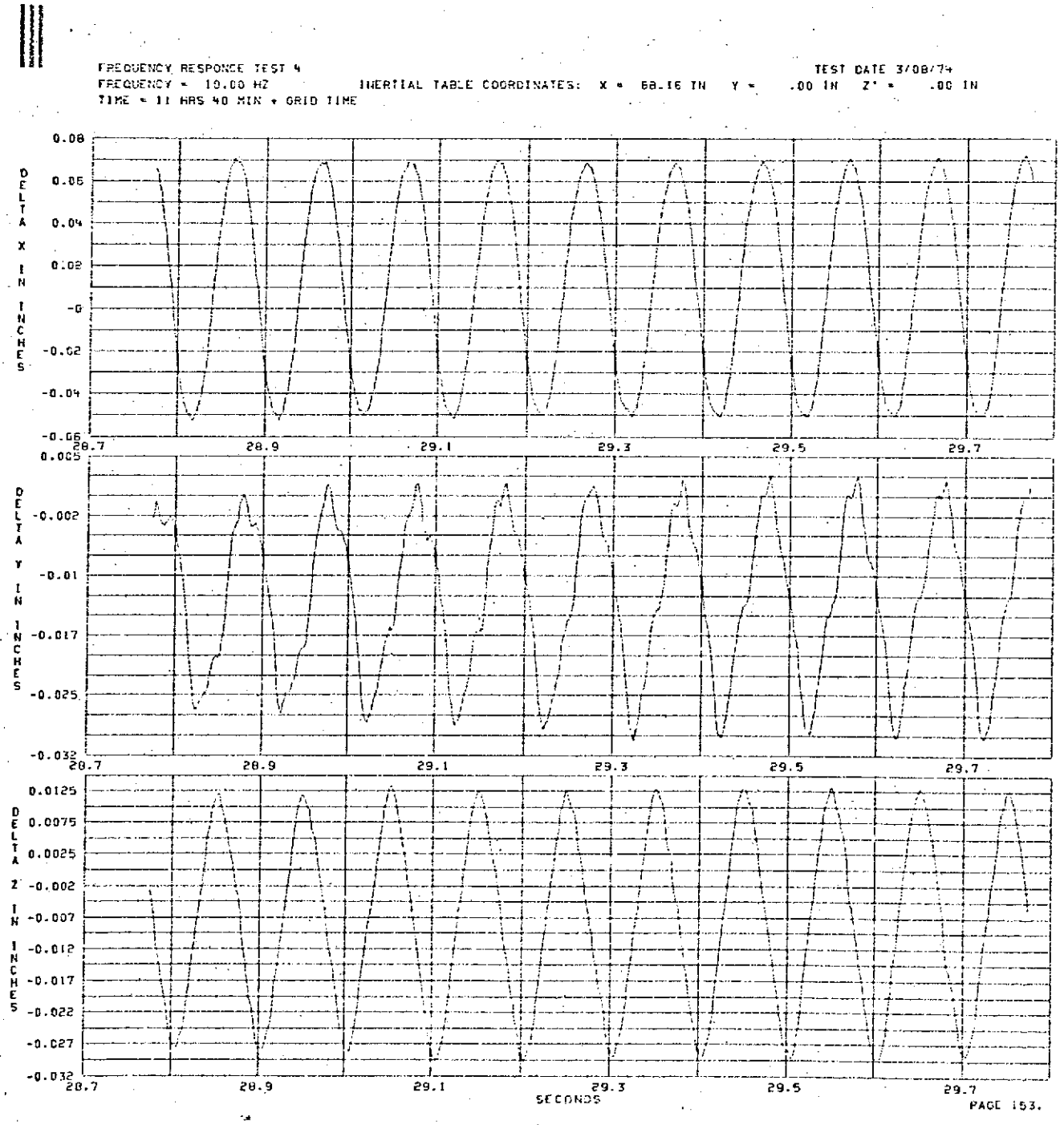
PAGE 150.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 10.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .50 IN
TIME = 11 HRS 40 MIN + GRID TIME

