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CALSPAN ADVANCED TECHNOLOGY CENTER

EVALUATION OF AGGRESSIVENESS TEST TECHNIQUES

Walter E. Levan

CALSPAN REPORT NO. 6706-V-2



TEST: TEST NO. 2
TYPE OF TEST: SYMMETRIC FRONTAL CAR-TO-BARRIER IMPACT
1980 AMERICAN MOTORS CONCORD
DEFORMABLE MOVING BARRIER
TEST DATE: APRIL 30, 1981
CONTRACT NO.: DOT-HS-8-01938
TASK ORDER NO.: 7

Prepared for:

U. S. DEPARTMENT OF TRANSPORTATION
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WASHINGTON, D. C. 20590

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Approved: <u>Donald Alcanella</u> Head, Experimental Operations Section Transportation Research Department			
16. Abstract A symmetric frontal impact of a 1980 American Motors Concord and a deformable moving barrier was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department, Buffalo, New York on April 30, 1981. Impact speed of each vehicle was 32.67 mph. Ambient temperature on the test date was 60° F. <u>32.5 ± .2</u> Both the driver and right front passenger of the American Motors Concord complied with FMVSS-208 injury criteria value. Maximum crush of the Concord was <u>31.6</u> inches on the left front and <u>28</u> inches on the right front. Maximum firewall intrusion was 7.4 inches. Maximum crush of the honeycomb on the face of the moving barrier was <u>16</u> inches. 25" @ L 24" avg			
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SECTION 1

TEST OBJECTIVE

The test objective was to obtain baseline data, using a deformable moving barrier impacting vehicles judged to have dissimilar aggressivity. Secondly to determine the feasibility of using such a barrier to evaluate vehicle aggressiveness.

This test was a symmetric frontal impact of a 1980 American Motors Concord and a deformable moving barrier with a nominal closing speed of 65.34 mph. This test was performed at Calspan Corporation, Advanced Technology Center on April 30, 1981.

The test program is part of the National Traffic Safety Administration (NHTSA) Contract DOT-HS-8-01938, Task 7 to evaluate aggressiveness test techniques.

SECTION 2

SUMMARY OF TEST NUMBER 616-2-515

A frontal car-to-barrier impact (Figure A-1) of a 1980 American Motors Concord into a Deformable Moving Barrier, with each vehicle traveling at 32.67 mph, was performed at the Calspan Corporation, Advanced Technology Center on April 30, 1981. A summary of the test conditions can be found in Table 1 and pre- and post-test photographs can be found in Appendix A.

Two part 572, 50th percentile male Anthropometric Test Devices (ATDs) were placed in the 1980 American Motors Concord in the driver and right-front passenger seating positions, according to dummy placement procedures specified in Laboratory Procedures for Vehicle Assessment TP-212-02.

The occupant dummies were instrumented with triaxial accelerometer packages in the head and chest region with load cells in each femur. Load cells were also placed on the lap and shoulder belts to measure dummy torso and lap loading. Each of the ATDs had been certified prior to the test and certification data sheets, along with instrumentation calibration data are presented in Appendix C.

The 55 channels of data were recorded on 5 FM tape recorders. Firewall Accelerometer Packs 12(X) and 12(Z) experienced a zero shift at 70 milliseconds due to a cut signal cable. Vehicle and Dummy response data traces are found in Appendix B.

The crash event was recorded by one real time and ten high speed cameras. Camera locations and other pertinent camera information are found in Section 3 of this report.

TABLE 1

CRASH TEST SUMMARY

TEST NO.	<u>616-2-515</u>		PROJECT	<u>Evaluation of Aggressiveness Test Techniques</u>	
DATE	<u>4/30/81</u>		TIME	<u>1338</u>	TEMP. <u>60° F.</u>
TEST CONDITION	<u>Symmetric Frontal - 65.34 mph Closing Speed</u>				
VEHICLE NO. 1	<u>1980 American Motors Concord</u>				
VEHICLE NO. 2	<u>Deformable Moving Barrier</u>				
	<i>IMP=6062</i>				
	VEH. NO. 1		VEH. NO. 2		
TEST WEIGHT (lbs)	<u>3920</u>		<u>3450</u>	<u>7370</u>	
IMPACT ANGLE (deg)*	<u>0</u>		<u>0</u>		
IMPACT VELOCITY (mph)**	<u>32.67</u>		<u>32.67</u>	<u>65.34</u>	
MAX. CRUSH (in) (Static)	<u>31.6</u>		<u>16</u>		
MAX. INTRUSION (in)	<u>7.4</u>		<u>-</u>		
	<i>ΔV=30.5866</i>				
OCCUPANTS	VEH. NO. 1		VEH. NO. 2		
TYPE	<u>Part 572, 50th Percentile Male</u>		<u>None</u>		
LOCATION	<u>LF(1) RF(2)</u>		<u>-</u>		
RESTRAINT	<u>3-Point Belt System</u>		<u>-</u>		
I.D. NO.	<u>97</u>	<u>111</u>			
NUMBER OF DATA CHANNELS	<u>55</u>				
NUMBER OF HIGH SPEED CAMERAS	<u>10 + 1 Real Time</u>				

* WITH RESPECT TO TOW TRACK CENTERLINE

** SPEED TRAP MEASUREMENT (±0.5% ACCURACY)

OBSERVATIONS (VEHICLE NO. 1) 1980 American Motors Concord windshield shattered and loss of windshield retention occurred on the driver side. Figure A-14.

GLAZING _____

DOORS _____ Neither front door could be opened after impact.

SEAT _____ Back of the right front passenger seat yielded upon dummy rebound (Figure A-12). Seat anchors intact.

RESTRAINTS _____ Intact - see General Comments below.

OBSERVATIONS (VEHICLE NO. 2)

GLAZING _____

DOORS _____

SEAT ANCHORAGES _____

RESTRAINTS _____

GENERAL COMMENTS _____ The production-type 3-point retractor belt system was modified to a fixed 3-point belt system.

Table 2

VEHICLE TEST WEIGHTS AS TESTED

Left Front 1050 lbs
 Right Front 960 lbs
 TOTAL FRONT 2010 lbs

Left Rear 960 lbs
 Right Rear 950 lbs
 TOTAL REAR 1910 lbs

Total Weight = 2010 + 1910 = 3920 lbs

Wheel Base = 108 inches

$Cg_{F.W.} = \frac{1910 \text{ lbs} \times 108 \text{ inches}}{3920 \text{ lbs}} = \underline{52.62} \text{ inches}$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
 UDW = Unloaded Delivered Weight (3110 lbs)
 VCW = Vehicle Capacity Weight (775 lbs)
 DSC = Designated Seating Capacity (4)

RCLW = VCW - 150 (DSC)

RCLW = 775 - 150 (600) = 175 lbs

TEST WEIGHT = UDW + RCLW + (No. Dummies x 164 lbs)

TEST WEIGHT = 3110 lbs + 175 lbs + 2 (164 lbs)

CALC. TEST WEIGHT = 3613 lbs (calculated)

15015 J

TEST VEHICLE INFORMATION

Vehicle Manufacturer		American Motors Corporation	
Make/Model	American Motors Concord		
Body Style	2-Door	Model Year	1980
VIN	A0A065C283615	Build Date	3/80
NHTSA No.	616-2-515	Color	Red
Engine Data:	6 cylinders	258 in ³ /	displacement
Transmission Data:	3 speed () Manual (x) Automatic		
Date Vehicle Received by Laboratory 3/19/81 Air Cond.-NO; PW.STR.-YES; PW.BR.-NO			
Dealer's Name & Address Holiday Olds., Williamsville, N.Y. 14221			

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR 'B' POST

Vehicle Manufactured by		American Motors Corporation					
Date of Manufacture		3/80		VIN		A0A065C283615	
GVRW	4142	lbs	GAWR: Front	2156	lbs	Rear	2008 lbs

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.

Vehicle Load (up to capacity) - Front 24 psi
Rear 24 psi

Recommended Tire Size D78-14 Load Range: x B C D

Vehicle Capacity: Types of Seats Bench x Bucket Split Bench

Number of Occupants (Designated Seating Capacity): 2 Front
2 Rear
4 TOTAL

Cargo Load = 175 lbs

TOTAL = 775 lbs

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS)

Right Front	=	<u>850</u>	lbs	Right Rear	=	<u>690</u>	lbs
Left Front	=	<u>920</u>	lbs	Left Rear	=	<u>650</u>	lbs
TOTAL FRONT WEIGHT	=	<u>1770</u>	lbs	(<u>56.9</u> % of Total Vehicle Weight)			
TOTAL REAR WEIGHT	=	<u>1340</u>	lbs	(<u>43.1</u> % of Total Vehicle Weight)			
TOTAL DELV. WEIGHT	=	3110	lbs				

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 282 lbs CARGO

Right Front	=	<u>960</u>	lbs	Right Rear	=	<u>950</u>	lbs
Left Front	=	<u>1050</u>	lbs	Left Rear	=	<u>960</u>	lbs
TOTAL FRONT WEIGHT	=	<u>2010</u>	lbs	(<u>51.3</u> % of Total Vehicle Weight)			
TOTAL REAR WEIGHT	=	<u>1910</u>	lbs	(<u>48.7</u> % of Total Vehicle Weight)			
TOTAL TEST WEIGHT	=	<u>3920</u>	lbs				
Weight of ballast secured in vehicle trunk area				=	<u>200</u>	lbs	

Table 3
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test 4/30/81 Time of Test 1338 pm
Ambient Temperature 60 °F at impact area
Temperature in Occupant Compartment 69 °F

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude:	RF	<u>28.25</u>	LF	<u>28.5</u>	RR	<u>27.5</u>	LR	<u>28</u>
Test Attitude:	RF	<u>27.2</u>	LF	<u>27.2</u>	RR	<u>24.2</u>	LR	<u>24.6</u>

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 24 psi Rear = 24 psi
Recommended Tire Size D78-14 Load Range B
Tires on Vehicle Goodyear D78-14
Is Spare Tire a "Space Saver" x yes no
Is Spare Tire Standard Equipment x yes no

TEST FLUID DATA

Test Fluid Type: Red Stoddard Solvent #2 Spec. Grav.: 0.764
Kinematic Viscosity 0.96 Centistokes
EPA Capacity 22 gal
Test Volume 20.4 gal (93% of EPA Capacity)
Fuel System Capacity (data from Owner's Manual) 22 gal
Details of fuel system Engine operated fuel pump. Fuel tank is located aft of rear axle and held in place by two tank straps. The fuel tube is at rear center of vehicle and sealed by a screw-on type cap and is concealed by the hinged license plate door.
Electric Fuel Pump Yes x No Fuel Injection Yes x No
Does electric fuel pump operate with ignition switch "on" and the engine not operating - Yes - No

VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 185.0 /L 185.0 inches
Post-Test = R 157.0 /L 153.4 inches
Crush = R 28.0 /L 31.6

SECTION 3

VEHICLE AND OCCUPANT INFORMATION

The production-type 3-point retractor belt system was modified to a 3-point fixed belt system by removing the belt from the retractor and replacing the "D" ring with a belt-type clamp.

The driver's seat of the 1980 American Motors Concord (Vehicle No. 1) was adjusted with respect to the brake pedal using a box beam measuring 20.5 inches long, 3 inches high and 2 inches wide. The box beam was placed on the driver seat cushion and the seat was adjusted per instructions of the CTM as shown in Figure 8. The passenger seat was then adjusted so that the seat-back was in line with the driver's seatback.

Vehicle No. 1 - 1980 American Motors Concord

The American Motors Concord was a 2-door sedan equipped with a 258 cubic inch, 6-cylinder engine, 3-speed automatic transmission and power brakes. The fuel tank, which is located aft of the rear axle, was filled to ninety-three percent (20.4 gallons) with red Stoddard fluid. The total test weight with two dummies, instrumentation, cameras and 200 pounds of ballast secured in the vehicle's trunk area was 3920 pounds.

Vehicle No. 2 - Deformable Moving Barrier

Vehicle No. 2 was a deformable moving barrier (Figure A-17 and Figure A-18) weighing 3450 pounds. The face of the moving barrier was fitted with honeycomb measuring 64 inches in length, 22 inches in height and 15 inches in depth. In addition, 4 inch denser honeycomb was placed in front to represent the front bumper.

POST-TEST OBSERVATIONS

Vehicle No. 1 - 1980 American Motors Concord

Both the driver and right front passenger complied with FMVSS-208, Injury Criteria requirements for head, chest and femurs. The driver's head struck the center of the steering wheel hub (Figure A-13) and the femurs contacted the underside of the dash panel. No interim contact of the right front passenger was observed from the high speed film. Occupant results are summarized in Table 14 and the data traces, along with vehicle data traces are presented in Appendix B.

Maximum crush on the vehicle was 31.6 inches on the left side and maximum firewall intrusion was 7.4 inches.

Windshield shattered and windshield retention loss occurred on the driver's side extending 24 inches vertically and 43 inches horizontally at the cowl, Figure A-14.

The right front passenger seatback yielded upon rebound, Figure A-12.

The weld between the front crossmember and right subframe broke, Figure A-15.

No fuel leakage in the entire fuel system.

Both front doors were inoperable after impact.

Vehicle No. 2 - Deformable Moving Barrier

Maximum crush of the honeycomb on the face of the moving barrier was 16 inches. Complete pre- and post-test measurements of the barrier face honeycomb are presented in Table 2.

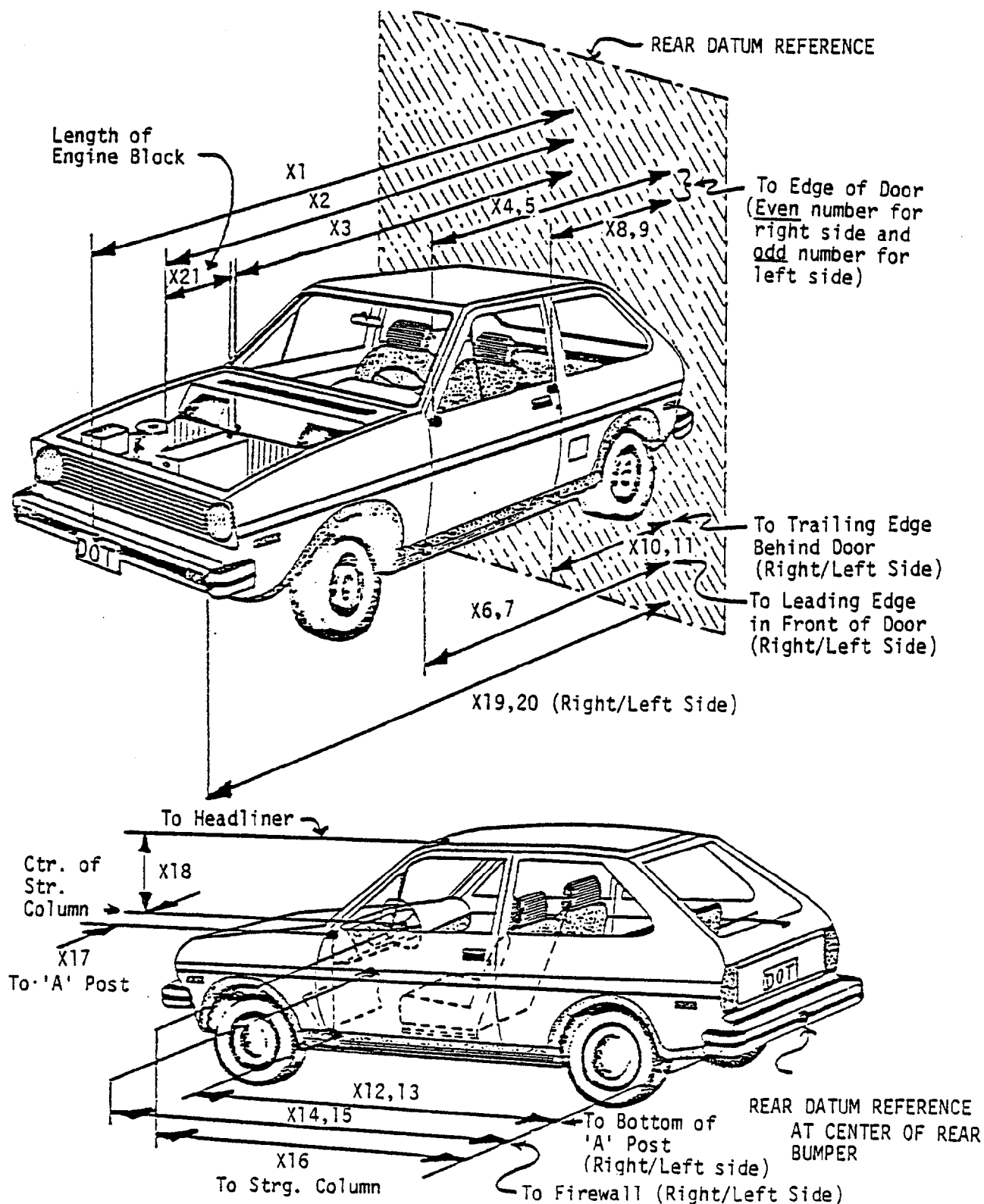


Figure 1 PRE-TEST AND POST-TEST MEASUREMENT POINTS

Table 4

NO.	TYPE OF MEASUREMENT	ALL DIMENSIONS IN INCHES		
		PRE- TEST	POST TEST	DIFF.
X1	Total Length of Vehicle at Centerline	186.7	161.6	25.1
X2	Rear Surface of Vehicle to Front of Engine	166.4	151.6	14.8
X3	Rear Surface of Vehicle to Firewall	138.3	130.9	7.4
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	129.9	129.7	.2
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	130.0	129.9	.1
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	129.0	128.5	.5
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	129.1	128.9	.2
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	79.2	79.1	.1
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	79.3	79.2	.1
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	79.2	78.9	.3
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	79.3	79.0	.3
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	126.3	125.9	.4
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	126.3	126.0	.3
X14	Rear Surface of Vehicle to Firewall - Right Side	137.1	132.0	5.1
X15	Rear Surface of Vehicle to Firewall - Left Side	136.2	130.8	5.4
X16	Rear Surface of Vehicle to Steering Column	110.9	107.8	3.1
X17	Center of Steering Column to "A" Post	15.1	17.0	-1.9
X18	Center of Steering Column to Headliner	15.7	16.1	-.4
X19	Rear Surface of Vehicle to Right Side of Front Bumper	185.0	157.0	28.0
X20	Rear Surface of Vehicle to Left Side of Front Bumper	185.0	153.4	31.6
X21	Length of Engine Block	28.2	28.2	0

Table 5
VEHICLE WEIGHTS AND RIDE HEIGHTS

Vehicle No. 1 - 1980 American Motors Concord

	WEIGHTS & RIDE HEIGHTS				L. BUMPER		R. BUMPER		CENTERLINE E.A.	
	L.F.	R.F.	R.R.	L.R.	Upper	Lower	Upper	Lower	Left	Right
CURB WEIGHT	Pounds	920	860	690	650					
RIDE HEIGHTS	Inches	28.5	28.25	27.5	28.0	21.3	15.3	20.9	14.8	17.2
CURB WEIGHT PLUS DUMMIES	Pounds	1000	960	770	730					
RIDE HEIGHTS	Inches	27.6	27.3	27.1	27.7	20.3	14.3	19.7	13.6	16.2
FINAL WEIGHT INSTRUMENTATION AND DUMMIES	Pounds	1050	960	950	960					
RIDE HEIGHTS	Inches	27.2	27.2	24.2	24.6	20.9	14.9	20.4	14.3	16.9

TABLE 6

Vehicle No. 1-1980 American Motors Concord DATE April 29, 1981

REFERENCE DISTANCE FROM REAR 186.7

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6	0	6	12	18	24	30	36
Lower Bumper	Pre							15.0						
	Post							26.2						
Upper Bumper	Pre							19.5						
	Post							30.1						
1/2 Bumper To Hood	Pre							24.75						
	Post							36.0						
Hood	Pre							31.75						
	Post							42.0						

HORIZONTAL DISTANCE FROM REFERENCE

Lower Bumper	Pre		2.3	2.0	1.5	1.3	1.0	.7	1.0	1.3	1.5	2.0	2.3
	Post		31.4	29.5	26.5	25.6	25.0	24.5	24.6	24.9	25.6	27.0	28.3
	Diff.		29.1	27.5	25.0	24.3	24.0	23.8	23.6	23.6	24.1	25.0	26.0
Upper Bumper	Pre		1.7	1.4	.9	.6	.3	0	.3	.6	.9	1.4	1.7
	Post		34.0	31.8	29.0	27.2	25.8	25.0	25.6	26.8	27.8	29.5	30.7
	Diff.		32.3	30.4	28.1	26.6	25.5	25.0	25.3	26.2	26.9	28.1	29.0
1/2 Bumper To Hood	Pre		6.3	6.3	5.9	5.0	4.7	4.4	4.7	4.9	6.0	6.4	6.3
	Post		34.0	34.1	33.6	31.1	29.8	28.8	30.3	30.9	31.8	30.0	29.3
	Diff.		27.7	27.8	27.7	26.1	25.1	24.4	25.6	26.0	25.8	23.6	23.0
Hood	Pre		8.1	7.5	7.1	6.8	6.5	6.2	6.5	6.8	7.1	7.5	8.1
	Post		29.2	30.9	19.6	19.6	20.1	20.1	20.4	20.7	21.1	29.7	29.4
	Diff.		21.1	23.4	12.5	12.8	13.6	13.9	13.9	13.9	14.0	22.2	21.3

TABLE 7

Vehicle No. 2-Deformable Moving Barrier

DATE April 29, 1981

REFERENCE DISTANCE FROM REAR EDGE OF HONEYCOMB BACKING PLATE 21.2 MPH

VERTICAL HEIGHTS

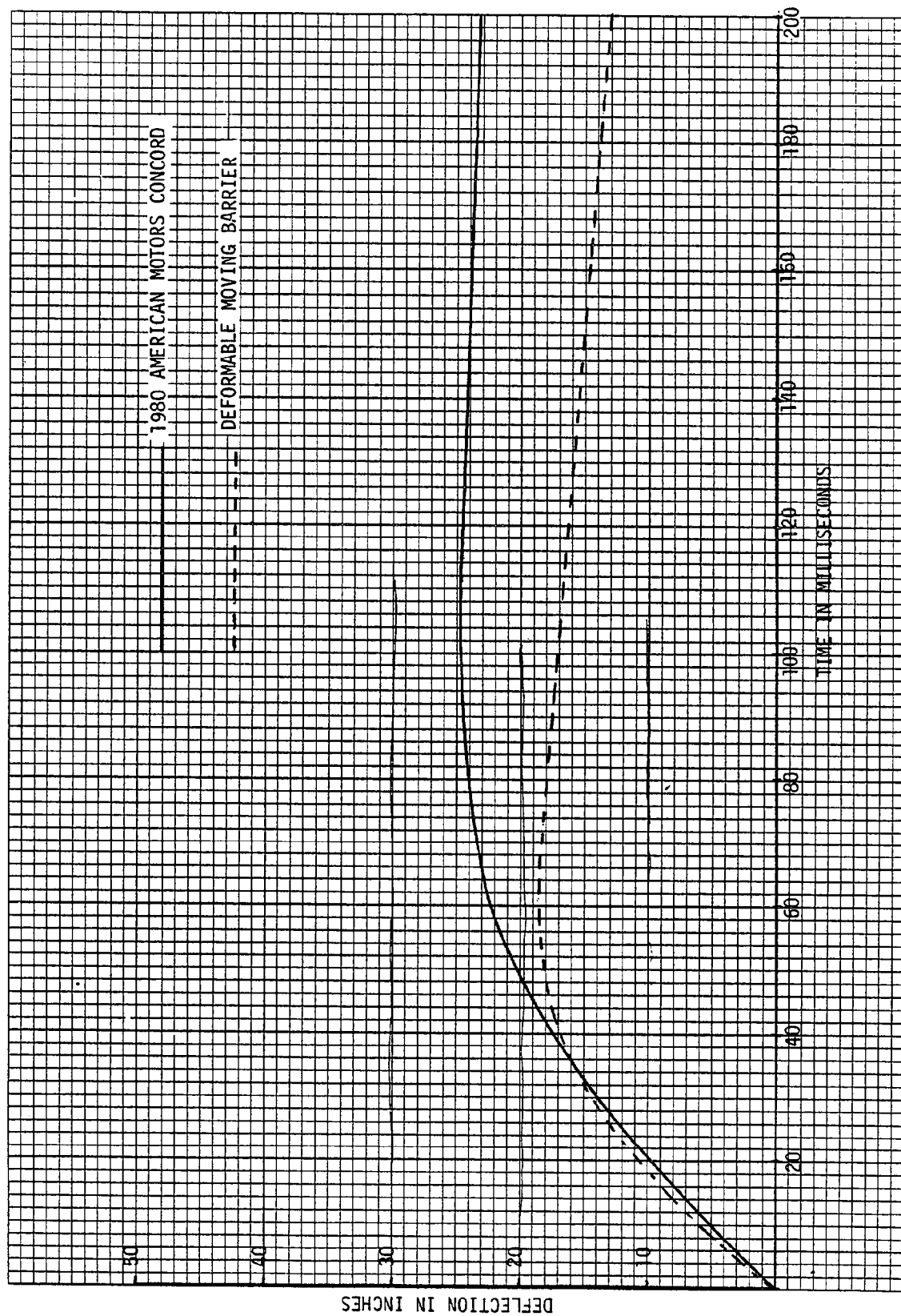
		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6		6	12	18	24	30	36
Lower Bumper	Pre							14.7						
	Post		← 14.7	15.4	16.6	15.7	15.8	15.8	16.0	16.2	16.8	15.1	13.3	→
Upper Bumper	Pre							19.7						
	Post		← 19.4	19.9	20.7	20.8	21.0	21.0	21.0	20.9	21.2	19.7	18.9	→
1/2 Bumper To Hood	Pre							26.5						
	Post		← 23.6	23.2	23.4	23.5	24.1	24.9	23.7	24.0	23.3	23.0	23.1	→
Hood	Pre							32.5						
	Post		← 29.1	28.8	28.8	28.9	29.1	29.7	29.2	28.7	28.5	28.5	28.3	→

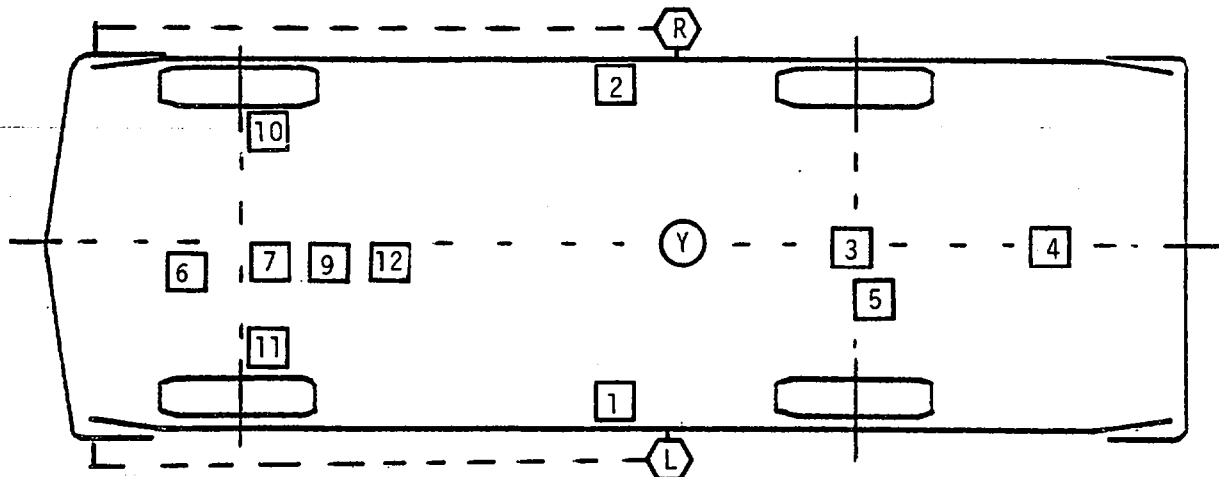
HORIZONTAL DISTANCE FROM REFERENCE

13.3" AUG

Lower Bumper	Pre		0	0	0	0	0	0	0	0	0	0	0	155.8
	Post		12.4	13.6	16.0	15.6	16.0	16.0	15.5	15.1	15.1	11.5	9.0	
	Diff.		12.4	13.6	16.0	15.6	16.0	16.0	15.5	15.1	15.1	11.5	9.0	
Upper Bumper	Pre		0	0	0	0	0	0	0	0	0	0	0	136.1
	Post		10.1	11.0	12.9	13.7	15.2	16.0	14.9	13.4	12.6	9.2	7.1	
	Diff.		10.1	11.0	12.9	13.7	15.2	16.0	14.9	13.4	12.6	9.2	7.1	
1/2 Bumper To Hood	Pre		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
	Post		10.9	10.3	10.7	11.6	12.9	14.6	12.9	12.0	9.3	7.8	7.4	
	Diff.		6.9	6.3	6.7	7.6	8.9	10.6	8.9	8.0	5.3	3.8	3.4	
Hood	Pre		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
	Post		12.5	11.7	11.0	10.2	10.6	12.4	12.0	10.2	10.1	9.6	9.9	
	Diff.		8.5	7.7	7.0	6.2	6.6	8.4	8.0	6.2	6.1	5.6	5.9	

FIGURE 2 REAR TARGET DISPLACEMENT WITH
RESPECT TO A FIXED GROUND
REFERENCE





ACCELEROMETER NUMBER *	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Rocker Panel Near LF "B" Pillar	X		X
2	Rocker Panel Near RT "B" Pillar	X		X
3	C/L of Rear Deck Above Rear Axle	X	X	X
4	Bumper Crossmember (Rear)	X		X
5	Rear Axle	X		X
6	Top of Engine Block	X		X
7	Front Crossmember	X		X
9	Bottom of Engine	X		X
10	RT Brake Caliber	X		
11	LF Brake Caliber	X		
12	Firewall	X		X
(Y)	Yaw Rate Gyro	X		
(R)	RT Bumper Deflection	X		
(L)	LF Bumper Deflection	X		

*The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

VEHICLE NO. 1 - 1980 AMERICAN MOTORS CONCORD

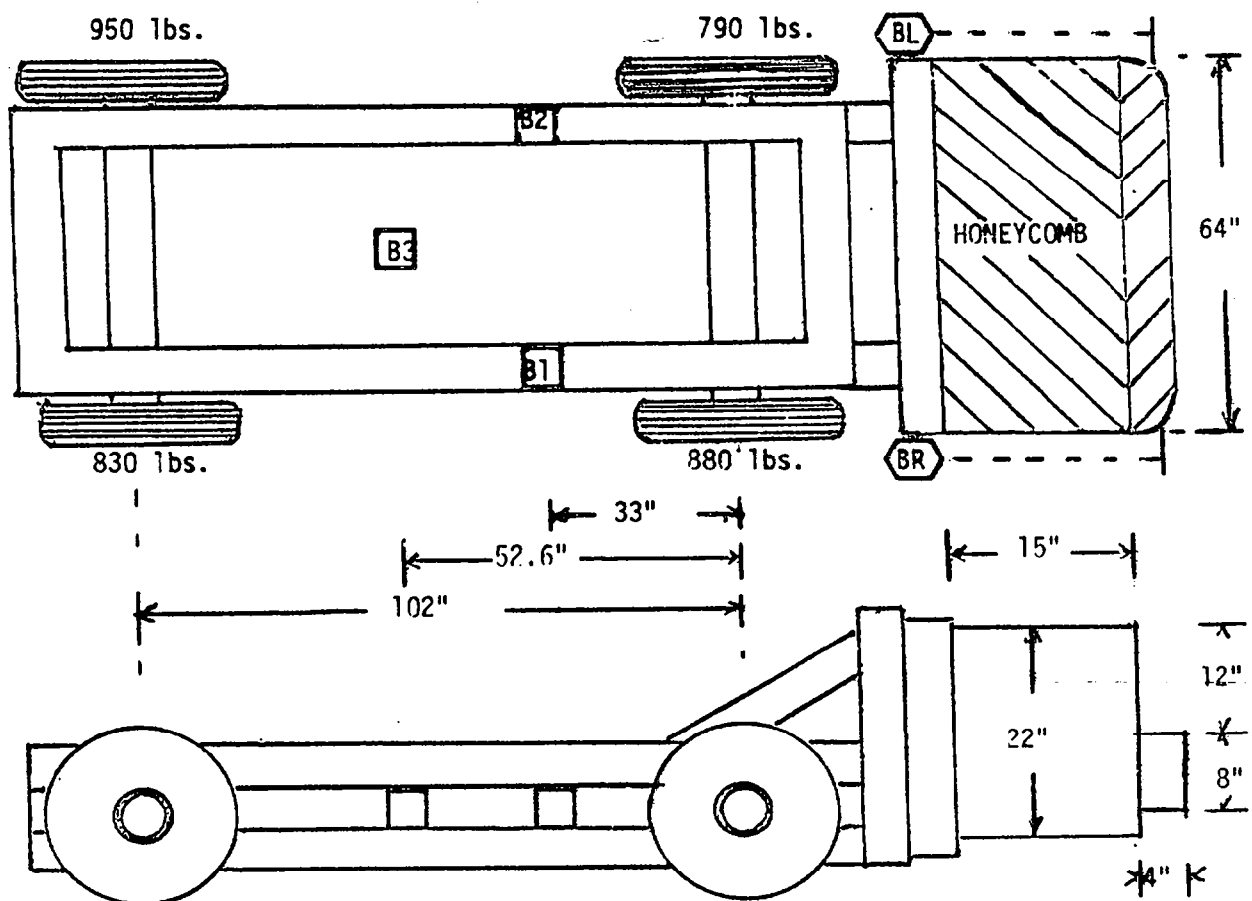
FIGURE 3 - VEHICLE NO. 1 - INSTRUMENTATION

VEHICLE No. 1 - AMERICAN MOTORS CONCORD

TEST 616-2-515 DATE 4/24/81

TRANSDUCER NUMBER	INCHES FROM REAR	INCHES LEFT OF C/L	ON C/L	INCHES RIGHT OF C/L
1	70.8	23.2		
2	70.8			23.2
3	46.2		X	
4	23.4		X	
5	41.4	11.3		
6	152.5	7.8		
7	149.7	5.1		
9	145.8	3.6		
10	155.8			25.5
11	155.8	25.5		
12	138.3	6.4		
Y	60.5		X	

FIGURE 4 VEHICLE TRANSDUCER LOCATION MEASUREMENTS



ACCELEROMETER NUMBER *	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
B1	Right Upper Frame Rail	X		X
B2	Left Upper Frame Rail	X		X
B3	C/G	X	X	X
BR	Right Bumper Deflection	X		
BL	Left Bumper Deflection	X		

*The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

FIGURE 5 VEHICLE NO. 2 - BARRIER INSTRUMENTATION LOCATIONS

NOTE: Camera Information Shown on Table 8.

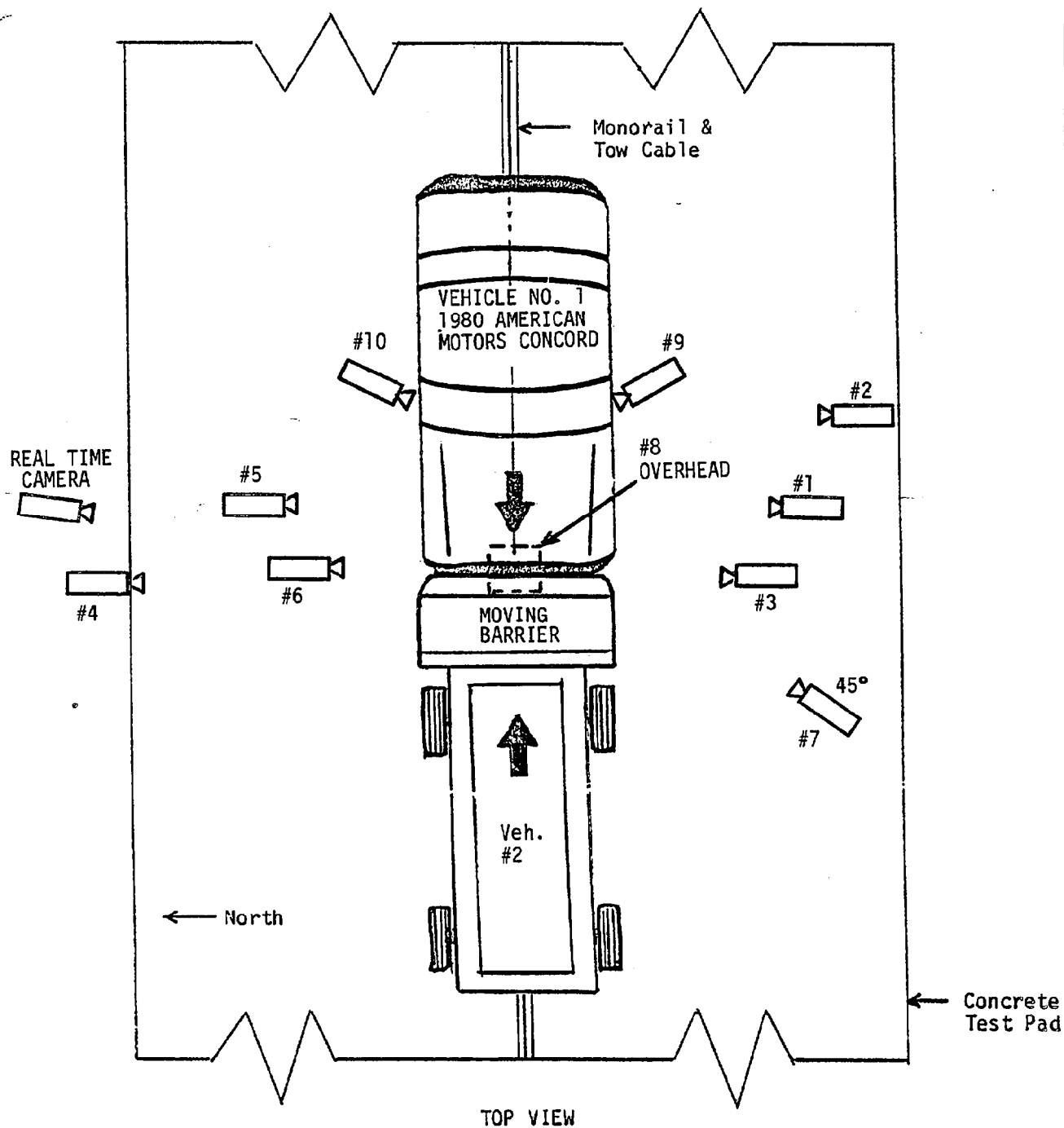


FIGURE 6 CAMERA POSITION FOR FRONTAL IMPACTS

Table 8

HIGH SPEED CAMERA LOCATIONSTest No.: 616-2-515Vehicle No. 1-1980 AMERICAN MOTORS CONCORD

CAMERA NUMBER	VIEW	CAMERA POSITIONS (IN)*			CAMERA ANGLE (DEG)**	FILM PLANE TO HEAD TARGET (IN) X
		X	Y	Z		
1	OVERALL OF VEHICLE NO. 1 & NO. 2	284	30	45	-4	265
2	OVERALL OF VEHICLE NO. 1 (LF)	336	113	41	-3	317
3	FRONT OF VEHICLE NO. 1 & NO. 2	235	0	44	-6	-
4	OVERALL OF VEHICLE NO. 1 & NO. 2	501	0	60	-2	482
5	OVERALL OF VEHICLE NO. 1 (RT)	274	25	43	-4	255
6	FRONT OF VEHICLE NO. 1 and NO. 2	253	0	40	-4	-
7	45° TOWER	204	96	122	-45	-
8	OVERHEAD (TOWER)	0	70	388	-80	-
9	VIEW OF DRIVER	-	-	-	-	-
10	VIEW OF RIGHT FRONT PASSENGER	-	-	-	-	-

*X = film plane to monorail centerline

Y = film plane to impact location

Z = film plane to ground

**Referenced to Horizontal Plane

FIGURE 7

HIGH SPEED CAMERA INFORMATION (TEST 2 616-2-515)

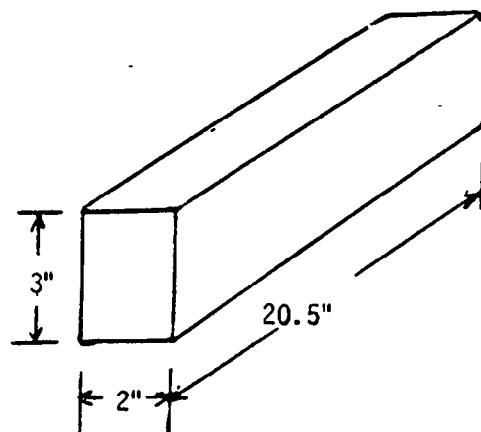
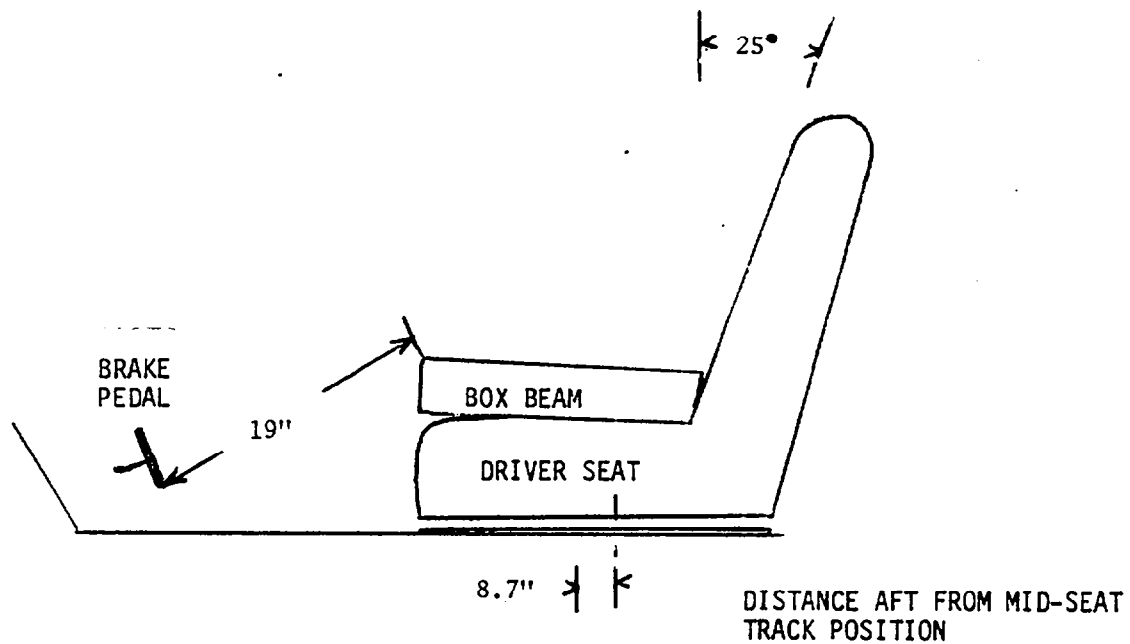
CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	Vehicle #1 & #2	Photosonic	13 mm	900
2	Vehicle #1 (LF)	Photosonic	13 mm	900
3	Front of Veh. #1 & #2	Photosonic	25 mm	900
4	Vehicle #1 & #2	Photosonic	13 mm	900
5	Veh. #1 (RT)	Photosonic	13 mm	900
6	Front of Veh. #1 & #2	Photosonic	25 mm	900
7	45° Tower	Photosonic	13 mm	No Timing
8	Overhead	Photosonic	13 mm	900
9	Driver	Stalex	8 mm	1100
10	Right Front Pass.	Stalex	8 mm	1100

NOTE: CAMERAS ARE NUMBERED ACCORDING TO SPLICING SEQUENCE OF FILM.

(24 fps) REAL TIME MOVIE FILM COVERAGE OF PRE-CRASH, POST-CRASH
AND CRASH EVENT SPLICED AT START AND END OF FILM.

TEST NO. 616-2-515

VEHICLE NO. 1-1980 American Motors Concord



BOX BEAM DIMENSIONS

FIGURE 8 DRIVER SEAT POSITION

FIGURE 9
PART 572 DUMMY IN-VEHICLE POSITION

Test No. 616-2-515

Vehicle 1990 American Motors Concord

SEAT TYPE:

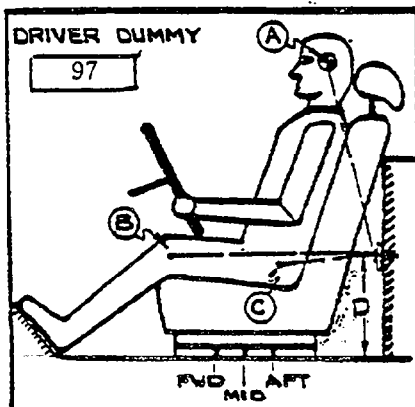
☐ Bench
☒ Bucket
☐ Split Bench

ADJUSTER TYPE:

☒ Manual
☐ Power

BUCKET SEAT BACK TYPE:

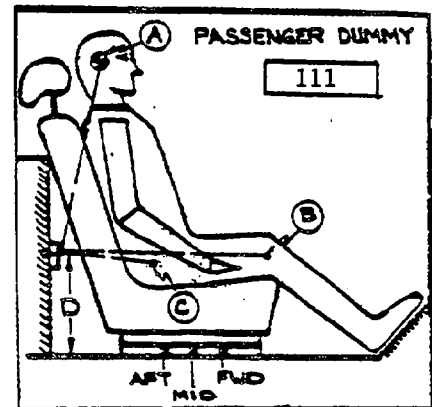
☒ Fixed
☐ Adjustable Reclining



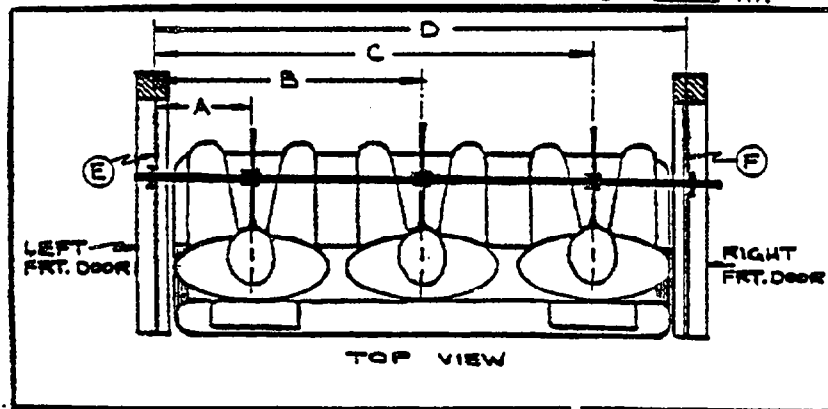
A = 23.7 in. 14 Degrees
B = 29.3 in. 90 Degrees
C = 15.2 in. 106 Degrees
D = 122 in.

MEASUREMENT LOCATION

A - Head Target
B - Knee Joint
C - Approximate 'H' Point
D - Sill to Reference Point



A = 23.2 in. 13 Degrees
B = 29.2 in. 92 Degrees
C = 14.5 in. 103 Degrees
D = 122 in.

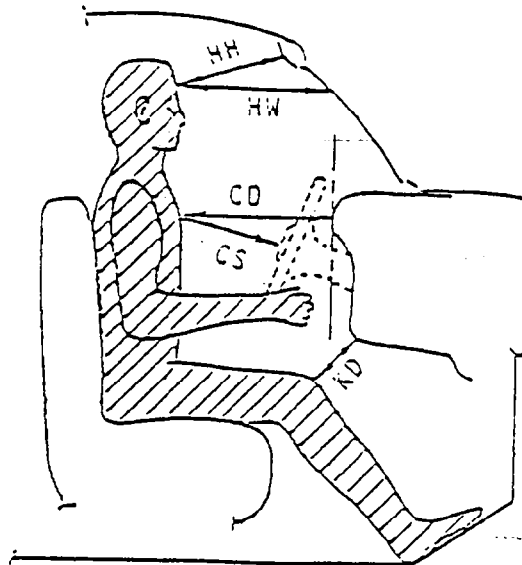


DUMMY ID

97 - 111

A	=	Left Door to Driver Centerline	<u>14.5</u> in.
B	=	Left Door to Center Passenger Centerline	<u>-</u> in.
C	=	Left Door to Right Passenger Centerline	<u>39.5</u> in.
D	=	Left Door to Right Door	<u>53.8</u> in.
E, F	=	Window Glass Height (Right and Left Must be Equal)	<u>9.5</u> in.

