

DOT 436 TEST 2
DOT 437 TEST 4
DOT 438 TEST 1

REPEATABILITY TESTING OF SIDE IMPACTOR

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Calspan Report No. 6944-V-1



TYPE OF TESTS: One Full Frontal 90° and
Three Full Frontal 71° Crash
Tests of the Side Impactor
into Load Cell Fixed Barrier

TEST DATE: Week of February 21, 1982

CONTRACT NO.: DTNH22-81-C-87088

TASK ORDER NO: 6

Prepared for:

U. S. Department of Transportation
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Washington, DC 20590

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SECTION 1

TEST OBJECTIVE

The test objective was to obtain data that could be used to evaluate the repeatability of the Side Impact (SI) energy absorbing assembly and in evaluating the dynamic sensitivity to changes in honeycomb properties.

The test series consisted of four tests. One full frontal 90° crash test of the Side Impactor into the Load Cell Fixed Barrier (LCFB) and three frontal 71° crash tests of the SI into the LCFB. All four of the tests in this series were performed using honeycomb that had different properties.

The four tests were performed at Calspan Corporation Advanced Technology Center during the week of February 21, 1982.

The test program is part of the National Highway Traffic Safety Administration (NHTSA) Contract DTNH22-81-C-87088, Task Order No. 6, to evaluate "Repeatability Testing of Side Impactor."

SECTION 2

SUMMARY OF RESULTS

A test program for evaluating the repeatability of the Side Impactor Energy Absorbing assembly and evaluating the dynamic sensitivity to changes in honeycomb properties was performed at Calspan Corporation, Advanced Technology Center during the week of February 21, 1982. The test series consisted of one frontal 90° at 27 mph and three frontal 71° at 14.5 mph crash tests of the side impactor into the Load Cell Fixed Barrier.

The test matrix as performed is summarized in Table 1 below.

The pre- and post-static crush measurements of the honeycomb energy absorption assemblies that were mounted to the front of the side impactor for the four crash tests is presented in Tables 2 through 5.

Table 6 shows the distribution weight and the Cg calculation for the side impactor as tested.

Instrumentation on the side impactor is as shown in Figure 1 and consisted of 12 accelerometers and 5 load cells. The load cell fixed barrier instrumentation consisted of 36 load cells. The electronic data traces are presented in Section 4 of this report.

Pre- and post-test black and white photographs of each test are presented in Section 3. High-speed motion pictures were obtained and have been submitted to the sponsor.

Data tapes prepared per NHTSA's required format have been submitted to the sponsor.

Table 1

TEST MATRIX

Test No.	Date	Impact Angle	Velocity (mph)	Honeycomb Material	Strength (psi)	Approximate Dynamic Crush (in.)	Max. Static Crush (in.)	Total Moving Barrier Force (lbs.)	Total Load Cell Barrier Force (lbs.)
1	2/26/82	90°	27.25	41860A	45.5	13.0	11.2	82.0K @ 35 ms.	80.0K @ 40 ms.
2	2/25/82	71°	14.71	41856A	47.5	12.5	10.4	33.9K @ 67 ms.	34K @ 68 ms.
3	2/25/82	71°	14.73	41863A	44.7	12.6	10.3	33.4K @ 69 ms.	33.0K @ 66 ms.
4	2/24/82	71°	14.73	B0060A	43.0	12.8	10.1	35.0K @ 68 ms.	34.5K @ 66 ms.

TABLE 2 SIDE IMPACTOR - FRONT PROFILE

Test No. 1 - 41860A - 45.5 psi

Date 2/26/82

VERTICAL HEIGHTS

		INCHES LEFT						C/L	INCHES RIGHT					
		36	30	24	18	12	6		6	12	18	24	30	36
LOWER BUMPER	PRE							16.2						
	POST		←					13.0					→	
UPPER BUMPER	PRE							21.2						
	POST		←					18.1					→	
1/2 BUMPER TO HOOD	PRE							28.6						
	POST		←					24.7					→	
HOOD	PRE							34.0						
	POST		←					30.4					→	

HORIZONTAL DISTANCE FROM REFERENCE

LOWER BUMPER	PRE							0.0		0.0	0.0	0.0	0.0	
	POST							11.2		11.1	11.0	10.9	10.9	
	DIFF.							11.2		11.1	11.0	10.9	10.9	
UPPER BUMPER	PRE							0.0		0.0	0.0	0.0	0.0	
	POST							10.3		10.2	10.0	10.0	9.9	
	DIFF.							10.3		10.2	10.0	10.0	9.9	
1/2 BUMPER TO HOOD	PRE							4.0		4.0	4.0	4.0	4.0	
	POST							10.6		10.5	10.4	10.3	10.3	
	DIFF.							6.6		6.5	6.4	6.3	6.3	
HOOD	PRE							4.0		4.0	4.0	4.0	4.0	
	POST							10.7		10.6	10.5	10.5	10.5	
	DIFF.							6.7		6.6	6.5	6.5	6.5	

TABLE 3 SIDE IMPACTOR - FRONT PROFILE

Test No. 2 - 41856A - 47.5 psi

Date 2/25/82

VERTICAL HEIGHTS

	INCHES LEFT						C/L	INCHES RIGHT						
	36	30	24	18	12	6		0	6	12	18	24	30	36
LOWER BUMPER	PRE							16.2					↗	
	POST		↖					16.2					↗	
UPPER BUMPER	PRE							21.2					↗	
	POST		↖					21.2					↗	
1/2 BUMPER TO HOOD	PRE							28.6					↗	
	POST		↖					28.6					↗	
HOOD	PRE							34.0					↗	
	POST		↖					34.0					↗	

HORIZONTAL DISTANCE FROM REFERENCE

		HORIZONTAL DISTANCE FROM REFERENCE												
		PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	PRE POST DIFF.	
LOWER BUMPER	PRE													0.0
	POST		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4
UPPER BUMPER	PRE													0.0
	POST		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1
1/2 BUMPER TO HOOD	PRE													4.0
	POST		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	10.6
HOOD	PRE													4.0
	POST		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	10.7
	DIFF.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7

TABLE 4 SIDE IMPACTOR - FRONT PROFILE

Test No. 3 - 41863A - 44.9 psi

Date 2/25/82

VERTICAL HEIGHTS

		INCHES LEFT						C/L	INCHES RIGHT					
		36	30	24	18	12	6		6	12	18	24	30	36
LOWER BUMPER	PRE POST	←						16.2					→	
UPPER BUMPER	PRE POST	←	←					21.2					→	
1/2 BUMPER TO HOOD	PRE POST	←	←					21.2					→	
	PRE POST	←	←					28.6					→	
	PRE POST	←	←					28.6					→	
HOOD	PRE POST	←	←					34.0					→	
	PRE POST	←	←					34.0					→	

HORIZONTAL DISTANCE FROM REFERENCE

		HORIZONTAL DISTANCE FROM REFERENCE											
		36	30	24	18	12	6	0	6	12	18	24	30
LOWER BUMPER	PRE POST DIFF.		0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.8 0.8	0.0 0.0 0.0	0.0 2.7 2.7	0.0 4.6 4.6	0.0 8.5 8.5	0.0 10.3 10.3
UPPER BUMPER	PRE POST DIFF.		0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.7 0.7	0.0 0.0 0.0	0.0 2.6 2.6	0.0 4.5 4.5	0.0 8.3 8.3	0.0 10.0 10.0
1/2 BUMPER TO HOOD	PRE POST DIFF.		4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.2 0.2	4.0 5.0 1.0	4.0 8.7 4.7	4.0 10.6 6.6
HOOD	PRE POST DIFF.		4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.9 0.9	4.0 8.7 4.7	4.0 10.6 6.6

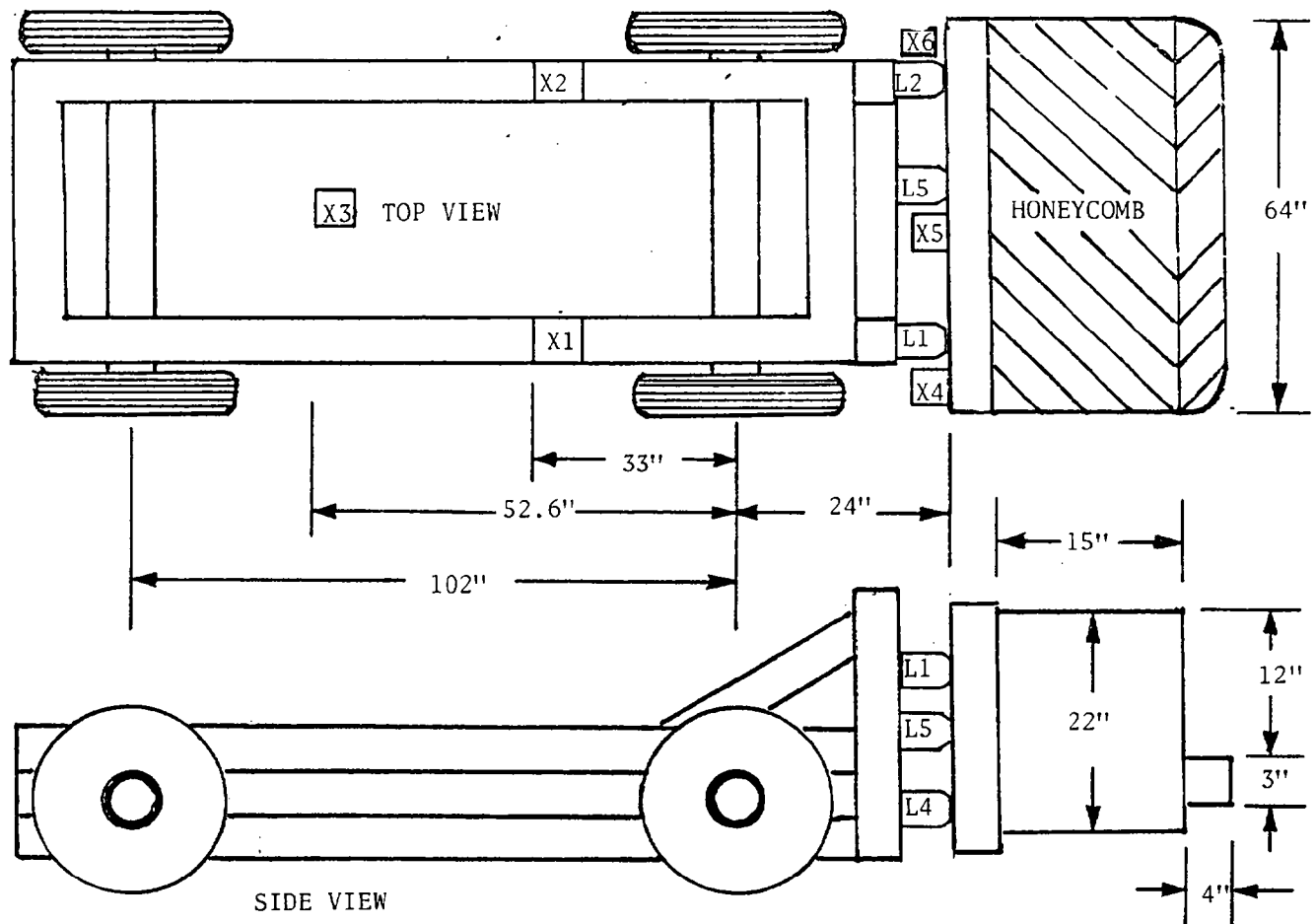
TABLE 5 SIDE IMPACTOR - FRONT PROFILE

Test No. 4 - B0060A - 43.0 psi

Date 2/22/82

VERTICAL HEIGHTS														
		INCHES LEFT						C/L	INCHES RIGHT					
		36	30	24	18	12	6	0	6	12	18	24	30	36
LOWER BUMPER	PRE		<					16.2					>	
	POST		<					16.2					>	
UPPER BUMPER	PRE		<					21.2					>	
	POST		<					21.2					>	
1/2 BUMPER TO HOOD	PRE		<					28.6					>	
	POST		<					28.6					>	
HOOD	PRE		<					34.0					>	
	POST		<					34.0					>	

HORIZONTAL DISTANCE FROM REFERENCE														
LOWER BUMPER	PRE POST DIFF.		0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.1 0.1	0.0 0.2 0.2	0.0 0.9 0.9	0.0 2.7 2.7	0.0 4.6 4.6	0.0 6.5 6.5	0.0 8.4 8.4	0.0 10.1 10.1	
UPPER BUMPER	PRE POST DIFF.		0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.1 0.1	0.0 0.2 0.2	0.0 0.8 0.8	0.0 2.6 2.6	0.0 4.5 4.5	0.0 6.3 6.3	0.0 8.2 8.2	0.0 9.9 9.9	
1/2 BUMPER TO HOOD	PRE POST DIFF.		4.0 4.1 0.1	4.0 4.1 0.1	4.0 4.1 0.1	4.0 4.1 0.1	4.0 4.1 0.1	4.0 4.2 0.2	4.0 4.3 0.3	4.0 5.3 1.3	4.0 6.9 2.9	4.0 8.7 4.7	4.0 10.6 6.6	
HOOD	PRE POST DIFF.		4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.0 0.0	4.0 4.1 0.1	4.0 4.8 0.8	4.0 6.7 2.7	4.0 8.5 4.5	4.0 10.6 6.6	



TRANSDUCER NUMBER*	TRANSDUCER LOCATION	DIRECTION		
		X	Y	Z
X1	RT upper frame rail accel.	x	x	x
X2	LT upper frame rail accel.	x	x	x
X3	C/G accel.	x	x	x
X4	RT side bumper accel.	x		
X6	LT side bumper accel.	x		
L1	Top RT load cell	x		
L2	Top LT load cell	x		
L3	Bottom LT load cell	x		
L4	Bottom RT load cell	x		
L5	Center load cell	x		
X5	Center bumper accel.	x		

*The transducer pack number can be correlated with the vehicle response data traces.

Figure 1 SIDE IMPACTOR MOVING BARRIER TRANSDUCER LOCATIONS

Table 6

SIDE IMPACTOR WEIGHT AND C.G. CALCULATIONS

Wheel Base 102 inches

Left Front	940 lbs.
Right Front	<u>940 lbs.</u>
TOTAL FRONT	1880 lbs.

Left Rear	560 lbs.
Right Rear	<u>560 lbs.</u>
TOTAL REAR	1120 lbs.

TOTAL WEIGHT = 1880 lbs. + 1120 lbs. = 3000 lbs.

C.G. F.W. = $\frac{1120 \text{ lbs. (102 inches)}}{3000 \text{ lbs.}}$ = 38.08 inches

SECTION 3
PHOTOGRAPHS

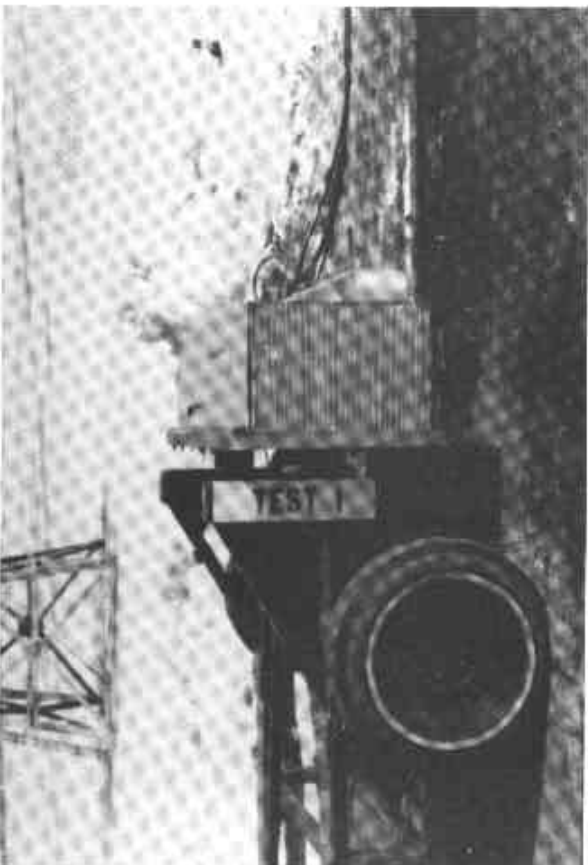
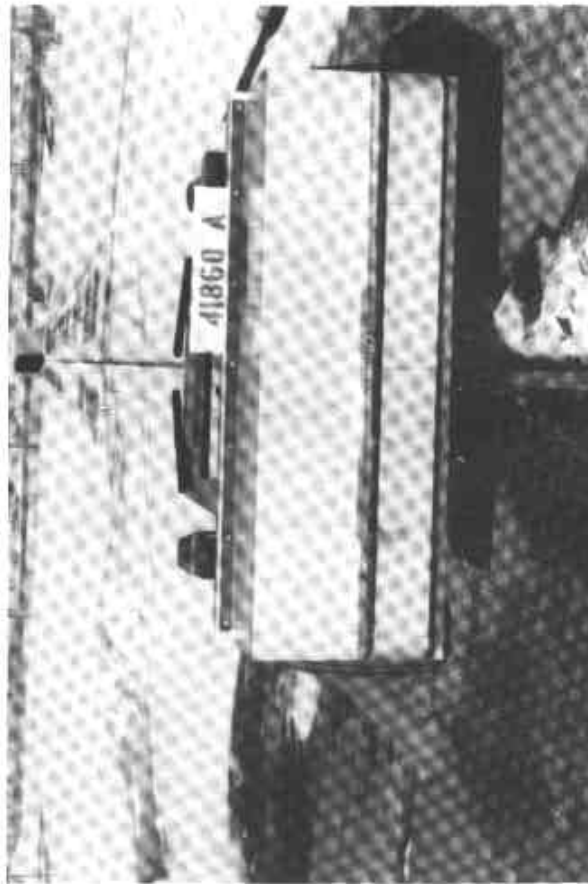


Figure 2: TEST NO. 1 PRE-TEST PHOTOGRAPHS

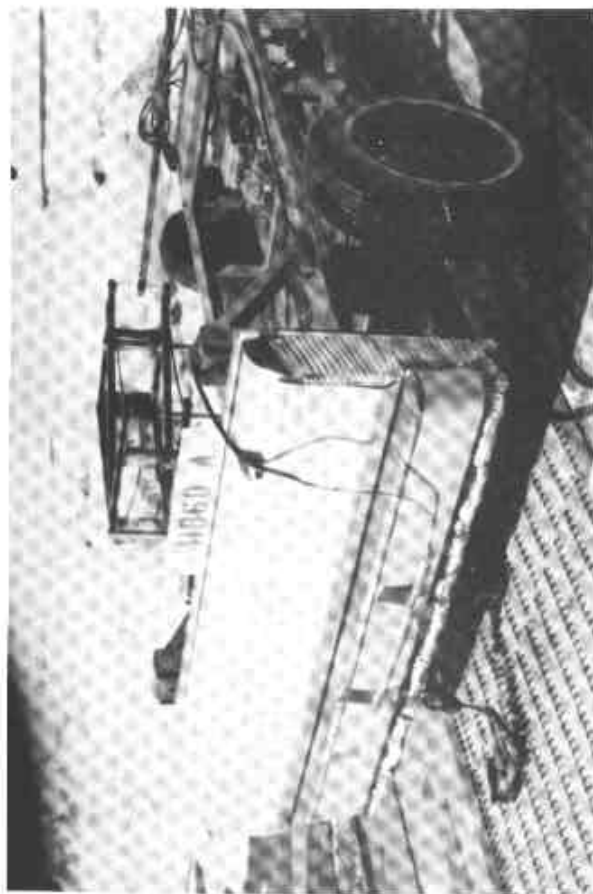


Figure 3: TEST NO. 1 POST-TEST PHOTOGRAPHS

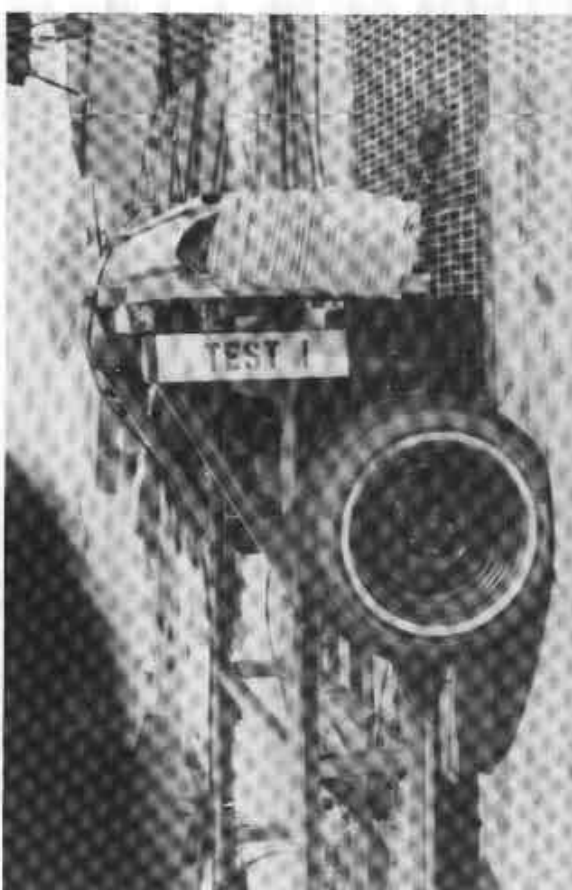
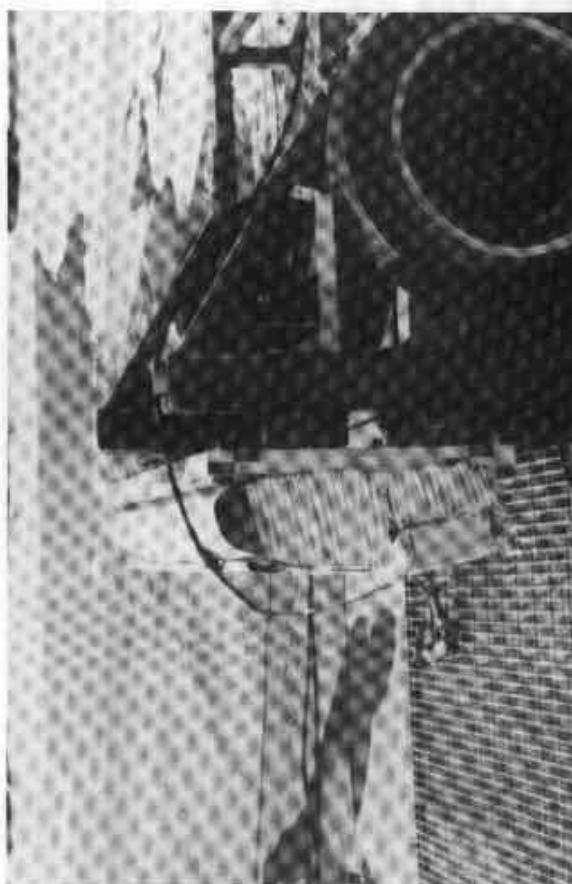
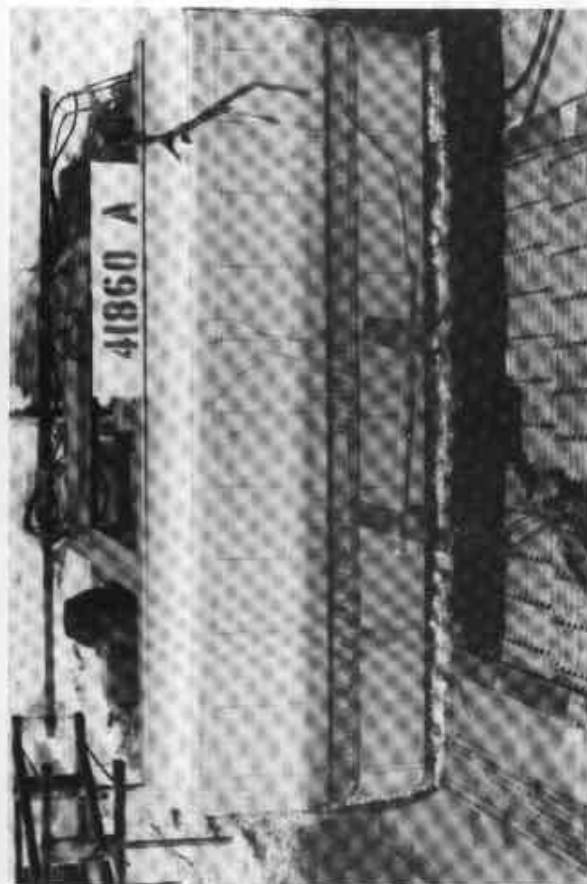


Figure 4: TEST NO. 1 POST-TEST PHOTOGRAPHS

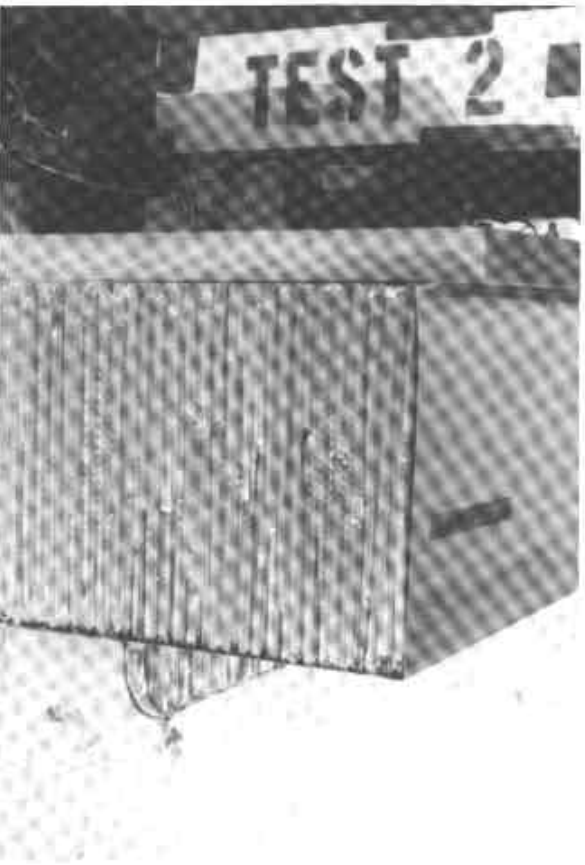
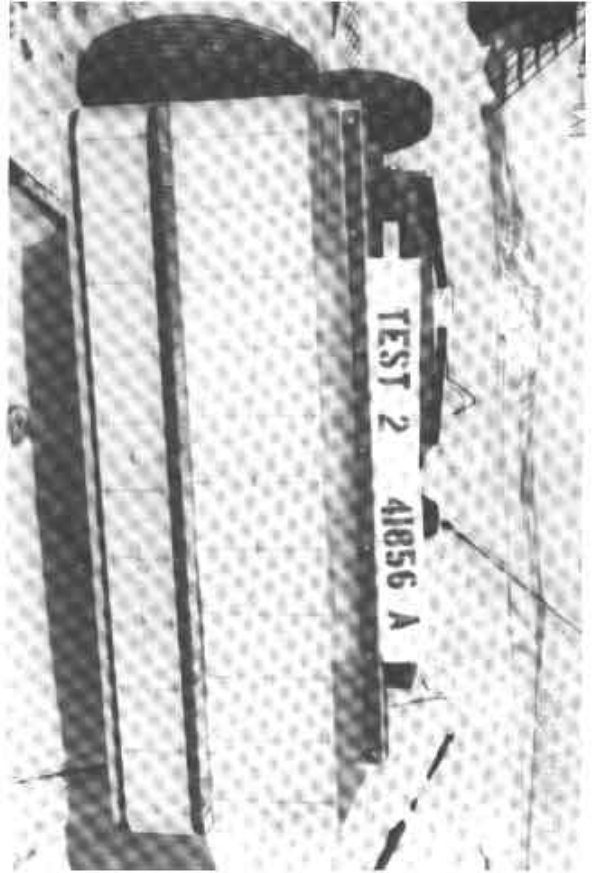