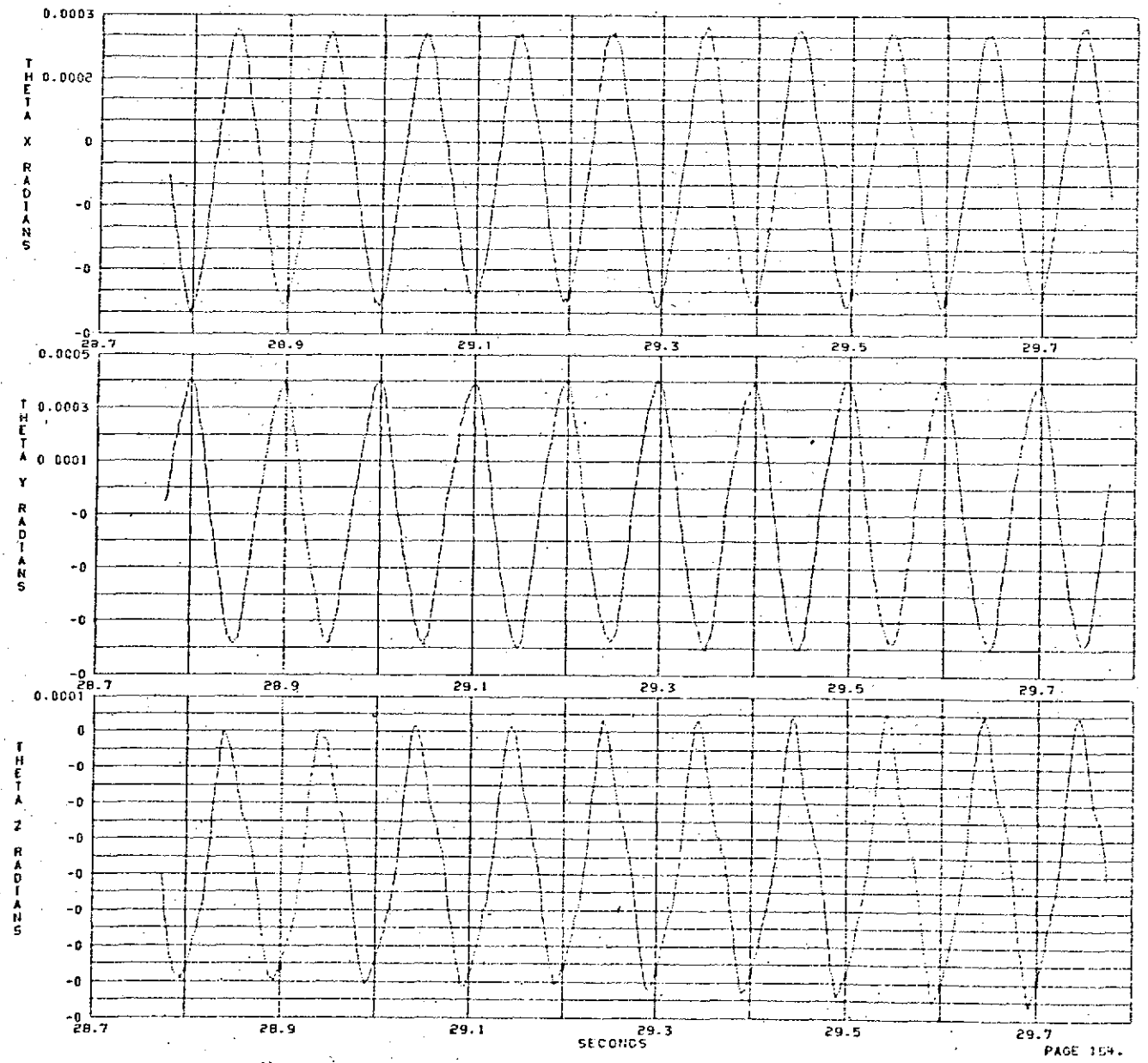


PAGE 151.

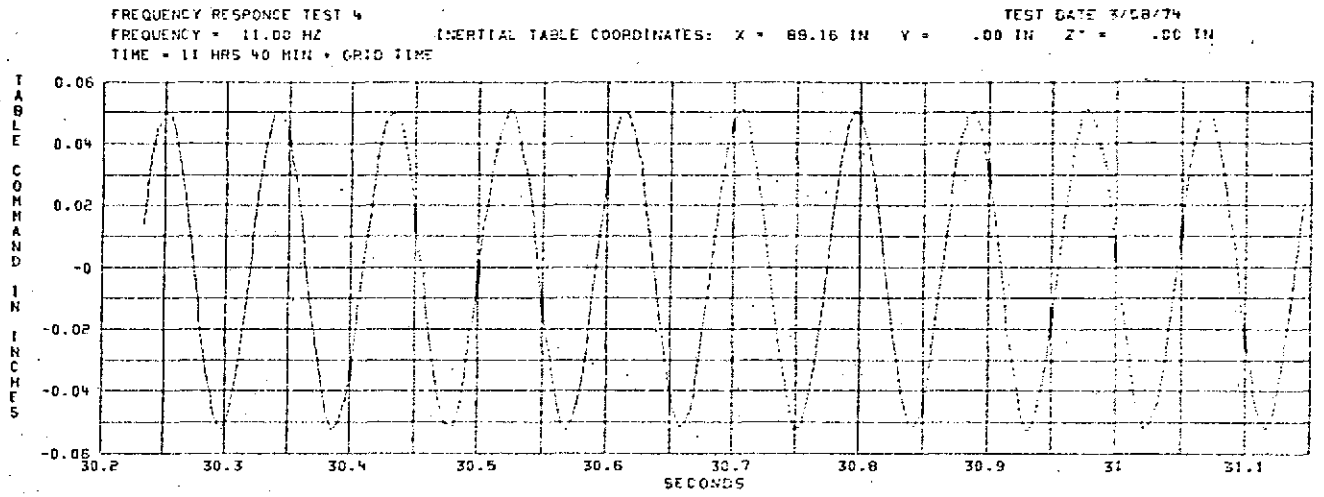

FREQUENCY RESPONCE TEST 4
TEST DATE 3/08/74
FREQUENCY = 10.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN + GRID TIME
L4 IN INCHES
167.67
167.66
167.65
167.64
167.63
167.62
167.61
167.6
167.59
L5 IN INCHES
168.25
168.23
168.21
168.19
168.17
168.15
168.13
168.11
L6 IN INCHES
167.69
167.67
167.65
167.63
167.61
167.59
167.57
28.7
28.9
29.1
29.3
29.5
29.7
SECONDS
PAGE 152.

