

EVALUATION OF AGGRESSIVENESS
TEST TECHNIQUES

Walter E. Levan

Calspan Report No. 6892-V-3



TEST: 752-3-531
TYPE OF TEST: Symmetrical Frontal Car-to-Barrier Impact
1981 Volkswagen Rabbit
Deformable Moving Barrier
TEST DATE: 10/22/81
CONTRACT NO.: DTNH22-81-C-87088
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16. Abstract A symmetric frontal impact of a 1981 Volkswagen Rabbit and a deformable moving barrier was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department, Buffalo, NY, on October 22, 1981. Impact speed of each vehicle was 32.8 mph. Ambient temperature on the test date was 44°F. The driver of the Volkswagen Rabbit exceeded the upper limits of FMVSS 208 Injury Criteria for the head with a HIC value of 2246. The right front passenger was within the limits of FMVSS 208 for head, chest, and femurs. Maximum crush of the 1981 Volkswagen Rabbit was 28 inches on the left side and maximum firewall intrusion was 11.5 inches. Windshield retention loss on the 1981 Volkswagen Rabbit was greater than 75%. Maximum crush of the honeycomb on the face of the moving barrier was 14.5 inches.					
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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, it was to determine the feasibility of using such a barrier to evaluate vehicle aggressiveness.

This test was a symmetric frontal impact of a 1981 Volkswagen Rabbit and a deformable moving barrier with a nominal closing speed of 65.6 mph. This test was performed at Calspan Corporation, Advanced Technology Center on October 22, 1981.

The test program is part of the National Traffic Safety Administration (NHTSA) Contract DTNH22-81-C-87088, Task 2, to evaluate aggressiveness test techniques.

SECTION 2

SUMMARY OF TEST NUMBER 752-3-531

A frontal car-to-barrier impact (Figure A-1) of a 1981 Volkswagen Rabbit into a deformable moving barrier, with each vehicle traveling at 32.8 mph, was performed at the Calspan Corporation, Advanced Technology Center, on October 22, 1981. A summary of the test conditions are presented 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 1981 Volkswagen 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 head and chest triaxial accelerometers and femur load cells. The driver ATD, serial no. 183, had been used in two prior tests (752-1-527 and 615-2-530), and the FMVSS 208 Injury Criteria Value was not exceeded in those tests. The right front passenger ATD (serial no. 163) had been certified prior to the test, and the certification data sheets, along with instrumentation calibration data, are presented in Appendix C.

The crash event was recorded by 10 high-speed cameras and one Real Time camera. Camera locations and other pertinent camera information are found in Section 3 of this report.

The 59 channels of data were recorded on 5-14 Channel FM tape recorders. All data channels checked out prior to the test. The following are data losses experienced during the test.

Accelerometer Pack. #5(X) - Lost data after 30 millisec. Damaged Accelerometer.
Accelerometer Pack. #7(X) and 7(Z) - Package broke off crossmember at impact.
Accelerometer Pack. #10(X) - Intermittent data. Reason unknown.
Accelerometer Pack. #B1(X) - Intermittent data after 65 millisec.

TABLE 1

CRASH TEST SUMMARY

TEST NO.	<u>752-3-531</u>	PROJECT	<u>Evaluation of Aggressiveness</u> <u>Test Techniques</u>
DATE	<u>10/22/81</u>	TIME	<u>12:15 p.m.</u> TEMP. <u>44°F</u>
TEST CONDITION	<u>Symmetrical Frontal - 65.6 mph closing speed</u>		
VEHICLE NO. 1	<u>1981 Volkswagen Rabbit, 2 door hatchback</u>		
VEHICLE NO. 2	<u>Deformable moving barrier</u>		

	VEH. NO. 1	VEH. NO. 2
TEST WEIGHT (lbs)	<u>2570</u>	<u>3450</u>
IMPACT ANGLE (deg)*	<u>0°</u>	<u>0°</u>
IMPACT VELOCITY (mph)**	<u>32.8</u>	<u>32.8</u>
MAX. CRUSH (in) (static)	<u>28.0 (LF side)</u>	<u>14.5</u>
MAX. INTRUSION (in)	<u>11.6 (LF side)</u>	<u>---</u>

	VEH. NO. 1	VEH. NO. 2
DUMMIES		
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>
ID No.	<u>183</u> <u>163</u>	

NUMBER OF DATA CHANNELS	<u>59</u>
NUMBER OF HIGH SPEED CAMERAS	<u>10 + 1 Real Time</u>

*WITH RESPECT TO TOW TRACK CENTERLINE

**SPEED TRAP MEASUREMENT (±0.5% ACCURACY)

TABLE 1 (cont'd)

OBSERVATIONS (VEHICLE NO. 1) 1981 Volkswagen Rabbit

GLAZING Windshield has stress crack and the windshield along with the rubber retention molding separated from the vehicle (Fig. A-12)

DOORS Both front doors were operable after impact.

SEAT ANCHORAGES Intact.

RESTRAINTS Intact, see General Comments below.

OBSERVATIONS (VEHICLE NO. 2) Deformable Moving Barrier

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 700 1bs
Right Front 730 1bs
TOTAL FRONT 1430 1bs

Left Rear 580 1bs
Right Rear 560 1bs
TOTAL REAR 1140 1bs

Total Weight = $\frac{1430 + 1140}{2570}$ 1bs

Wheel Base = 95 inches

$Cg_{F.W.} = \frac{1140 \text{ lbs} \times 95 \text{ inches}}{2570 \text{ lbs}} = 42.1 \text{ inches}$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
UDW = Unloaded Delivered Weight (1780 lbs)
VCW = Vehicle Capacity Weight (785 lbs)
DSC = Designated Seating Capacity (4)

RCLW = VCW - 150 (DSC)

RCLW = 785 - 150 (4) = 185 lbs

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

TEST WEIGHT = 1780 lbs + 185 lbs + 2 (164 lbs)

TEST WEIGHT = 2293 lbs (calculated)

Table 3
SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION

Vehicle Manufacturer Volkswagen of America Corp.
 Make/Model Volkswagen Rabbit
 Body Style 2-door hatchback Model Year 1981
 VIN 1VWAB0171BV112822 Build Date 3/81
 NHTSA No. 752-3-531 Color light blue
 Engine Data: 4 cylinders 105 in³/cc displacement
 Transmission Data: 4 speed (X) Manual () Automatic
 Date Rec'd 10/5/81 Air Cond. --- PW. STR. --- PW. BR. ---
 Dealer's Name & Address Moore Motors, 4640 N. Broad St., Philadelphia, PA 19140

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

Vehicle Manufactured by Volkswagen of America Corp.
 Date of Manufacture 3/81 VIN 1VWAB0171BV112822
 GVRW 2822 lbs GAWR: Front 1609 lbs Rear 1278 lbs

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

Vehicle Load (up to capacity) - Front 27 psi
 Rear 31 psi
 Recommended Tire Size P155/80D13 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 = 185 lbs
 TOTAL = 785 lbs

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

Right Front = 570 lbs Right Rear = 300 lbs
 Left Front = 610 lbs Left Rear = 300 lbs
 TOTAL FRONT WEIGHT = 1180 lbs (66.3 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 600 lbs (33.7 % of Total Vehicle Weight)
 TOTAL DELV. WEIGHT = 1780 lbs

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 0 lbs CARGO

Right Front = 730 lbs Right Rear = 560 lbs
 Left Front = 700 lbs Left Rear = 580 lbs
 TOTAL FRONT WEIGHT = 1430 lbs (55.6 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 1140 lbs (44.4 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 2570 lbs
 Weight of ballast secured in vehicle trunk area = 0 lbs

Table 3
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test 10/22/81 Time of Test 12:15 am/pm
Ambient Temperature 40 °F at impact area
Temperature in Occupant Compartment 70 °F
Windshield Molding Temperature 45 °F

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude:	RF	<u>26.25</u>	LF	<u>25.7</u>	RR	<u>25.7</u>	LR	<u>25.4</u>
Test Attitude:	RF	<u>24.6</u>	LF	<u>24.7</u>	RR	<u>22.7</u>	LR	<u>22.7</u>

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 27 psi Rear = 31 psi
Recommended Tire Size P155/80D13 Load Range B
Tires on Vehicle Goodyear P155/80D13
Is Spare Tire a "Space Saver" yes X 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* gal
Test Volume gal (93% of EPA Capacity)
Fuel System Capacity (data from Owner's Manual) gal
Details of fuel system Test conducted with fuel tank empty.

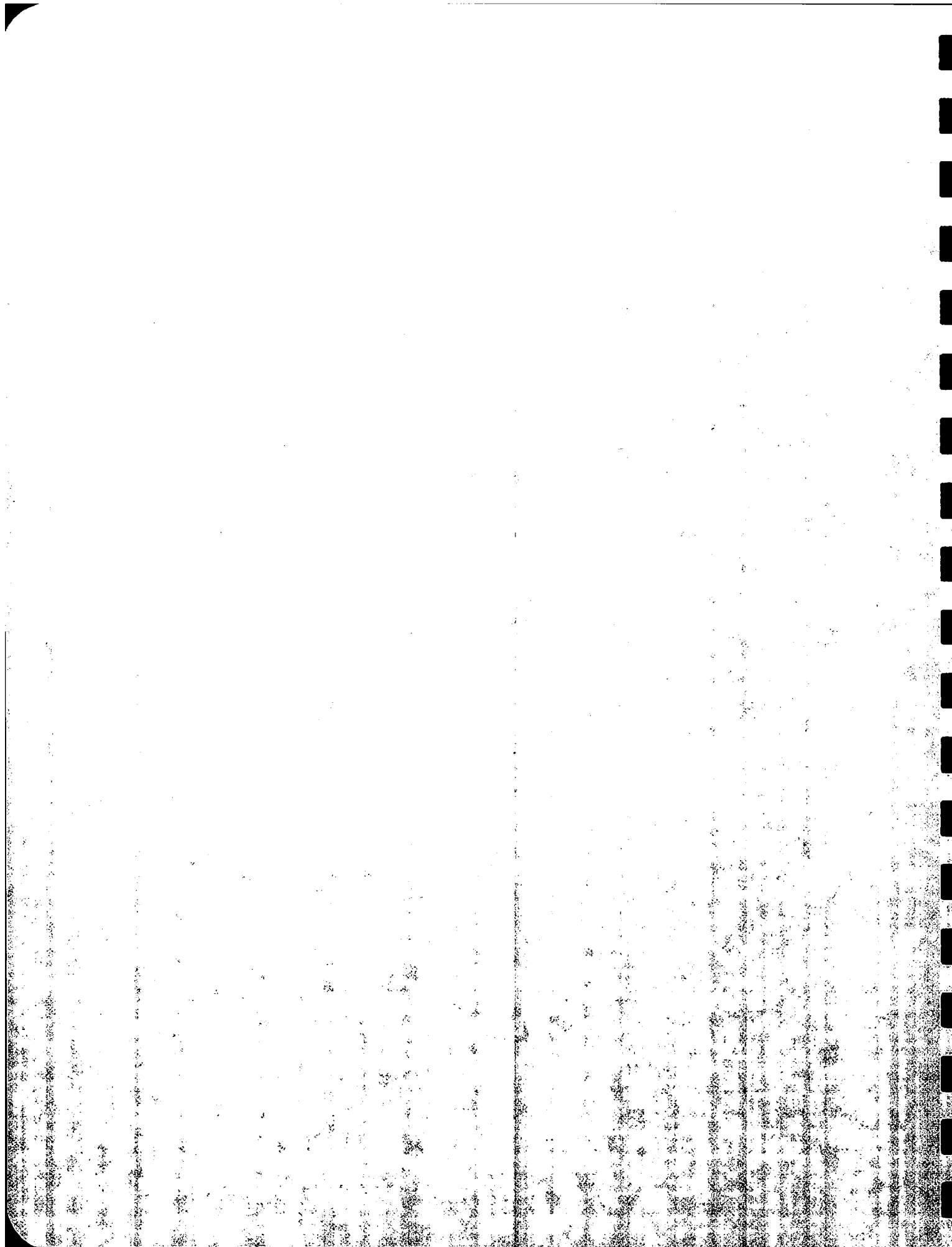
Electric Fuel Pump X Yes No Fuel Injection X Yes No
Does electric fuel pump operate with ignition switch "on" and the engine
not operating Yes X No

VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 153.0 /L 153.0 inches
Post-Test = R 125.5 /L 125.0 inches
Crush = R 27.5 /L 28.0

FOR FRONTAL IMPACTS, distance from front of test vehicle to the barrier
after impact = inches

*With entire fuel system filled from fuel tank through carburetor bowl.



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 1981 Volkswagen Rabbit (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 6. The passenger seat was then adjusted so that the seat back was in line with the driver seat back.

Vehicle No. 1 - 1981 Volkswagen Rabbit

The 1981 Volkswagen Rabbit was a 2-door hatchback equipped with a 105 cubic inch, 4 cylinder transverse engine and a 4-speed manual transmission. The total test weight with 2 dummies, instrumentation, and two on-board cameras was 2,570 pounds.

Vehicle No. 2 - Deformable Moving Barrier

Vehicle No. 2 was a deformable moving barrier (Fig. A-15 and A-16) weighing 3,450 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, a 4-inch denser honeycomb was placed in front to represent the front bumper. Five load cells were attached to the backer plate of the moving barrier as illustrated in Figure 4 to measure peak forces.

POST-TEST OBSERVATIONS

Vehicle No. 1 - 1981 Volkswagen Rabbit

The driver failed to comply with FMVSS 208 Injury Criteria Requirements for the head. The driver's head struck the center of the steering wheel hub (Fig. A-9) as evident by the chalk mark and the high-speed film. Head contact with the steering wheel occurred at 80 millisec. after impact with a HIC value of 2246, calculated between .0813 and .0840 millisec. The right front passenger complied with FMVSS 208 Injury Criteria Values for the head, chest, and femurs. Occupant results are summarized in Table 11, and the data traces along with the vehicle data traces are presented in Appendix B.

Maximum static crush of the vehicle was 28 inches on the left side, and maximum firewall intrusion was 11.6 inches.

The windshield has stress cracks, and windshield retention loss was greater than 75 percent. The rubber molding securing the windshield to the vehicle, separated along the entire top and sides (Fig. 12).

Both front doors were operable after impact.

Vehicle No. 2 - Deformable Moving Barrier

Maximum crush of the honeycomb on the face of the moving barrier was 14.5 inches. The total maximum force as measured by the 5 load cells was 88,500 pounds at 37 millisec. after impact. Complete pre- and post-test measurements of the barrier face honeycomb are presented in Table 7 , and data traces are found in Appendix B.

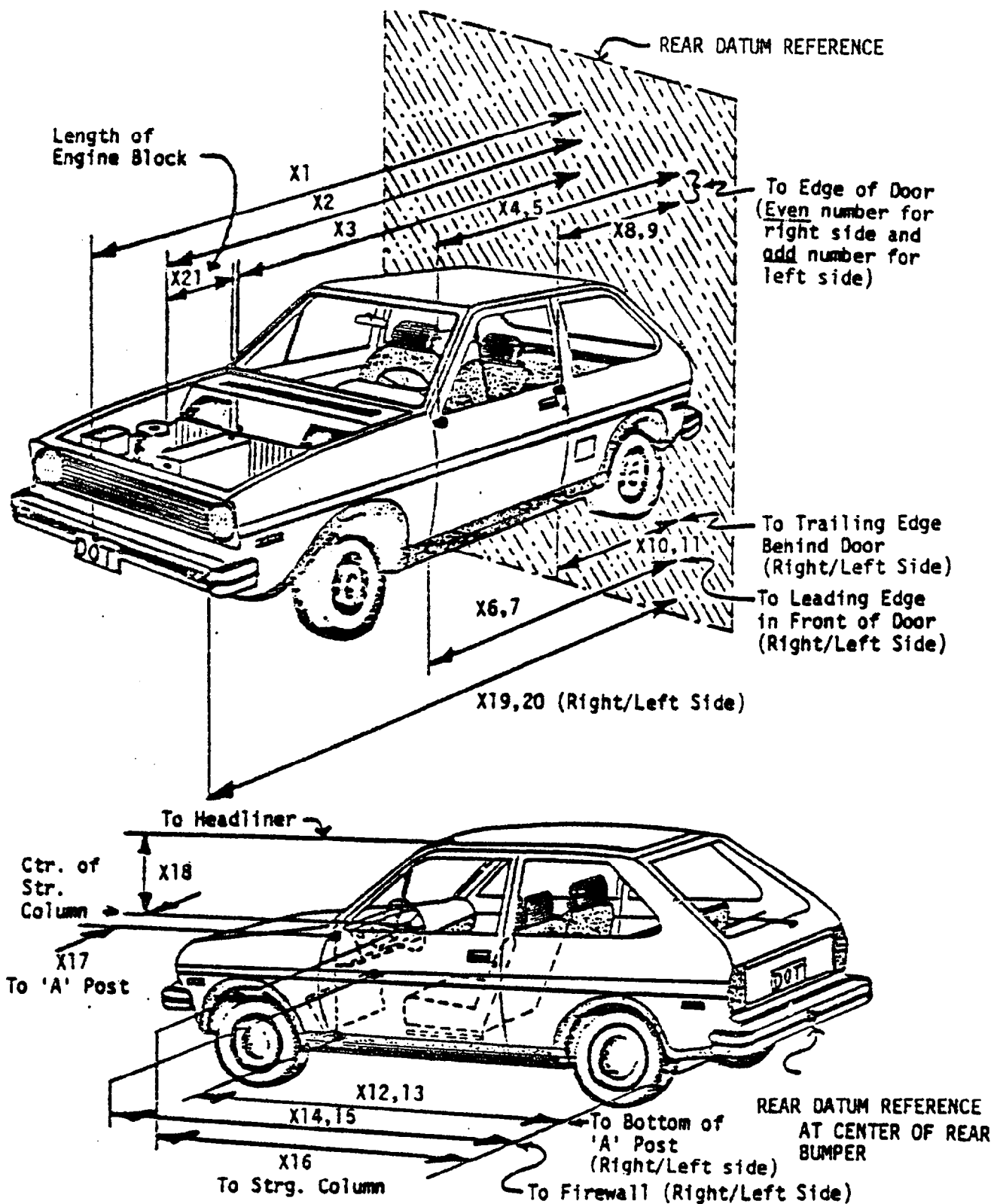


Figure 1 PRE-TEST AND POST-TEST MEASUREMENT POINTS

TABLE 4

VEHICLE MEASUREMENTS

No.		All Dimensions in Inches			
Vehicle No. 1 - 1981 Volkswagen Rabbit		Pre-Test	Post-Test	Difference	
X1	Total Length of Vehicle at Centerline	154.1	131.3	22.8	
X2	Rear Surface of Vehicle to Front of Engine	129.7	114.5	15.2	
X3	Rear Surface of Vehicle to Firewall	114.5	106.6	7.9	
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	102.4	102.5	-.1	
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	102.5	102.5	0.0	
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	102.5	101.7	.8	
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	102.5	101.8	.7	
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	58.0	58.0	0.0	
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	58.1	58.0	.1	
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	58.2	57.7	.5	
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	58.3	57.7	.6	
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	102.0	101.9	.1	
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	102.1	101.8	.3	
X14	Rear Surface of Vehicle to Firewall, Right Side	11.4	108.0	3.4	
X15	Rear Surface of Vehicle to Firewall, Left Side	115.3	103.7	11.6	
X16	Rear Surface of Vehicle to Steering Column	87.1	84.6	2.5	
X17	Center of Steering Column to "A" Post	14.8	12.7	2.1	
X18	Center of Steering Column to Headliner	17.8	18.1	-.3	
X19	Rear Surface of Vehicle to Right Side of Front Bumper	153.0	125.5	27.5	
X20	Rear Surface of Vehicle to Left Side of Front Bumper	153.0	125.0	28.0	
X21	Length of Engine Block	13.2	13.2	0.0	

Table 5

VEHICLE WEIGHTS AND RIDE HEIGHTS

Vehicle No. 1 - 1981 Volkswagen Rabbit

	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	610	570	300						
RIDE HEIGHTS	Inches	26 1/4"	26 1/4"	25 3/4"	21.9	16.9	22.0	17.0	18.6	18.75
CURB WEIGHT PLUS DUMMIES	Pounds	680	620	380						
RIDE HEIGHTS	Inches	25"	25"	25 1/4"						
FINAL WEIGHT INSTRUMENTATION AND DUMMIES	Pounds	700	730	560						
RIDE HEIGHTS	Inches	24.7	24.6	22.7	20.3	15.3	20.8	15.8	17.1	17.4

TABLE 6

VEHICLE No. 1 - 1981 Volkswagen RabbitDATE 10/14/81REFERENCE DISTANCE FROM REAR 154.1

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6	0	6	12	18	24	30	36
Lower Bumper	Pre			←				17.0				→		
	Post			←				26.5				→		
Upper Bumper	Pre			←				20.2				→		
	Post			←				28.3				→		
1/2 Bumper To Hood	Pre			←				24.8				→		
	Post			←				33.0				→		
Hood	Pre			←				29.0				→		
	Post			←				36.0				→		

HORIZONTAL DISTANCE FROM REFERENCE

Lower Bumper	Pre Post			.9	.5	.3	.1	0	.1	.3	.5	.9		
				30.0	29.8	29.7	29.6	29.4	29.4	29.5	29.5	29.4		
				29.1	29.3	29.4	29.5	29.4	29.3	29.2	29.0	28.5		
Upper Bumper	Pre Post			1.0	.6	.5	.3	.2	.3	.5	.6	1.0		
				32.5	32.3	32.2	31.9	31.9	31.9	31.9	32.0	32.1		
				31.5	31.7	31.7	31.6	31.7	31.6	31.4	31.4	31.1		
1/2 Bumper To Hood	Pre Post			7.5	7.2	5.5	5.4	5.2	5.4	5.5	7.2	7.5		
				35.6	36.3	36.5	36.2	37.9	36.5	36.0	37.8	33.2		
				28.1	29.1	31.0	30.8	32.7	31.1	30.5	30.6	25.7		
Hood	Pre Post			6.4	5.8	5.5	5.4	5.3	5.4	5.5	5.8	6.4		
				35.1	36.1	36.6	37.1	37.2	37.3	38.1	38.1	37.9		
				28.7	30.3	31.1	31.7	31.9	31.9	32.6	32.3	31.5		

TABLE 7

VEHICLE No. 2 - Deformable Moving Barrier

DATE 10/22/81

REFERENCE DISTANCE FROM REAR Edge of Backing Plate 21.1

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6	0	6	12	18	24	30	36
Lower Bumper	Pre							14.7						
	Post							15.0						
Upper Bumper	Pre							19.7						
	Post							19.1						
1/2 Bumper to Hood	Pre							26.5						
	Post							24.0						
Hood	Pre							32.5						
	Post							29.1						

HORIZONTAL DISTANCE FROM REFERENCE

Lower Bumper	Pre		0	0	0	0	0	0	0	0	0	0	0	
	Post		14.0	14.3	14.5	14.3	14.3	14.2	14.1	14.0	13.7	13.3	12.9	
	Diff.		14.0	14.3	14.5	14.3	14.3	14.2	14.1	14.0	13.7	13.3	12.9	
Upper Bumper	Pre		0	0	0	0	0	0	0	0	0	0	0	
	Post		10.5	11.0	11.4	11.7	11.7	11.6	11.4	11.3	11.2	10.9	10.3	
	Diff.		10.5	11.0	11.4	11.7	11.7	11.6	11.4	11.3	11.2	10.9	10.3	
1/2 Bumper to Hood	Pre		4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
	Post		9.0	8.8	8.6	8.6	9.0	9.2	8.9	9.2	10.5	11.5	6.3	
	Diff.		4.9	4.1	4.5	4.5	4.9	5.1	4.8	5.1	6.4	7.4	2.2	
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		5.5	7.1	6.8	6.0	5.4	5.4	5.5	6.2	7.1	6.7	5.1	
	Diff.		1.5	3.1	3.8	2.0	1.4	1.4	1.5	2.2	3.1	2.7	1.1	

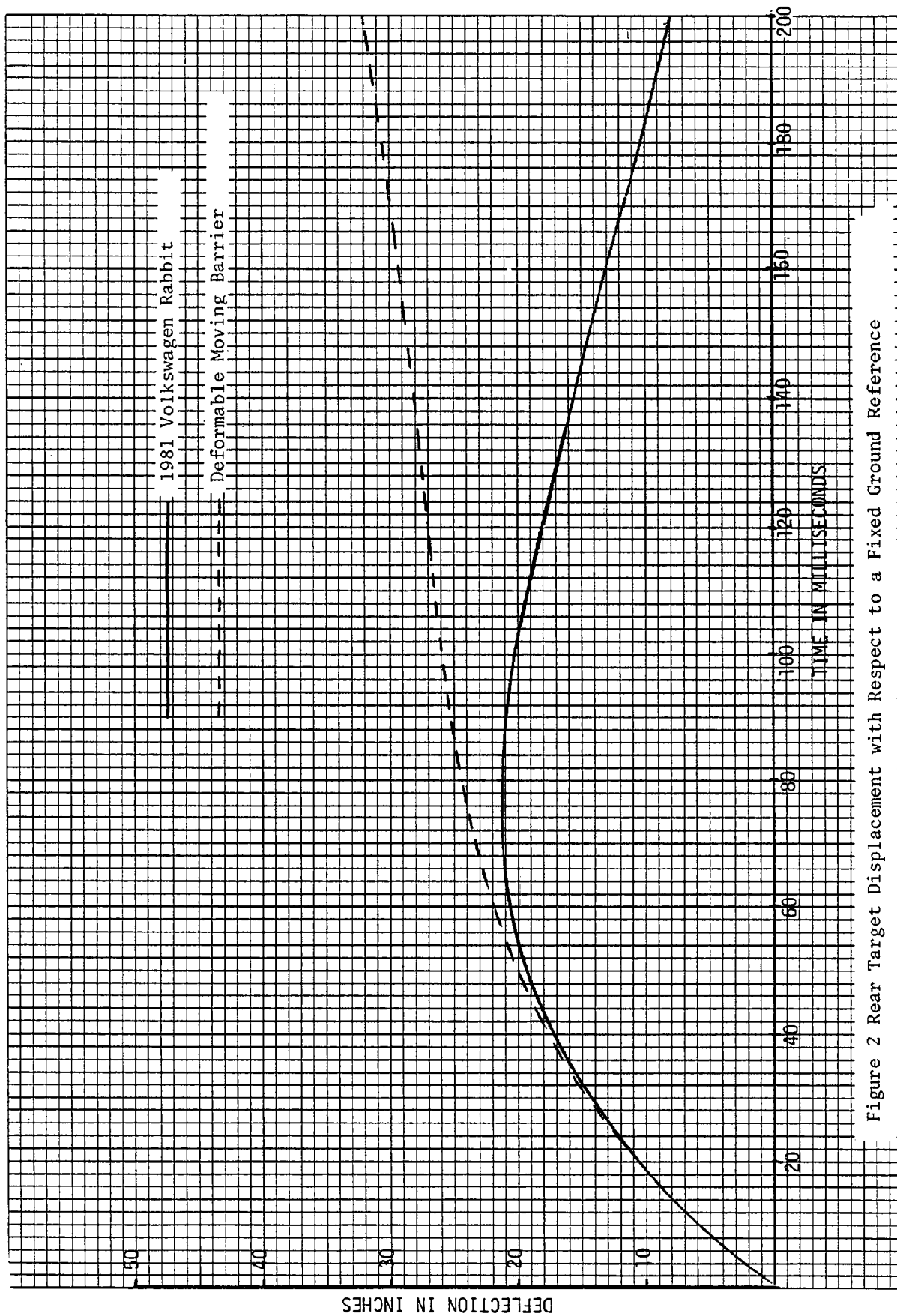
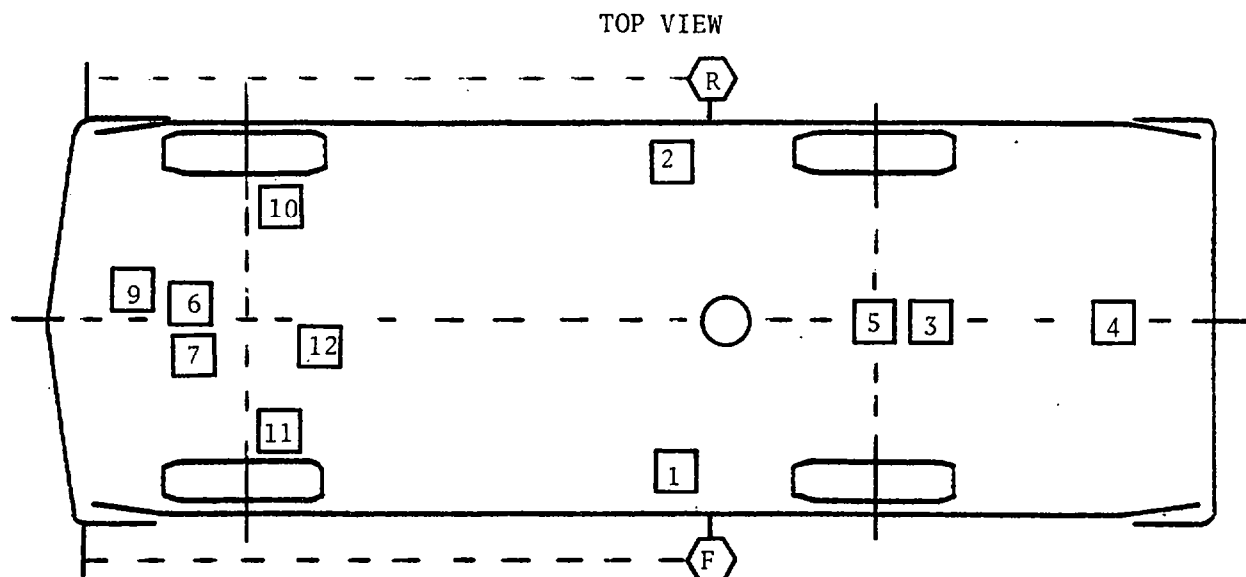


Figure 2 Rear Target Displacement with Respect to a Fixed Ground Reference



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	X	X	X
4	Rear bumper crossmember	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 - 1981 Volkswagen Rabbit

FIGURE 3 Vehicle No. 1 - Instrumentation

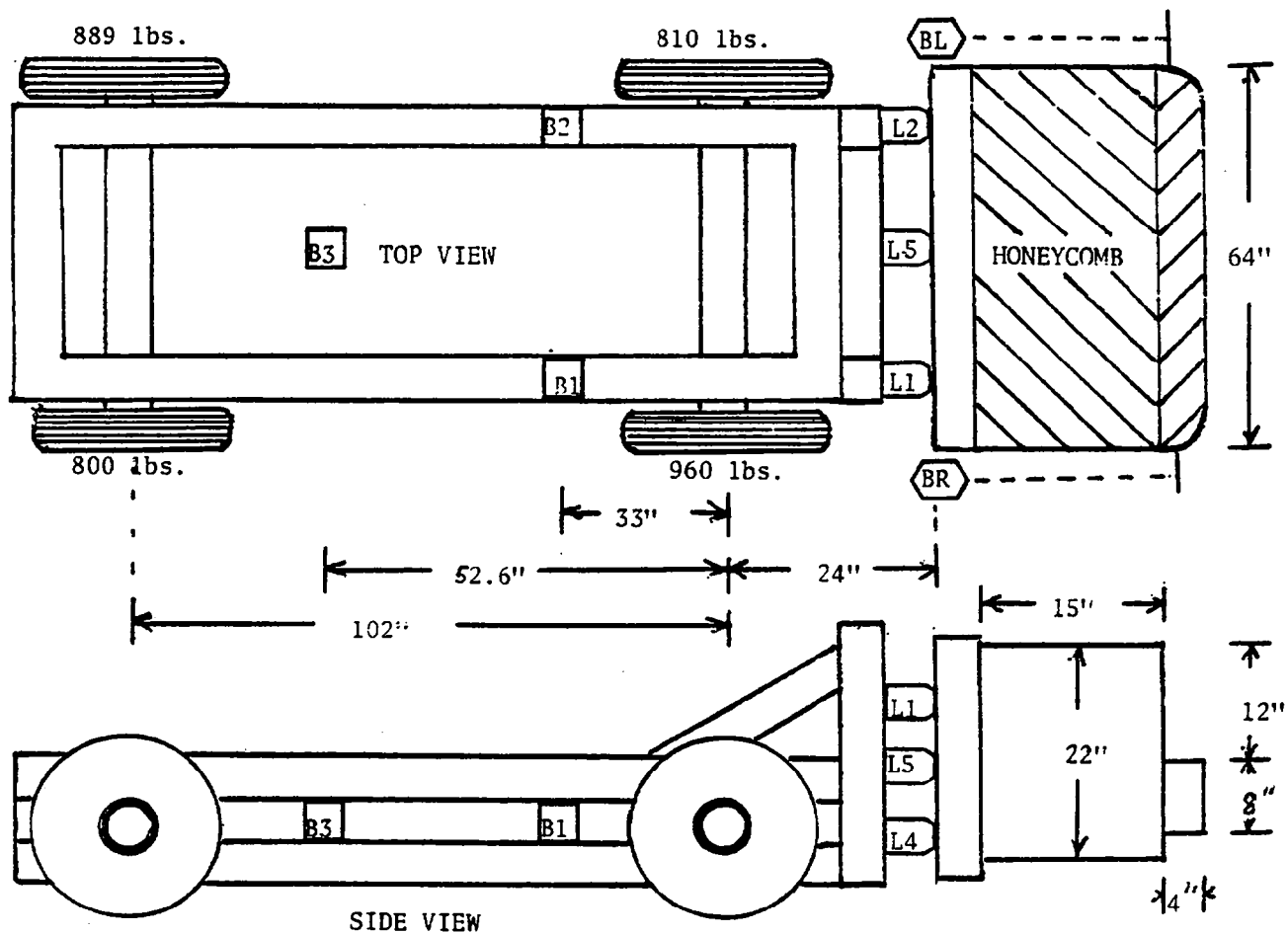
VEHICLE 1981 Volkswagen Rabbit

TEST 752-3-532

DATE 10/22/81

TRANSDUCER NUMBER	INCHES FROM REAR	INCHES LEFT OF C/L	ON C/L	INCHES RIGHT OF C/L
1	53.4	20.4		
2	53.7			21.2
3	34.5		X	
4	8.9		X	
5	39.5		X	
6	125.8			5.5
7	125.3	10.1		
8				
9	126.1			6.4
10	124.7			22.6
11	124.3	22.6		
12	114.5	10.0		
Y	49.4		X	

TABLE 8 VEHICLE TRANSDUCER LOCATION MEASUREMENTS



TRANSDUCER NUMBER*	TRANSDUCER LOCATION	DIRECTION		
		X	Y	Z
B1	RT upper frame rail accel.	x		x
B2	LT upper frame rail accel.	x		x
B3	C/G accel.	x	x	x
BR	Right bumper deflection	x		
BL	Left bumper deflection	x		
L1	Top right load cell	x		
L2	Top left load cell	x		
L3	Bottom left load cell	x		
L4	Bottom right load cell	x		
L5	Center load cell	x		

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

Figure 4 VEHICLE NO. 2 - MOVING BARRIER TRANSDUCER LOCATIONS

NOTE: Camera Information Shown on Table 9 and 10.

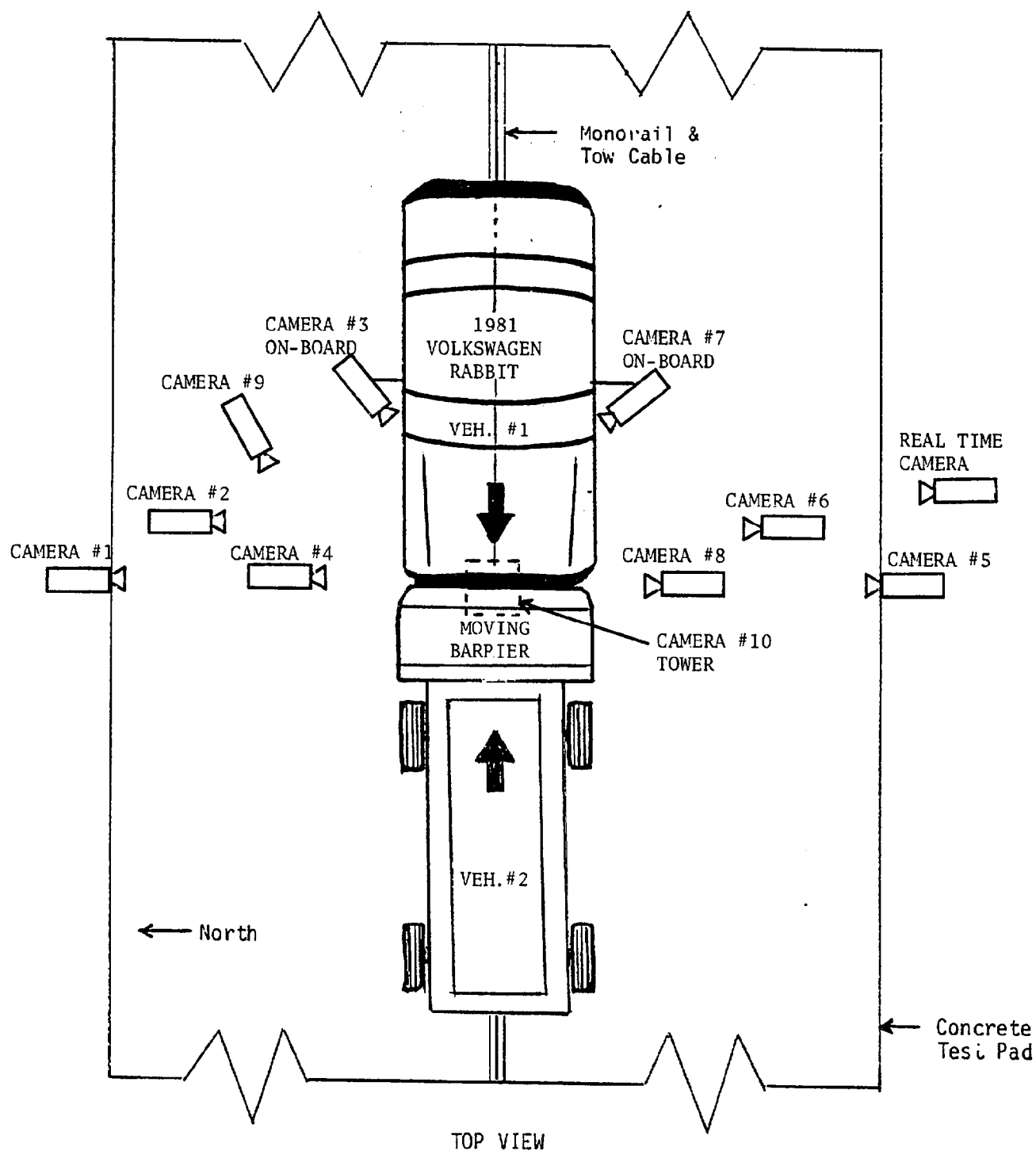


FIGURE 5 CAMERA POSITION FOR FRONTAL IMPACTS

Table 9

HIGH SPEED CAMERA LOCATIONSTest No.: 752-3-531Vehicle No.1 1981 Volkswagen RabbitVehicle No. 2 Deformable Moving Barrier

CAMERA NUMBER	VIEW	CAMERA POSITIONS (IN)*			CAMERA ANGLE (DEG)**	FILM PLANE TO HEAD TARGET (IN) X
		X	Y	Z		
1	Overall of Veh. Nos. 1 & 2 (RT)	487	12	58	-2	---
2	Overall of Veh. No. 1 (RT)	328	36	41	-2	471
3	Right Front Passenger	---	--	--	--	---
4	Front of Veh. Nos. 1 & 2 (RT)	290	0	13	-1	---
5	Overall of Veh. Nos. 1 & 2 (LF)	489	0	41	0	---
6	Overall of Veh. No. 1 (LF)	288	48	41	-1.5	272
7	Driver	---	--	--	--	---
8	Front of Veh. Nos. 1 & 2 (LF)	264	0	14	+3	---
9	Veh. Nos. 1 & 2	222	108	123	-19	---
10	Overhead of Veh. 1 & 2	0	75	388	-80	---

* X = film plane to monorail centerline

Y = film plane to impact location

Z = film plane to ground

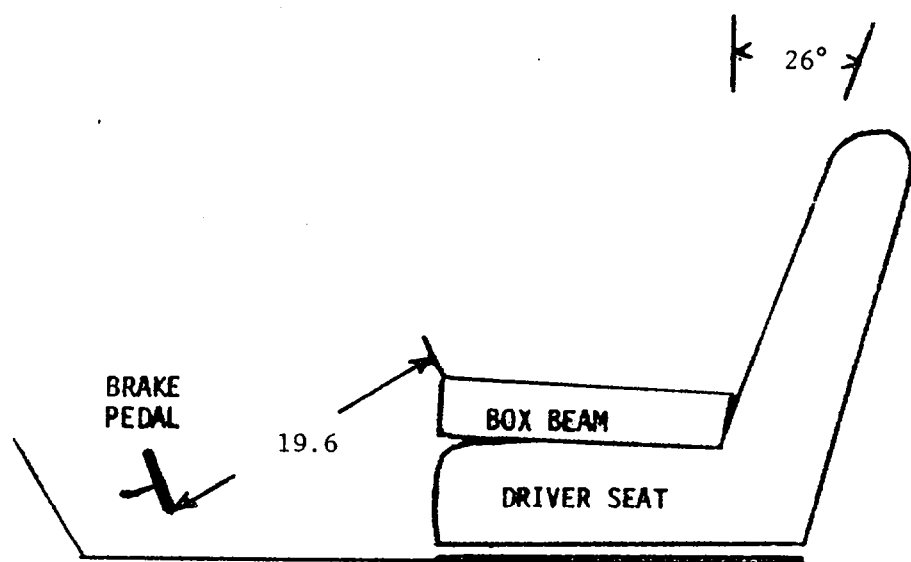
** Referenced to Horizontal Plane

TABLE 10
HIGH-SPEED CAMERA INFORMATION (TEST 752-3-531)

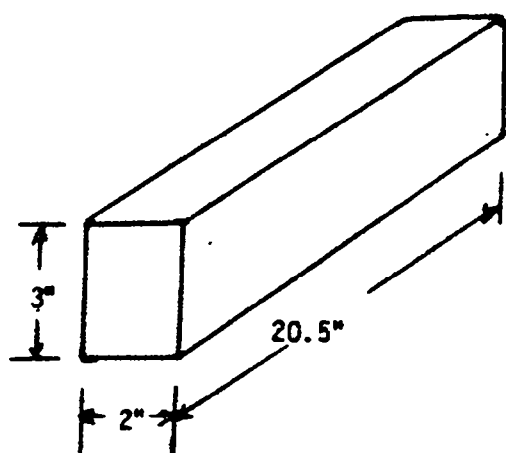
CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	Vehicle Nos. 1 & 2	Photosonic	13 mm	700
2	Vehicle No. 1	Photosonic	13 mm	650
3	RT Front Passenger	Stalex	8 mm	900
4	Front of Veh. Nos. 1 & 2	Photosonic	25 mm	650
5	Vehicle Nos. 1 & 2	Photosonic	13 mm	700
6	Vehicle No. 1	Photosonic	13 mm	650
7	Driver	Stalex	8 mm	1000
8	Front of Veh. Nos. 1 & 2	Photosonic	25 mm	650
9	Vehicle Nos. 1 & 2	Photosonic	13 mm	670
10	Overhead	Photosonic	13 mm	670

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 of film.



DISTANCE AFT FROM MID-SEAT
TRACK POSITION



BOX BEAM DIMENSIONS

FIGURE 6 DRIVER SEAT POSITION

FIGURE 7
PART 572 DUMMY IN-VEHICLE POSITION

Test No. 752-3-531

Vehicle 1981 Volkswagen Rabbit

SEAT TYPE:

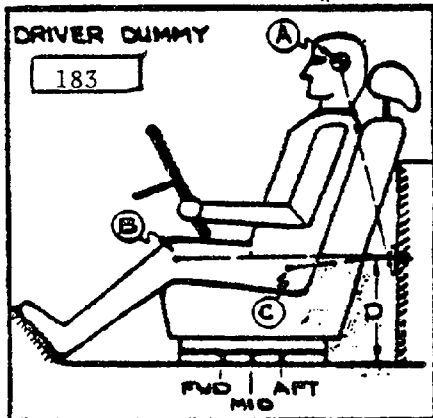
 Bench
 x Bucket
 Split Bench

ADJUSTER TYPE:

 x Manual
 Power

BUCKET SEAT BACK TYPE:

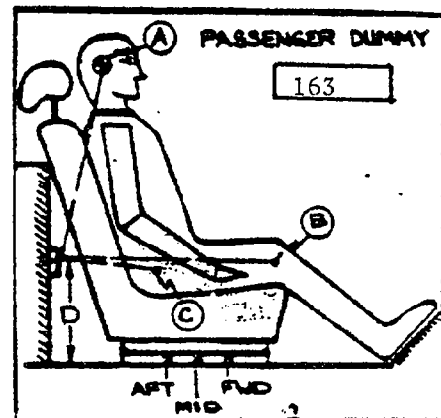
 x Fixed
 Adjustable Reclining



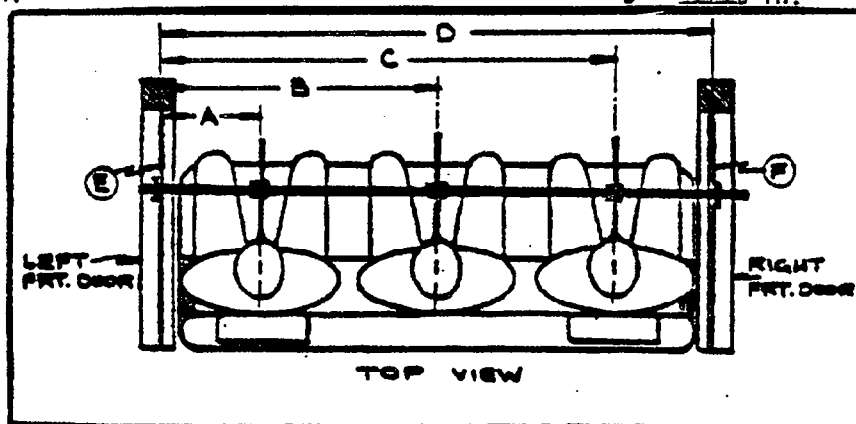
A = 18.3 in. 13 Degrees
B = 29.5 in. 105 Degrees
C = 15.0 in. 127 Degrees
D = 17.0 in.

MEASUREMENT LOCATION

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



A = 18 in. 15 Degrees
B = 30.5 in. 102 Degrees
C = 15.5 in. 124 Degrees
D = 17.0 in.



DUMMY ID

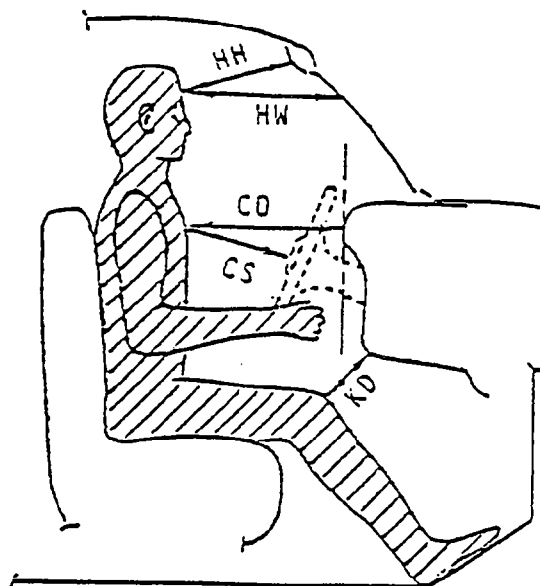
183

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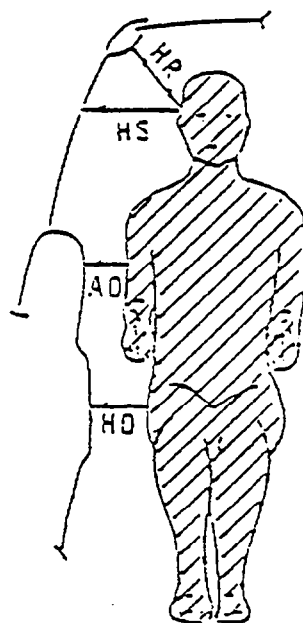
163

A	=	Left Door to Driver Centerline	<u>11.6</u> in.
B	=	Left Door to Center Passenger Centerline	<u>---</u> in.
C	=	Left Door to Right Passenger Centerline	<u>37.2</u> in.
D	=	Left Door to Right Door	<u>47.8</u> in.
E, F	=	Window Glass Height (Right and Left Must be Equal)	<u>11.25</u> in.

	<u>DRIVER</u>	<u>PASS</u>
HH	21	21.5
HW	25.5	26.0
CD	24.3	25.5
CS	17.0	---
KDL	8.5	8.3
KDR	8.25	8.3



HR	6.2	6.0
HS	7.5	7.5
AD	4.0	4.0
HD	6.3	5.7



Vehicle No. 1 - 1981 Volkswagen Rabbit

Figure 8 OCCUPANT CLEARANCE DIMENSIONS

TABLE 11
DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G") *							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	-120	-60	52	125	-36	-44	-28	58
DUMMY (2)	-28	38	42	61	-36	28	-16	39
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	400	113
DUMMY (2)	428	170
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)	1525	***	1575
DUMMY (2)	3100	2750	***
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)	2246.0	.0813	.0840	233.4	3413.7
DUMMY (2)	707.5	.0372	.1752	30.5	963.3
DUMMY (3)					
DUMMY (4)					

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

*** Unable to attach in-board lap belt load cells.

TABLE 12

TEST PROCEDURE CHECK LIST

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	10/22	
2.	Fill out summary sheet. Apply identification number to vehicle.	JC	10/22	
3.	Inspect vehicle and record any damage or missing parts.	OWZ	10/13	
4.	Add fluids to specified levels or fill to capacity.	JC		
5.	Weigh vehicle and record weight at each wheel on summary sheet.	JC	10/22	
6.	Apply reference height marks at each wheel and record on summary sheet.	JC	10/22	
7.	Pump fuel from tank and run engine until fuel lines are empty.	JC	10/23	
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	10/23	
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	10/23	
0.	Siphon 7% of solvent from fuel tank and record amount removed on Summary Sheet.	JC	10/23	

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
11.	Perform pre-test vehicle measurements	WS	10/20	
12.	Mark forward-most and rear-most positions of seat. Measure and mark seat and sill mid-positions.	Jc	10/23	
13.	Install mounting plates for accelerometers as specified in the Test Plan.	Jc	10/26	
14.	Install mounting plate and instrumentation in trunk area.	Jc	10/26	
15.	Install accelerometers.	Jc	10/26	
16.	Place certified dummies in both front seats with seats in correct position.	Jc	10/28	
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.	ML	10/22/81	
18.	Install on-board lighting to illuminate field of view of ground cameras.	ML	10/22/81	
19.	Route and secure all electrical cables.	GG	10/22/81	
20.	Install speed trap breaker bar on vehicle.	Jc	10/29	
21.	Install guide rollers and abort straps to vehicle.	Jc	10/28	
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	10/28	
23.	Measure and record ride height.	WS	10/22	
24.	Apply targets and tape striping as specified in TP-212-02 - (Laboratory Procedure for Vehicle Assessment.)	ML	10/22/81	
		Jc	10/28	

TABLE 12 (cont'd)

AT IMPACT SITE

ITEM NO.	DESCRIPTION	CHECKED		DATE	COMMENTS
		BY			
25.	Position vehicle front to bumper at impact point.	W.S.		10/22	
26.	Photograph the following:				
	a) Vehicle overall & closeup left and right views.	W.S.			
	b) Windshields overall and close-up left and right quarter views	W.S.		10/22/81	
	c) Real time documentary	W.S.			
27.	Align and focus stationary high speed cameras.	W.S.			
28.	Measure and document camera positions.	W.S.		10/22/81	
29.	Test operation of all high speed cameras.	GG		10/22/81	
30.	Set up speed traps and measure breaker bar when vehicles are at impact point.	W.S.		10/22/81	
31.	Check vehicle attitude and ride height and document on summary sheet.	W.S.		10/22	
		W.S.		10/22/81	
32.	Check speed traps operation.				
33.	Move test vehicles to starting point	W.S.		10/22	
STARTING POINT PROCEDURE					
34.	Adjust dummy positions as per dummy positioning check list and make required measurements.	W.S.		10/22/81	
35.	Connect umbilical cables.	GG		10/22/81	
36.	Make operation check of all instrumentation and calibrate system.	GG		10/22/81	
37.	Take all pre-test photographs.	W.S.		10/22/81	

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
38.	Check operation of camera interlock and flash bulbs correlation.			
39.	Latch trunk and leave key in lock.			
40.	Verify that fuel tank cap is tight.	OKZ	10/22/81	
41.	Place transmission in neutral. Release parking brake.	OKZ	10/22/81	
42.	Verify that hood latch is latched.	OKZ	10/22/81	
43.	Close all windows & vents (except front windows).	OKZ	10/22/81	
44.	Close doors leave unlocked.	OKZ	10/22/81	
45.	Check operation of all systems.	OKZ	10/22/81	
46.	Record temperature of interior of vehicle.	OKZ	10/22/81	
47.	Complete countdown procedures and proceed with test.			
<u>POST-TEST PROCEDURES</u>				
48.	Make operational check of all instrumentation.	GG	10/22/81	
49.	Photograph with real time camera:	OKZ	10/22/81	
a)	Post-test overall scene.	↓	↓	
b)	Close-up of pertinent damage to windshield or fuel system.	↓	↓	
c)	Dummies failed restraints or failed seat anchorages.	↓	↓	
d)	Any other type of failure.	↓	↓	
e)	Opening of vehicle doors.	↓	↓	

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
50.	Take post-test still photographs. Record visual observations of vehicle condition, dummy positions, any anomalies, etc.	<i>WZ</i>	<i>10/22/81</i>	
51.	Separate vehicles and photograph front of each vehicle.	<i>WZ</i>	<i>10/22/81</i>	
52.	Remove umbilicals.	<i>GG</i>	<i>10/22/81</i>	
	Remove vehicles from test track.			