	<u>DRIVER</u>	<u>PASS</u>
HH	16	15.8
HW	21.7	21.0
CD	26.2	25.2
CS	18.4	-
KDL	12.3	13.0
KDR	12.3	13.0



HR	6.2	6.0
HS	8.0	7.7
AD	4.7	5.0
HD	7.0	7.5

All Dimensions

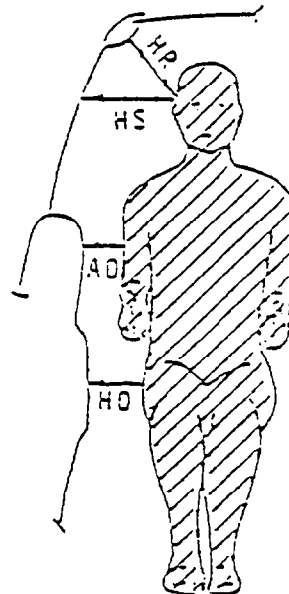


Figure 10 OCCUPANT CLEARANCE DIMENSIONS
1980 AMERICAN MOTORS CONCORD

TABLE 9
DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G") *							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	-80	-35	68	85.3	-56	-10	-19	57.6
DUMMY (2)	-25	30	28	44.4	-25	24	-26	38.0
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	1100	1825
DUMMY (2)	525	675
DUMMY (3)		
DUMMY (4)		

	MAXIMUM FORCE-SEAT BELTS LOADS (LBS)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
DUMMY (1)	1700	750	950
DUMMY (2)	2335	4500	640
DUMMY (3)			
DUMMY (4)			

	HEAD INJURY CRITERIA**				SEVERITY INDEX
	HIC	t ₁ (SEC)	t ₂ (SEC)	AVE. ACC. (g) t ₁ TO t ₂	HEAD
DUMMY (1)	806.0	.0786	.1062	61.1	1405.8
DUMMY (2)	523.4	.0441	.1758	27.5	666.9
DUMMY (3)					
DUMMY (4)					

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

APPENDIX B

TEST PROCEDURE CHECK LIST
NEW CAR ASSESSMENT VEHICLE

ITEM NO.	DESCRIPTION	CHECK BY	DATE	COMMENTS
1.	Inflate tires to recommended mfg's cold pressure for vehicle capacity weight (including spare). Check tires for recommended size.	Jc	4/24	
2.	Fill out summary sheet. Apply identification number to vehicle.	Jc	4/24	
3.	Inspect vehicle and record any damage or missing parts.			
4.	Add fluids to specified levels or fill to capacity.	Jc	4/24	
5.	Weigh vehicle and record weight at each wheel on summary sheet.			
6.	Apply reference height marks at each wheel and record on summary sheet.	Jc	4/24	
7.	Pump fuel from tank and run engine until fuel lines are empty.	Jc	4/24	
8.	Drain following fluids from vehicle and check N/A if not applicable: ☒ a) coolant ☒ b) engine oil ☒ c) transmission fluid ☒ d) windshield washer fluid ☒ e) battery acid (drain & flush) ☒ f) power steering fluid	Jc	4/24	
9.	Fill fuel tank to recommended EPA capacity with red dyed Stoddard solvent. Record volume of Stoddard on Summary Sheet. Crank engine to fill carburetor.	Jc	4/24	
10.	Siphon 7% of solvent from fuel tank and record amount removed on Summary Sheet.	Jc	4/24	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
11.	Perform pre-test vehicle dimensions as specified in Figure 5 of Test Plan and recorded on Table 7.			
12.	Mark forward-most and rear-most positions of seat. Measure and mark seat and sill mid-positions.	Jc	4/27	
13.	Install mounting plates for accelerometers as specified in Figure 1 of Test Plan.	Jc	4/27	
14.	Install mounting plate and instrumentation in trunk area.	Jc	4/27	
15.	Install accelerometers.	Jc	4/27	
16.	Place certified dummies in both front seats with seats in mid-position.	DWH	4-28	
17.	Install seat belt load cells on lap and torso portions on both front seat belts and make provisions to remove weight of the load cells.	DWH	4-28	
18.	Install on-board lighting to illuminate field of view of ground cameras.	Jc	4/28	
19.	Route and secure all electrical cables.	DWH	4-28	
20.	Install speed trap breaker bar on vehicle.	Jc	4/30	
21.	Install guide rollers and abort straps to vehicle.	Jc	4/30	
22.	Weigh vehicle and add ballast if required. Place ballast so that weight distribution will be as close as possible to delivered distribution. Record on Summary Sheet.	Jc	4/30	
23.	Measure and record ride height.	Jc	4/29	
24.	Apply targets and tape striping as specified in TP-212-02 - (Laboratory Procedure for Vehicle Assessment.)	Jc	4/29	

AT IMPACT SITE

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
25.	Position vehicle front to bumper at impact point.	<i>PC</i>	4/30	
26.	Photograph the following:			
	a) Vehicle overall & closeup left and right views.	<i>WZ</i>		
	b) Windshields overall and close-up left and right quarter views	<i>WZ</i>	4/30	
	c) Real time documentary	<i>WZ</i>		
27.	Align and focus stationary high speed cameras.	<i>WZ</i>		
28.	Measure and document camera positions on Table 6 of Test Plan.	<i>WZ</i>	4/30	
29.	Test operation of all high speed cameras.	<i>WZ</i>	4/30	
30.	Set up speed traps and measure breaker bar when vehicles are at impact point.	<i>PC</i>	4/30	
31.	Check vehicle attitude and ride height and document on summary sheet.	<i>W.S</i>	4/30	
32.	Ready fuel leakage sample bottles, drip pan and stop switch.	<i>W.S</i>	4/30	
33.	Check speed traps operation.	<i>W.S</i>	4/30	
34.	Move test vehicles to starting point.	<i>PC</i>	4/30	
<u>STARTING POINT PROCEDURE</u>				
35.	Adjust dummy positions as per dummy positioning check list and make required measurements.	<i>WZ</i>	4/30	
36.	Connect umbilical cables.	<i>DLH</i>	4-30	
37.	Make operation check of all instrumentation and calibrate system.	<i>DLH</i>	4-30	
38.	Take all pre-test photographs.	<i>WZ</i>	4/30	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
39.	Check operation of camera interlock and flash bulbs correlation.	W.S.	4/30	
40.	Latch trunk and leave key in lock.	W.S.	4/30	
41.	Verify that fuel tank cap is tight.	W.S.	4/30	
42.	Place transmission in neutral. Release parking brake, turn ignition key on.	W.S.	4/30	
43.	Verify that hood latch is latched.	W.S.	4/30	
44.	Close all windows & vents (except front windows).	W.S.	4/30	
45.	Close doors, leave unlocked.	W.S.	4/30	
46.	Check operation of all systems.	W.S.	4/30	
47.	Record temperature of interior of vehicle.	W.S.	4/30	
48.	Complete countdown procedures and proceed with test.	W.S.	4/30	
POST-TEST PROCEDURES				
49.	Start-stop watch at moment of impact - collect samples of leaking fuel if leakage occurs. Take movies of all leakage.	W.S.	4/30	
50.	If loss of windshield retention occurs, mark opening. Measure windshield retention record.	W.S.	4/30	
51.	Make operational check of all instrumentation.	JWH	4-30	
52.	Photograph with real time camera:			
	a) Post-test overall scene.	W.S.	4/30	
	b) Close-up of pertinent damage to windshield or fuel system.	W.S.	4/30	
	c) Dummies failed restraints or failed seat anchorages.	W.S.	4/30	
	d) Any other type of failure.	W.S.	4/30	
	e) Opening of vehicle doors.	W.S.	4/30	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
53.	Take post-test still photographs. Record visual observations of vehicle condition, dummy positions, any anomalies, etc.	HZ	4/30	
54.	Separate vehicles and photograph front of each vehicle.	WPC	4/30	
55.	Remove umbilicals.	DWA	4-30	
56.	Remove vehicles from test track.	JL	4/30	

APPENDIX A

STILL PHOTOGRAPHS

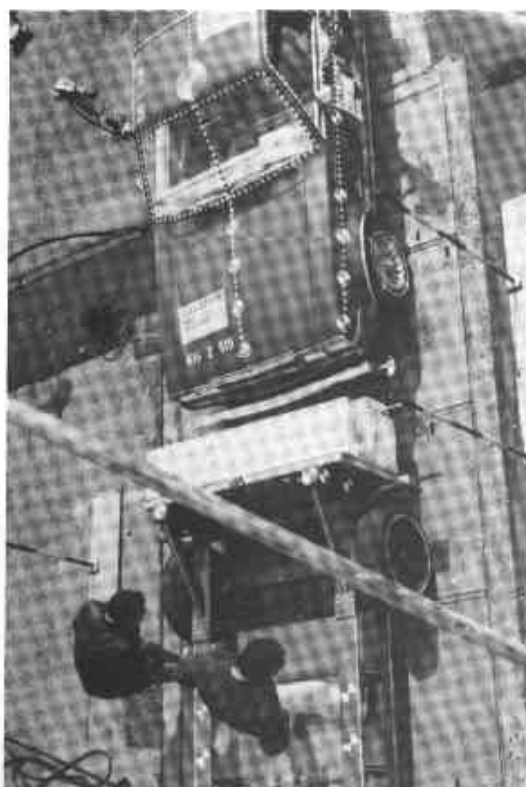
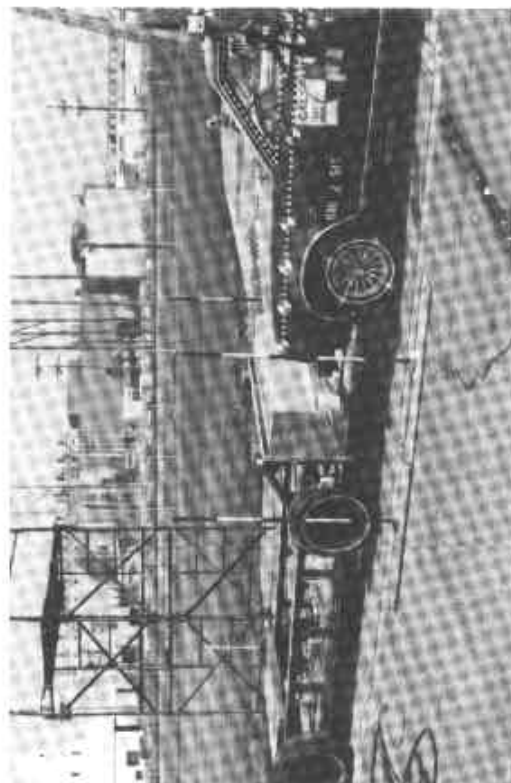
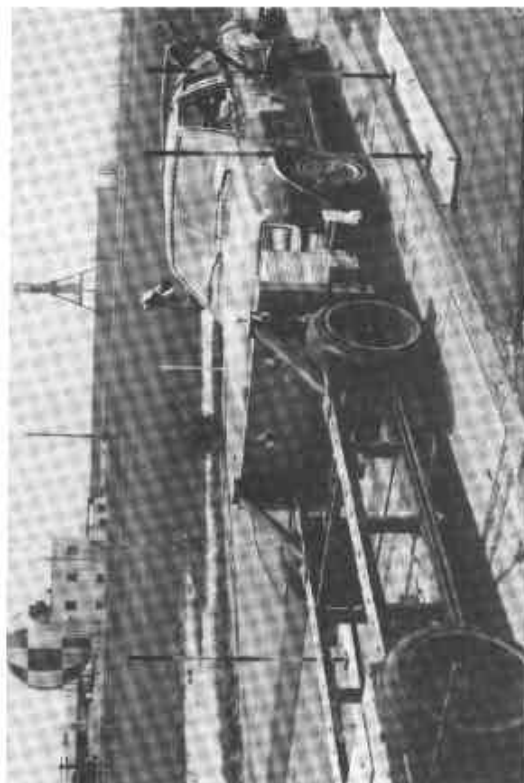


FIGURE A-1 VEHICLES NOS. 1 AND 2 - PRE-TEST IMPACT CONFIGURATION

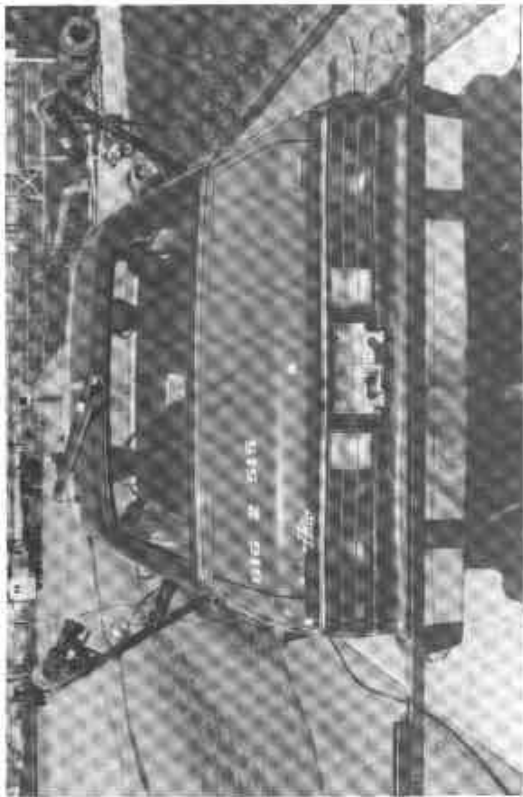


FIGURE A-2 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR

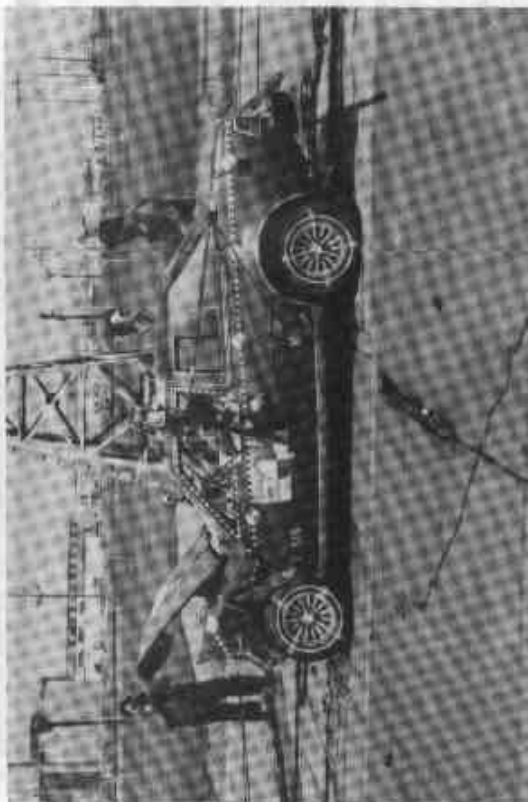
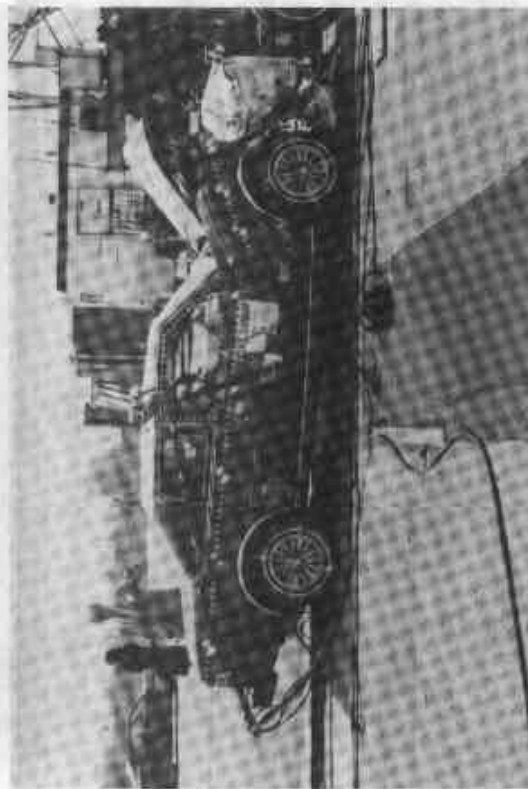
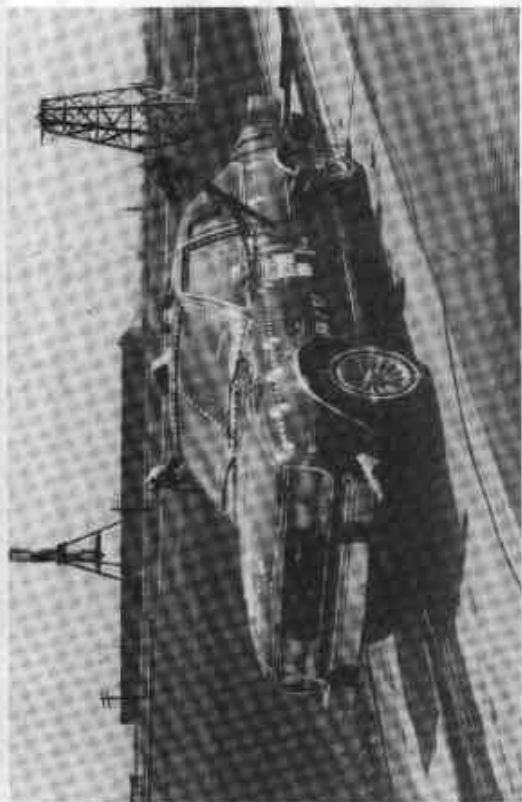
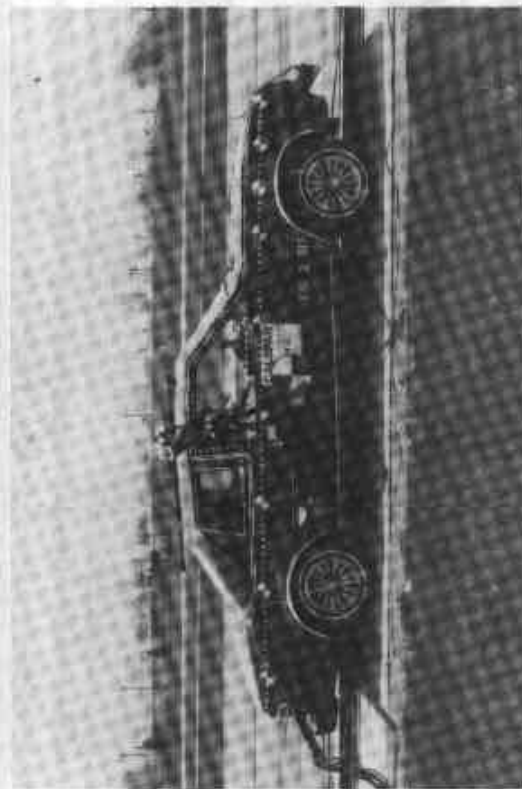


FIGURE A-3 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT SIDES

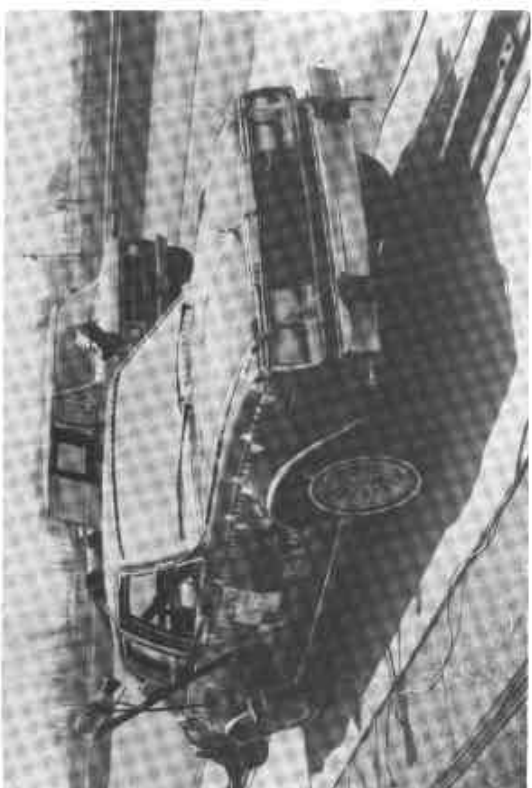


FIGURE A-4 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT THREE-QUARTERS

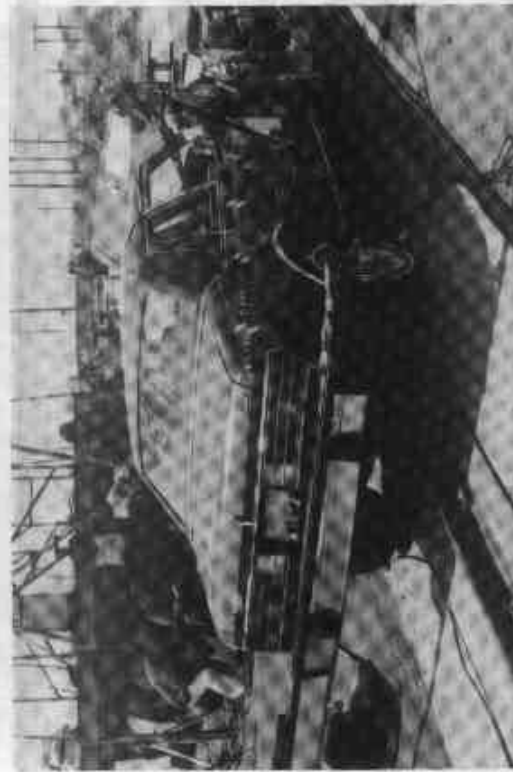
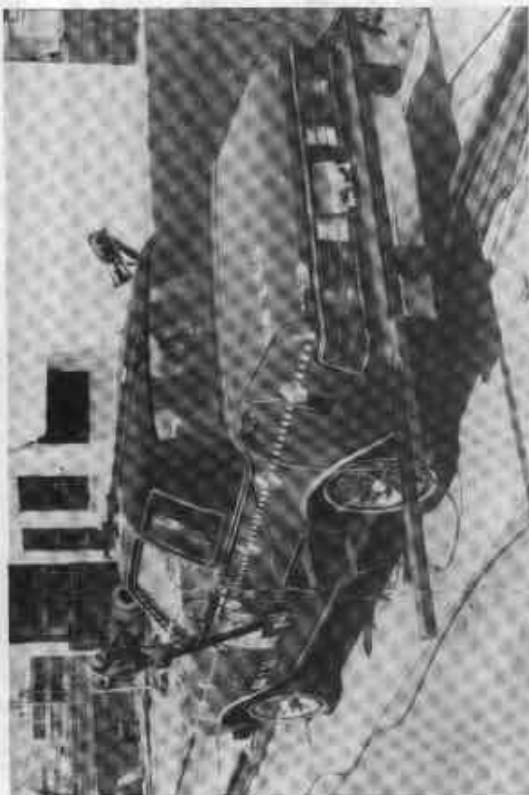


FIGURE A-5 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF REAR THREE-QUARTERS

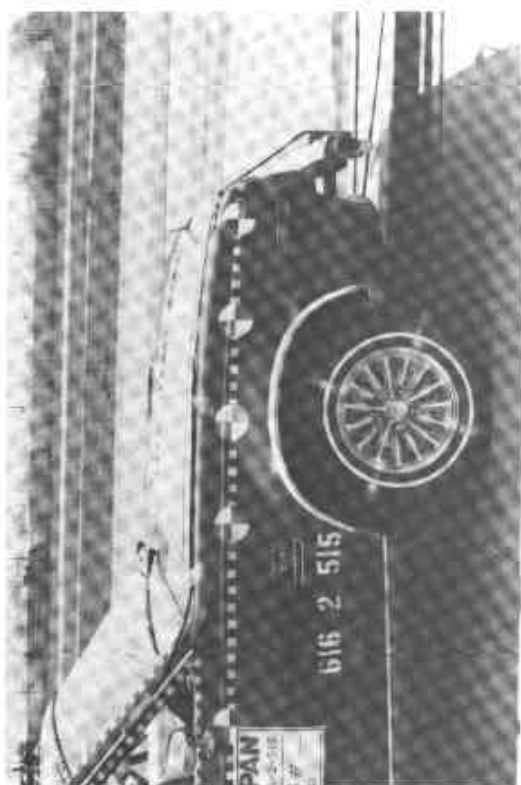
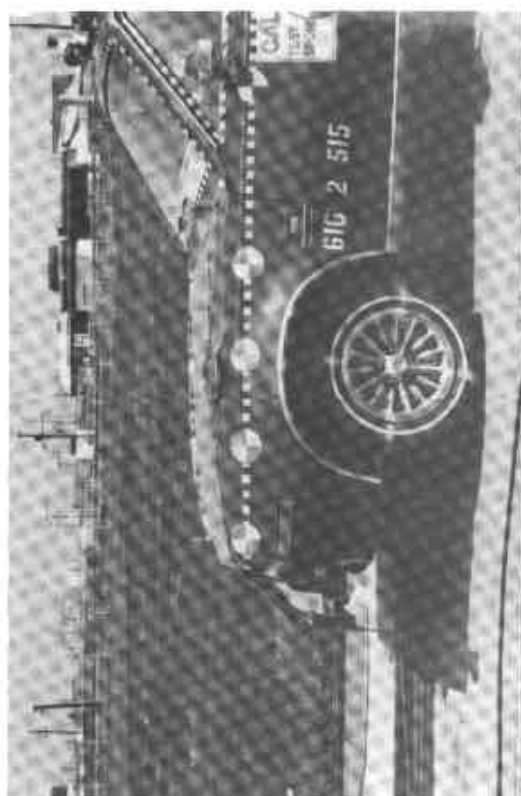


FIGURE A-6 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTERS

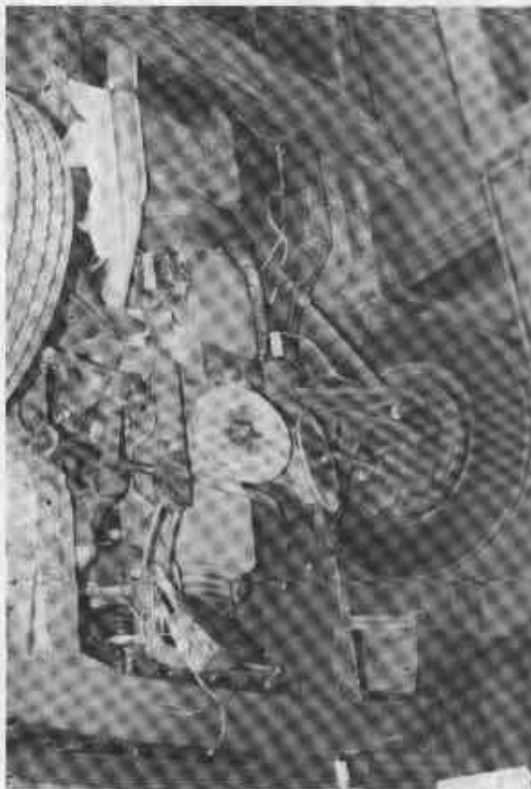


FIGURE A-7 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT UNDERBODY



FIGURE A-8 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF REAR UNDERBODY



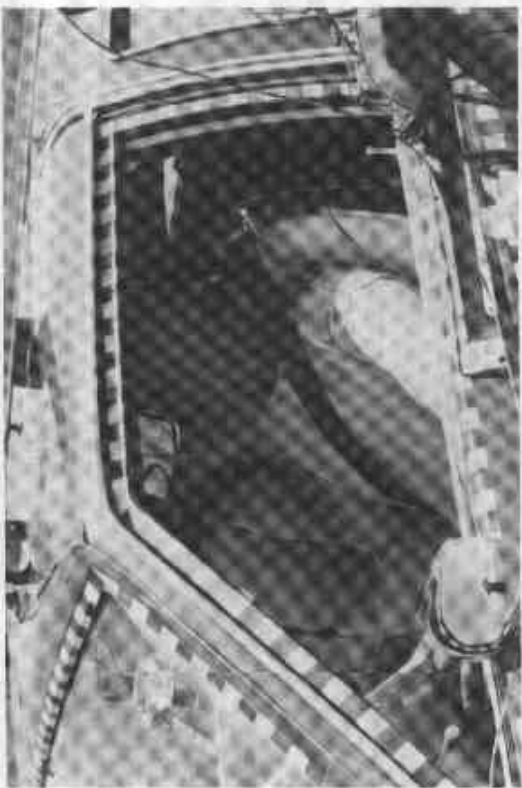
FIGURE A-9 VEHICLE NO. 1 - PRE-TEST VIEW OF ENGINE COMPARTMENT



FIGURE A-10 VEHICLE NO. 1 - FUEL TUBE AND CAP



A-10



6706-V-2



FIGURE A-11 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF DRIVER POSITIONS



FIGURE A-12 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF RIGHT FRONT PASSENGER POSITION



FIGURE A-13 VEHICLE NO. 1 - POST-TEST VIEW OF HEAD CONTACT WITH STEERING WHEEL



FIGURE A-14 VEHICLE NO. 1 - POST-TEST VIEW OF WINDSHIELD AND RETENTION LOSS



FIGURE A-15 VEHICLE NO. 1 - VIEW OF BROKEN WELD ON SUB FRAME

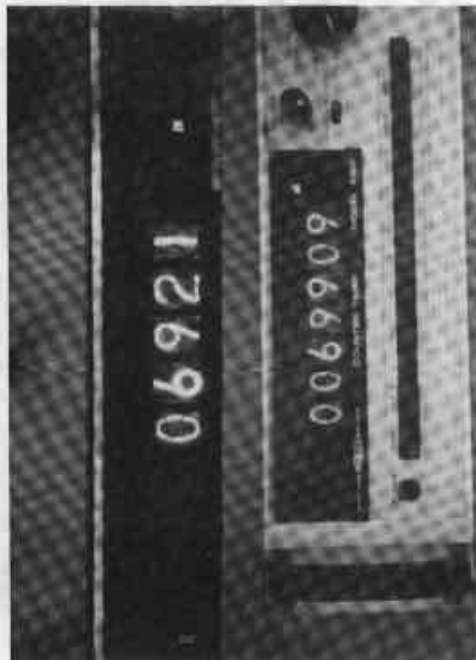


FIGURE A-16 VELOCITY TRAP COUNTER DISPLAY

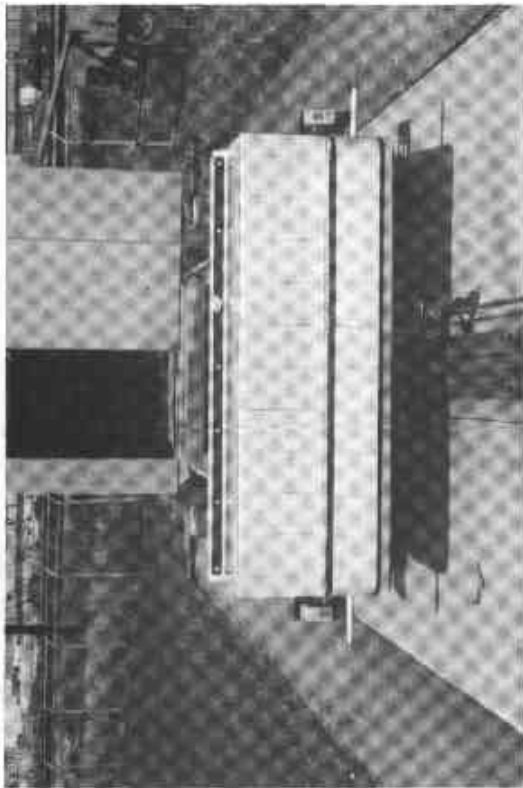
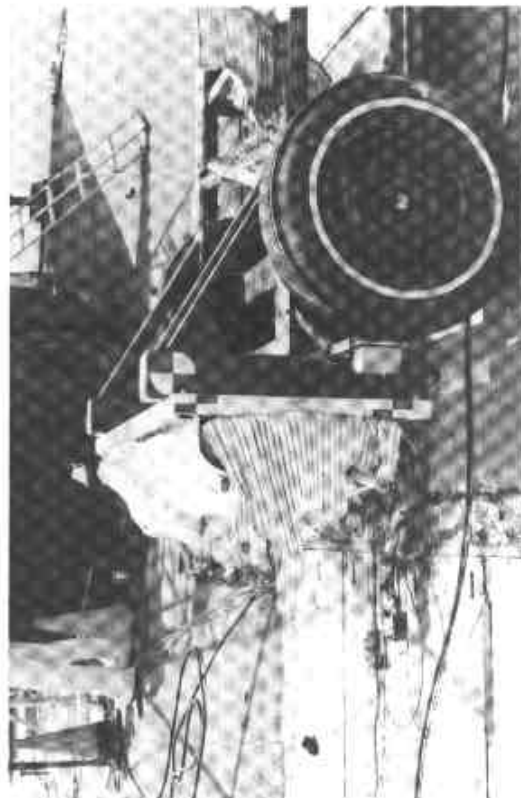
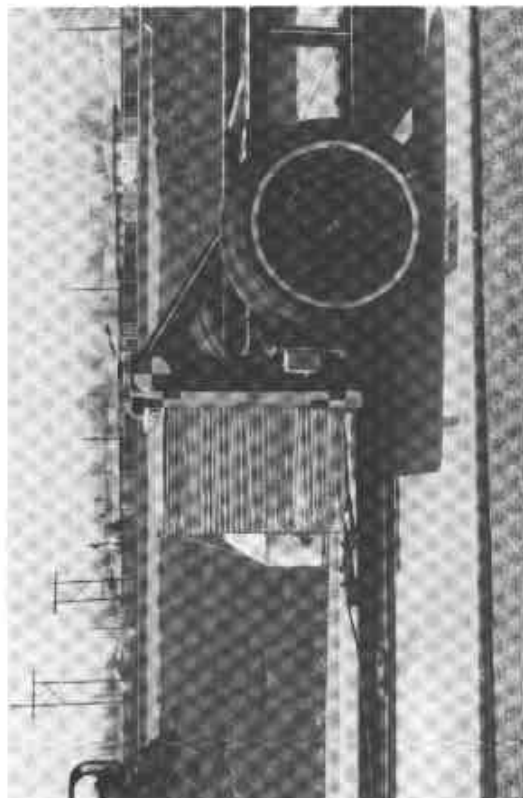


FIGURE A-17 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF BARRIER HONEYCOMB

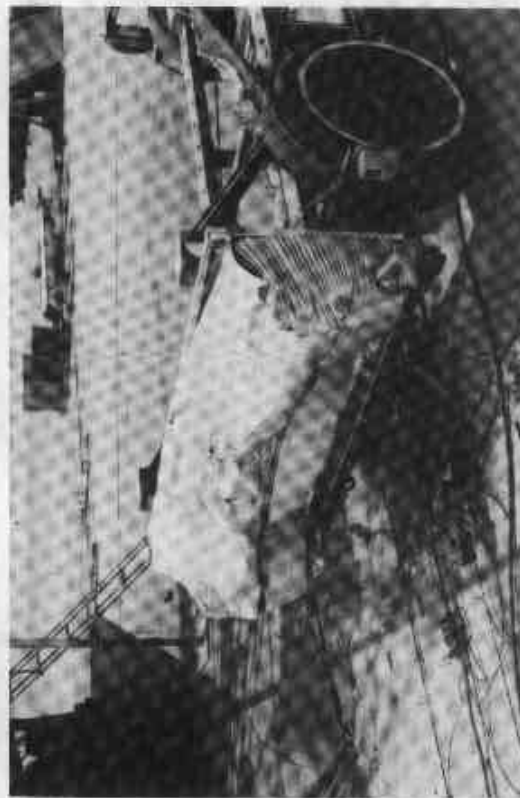
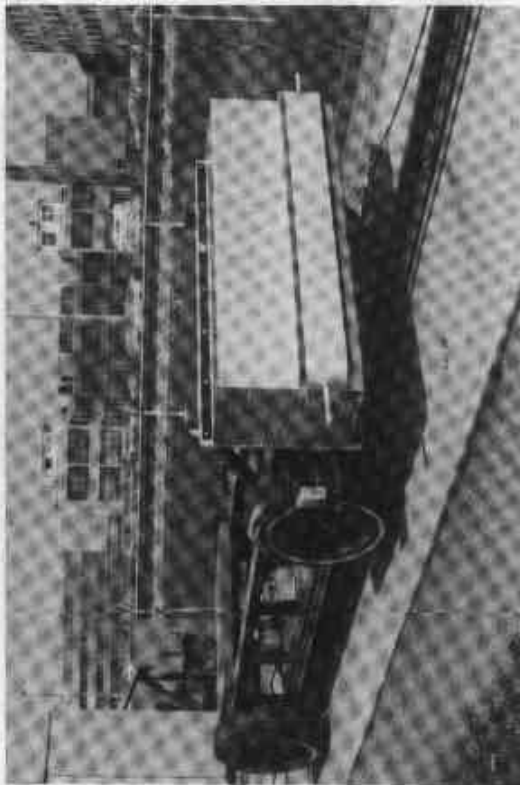
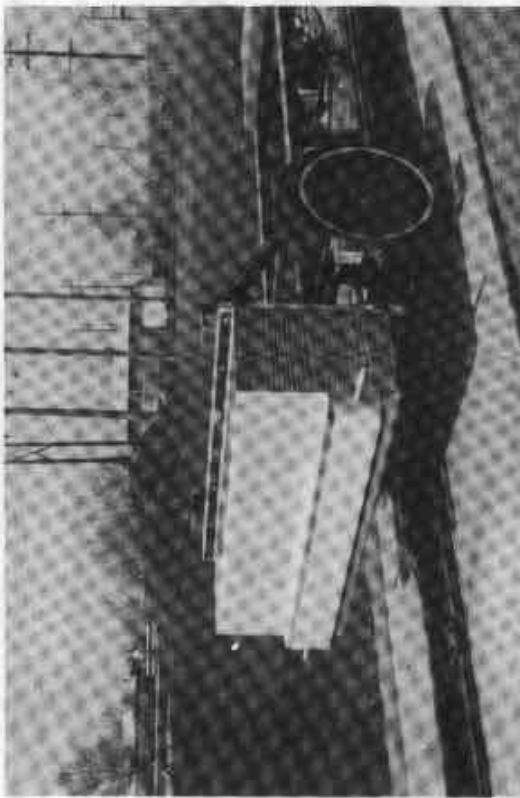


FIGURE A-18 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF LEFT AND RIGHT HONEYCOMB

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

TEST NO. 616-2-515

1980 AMERICAN MOTORS CONCORD

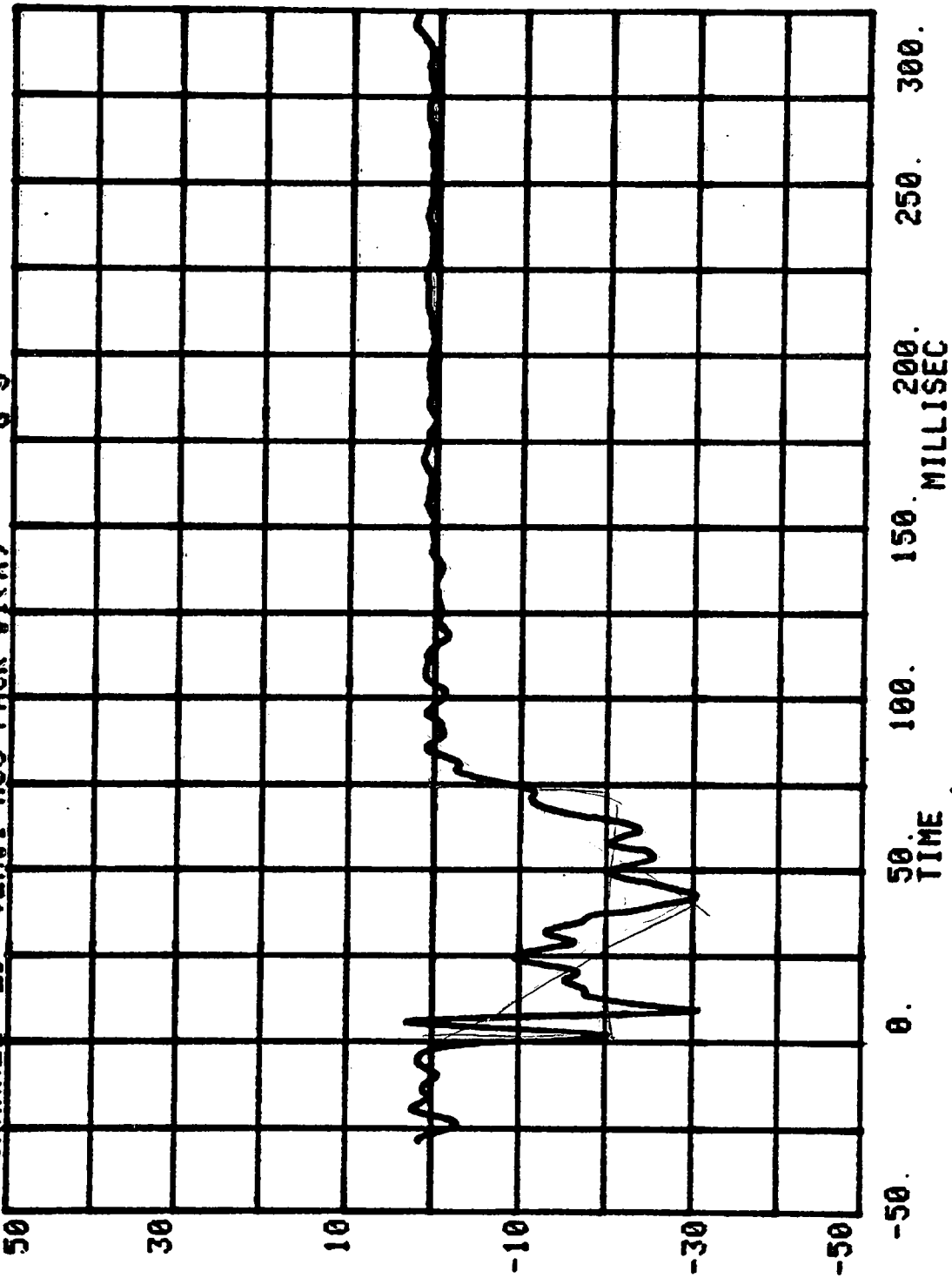
VEHICLE NO. 1 DATA

VEHICLE DATA

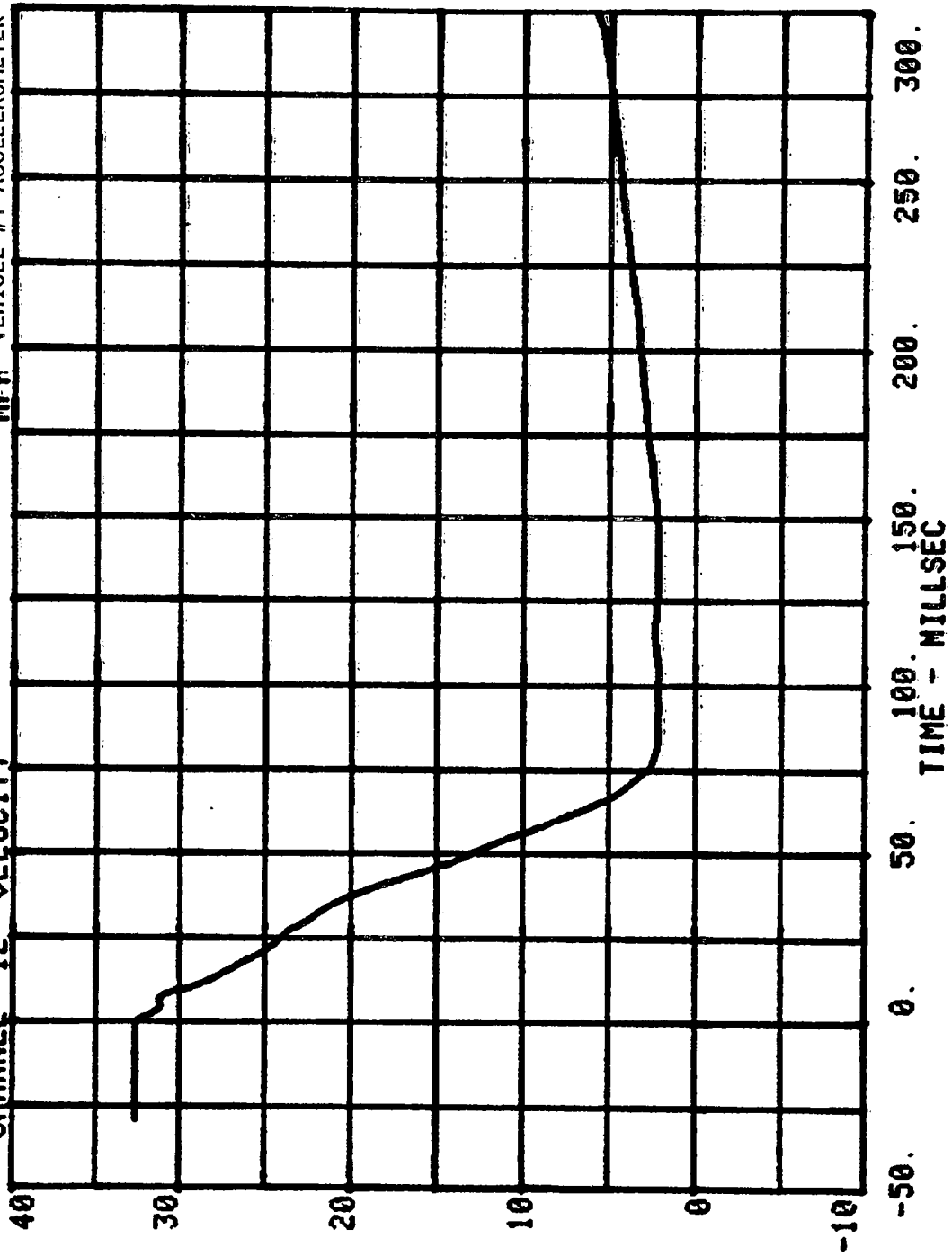
FILTER CHANNEL CLASS

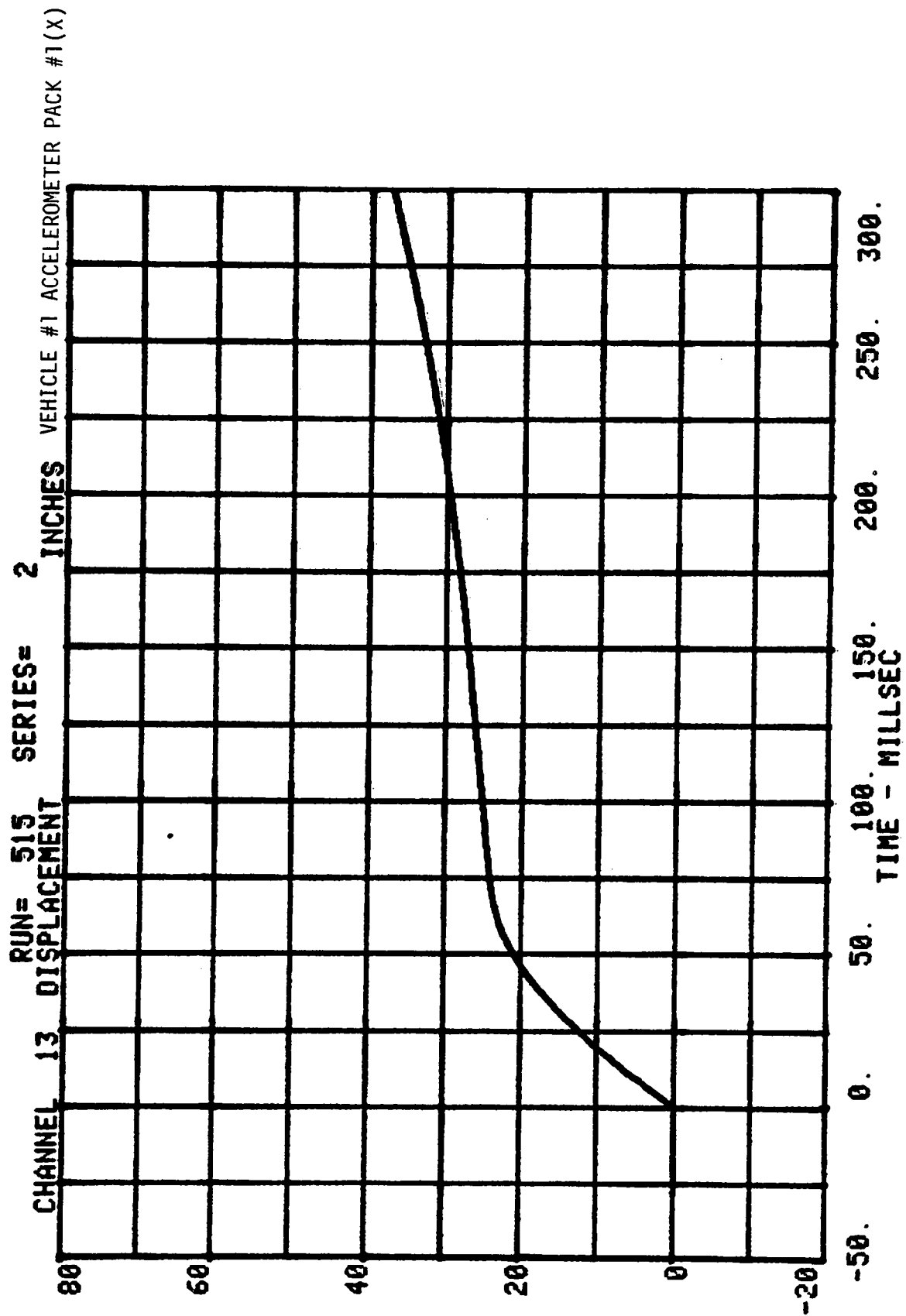
60

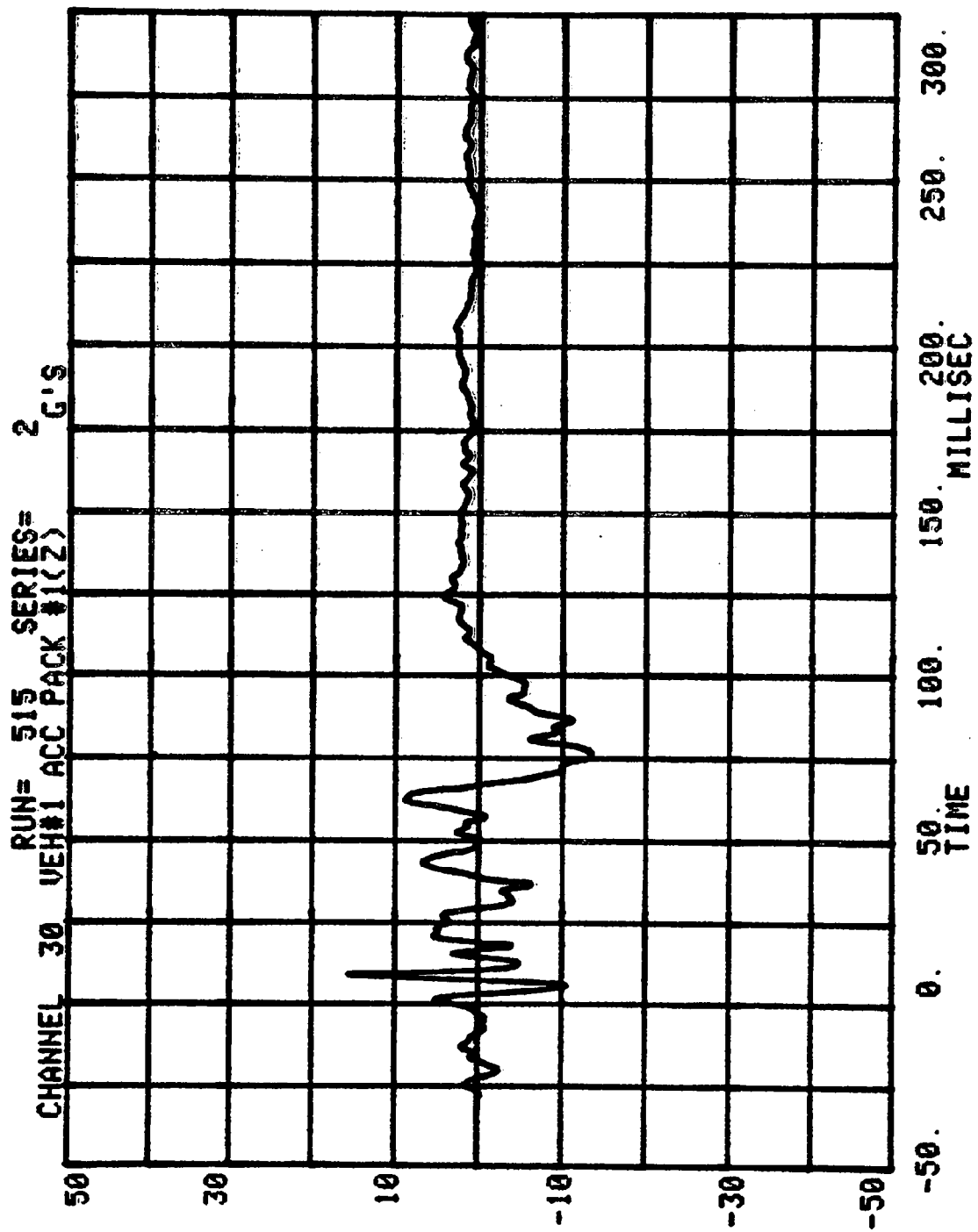
CHANNEL 29 RUN= 515 SERIES= 2 G'S
VEH#1 ACC PACK #1(X)



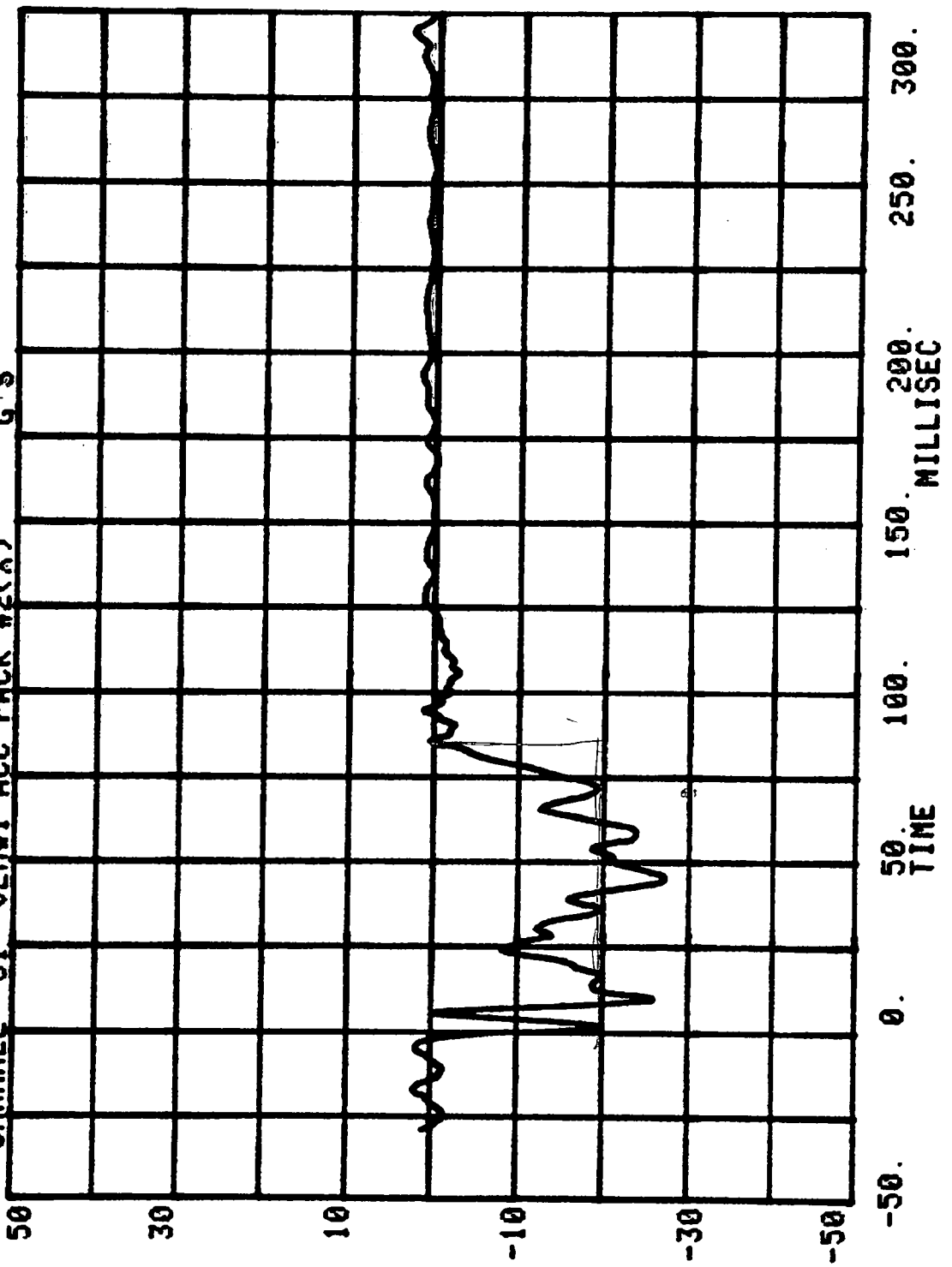
RUN= 515 SERIES= 2
CHANNEL 12 VELOCITY MPH VEHICLE #1 ACCELEROMETER PACK #1(X)