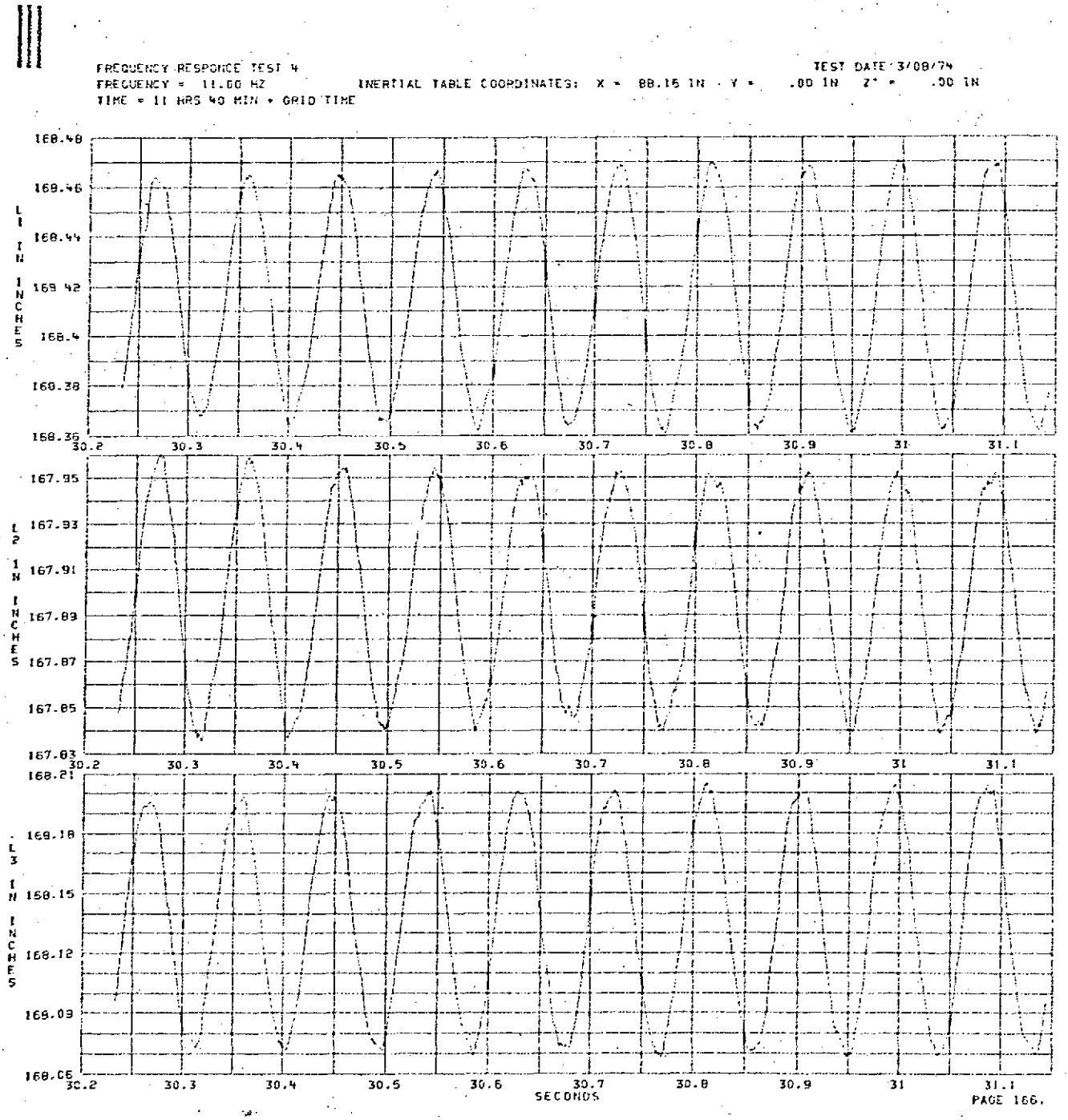

FREQUENCY RESPONSE TEST 4
FREQUENCY = 10.00 HZ
TIME = 11 HRS 40 MIN = GRID TIME
INERTIAL TABLE COORDINATES: X = 68.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
DELTA X IN INCHES
0.08
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
DELTA Y IN INCHES
0.005
-0.002
-0.01
-0.017
-0.025
-0.032
DELTA Z IN INCHES
0.0125
0.0075
0.0025
-0.002
-0.007
-0.012
-0.017
-0.022
-0.027
-0.032
28.7
28.9
29.1
29.3
29.5
29.7
SECONDS
PAGE 153.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 10.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN - GRID TIME

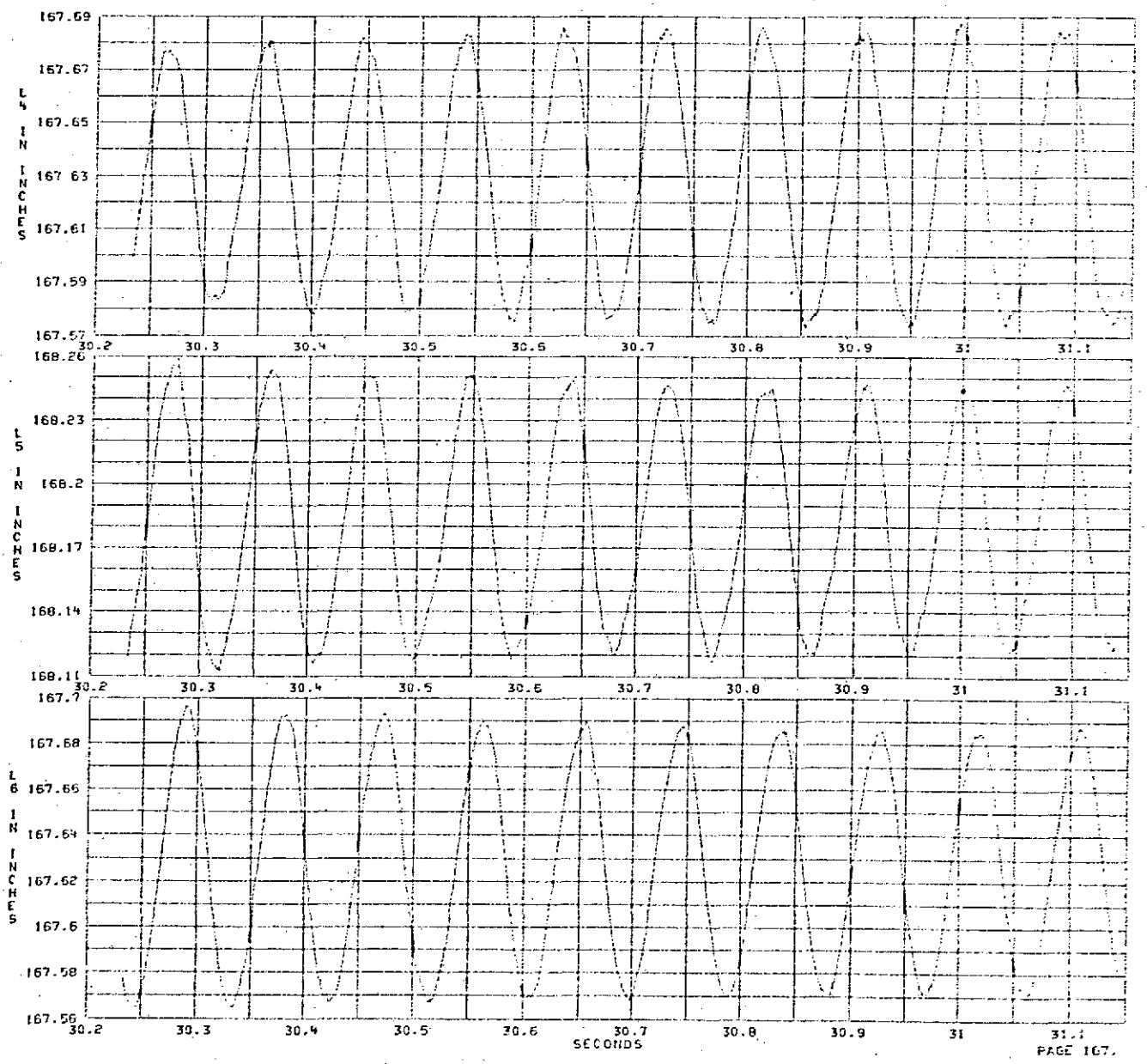


PAGE 154.


FREQUENCY RESPONCE TEST 4
FREQUENCY = 11.00 HZ
TIME = 11 HRS 40 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/28/74
TABLE COMMAND IN INCHES
0.06
0.04
0.02
-0
-0.02
-0.04
-0.06
30.2
30.3
30.4
30.5
30.6
30.7
30.8
30.9
31
31.1
SECONDS