APPENDIX A

PHOTOGRAPHS

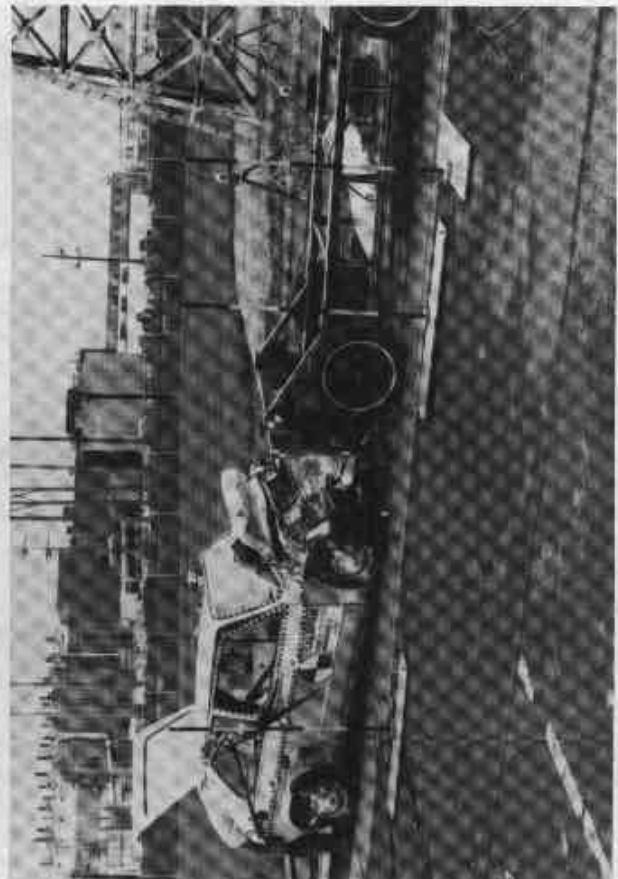
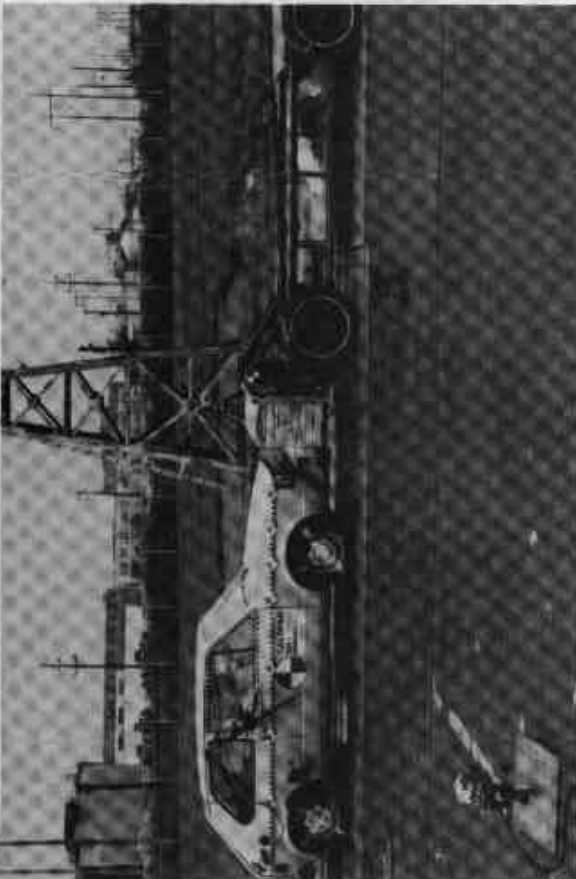
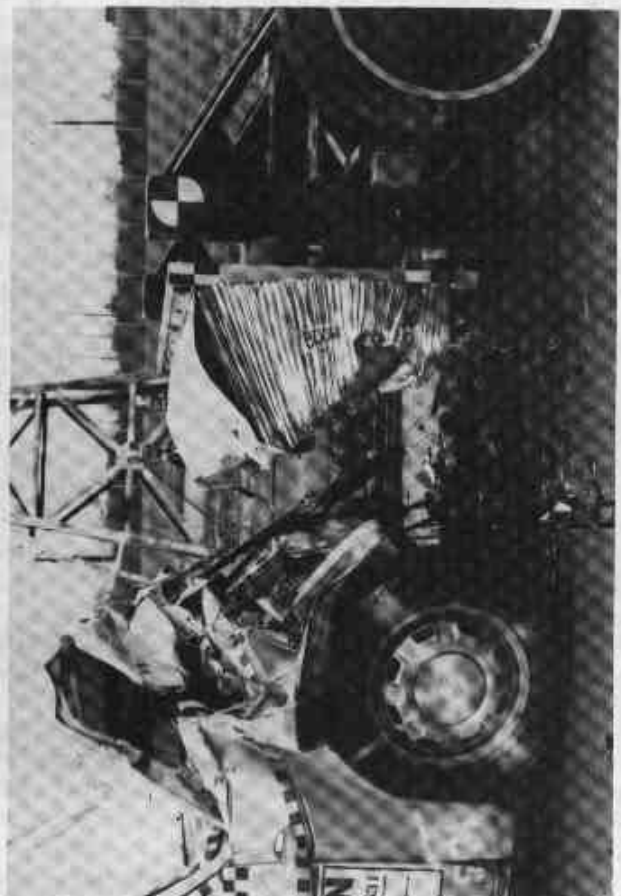
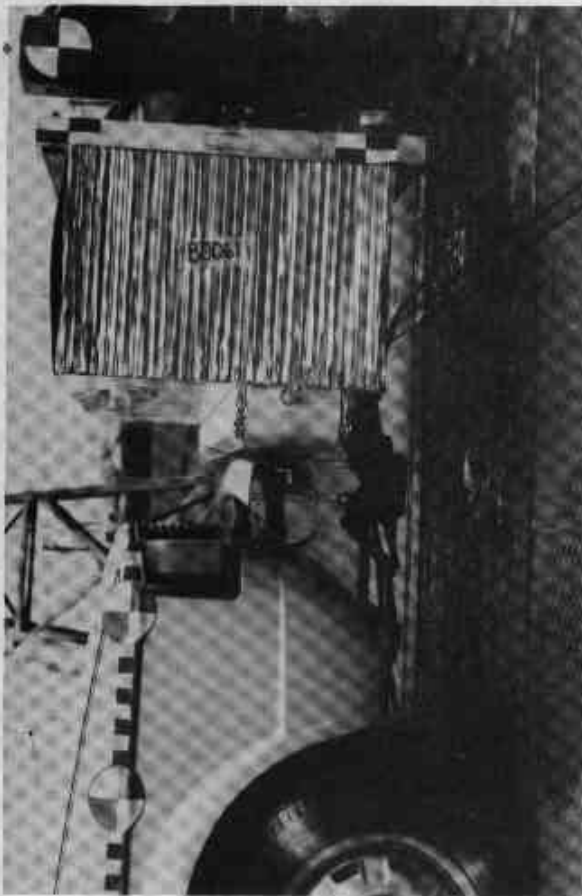


Figure A-1 Vehicles Nos. 1 and 2 Pre- and Post-Test Impact Configuration

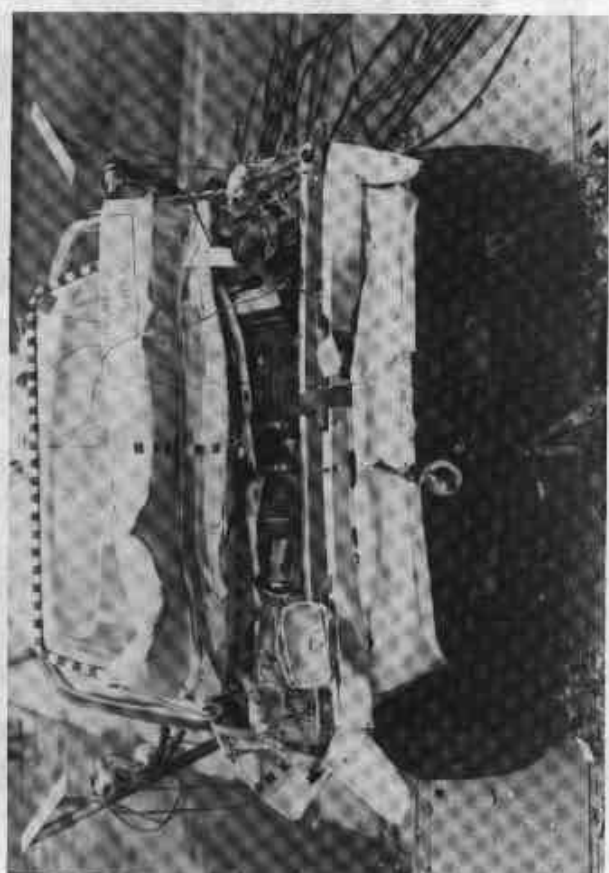
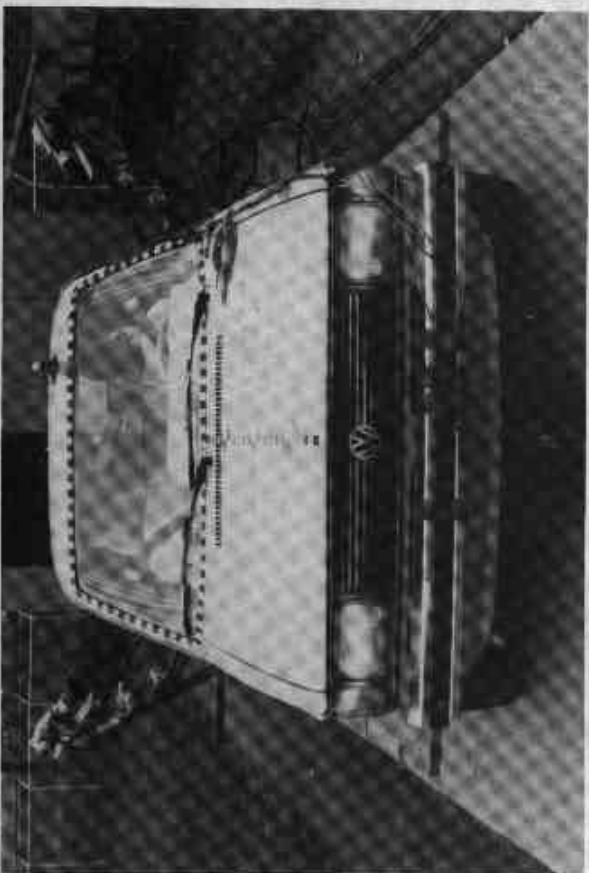


Figure A-2 Vehicle No. 1 - Pre- and Post-Test Views of Front and Rear

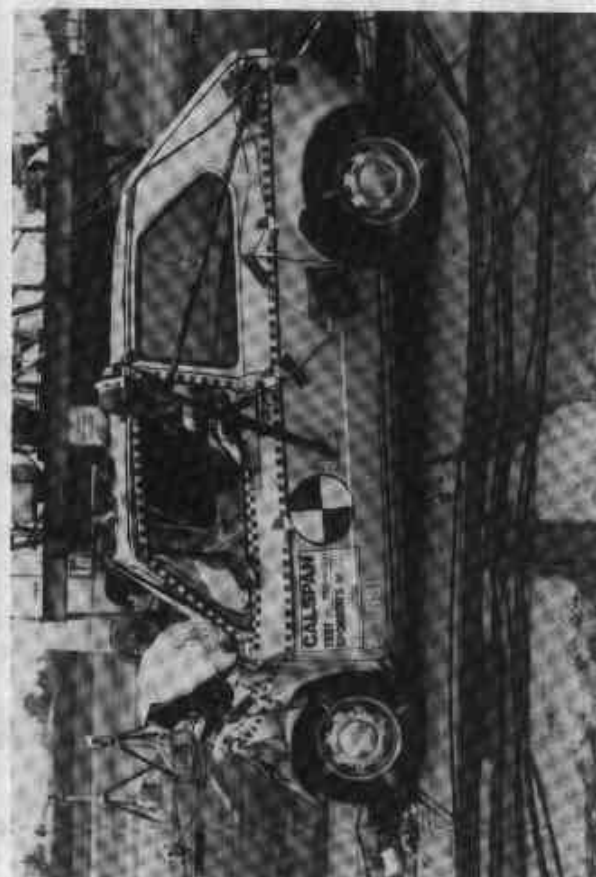
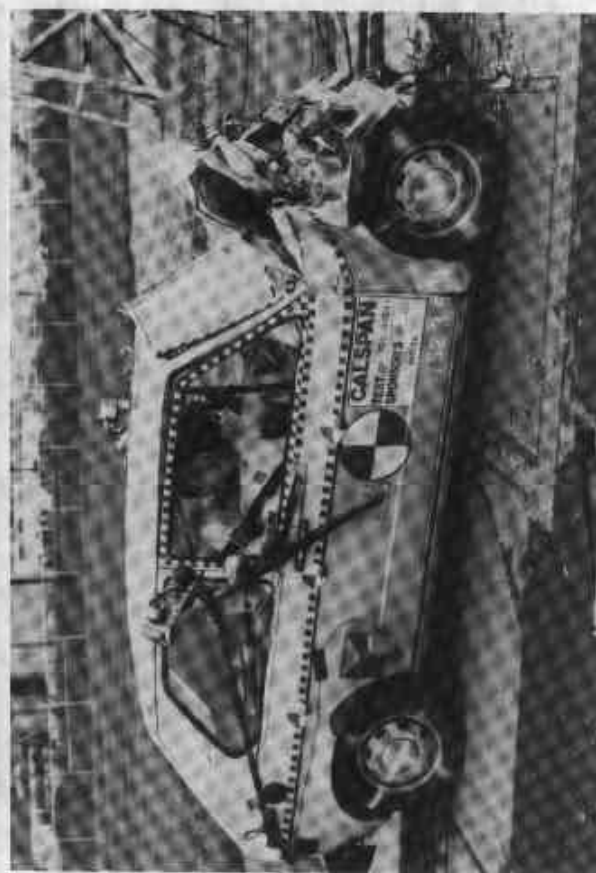
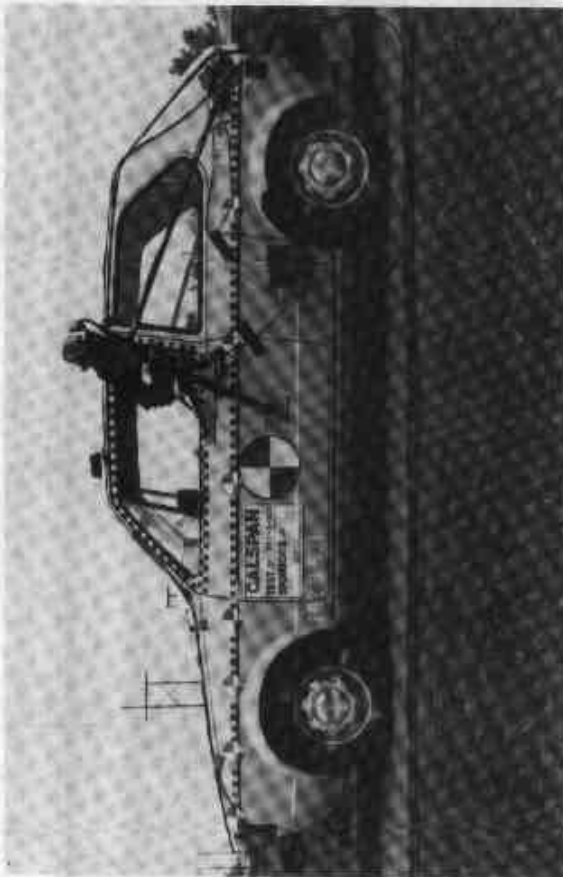


Figure A-3 Vehicle No. 1 - Pre- and Post-Test of Right and Left Sides

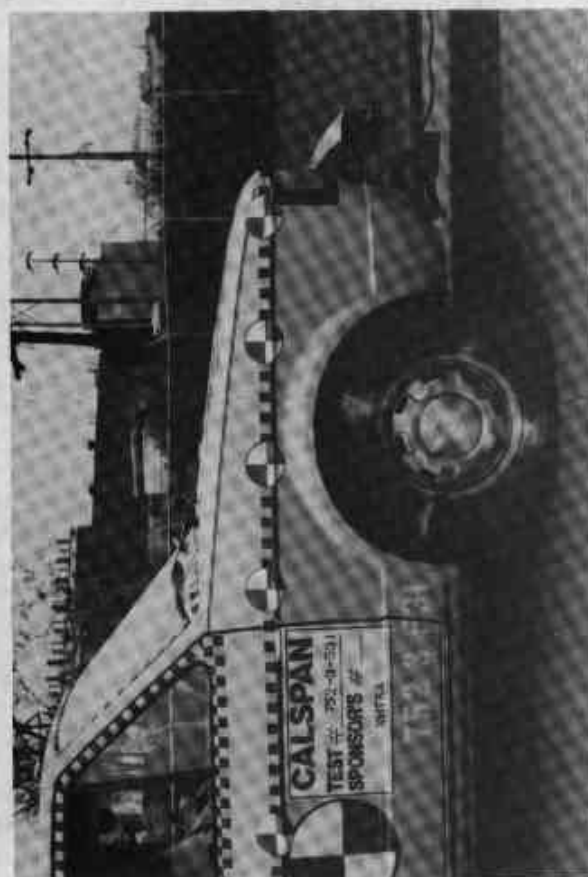
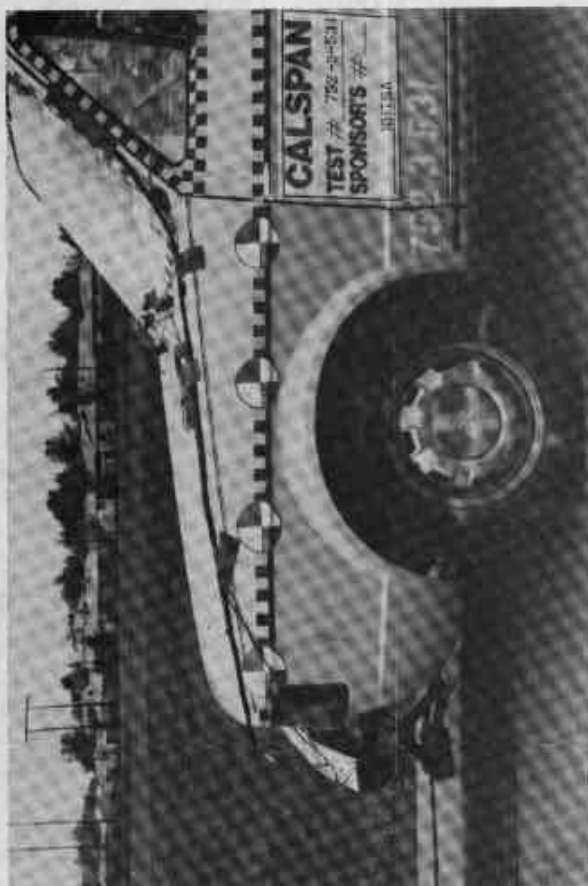


Figure A-4 Vehicle No. 1 - Pre- and Post-Test Views of Right and Left Front Quarters

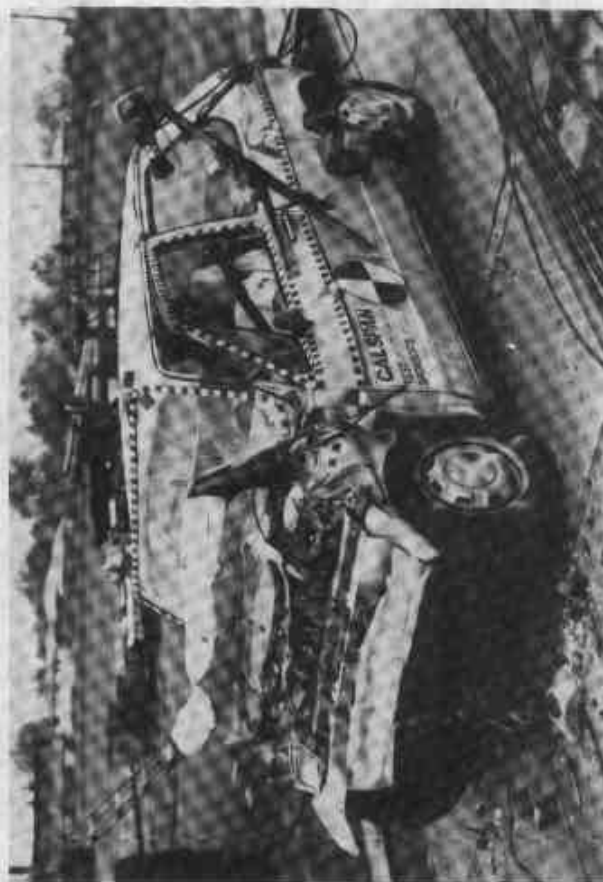
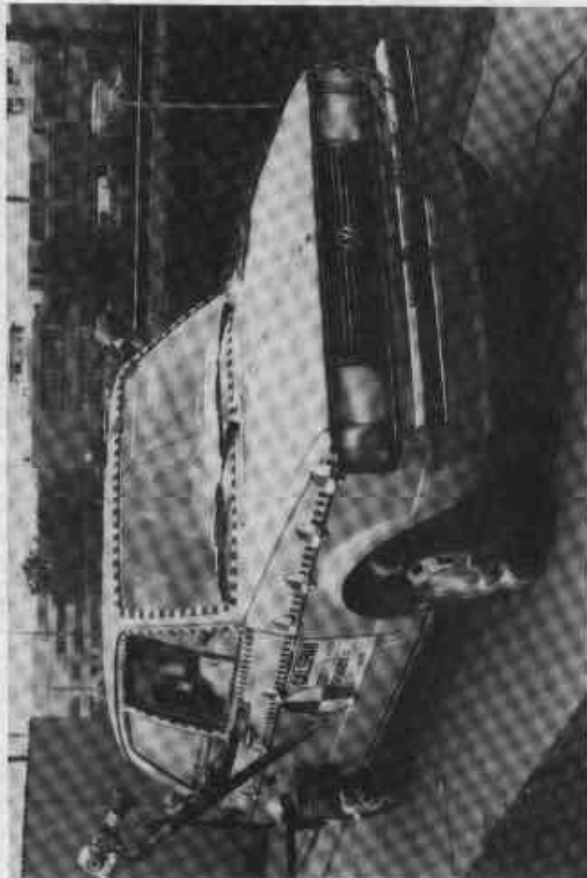
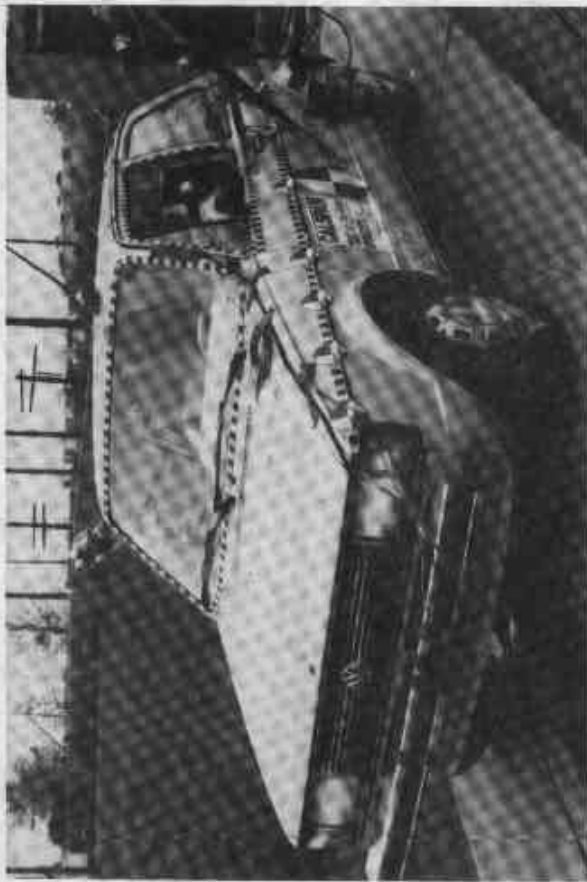


Figure A-5 Vehicle No. 1 - Pre- and Post-Test Views of Front Three-Quarters

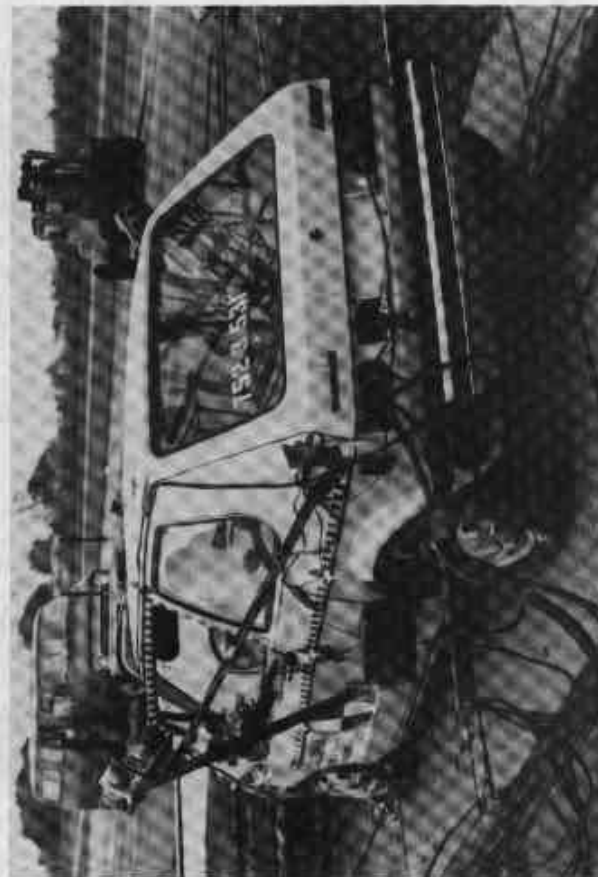
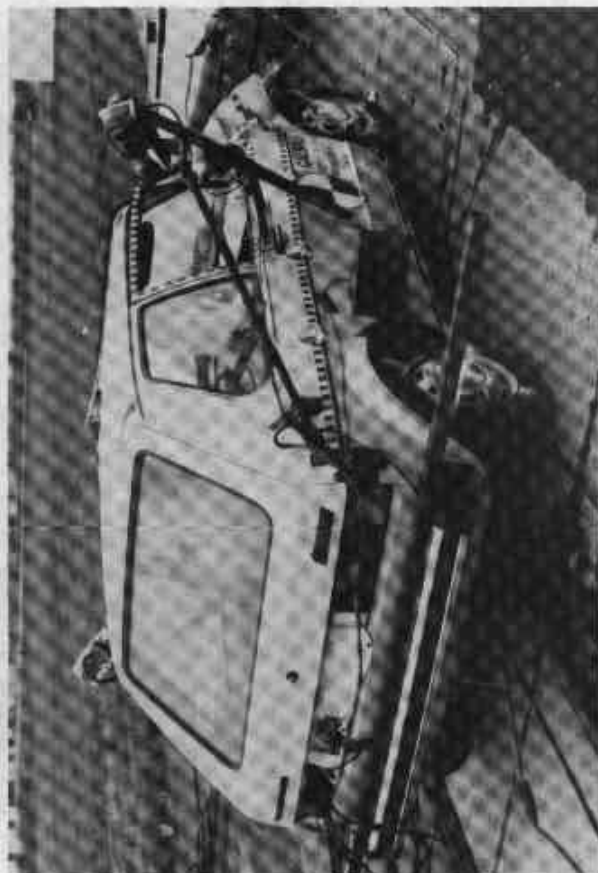


Figure A-6 Vehicle No. 1 - Pre- and Post-Test Views of Rear Three-Quarters

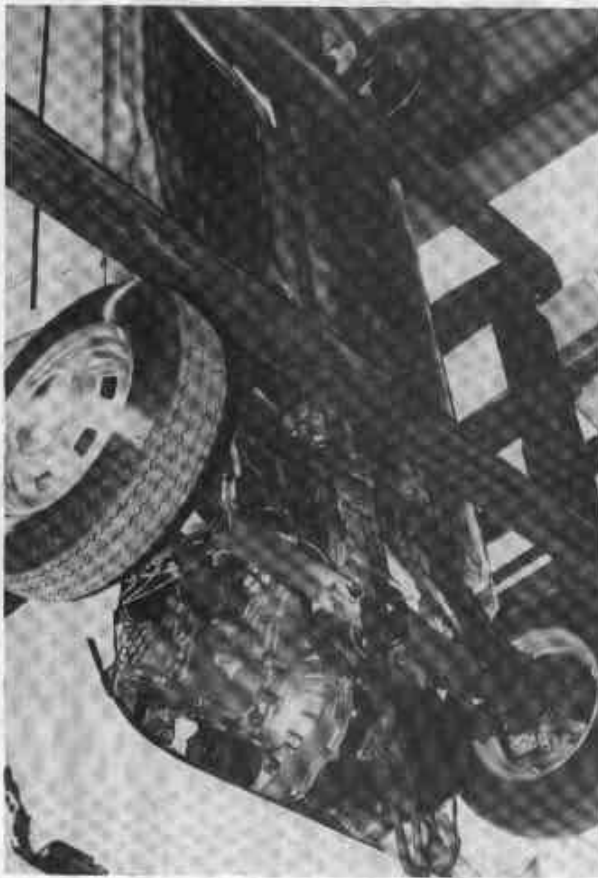
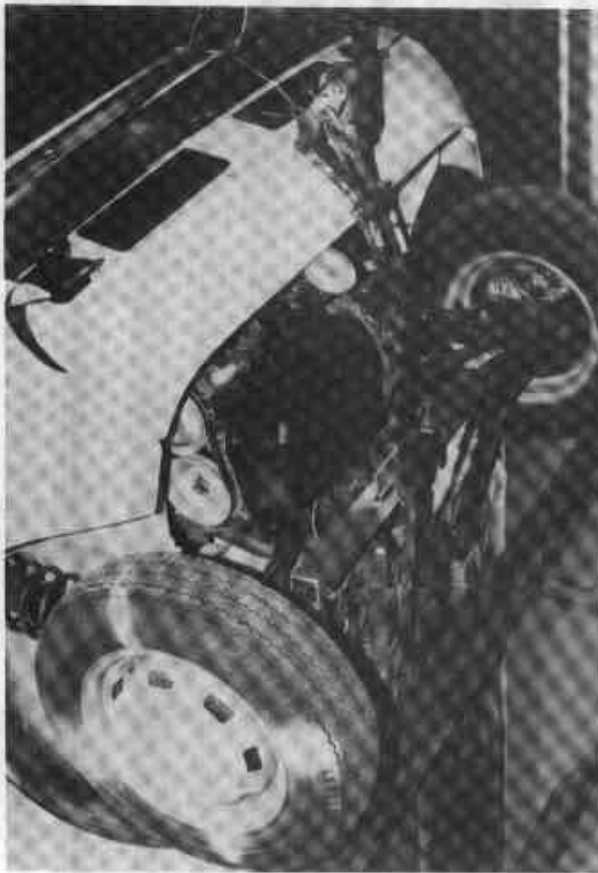


Figure A-7 Vehicle No. 1 - Pre- and Post-Test Side Views of Front Underbody

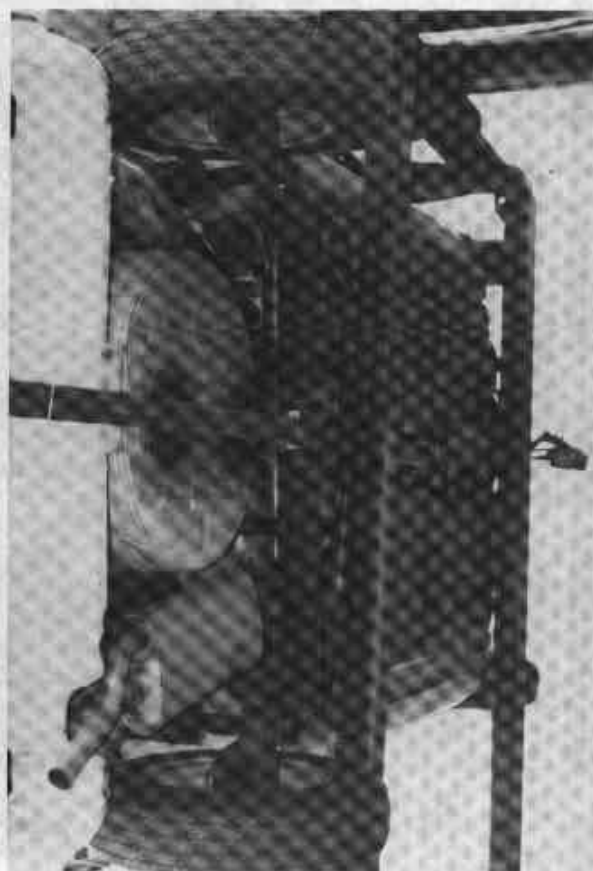
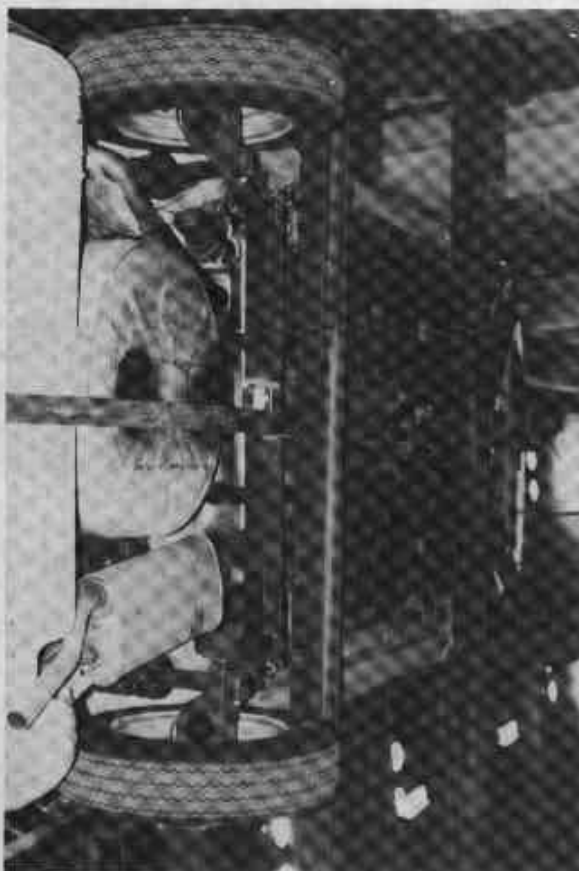


Figure A-8 Vehicle No. 1 - Pre- and Post-Test Views of Front and Rear Underbody

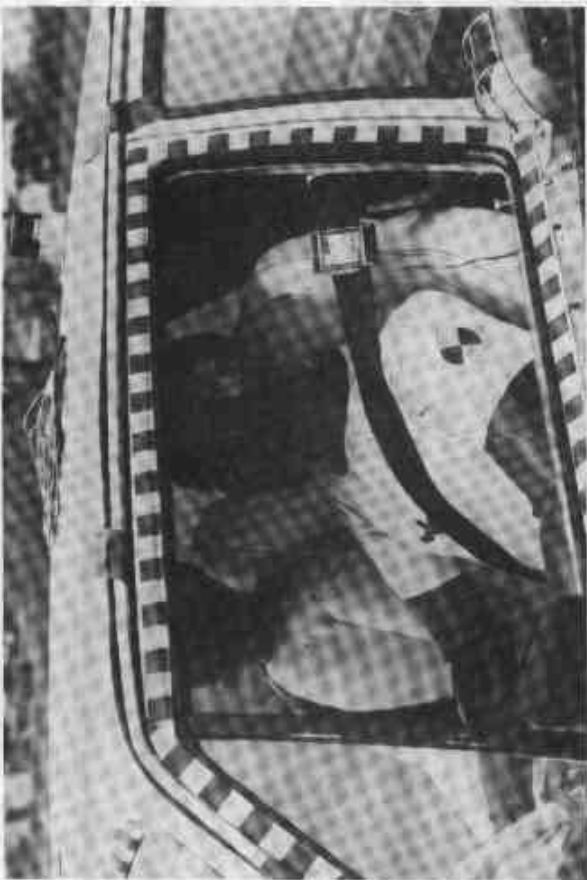


Figure A-9 Vehicle No. 1 - Pre- and Post-Test Views of Driver Position

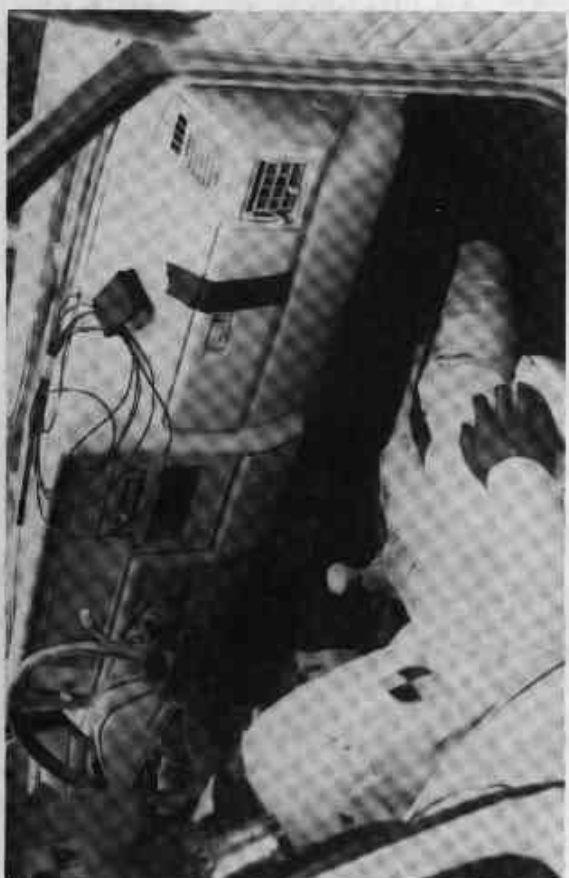
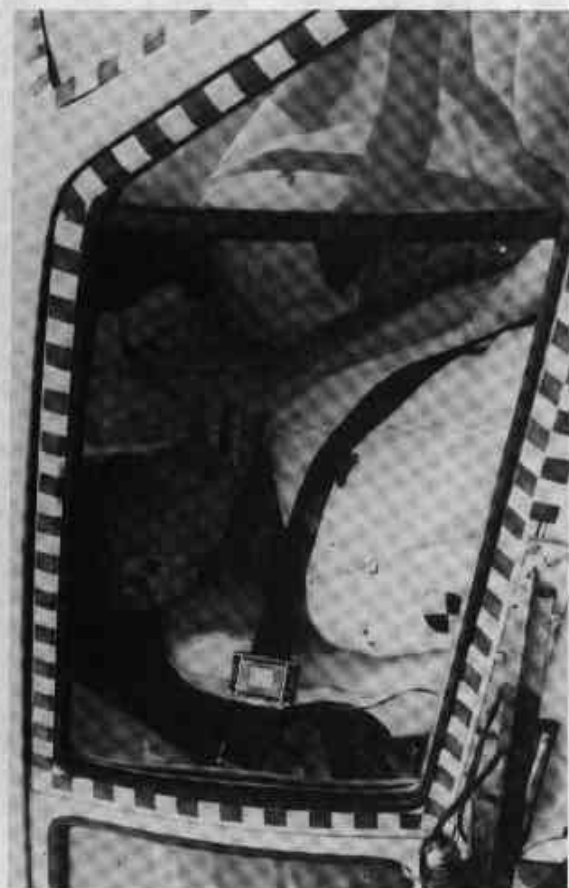


Figure A-10 Vehicle No. 1 - Pre- and Post-Test Views of Right Front Passenger Positions



Figure A-11 Vehicle No. 1 - Post-Test View of Vehicle Interior

A-12



Figure A-12 Vehicle No. 1 - Post-Test View of Windshield and Door Separation

6892-V-3

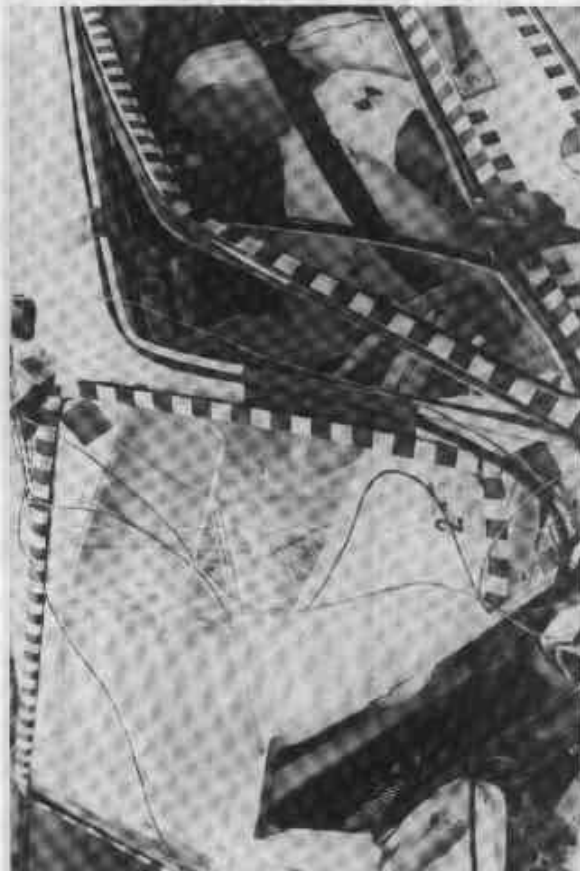




Figure A-14 Vehicle No. 2 - View of Moving Barrier Load Cells

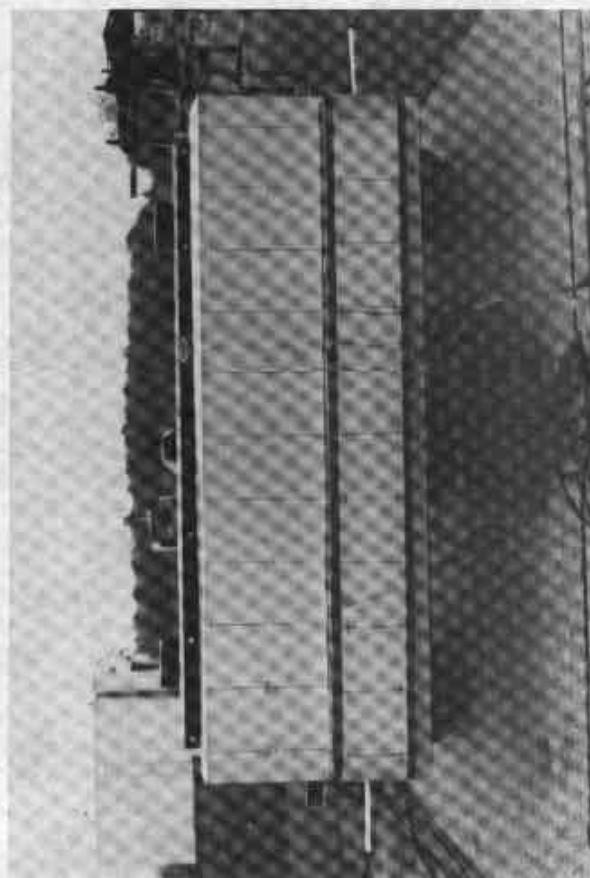


Figure A-15 Vehicle No. 2 - Pre- and Post-Test Front View of Barrier Honeycomb



Figure A-13 Velocity Trap Counter



Figure A-15 Vehicle No. 2 - Pre- and Post-Test Front View of Barrier Honeycomb

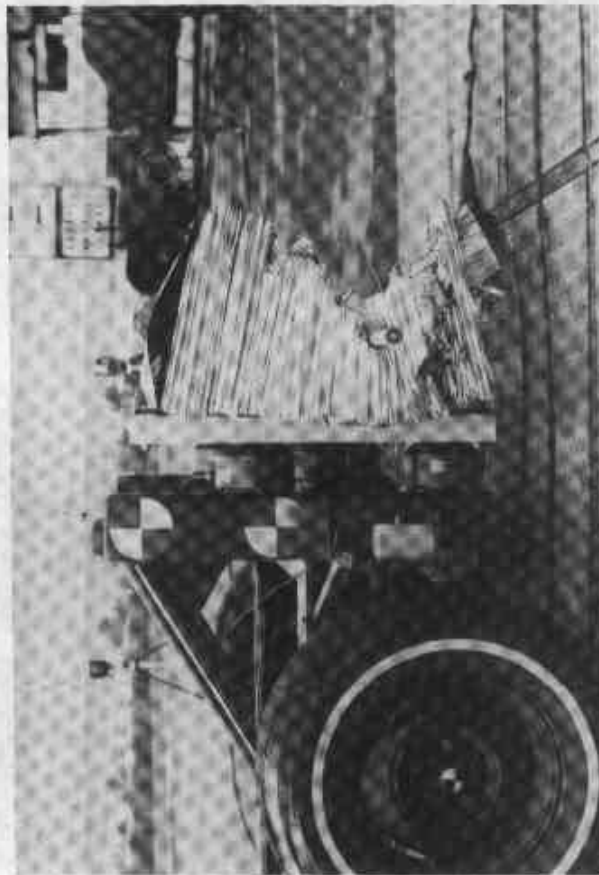
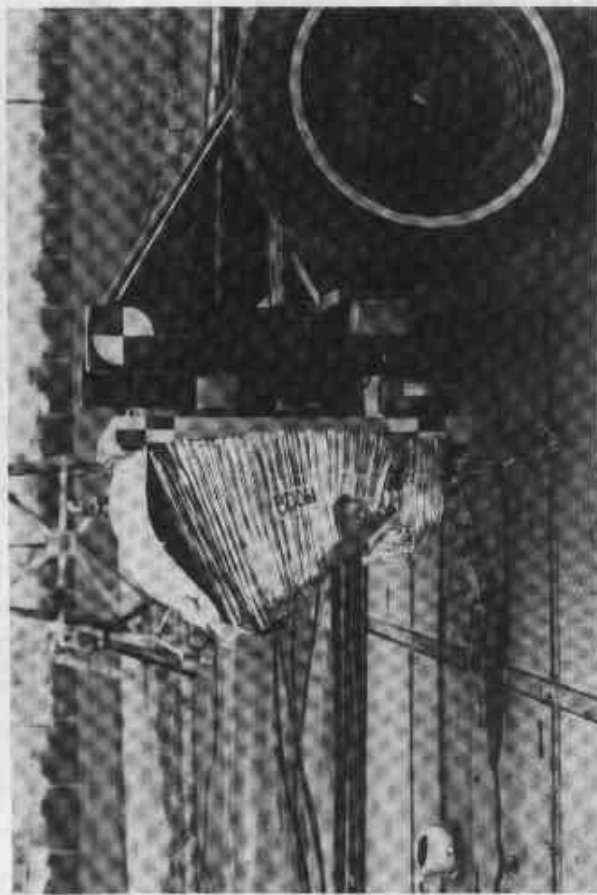
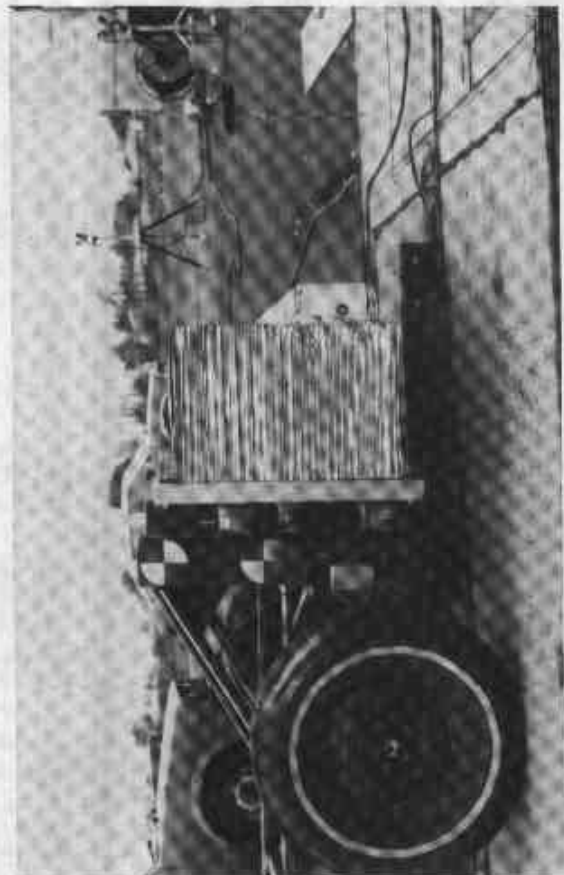
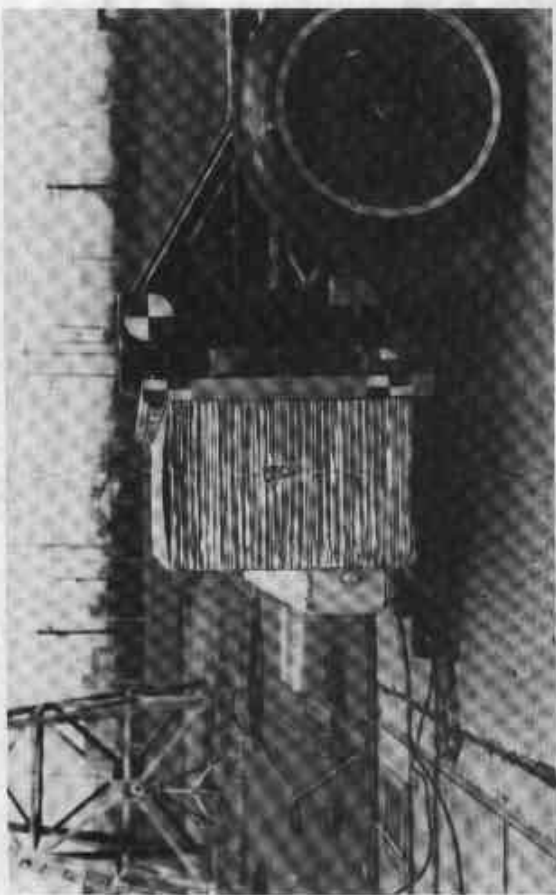


Figure A-16 Vehicle No. 2 - Pre- and Post-Test Side Views of Barrier Honeycomb

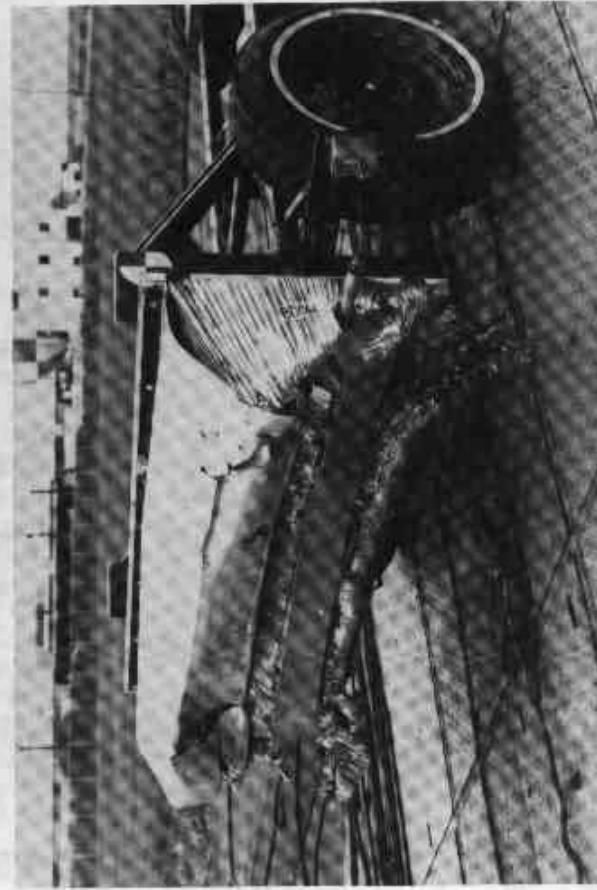
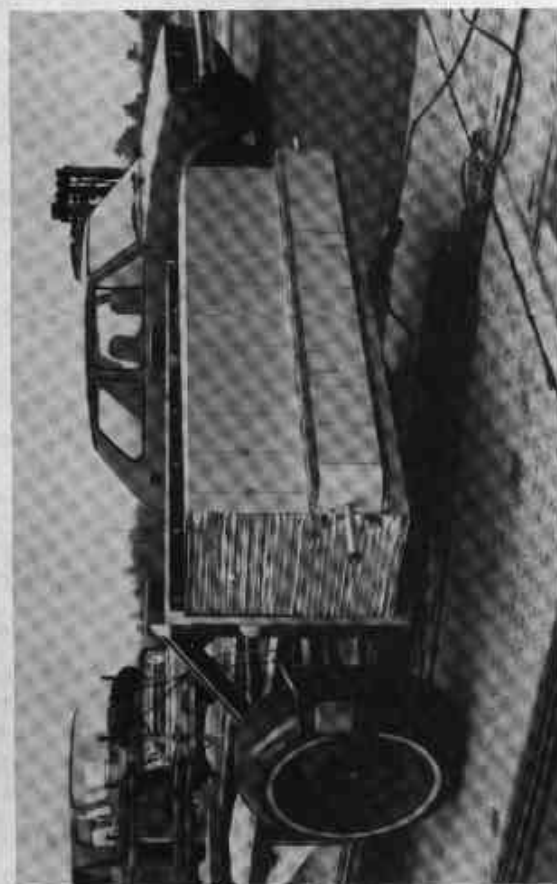
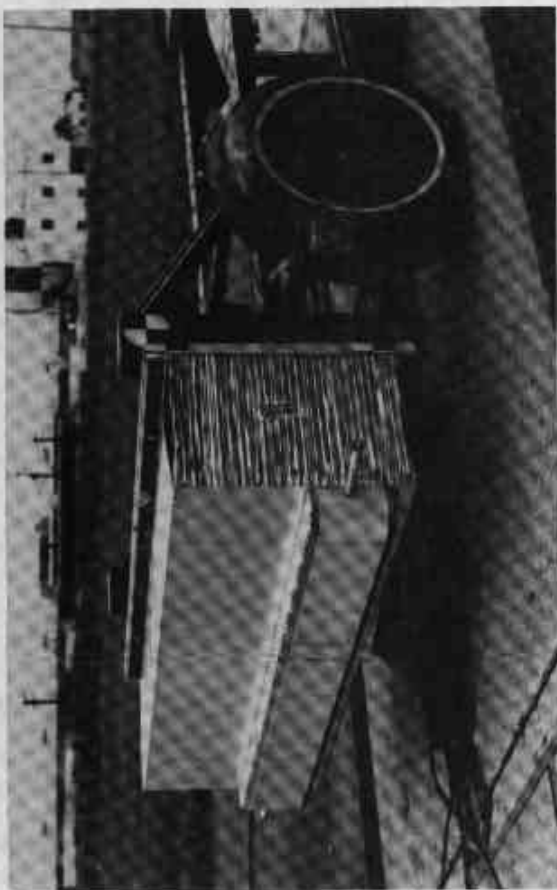


Figure A-17 Vehicle No. 2 - Pre- and Post-Test Three-Quarter Views of Barrier Honeycomb

