LEVEL II (2)

AFWL-TR-
78-158
Pt. 3

AD A071523

SIMULATION DEVELOPMENT FOR TARGET ASSESSMENT

Part 3 of 3

J. A. Earickson

Eric H. Wang Civil Engineering Research Facility
University of New Mexico
Albuquerque, NM 87131

March 1979

Final Report

Approved for public release; distribution unlimited.

DDC FILE COPY

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base, NM 87117

This final report was prepared by the Eric H. Wang Civil Engineering Research Facility, under Contract F29601-76-C-0015, Job Order 88091323 with the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico. Lt Williams (DED) was the Laboratory Project Officer-in-Charge.

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report has been authored by a contractor of the United States Government. Accordingly, the United States Government retains a nonexclusive, royalty-free license to publish or reproduce the material contained herein, or allow others to do so, for the United States Government purposes.

This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

JACK D. WILLIAMS
Lt, USAF
Project Officer

FOR THE COMMANDER

RUDOLPH V. MATALUCCI
Lt Colonel, USAF
Chief, Simulation Branch

STEWART W. JOHNSON
Lt Colonel, USAF
Chief, Civil Engineering Research Division

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFWL-TR-78-158, Pt. 3	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SIMULATION DEVELOPMENT FOR TARGET ASSESSMENT		5. TYPE OF REPORT & PERIOD COVERED Final Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) J. A. Earickson		8. CONTRACT OR GRANT NUMBER(s) F29601-76-C-0015
9. PERFORMING ORGANIZATION NAME AND ADDRESS Eric H. Wang Civil Engineering Research Facility University of New Mexico Albuquerque, NM 87117		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62601F 88091323
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Weapons Laboratory (DED) Kirtland Air Force Base, NM 87117		12. REPORT DATE March 1979 13. NUMBER OF PAGES 166
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

This report consists of 3 parts. Part 1 contains the front matter and pages 1 to 178. Part 2 contains pages 179 to 364- Part 3 contains pages 365 to 530.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Simulator
HEST (High Explosive Simulation Technique)
Target Assessment
Air Shock

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

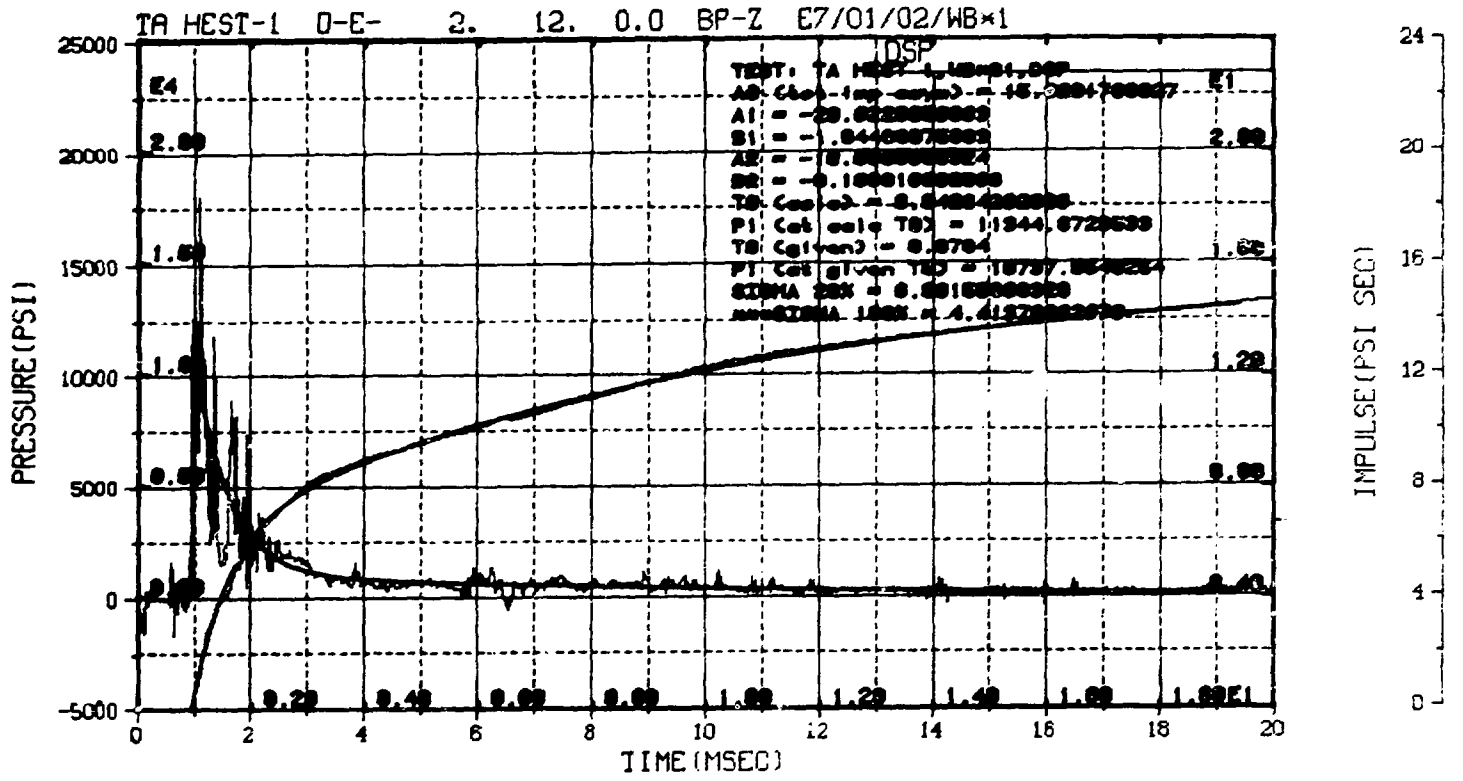
This effort produced design information and experiment data for improving high explosive simulation of nuclear airblasts. Specifically, a peak pressure versus charge density relationship for Irenits in 100 percent foam cavities was obtained for pressure up to 68 MPa. The results of this effort were transmitted to USAE Waterways Experiment Station. WES is conducting tests on generic silos as part of a DNA targeting research and test program.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 68 IS OBSOLETE

UNCLASSIFIED

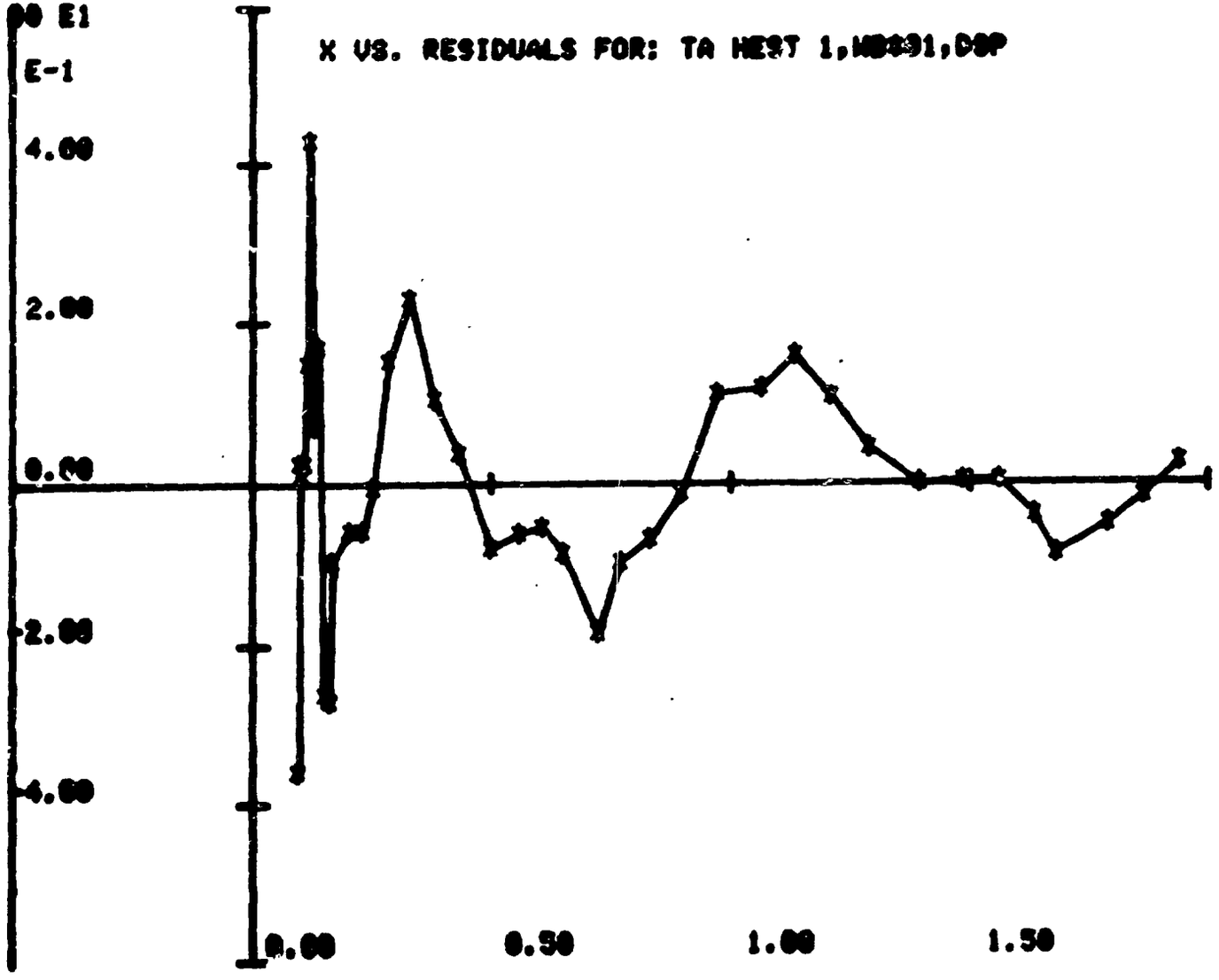
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

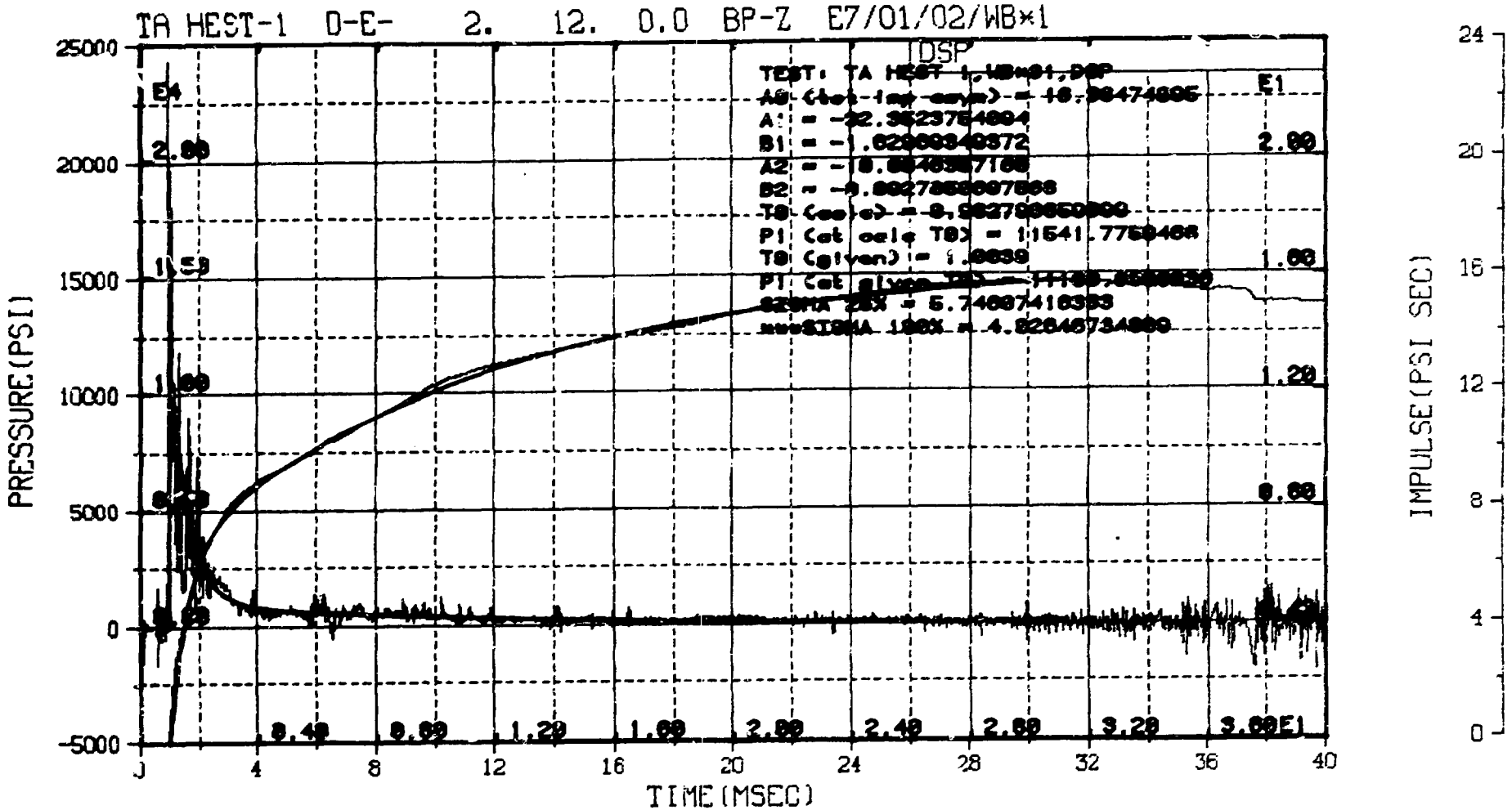
APPENDIX B
DOUBLE-EXPONENTIAL PEAK PRESSURE OVERLAY PLOTS AND CALCULATED RESIDUALS VERSUS X-COORDINATED PLOTS



M.N. -80001	E.U. -0.000,21450.000	VSN=
TSKIP=10.350	DIGITS=0.000,1568.875	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=1

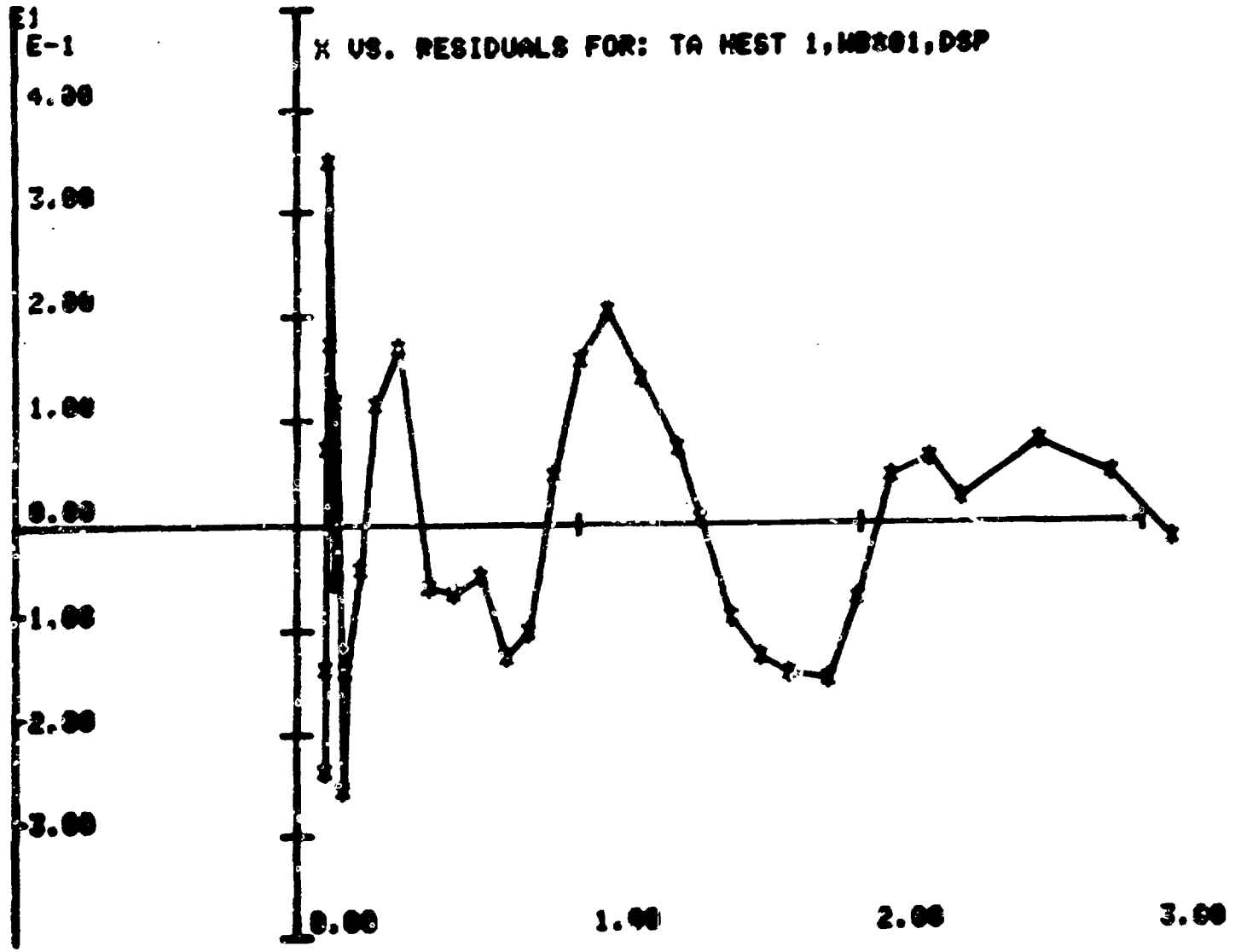
1

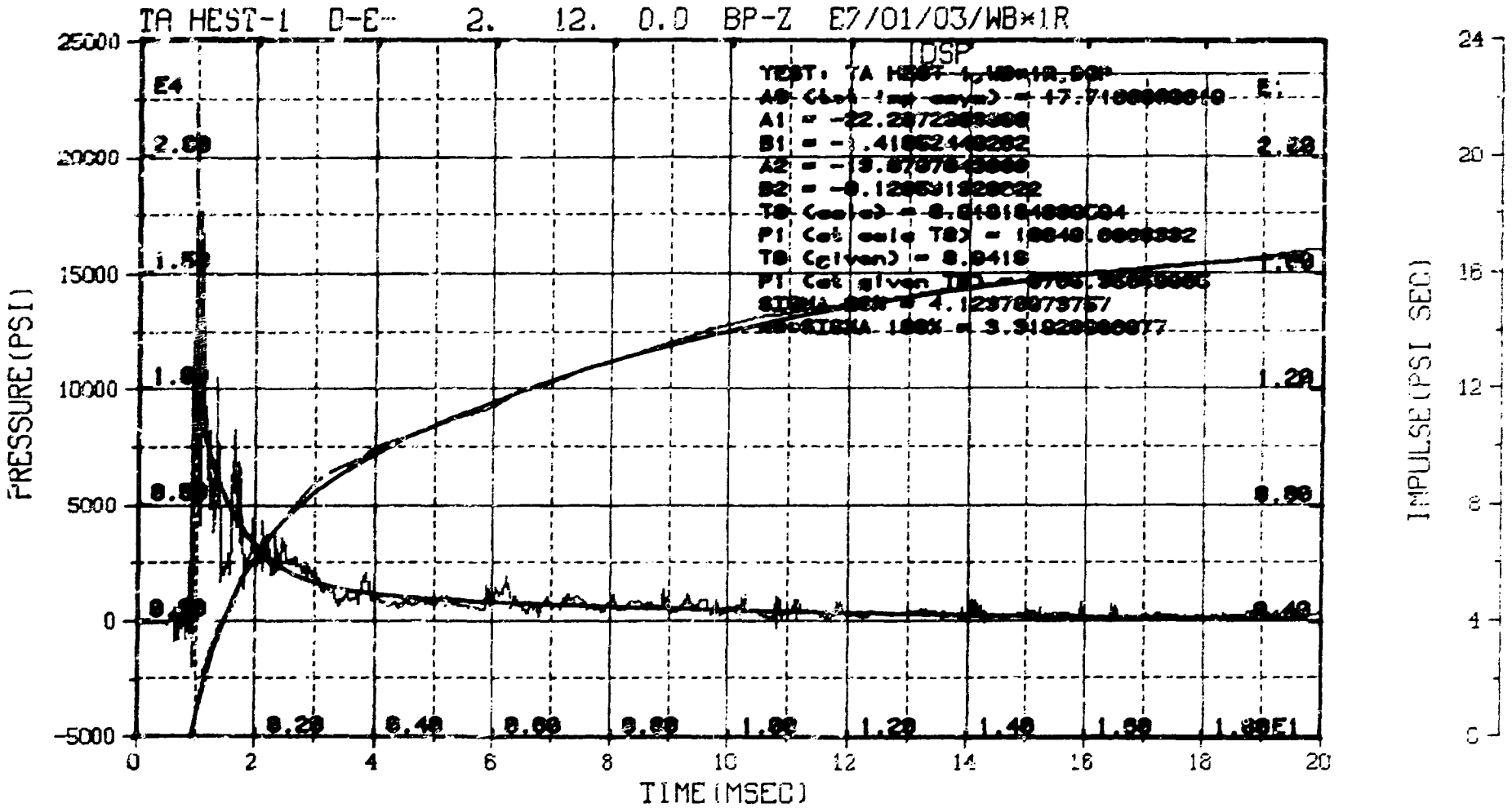

X VS. RESIDUALS FOR: TA HEST 1,MB491,DSP
E1
E-1
4.00
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.



M.N. =80001	E.U. =0.000,21450.000	VSN=
TSKIP=10.350	DIGITS=0.000,1568.875	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=1

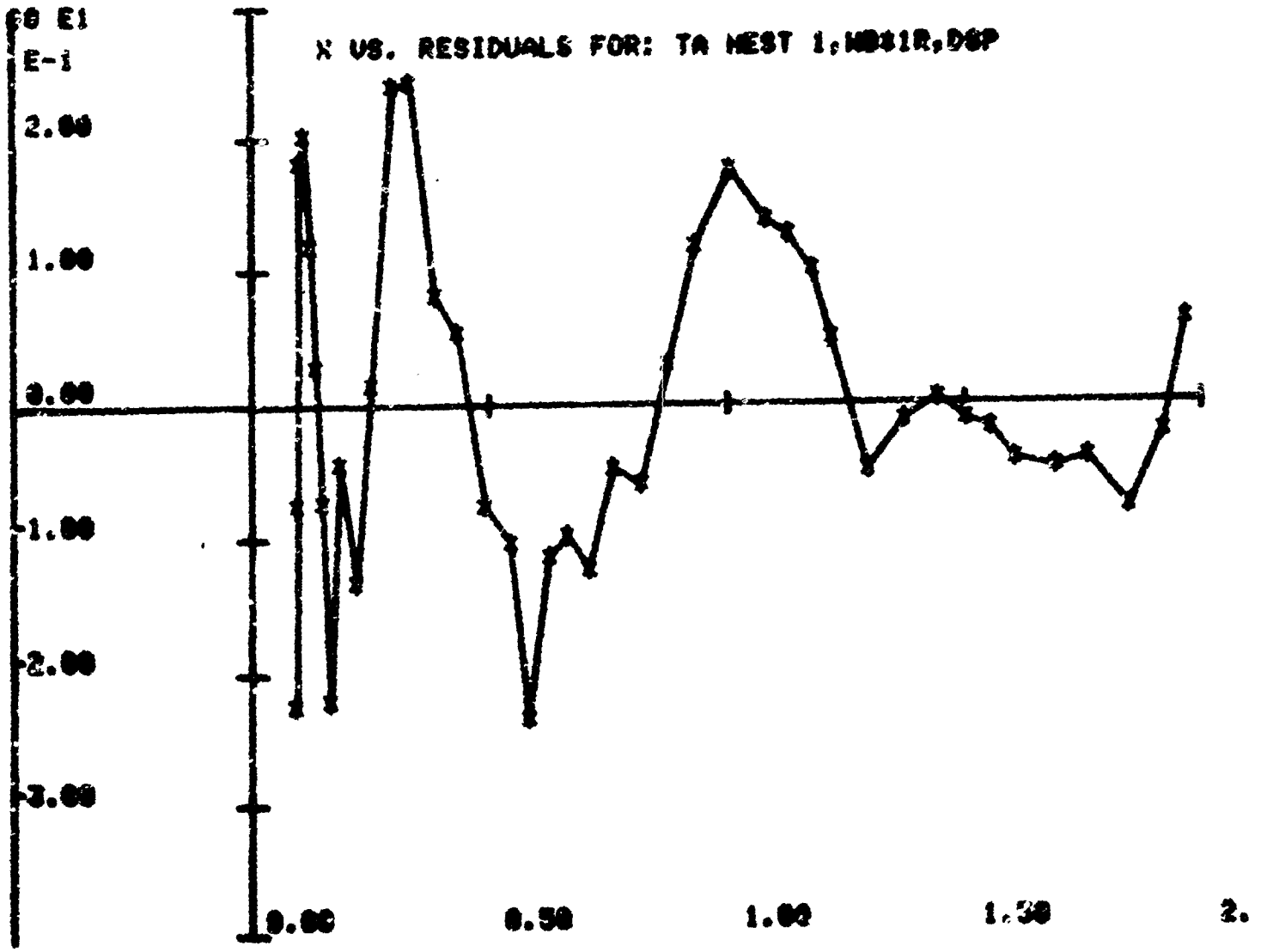
1

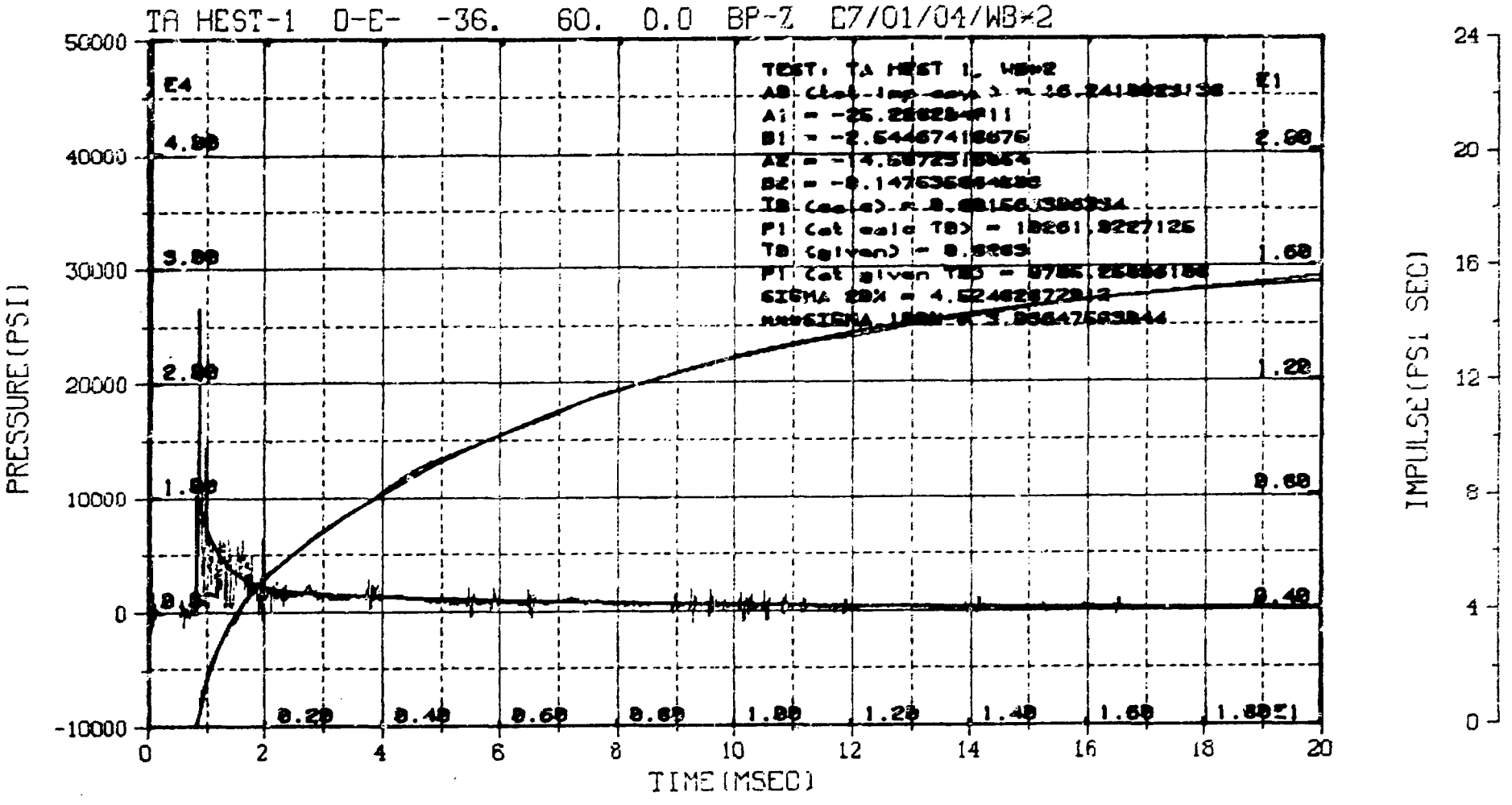

E1
E-1
X VS. RESIDUALS FOR: TA WEST 1,WB301,DSP
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00



M.N. =80001	E.U. =0.000,21450.000	VSN=
TSKIP=10.350	DIGITS=0.000,1040.500	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=2

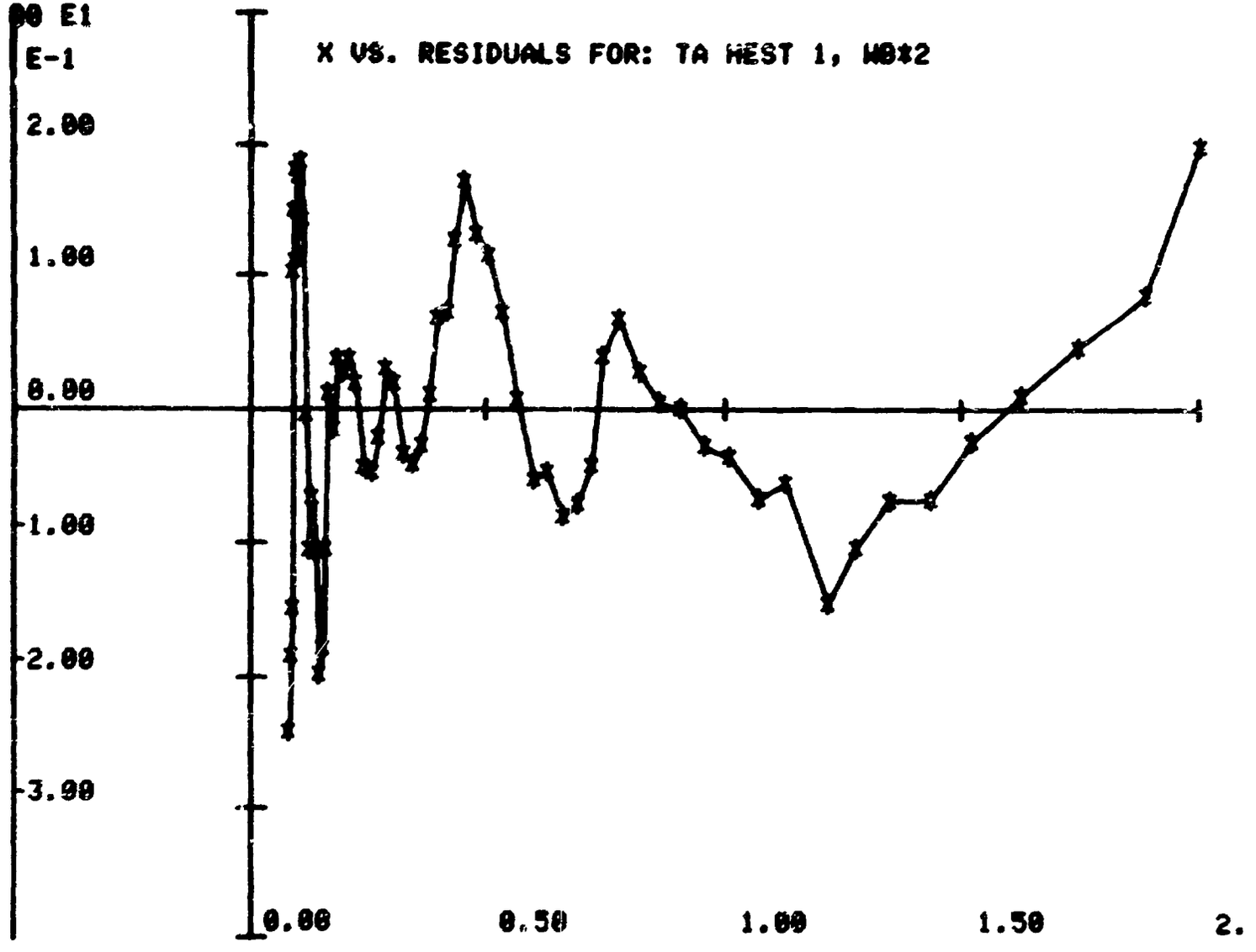
1

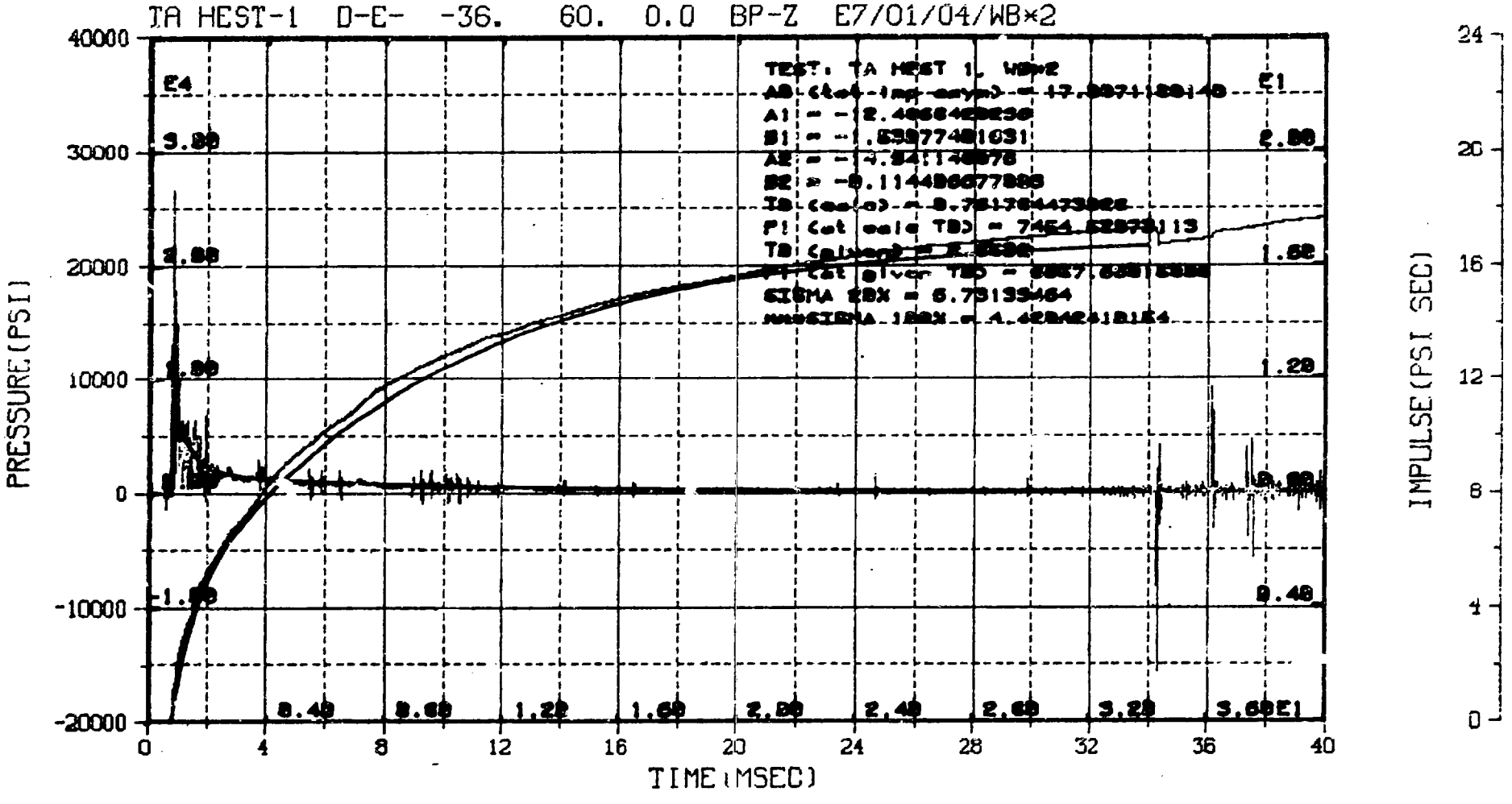

X VS. RESIDUALS FOR: TA WEST 1;WB31R,DSP
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.



M.N. = 2	E.U. =0.000,25070.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1495.000	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=8

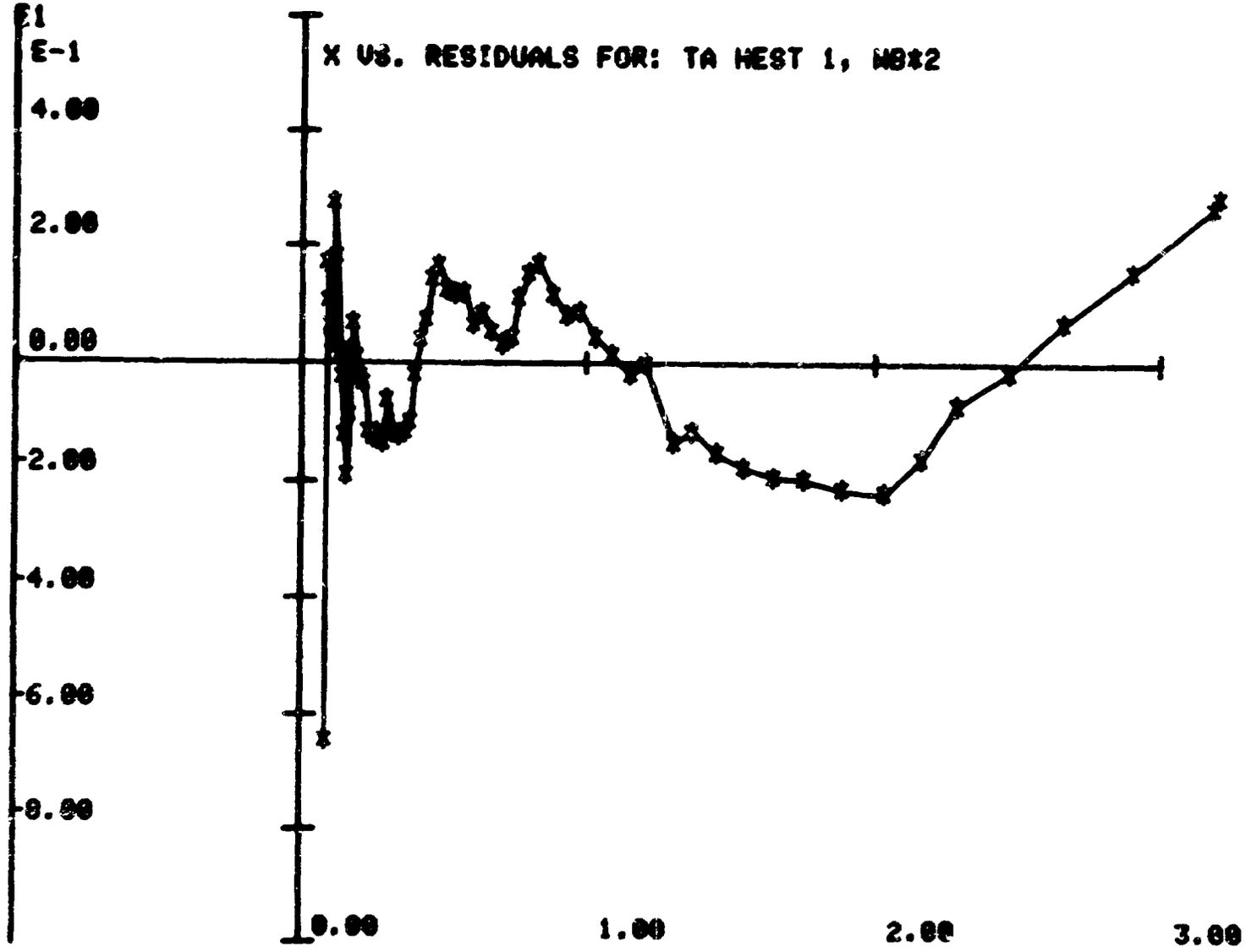
1

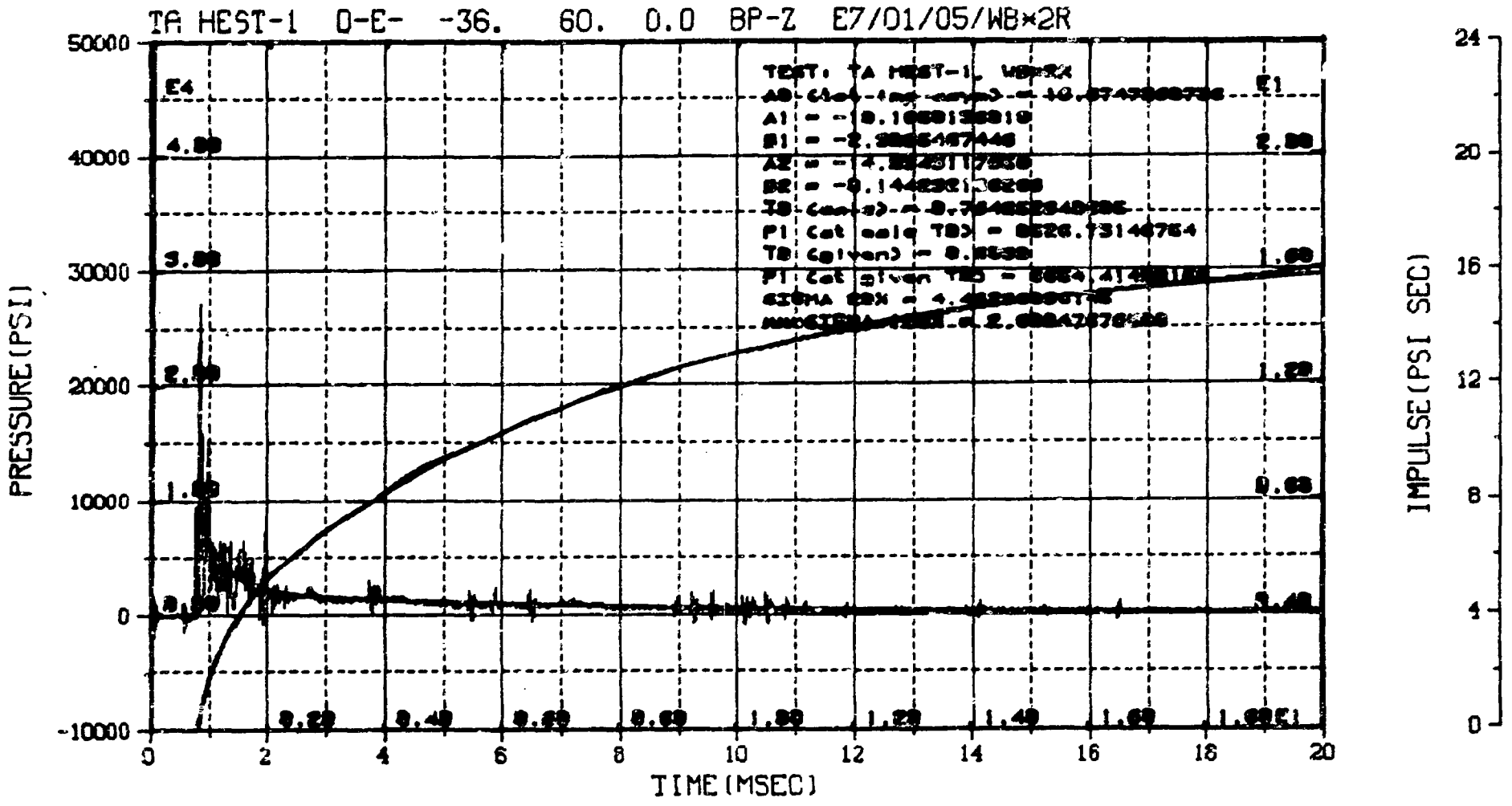

X VS. RESIDUALS FOR: TA WEST 1, WB*2
E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.



M.N. = 2	E.U. =0.000,25070.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1495.000	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=8

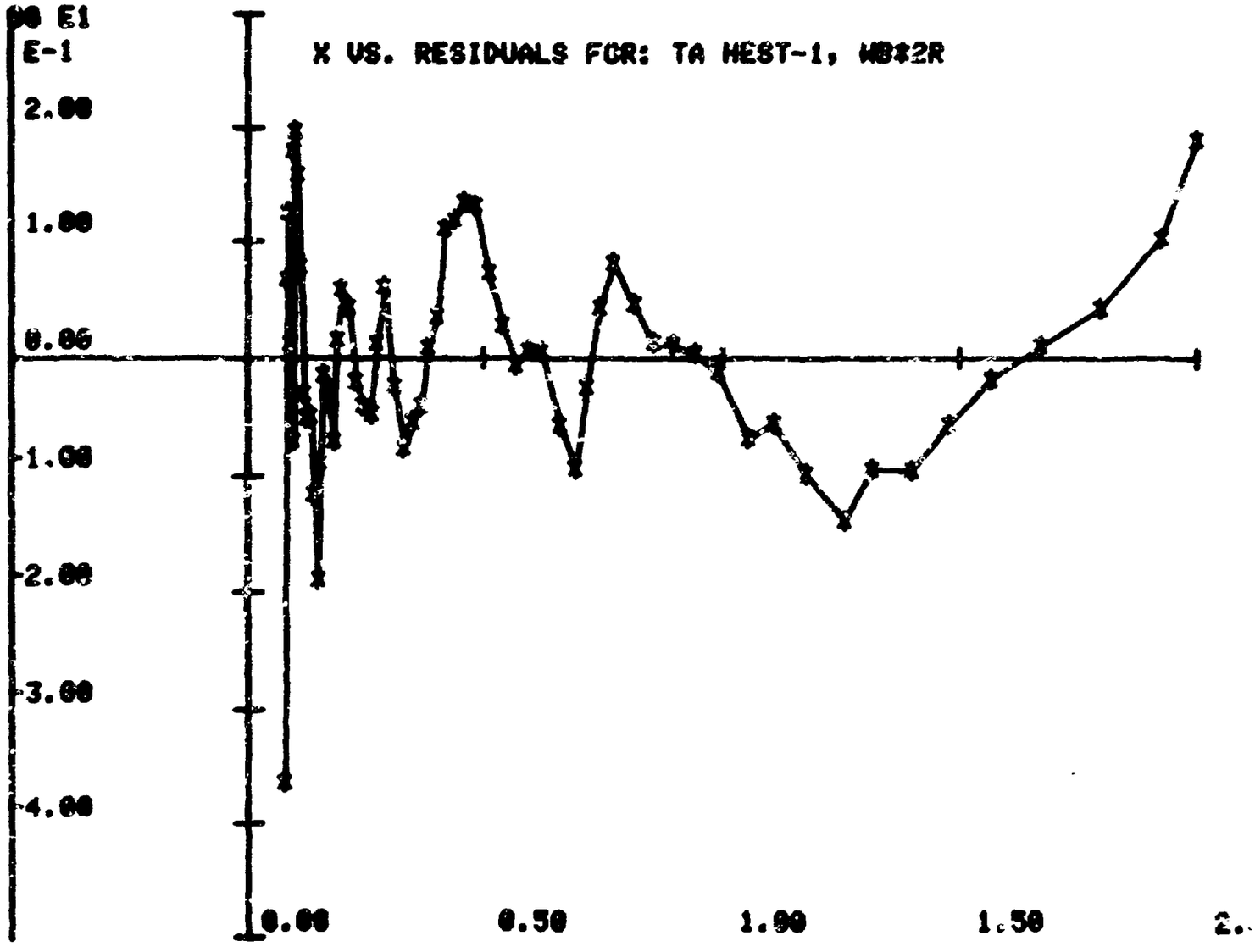
1

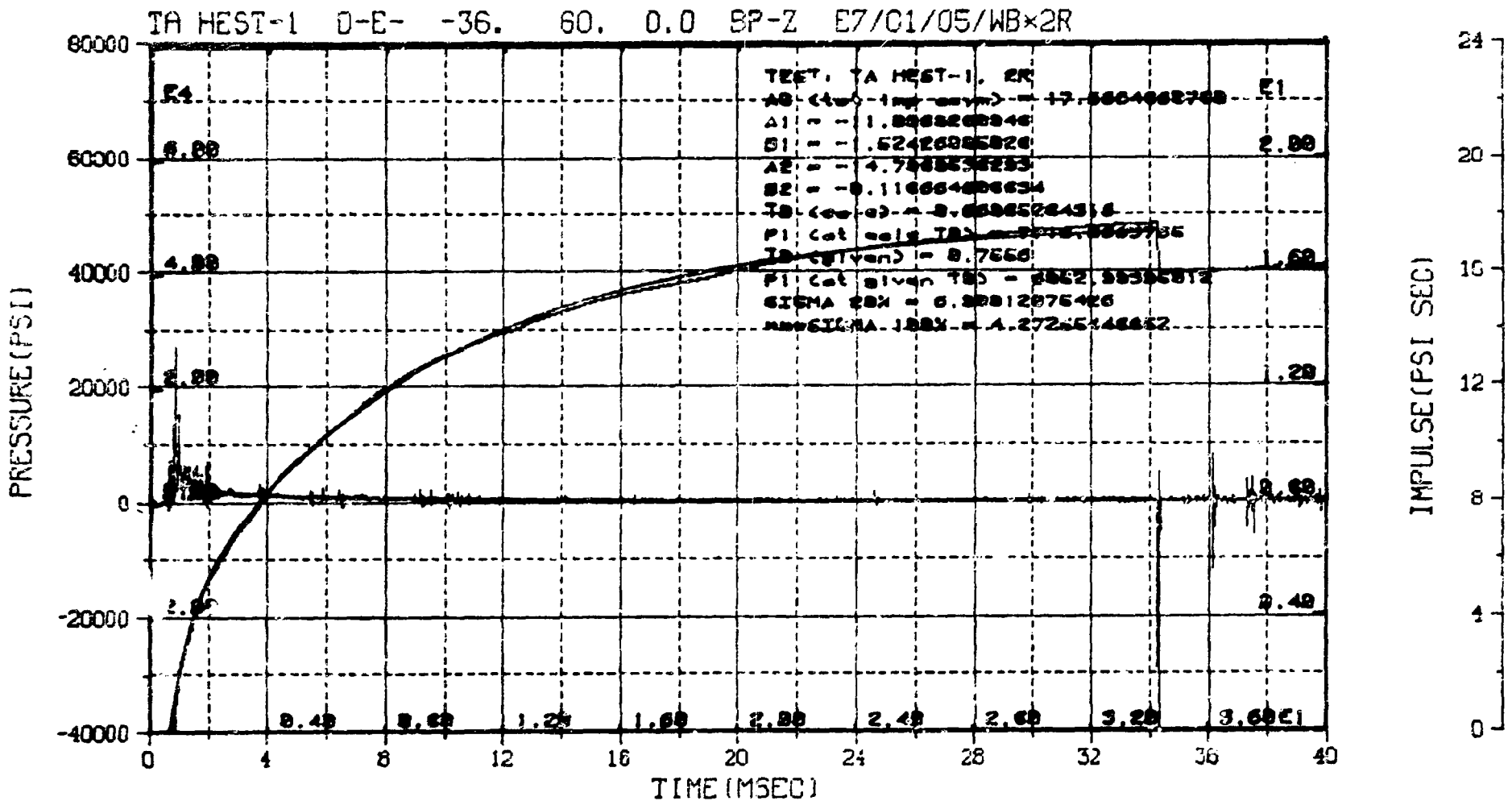

E1
E-1
X VS. RESIDUALS FOR: TA HEST 1, NB=2
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.00
1.00
2.00
3.00



M.N. = 2	E.U. =0.000,25070.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1201.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=10

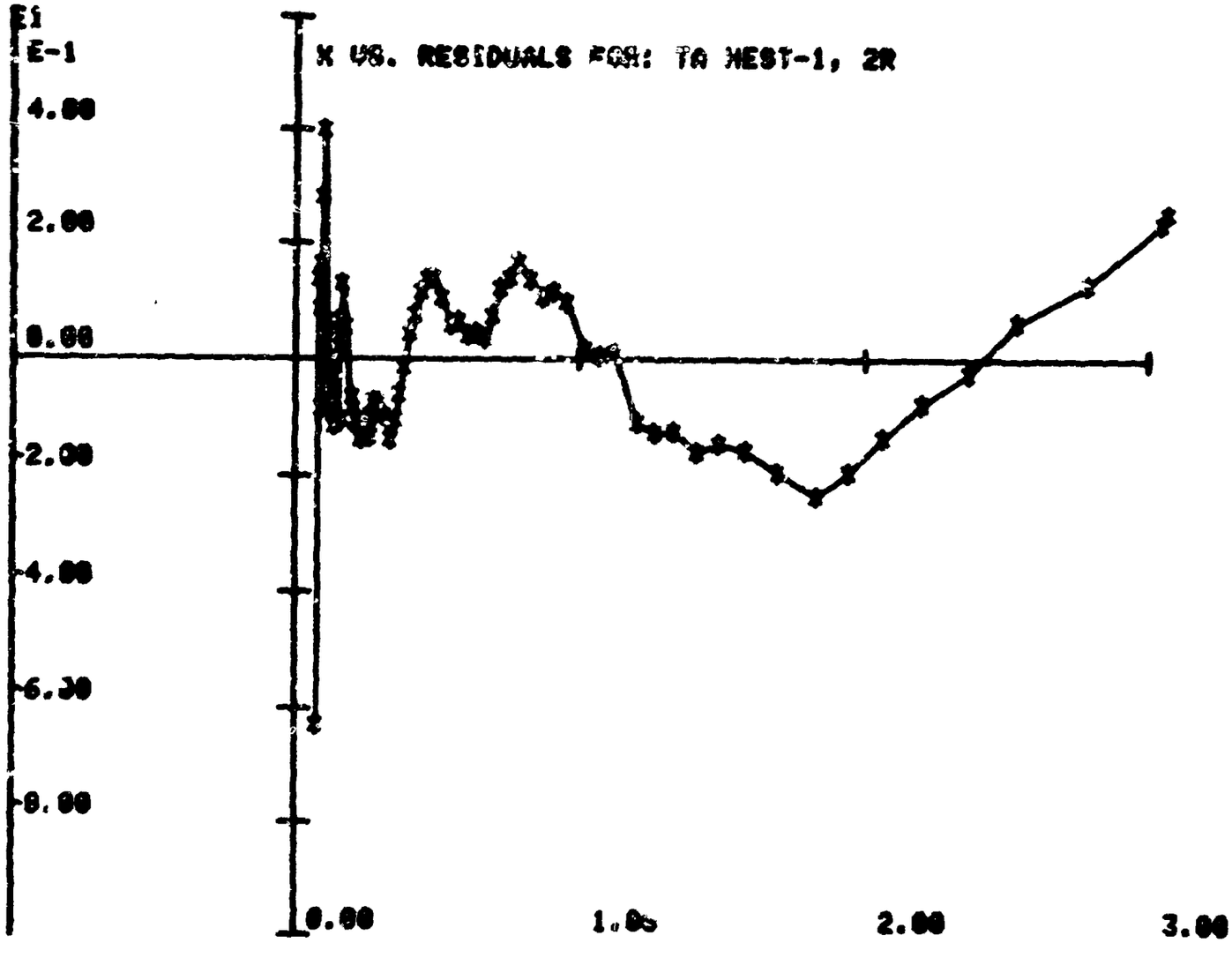
1

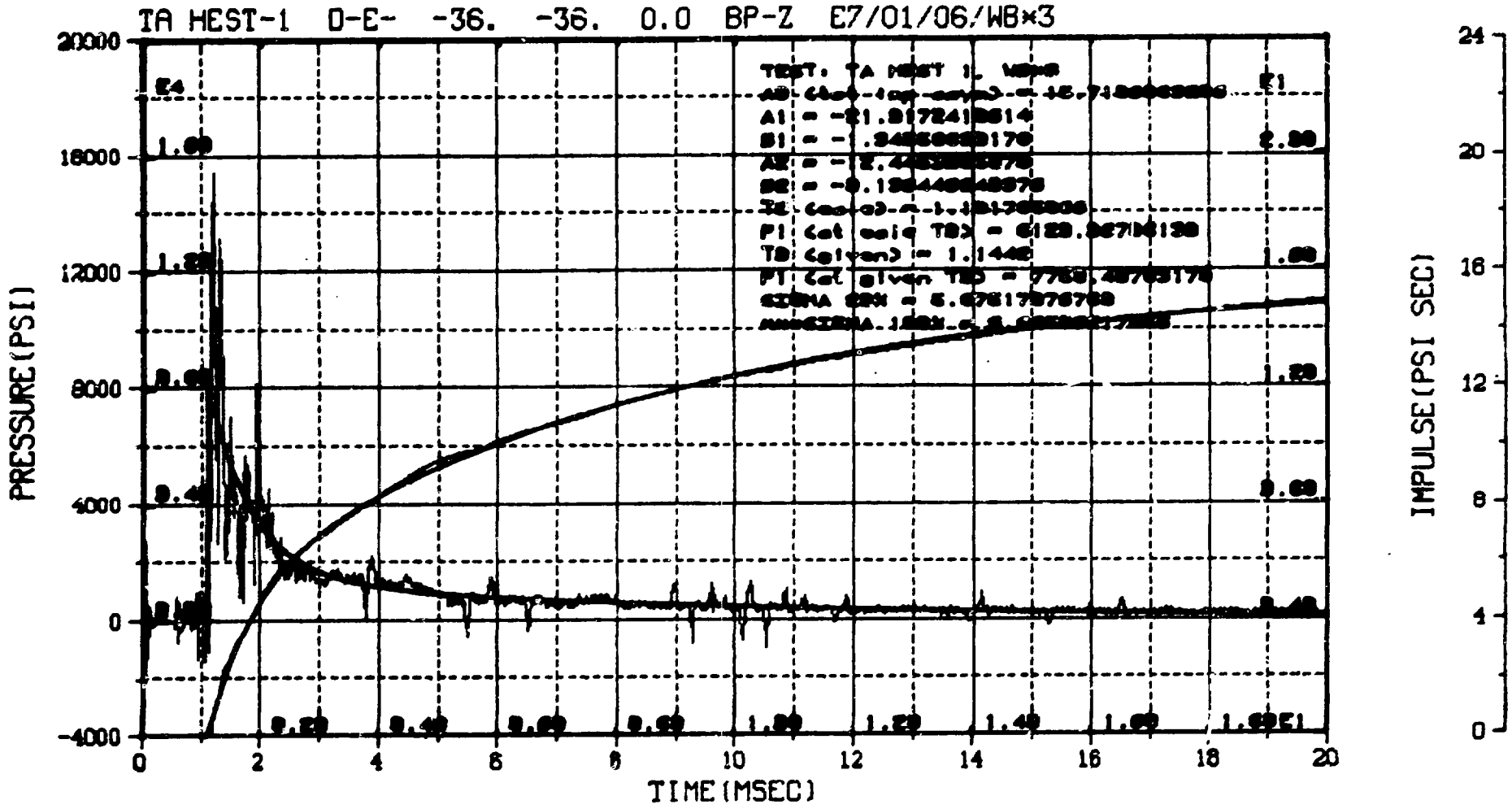

X VS. RESIDUALS FOR: TA HEST-1, WB#2R
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.



M.N. = 2	E.U. =0.000,25070.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1201.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=10

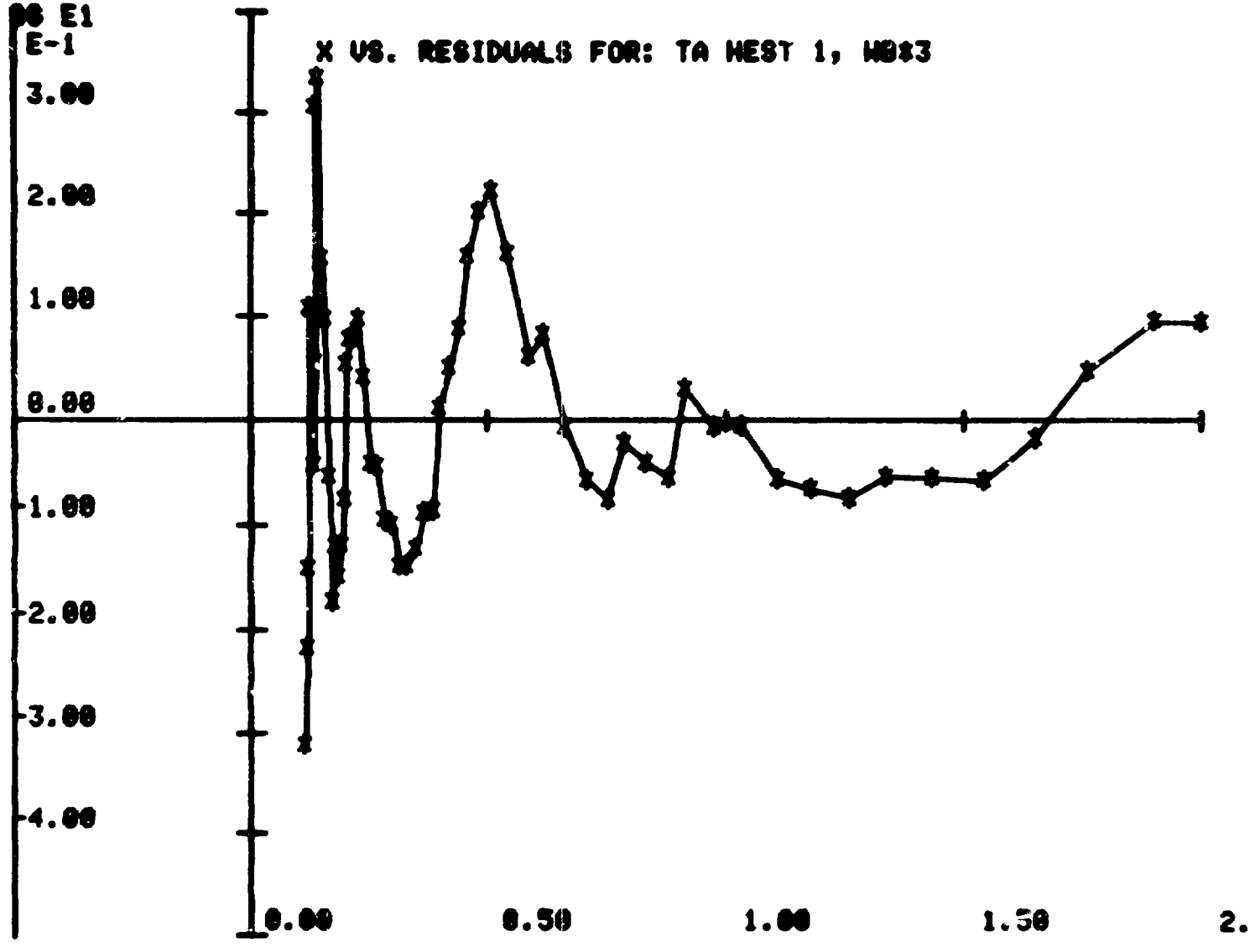
1

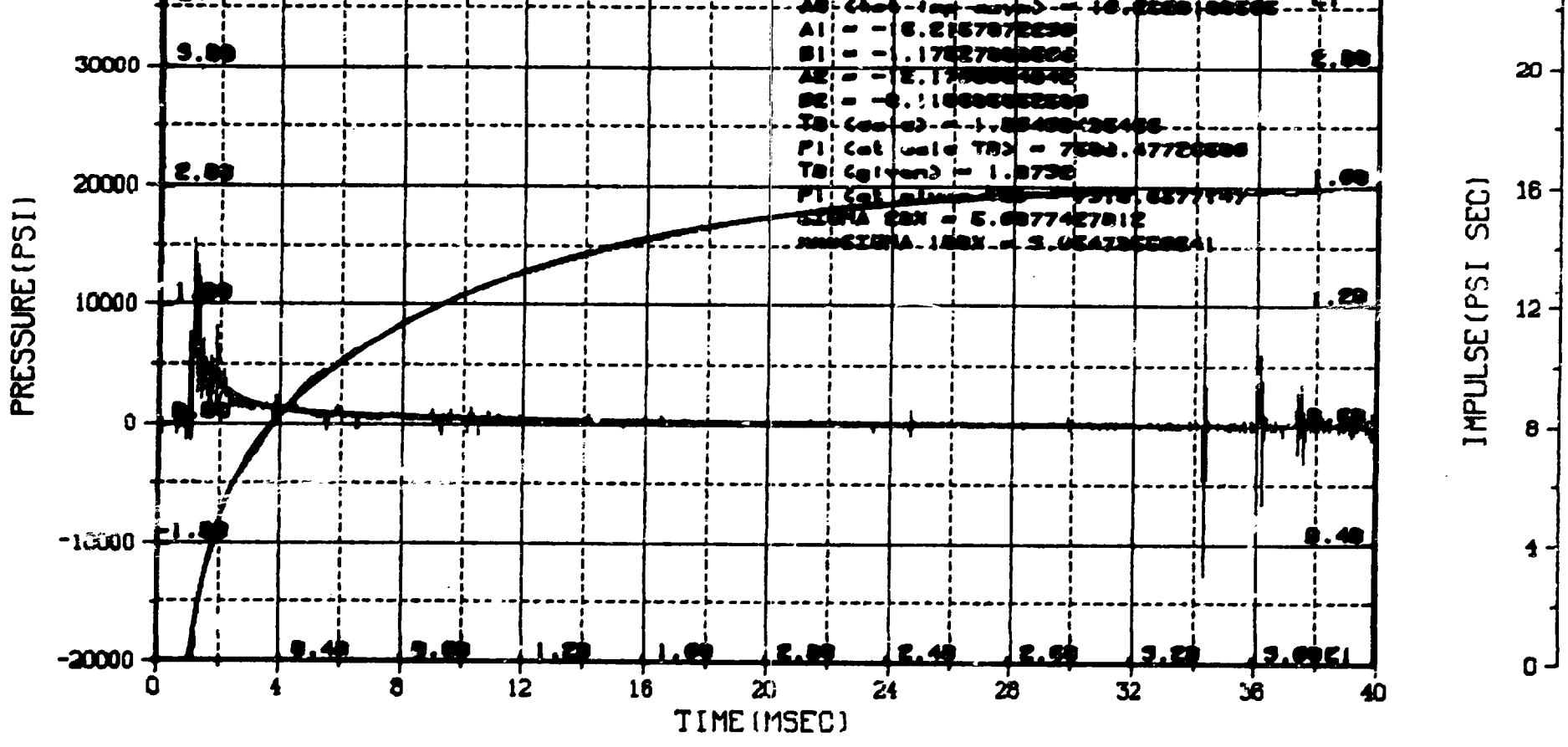

Ei
E-1
X VS. RESIDUALS FOR: TA MEST-1, 2R
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.00
1.00
2.00
3.00



M.N. = 3	E.U. -0.000,25416.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1472.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=12

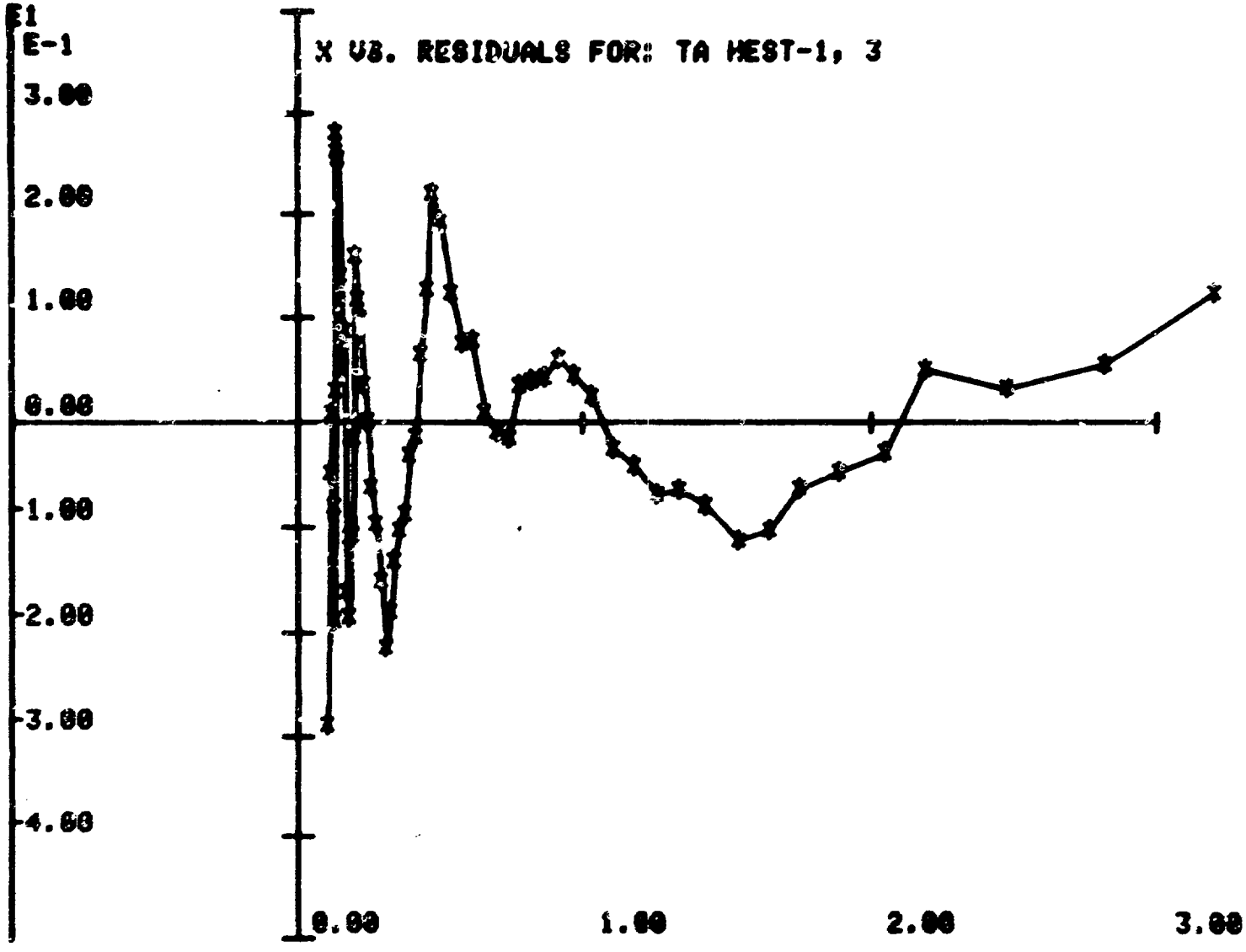
1

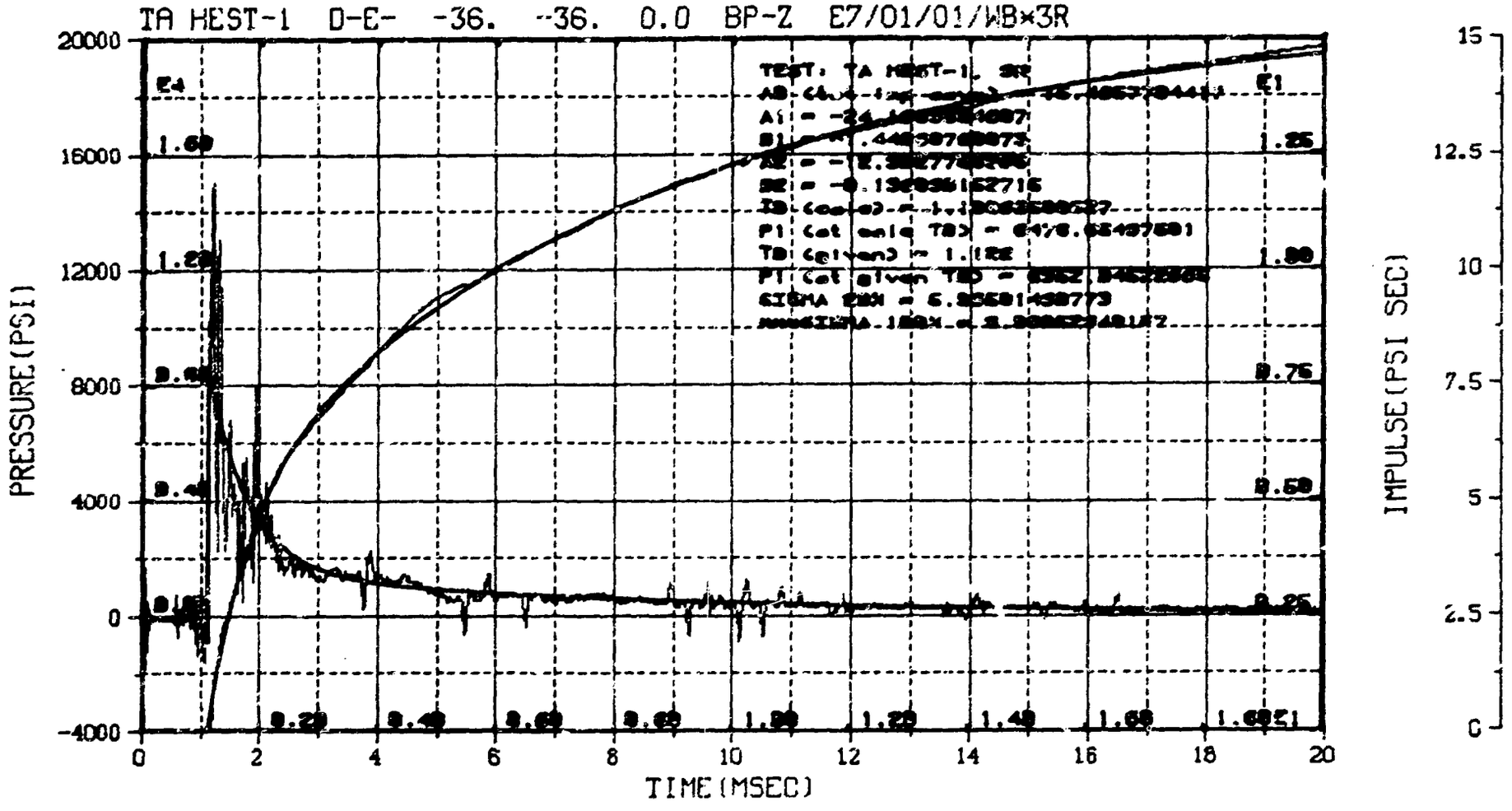

X VS. RESIDUALS FOR: TA WEST 1, WB#3
E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.