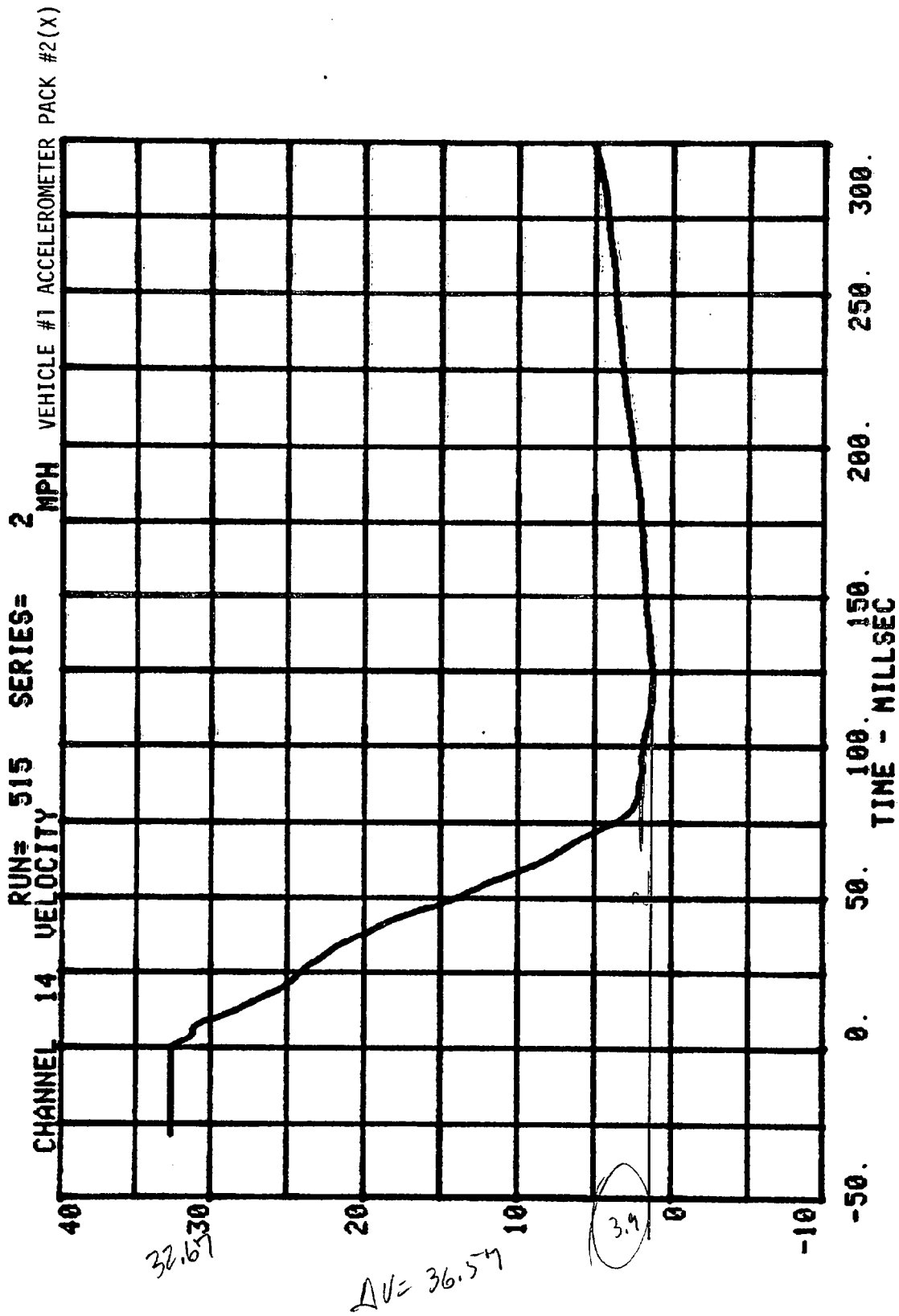




CHANNEL 31 RUN= 515 SERIES= 2
VEH#1 ACC PACK #2(X) G'S

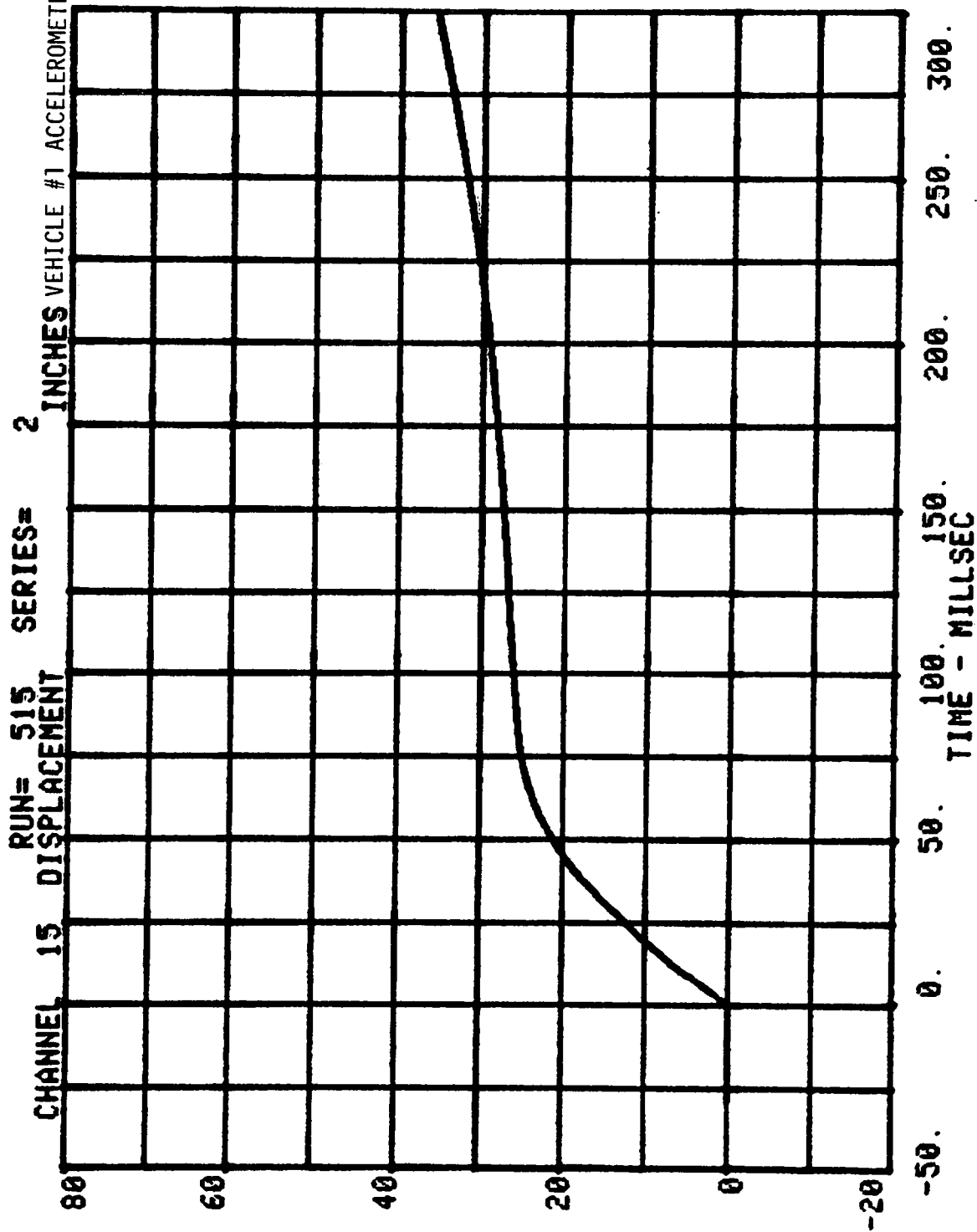


IMP=6522

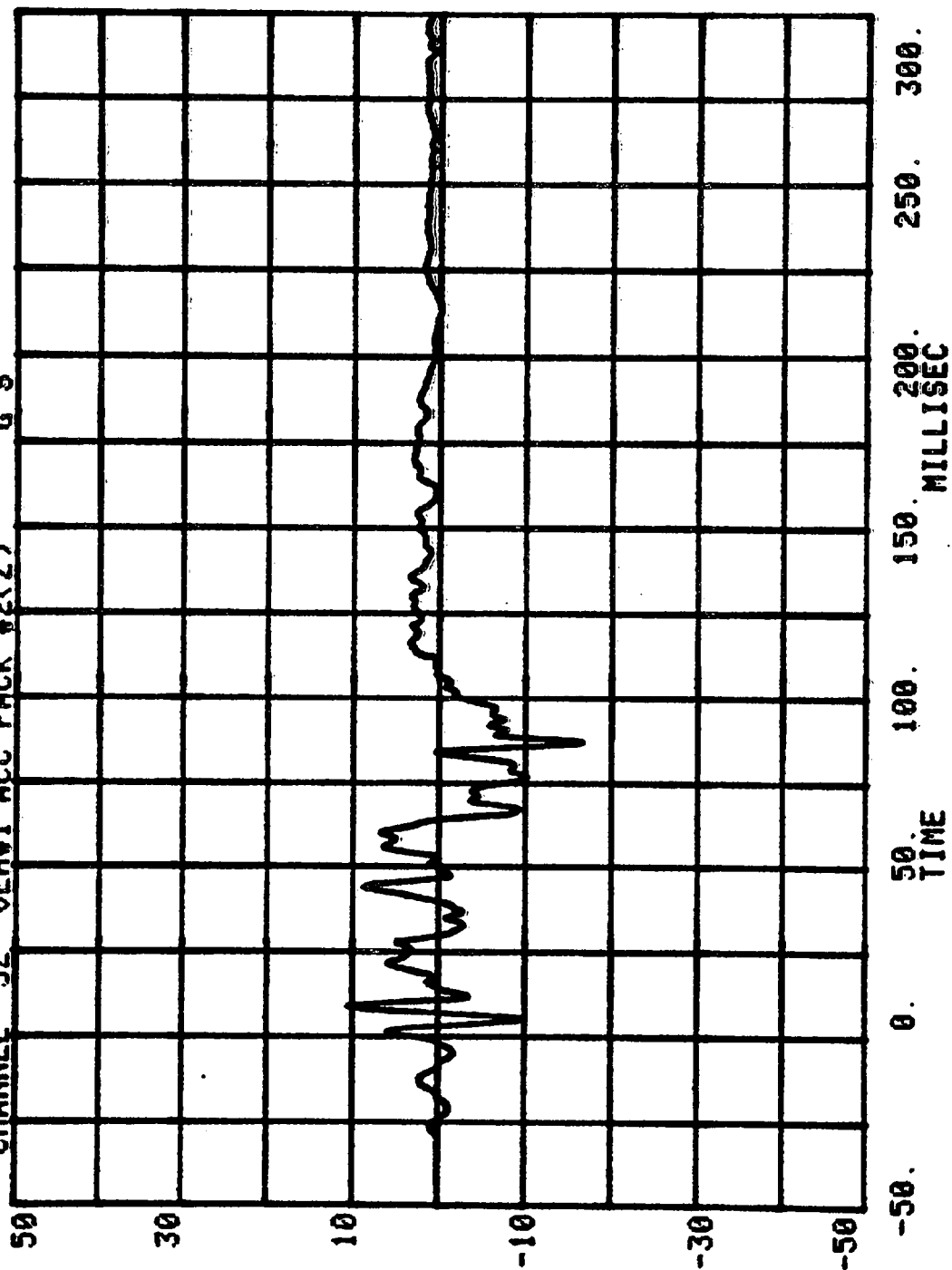


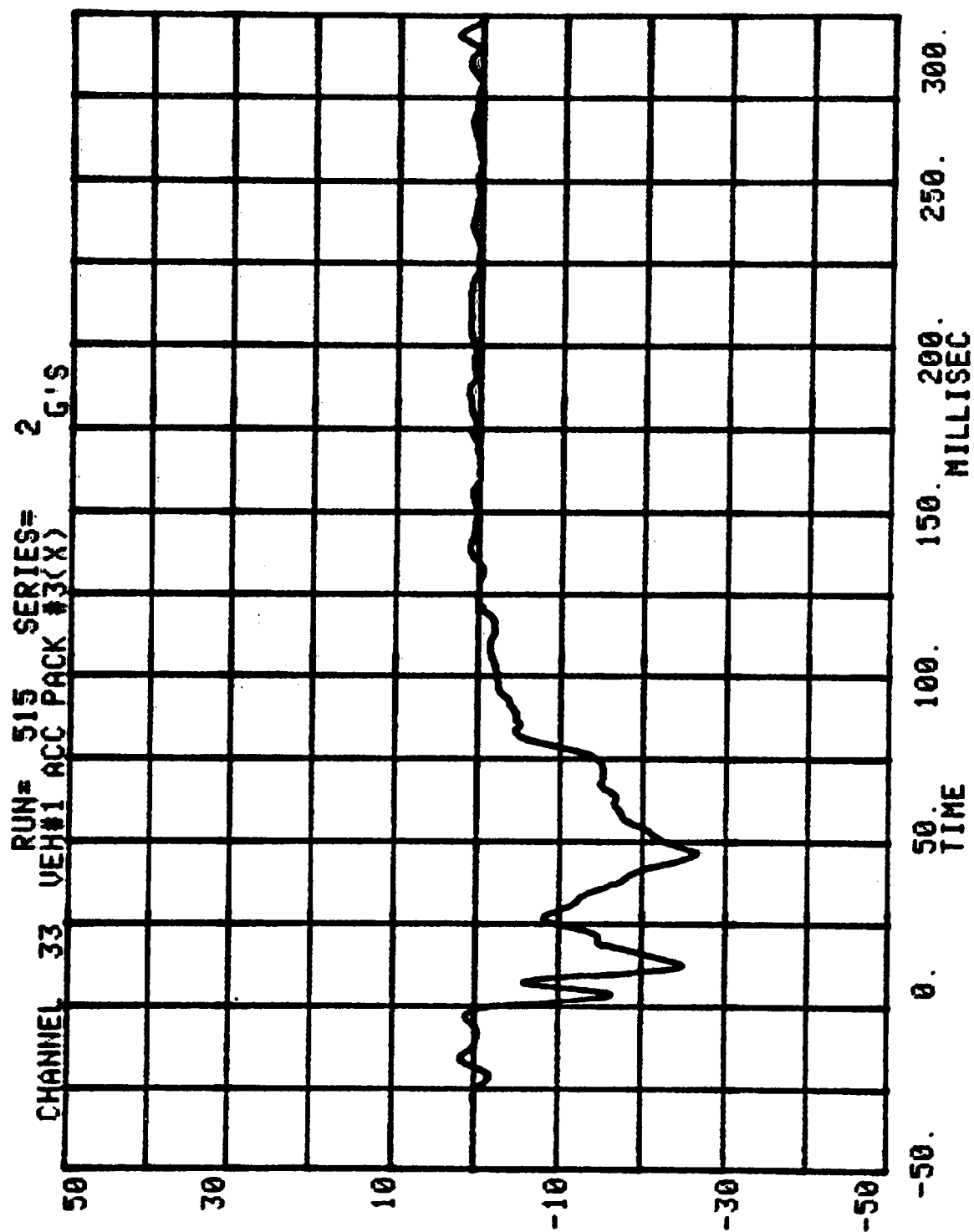
$$\begin{array}{r} 3450 \\ 3920 \\ \hline 7370 \end{array}$$

$$\Delta V = 65 \times \frac{3450}{7370} = 30.4 \text{ MP4}$$

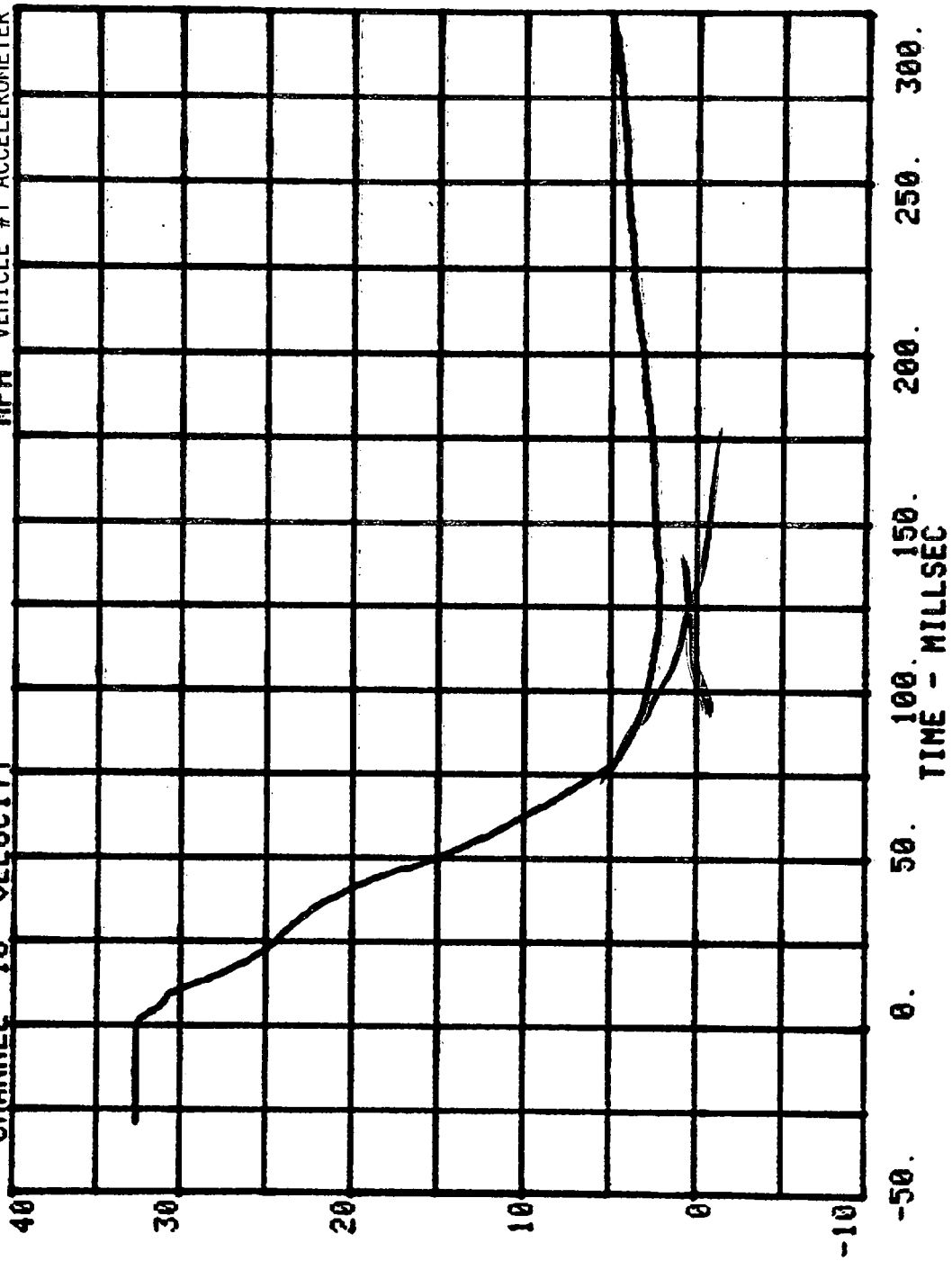


CHANNEL 32 RUN= 515 SERIES= 2 G'S
VEH#1 ACC PACK #2(Z)

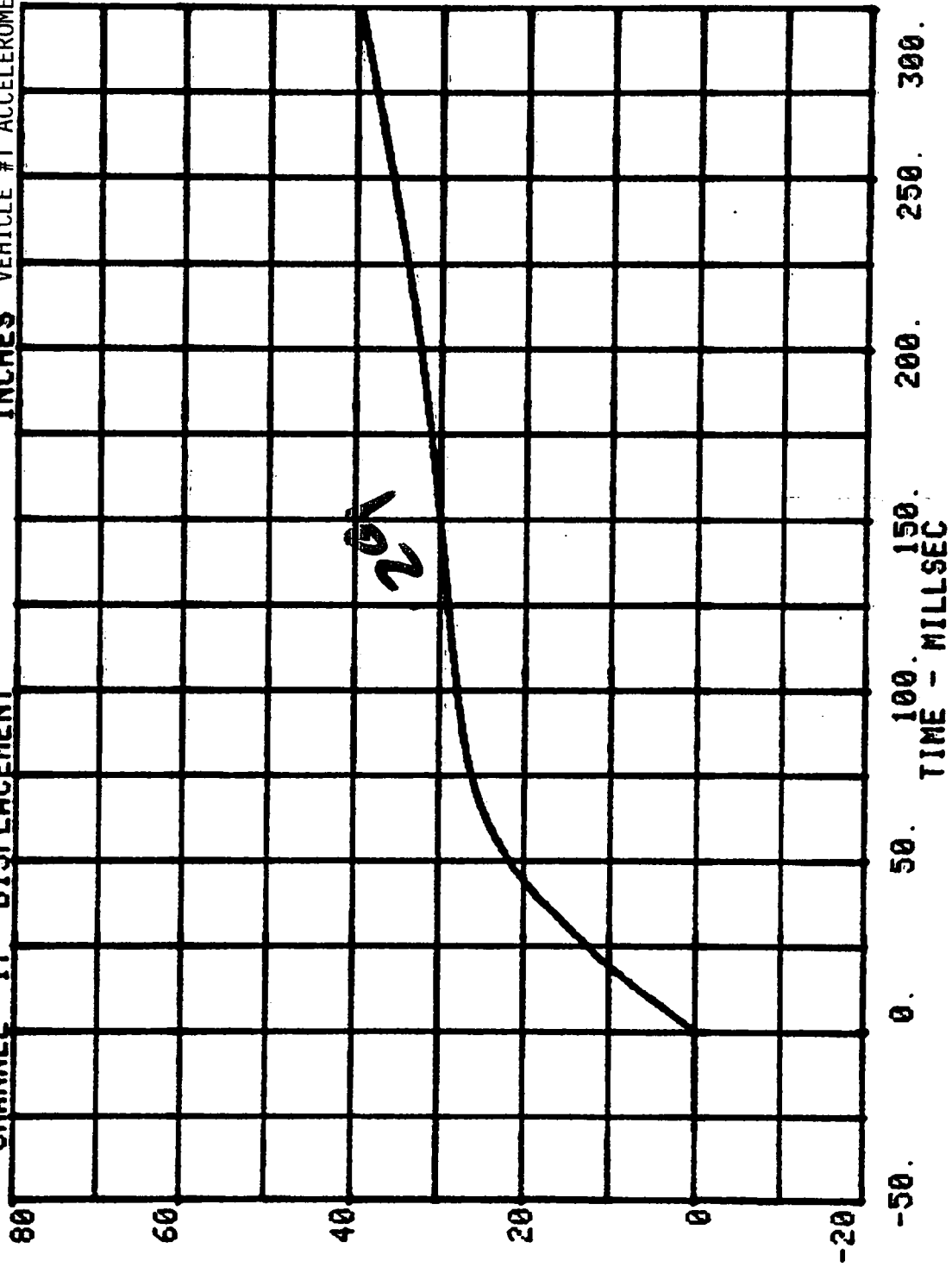


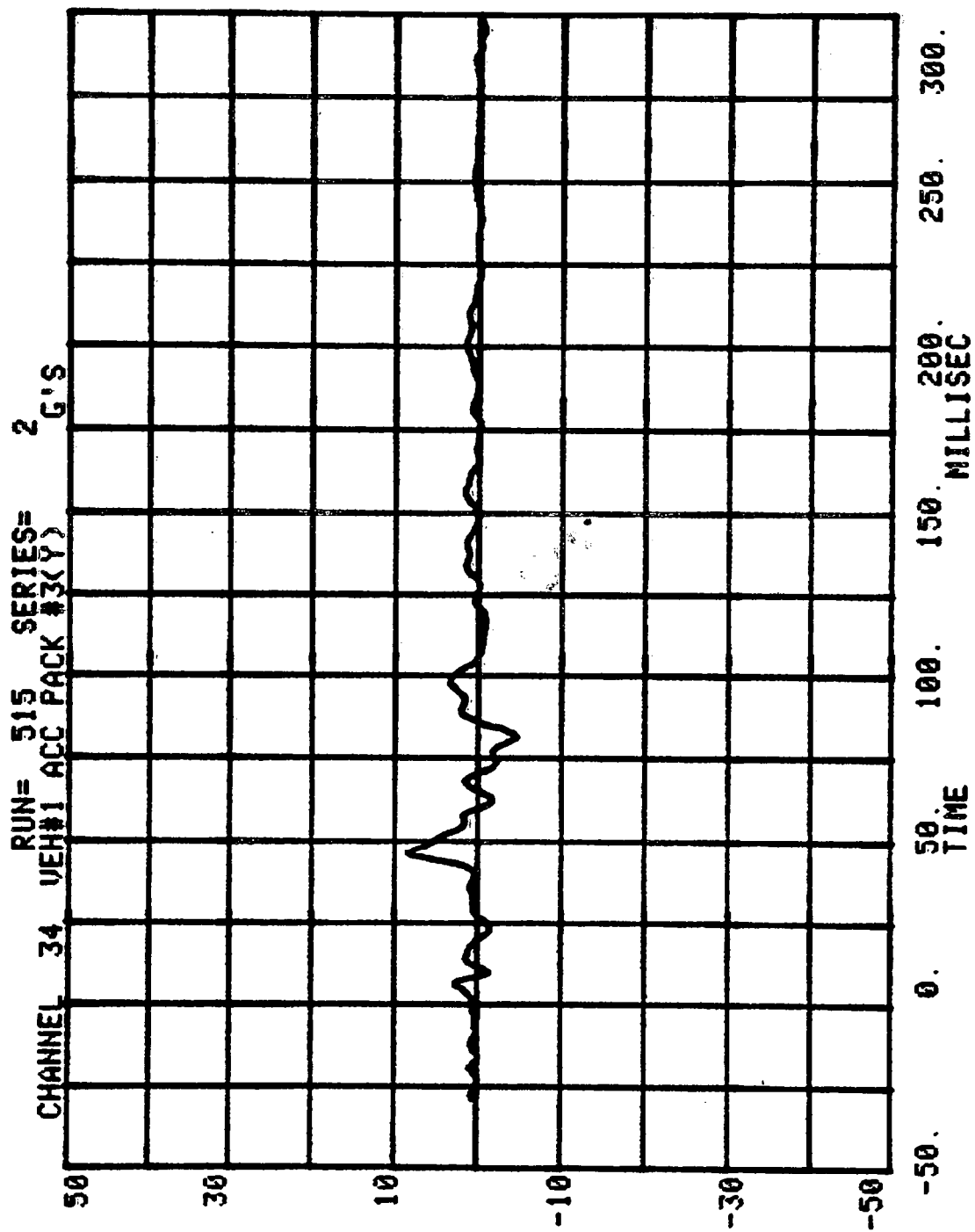


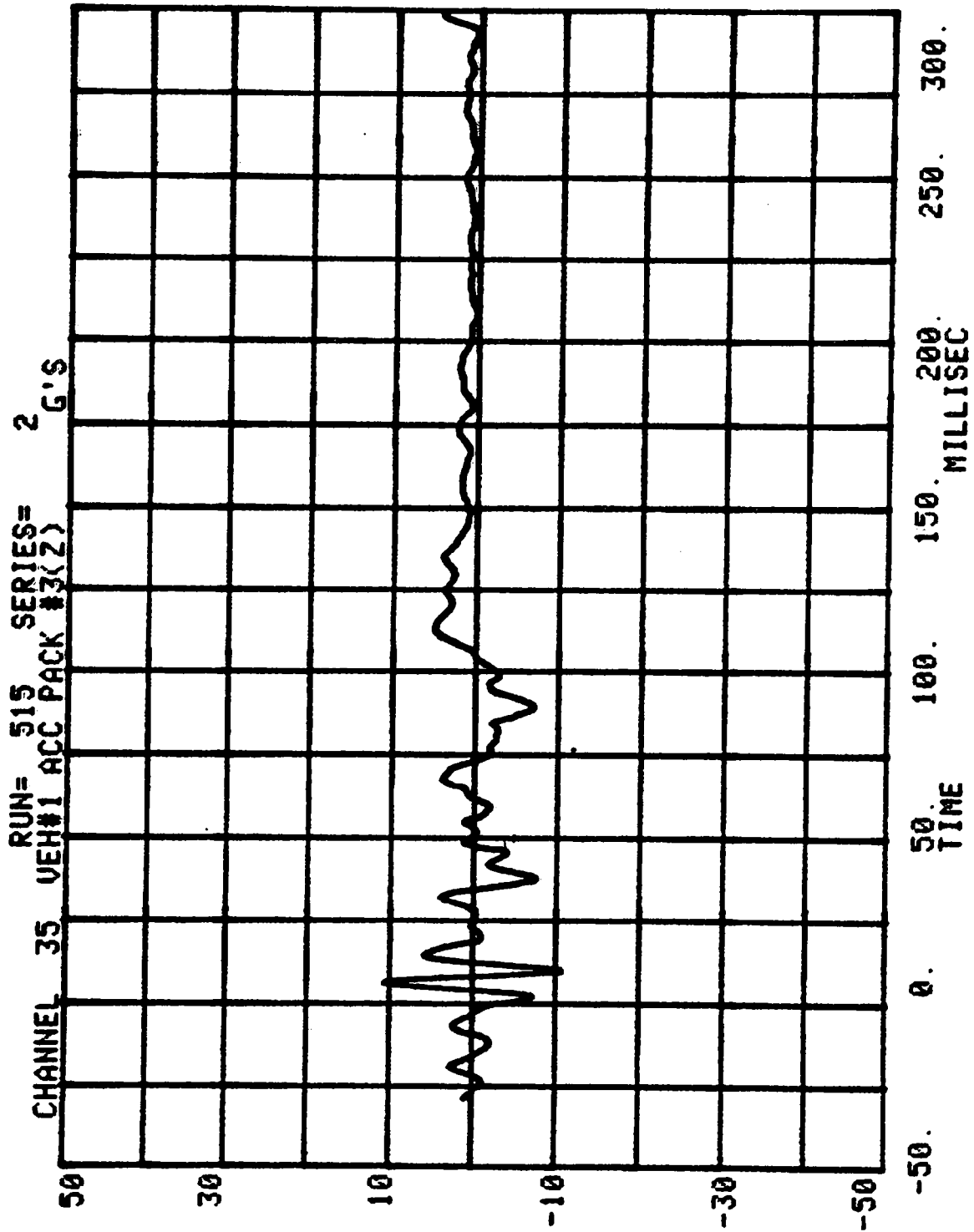
CHANNEL 16 VELOCITY
RUN= 515 SERIES= 2 MPH VEHICLE #1 ACCELEROMETER PACK #3(X)

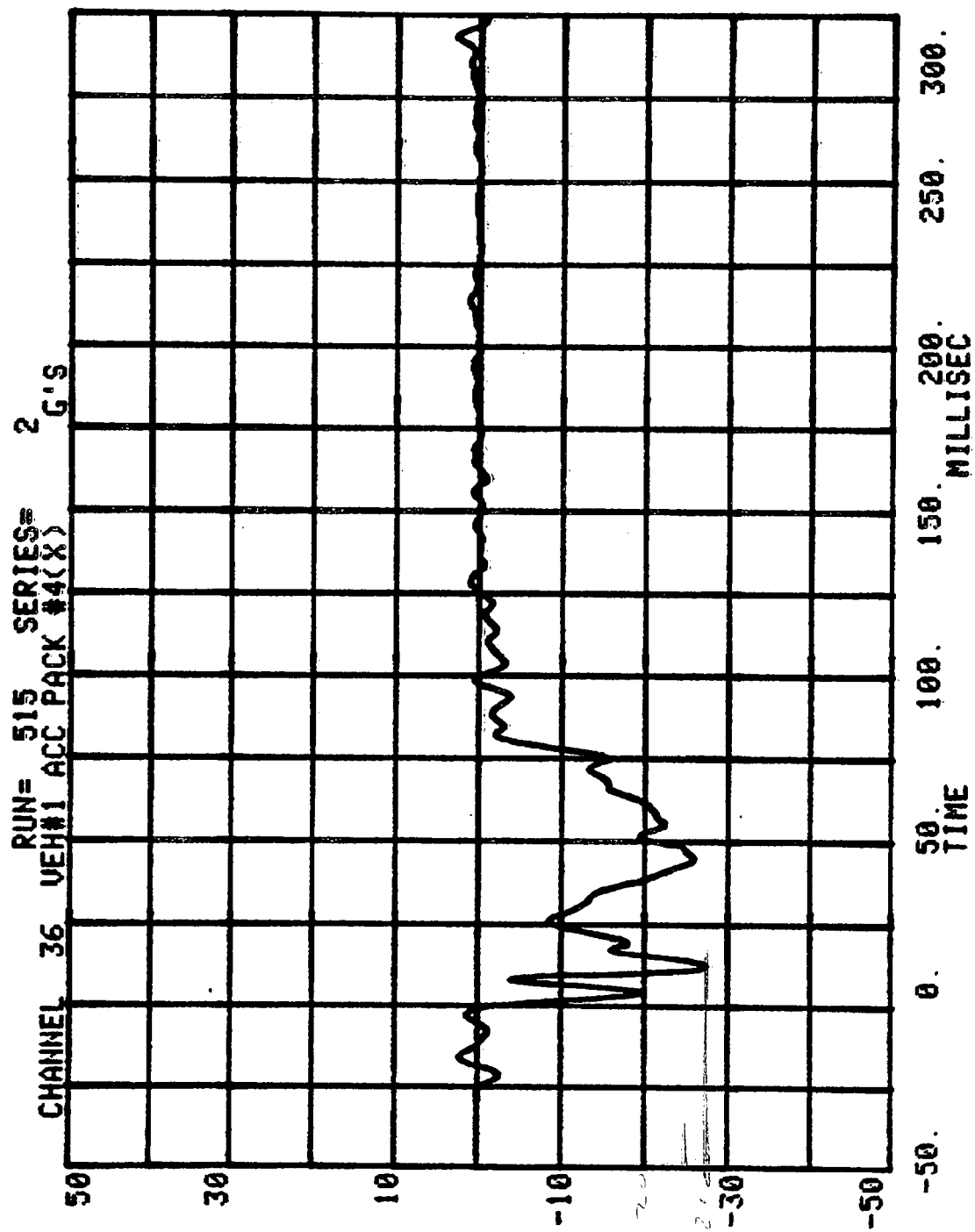


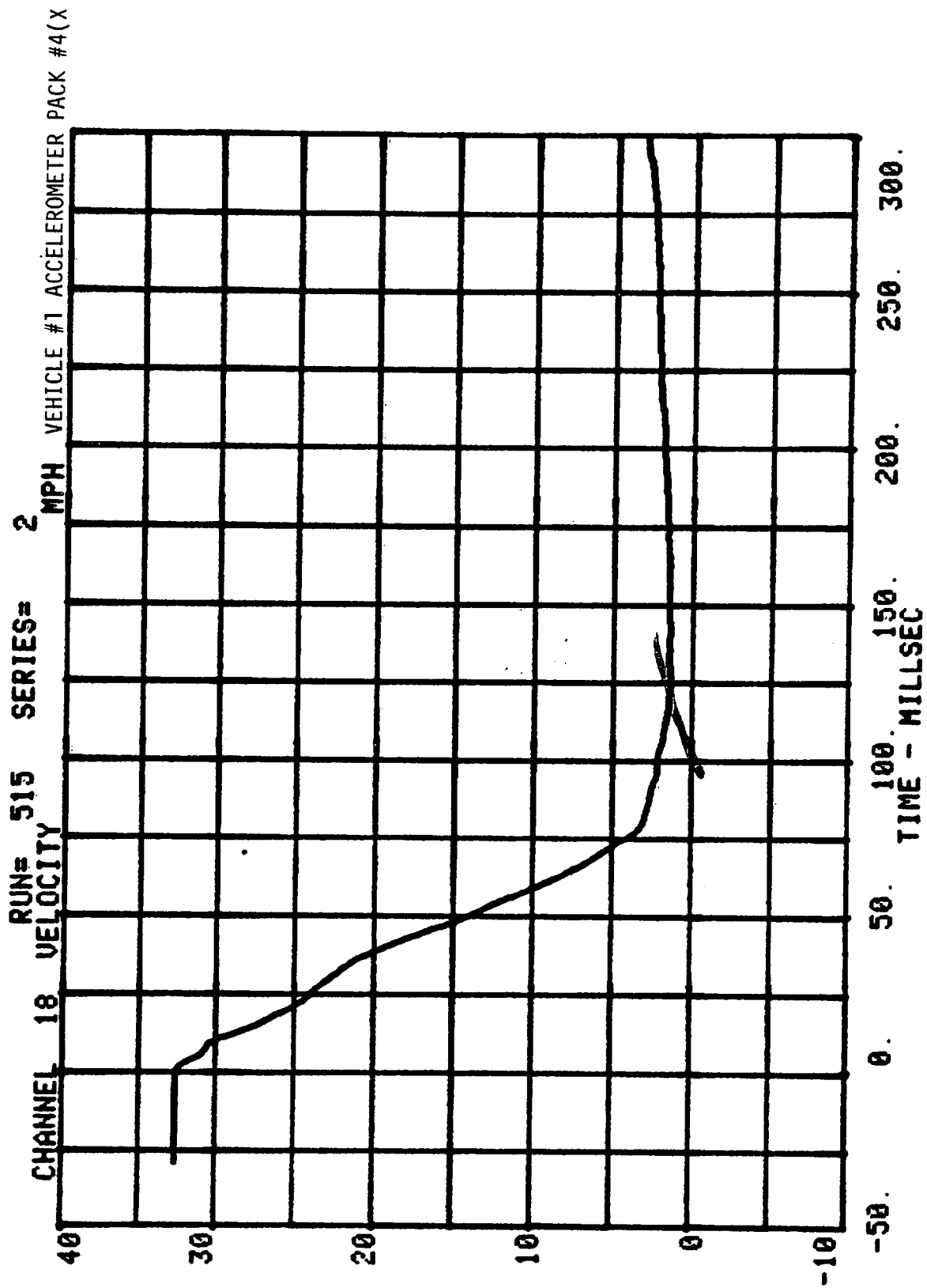
CHANNEL 17 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #3(X



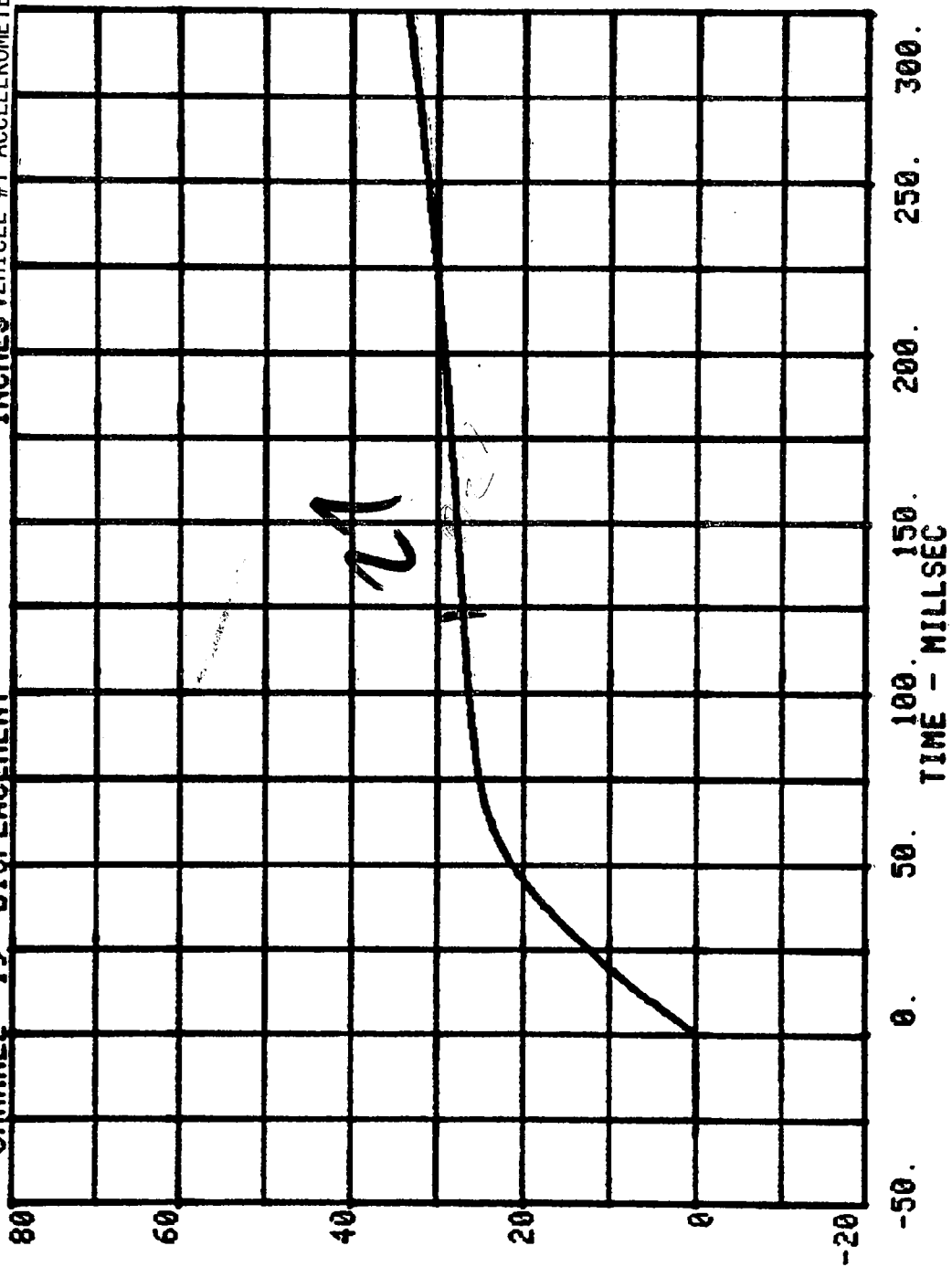


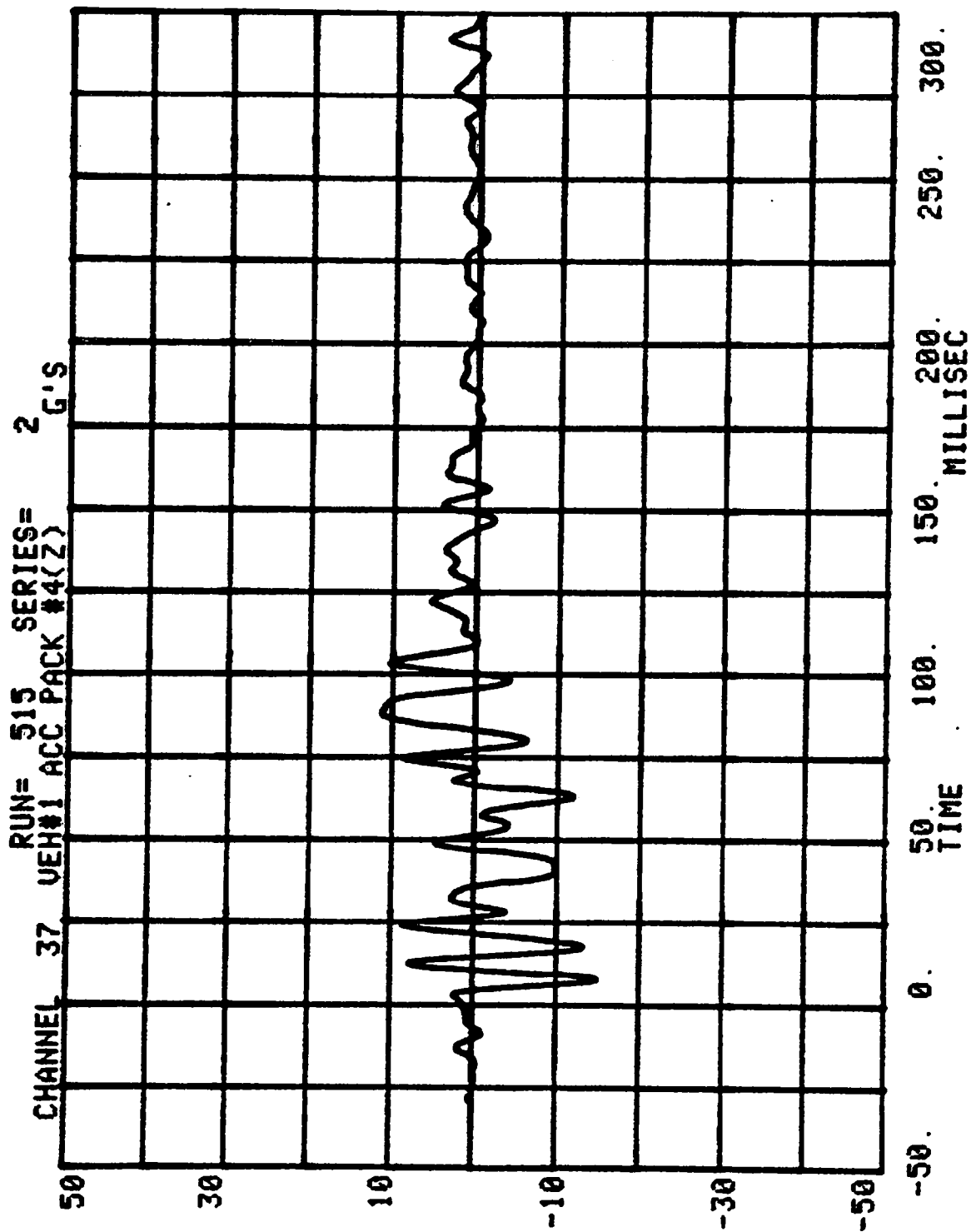


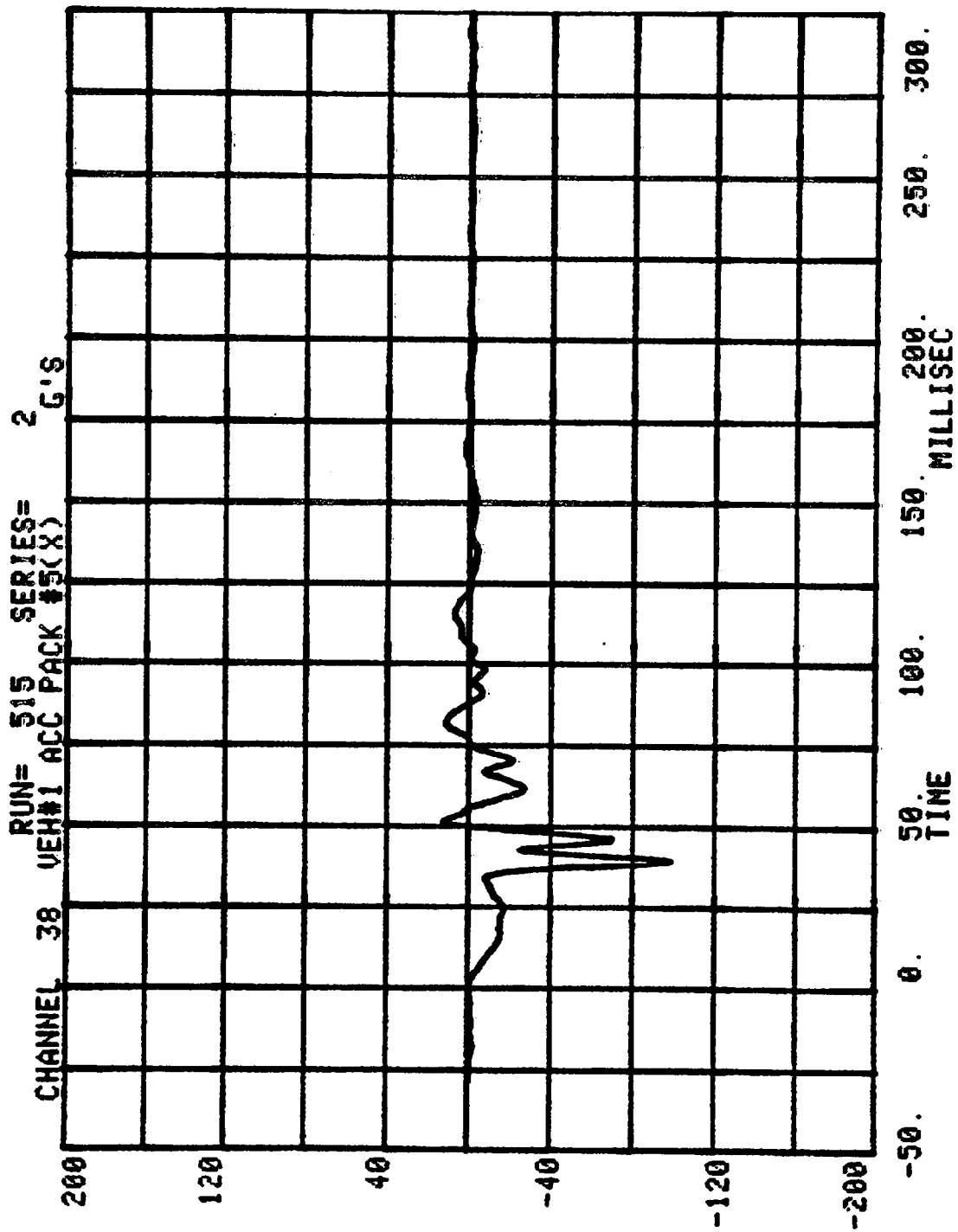


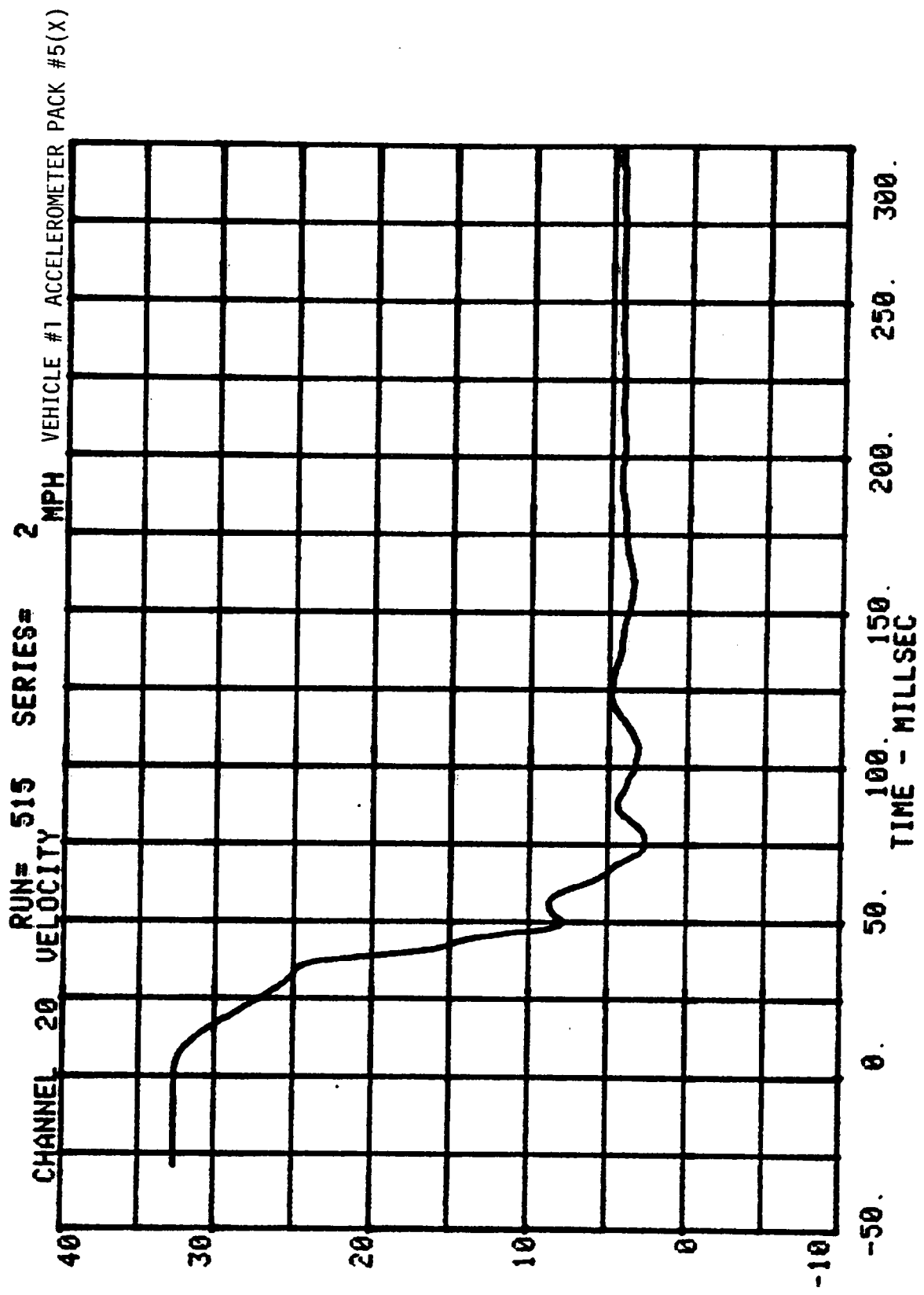


CHANNEL 19 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #4(X)

