1502

REPORT NUMBER: CAL-90-N05

NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST

HYUNDAI MOTOR COMPANY
1990 EXCEL
3-DOOR HATCHBACK

NHTSA NUMBER: ML0502

CALSPAN TEST NUMBER: 7776-5

CALSPAN CORPORATION
ADVANCED TECHNOLOGY CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225

January 9, 1990

FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation
National Highway Traffic Safety Administration
Office of Market Incentives
400 Seventh Street, S.W.
Room No. 5313 (NRM-20)
Washington, DC 20590

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16. Abstract

A frontal load cell barrier test of a 1990 Hyundai Excel 3-Door Hatchback was performed at Calspan Advanced Technology Center crash test facility in Buffalo, New York on January 9, 1990.

The impact speed was 35.0 mph and the ambient temperature at the barrier face at the time of impact was 40°F. The maximum post-test vehicle crush was 19.2 inches. The test vehicle was equipped with an automatic torso belt and a manual lap belt at each of the front outboard seating positions.

With regard to FMVSS 208-"Occupant Crash Protection," injury criteria, both the driver and passenger dummies appear to satisfy the head, chest and femur requirements.

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Section I

PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY 90 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-87-D-02012. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph requirements.

The 35 mph frontal barrier impact test was conducted in accordance with the Office of Market Incentives (OMI) Laboratory Indicant Test procedure.

Section 2

SUMMARY OF TEST NUMBER ML0502

A load cell barrier consisting of 36 load cells was impacted by a 1990 Hyundai Excel 3-Door Hatchback at a velocity of 35.0 mph. The test was performed at the Calspan Corporation Advanced Technology Center on January 9, 1990. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by one real-time camera and 13 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head and chest triaxial accelerometers and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver ATD (Serial No. 357) and the right-front passenger ATD (Serial No. 358) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 65 channels of data were recorded on six 14-channel FM tape recorders. Appendix B contains the vehicle, load cell barrier and dummy response data traces. Vehicle accelerometer #3 experienced a cut wire during the impact. Vehicle accelerometer #4 did not record accurately during the impact.

The driver's head struck the steering wheel rim and hub; the HIC was 695.8. The maximum chest deceleration over 3 milliseconds was 41.2 g's and femur loads were 1384.8 and 1920.8 pounds.

The right front passenger's HIC was 419.1 and maximum chest deceleration over 3 milliseconds was 38.7 g's. Femur loads were 1681.6 and 964.3 pounds.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1990 Hyundai Excel 3-Door Hatchback

NHTSA No.: ML0502 VIN.: KMHVD12J7LU003220

Body Color: Silver Date Of Manufacture: September 6, 1989

Engine: 4 Cylinders; - C.I.D.; 1.5 Liters; - CC
X Gas; - Diesel; - Turbocharged
- Longitudinal; X Transverse

Transmission: 4 Speed; X Manual; - Automatic; X Overdrive

Final Drive: X Front Wheel; - Rear Wheel; - Four Wheel

Date Received: 12-5-89 Odometer Reading: 026.9

- A/C; - P/S; X P/B; - P/wdo.; - Tilt Wheel
- P/seats; - Cruise Control

Type of Occupant Restraint:
Automatic torso belt, Manual lap belt.

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 28 psi, Rear 28 psi

Recommended Tire Size: P155/80R13 OR P175/70R13

Recommended Cold Tire Pressure: Front 28 psi, Rear 28 psi

Tires on Vehicle: P155/80R13 ; Manufacturer: Goodyear

Number of Occupants: 2 Front; 3 Rear; - 3rd Seat; 5 TOTAL

Type of Front Seats: X Bucket; - Bench; - Split Bench

Type of Front Seat Back: - Fixed; X Adj. With X Lever - Rot. Knob

Vehicle Capacity Weight (VCW) = 850 lbs. (A)

No. of Occupants x 150 lbs. = 750 lbs. (B)

Rated Cargo and Luggage
Weight (RCLW) A-B = 100 lbs.

GVWR 3298 lbs. GAWR: Front 1730 lbs. Rear 1630 lbs.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

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

Right Front = 640 lbs. Right Rear = 430 lbs.

Left Front = 710 lbs. Left Rear = 420 lbs.

TOTAL FRONT WEIGHT = 1350 lbs. (61 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 850 lbs. (39 % of Total Vehicle Weight)

TOTAL DELIVERY WEIGHT = 2200 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (2200 lbs.)

VCW = Vehicle Capacity Weight (850 lbs.)

DSC = Designated Seating Capacity (5)

RCLW = VCW - 150 (DSC) = 100 lbs.

Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)

Target Test Weight = 2628 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 132 POUNDS CARGO:

Right Front = 740 lbs. Right Rear = 590 lbs.

Left Front = 720 lbs. Left Rear = 610 lbs.

TOTAL FRONT WEIGHT = 1460 lbs. (55 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 1200 lbs. (45 % of Total Vehicle Weight)

TOTAL TEST WEIGHT = 2660 lbs.

Weight of ballast secured in vehicle trunk area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude: RF 25.7" LF 25.5" RR 24.6" LR 24.2"

Test Attitude: RF 25.9" LF 26.1" RR 22.8" LR 22.8"

Wheel Base: 94.1 in.; C.G. = 42.3 in. rearward of front wheel C/L

Remarks: _____

_____

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Angle: 0°

Date of Test: January 9, 1990 Time of Test: 13:05

Ambient Temperature: 40 °F at impact area

Temperature in Occupant Compartment: 70 °F

Windshield Molding Temperature: 68 °F

Required Impact Velocity Range: 34.5 to 35.5 mph

Impact Velocity: primary = 35.0 mph, secondary = 35.1 mph

Distance From Front Bumper to Barrier Face When

Entering Speed Trap: 52 inches

Exiting Speed Trap: 12 inches

VEHICLE REBOUND AND CRUSH (inches):

Vehicle Length:	Pre-test	= R	157.5	C_L	160.6	L 157.7
	Post-test	= R	140.8	C_L	141.4	L 140.2
	Crush	= R	16.7	C_L	19.2	L 17.5

Distance from front of test vehicle to point of impact:

R 12.6" C_L 11.7" L 12.2"

VISIBLE DUMMY CONTACT POINTS:

	Driver	Passenger
Head	Steering Wheel Rim and Steering Wheel Hub	No Contact
Chest	Lower Steering Rim	No Contact
Abdomen	Lower Steering Rim	No Contact
Left Knee	Dash Panel	Dash Panel
Right Knee	Dash Panel	Dash Panel

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

	Front		Rear	
	Left	Right	Left	Right
Door Opening	operable	operable	-	-

	Front		Rear	
Seat Movement	Left	Right	Left	Right
Seat Back Failure	none	none	-	-
Seat Shift (in.)	none	none	-	-

Glazing Damage

Backlight/Windshield: Windshield sustained stress cracks but remained intact.

Section 3

OMI FINAL DATA

Occupant and Vehicle Information

I. OMI DATA

1. Dummy Injury Criteria Data Summary
2. Dummy Positioning Data
3. Seat Belt Positioning Data
4. Seat Belt Performance Assessment Data
5. Driver Dummy to Steering Column Dimensions
6. Camera Locations
7. Vehicle Target Locations

II. OVR DATA

1. Load Cell Barrier Data
2. Vehicle Accelerometer Data
3. Test Vehicle Measurements

Table 2

DUMMY INJURY CRITERIA VALUES

NHTSA No.: ML0502 Vehicle: 1990 Hyundai Excel 3-Door Hatchback

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-134.5	-46.5	86.0	164.0
Position #2 - Passenger	27.0	18.8	49.4	56.9

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-41.8	-13.2	-17.1	41.2
Position #2 - Passenger	-39.0	19.6	24.1	38.7

The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

	MAXIMUM FORCE - FEMUR LOAD (lbs.)	
	LEFT FEMUR	RIGHT FEMUR
Position #1 - Driver	1384.8	1920.8
Position #2 - Passenger	1681.6	964.3

	MAXIMUM FORCE - SEAT BELT LOADS (lbs.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	1870.8	-	405.8
Position #2 - Passenger	2479.8	599.8	-

	HEAD INJURY CRITERIA (HIC)			
	HIC	t_1 (SEC)	t_2 (SEC)	Average Acceleration t_1 TO t_2
Position #1 - Driver	695.8	.06172	.09772	51.8
Position #2 - Passenger	419.1	.05955	.09555	42.3

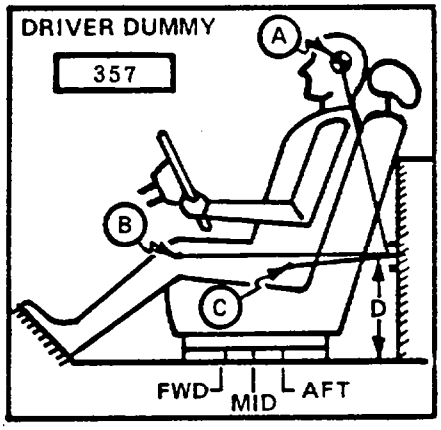
HIC is as defined in FMVSS 208. The maximum time interval from t_1 to t_2 is 36 milliseconds.

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION

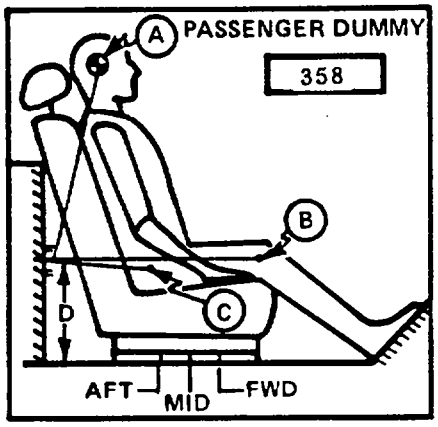
Test No.: ML0502 Vehicle: 1990 Hyundai Excel 3-Door Hatchback

SEAT TYPE:	ADJUSTER TYPE:	BUCKET SEAT BACK TYPE:
- Bench	X Manual	- Fixed
X Bucket	- Power	X Adjustable Reclining
- Split Bench		

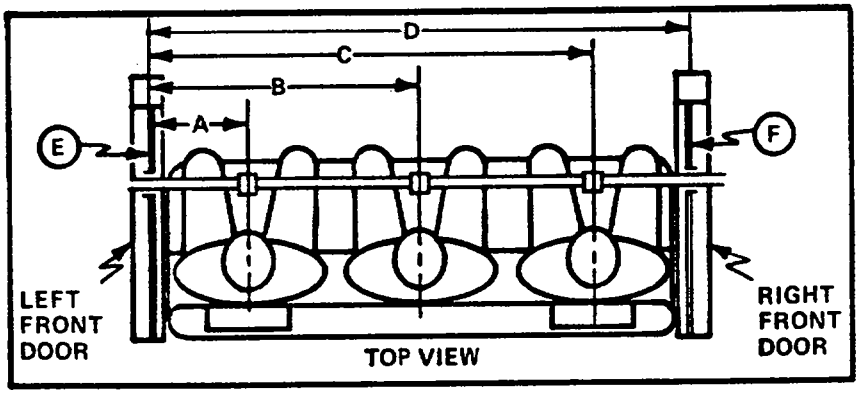


MEASUREMENT LOCATION

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



	357		358	
A =	23.6 in.	25 Degrees	22.8 in.	19 Degrees
B =	30.5 in.	93 Degrees	30.5 in.	95 Degrees
C =	16.2 in.	112 Degrees	15.7 in.	106 Degrees
D =	14.3 in.		14.3 in.	



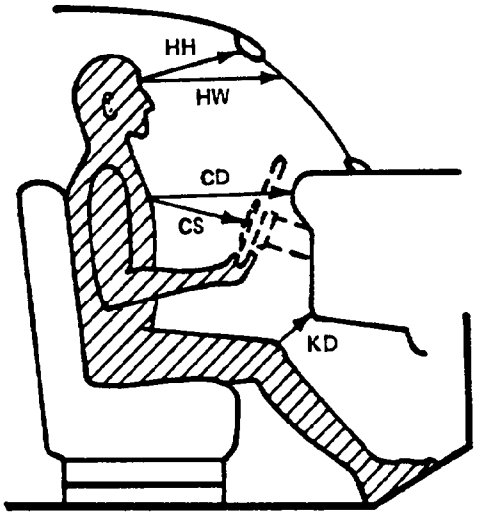
DUMMY ID

		357	358
A =	Left Door to Driver Centerline	11.1	in.
B =	Left Door to Center Passenger Centerline	-	in.
C =	Left Door to Right Passenger Centerline	35.4	in.
D =	Left Door to Right Door	46.3	in.
E,F =	Window Glass Height (Right and Left Must Be Equal)	11.0	in.

Figure 2

OCCUPANT CLEARANCE DIMENSIONS

	DRIVER	PASSENGER
HH	14.4	15.1
HW	20.3	20.3
CD	22.3	23.3
CS	14.7	-
KDL	6.8	7.8
KDR	7.2	7.7
SA	See note	See note
TA	24°	24°



HH = Head to Windshield Header

HW = Head to Windshield

CD = Chest to Dash

CS = Chest to Steering Wheel

KD(L/R) = Knee to Dash (Left/Right)

SA = Seat Back Angle

TA = Torso Angle

HA = Head Target to "A" Pillar

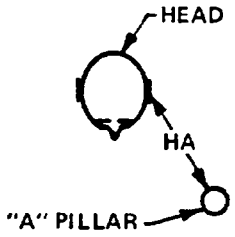
HR = Head to Side Roof

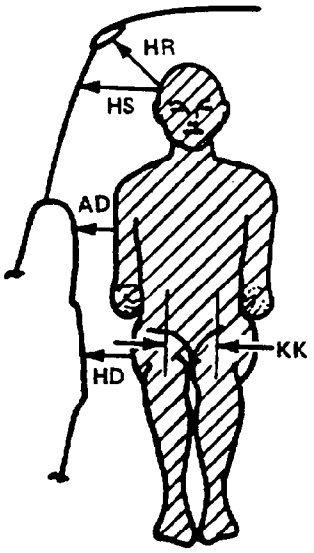
HS = Head to Side Window

AD = Arm to Door

HD = Hip to Door

KK = Knee to Knee



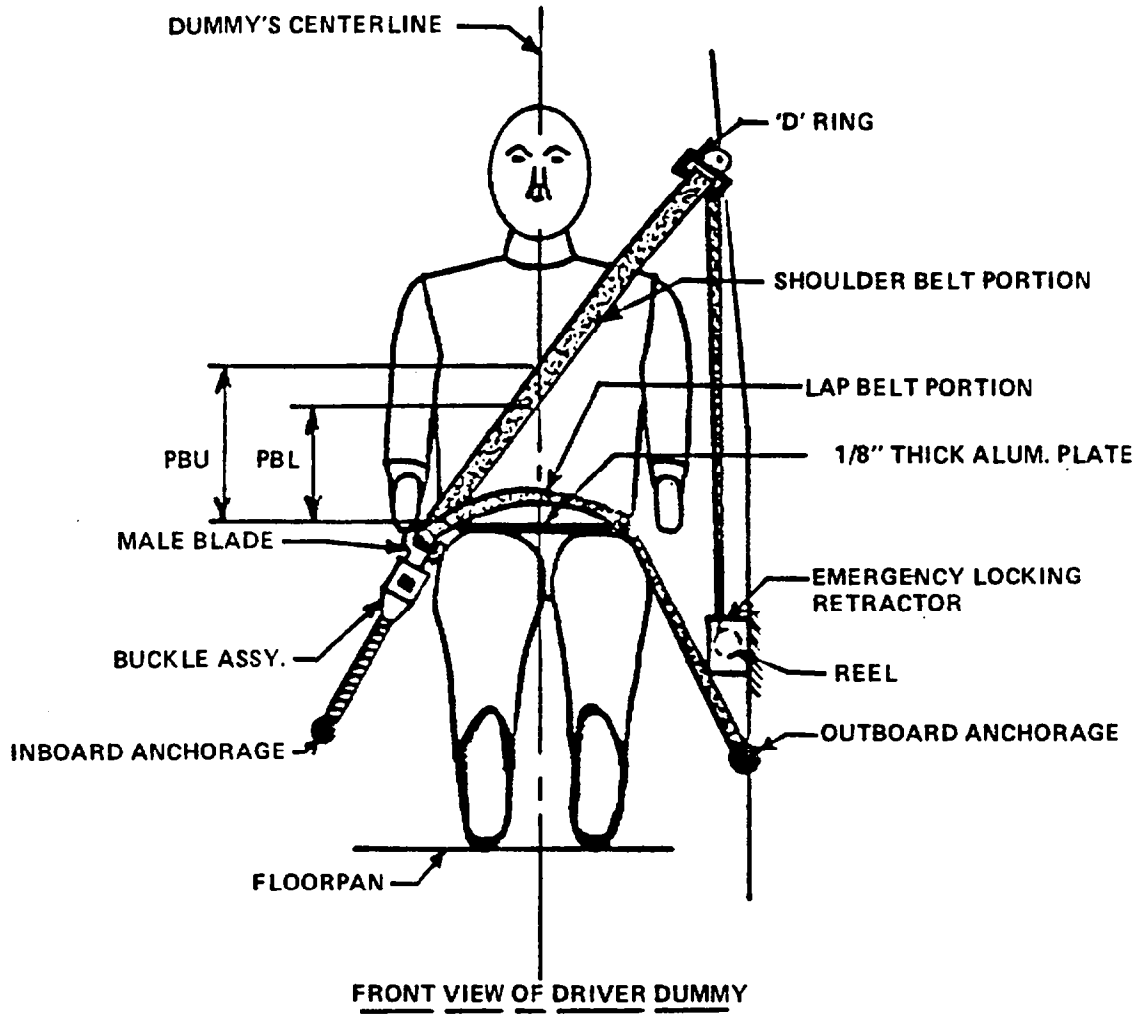


	DRIVER	PASSENGER
HR	4.9	4.7
HS	8.0	7.8
AD	3.8	4.5
HD	5.8	6.5
KK	10.1	8.3
HA	19.3	19.8

Note: Seat back was positioned as specified by the manufacturer.

Figure 3

SEAT BELT POSITIONING DATA



	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
PBU -- Top surface of alum. plate to upper edge	13.5	13.5
PBL -- Top surface of alum. plate to belt lower edge	10.3	10.3

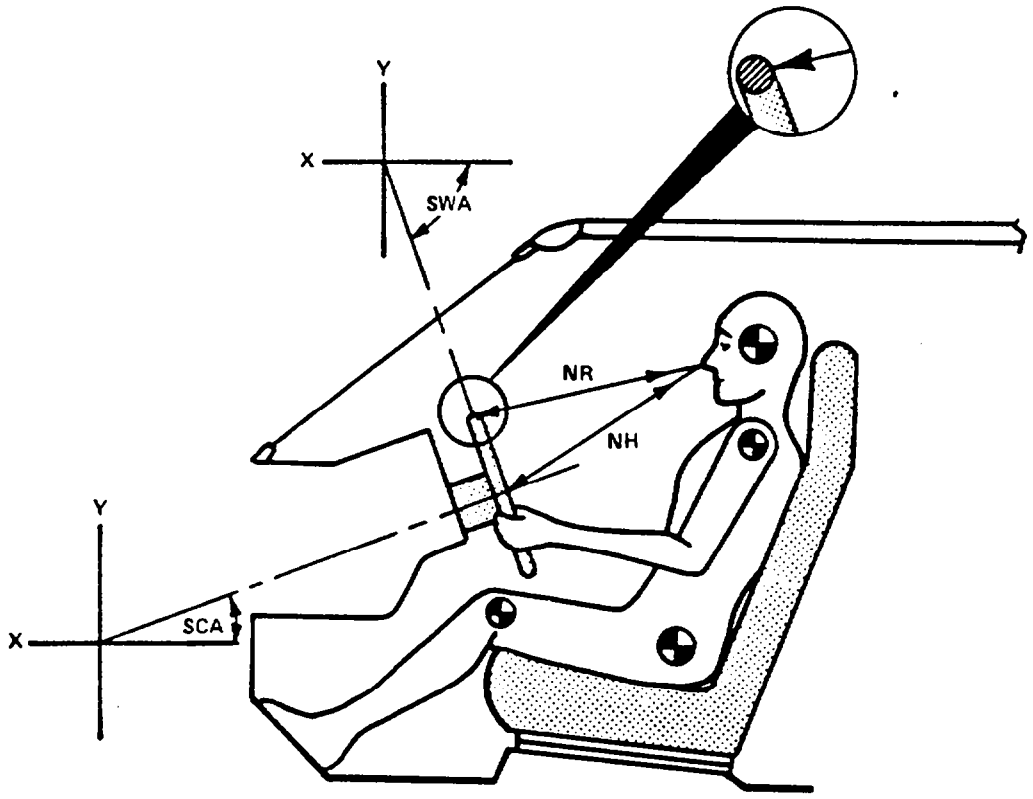
Table 3

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

BELT LENGTH DATA:	Driver	Passenger
Shoulder belt length as measured on Part 572 Dummy.	37.5"	37.5"
Lap belt length as measured on Part 572 Dummy.	35.0"	34.5"
LAP BELT SPOOL-OFF DATA:		
As determined mechanically.	1.8"	1.5"
SHOULDER BELT SPOOL-OFF DATA:		
As determined mechanically.	1.3"	2.0"
BELT STRETCH DATA:		
Measured electronically between shoulder belt load cell and the "D" ring.	1.0 in/ft	0.6 in/ft
Measured mechanically	0.0 in/ft	0.0 in/ft

Figure 4

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



LEFT SIDE VIEW

	MEASUREMENTS	
NR -- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim	19.6	Inches
NH -- Distance from tip of dummy's nose to center of steering column hub	19.8	Inches
SCA -- Angle of steering column relative to the horizontal X axis	26.0	Degrees
SWA -- Angle of steering wheel relative to the horizontal X axis	-64.0	Degrees

Figure 5

CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

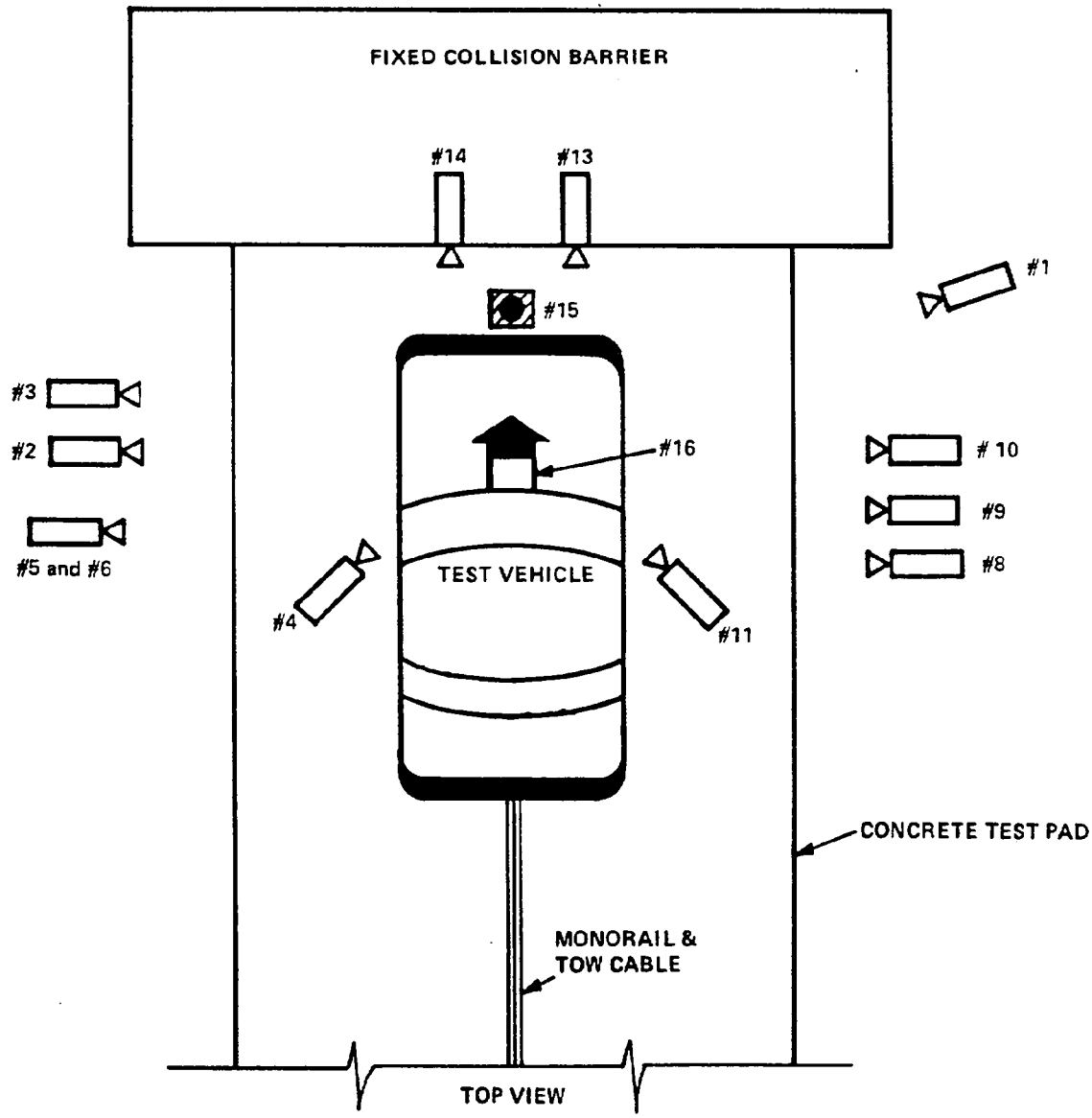


Table 4

HIGH-SPEED CAMERA LOCATIONS

Test No. ML0502 Vehicle: 1990 Hyundai Excel 3-Door Hatchback

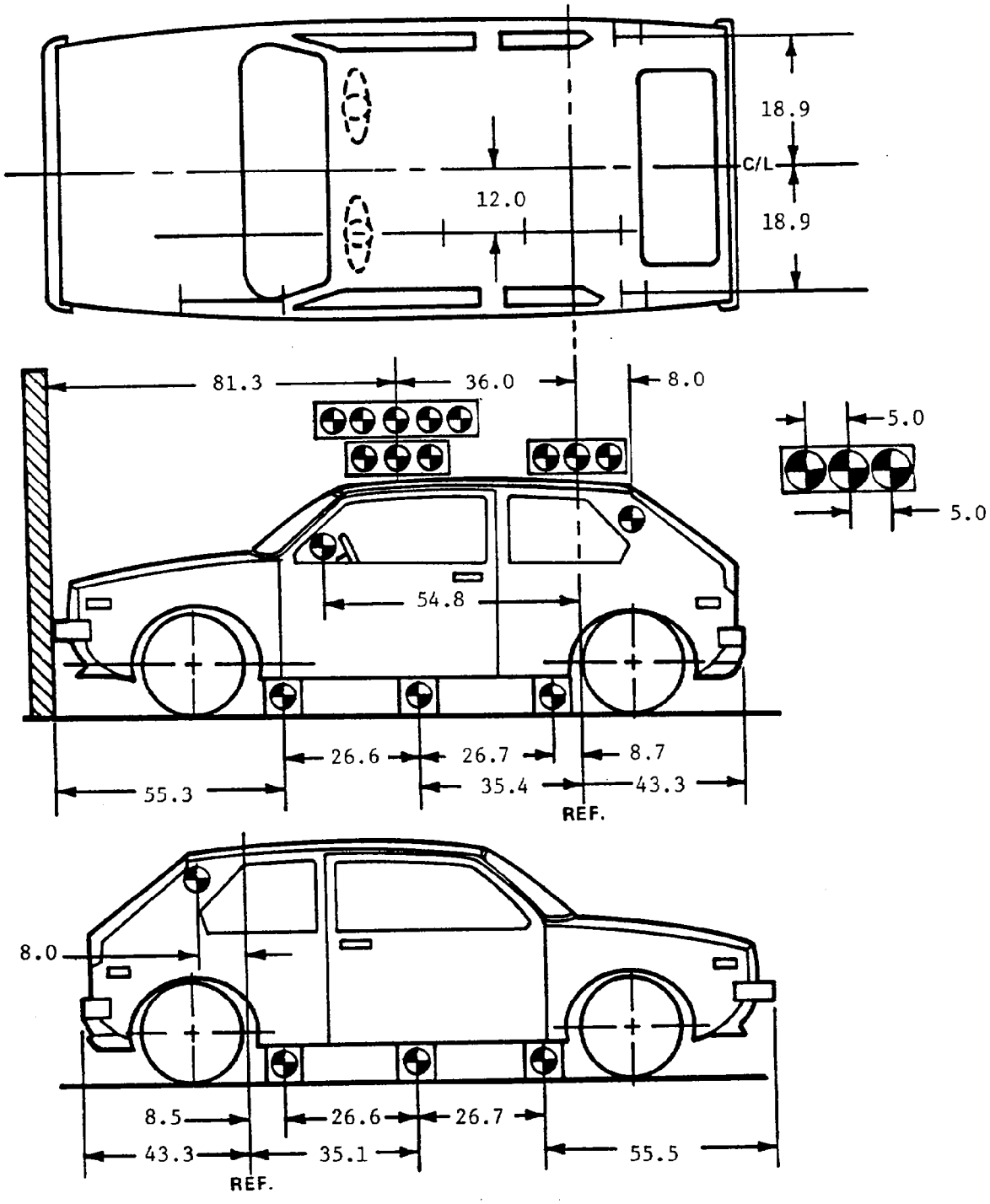
CAMERA NO.	VIEW	CAMERA POSITIONS (in)* X	Y	Z	ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
1	Real-Time Camera	–	–	–	–	–	–	24
2	Overall Left Side	315	60	41	-4	300	13	550
3	Left Side View	305	41	40	-3	290	25	535
4	Driver and Interior View	105	108	71	-18	90	13	See Note
5	Steering Column (Bottom)	265	79	46	-4	250	25	570
6	Steering Column (Top)	265	79	70	-12	250	25	570
7	Overall Right Side	220	71	41	-6	205	13	See Note
8	Right Side View	298	51	42	-3	283	25	780
9	Right Passenger View	298	66	54	-4	283	35	665
10	Passenger and Interior View	101	117	69	-22	86	25	620
11	Passenger Front View	24	-5	73	-43	–	13	590
12	Driver Front View	24	-5	73	-43	–	13	540
13	Windshield View	0	0	126	-45	–	13	500
14	Pit View of Engine	0	32	-120	90	–	13	See Note

*X = film plane to monorail centerline
Y = film plane to impact location
Z = film plan to ground
** = referenced to horizontal plane

Note: Film speed is not available for this camera.

Figure 6

VEHICLE TARGET LOCATIONS

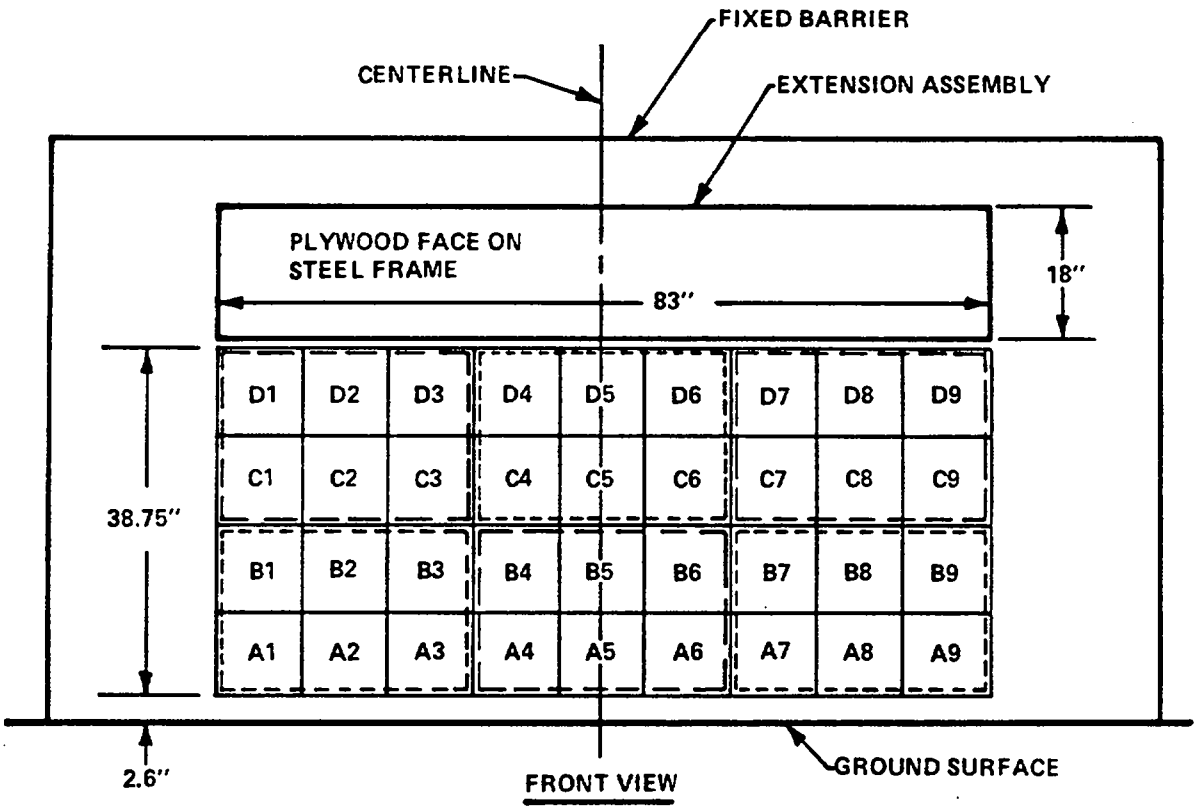


(DIMENSIONS IN INCHES)

Figure 7

LOAD CELL LOCATIONS ON FIXED BARRIER

36 Load Cells
4 Rows
9 Columns
6 Groupings (6 cells/group)



6 GROUPS OF 6 LOAD CELLS EACH

Group 4 C1 thru D3	Group 5 C4 thru D6	Group 6 C7 thru D9
Group 1 A1 thru B3	Group 2 A4 thru B6	Group 3 A7 thru B9

The following data is presented in Appendix B:

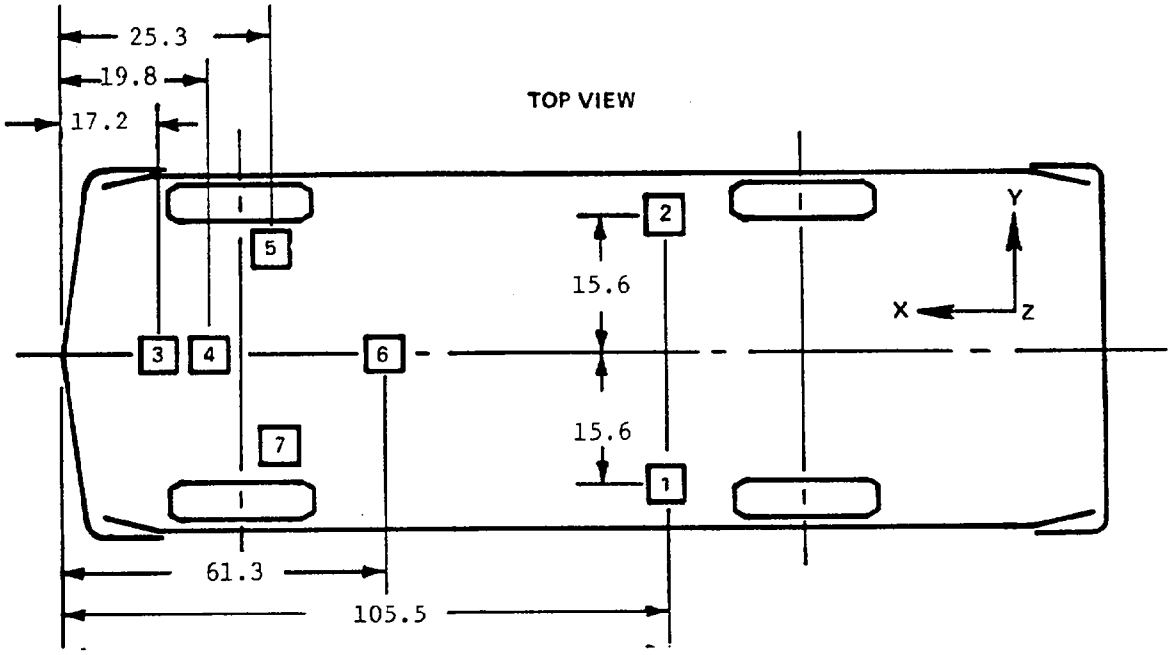
(1) Data from 36 individual load cells

(2) Total or Sum of 36 individual load cells

(3) Data from 6 Groupings shown above (6 cells/group)

Figure 8

VEHICLE ACCELEROMETER LOCATIONS



ACCELEROMETER NUMBER*	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Left Rear Seat Crossmember	X		
2	Right Rear Seat Crossmember	X		
3	Top of Engine	X		
4	Bottom of Engine	X		
5	Right Disc Brake Caliper	X		
6	Instrument Panel	X		
7	Left Disc Brake Caliper	X		

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

Figure 9

TEST VEHICLE MEASUREMENTS

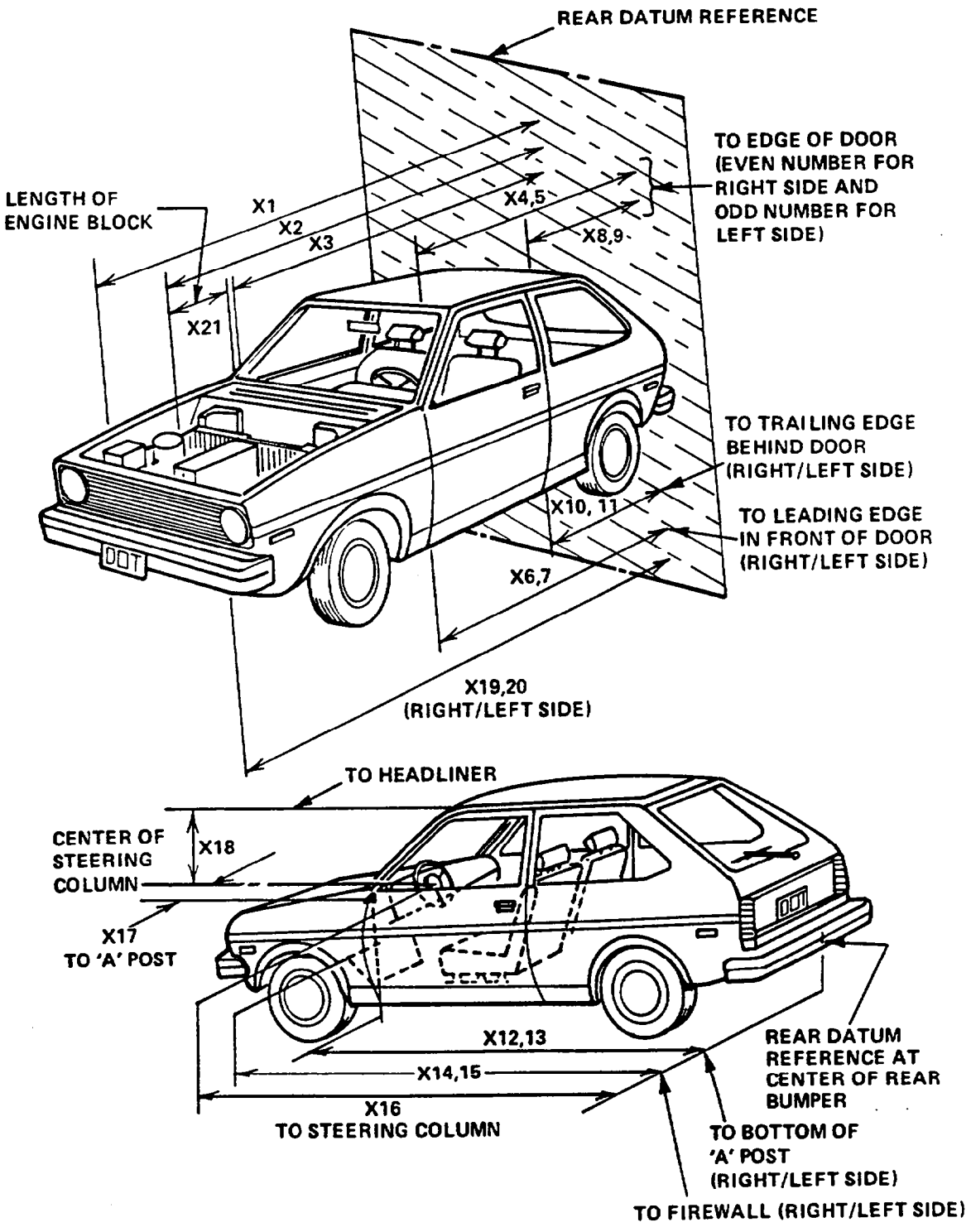


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Table 5

VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	160.6	141.4	19.2
X2	Rear Surface of Vehicle to Front of Engine	139.6	131.5	8.1
X3	Rear Surface of Vehicle to Firewall	119.7	117.5	2.2
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	108.0	108.1	-0.1
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	108.5	107.4	1.1
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	107.4	107.8	-0.4
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	107.5	107.2	0.3
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	60.3	60.2	0.1
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	60.6	59.7	0.9
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	61.9	62.2	-0.3
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	62.0	61.8	0.2
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	106.6	106.8	-0.2
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	107.3	107.1	0.2
X14	Rear Surface of Vehicle to Firewall, Right Side	118.4	116.7	1.7
X15	Rear Surface of Vehicle to Firewall, Left Side	118.5	116.6	1.9
X16	Rear Surface of Vehicle to Steering Column	92.1	89.4	2.7
X17	Center of Steering Column to "A" Post	16.6	15.4	1.2
X18	Center of Steering Column to Headliner	17.4	16.9	0.5
X19	Rear Surface of Vehicle to Right Side of Front Bumper	157.5	140.8	16.7
X20	Rear Surface of Vehicle to Left Side of Front Bumper	157.7	140.2	17.5
X21	Length of Engine Block	16.0	16.0	0.0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	98.8	98.5	0.3
CD	Rear Surface of Vehicle to Center of Dash Panel	100.3	98.0	2.3
LD	Rear Surface of Vehicle to Left Side of Dash Panel	100.3	98.8	1.5

Appendix A

PHOTOGRAPHS

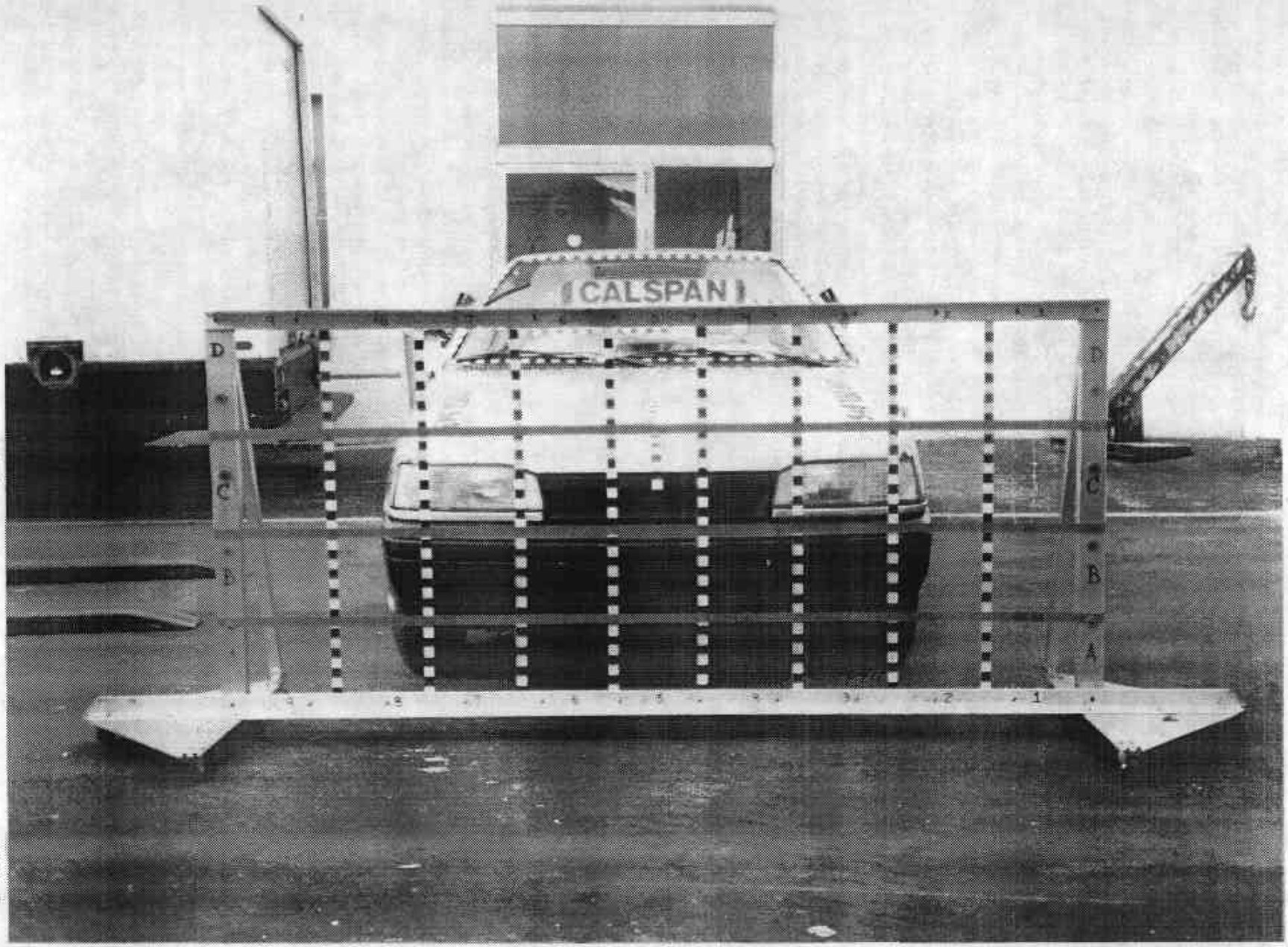

Figure A-1 PRE-TEST LOAD CELL LOCATIONS

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Figure A-2 PRE-TEST FRONT VIEW

Figure A-3 POST TEST FRONT VIEW

Figure A-4 PRE-TEST LEFT SIDE VIEW

Figure A-5 POST TEST LEFT SIDE VIEW

Figure A-6 PRE-TEST RIGHT SIDE VIEW

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Figure A-7 POST-TEST RIGHT SIDE VIEW