M.N. = 3	E.U. -0.000,25416.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1472.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=12

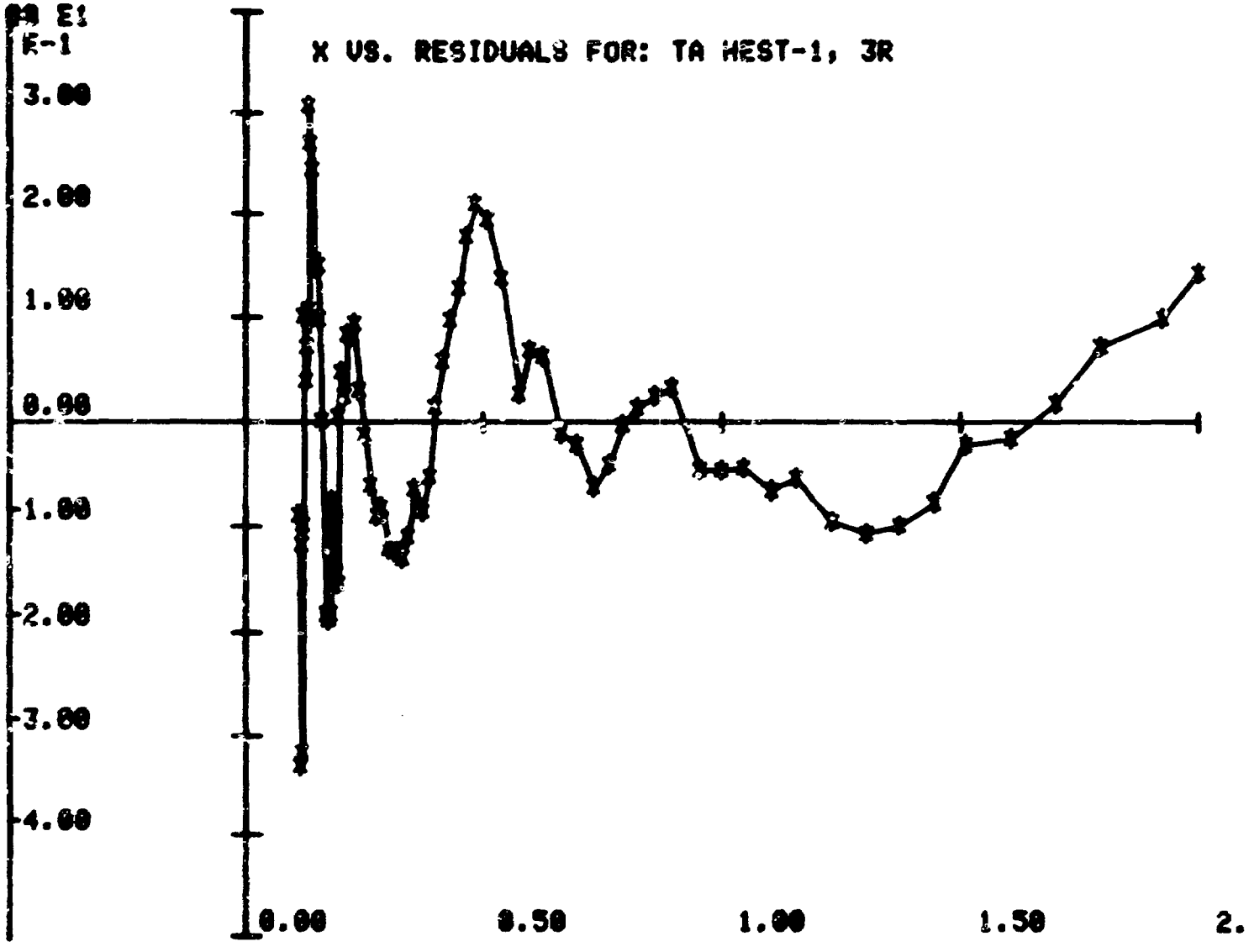
1

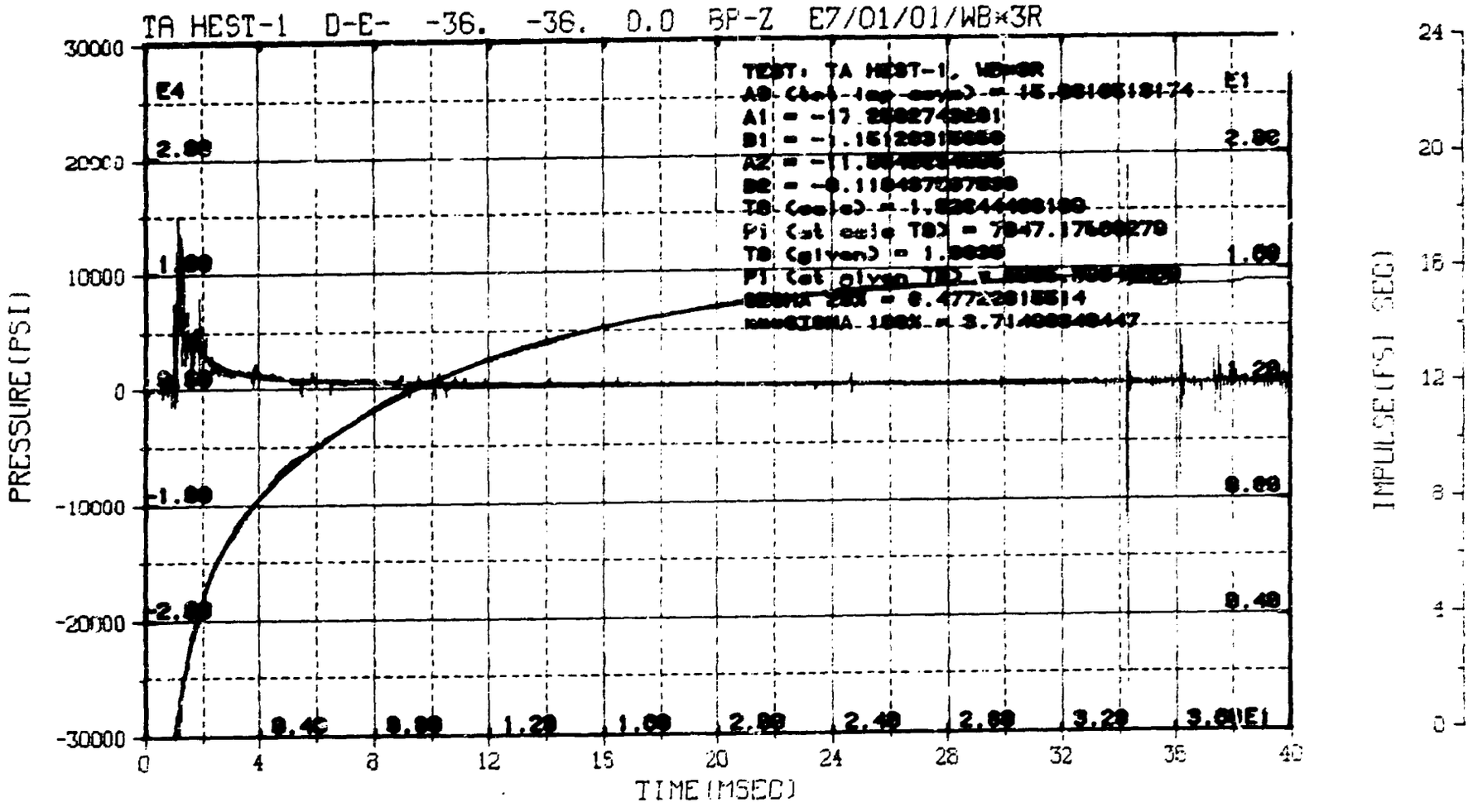

E1
E-1
X VS. RESIDUALS FOR: TA WEST-1, 3
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00



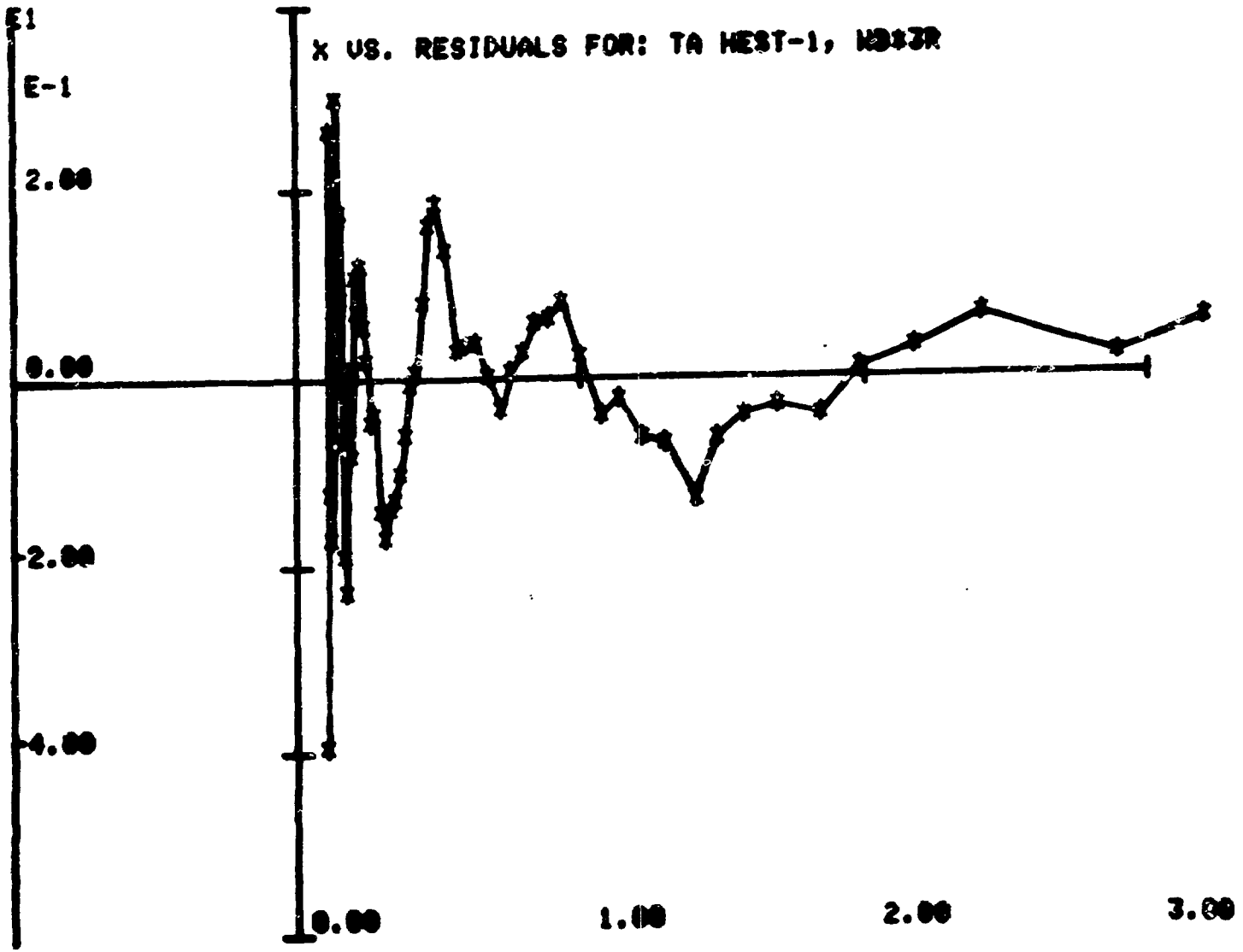
M.N. = 3	E.U. =0.000,25416.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1162.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=2

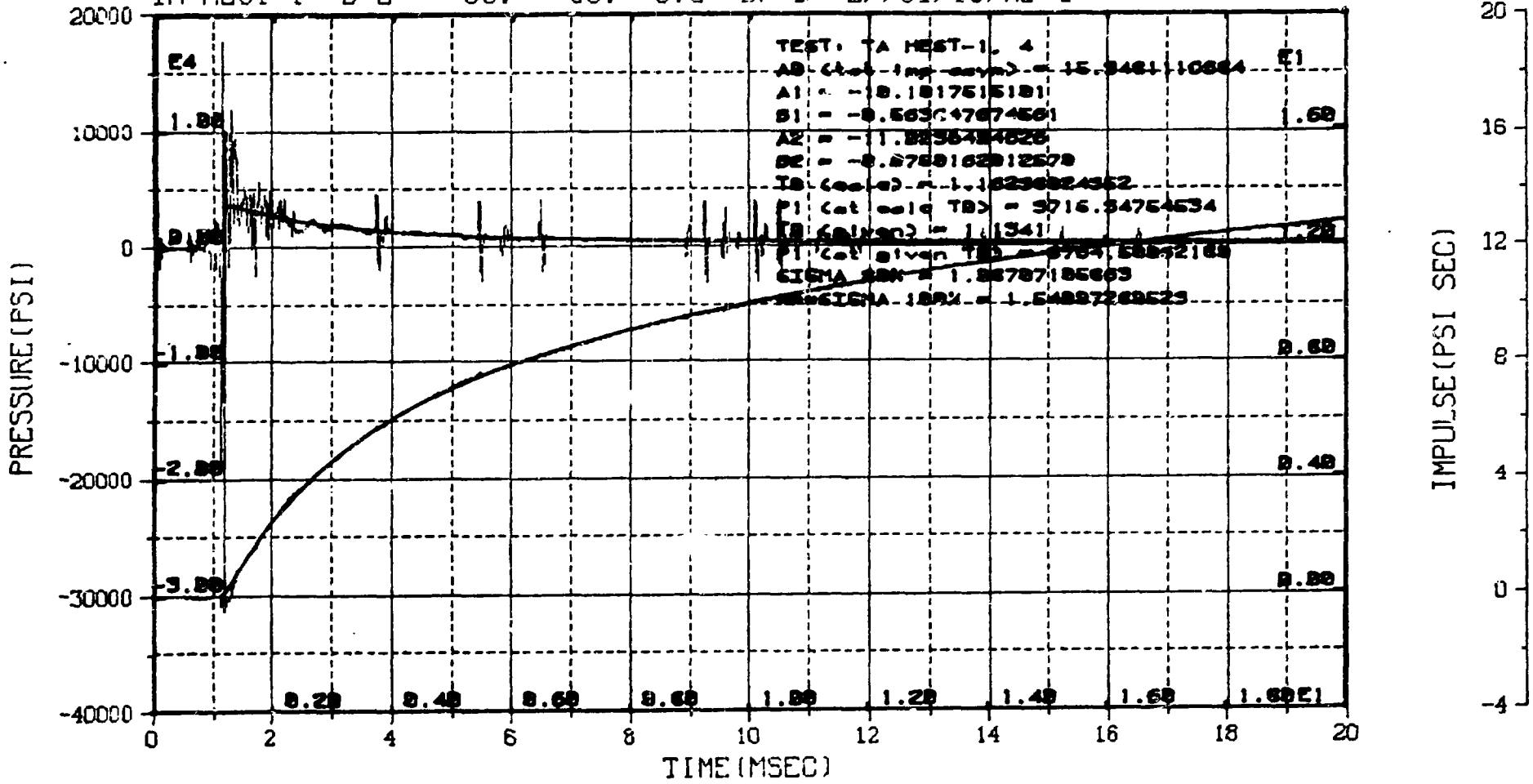
1


E1
E-1
X VS. RESIDUALS FOR: TA HEST-1, 3R
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.



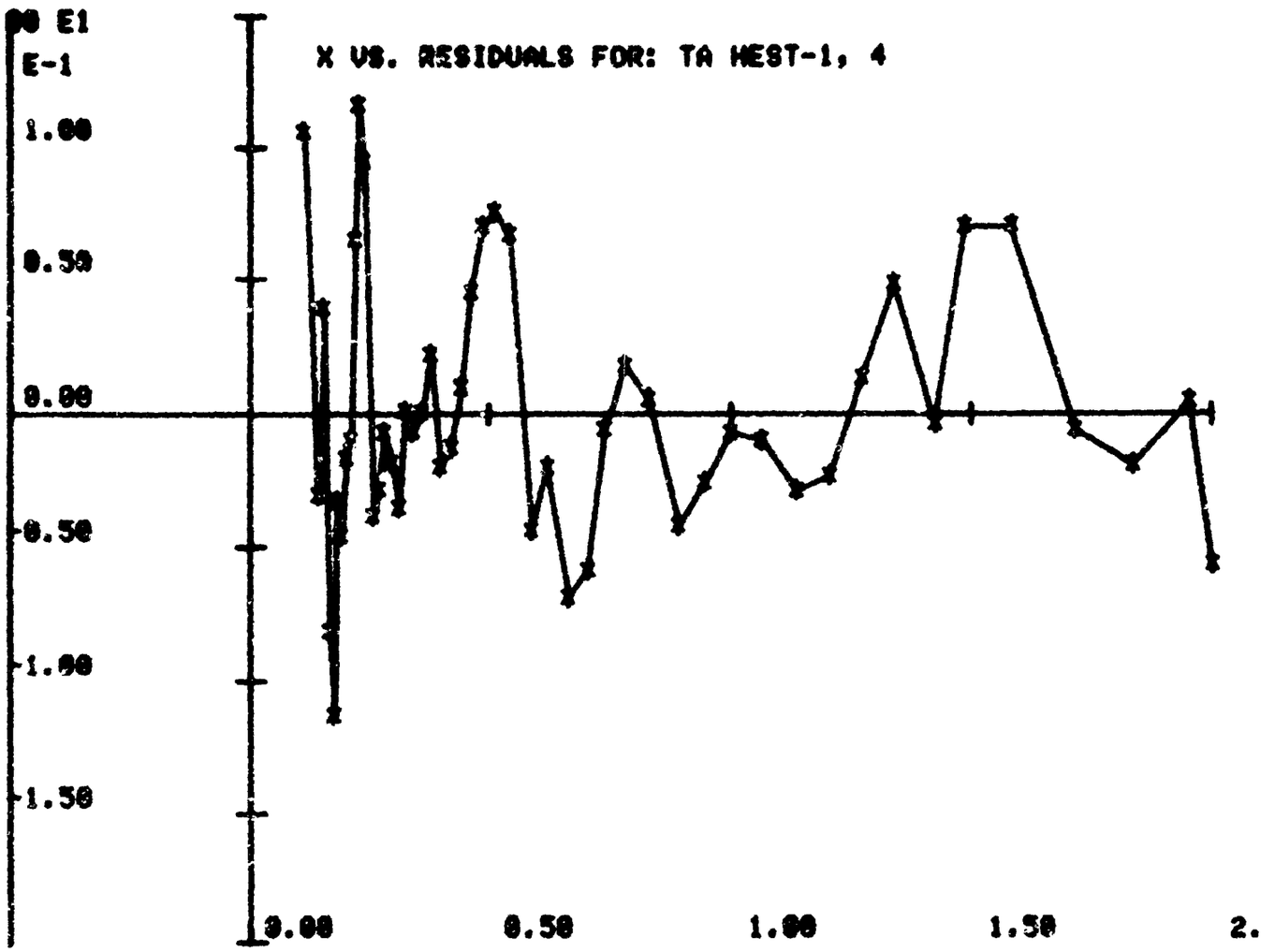
M.N. = 3	E.U. =0.000,25416.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1162.500	TAPE22
S.R. =100.00 KHZ	6 13 PM, 2 MAR 78.	FILE=2

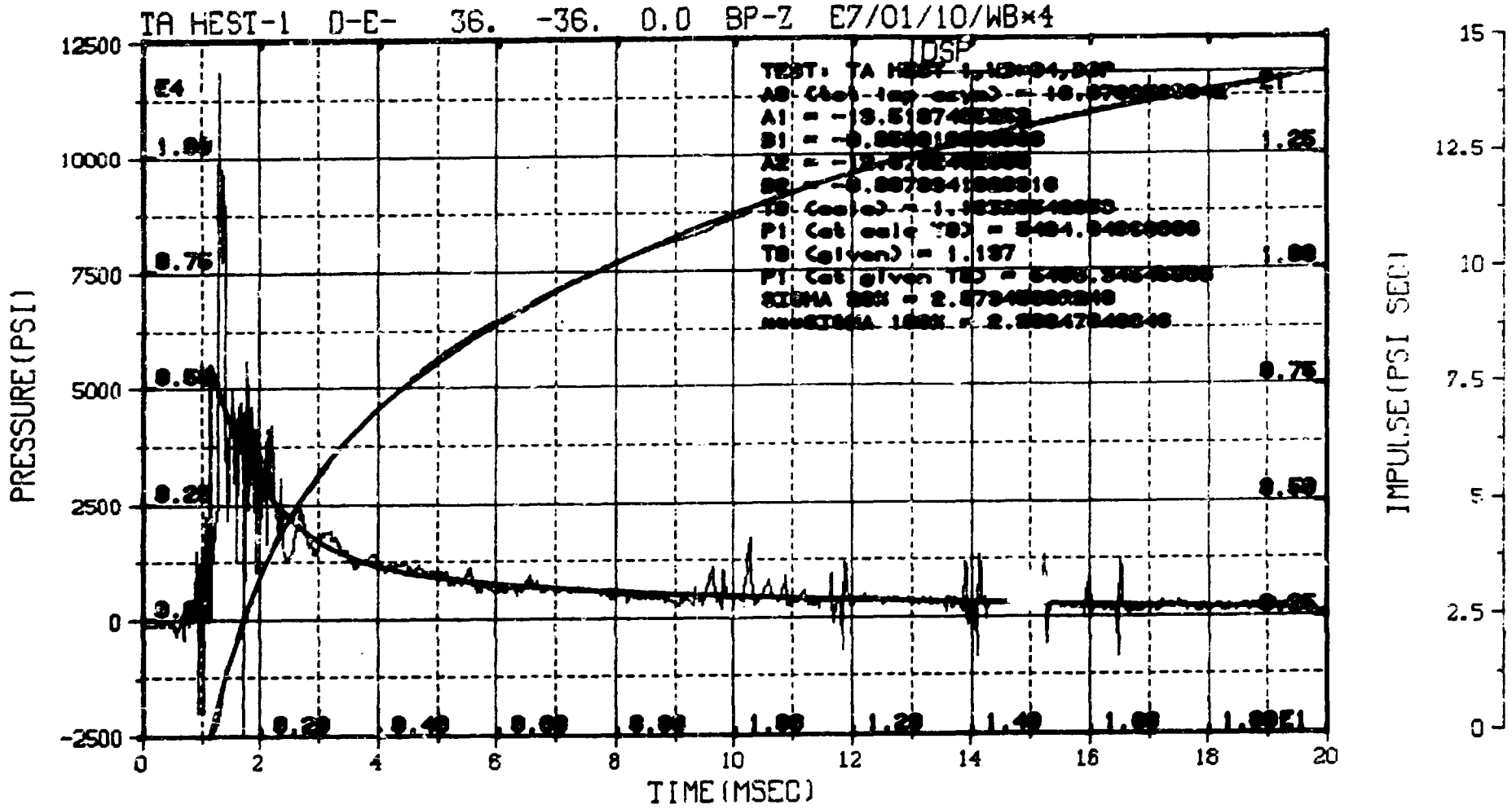

E1
E-1
X VS. RESIDUALS FOR: TA WEST-1, W
2.00
0.00
-2.00
-4.00
0.00
1.00
2.00
3.00



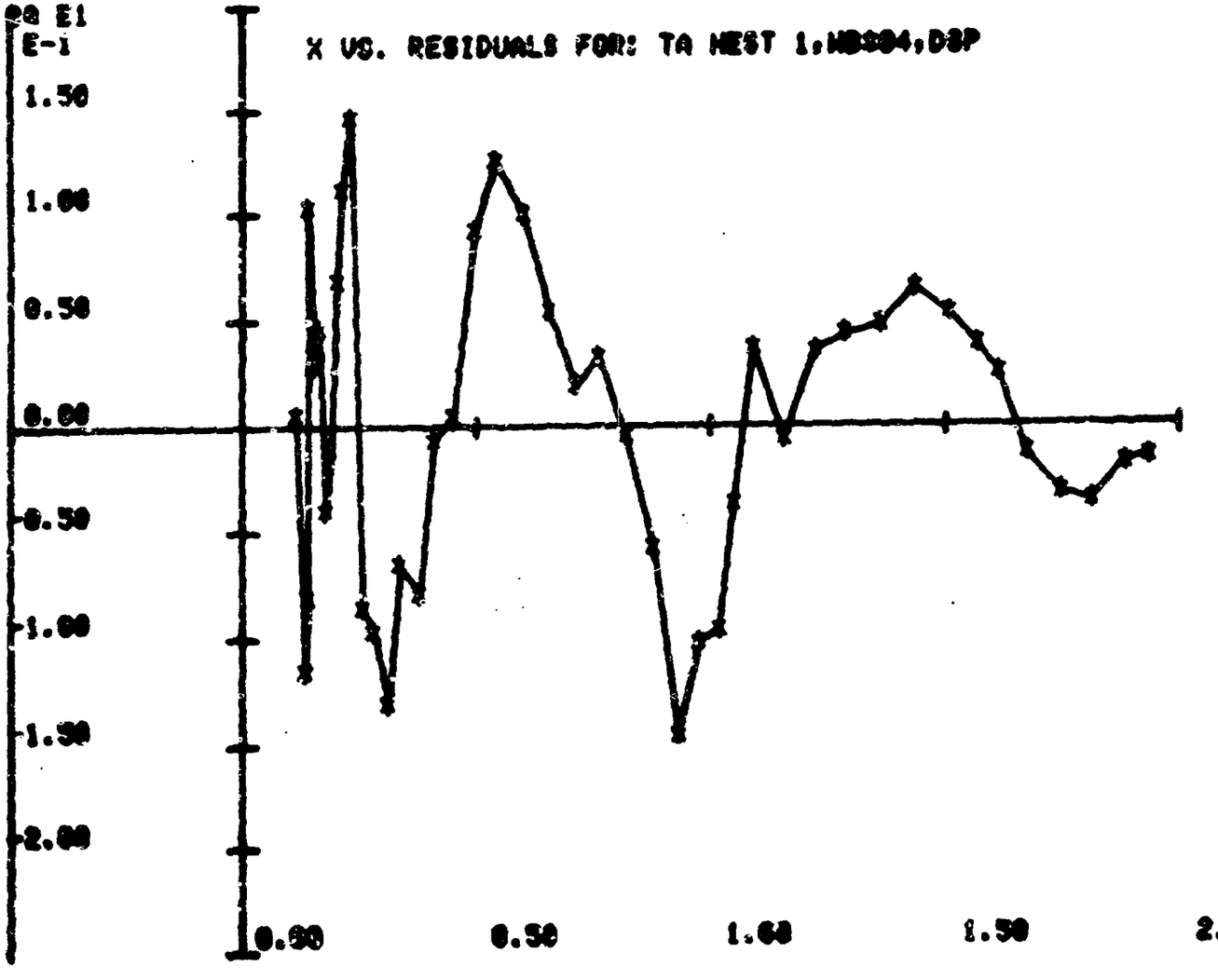
M.N. = 4	E.U. =0.000,28698.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1510.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=16

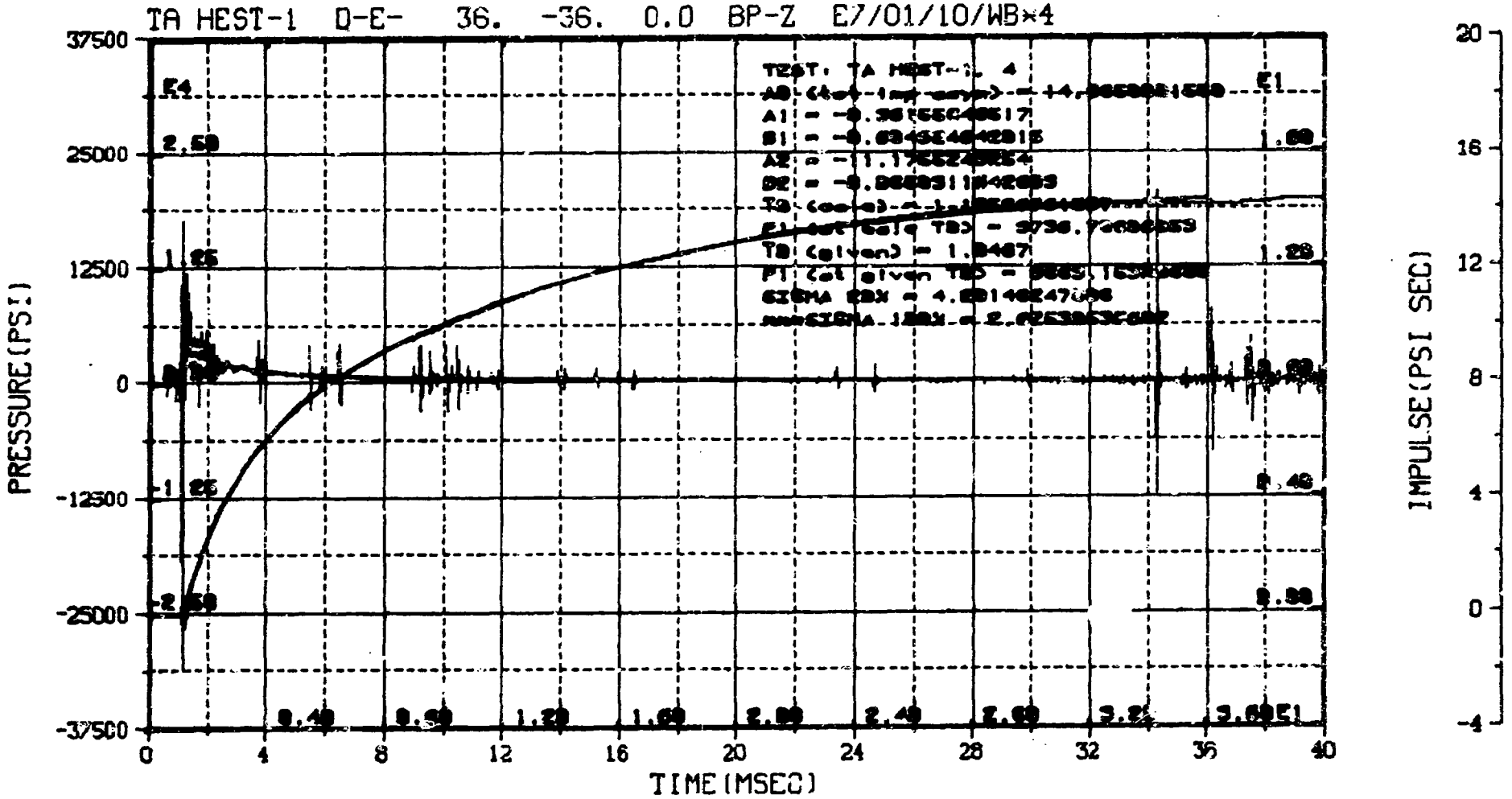
1


X VS. RESIDUALS FOR: TA WEST-1, 4
E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
0.50
1.00
1.50
2.

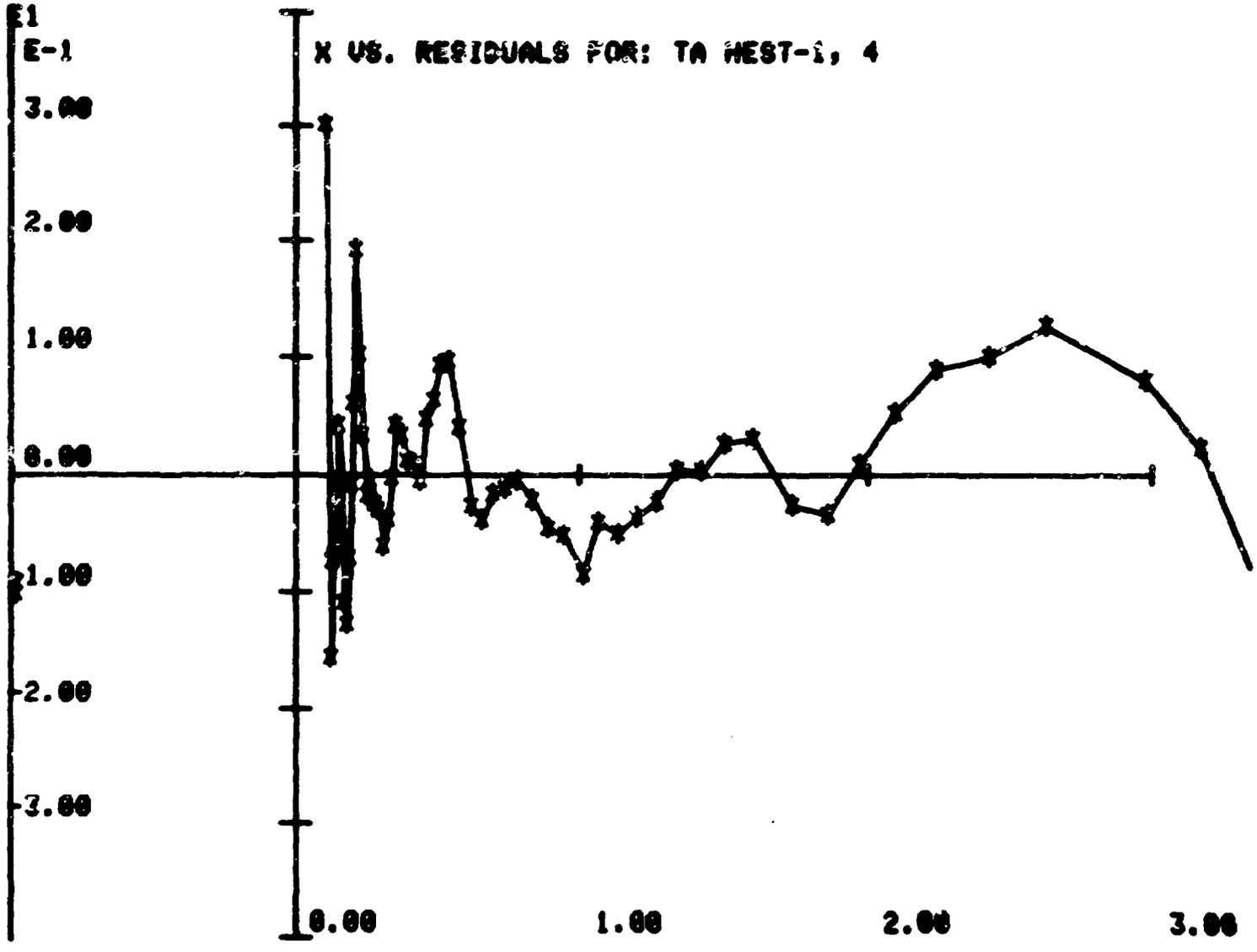


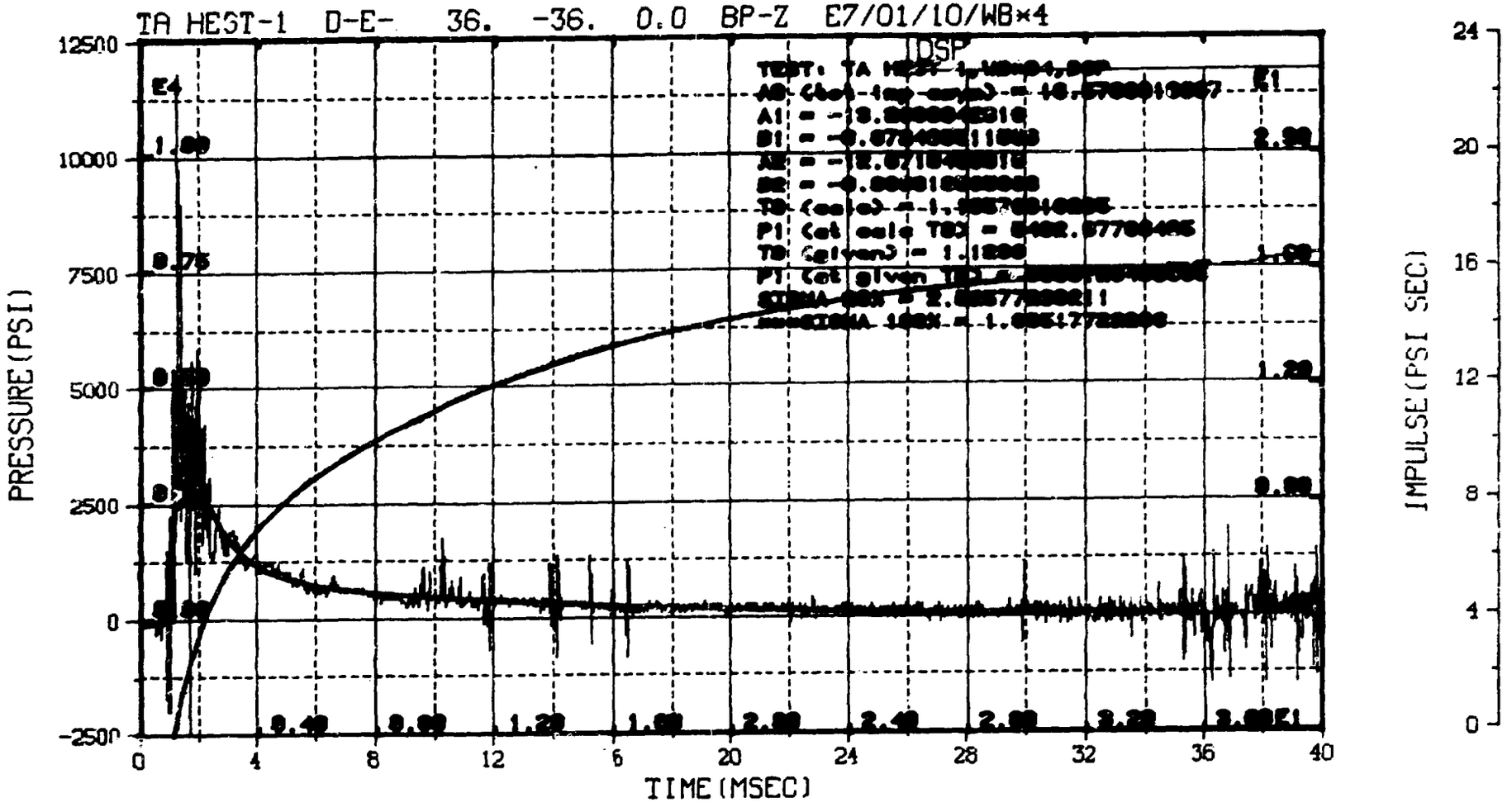
M.N. =80004	E.U. =-0.000,28698.000	VSN=
TSKIP=10.350	DIGITS=-0.000,1510.500	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=3


X VS. RESIDUALS FOR: TA WEST 1,WB304,DSP
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
0.50
1.00
1.50
2.

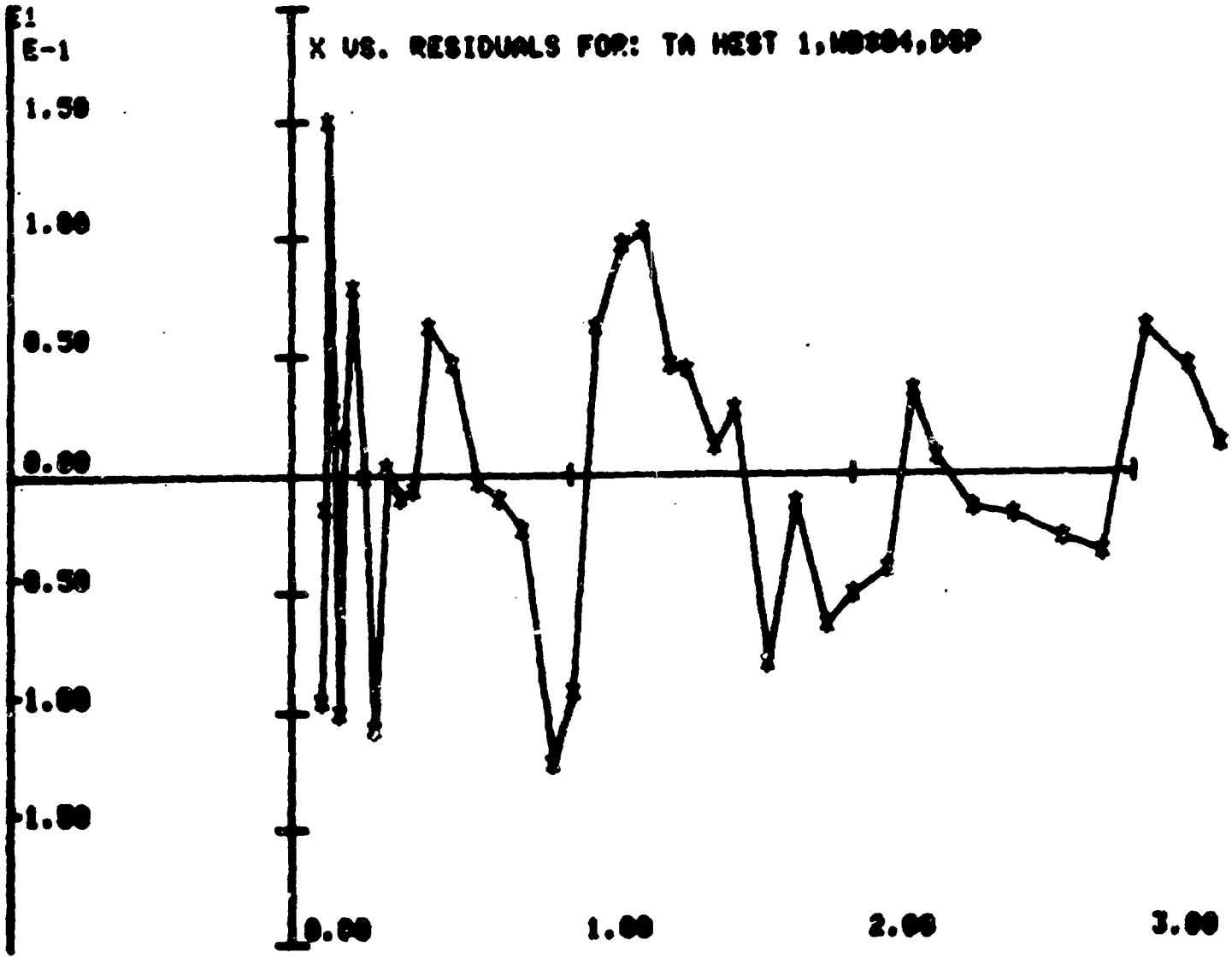


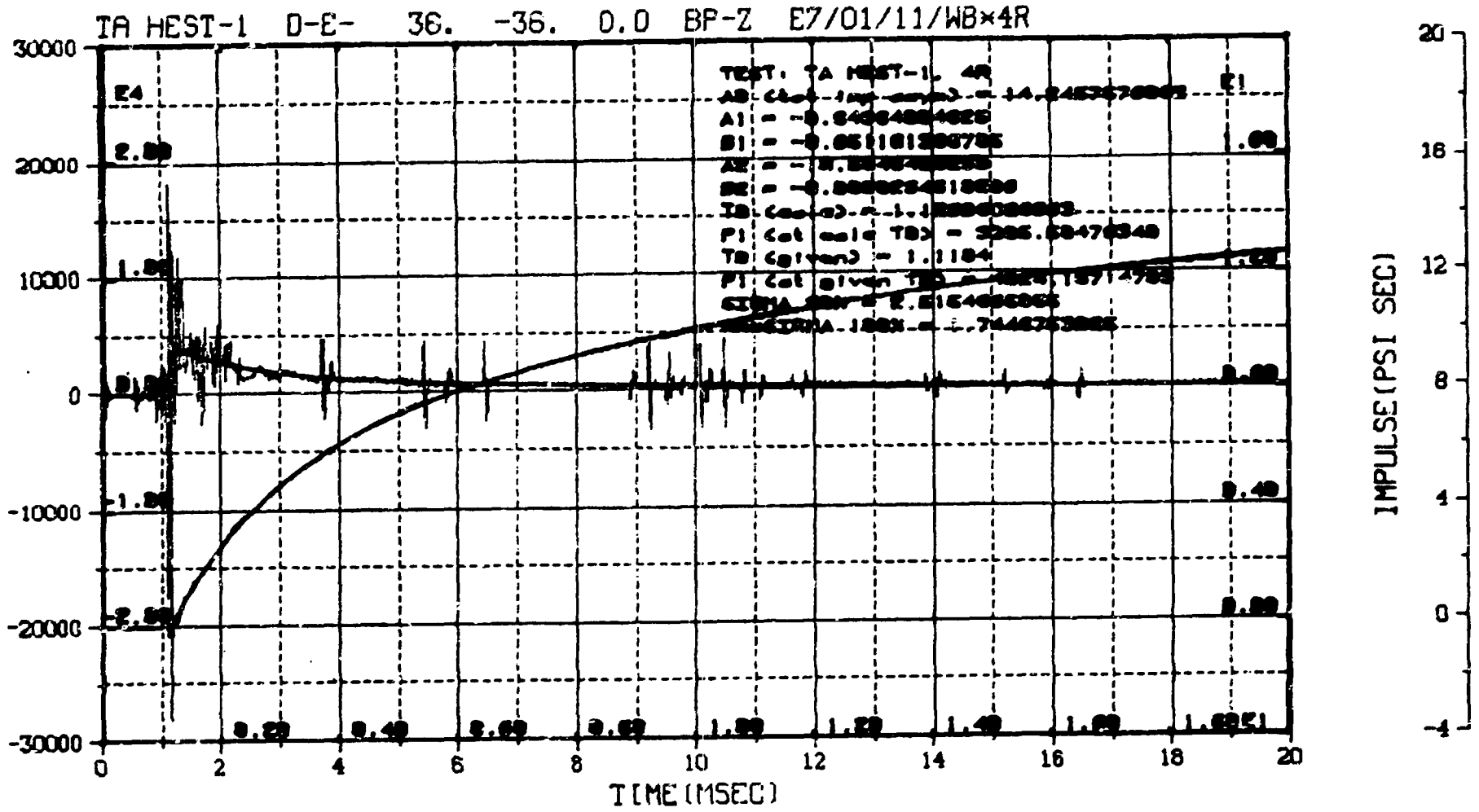
M.N. = 4	E.U. -0.000,28698.000	VSN=BD54
TSKIP=10.350	DIGITS-0.000,1510.500	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=16


E1
E-1
X VS. RESIDUALS FOR: TA MEST-1, 4
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00



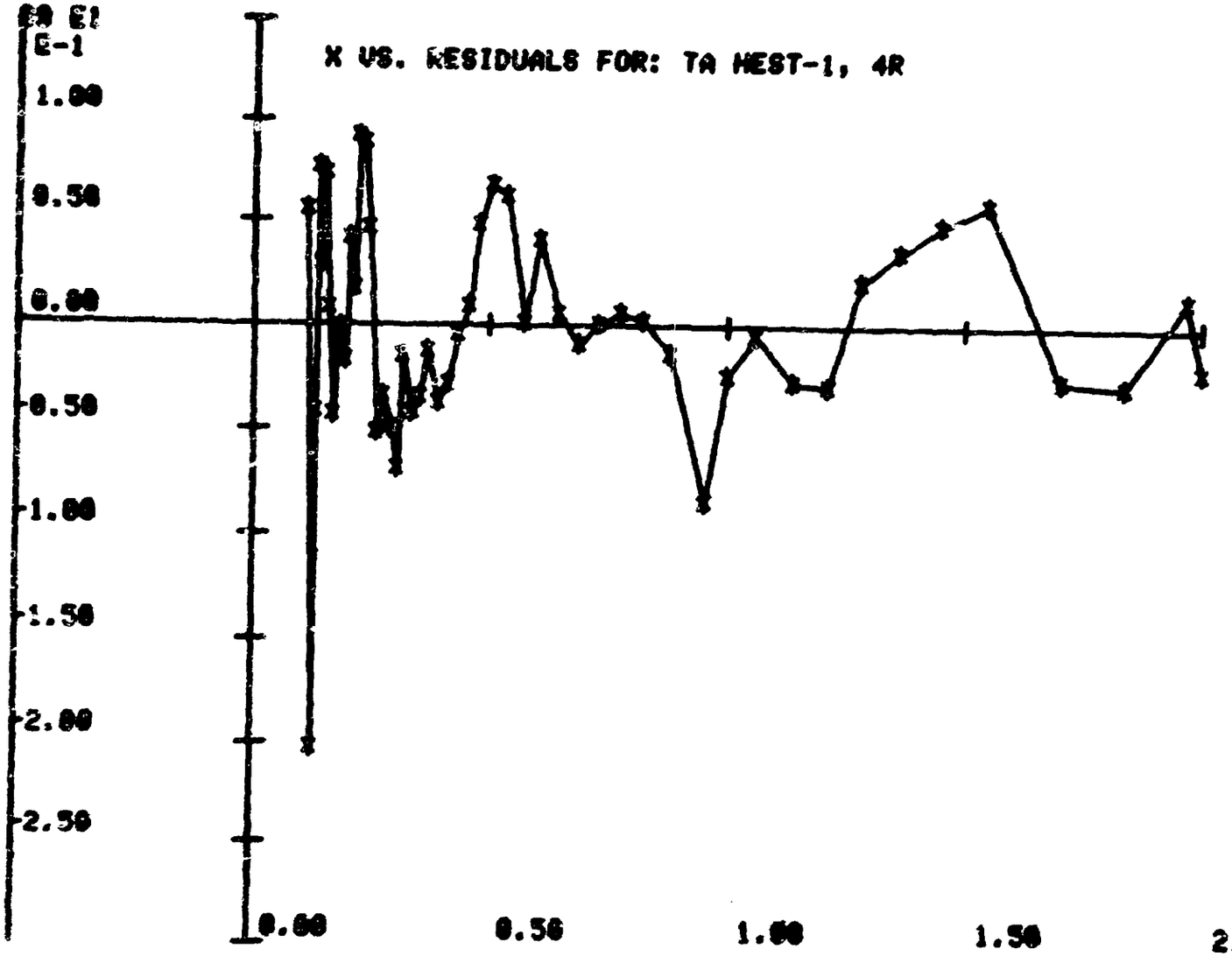
M.N. =80004	E.U. =0.000,28698.000	VSN=
TSKIP=10.350	DIGITS=0.000,1510.500	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=3

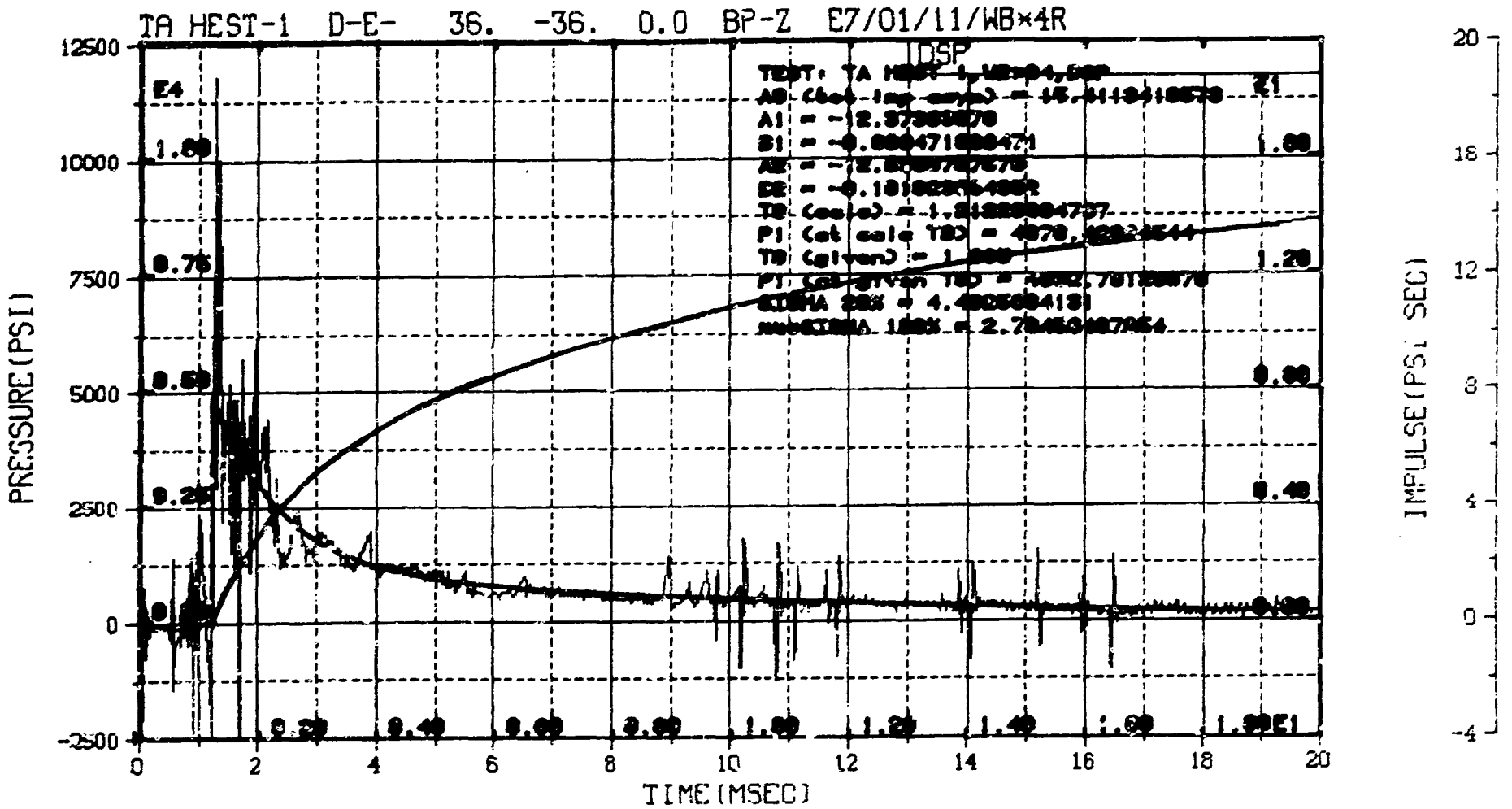

E1
E-1
X VS. RESIDUALS FOR: TA WEST 1,WB284,DSP
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00



M.N. = 4	E.U. =-0.000,28698.000	VSN=BU54
TSKIP=10.350	DIGITS=-0.000,1308.875	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=18

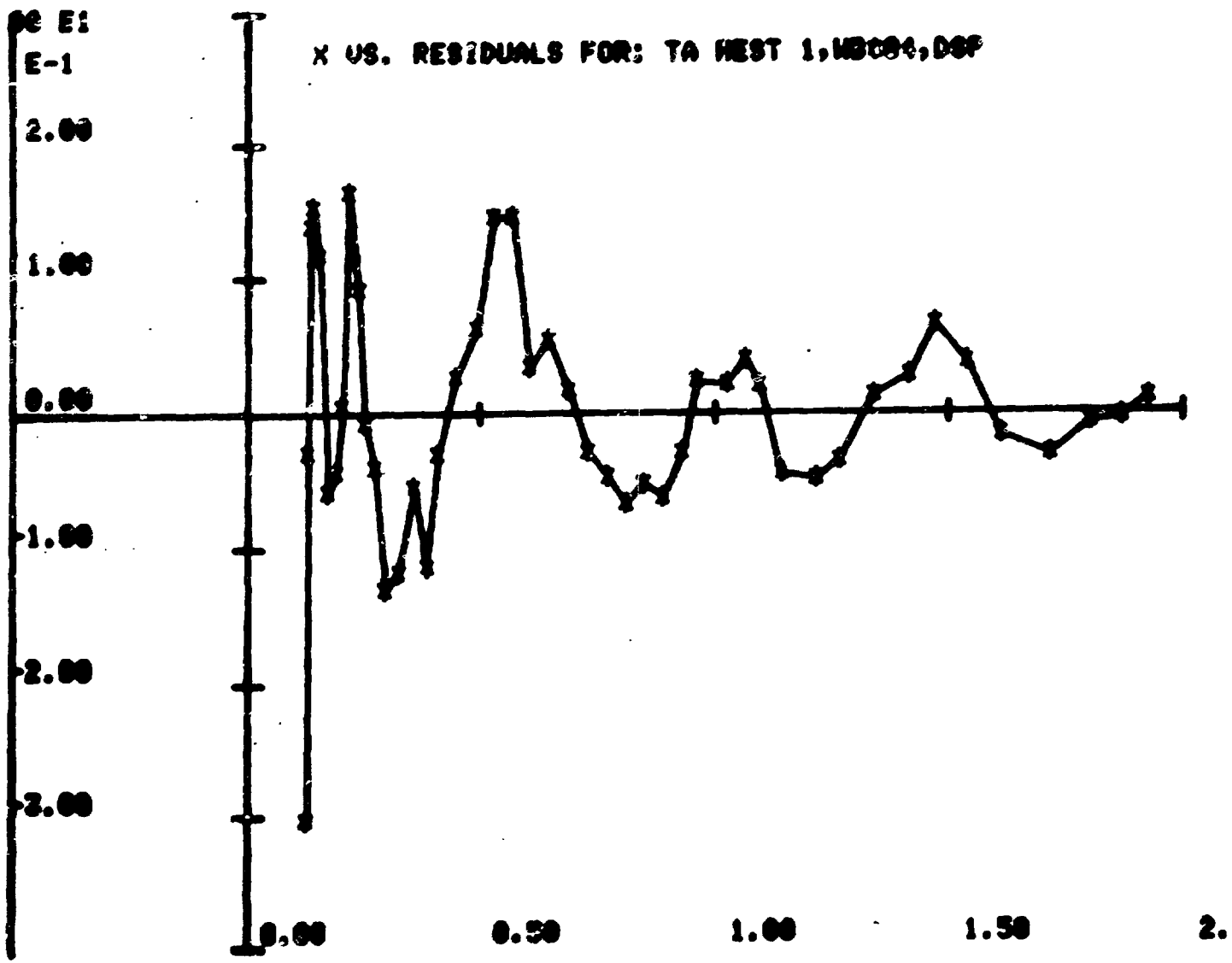
1

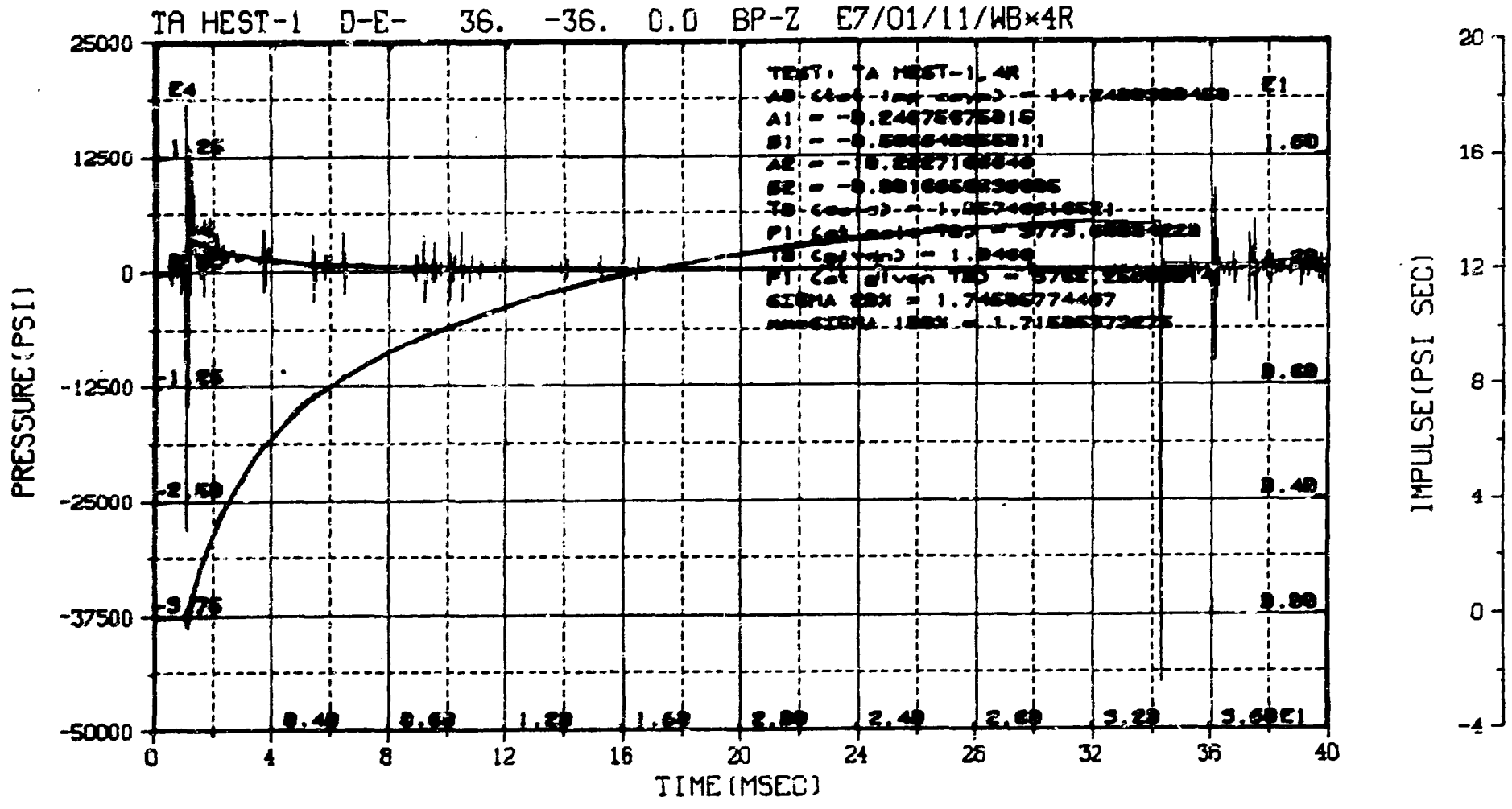

E-1
X VS. RESIDUALS FOR: TA HEST-1, 4R
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
0.00
0.50
1.00
1.50
2.



M.N. =80004	E.U. =0.000,20698.000	VSN=
TSKIP=10.350	DIGITS=0.000,1308.875	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=4

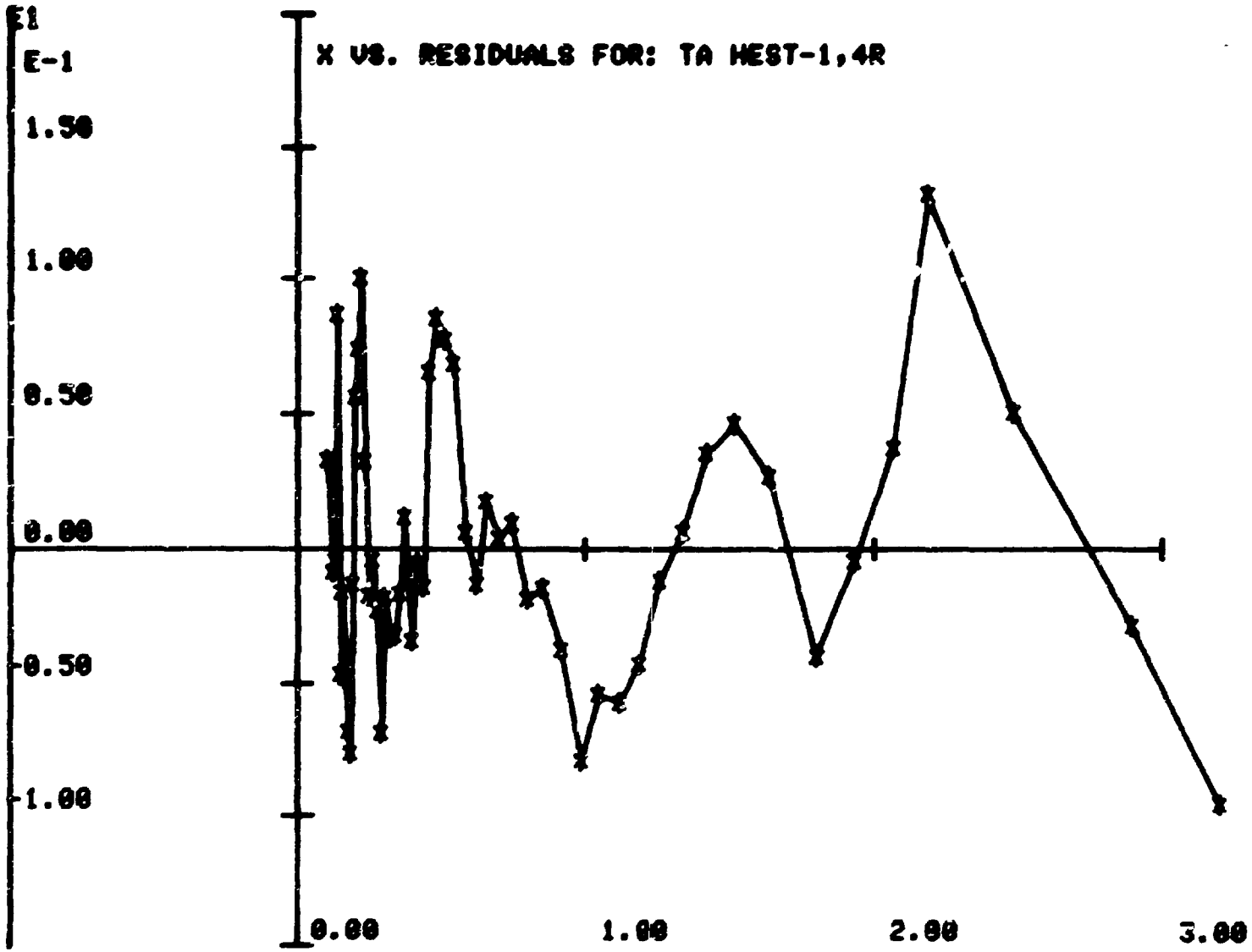
1

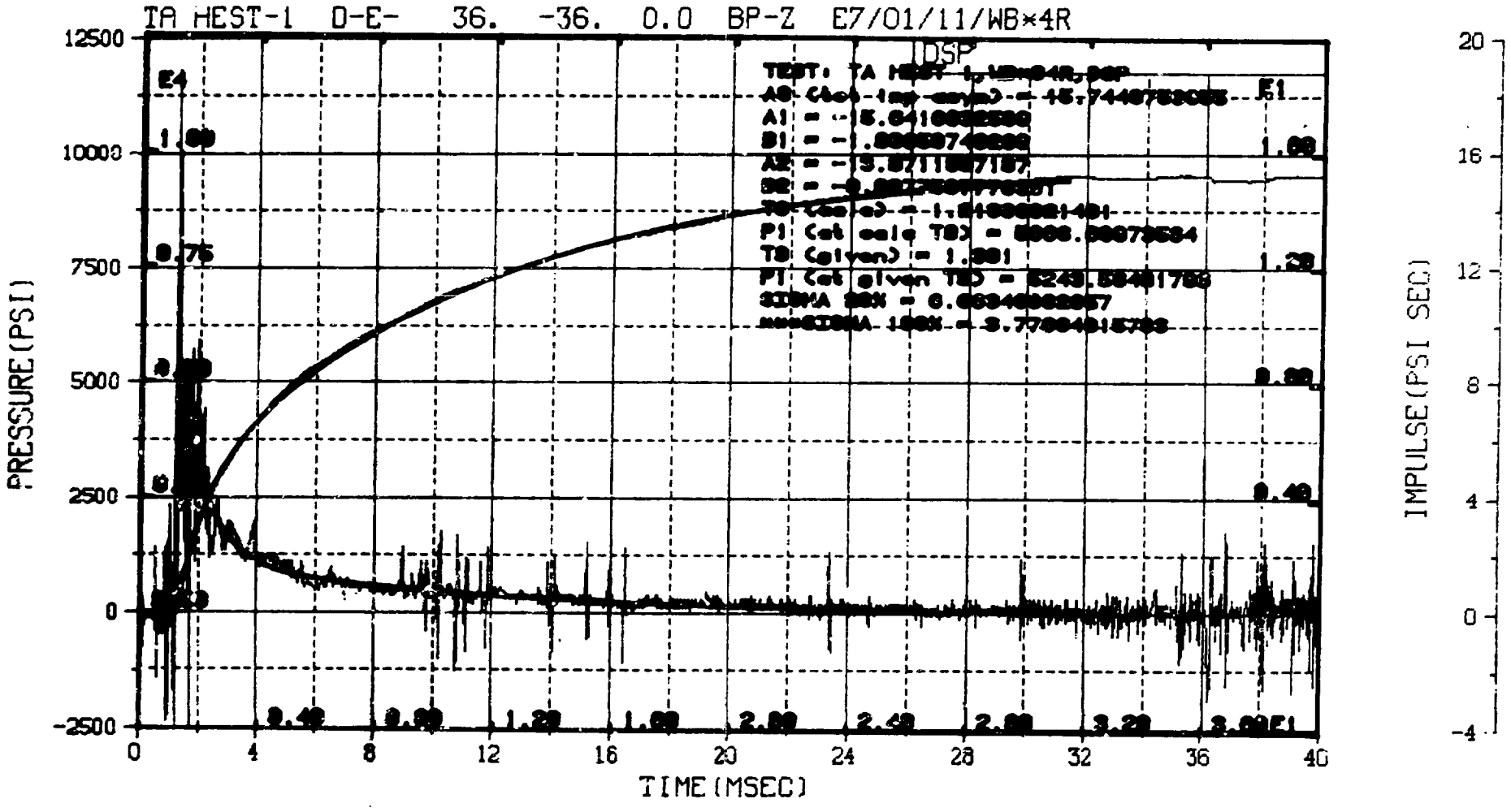

X VS. RESIDUALS FOR: TA WEST 1,WBC04,DSF
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.



