

WYLE

LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP

WYLE LABORATORIES - RESEARCH STAFF
TECHNICAL REPORT 66338-01

A DATA BASE AND ANALYSIS PROGRAM
FOR SHUTTLE MAIN ENGINE
DYNAMIC PRESSURE MEASUREMENTS
APPENDIX F

DATA BASE PLOTS FOR SSME TESTS
750-120 through 750-200

(NASA-CR-178813) A DATA BASE AND ANALYSIS
PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC
PRESSURE MEASUREMENTS. APPENDIX F: DATA
BASE PLOTS FOR SSME TESTS 750-120 THROUGH
750-200. Final Report (Wyle Labs., Inc.)

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G3/20 06057



research REPORT

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A DATA BASE AND ANALYSIS PROGRAM
FOR SHUTTLE MAIN ENGINE
DYNAMIC PRESSURE MEASUREMENTS
APPENDIX F

DATA BASE PLOTS FOR SSME TESTS
750-120 through 750-200

by

Thomas Coffin

A final report of
work performed under contract NAS8-34343

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

January 1986

FOREWORD

This report describes a dynamic pressure data base and data base management system developed to characterize the Space Shuttle Main Engine (SSME) dynamic pressure environment. The data base represents dynamic pressure measurements obtained during single engine hot firing tests of the SSME. Software is provided to permit statistical evaluation of selected measurements under specified operating conditions. An interpolation scheme is also included to estimate spectral trends with SSME power level. This report was prepared by Wyle Laboratories Scientific Services and Systems Group for the National Aeronautics and Space Administration, George C. Marshall Space Flight Center. The work was performed under NASA contract NAS 8-34343, entitled "Flow Dynamic Environments in High Performance Rocket Engines."

The author wishes to acknowledge the contribution to this study by Dr. G. Meares, Chief Architect of the data base management software described herein. Messrs. B. Dobbs and D. Duck contributed long hours over a digitizer pad to accomplish data base input. The singular value decomposition software for spectrum interpolation was developed by Dr. J. Jong. Mr. T. Nesman, MSFC technical contract monitor, provided continuing support through informal project reviews and served as a focal point for definition of SSME data requirements.

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
120	THRUST	20,000	30
	HPOP BAL CAV PR2		100
	HPOP BAL CAV PR1		200
	HPOP DS PR		30
	MCC HOT GAS IN PR		100
	PBP DS PR		200
	LPOP DS PR		30
	HPOP DS PR		100
	MCC HOT GAS IN PR		200
	PBP DS PR		30
	HPOP DS PR		100
	MCC HOT GAS IN PR		200
	PBP DS PR		30
	HPFP BAL CAV PR		100
	OPB PC PR DC		200
			30
			100
	200		
121	THRUST	20,000	8
	LPOP DS PR		16
	HPOP DS PR		8
	MCC HOT GAS IN PR		16
	HOT GAS MAN PR2		8
	HPFP BAL CAV PR		16
	OPB PC PR DC		8
			16
			8
			16
			8

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
123	THRUST		
124	↓		
125	MCC FUEL INJ PR	20,000	6
	↓	↓	95
			125
			155
			185
			215
			245
			265
			285
		40,000	6
		↓	10
			50
			95
			125
			155
			185
			215
			245
			265
			285
126	THRUST		
127	↓		
	FPB PC	20,000	6
	↓	↓	11
128	THRUST		
	↓		
	FPB PC	20,000	6
	↓	↓	↓
	OPB PC PR DC		
129	THRUST		
	↓		
	FPB PC	20,000	6
	↓	↓	11
	MCC FUEL INJ PR	40,000	5
	↓	↓	11
	OPB PC PR DC	20,000	6
	↓	↓	11
130	THRUST		
	↓		
	FPB PC	20,000	6
	↓	↓	11
	MCC FUEL INJ PR		6
	↓	↓	11
		40,000	6
	↓	↓	11

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
130	OPB PC PR DC	20,000	6
131	THRUST		11
	MCC FUEL INJ PR	20,000	30
			70
	FPB PC		100
			30
			70
		40,000	100
			30
			70
	OPB PC PR DC	20,000	100
			30
			70
132	THRUST		100
	MCC FUEL INJ PR	20,000	30
	OPB PC PR DC		70
	FPB PC		100
			10
			90
			150
			260
			291
	MCC FUEL INJ PR		10
			90
			150
			260
		40,000	291
			10
			90
			150
			260
			291
	OPB PC PR DC	20,000	10
			90
			150
			260
			291
133	THRUST		6
	FPB PC	20,000	71
			76
			150
			280

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
133	OPB PC PR DC	20,000	6
			71
134	THRUST MCC FUEL INJ PR	20,000	76
			150
			280
			4
			30
			45
			150
			280
			40,000
			4
			30
			45
135	FPB PC	20,000	150
			200
			4
			30
			55
			150
			280
			MCC FUEL INJ PR DC
			4
			30
			45
			150
280			
40,000			
4			
30			
45			
150			
280			
135	OPB PC PR DC	20,000	4
			30
			45
			150
			280
			THRUST MCC FUEL INJ PR
			20,000
			6
			15
			45
			75
			150
40,000			
6			
15			
45			

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>	
135	MCC FUEL INJ PR	40,000	75	
	▼	▼	150	
	MCC FUEL INJ PR DC	20,000	6	
	▼	▼	15	
	▼	▼	45	
	▼	▼	75	
	▼	▼	150	
	▼	40,000	6	
	▼	▼	15	
	▼	▼	45	
	▼	▼	75	
	▼	▼	150	
	▼	20,000	6	
	▼	▼	15	
	▼	▼	45	
▼	▼	75		
▼	▼	150		
136	THRUST	20,000	4	
	MCC FUEL INJ PR		25	
	▼		50	
	▼		150	
	▼		280	
	▼		40,000	4
	▼		▼	25
	▼		▼	50
	▼		▼	150
	▼		▼	280
	▼		20,000	4
	▼		▼	25
	▼		▼	50
	▼		▼	150
	▼		▼	280
138	OPB PC PR DC	20,000	25	
	▼		50	
	▼		150	
	▼		280	
	▼		25	
	▼		▼	50
	▼		▼	150
	▼		▼	280
	▼		▼	25
	▼		▼	50
	▼		▼	150
	▼		▼	280
	▼		▼	25
	▼		▼	50
	▼		▼	150
▼	▼	280		
139	THRUST			
140	▼			
141	▼			
142	▼			
143	▼			
144	▼			
145	▼			
146	▼			

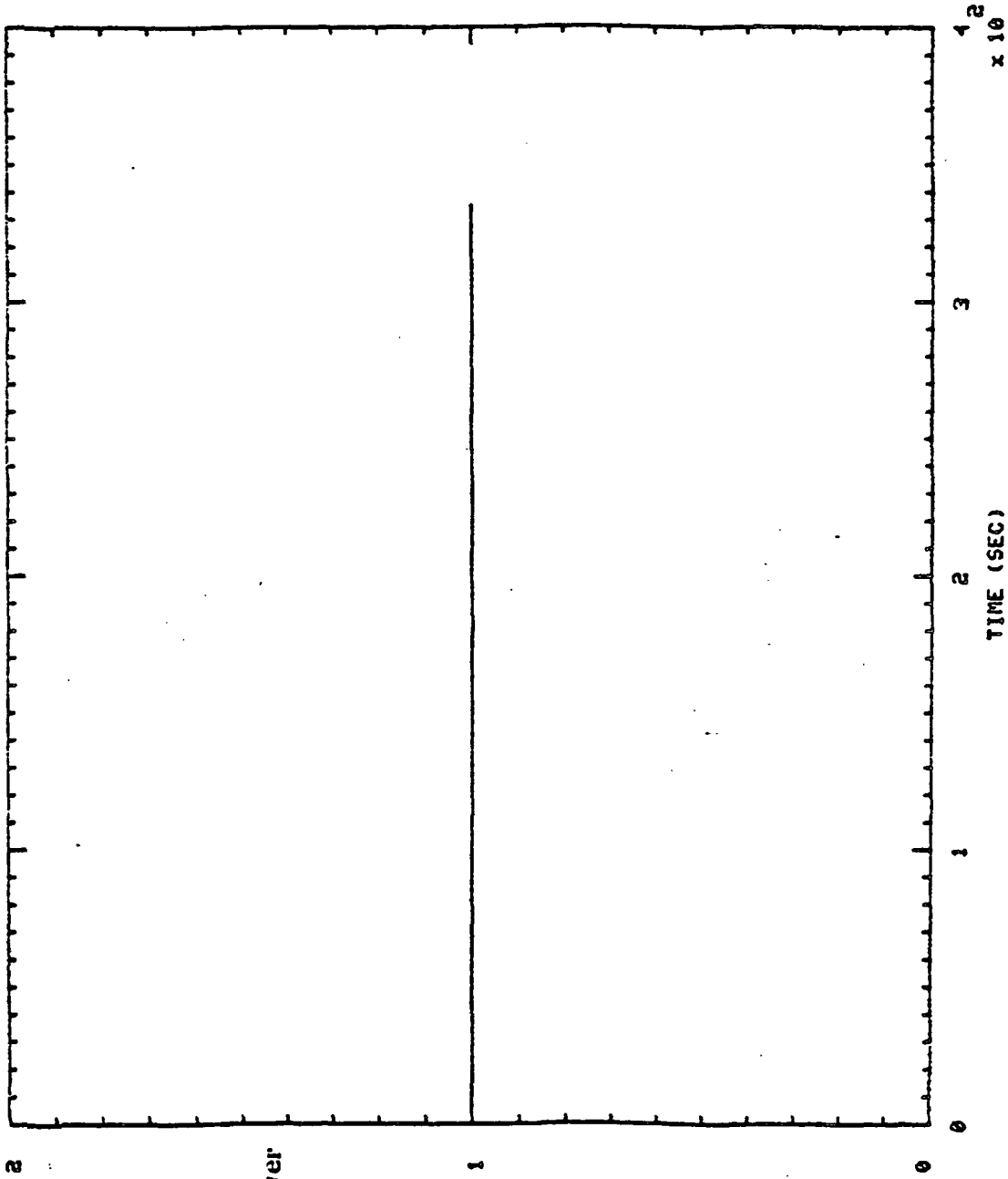
DATA PLOT LISTING FOR TEST STAND A3 (Concluded)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
147	THRUST		
148			
150			
151			
152			
153			
154			
155			
156			
157			
158			
161			
164			
165			
166			
167			
168			
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187			
188			
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192			
193			
194			
195			
196			
197			
198			
199			
200			

750120 THRUST (UNFILTERED)

Percent of Rated Power

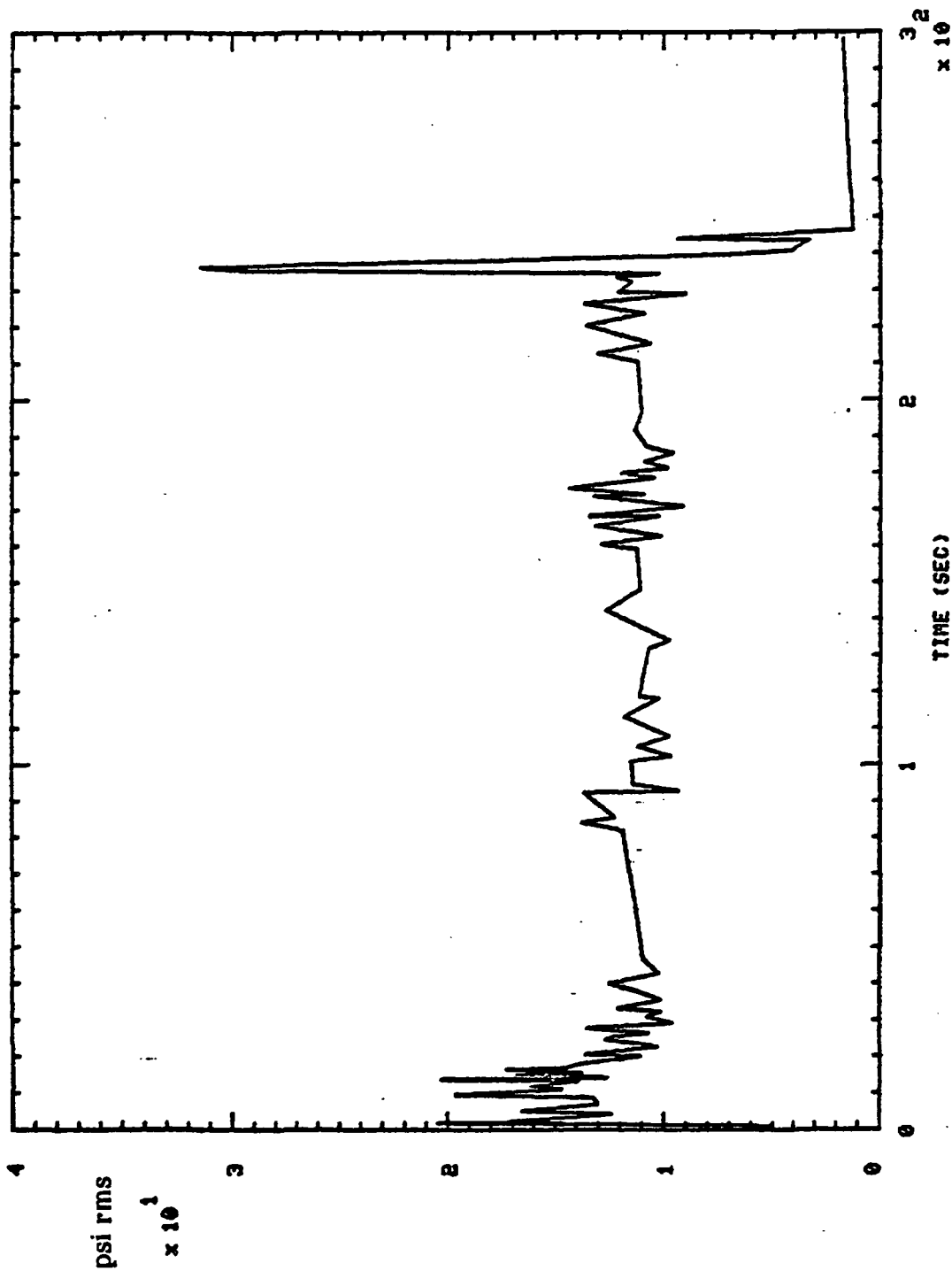
$\times 10^2$



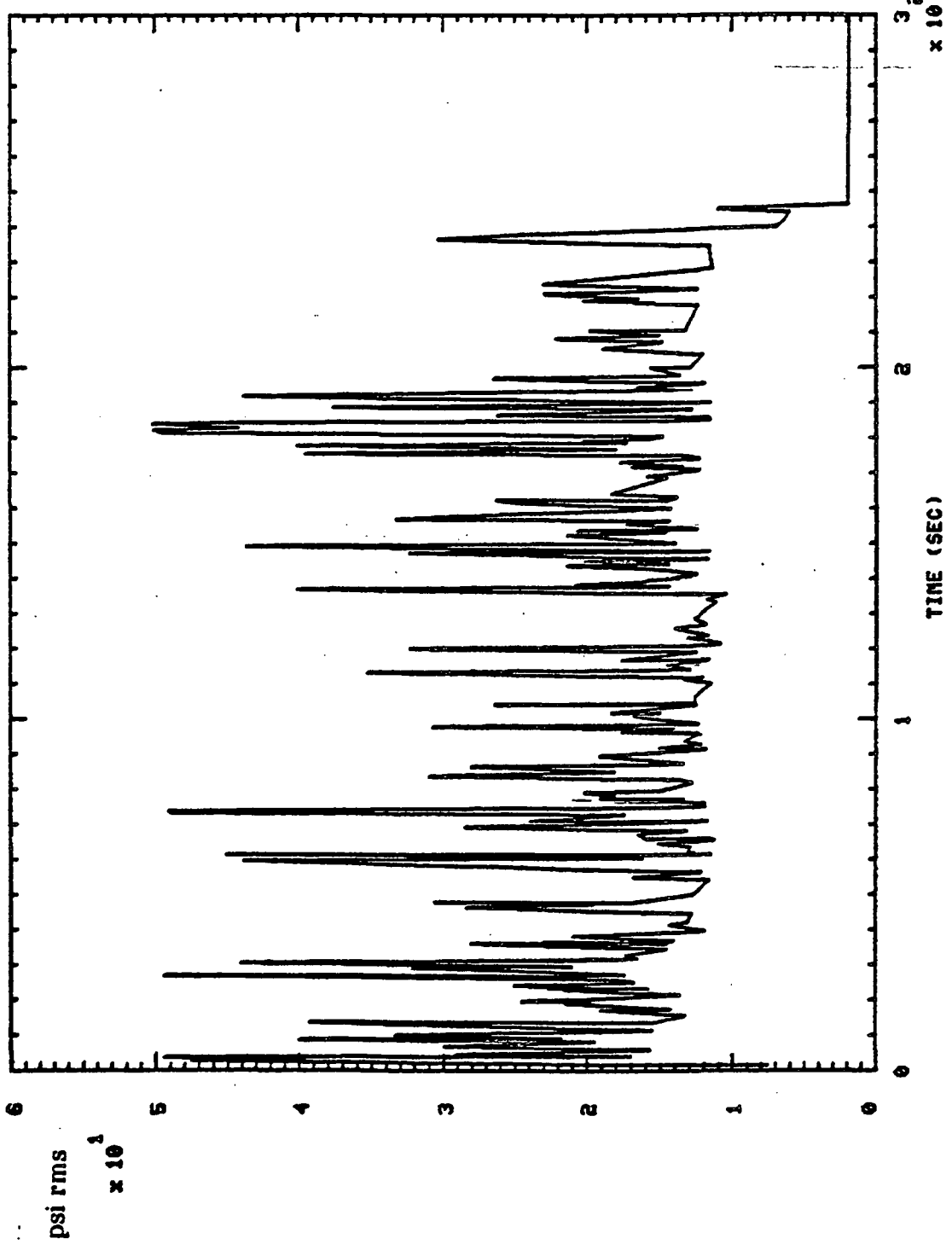
759120

HPOP BAL CAU PR2

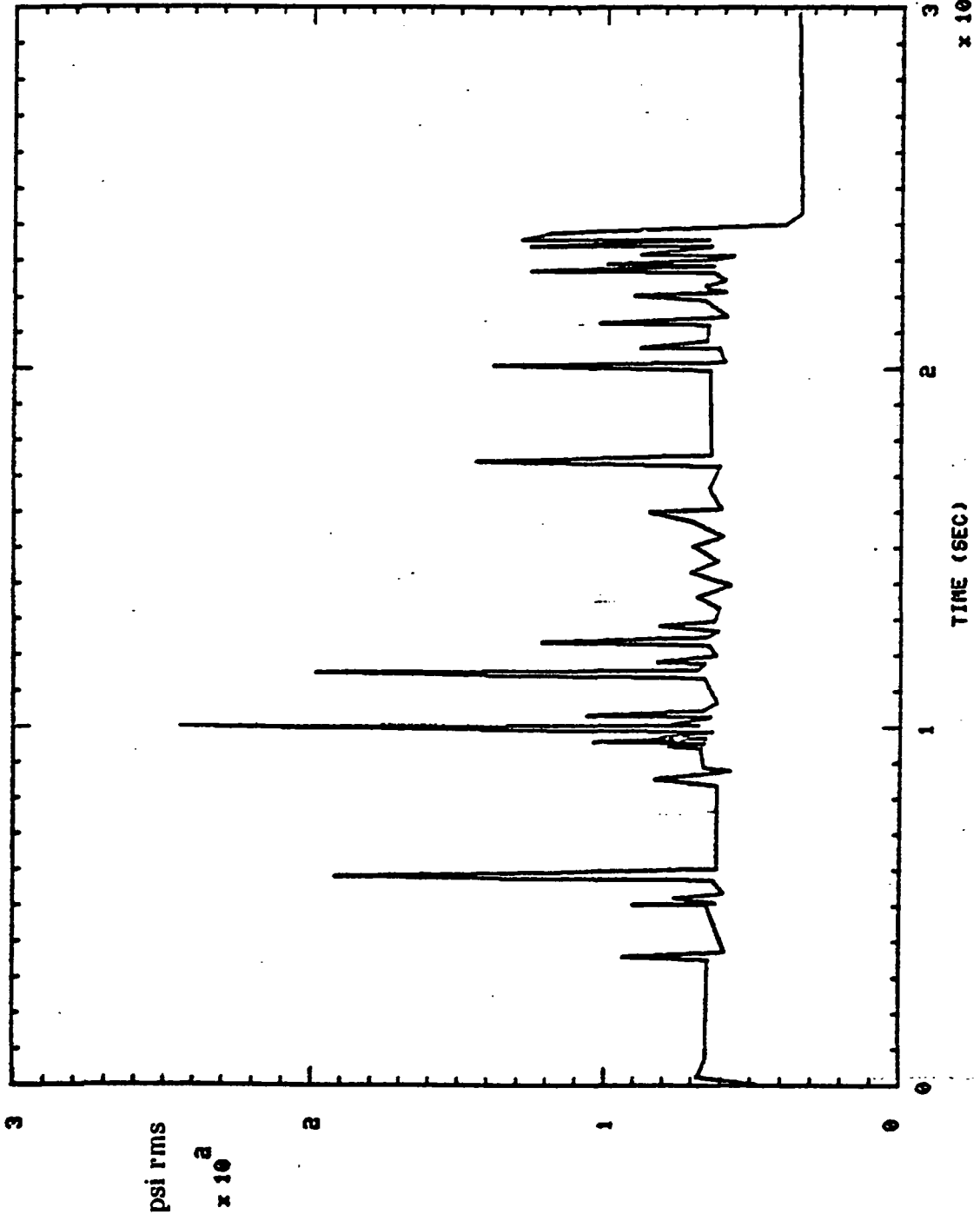
(1 - 20K HZ) 204



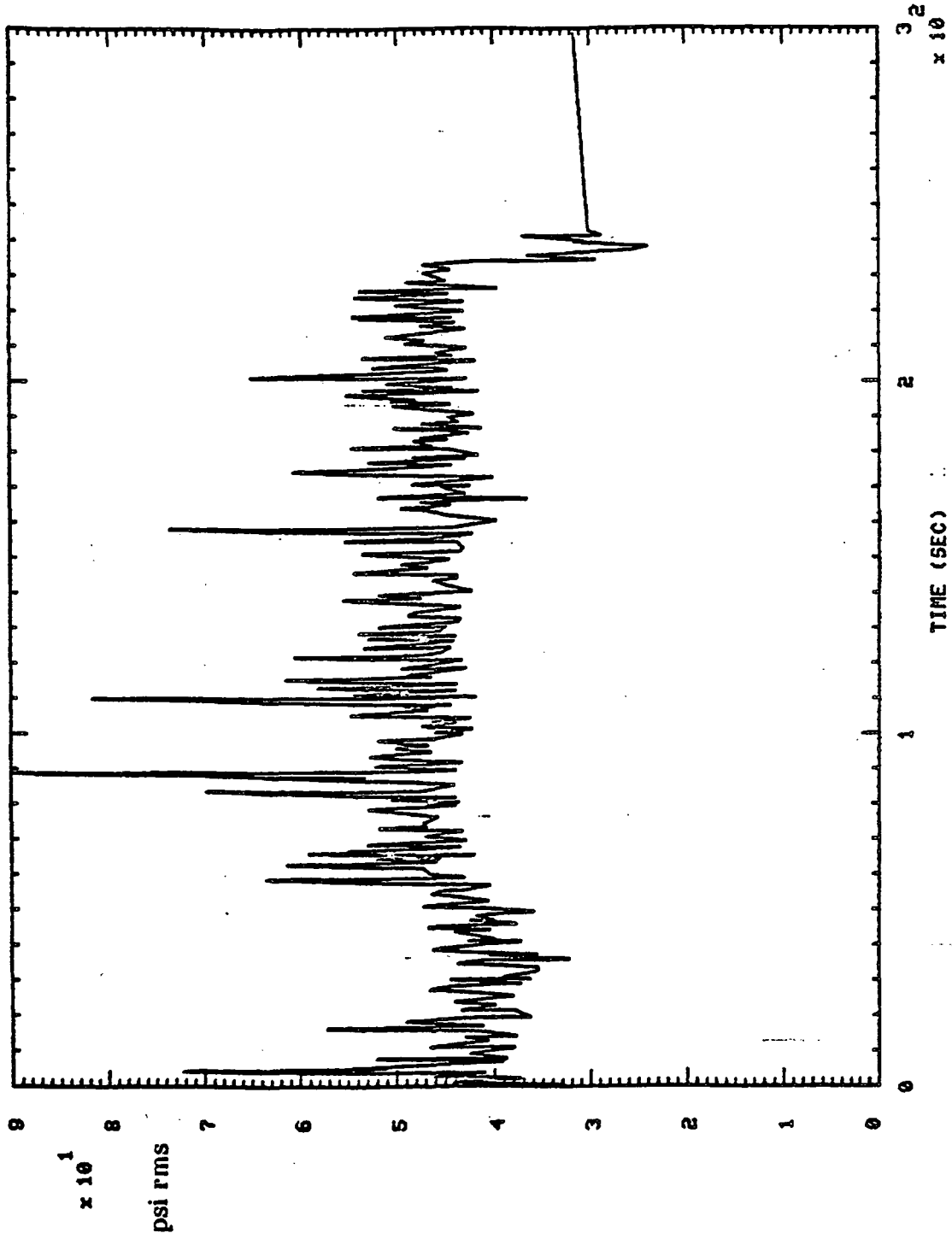
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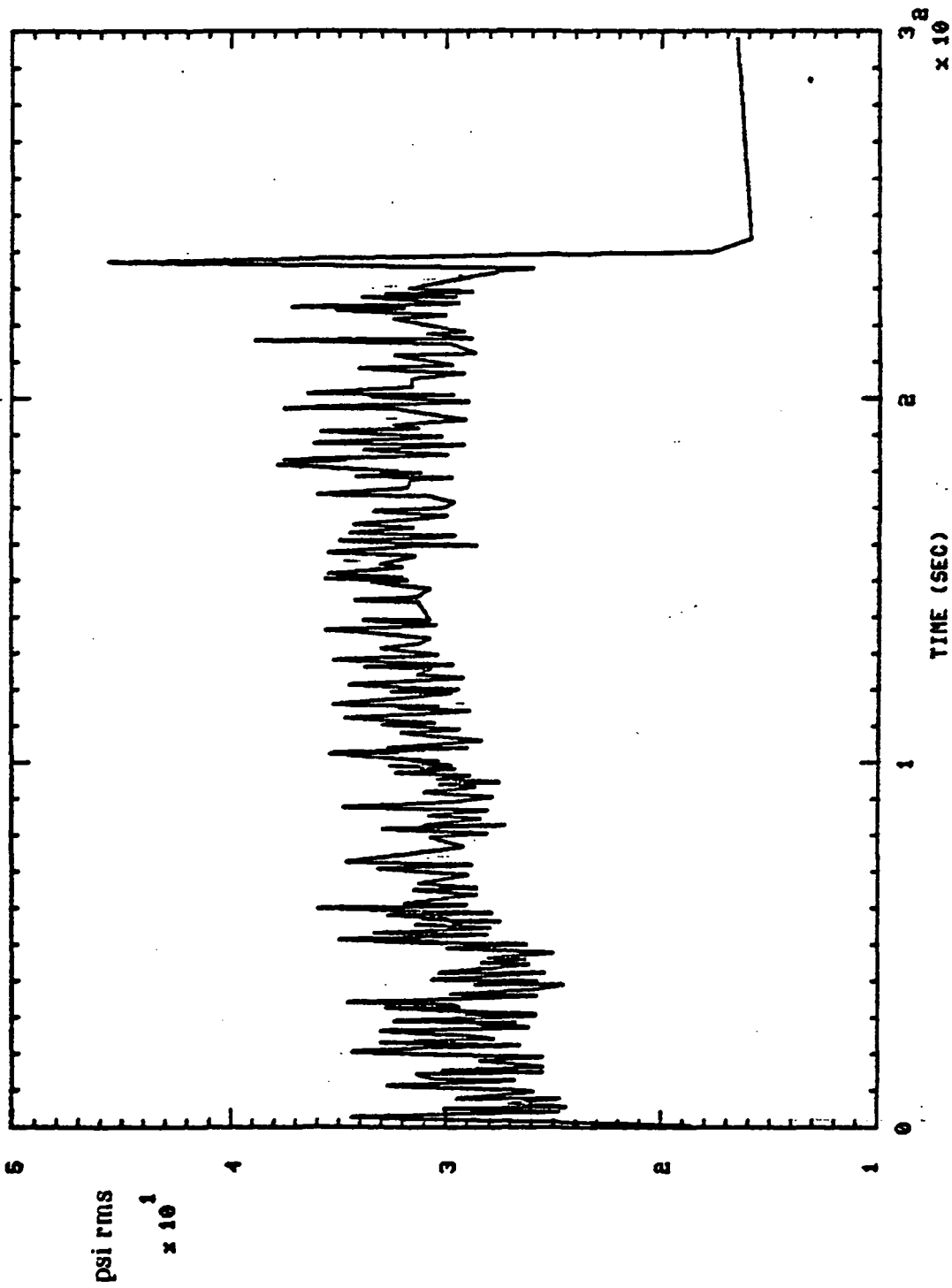
750120 HPOP DS PR (1 - 20K HZ) 204



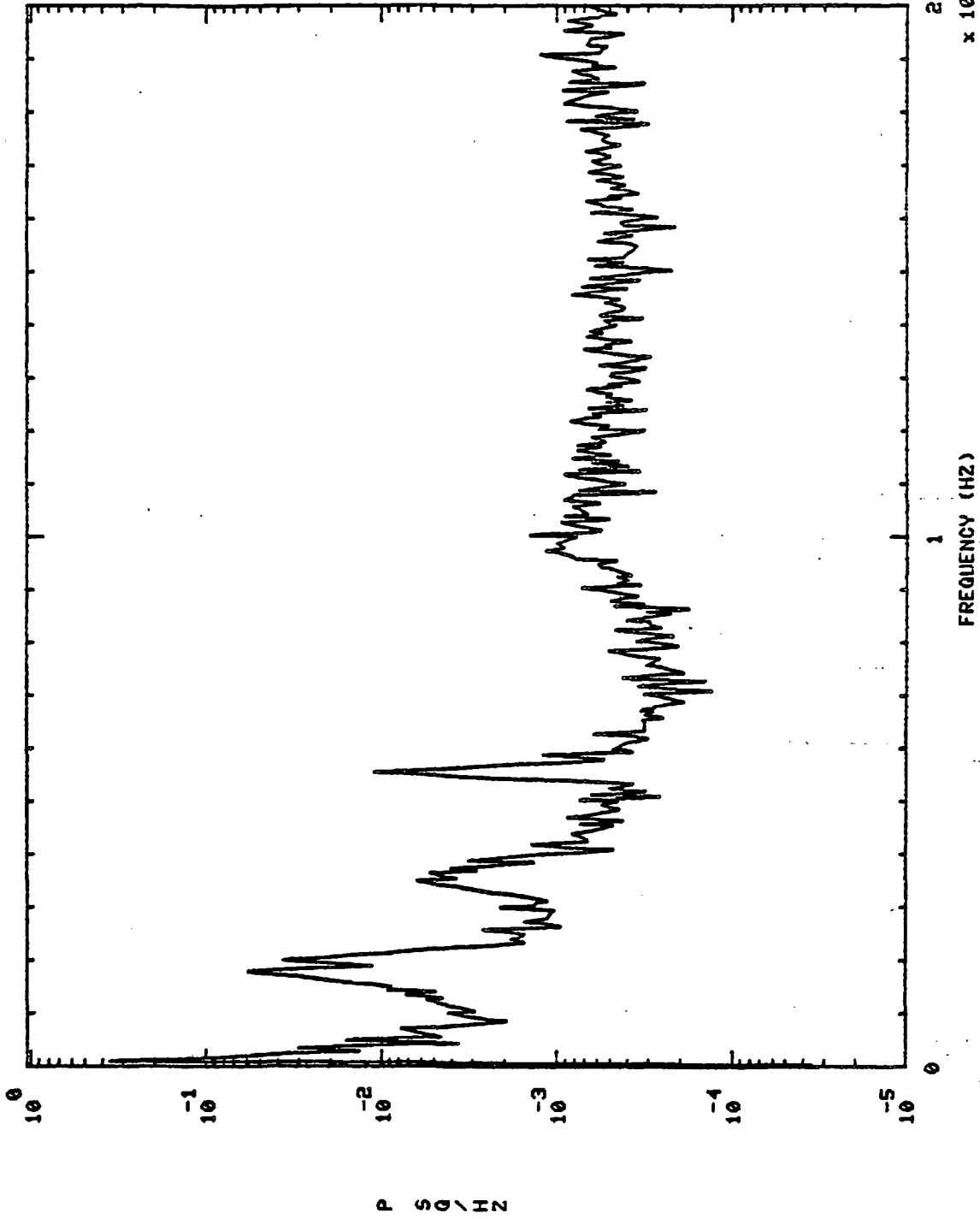
750120 MCC HOT GAS IN PR (1 - 20K HZ)



750120 PBP DS PR (1 - 20K HZ) 204

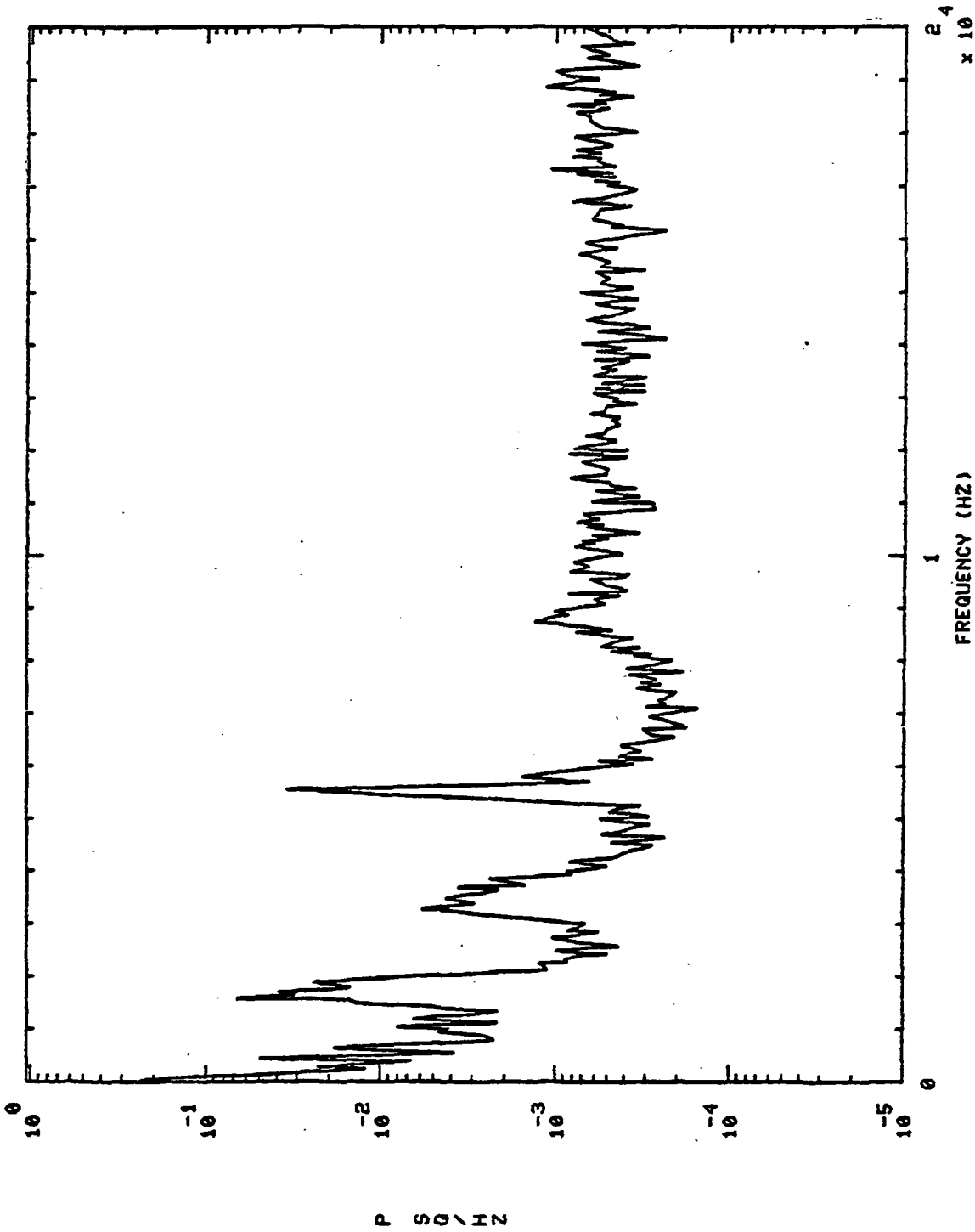


750120 LPOP DS PR S+ 30.01H0,'S



750120 LPOP DS PR 5+ 100.01H0,'S

750120 LPOP DS PR

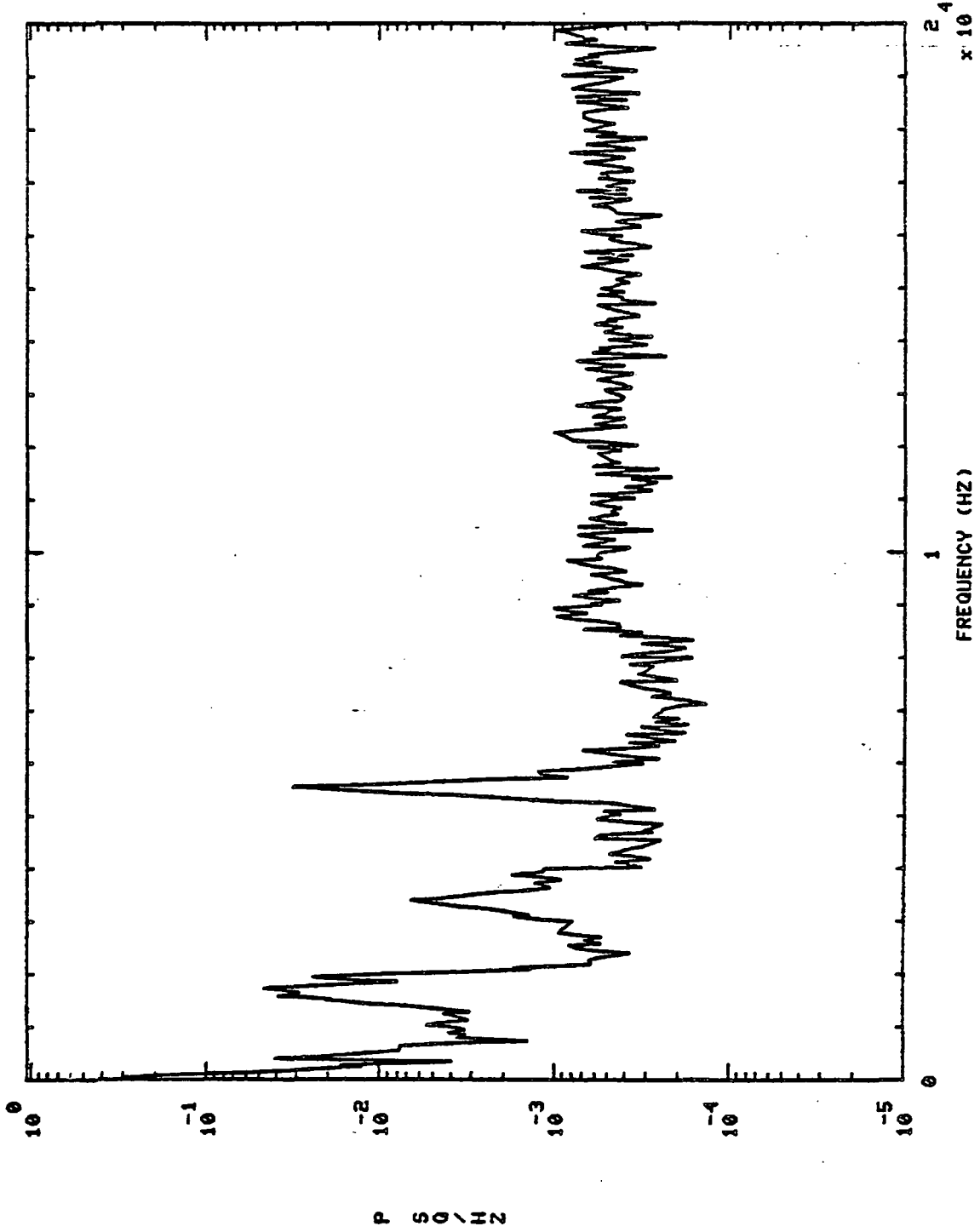


10^4
 $\times 10$

1
FREQUENCY (HZ)

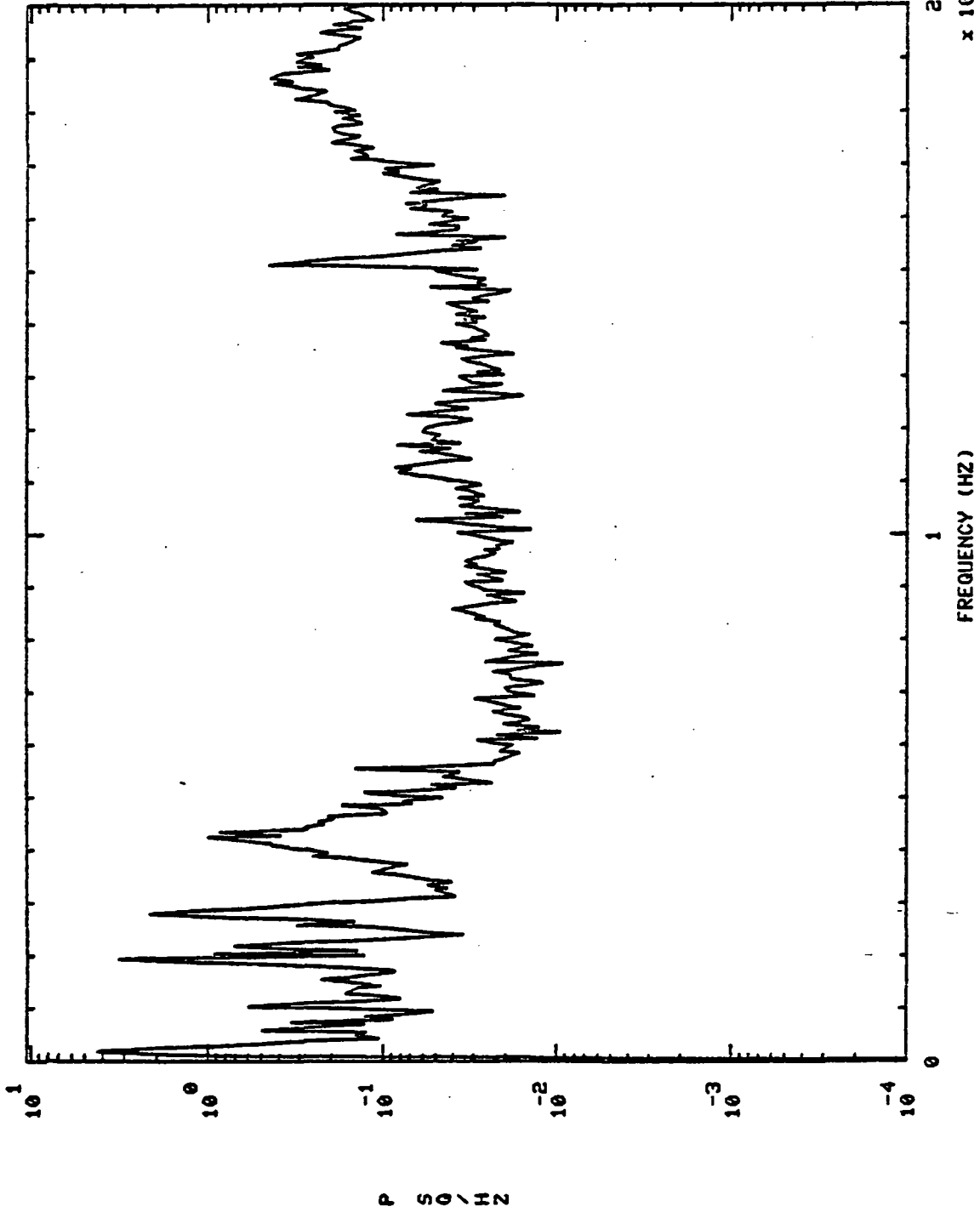
St 200.01H0,'S

750120 LPOP DS PR

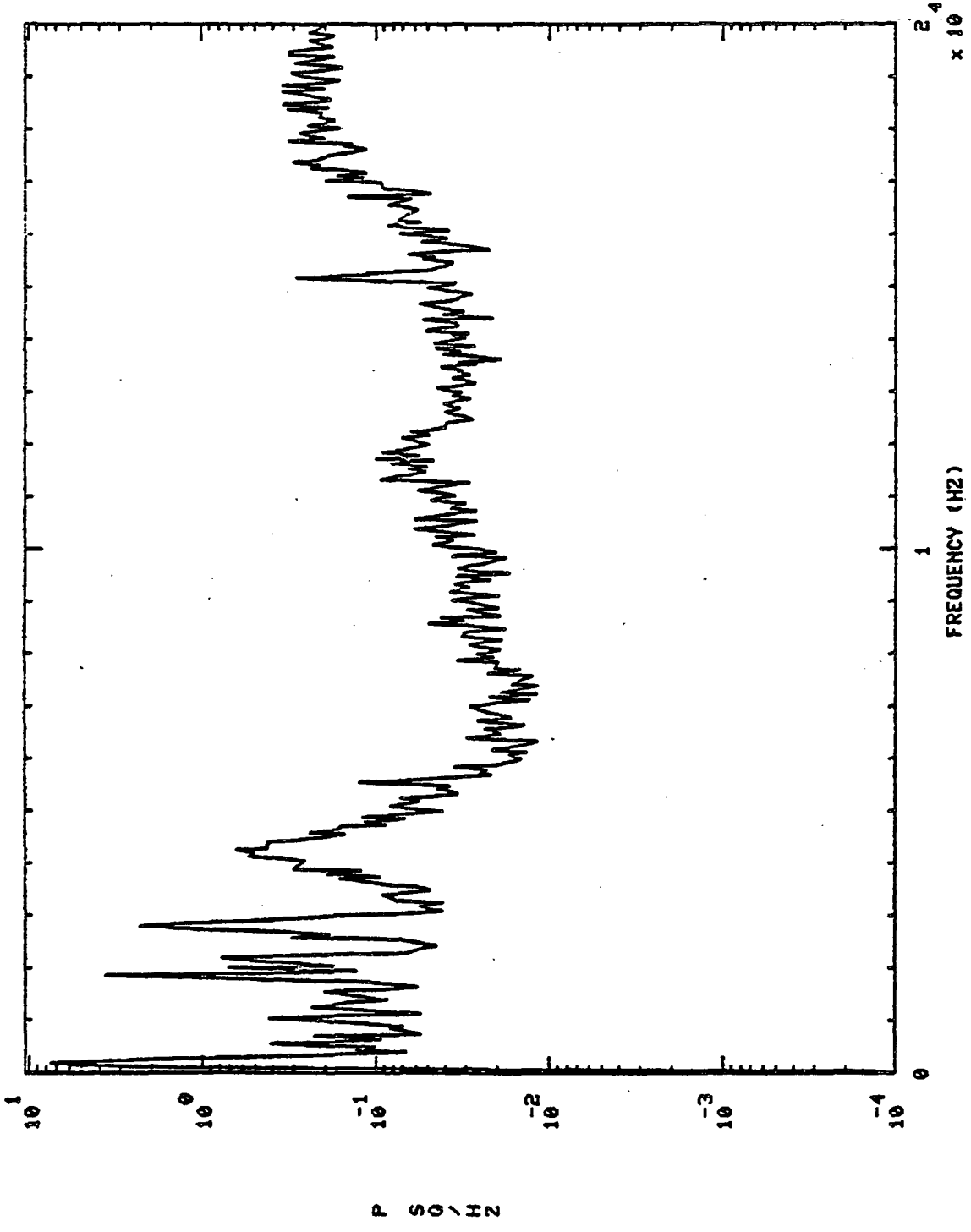


S+ 30.01H0,'S

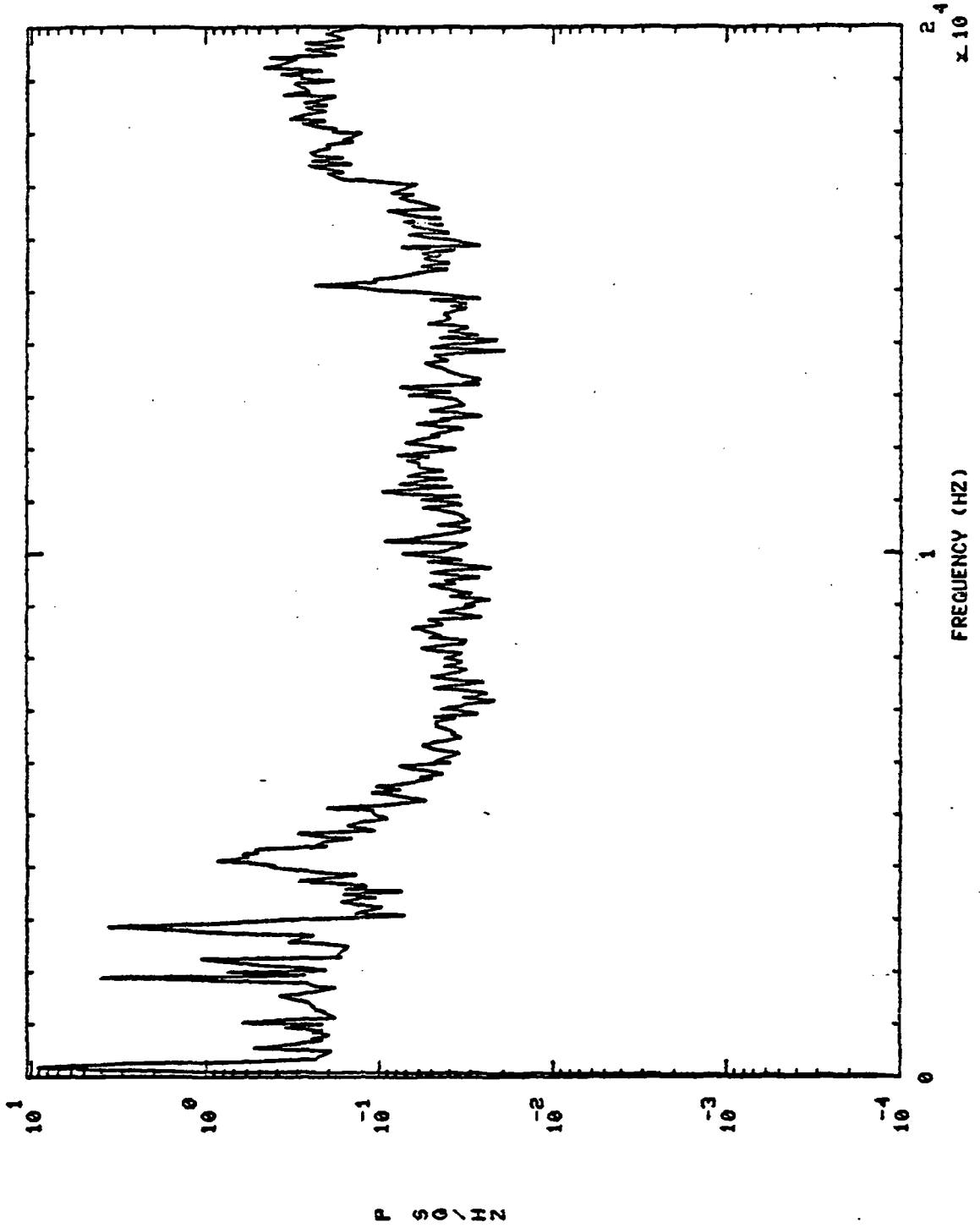
750120 HPOP DS PR



750120 HPOP DS PR S+ 100.01H0,'S



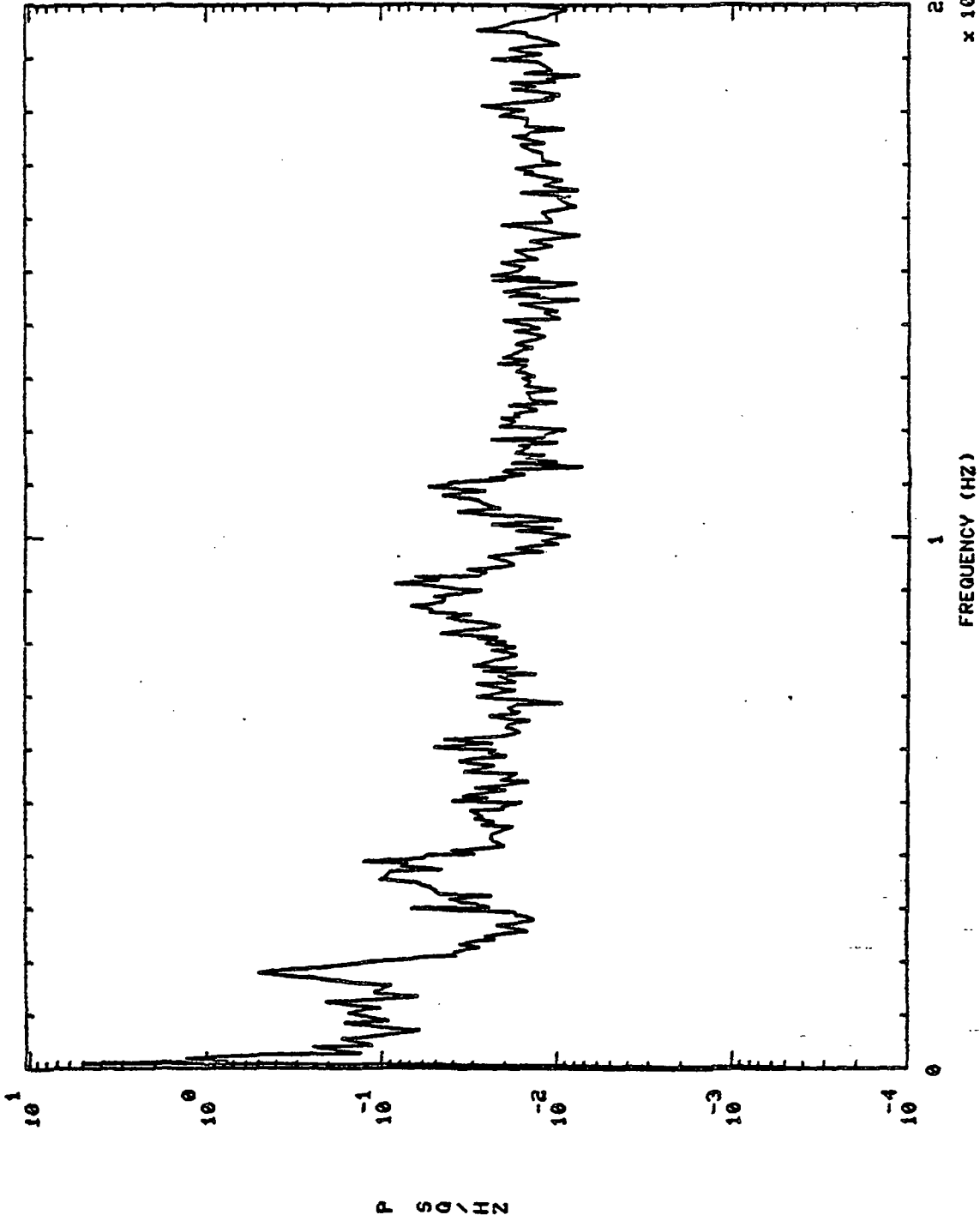
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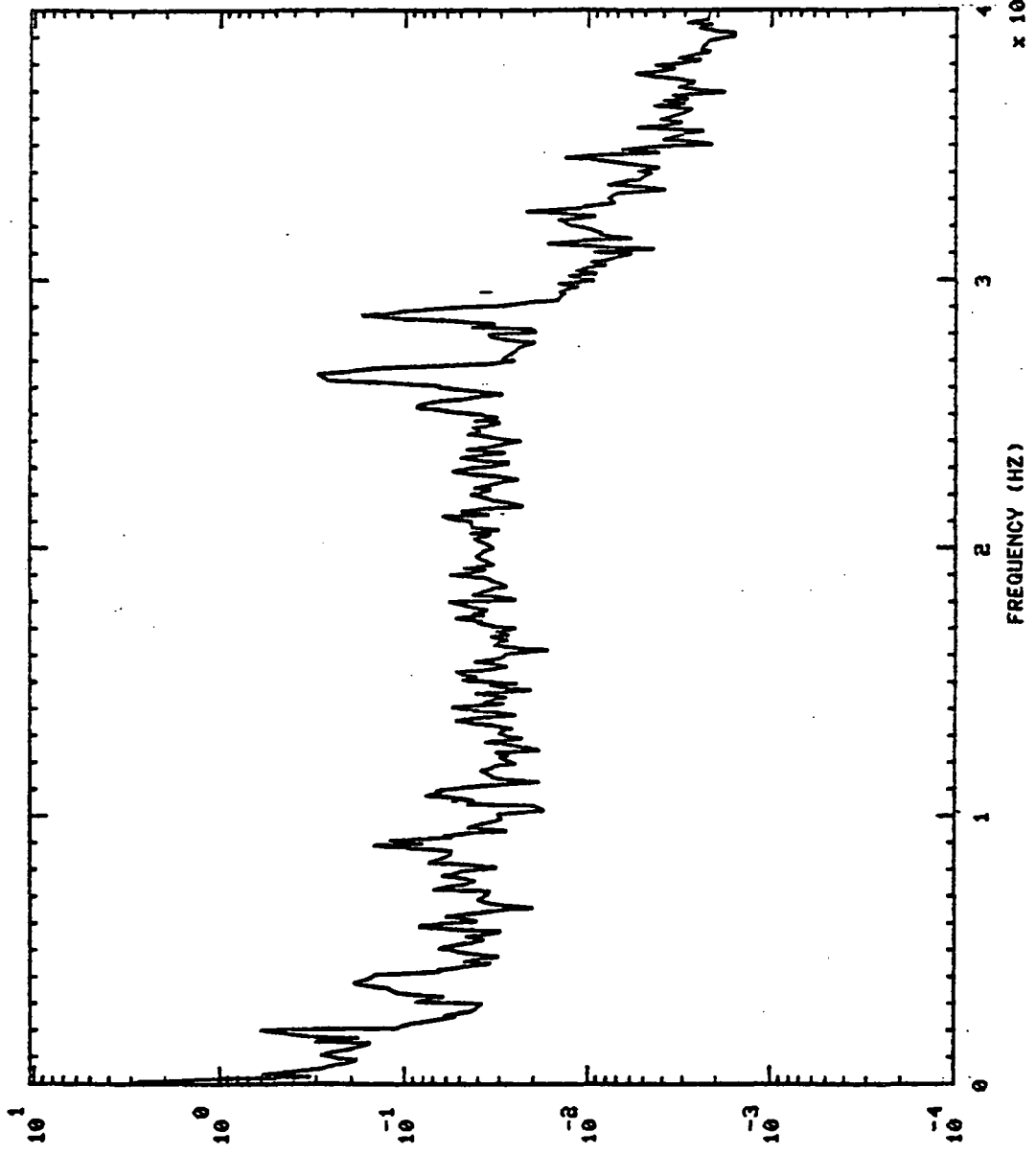
750120

MCC HOT GAS IN PR

S+ 30.01H0,'S

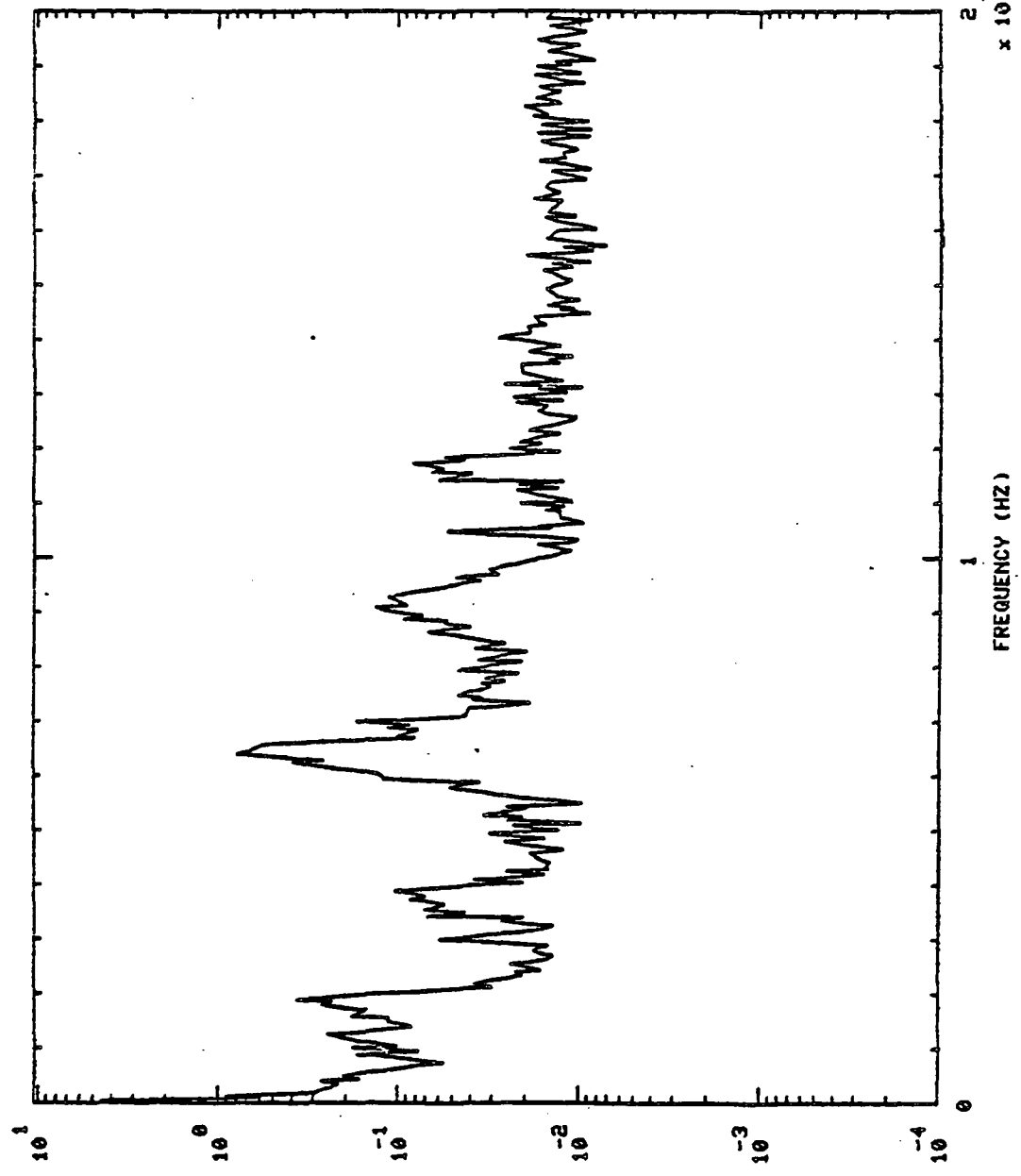


750120 MCC HOT GAS IN PR S+ 30.01H0,'S



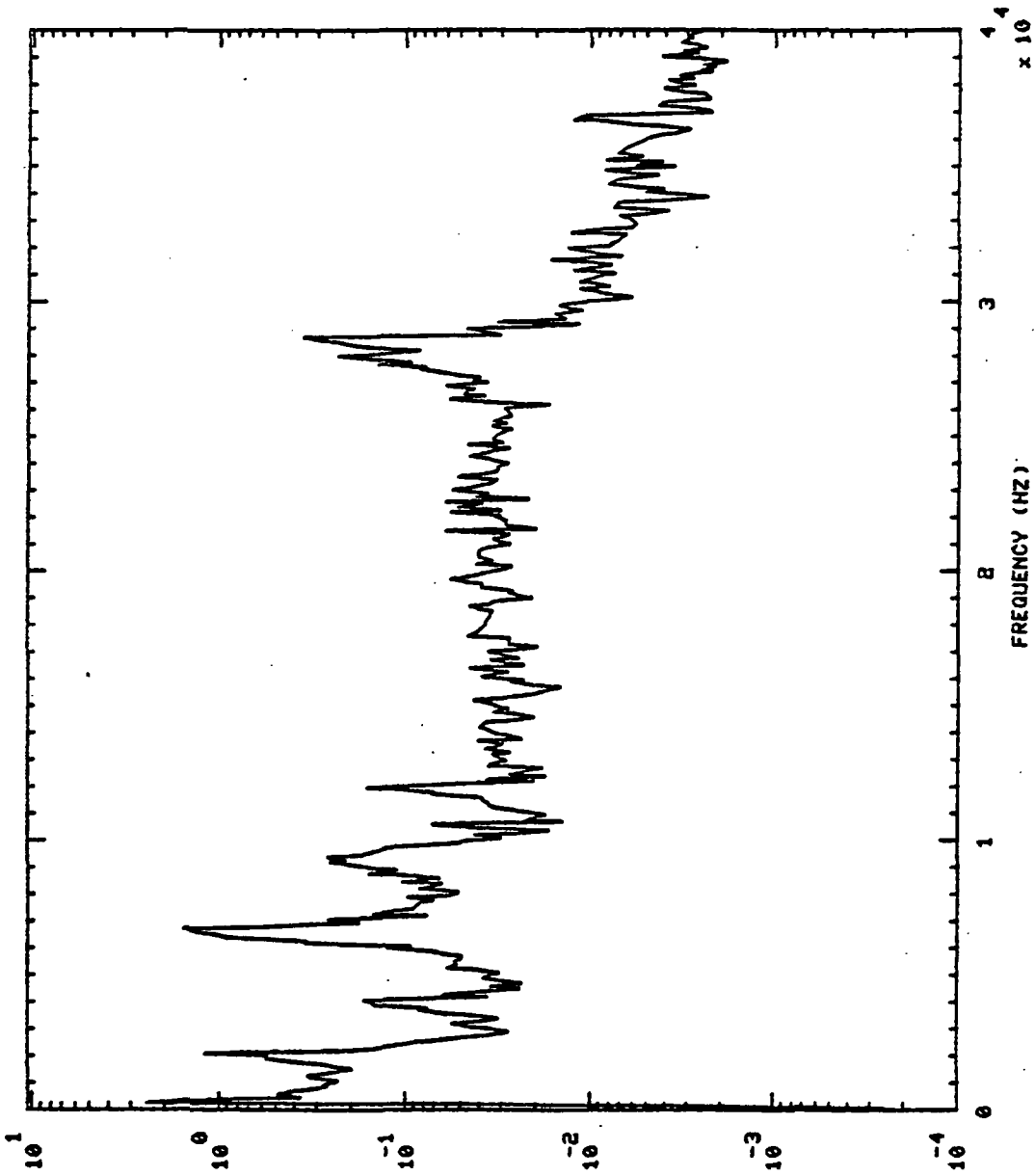
P SQ / HZ

750120 MCC HOT GAS IN PR S+ 100.01H0,'S



P S D

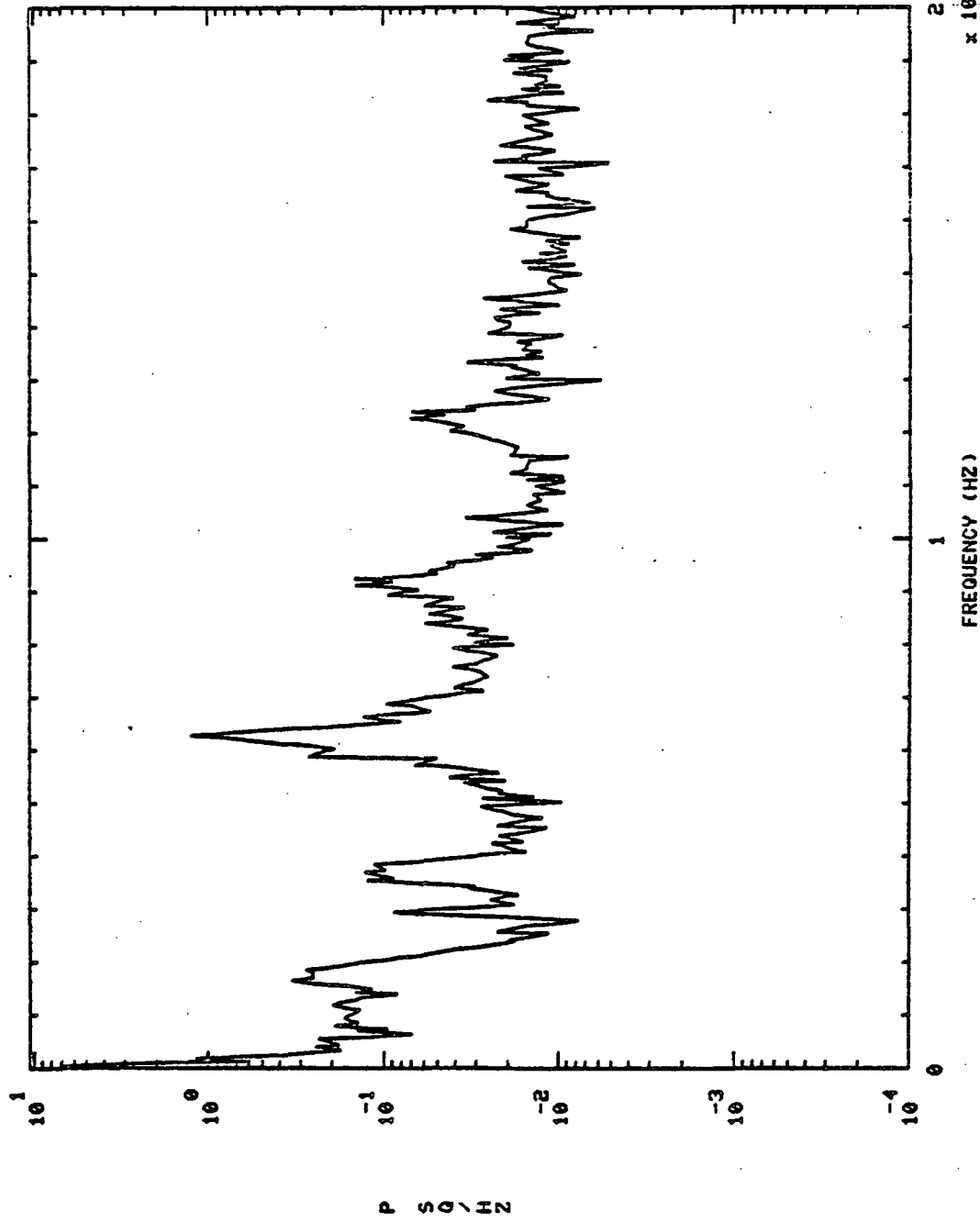
750120 MCC HOT GAS IN PR S+ 100.01H0,'S



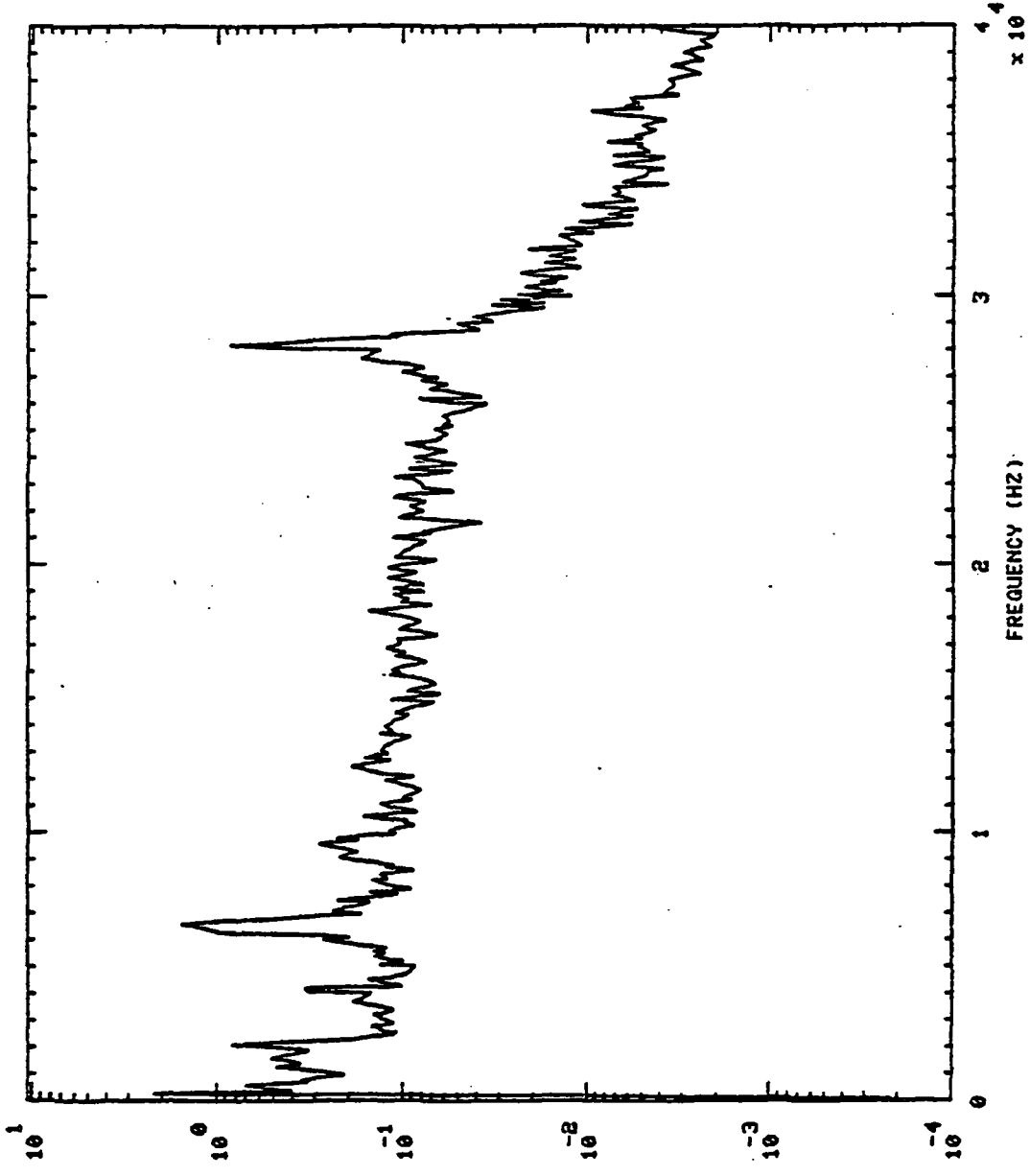
P S G / H Z

S+ 200.01H0.'S

750120 MCC HOT GAS IN PR



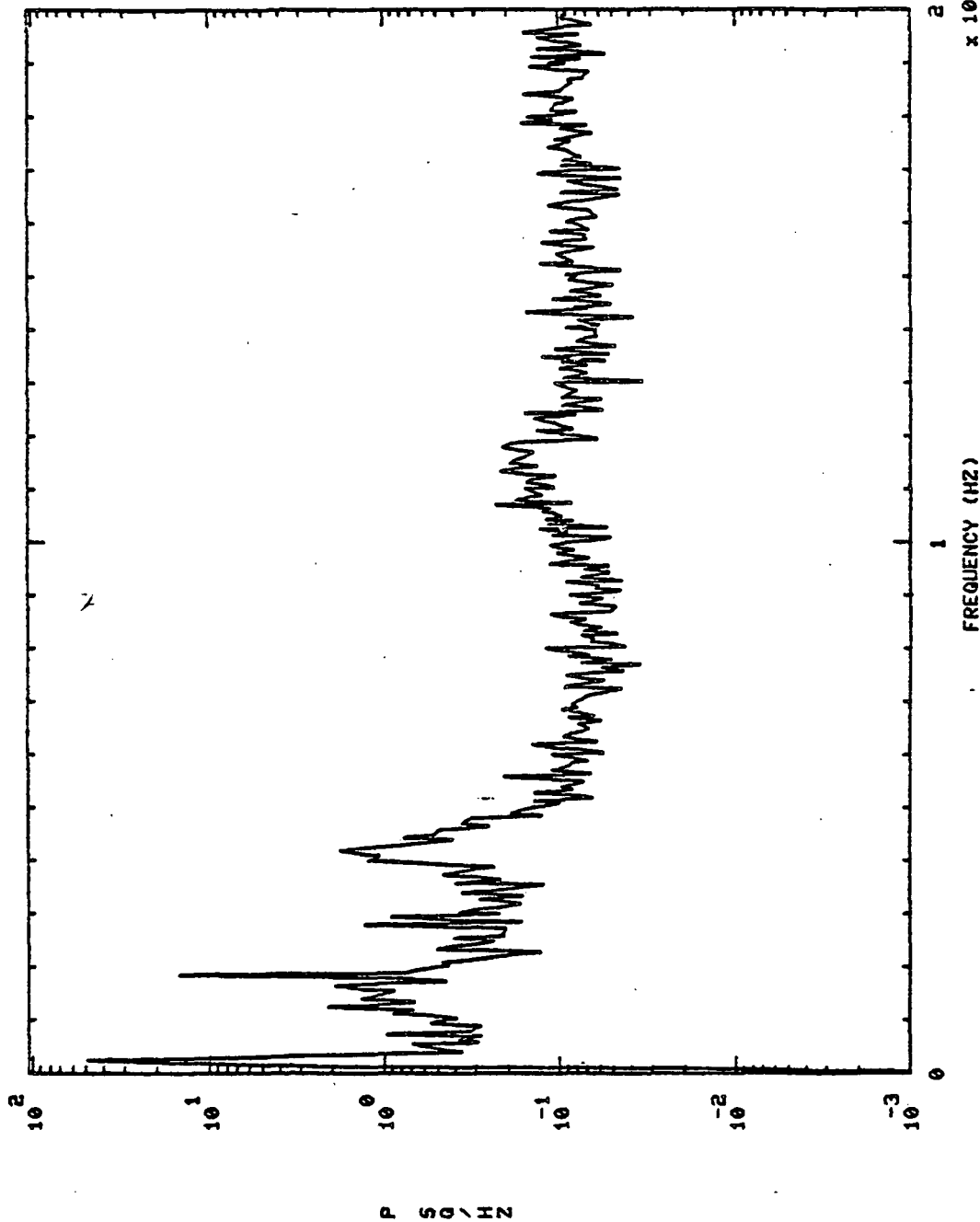
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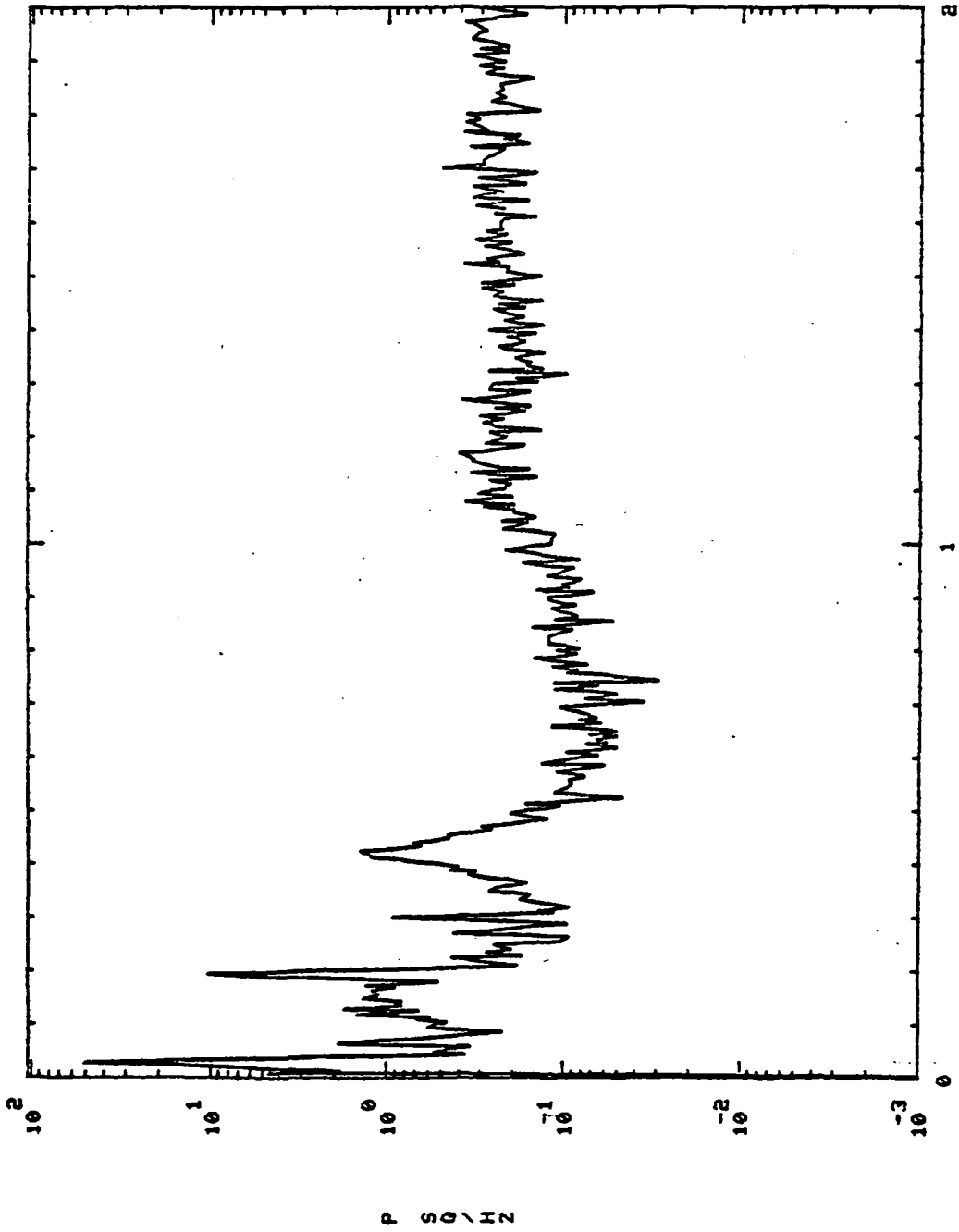
P S D / H Z

S+ 30.01H0,'S

750120 PBP DS PR



750120 PBP DS PR S+ 100.01HO, 'S

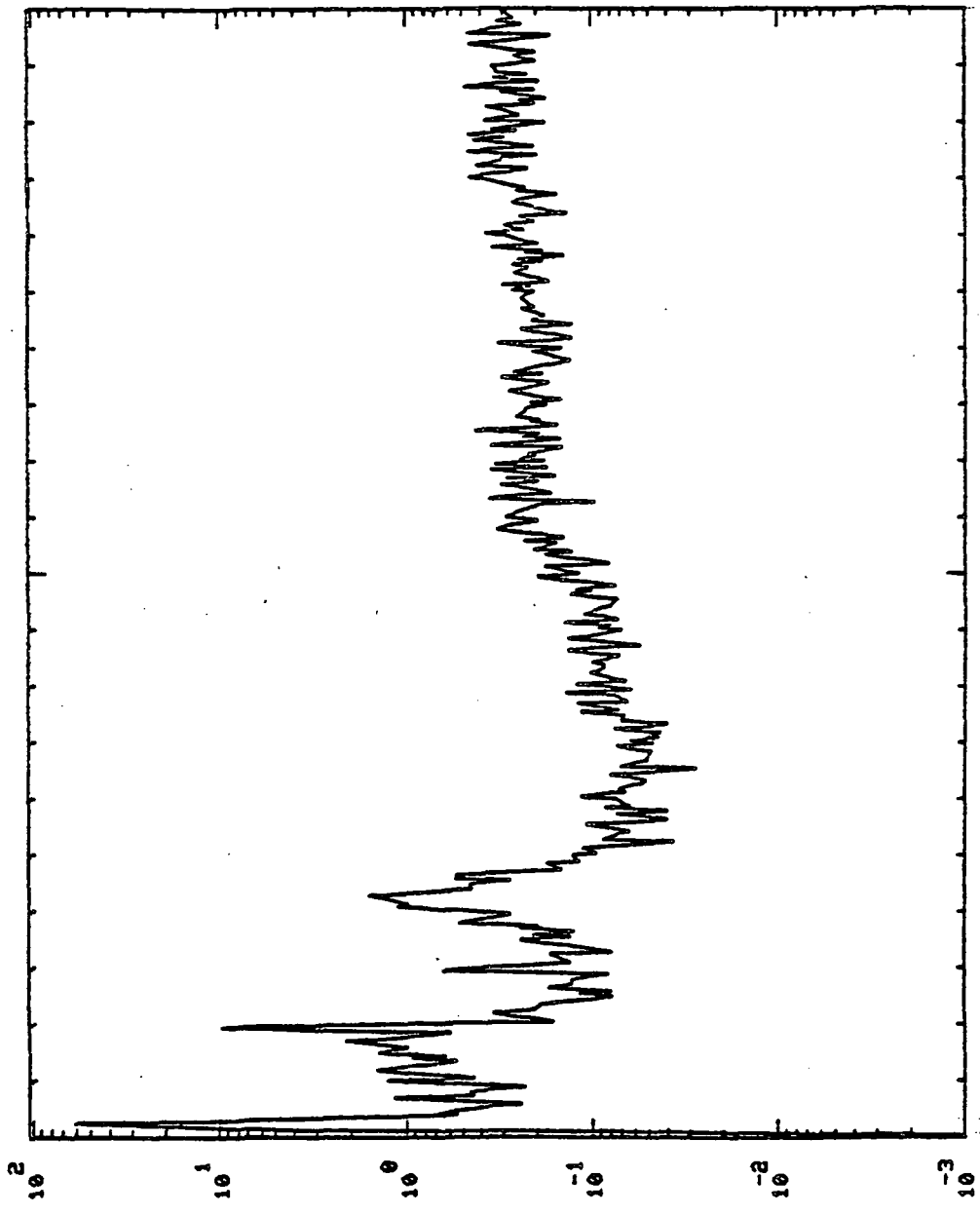


10^4
 $\times 10^4$

FREQUENCY (HZ)

S+ 200.01H0,'S

750120 PBP DS PR



2.4 x 10⁴

1
FREQUENCY (HZ)

P SQ/HZ

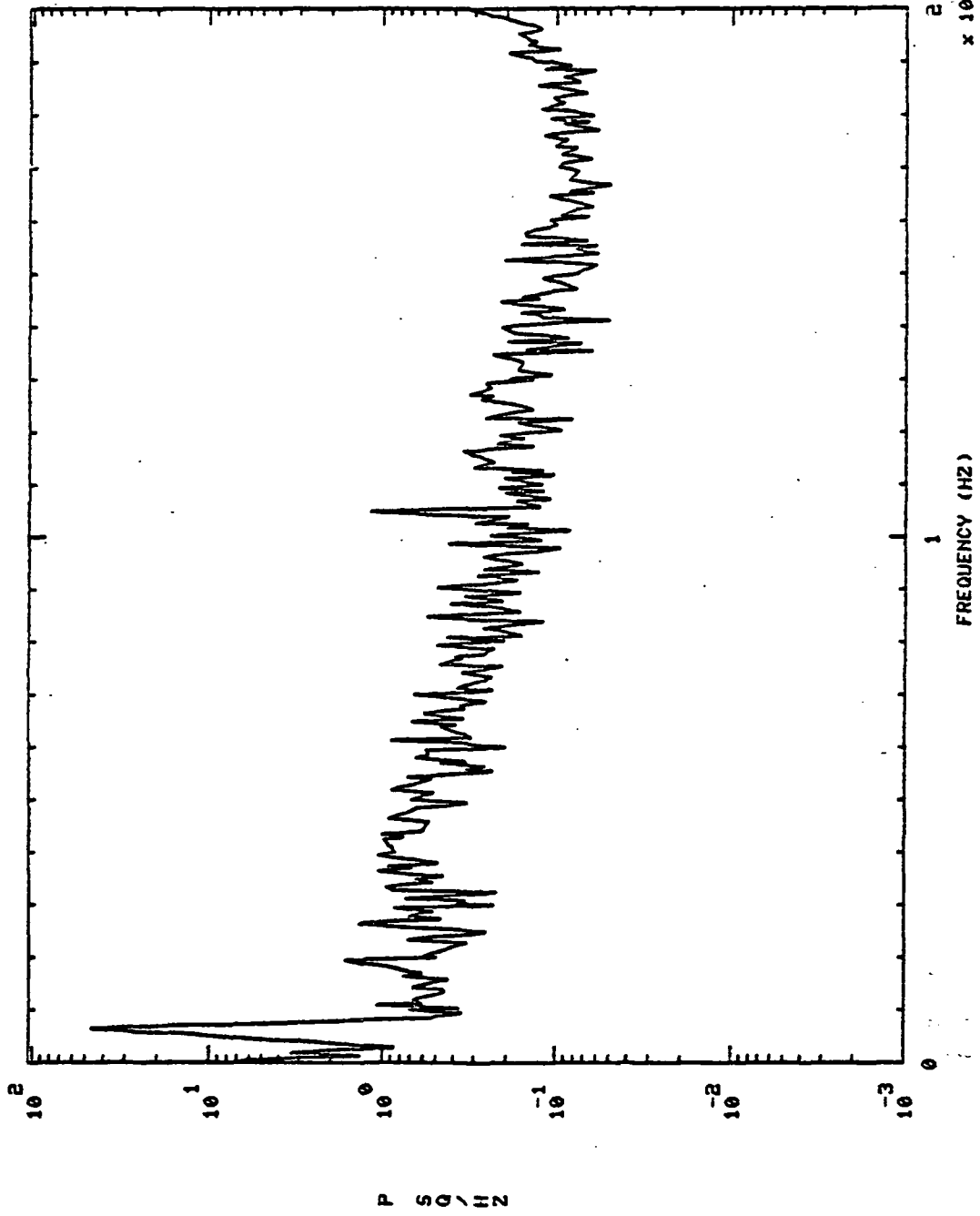
750120 HPFP BAL CAU PR St 30.01H0,'S

750120 HPFP BAL CAU PR

750120

HPFP BAL CAU PR

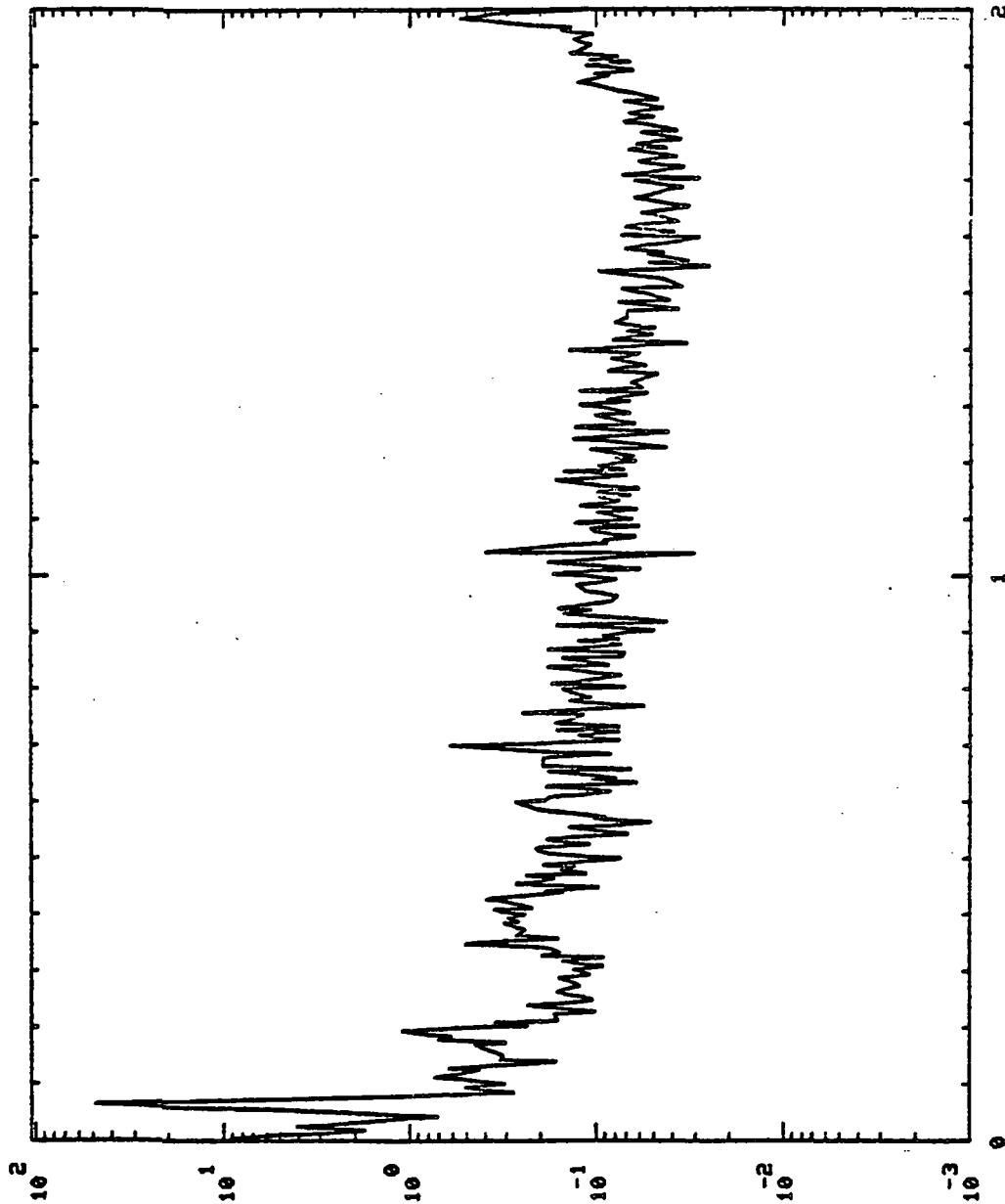
St 30.01H0,'S



S+ 100.01H0,'S

HPFP BAL CAU PR

750120

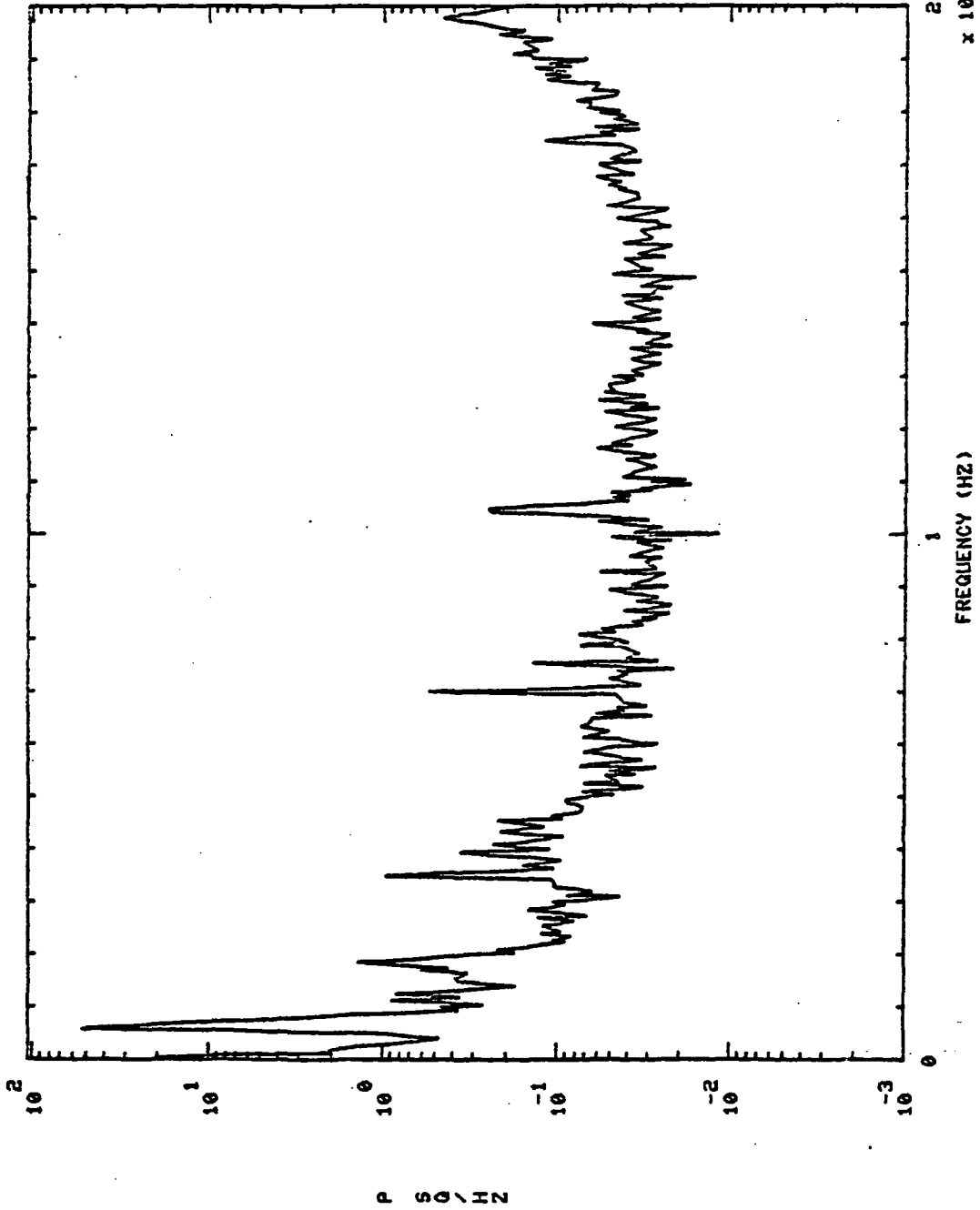


P S D \ HZ

FREQUENCY (HZ)

2.4
x 10⁴

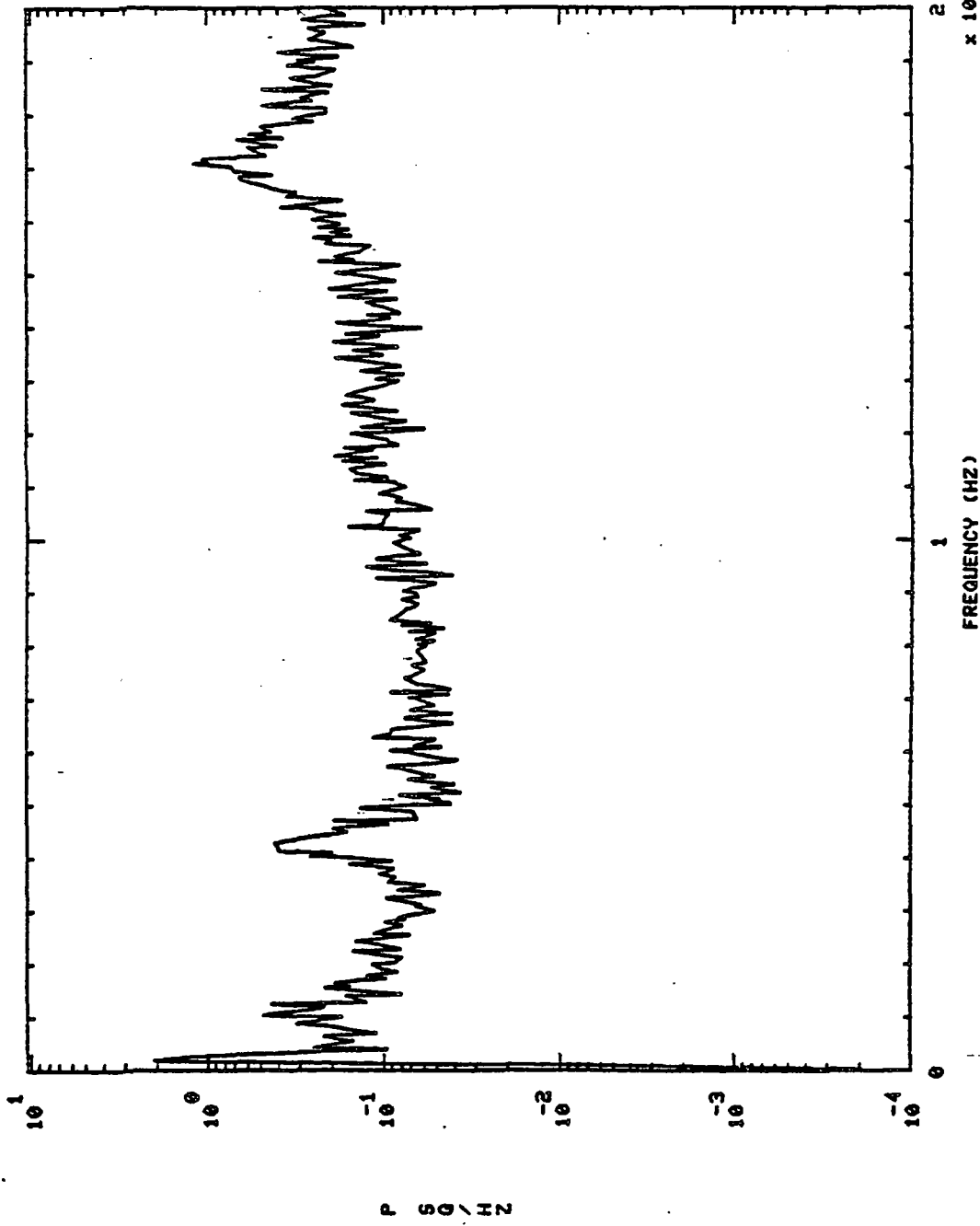
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S+ 30.01H0,'S

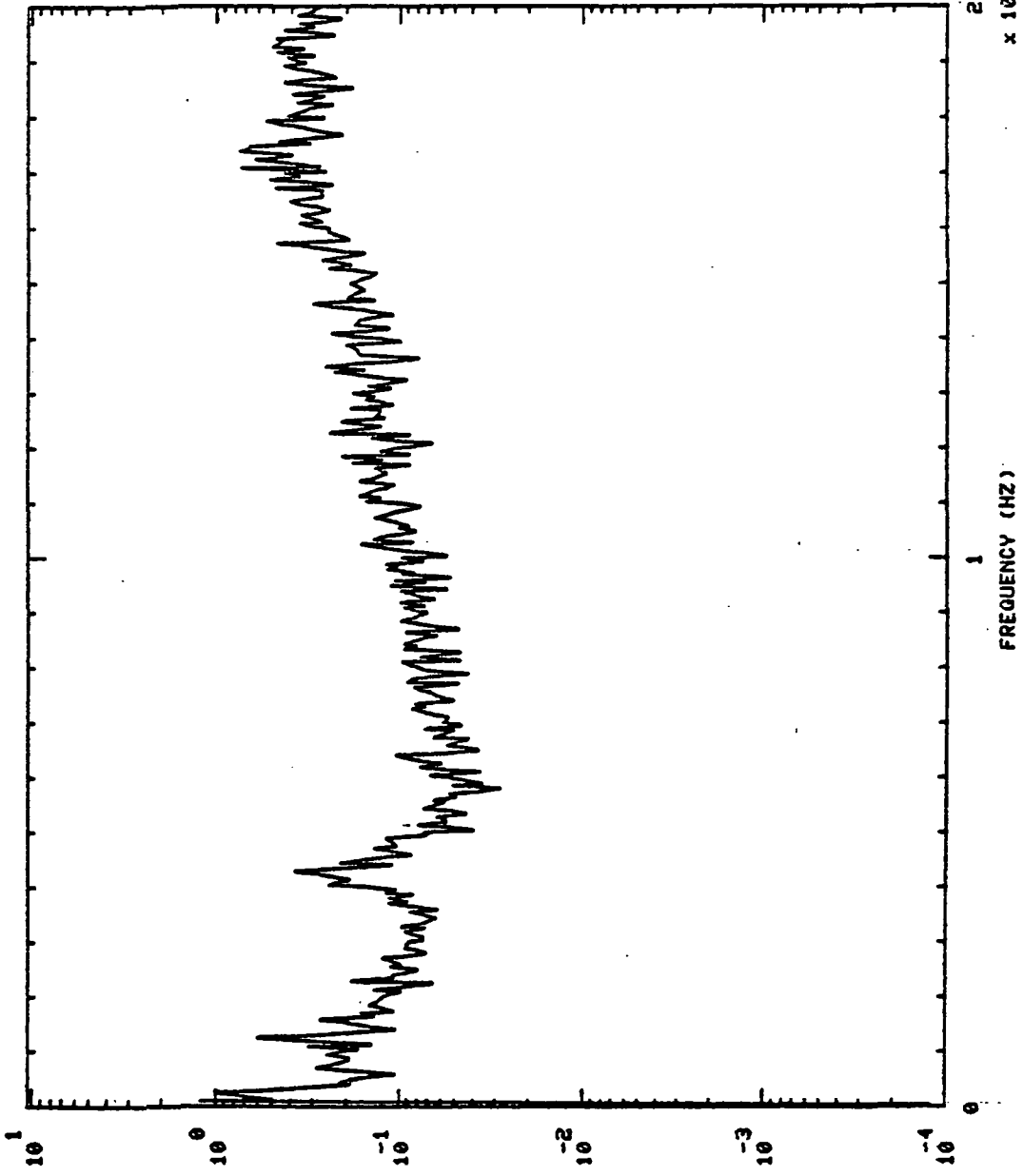
OPB PC PR DC

750120



2.4
x 10¹

750120 OPB PC PR DC S+ 100.01H0,'S



P SQ / HZ

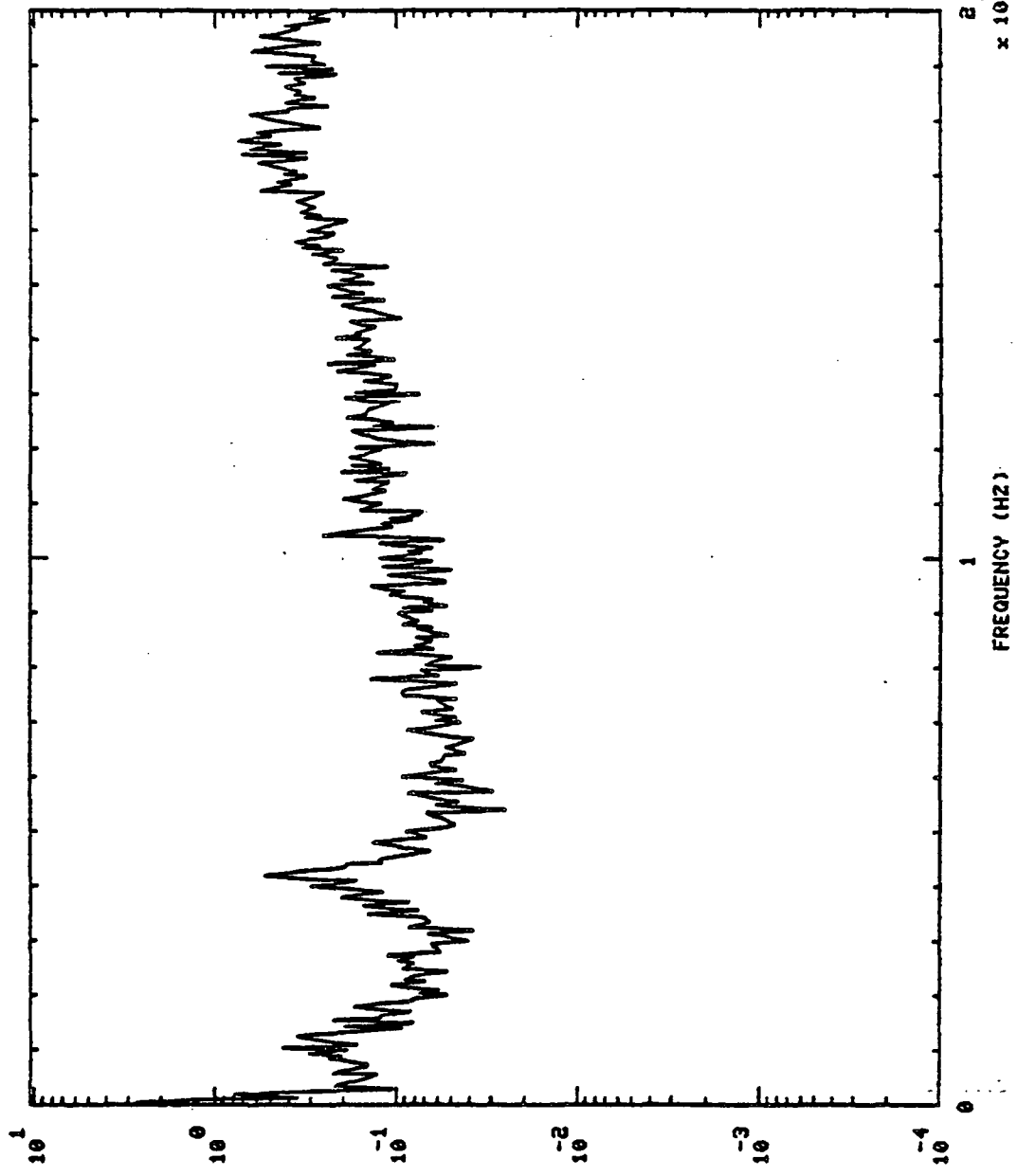
FREQUENCY (HZ)

x 10⁴

750120

OPB PC PR DC

S+ 200.01H0,'S

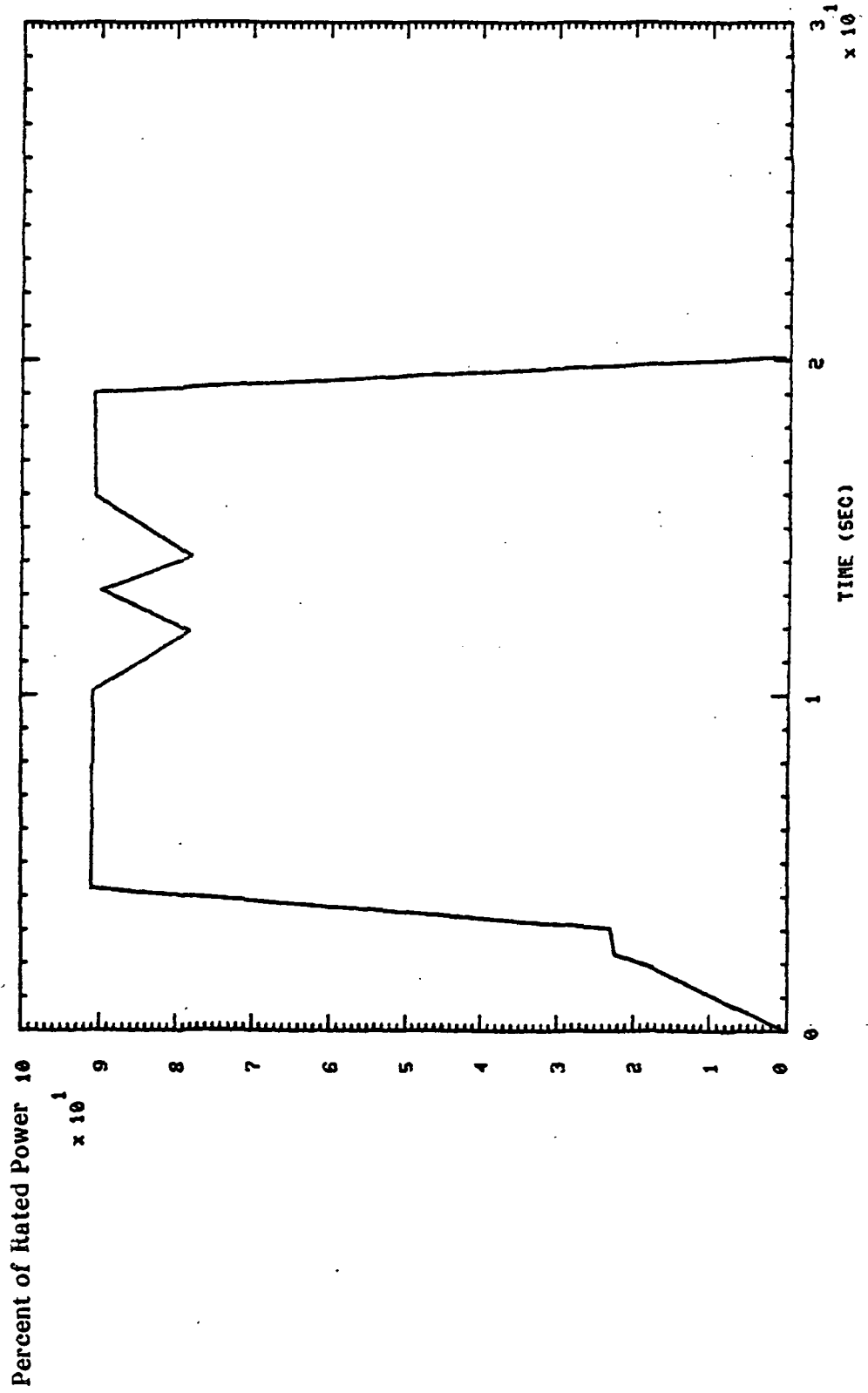


x 10⁴

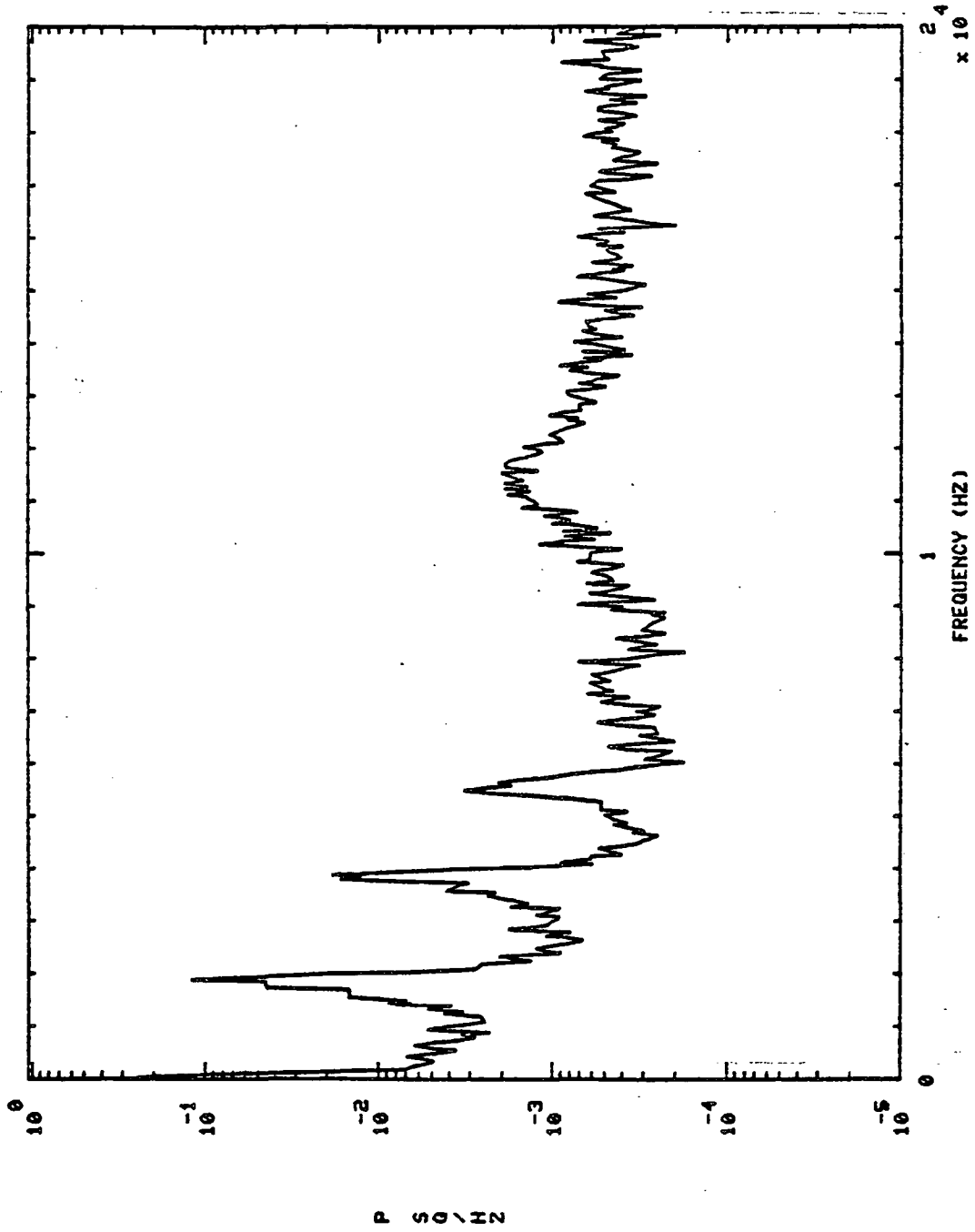
1

FREQUENCY (HZ)

750121 THRUST (UNFILTERED)

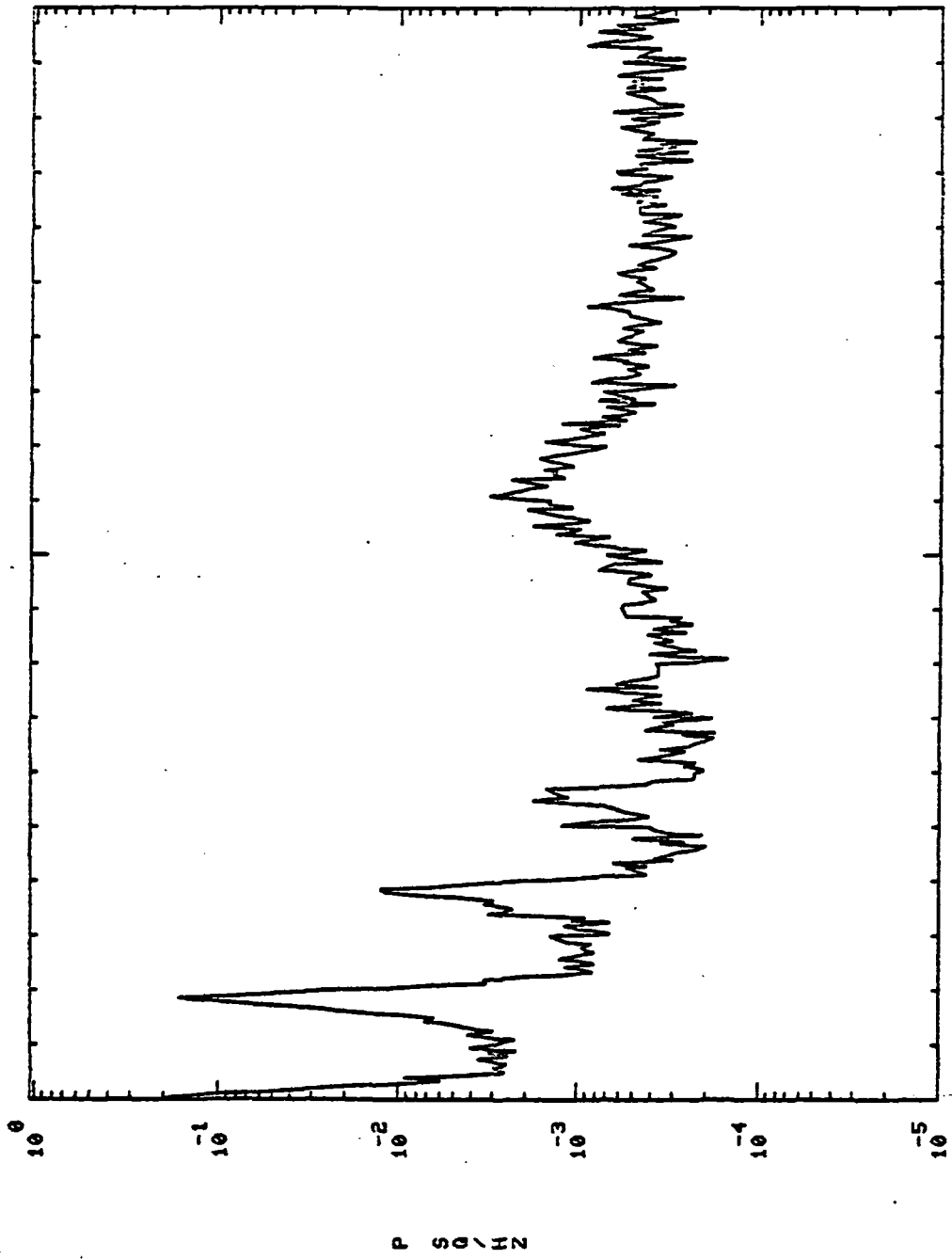


750121 LPOP DS PR S+ 8.01H0,'S



750121 LPOP DS PR S+ 16.0110,'S

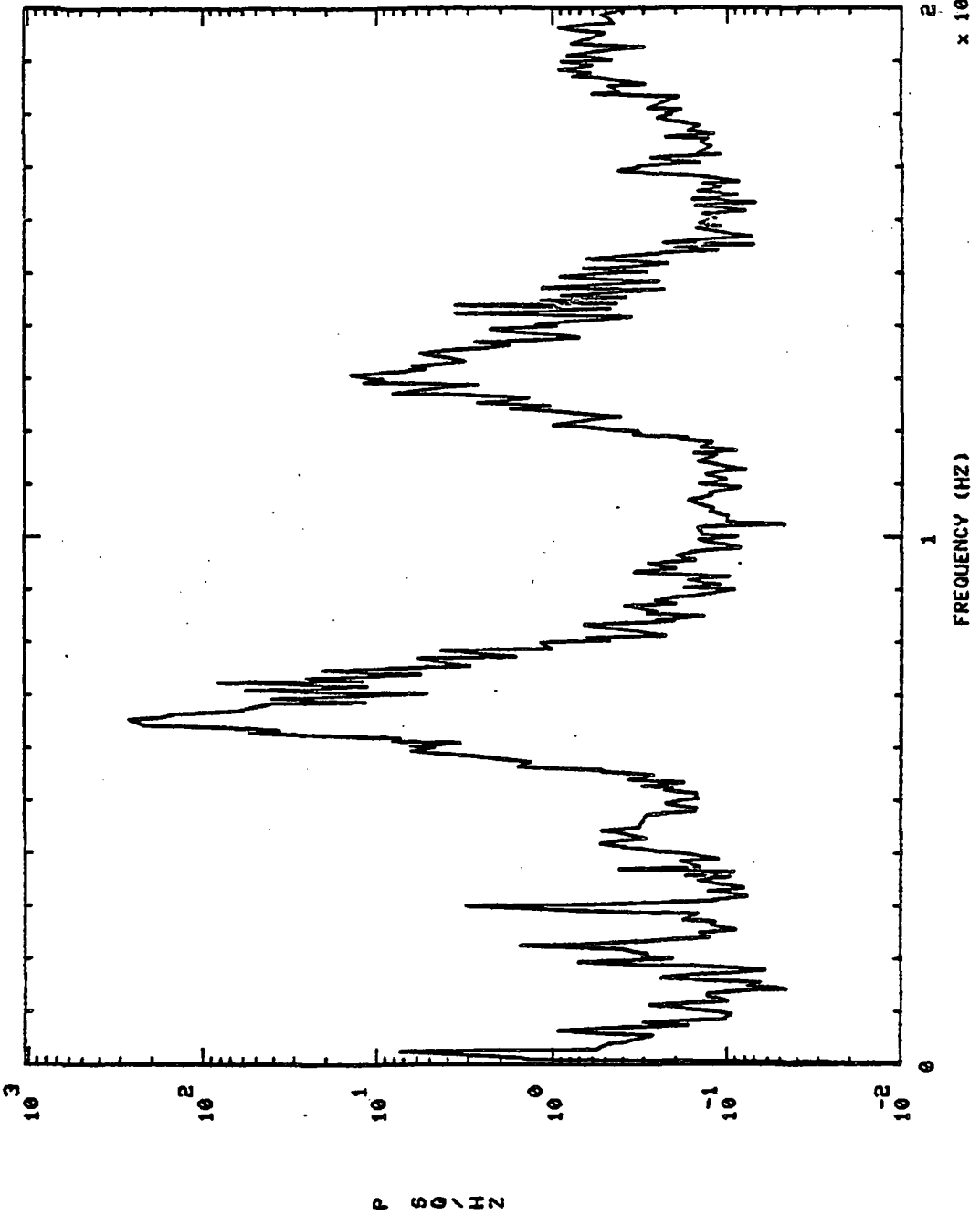
750121 LPOP DS PR



10^4
 $\times 10^4$

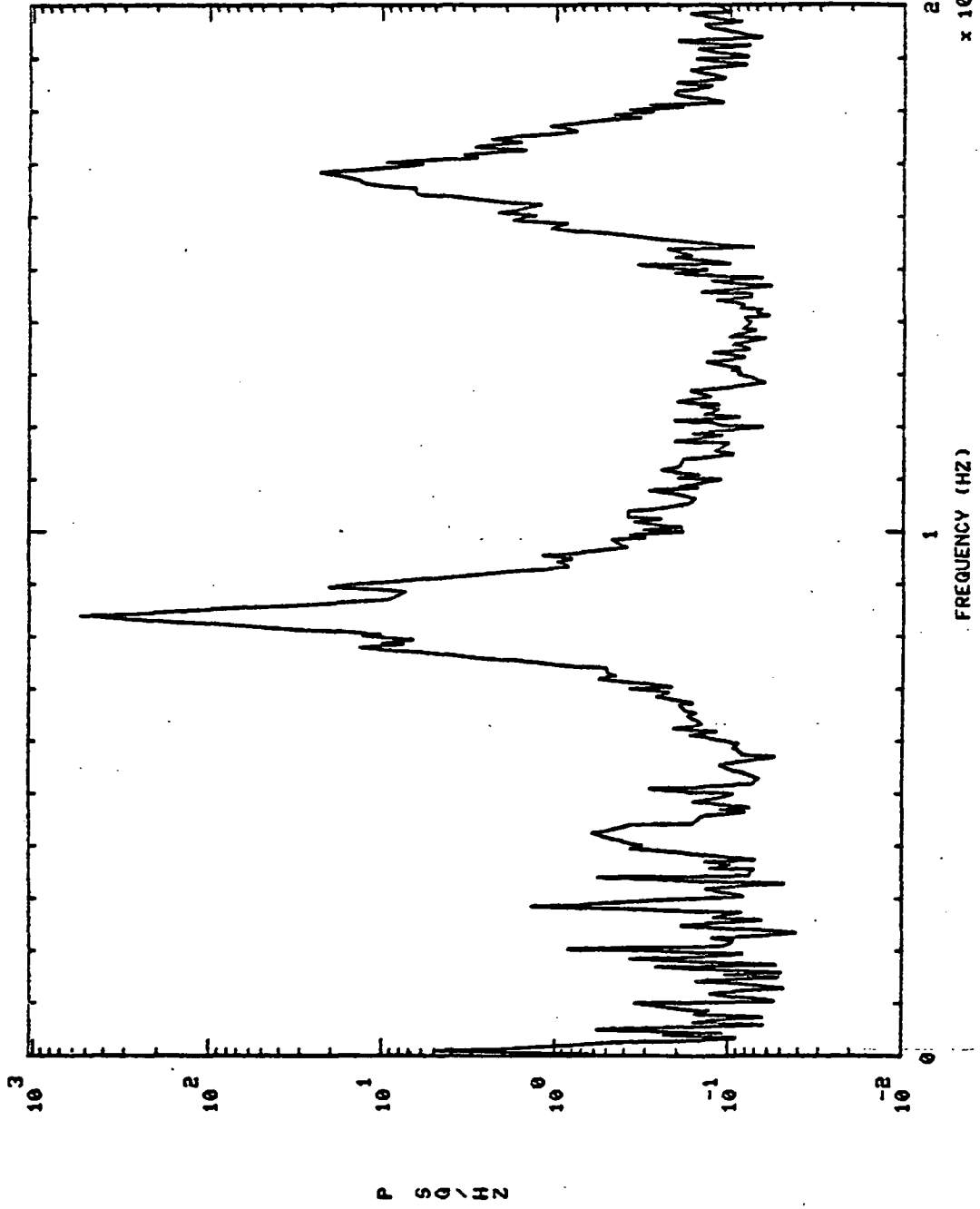
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FREQUENCY (HZ)