Figure A-8 PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

Figure A-9 POST-TEST RIGHT FRONT THREE-QUARTER VIEW

Figure A-10 PRE-TEST LEFT REAR THREE-QUARTER VIEW

Figure A-11 POST-TEST LEFT REAR THREE-QUARTER VIEW

Figure A-12 PRE-TEST WINDSHIELD VIEW

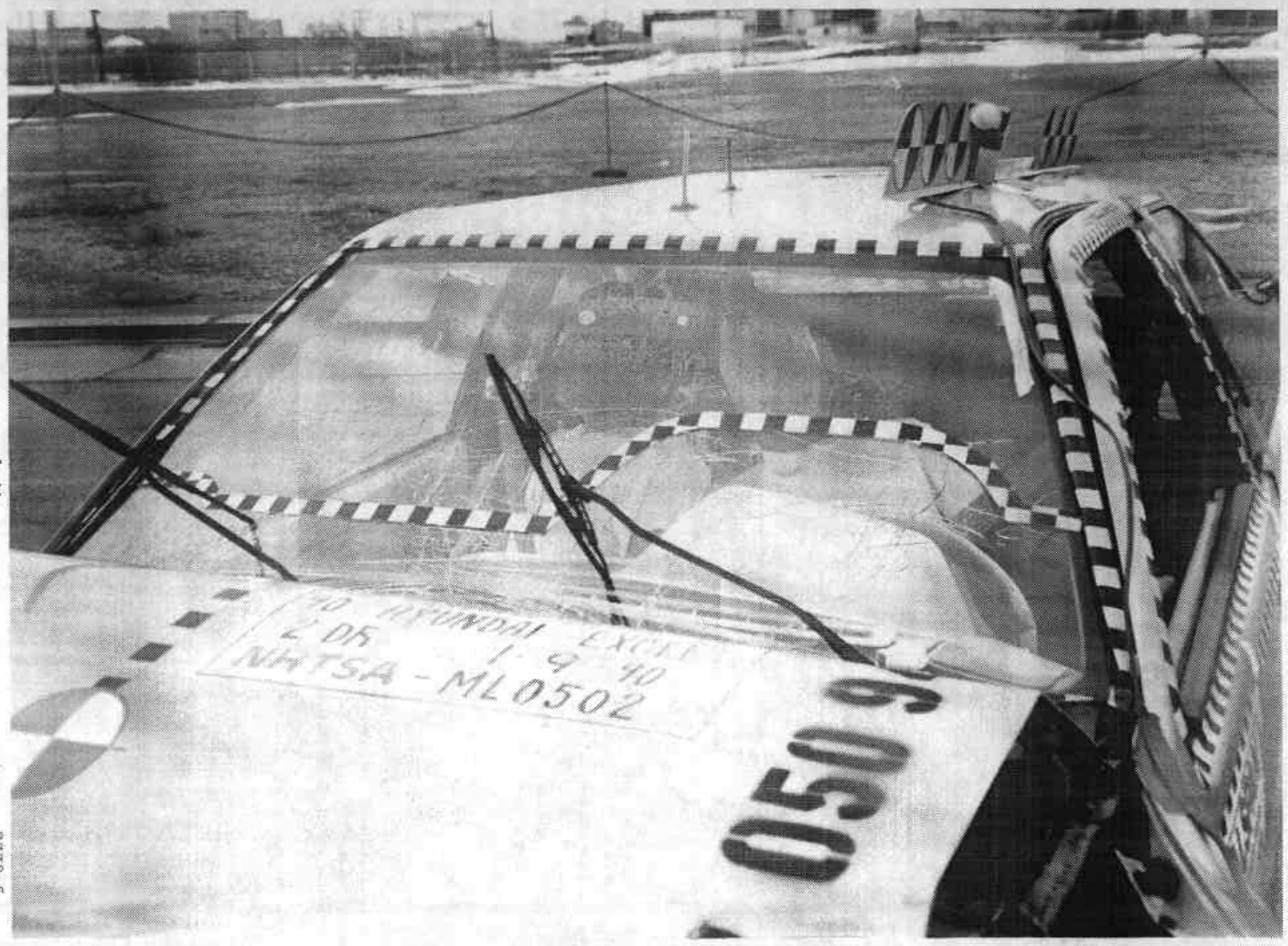

Figure A-13 POST-TEST WINDSHIELD VIEW

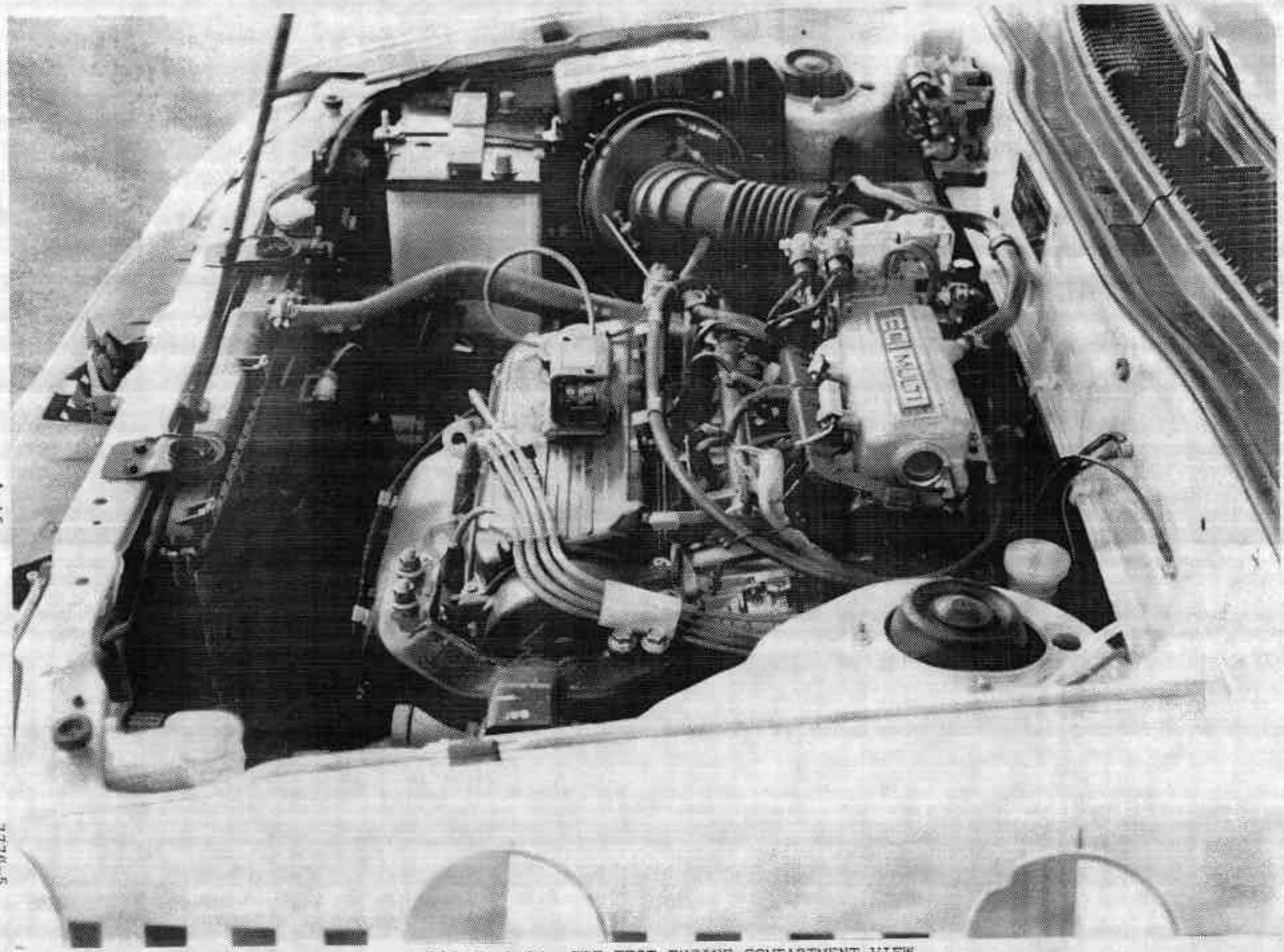

Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

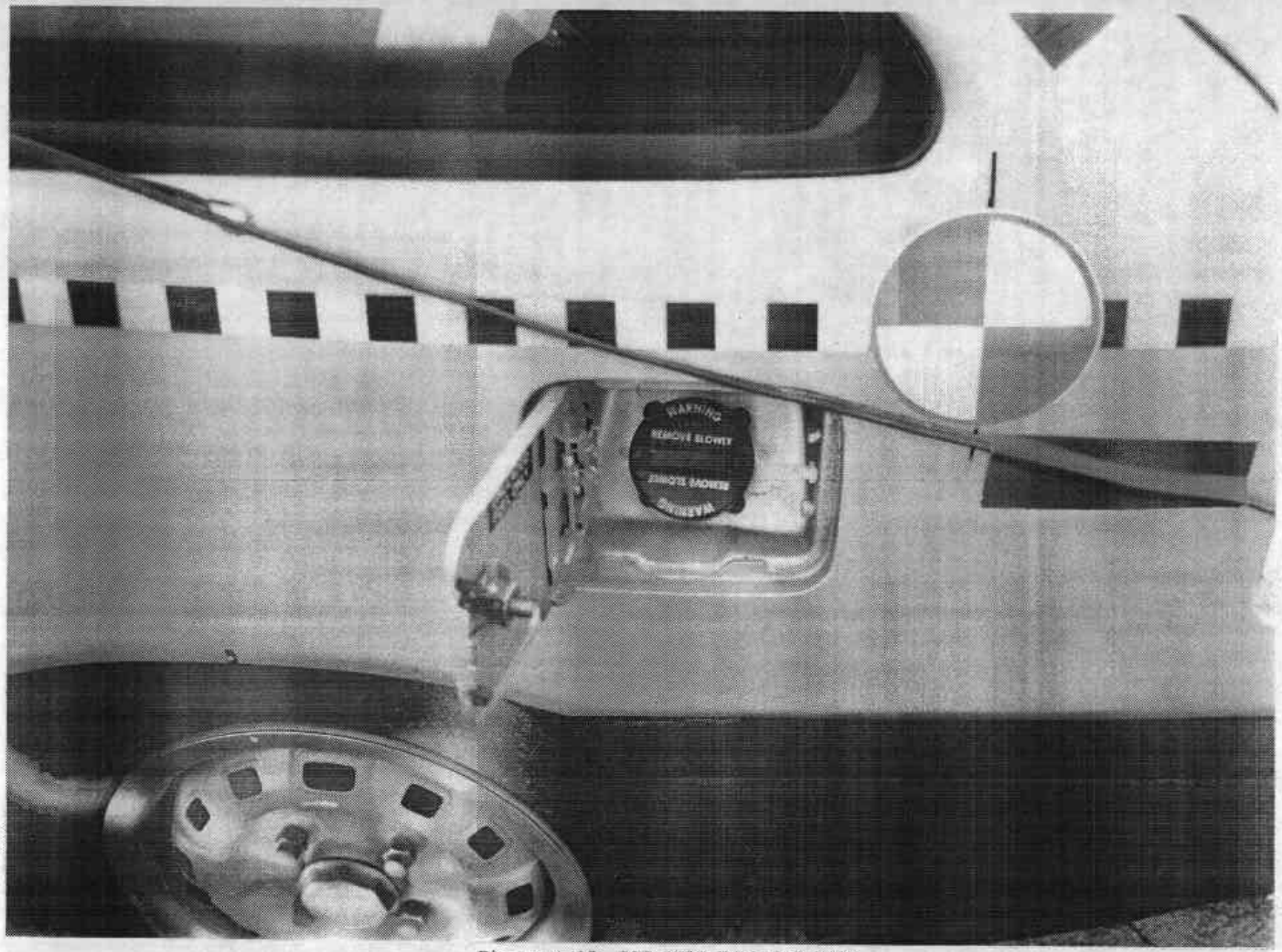

Figure A-15 PRE-TEST FUEL CAP VIEW

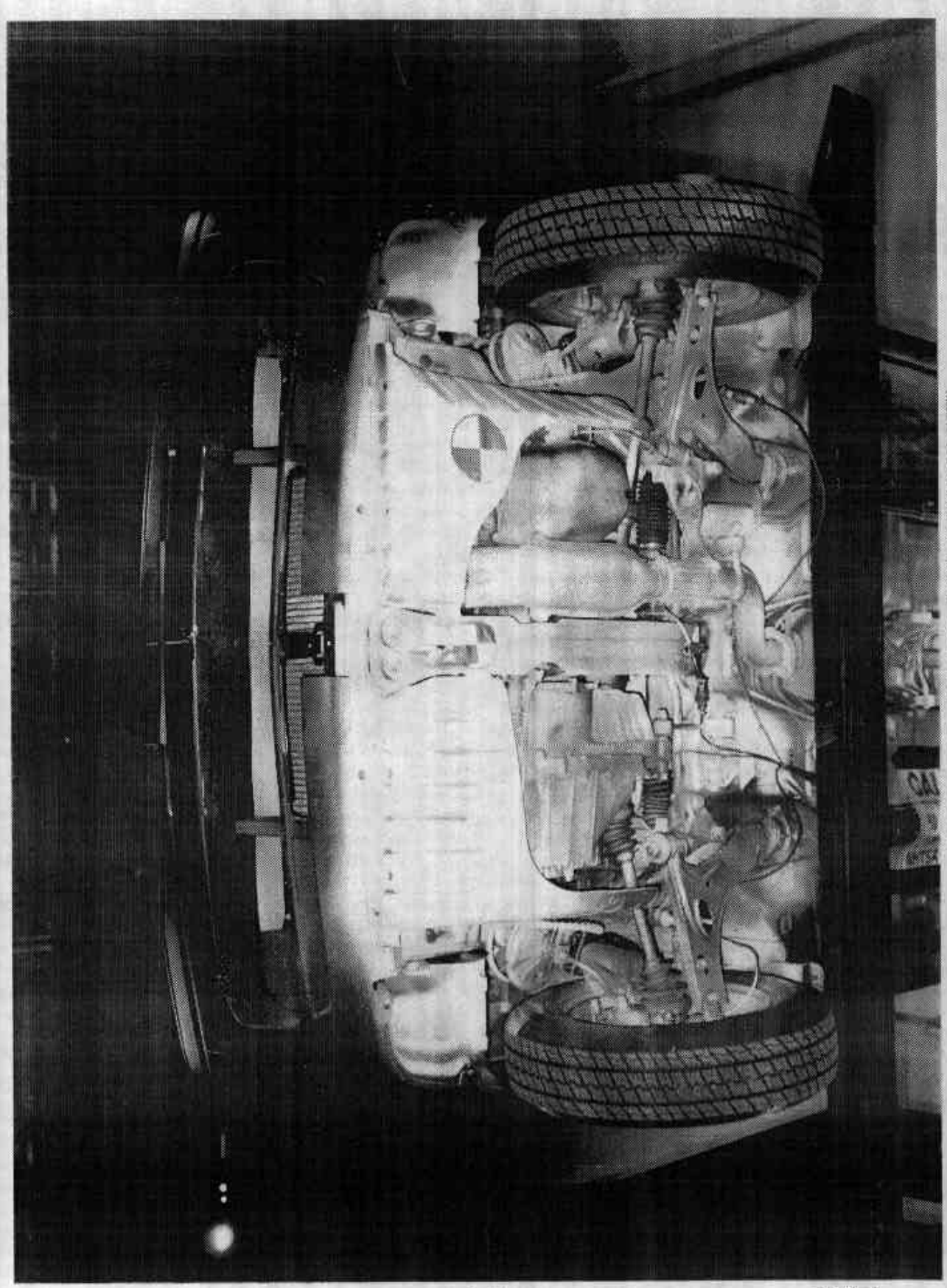

Figure A-18 PRE-TEST FRONT UNDERBODY VIEW

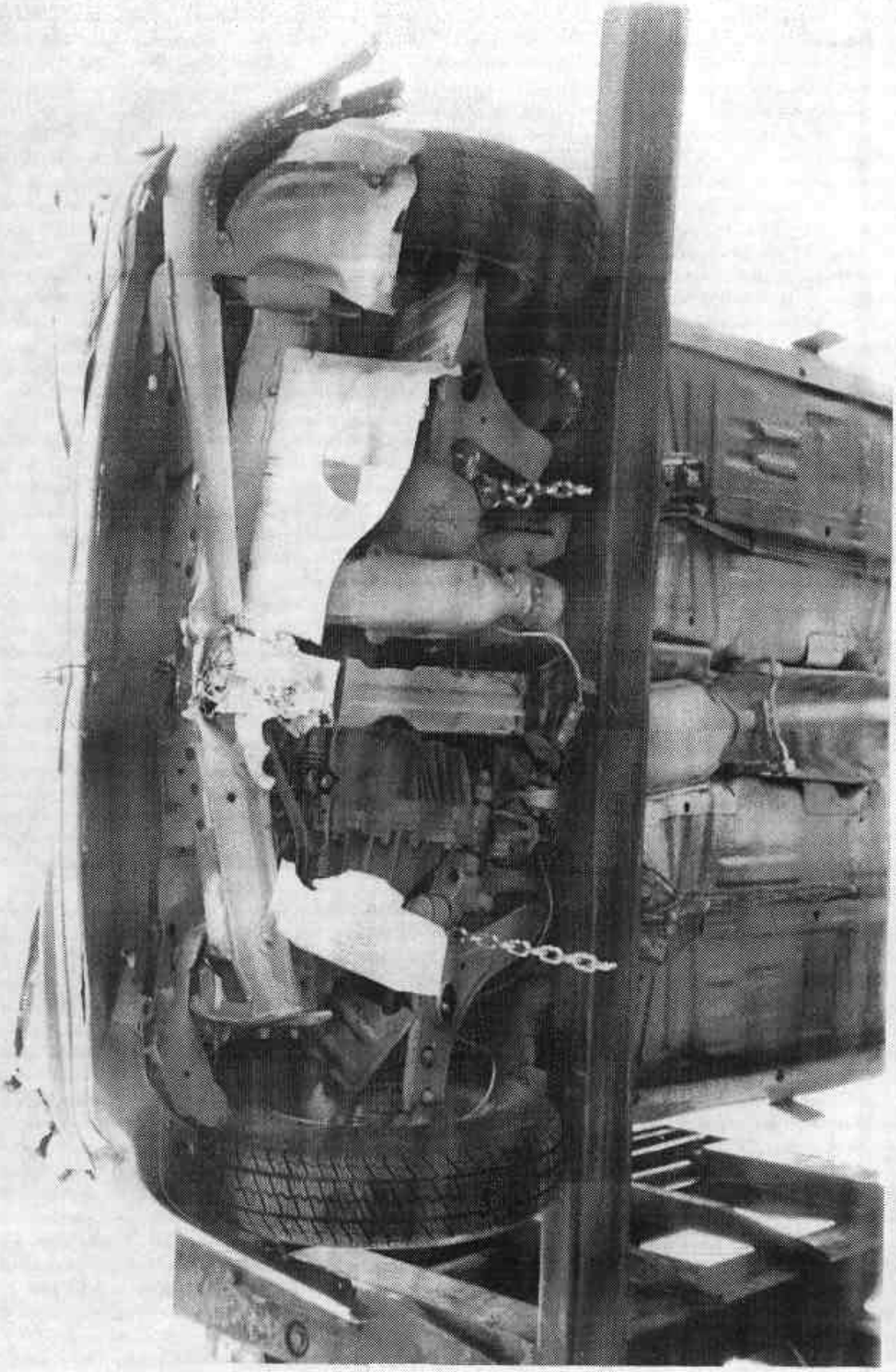

Figure A-17 POST-TEST FRONT UNDERBODY VIEW

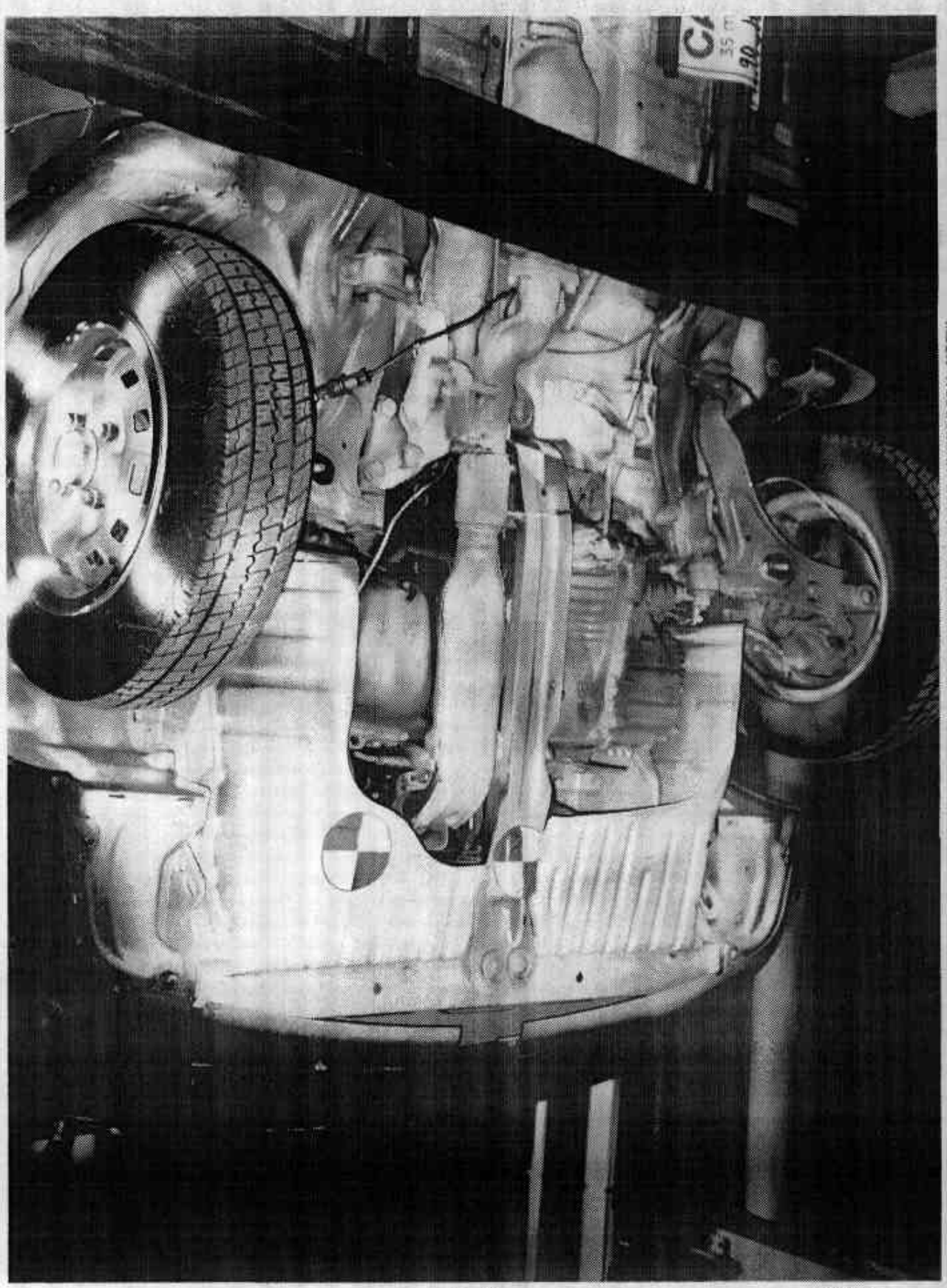

Figure A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW

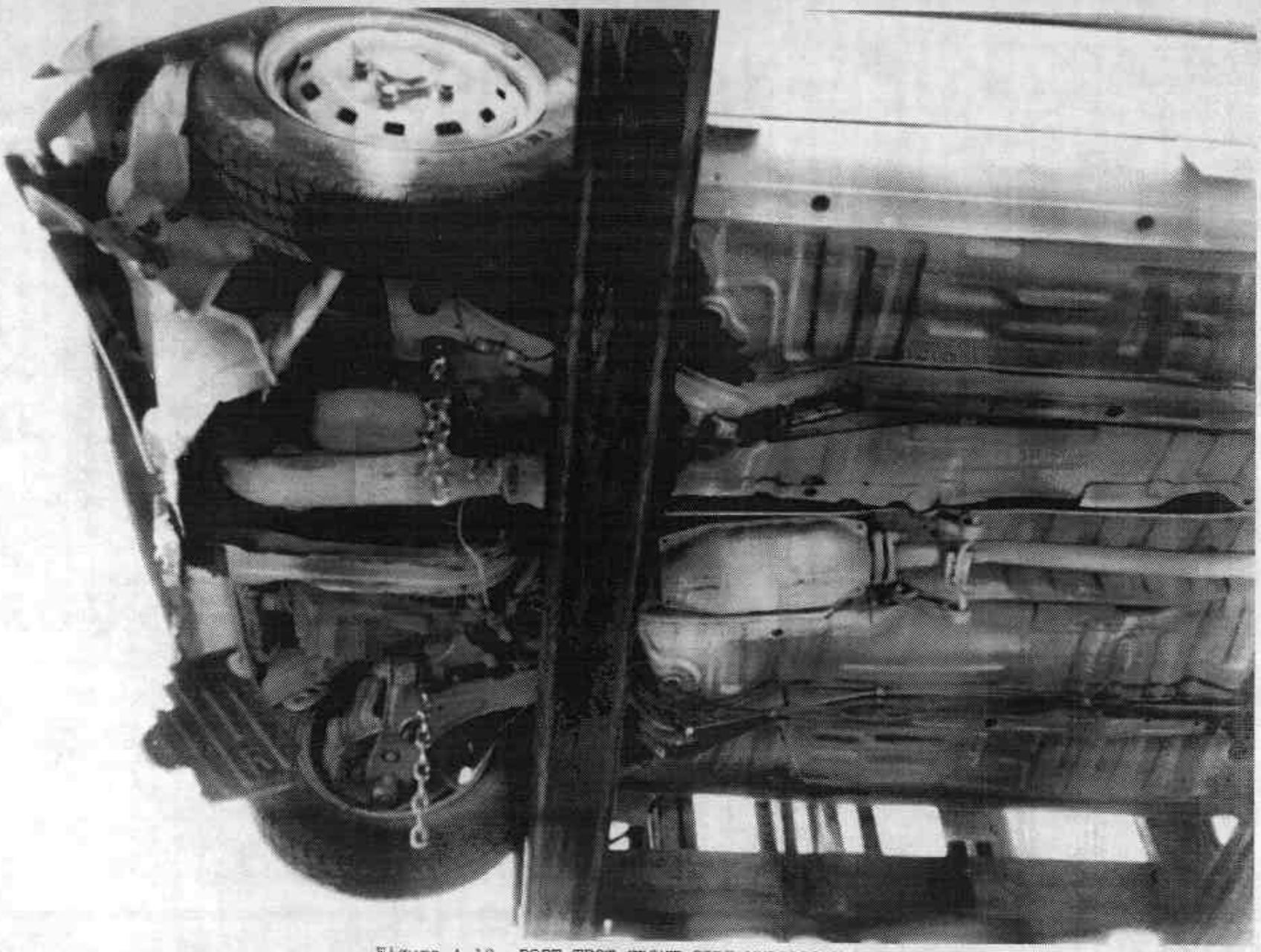

Figure A-19 POST-TEST FRONT SIDE UNDERBODY VIEW

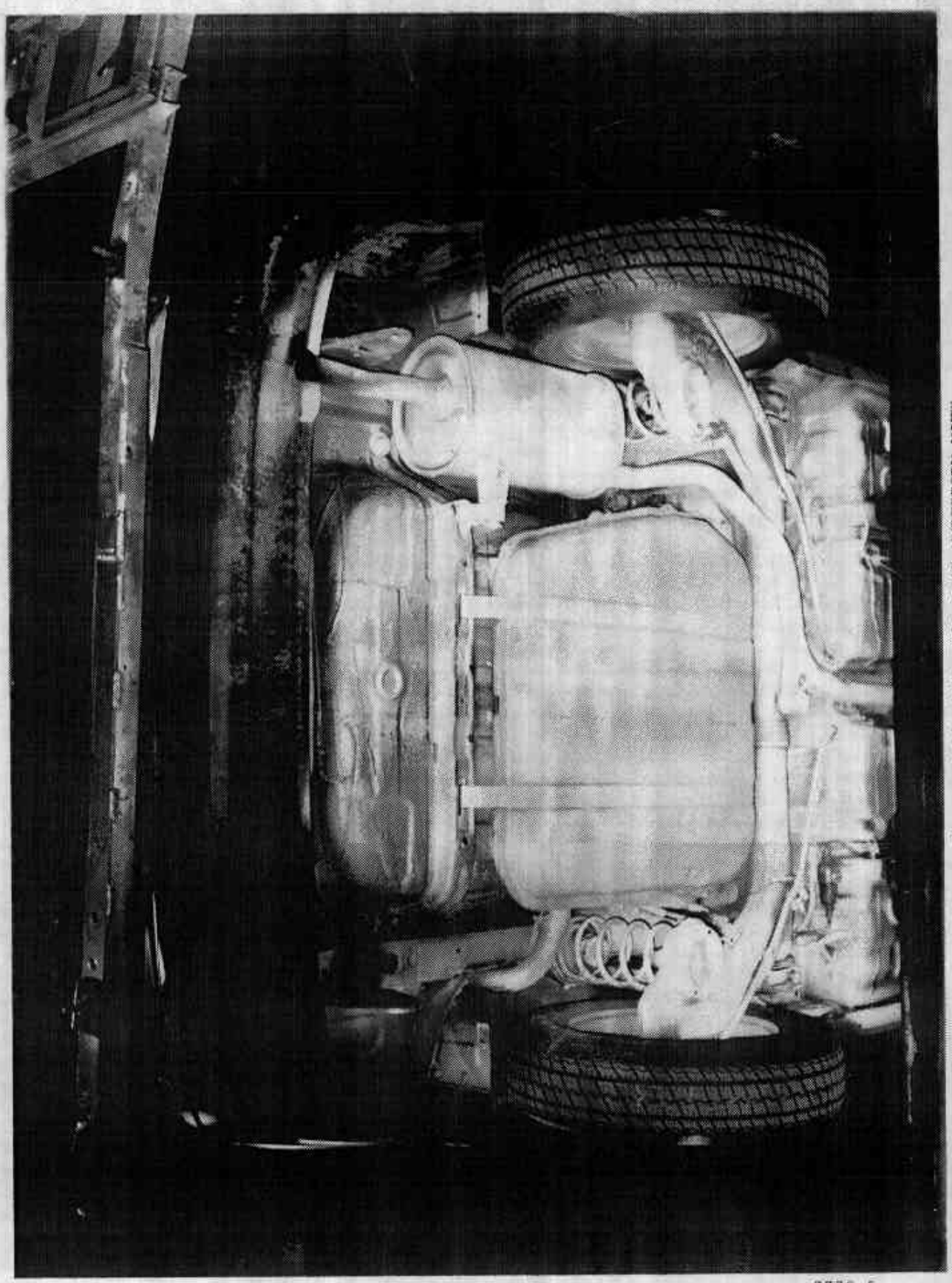

Figure A-20 PRE-TEST REAR UNDERBODY VIEW

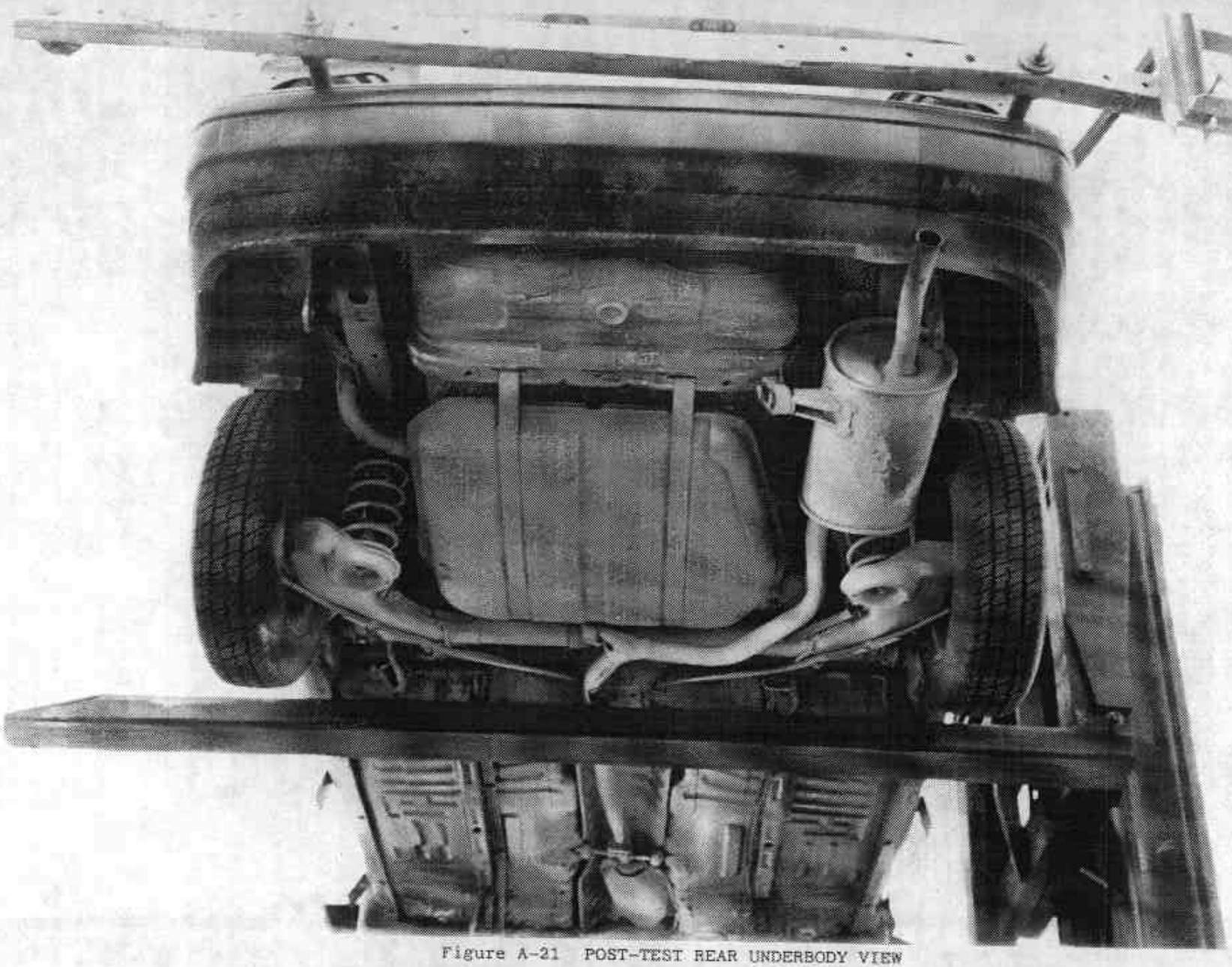

Figure A-21 POST-TEST REAR UNDERBODY VIEW

Figure A-22 PRE-TEST DRIVER POSITION VIEW

Figure A-23 POST-TEST DRIVER POSITION VIEW

Figure A-24 PRE-TEST PASSENGER POSITION VIEW

Figure A-25 POST-TEST PASSENGER POSITION VIEW

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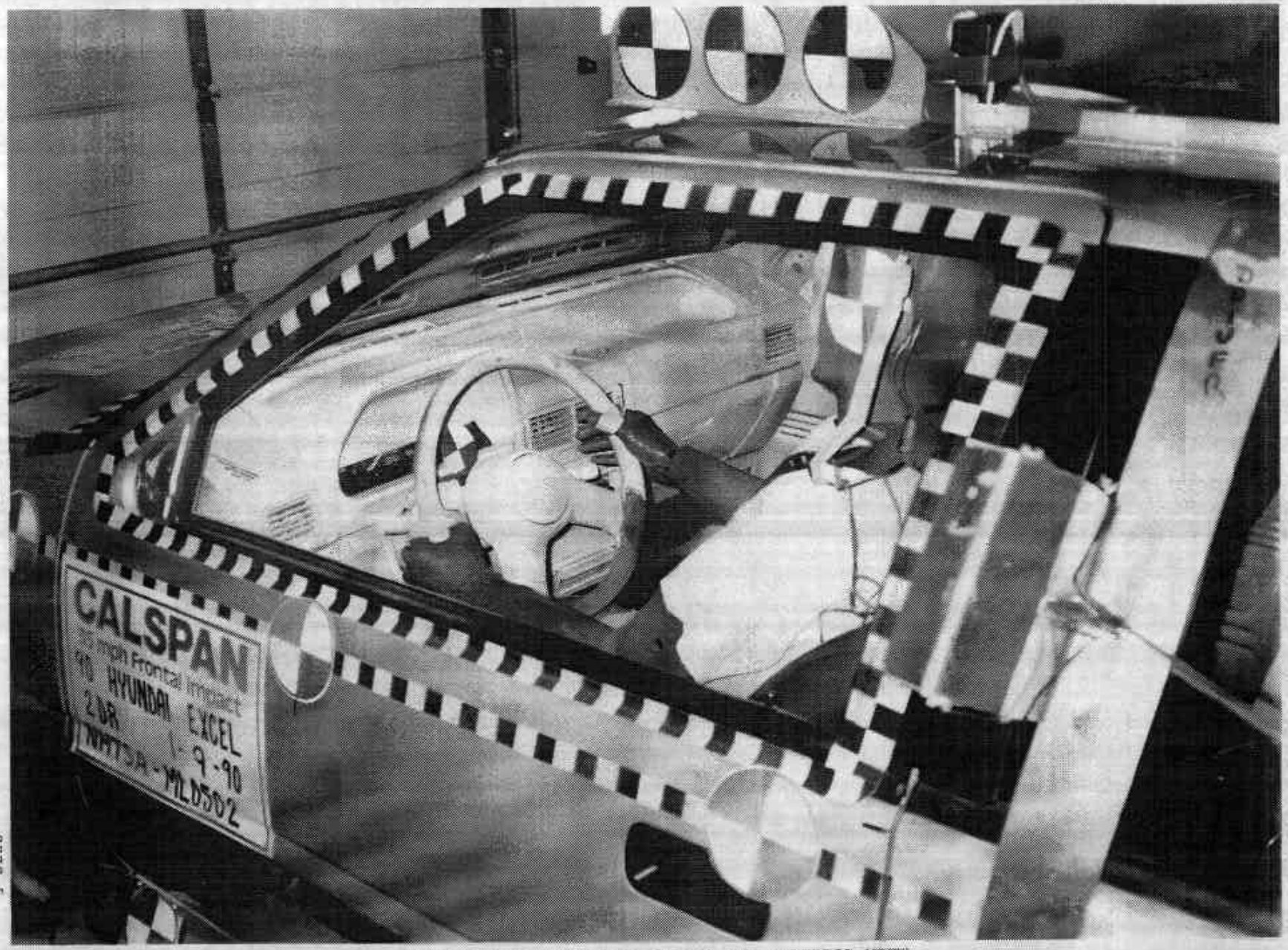


Figure A-26 PRE-TEST DRIVER AND INTERIOR VIEW

Figure A-27 POST-TEST DRIVER AND INTERIOR VIEW

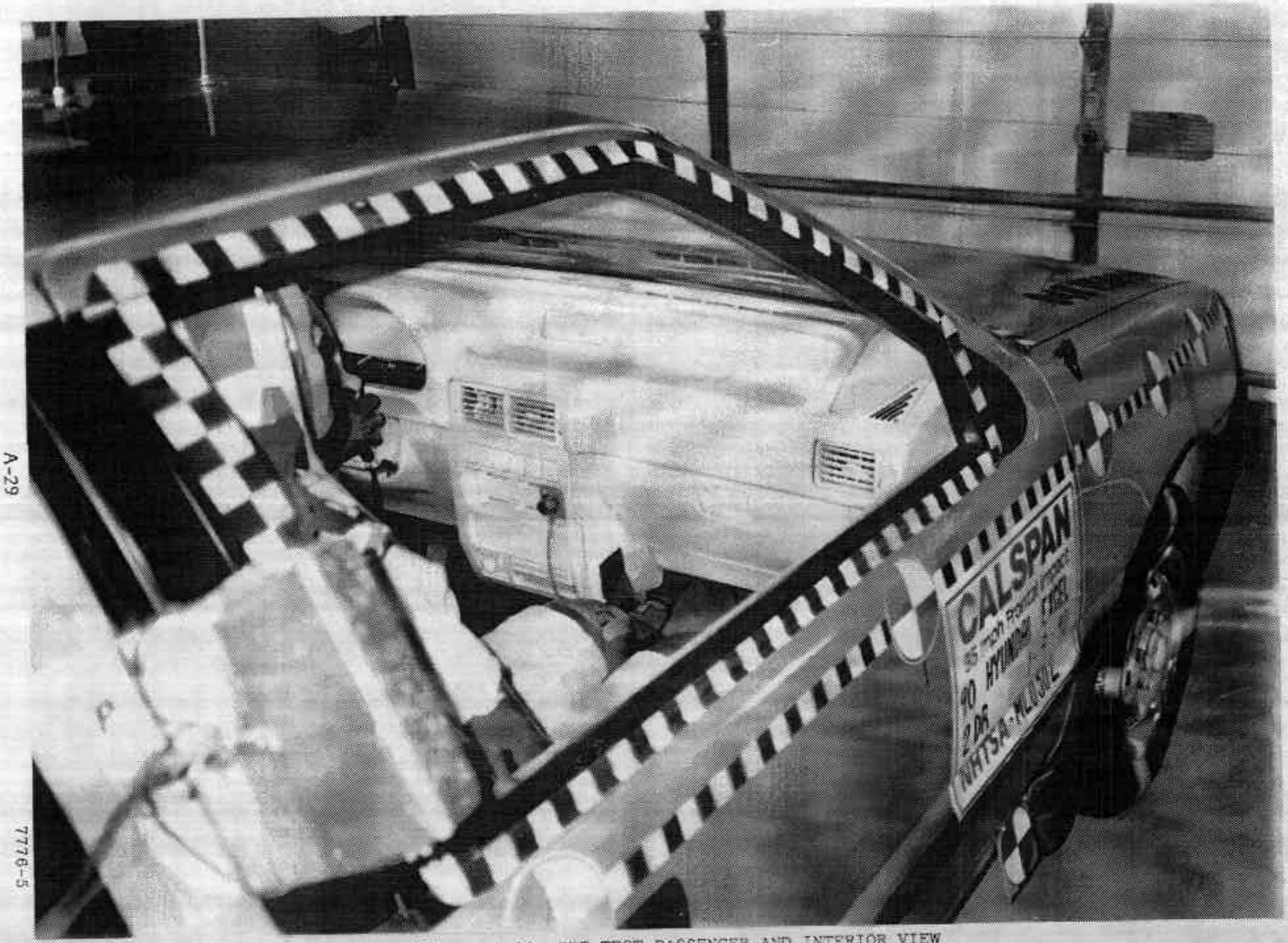


Figure A-28 PRE-TEST PASSENGER AND INTERIOR VIEW

7716-5

Figure A-29 POST-TEST PASSENGER AND INTERIOR VIEW

7776-5

Figure A-30 IMPACT VIEW

Appendix B

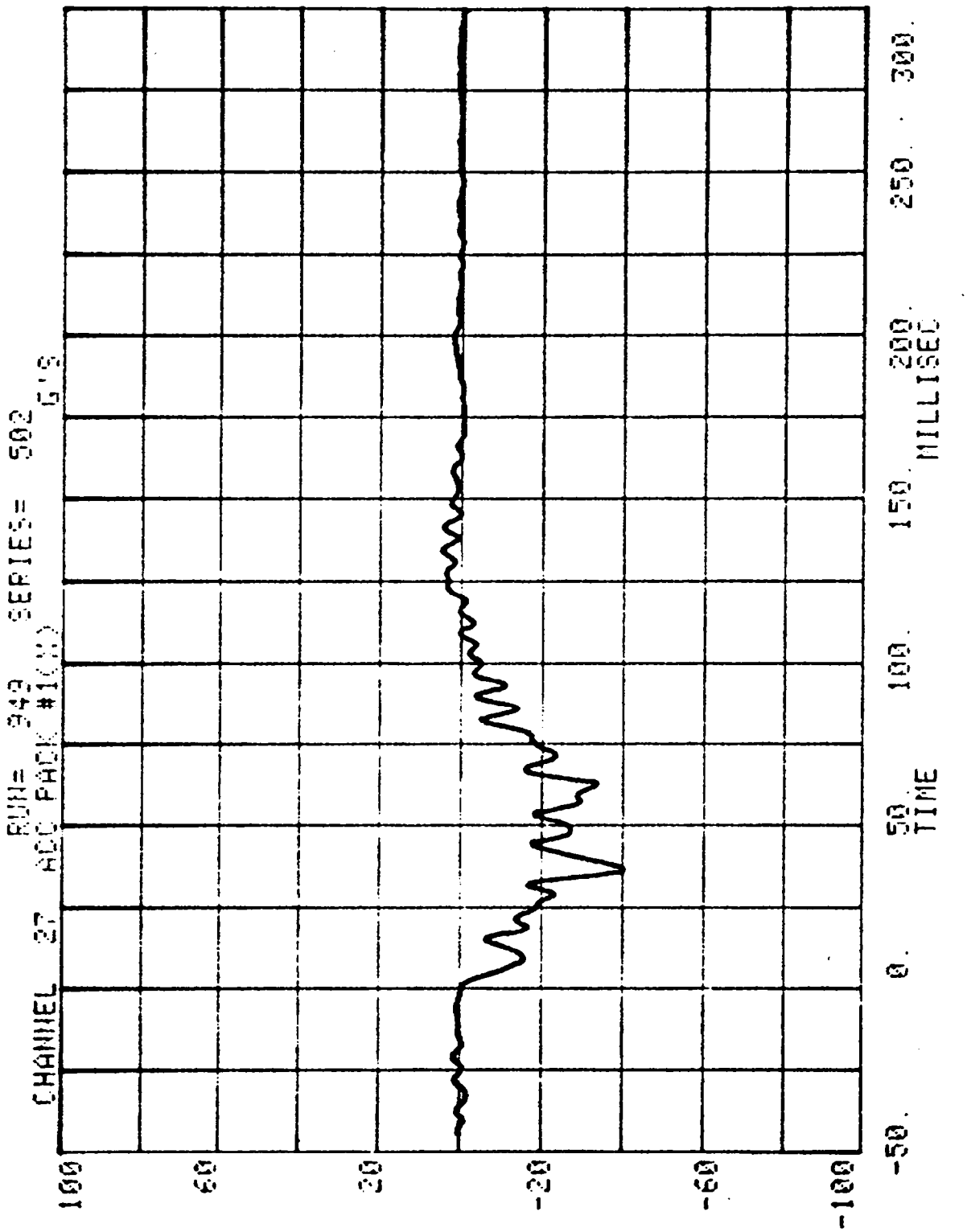
VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

TEST NO. ML0502

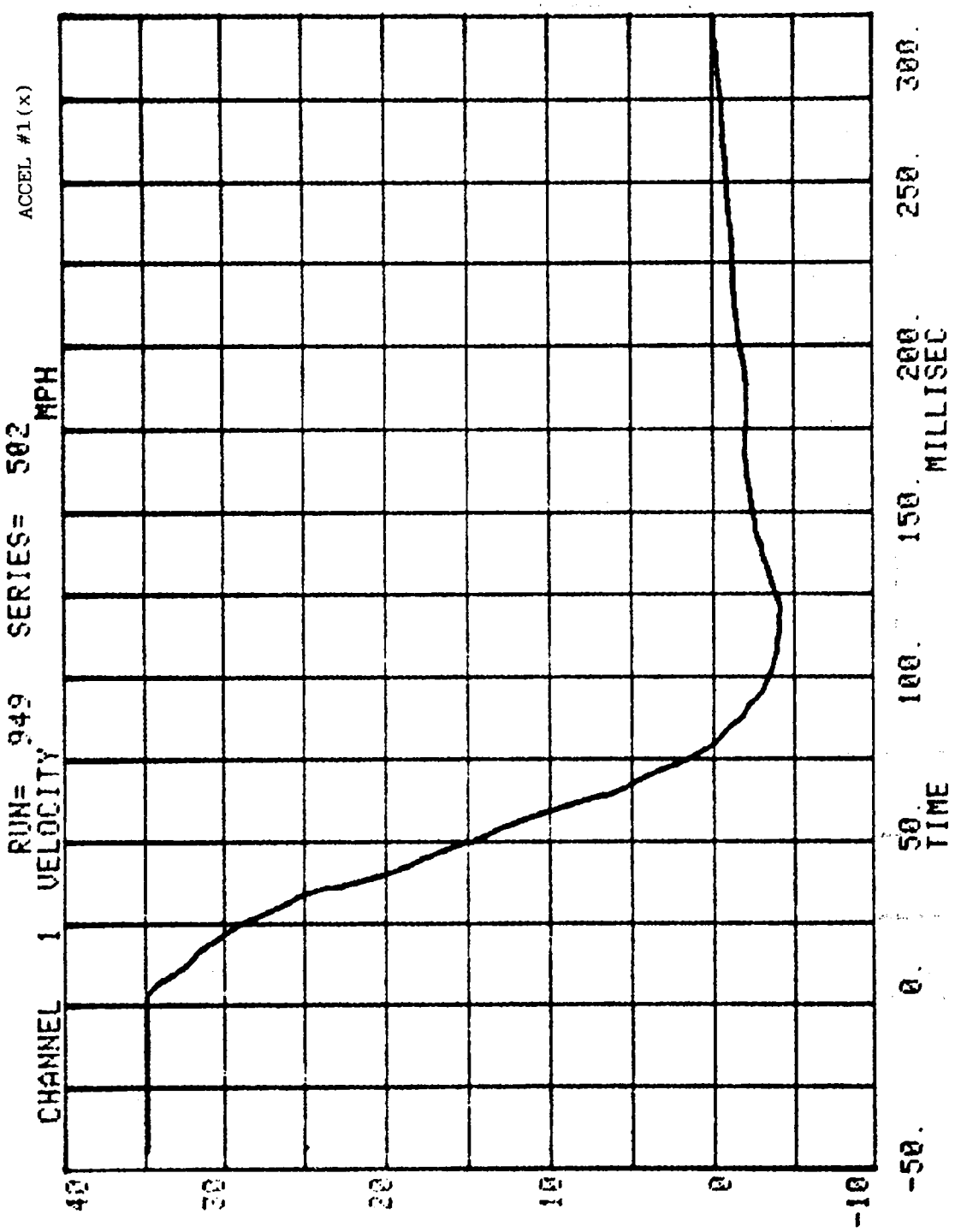
VEHICLE DATA

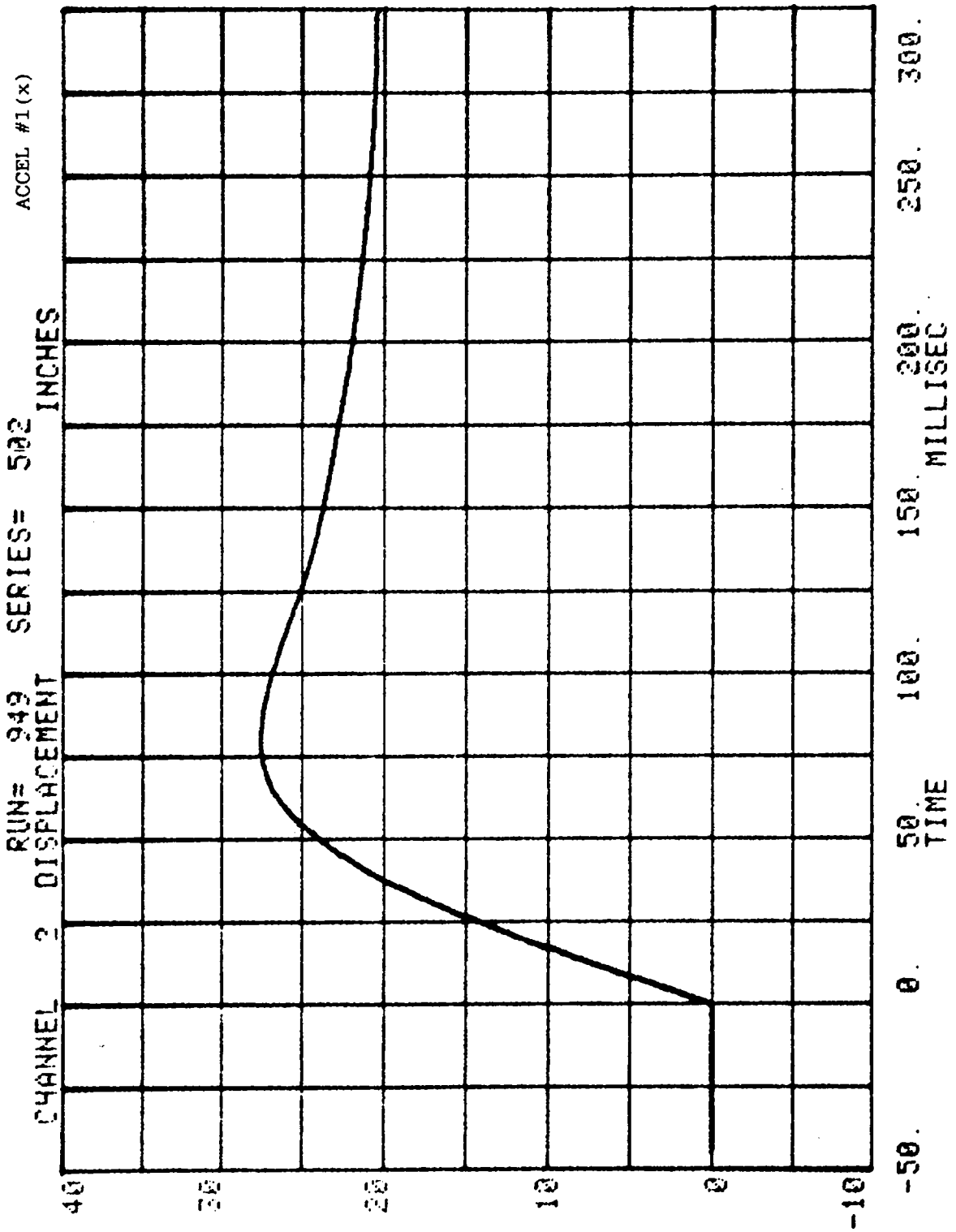
FILTER CHANNEL CLASS

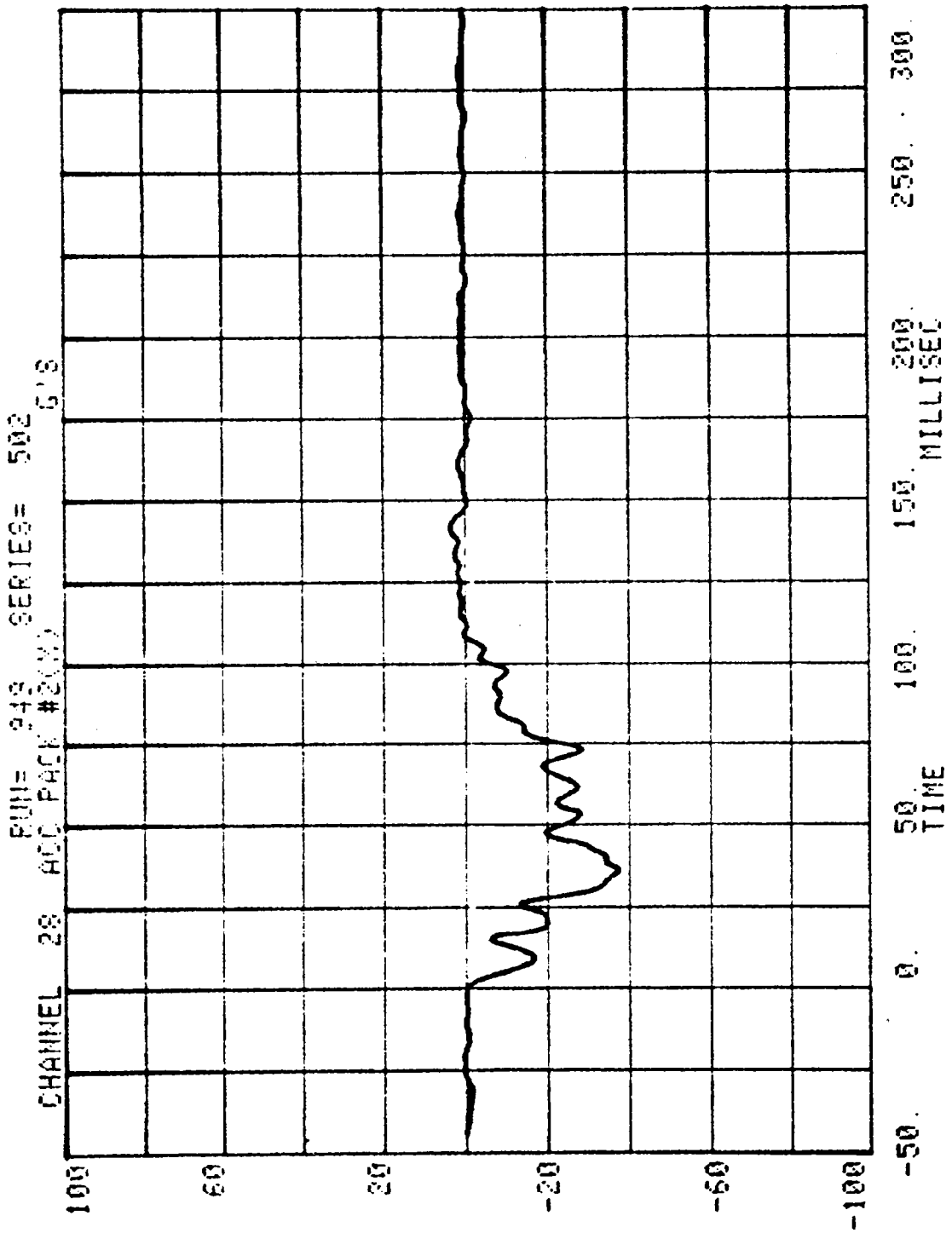
60


CHANNEL 27 ACC PACK #1(X)
RUN= 242 SERIES= 502
G'S
100
50
0
-50
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

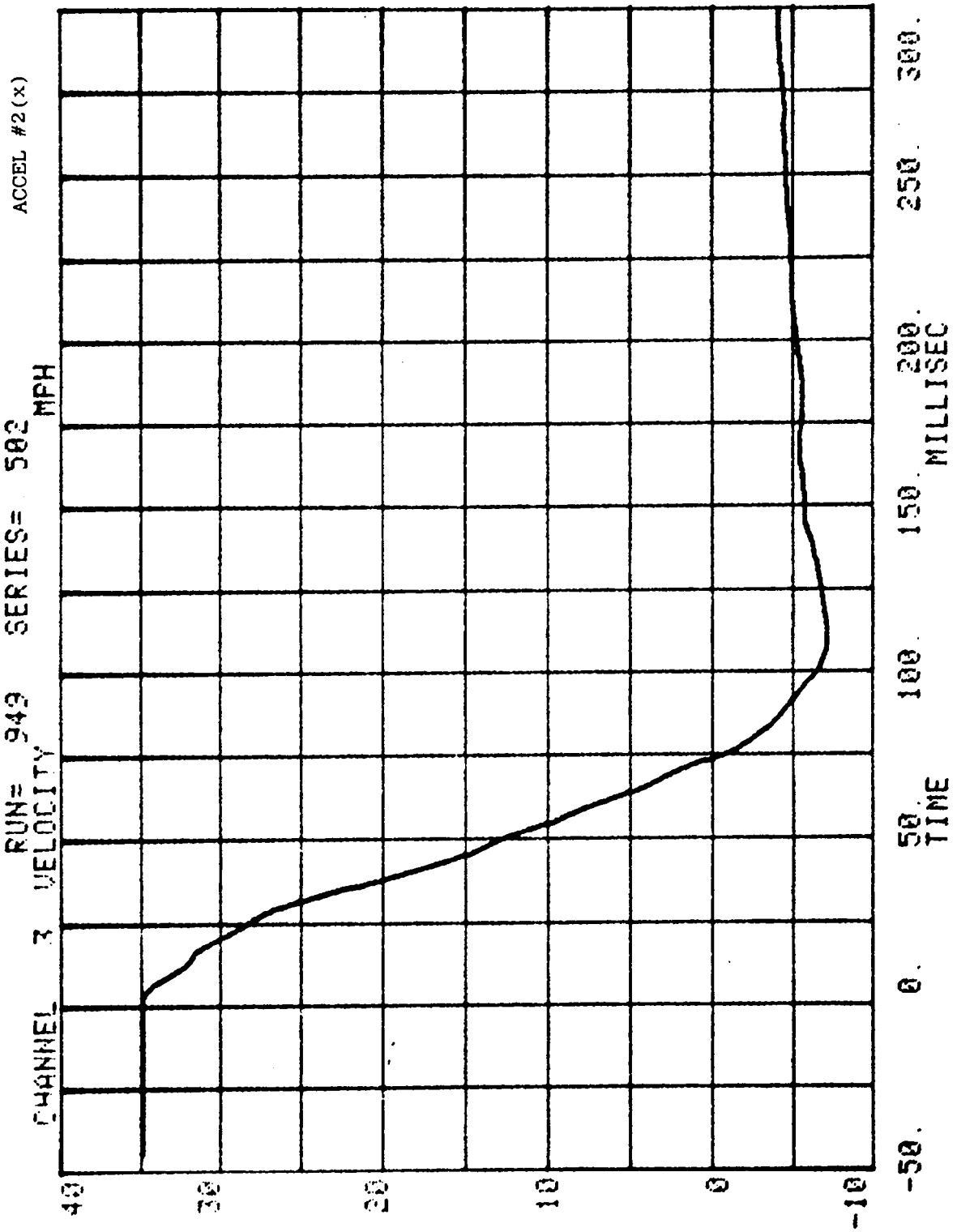
7776-5

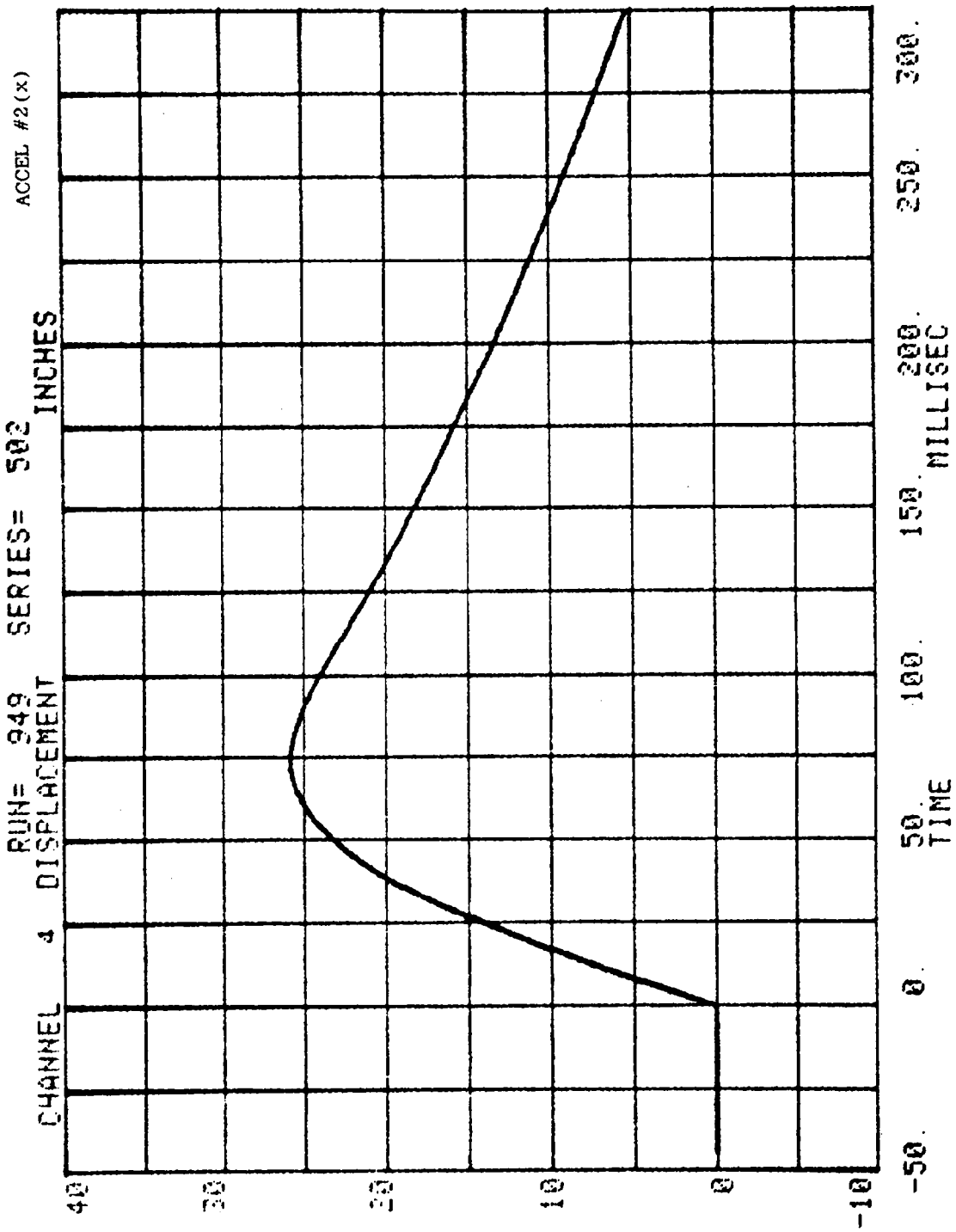

ACCEL #1(X)
CHANNEL 1 VELOCITY
RUN= 949 SERIES= 502
MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


ACCEL #1(x)
CHANNEL 2 DISPLACEMENT
RUN= 949 SERIES= 502 INCHES
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