M.N. = 4	E.U. =0.000,28698.000	VSN=BD54
TSKIP=10.350	DIGITS=0.000,1308.875	TAPE22
S.R. =100.00 KHZ	2 40 PM, 6 MAR 78.	FILE=18

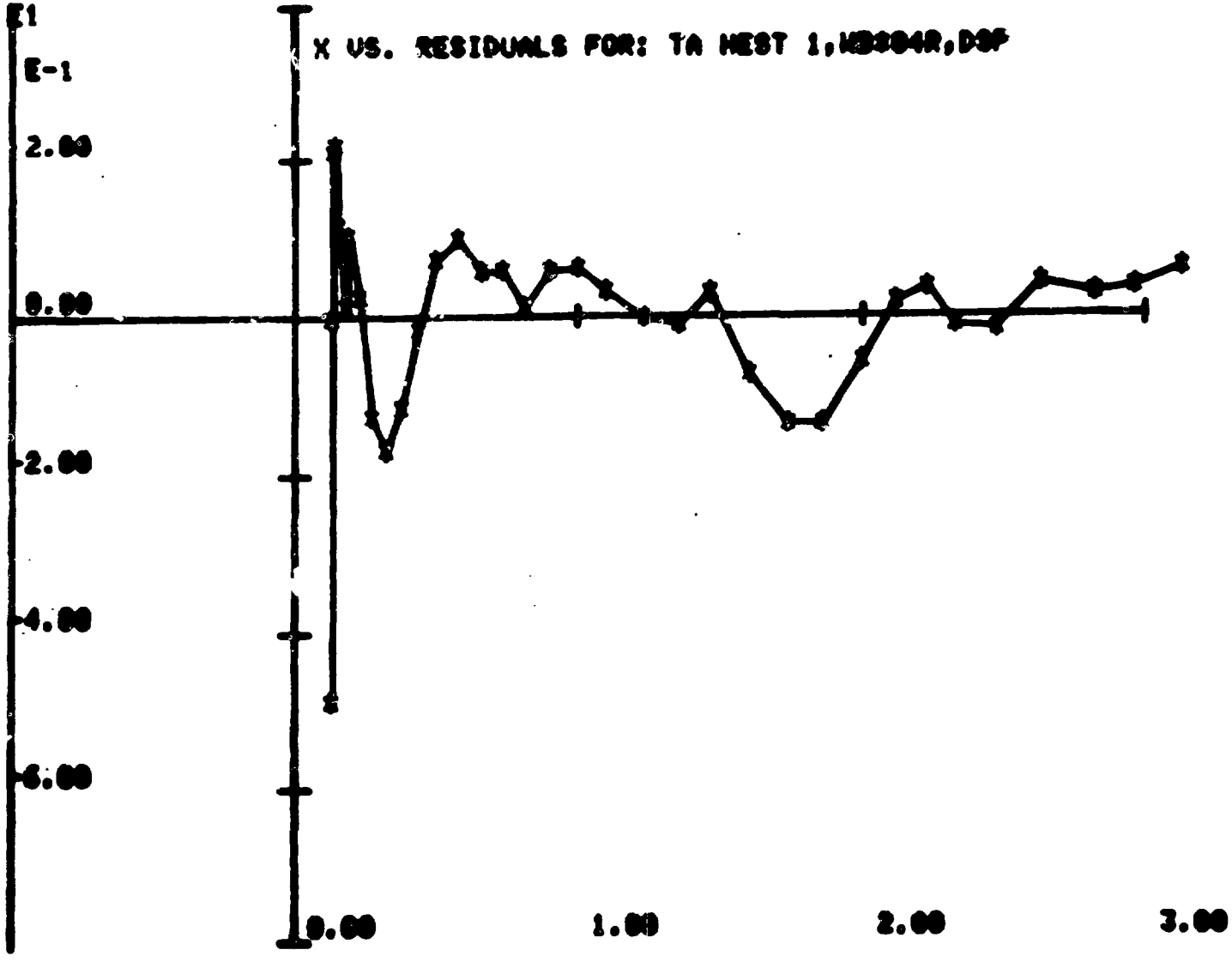
1

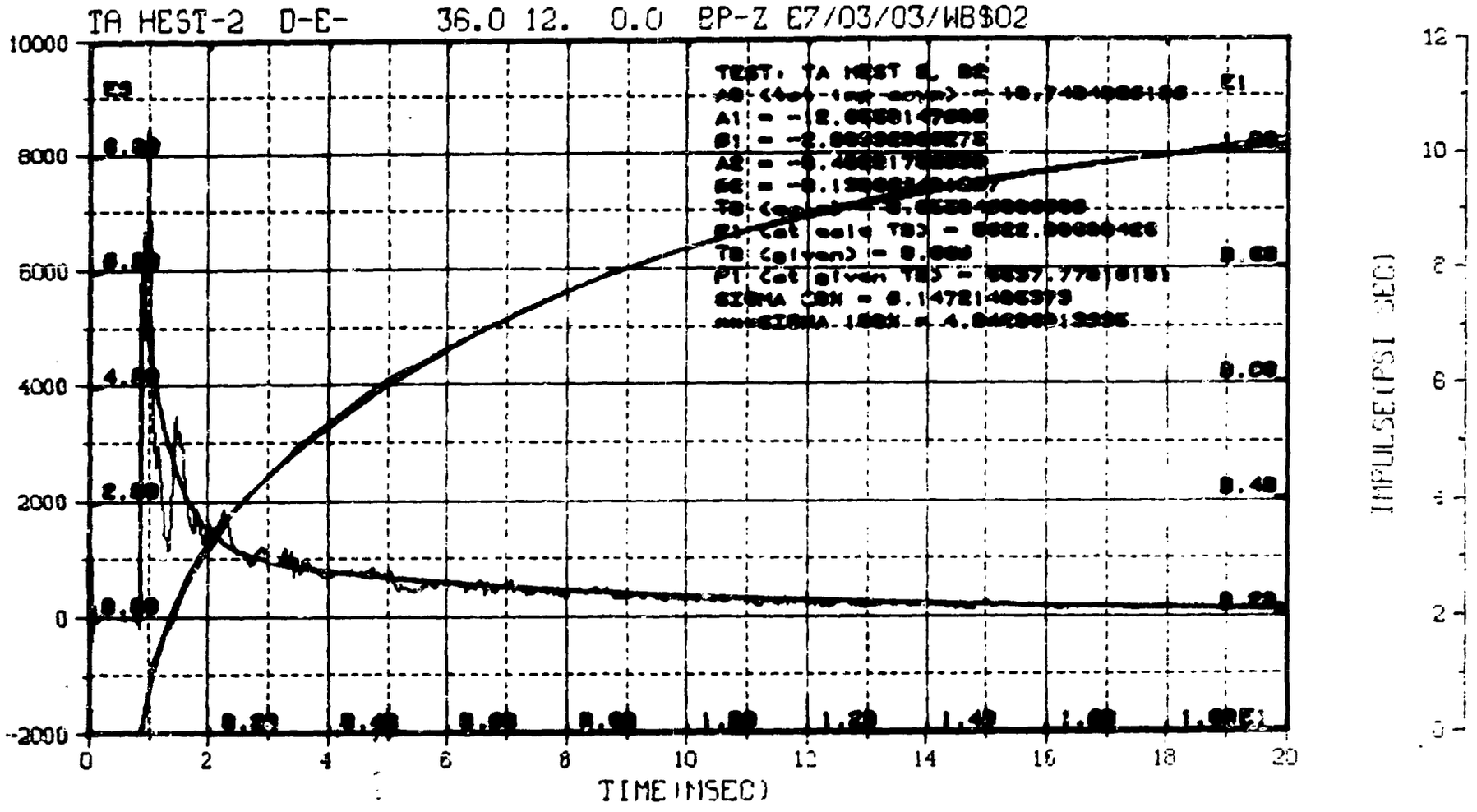

E1
E-1
X VS. RESIDUALS FOR: TA HEST-1,4R
1.50
1.00
0.50
0.00
-0.50
-1.00
0.00
1.00
2.00
3.00



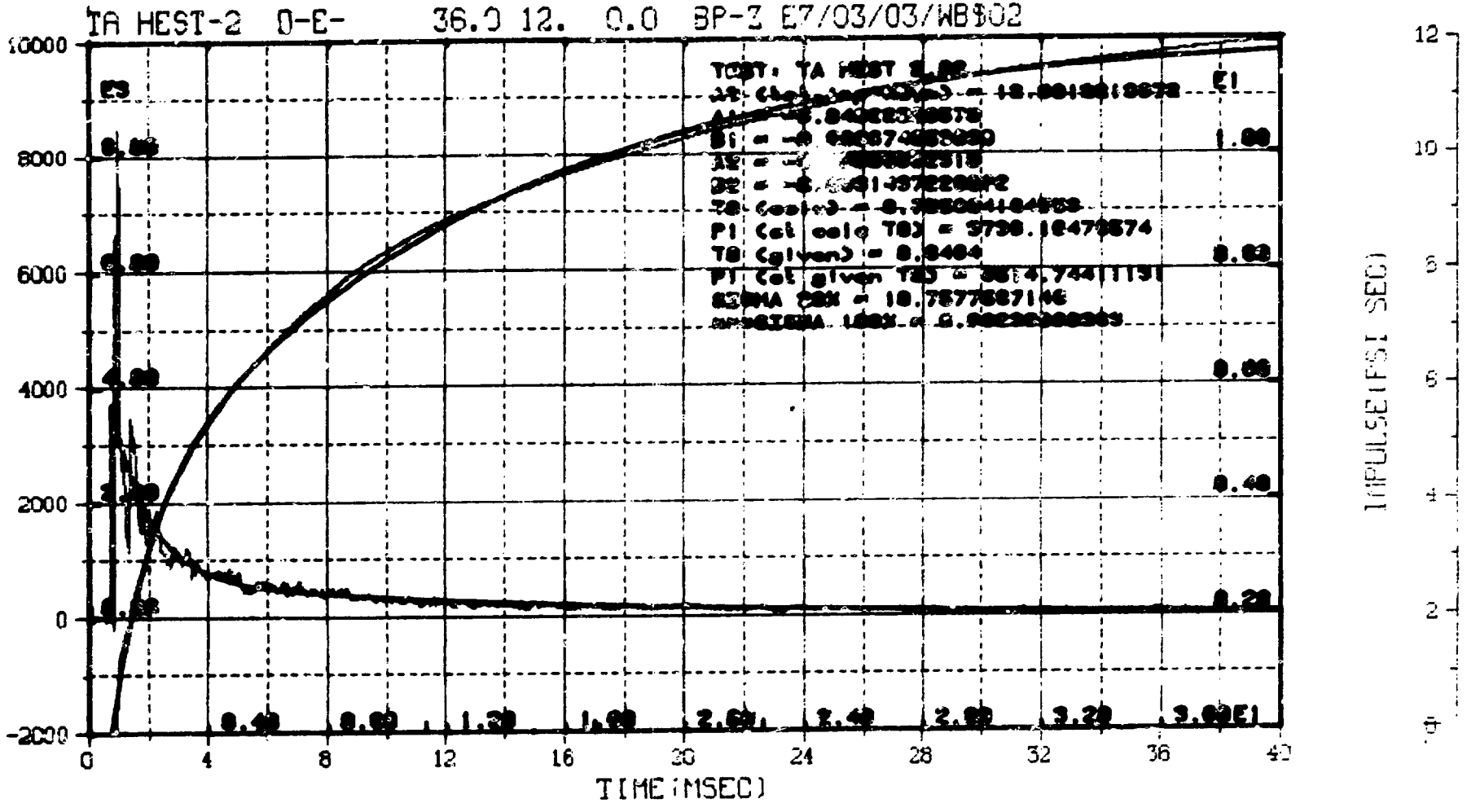
M.N. =80004	F.U. =0.000,28698.000	VSN=
TSKIP=10.350	DIGITS=0.000,1308.875	TAPE26
S.R. =50.00 KHZ	3 49 PM,11 APR 78.	FILE=4

1


E1
E-1
X VS. RESIDUALS FOR: TA WEST 1,WB004R,DOF
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00

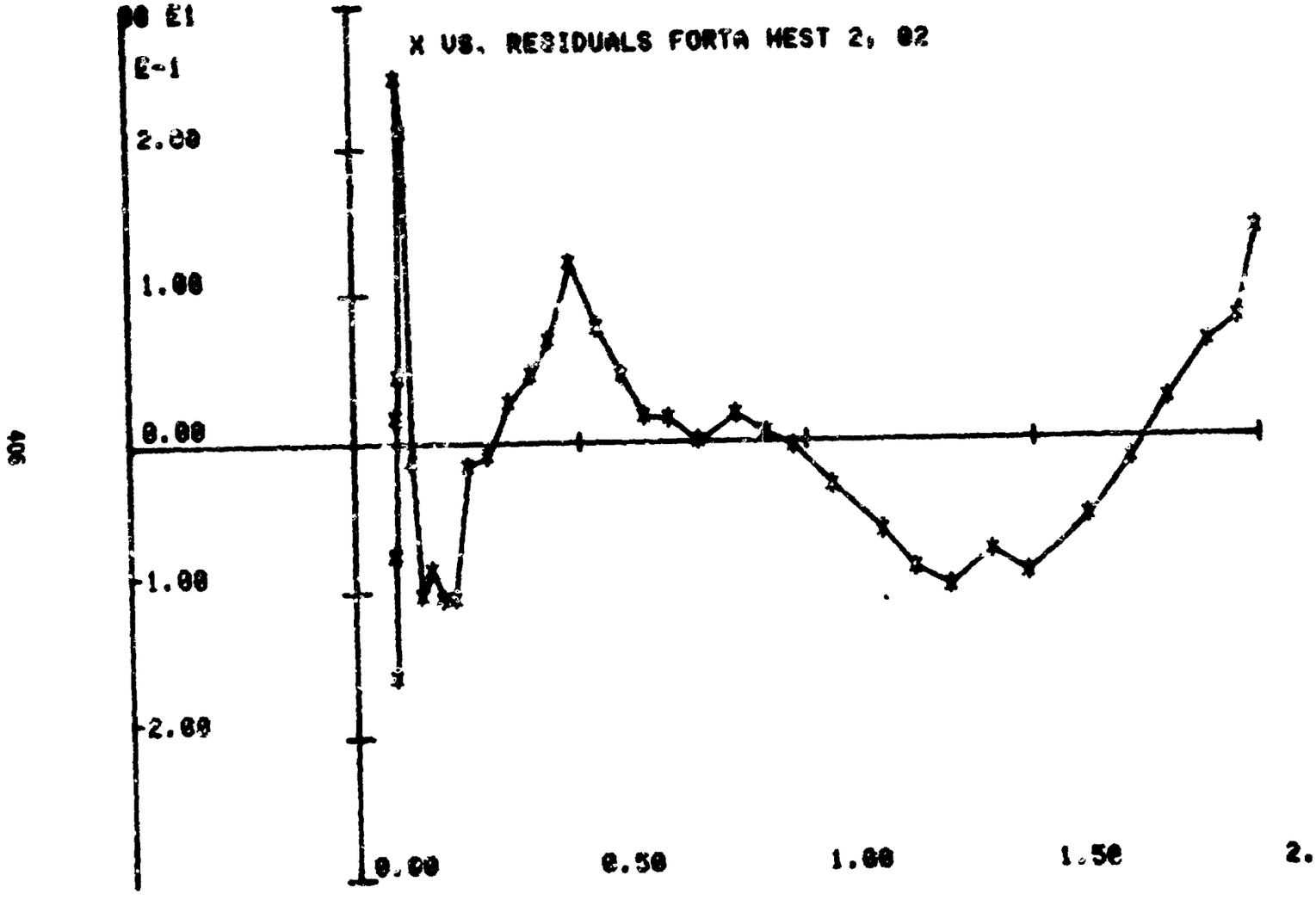


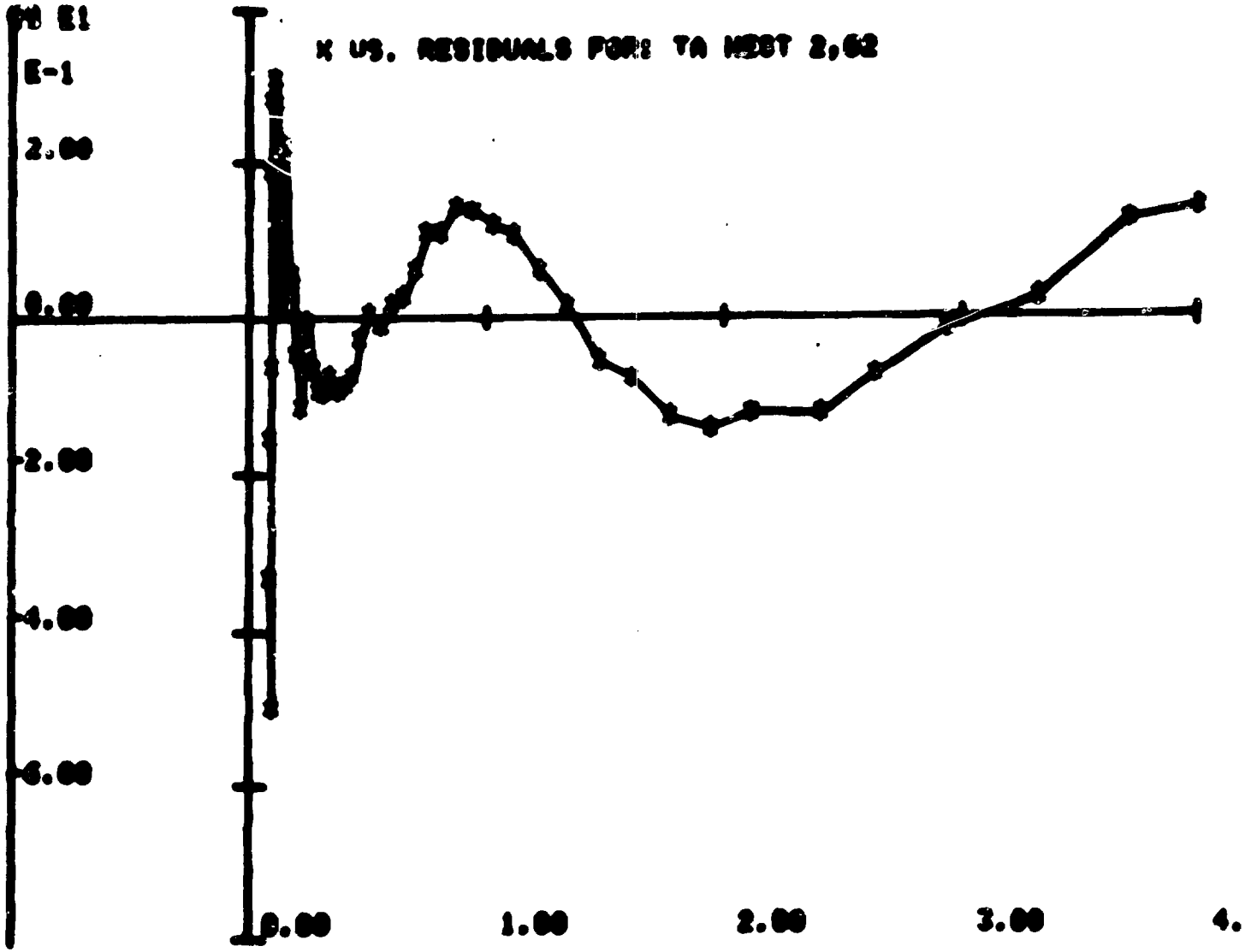
M.N. = 2	E.U. =0.000,5117.900	VSN=
TSKIP=15.100	DIGITS=0.000,976.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=42

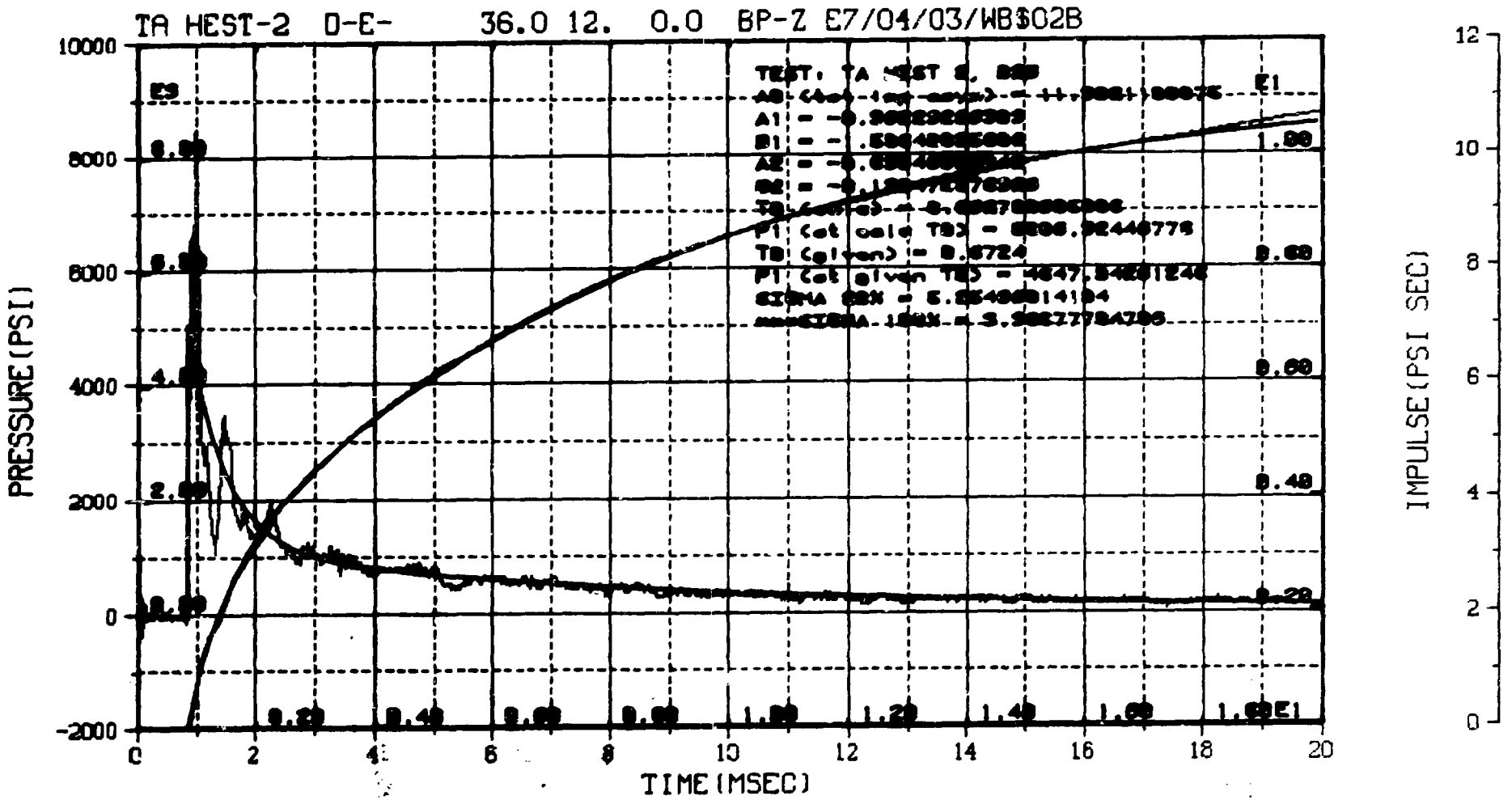


M.N. = 2	E.U. =0.000,5117.900	VSN=
TSKIP=15.100	DIGITS=0.000,976.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=42

1

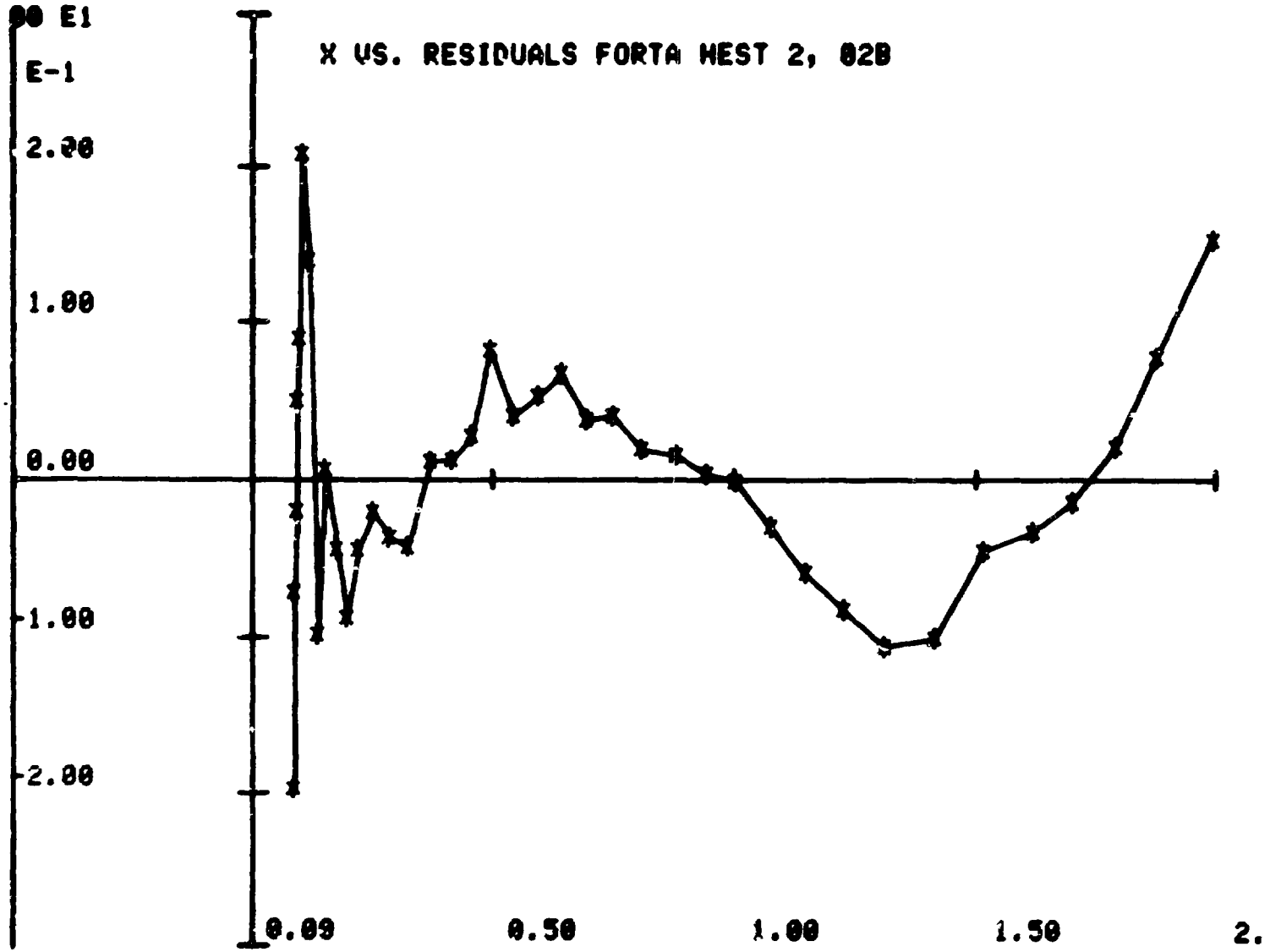

X VS. RESIDUALS FORTA MEST 2, 02
E1
E-1
2.00
1.00
0.00
1.00
2.00
0.00
0.50
1.00
1.50
2.

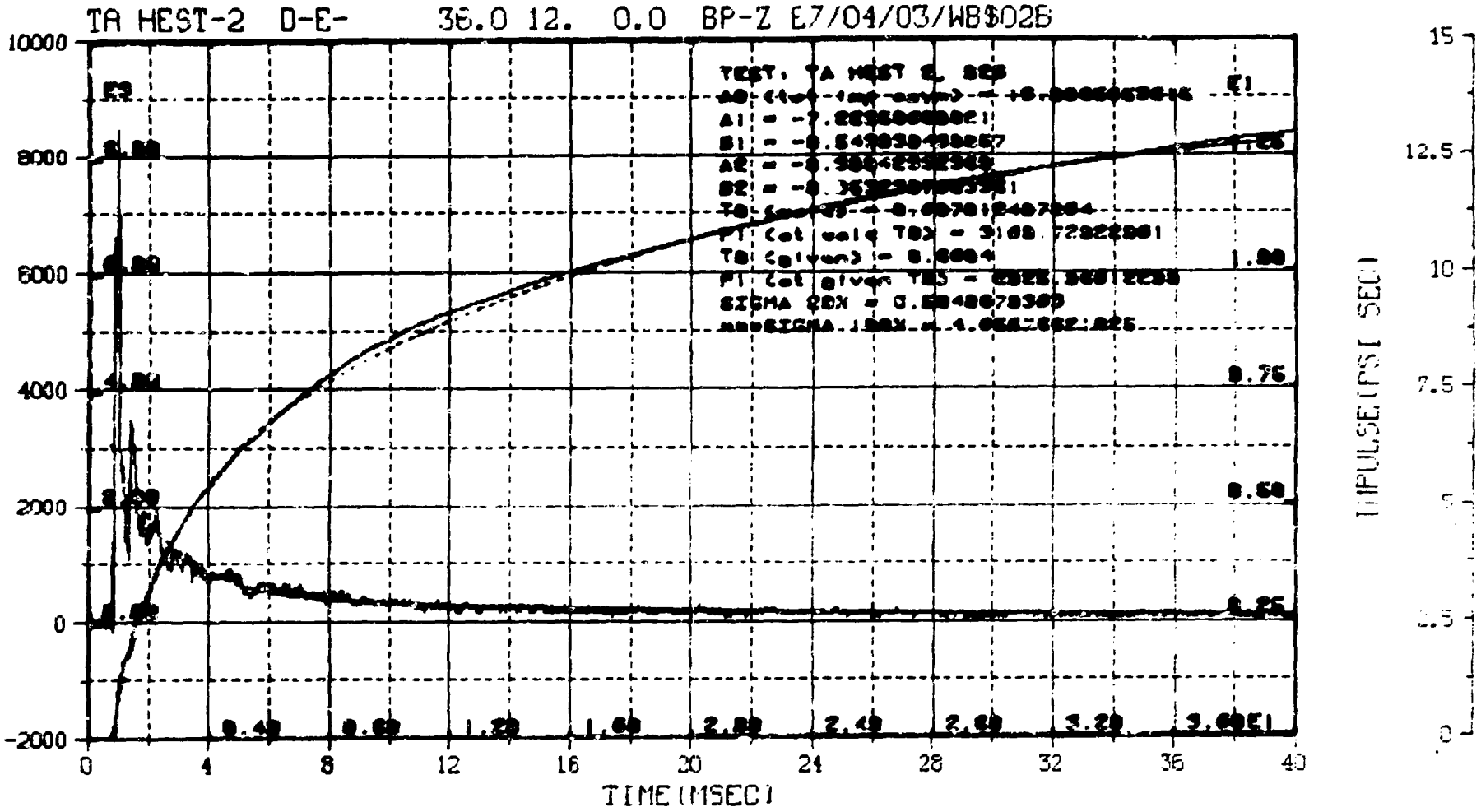

X VS. RESIDUALS FOR: TA MEET 2,62
E-1
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.



M.N. - 2	E.U. -0.000,5117.900	VSN-
TSKIP-15.110	DIGITS-0.000,377.000	TAPE22
S.R. -100.00 KHZ	9:00 AM, 29 MAR 78.	FILE-58

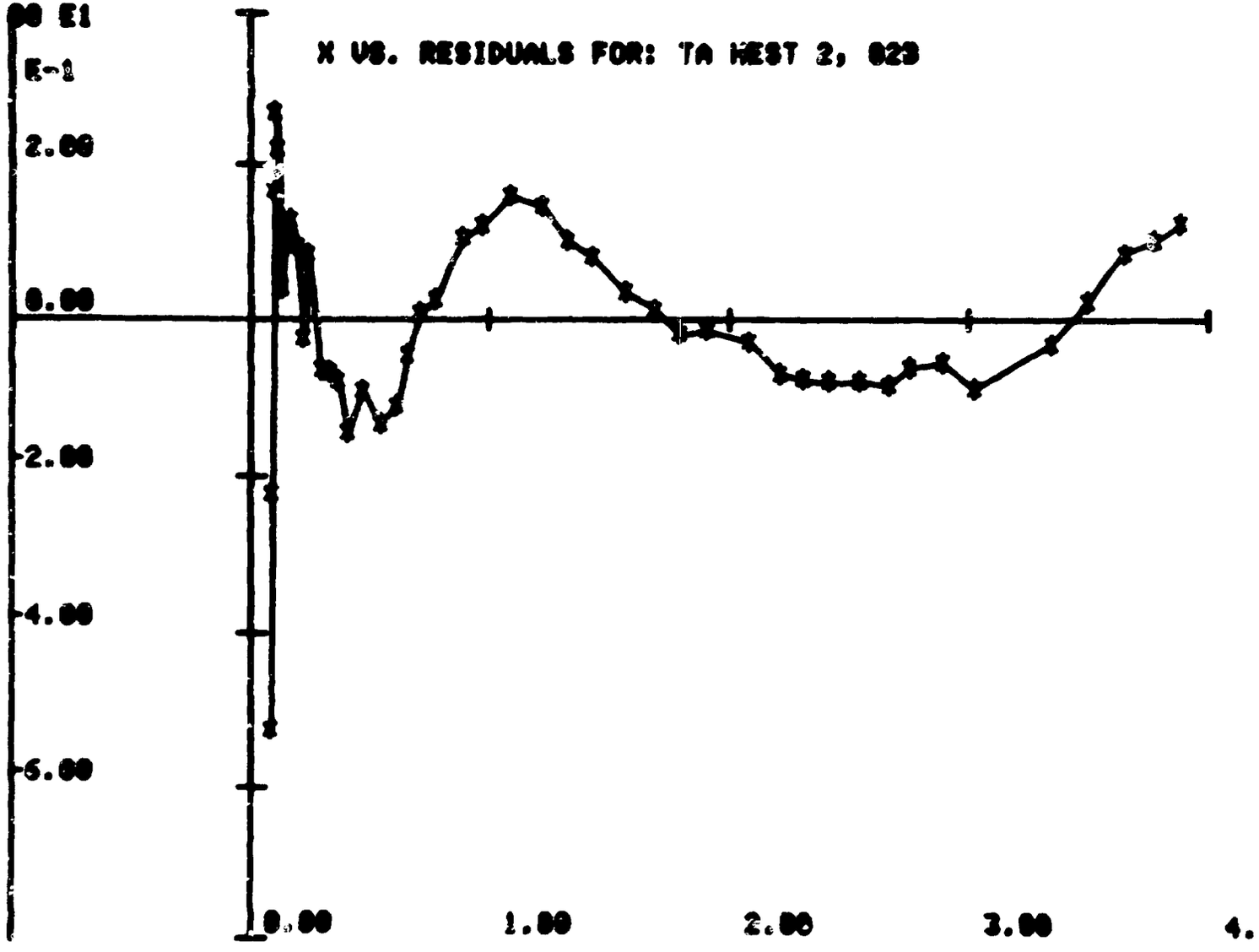
1

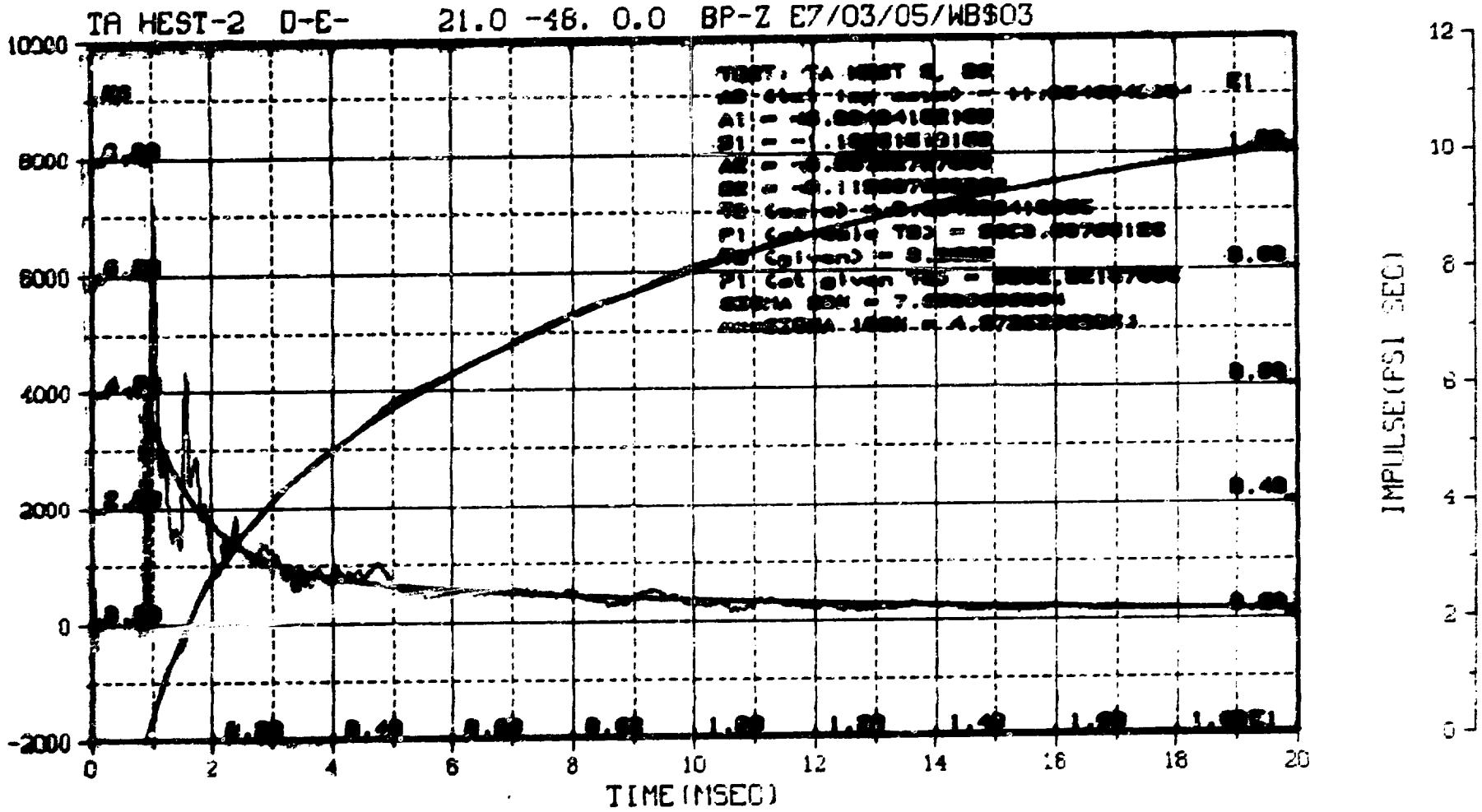

X VS. RESIDUALS FORTA WEST 2, 82B
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



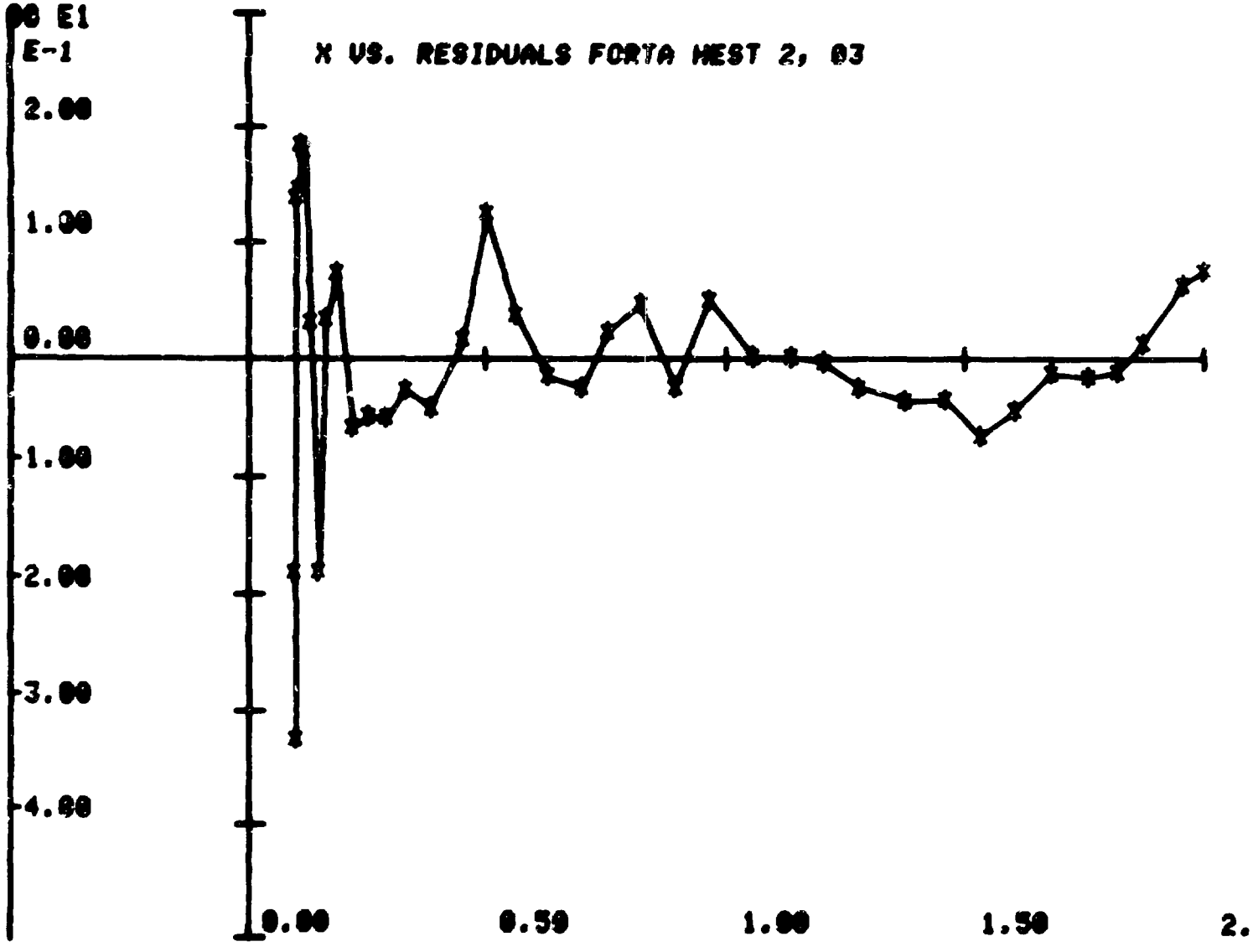
M.N. = 2	E.U. =0.000,5117.900	VSN=
TSKIP=15.110	DIGITS=0.000,377.000	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=58

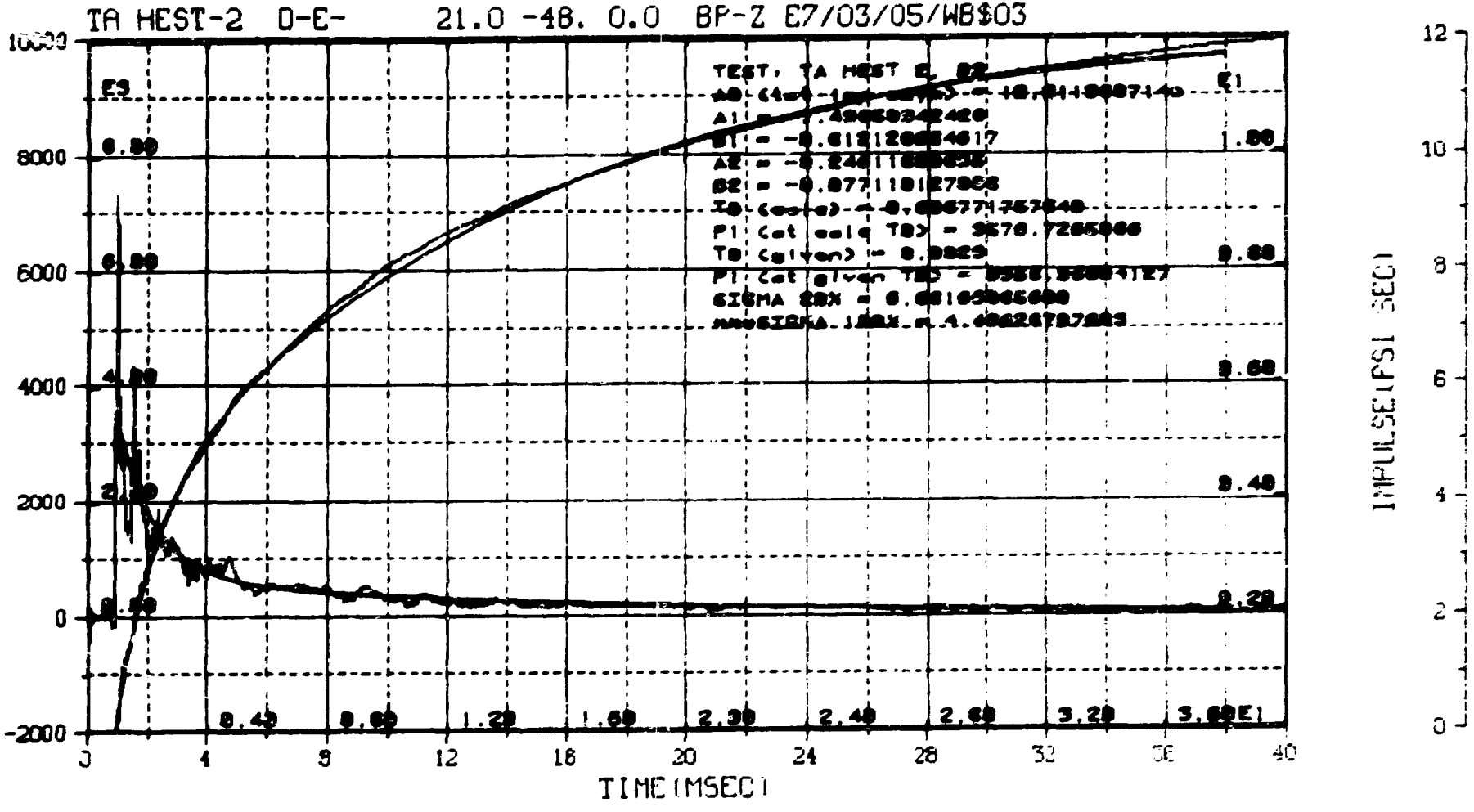
1


X VS. RESIDUALS FOR: TA WEST 2, 823
E-1
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.

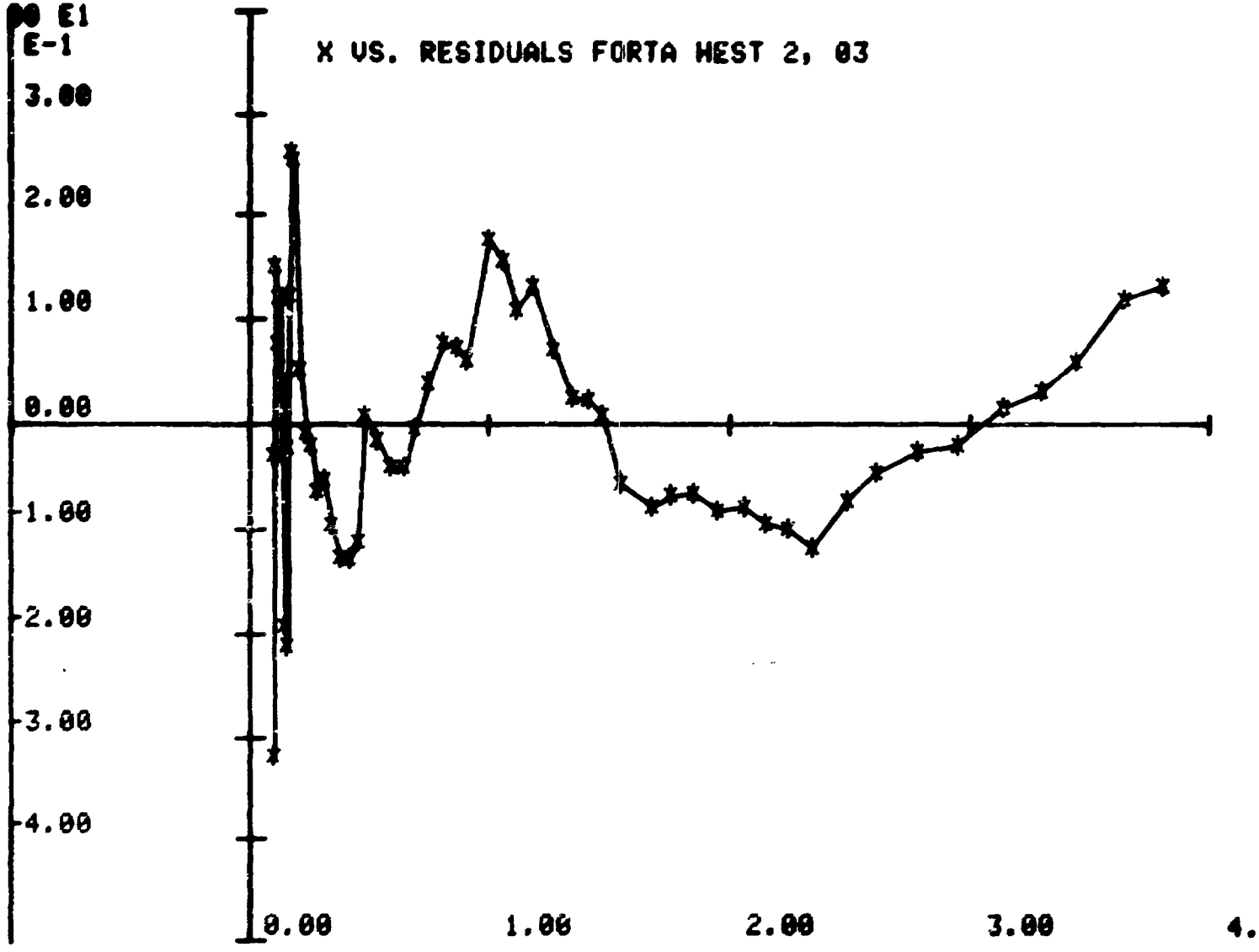


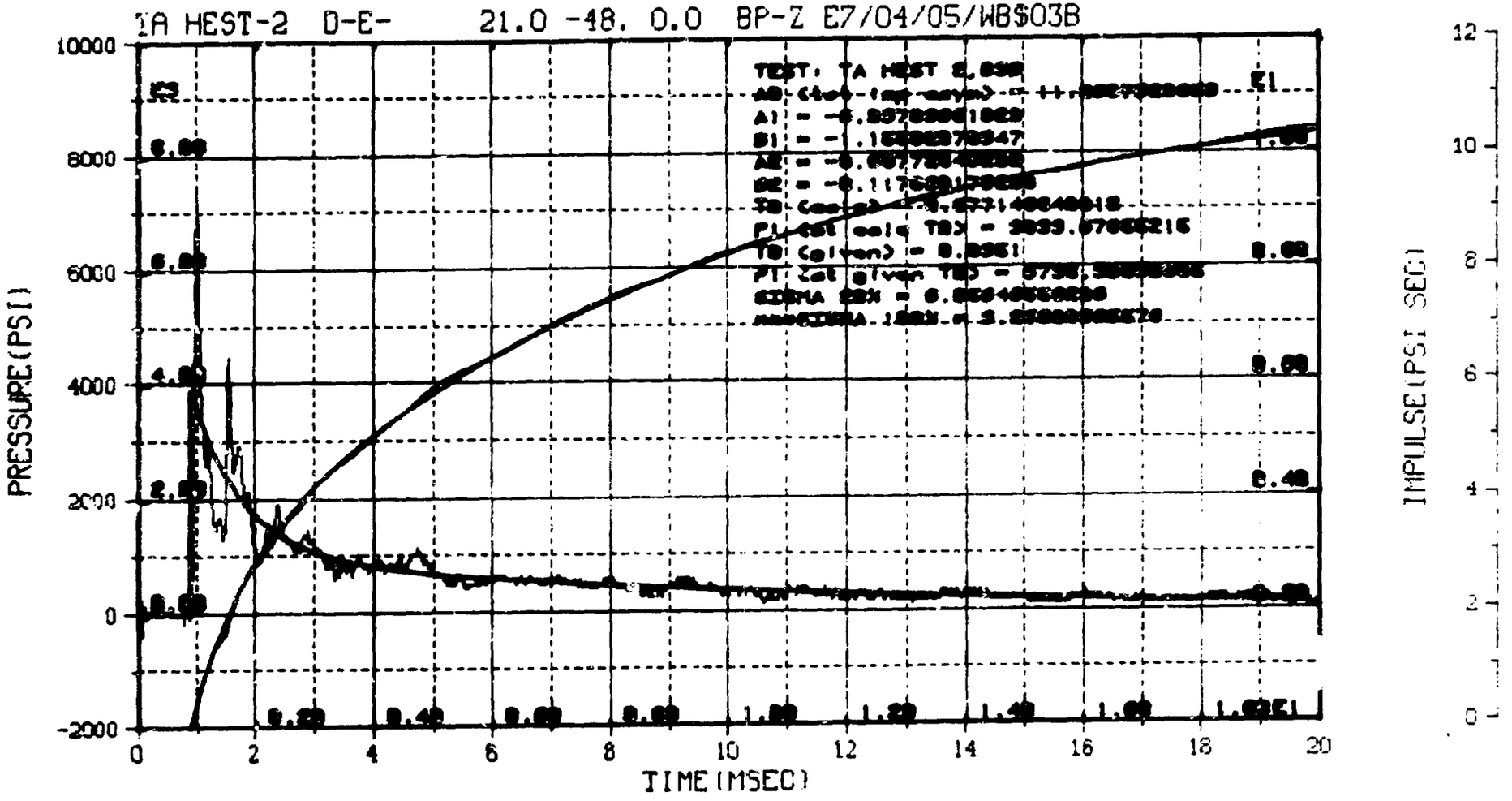
M.N. = 3	E.U. =0.000,5352.100	VSN=
TSKIP=15.100	DIGITS=0.000,729.500	TAPE22
S.R. =100.00 KHZ	10 04 PM,28 MAR 78.	FILE=44


X VS. RESIDUALS FORTA MEST 2, 03
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.

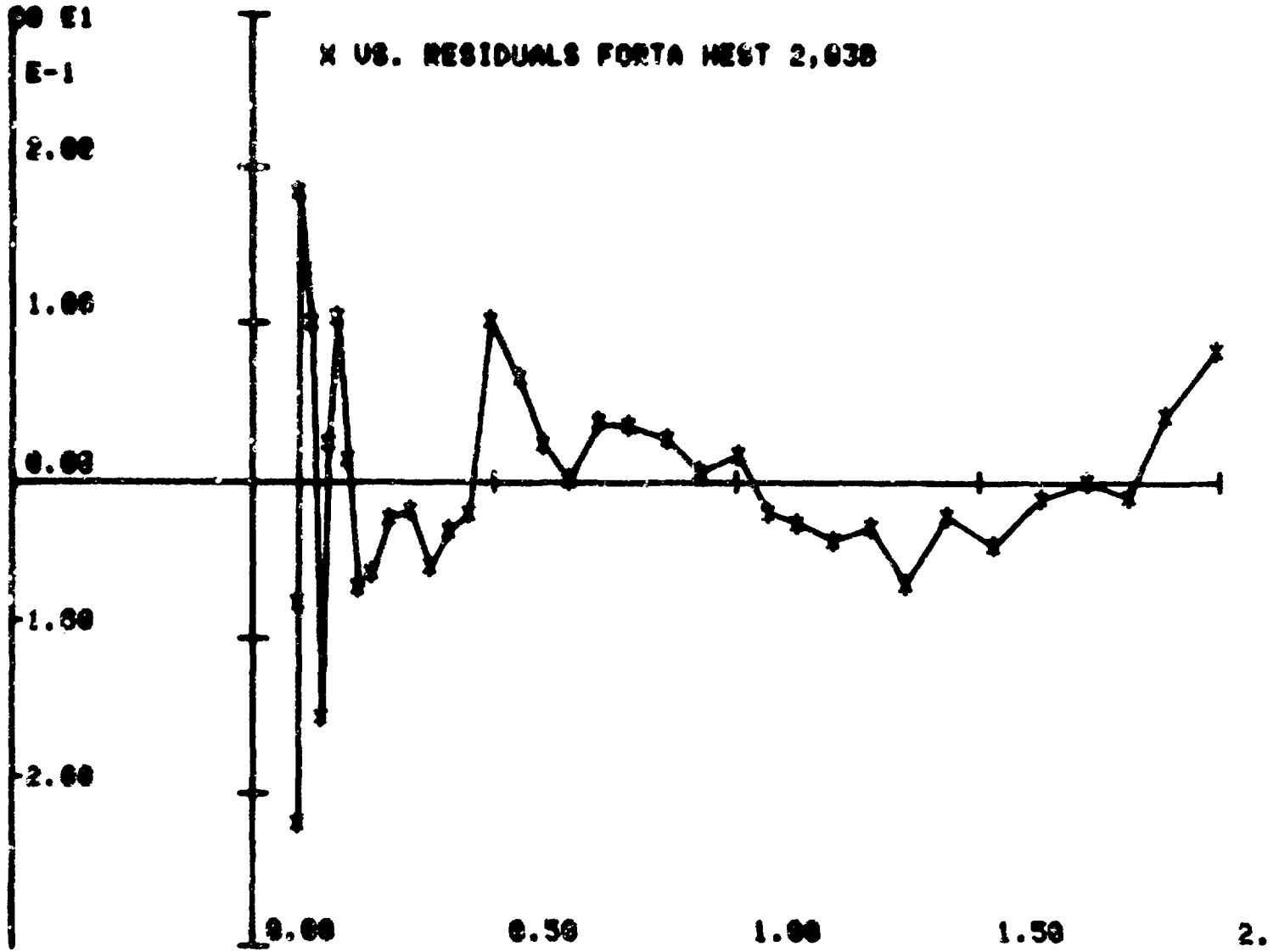


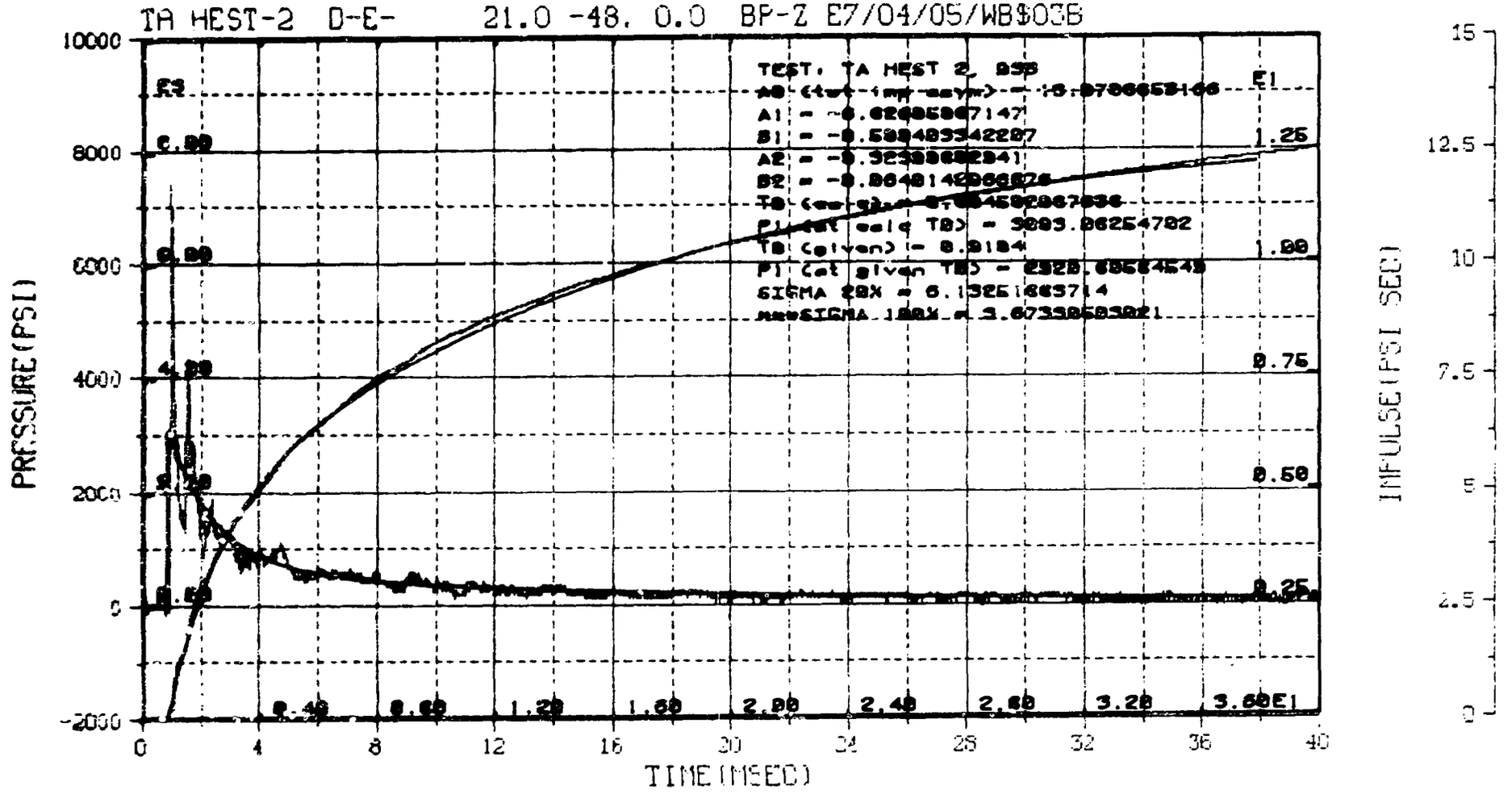
M.N. = 3	E.U. =0.000,5352.100	VSN=
TSKIP=15.100	DIGITS=0.000,729.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=44


E1
E-1
X VS. RESIDUALS FORTA HEST 2, 03
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.



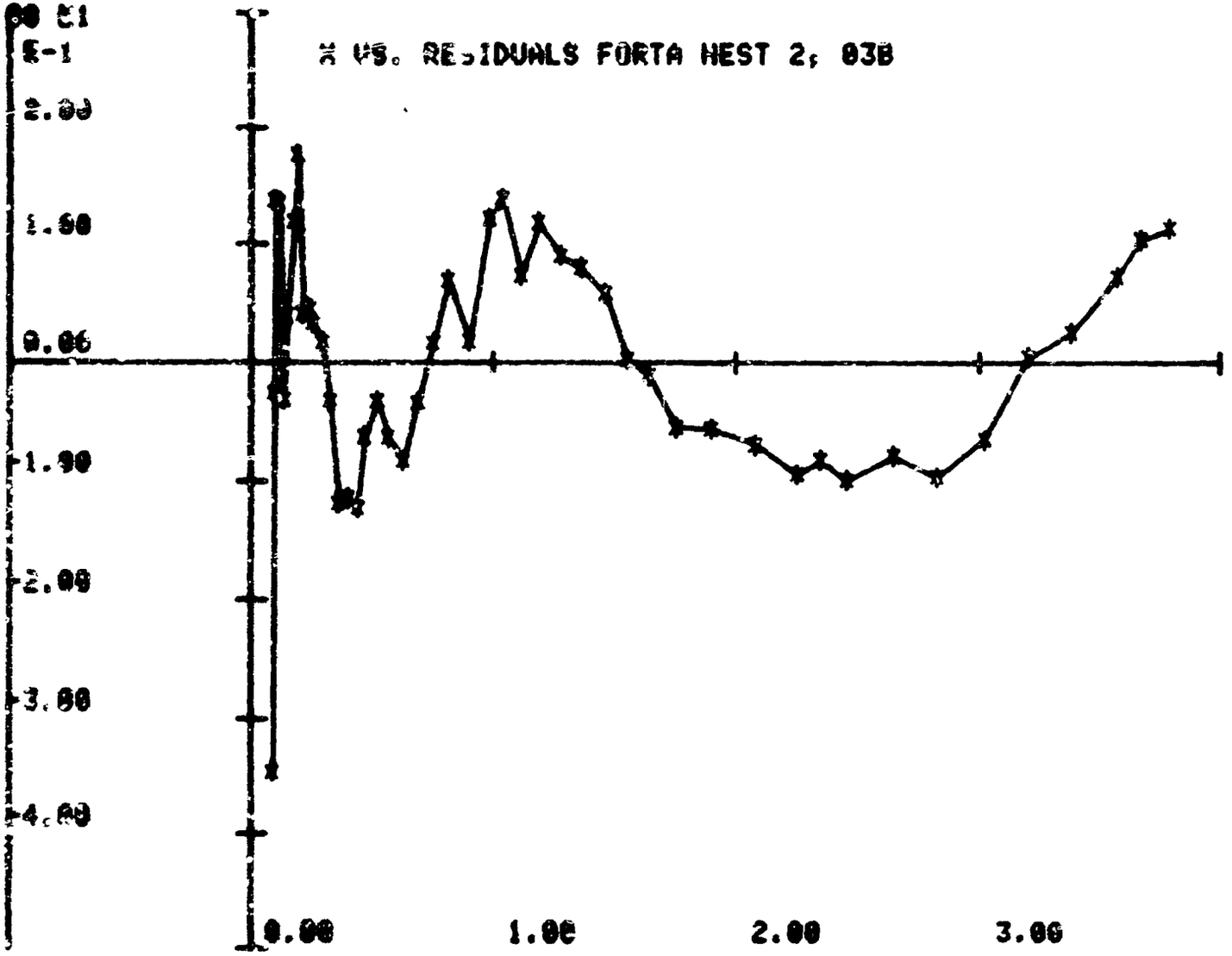
M.N. = 3	E.U. =0.000,5352.100	VSN=
TSKIP=15.110	DIGITS=0.000,290.500	TAPE22
S.R. =100.00 KHZ	9 00 AM, 29 MAR 78.	FILE=60

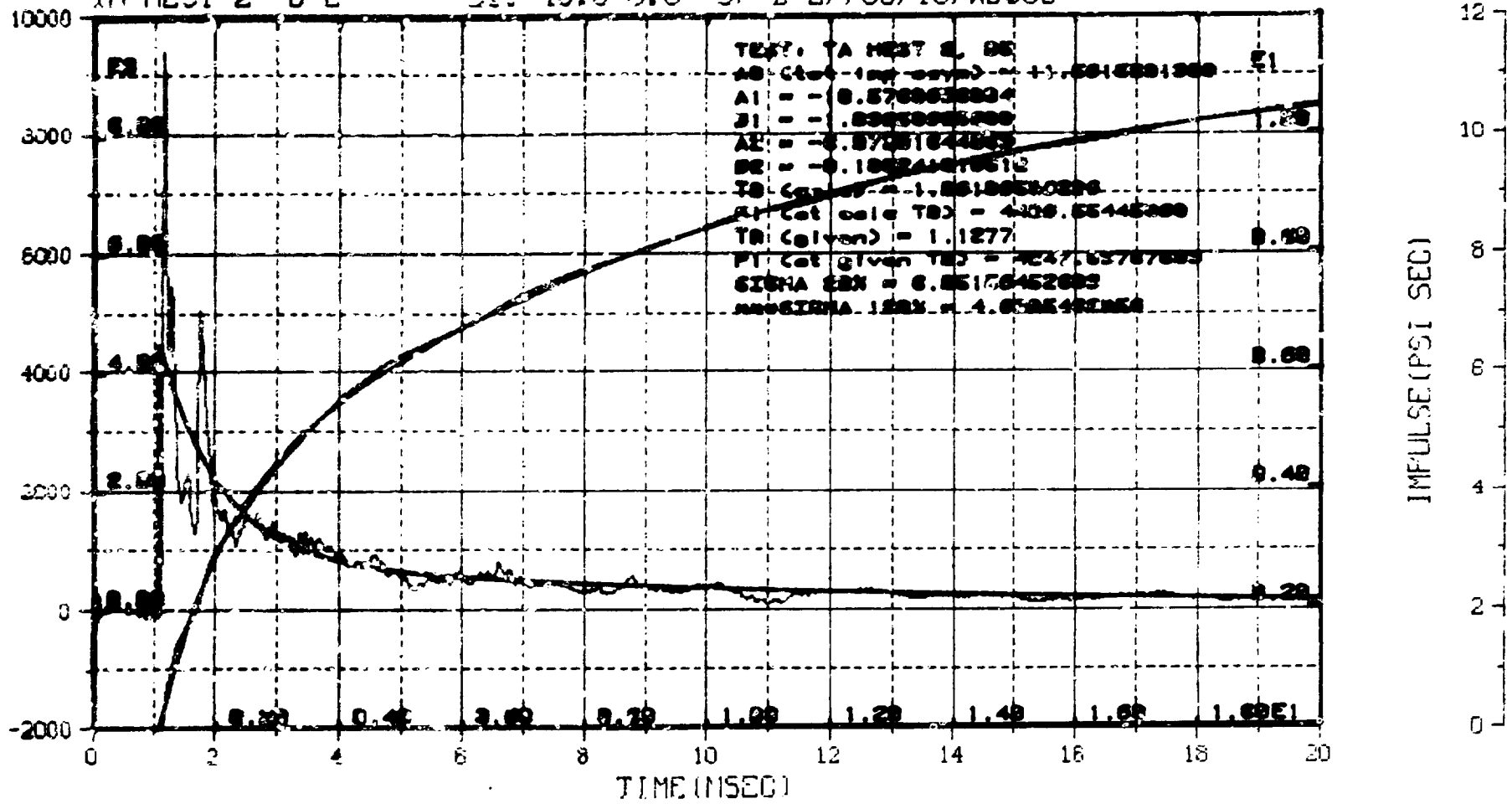

X VS. RESIDUALS FORTA WEST 2,038
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



M.N. = 3	E.U. =0.000,5352.100	VSN=
TSKIP=15.110	DIGITS=0.000,290.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=60

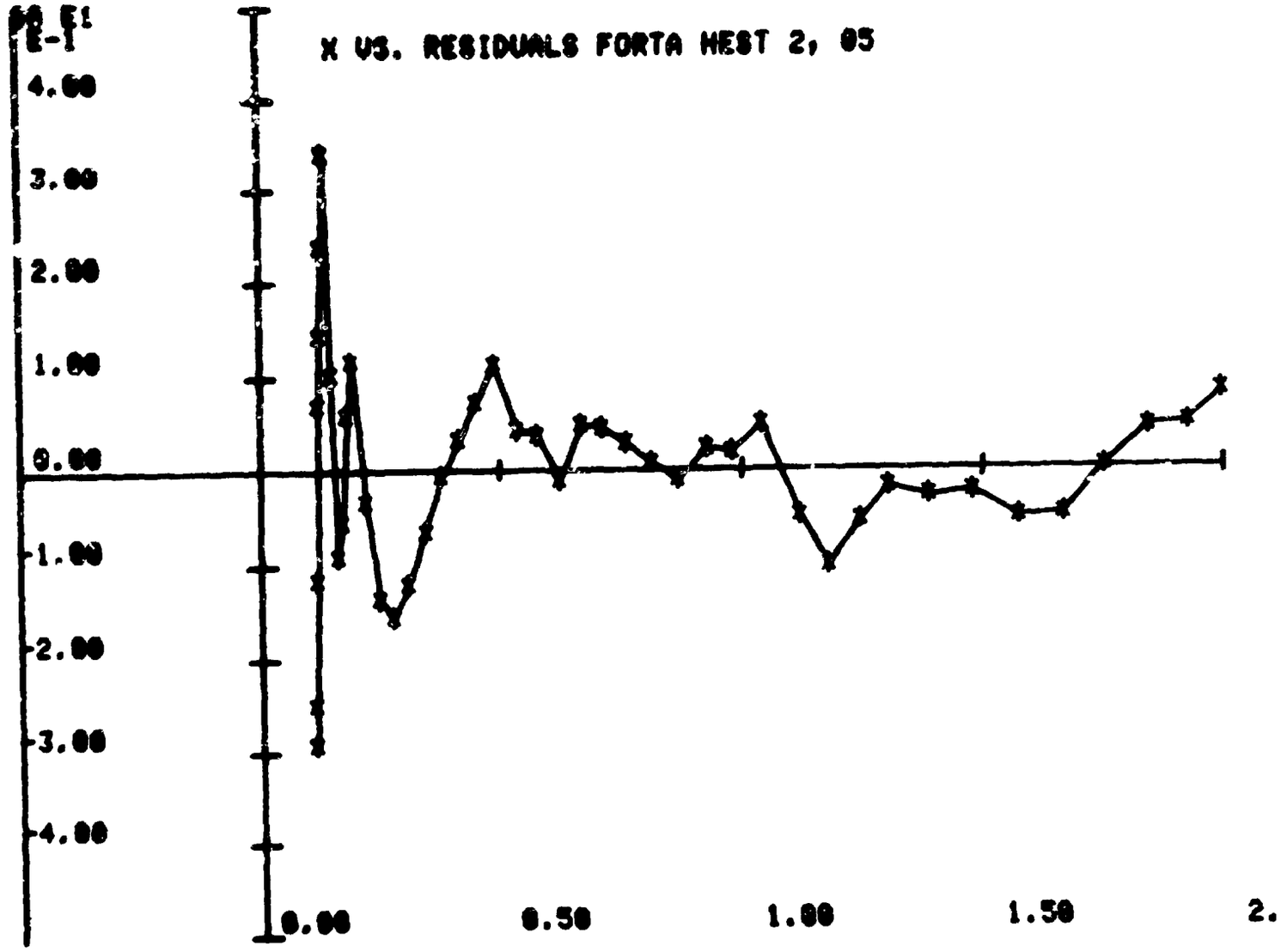
1

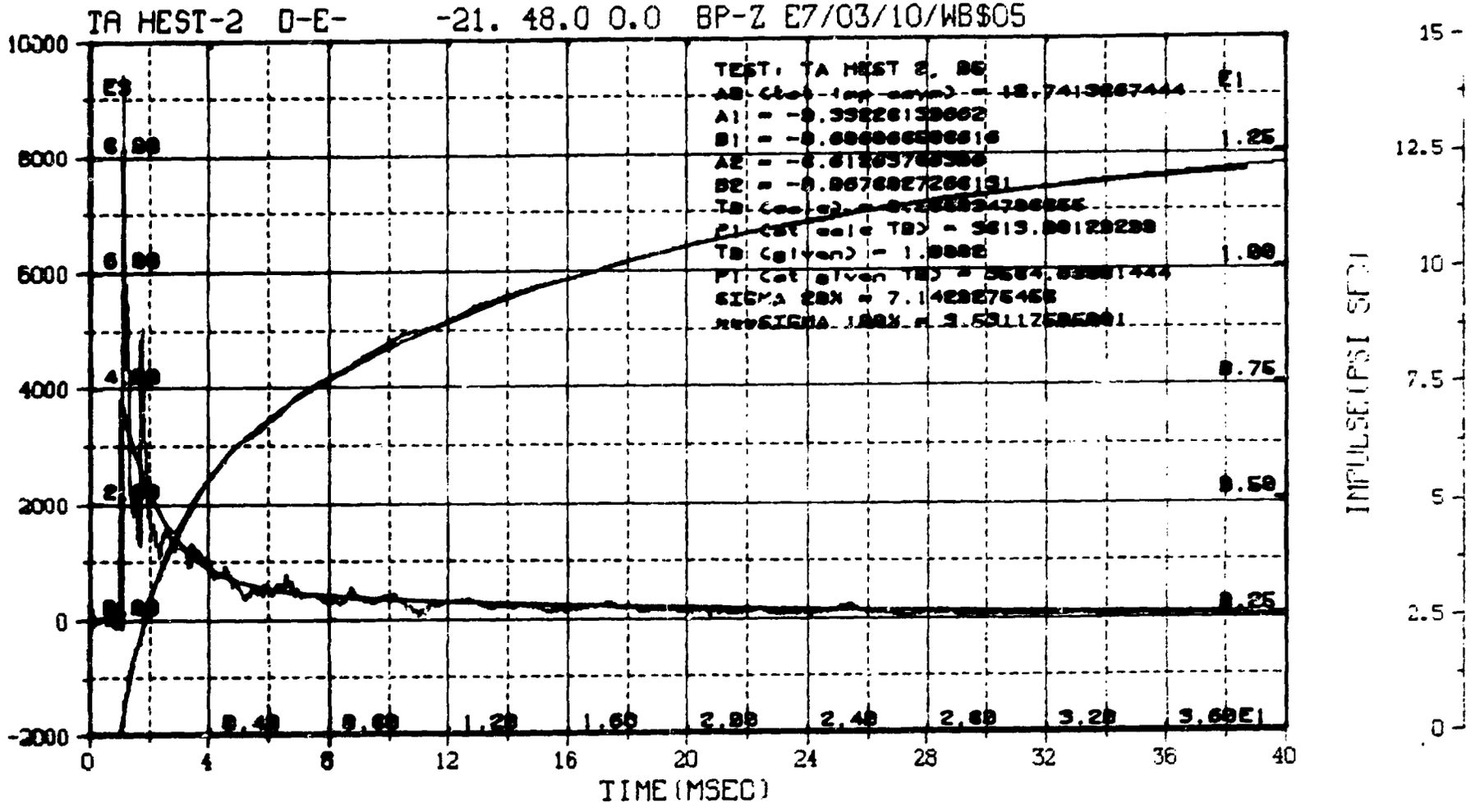

E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.



M.N. = 5	E.U. =0.000,5371.600	WSN=
TSKIP=15.100	DIGITS=0.000,722.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=48

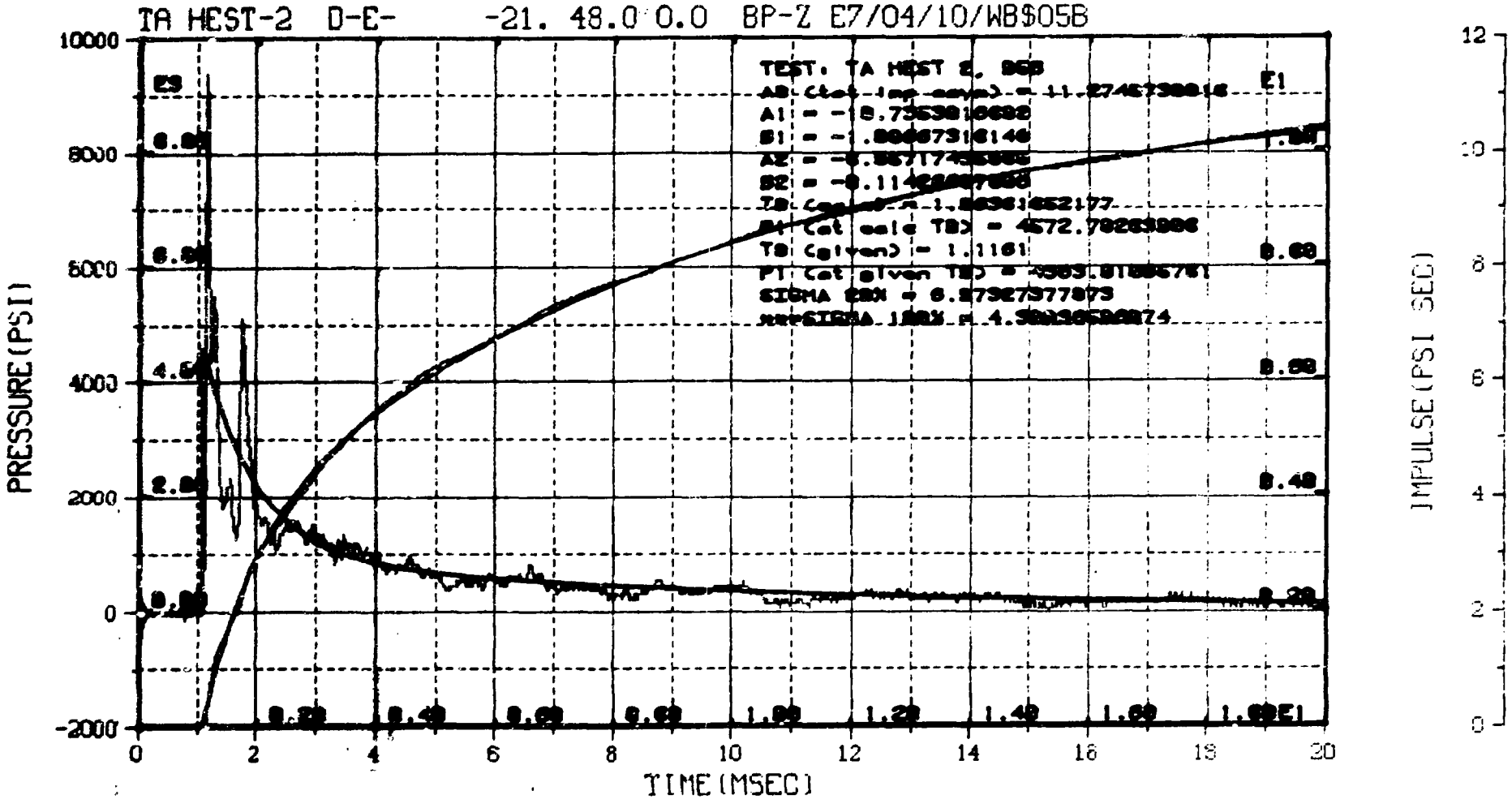
1


X VS. RESIDUALS FORTA HEST 2, 05
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.