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

TEST NO. 752-3-531

1981 VOLKSWAGEN RABBIT

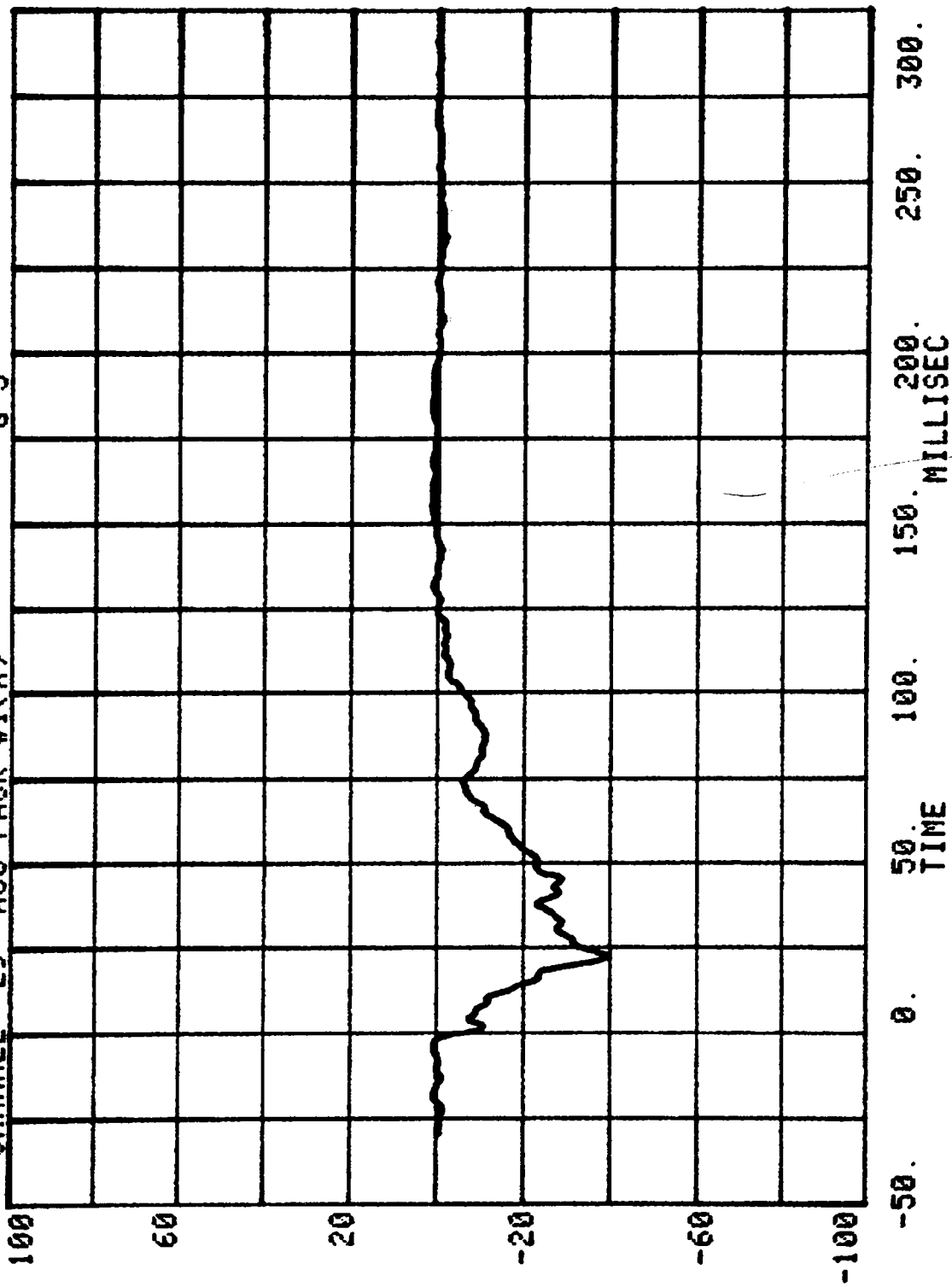
VEHICLE NO. 1 DATA

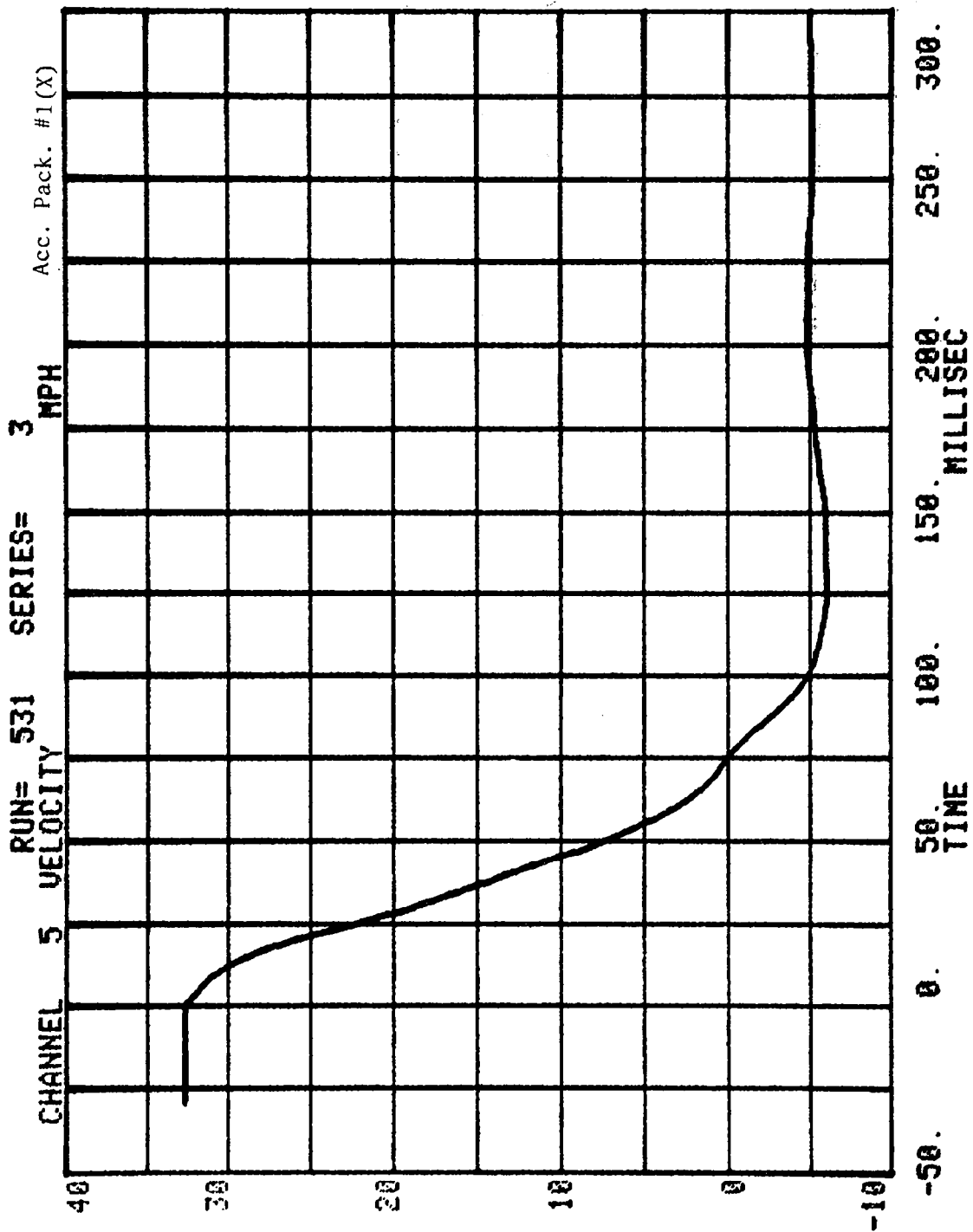
VEHICLE DATA

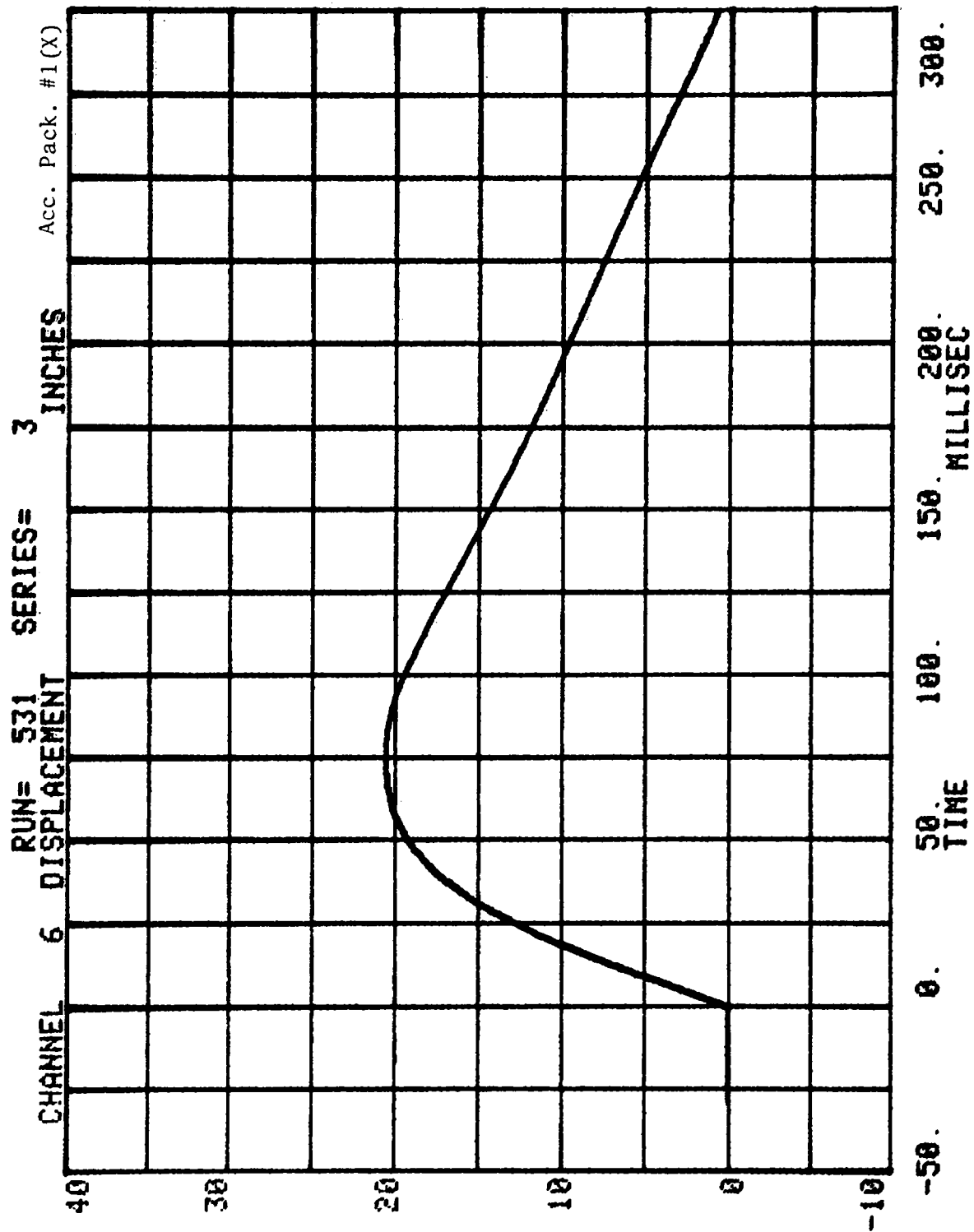
FILTER CHANNEL CLASS

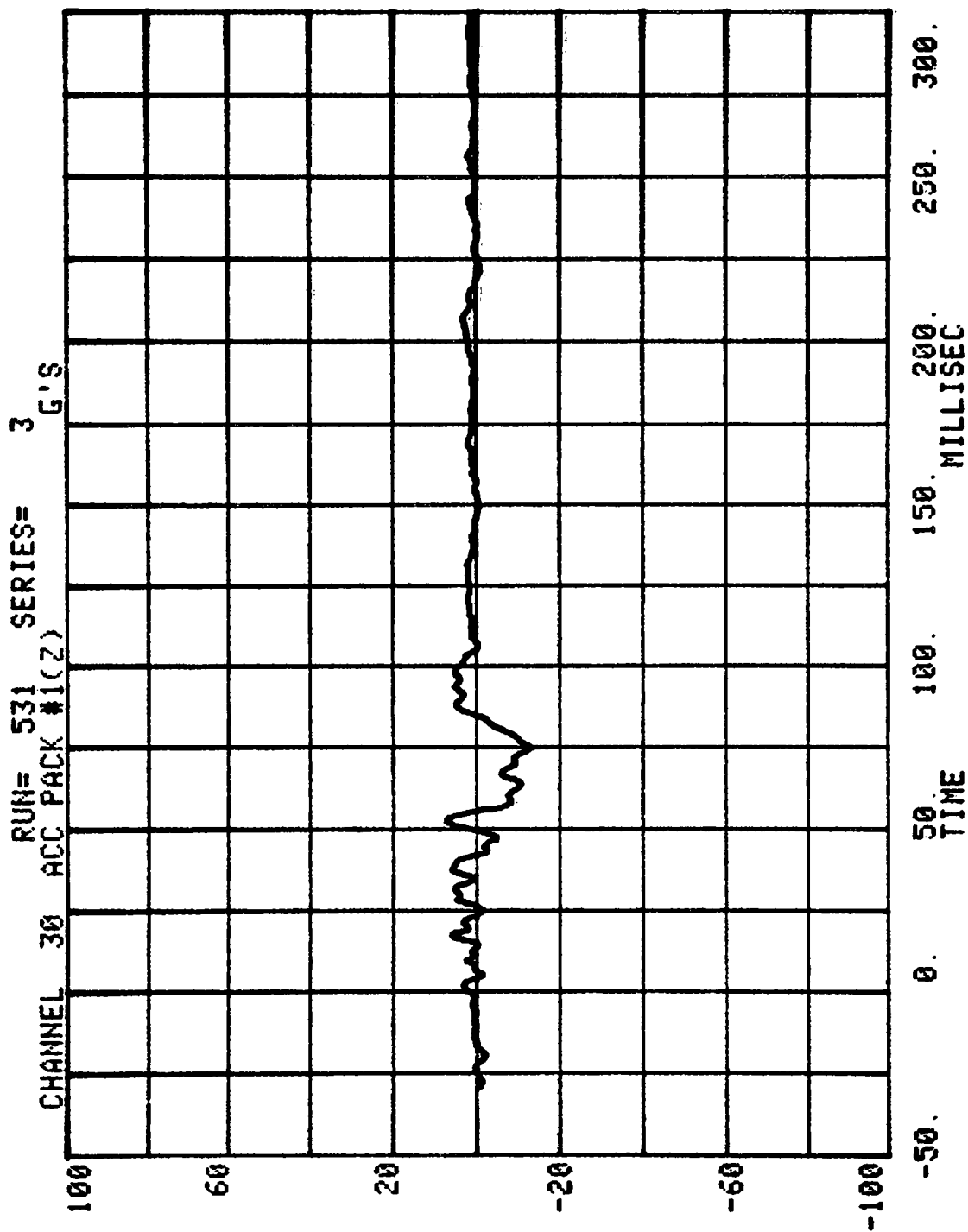
60

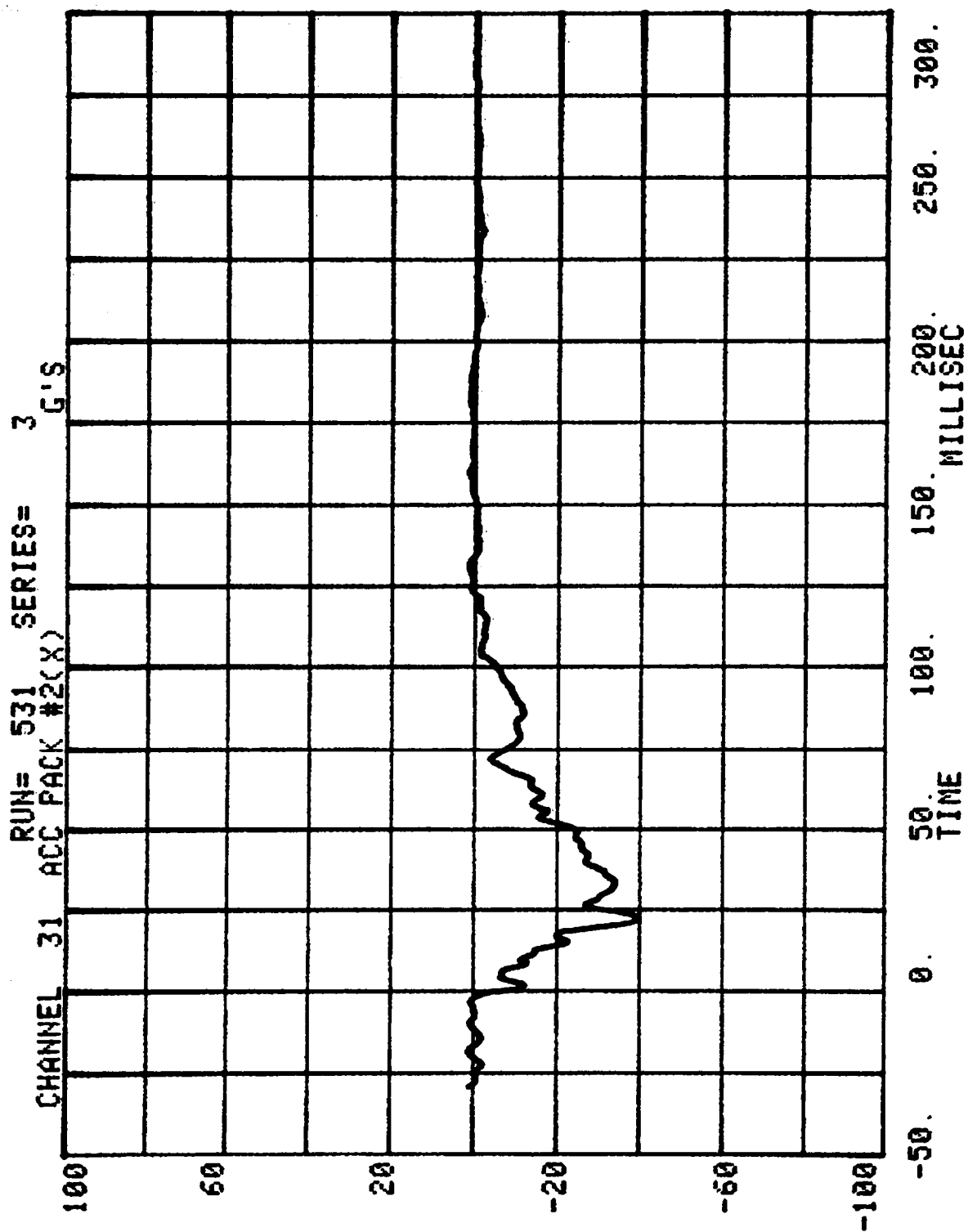
RUN= 531 SERIES= 3
CHANNEL 29 ACC PACK #1(X) G'S

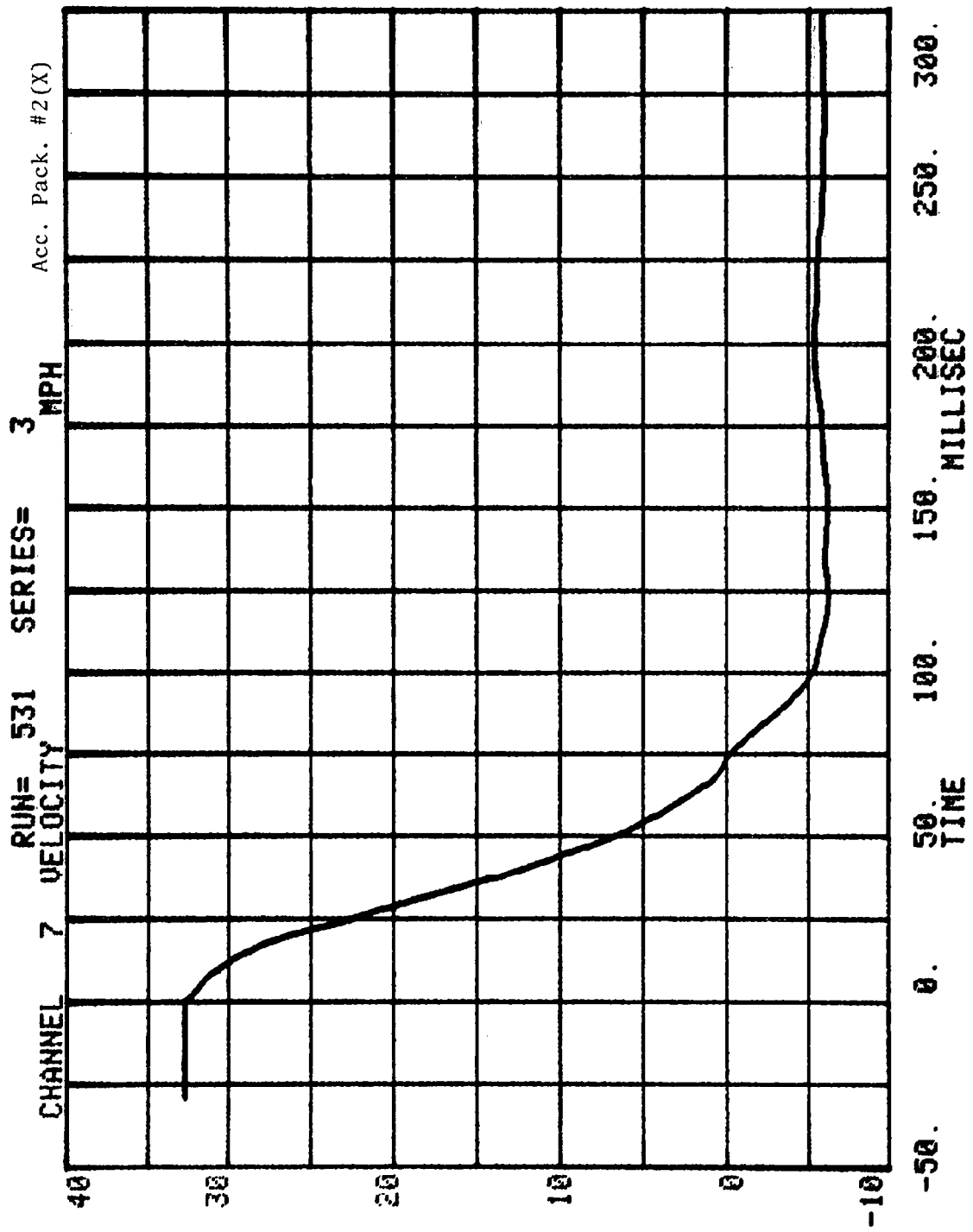




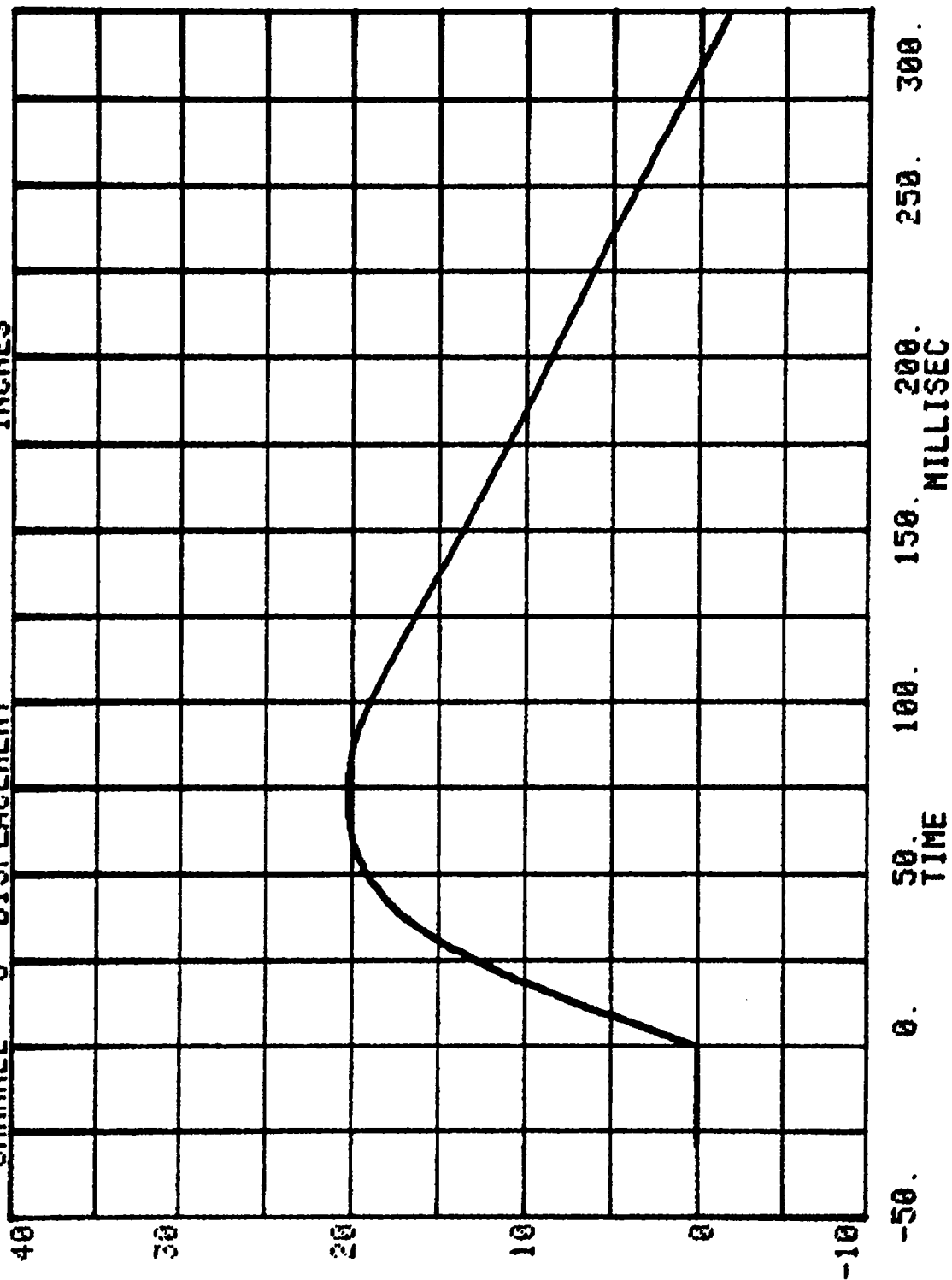




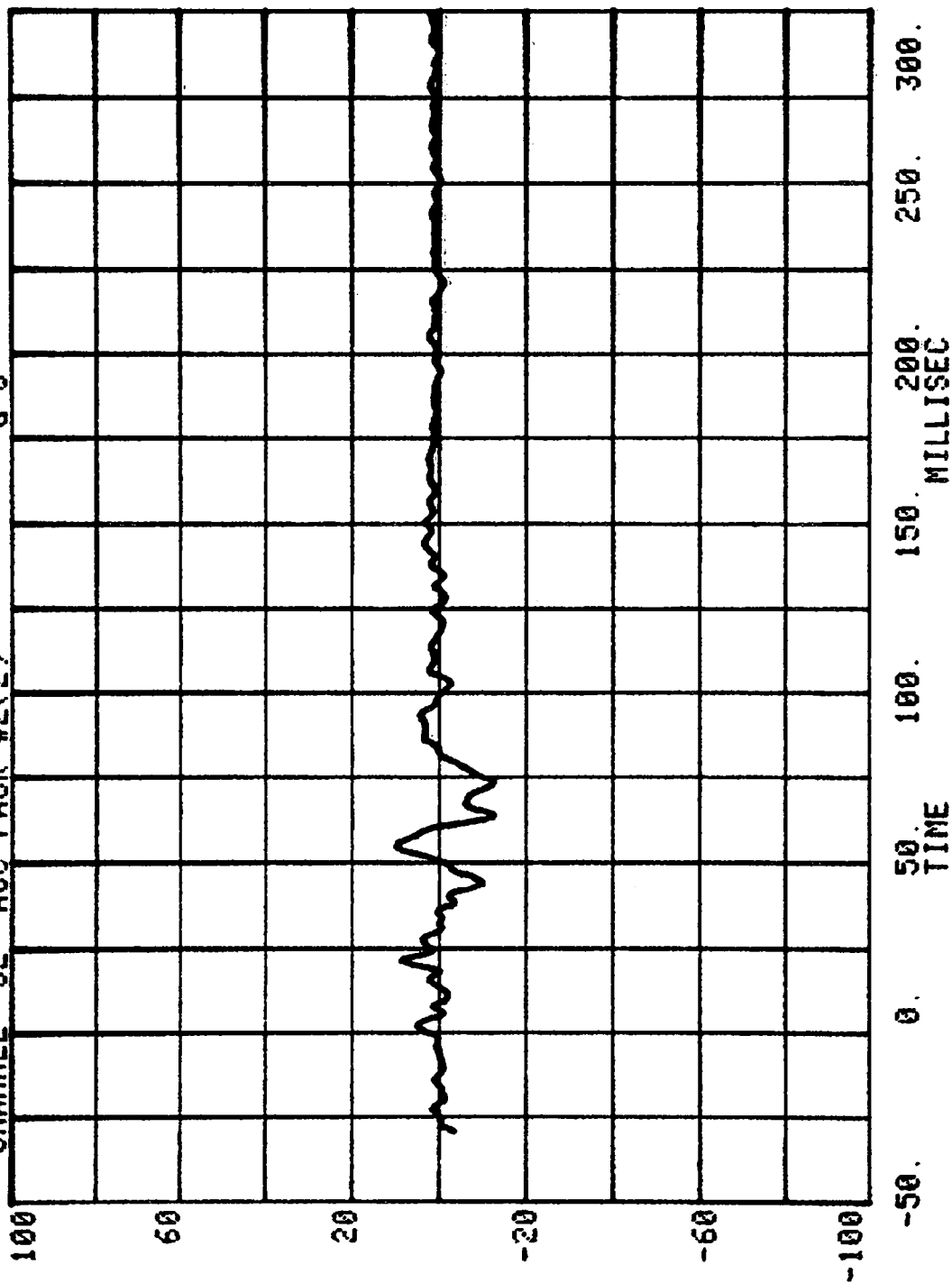




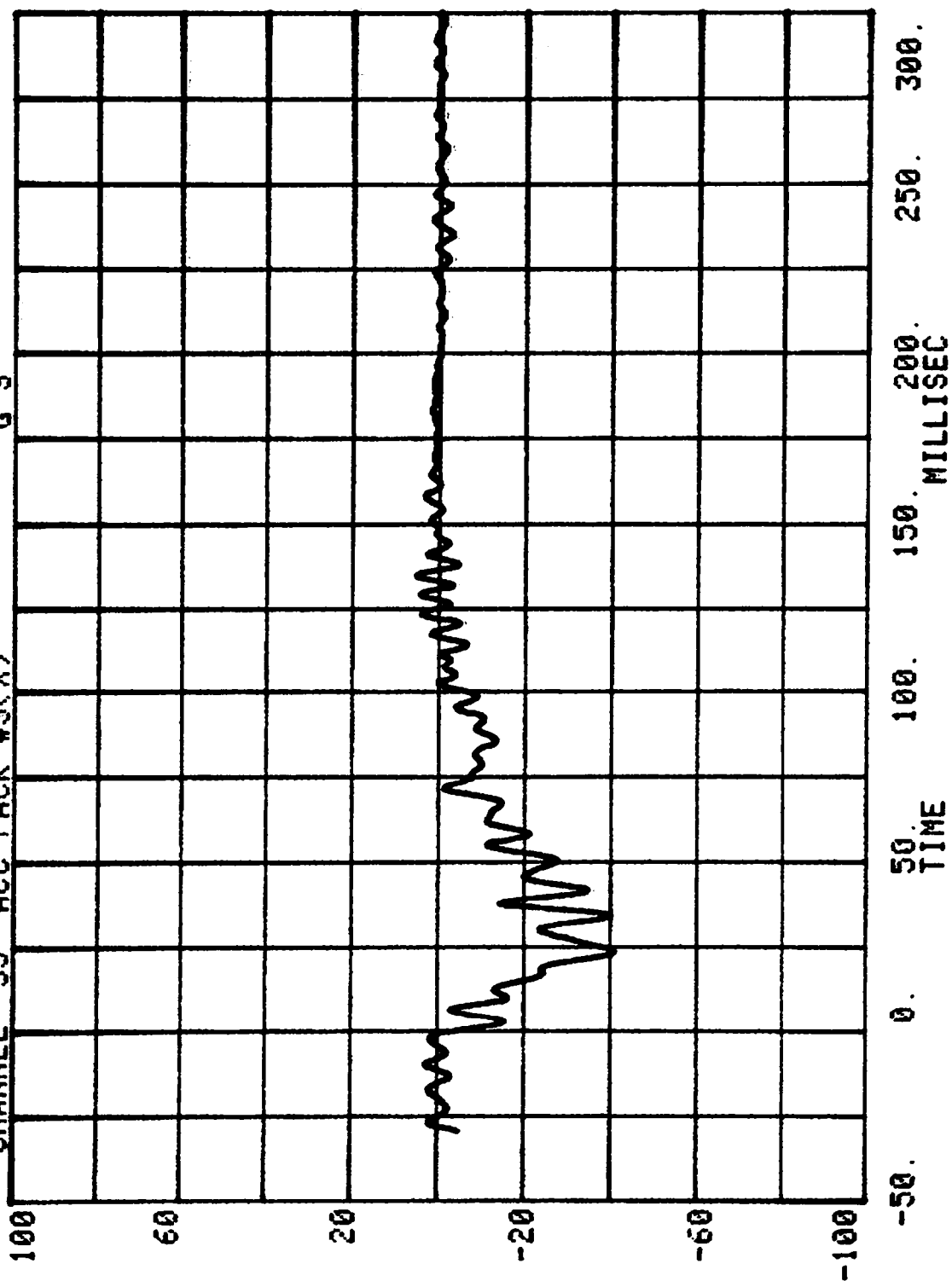
CHANNEL 8 DISPLACEMENT RUN= 531 SERIES= 3 INCHES Acc. Pack. #2(X)

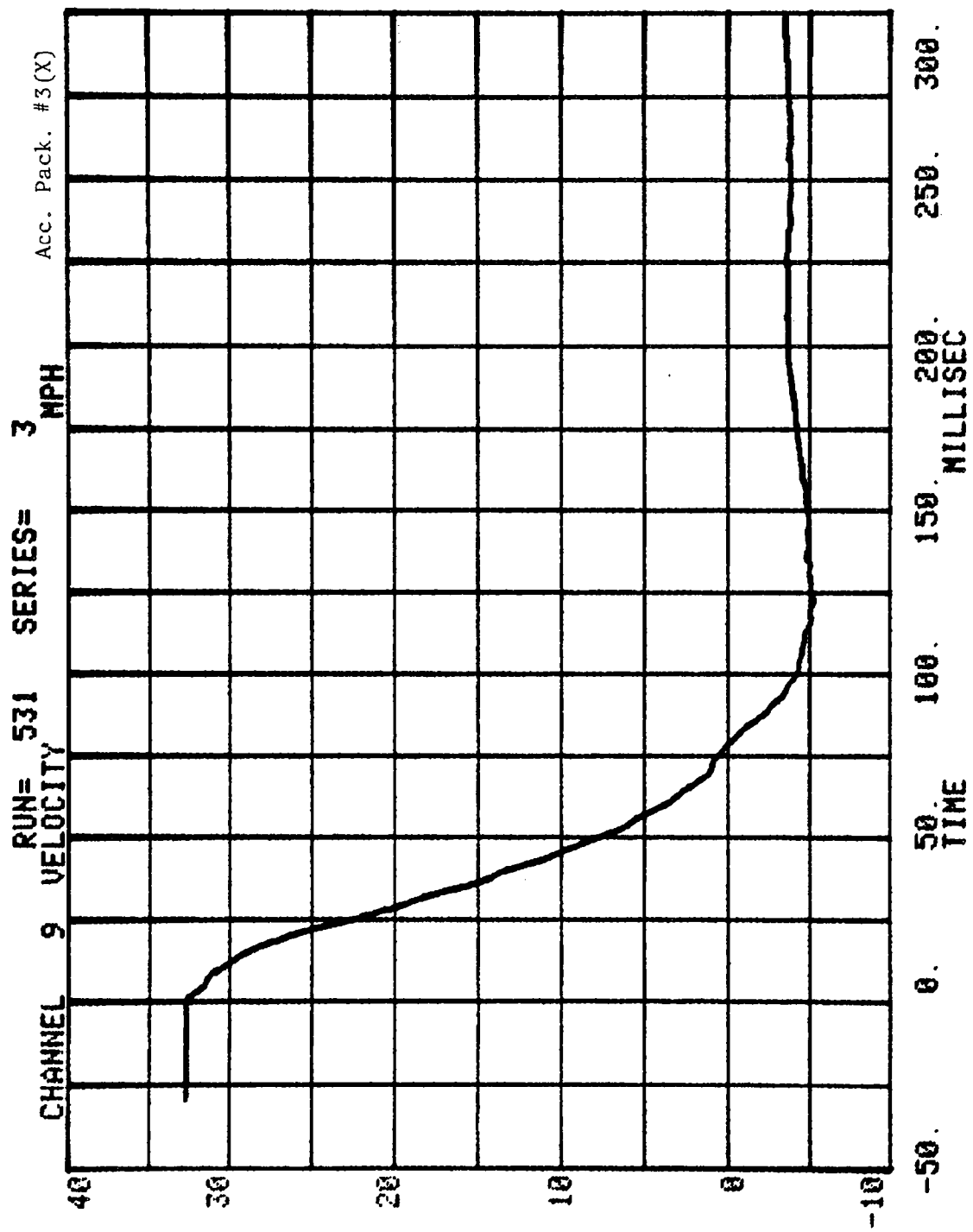


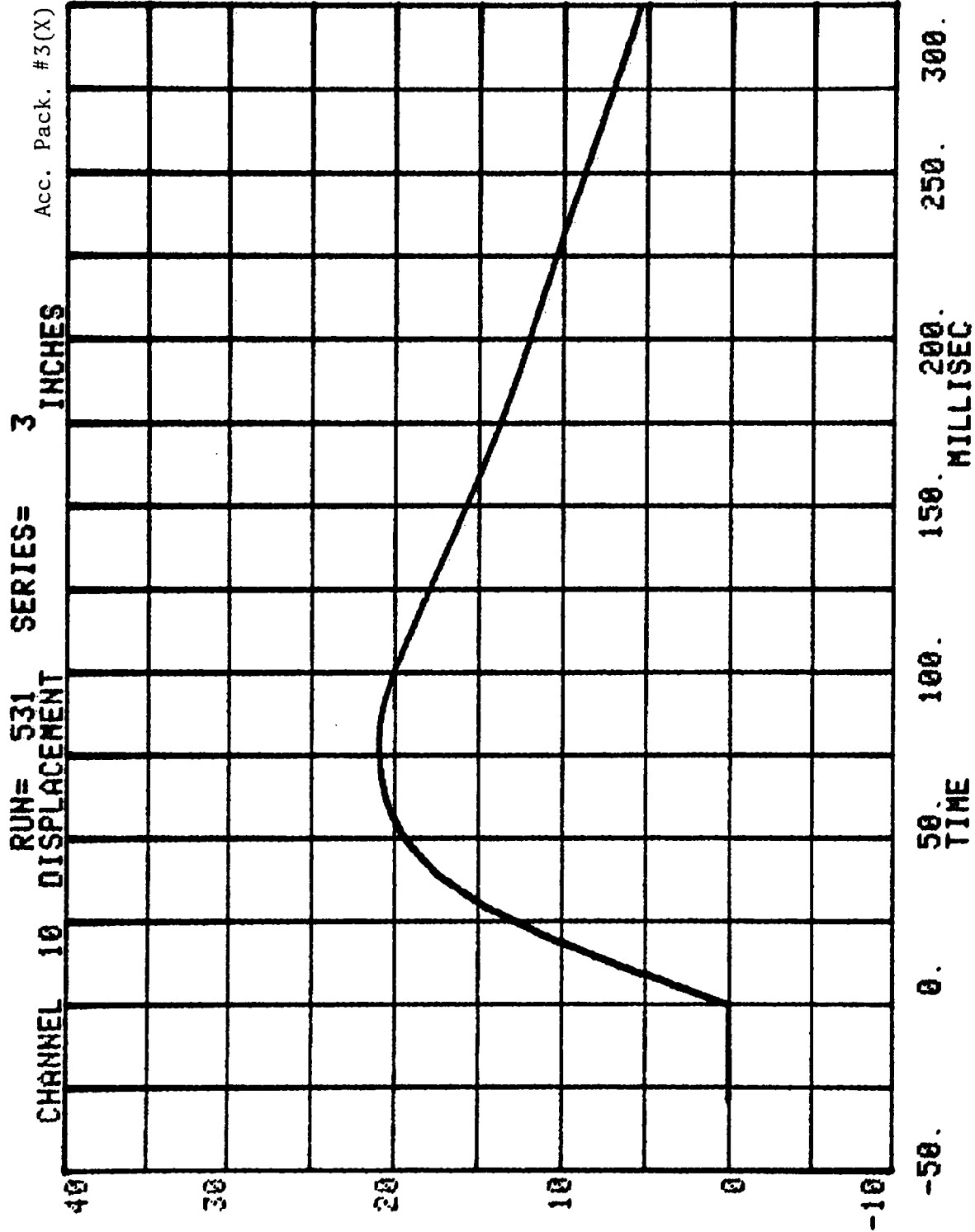
CHANNEL 32 ACC PACK #2(2) RUN= 531 SERIES= 3 G'S

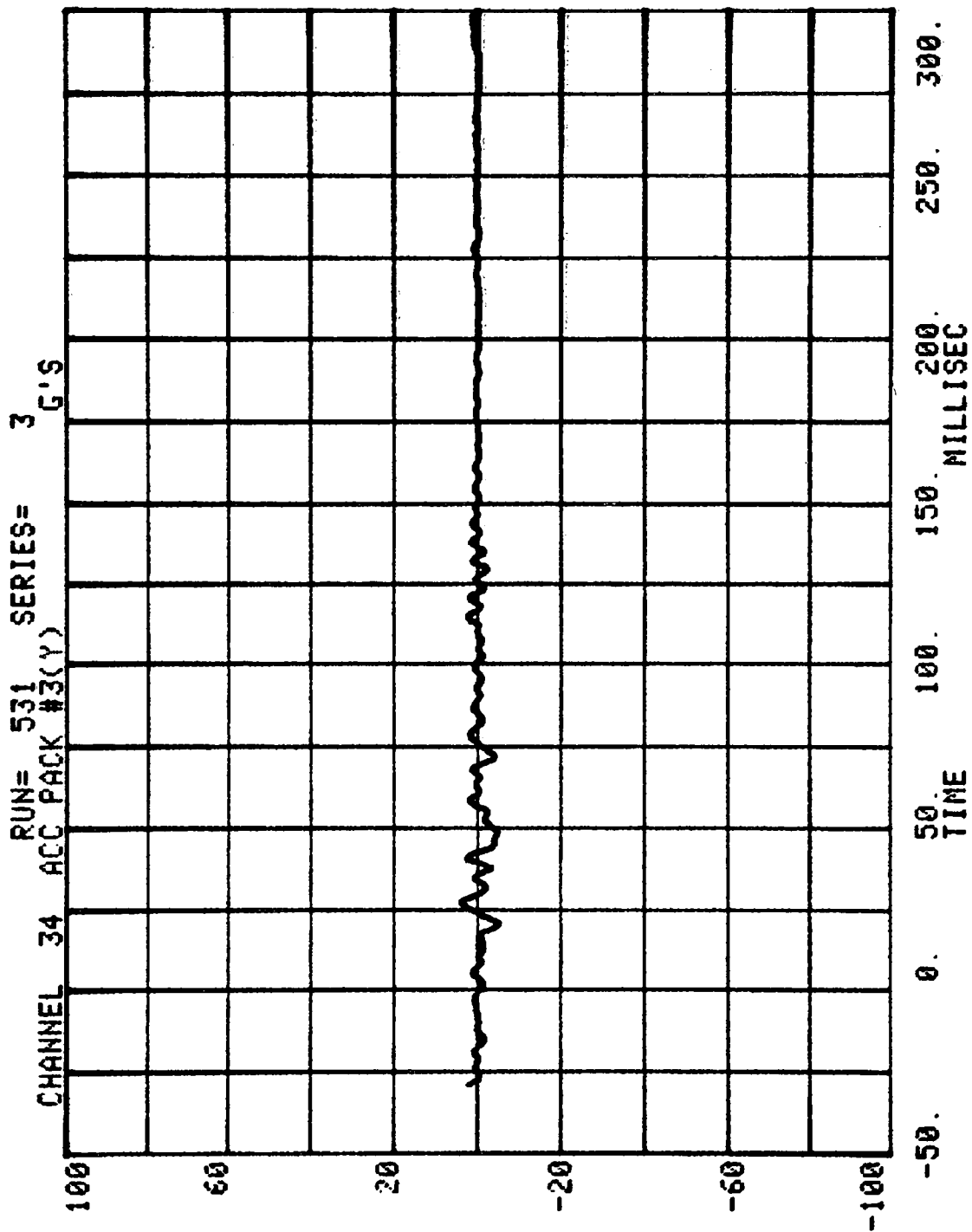


CHANNEL 33 ACC PACK #3(X) RUN= 531 SERIES= 3 G'S

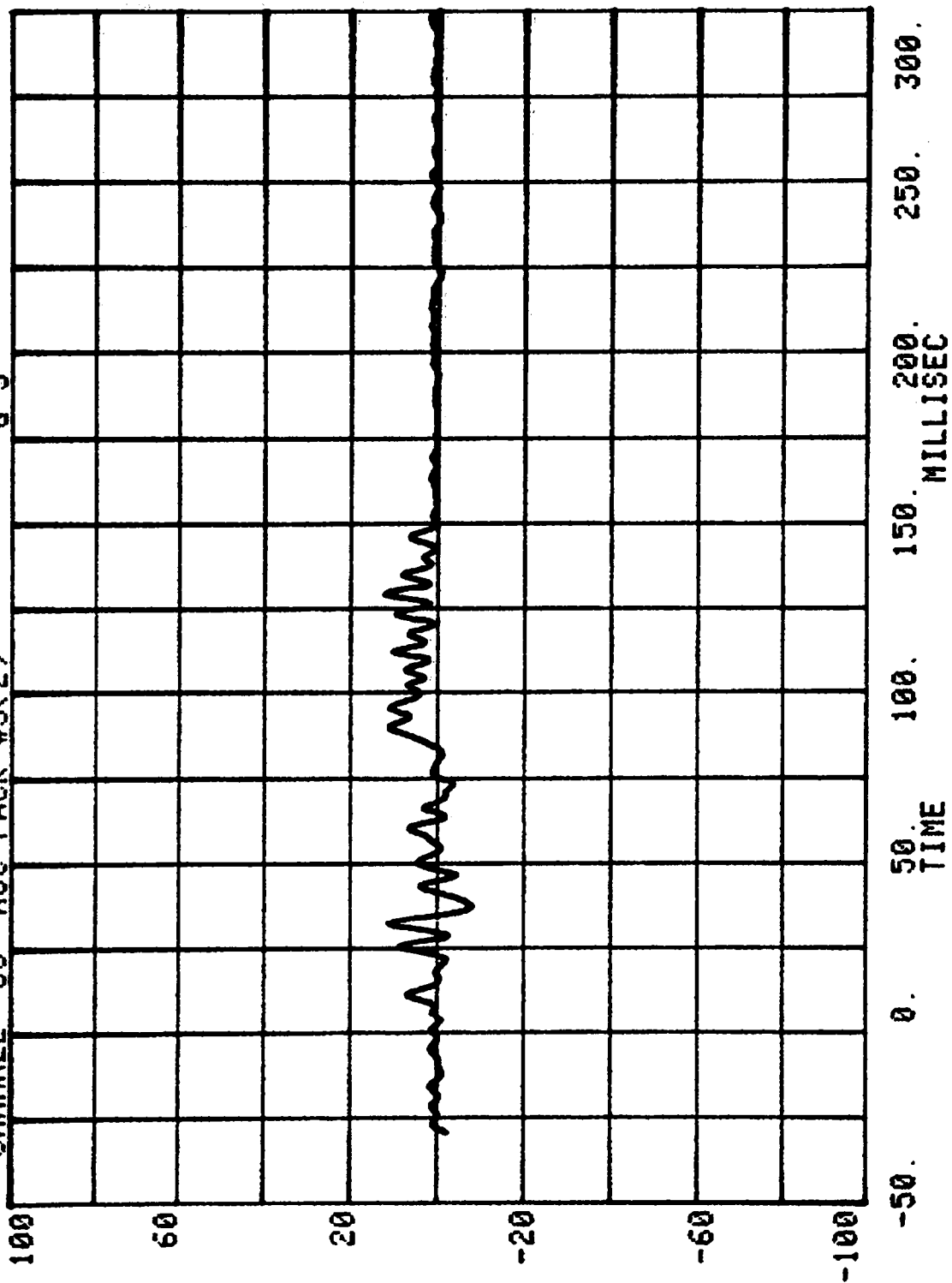




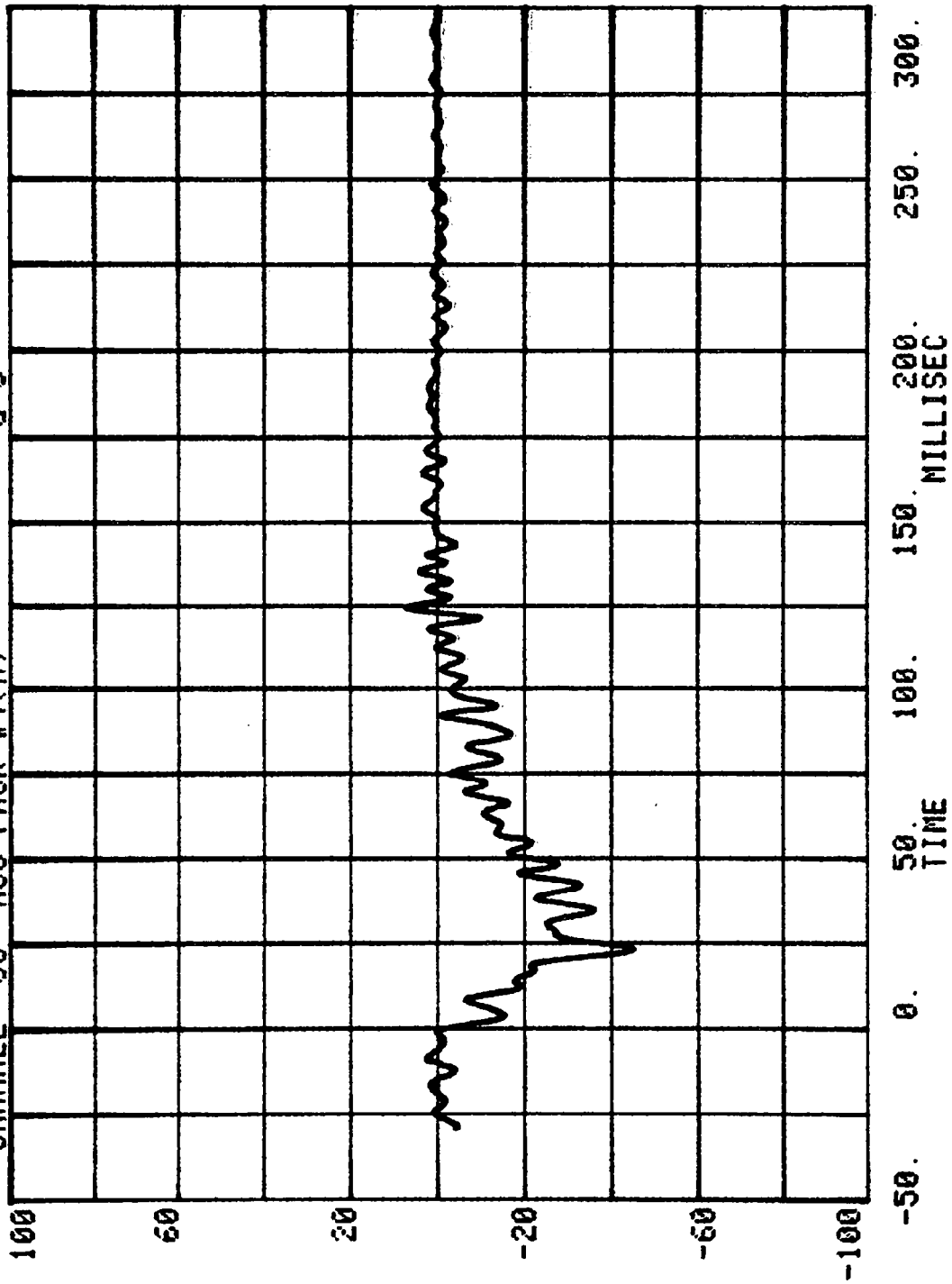


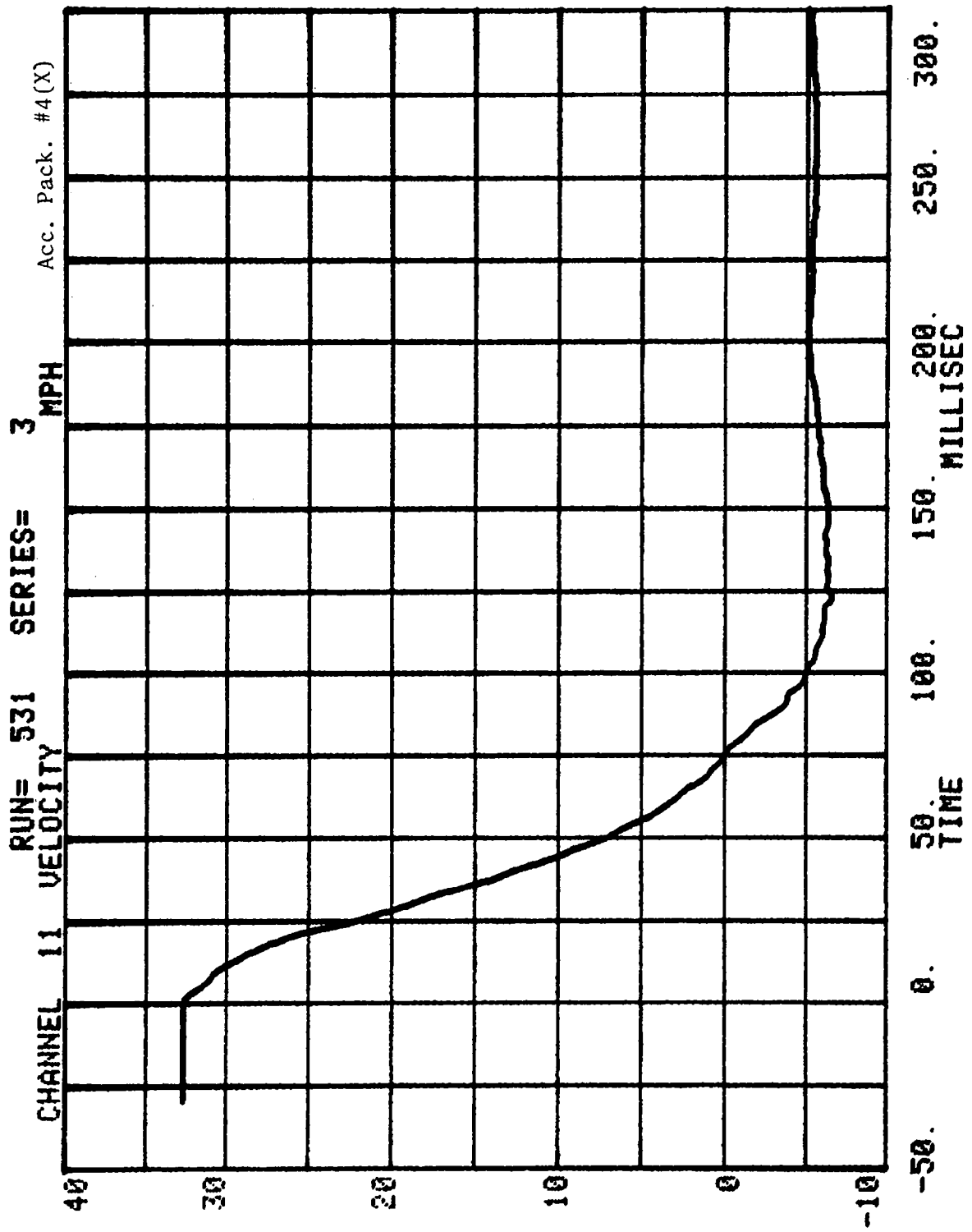


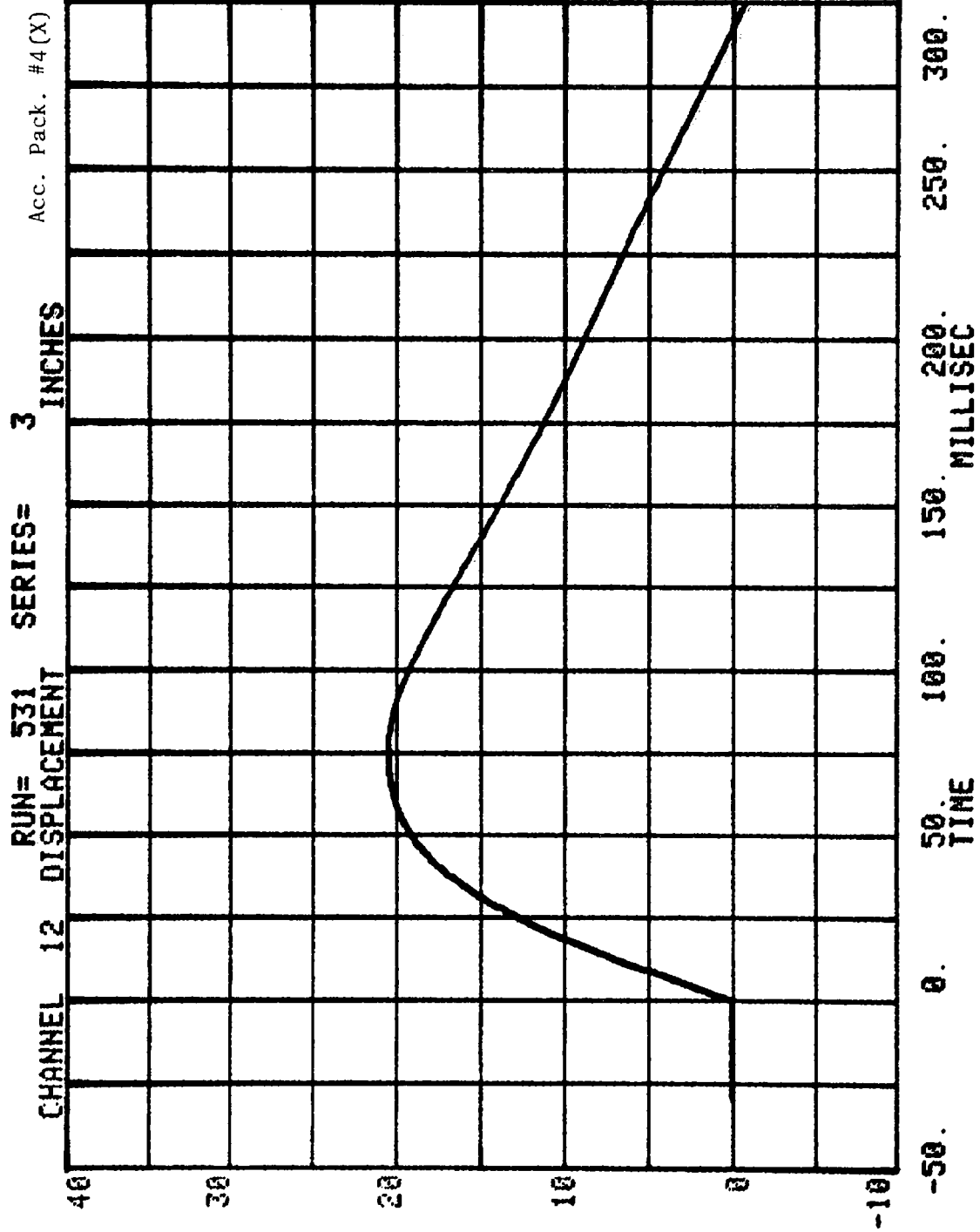
RUN= 531 SERIES= 3
CHANNEL 35 ACC PACK #3(Z) G'S



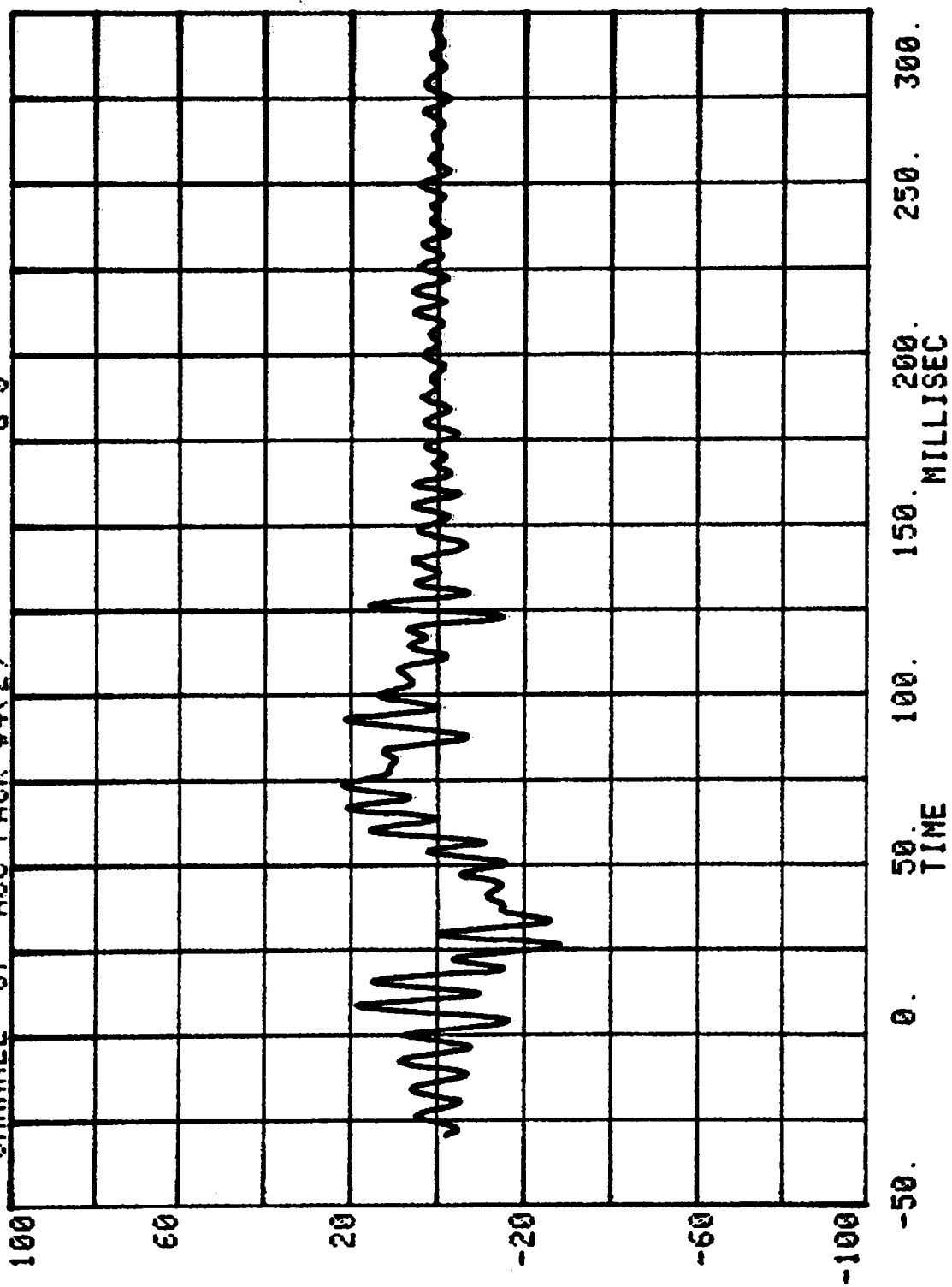
RUN= 531 SERIES= 3
CHANNEL 36 ACC PACK #4(X) G'S