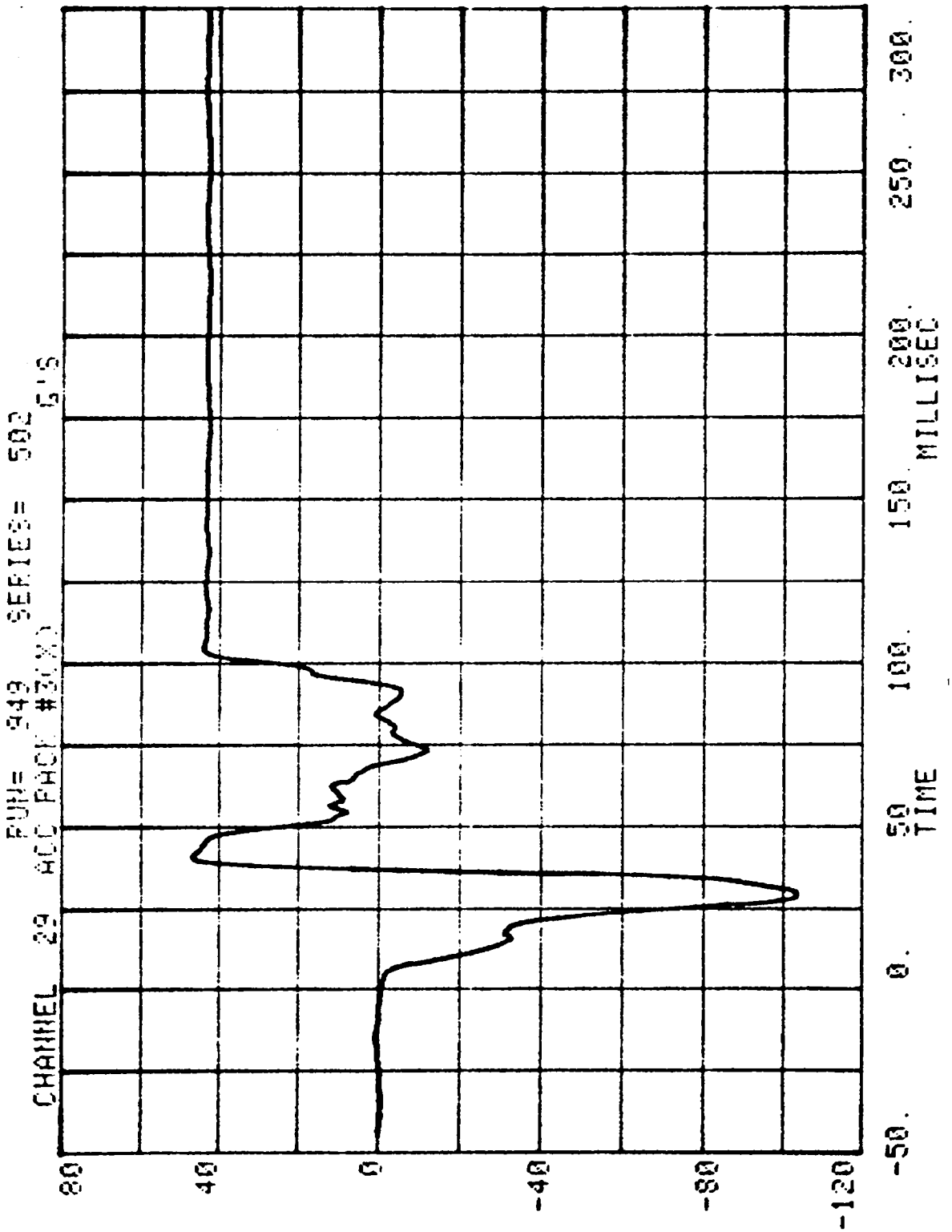

CHANNEL 28 ACC PACK #2(X)
RUN= 243 SERIES= 502
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

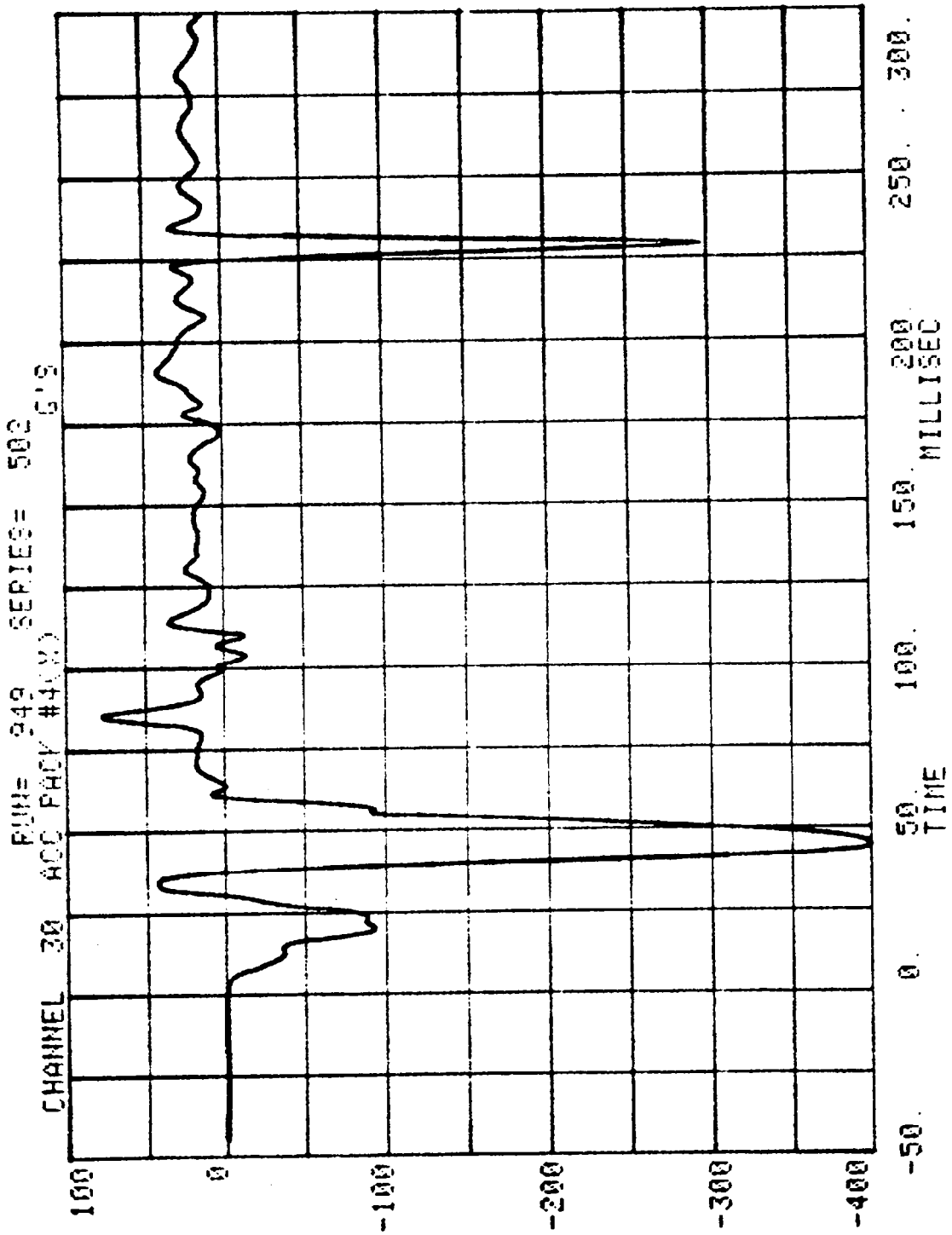
7776-5


ACCEL #2(x)
CHANNEL 3 VELOCITY
RUN= 942 SERIES= 502 MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

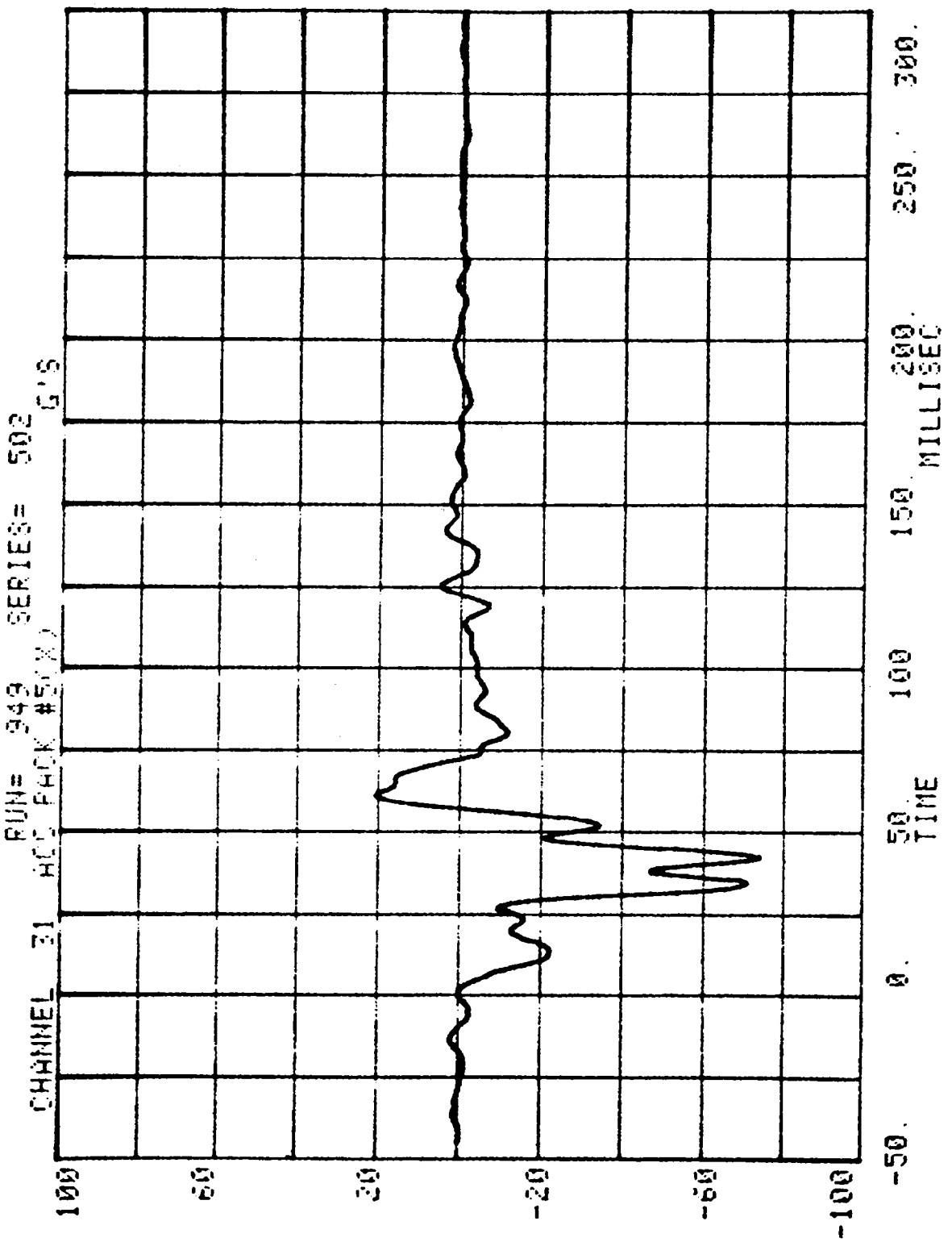

CHANNEL 4 DISPLACEMENT
RUN= 949 SERIES= 502
INCHES
ACCEL #2(x)
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

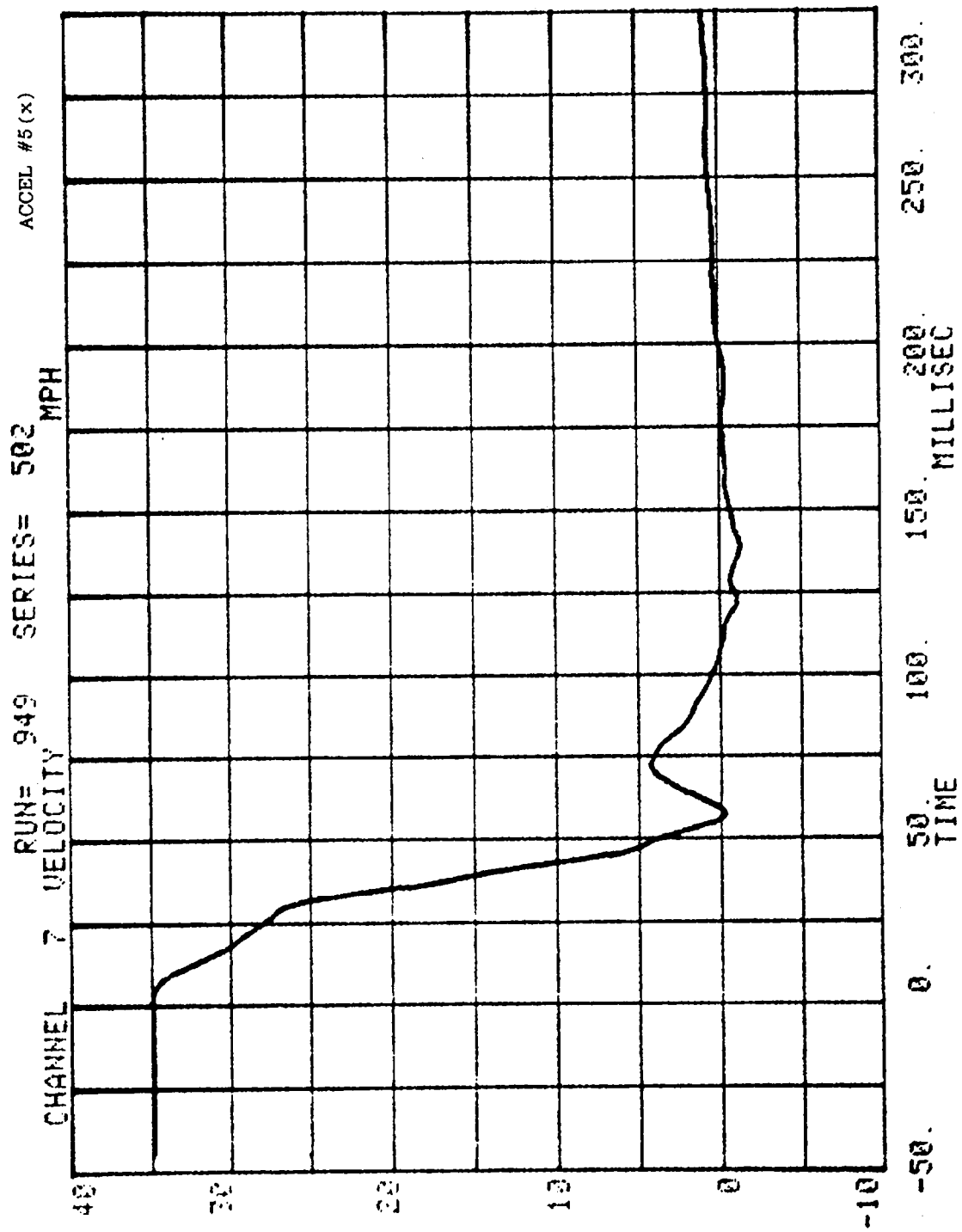

CHANNEL 29
RUN= 343
SERIES= 502
G'S
80
40
0
-40
-80
-120
-50.
0.
50
100
150
200
250
300
TIME
MILLISEC


CHANNEL 30
RUN= 949
SERIES= 502
G'S
MILLISEC
TIME
100
0
-100
-200
-300
-400
-50
0
50
100
150
200
250
300

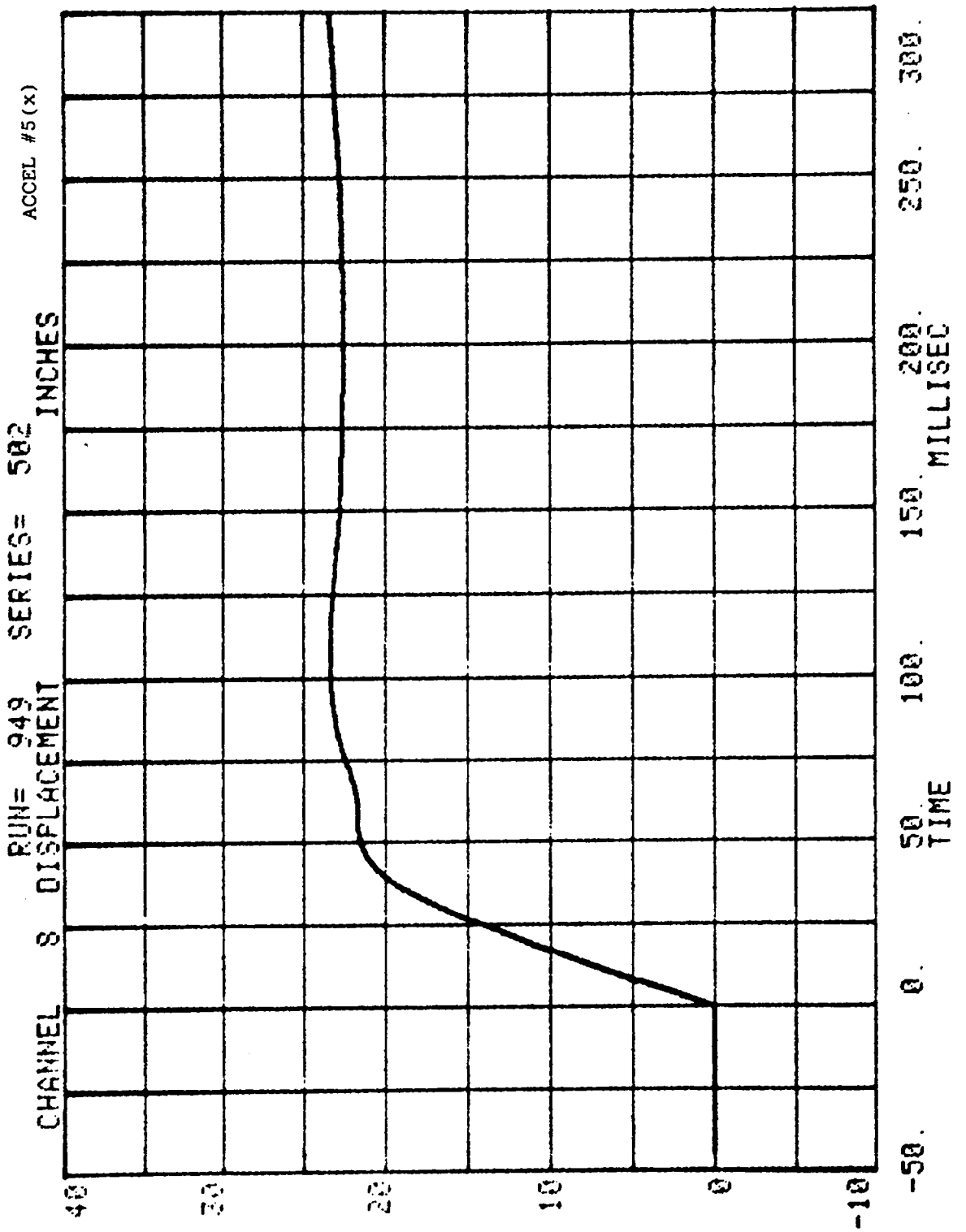
7776-5


CHANNEL 31
RUN= 343
SERIES= 502
G'S
-50.
0.
50.
100
150.
200.
250.
300.
TIME
MILLISEC
100
60
30
-20
-60
-100

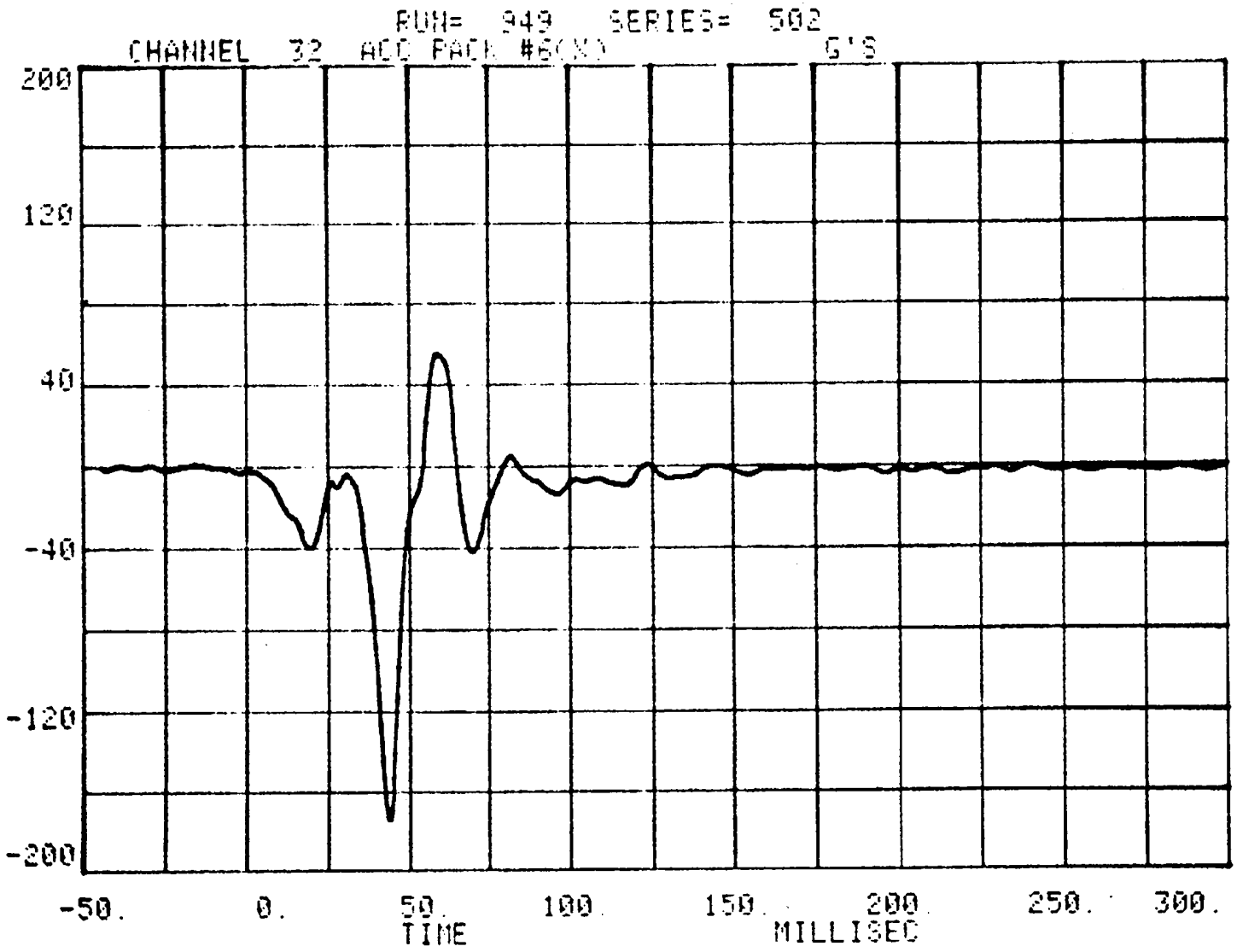
7776-5


ACCEL #5(x)
CHANNEL 7 VELOCITY
RUN= 949 SERIES= 502
MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

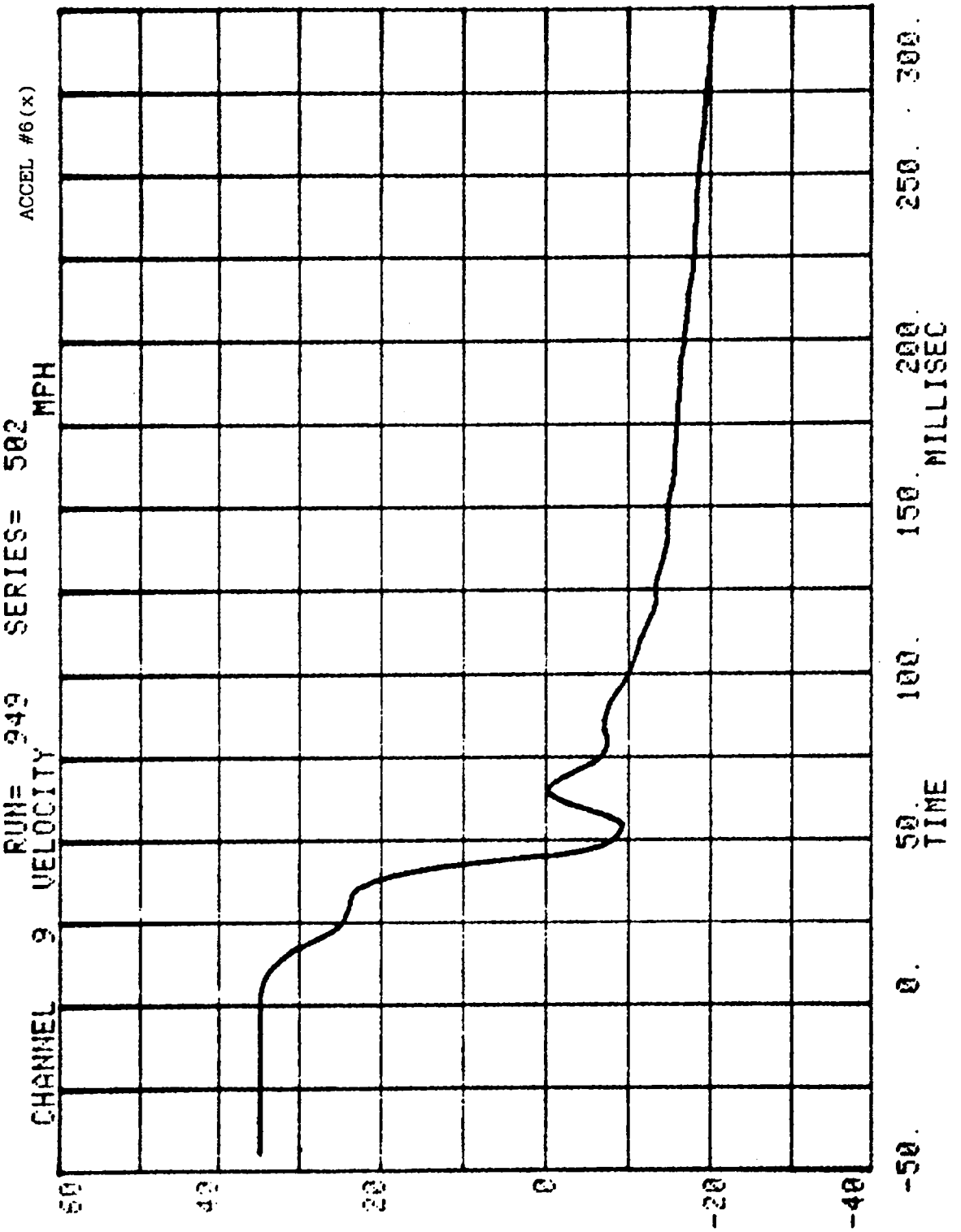
7776-5

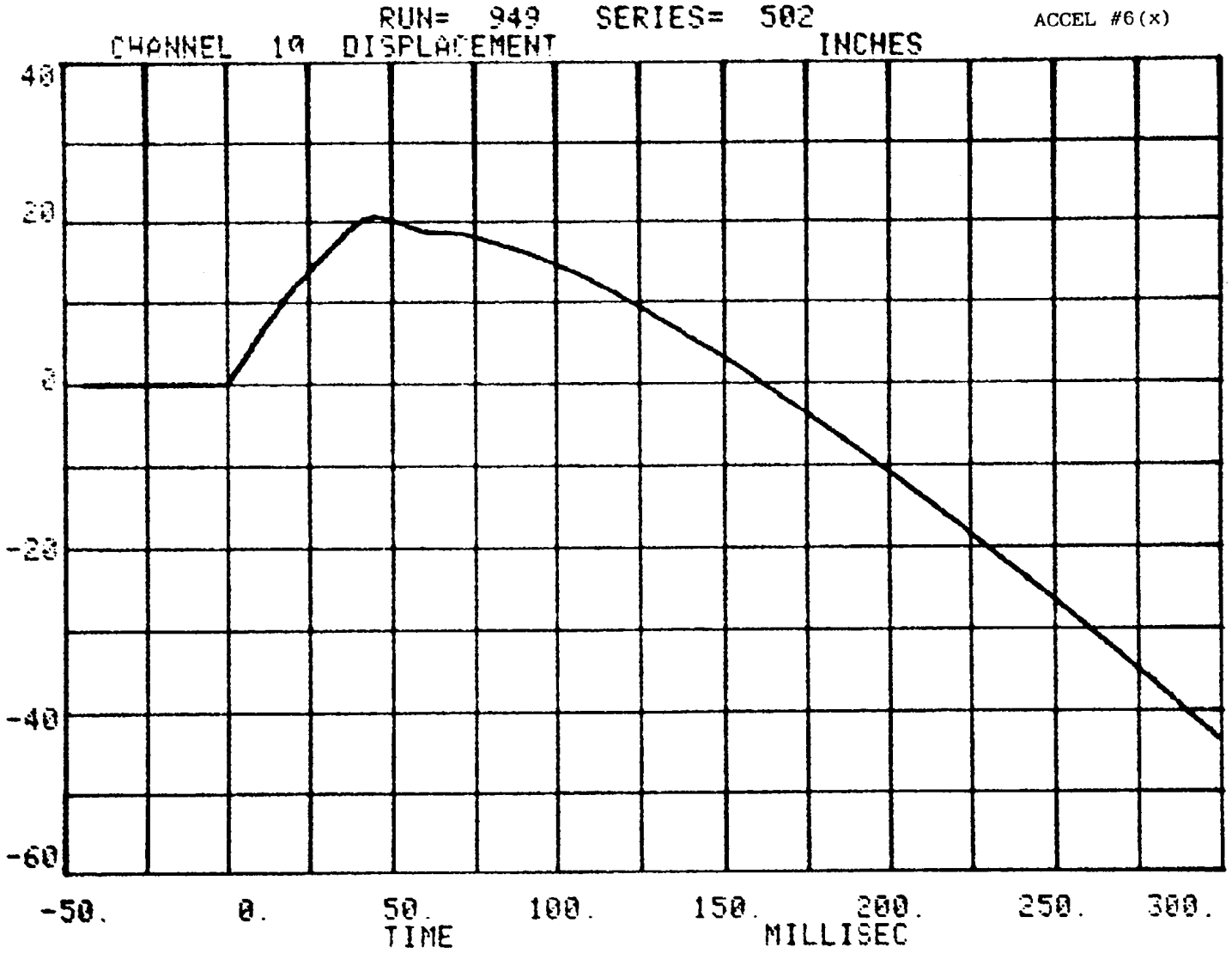

CHANNEL S DISPLACEMENT
RUN= 949 SERIES= 502
INCHES
ACCEL #5(x)
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

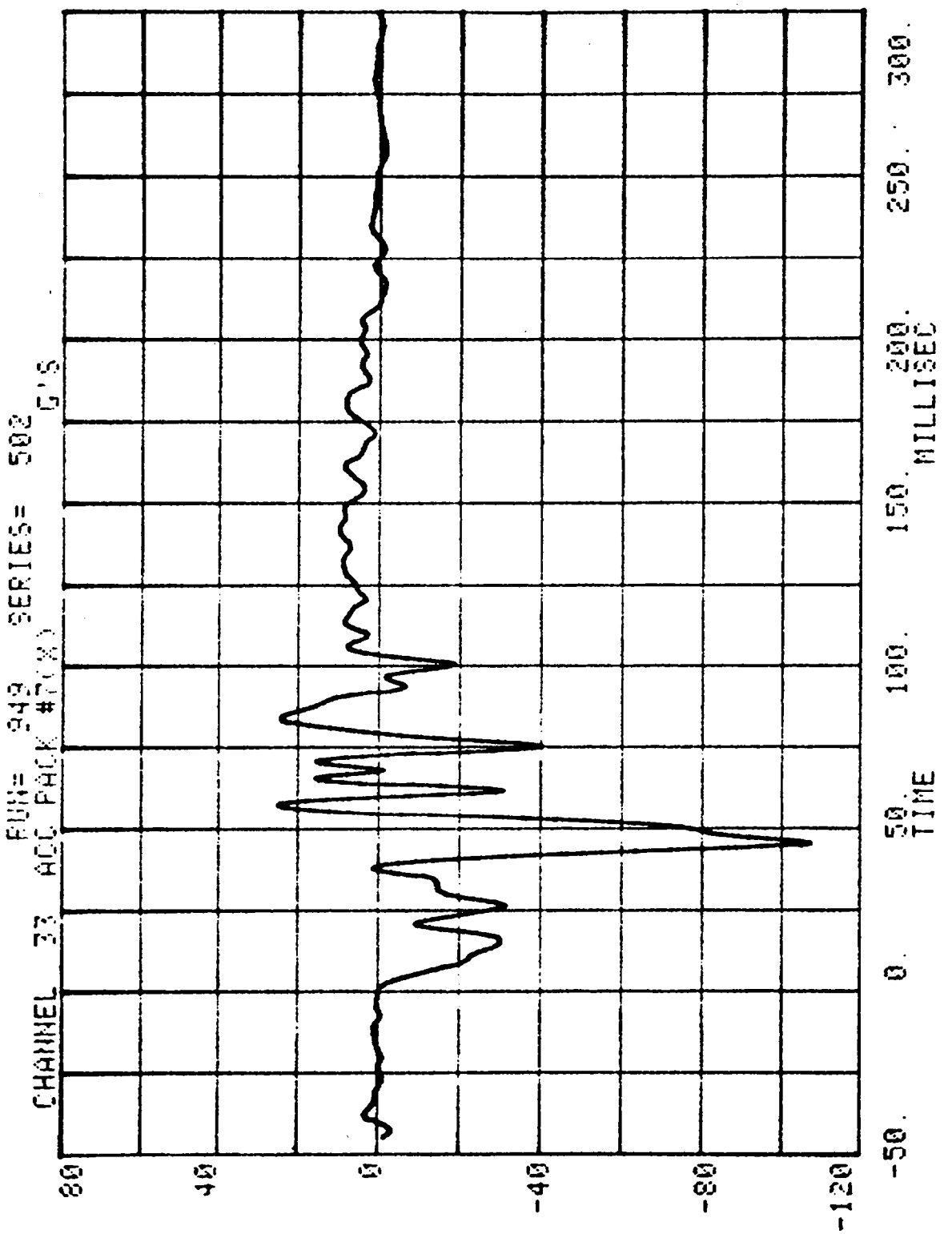

RUN= 949 SERIES= 502
CHANNEL 32 ACC PACK #6(X)
G'S
200
120
40
-40
-120
-200
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

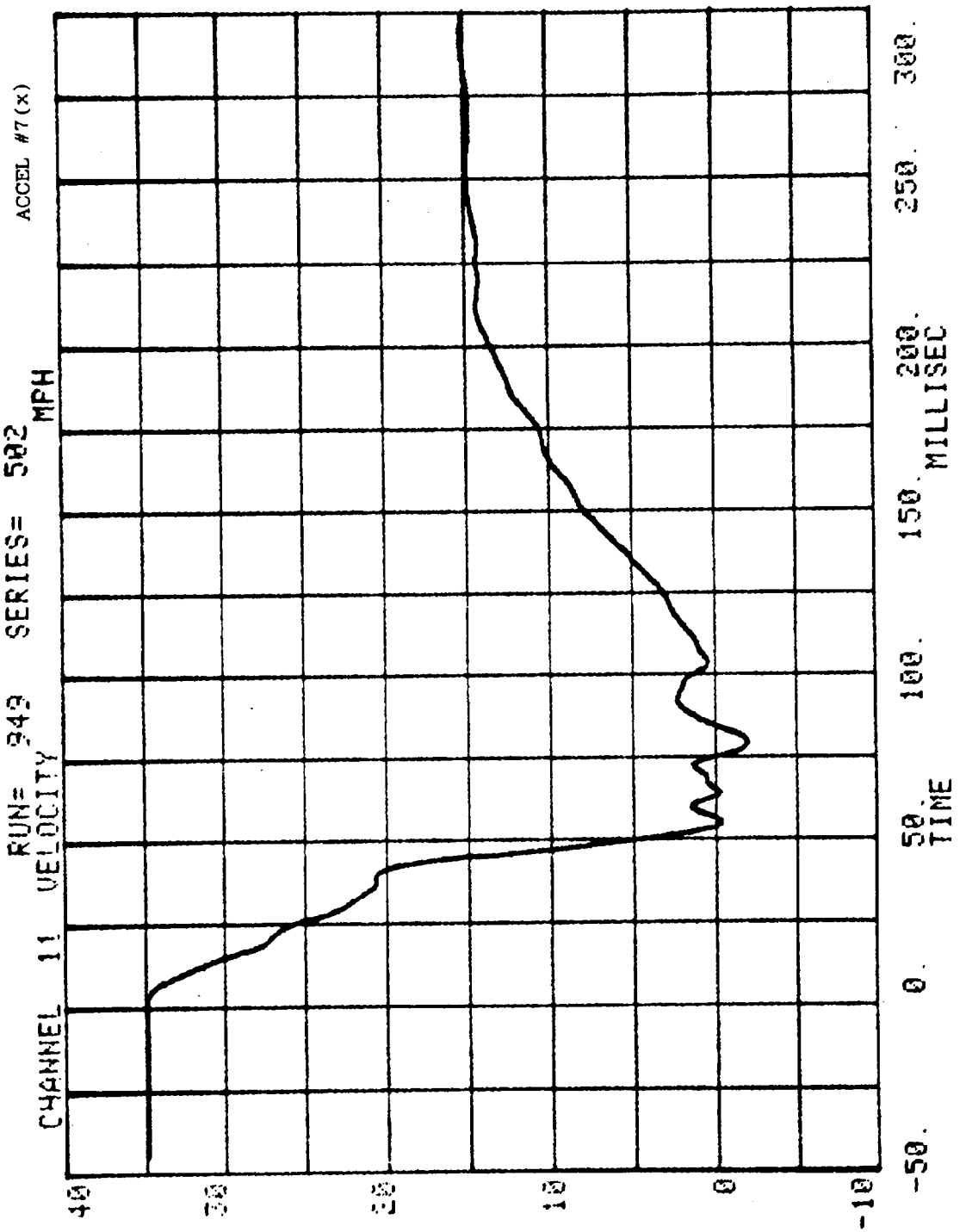
7776-5


ACCEL #6(x)
CHANNEL 9 VELOCITY
RUN= 249 SERIES= 502 MPH
60
40
20
0
-20
-40
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

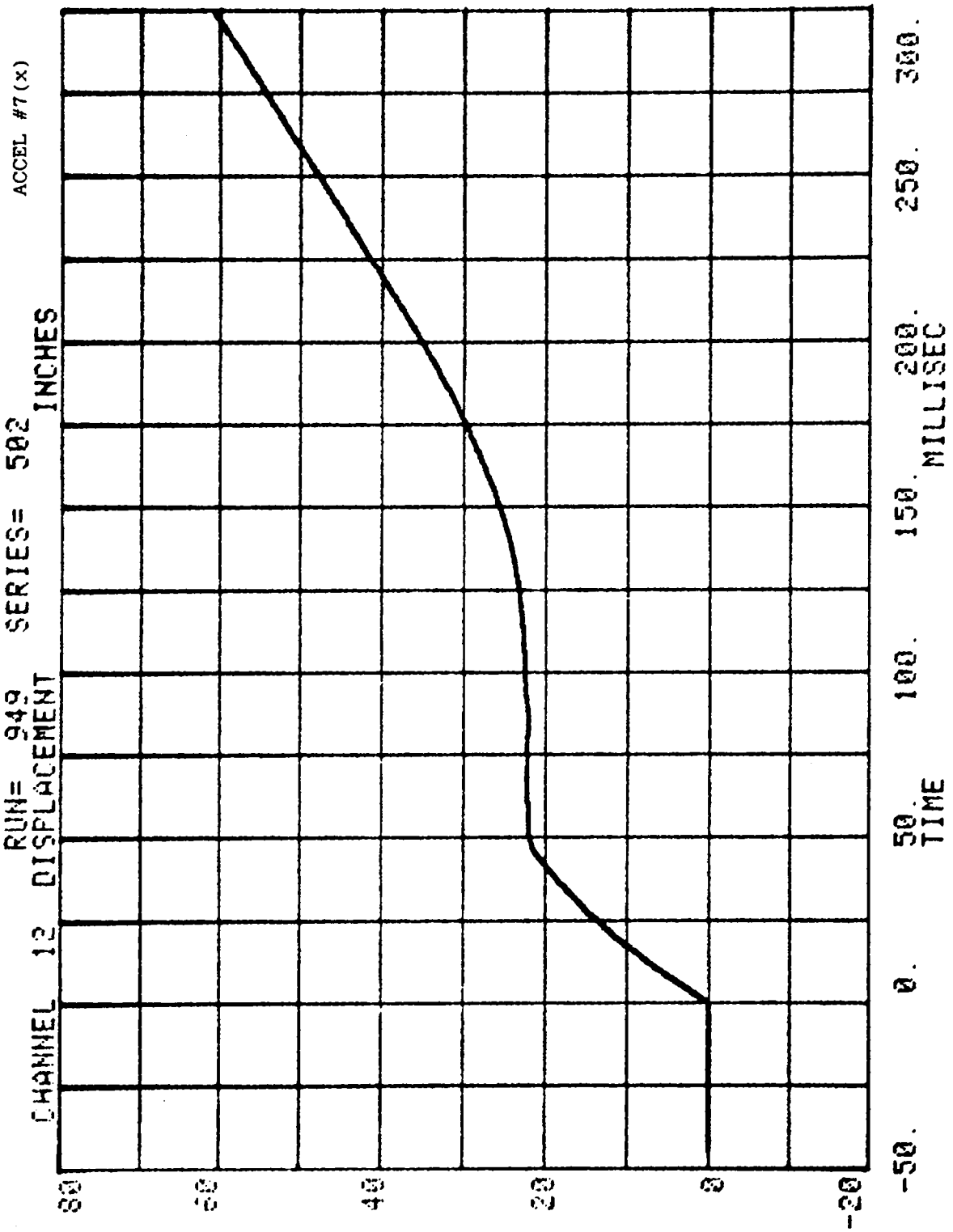

RUN= 949 SERIES= 502
ACCEL #6(x)
CHANNEL 10 DISPLACEMENT
INCHES
40
20
0
-20
-40
-60
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 33 ACC PACK #2 (X)
RUN= 349 SERIES= 502
G'S
80
40
0
-40
-80
-120
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


ACCEL #7(x)
RUN= 942 SERIES= 502
CHANNEL 11 VELOCITY
MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


ACCEL #7(x)
CHANNEL 12 DISPLACEMENT
RUN= 949 SERIES= 502
INCHES
80
60
40
20
0
-20
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

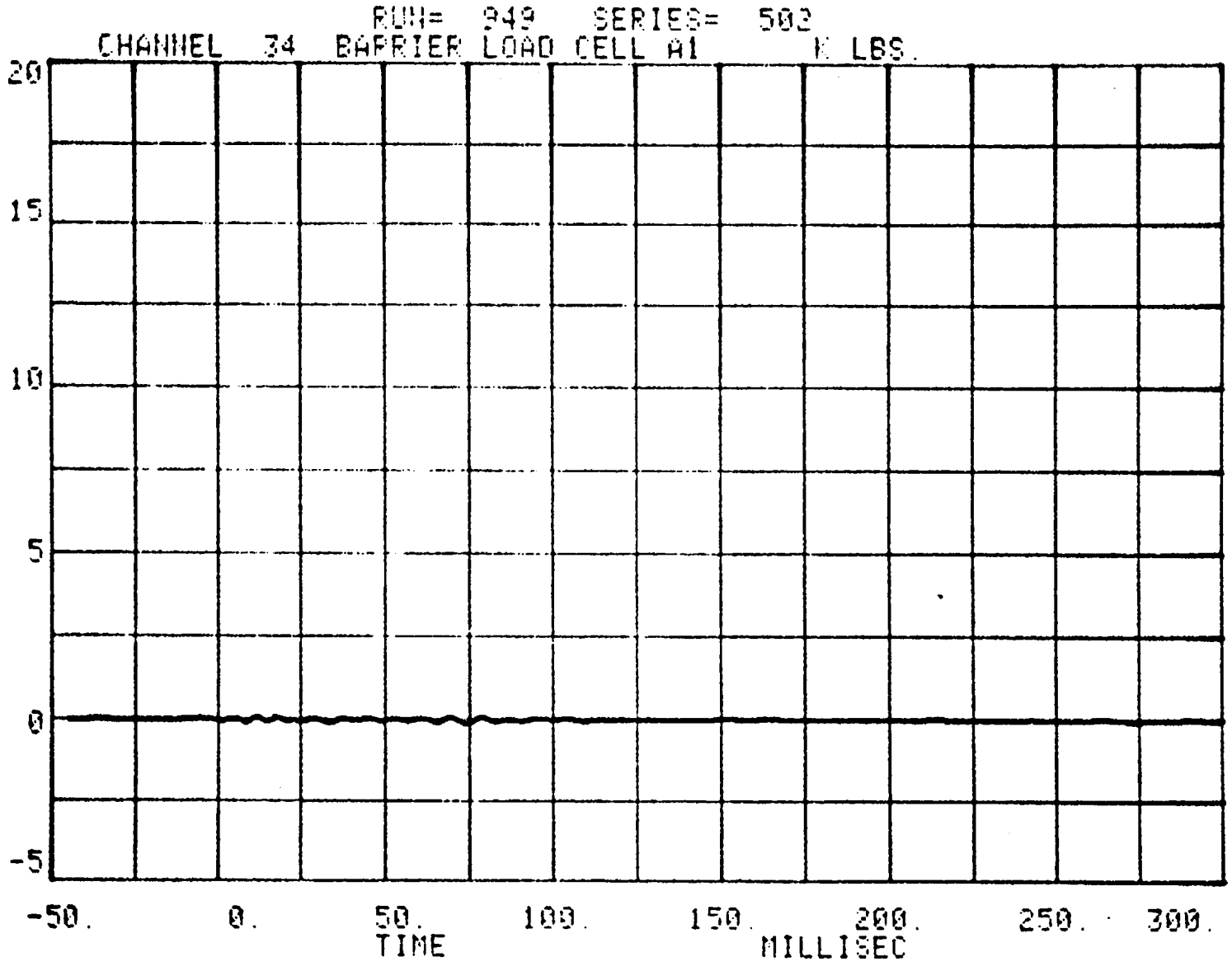
7776-5

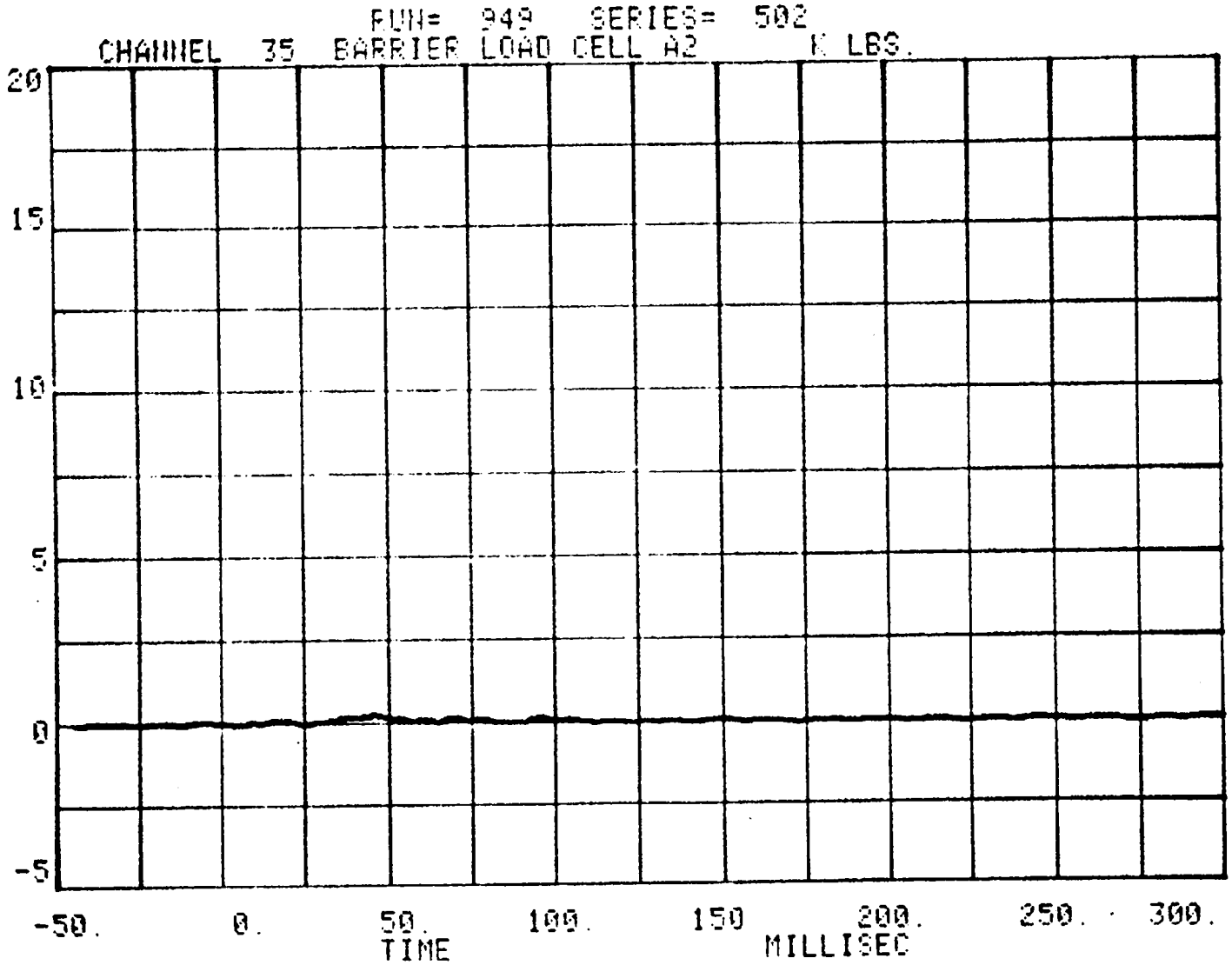
TEST NO. ML0502

LOAD CELL BARRIER DATA

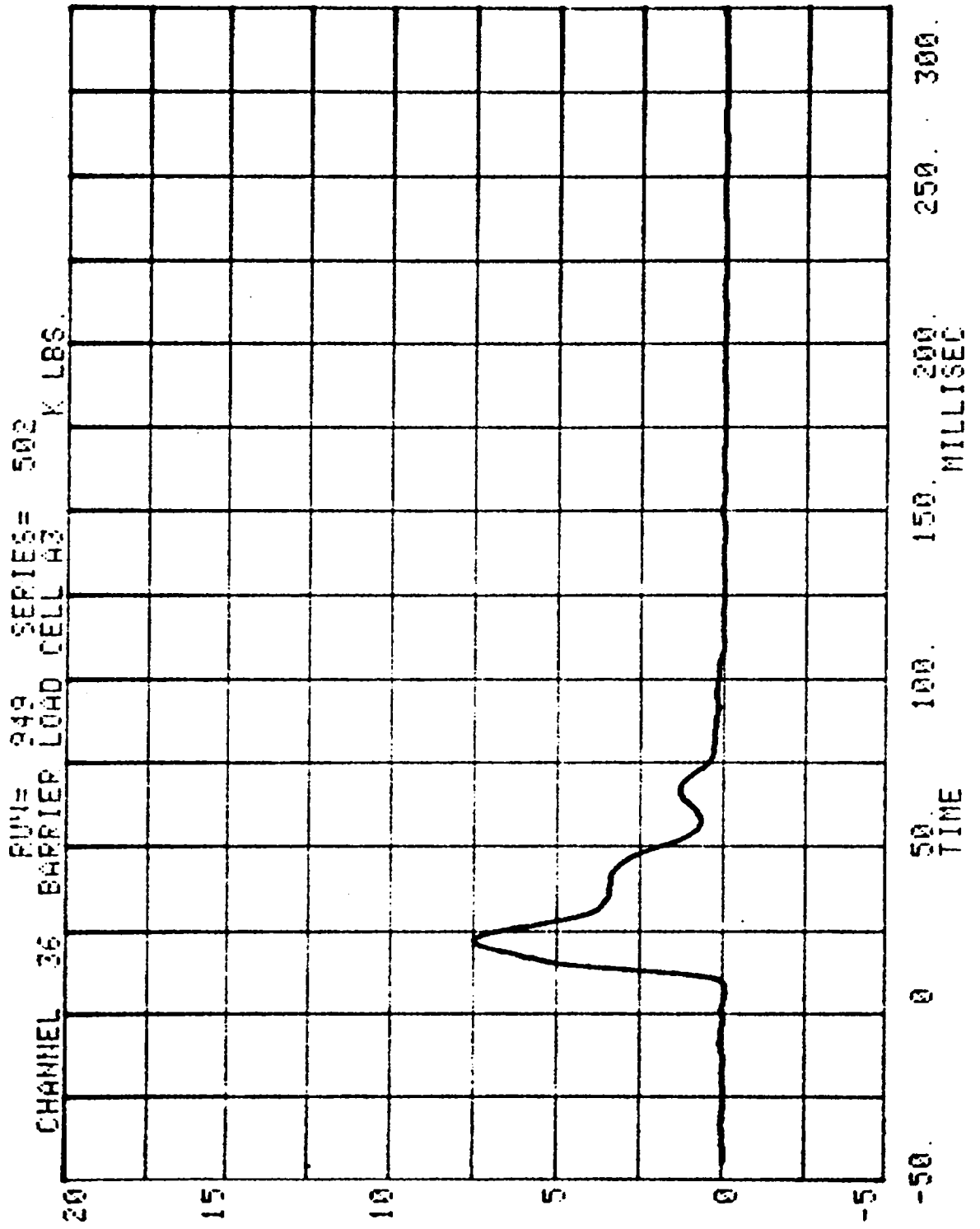
FILTER CHANNEL CLASS

60

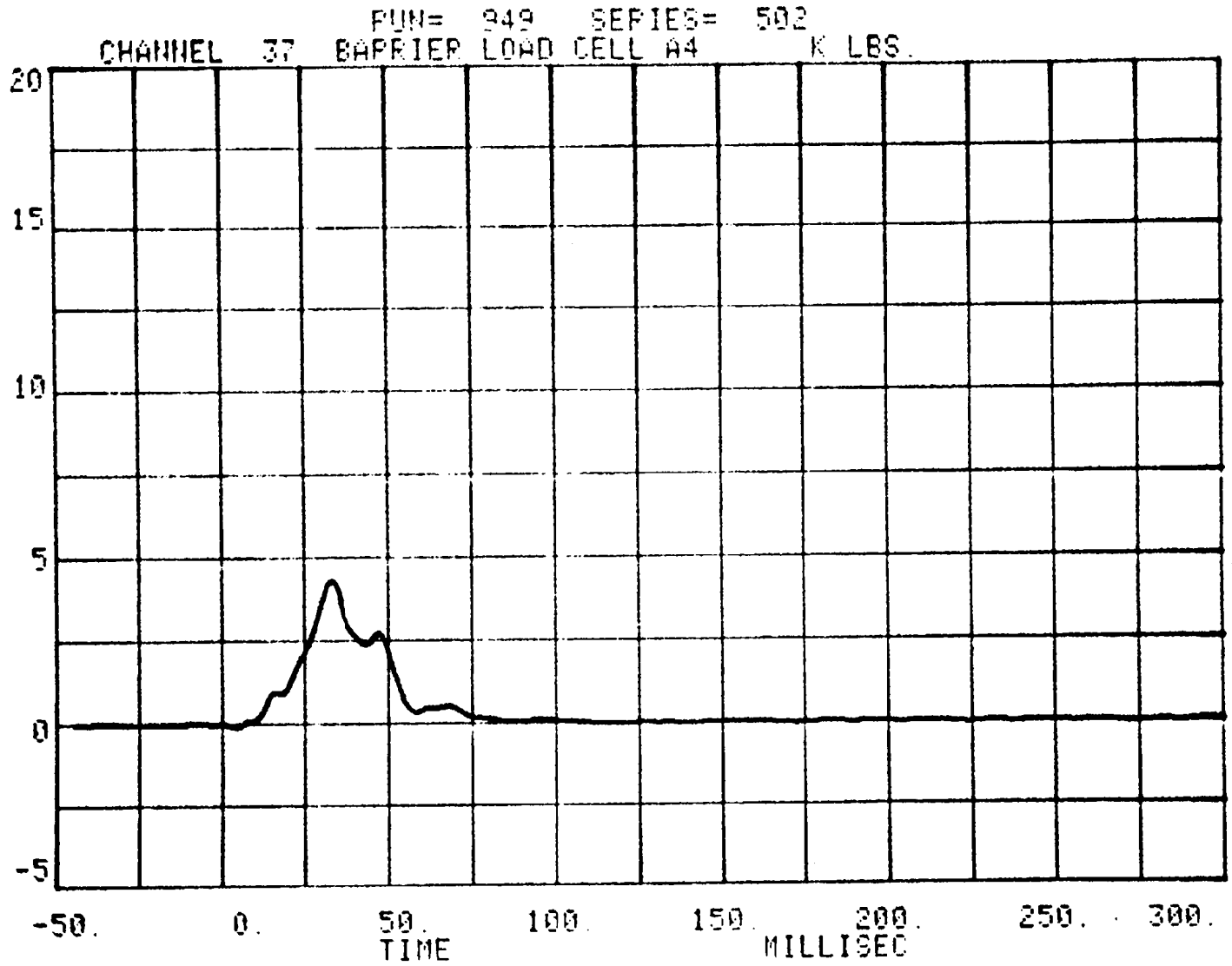

RUN= 949 SERIES= 502
CHANNEL 34 BARRIER LOAD CELL A1 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