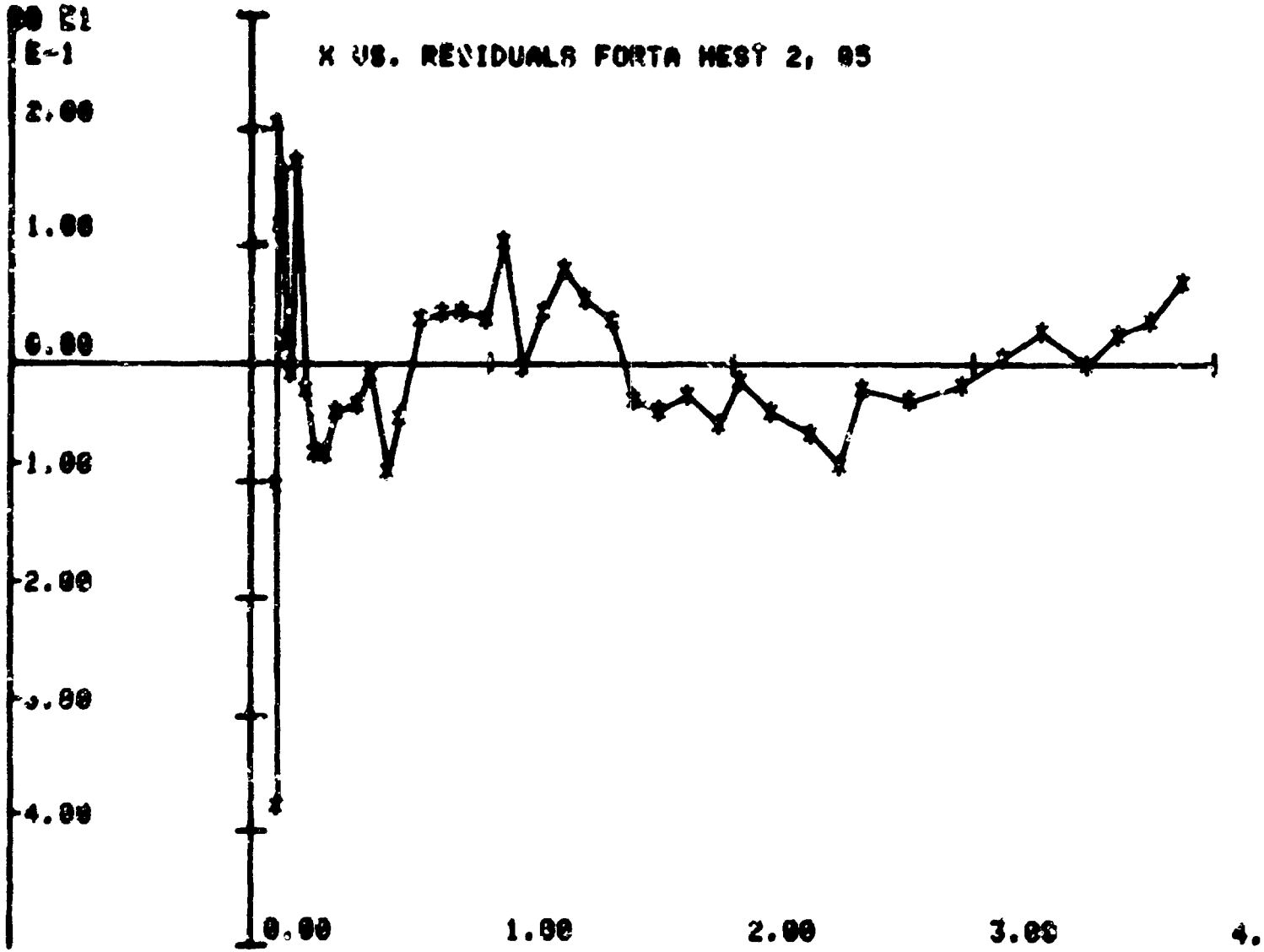
M.N. = 5	E.U. =0.000,5371.600	VSN=
TSKIP=15.100	DIGITS=0.000,722.500	TAPE22
S.R. =100.00 KHZ	10 04 PM,28 MAR 78.	FILE=48

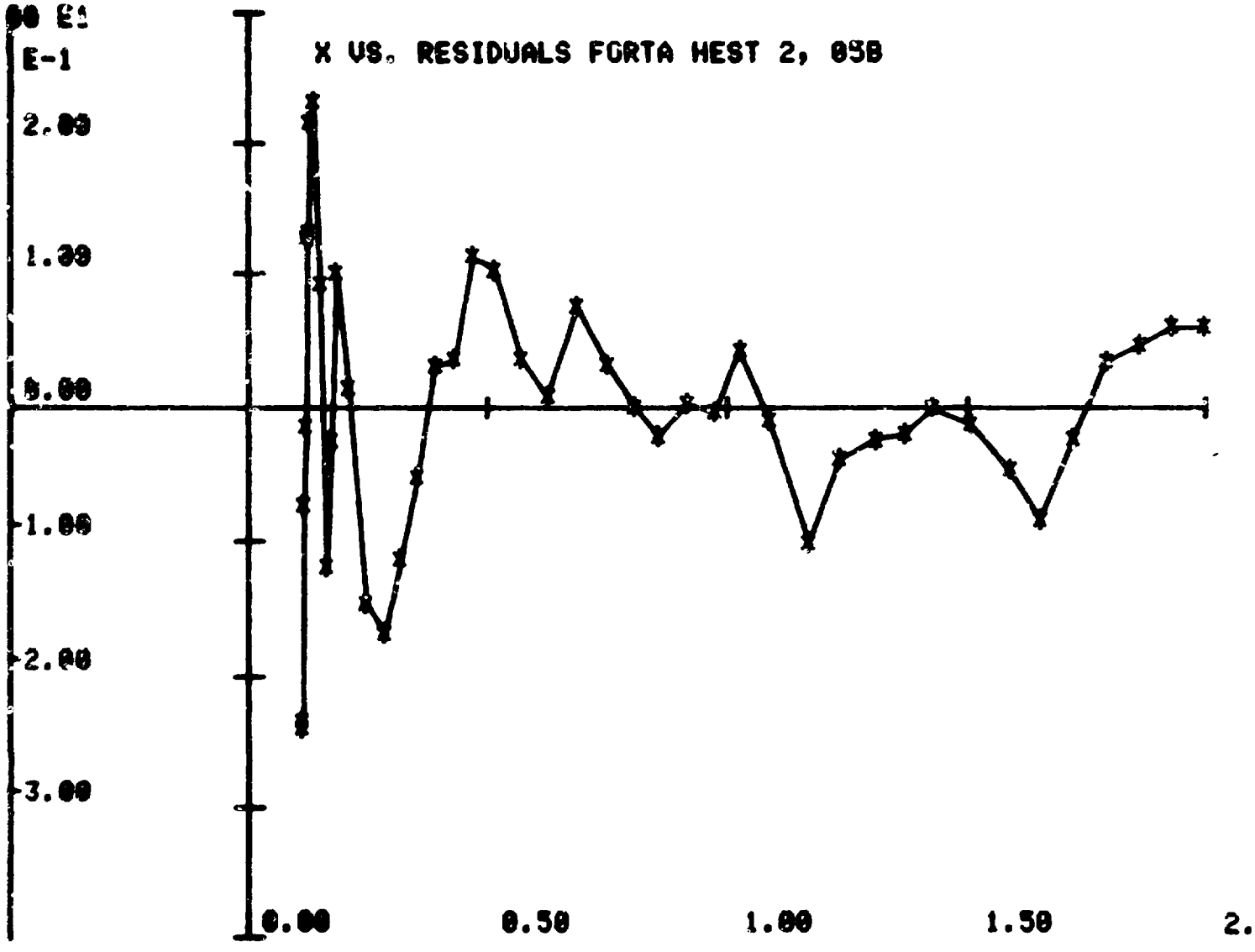
1

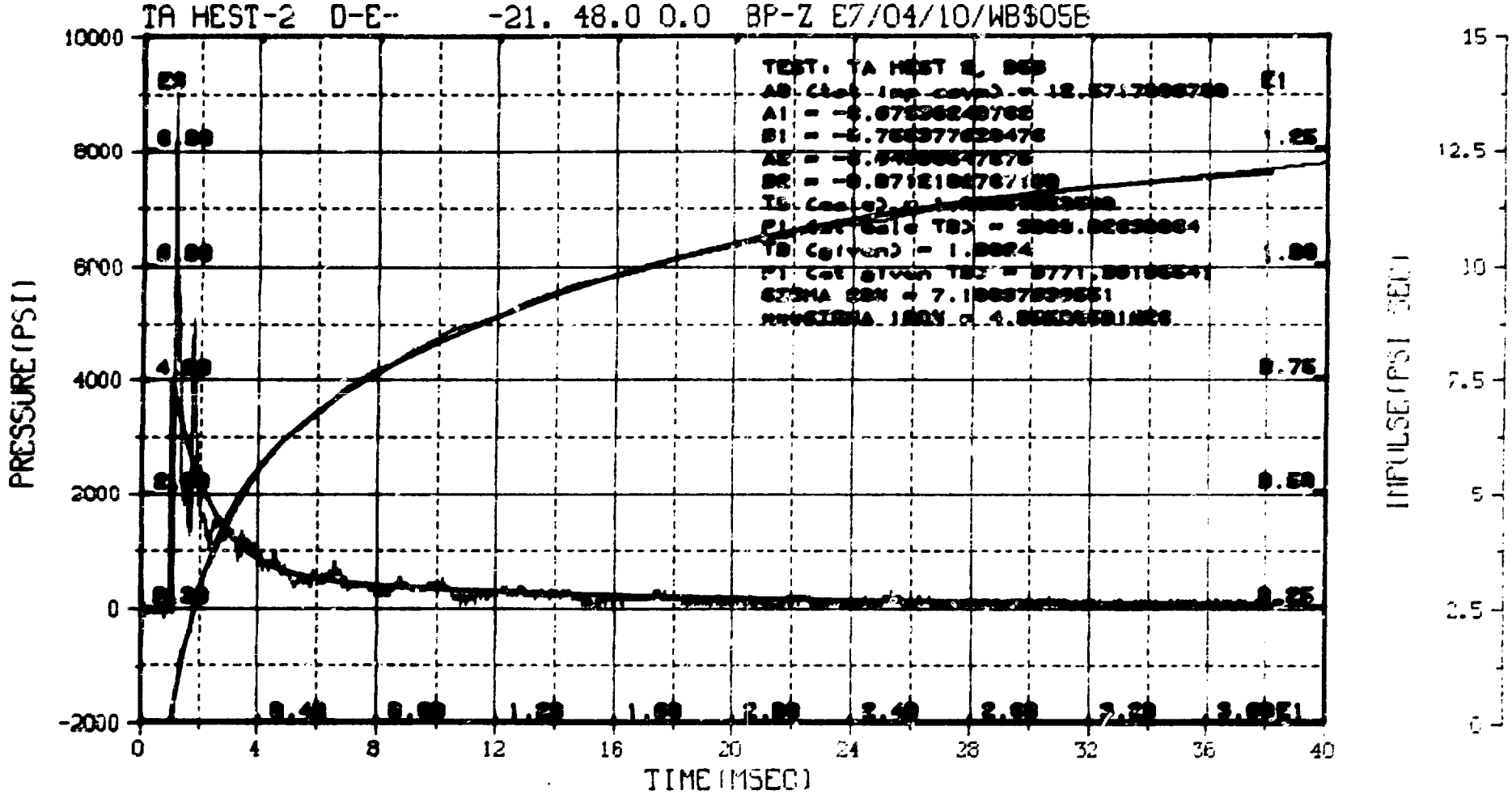


M.N. - 5	E.U. =0.000,5371.600	VSN=
TSKIP=15.110	DIGITS=0.000,386.000	TAPE22
S.R. =100.00 KHZ	9 00 AM, 29 MAR 78.	FILE=64

1

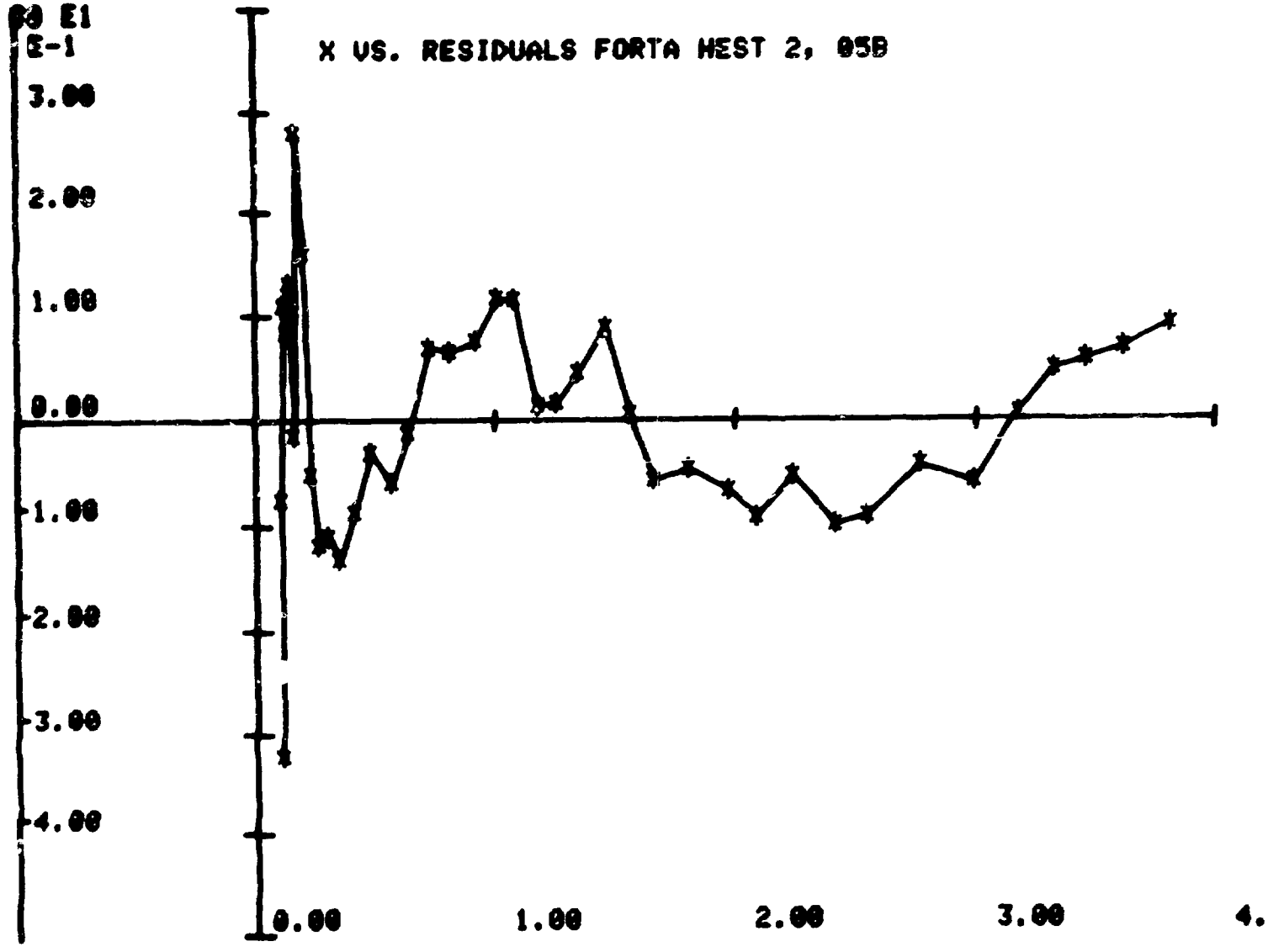

E-1
X VS. RESIDUALS FORTA MEST 2, 05
2.00
1.00
0.00
1.00
2.00
3.00
4.00
0.00
1.00
2.00
3.00
4.

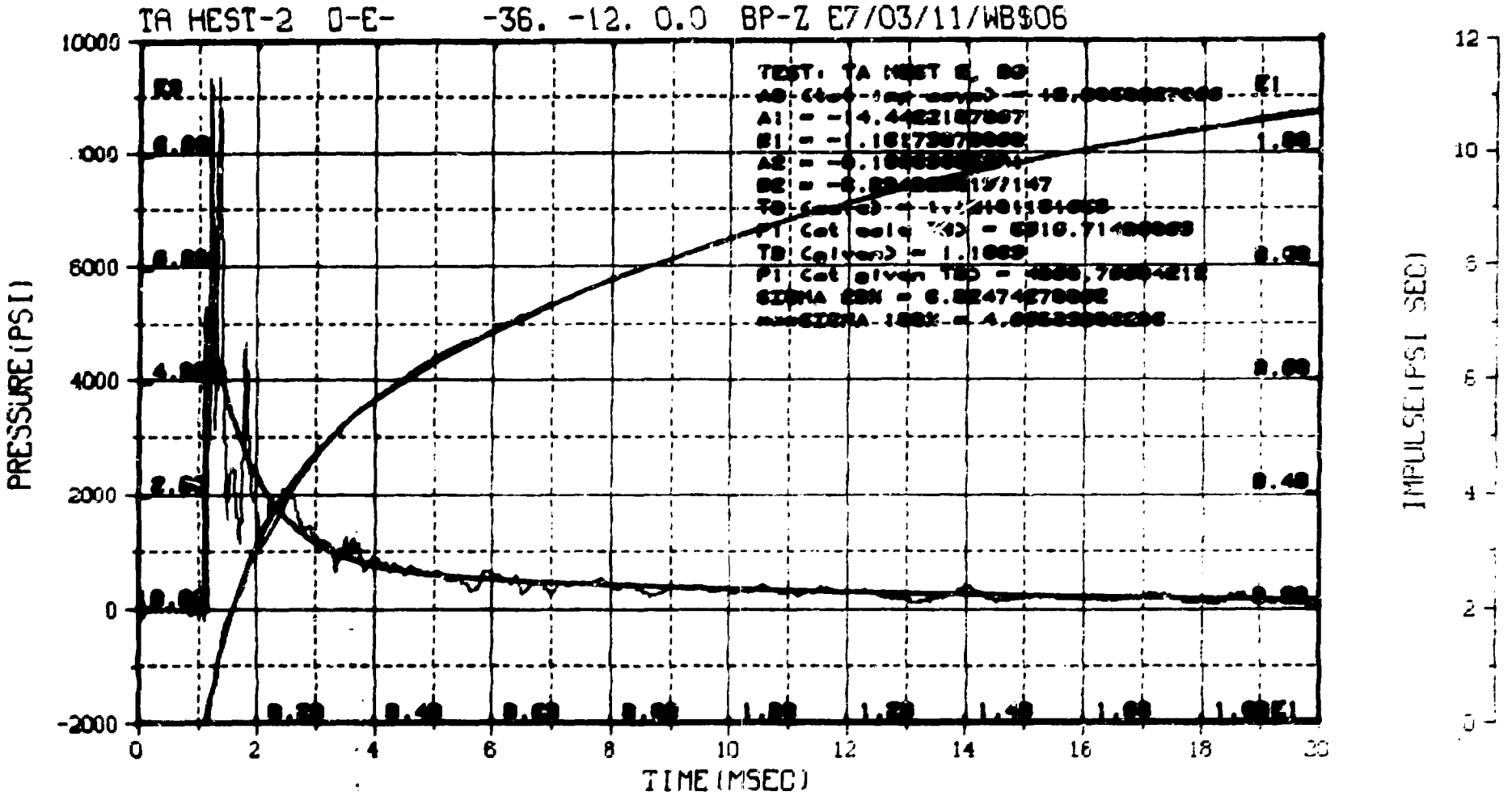

X VS. RESIDUALS FORTA HEST 2, 05B
E-1
2.00
1.00
0.00
1.00
2.00
3.00
0.00
0.50
1.00
1.50
2.



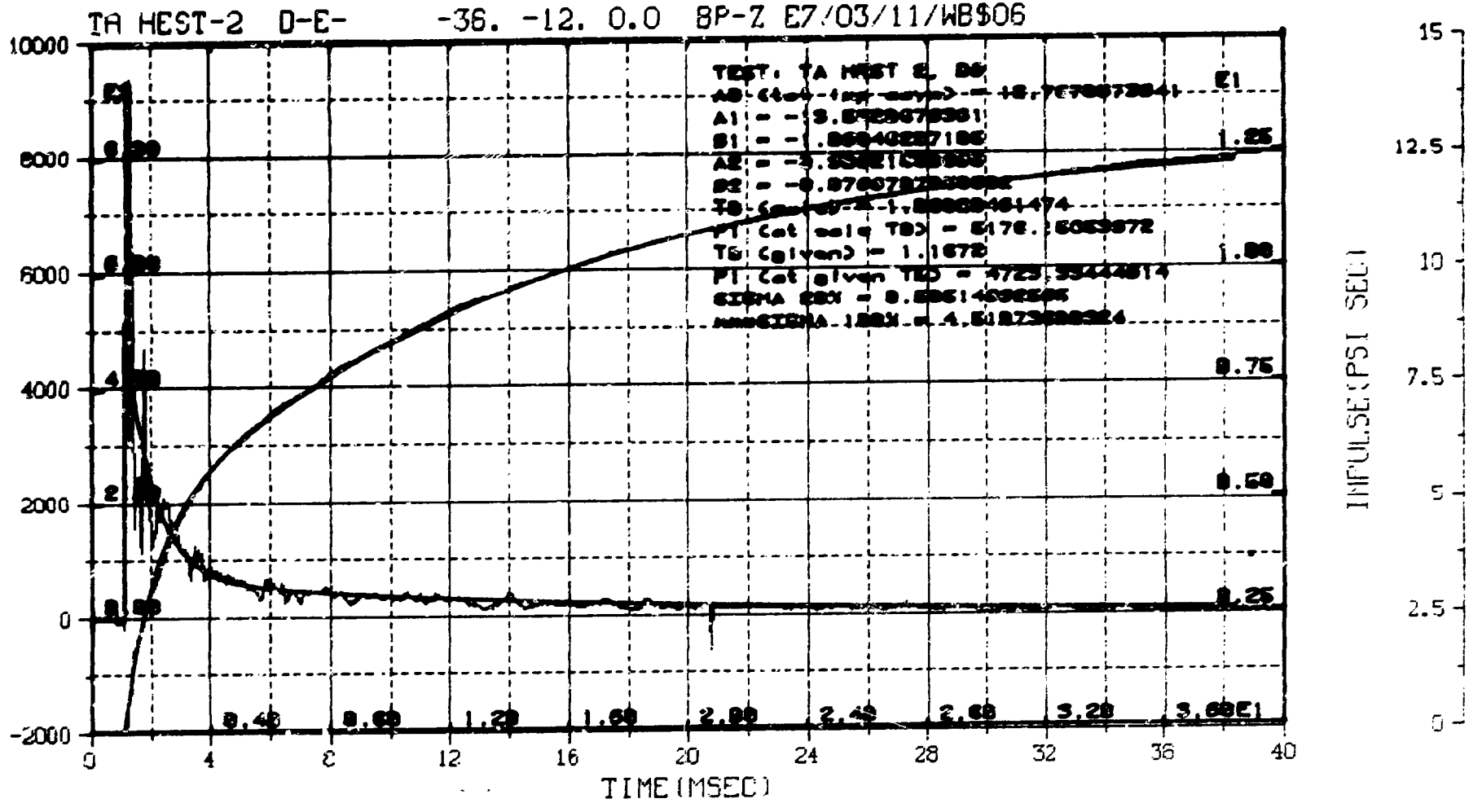
M.N. = 5	E.U. =0.000,5371.600	VSN=
TSKIP=15.110	DIGITS=0.000,4096.000	TAPE22
S.R. =100.00 KHZ	10 04 PM,28 MAR 78.	FILE=64

1


X VS. RESIDUALS FORTA MEST 2, 05B
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.

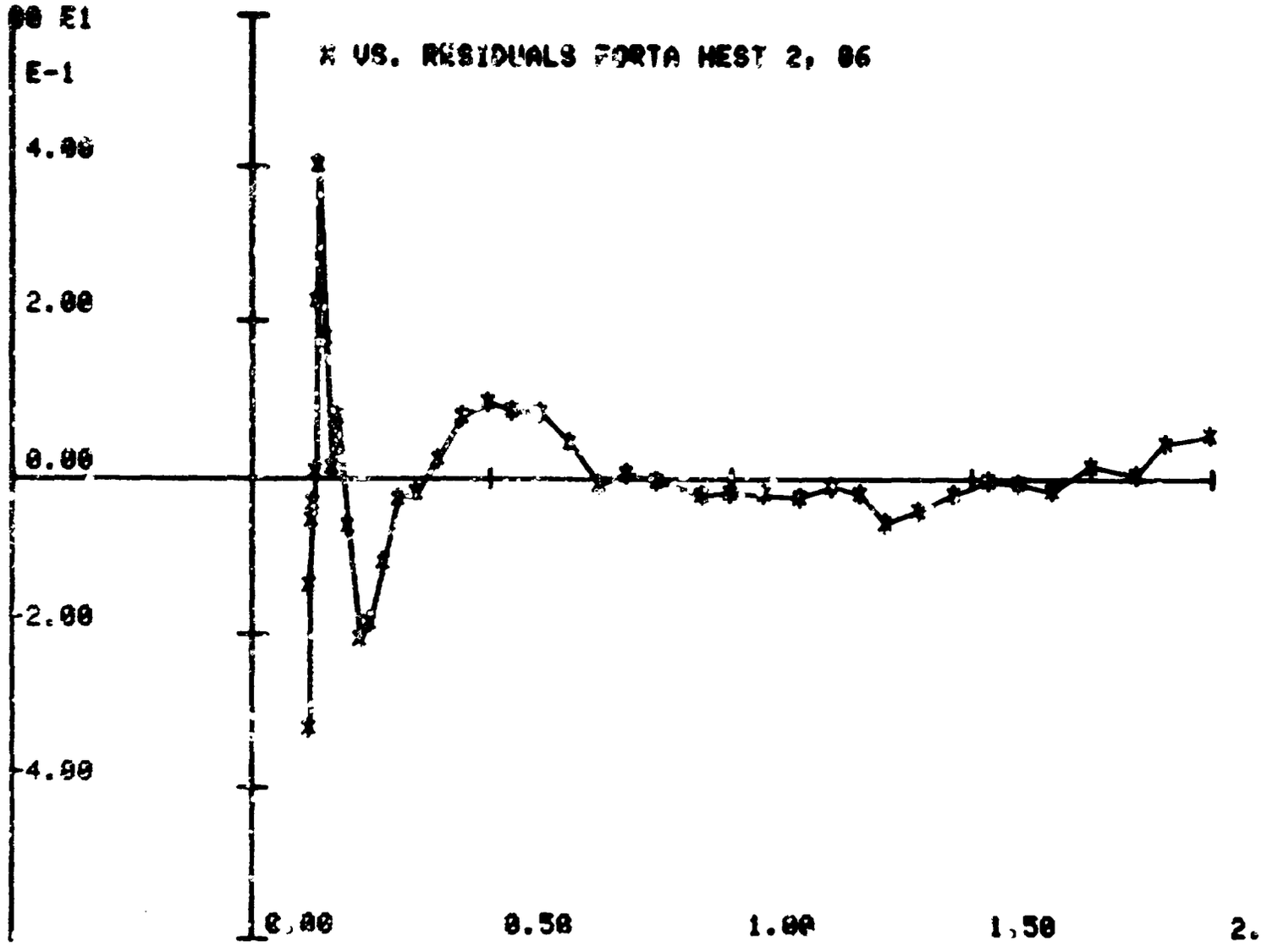


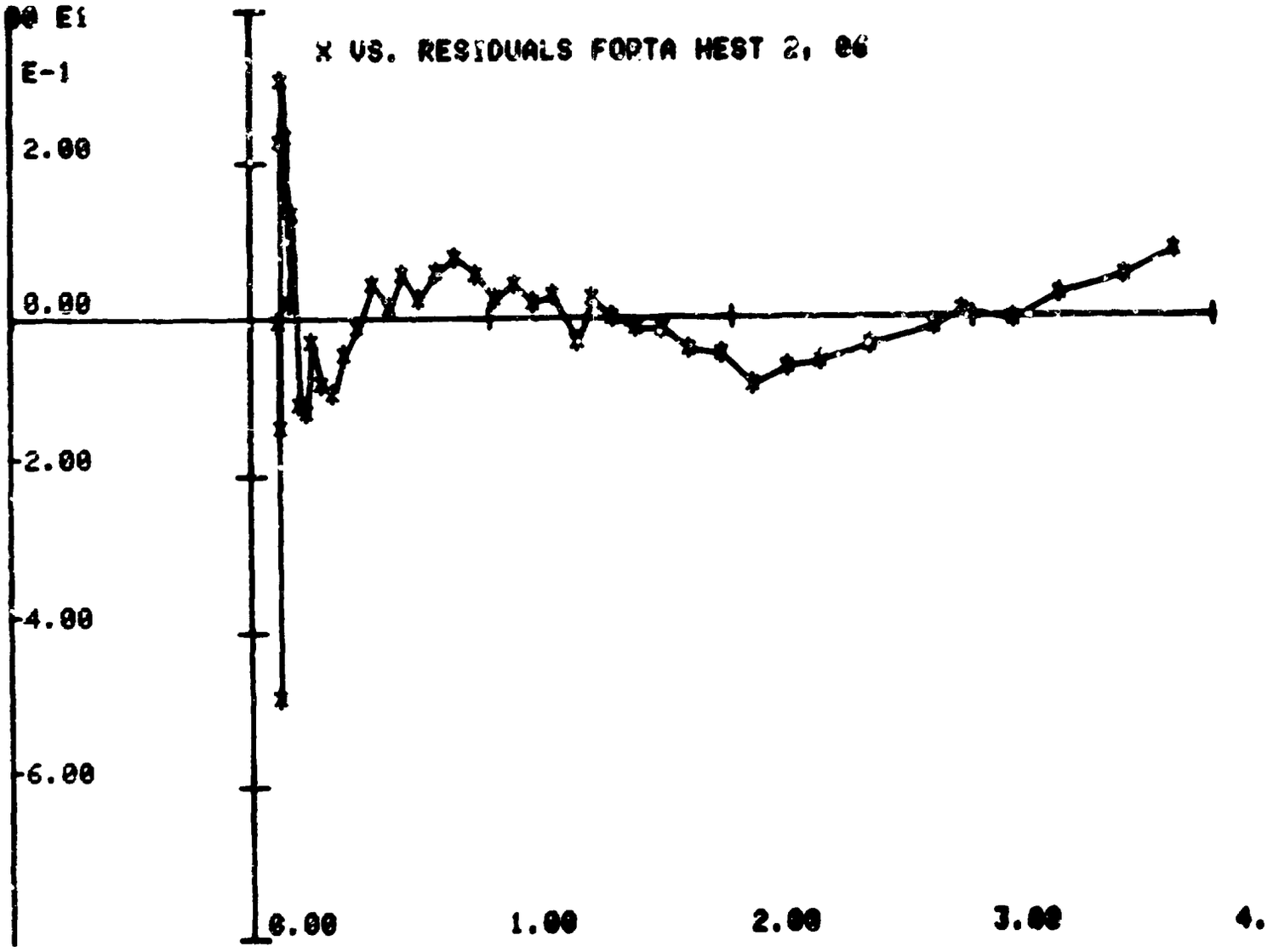
M.N. - S	E.U. -0.000,5416.600	VSN=
TSKIP=15.100	DIGITS=0.000,966.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=50

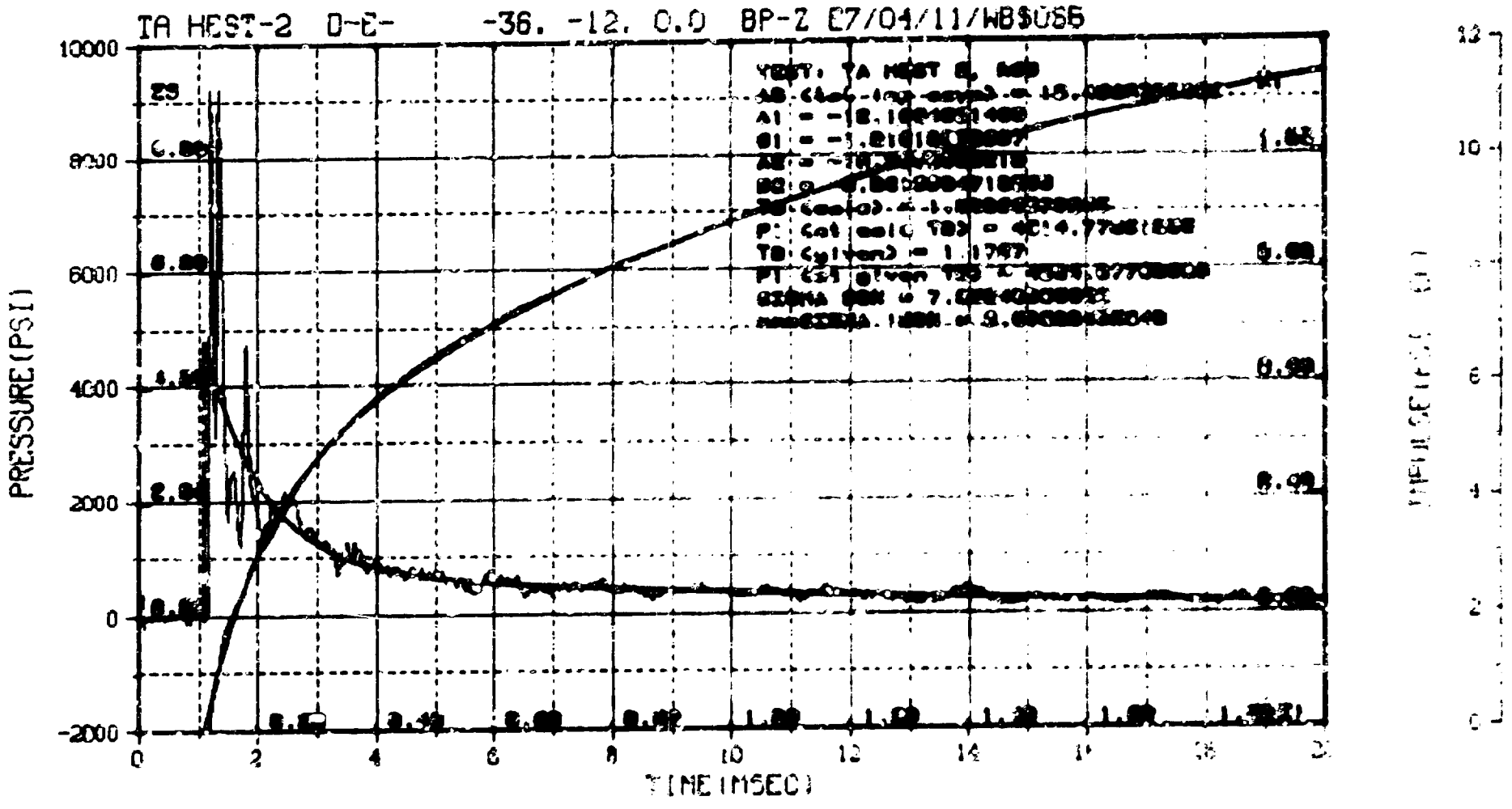


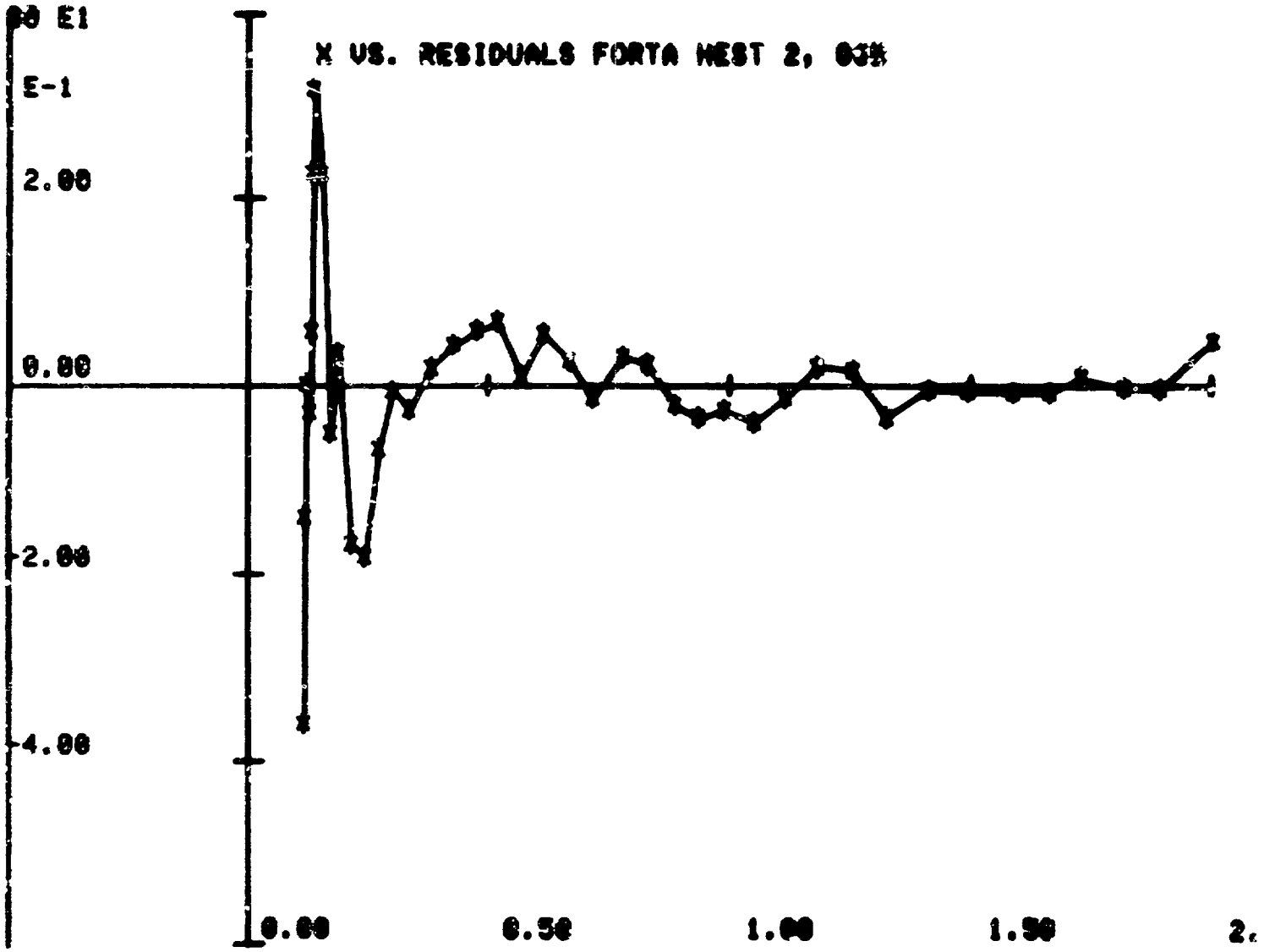
M.N. = 6	E.U. =0.000,5416.600	VSN=
TSKIP=15.100	DIGITS=0.000,966.500	TAPE22
S.R. =100.00 KHZ	10 04 PM,28 MAR 78.	FILE=50

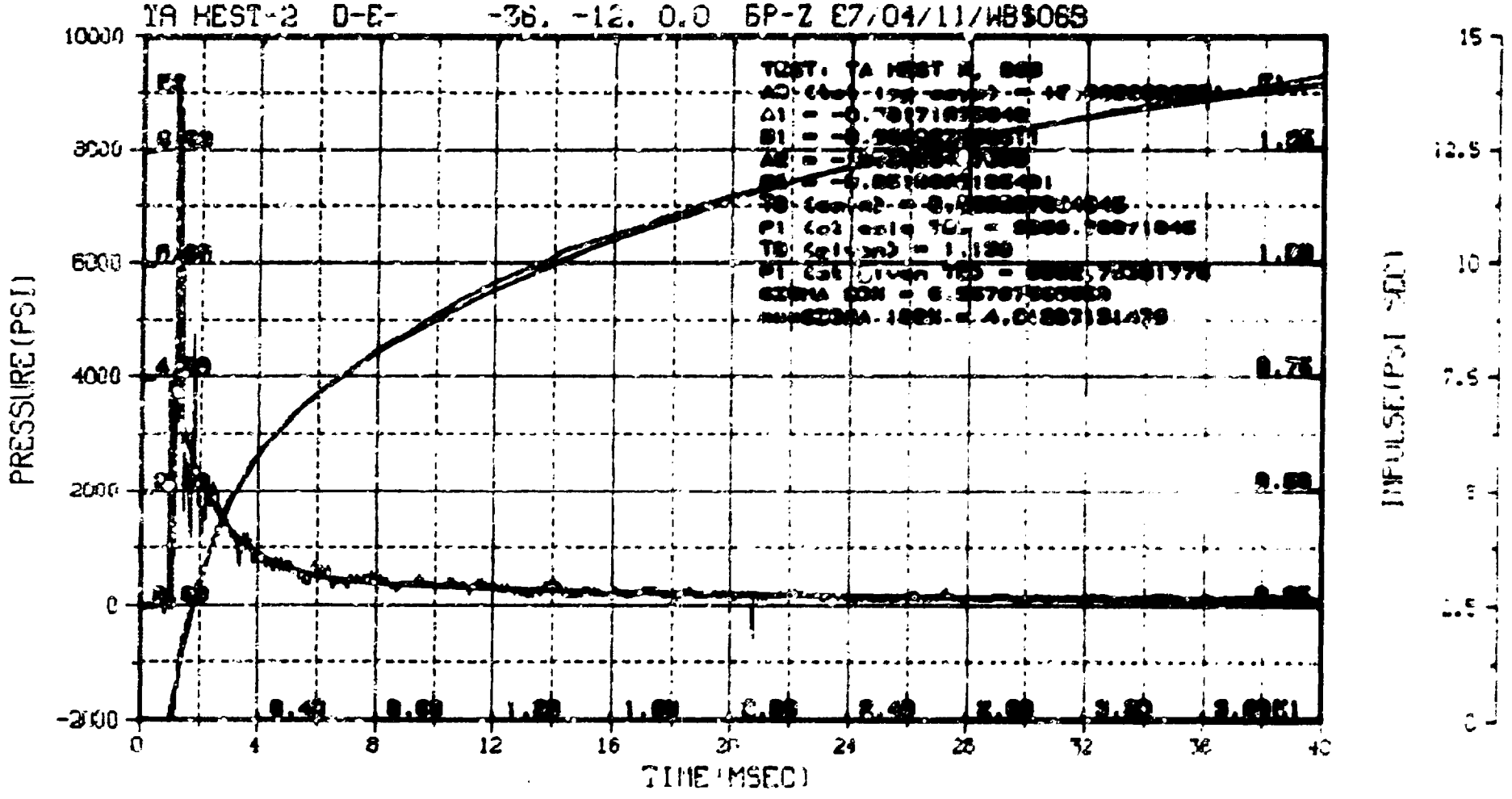
1


00 E1
E-1
X VS. RESIDUALS FORTA HEST 2, 86
4.00
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.

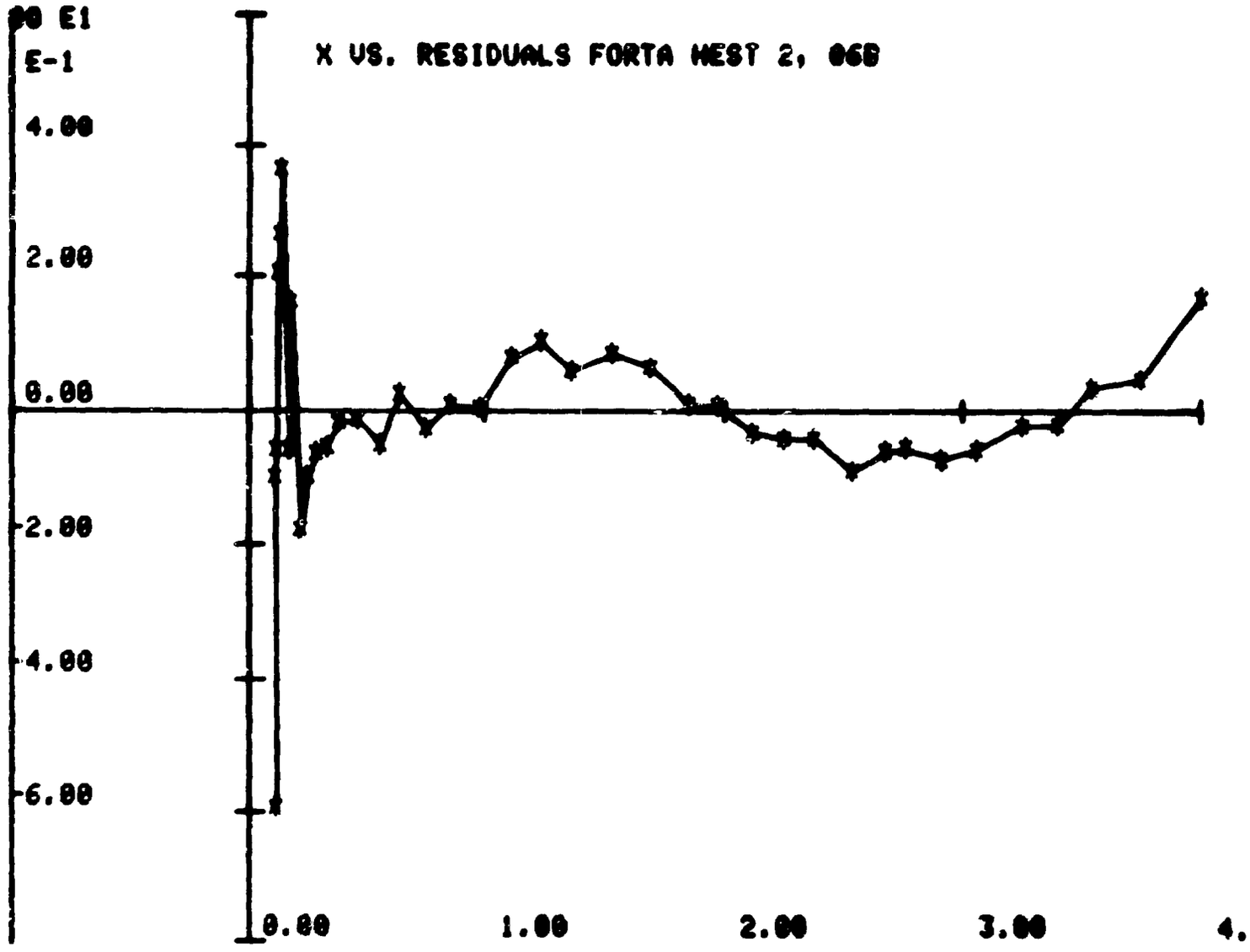

X VS. RESIDUALS FORTA HEST 2, 06
E-1
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.

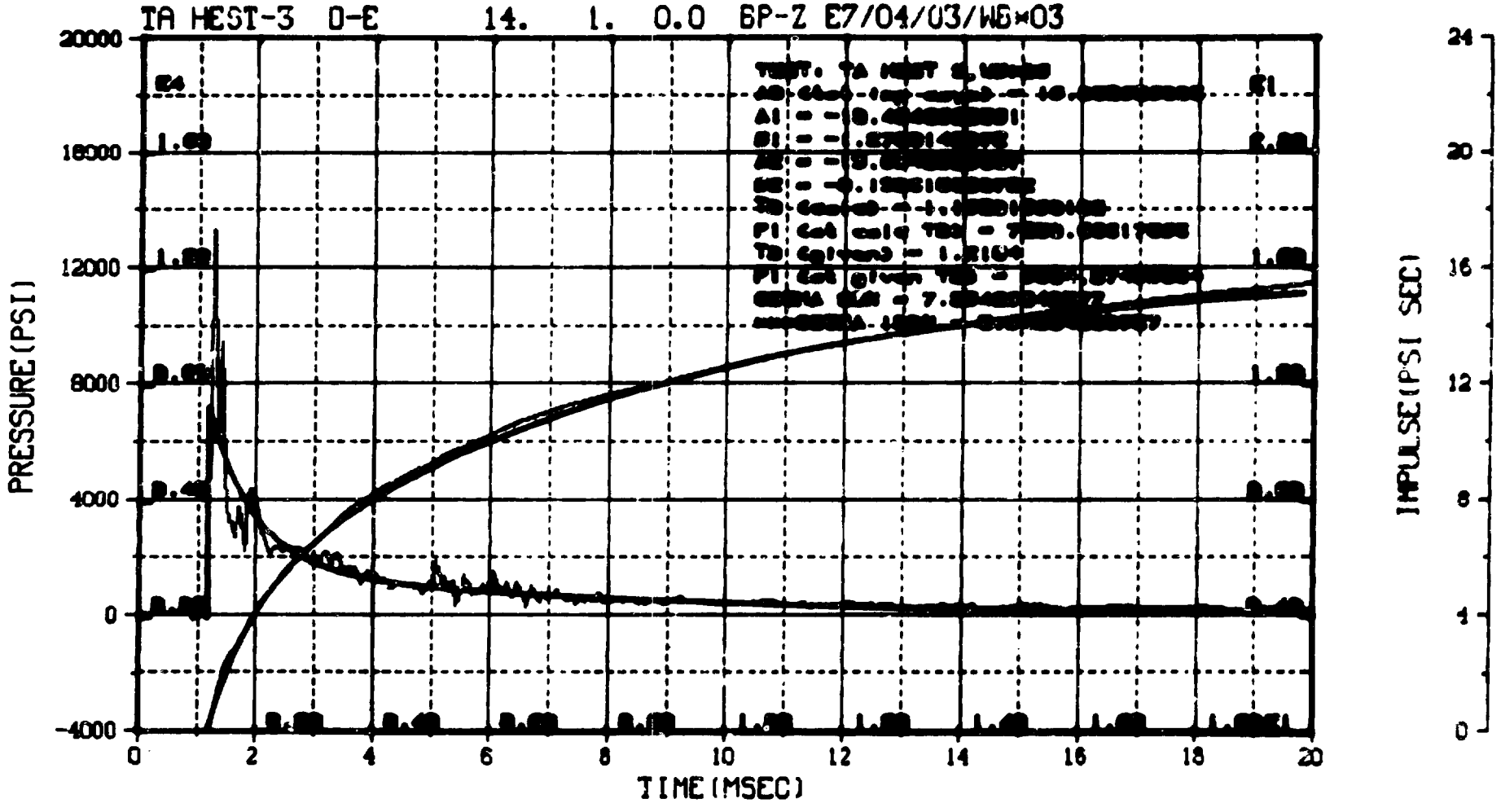

TA HEST-2 D-E- -36. -12. 0.0 BP-2 E7/04/11/WB$065
PRESSURE(PSI)
TIME(MSEC)
10000
8000
6000
4000
2000
0
-2000
0
2
4
6
8
10
12
M.N. = 6
TSKIP=15.110
S.R. =100.00 KHZ
E.U. =0.000,5416.000
DIGITS=0.000,392.500
9 00 AM, 29 MAR


X VS. RESIDUALS FORTA WEST 2, 83%
E1
E-1
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.

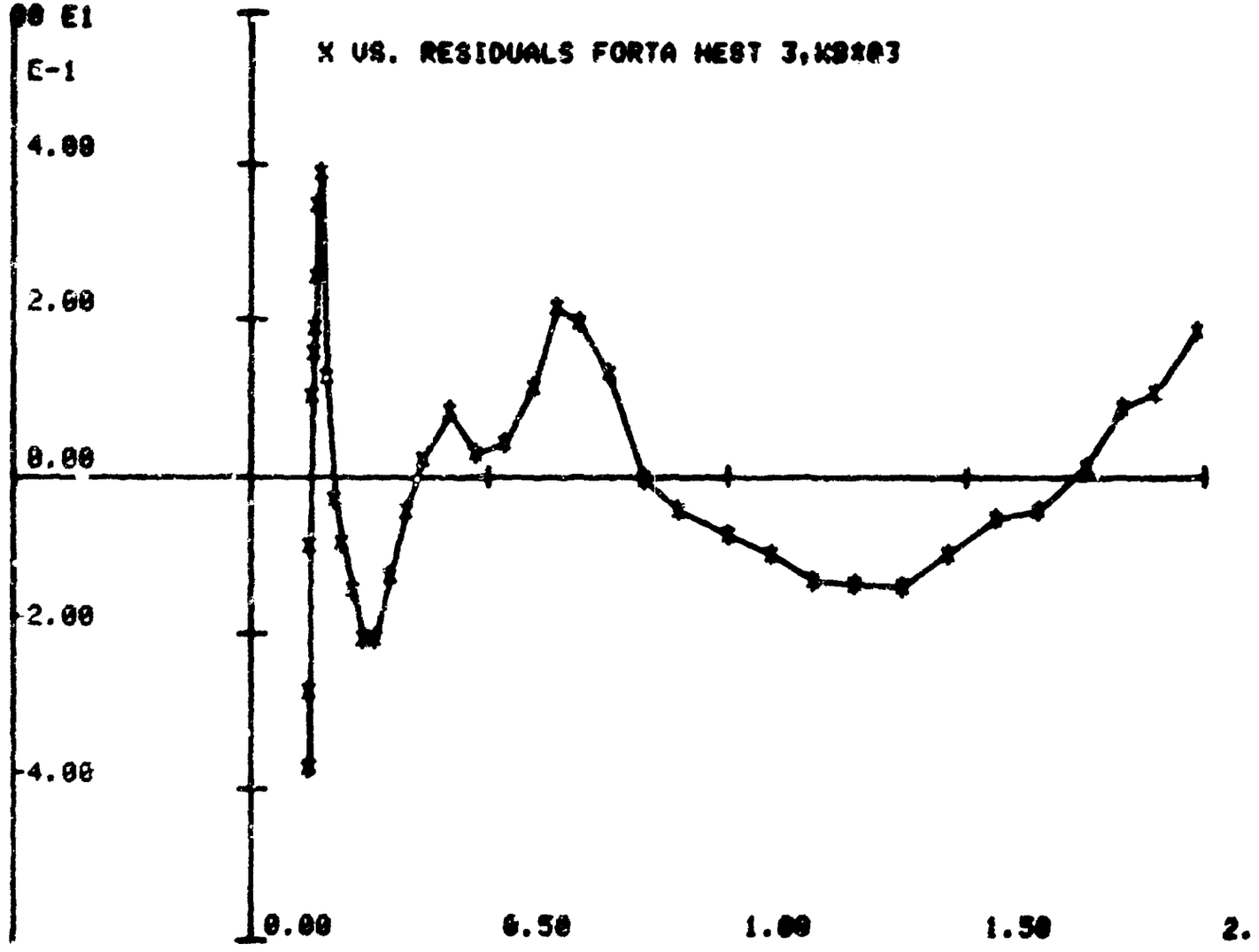


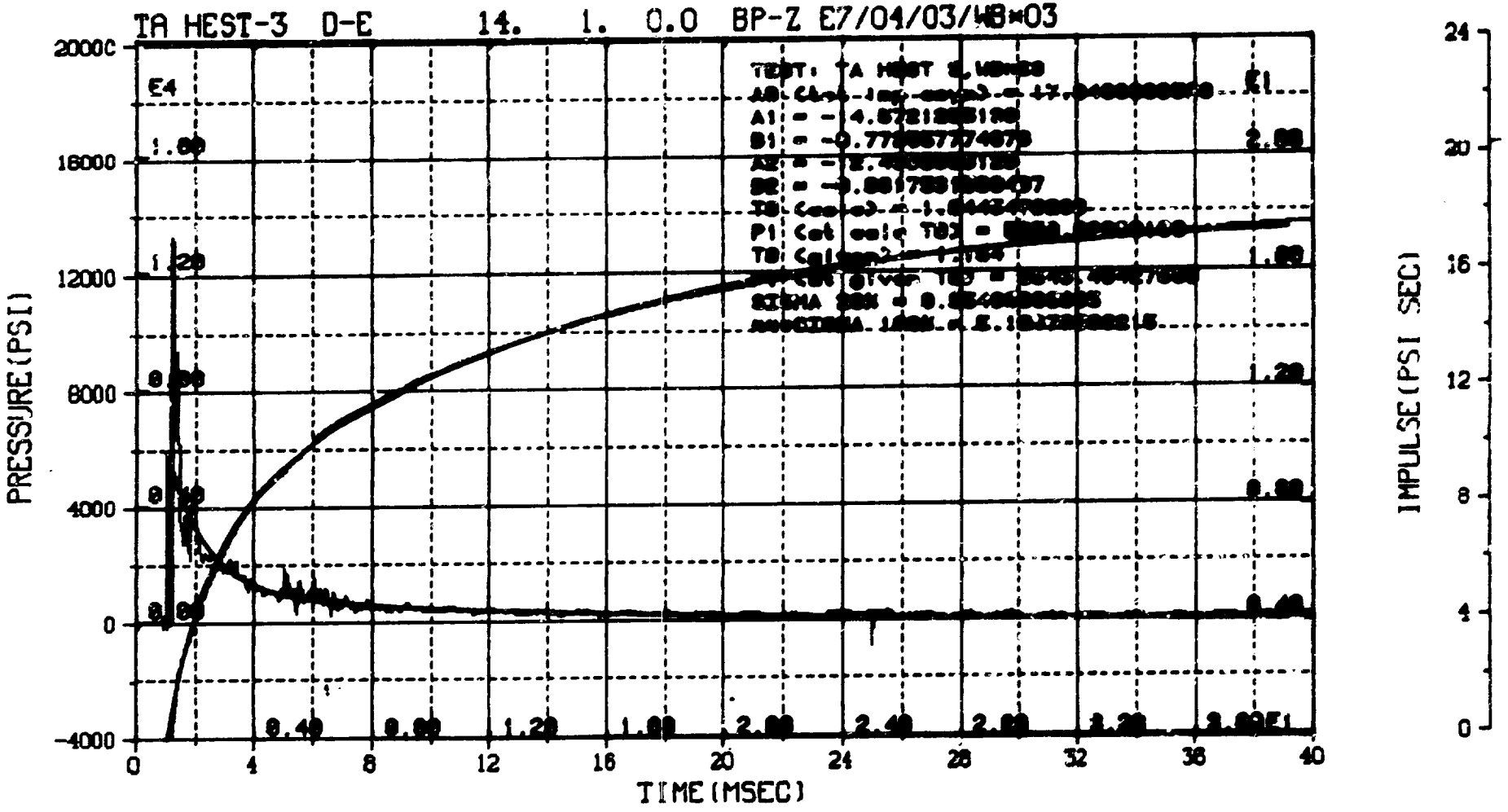
M.N. - 435 S	E.U. -0.000,5416.600	VSN-
TSKIP=15.110	DIGITS=0.000,393.500	TAPE22
S.R. =100.00 KHZ	10 04 PM, 28 MAR 78.	FILE=66


X VS. RESIDUALS FORTA WEST 2, 068
E1
E-1
4.00
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.

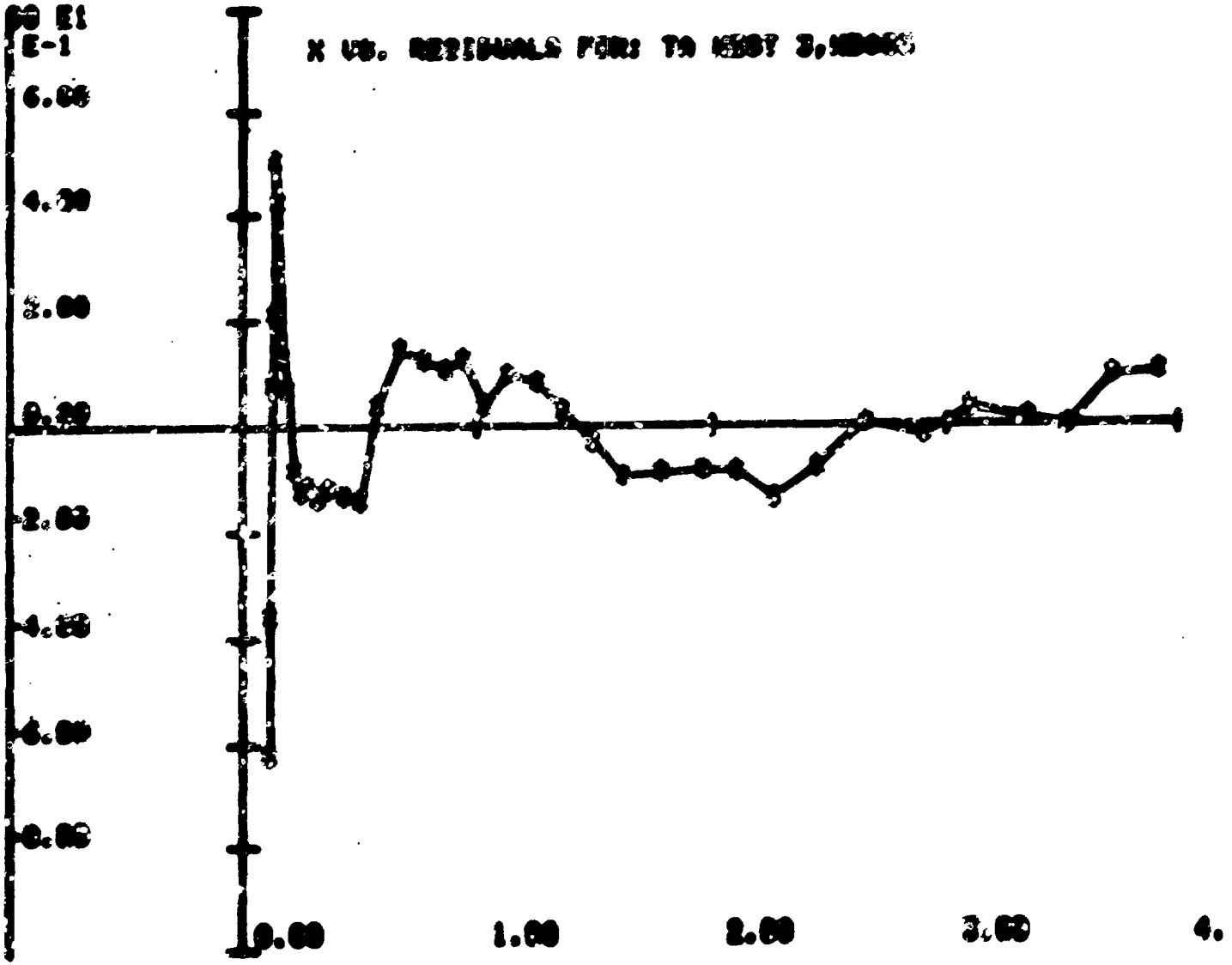


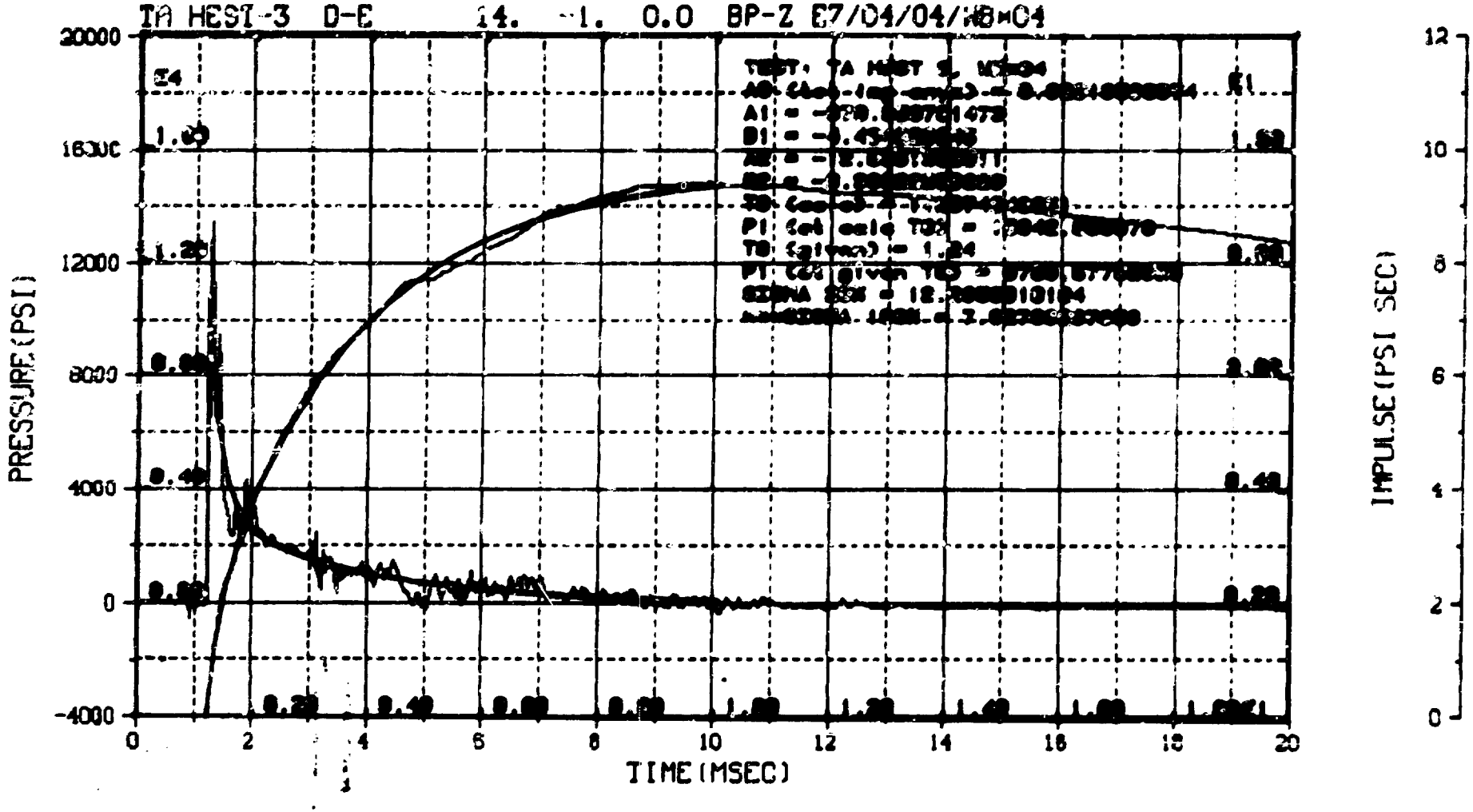
M.N. - 3	E.U. -0.000,7820.000	VSN- ED23
TSKIP-12.650	DIGITS-0.000,746.875	TAPE22
S.R. -100.00 KHZ	11 36 AM, 2 MAY 78.	FILE-36


X VS. RESIDUALS FORTA MEST 3,KB*03
E1
E-1
4.00
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.

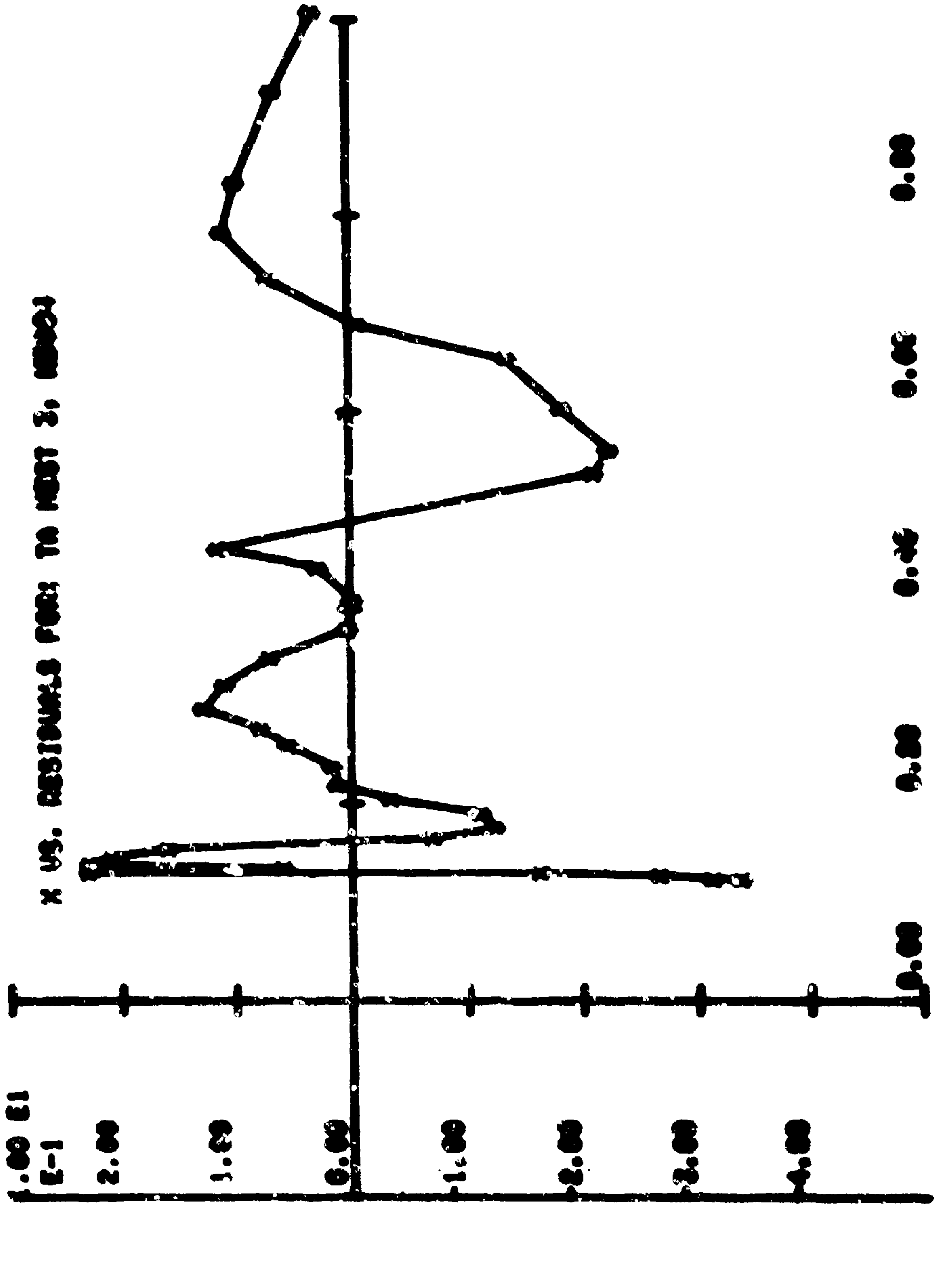


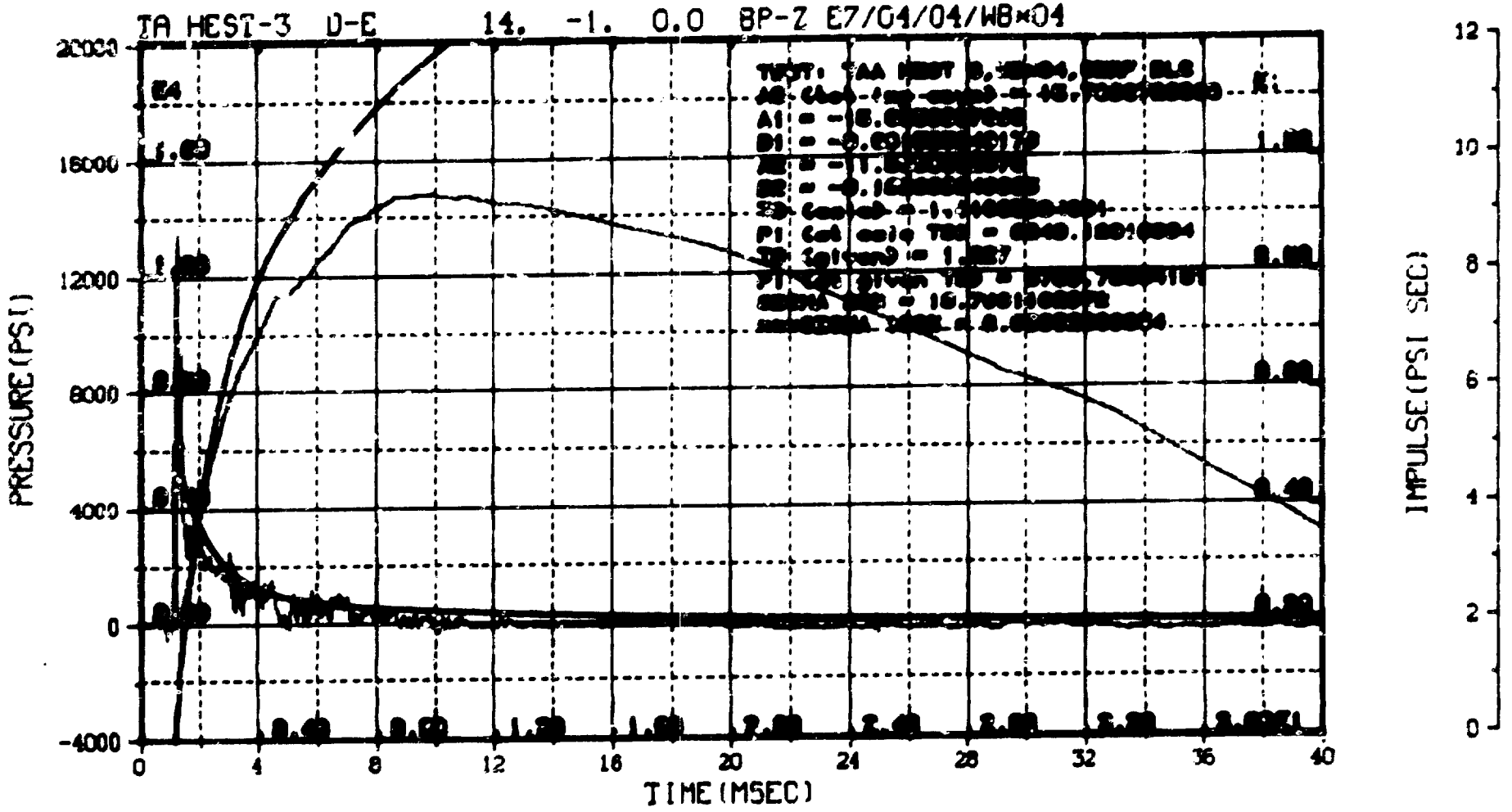
M.N. = 3	E.U. =0.000,7820.000	VSN=
TSKIP=12.650	DIGITS=0.000,746.875	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=36


E1
E-1
6.00
4.00
2.00
0.00
2.00
4.00
6.00
0.00
1.00
2.00
3.00
4.

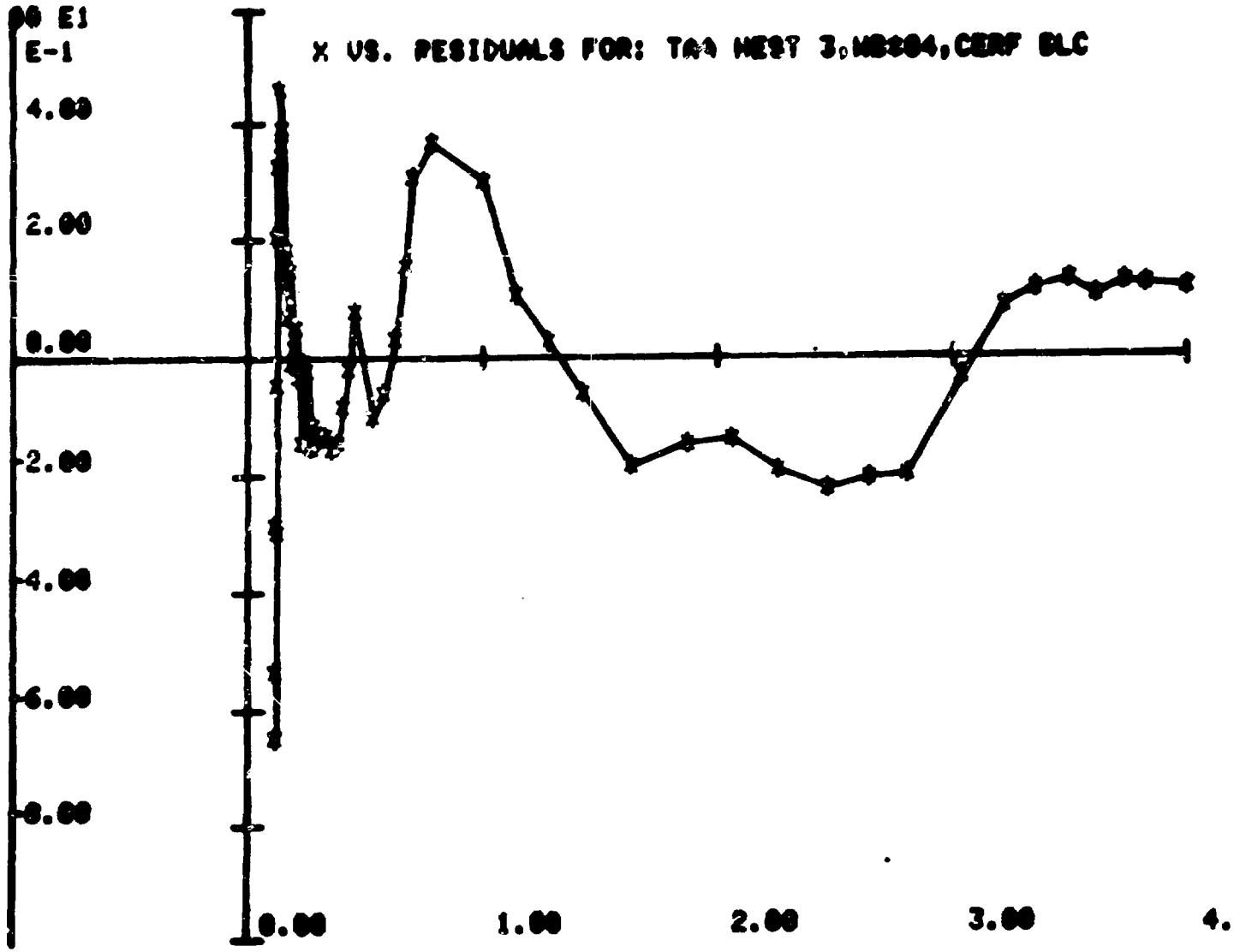


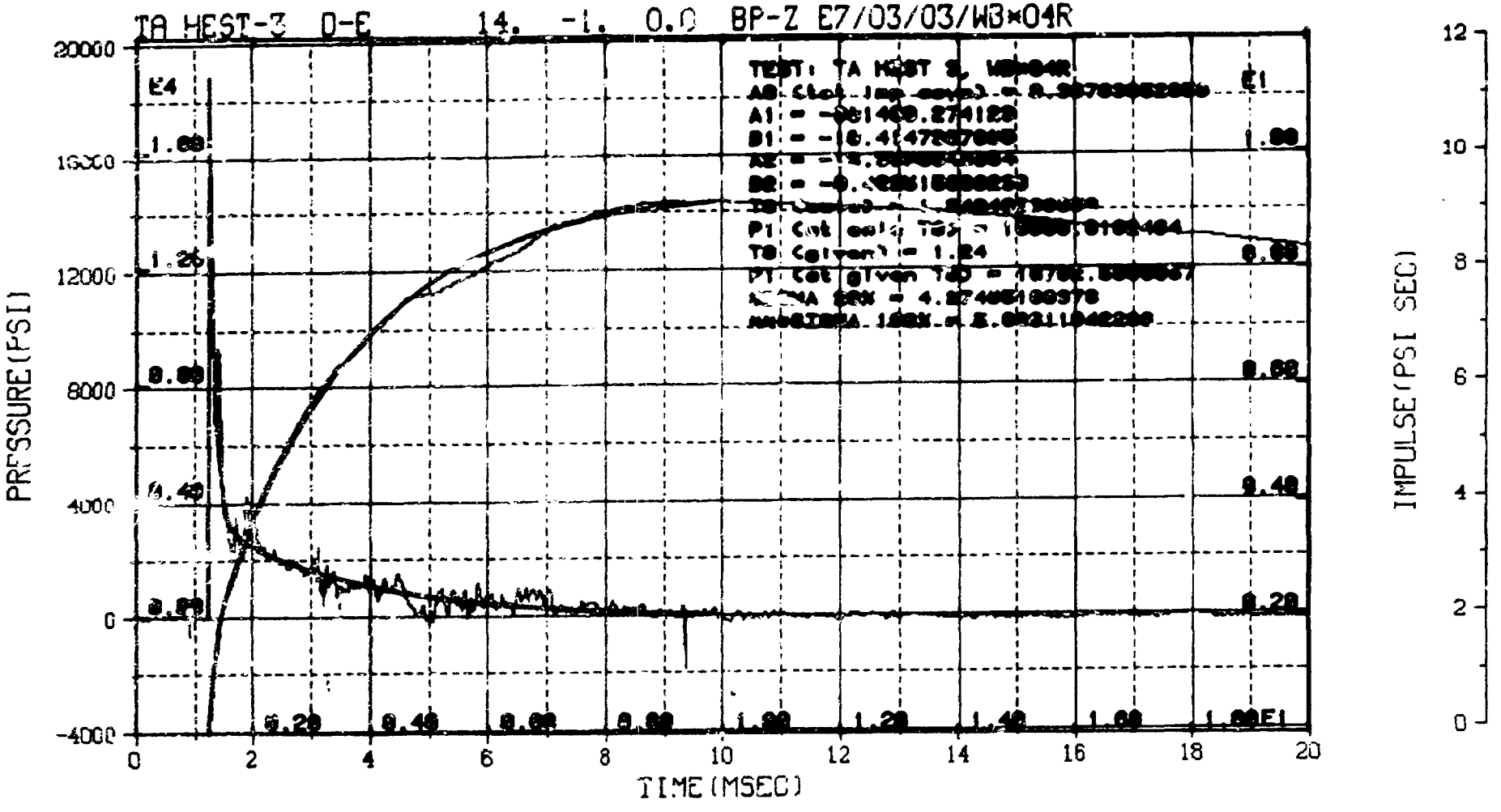
M,N. = 4	E.U. -0.000,9265.000	VSN= EC23
TSKIP=12.650	DIGITS=0.000,692.000	TAPE22
S.R. =100.00 KHZ	11 36 AM, 2 MAY 78.	FILE=38


X VS. RESIDUALS FOR:
E-1
2.00
0.00
0.00

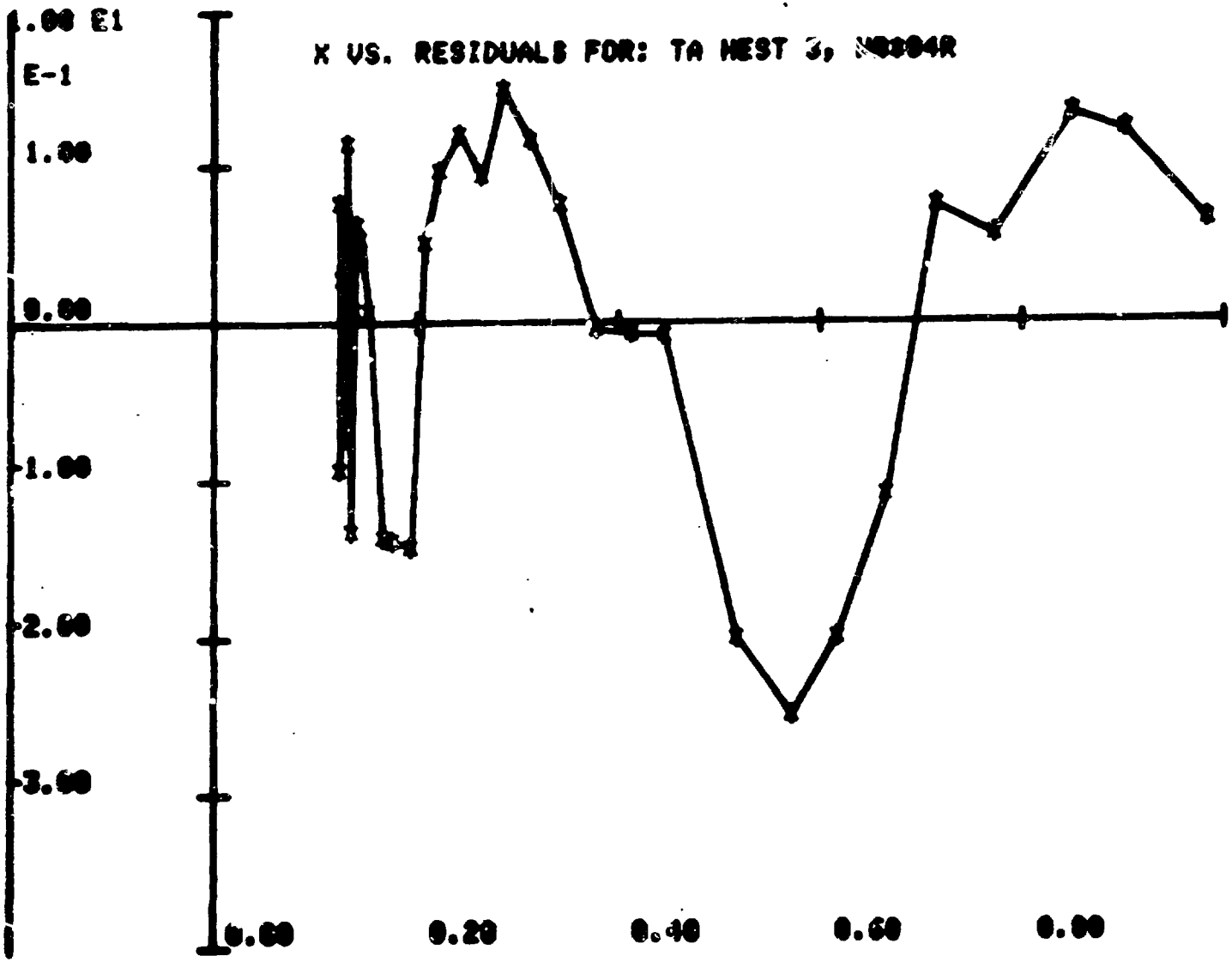


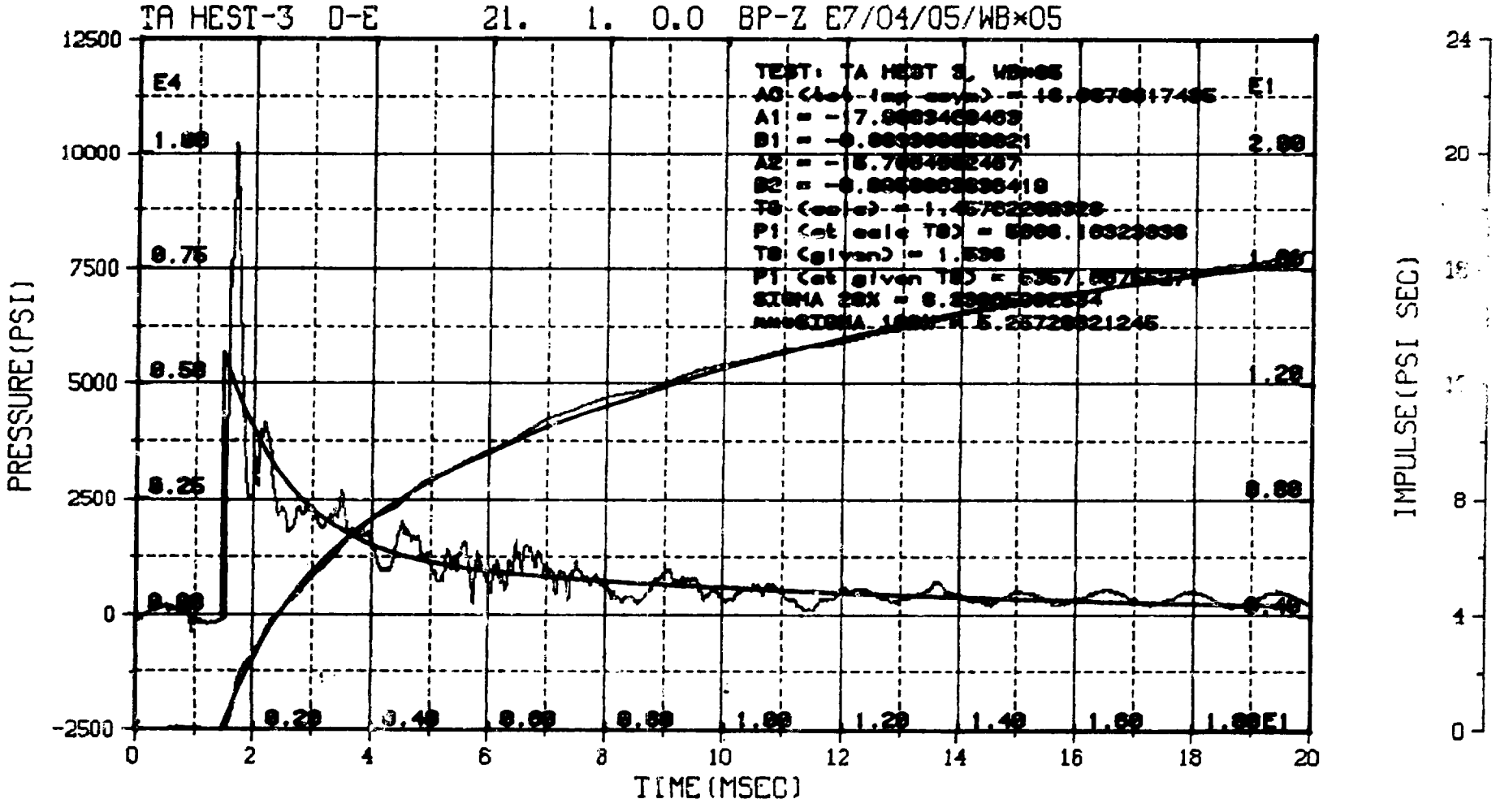
M.N. - 4	E.U. -0.000,9265.000	VSN-
TSKIP-12.650	DIGITS-0.000,692.000	TAPE22
S.R. -100.00 KHZ	8 50 AM, 2 MAY 78.	FILE-38


E1
E-1
X VS. RESIDUALS FOR: TA4 NEST 3,MB204,CERF BLC
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.00
1.00
2.00
3.00
4.