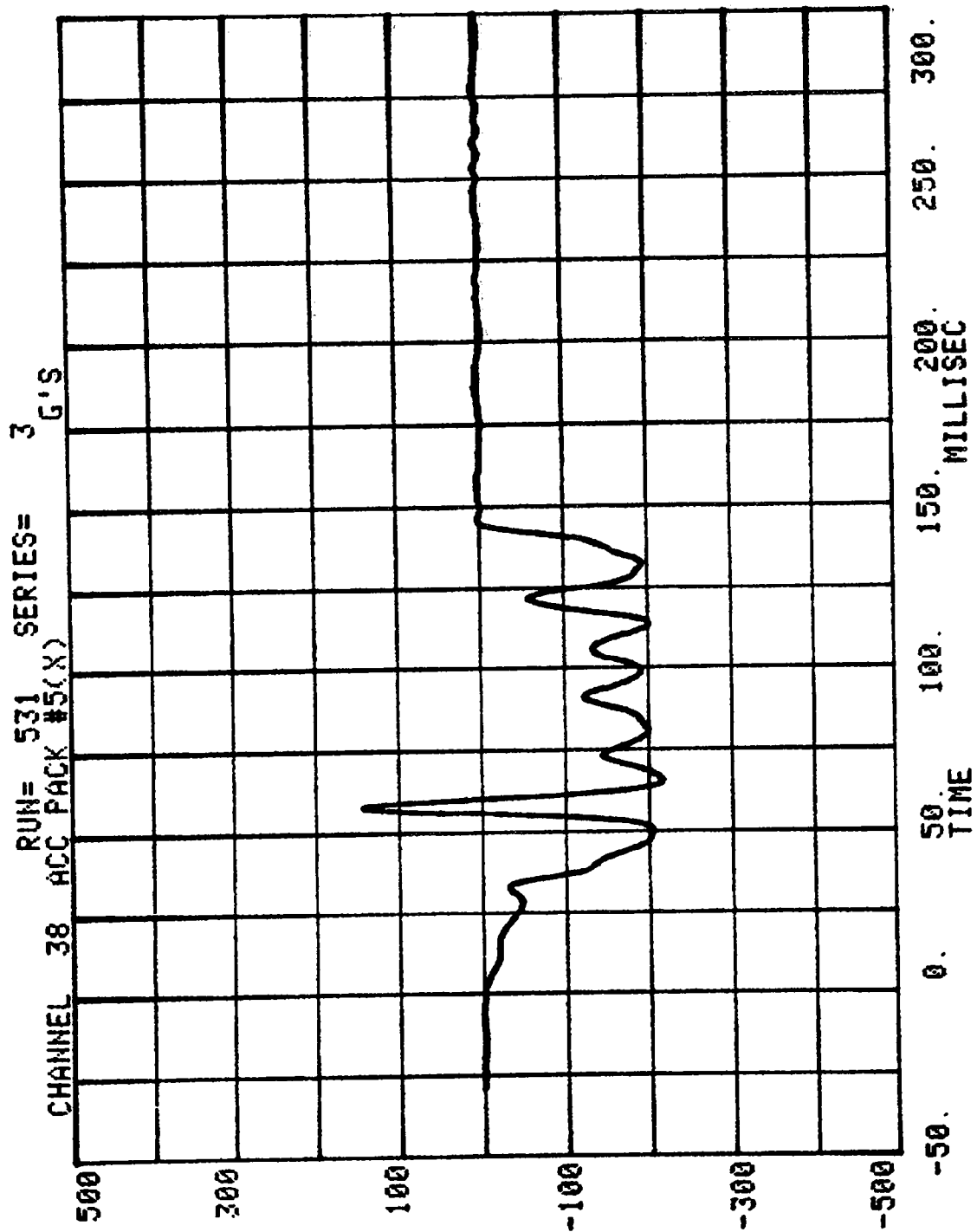


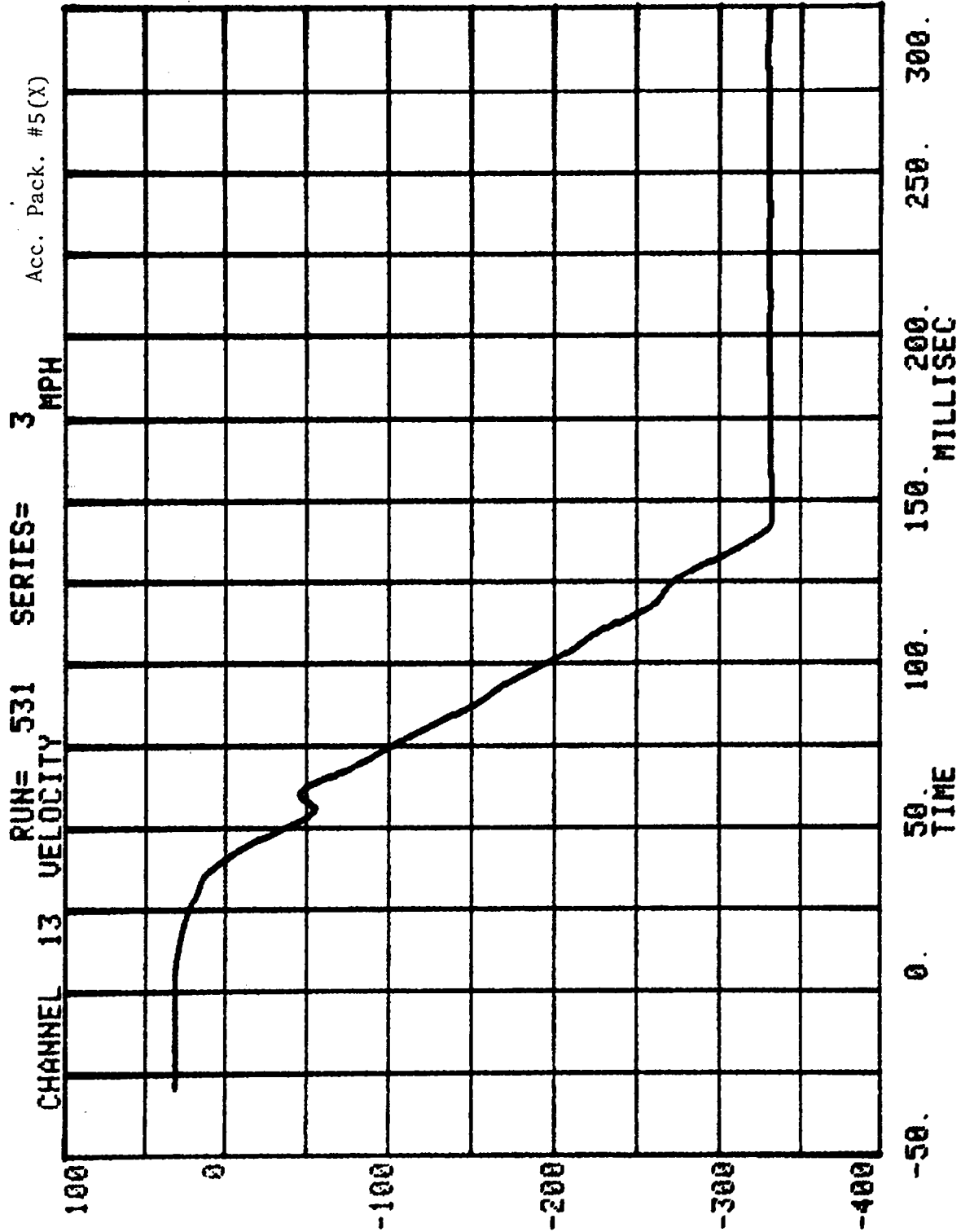


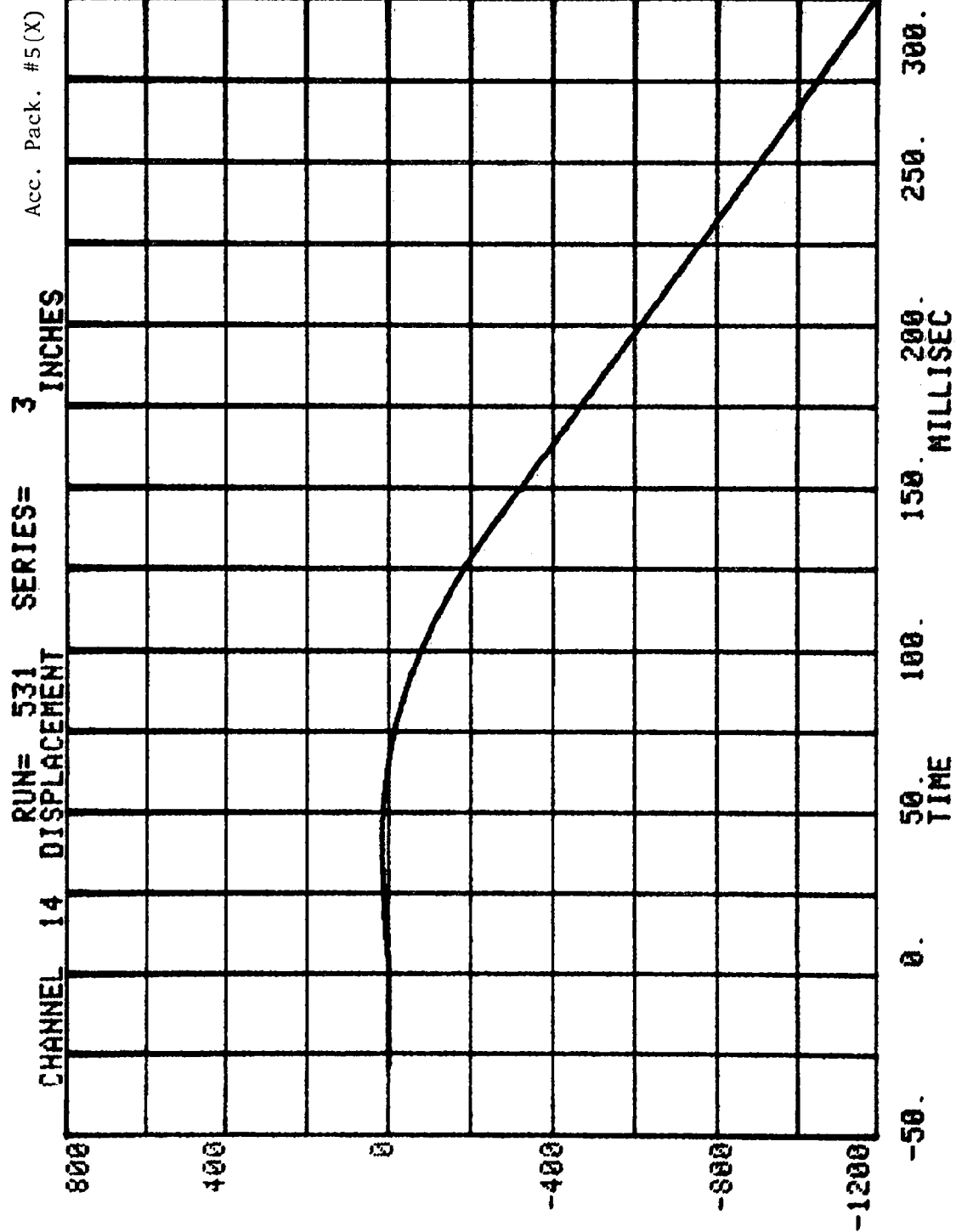


CHANNEL 37 ACC PACK #4(Z) RUN= 531 SERIES= 3 G'S

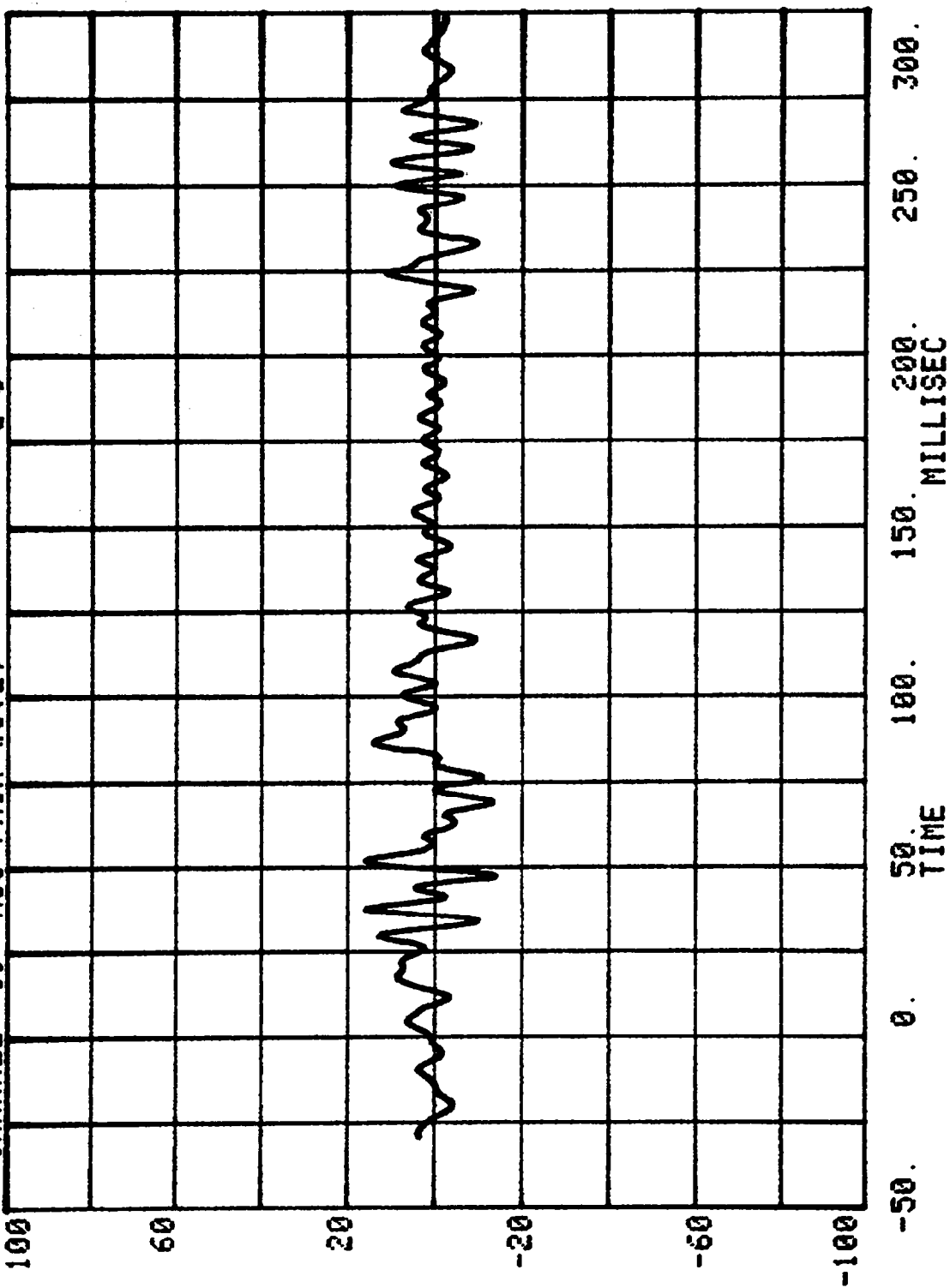


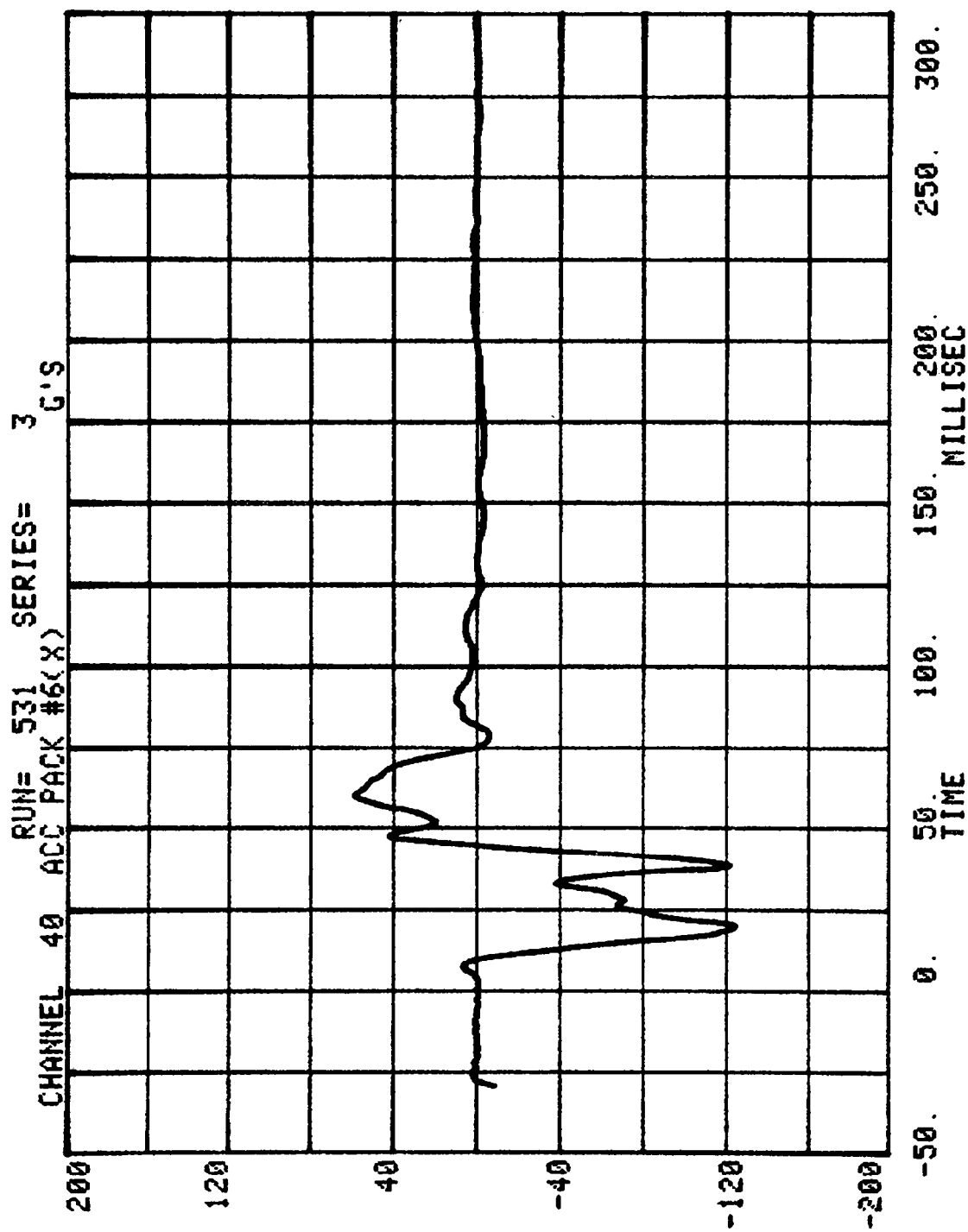






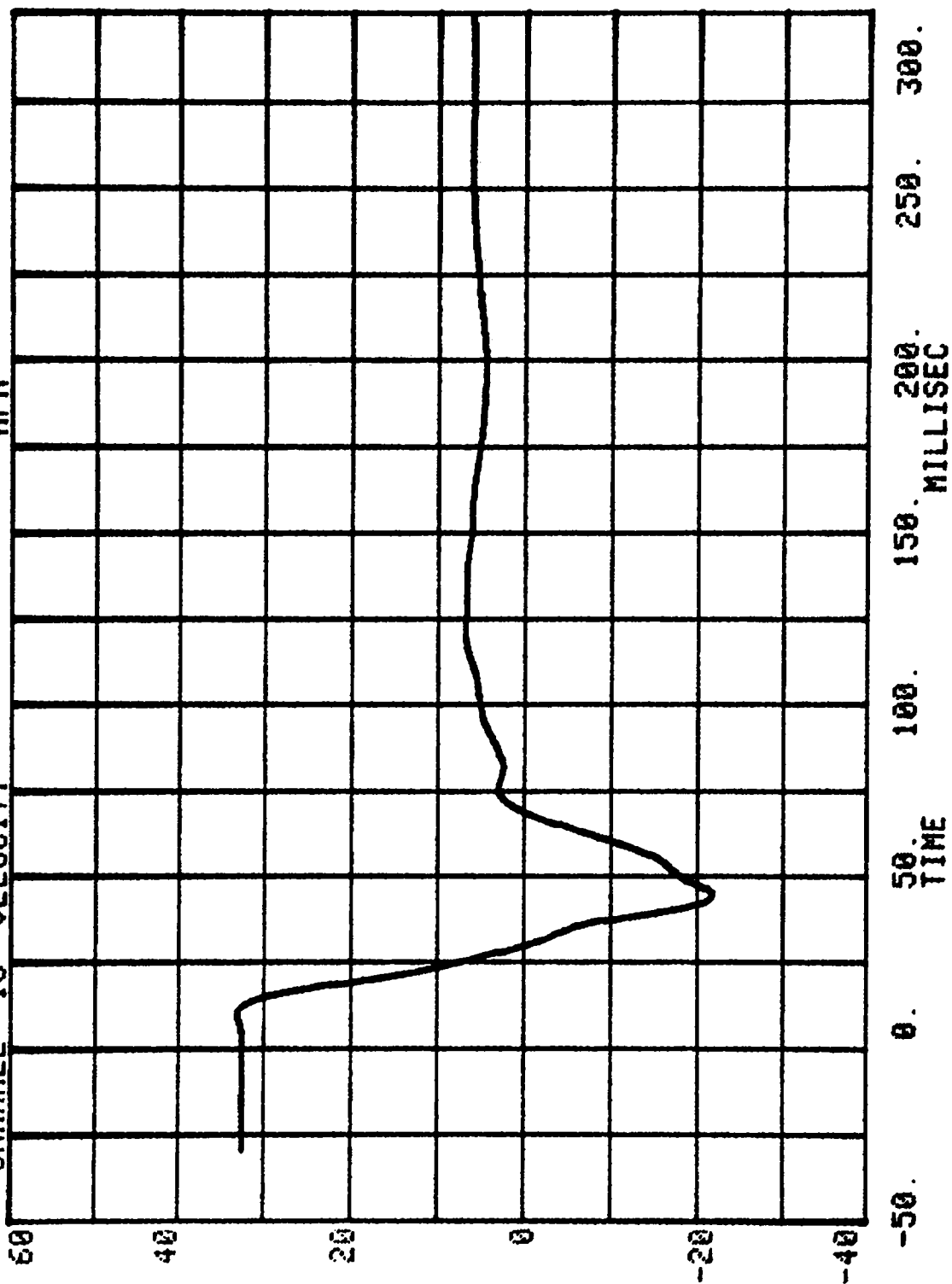
CHANNEL 39 ACC PACK #5(Z) RUN= 531 SERIES= 3 G'S

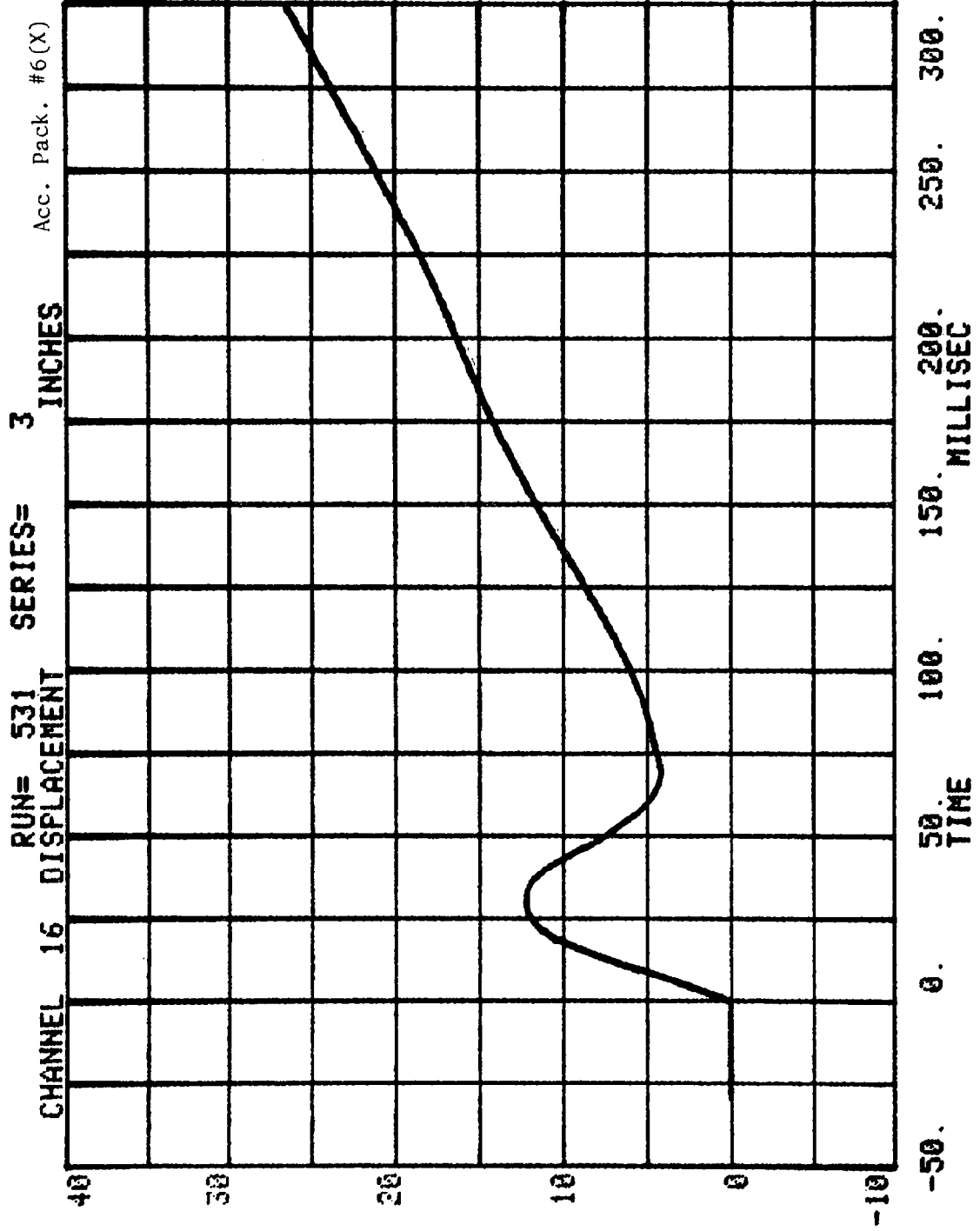




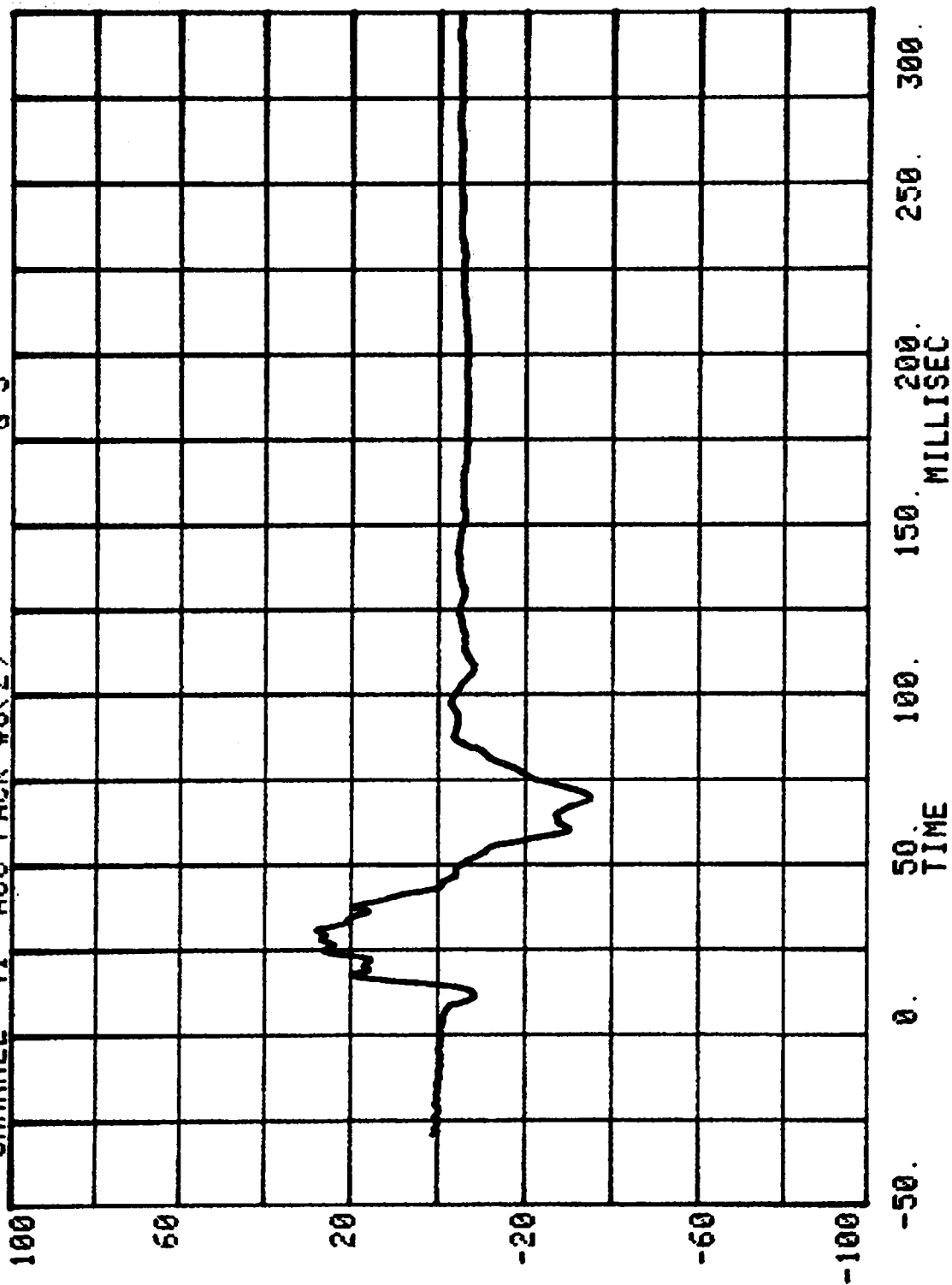
Acc. Pack. #6(X)

CHANNEL 15 VELOCITY
RUN= 531 SERIES= 3 MPH

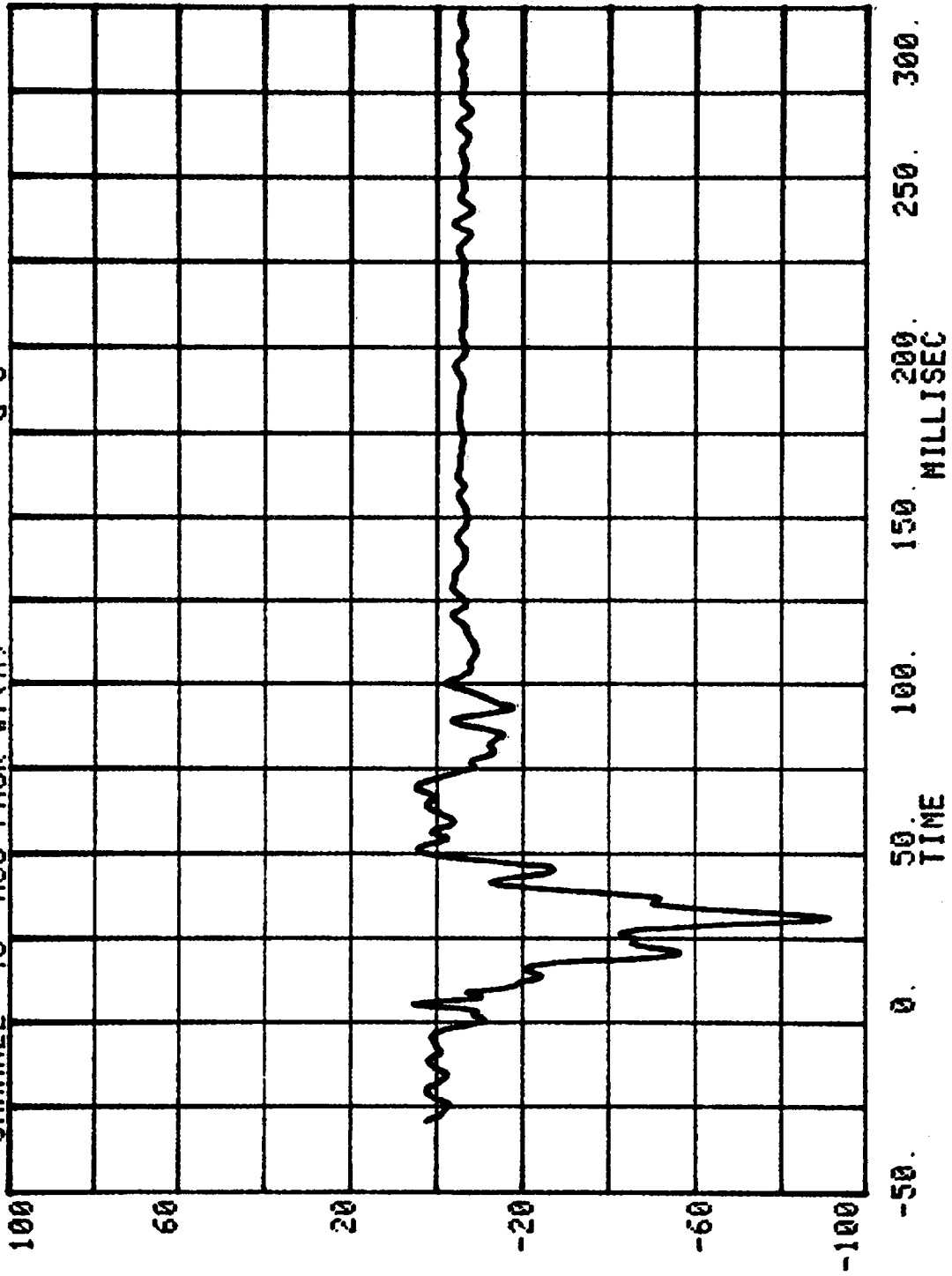


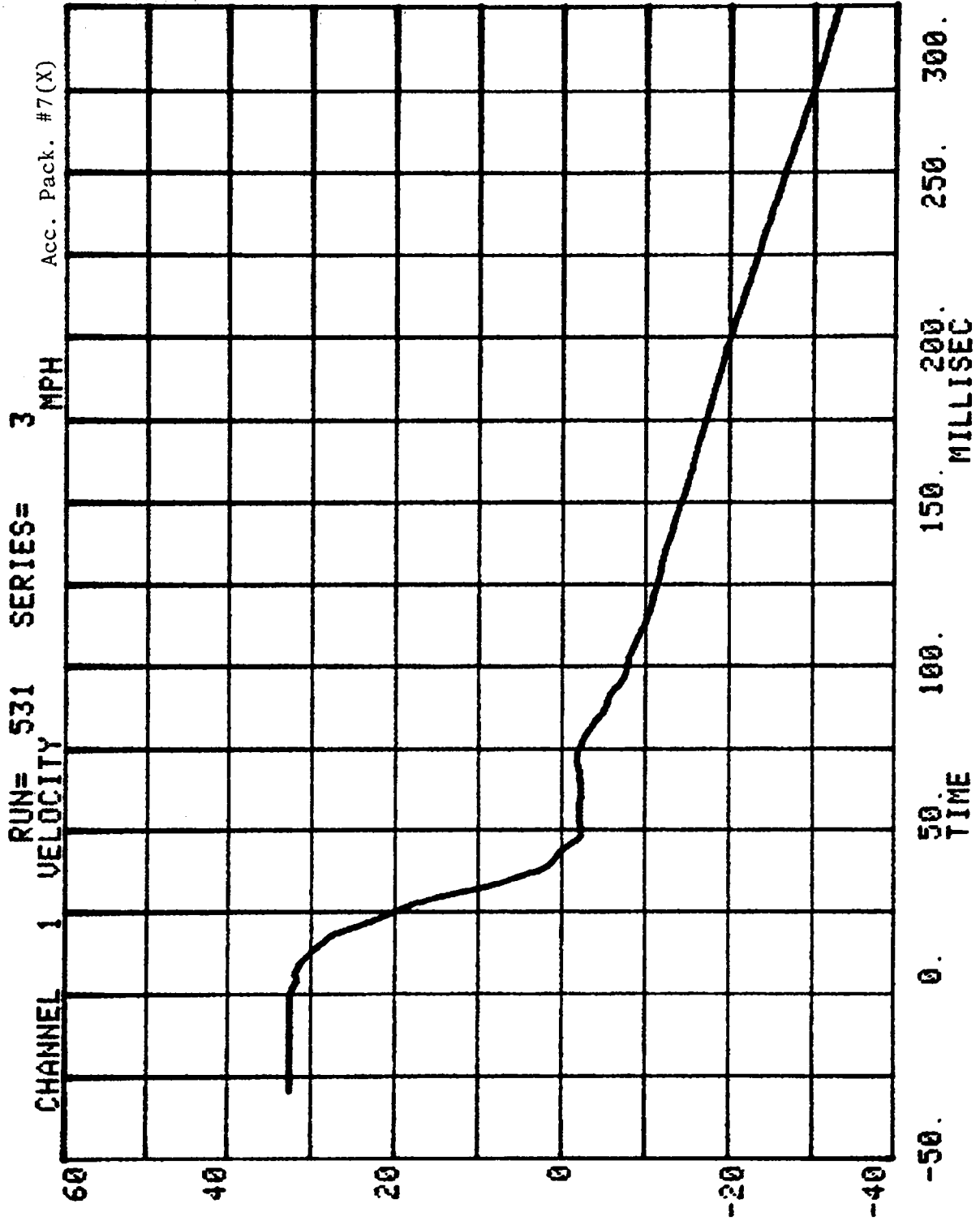


CHANNEL 41 ACC PACK #6(Z) RUN= 531 SERIES= 3 G'S



CHANNEL 43 ACC PACK #7(X) RUN= 531 SERIES= 3 G'S



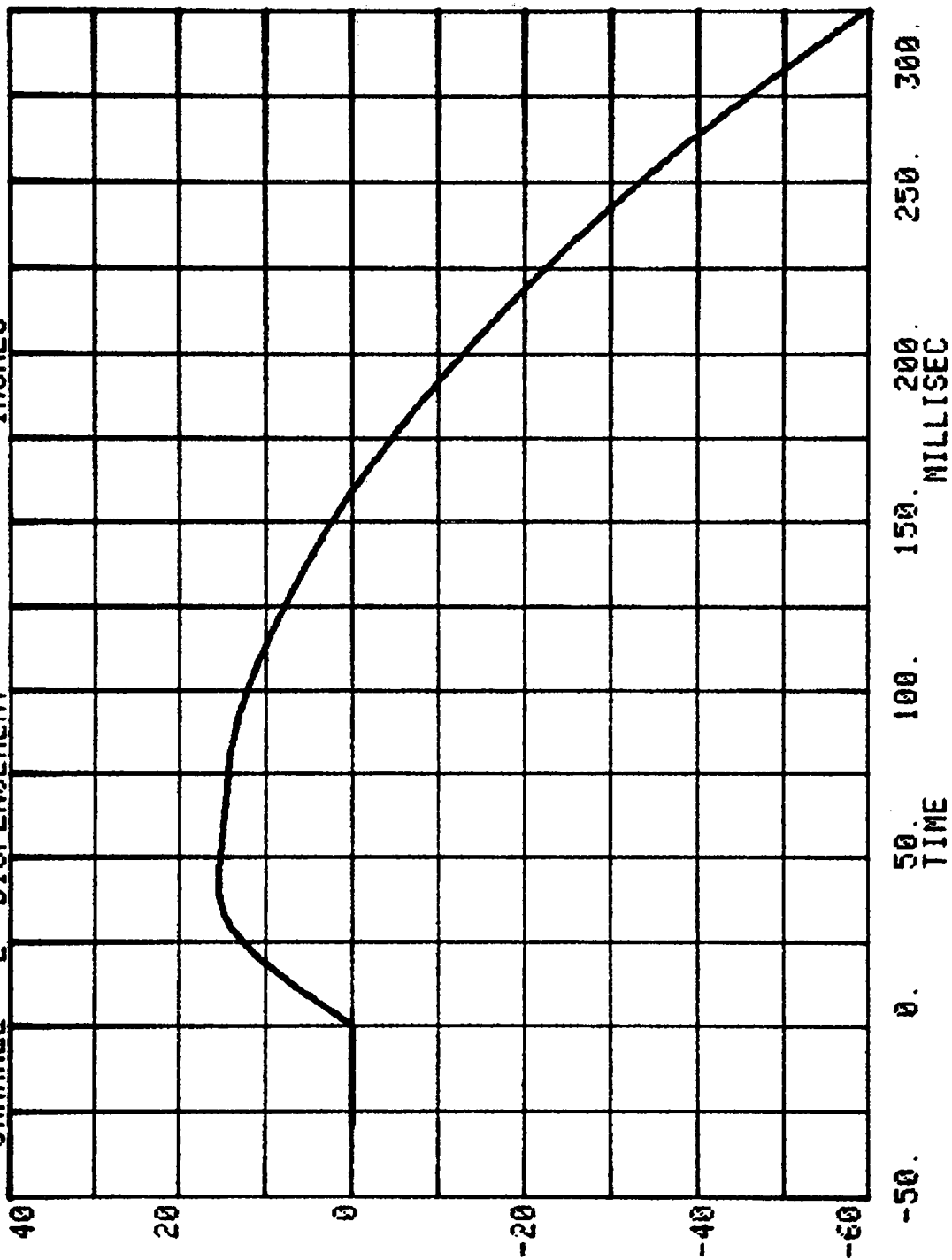


Acc. Pack. #7(X)

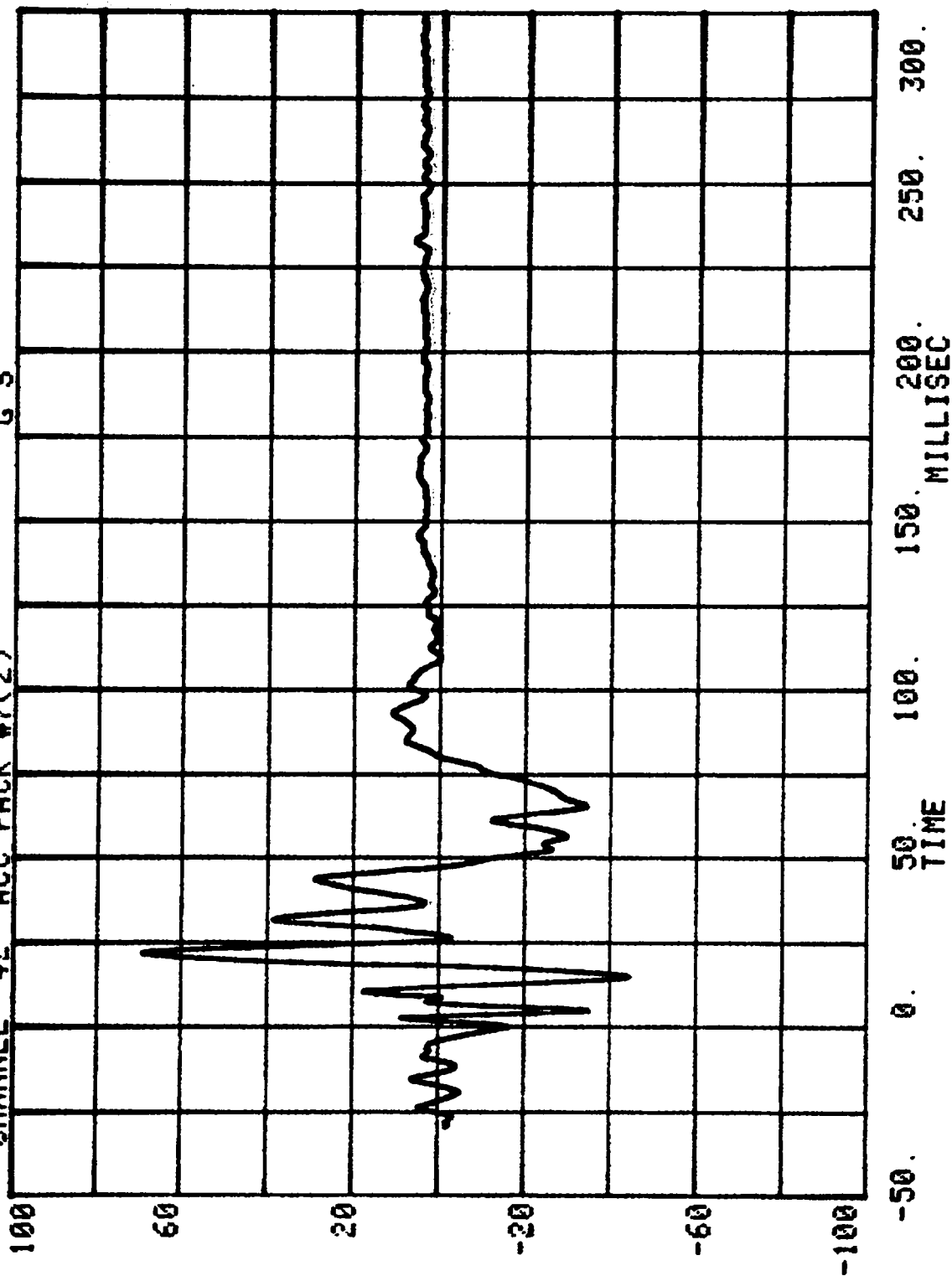
SERIES= 3 INCHES

RUN= 531 DISPLACEMENT

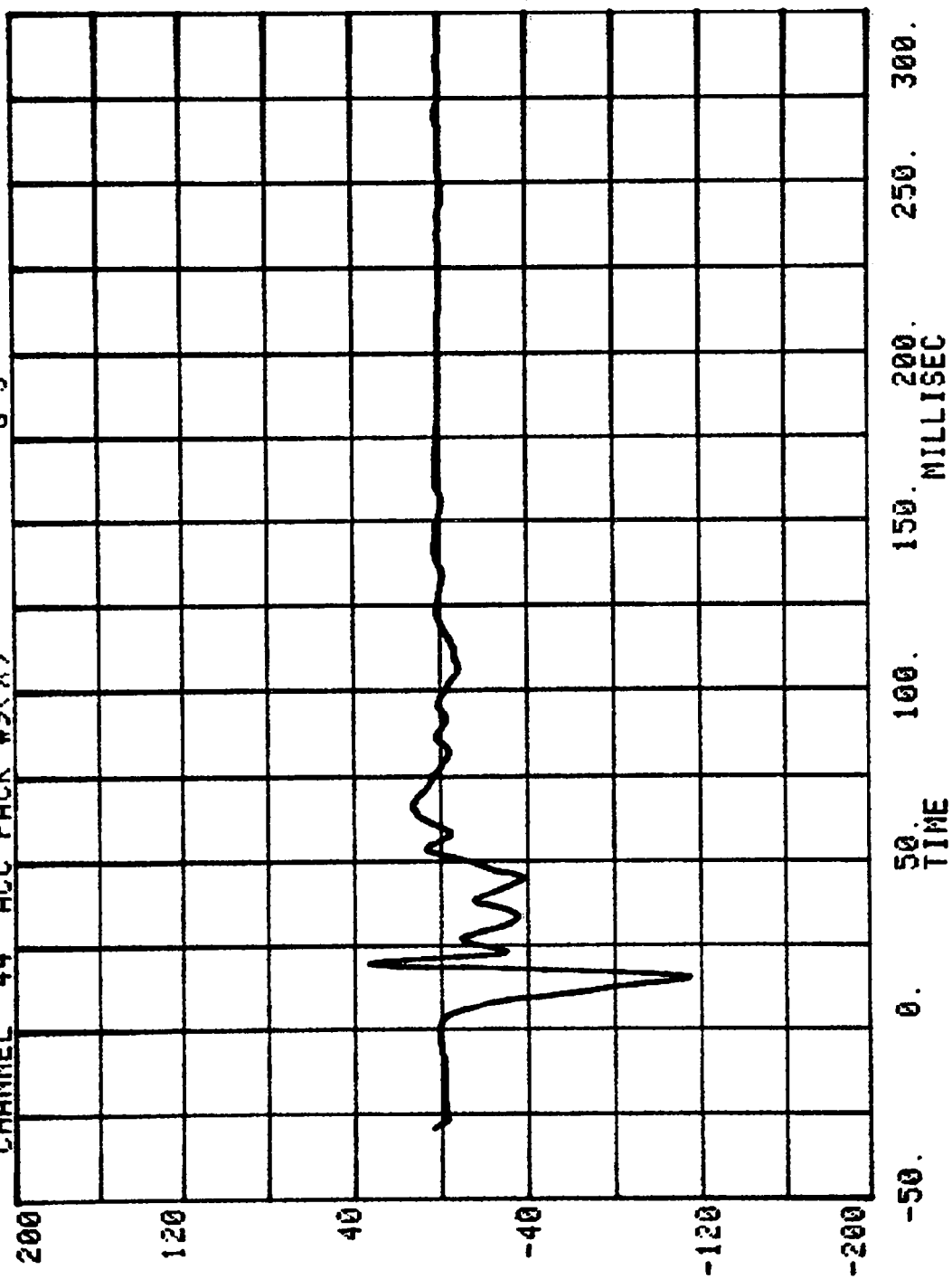
CHANNEL 2

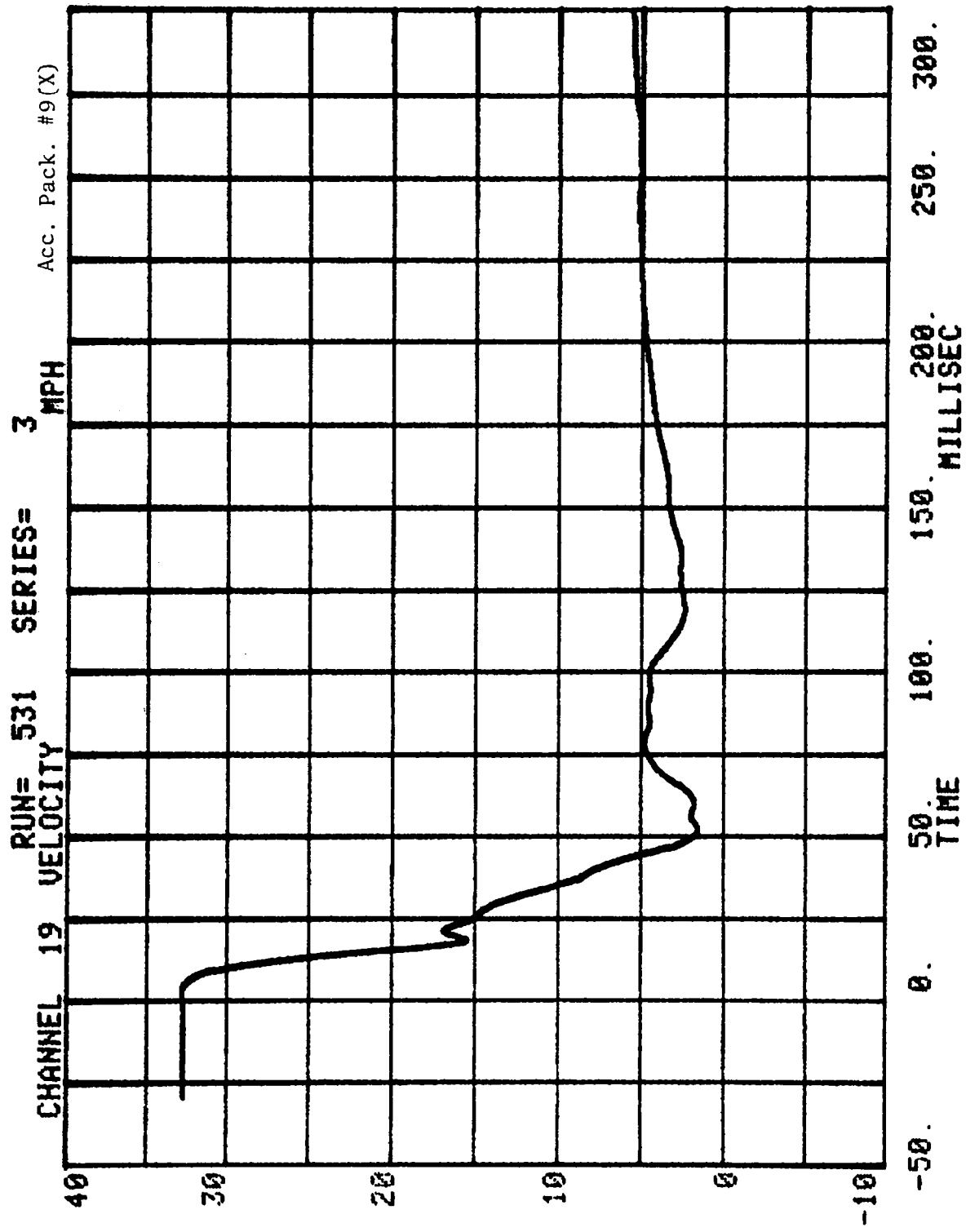


CHANNEL 42 ACC PACK #7(Z) RUN= 531 SERIES= 3 G'S



CHANNEL 44 ACC PACK #9(X) RUN= 531 SERIES= 3 G'S

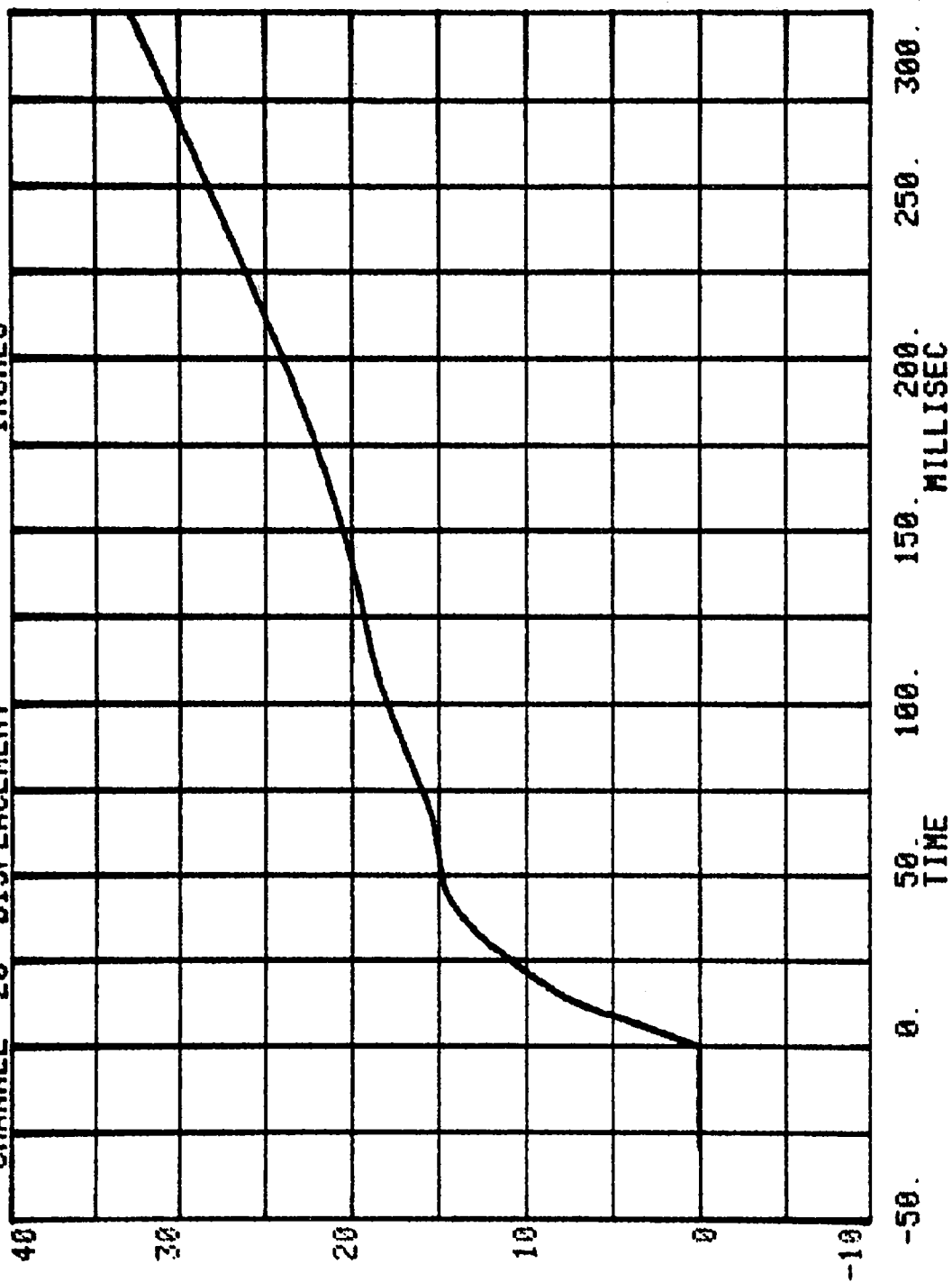




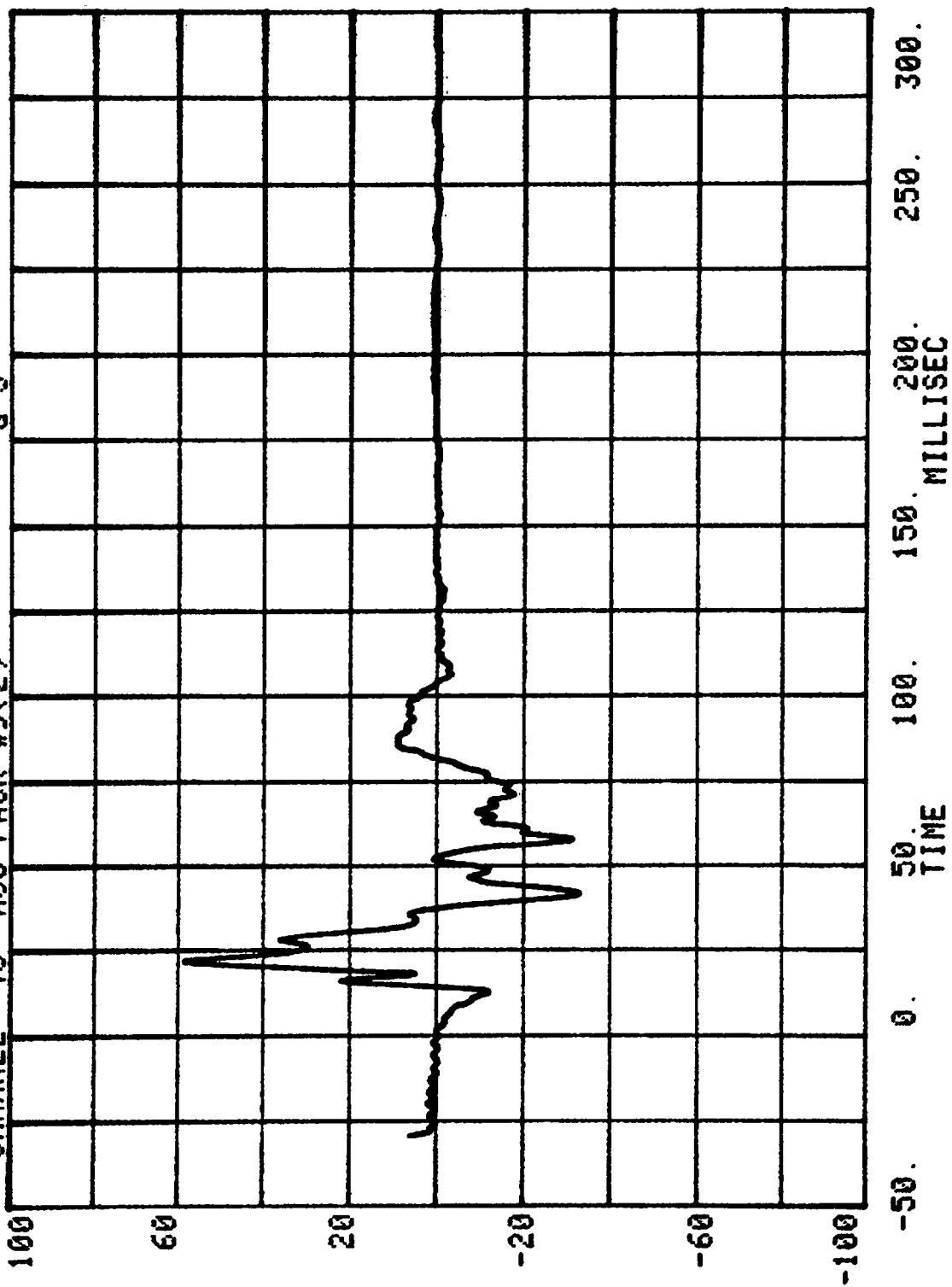
RUN= 531
CHANNEL 20 DISPLACEMENT

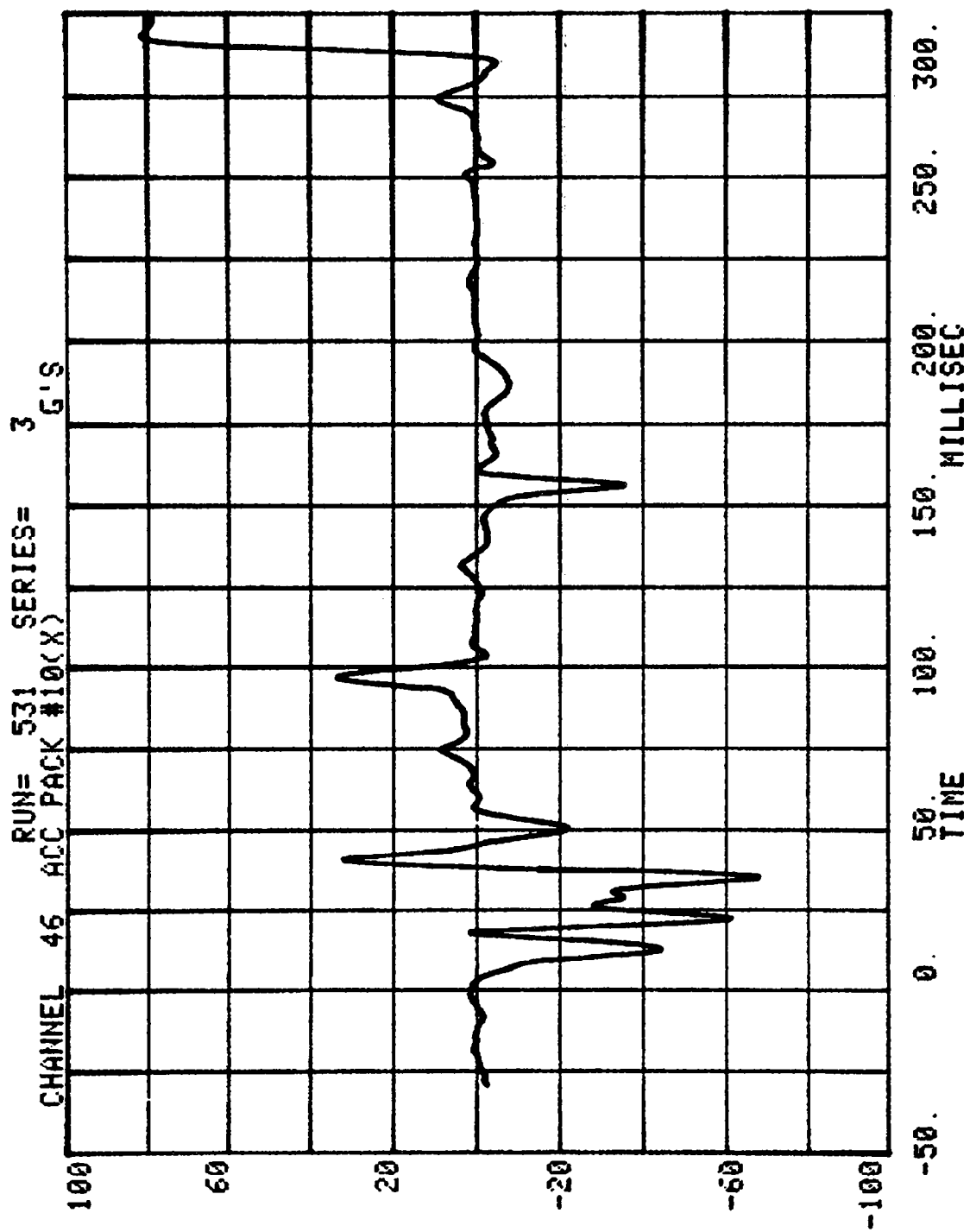
SERIES= 3
INCHES

Acc. Pack. #9(X)