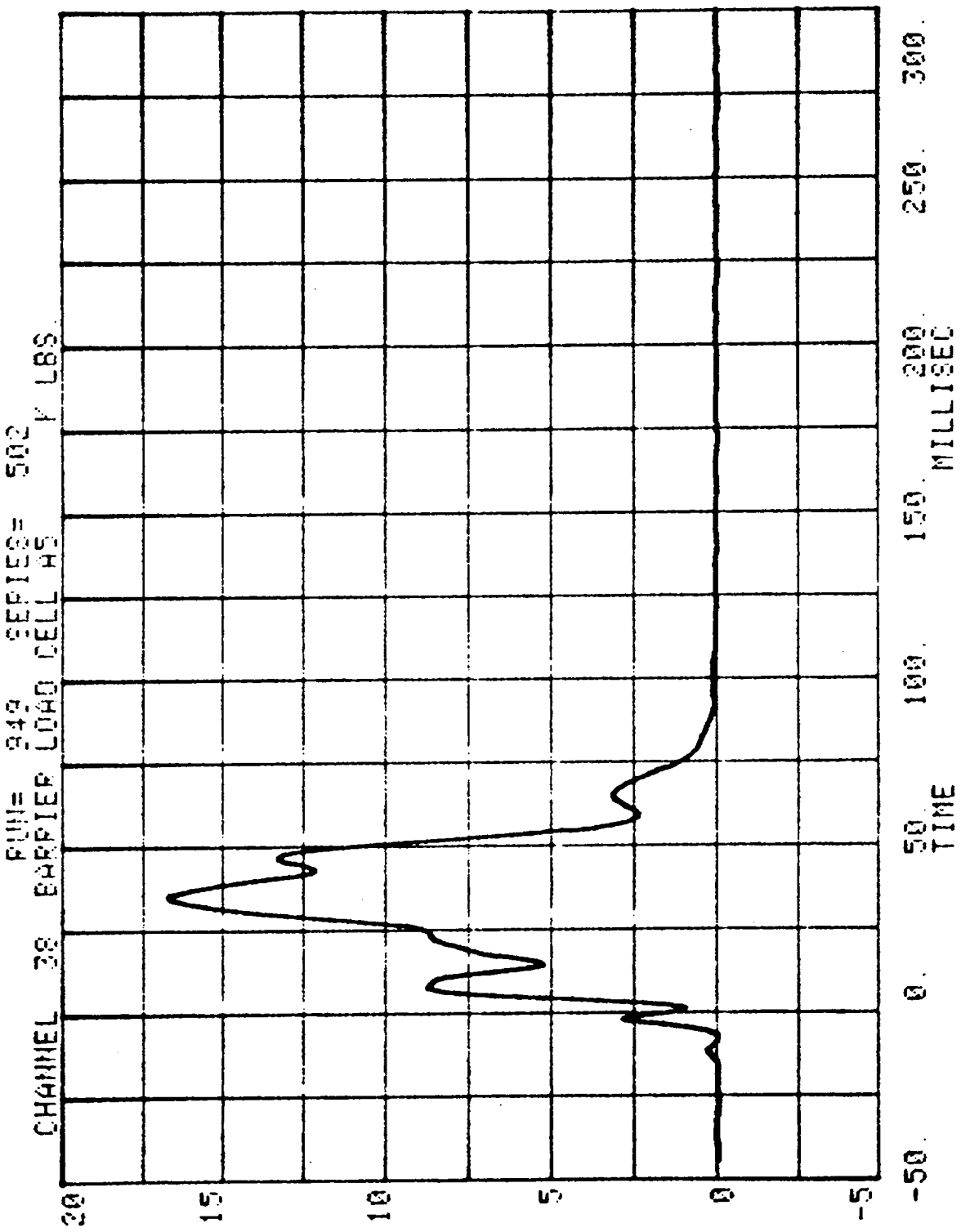

RUN= 949 SERIES= 502
CHANNEL 35 BARRIER LOAD CELL A2 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150
200.
250.
300.
TIME
MILLISEC

7776-5

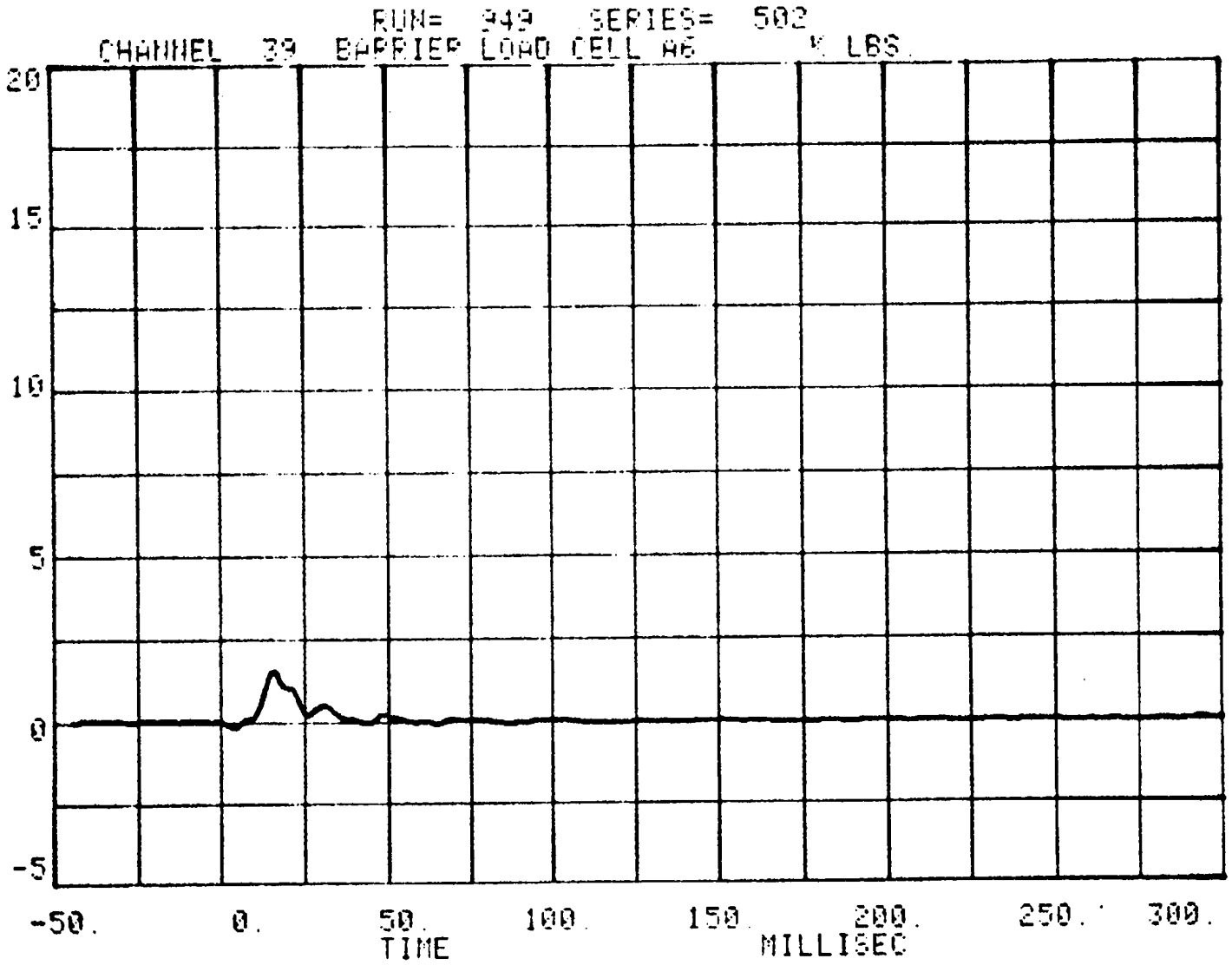

CHANNEL 36 BARRIER LOAD CELL #3
RUN= 249 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

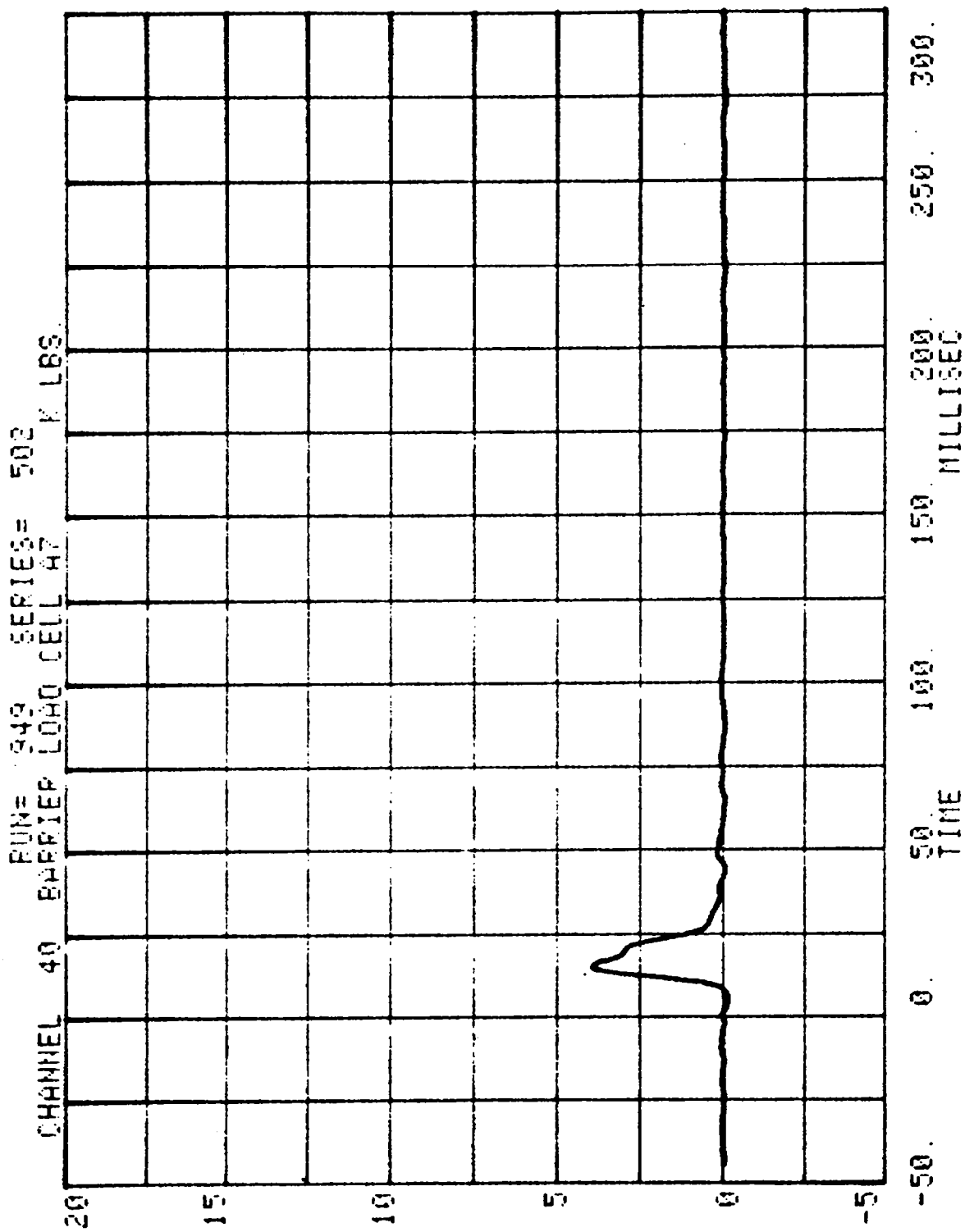
7776-5

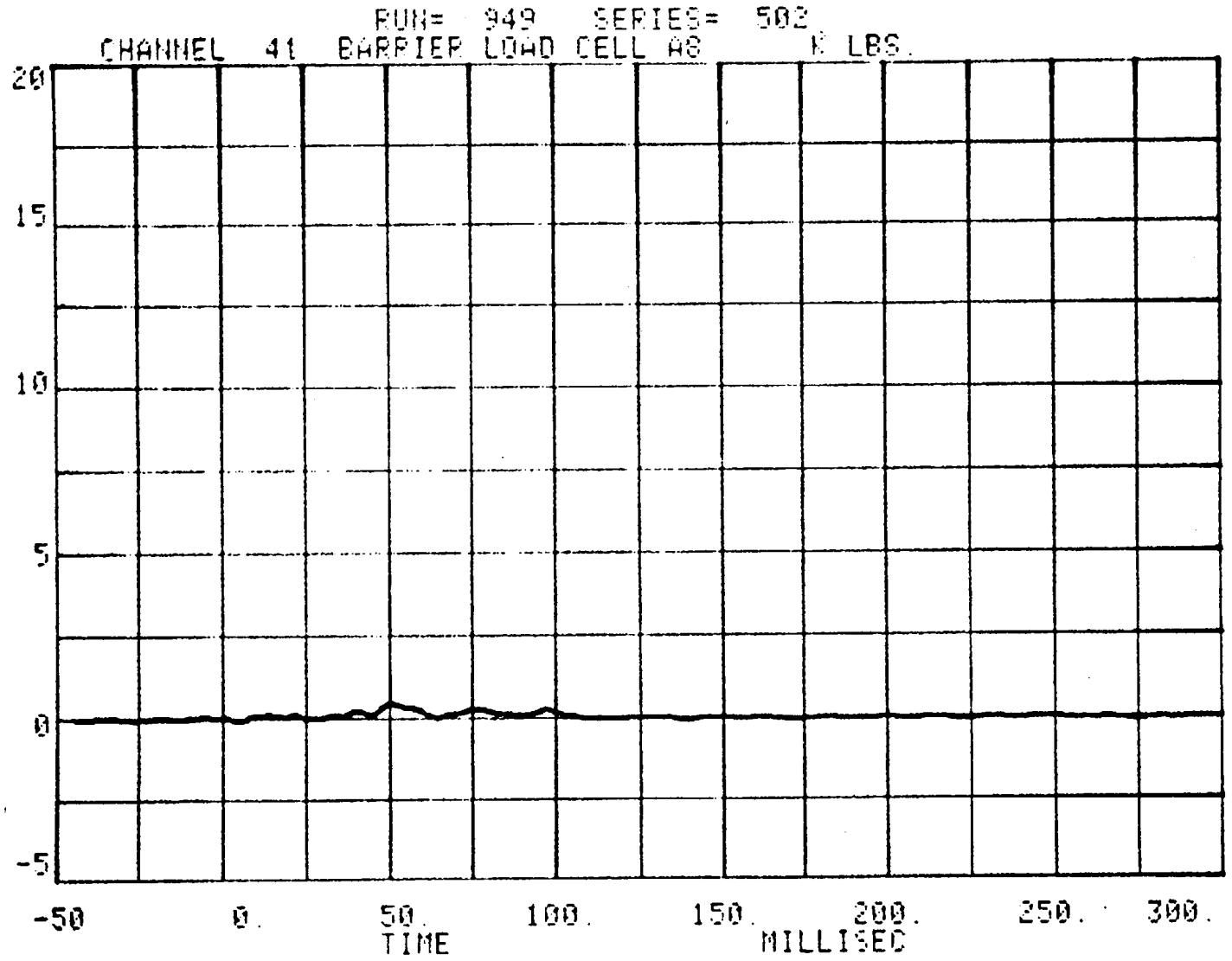

RUN= 949 SERIES= 502
CHANNEL 37 BARRIER LOAD CELL A4 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

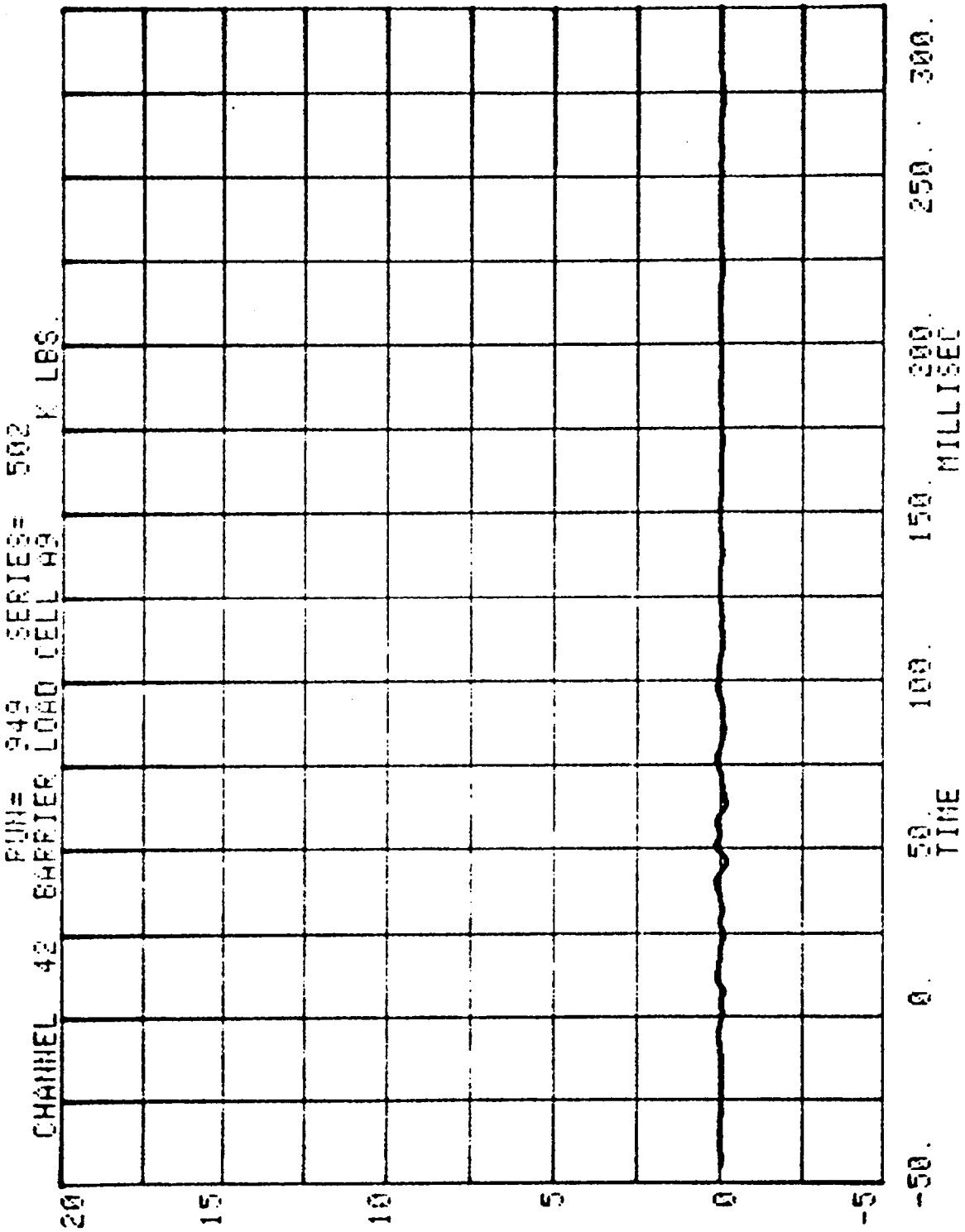

CHANNEL 28 BARRIER LOAD CELL HS
RUN= 949 SERIES= 502
P LBS
20
15
10
5
0
-5
-50
0.
50
100.
150.
200.
250.
300.
TIME
MILLISEC

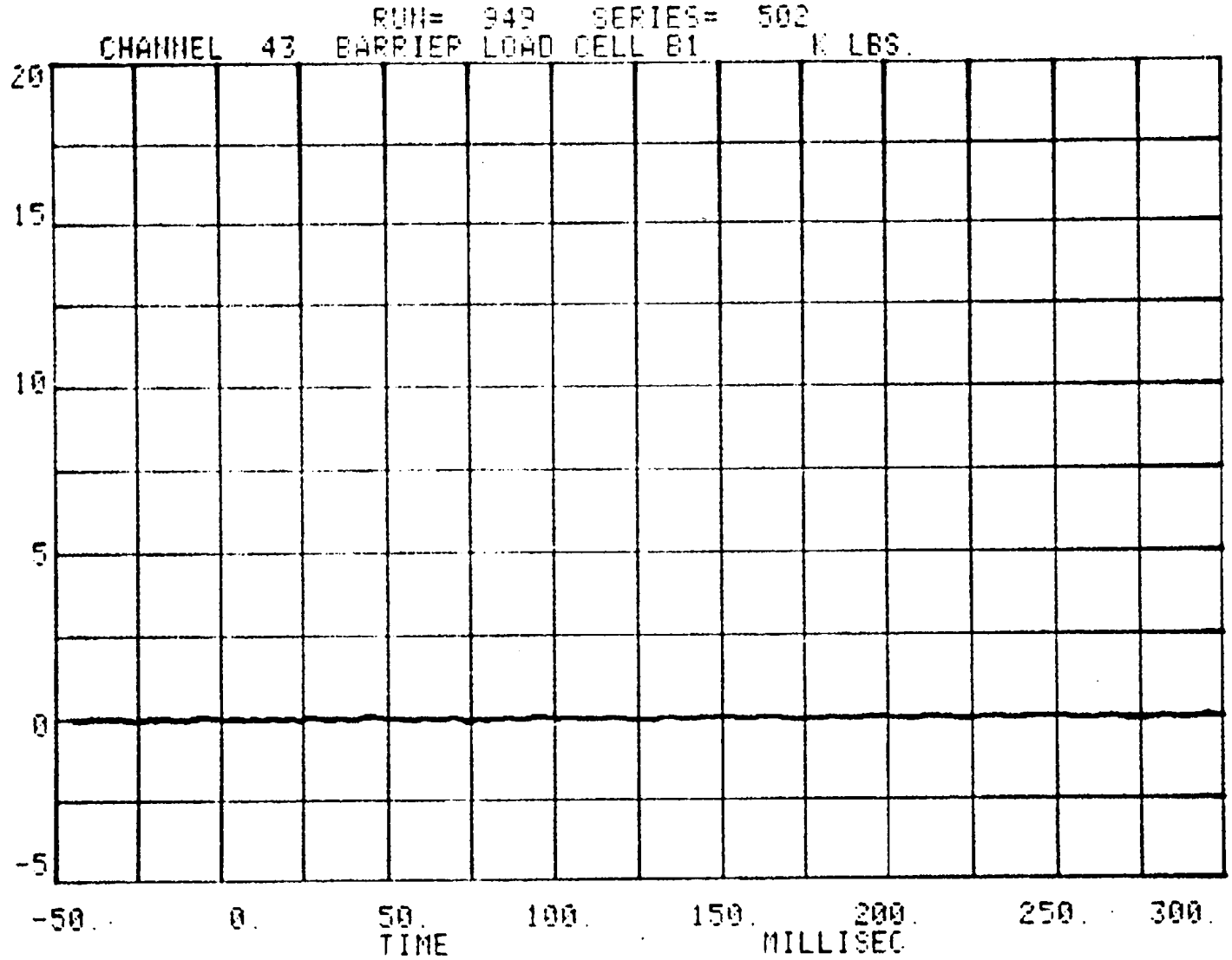
7776-5

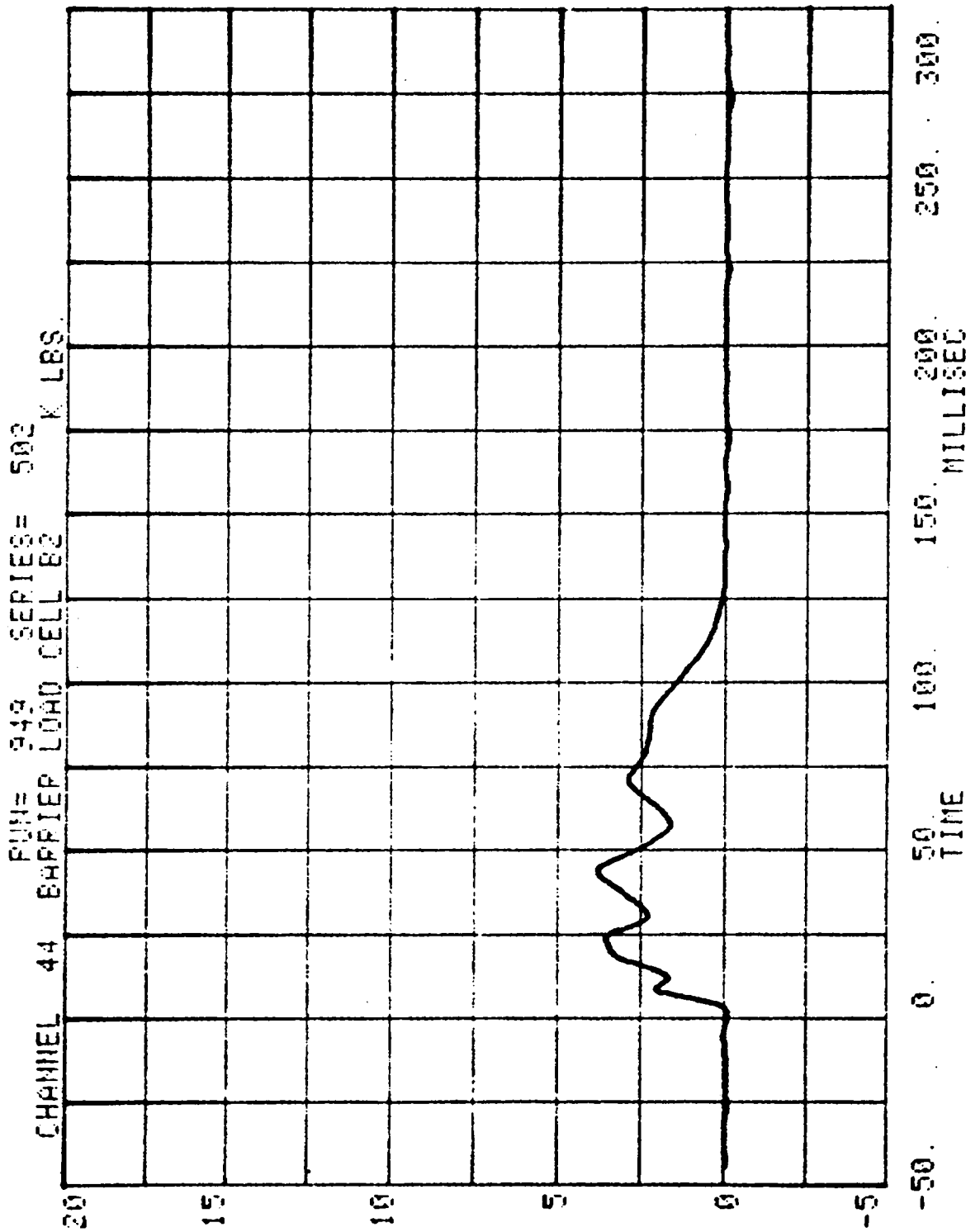

RUN= 349 SERIES= 502
CHANNEL 39 BARRIER LOAD CELL A6 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 40 BARRIER LOAD CELL #2
RUN= 342 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

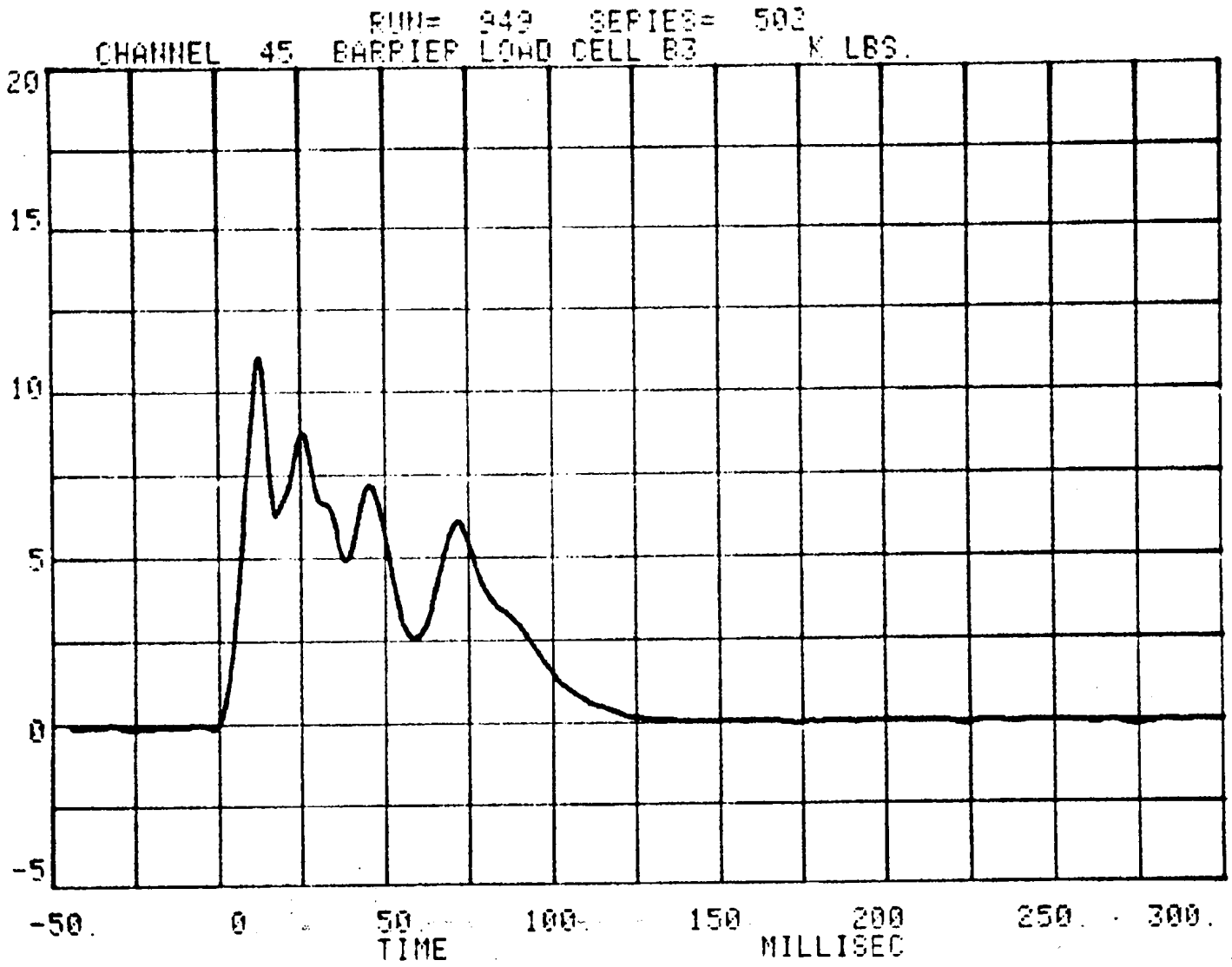

RUN= 949 SERIES= 502
CHANNEL 41 BARRIER LOAD CELL A8 K LBS.
20
15
10
5
0
-5
-50
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 42 BARRIER LOAD CELL #3
RUN= 949 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

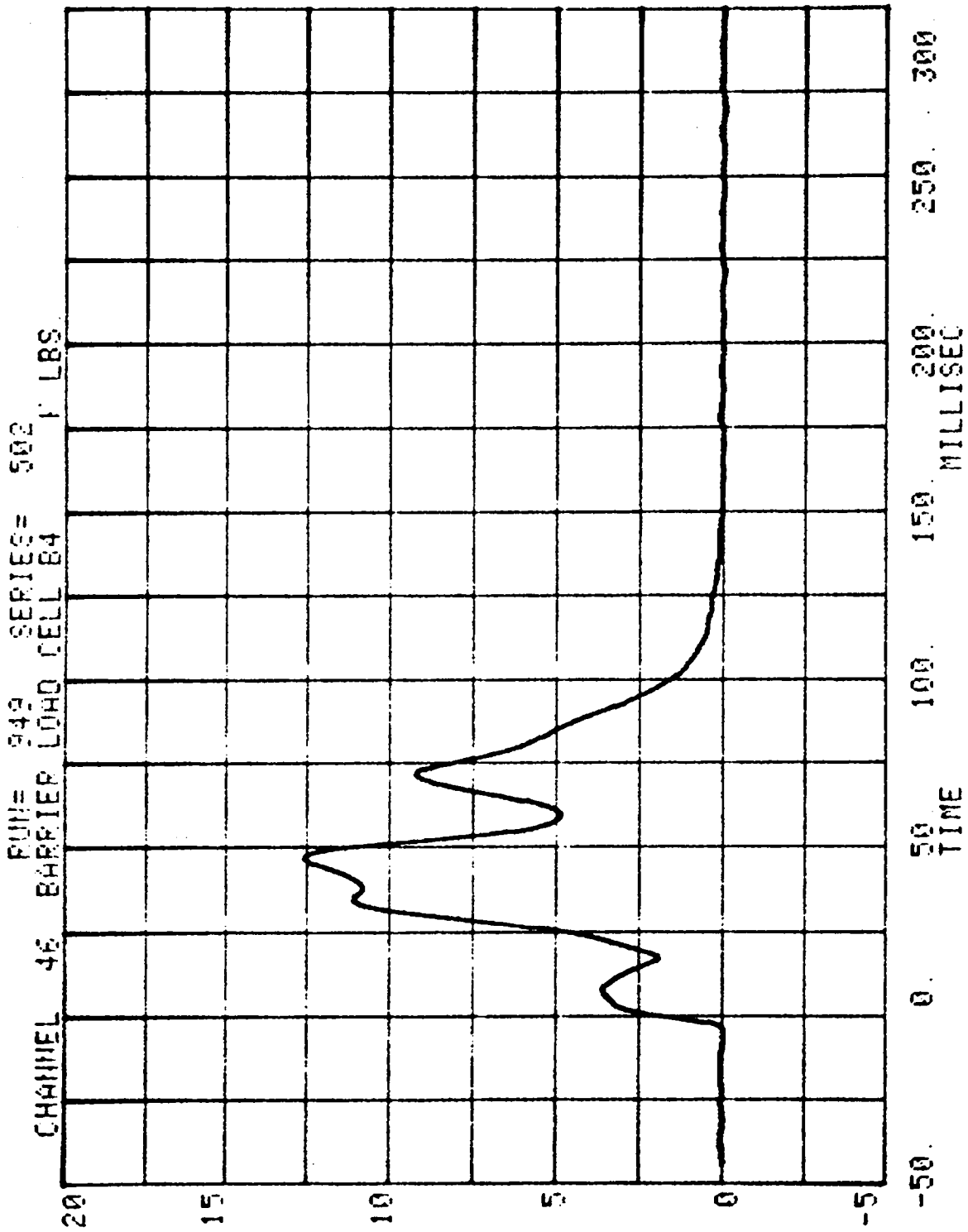

RUN= 949 SERIES= 502
CHANNEL 43 BARRIER LOAD CELL B1 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 44 BARRIER LOAD CELL B2
RUN= 949 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

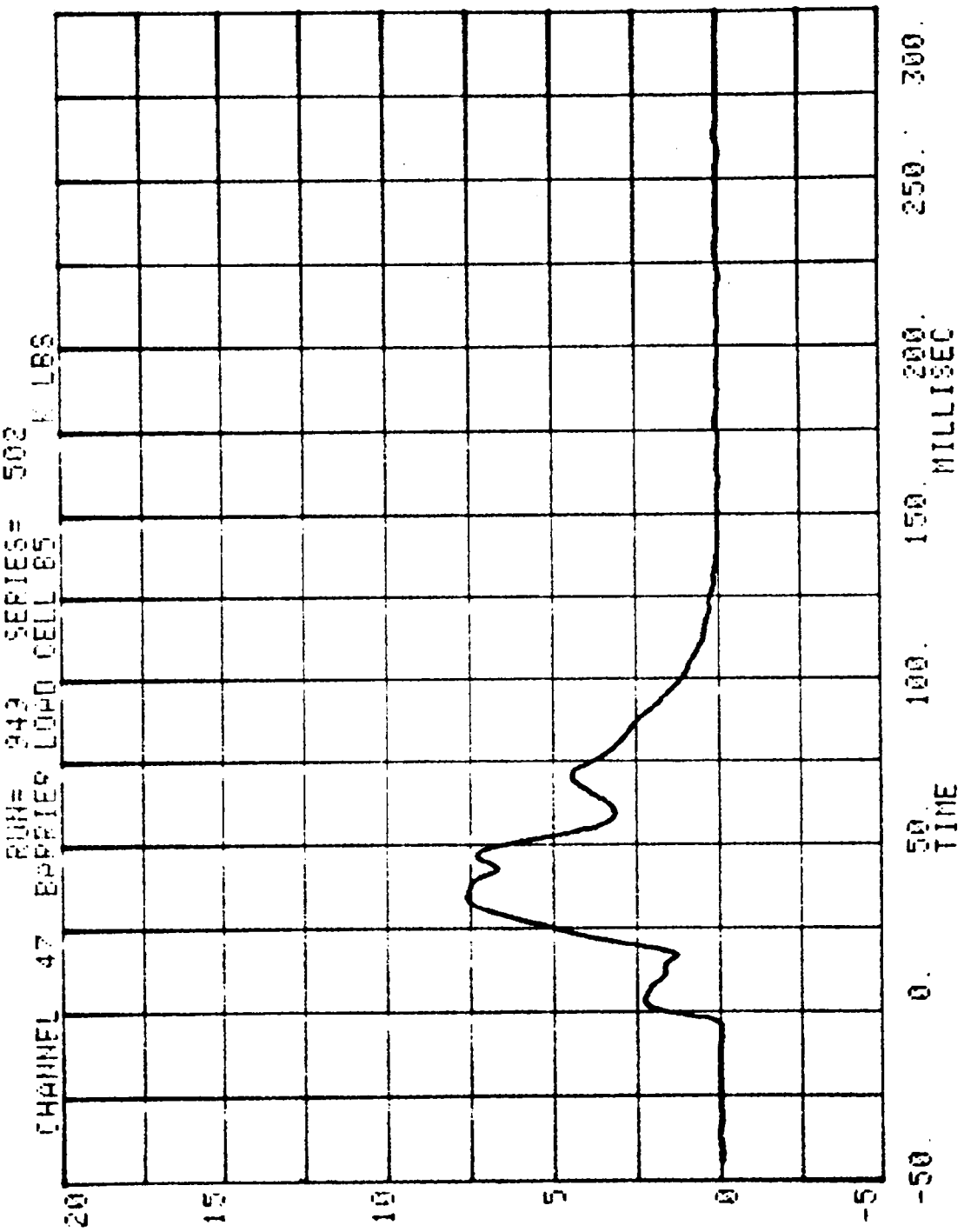
7776-5

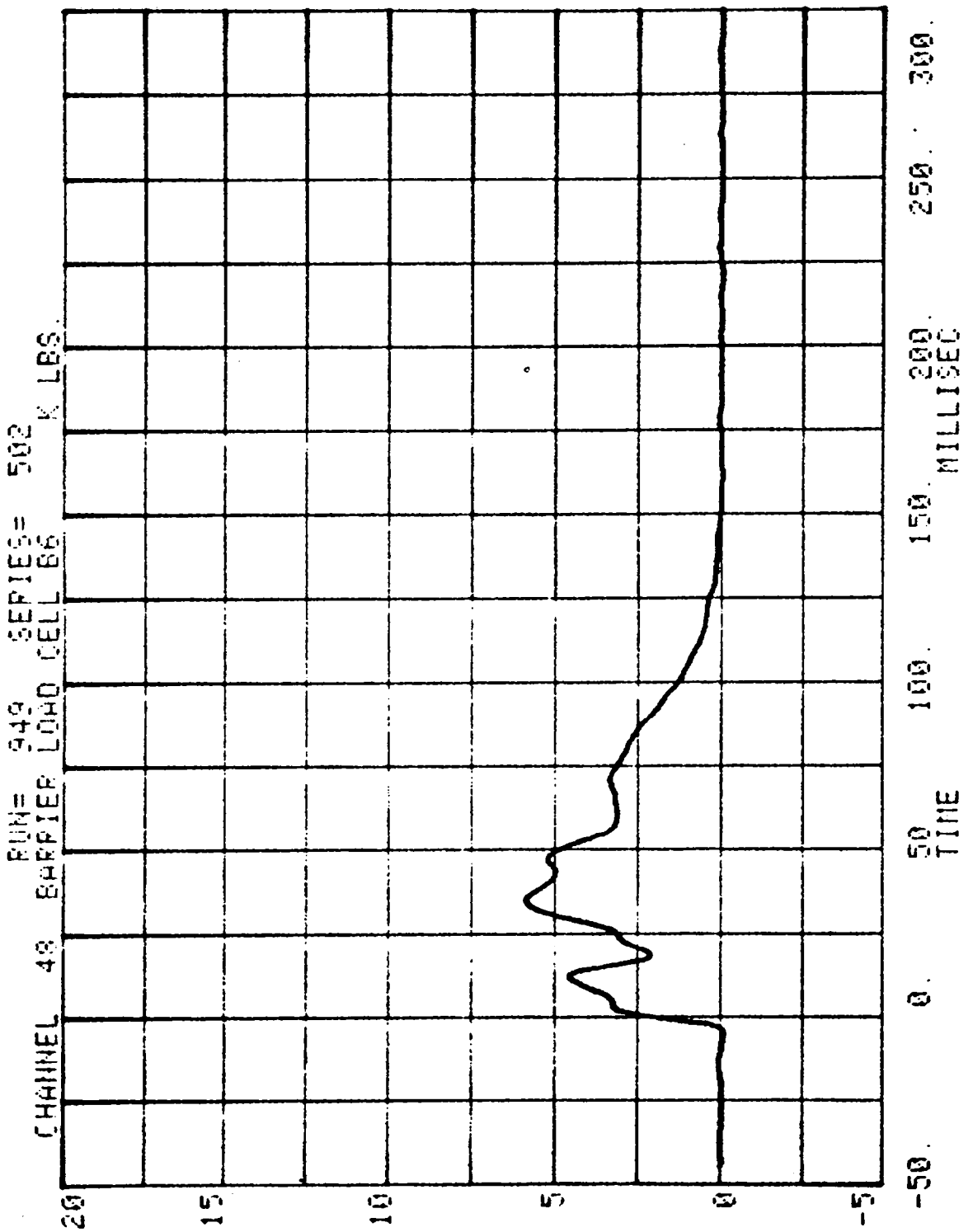

RUN= 949 SERIES= 503
CHANNEL 45 BARRIER LOAD CELL B3 K LBS.
20
15
10
5
0
-5
-50.
0
50.
100.
150
200
250.
300.
TIME
MILLISEC

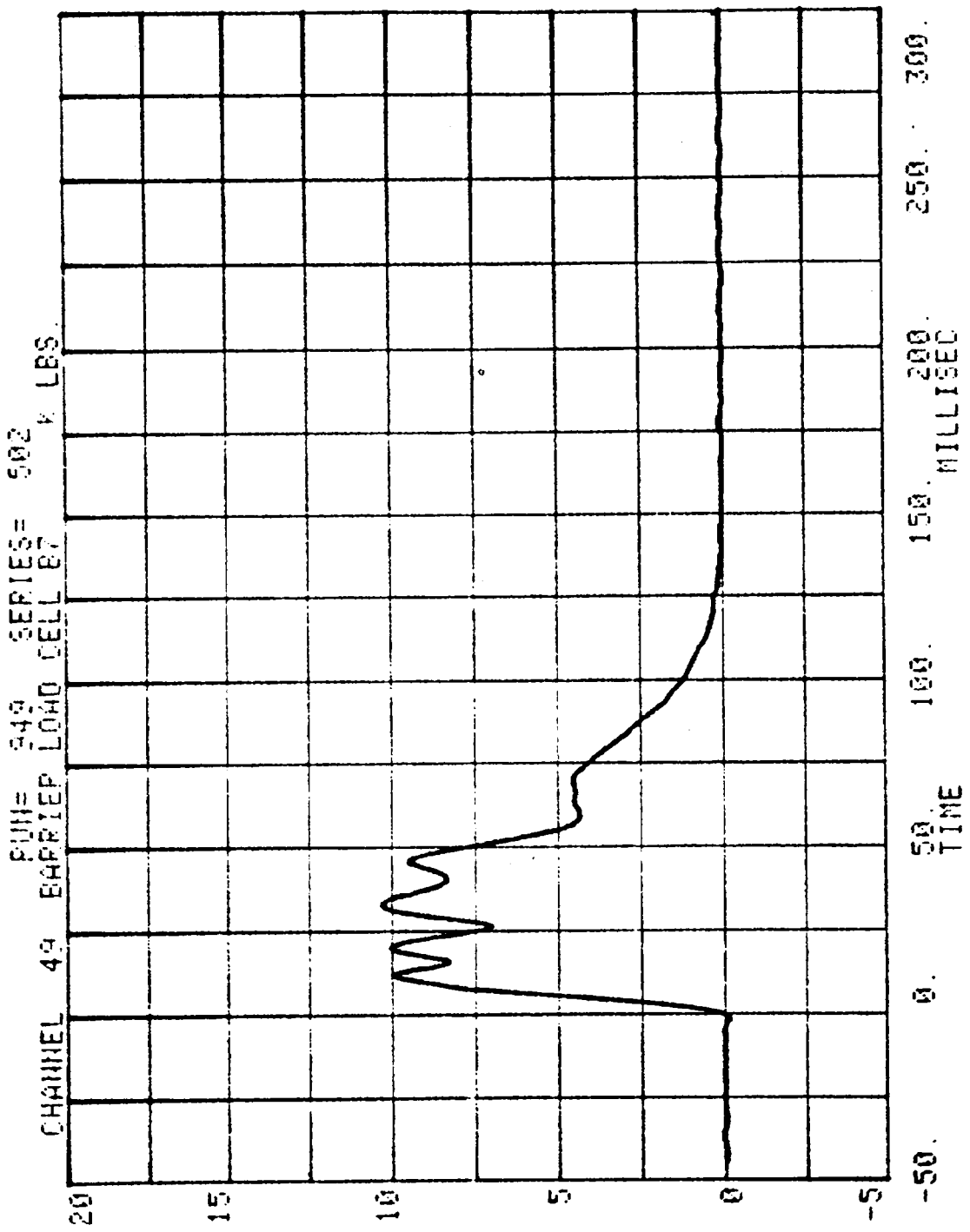
7776-5

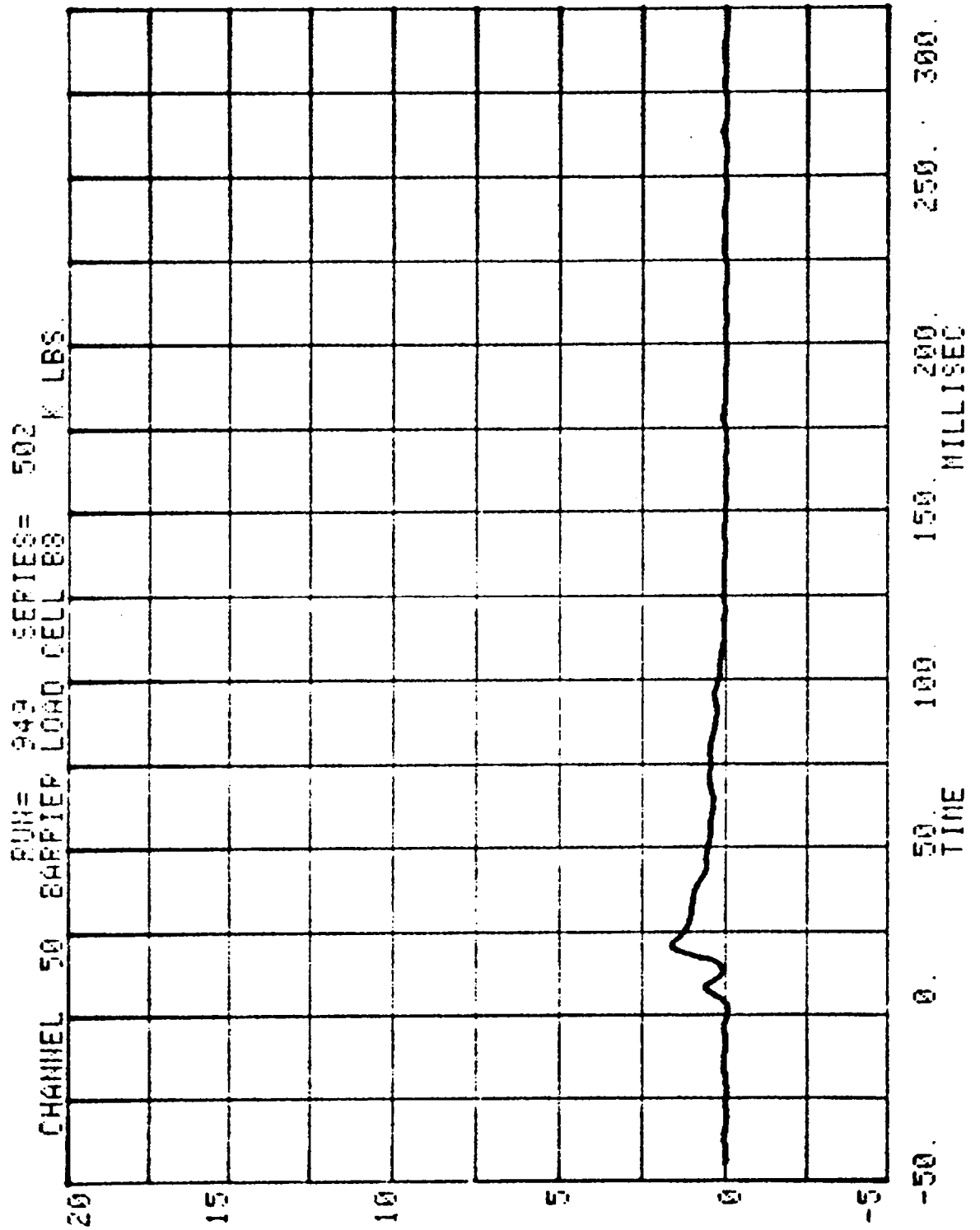

CHANNEL 46 BARRIER LOAD CELL 84
RUN= 949 SERIES= 502
1 LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

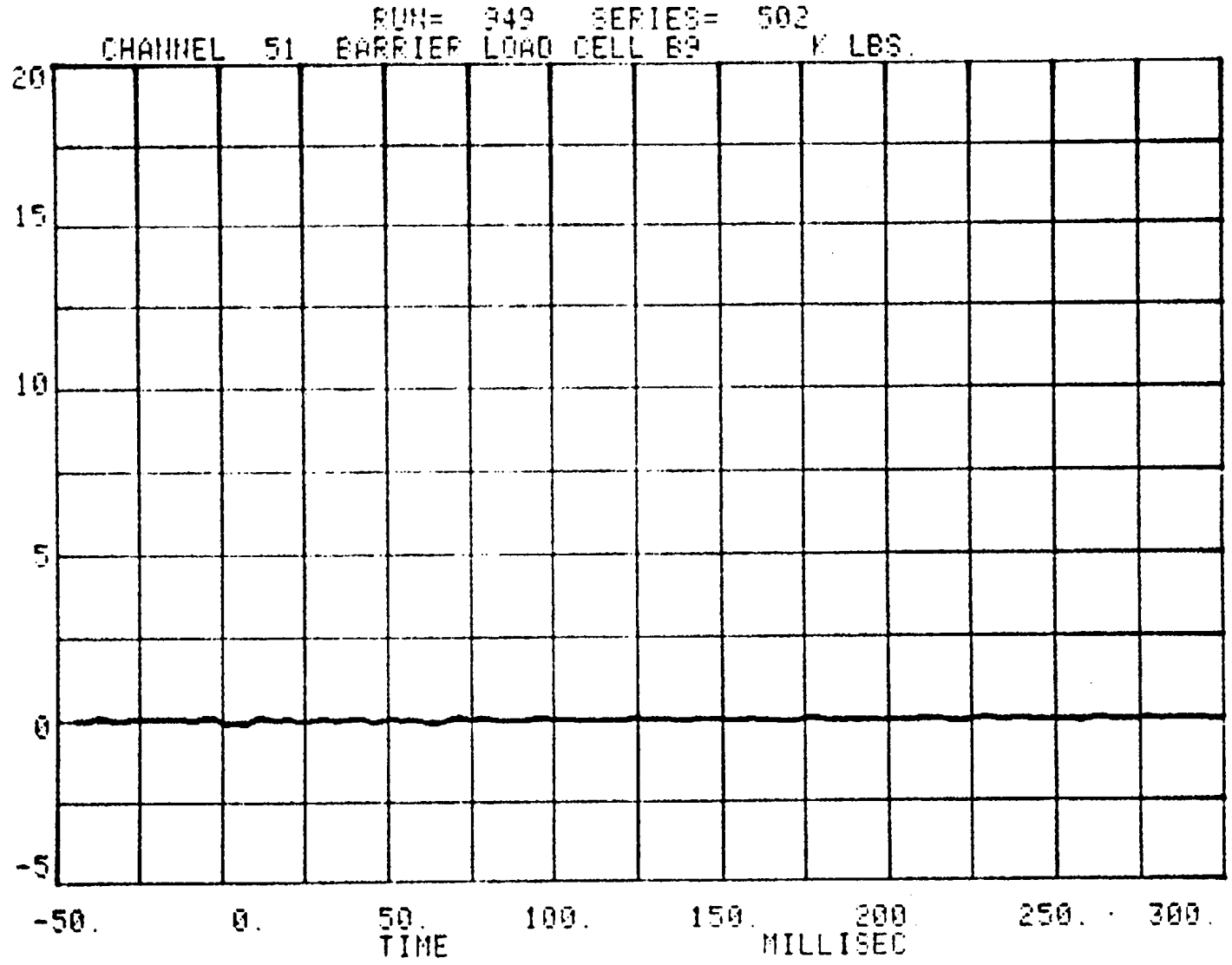
7776-5


CHANNEL 47 BARRIER LOAD CELL 85
RUN= 242 SERIES= 502
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

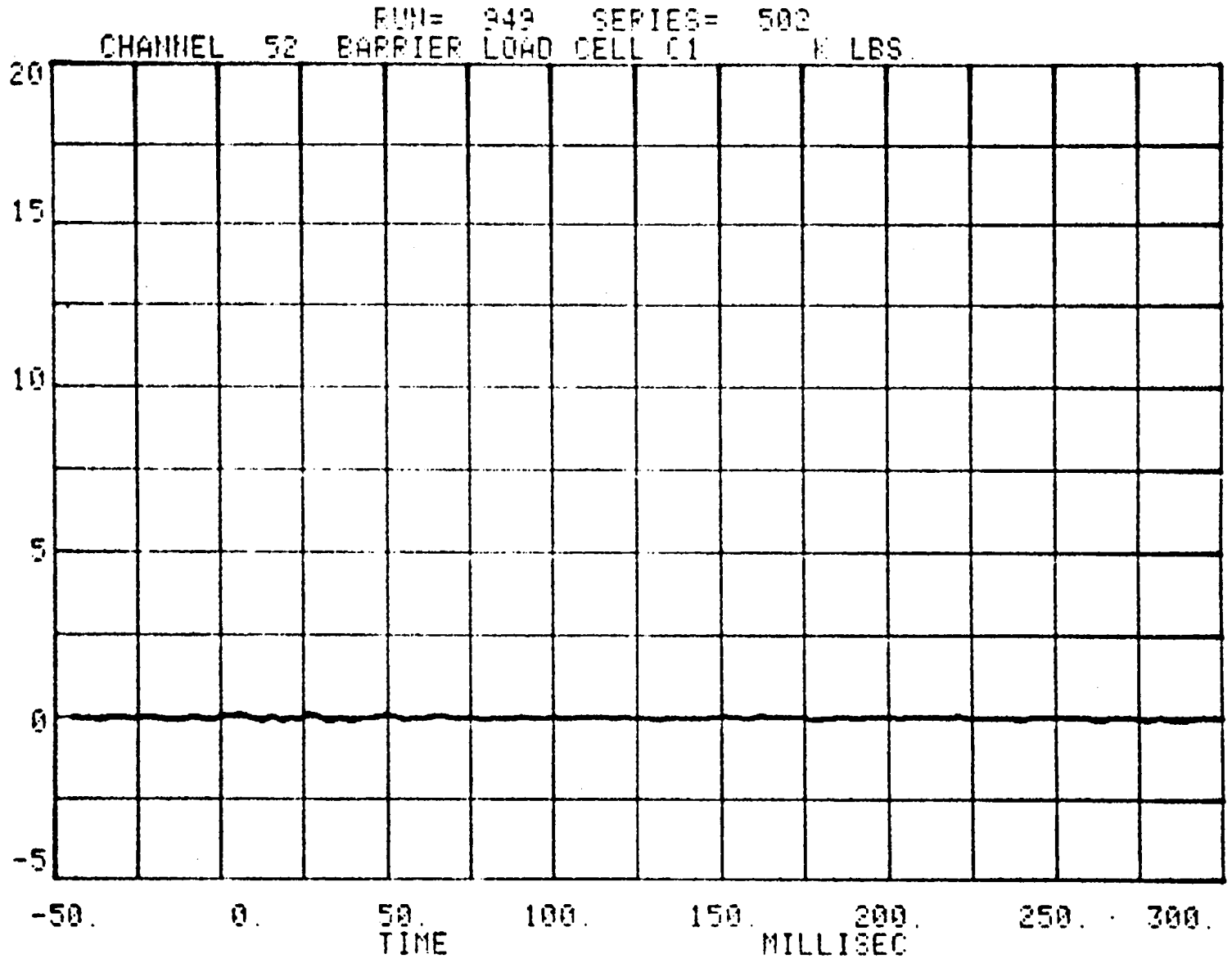

CHANNEL 43 BARRIER
RUN= 949 SERIES= 502
LOAD CELL 66
K LBS.
20
15
10
5
0
-5
-50.
0.
50
TIME
100.
150.
200.
MILLISEC
250.
300.