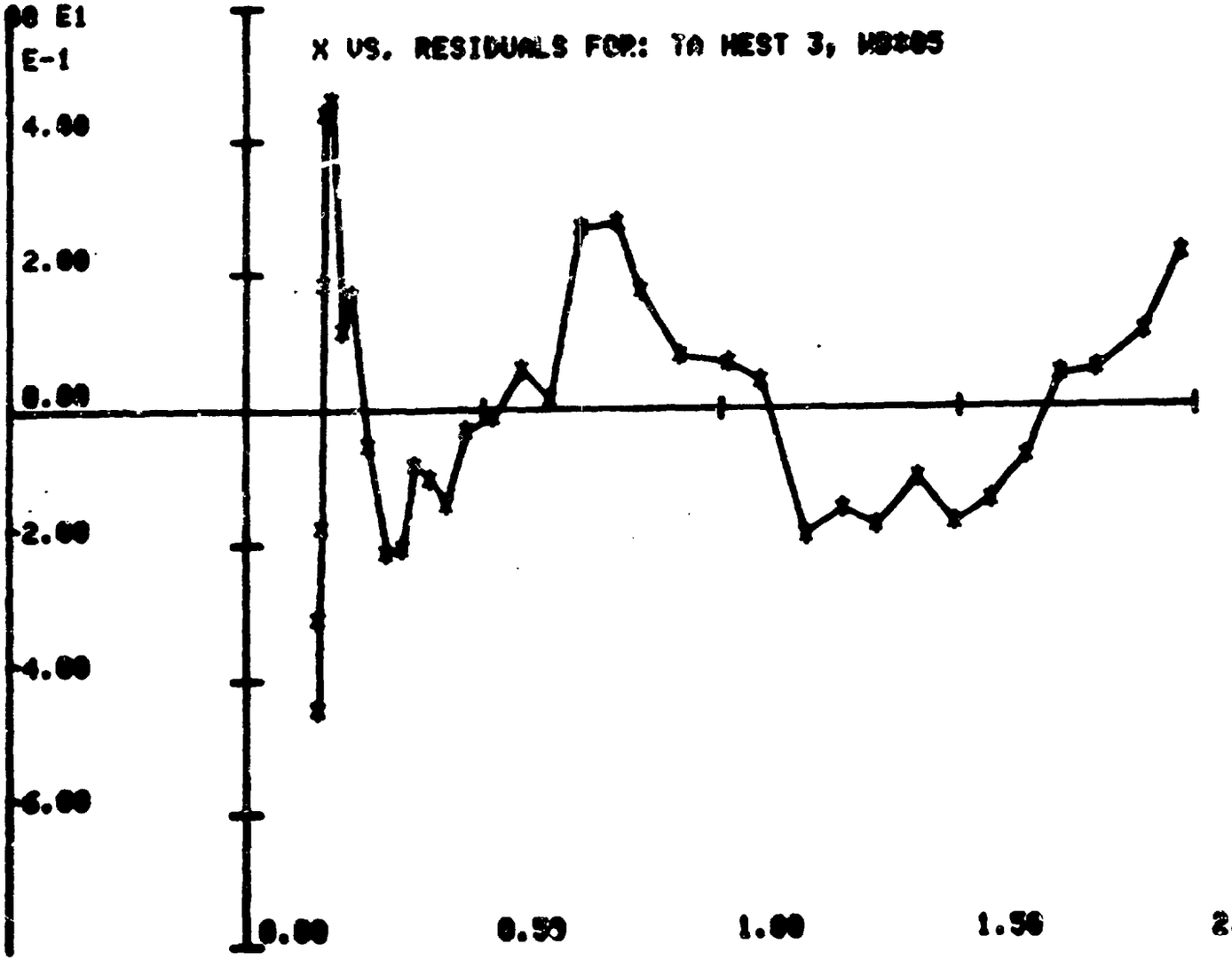
M.N. = 4	E.U. =0.000,9265.000	VSN=
TSKIP=12.640	DIGITS=0.000,680.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=24

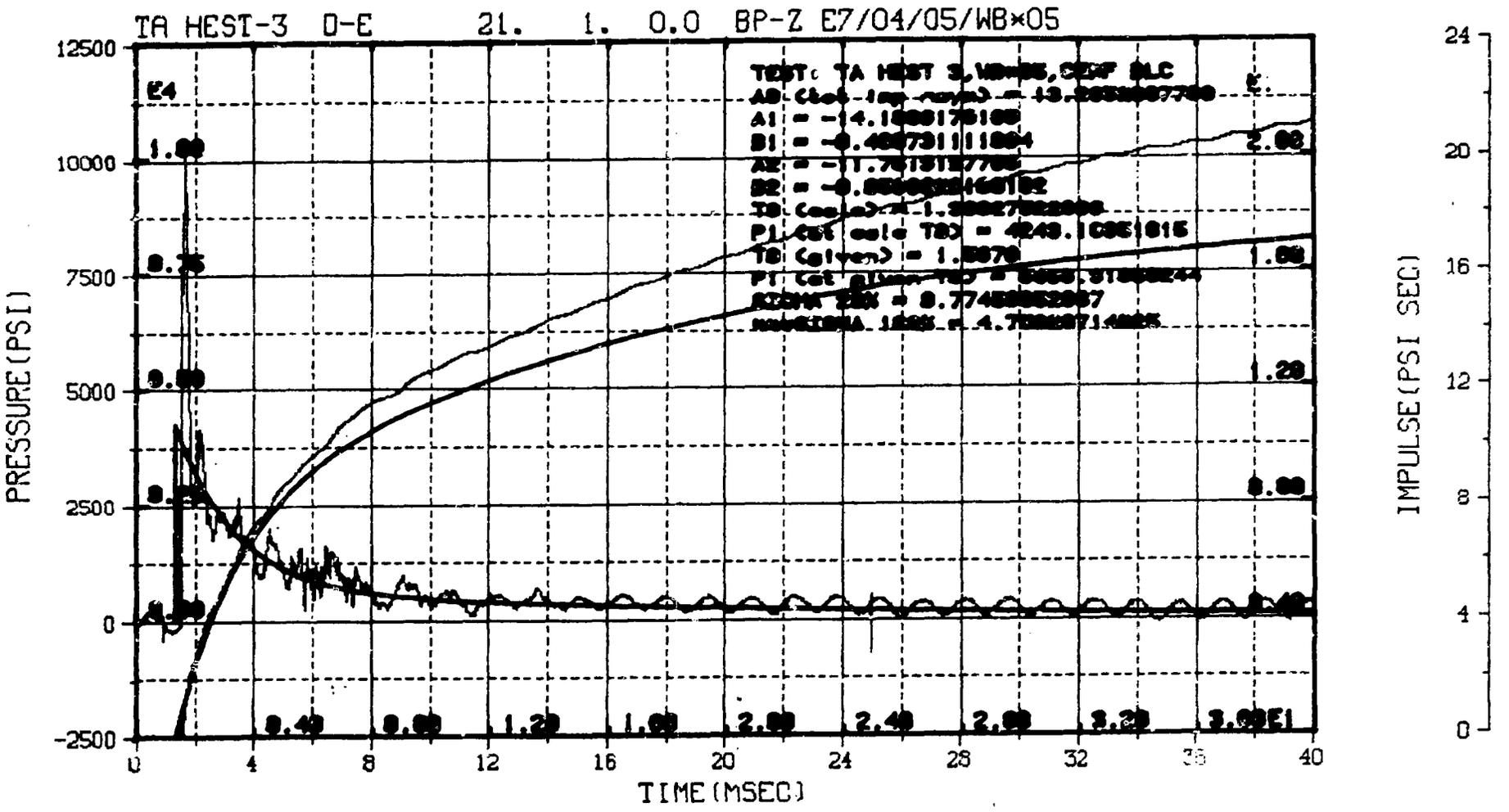

X VS. RESIDUALS FOR: TA WEST 3,
1.00 E1
E-1
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.20
0.40
0.60
0.80

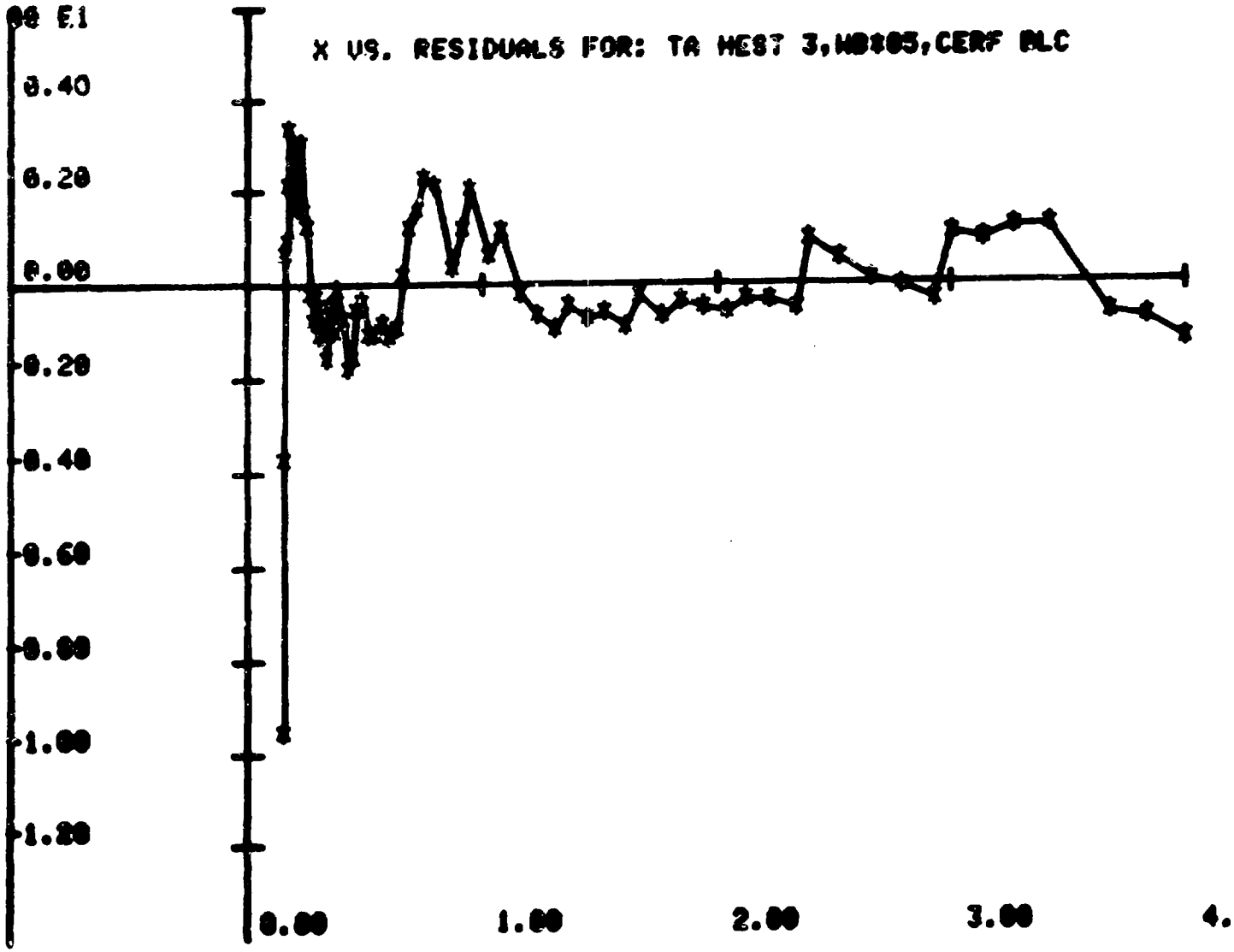


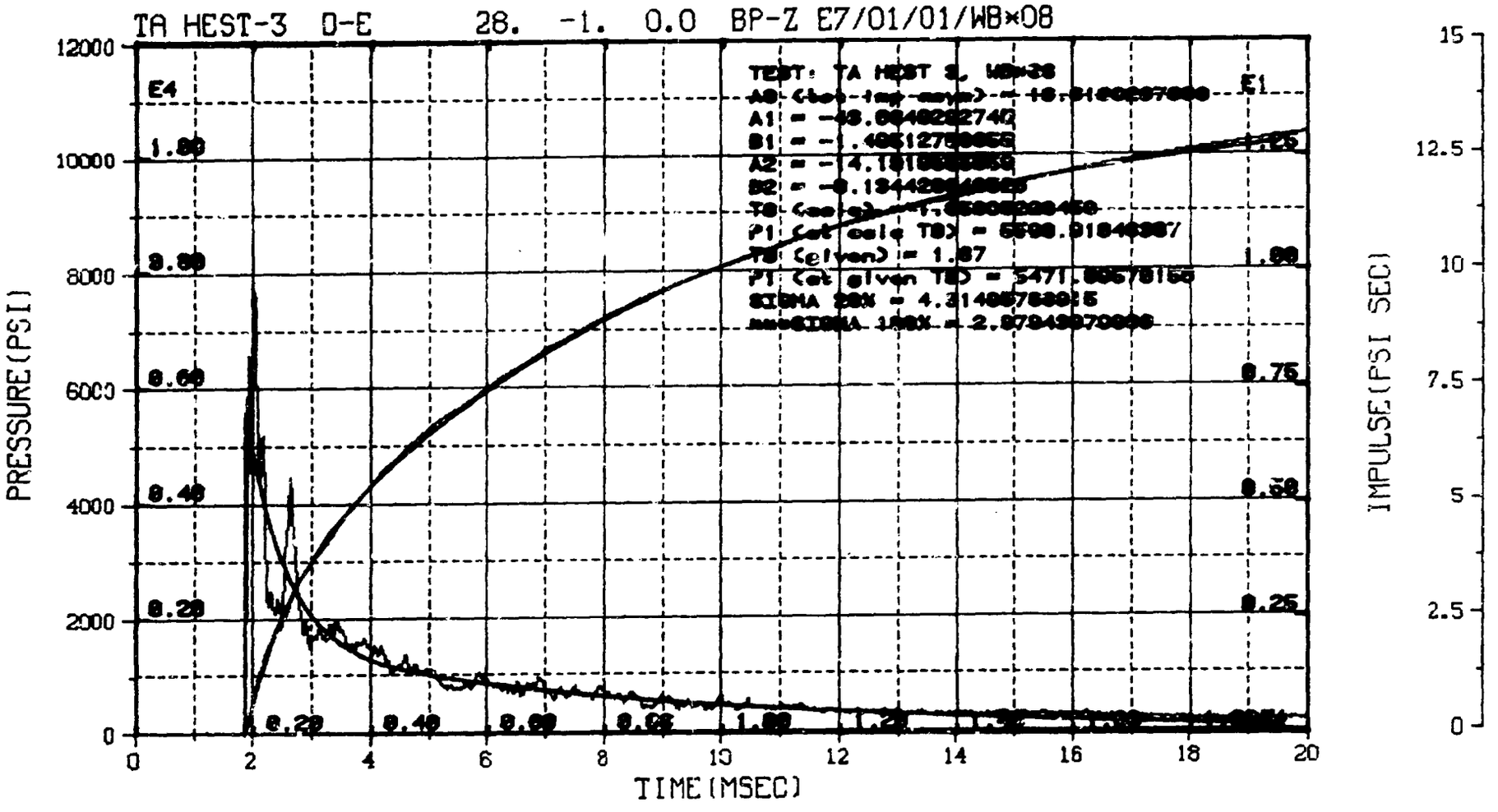
M.N. = 5	E.U. =0.000,7095.000	VSN= ED23
TSKIP=12.650	DIGITS=0.000,756.000	TAPE22
S.R. =100.00 KHZ	11 36 AM, 2 MAY 78.	FILE=40

1


X VS. RESIDUALS FOR: TA WEST 3, WB#05
E1
E-1
4.00
2.00
0.00
-2.00
-4.00
-6.00
0.00
0.50
1.00
1.50
2.

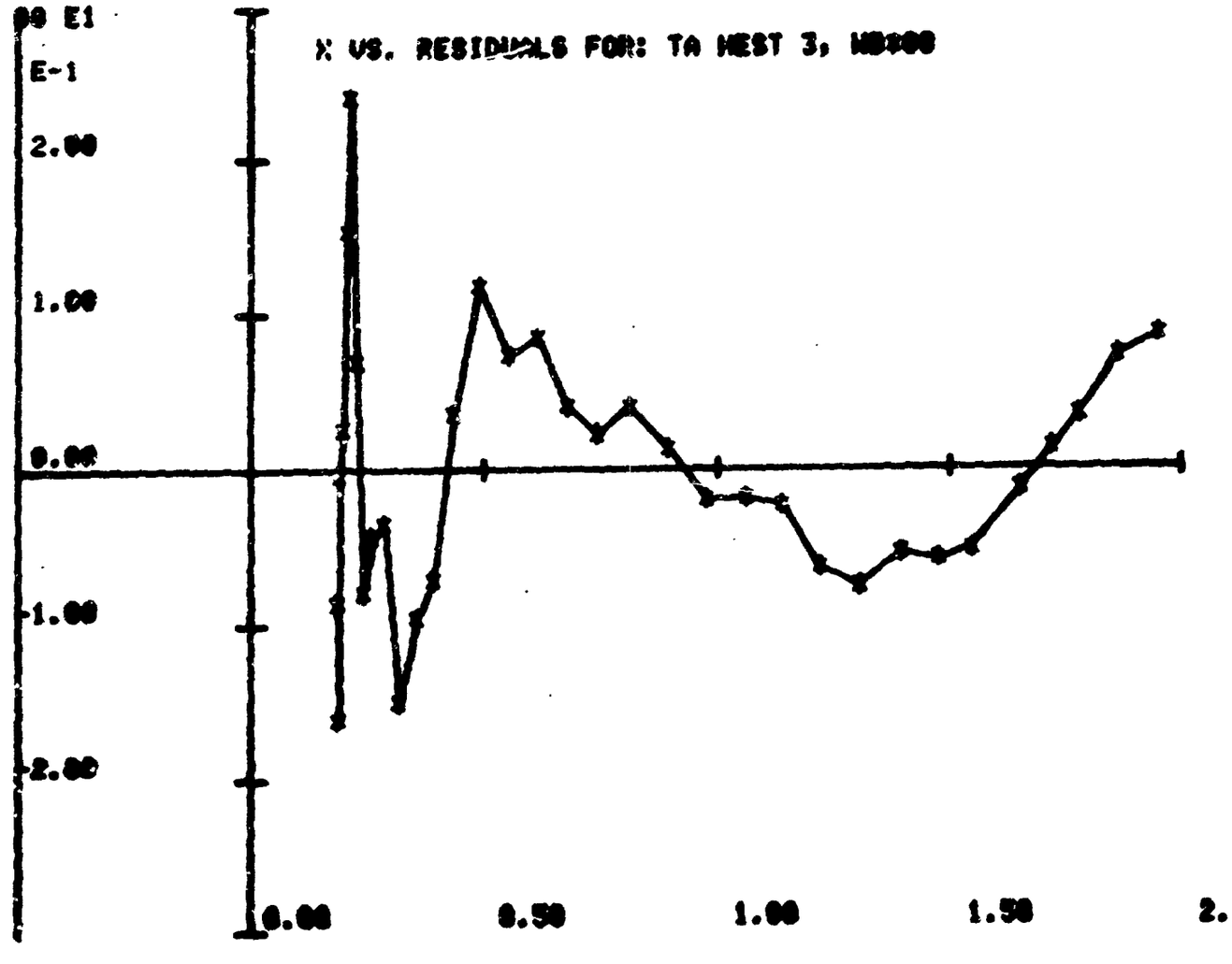

TA HEST-3 D-E 21. 1. 0.0 BP-Z E7/04/05/WB×05
PRESSURE(PSI)
IMPULSE(PSI SEC)
TIME(MSEC)
12500
10000
7500
5000
2500
0
-2500
24
20
16
12
8
4
0
0
4
8
12
16
20
24
28
32
36
40
E4
M.N. = 5
TSKIP 12.650
S.R. =100.00 KHZ
E.U. =0.000,7095.000
DIGITS=0.000,756.000
8 50 AM, 2 MAY 78.
VSN=
TAPE22
FILE=40

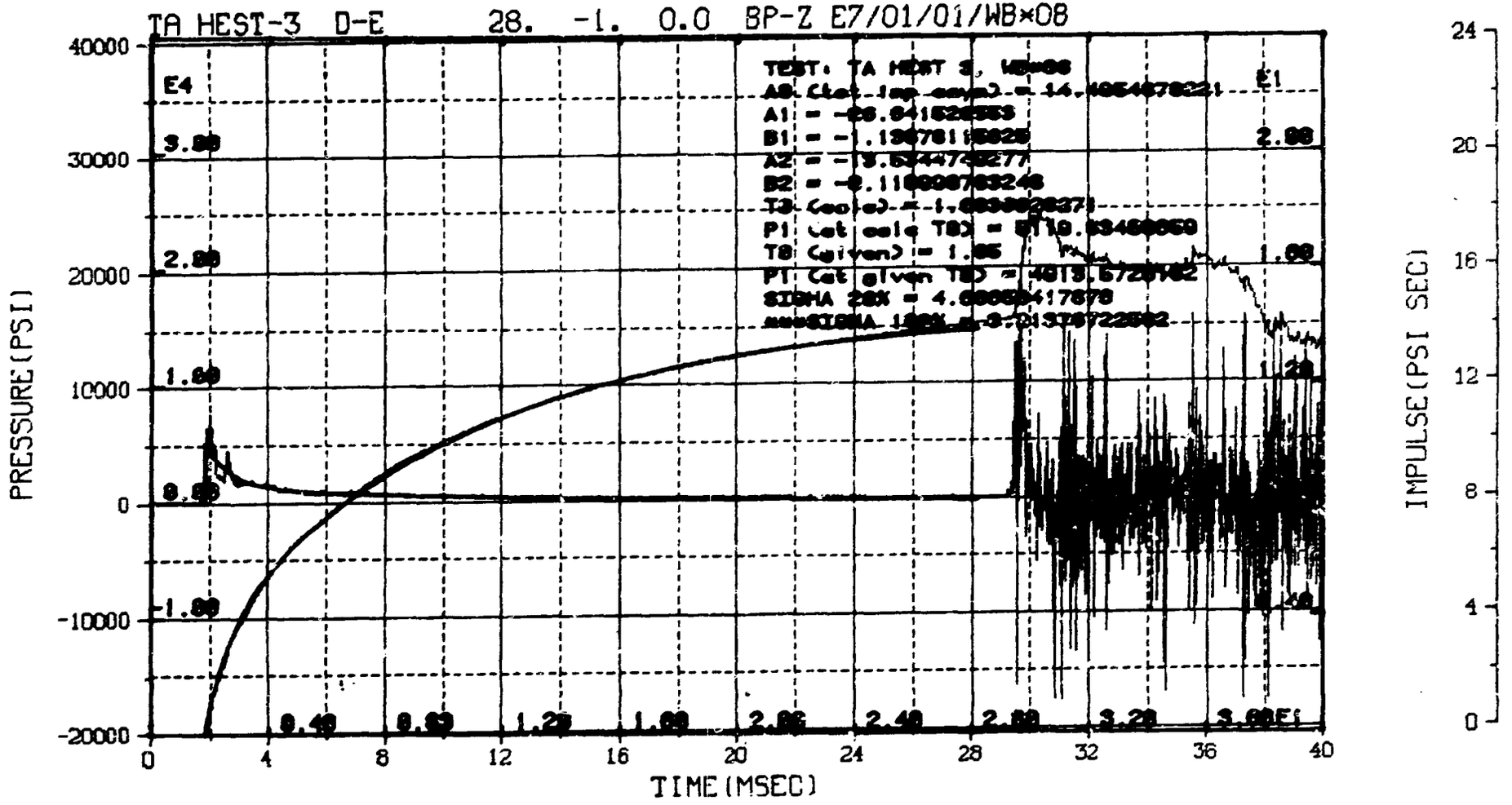

X VS. RESIDUALS FOR: TA HEST 3,MB#85,CERF BLC
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
0.00
1.00
2.00
3.00
4.



I.N. = 8	E.U. =0.000,6514.000	VSN=
TSKIP=12.640	DIGITS=0.000,764.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=2

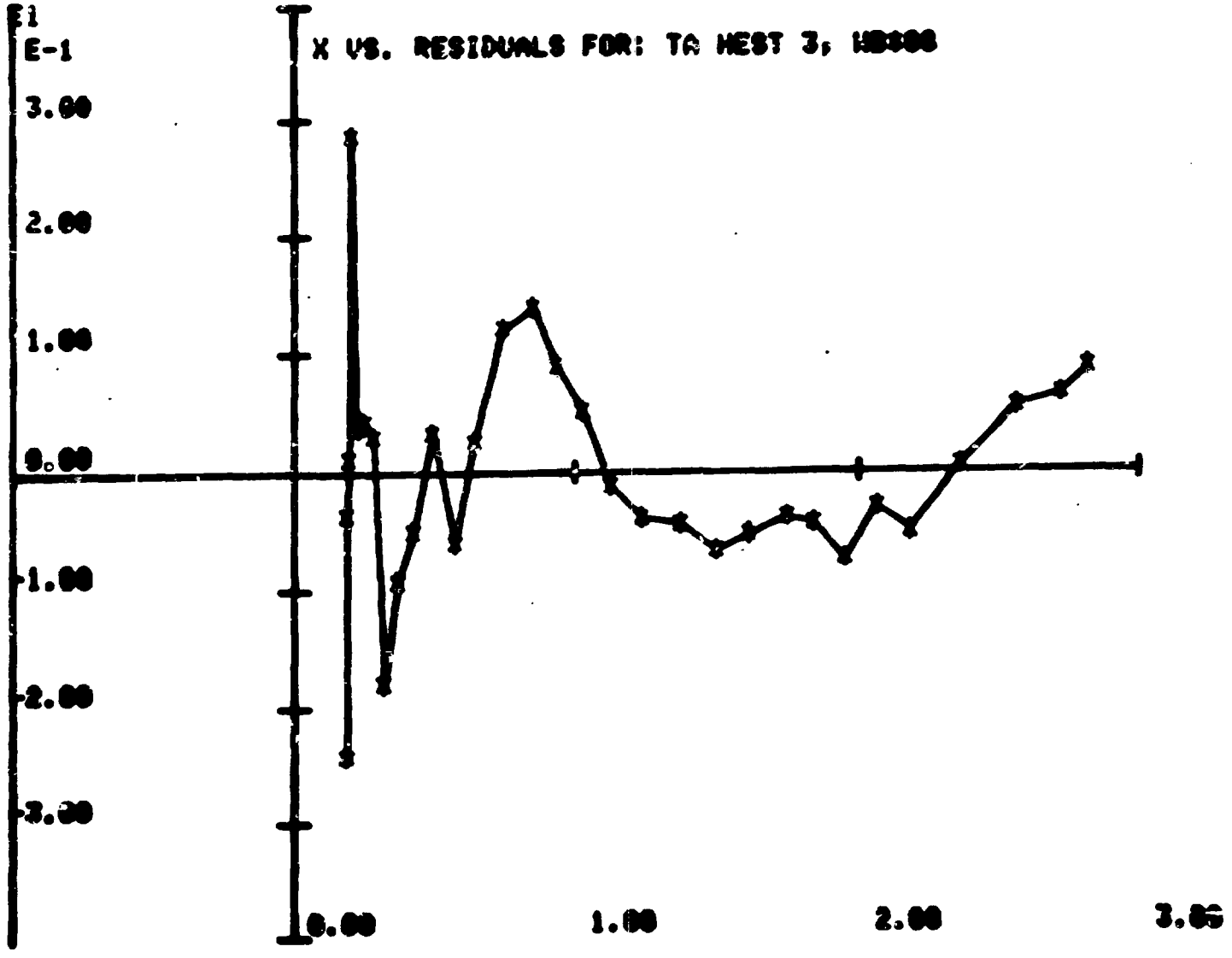
1

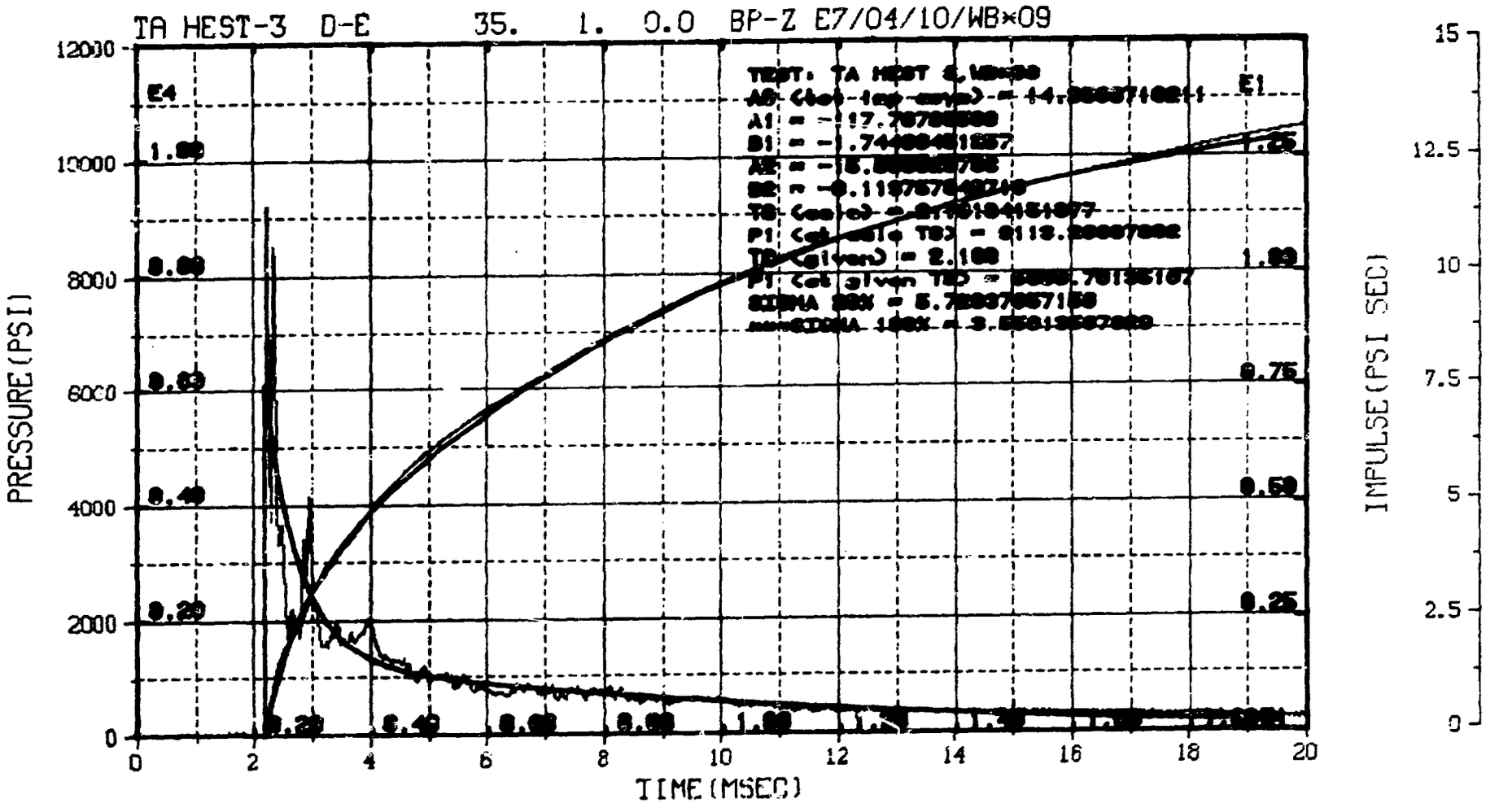

X VS. RESIDUALS FOR: TA WEST 3, WB000
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



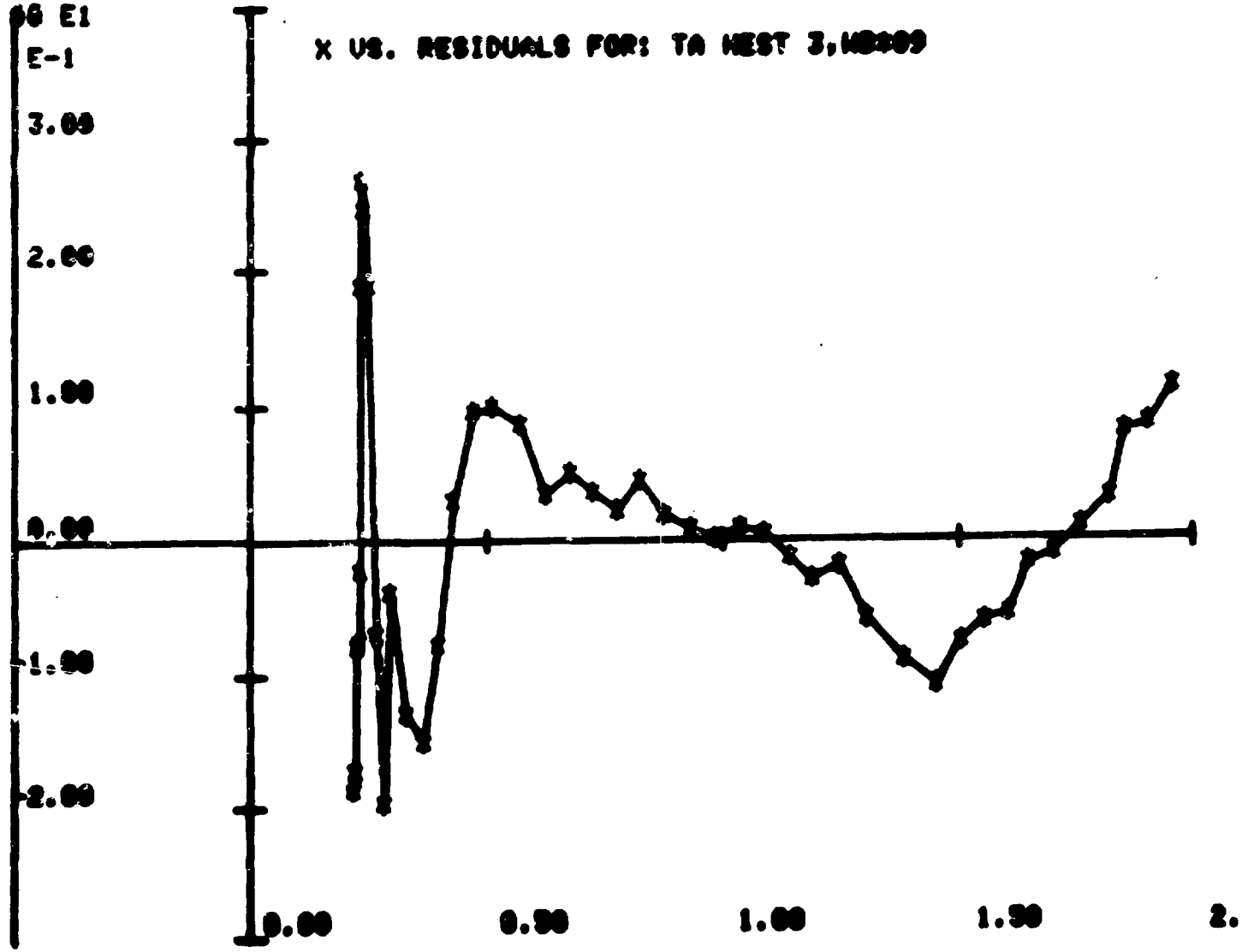
M.N. = 8	E.U. =0.000,6514.000	VSN=
TSKIP=12.640	DIGITS=0.000,764.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=2

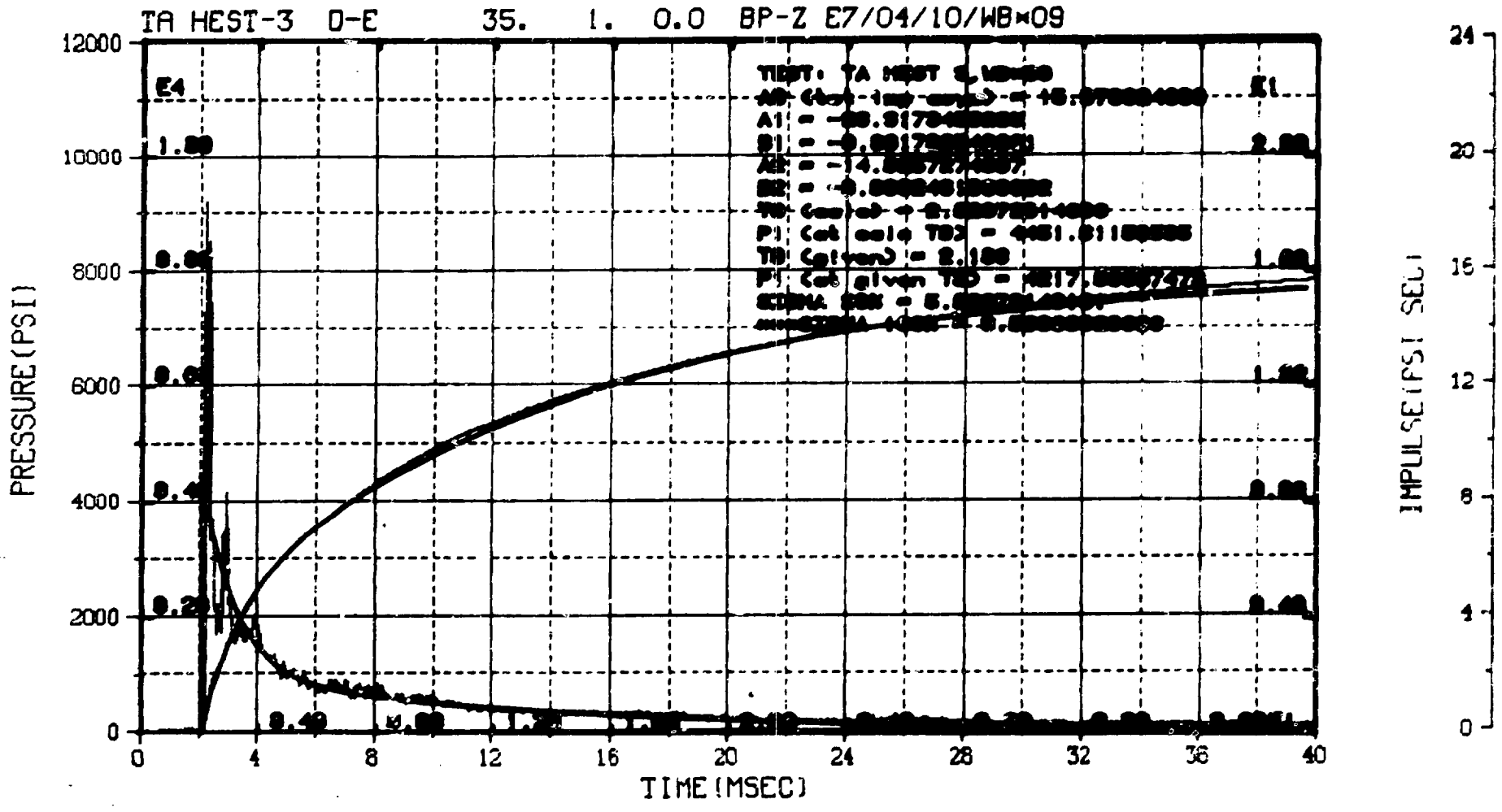
1


E1
E-1
X VS. RESIDUALS FOR: TA HEST 3, HB006
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00

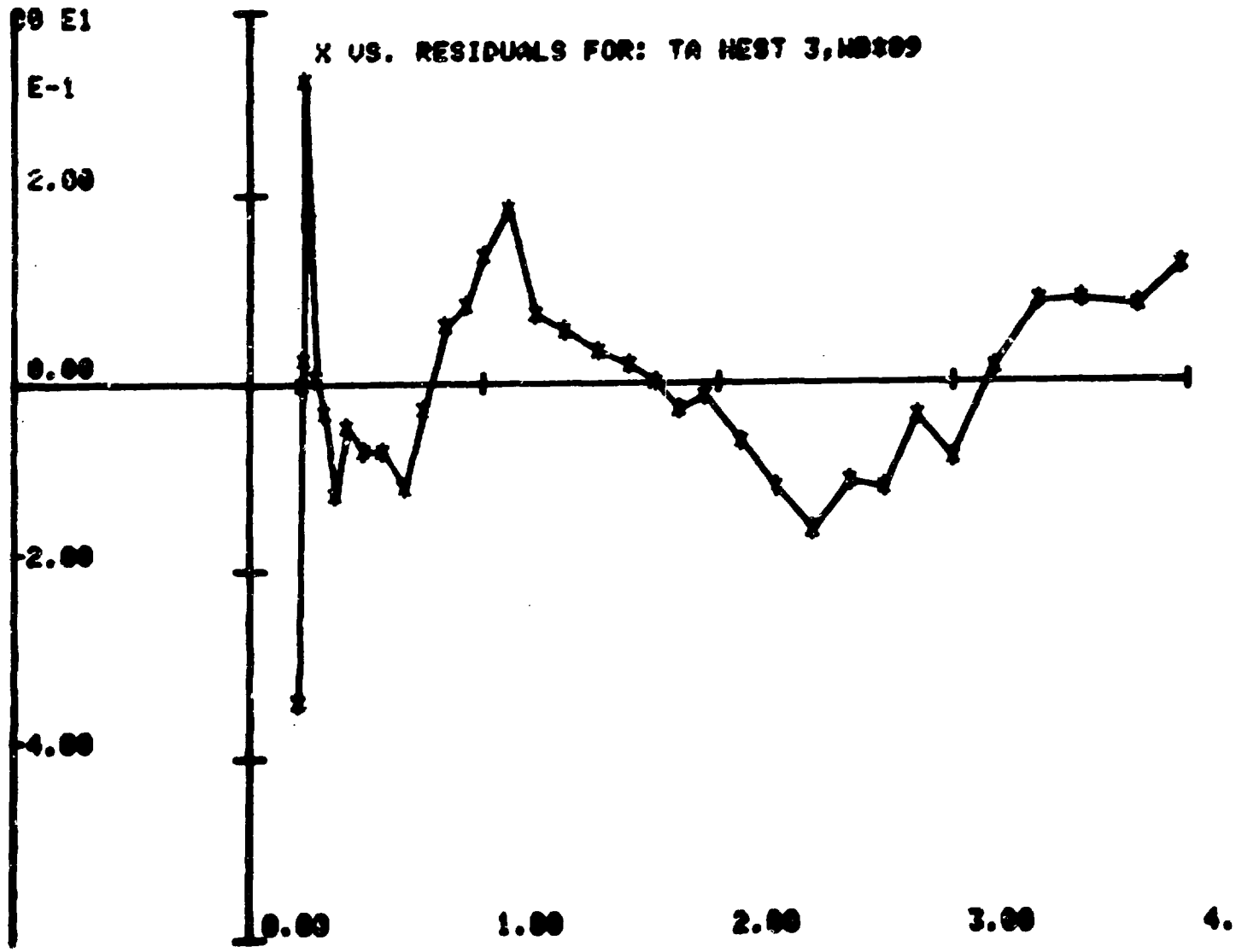


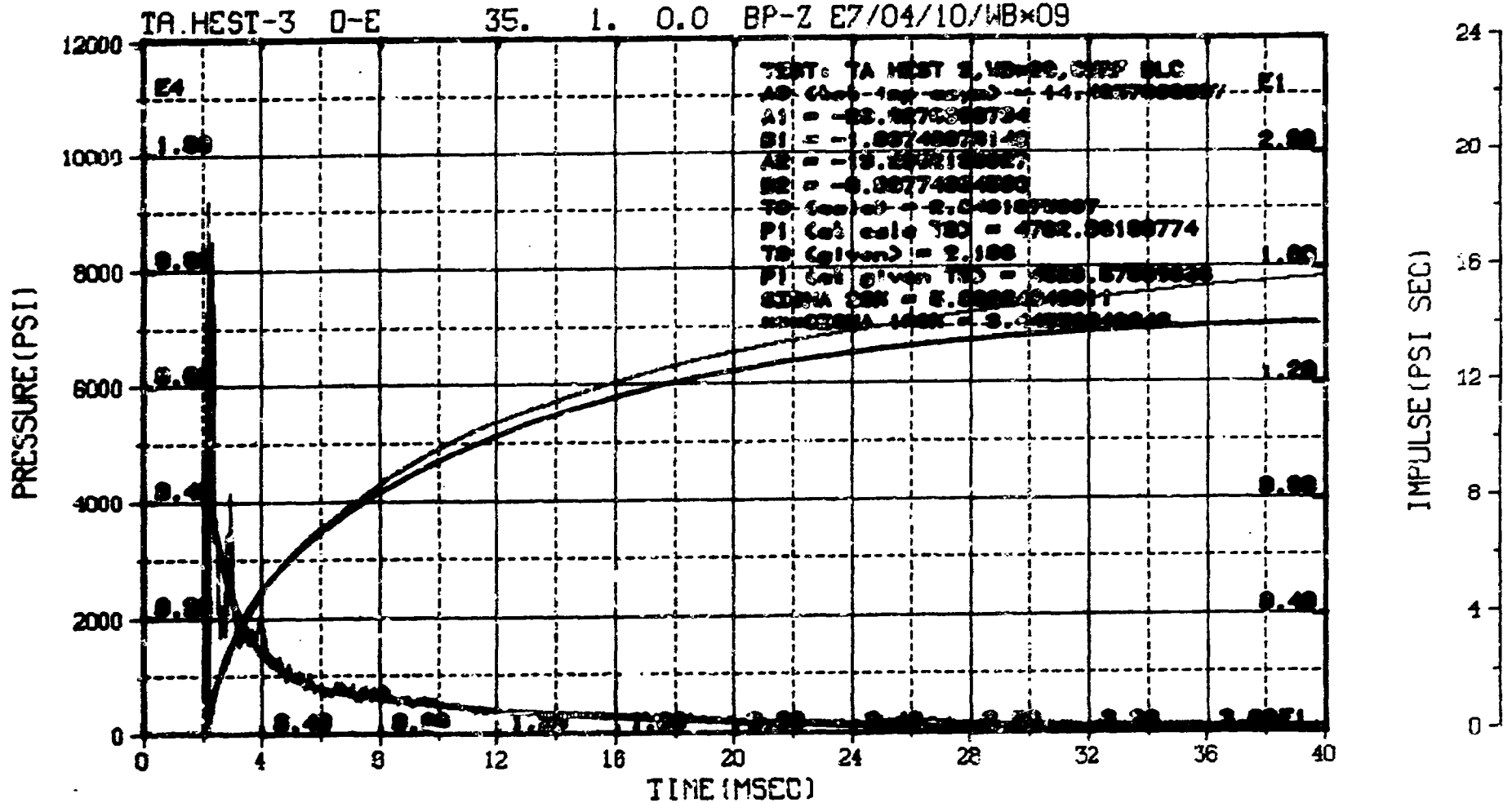
M.N. = 9	E.U. -0.000,6454.000	VSN= ED23
TSKIP=12.650	DIGITS-0.000,831.500	TAPE22
S.R. =100.00 KHZ	11 36 AM, 2 MAY 78.	FILE=44


E1
E-1
X VS. RESIDUALS FOR: TA WEST 3,WB909
3.00
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



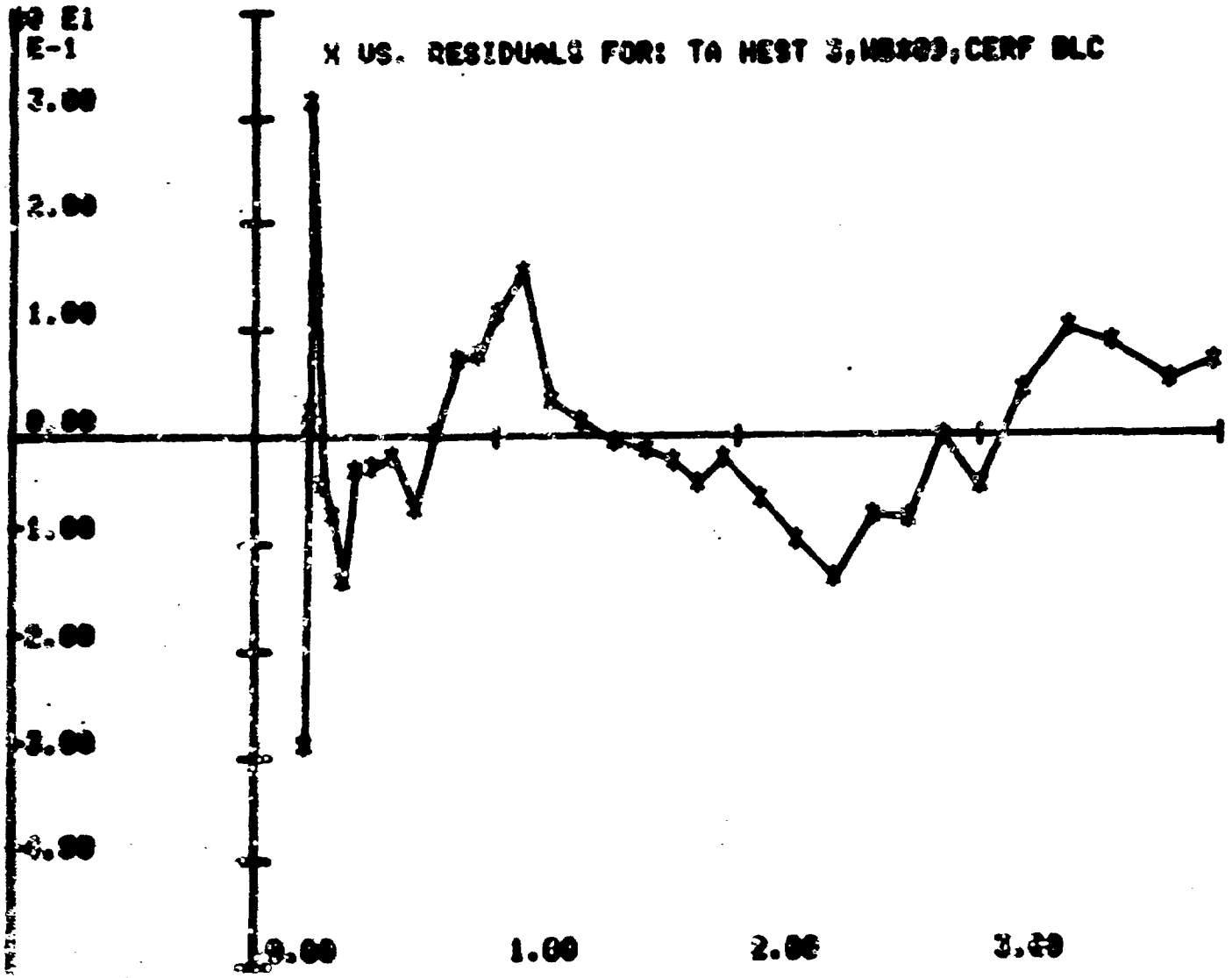
M.N. = 9	E.U. -0.000,6454.000	VSN=
TSKIP=12.650	DIGITS-0.000,631.500	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=44

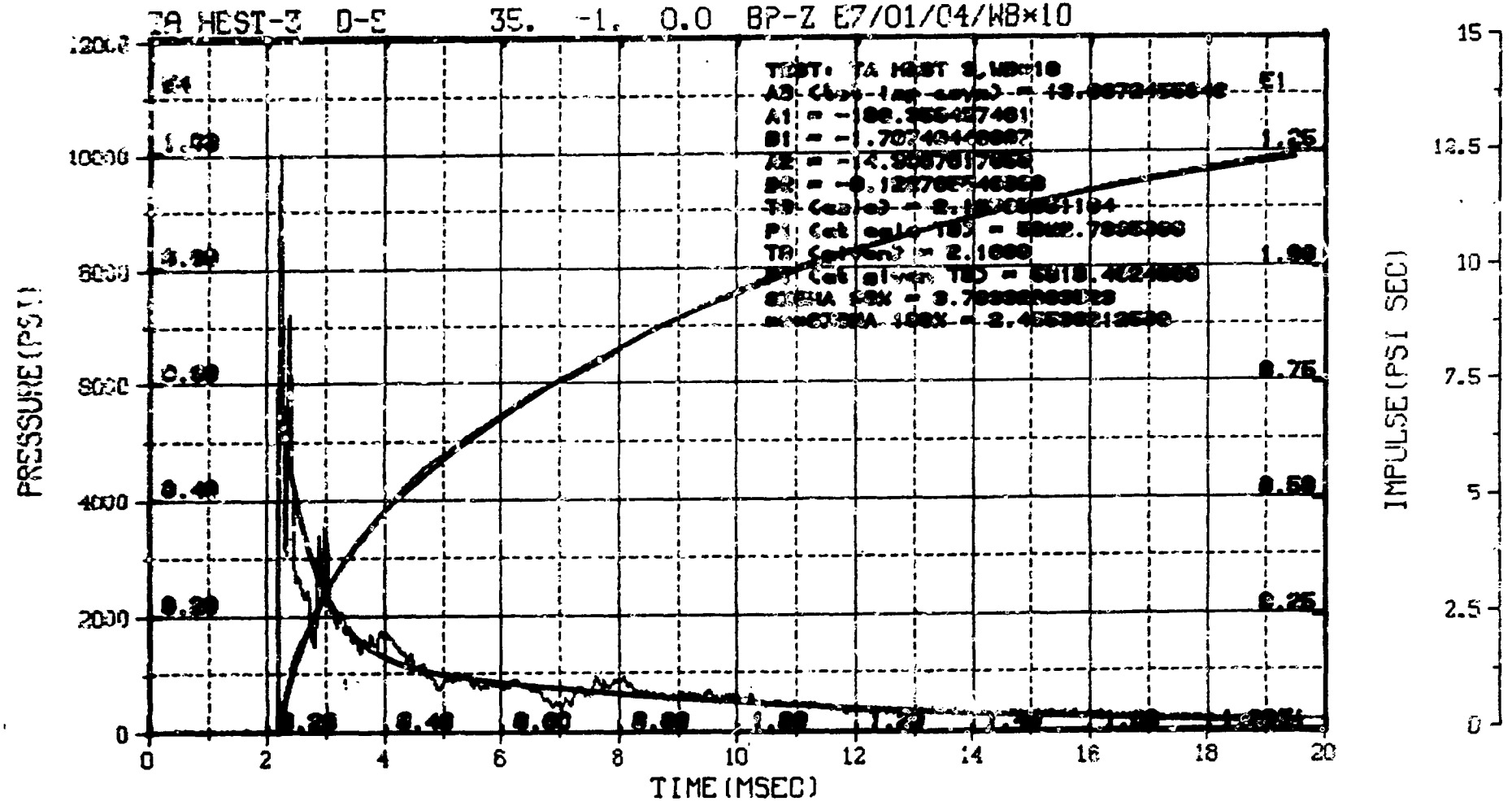

X VS. RESIDUALS FOR: TA WEST 3,WB#09
E-1
2.00
0.00
-2.00
-4.00
0.00
1.00
2.00
3.00
4.



M.N. = 9	E.U. =0.000,6454.000	VSN=
TSKIP=12.650	DIGITS=0.000,831.500	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=44

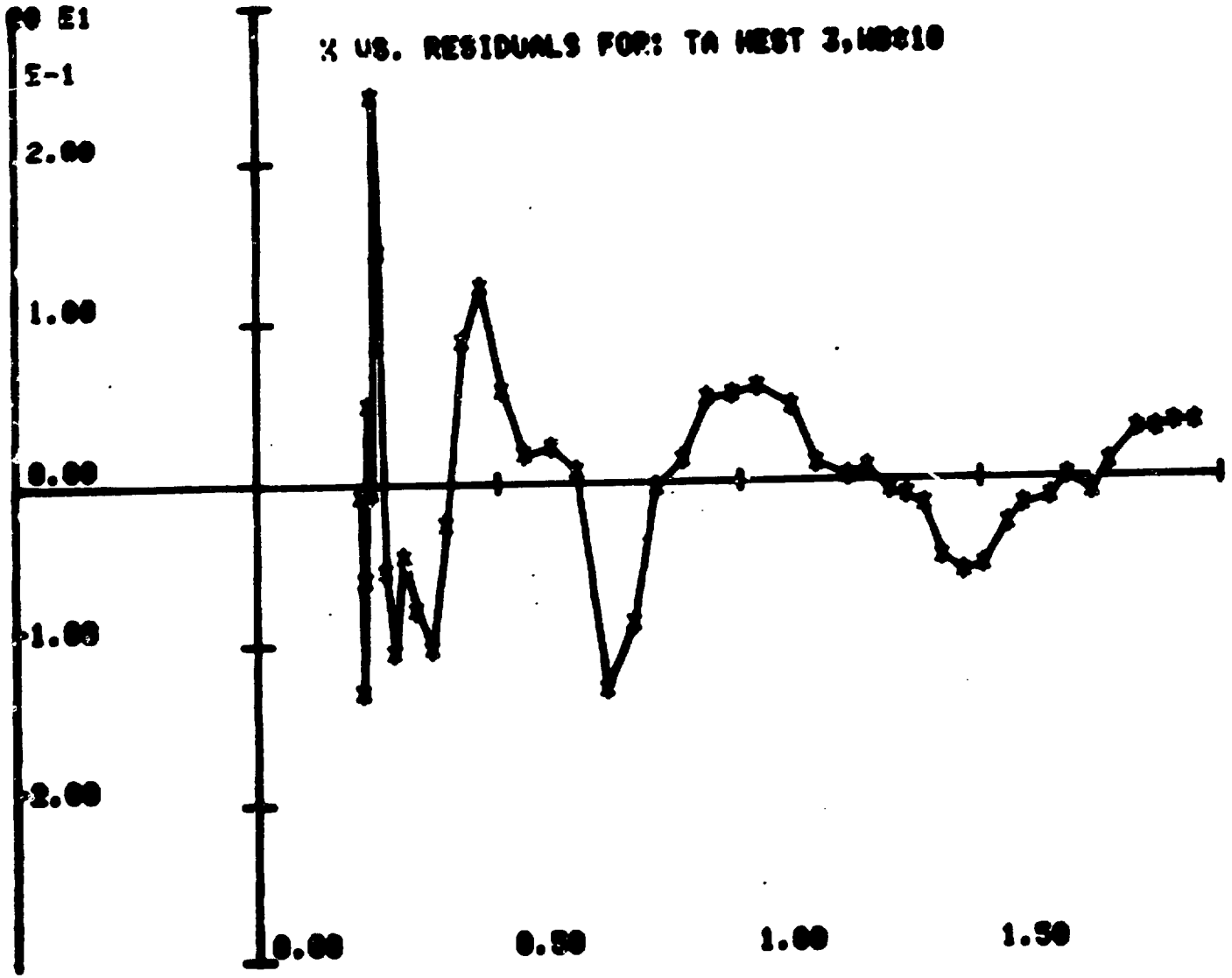
1

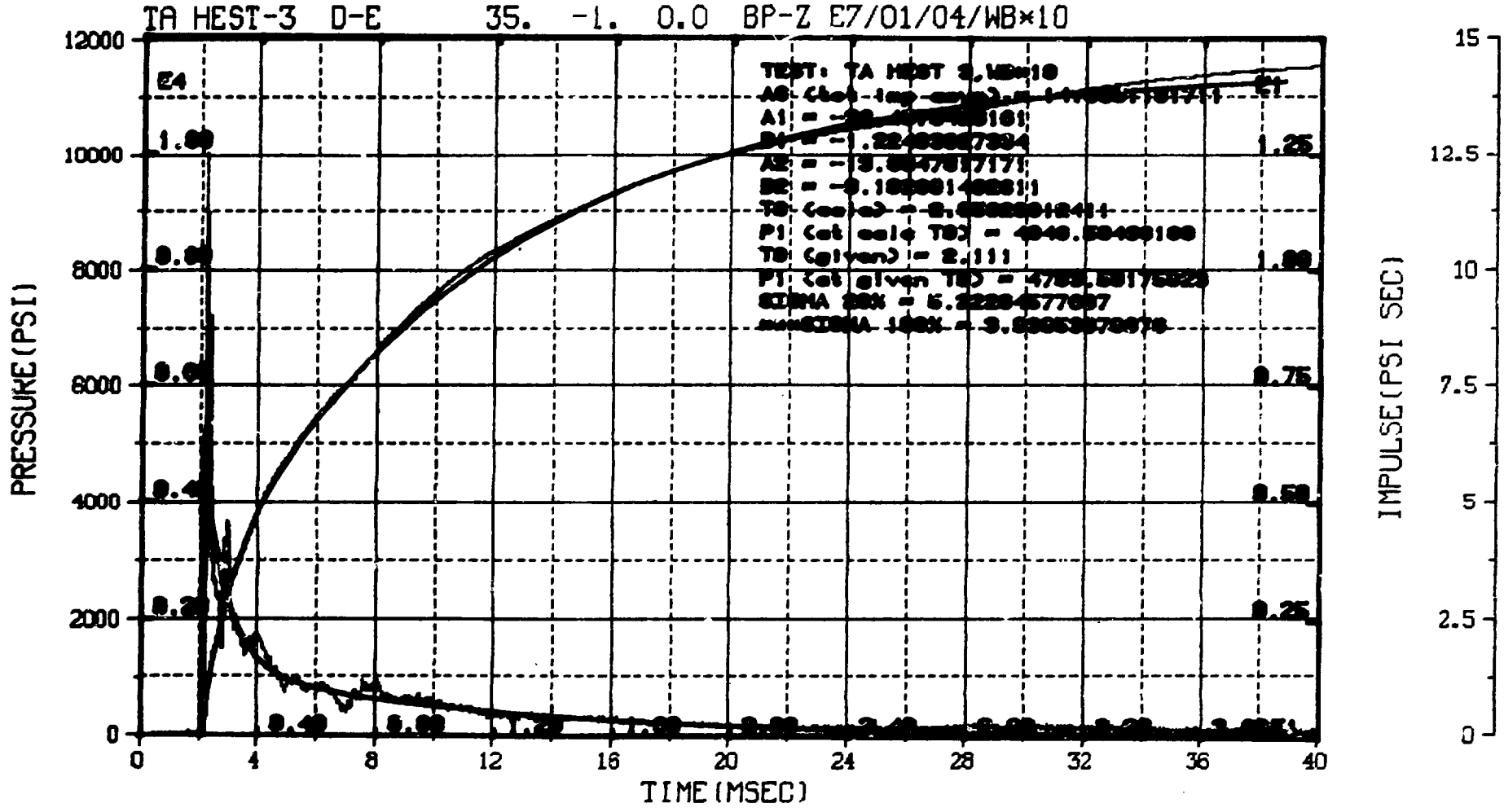

X VS. RESIDUALS FOR: TA WEST 3,WB#09,CERF BLC
E-1
3.00
2.00
1.00
0.00
1.00
2.00
3.00
0.00
1.00
2.00
3.00
4.