Figure 6: PRE-TEST NO. 2 PHOTOGRAPHS

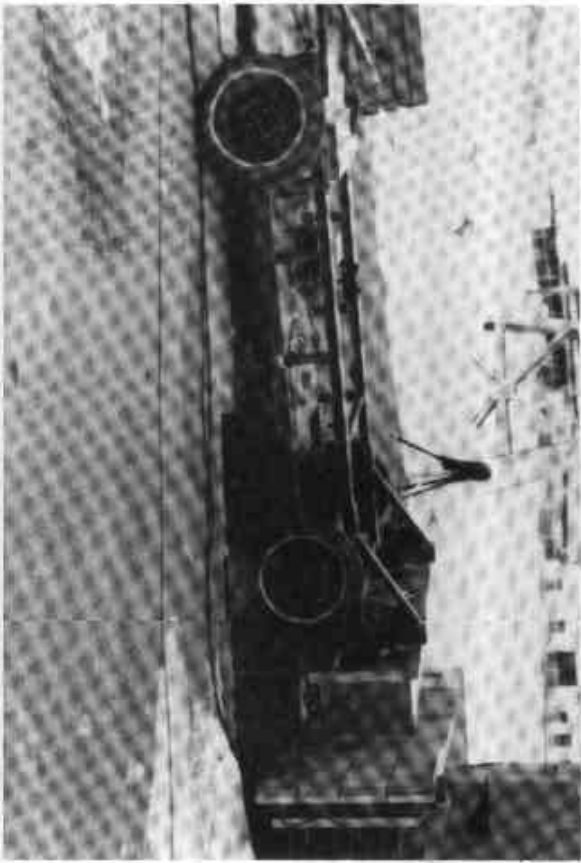
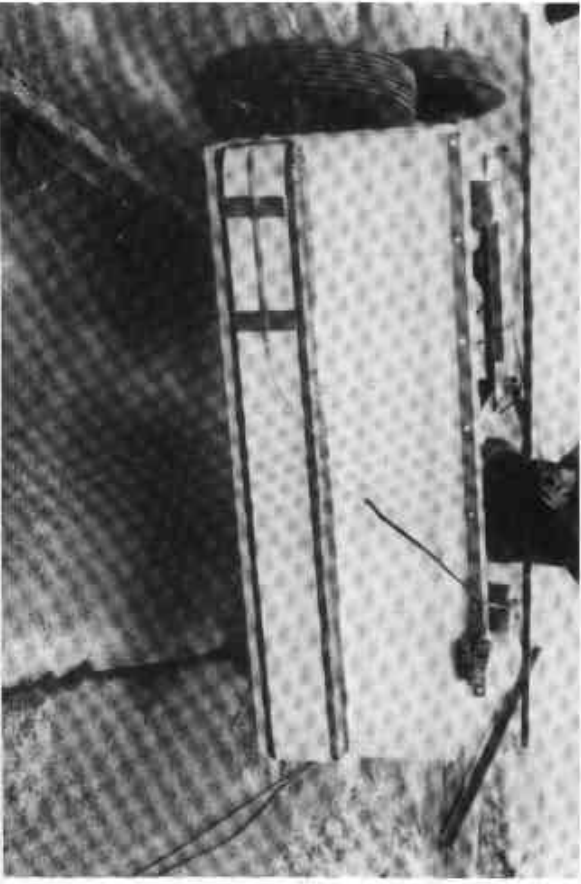
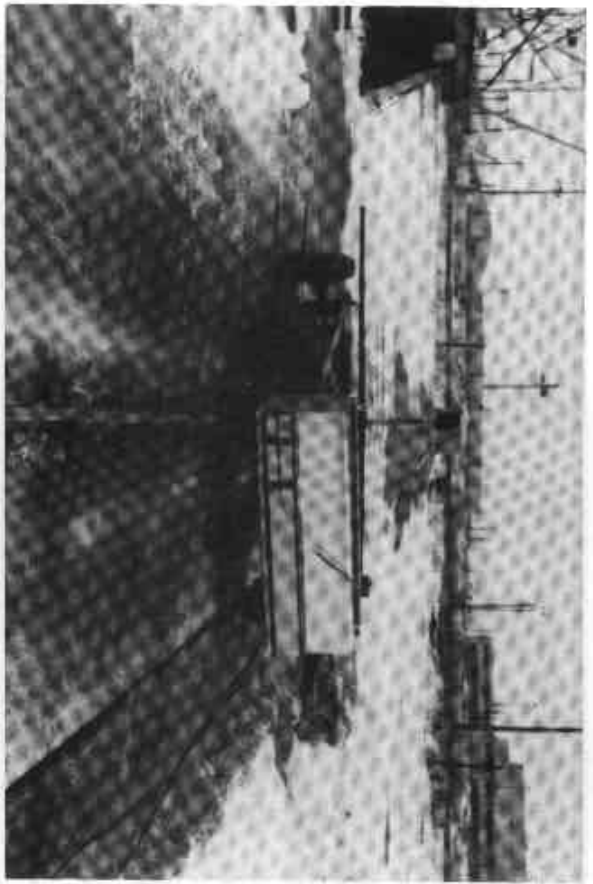


Figure 5: PRE-TEST SET-UP FOR 72° IMPACTS



Figure 7: POST-TEST NO. 2 PHOTOGRAPHS

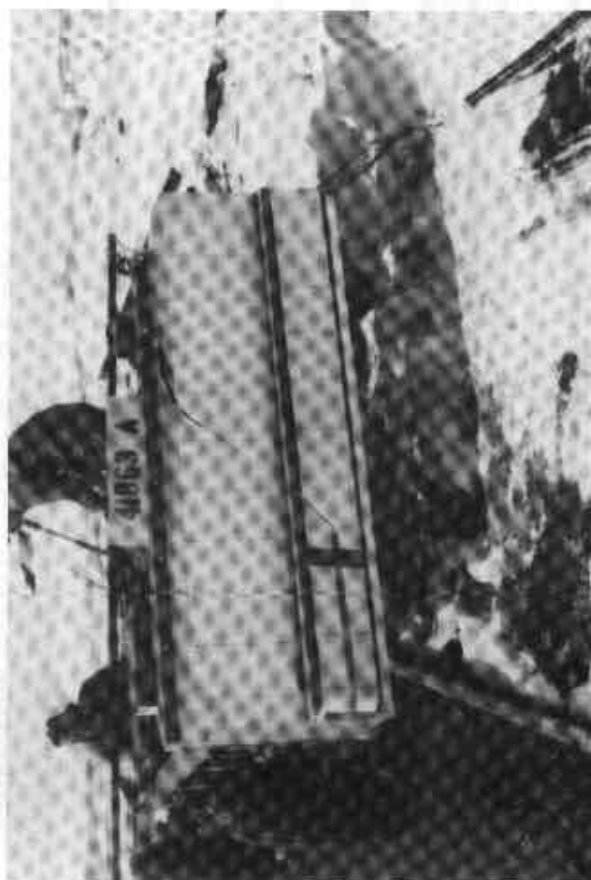


Figure 8: PRE-TEST NO. 3 PHOTOGRAPHS

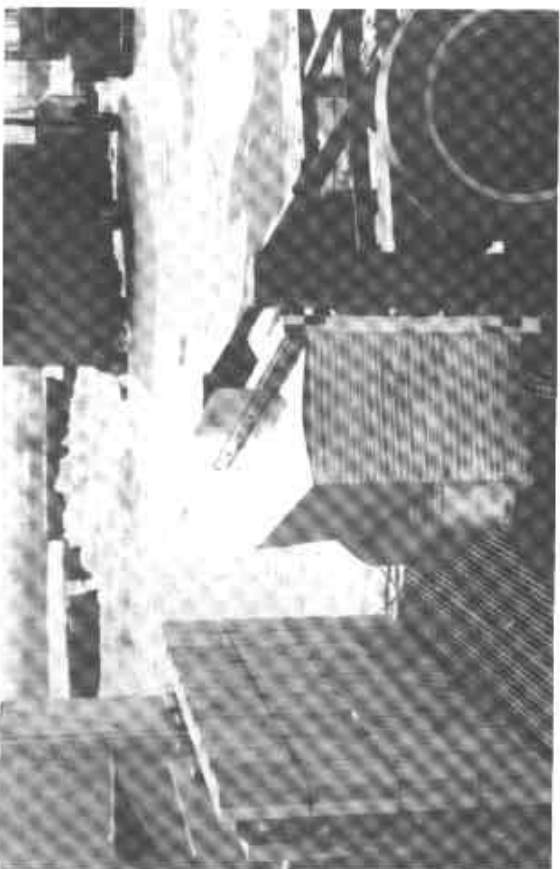


Figure 9: POST-TEST NO. 3 PHOTOGRAPHS

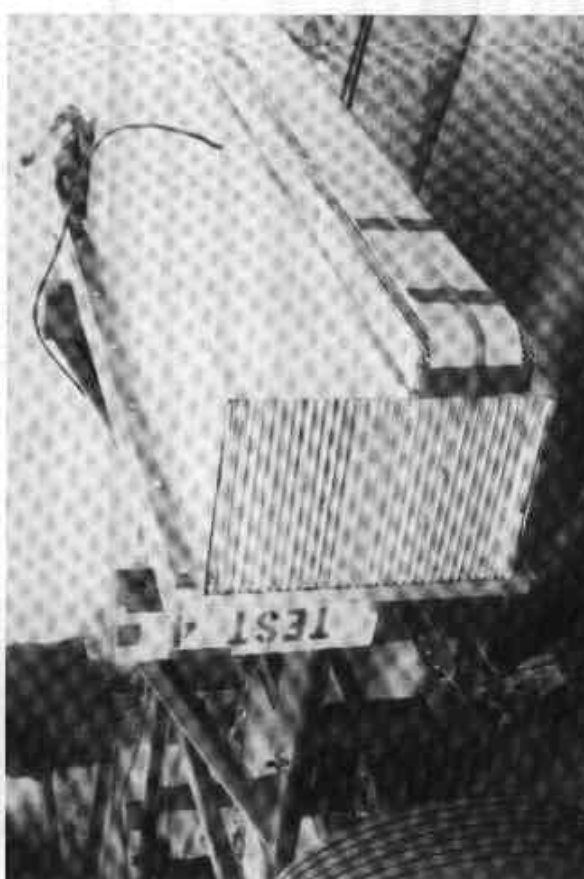
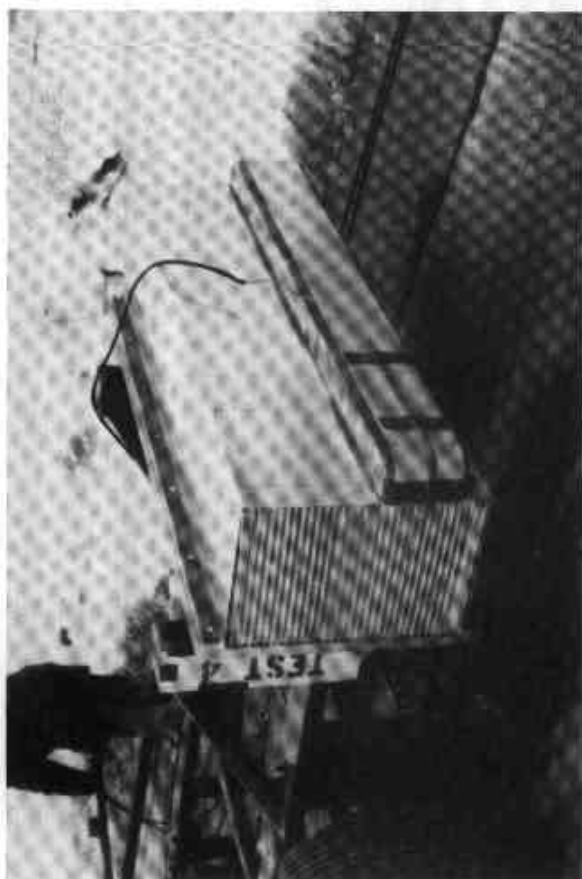


Figure 10: PRE-TEST NO. 4 PHOTOGRAPHS

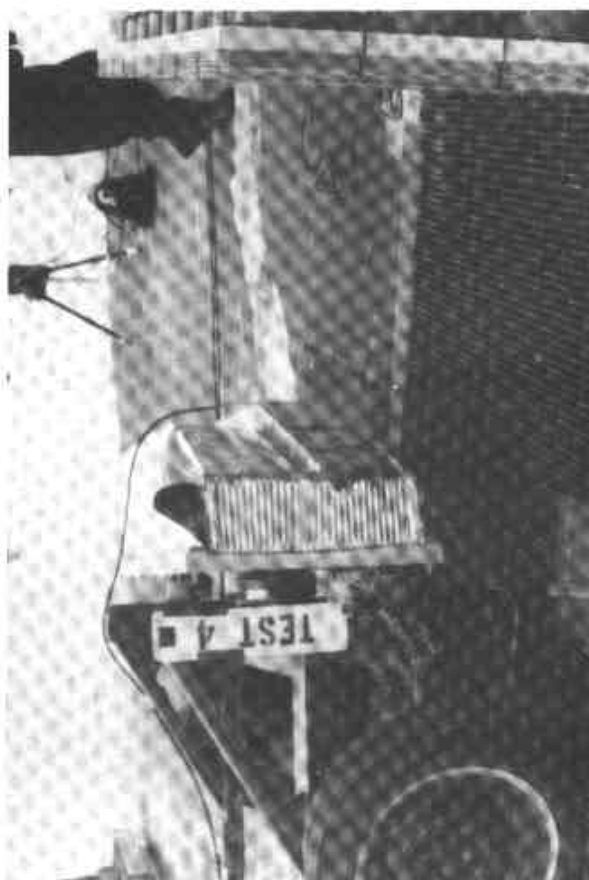
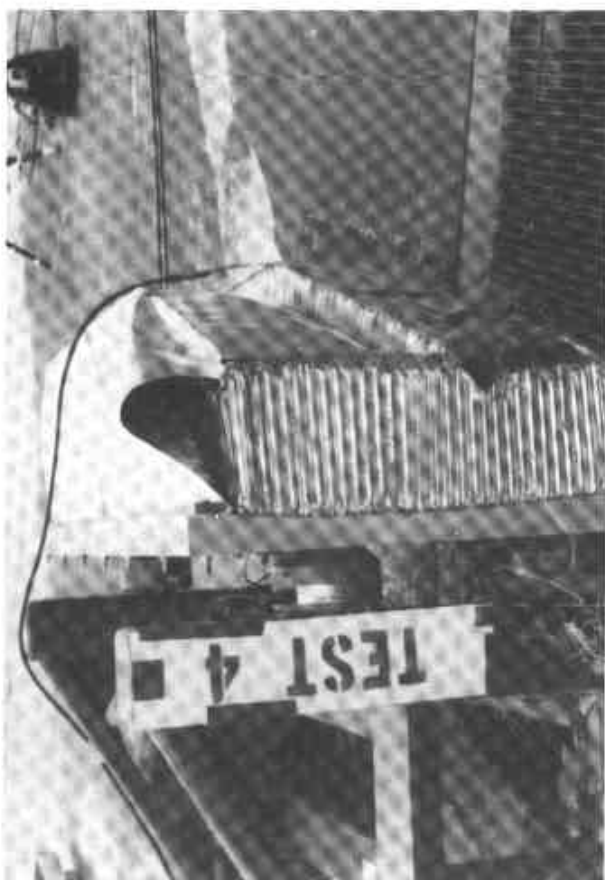
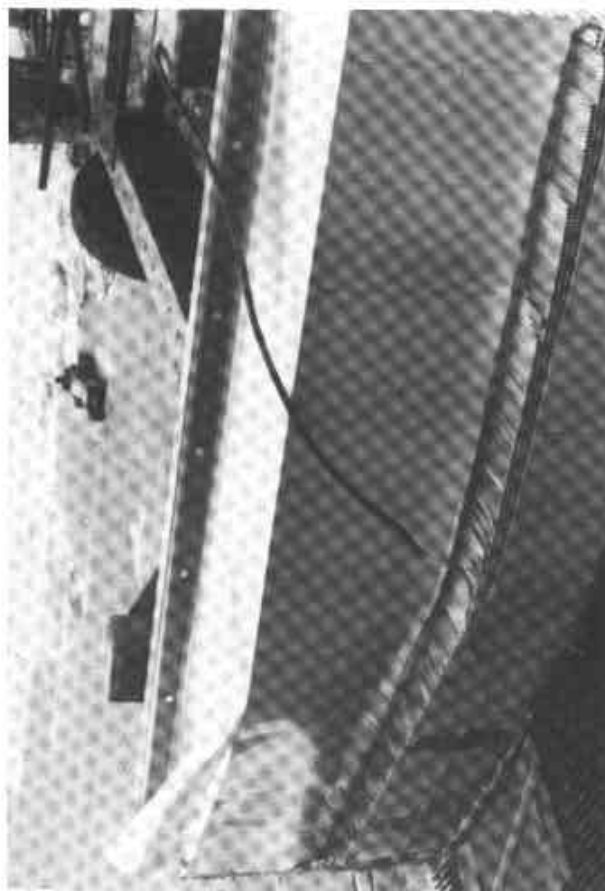


Figure 11: POST-TEST NO. 4 PHOTOGRAPHS

SECTION 4

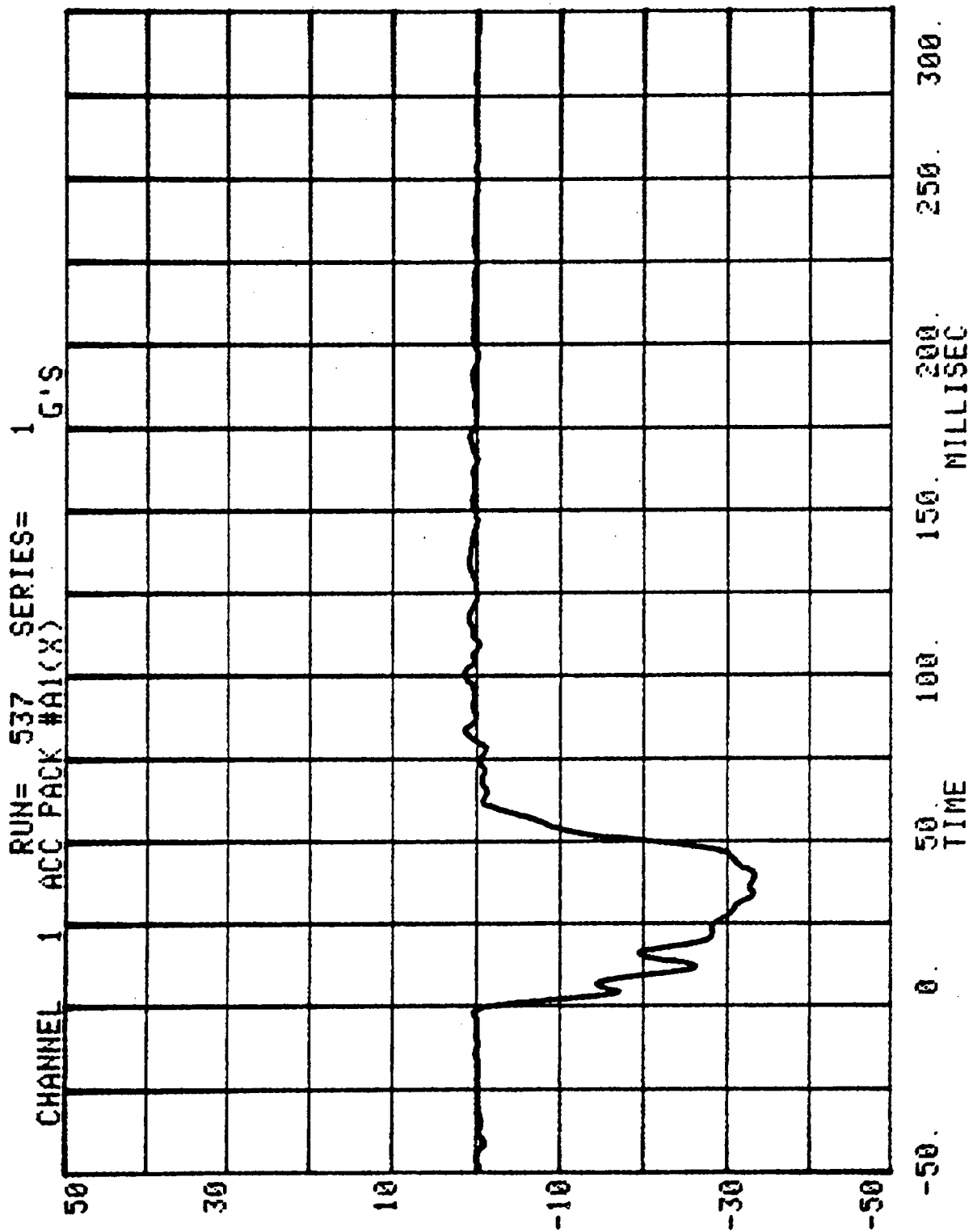
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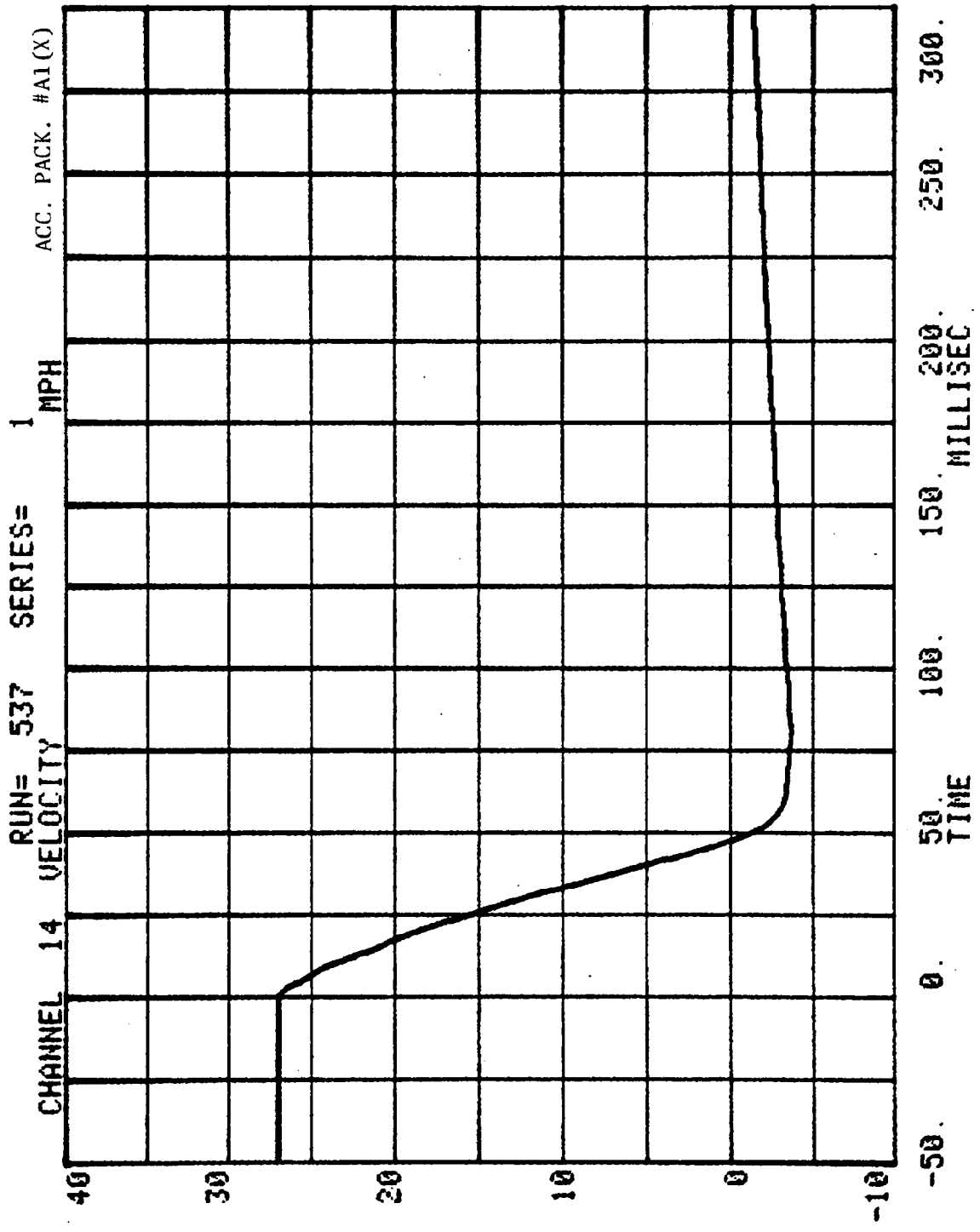
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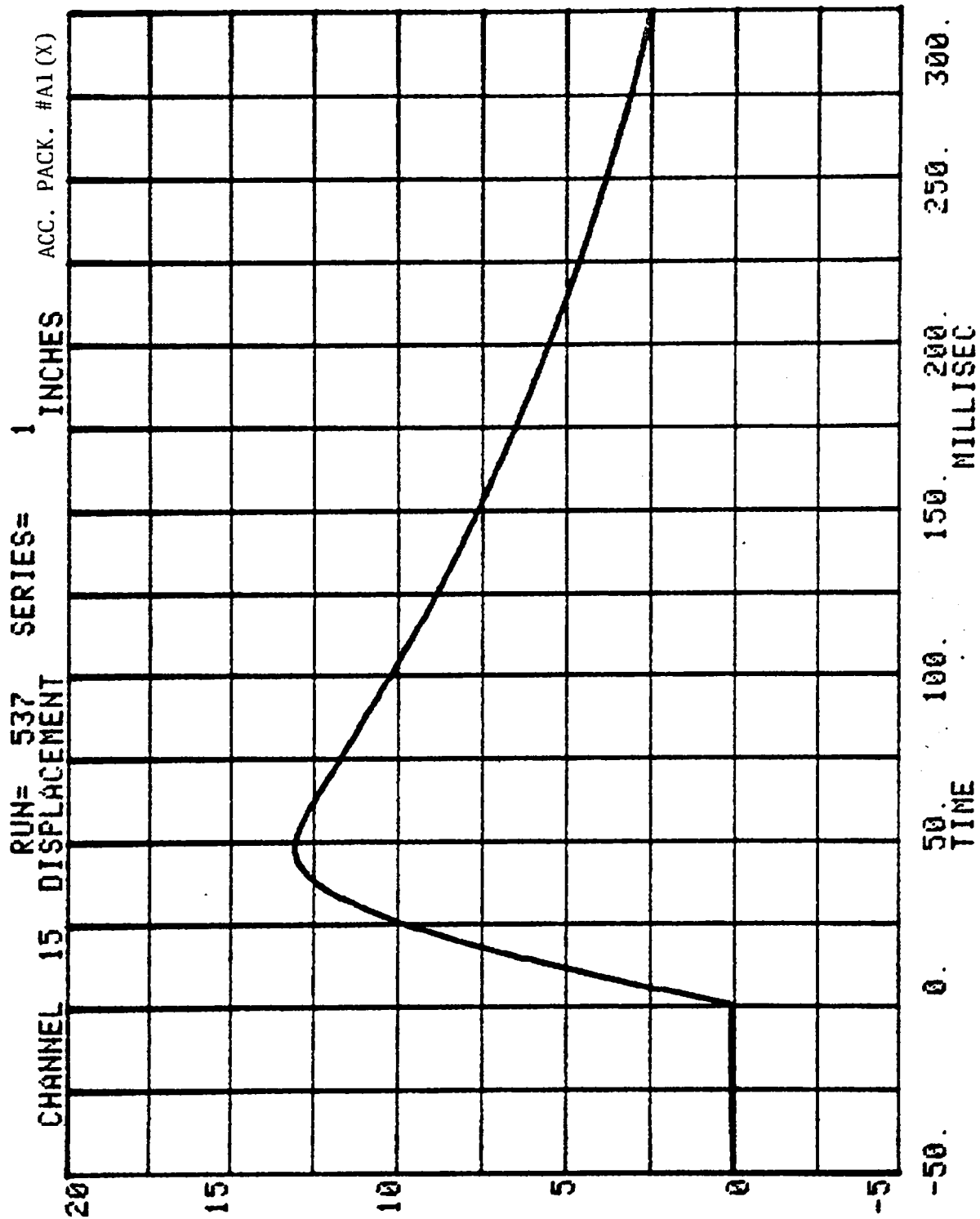
TEST NO. 1

VEHICLE DATA

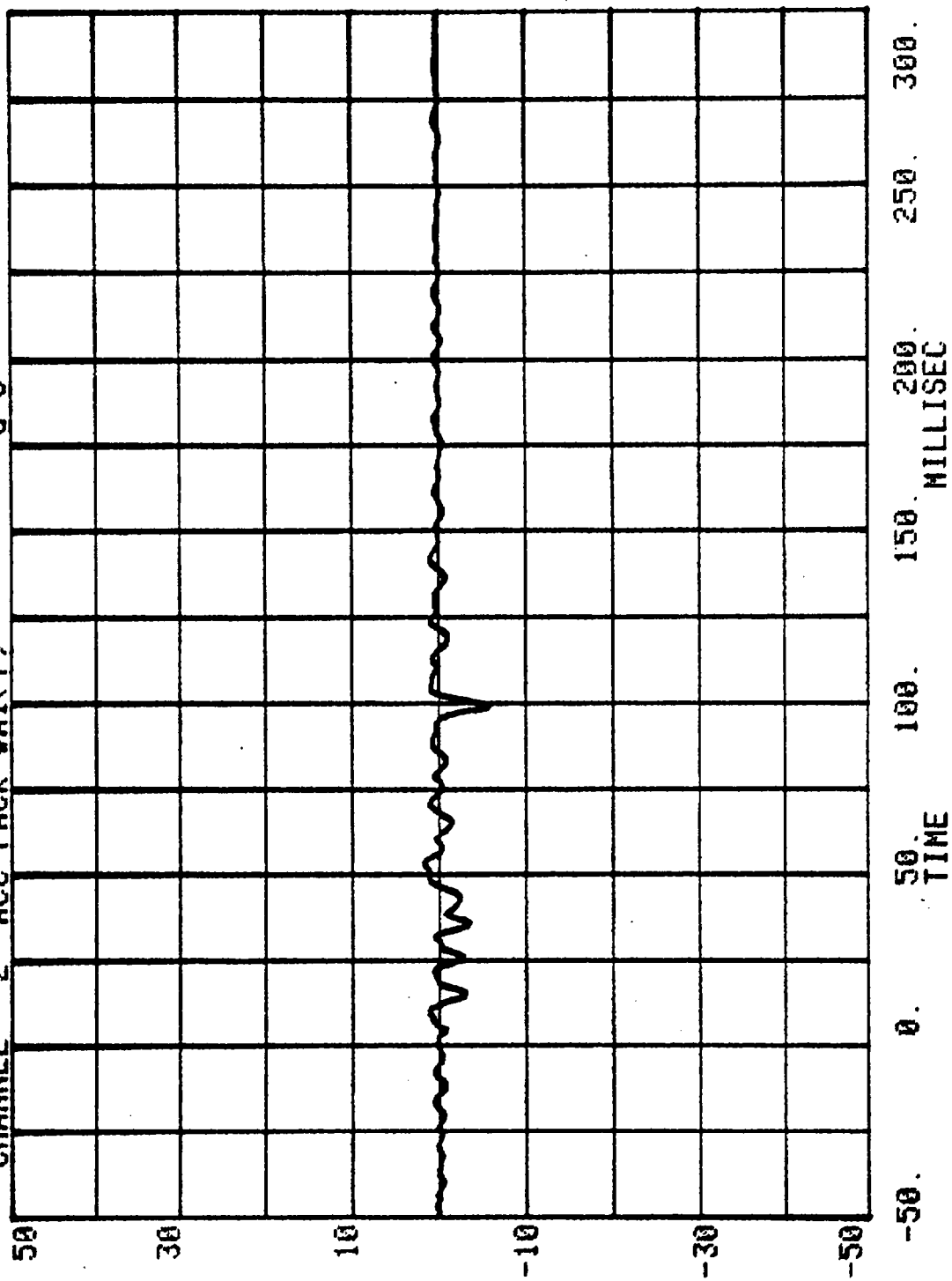
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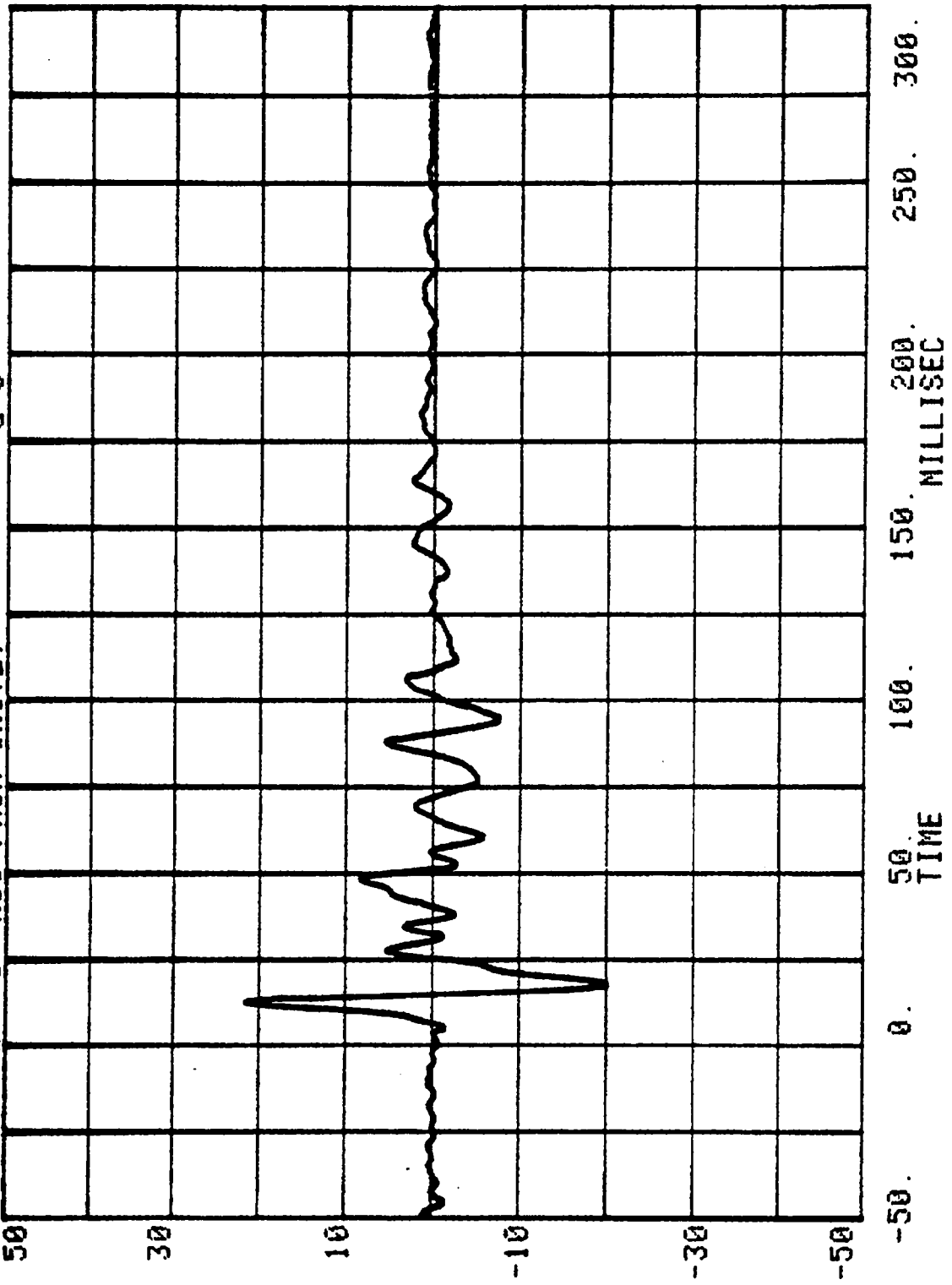