RUN= 531 SERIES= 3
CHANNEL 45 ACC PACK #9(Z) G'S





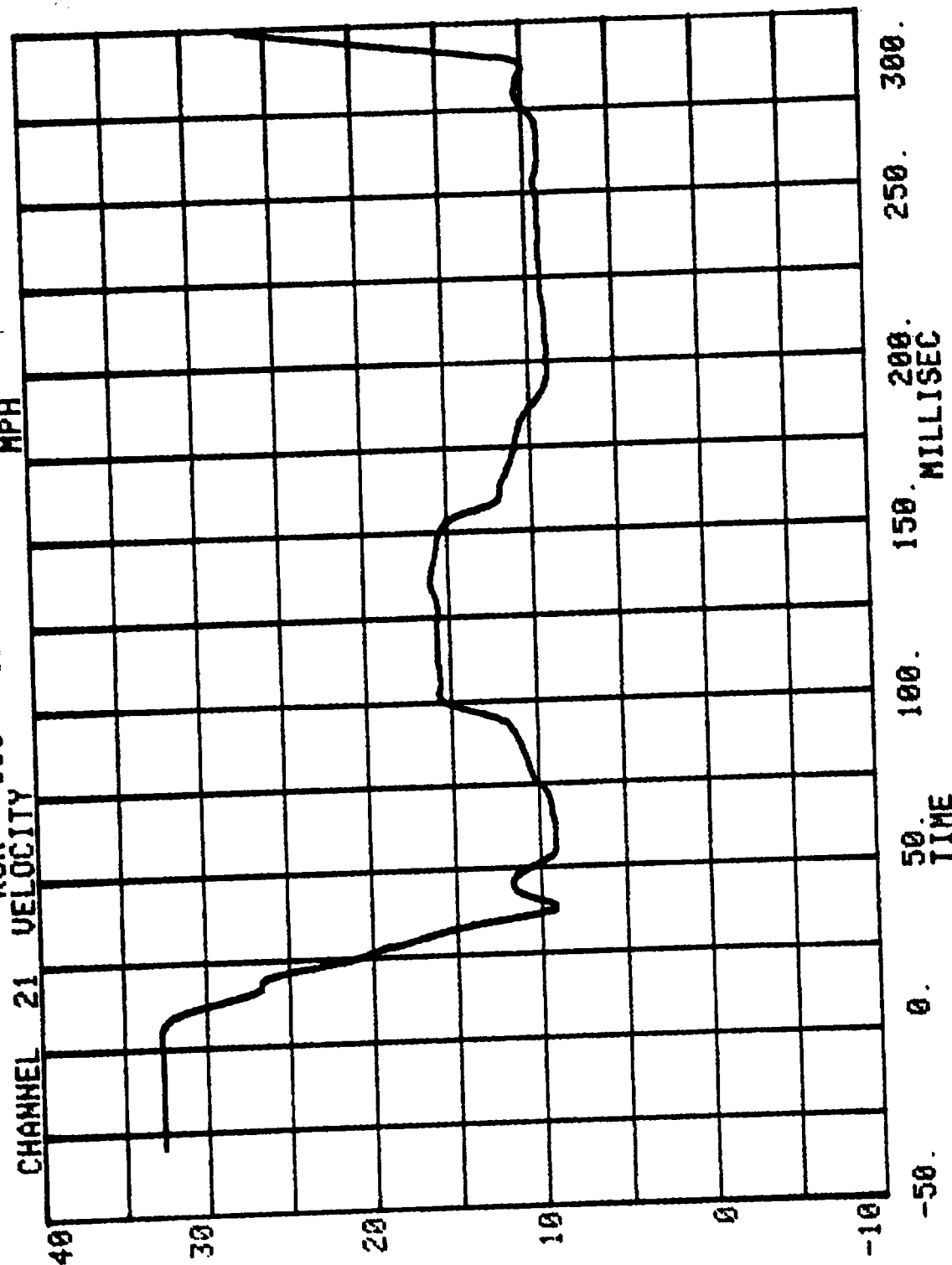
Acc. Pack. #10(X)

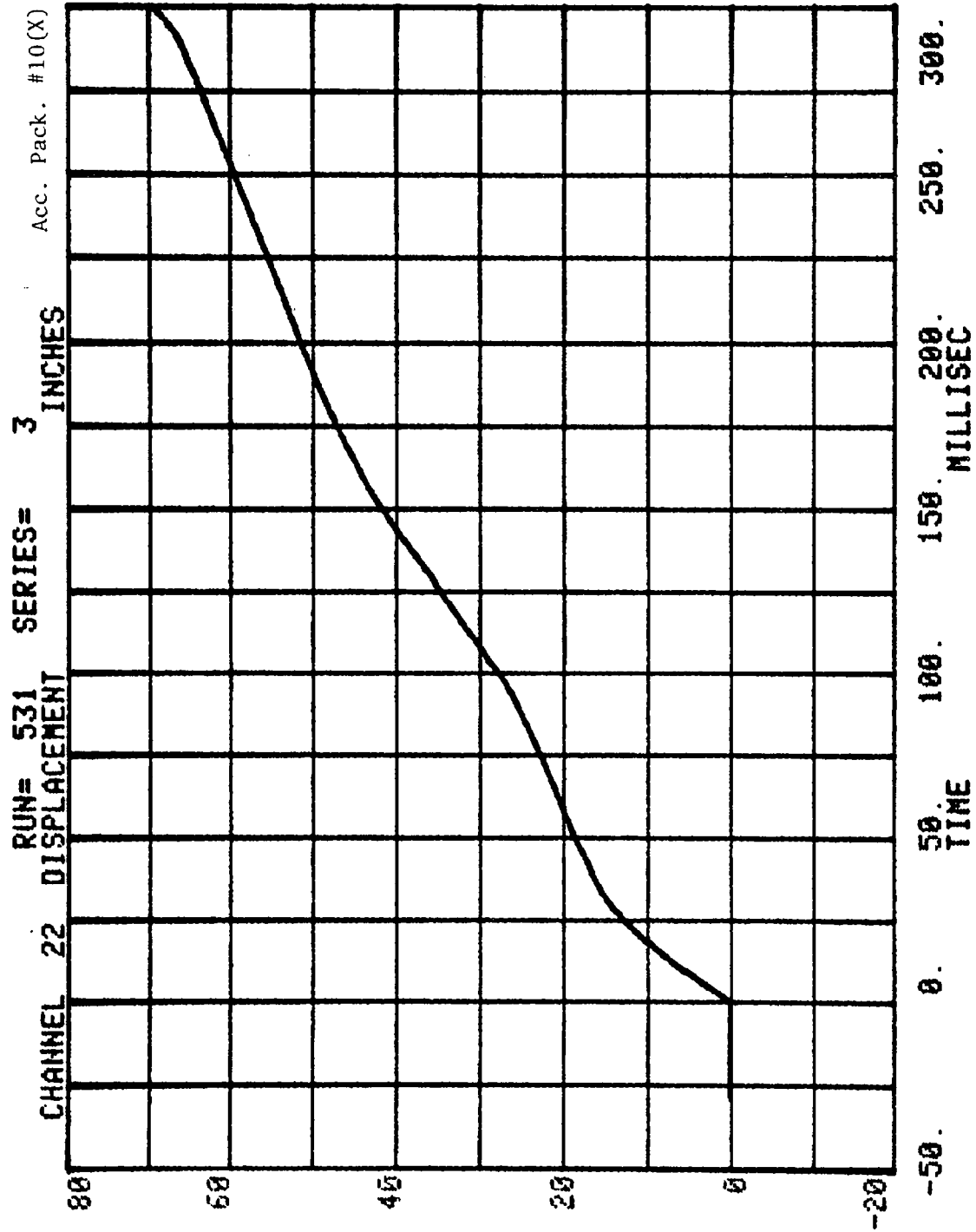
3 MPH

SERIES=

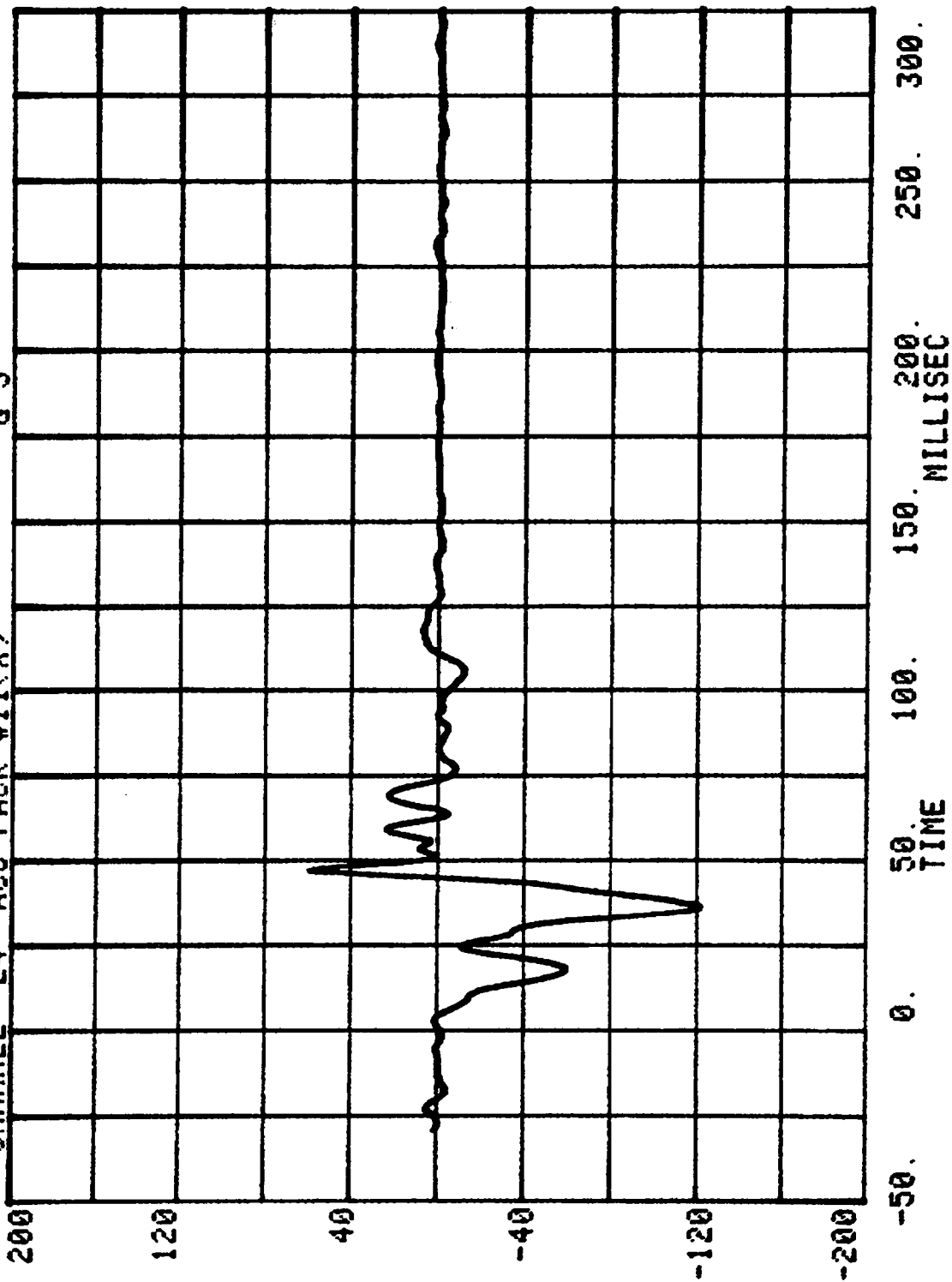
RUN= 531

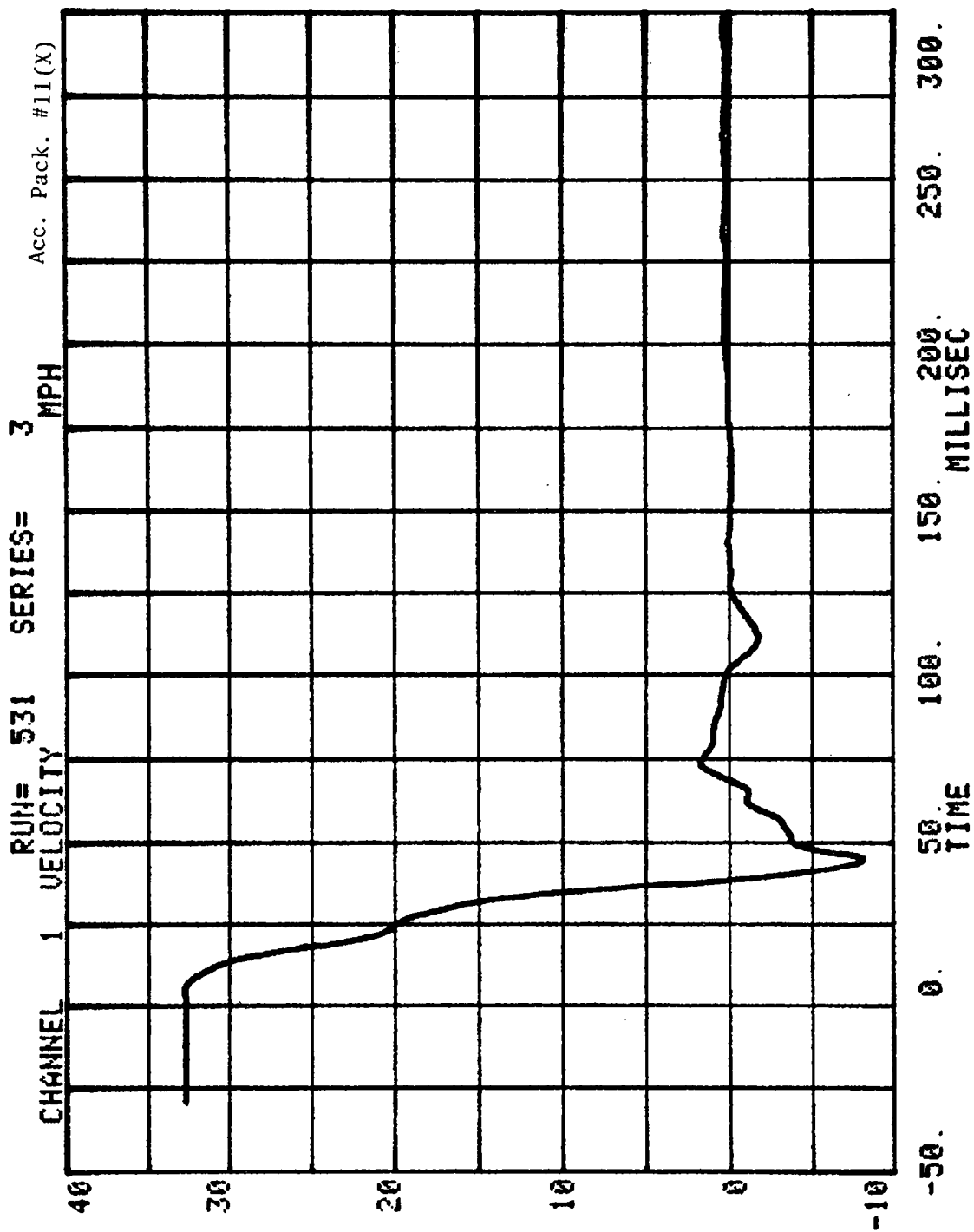
CHANNEL 21 VELOCITY



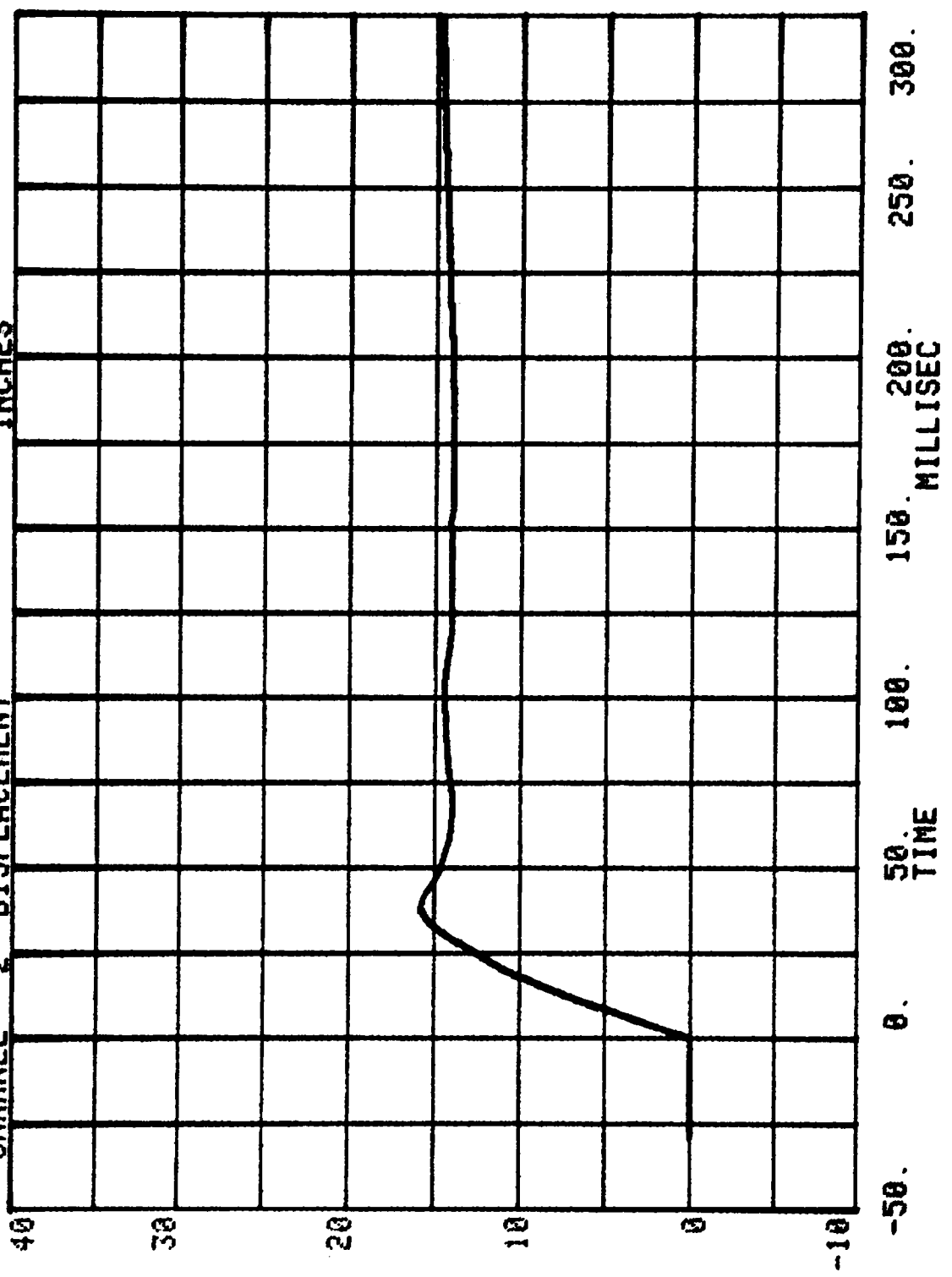


CHANNEL 24 ACC PACK #11(X) RUN= 531 SERIES= 3 G'S

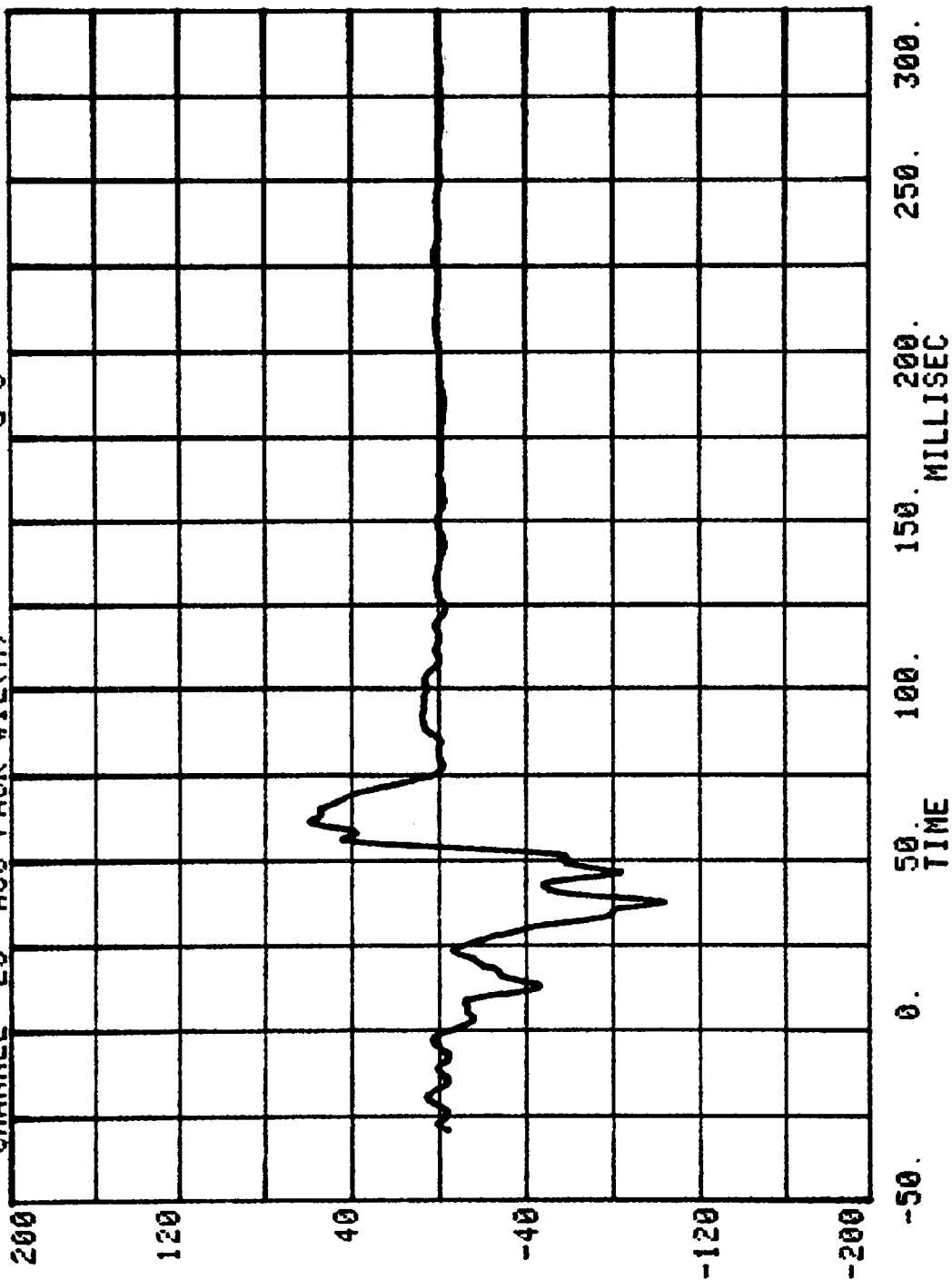




CHANNEL 2 DISPLACEMENT RUN= 531 SERIES= 3 INCHES Acc. Pack. #11(X)



RUN= 531 SERIES= 3
CHANNEL 25 ACC PACK #12(X) G'S



Acc. Pack. #12(X)

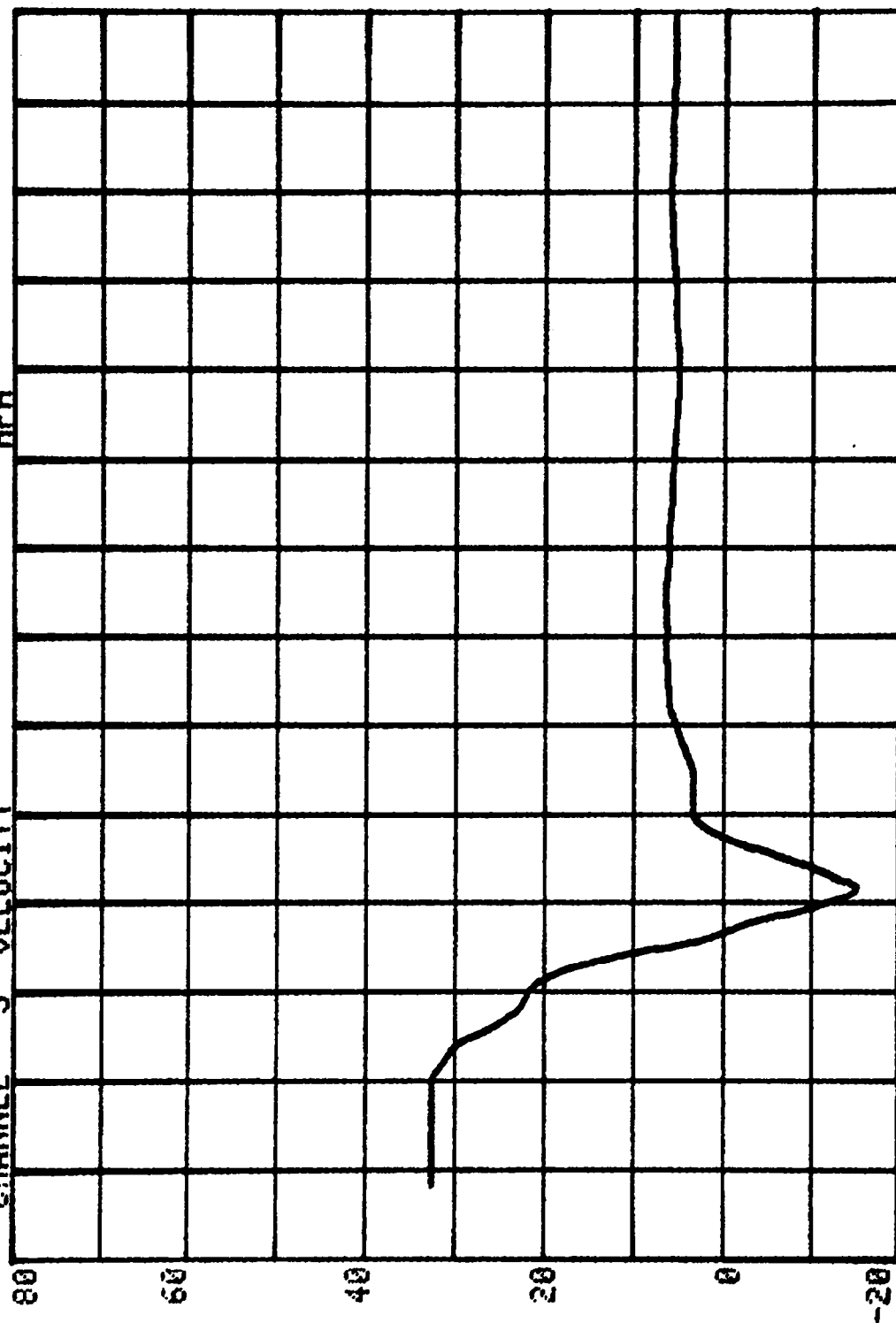
3 MPH

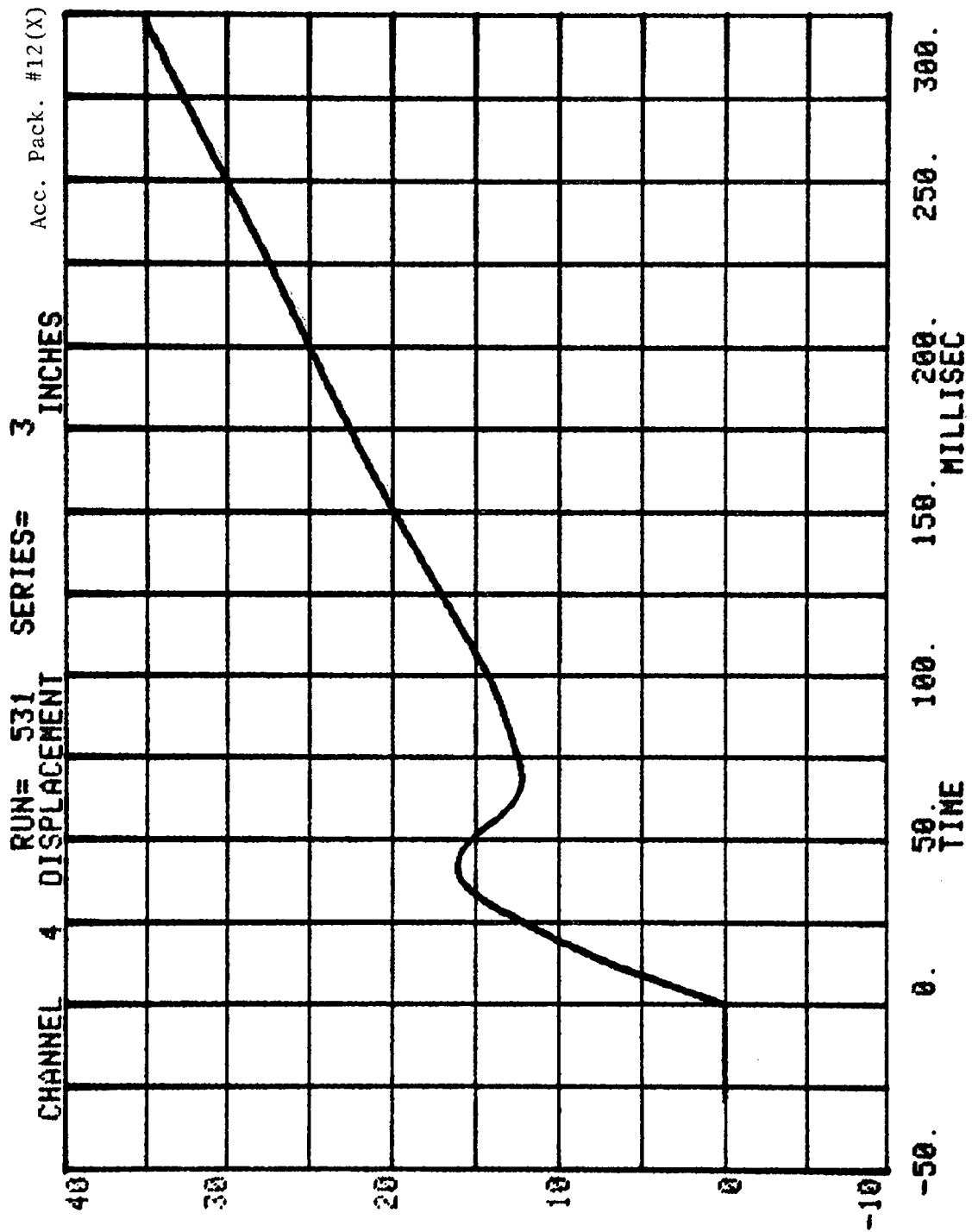
SERIES=

RUN= 531

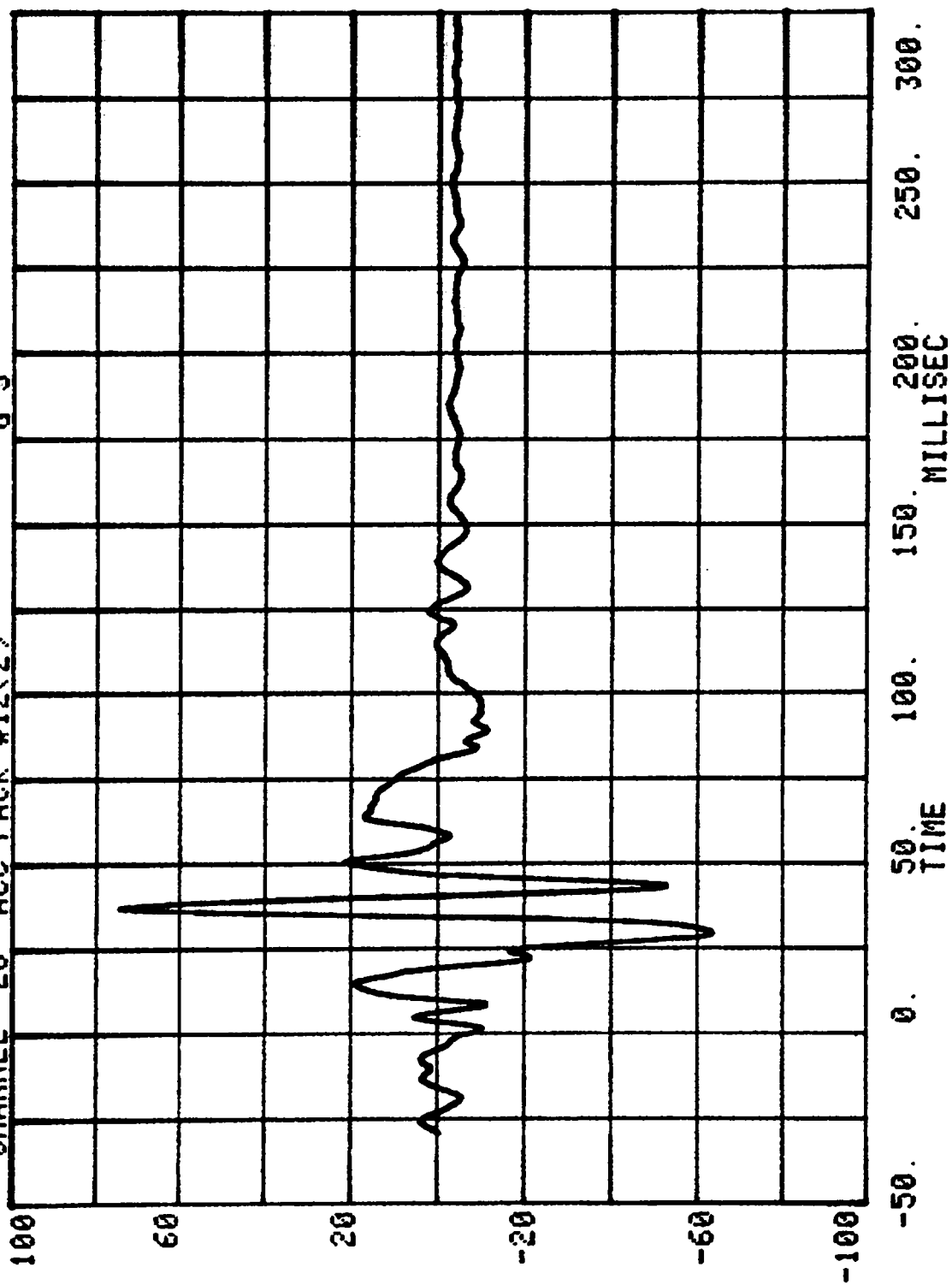
3 VELOCITY

CHANNEL

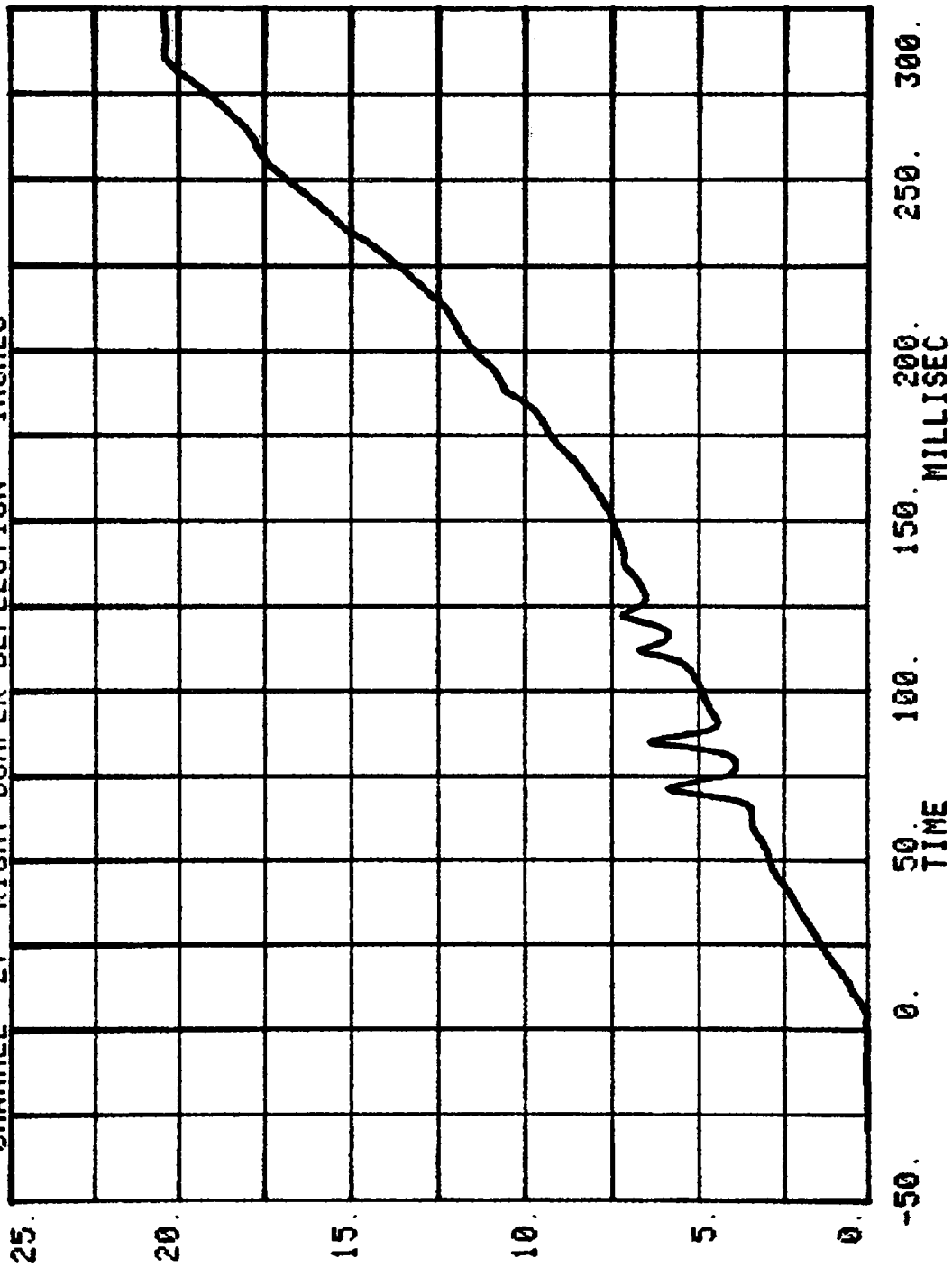




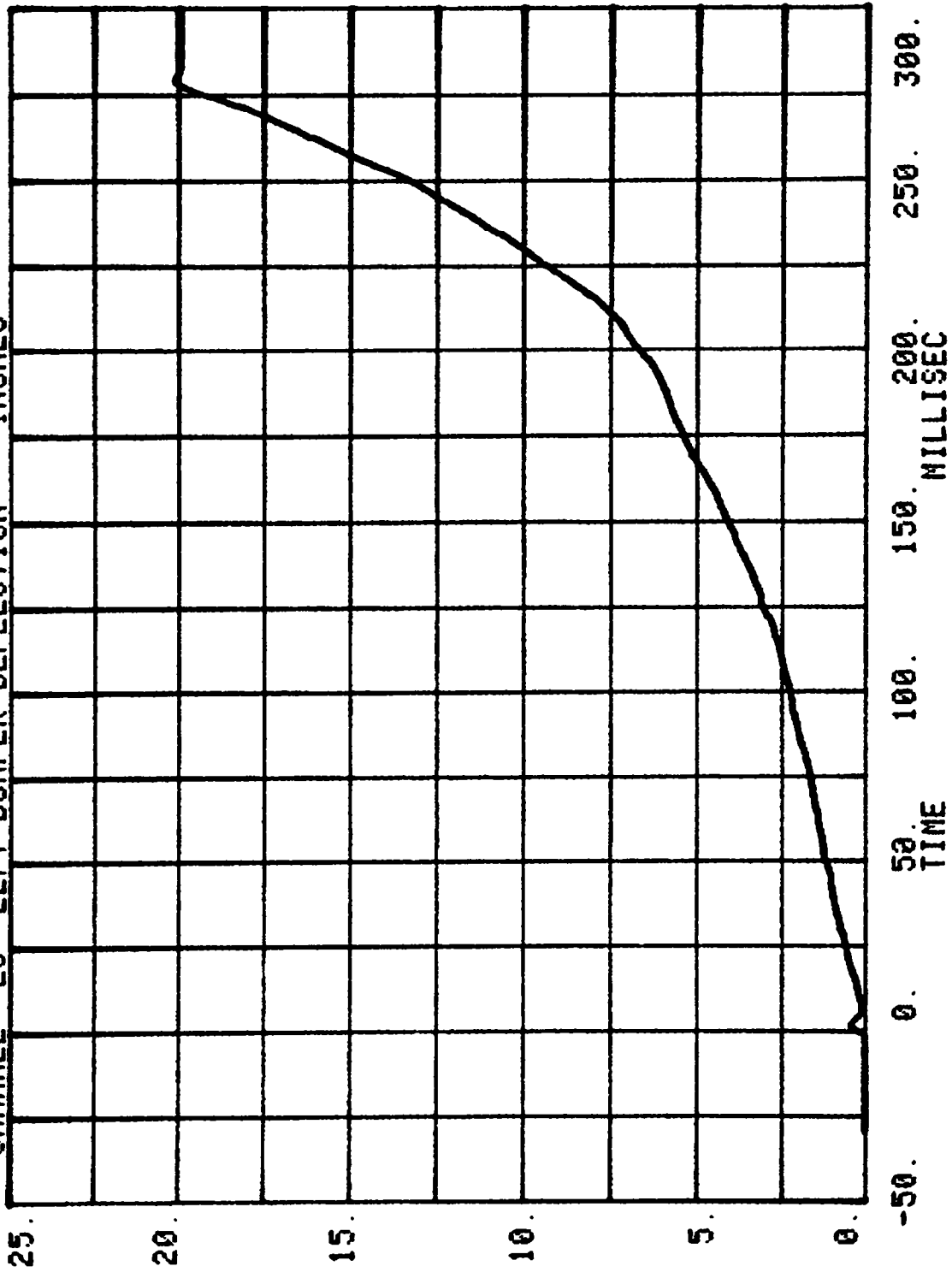
CHANNEL 26 ACC PACK #12(Z) RUN= 531 SERIES= 3 G'S

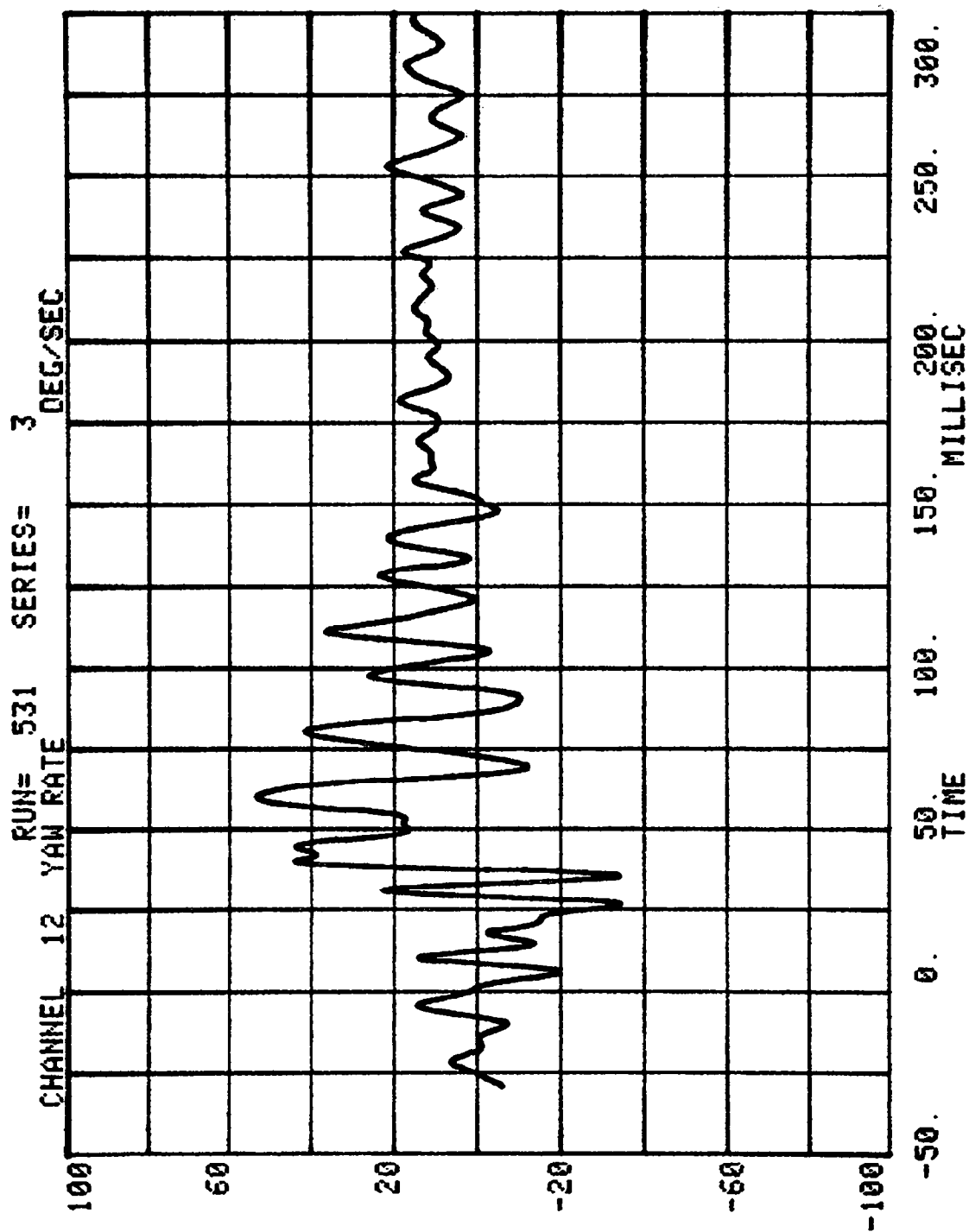


CHANNEL 27 RIGHT BUMPER DEFLECTION 3 INCHES



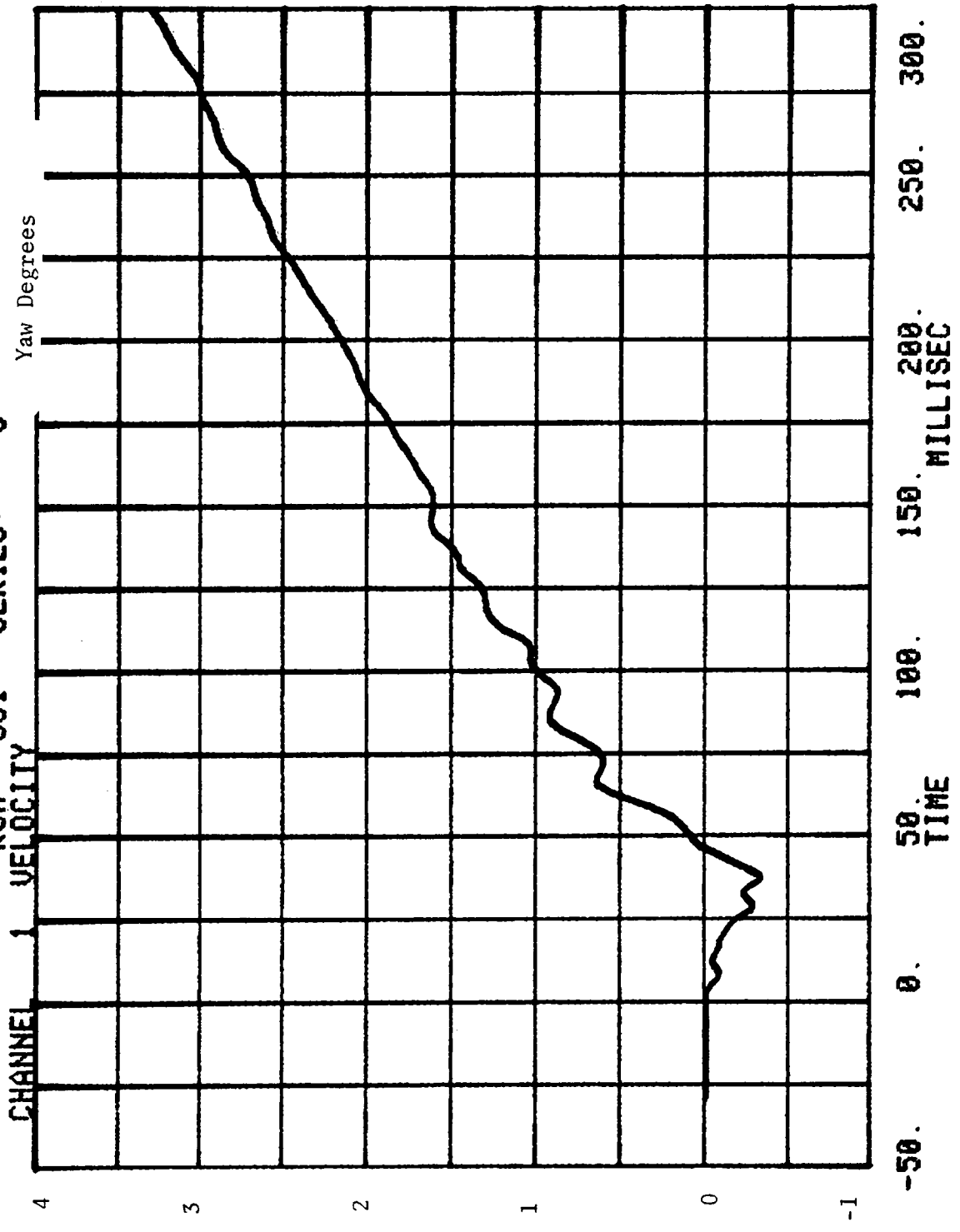
CHANNEL 28 LEFT BUMPER DEFLECTION 3 INCHES