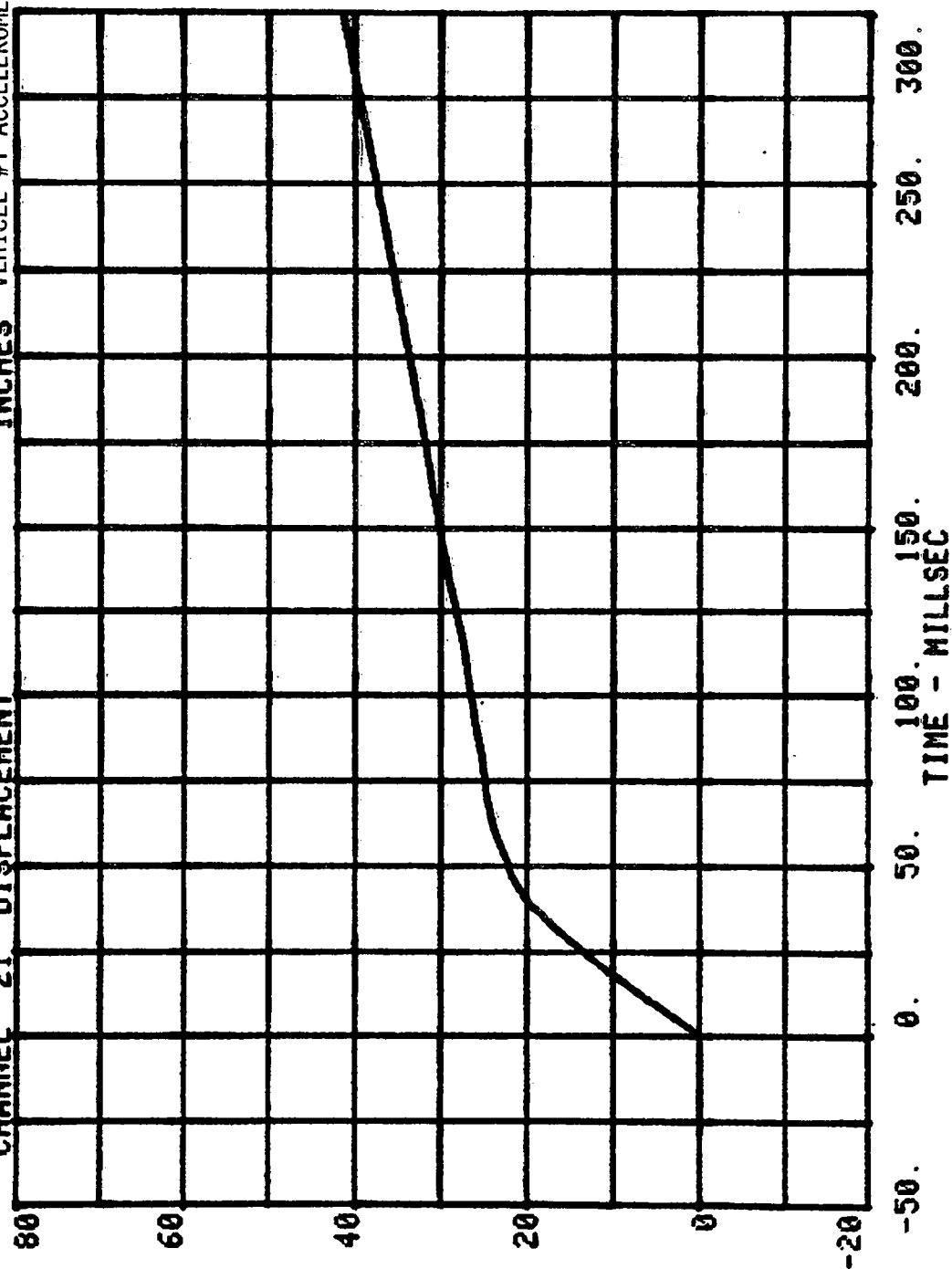


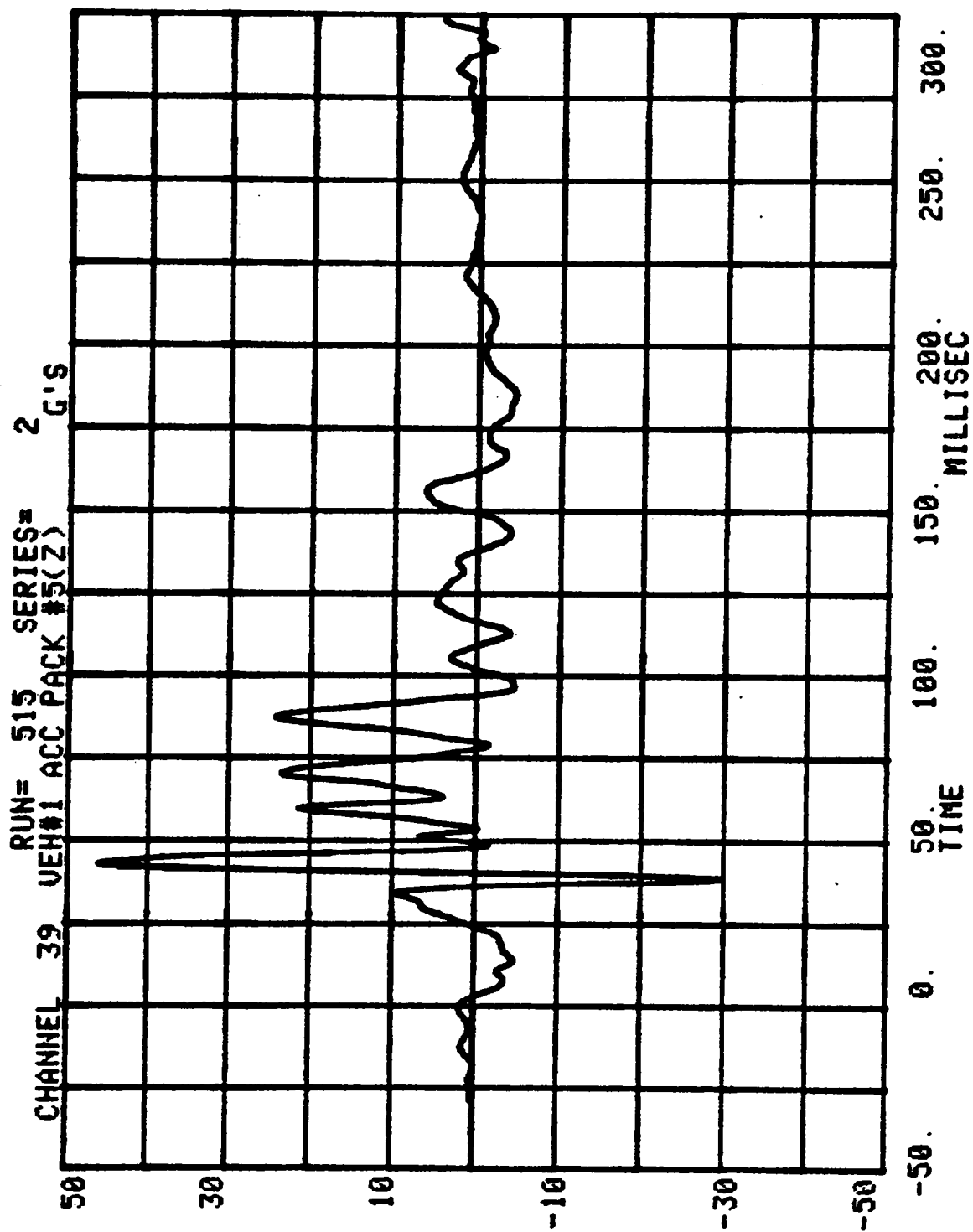




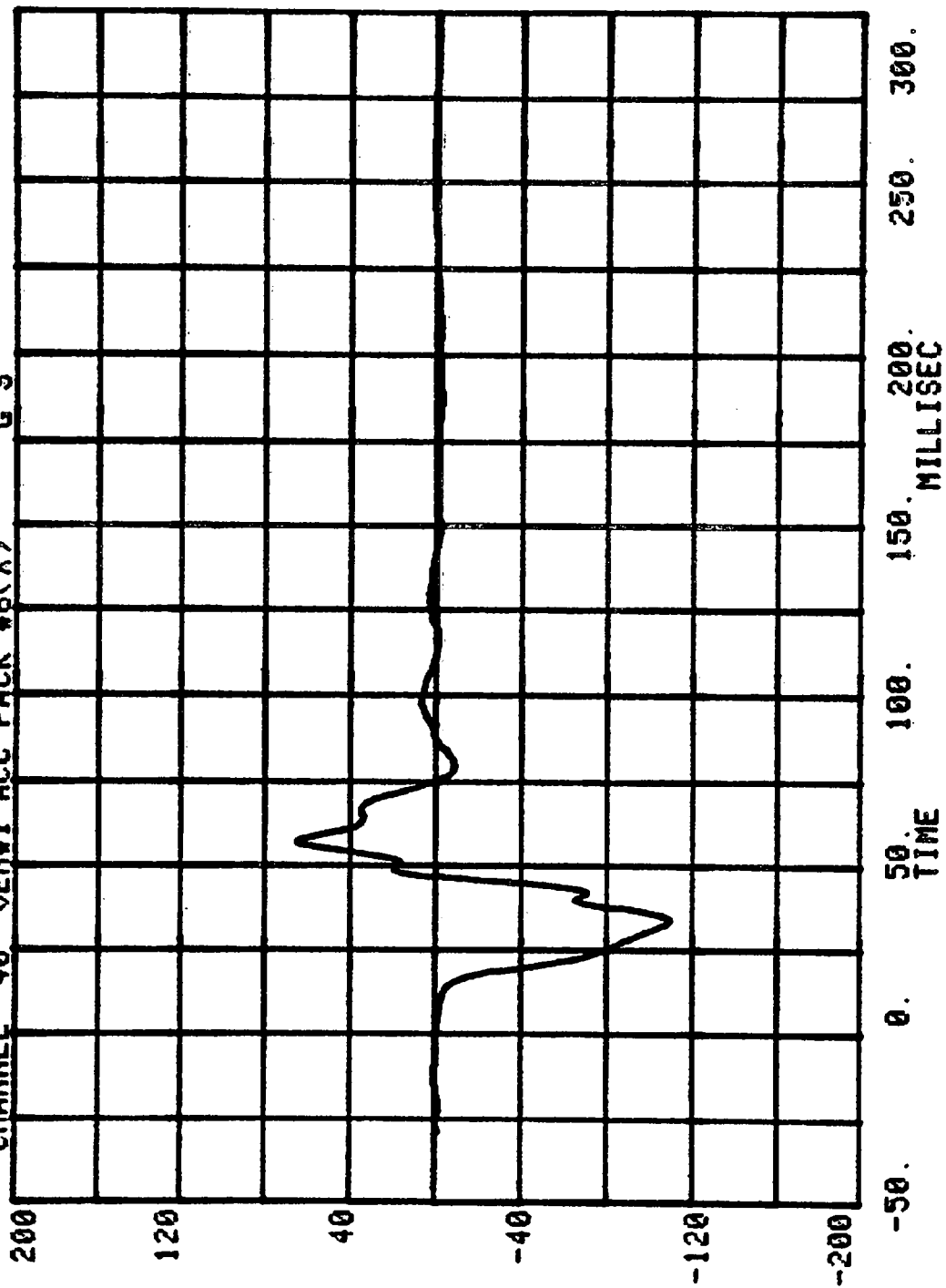


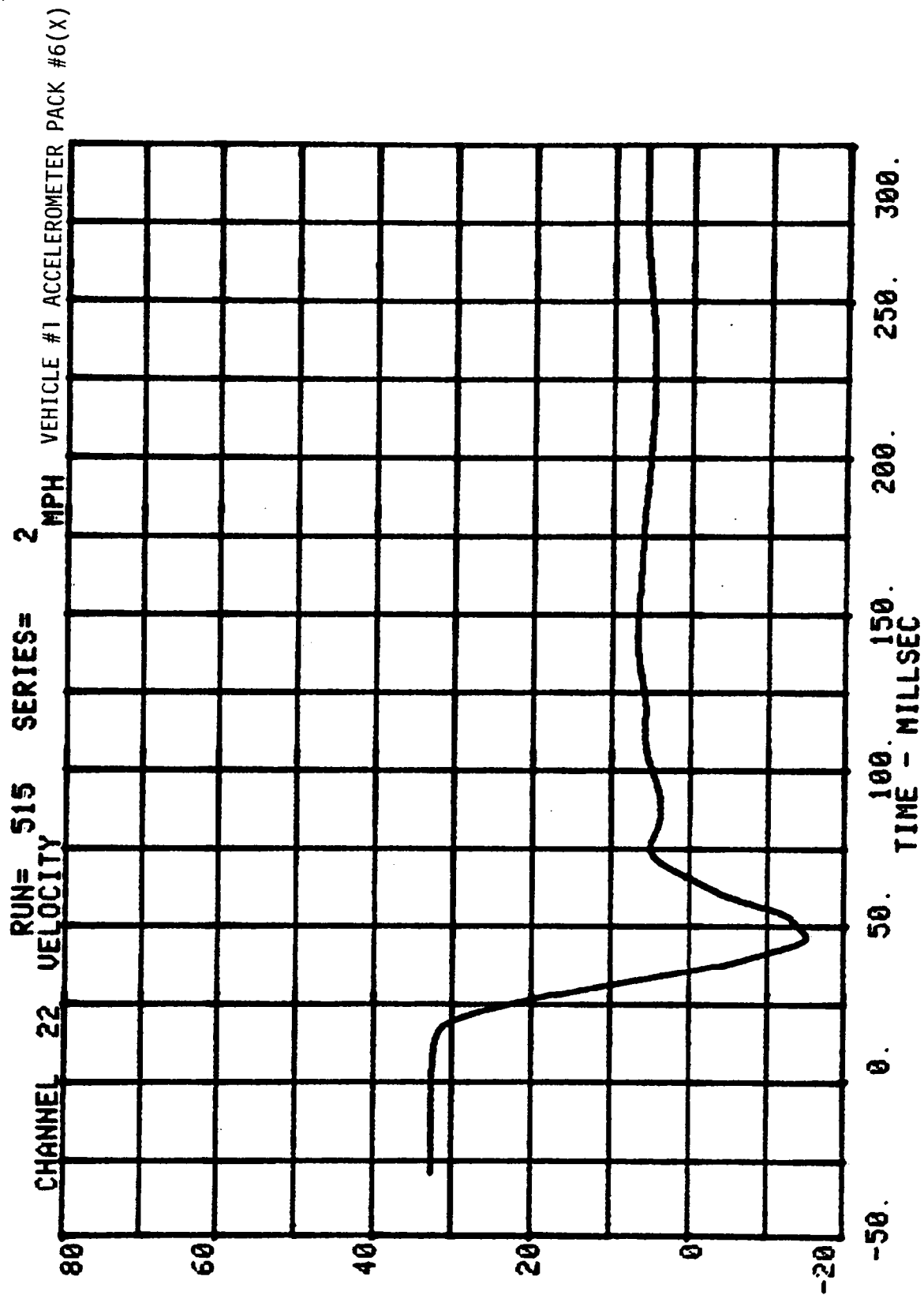
CHANNEL 21 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #5(X)



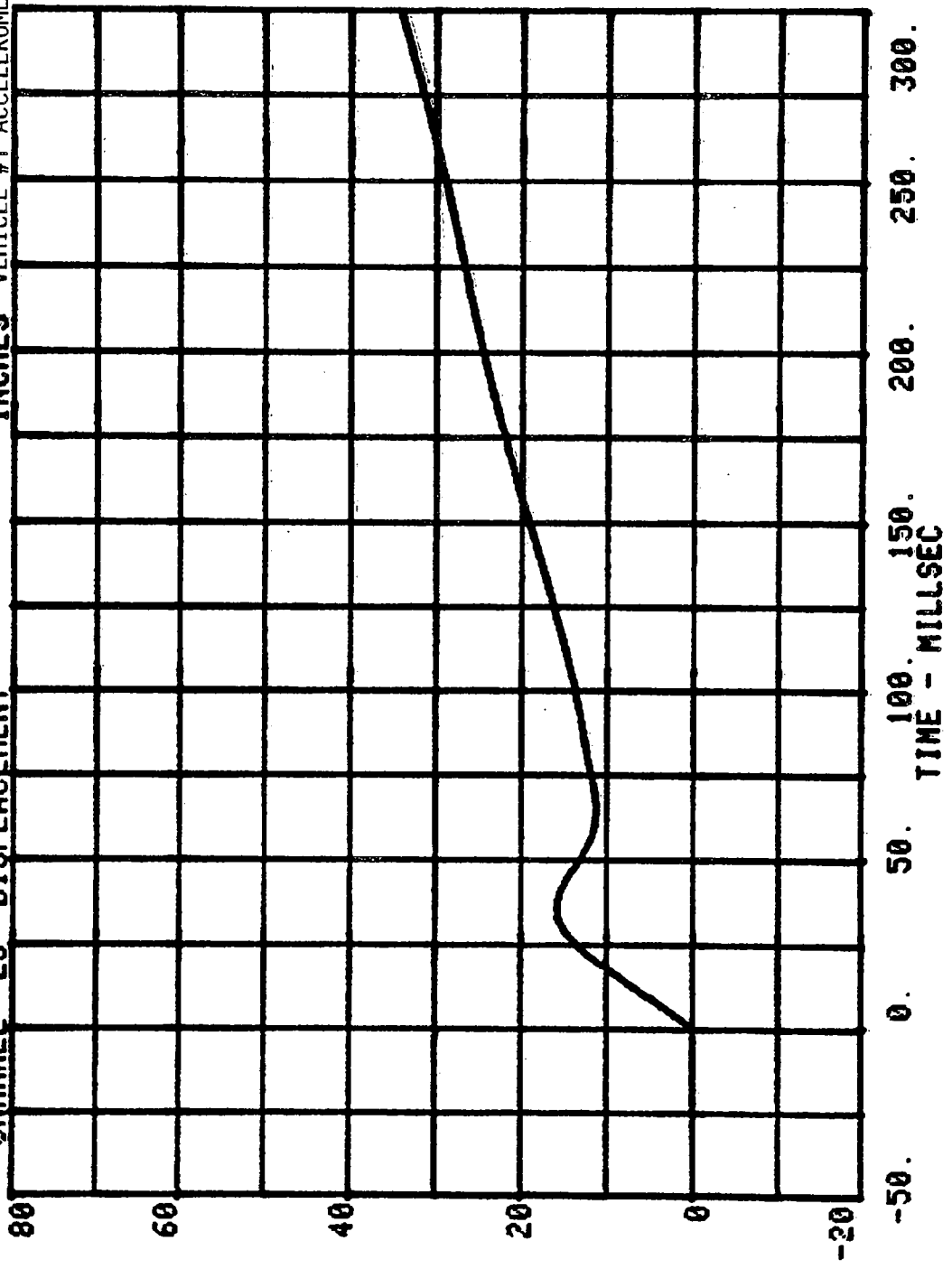


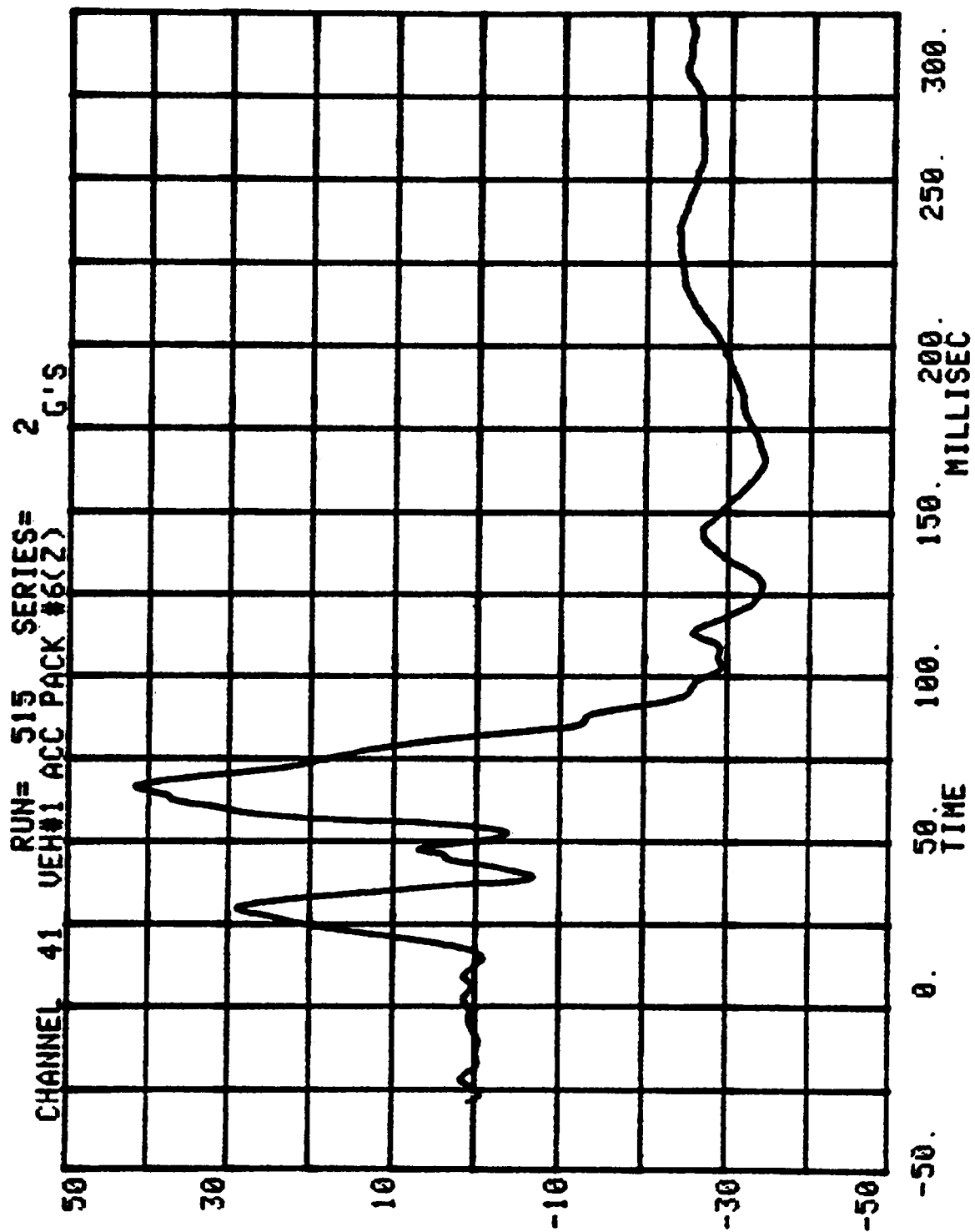
CHANNEL 40 RUN= 515 SERIES= 2
VEH#1 ACC PACK #6(X) G'S

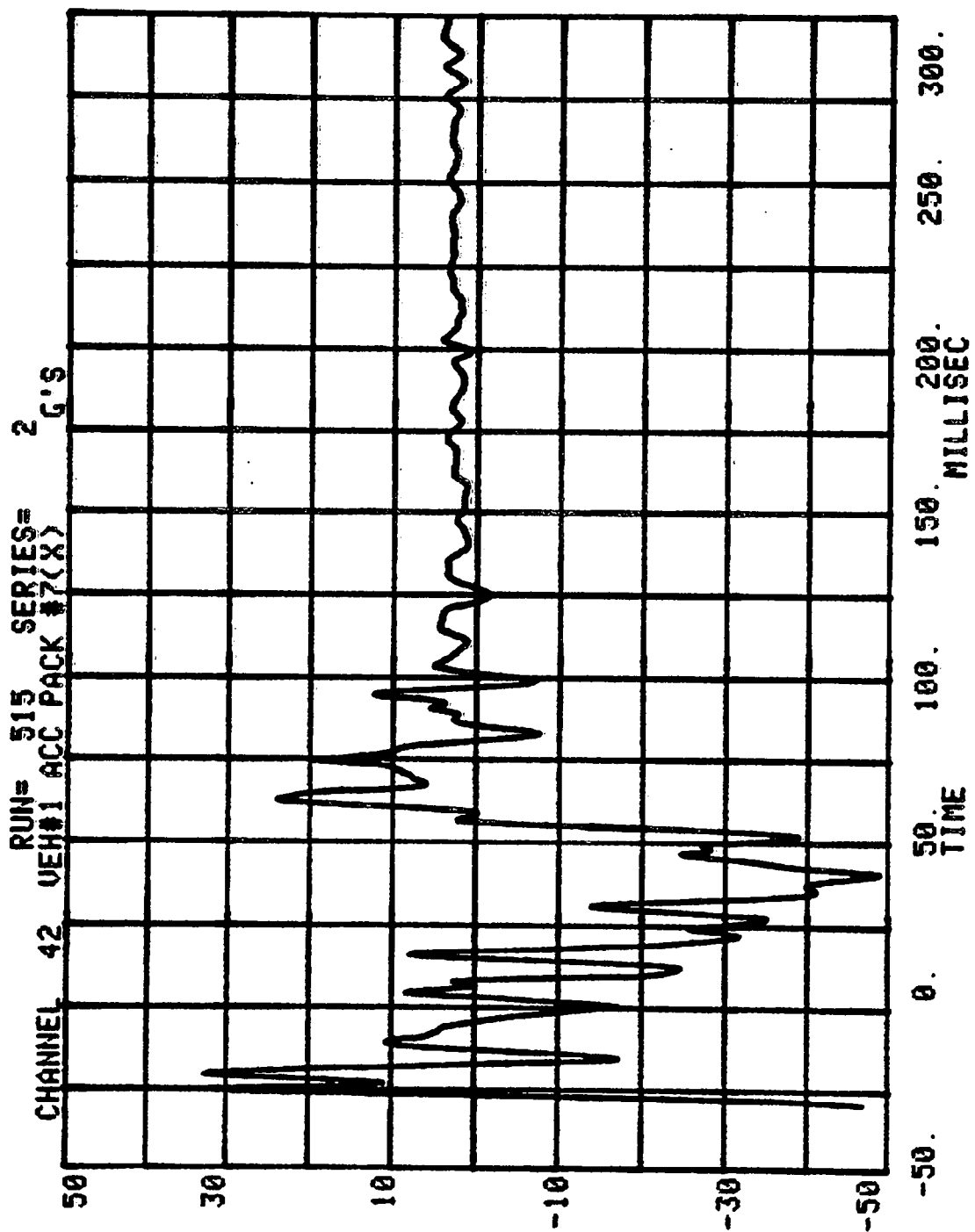


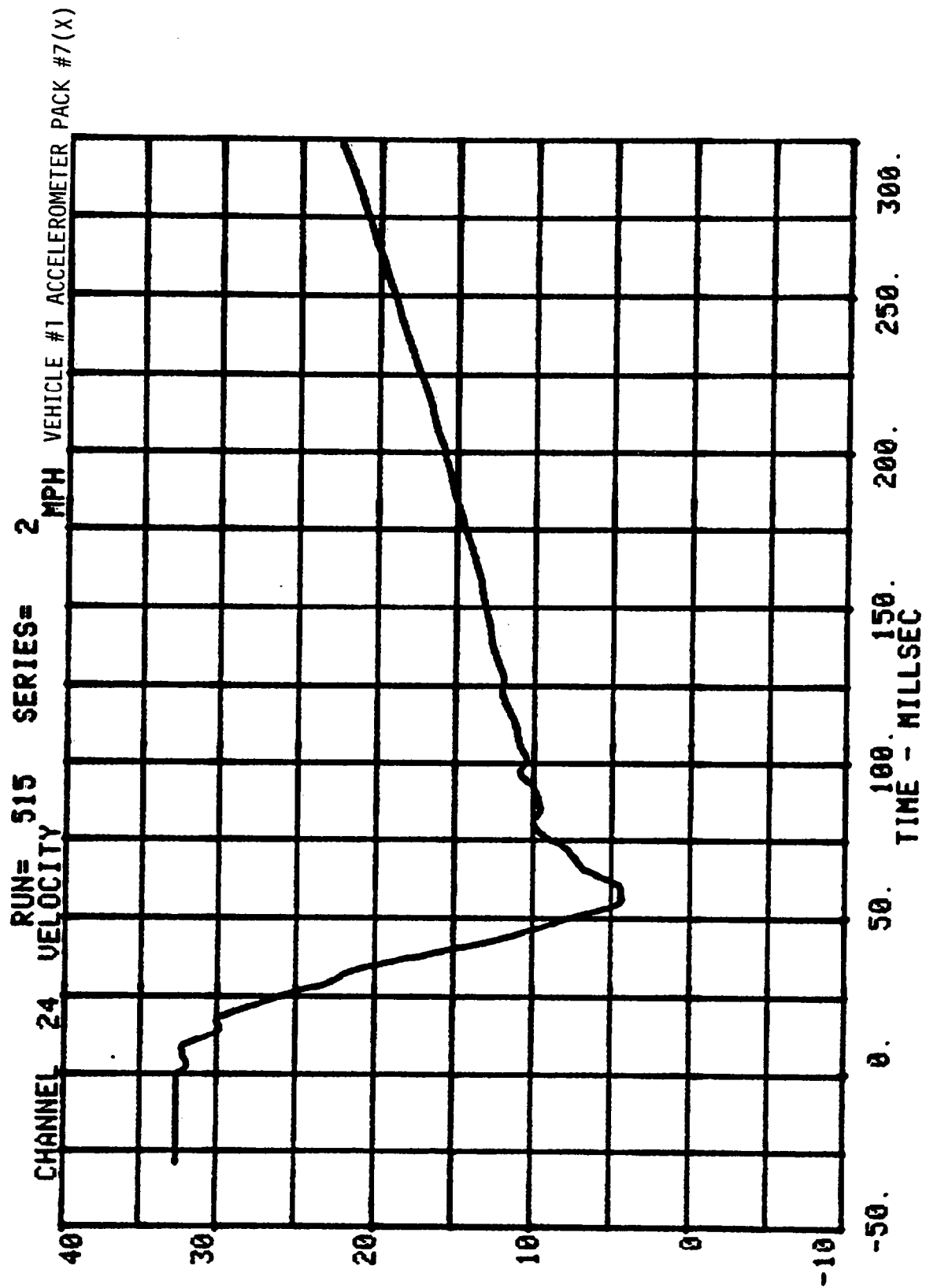


RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #6(X)
CHANNEL 23 DISPLACEMENT

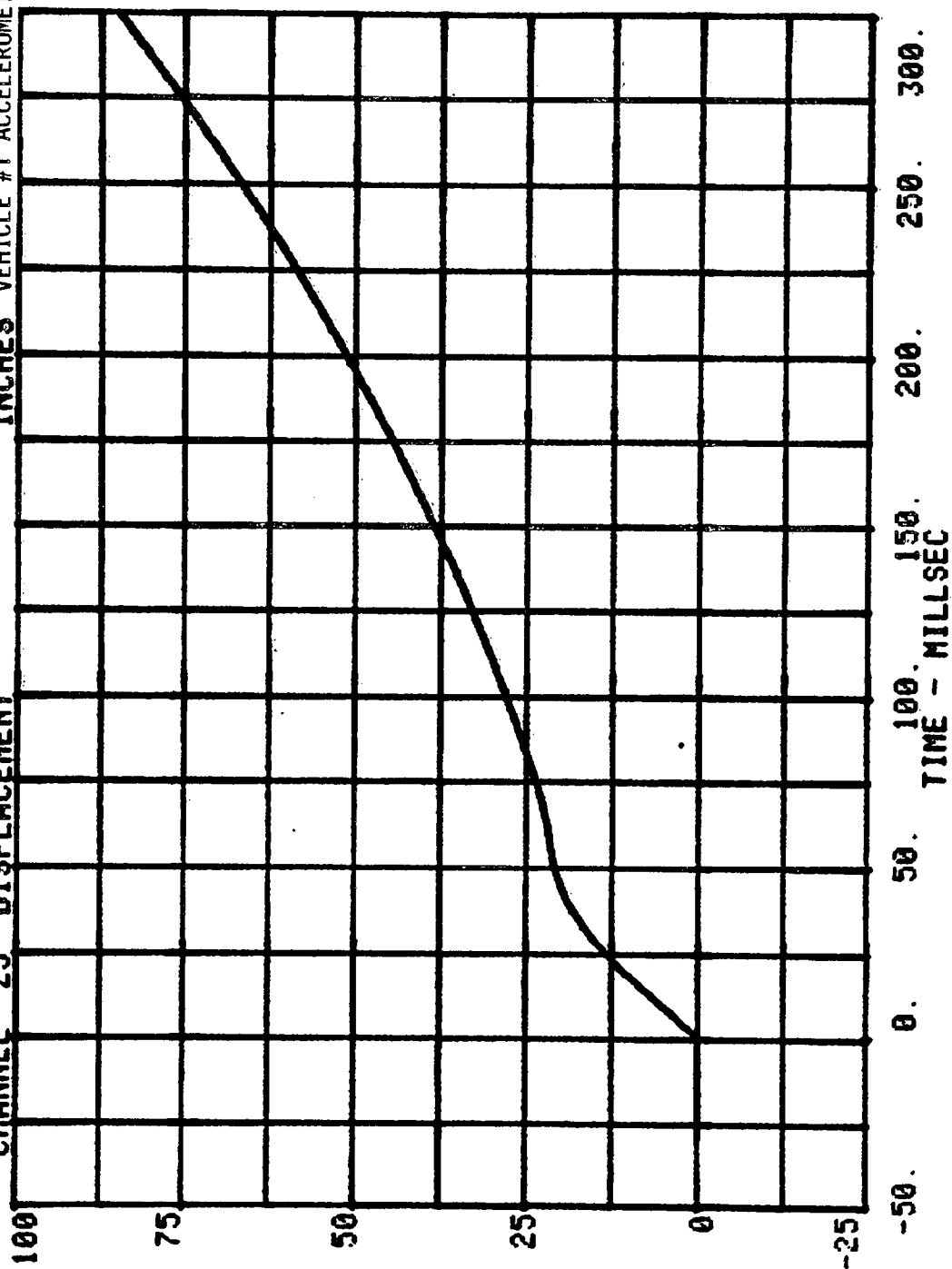


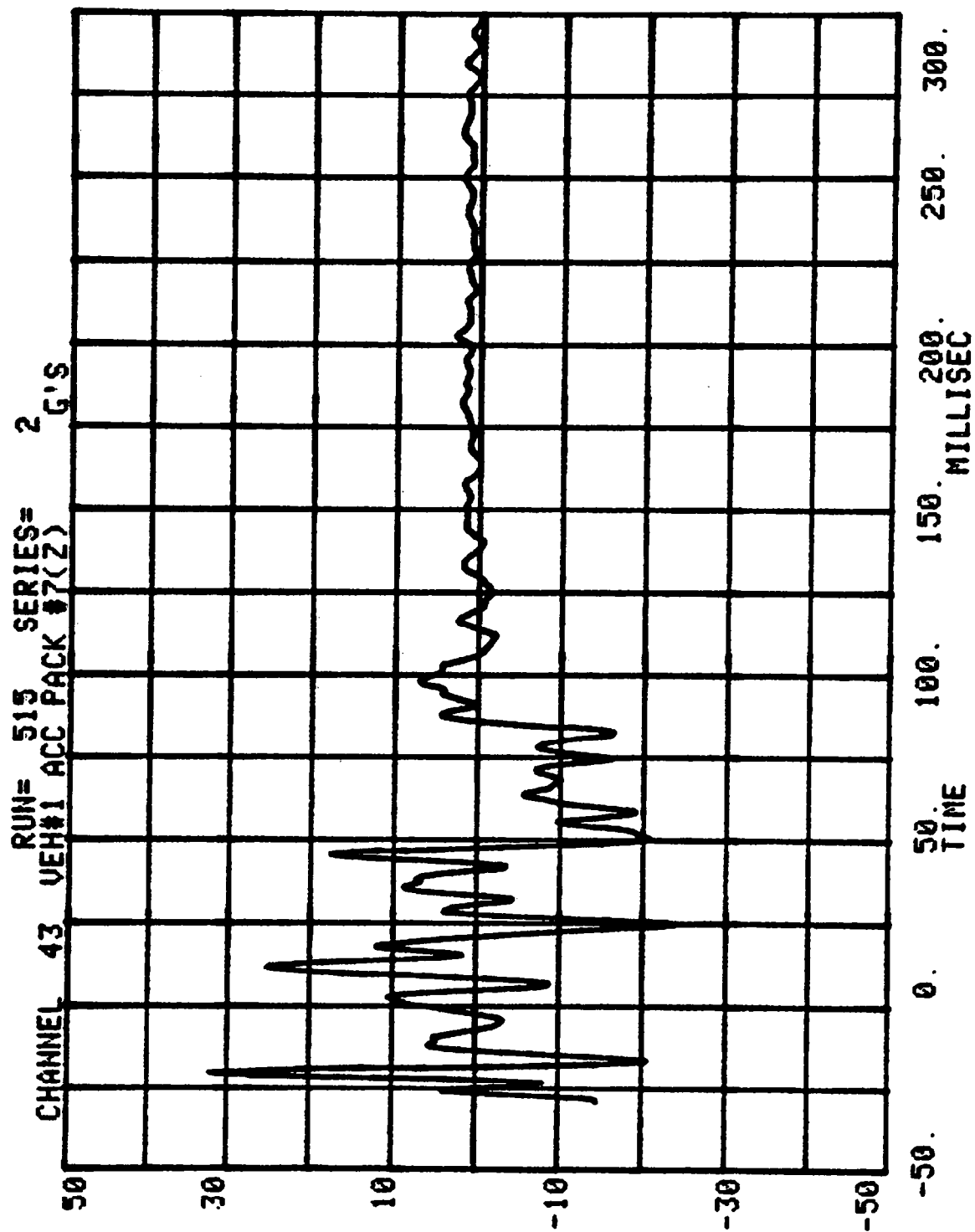


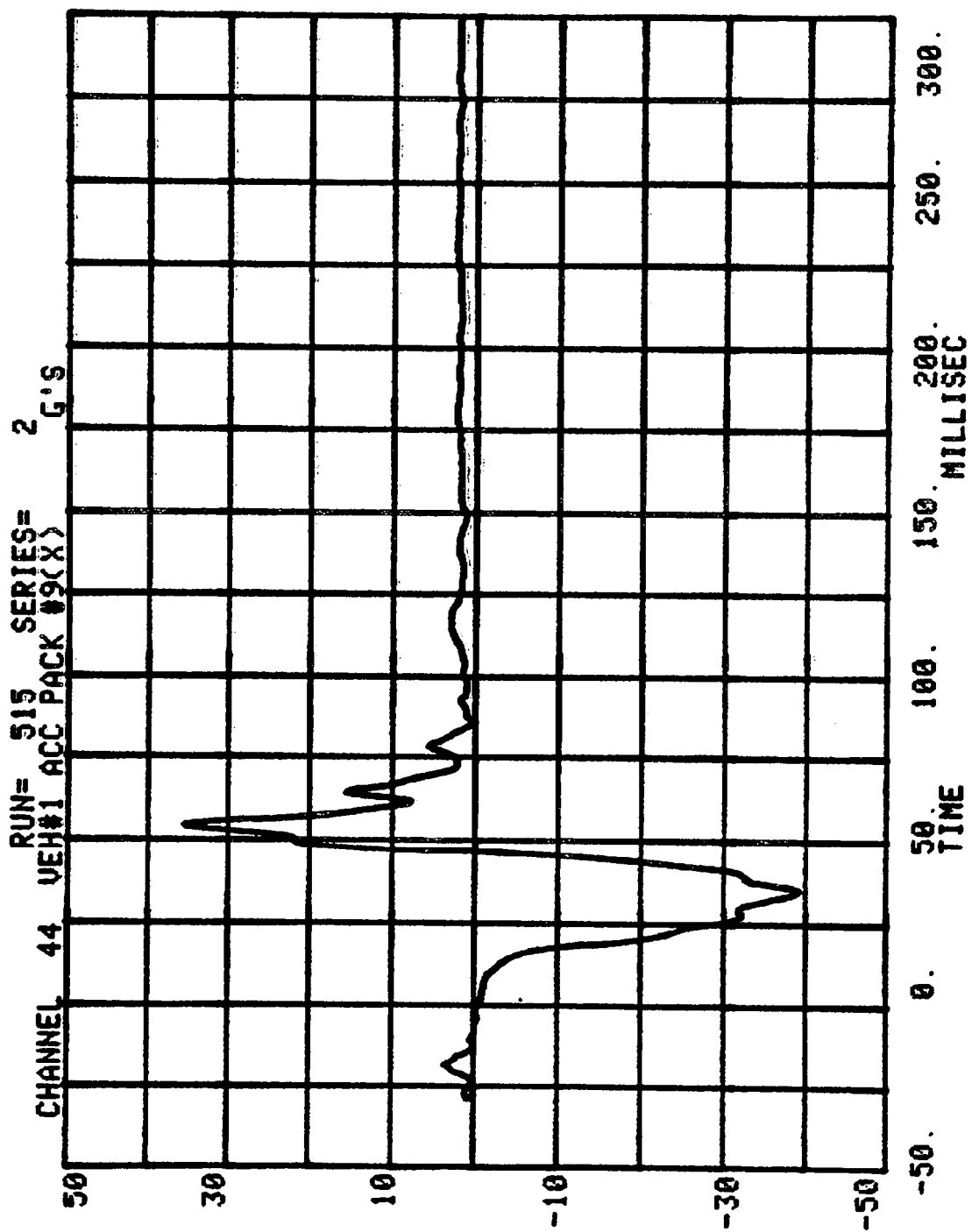




RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #7(X)
 CHANNEL 25 DISPLACEMENT







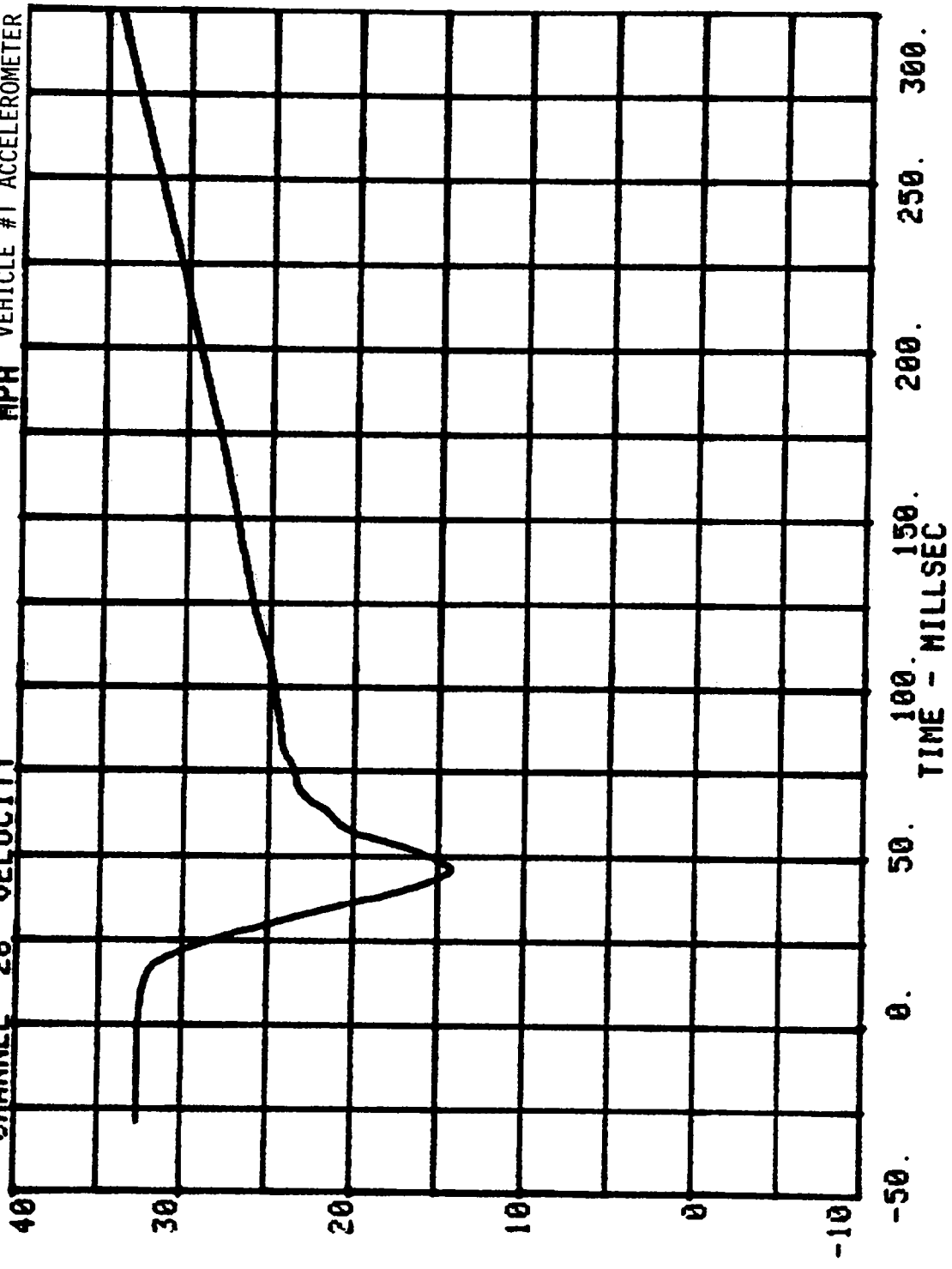
CHANNEL 26 VELOCITY

RUN= 515

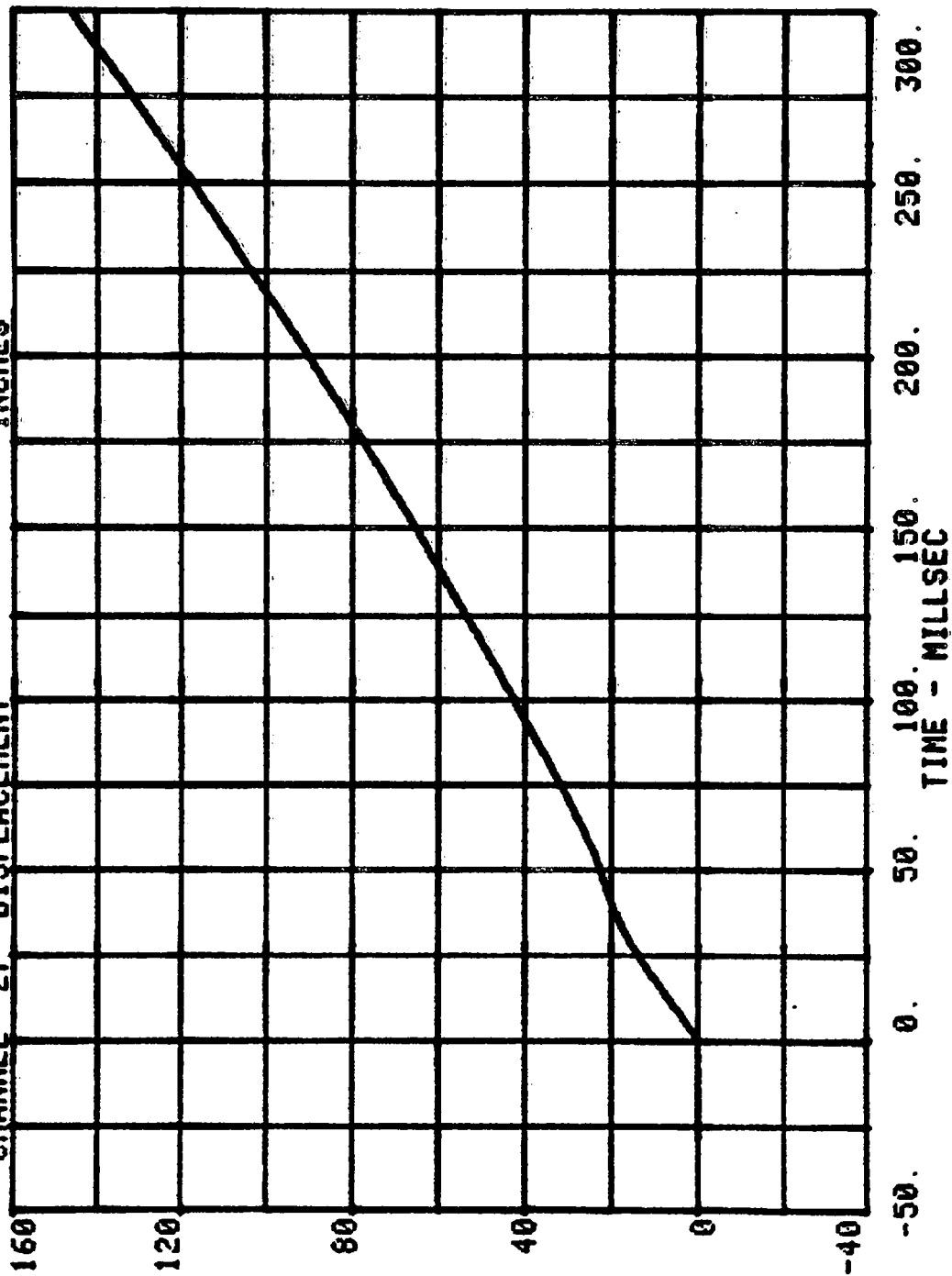
SERIES=

2

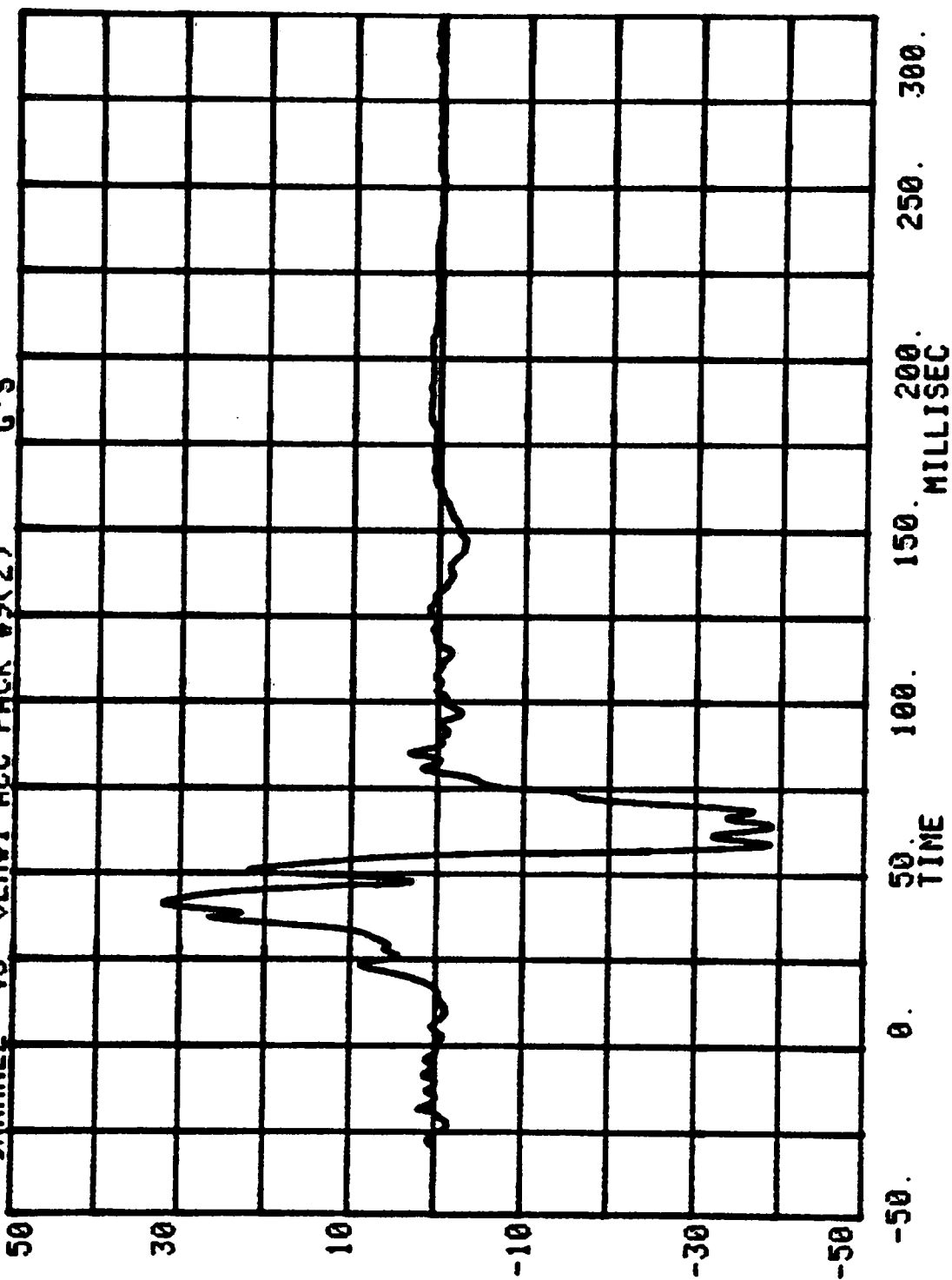
MPH VEHICLE #1 ACCELEROMETER PACK #9(X)