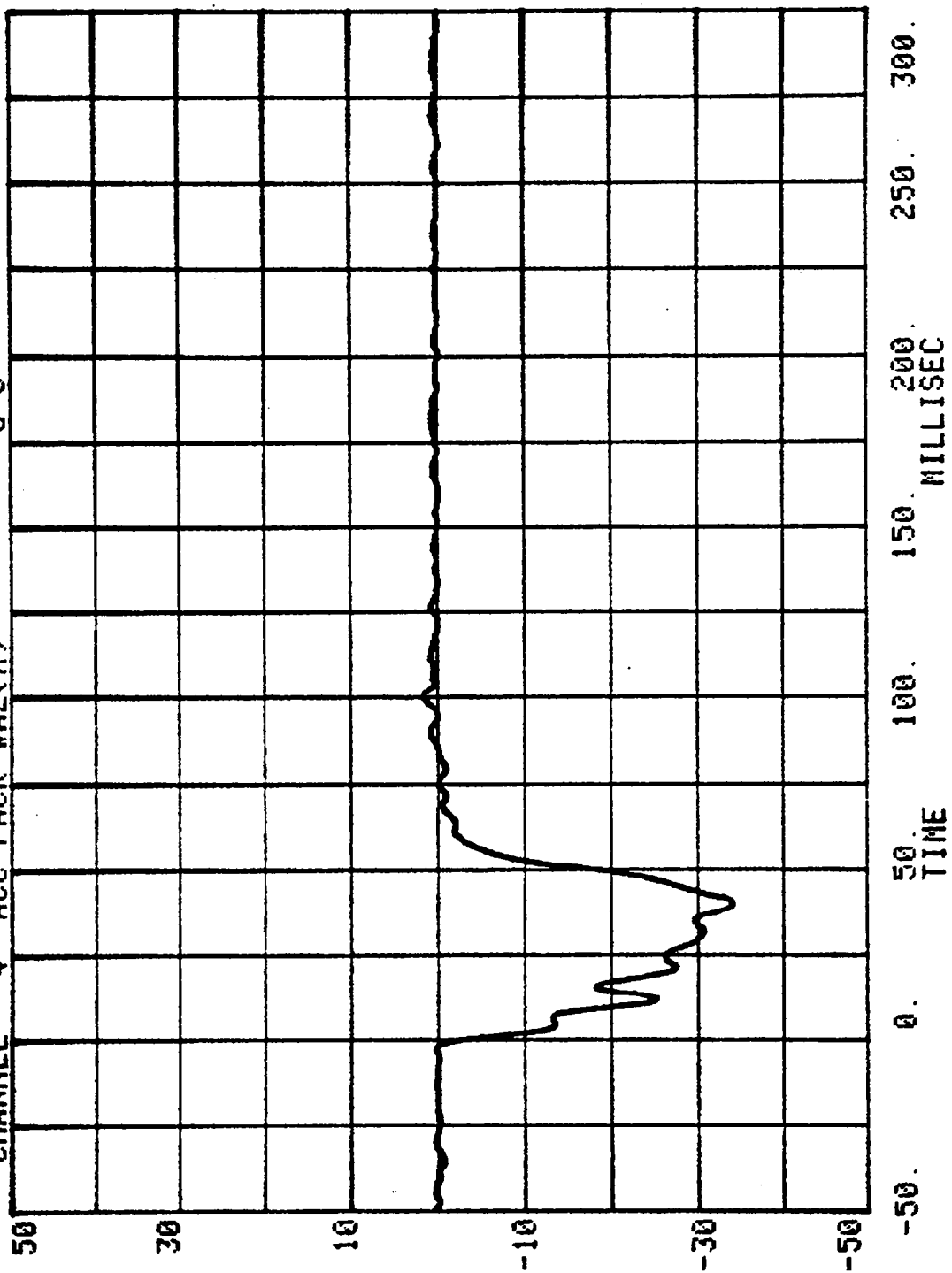
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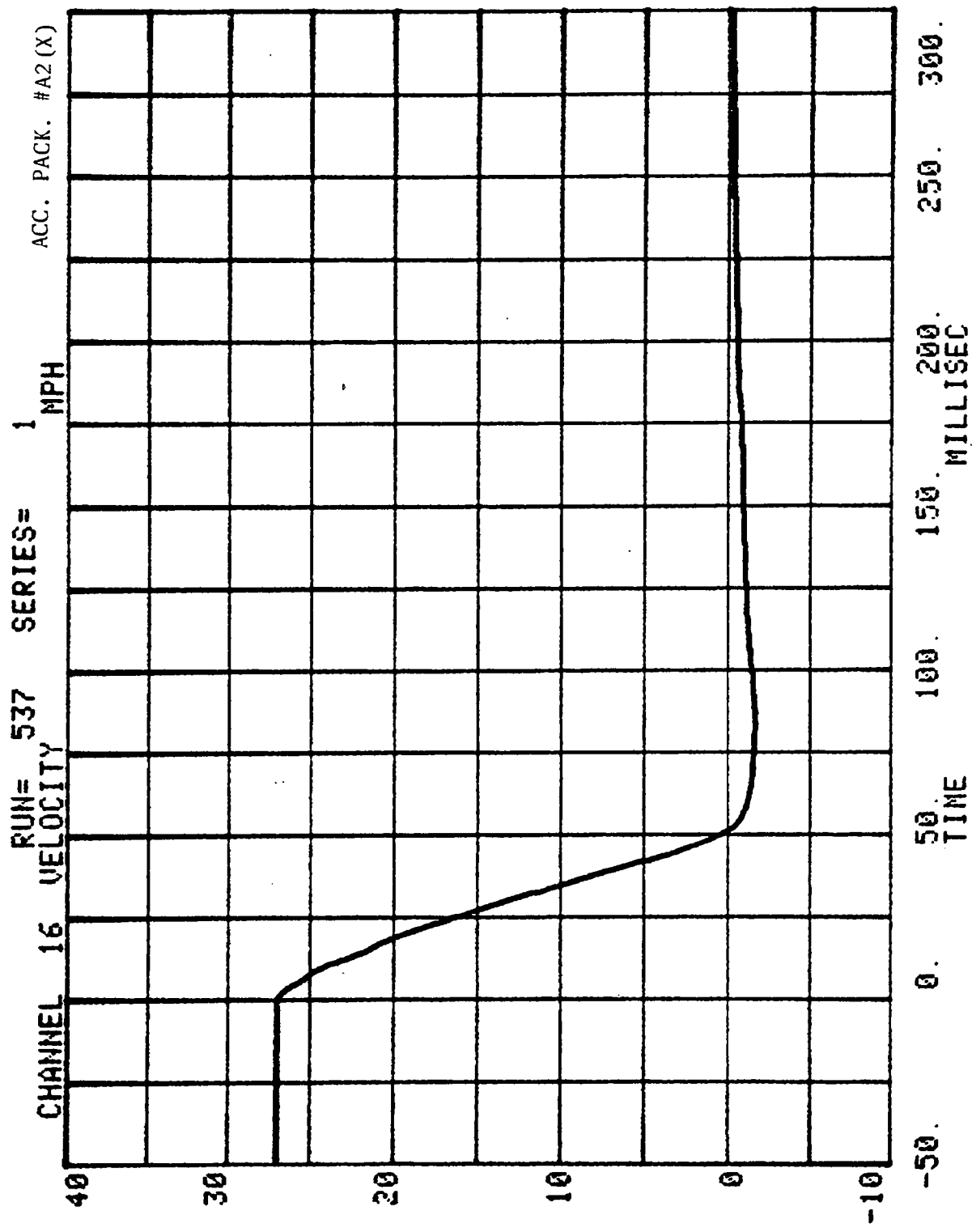


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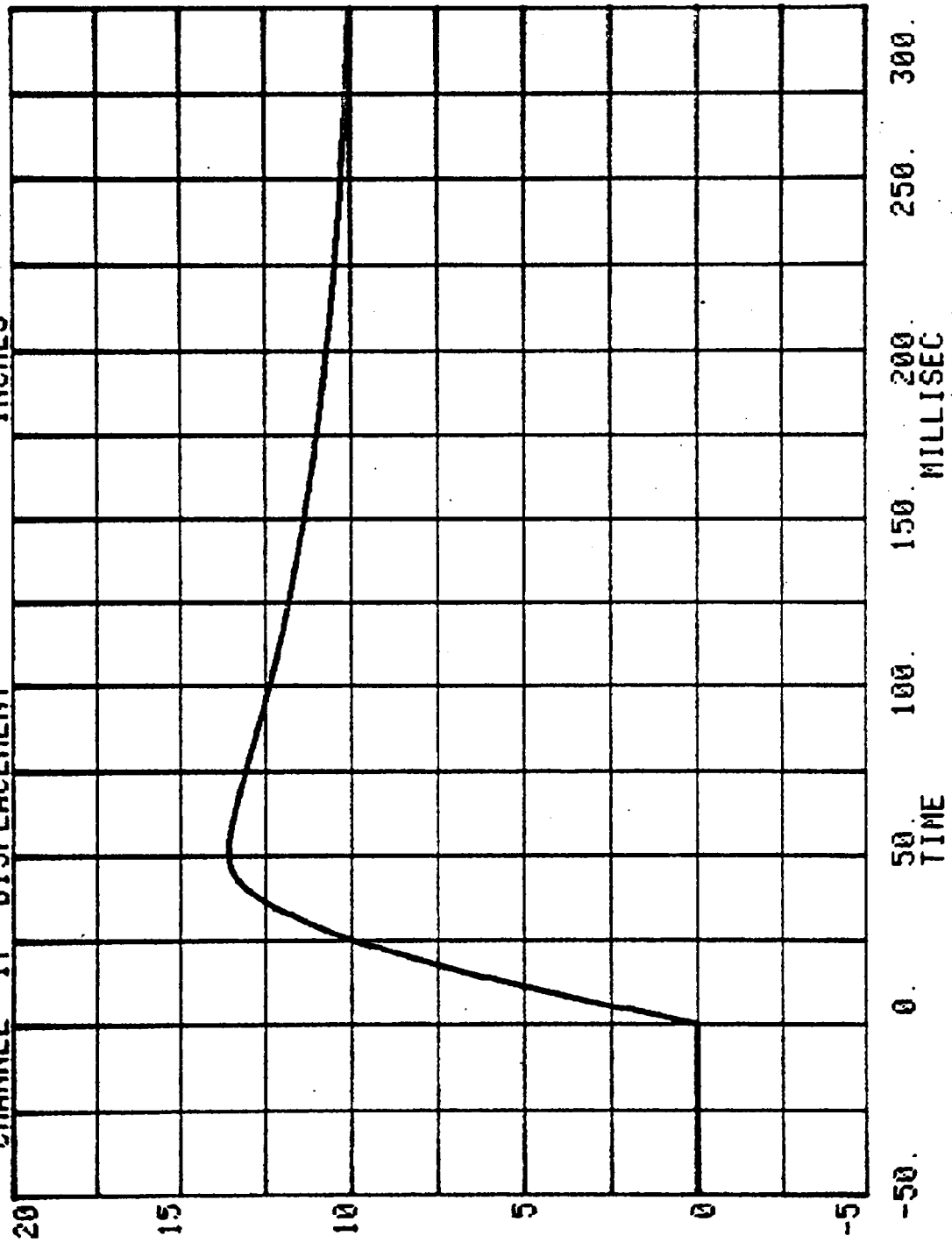


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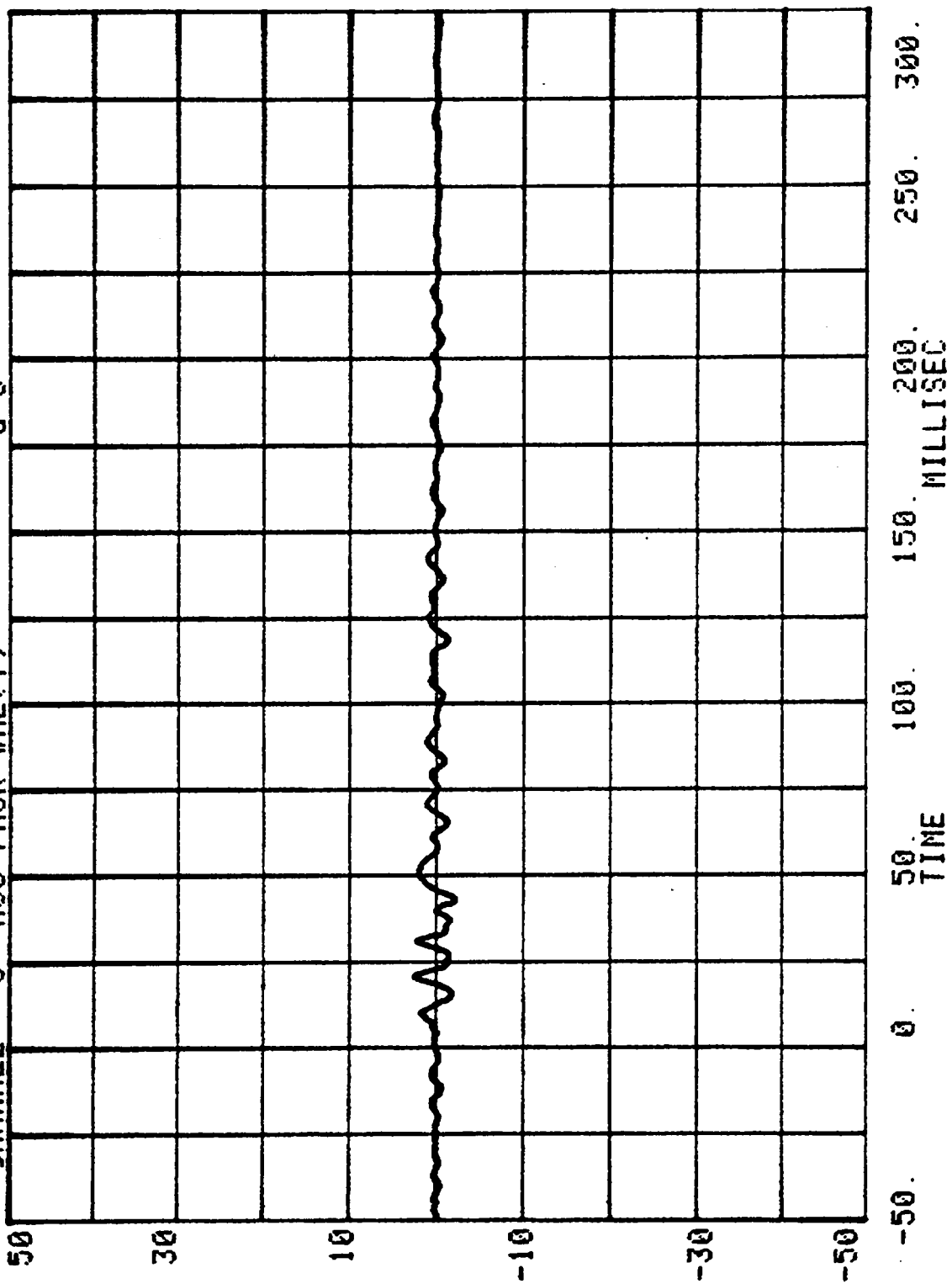




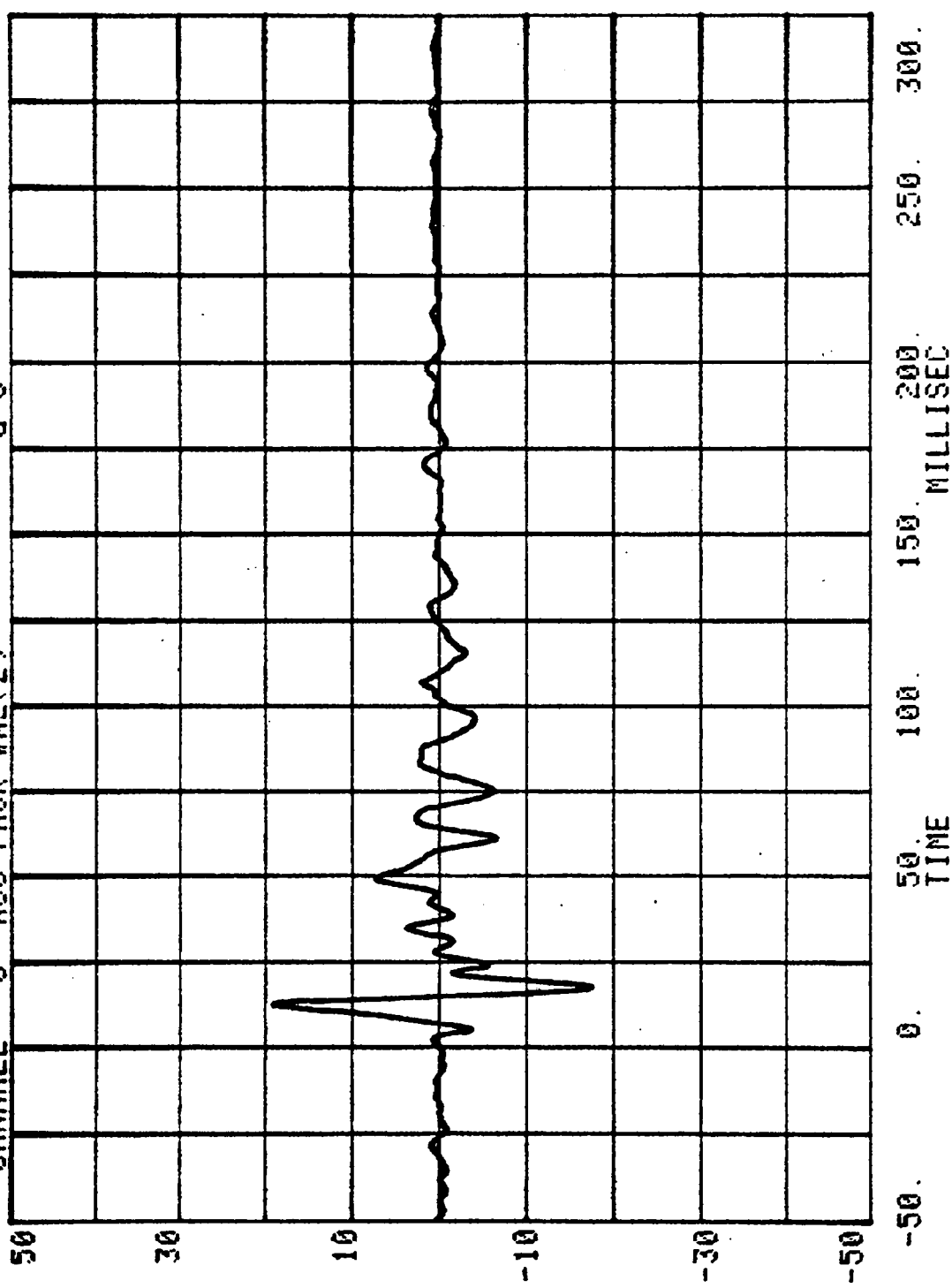
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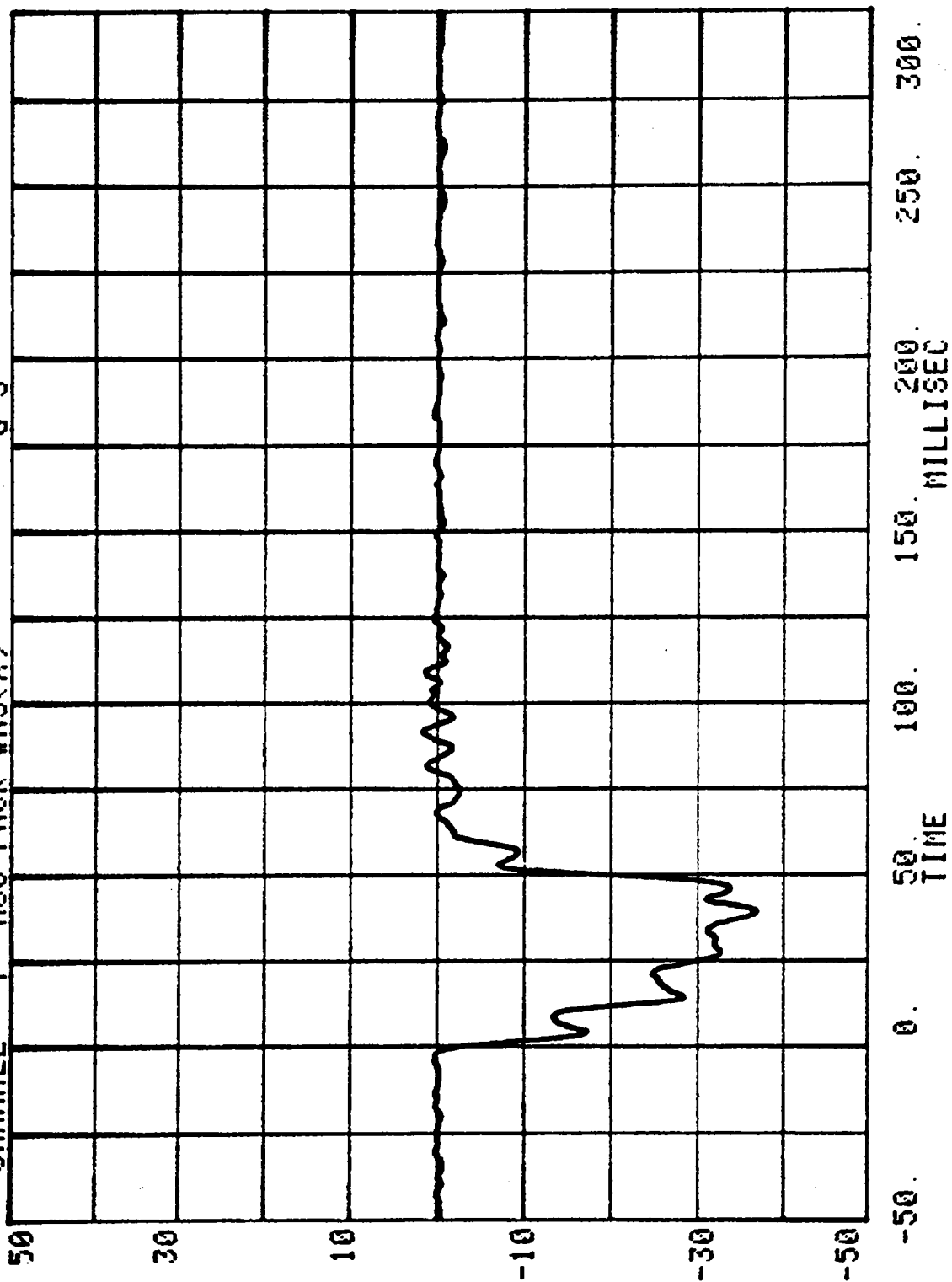
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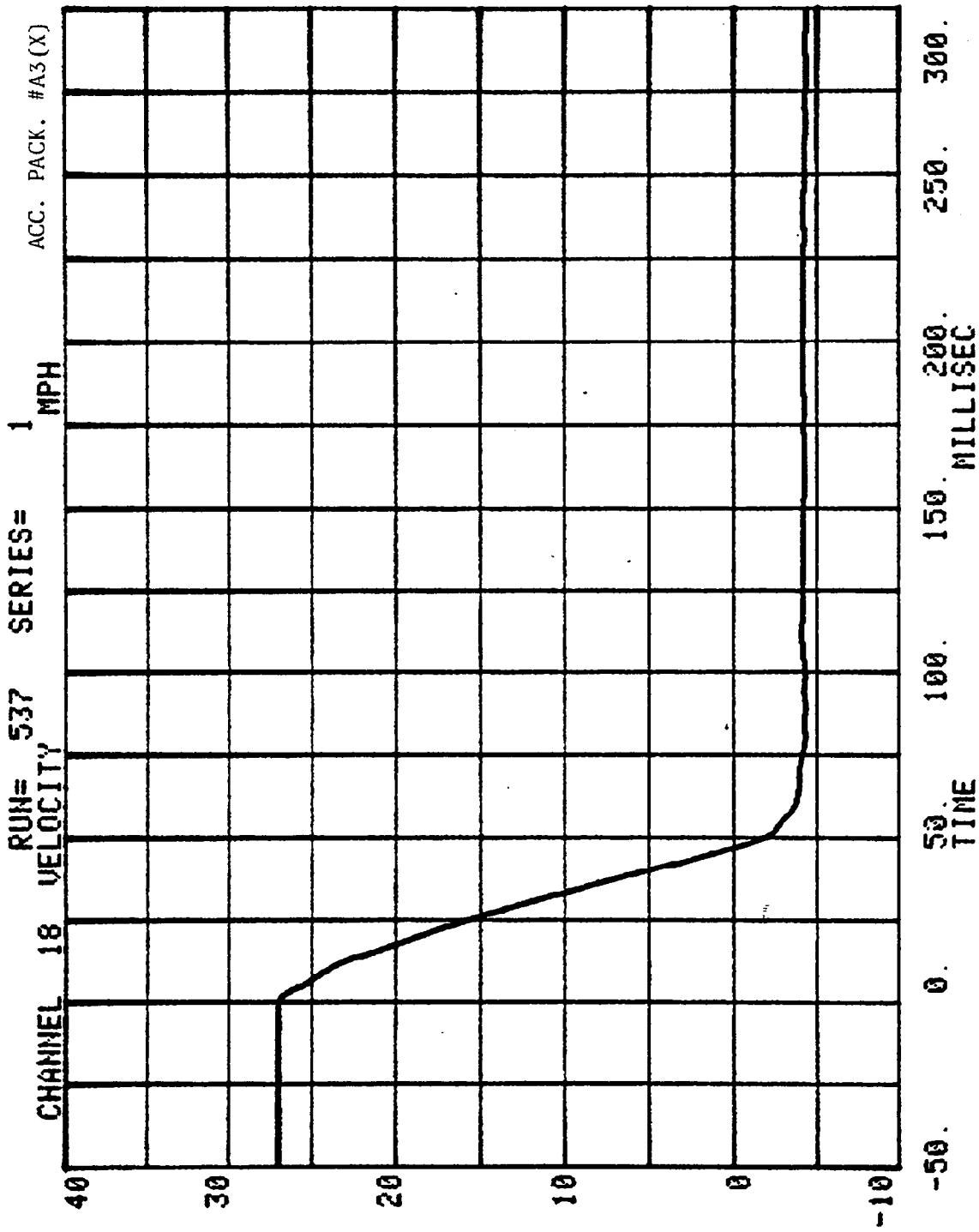