M.N. = 10	E.U. -0.000,6272.000	VSN=
TSKIP=12.640	DIGITS-0.000,834.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=8

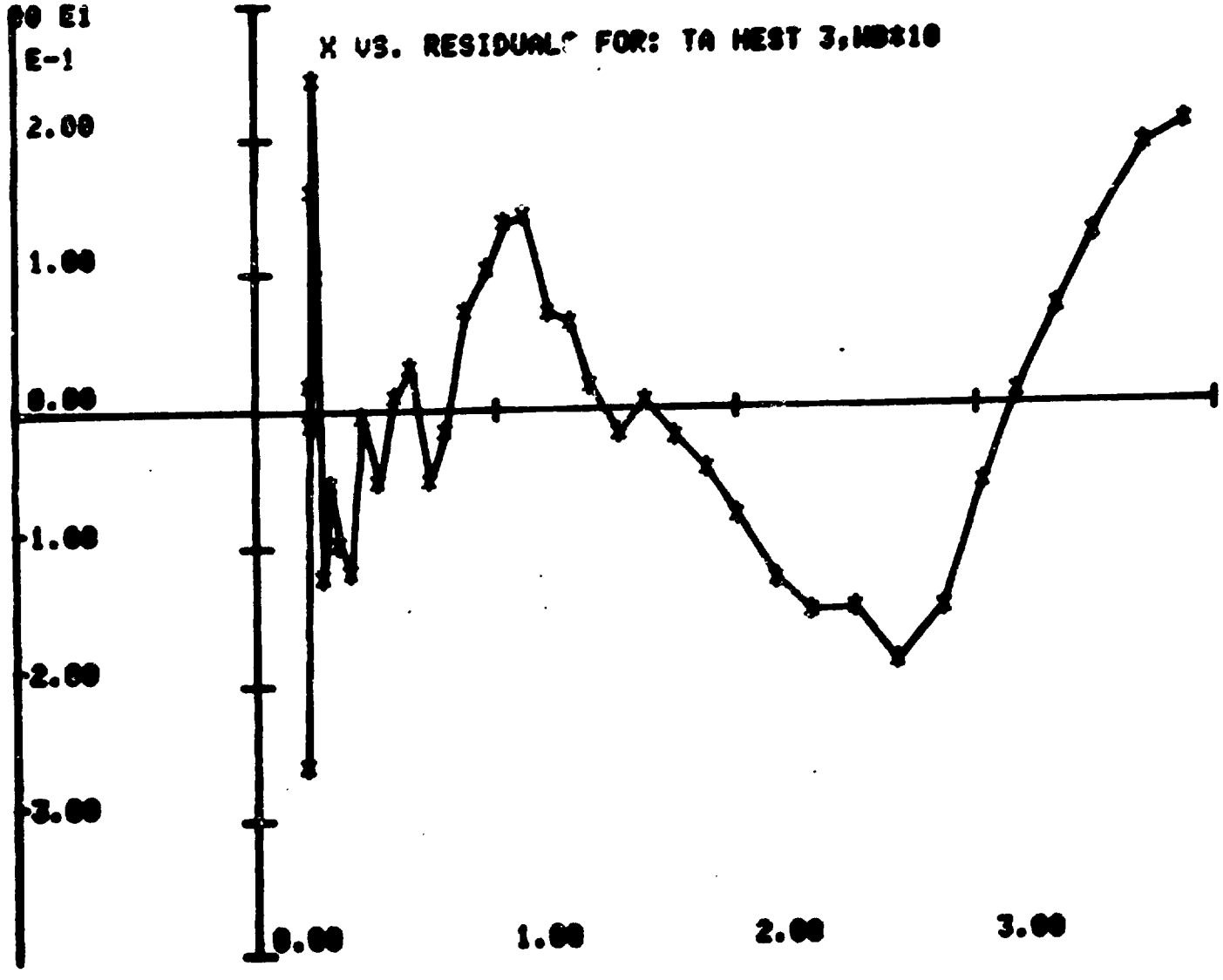
1

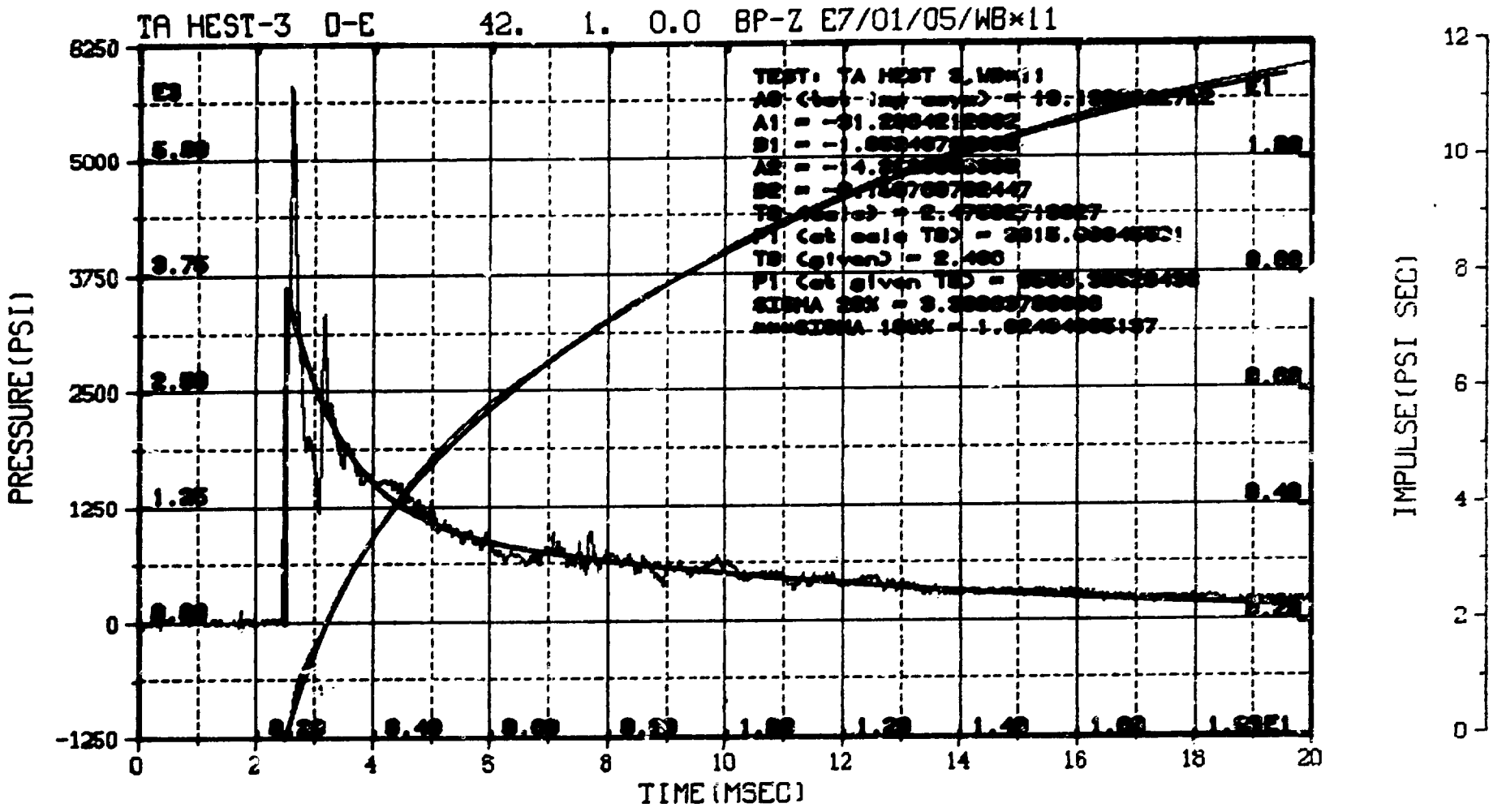

E1
Σ-1
% US. RESIDUALS FOR: TA WEST 3,WB#10
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



M.N. = 10	E.U. -0.000,6272.000	VSN=
TSKIP=12.640	DIGITS=0.000,834.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=8

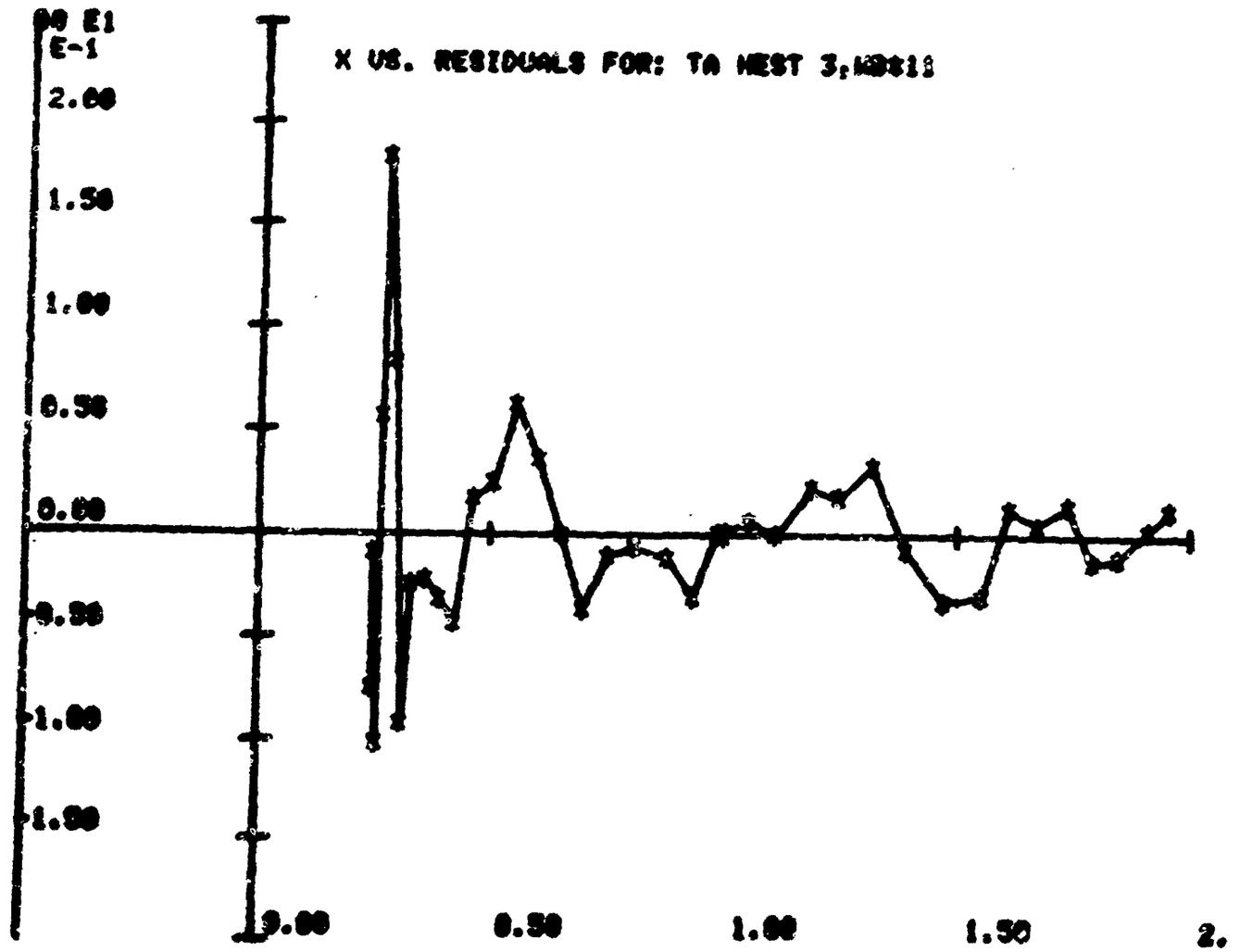
1

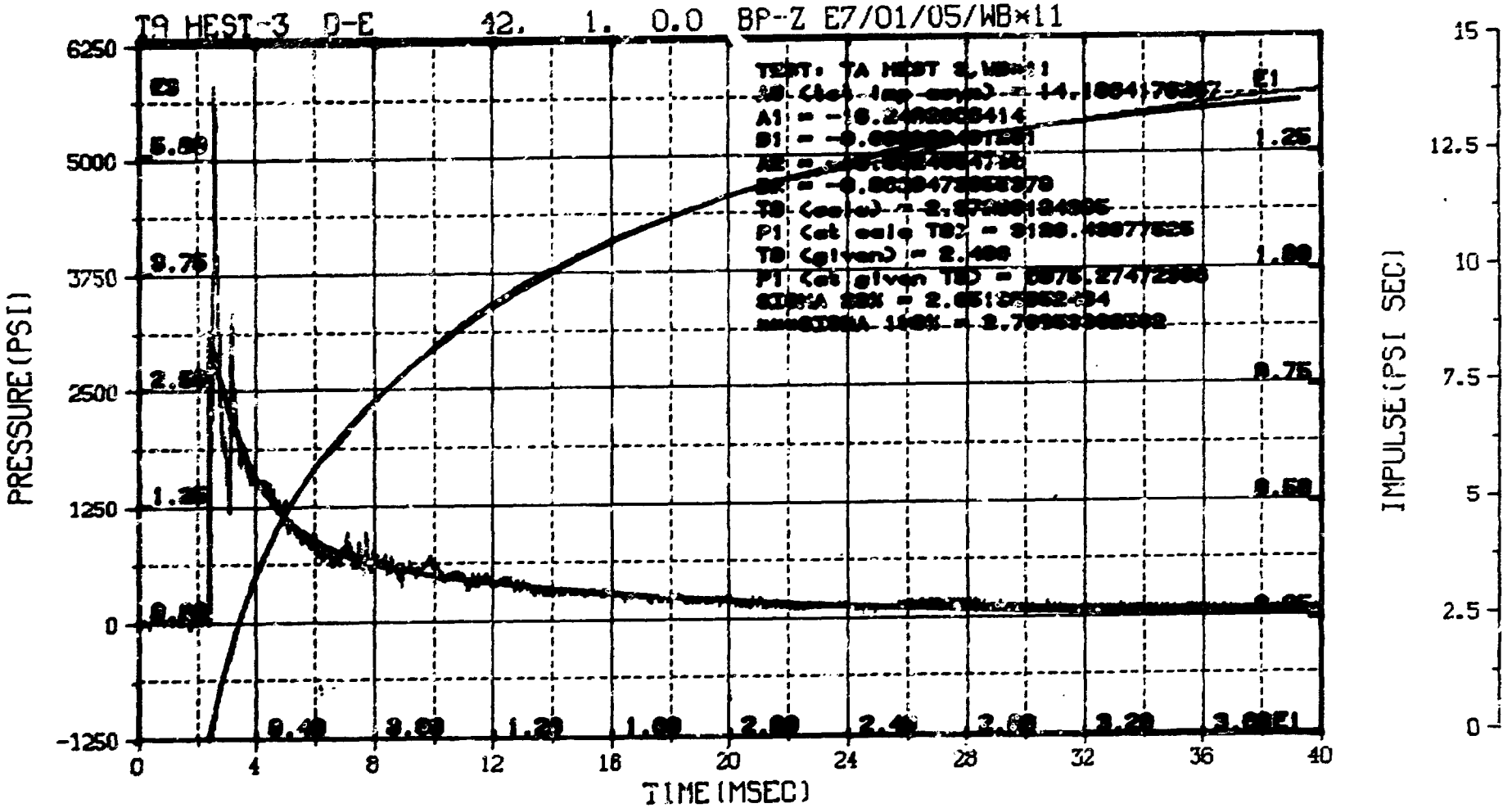

X VS. RESIDUALS FOR: TA WEST 3,NB=10
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00
4.



M.N. = i1	E.U. =0.000,4222.000	VSN=
TSKIP=12.640	DIGITS=0.000,602.500	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=10

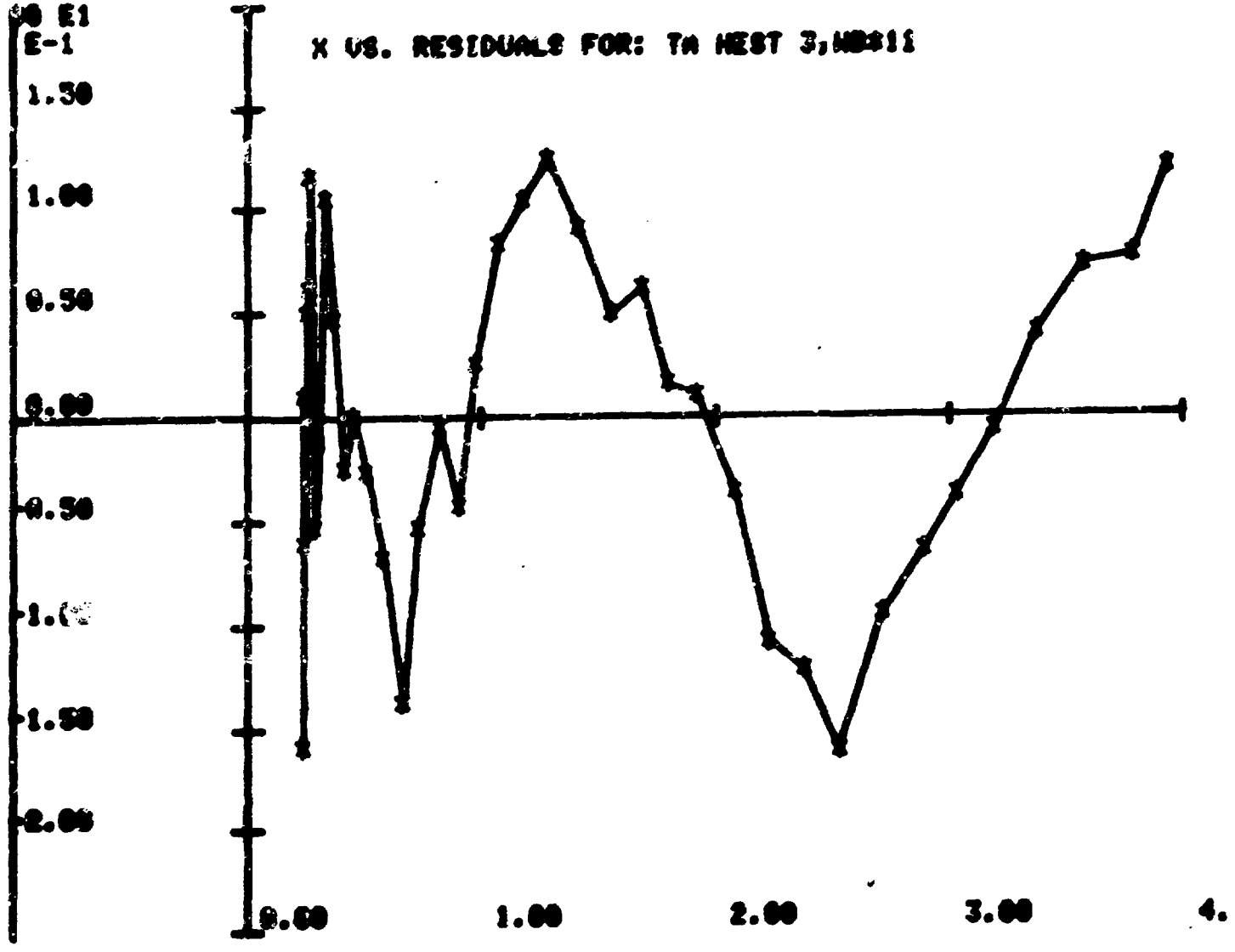
1

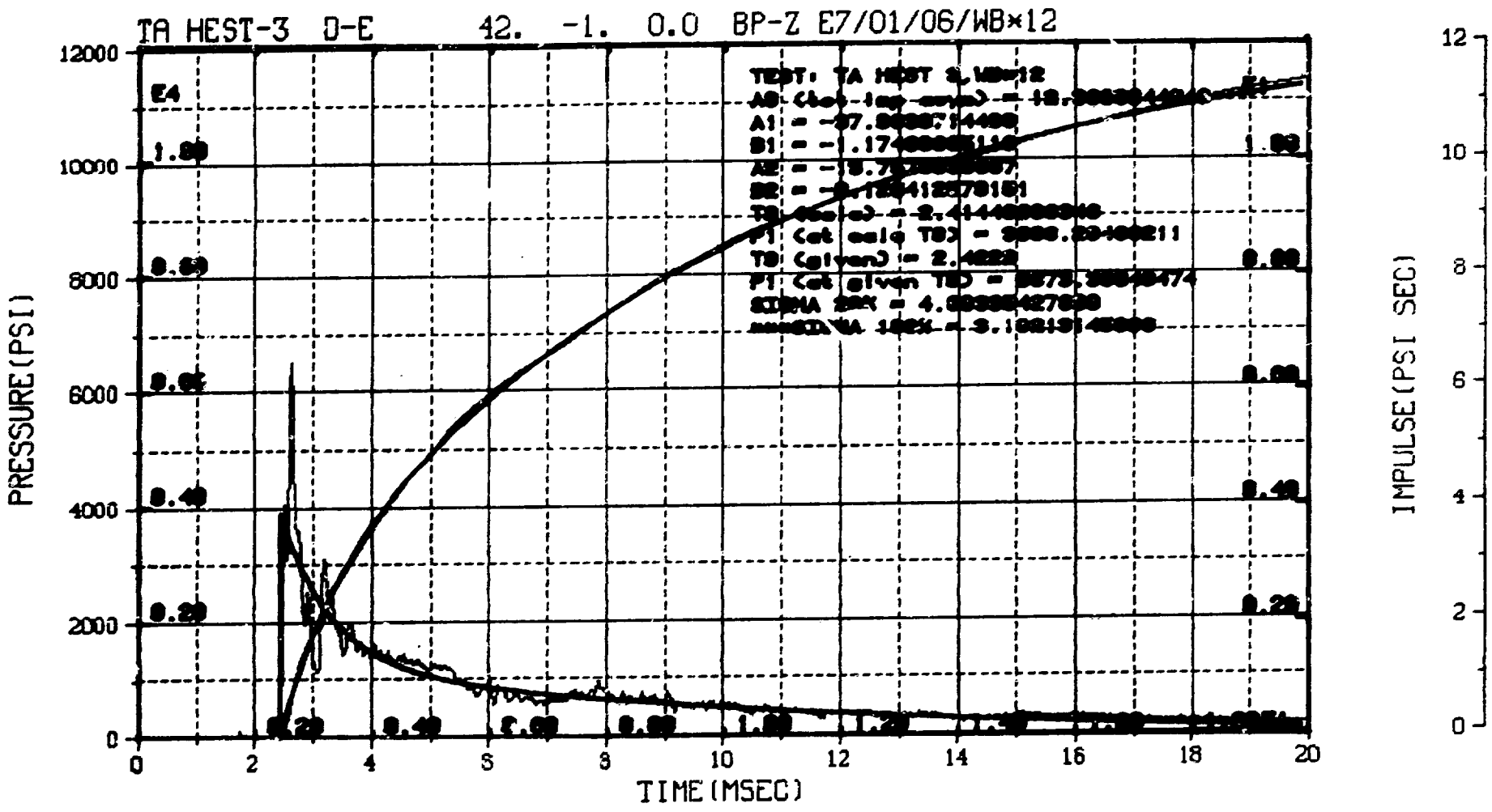

X VS. RESIDUALS FOR: TA WEST 3,WD#11
E-1
2.00
1.50
1.00
0.50
0.00
1.00
1.00
0.00
0.50
1.00
1.50
2.



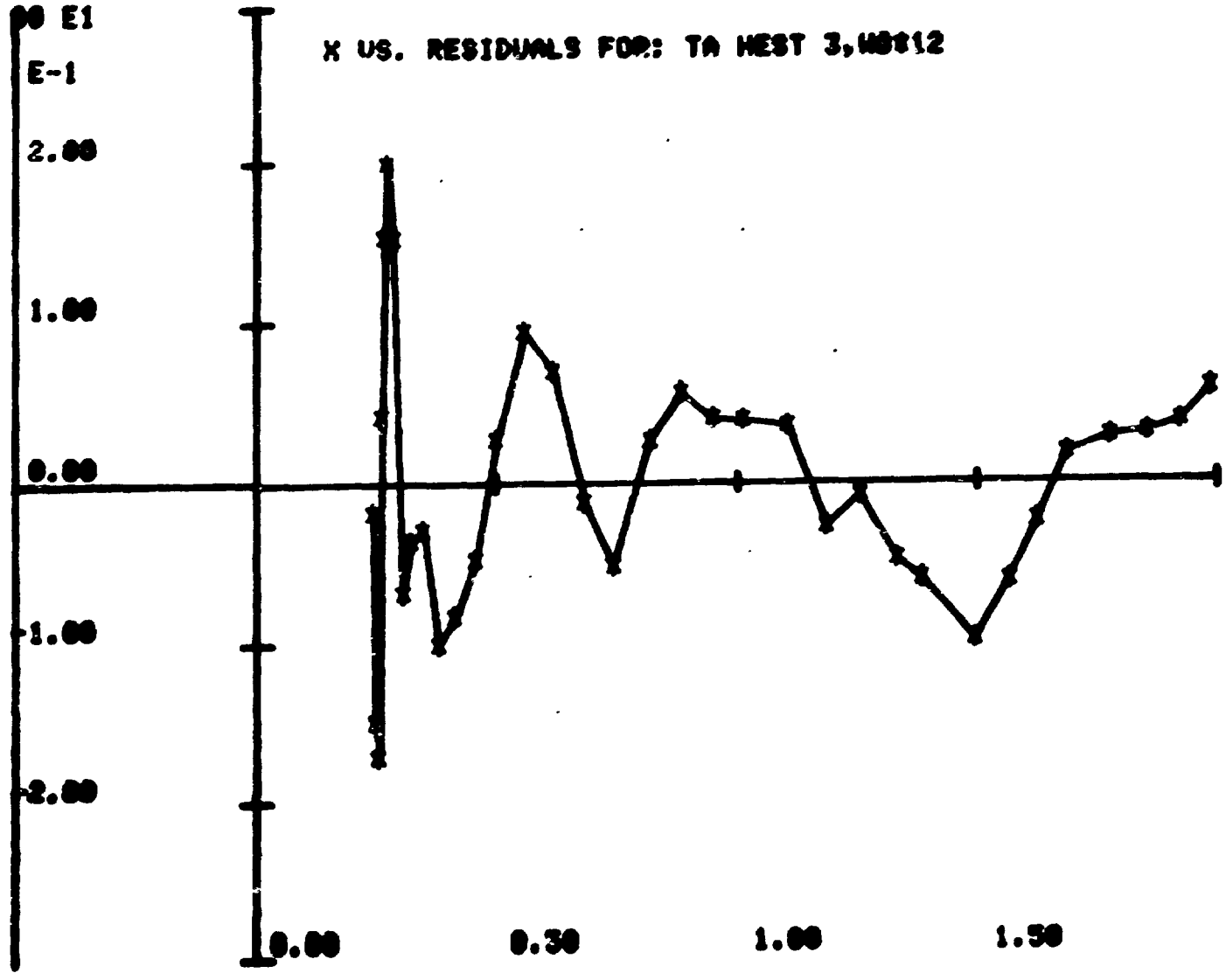
M.N. = 11	E.U. -0.000, 4222.000	VSN=
TSKIP=12.640	DIGITS=0.000, 602.500	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=10

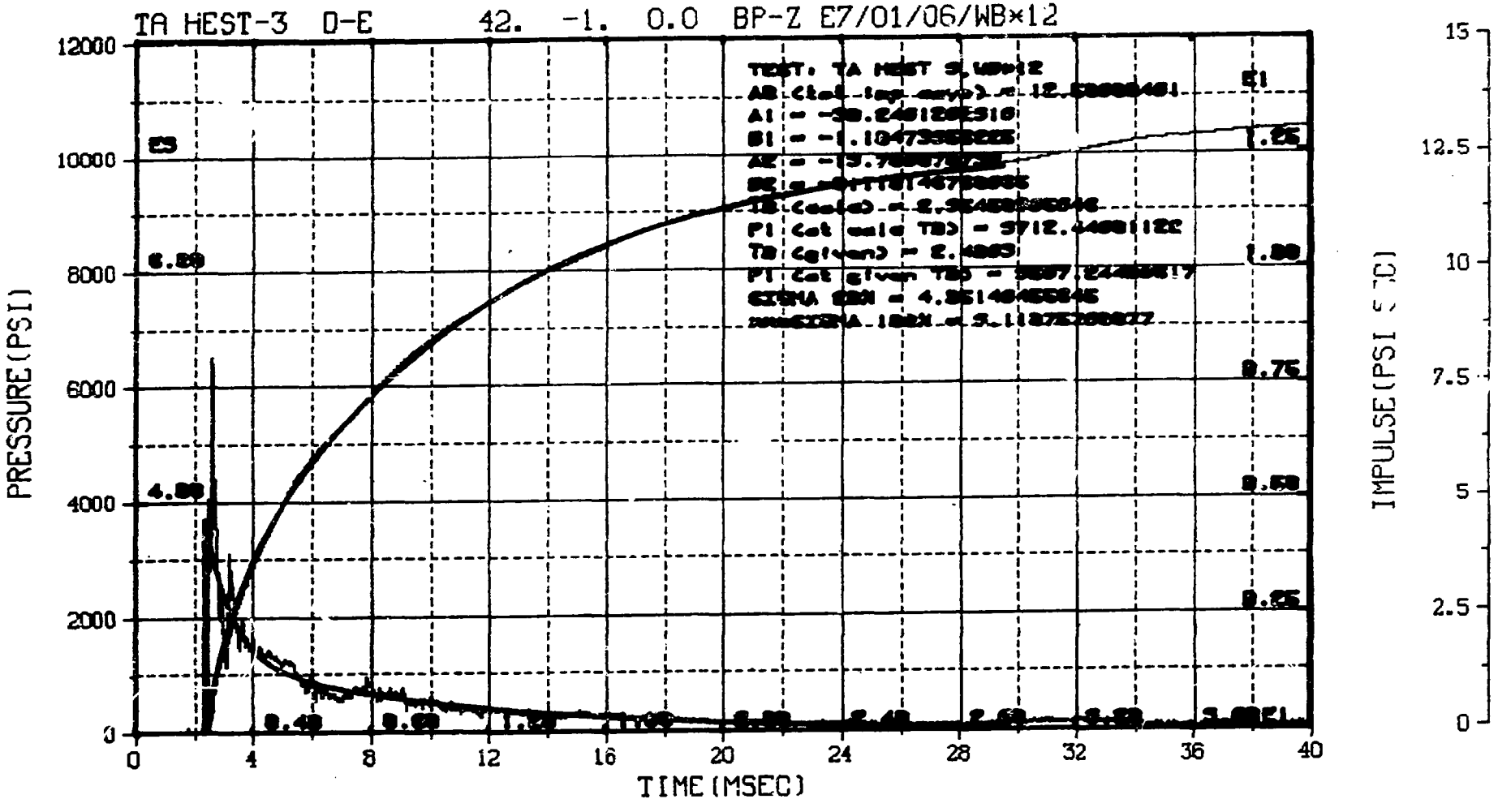
1


E1
E-1
X VS. RESIDUALS FOR: TA HEST 3,NB=11
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
1.00
2.00
3.00
4.



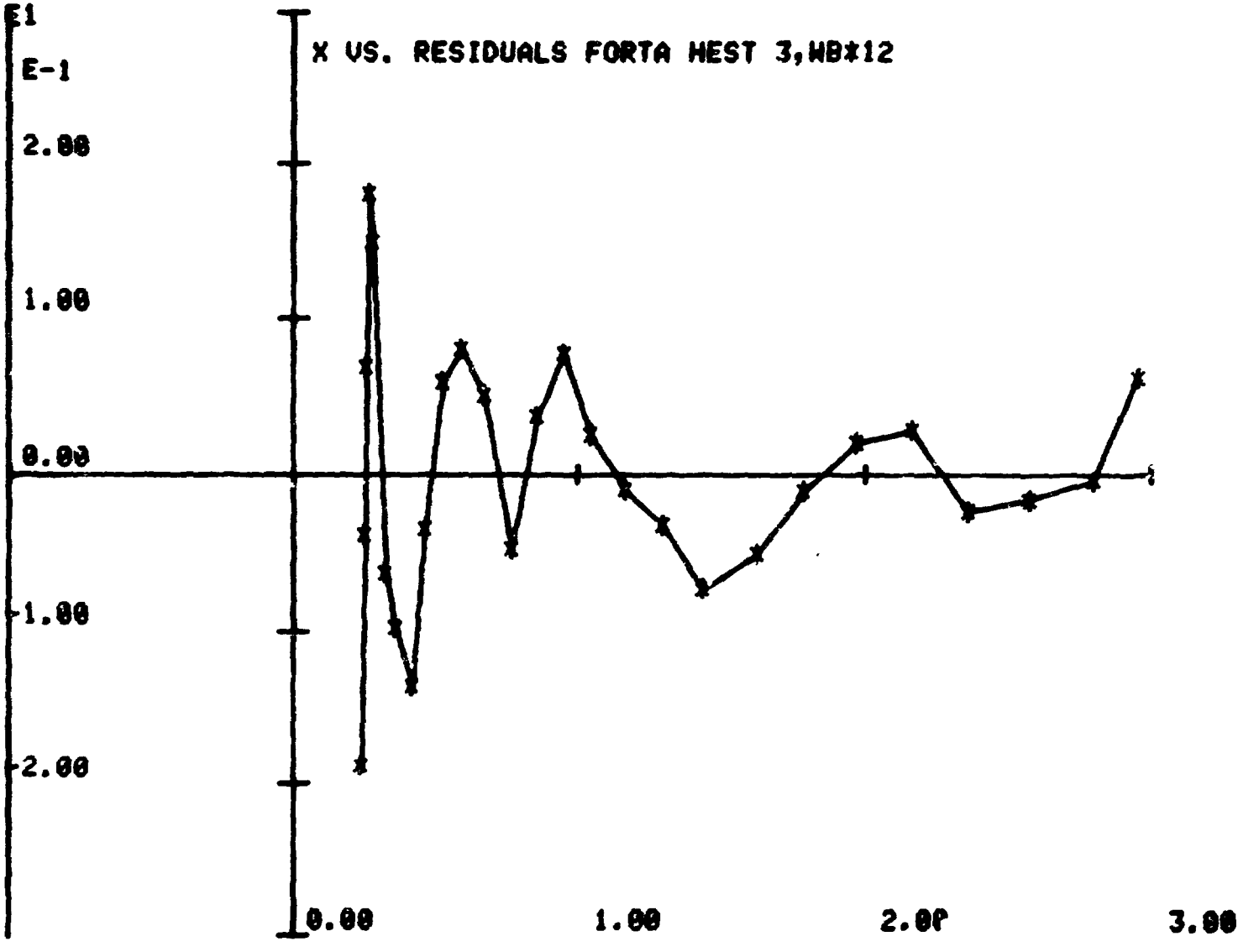
M.N. = 12	E.U. =0.000,6372.000	VSN=
TSKIP=12.640	DIGITS=0.000,919.125	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=12

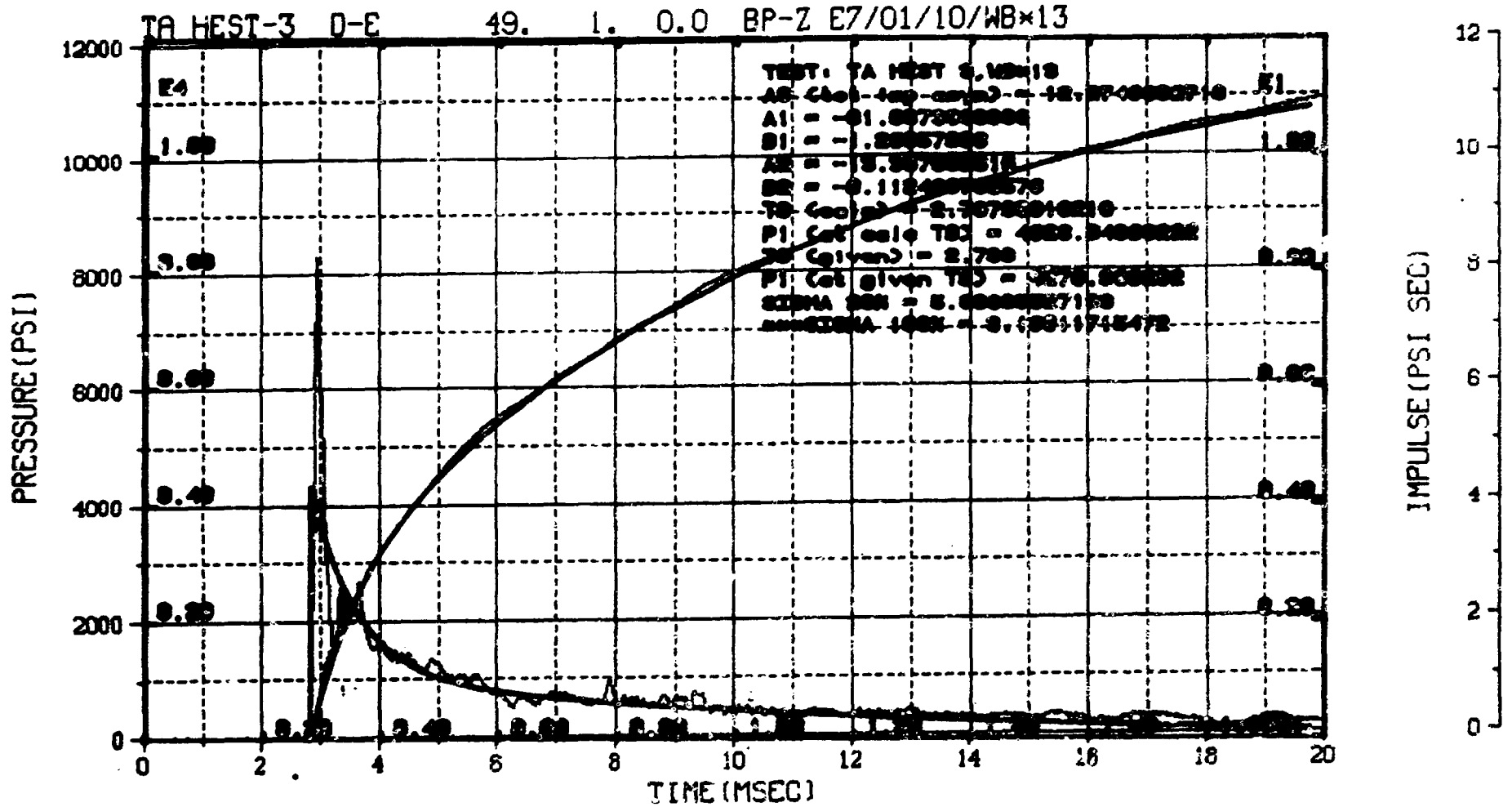

X VS. RESIDUALS FOR: TA WEST 3,WB812
E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



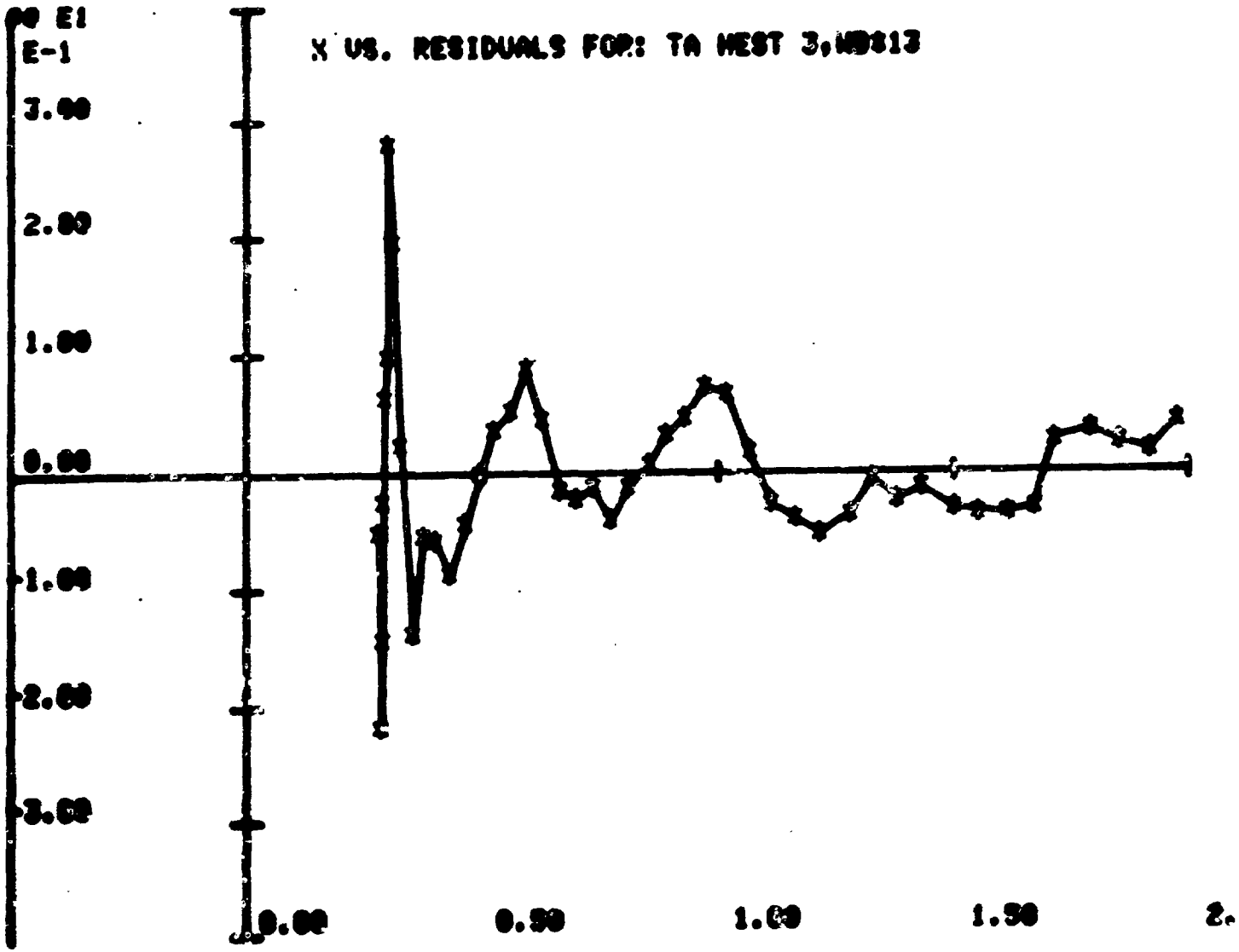
M.N. = 12	E.U. =0.000,6372.000	VSN=
TSKIP=12.640	DIGITS=0.000,919.125	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=12

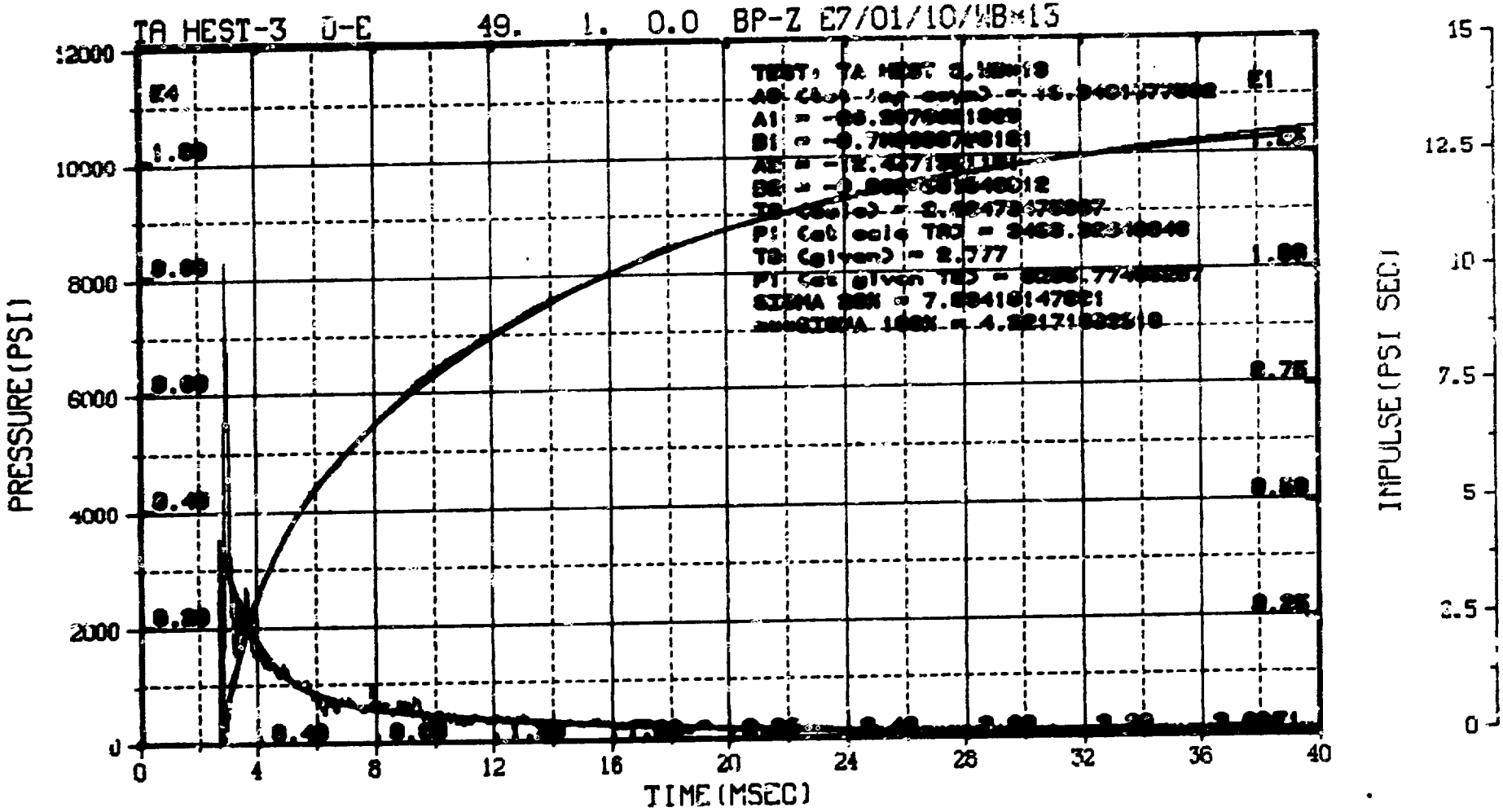
1


E1
E-1
X VS. RESIDUALS FORTA HEST 3,HB*12
2.00
1.00
0.00
-1.00
-2.00
0.00
1.00
2.00
3.00



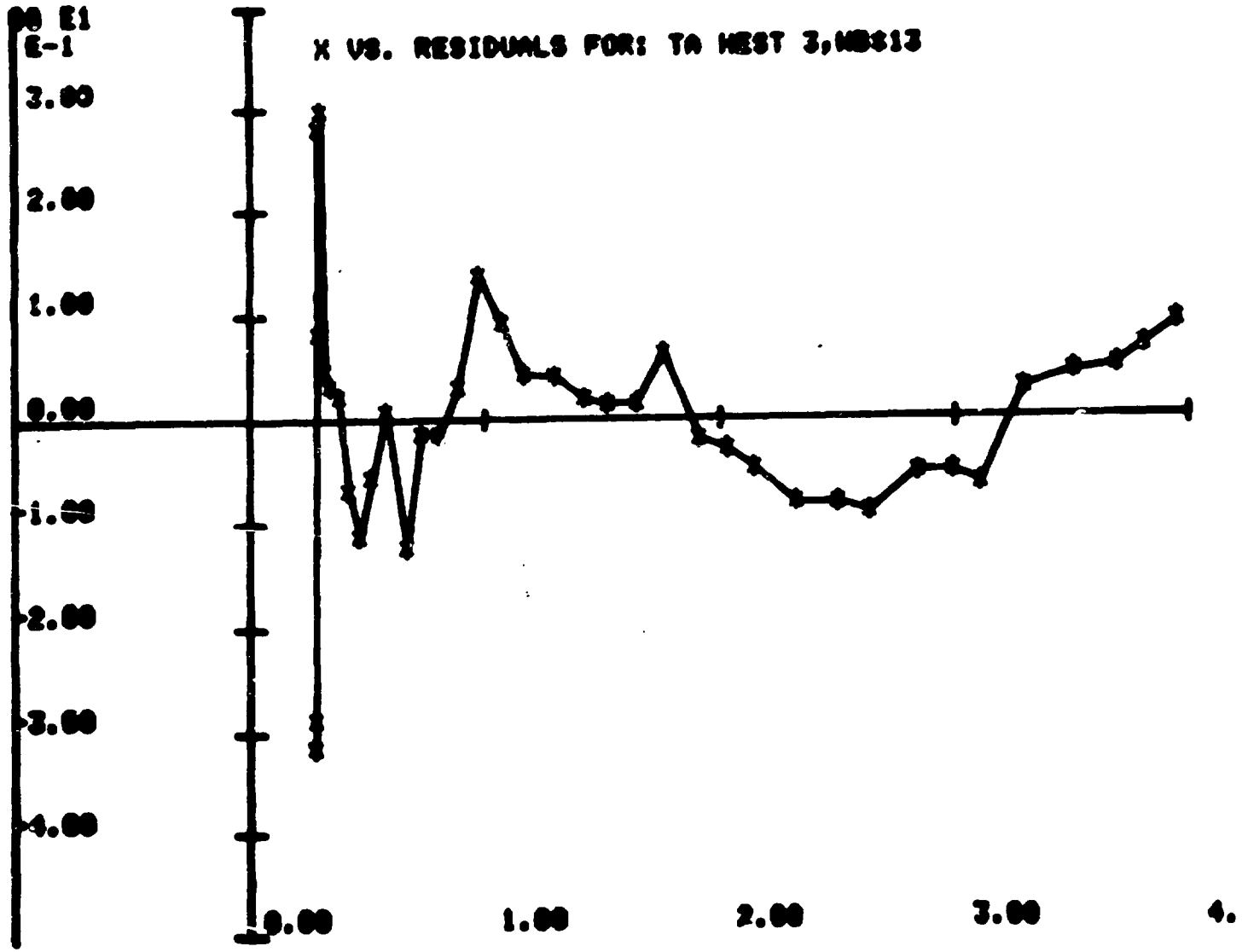
M.N. = 13	E.U. =0.000,6602.000	VSN=
TSKIP=12.640	DIGITS=0.000,970.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=14

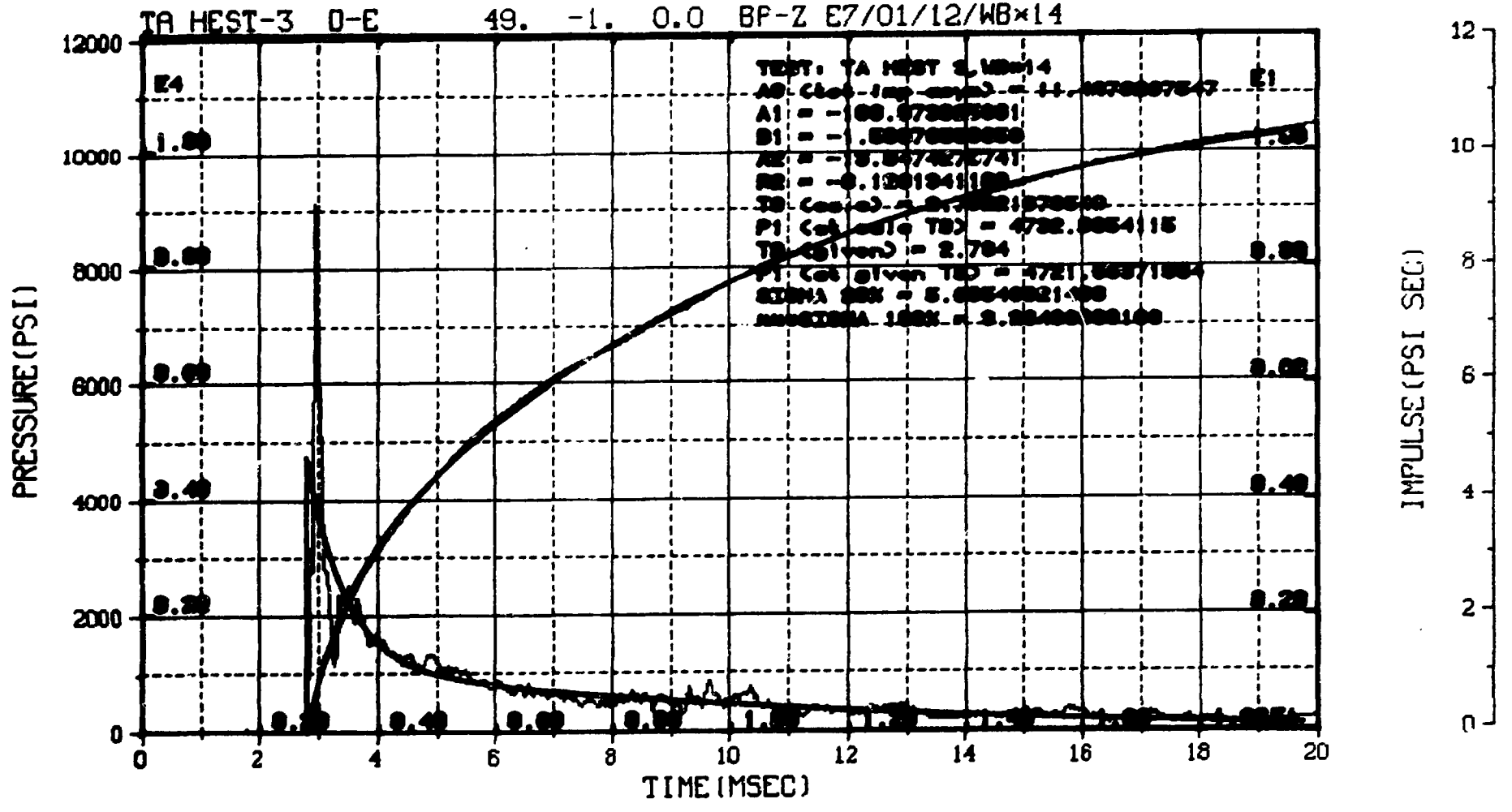

E1
E-1
X VS. RESIDUALS FOR: TA WEST 3,WD#13
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.



M.N. = 13	E.U. -0.000,6602.000	VSN=
TSKIP=12.540	DIGITS-0.000,970.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=14

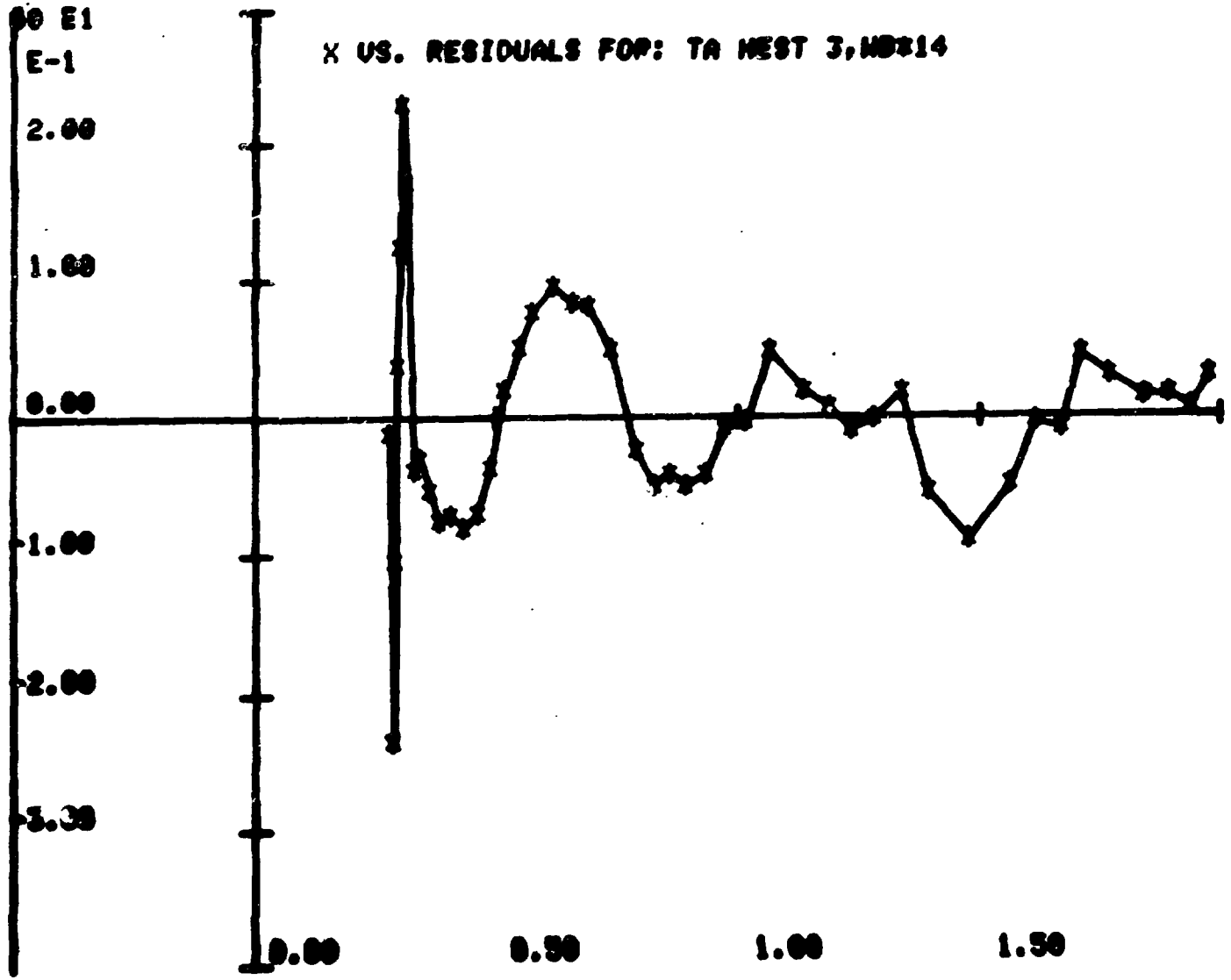
1

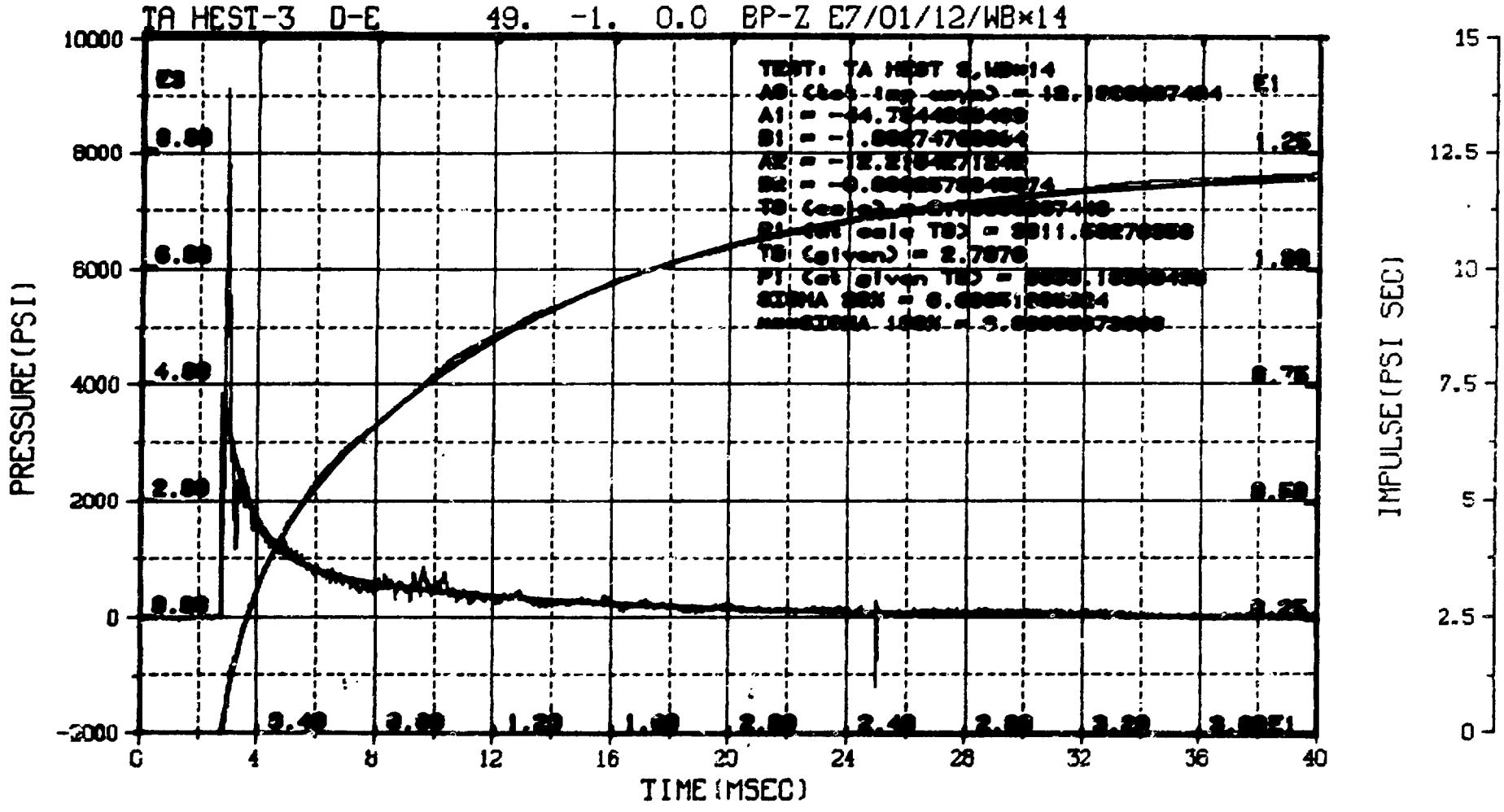

X VS. RESIDUALS FOR: TA WEST 3,WB313
E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.



M.N. = 14	E.U. -0.000,6965.000	VSN=
TSKIP=12.640	DIGITS=0.000,1002.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=18

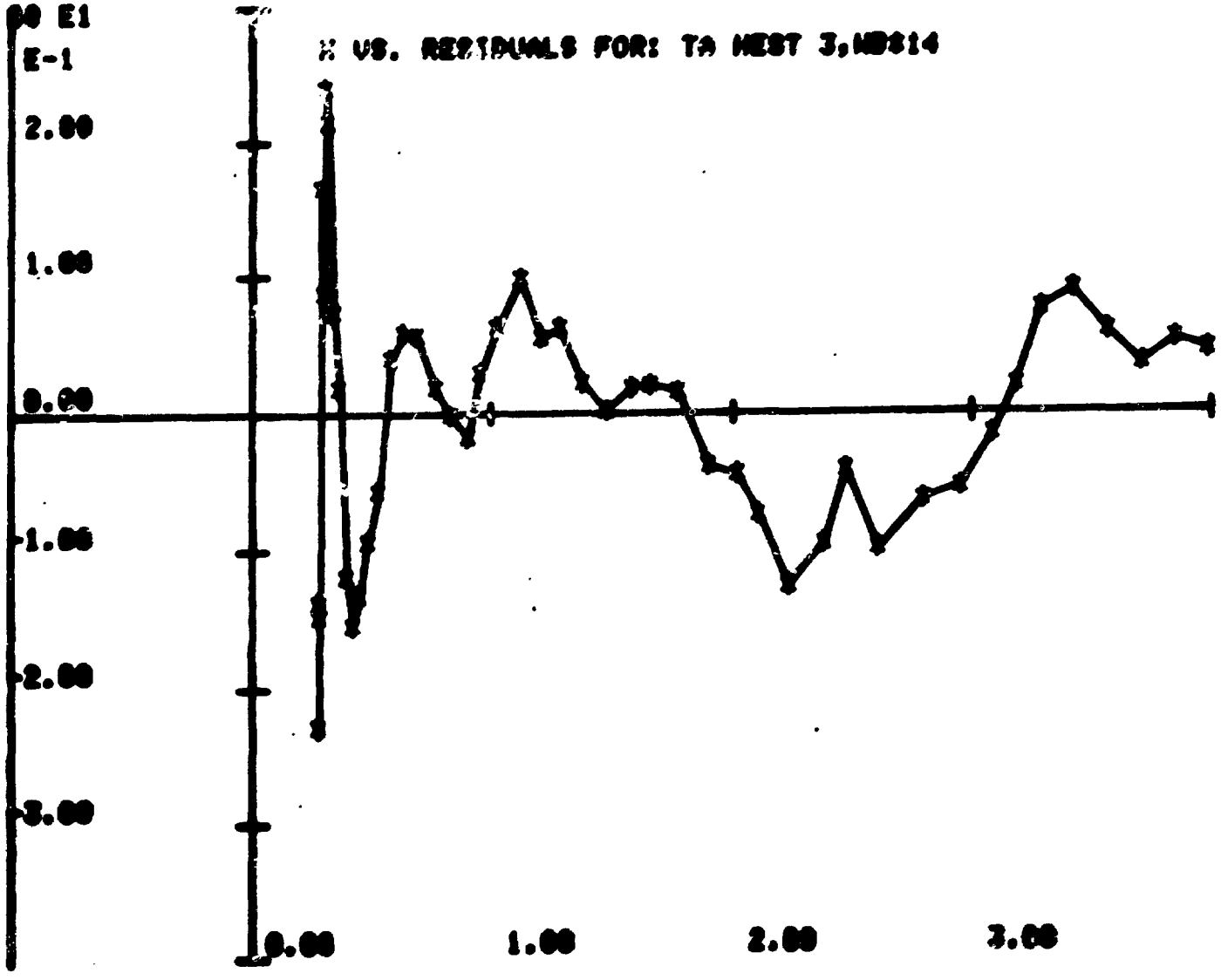
1

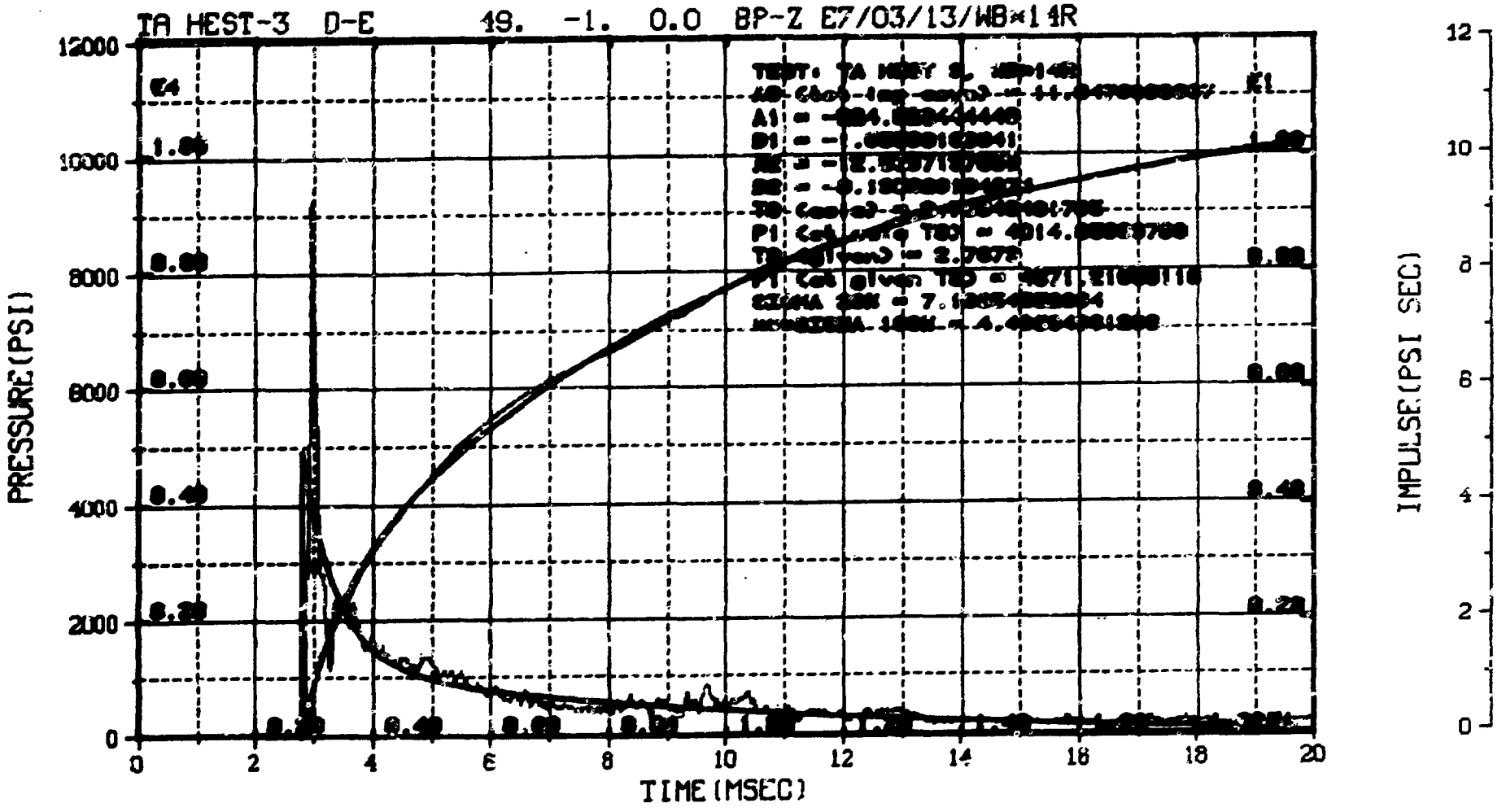

X VS. RESIDUALS FOR: TA WEST 3,WD=14
E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.



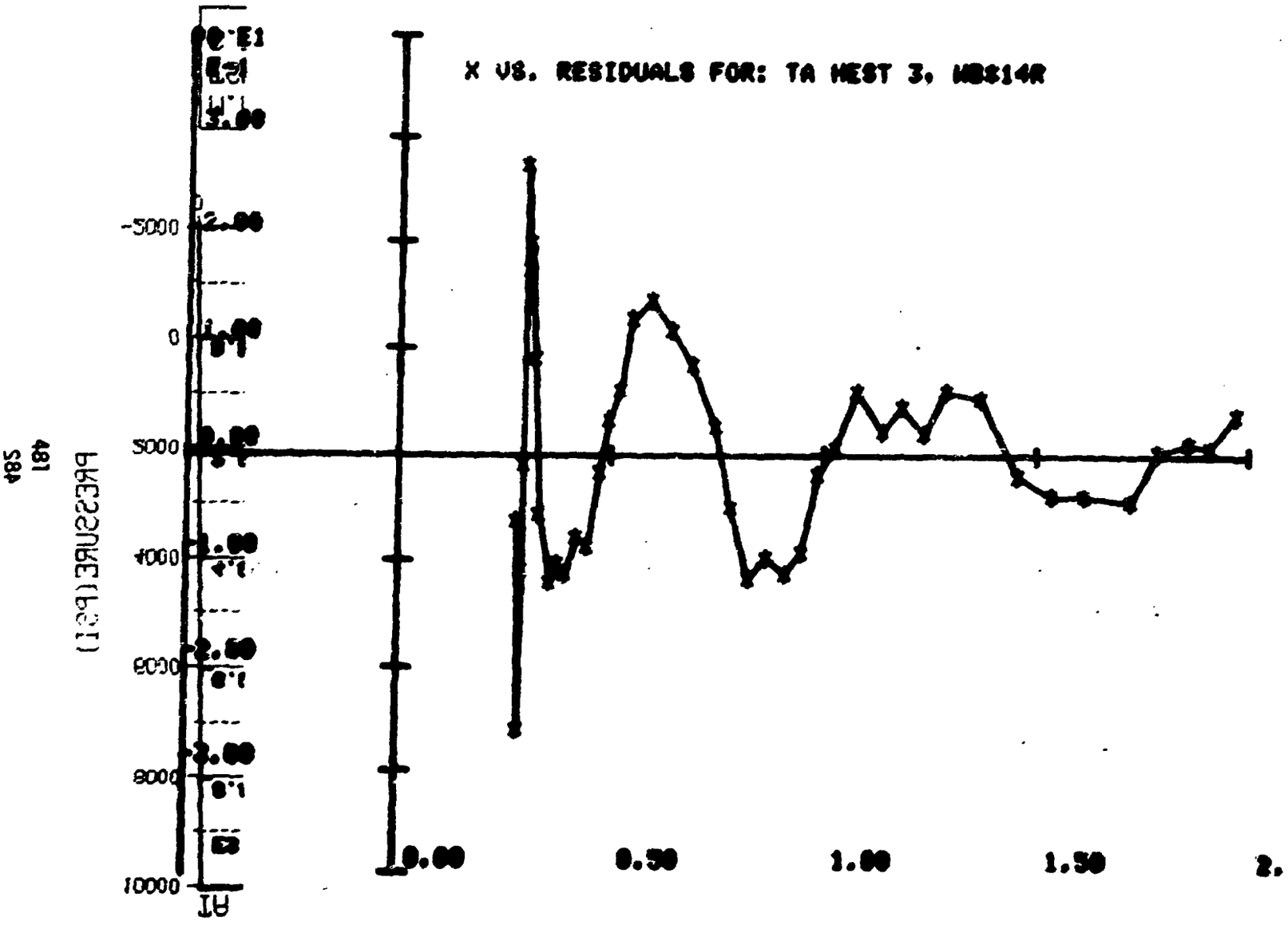
M.N. = 14	E.U. =0.000,6965.000	VSN=
TSKIP=12.640	DIGITS=0.000,1002.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=18

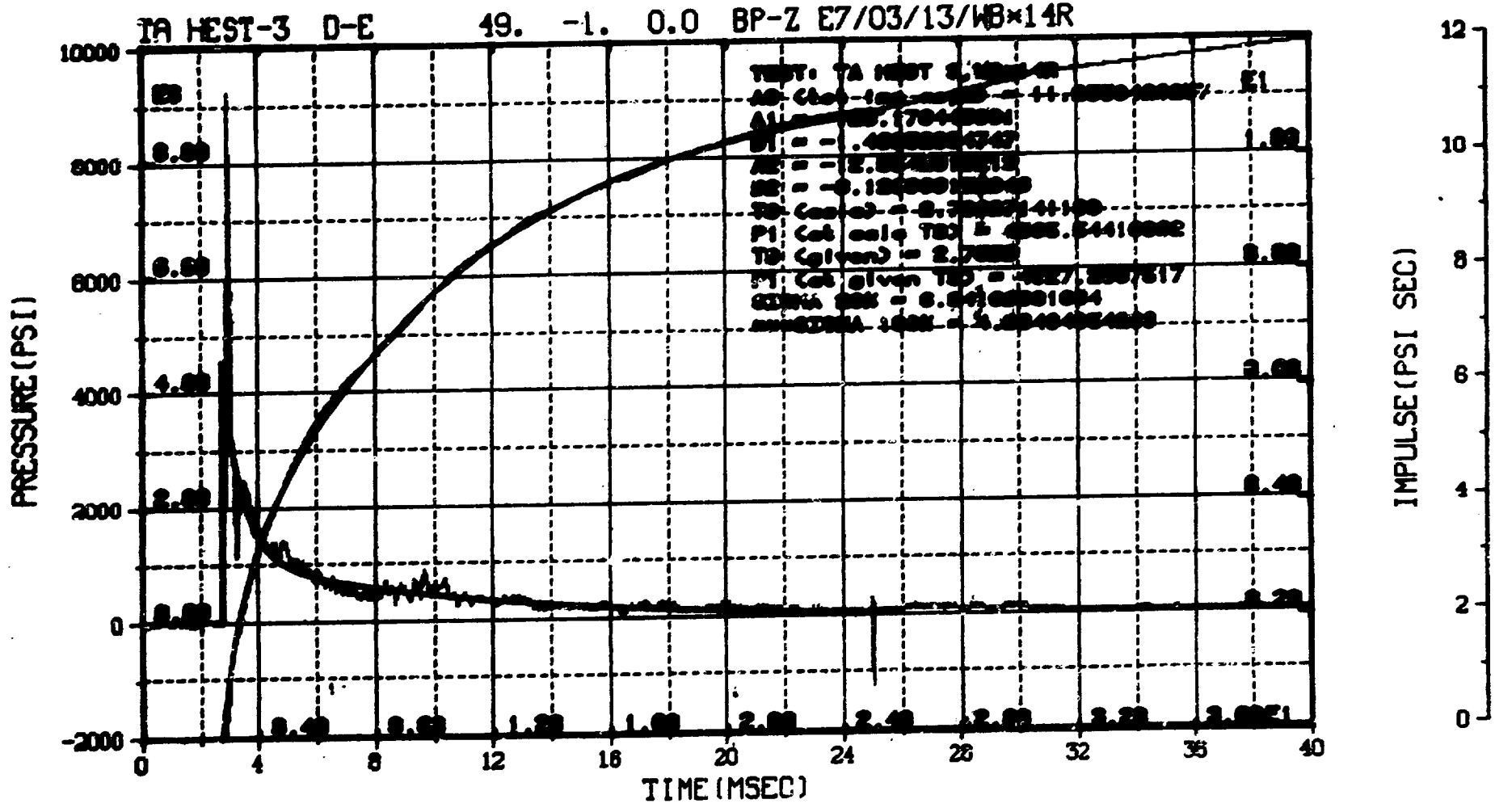
1


E1
E-1
X VS. RESIDUALS FOR: TA WEST 3,WB814
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00
4.



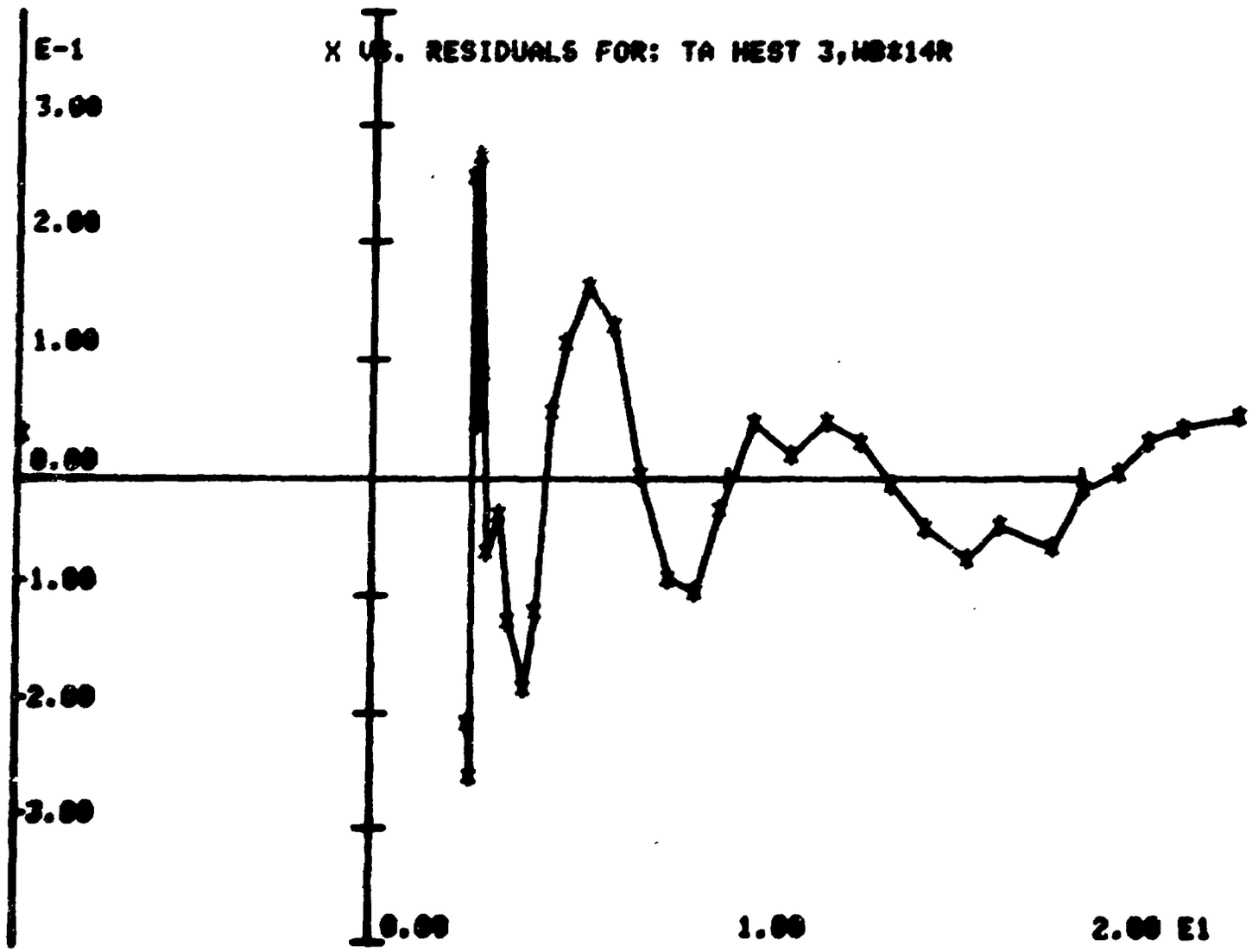
M.N. = 14	E.U. -0.000,6965.000	VSN-
TSKIP=12.640	DIGITS=0.000,614.250	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=28

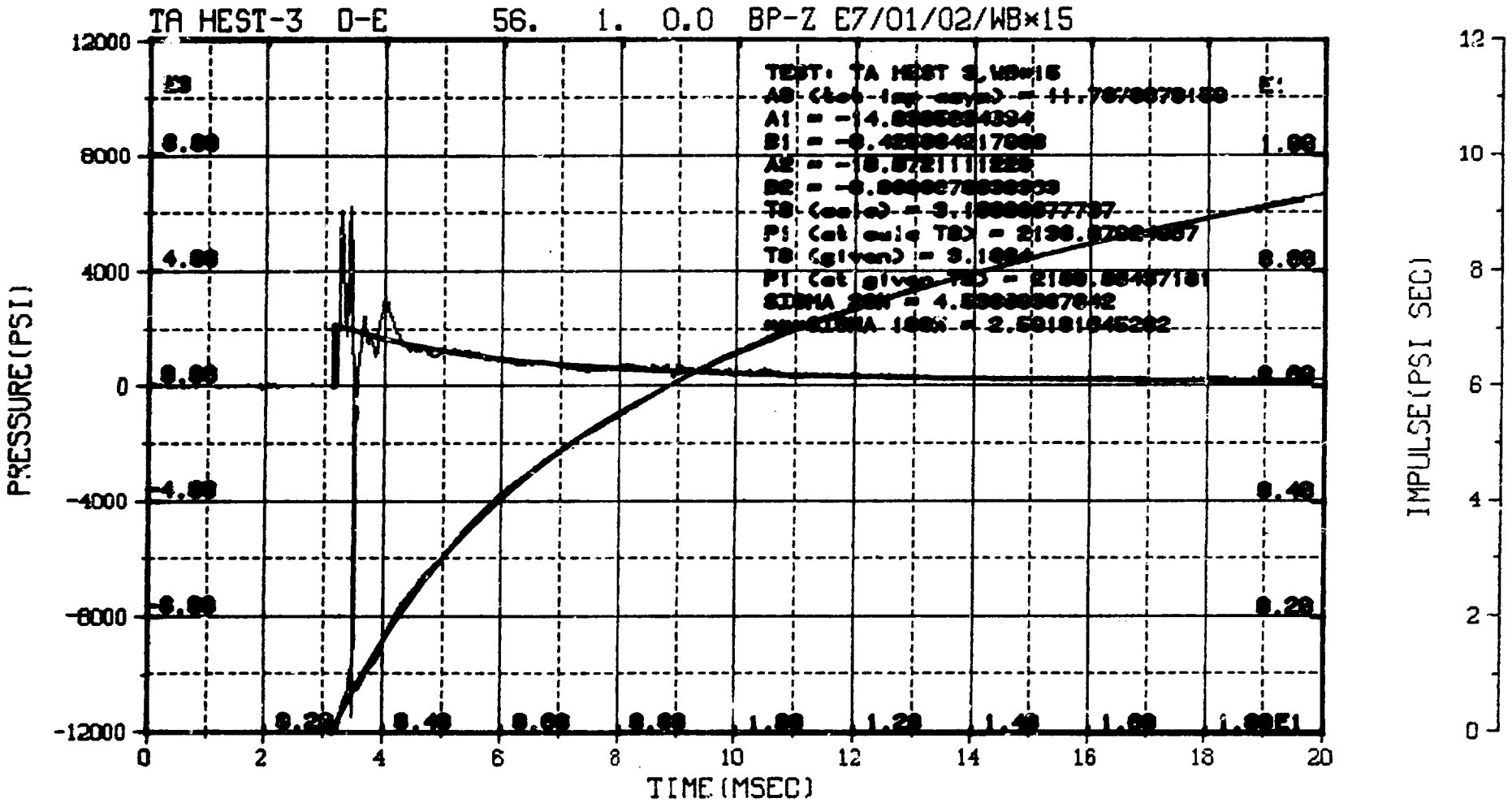

X VS. RESIDUALS FOR: TA WEST 3, WBS14R
-5000
0
5000
0.00
0.50
1.00
1.50
2.