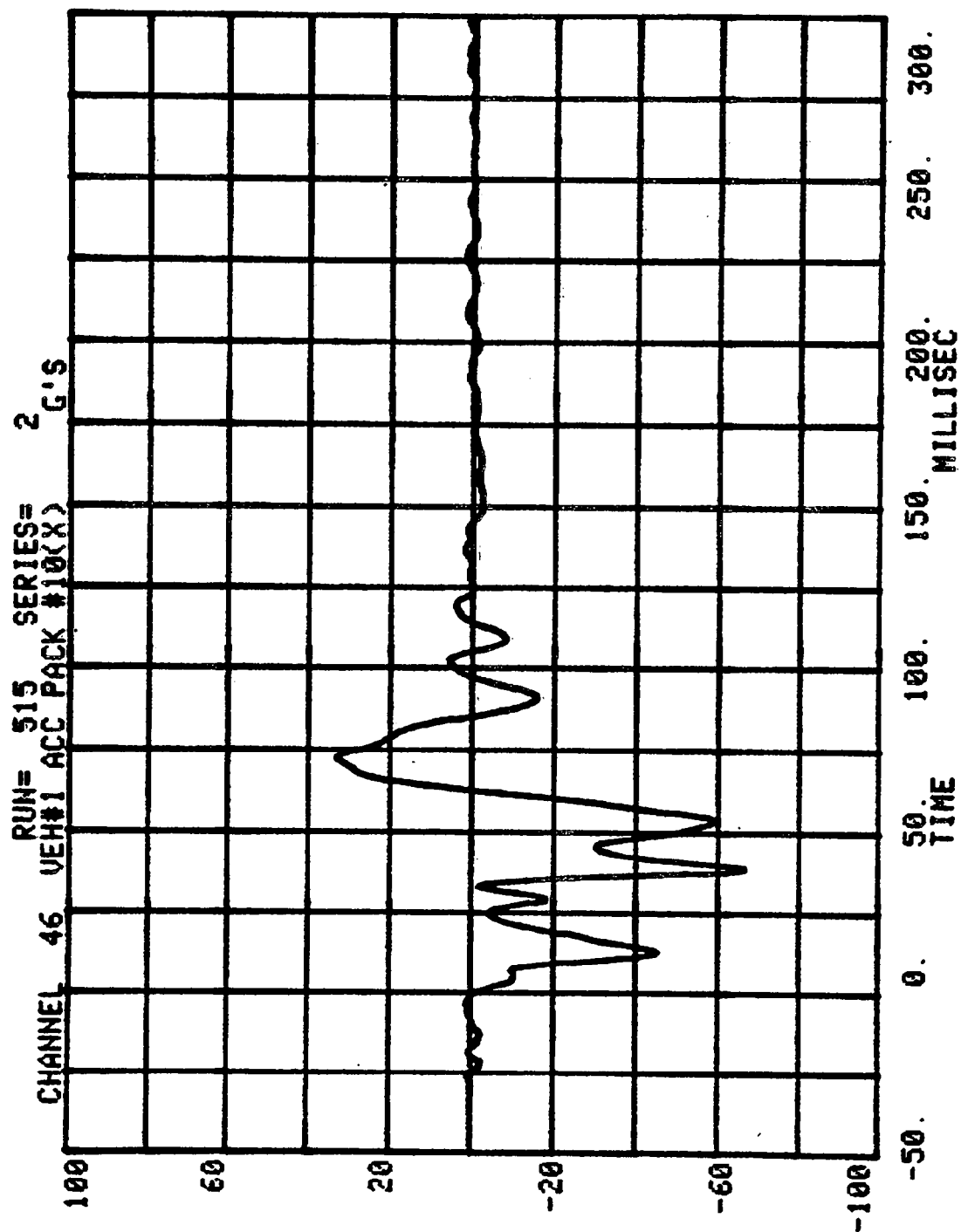


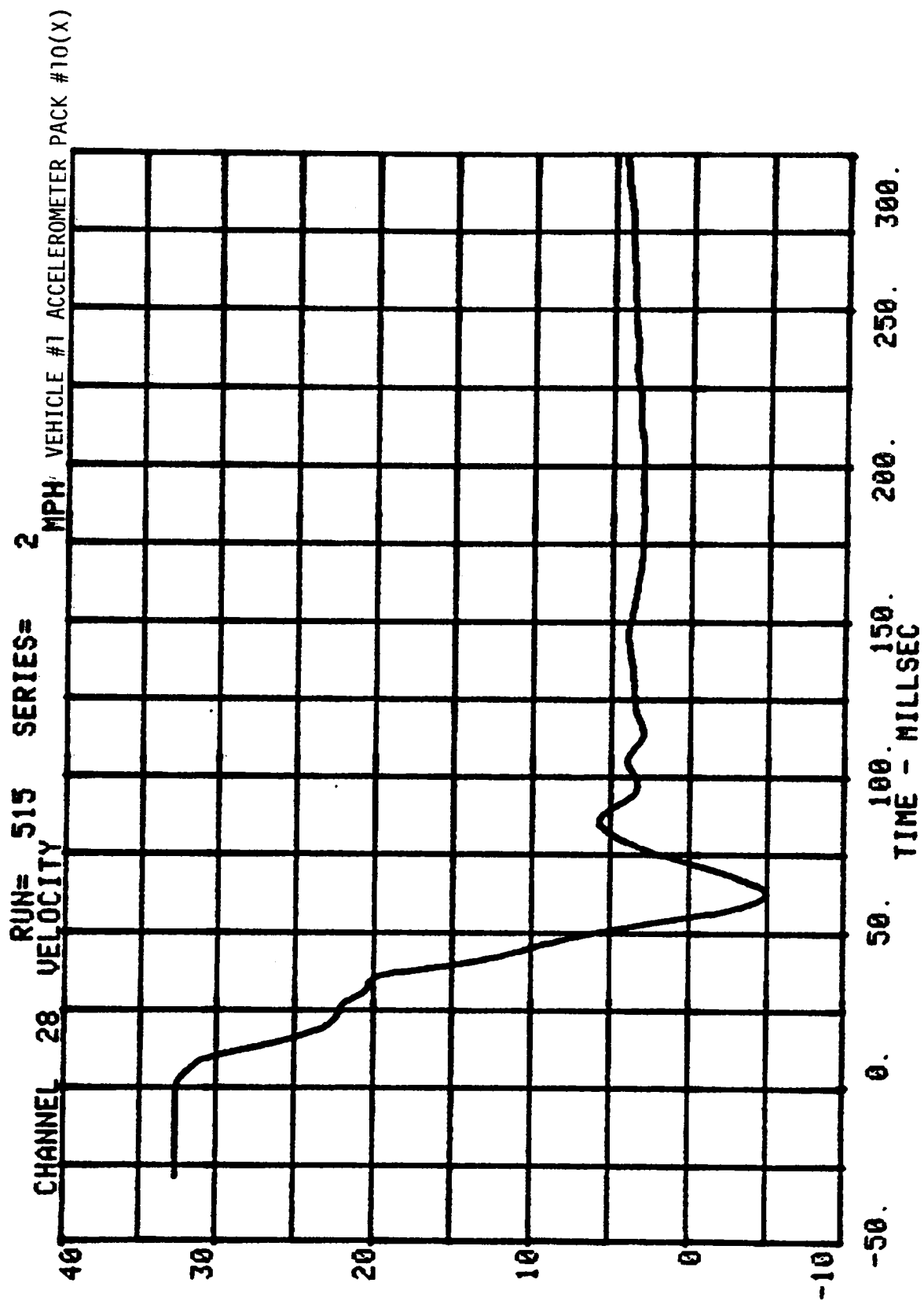
CHANNEL 27 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #9(X)



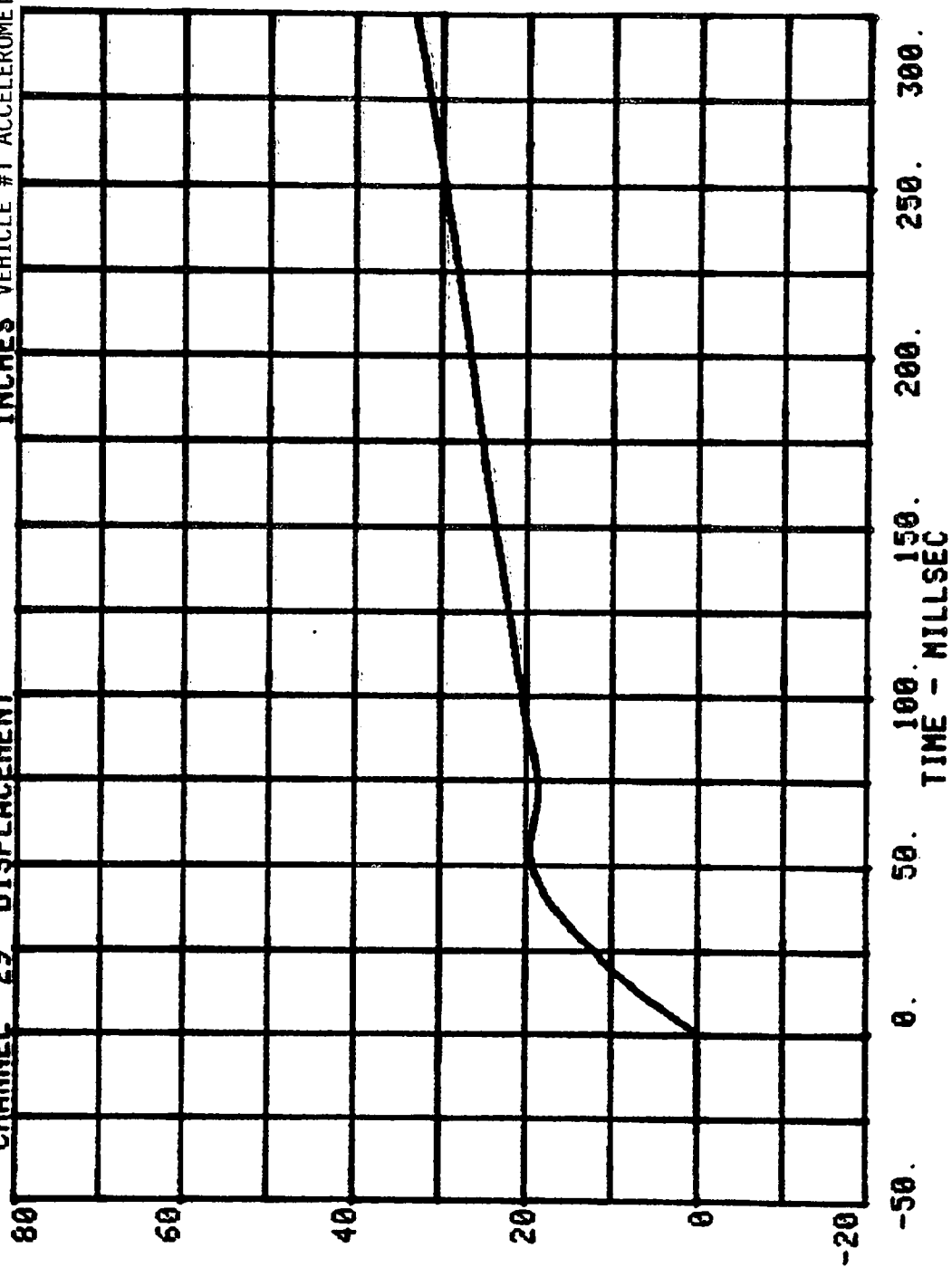
CHANNEL 45 RUN= 515 SERIES= 2
VEH#1 ACC PACK #9(Z) G'S

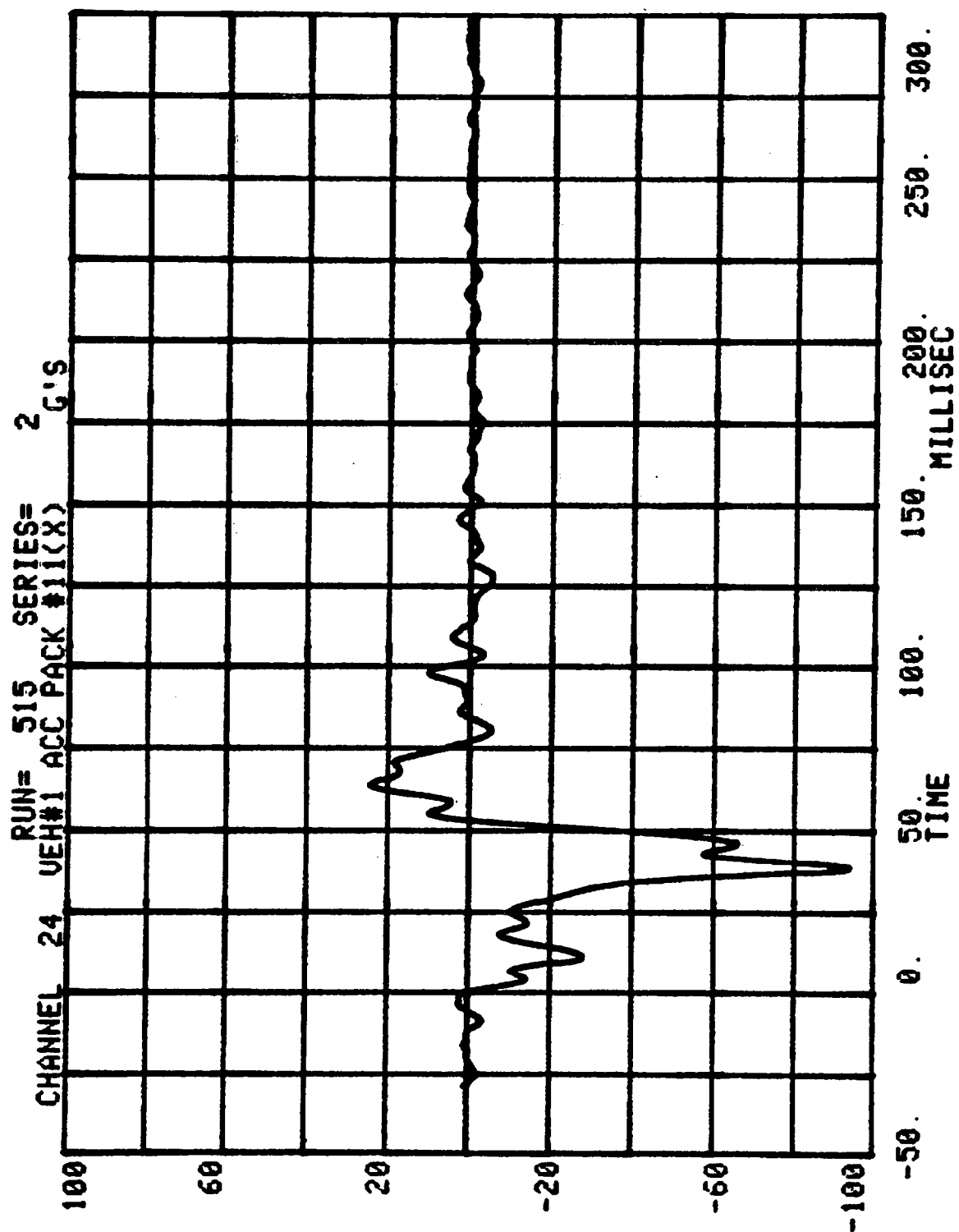


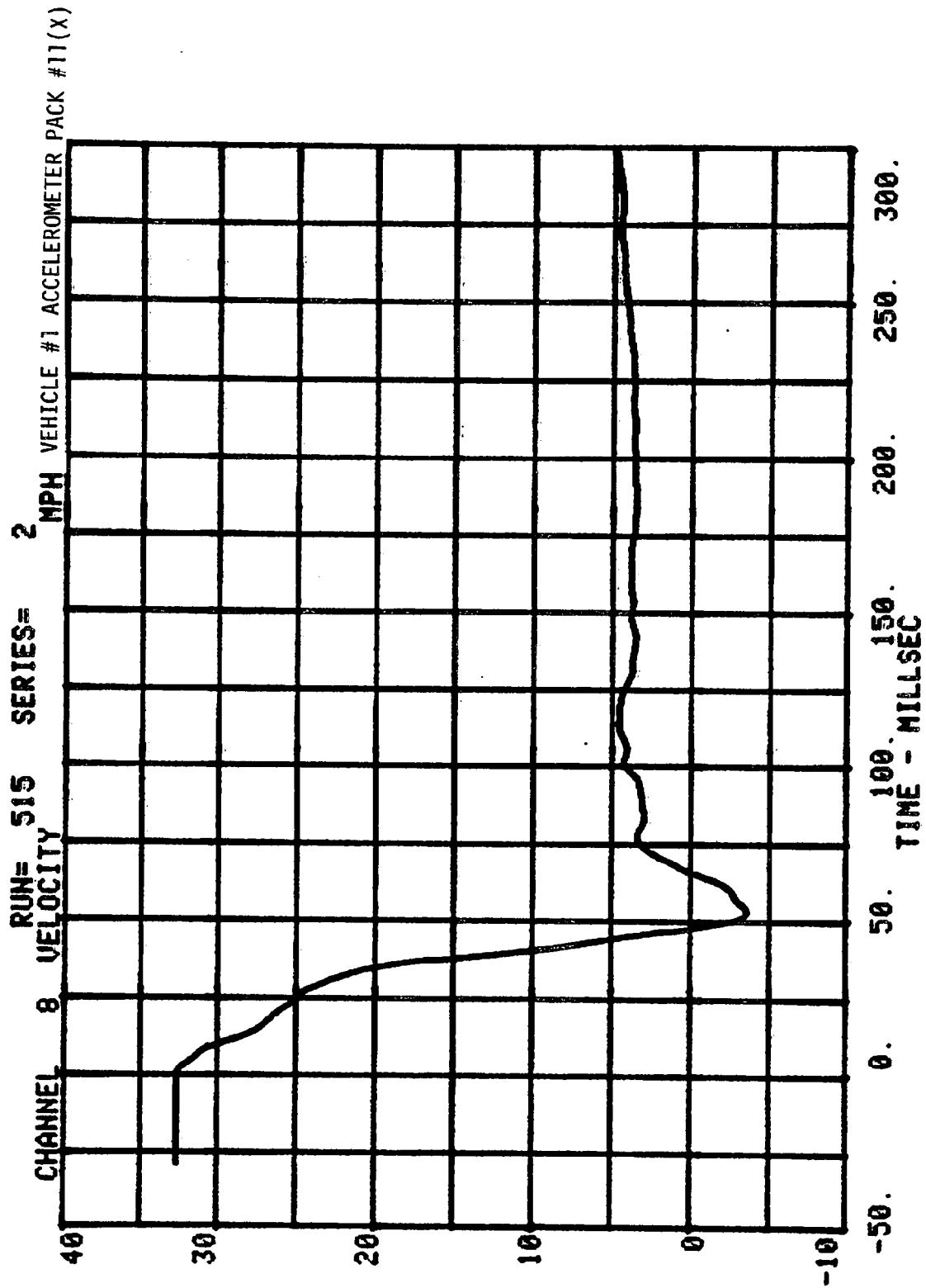


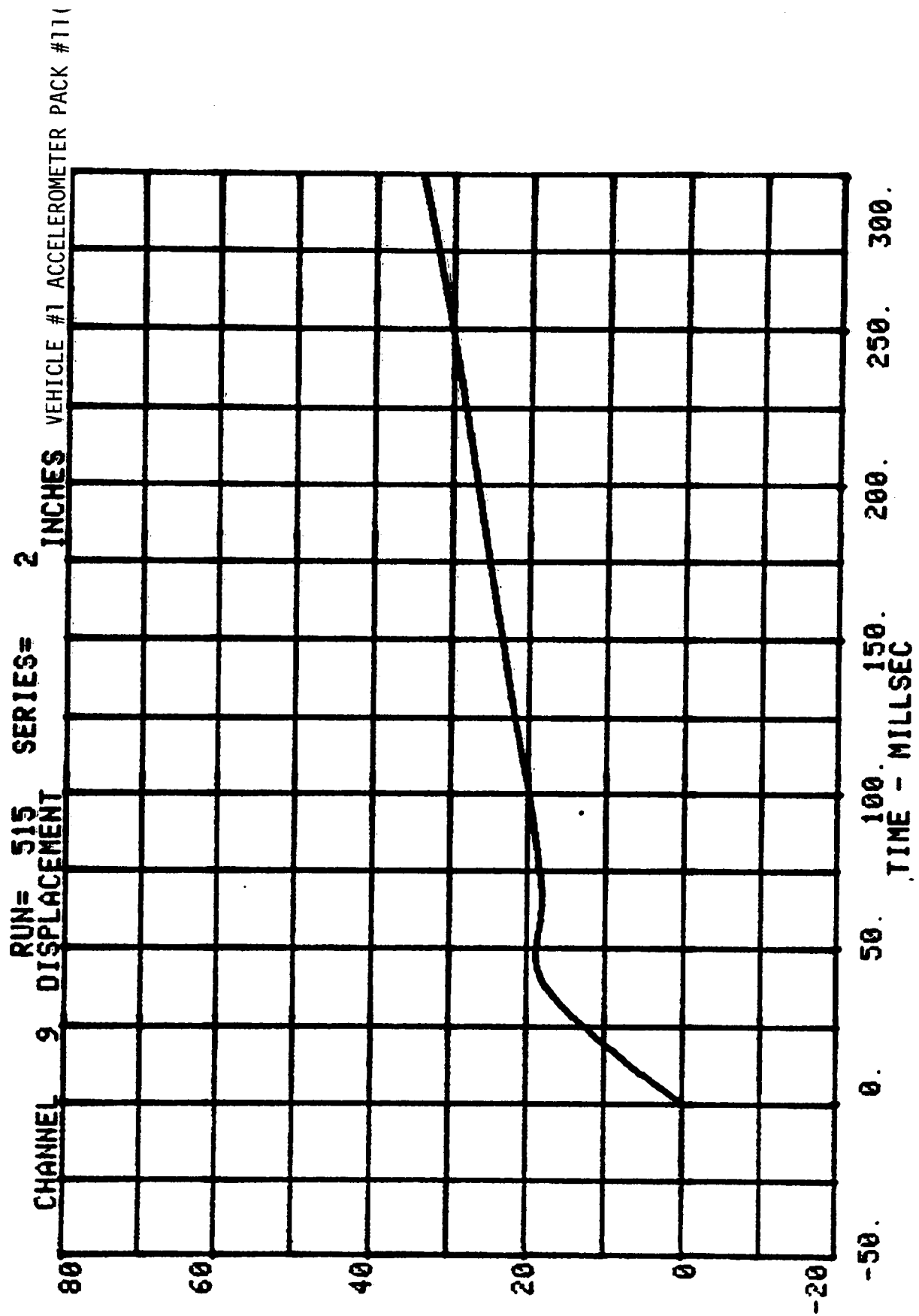


CHANNEL 29 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #10(X)

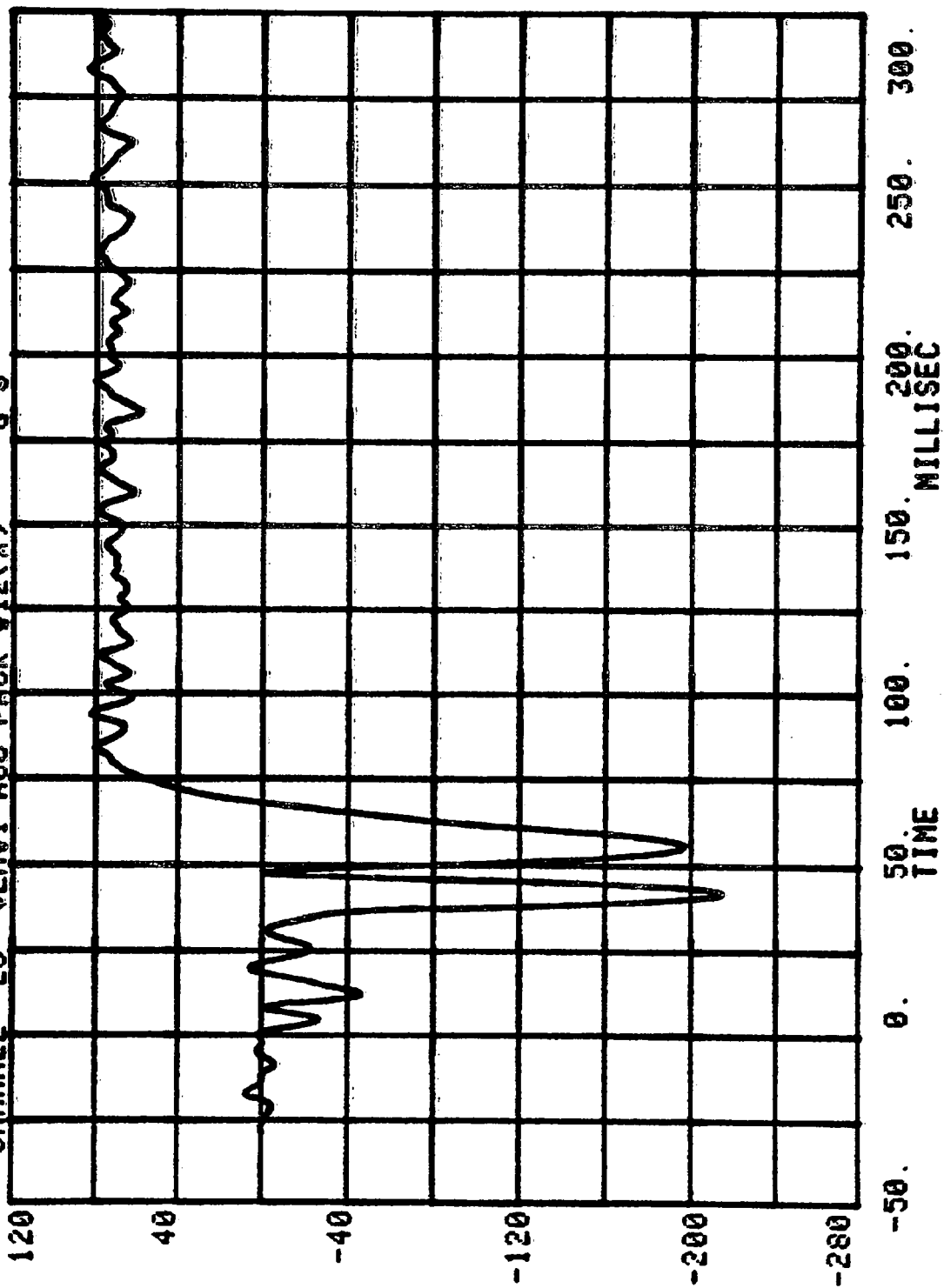


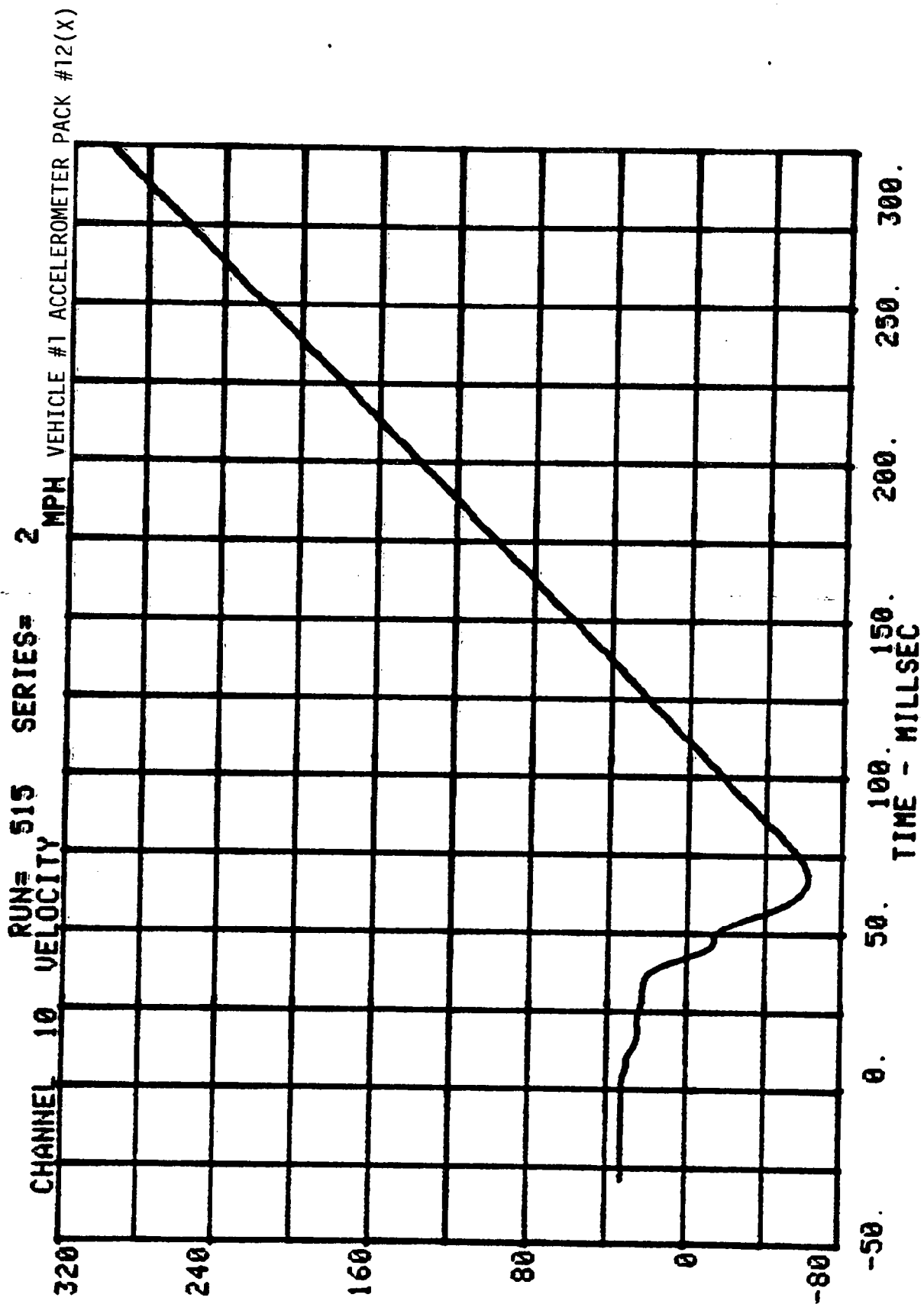




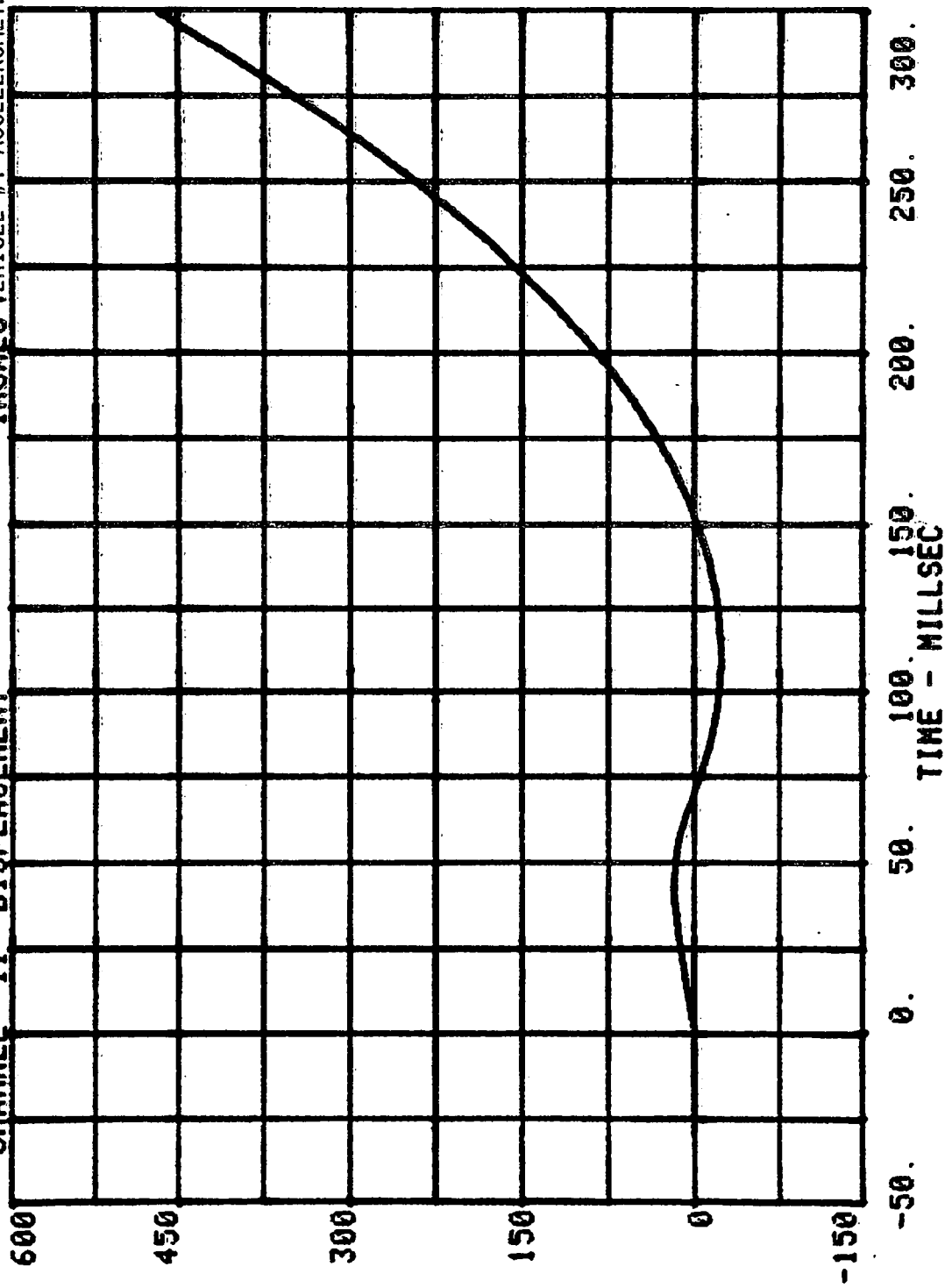


CHANNEL 25 RUN= 315 SERIES= 2 G'S
VEH#1 ACC PACK #12(X)

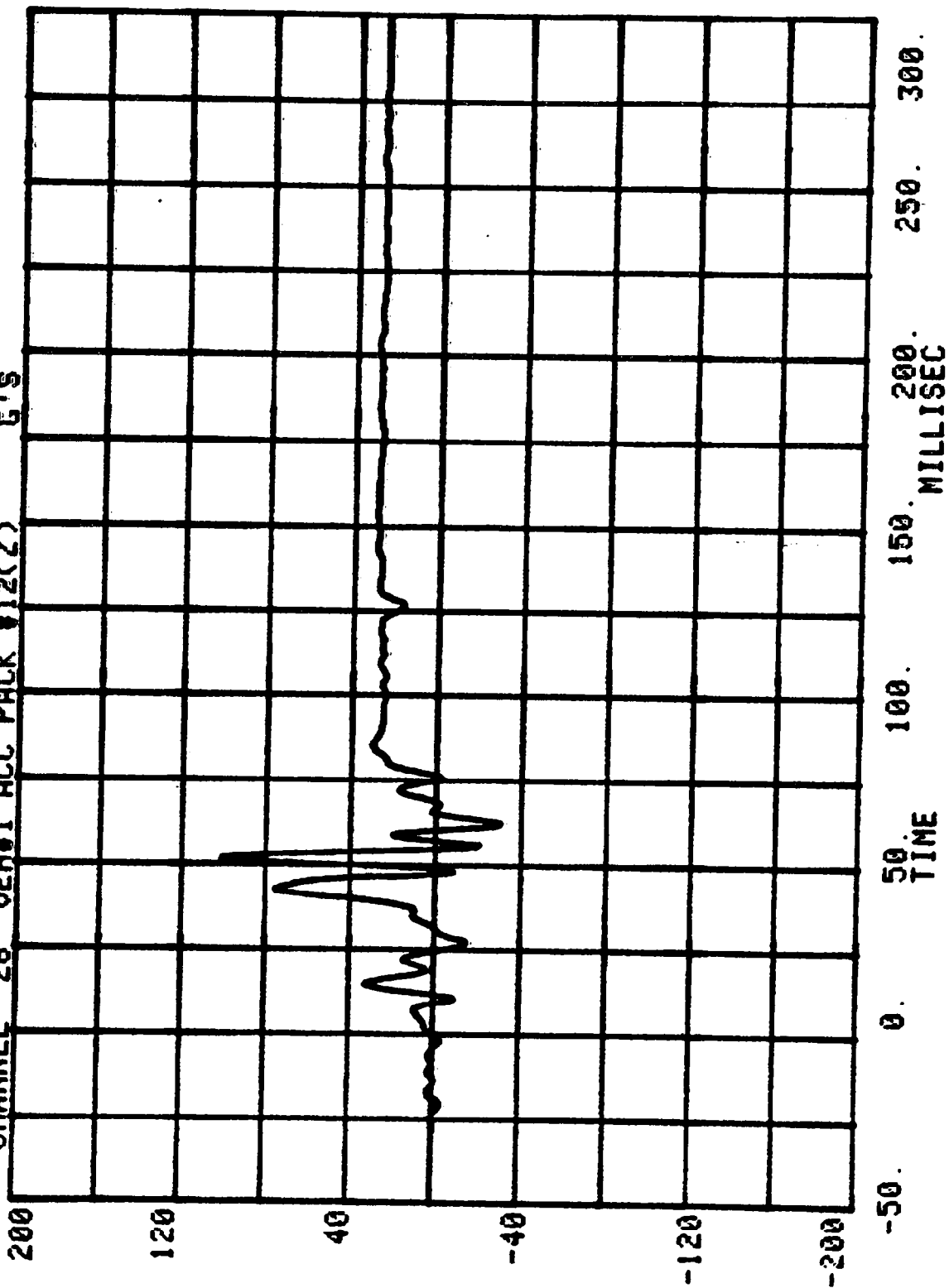




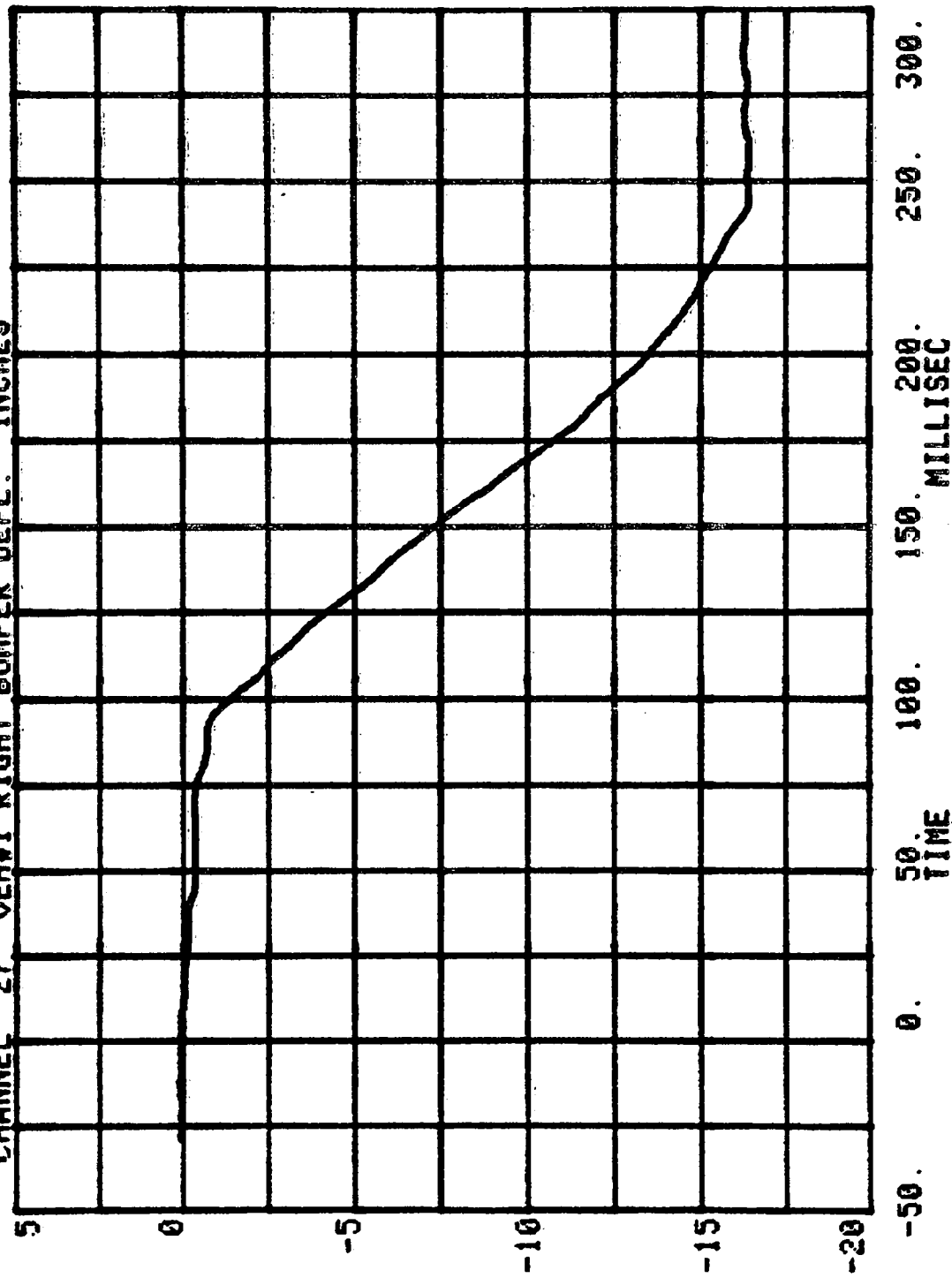
CHANNEL 11 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #1 ACCELEROMETER PACK #12(X)



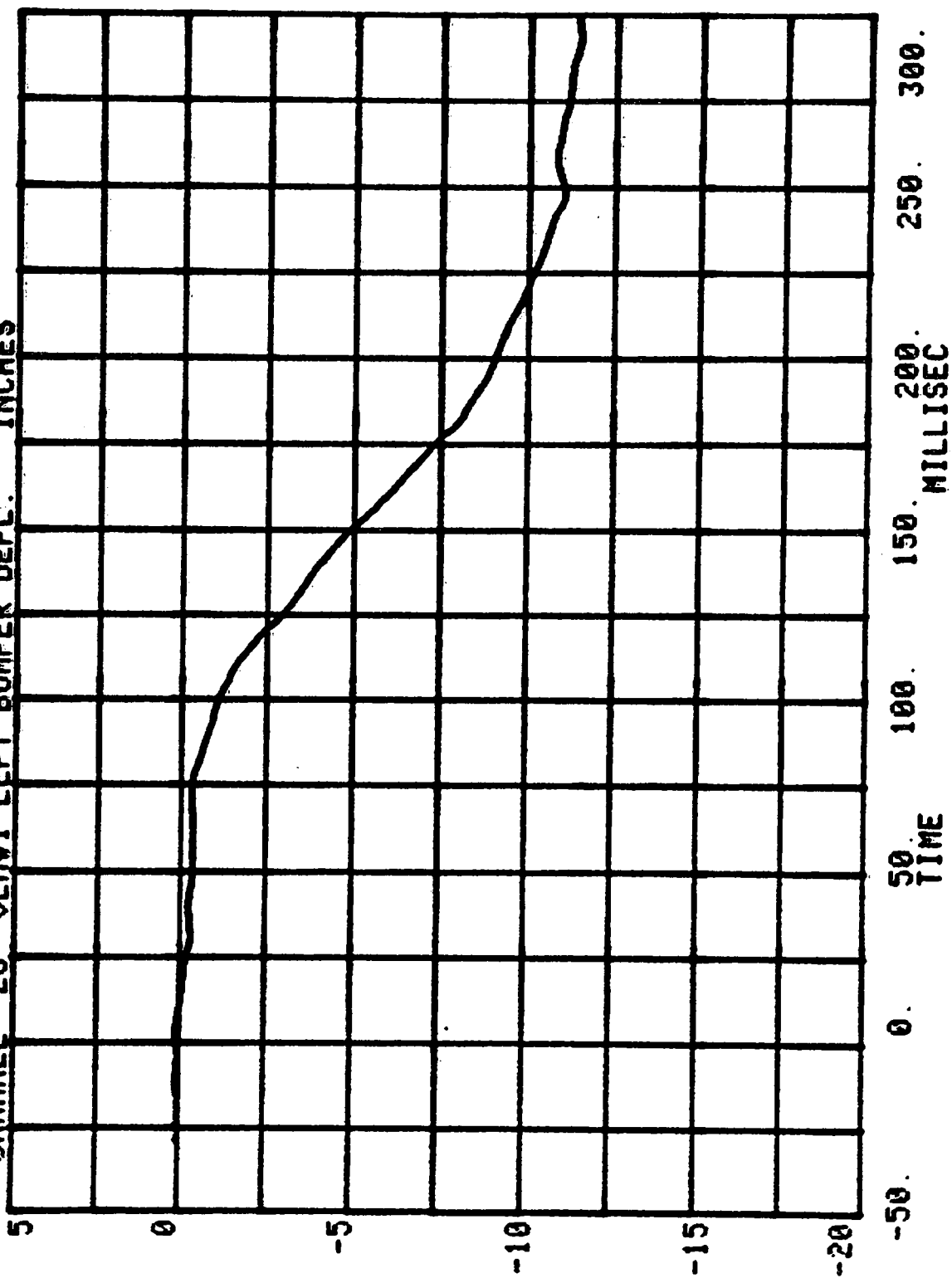
RUN= 515 SERIES= 2
CHANNEL 26 UEH#1 ACC PACK #12(Z) G'S



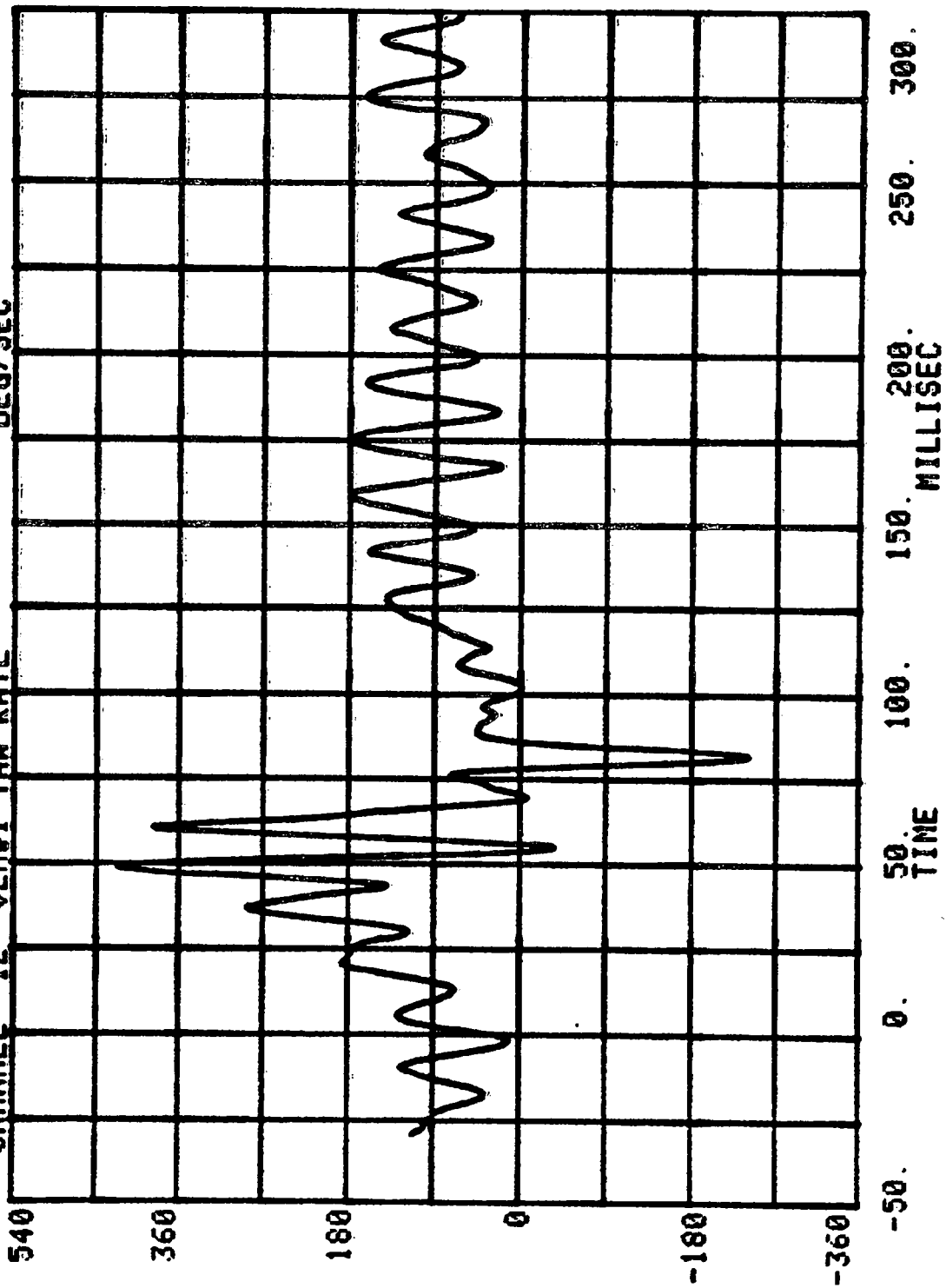
CHANNEL 27. RUN= 515. SERIES= 2. INCHES
VEH#1 RIGHT BUMPER DEFL.