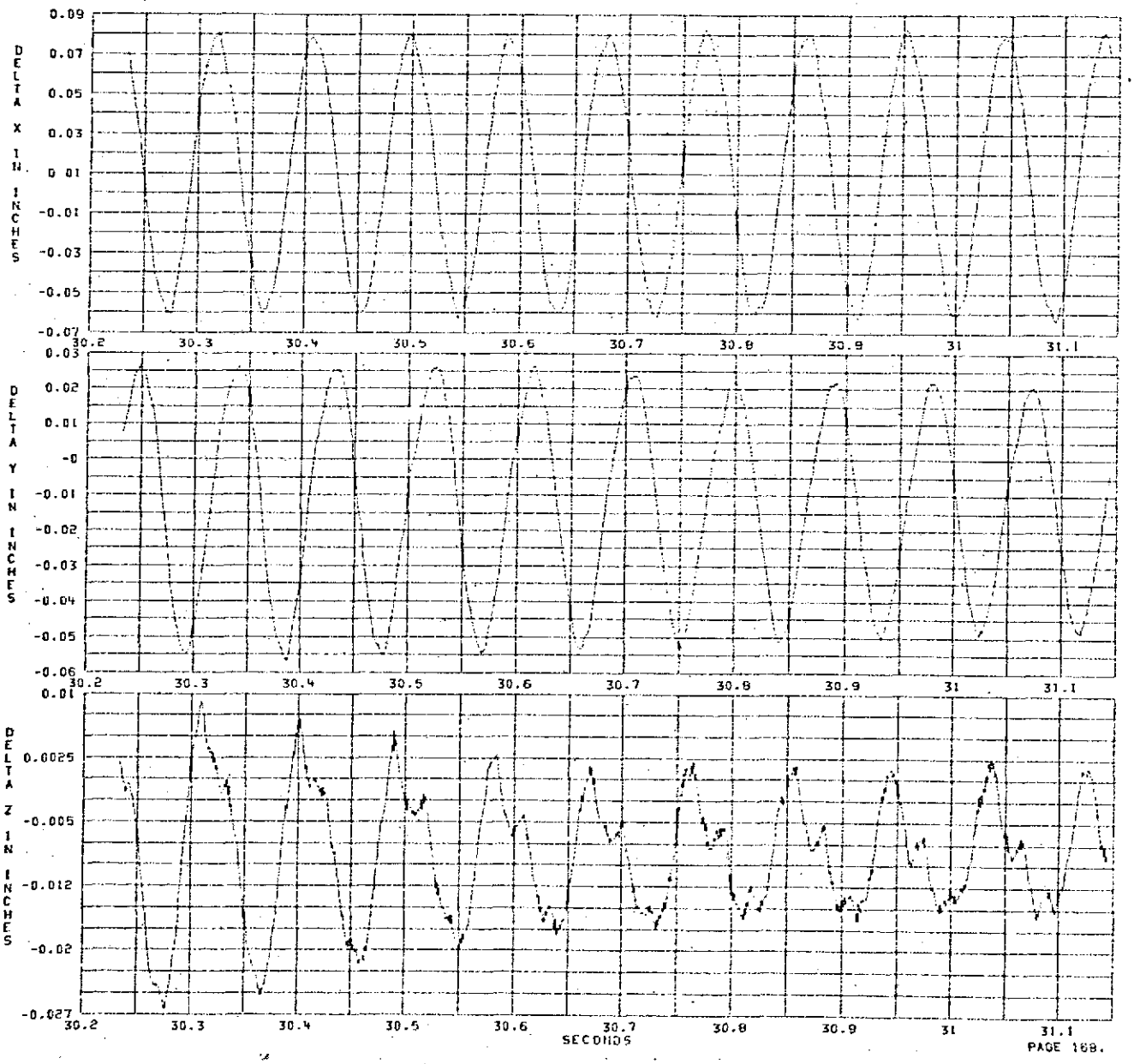

FREQUENCY RESPONCE TEST 4
FREQUENCY = 11.00 HZ
TIME = 11 HRS 40 MIN + GRID TIME
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .00 IN
TEST DATE 3/08/74
L1 IN INCHES
168.48
169.46
168.44
169.42
168.4
168.38
168.36
L2 IN INCHES
167.95
167.93
167.91
167.89
167.87
167.85
167.83
L3 IN INCHES
168.21
169.18
168.15
168.12
168.09
168.06
30.2
30.3
30.4
30.5
30.6
30.7
30.8
30.9
31
31.1
SECONDS
PAGE 166.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 11.00 HZ INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .30 IN
TIME = 11 HRS 40 MIN + GRID TIME