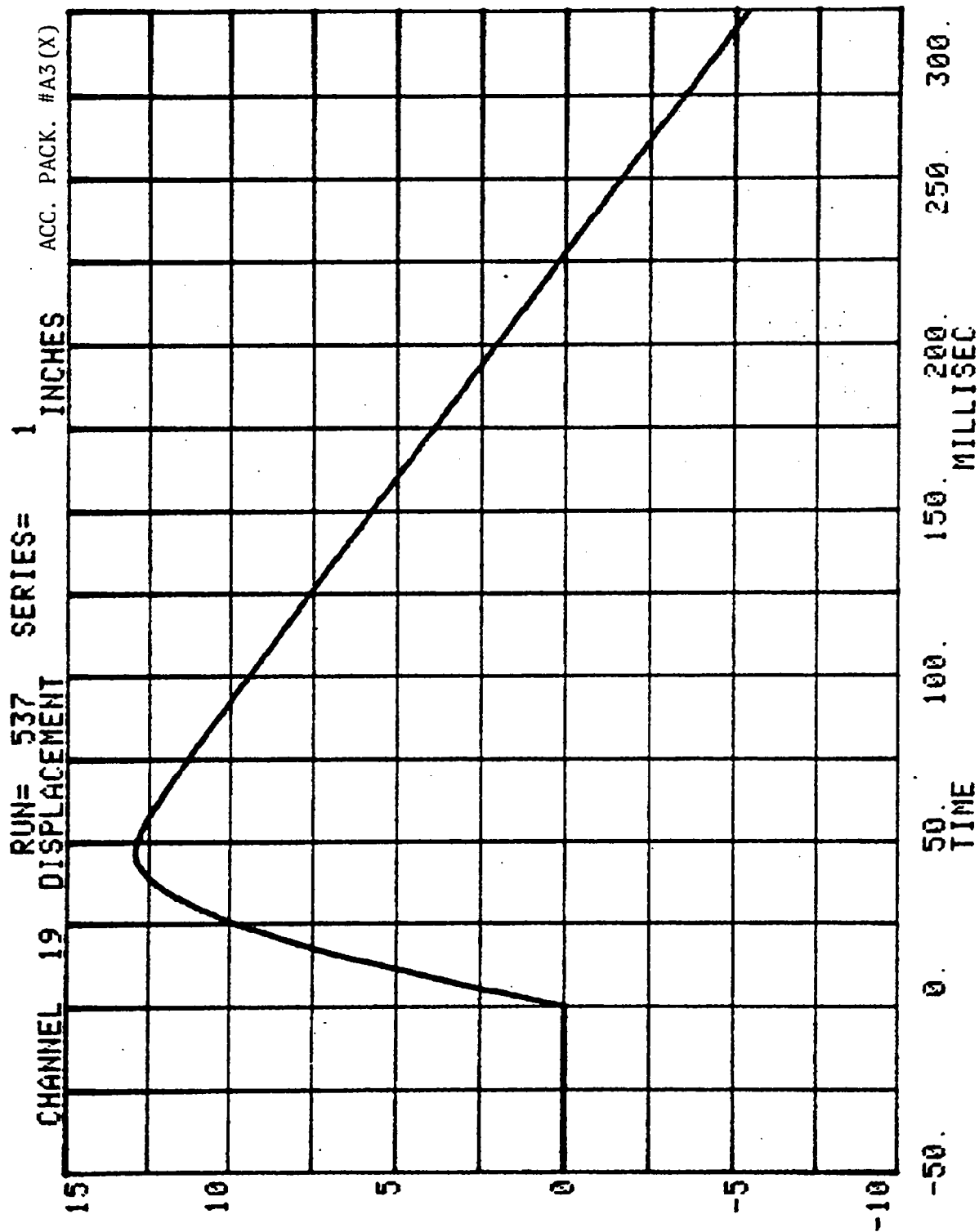
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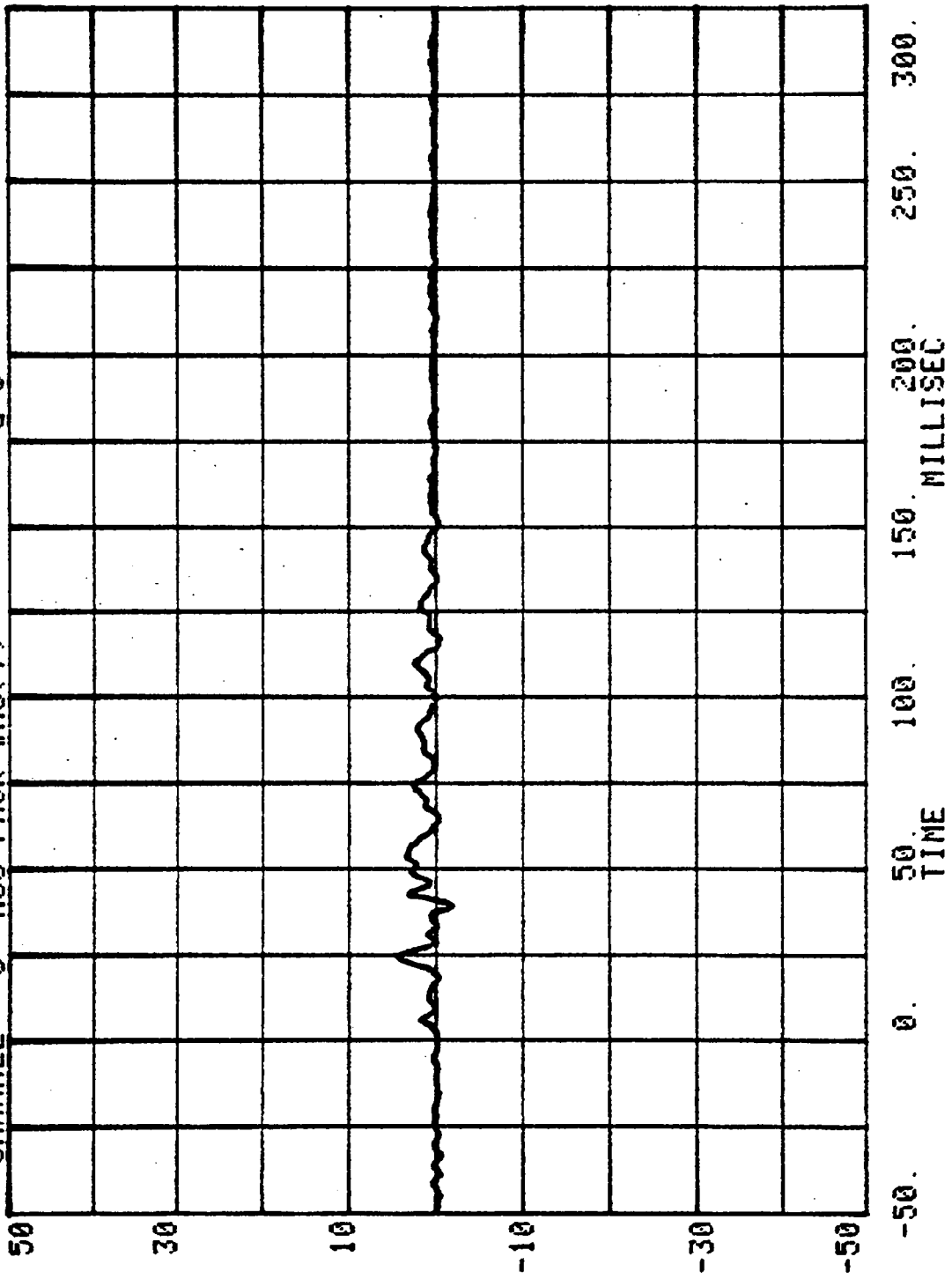
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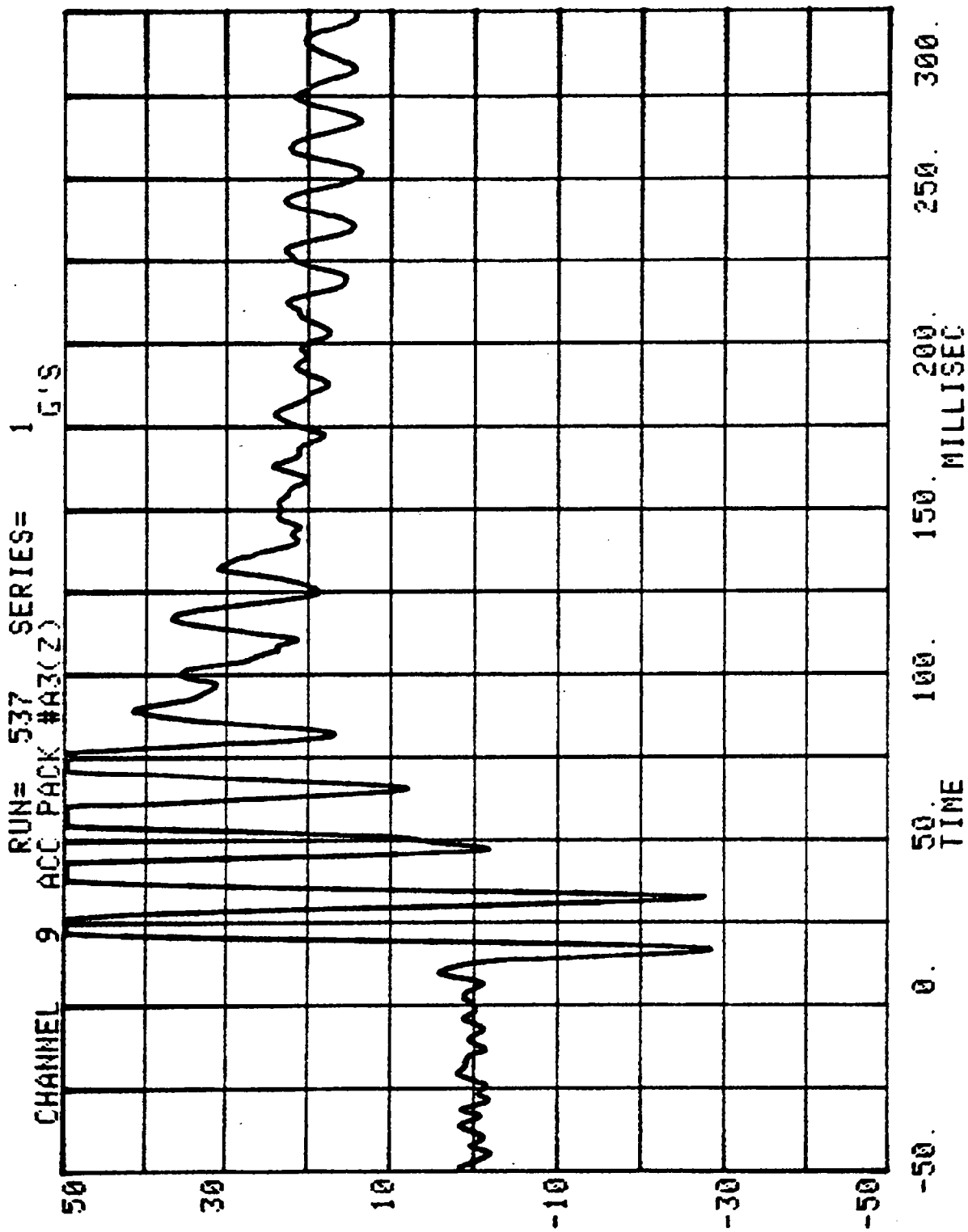




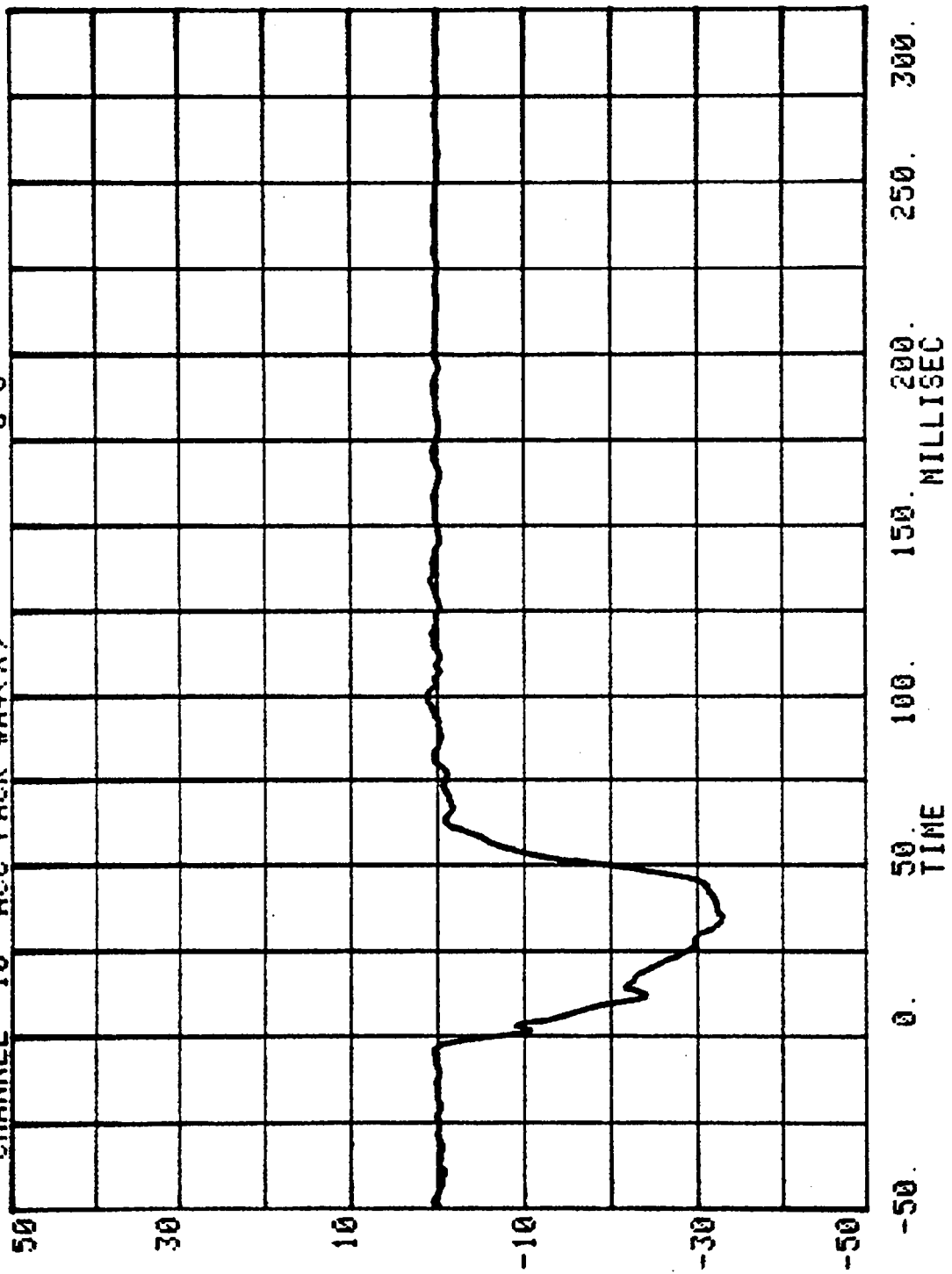


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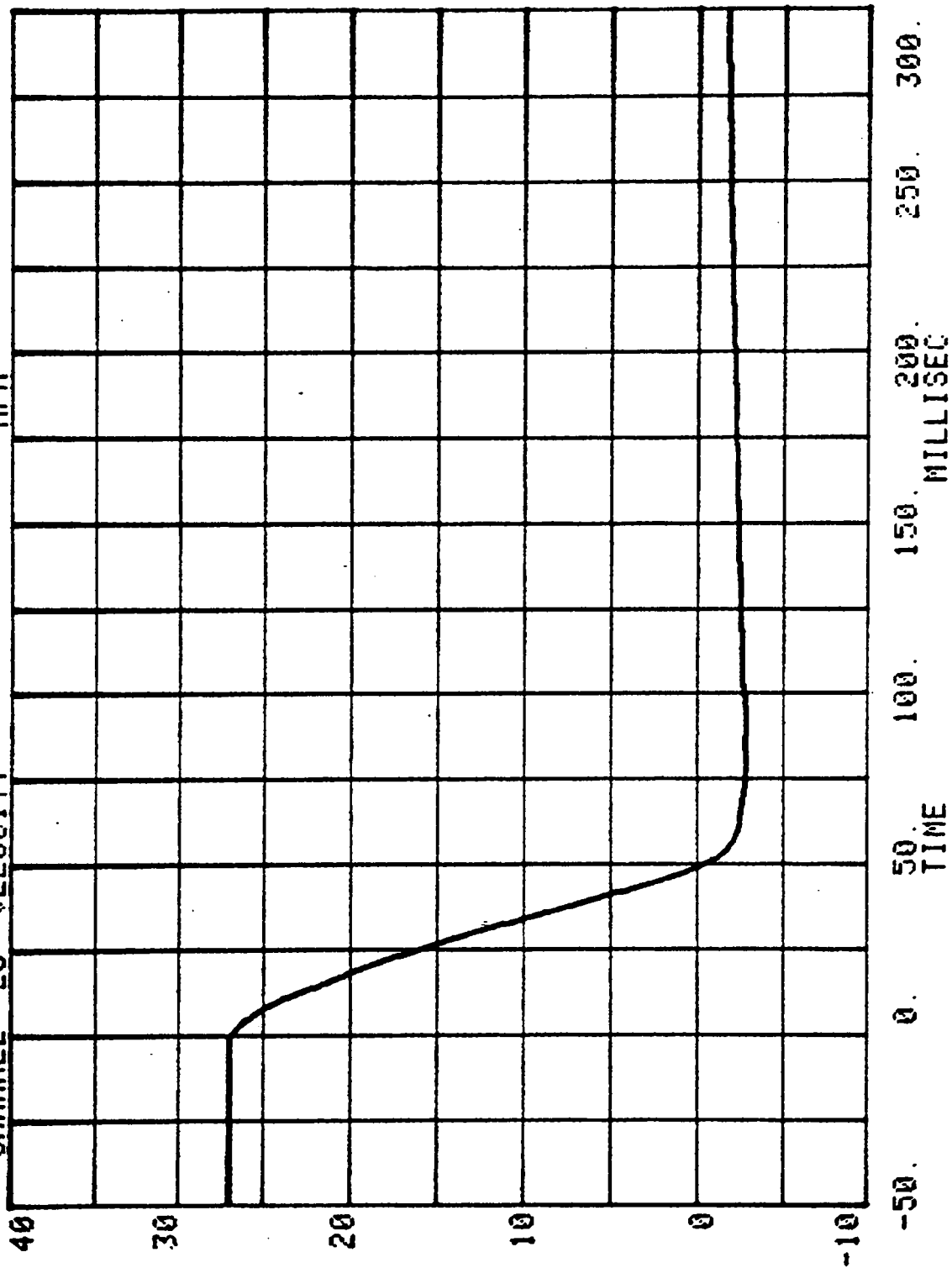


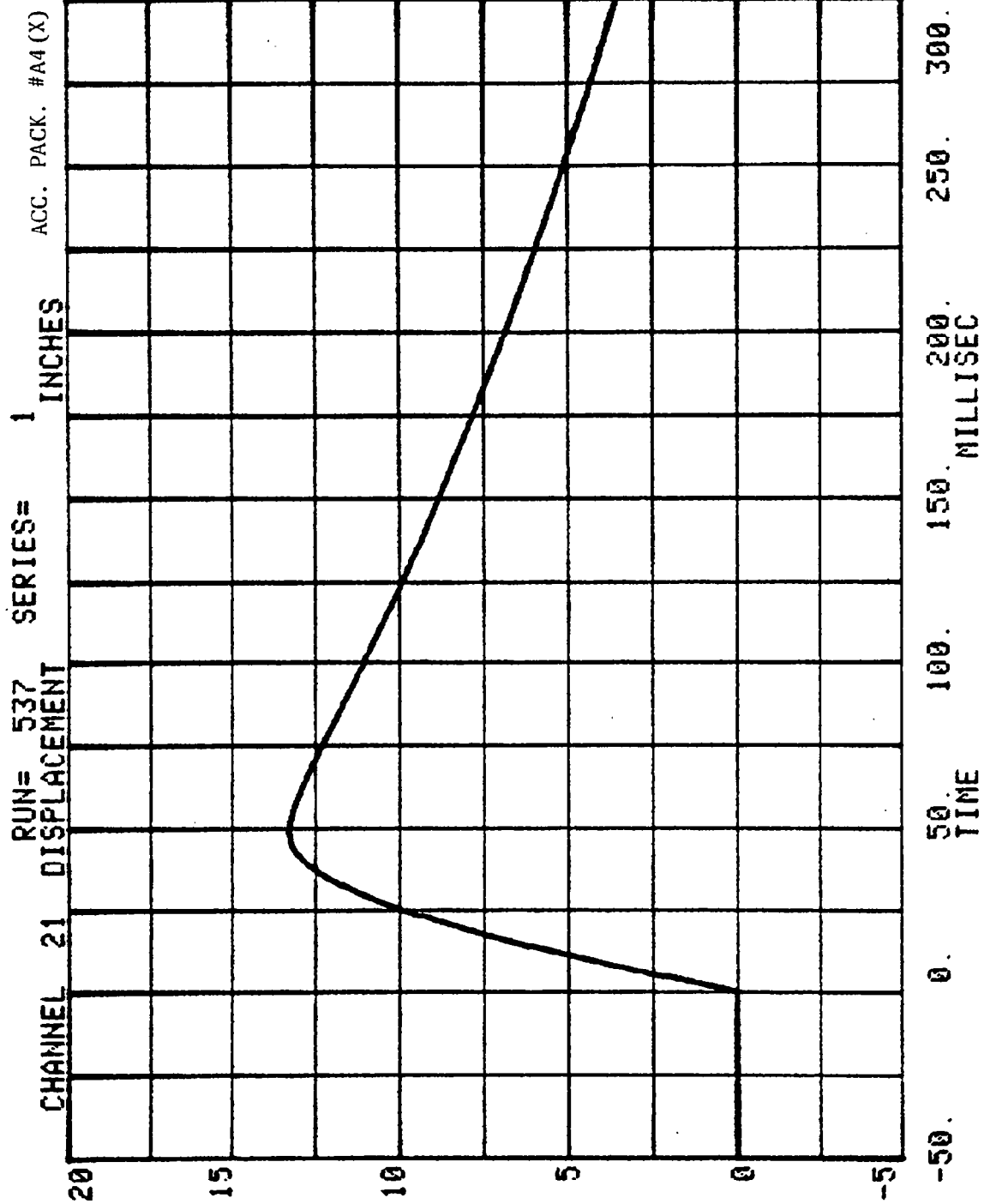


CHANNEL 10 ACC PACK #A4(X) RUN= 537 SERIES= 1 G'S

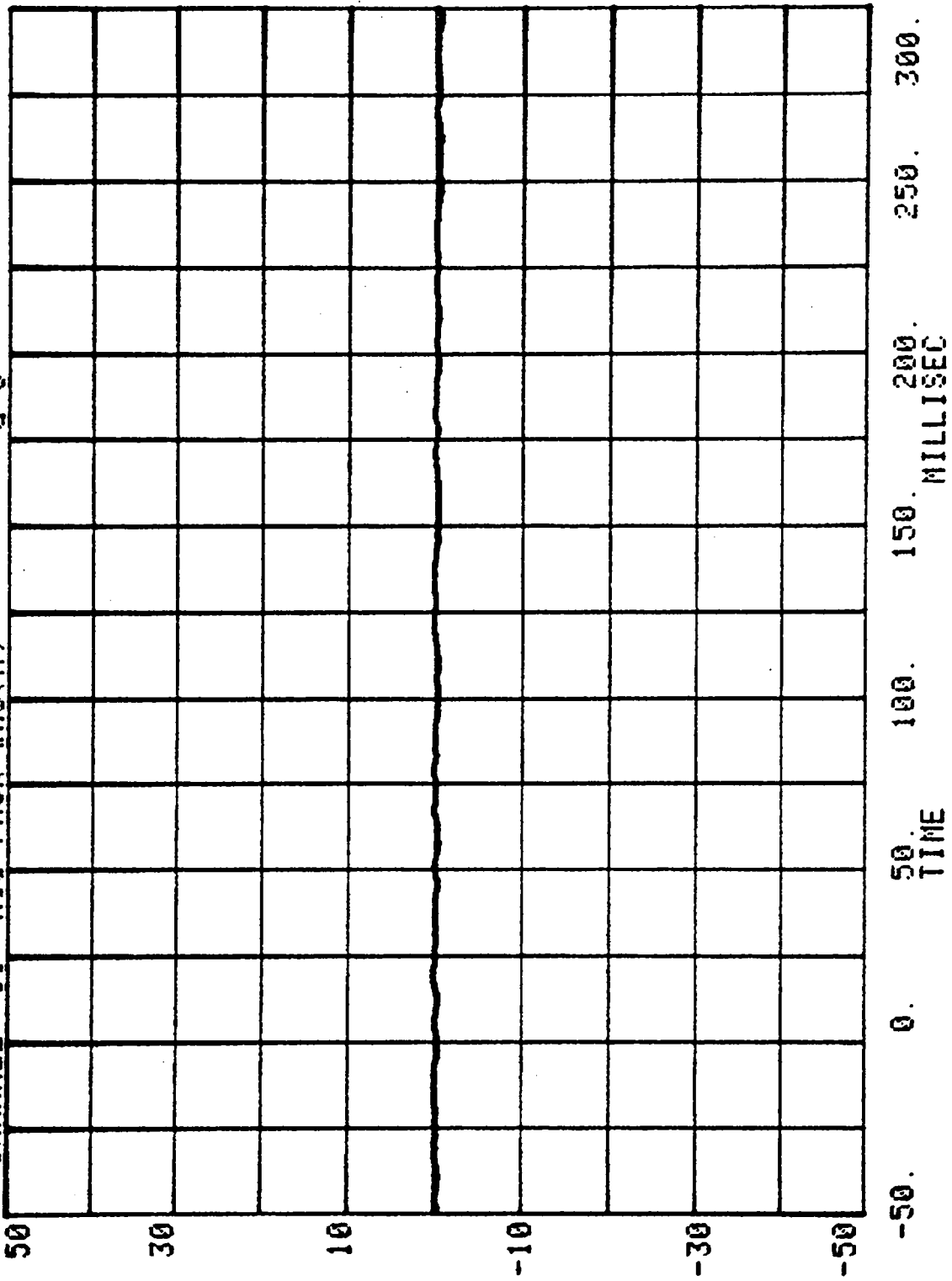


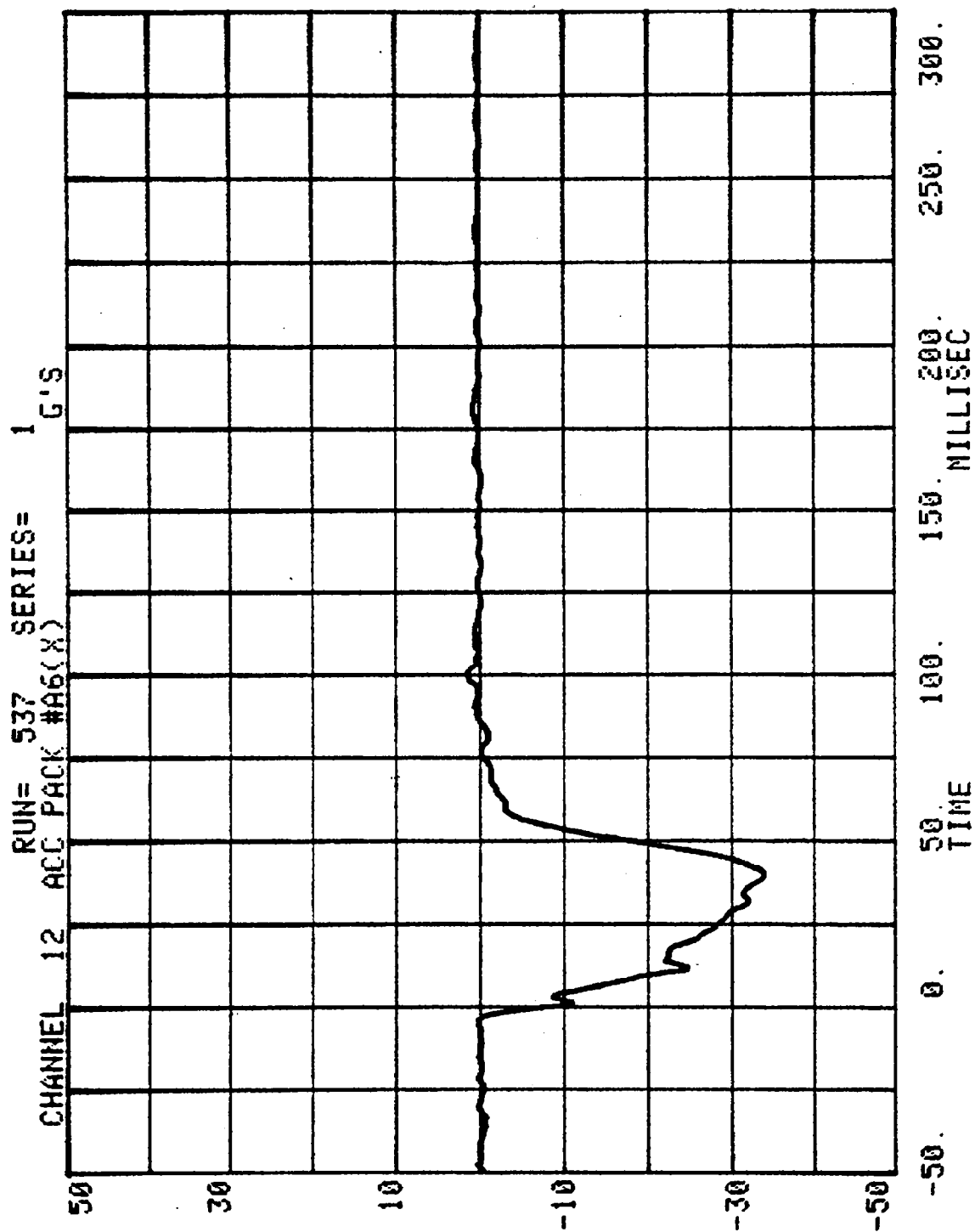
CHANNEL 20 VELOCITY 1 MPH
RUN= 537 SERIES= 1
ACC. PACK. #A4(X)