CHANNEL 28 VEH#1 LEFT BUMPER DEFL. 2 INCHES



CHANNEL 12 RUN= 515 SERIES= 2
VEH#1 YAW RATE DEG/SEC

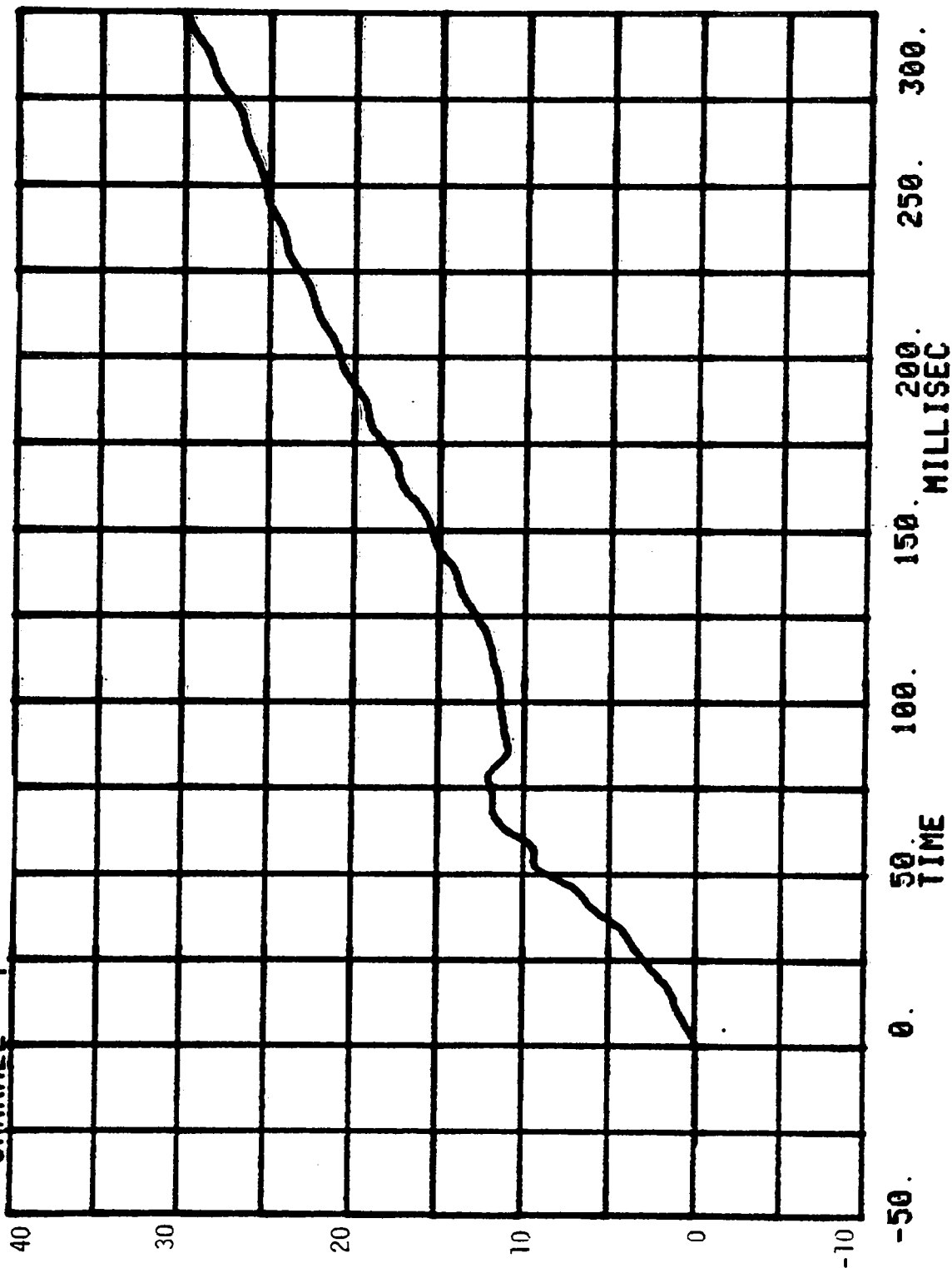


VEHICLE #1 YAW DEGREES

RUN= 515 SERIES= 2

CHANNEL 7

DEGREES



TEST NO. 616-2-515

MOVING DEFORMABLE BARRIER

VEHICLE NO. 2

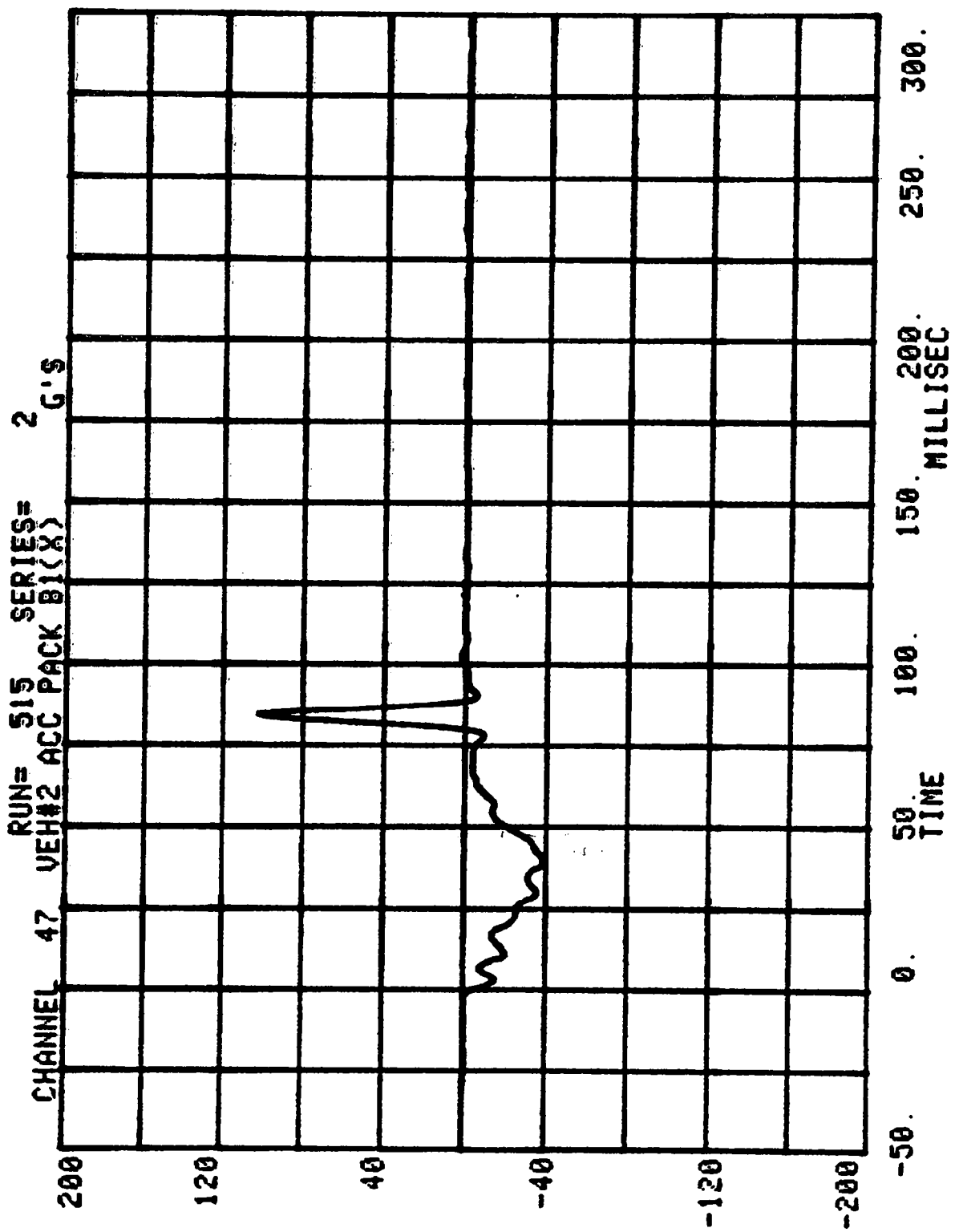
VEHICLE DATA

FILTER CHANNEL CLASS

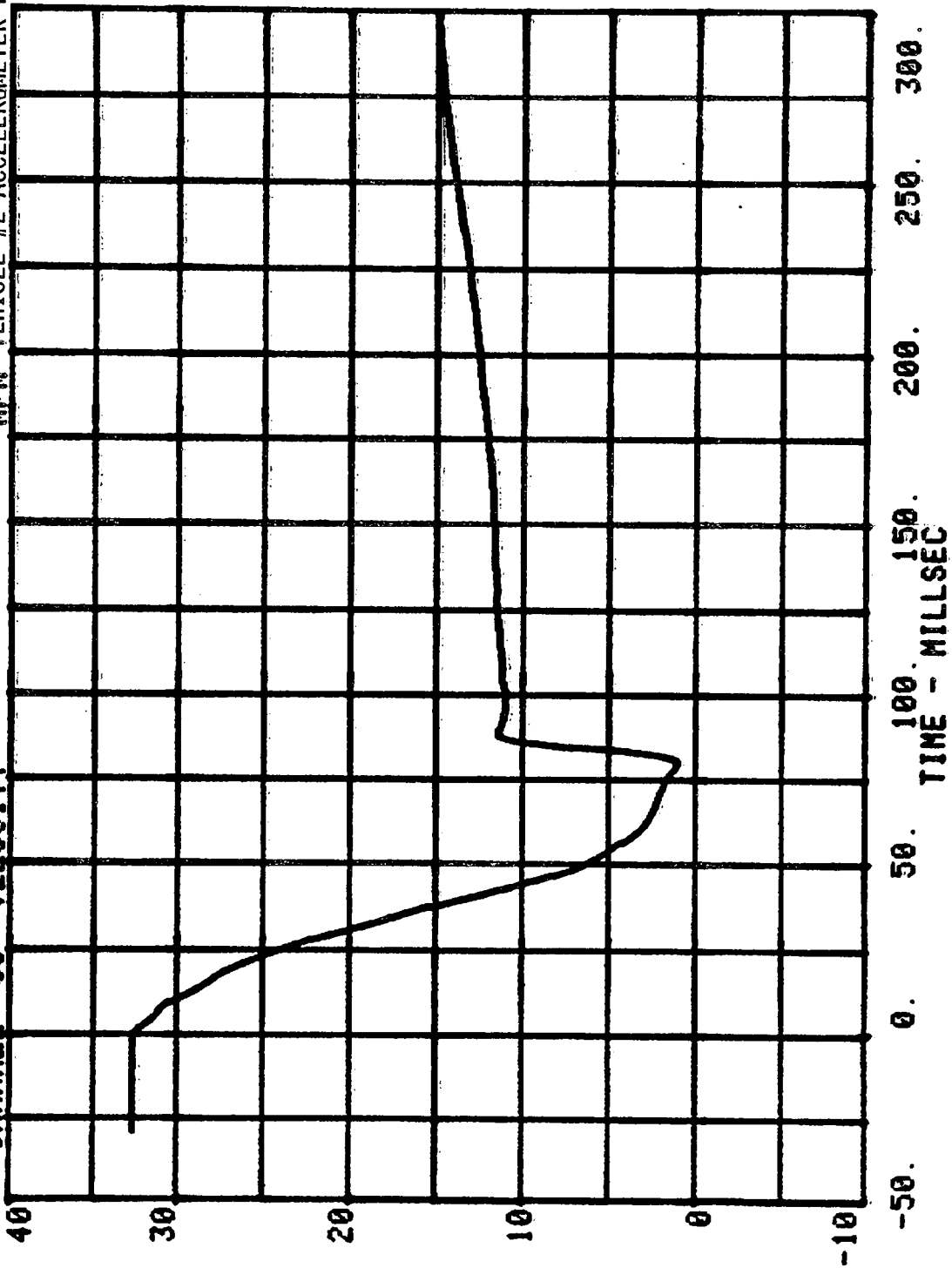
60

B-50

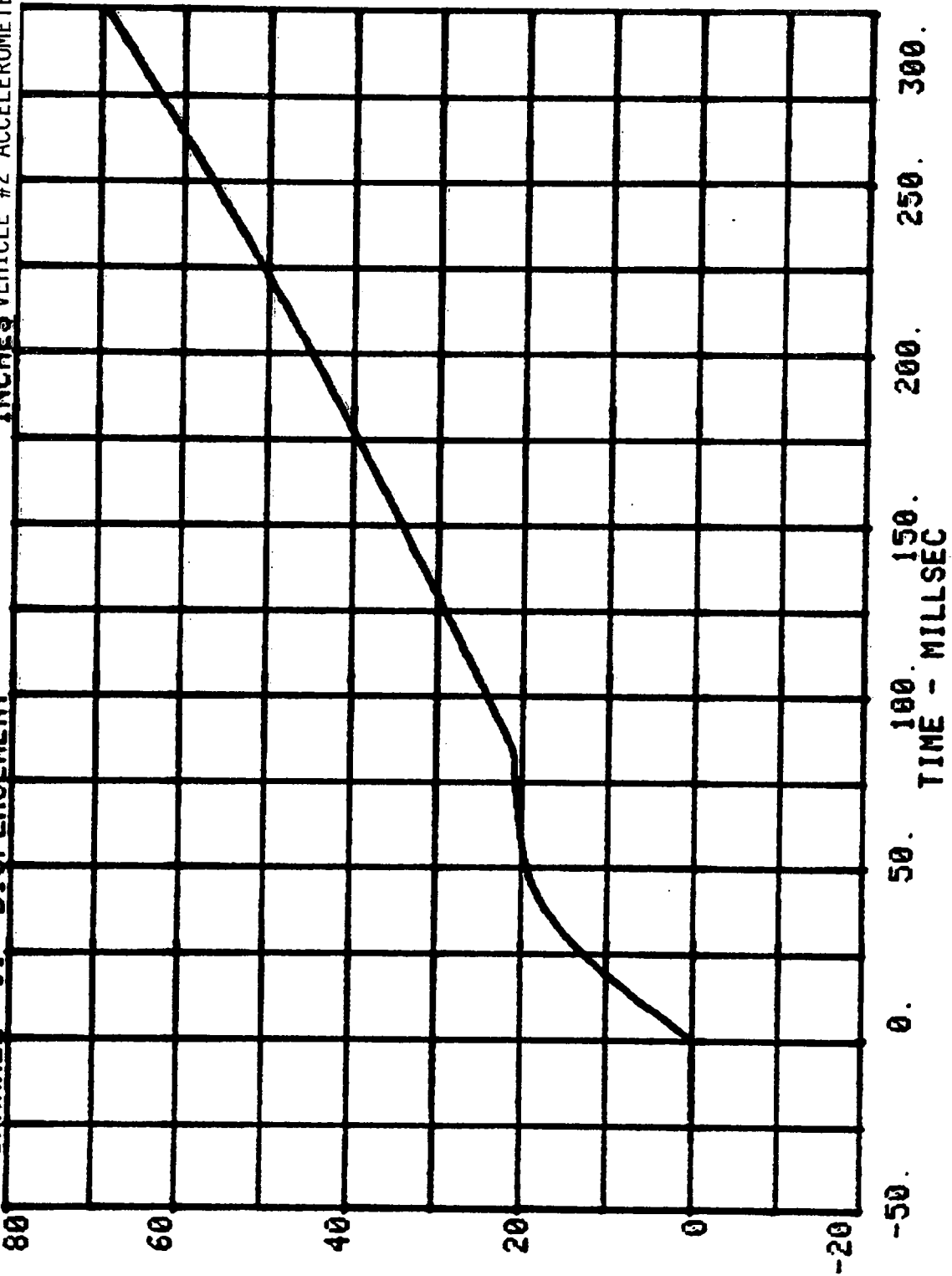
6706-V-2



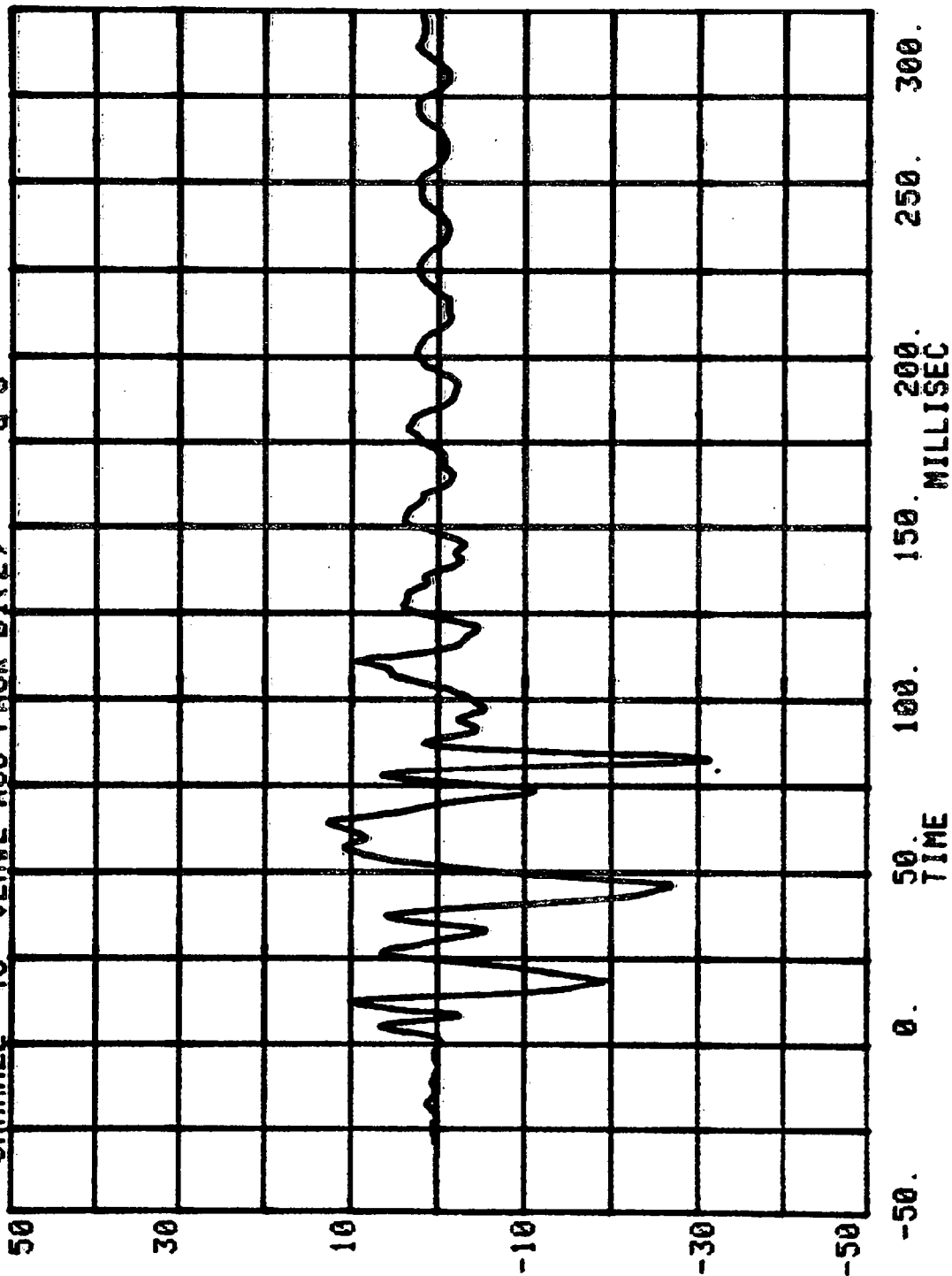
RUN= 515 SERIES= 2
CHANNEL 30 VELOCITY MPH VEHICLE #2 ACCELEROMETER PACK #B1(X)

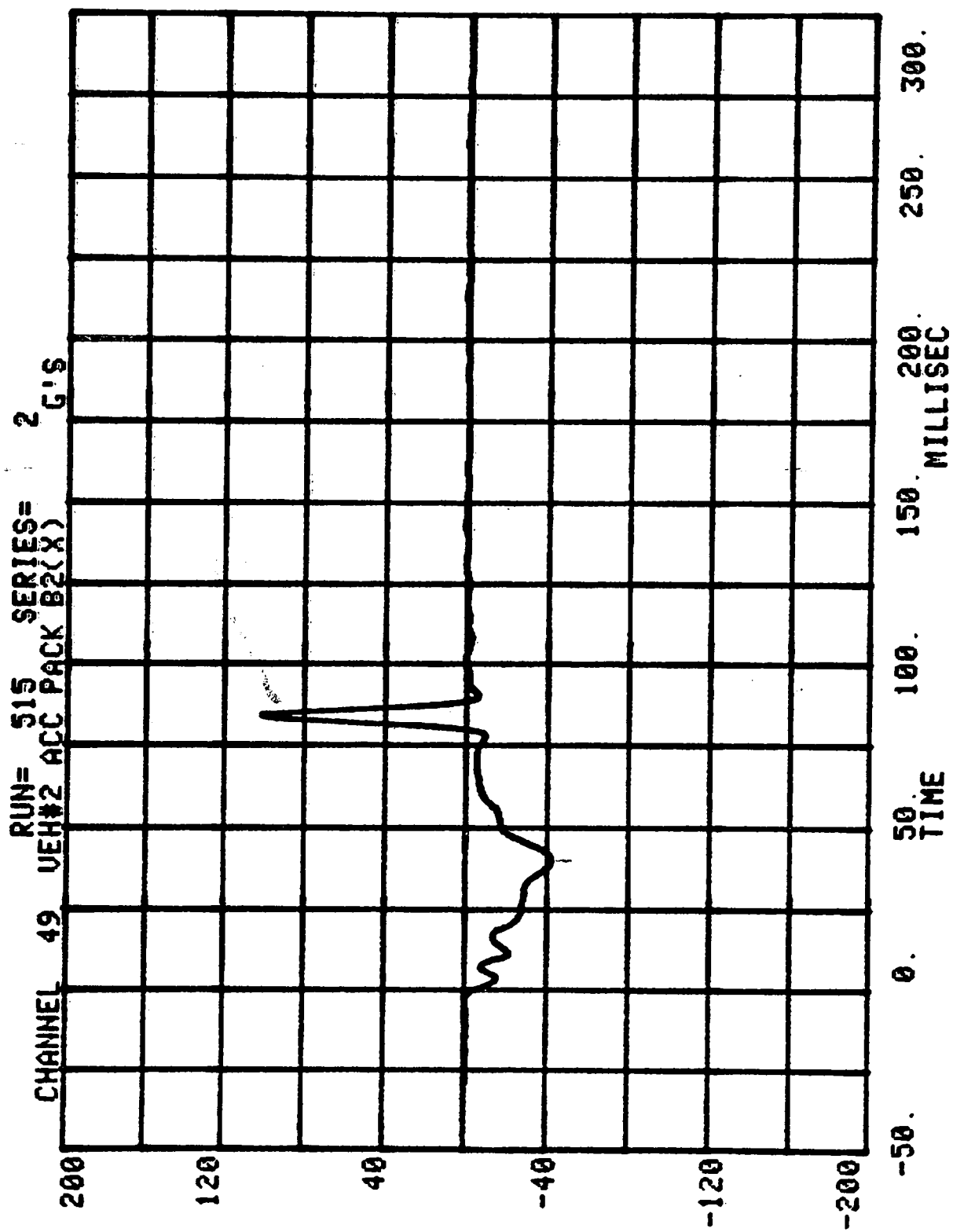


CHANNEL 31 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #2 ACCELEROMETER PACK #1

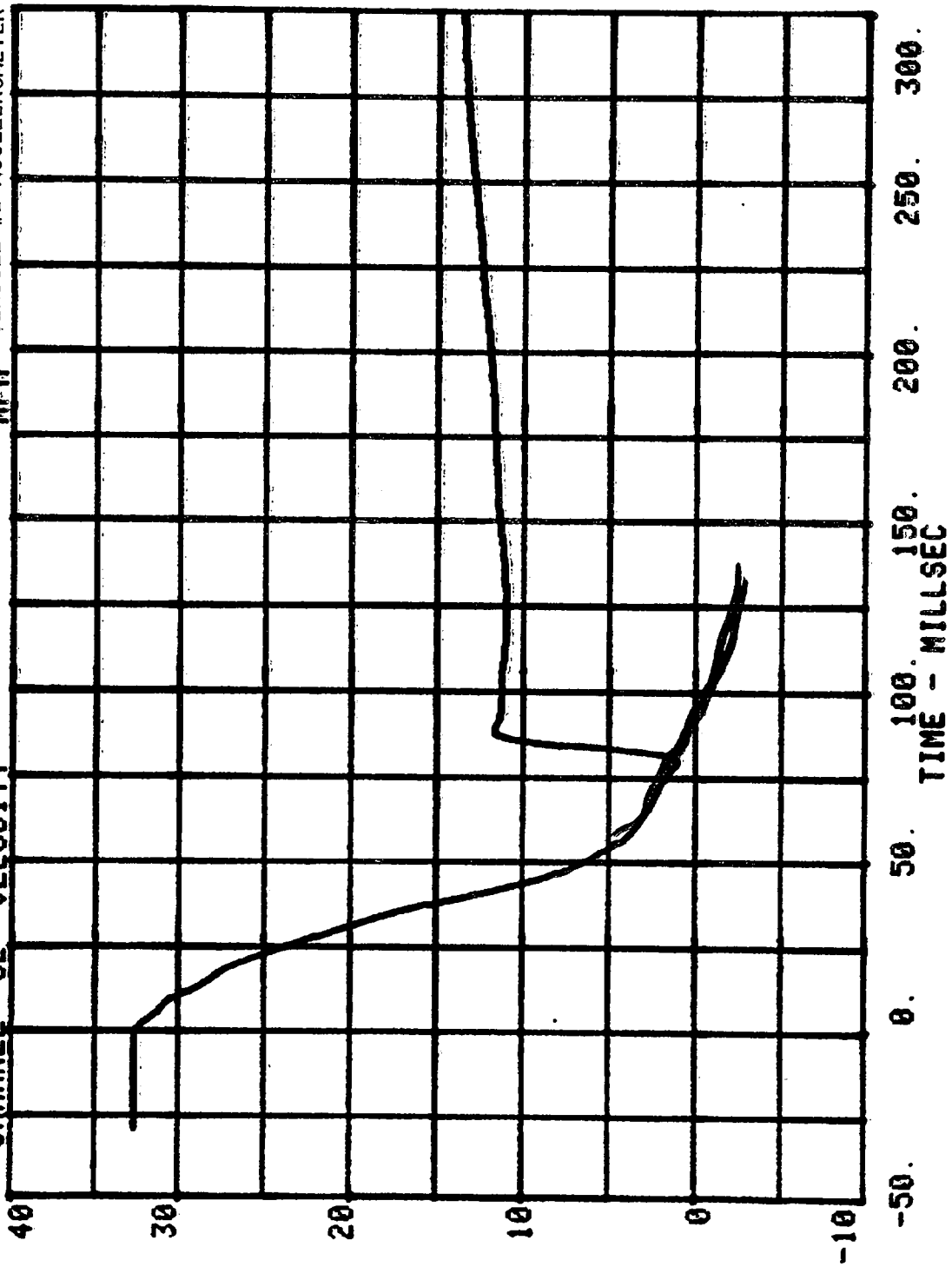


CHANNEL 48 RUN= 515 SERIES= 2
VEH#2 ACC PACK B1(Z) G'S

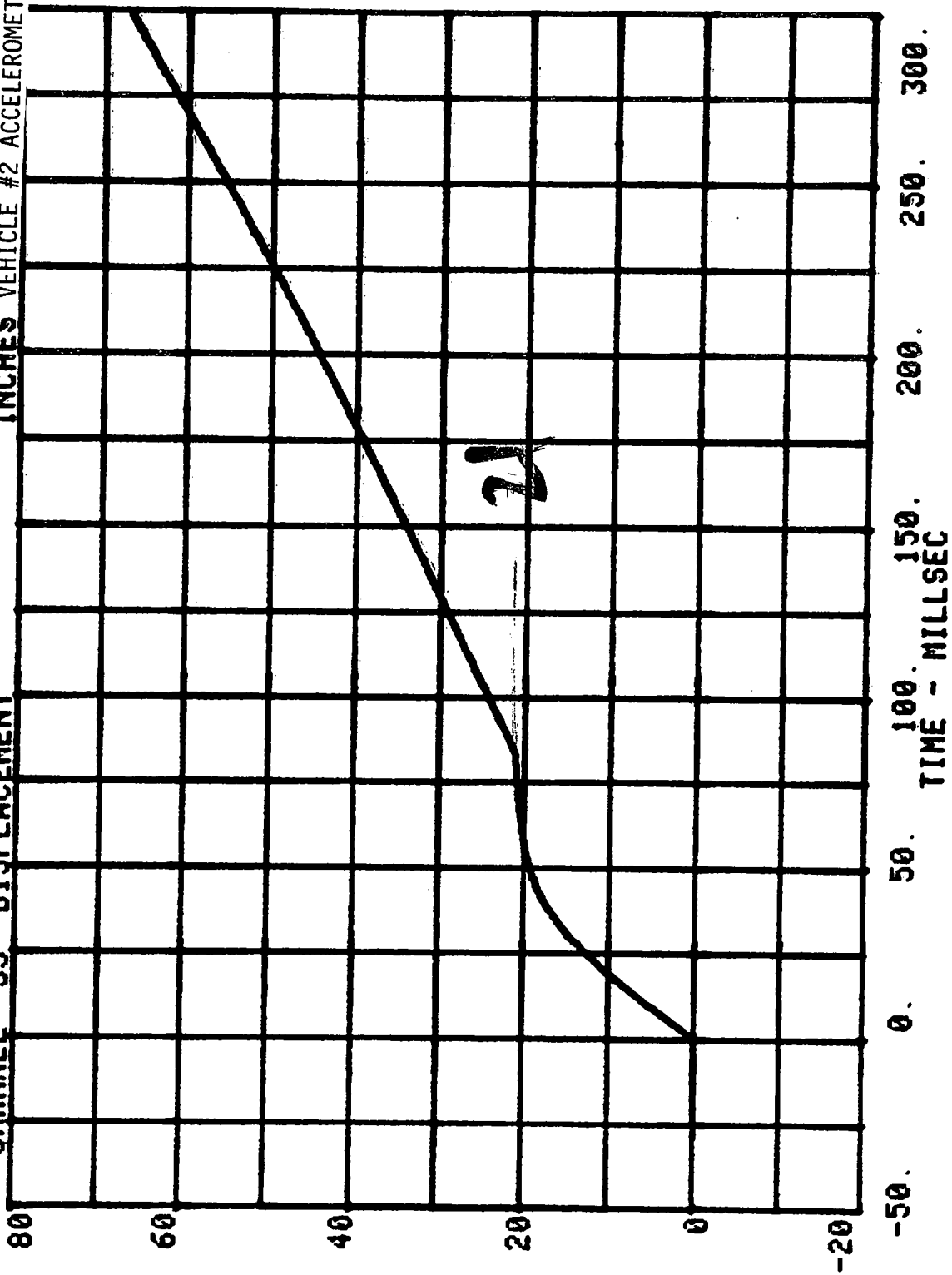




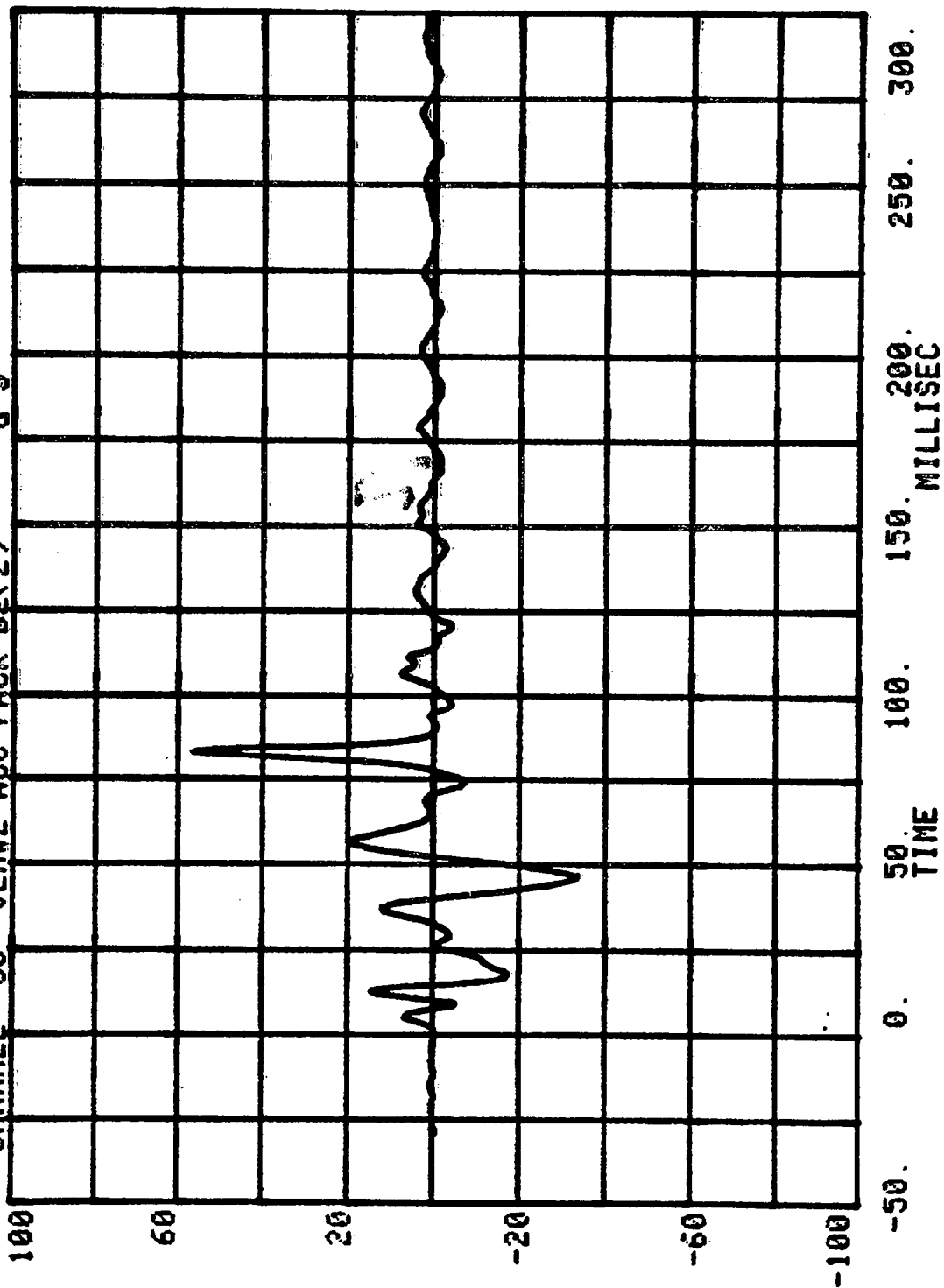
RUN= 515 SERIES= 2
CHANNEL 32 VELOCITY MPH VEHICLE #2 ACCELEROMETER PACK #B2(X)

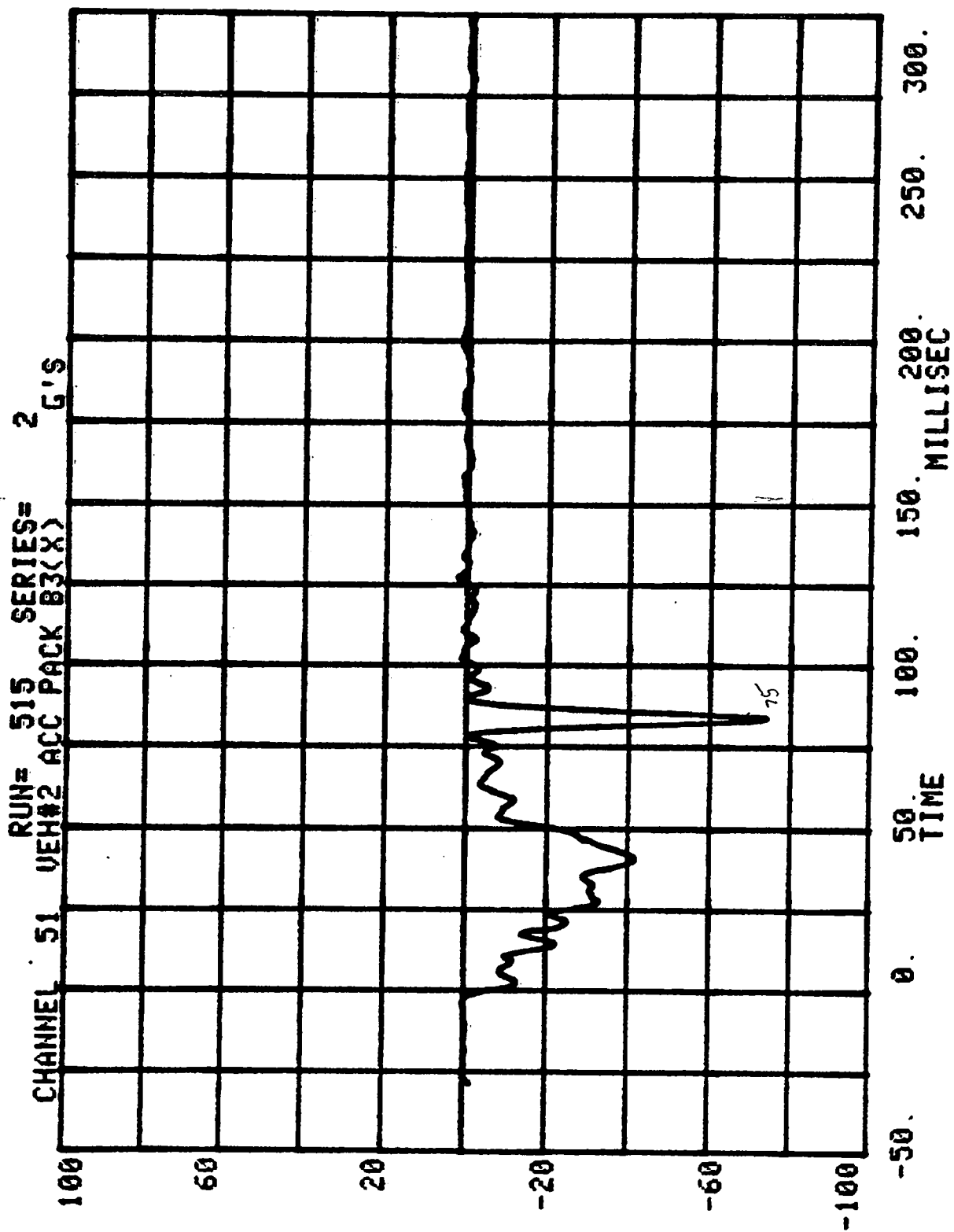


CHANNEL 33 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #2 ACCELEROMETER PACK #B;

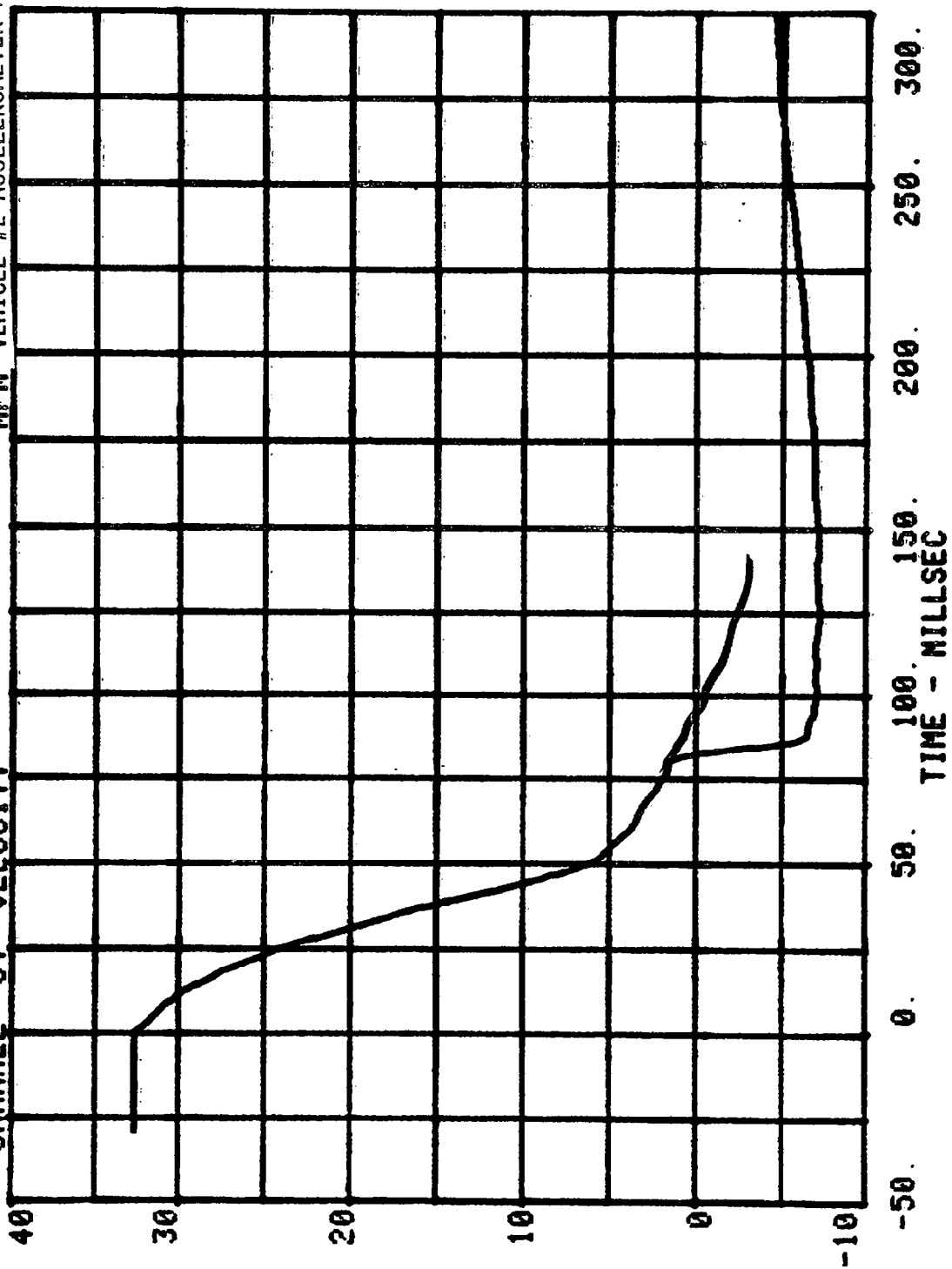


RUN= 515 SERIES= 2
CHANNEL 50 VEH#2 ACC PACK B2(Z) G'S

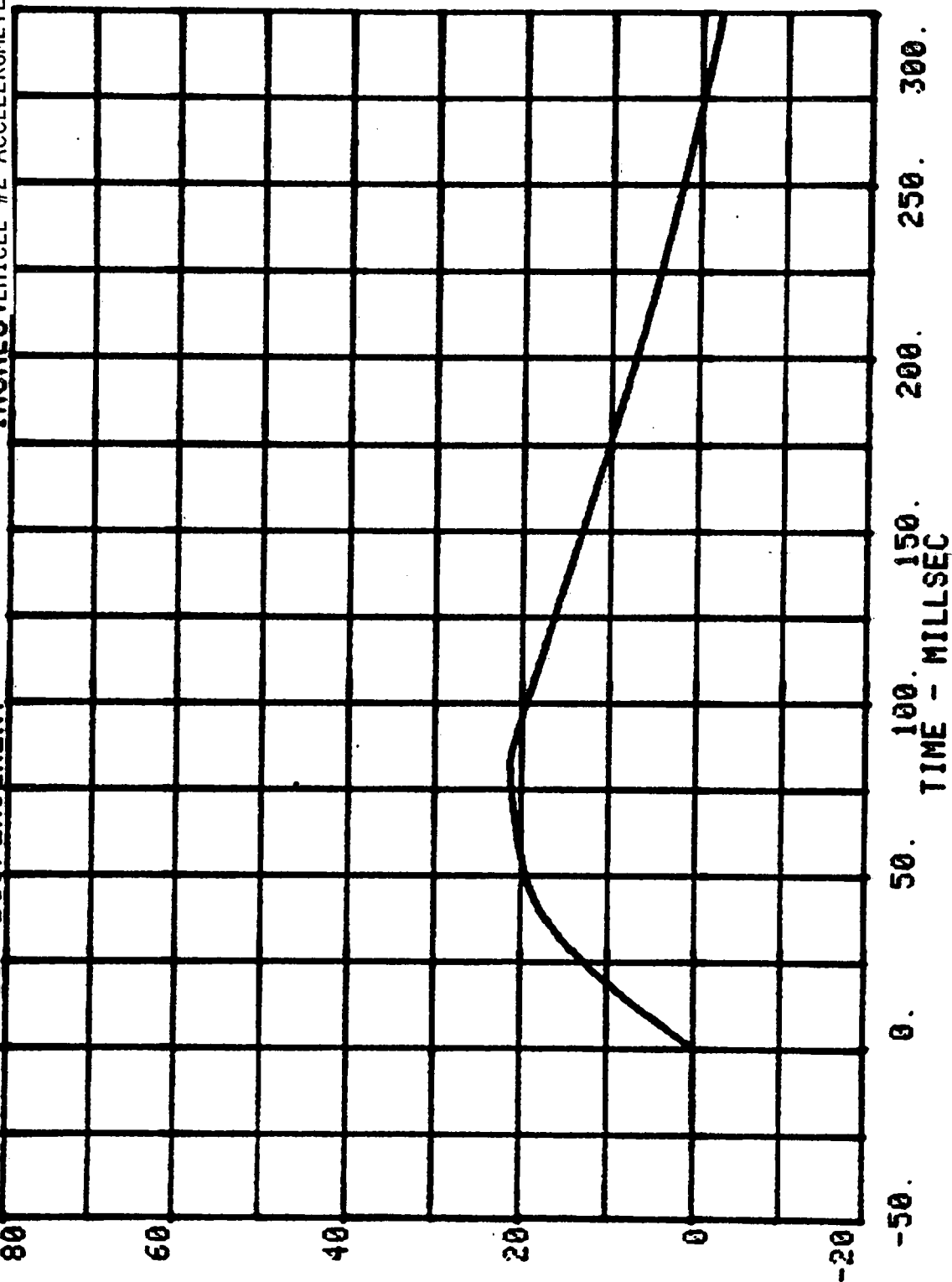




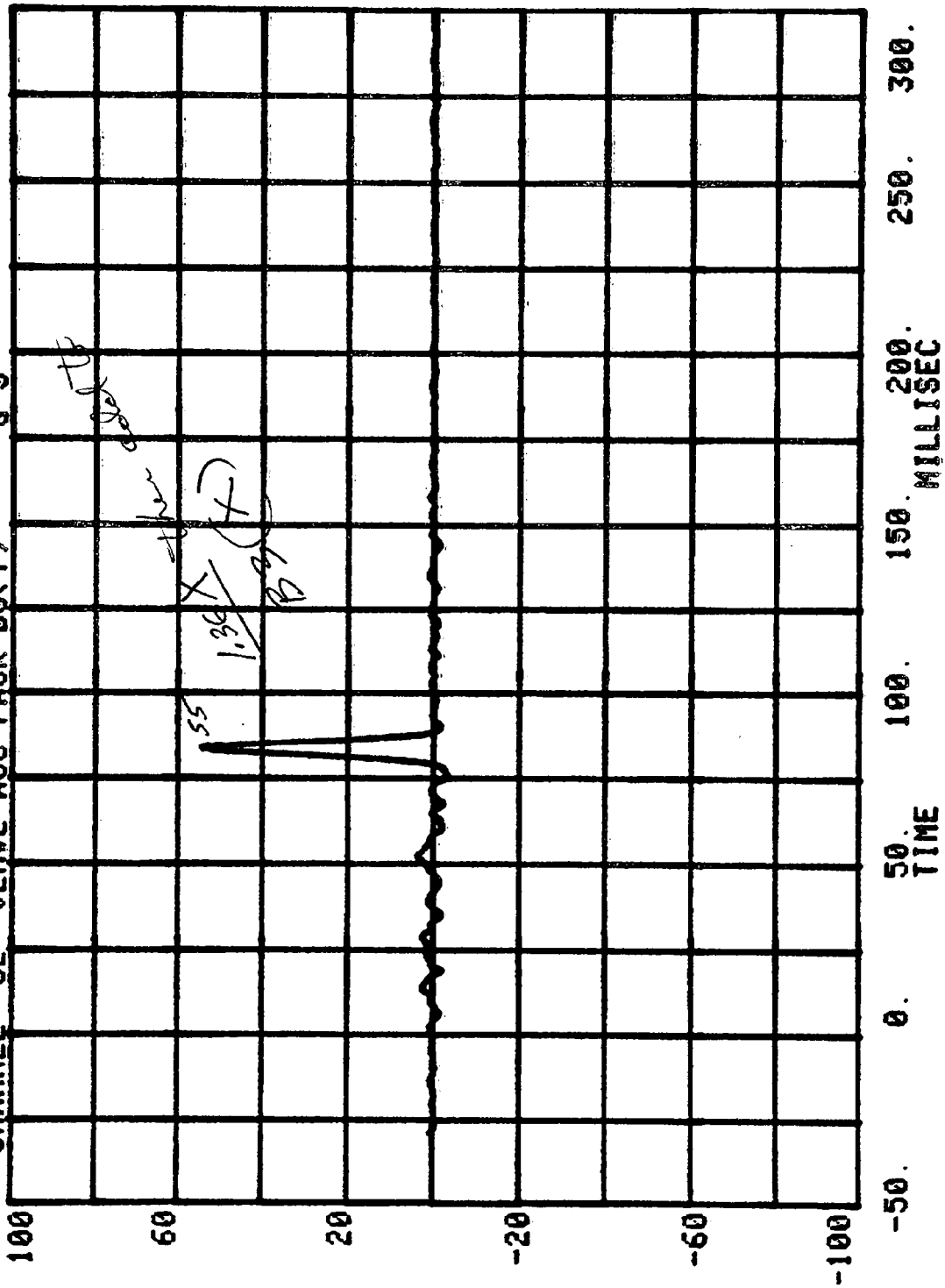
CHANNEL 34 VELOCITY
RUN= 515 SERIES= 2
MPH VEHICLE #2 ACCELEROMETER PACK #B3(X)



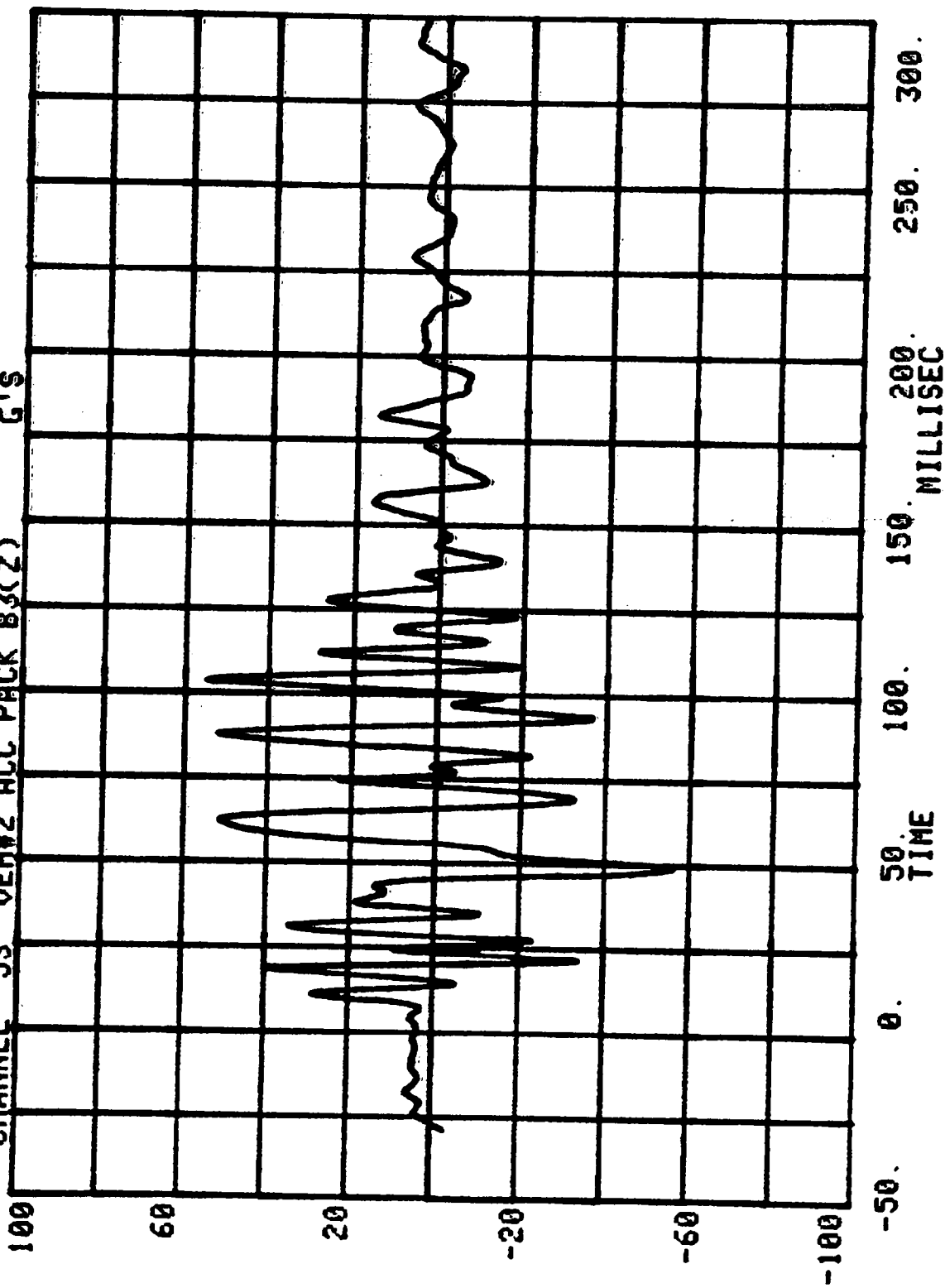
CHANNEL 35 DISPLACEMENT RUN= 515 SERIES= 2 INCHES VEHICLE #2 ACCELEROMETER PACK #1



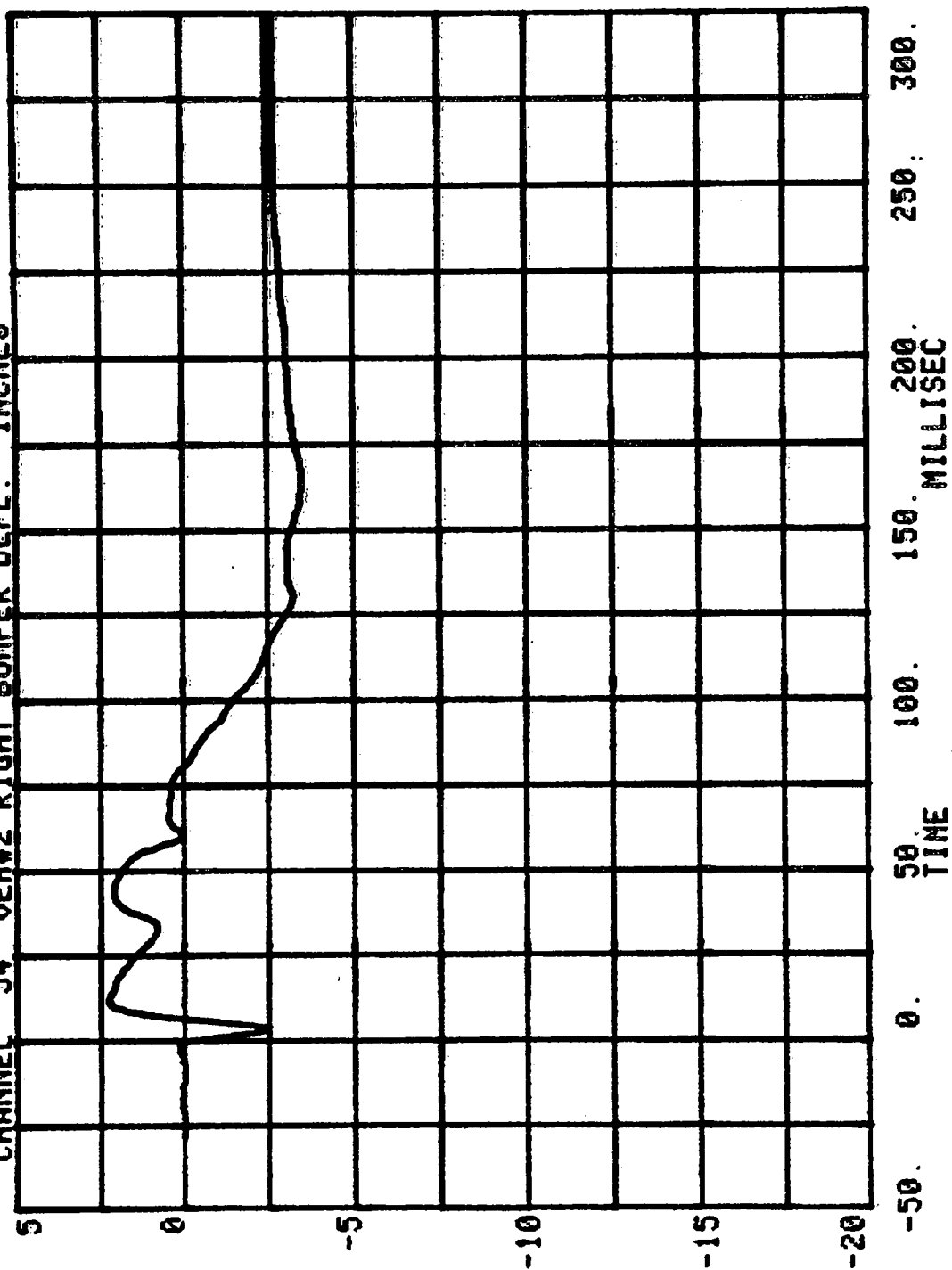
CHANNEL 52 RUN= 515 SERIES= 2 G'S
VEH#2 ACC PACK B3(Y)



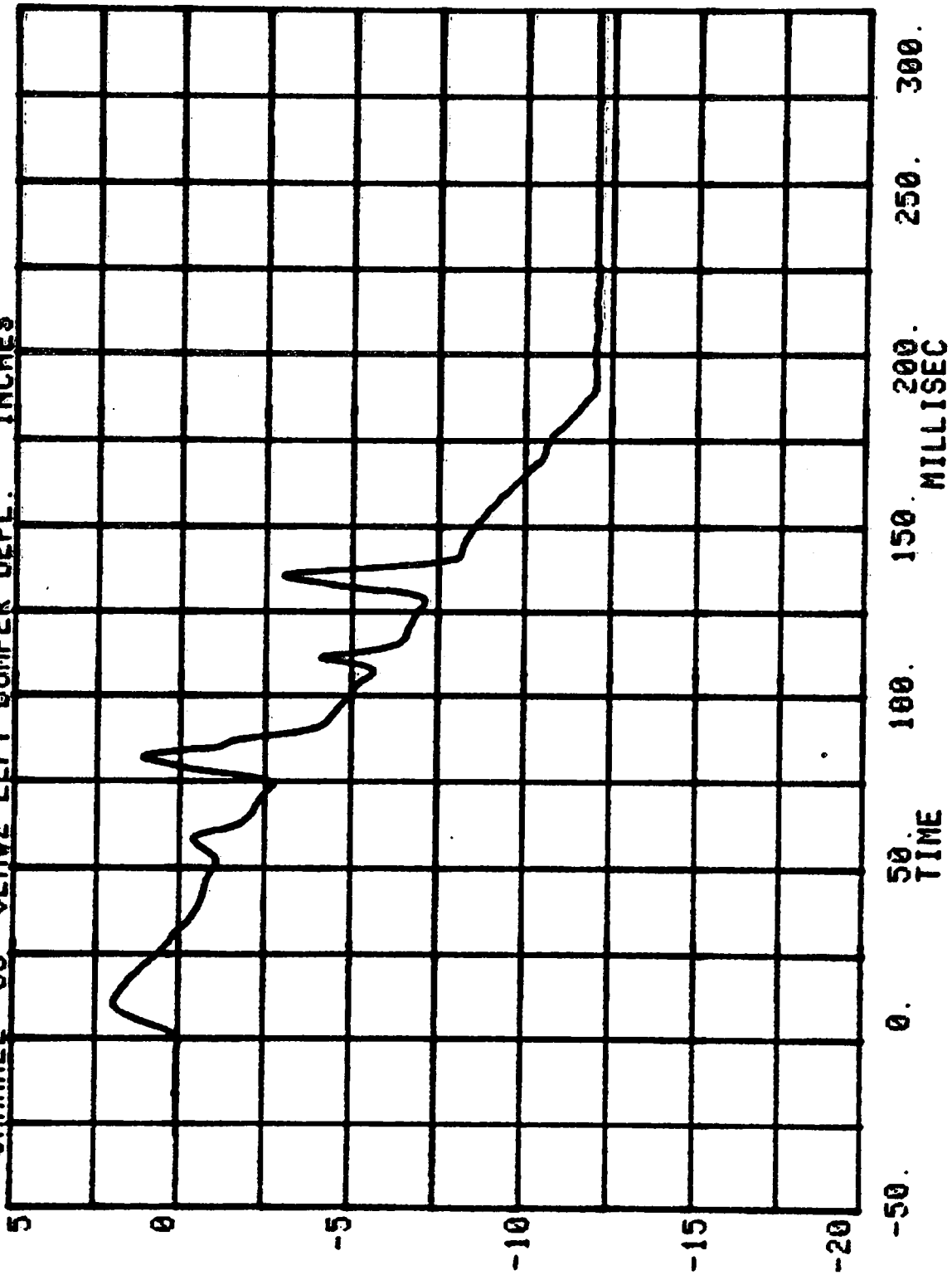
CHANNEL 53 RUN= 515 SERIES= 2 G'S
VEH#2 ACC PACK B3(Z)



CHANNEL 54 RUN= 515 SERIES= 2 INCHES
VEH#2 RIGHT BUMPER DEFL.