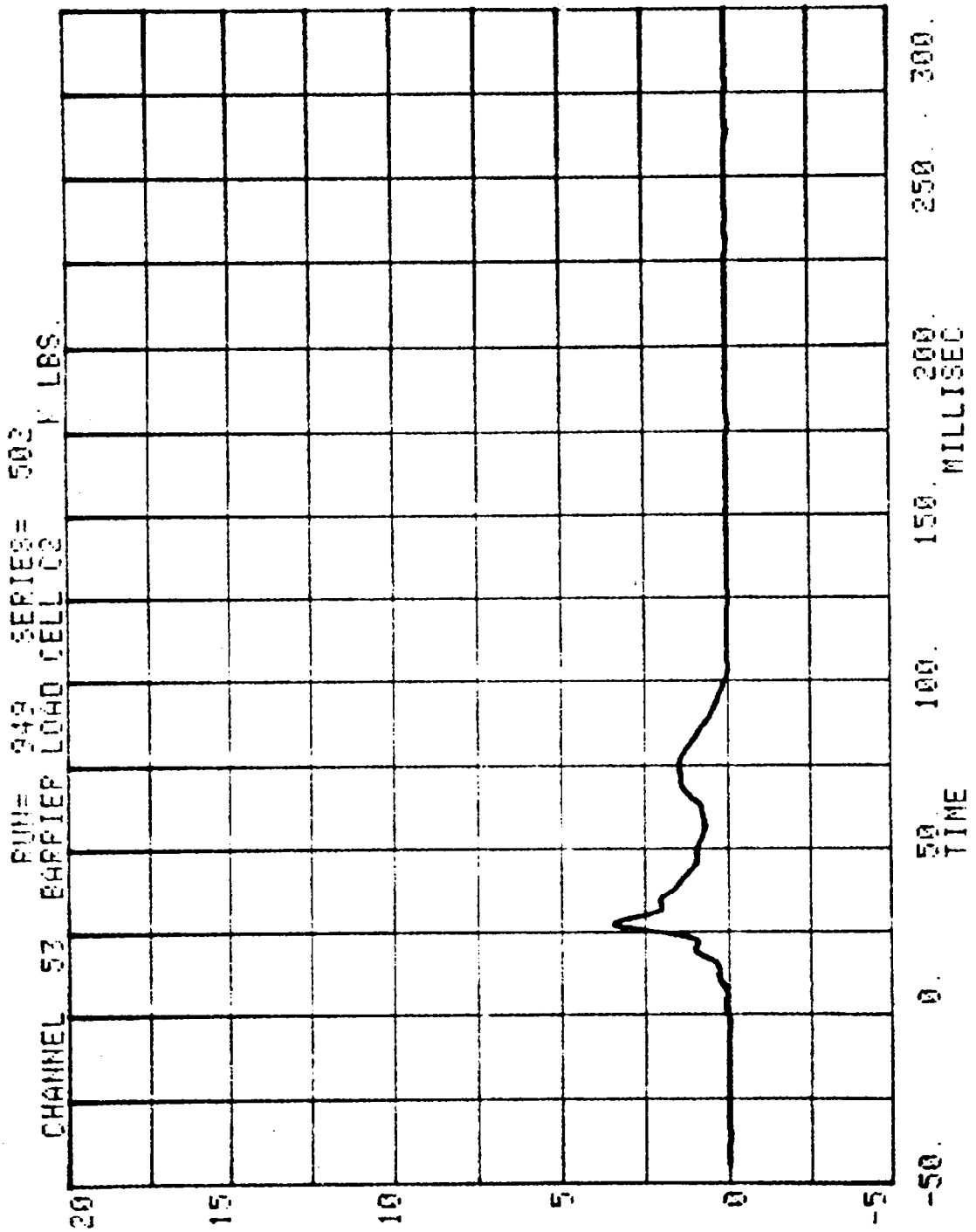

CHANNEL 42 BARRIER LOAD CELL B7
RUN= 949 SERIES= 502
* LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 50 SAMPLED LOAD CELL 88
RUN= 343 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100
150.
200.
250.
300.
TIME
MILLISEC

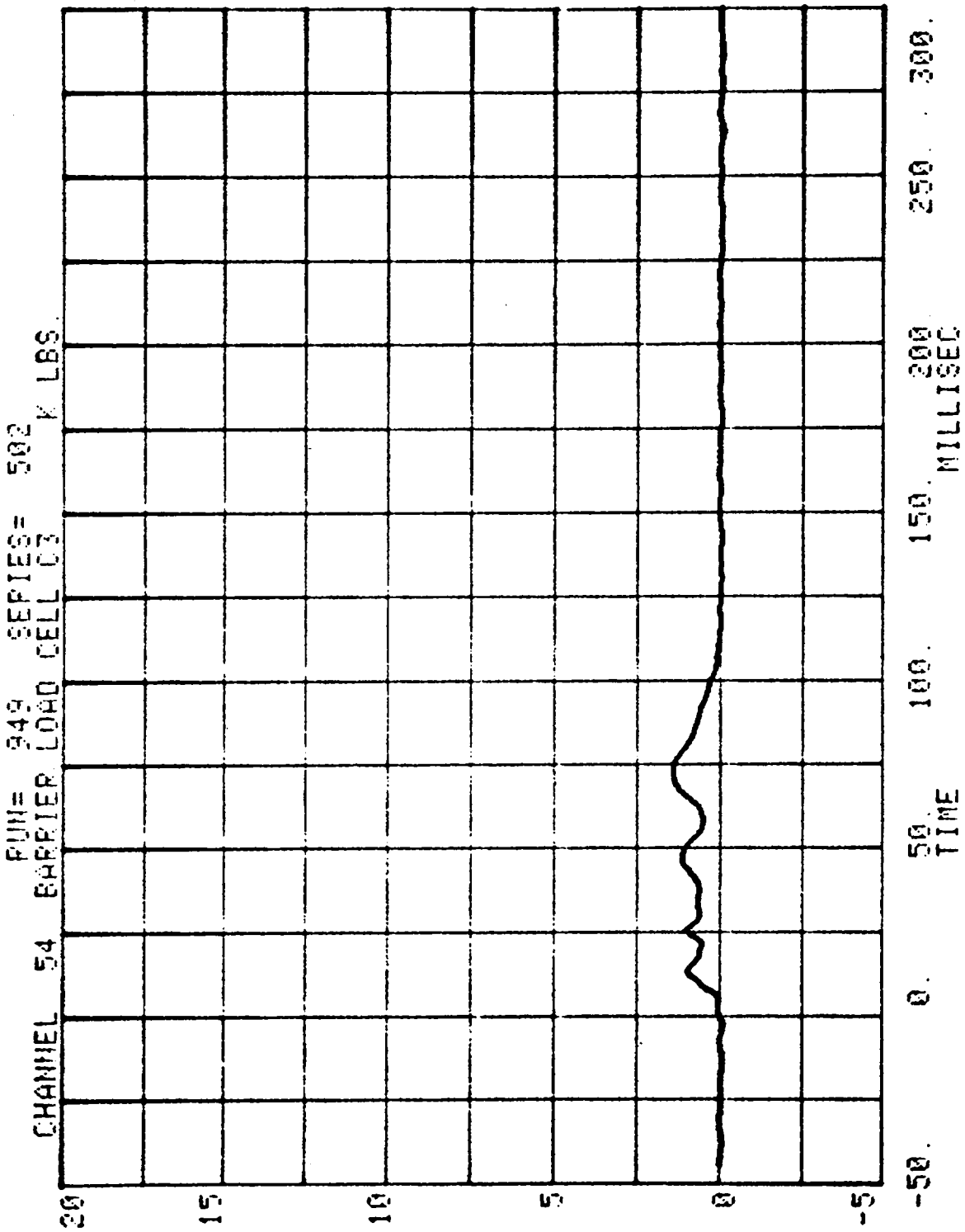

RUN= 349 SERIES= 502
CHANNEL 51 BARRIER LOAD CELL B9 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200
250.
300.
TIME
MILLISEC

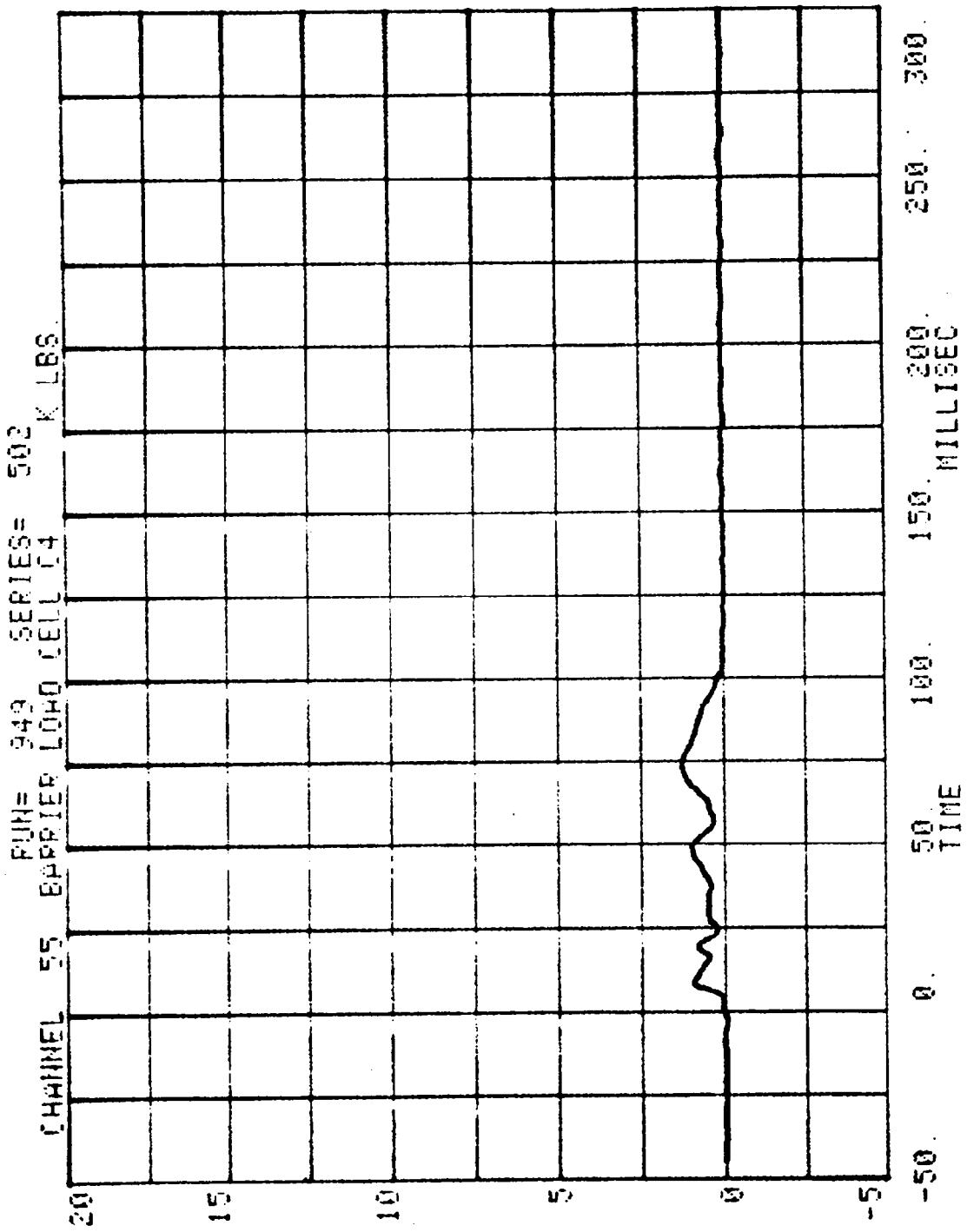
7776-5


RUN= 949 SERIES= 502
CHANNEL 52 BARRIER LOAD CELL C1 K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

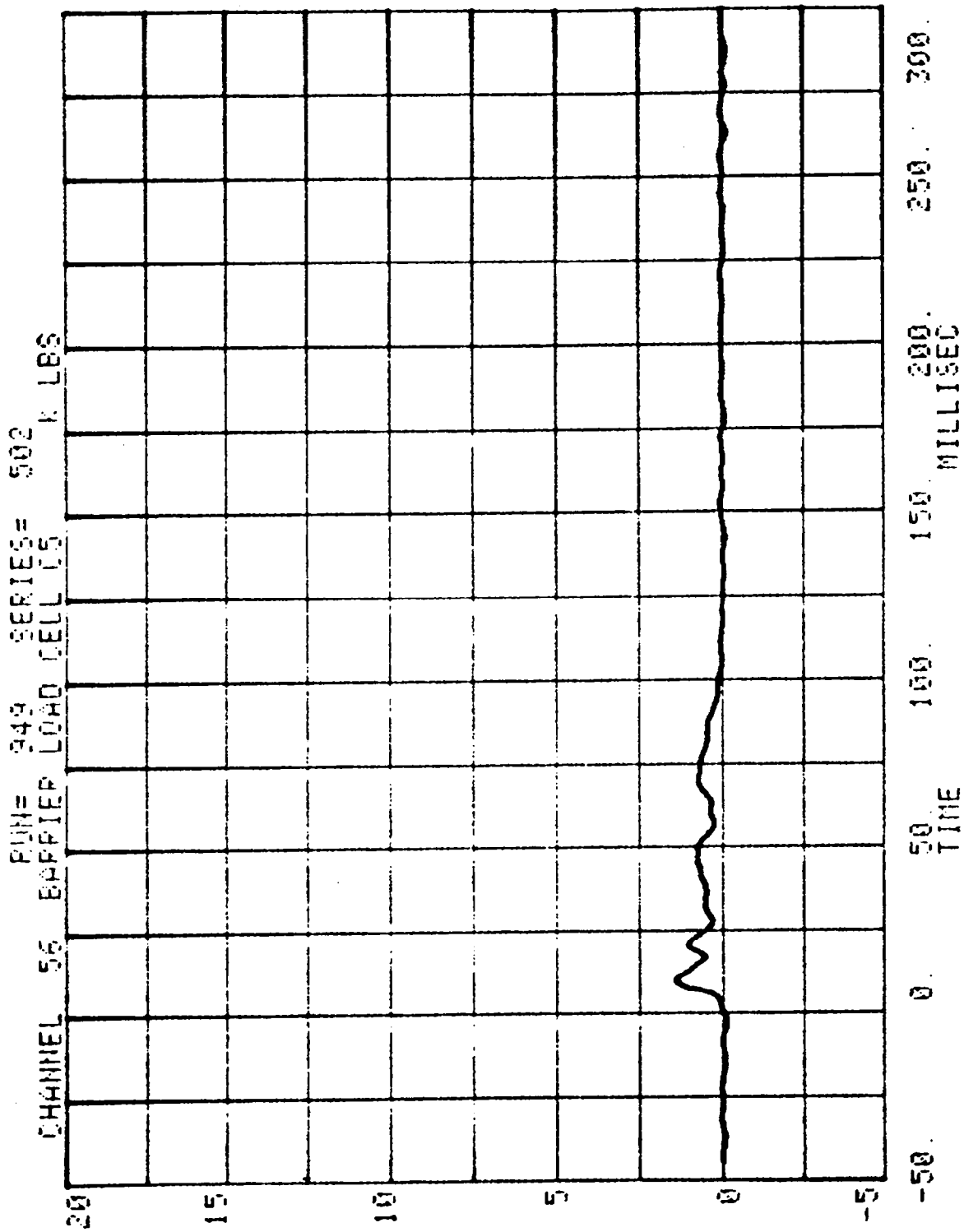

CHANNEL 52 BARRIER LOAD CELL C2
RUN= 242 SERIES= 502
F LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

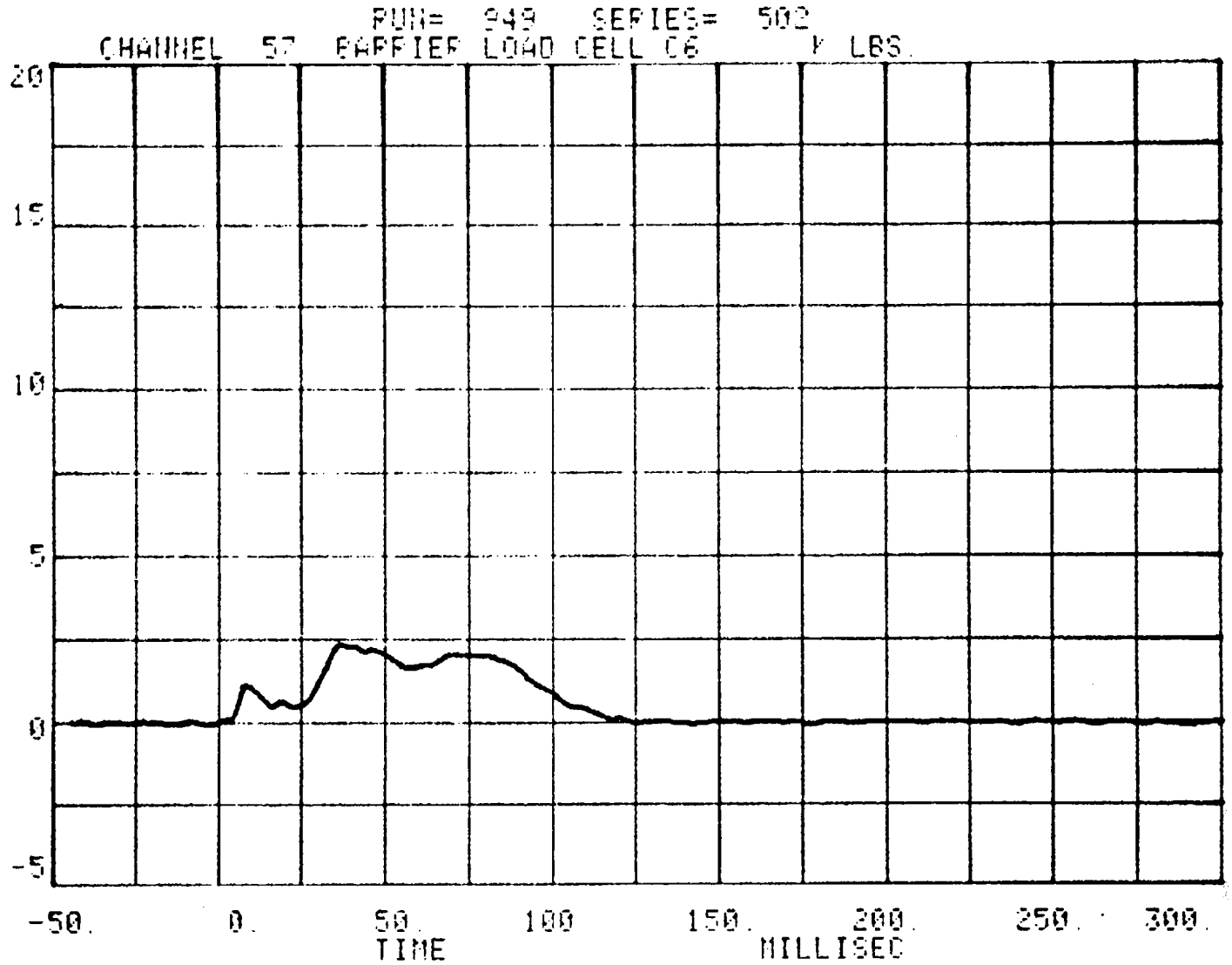
7776-5


CHANNEL 54 BARRIER LOAD CELL C3
RUN= 349 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200
250
300.
TIME
MILLISEC

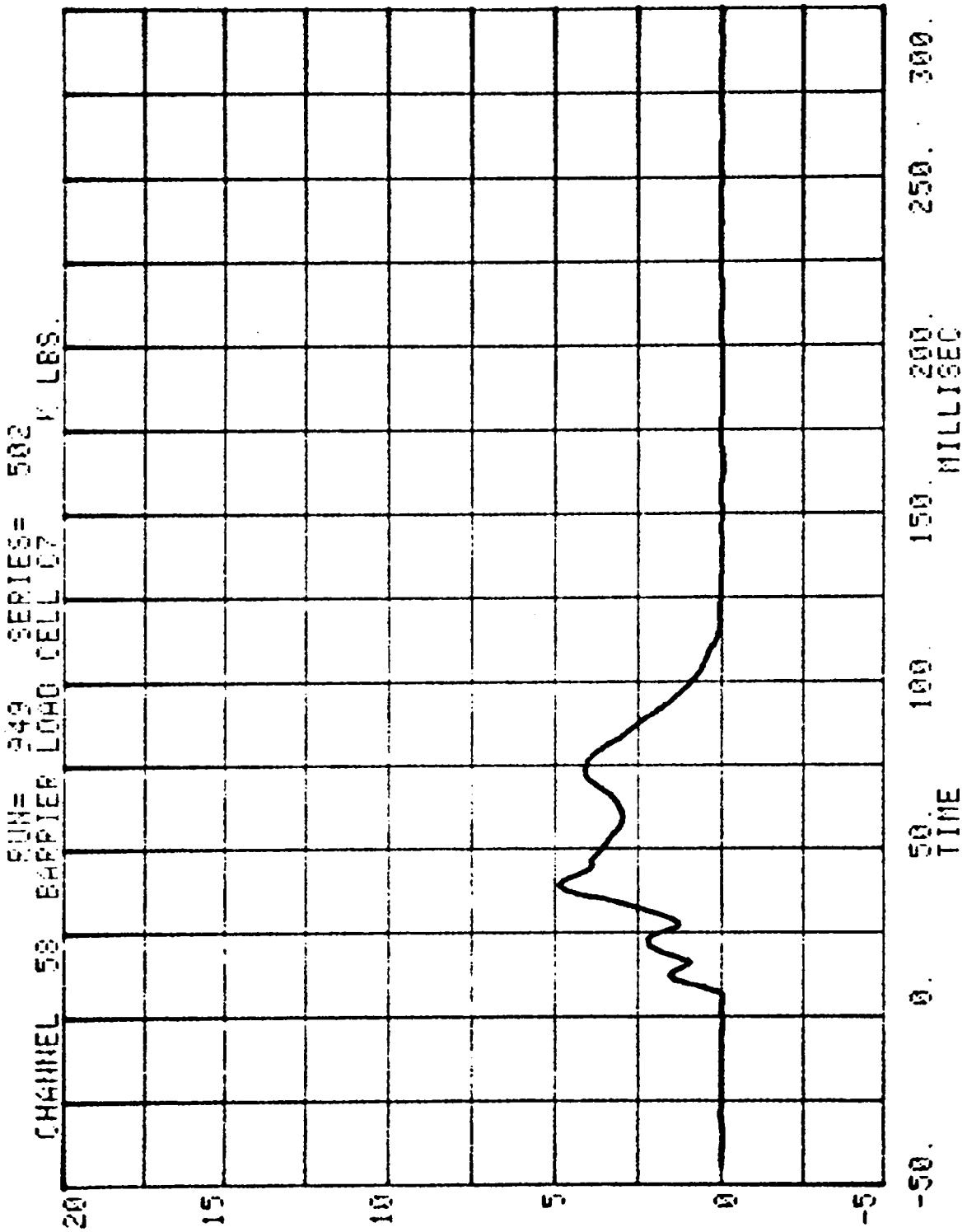

CHANNEL 55
RUN= 949
SERIES= 502
K LBS
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC
20
15
10
5
0
-5

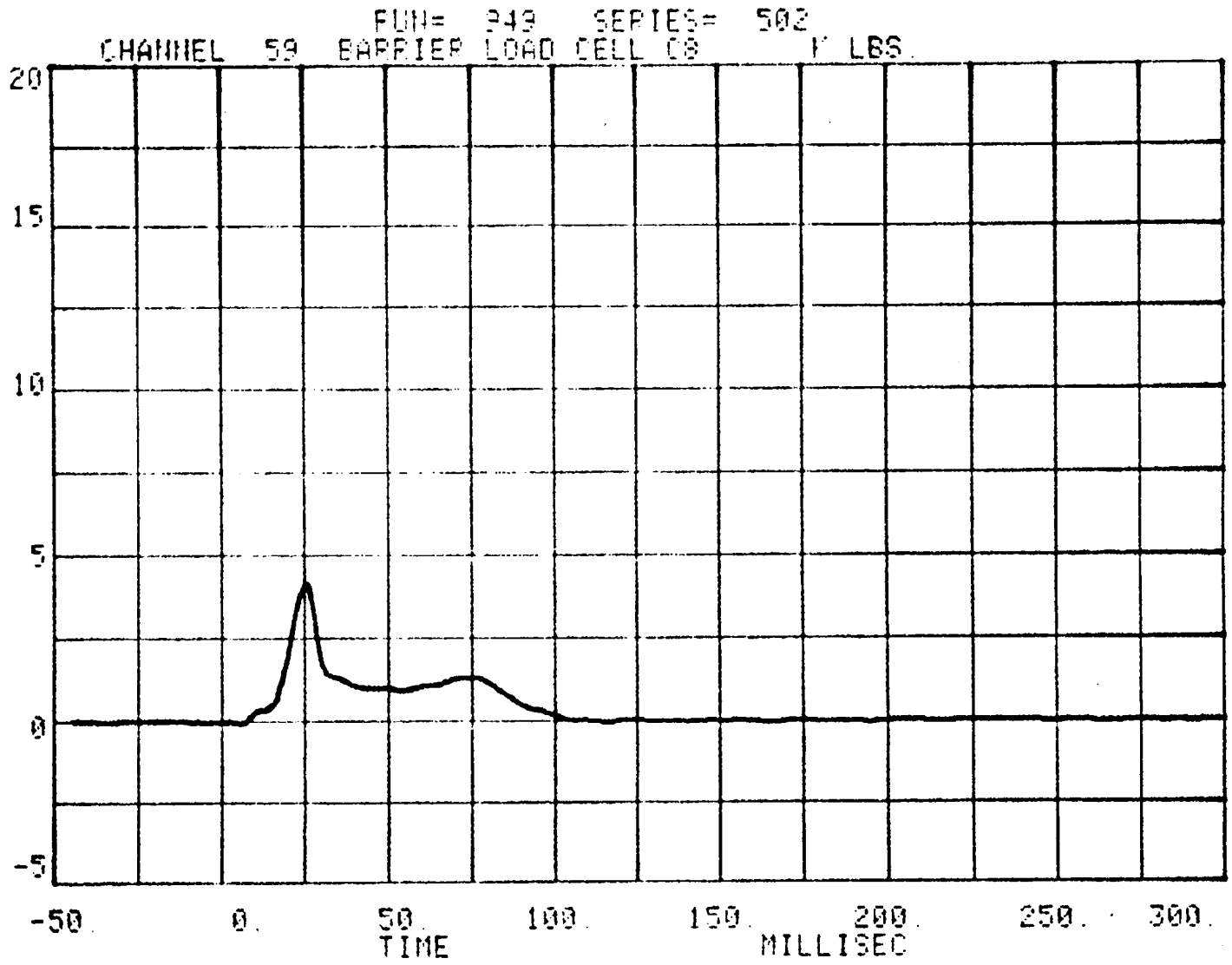
7776-5

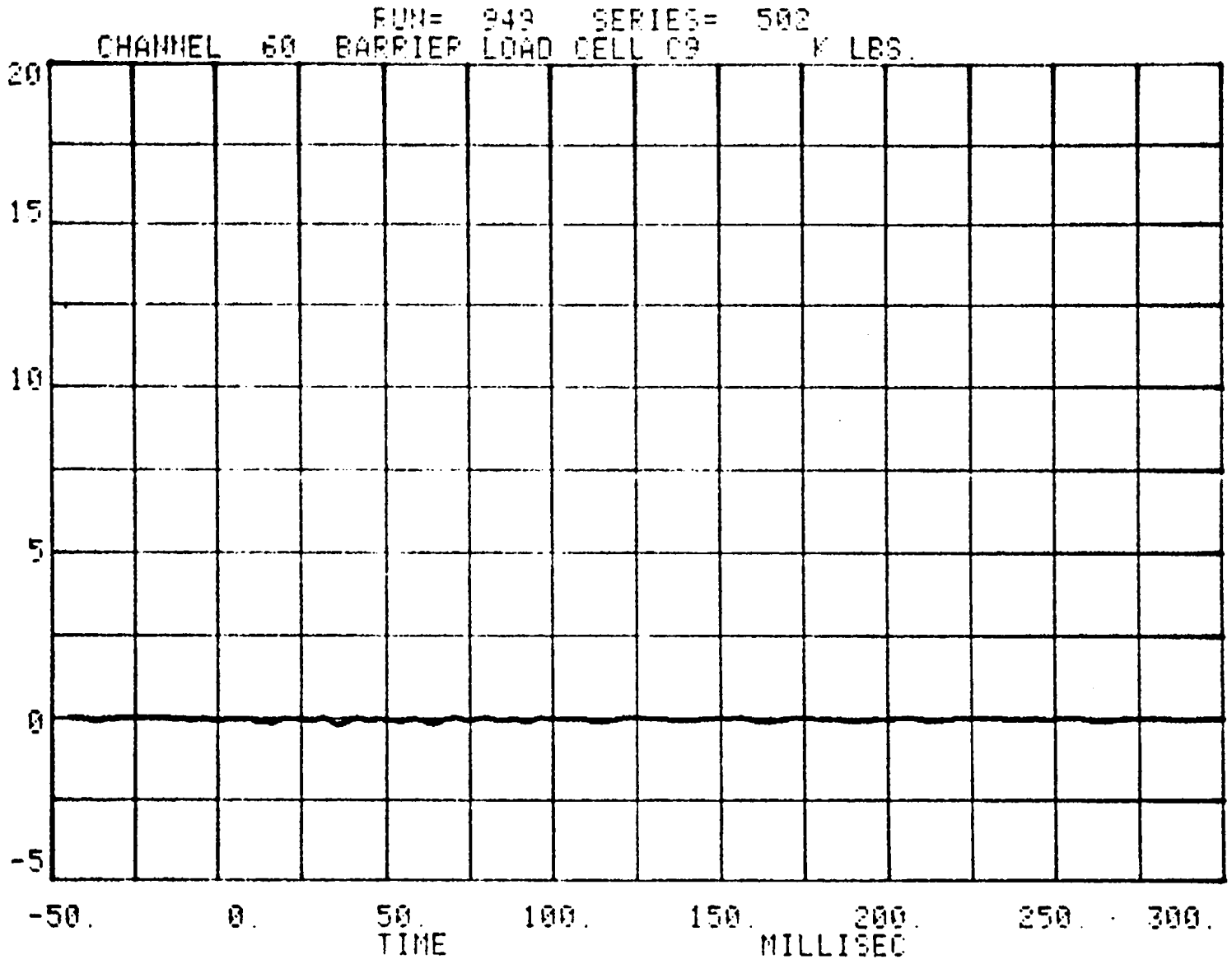

CHANNEL 56 BARRIER LOAD CELL 15
RUN= 949 SERIES= 502
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

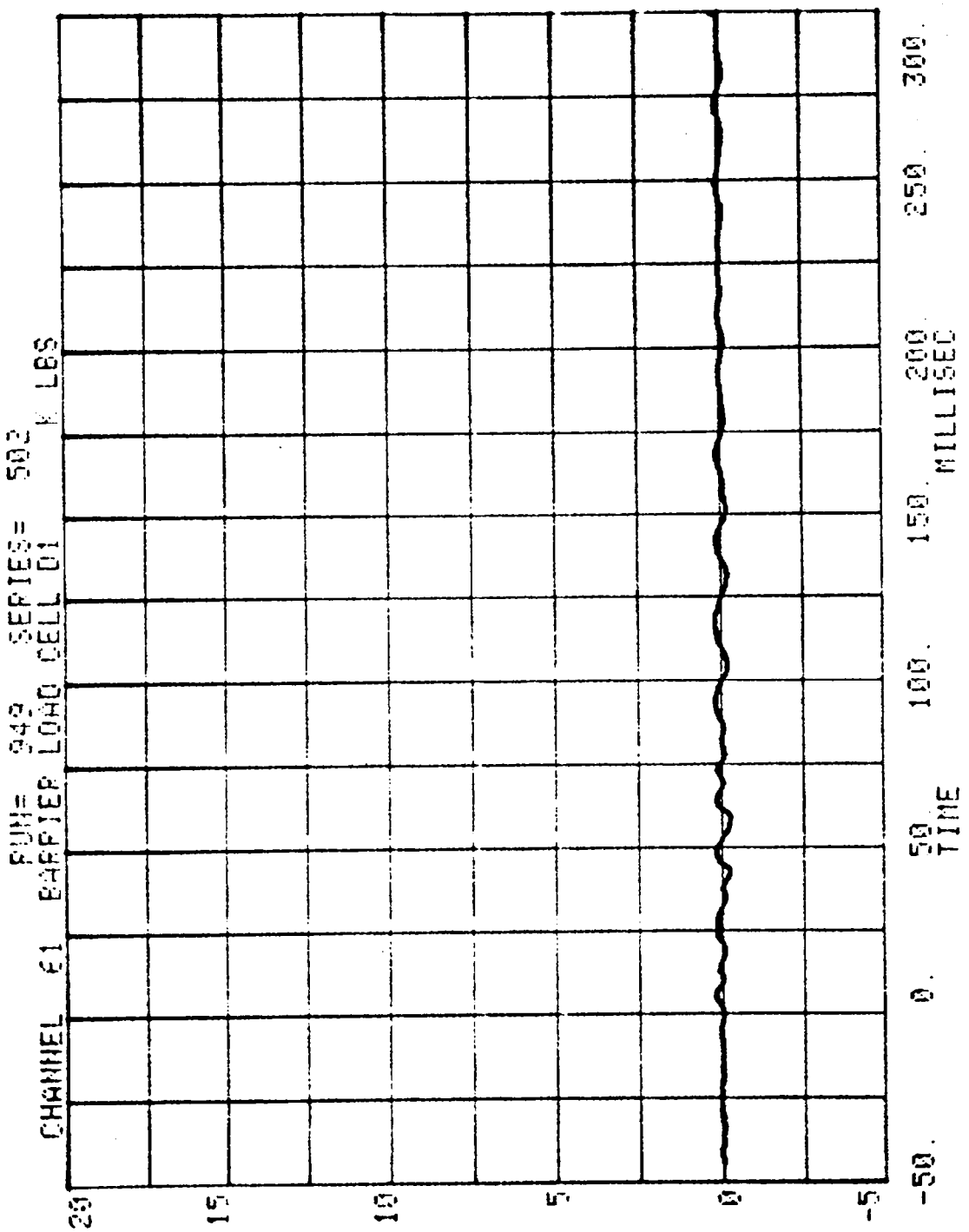

RUN= 949 SERIES= 502
CHANNEL 57 BARRIER LOAD CELL C6 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100
150.
200.
250.
300.
TIME
MILLISEC

7776-5

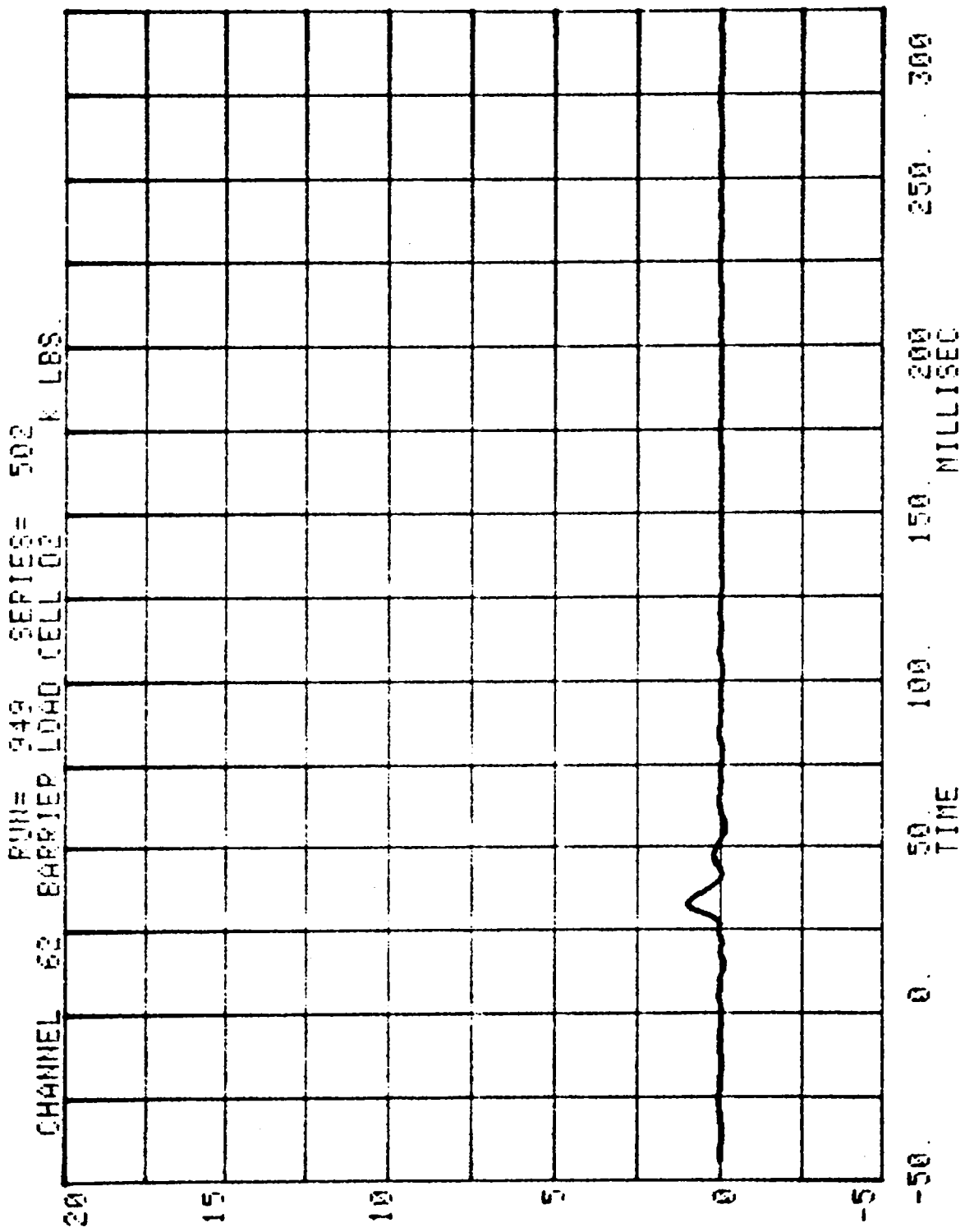

CHANNEL 58 BARRIER LOAD CELL C7
RUN= 349 SERIES= 502
Y LBS.
20
15
10
5
0
-5
-50.
0.
50.
100
150.
200.
250.
300.
TIME
MILLISEC

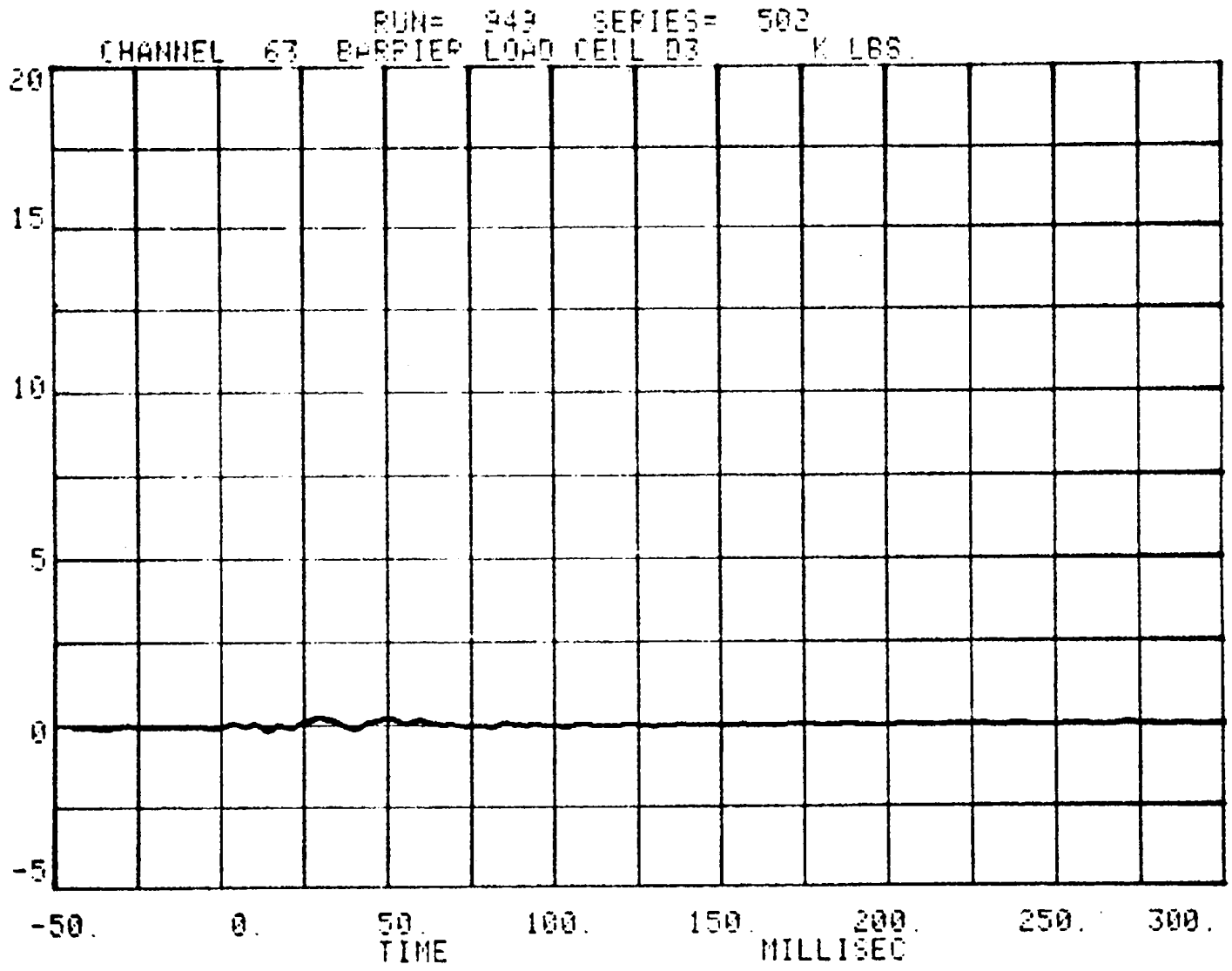

RUN= 949 SERIES= 502
CHANNEL 59 BARRIER LOAD CELL CB K LBS.
20
15
10
5
0
-5
-50
0.
50
100
150
200
250.
300.
TIME
MILLISEC


RUN= 943 SERIES= 502
CHANNEL 60 BARRIER LOAD CELL C9 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

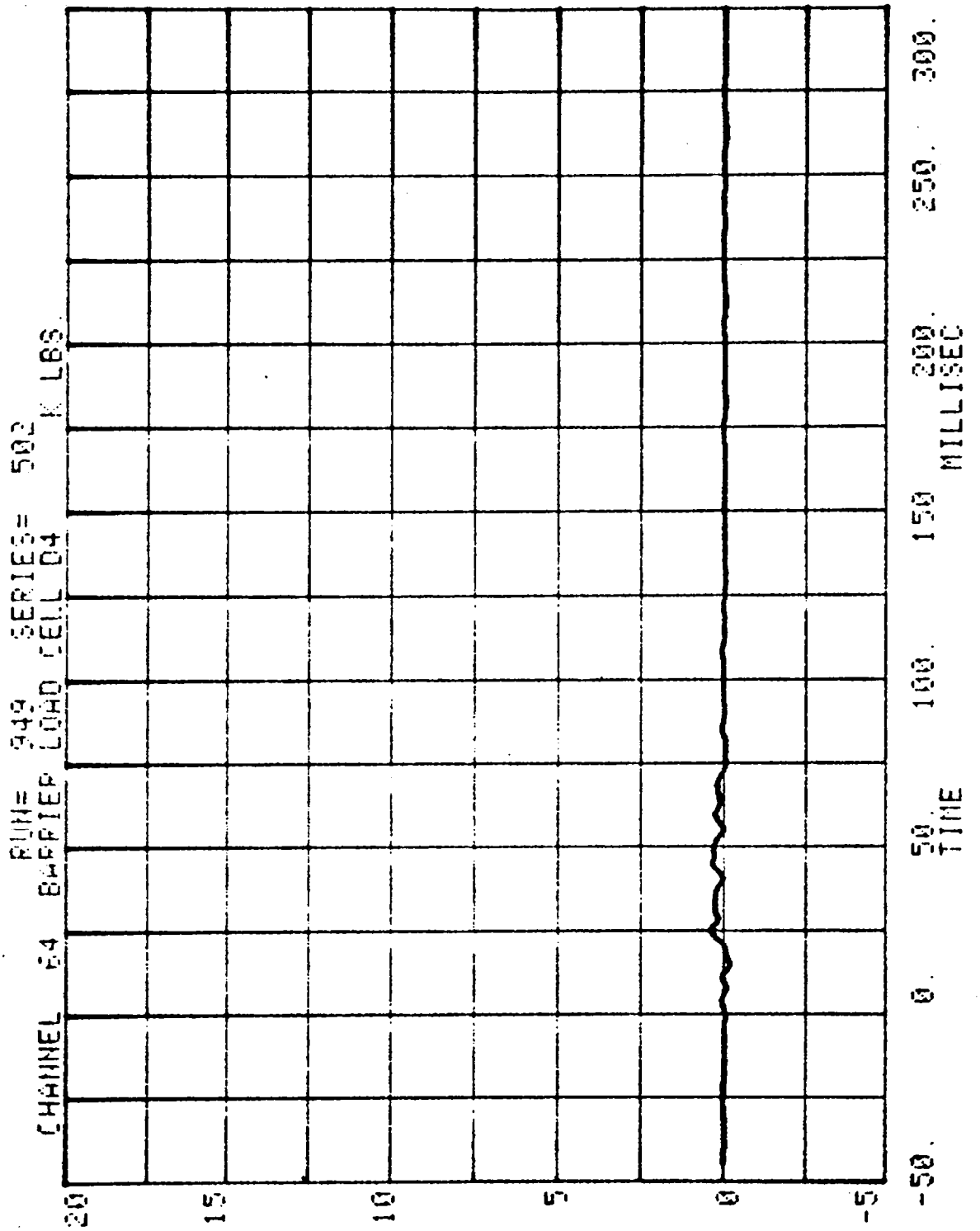

CHANNEL 41 BARRIER LOAD CELL 01
RUN= 942 SERIES= 502
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

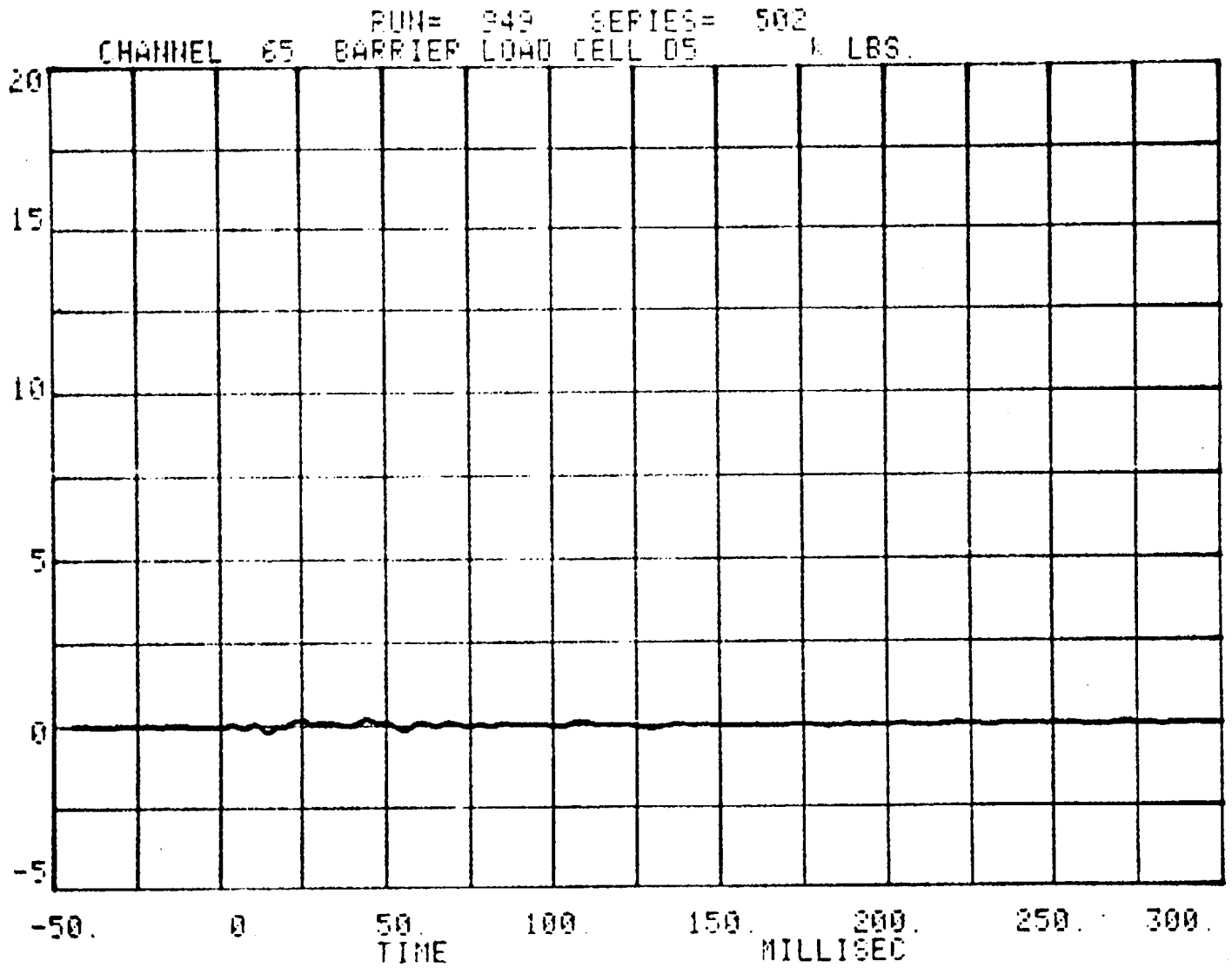

CHANNEL 82 BARRIER LOAD CELL 02
RUN= 349 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

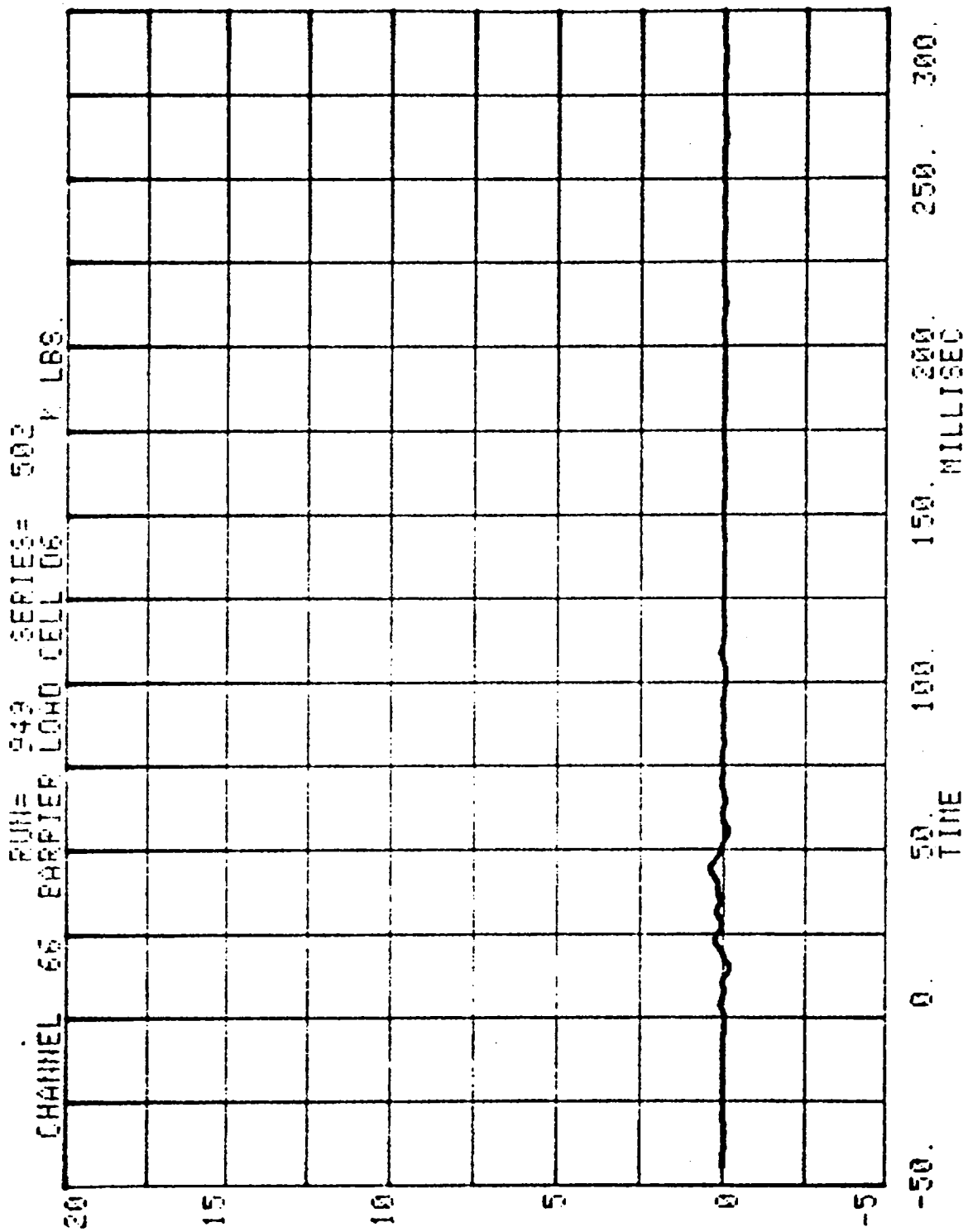

RUN= 949 SERIES= 502
CHANNEL 63 BARRIER LOAD CELL 03 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