M.N. - 14	E.U. -0.000,6965.000	VSN-
TSKIP=12.640	DIGITS=0.000,614.250	TAPE22
S.R. -100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=28

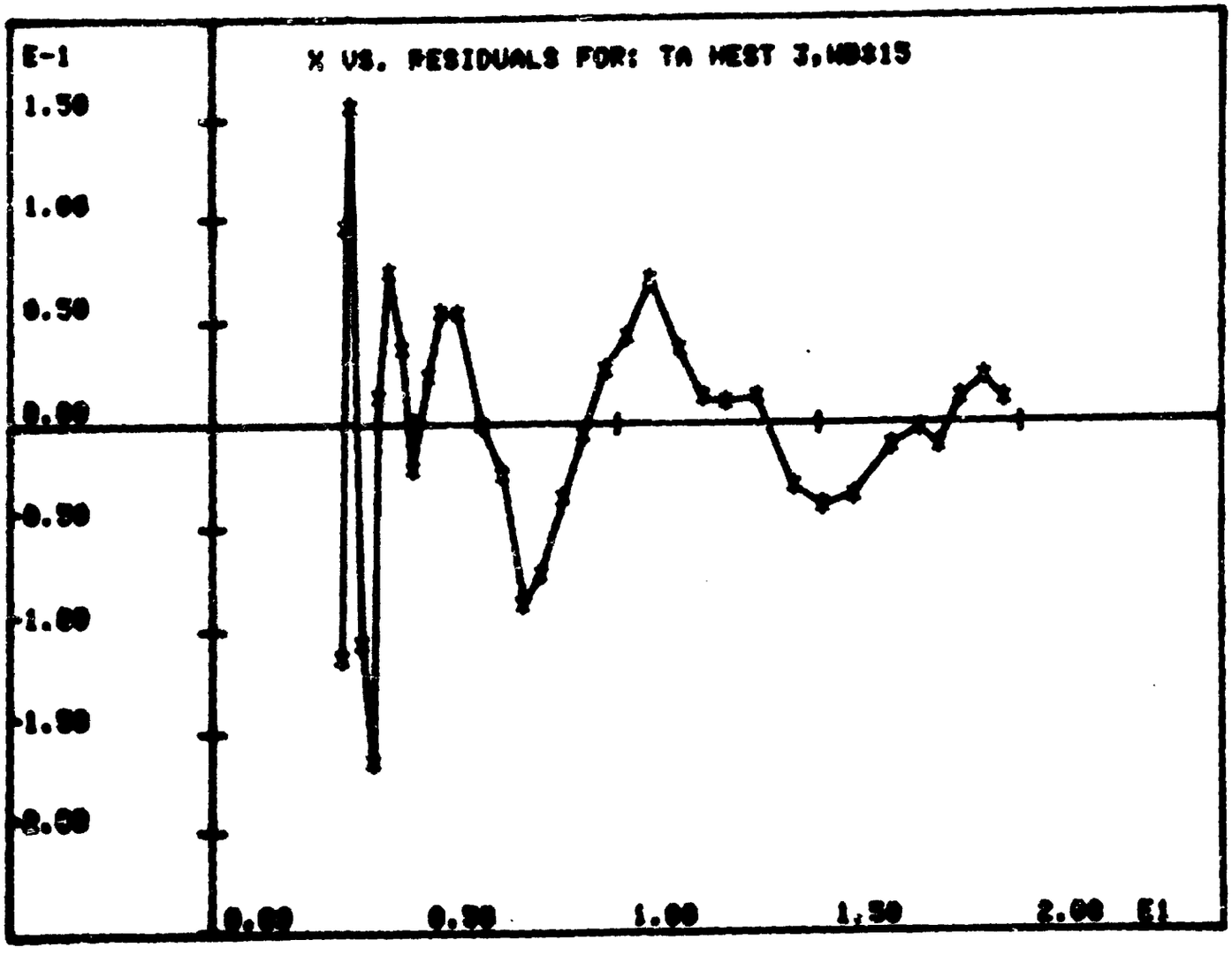
1

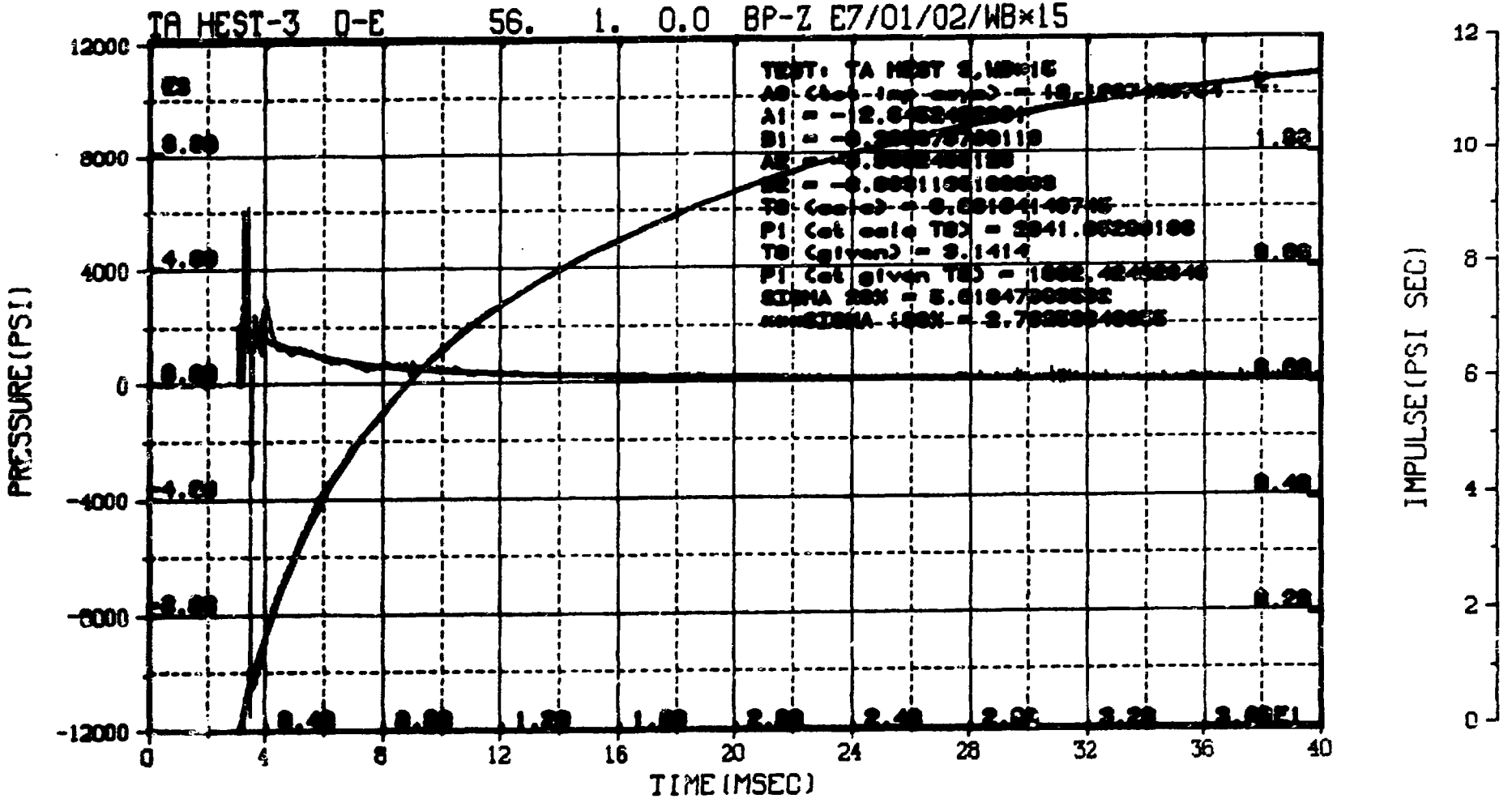

E-1
X VS. RESIDUALS FOR: TA WEST 3,WB#14R
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00 E1



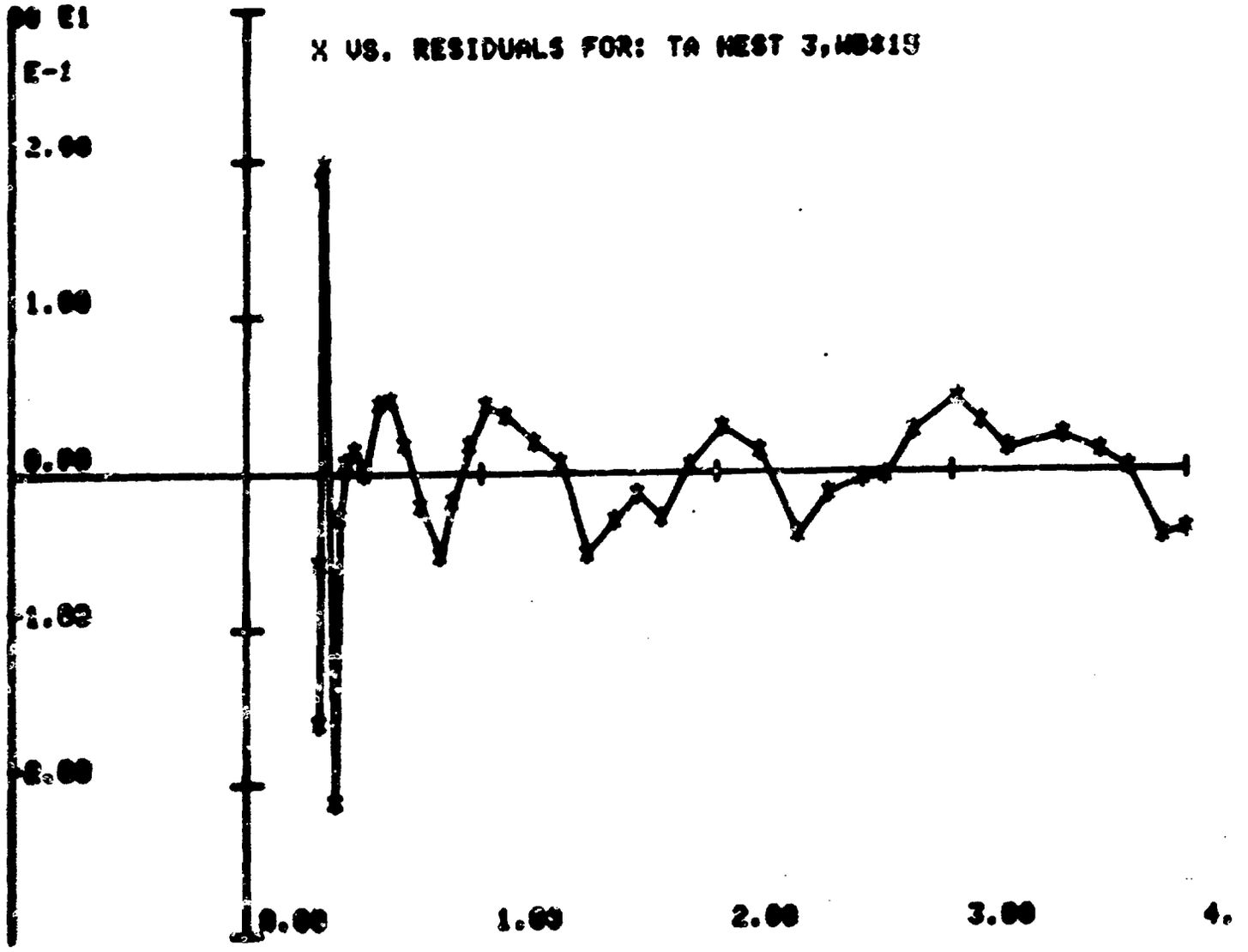
M.N. = 15	E.U. =0.000,4108.000	VSN=
TSKIP=12.640	DIGITS=0.000,675.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=4

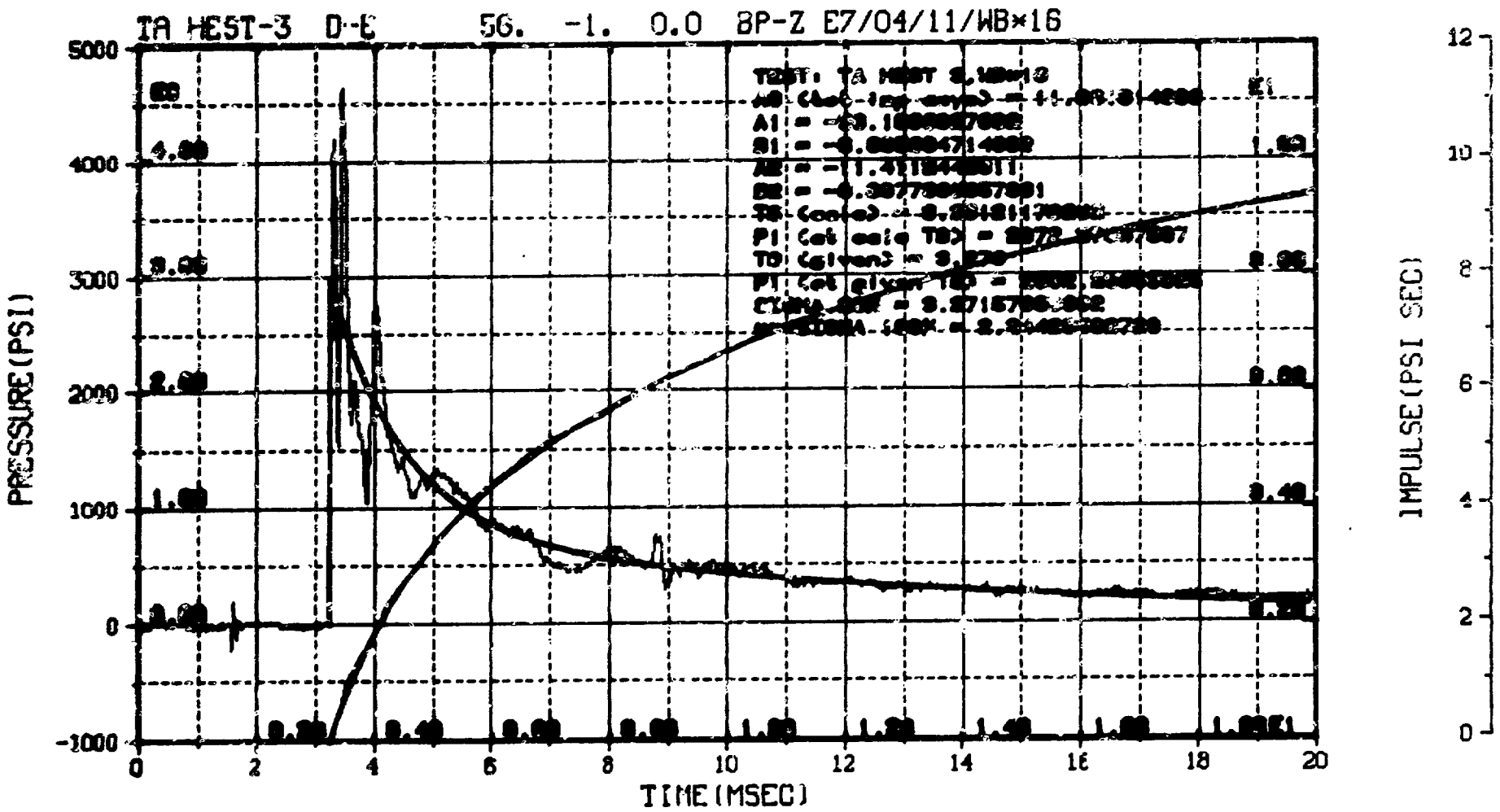
1


E-1
X VS. RESIDUALS FOR: TA WEST 3,WB315
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
0.50
1.00
1.50
2.00 E1



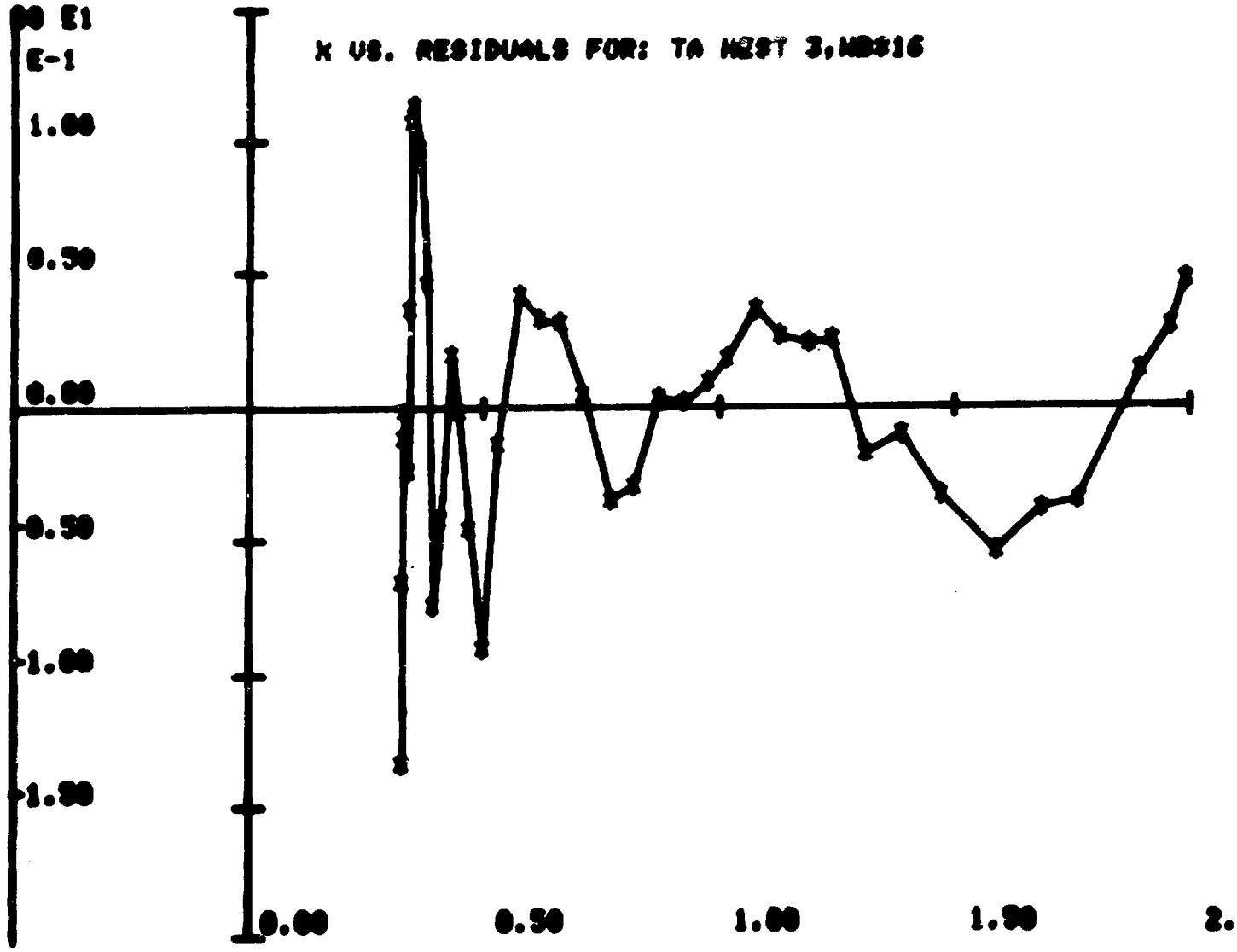
M.N. = 15	E.U. =0.000,4108.000	VSN=
TSKIP=12.640	DIGITS=0.000,675.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=4

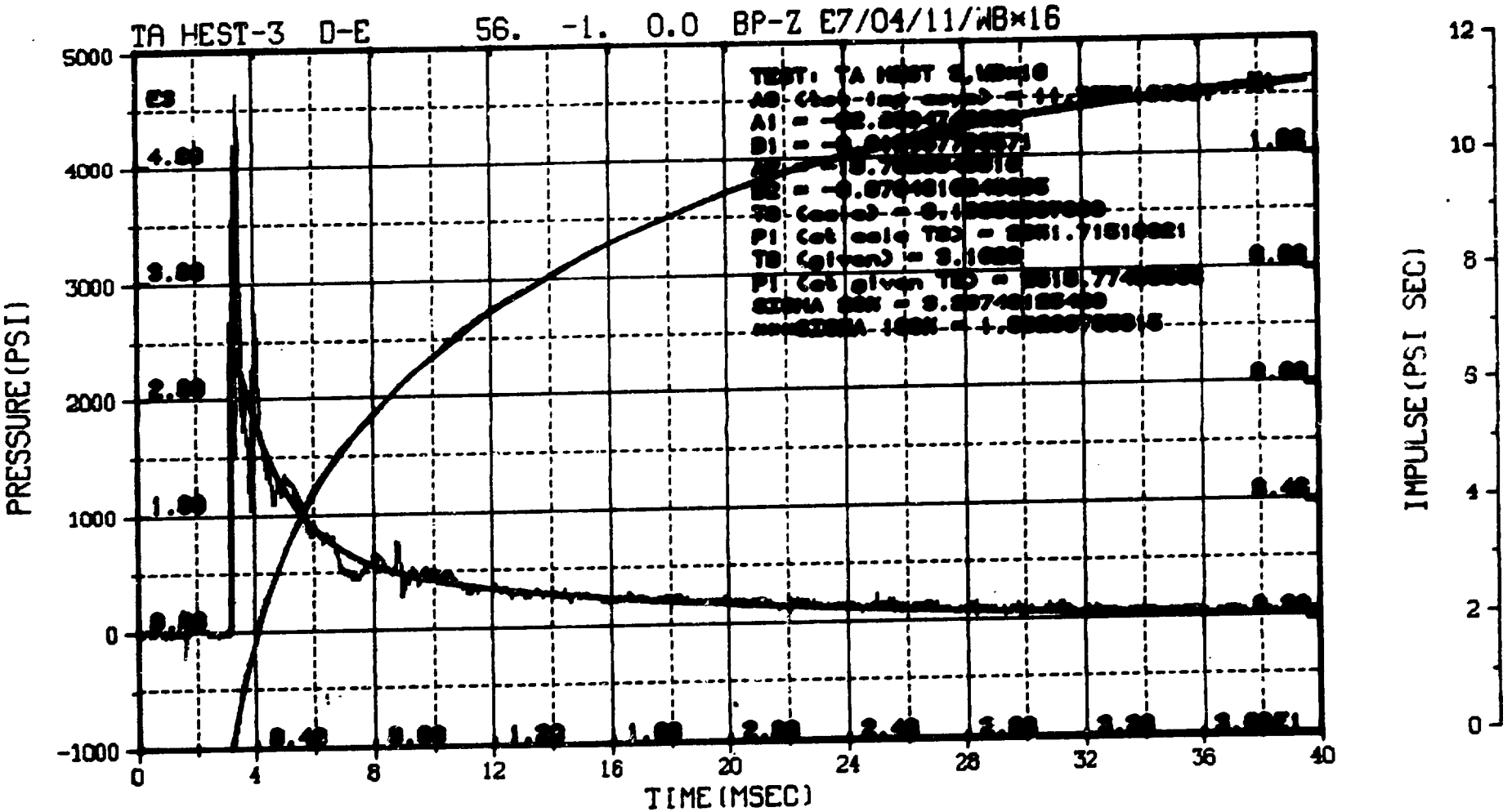

X VS. RESIDUALS FOR: TA WEST 3,WB#19
E1
E-1
2.00
1.00
0.00
1.00
2.00
0.00
1.00
2.00
3.00
4.



M.N. - 16	E.U. -0.000,4093.000	VSN- ED23
SKIP-12.650	DIGITS-0.000,680.000	TAPE22
S.R. -100.00 KHZ	11 36 AM, 2 MAY 78.	FILE-46

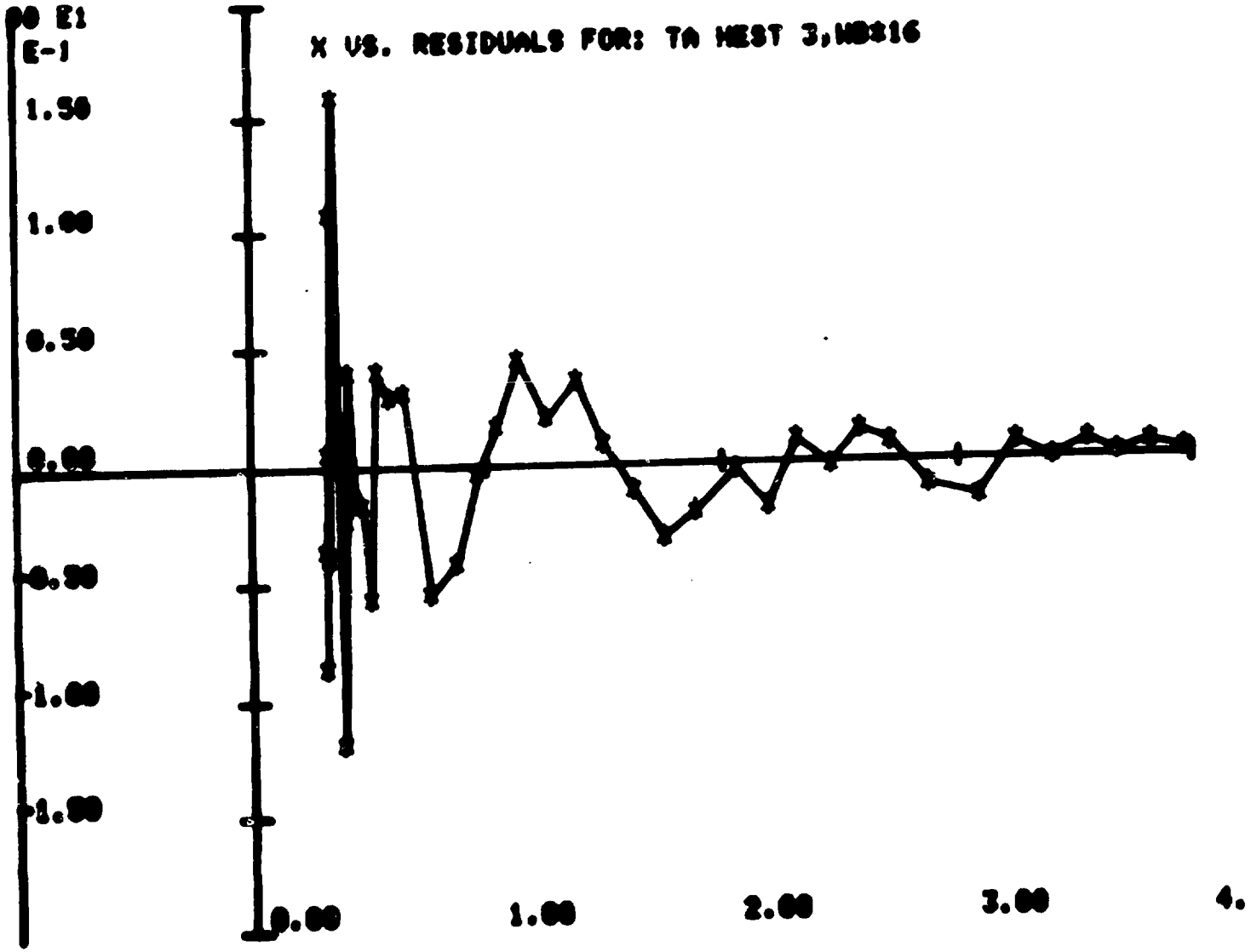
1

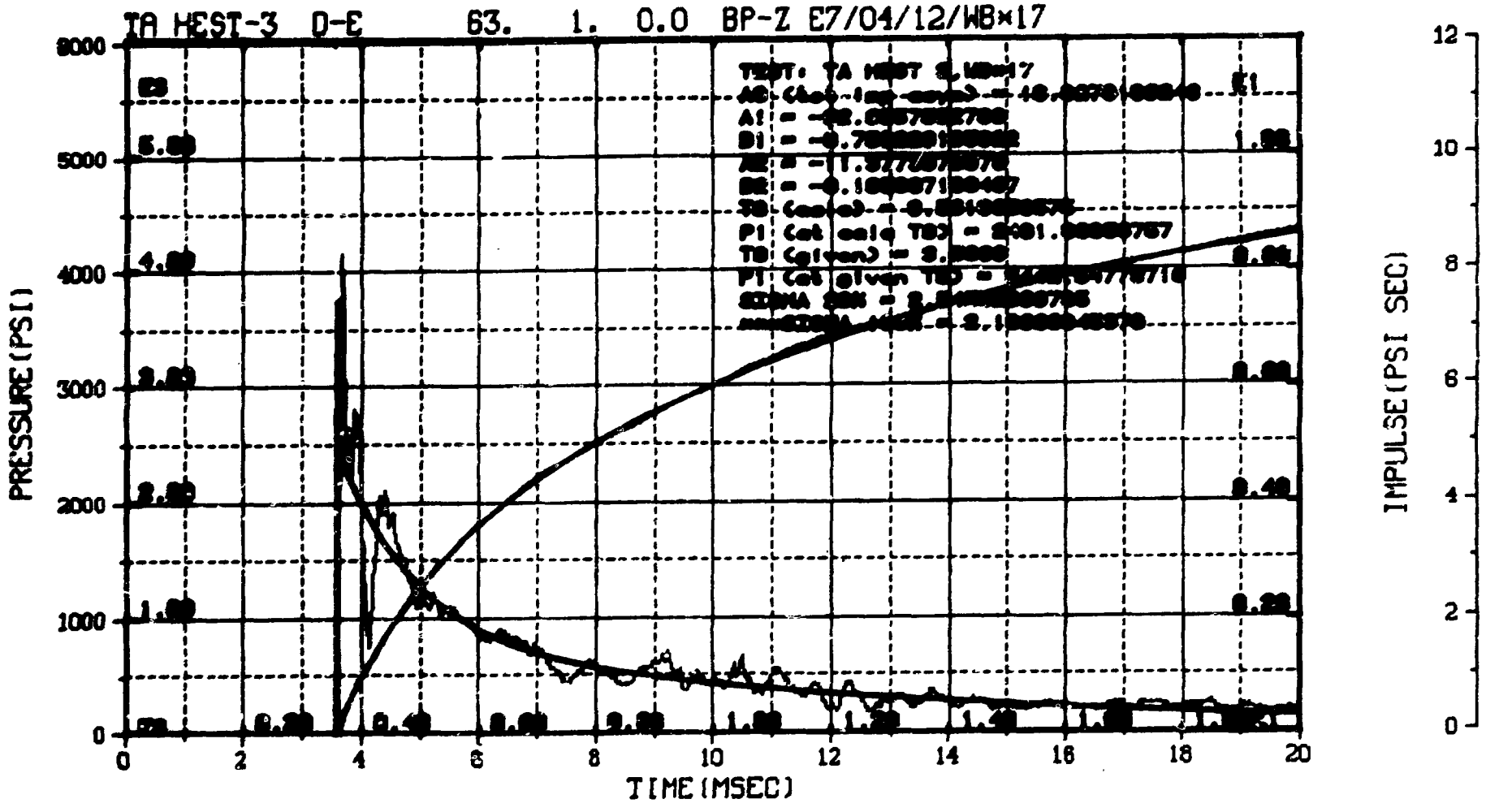

X VS. RESIDUALS FOR: TA WEST 3,WBS16
E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
0.50
1.00
1.50
2.



M.N. = 16	E.U. -0.000,4093.000	VSN=
TSKIP=12.650	DIGITS-0.000,680.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=46

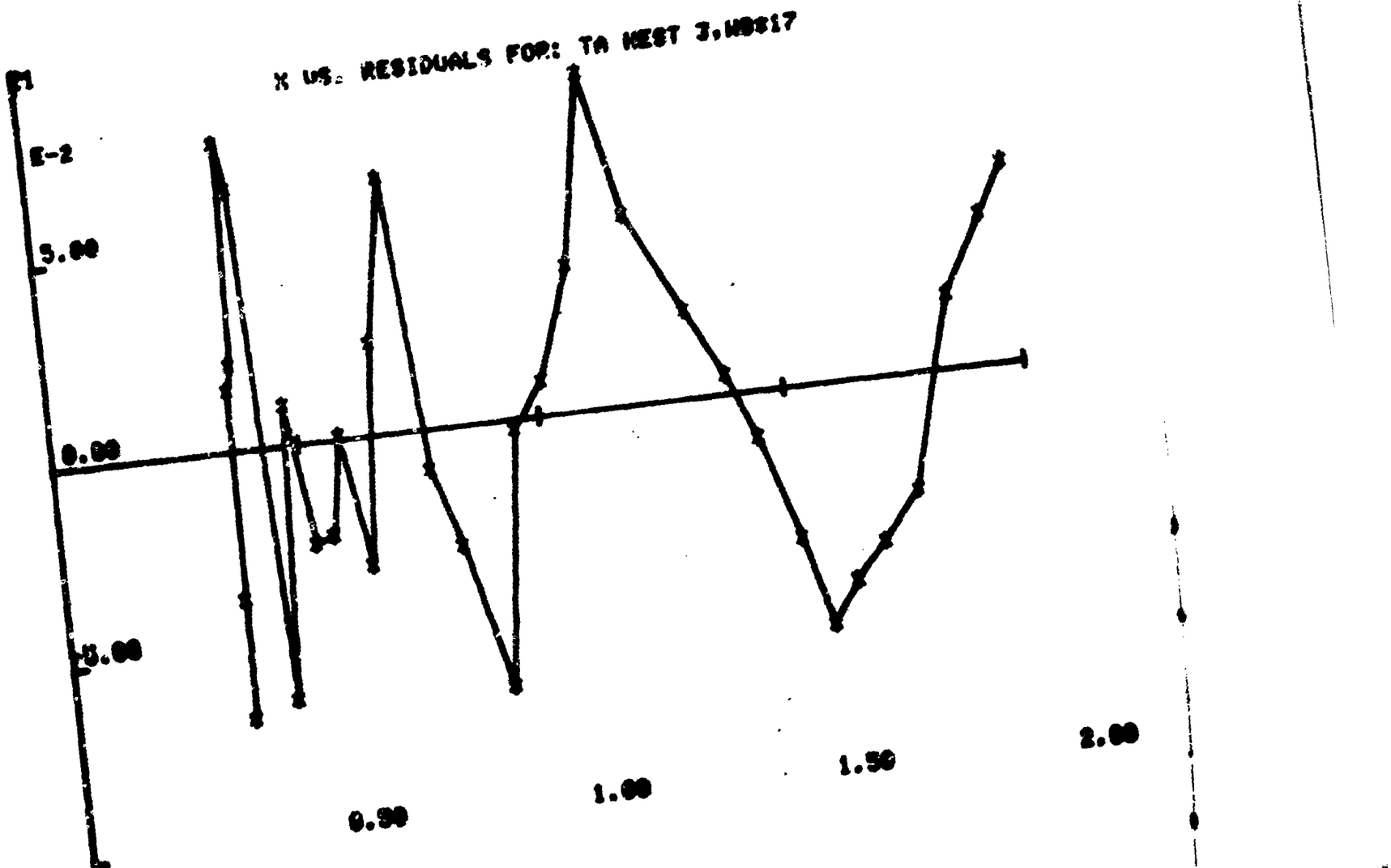
1

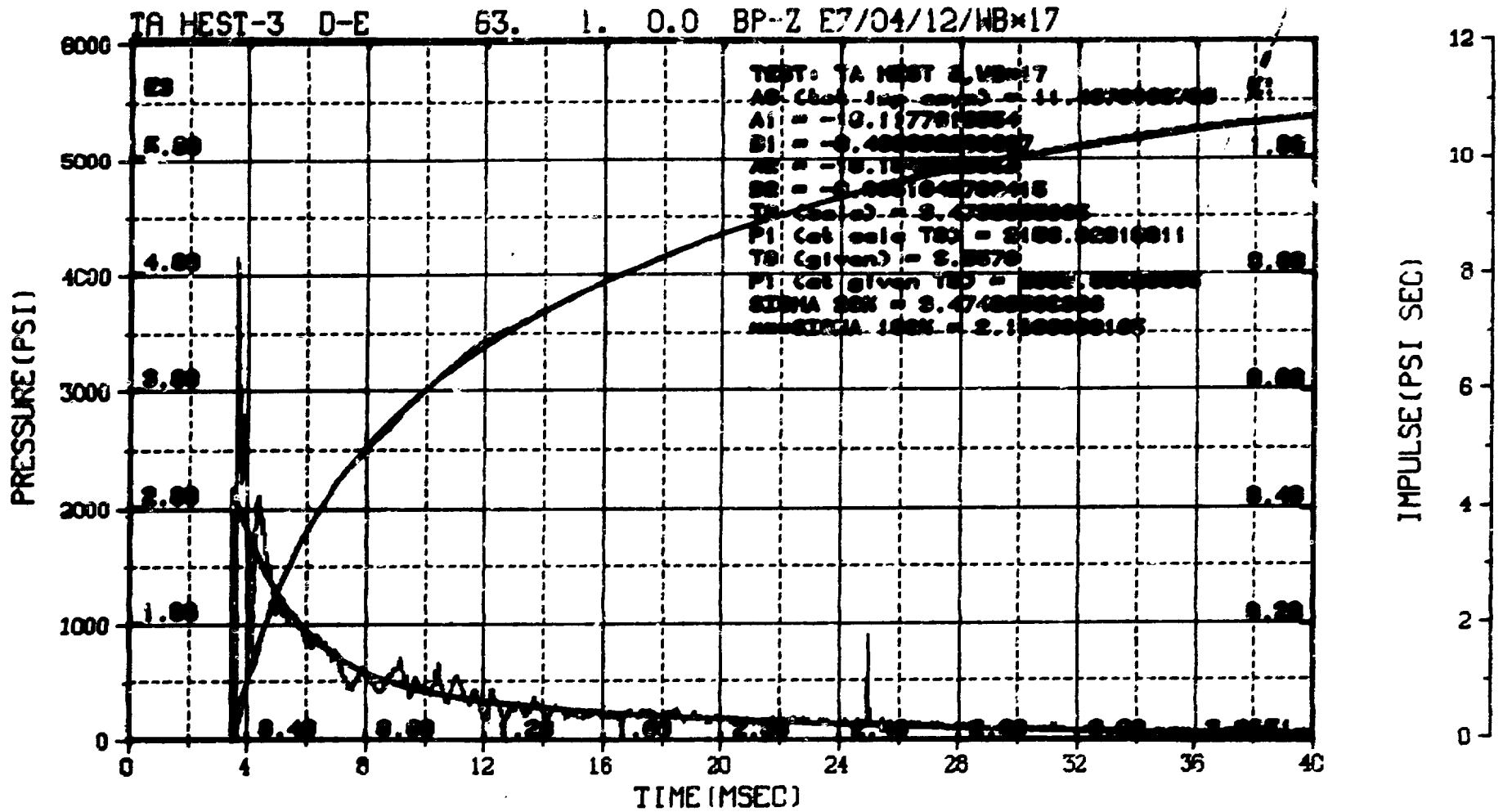

X VS. RESIDUALS FOR: TA WEST 3,WB#16
E1
E-1
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00
4.



M.N. = 17	E.U. -0.000,4094.000	VSN- ED23
T3KIP=12.650	DIGITS=0.000,760.750	TAPE22
S.R. =100.00 KHZ	11 36 AM, 2 MAY 78.	FILE=48

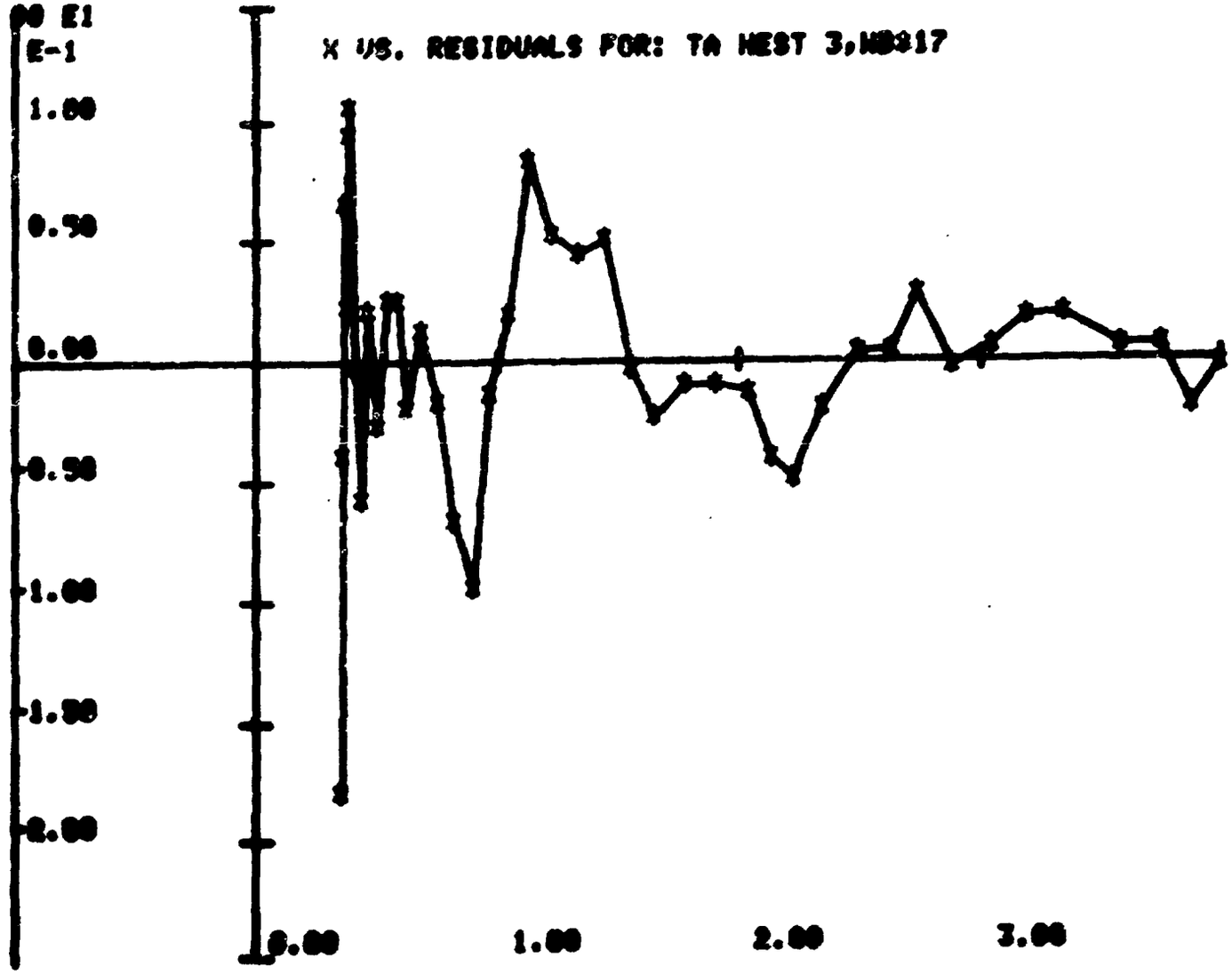
1

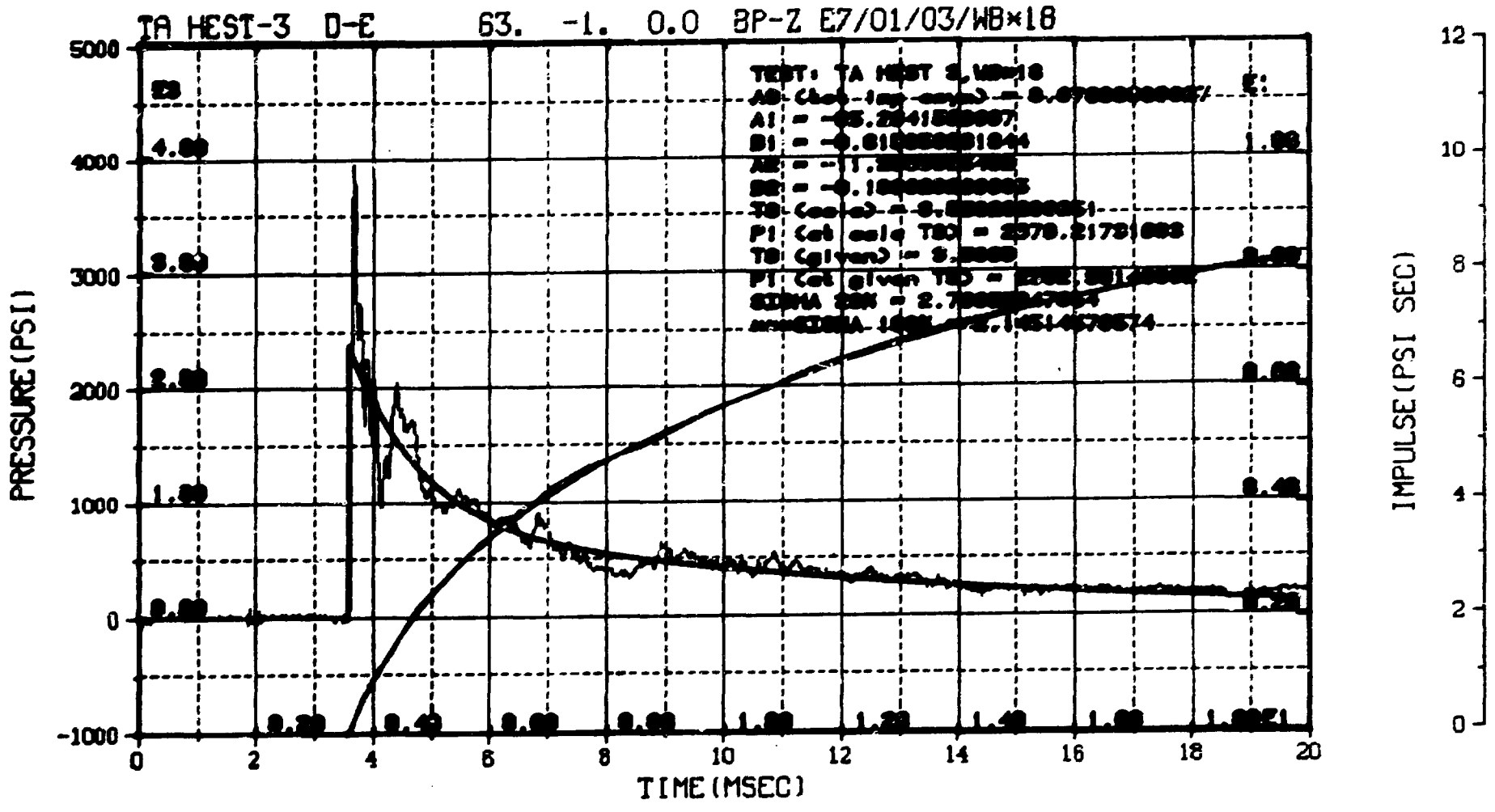

X VS. RESIDUALS FOR: TA WEST 3.WB817
E-2
5.00
0.00
-5.00
0.50
1.00
1.50
2.00



M.N. - 17	E.U. -0.000,4094.000	VSN-
TSKIP-12.650	DIGITS-0.000,760.750	TAPE22
S.R. -100.00 KHZ	8 50 AM, 2 MAY 78.	FILE-48

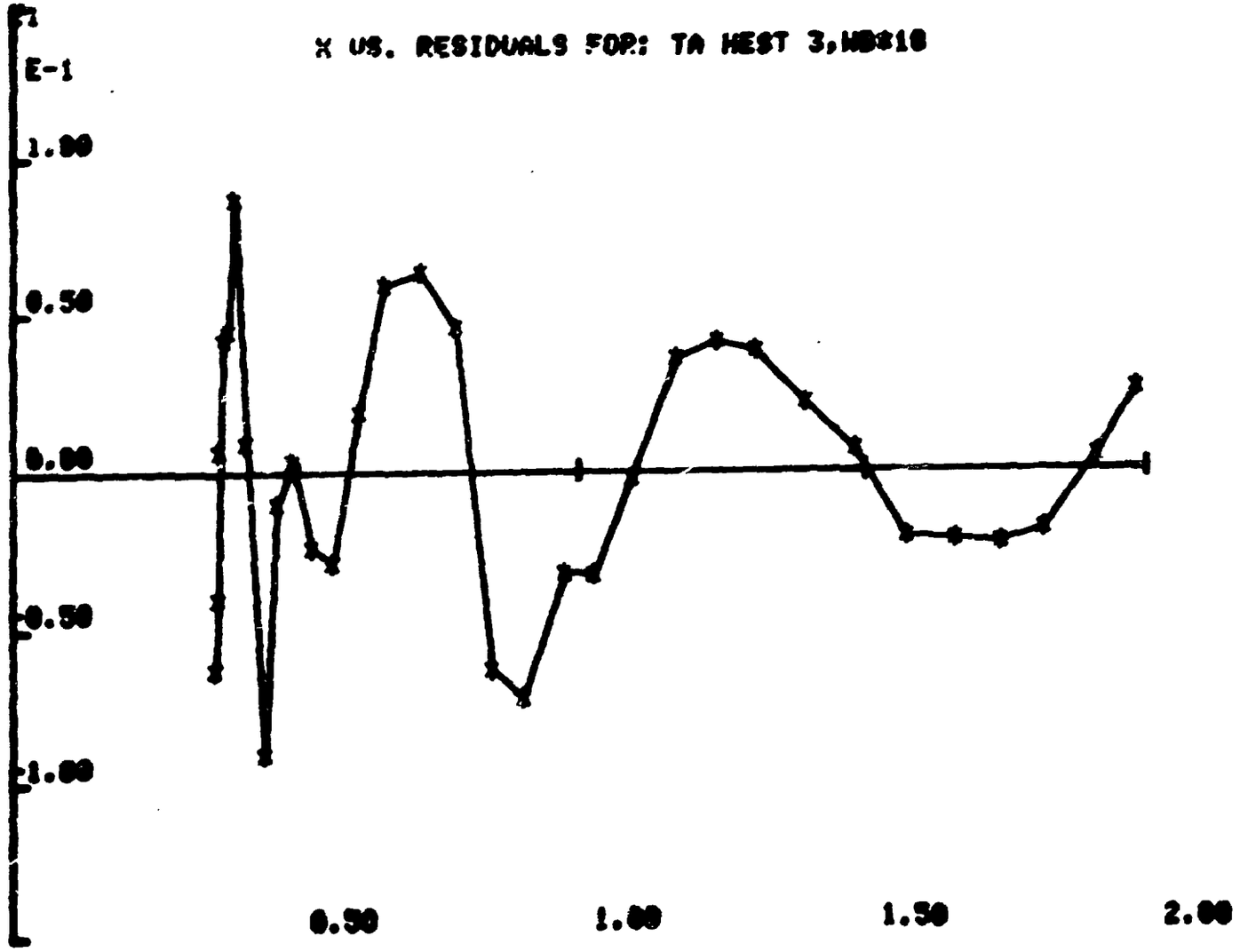
1

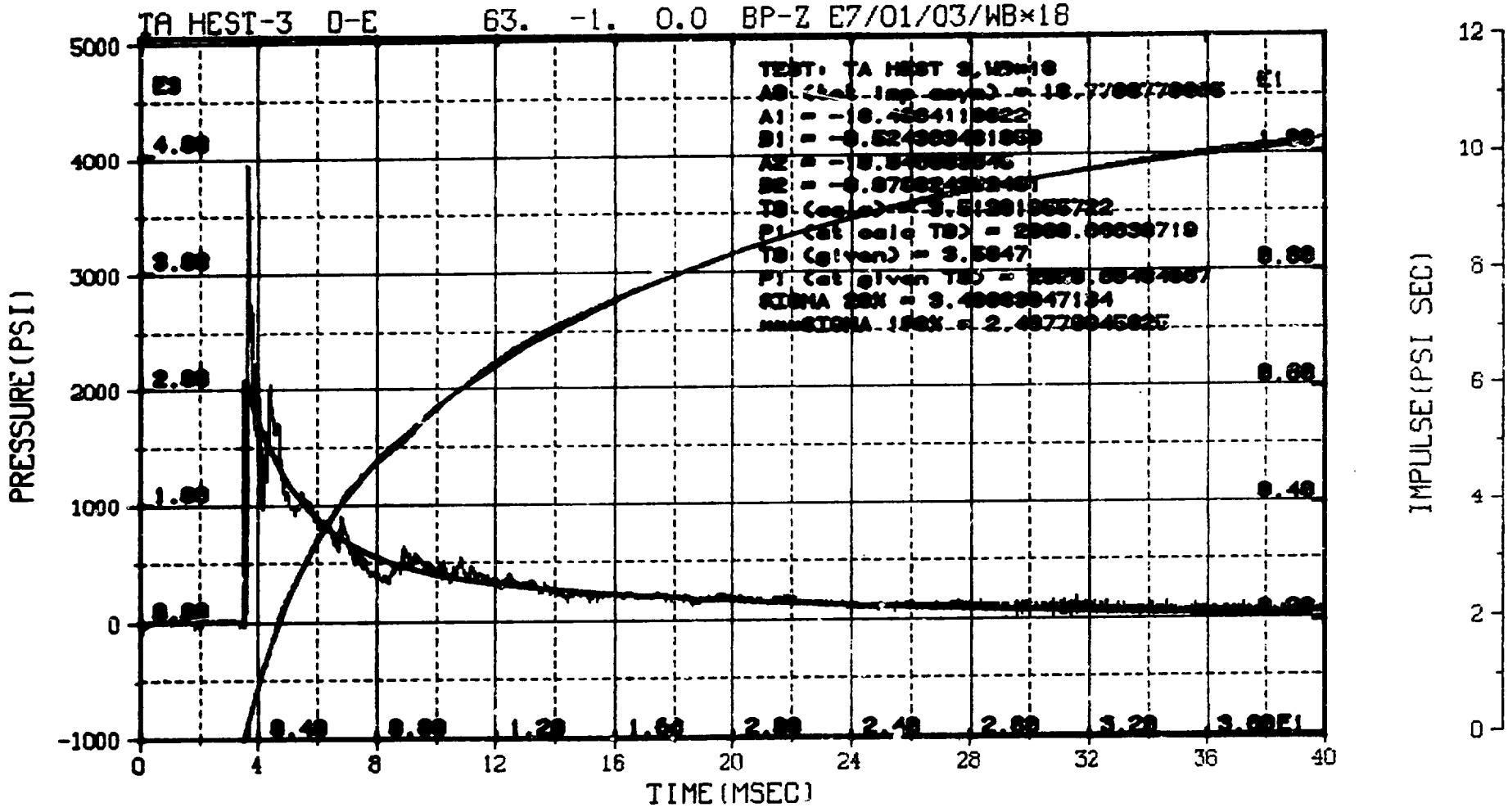

00 E1
E-1
X I/S. RESIDUALS FOR: TA WEST 3,WB317
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
1.00
2.00
3.00
4.



M.N. = 18	E.U. =-0.000,4011.000	VSN=
TSKIP=12.640	DIGITS=0.000,763.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=6

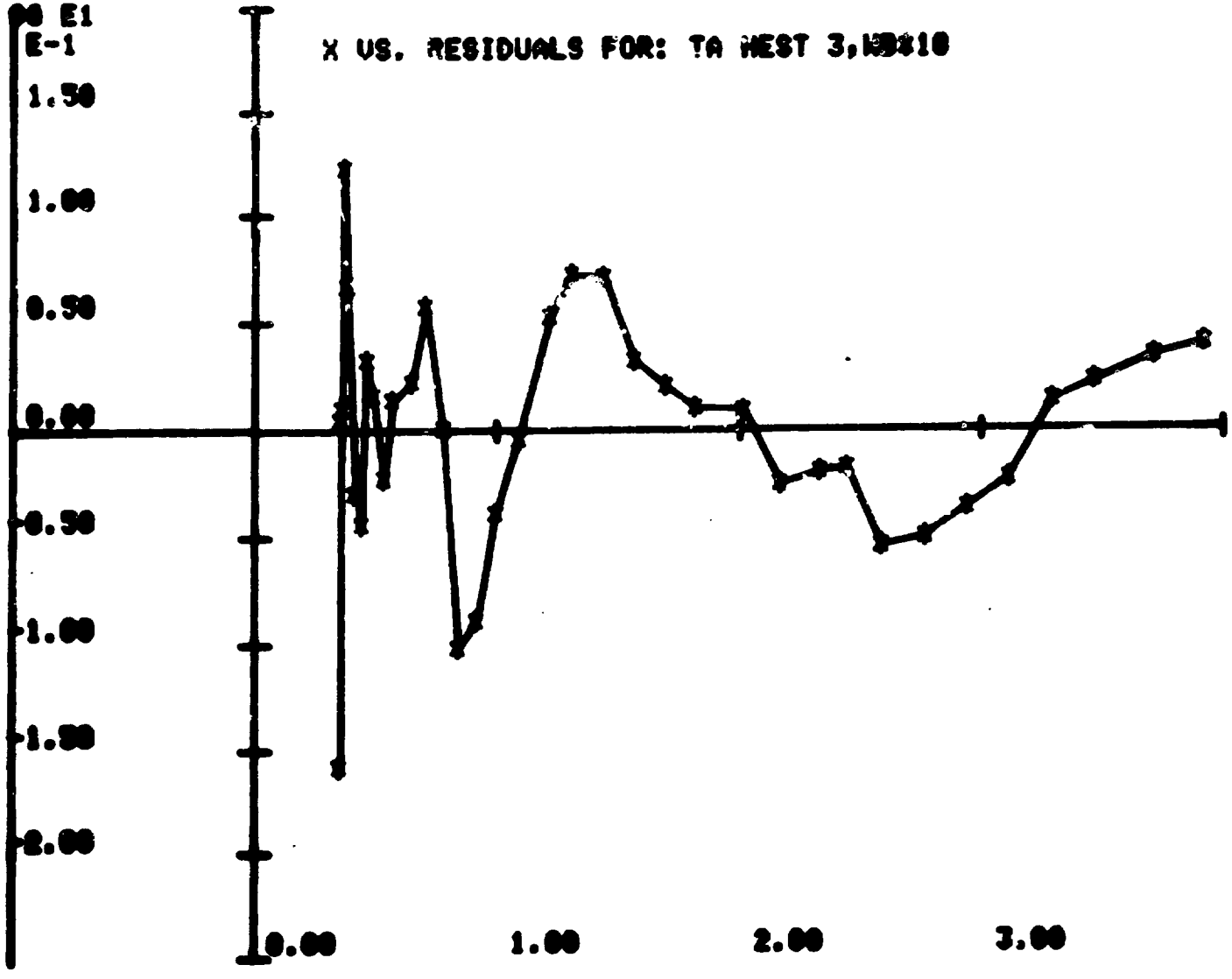
1

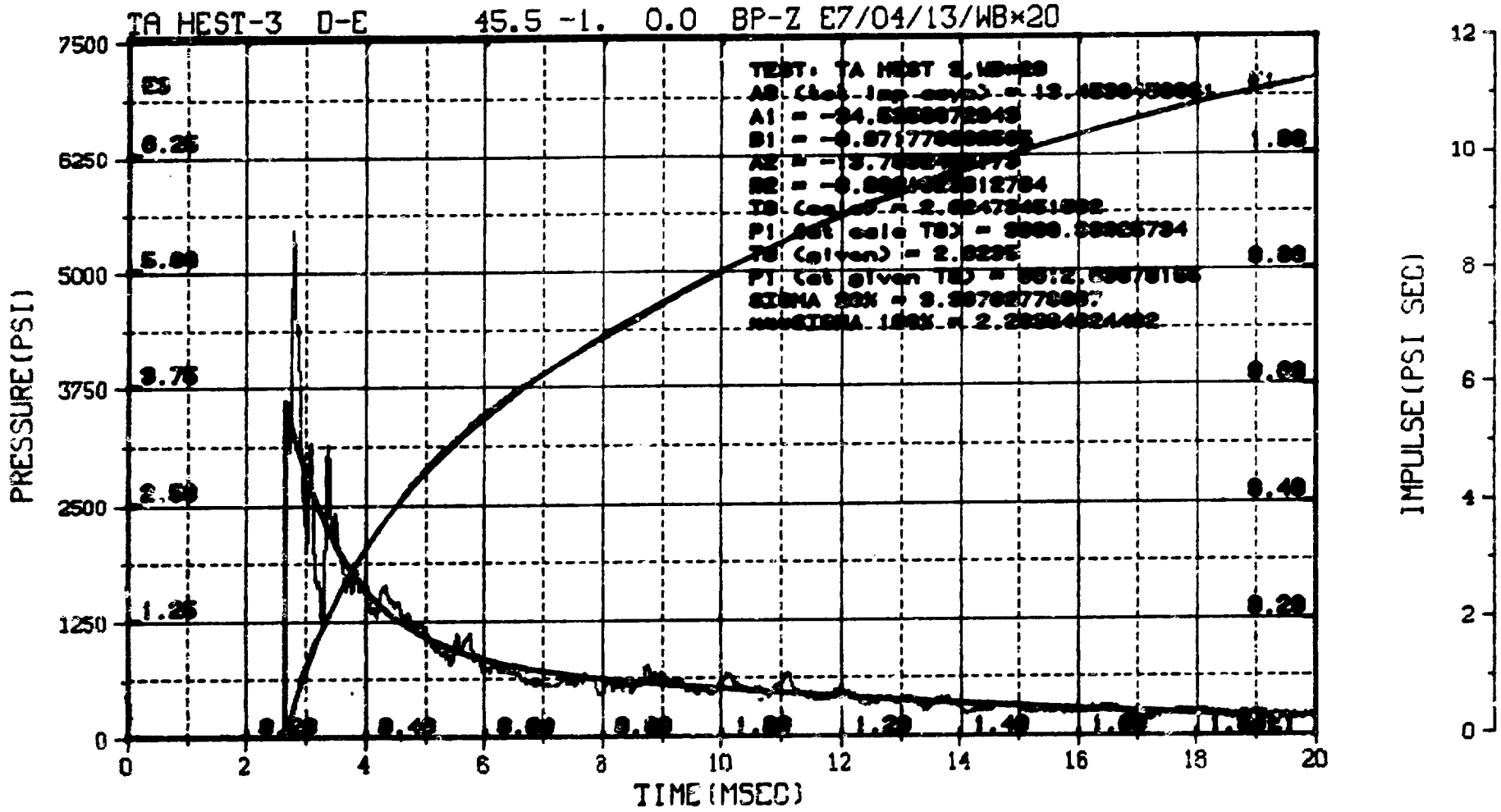

X VS. RESIDUALS FOR: TA WEST 3,WB*10
E-1
1.00
0.50
0.00
-0.50
-1.00
0.50
1.00
1.50
2.00



M.N. = 18	E.U. =0.000,4011.000	VSN=
TSKIP=12.640	DIGITS=0.000,753.000	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=6

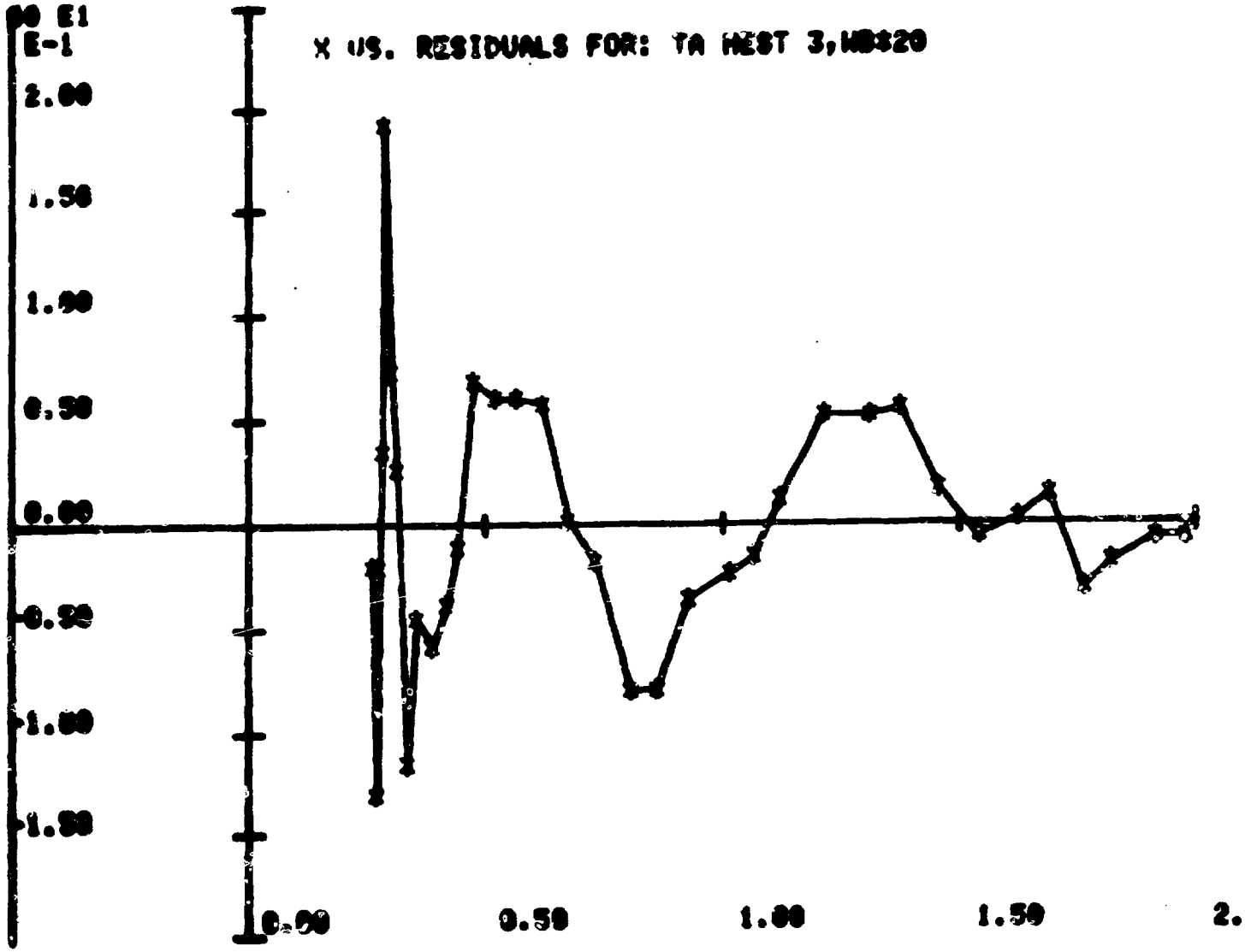
1

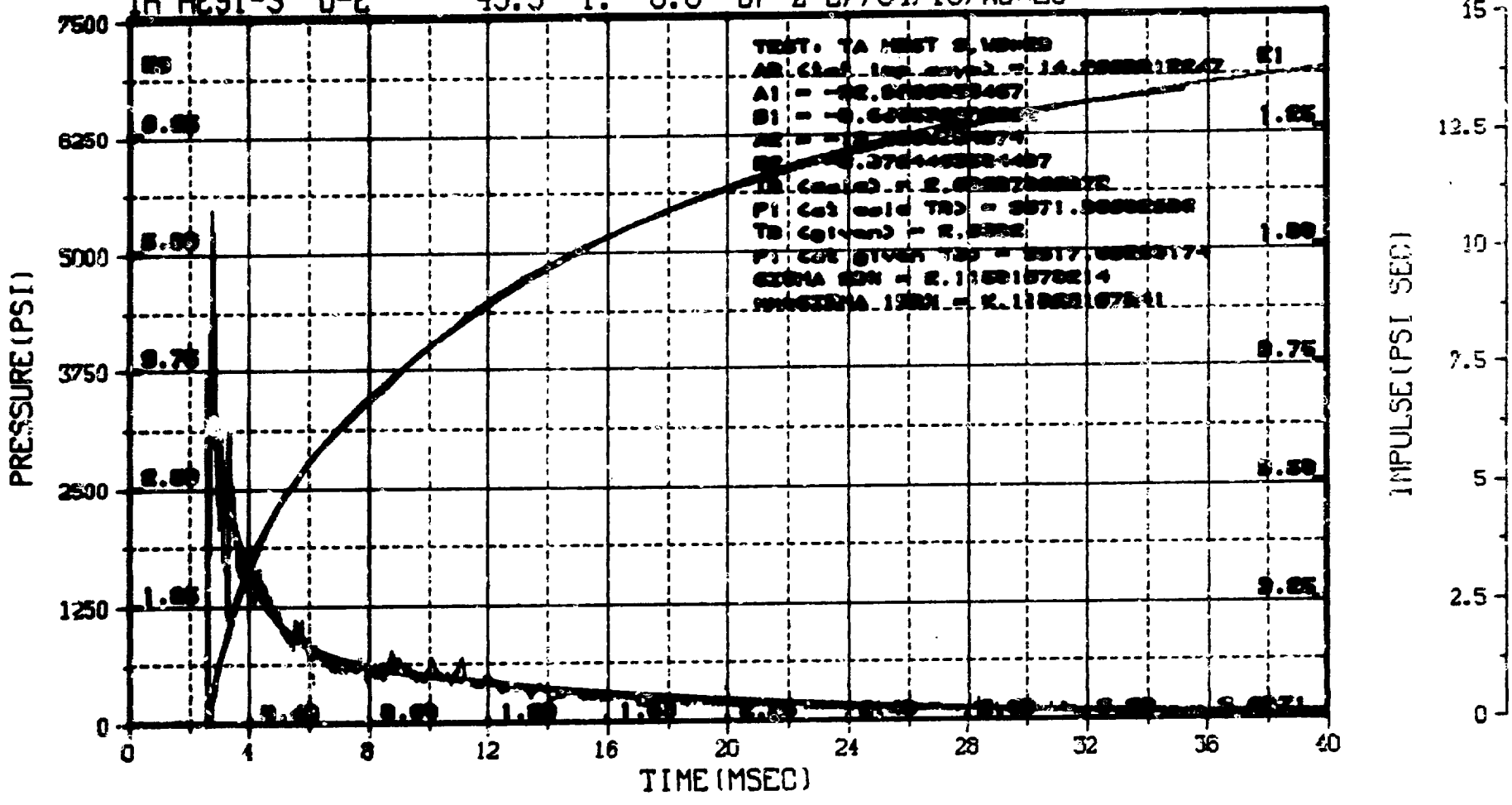

E1
E-1
X VS. RESIDUALS FOR: TA WEST 3,
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
1.00
2.00
3.00



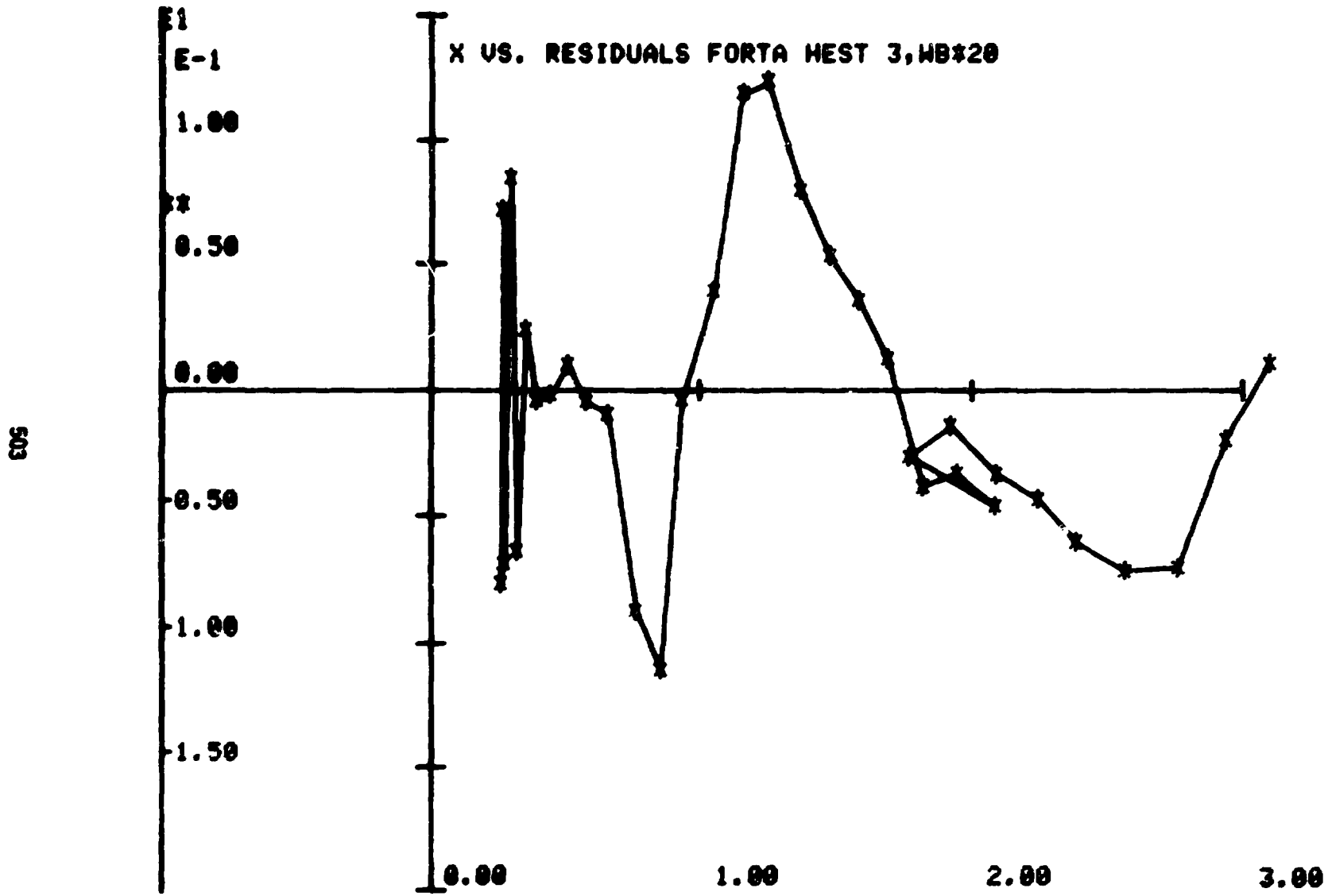
M.N. = 20	E.U. -0.000,4175.000	VSN= ED23
TSKIP=12.650	DIGITS-0.000,614.500	TAPE22
S.R. =100.00 KHZ	11 35 AM, 2 MAY 78.	FILE=50

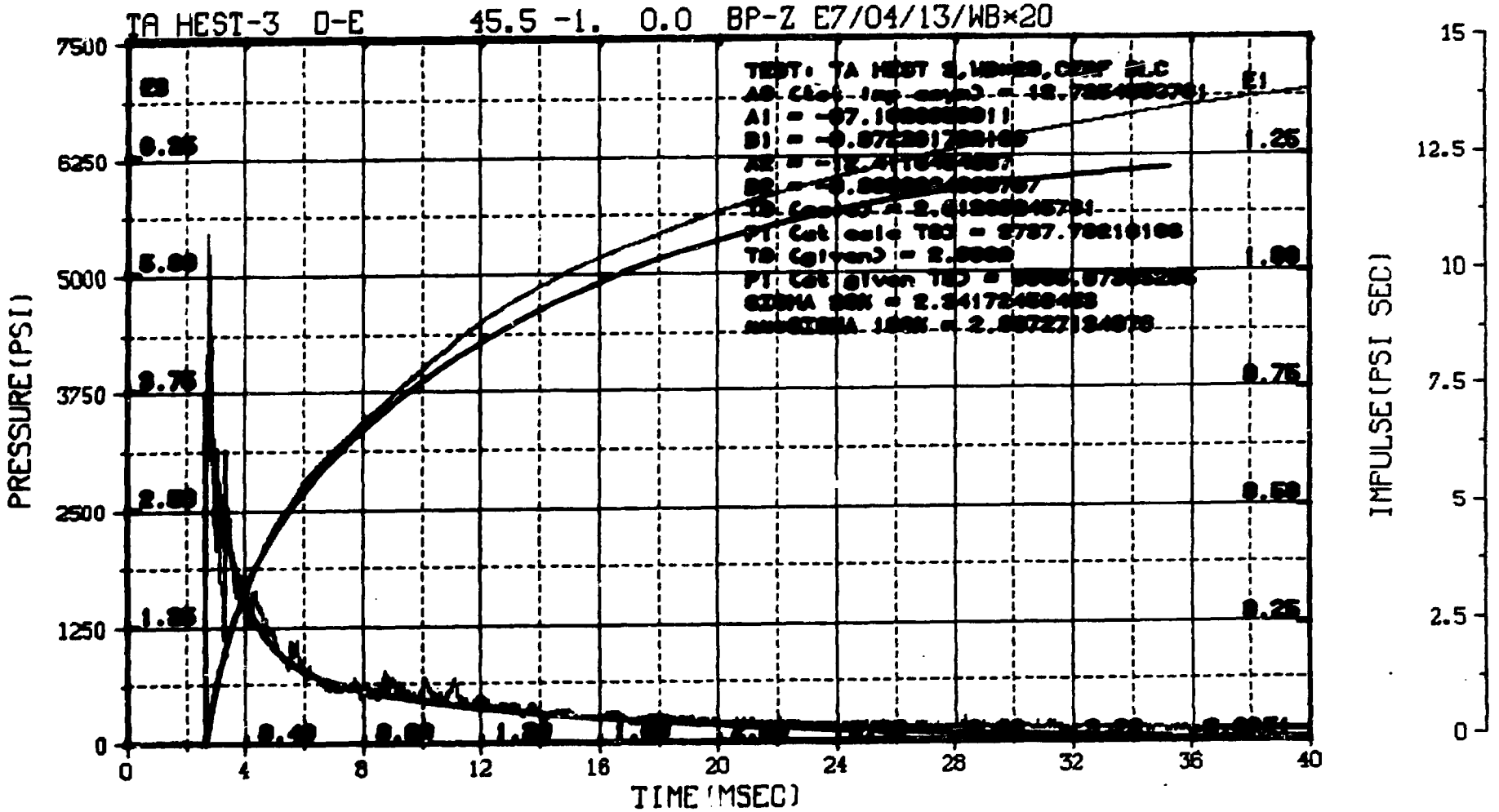
1


X VS. RESIDUALS FOR: TA WEST 3,WB$20
E-1
2.00
1.50
1.00
0.50
0.00
1.00
1.50
0.00
0.50
1.00
1.50
2.