CHANNEL 55 RUN= 515 SERIES= 2 INCHES
VEH#2 LEFT BUMPER DEFL.



TEST NO. 616-2-515

1980 AMERICAN MOTORS CONCORD

DUMMY DATA

FILTER CHANNEL CLASS

HEAD ACCELERATIONS	1000
CHEST ACCELERATIONS	180
FEMUR FORCES	600
BELT LOADS	60

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

VEHICLE AGGRESSIVENESS CAR-TO-CAR TEST #2

RUN= 515

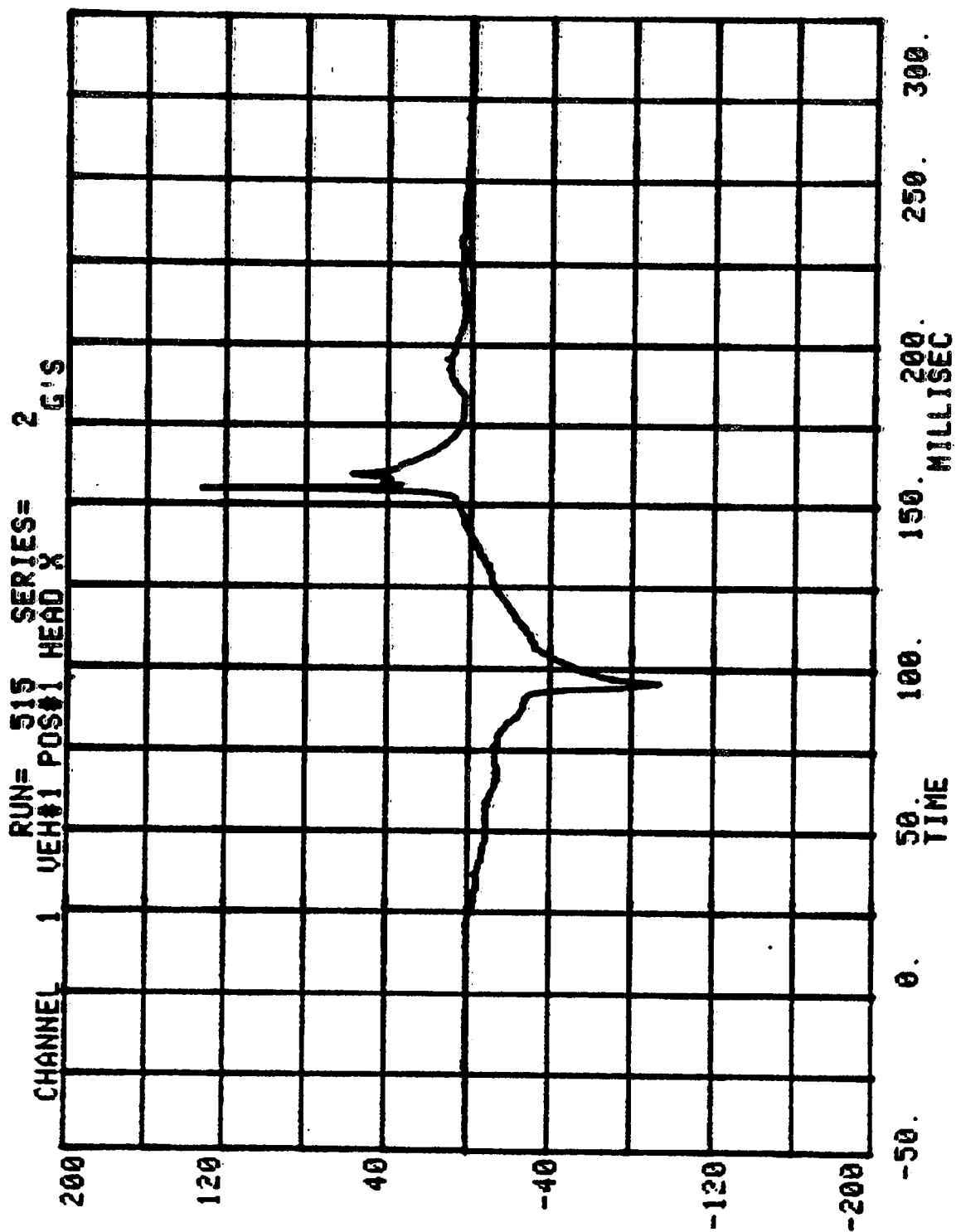
VEH#1 POS#1 HEAD RESULT.

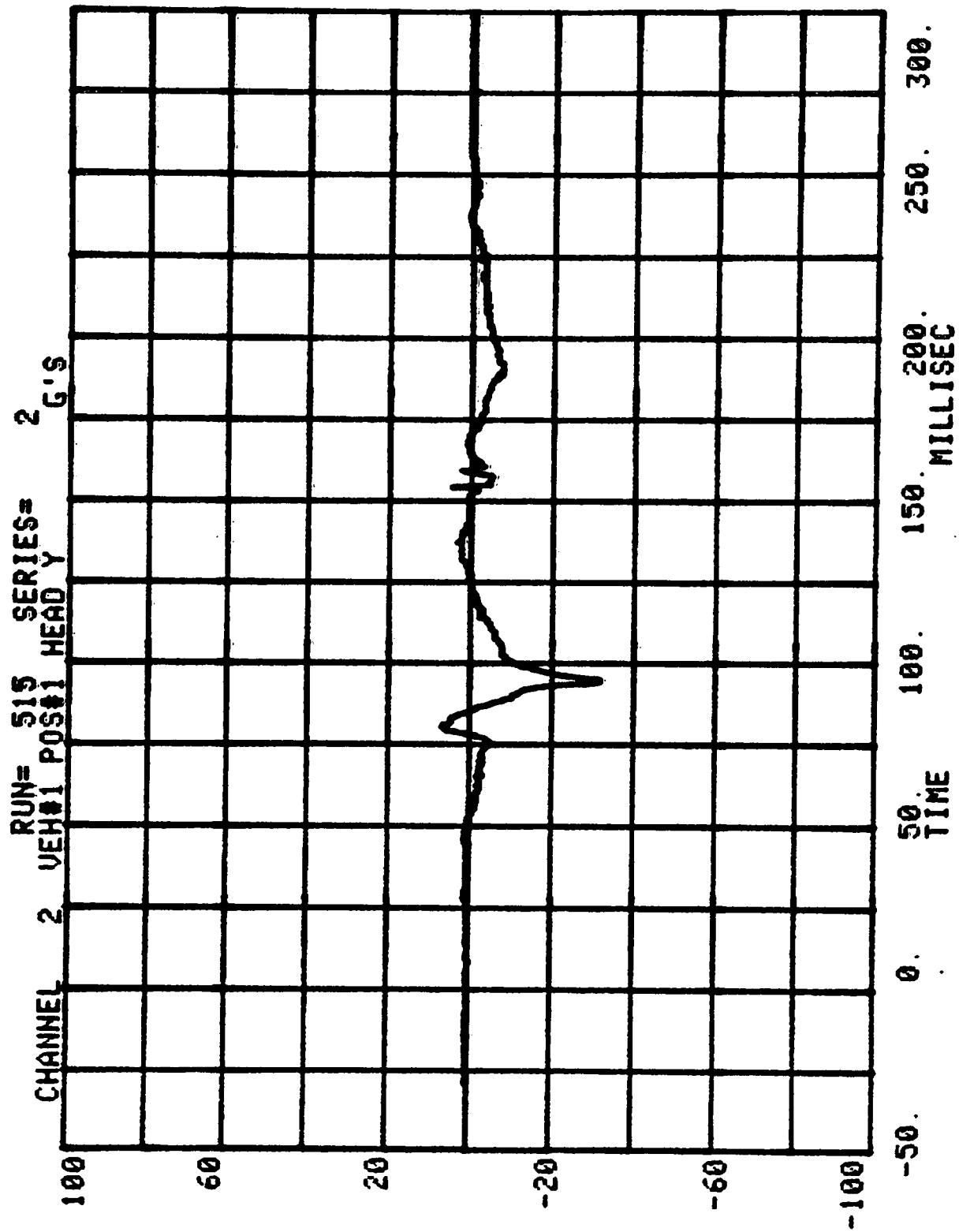
HIC= 806.0 FROM T1= .07860 TO T2= .10620

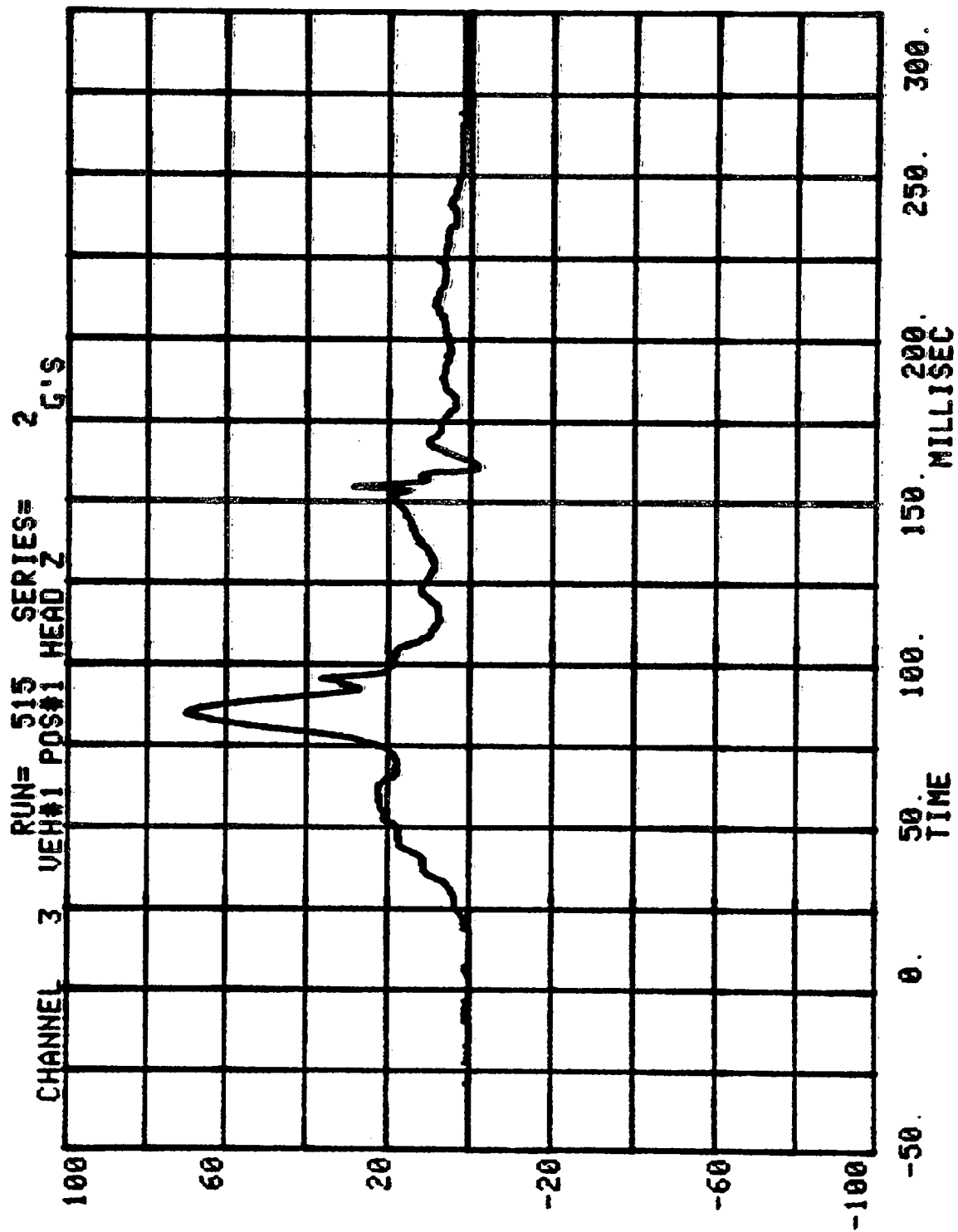
AVERAGE ACCELERATION BETWEEN T1 AND T2= 61.1G'S

EVENT TIME= 300.0 MSEC

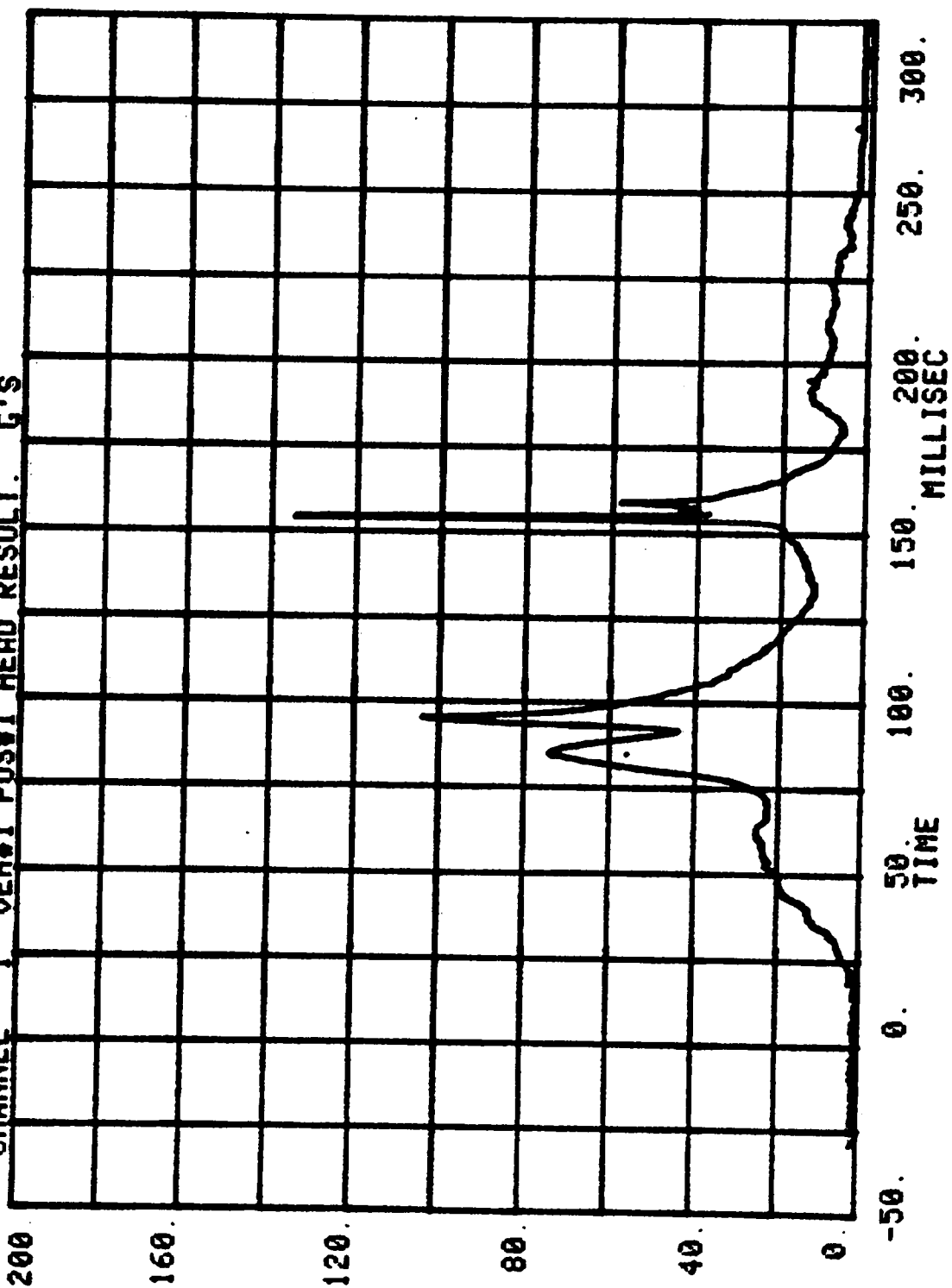
SEVERITY INDEX=1405.8

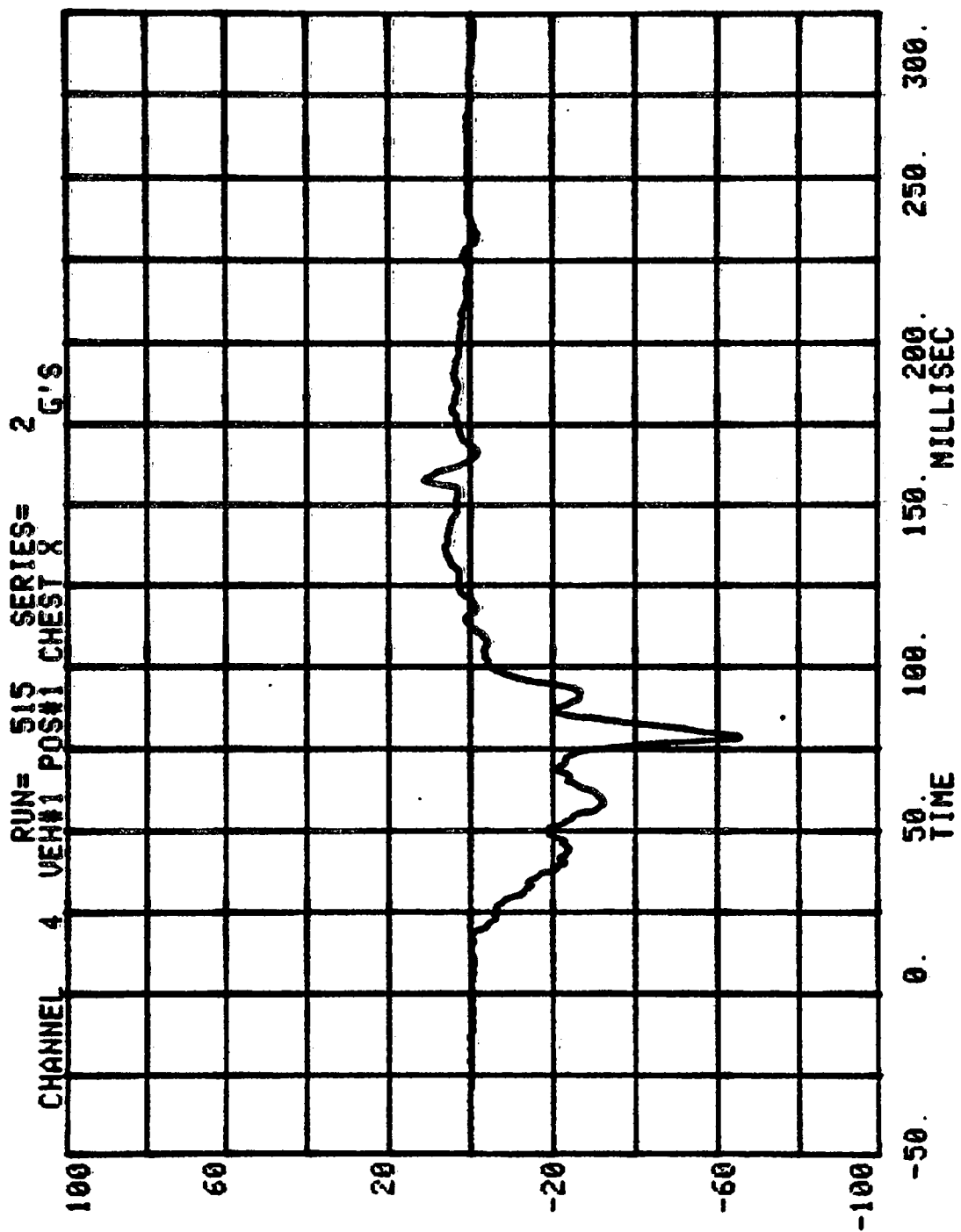


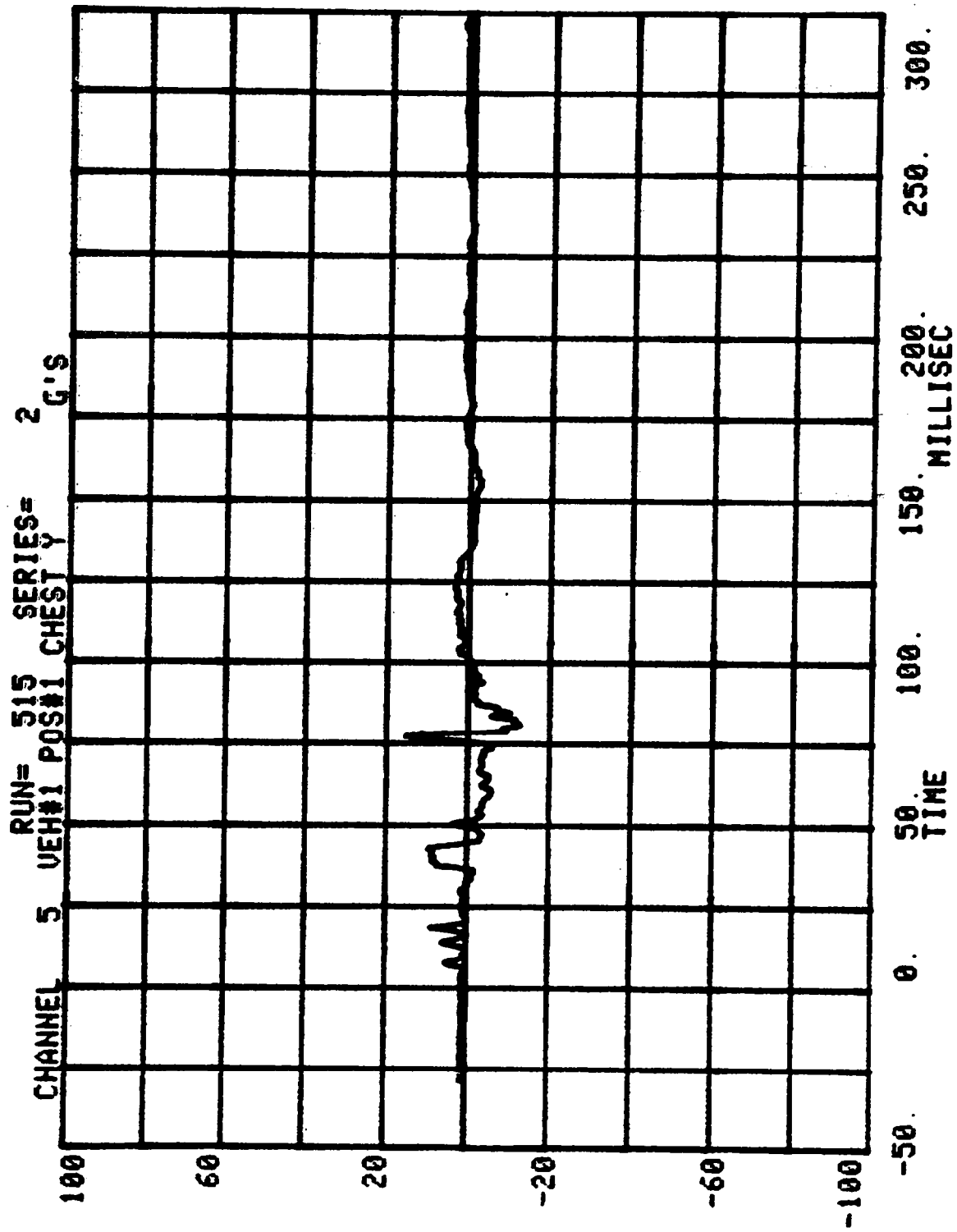


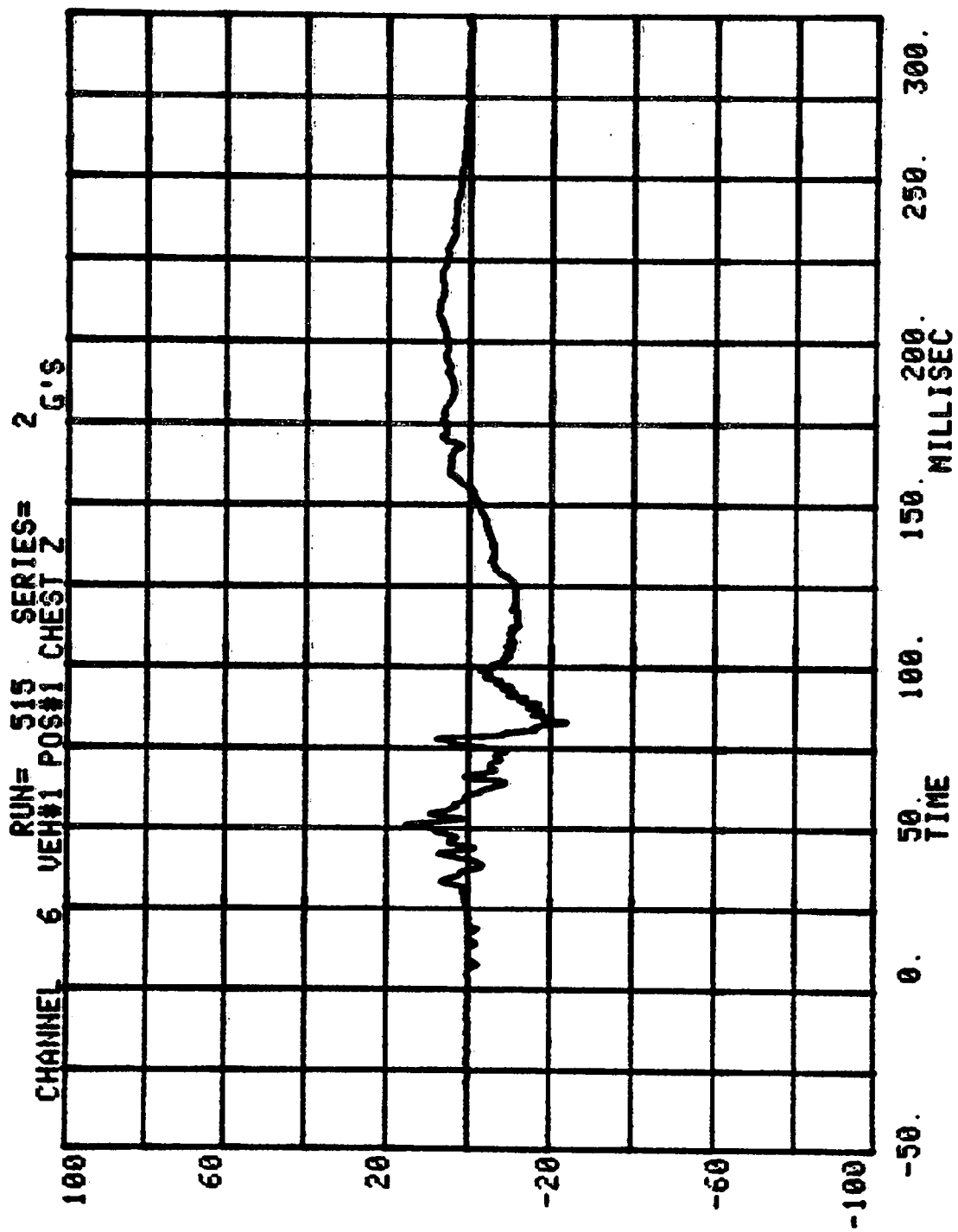


CHANNEL 1 RUN= 515 SERIES= 2
VEH#1 POS#1 HEAD RESULT. G'S



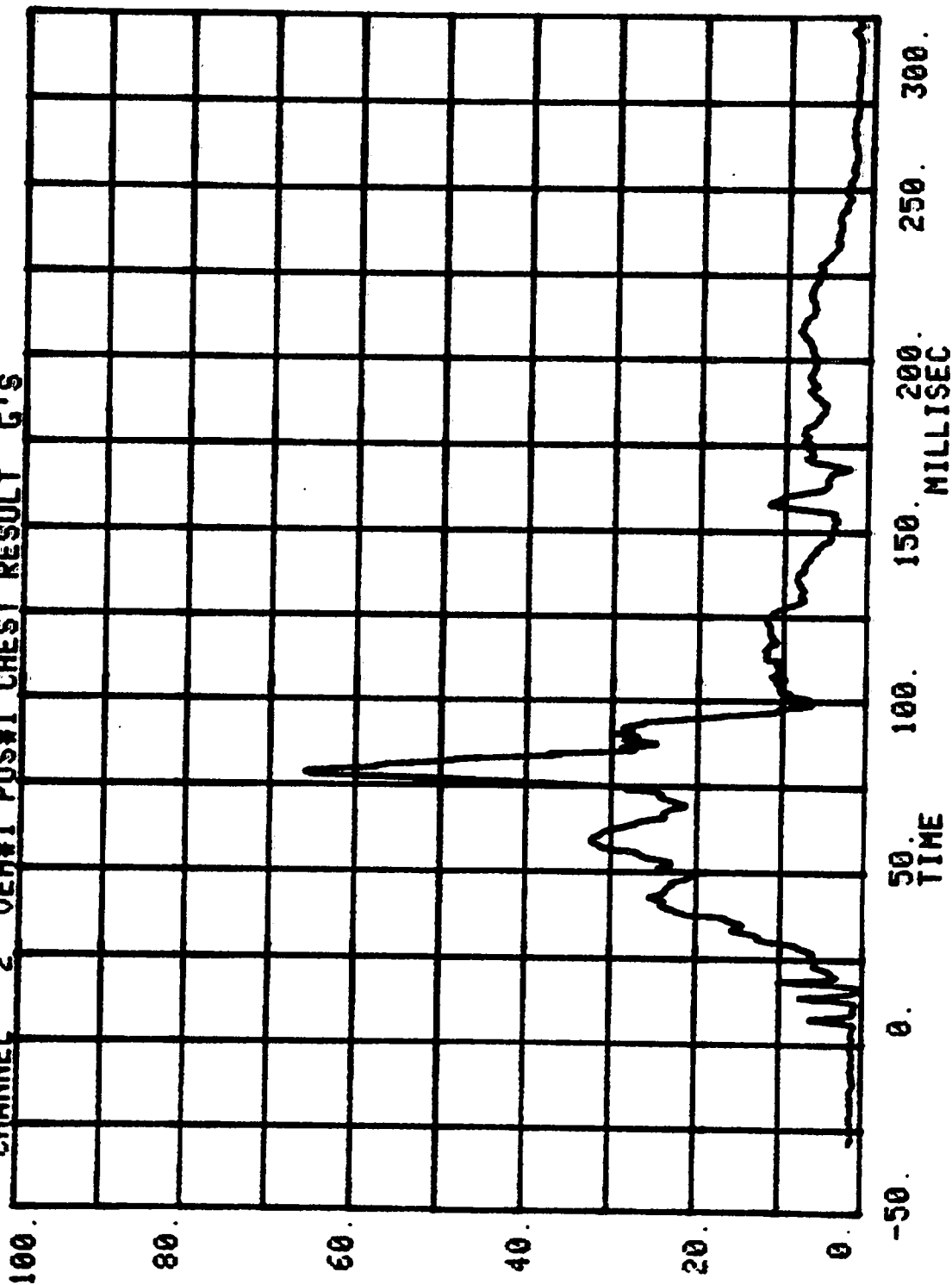




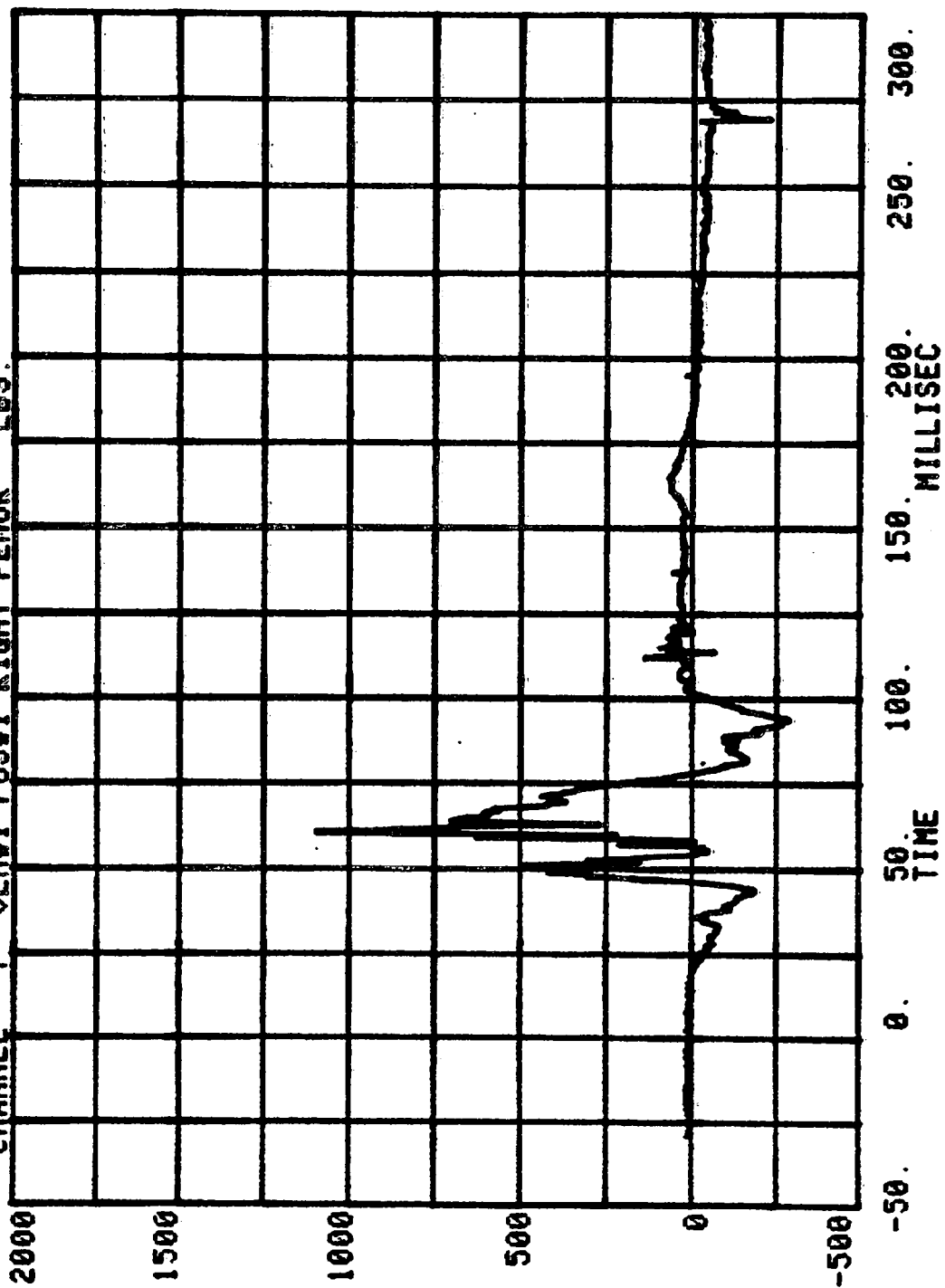


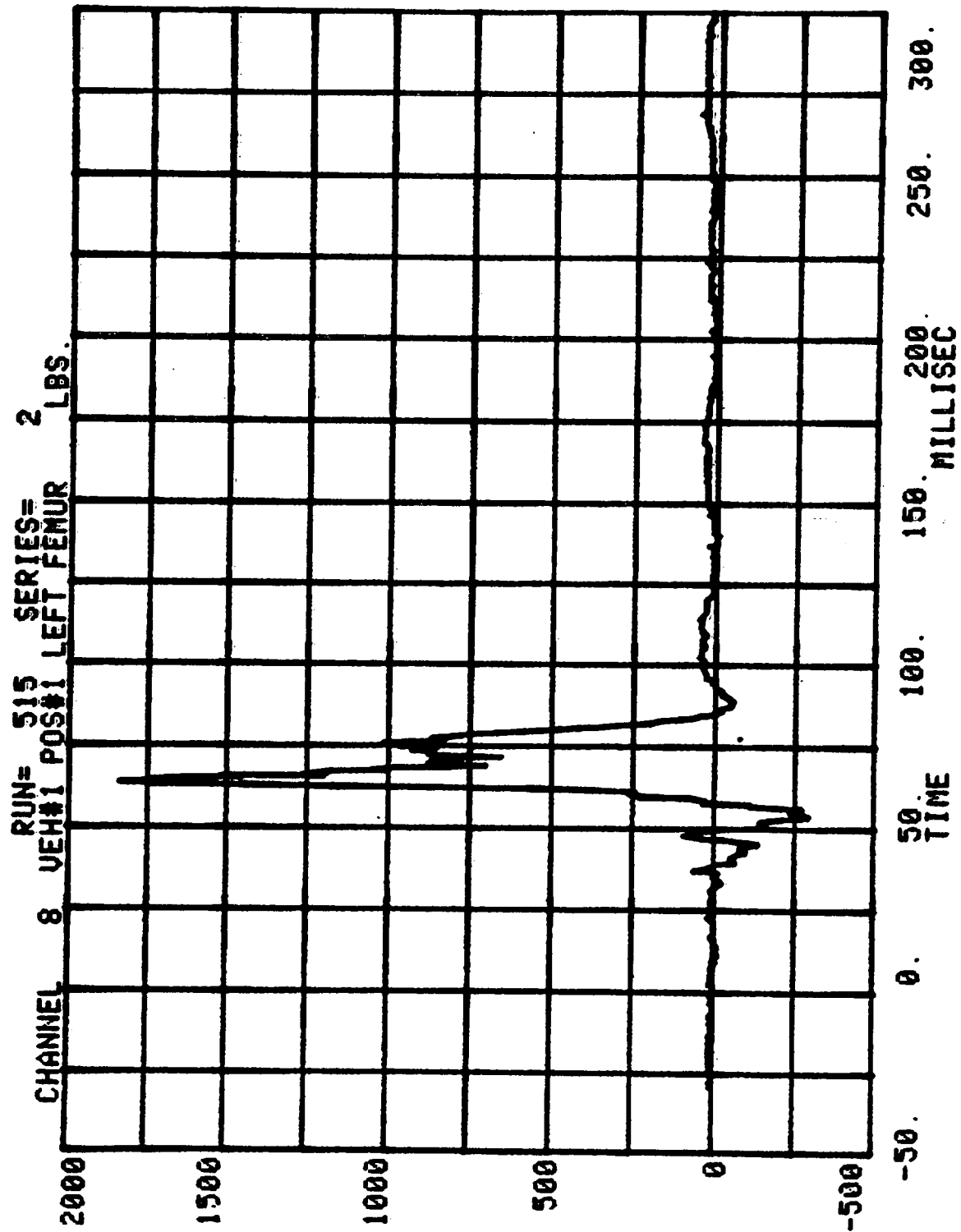
CHANNEL 2 VEH#1 POS#1 CHEST RESULT G'S

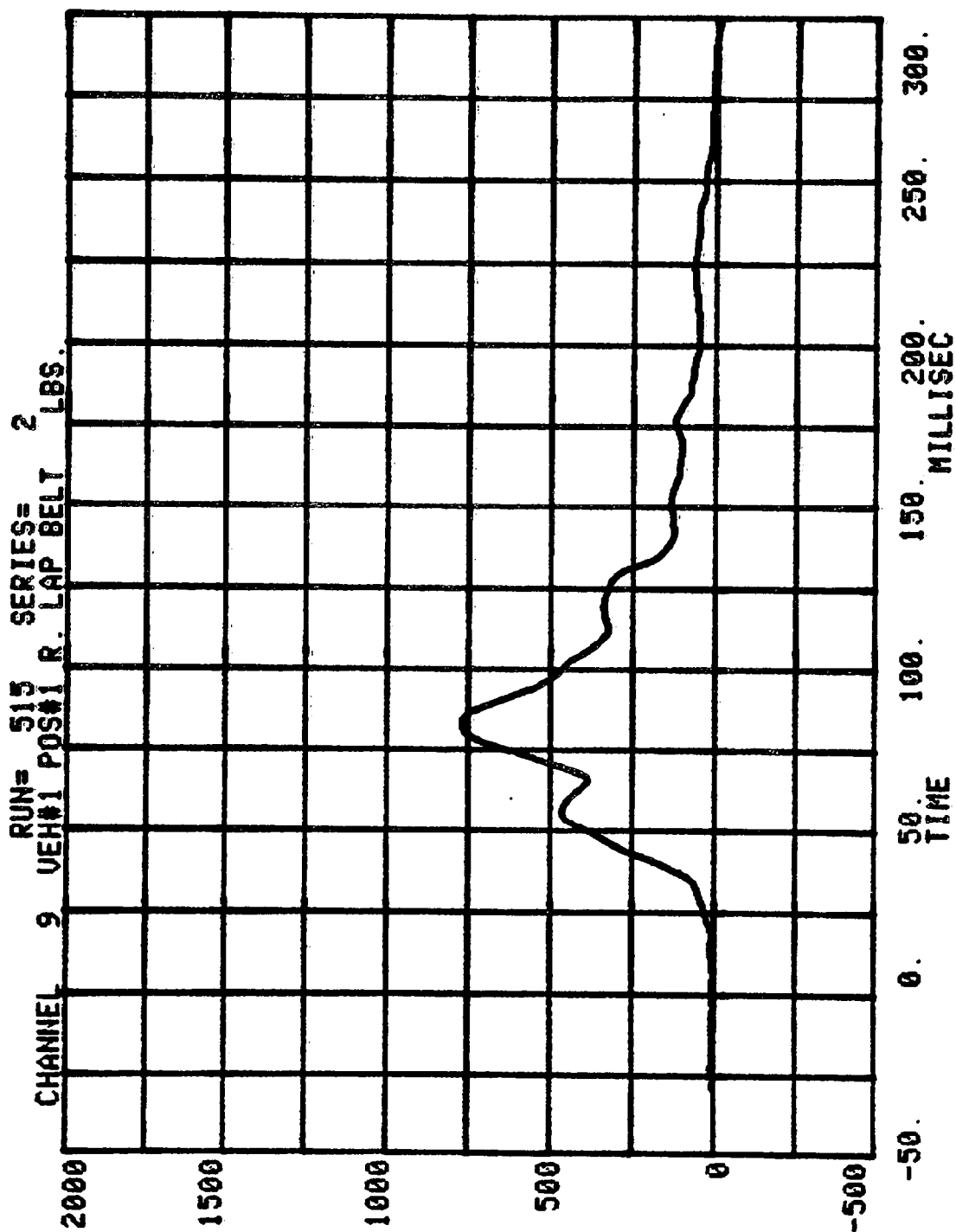
RUN= 515 SERIES= 2



CHANNEL 7 RUN= 315 SERIES= 2
VEH#1 POS#1 RIGHT FEMUR LBS.

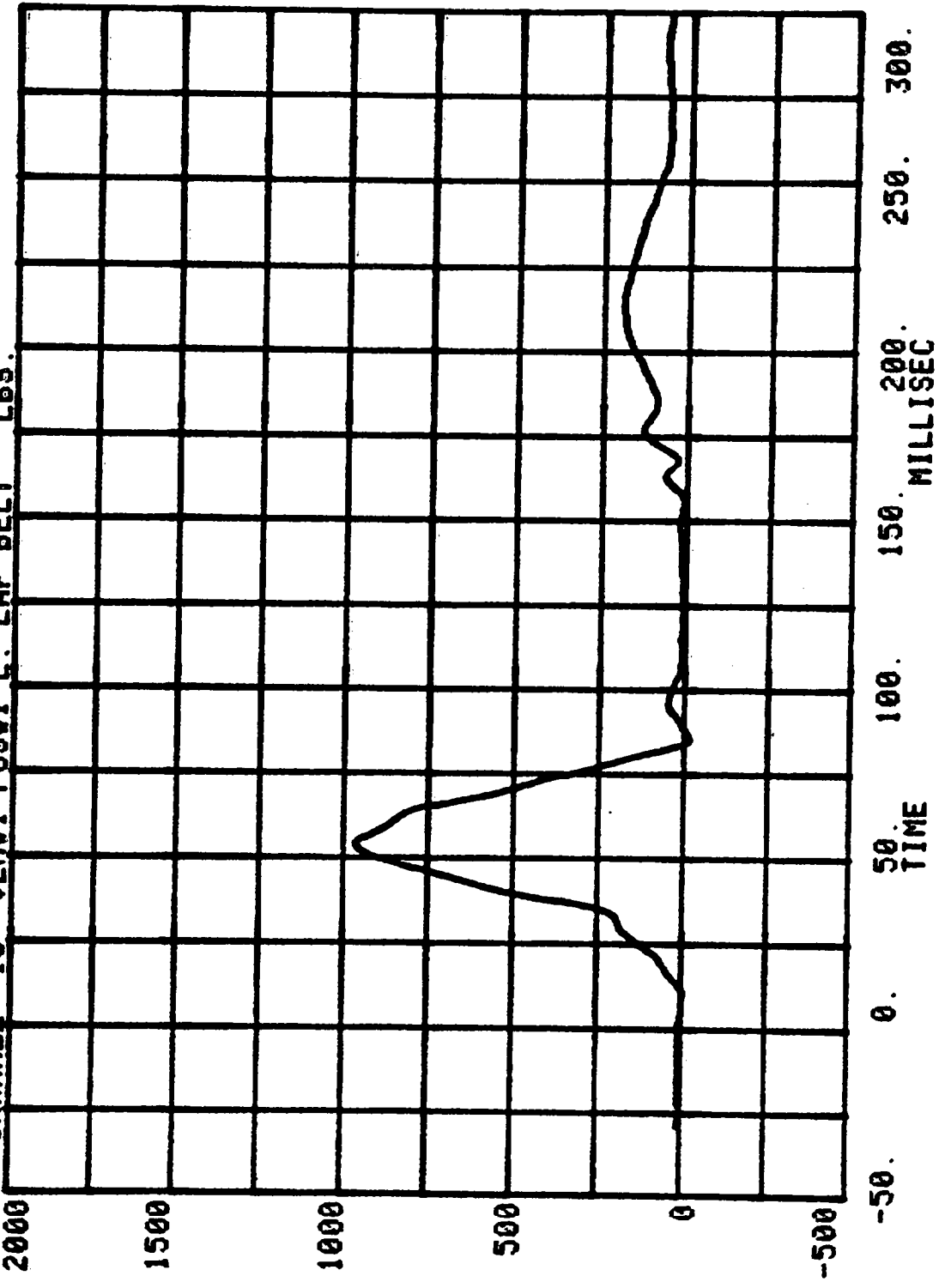


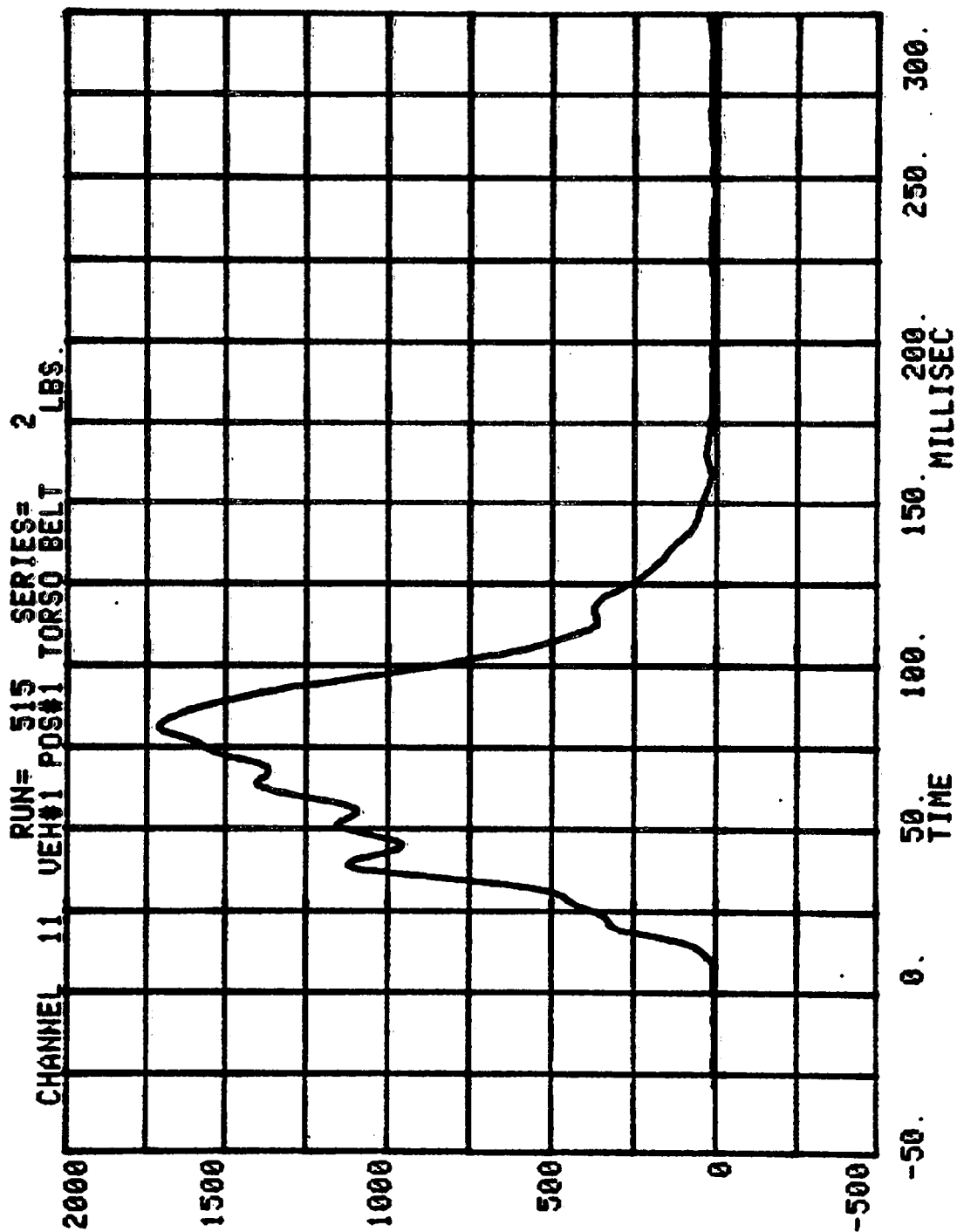




CHANNEL 10 VEH#1 POS#1 L. LAP BELT LBS.

RUN= 515 SERIES= 2





HEAD INJURY CRITERION
HEAD SEVERITY INDEX

VEHICLE AGGRESSIVENESS CAR-TO-CAR TEST #2

RUN= 515

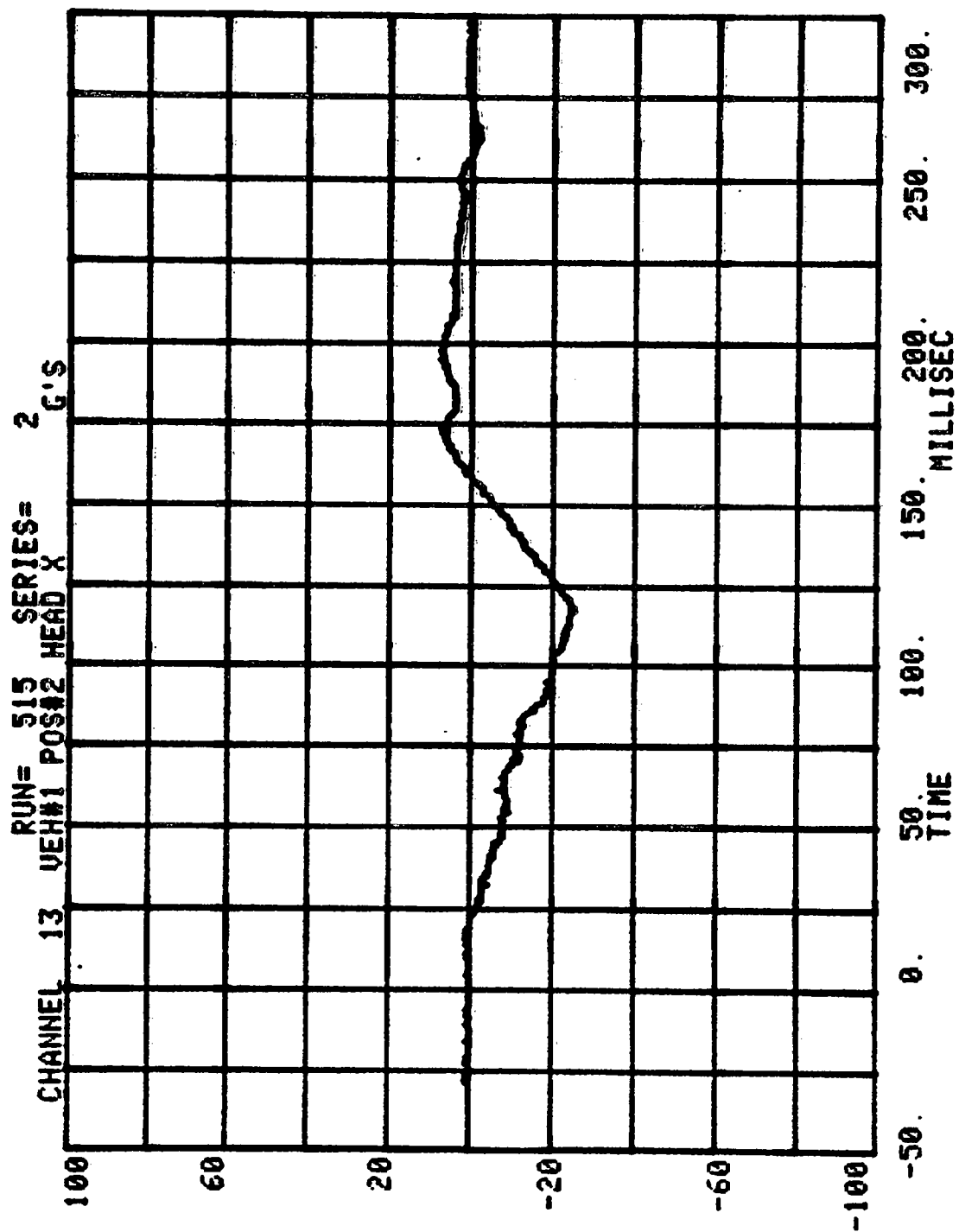
VEH#1 POS#2 HEAD RESULT.