750121 HPOP DS PR S+ 8.01H0,'S

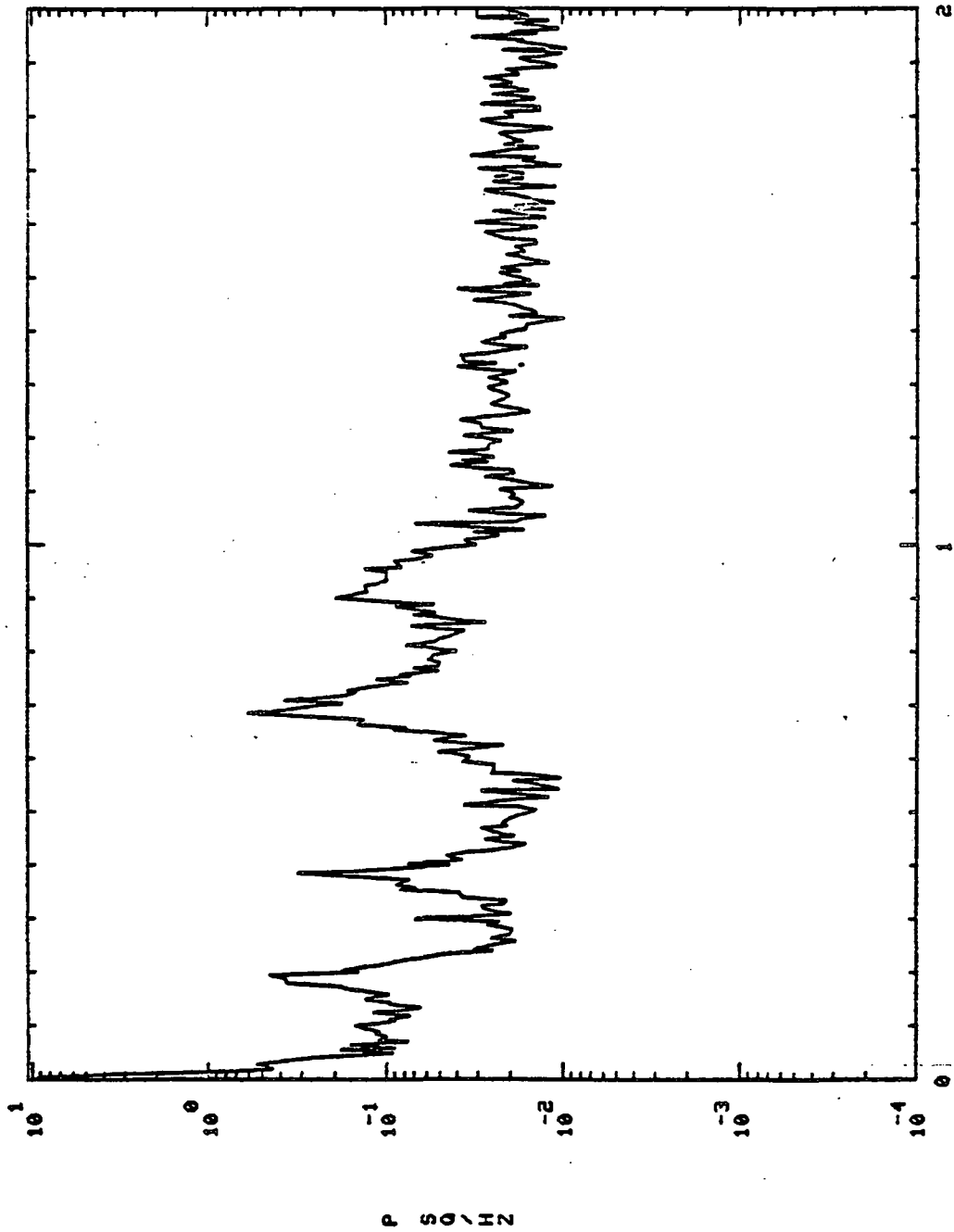


750121 HPOP DS PR S+ 16.01H0,'S

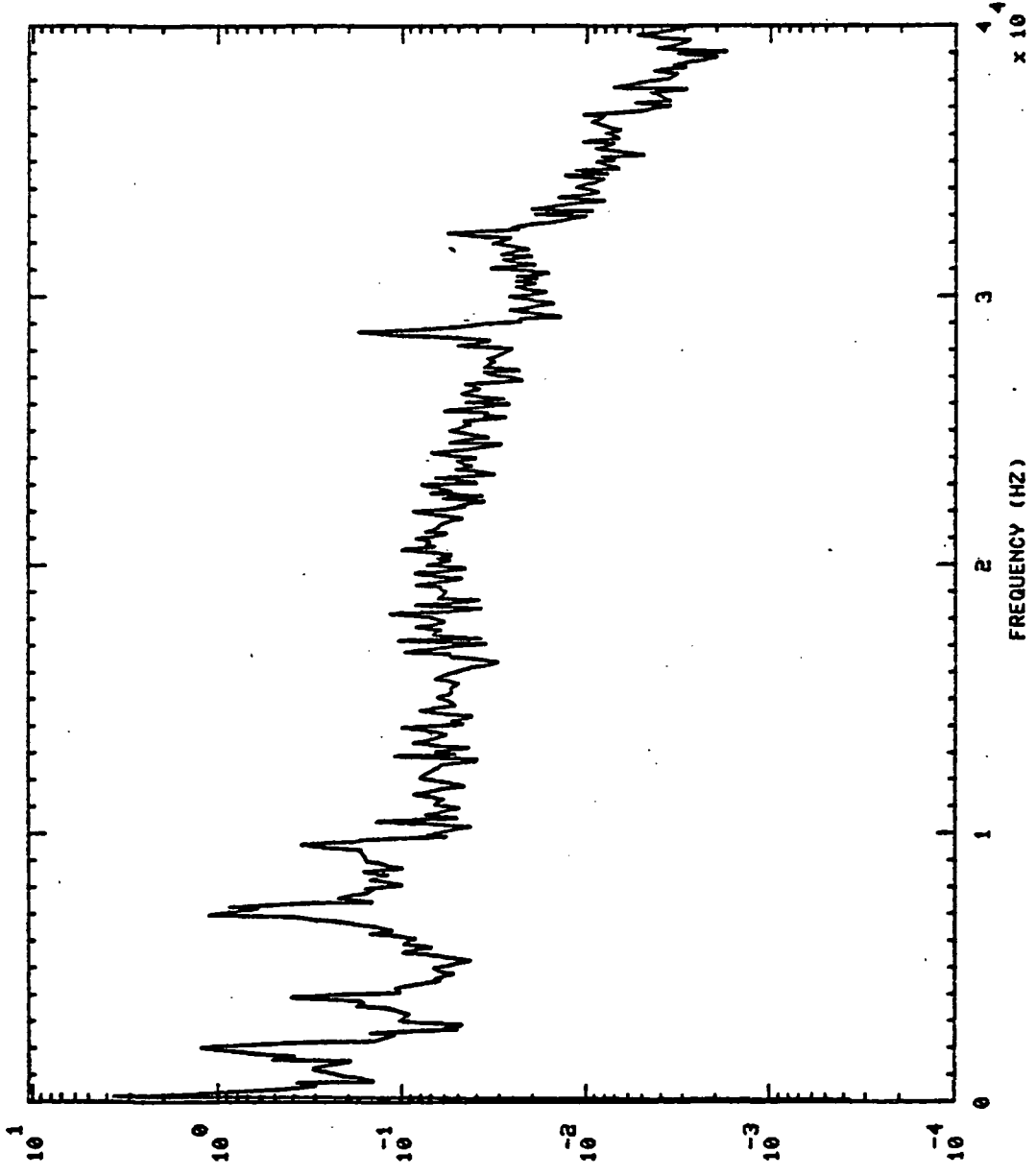
750121 HPOP DS PR



750121 MCC HOT GAS IN PR S+ 8.01H0.'S

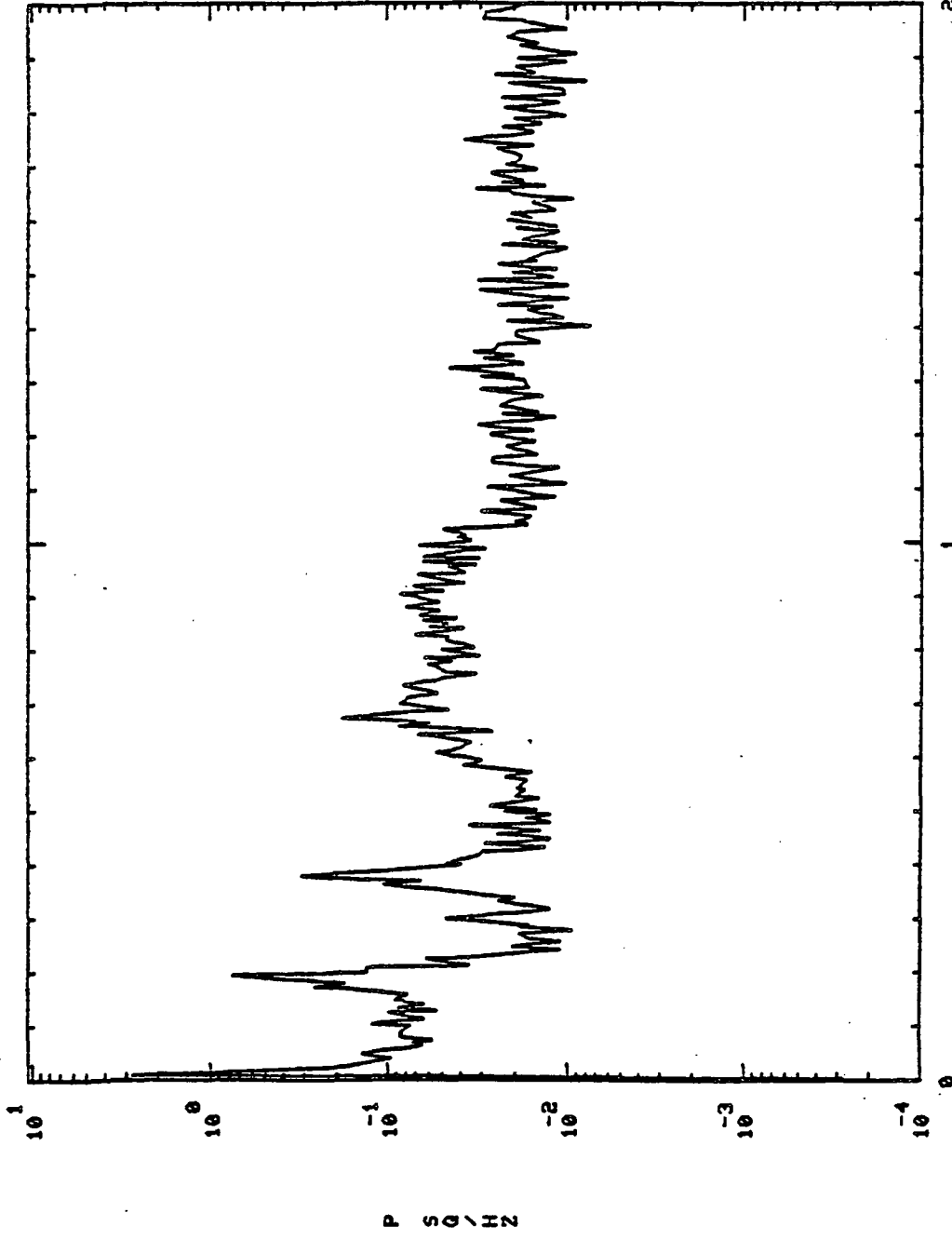


750121 MCC HOT GAS IN PR. S+ 8.01H0,'S



P S D \ HZ

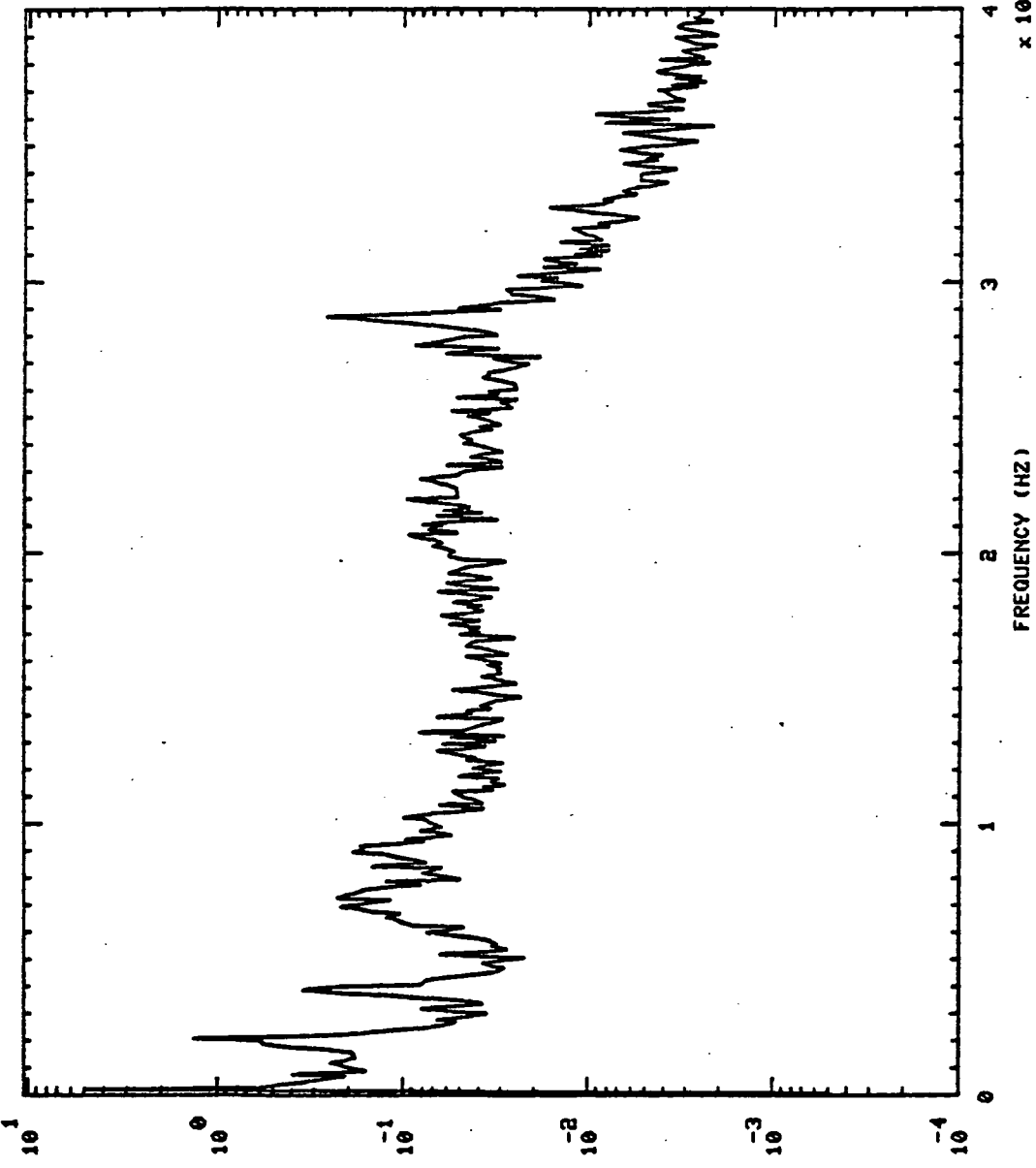
750121 MCC HOT GAS IN PR ST 16.01H0,'S



2 4
x 10⁴

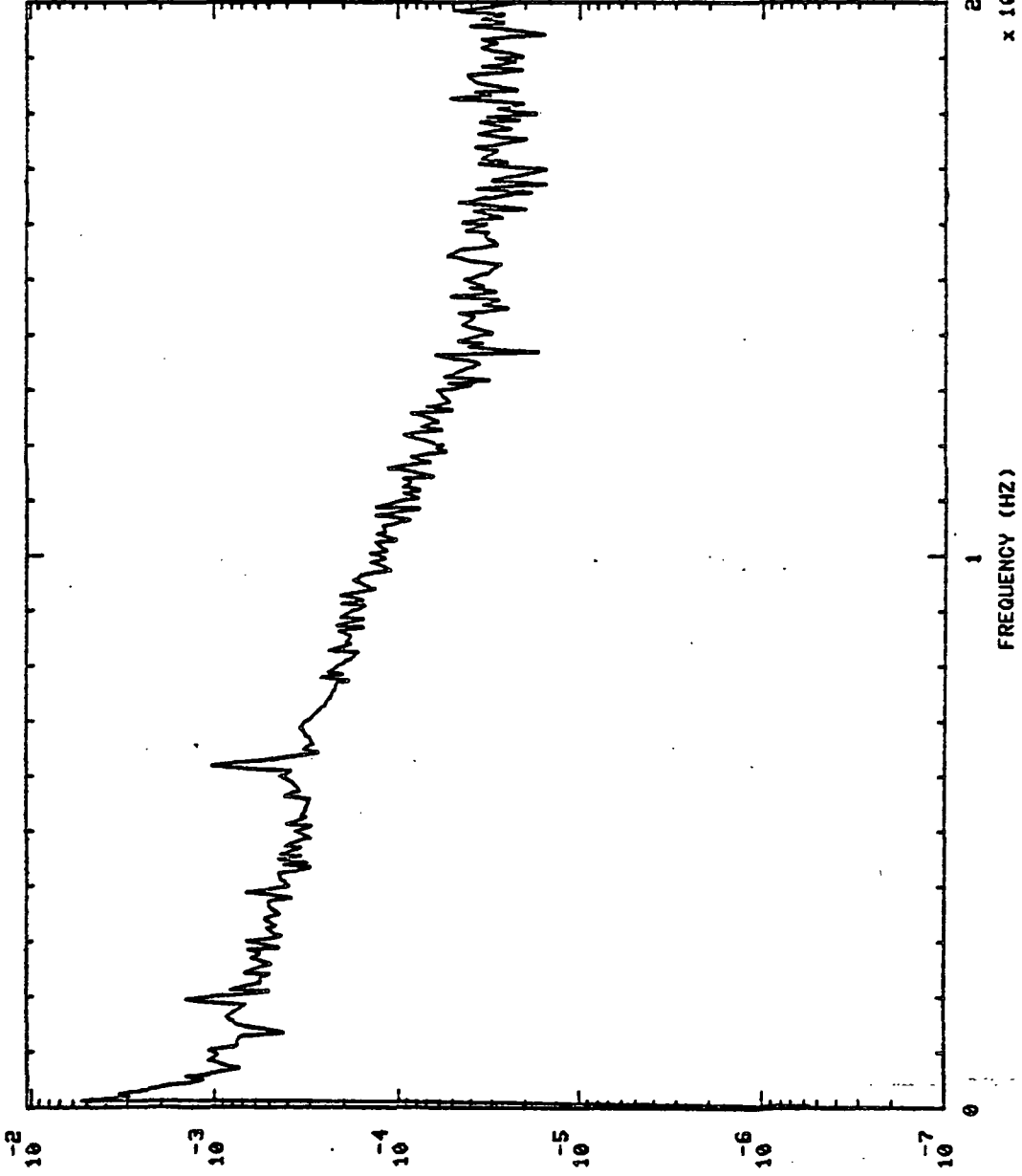
FREQUENCY (HZ)

750121 MCC HOT GAS IN PR S+ 16.01H0,'S



P S D / H Z

750121 HOT GAS MAIN PR2 S+ B.01H0,'S

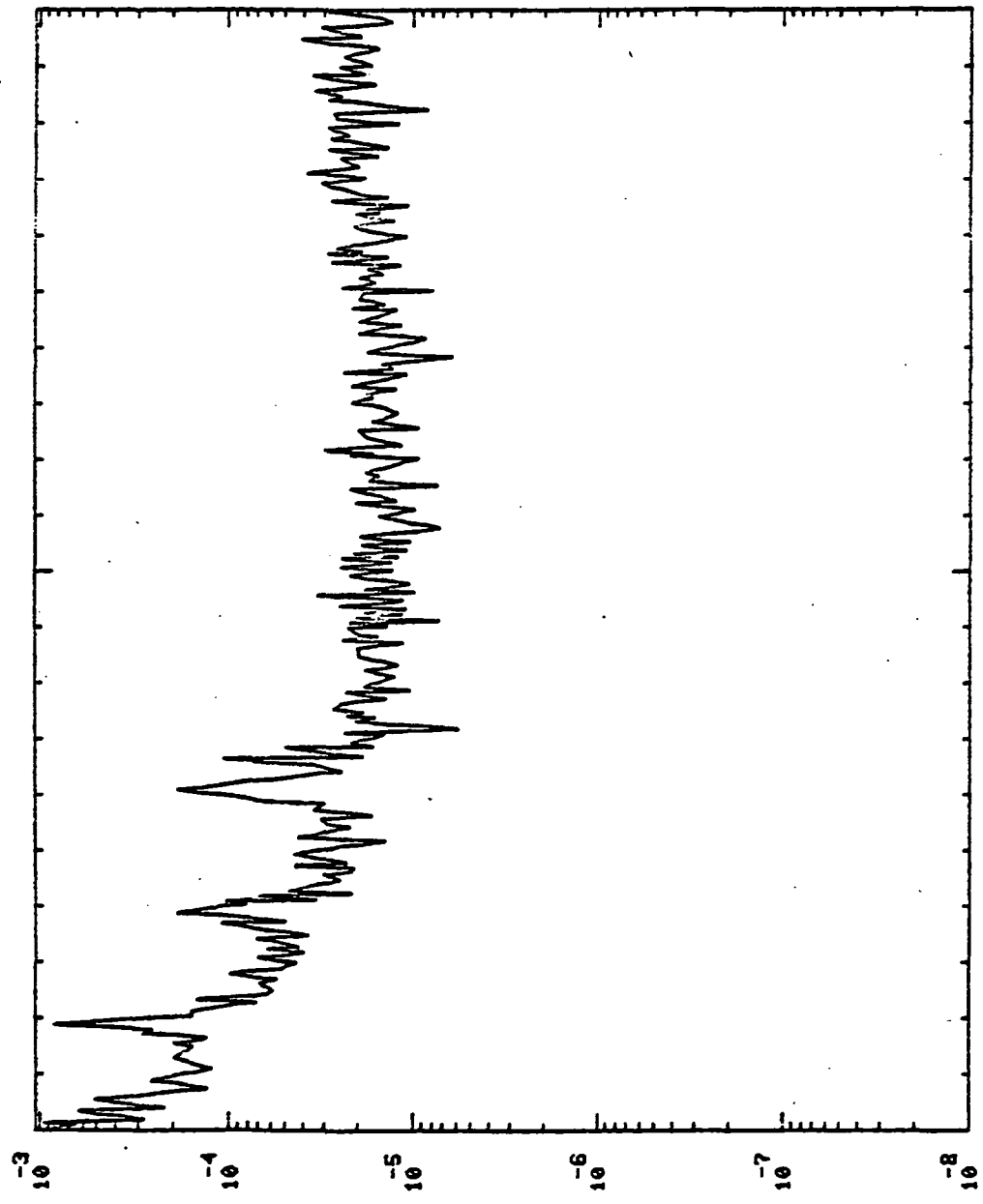


PSD / HZ

FREQUENCY (HZ)

x 10⁴

750121 HOT GAS MAIN PR2 ST 16.01110,'S

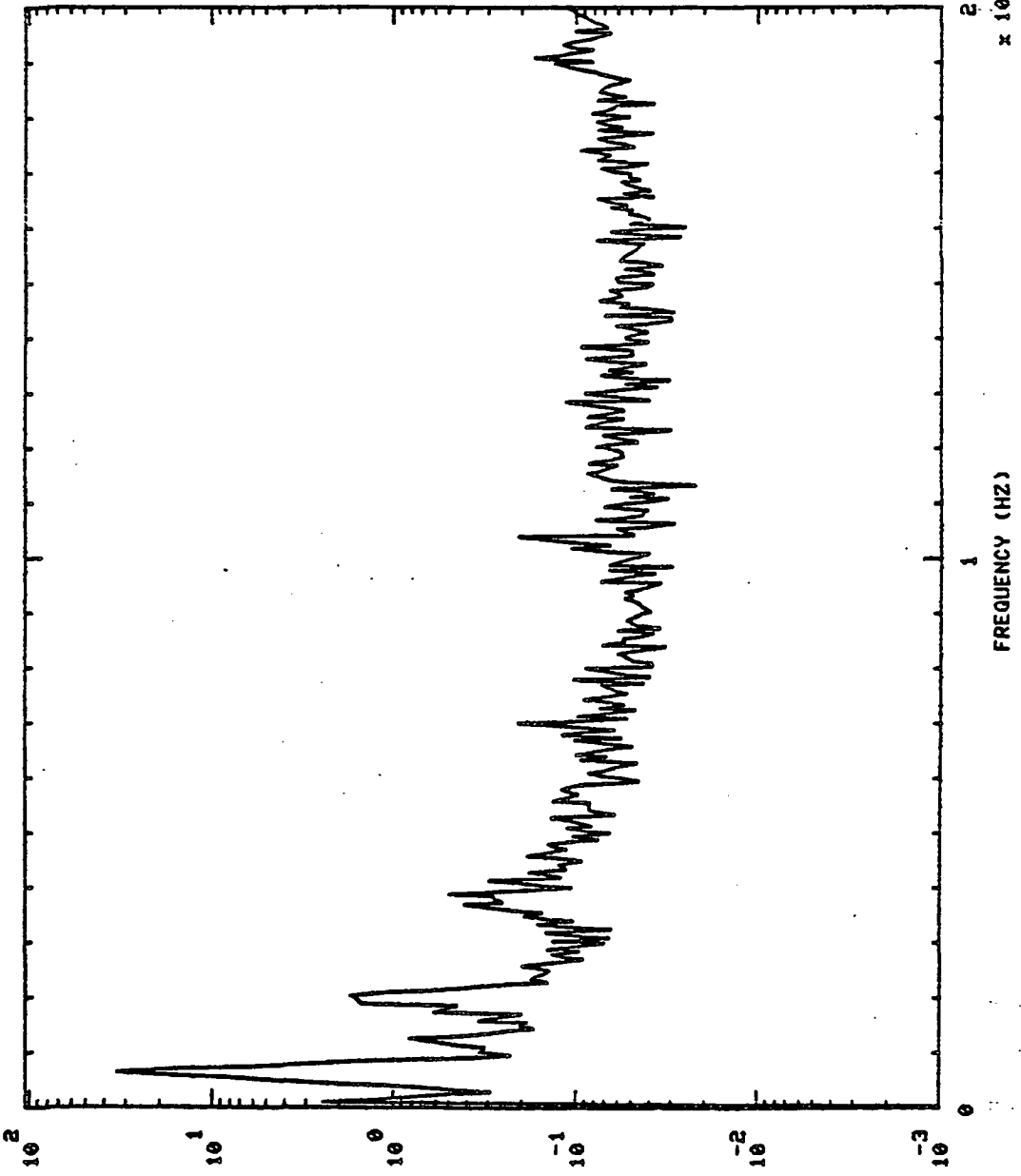


P S G / H Z

FREQUENCY (HZ)

2.4×10^4

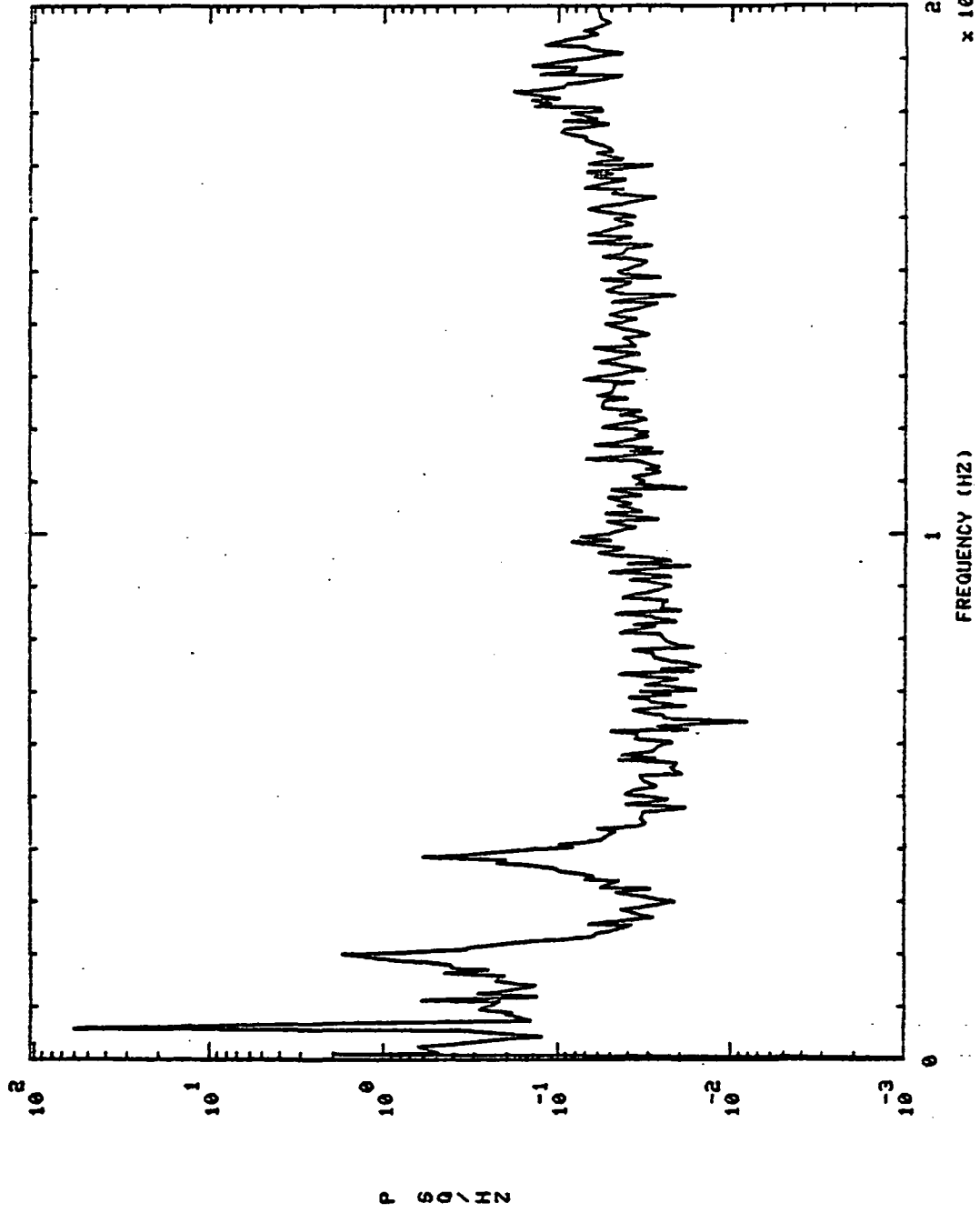
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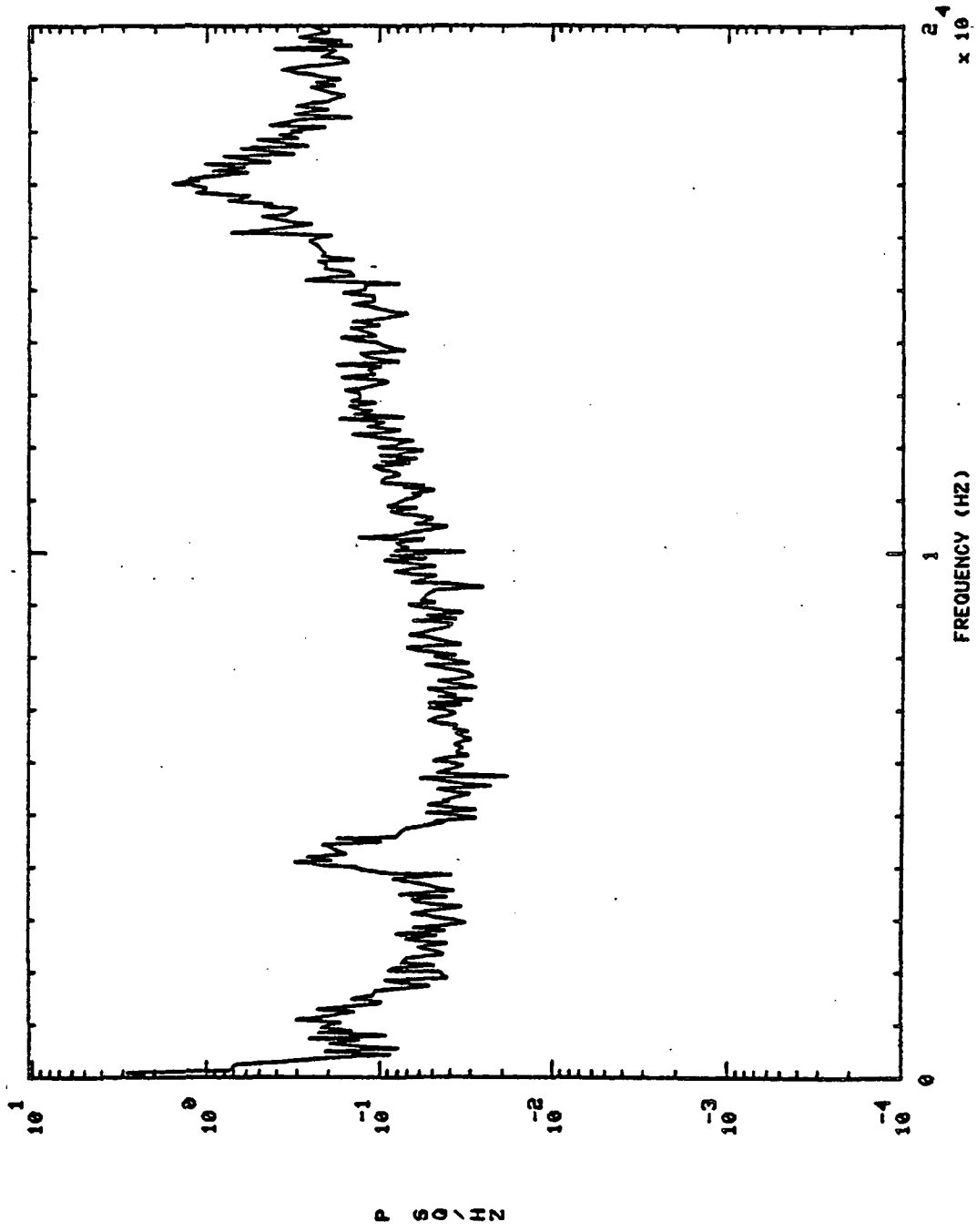
P SO / HZ

FREQUENCY (HZ)
x 10⁴

750121 HPFP BAL CAU PR S+ 16.01H0,'S



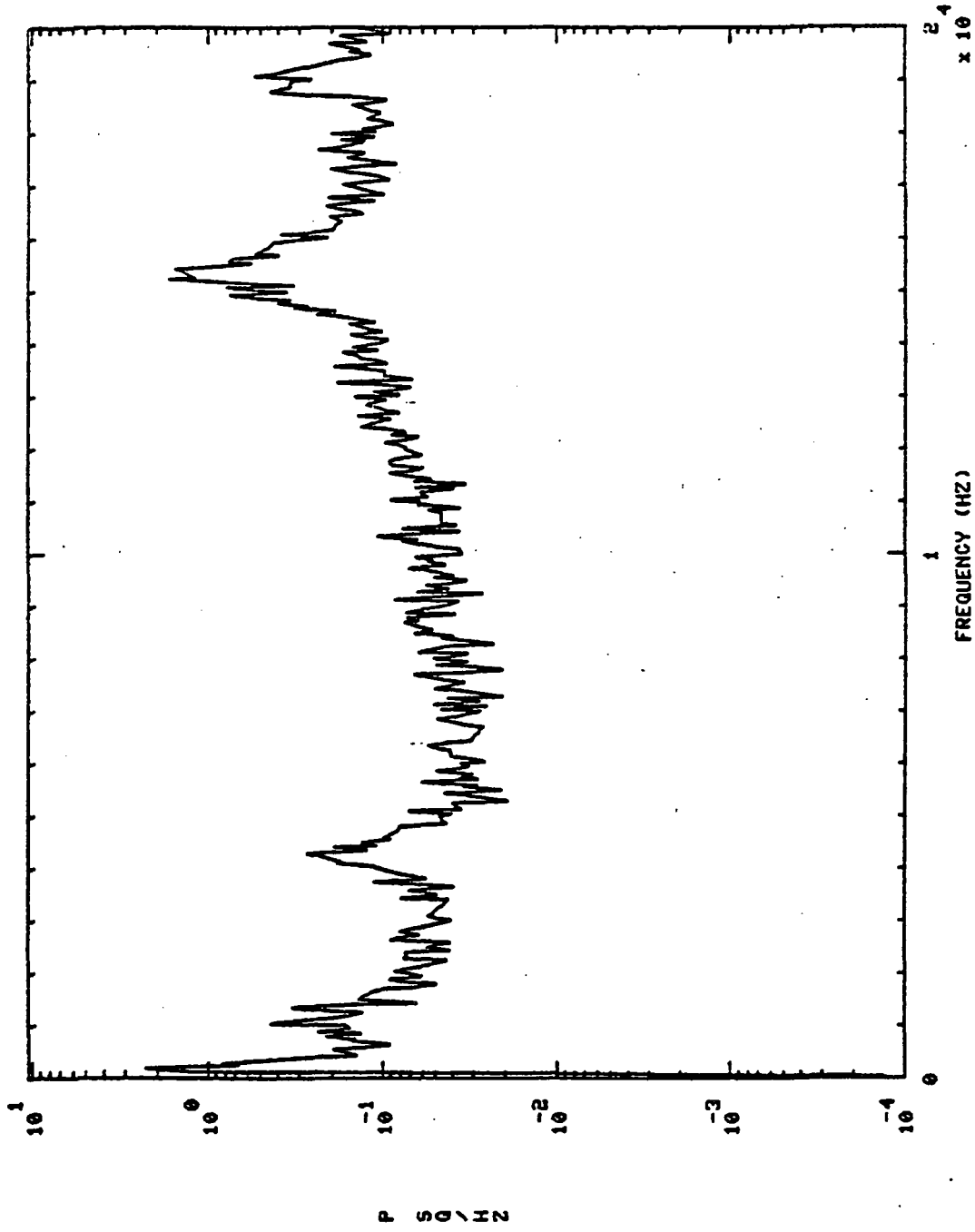
750121 OPB PC PR DC S+ 8.01H0.'S



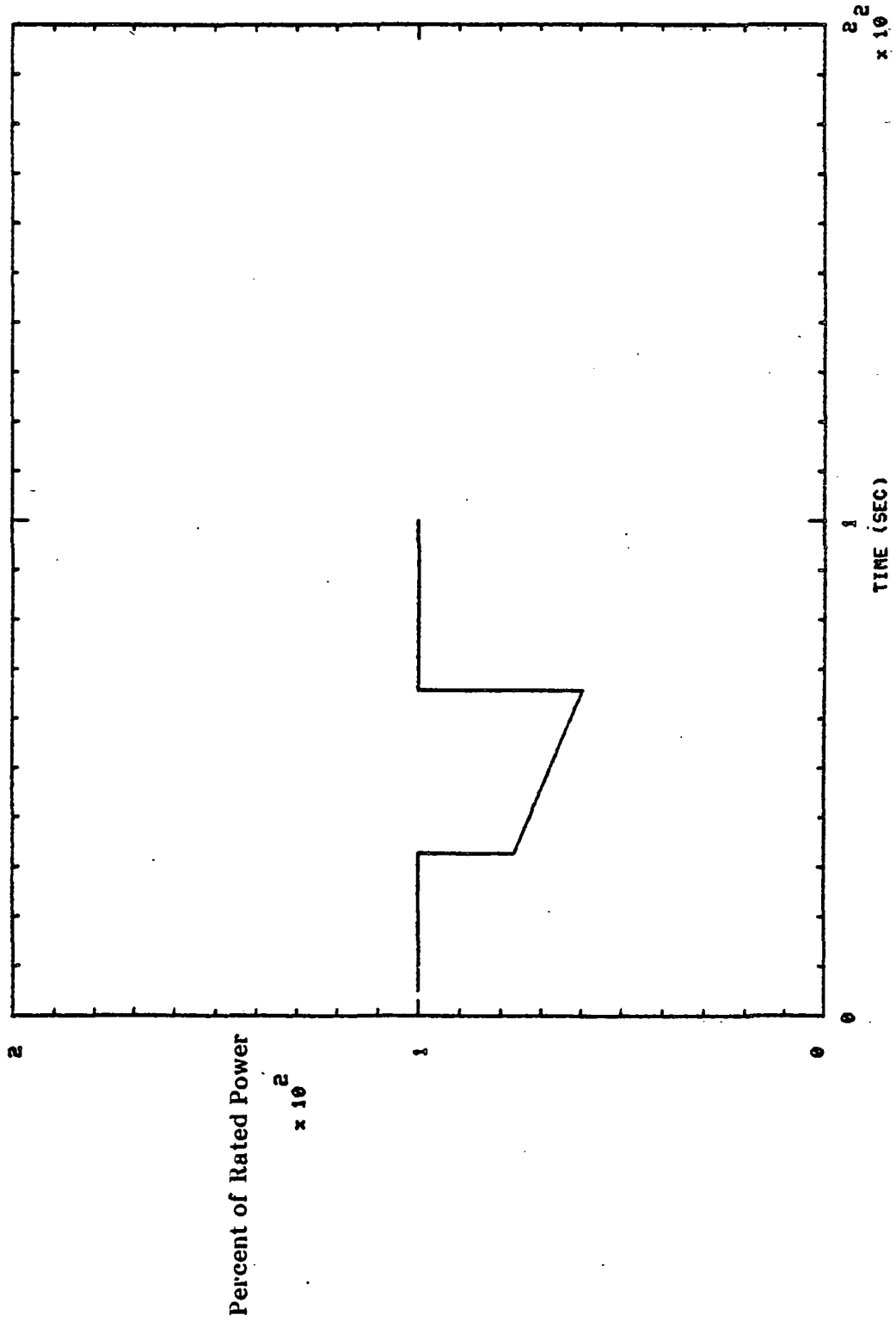
750121

OPB PC PR DC

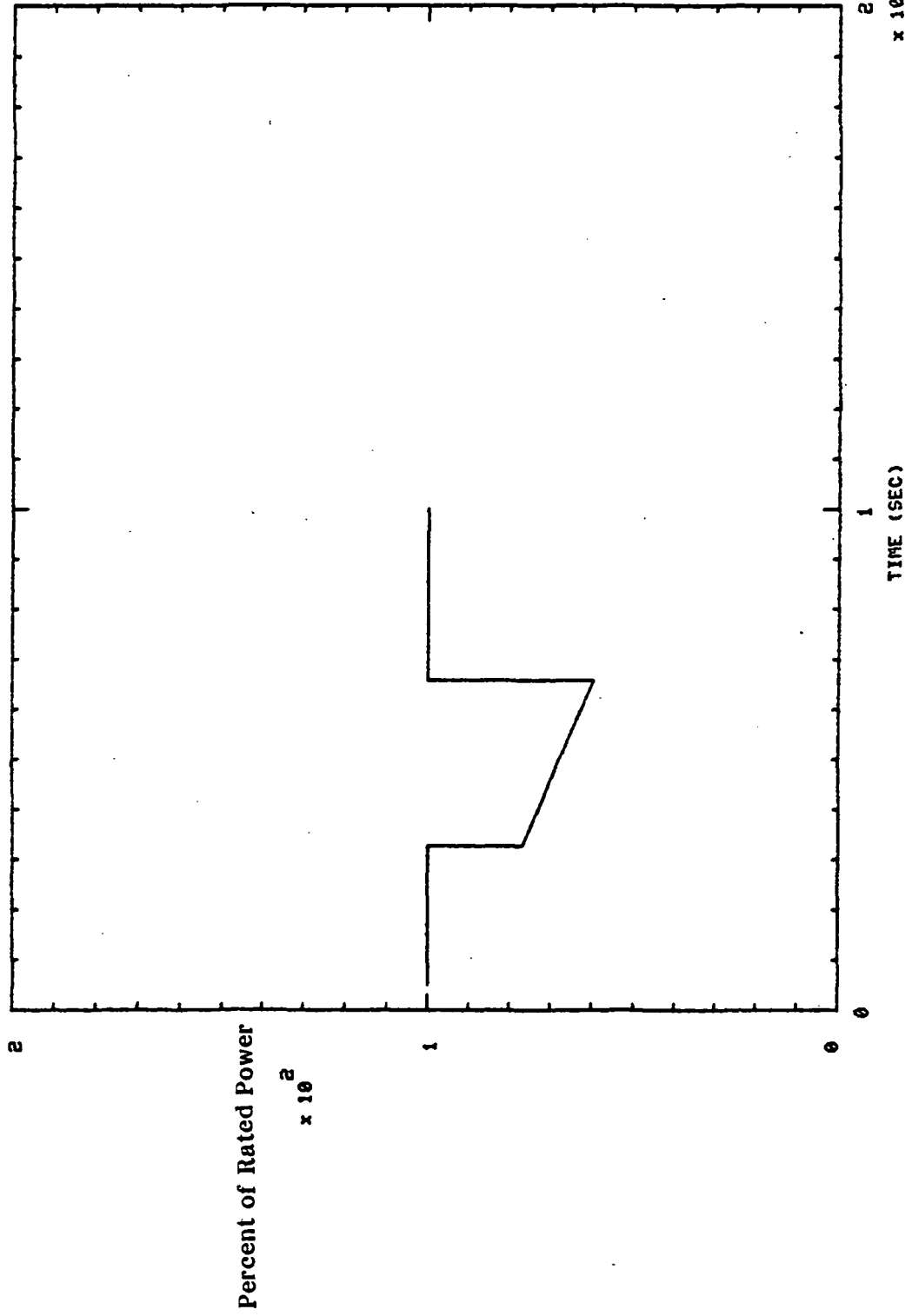
S+ 16.01H0,'S



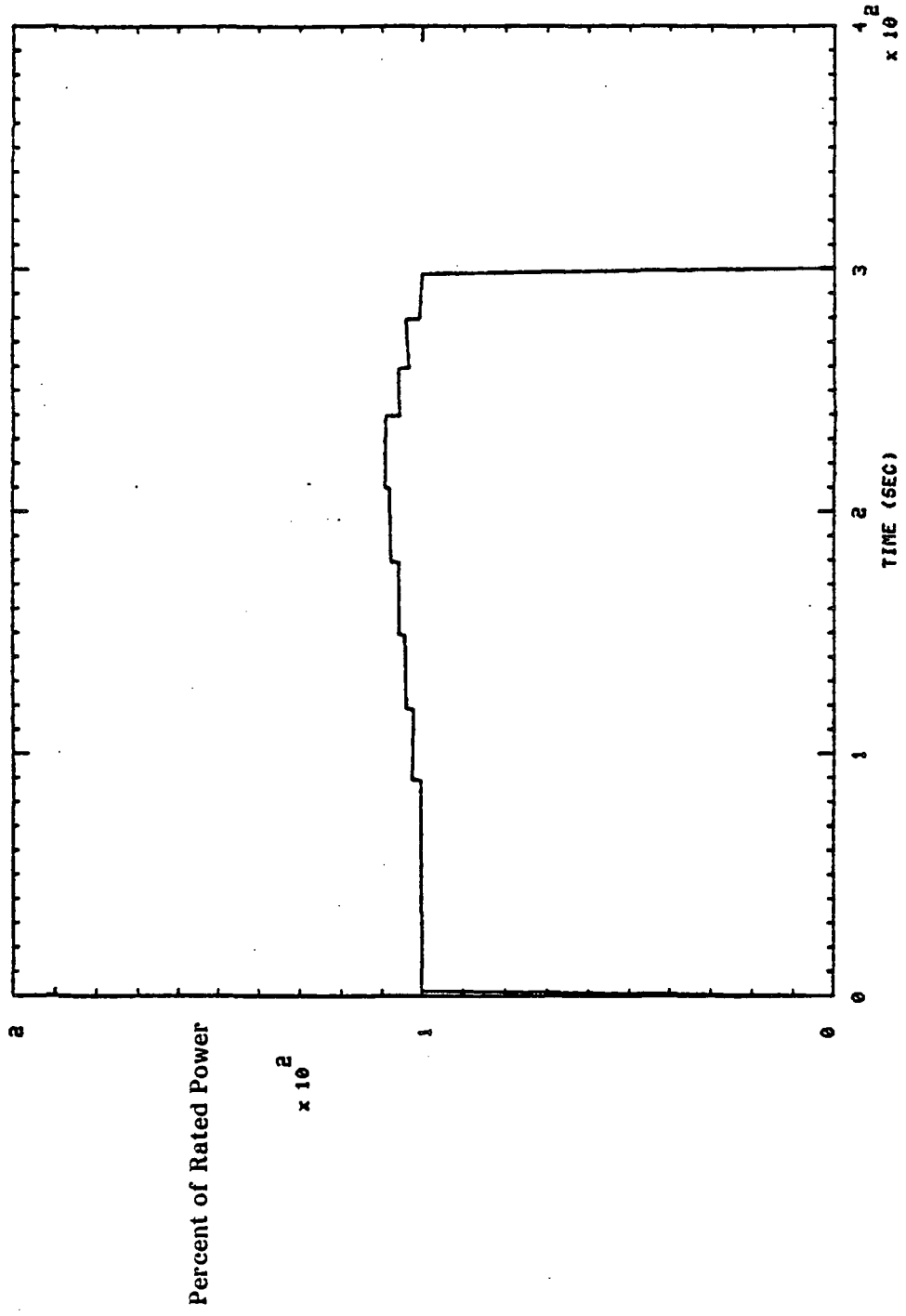
750123 THRUST (UNFILTERED)



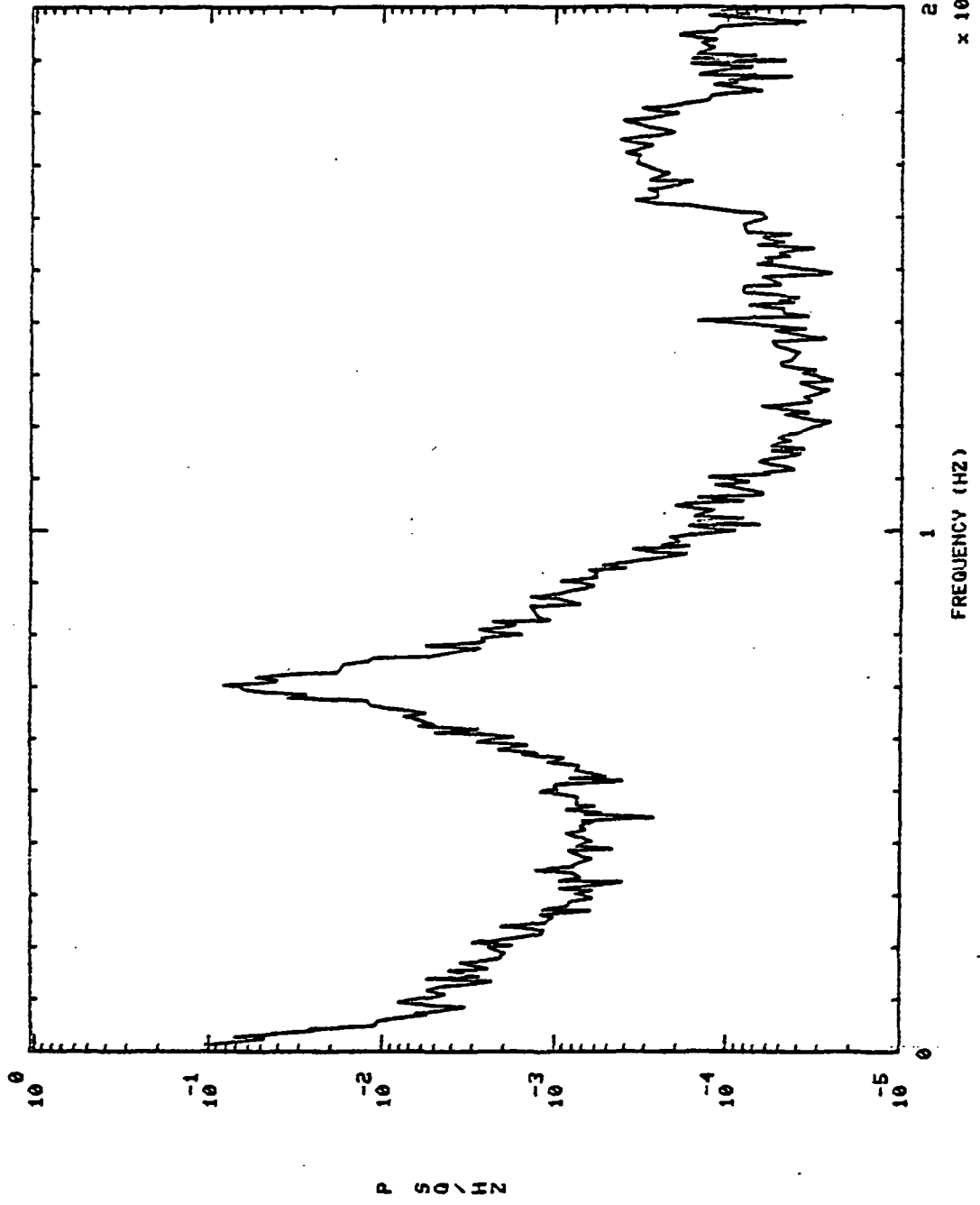
750124 THRUST (UNFILTERED)



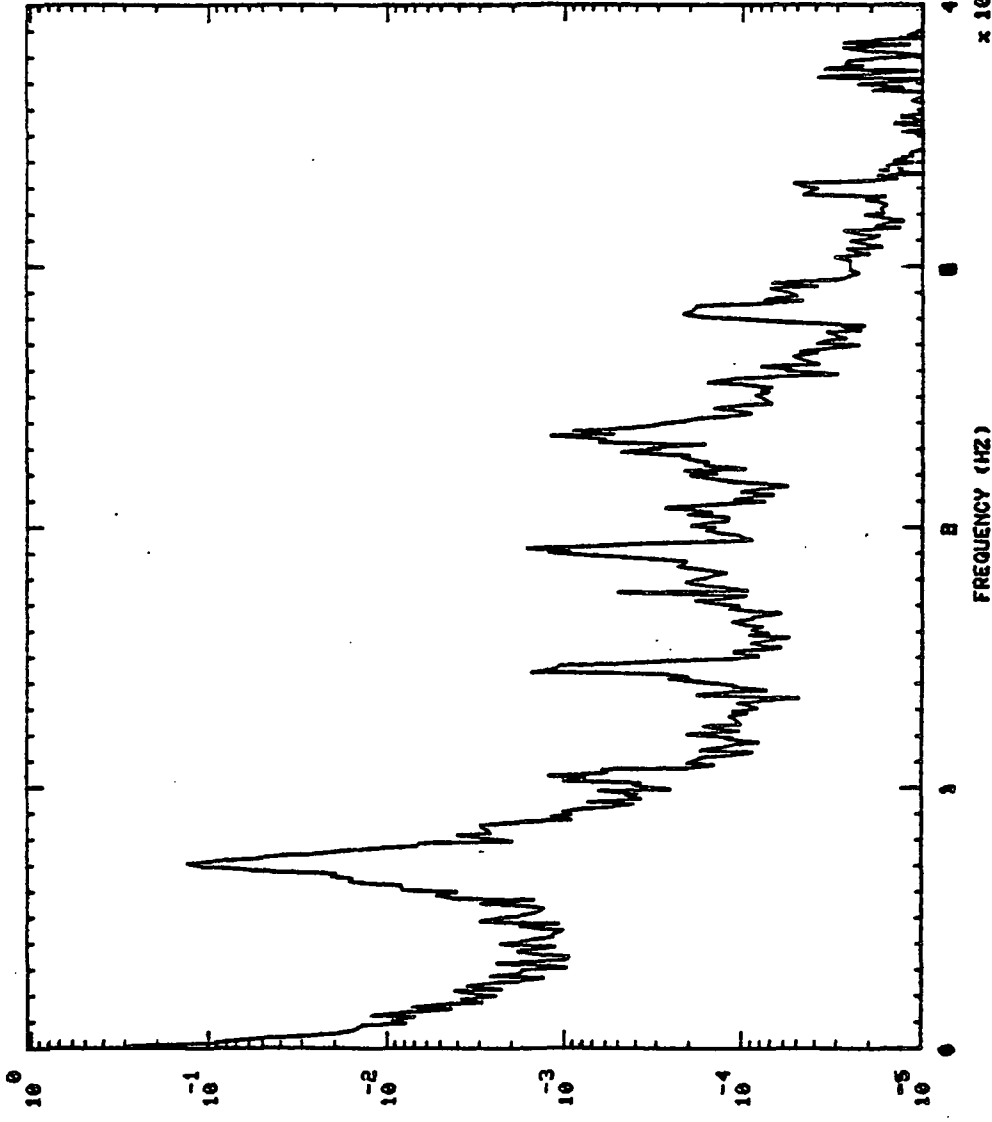
750125 THRUST (UNFILTERED)



750125 MCC FUEL INJ PR ST 6.01H0,'S

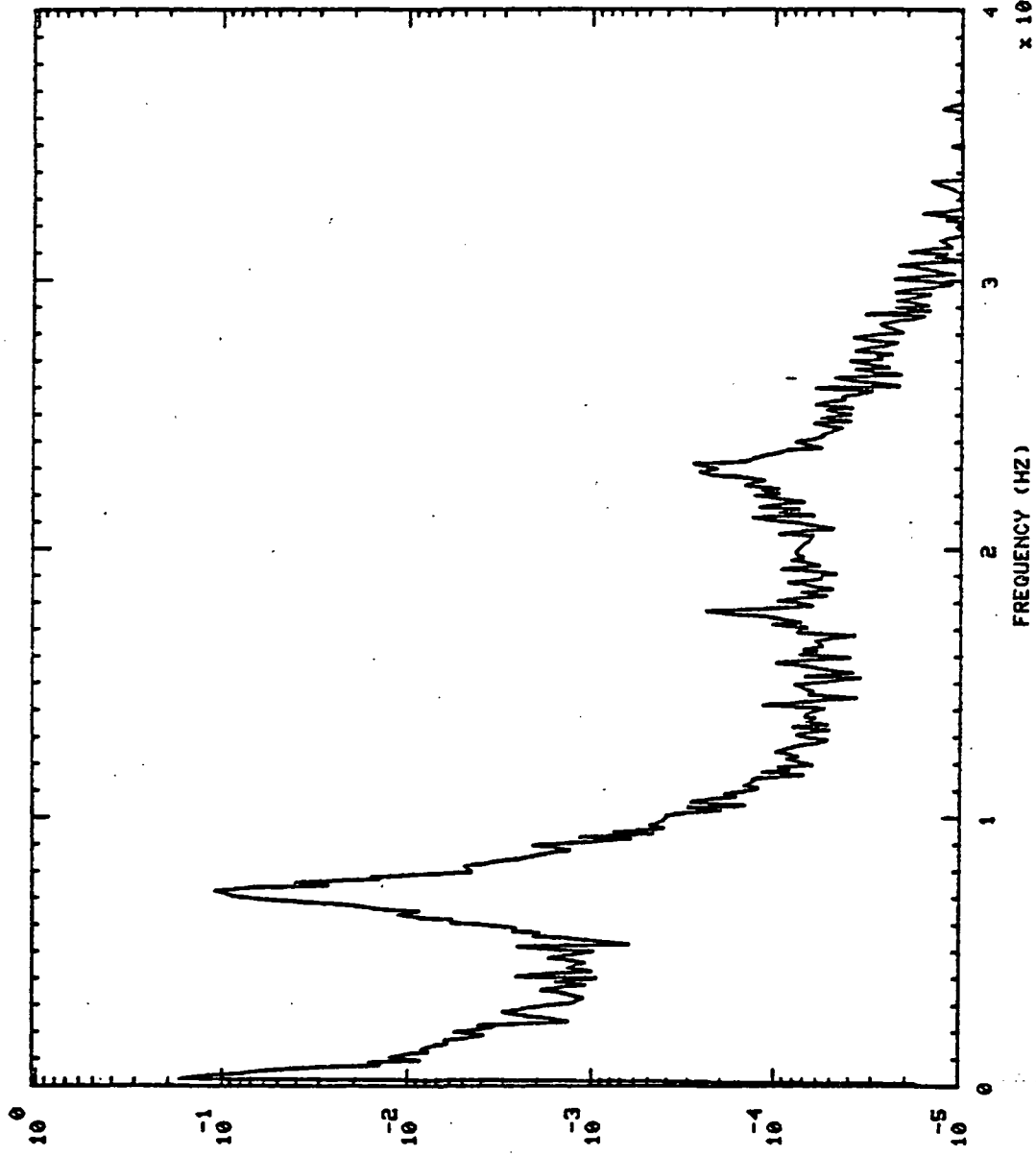


750125 MCC FUEL INJ PR S+ 6.01H0.'S



P S D / H Z

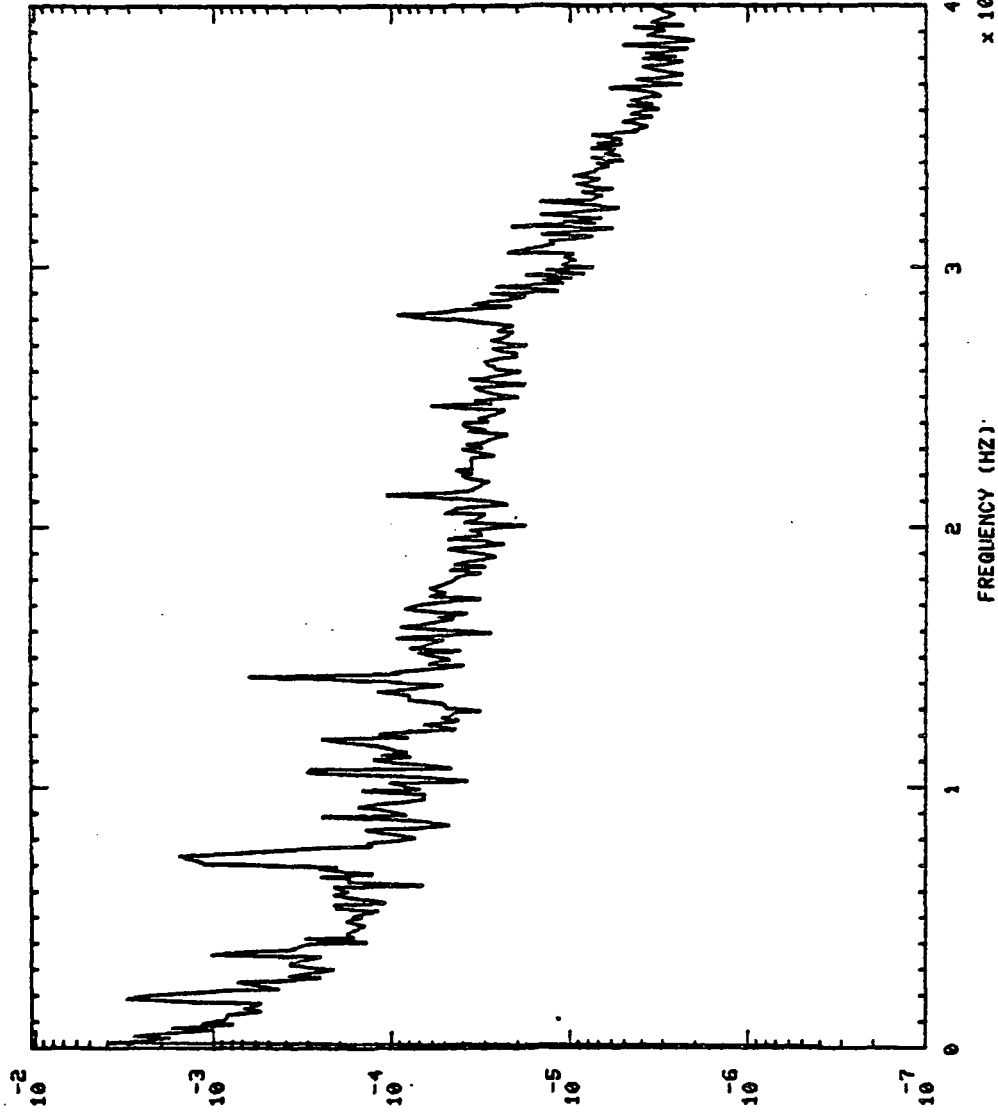
750125 MCC FUEL INJ PR S+ 10.01H0,5



P S0 / HZ

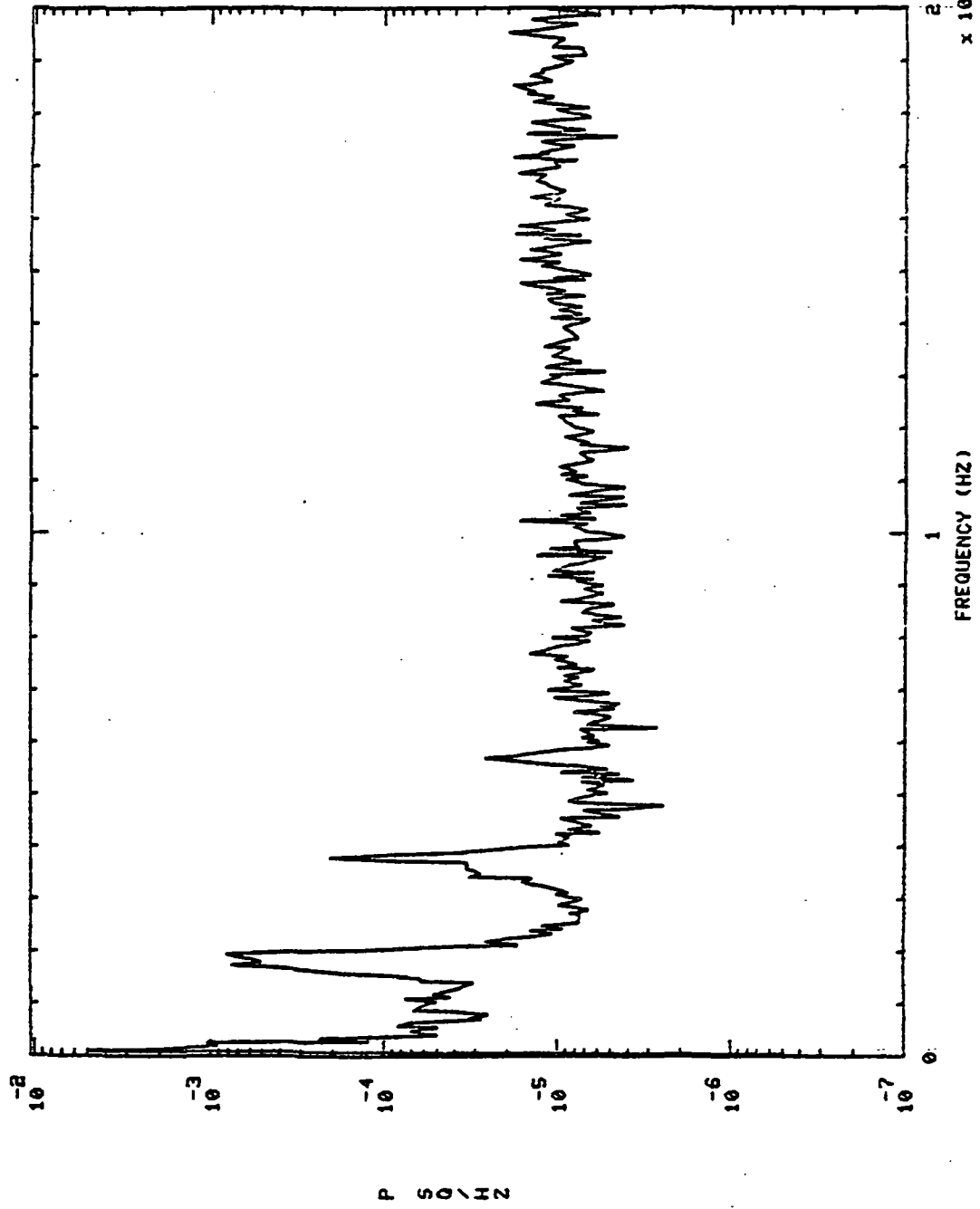
FREQUENCY (HZ)
x 10^4

750125 MCC FUEL INJ PR S+ 50.01H0,'S

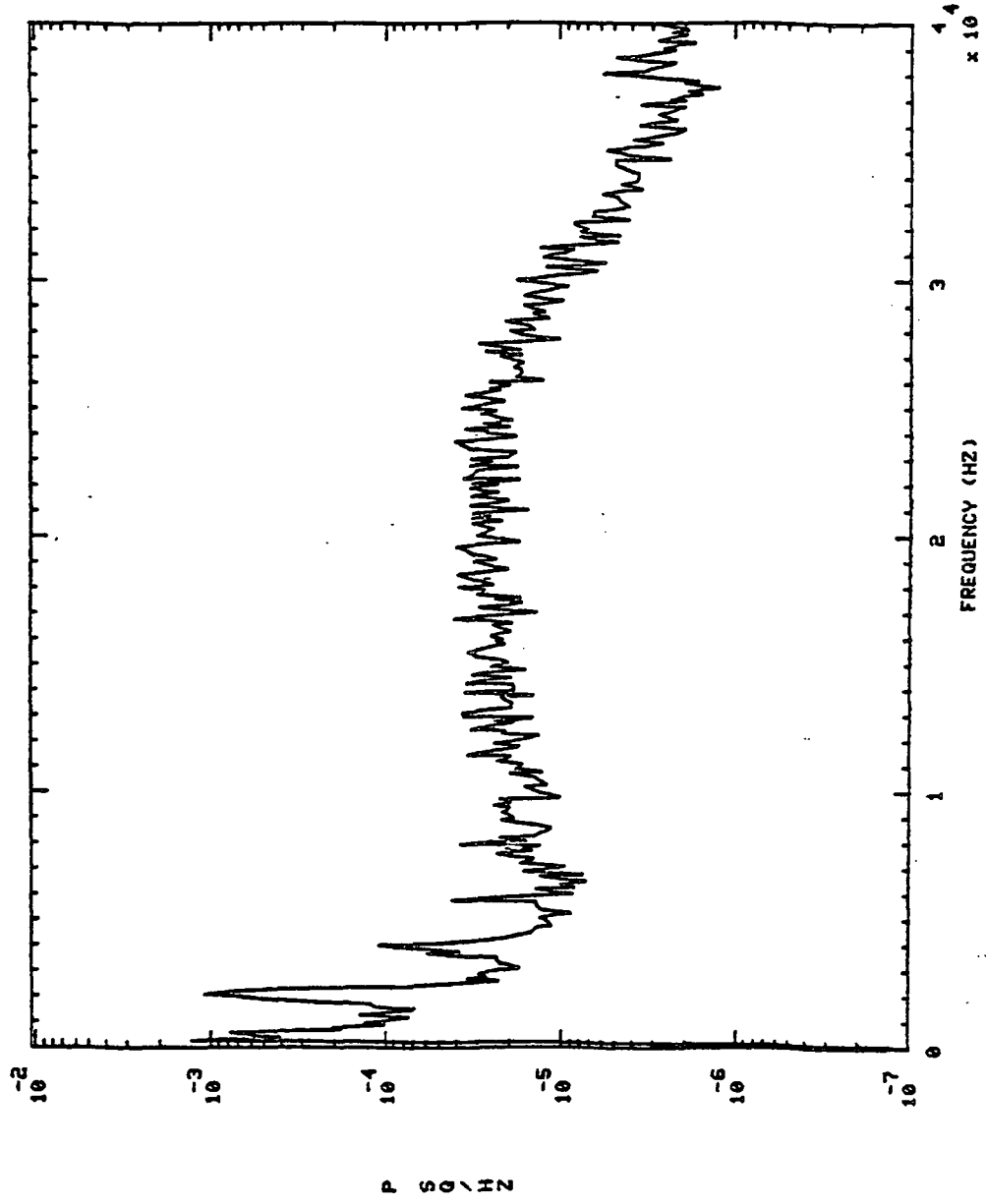


P S D

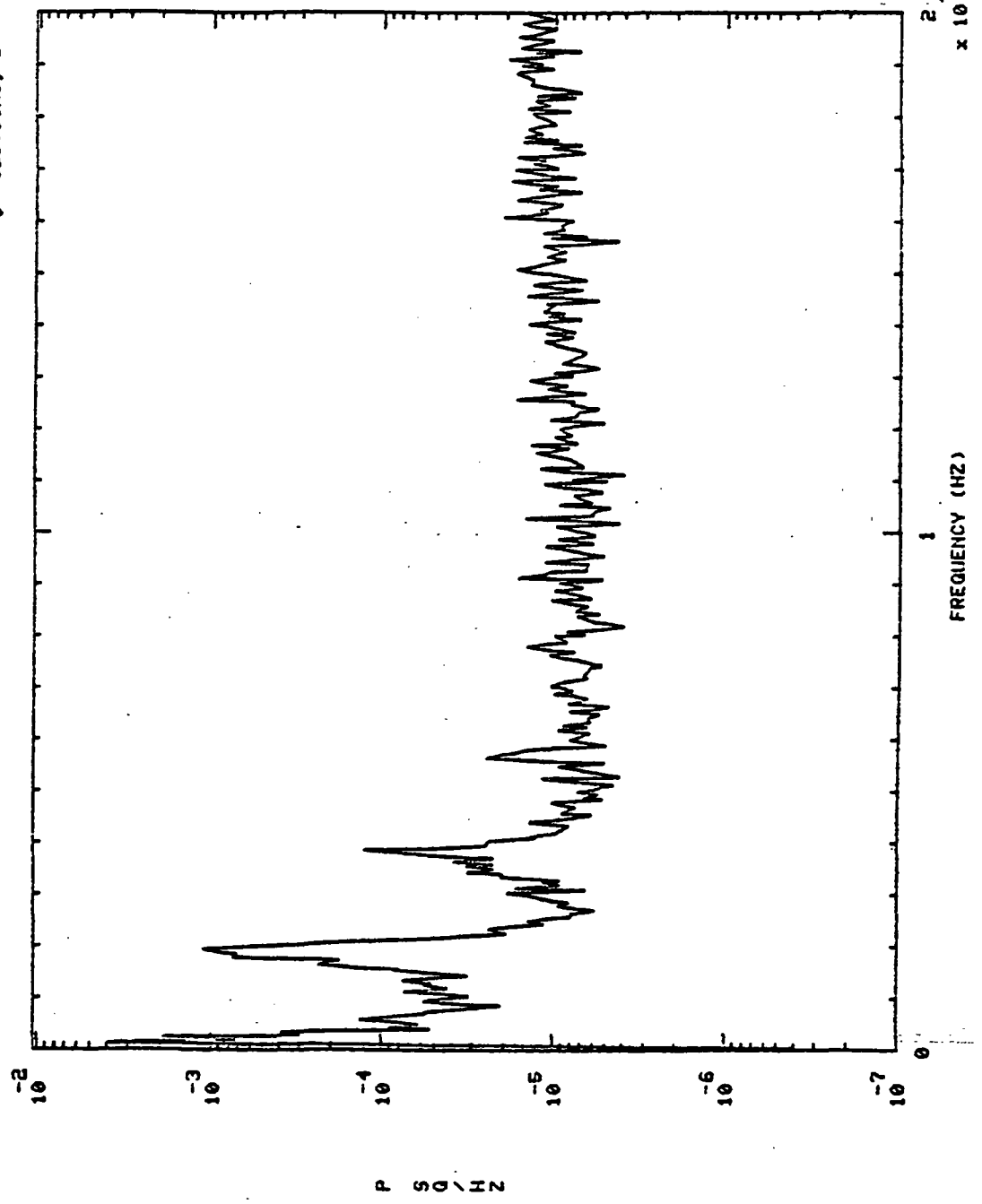
750125 MCC FUEL INJ PR S+ 95.01H0,'S



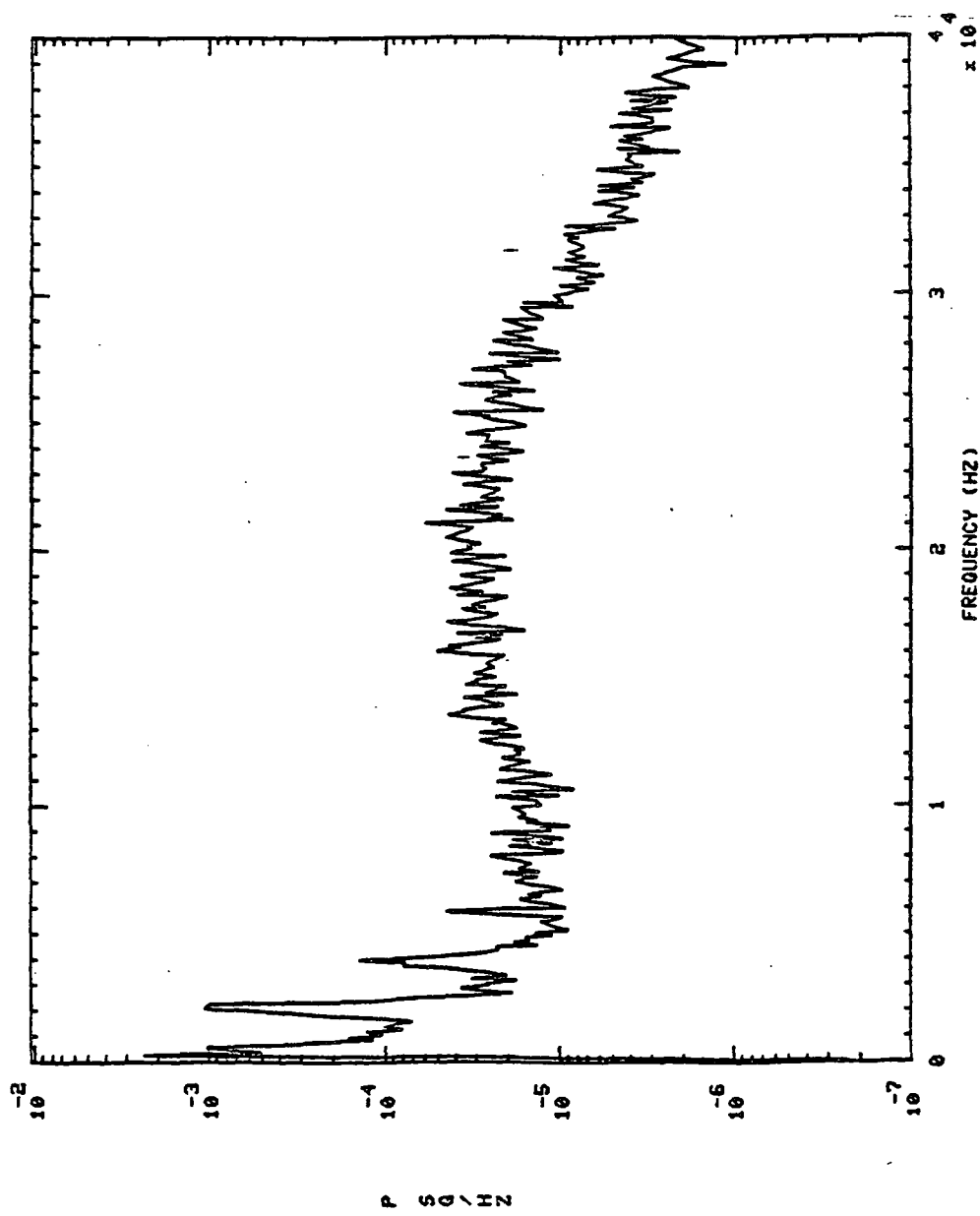
750125 MCC FUEL INJ PR S+ 95.0



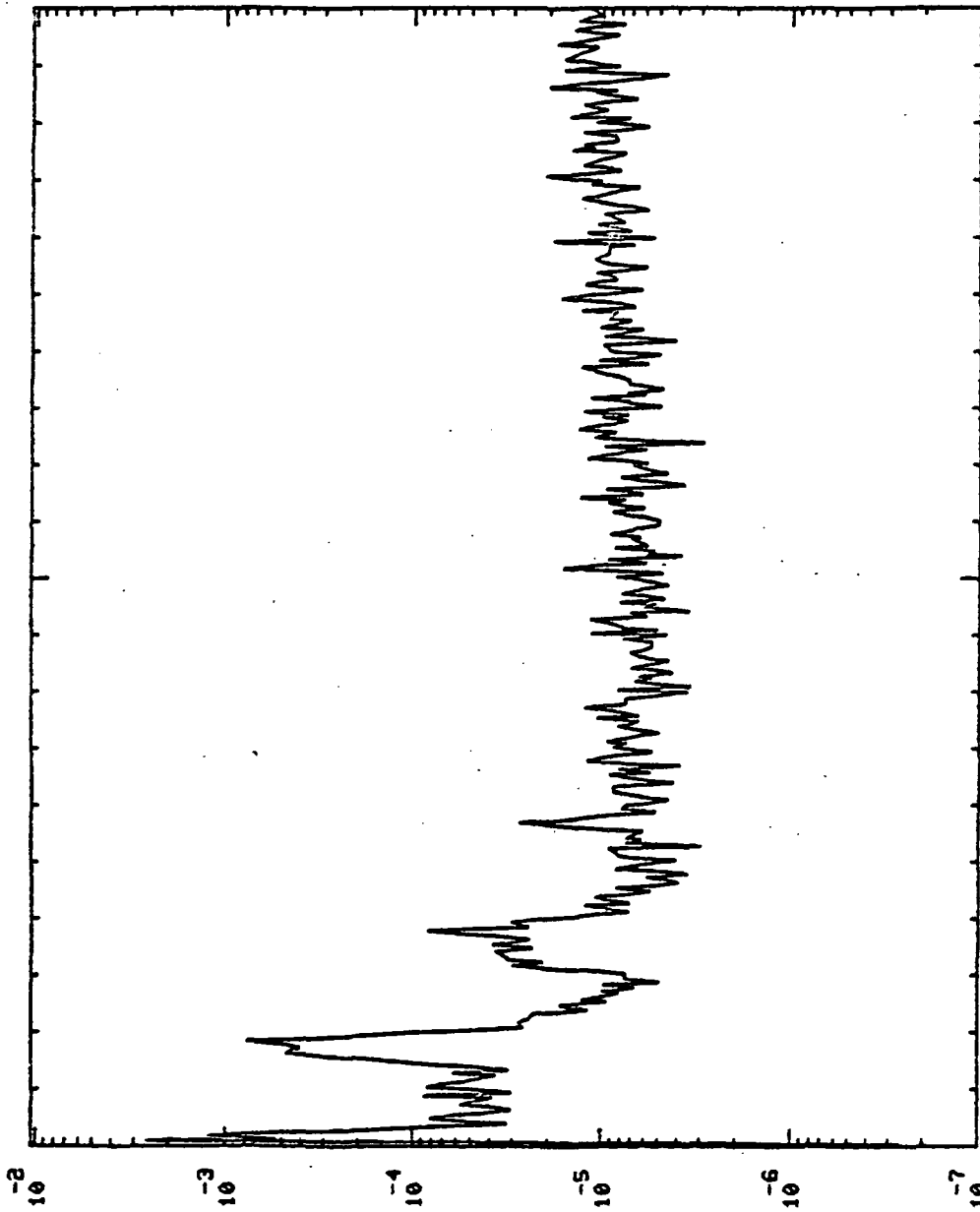
750125 MCC FUEL INJ PR S+ 125.01H0,'S



750125 MCC FUEL INJ PR S+ 125.0



750125 MCC FUEL INJ PR S+ 155.01H0,'S



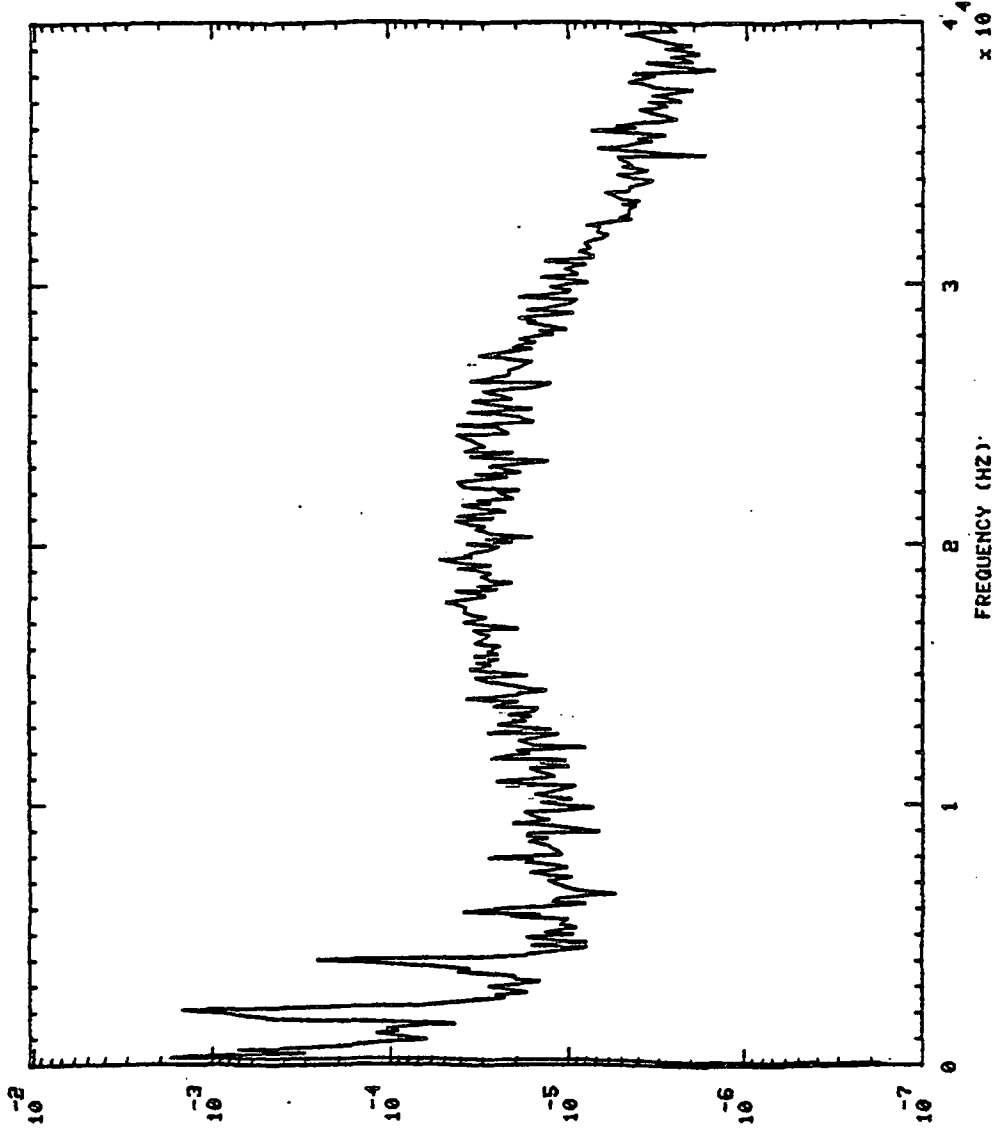
P SQ / HZ

FREQUENCY (HZ)

2.4×10^4

S+ 155.0

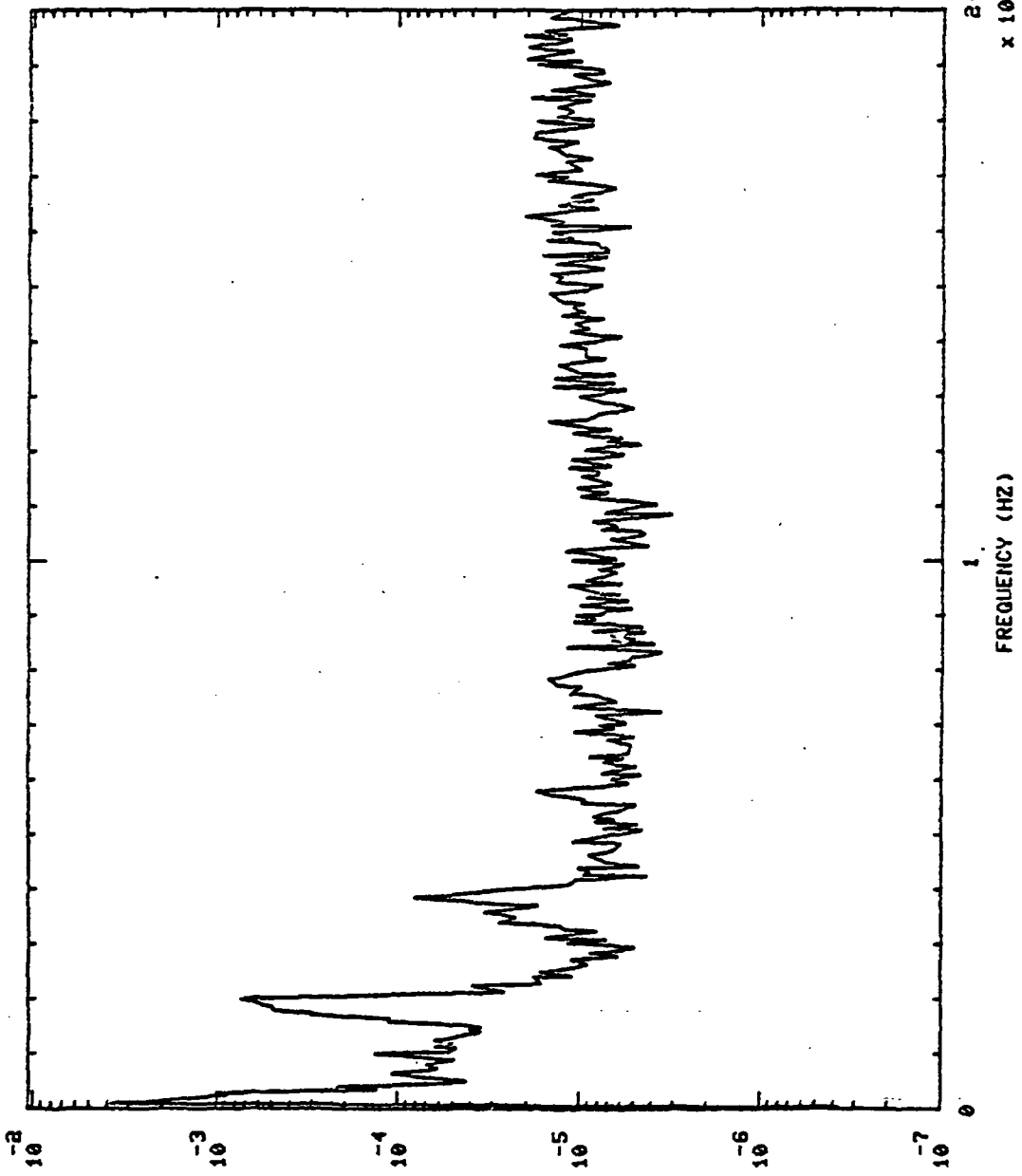
750125 MCC FUEL INJ PR



P S D

S4 185.01H0,'S

750125 MCC FUEL INJ PR



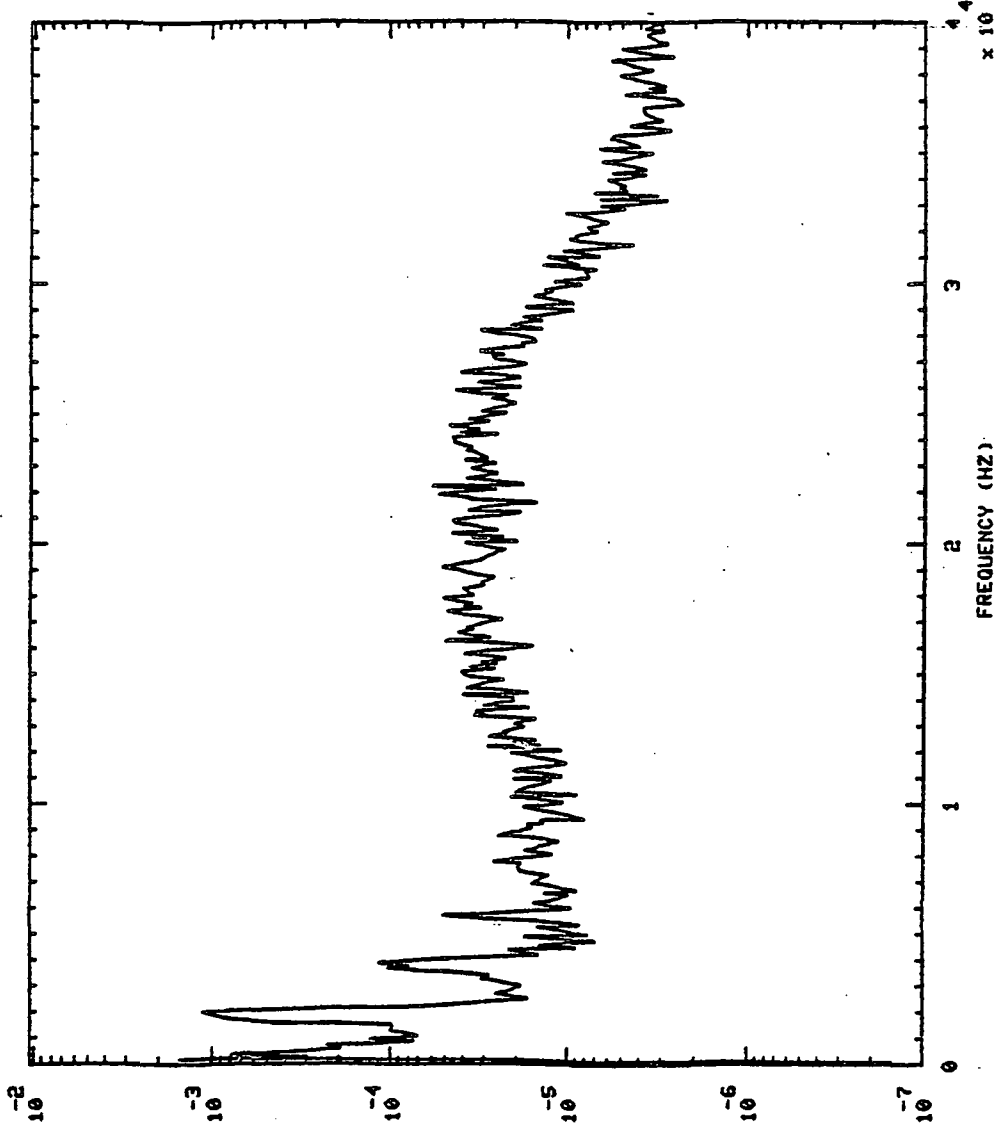
P SQ \ HZ

2.4
x 10⁴

FREQUENCY (HZ)

750125 MCC FUEL INJ PR

S+ 185.0

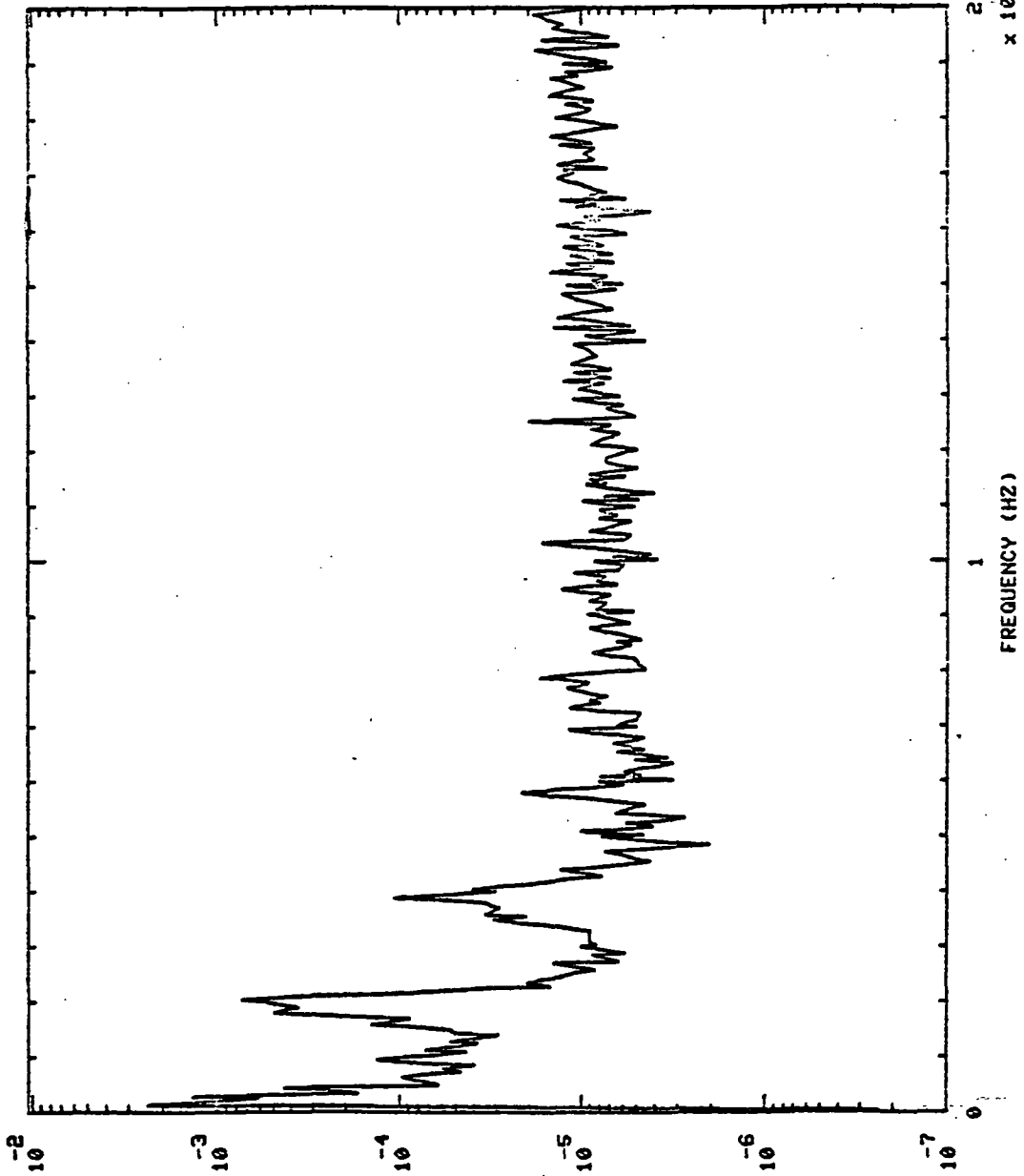


P SQ / HZ

57 215.0110, 'S

MCC FUEL INJ PR

750125

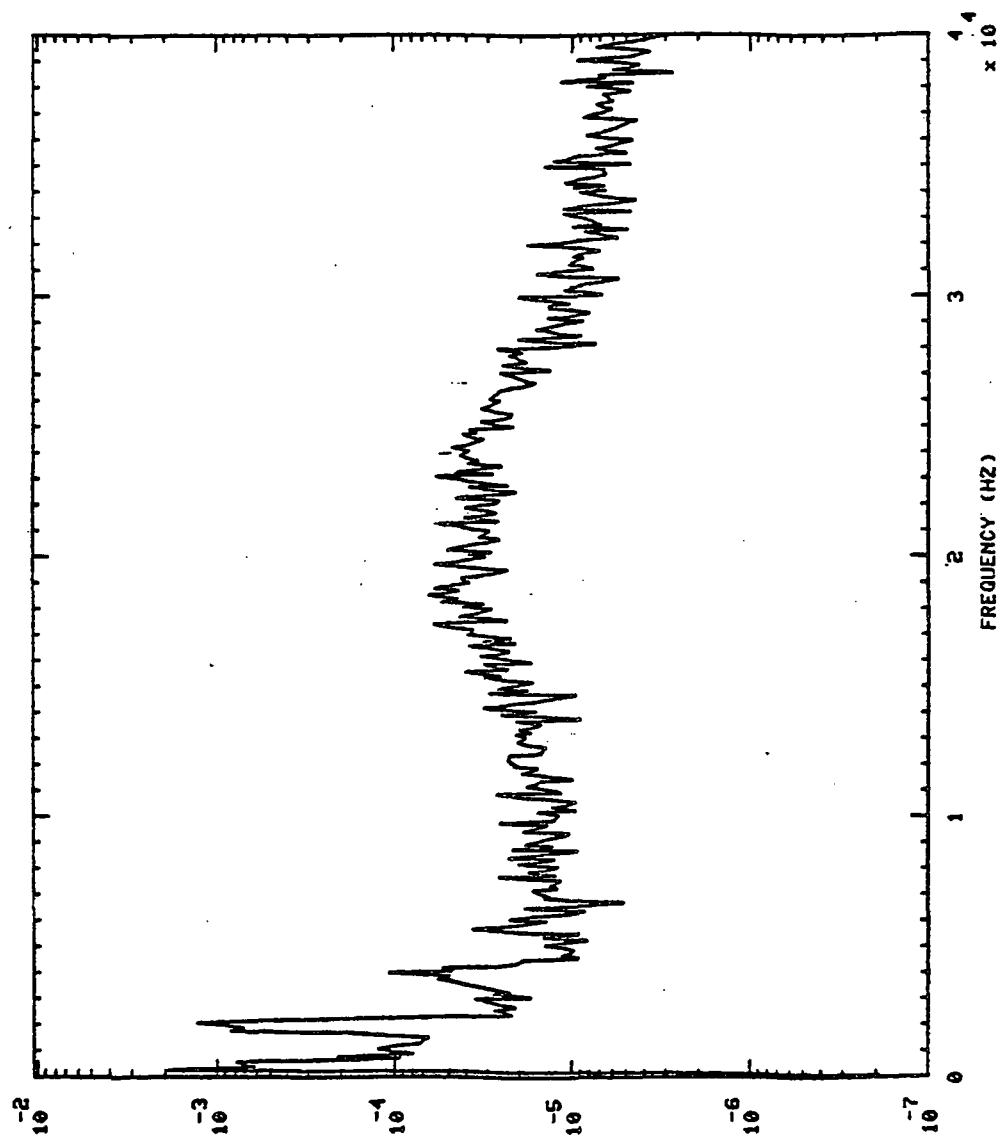


P S D \ H Z

FREQUENCY (HZ)

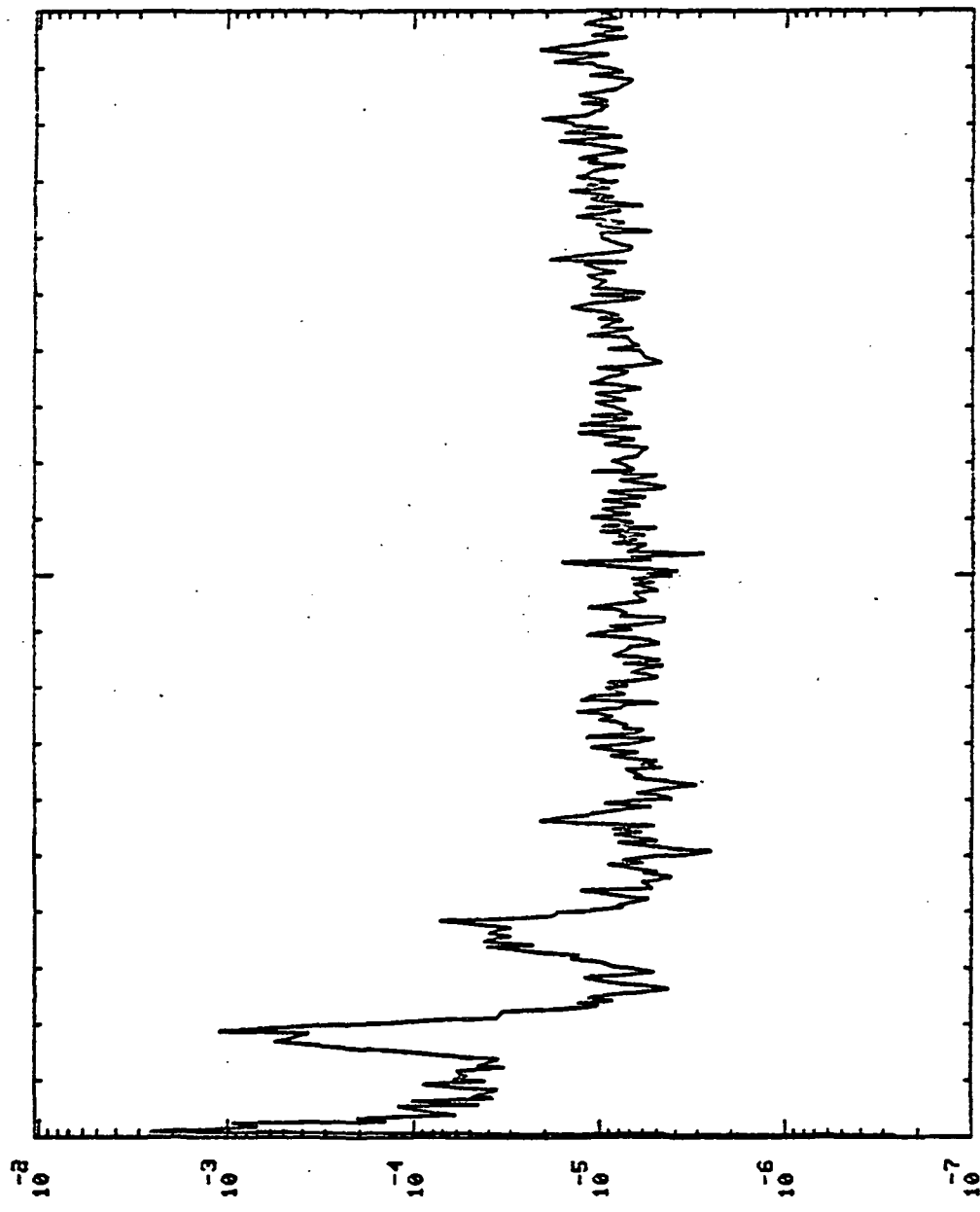
2.4
x 10⁴

750125 MCC FUEL INJ PR S+ 215.0



P S\ IN

750125 MCC FUEL INJ PR S+ 245.01H0,'S

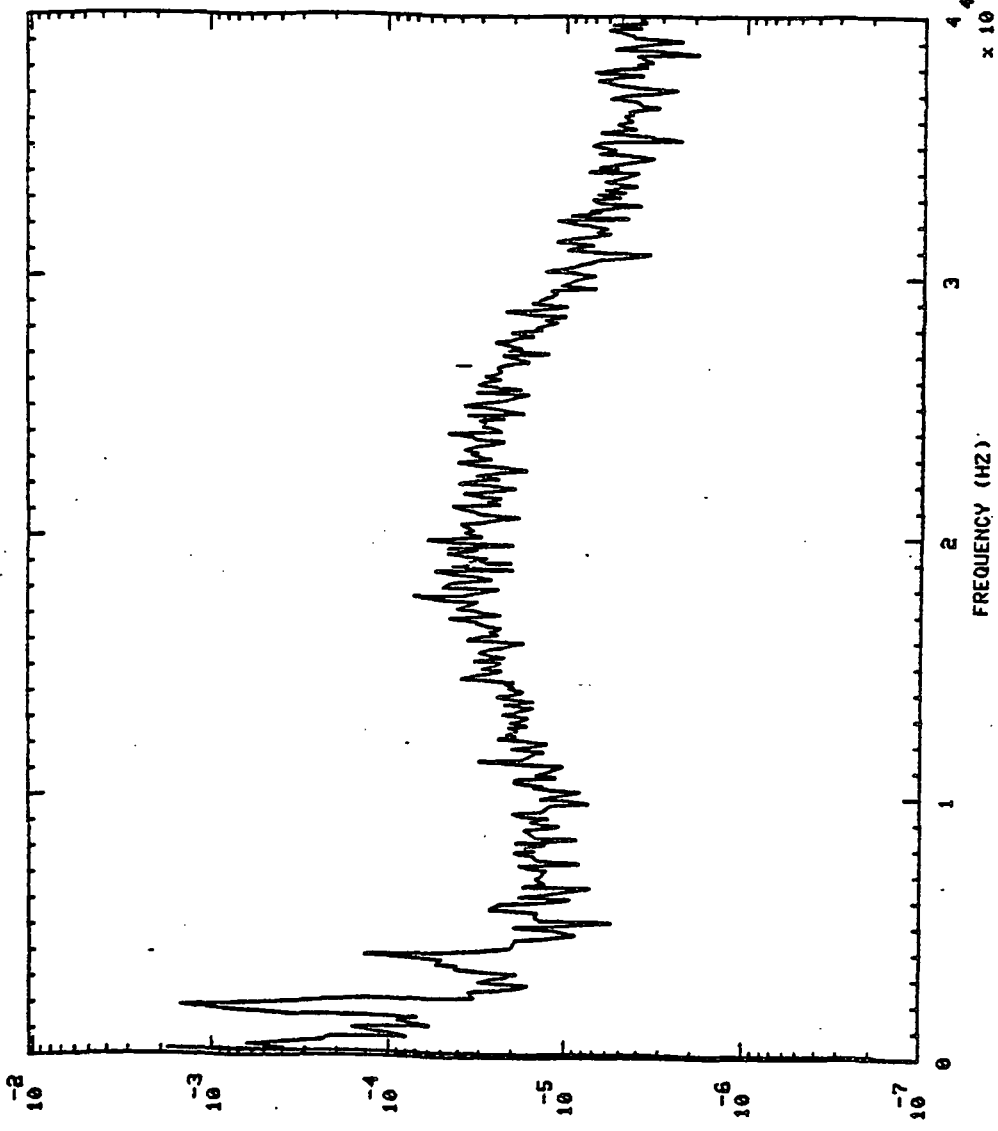


P S D \ H Z

FREQUENCY (HZ) x 10⁴

S+ 245.0

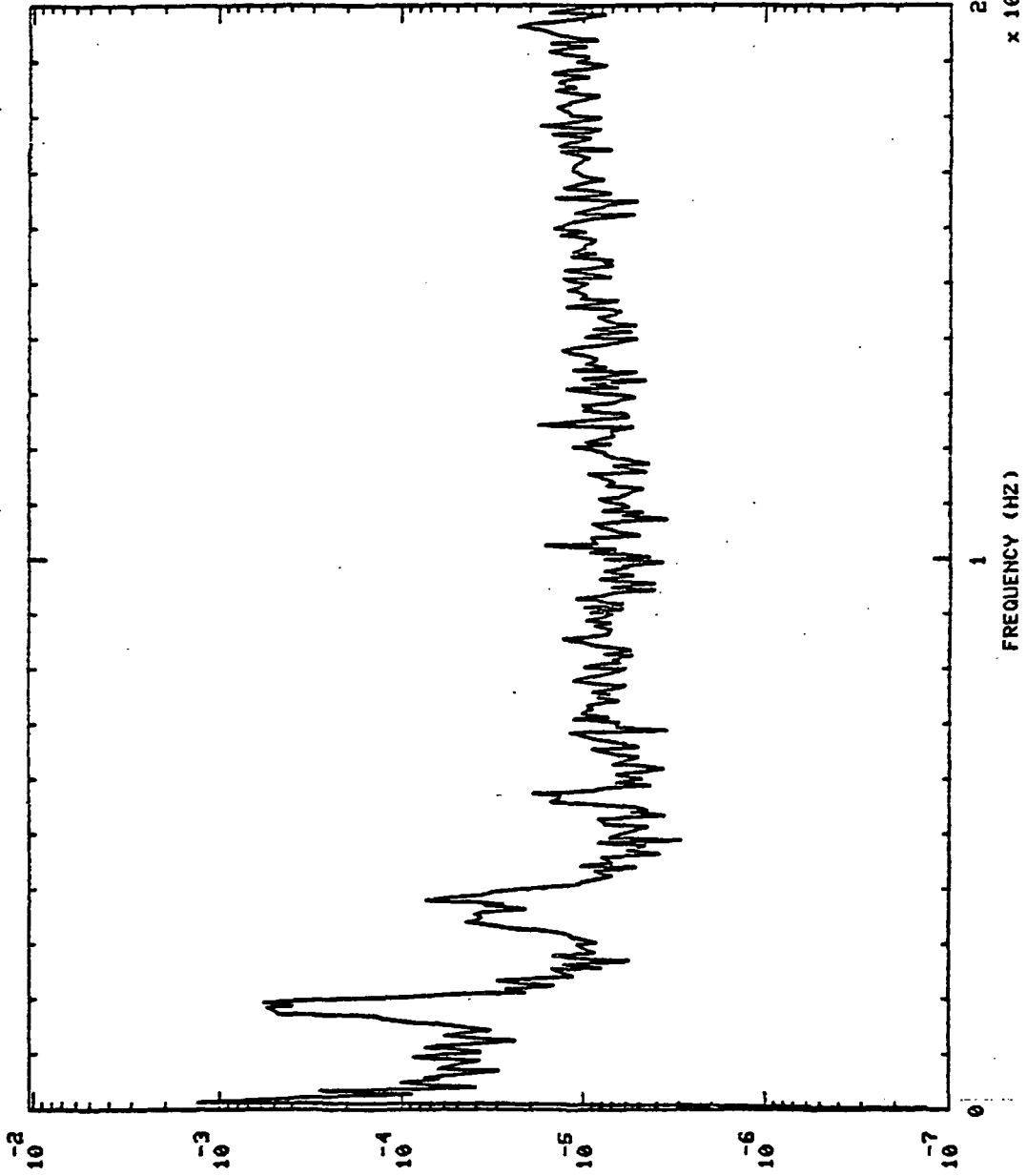
750125 MCC FUEL INJ PR



St 265.0110, 'S

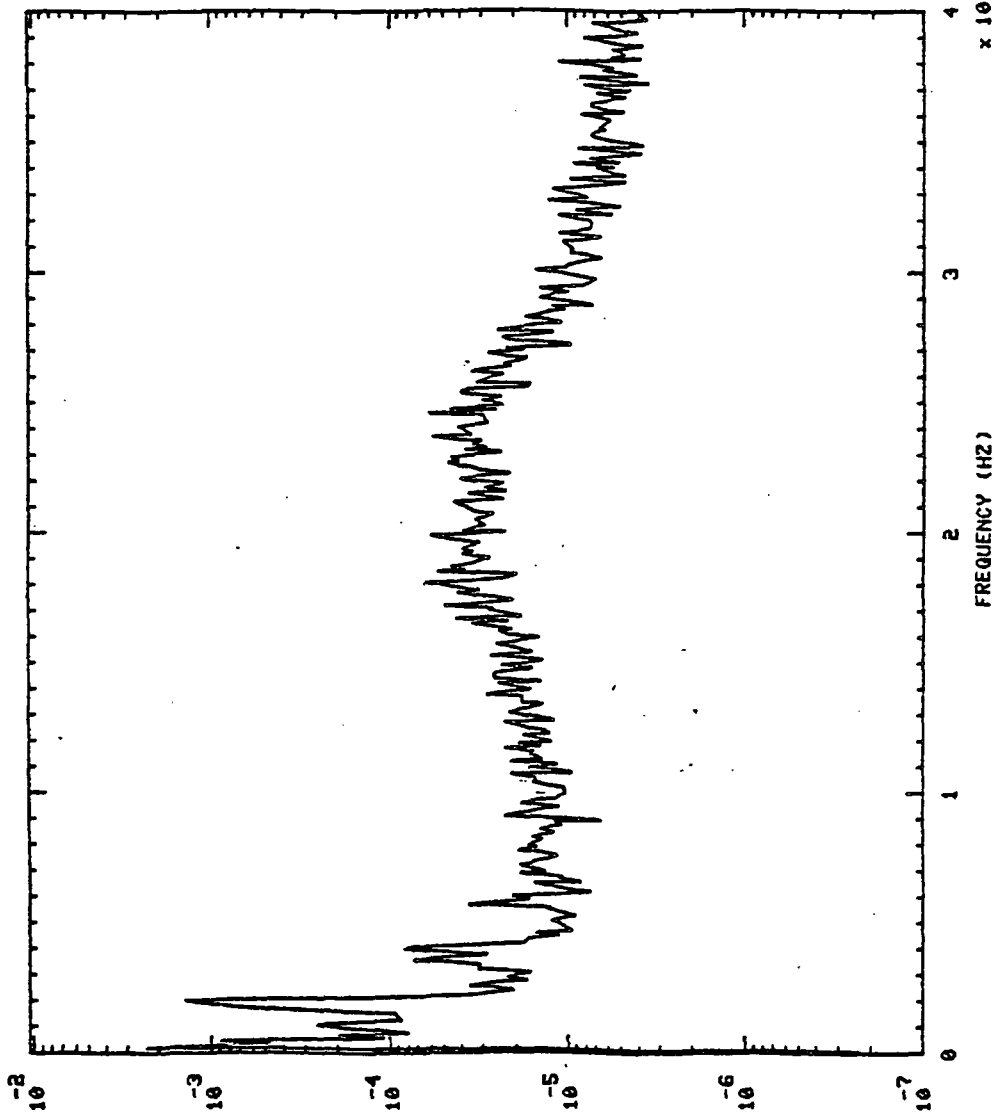
MCC FUEL INJ PR

750125



P S D \ H Z

750125 MCC FUEL INJ PR S+ 265.0



P 50/HN

10/10/75

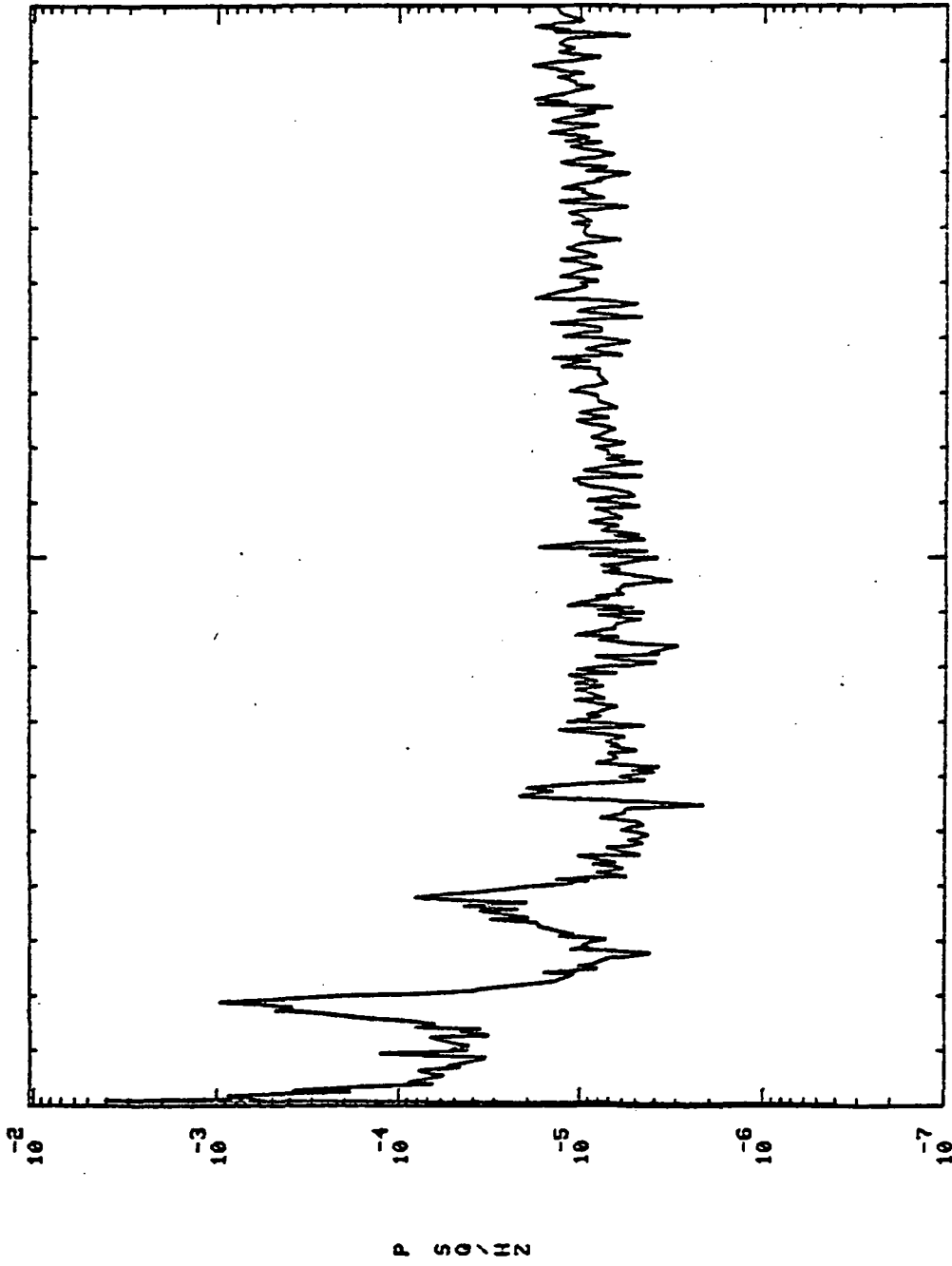
750125 MCC FUEL INJ PR S+ 285.01H0,'S

750125 MCC FUEL INJ PR

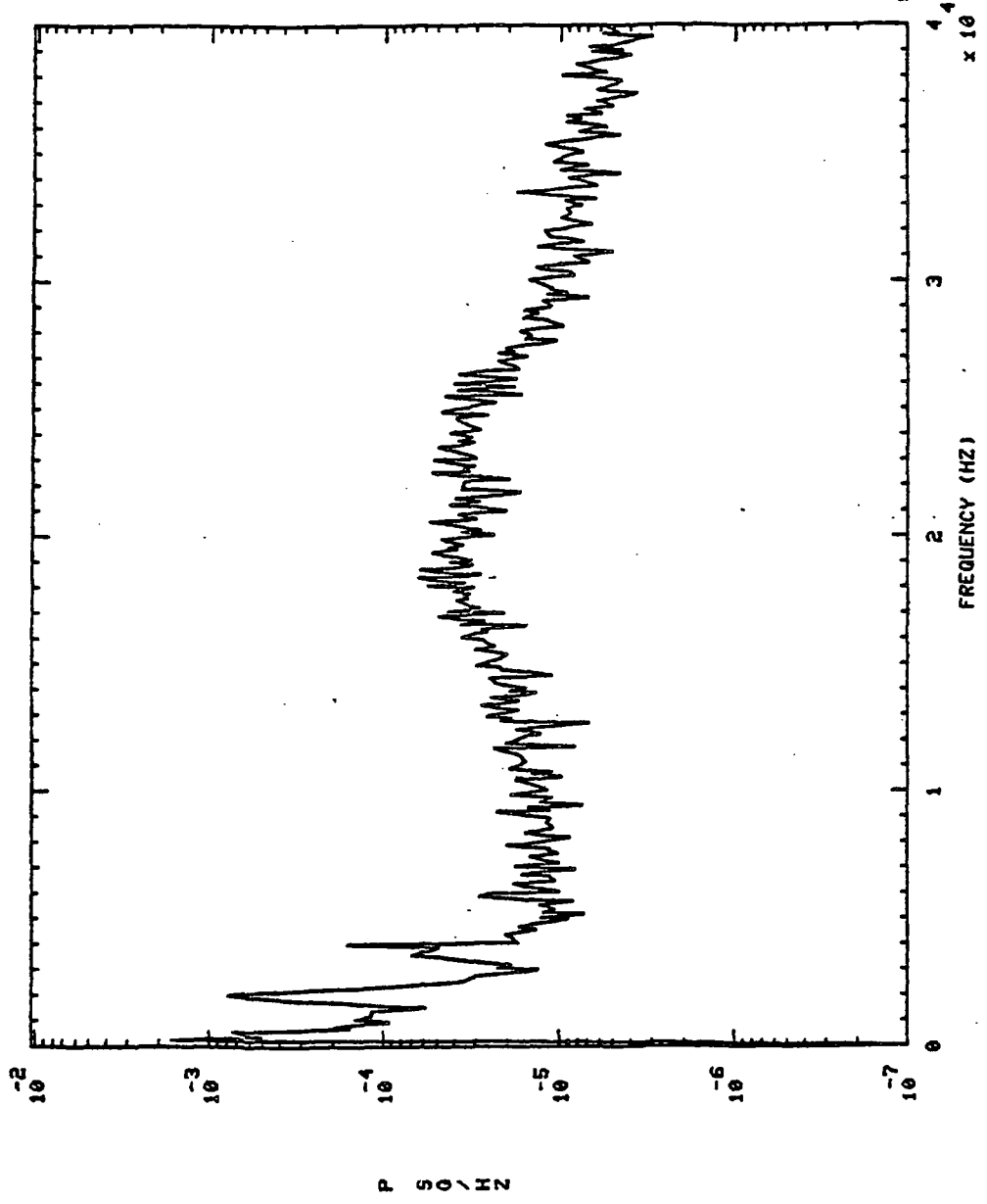
750125

MCC FUEL INJ PR

S+ 285.01H0,'S

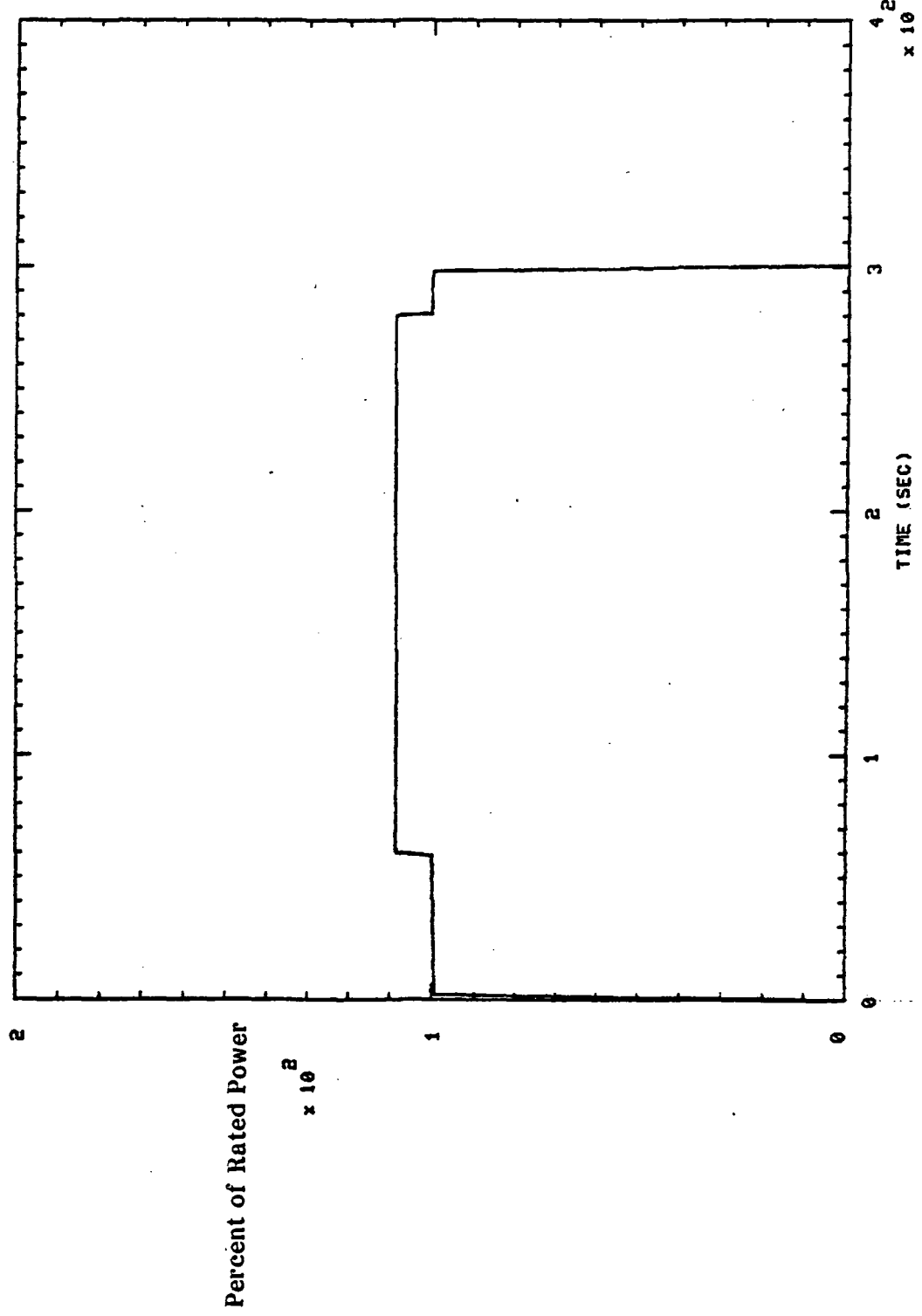


750125 MCC FUEL INJ PR S+ 285.0

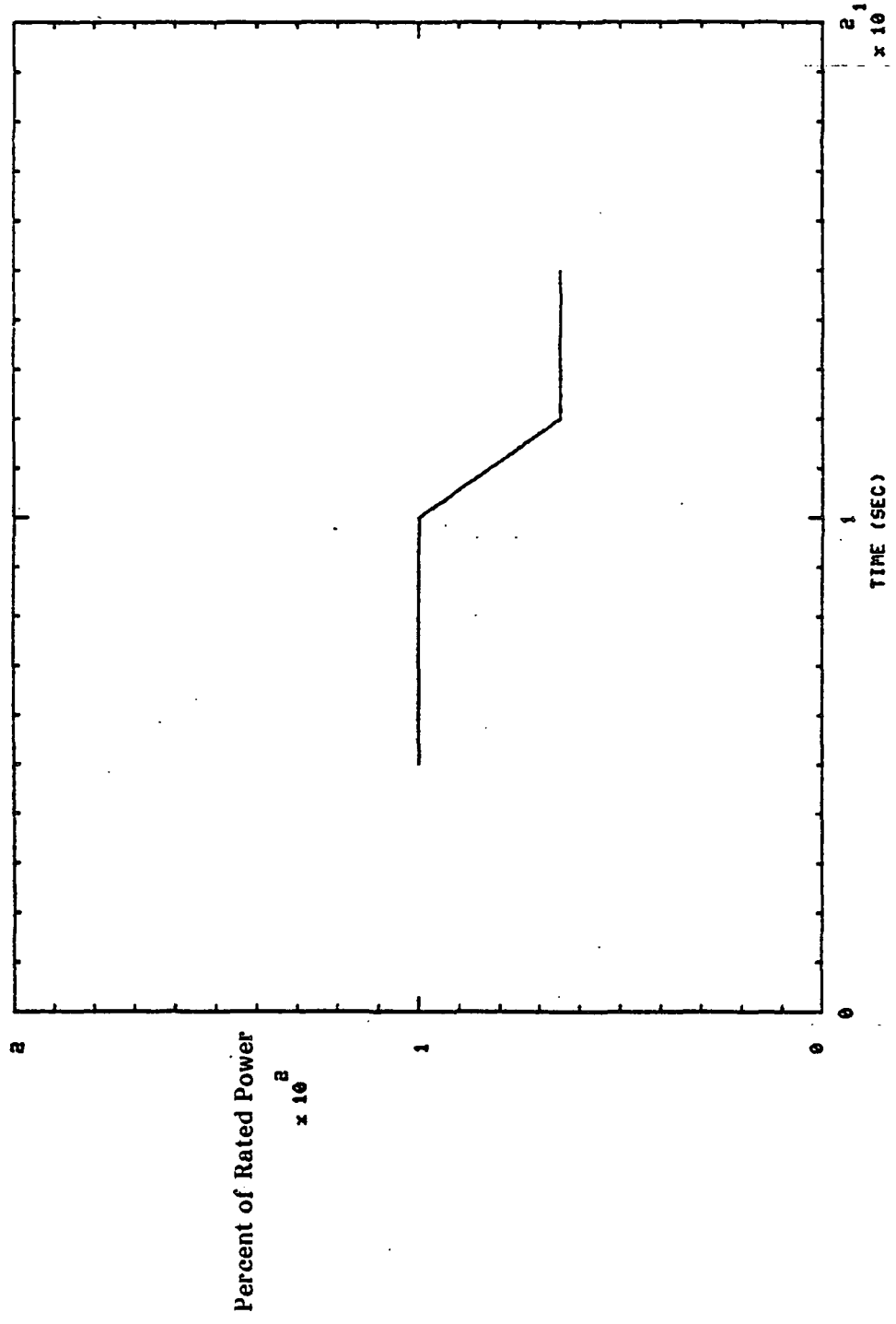


750126 THRUST

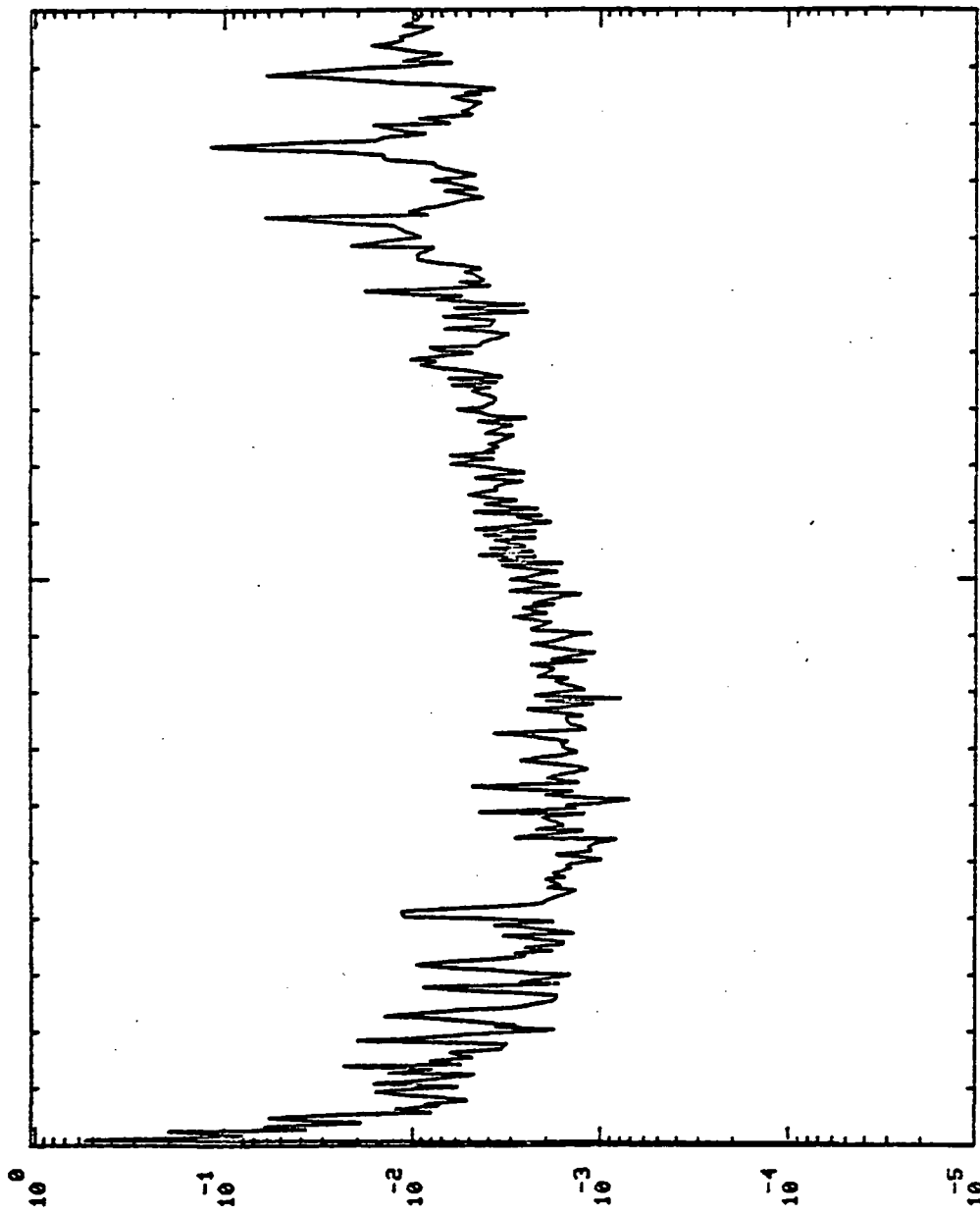
(UNFILTERED)