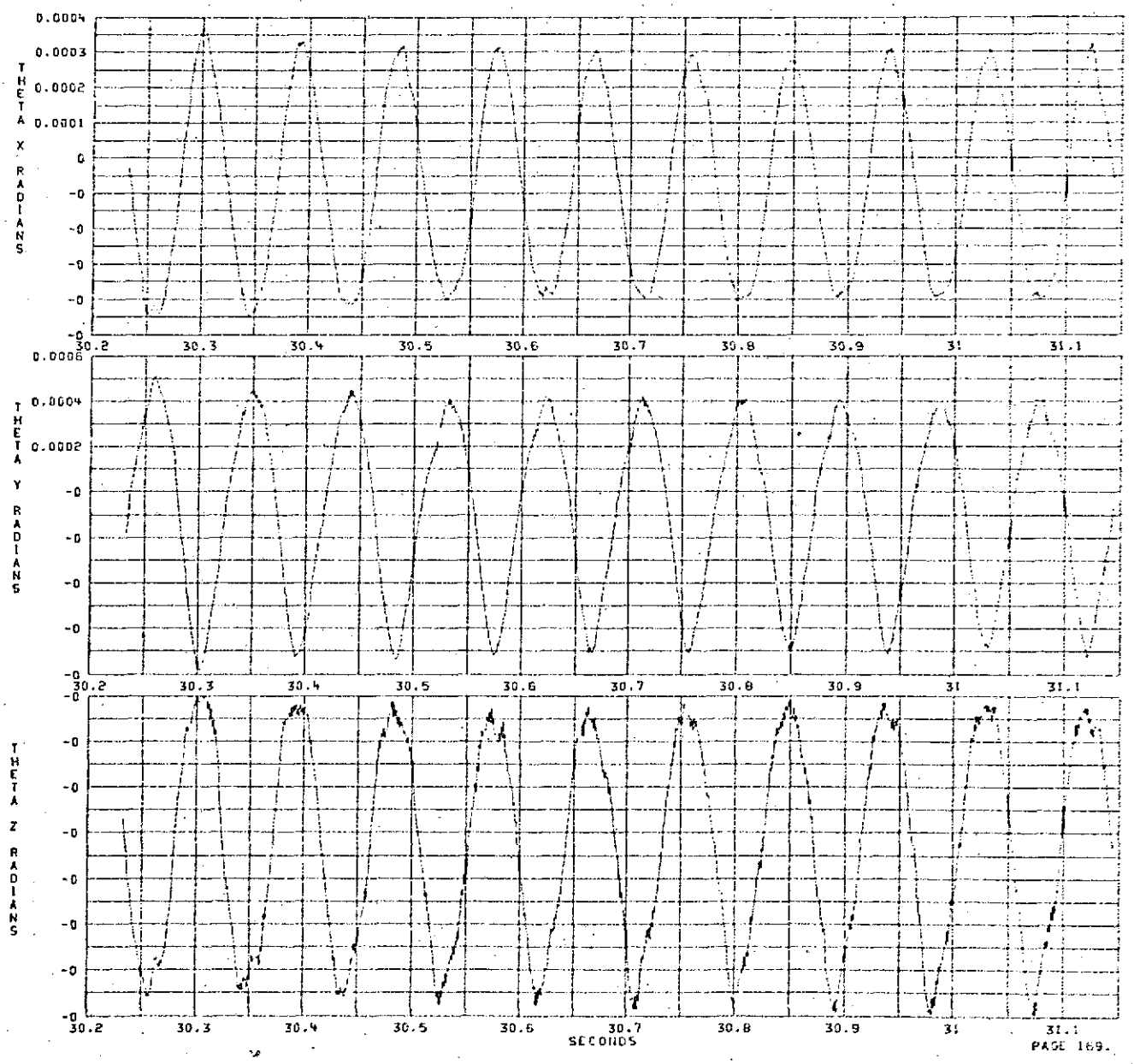


PAGE 167.

FREQUENCY RESPONCE TEST 4 TEST DATE 3/08/74
FREQUENCY = 11.00 HZ INERTIAL TABLE COORDINATES: X = 89.16 IN Y = .00 IN Z = .00 IN
TIME = 11 HRS 40 MIN = GRID TIME

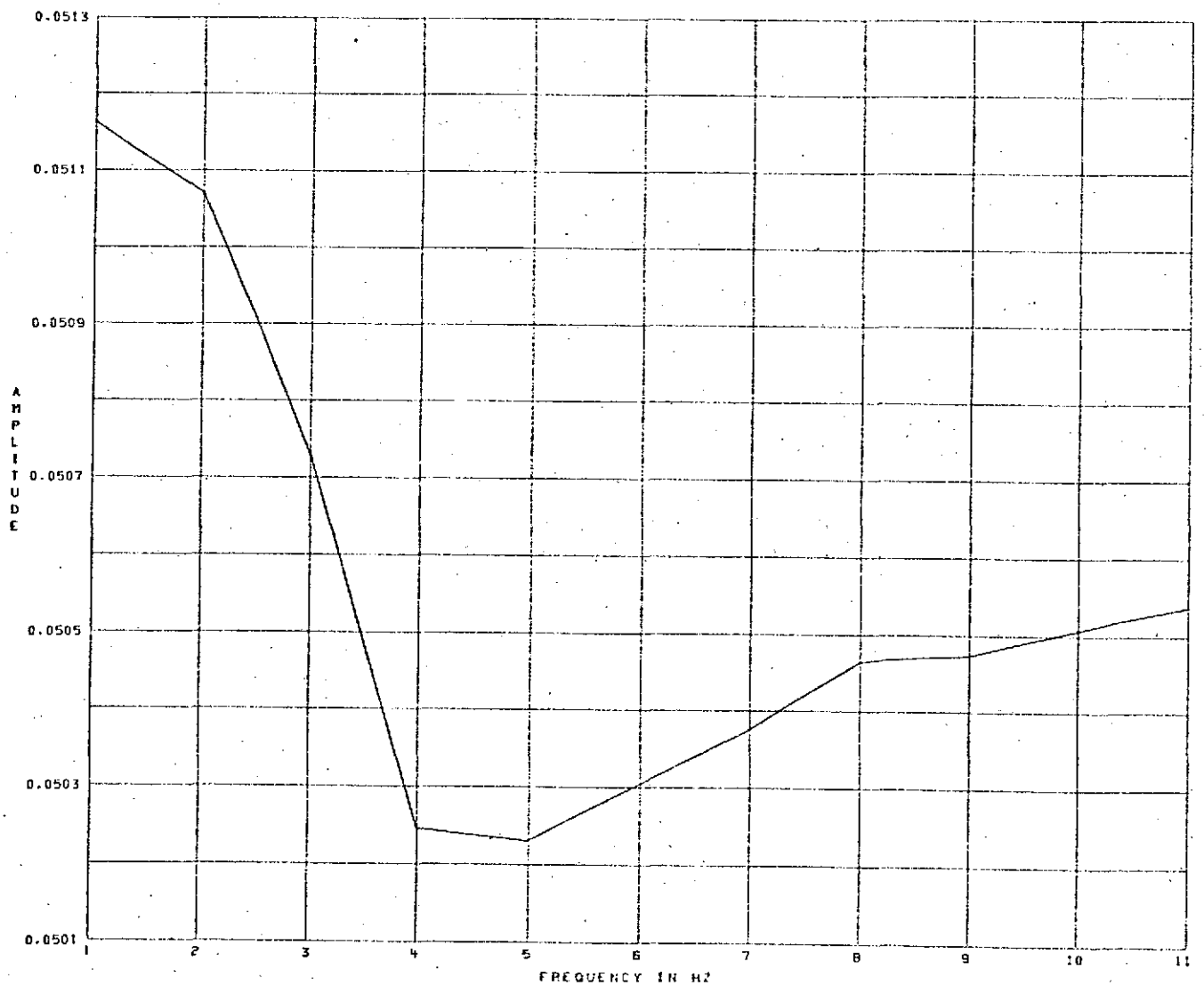


PAGE 188.


FREQUENCY RESPONCE TEST 4
TEST DATE 3/09-74
FREQUENCY = 11.00 HZ
INERTIAL TABLE COORDINATES: X = 88.16 IN Y = .00 IN Z = .30 IN
TIME = 11 HRS 40 MIN + GRID TIME
THETA X RADIANS
THETA Y RADIANS
THETA Z RADIANS
SECONDS
PAGE 169.