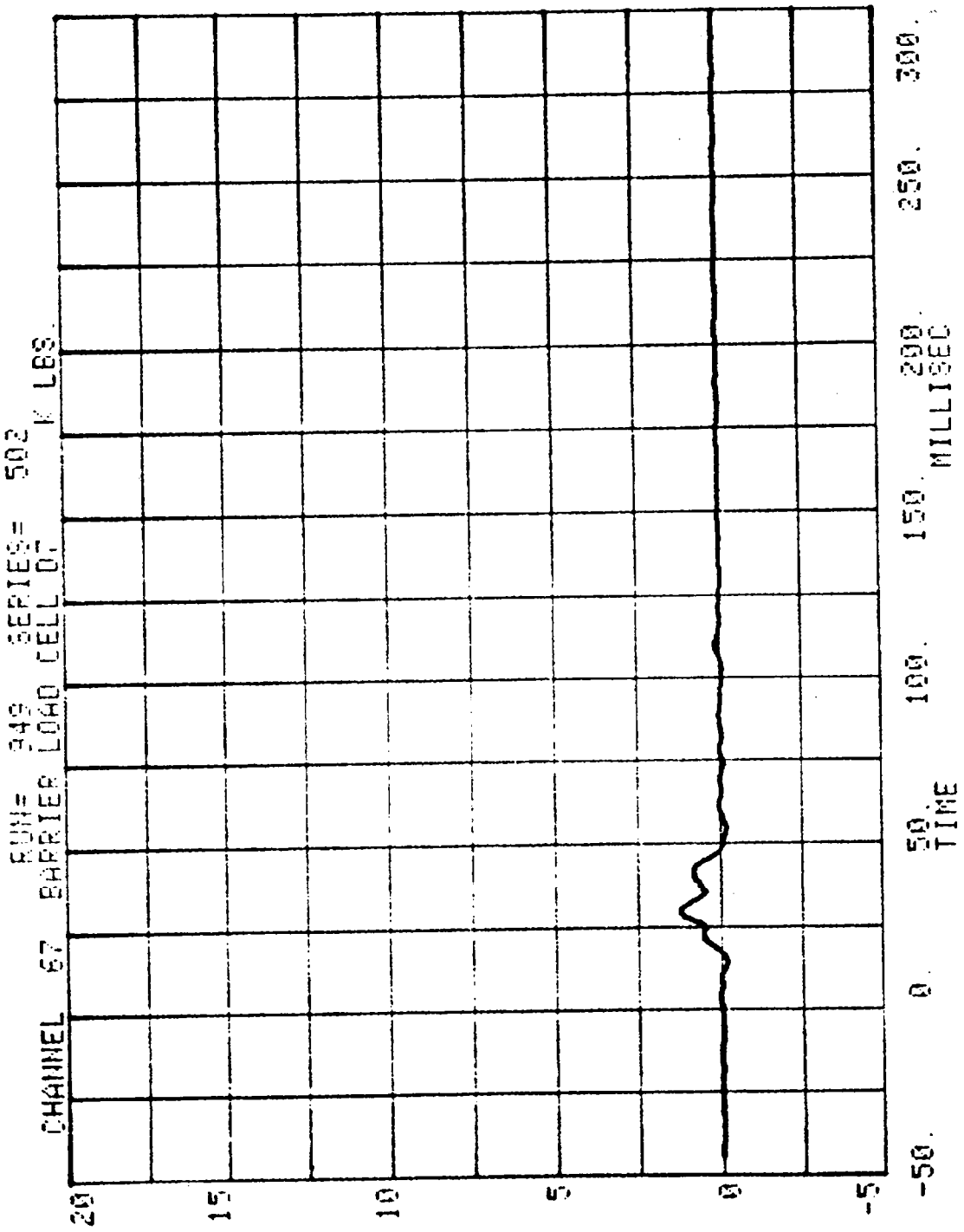

CHANNEL 64 BARRIER LOAD CELL 04
RUN= 949 SERIES= 502
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150
200.
250.
300.
TIME
MILLISEC

7776-5

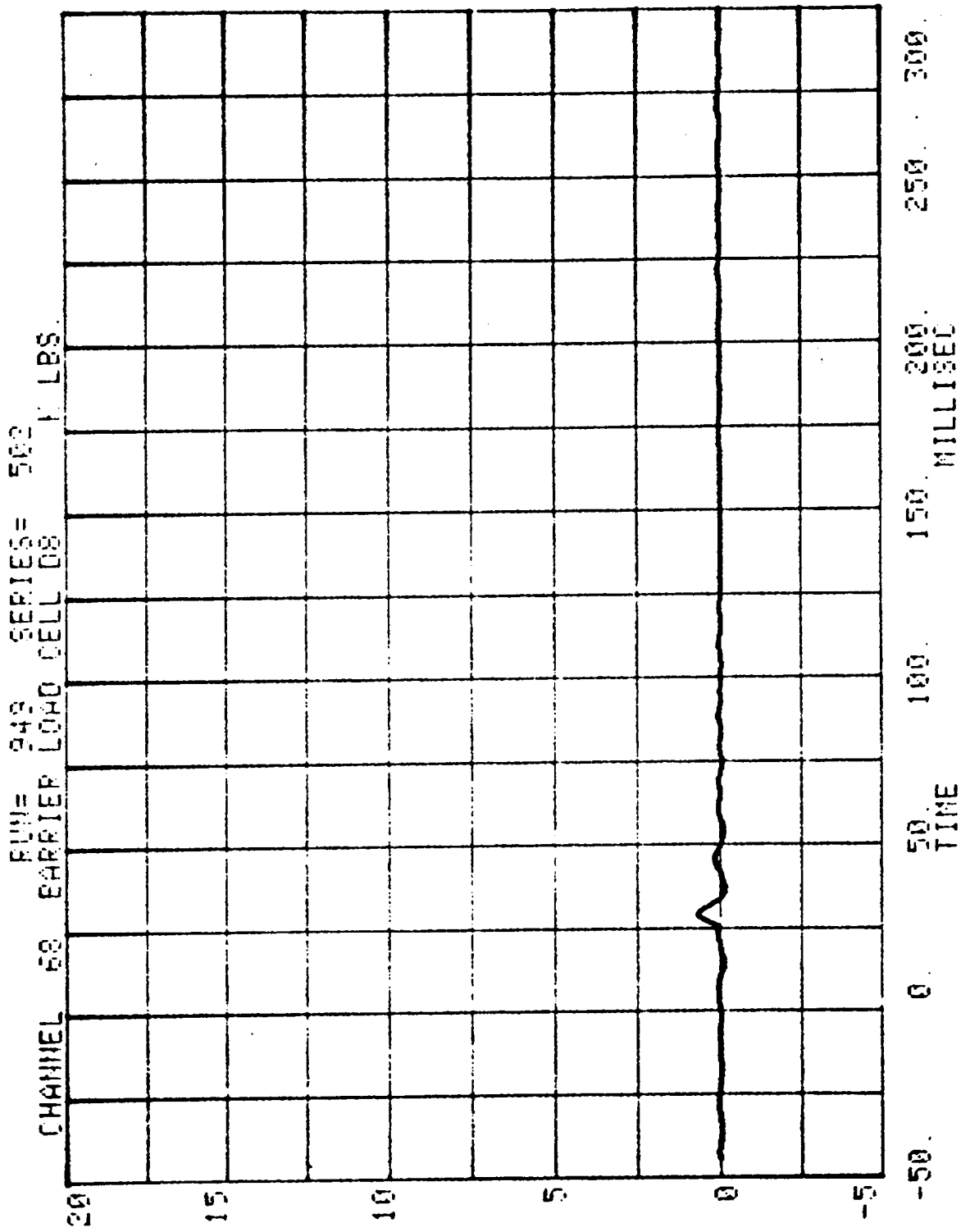

RUN= 949 SERIES= 502
CHANNEL 65 BARRIER LOAD CELL 05 K LBS.
20
15
10
5
0
-5
-50.
0
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

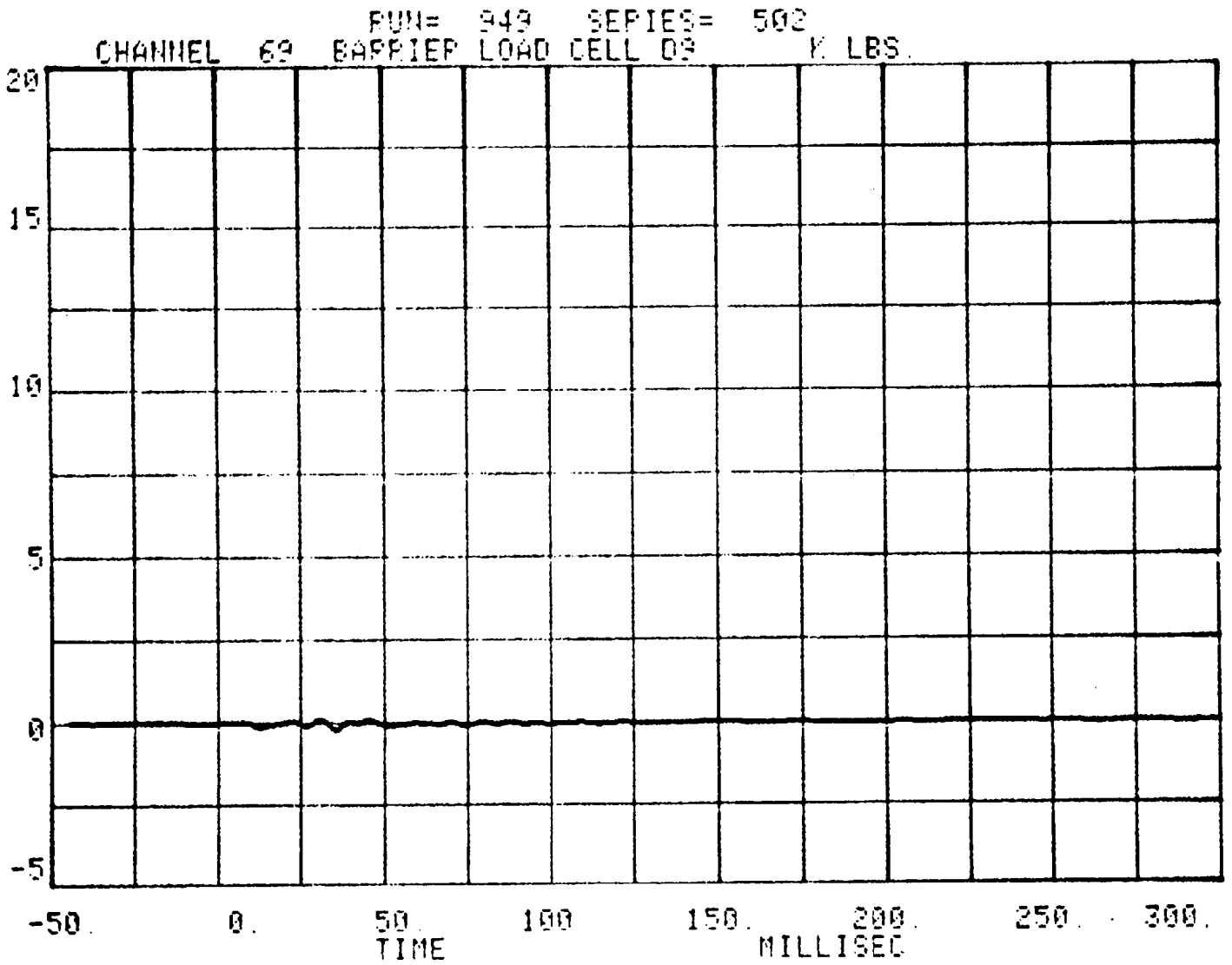

CHANNEL 68 BARRIER LOAD CELL 06
RUN= 943 SERIES= 502
# LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 67 BARRIER LOAD CELL 07.
RUN= 349 SERIES= 502
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

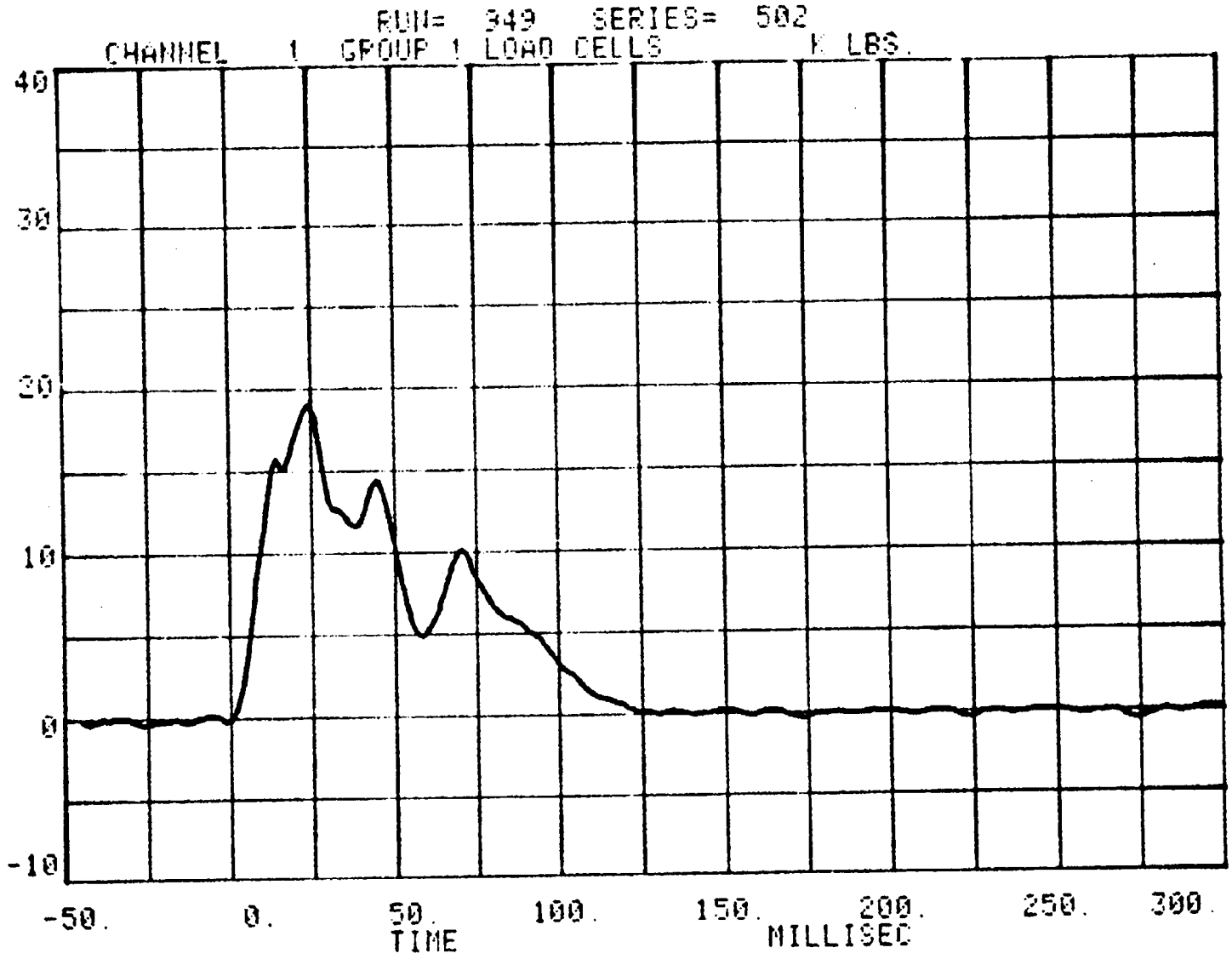

CHANNEL 58 BARRIER LOAD CELL 08
RUN= 248 SERIES= 502
1 LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


RUN= 949 SERIES= 502
CHANNEL 69 BARRIER LOAD CELL 09 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100
150.
200.
250.
300.
TIME
MILLISEC

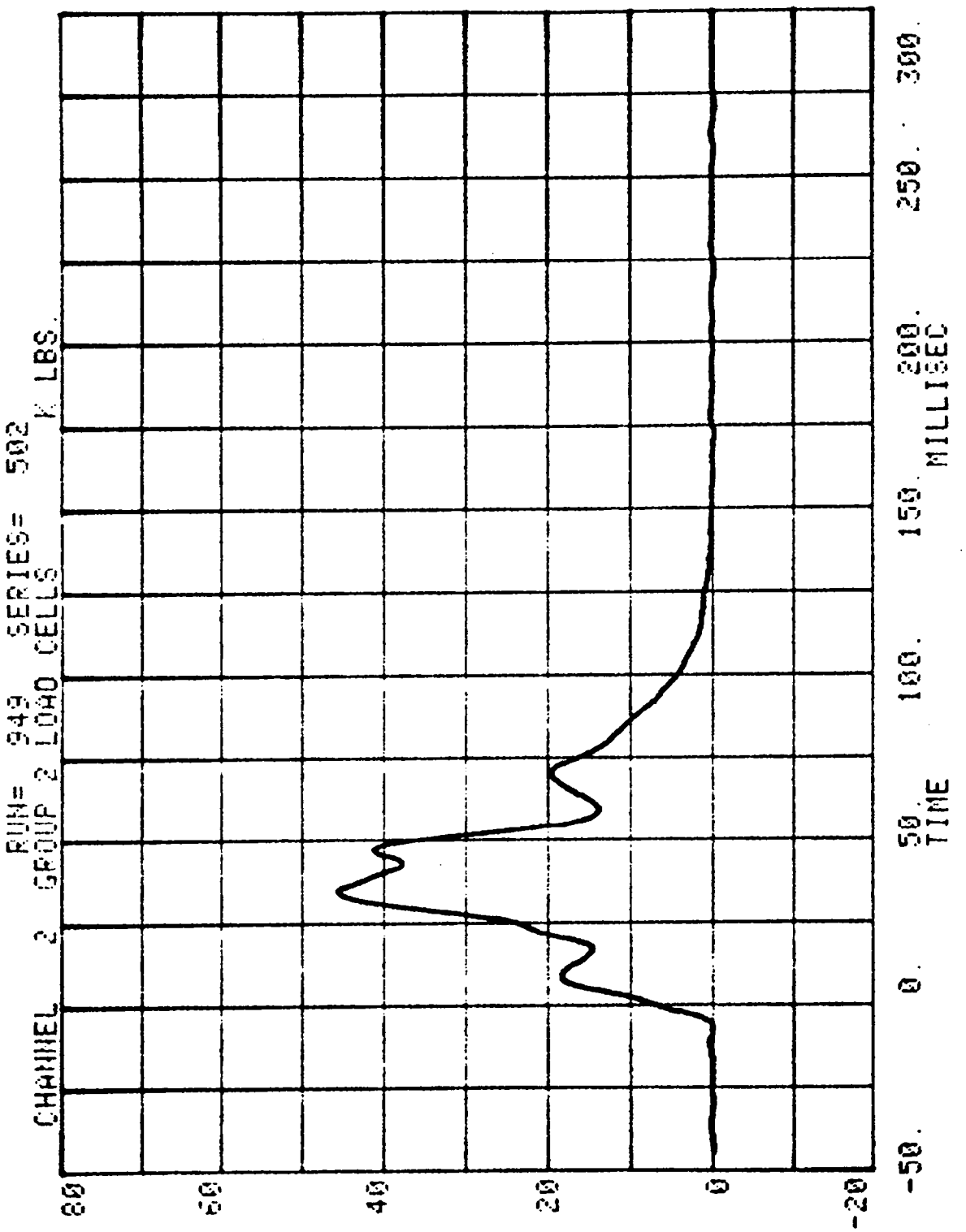
NEW CAR ASSESSMENT PROGRAM - 1990

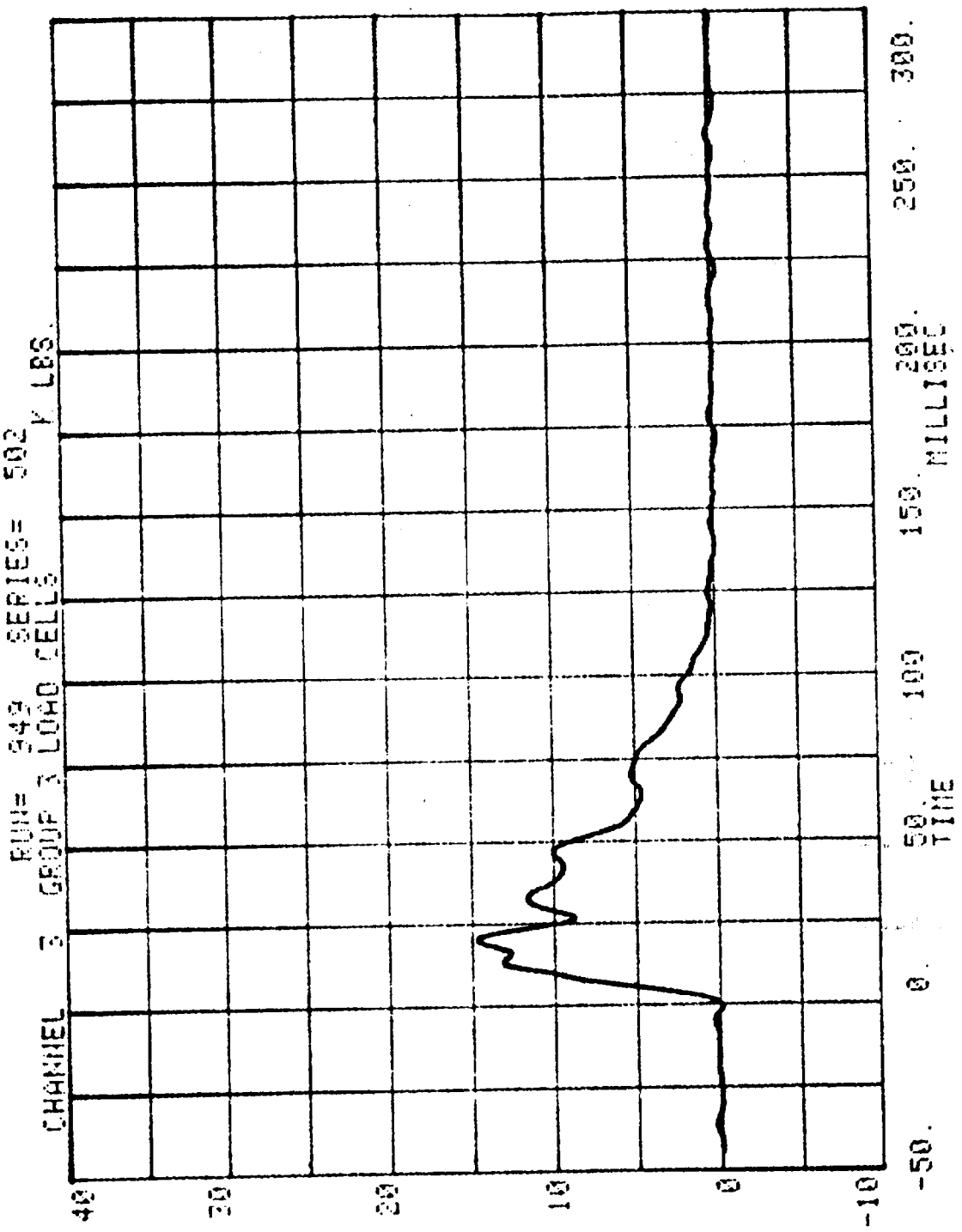
RUN # 949 SERIES # 502

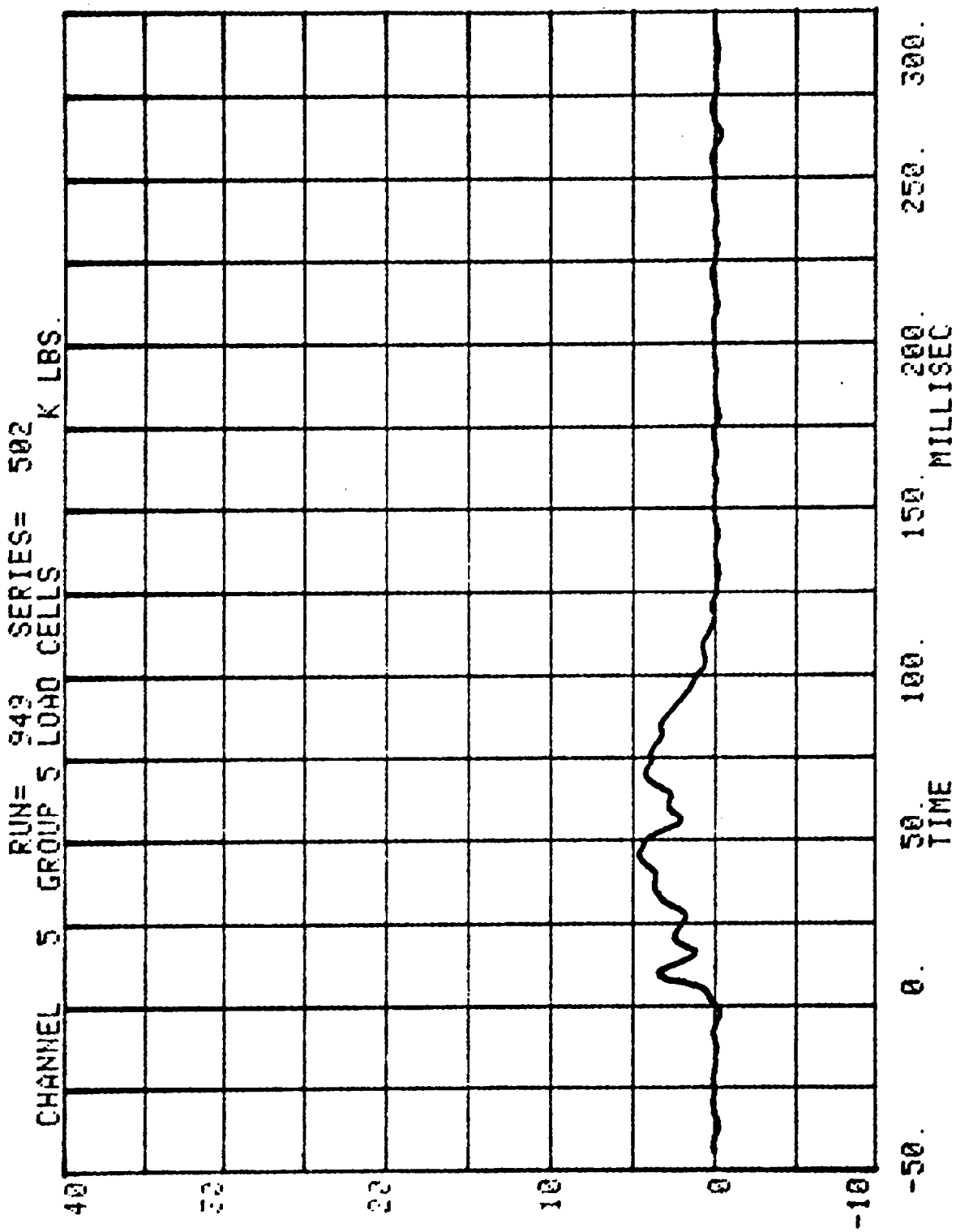
CHAN	TITLE	MINIMUM/MAXIMUM	AT	TIME
1	GROUP 1 LOAD CELLS	-.477 K LBS 19.048 K LBS.		274.20 MS. 24.00 MS.
2	GROUP 2 LOAD CELLS	-.273 K LBS. 45.688 K LBS.		221.85 MS. 34.35 MS.
3	GROUP 3 LOAD CELLS	-.297 K LBS. 14.763 K LBS.		222.07 MS. 20.47 MS.
4	GROUP 4 LOAD CELLS	-.371 K LBS. 4.732 K LBS.		130.95 MS. 27.52 MS.
5	GROUP 5 LOAD CELLS	-.365 K LBS. 4.693 K LBS.		263.55 MS. 45.60 MS.
6	GROUP 6 LOAD CELLS	-.309 K LBS. 6.637 K LBS.		164.78 MS. 39.82 MS.
7	TOTAL LOAD CELL SUM	-.540 K LBS. 81.552 K LBS.		224.10 MS. 33.82 MS.


RUN= 349 SERIES= 502
CHANNEL 1 GROUP 1 LOAD CELLS K LBS.
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

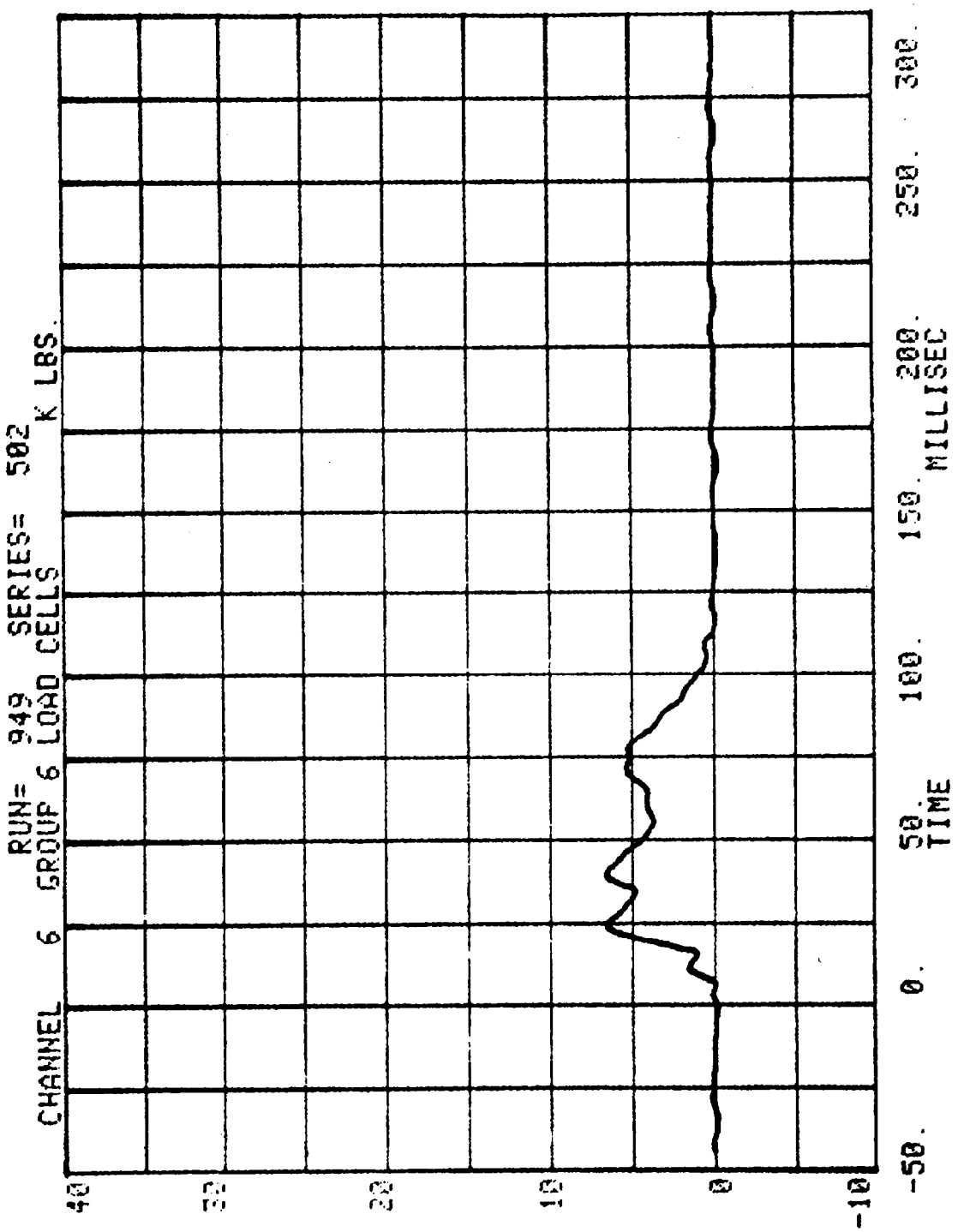
7776-5


CHANNEL 2 GROUP 2 LOAD CELLS
RUN= 949 SERIES= 502
K LBS.
80
60
40
20
0
-20
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

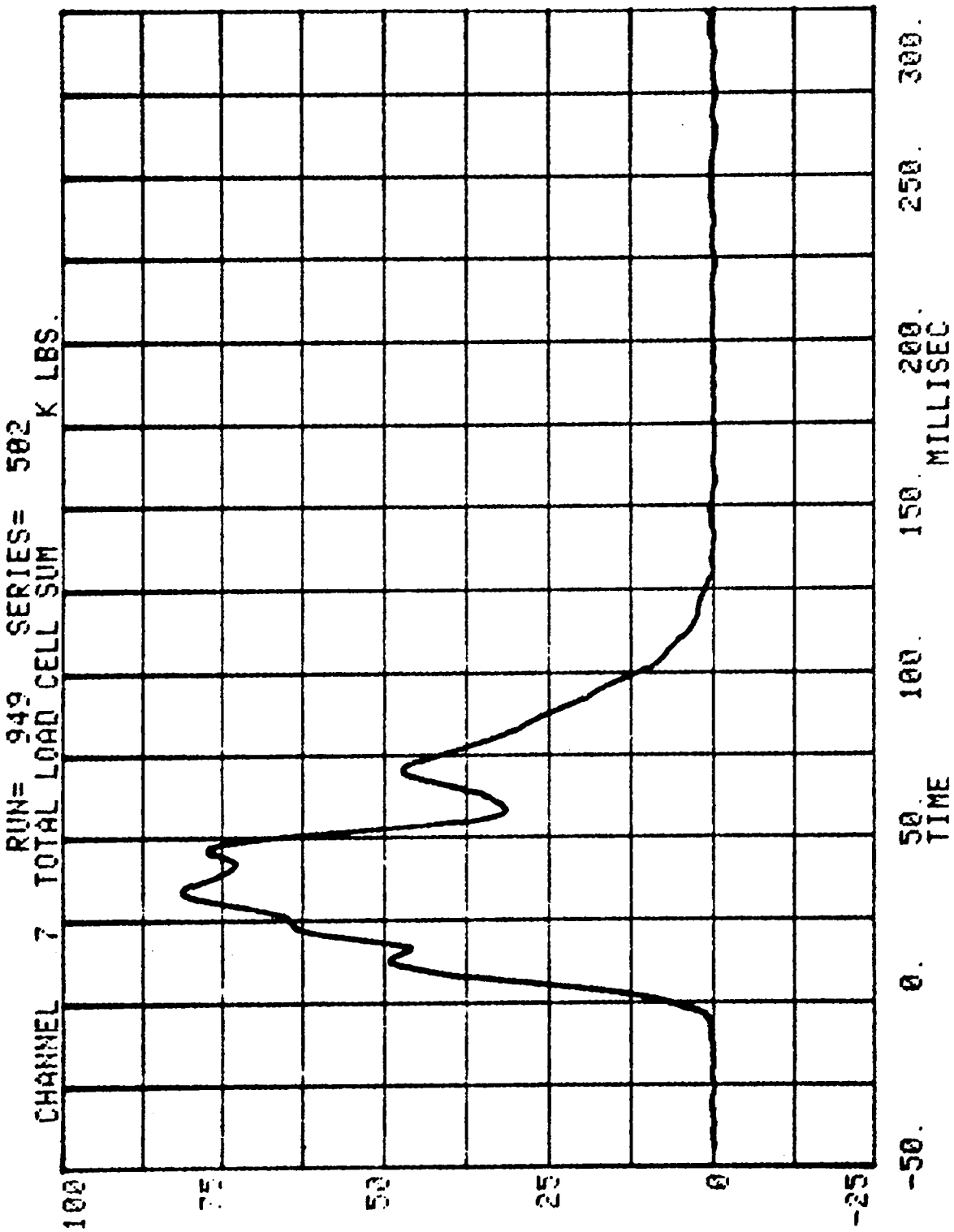

RUN= 342 SERIES= 502
CHANNEL 3 GROUP 3 LOAD CELLS
K LBS.
40
20
0
-10
-50.
0.
50.
100
150.
200.
250.
300.
TIME
MILLISEC.


CHANNEL 5 GROUP 5 LOAD CELLS
RUN= 942 SERIES= 502
K LBS.
40
32
22
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 6 GROUP 6 LOAD CELLS
RUN= 949 SERIES= 502
K LBS.
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 7 TOTAL LOAD CELL SUM
RUN= 949 SERIES= 502
K LBS.
100
75
50
25
0
-25
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

TEST NO. ML0502

DUMMY DATA

CLASS	FILTER CHANNEL
Head Accelerations	1000
Chest Accelerations	180
Femur Forces	600
Belt Loads	60

HEAD INJURY CRITERION
HEAD SEVERITY INDEX
36MS. MAXIMUM DURATION

NEW CAR ASSESSMENT PROGRAM - 1990

RUN= 349

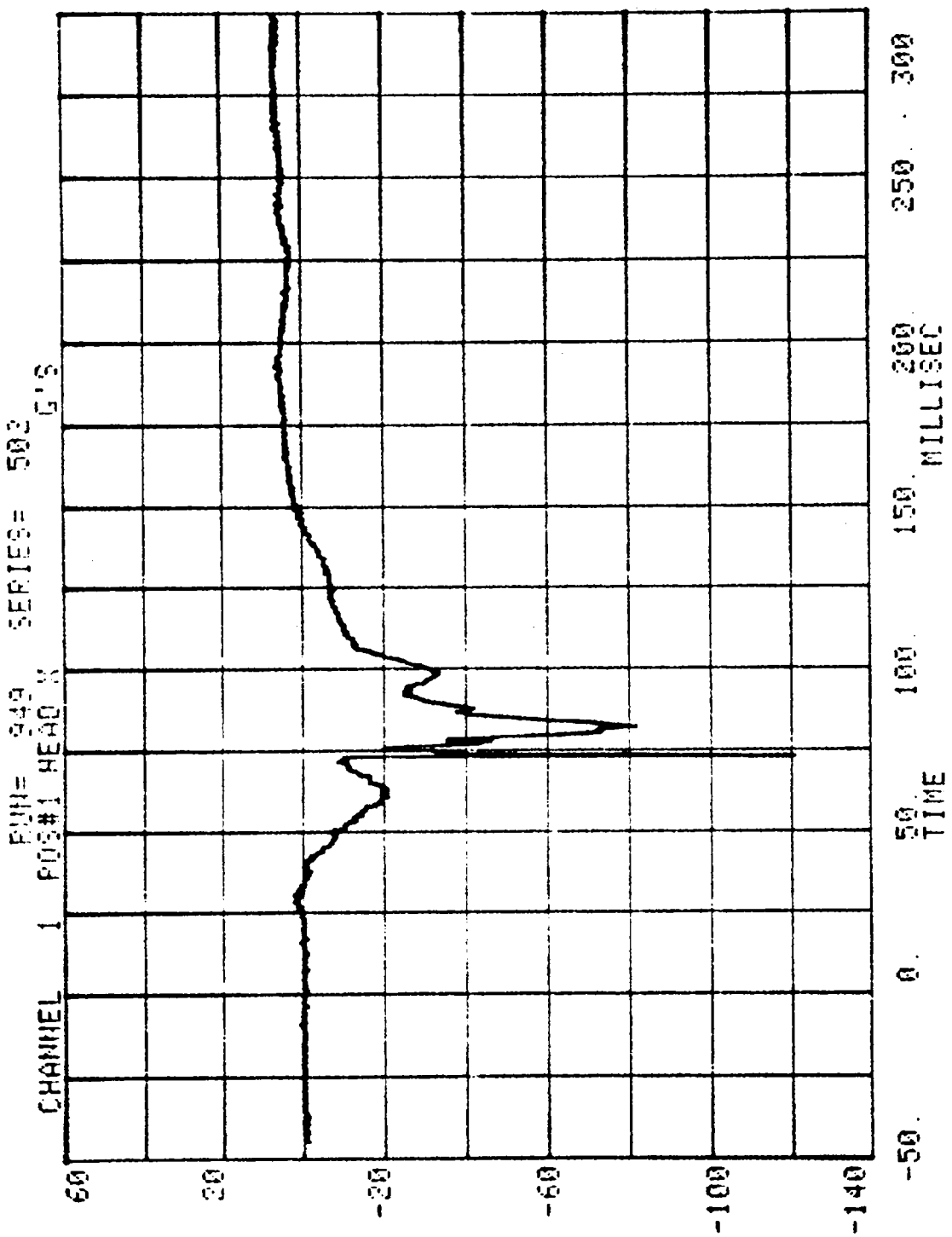
POS#1 HEAD R

HIC= 695.8 FROM T1= .06172 TO T2= .09772

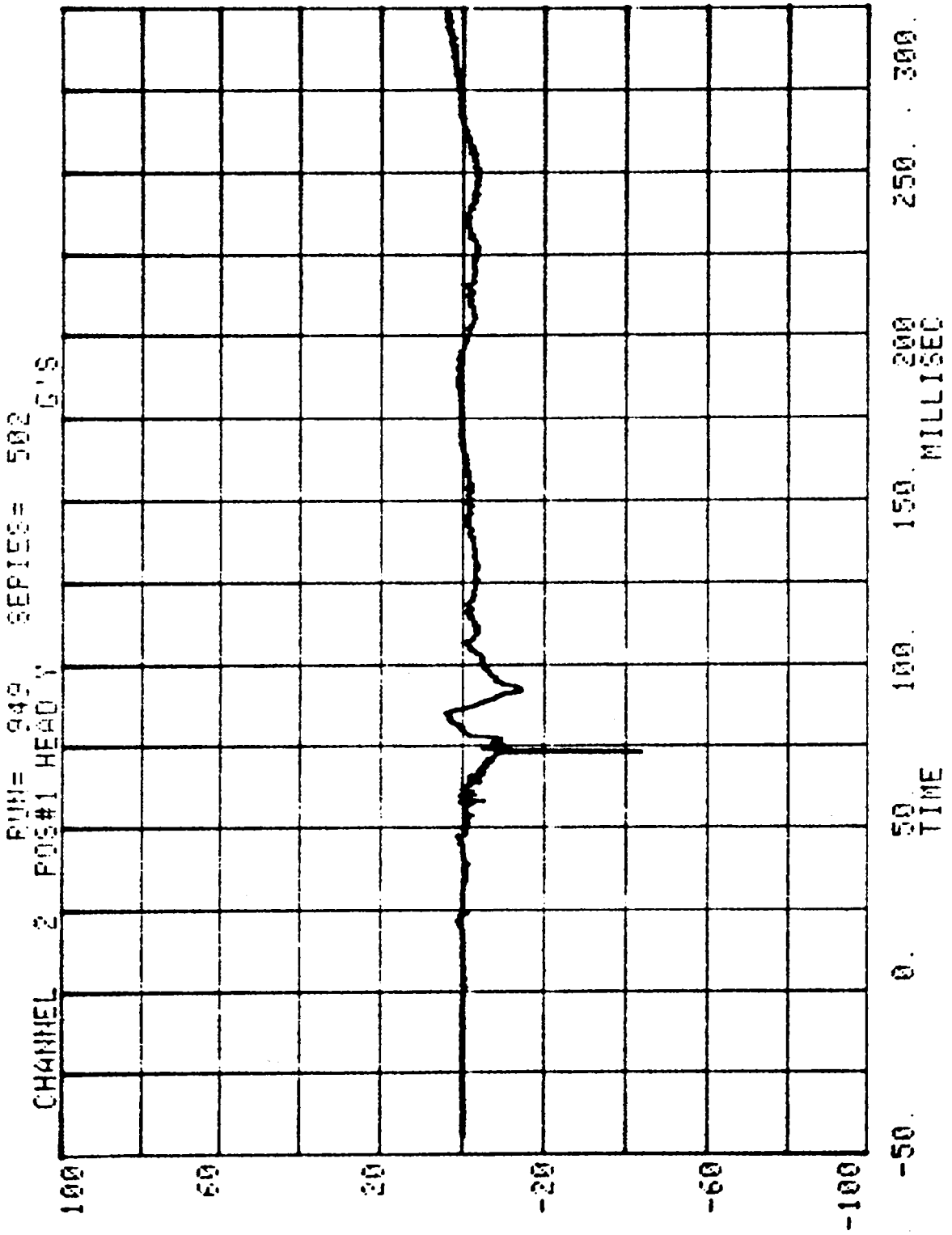
AVERAGE ACCELERATION BETWEEN T1 AND T2= 51.8G'S

EVENT TIME= 300.0 MSEC

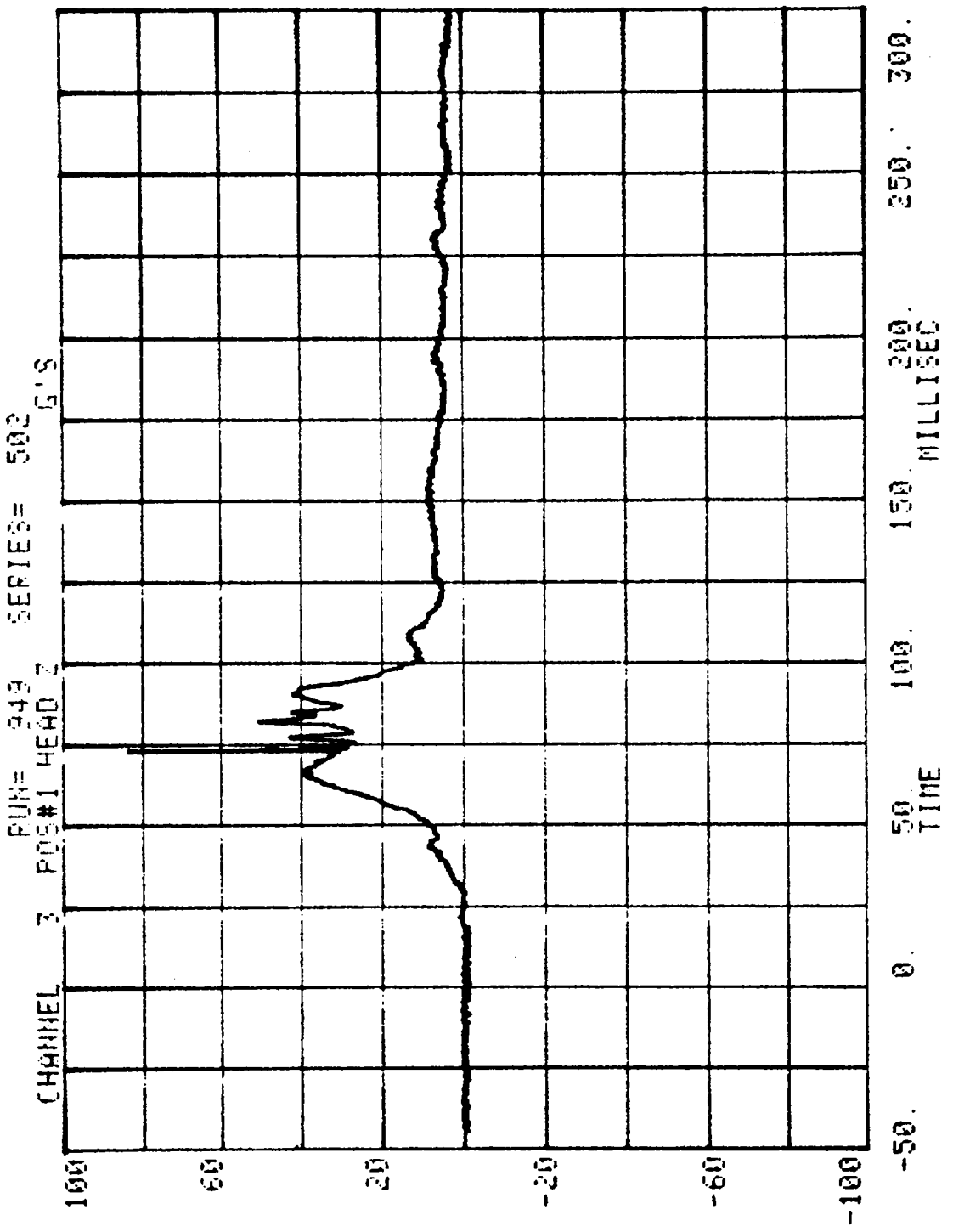
SEVERITY INDEX=1007.4


CHANNEL 1 POS#1 HEAD X
RUN= 949 SERIES= 502
G'S
60
20
-20
-60
-100
-140
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

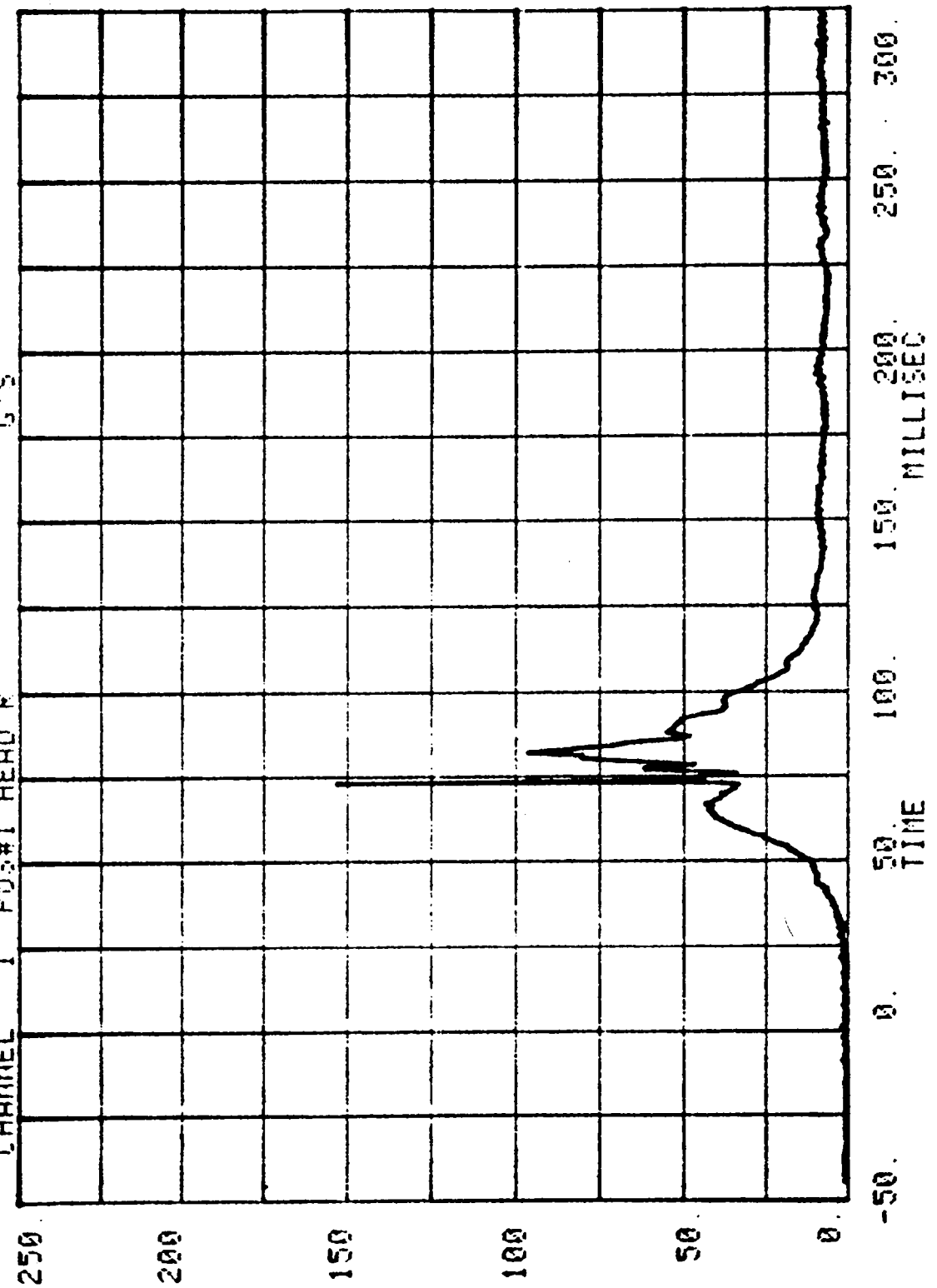
7776-5


CHANNEL 2 POS#1 HEAD 1
RUN= 949 SERIES= 502
G'S
100
50
0
-50
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

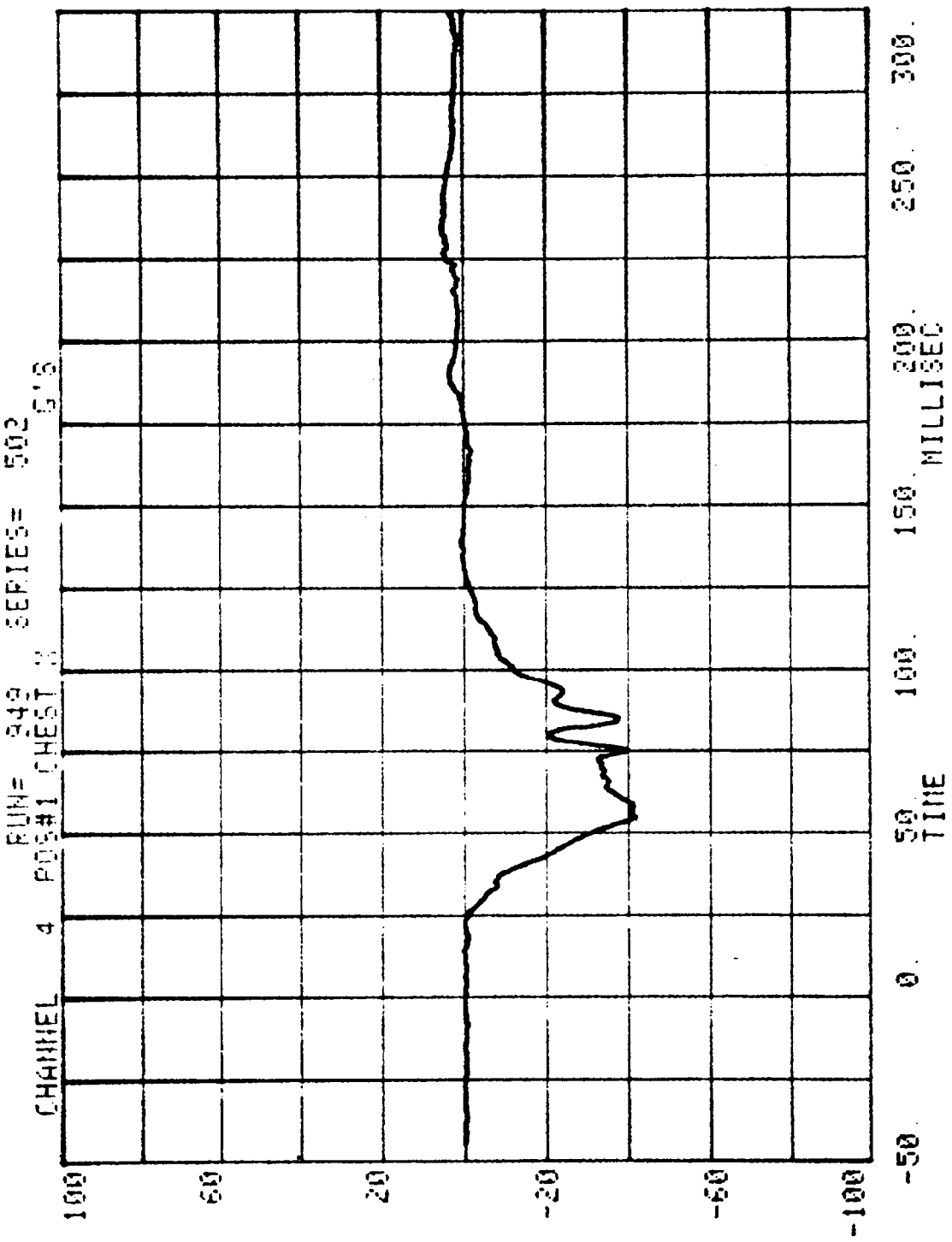
7776-5


CHANNEL 3 POS#1 HEAD 2
RUN= 949 SERIES= 502
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