750127 THRUST (UNFILTERED)



750127 FPB PC St 6.01H0,'S



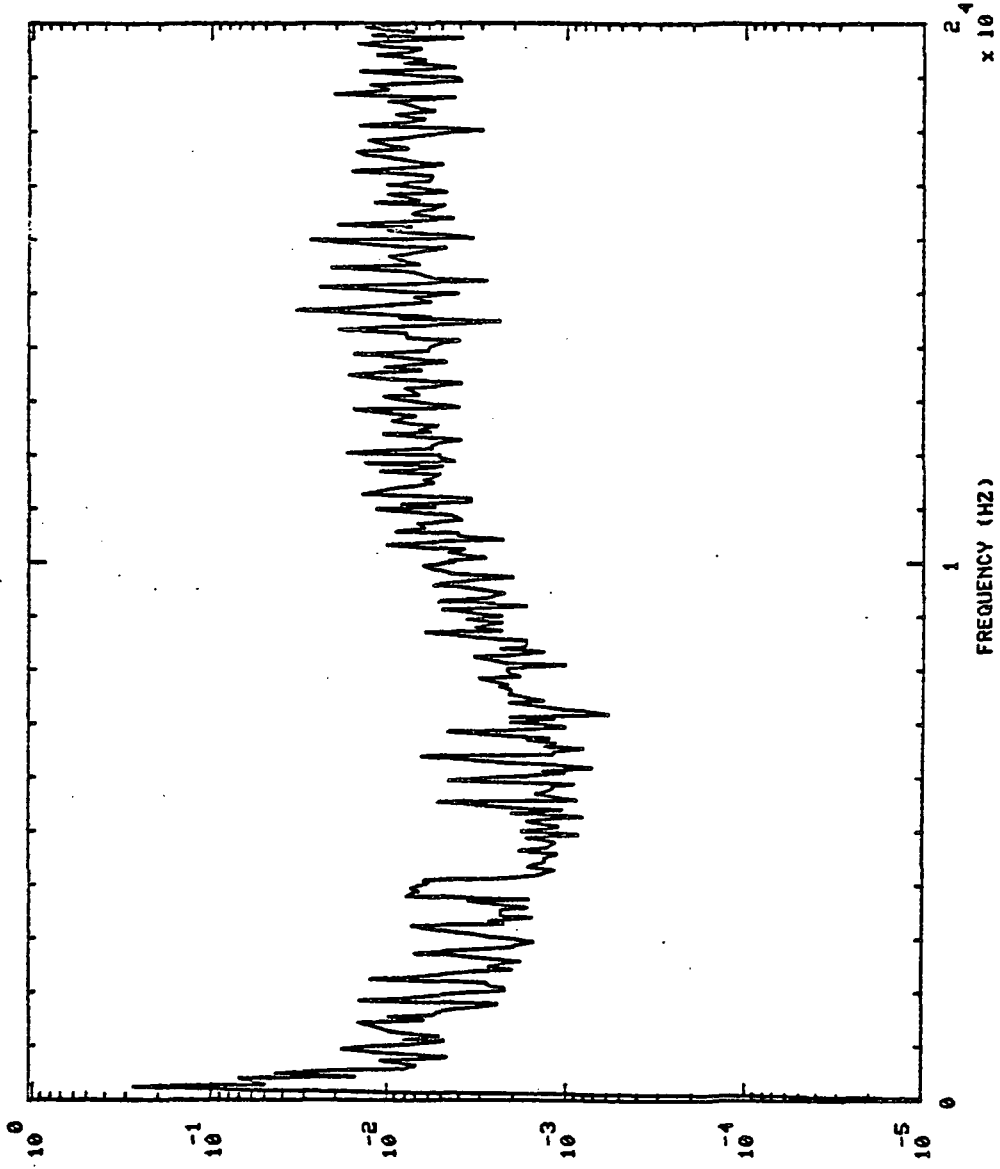
P S D \ H Z

FREQUENCY (HZ) x 10⁴

750127

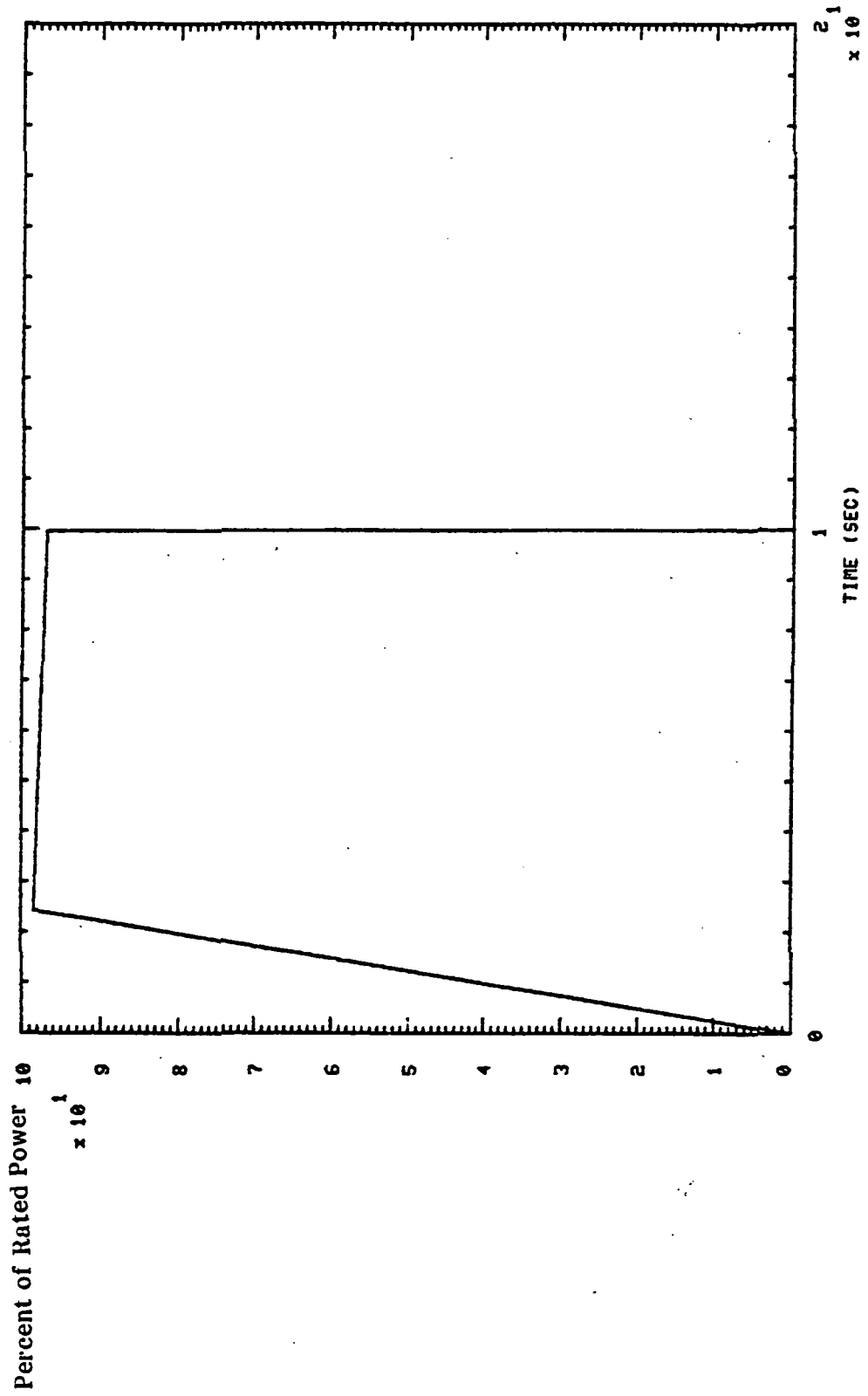
FPB PC

S+ 11.01H0.'S



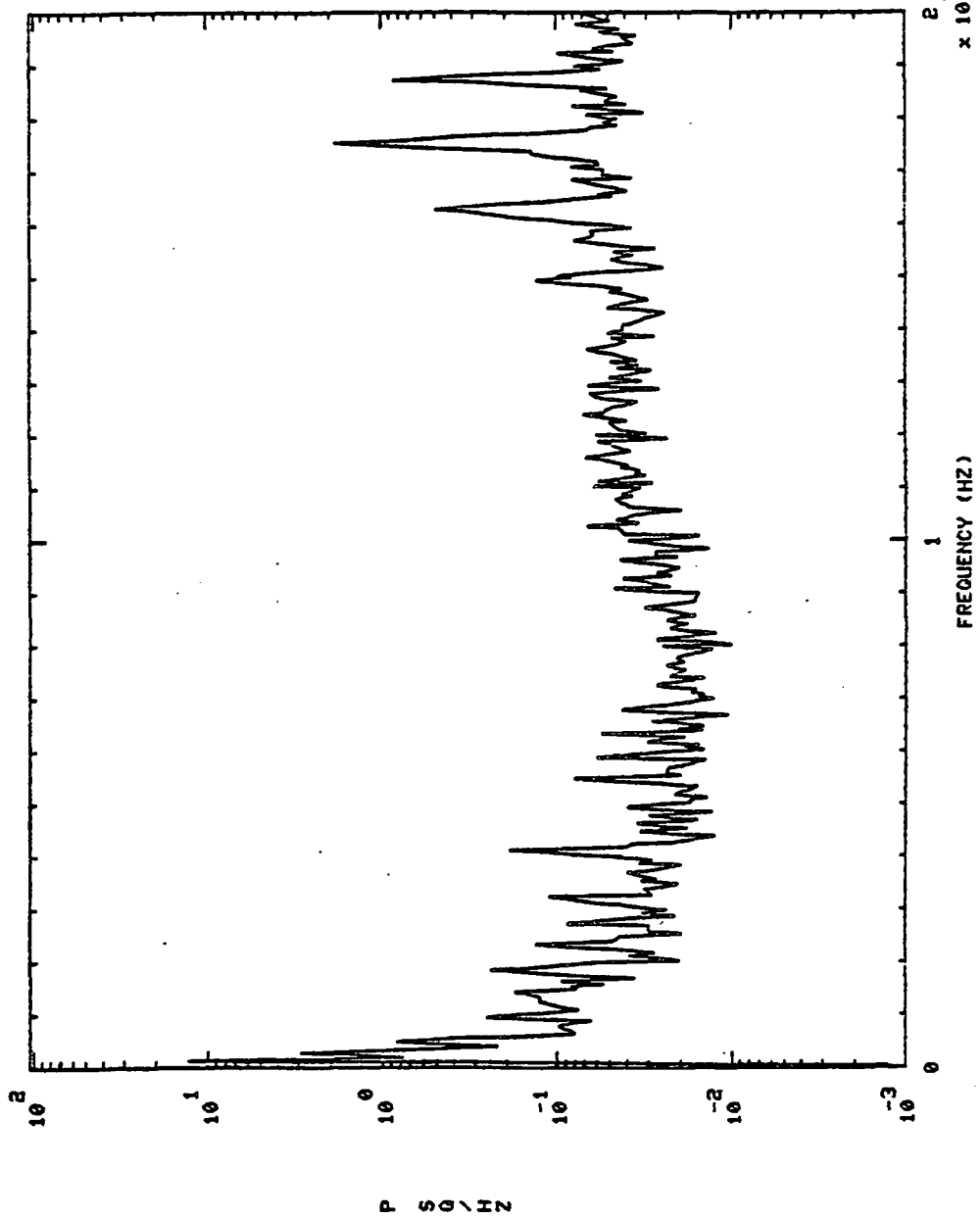
(UNFILTERED)

750128 THRUST

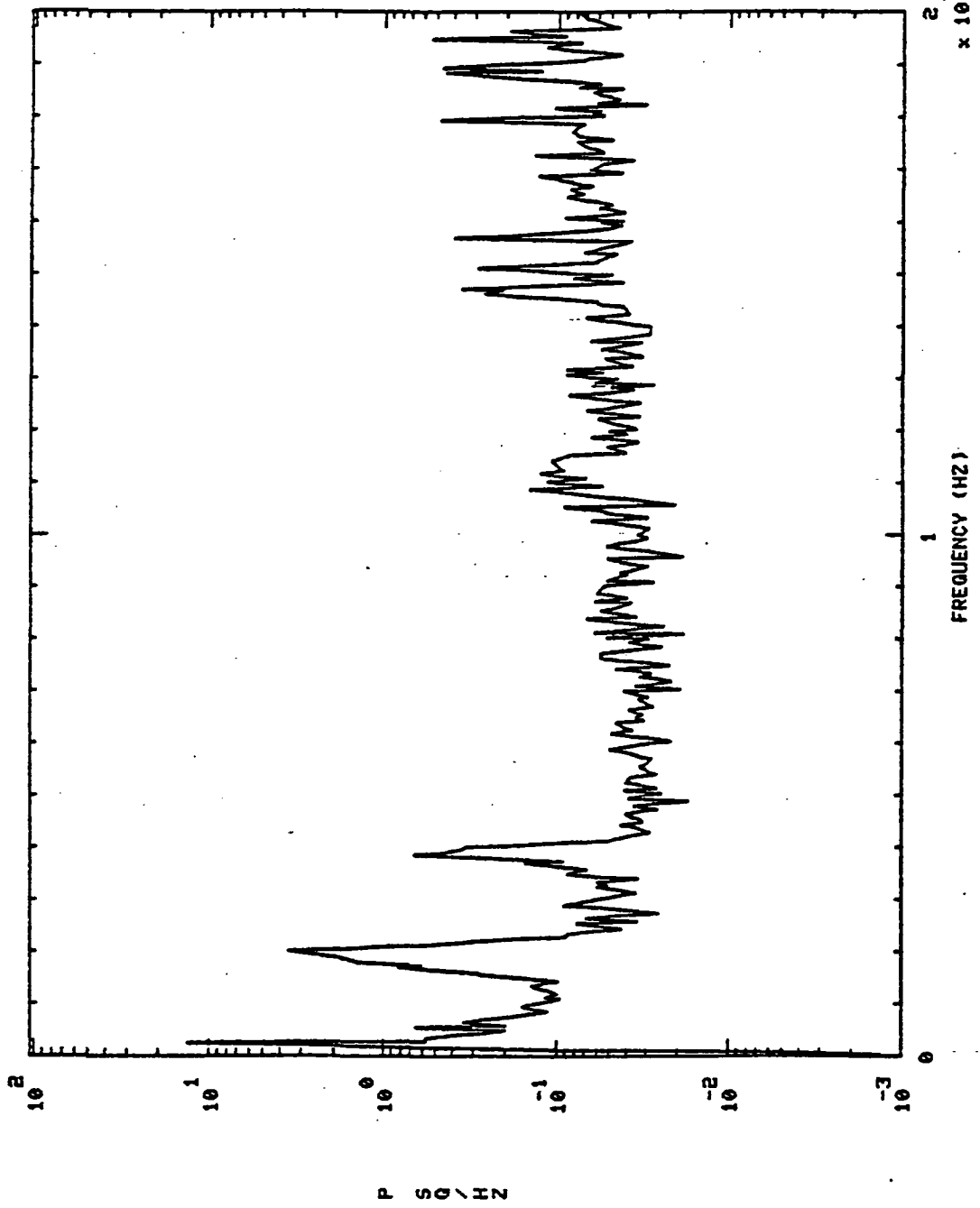


750128 S+ 6.01H0,'S

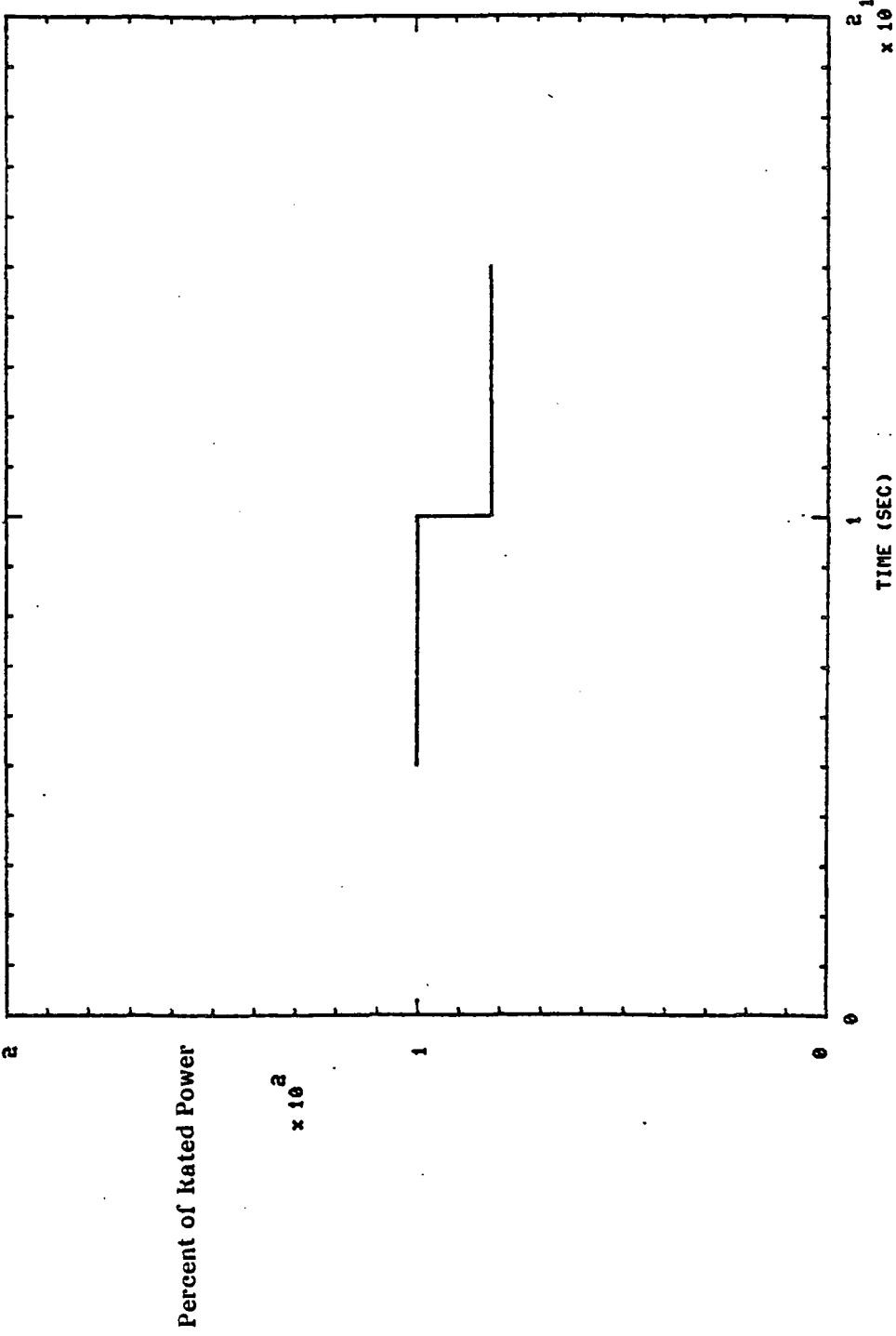
FPB PC



750128 OPB PC PR DC S+ 6.0140,'S

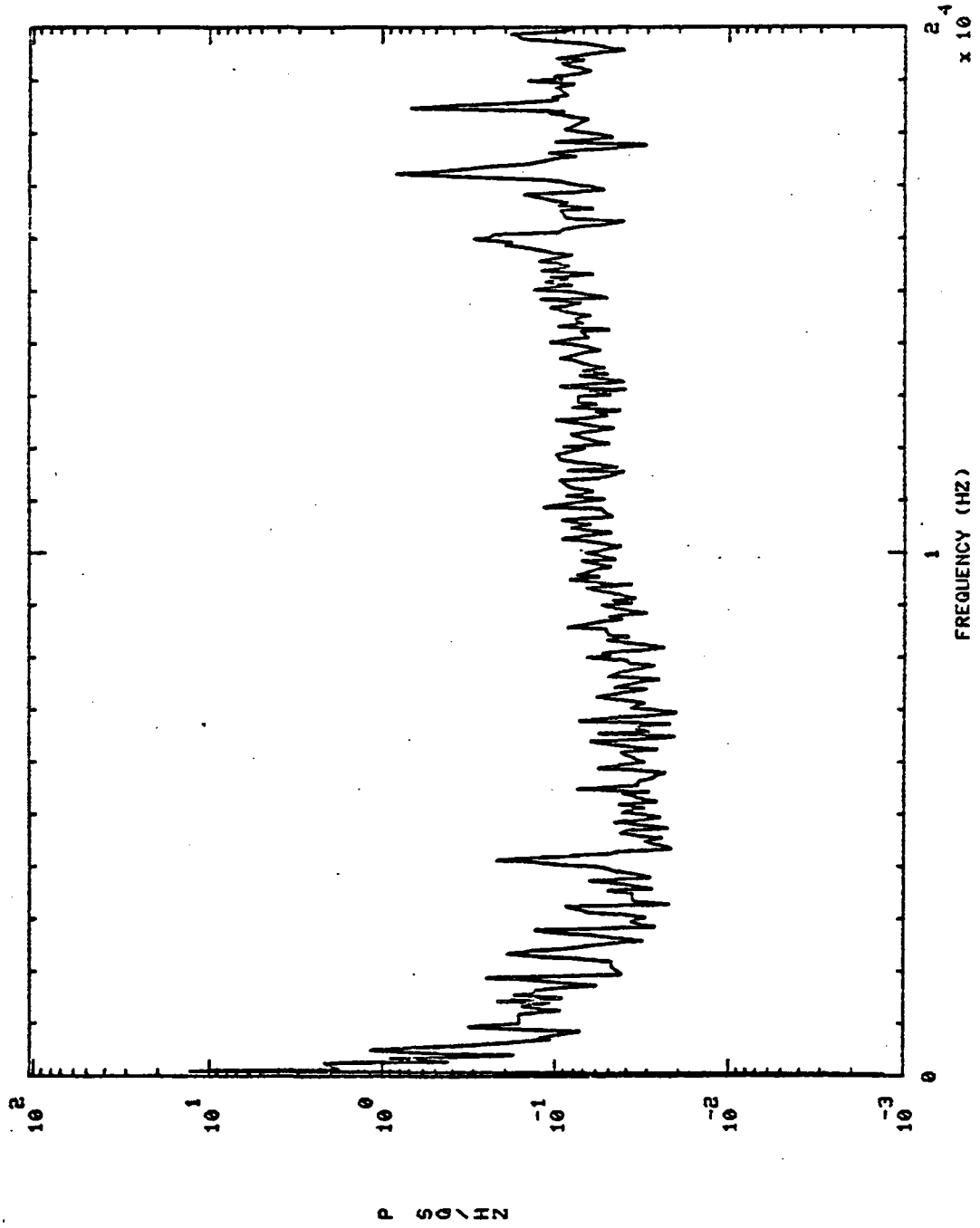


750129 THRUST (UNFILTERED)

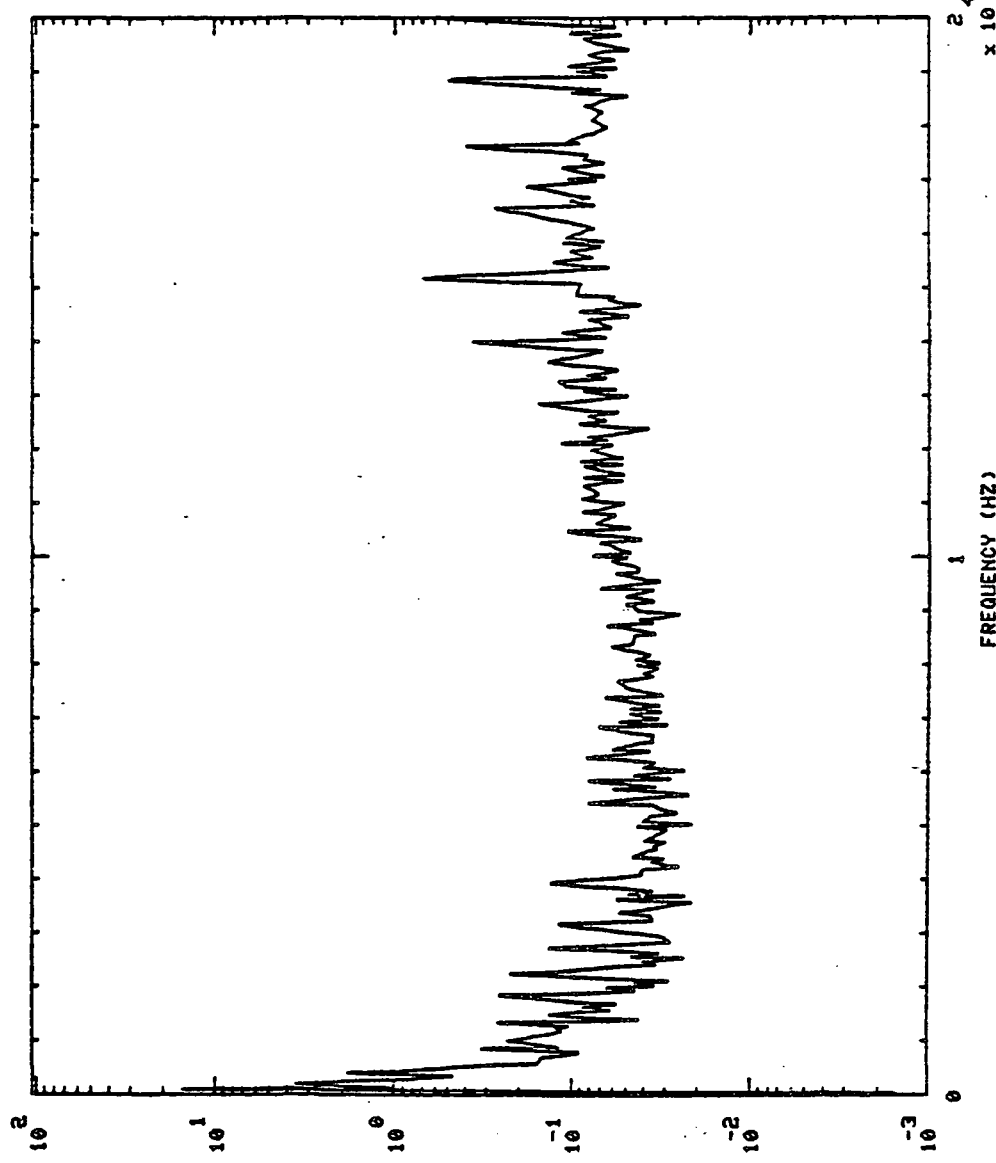


750129 THRUST (UNFILTERED)

750129 FPB PC S+ 6.01H0,'S



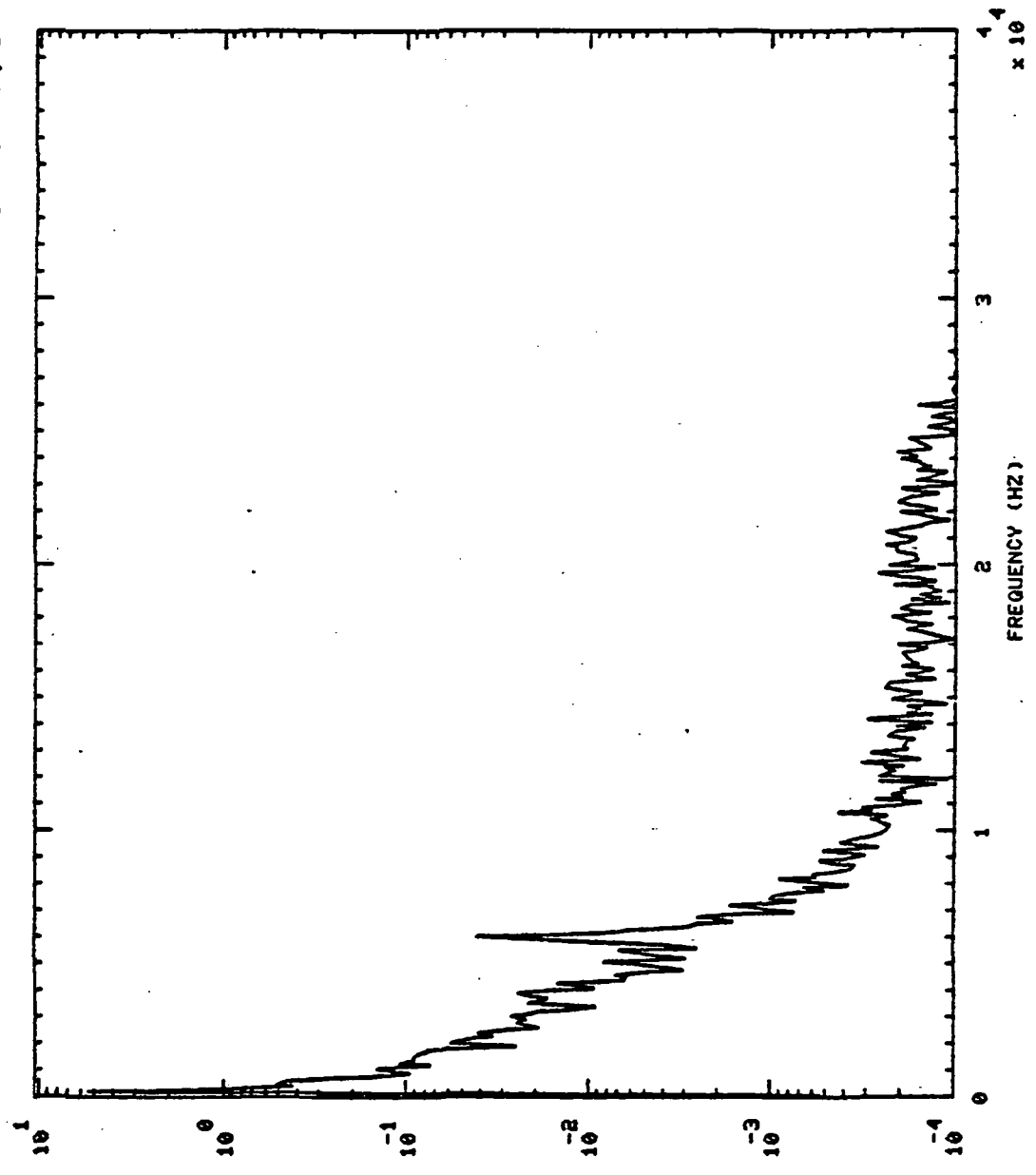
750129 FPB PC S+ 11.0110.'S



P S D IN

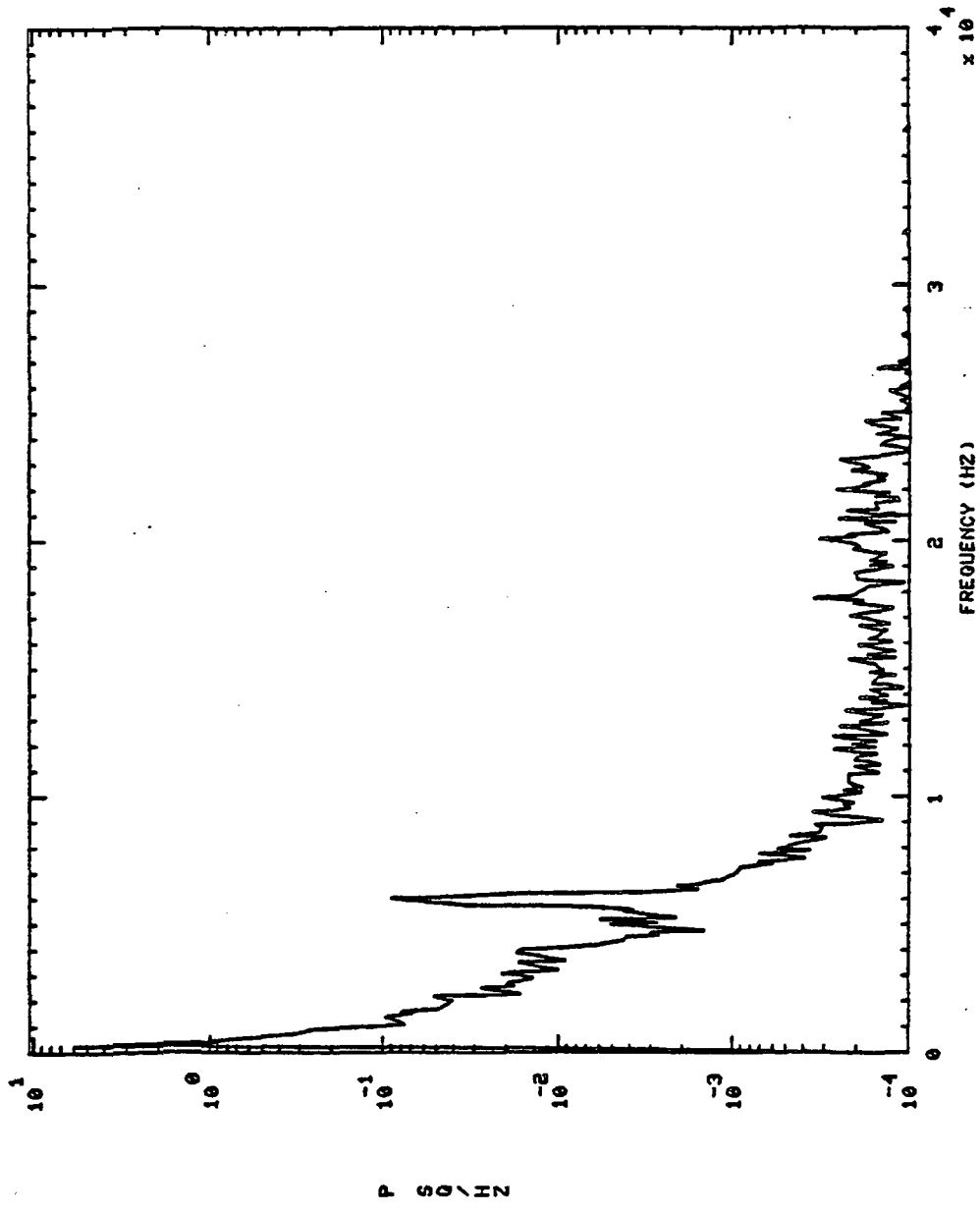
FREQUENCY (HZ) x 10⁴

750129 MCC FUEL INJ PR S+ 5.01H0.75

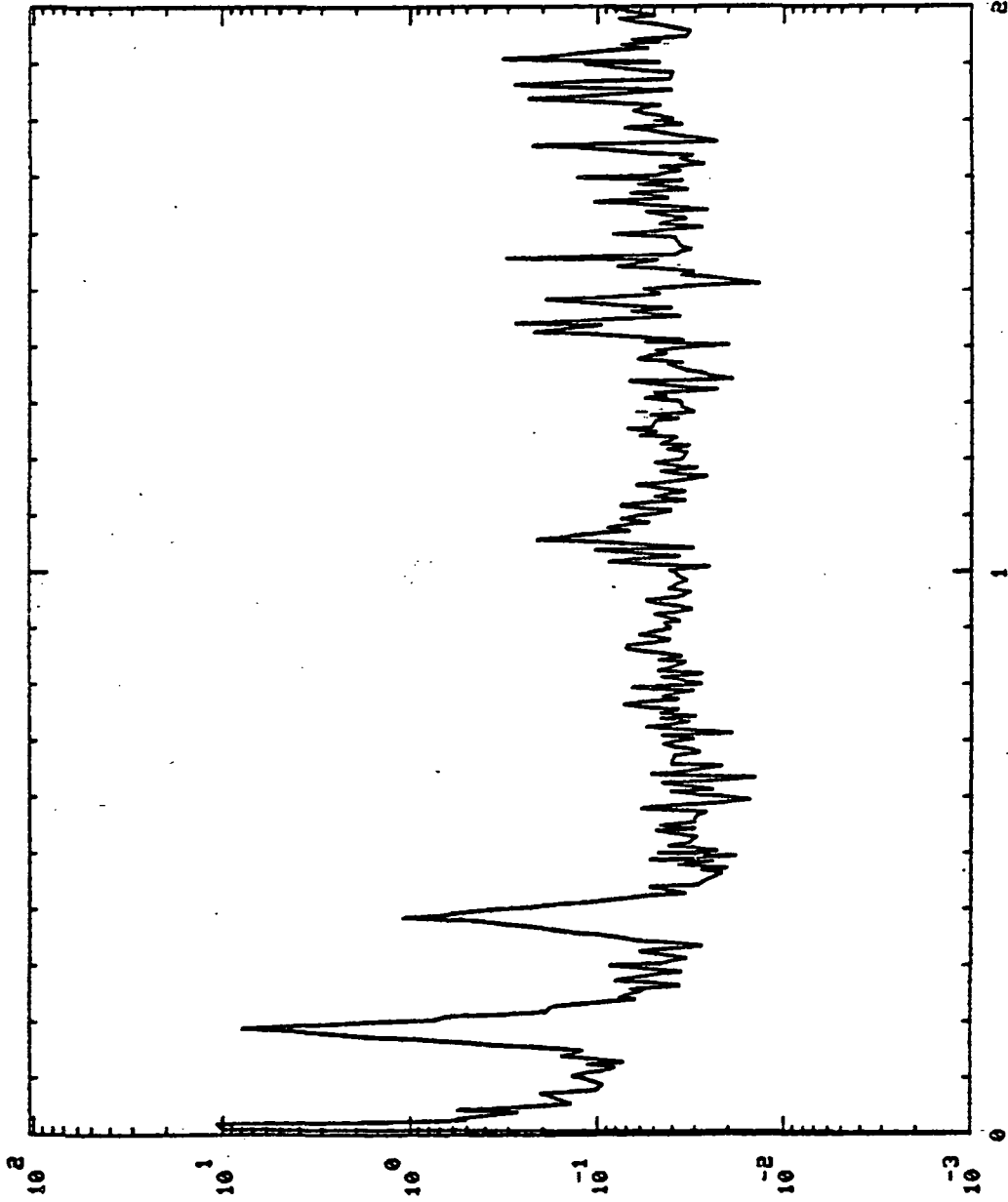


P S / Hz

750129 MCC FUEL INJ PR S+ 11.01H0'S



750129 OPB PC PR DC S+ 6.01H0,'S

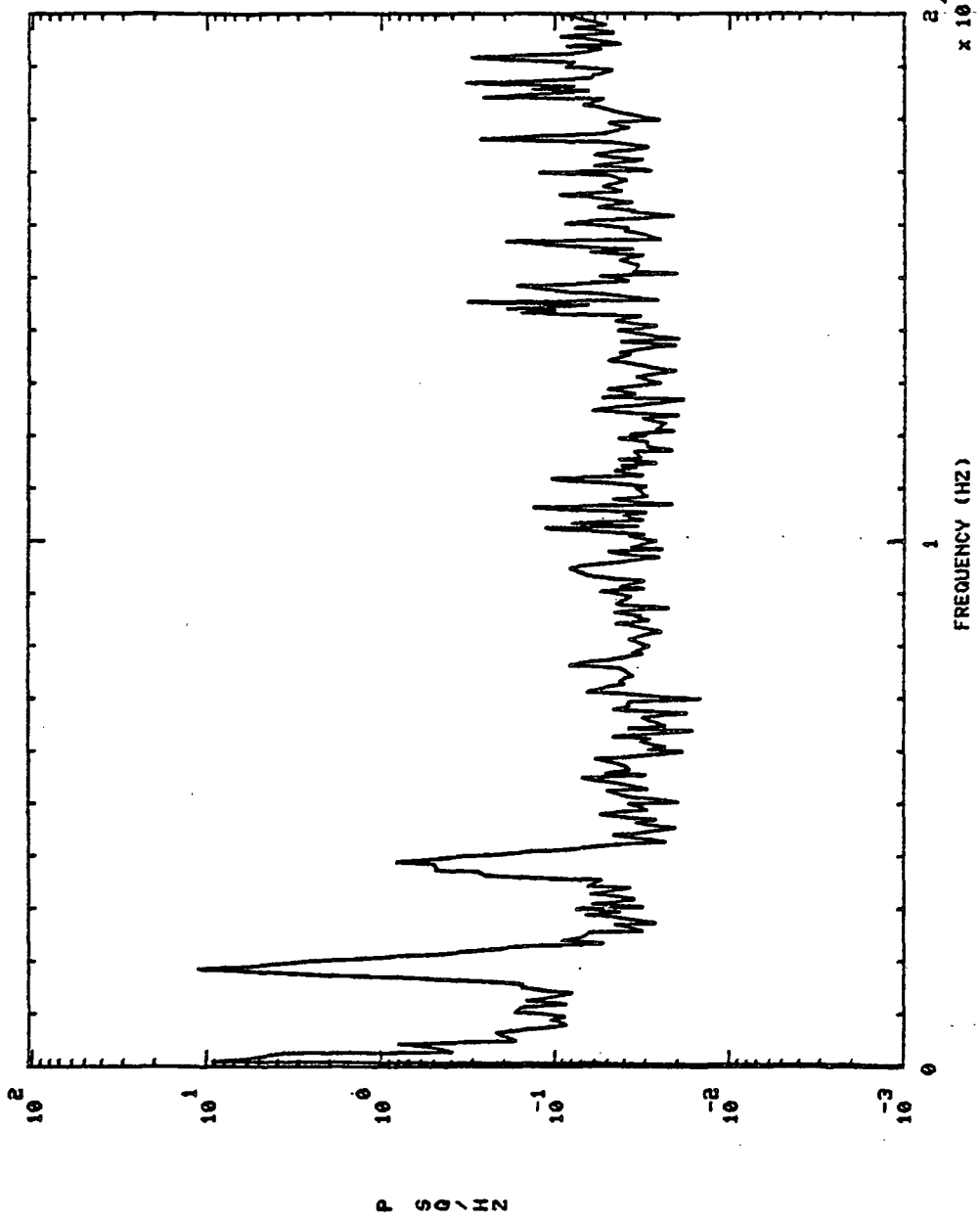


PSQ / HZ

FREQUENCY (HZ)

x 10^4

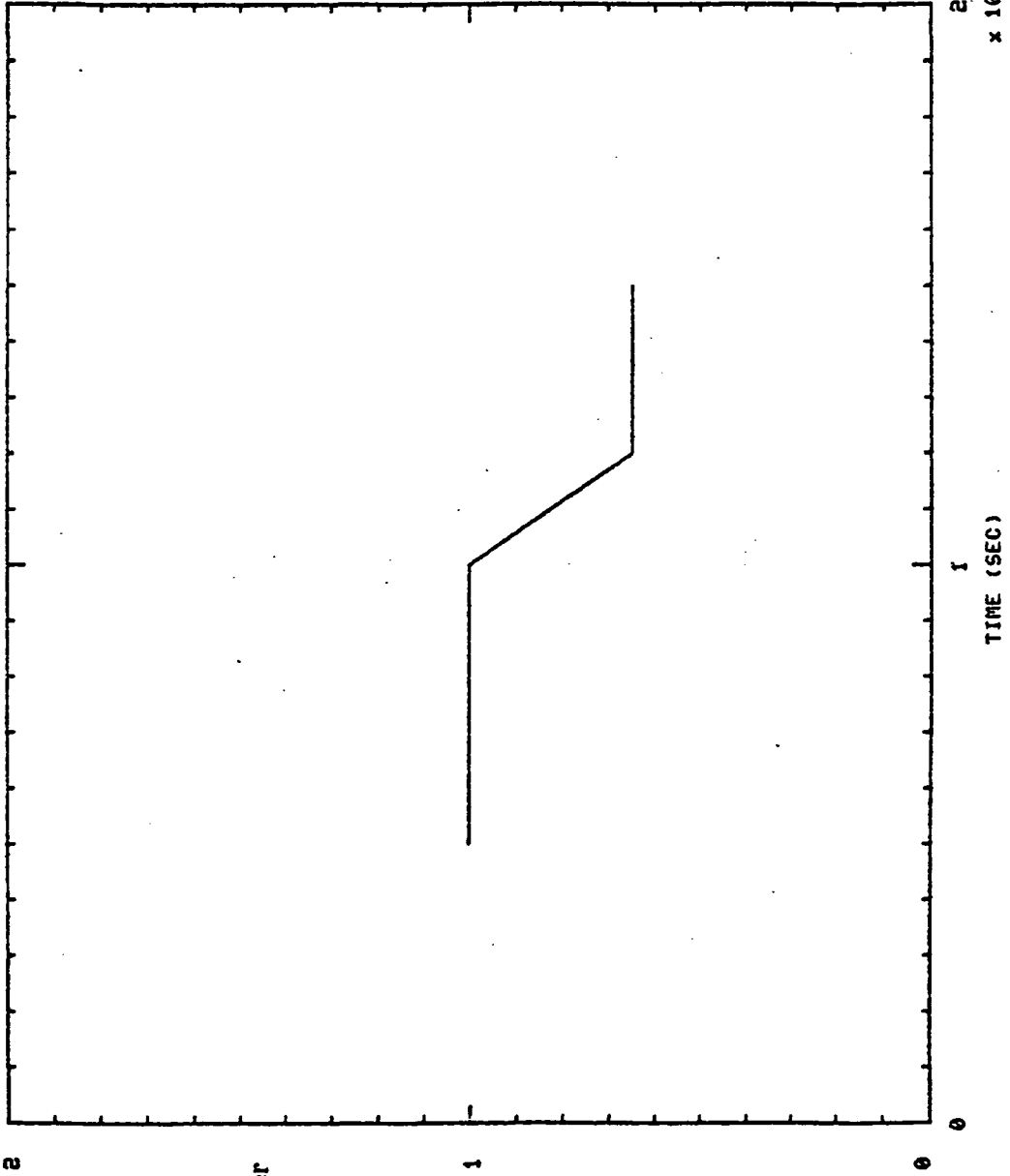
750129 OPB PC PR DC S+ 11.01H0,'S



(UNFILTERED)

THRUST

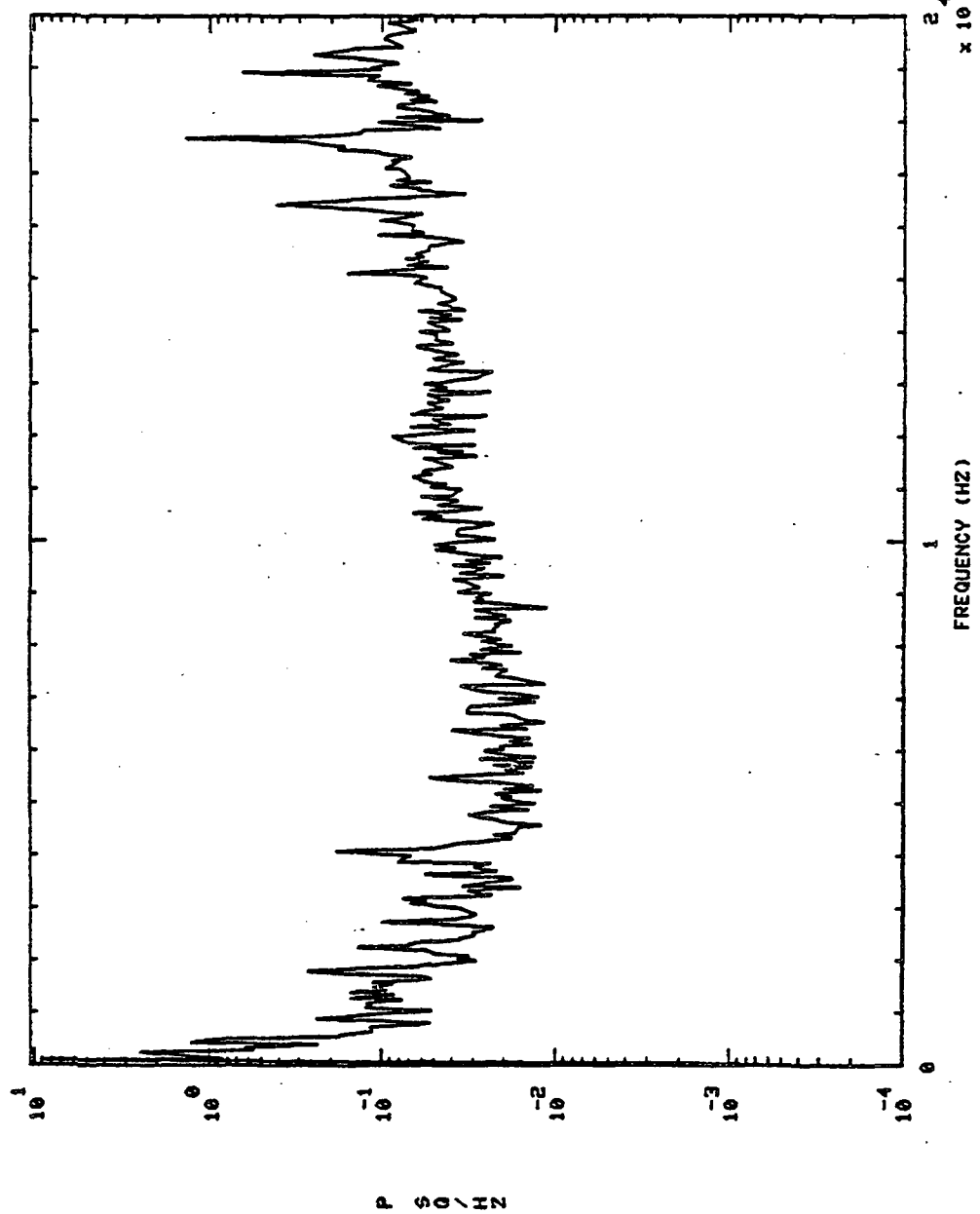
750130



Percent of Rated Power
 $\times 10^2$

TIME (SEC)
 $\times 10^1$

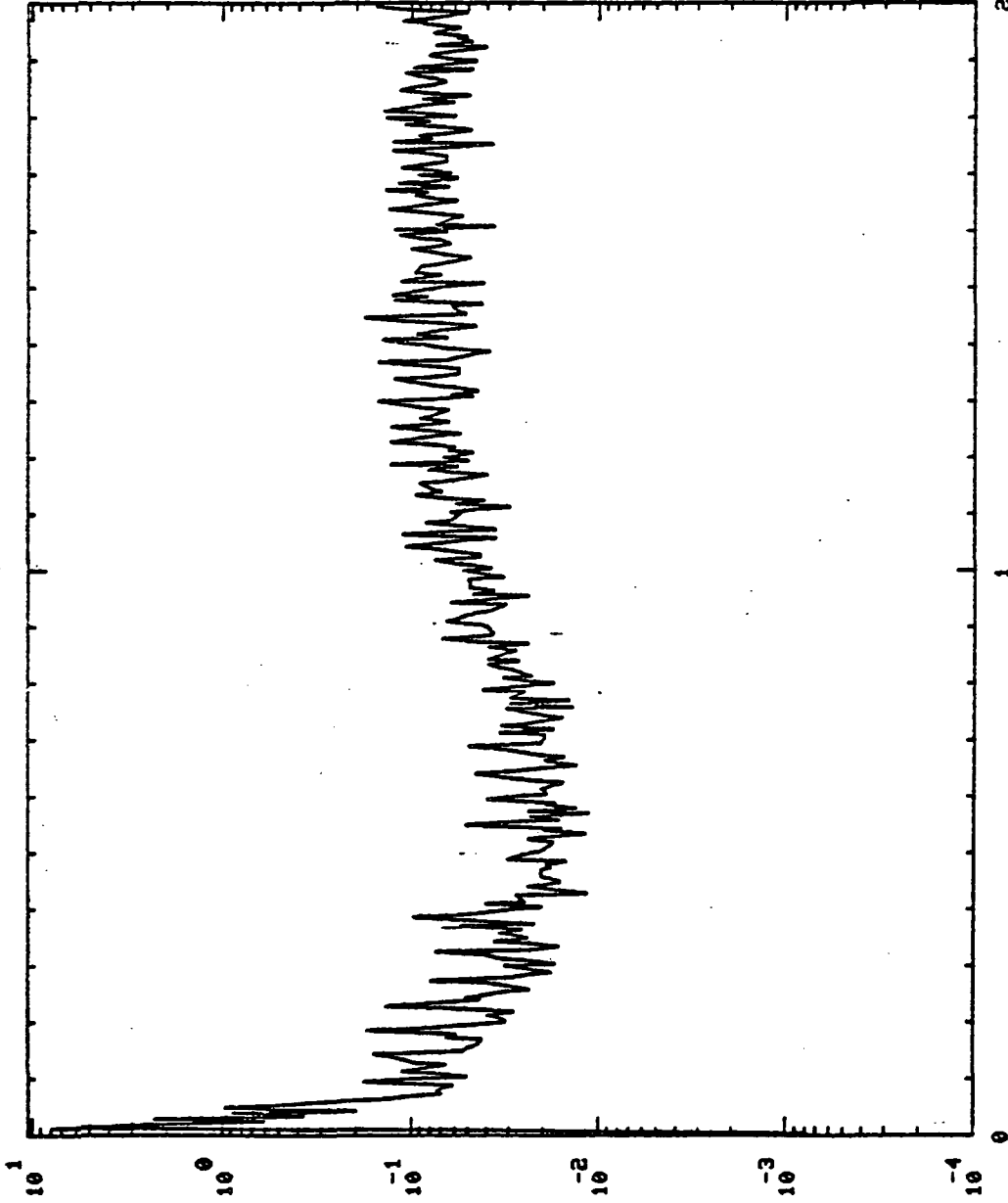
750130 FFB PC S+ 6.01H0,'S



St 11.01H0,'S

FPB PC

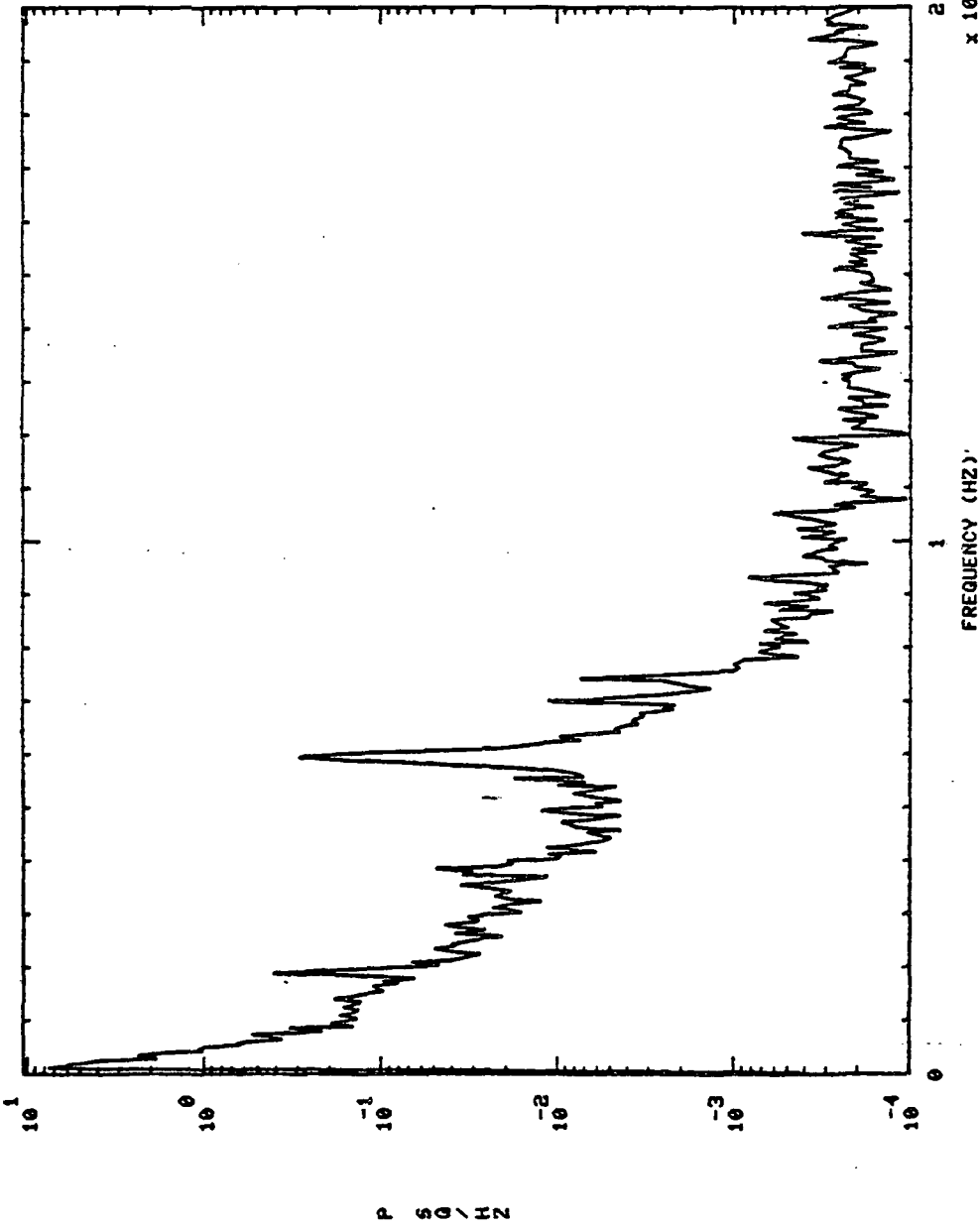
750130



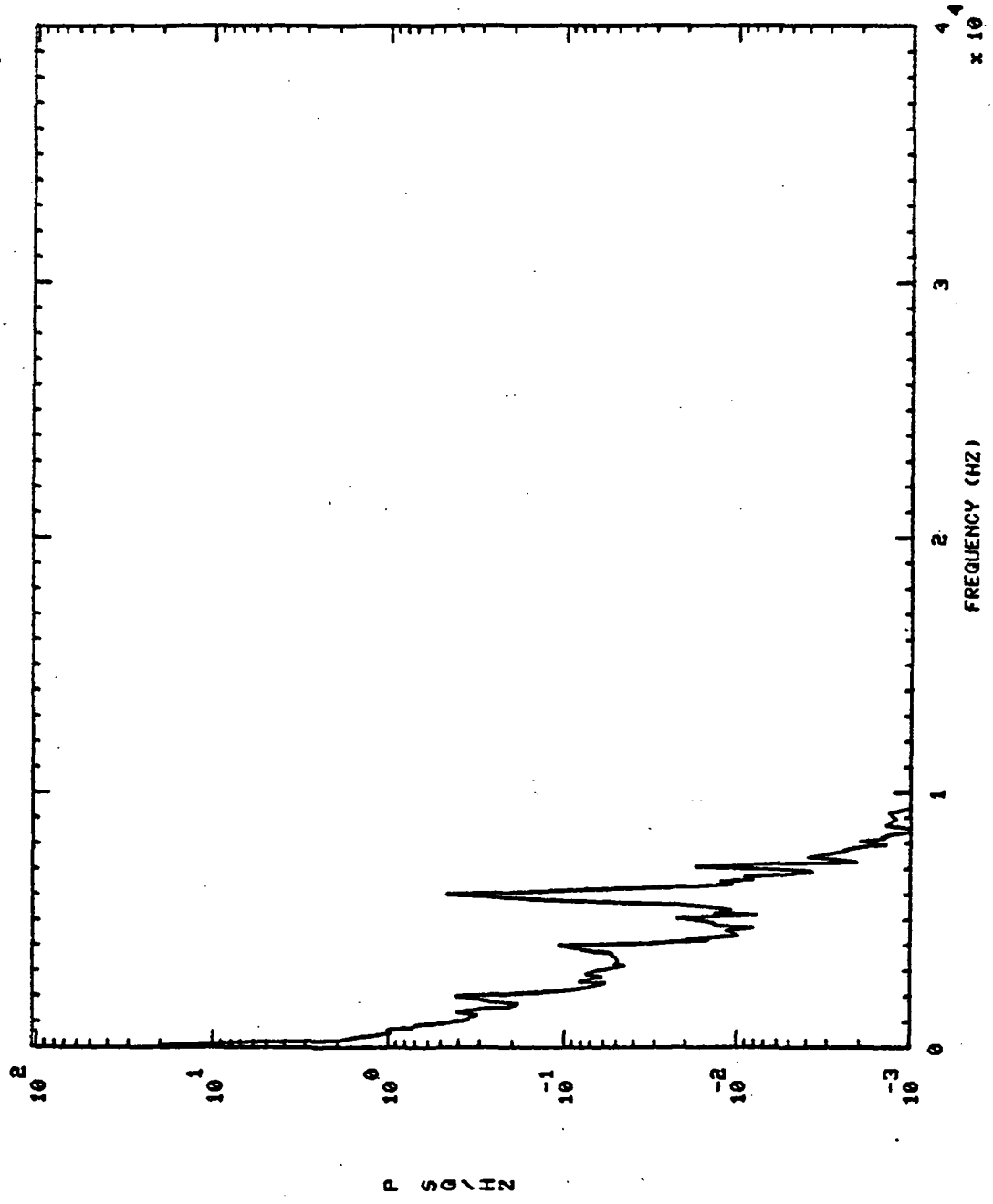
P S \ HN

FREQUENCY (HZ) x 10⁴

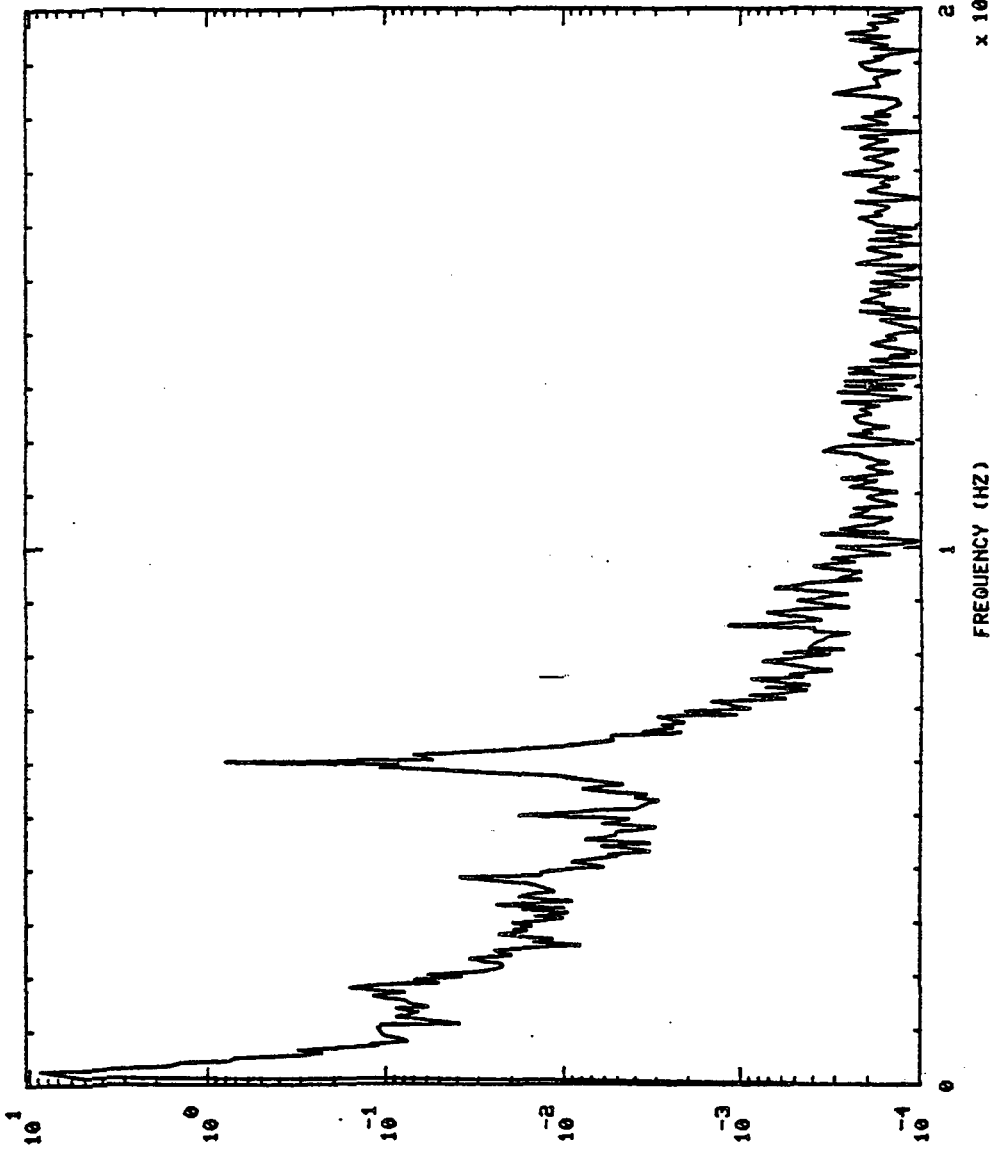
750130 MCC FUEL INJ PR 5+ 6.01H0,'S



750130 MCC FUEL INJ PR S+ 6.01H0.'S

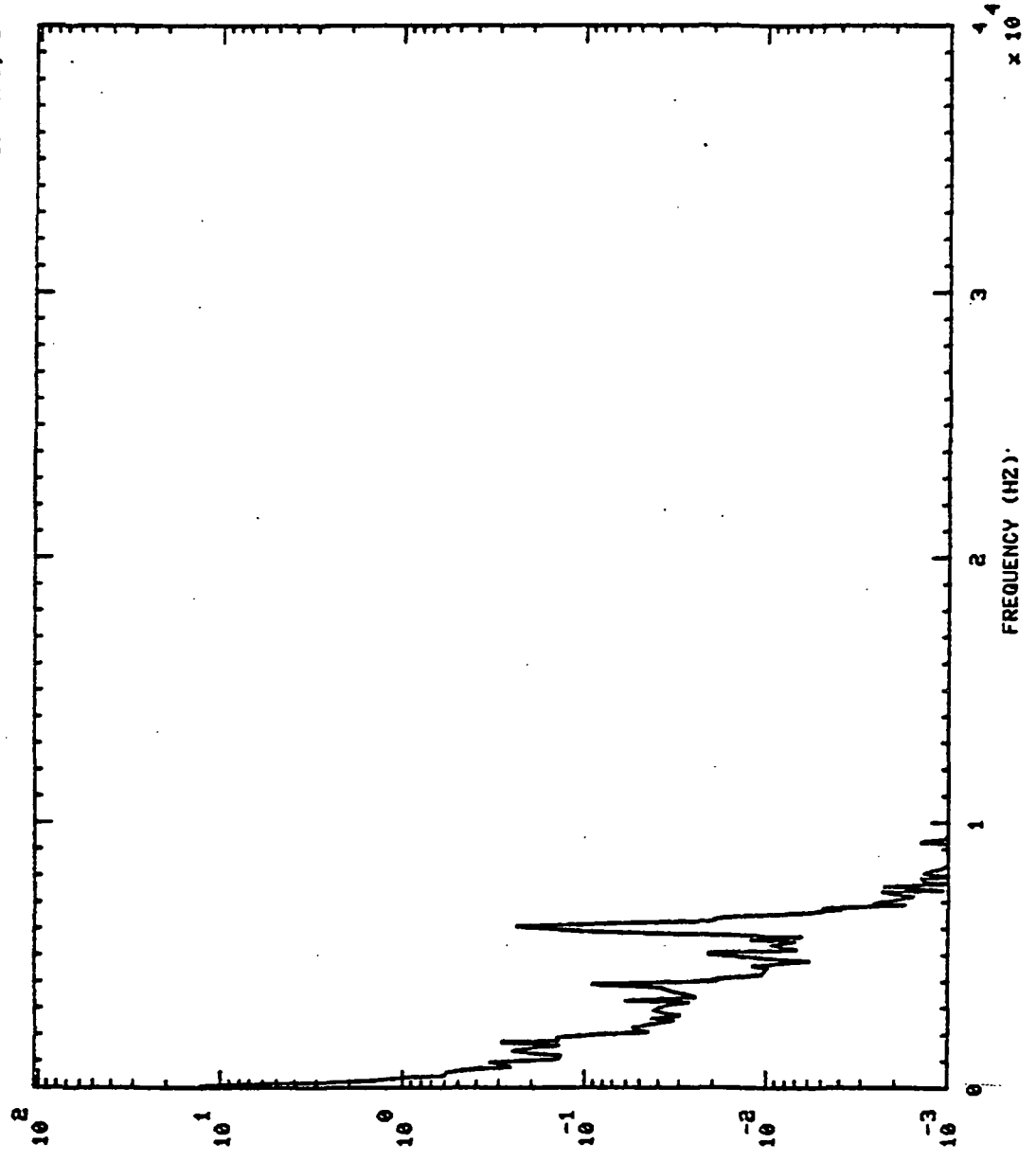


750130 MCC FUEL INJ PR S+ 11.01H0,'S



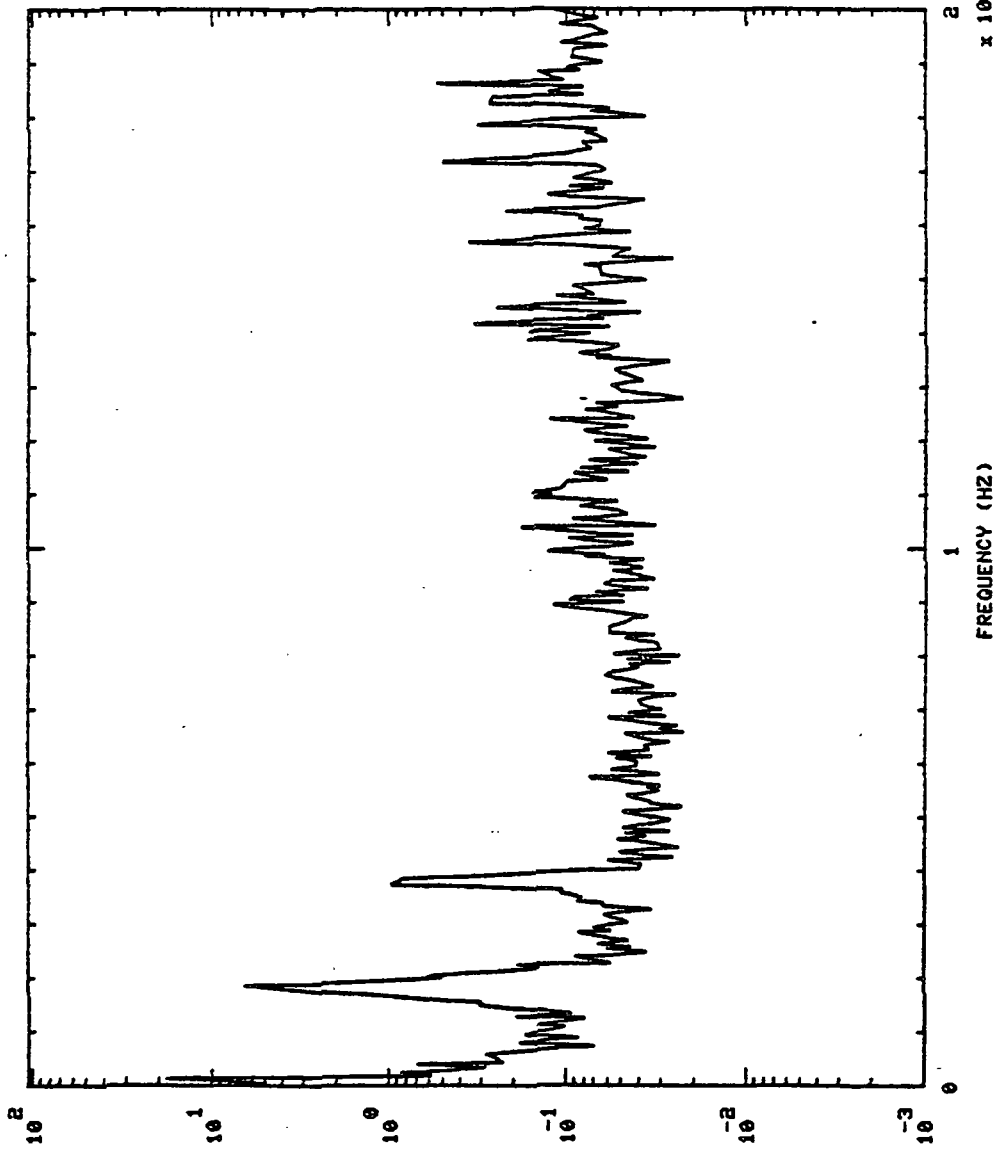
P 50 / HZ

750130 MCC FUEL INJ PR S+ 11.01H0,'S



P S G^2 / HZ

750130 OPB PC PR DC St 6.01H0, 'S

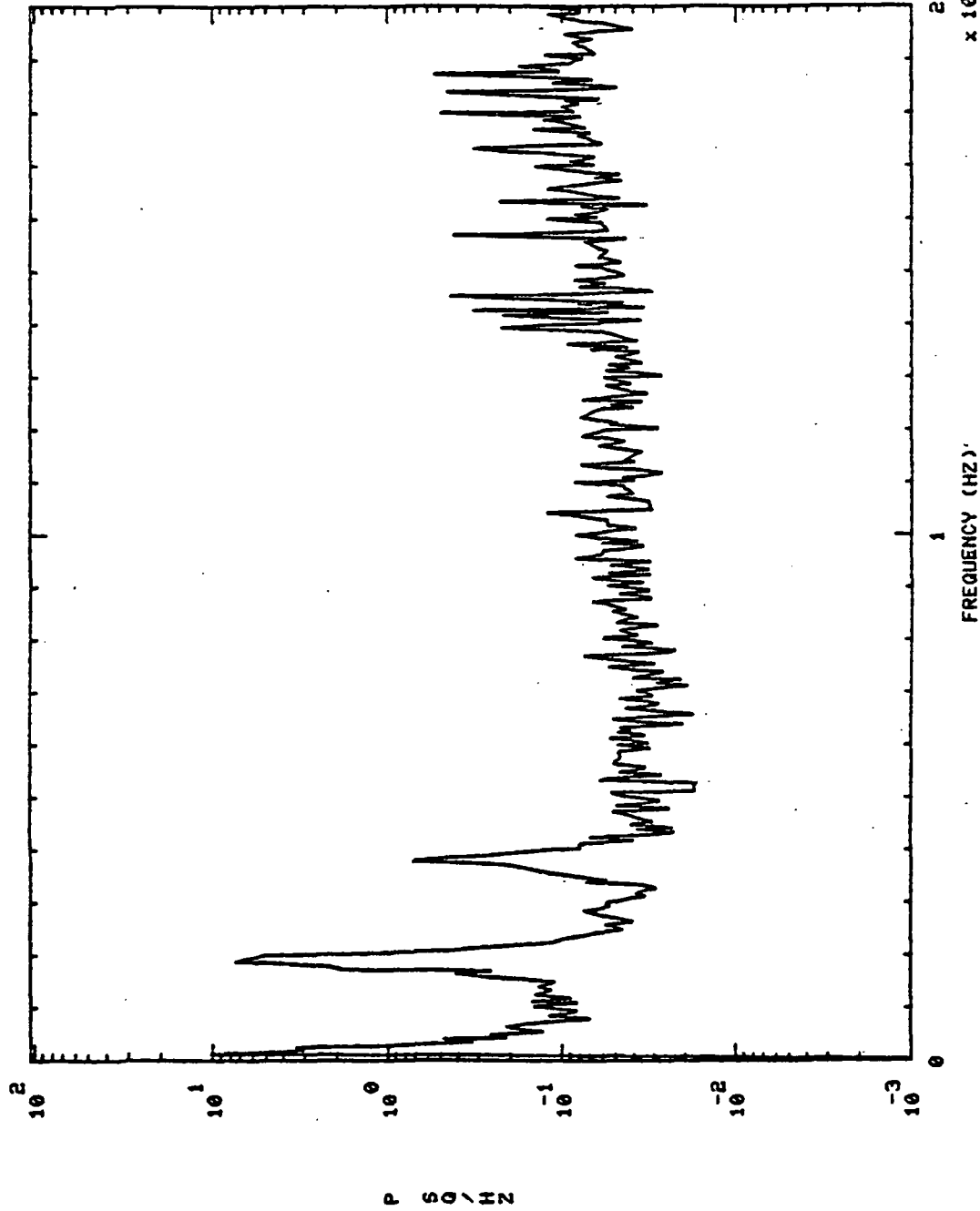


P S / IN

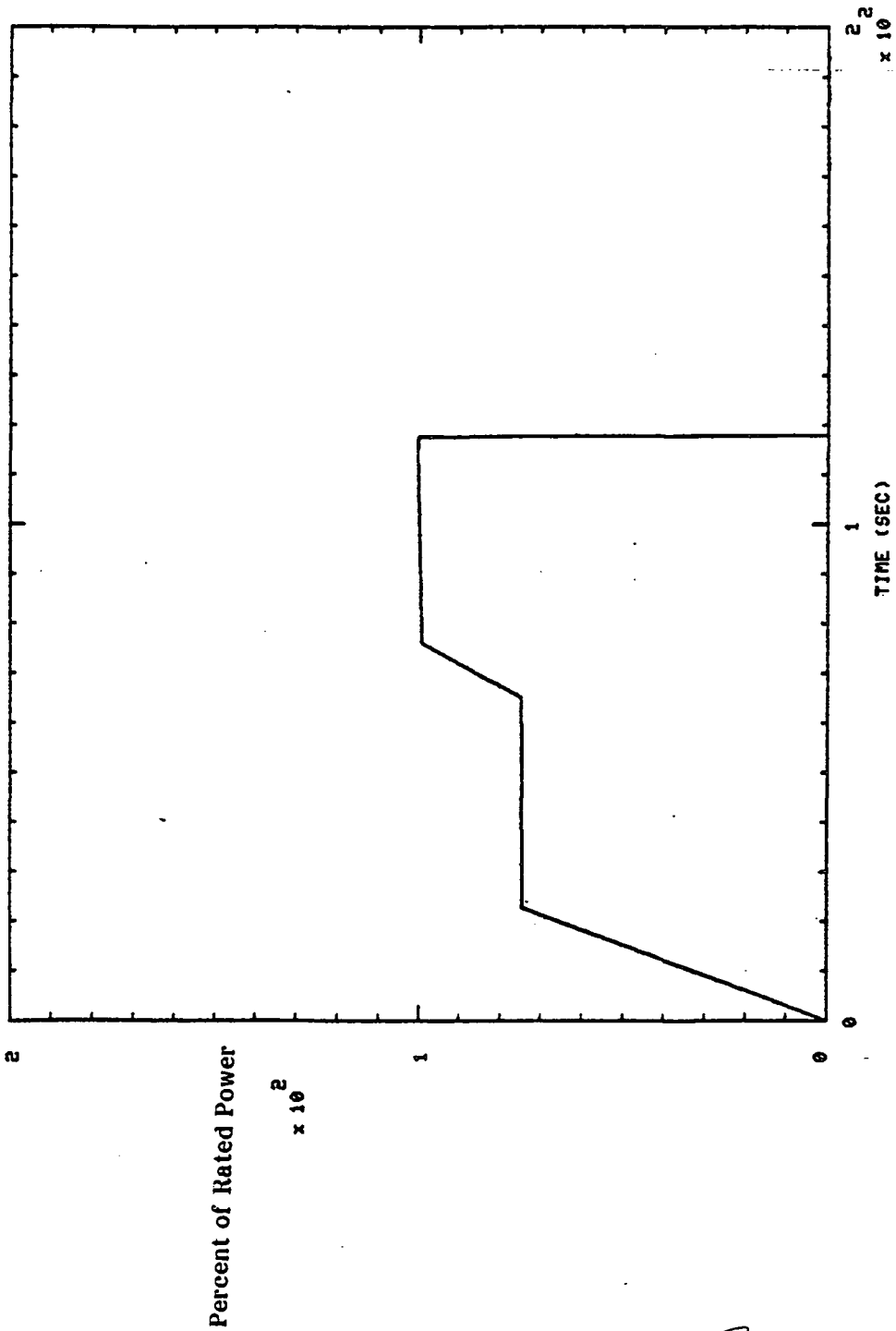
750130

OPB PC PR DC

S+ 11.01H0,'S

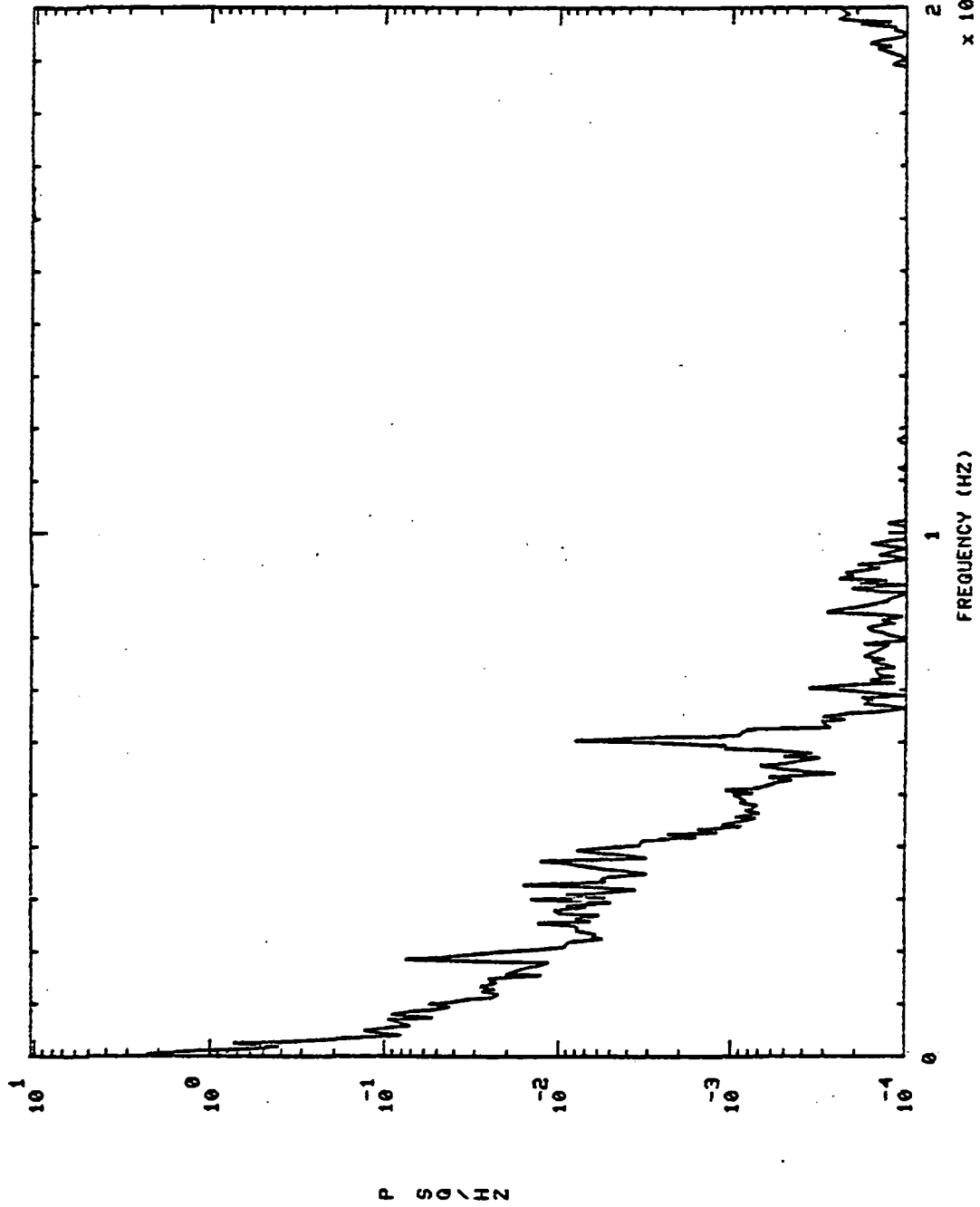


750131 THRUST (UNFILTERED)

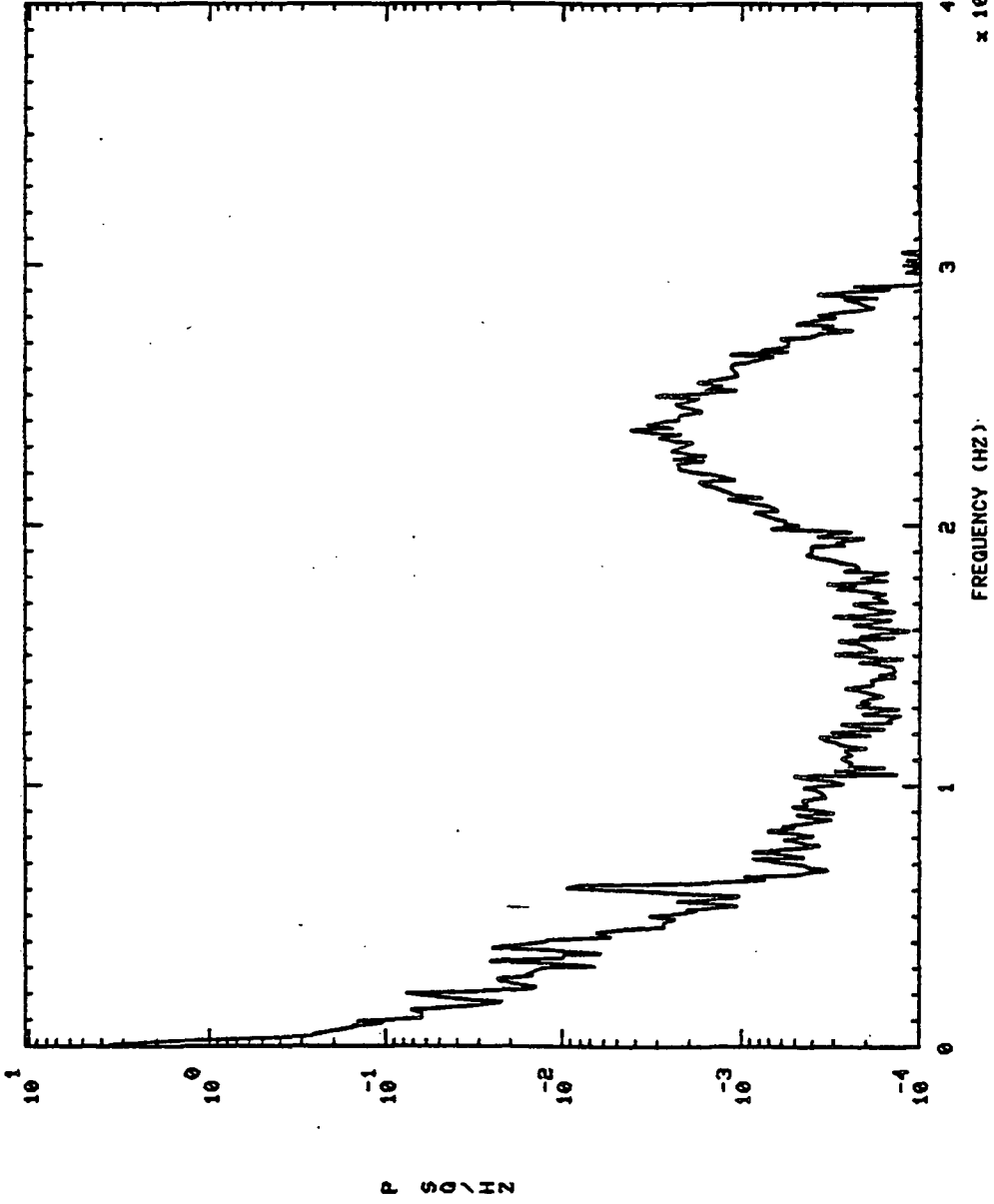


C-2

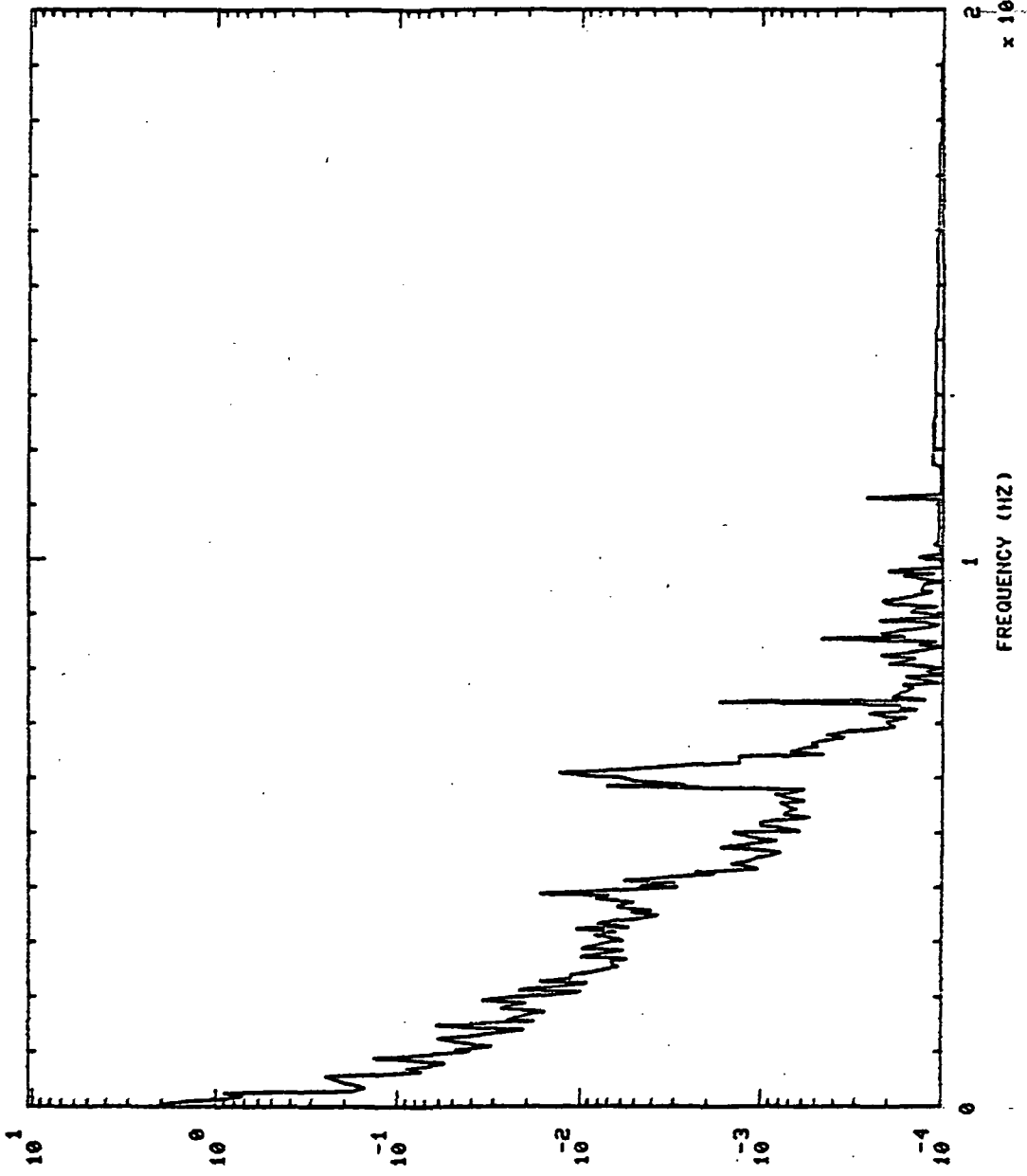
750131 MCC FUEL INJ PR S+ 30.01H0,'S



750131 MCC FUEL INJ PR S+ 30.010, '5



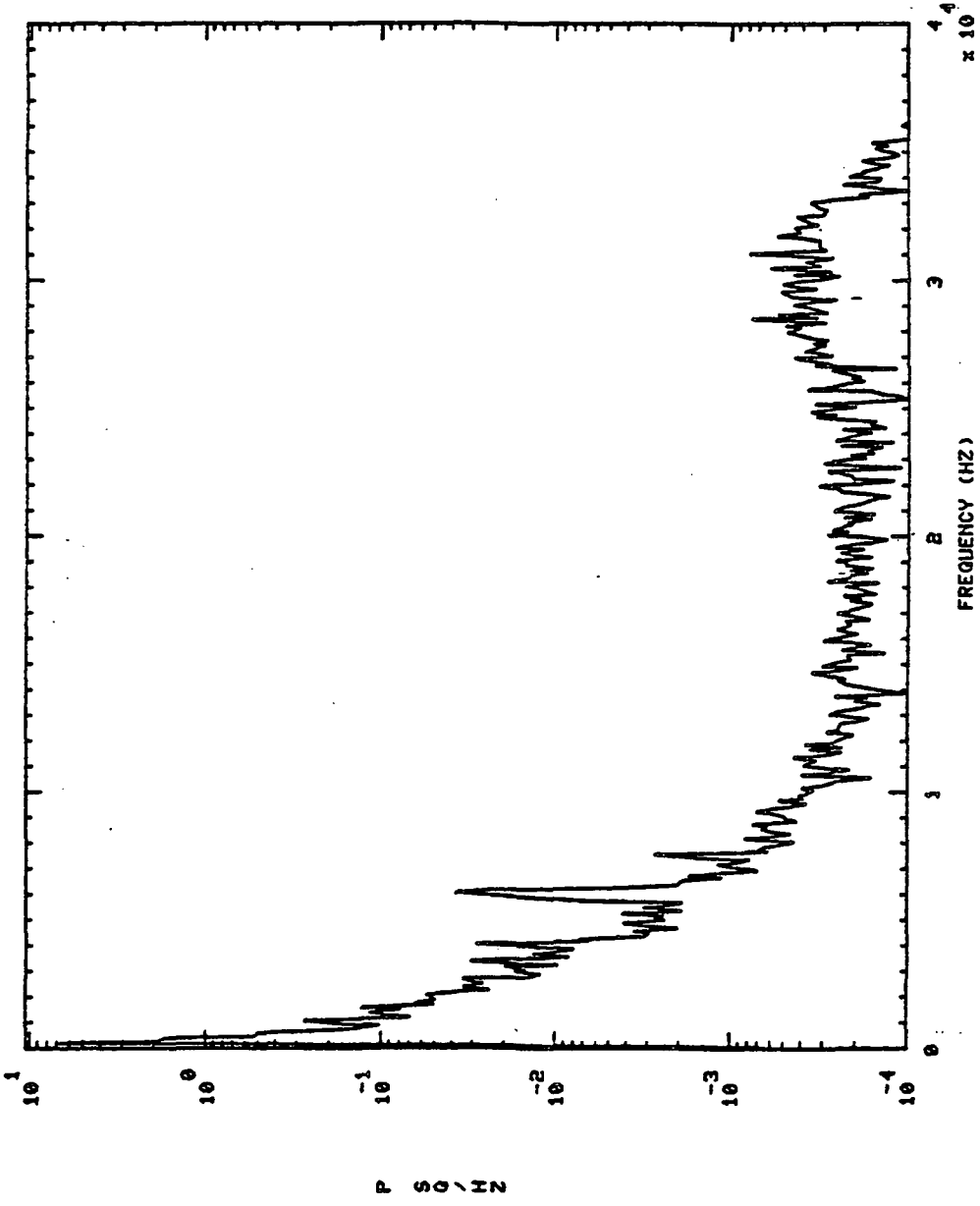
750131 MCC FUEL INJ PR S+ 70.01H0,'S



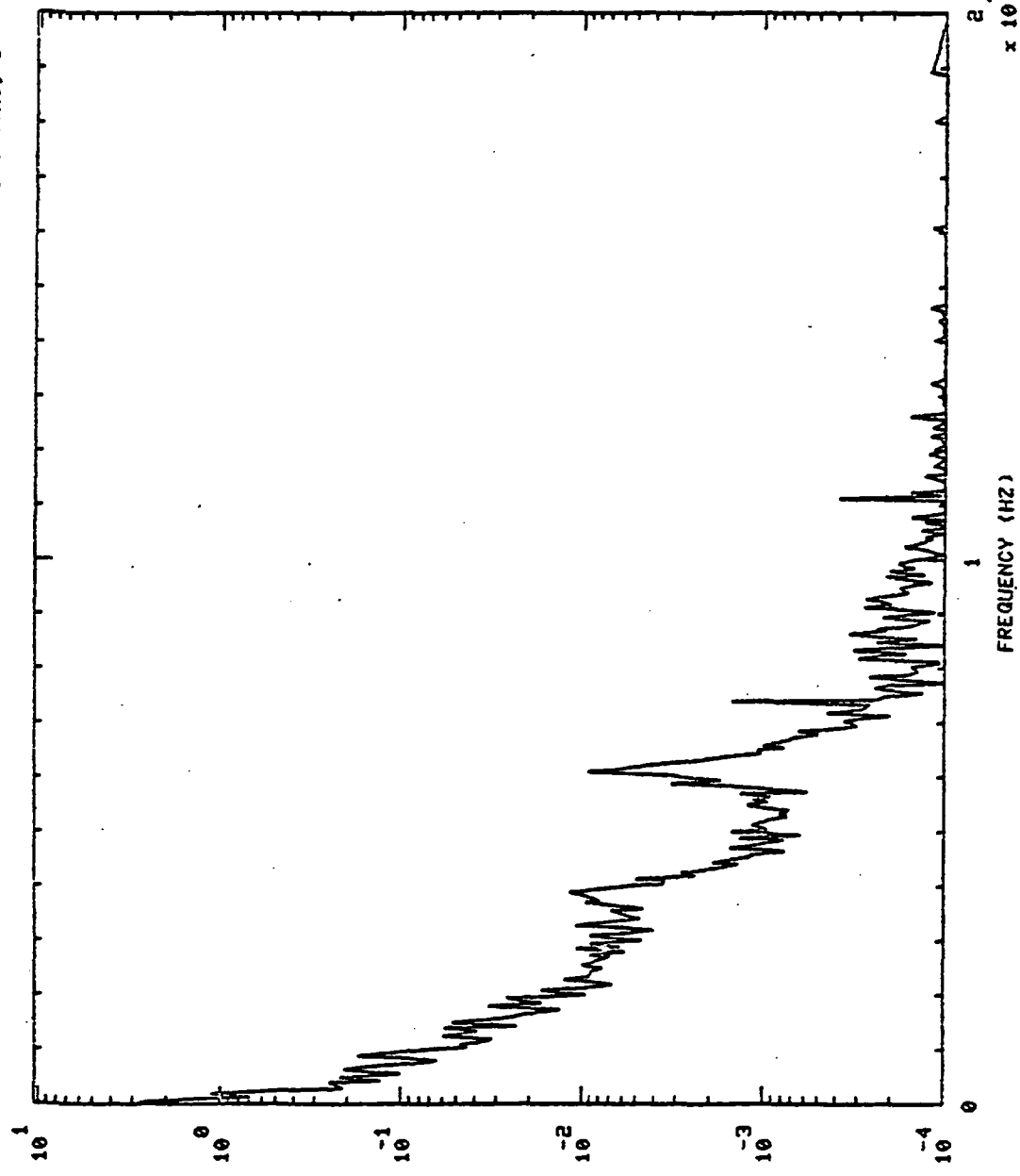
P S O / H Z

FREQUENCY (H Z)
x 10⁴

750131 MCC FUEL INJ PR S+ 70.01H0,'S

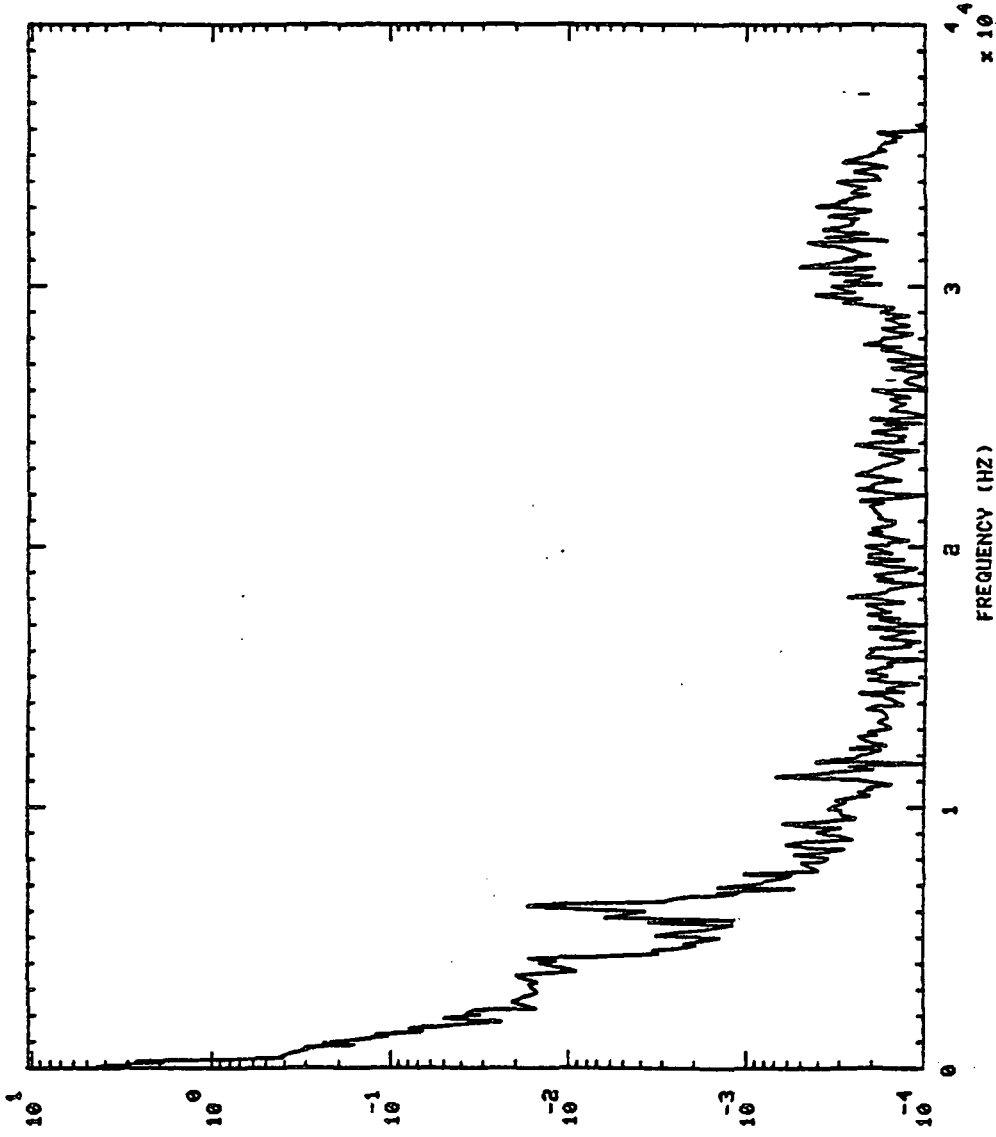


750131 MCC FUEL INJ PR S+ 100.01H0.'S



P S D N

750131 MCC FUEL INJ PR S+ 100.01H0,'S

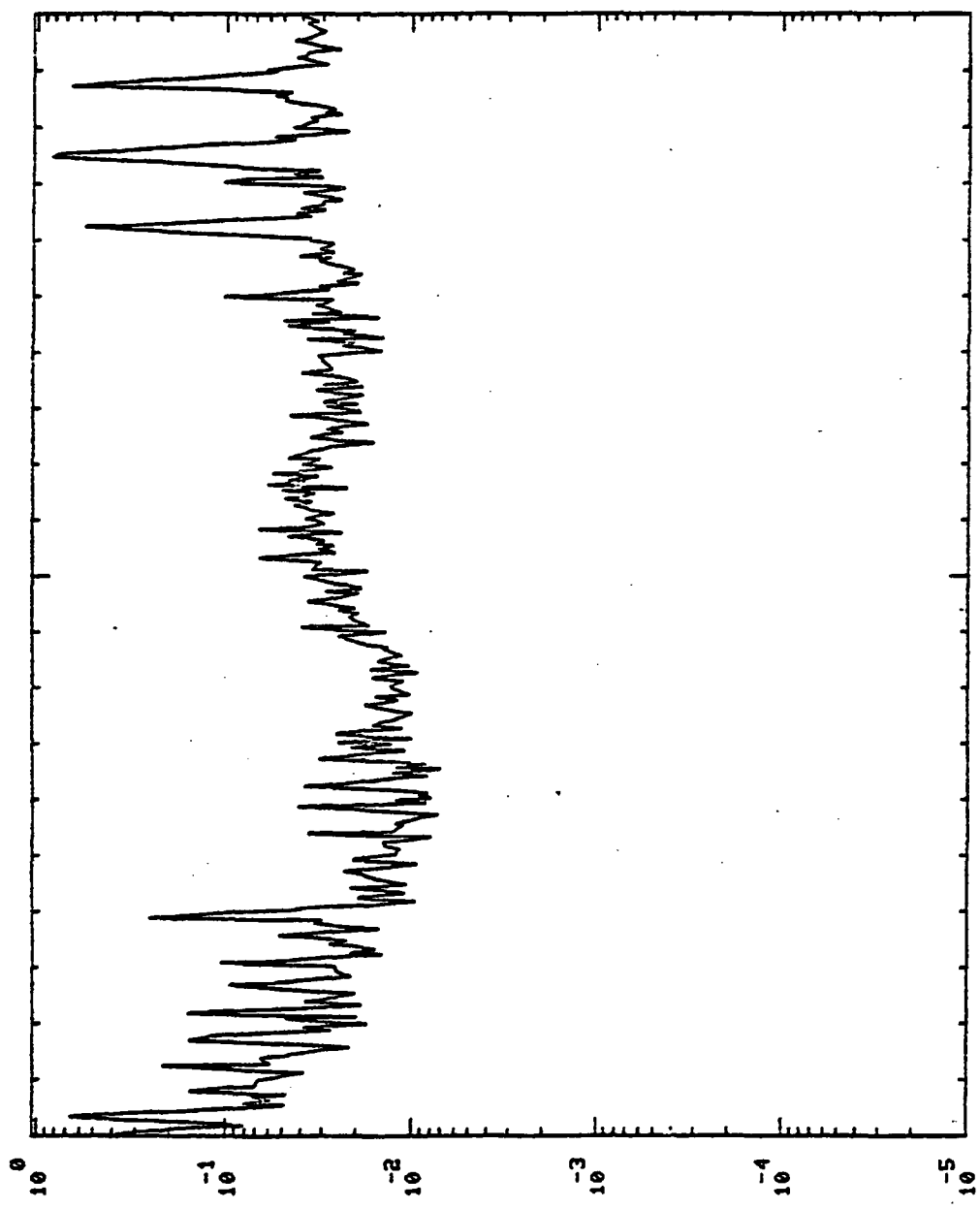


P S0/HZ

FREQUENCY (HZ)

$\times 10^4$

750131 FFB PC S+ 10.01H0,'S

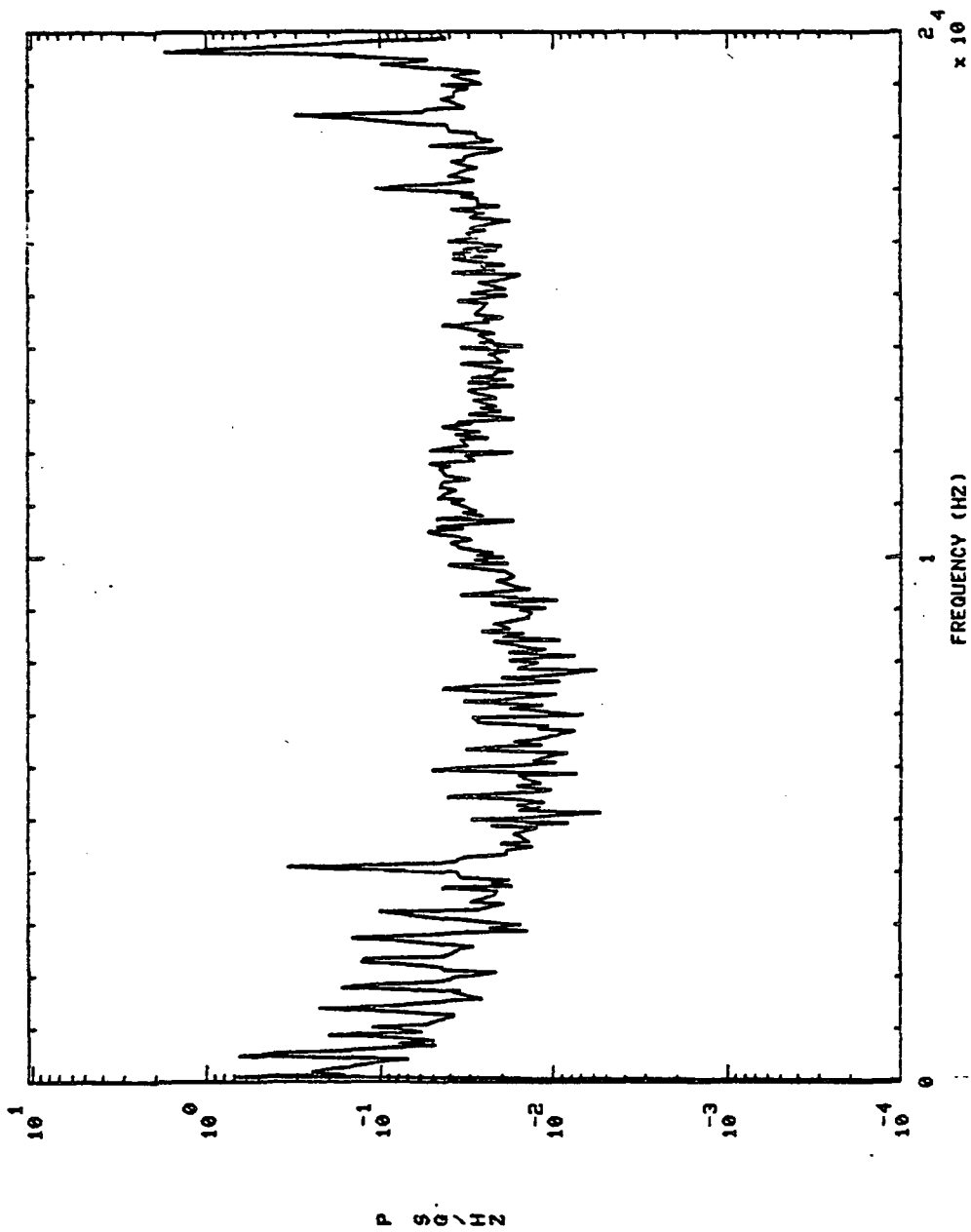


PSD / HZ

FREQUENCY (HZ) 1 24 x 10⁴

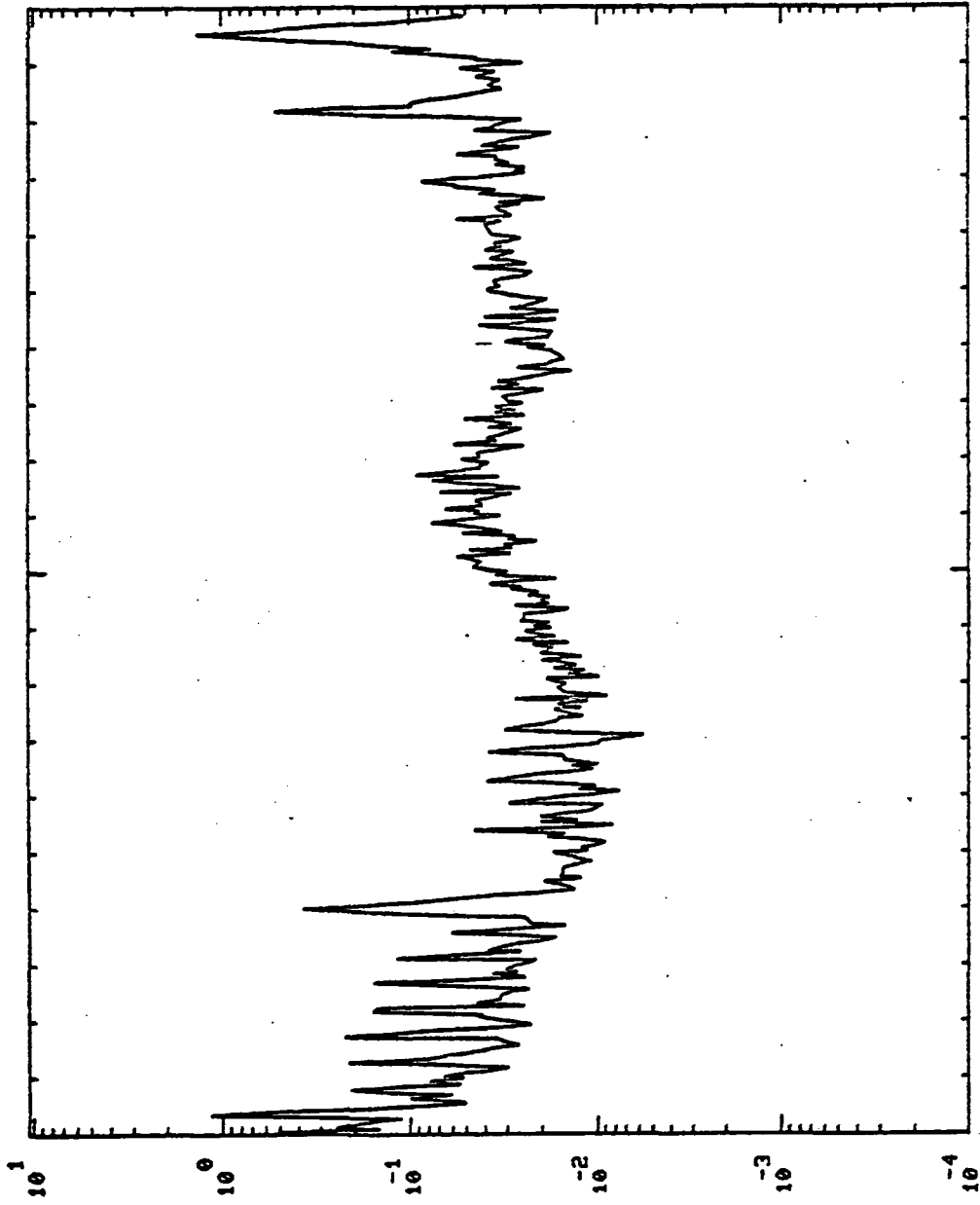
750131 FFB PC ST 70.01H0.'S

750131 FFB PC



S+ 100.01H0,'S

750131 FPB PC

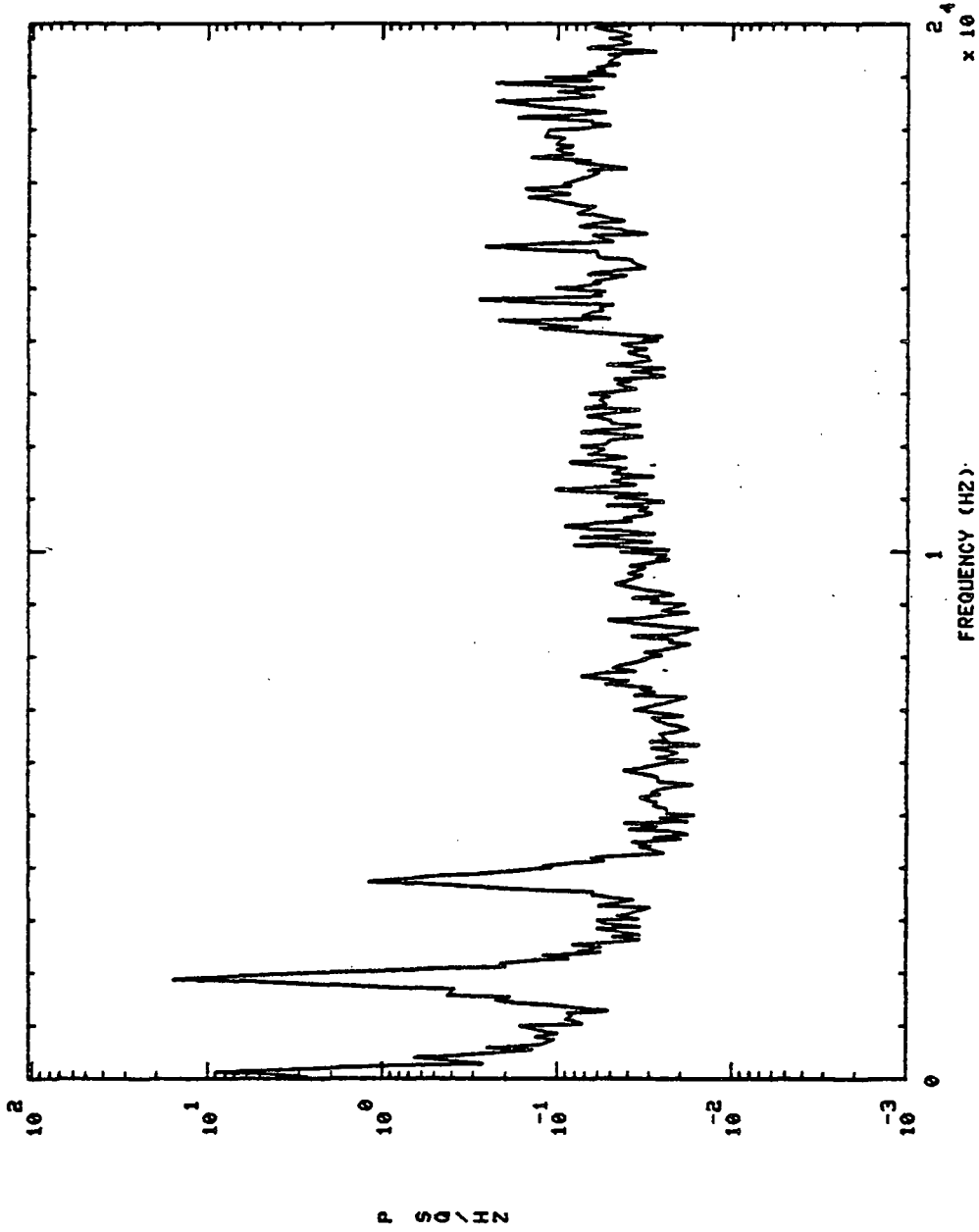


P SQ / HZ

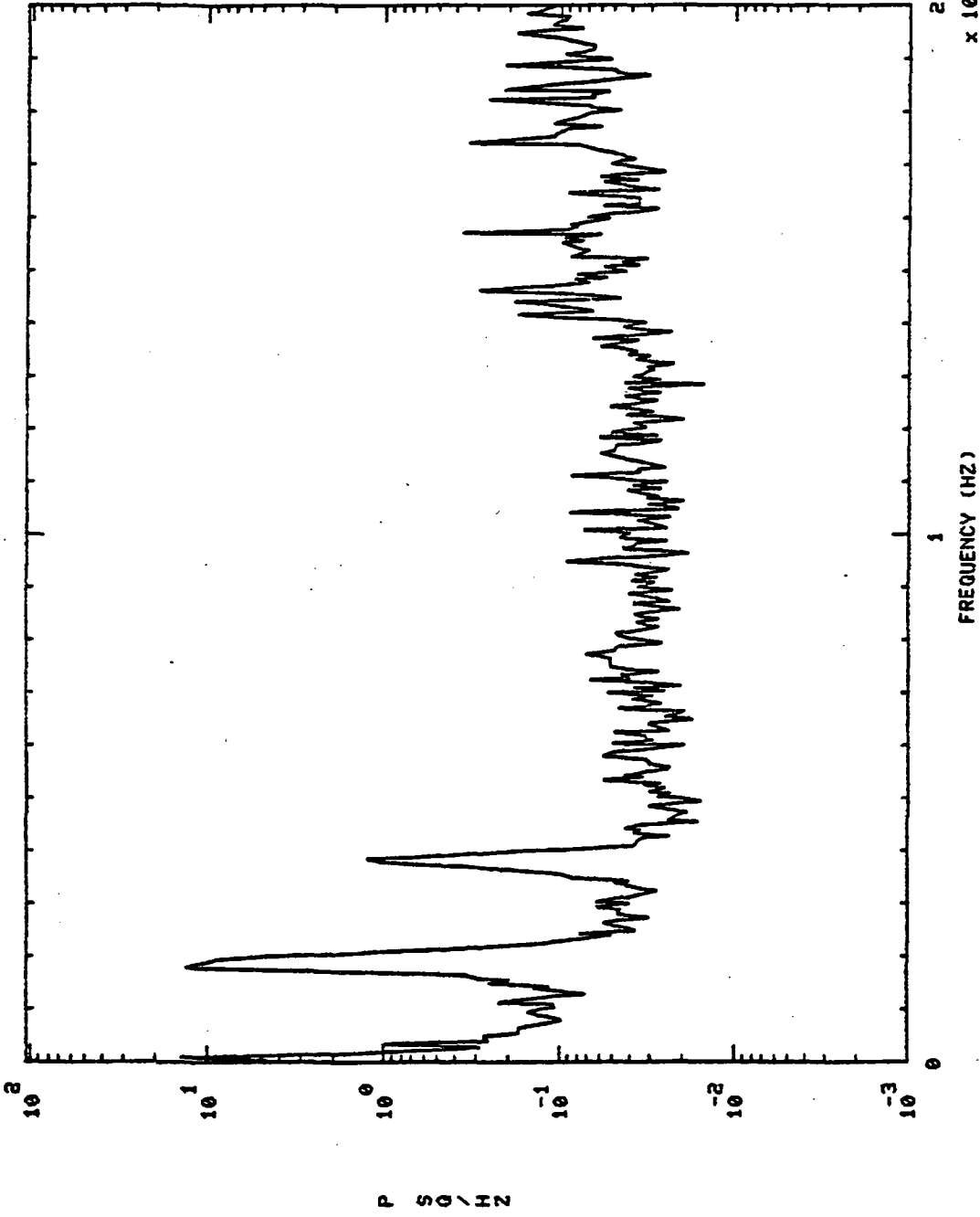
FREQUENCY (HZ)