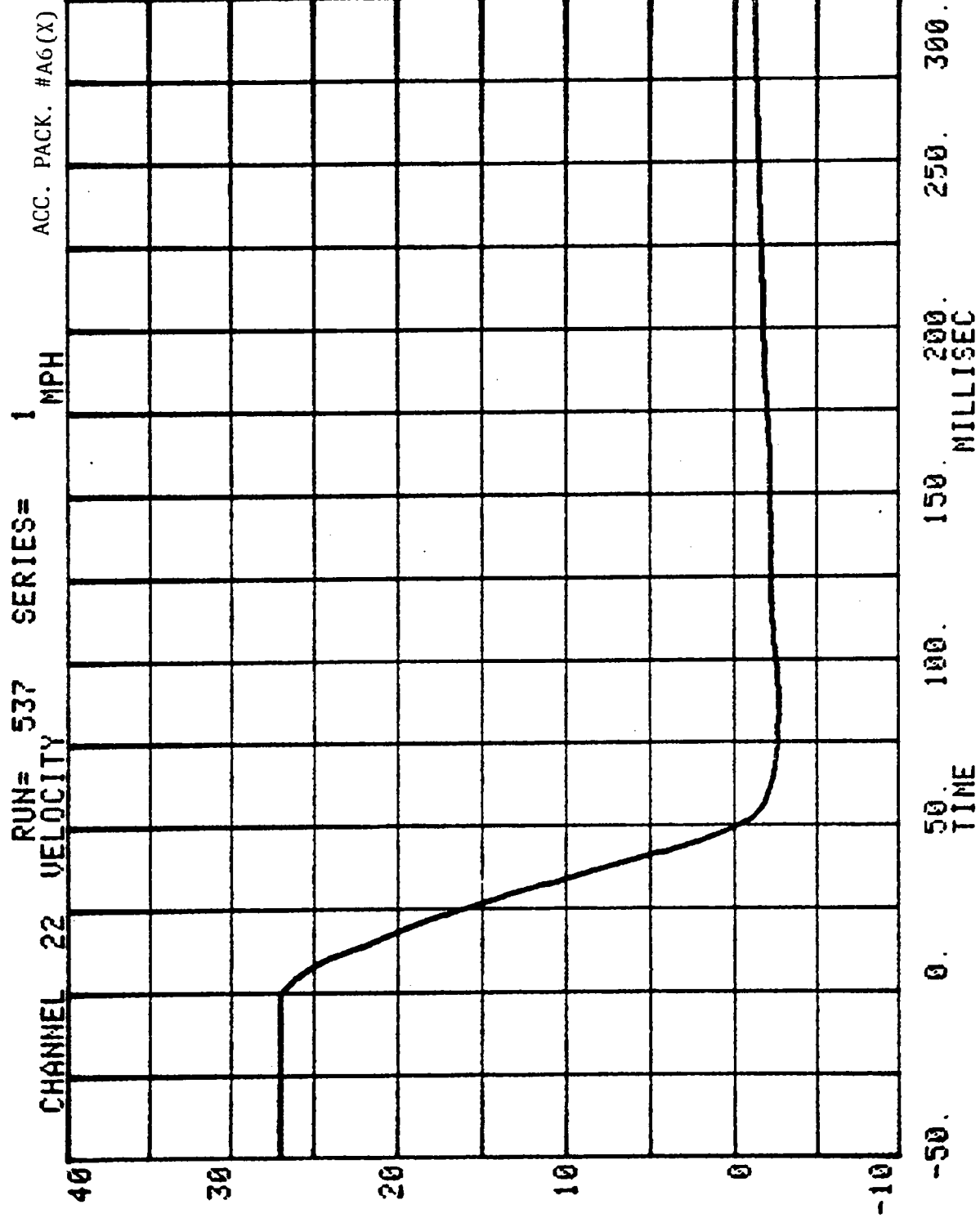


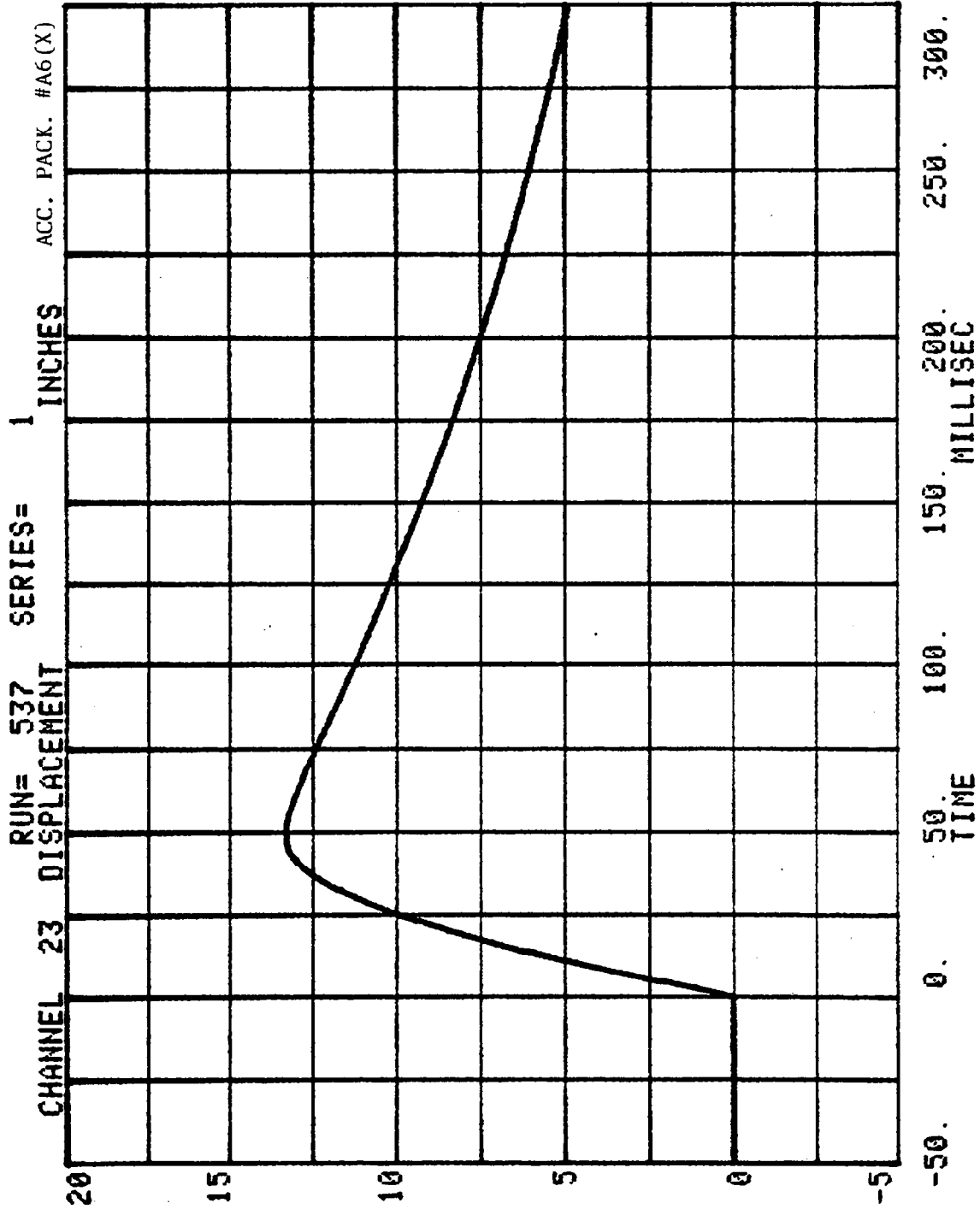


RUN= 537 SERIES= 1
CHANNEL 11 ACC PACK #A5(X) G'S









MOVING BARRIER LOAD CELL DATA

TEST NO. 1

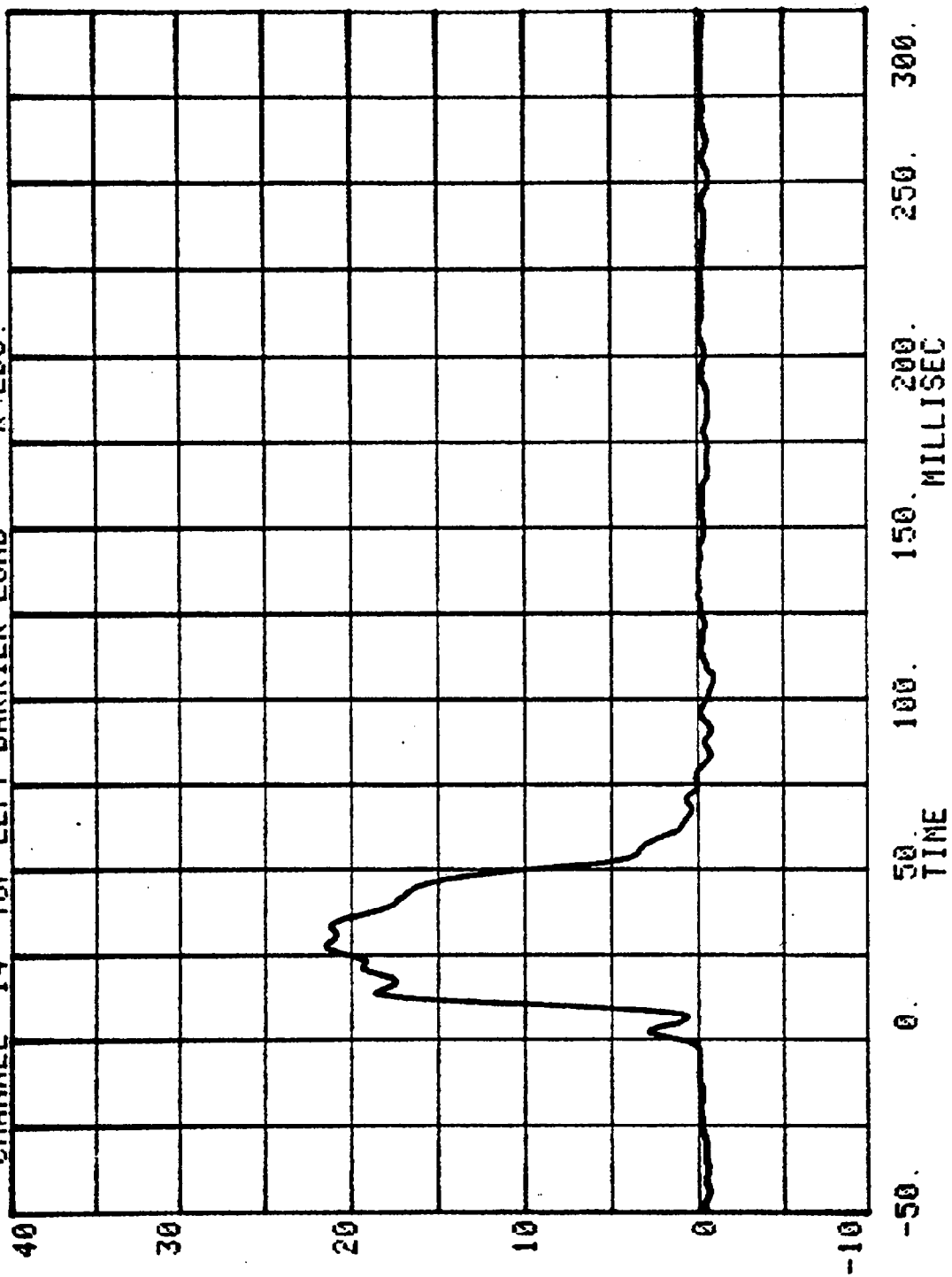
VEHICLE LOAD CELL DATA

FILTER CLASS 60

CHANNEL 14 TOP LEFT BARRIER LOAD

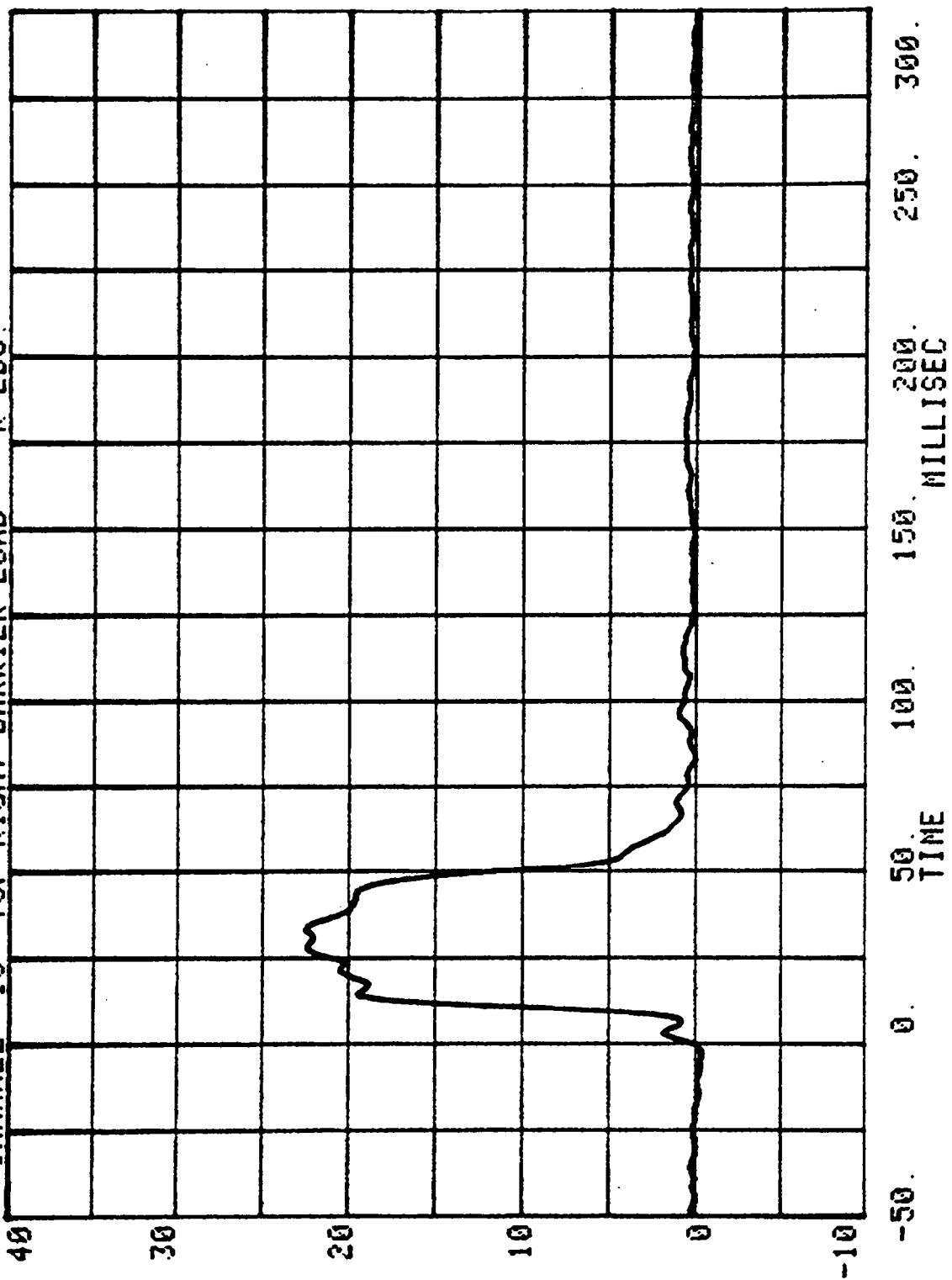
RUN= 537 SERIES= 1

K LBS.



CHANNEL 13 TOP RIGHT BARRIER LOAD 1 K LBS.

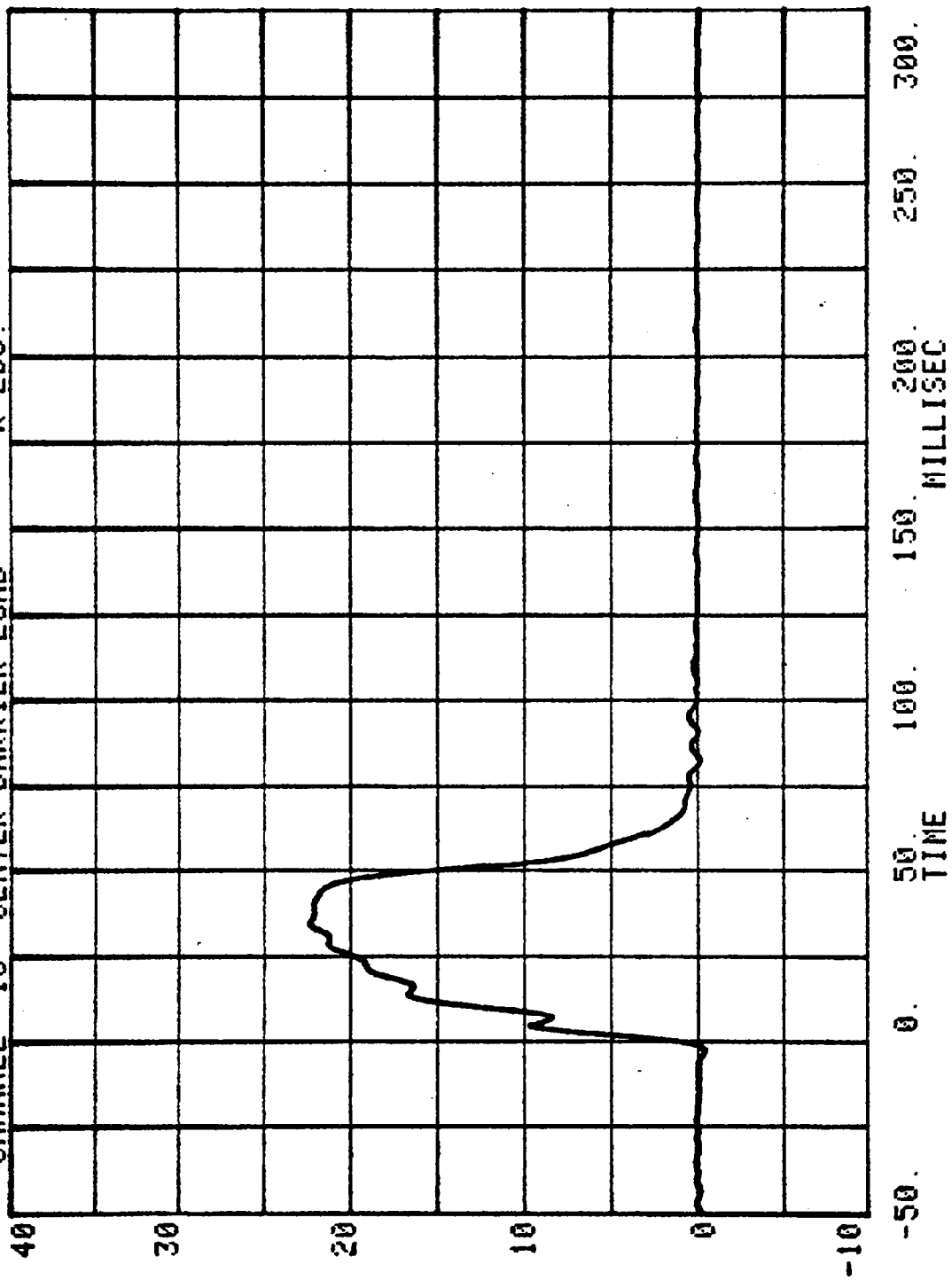
RUN= 537 SERIES=



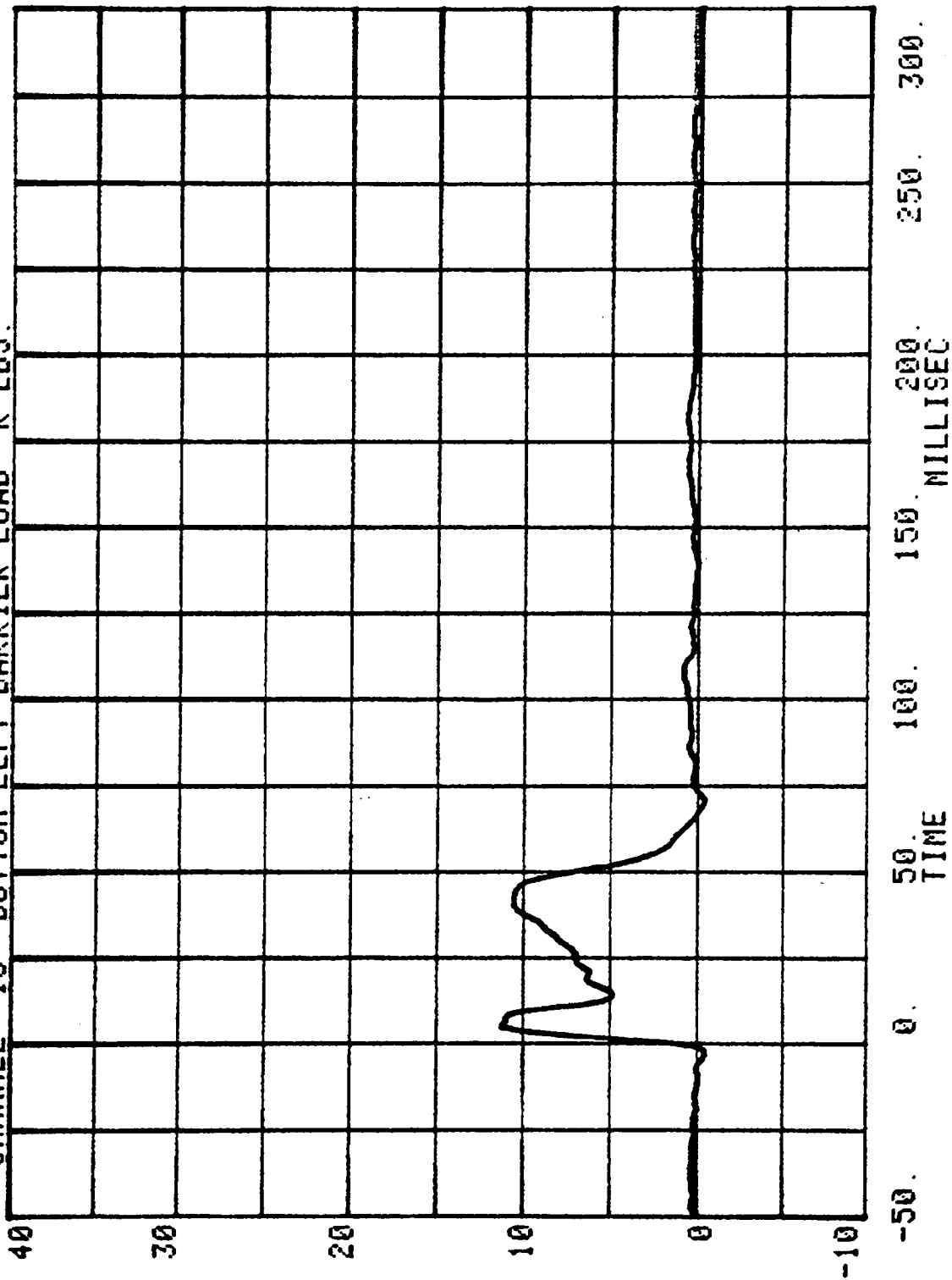
CHANNEL 15 CENTER BARRIER LOAD

RUN= 537 SERIES= 1

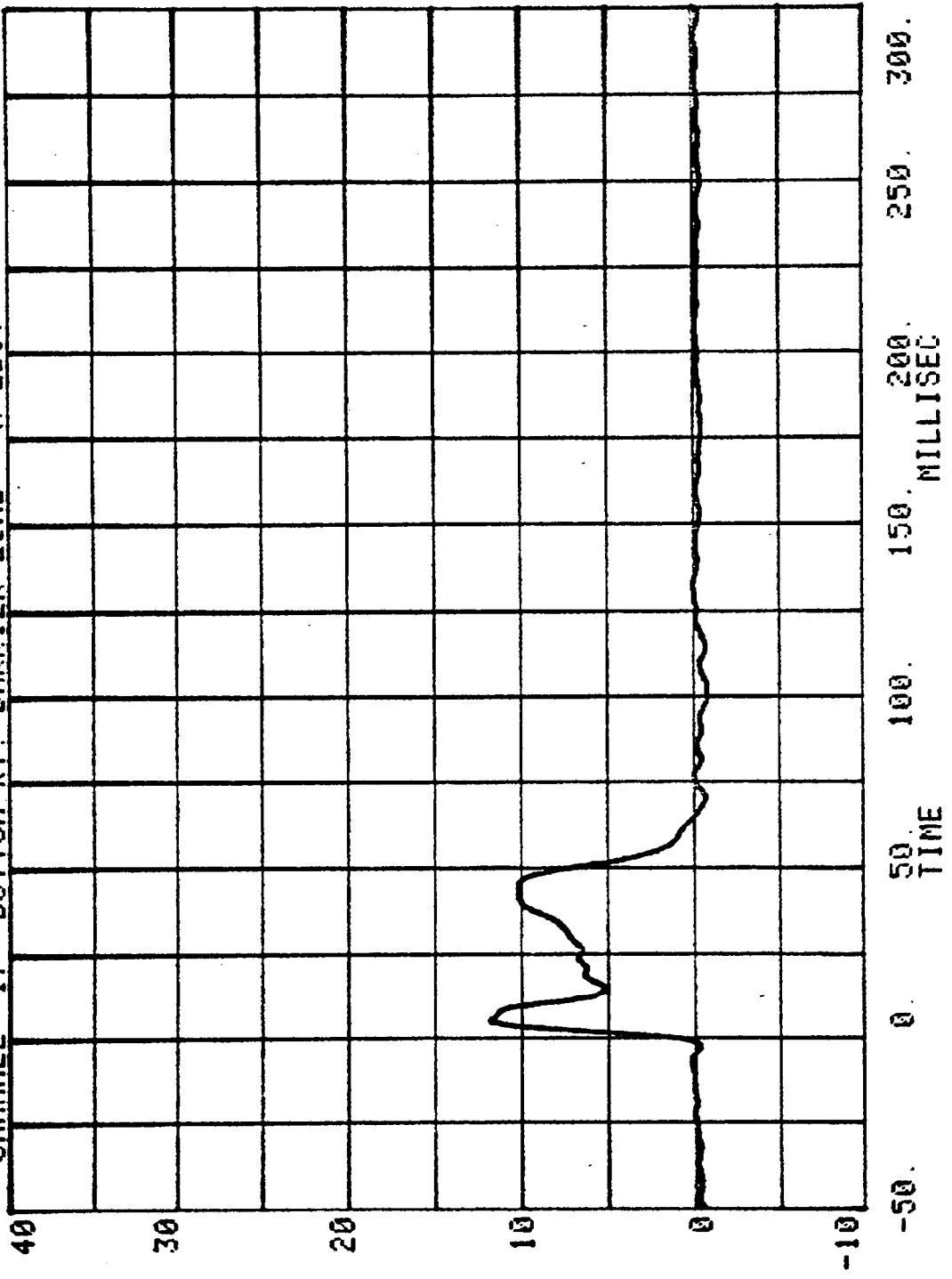
K LBS.

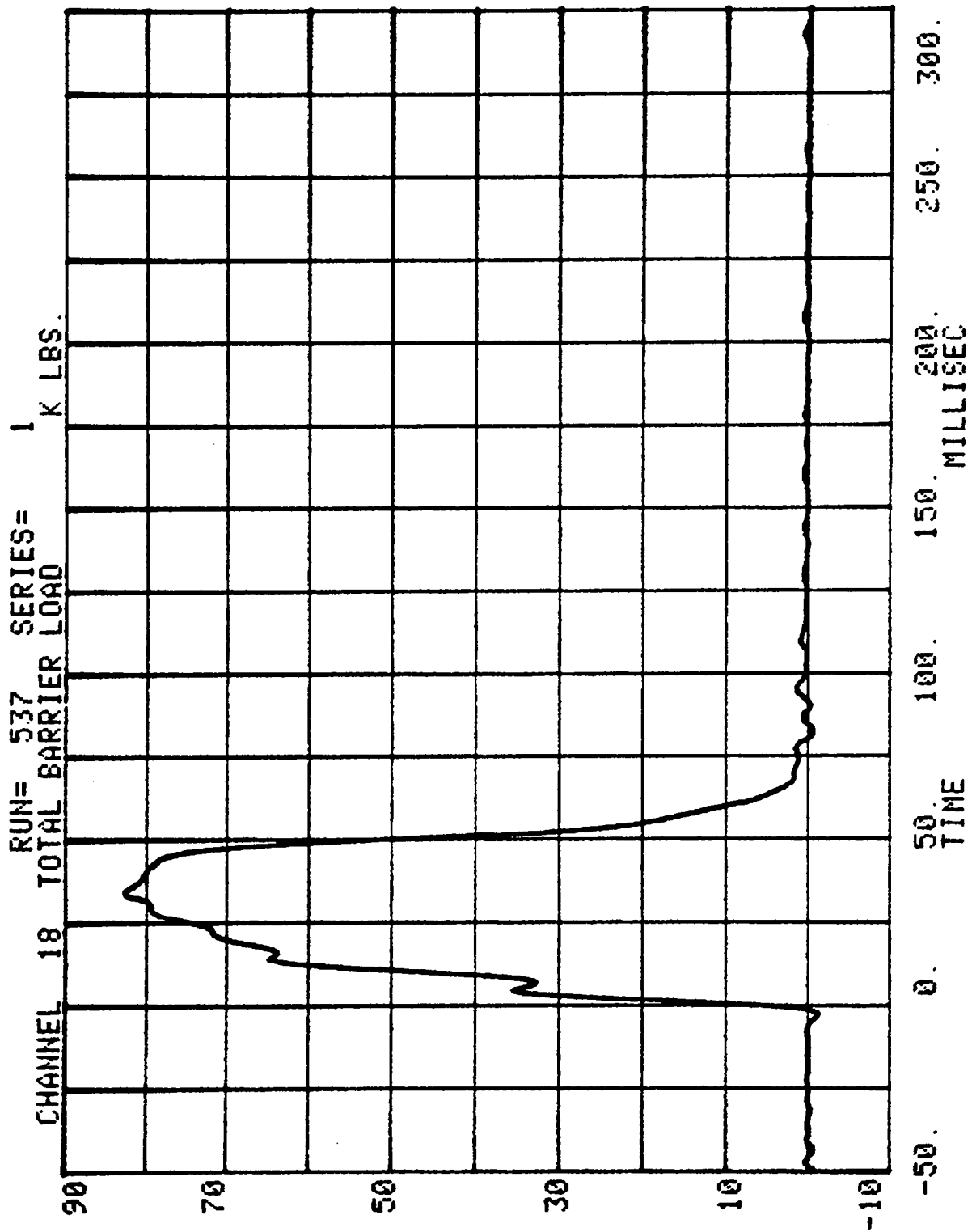


RUN= 537 SERIES= 1
CHANNEL 16 BOTTOM LEFT BARRIER LOAD K LBS.