FREQUENCY RESPONCE TEST 4
REFERENCE SENSOR - TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ

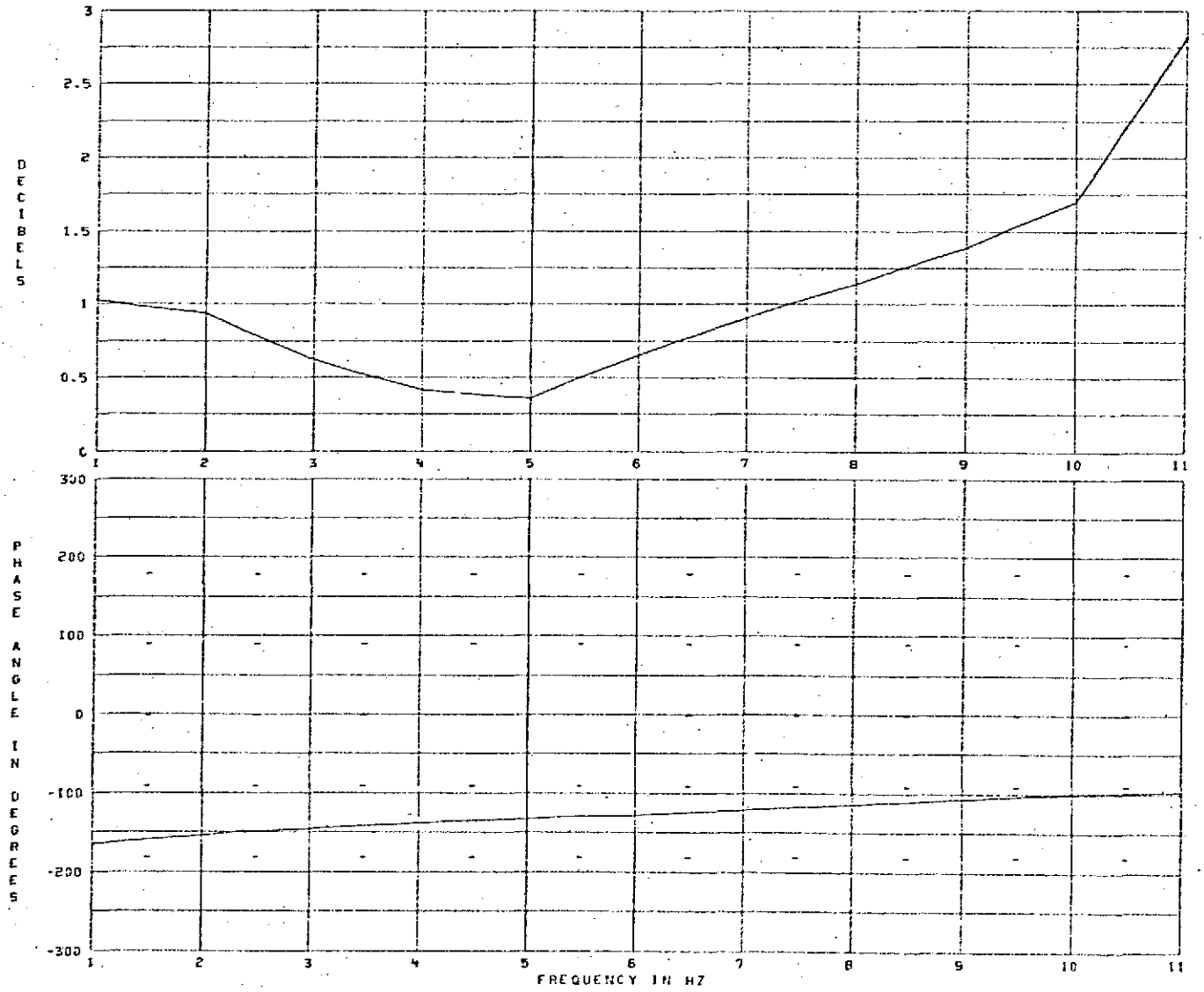
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 45.30 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 8.

FREQUENCY RESPONCE TEST 4
SENSOR -DELT X NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ

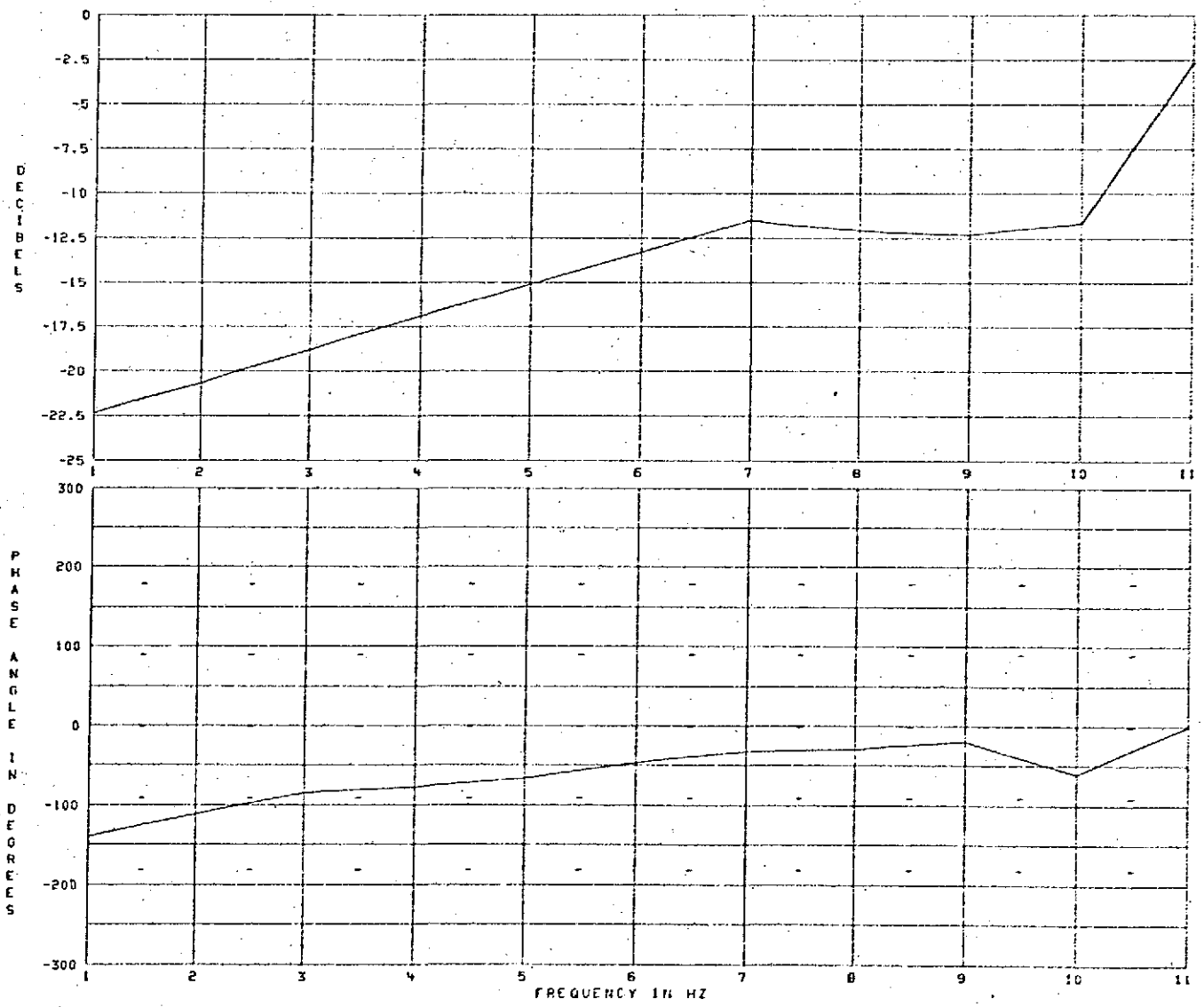
DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 45.30 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 1.