$\times 10^4$

750131 OPB FC PR DC S+ 30.0140,'S

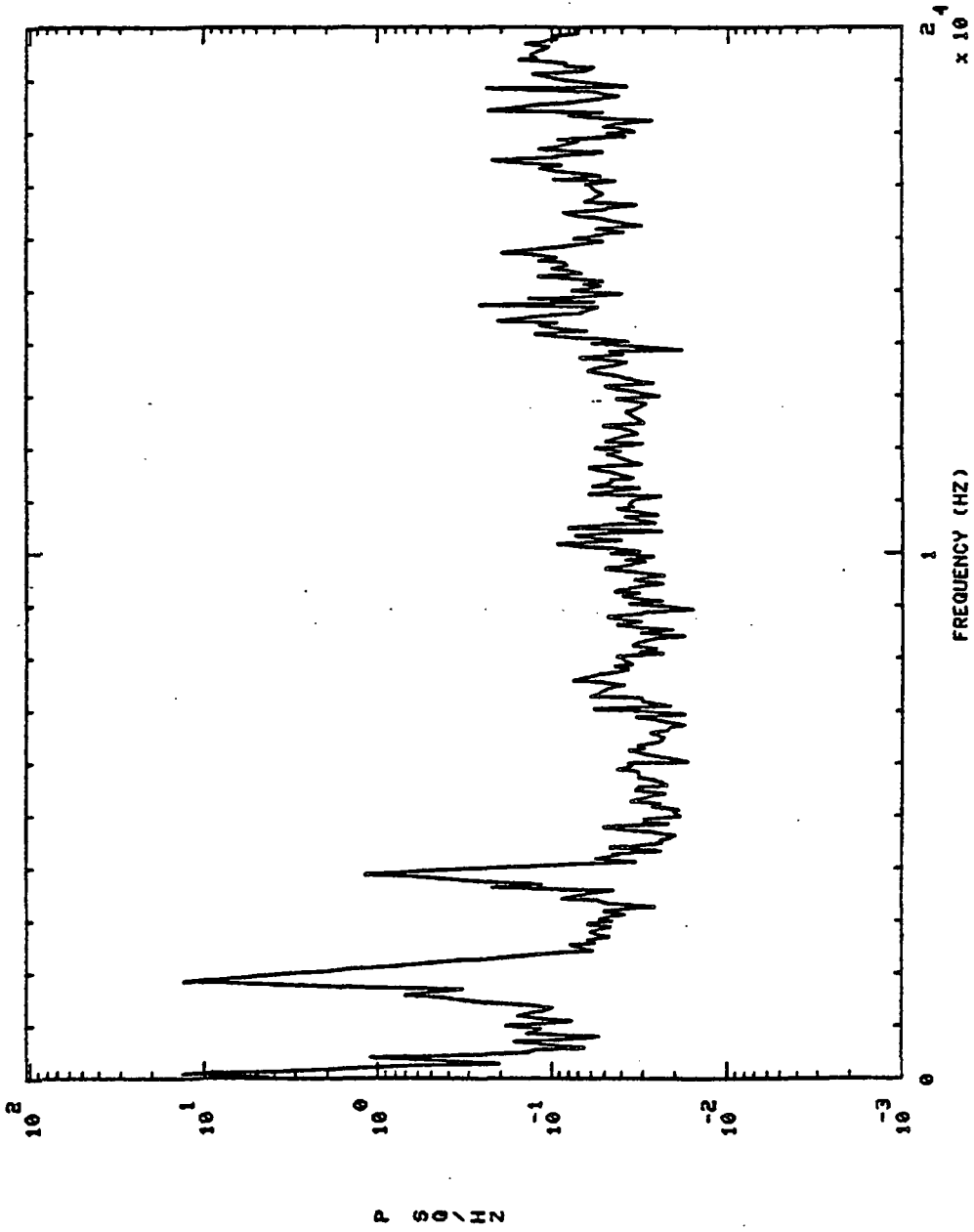


750131 OPB PC PR DC S+ 70.01H0,'S

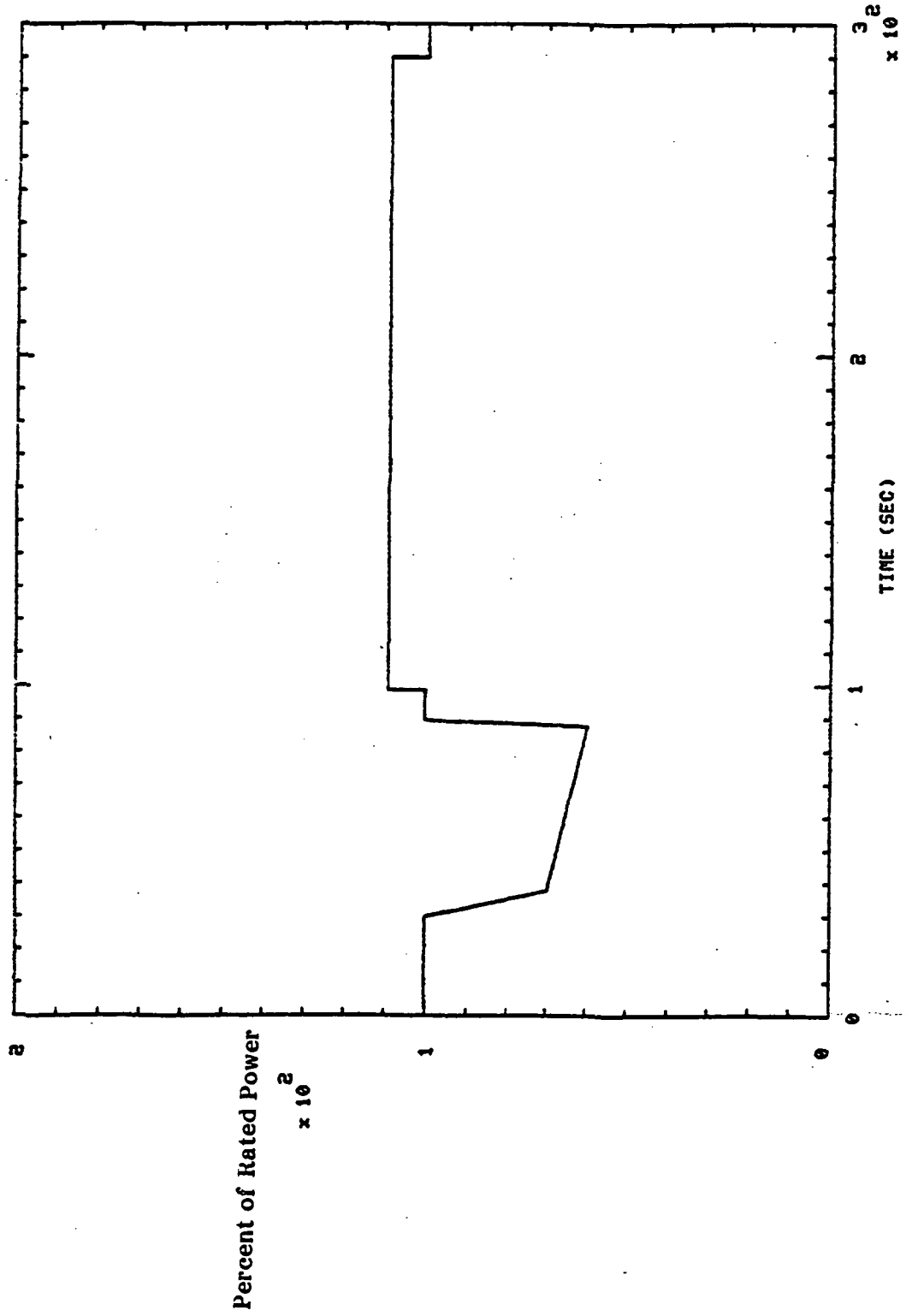


2 4
x 10

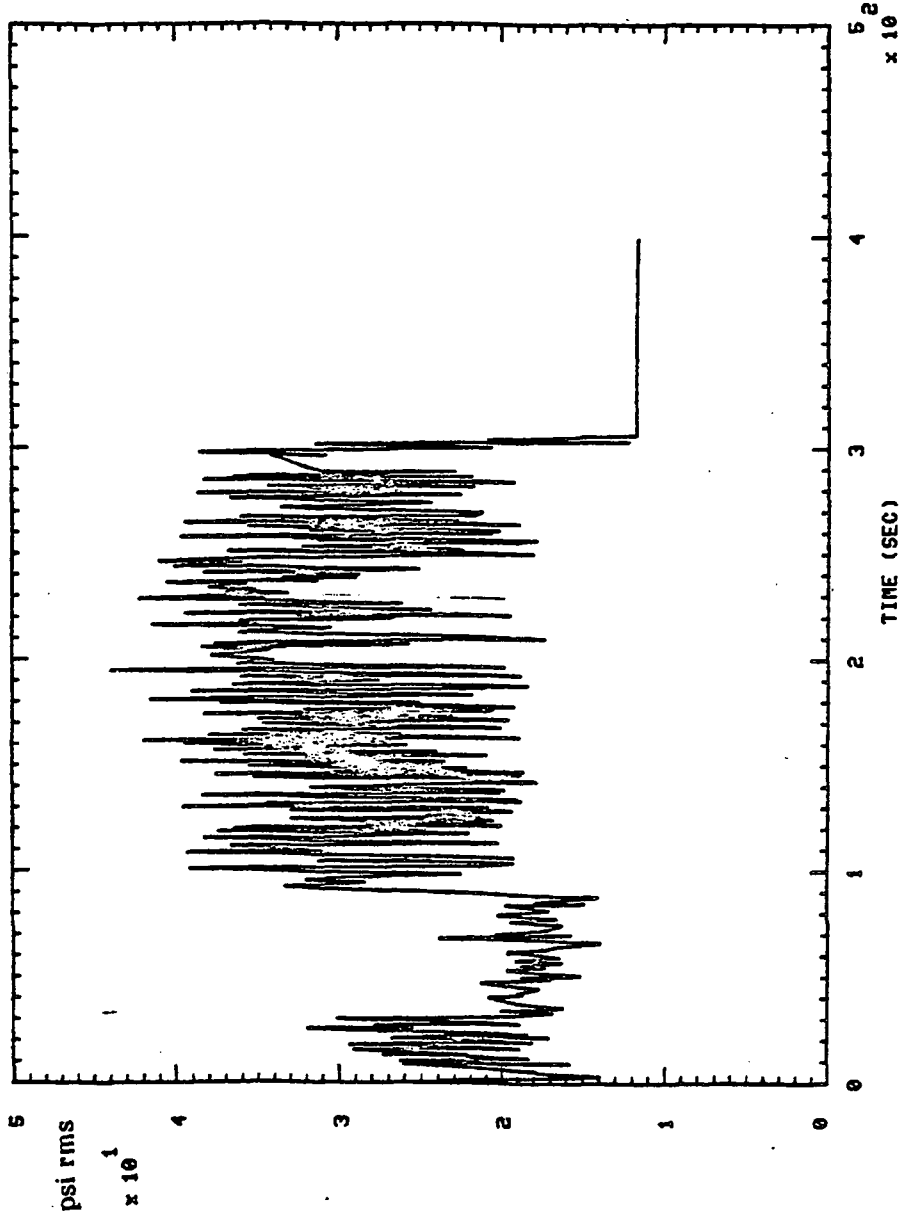
750131 OPB PC PR DC S+ 100.01H0,'S



750132 THRUST (UNFILTERED)

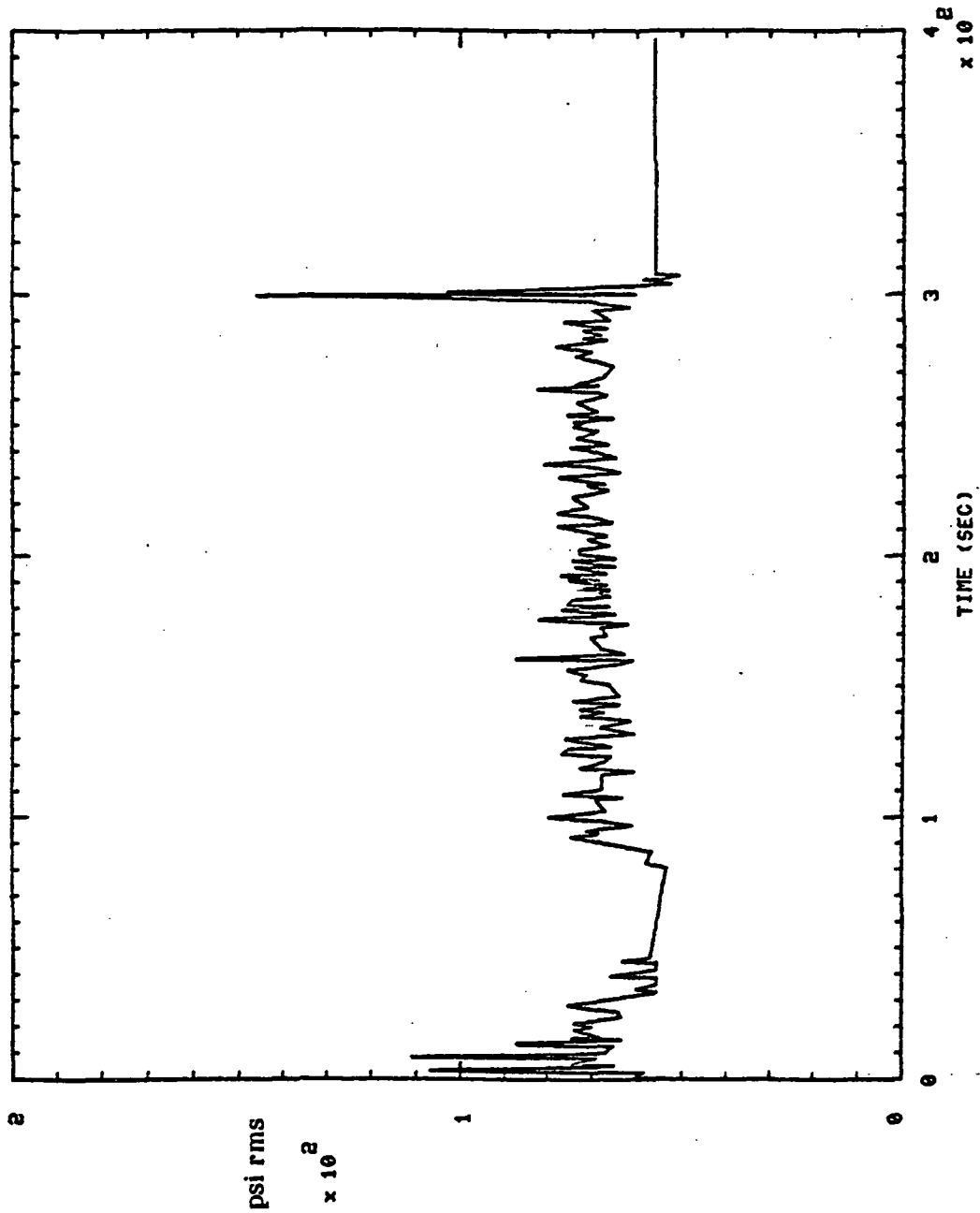


750132 MCC FUEL INJ PR (UNFILTERED)

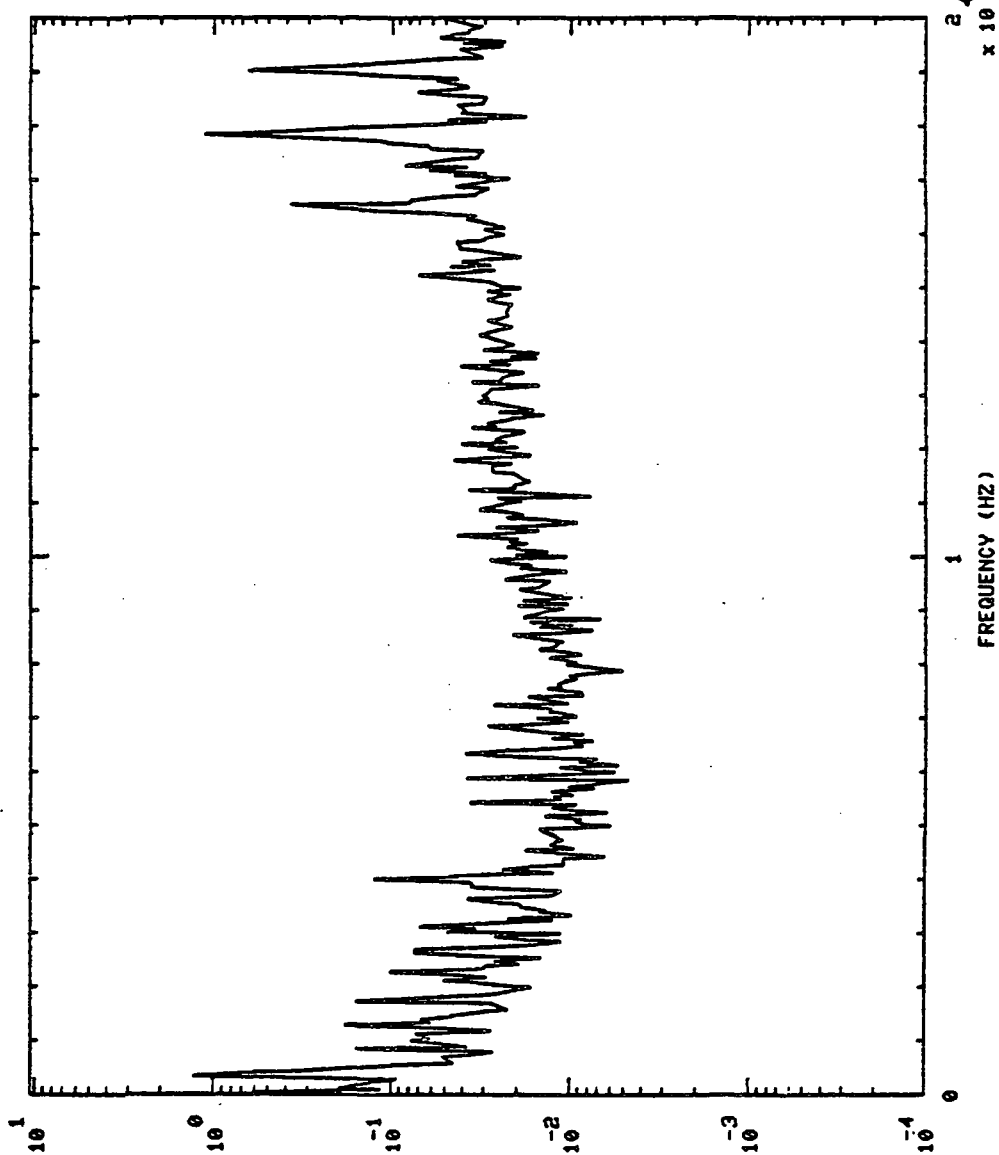


(UNFILTERED)

750132 OPB PC PR DC



750132 FP8 PC S+ 10.01H0.'S

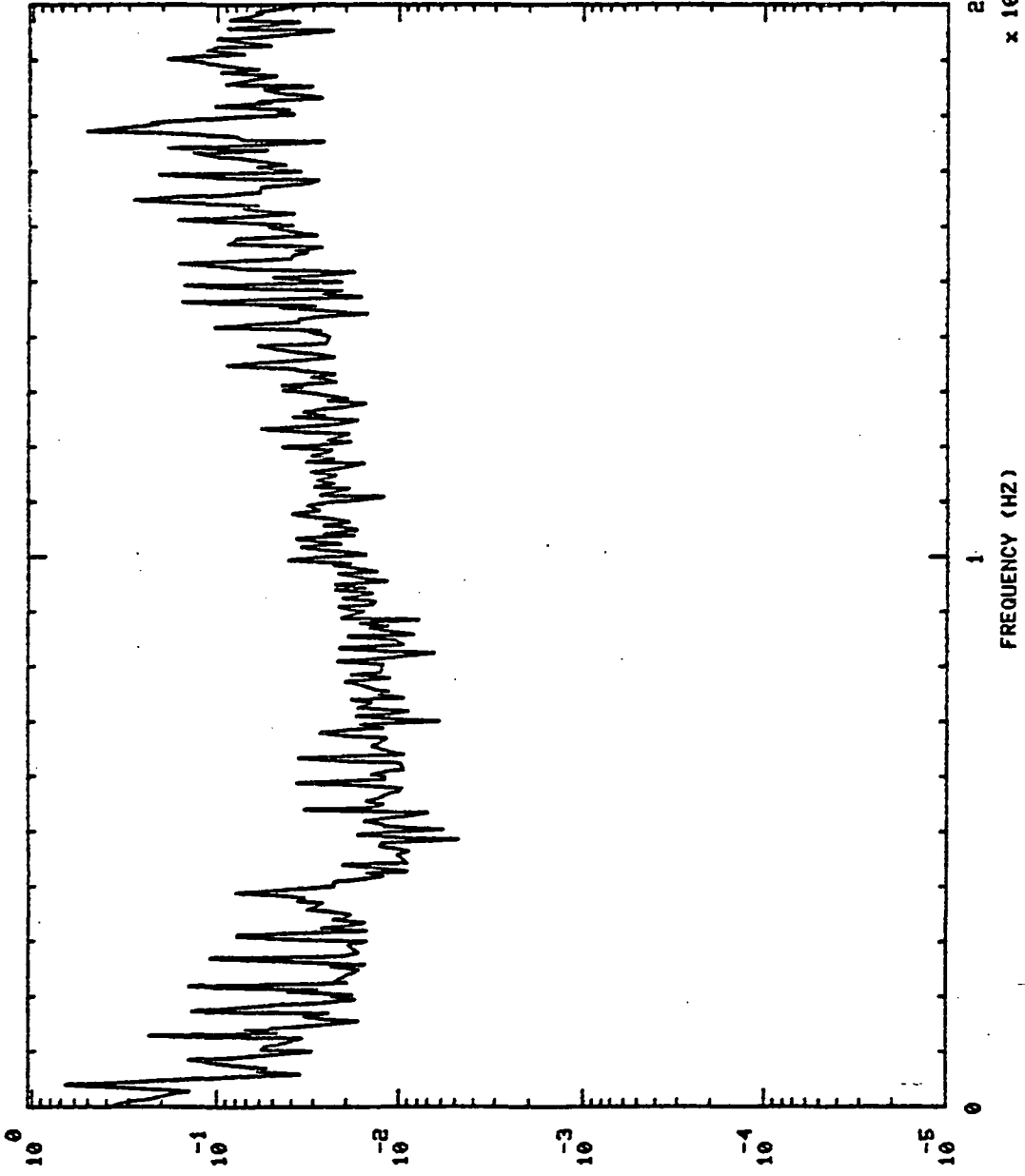


P S G \ H Z

S+ 90.0110,'S

FPB PC

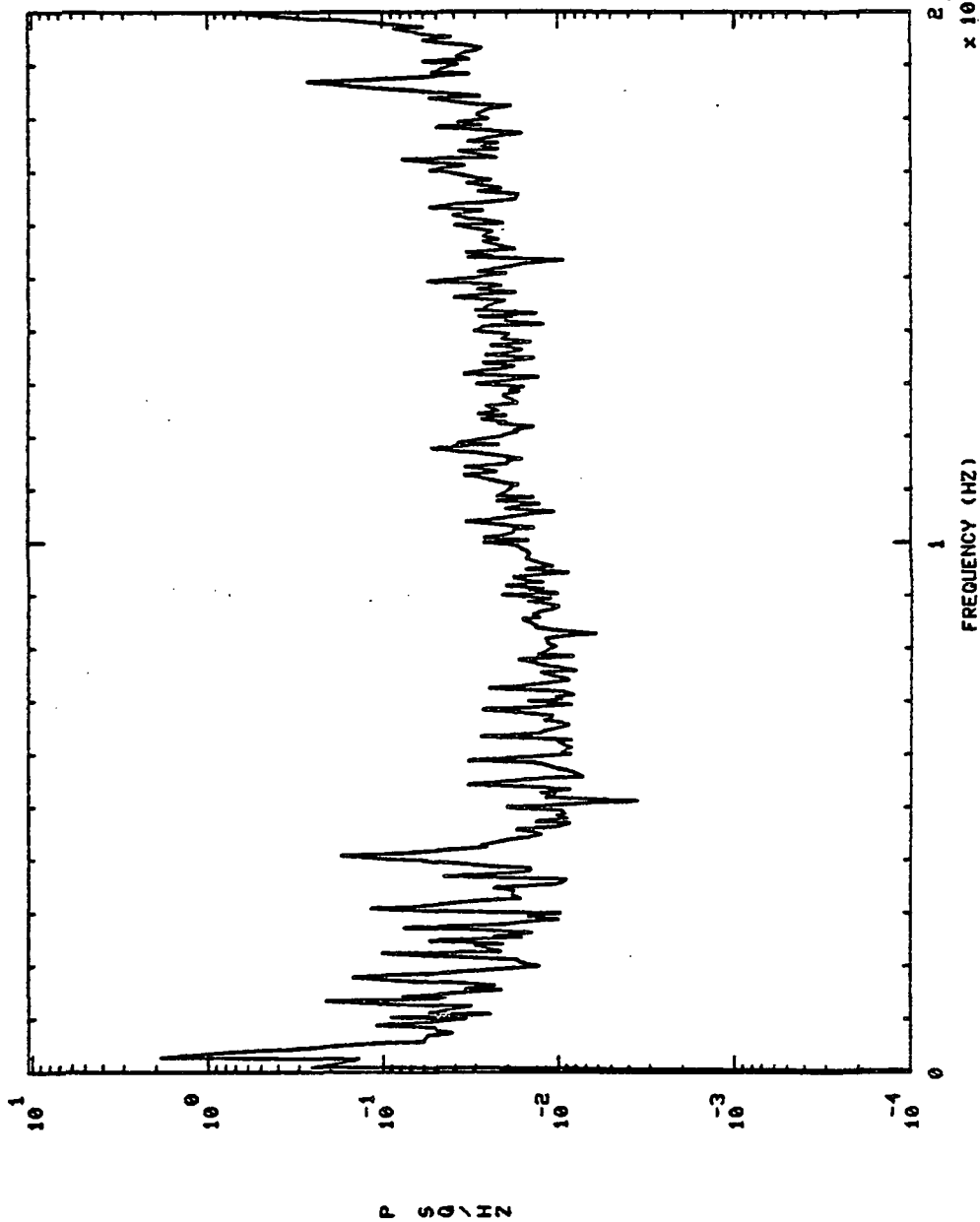
750132



P SQ/HZ

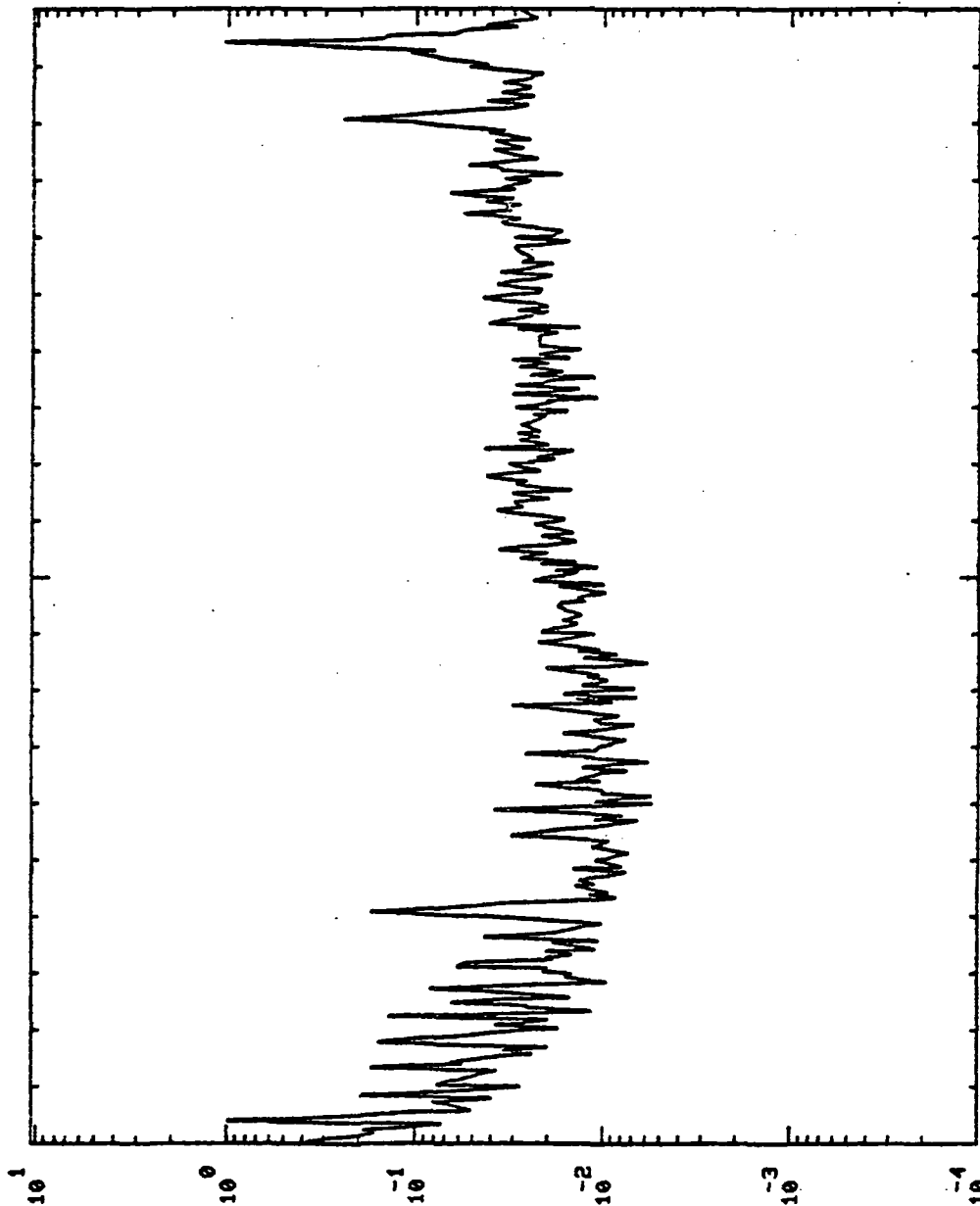
S+ 150.01H0,'S

750132 FPB PC



S+ 260.01H0,'S

750132 FFB PC



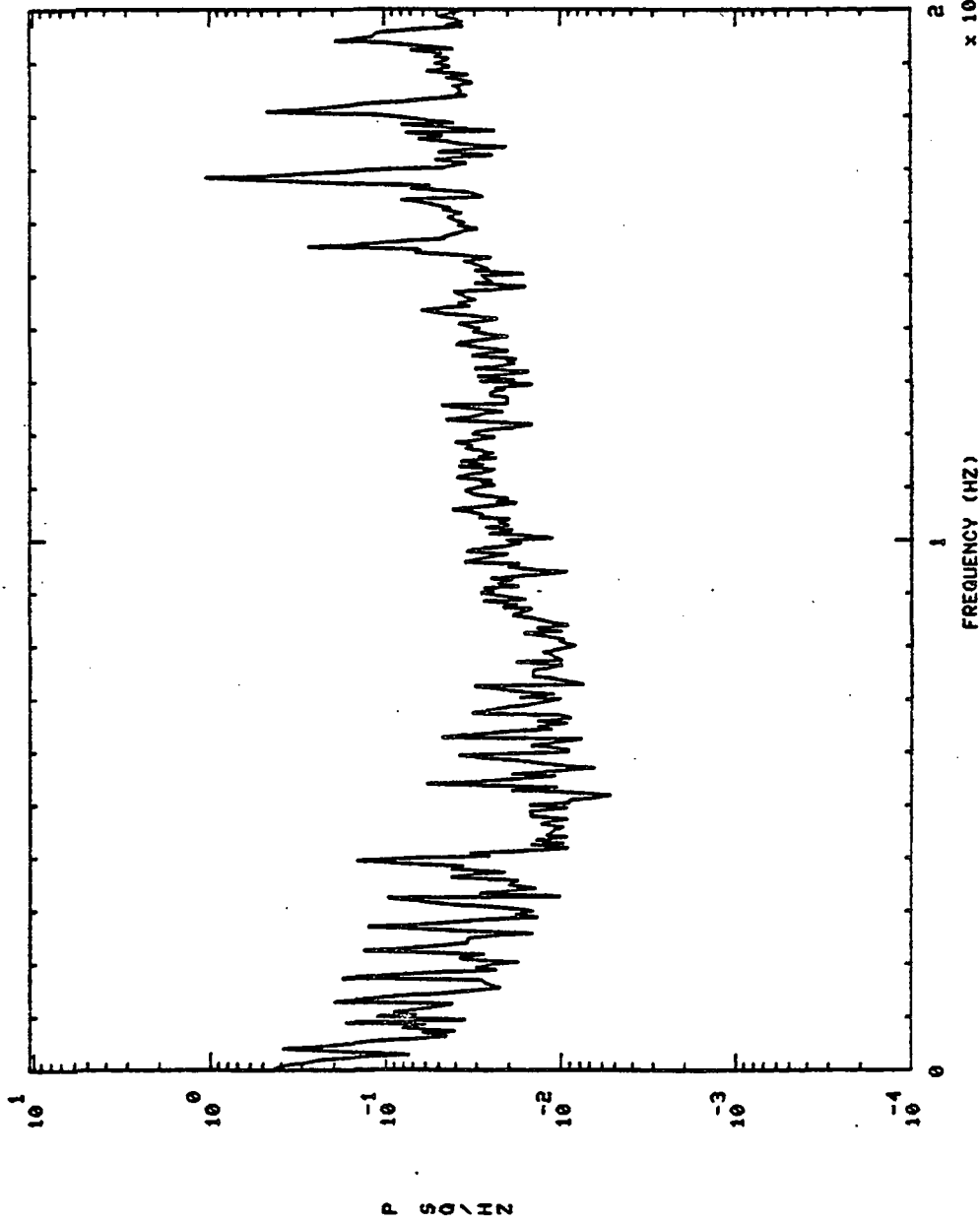
2^4
 $\times 10$

FREQUENCY (HZ)

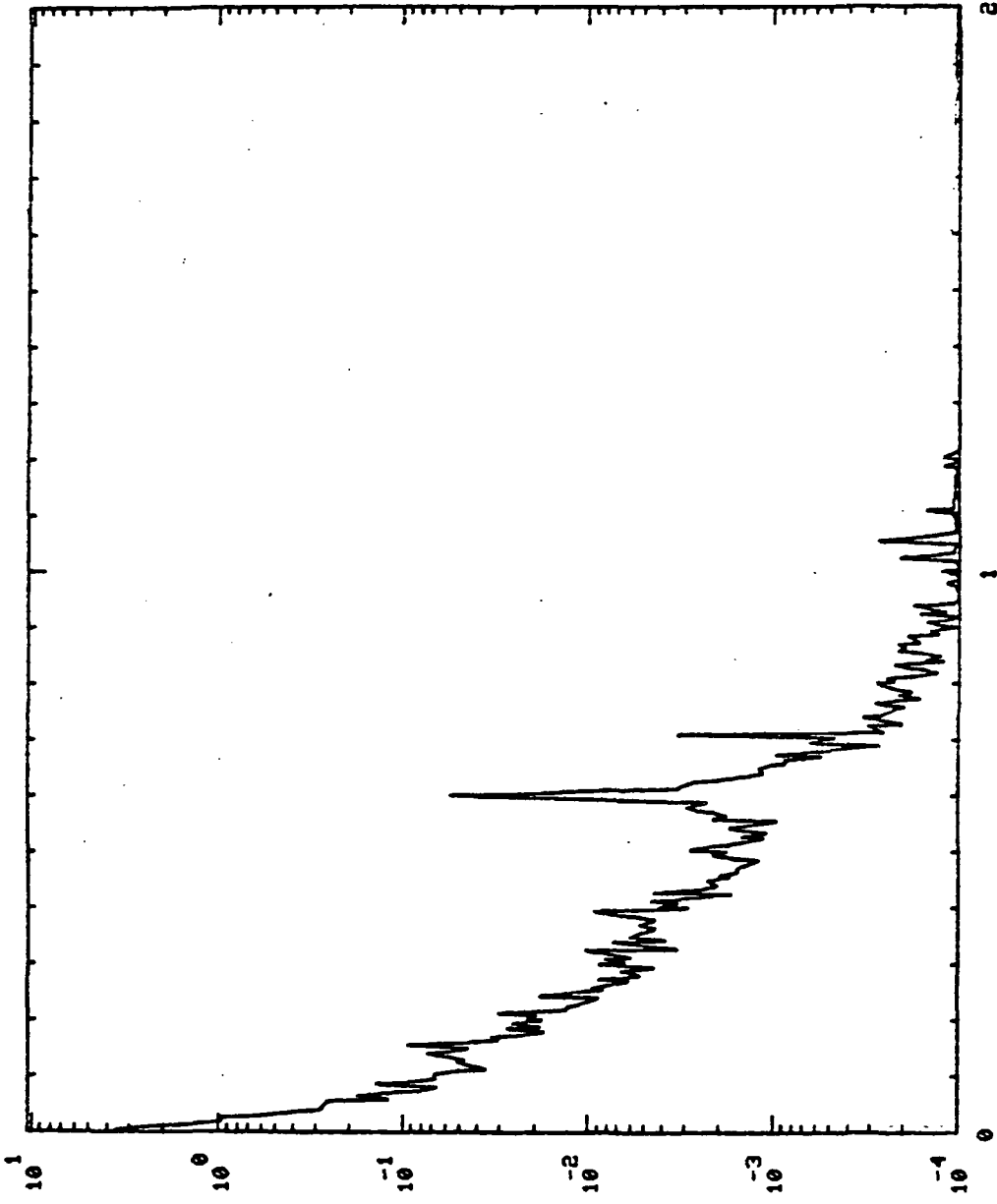
P S D \ HZ

S+ 291.01H0,'S

750132 FPB PC



750132 MCC FUEL INJ PR S+ 10.01H0,'S

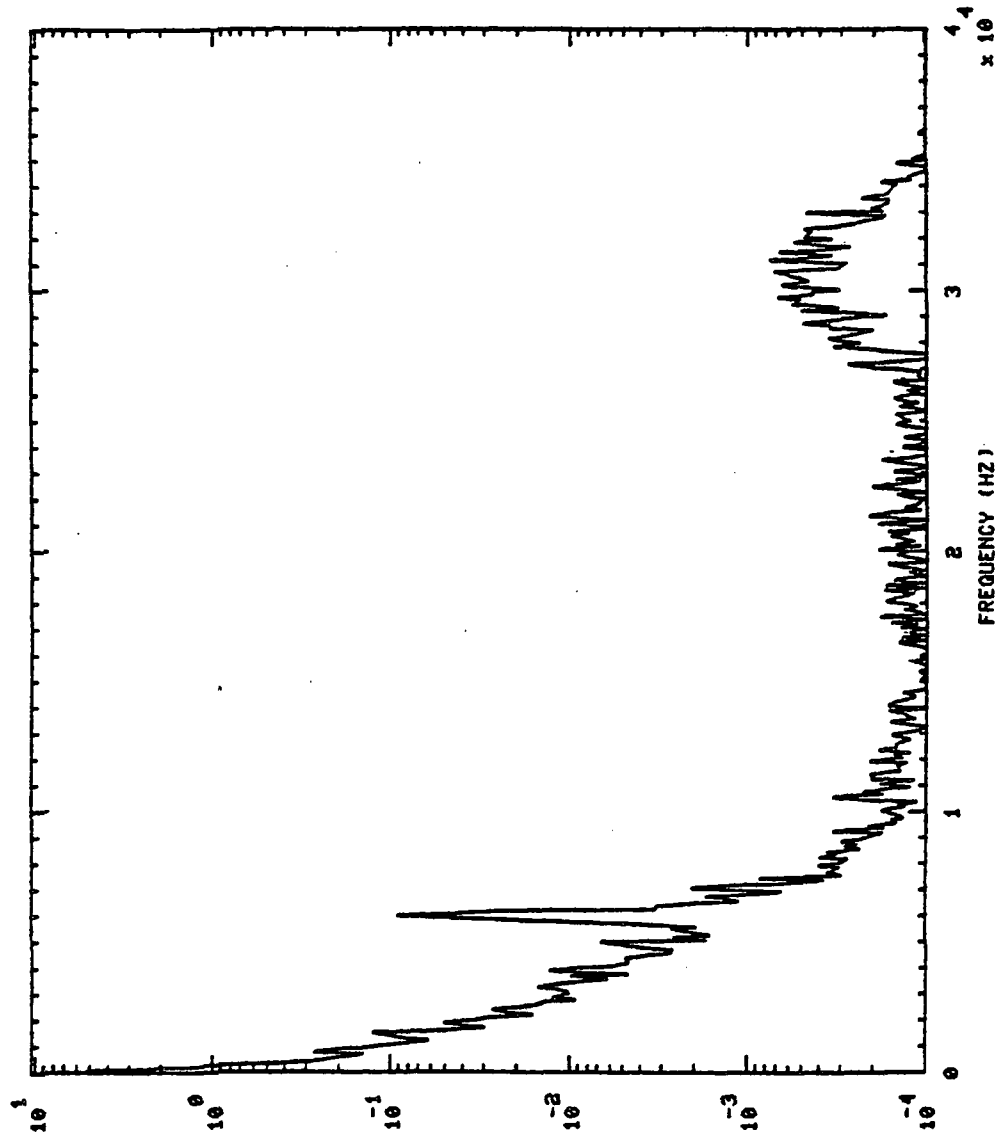


P SQ / HZ

FREQUENCY (HZ)

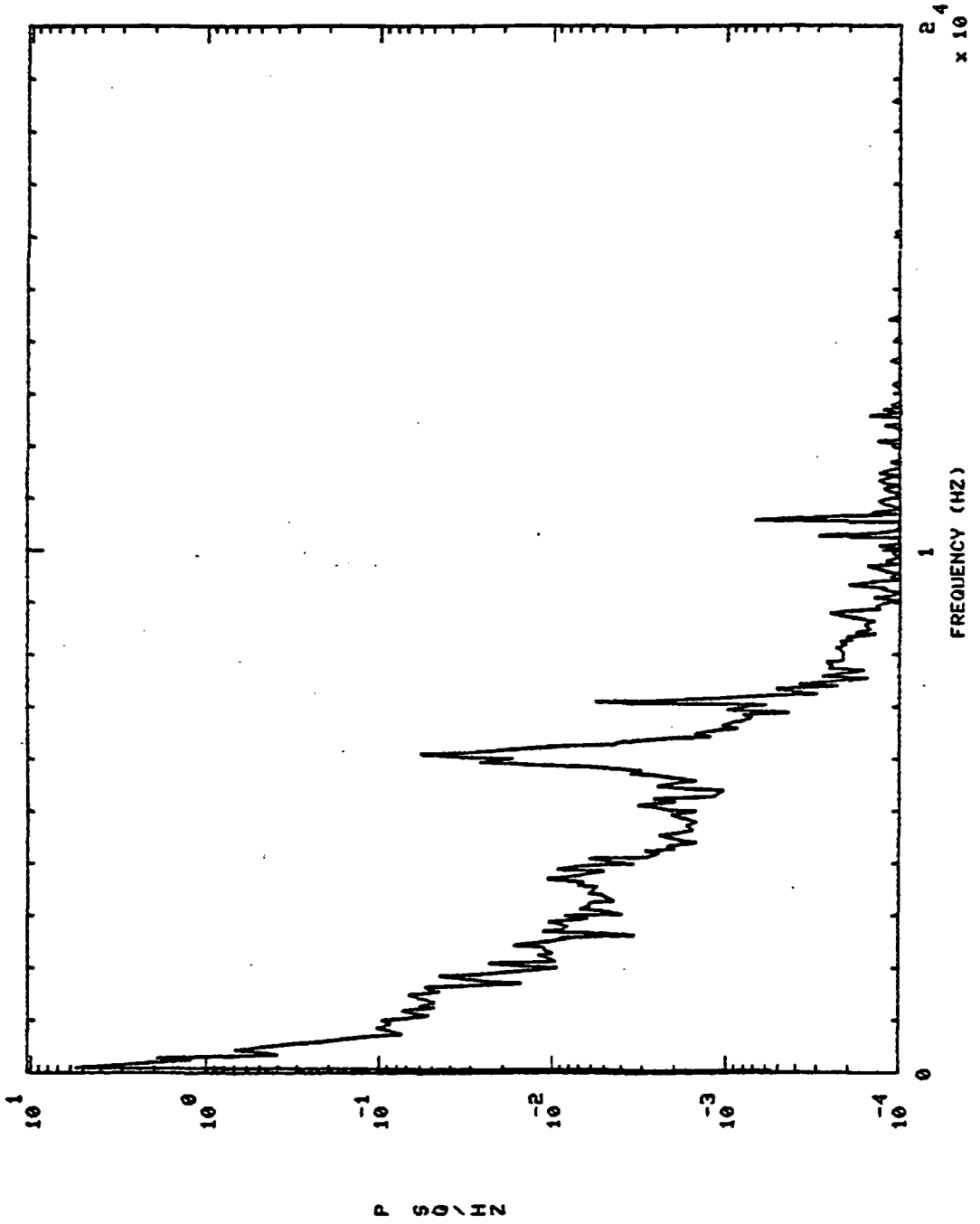
x 10⁴

750132 MCC FUEL INJ PR S+ 10.01H0.'S

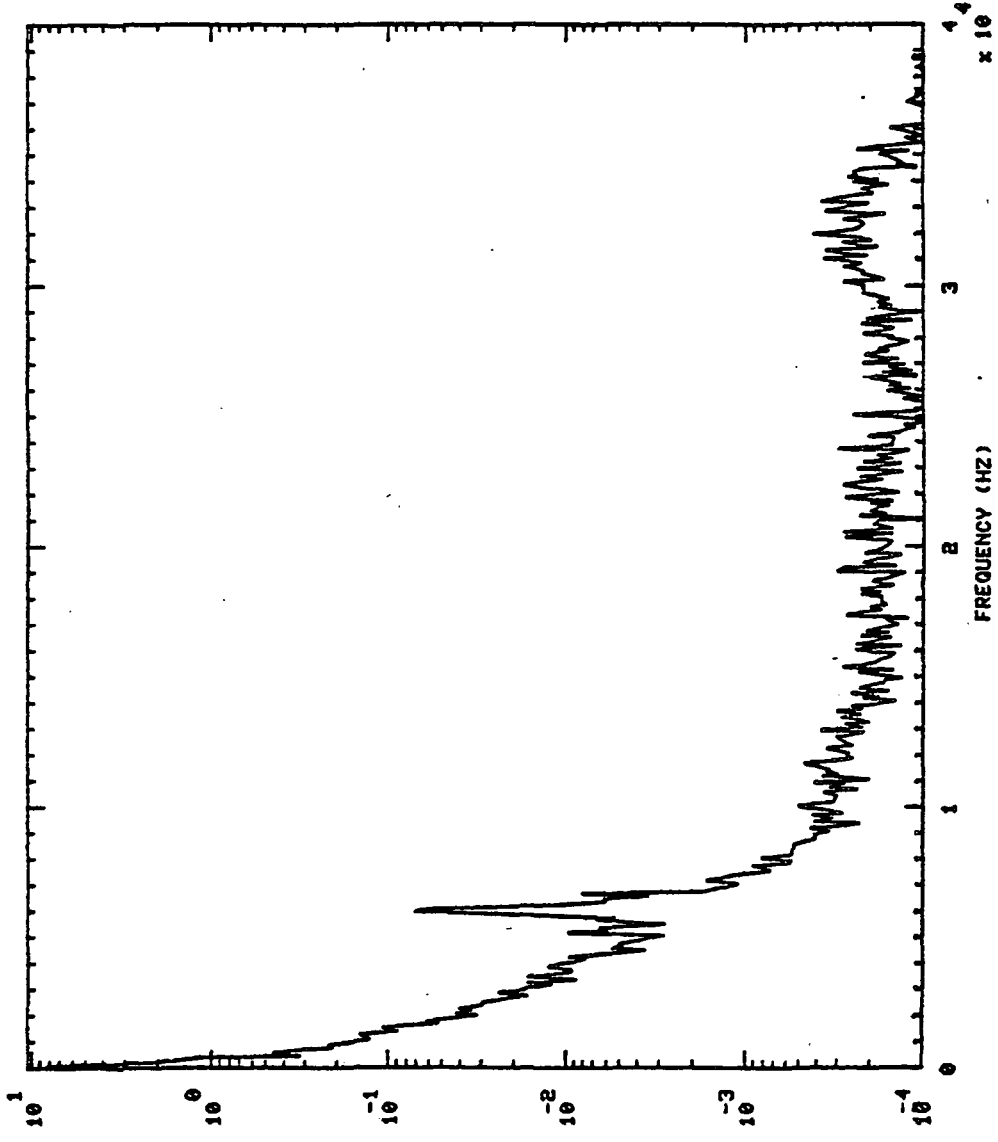


P S D \ HZ

750132 MCC FUEL INJ PR S+ 90.01H0,'S

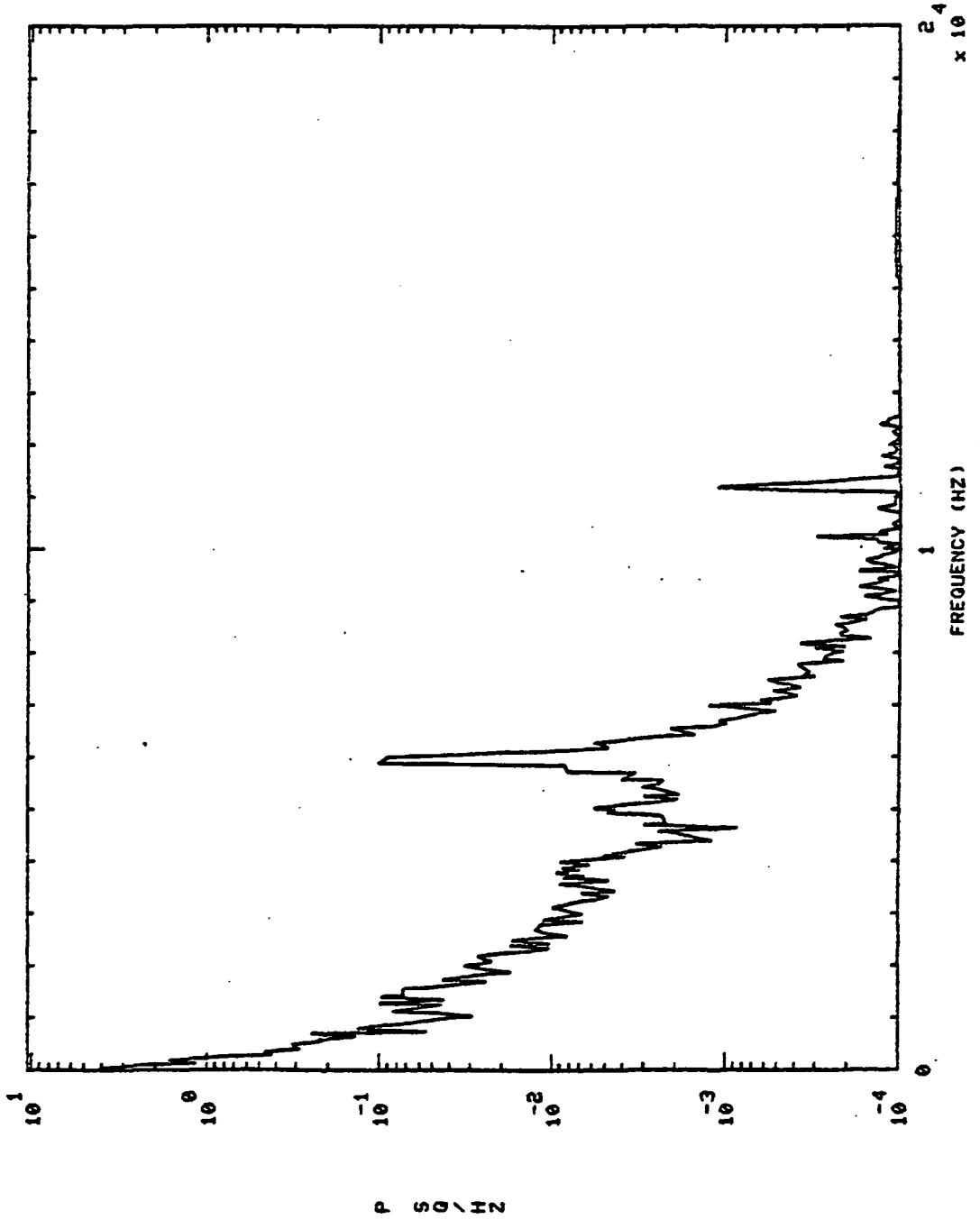


750132 MCC FUEL INJ PR S+ 90.01H0'S

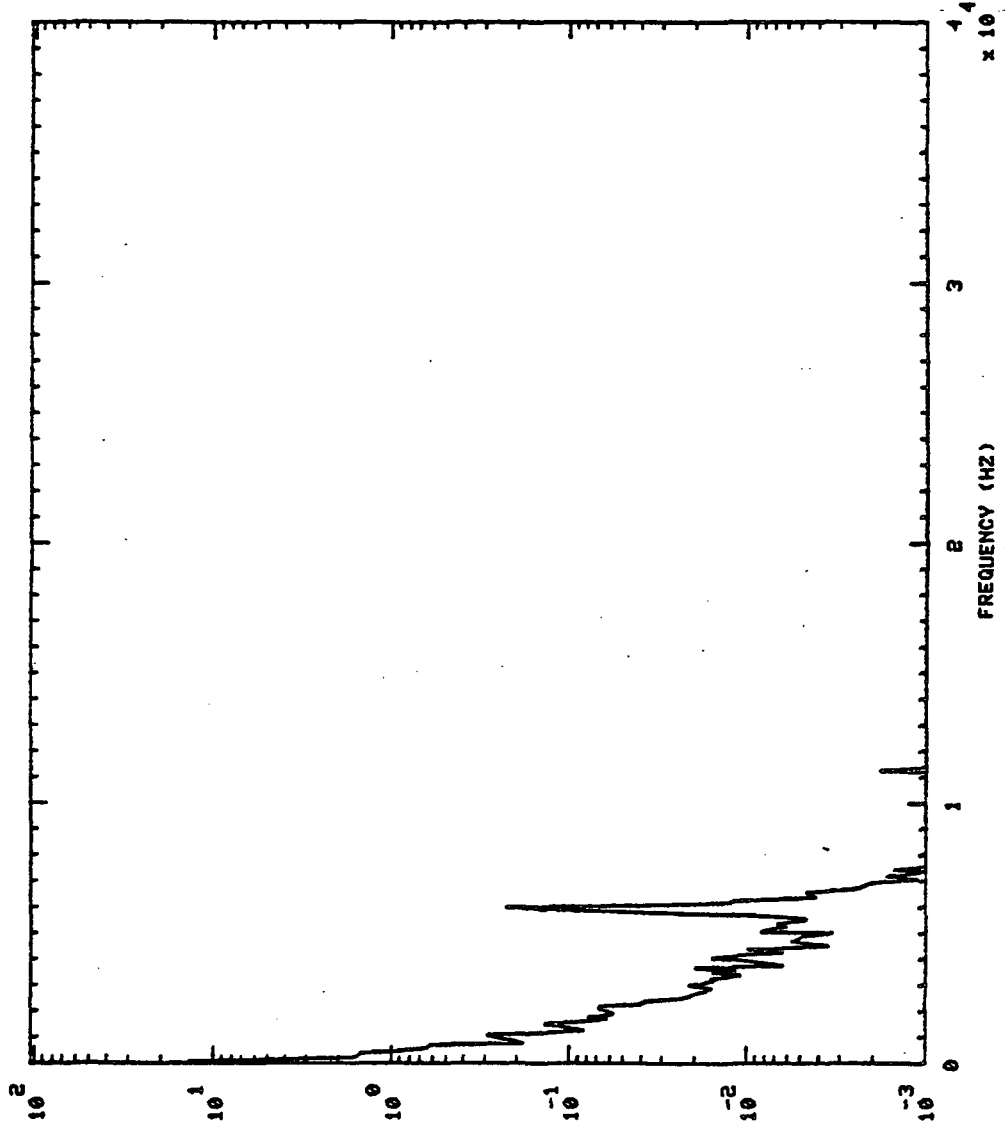


P G²/HZ

750132 MCC FUEL INJ PR S+ 150.01H0,'S



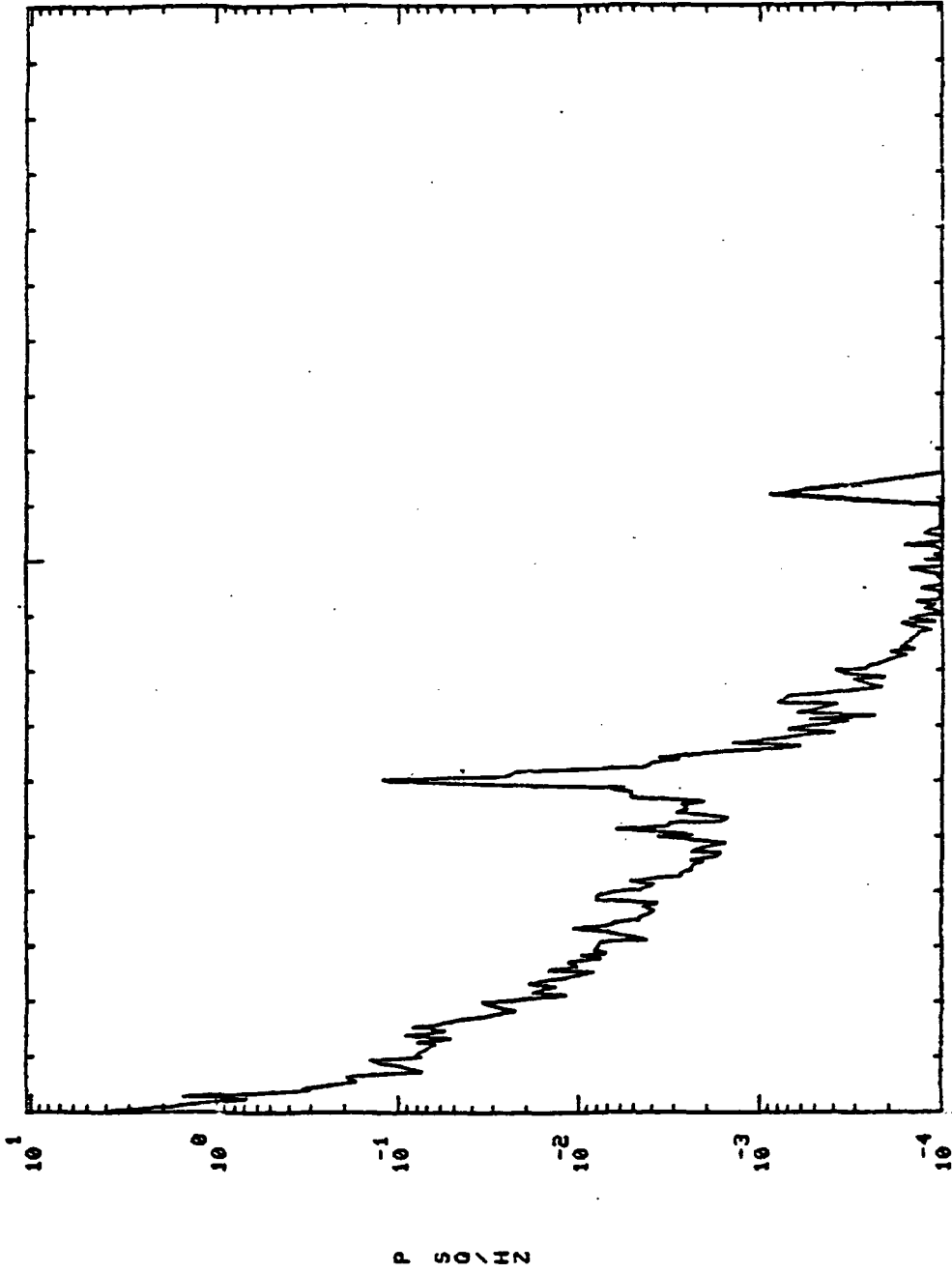
750132 MDC FUEL INJ PR S+ 150.01H0,'S



P S O \ H N

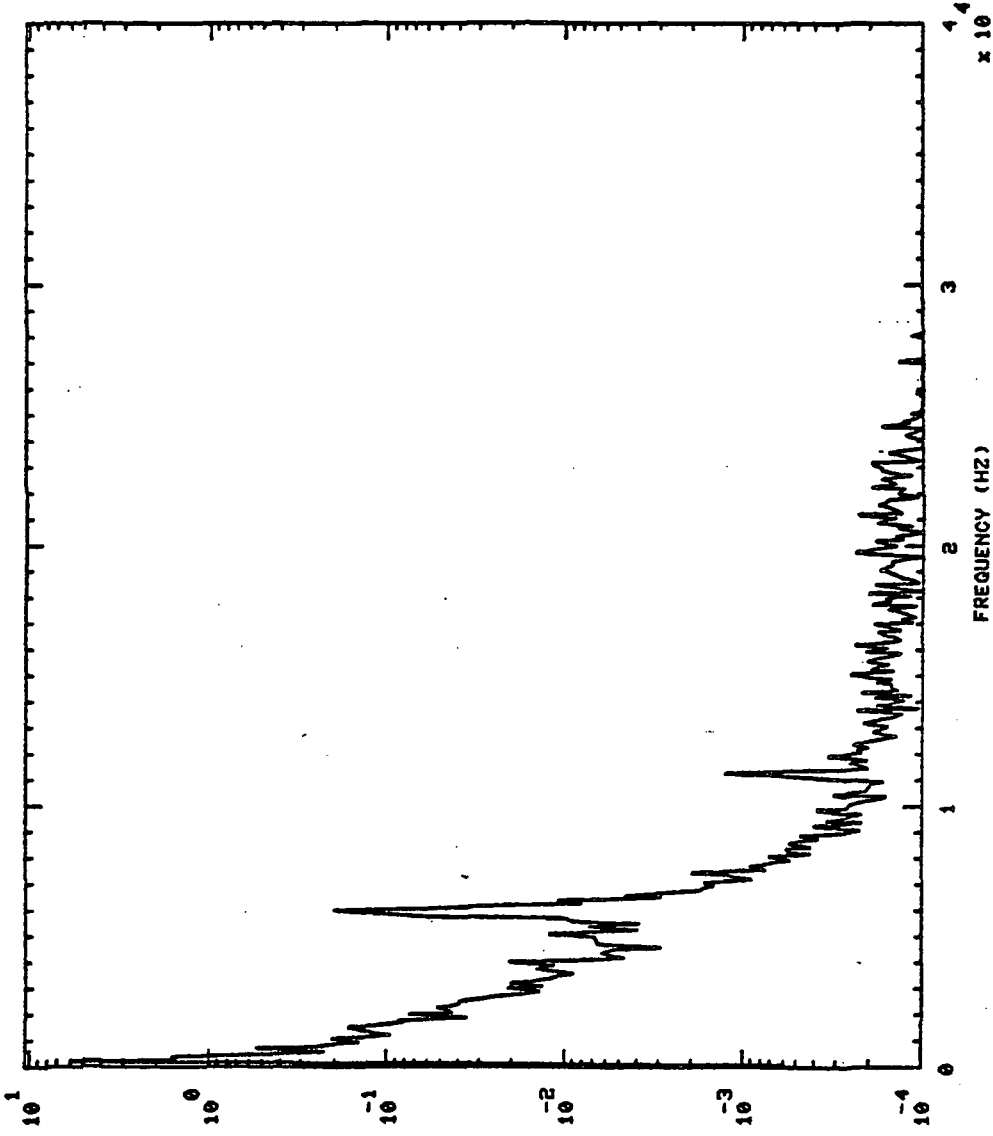
S+ 260.01H0,'S

750132 MCC FUEL INJ PR



S+ 260.01H0,'S

750132 MCC FUEL INJ PR

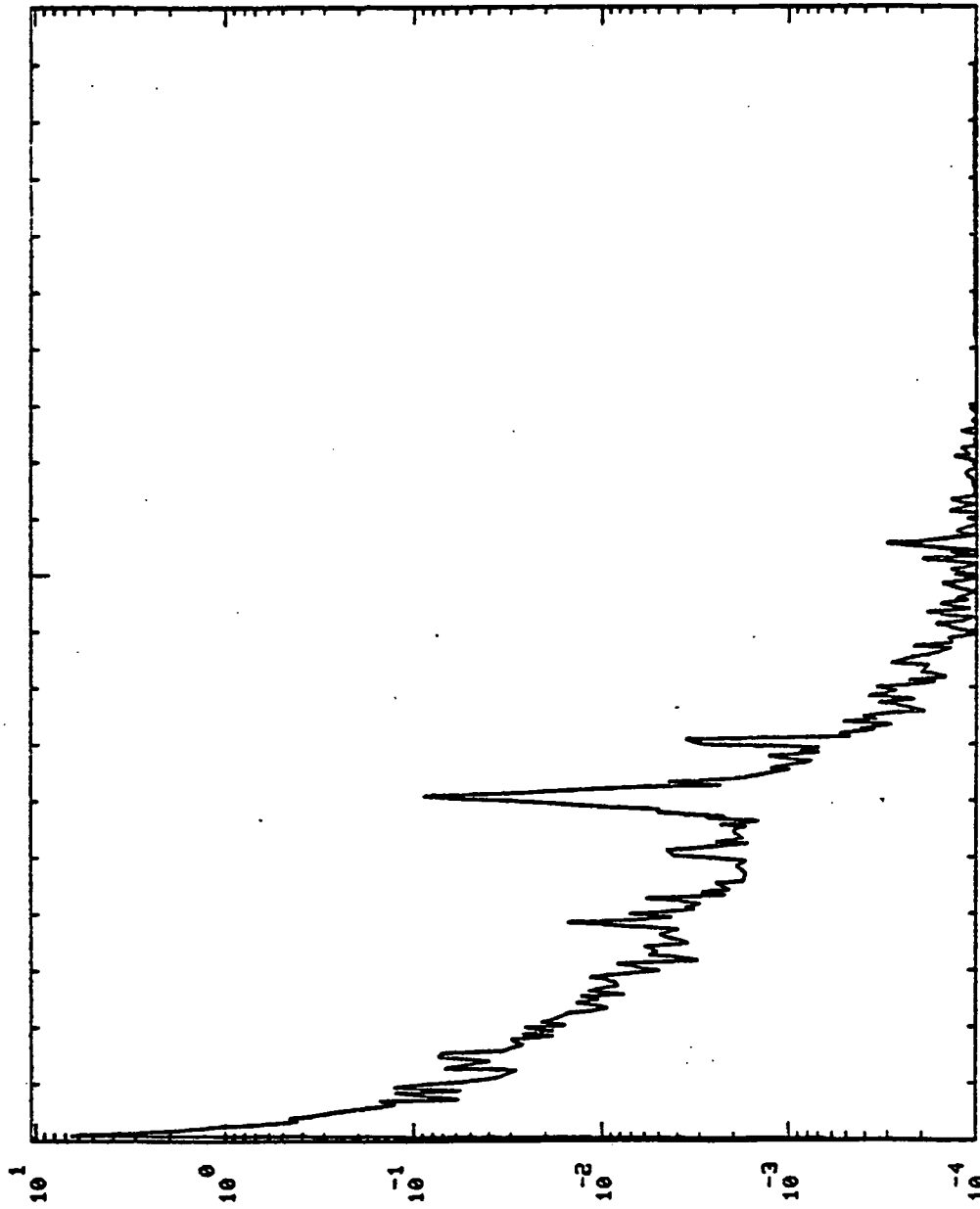


P S Q \ H Z

S+ 291.01H0,'S

MCC FUEL INJ PR

750132

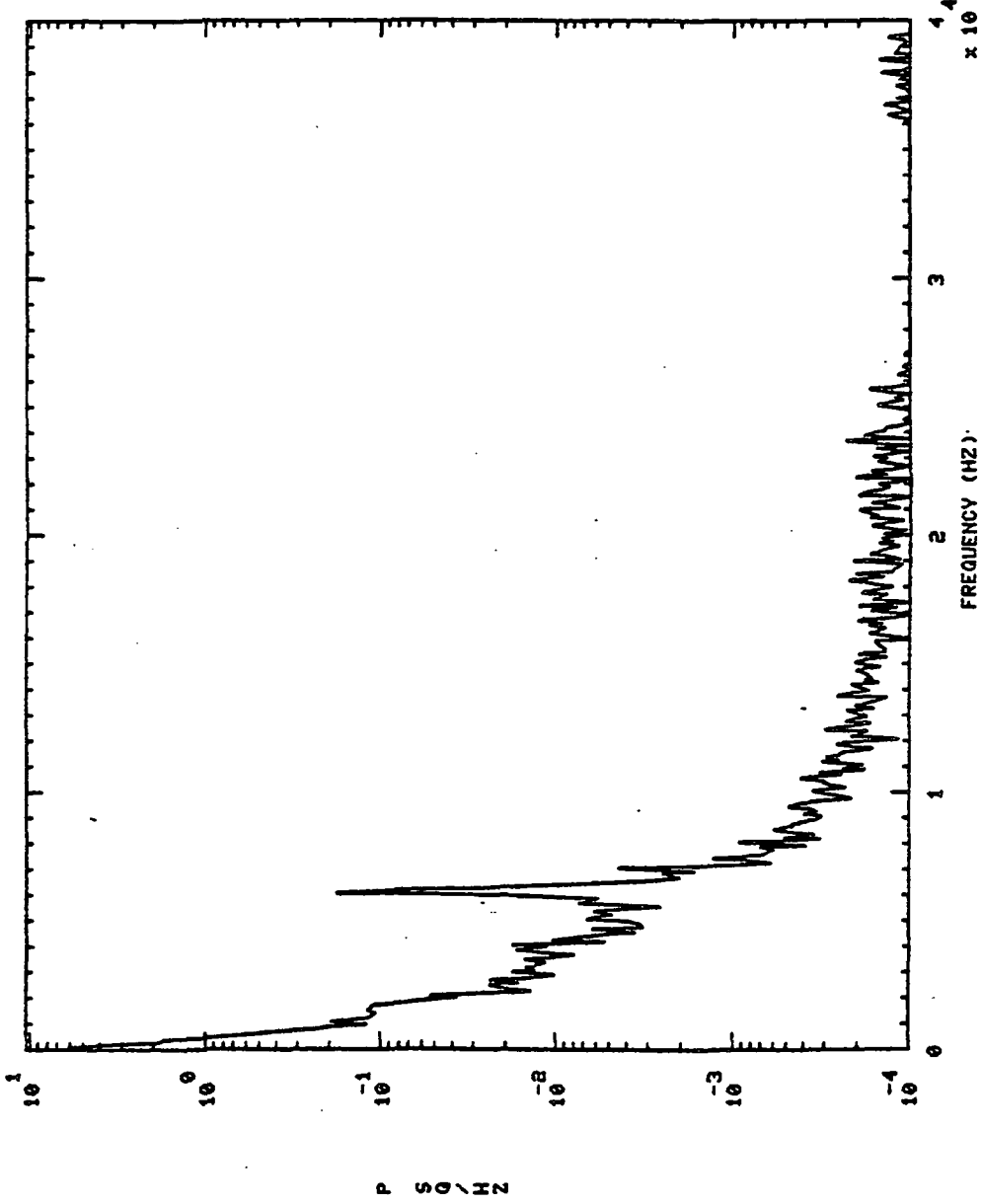


2 4
x 10

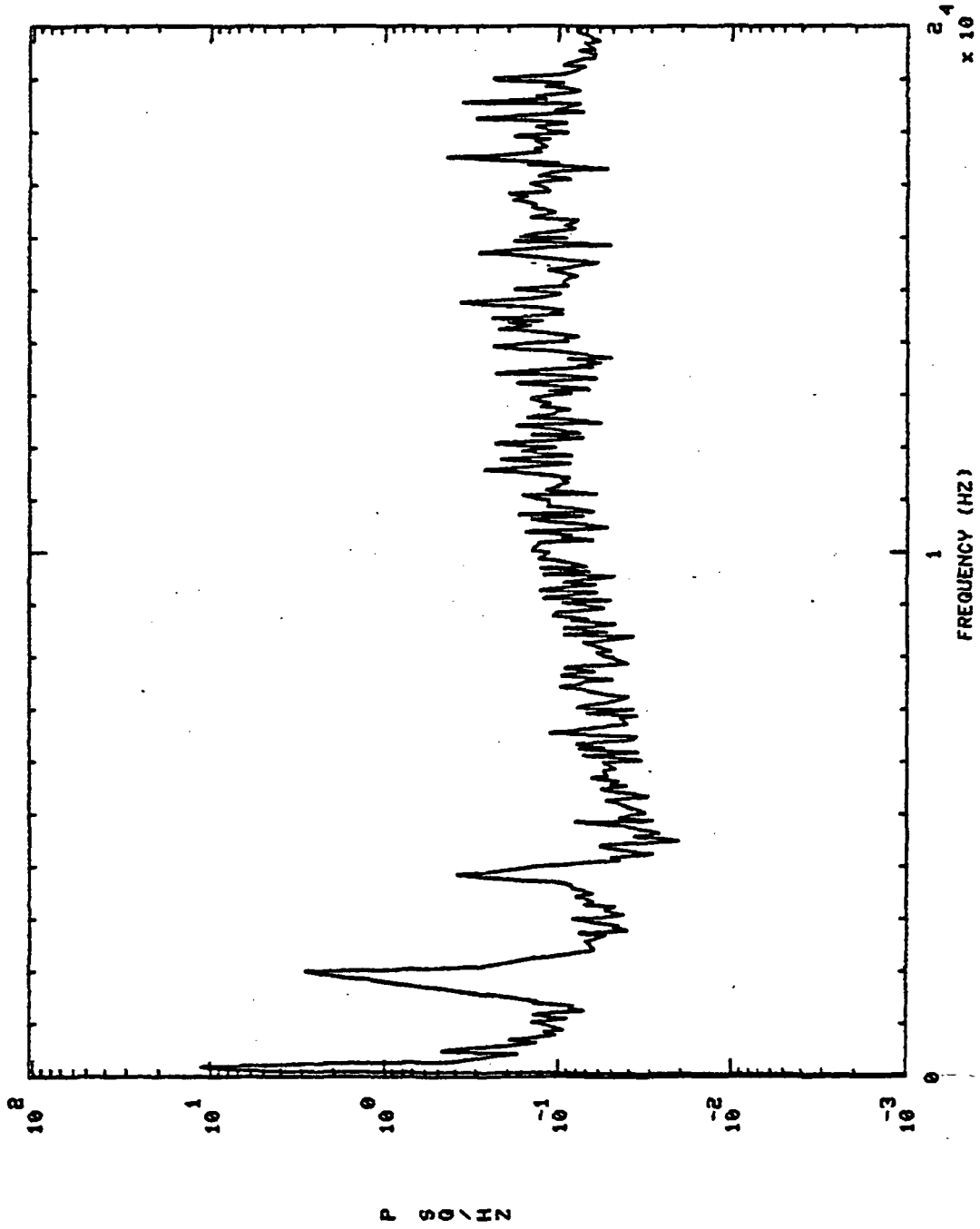
1
FREQUENCY (HZ)

P S D \ H Z

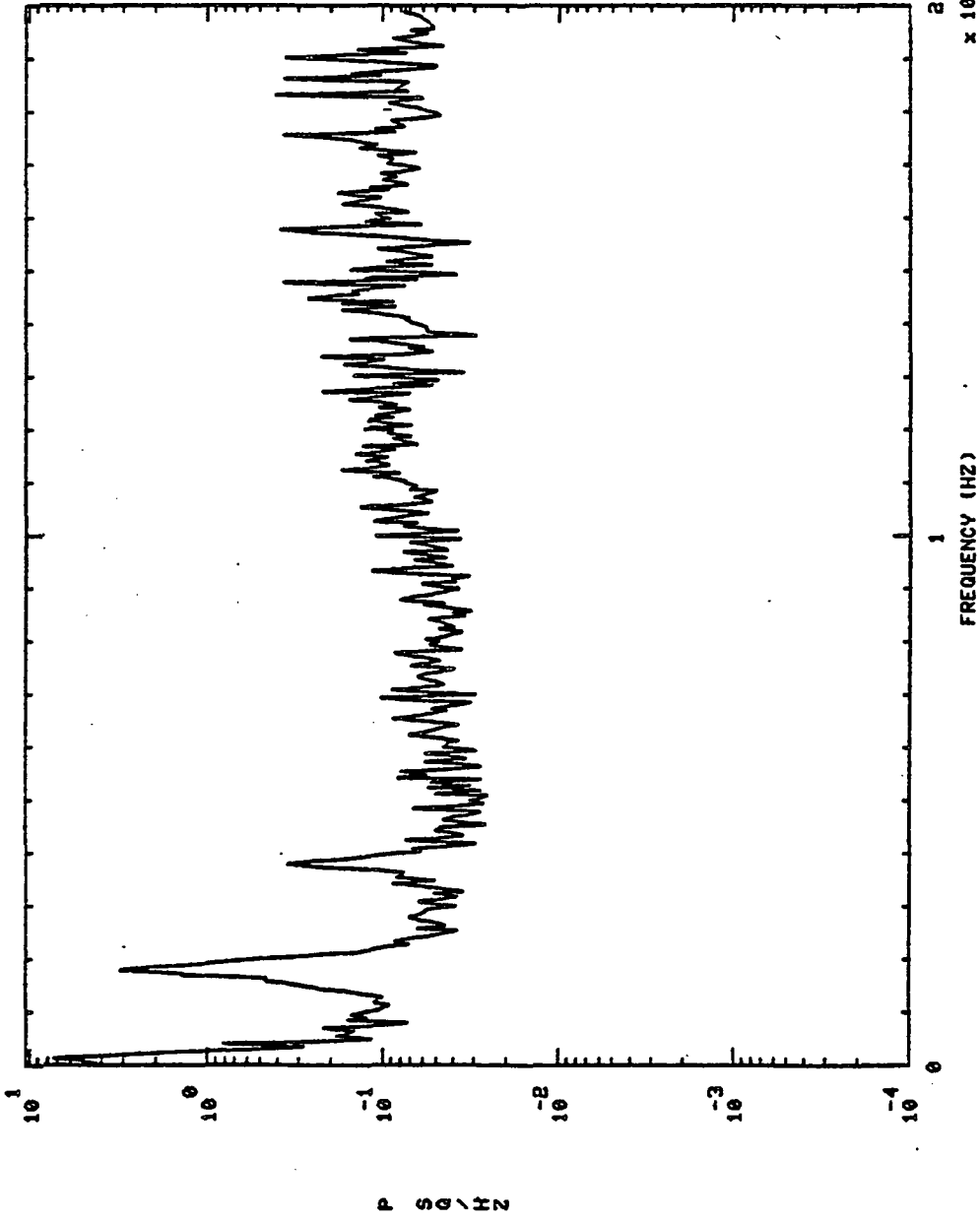
750132 MCC FUEL INJ PR. S+ 291.01H0,'S



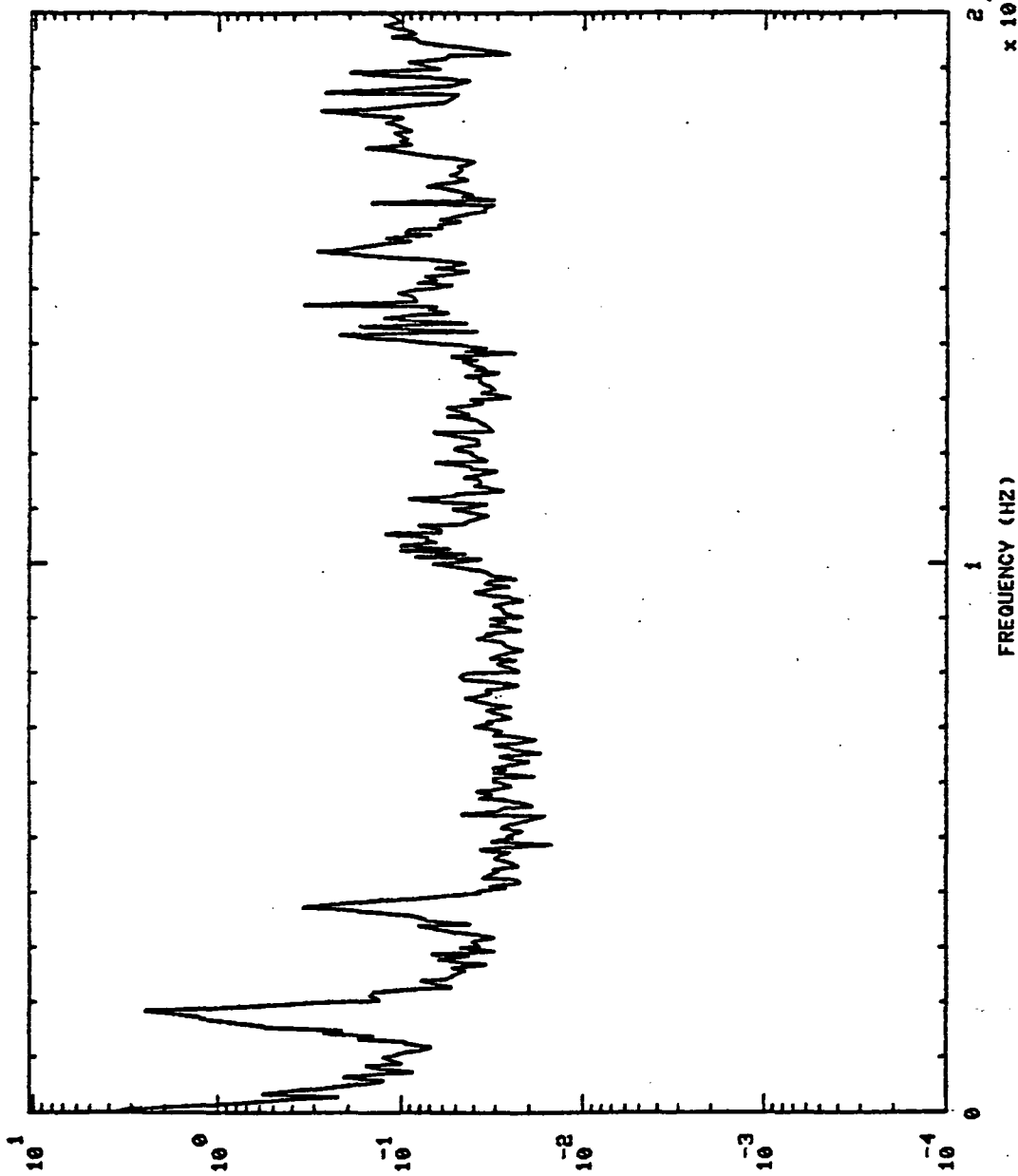
750132 OPB PC PR DC S+ 10.01H0.5



750132 OPB PC PR DC S+ 90.01H0,'S



750132 OPB PC PR DC S+ 150.01H0,'S



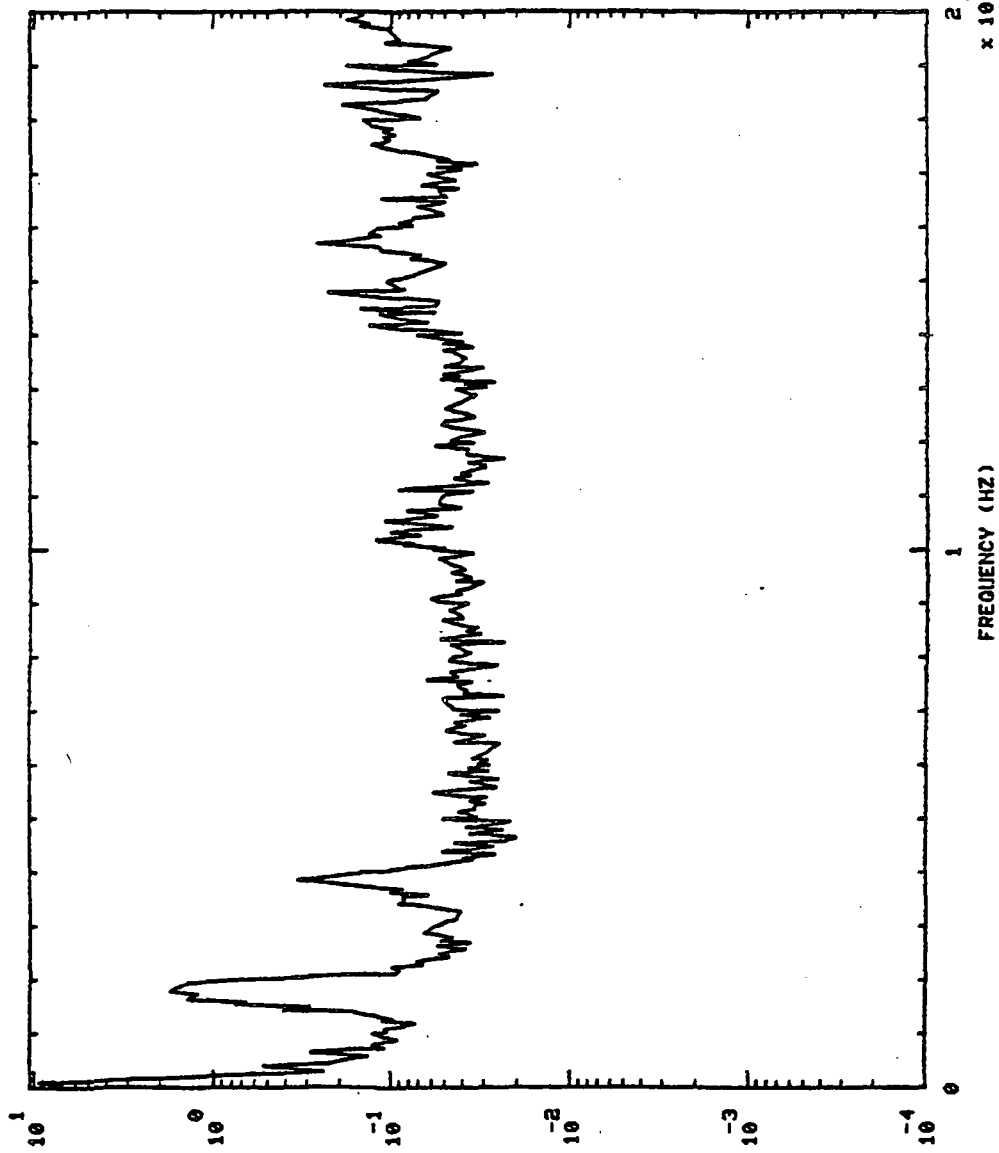
P S D / H Z

$10^{2.4}$
x 10^0

FREQUENCY (HZ)

5+ 260.0110,'S

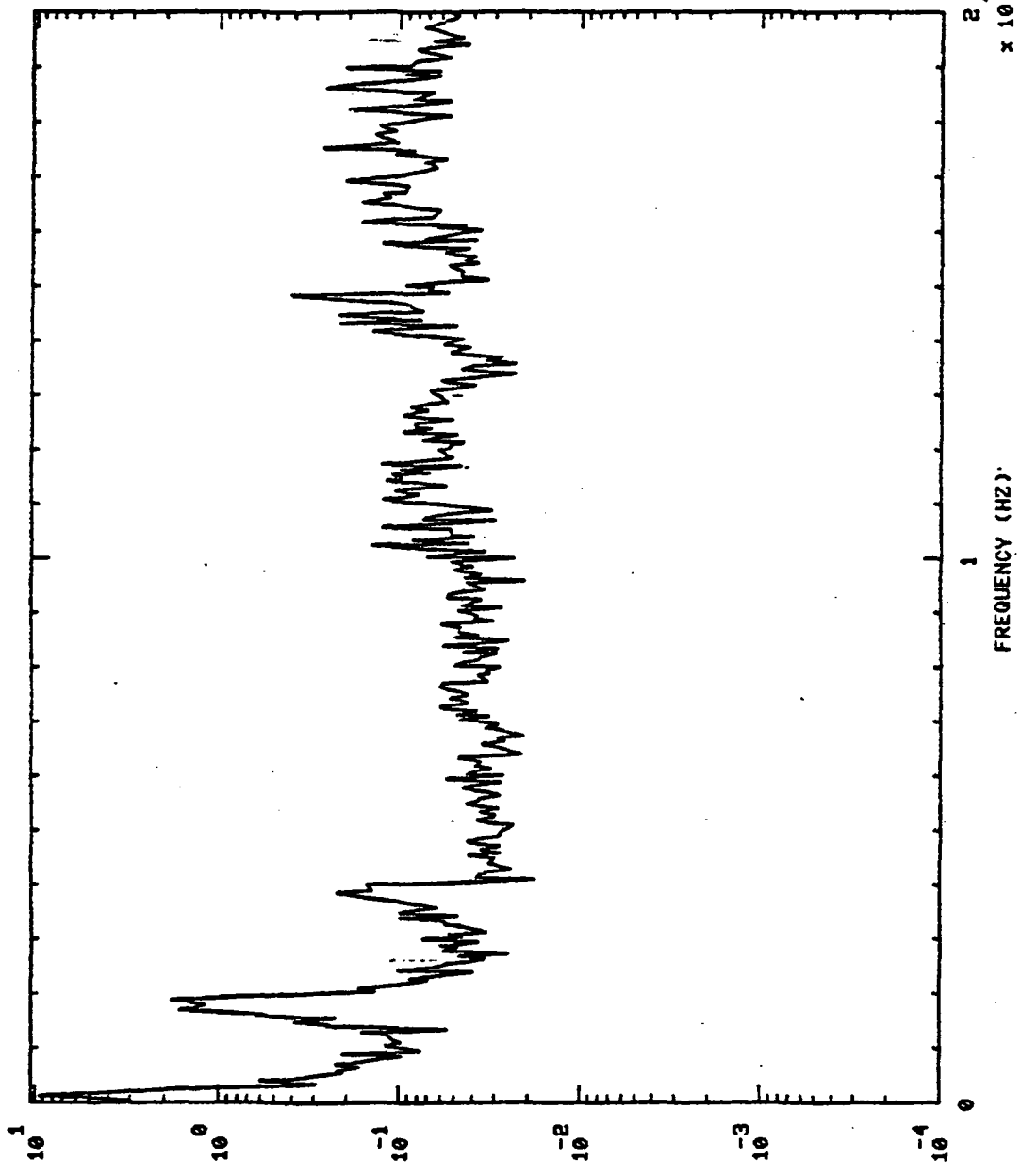
75013B OPB PC PR DC



P S O \ H Z

FREQUENCY (HZ)
x 10⁴

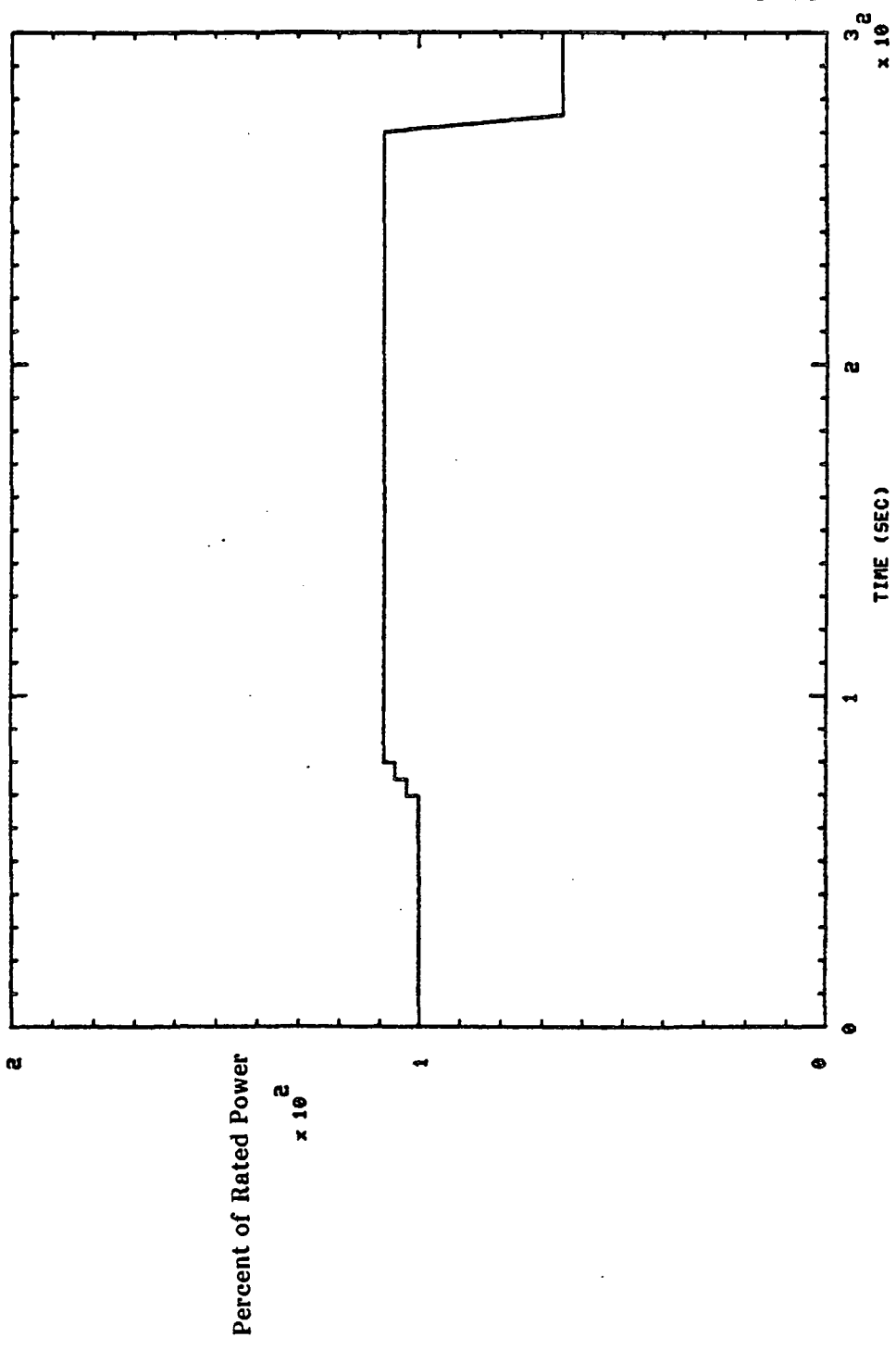
750132 OPB PC PR DC S+ 291.01H0.'S



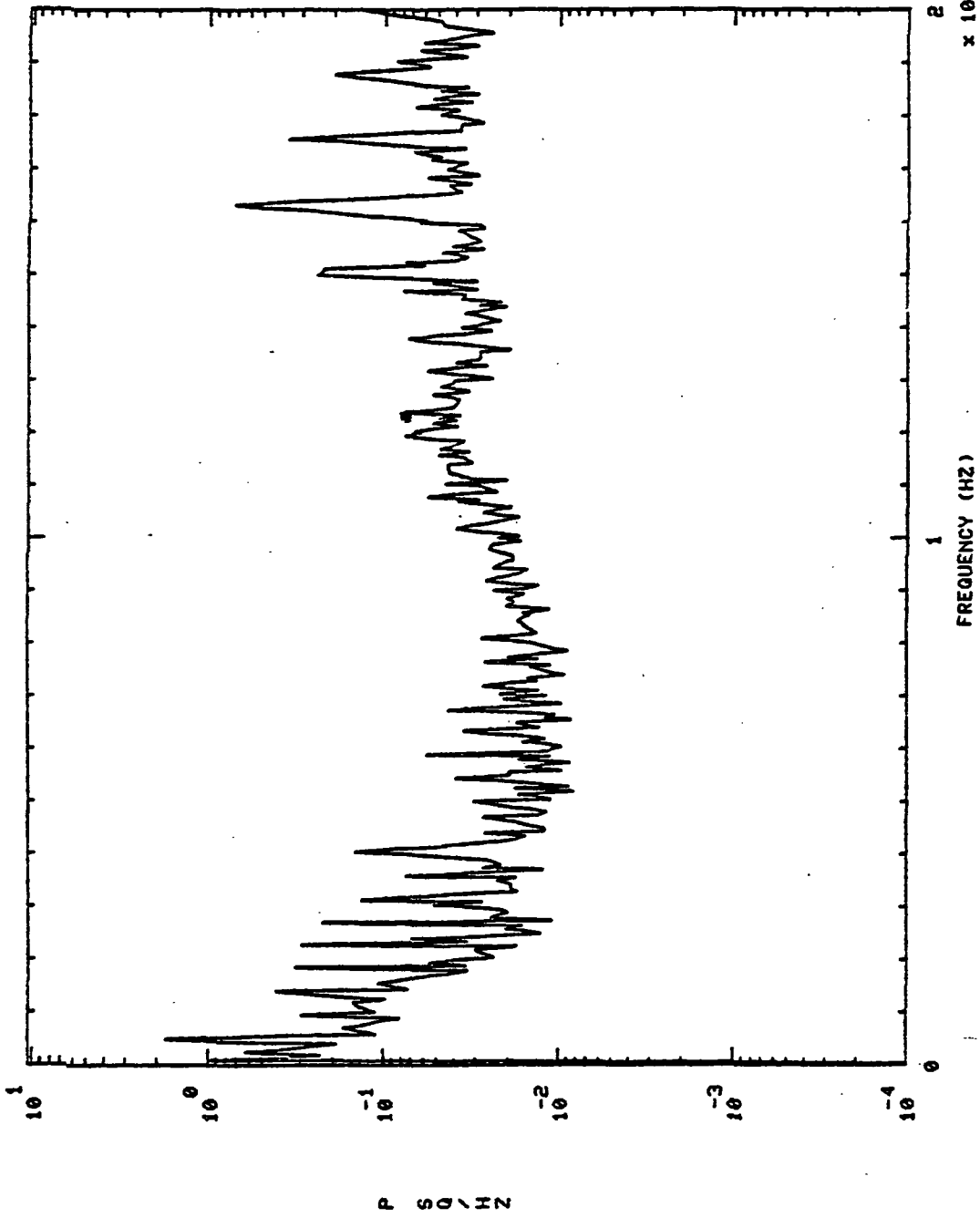
P S D / HZ

FREQUENCY (HZ) x 10⁴

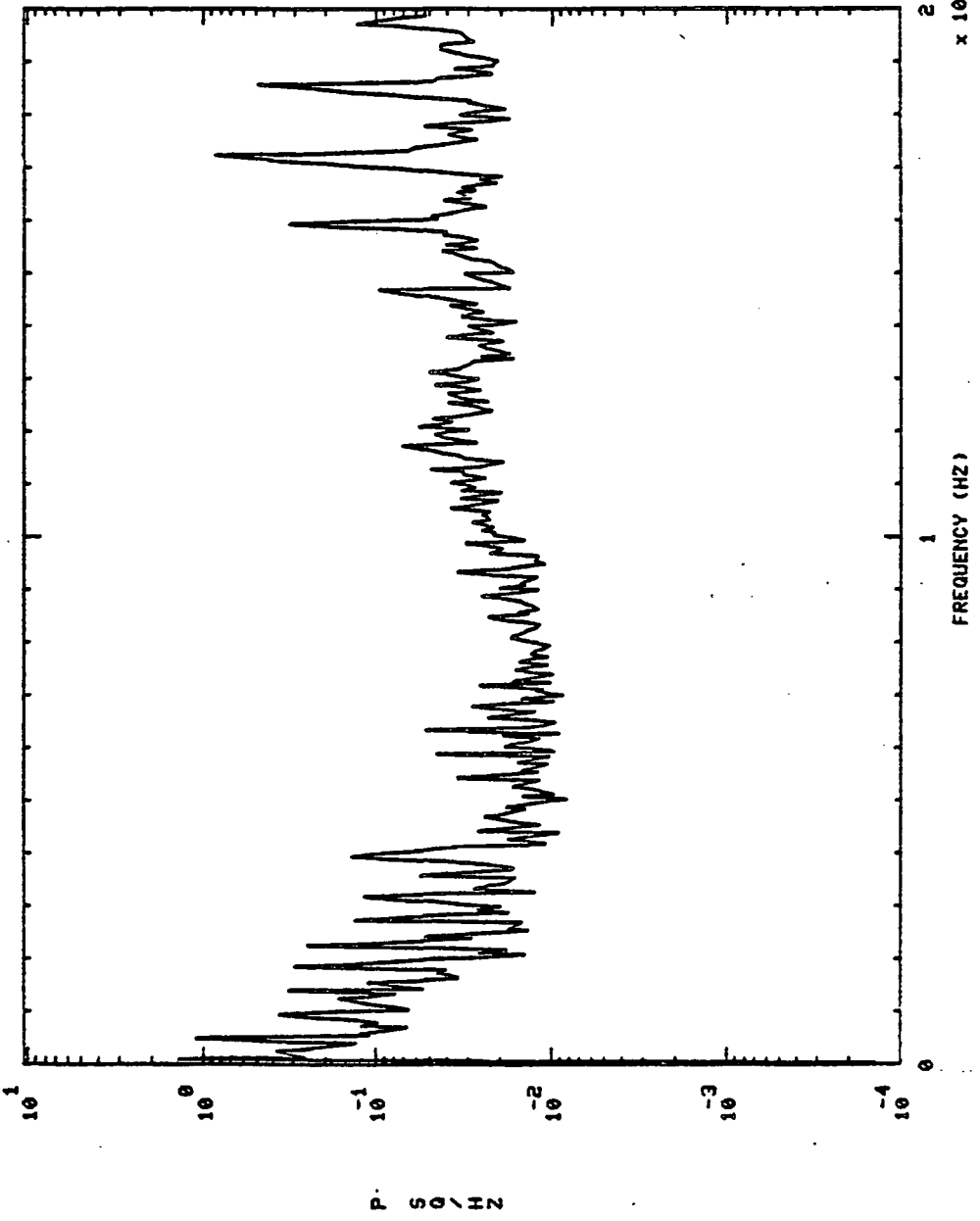
750133 THRUST (UNFILTERED)



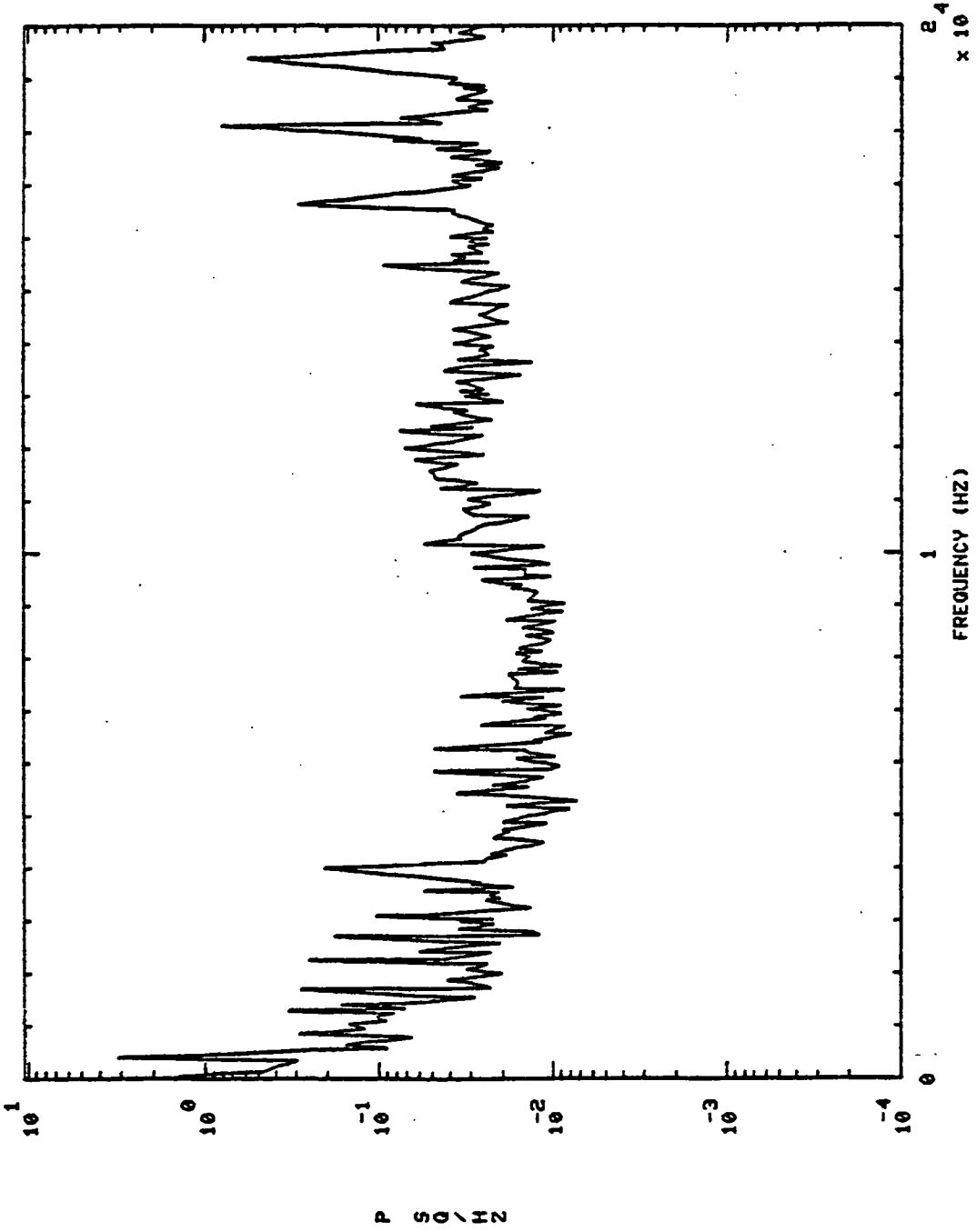
750133 FFB PC S+ 6.01HQ, 'S



750133 FPB PC S+ 71.01H0,'S

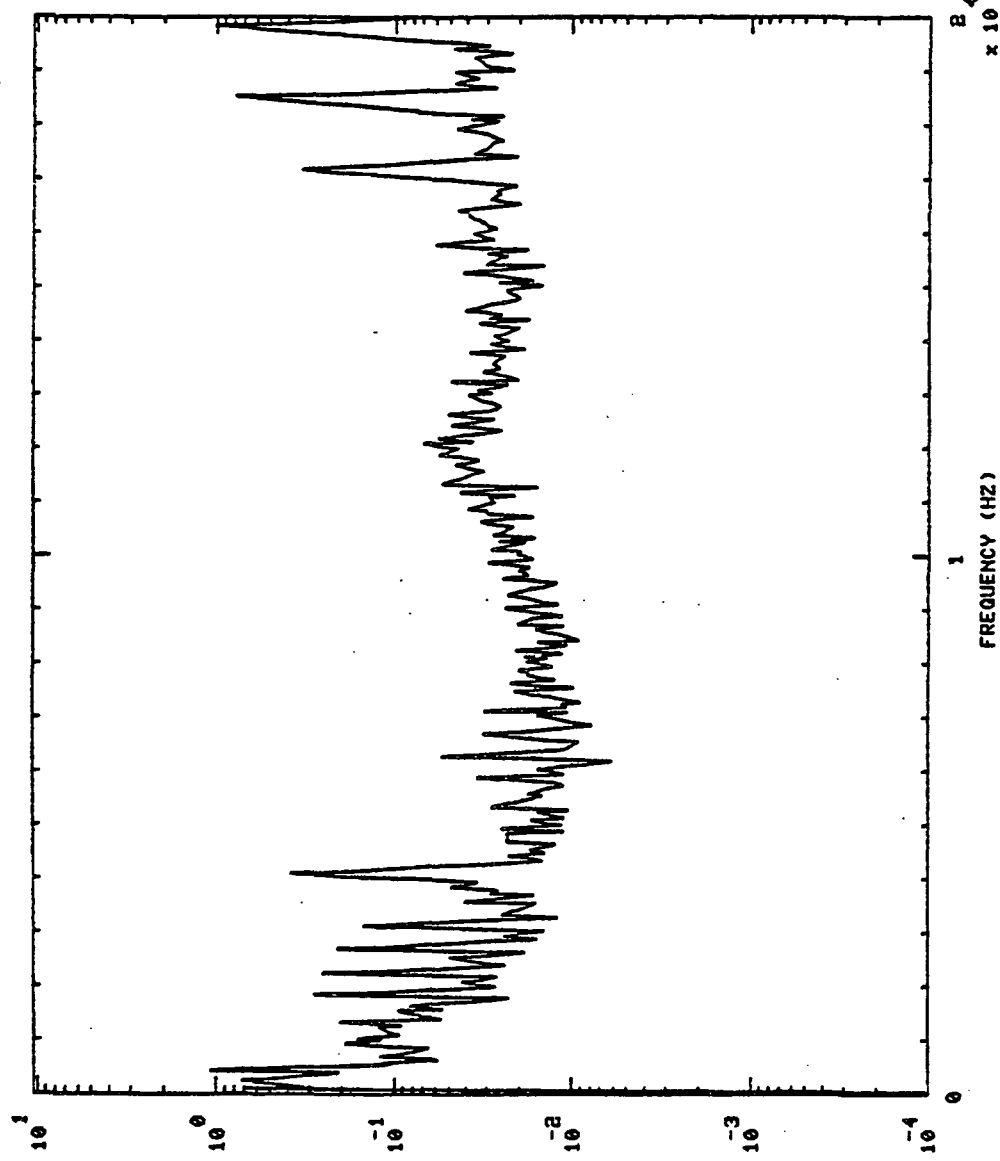


750133 FPB PC S+ 76.01H0,'S



S+ 150.01H0,'S

750133 FPB PC

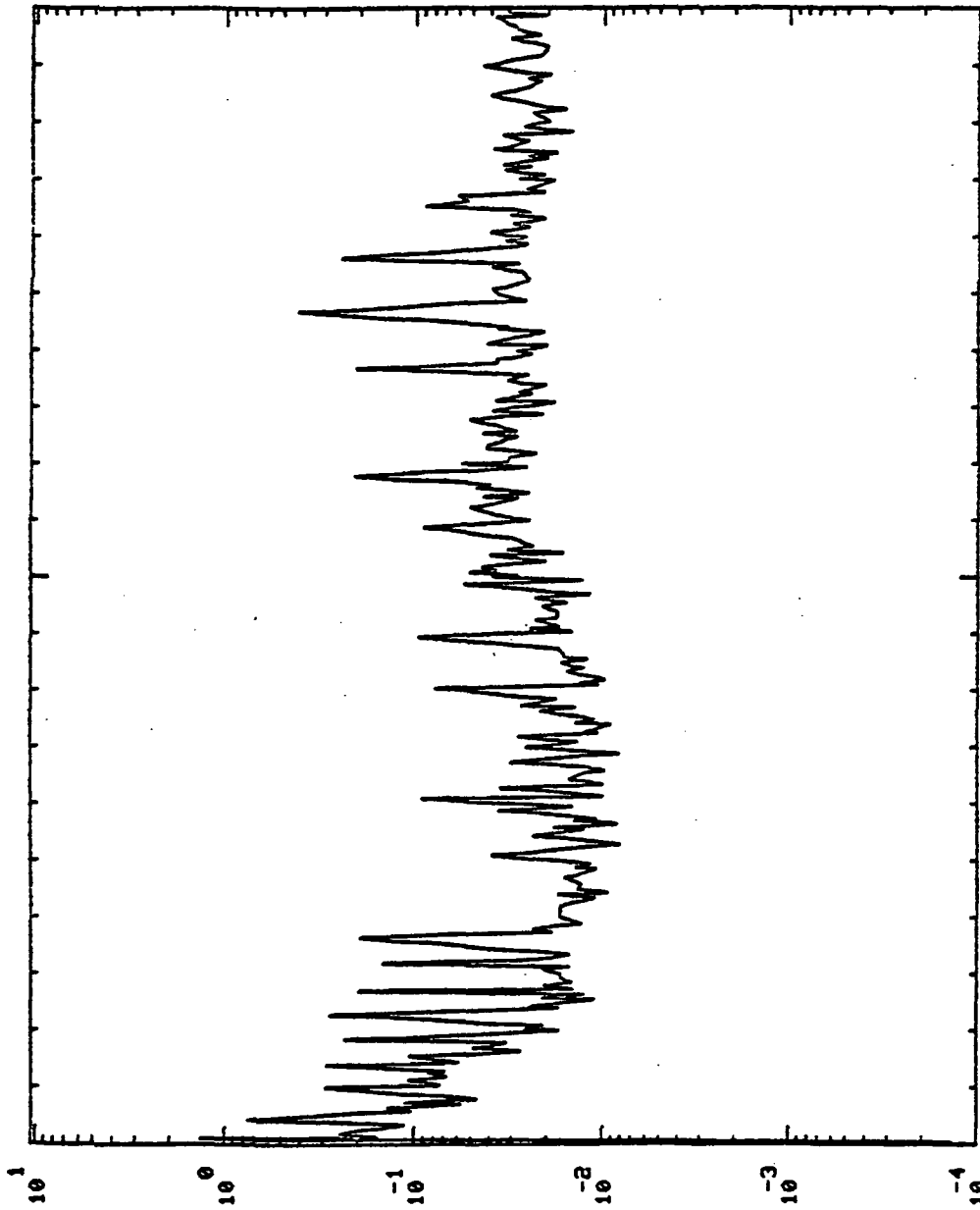


B 4
x 10

P S \ IN

S+ 280.0140,'S

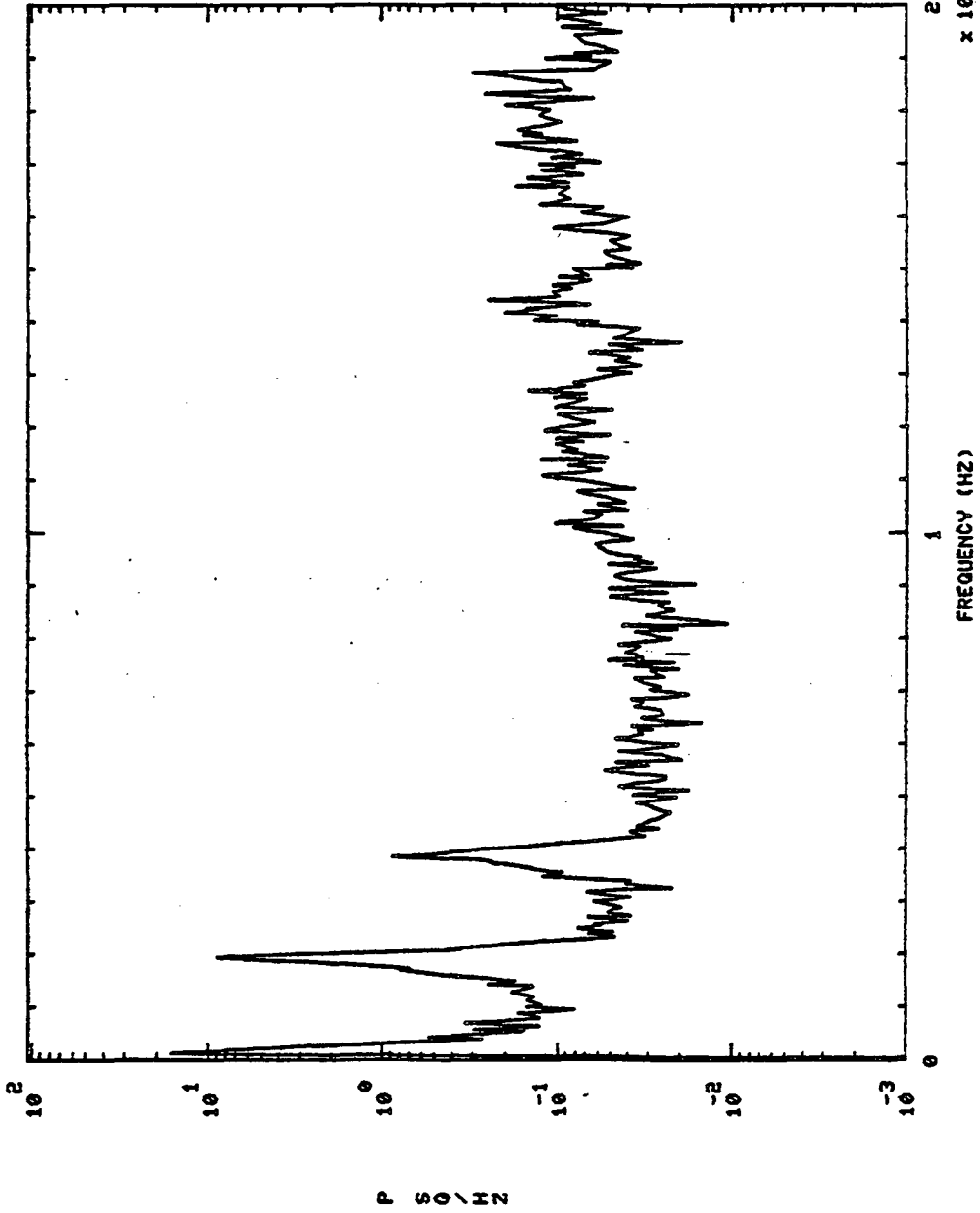
750133 FPB PC



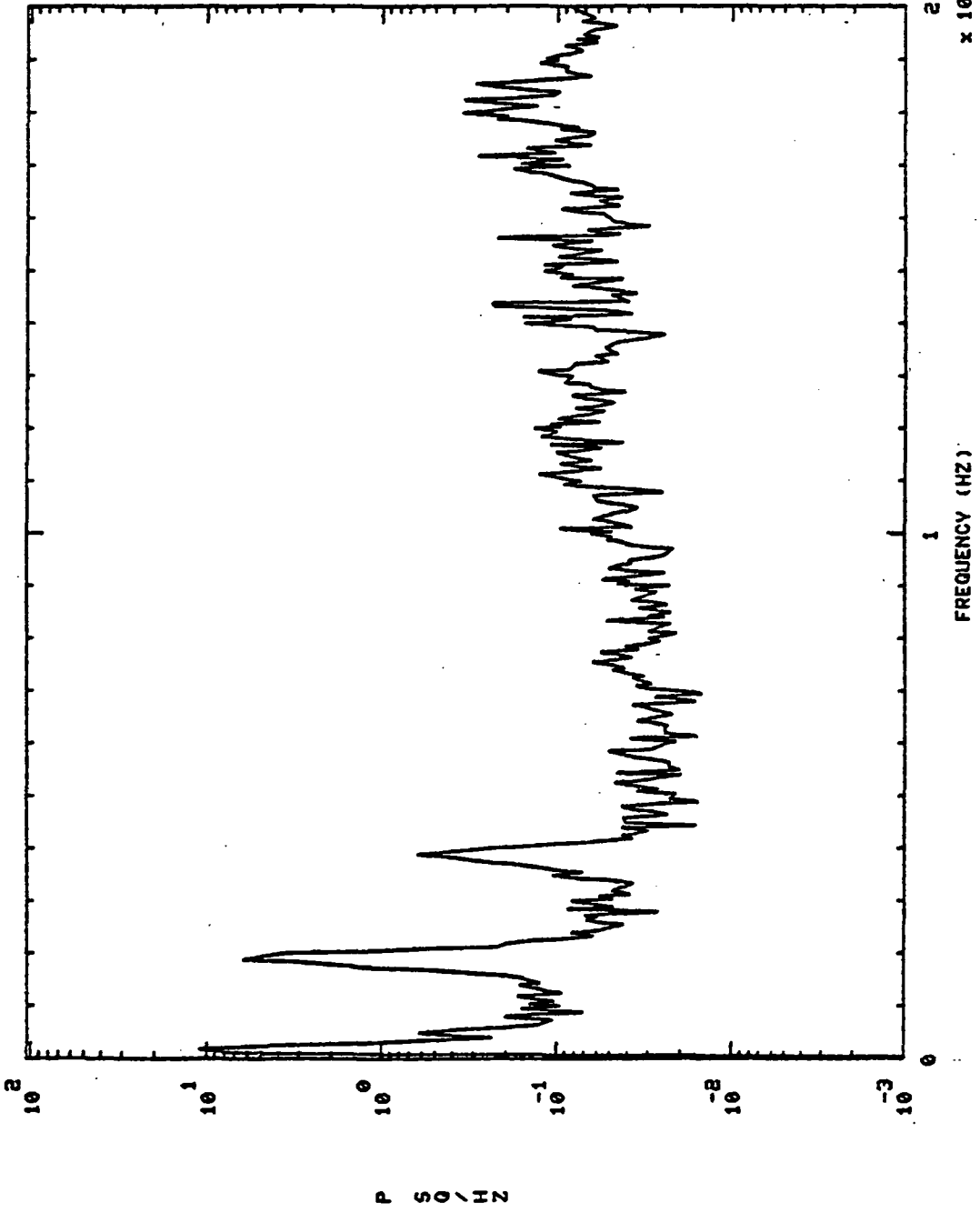
2 4
x 10

1
FREQUENCY (HZ)

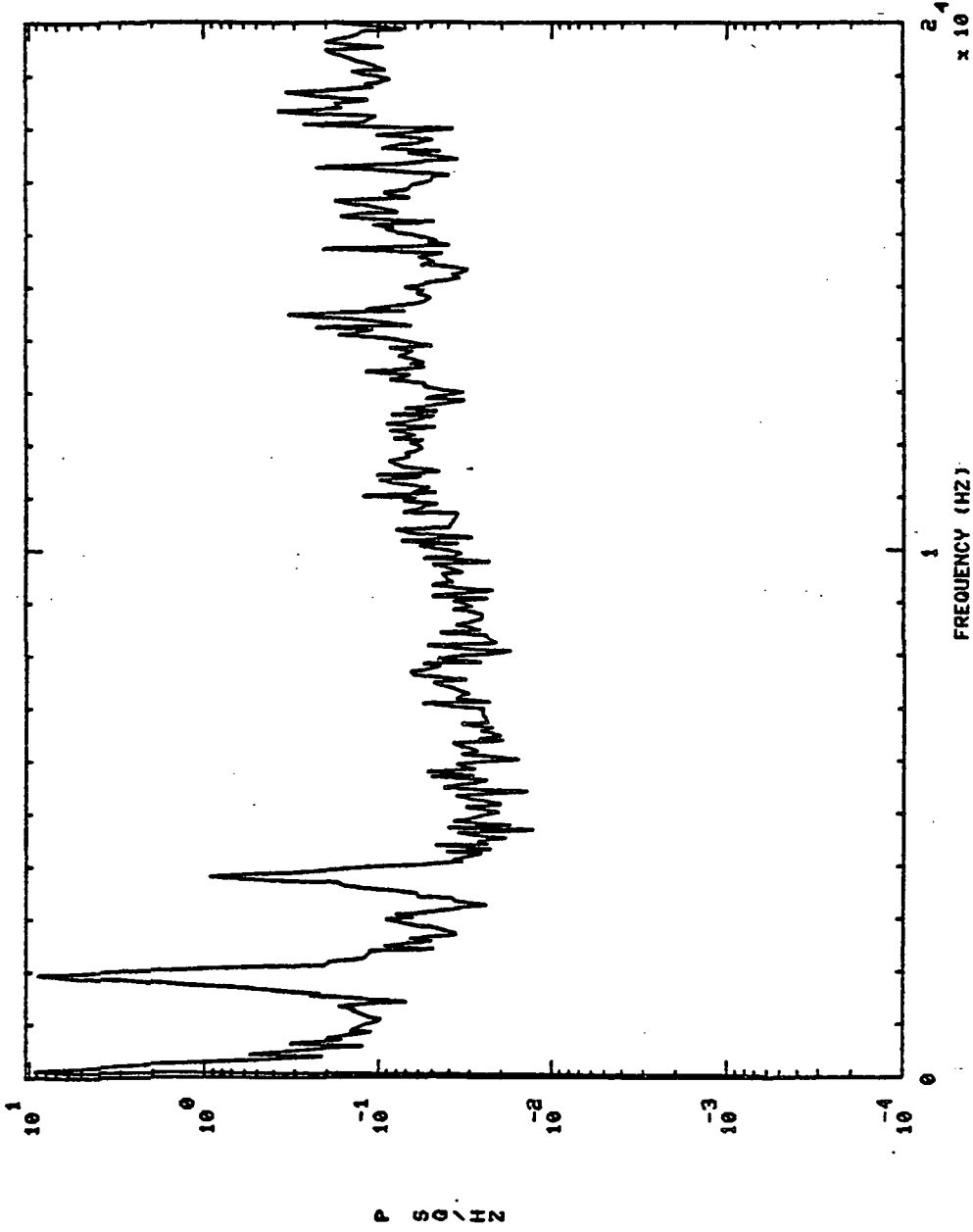
750133 OPB PC PR DC S+ 6.01H0.'S



750133 OPB PC PR DC S+ 71.0140,'S



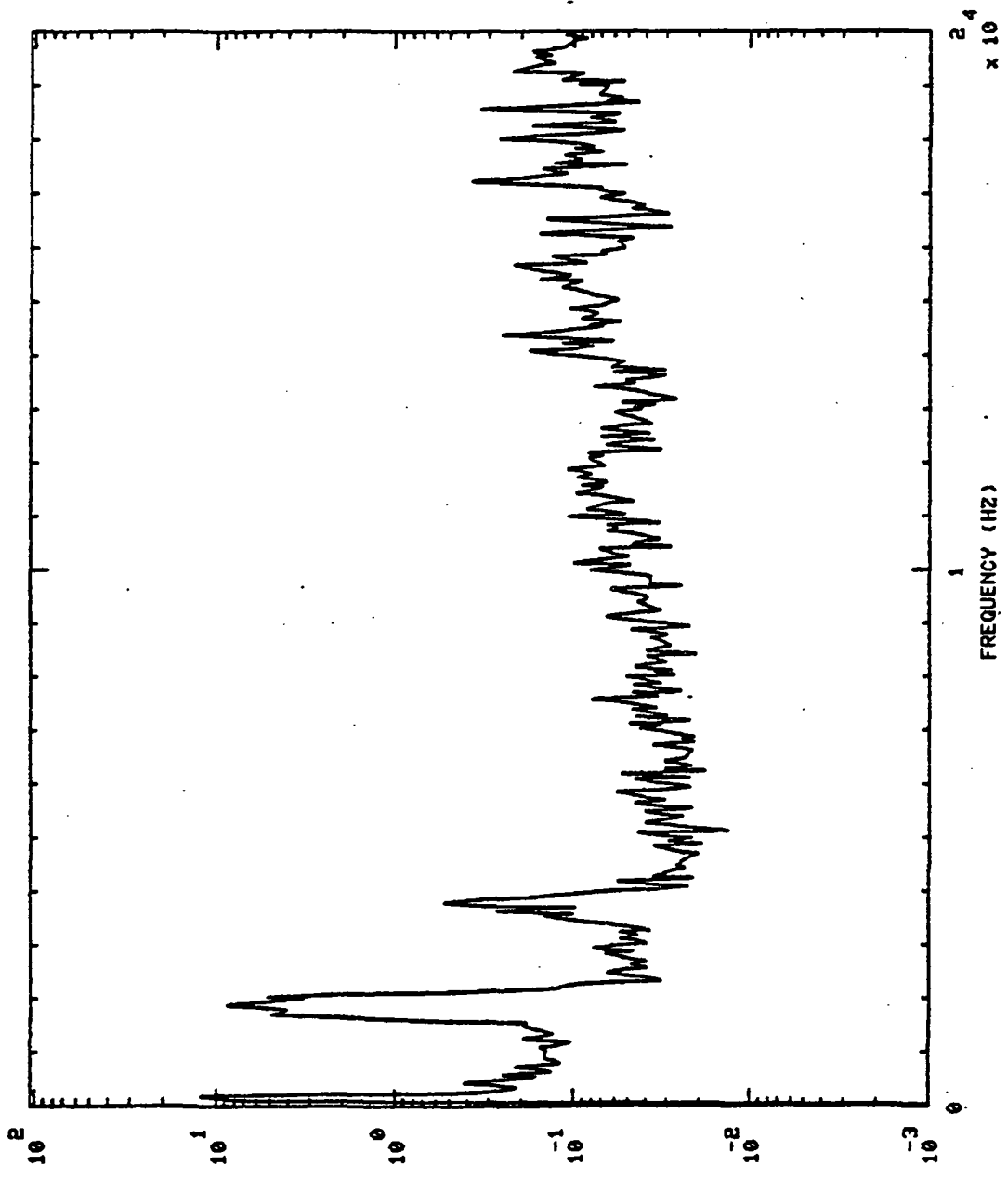
750133 OPB PC PR DC S+ 75.0110,'S



S+ 150.01H0,'S

OPB FC FR DC

750133

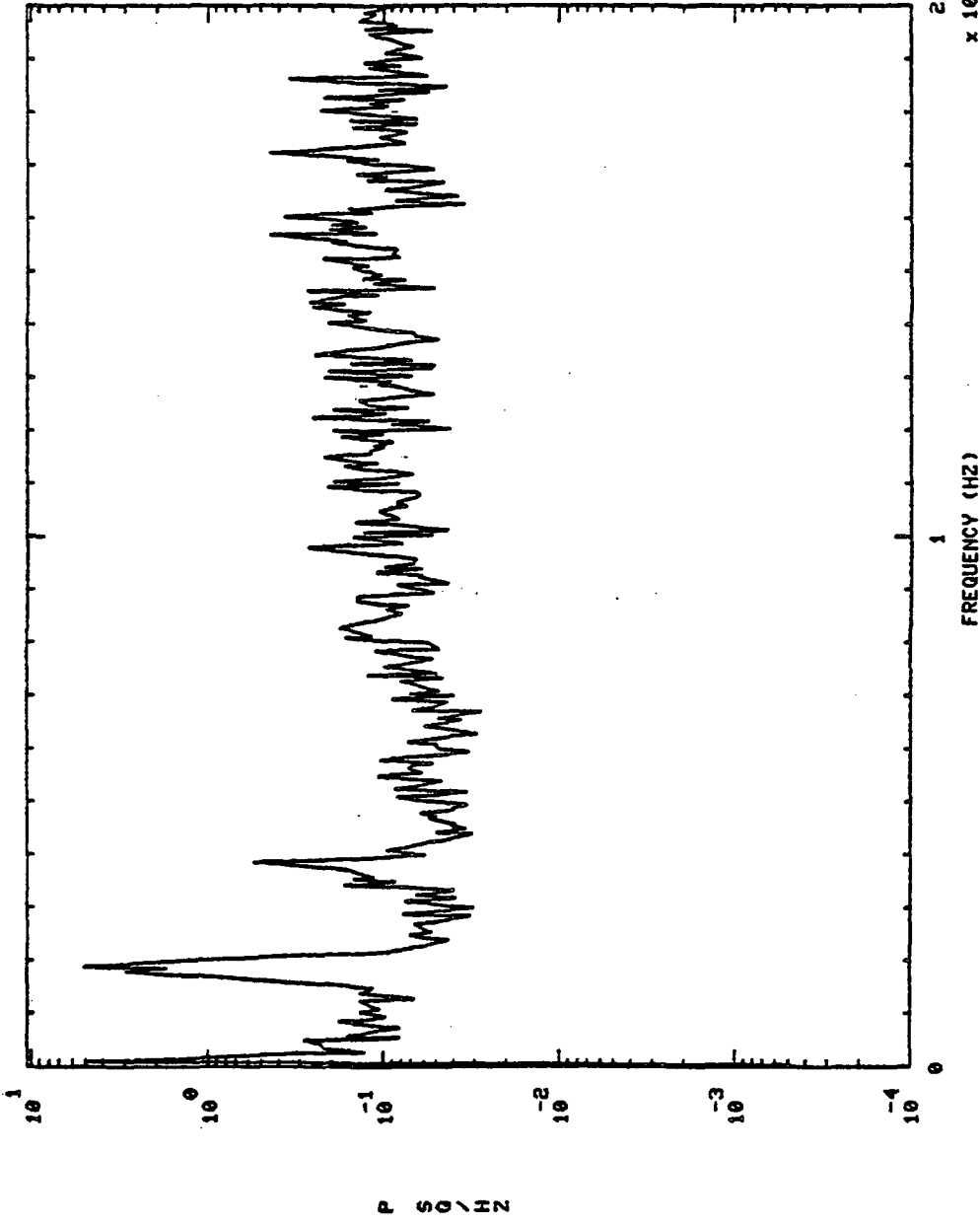


P S D / H Z

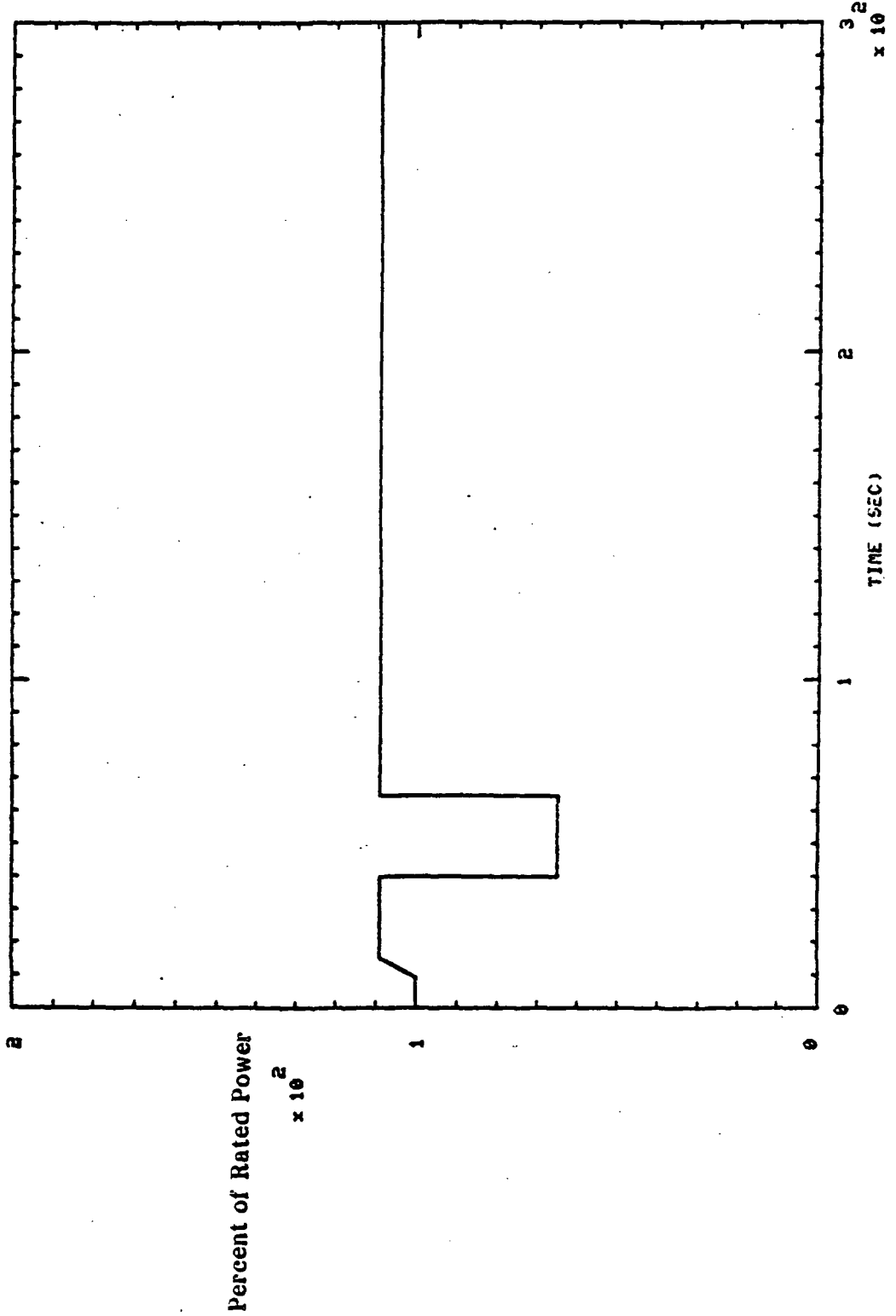
FREQUENCY (HZ) x 10^4

S+ 280.01H0, 'S

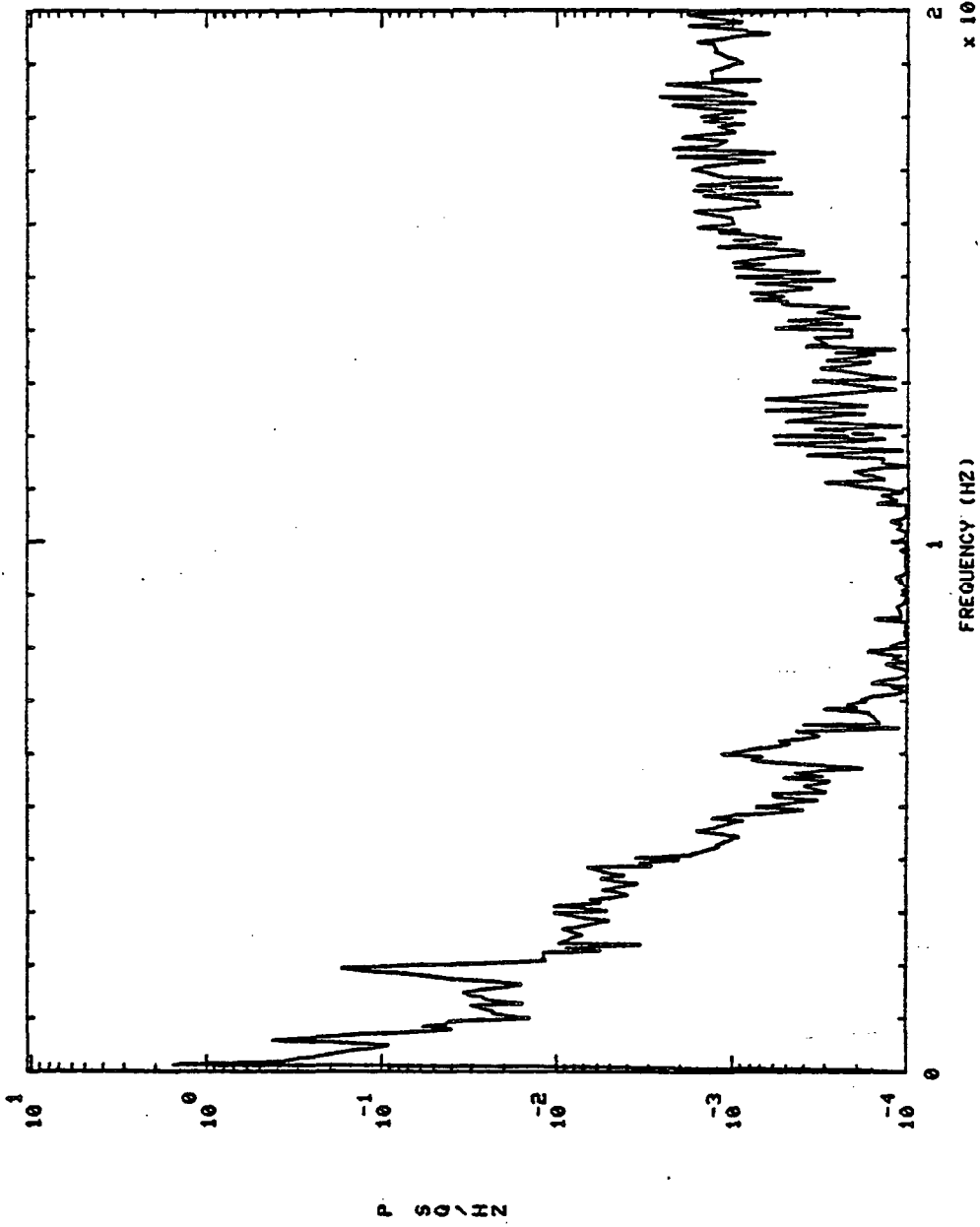
750133 OPB PC PR DC



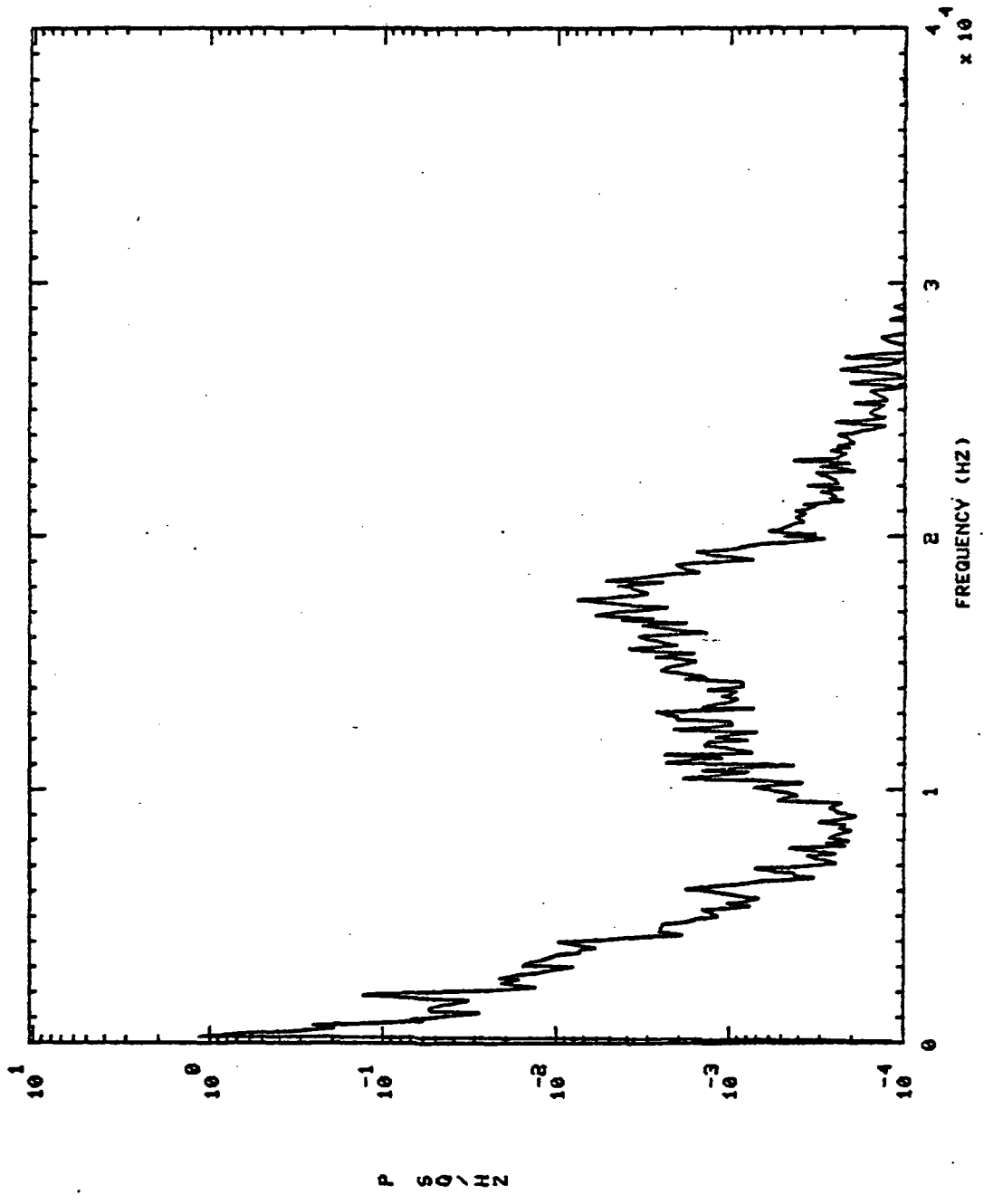
750134 THRUST (UNFILTERED)