CHANNEL 17 BOTTOM RT. BARRIER LOAD 1 K LBS.





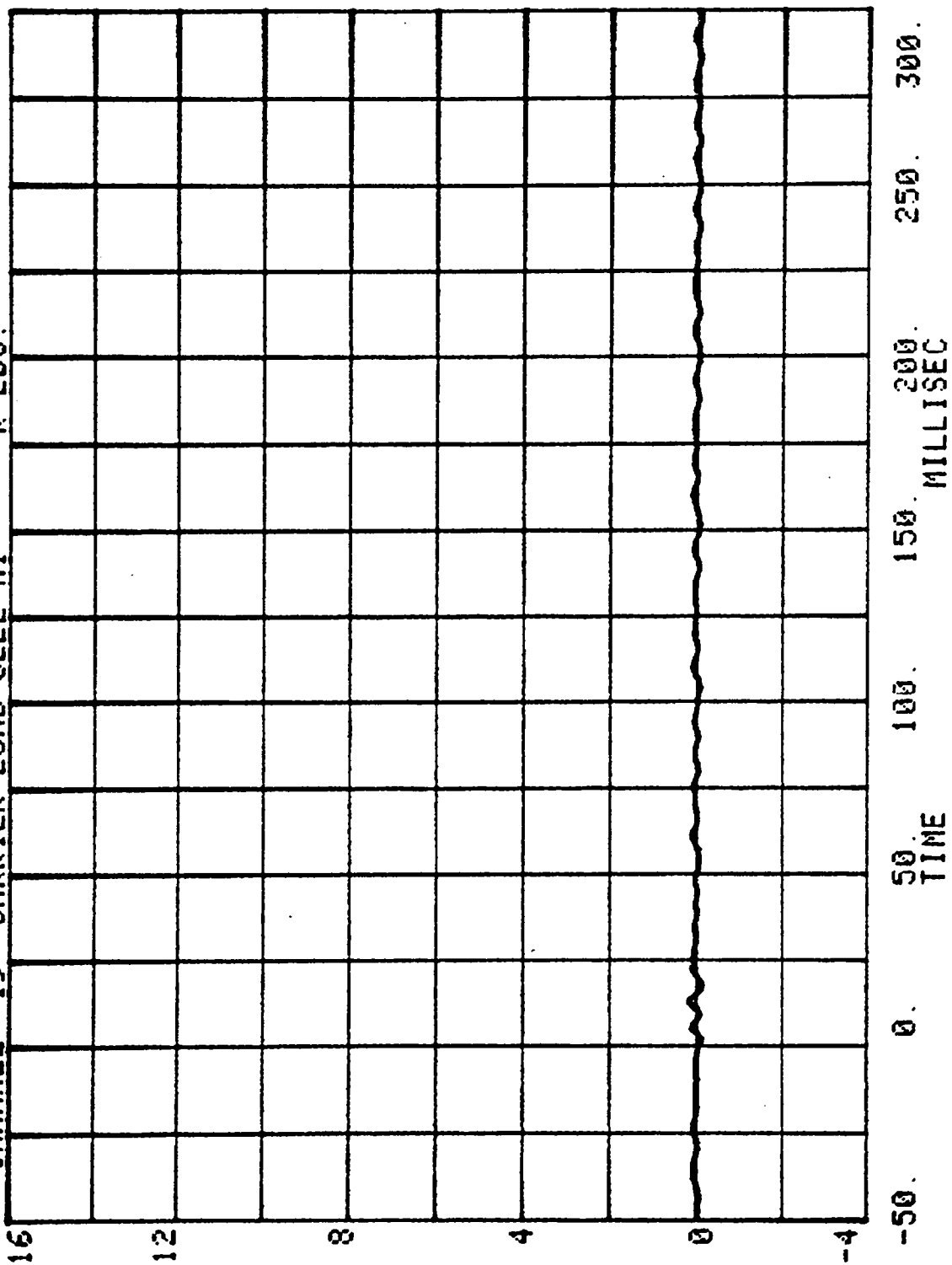
FIXED BARRIER LOAD CELL DATA

TEST NO. 1

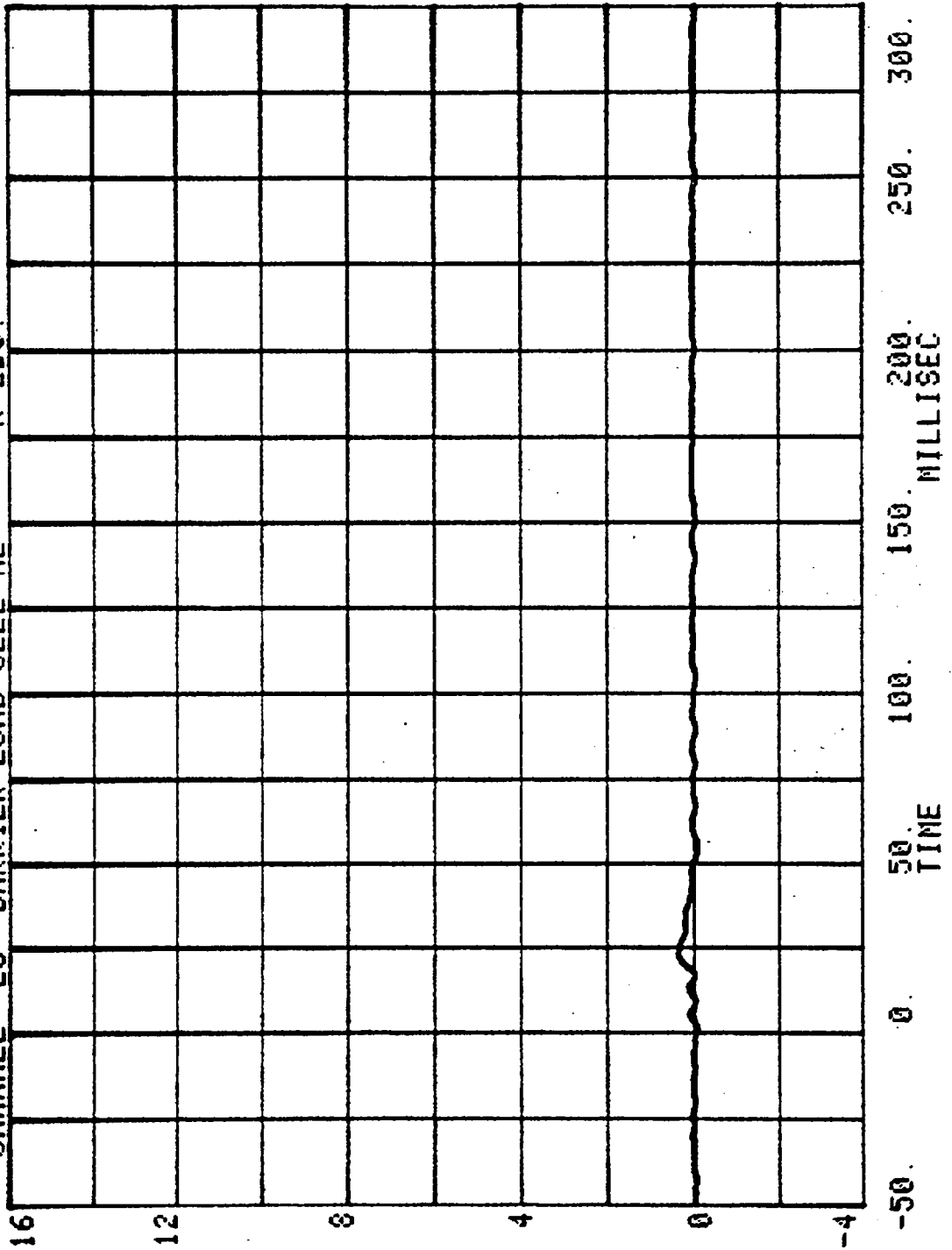
FIXED BARRIER LOAD CELL DATA

FILTER CLASS 60

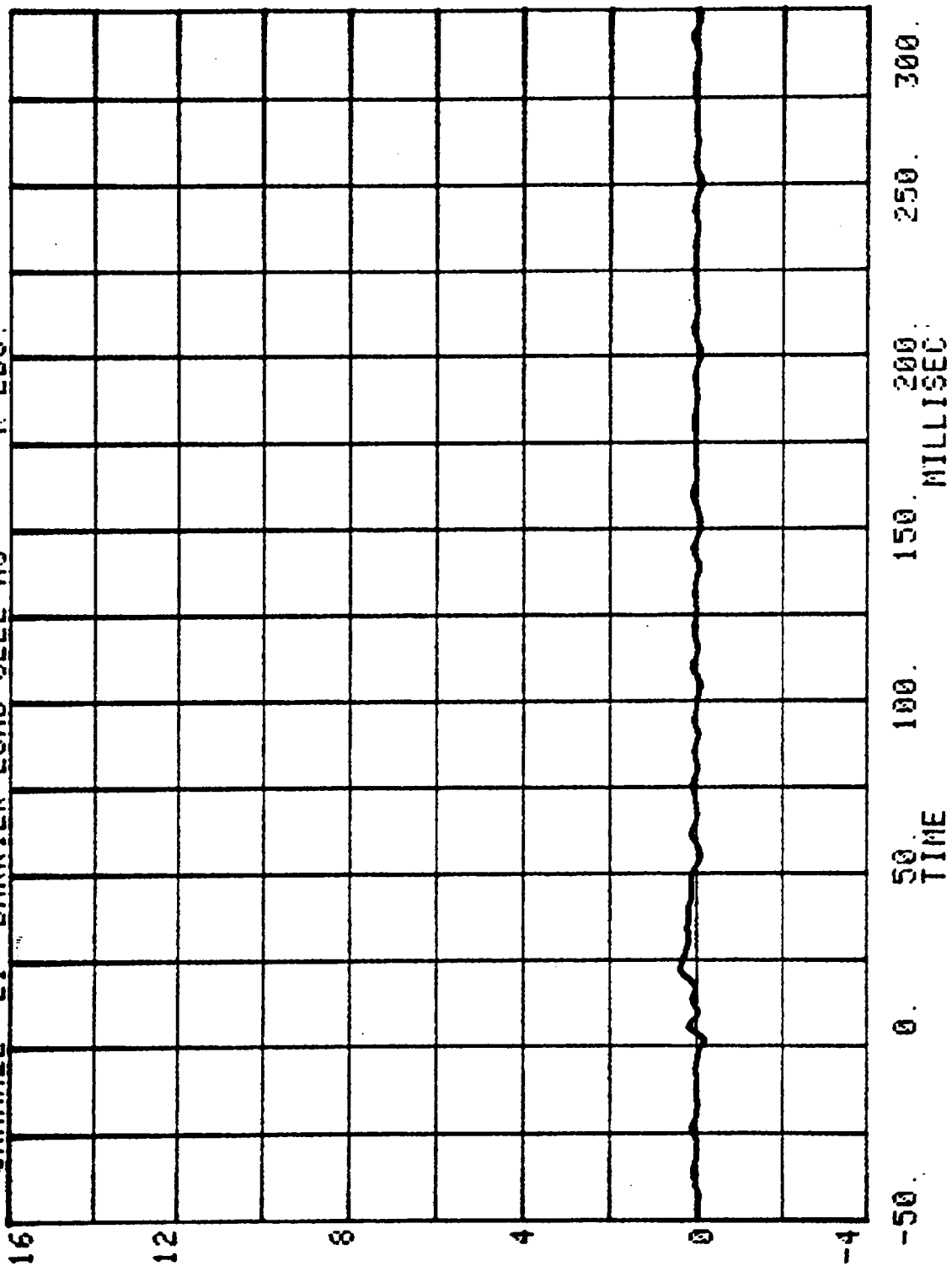
CHANNEL 19 RUN= 537 SERIES= 1 K LBS.
BARRIER LOAD CELL A1



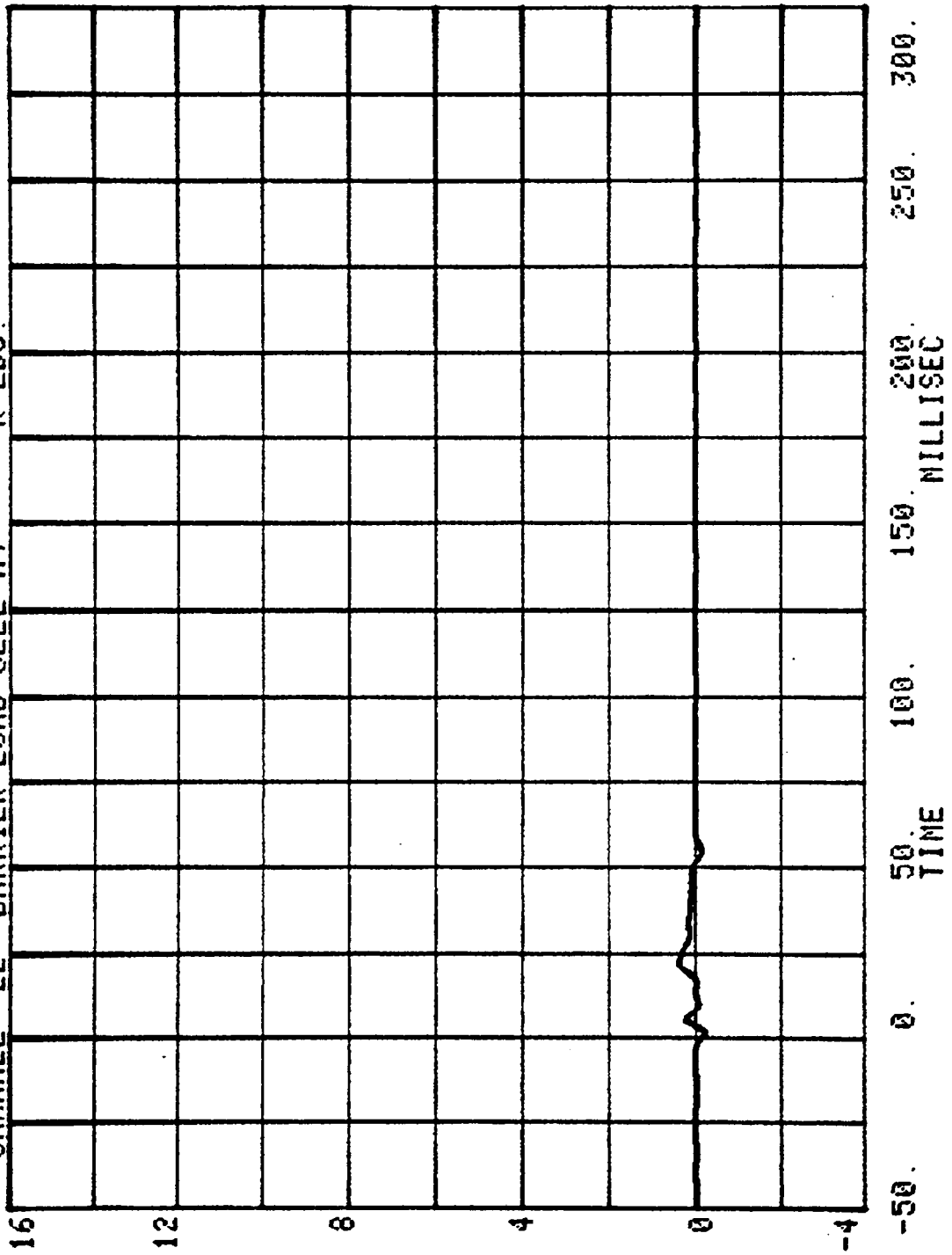
CHANNEL 20 BARRIER LOAD CELL A2 RUN= 537 SERIES= 1 K LBS.



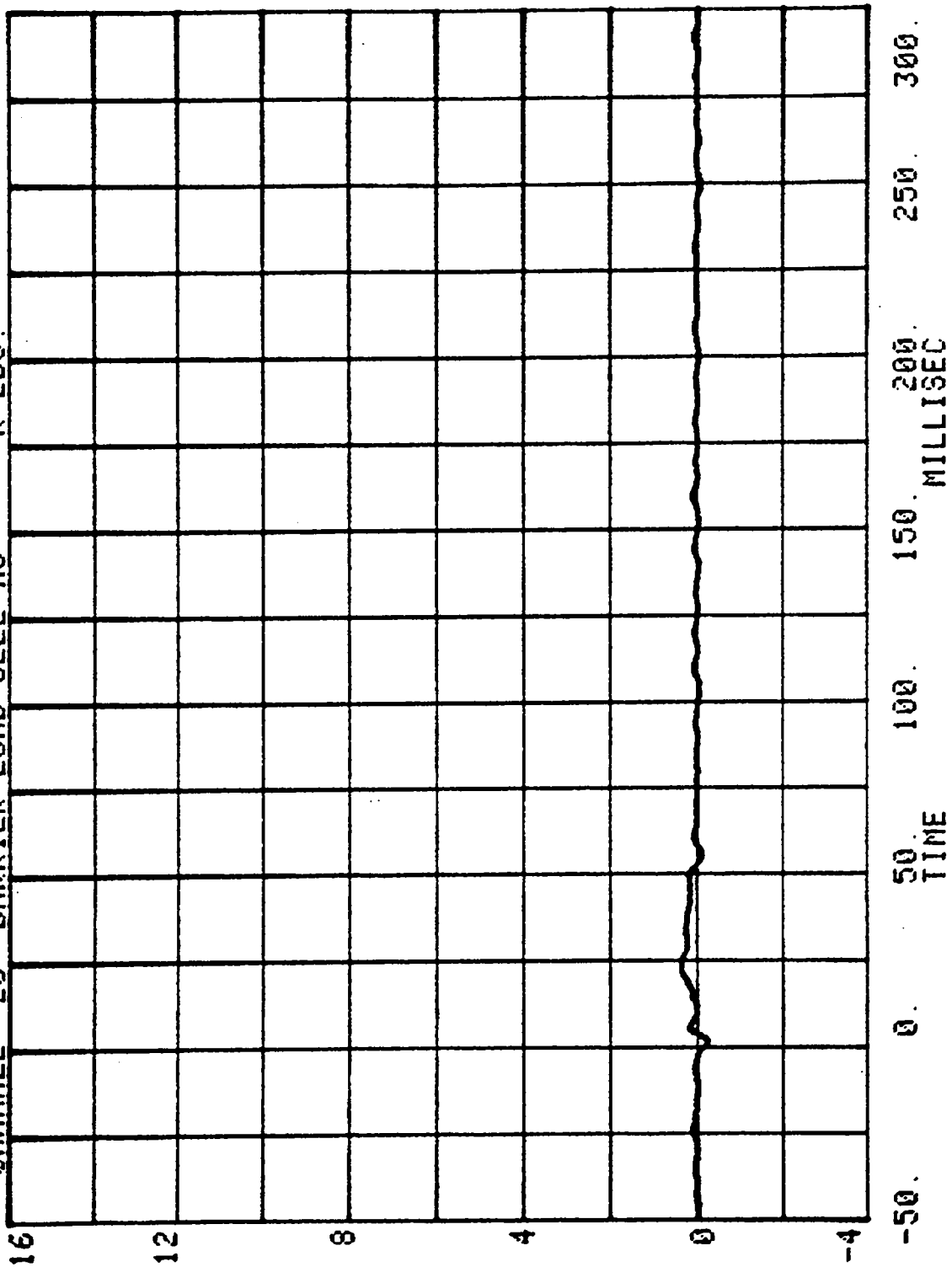
RUN= 537 SERIES= 1
CHANNEL 21 BARRIER LOAD CELL A3 K LBS.



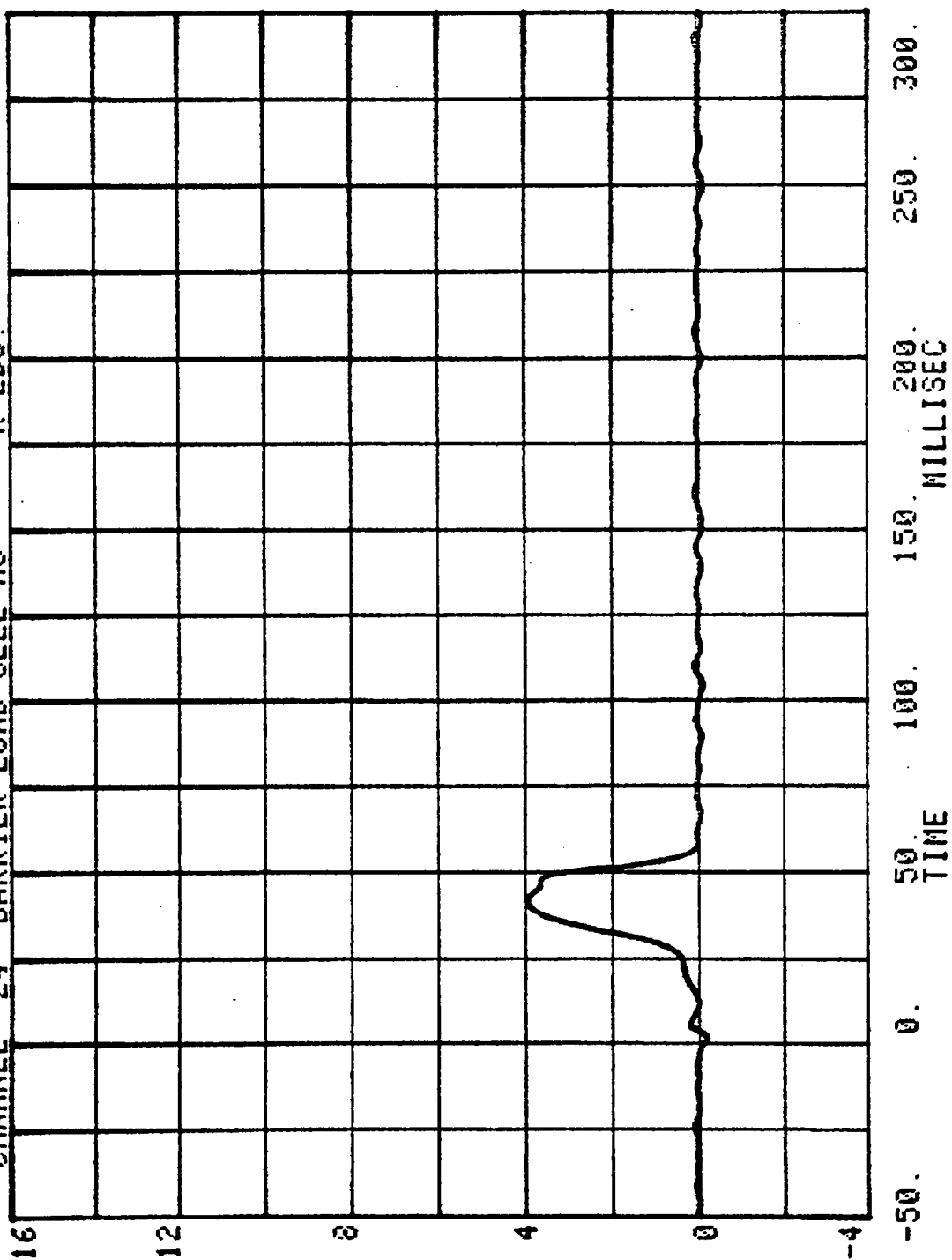
CHANNEL 22 BARRIER LOAD CELL A4 RUN= 537 SERIES= 1 K LBS.



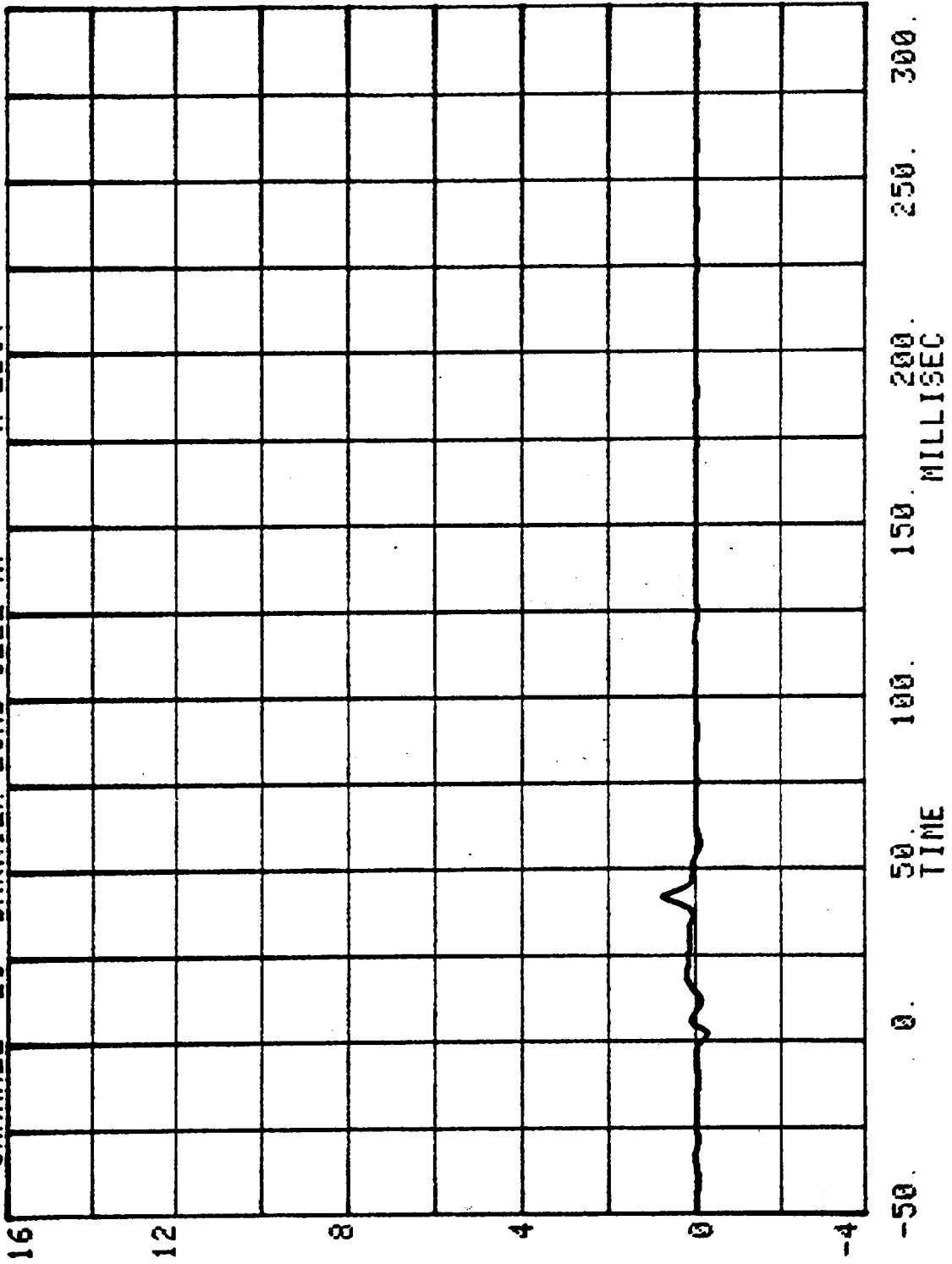
CHANNEL 23 BARRIER LOAD CELL A5 RUN= 537 SERIES= 1 K LBS.



CHANNEL 24 BARRIER LOAD CELL A6 RUN= 537 SERIES= 1 K LBS.