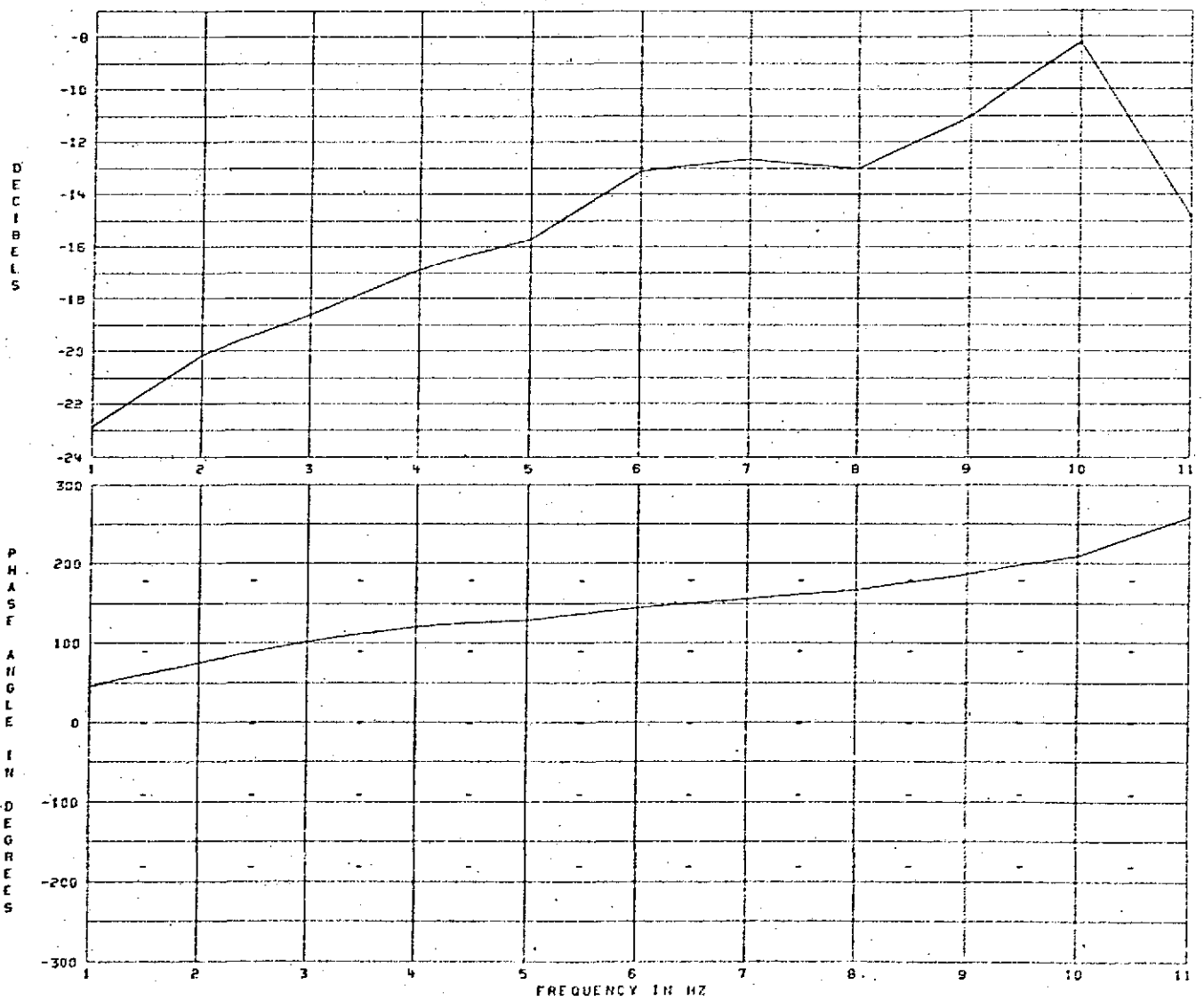
FREQUENCY RESPONCE TEST 4
SENSOR -DELT Y NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 45.30 SEC
FREQUENCY INCREMENTS = 1.00 HZ



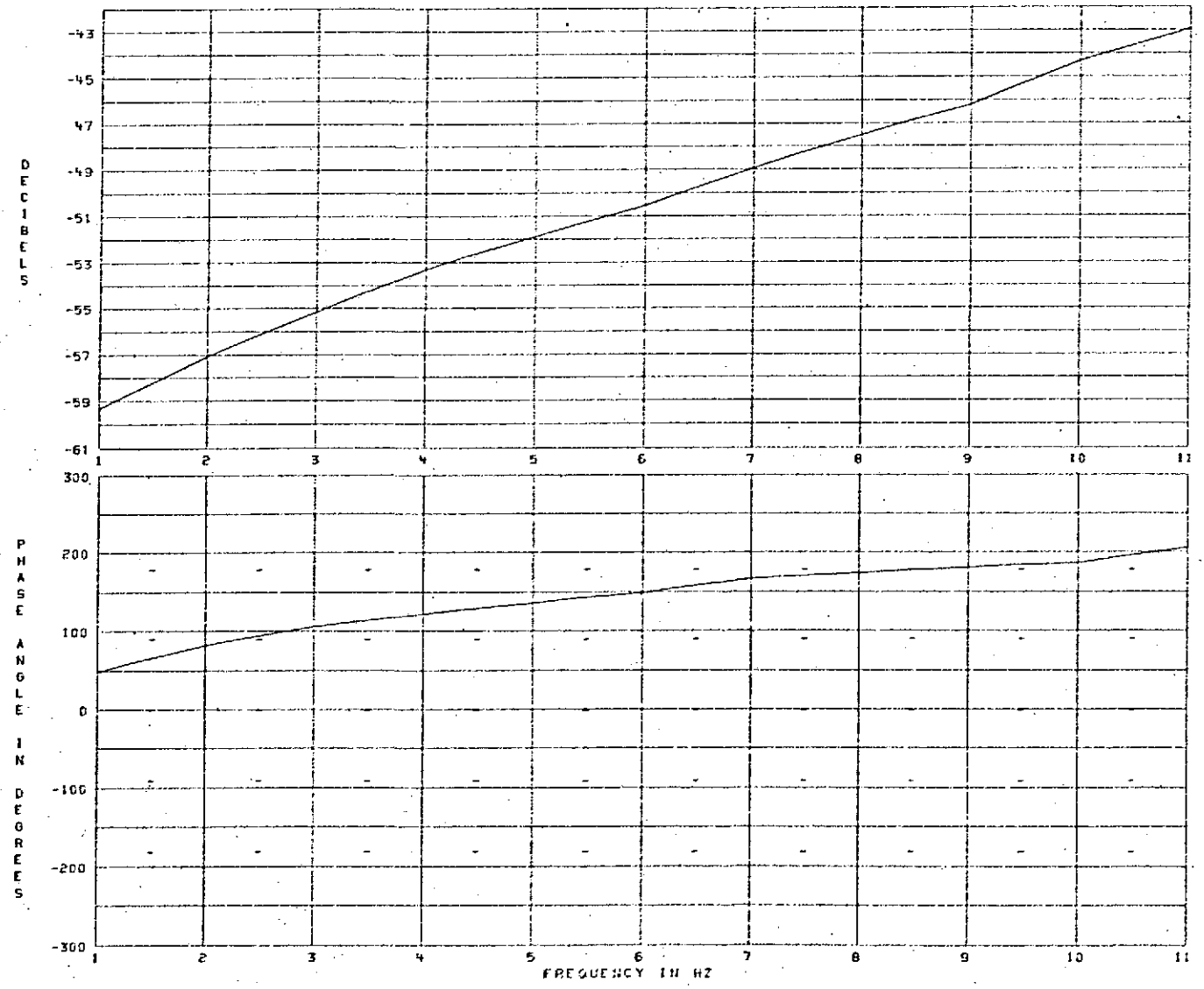
PAGE 2.