750134 MCC FUEL INJ PR S+ 4.01H0,'S



750134 MCC FUEL INJ PR S+ 4.01H0.'S



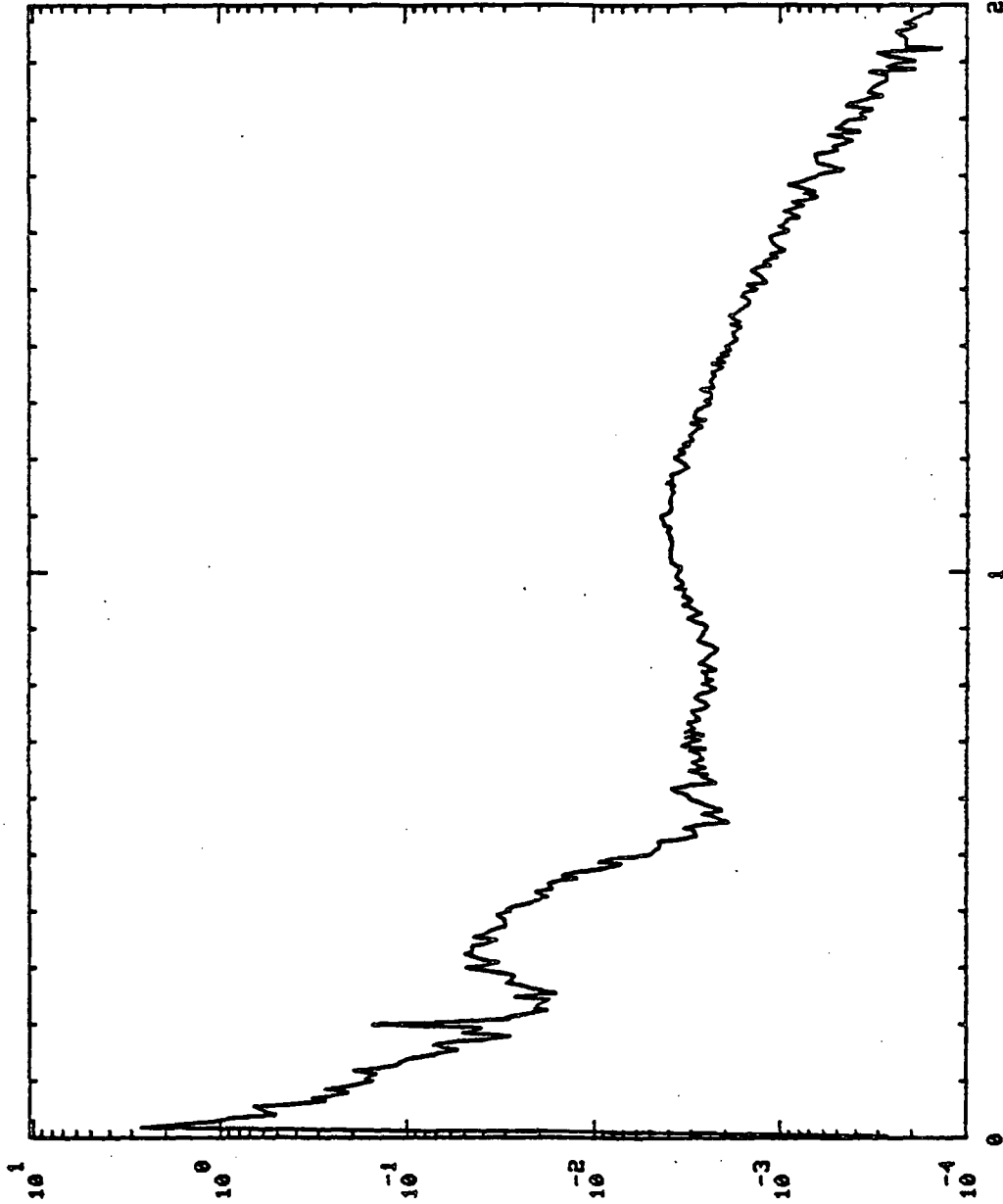
750134 MCC FUEL INJ PR S+ 30.01H0,'S

750134 MCC FUEL INJ PR

750134

MCC FUEL INJ PR

S+ 30.01H0,'S

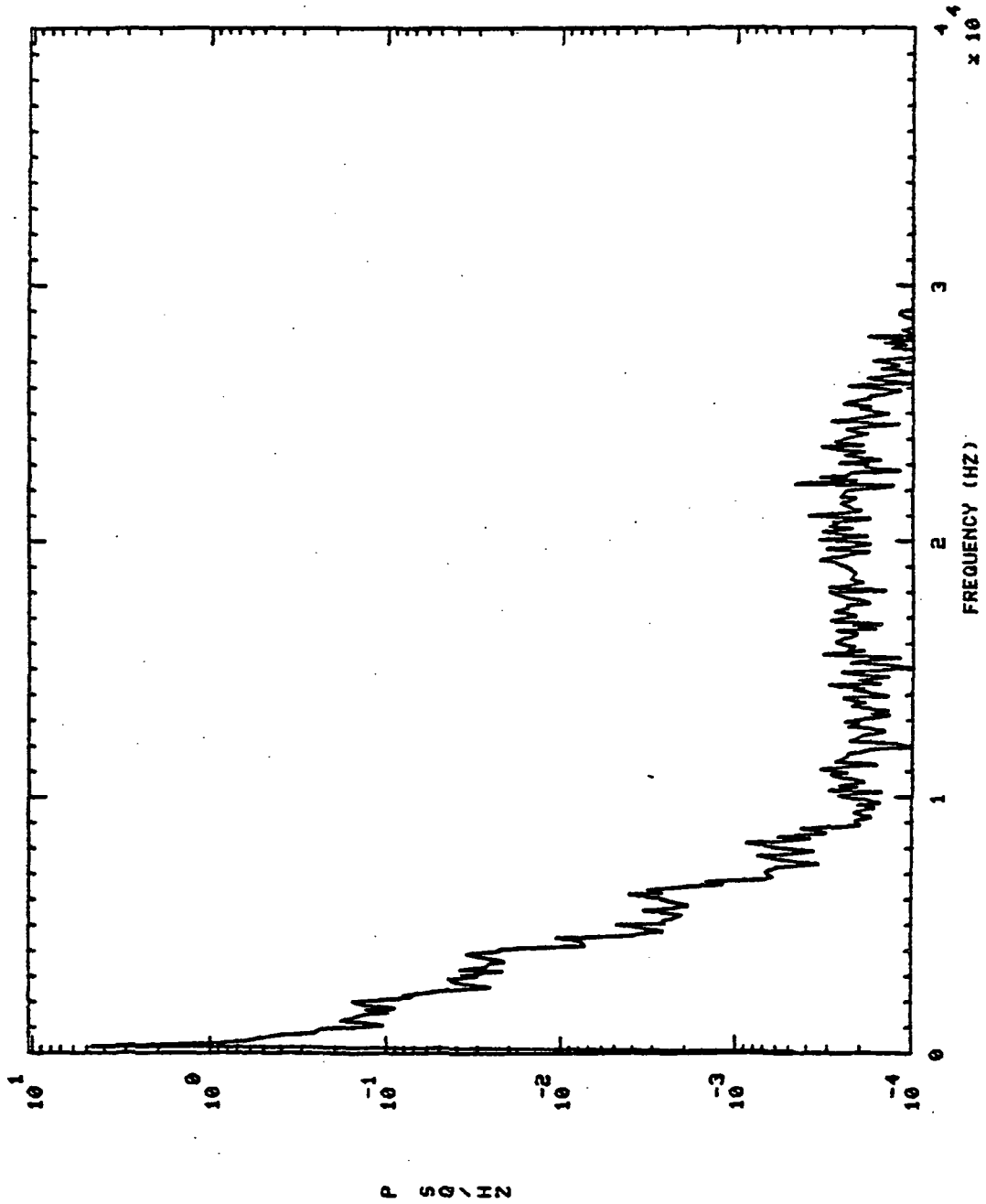


P SQ / HZ

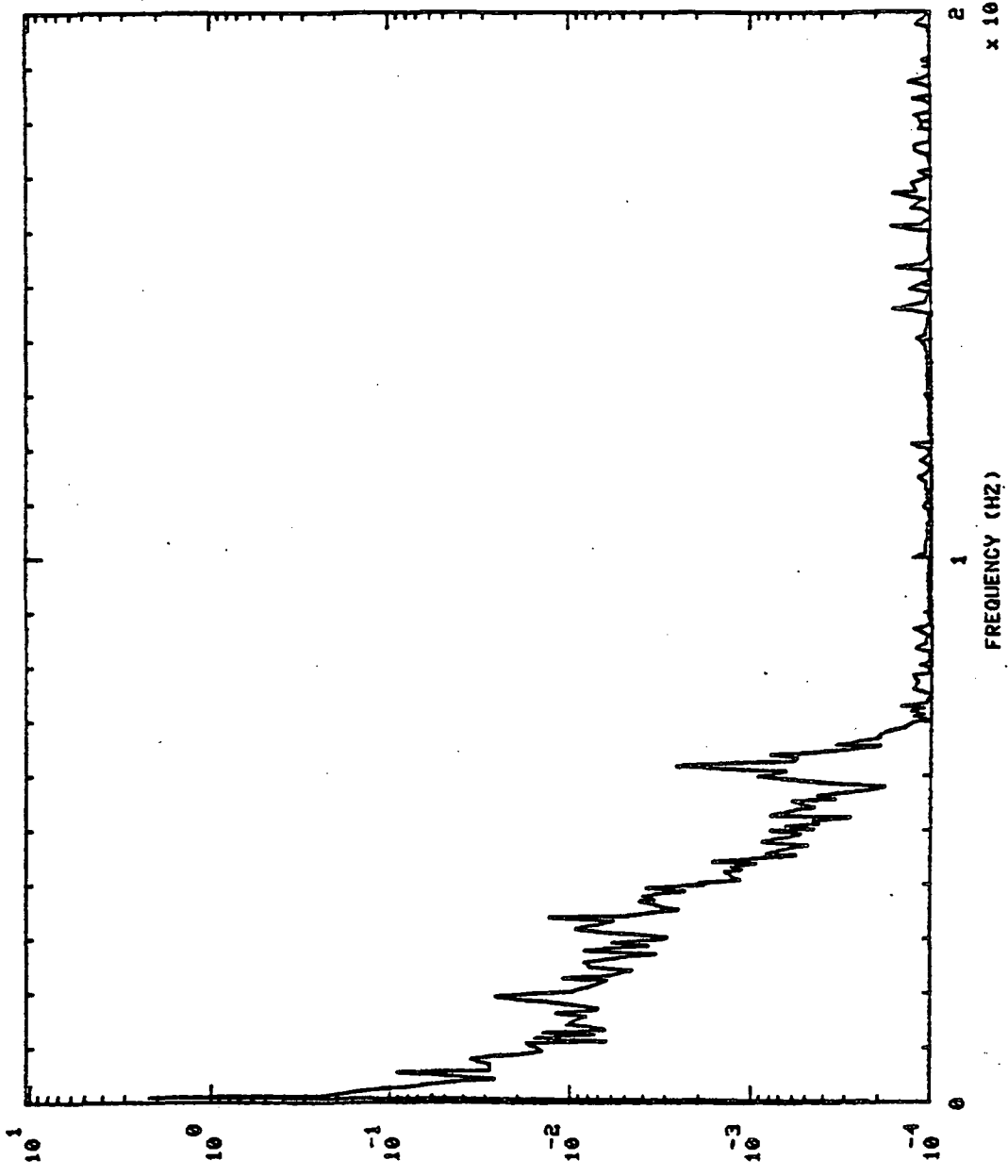
2 4
x 10

FREQUENCY (HZ)

750134 MCC FUEL INJ PR S+ 30.01H0'S



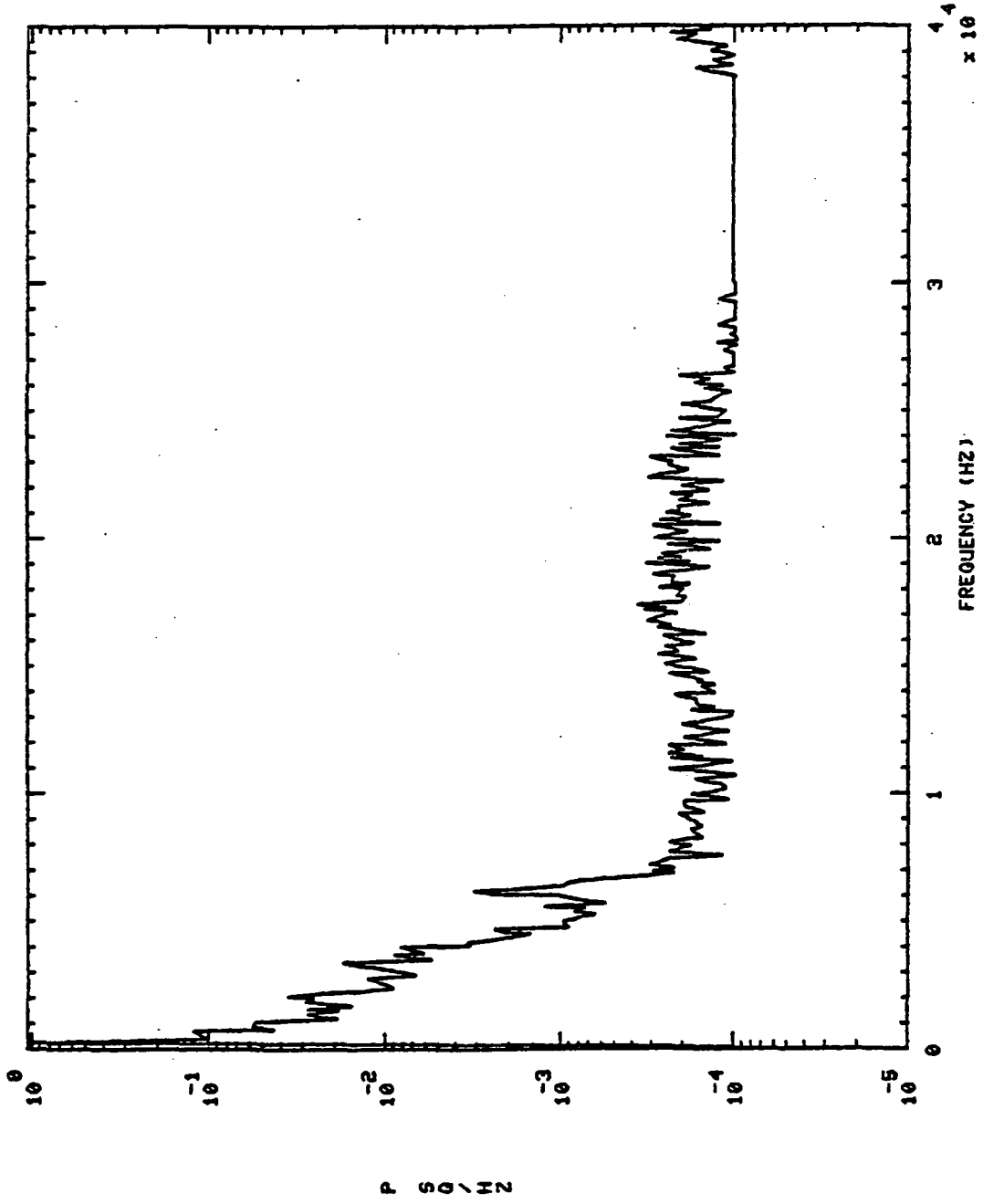
750134 MCC FUEL INJ PR S+ 45.01H0.'S



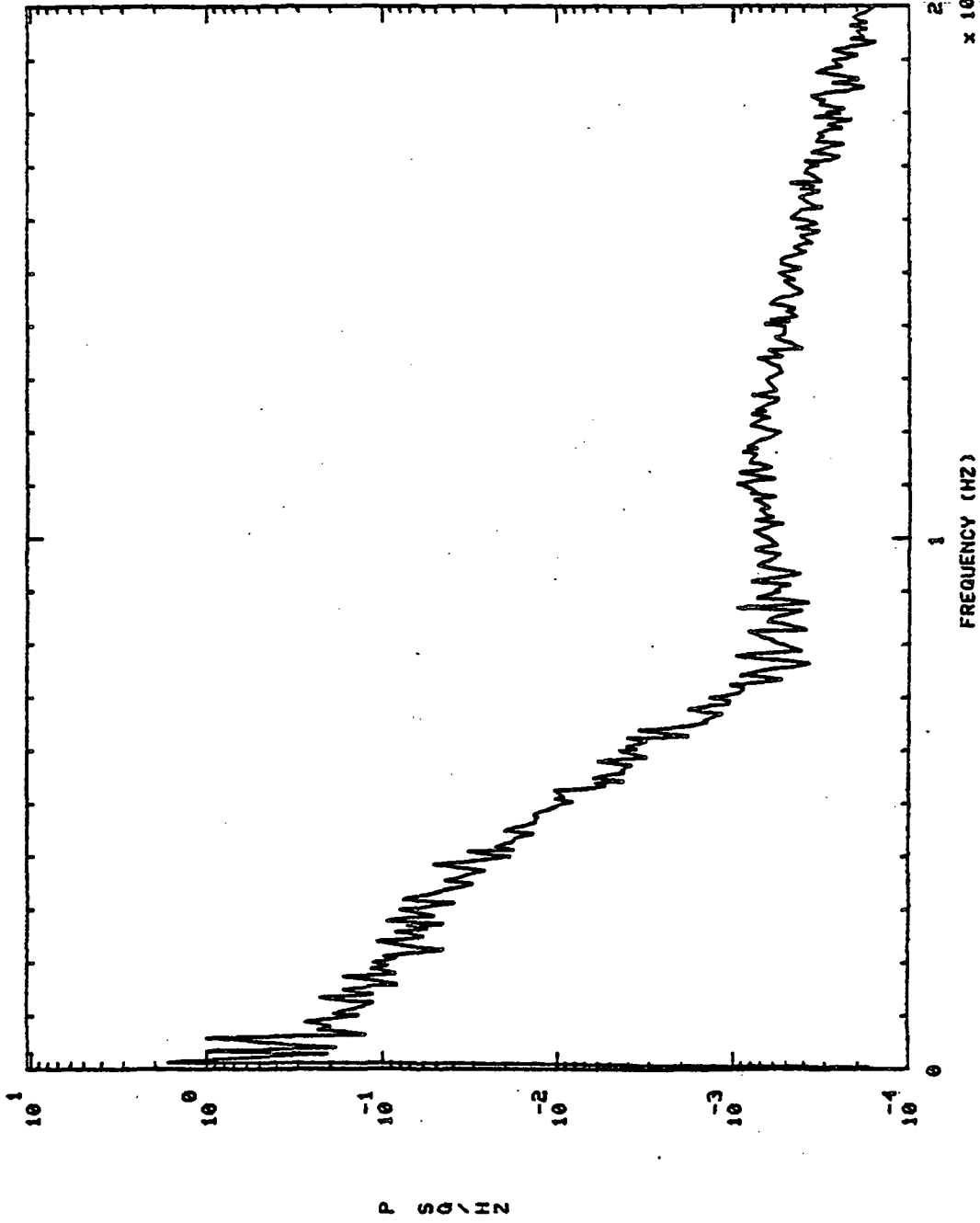
P S O \ H Z

FREQUENCY (HZ) x 10²

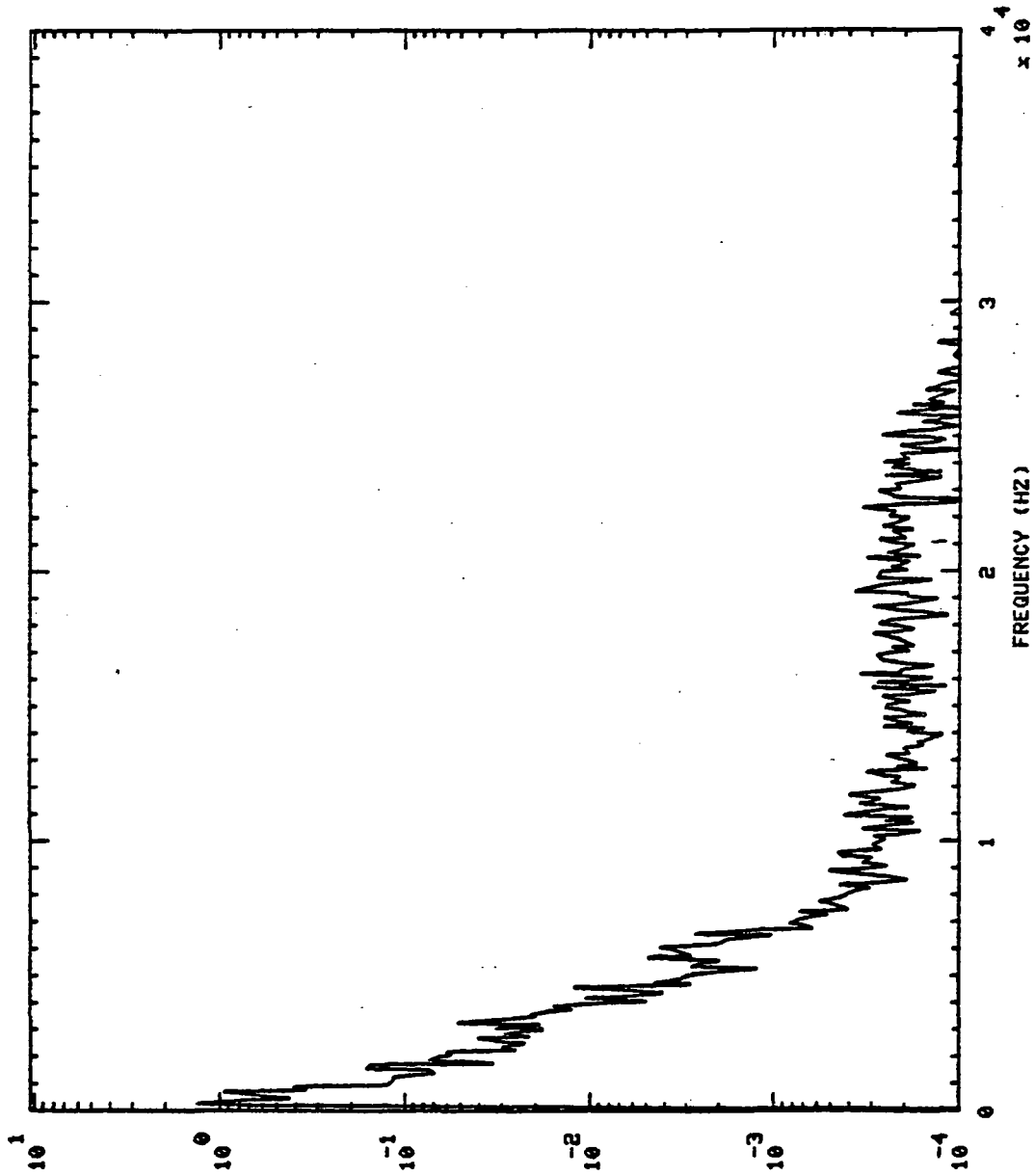
750134 MCC FUEL INJ PR S+ 45.01H0,'S



750134 MCC FUEL INJ PR S+ 150.01H0,'S



750134 MCC FUEL INJ PR S+ 150.01H0,'S

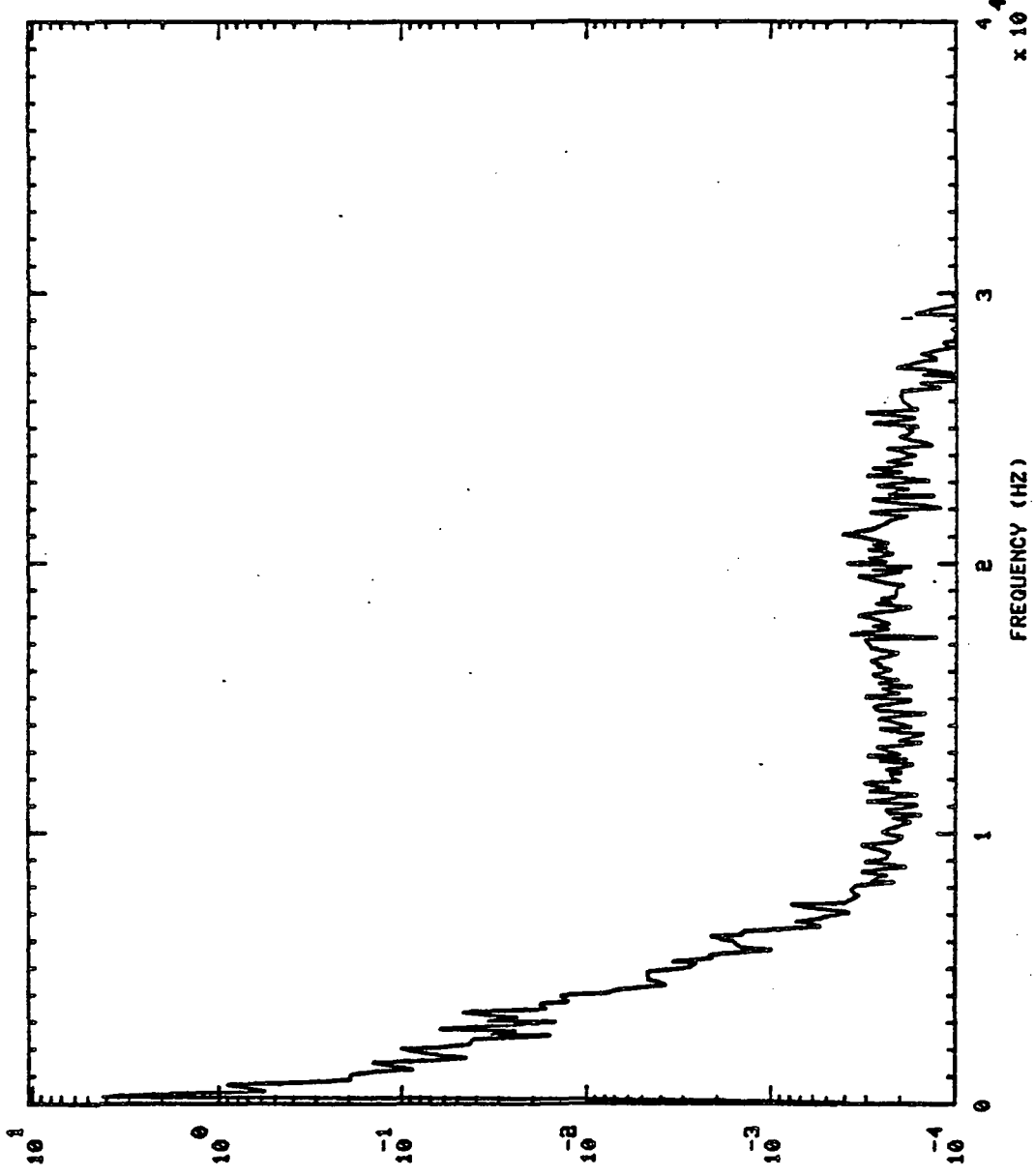


P S / HZ

S+ 200.01H0,'S

MCC FUEL INJ PR

750134

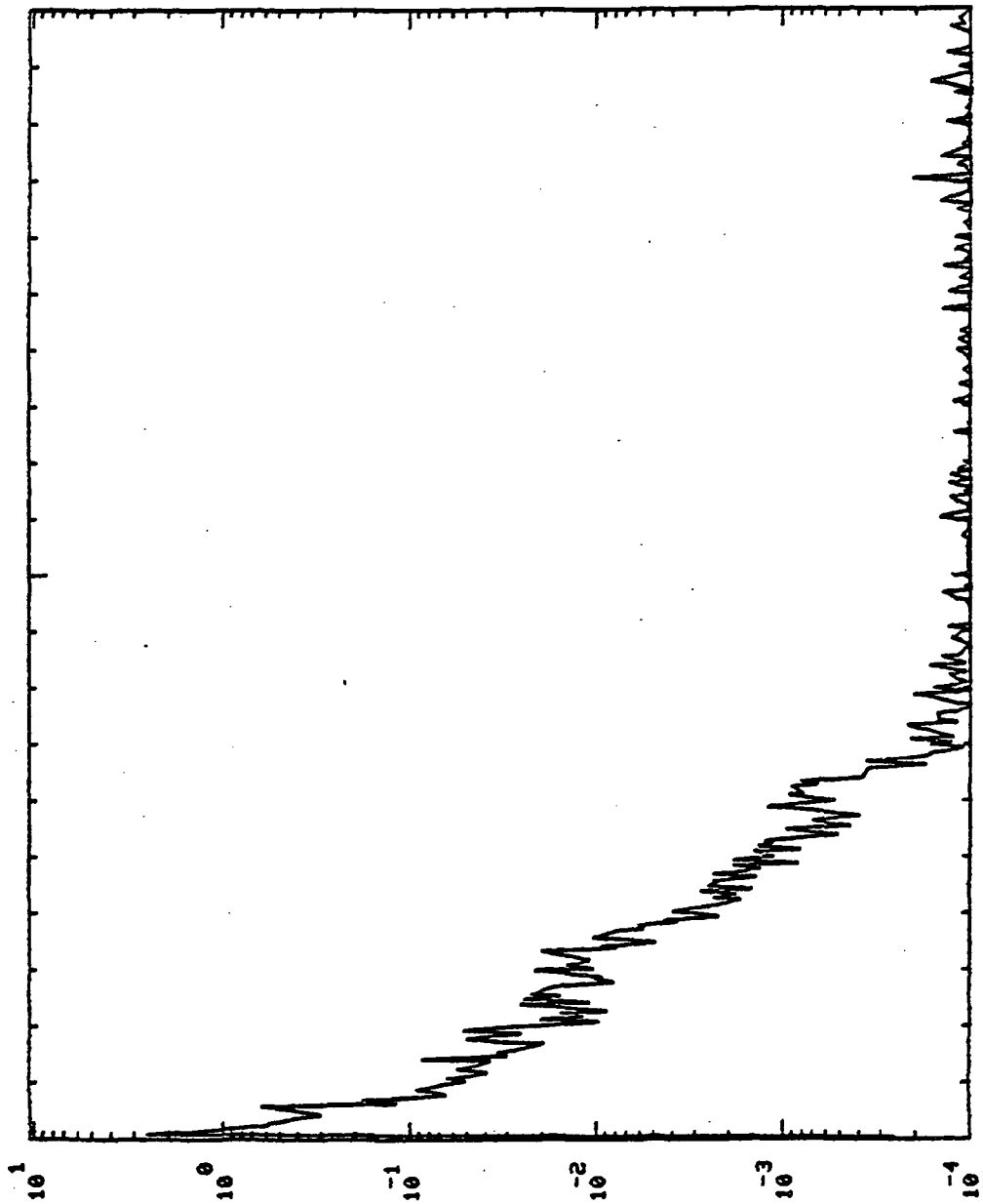


P S O \ H Z

FREQUENCY (HZ) x 10^4

S+ 280.01H0,'S

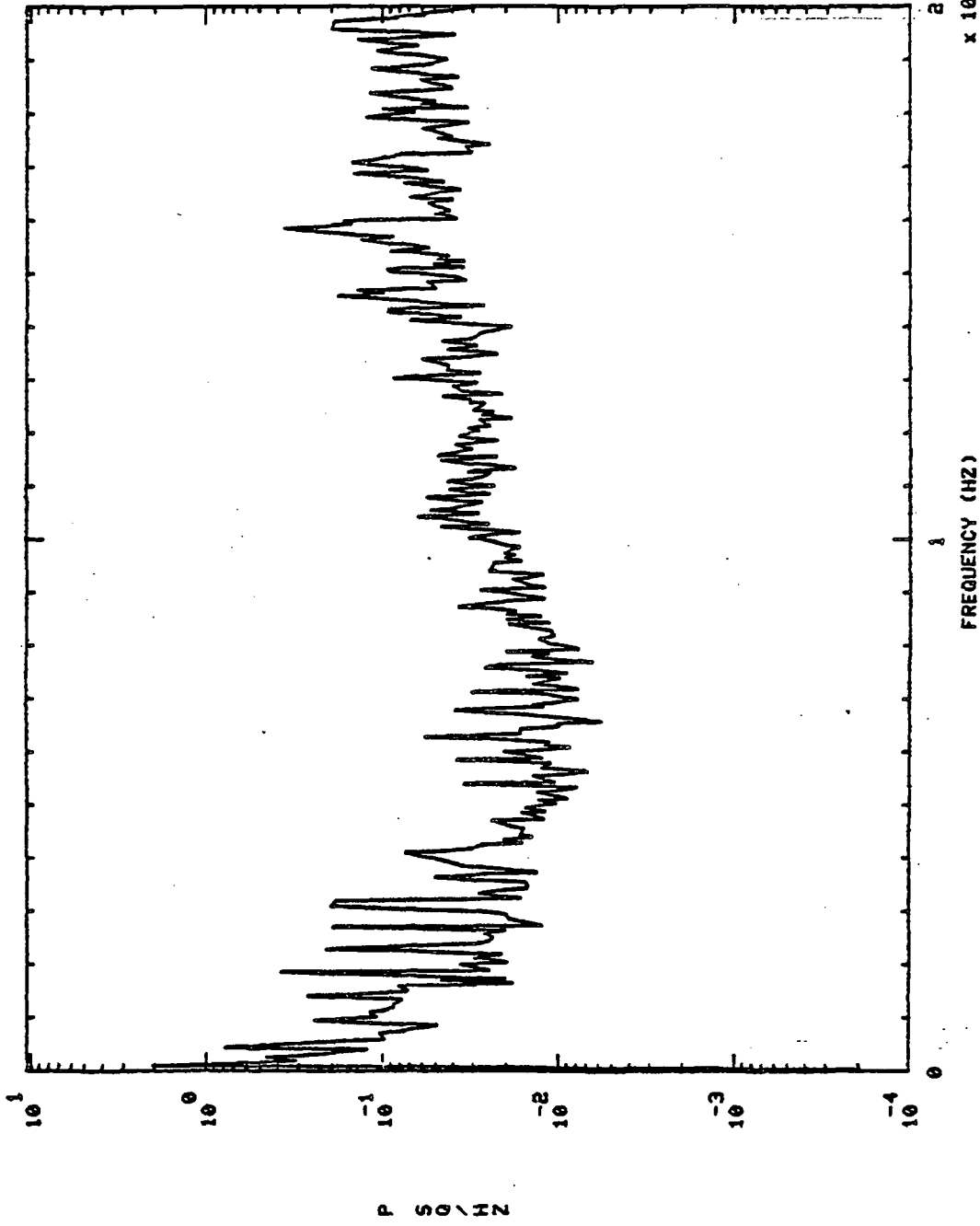
750134 MCC FUEL INJ PR



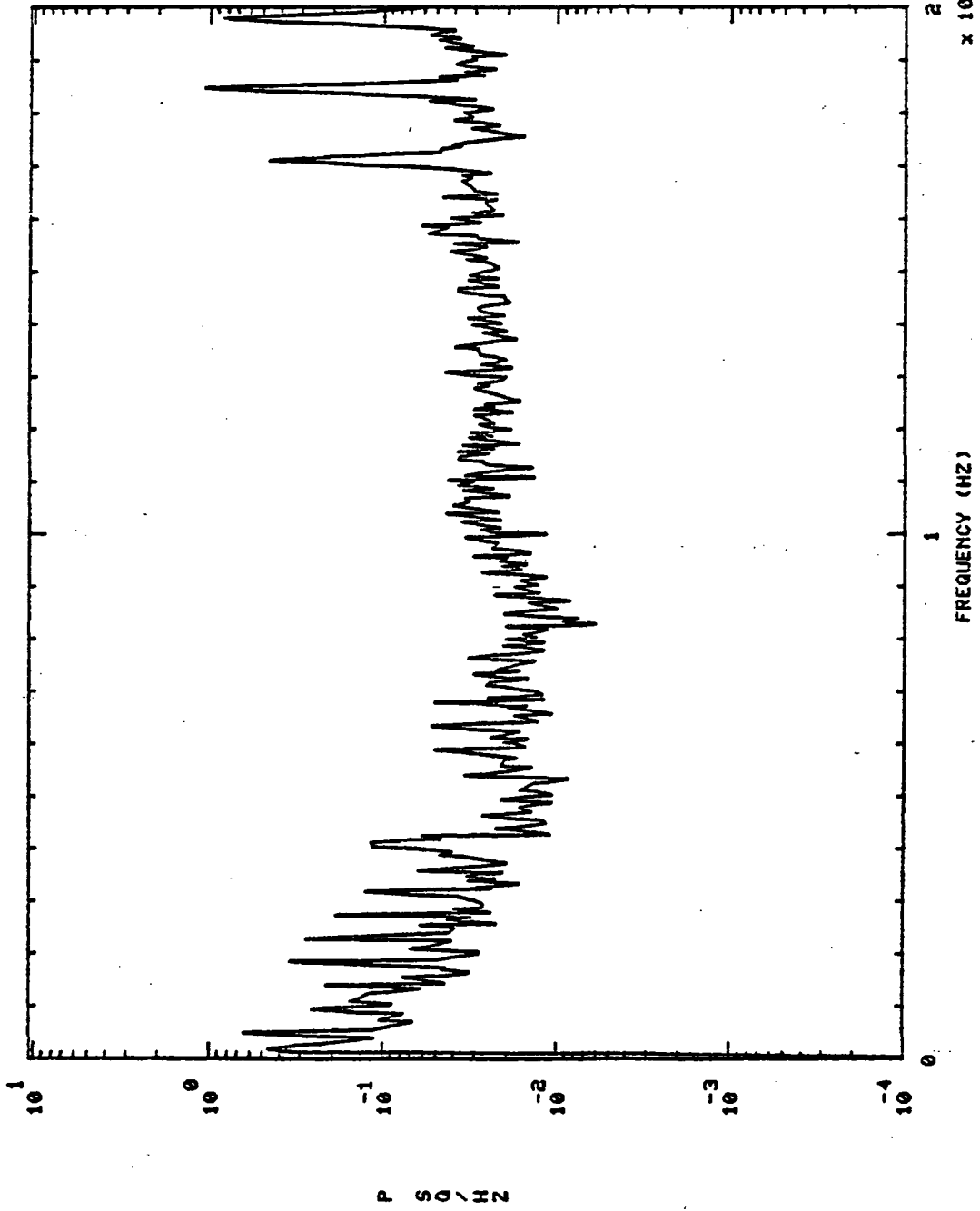
P S O / H Z

1
FREQUENCY (HZ)
2.4
 $\times 10^4$

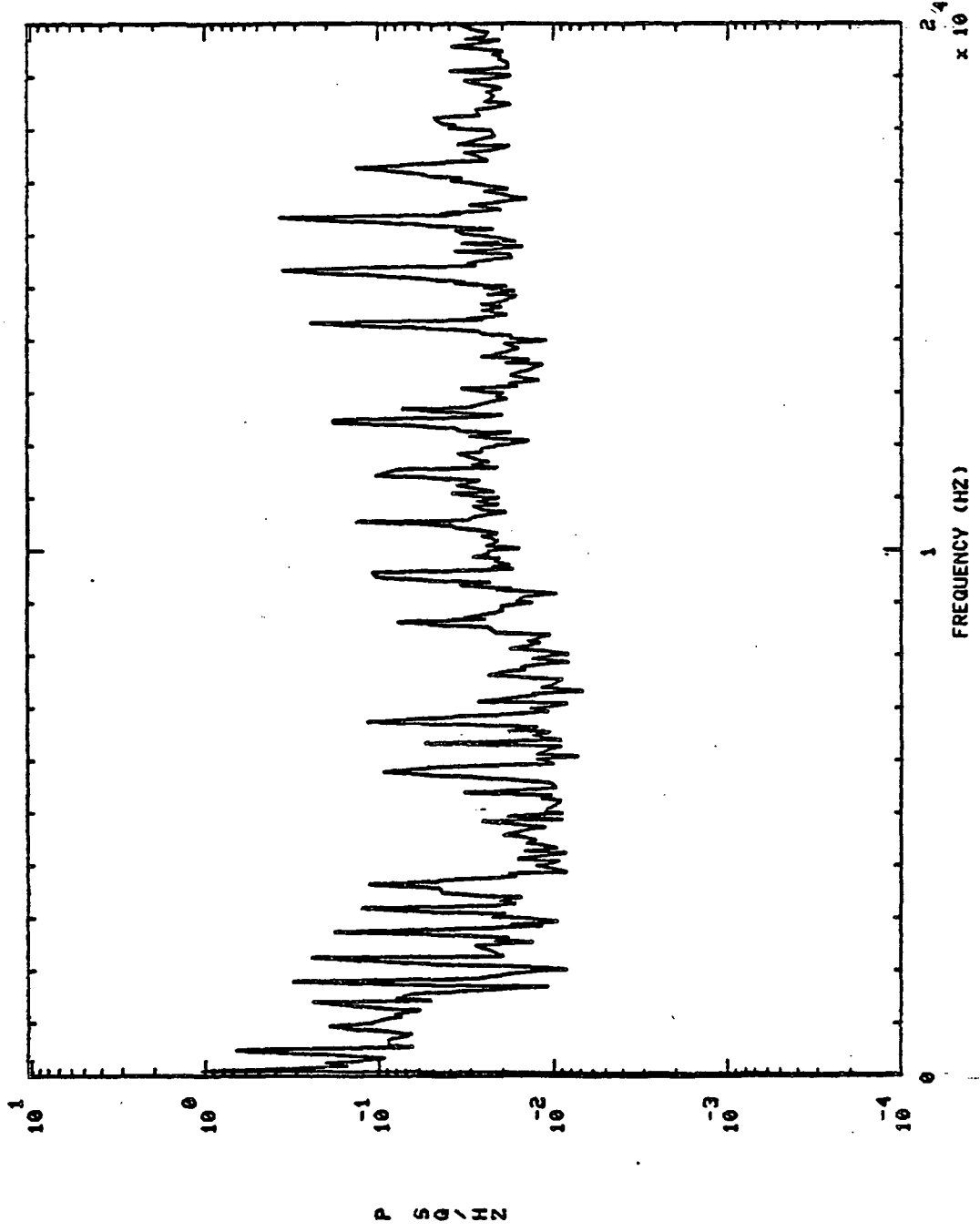
750134 FPB PC S+ 4.01H0,'S



750134 FPB PC S+ 30.01H0,'S

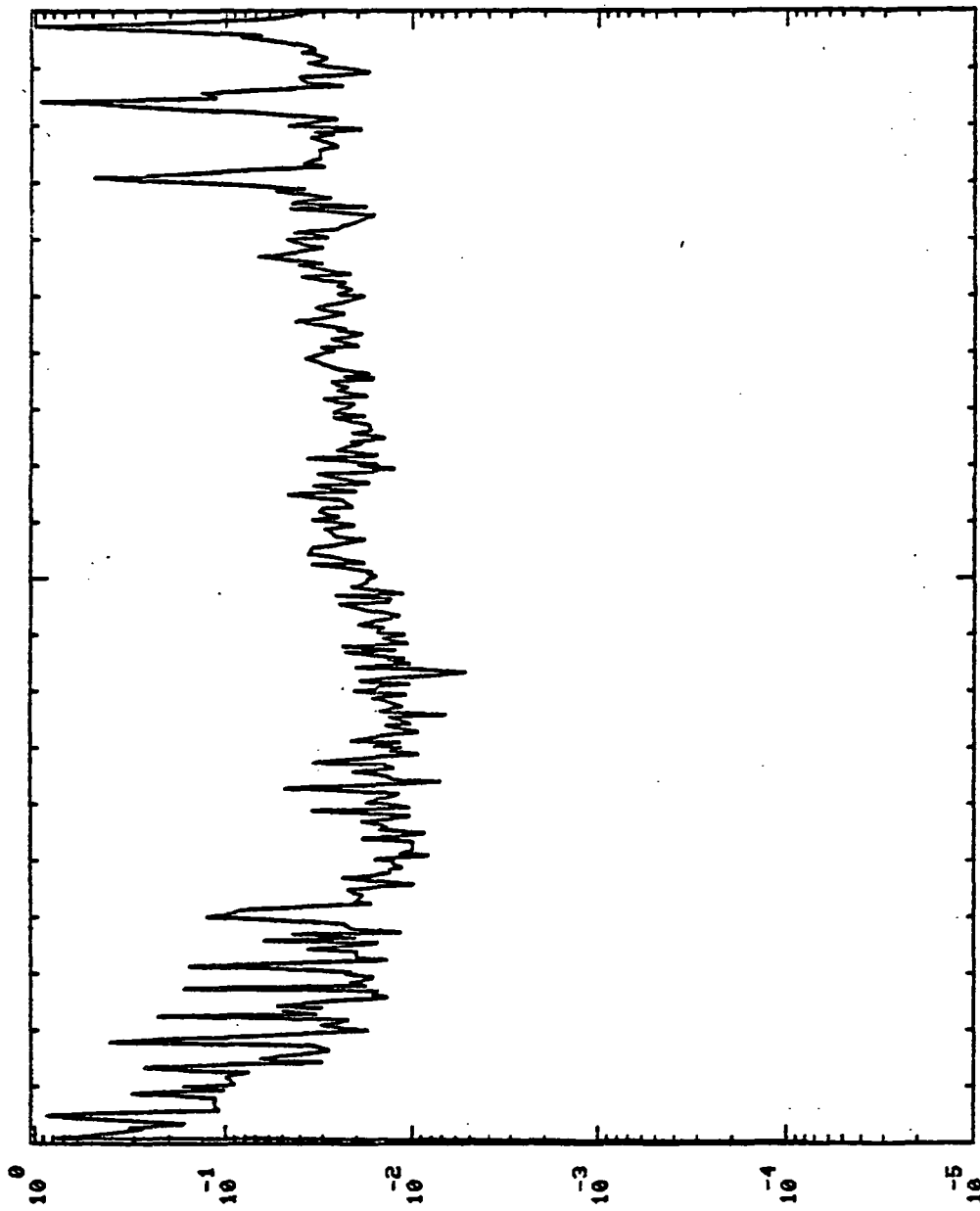


750134 FPB PC S+ 55.01H0,'S



S+ 150.0140.'S

750134 FPB PC



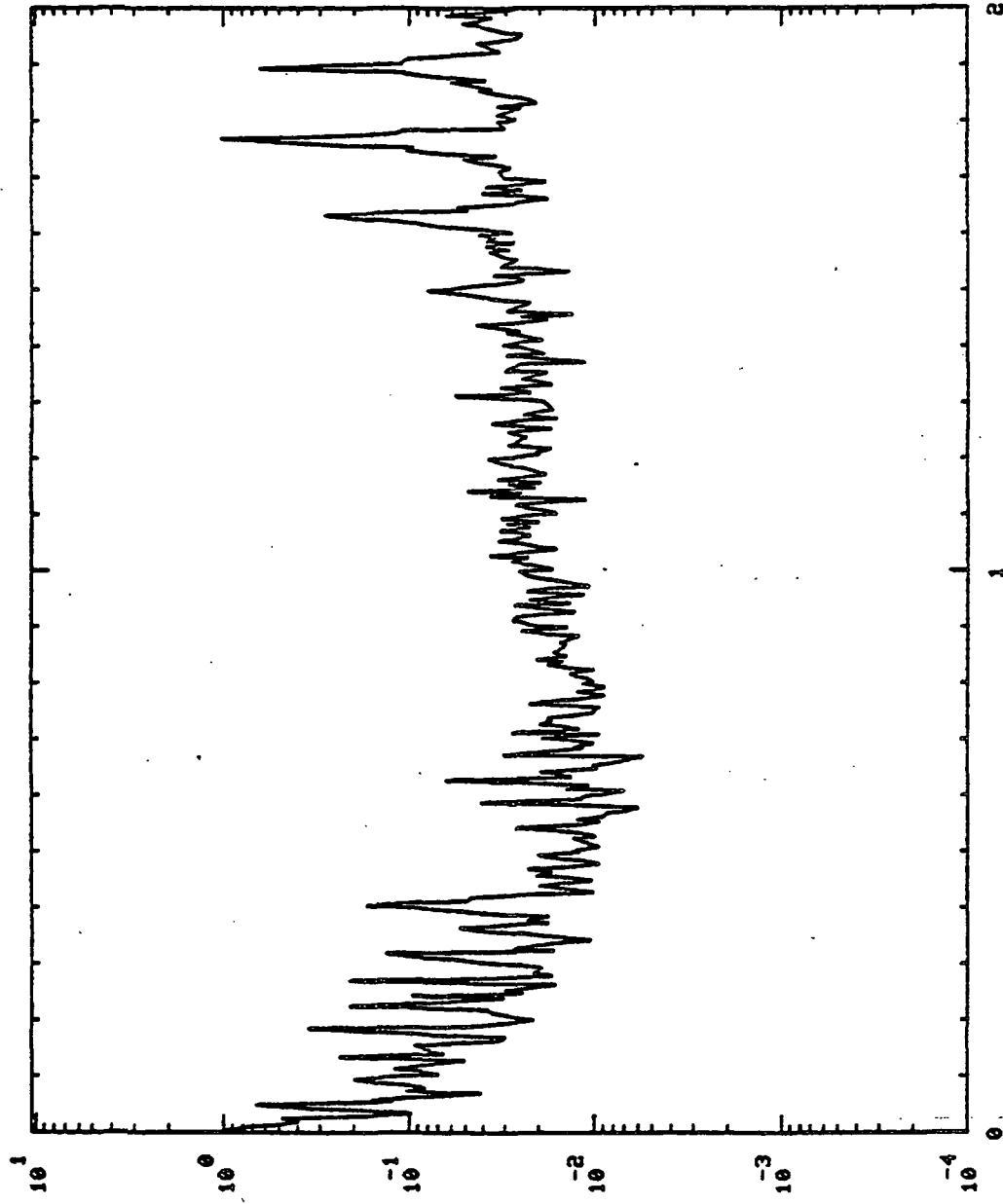
10^4
 $\times 10$

FREQUENCY (HZ)

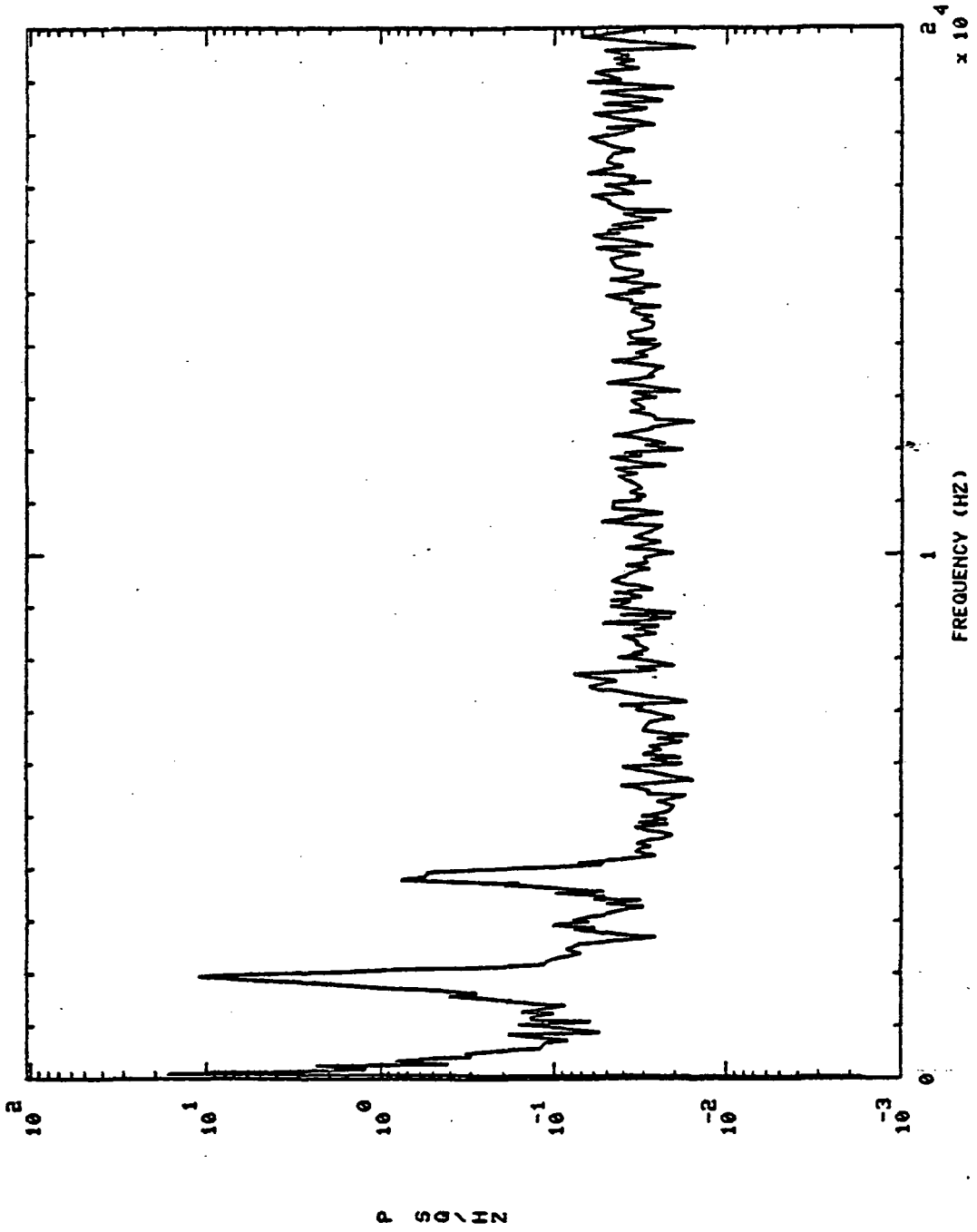
P S D \ H Z

S+ 280.01H0,'S

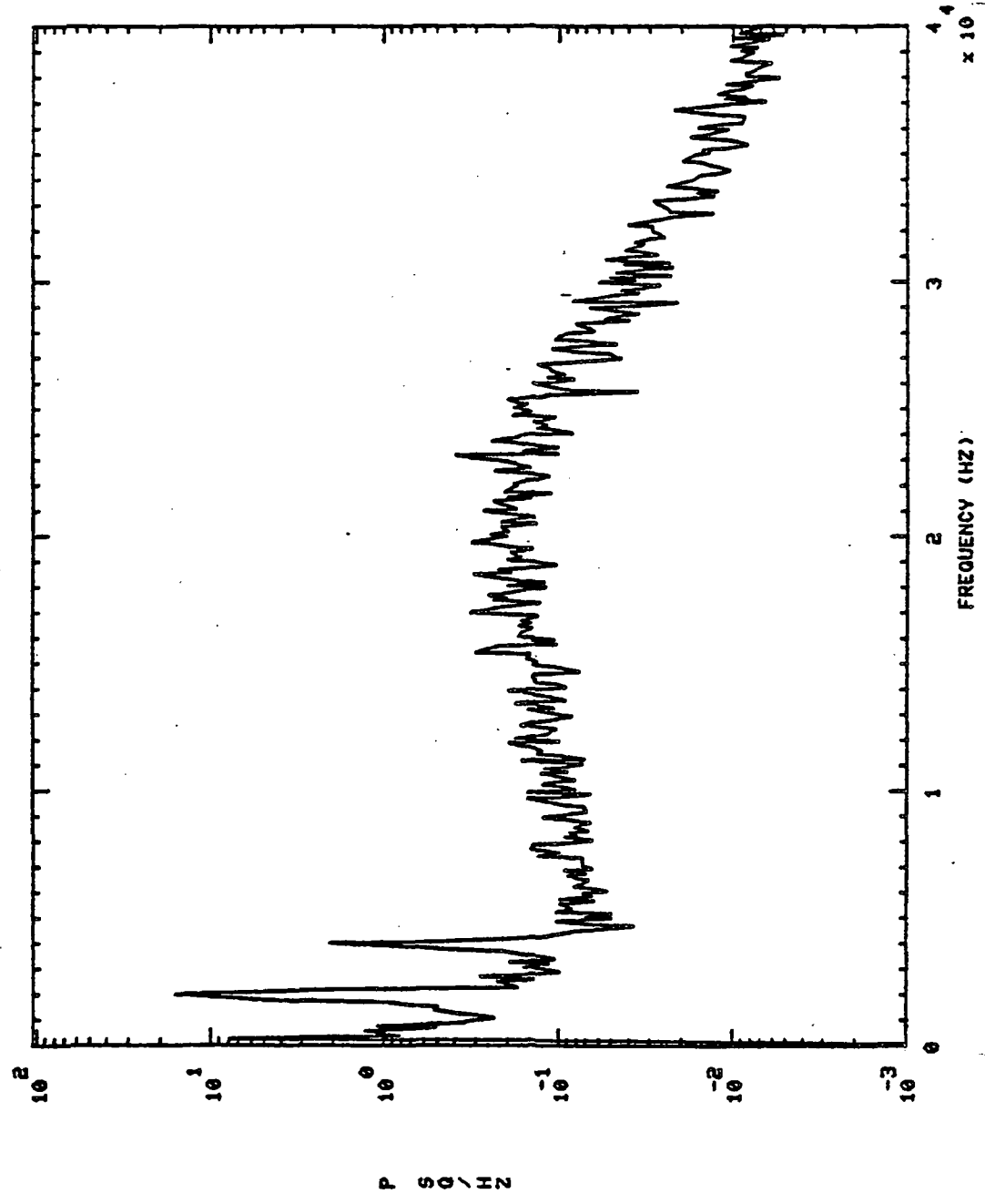
750134 FPB PC



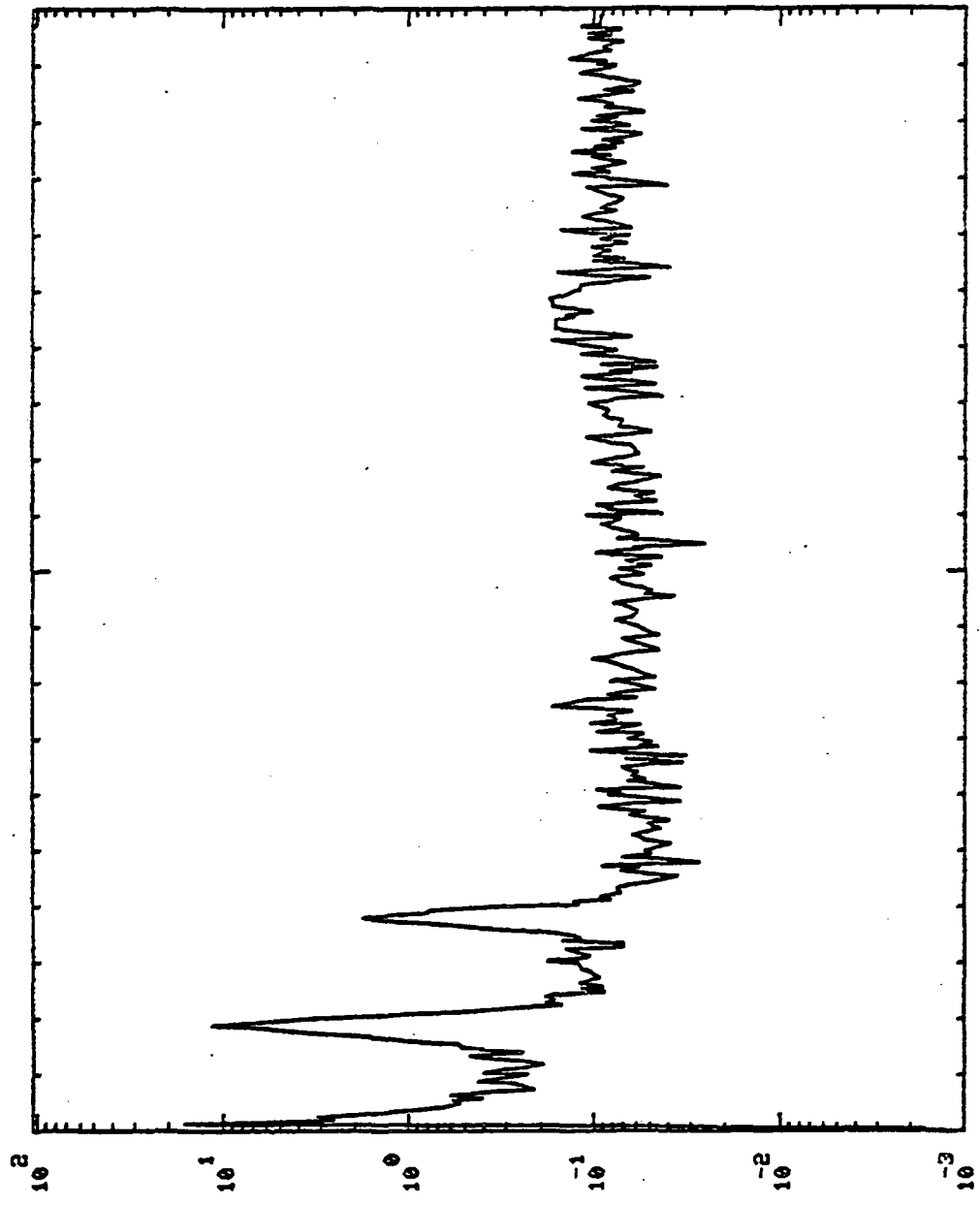
750134 MCC FUEL INJ PR DC S+ 4.01H0,'S



750134 MCC FUEL INJ PR DC S+ 4.01H0,'S



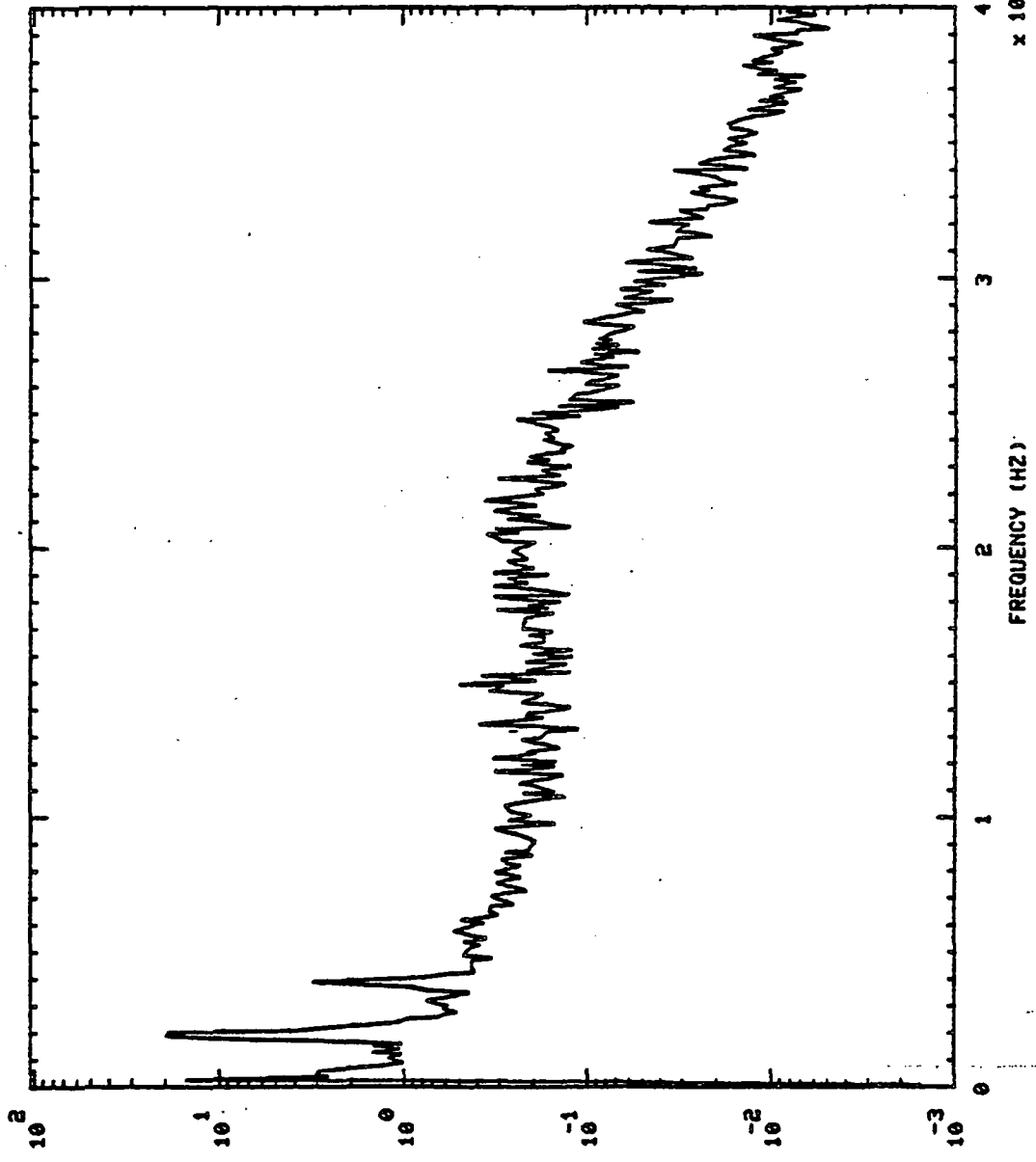
750134 MCC FUEL INJ PR DC S+ 30.01H0,'S



P S G / H Z

FREQUENCY (HZ) x 10⁴

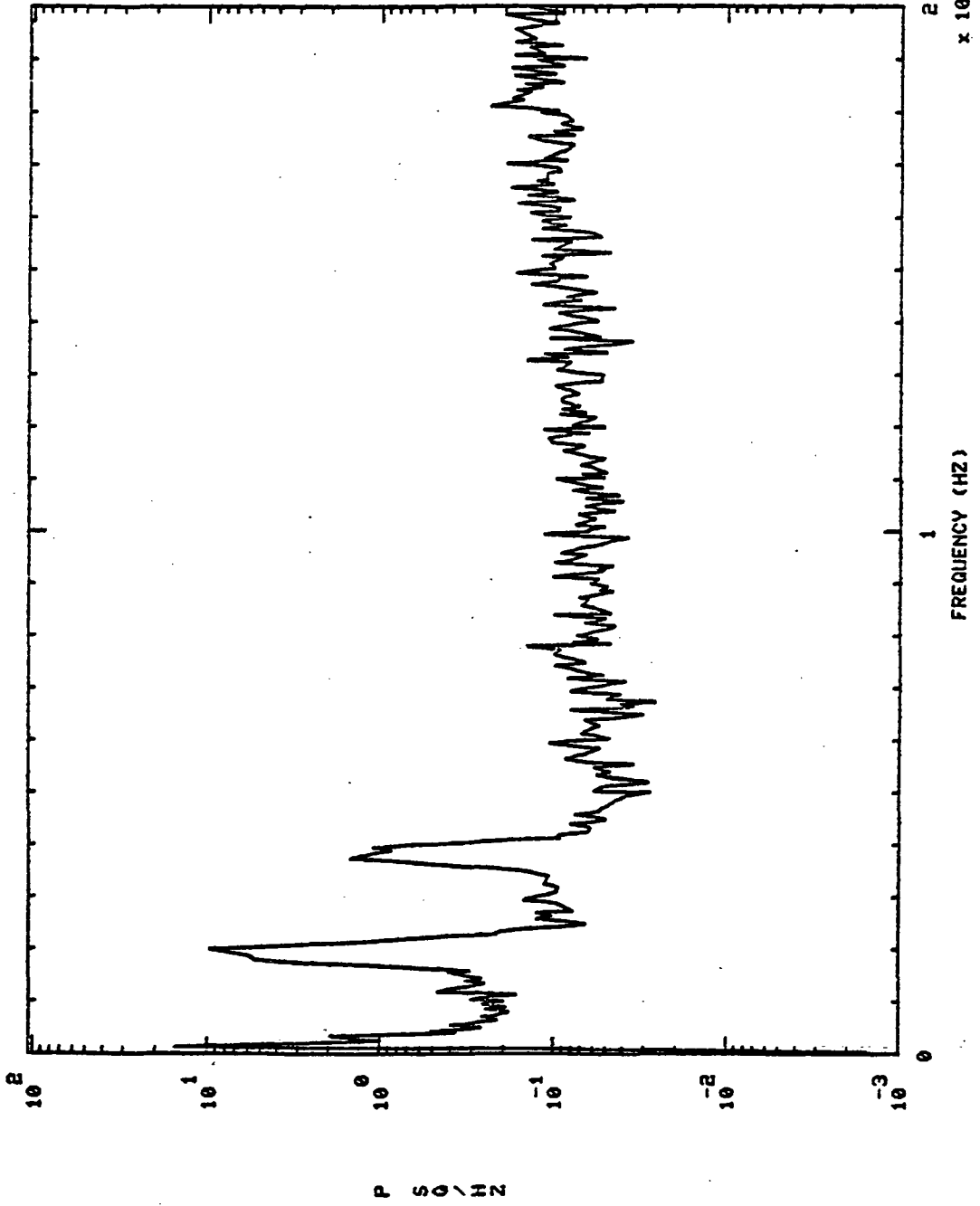
750134 MCC FUEL INJ PR DC S+ 30.01H0,'S



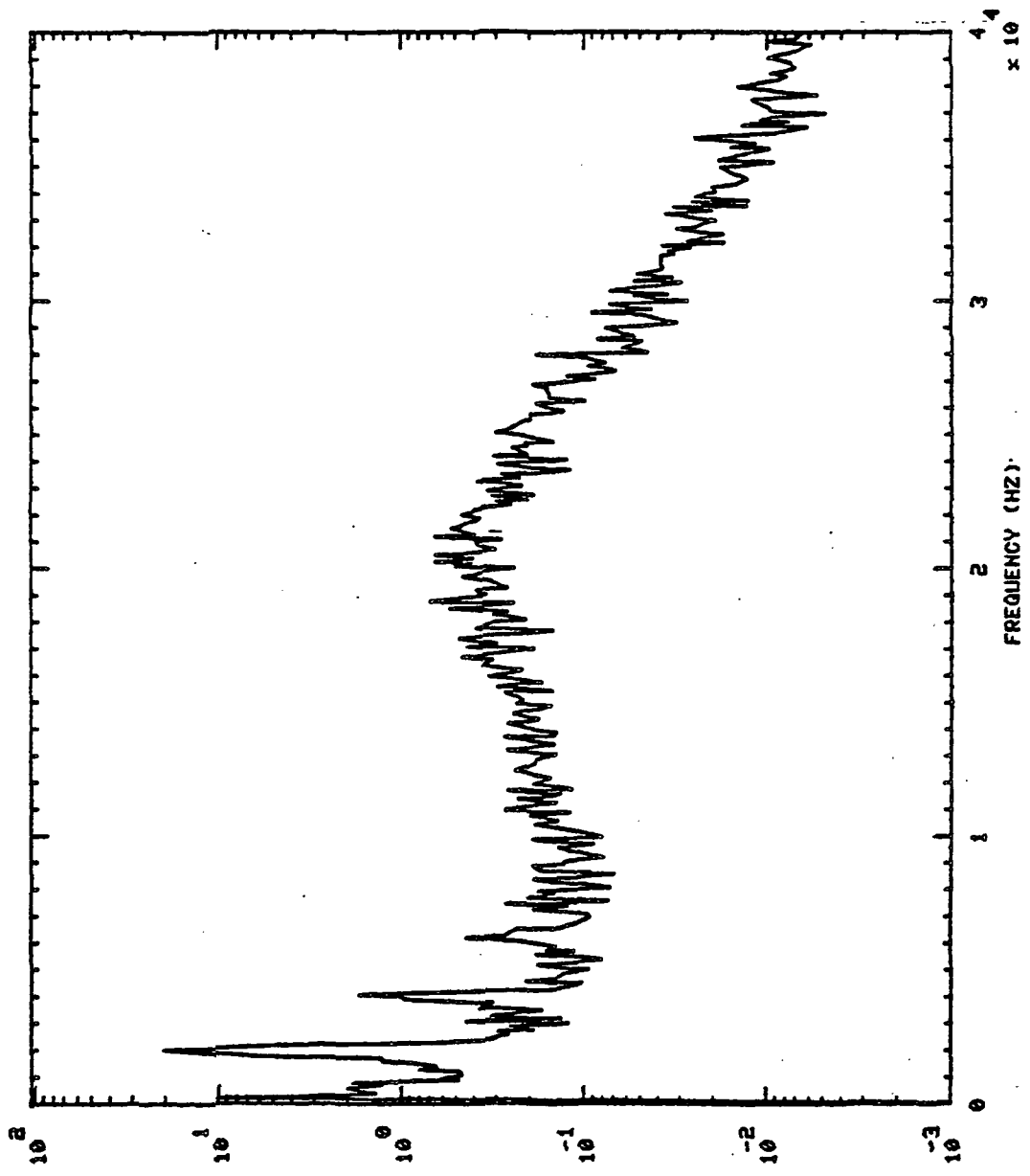
PSD / HZ

FREQUENCY (HZ) x 10^4

750134 NCC FUEL INJ PR DC S+ 45.01H0,'S

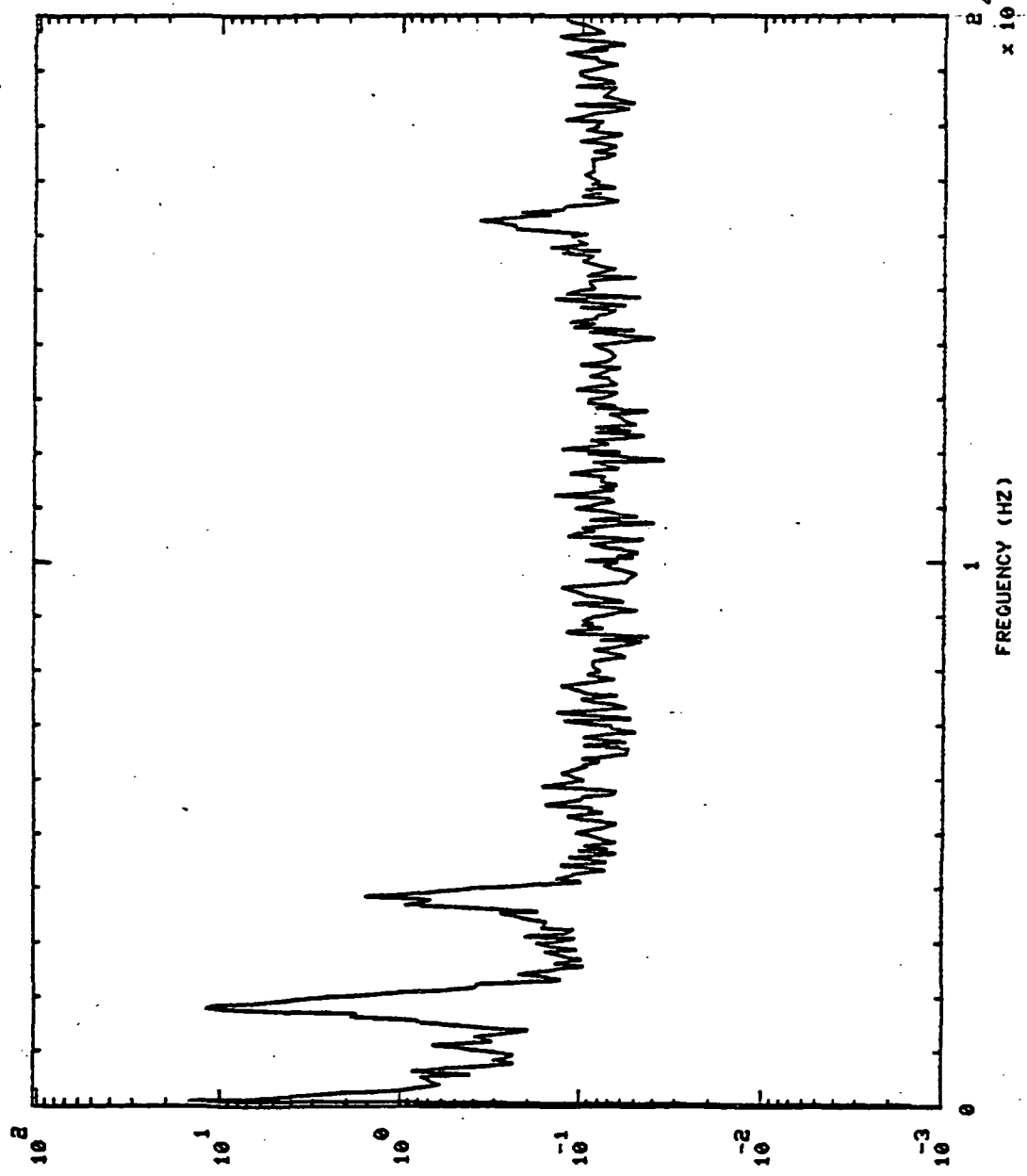


750134 MCC FUEL INJ PR DC S+ 45.01H0,'S



P S D / H Z

750134 MCC FUEL INJ PR DC S+ 150.01H0,'S

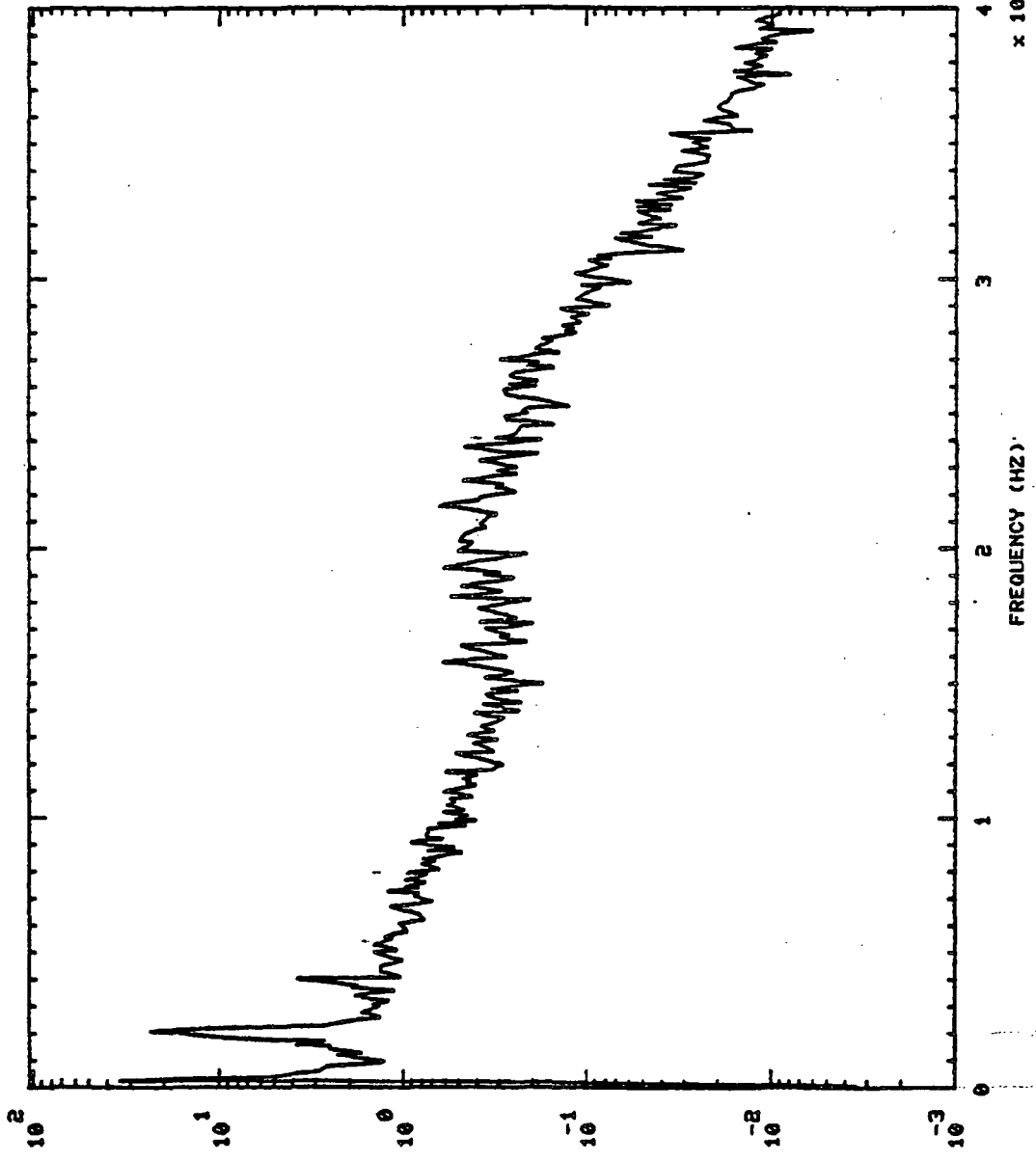


P SO IN

S+ 150.01H0.'S

MCC FUEL INJ PR DC

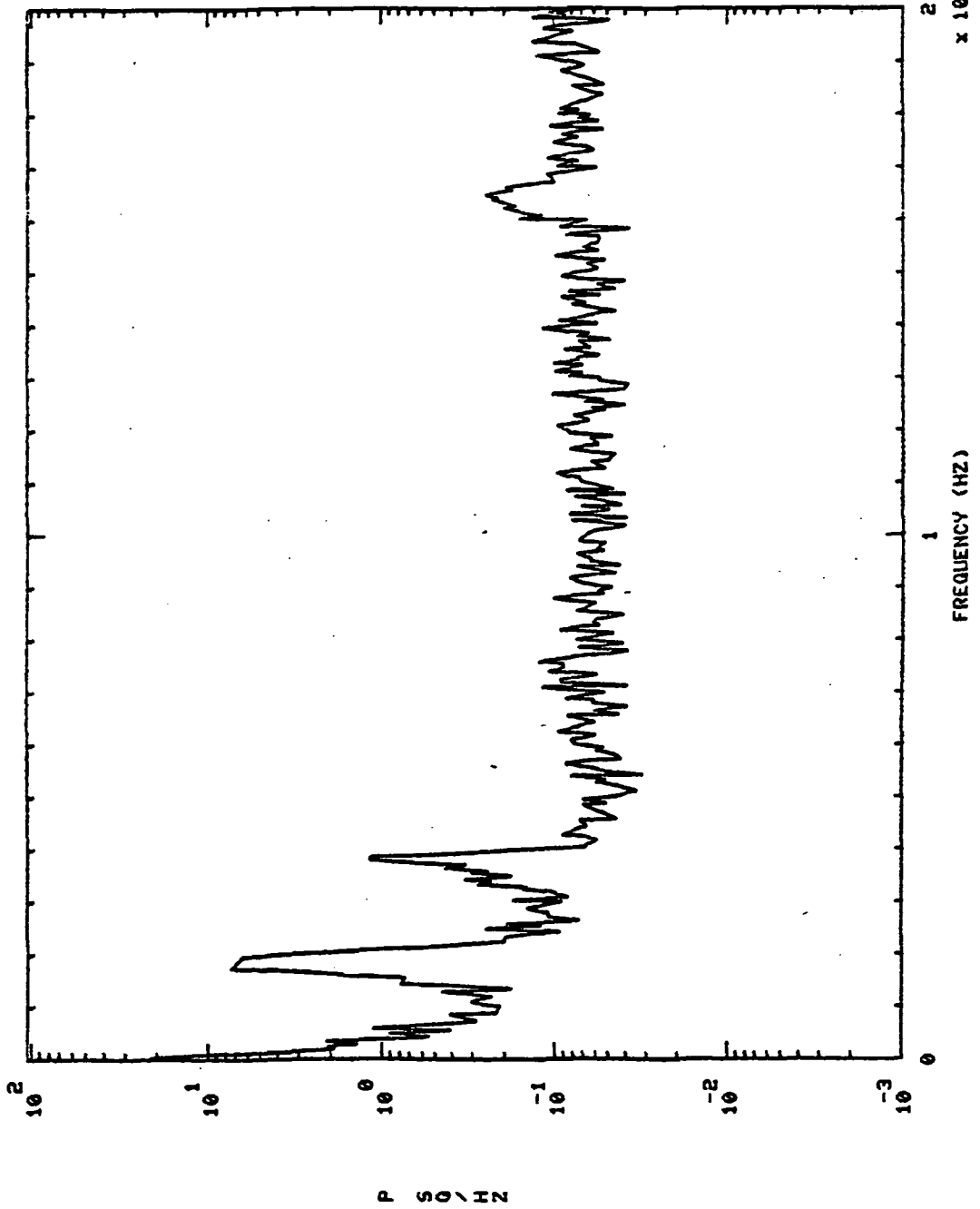
750134



P S D / H Z

L

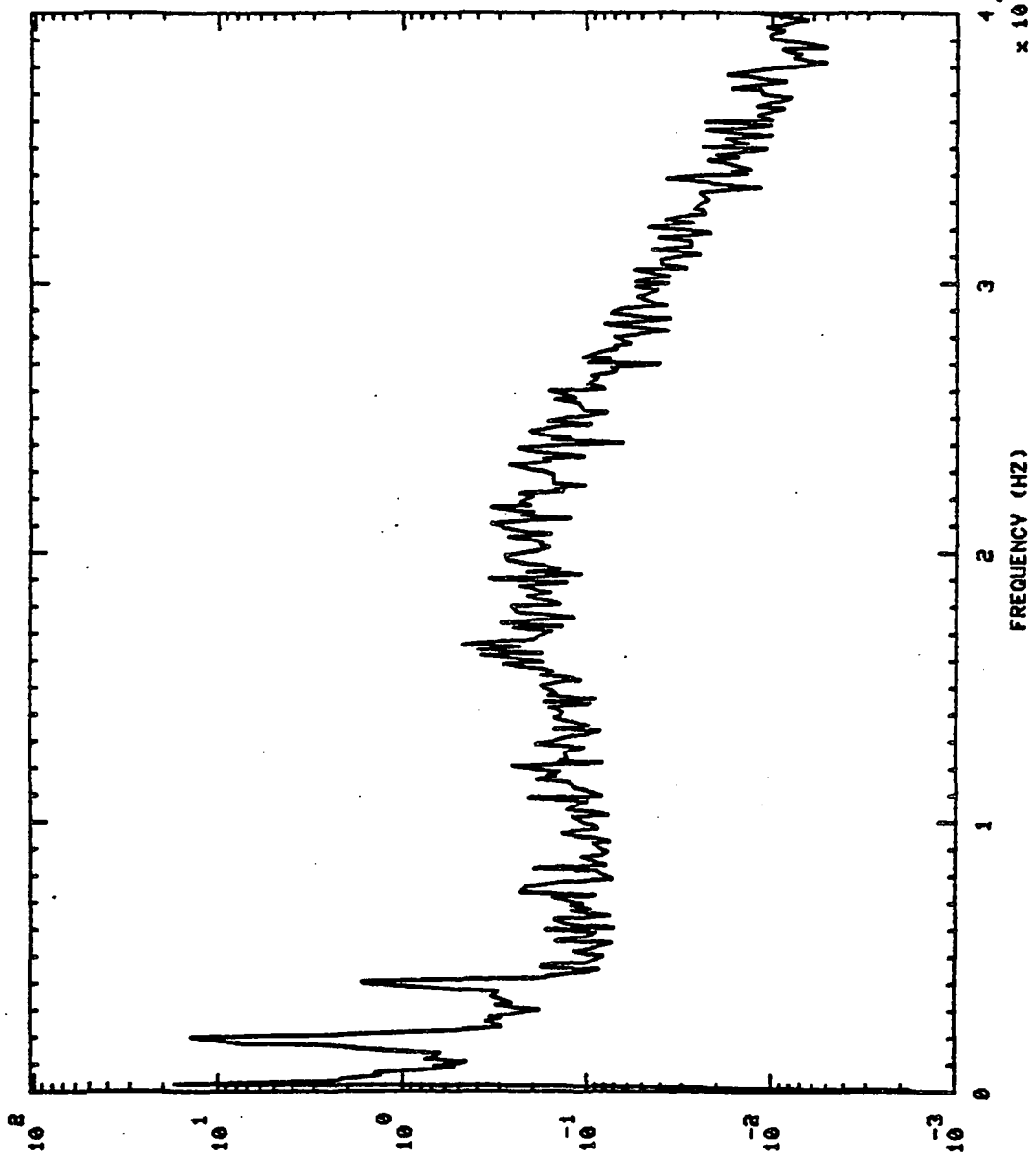
750134 MCC FUEL INJ PR DC S+ 280.01H0,'S



5+ 280.01H0,'S

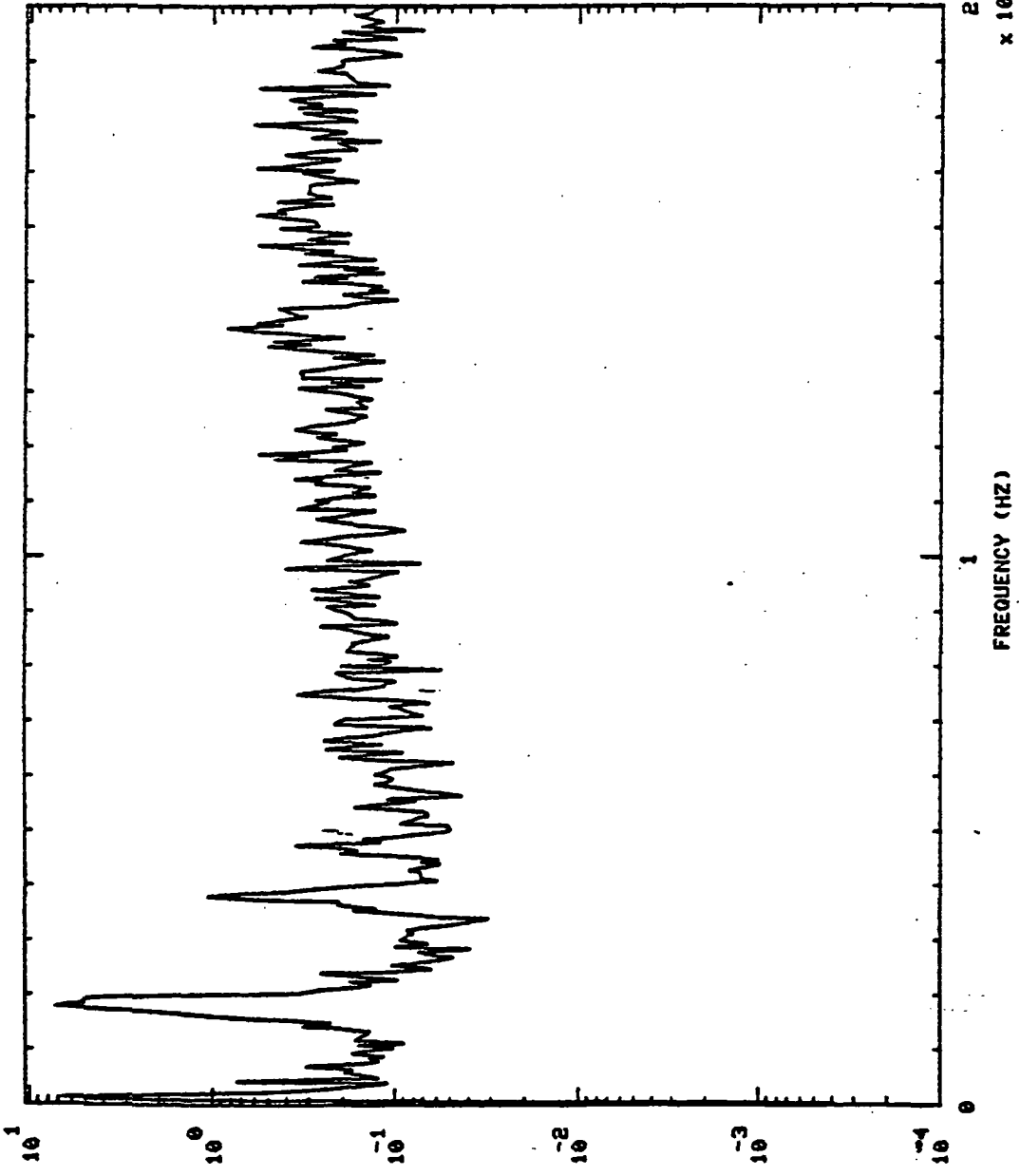
MCC FUEL INJ PR DC

750134



P S D / HZ

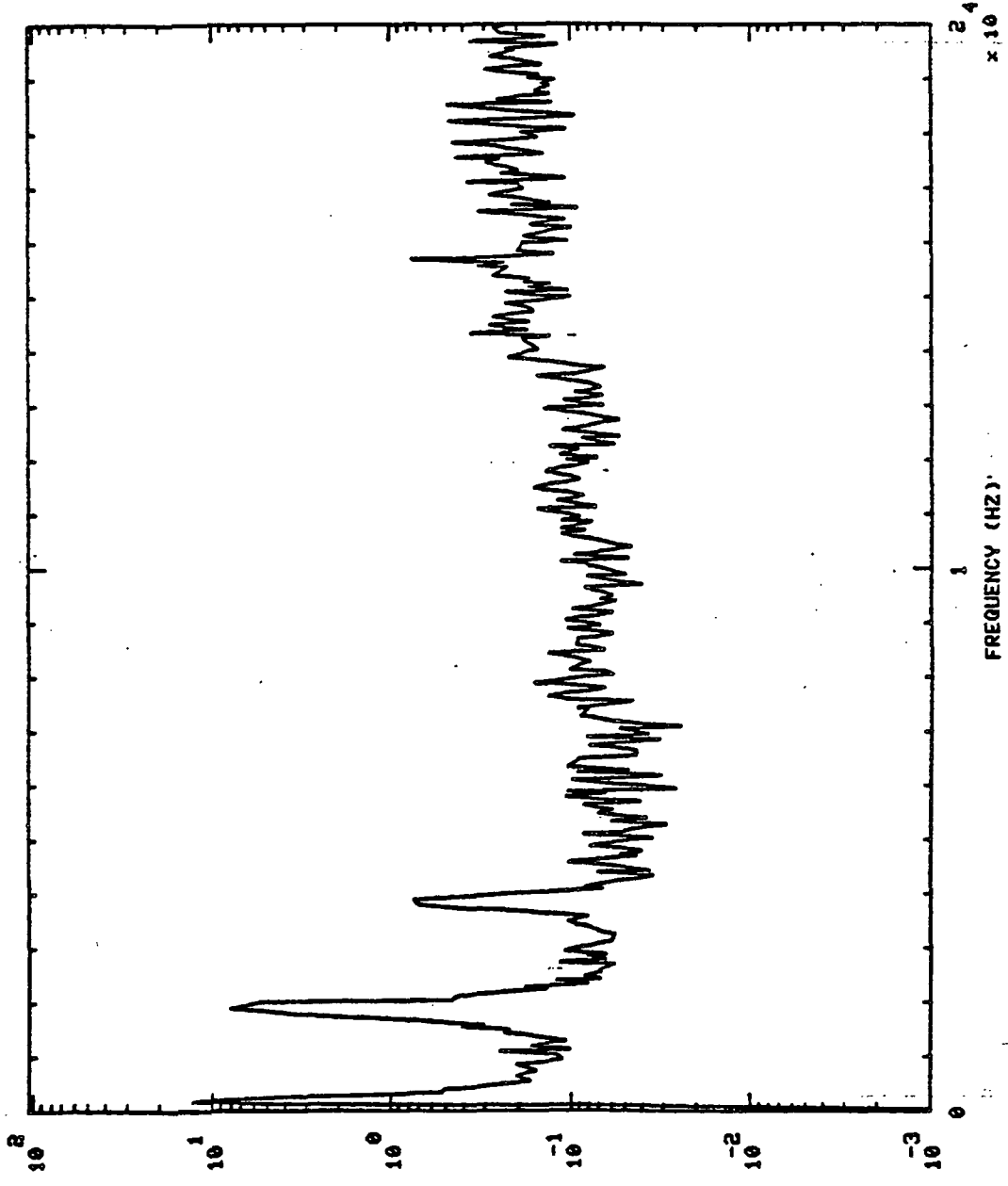
750134 OPB PC PR DC S+ 4.01H0,'S



P S G \ HZ

FREQUENCY (HZ) x 10⁴

750134 OPB FC PR DC S+ 30.01H0,'S



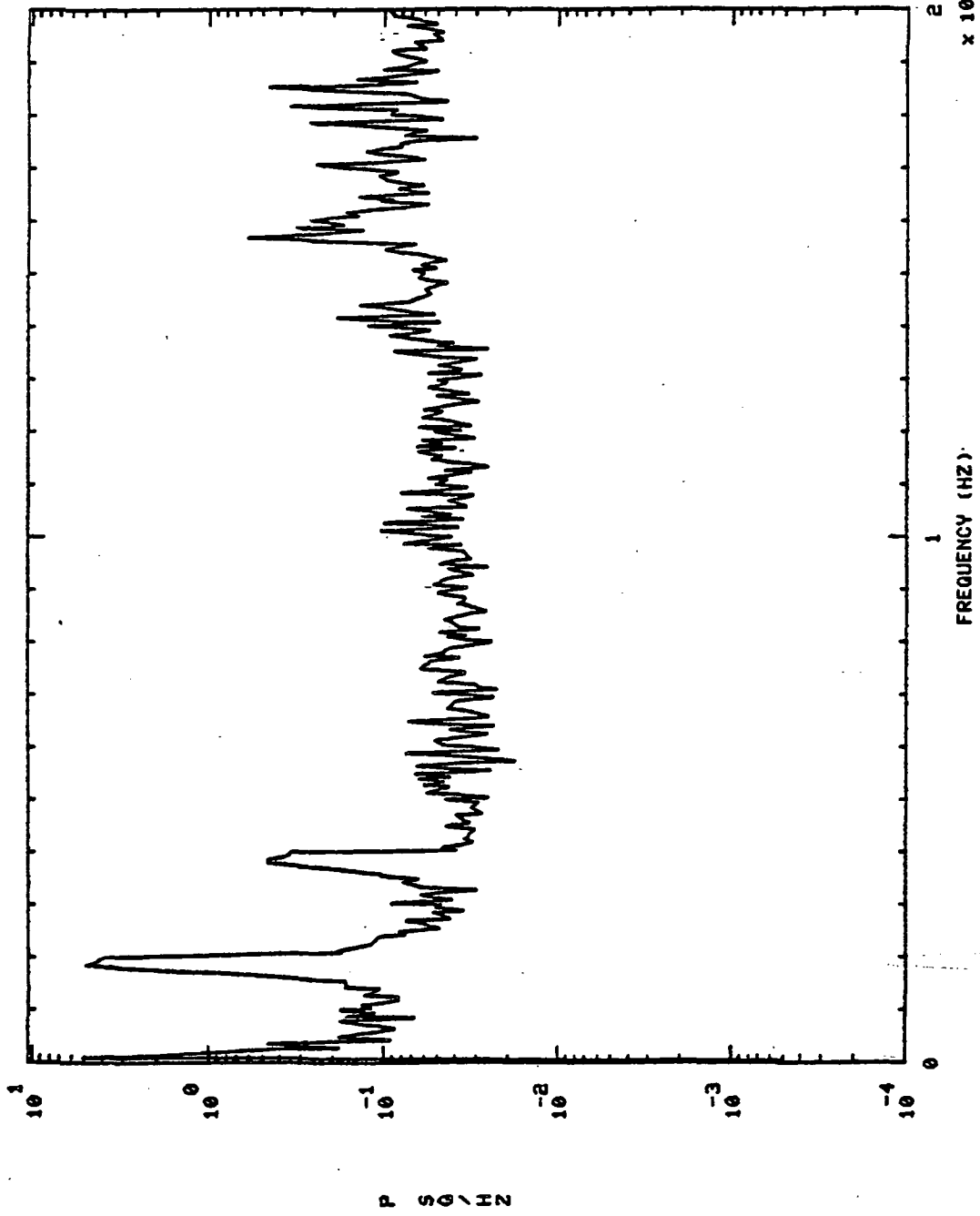
P S G \ H N

10^4
 $\times 10$

FREQUENCY (HZ)