raw \

RUN= 531 SERIES= 3



TEST NO. 752-3-531

MOVING DEFORMABLE BARRIER

VEHICLE NO. 2

VEHICLE DATA

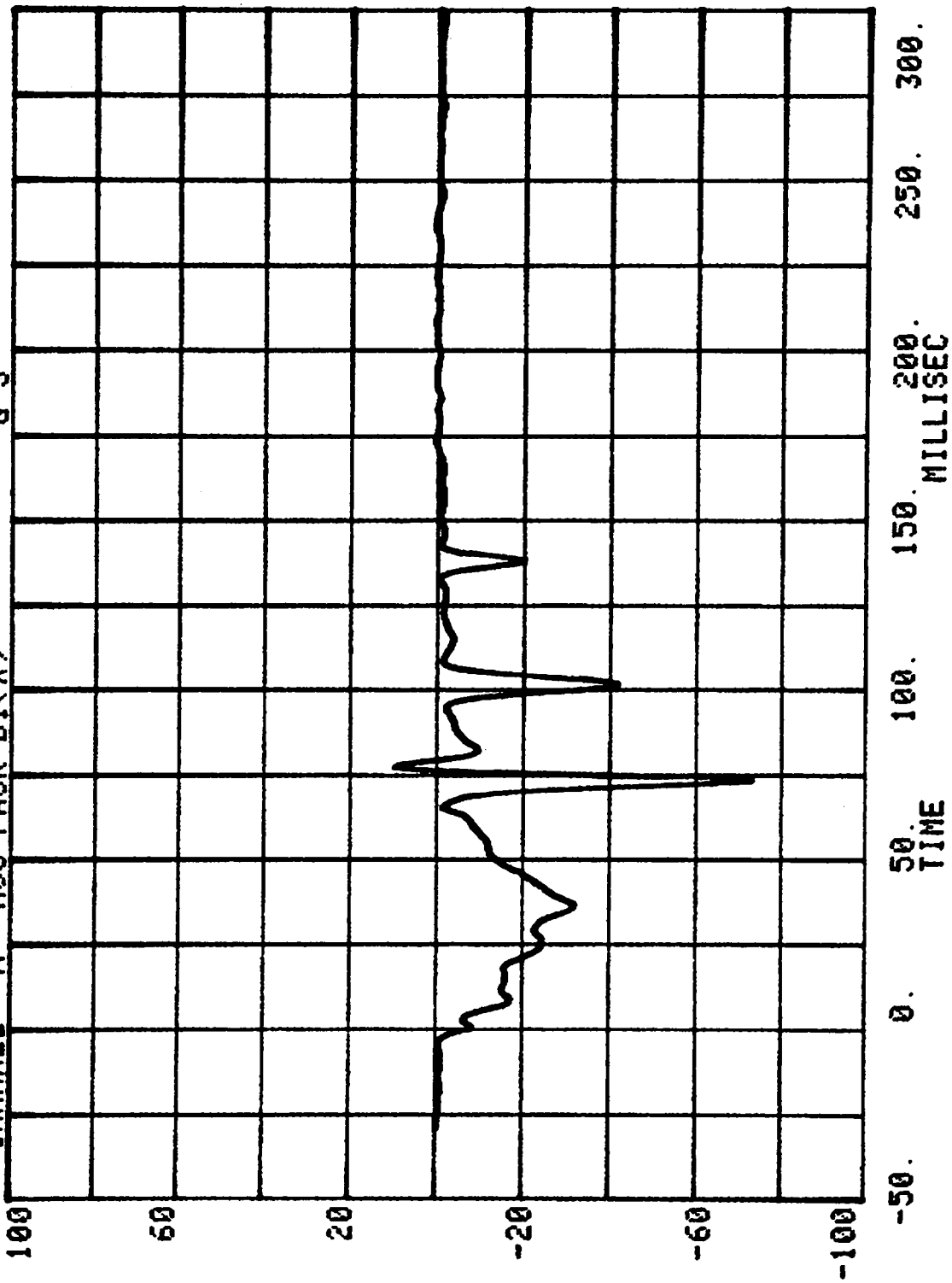
FILTER CHANNEL CLASS

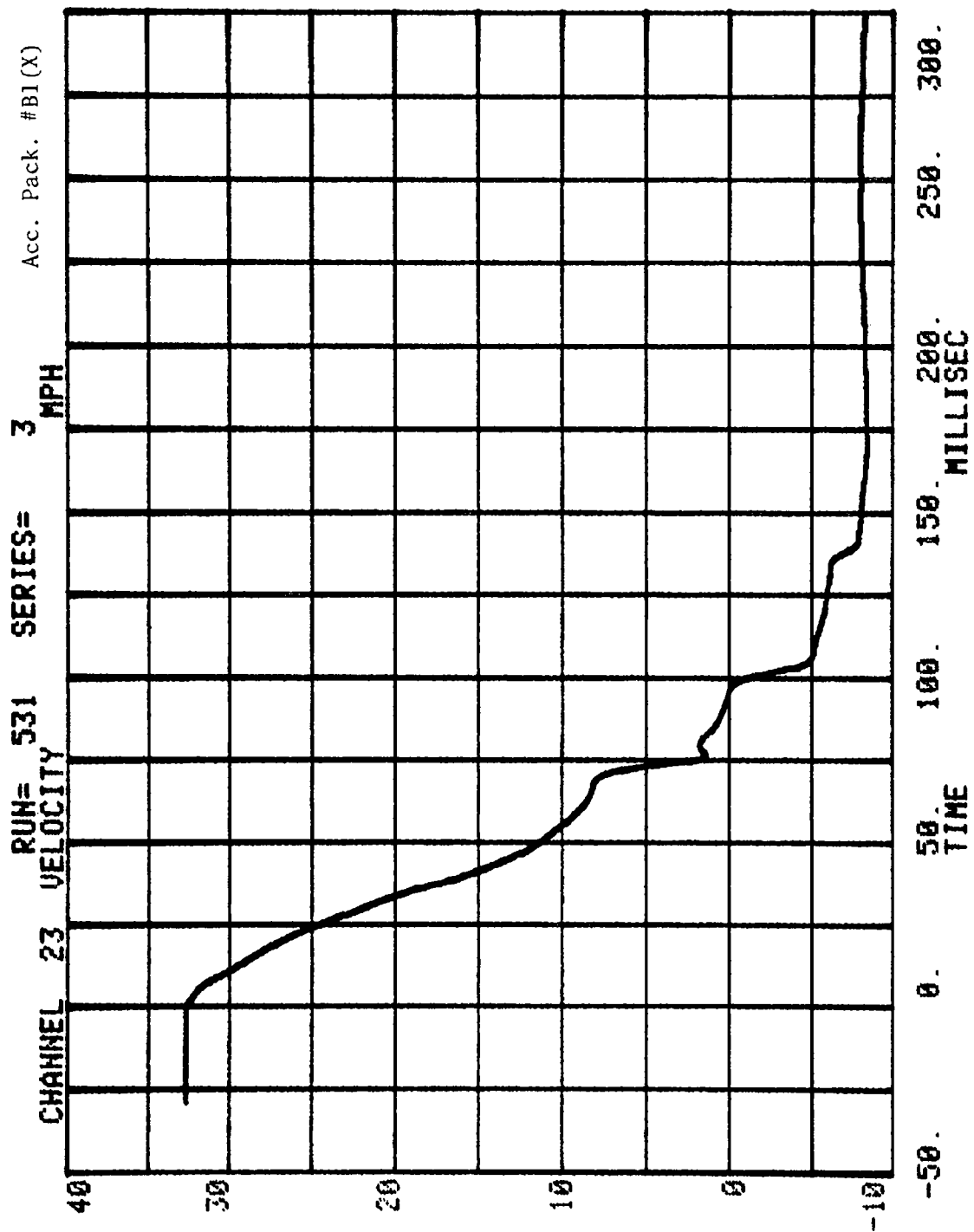
60

B-50

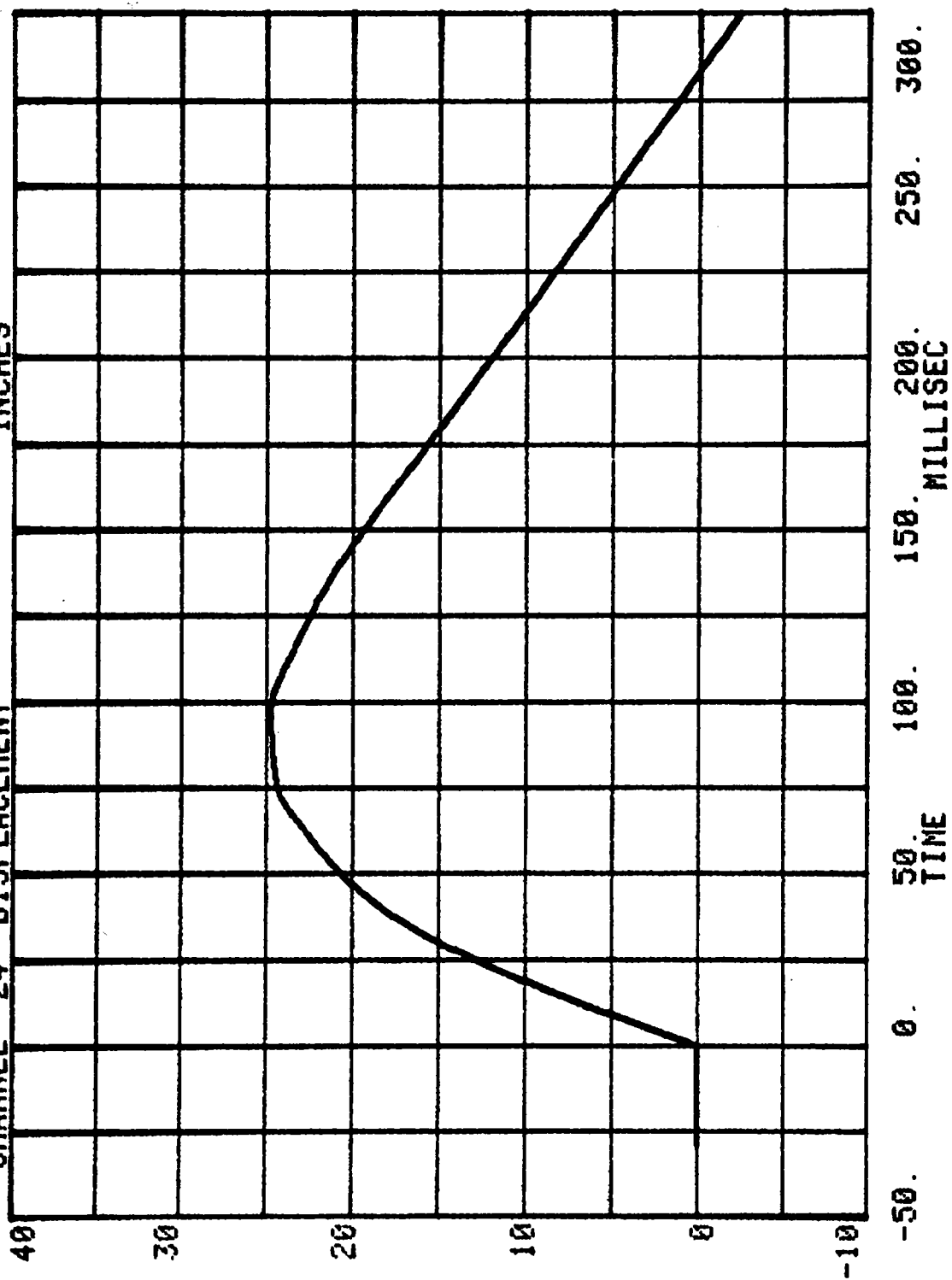
6892-V-3

CHANNEL 47 ACC PACK B1(X) RUN= 531 SERIES= 3 G'S

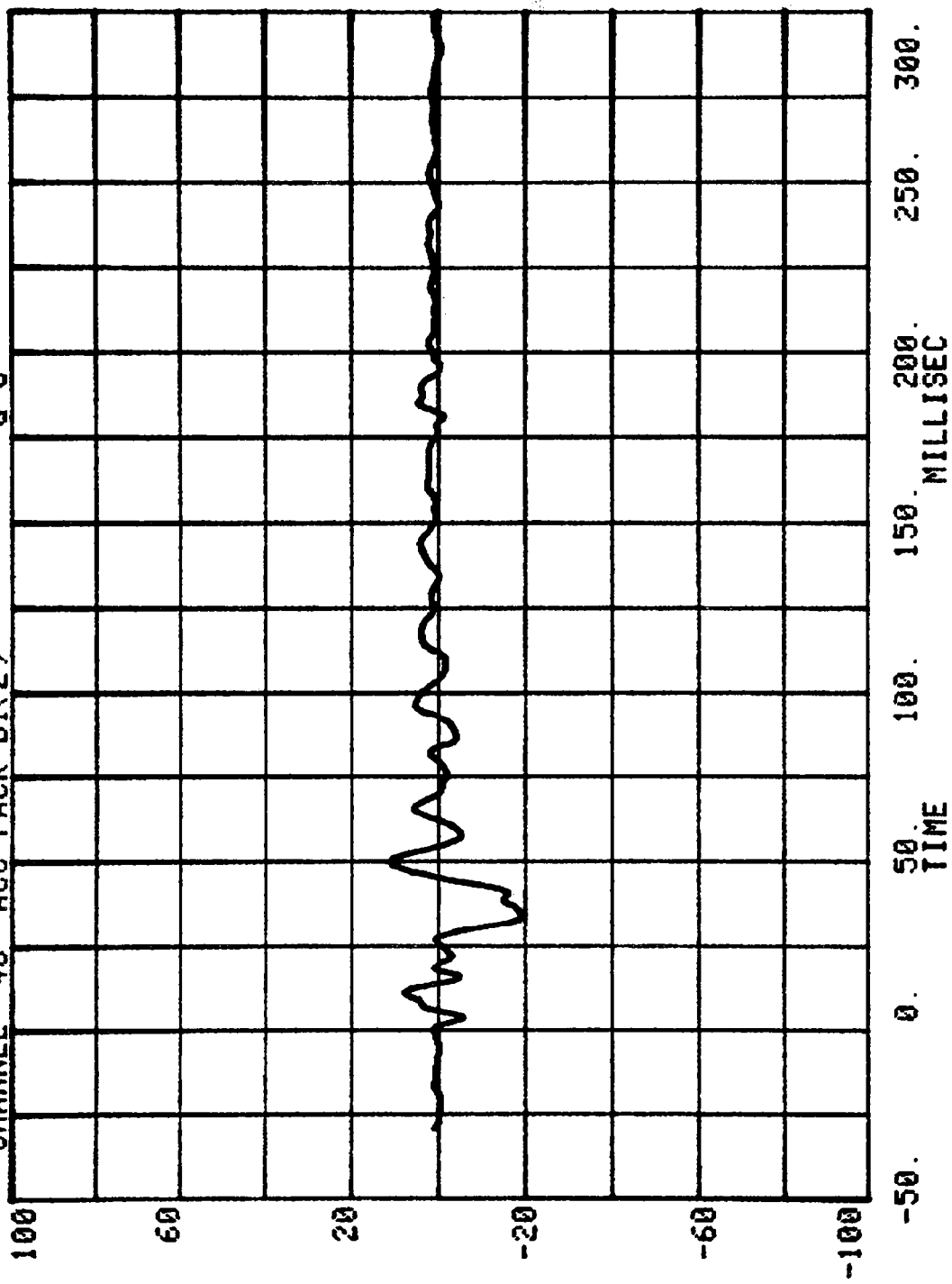




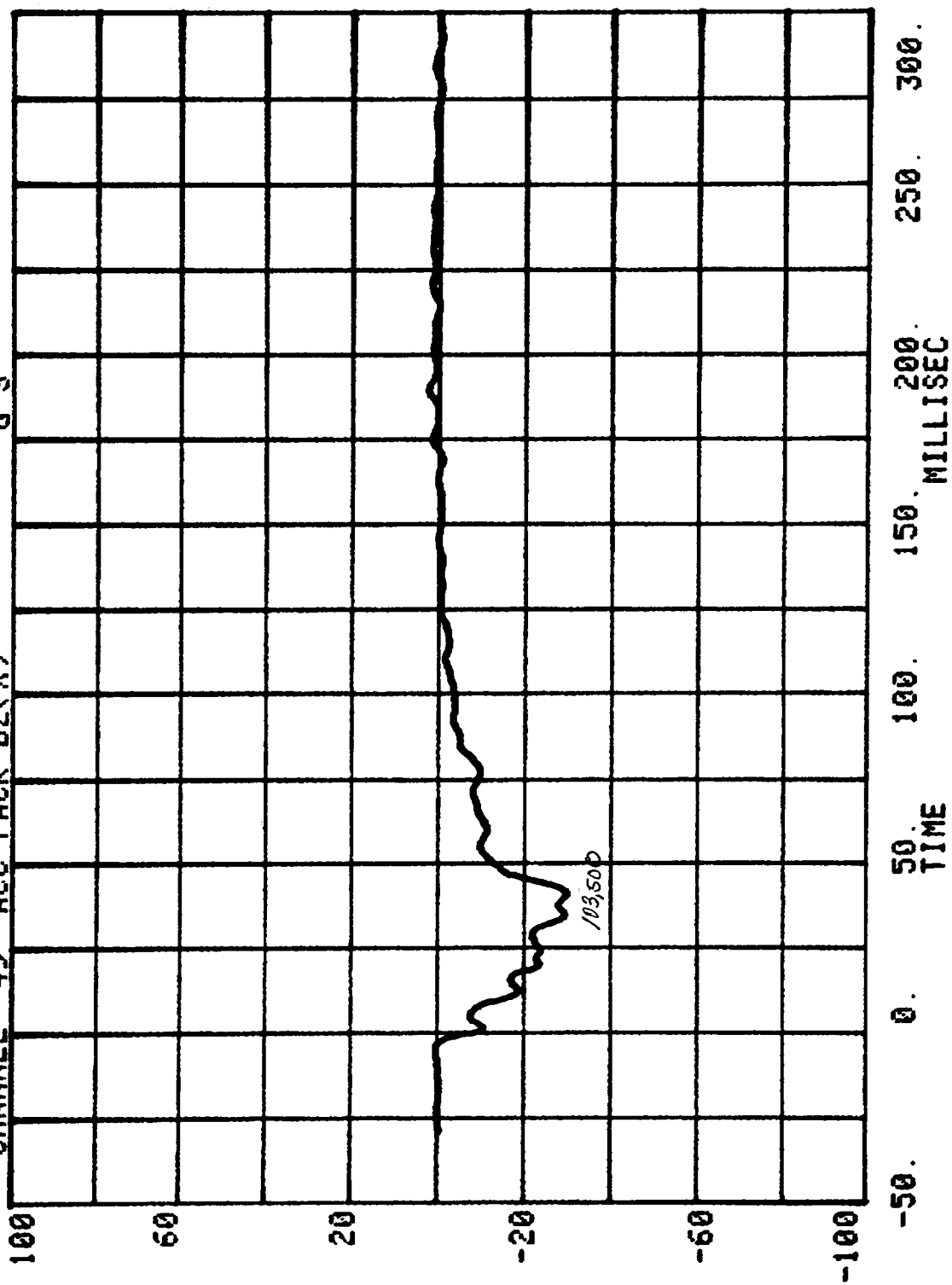
CHANNEL 24 DISPLACEMENT RUN= 531 SERIES= 3 INCHES Acc. Pack. #B1(X)



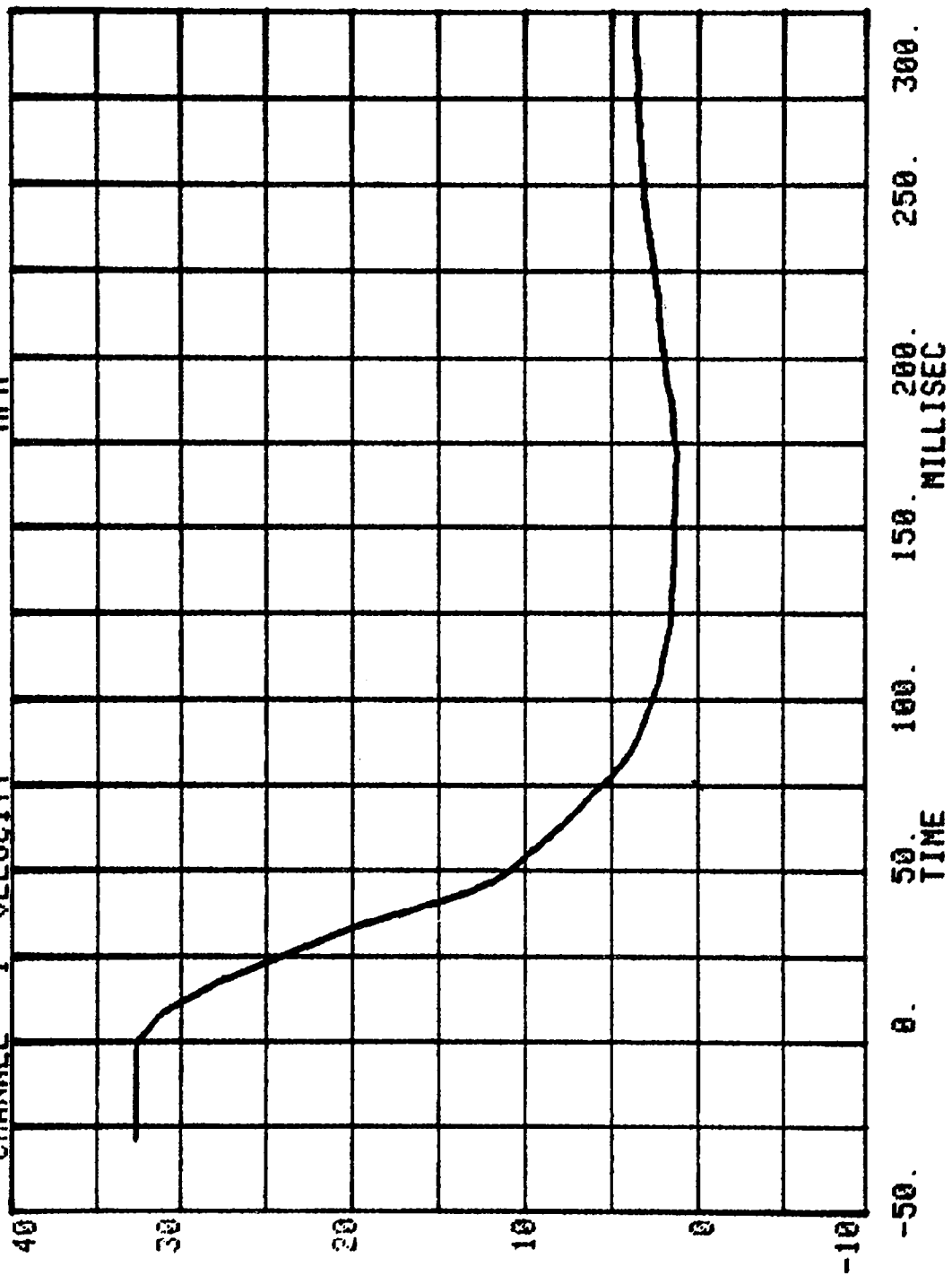
CHANNEL 48 ACC PACK B1(Z) RUN= 531 SERIES= 3 G'S



CHANNEL 49 ACC PACK 62(X) RUN= 531 SERIES= 3 G'S



CHANNEL 1 VELOCITY
 RUN= 531 SERIES= 3 MPH
 Acc. Pack. #B2(X)

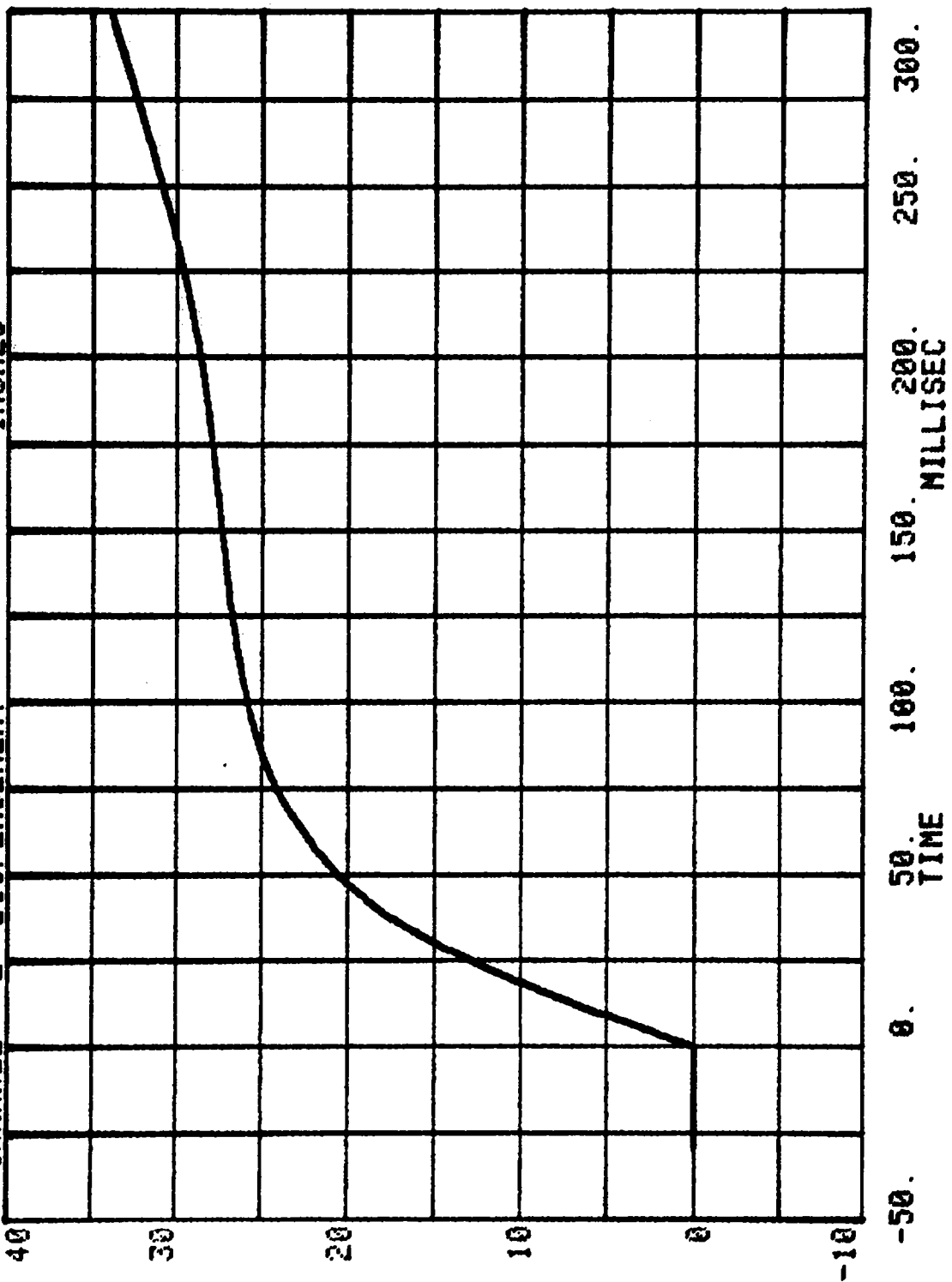


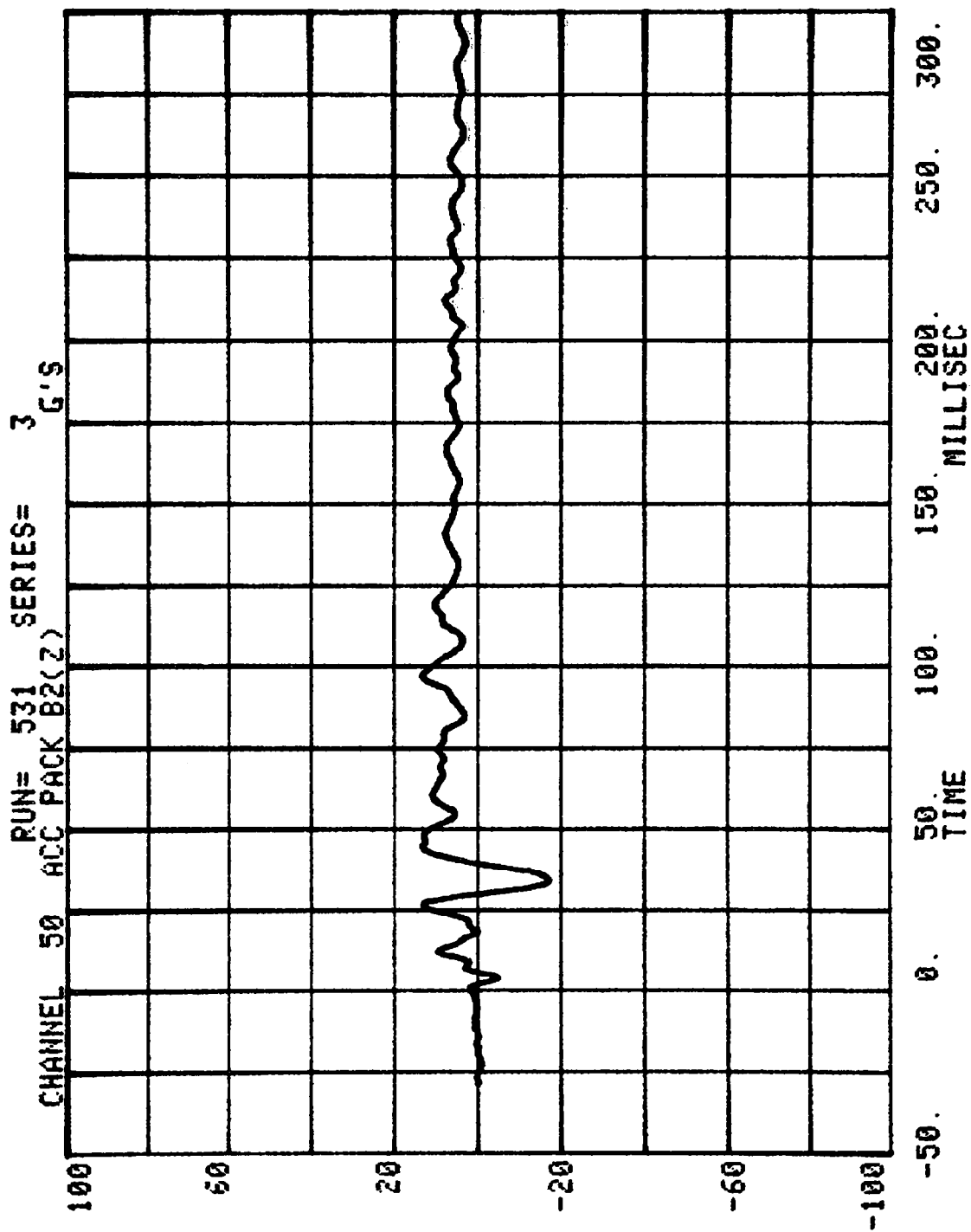
B-56

THRESHOLD AV = 28

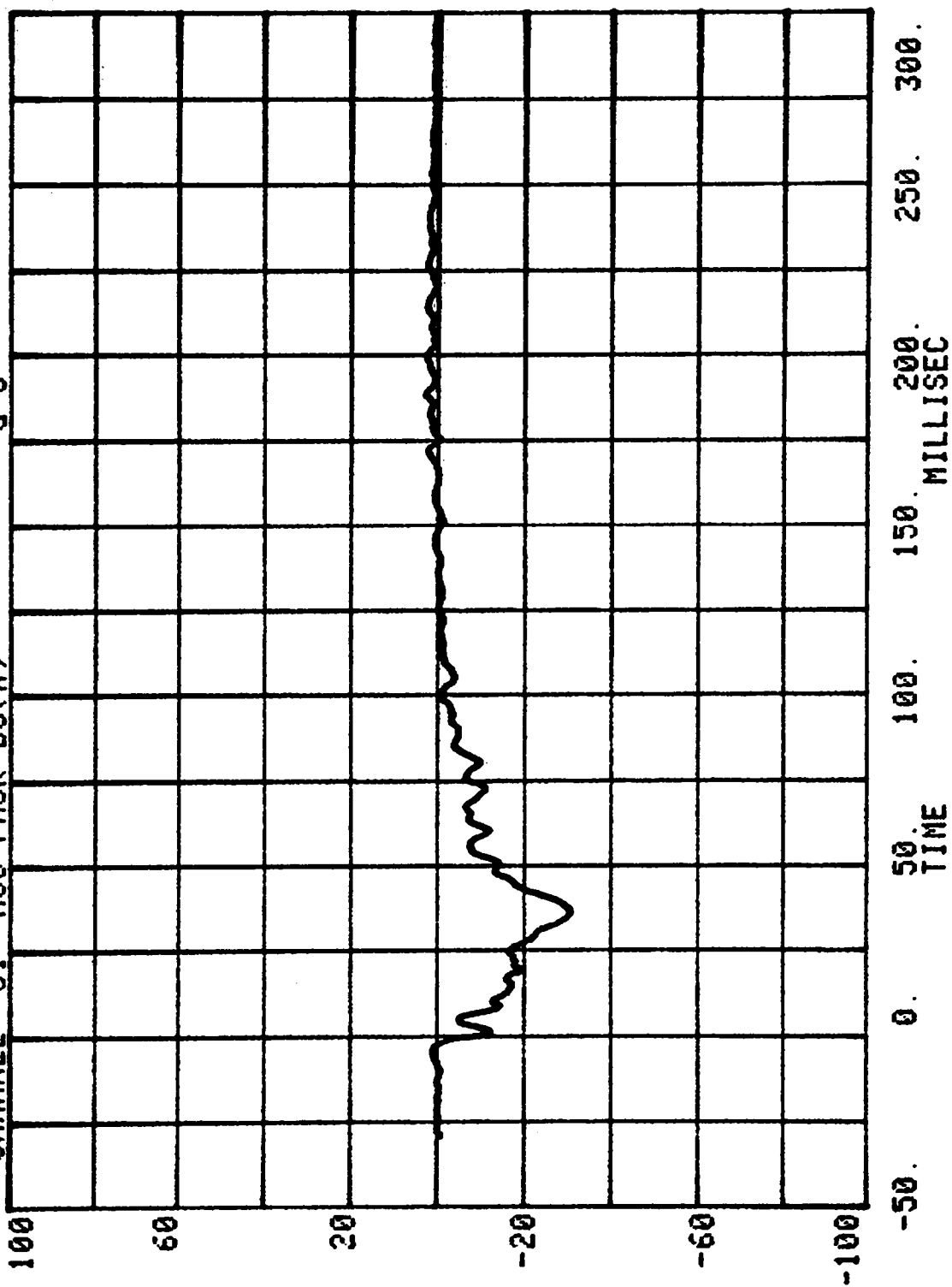
6892-V-3

CHANNEL 2 DISPLACEMENT RUN= 531 SERIES= 3 INCHES Acc. Pack. #B2(X)



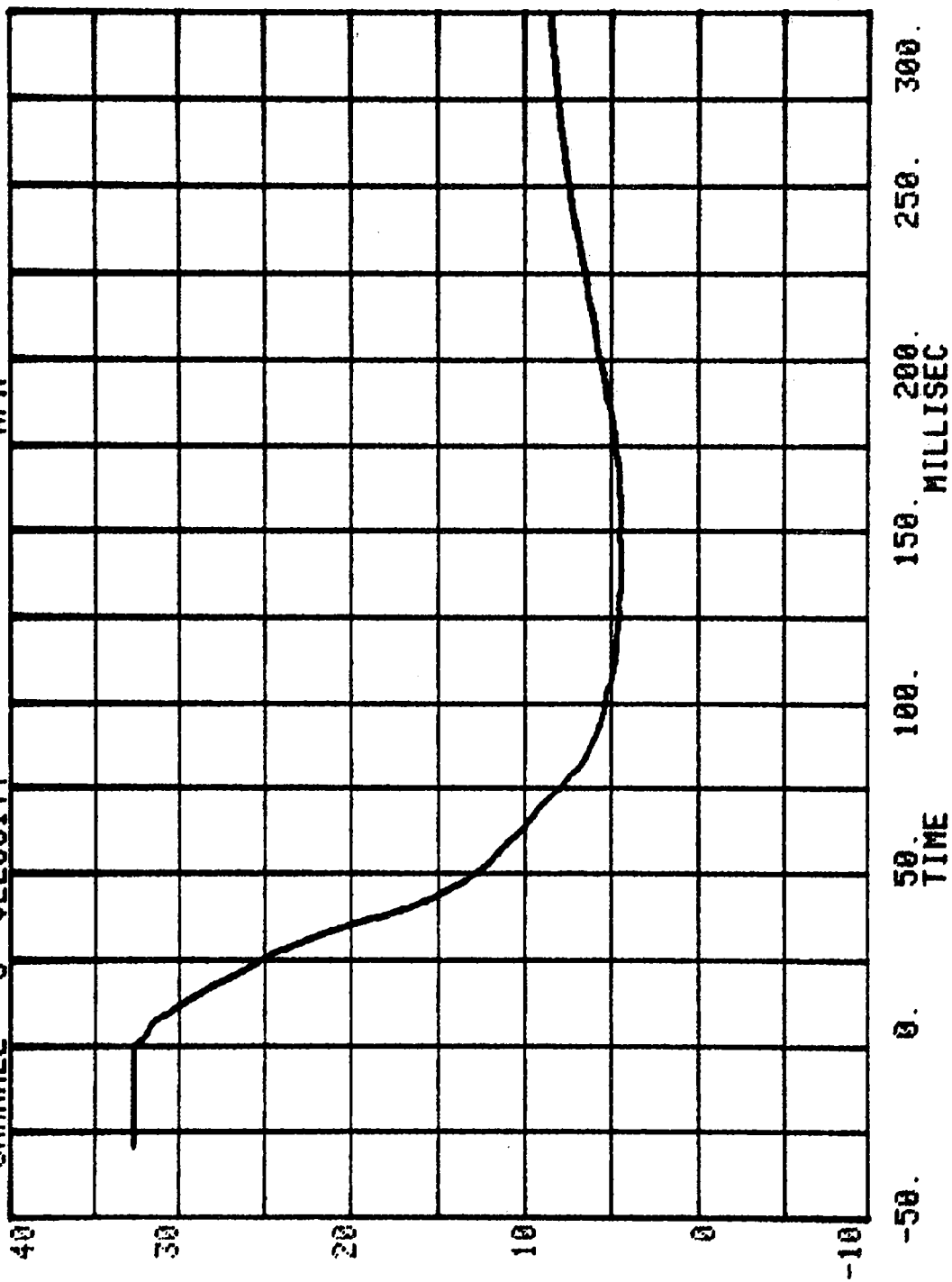


CHANNEL 51 ACC PACK B3(X) RUN= 531 SERIES= 3 G'S



Acc. Pack. #B3(X)

CHANNEL 3 VELOCITY
RUN= 531 SERIES= 3 MPH



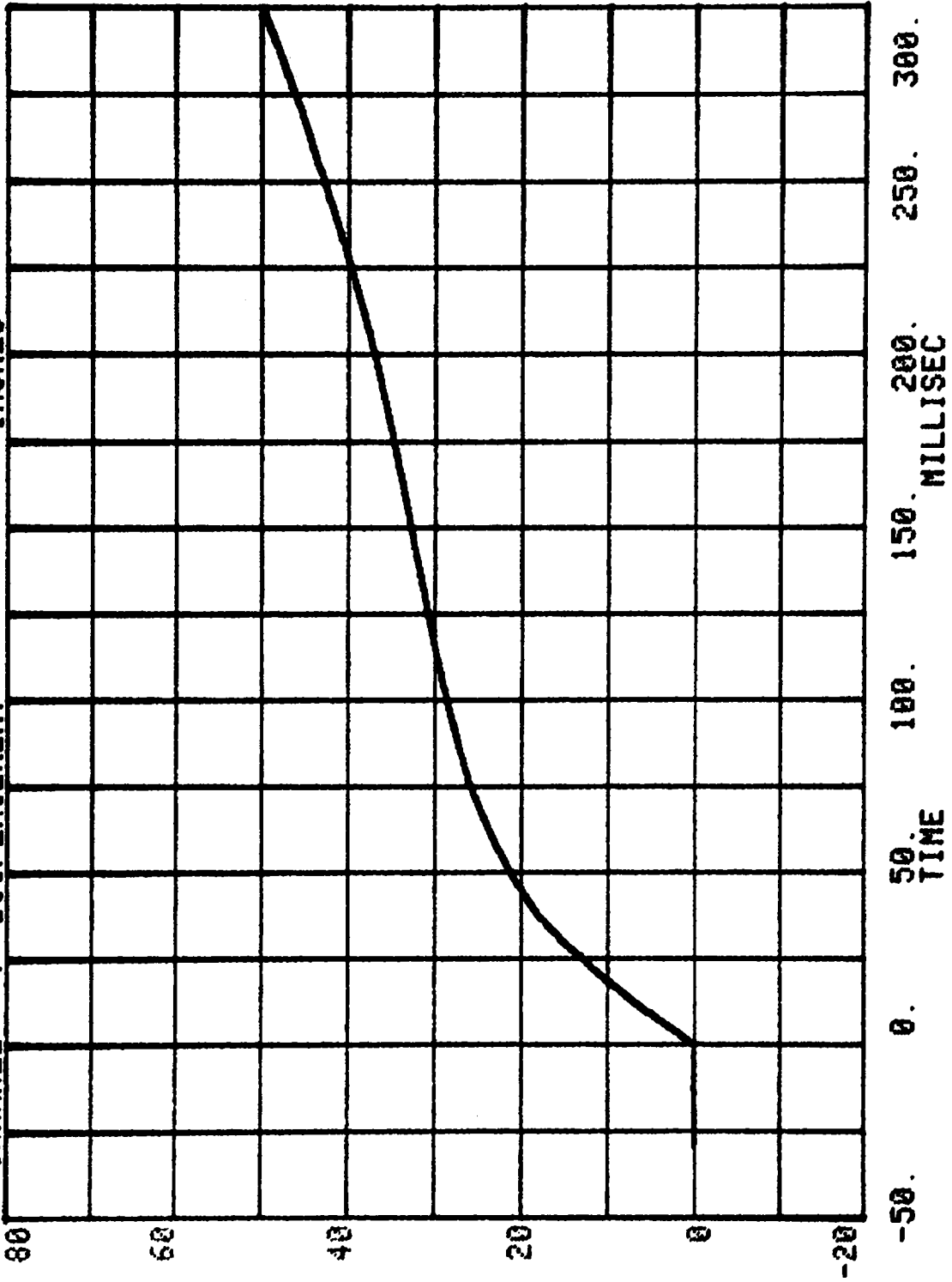
Acc. Pack. #B3(X)

CHANNEL 4 DISPLACEMENT

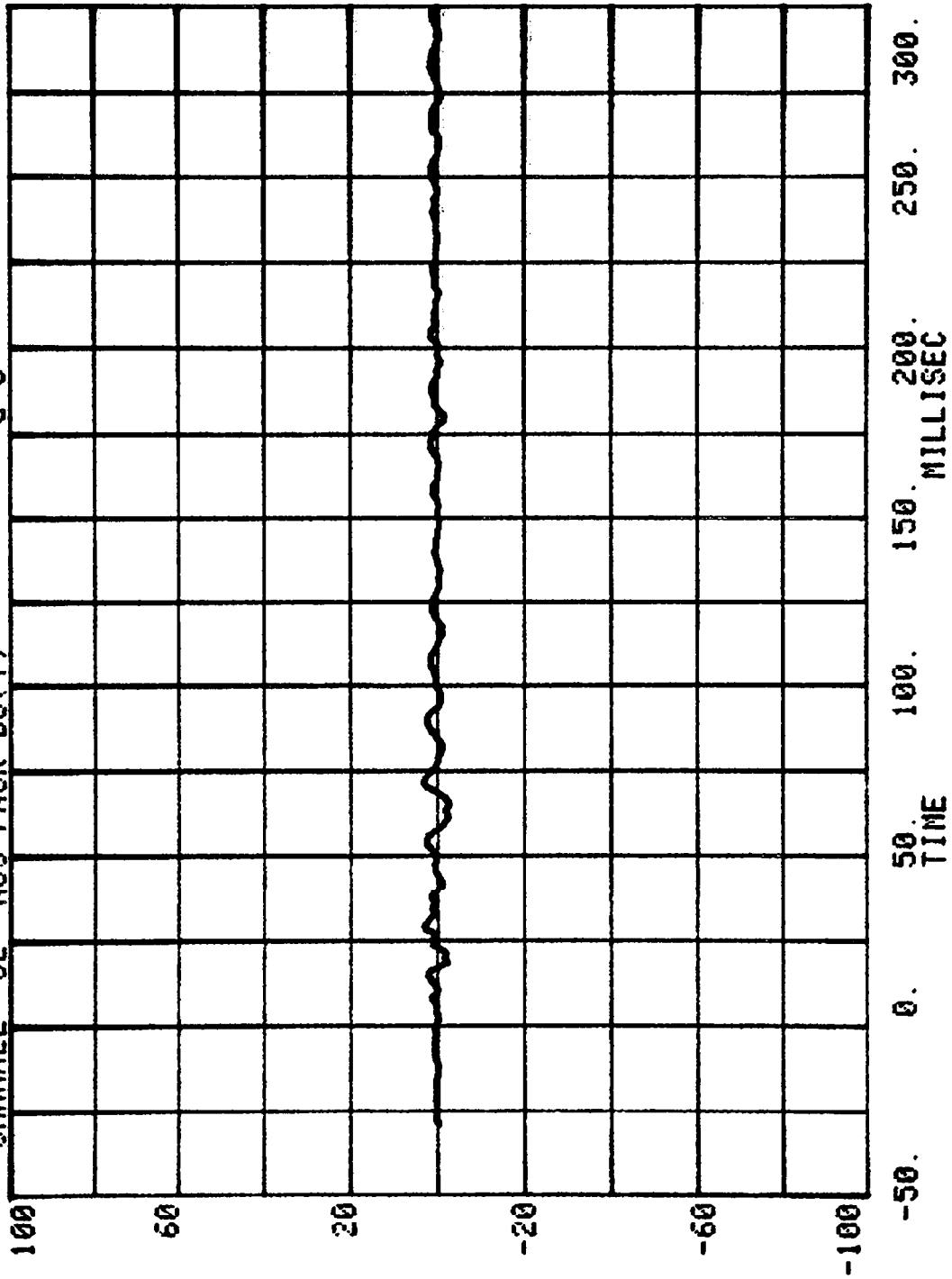
RUN= 531

SERIES= 3

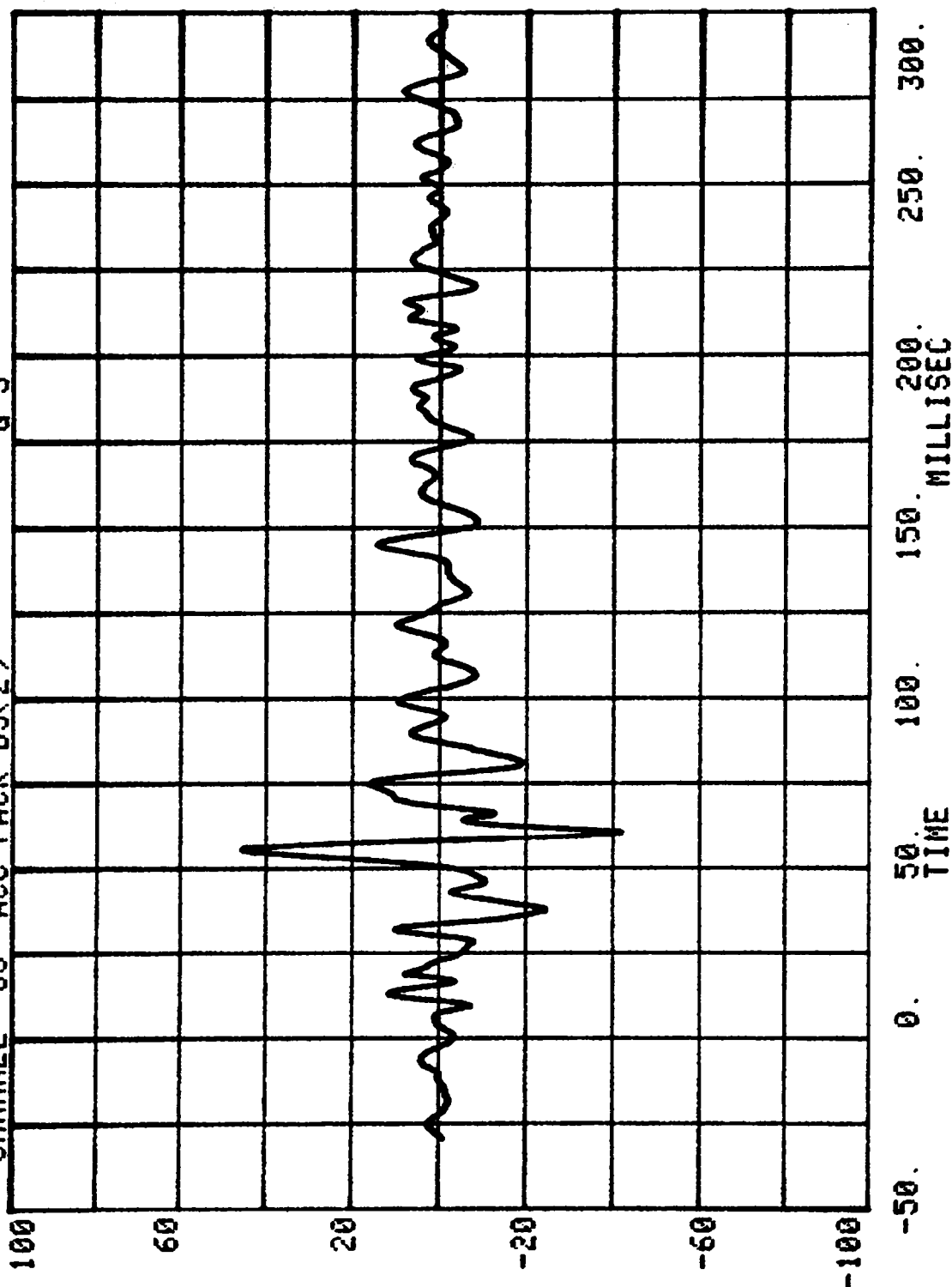
INCHES

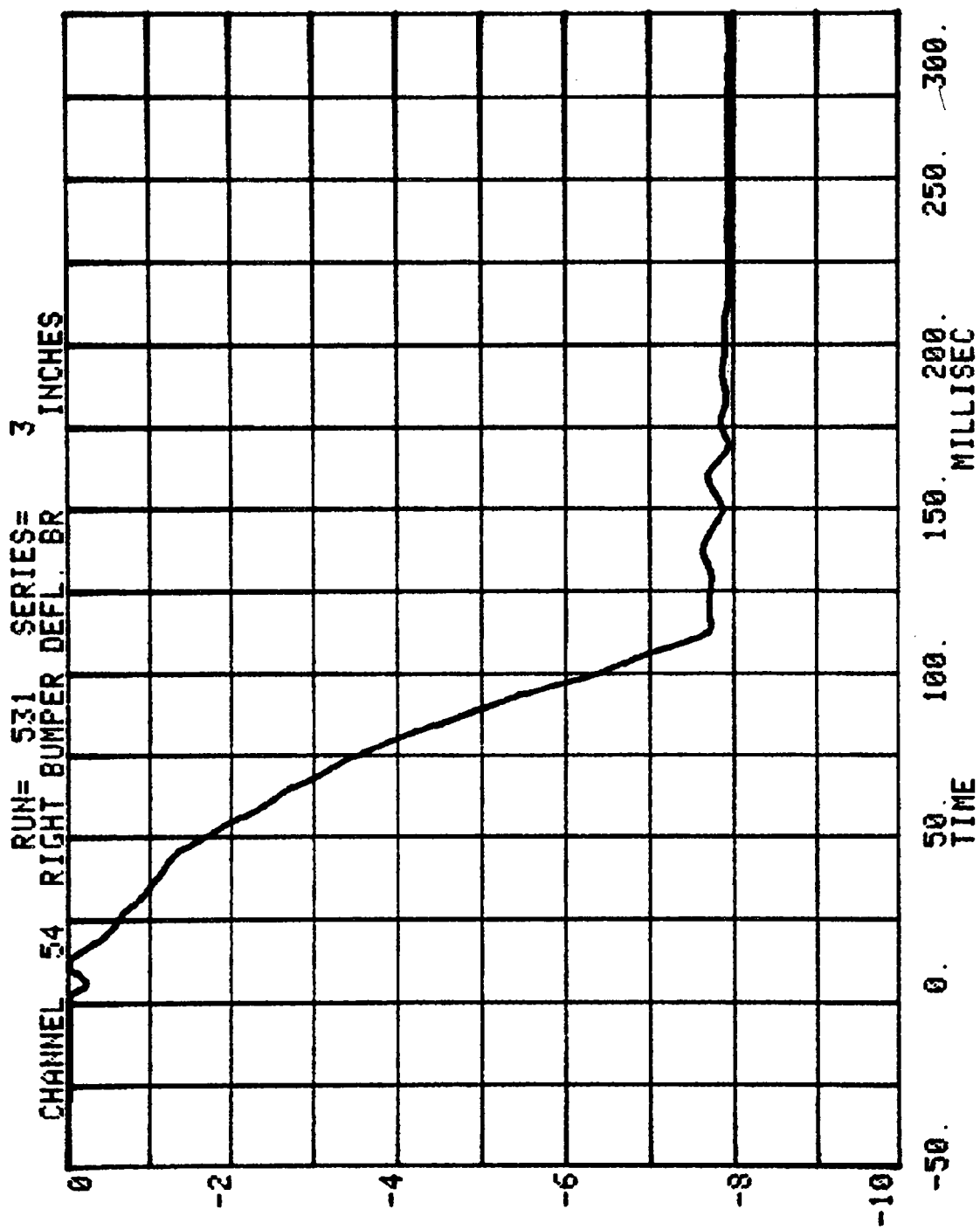


RUN= 531 SERIES= 3
CHANNEL 52 ACC PACK B3(Y) G'S



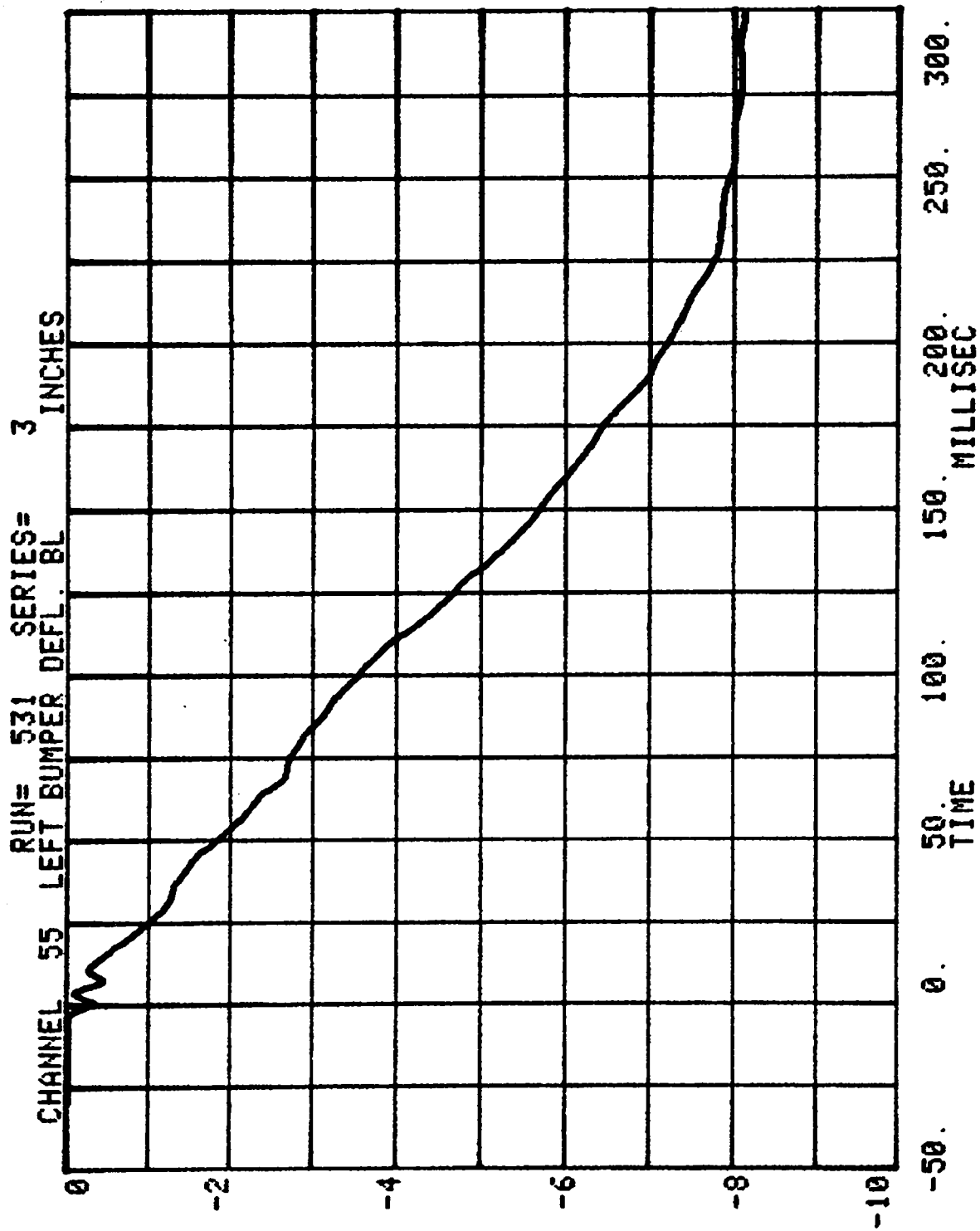
CHANNEL 53 ACC PACK B3(Z) RUN= 531 SERIES= 3 G'S



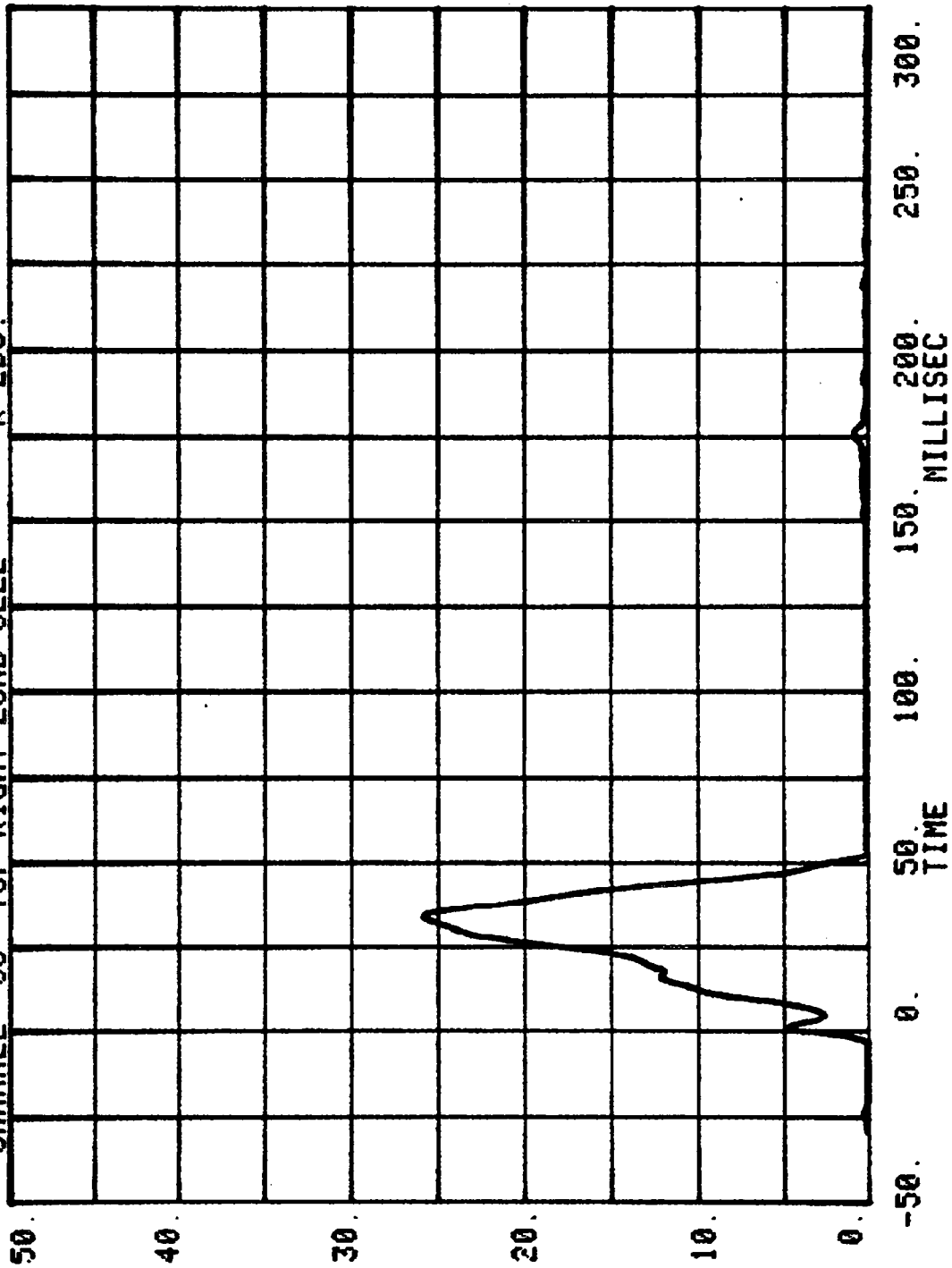


B-64

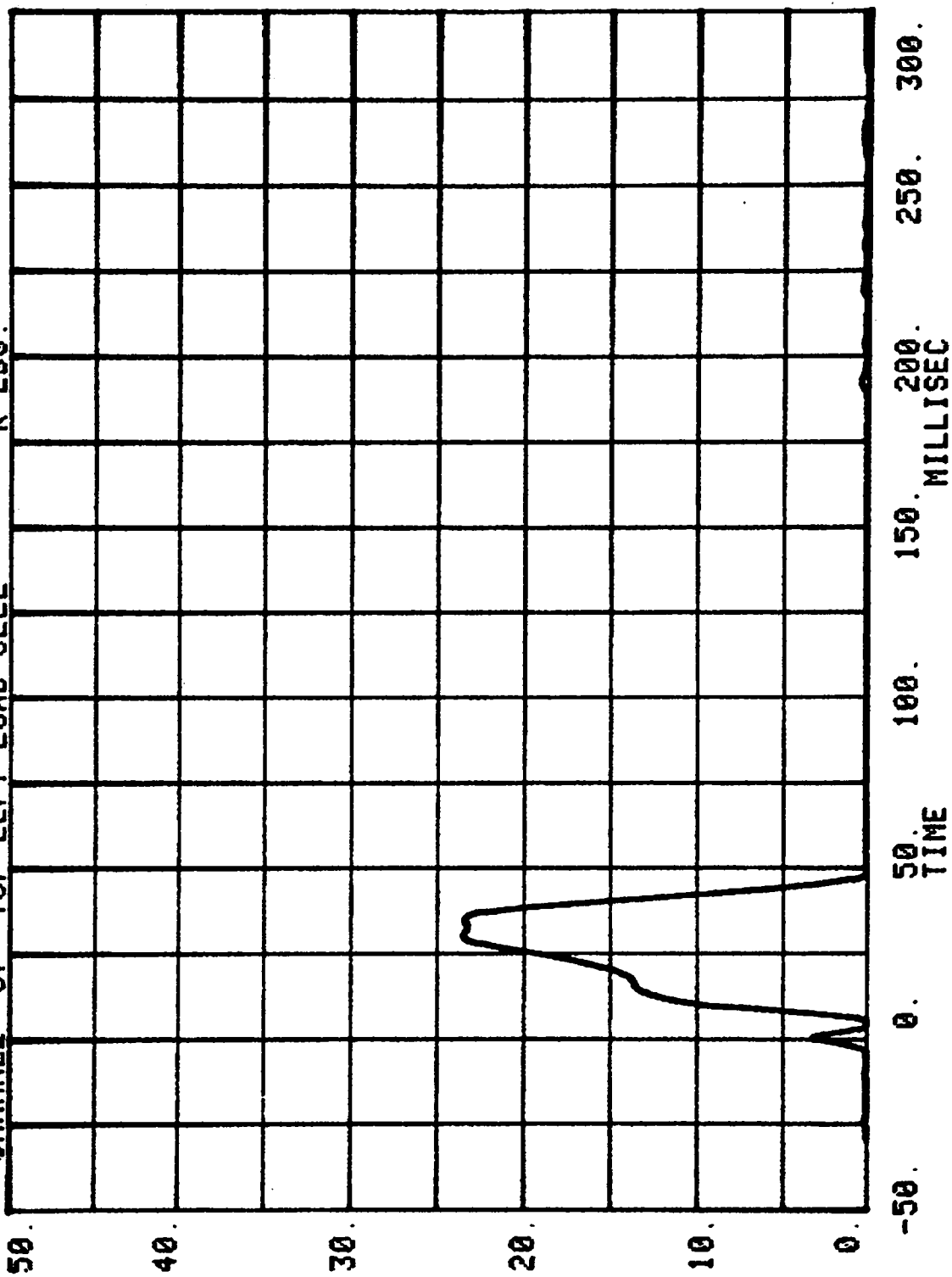
6892-V-3

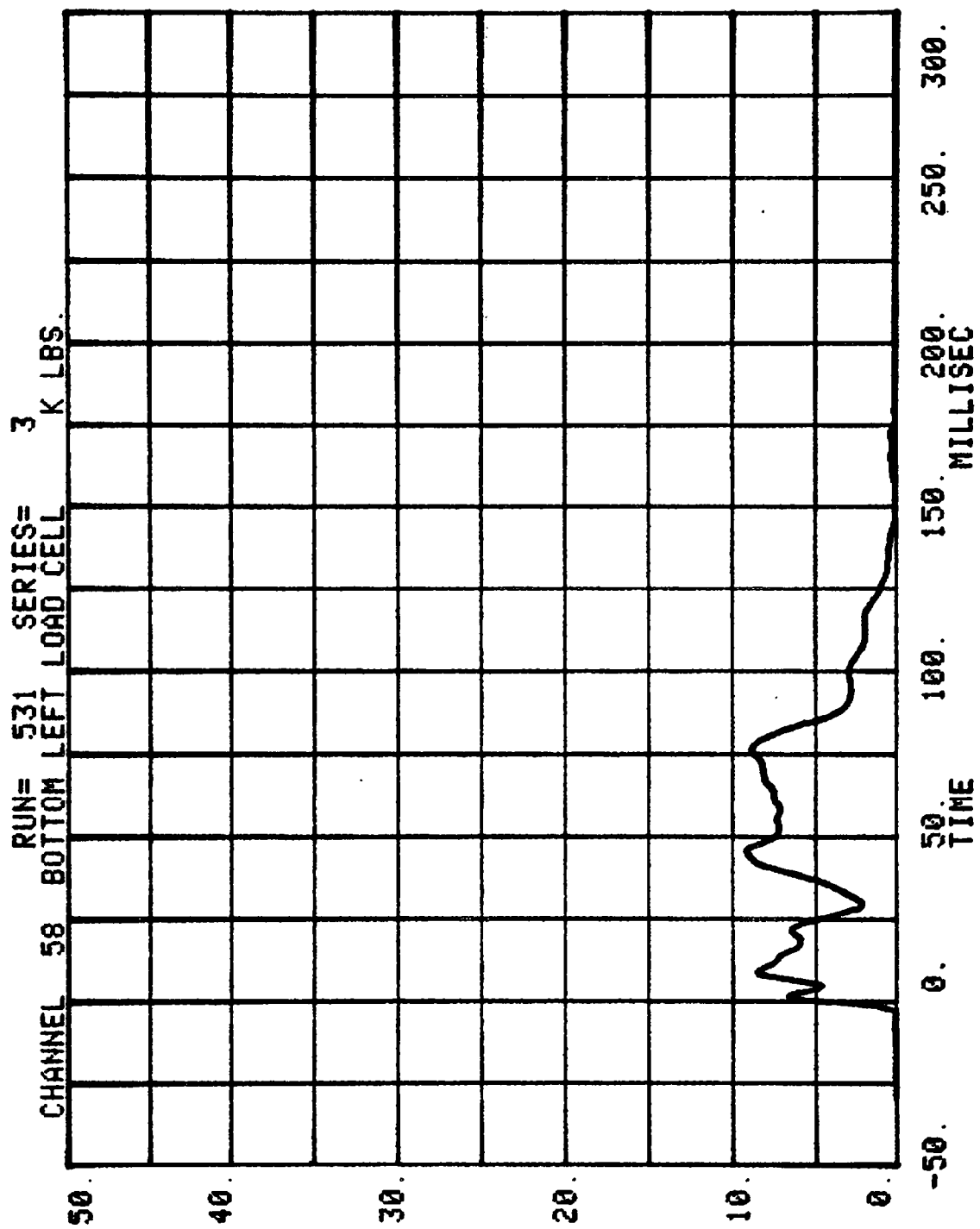


CHANNEL 56 TOP RIGHT LOAD CELL
RUN= 531 SERIES= 3 K LBS.