FREQUENCY RESPONCE TEST 4 — DATE PROCESSED - 09APR74
SENSOR -DELT Z NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0 — TOTAL PERIOD PROCESSED = 45.30 SEC
FIRST FREQUENCY = 1.00 HZ — FREQUENCY INCREMENTS = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ



FREQUENCY RESPONCE TEST 4
SENSOR -XTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 45.30 SEC
FREQUENCY INCREMENTS = 1.00 HZ



PAGE 4.

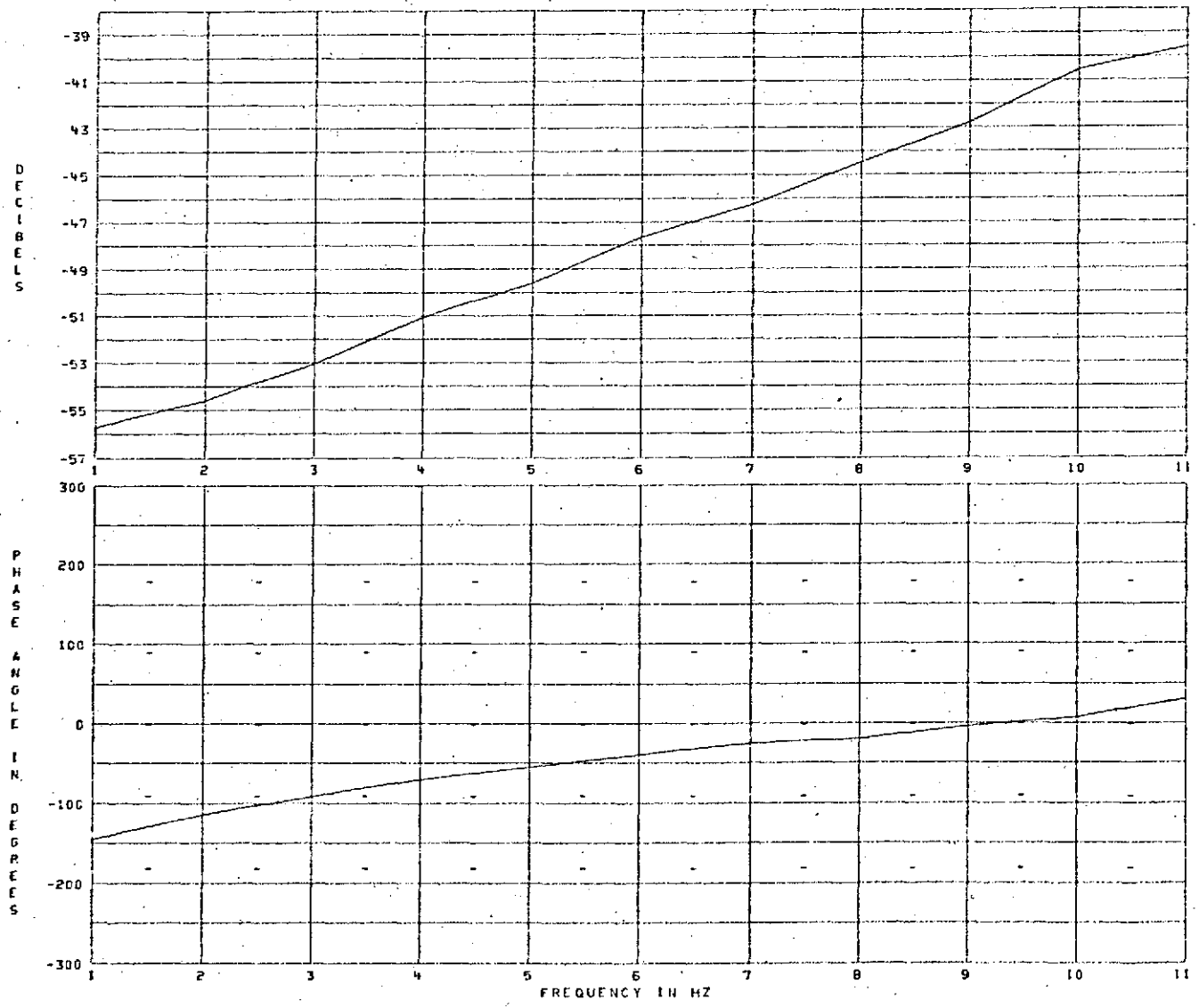
FREQUENCY RESPONCE TEST 4 DATE PROCESSED - 09APR74

SENSOR -YTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM

TOTAL CYCLES PROCESSED = 0 TOTAL PERIOD PROCESSED = 45.30 SEC

FIRST FREQUENCY = 1.00 HZ FREQUENCY INCREMENTS = 1.00 HZ

BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ



PAGE 5.

FREQUENCY RESPONCE TEST 4
SENSOR -ZTHETA NORMALIZED BY REFERENCE SENSOR -TABCOM
TOTAL CYCLES PROCESSED = 0
FIRST FREQUENCY = 1.00 HZ
BANDWIDTH RANGE FOR FREQUENCY INTERVAL TO 11.00 HZ WAS .100 HZ TO 1.100 HZ

DATE PROCESSED - 09APR74
TOTAL PERIOD PROCESSED = 45.30 SEC
FREQUENCY INCREMENTS = 1.00 HZ