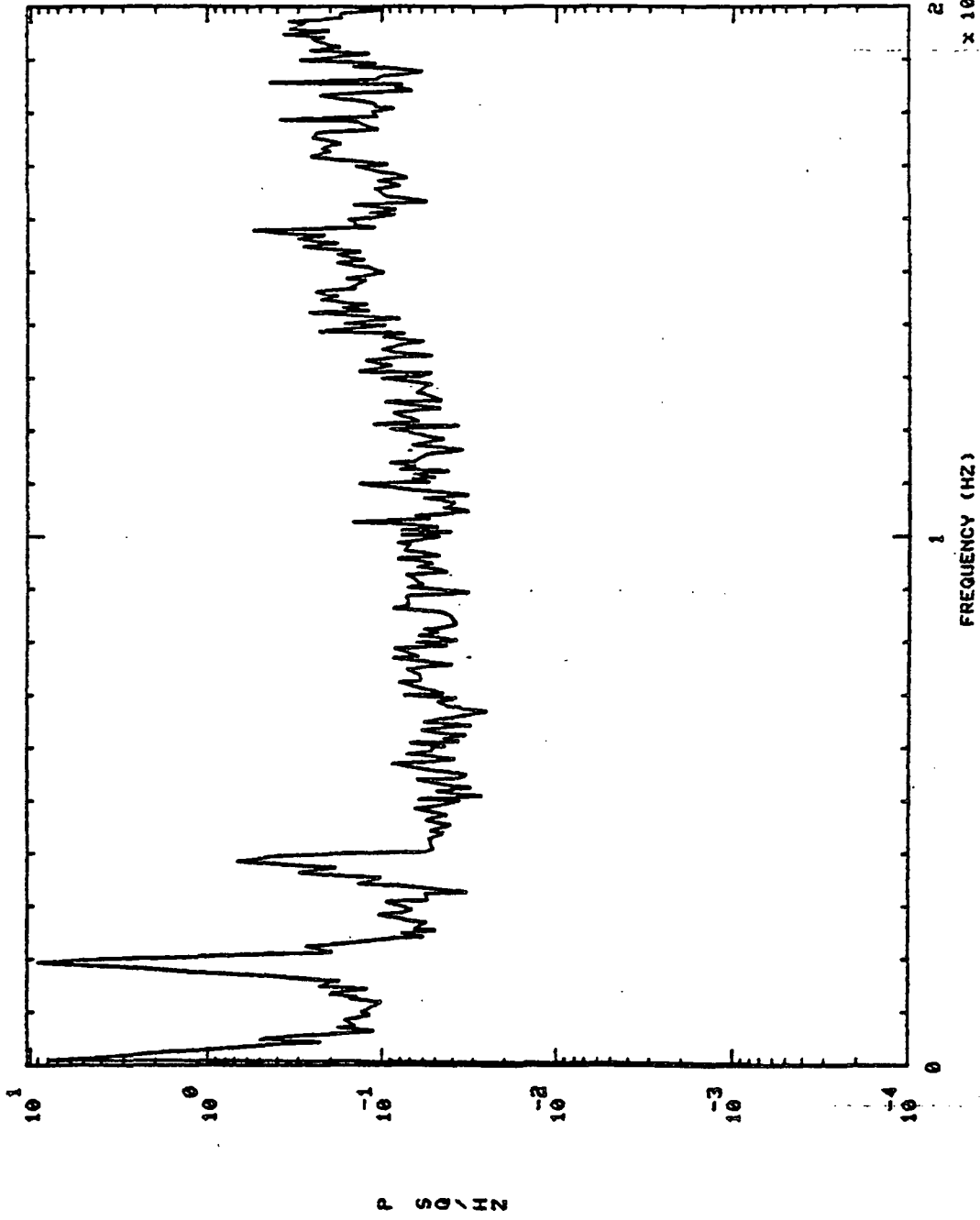
S+ 45.01H0,'S

750134 OPB PC PR DC



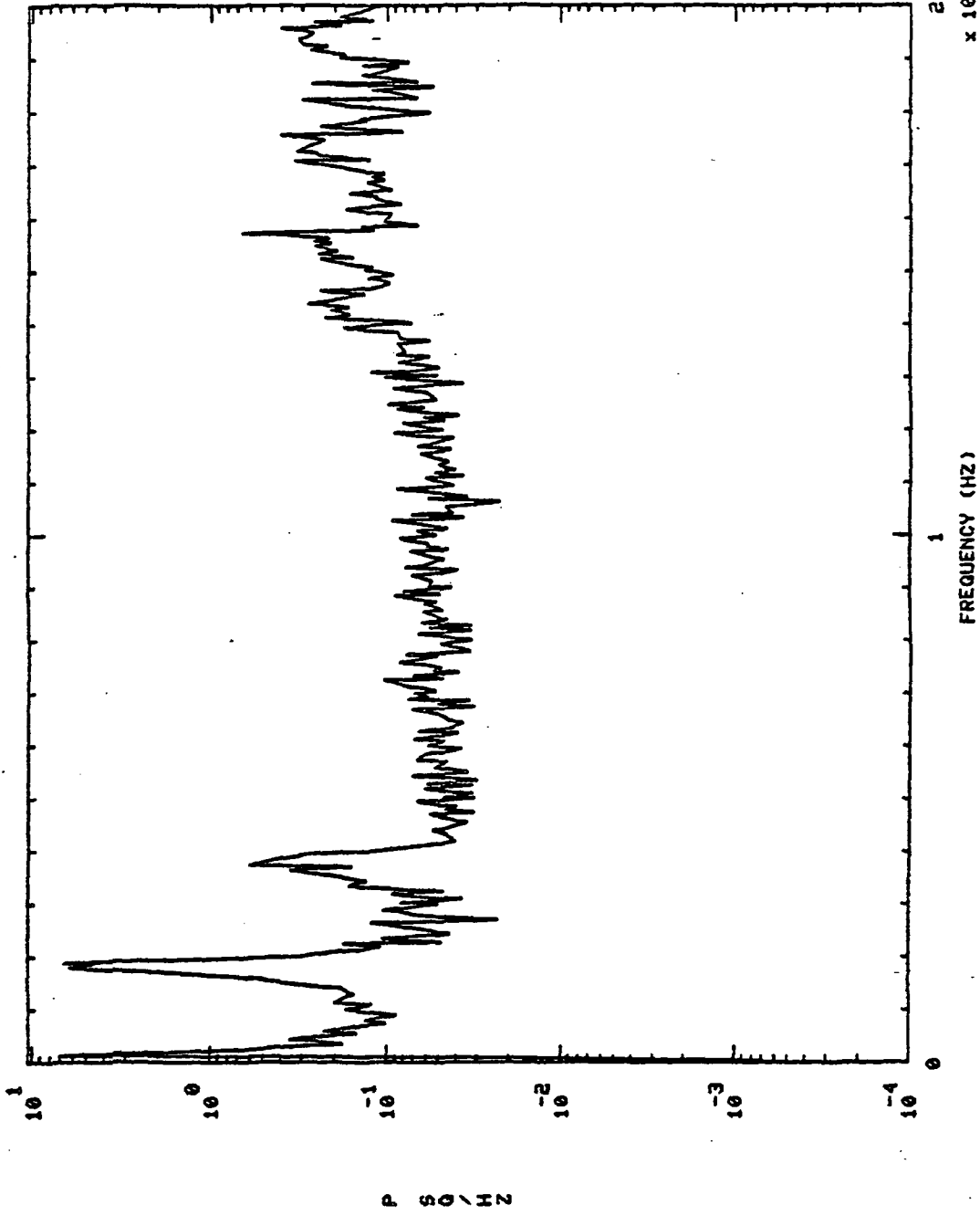
S+ 150.01H0,'S

750134 OPB PC PR DC

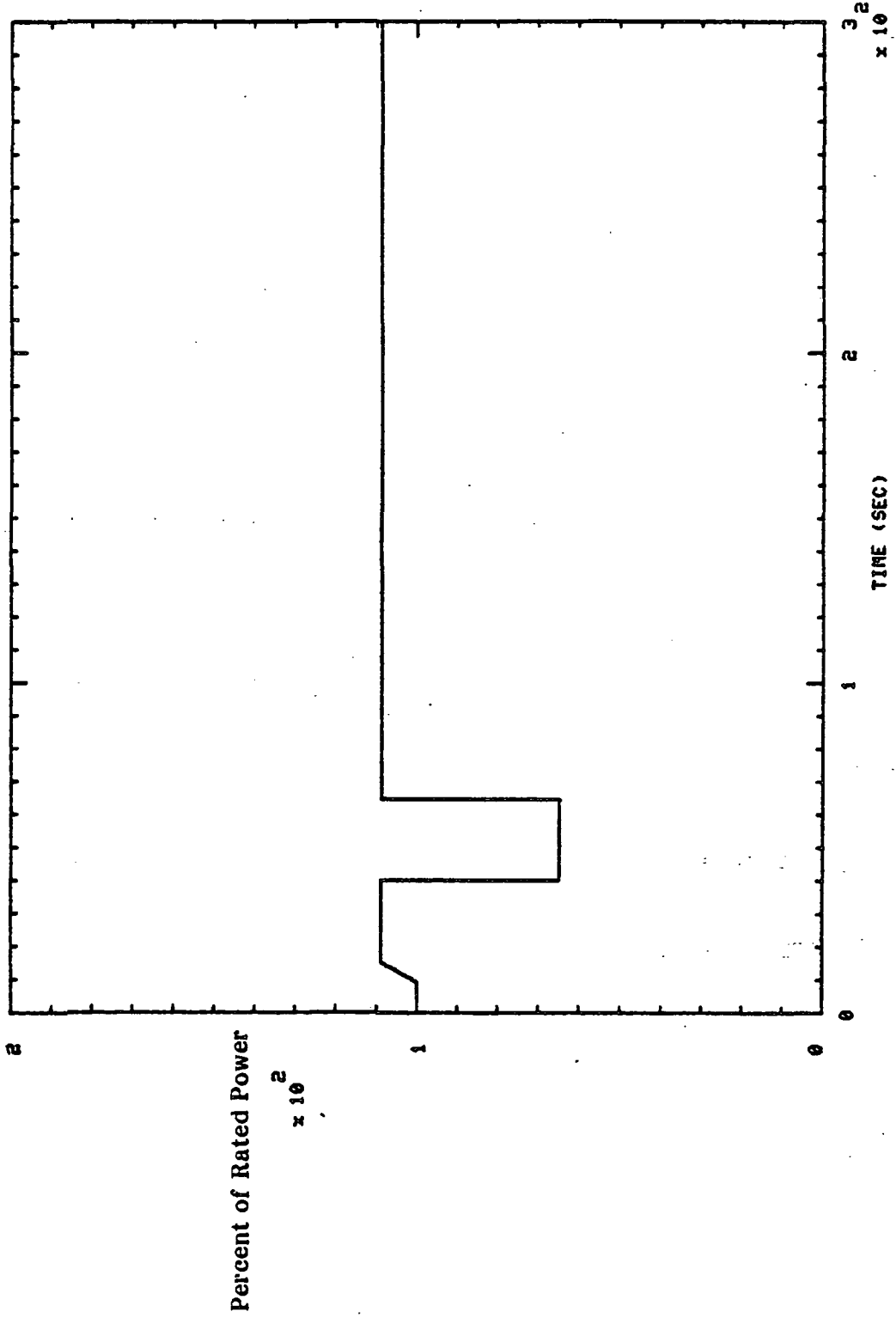


ST 280.01H0,'S

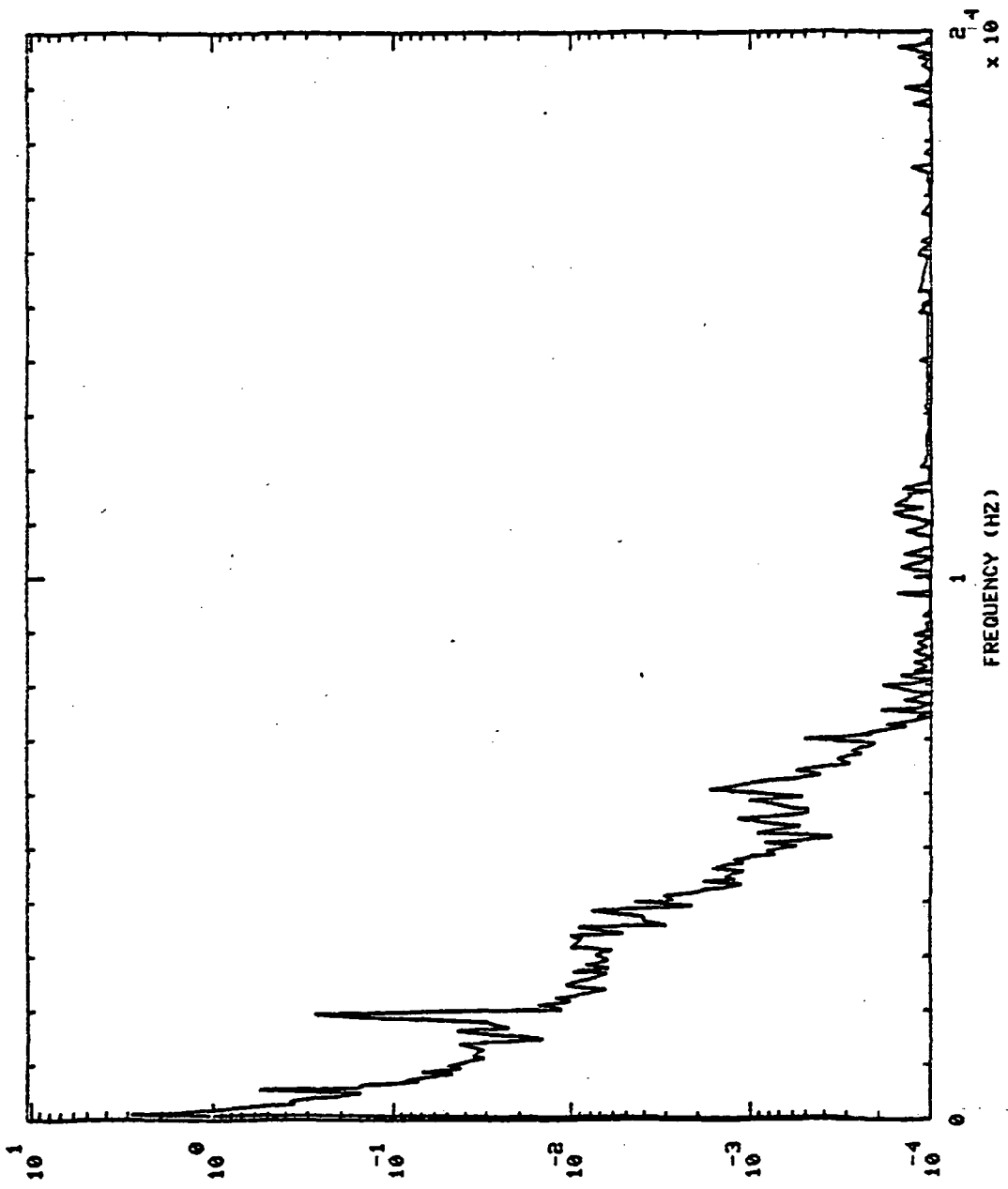
750134 OPB PC PR DC



750135 THRUST (UNFILTERED)



750135 MCC FUEL INJ PR S+ 6.01H0, 'S

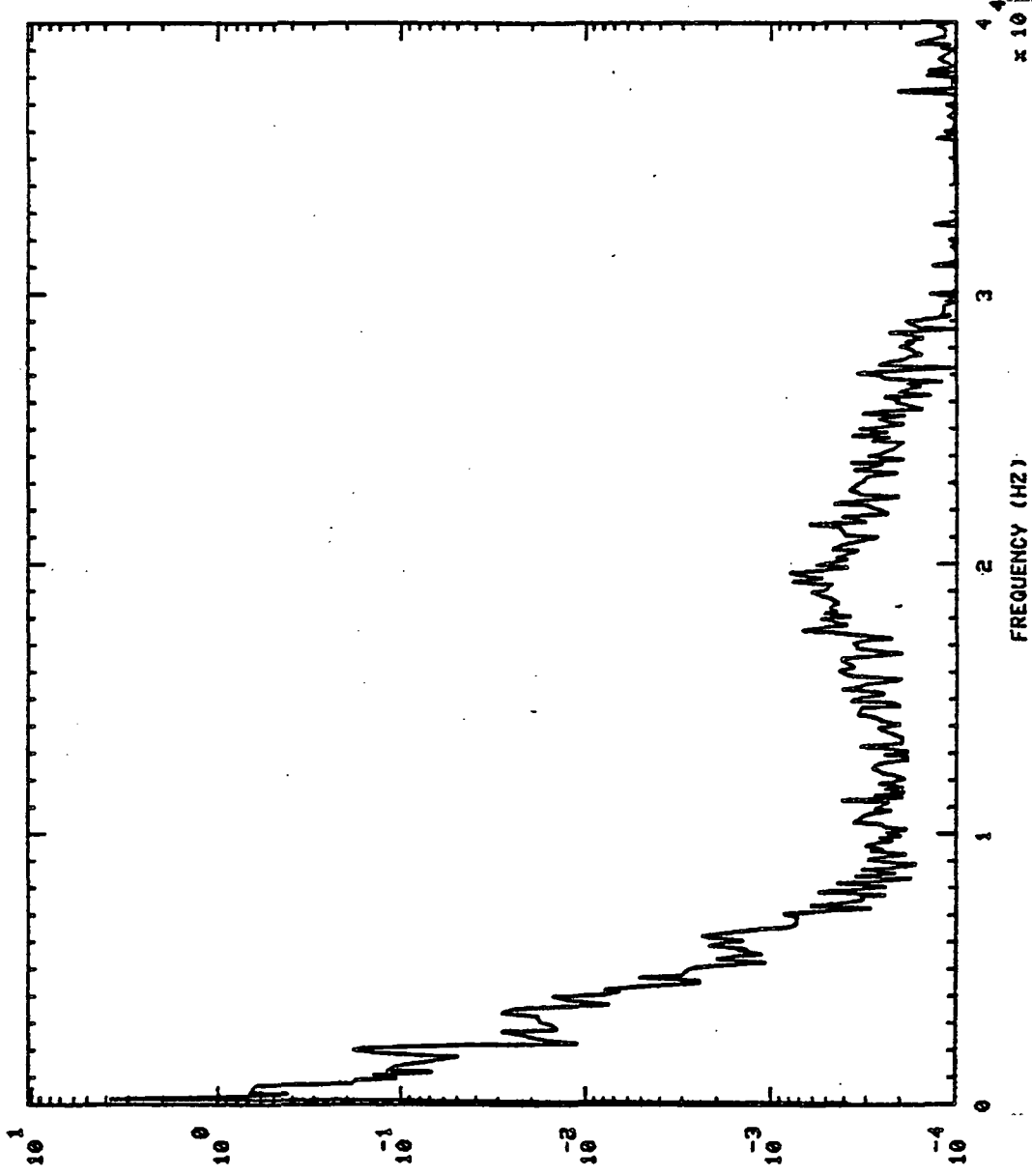


P SQ/IN

FREQUENCY (HZ)

x 10⁴

750135 MCC FUEL INJ PR 5+ 6.01H0,'8

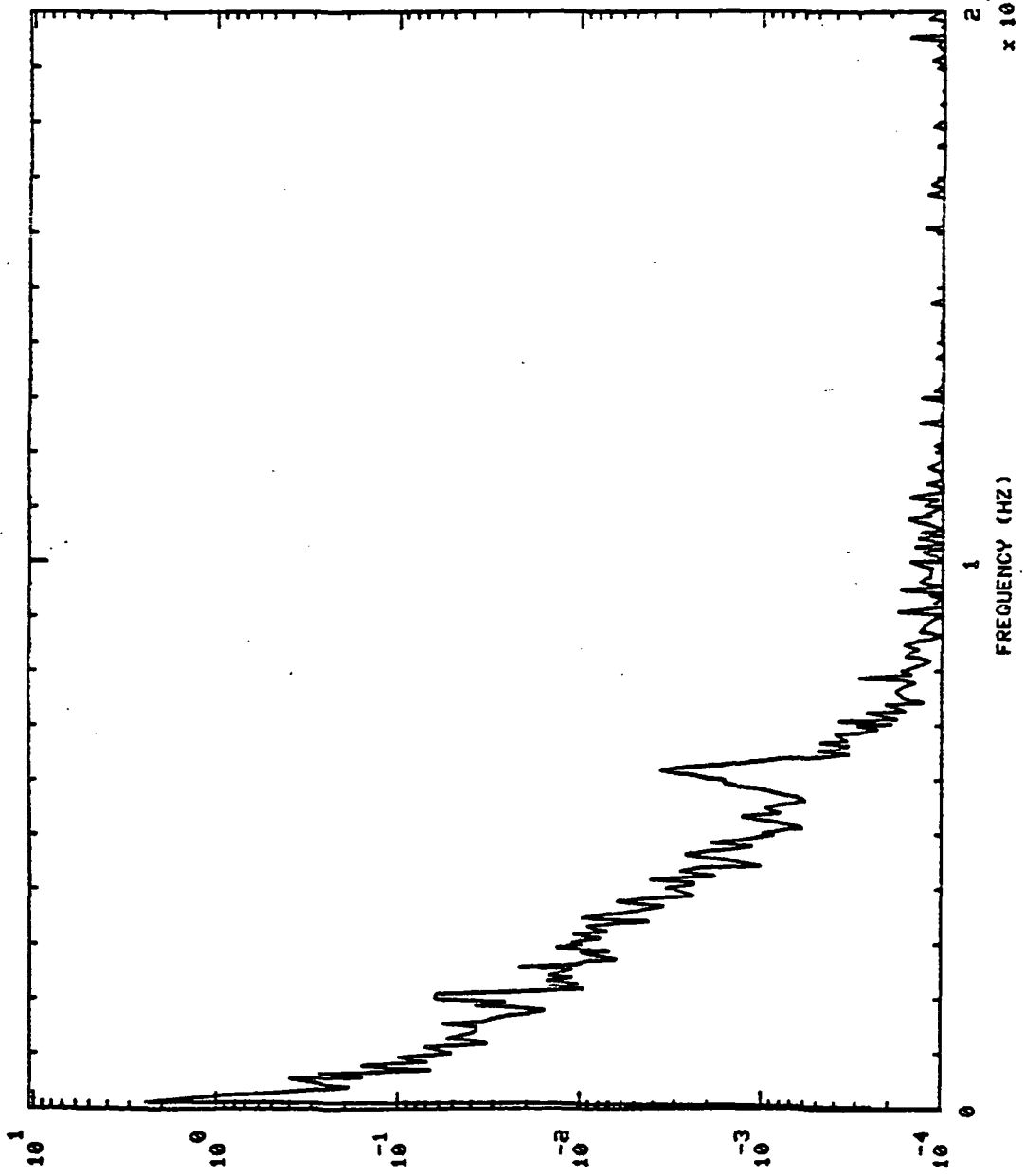


P S D / HZ

FREQUENCY (HZ)

x 10⁴

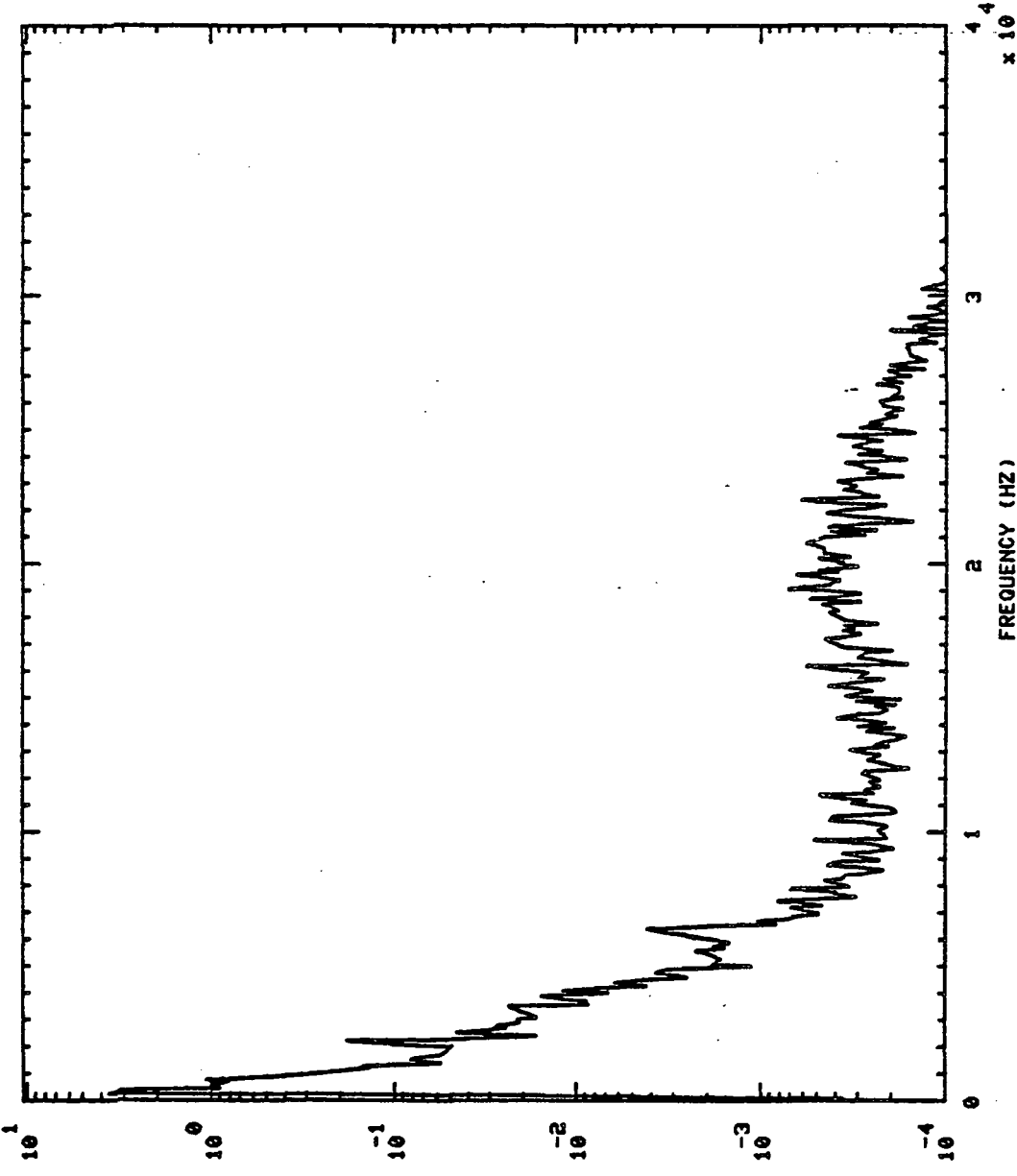
750135 MCC FUEL INJ PR S+ 15.01H0,'S



P S G / H Z

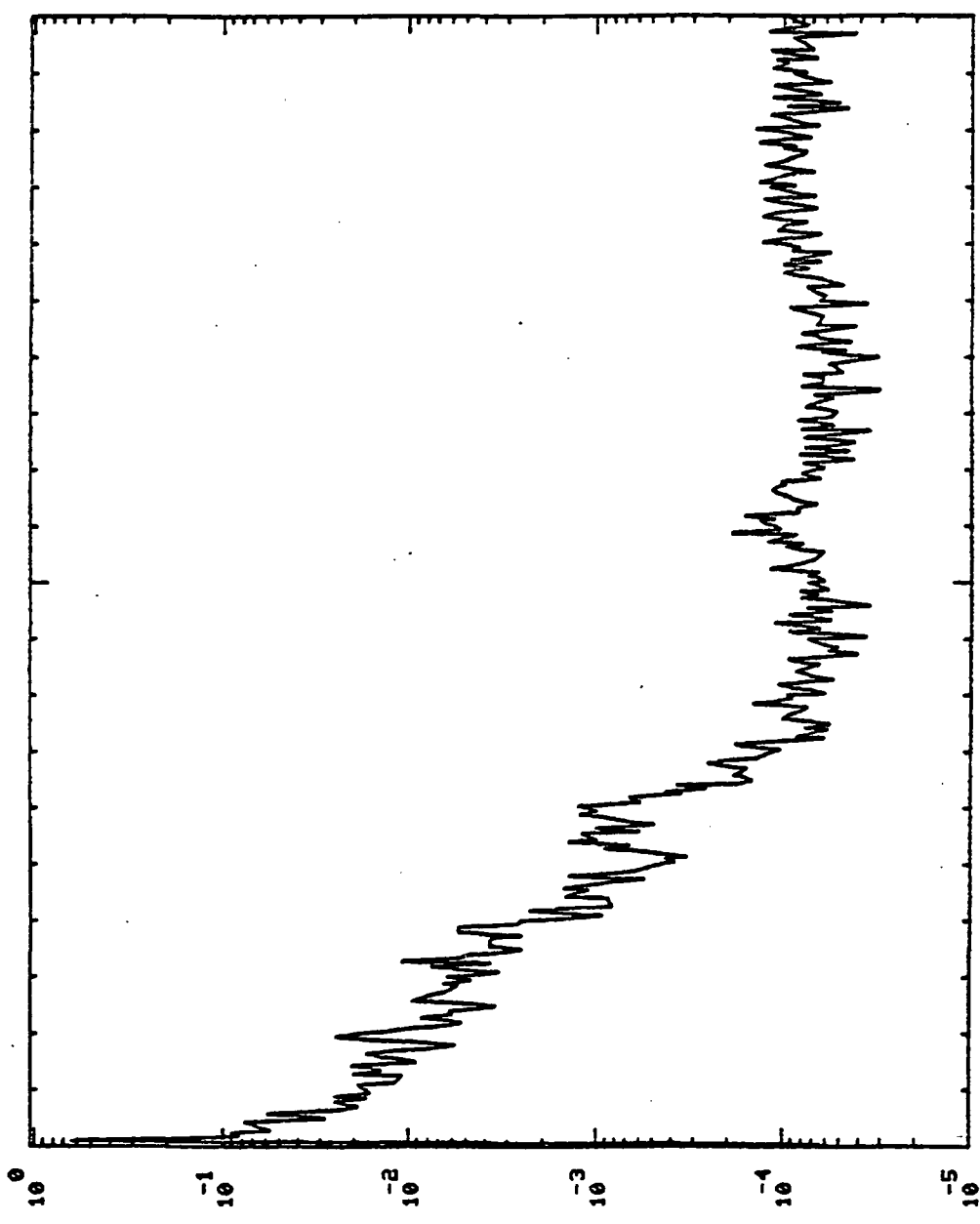
FREQUENCY (HZ)
x 10⁴

750135 MCC FUEL INJ PR S+ 15.01H0,'S



P SQ\IN

750135 MCC FUEL INJ PR S+ 45.01H0,'S



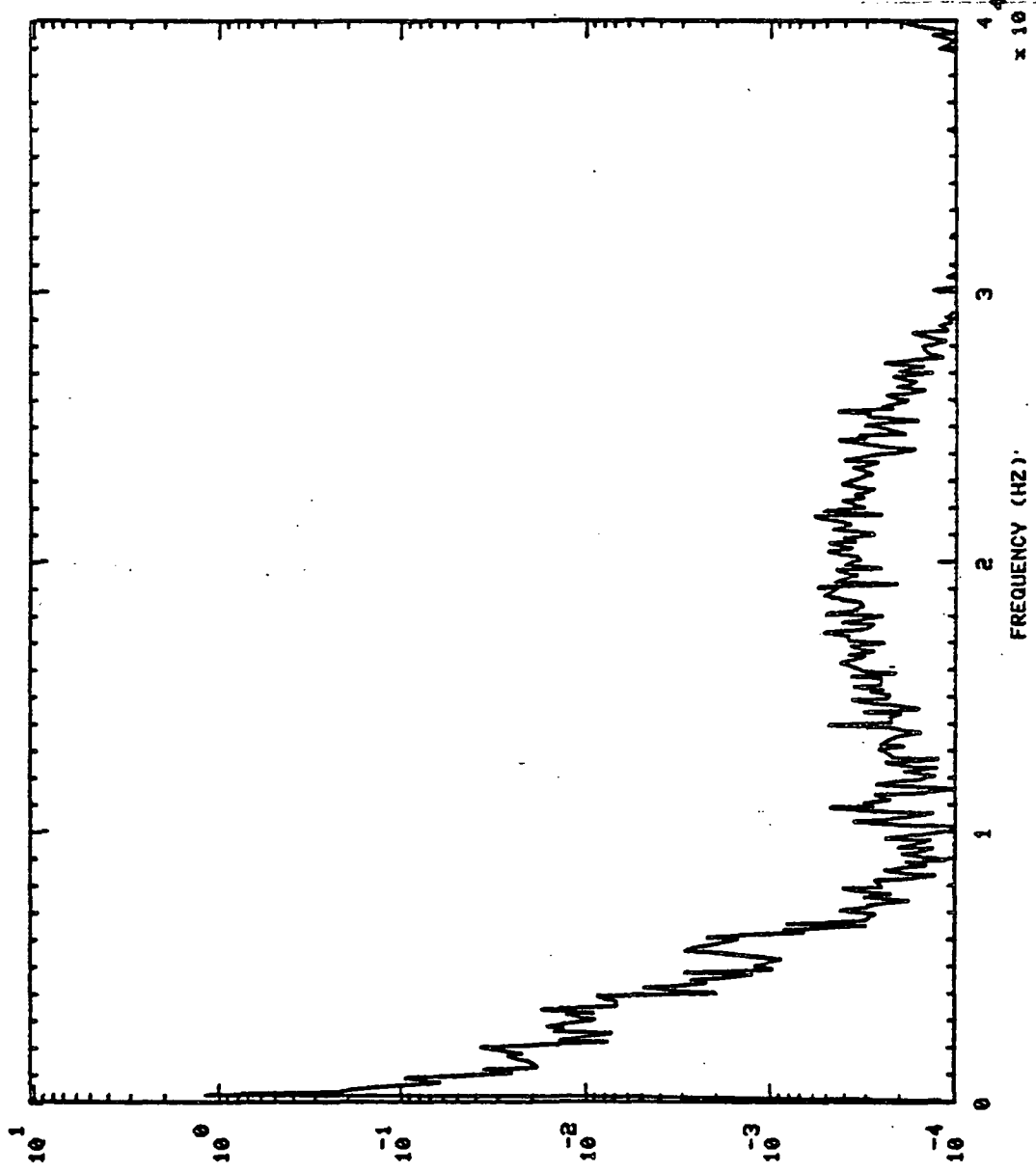
P SQ / HZ

FREQUENCY (HZ) x 10⁴

S+ 45.01H0,'S

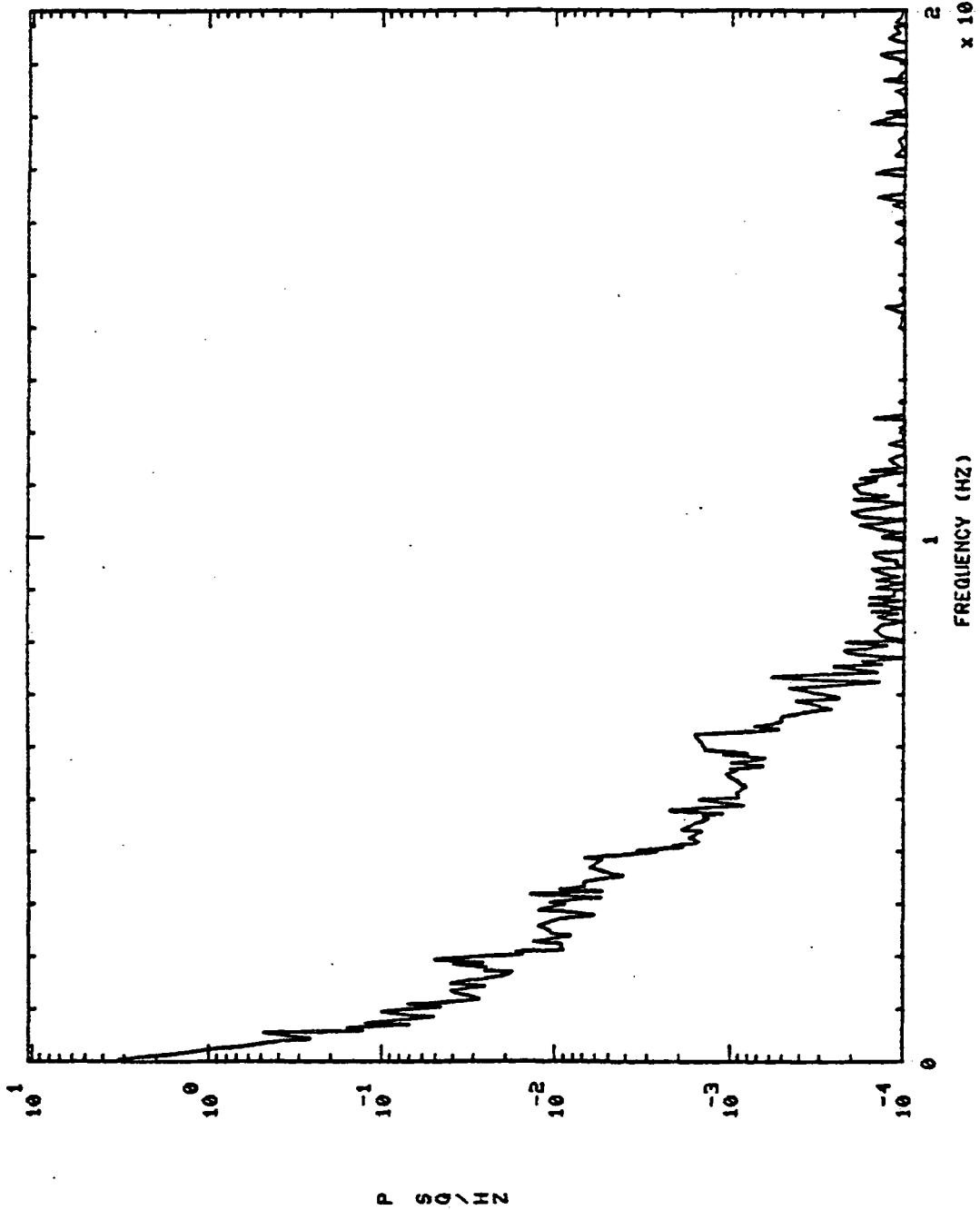
MCC FUEL INJ PR

750135



P SQ / HZ

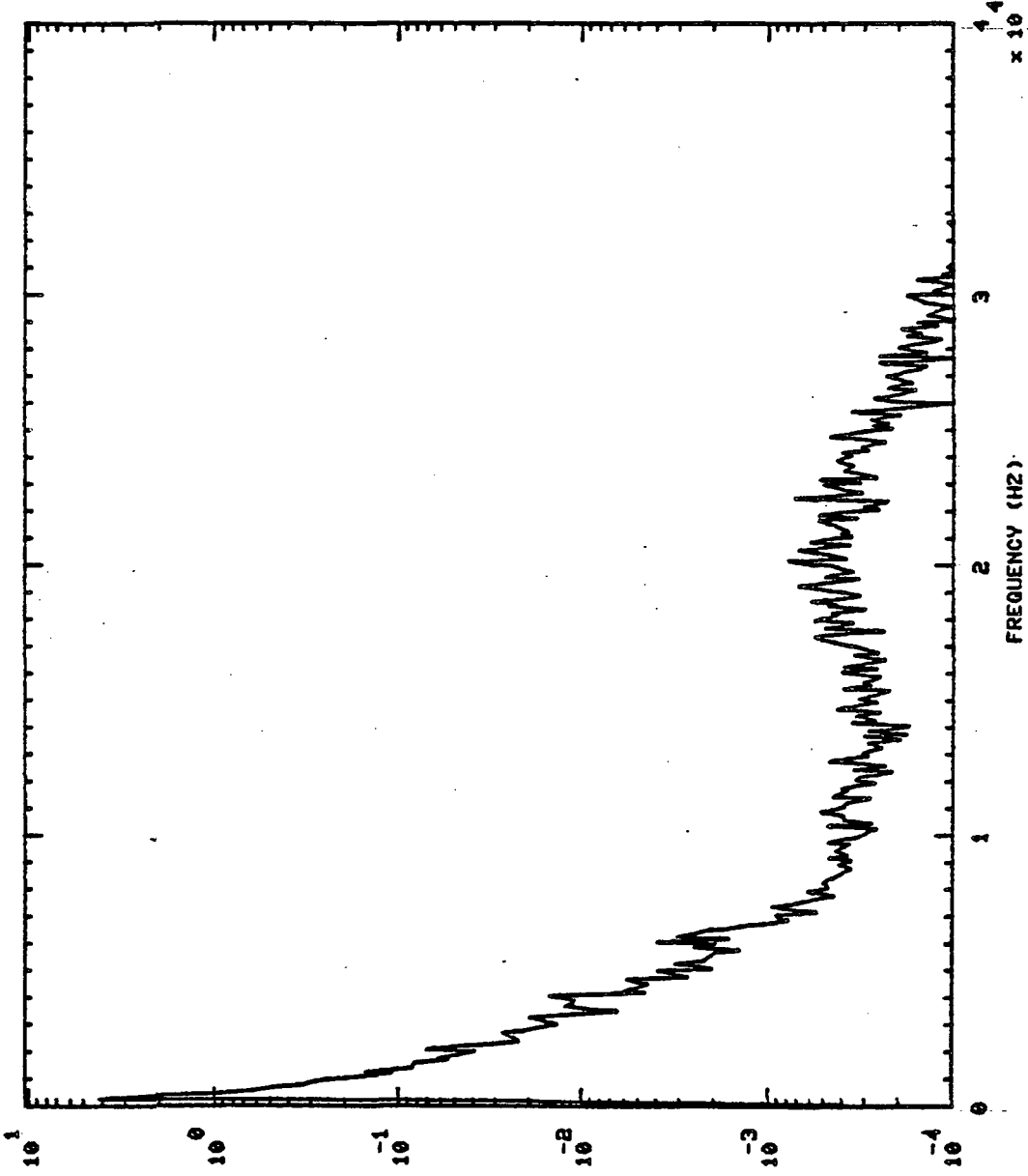
750135 MCC FUEL INJ PR S+ 75.01H0,'S



S+ 75.01H0,'S

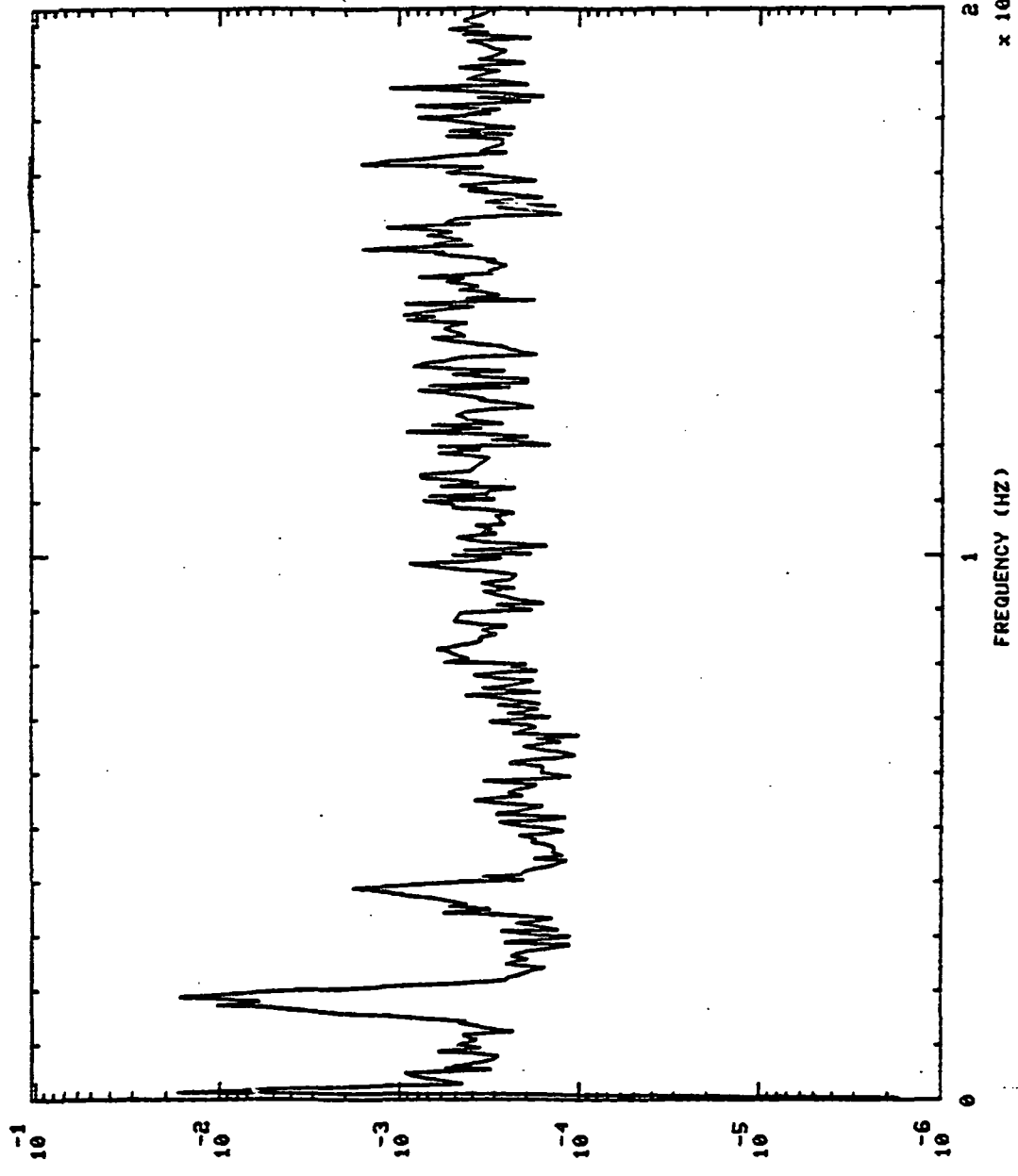
MCC FUEL INJ PR

750135



P S G \ H Z

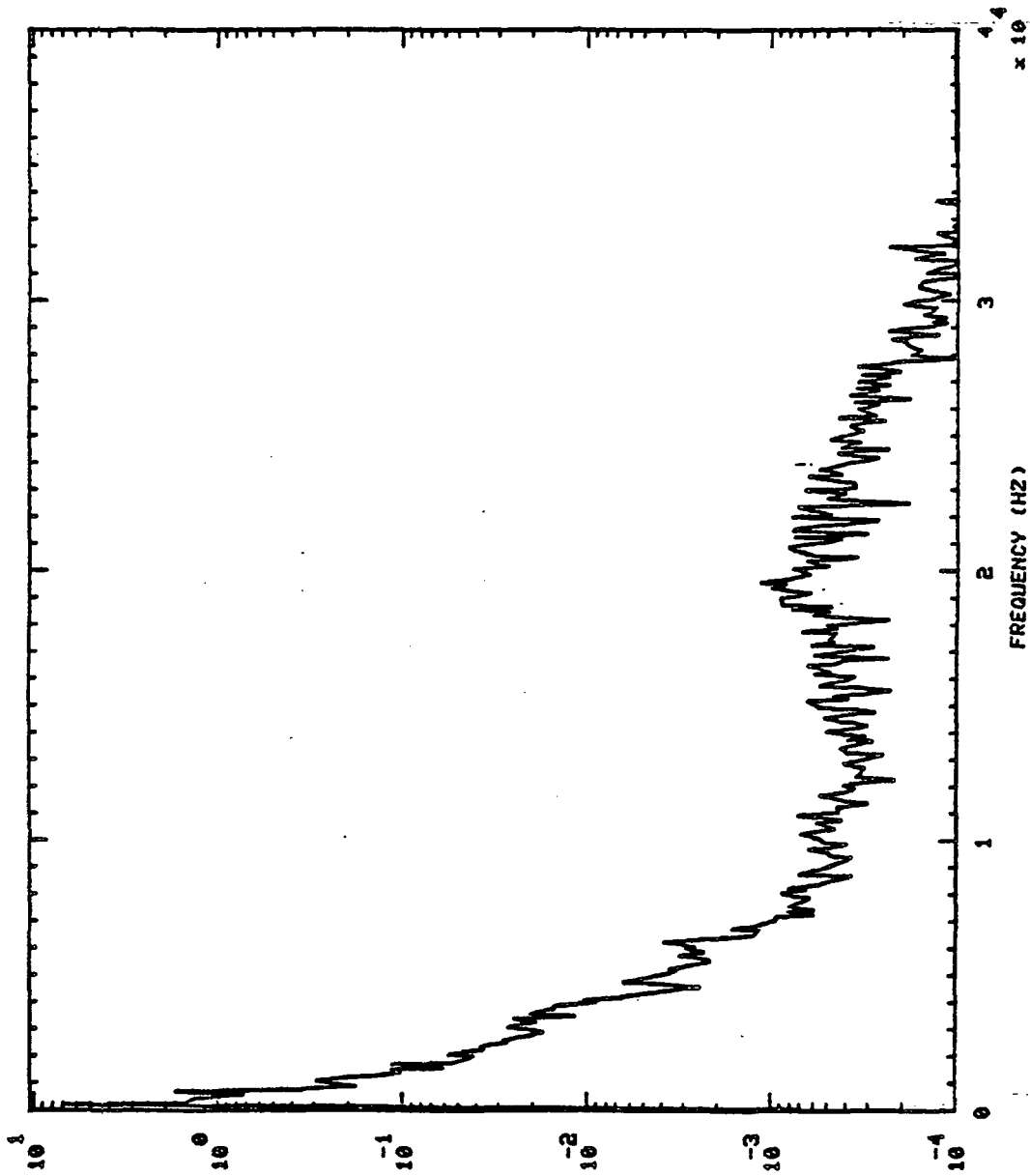
750135 MCC FUEL INJ PR Sr 150.01H0,'S



P S O / H N

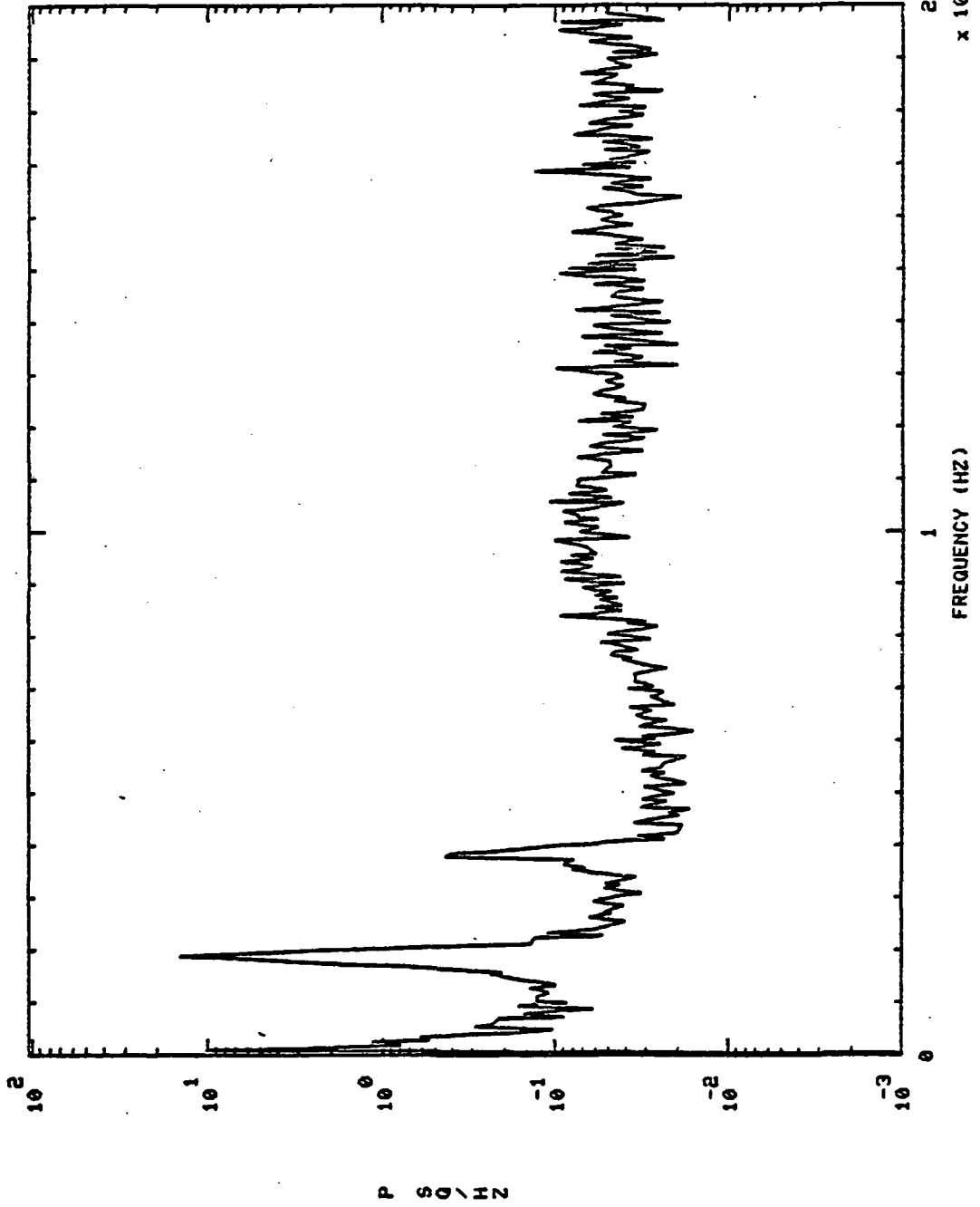
FREQUENCY (HZ) x 10^4

750135 MCC FUEL INJ PR S+ 150.01H0,'S

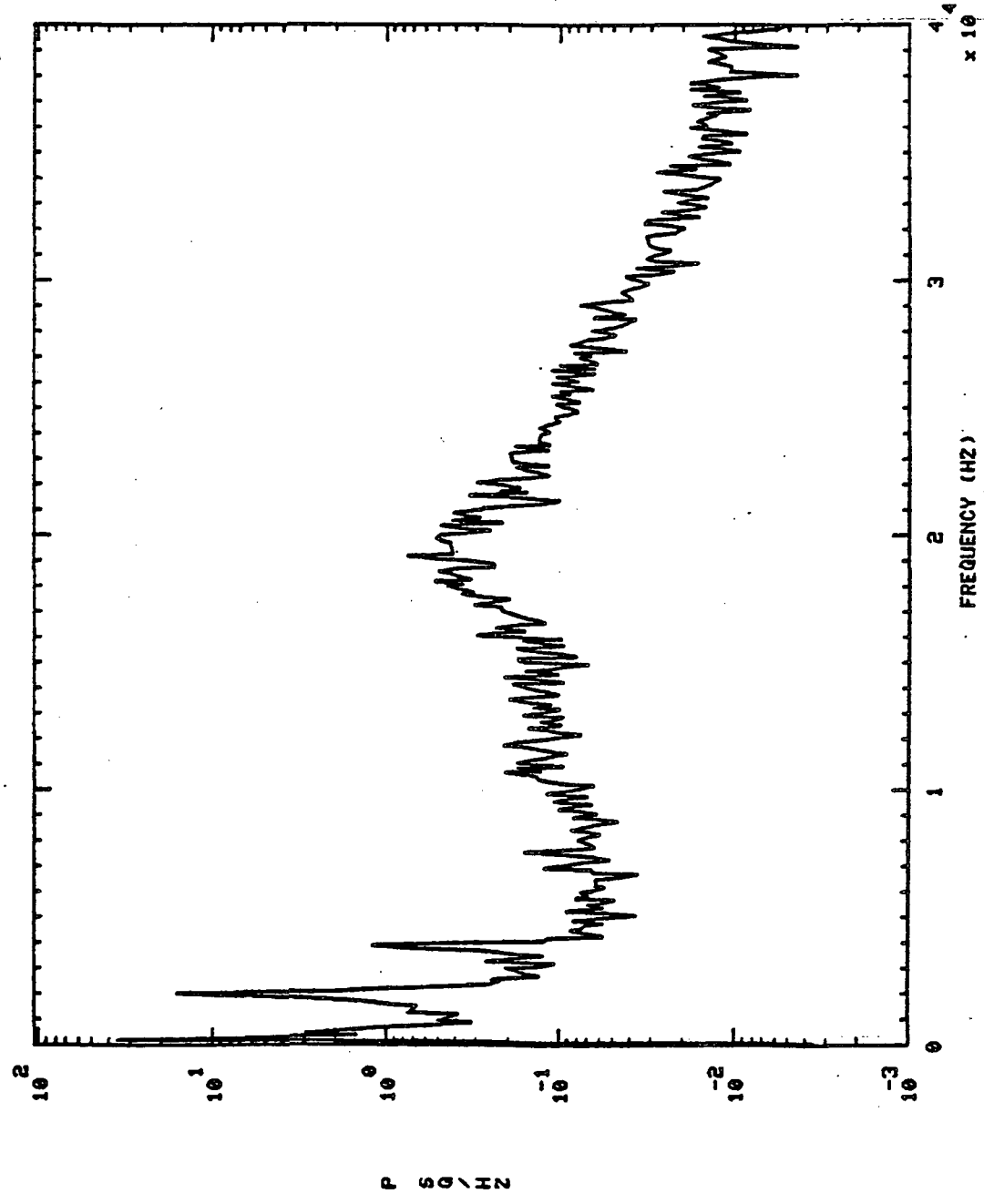


P SQ/IN

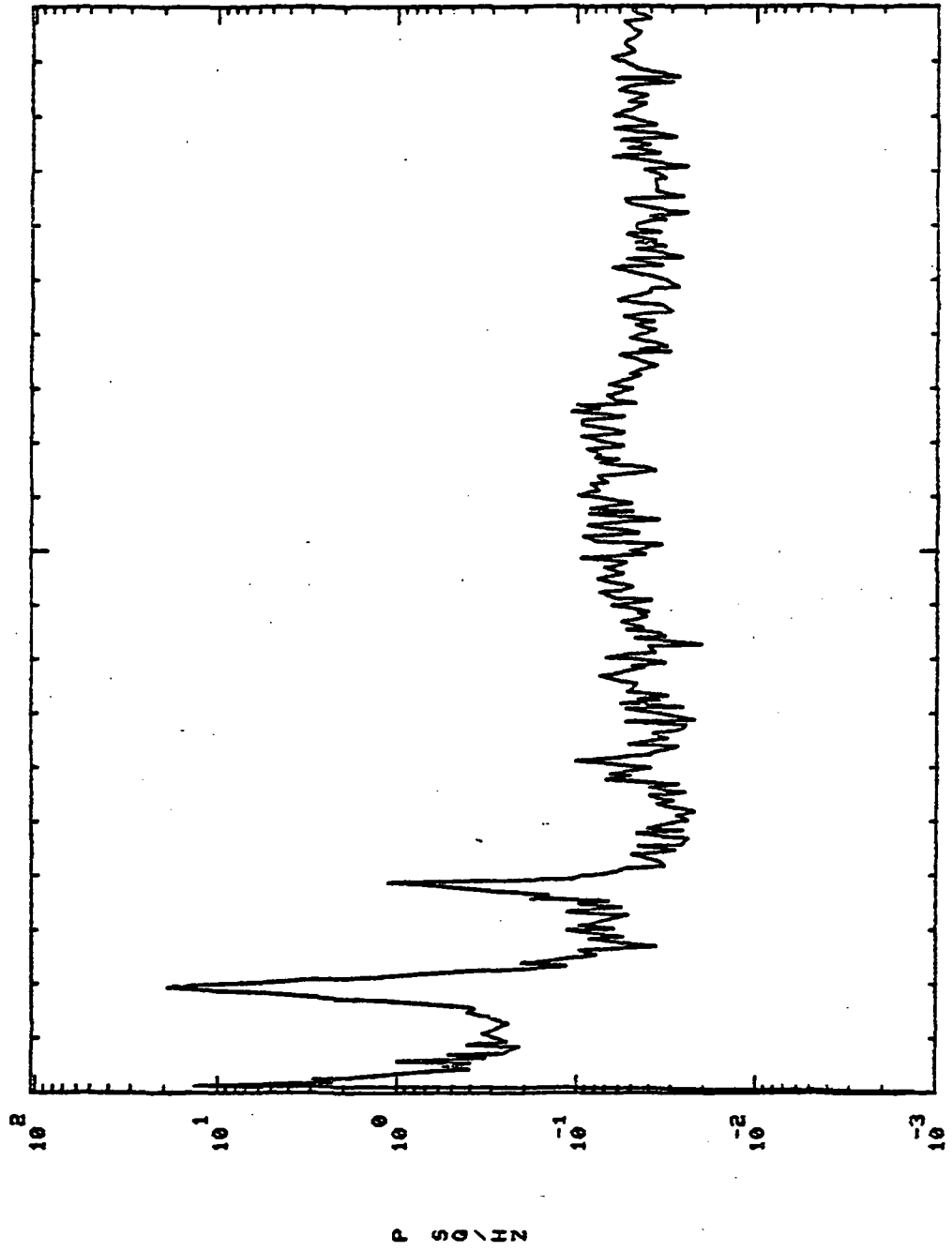
750135 MCC FUEL INJ PR DC S+ 6.0140,'S



750135 MCC FUEL INJ PR DC 6+ 6.01H0,'S

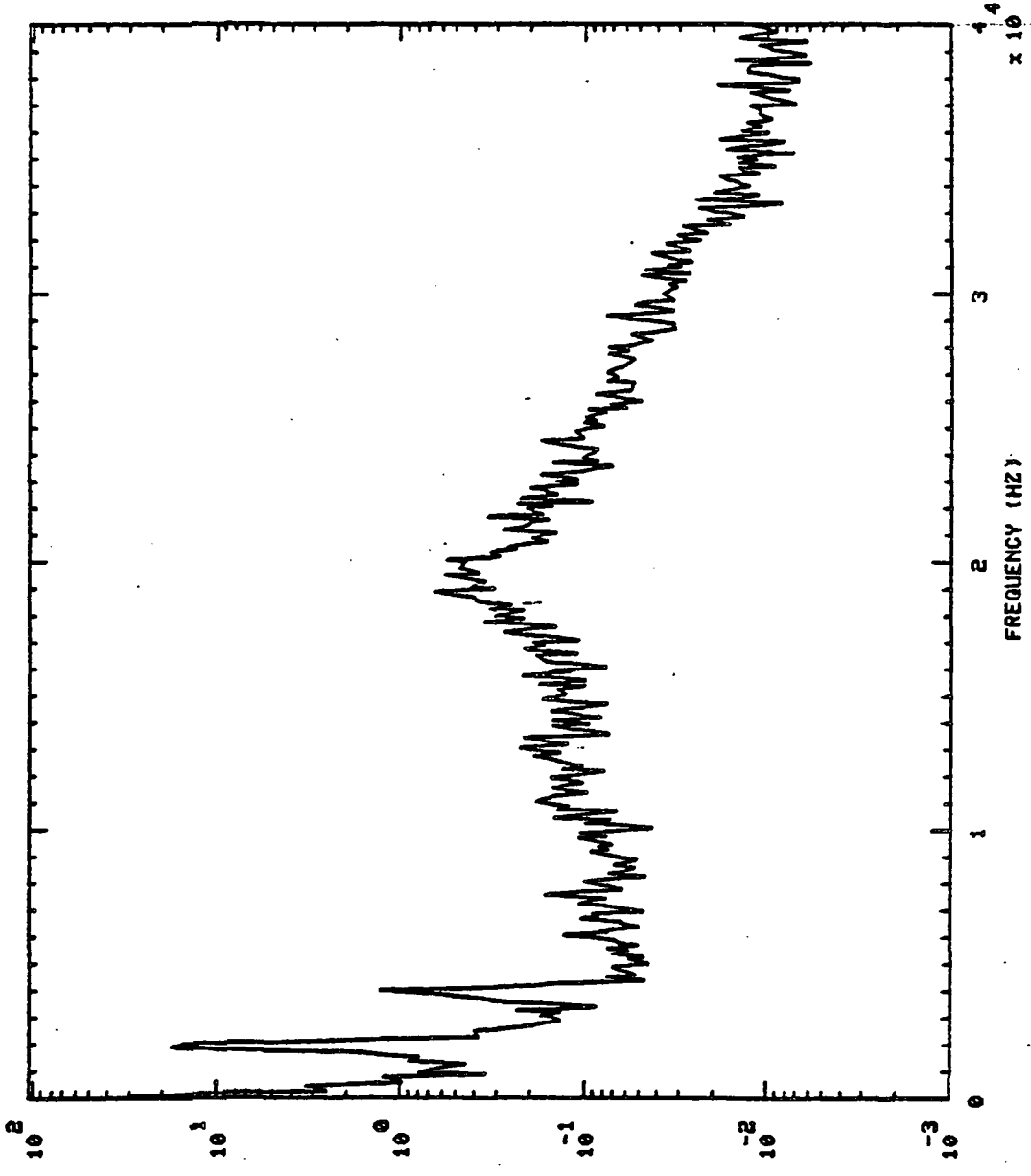


750135 MCC FUEL INJ PR DC S+ 15.01H0,'S



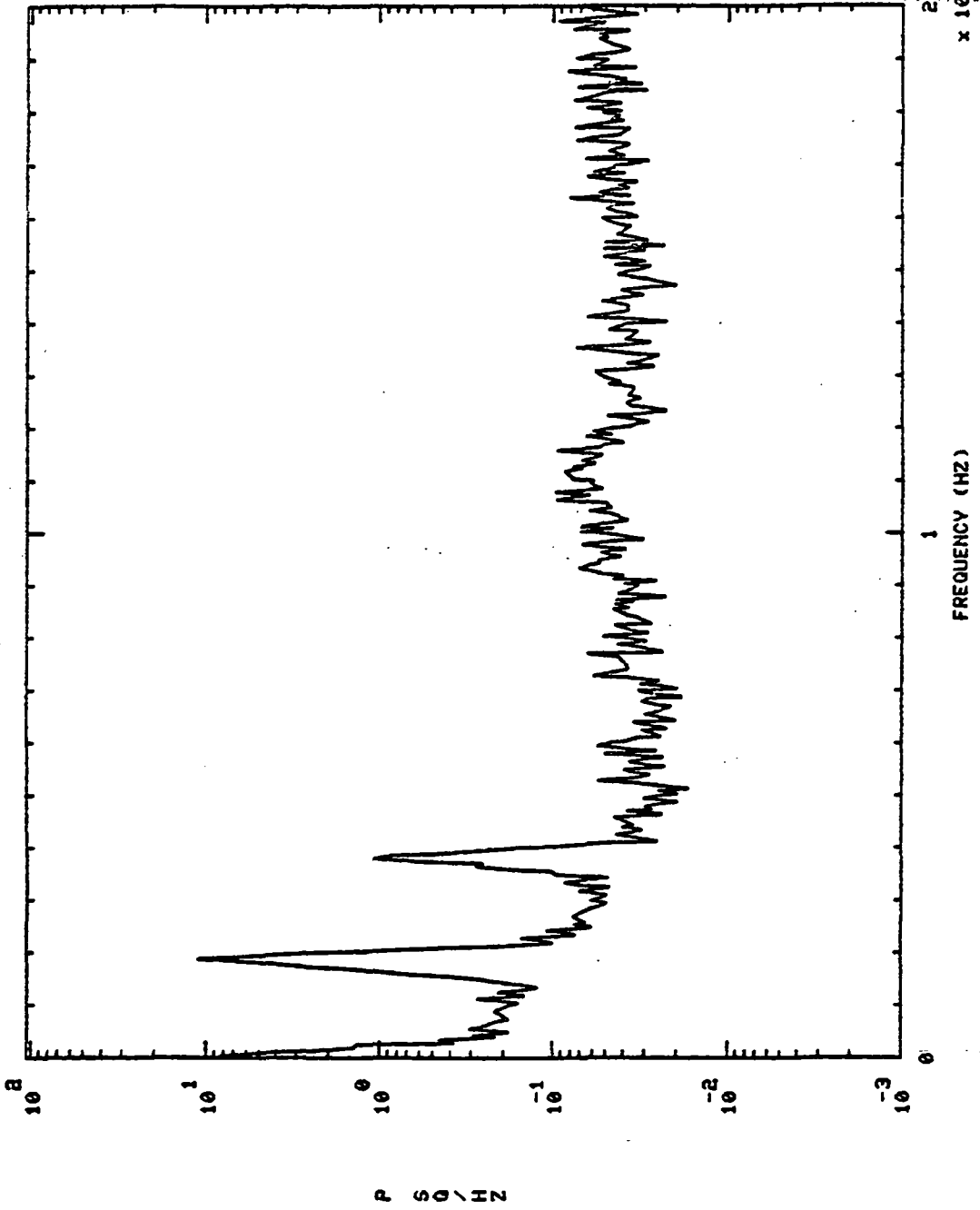
10^4
x 10^4

750135 MCC FUEL INJ PR DC S+ 15.01H0,'S

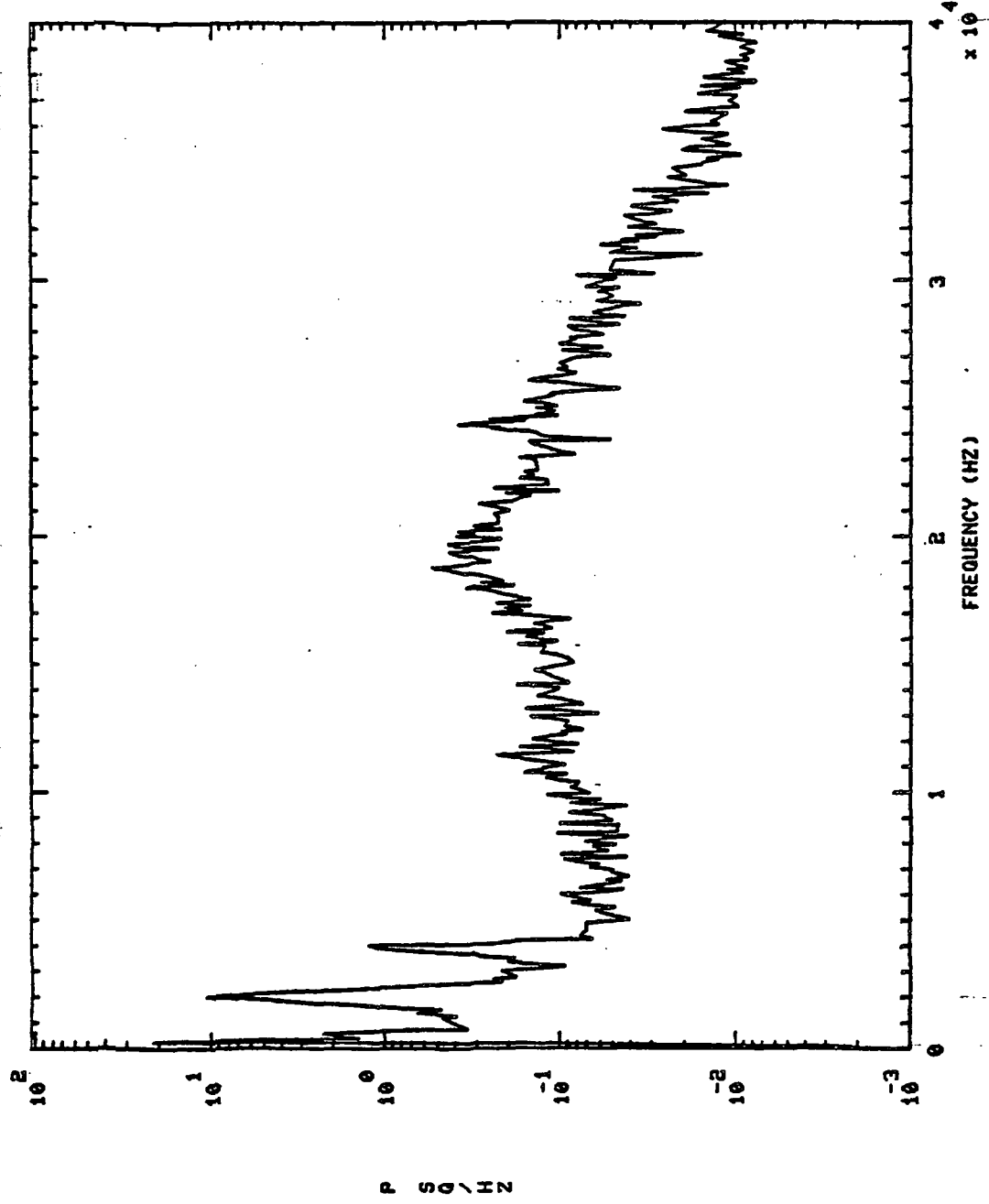


P 90/112

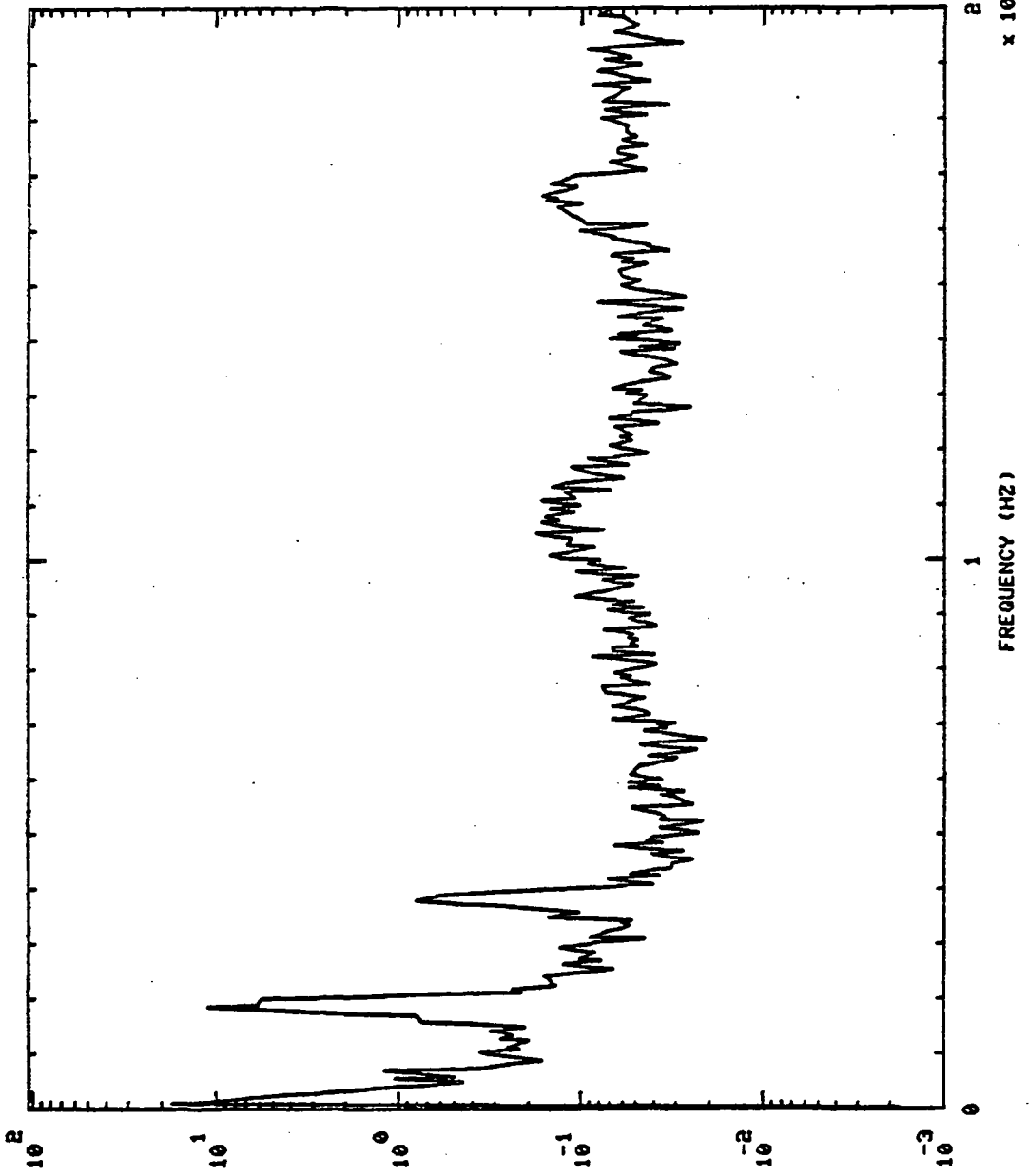
750135 MCC FUEL INJ PR DC S+ 45.01H0,'S



750135 MCC FUEL INJ PR DC S+ 45.01H0.'S

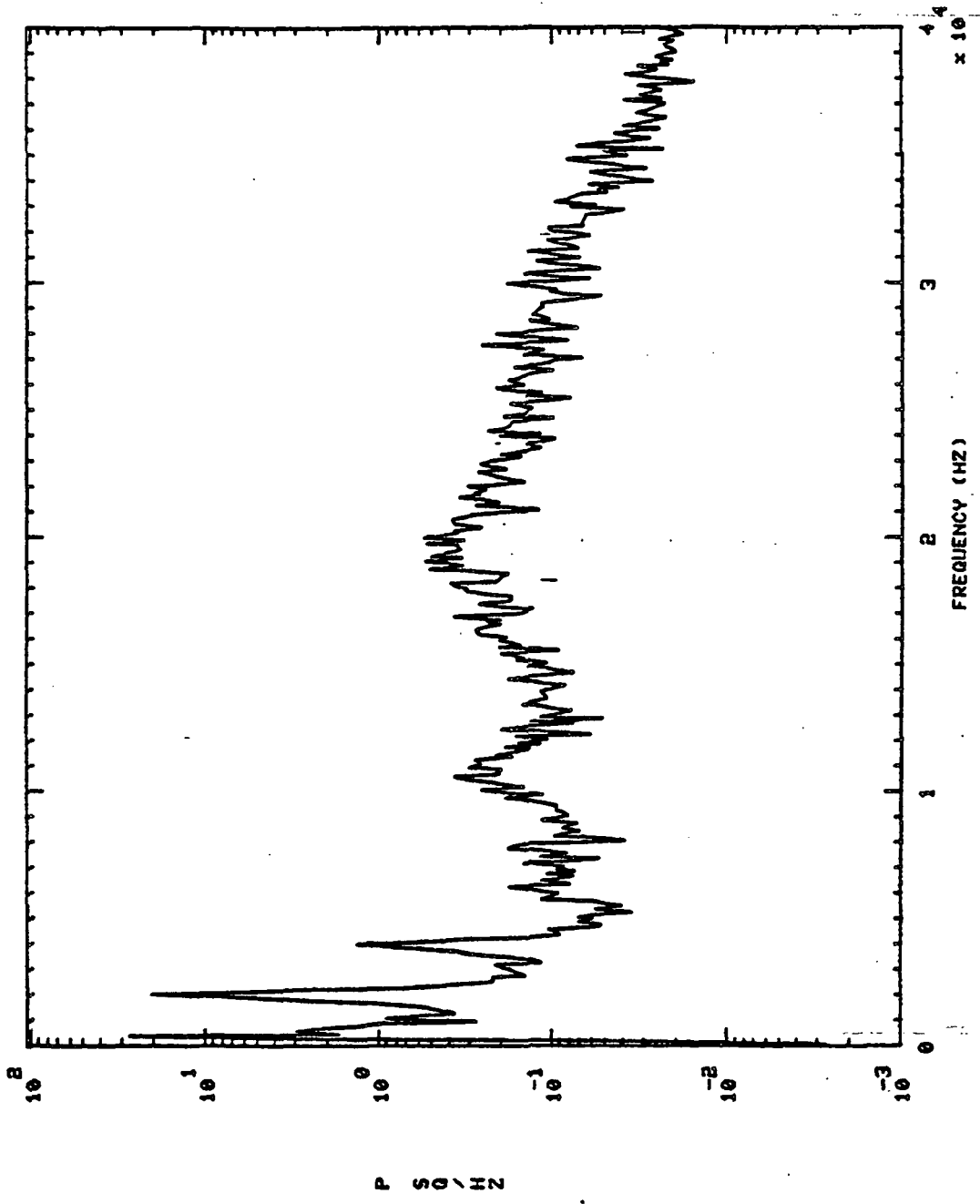


750135 MCC FUEL INJ PR DC S+ 75.01H0,'S

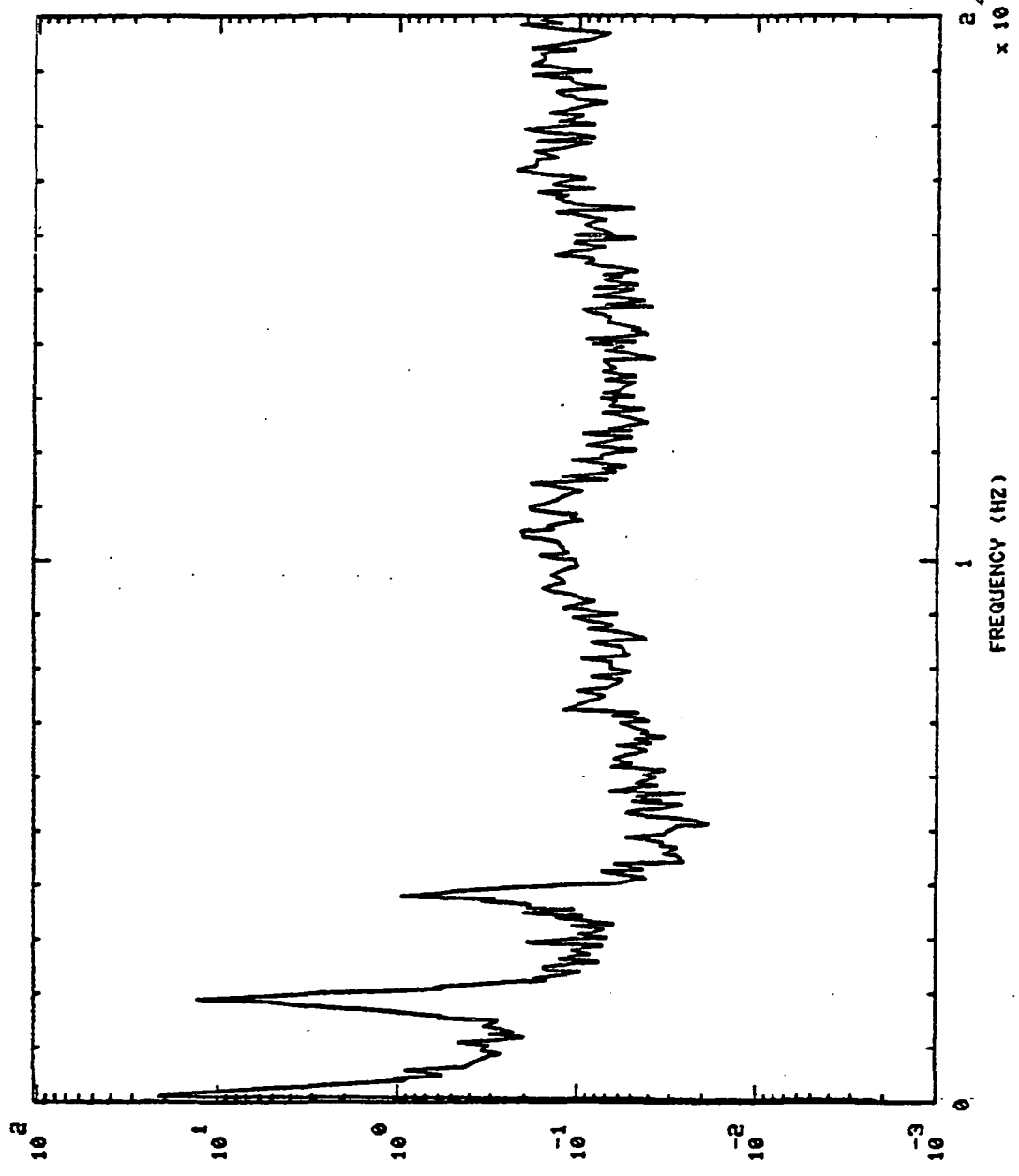


P S D \ S

750135 MCC FUEL INJ PR DC S+ 75.01H0,'6



750135 MCC FUEL INJ PR DC S+ 150.01H0,'S

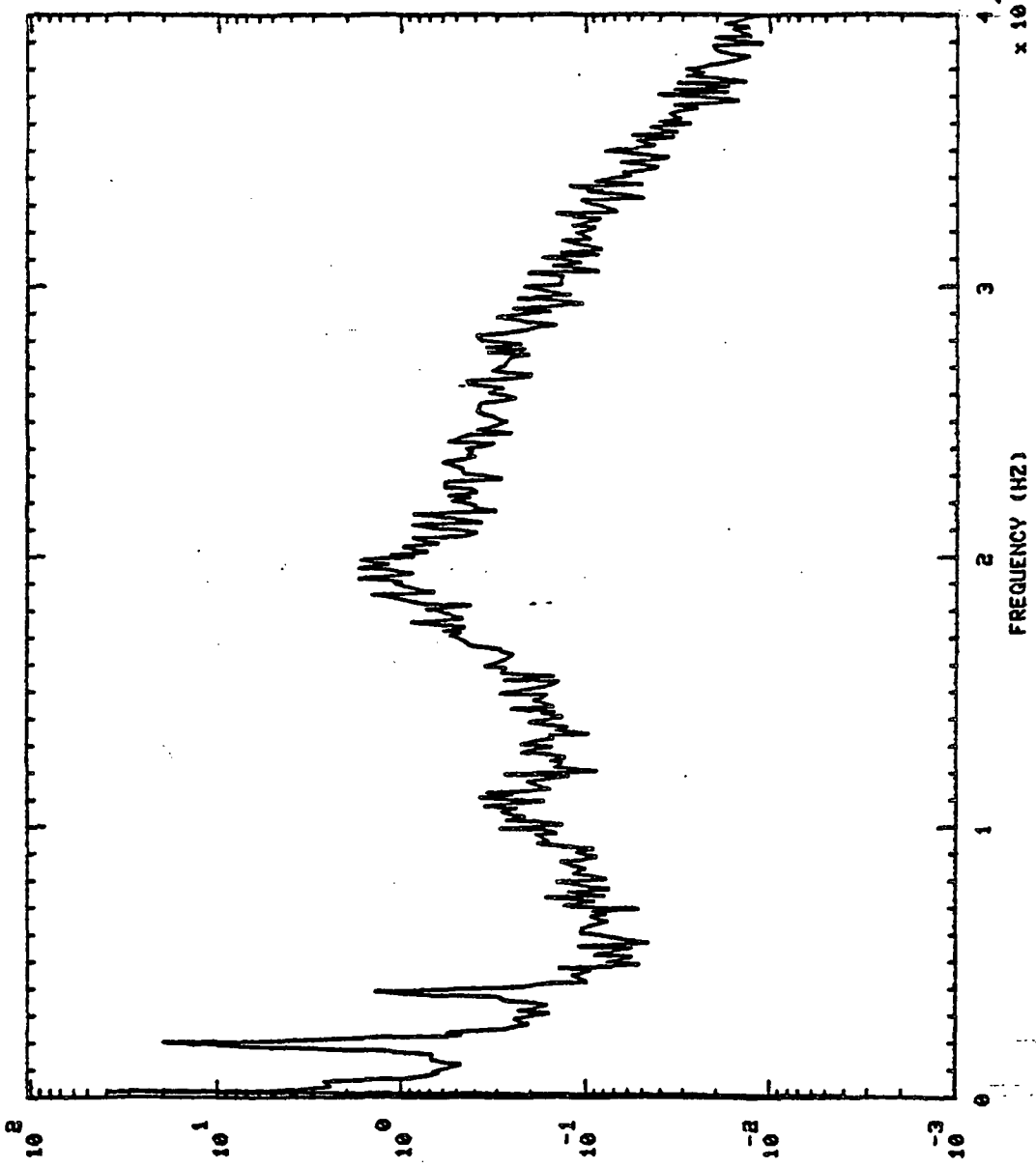


PSG / HZ

FREQUENCY (HZ) x 10^4

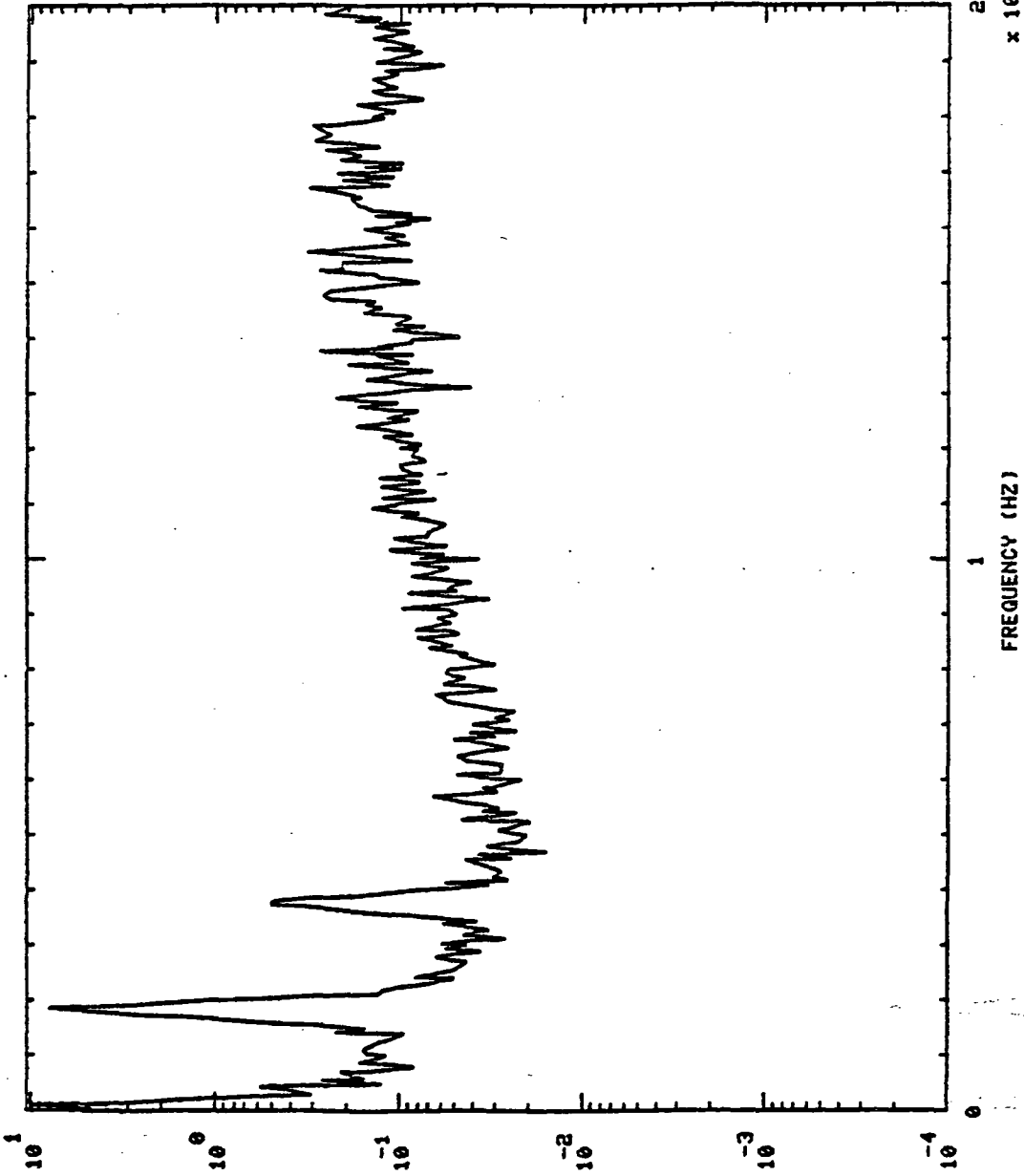
C-3

750135 MCC FUEL INJ PR DC S+ 150.01H0,'S



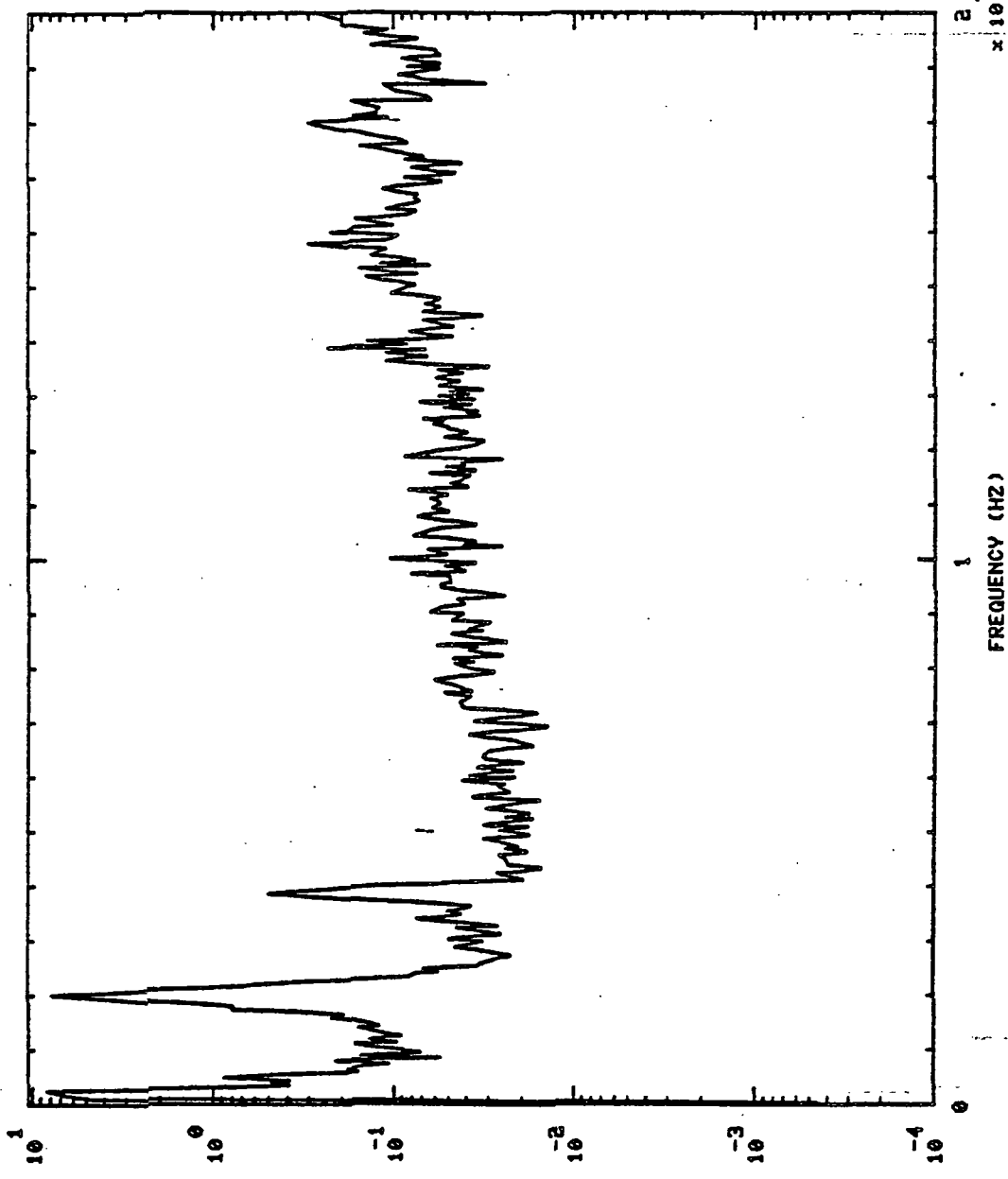
P S Q / H 2

750135 OPB PC PR DC St 6.01H0,'S

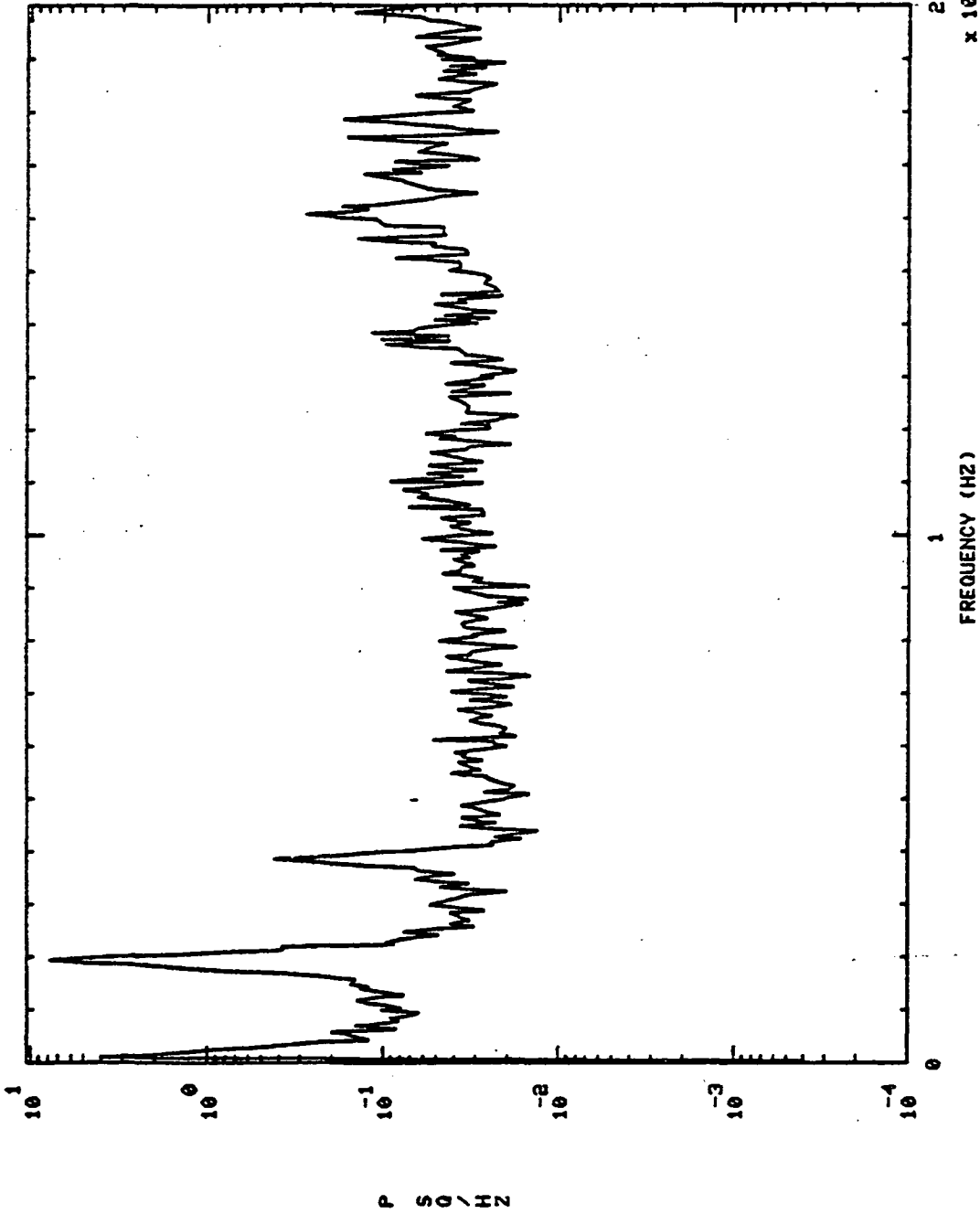


P SQ / HZ

750135 OPB PC PR DC S+ 15.01H0,'S

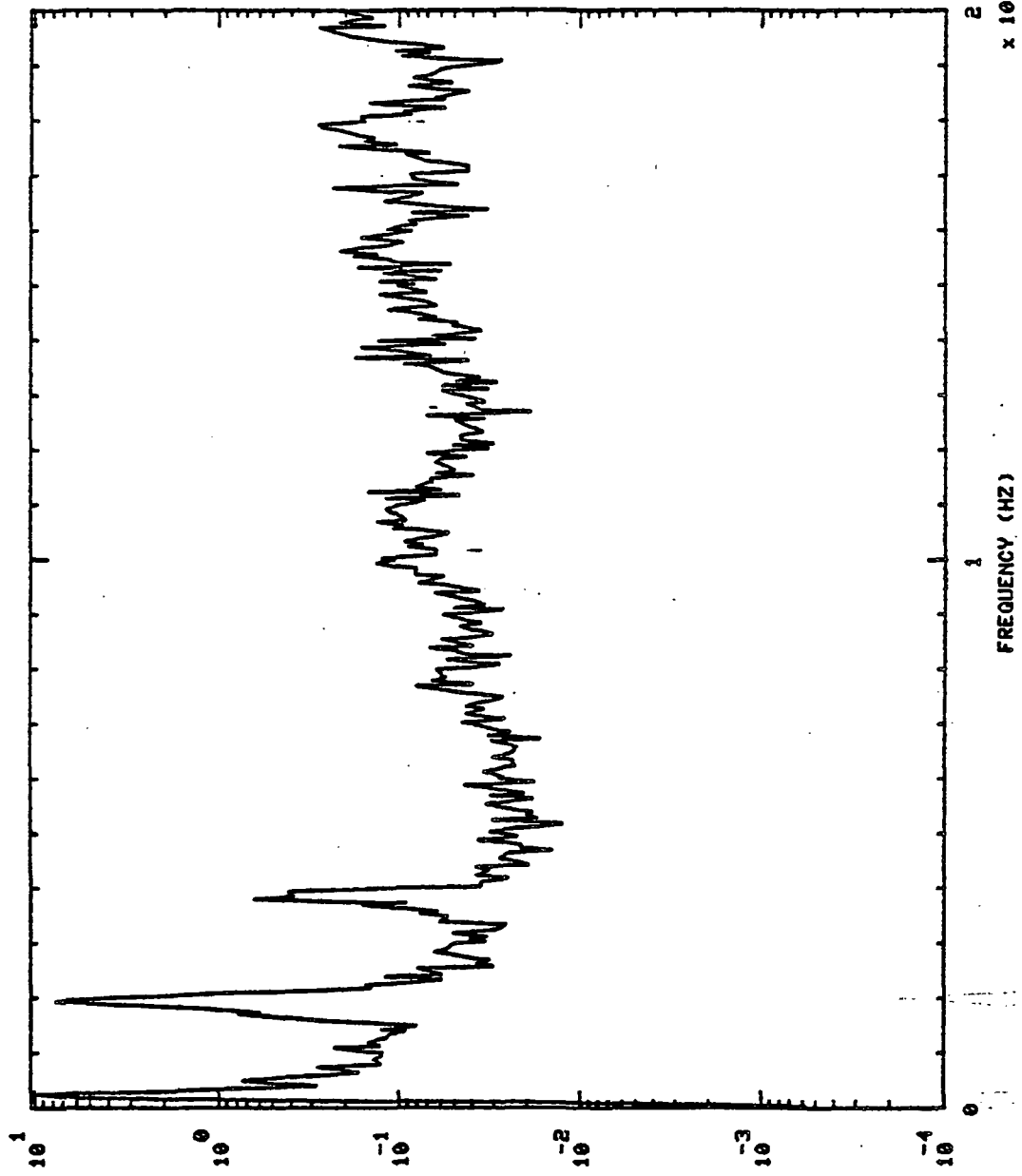


750135 OPB PC PR DC S+ 45.01H0,'S



750135 OPB PC PR DC

ST 75.01H0, 'S

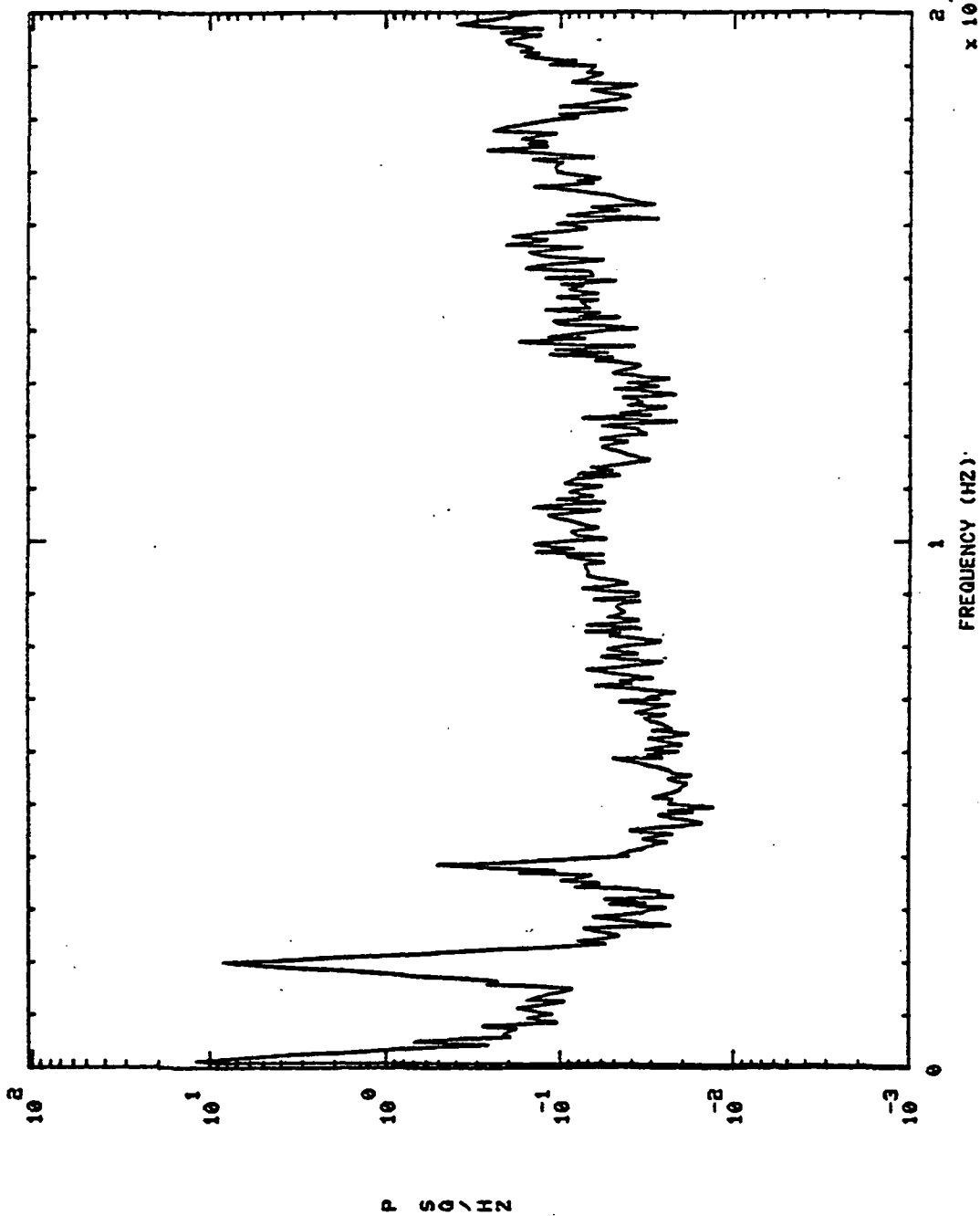


P S D \ HZ

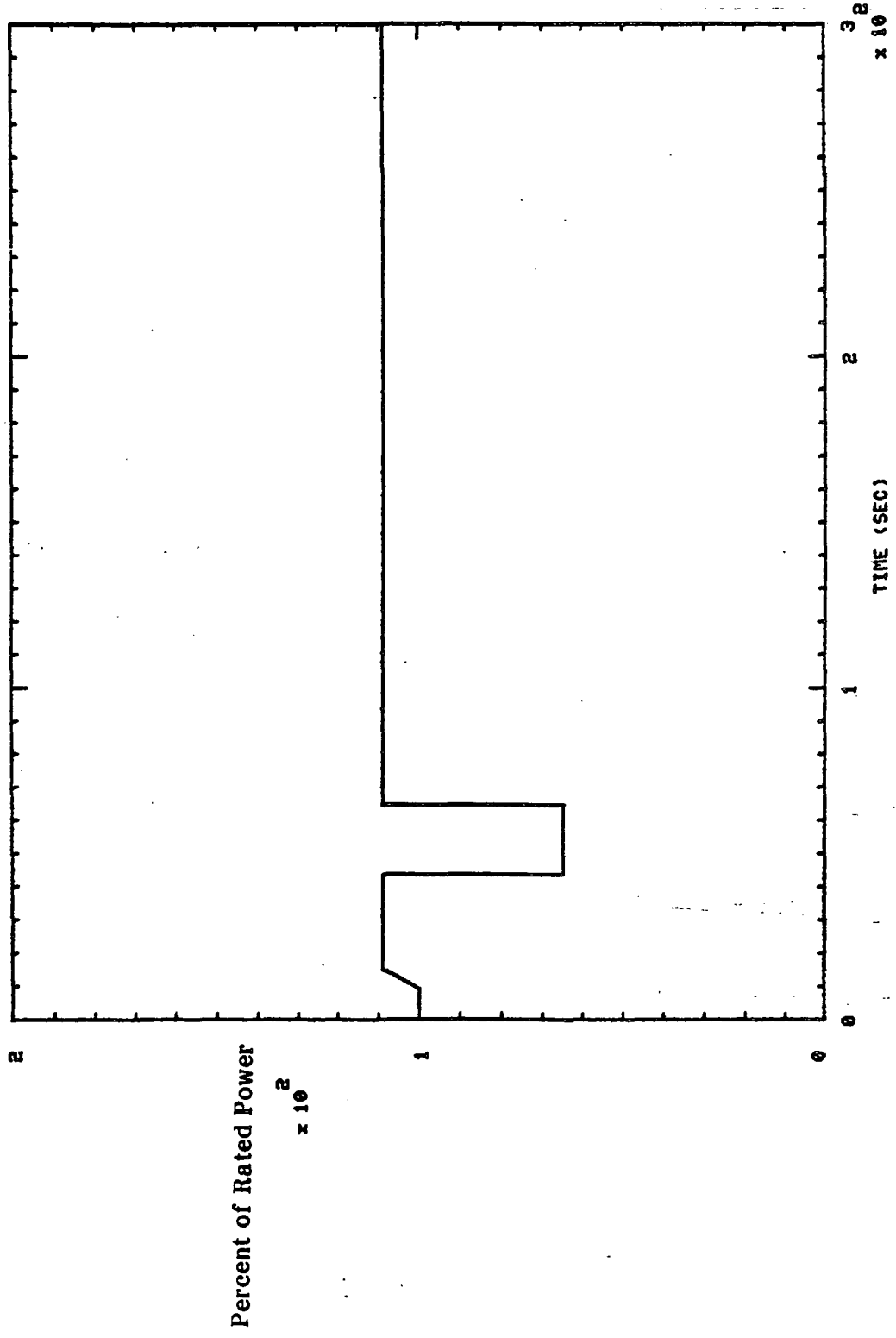
FREQUENCY (HZ) x 10⁴

S+ 150.01H0.'S.

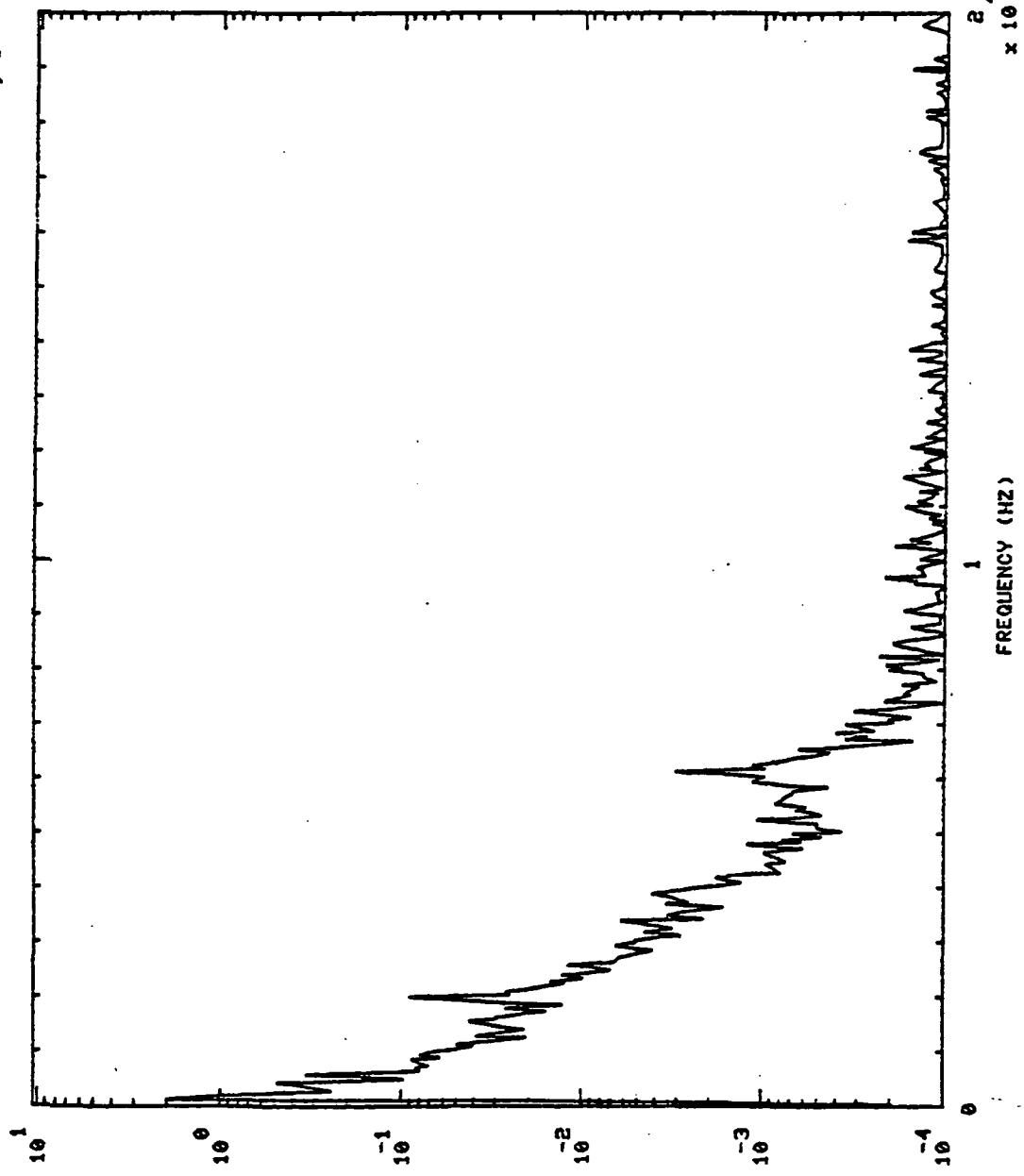
750135 OPB PC PR DC



750136 THRUST (UNFILTERED)



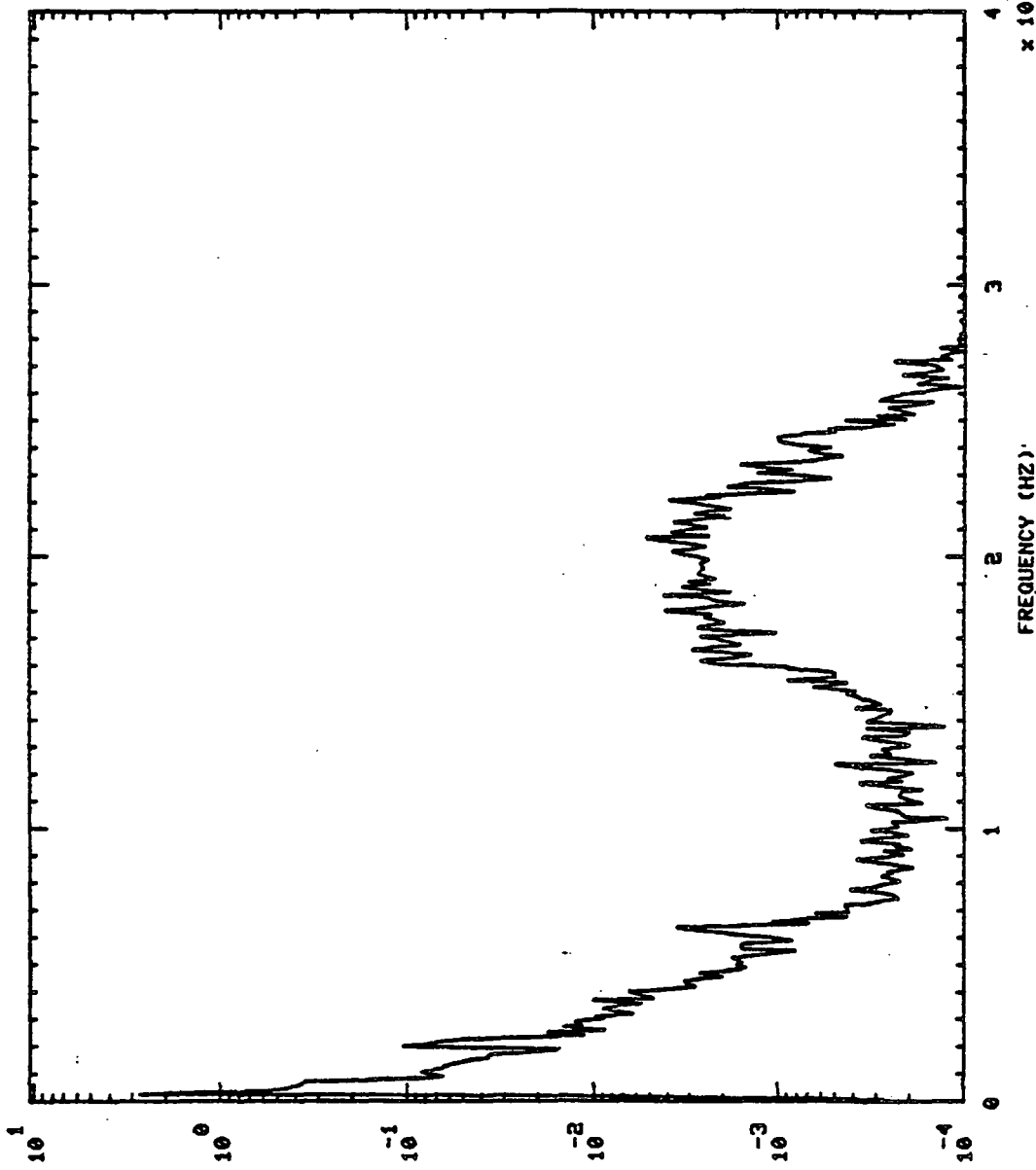
750136 MCC FUEL INJ PR 5+ 4.01H0,'S



P S D / H Z

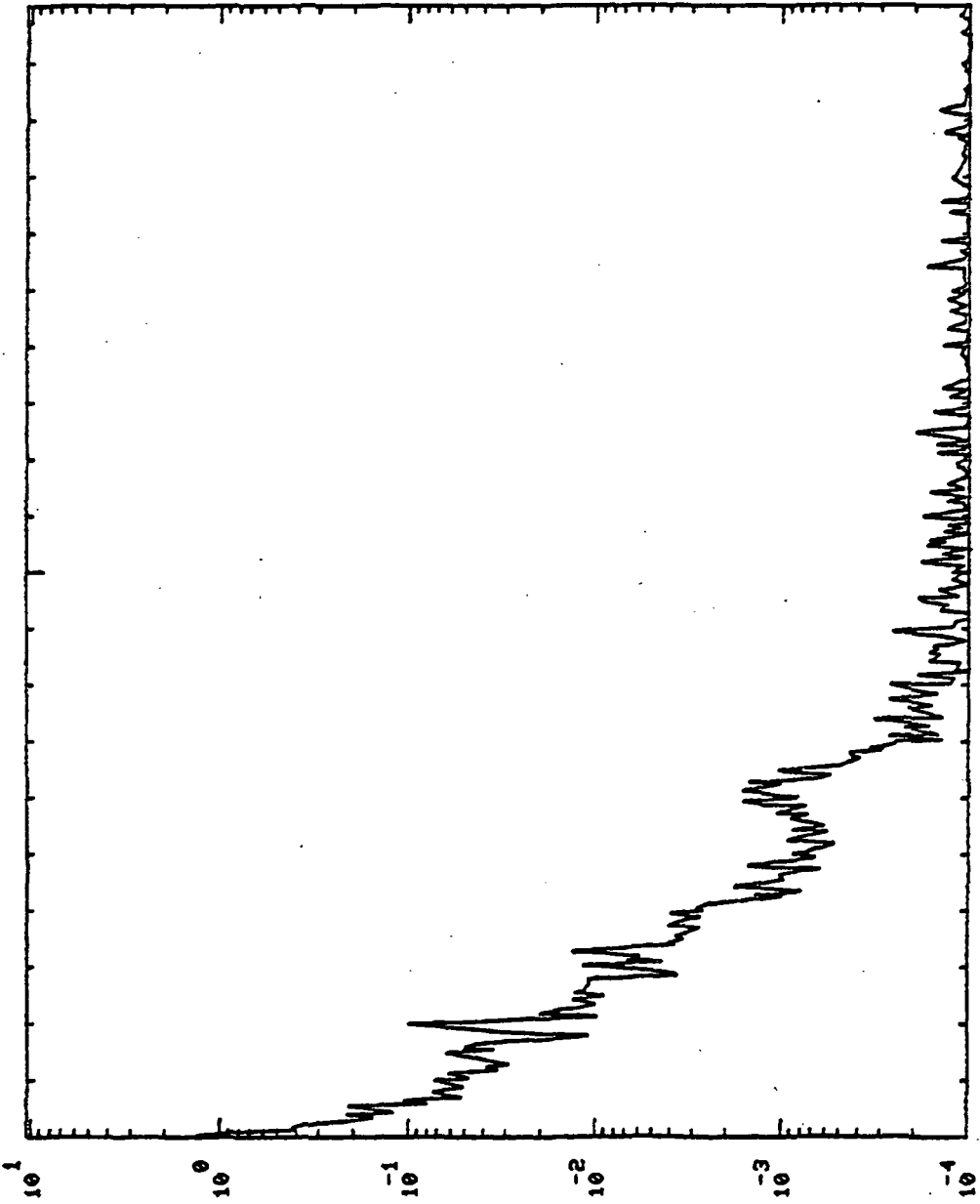
FREQUENCY (HZ) $\times 10^4$

750136 MCC FUEL INJ PR S+ 4.01H0,'6



P 50/112

750136 MCC FUEL INJ PR S+ 25.01H0,'S

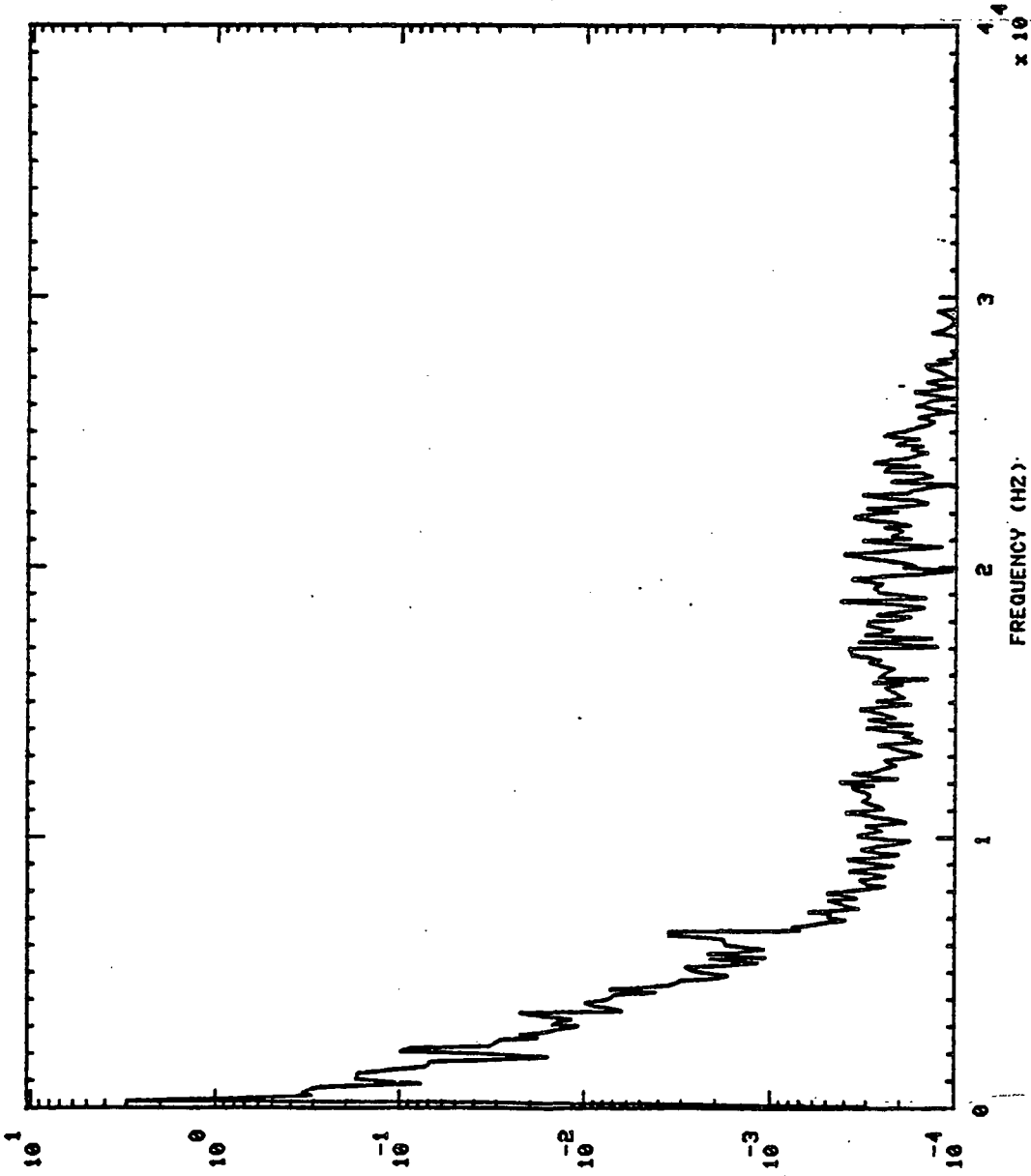


P S D \ HZ

FREQUENCY (HZ)

$\times 10^4$

750136 MCC FUEL INJ PR. S+ 25.01H0,'S

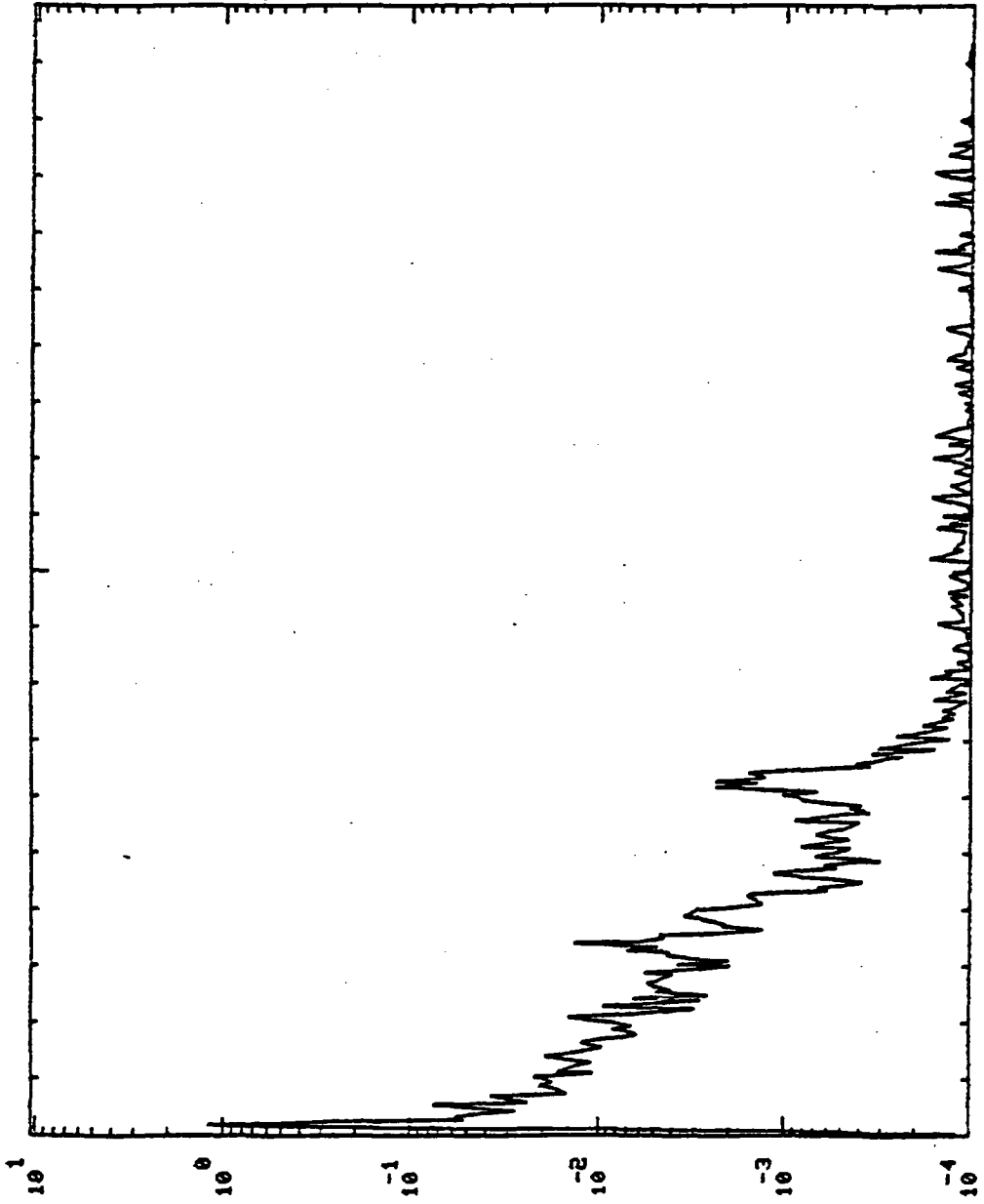


P S D \ H Z

S+ 50.01H0,'S

MCC FUEL INJ PR

750136

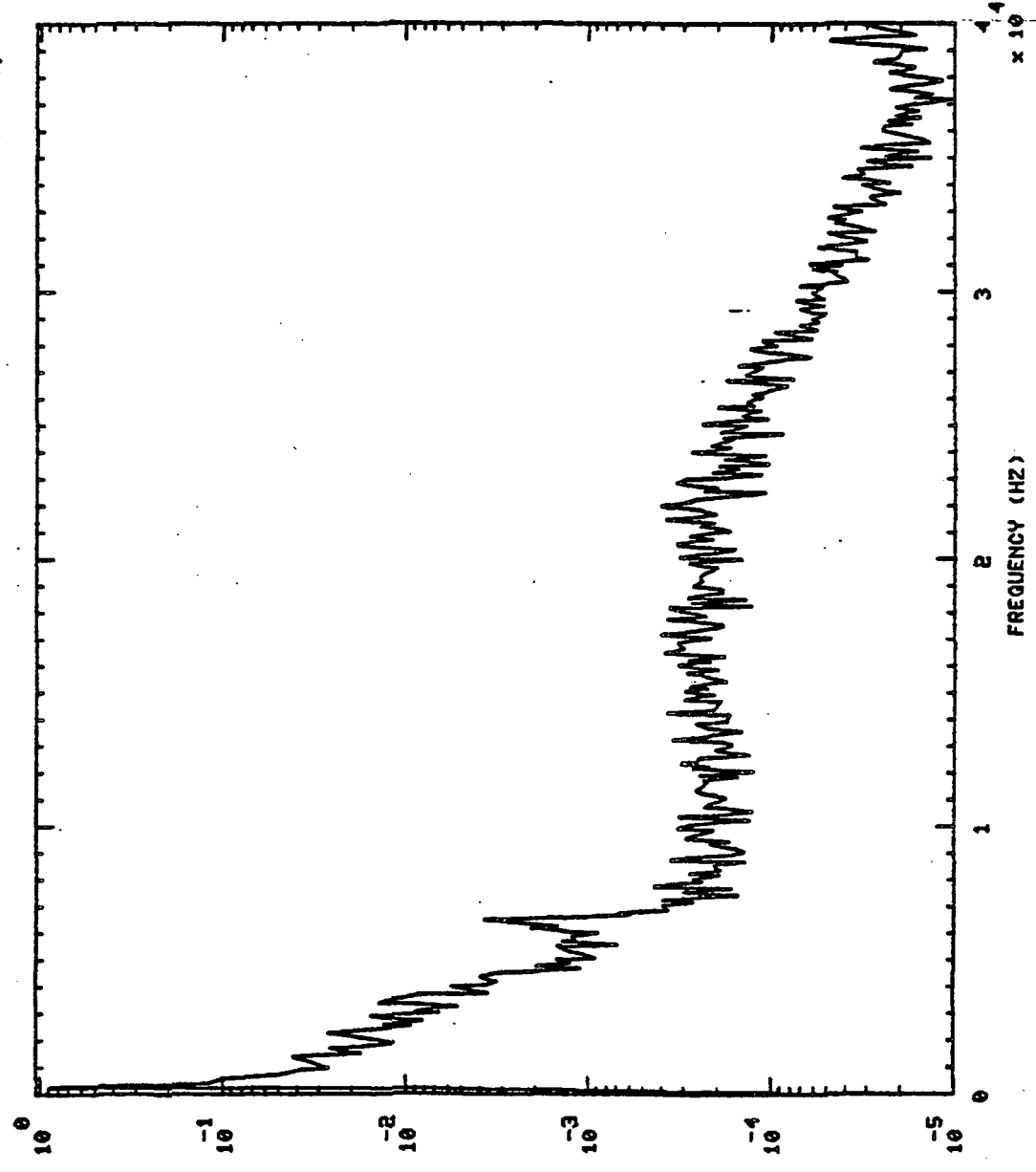


P S0/HZ

2.4
x 10⁴

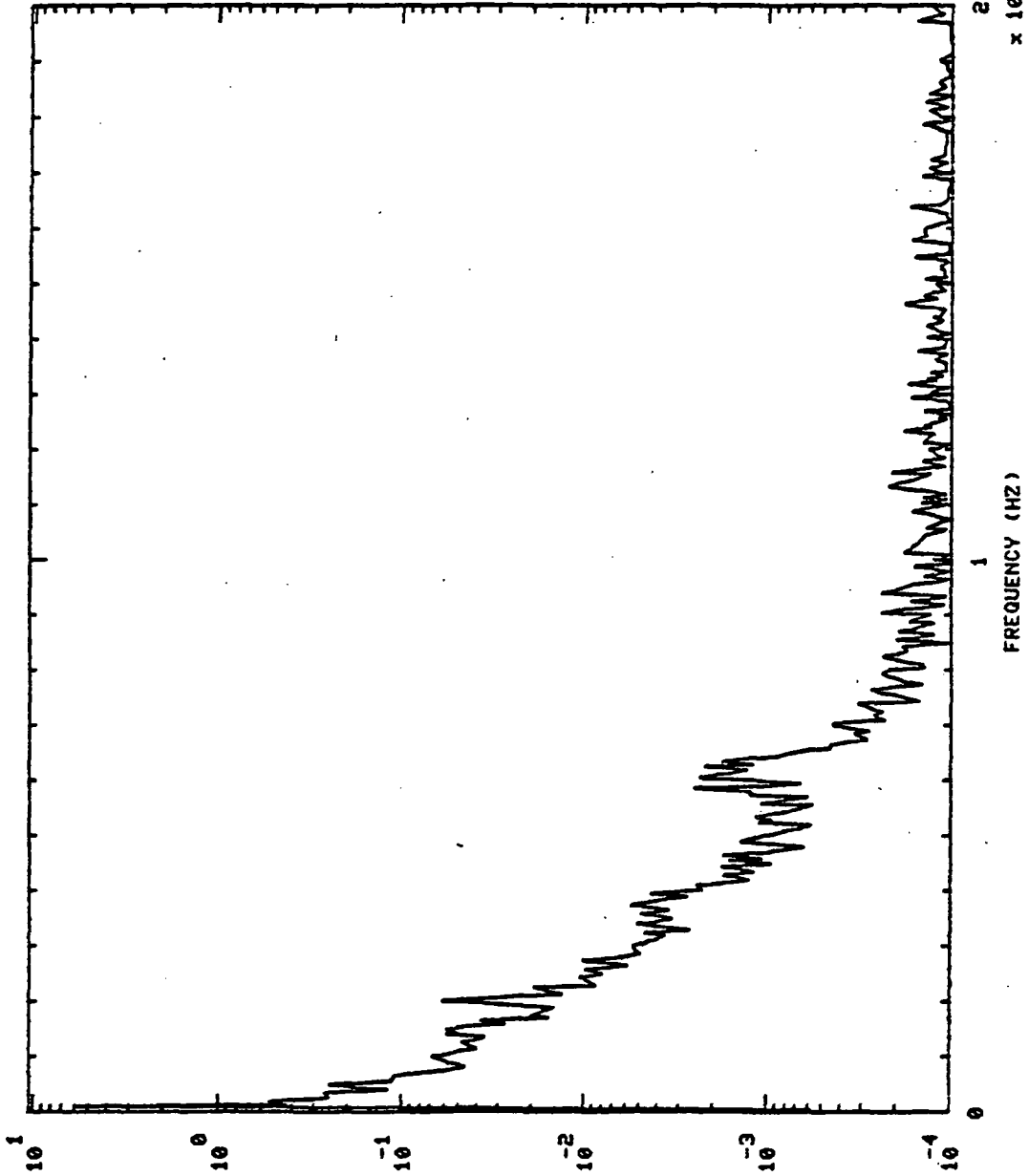
1
FREQUENCY (HZ)