CHANNEL 57 TOP LEFT LOAD CELL RUN= 531 SERIES= 3 K LBS.

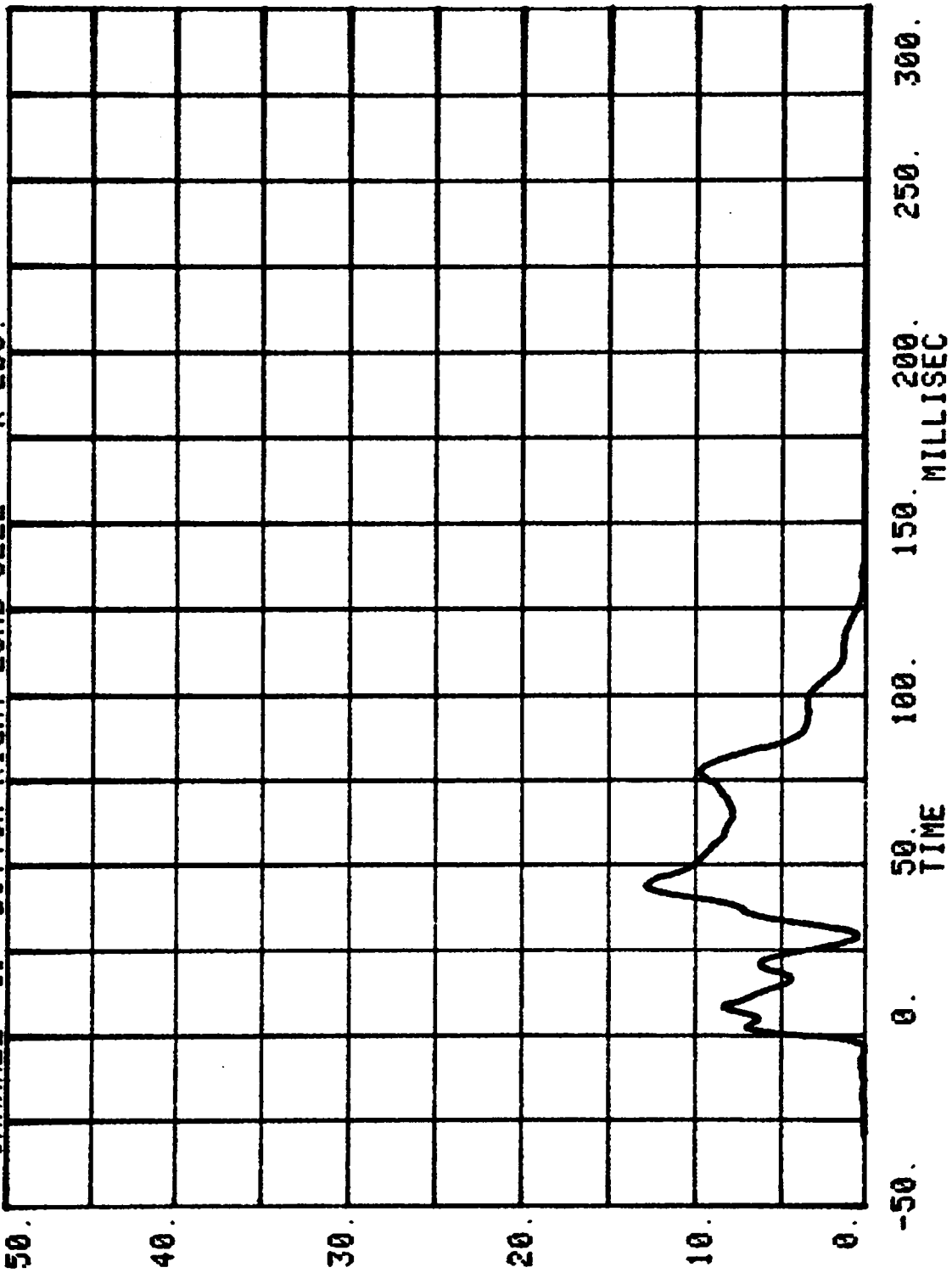


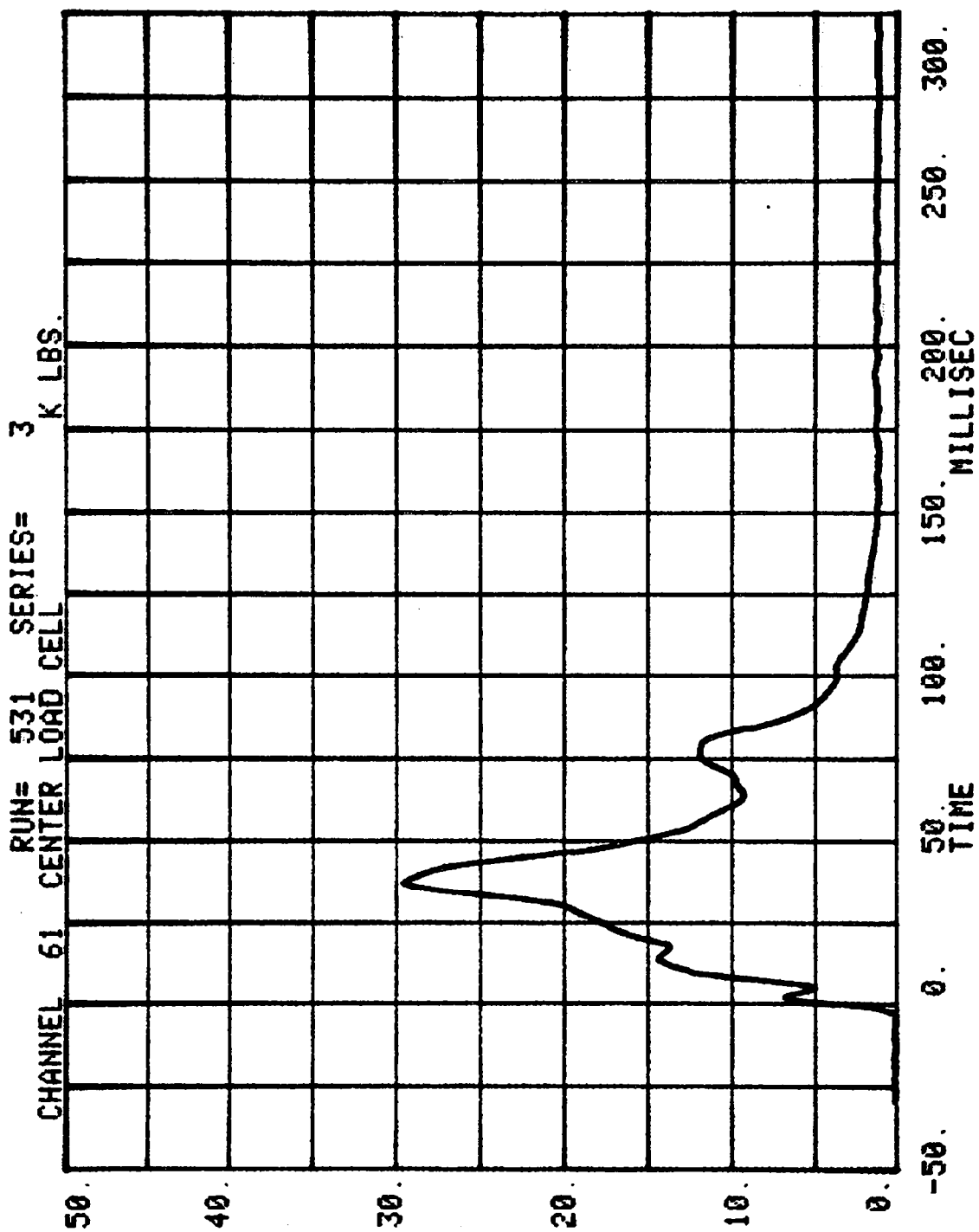


B-68

6892-V-3

CHANNEL 59 BOTTOM RIGHT LOAD CELL 3 K LBS.

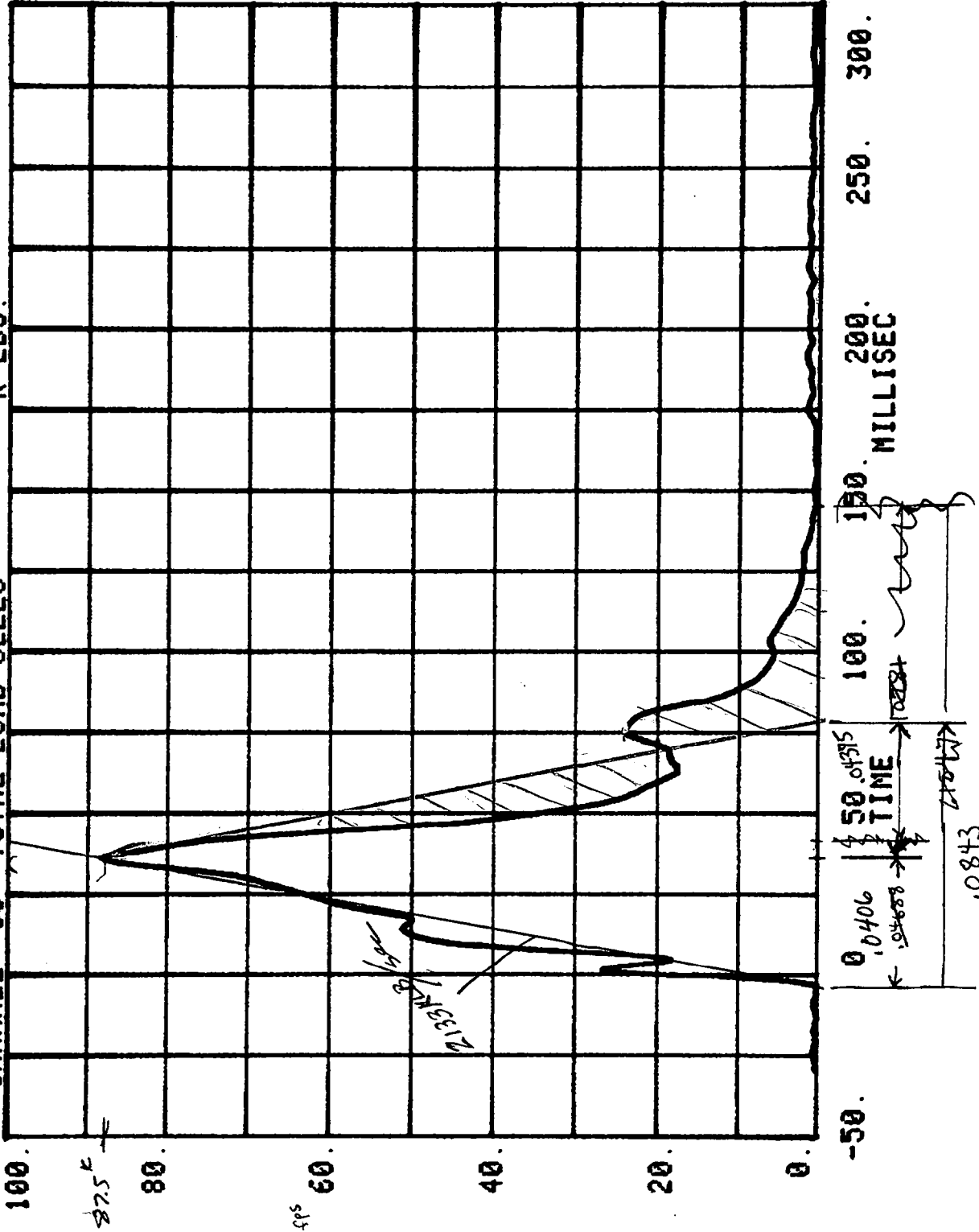




B-70

6892-V-3

CHANNEL 60 TOTAL LOAD CELLS RUN= 531 SERIES= 3 K LBS.



$$N = \frac{92.5 \text{ f/s}}{2} = 46.24 \text{ f/s}$$

$$= 31.5 \text{ MPH}$$

B-71

TEST NO. 752-3-531

1981 VOLKSWAGEN RABBIT

DUMMY DATA

	FILTER CHANNEL CLASS
HEAD ACCELERATIONS	1000
CHEST ACCELERATIONS	180
FEMUR FORCES	600
BELT LOADS	60

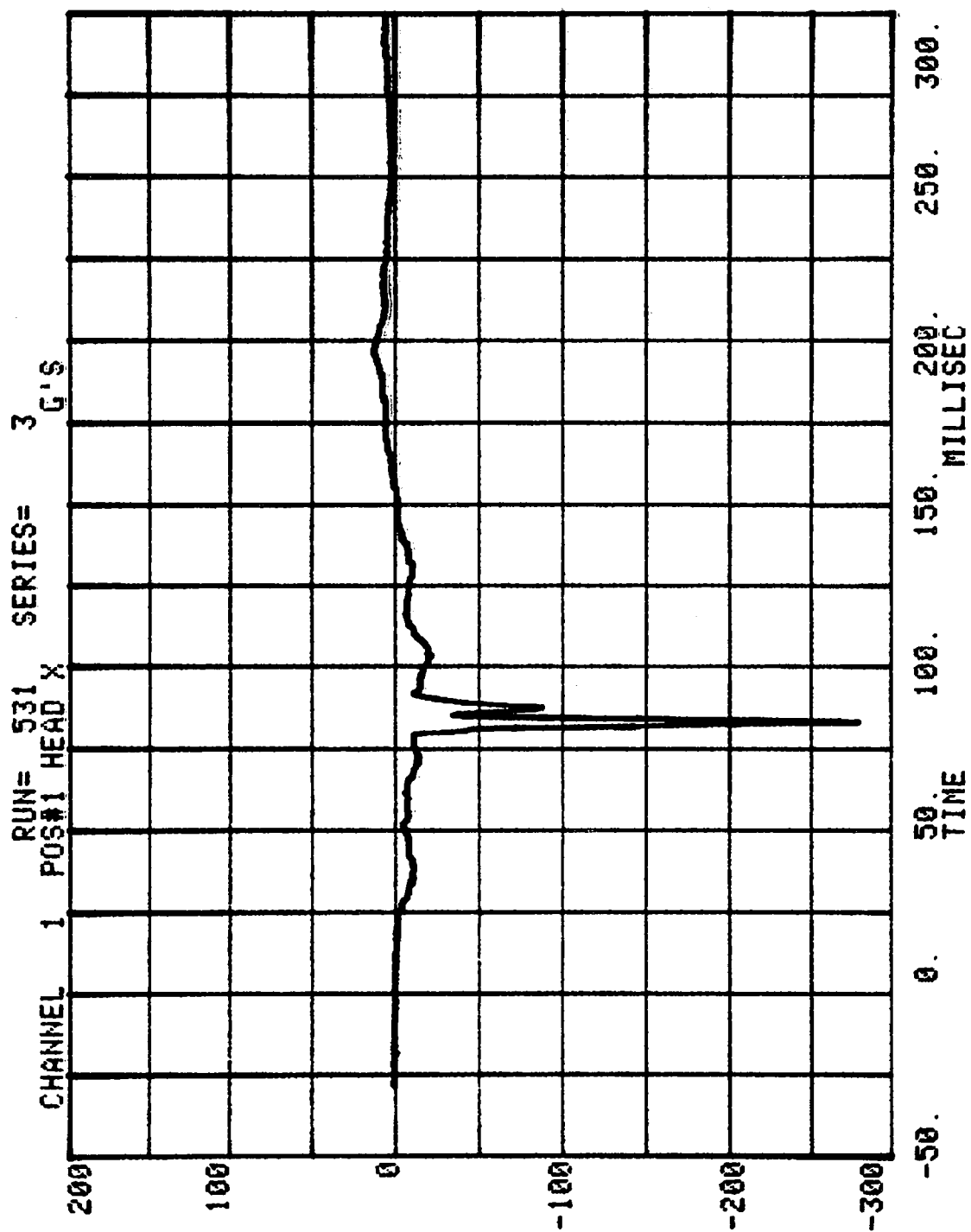
HEAD INJURY CRITERION
HEAD SEVERITY INDEX

DEFORMABLE BARRIER

RUN= 531

POS#1 HEAD RESULTANT

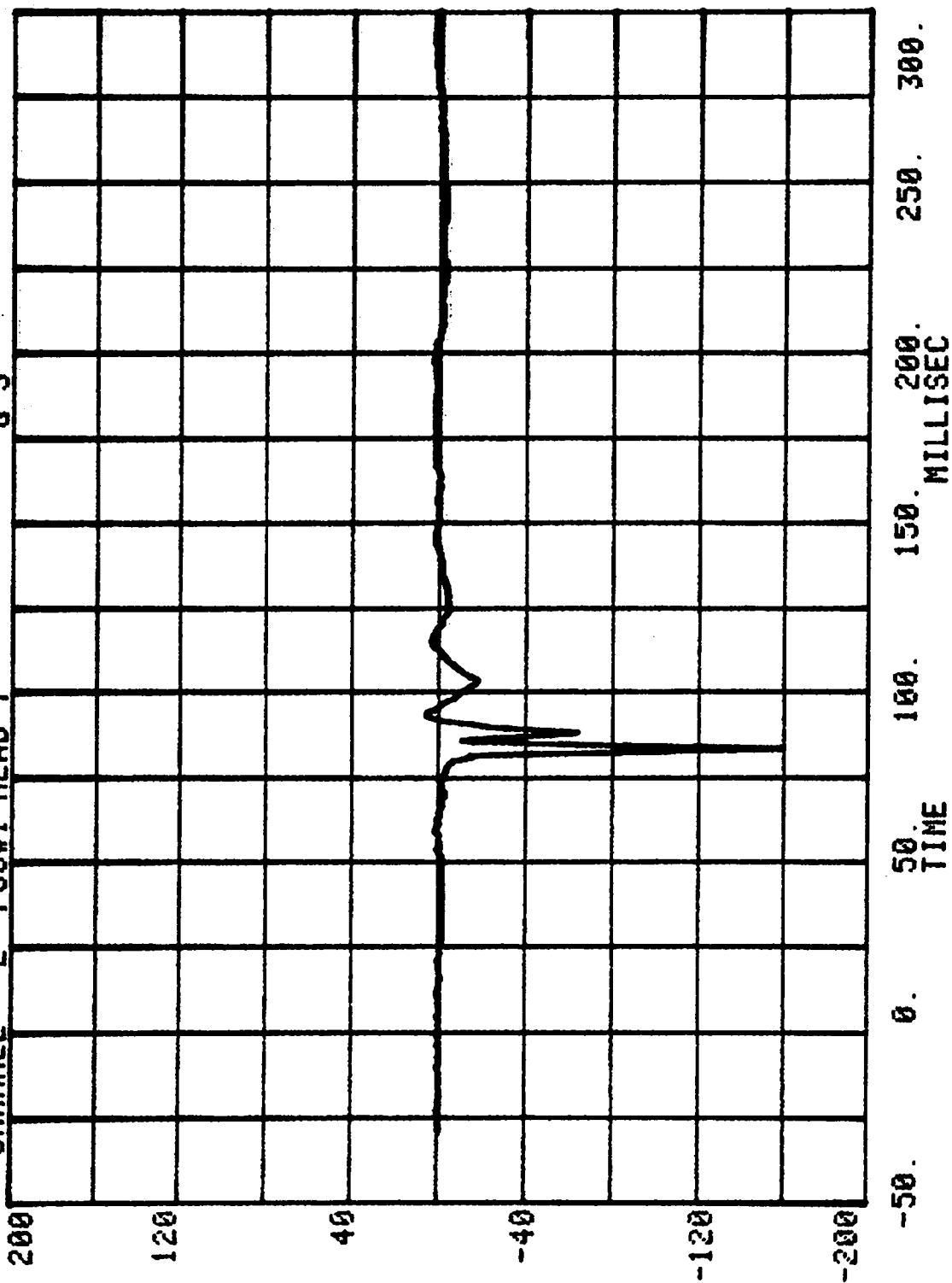
HIC=2246.0 FROM T1= .08130 TO T2= .08400
AVERAGE ACCELERATION BETWEEN T1 AND T2= 233.4G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX=3413.7

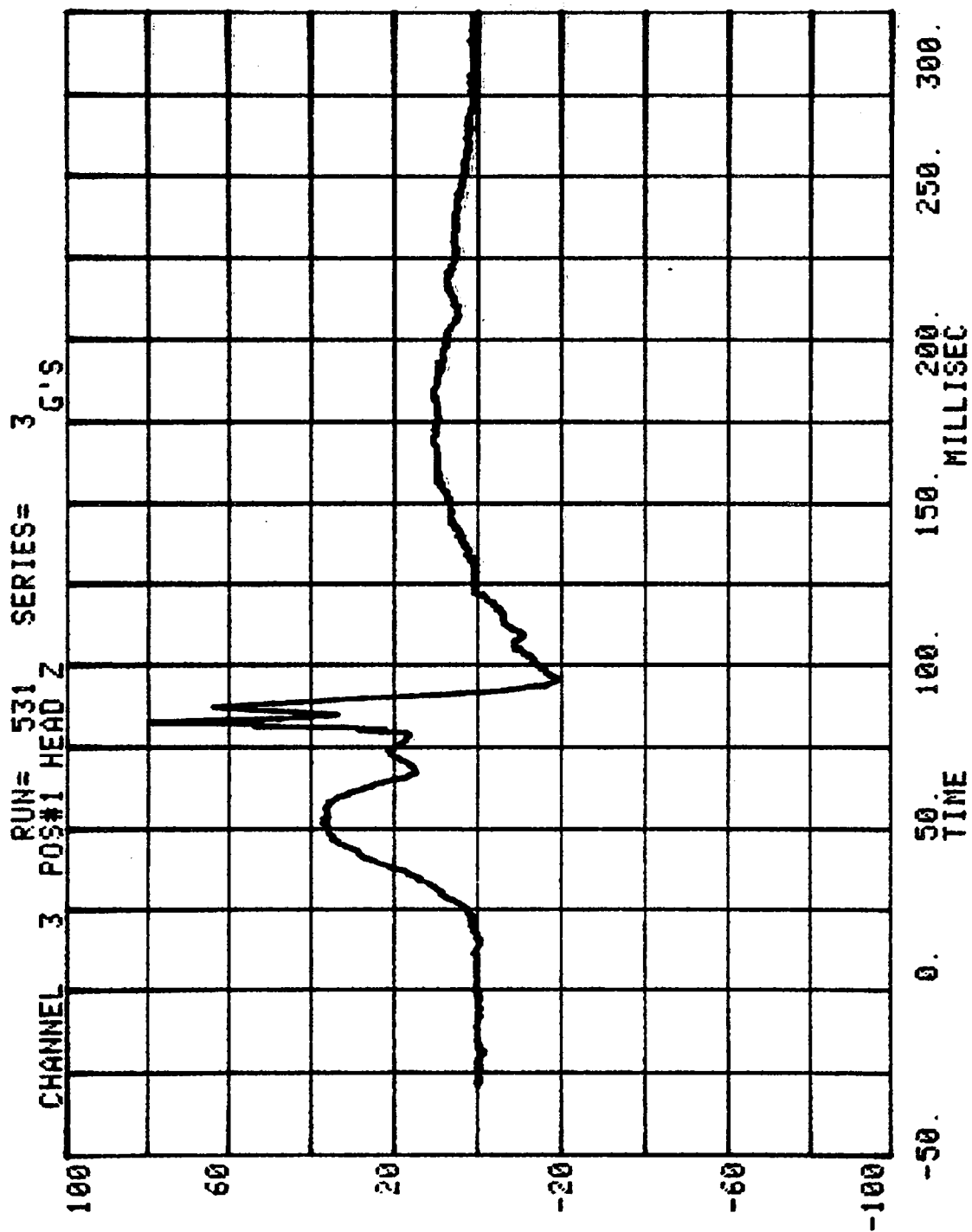


B-74

6892-V-3

CHANNEL 2 POS#1 HEAD Y RUN= 531 SERIES= 3 G'S

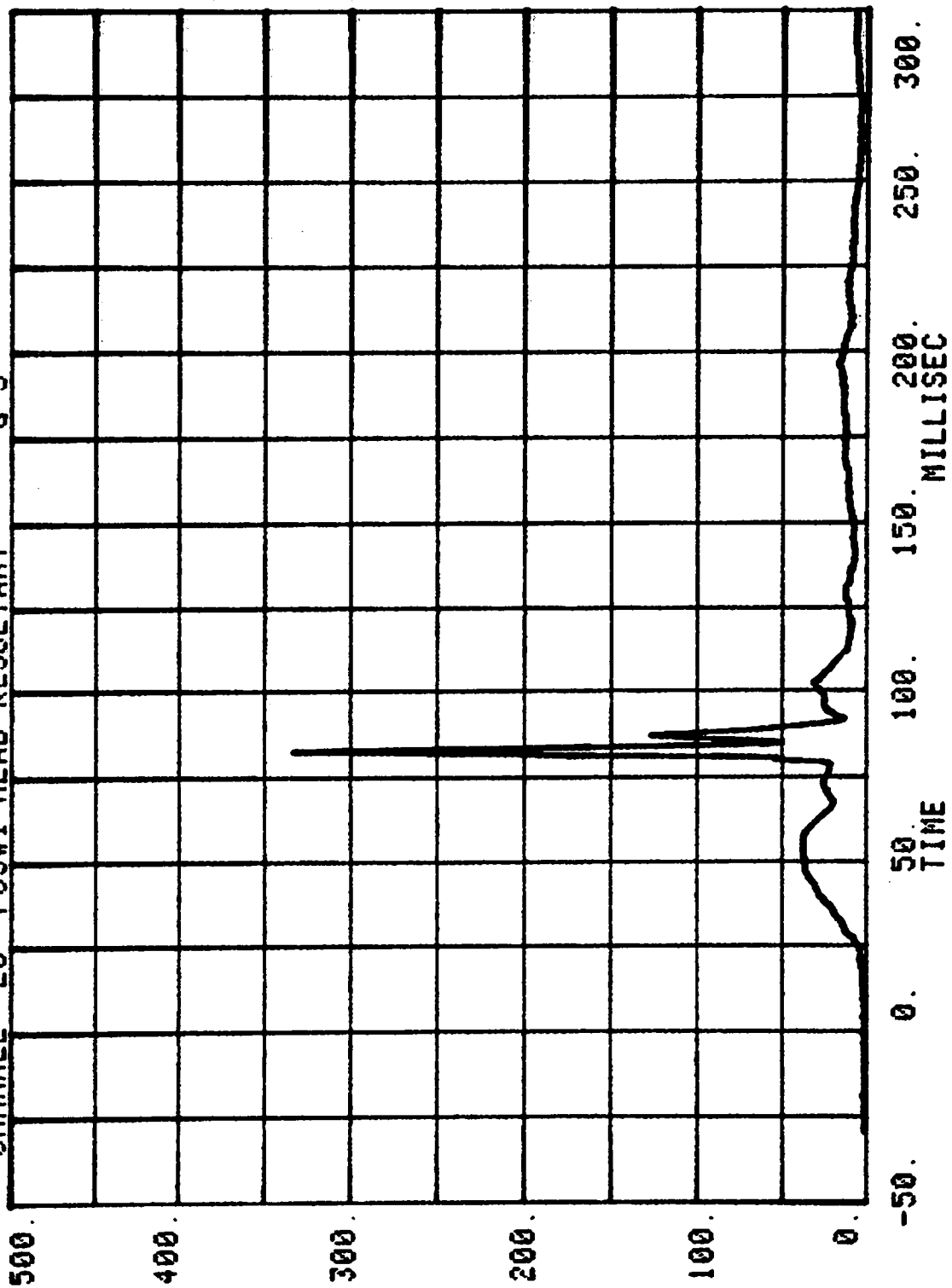


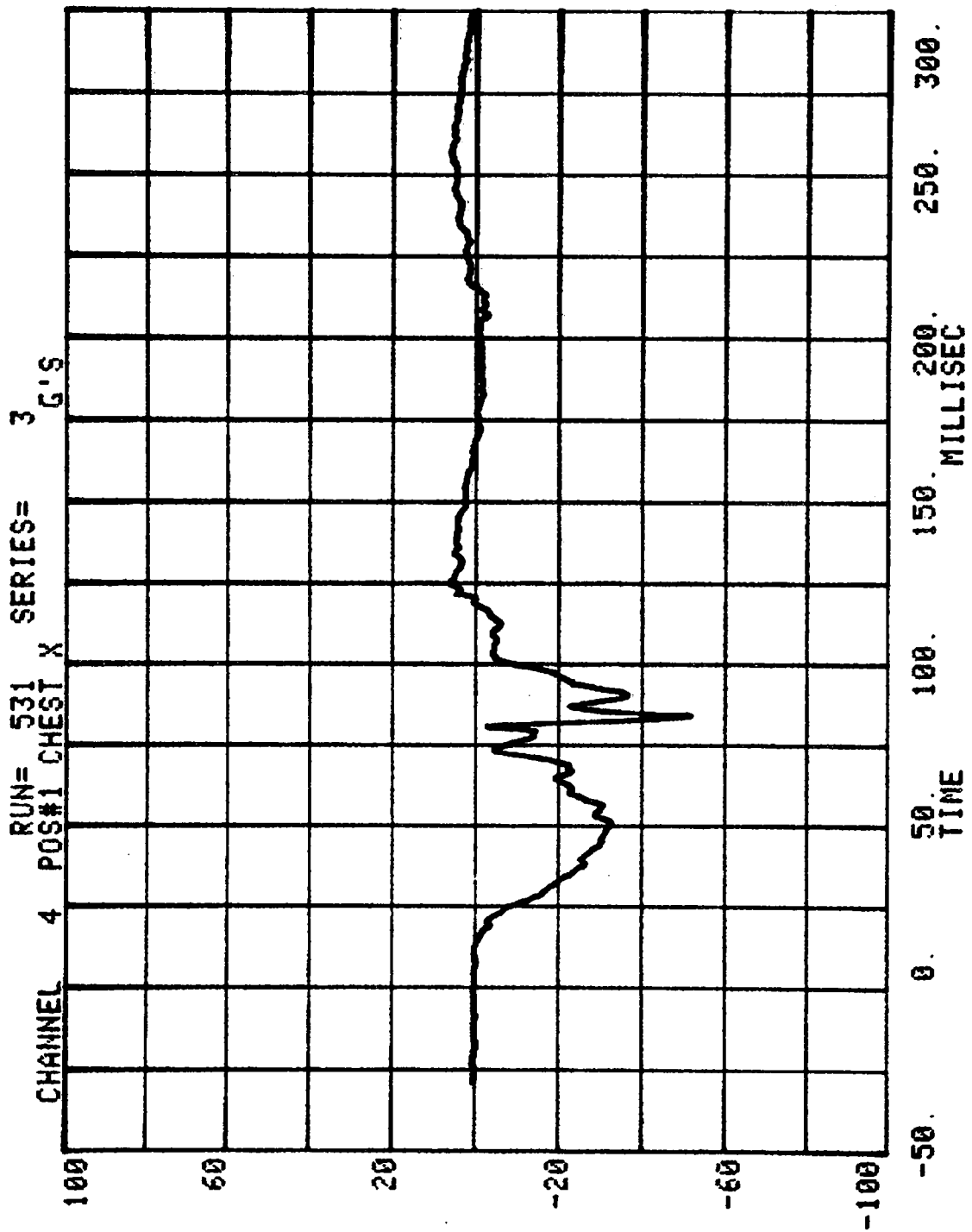


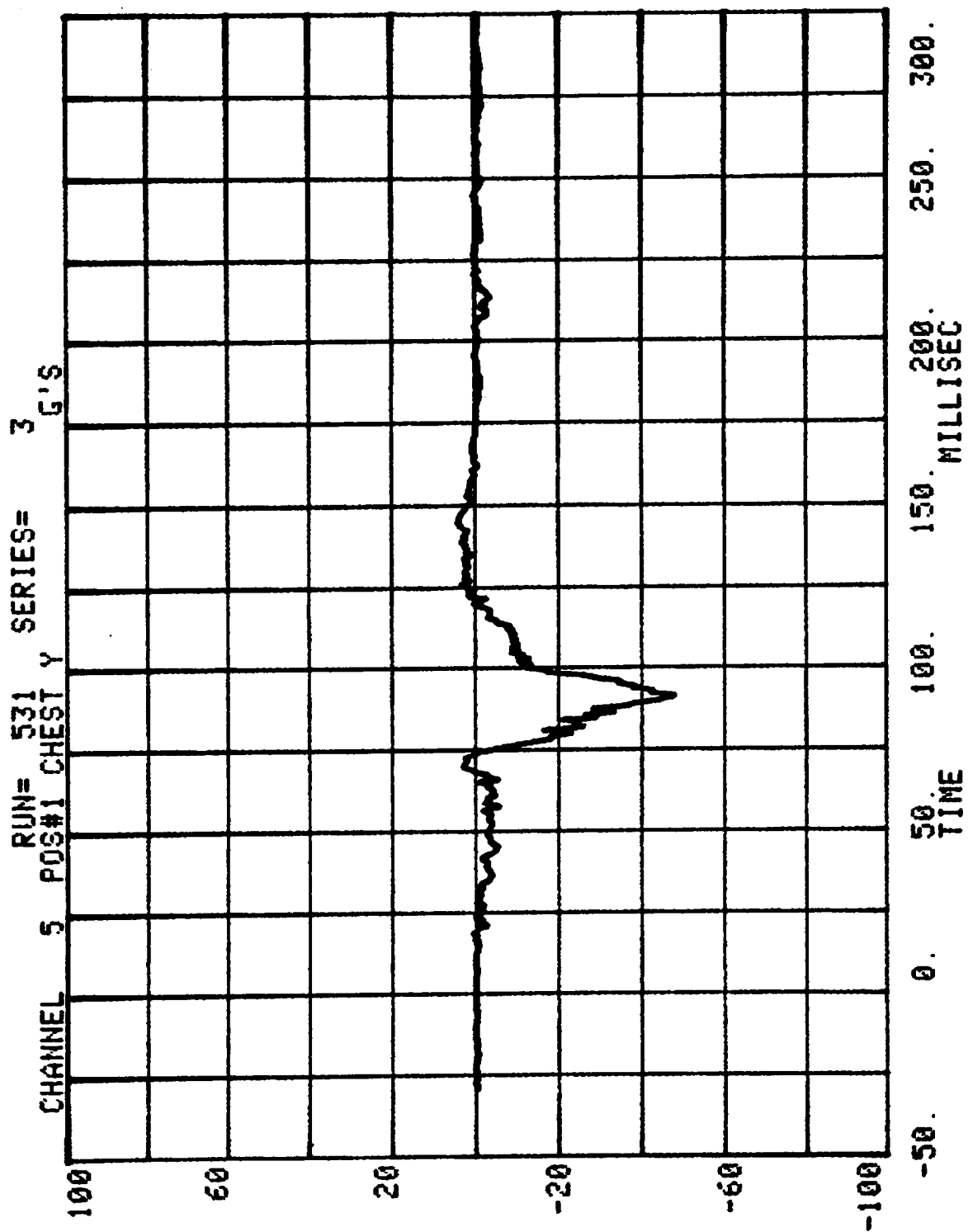
B-76

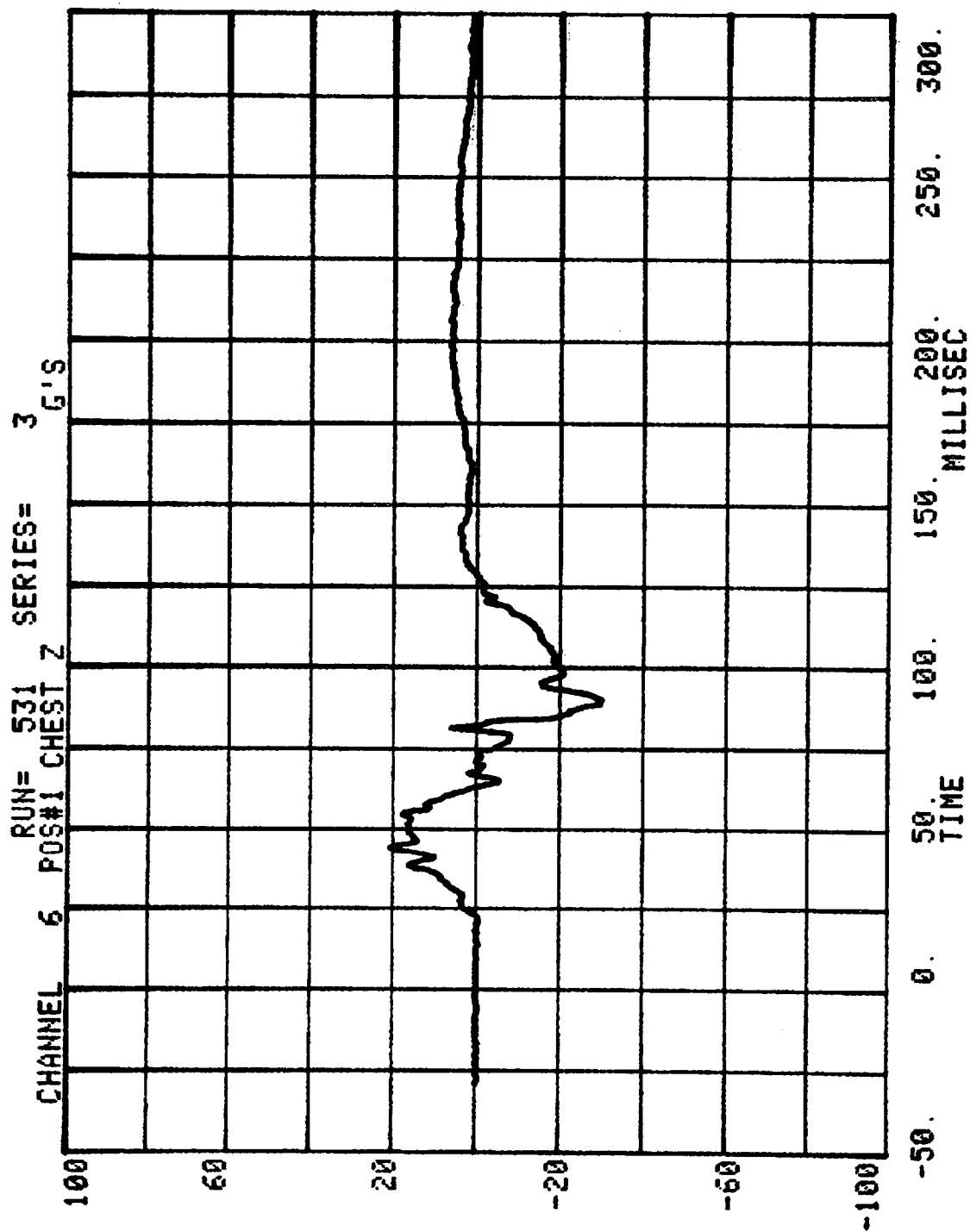
6892-V-3

RUN= 531 SERIES= 3
CHANNEL 20 POS#1 HEAD RESULTANT G'S





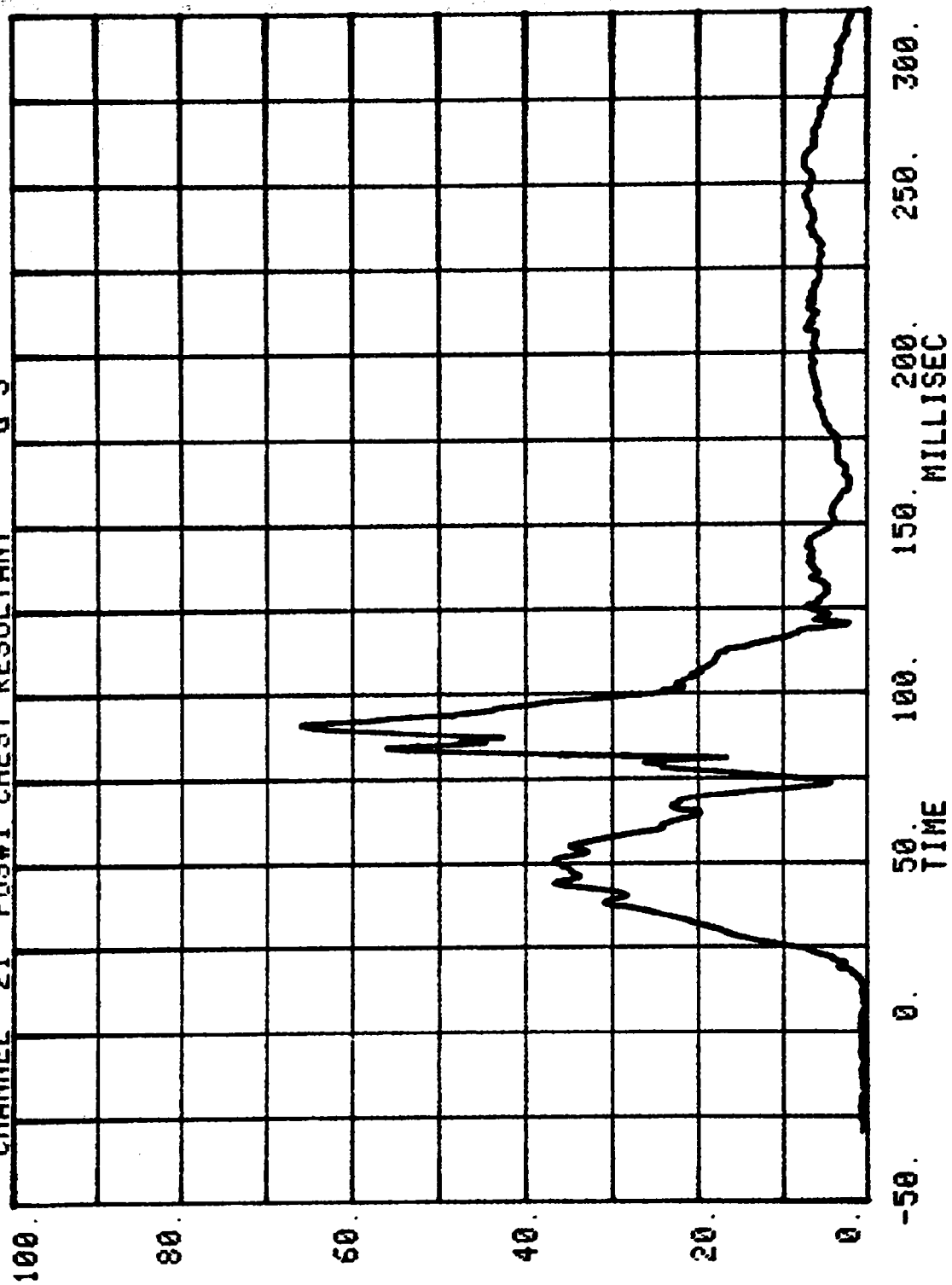


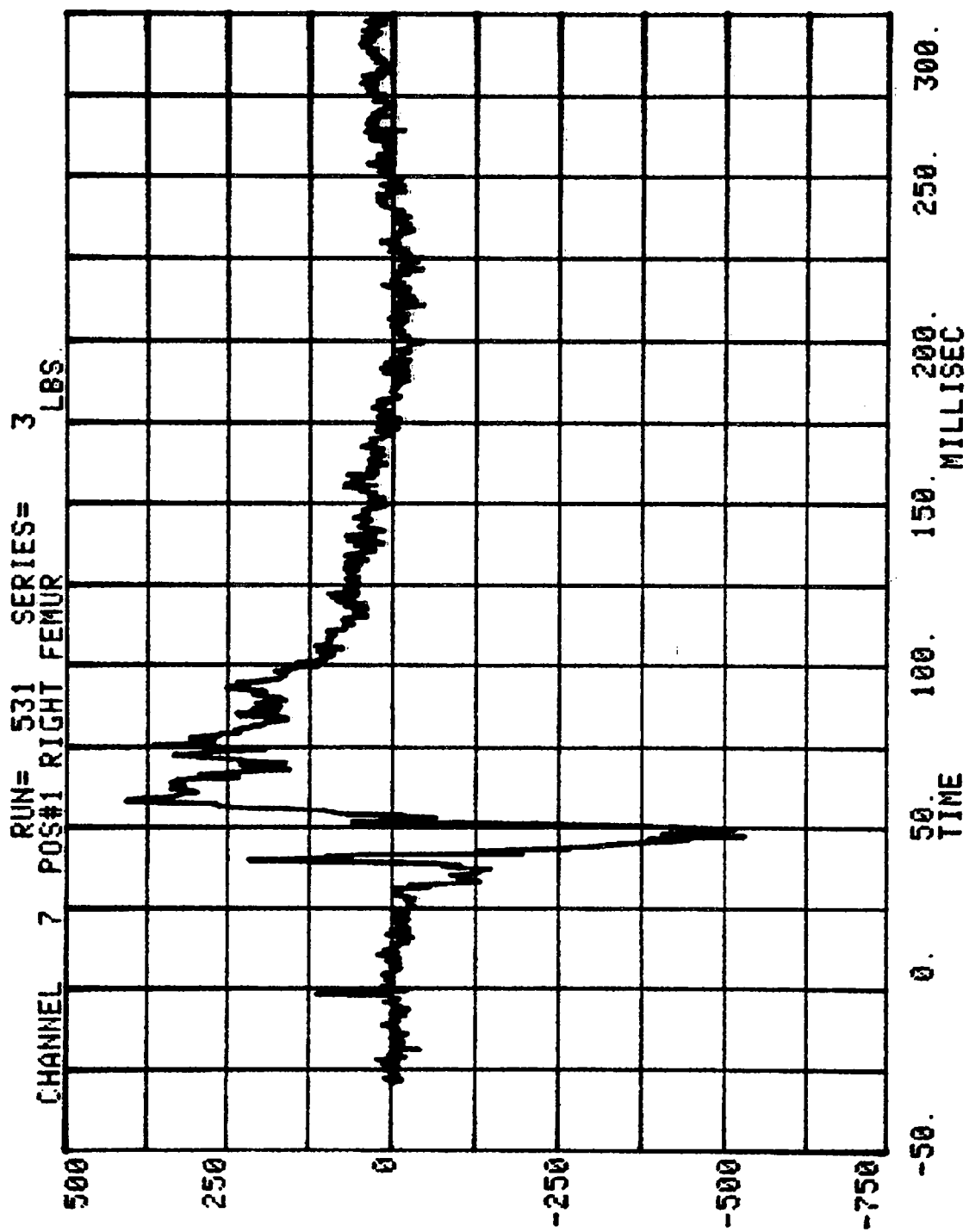


B-80

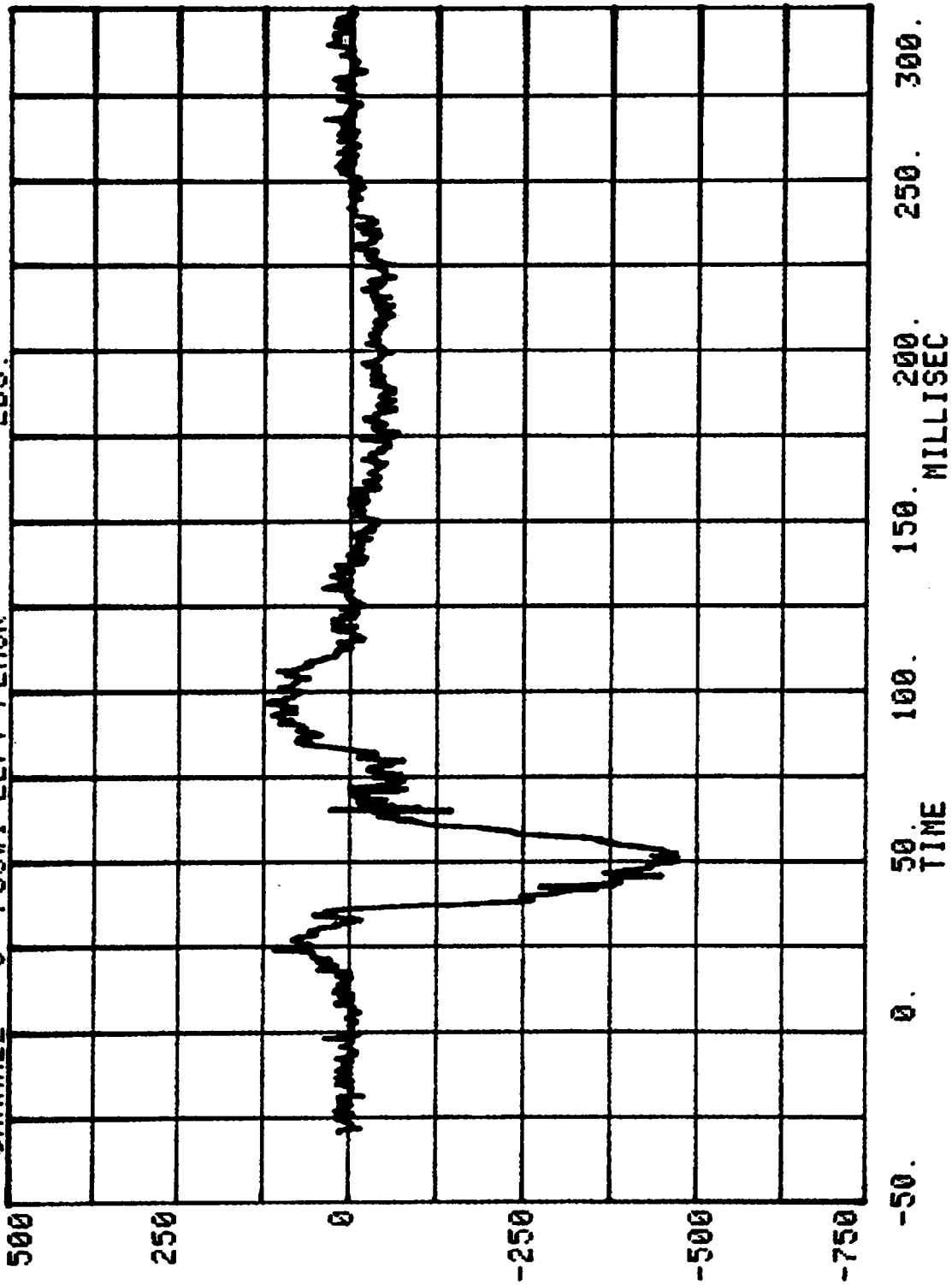
6892-V-3

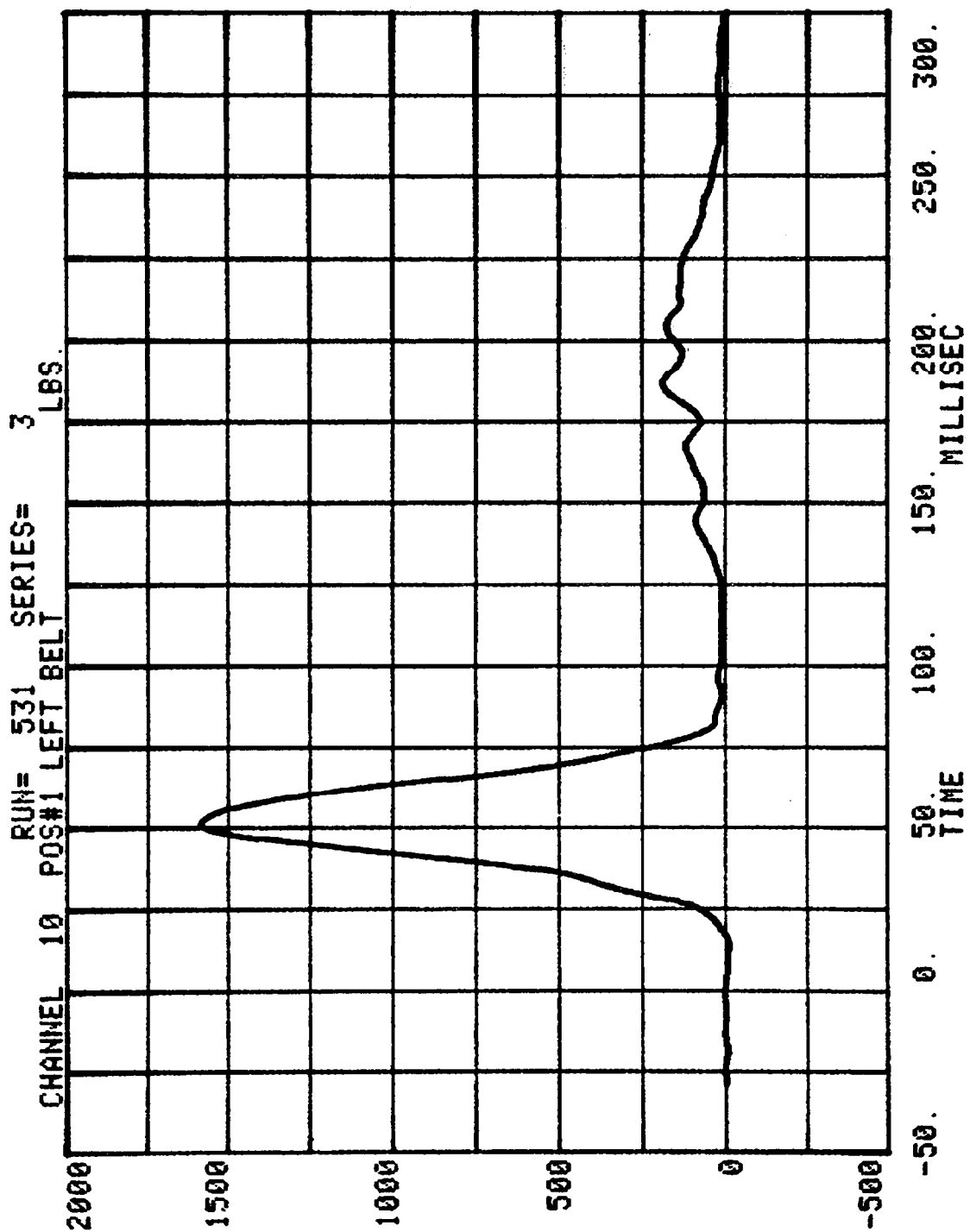
CHANNEL 21 POS#1 CHEST RESULTANT 3 G'S





CHANNEL 8 POS#1 LEFT FEMUR RUN= 531 SERIES= 3 LBS.