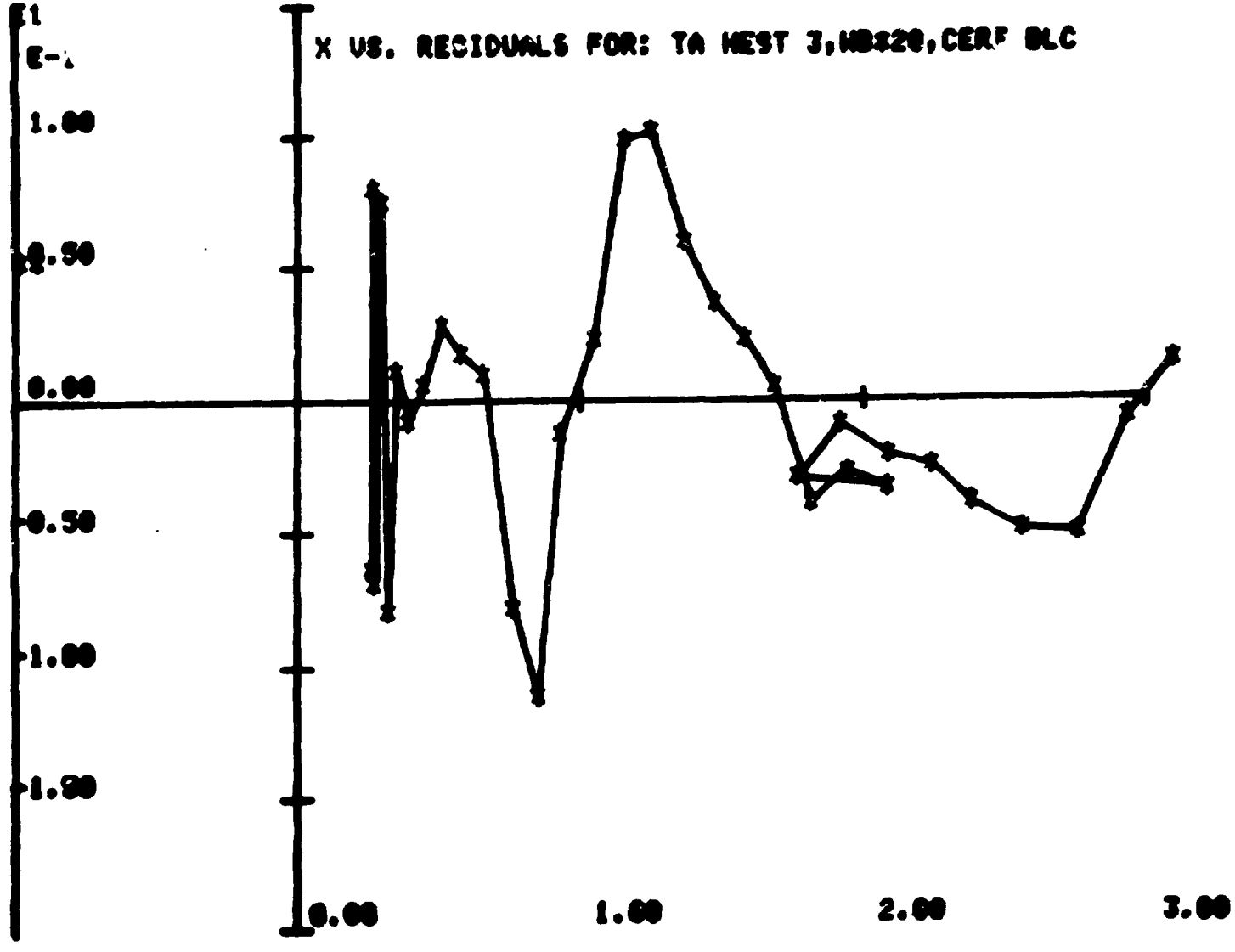
M.N. = 20	E.U. =0.000,4175.000	VSN=
TSKIP=12.650	DIGITS=0.000,614.500	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=50


X VS. RESIDUALS FORTA HEST 3,HB*20
E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00
SOS

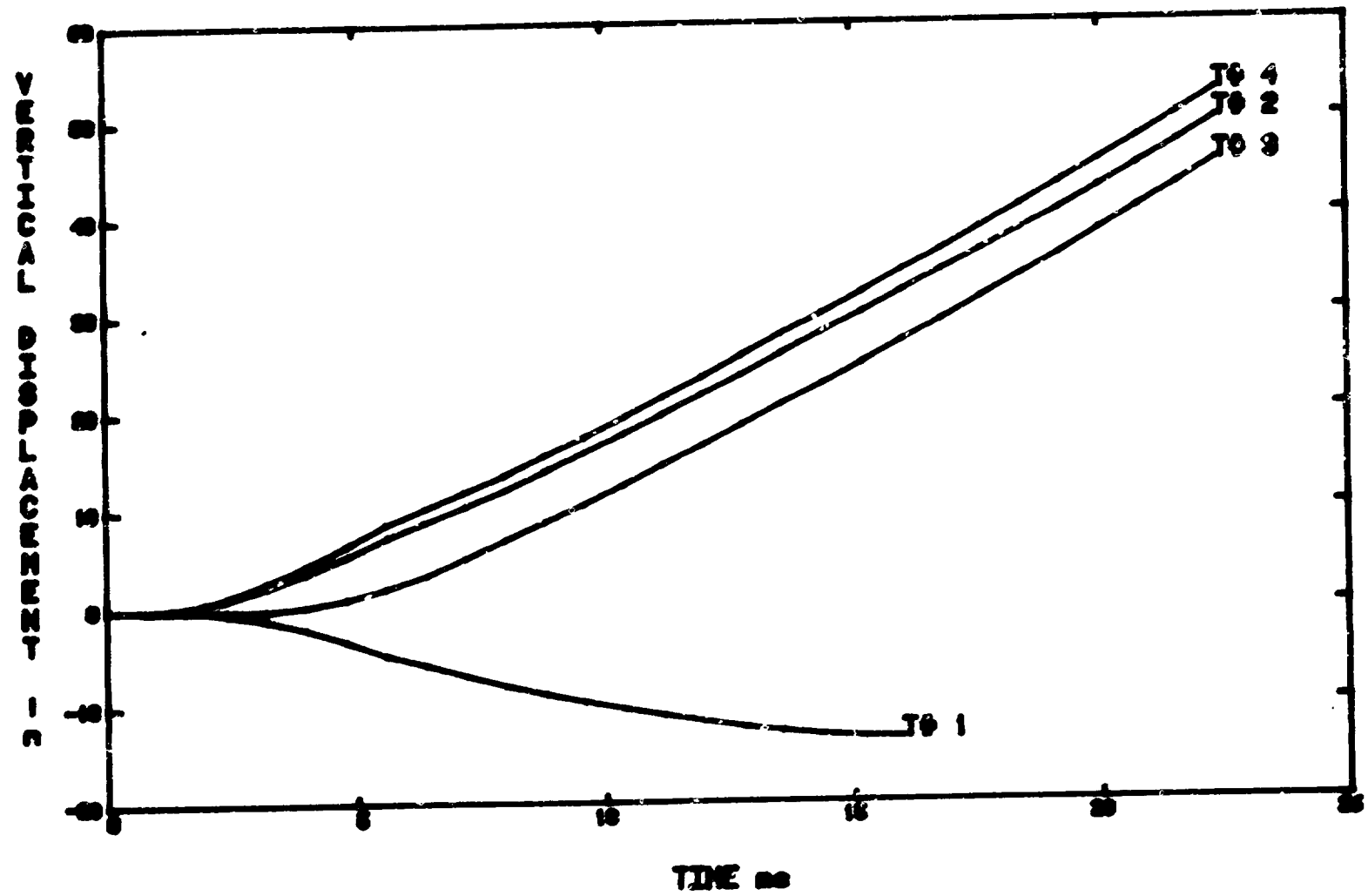


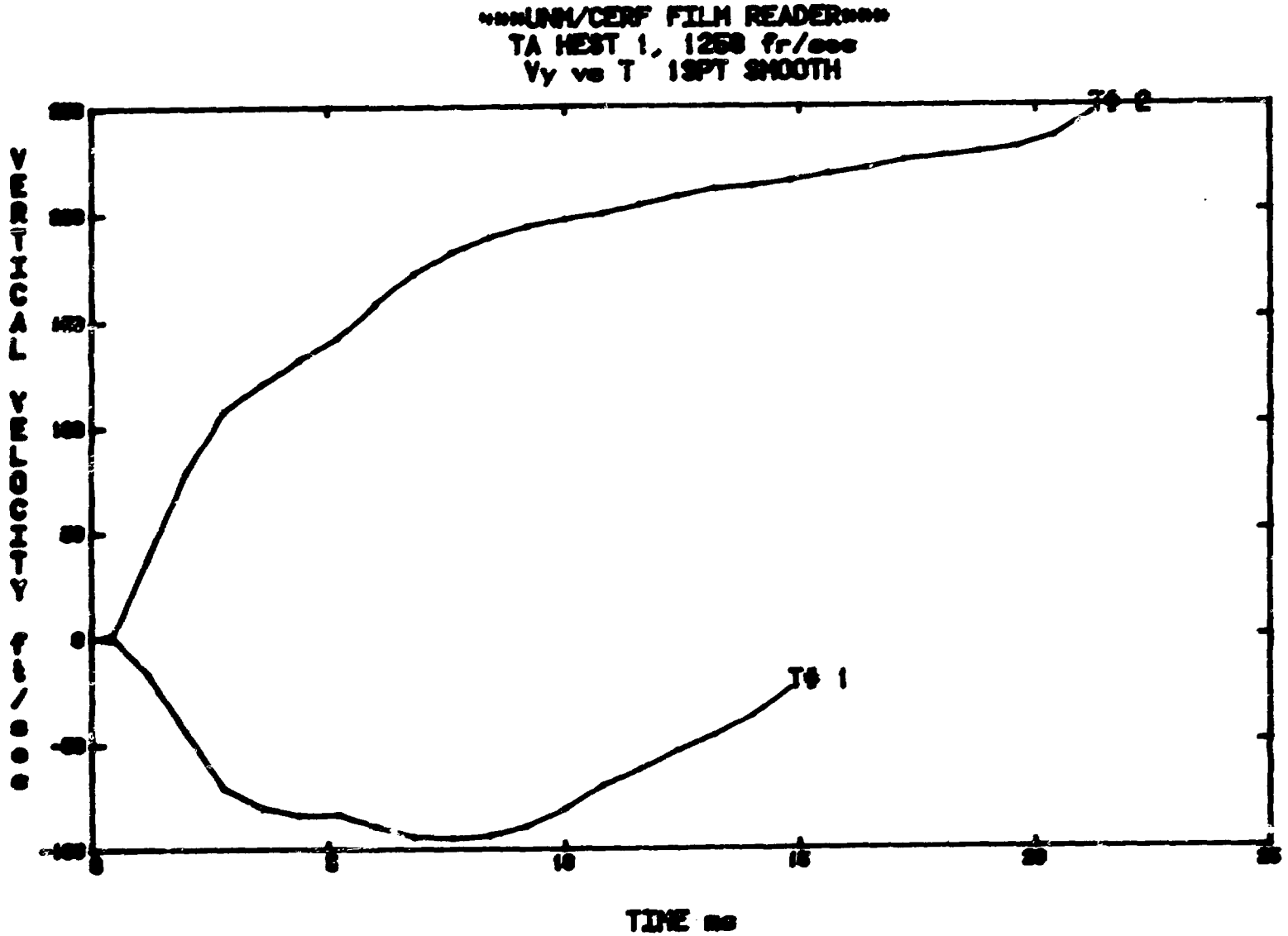
M.N. = 20	E.U. =0.000,4175.000	VSN=
TSKIP=12.650	DIGITS=0.000,614.500	TAPE22
S.R. =100.00 KHZ	8 50 AM, 2 MAY 78.	FILE=50

1

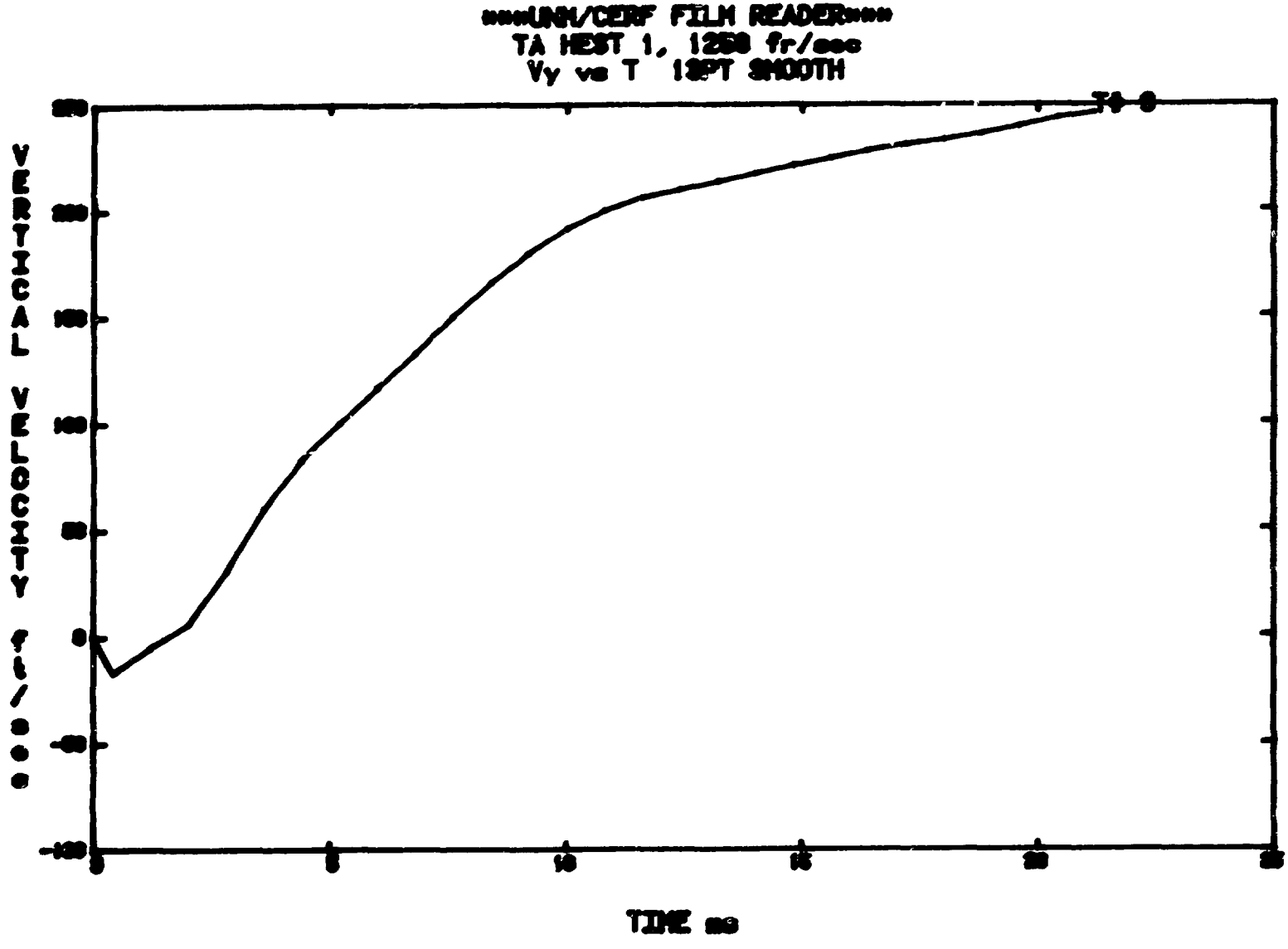

X VS. RESIDUALS FOR: TA WEST 3,WB120,CERF BLC
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00

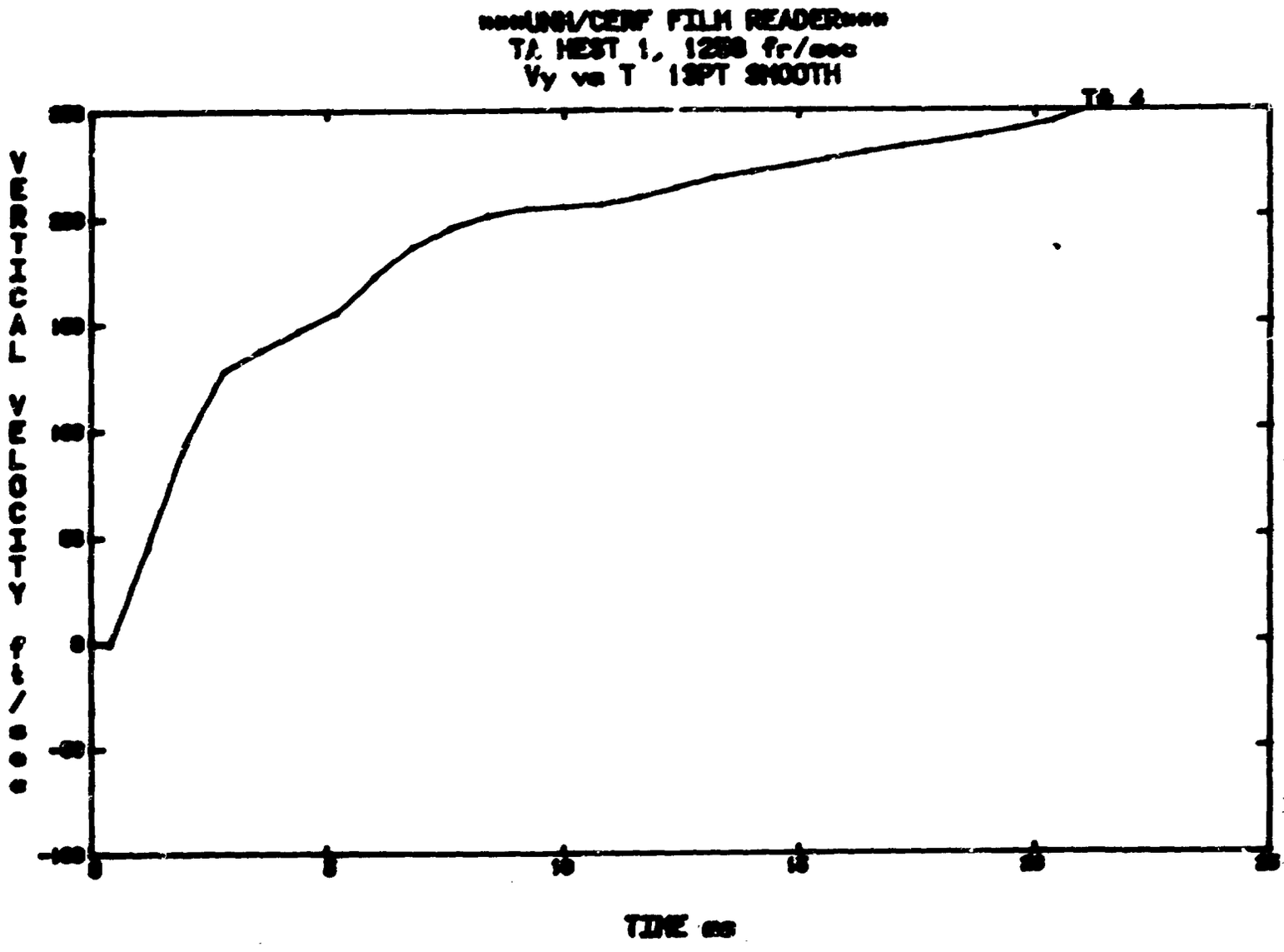
APPENDIX C
PLOTTED PHOTOPOLE DATA

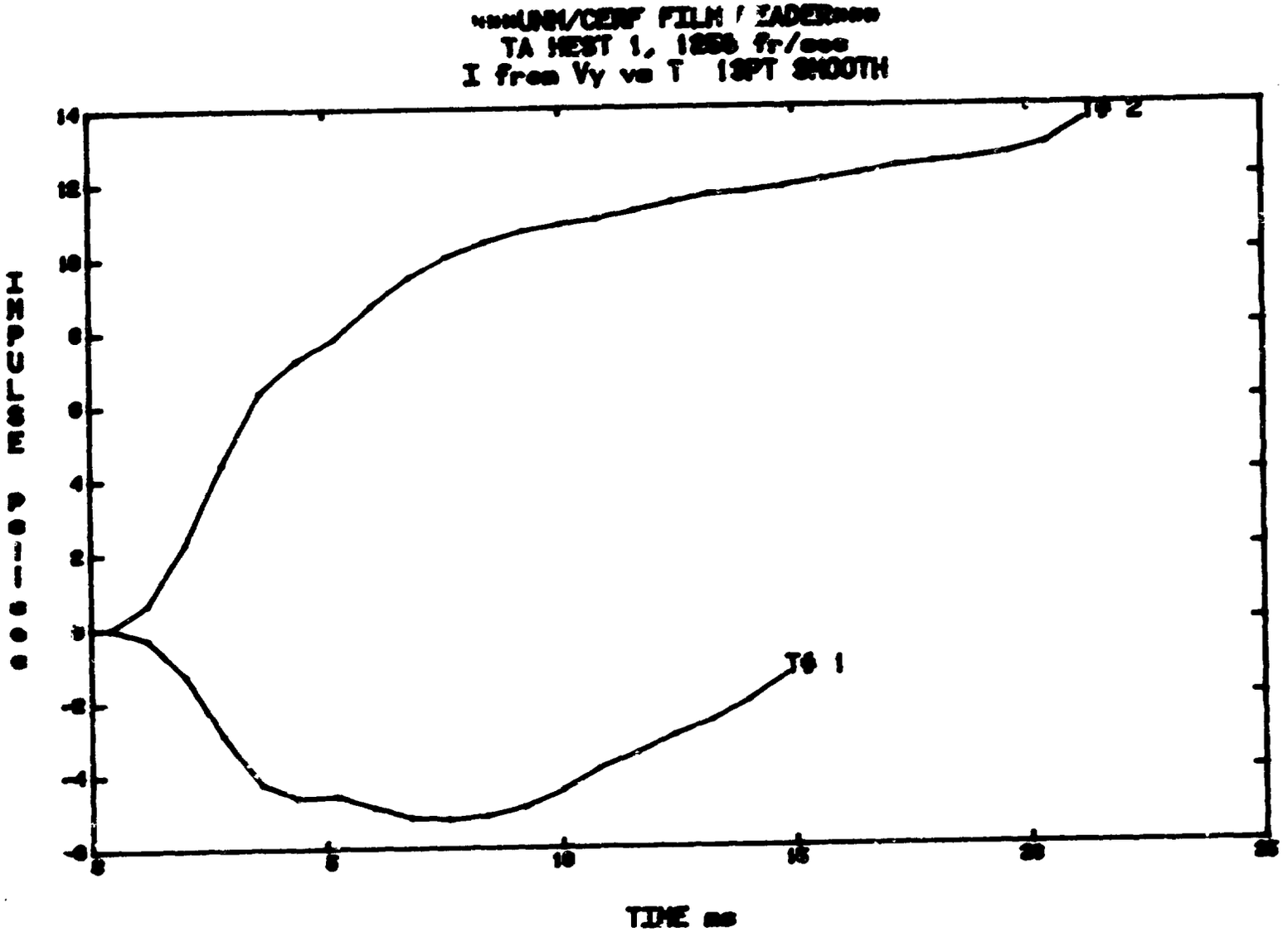

UNIV/CERF FILM READER
TA HEST 1, 1250 fr/sec
Y vs T SPT SMOOTH
VERTICAL DISPLACEMENT - IN
TIME sec
TG 4
TG 2
TG 3
TG 1

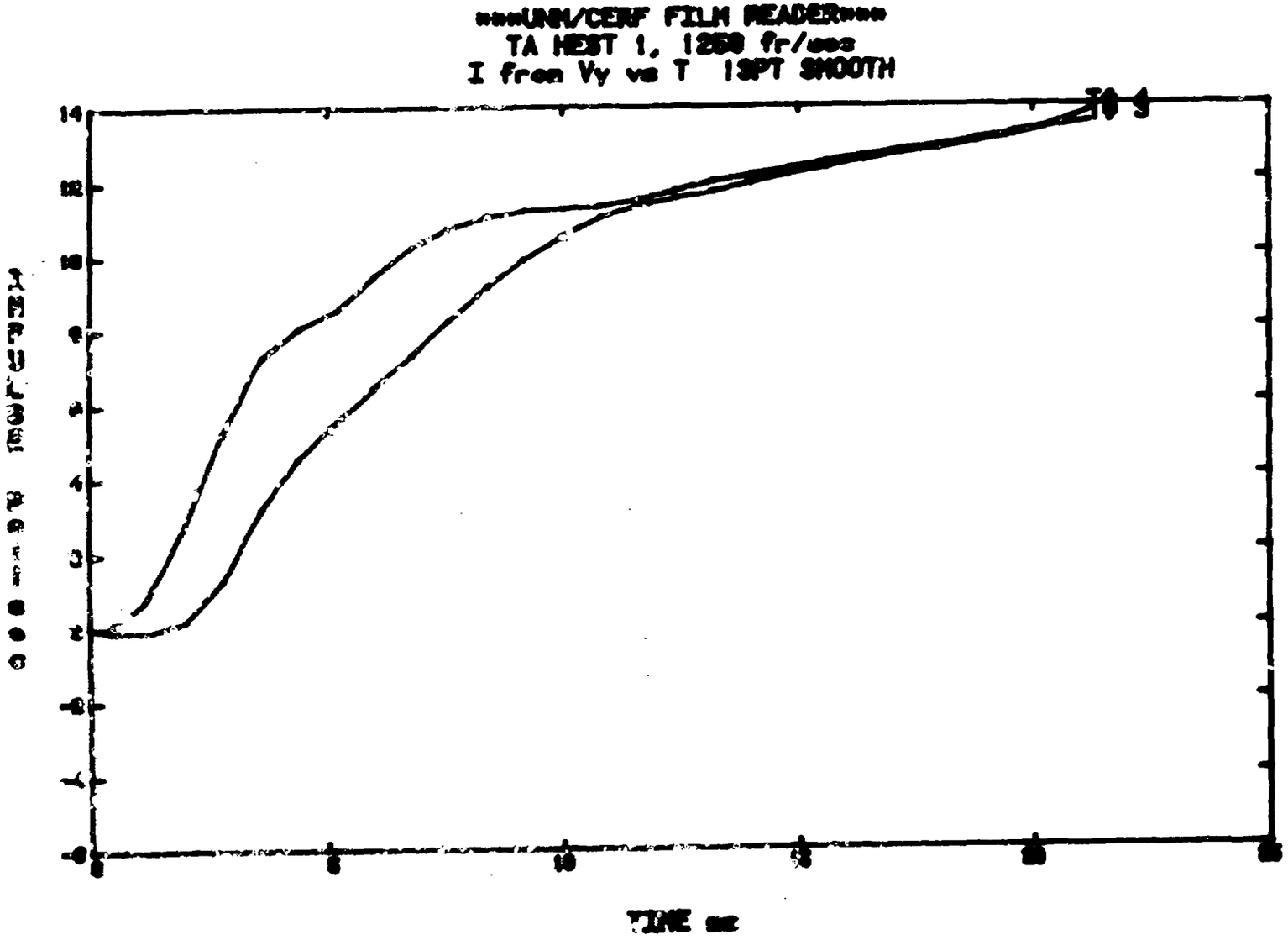

«««UNM/CERF FILM READER»»»
TA WEST 1, 1250 fr/sec
Vy vs T 13PT SMOOTH
VERTICAL VELOCITY ft/sec
TIME sec
T# 2
T# 1

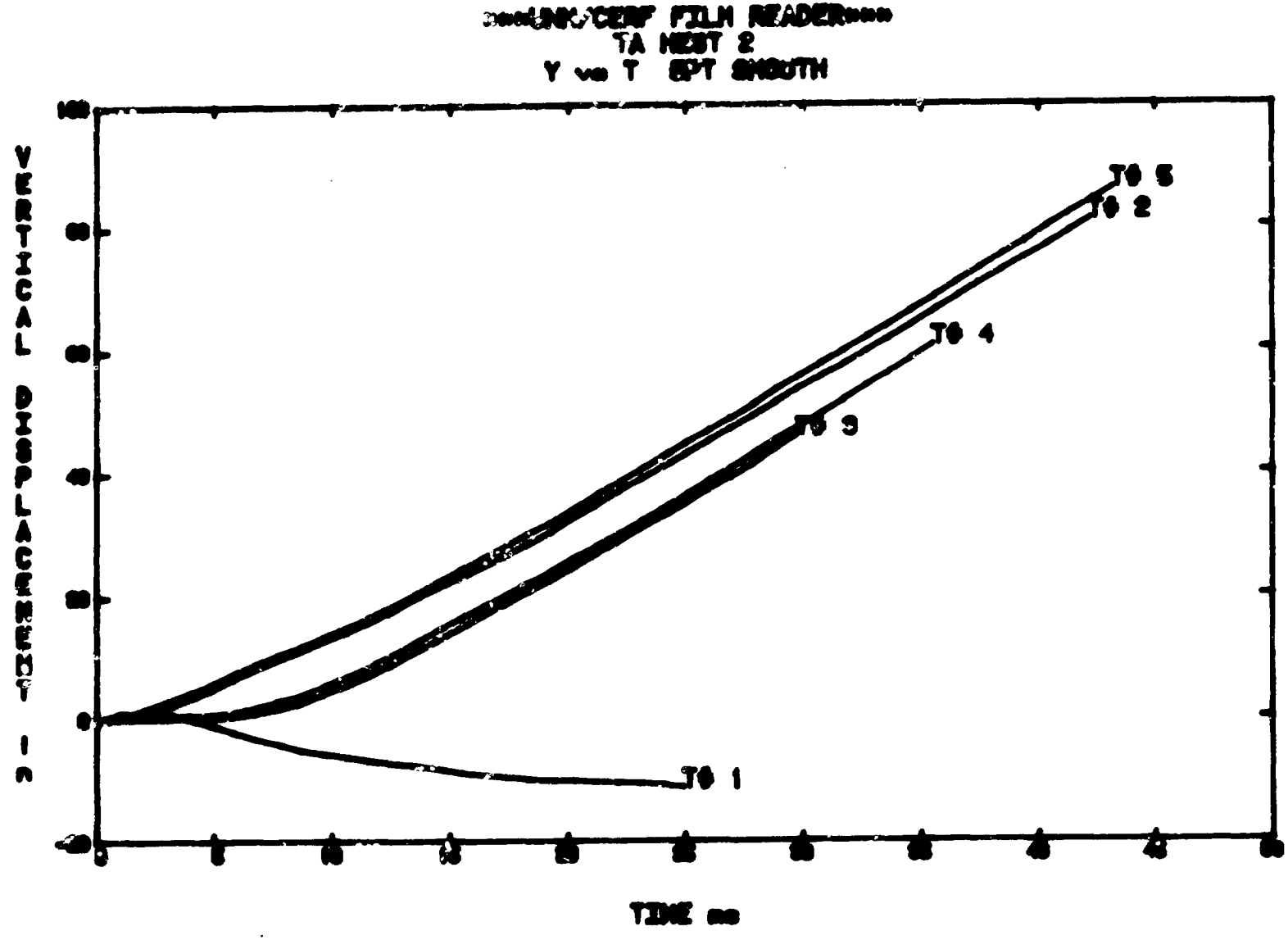
SOS

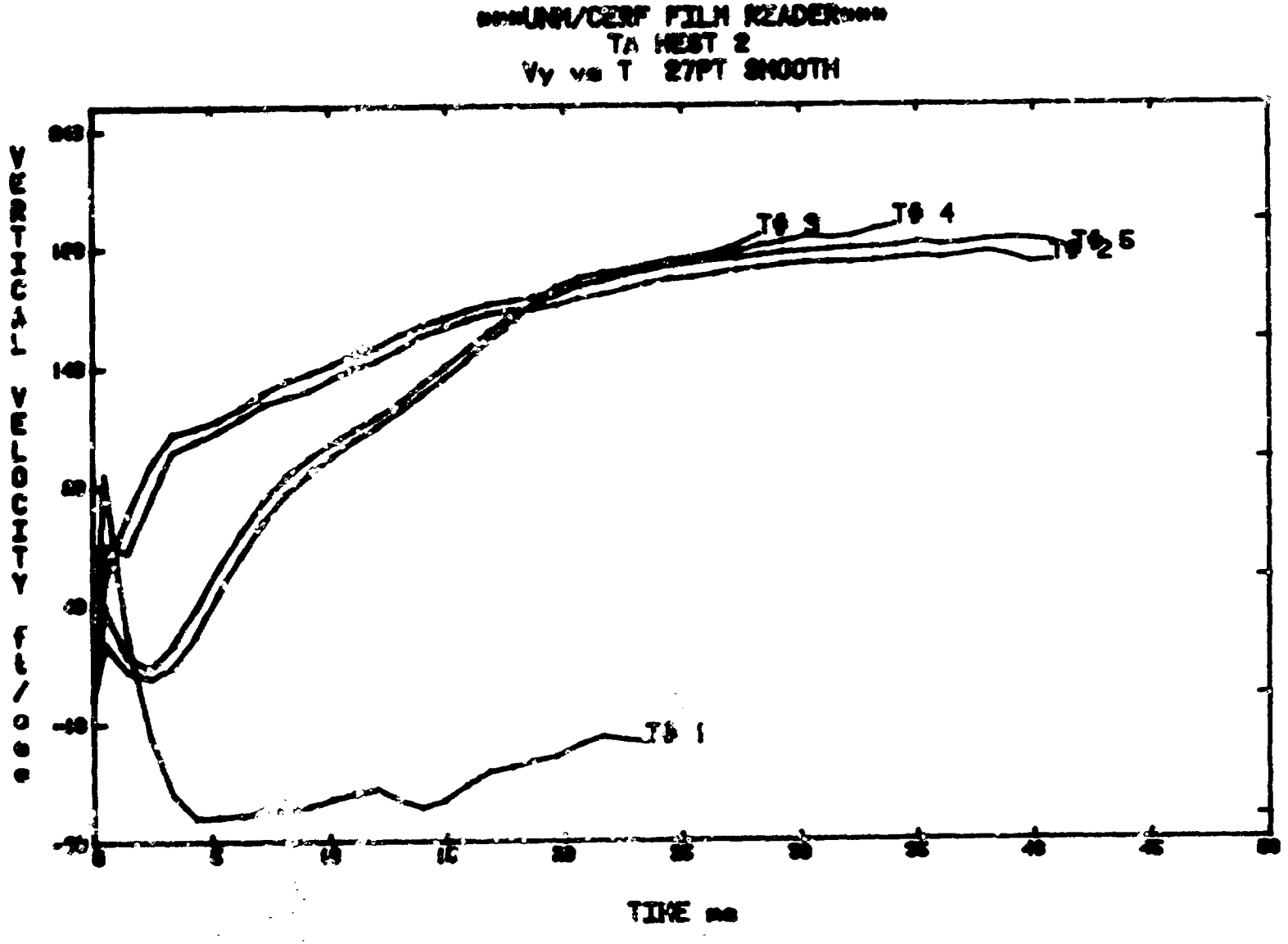

UNH/CERF FILM READER
TA HEST 1, 1250 fr/sec
Vy vs T 12PT SMOOTH
VERTICAL VELOCITY ft/sec
TIME sec

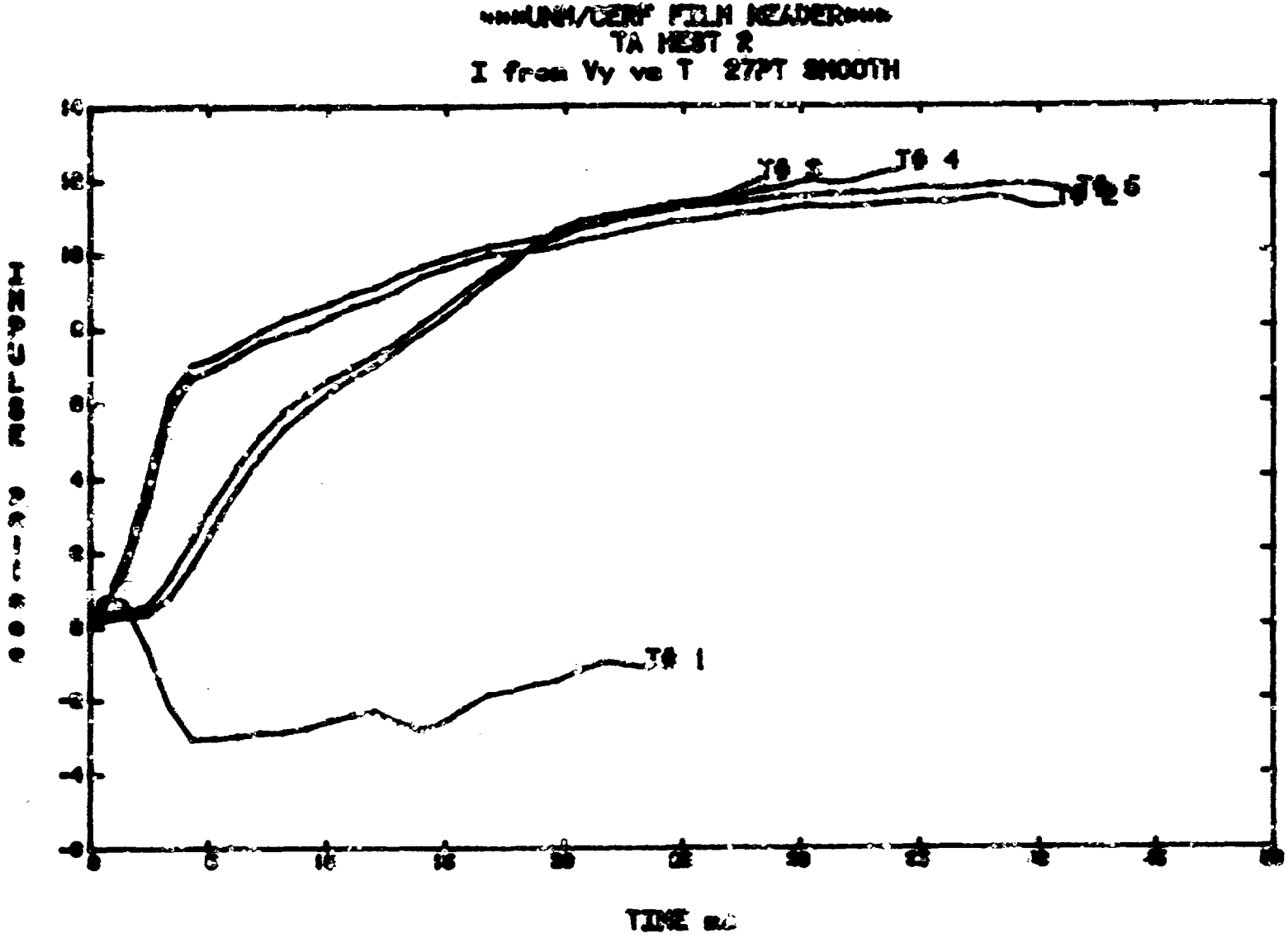

UNIV/CERF FILM READER
T1. HEST 1, 1250 fr/sec
Vy vs T 12PT SMOOTH
T8 4
VERTICAL VELOCITY ft/sec
TIME sec

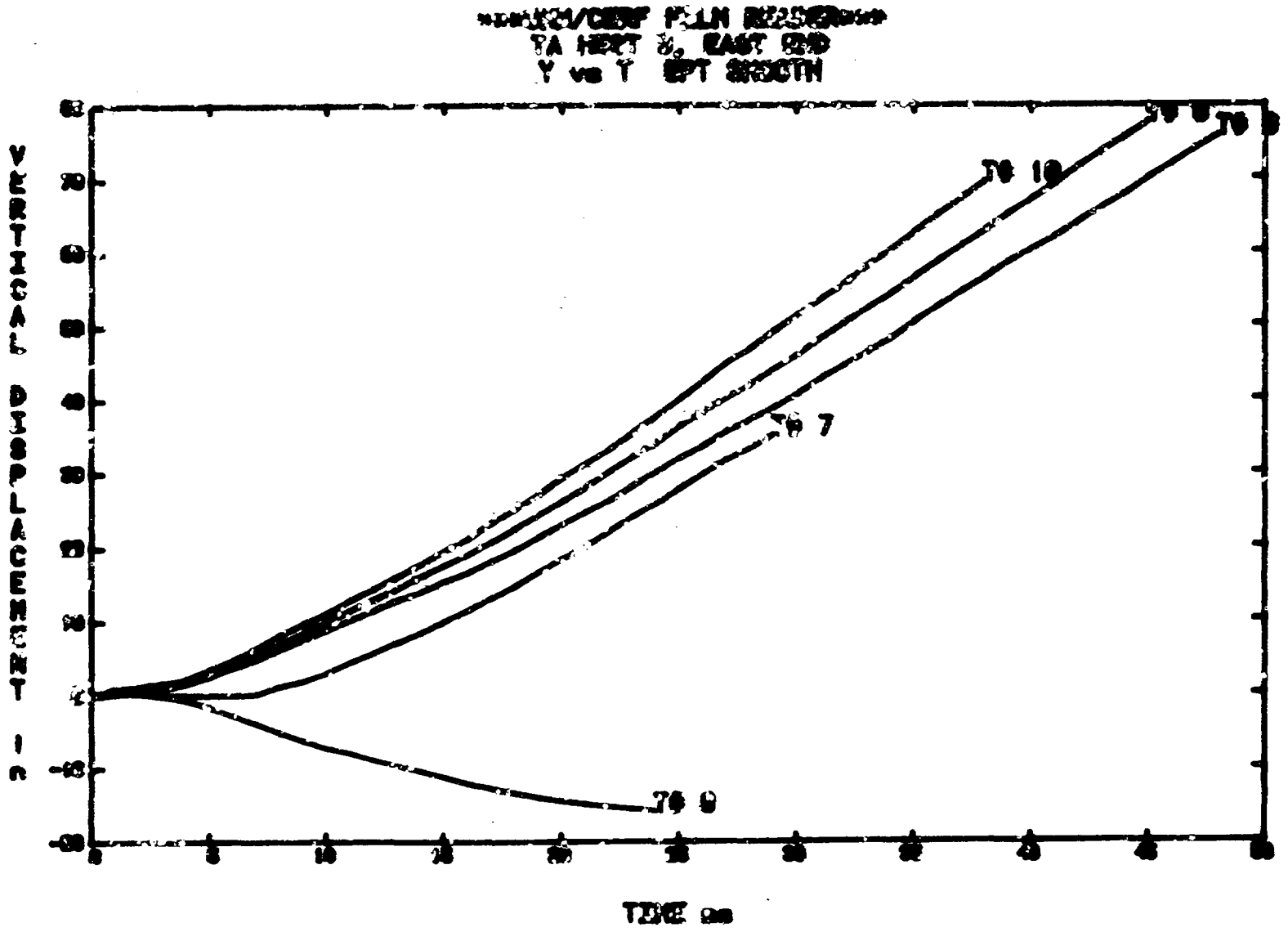

UNM/CERF FILM / ZADER
TA WEST 1, 1000 fr/sec
I from Vy vs T 13PT SMOOTH
IMPULSE
TIME ms
T# 2
T# 1

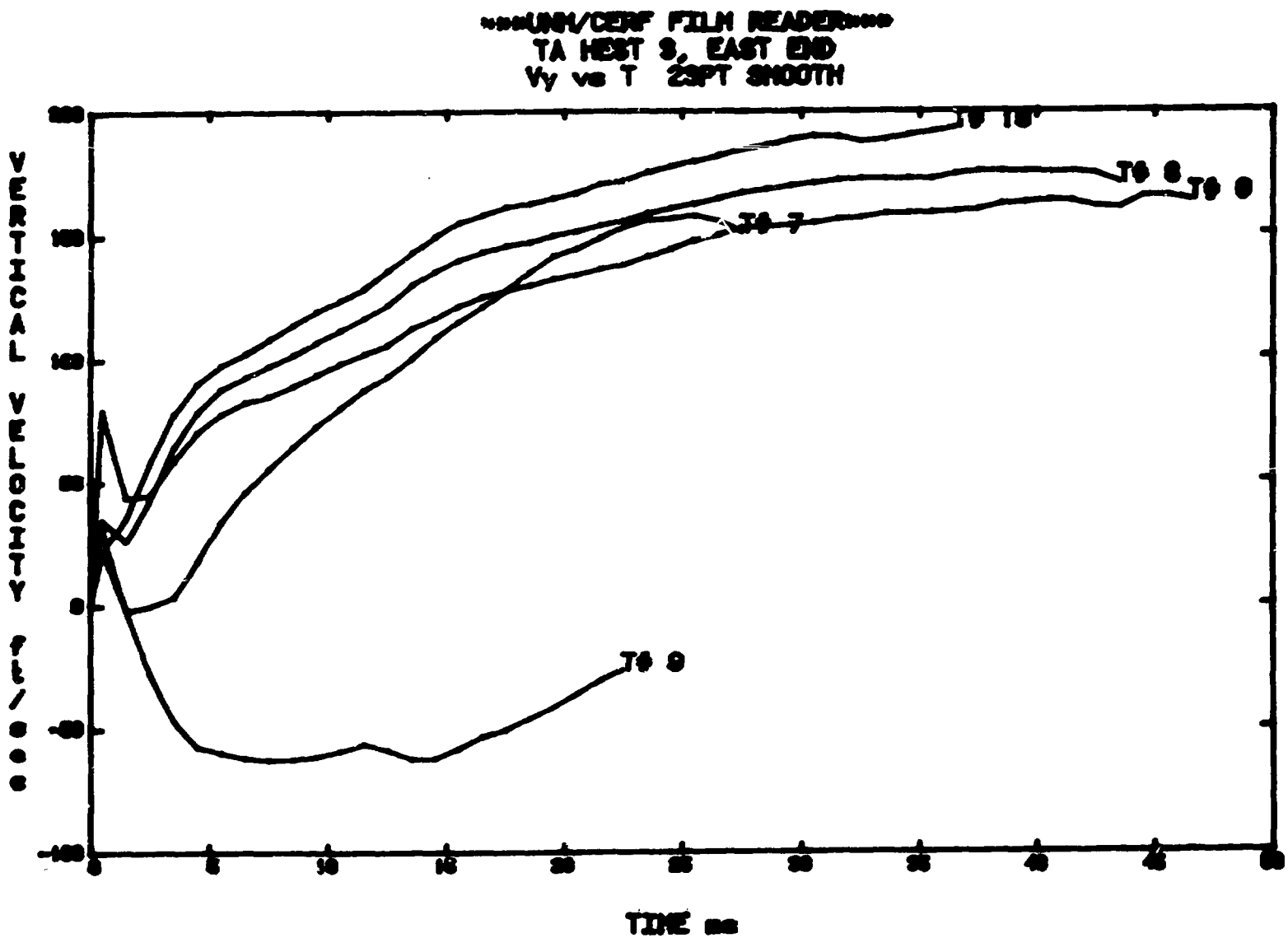

UNM/CERF FILM READER
TA HEST 1, 1250 fr/sec
I from Vy vs T 19PT SMOOTH
14
12
10
8
6
4
2
0
TIME sec

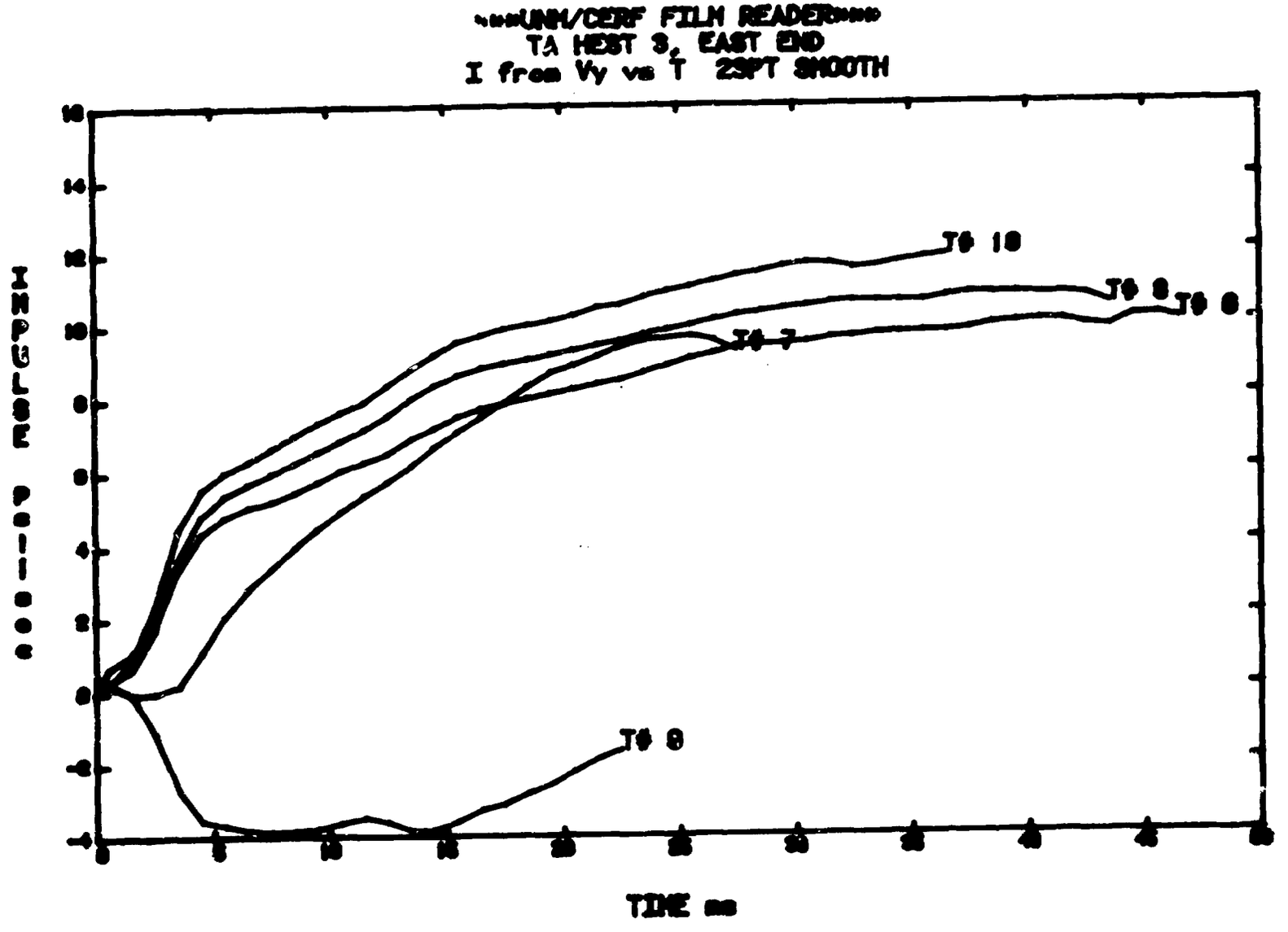

LINK/CERF FILM READER
TA NEST 2
Y vs T EPT SMOOTH
VERTICAL DISPLACEMENT - IN
TIME sec
TR 5
TR 2
TR 4
TR 3
TR 1

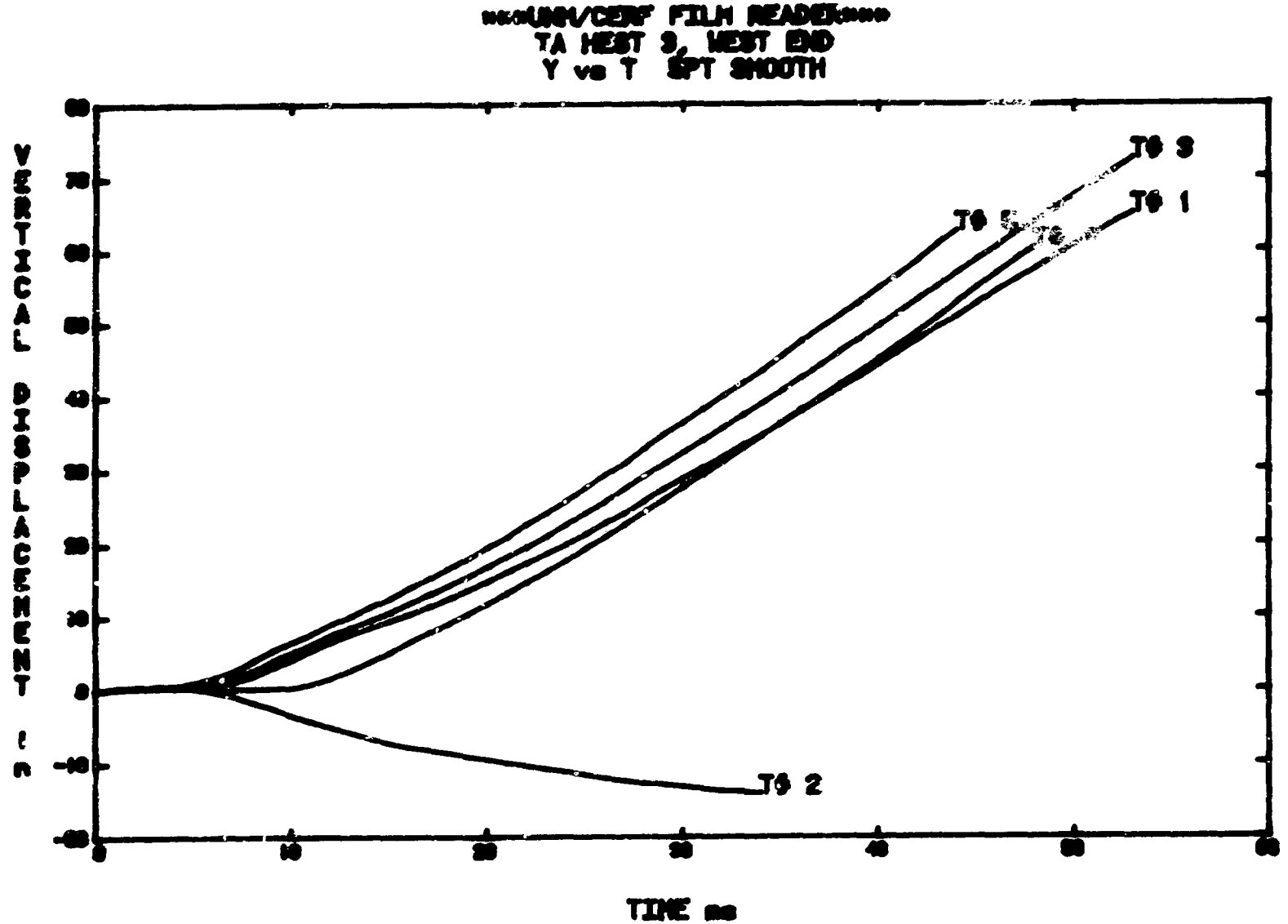

UNM/CERF FILM READER
TA TEST 2
Vy vs T 27PT SMOOTH
VERTICAL VELOCITY FT/SEC
TIME ms
T# 1
T# 3
T# 4
T# 5

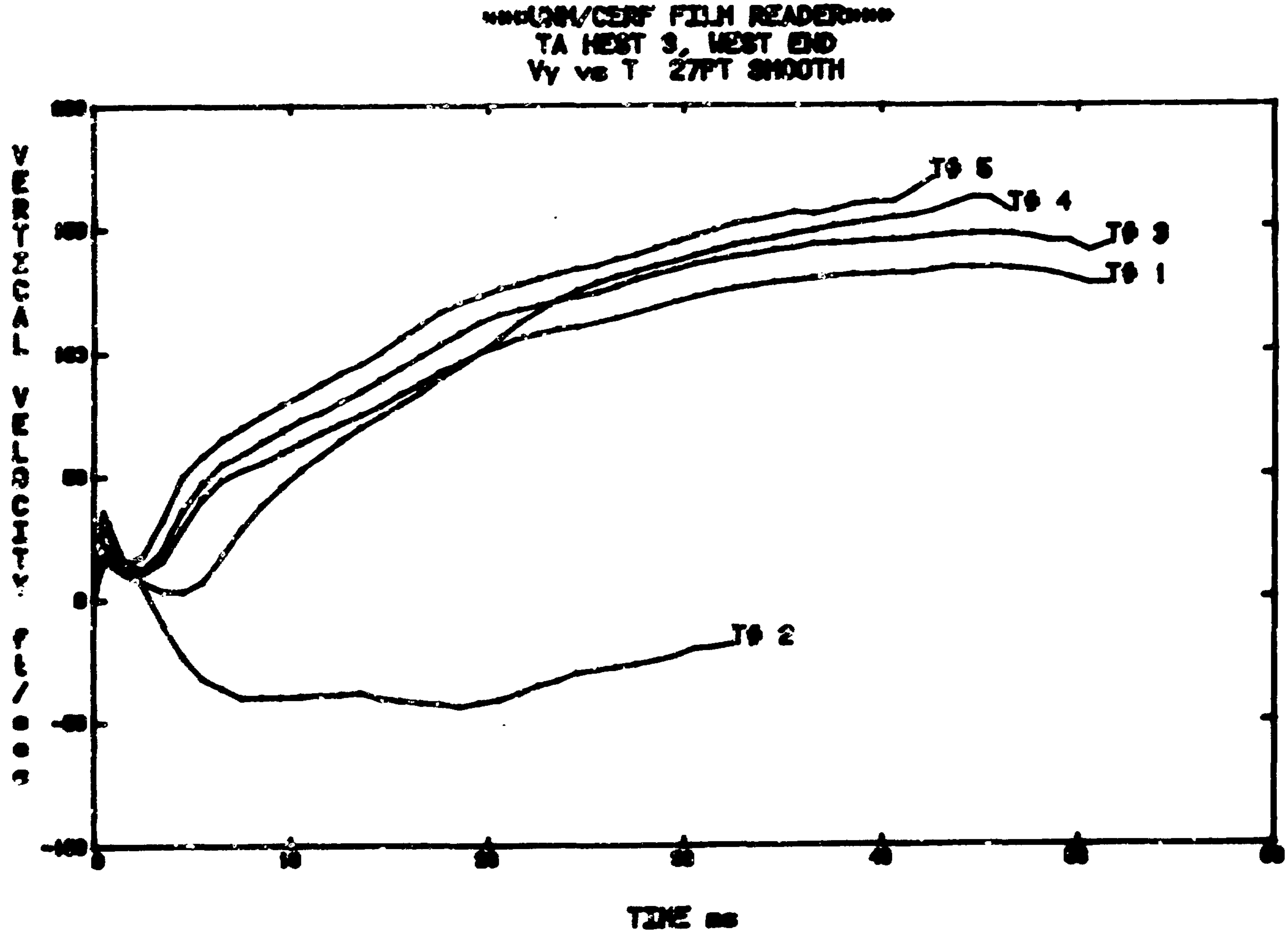

UNH/CERF FILM READER
TA TEST 2
I from Vy vs T 27PT SMOOTH
T# 1
T# 4
T# 5
TIME


TA HEXT 8, EAST END
Y vs T SPT SMOOTH
VERTICAL DISPLACEMENT - C
TIME ms
79 10
79 7
79 9

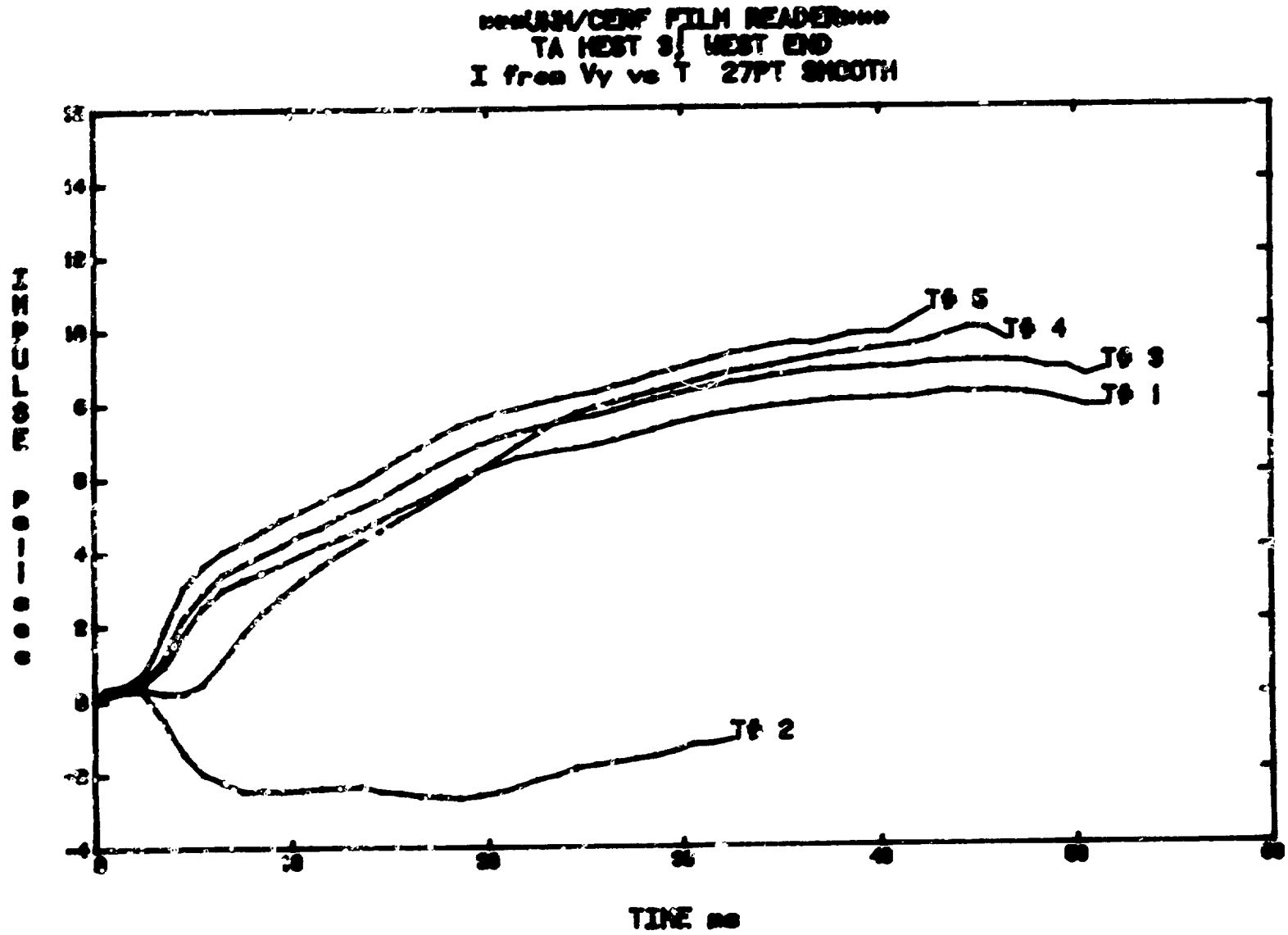

»»»UNH/CERF FILM READER«««
TA HEST 8, EAST END
Vy vs T 23PT SMOOTH
VERTICAL VELOCITY ft/sec
TIME ms
T# 8
T# 7
T# 9


UNM/CERF FILM READER
TA HEST 3, EAST END
I from Vy vs T 23PT SMOOTH
IMPULSE
TIME ms
T# 10
T# 9
T# 8
T# 7
T# 6


UNIV/CERF FILM READER
TA HEST 9, WEST END
Y vs T SPT SMOOTH
VERTICAL DISPLACEMENT - ft
TIME ms
T9 3
T9 1
T9 5
T9 2



UNM/CERF FILM READER
TA WEST 3, WEST END
Vy vs T 27PT SMOOTH
VERTICAL VELOCITY ft/sec
TIME ms
T$ 5
T$ 4
T$ 3
T$ 1
T$ 2


TA MEST 3[MEST END
I from Vy vs T 27PT SMOOTH
IMPULSE
TIME ms
T# 5
T# 4
T# 3
T# 1
T# 2

APPENDIX D

TEST INSTRUMENTATION DETAILS

Test: TA HEST 1 - Blast Pressure Measurements
Date: February 24, 1978

Measurement Number	Gage Number	Gage Type	Debris Shield	Locations						Posttest Elevation Change (ΔZ), in
				As Planned, in			As Built, in			
				X	Y	Z	X	Y	Z	
1	2-7	Kulite 30K	10	+2	+12	0	+2	+12-1/4	0	-12.06
2	4-1	Kulite 20K	18	-36	+60	0	-36	+60-1/4	0	-11.04
3	4-6	Kulite 20K	18	-36	-36	0	-35-3/4	-36-3/8	+3/16	-11.04
4	5-22	Kulite 20K	18	-36	-36	0	+36-1/2	-36-3/8	+1/8	-11.46
5	351	Bar 6K	None	+2	-6	0	+2-1/8	-6-1/8	+1/16	-11.88
6	353	Bar 6K	None	+1-3/8	-18	0	+15/16	-18	+1/16	-11.64
7	357	Bar 6K	None	+3/4	-30	0	+3/4	-30-1/4	+3/16	-11.04
9	362	Bar 6k	None	0	-42	0	-1/4	-42-1/2	+3/16	-10.62
									Average =	-11.35

TA HEST 1 - Time-of-Arrival (TOA) Measurements

Measurement Number	Gage Type[a]	Locations, in			TOA[b], ms
		X	Y	Z	
1		+72	+24	+3-3/4	
2		+36	0	+3-3/4	
3		0	+24	+3-3/4	
4		-36	0	+3-3/4	
5		-72	+24	+3-3/4	
6		+72	-72	+3-3/4	
7		+36	-48	+3-3/4	
8		0	-72	+3-3/4	
9		-36	-48	+3-3/4	
10		-72	-72	+3-3/4	
11		0	+12	+3-3/4	
12		0	0	+3-3/4	
13		0	-12	+3-3/4	
14		+72	+72	+5-3/8	
15		+36	+48	+5-3/8	
16		0	+72	+5-3/8	
17		-36	+48	+5-3/8	
18		-72	+72	+5-3/8	
19		+72	-24	+5-3/8	
20		+36	-48	+5-3/8	
21		0	-24	+5-3/8	
22		-36	-48	+5-3/8	
23		-72	-24	+5-3/8	

[a]All gages were crystal type.

[b]Data unavailable due to pin box failure.

Test: TA HEST 2 - Blast Pressure Measurements
Date: March 24, 1978

Measurement Number	Gage Number	Gage Type	Debris Shield	Locations						Posttest Elevation Change (ΔZ), in
				As Planned, in			As Built, in			
				X	Y	Z	X	Y	Z	
1	4-1	Kulite 20K	18	+57	0	0	+57	0	+1/8	-8.52
2	4-6	Kulite 20K	12	+36	+12	0	+35-1/2	+12	+3/16	-8.16
3	5-22	Kulite 20K	18	+21	-48	0	+21	-48	+3/16	-6.54
4	2-7	Kulite 30K	10	0	0	0	0	0	0	-7.38
5	5-23	Kulite 20K	18	-21	+48	0	-21-3/8	+48	0	-6.90
6	5-37	Kulite 20K	18	-36	-12	0	-36	-11-3/4	+1/16	-6.72
7	355	Bar 6K	None	+12	0	0	+12-5/16	0	+1/16	-7.38
									Average =	-7.37

TA HEST 2 - Time-of-Arrival (TOA) Measurements

Measurement Number	Gage Type[a]	Location, in			TOA, ms
		X	Y	Z	
1		+72	+24	+3-3/4	0.523
2		+36	0	+3-3/4	0.687
3		0	+24	+3-3/4	0.842
4		-36	0	+3-3/4	1.006
5		-72	+24	+3-3/4	1.162
6		+72	-72	+3-3/4	0.522
7		+36	-48	+3-3/4	0.683
8		0	-72	+3-3/4	0.849
9		-36	-48	+3-3/4	1.010
10		-72	-72	+3-3/4	1.165
11		0	+12	+3-3/4	0.934
12		0	0	+3-3/4	1.153
13		0	-12	+3-3/4	Failed
14		+72	+72	+5-3/8	0.532
15		+36	+48	+5-3/8	0.692
16		0	+72	+5-3/8	0.946
17		-36	+48	+5-3/8	1.020
18		-72	+72	+5-3/8	Failed
19		+72	-24	+5-3/8	0.531
20		+36	-48	+5-3/8	0.683
21		0	-24	+5-3/8	0.857
22		-36	-48	+5-3/8	1.019
23		-72	-24	+5-3/8	1.160

[a]All gages were crystal type.

Test: TA HEST 3 - Blast Pressure Measurements
Date: April 27, 1978

Measurement Number	Gage Number	Gage Type[a]	Debris Shield	Locations						Posttest Elevation Change (ΔZ), in
				As Planned, ft			As Built, ft			
				X	Y	Z	X	Y	Z	
1	2-2	30K	10	+7.0	+1	0	6.968	+1	0.00	-18.12
2	2-4	30K	10	+7.0	-1	0	6.974	-1	+0.03	-17.40
3	2-5	30K	10	+14.0	+1	0	14.000	+1	0.00	-15.36
4	2-9	30K	10	+14.0	-1	0	14.000	-1	+0.02	-15.24
5	2-11	30K	10	+21.0	+1	0	21.000	+1	+0.02	-13.92
6	2-12	30K	10	+21.0	-1	0	20.989	-1	+0.02	-12.72
7	4-3	20K	18	+28.0	+1	0	28.000	+1	-0.04	-12.48
8	4-4	20K	18	+28.0	-1	0	28.000	-1	-0.01	-11.88
9	4-6	20K	18	+35.0	+1	0	34.989	+1	-0.07	-12.00
10	4-7	20K	18	+35.0	-1	0	34.979	-1	-0.05	-10.92
11	4-9	20K	18	+42.0	+1	0	42.000	+1	-0.09	-12.84
12	4-11	20K	18	+42.0	-1	0	42.000	-1	-0.03	-11.52
13	4-14	20K	18	+49.0	+1	0	49.000	+1	-0.07	-13.20
14	4-27	20K	18	+49.0	-1	0	48.968	-1	-0.09	-12.36
15	5-21	20K	18	+56.0	+1	0	56.020	+1	-0.10	-12.24
16	5-22	20K	18	+56.0	-1	0	56.000	-1	-0.11	-12.00
17	5-23	20K	18	+63.0	+1	0	63.000	+1	-0.09	-11.64
18	5-26	20K	18	+63.0	-1	0	63.000	-1	-0.07	-11.52
19	2-13	30K	10	+24.5	-1	0	24.500	-1	-0.01	-12.24
20	2-37	20K	18	+45.5	-1	0	45.468	-1	-0.04	-11.88
										Average = -13.07

[a]All gages were Kulite type.

TA WEST 3 - Time-of-Arrival (TOA) Measurements

Measurement Number	Gage Type[a]	Locations, ft			TOA, ms
		X	Y	Z	
1		0.0	+4.0	0.312	0.488
2		0.0	0.0	0.312	0.448
3		0.0	-4.0	0.312	0.485
4		9.0	0.0	0.312	0.825
5		18.0	+4.0	0.312	1.389
6		18.0	-4.0	0.312	1.266
7		27.9	+4.0	0.312	Failed
8		27.9	0.0	0.312	1.692
9		27.9	-4.0	0.312	1.712
10		35.9	+2.0	0.312	2.070
11		40.4	+4.0	0.312	2.288
12		40.4	0.0	0.312	2.291
13		40.4	-4.0	0.312	2.297
14		44.4	+2.0	0.312	2.488
15		47.9	0.0	0.312	2.661
16		50.9	+2.0	0.312	2.821
17		53.8	+4.0	0.312	2.975
18		53.8	0.0	0.312	2.973
19		53.8	-4.0	0.312	2.988
20		56.5	+2.0	0.312	3.124
21		59.2	0.0	0.312	3.273
22		61.7	+2.0	0.312	3.416
23		64.0	+4.0	0.312	3.552
24		64.0	0.0	0.312	3.549
25		64.0	-4.0	0.312	3.551
26		66.3	+2.0	0.312	3.683
27		68.5	0.0	0.312	3.819
28		0.0	+4.0	0.447	Failed
29		0.0	0.0	0.447	0.442
30		0.0	-4.0	0.447	0.489
31		9.0	+4.0	0.447	0.896
32		9.0	-4.0	0.447	0.885
33		18.0	0.0	0.447	1.258
34		27.9	+4.0	0.447	1.715
35		27.9	0.0	0.447	1.701
36		27.9	-4.0	0.447	1.731
37		40.4	0.0	0.447	2.290
38		47.9	+4.0	0.447	2.674
39		47.9	0.0	0.447	2.666
40		47.9	-4.0	0.447	2.687
41		53.8	0.0	0.447	2.981
42		59.2	+4.0	0.447	3.285
43		59.2	0.0	0.447	3.280
44		59.2	-4.0	0.447	3.296
45		64.0	0.0	0.447	3.559
46		68.5	+4.0	0.447	3.826
47		68.5	0.0	0.447	3.825
48		68.5	-4.0	0.447	3.825

[a]All gages were crystal type.

APPENDIX E
HEST LOCKUP CODE DESCRIPTION

The lockup impulse code is used to calculate HEST pressure and impulse histories for a given initial pressure, cavity, and overburden dimensions soil properties, as well as the ratio of specific heats (γ) of the detonation products. The code is small enough to run on the HP 9825A programmable calculator, and a BASIC version for the Tektronix 4051 is available. No provision is made for handling layered soils; the overburden and test bed materials are assumed uniform and homogeneous. The calculations are one-dimensional, and the three-dimensional properties of a HEST calculation are approximated. The detonation product/air mix in the cavity is assumed to have a uniform pressure distribution, and dynamic properties are neglected. The detonation product/air mix is assumed to be a "gamma law" gas with gamma held constant. The lockup code is typically used to design a HEST so that its pressure history matches a given nuclear waveform. This is done by varying cavity and overburden dimensions until the calculated HEST waveform most closely matches the desired nuclear waveform.

The code is also used in the analysis of data obtained from a HEST test. In this case, one inputs the appropriate soil model, as-built dimensions, etc., into the code and varies the initial pressure until the calculated HEST impulse-time trace most closely matches the given data trace. This initial pressure is called the Simulation Peak Pressure. This method of determining peak pressures is an alternative to using the peak pressure routine[a]. In fitting a data trace with the lockup code the user determines the quality of the fit by inspection. Since these HESTs were designed with the lockup code, fitting data traces with the code yields information about the quality of the simulation. The lockup code should be used in the analysis of HEST test data whenever the results of that analysis are to be used as inputs in future HEST designs.

---

[a]Dempler, Howard W., and Earickson, Jeff A., *High-Pressure and Foam HEST Analyses*, CERF AST-10, Civil Engineering Research Facility, University of New Mexico, Albuquerque, New Mexico, publication pending.