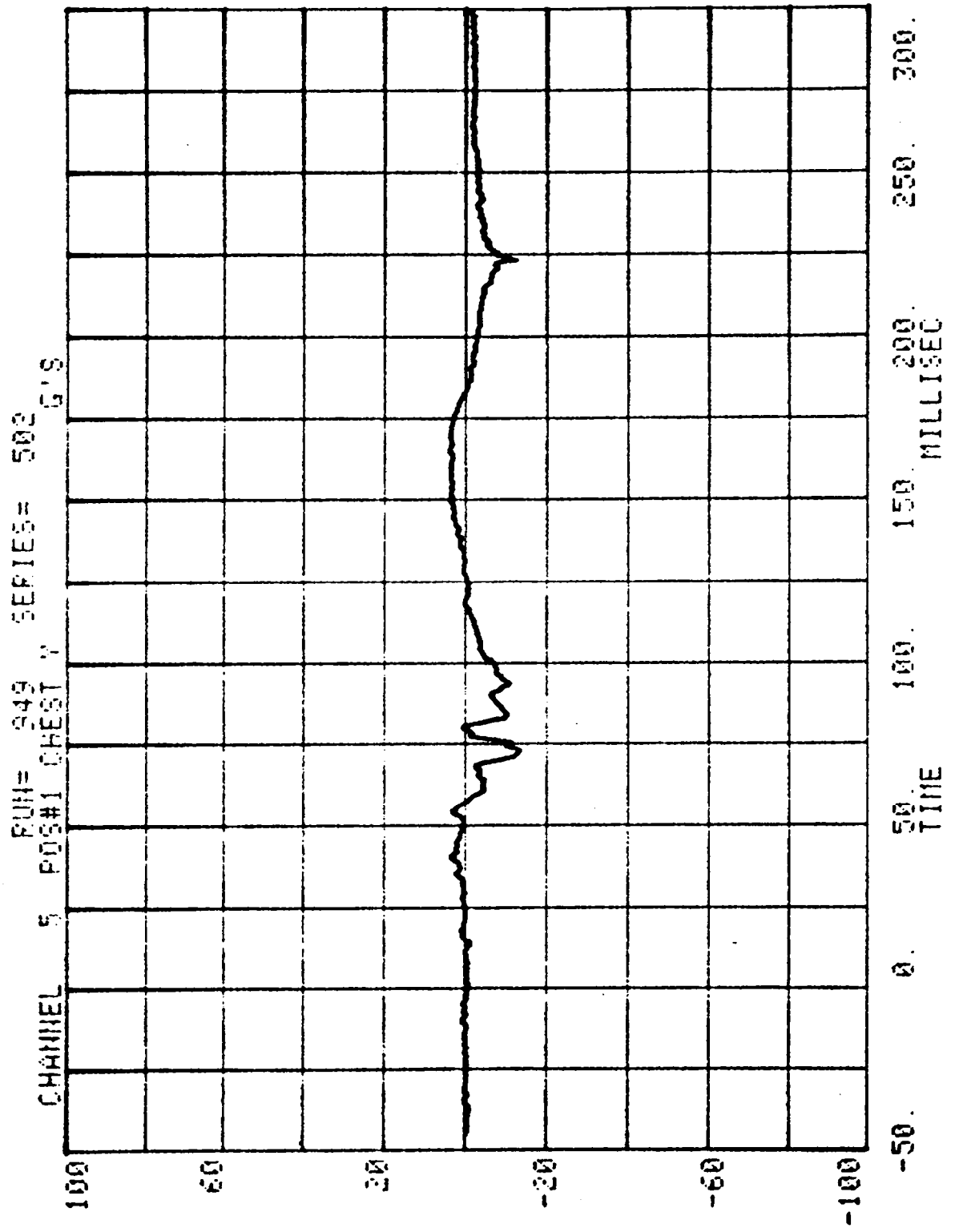
7776-5


CHANNEL 1 POS#1 HEAD R
RUN= 949 SERIES= 502
G'S
250
200
150
100
50
0
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

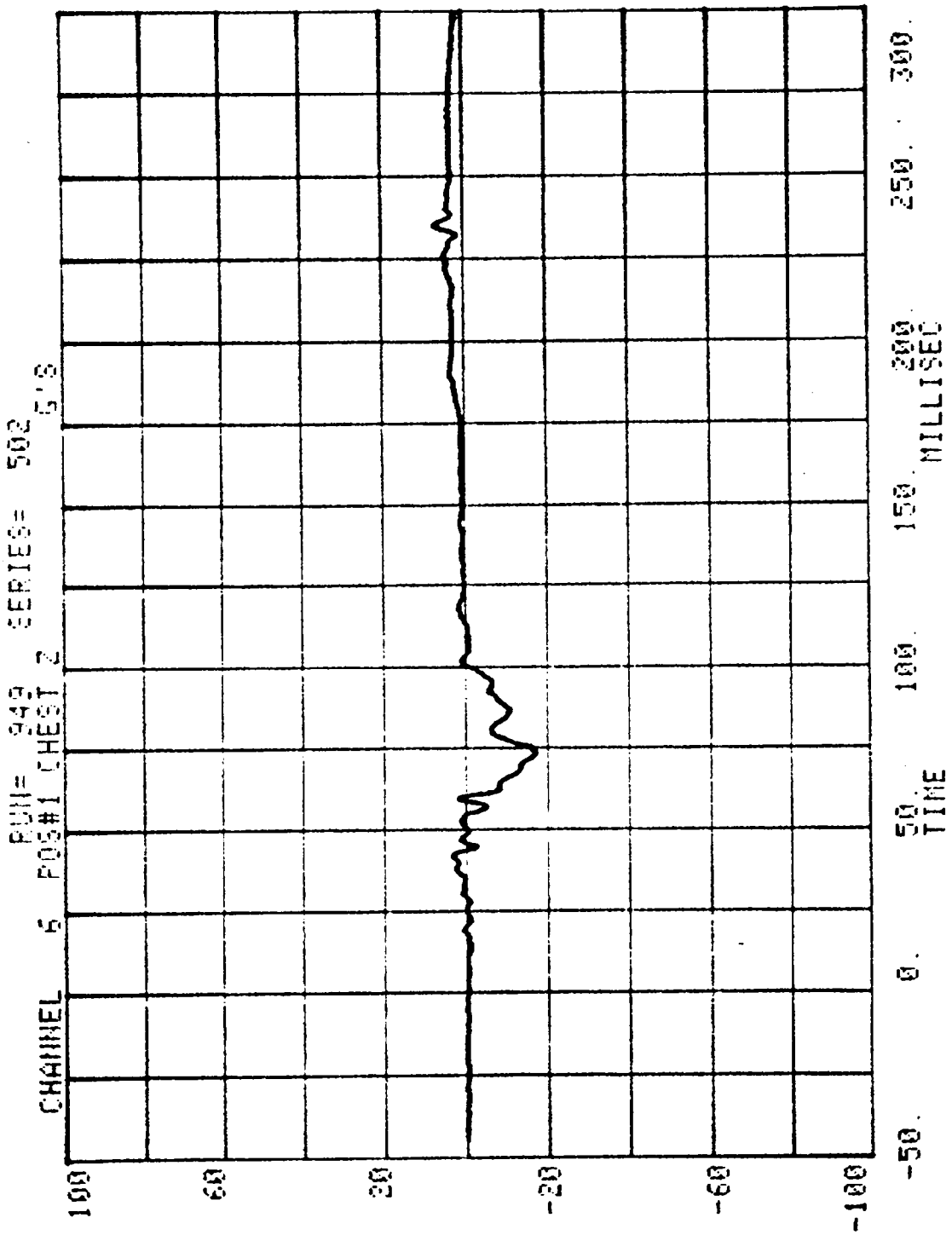
7776-5


RUN= 949 SERIES= 502
CHANNEL 4 POS#1 CHEST
100
60
20
-20
-60
-100
-50
0
50
100.
150.
200.
250.
300.
TIME
MILLISEC

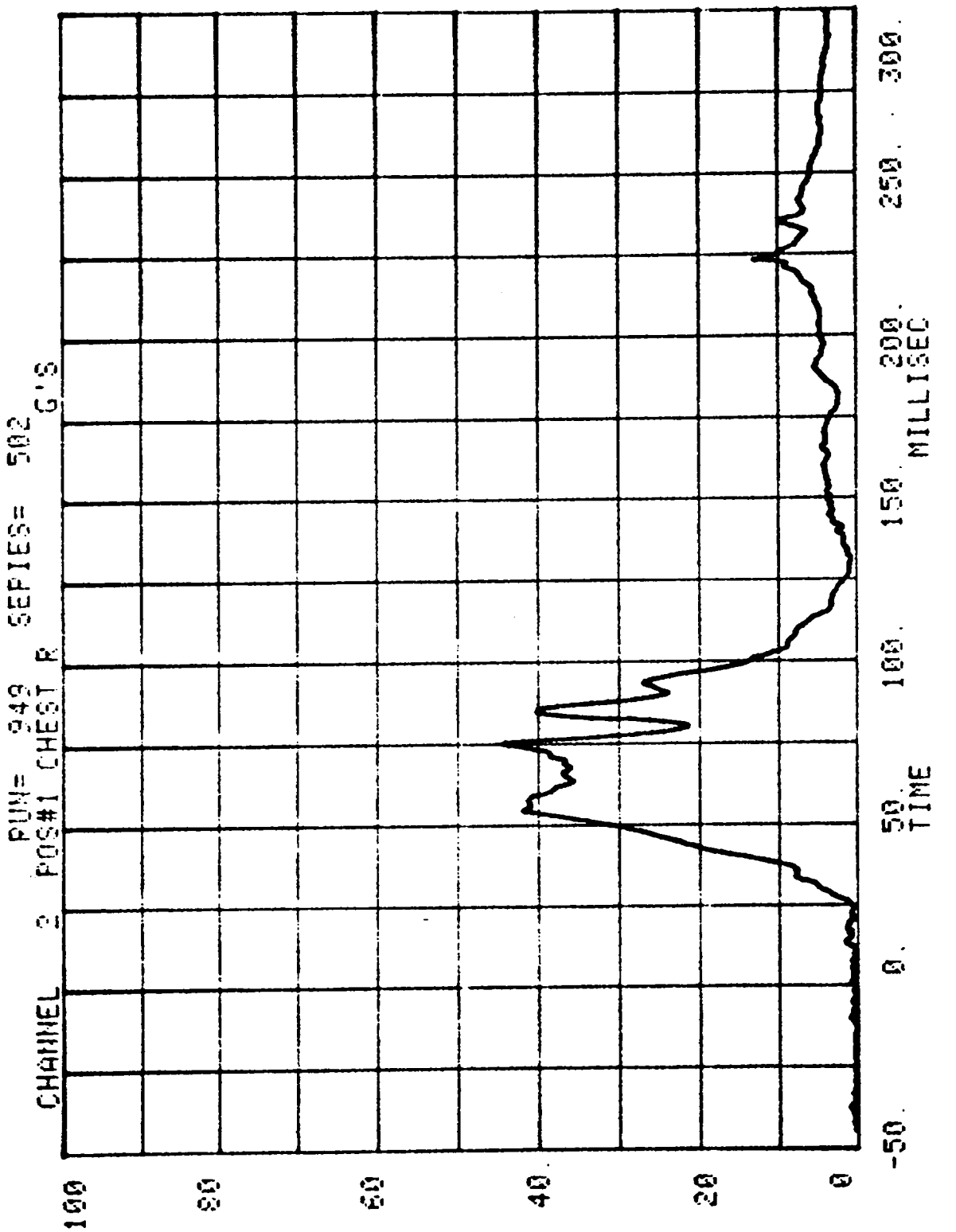
7776-5


CHANNEL 5 POS#1 CHEST Y
RUN= 949 SERIES= 502 G'S
100
50
0
-50
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

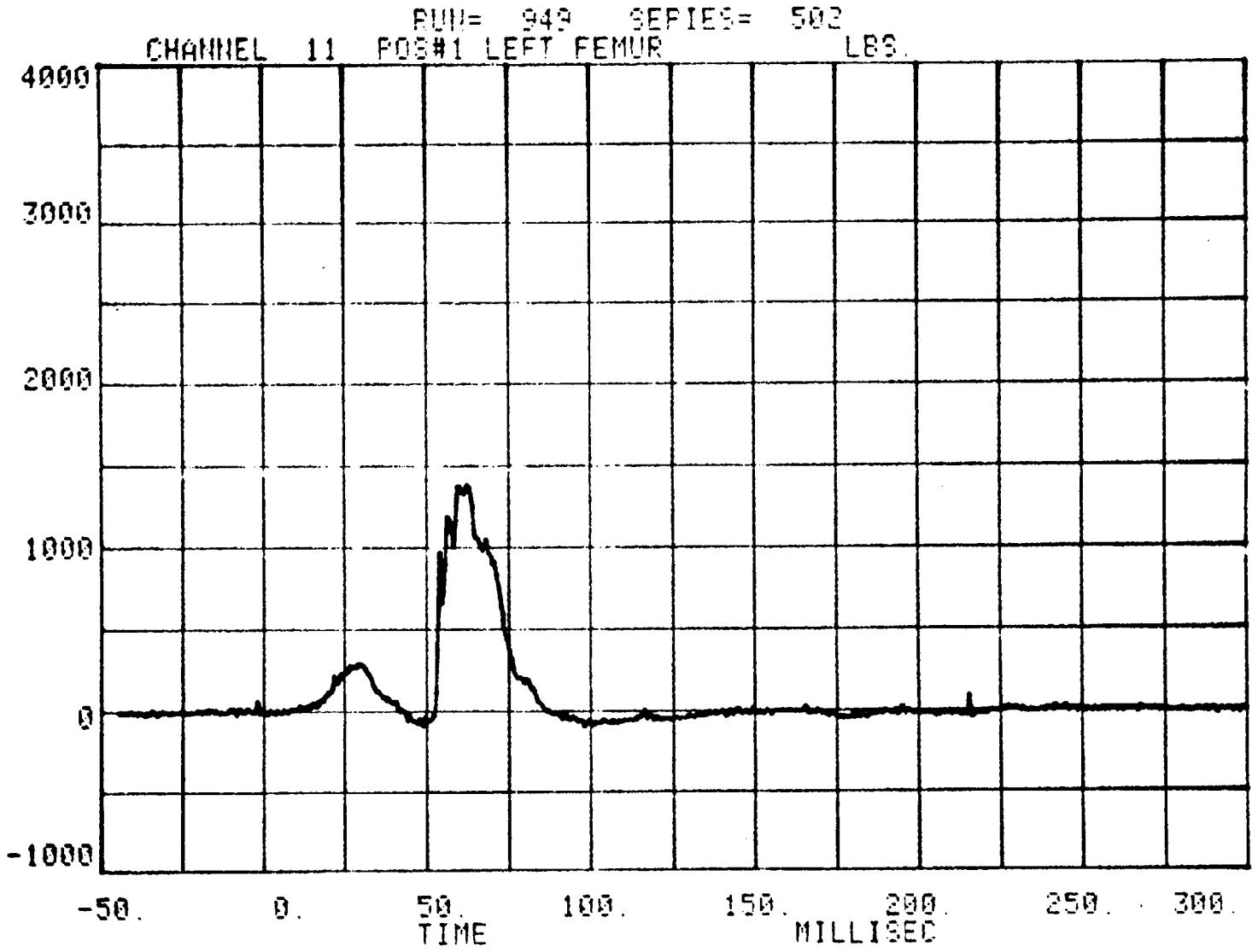
7776-5


RUN= 949 SERIES= 502
CHANNEL 5 POS#1 CHEST 2
100
60
20
-20
-60
-100
-50.
0.
50.
100
150
200
250.
300.
TIME
MILLISEC

7776-5

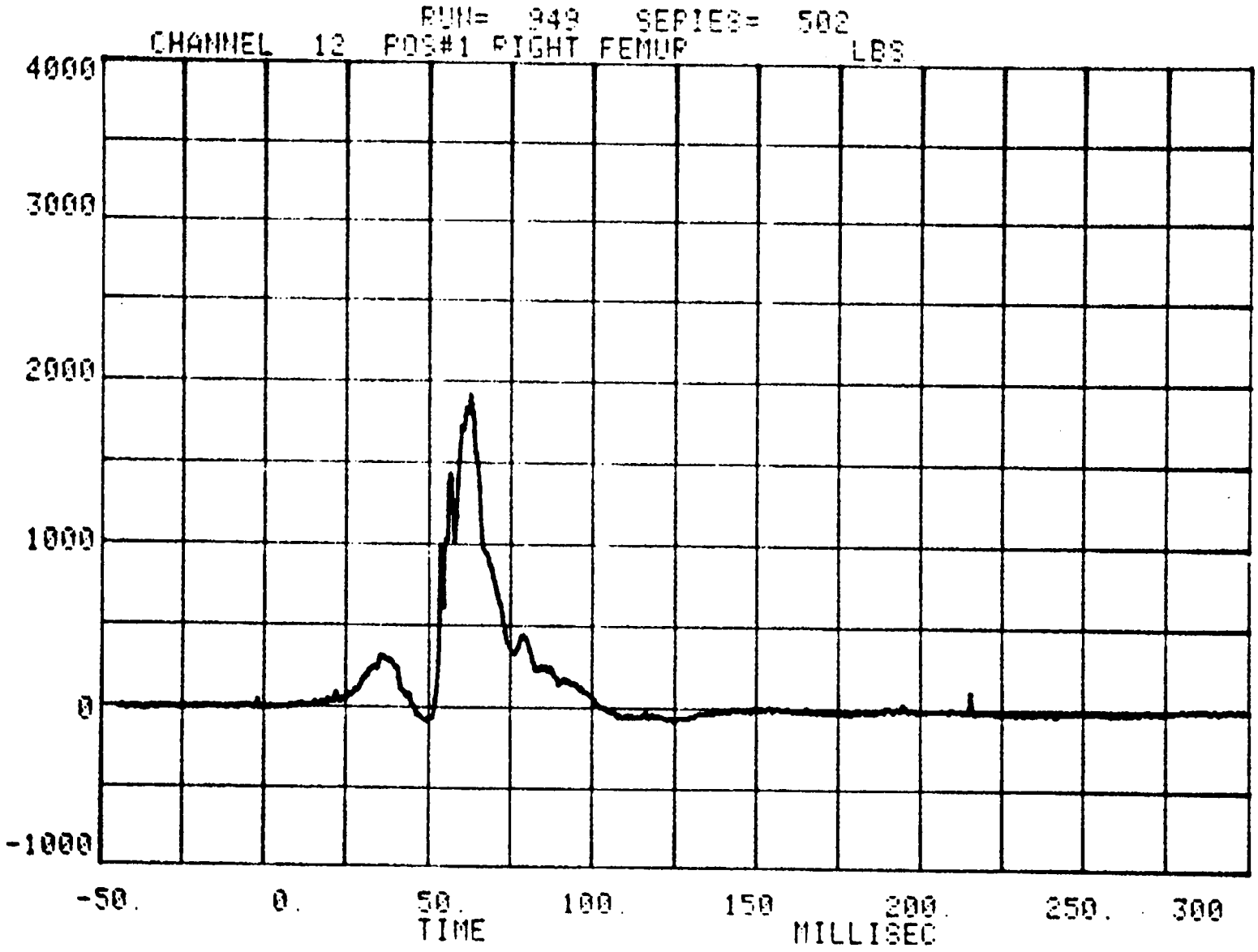

CHANNEL 2 POS#1 CHEST R
RUN= 949 SERIES= 502
G'S
100
80
60
40
20
0
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

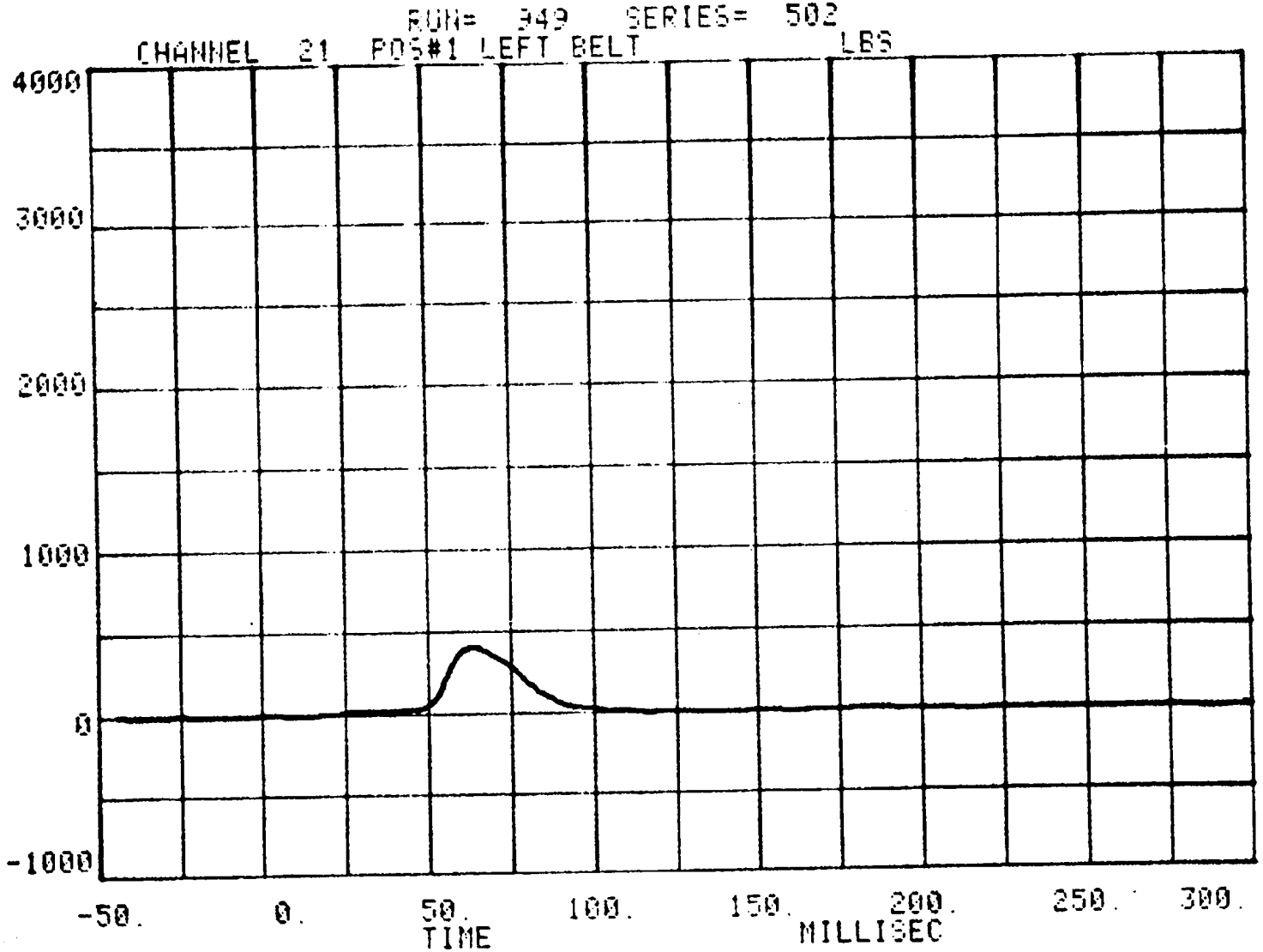

RUN= 949 SERIES= 502
CHANNEL 11 POS#1 LEFT FEMUR LBS.
4000
3000
2000
1000
0
-1000
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

B-75

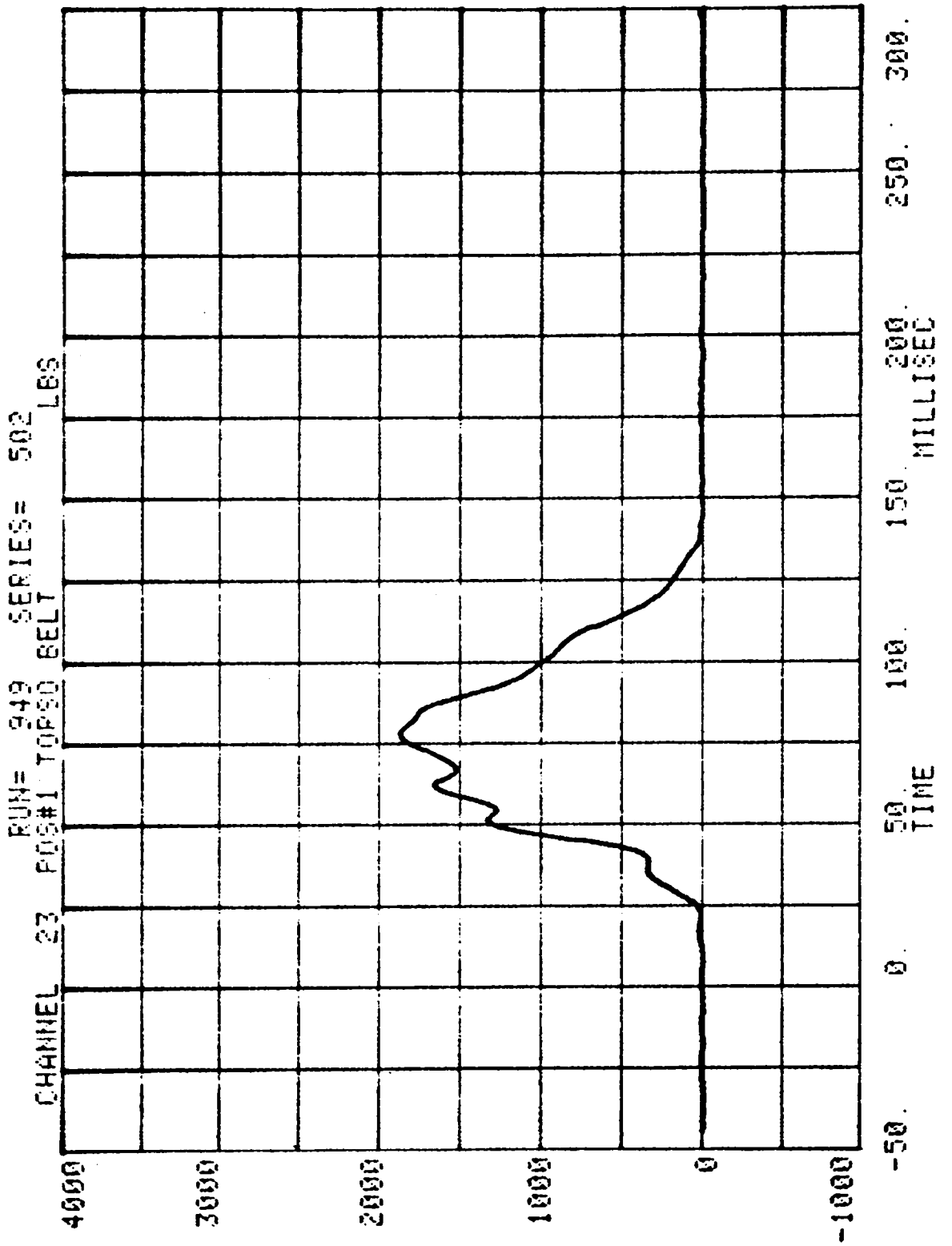
7776-5


RUN= 949 SERIES= 502
CHANNEL 12 POS#1 RIGHT FEMUR LBS
4000
3000
2000
1000
0
-1000
-50.
0.
50.
100.
150
200.
250.
300
TIME
MILLISEC

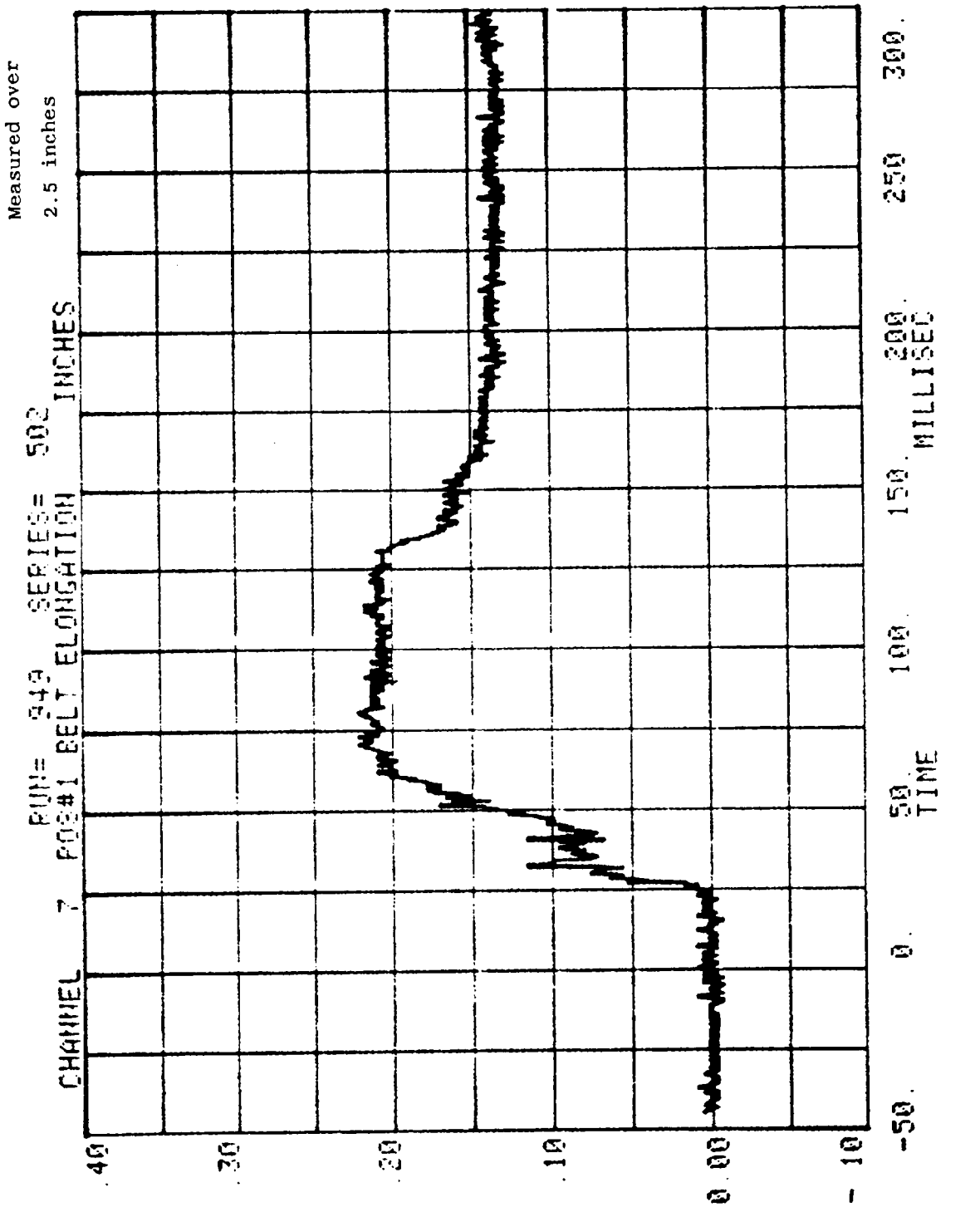
7776-5


RUN= 949 SERIES= 502
CHANNEL 21 POS#1 LEFT BELT LBS
4000
3000
2000
1000
0
-1000
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 23 POS#1 TOPSD BELT
RUN= 949 SERIES= 502
LBS
4000
3000
2000
1000
0
-1000
-50.
0
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 7 FOR#1 BELT ELONGATION
RUN= 343 SERIES= 502
INCHES
Measured over
2.5 inches
40
30
20
10
0.00
-10
-50.
0.
50.
100.
150.
200.
250
300.
TIME
MILLISEC

7776-5

HEAD INJURY CRITERION
HEAD SEVERITY INDEX
36MS. MAXIMUM DURATION

NEW CHR ASSESSMENT PROGRAM - 1990

RUN= 949

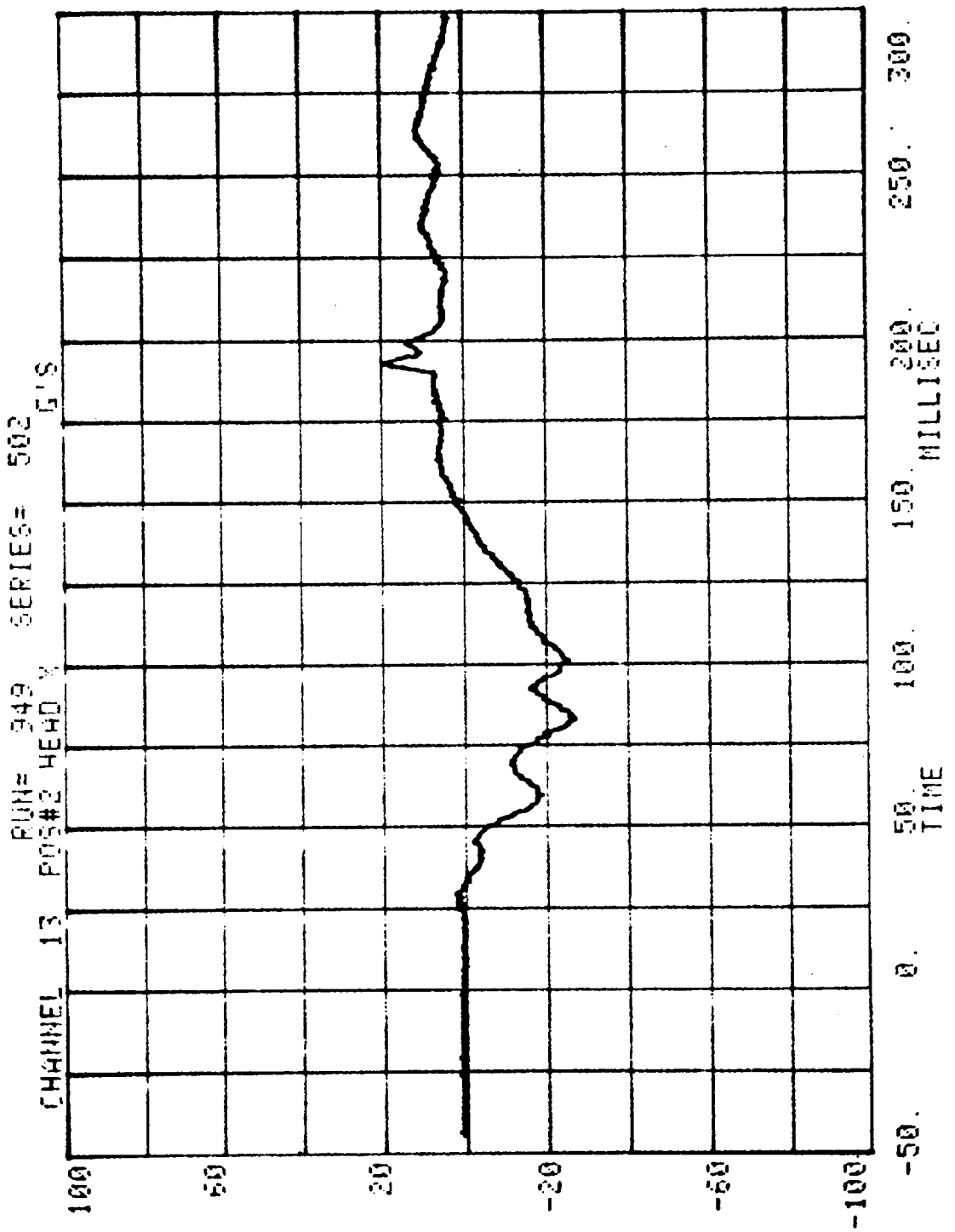
POS#2 HEAD R

HIC= 419.1 FROM T1= .05355 TO T2= .09555

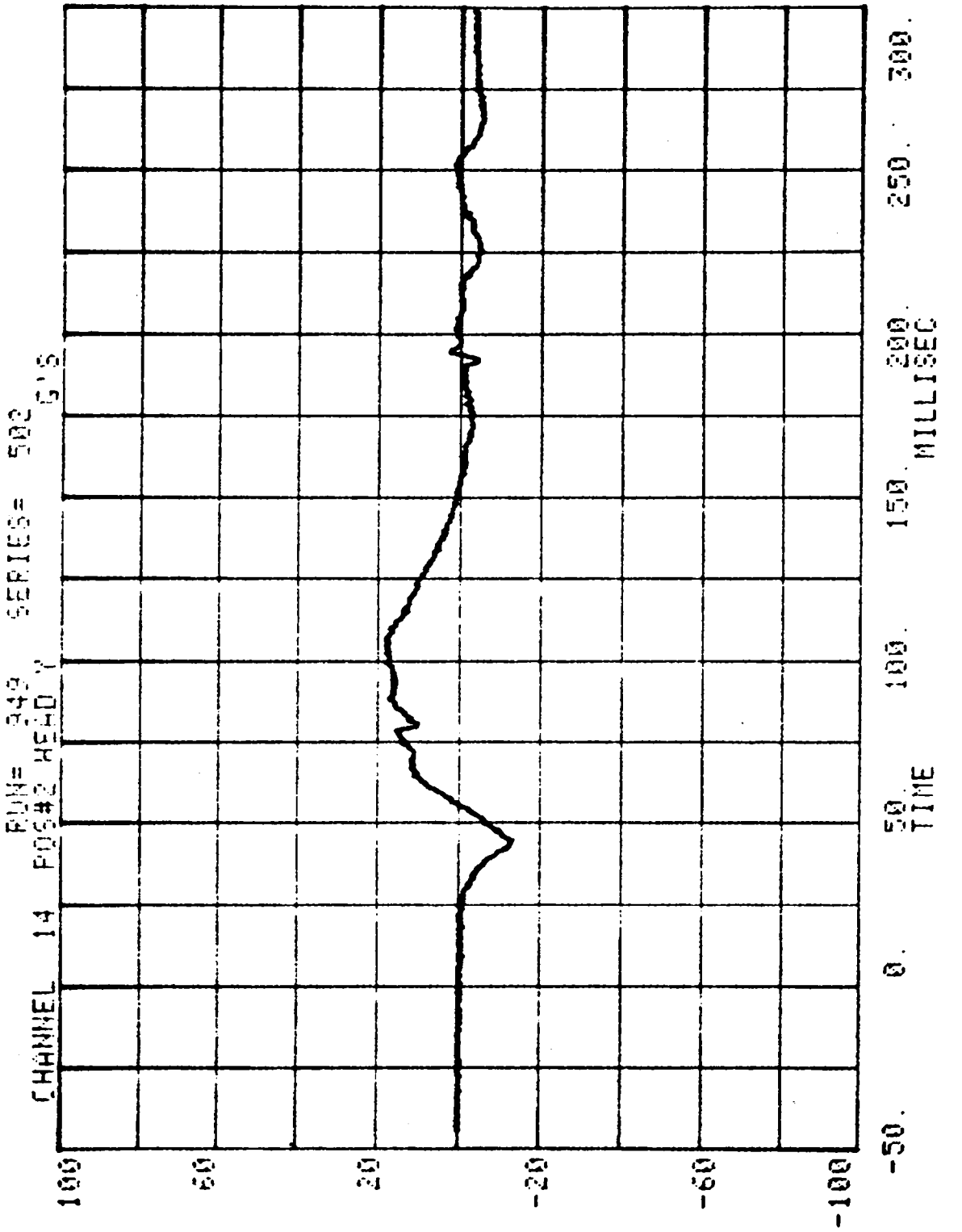
AVERAGE ACCELERATION BETWEEN T1 AND T2= 42 3G'S

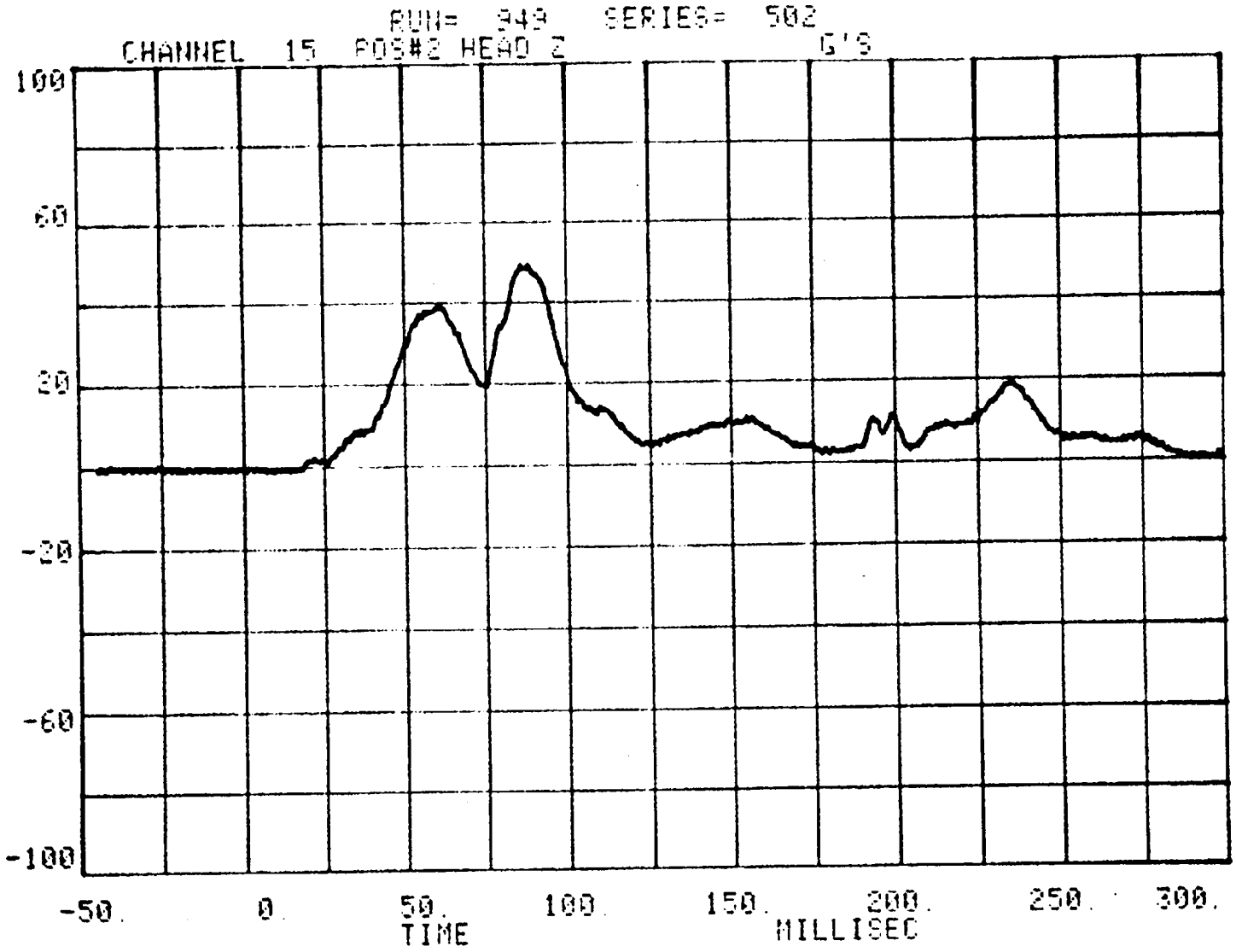
EVENT TIME= 300 0 MSEC

SEVERITY INDEX= 803.9


CHANNEL 13 POS#2 HEAD X RUN= 949 SERIES= 502
G'S
100
50
20
-20
-50
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

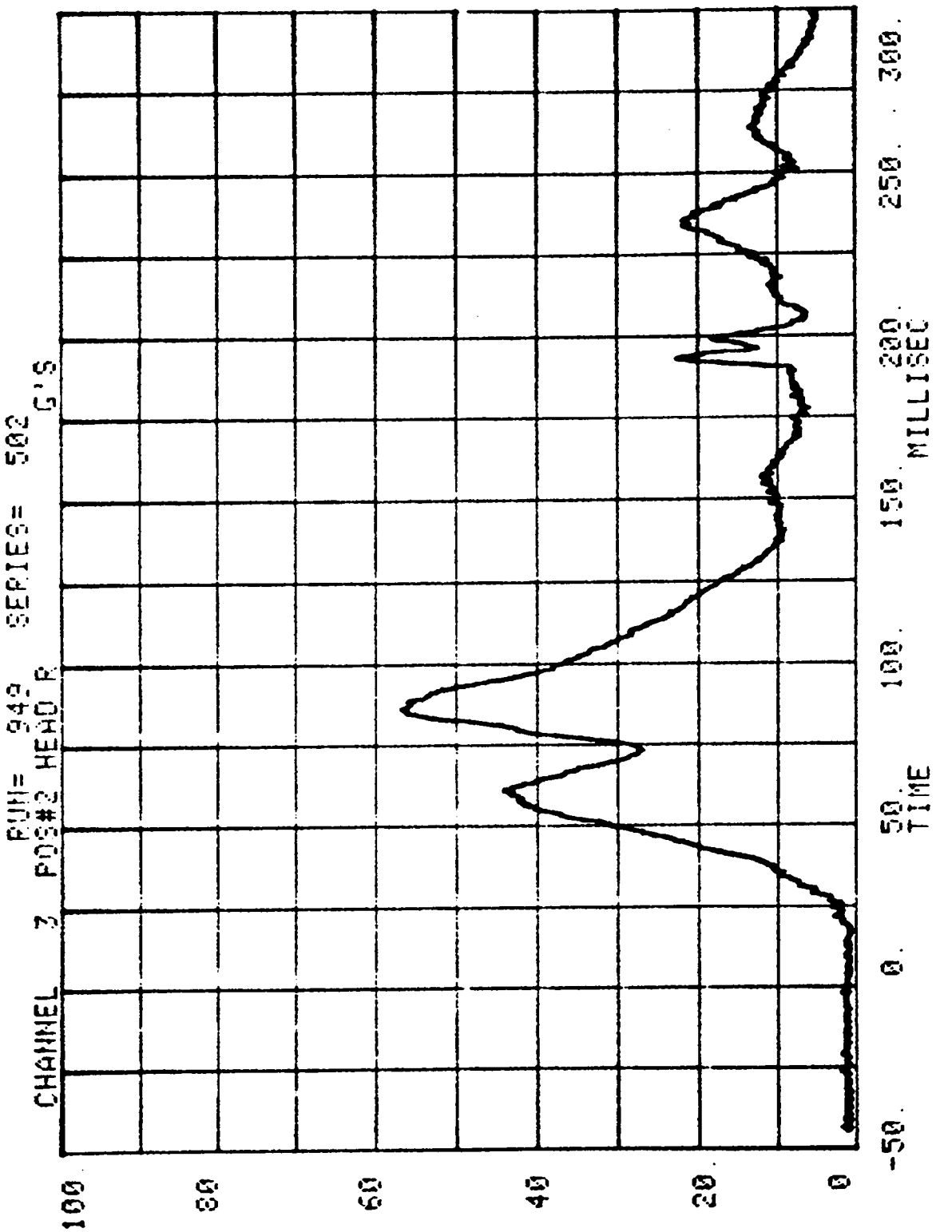
7776-5


CHANNEL 14 POS#2 HEAD 2 RUN= 342 SERIES= 502 G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

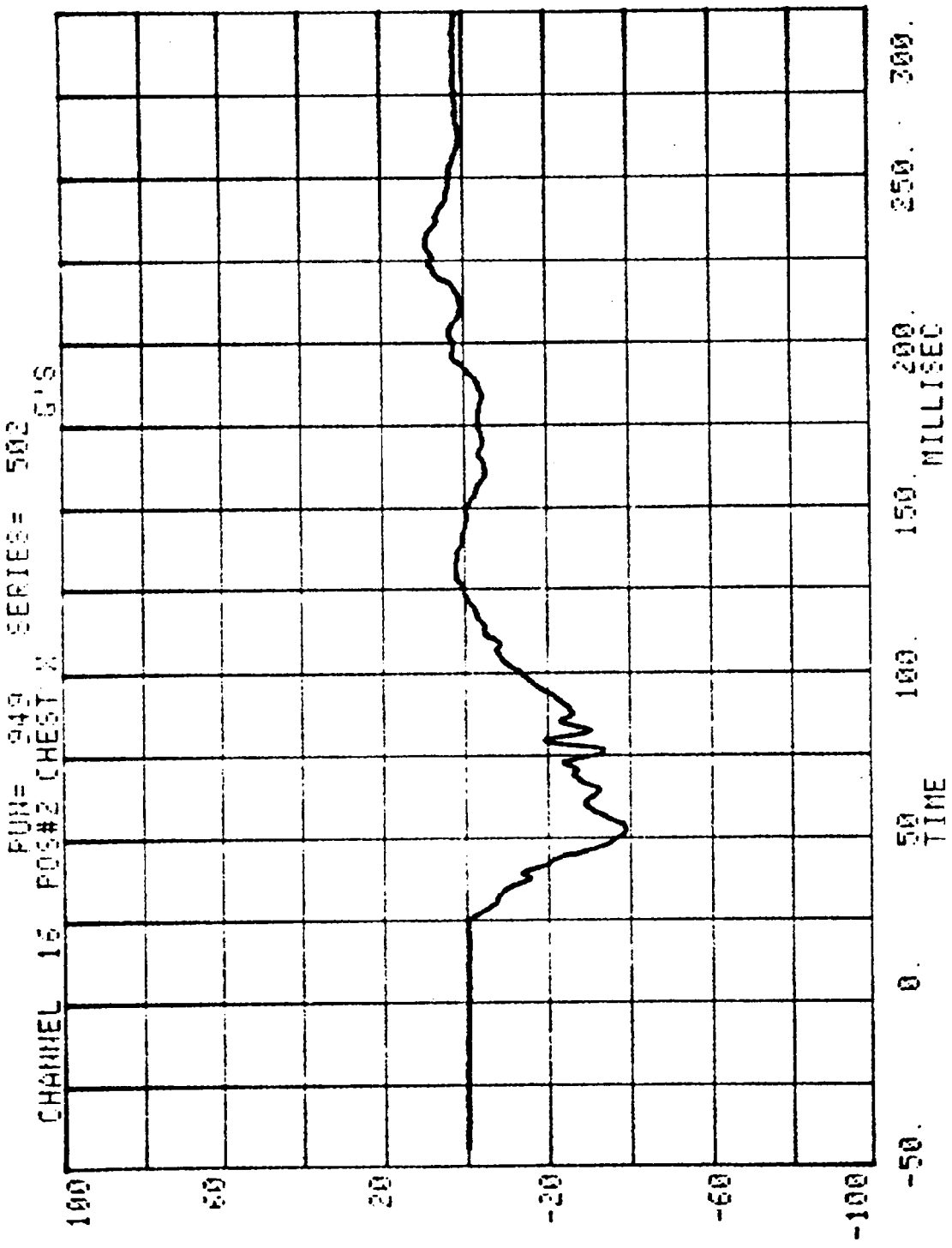

RUN= 949 SERIES= 502
CHANNEL 15 POS#2 HEAD Z
G'S
100
60
20
-20
-60
-100
-50.
0
50.
100
150.
200.
250.
300.
TIME
MILLISEC

B-83

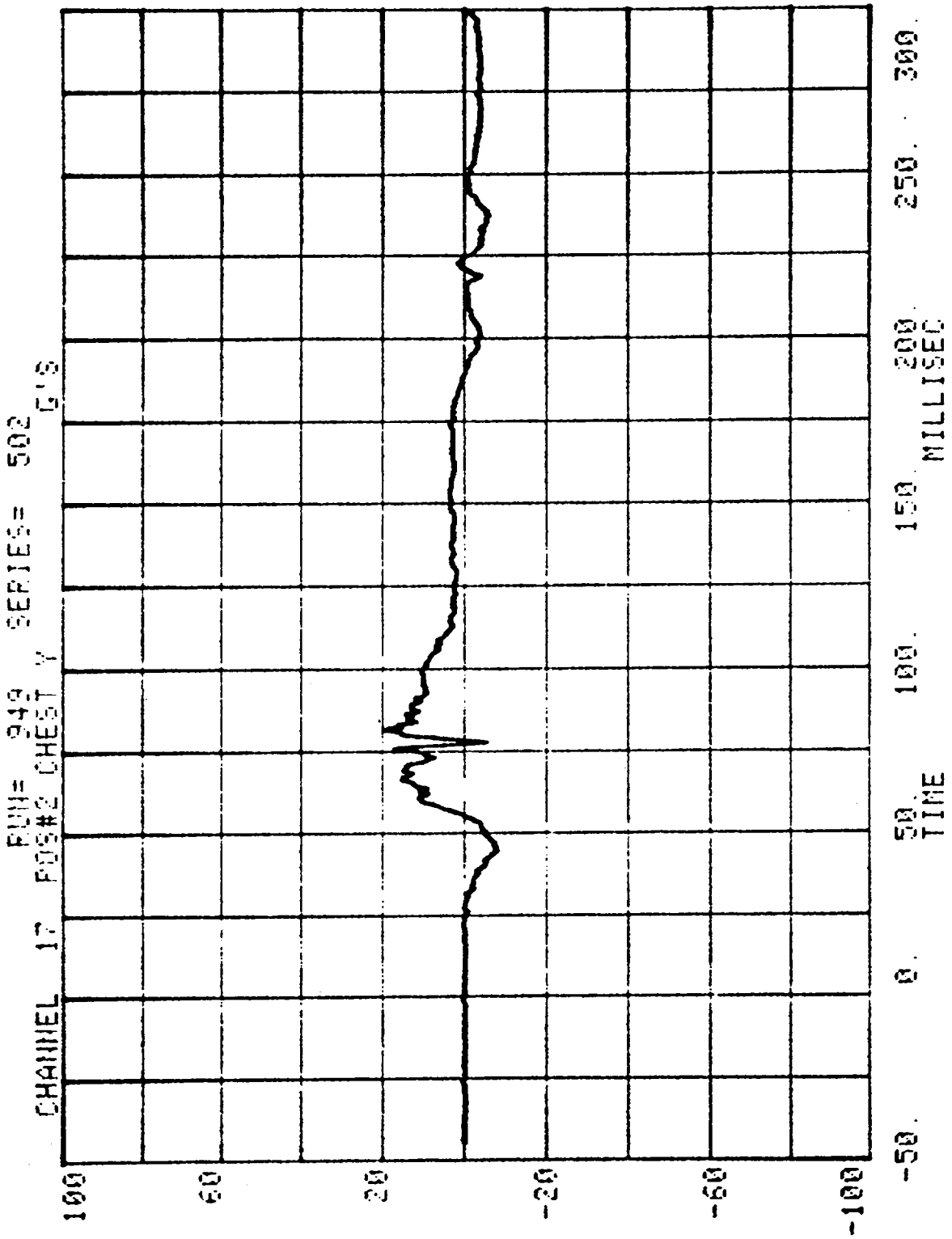
7776-5

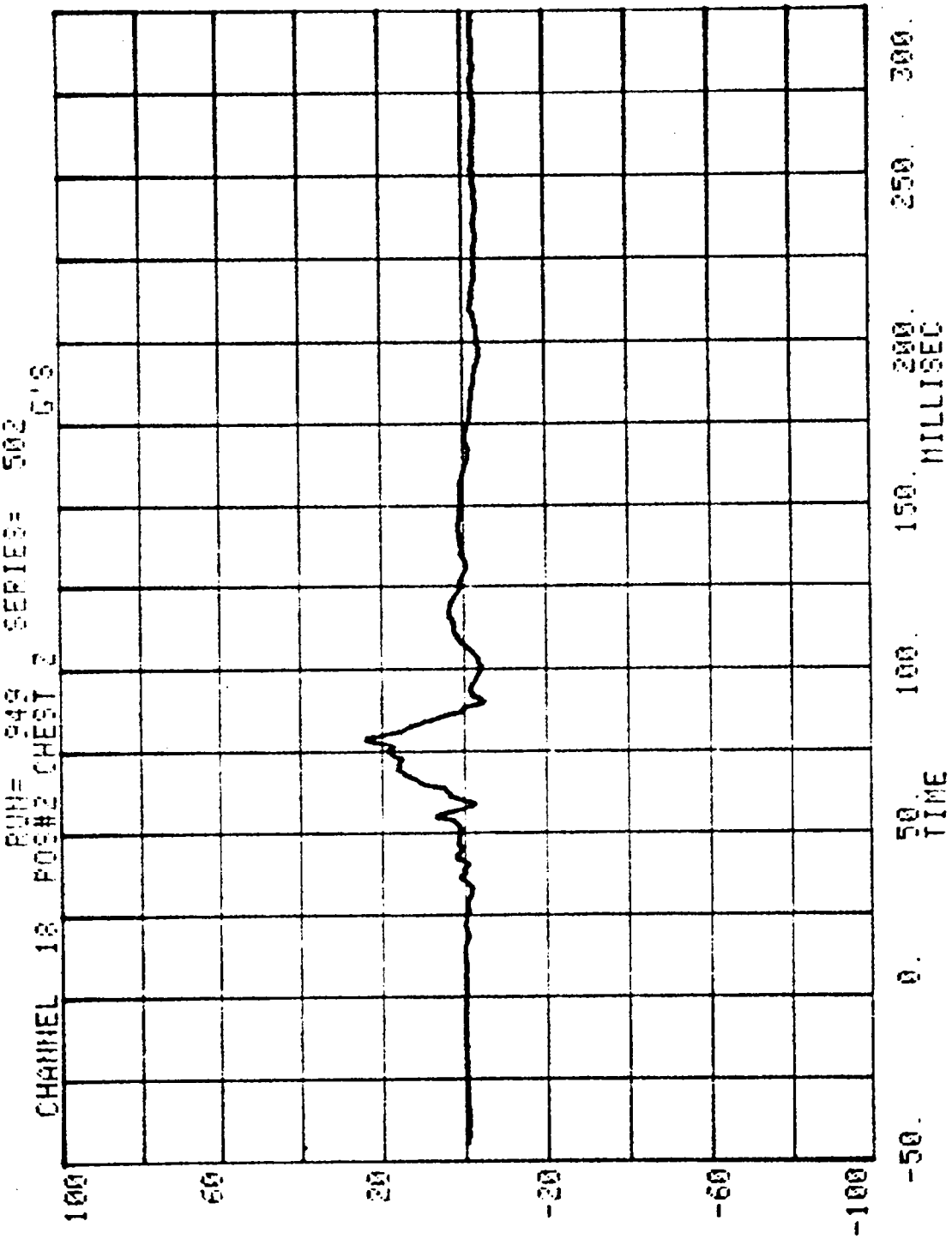

CHANNEL 2 POS#2 HEAD R
RUN= 949 SERIES= 502 G'S
100
80
60
40
20
0
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5