750136 MCC FUEL INJ PR S+ 50.01H0,'S



P S D / HZ

750136 MCC FUEL INJ PR S+ 150.01H0,'S

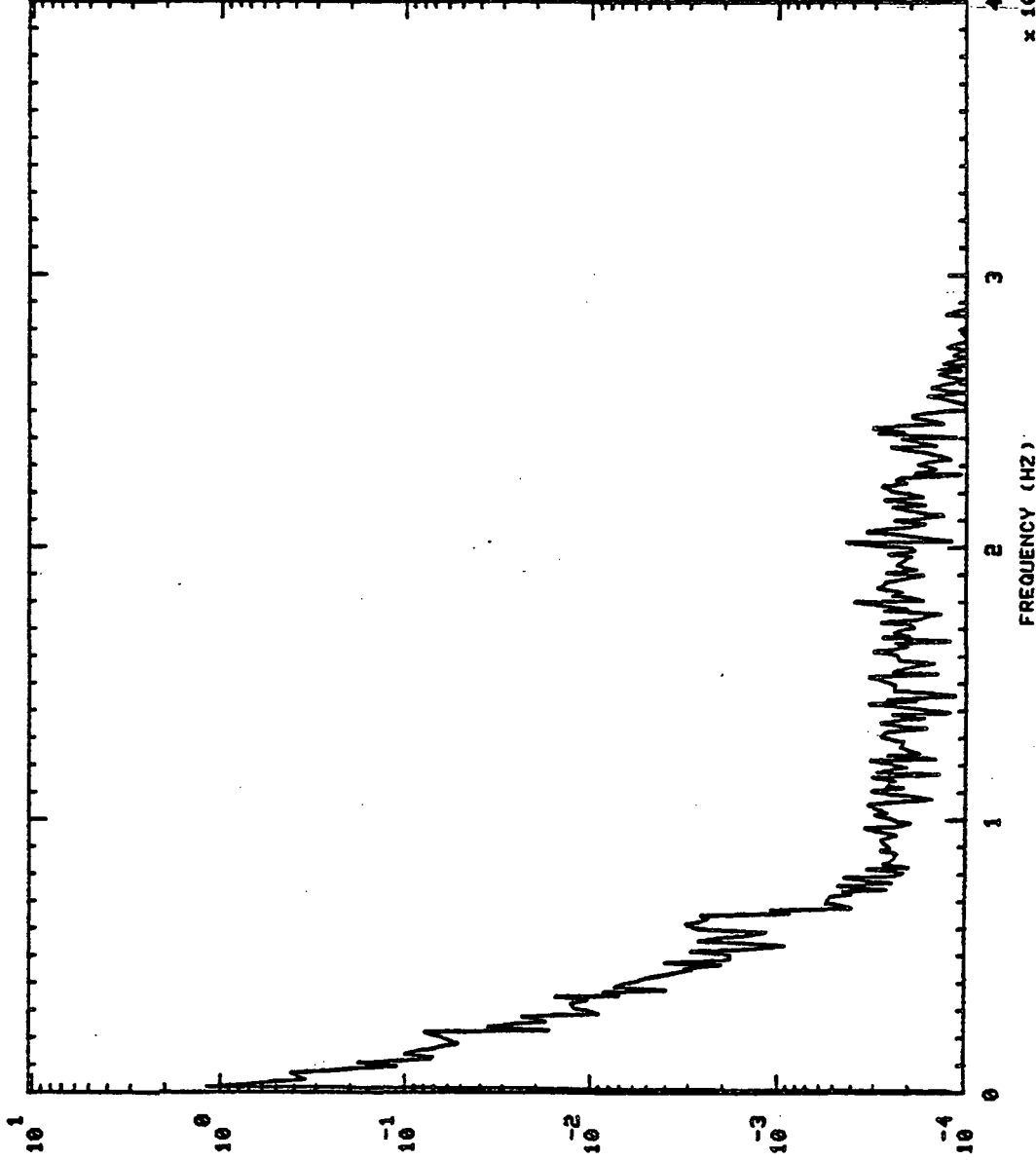


P S O \ HZ

S+ 150.01H0,'S

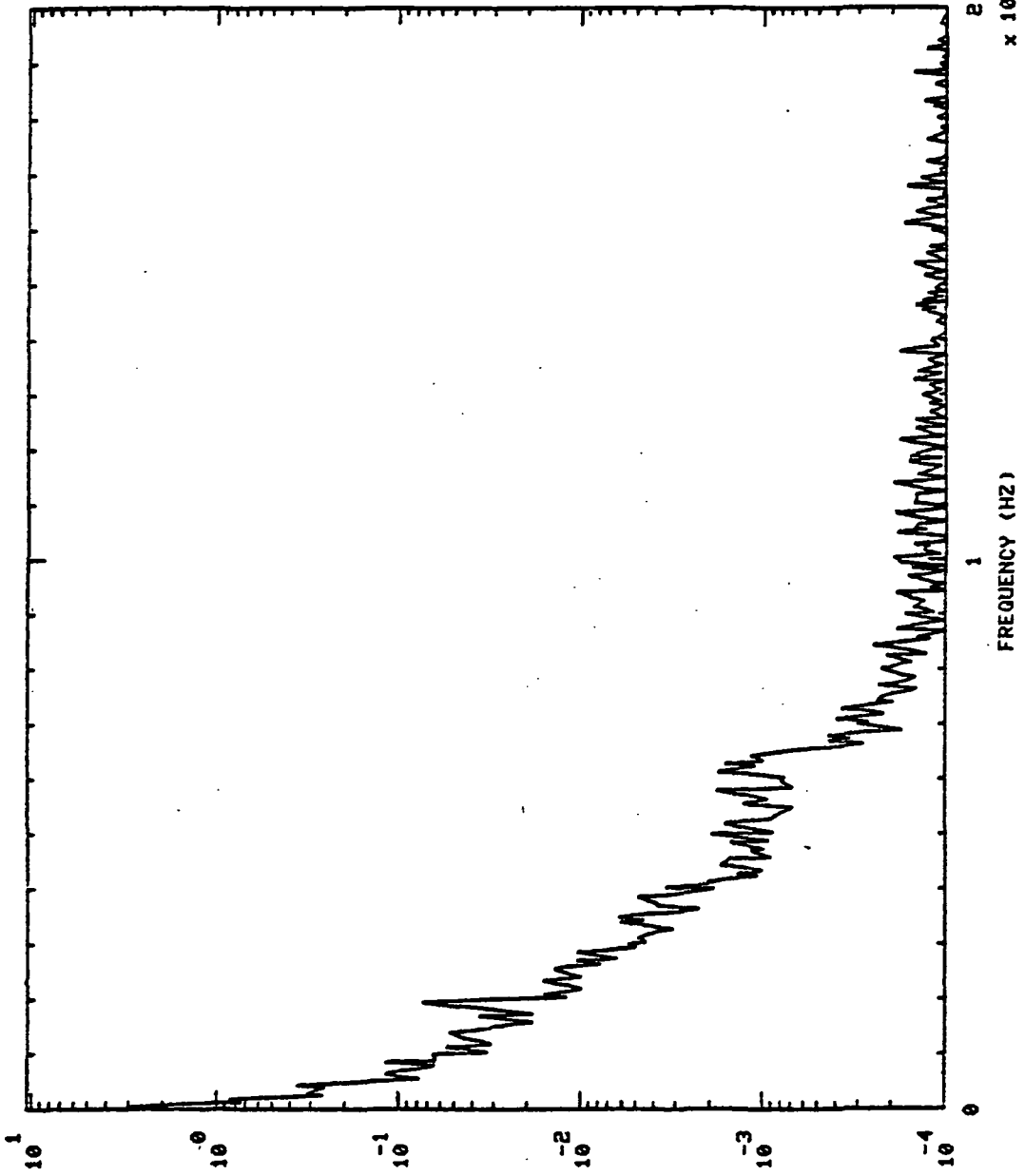
MCC FUEL INJ PR

750136



P SQ/Hz

750136 MCC FUEL INJ PR S+ 280.0140,'S

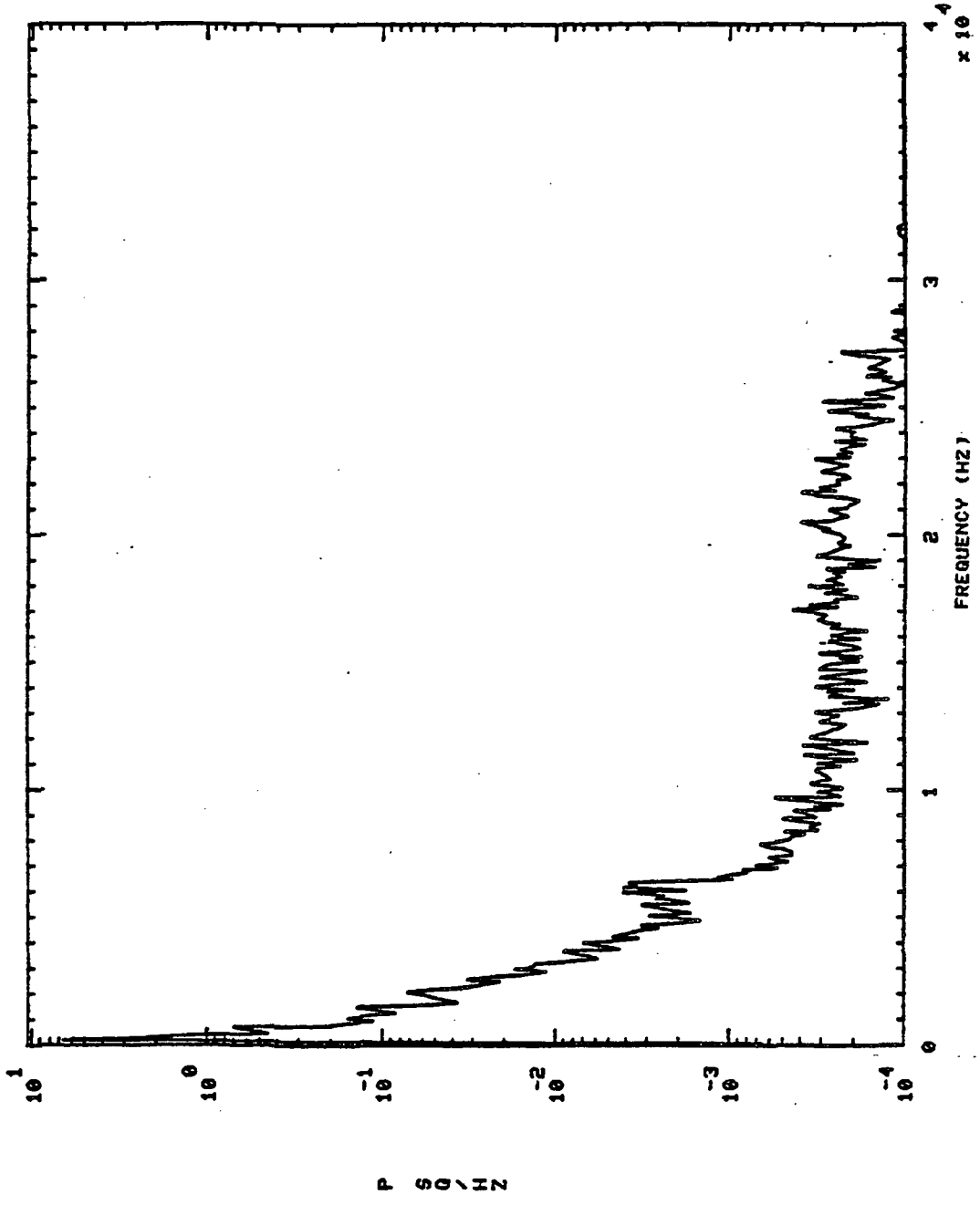


PSD / HZ

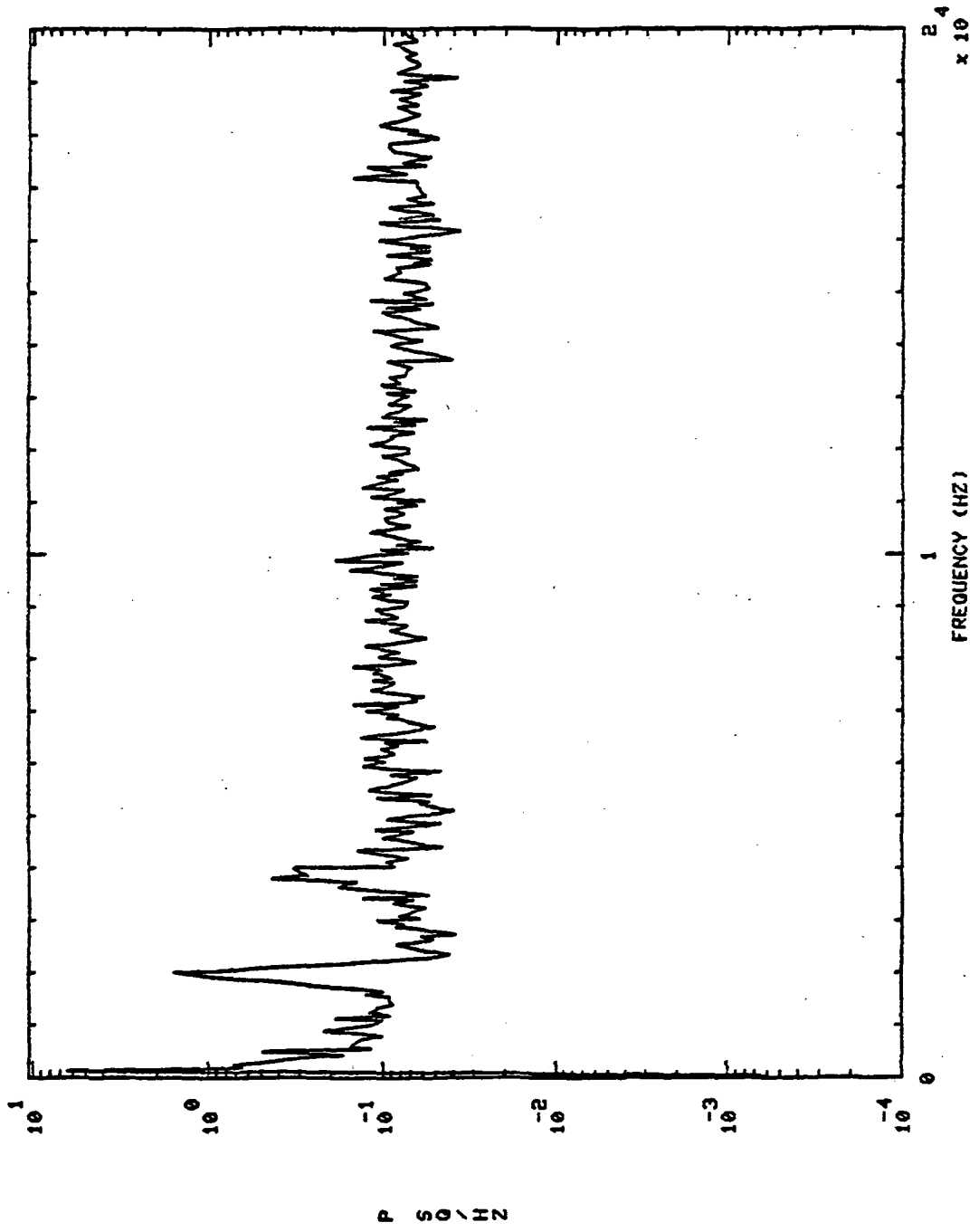
FREQUENCY (HZ)

10^4
x 10

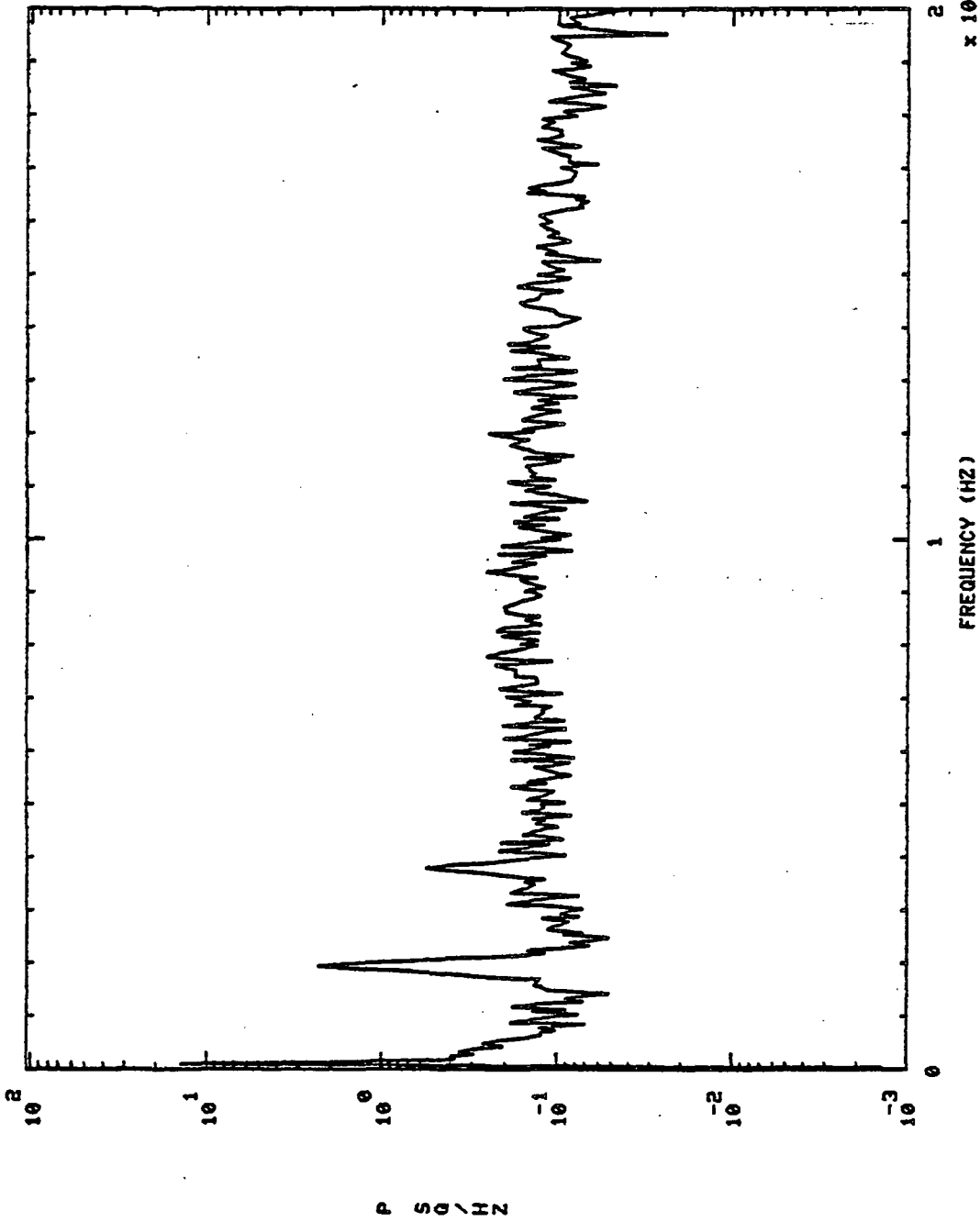
750136 MCC FUEL INJ PR S+ 280.01H0,'S



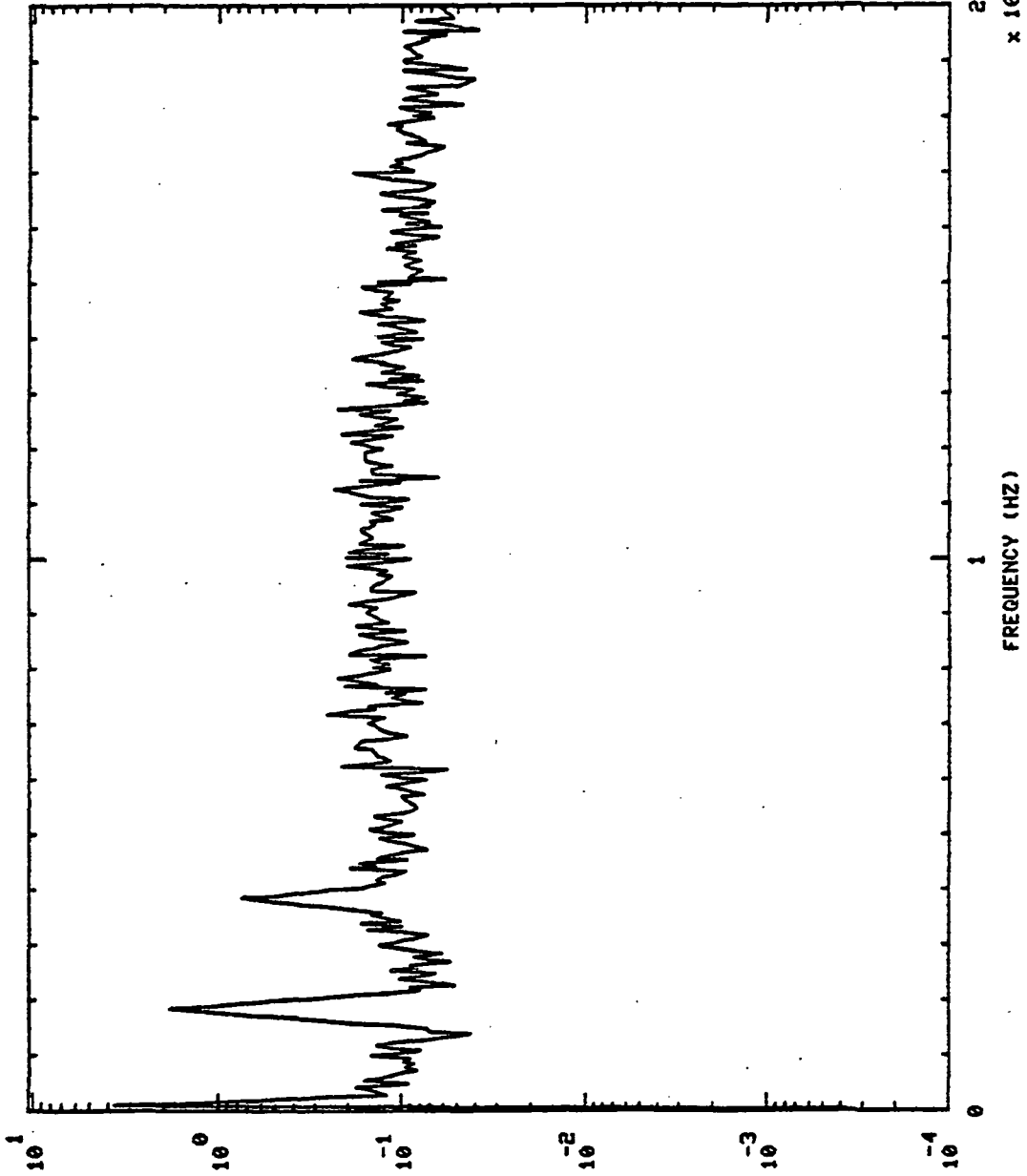
750138 MCC FUEL INJ PR DC S+ 4.01H0,'S



750136 MCC FUEL INJ PR DC S+ 25.01H0,'S

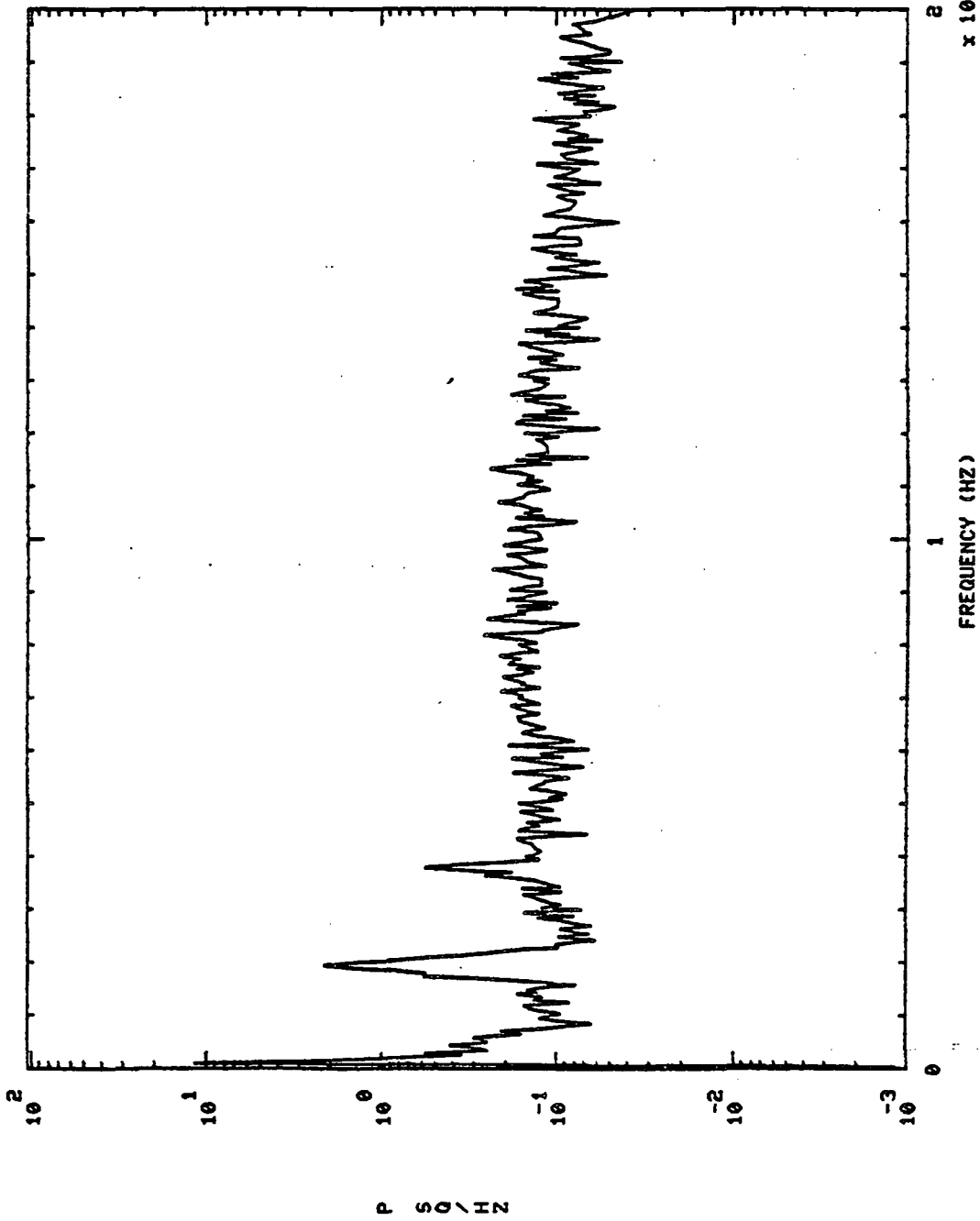


750136 MCC FUEL INJ PR DC S+ 50.01H0,'S

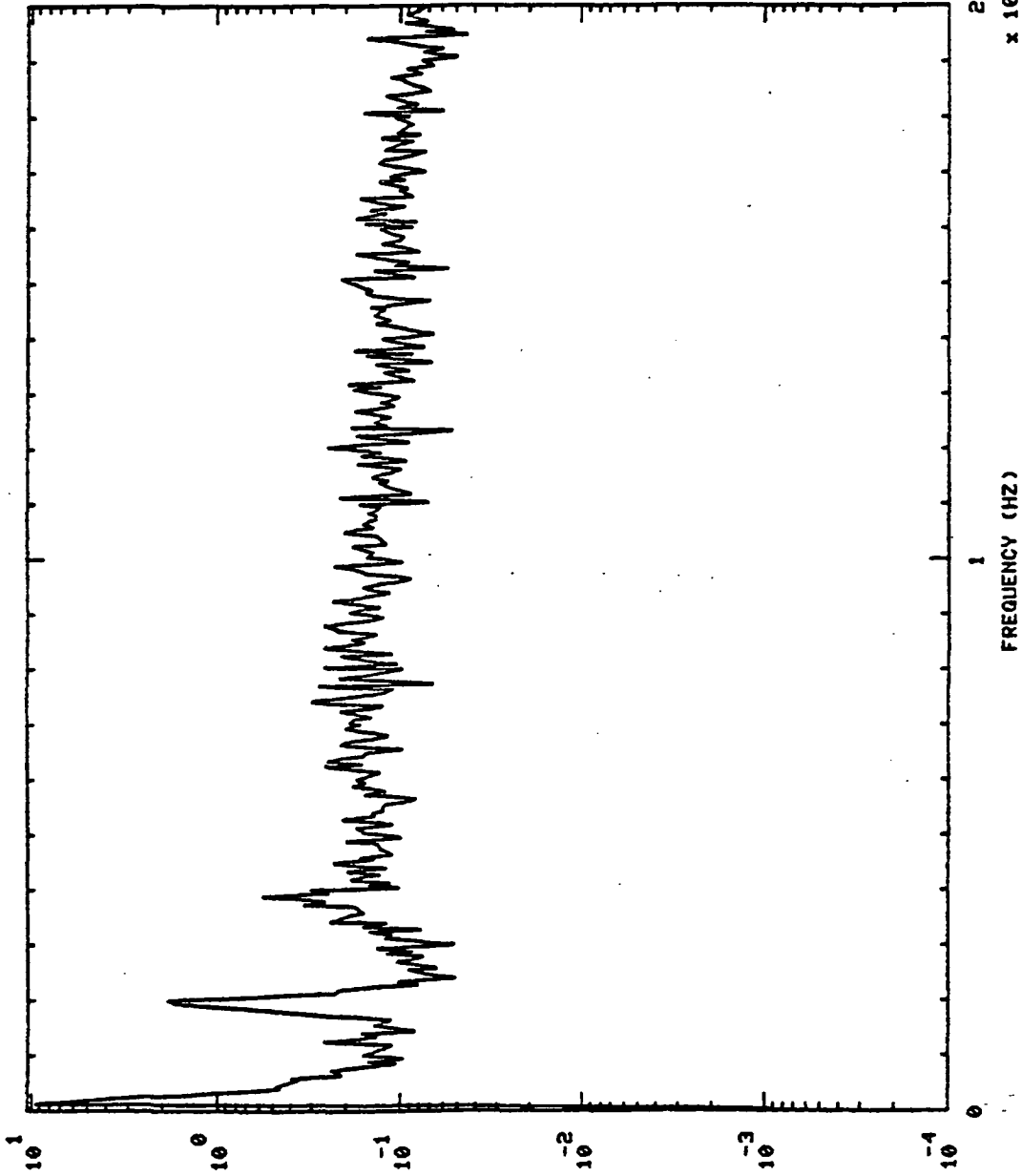


P SQ \ HZ

750136 MCC FUEL INJ PR DC S+ 150.01H0,'S



750136 MCC FUEL INJ PR DC S+ 280.01H0,'6

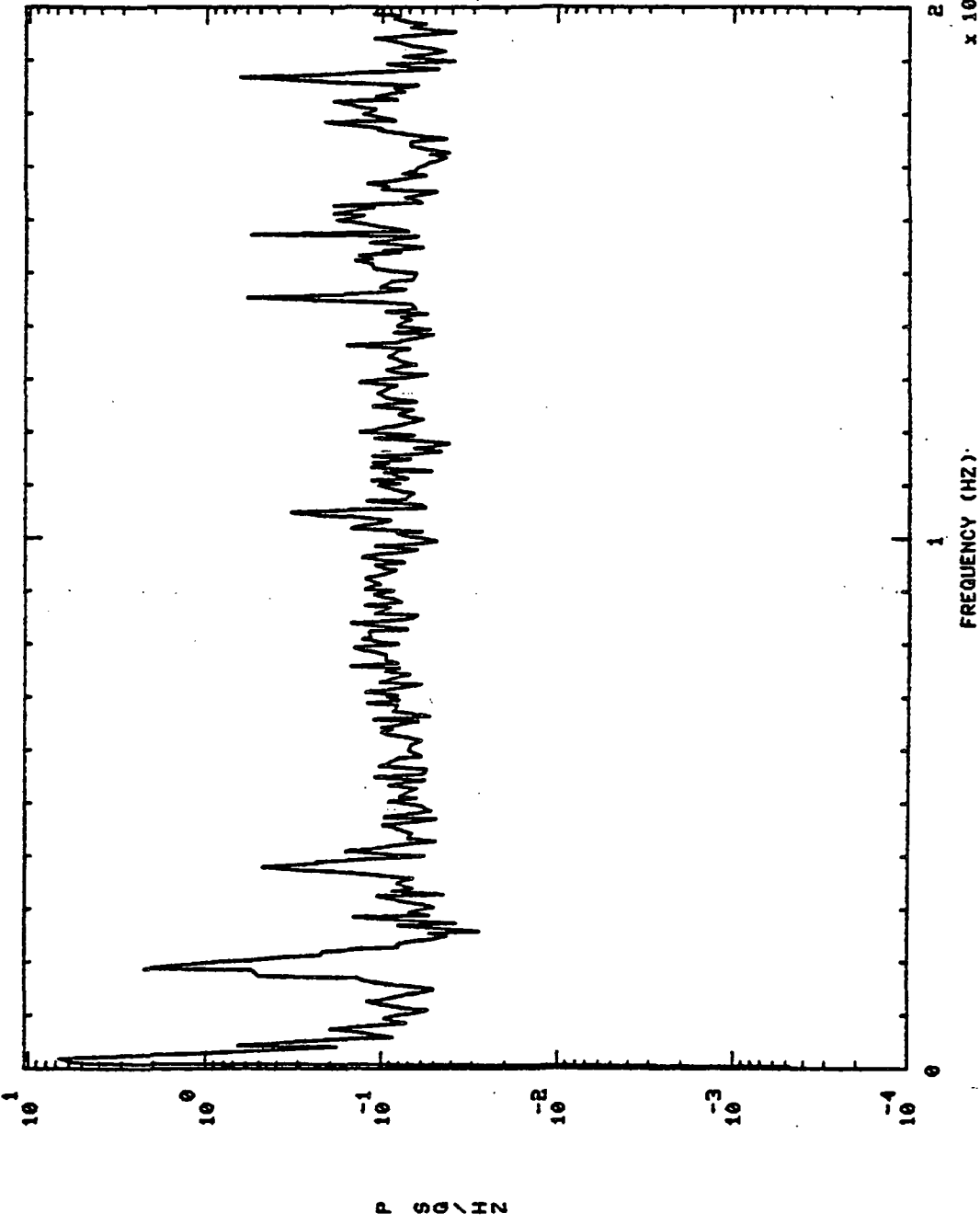


P S D / H Z

S+ 25.01H0,'S

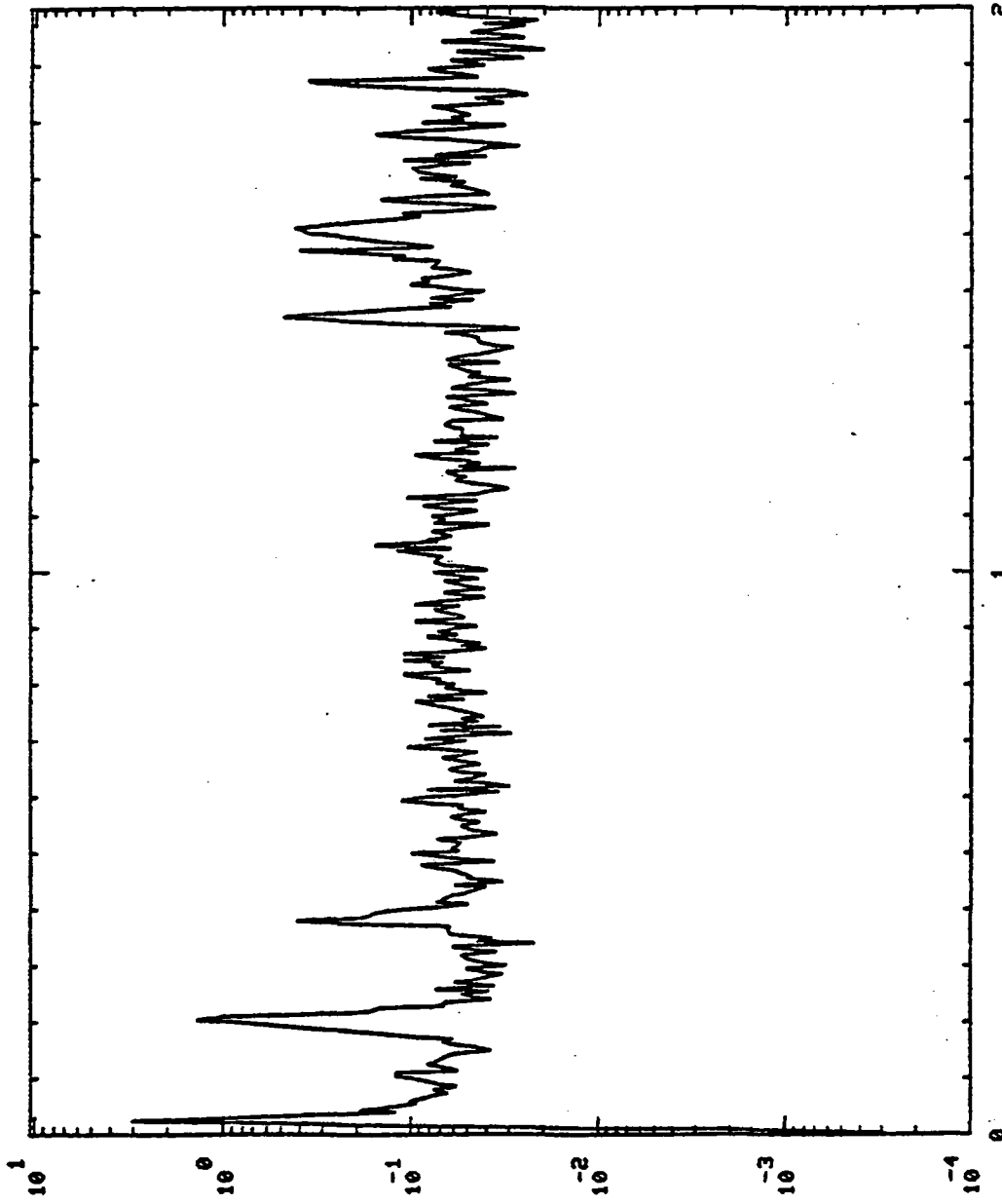
OPB PC PR DC

750136



10^4
x 10

750136 OPB PC PR DC S+ 50.01H0,'S



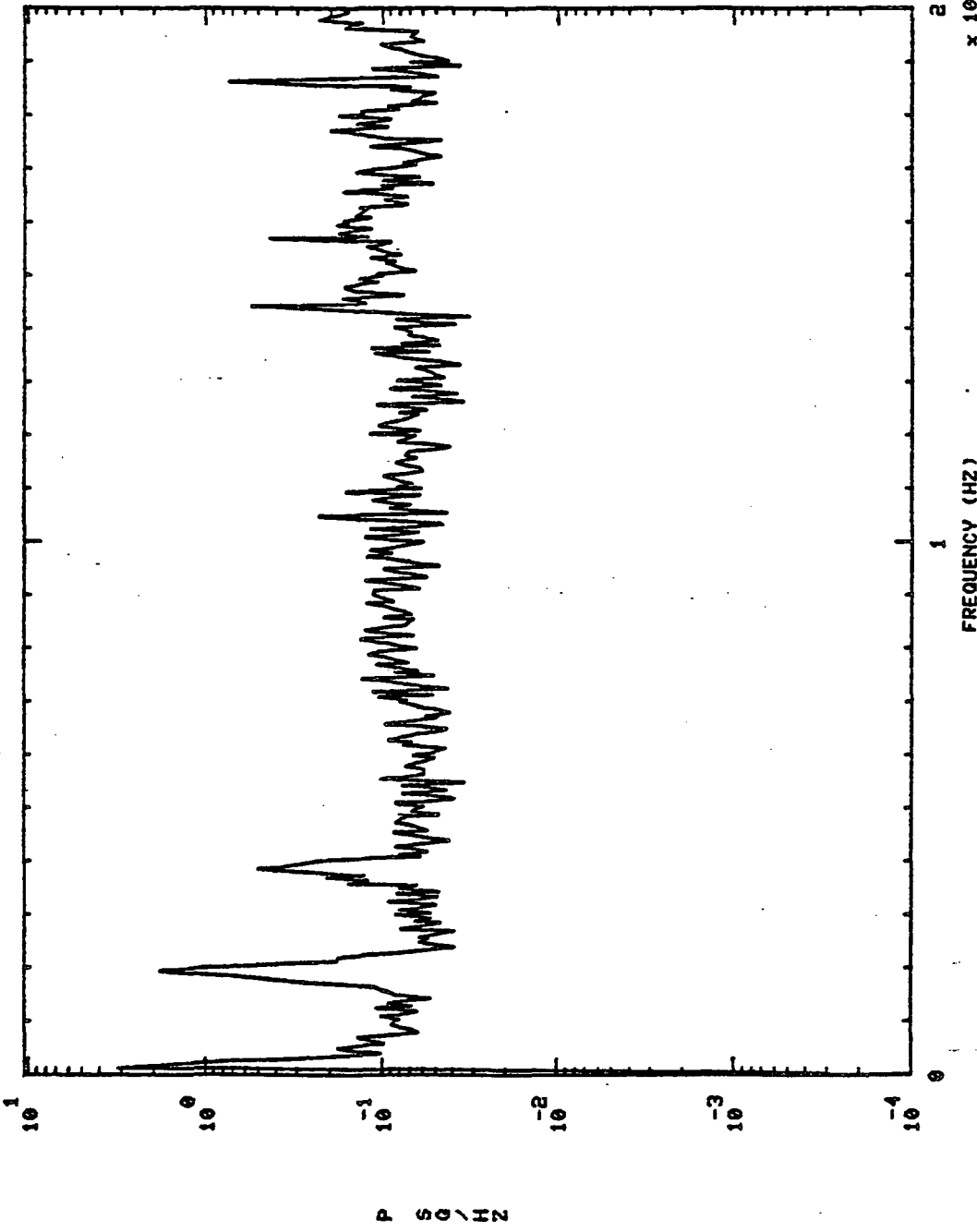
P S G / H 2

FREQUENCY (HZ)

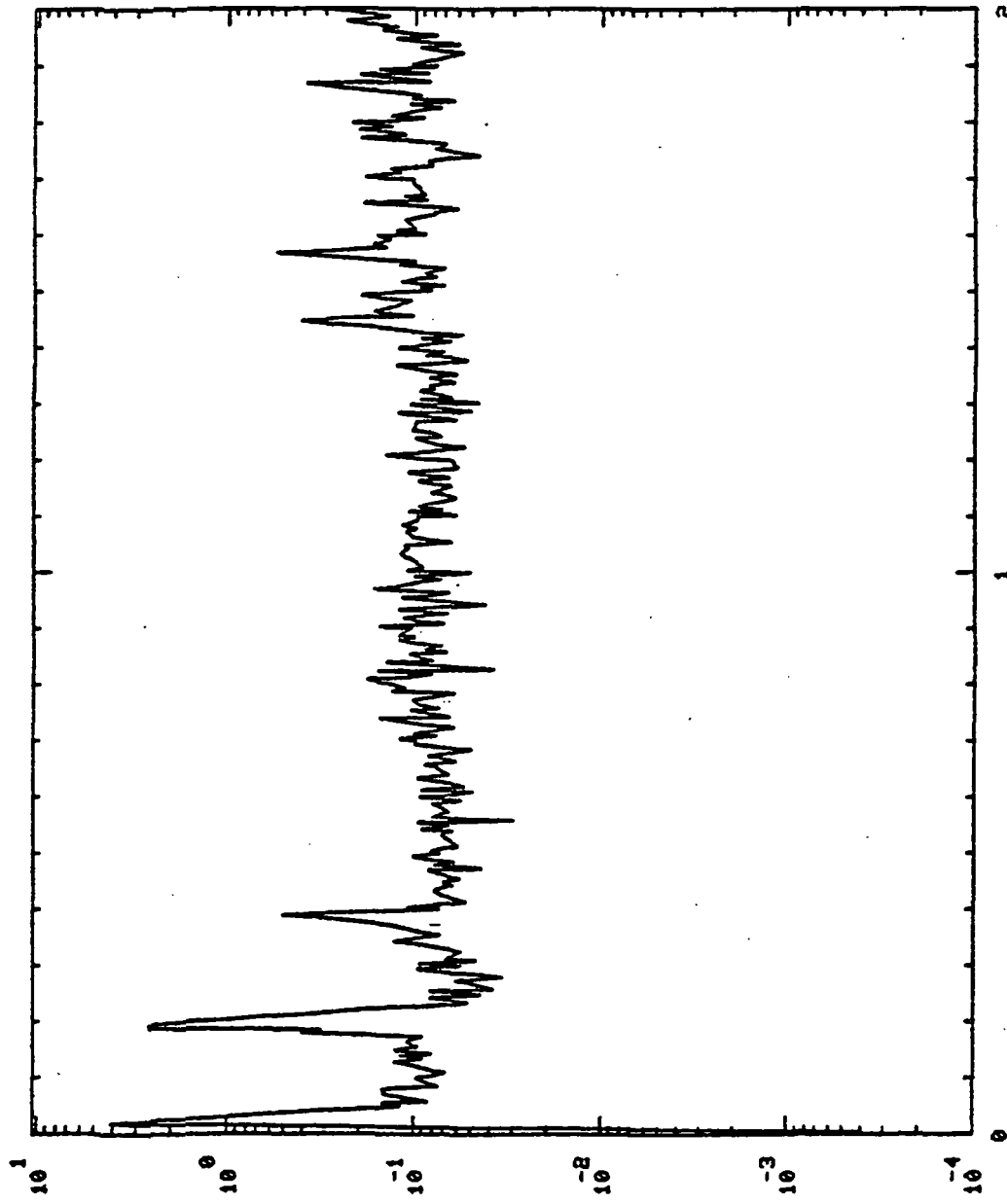
$\times 10^4$

S+ 150.01M0,'S

750136 OPB PC PR DC



750136 OPB PC PR DC S+ 280.01H0.'S

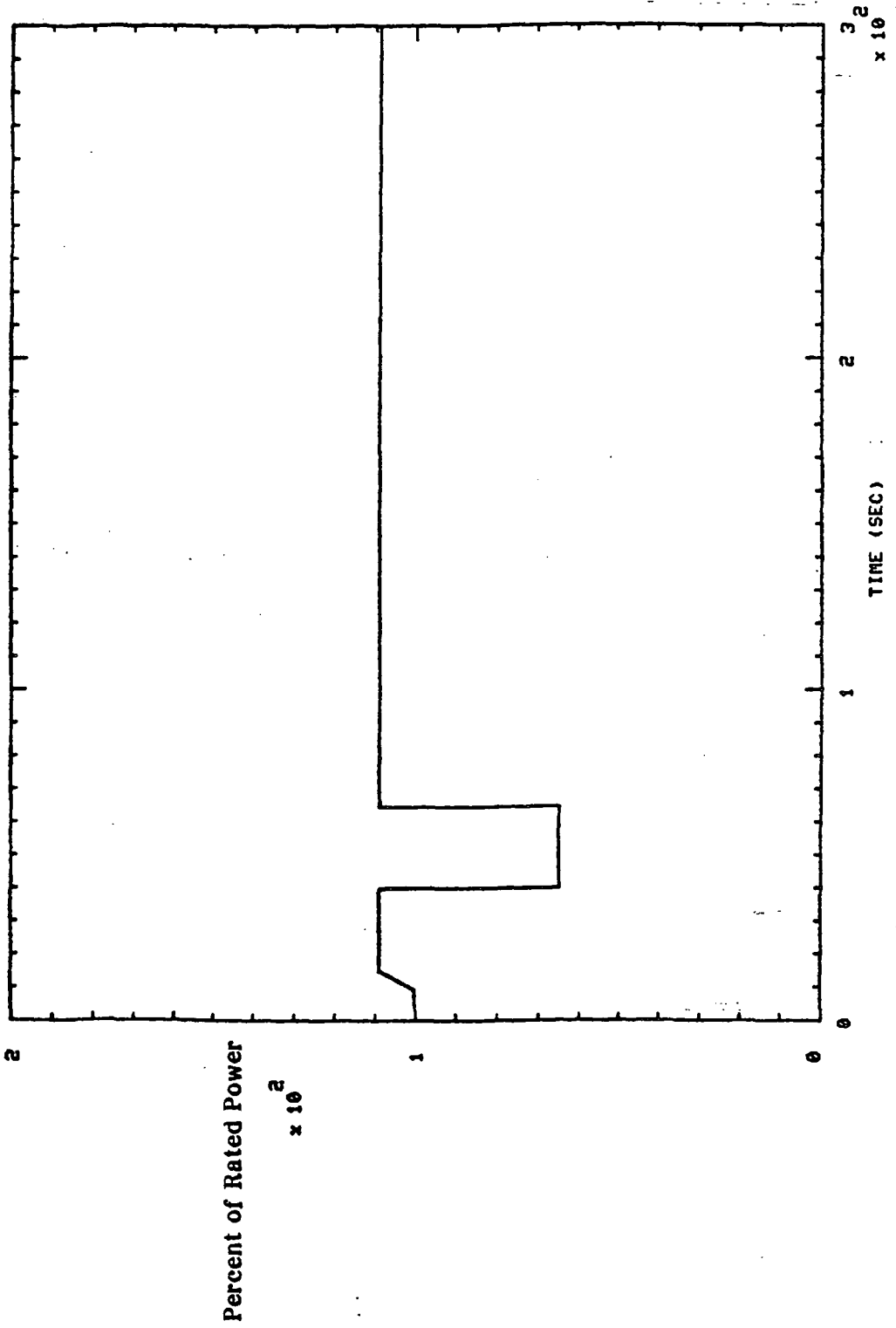


P S D / H Z

2.4
x 10⁴

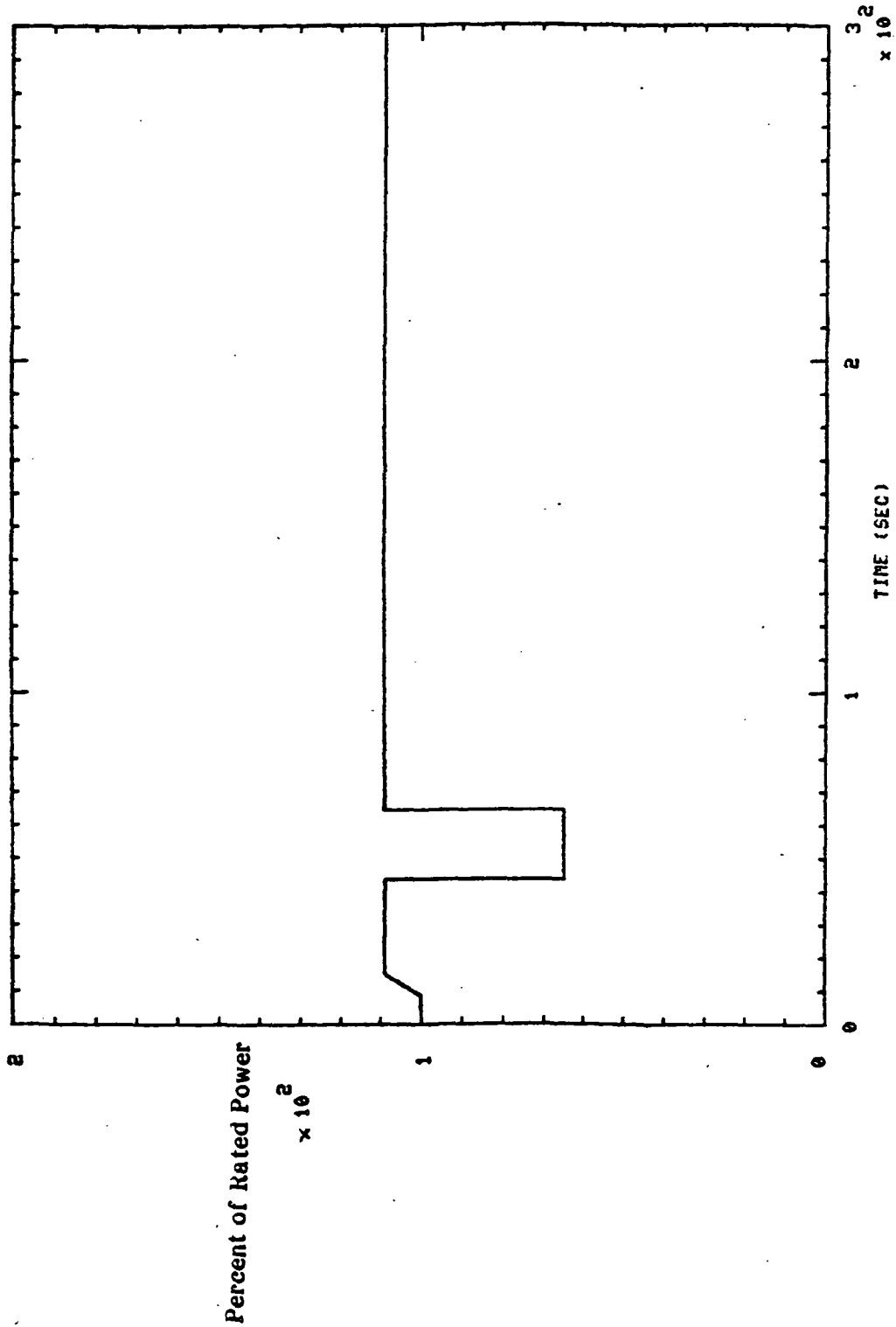
FREQUENCY (HZ)

750138 THRUST (UNFILTERED)

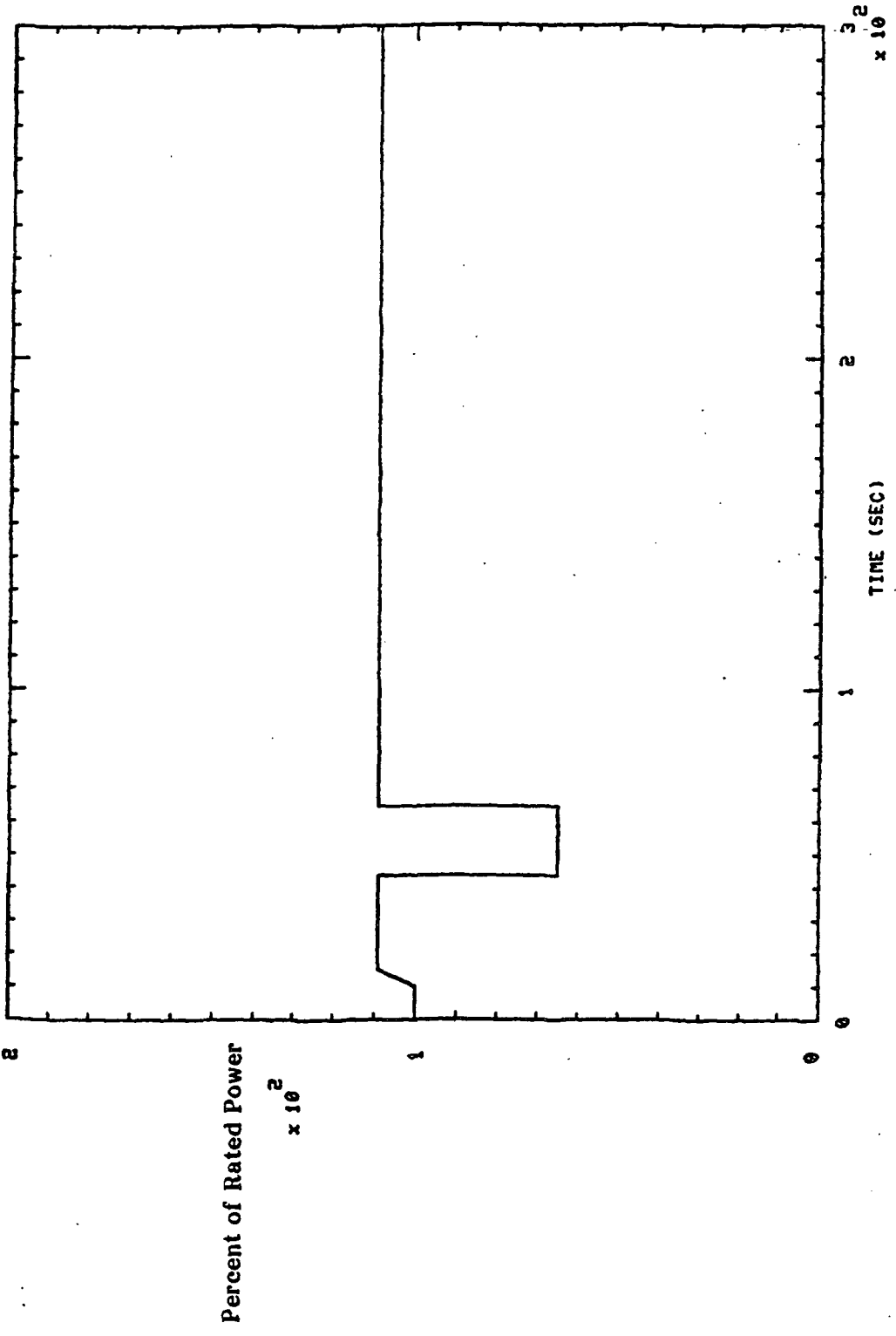


(UNFILTERED)

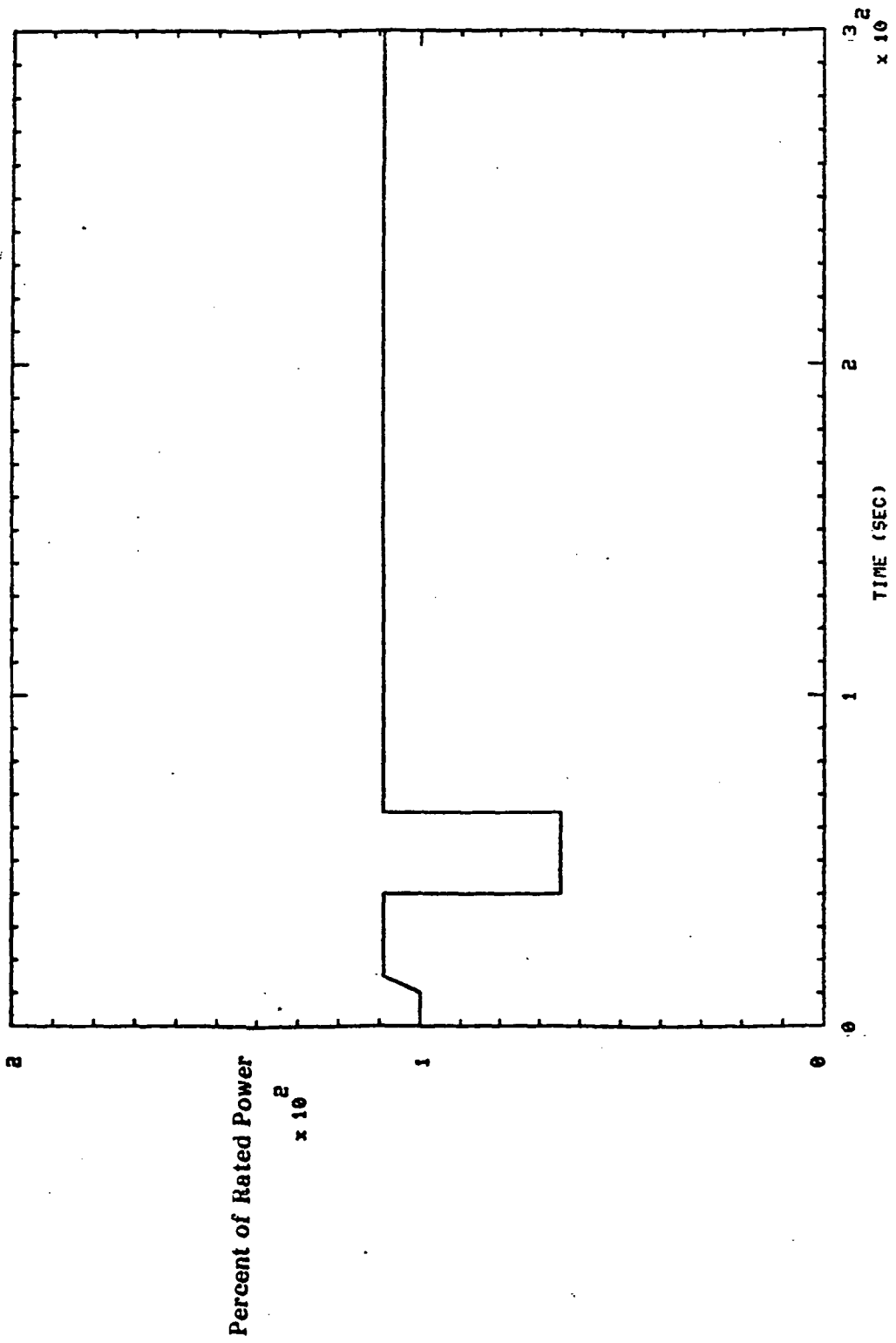
750139 THRUST



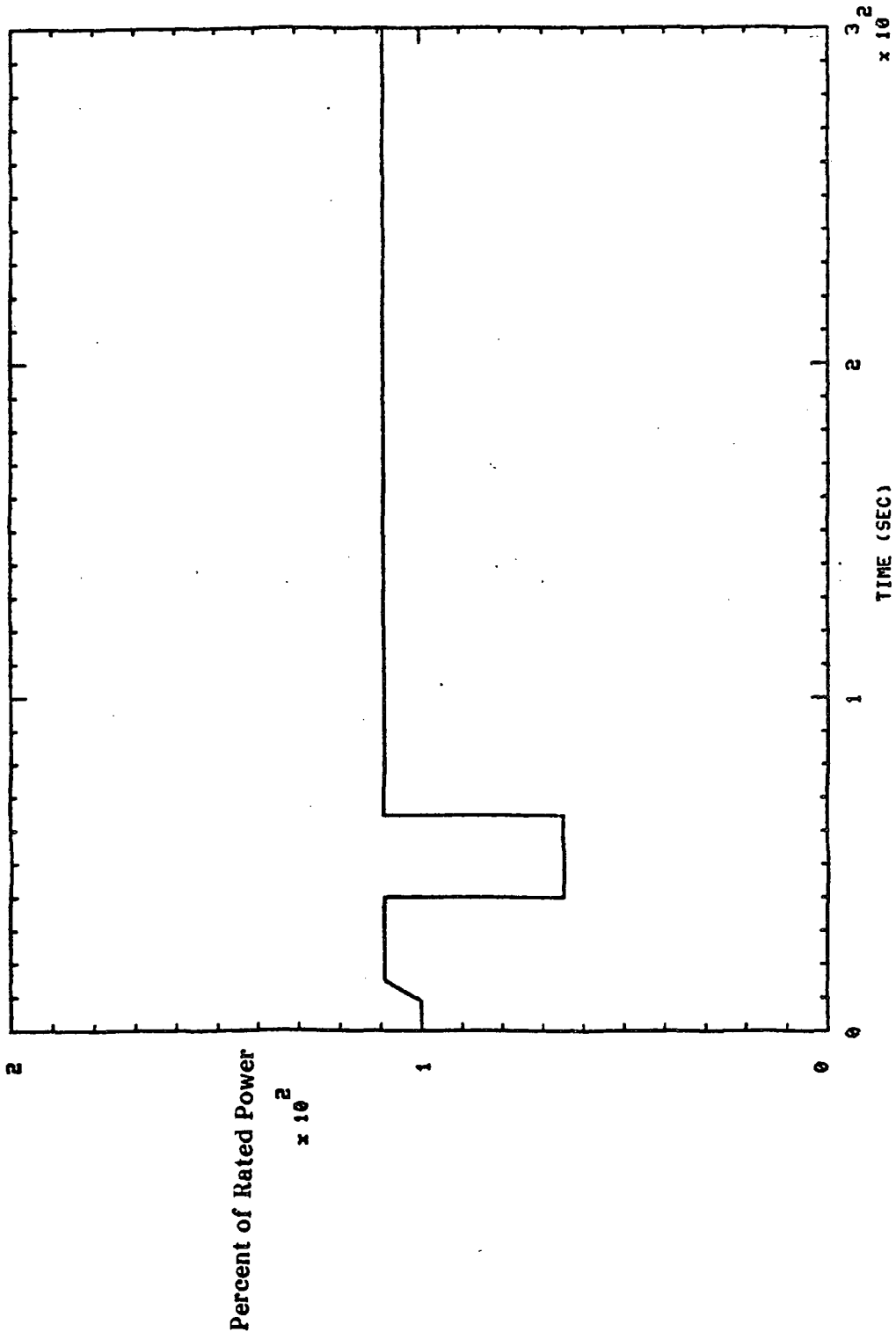
750140 THRUST (UNFILTERED)



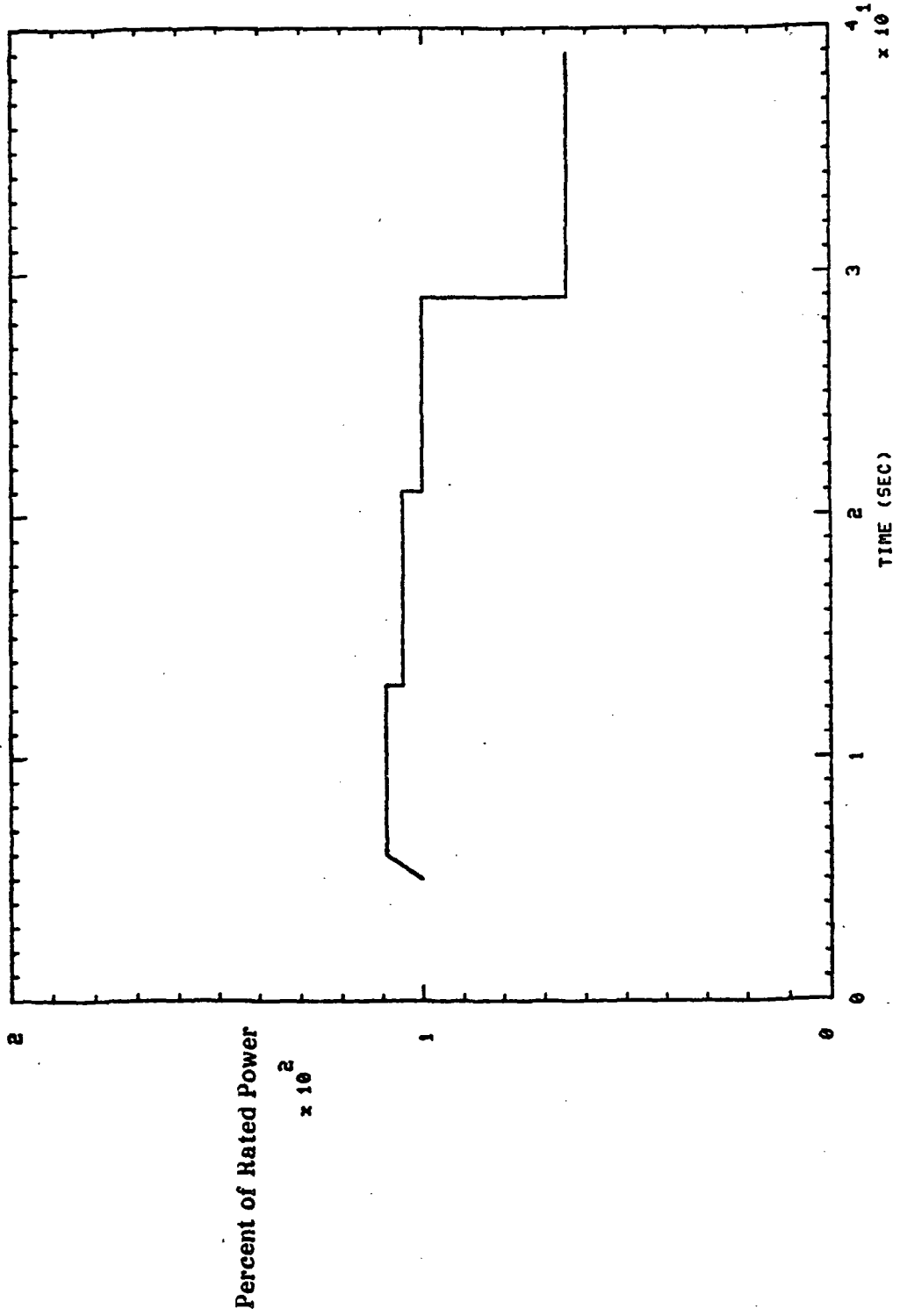
750141 THRUST (UNFILTERED)



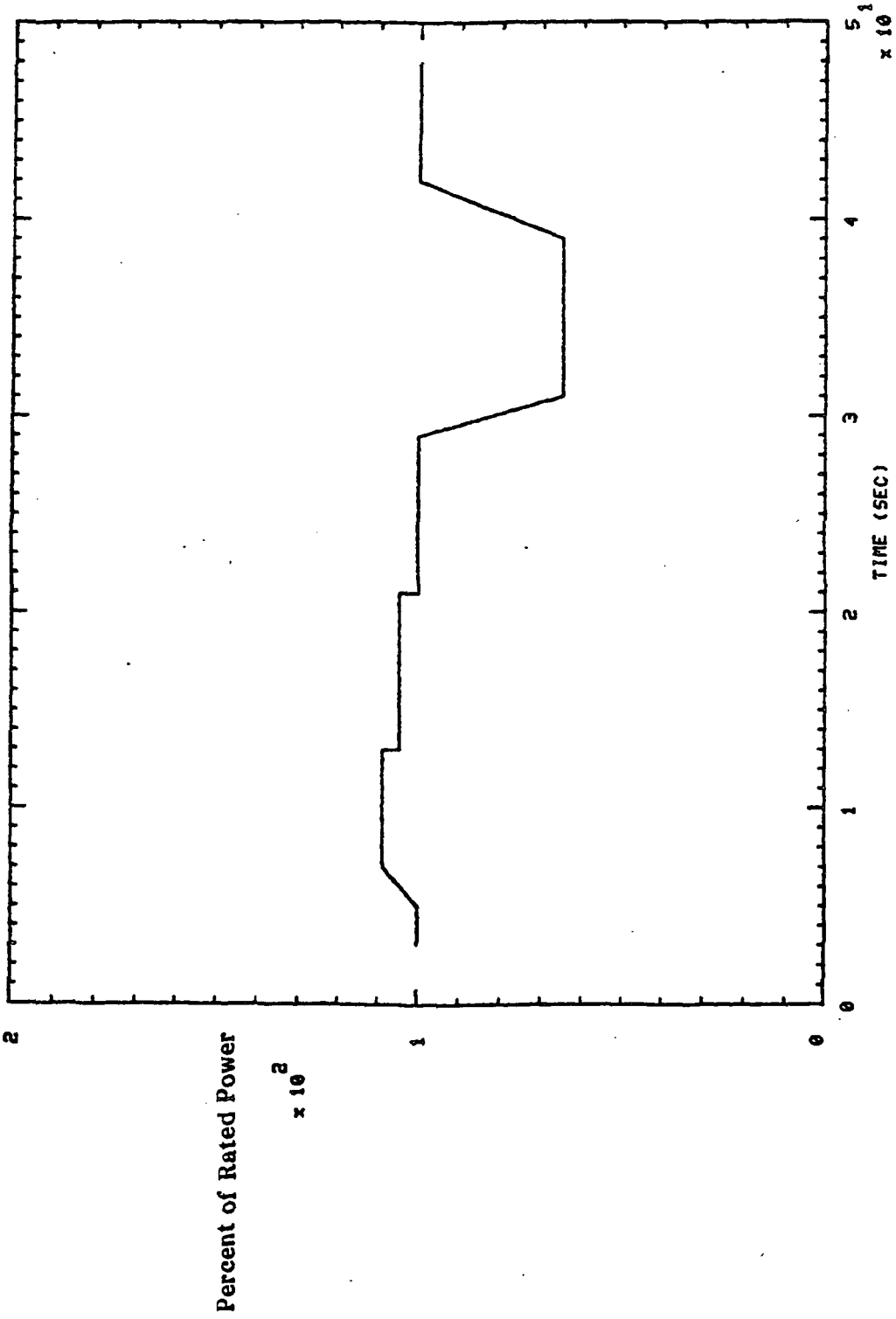
750142 THRUST (UNFILTERED)



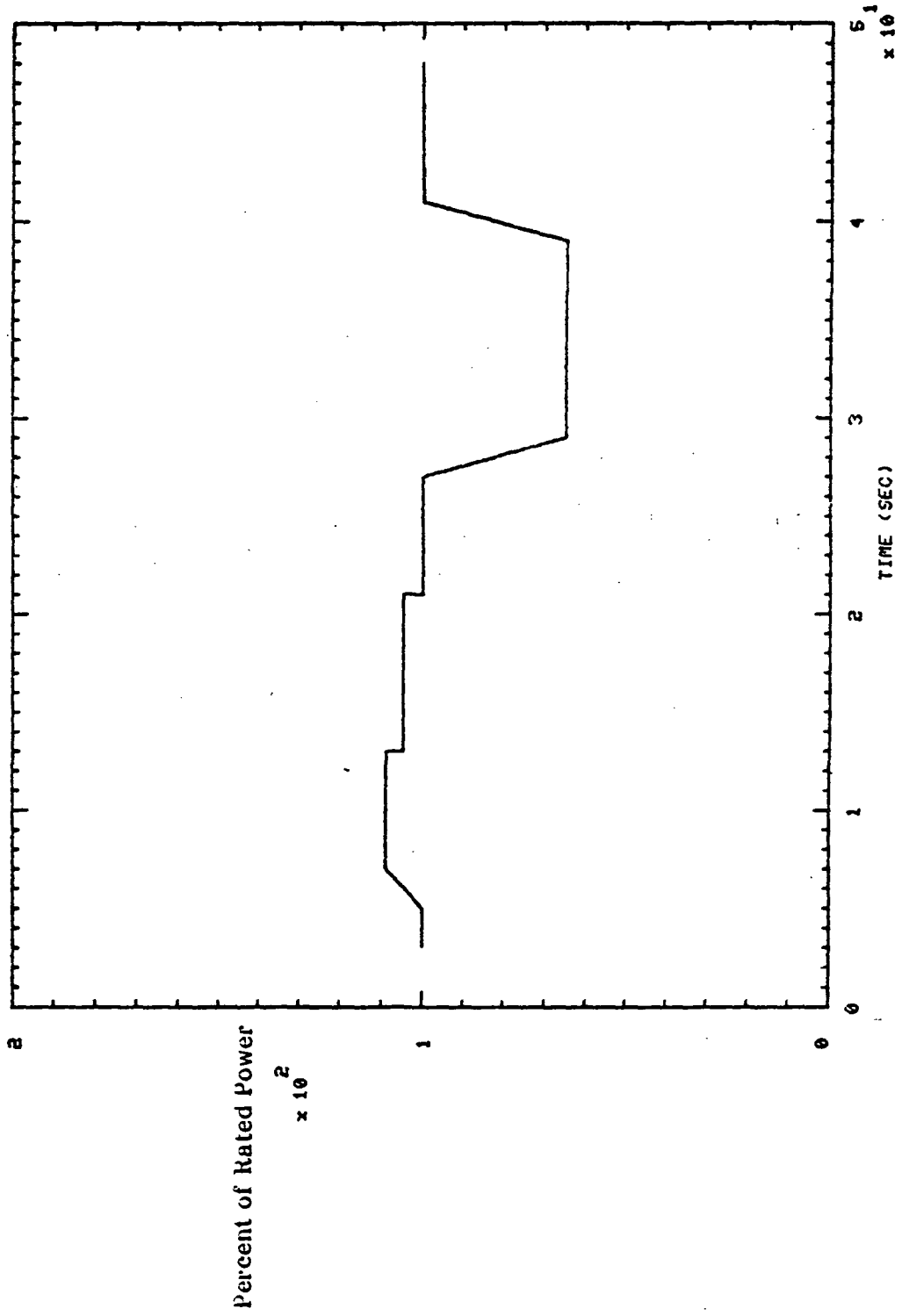
750143 THRUST (UNFILTERED)



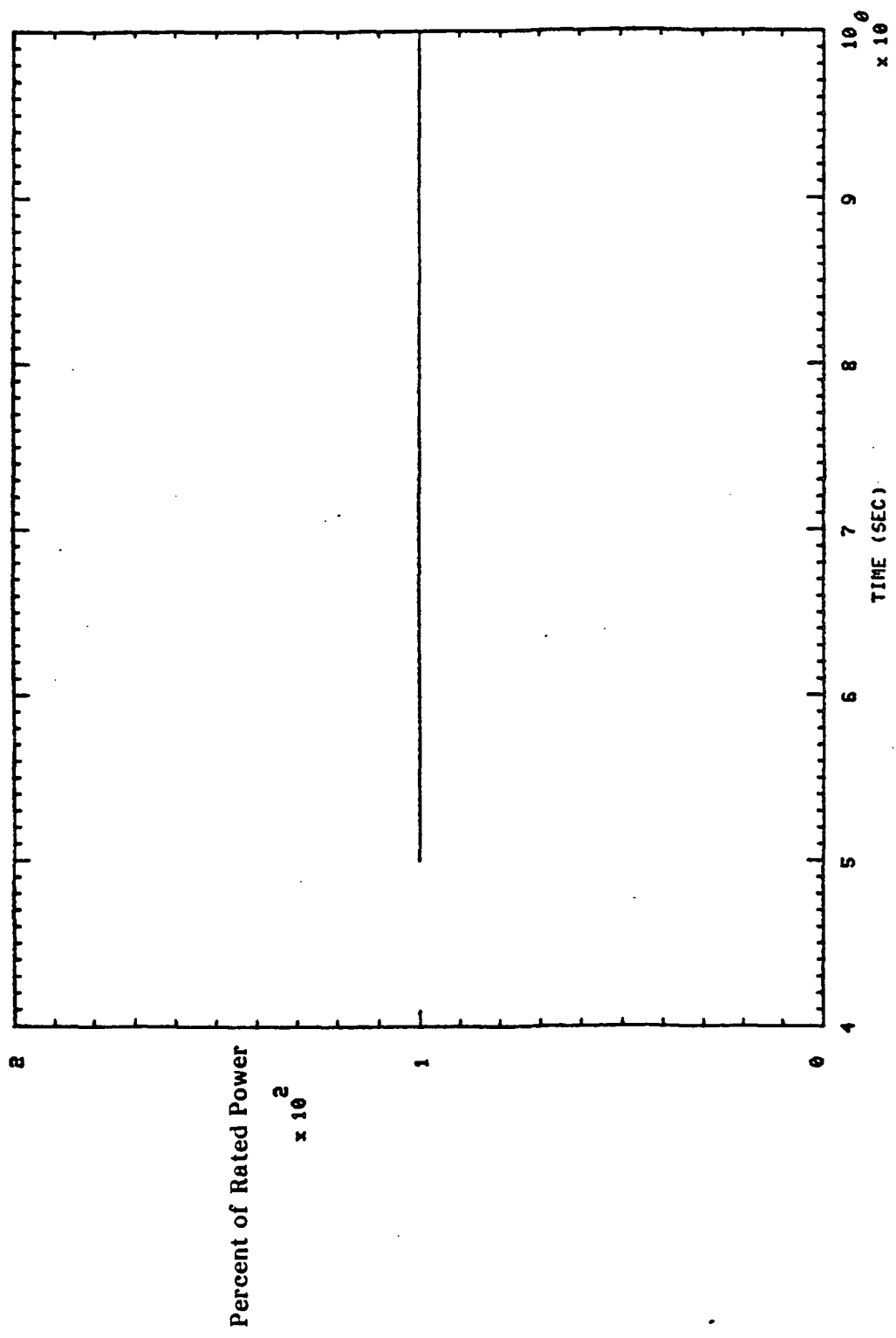
750144 THRUST (UNFILTERED)



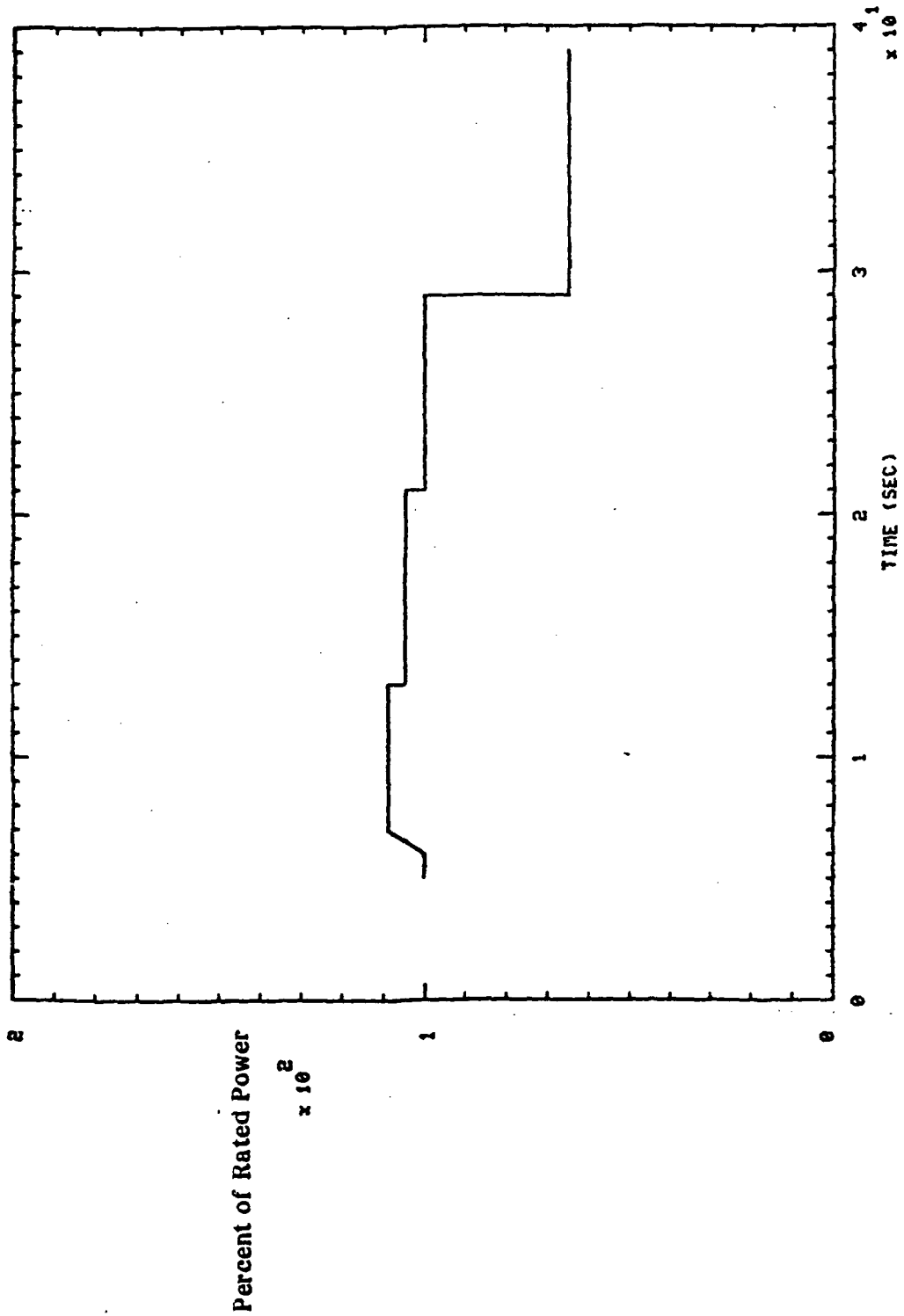
750145 THRUST (UNFILTERED)



750146 THRUST (UNFILTERED)

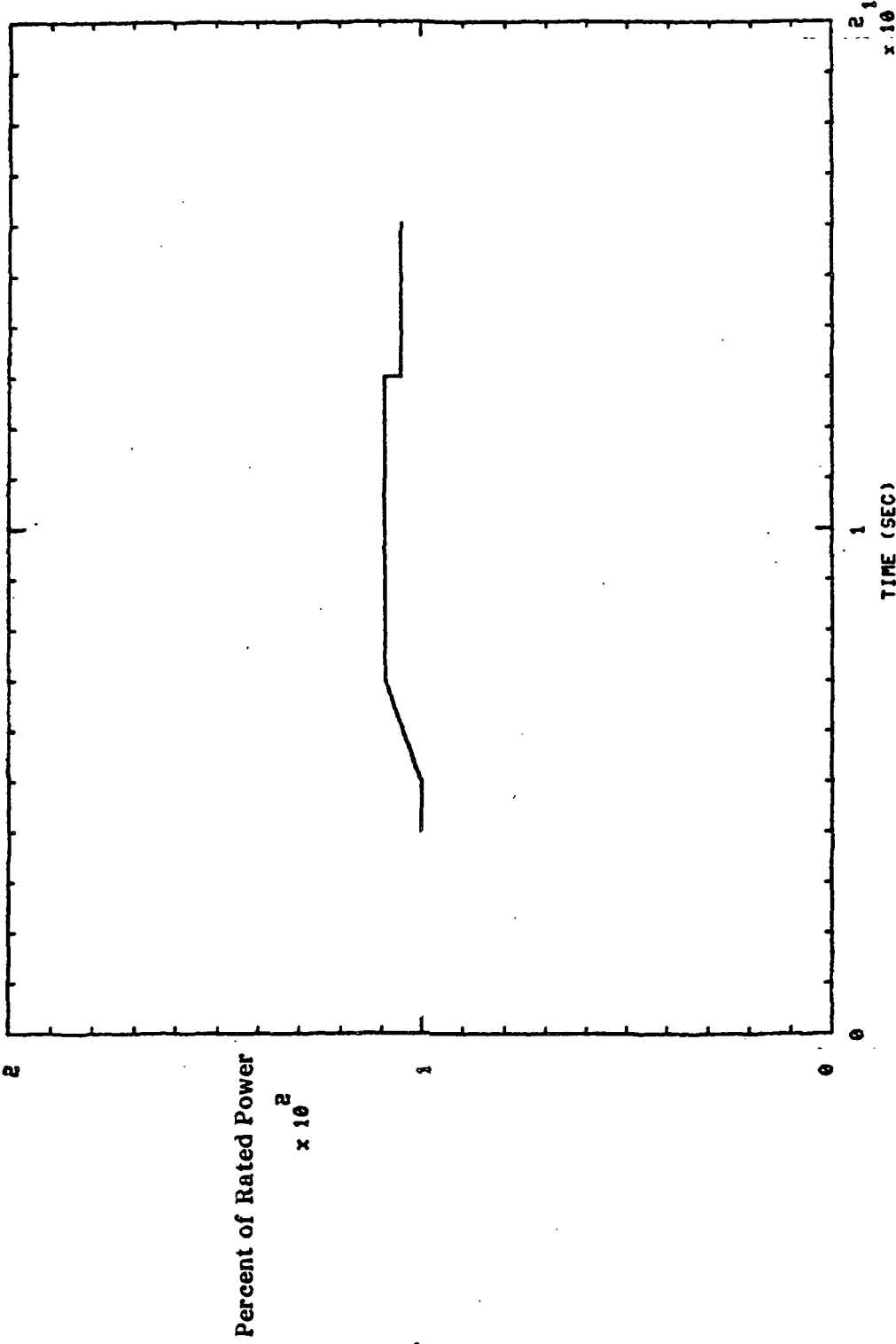


750147 THRUST (UNFILTERED)



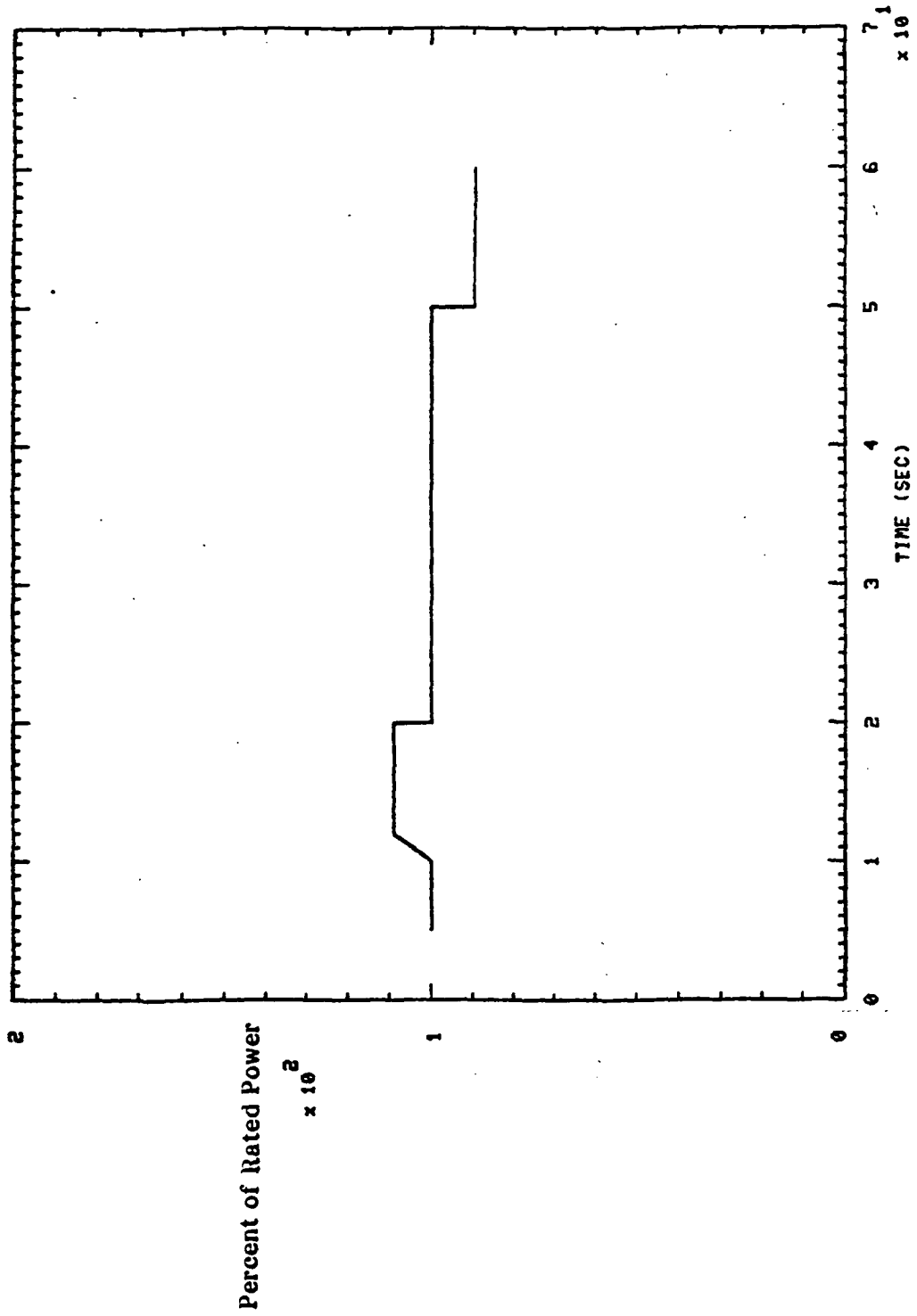
750148 THRUST (UNFILTERED)

750148 THRUST

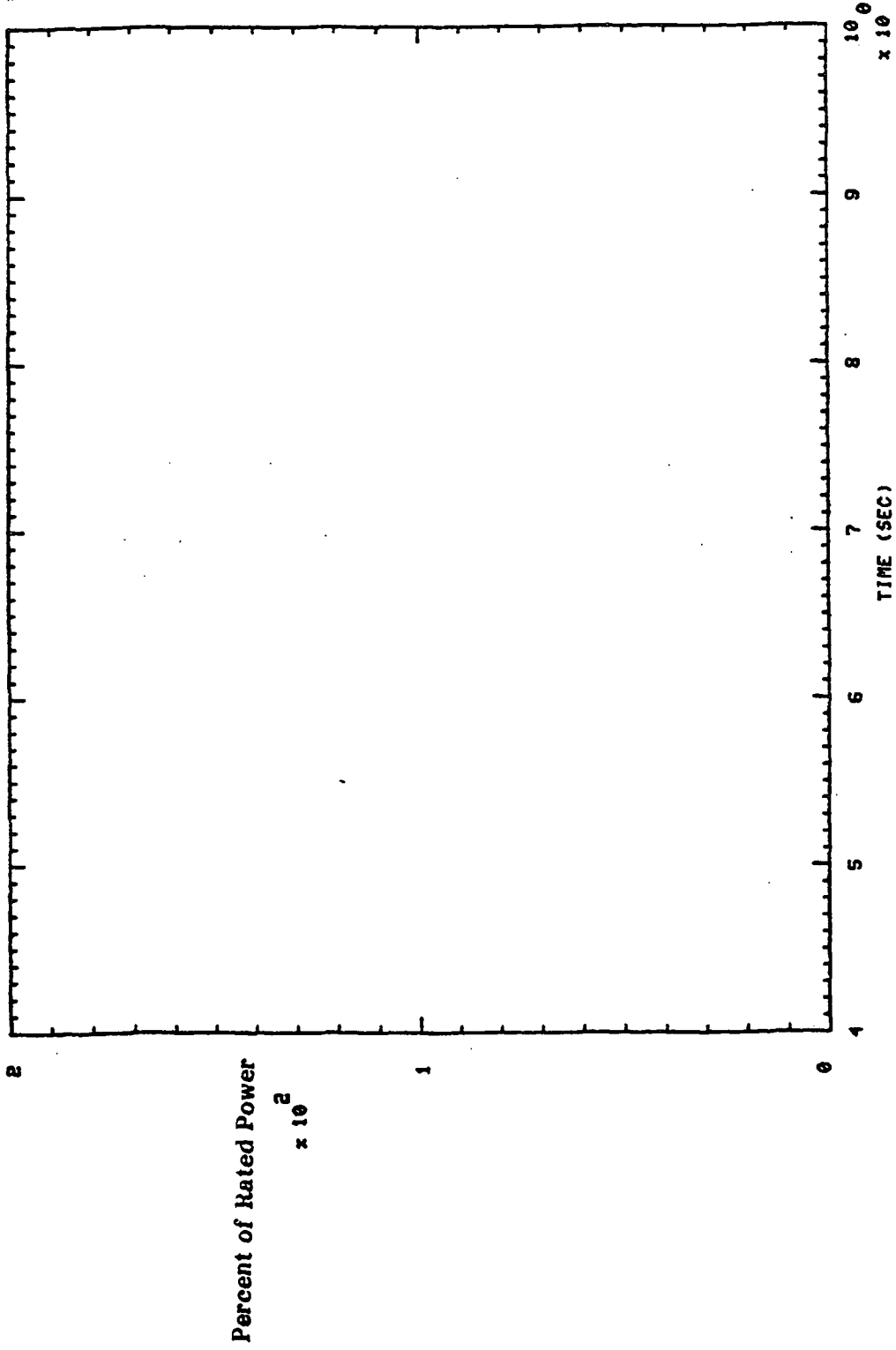


(UNFILTERED)

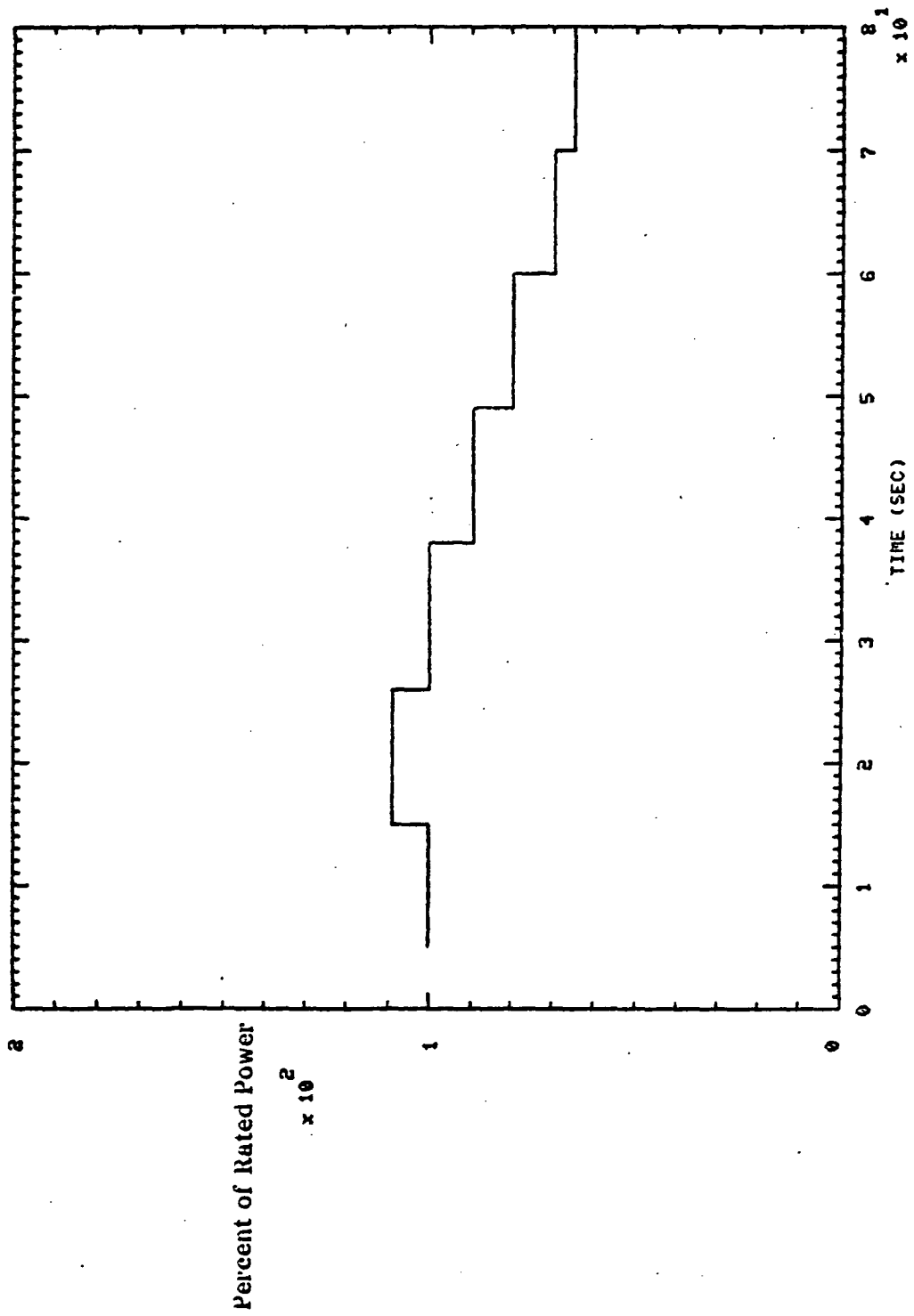
750150 THRUST



750151 THRUST (UNFILTERED)

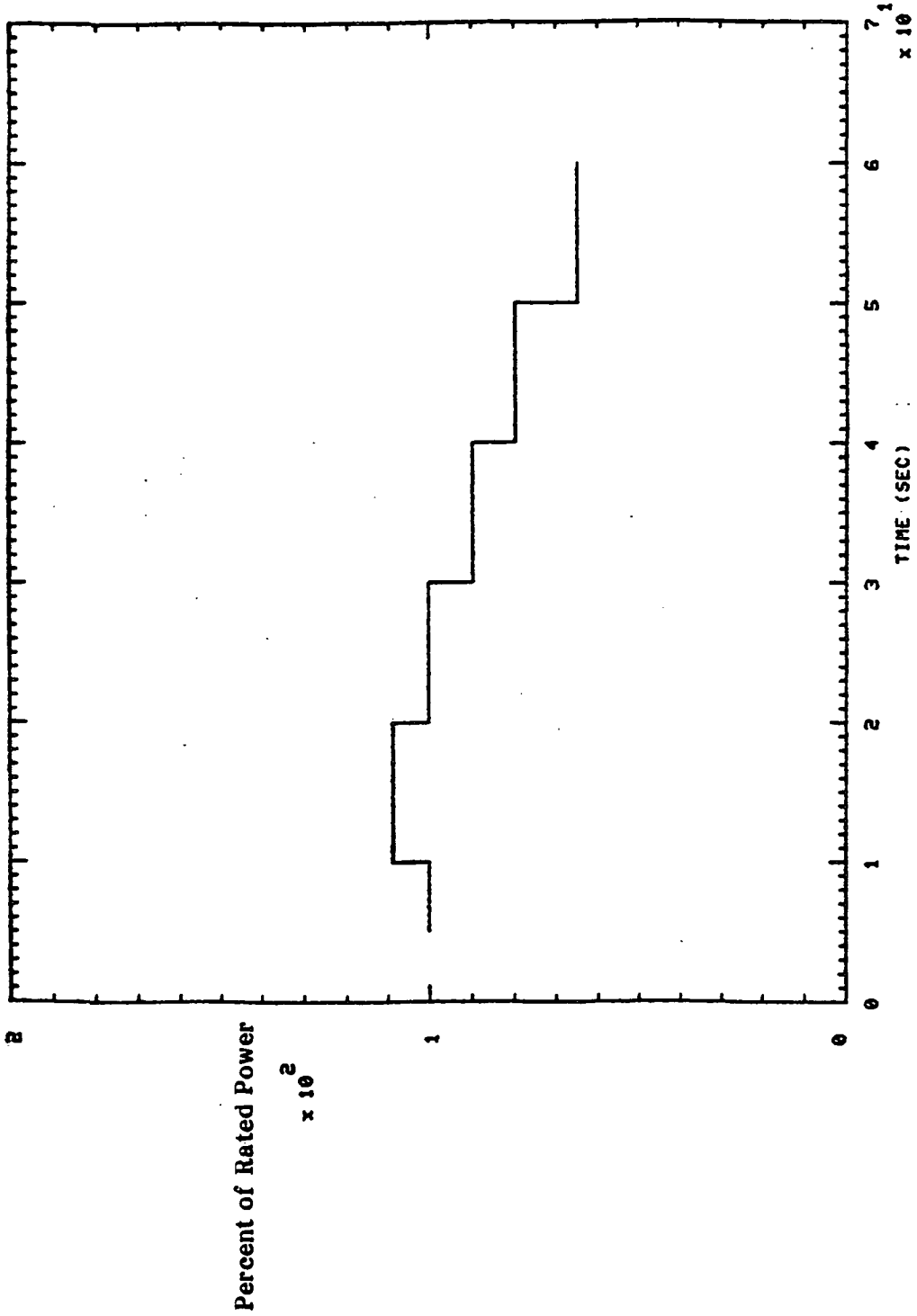


750152 THRUST (UNFILTERED)



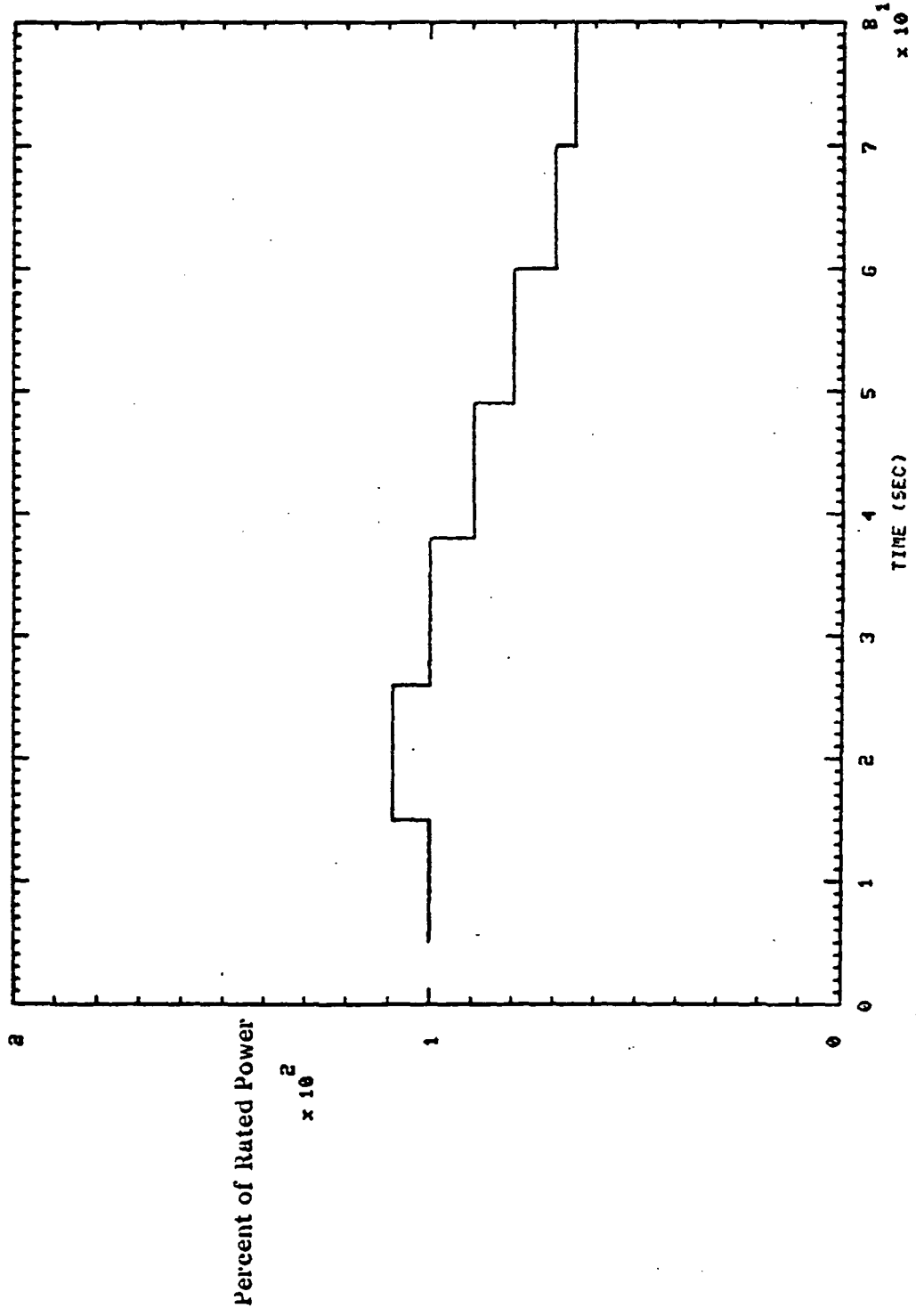
750153 THRUST (UNFILTERED)

750153 THRUST

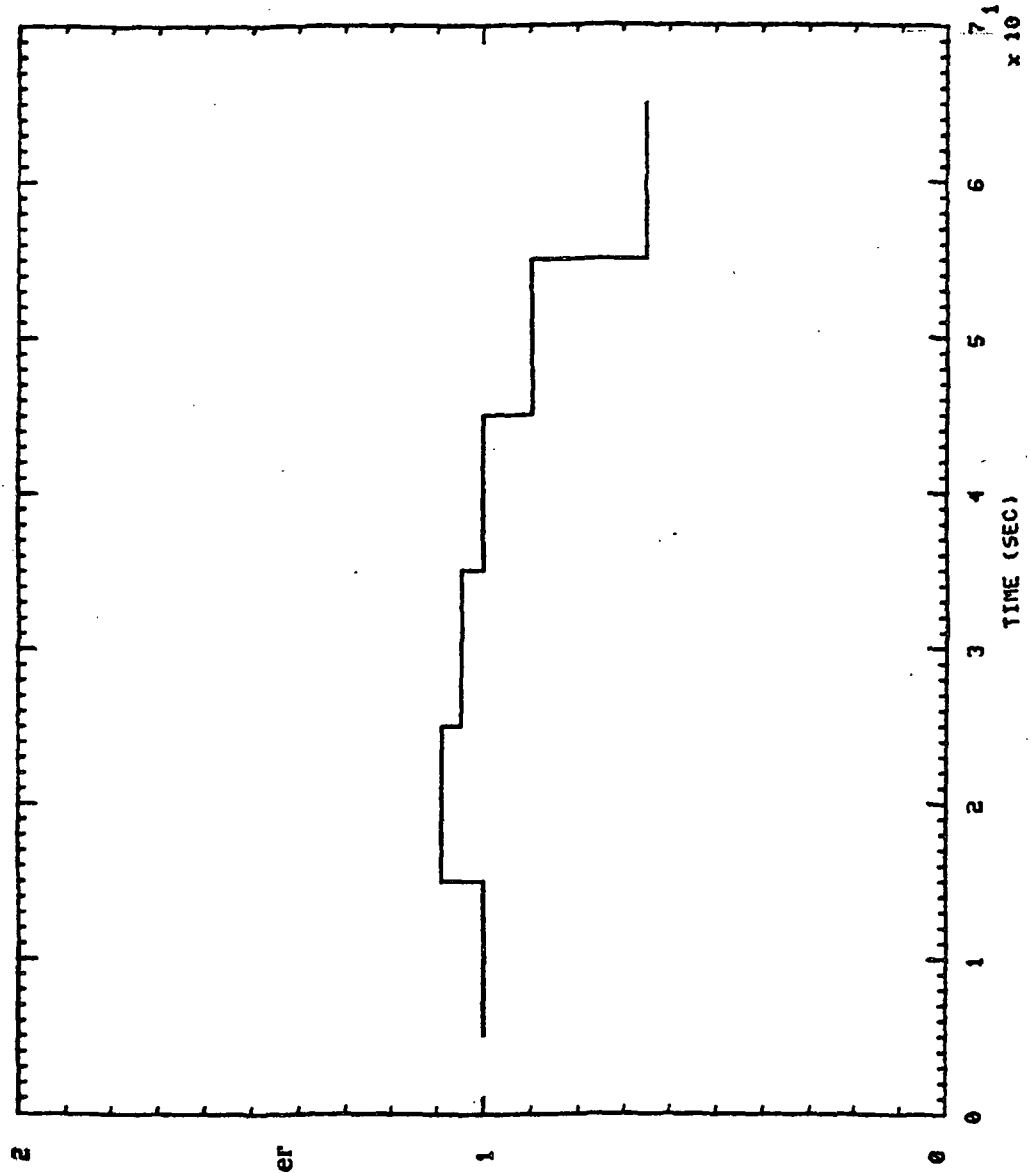


750152 THRUST

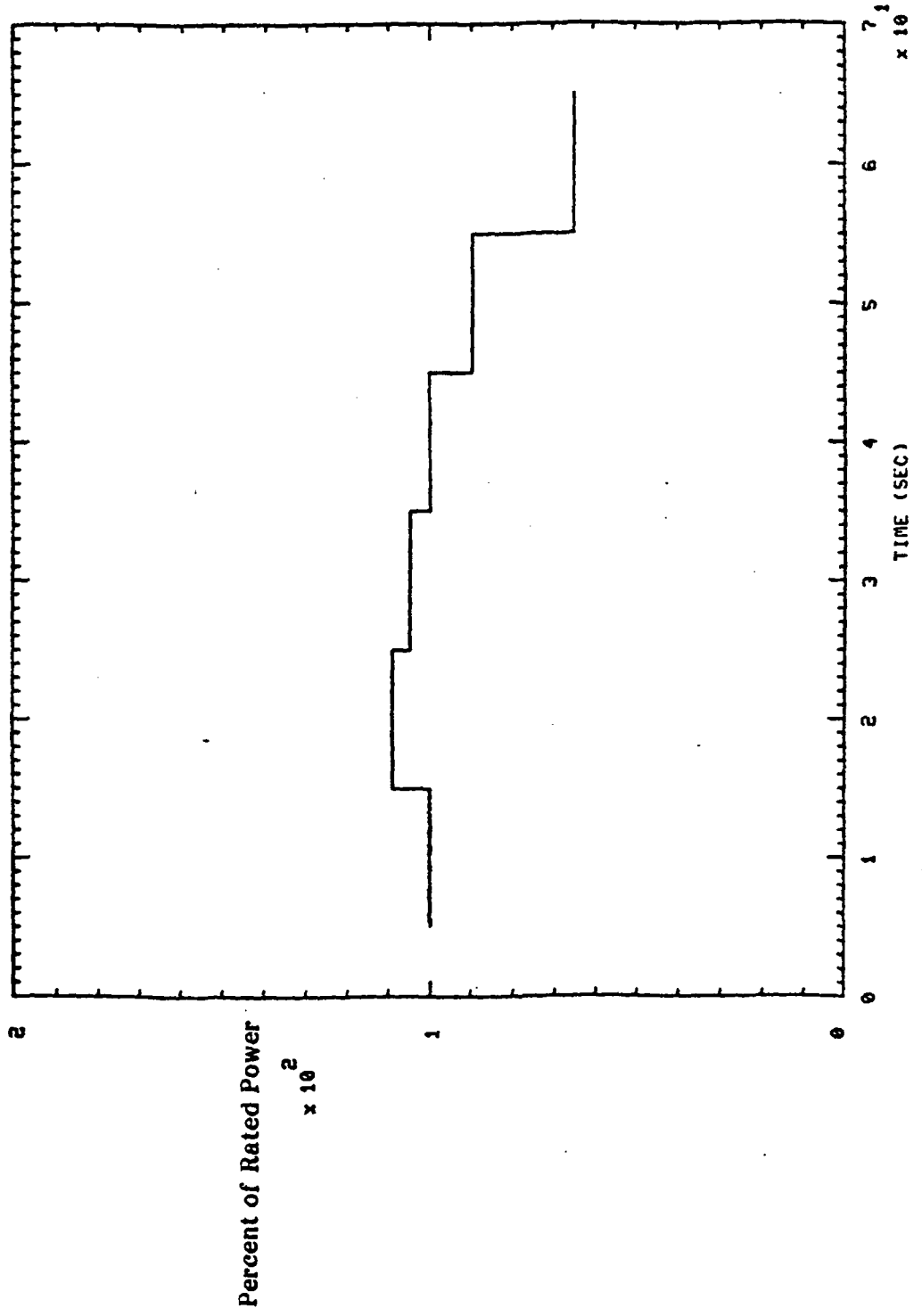
(UNFILTERED)



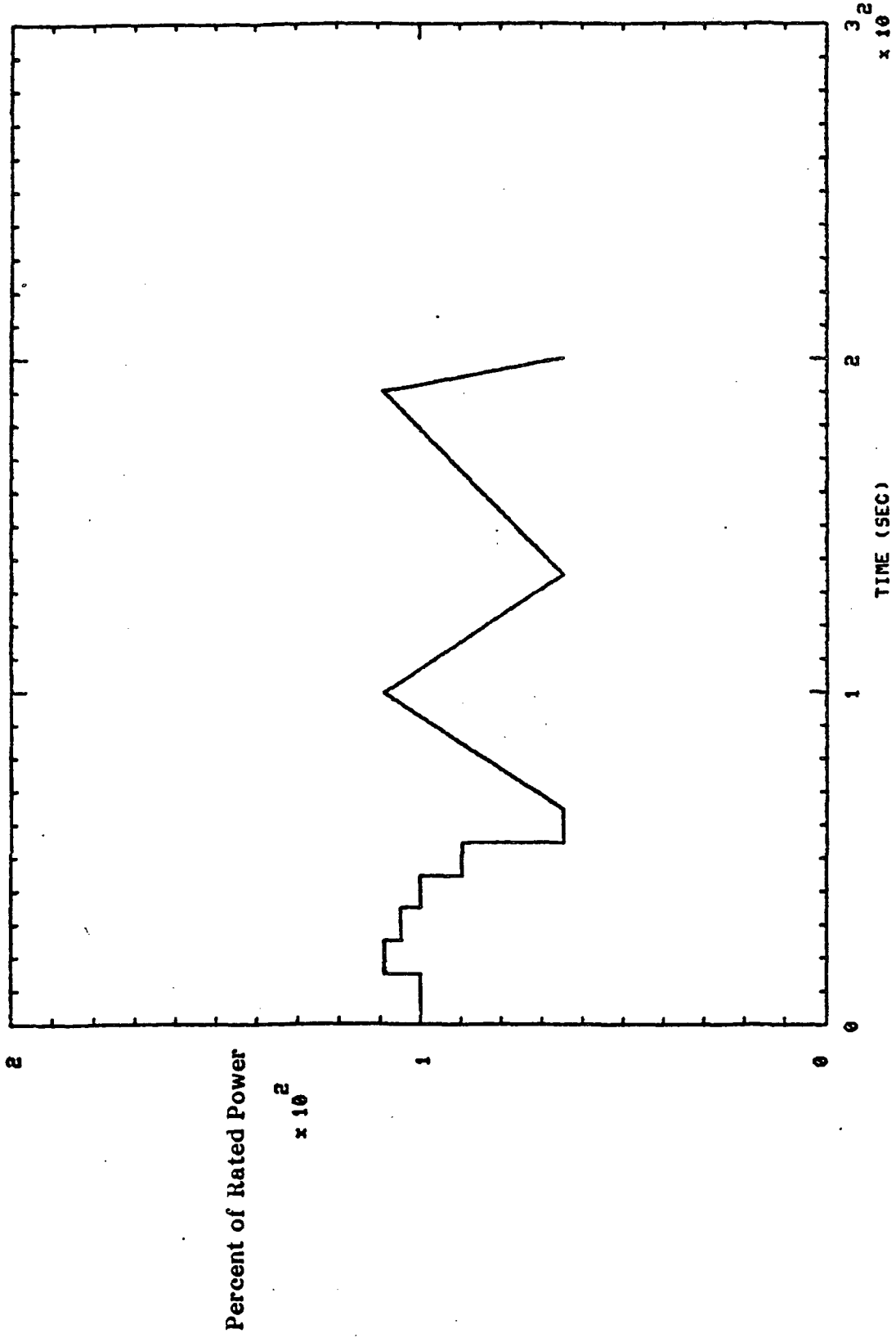
750155 THRUST (UNFILTERED)



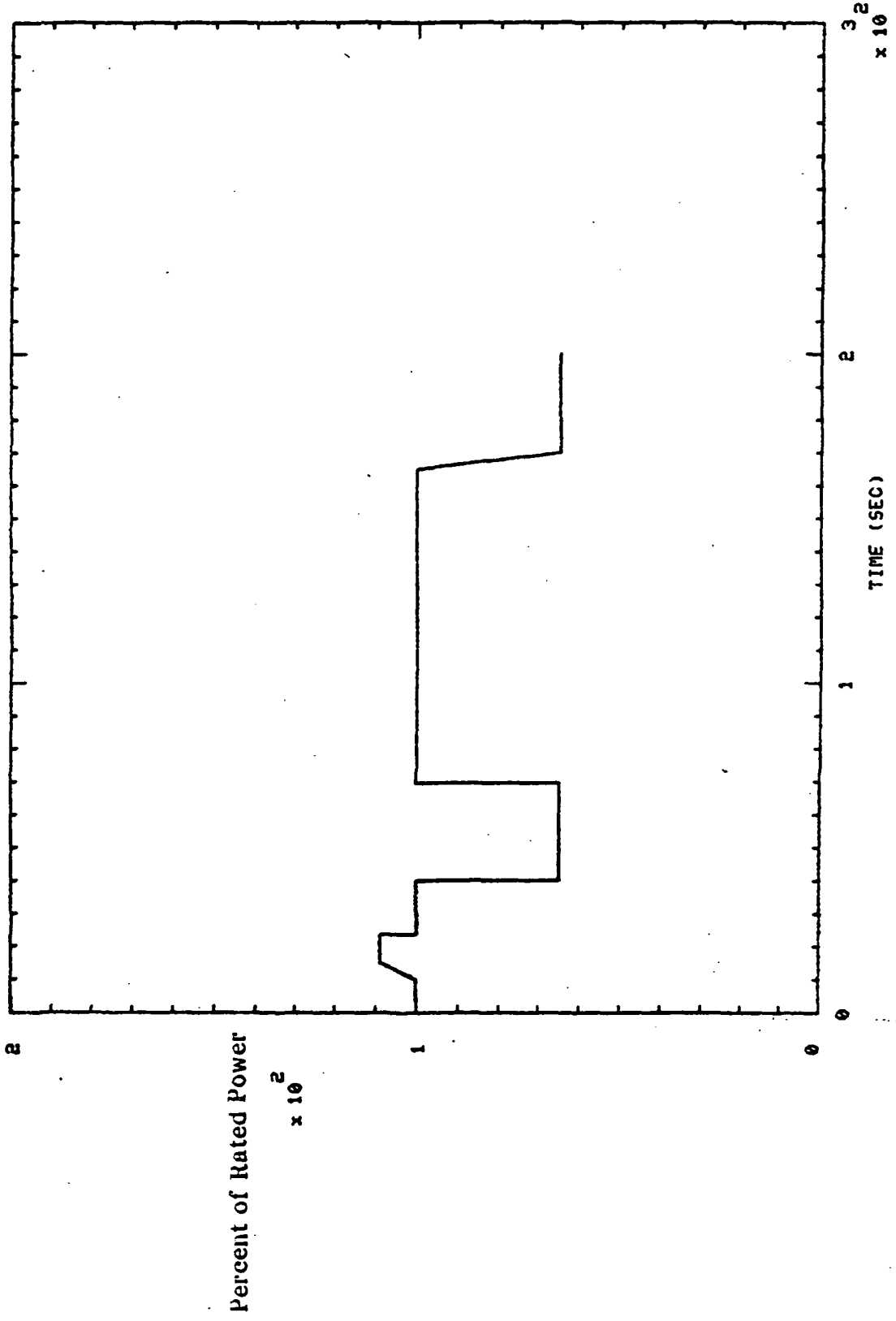
750154 THRUST (UNFILTERED)



750157 THRUST (UNFILTERED)



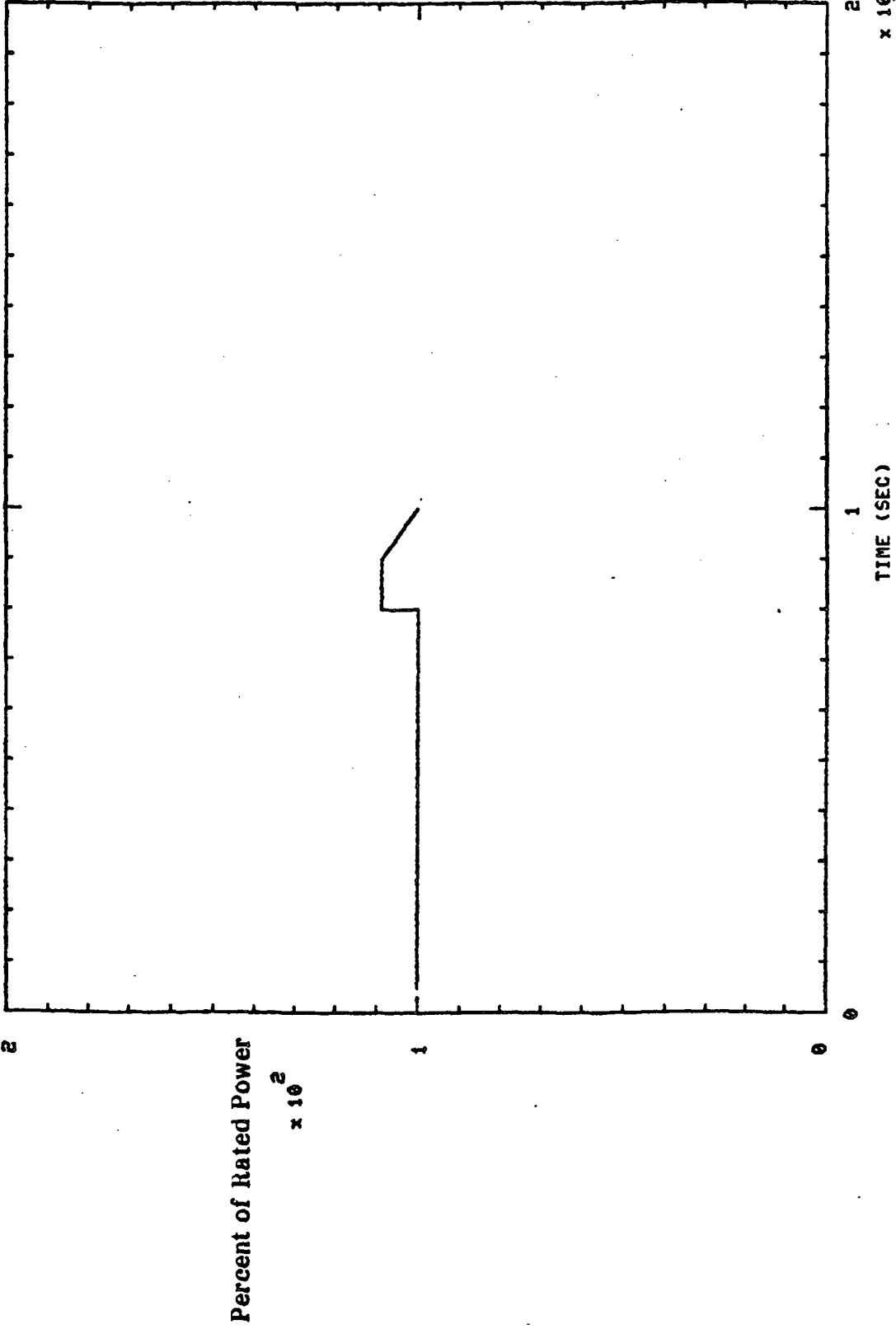
750158 THRUST (UNFILTERED)



(UNFILTERED)