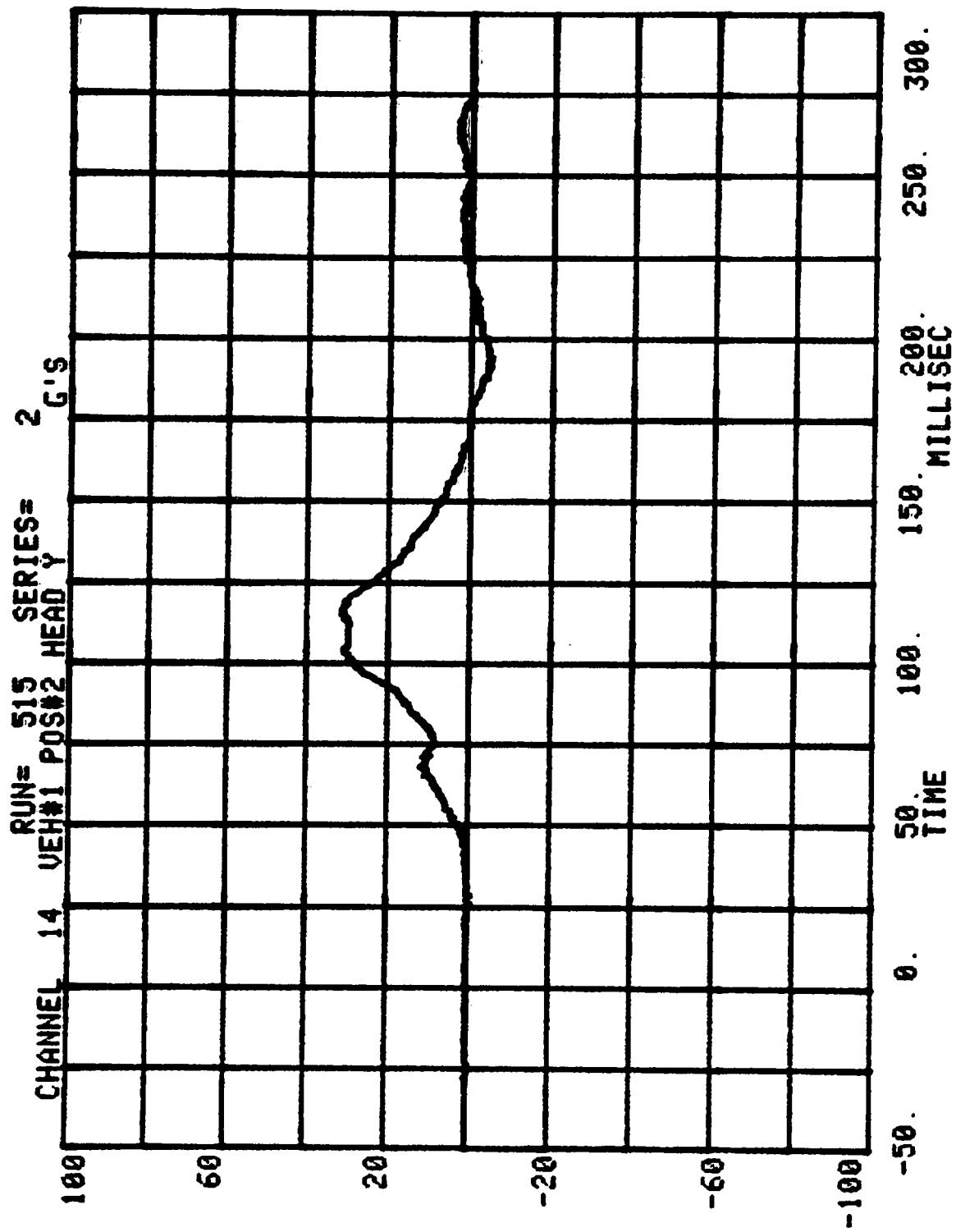
HIC= 523.4 FROM T1= .04410 TO T2= .17580

AVERAGE ACCELERATION BETWEEN T1 AND T2= 27.5G'S

EVENT TIME= 300.0 MSEC

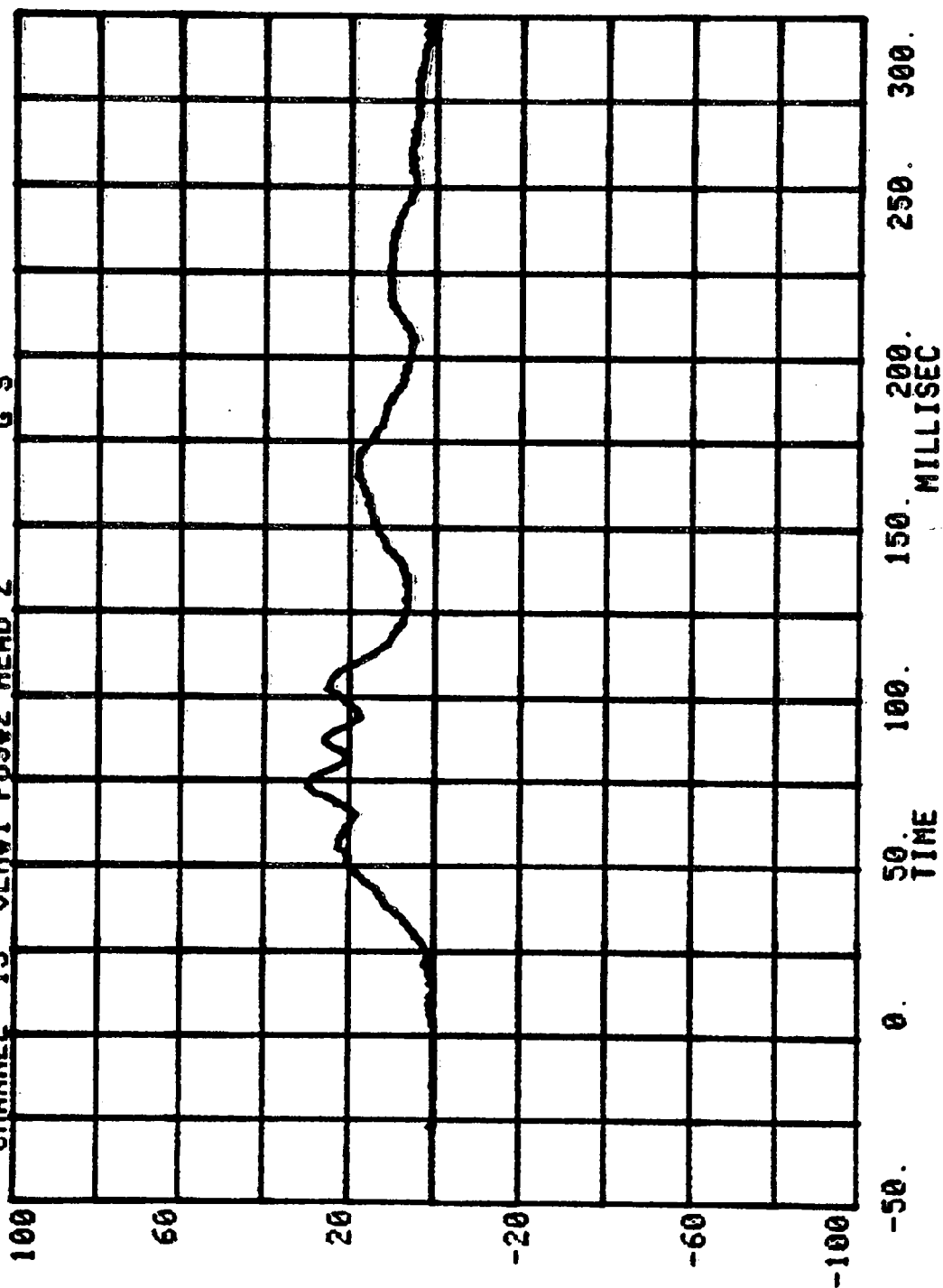
SEVERITY INDEX= 666.9



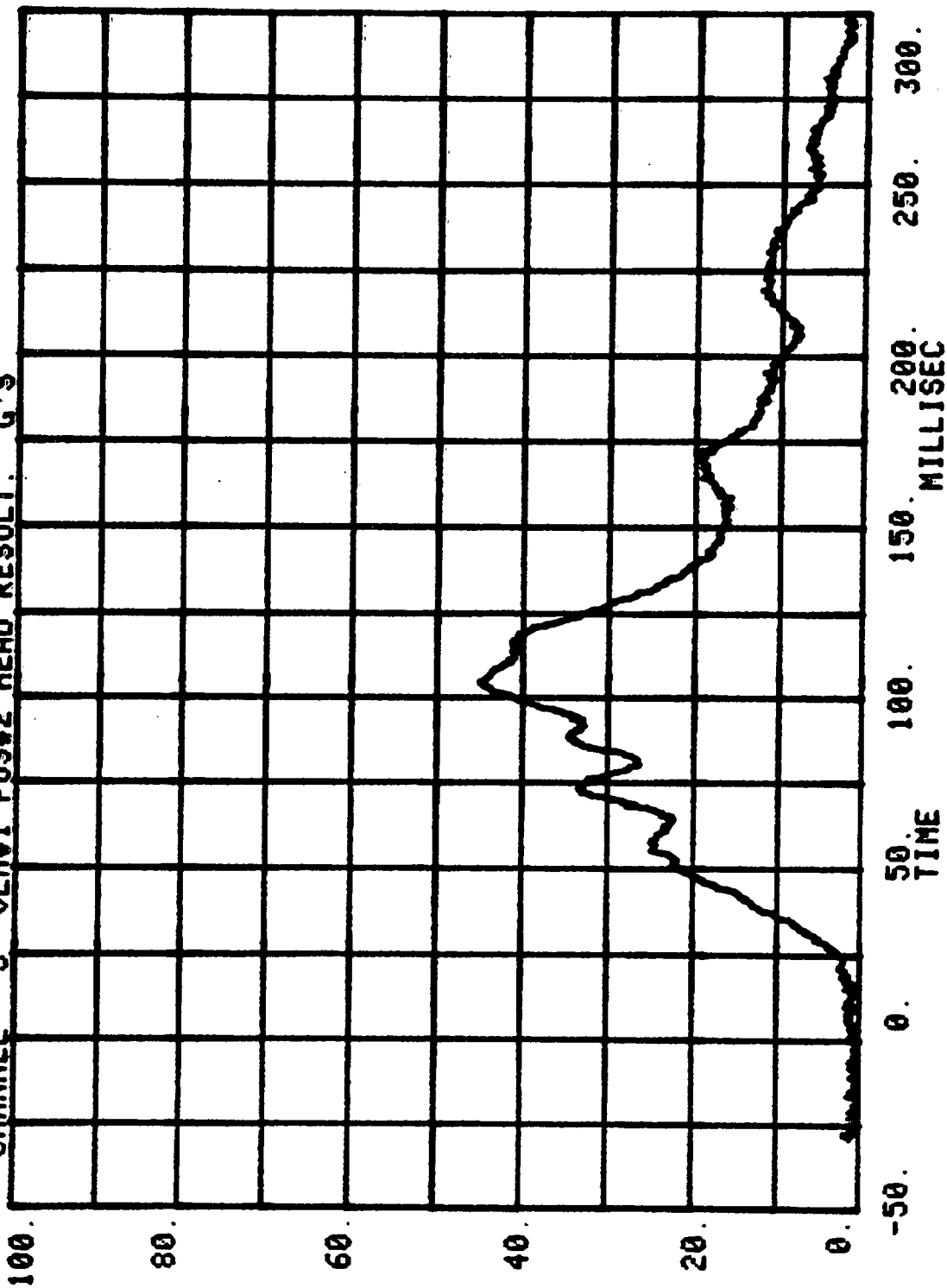


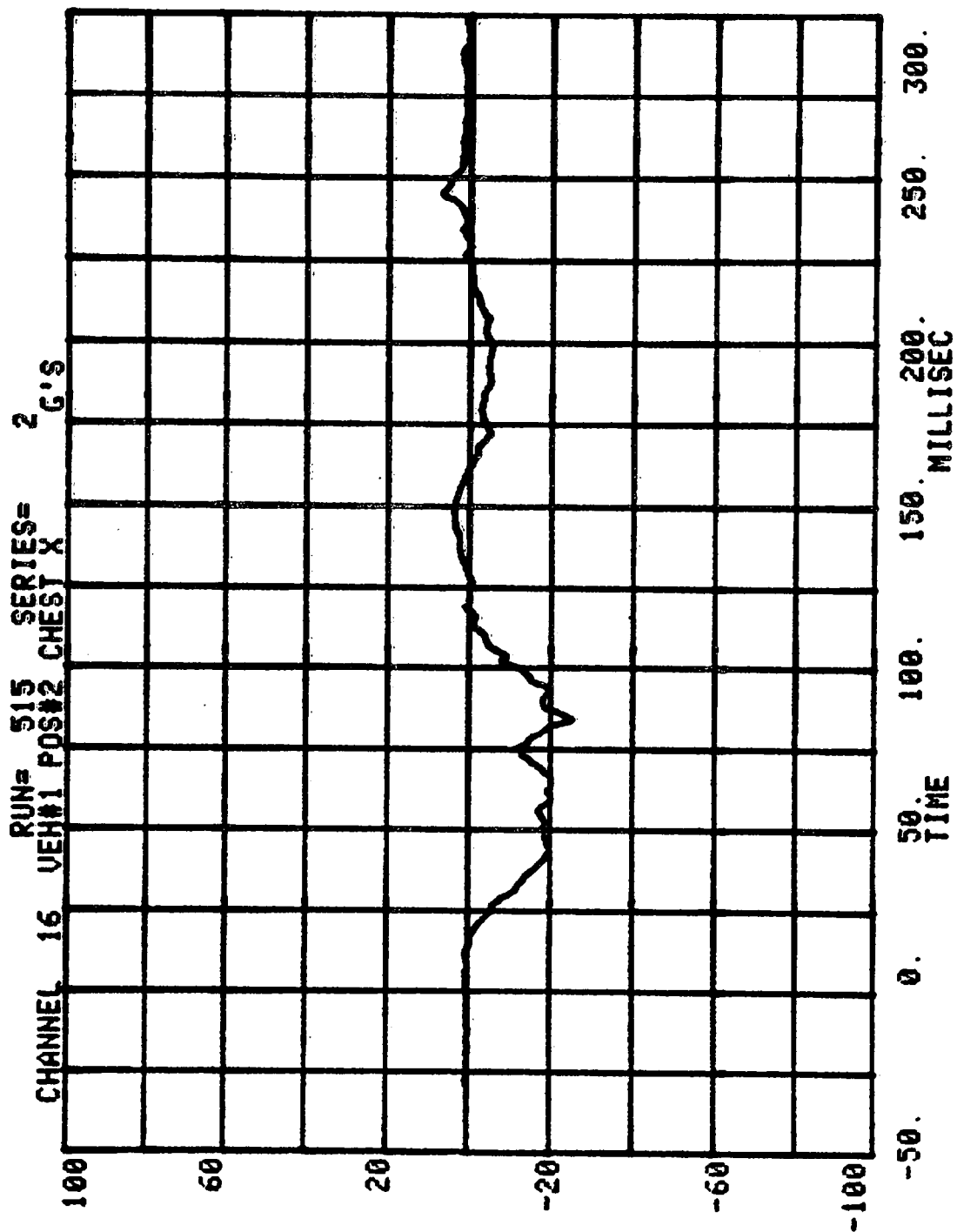
CHANNEL 15 VEH#1 POS#2 HEAD 2 G'S

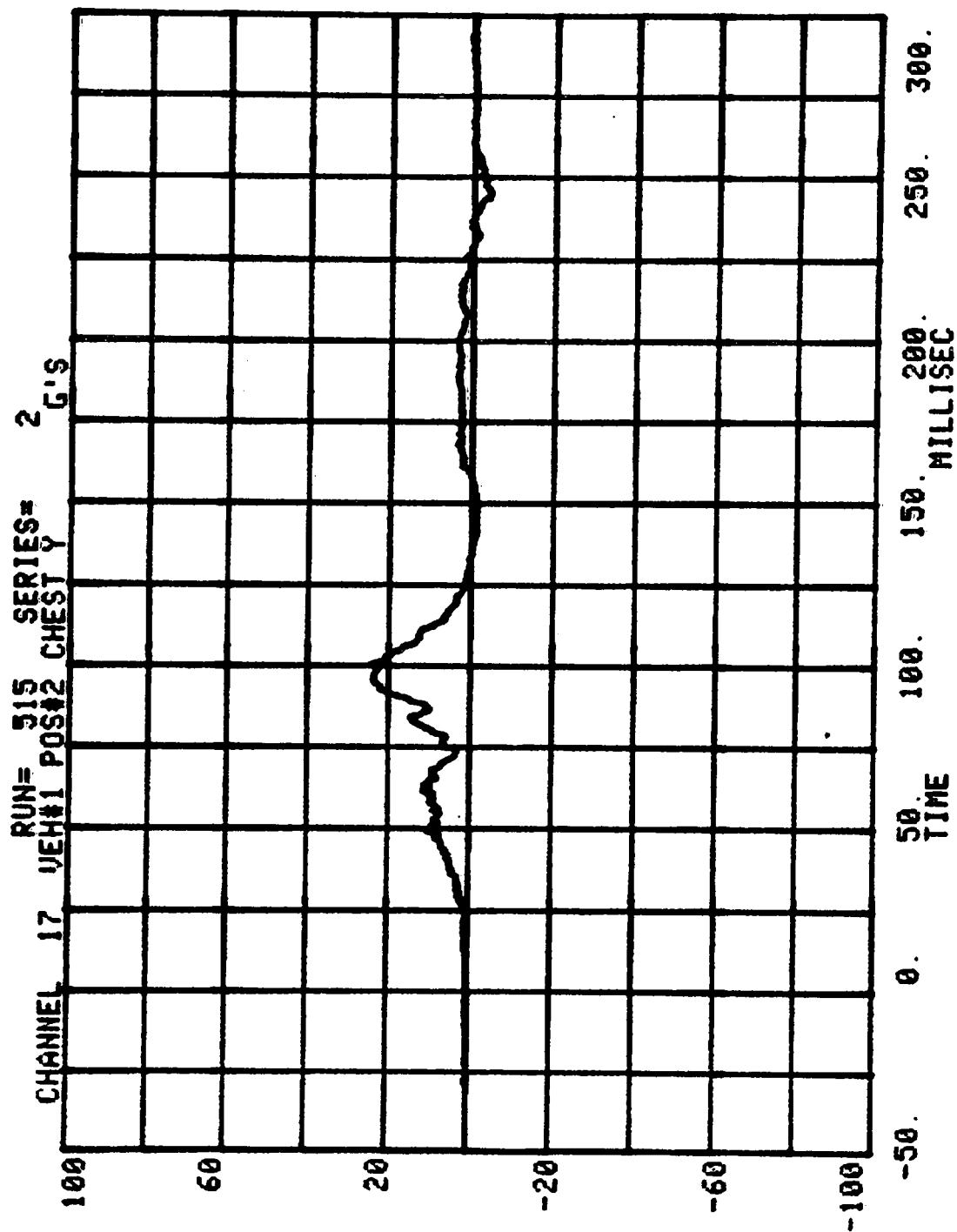
RUN= 315 SERIES= 2

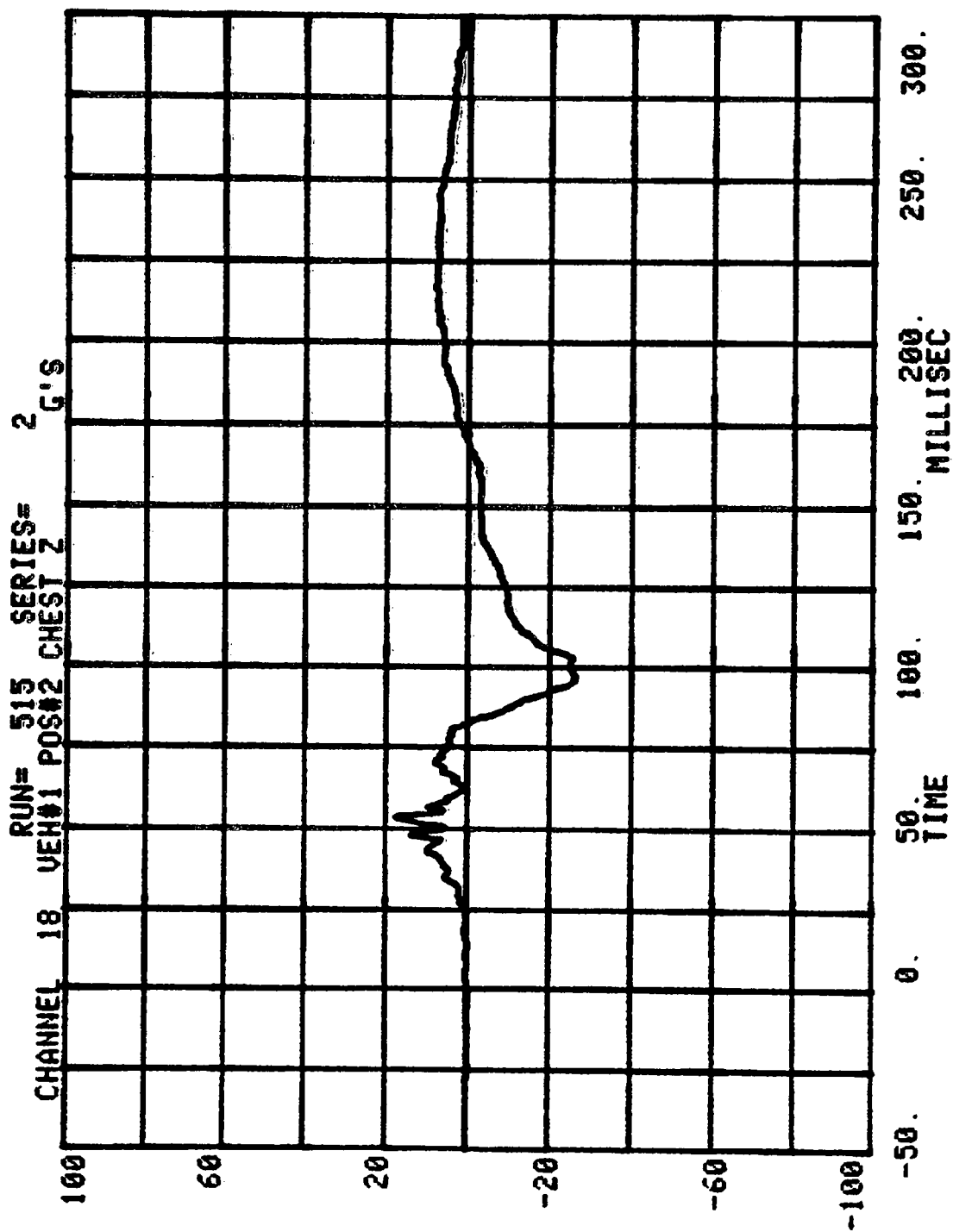


CHANNEL 3 RUN= 515 SERIES= 2
VEH#1 POS#2 HEAD RESULT. G'S

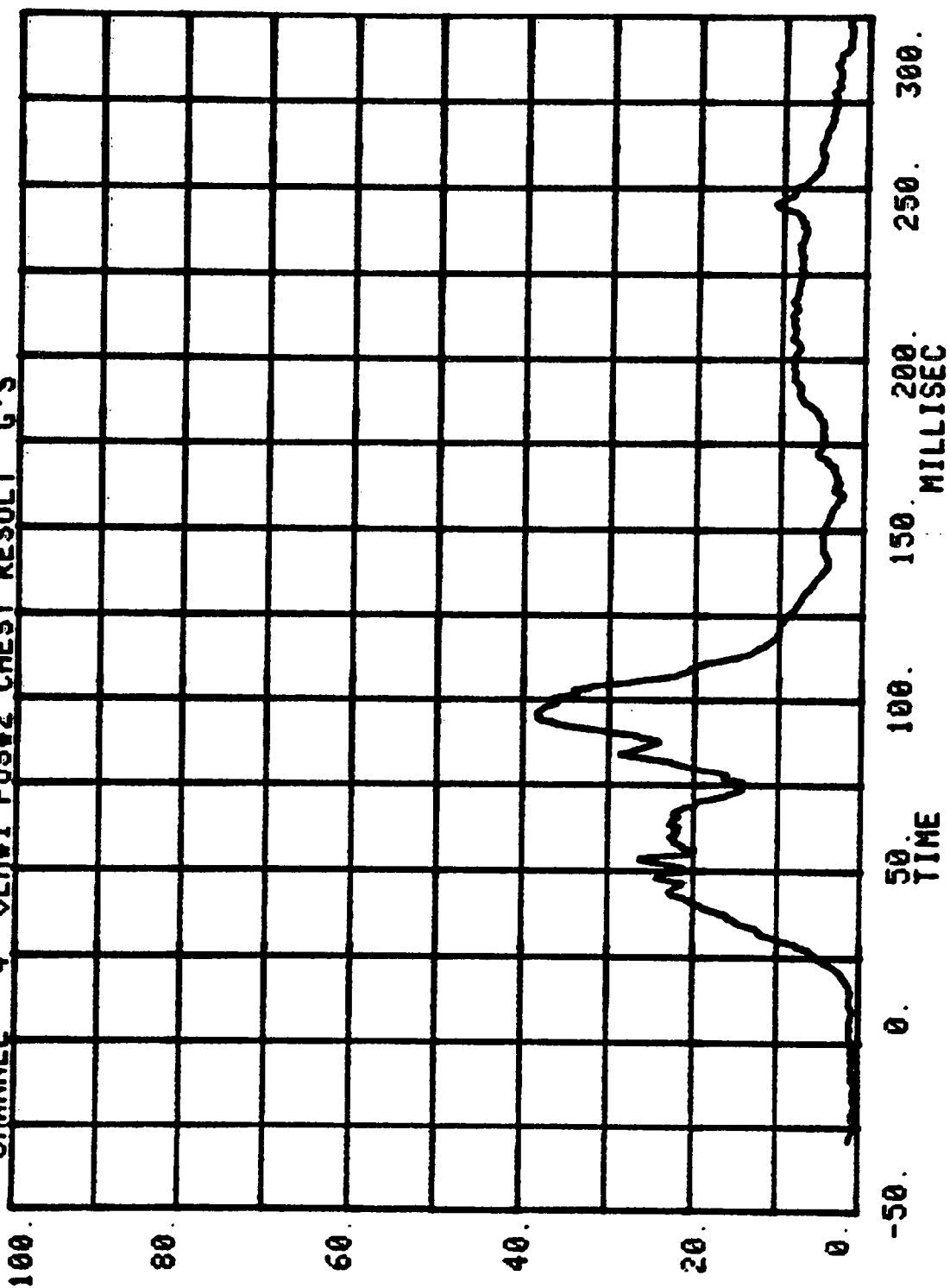


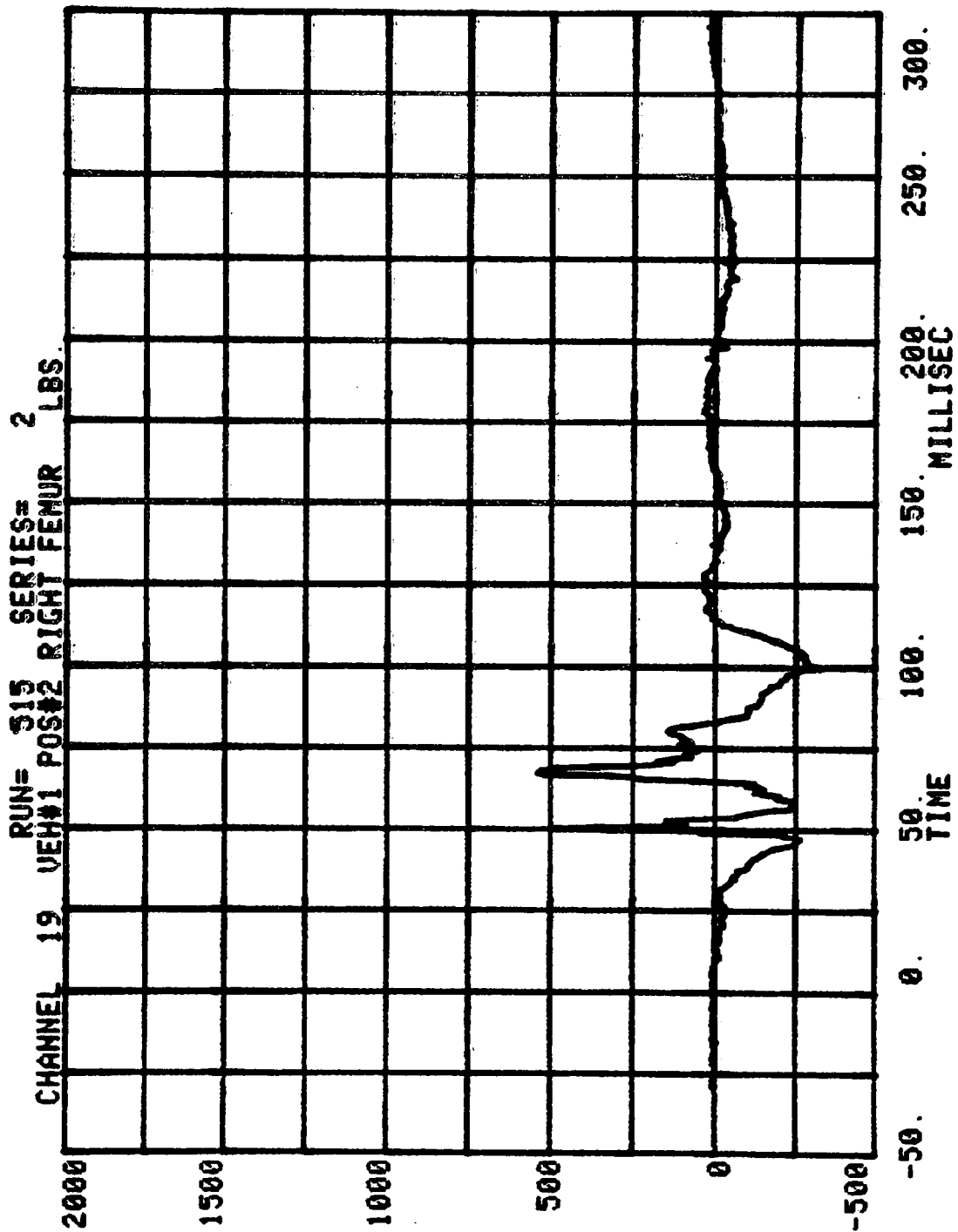


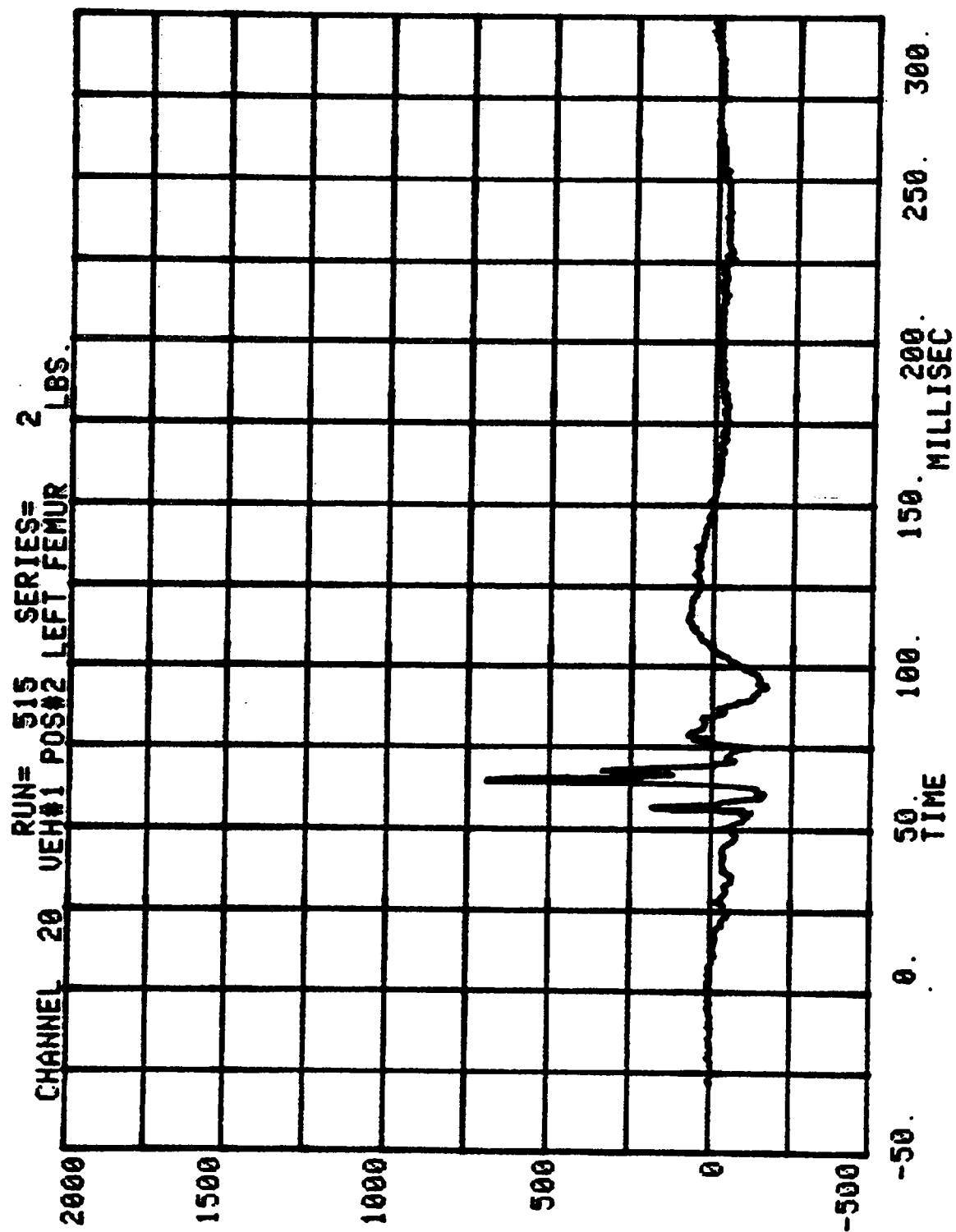


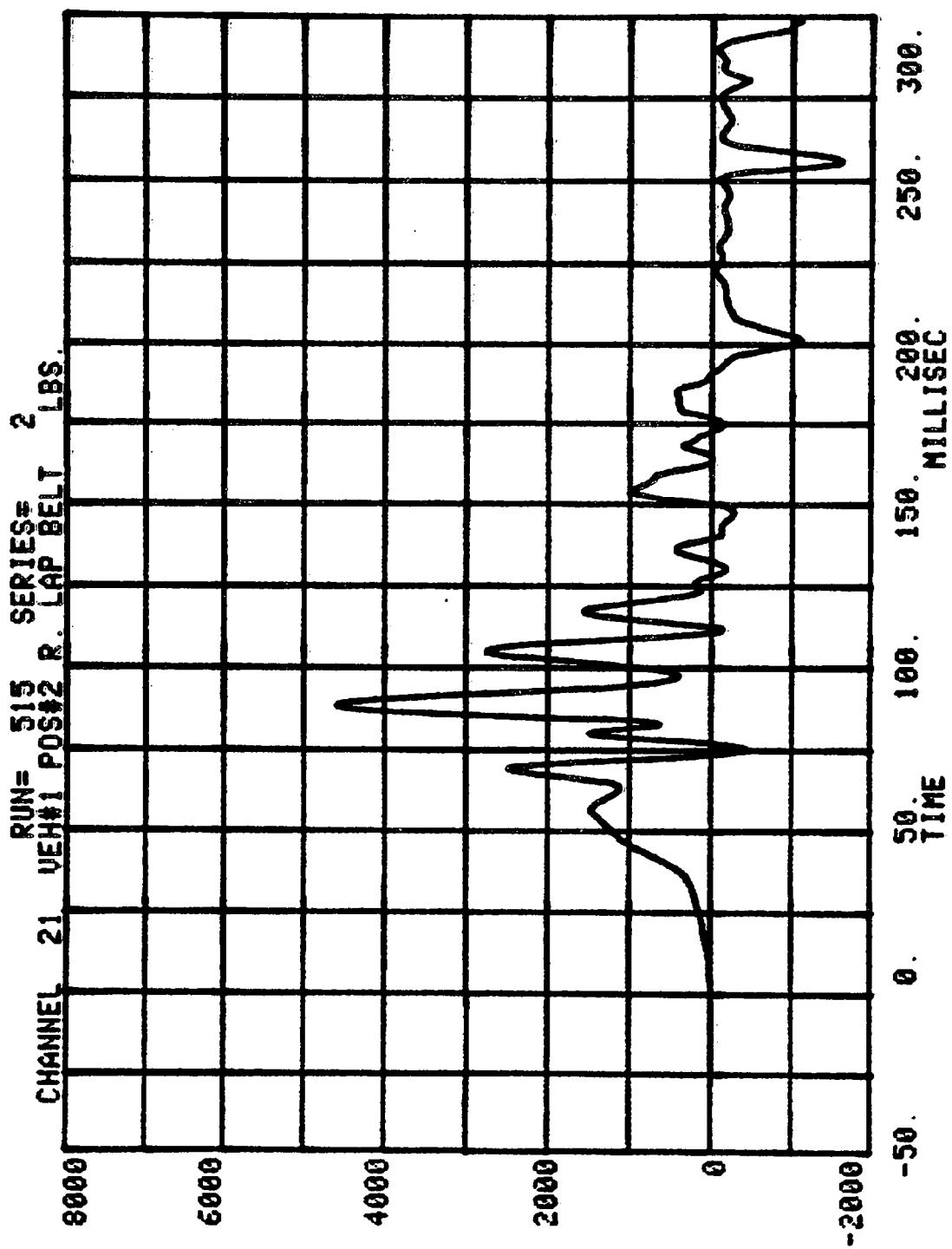


CHANNEL 4 RUN= 515 SERIES= 2
VEH#1 POS#2 CHEST RESULT G'S

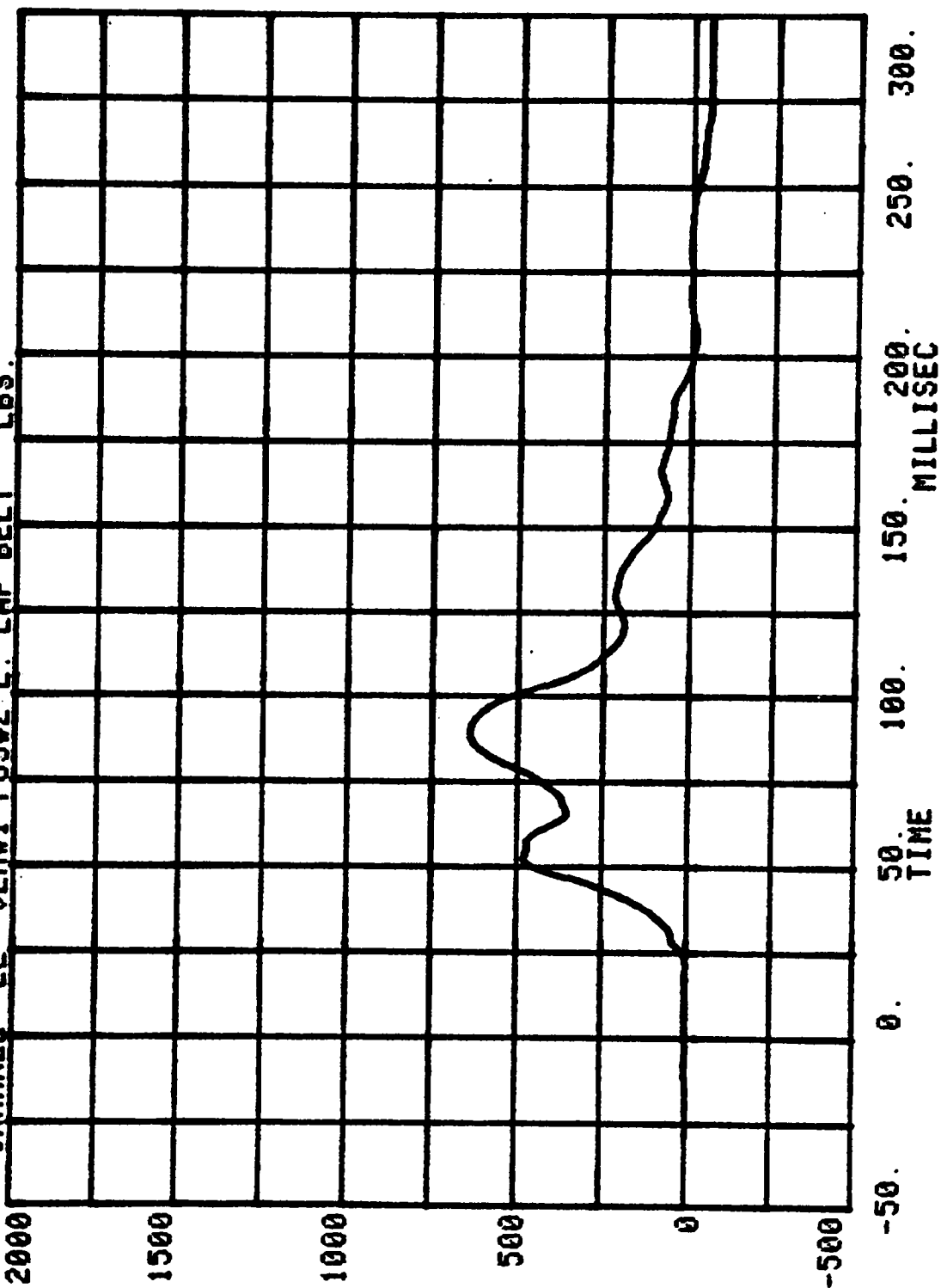


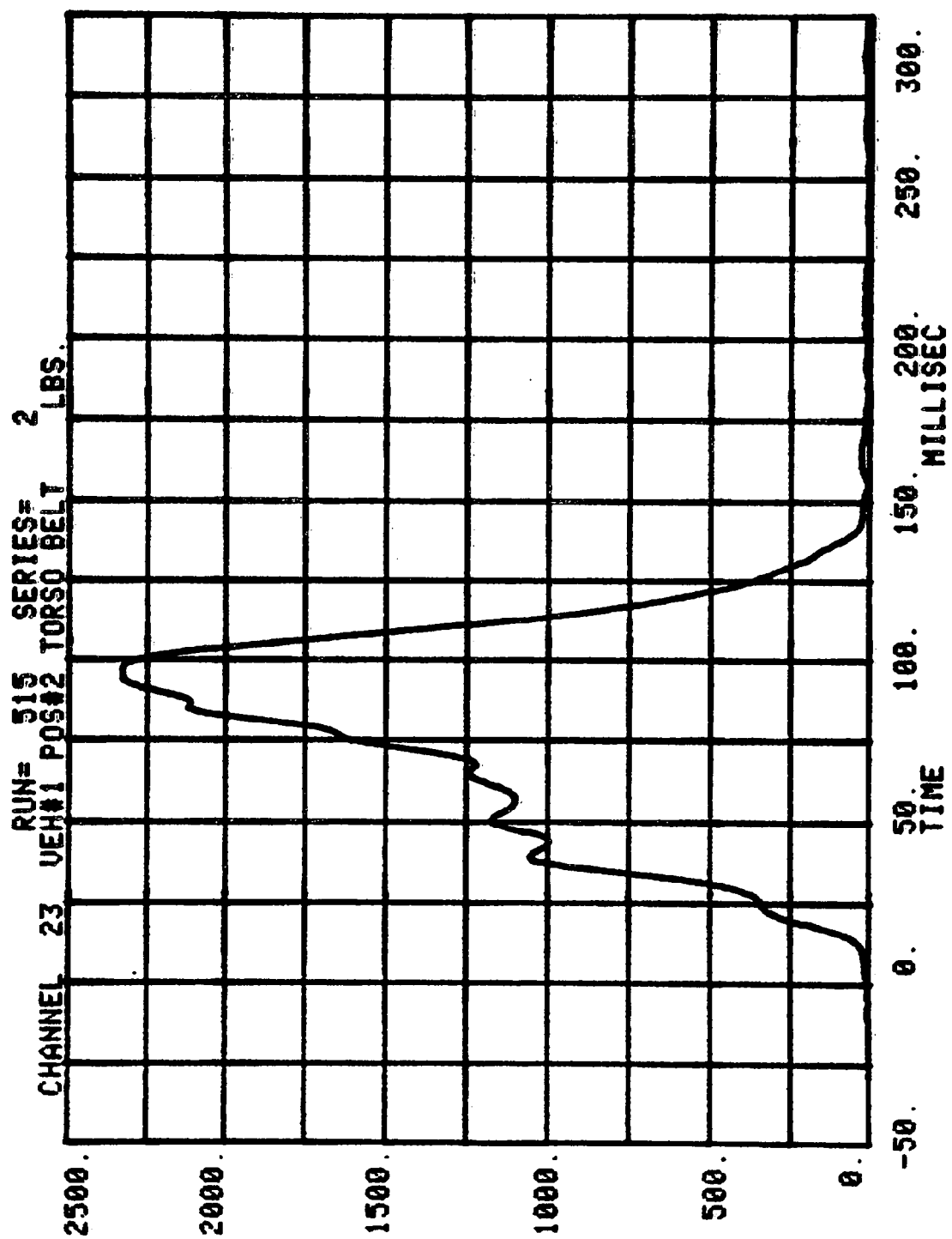






CHANNEL 22 RUN= 515 SERIES= 2
VEH#1 POS#2 L. LAP BELT LBS.





APPENDIX C

DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the Alderson Research Laboratories Model ATD 30034, 50th percentile male anthropometric test devices utilized for this crash test. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Vol. 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation, Advanced Technology Center. A summary of the test results, Part 572 specifications and instrument calibration information is included in this Appendix.

Dummy serial numbers and certification dates are:

<u>Serial No.</u>	<u>Completion Date</u>
97	4/20/81
111	4/20/81

Electronic Test Equipment

The complement of signal conditioning recording and display equipment in conjunction with dummy certification testing can be found in New Car Assessment and Standards Indicant Testing Final Report, Report Number 6525-V-1.

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

0	9	7
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LABORATORY TECHNICIAN: Gary R. Gestwick

APPROVED BY:

D. Alonzo

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		4/15/81-4/20/81	
Calibration Sequential Number for Dummy - - - -		4	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		66° - 68°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		26% - 44%	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	248 g	
b. Peak Lateral Accel. -	≤10G	3 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.2 ms	
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	22.78 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	23.7 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	26 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	28 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	5 ms	
g. Pendulum Direction Reversal Time - - - -		103 ms	
h. Max. Head Rotation - -	63 to 73°	66°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0 ms
	Displ.	-.5 to .5 in	0.0 in.
30°	Time	25.6 to 34.4 ms	29 ms
	Displ.	2.1 to 3.1 in.	2.7 in.
60°	Time	40.3 to 51.7 ms	44 ms
	Displ.	4.3 to 5.3 in.	4.7 in.
Maximum	Time	53.2 to 66.8 ms	58 ms
(°)	Displ.	5.0 to 6.0 in.	5.2 in.

Continued

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6706 -V-2

P. 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

0 9 7

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST			
<u>Continued</u>			
i. Chordal Displacement:			
Head Rotation Angle --			
60°	Time	67.0 to 83.0 ms	67 ms
	Displ.	4.3 to 5.3 in.	4.8 in.
30°	Time	85.4 to 104.6 ms	86 ms
	Displ.	2.1 to 3.1 in.	2.4 in.
0°	Time	101.0 to 123.0 ms	101 ms
	Displ.	-.5 to 0.5 in.	0.0 in.
3. ABDOMINAL COMPRESSION TEST:			
(Preload = 10 pounds)			
a. Force @ 1" - - - -	50 to 63 lbs.	53 lbs.	
b. Force @ 1.3" - - - -	73 to 88 lbs.	77 lbs.	
4. LUMBAR FLEXION TEST:			
a. Force @ 20° - - - -	22 to 34 lbs.	33 lbs.	
b. Force @ 30° - - - -	34 to 46 lbs.	43 lbs.	
c. Force @ 40° - - - -	46 to 58 lbs.	54 lbs.	
d. Return Angle - - - -	12° maximum	8°	
5. CHEST IMPACT TESTS:			
a. High Speed			
(1) Probe Speed - -	21.78-22.22 fps	21.85 fps	
(2) Peak Deflection -	1.7" maximum	1.32 in.	
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	1968 lbs.	
(4) Internal Hysteresis - - - -	50 to 70%	61.53%	
b. Low Speed			
(1) Probe Speed - - -	13.86-14.14 fps	14.10 fps	
(2) Peak Deflection -	1.1" maximum	.8 in.	
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1269 lbs.	
(4) Internal Hysteresis - - - -	50 to 70%	51.57%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

0	9	7
---	---	---

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.91 fps	
(2) Maximum Force - -	1850 to 2500 lbs	1925 lbs	
(3) Time Above 1000#	1.7 ms minimum	2.2 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.01 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1850 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.3 lbs.	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

0 9 7

CALIB. SEQ. NOS. FOR DUMMY: _____ & _____

A. DUMMY INSTRUMENTS:

1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

3. Chest Potentiometer - - -

4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push
Force Gauge - - - - -

4. Abdominal Compression Test
Force Gauge - - - - -

5. Abdominal Compression Test
Displacement Gauge - - - -

MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
ENDEVCO	CS75	1/81	7/81
ENDEVCO	CU62	1/81	7/81
ENDEVCO	CE18	1/81	7/81
GSE	75	1/81	7/81
GSE	74	1/81	7/81
	A72		
CEC	22958	1/81	7/81
CEC	A52 16929	1/81	7/81
TRANSDUCER, INC.	20051	1/81	7/81
BLH	72952	1/81	7/81
CIC	567-11	1/81	7/81
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P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

1	1	1
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LABORATORY TECHNICIAN: Gary R. Gestwick

APPROVED BY:

D. C. C. C. C.

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		4/15/81-4/20/81	
Calibration Sequential Number for Dummy - - - -		9	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		66° - 68°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		26% - 44%	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	253 g	
b. Peak Lateral Accel. - -	≤10G	4 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.1 ms	
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	22.02 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	21.8 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	25 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	2.5 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	27 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	7 ms	
g. Pendulum Direction Reversal Time - - - -		104 ms	
h. Max. Head Rotation - -	63 to 73°	66°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0 ms
	Displ.	-.5 to .5 in	0.0 in.
30°	Time	25.6 to 34.4 ms	29.5 ms
	Displ.	2.1 to 3.1 in.	2.6 in.
60°	Time	40.3 to 51.7 ms	46.5 ms
	Displ.	4.3 to 5.3 in.	4.9 in.
Maximum	Time	53.2 to 66.8 ms	60 ms
(°)	Displ.	5.0 to 6.0 in.	5.3 in.

Continued

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6706-V-2

P. 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

1	1	1
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TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST Continued				
i. Chordal Displacement:				
Head Rotation Angle --				
60°	Time	67.0 to 83.0 ms	69 ms	
	Displ.	4.3 to 5.3 in.	4.8 in.	
30°	Time	85.4 to 104.6 ms	88.5 ms	
	Displ.	2.1 to 3.1 in.	2.4 in.	
0°	Time	101.0 to 123.0 ms	103 ms	
	Displ.	-.5 to 0.5 in.	0.0 in.	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - -		50 to 63 lbs.	57 lbs.	
b. Force @ 1.3" - - - -		73 to 88 lbs.	80 lbs.	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - -		22 to 34 lbs.	32.5 lbs.	
b. Force @ 30° - - - -		34 to 46 lbs.	39 lbs.	
c. Force @ 40° - - - -		46 to 58 lbs.	48 lbs.	
d. Return Angle - - -		12° maximum	6°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - -		21.78-22.22 fps	21.90 fps	
(2) Peak Deflection -		1.7" maximum	1.35 in.	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	1761 lbs.	
(4) Internal Hysteresis - - - -		50 to 70%	55.55%	
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps	14.06 fps	
(2) Peak Deflection -		1.1" maximum	.82 in.	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1165 lbs.	
(4) Internal Hysteresis - - - -		50 to 70%	58.43%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

1	1	1
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TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.01 fps	
(2) Maximum Force - -	1850 to 2500 lbs	2075 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.25 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.00 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2100 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.1 ms	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1	1	1
---	---	---

CALIB. SEQ. NOS. FOR DUMMY: _____ & _____

A. DUMMY INSTRUMENTS:

1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

3. Chest Potentiometer - - -

4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push
Force Gauge - - - - -

4. Abdominal Compression Test
Force Gauge - - - - -

5. Abdominal Compression Test
Displacement Gauge - - - -

MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
ENDEVCO	CS75	1/81	7/81
ENDEVCO	CU62	1/81	7/81
ENDEVCO	CE18	1/81	7/81
GSE	75	1/81	7/81
GSE	74	1/81	7/81
CEC	A72 22958	1/81	7/81
CEC	A52 16929	1/81	7/81
TRANSDUCER, INC.	20051	1/81	7/81
BLH	72952	1/81	7/81
CIC	567-11	1/81	7/81
C-10		6706-V-2	