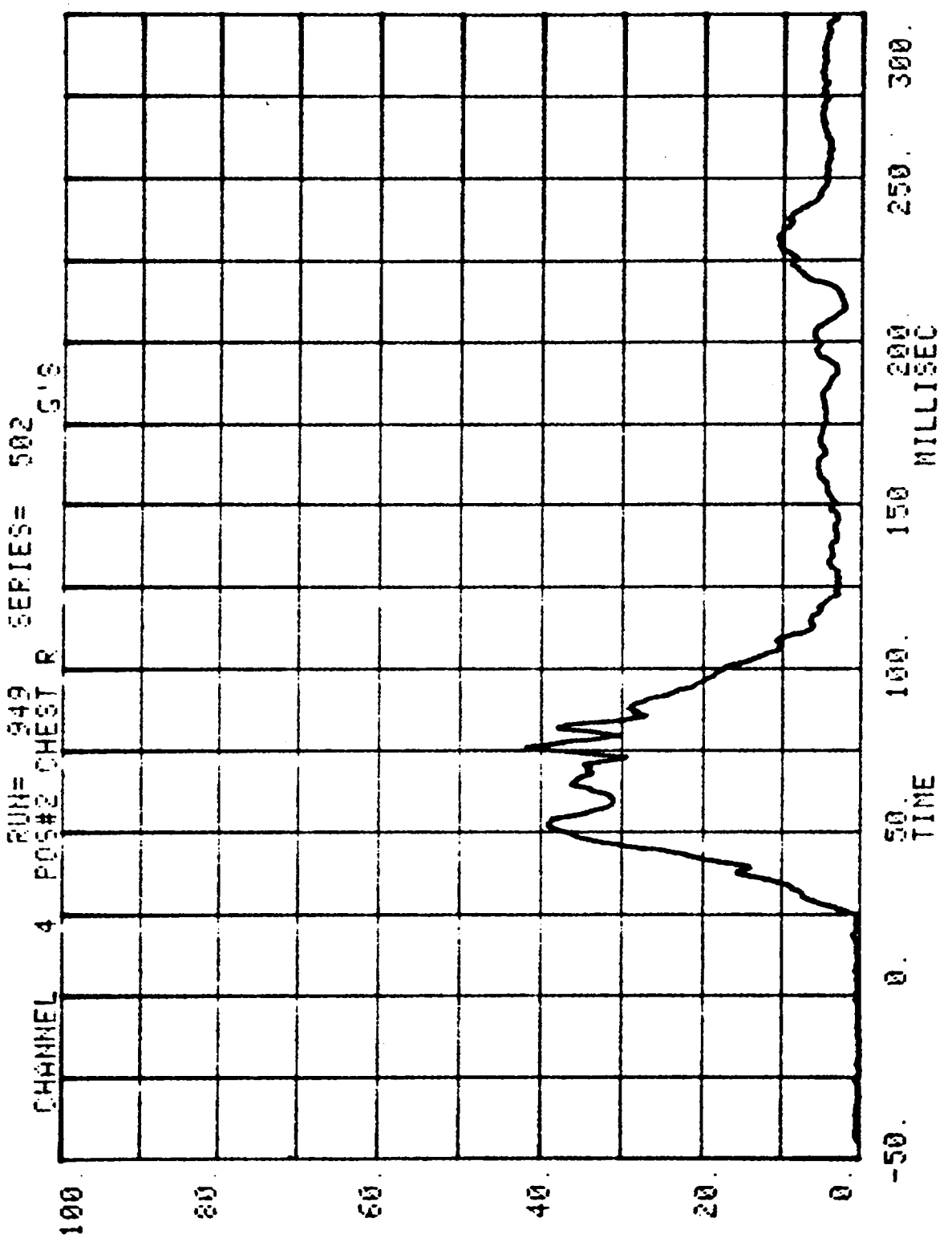

CHANNEL 15 POS#2 CHEST X
FUN= 949 SERIES= 502 G'S
100
50
20
-20
-50
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

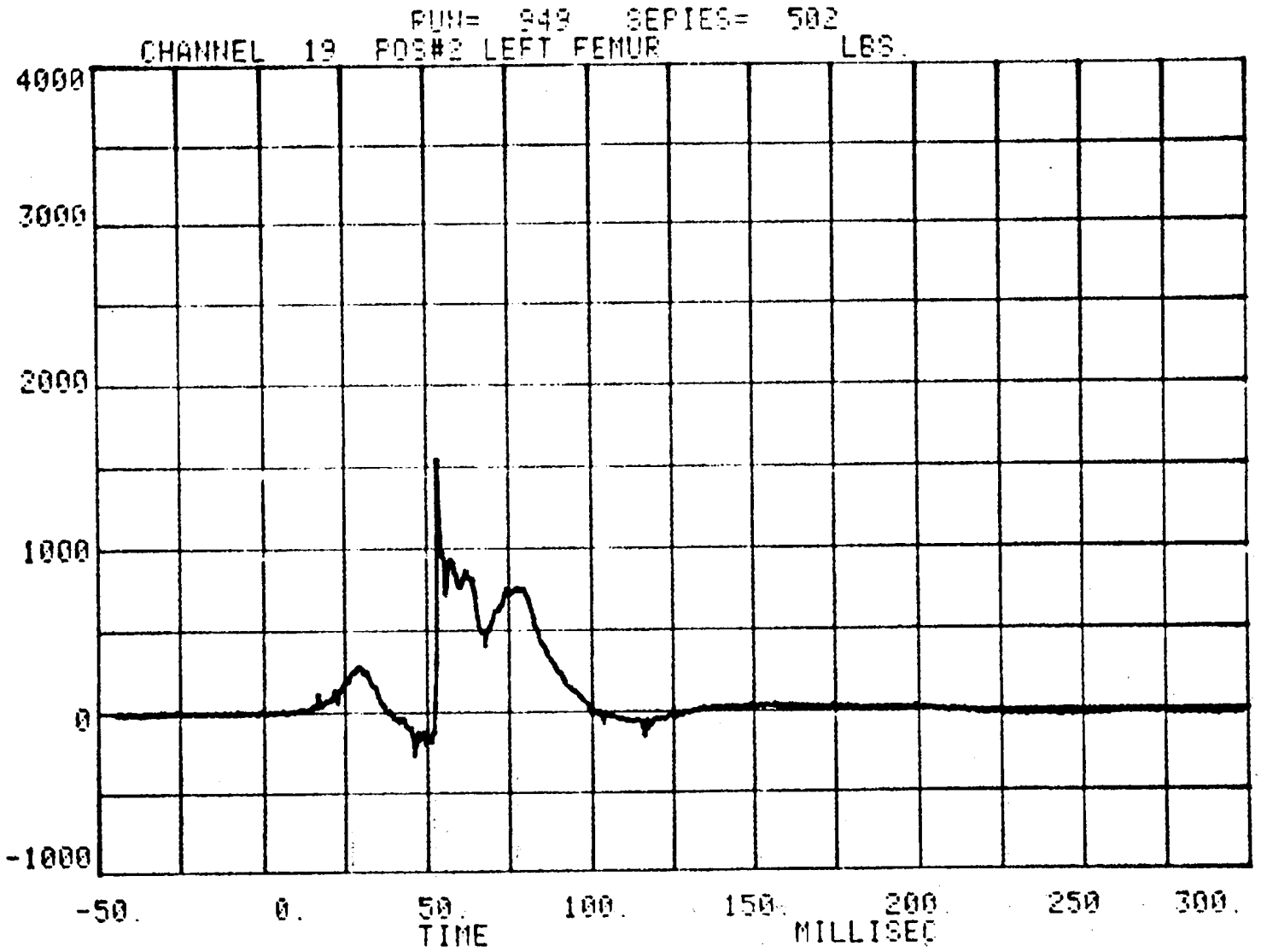
7776-5

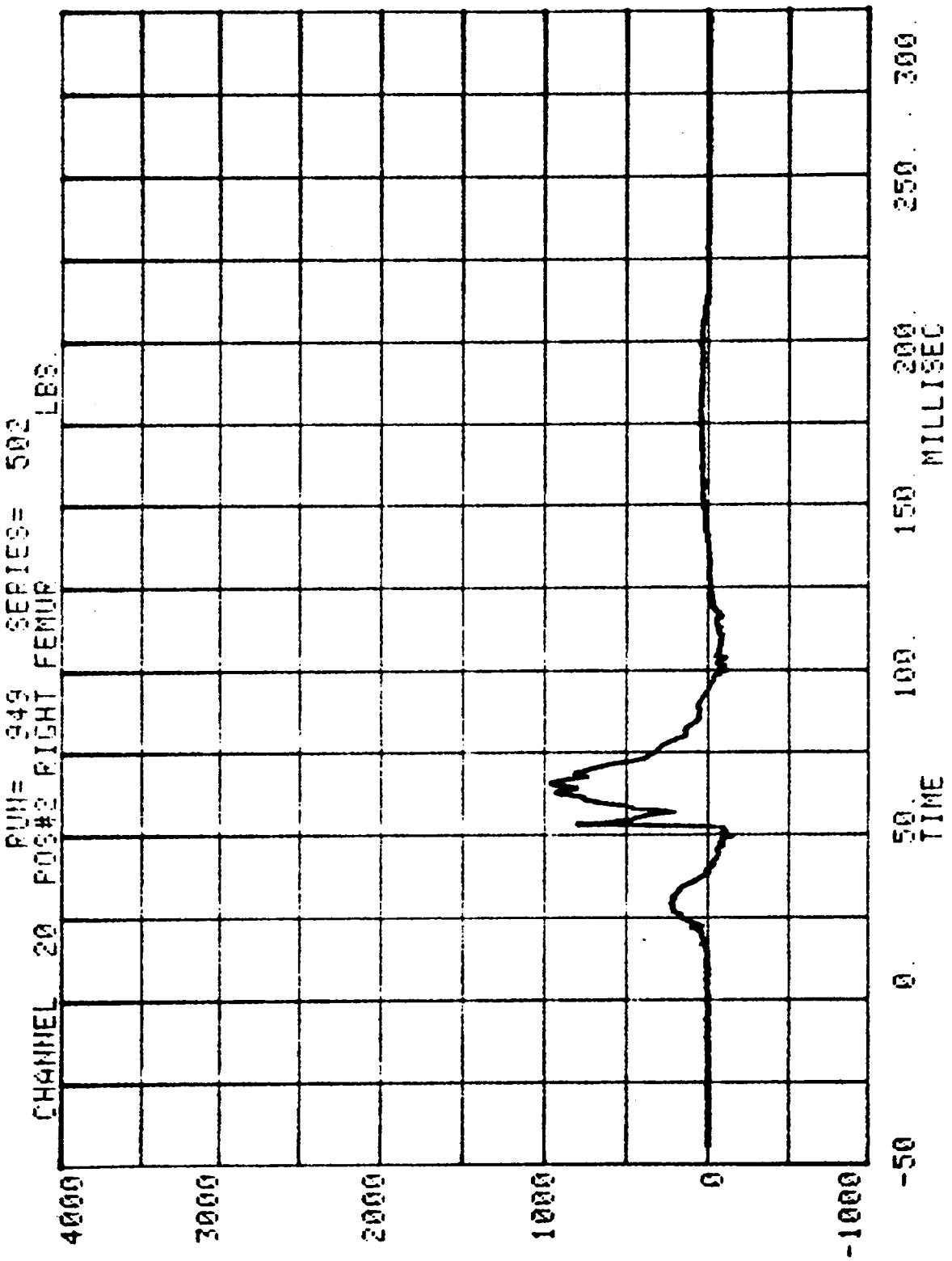

CHANNEL 17 POS#2 CHEST Y
RUN= 949 SERIES= 502 G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150
200.
250.
300.
TIME
MILLISEC


CHANNEL 18 POS#2 CHEST 2
RUN= 948 SERIES= 502 G'S
100
50
0
-50
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

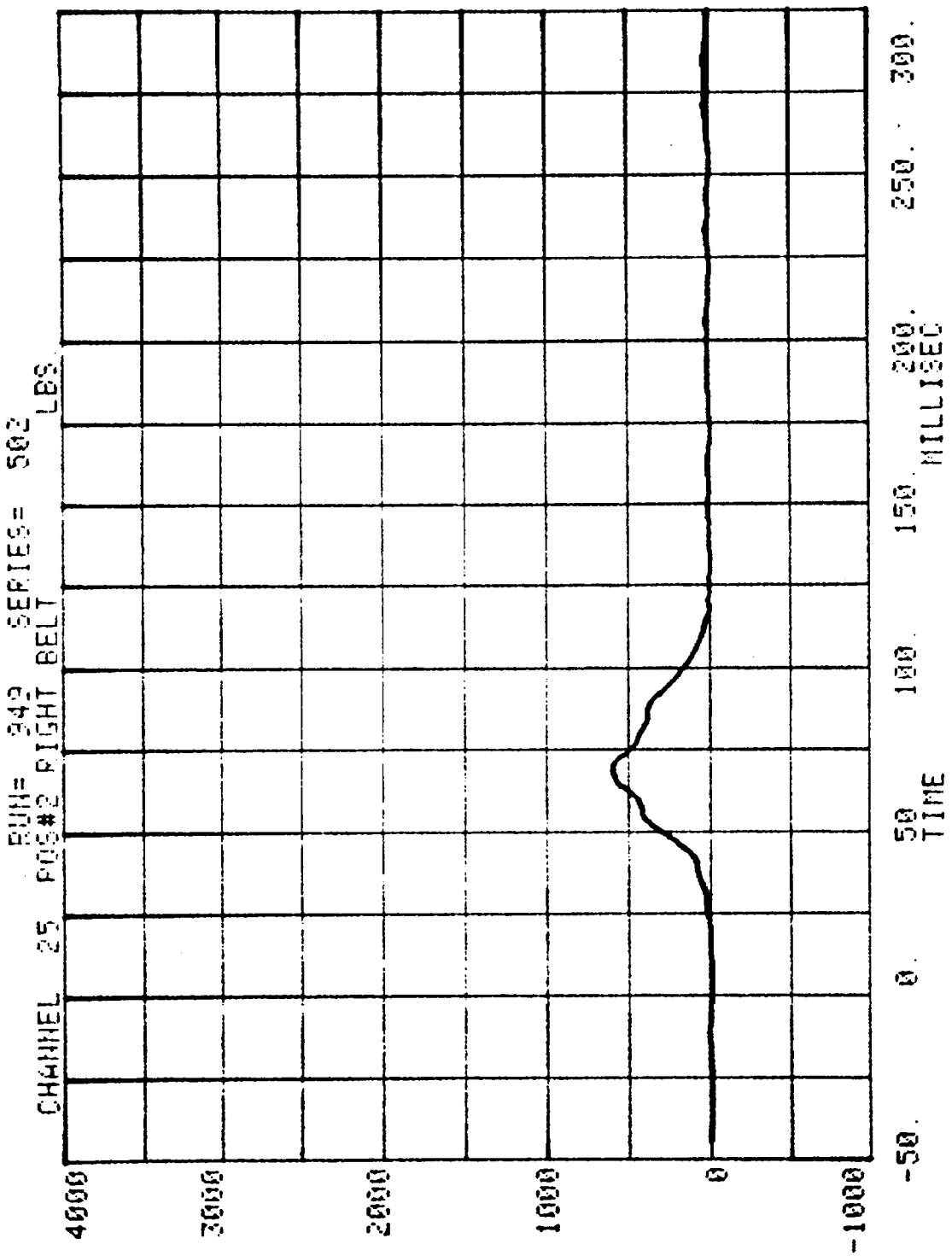
7776-5


CHANNEL 4 POS#2 CHEST R
RUN= 249 SERIES= 502 G'S
100.
80.
60.
40.
20.
0.
-50.
0.
50.
100.
150
200
250.
300.
TIME
MILLISEC

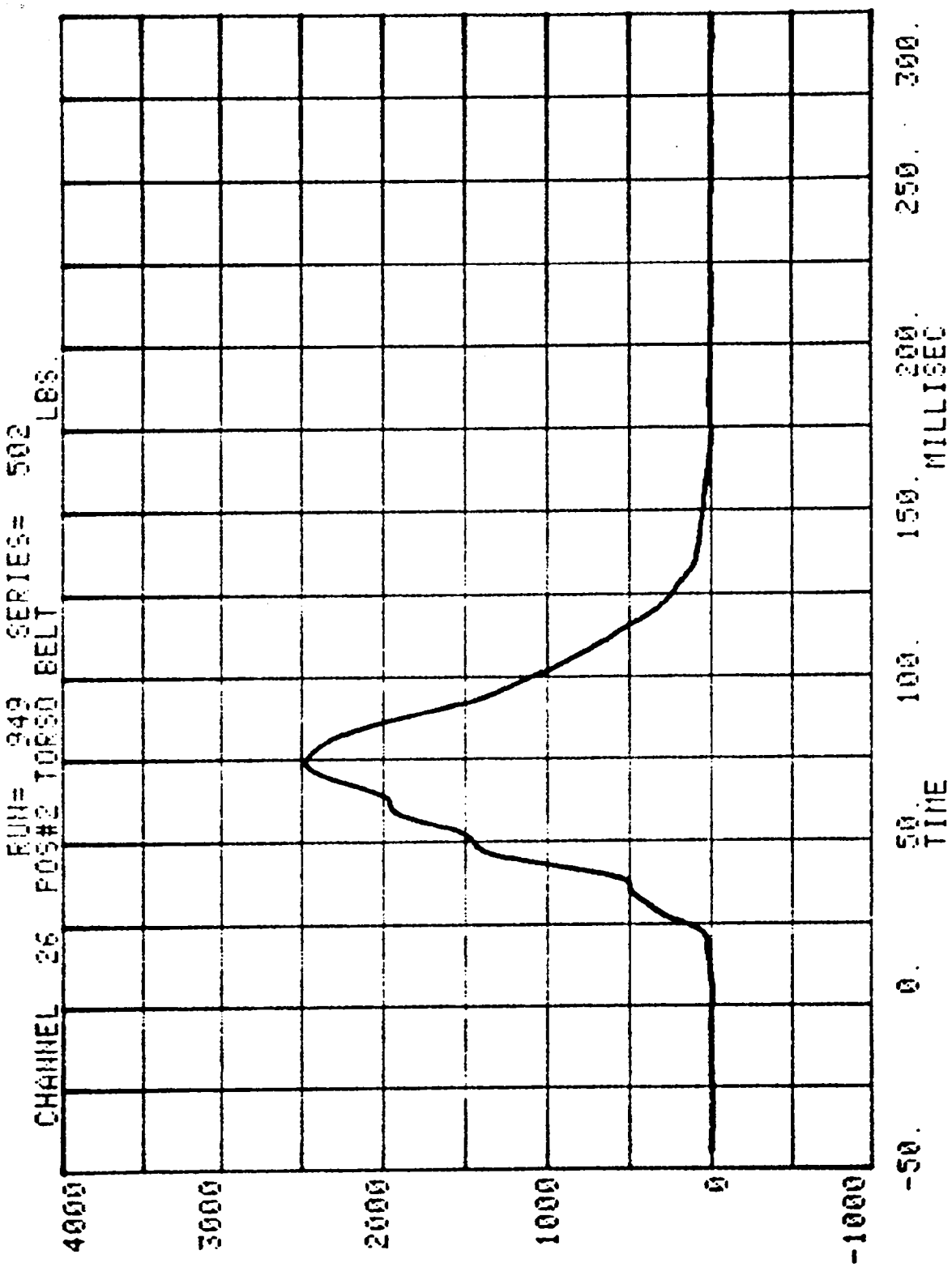

RUN= 949 SERIES= 502
CHANNEL 19 POS#2 LEFT FEMUR LBS.
4000
3000
2000
1000
0
-1000
-50.
0.
50.
100.
150.
200.
250
300.
TIME
MILLISEC


CHANNEL 20 POS#2 RIGHT FEMUR
RUN= 949 SERIES= 502
LBS.
4000
3000
2000
1000
0
-1000
-50
0
50
100
150
200
250
300
TIME
MILLISEC

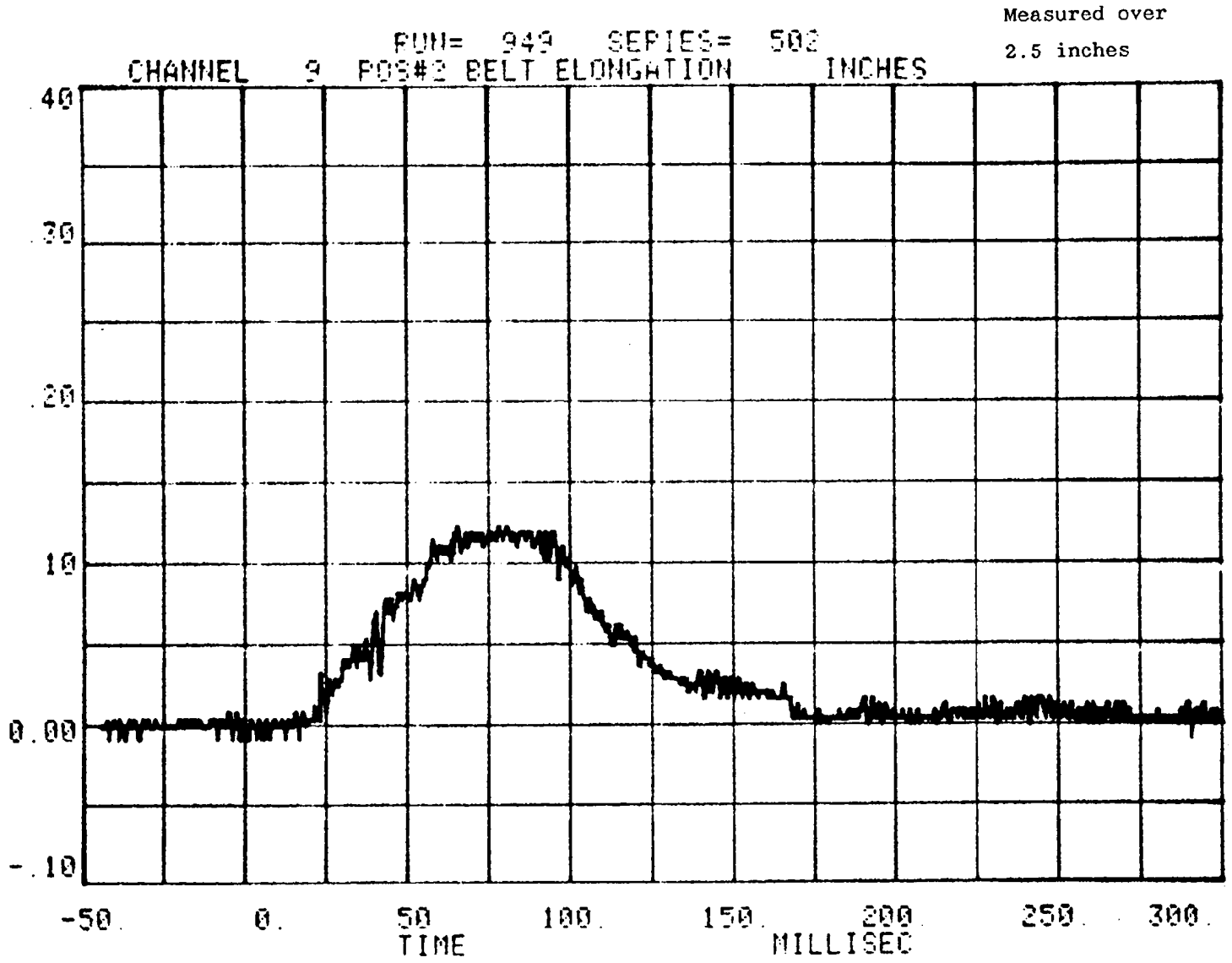
7776-5


RUN= 242 SERIES= 502
CHANNEL 25 POS#2 RIGHT BELT
LBS
4000
3000
2000
1000
0
-1000
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


CHANNEL 26 POS#2 TORSO BELT
RUN= 342 SERIES= 502
LBS.
4000
3000
2000
1000
0
-1000
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7776-5


RUN= 949 SERIES= 502
CHANNEL 9 POS#2 BELT ELONGATION INCHES
Measured over
2.5 inches
.40
.30
.20
.10
0.00
-.10
-50.
0.
50
100.
150.
200
250.
300.
TIME
MILLISEC

B-93

7776-5

Appendix C

DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the 50th percentile male anthropomorphic 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, Volume 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:

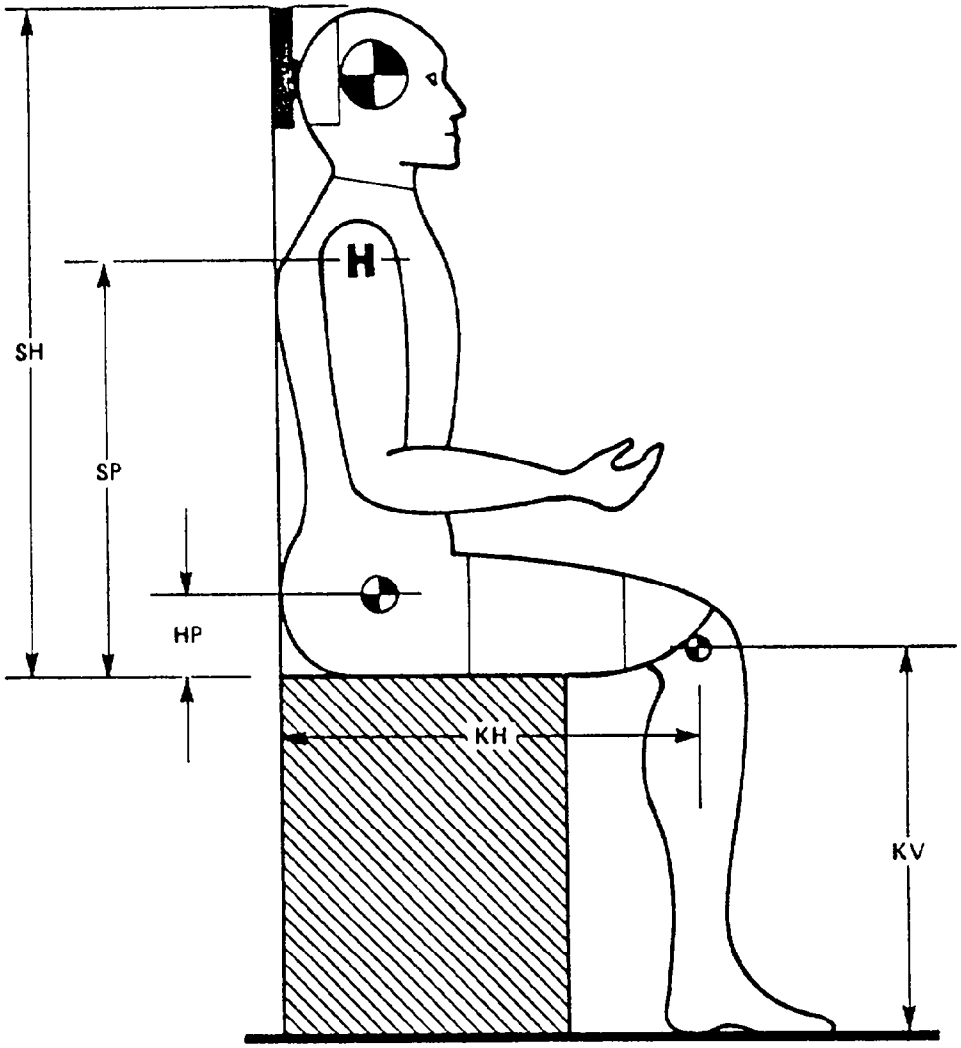
Serial No.	Completion Data
357	12-12-89
358	12-13-89

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 No. 6525-V-1.

Figure 10

DUMMY CONFIGURATION DIMENSIONS



PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NUMBER.: 357

I. CONFIGURATION VERIFICATION DATA

	P. 572 SPECIFICATION	PRE-TEST if required	POST-TEST if required
DATE OF CONFIGURATION VERIFICATION	XXXXXXXXXXXX	12-12-89	
VERIFICATION NUMBER FOR DUMMY (*)	XXXXXXXXXXXX	2	
SH - Seated Height	35.6 to 35.8"	35.6 "	"
SP - Shoulder Pivot Height	21.8 to 22.4"	21.9 "	"
HP - Hip Pivot Height	3.9" ref.	3.9 "	"
KH - Knee Pivot from Back Line	20.1 to 20.7"	20.4 "	"
KV - Knee Pivot from floor	19.3 to 19.9"	19.5 "	"
SW - Shoulder Width	17.8 to 18.4"	18.0 "	"
HW - Hip Width	14.0 to 15.4"	14.3 "	"

II. PERFORMANCE VERIFICATION DATA:

		PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION		12-12-89	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY (*)		2	
VERIFICATION LAB TEMPERATURE (66 to 78 deg.)		69-70 deg	deg
VERIFICATION LAB HUMIDITY (10 TO 70 %)		25-29 %	%
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST			
a. peak resultant accel.	210 to 260 G's	210.4 G's	G's
b. peak lateral accel.	<= 10 G's	1.7 G's	G's
c. Time above 100 G's	0.9 to 1.5 ms.	1.25 ms	ms

* Sequential number beginning with "1" at the start of each fiscal years's crash test program.

TECHNICIAN'S NAME: IVAN MINKEWICZ

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA...continued

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 357

TEST PARAMETER		SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
2. NECK BENDING TEST				
a. Pendulum Speed		21.5 to 25.5 fps.	23.0 fps	
b. Pend. Avg. Decel. over t3 to t2		20 to 24 G's	23.6 G's	
c. Peak Resultant Head Acceleration		26 G's max.	25.42 G's	
d. Pendulum Decel. (t2-t1)		<= 3 ms.	2.36 ms	
e. Pendulum Decel. (t3-t2)		25 to 30 ms.	26.66 ms	
f. Pendulum Decel. (t4-t3)		<= 10 ms.	3.72 ms	
g. Max. Head Rotation		63 to 73 deg.	69.46 deg	
h. Chordal Displacement				
HEAD ROTATION ANGLE				
0 deg.	Time	-2 to 2 ms.	0.0 ms	
	Displ.	-.5 to .5"	0.0 "	
30 deg.	Time	25.6 to 34.4 ms.	26.66 ms	
	Displ.	2.1 to 3.1"	2.51 "	
60 deg.	Time	40.3 to 51.7 ms.	41.29 ms	
	Displ.	4.3 to 5.3"	4.77 "	
Maximum	Time	53.2 to 66.8 ms.	53.88 ms	
	Displ.	5.0 to 6.0"	5.57 "	
60 deg.	Time	67.0 to 83.0 ms.	70.31 ms	
	Displ.	4.3 to 5.3"	4.85 "	
30 deg.	Time	85.4 to 104.6 ms.	87.8 ms	
	Displ.	2.1 to 3.1"	2.3 "	
0 deg.	Time	101.0 - 123.0 ms.	102.55 ms	
	Displ.	-.5 to 0.5"	0.0 "	

TECHNICIANS NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 357

TEST PARAMETER	SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
3. ABDOMINAL COMPRESSION			
TEST: (preload = 50 lbs.)			
a. Force @ 0.5"	23 to 36 lbs.	26 lbs	
b. Force @ 0.75"	36 to 50 lbs.	41 lbs	
c. Force @ 1.0"	50 to 63 lbs.	58 lbs	
d. Force @ 1.3"	73 to 88 lbs.	86 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20 deg.	22 to 34 lbs.	26 lbs	
b. Force @ 30 deg.	34 to 46 lbs.	39 lbs	
c. Force @ 40 deg.	46 to 58 lbs.	55 lbs	
d. Return Angle	12 deg. maximum	10 deg	
5. CHEST IMPACT TESTS:			
A. High Speed			
(1) Probe Speed	21.78-22.22 fps.	21.8 fps	
(2) Peak Deflection	1.7" maximum	1.6 "	
(3) Peak Resistive Force	2250 lbs maximum	2052 lbs	
(4) Internal Hysteresis	50 to 70%	61.5 %	
B. Low Speed			
(1) Probe Speed	13.86-14.14 fps.	14.0 fps	
(2) Peak Deflection	1.1" maximum	1.08 "	
(3) Peak Resistive Force	1450 lbs maximum	1247 lbs	
(4) Internal Hysteresis	50 to 70%	52.9 %	

TECHNICIAN'S NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 357

TEST PARAMETER	SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
6. KNEE IMPACT TEST			
A. Left Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	2490 lbs	
(3) Time above 1000 lbs.	1.7 ms. minimum	1.75 ms	
B. Right Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	2023 lbs	
(3) Time Above 1000 lbs.	1.7 ms. minimum	1.75 ms	

REMARKS:

TECHNICIAN'S NAME: IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER _____357_____

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	CK54	1-90	7-90
HY LATERAL--	ENDEVCO	GD98	1-90	7-90
HZ VERTICAL--	ENDEVCO	CD75	1-90	7-90
2. CHEST ACCELEROMETER-				
CX LONGITUDINAL--	CEC	A115	1-90	7-90
CY LATERAL--	ENDEVCO	CS09	1-90	7-90
CZ VERTICAL--	CEC	A29	1-90	7-90
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	548	1-90	7-90
RIGHT SIDE	GSE	549	1-90	7-90
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	1-90	7-90
2. TEST PROBE ACCELEROMETER--	CEC	A161	1-90	7-90
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS-DUCER INC	20051	7-89	1-90
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	7-89	1-90
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	7-89	1-90

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NUMBER.: 358

I. CONFIGURATION VERIFICATION DATA

	P. 572 SPECIFICATION	PRE-TEST if required	POST-TEST if required
DATE OF CONFIGURATION VERIFICATION	XXXXXXXXXXXX	12-13-89	
VERIFICATION NUMBER FOR DUMMY (*)	XXXXXXXXXXXX	2	
SH - Seated Height	35.6 to 35.8"	35.6 "	"
SP - Shoulder Pivot Height	21.8 to 22.4"	22.1 "	"
HP - Hip Pivot Height	3.9" ref.	3.9 "	"
KH - Knee Pivot from Back Line	20.1 to 20.7"	20.5 "	"
KV - Knee Pivot from floor	19.3 to 19.9"	19.6 "	"
SW - Shoulder Width	17.8 to 18.4"	18.0 "	"
HW - Hip Width	14.0 to 15.4"	14.8 "	"

II. PERFORMANCE VERIFICATION DATA:

		PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION		12-13-89	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY (*)		2	
VERIFICATION LAB TEMPERATURE (66 to 78 deg.)		69-70 deg	deg
VERIFICATION LAB HUMIDITY (10 TO 70 %)		25-29 %	%
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST			
a. peak resultant accel.	210 to 260 G's	223.2 G's	G's
b. peak lateral accel.	<= 10 G's	7.7 G's	G's
c. Time above 100 G's	0.9 to 1.5 ms.	1.25 ms	ms

* Sequential number beginning with "1" at the start of each fiscal years's crash test program.

TECHNICIAN'S NAME: IVAN MINKEWICZ

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 358

TEST PARAMETER		SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
2. NECK BENDING TEST				
a. Pendulum Speed		21.5 to 25.5 fps.	23.2 fps	
b. Pend. Avg. Decel. over t3 to t2		20 to 24 G's	23.6 G's	
c. Peak Resultant Head Acceleration		26 G's max.	25.48 G's	
d. Pendulum Decel. (t2-t1)		<= 3 ms.	2.36 ms	
e. Pendulum Decel. (t3-t2)		25 to 30 ms.	27.28 ms	
f. Pendulum Decel. (t4-t3)		<= 10 ms.	4.22 ms	
g. Max. Head Rotation		63 to 73 deg.	71.54 deg	
h. Chordal Displacement				
HEAD ROTATION ANGLE				
0 deg.	Time	-2 to 2 ms.	0.0 ms	
	Displ.	-.5 to .5"	0.0 "	
30 deg.	Time	25.6 to 34.4 ms.	26.54 ms	
	Displ.	2.1 to 3.1"	2.57 "	
60 deg.	Time	40.3 to 51.7 ms.	40.67 ms	
	Displ.	4.3 to 5.3"	4.88 "	
Maximum	Time	53.2 to 66.8 ms.	59.15 ms	
	Displ.	5.0 to 6.0"	5.67 "	
60 deg.	Time	67.0 to 83.0 ms.	71.55 ms	
	Displ.	4.3 to 5.3"	4.71 "	
30 deg.	Time	85.4 to 104.6 ms.	88.05 ms	
	Displ.	2.1 to 3.1"	2.41 "	
0 deg.	Time	101.0 - 123.0 ms.	103.3 ms	
	Displ.	-.5 to 0.5"	0.0 "	

TECHNICIANS NAME: IVAN MINKEWICZ

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 358

TEST PARAMETER	SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
3. ABDOMINAL COMPRESSION			
TEST: (preload = 50 lbs.)			
a. Force @ 0.5"	23 to 36 lbs.	26 lbs	
b. Force @ 0.75"	36 to 50 lbs.	41 lbs	
c. Force @ 1.0"	50 to 63 lbs.	57.5 lbs	
d. Force @ 1.3"	73 to 88 lbs.	84 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20 deg.	22 to 34 lbs.	28.5 lbs	
b. Force @ 30 deg.	34 to 46 lbs.	40 lbs	
c. Force @ 40 deg.	46 to 58 lbs.	51 lbs	
d. Return Angle	12 deg. maximum	10 deg	
5. CHEST IMPACT TESTS:			
A. High Speed			
(1) Probe Speed	21.78-22.22 fps.	21.8 fps	
(2) Peak Deflection	1.7" maximum	1.47 "	
(3) Peak Resistive Force	2250 lbs maximum	2115 lbs	
(4) Internal Hysteresis	50 to 70%	64.2 %	
B. Low Speed			
(1) Probe Speed	13.86-14.14 fps.	14.0 fps	
(2) Peak Deflection	1.1" maximum	1.03 "	
(3) Peak Resistive Force	1450 lbs maximum	1283 lbs	
(4) Internal Hysteresis	50 to 70%	53.4 %	

TECHNICIAN'S NAME: IVAN MINKEWICZ

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 358

TEST PARAMETER	SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
6. KNEE IMPACT TEST			
A. Left Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	2404 lbs	
(3) Time above 1000 lbs.	1.7 ms. minimum	1.75 ms	
B. Right Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	1986 lbs	
(3) Time Above 1000 lbs.	1.7 ms. minimum	1.875 ms	

REMARKS:

TECHNICIAN'S NAME: IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER _____358_____

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	EL86	10-89	4-90
HY LATERAL--	ENDEVCO	FR42	10-89	4-90
HZ VERTICAL--	ENDEVCO	GD35	10-89	4-90
2. CHEST ACCELEROMETER-				
CX LONGITUDINAL--	CEC	A150	1-90	7-90
CY LATERAL--	ENDEVCO	EL79	1-90	7-90
CZ VERTICAL--	CEC	A151	1-90	7-90
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	551	1-90	7-90
RIGHT SIDE	GSE	552	1-90	7-90
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	1-90	7-90
2. TEST PROBE ACCELEROMETER--	CEC	A161	1-90	7-90
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS-DUCER INC	20051	7-89	1-90
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	7-89	1-90
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	7-89	1-90

Appendix D

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

B09D1-A

Pregnant Women

The use of a seat belt is recommended for pregnant women to lessen the chance of injury in an accident. When a seat belt is used, it should be placed as low and snugly as possible on the hips, not across the abdomen. For specific recommendations, consult a physician.

B09E1-A

Injured Person

A seat belt should be used when an injured person is being transported. When this is necessary, you should consult a physician for recommendations.

B09F1-A

One Person Per Belt

Two people (including children) should never attempt to use a single seat belt. This could increase the severity of injuries in case of an accident.

B09G1-A

Do Not Lie Down

To prevent injuries in the event of an accident, and to achieve maximum effectiveness of the seat belt system, all passengers should be sitting up and the front seats should be in an upright position when the car is moving. As seat belt cannot operate properly if the person is lying down in the rear seat or if the front seat is at or near the fully reclined position.

B09H1-A

CARE OF SEAT BELTS

Seat belt systems should never be disassembled or modified. In addition, care should be taken to assure that seat belts and belt hardware are not damaged by seat hinges, doors or other abuse.

B09I1-A

Periodic Inspection

It is recommended that all seat belts be inspected periodically for wear or damage of any kind. Parts of the system that are damaged should be replaced as soon as possible.

B09J1-A

Keep Belts Clean and Dry

Seat belts should be kept clean and dry. If belts become dirty, they can be cleaned using a mild soap solution and warm water. Bleach, dye, strong detergents or abrasives should not be used because they may damage and weaken the fabric.

B09K1-A

When to Replace Seat Belts

The entire seat belt assembly or assemblies should be replaced if the vehicle has been involved in an accident. This should be done even if no damage is visible. Additional questions concerning seat belt operation should be directed to your Hyundai Dealer.

B09L1-A

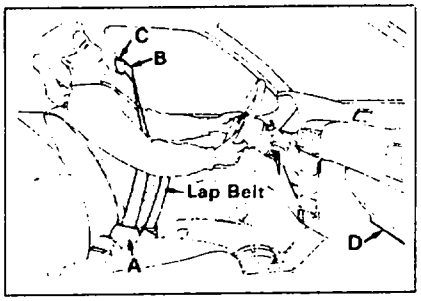
PASSIVE SEAT BELTS (Front seat)

Your Hyundai is equipped with a new safety seat belt system for the driver and the front seat passenger to be restrained automatically as they sit down and close the door. Your new safety seat belt system consists of a retractor (A), a tab (B), a buckle (C), a knee bolster (D) and a manual lap belt assembly. Always make sure that the metal tab is inserted into the buckle of the upper rear edge of the door before entering in your vehicle.

B09M1-A

WARNING:

- **For full restraint system protection, securely fasten the manual lap belt in addition to the automatic shoulder belt whenever the car is moving.**
- **Front seat passengers should not ride**



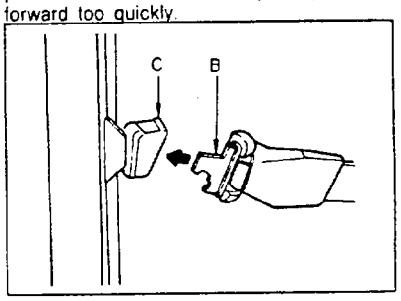
in a moving vehicle with the seatback reclined. The safety seat belts operate securely only when the seatback is in an upright position.

- **Both arms should not be under or over the belt. Rather, one should be over and the other under, as shown in the illustration.**
- **Do not wear the shoulder portion of the seat belt under your arm as this increases the possibility of serious injury to you in the event of an accident.**
- **When wearing the passive seat belt, make sure that the belt is positioned midway over the shoulder-NEVER ACROSS THE NECK.**
- **To operate the automatic seat belt system, the shoulder belt tongue should always remain inserted in the shoulder belt buckle.**
- **Do not wear the lap belt across the shoulder belt.**
- **Be careful not to damage the belt webbing or hardware, and that they do not get caught or pinched in the seat or doors.**
- **Hyundai recommends that children be seated in the rear seats.**
- **Avoid wearing twisted seat belts.**
- **Release the shoulder belt buckle from the tongue only in an emergency.**
- **The retractors lock only on sudden impact or stops. The belt will allow some freedom of movement if done slowly.**

B09N1-A

How The Passive Seat Belt System Works

The metal tab (B) is inserted in the buckle (C) which is fastened firmly to the upper rear edge of the door. The other end of the belt is wound automatically on the Web Locking Retractor (A) under the seat.
When you open the front doors, it extends the belt from the retractor and provides access to the interior. When the door is closed, the belt automatically places itself diagonally across the chest.
The seat belt automatically adjusts to the proper length. If you lean forward in a slow, easy motion, the belt will extend and let you move around. If there is a sudden stop or impact, however, the belt will lock into position. It will also lock if you try to lean forward too quickly.

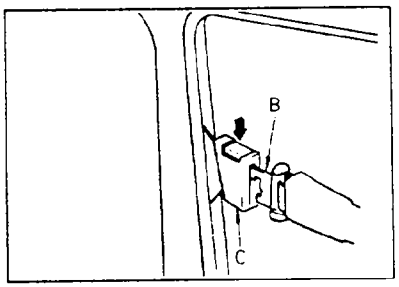


B0901-A

To Release The Seat Belt

If required, press the emergency release button on the buckle (C) marked PRESS EMERGENCY.
When it is released, the belt tab (B) should automatically drawback into the retractor.

For your safety, we recommend that you hold the belt tab (B) with your hand and allow it to retract gently.



1-9

B09P1-A

SEAT BELT WARNING LIGHT AND CHIME

With the key in the "ON" position and the lap belt unfastened,the seat belt warning light will stay on and the chime will sound for six seconds. (Driver's only).
If the shoulder belt is disconnected while the key is in the "ON" position, the buzzer will sound for 6 seconds and the warning light will flash for 60 seconds. (Driver's only).

B09Q1-A

LAP BELTS (2-Point Automatic Locking Retractor Type) (Front Seat)

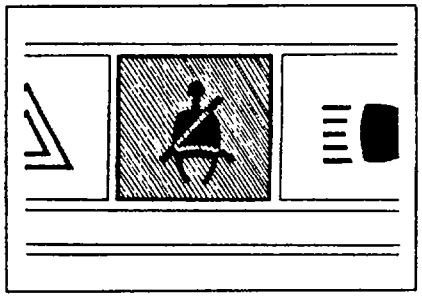
To Fasten Your Lap Belt

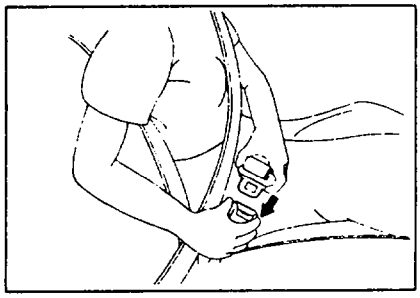
To fasten a 2-point type lap belt with an automatic locking retractor, pull it out of the retractor in one continuous motion and insert the metal tab into the buckle. The length of the lap belt is automatically locked into position when you stop pulling on it. Once it locks, it cannot be pulled out any further until it is allowed to retract completely. Then it can be pulled out again.
When you let go of the buckle, the excess length of the lap belt is retracted automatically so it adjusts to fit around you

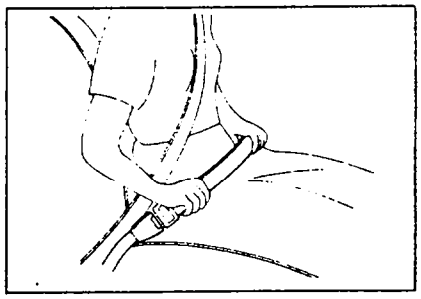
B09R1-A

Adjusting Your Lap Belt

You should place the belt as low as possible on your hips, not on your waist. If located too high on your body, the chances of sliding out from under it and being injured are increased. Pull the belt toward the retractor to take up extra slack







B09S1-A

To Release the Lap Belt

When you want to release the lap belt, press the button in the locking buckle. The lap belt should then retract automatically. If it does not, make sure it is not twisted and try again.

NOTE:

Inspect both front seat lap belt receivers periodically or immediately after an accident to see if a red "REPLACE BELT" sticker is visible (see figure).

WARNING:

If for any reason the red "REPLACE BELT" sticker is visible on the lap belt receiver, have the entire seat belt assembly replaced immediately.
Failure to replace the seat belt assembly may result in serious injury to the occupant in the event of a subsequent accident.

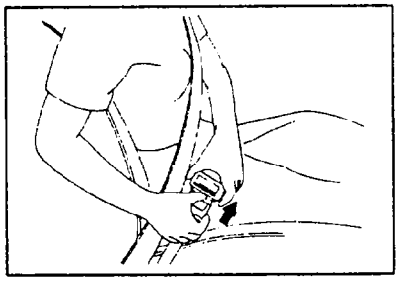
B09T1-A

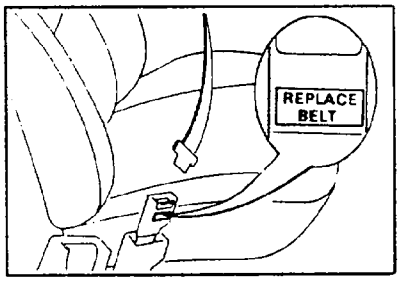
SEAT BELTS (3-Point Webbing Clamp Locking Retractor) (Rearseat outboard)

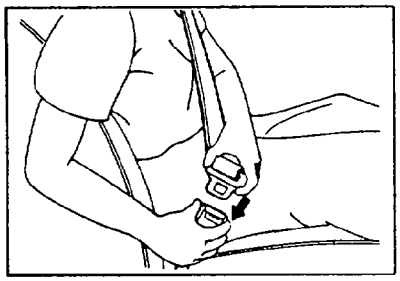
To Fasten Your Belt

To fasten your seat belt, pull it out of the retractor and insert the metal tab into the buckle. There will be an audible "click" when the tab locks into the buckle.

The seat belt automatically adjusts to the proper length only after the lap belt is adjusted manually so that it fits snugly around your hips. If you lean forward in a slow, easy motion, the belt will extend and let you move around. If there is a sudden stop or impact, however, the belt will lock into position. It will also lock if you try to lean forward too quickly.







1-11

B09U1-A

Adjusting Your Seat Belt

You should place the belt as low as possible on your hips, not on your waist. If located too high on your body, the chances of sliding out from under it and being injured are increased. Both arms should not be under or over the belt. Rather, one should be over and the other under, as shown in the illustration.

B09V1-A

To Release the Seat Belt

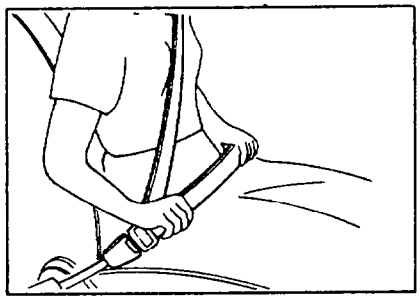
The seat belt is released by pressing the release button in the locking buckle. When it is released, the belt should automatically draw back into the retractor.
If this does not happen, check the belt to be sure it is not twisted, then try again.

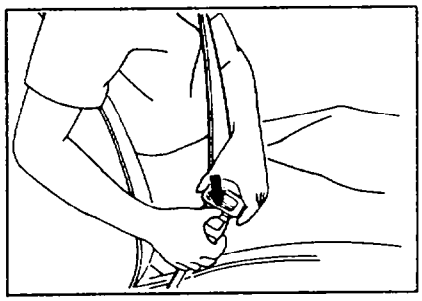
B09V-A

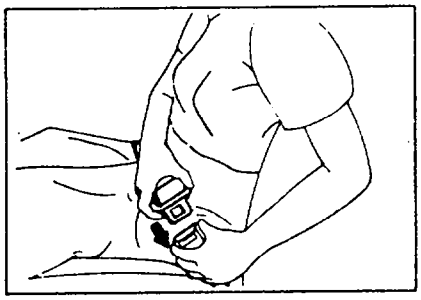
SEAT BELTS (2-Point Static Type) (Rear Seat Center)

To Fasten Your Belt

To fasten a 2-point static type belt, insert the metal tab into the locking buckle. There will be an audible "click" when the tab locks into the buckle. Check to make sure the belt is properly locked and that the belt is not twisted.





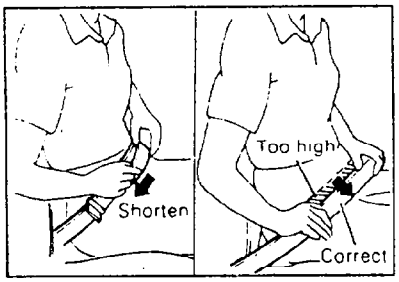


1-12

B09X1 B

Adjusting Your Belt

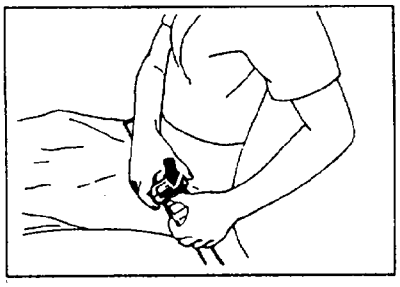
With this type of belt, the length must be adjusted manually so it fits snugly around your body. The belt should be placed as low as possible on your hips, not on your waist. If the belt is too high it could increase the possibility of your being injured in an accident because you could slide under it.



B09Y1 A

To Release the Belt

When you want to release the seat belt, press the button in the locking buckle.



B10A1 A

CHILD RESTRAINT SYSTEM

Children riding in the car should sit in the rear seat and be restrained to minimize the risk of injury in an accident, sudden stop, or sudden maneuver. According to accident statistics provided by the National Highway Traffic Safety Administration (NHTSA), children are safer when properly restrained in the rear seating positions than in the front seat.

Larger children should use one of the seat belts provided. For smaller children, we strongly recommend the use of a commercially available child restraint system that meets the requirements of the Federal Motor Vehicle Safety Standard, (FMVSS), because it offers the most protection against injury. All states now have laws which require that small children must be seated in a child passenger seat restraint system. Check local laws. All child restraint systems are designed to be secured by lap belts or the lap belt portion of a lap-shoulder belt.

Children could be injured in a crash if their restraints are not properly secured. For small children and babies we strongly recommend a child seat or infant seat. Before buying a particular child restraint system, make sure it fits your car seat and seat belts, and fits your child. Follow all the instructions provided by the manufacturer when installing the child restraint system.