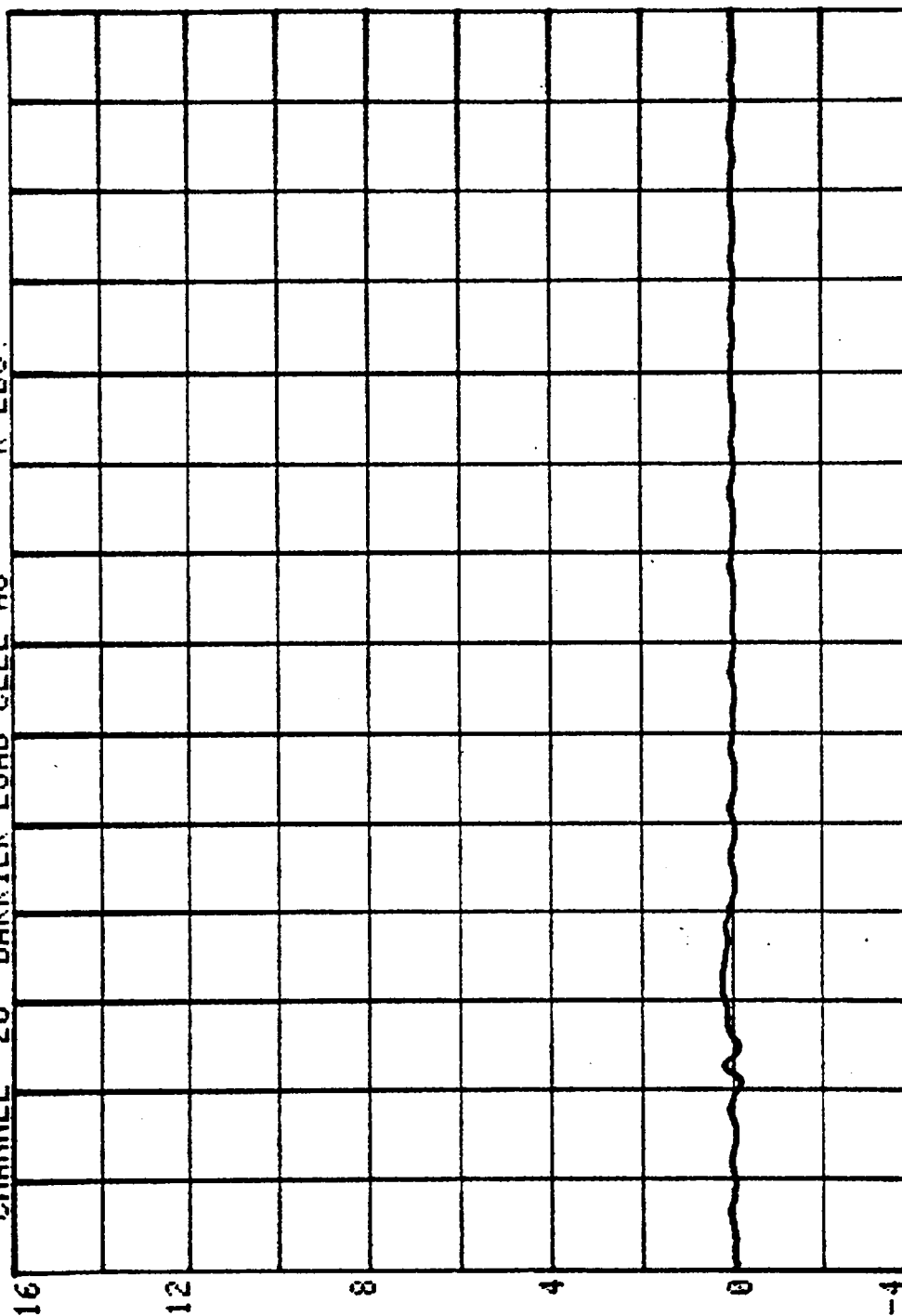
CHANNEL 25 RUN= 537 SERIES= 1 K LBS.
BARRIER LOAD CELL A7



CHANNEL 26 BARRIER LOAD CELL A8

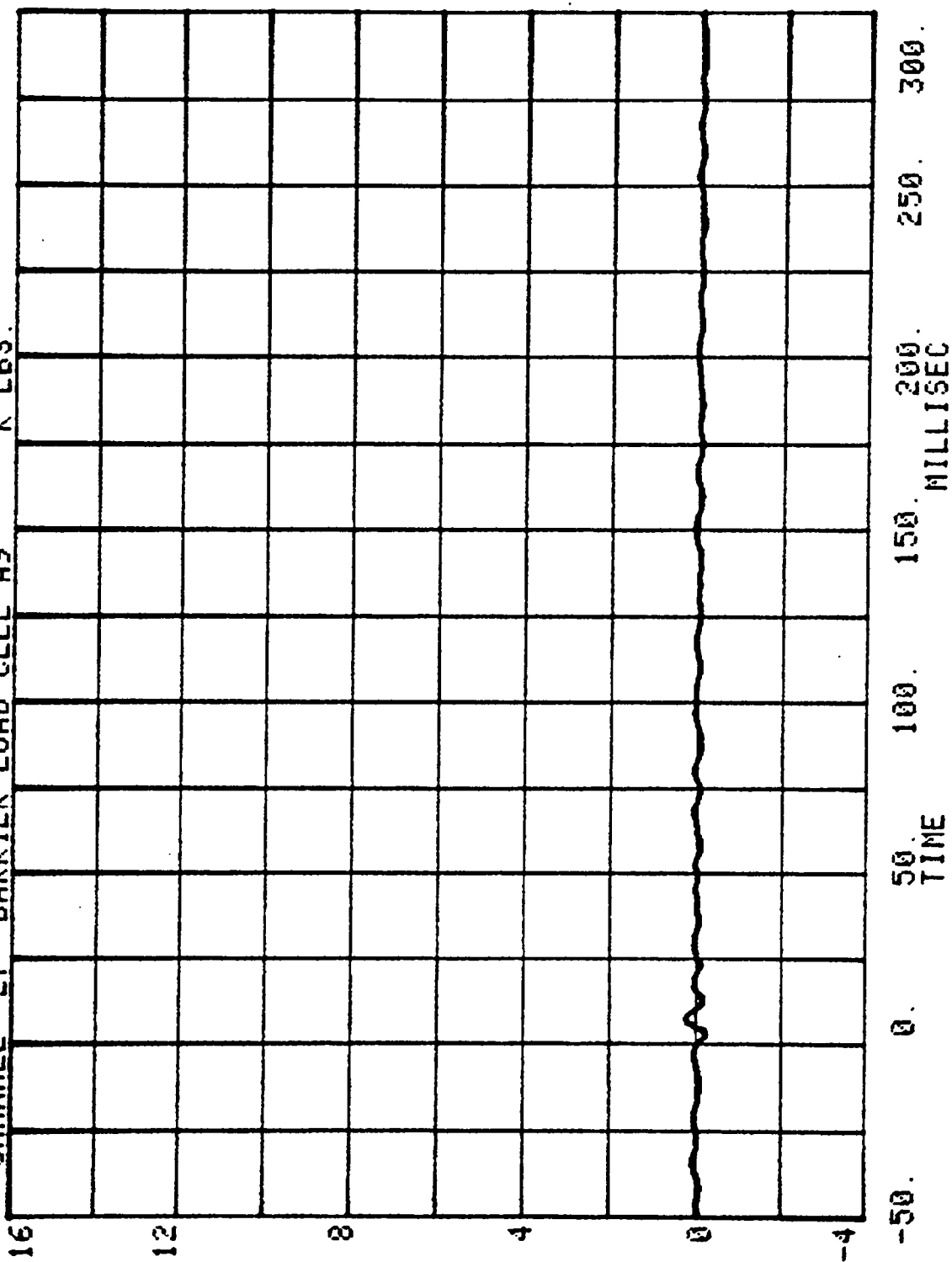
RUN= 537 SERIES= 1

K LBS.



-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

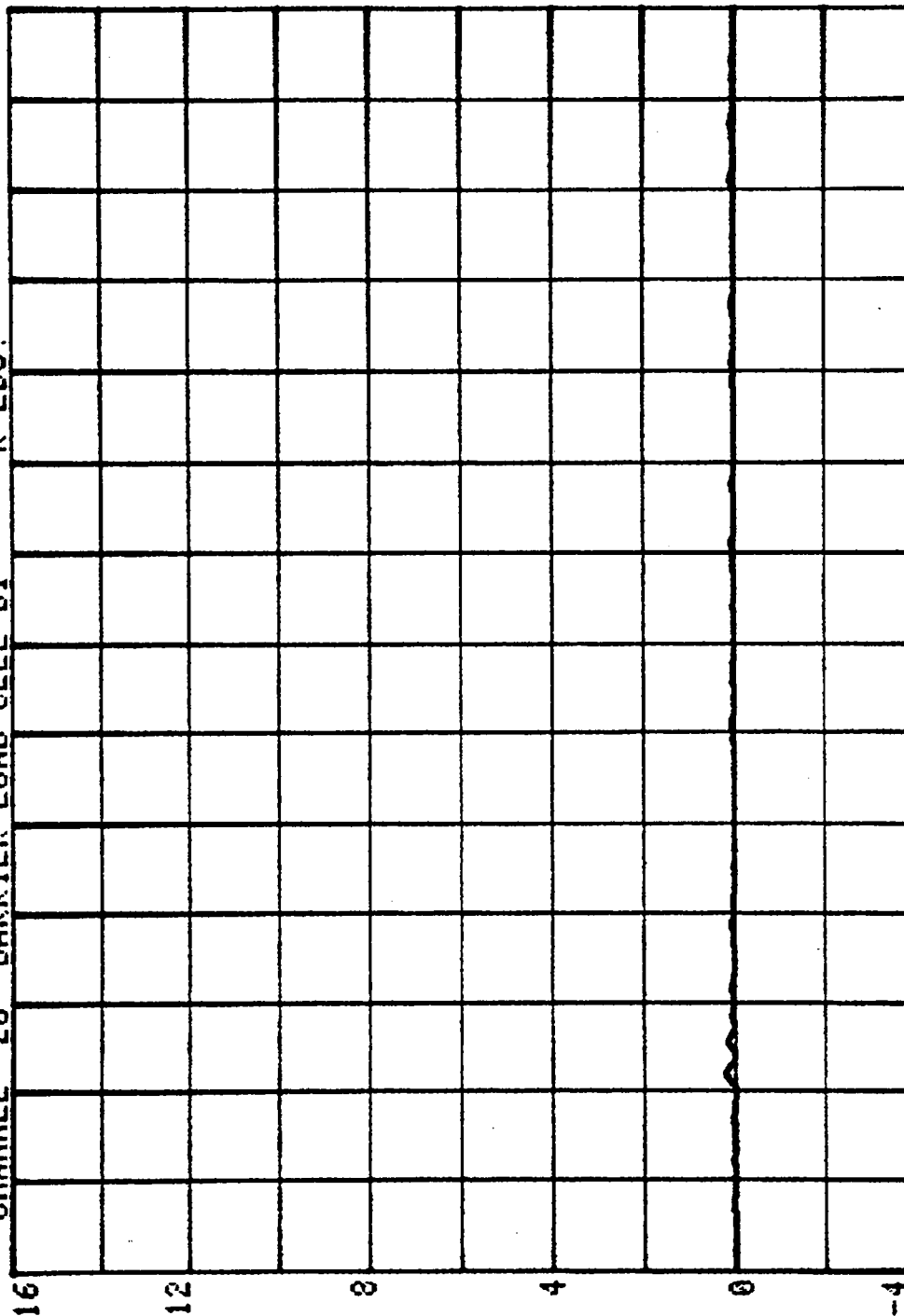
RUN= 537 SERIES= 1
CHANNEL 27 BARRIER LOAD CELL A9 K LBS.



CHANNEL 28 BARRIER LOAD CELL B1

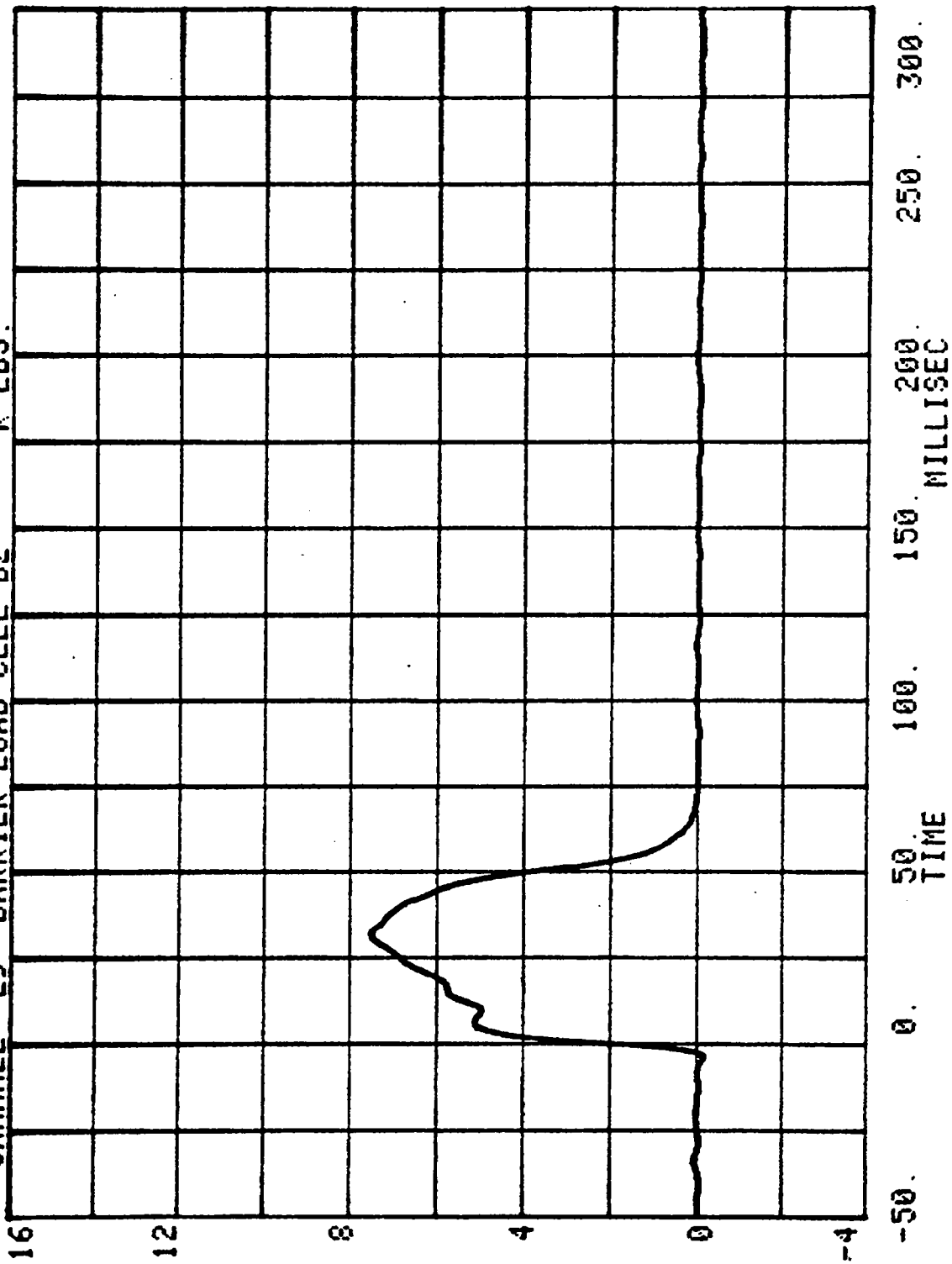
RUN= 537 SERIES= 1

K LBS.

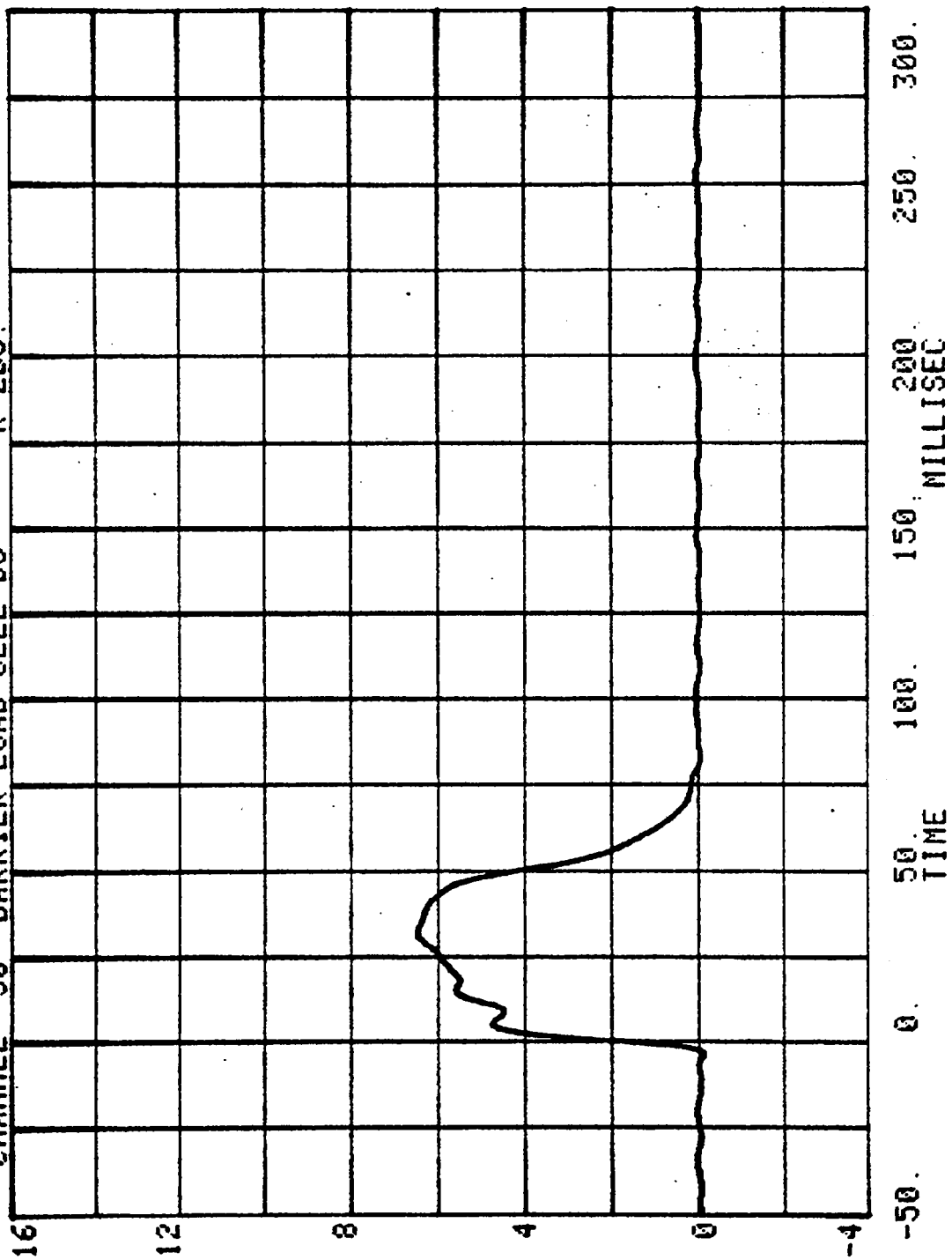


TIME

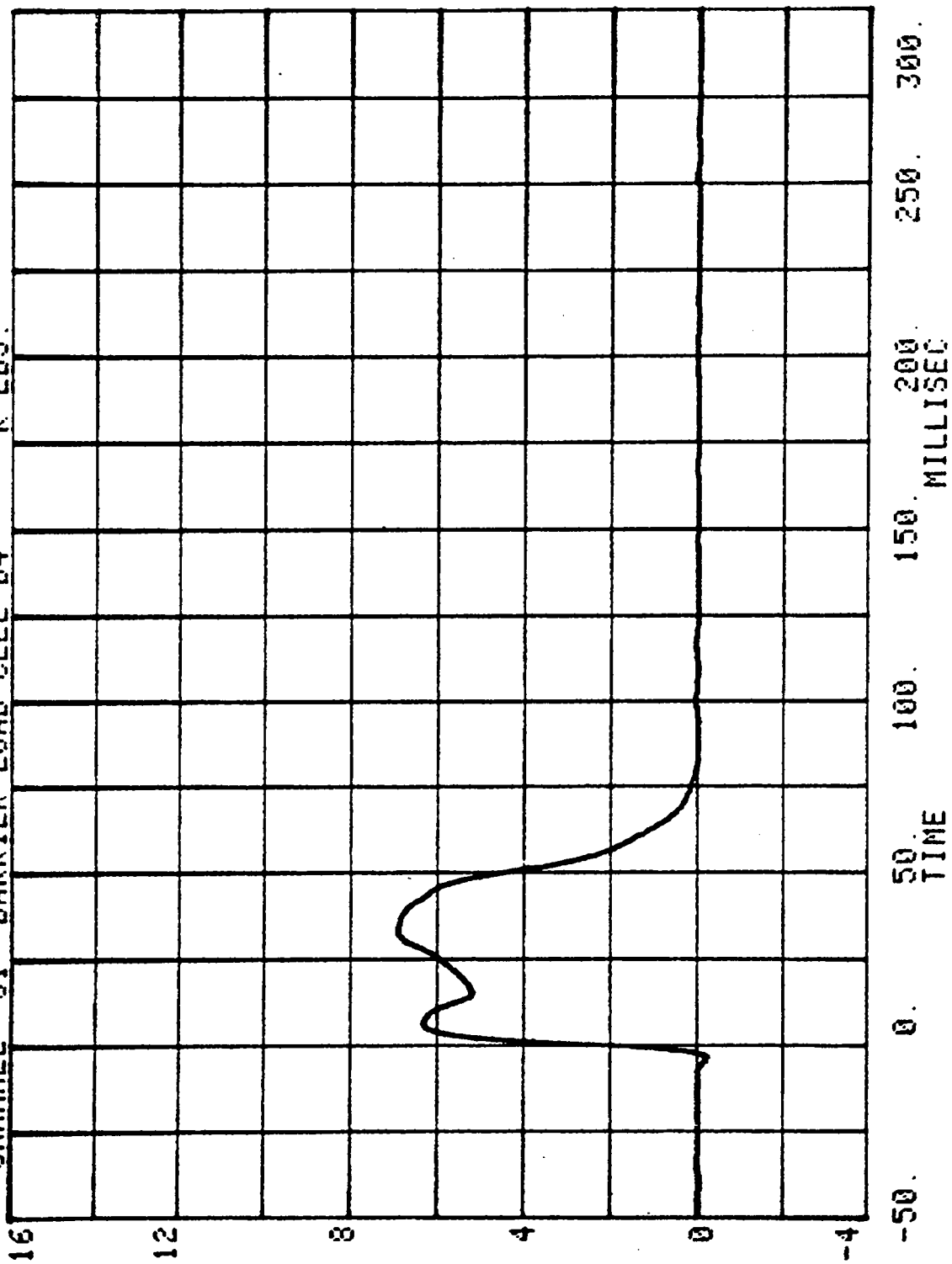
CHANNEL 29 BARRIER LOAD CELL B2
RUN= 537 SERIES= 1
K LBS.



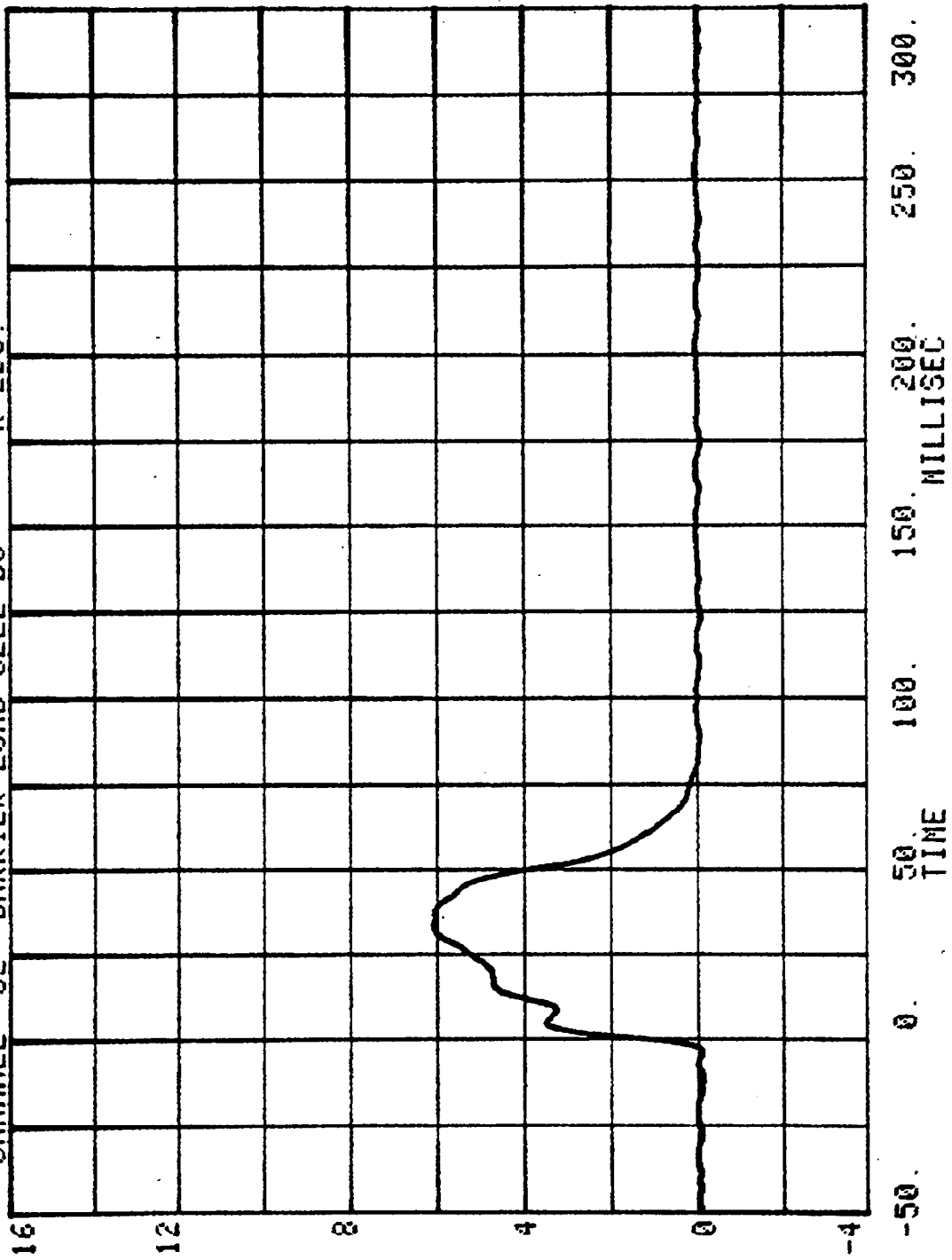
RUN= 537 SERIES= 1
CHANNEL 30 BARRIER LOAD CELL B3 K LBS.



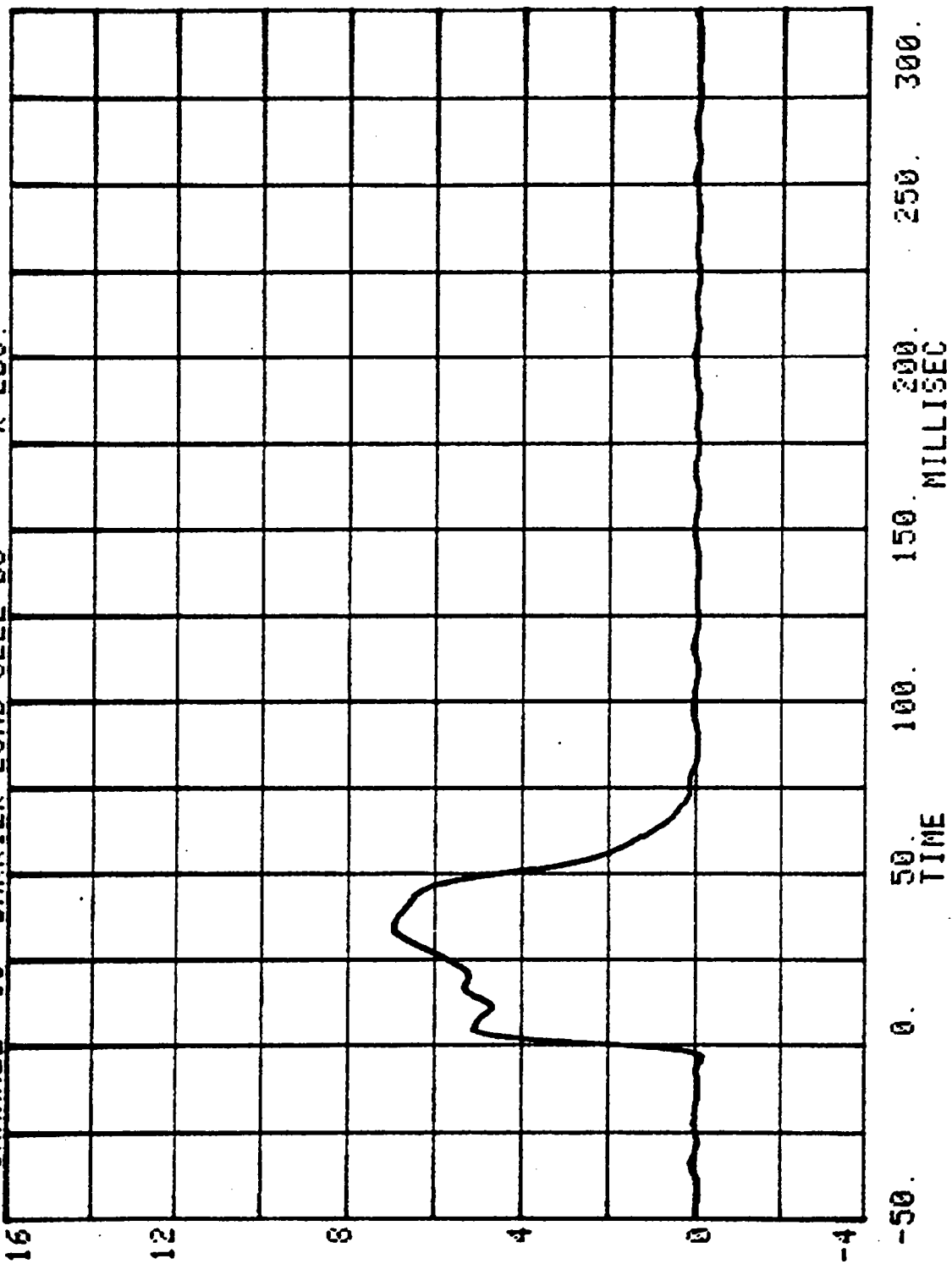
CHANNEL 31 RUN= 537 SERIES= 1 K LBS.
BARRIER LOAD CELL B4



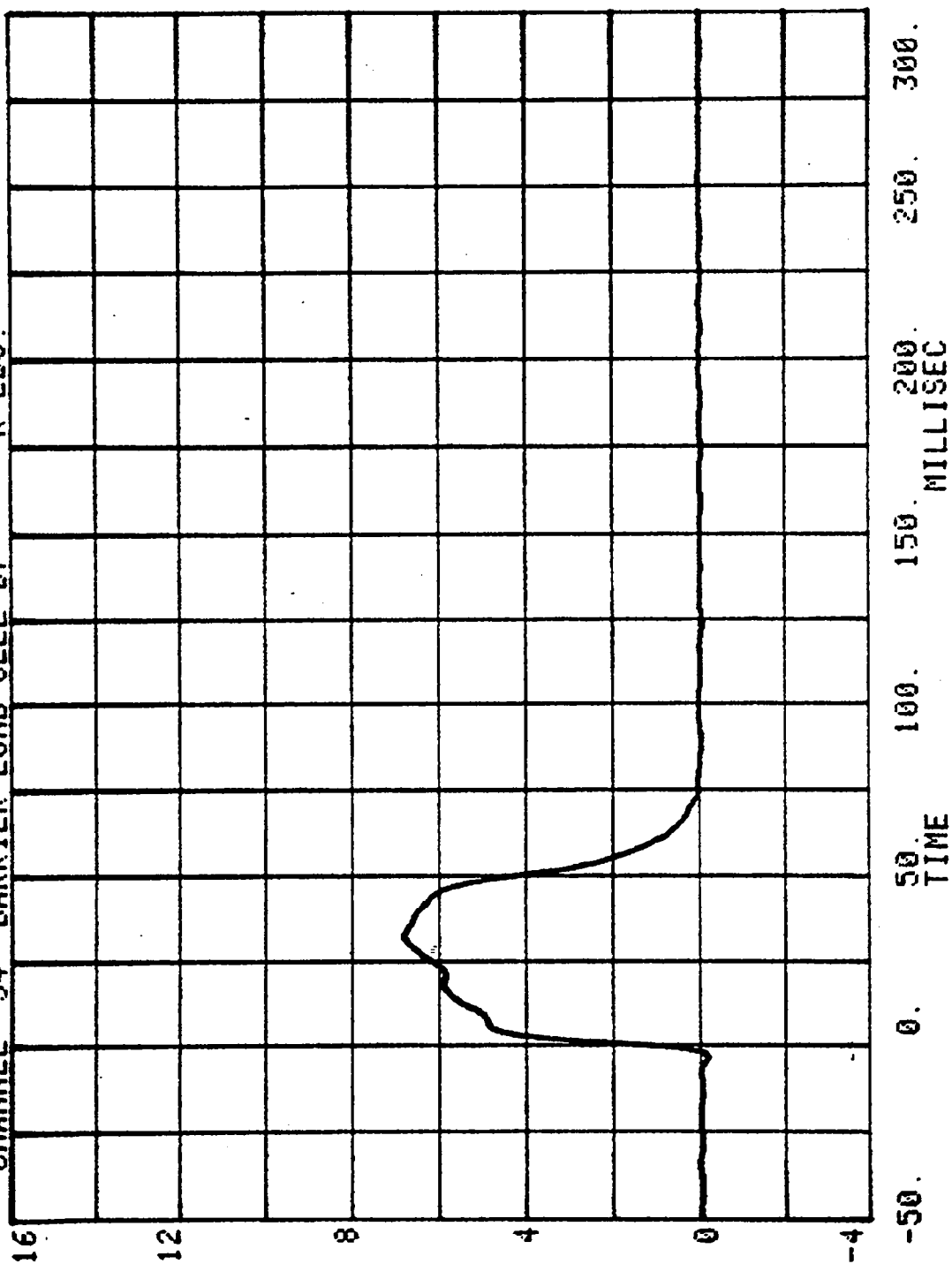
CHANNEL 32 BARRIER LOAD CELL B5
RUN= 537 SERIES= 1 K LBS.