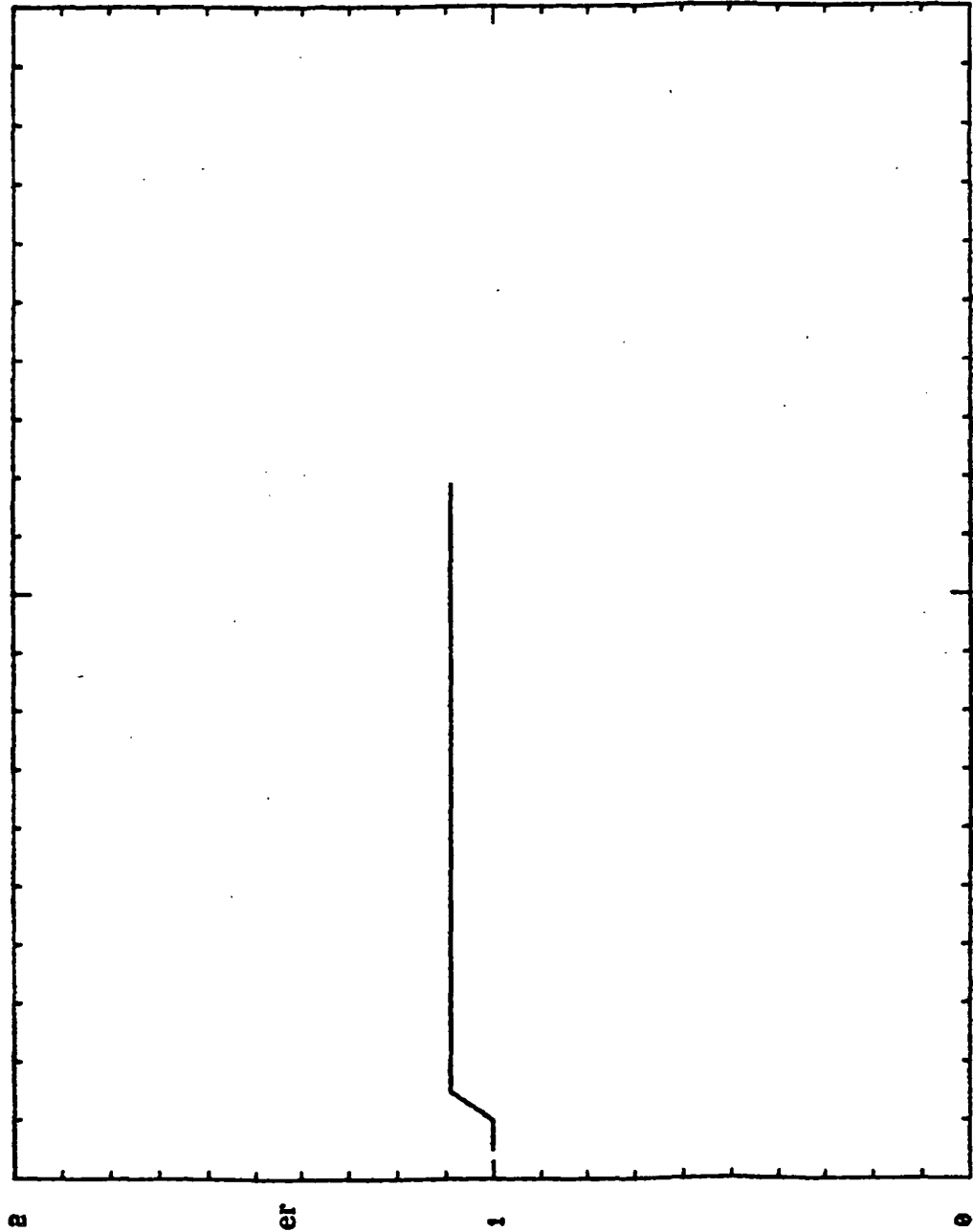
THRUST

750161



750164 THRUST (UNFILTERED)

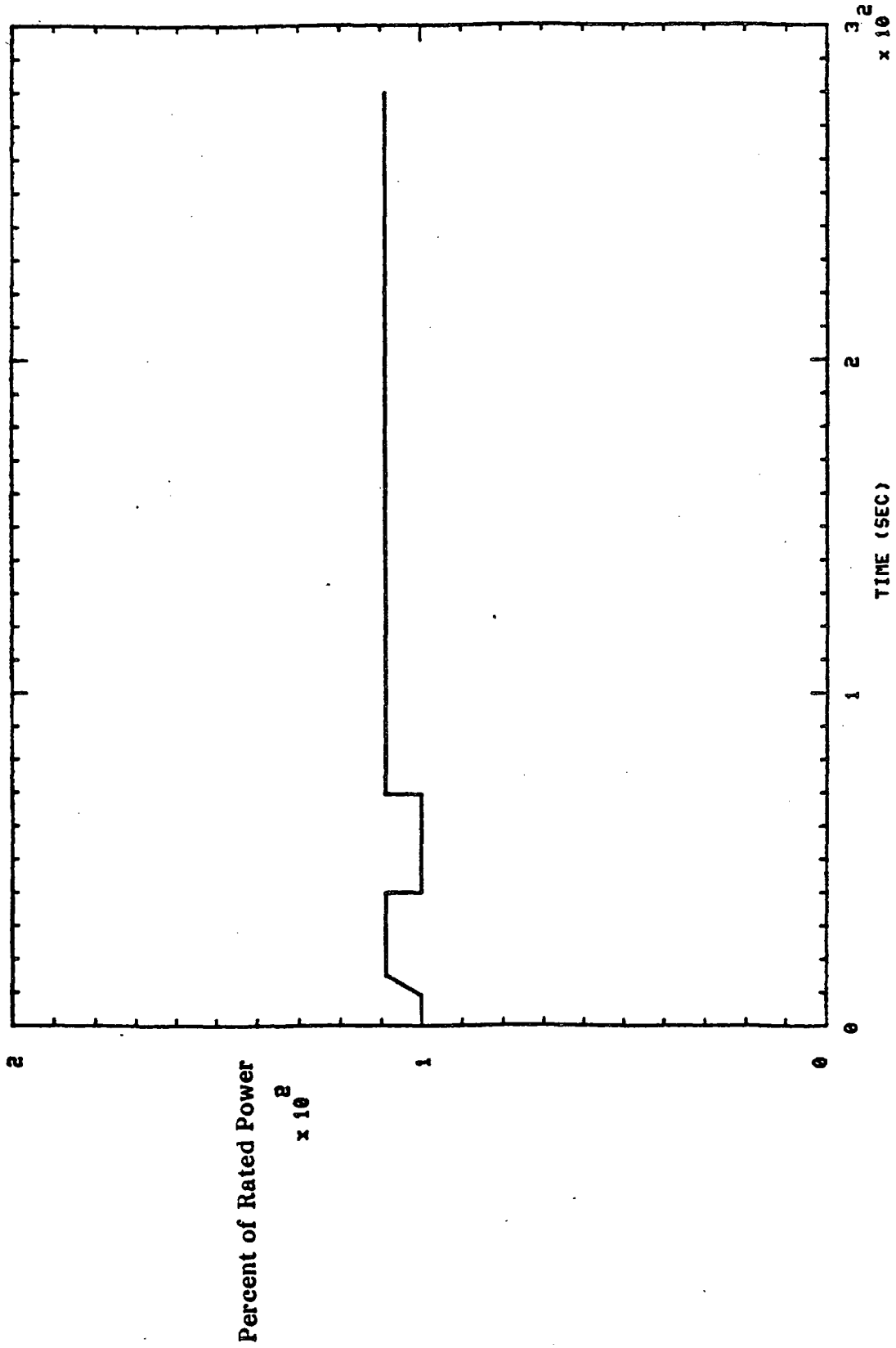
Percent of Rated Power



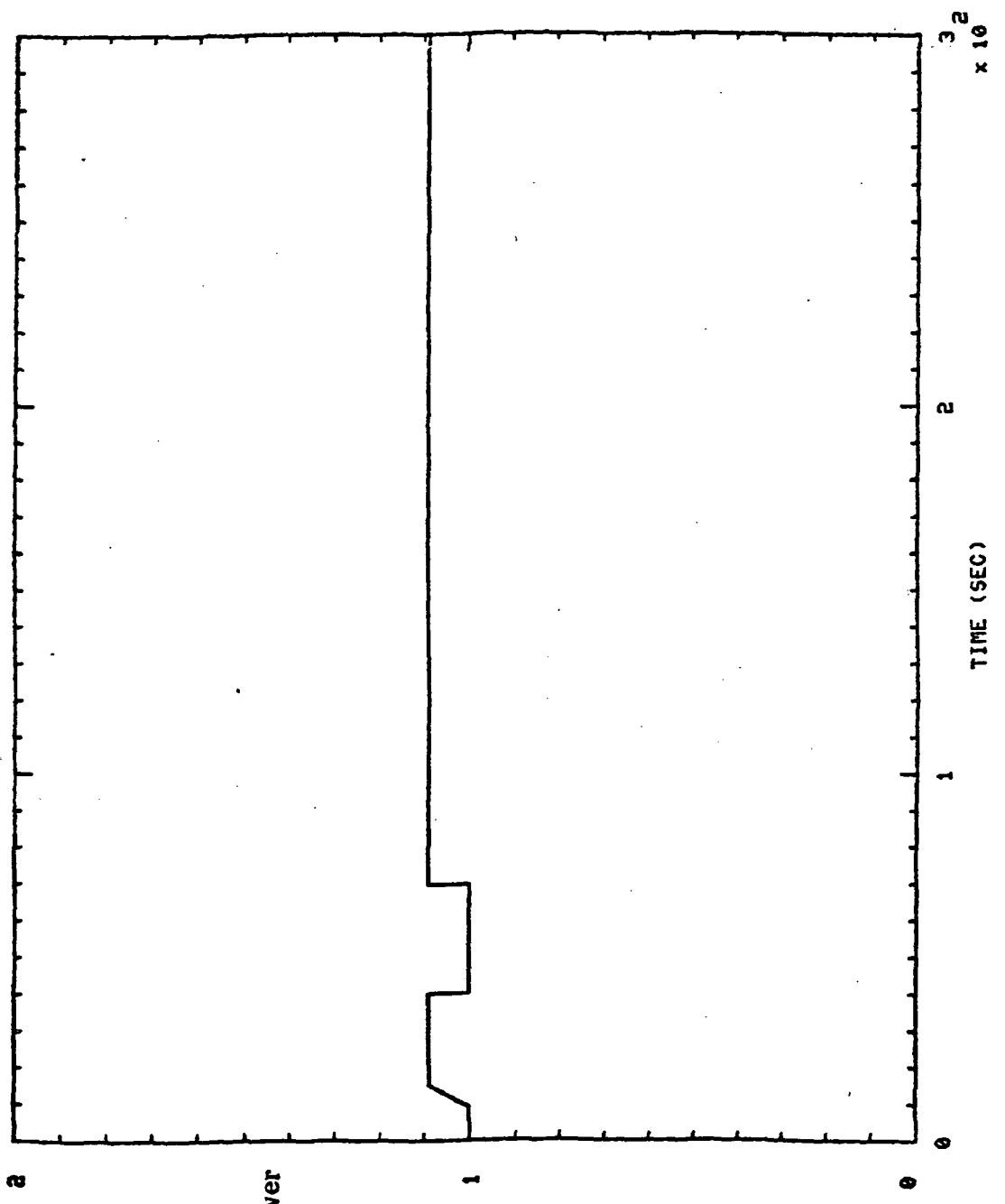
Percent of Rated Power $\times 10^2$

TIME (SEC) $\times 10^2$

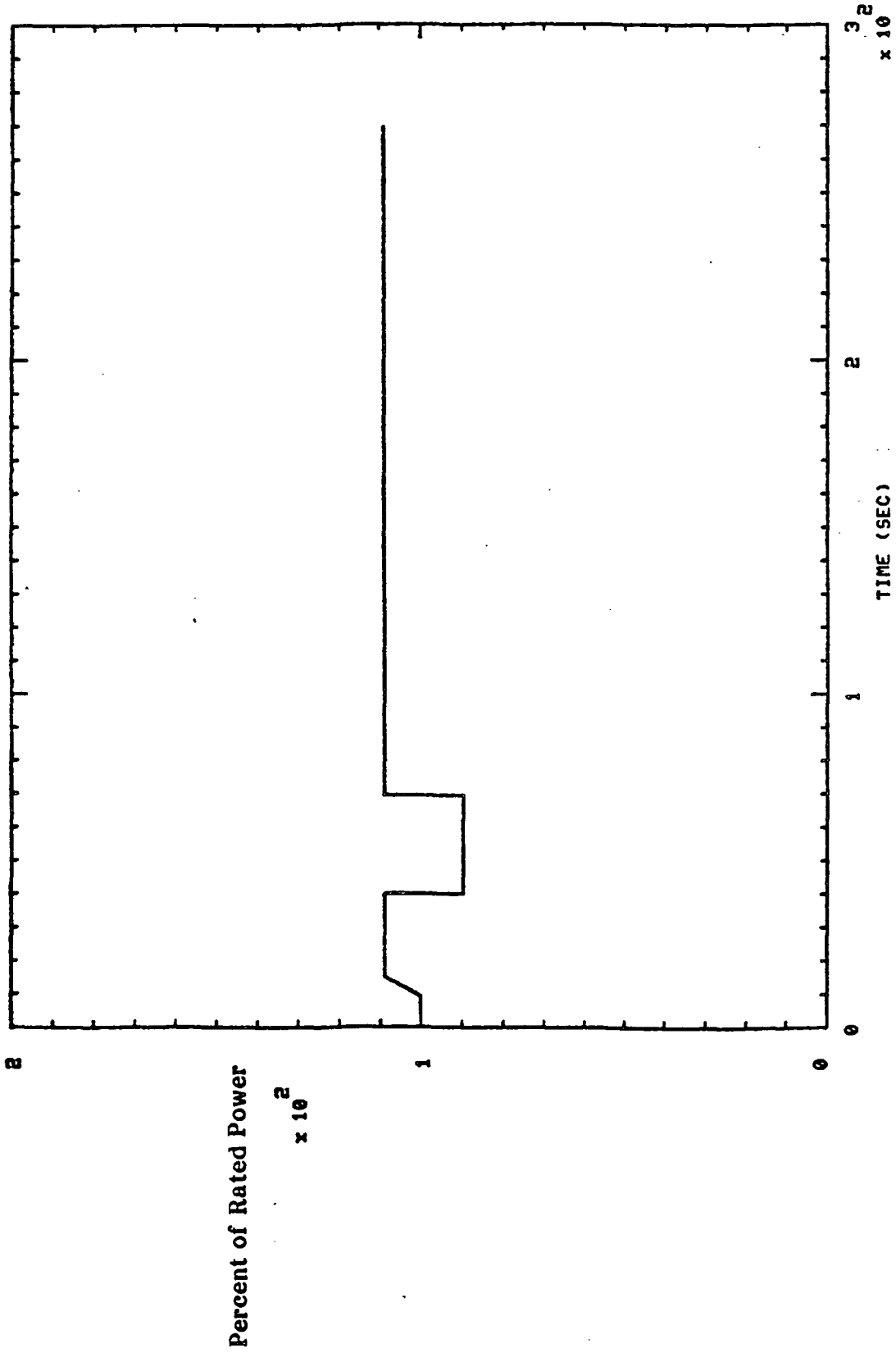
750165 THRUST (UNFILTERED)



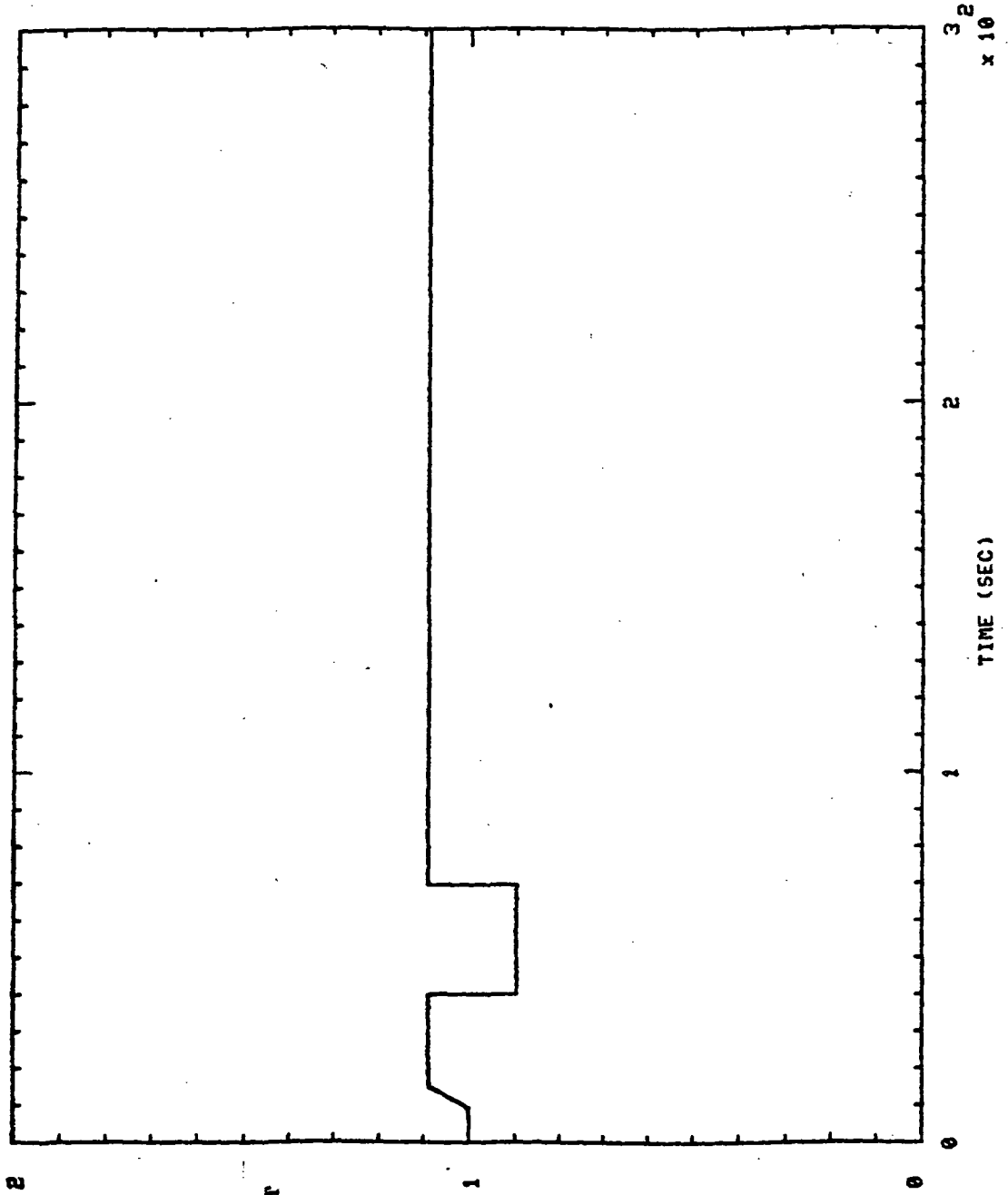
750166 THRUST (UNFILTERED)



750167 THRUST (UNFILTERED)



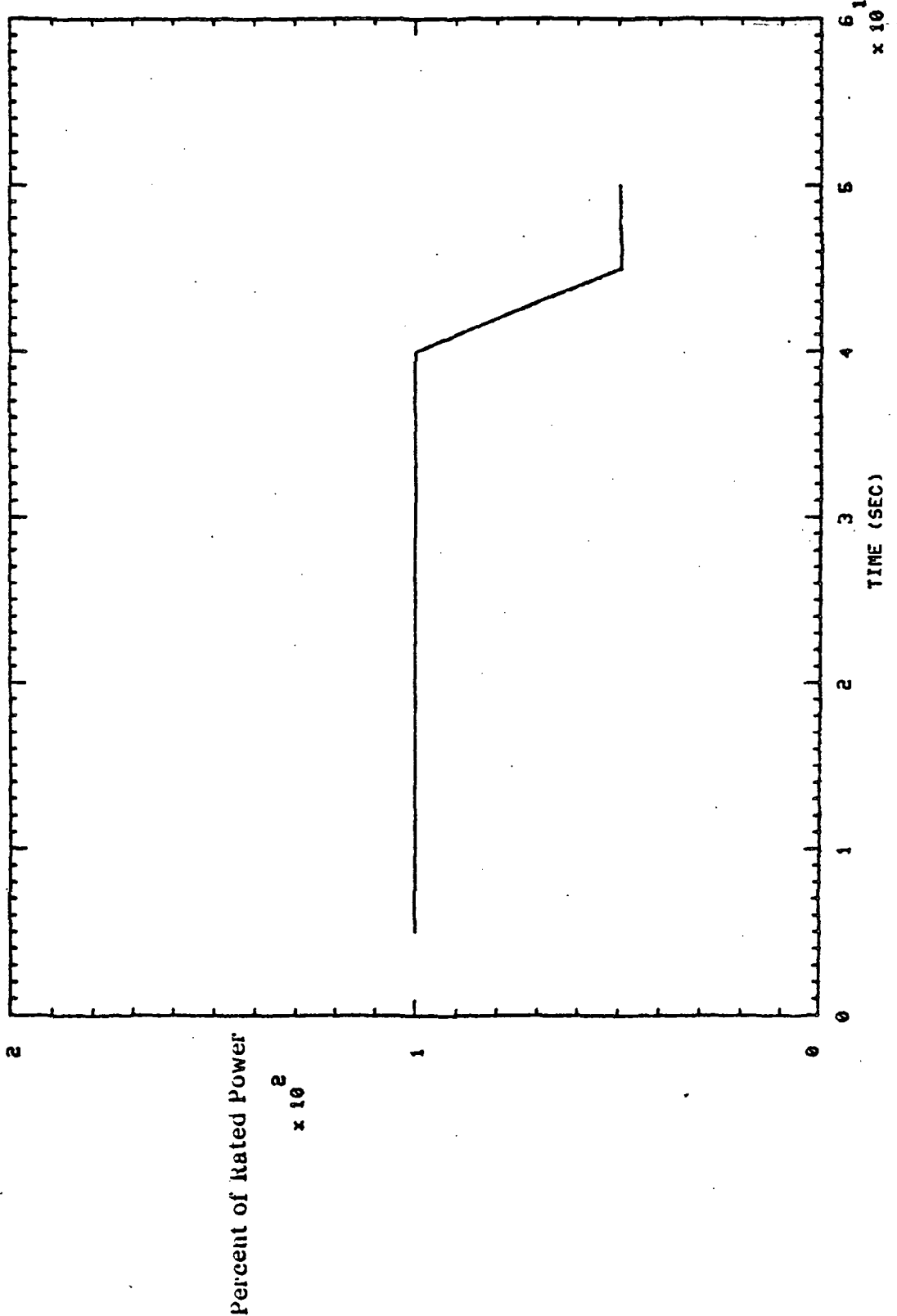
750168 THRUST (UNFILTERED)



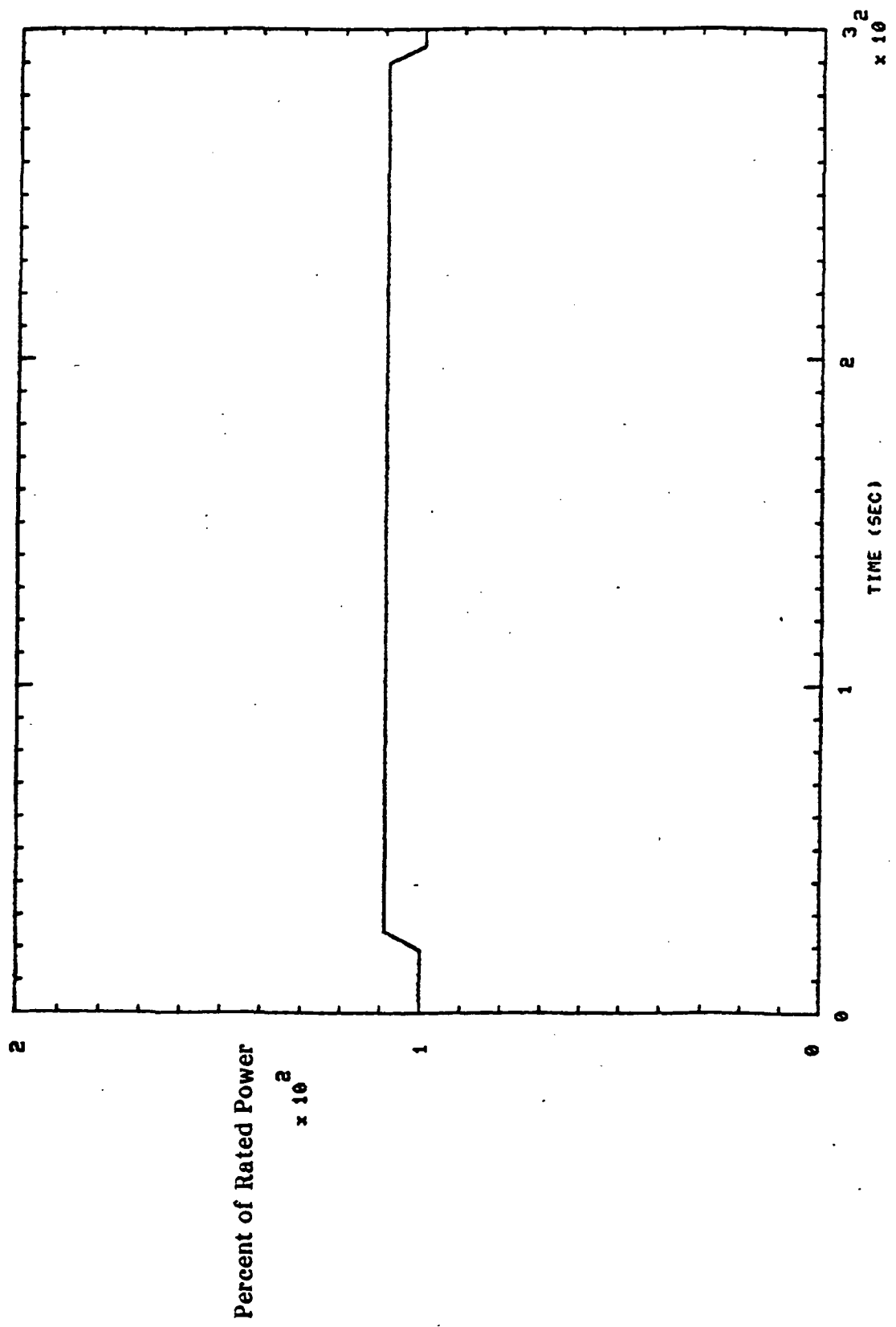
Percent of Rated Power
 $\times 10^2$

TIME (SEC)
 $\times 10^2$

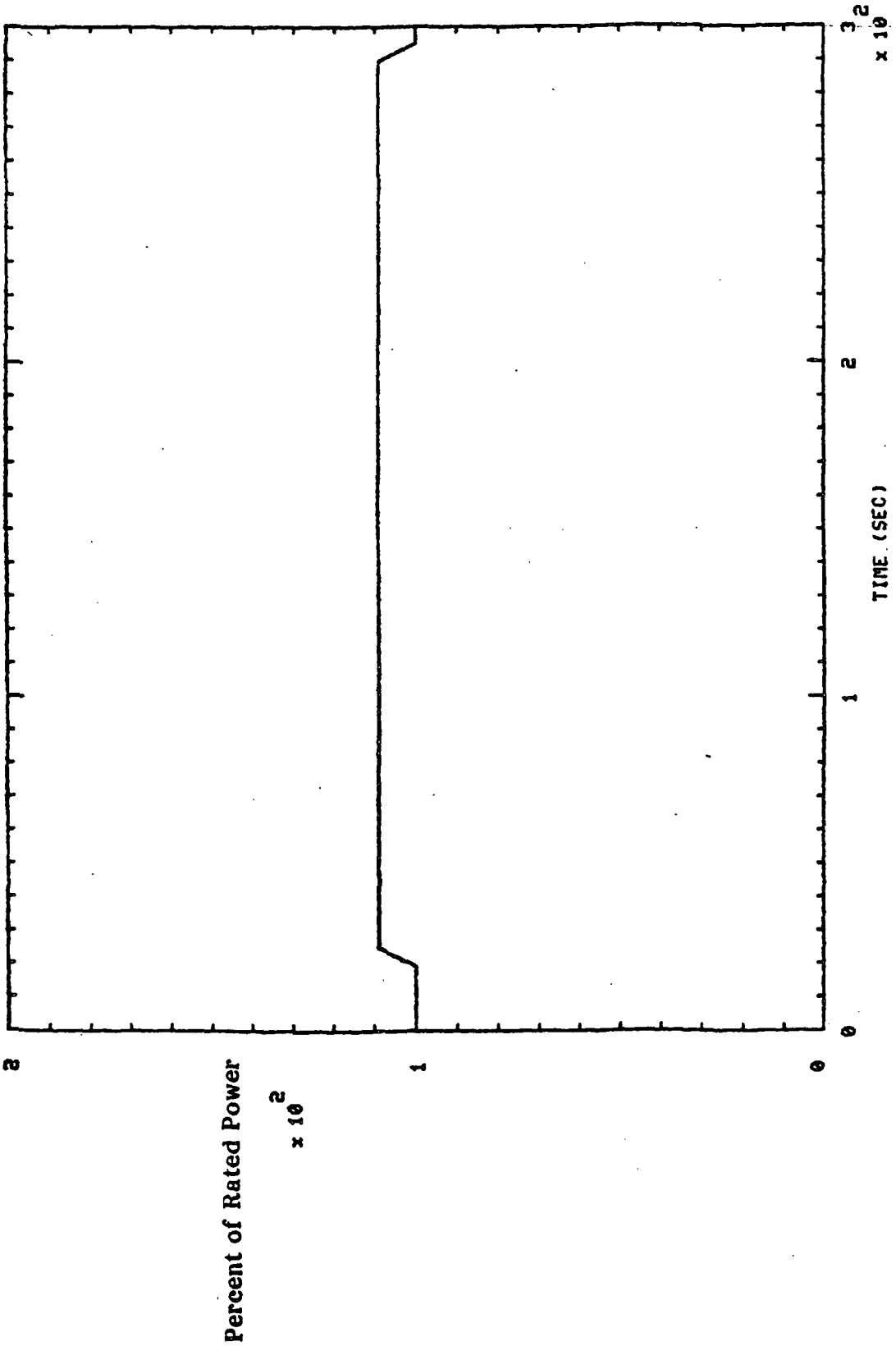
750170 THRUST (UNFILTERED)



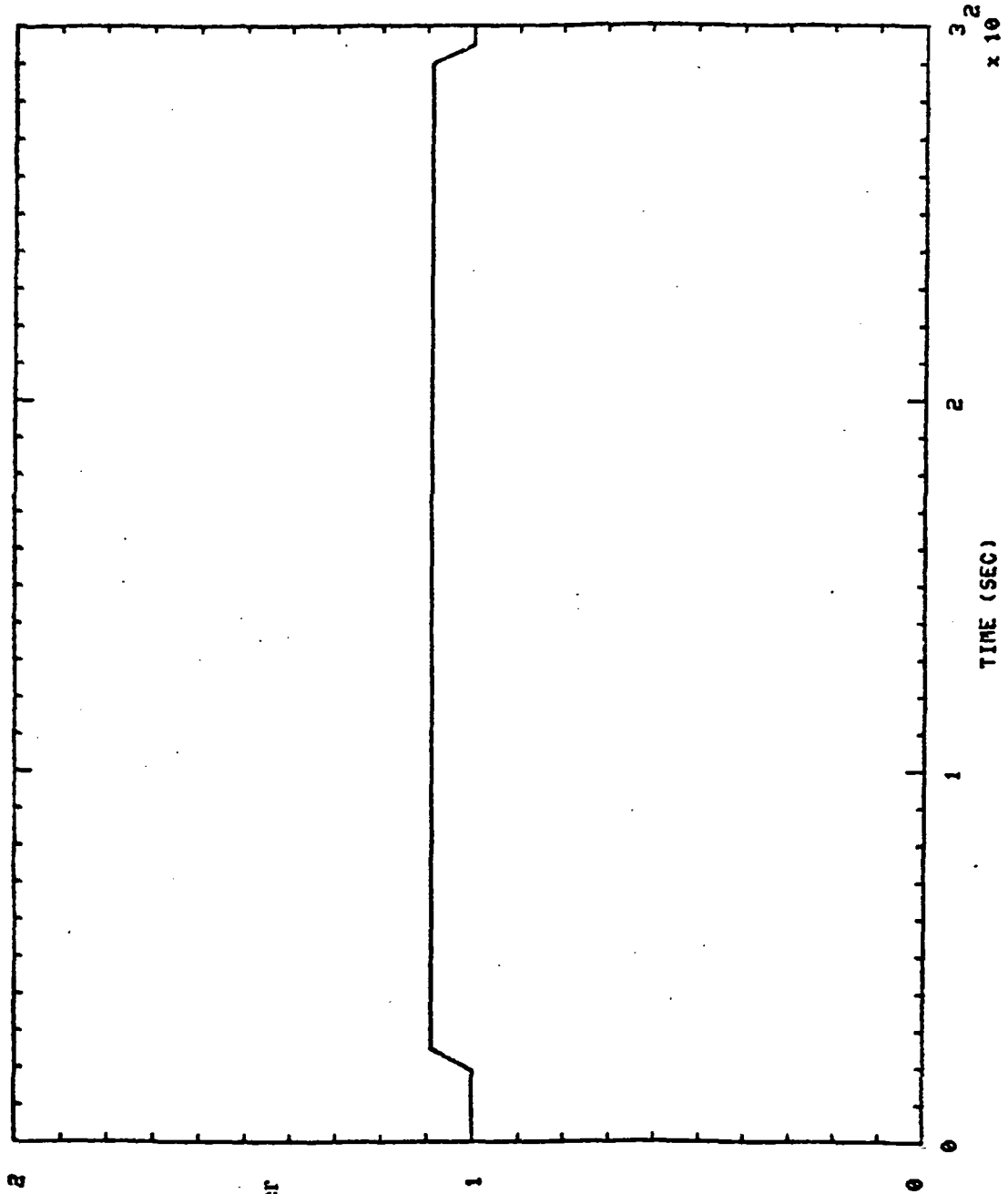
750171 THRUST (UNFILTERED)



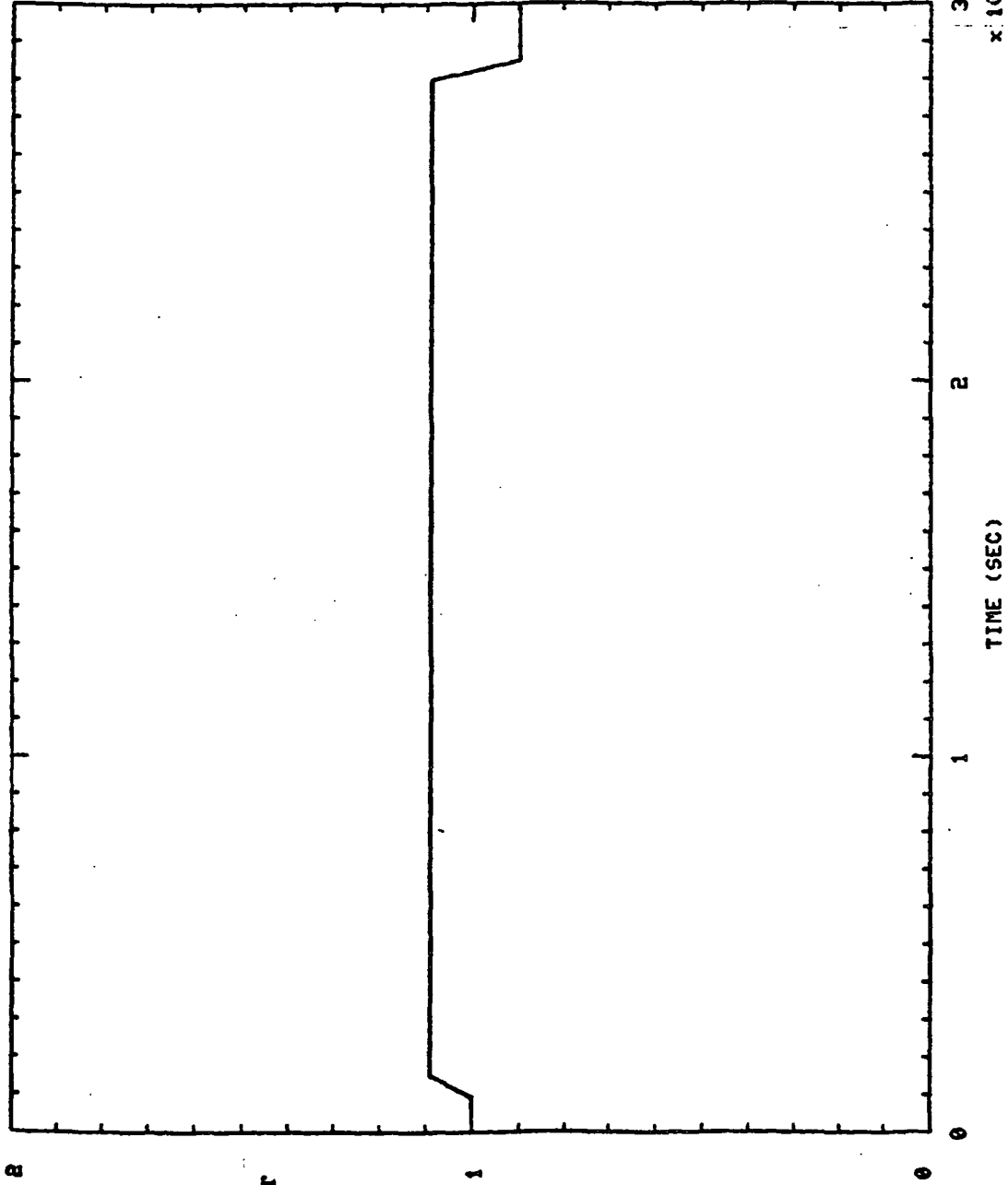
750172 THRUST (UNFILTERED)



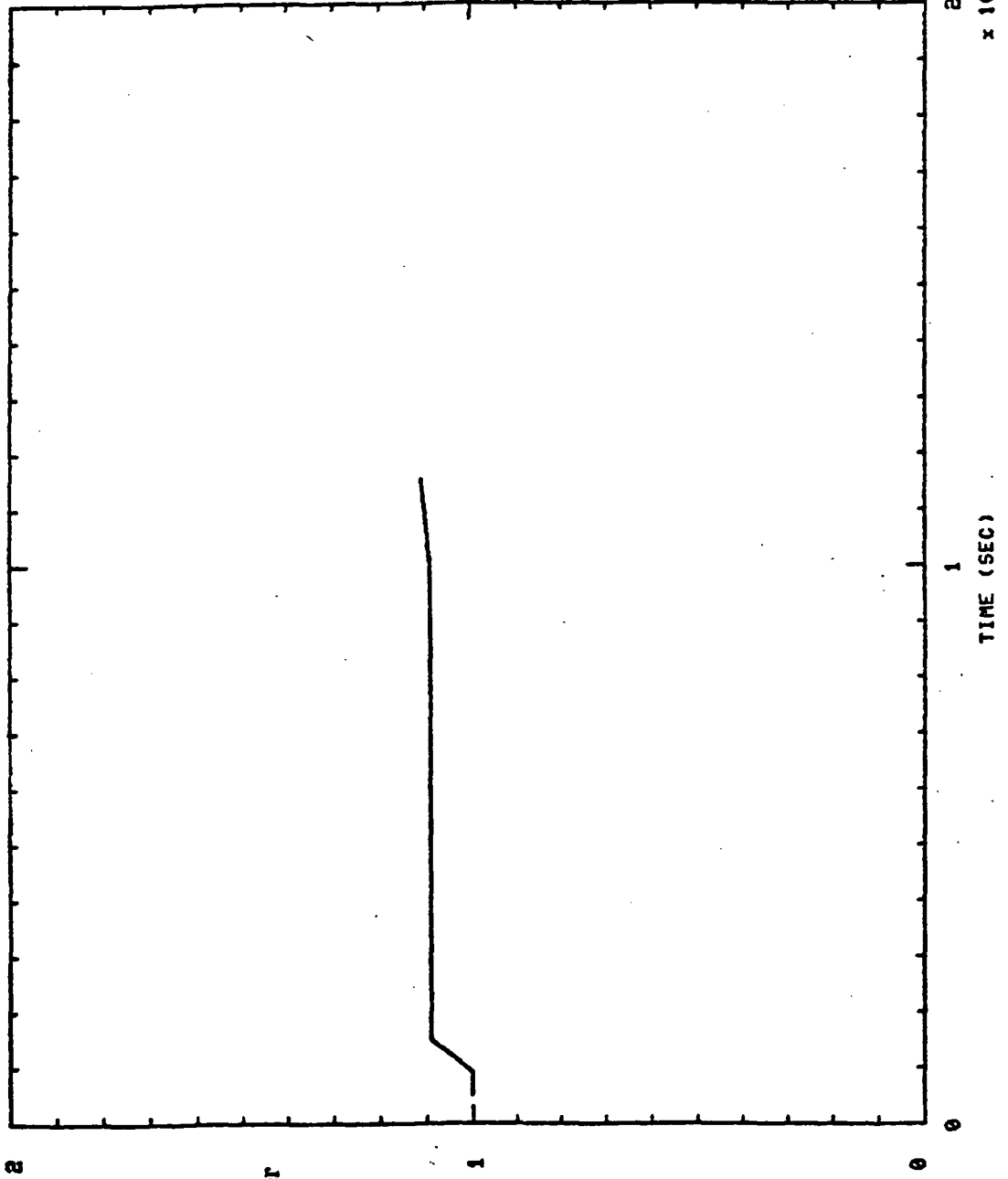
750173 THRUST (UNFILTERED)



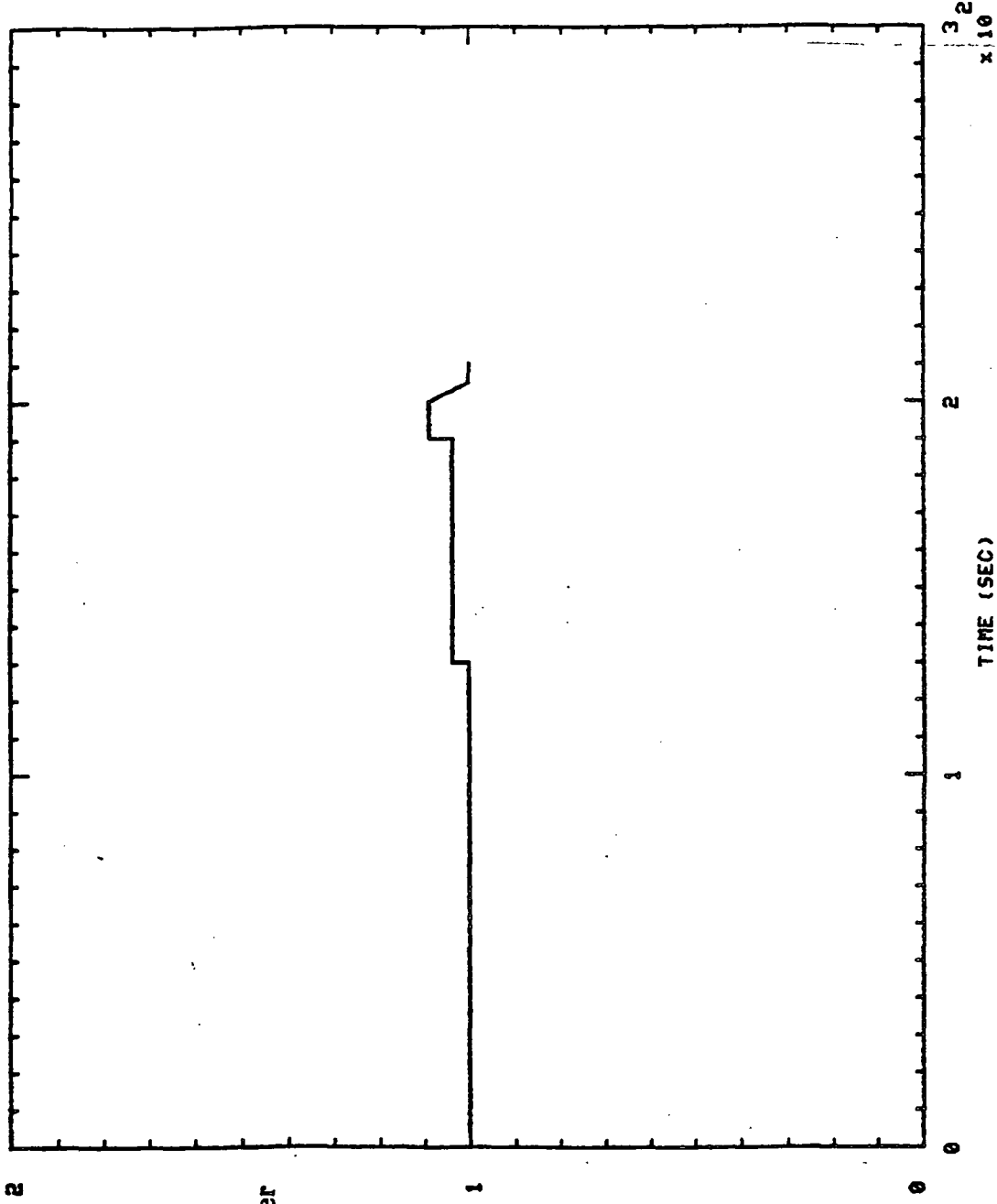
750174 THRUST (UNFILTERED)



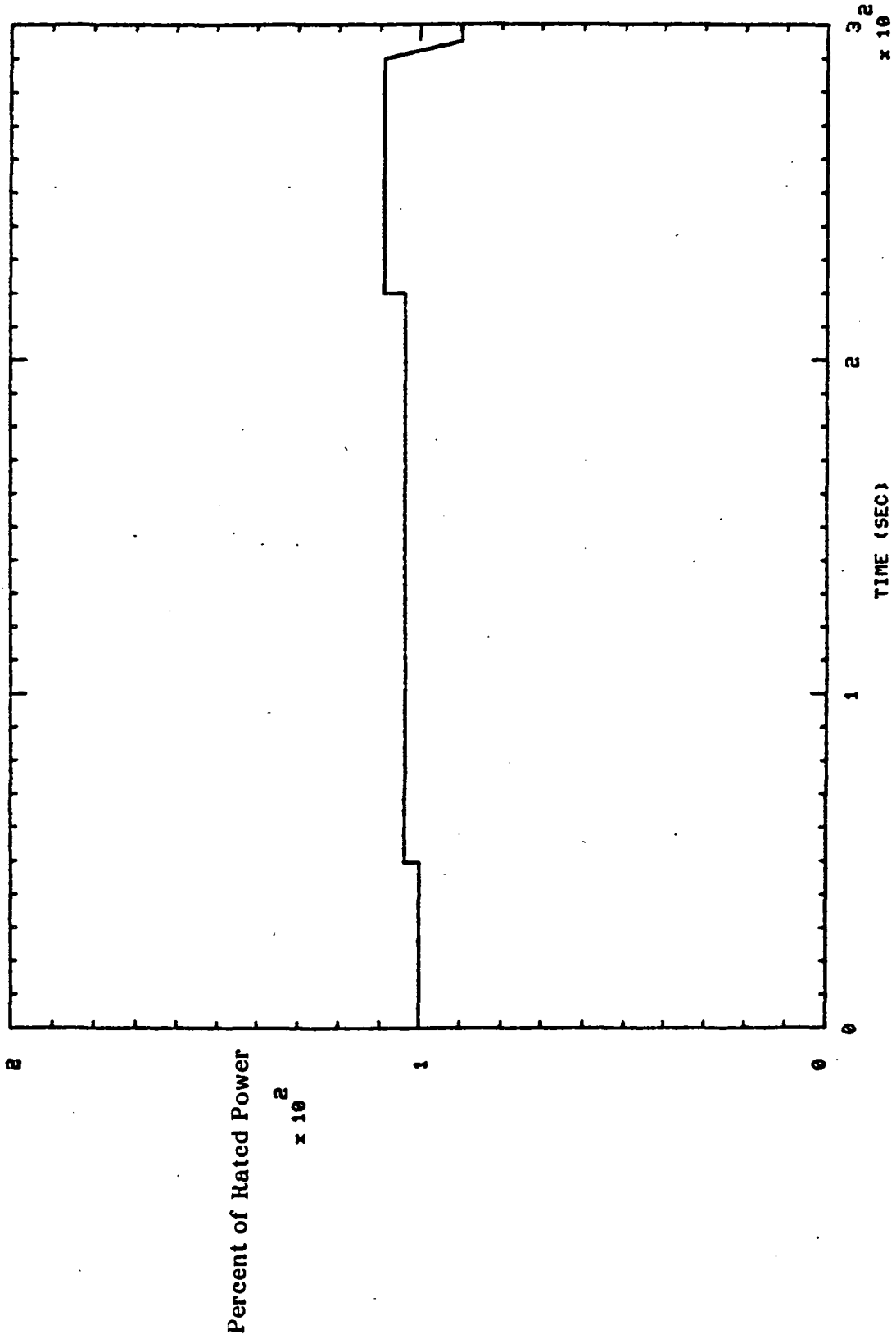
750175 THRUST (UNFILTERED)



750177 THRUST (UNFILTERED)

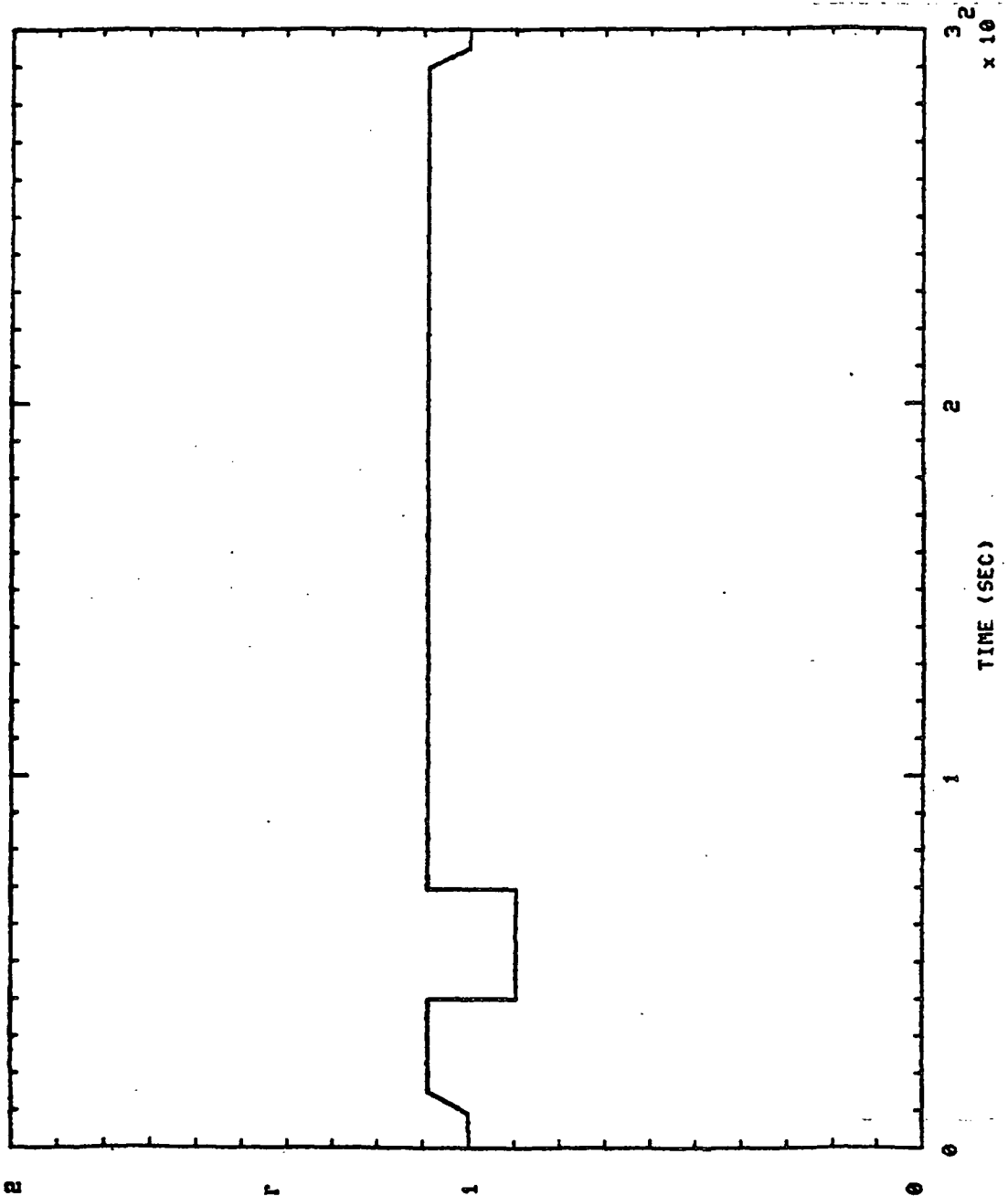


750178 THRUST (UNFILTERED)



760179 (UNFILTERED)

THRUST

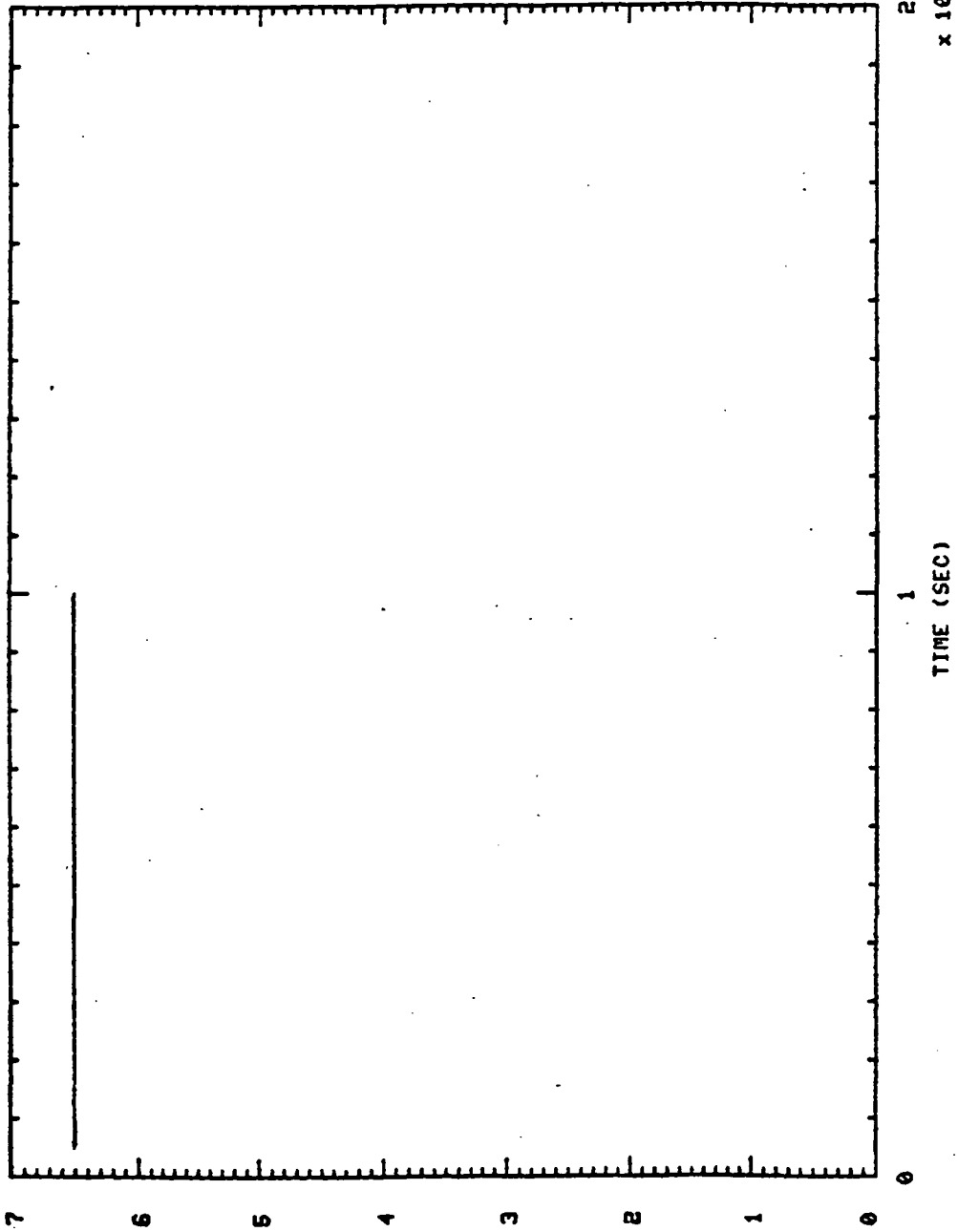


Percent of Rated Power
 $\times 10^2$

TIME (SEC)
 $\times 10^2$

750180 THRUST (UNFILTERED)

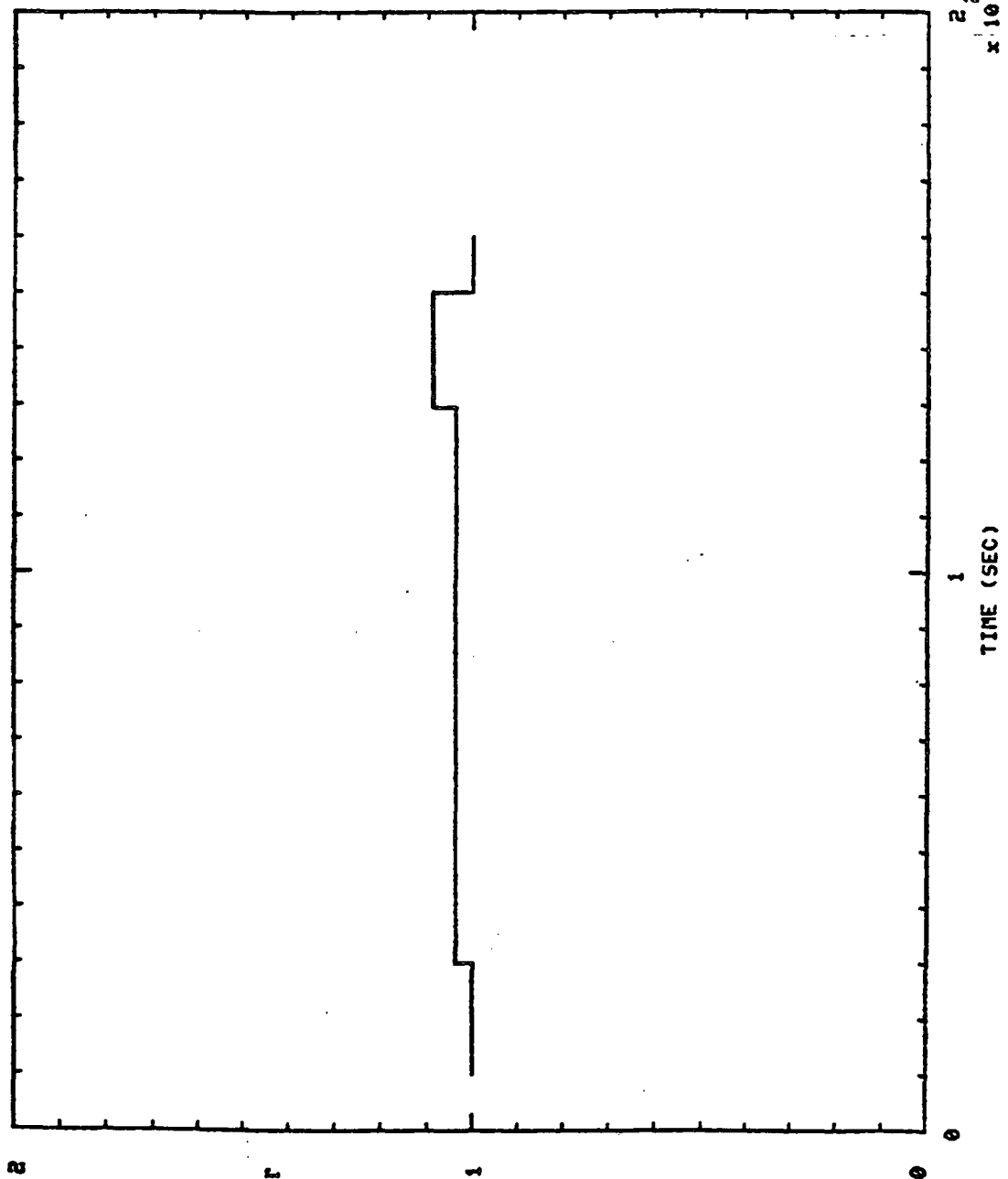
750180 THRUST



Percent of Rated Power
 $\times 10^1$

TIME (SEC)
 $\times 10^2$

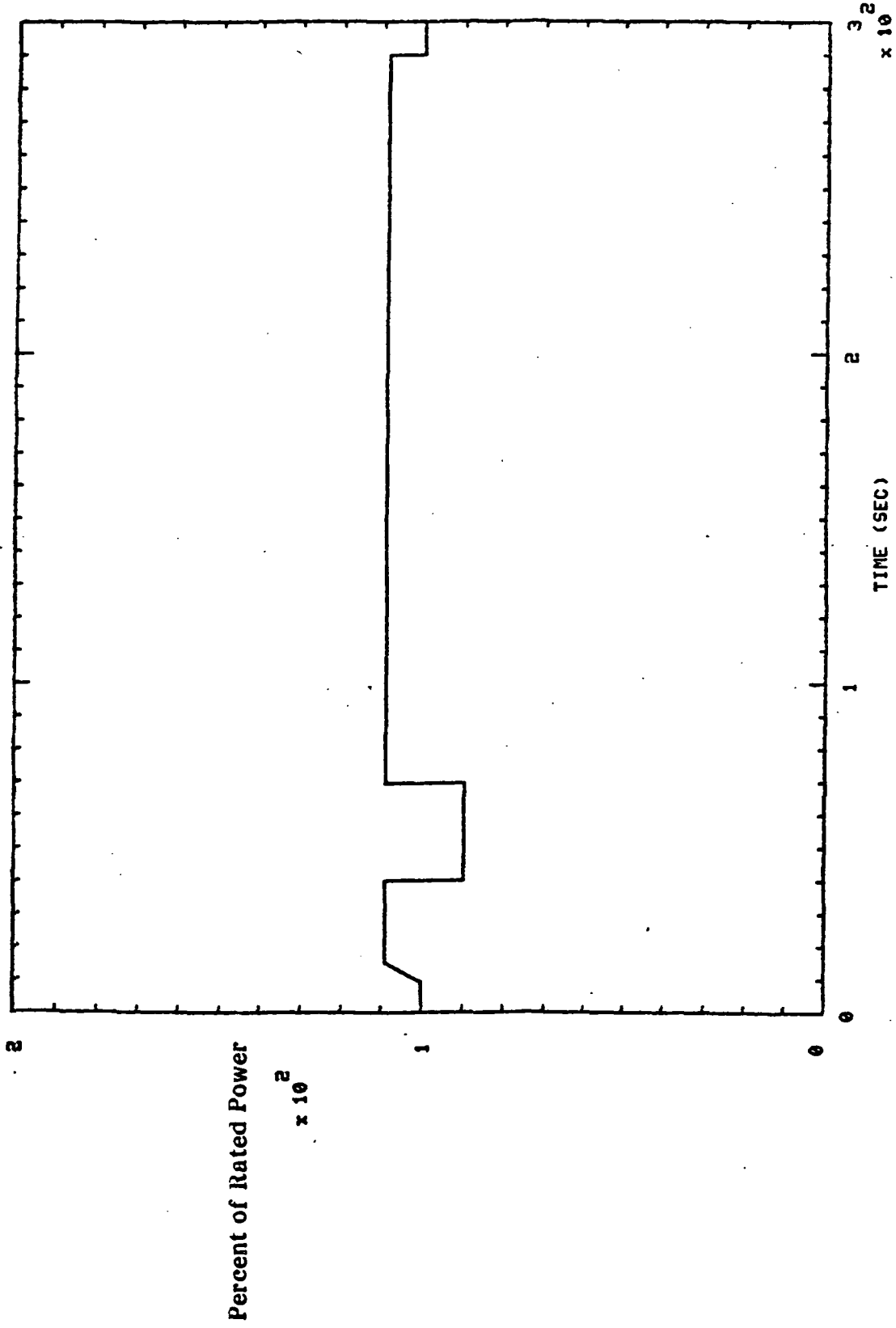
750181 THRUST (UNFILTERED)



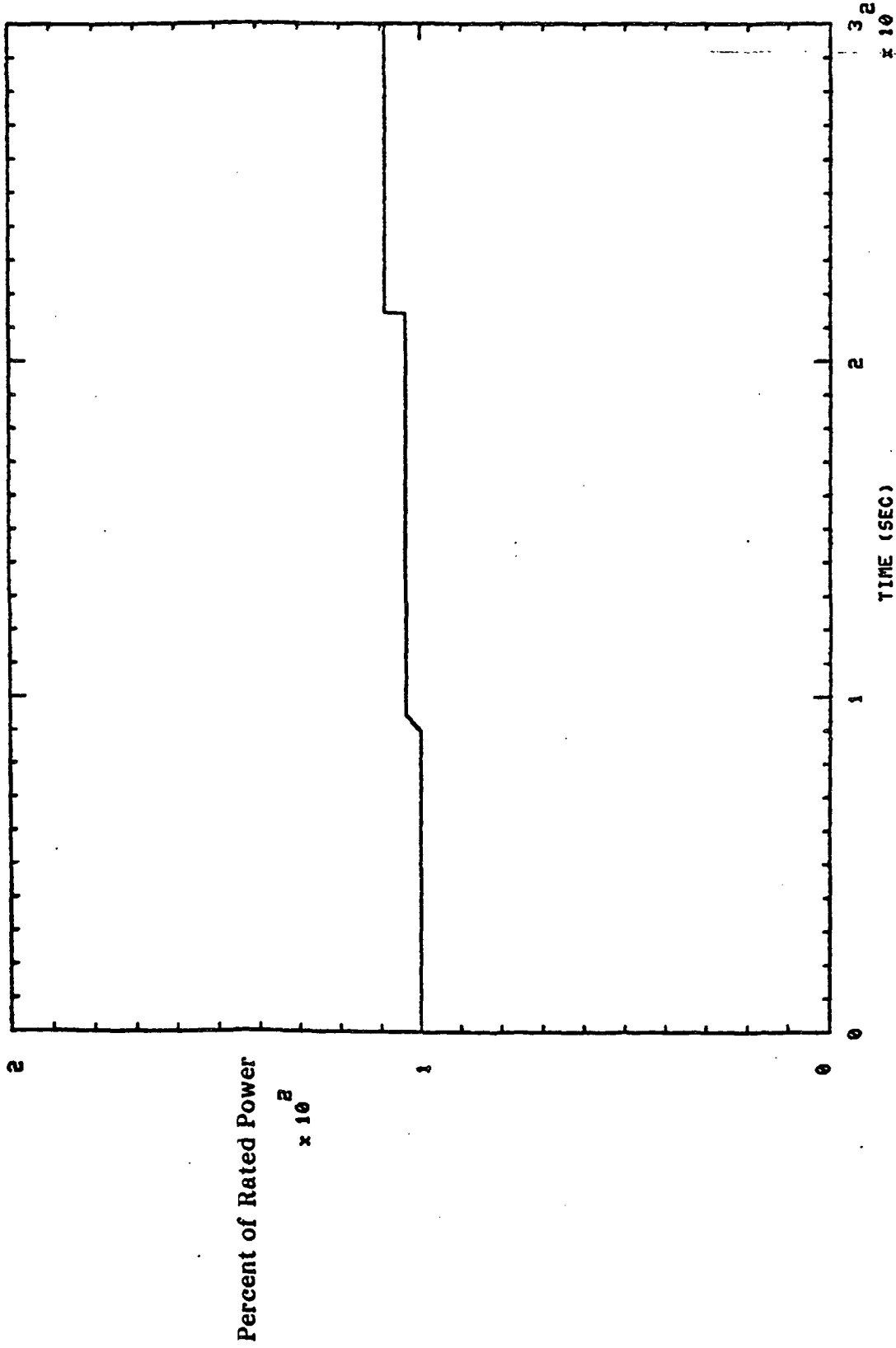
Percent of Rated Power
 $\times 10^2$

TIME (SEC)
 $\times 10^2$

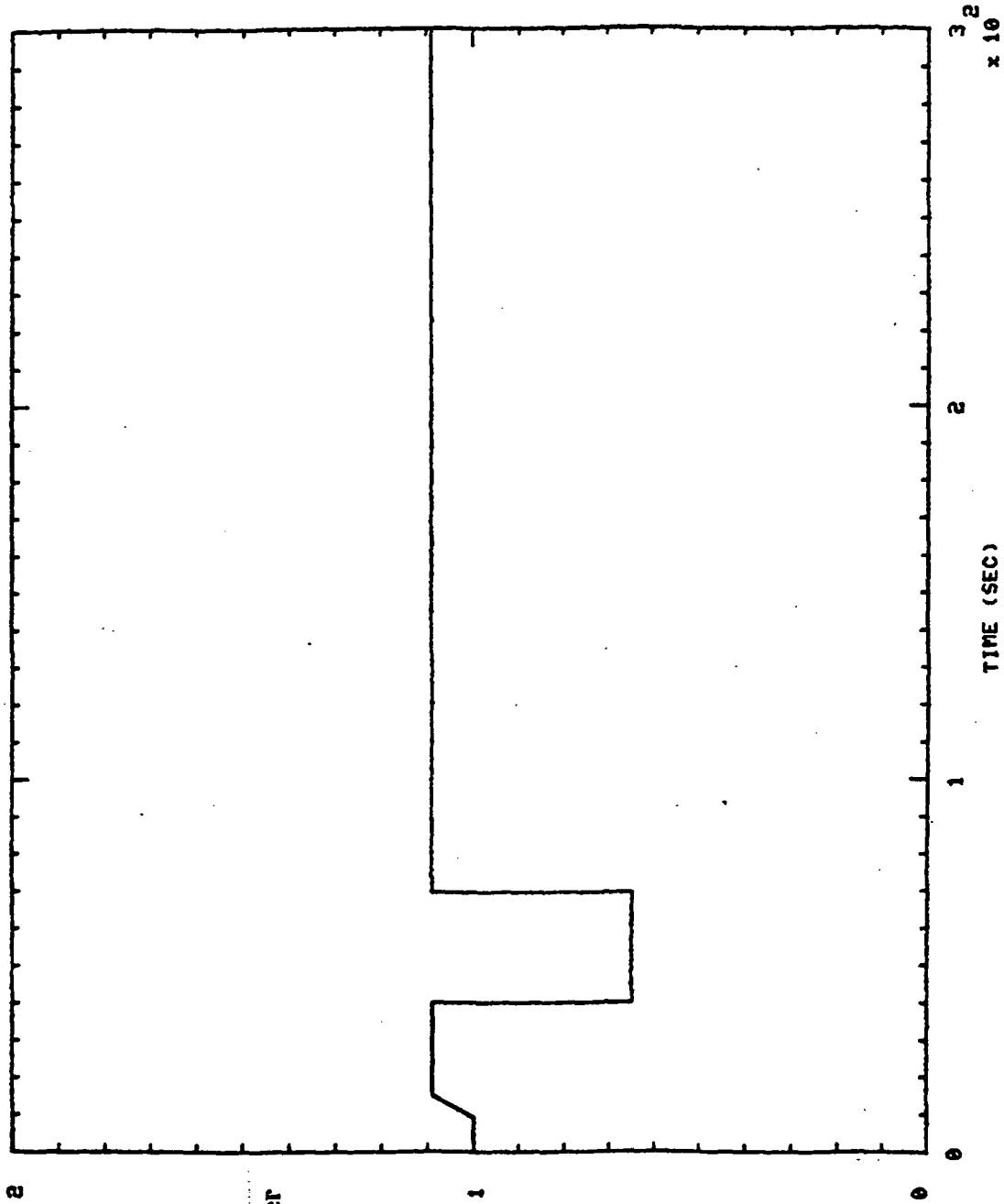
750182 THRUST (UNFILTERED)



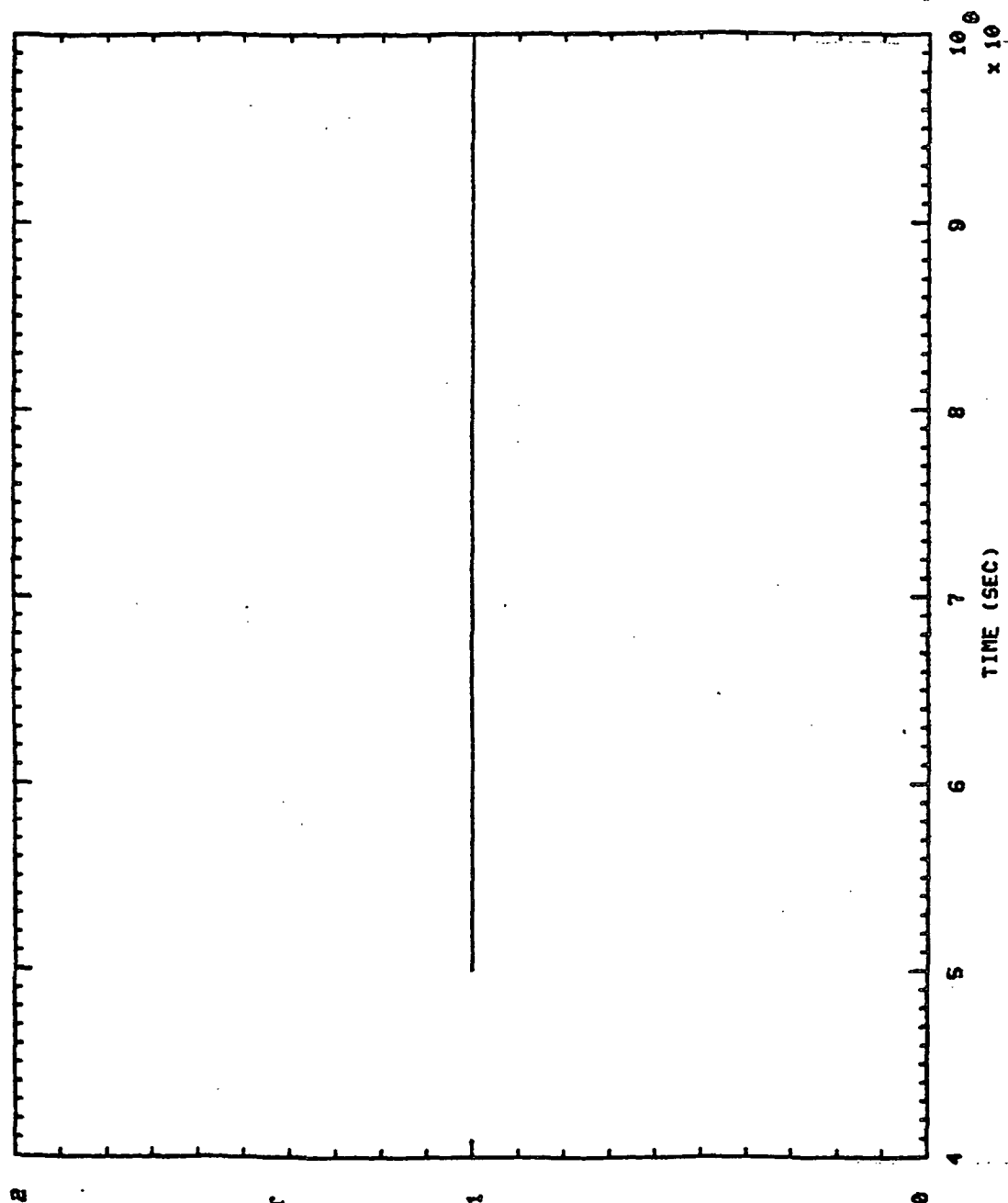
750183 THRUST (UNFILTERED)



750184 THRUST (UNFILTERED)



750185 THRUST (UNFILTERED)

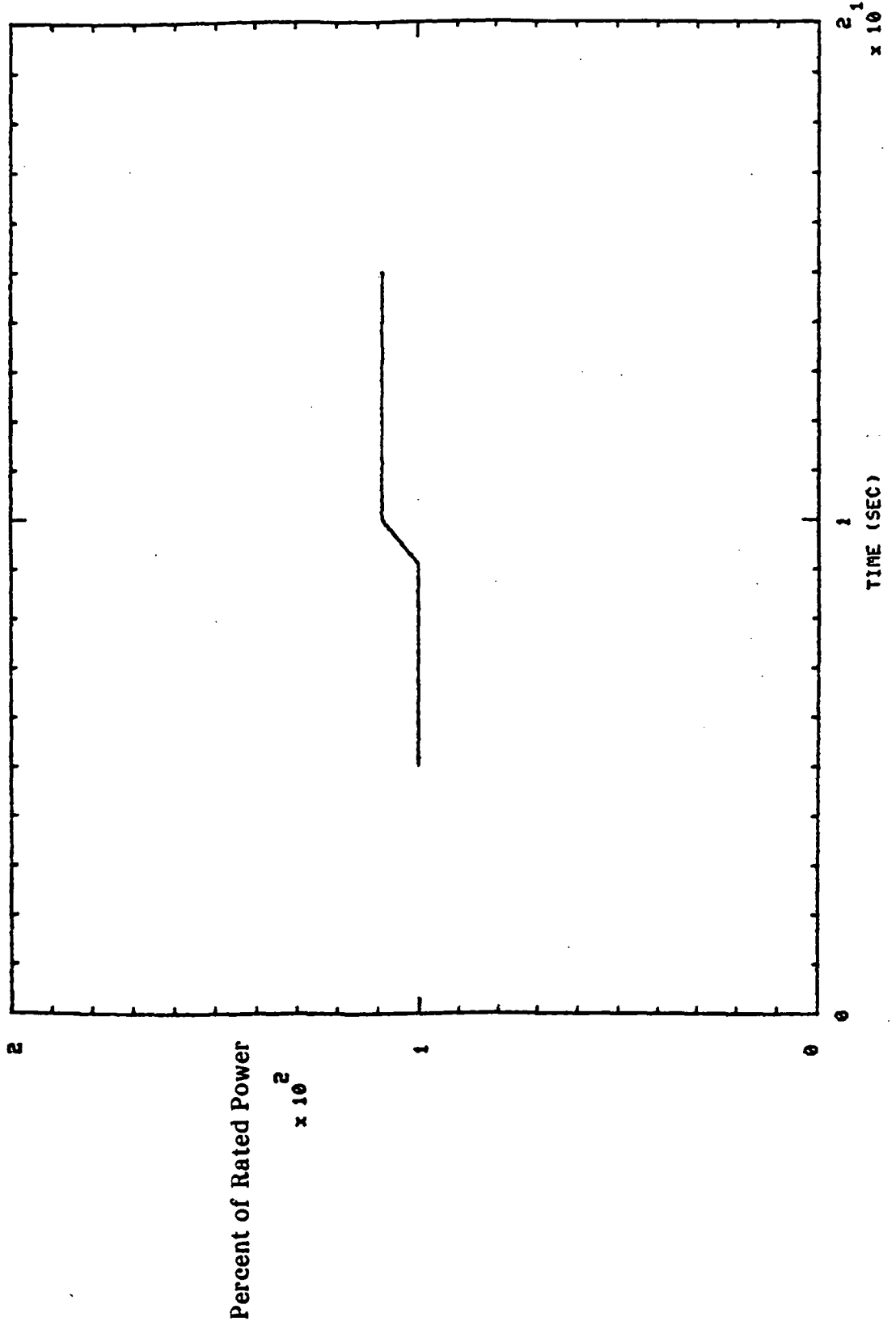


Percent of Rated Power
 $\times 10^2$

TIME (SEC)
 $\times 10^6$

(UNFILTERED)

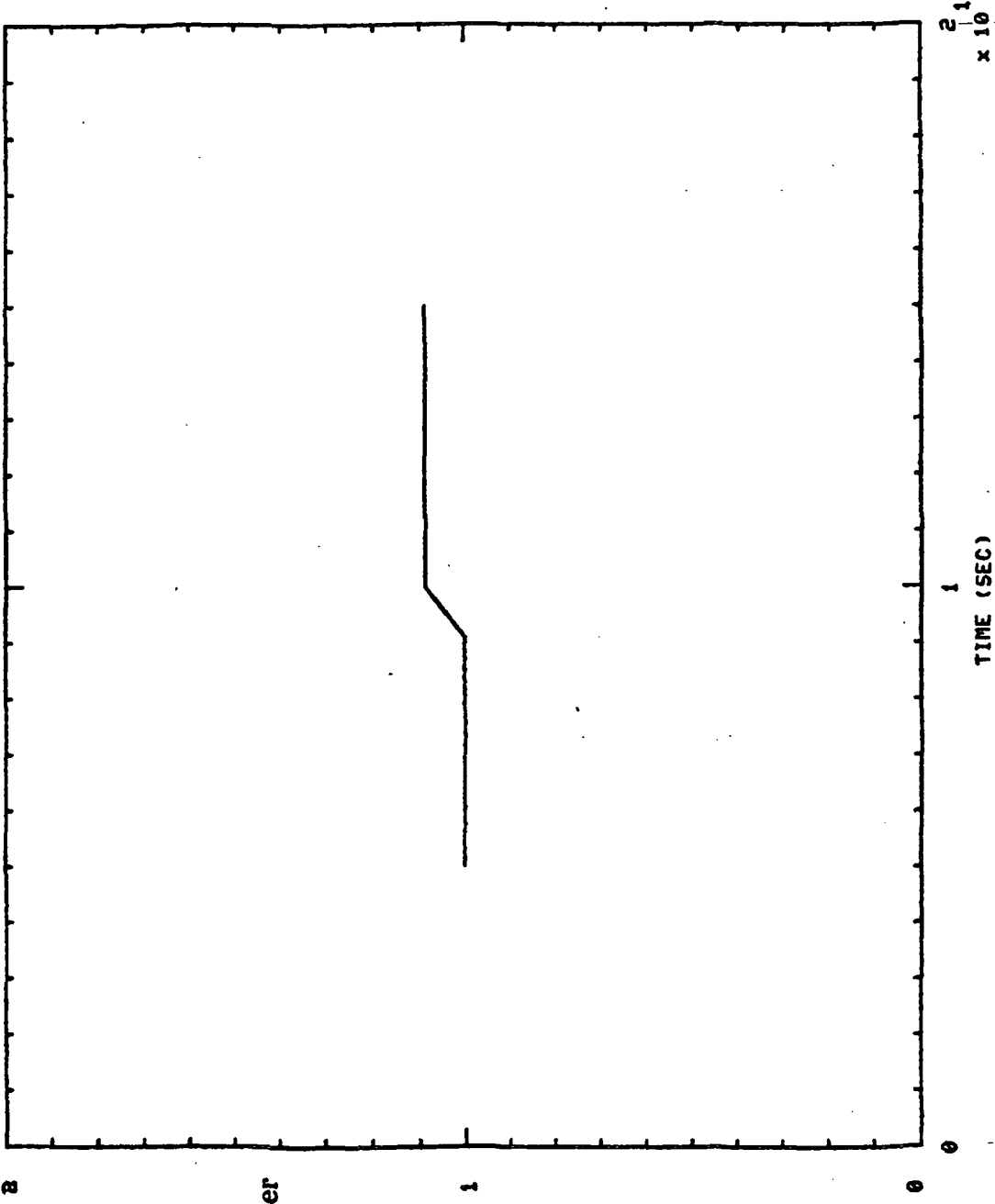
750186 THRUST



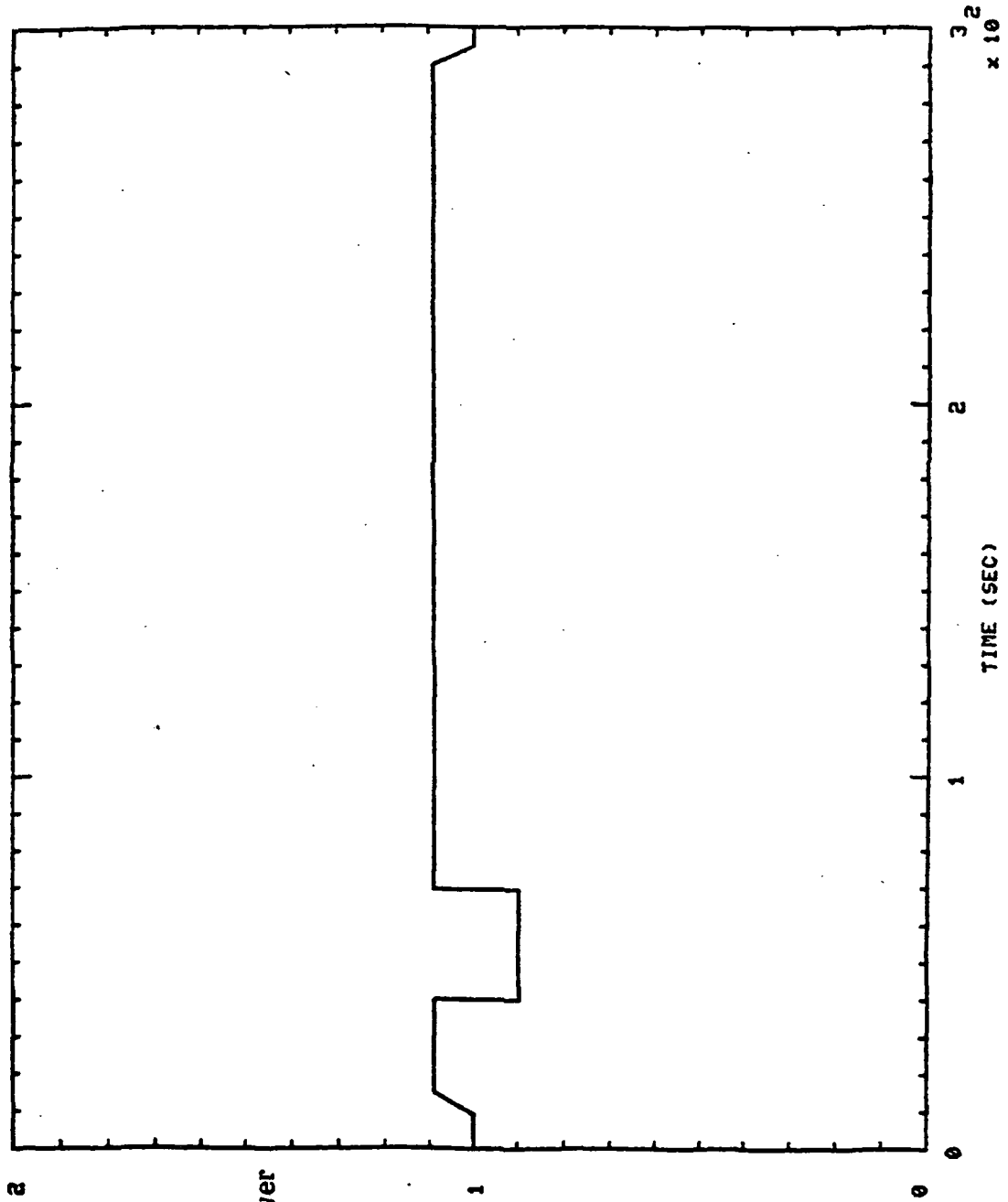
(UNFILTERED)

THRUST

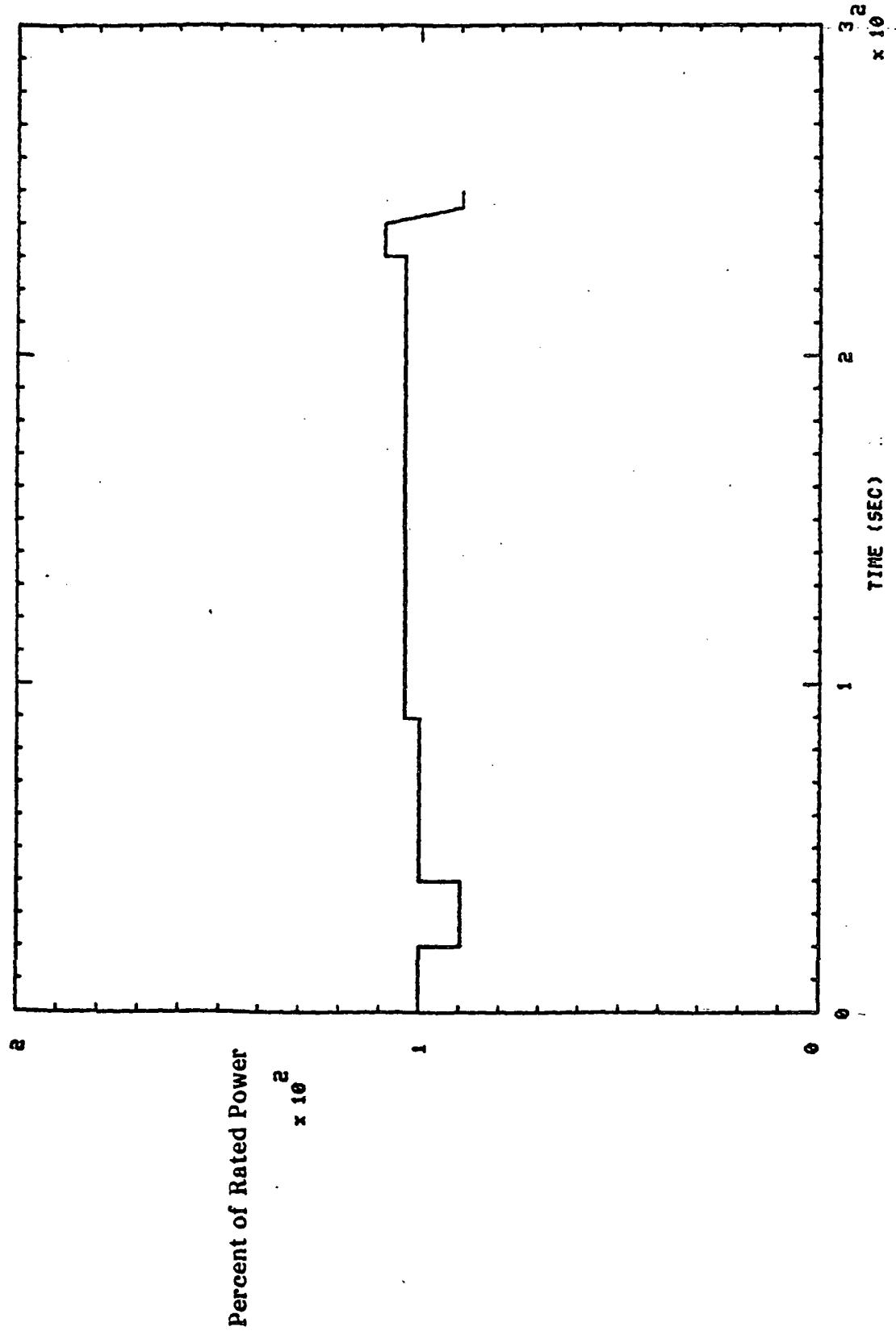
750187



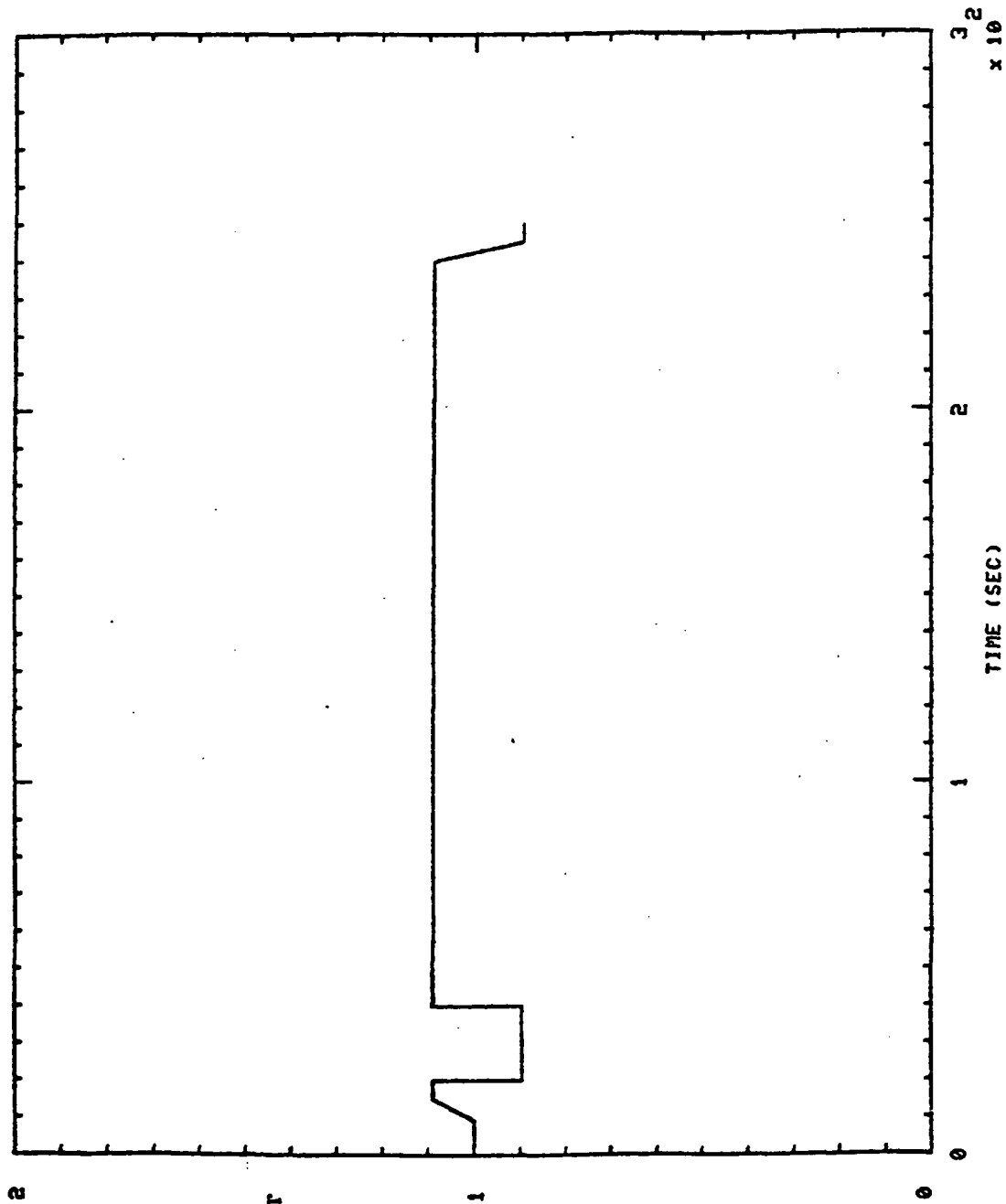
750188 THRUST (UNFILTERED)



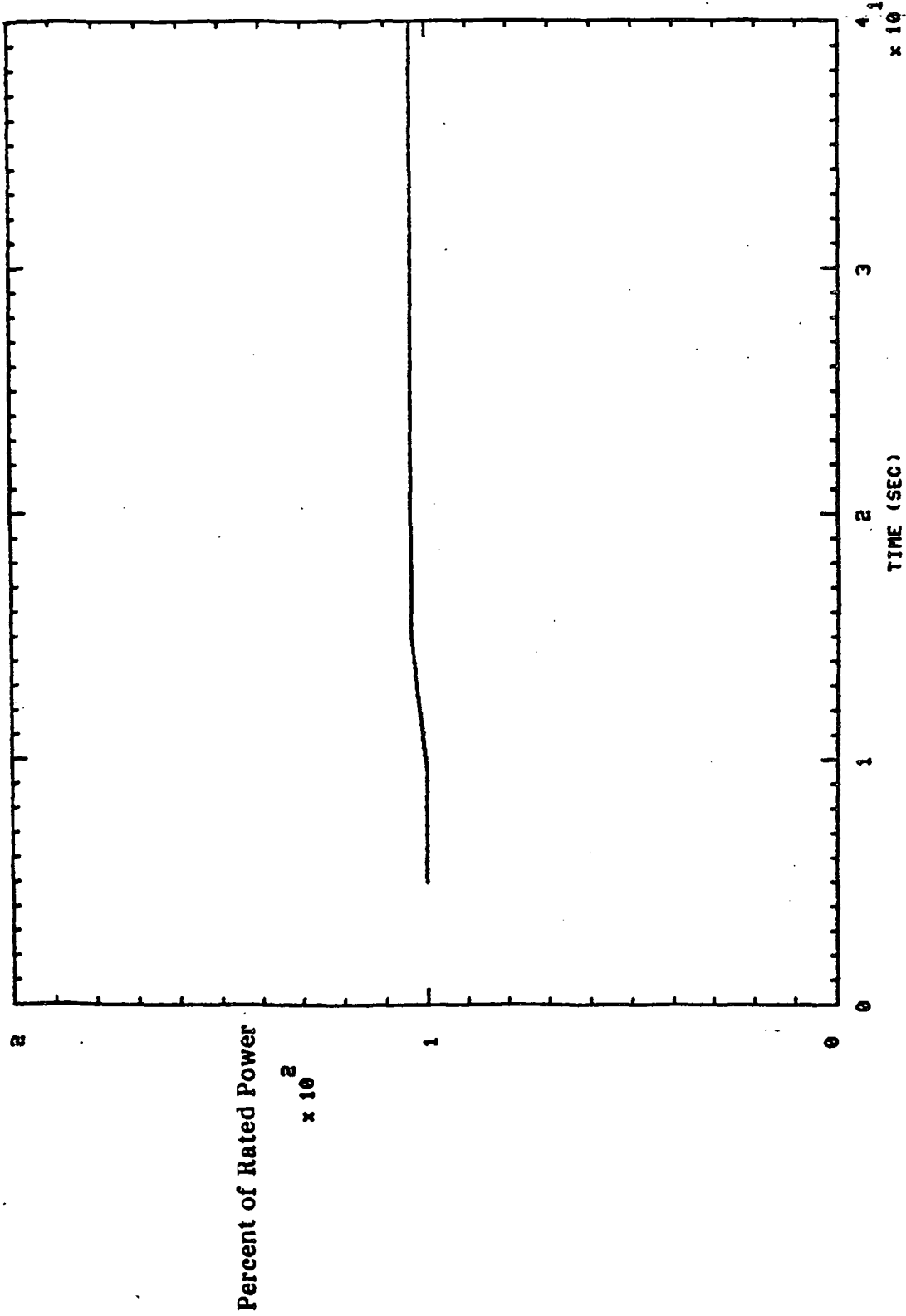
750190 THRUST (UNFILTERED)



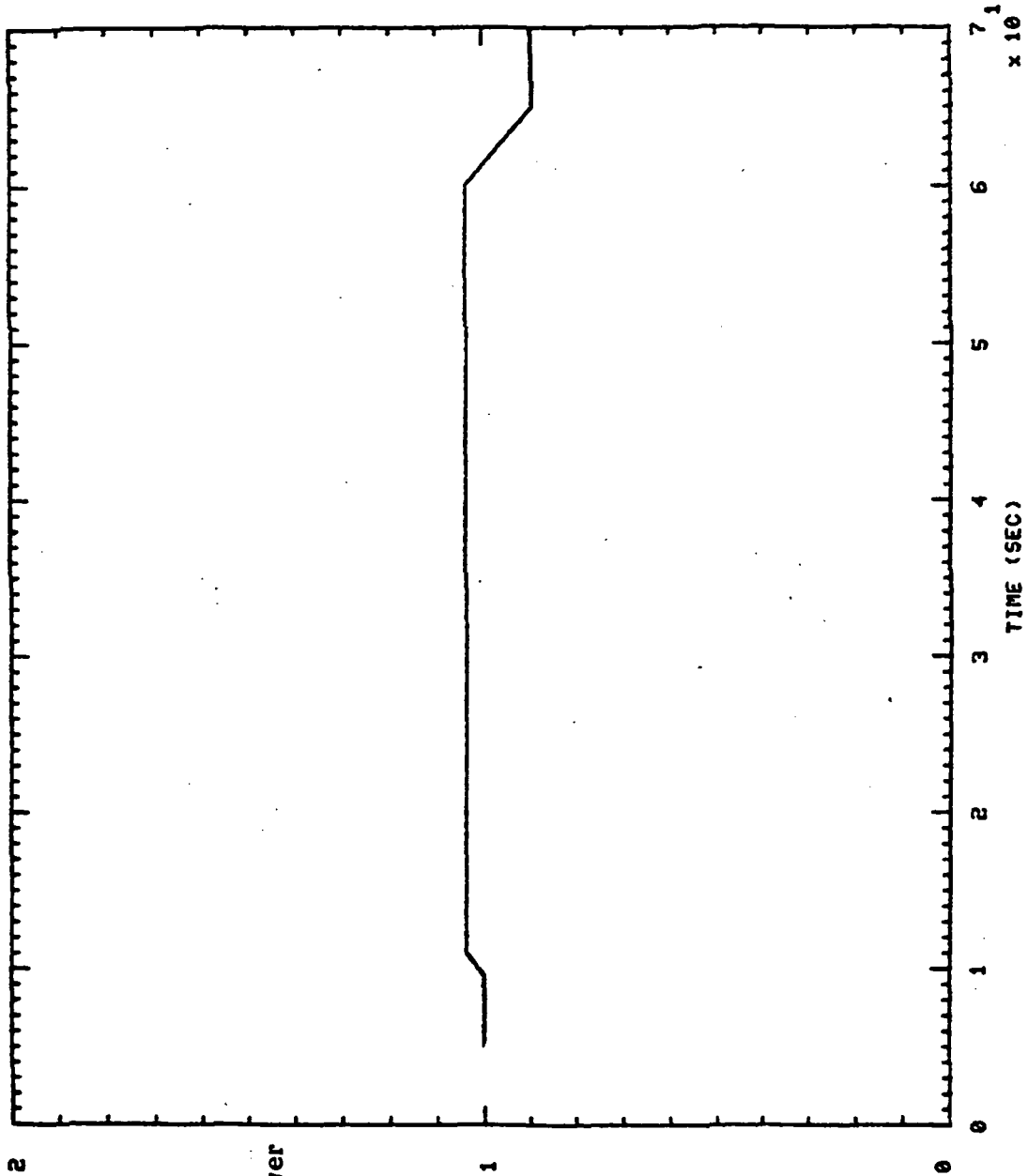
750191 THRUST (UNFILTERED)



750192 THRUST (UNFILTERED)

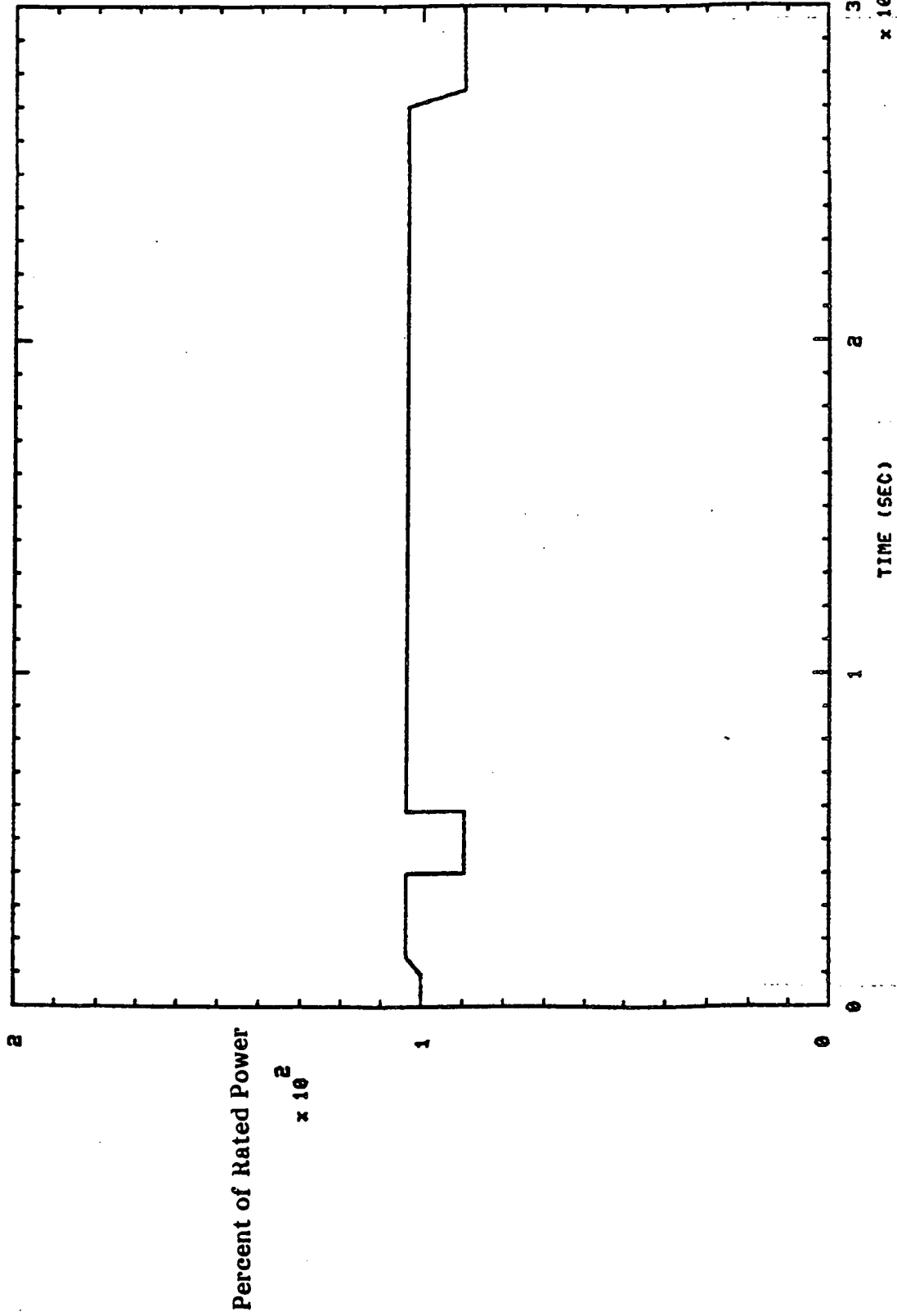


750193 THRUST (UNFILTERED)

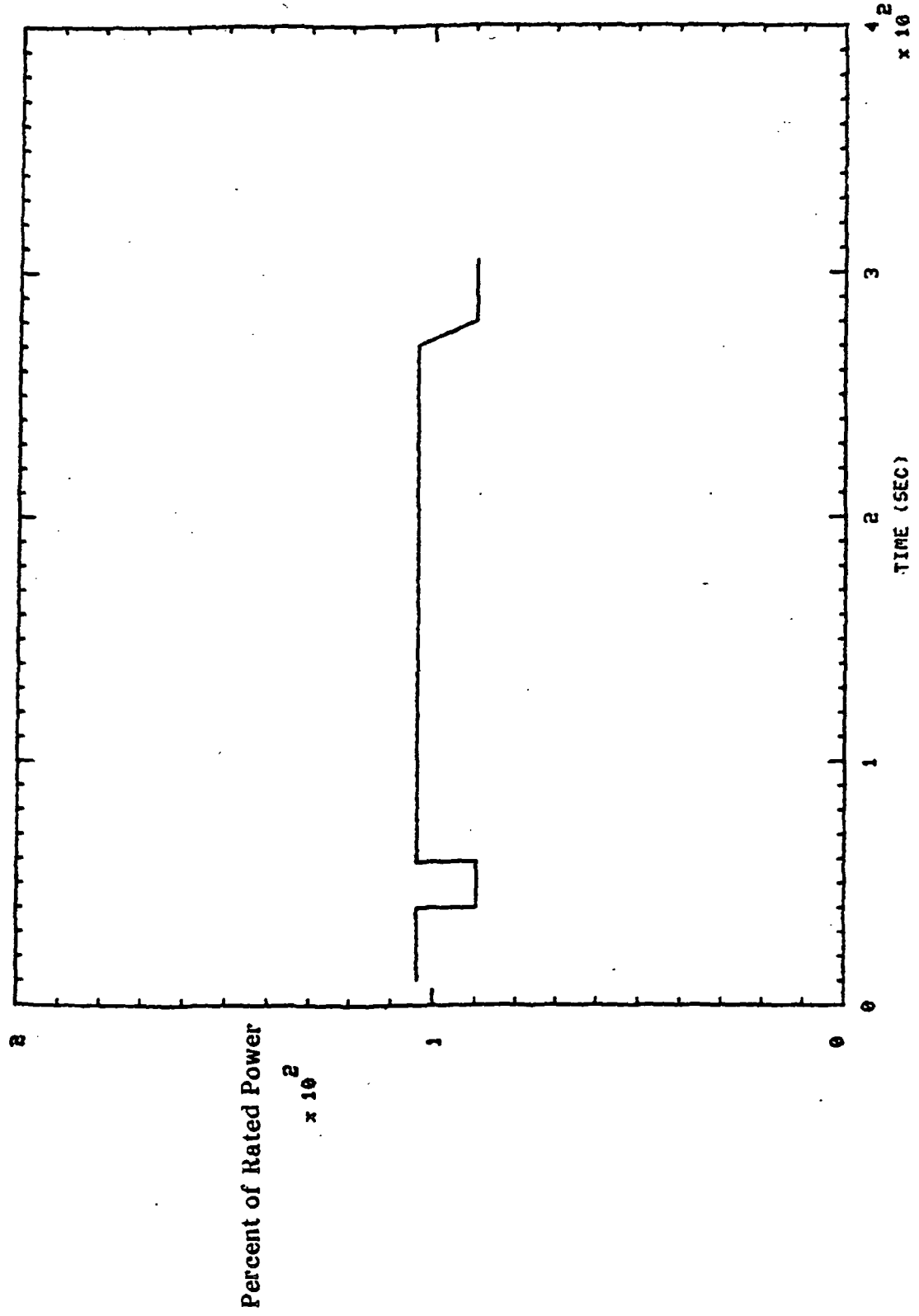


750194 THRUST

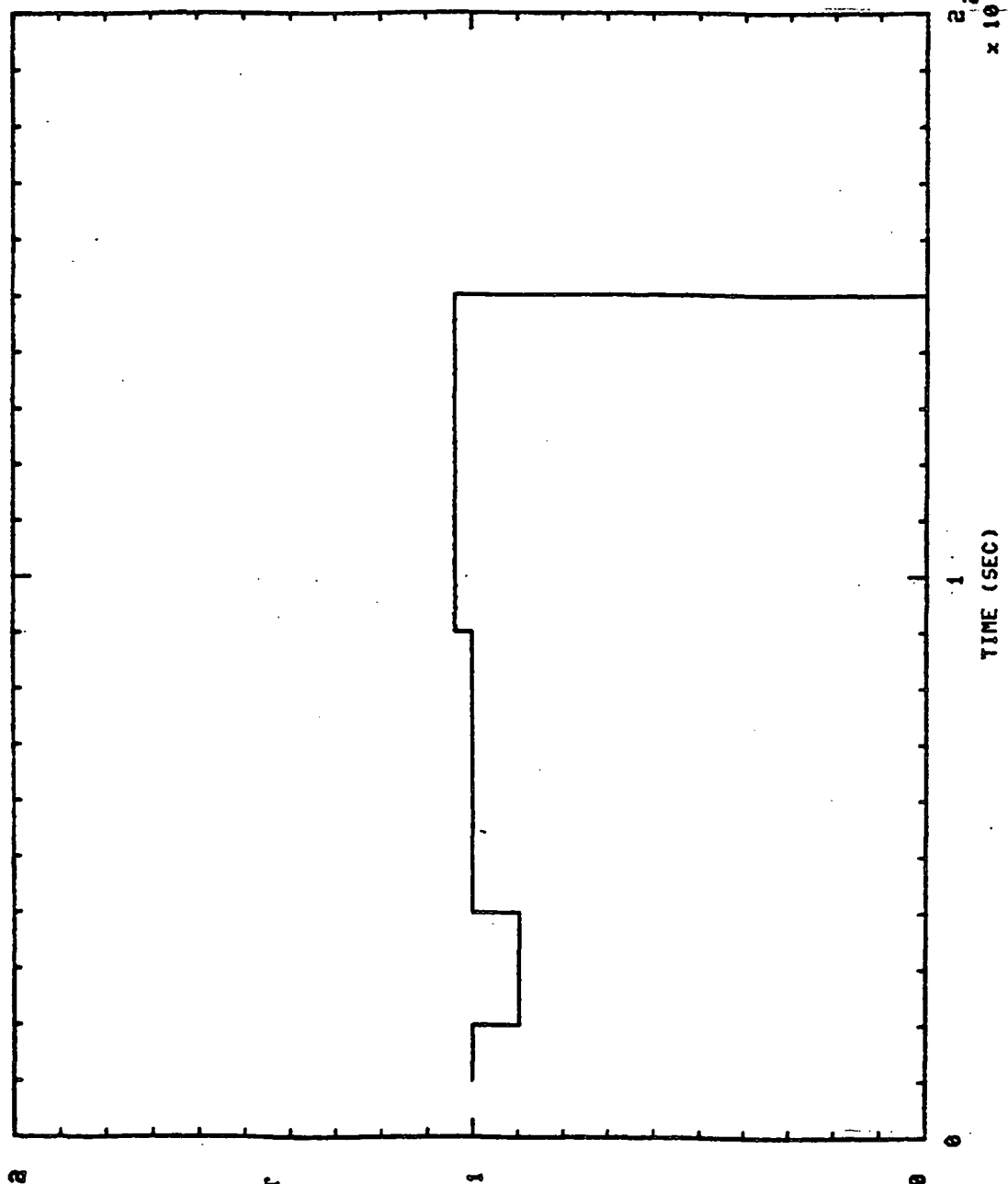
(UNFILTERED)



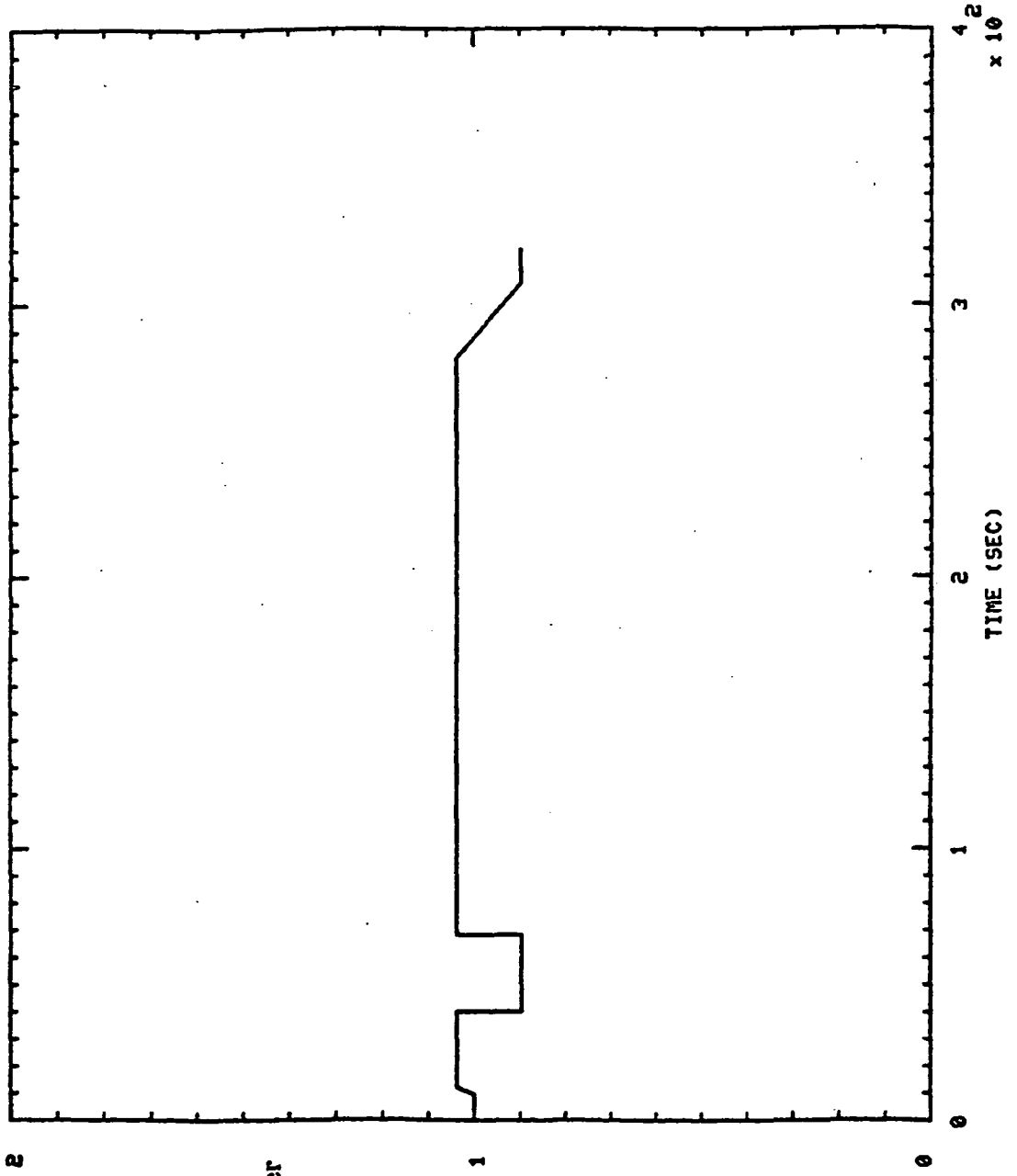
750195 THRUST (UNFILTERED)



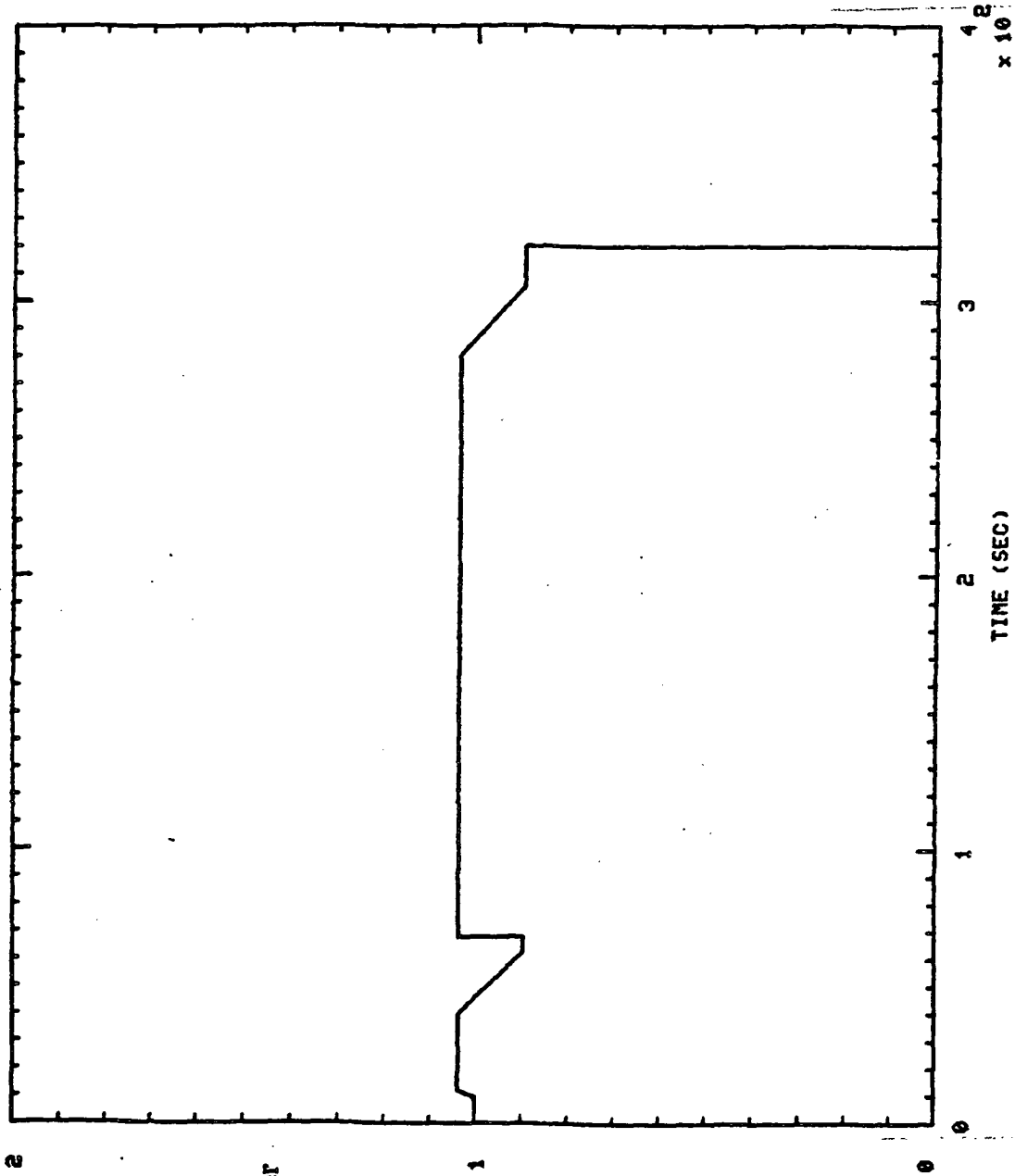
750196 THRUST (UNFILTERED)



750197 THRUST (UNFILTERED)



750198 THRUST (UNFILTERED)

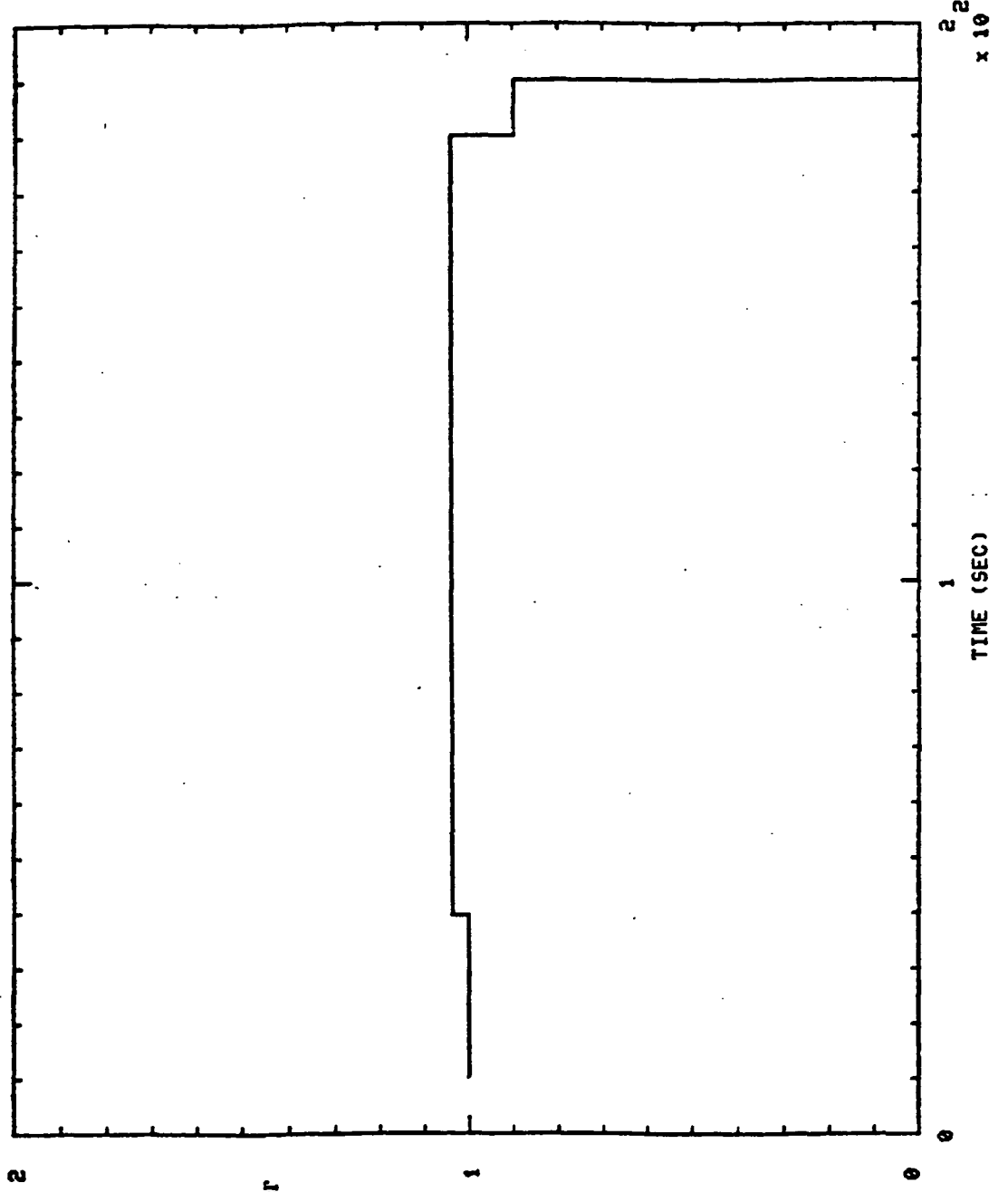


Percent of Rated Power
 $\times 10^2$

TIME (SEC)
 $\times 10^2$

750199 THRUST (UNFILTERED)

750199 THRUST



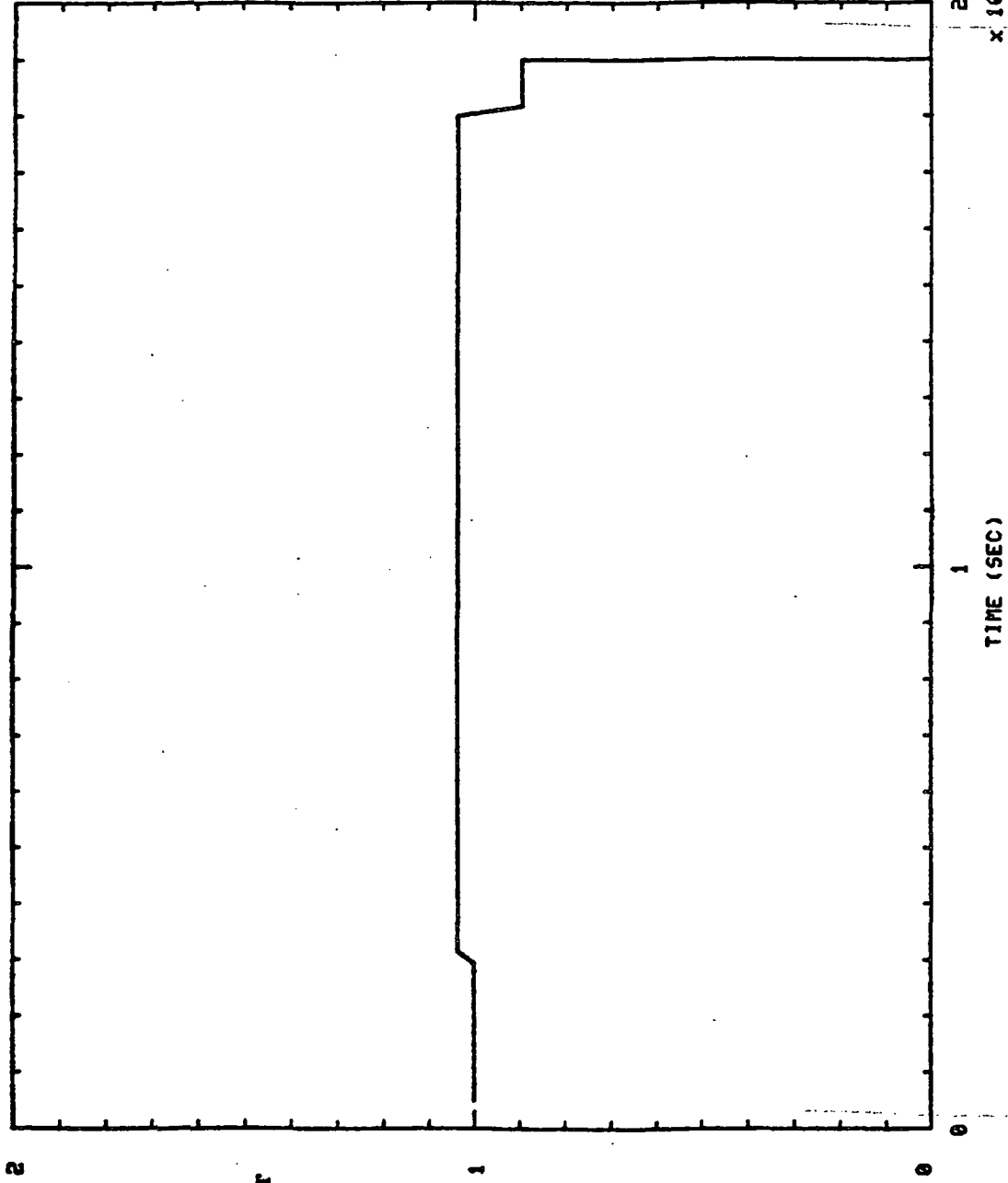
Percent of Rated Power
 $\times 10^2$

TIME (SEC)

$\times 10^2$

(UNFILTERED)

750200 THRUST



Percent of Rated Power
 $\times 10^2$

$\times 10^2$

TIME (SEC)