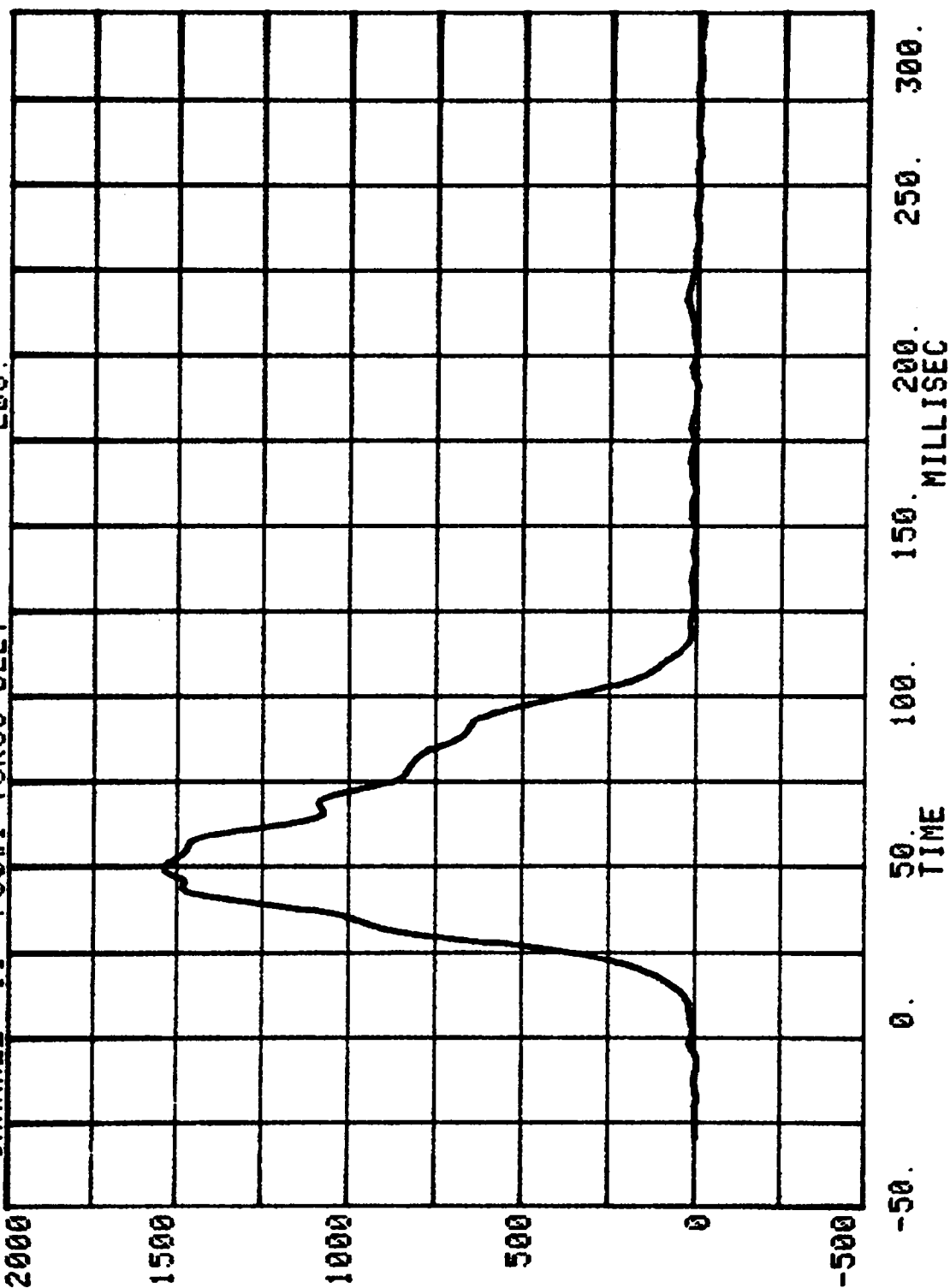




B-84

6892-V-3

CHANNEL 11 POS#1 TORSO BELT
RUN= 531 SERIES= 3 LBS.



HEAD INJURY CRITERION
HEAD SEVERITY INDEX

DEFORMABLE BARRIER

RUN= 531

POS#2 HEAD RESULTANT

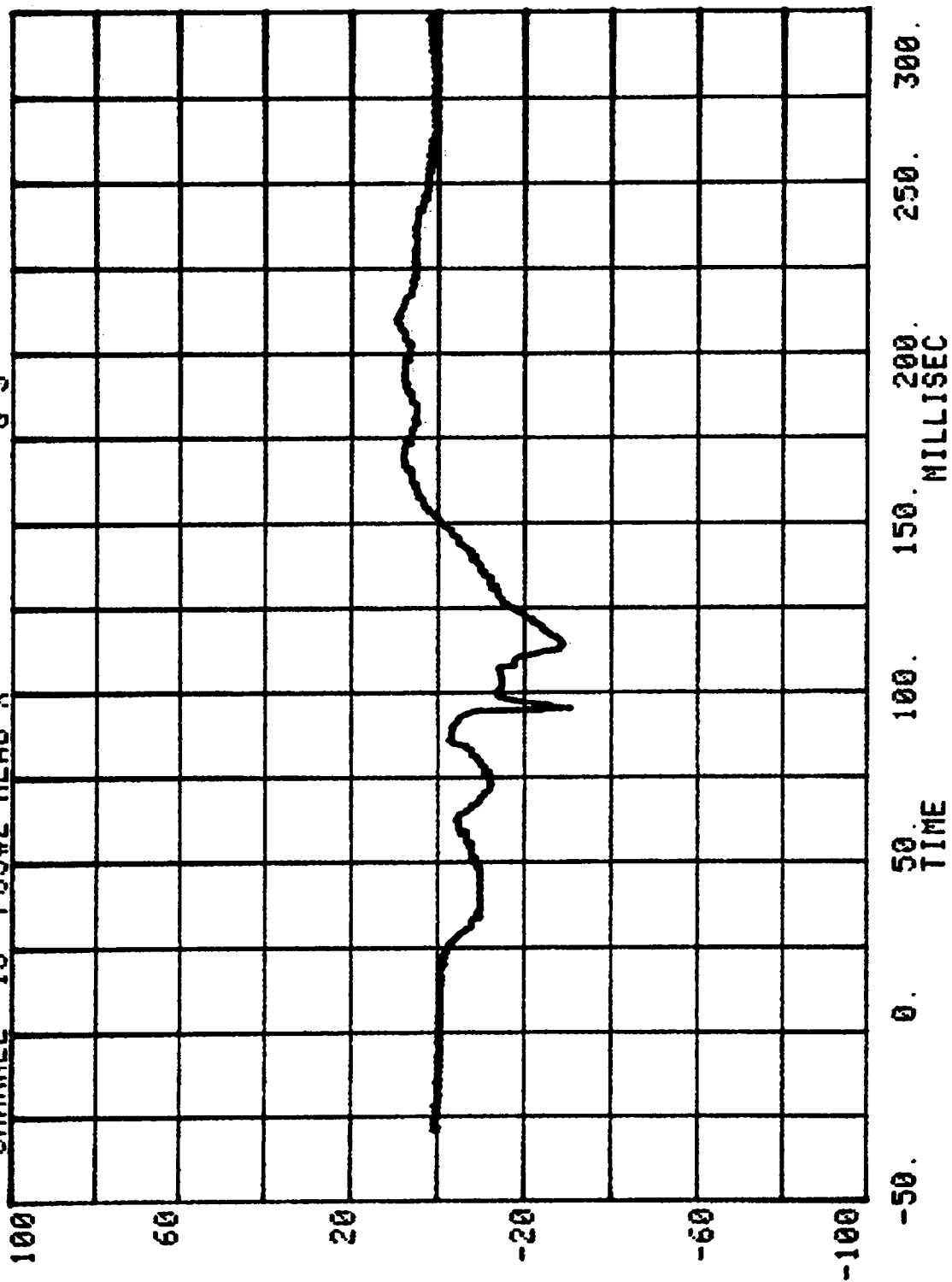
HIC= 707.5 FROM T1= .03720 TO T2= .17520

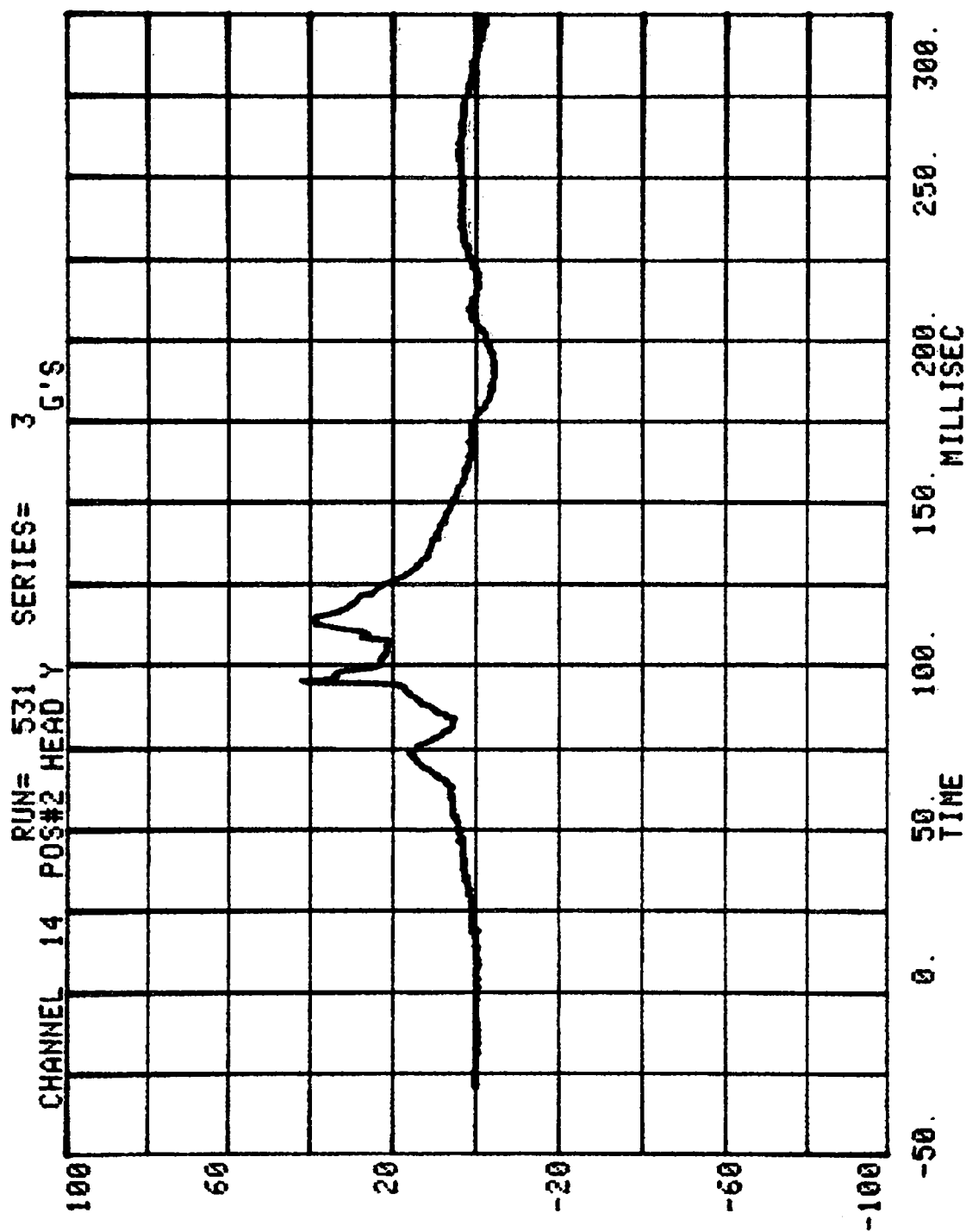
AVERAGE ACCELERATION BETWEEN T1 AND T2= 30.5G'S

EVENT TIME= 300.0 MSEC

SEVERITY INDEX= 963.3

CHANNEL 13 POS#2 HEAD X
RUN= 531 SERIES= 3 G'S

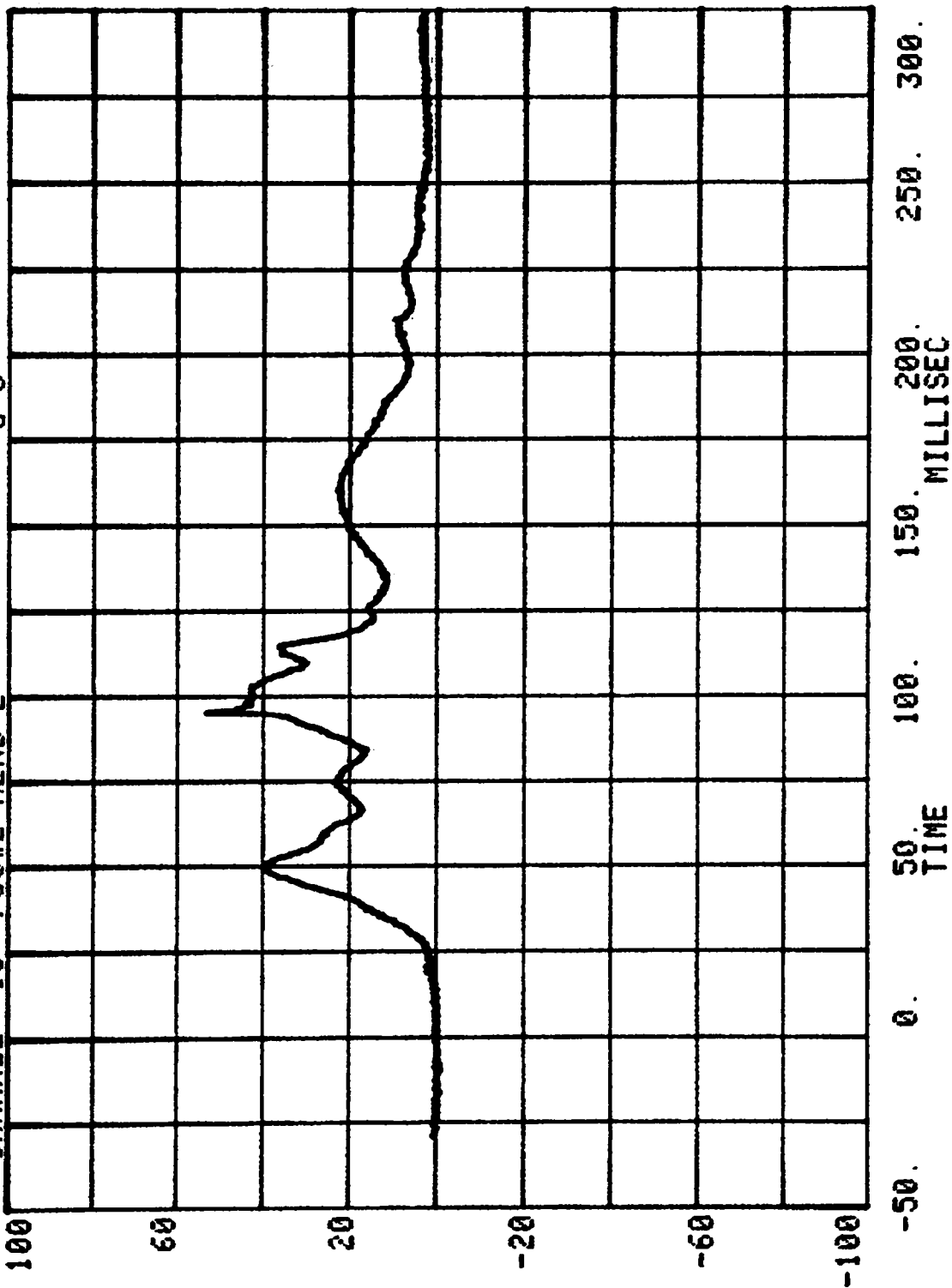


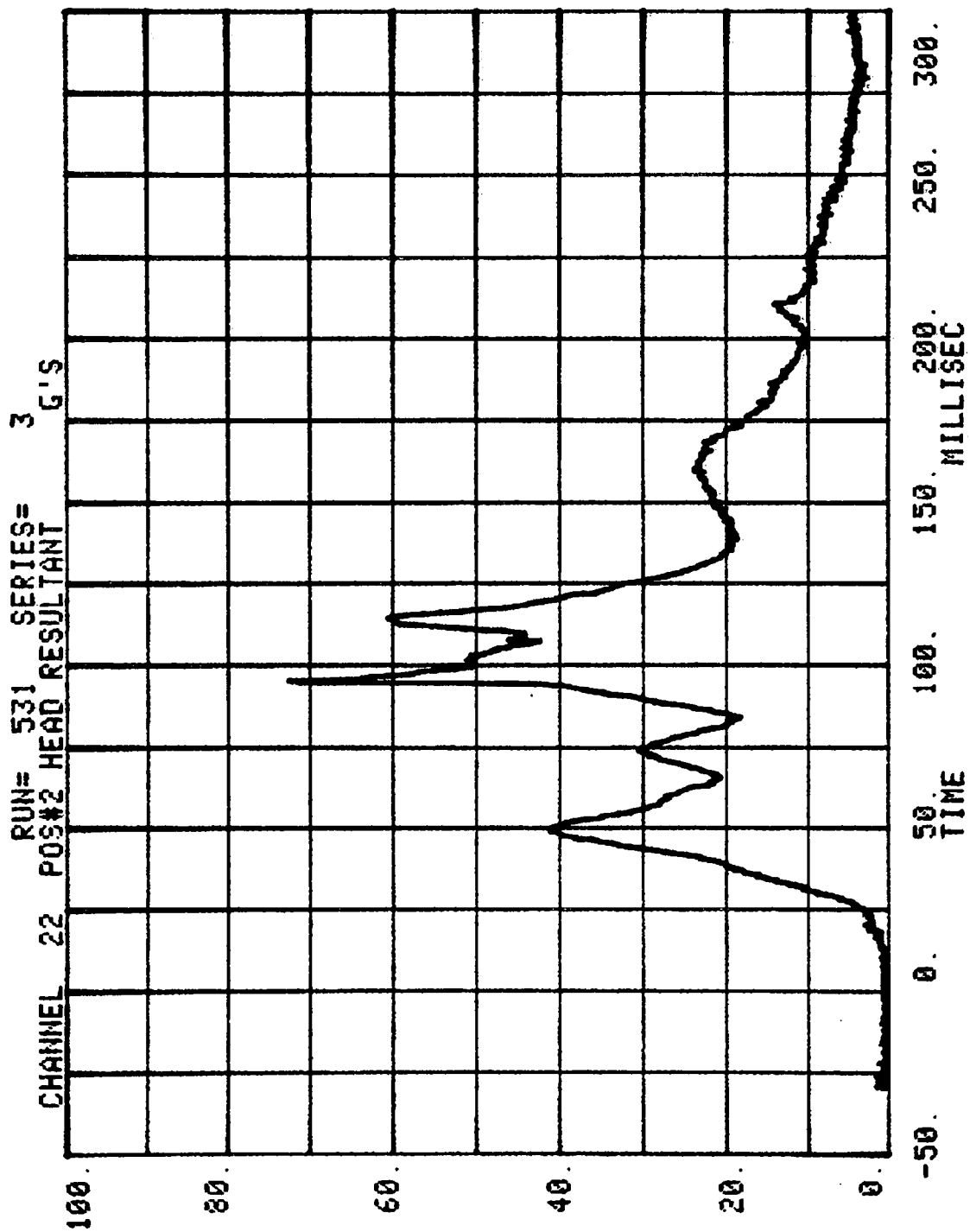


B-88

6892-V-3

CHANNEL 15 POS#2 HEAD Z RUN= 531 SERIES= 3 G'S

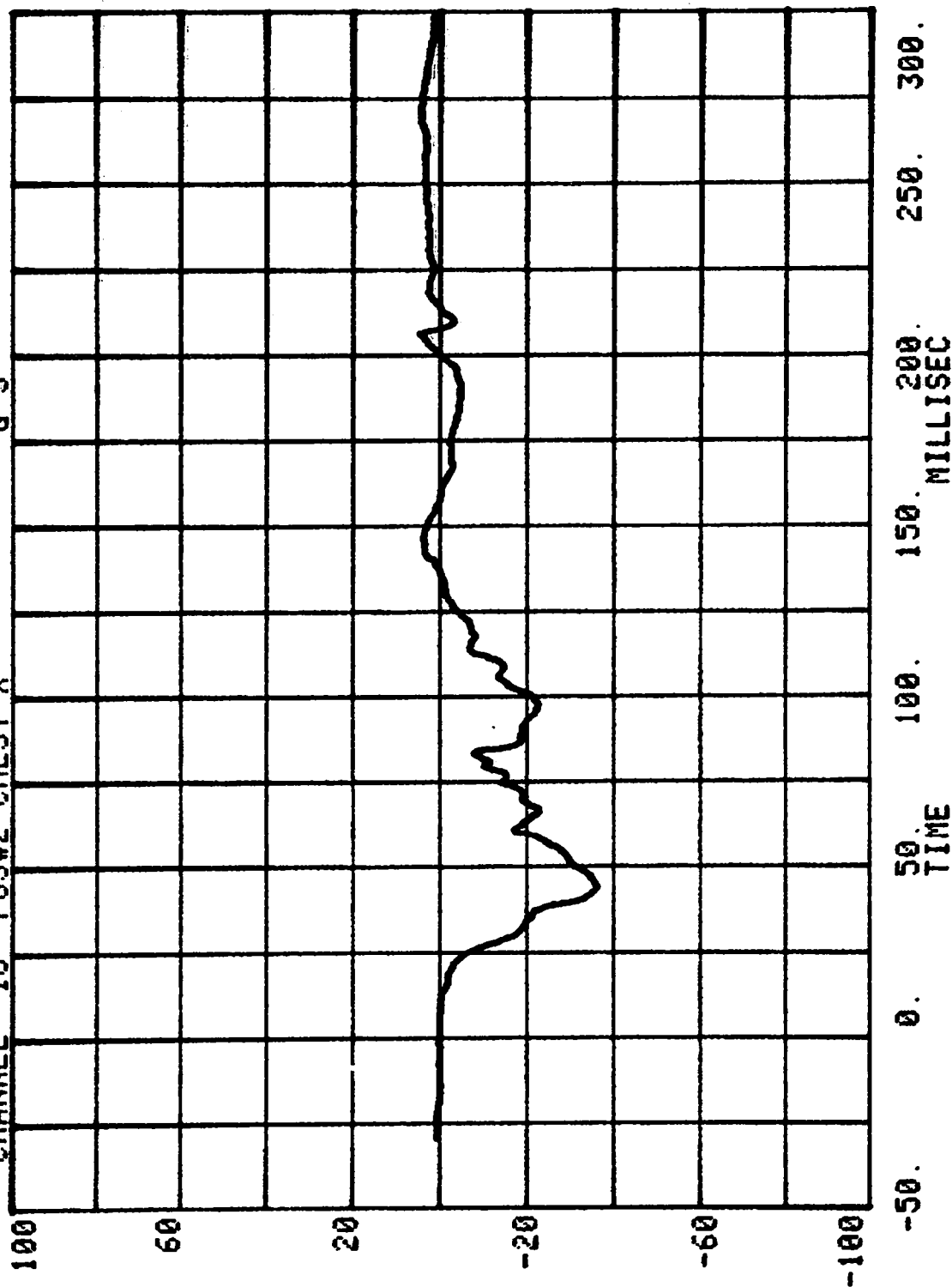




B-90

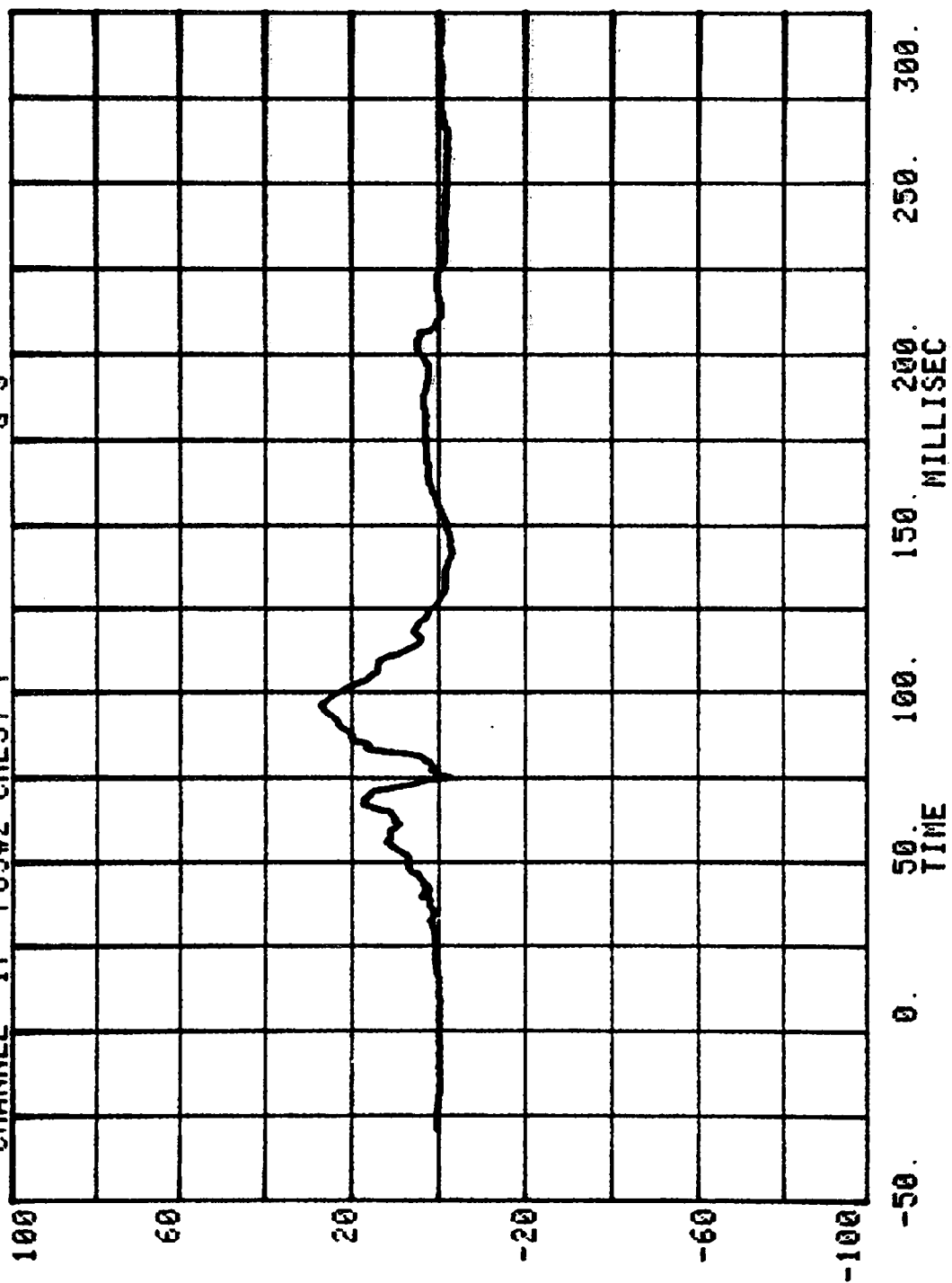
6892-V-3

CHANNEL 16 POS#2 CHEST X
RUN= 531 SERIES= 3 G'S



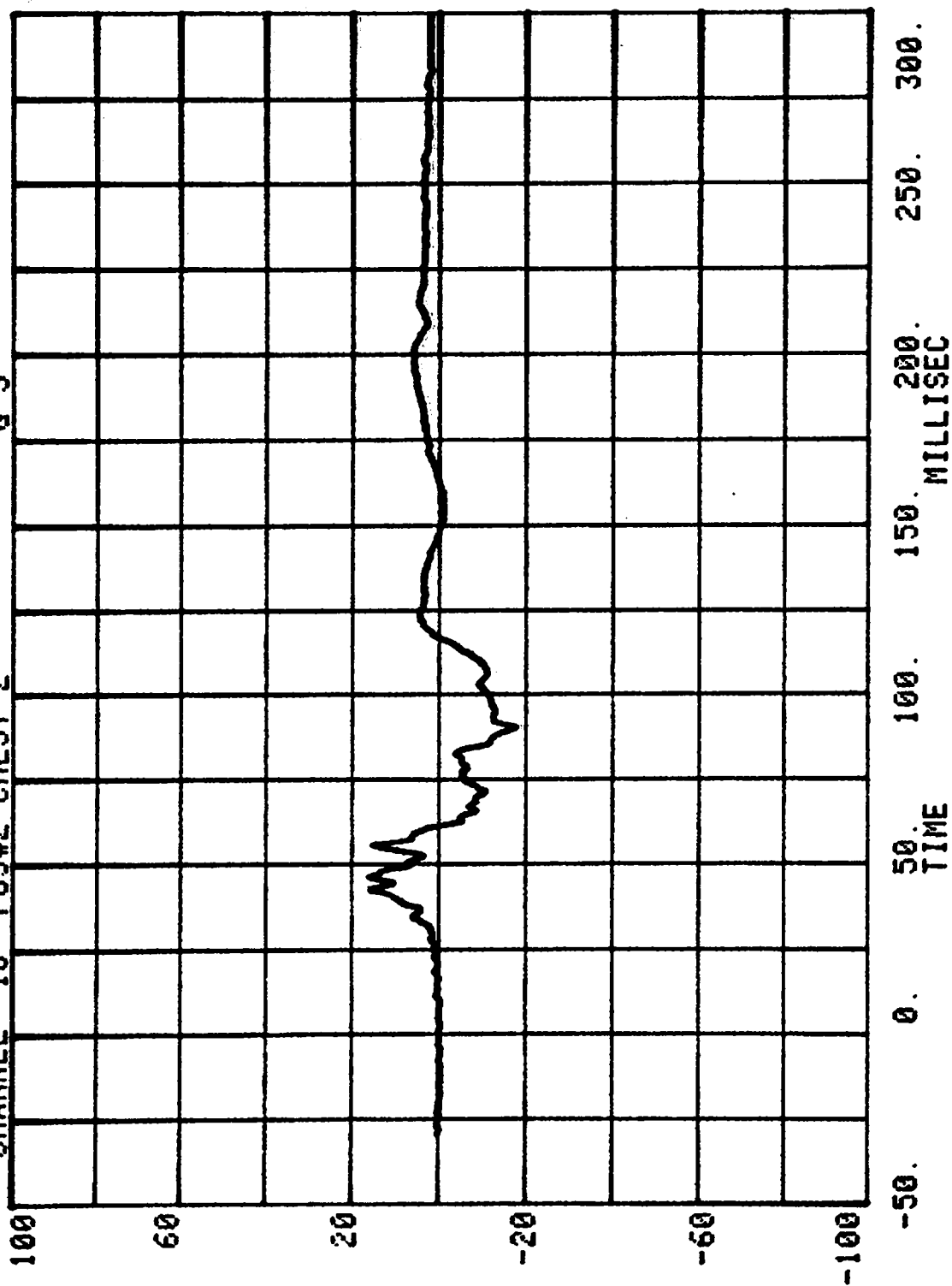
CHANNEL 17 POS#2 CHEST Y 3 G'S

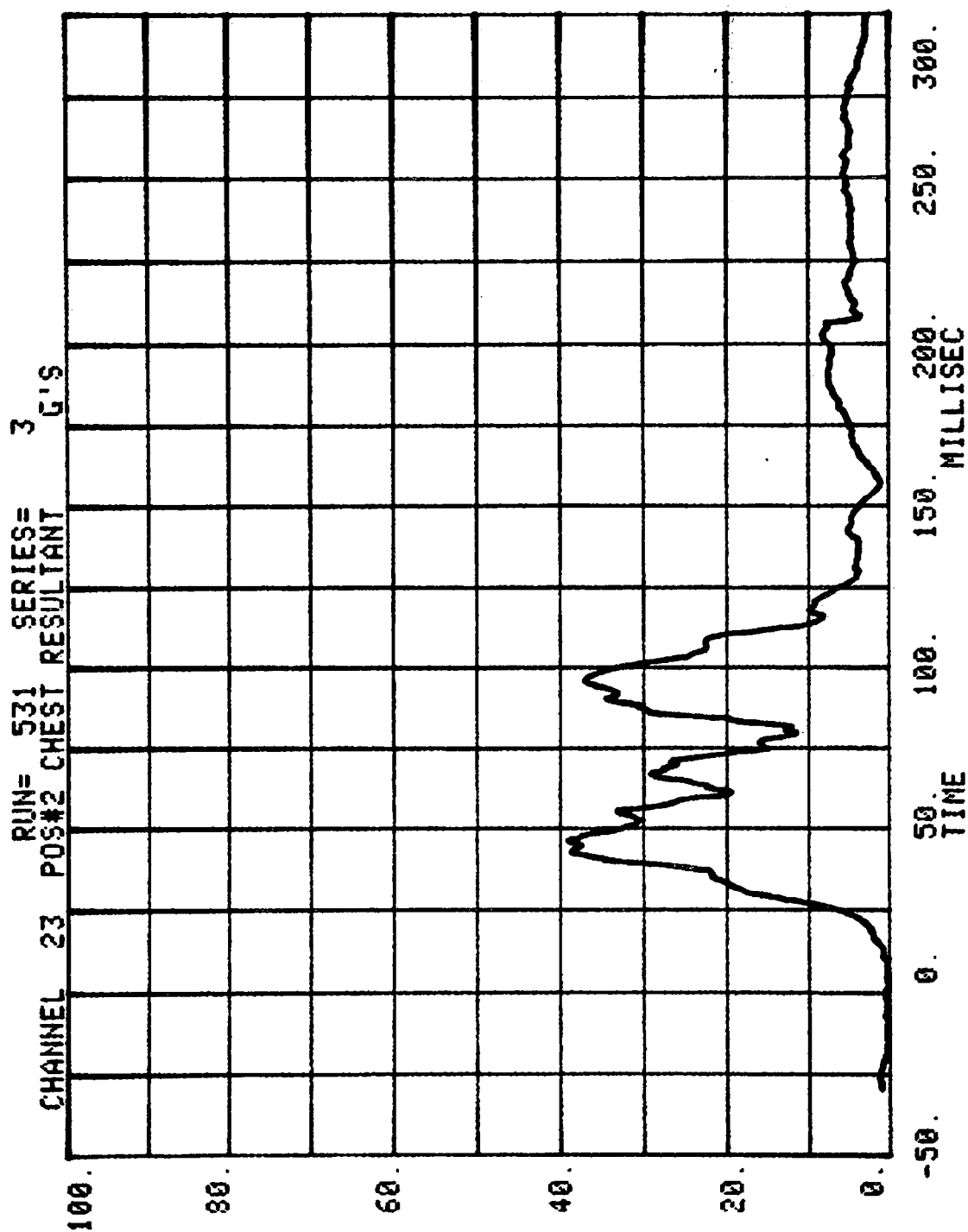
RUN= 531 SERIES=



CHANNEL 18 POS#2 CHEST Z 3 G'S

RUN= 531 SERIES=

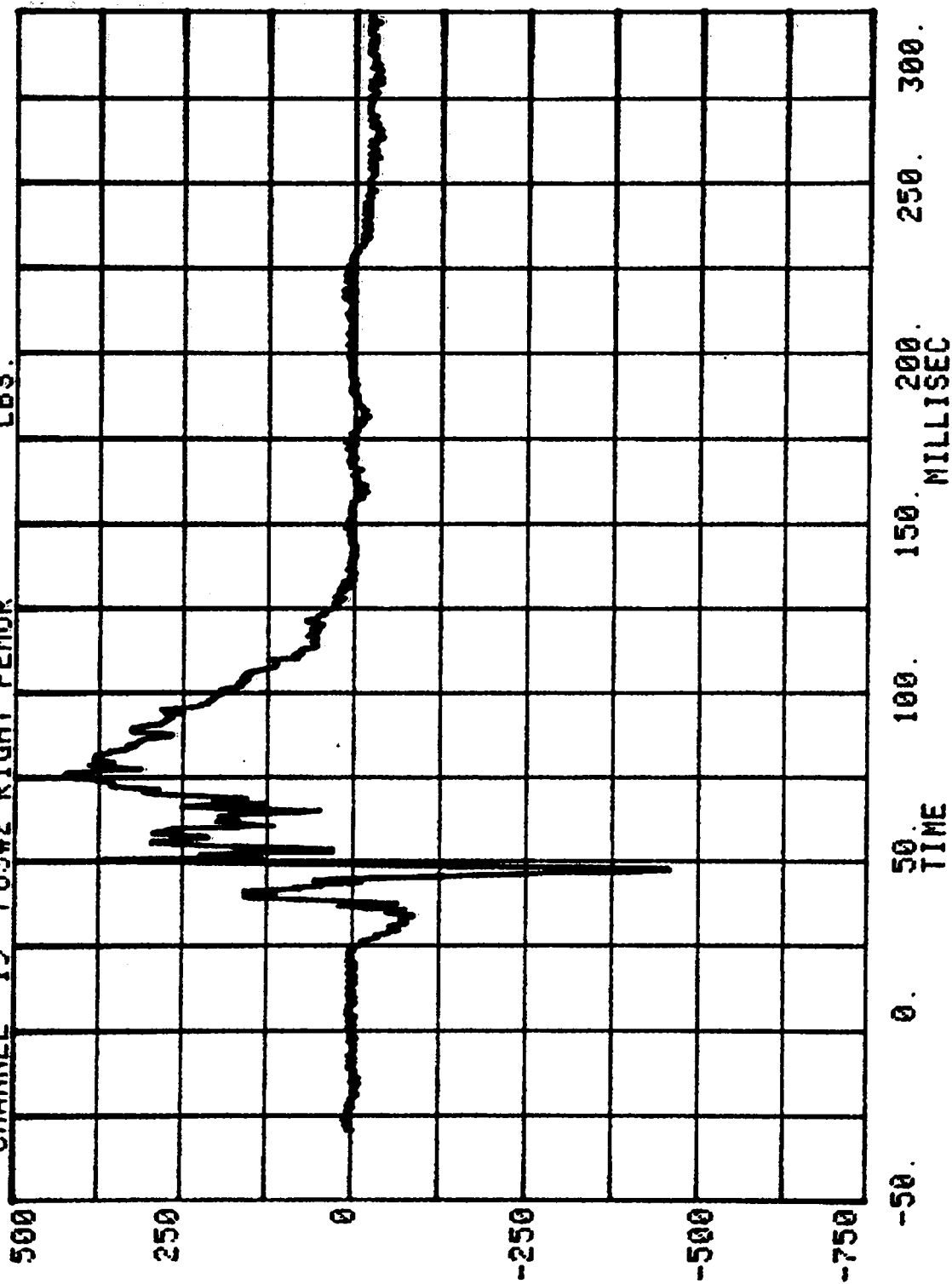




B-94

6892-V-3

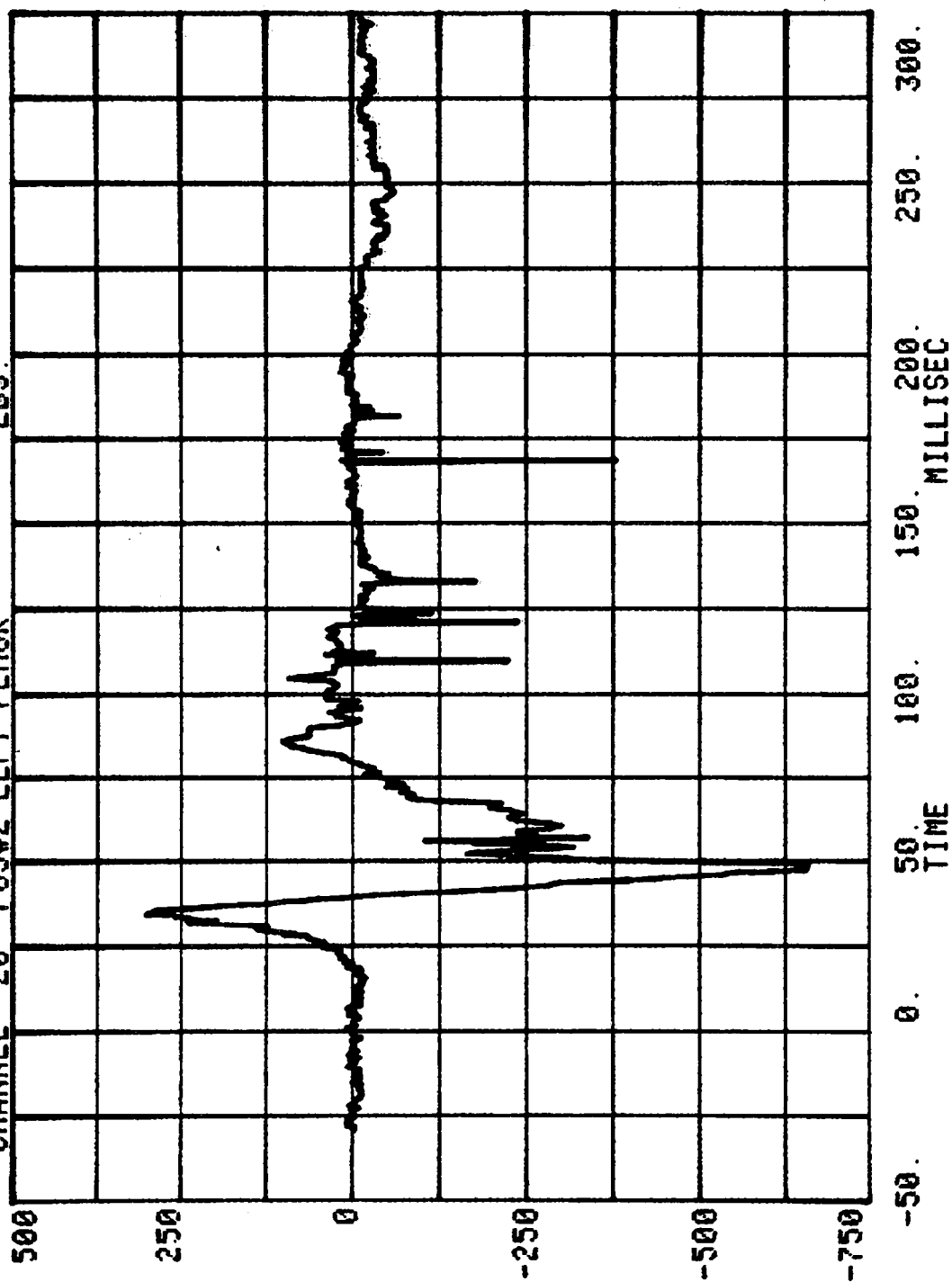
CHANNEL 19 POS#2 RIGHT FEMUR RUN= 531 SERIES= 3 LBS.

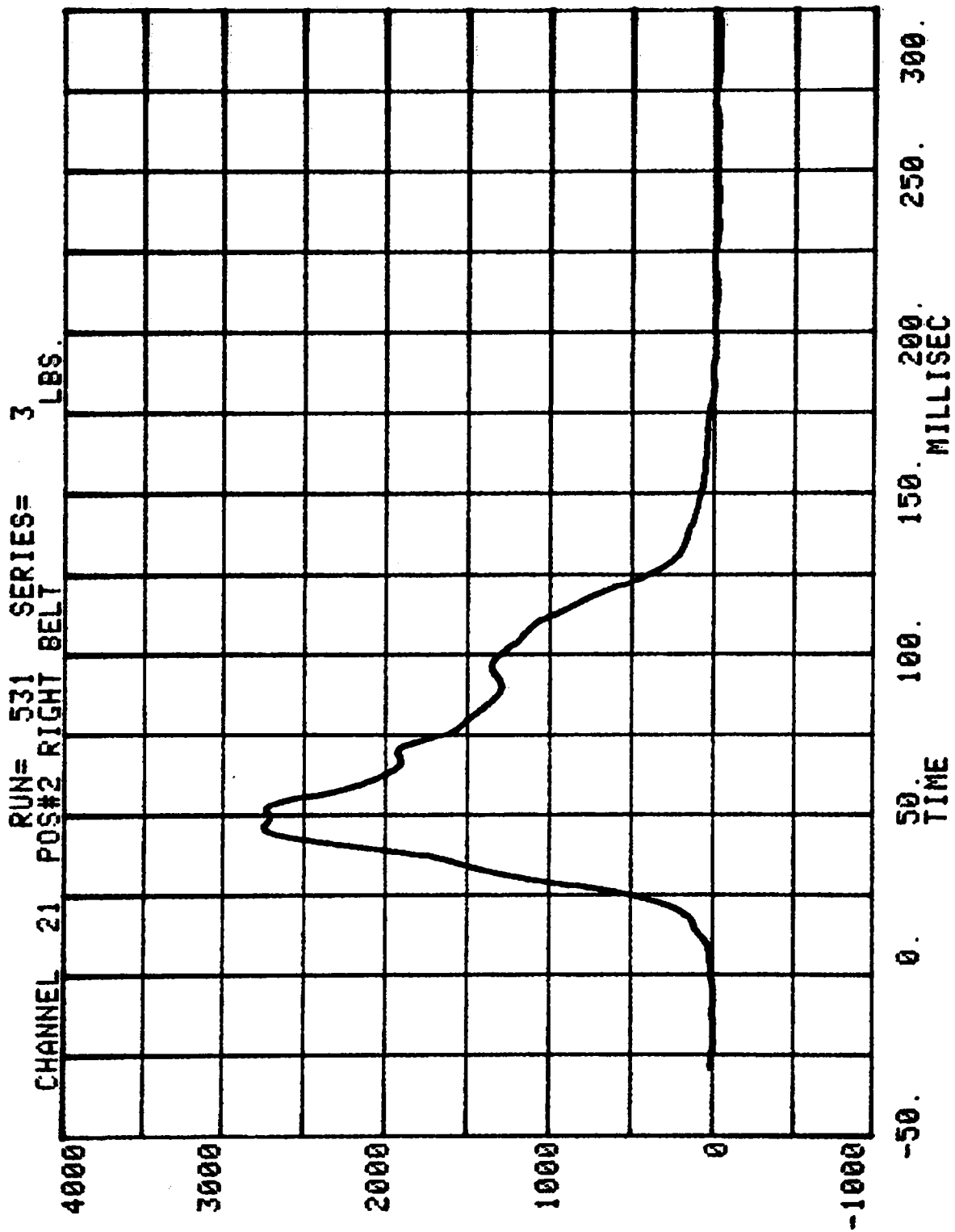


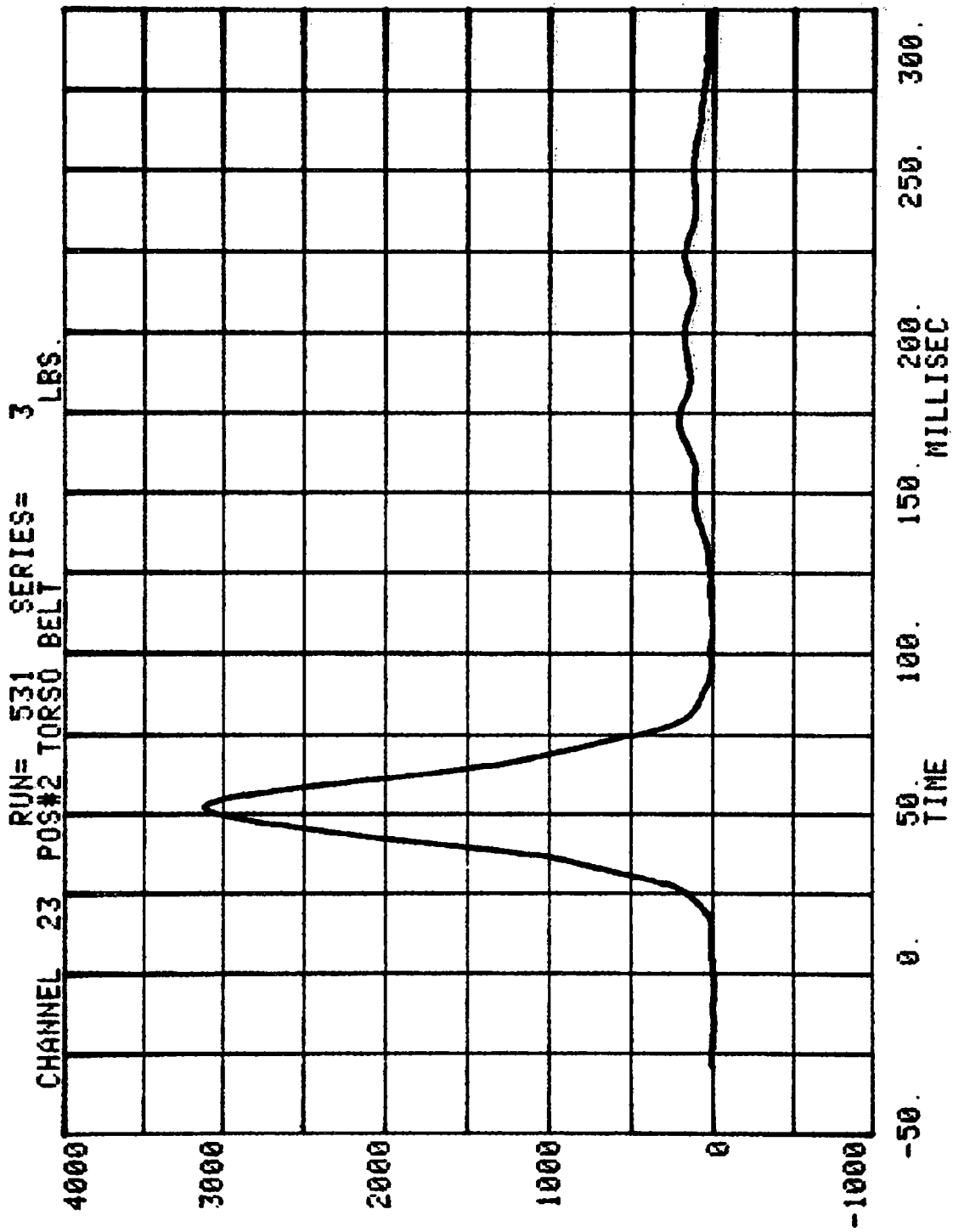
CHANNEL 20 POS#2 LEFT FEMUR

RUN= 531 SERIES= 3

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>
163	10/12/81
183	8/28/81

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 ID NO. 163

LABORATORY TECHNICIAN: Gary Gestwick

APPROVED BY: D.A. Alianello

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		10/1/81 to	
Calibration Sequential Number for Dummy - - - -		10/12/81	
5			
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		66° - 70°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		50% - 64%	
TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	250 g	
b. Peak Lateral Accel. - -	≤10G	3 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.125 ms	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	23.4 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	22.5 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	24 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1.25 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	28.1 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"
30°	Time	25.6 to 34.4 ms	29.5 ms
	Displ.	2.1 to 3.1 in.	2.7"
60°	Time	40.3 to 51.7 ms	45.5 ms
	Displ.	4.3 to 5.3 in.	4.8"
Maximum	Time	53.2 to 66.8 ms	57.5 ms
(°)	Displ.	5.0 to 6.0 in.	5.2"

Continued

P, 572 DUMMY CALIBRATION TEST DATA Continued:

NHTSA DUMMY ID NO. 163

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. <u>NECK BENDING TEST</u> <u>Continued</u>				
i. Chordal Displacement:				
Head Rotation Angle --				
60°	Time	67.0 to 83.0 ms	67.5 ms	
	Displ.	4.3 to 5.3 in.	4.8"	
30°	Time	85.4 to 104.6 ms	87 ms	
	Displ.	2.1 to 3.1 in.	2.4"	
0°	Time	101.0 to 123.0 ms	101 ms	
	Displ.	-.5 to 0.5 in.	0.0"	
3. <u>ABDOMINAL COMPRESSION TEST:</u> (Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.	54.0 #s	
b. Force @ 1.3" - - - - -		73 to 88 lbs.	80.0 #s	
4. <u>LUMBAR FLEXION TEST:</u>				
a. Force @ 20° - - - - -		22 to 34 lbs.	33.0 #s	
b. Force @ 30° - - - - -		34 to 46 lbs.	37.5 #s	
c. Force @ 40° - - - - -		46 to 58 lbs.	47.5 ms	
d. Return Angle - - - - -		12° maximum	8°	
5. <u>CHEST IMPACT TESTS:</u>				
a. High Speed				
(1) Probe Speed - - - - -		21.78-22.22 fps	22.04 fps	
(2) Peak Deflection - - - - -		1.7" maximum	1.32"	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	1968 #s	
(4) Internal Hysteresis - - - - -		50 to 70%	55.49%	
b. Low Speed				
(1) Probe Speed - - - - -		13.86-14.14 fps	14.10 fps	
(2) Peak Deflection - - - - -		1.1" maximum	.84"	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1295 #s	
(4) Internal Hysteresis - - - - -		50 to 7%	54.28%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

NHTSA DUMMY ID NO. 163

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side --			
(1) Probe Speed - - -	<u>6.76 to 7.04 fps</u>	6.98 fps	
(2) Maximum Force - -	<u>1850 to 2500 lbs</u>	2225 #s	
(3) Time Above 1000#	<u>1.7 ms minimum</u>	2.08 ms	
b. Left Side --			
(1) Probe Speed - - -	<u>6.76 to 7.04 fps</u>	7.00 fps	
(2) Maximum Force - -	<u>1850 to 2500 lbs.</u>	2000 #s	
(3) Time Above 1000#	<u>1.7 ms minimum</u>	2.24 ms	

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 163

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	7/81	1/82
ENDEVCO	C462	7/81	1/82
ENDEVCO	CE18	7/81	1/82
GSE	312	7/81	1/82
GSE	311	7/81	1/82
CEC	22958	7/81	1/82
CEC	26929	7/81	1/82
TRANSDUCER INC.	20051	7/81	1/82
BLH	72952	7/81	1/82
CIC	567-11	7/81	1/82

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY ID NO. 183 (Tape 1030)

LABORATORY TECHNICIAN: Gary Gestwick

APPROVED BY: D. A. Chambers

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		8/28/81	
Calibration Sequential Number for Dummy - - -		3	
Temperature in Lab. (Spec. = 66 to 78°F) - - -		66°-75°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		60%-69%	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	210 G	
b. Peak Lateral Accel. - -	≤10G	7 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	22.3 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	24 G	
c. Peak Resultant Head Acceleration - - - -	26G maximum	26 G	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1.5 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	27.5 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	4.3 ms	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	103 ms	
h. Max. Head Rotation - -	63 to 73°	67°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0.0 ms
	Displ.	-.5 to .5 in	0.0 in.
30°	Time	25.6 to 34.4 ms	28.7 ms
	Displ.	2.1 to 3.1 in.	2.7 in.
60°	Time	40.3 to 51.7 ms	43 ms
	Displ.	4.3 to 5.3 in.	4.7 in.
Maximum (°)	Time	53.2 to 66.8 ms	56.8 ms
	Displ.	5.0 to 6.0 in.	5.2 in.

Continued

P, 572 DUMMY CALIBRATION TEST DATA Continued:

NHTSA DUMMY ID NO. 183

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	67.5 ms	
	Displ.	4.3 to 5.3 in.	4.7 in.	
30°	Time	85.4 to 104.6 ms	86.25 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.	-.2 in.	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - -		50 to 63 lbs.	51.0 lbs.	
b. Force @ 1.3" - - - -		73 to 88 lbs.	80.0 lbs.	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - -		22 to 34 lbs.	33.5 lbs.	
b. Force @ 30° - - - -		34 to 46 lbs.	45.0 lbs.	
c. Force @ 40° - - - -		46 to 58 lbs.	55.0 lbs.	
d. Return Angle - - -		12° maximum	4°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - -		21.78-22.22 fps	22.10 fps	
(2) Peak Deflection -		1.7" maximum	1.7 in.	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	1839 lbs.	
(4) Internal Hysteresis - - - -		50 to 70%	51.48%	
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps	14.08 fps	
(2) Peak Deflection -		1.1" maximum	1.07 in.	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1166 lbs.	
(4) Internal Hysteresis- - - -		50 to 7%	53.4%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

NHTSA DUMMY ID NO. 183

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	6.79 fps	
(2) Maximum Force - -	1850 to 2500 lbs	1950 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.8 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.81 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2025 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.12 ms	

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 183

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	7/81	1/82
ENDEVCO	C462	7/81	1/82
ENDEVCO	CE18	7/81	1/82
GSE	312	7/81	1/82
GSE	311	7/81	1/82
CEC	22958	7/81	1/82
CEC	26929	7/81	1/82
TRANSDUCER INC.	20051	7/81	1/82
BLH	72952	7/81	1/82
CIC	567-11	7/81	1/82