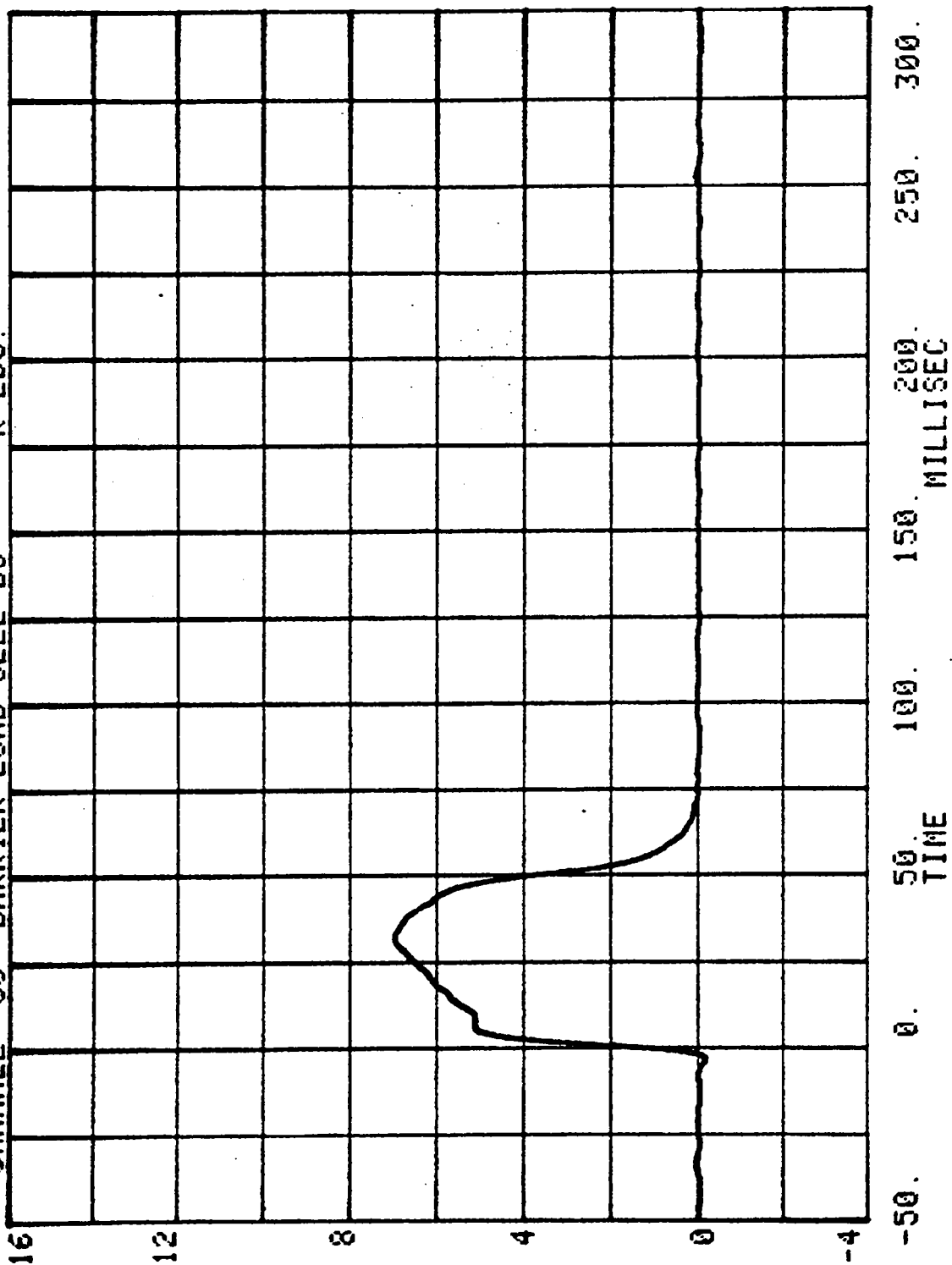
CHANNEL 33 BARRIER LOAD CELL B6
RUN= 537 SERIES= 1 K LBS.



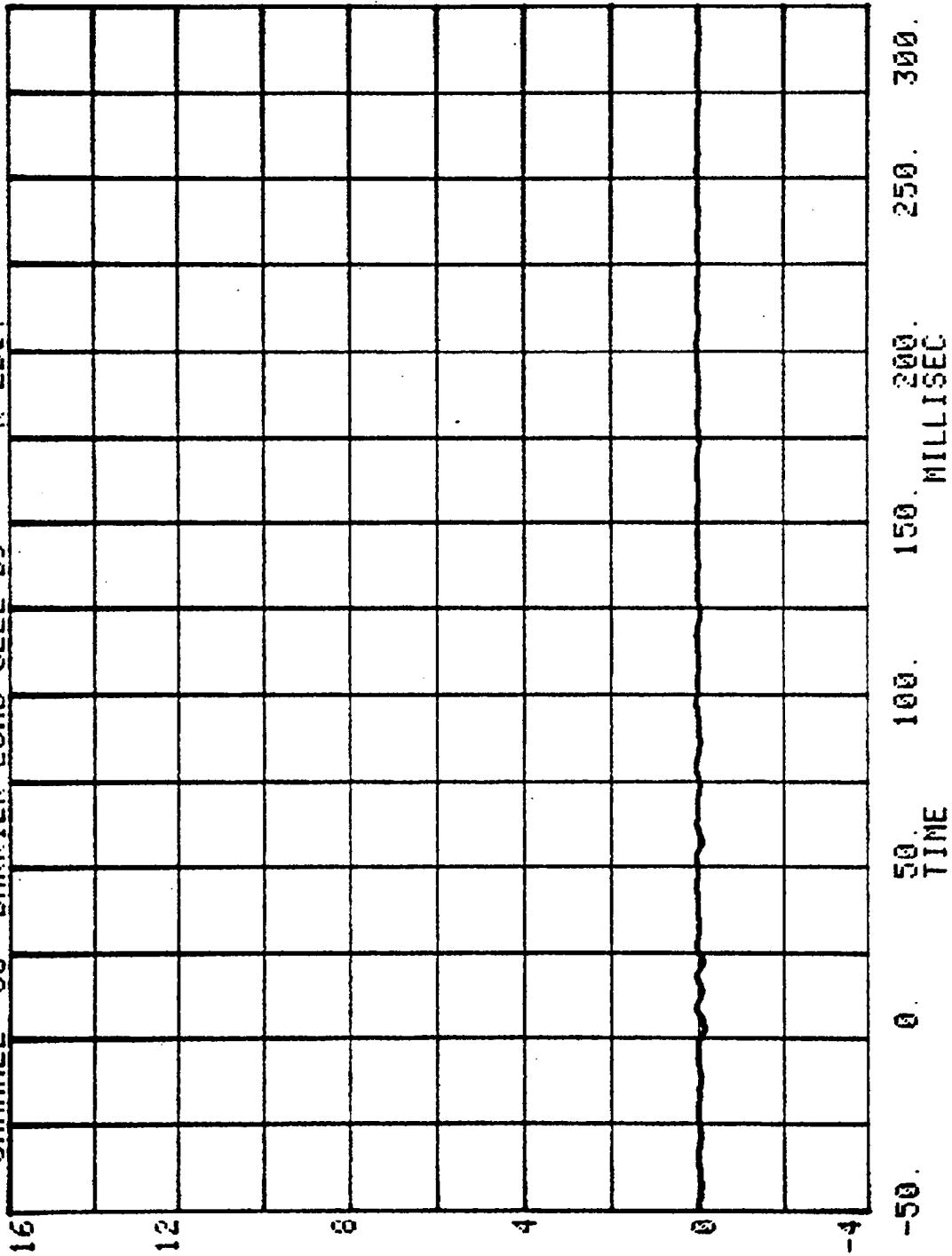
CHANNEL 34 BARRIER LOAD CELL B7 RUN= 537 SERIES= 1 K LBS.



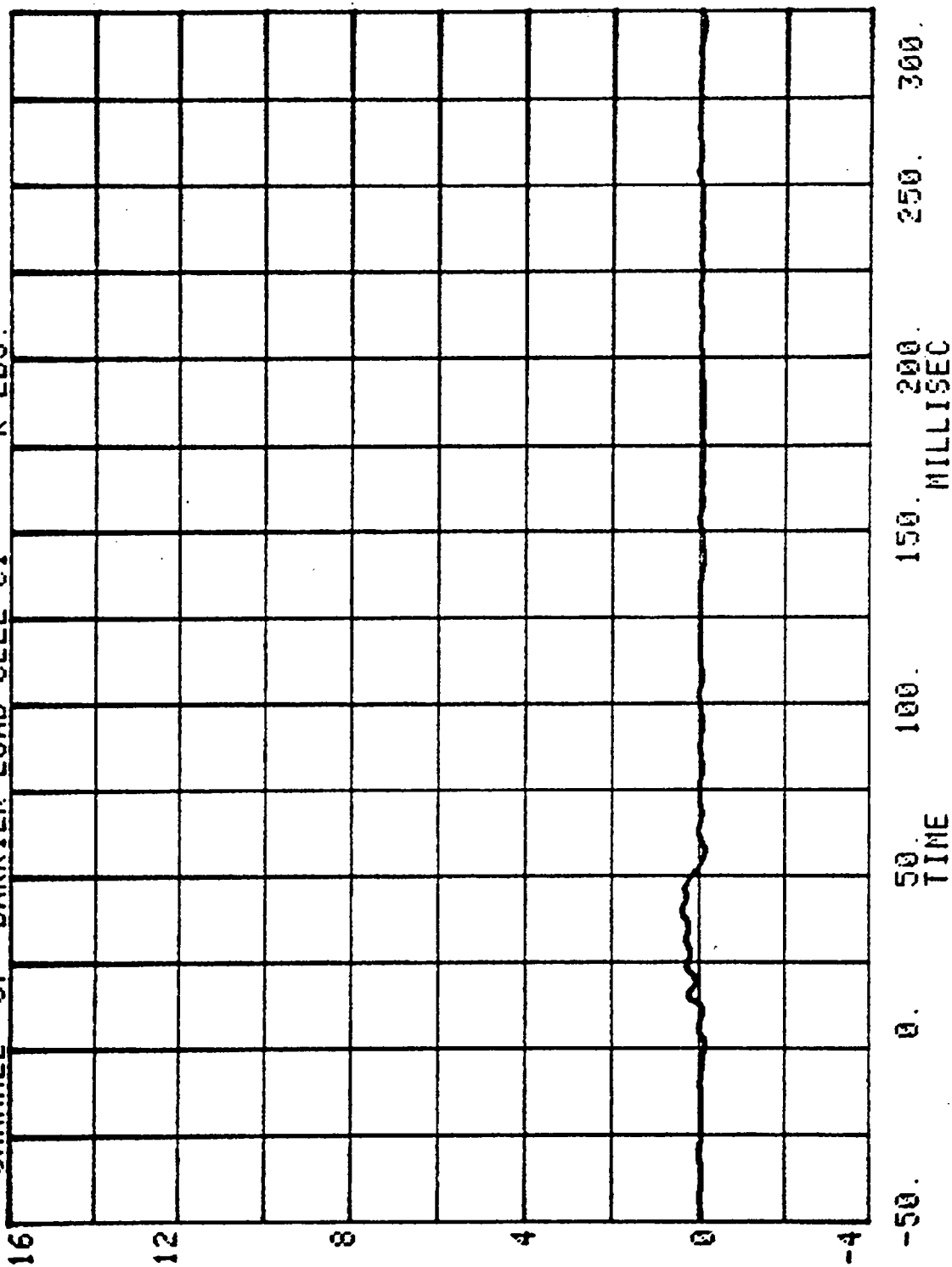
CHANNEL 35 BARRIER LOAD CELL B8 RUN= 537 SERIES= 1 K LBS.

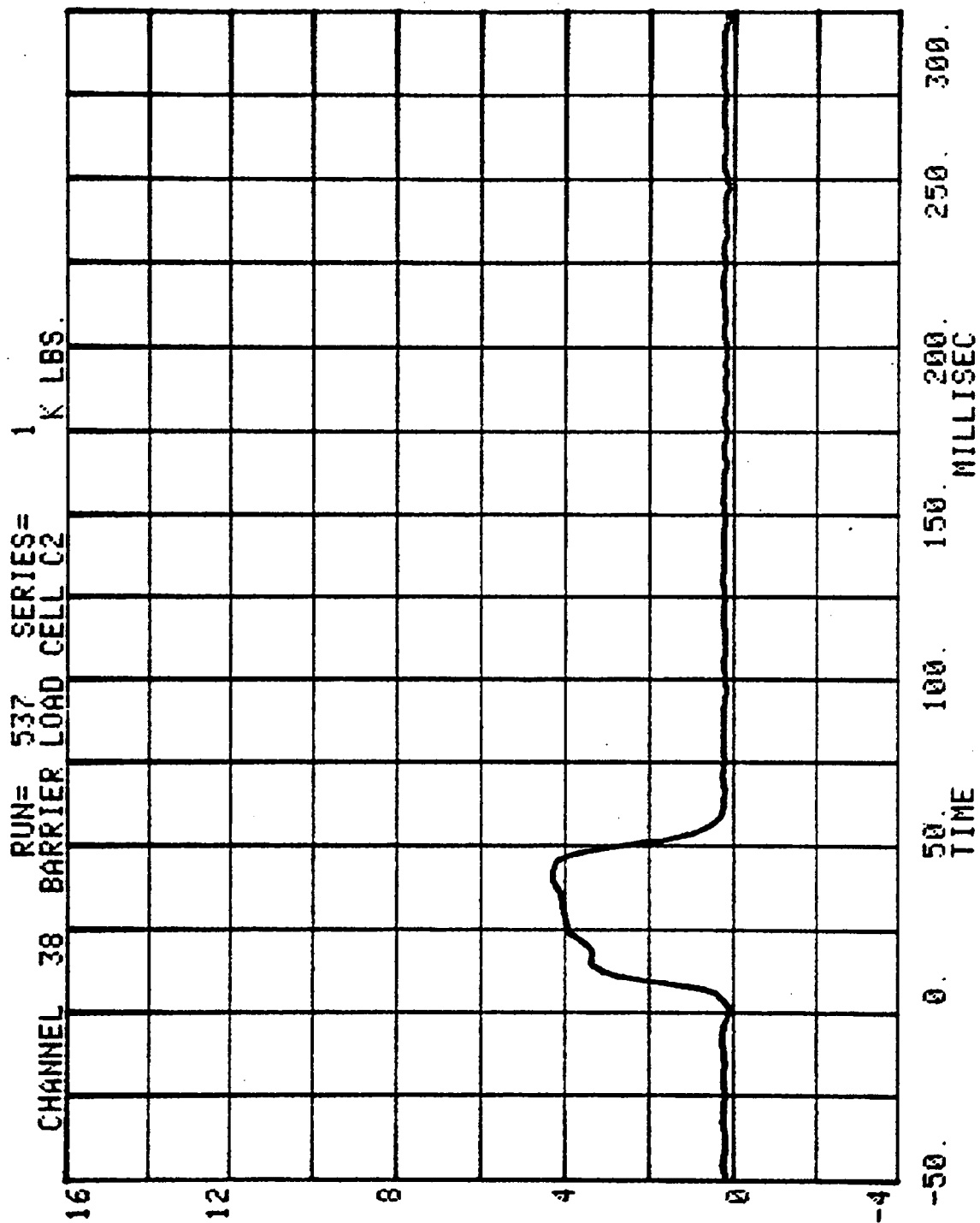


CHANNEL 36 BARRIER LOAD CELL 89 RUN= 537 SERIES= 1 K LBS.

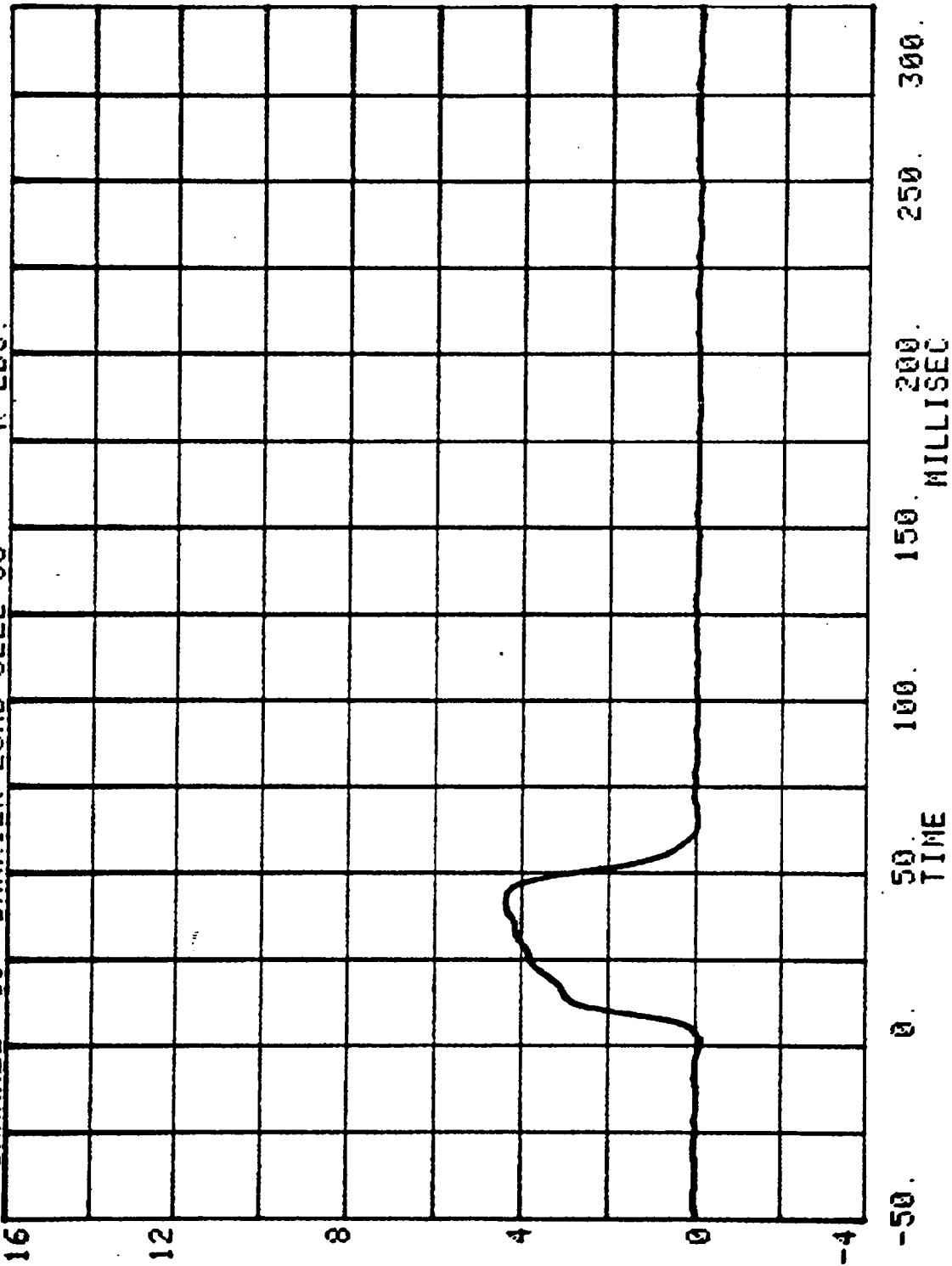


CHANNEL 37 RUH= 537 SERIES= 1 K LBS.
BARRIER LOAD CELL C1





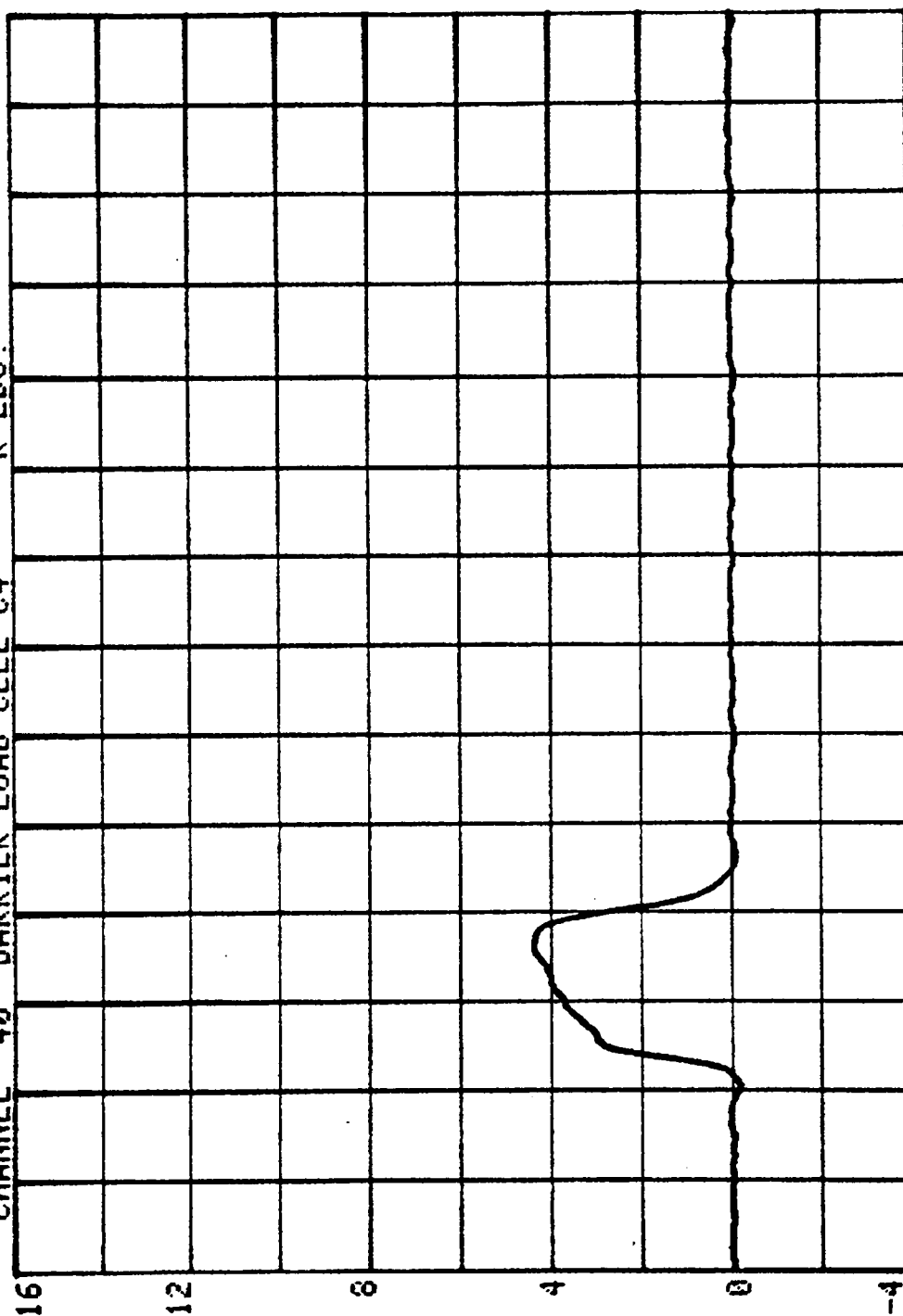
RUN= 537 SERIES= 1
CHANNEL 39 BARRIER LOAD CELL C3 K LBS.



CHANNEL 40 BARRIER LOAD CELL C4

RUN= 537 SERIES= 1

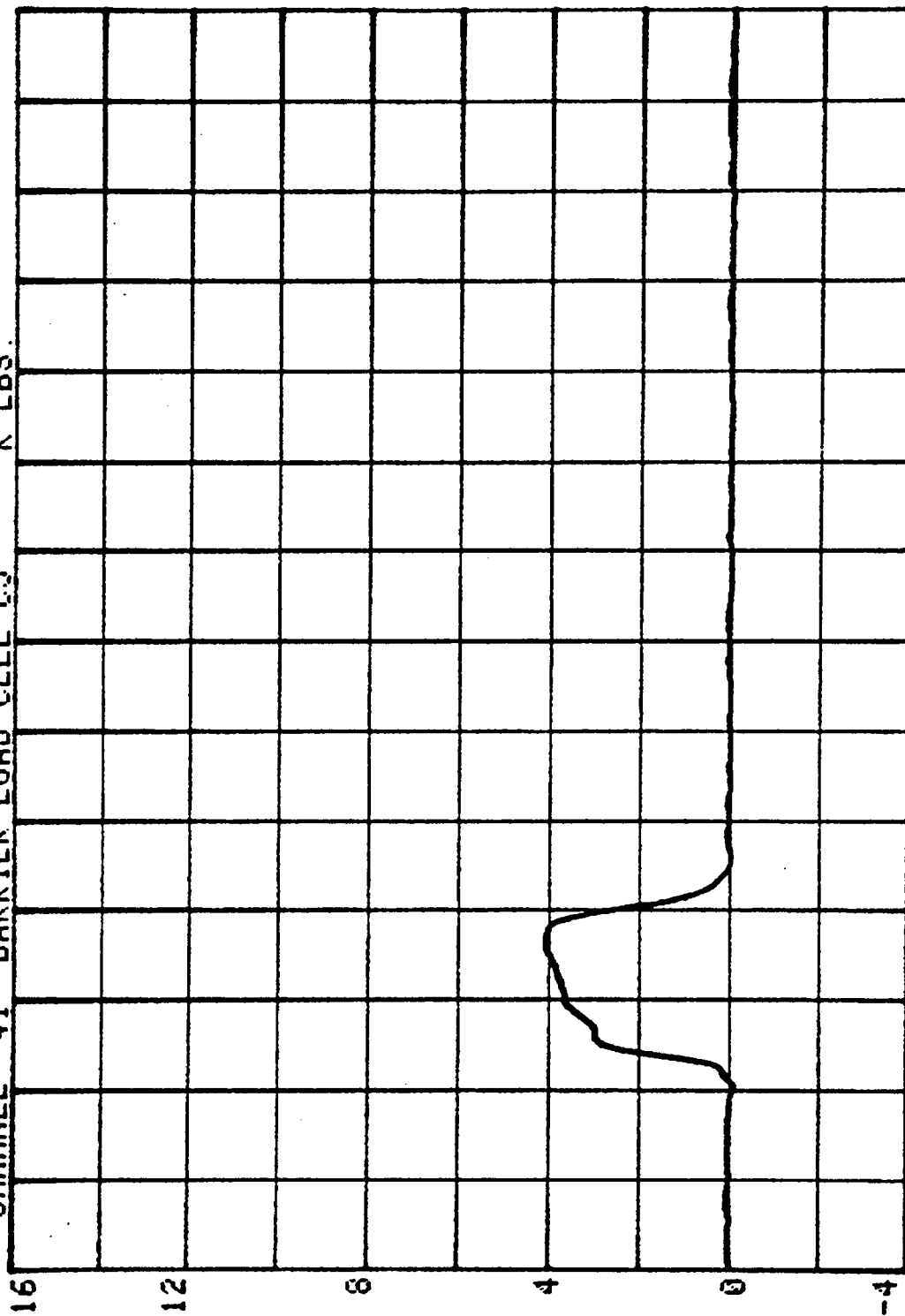
K LBS.



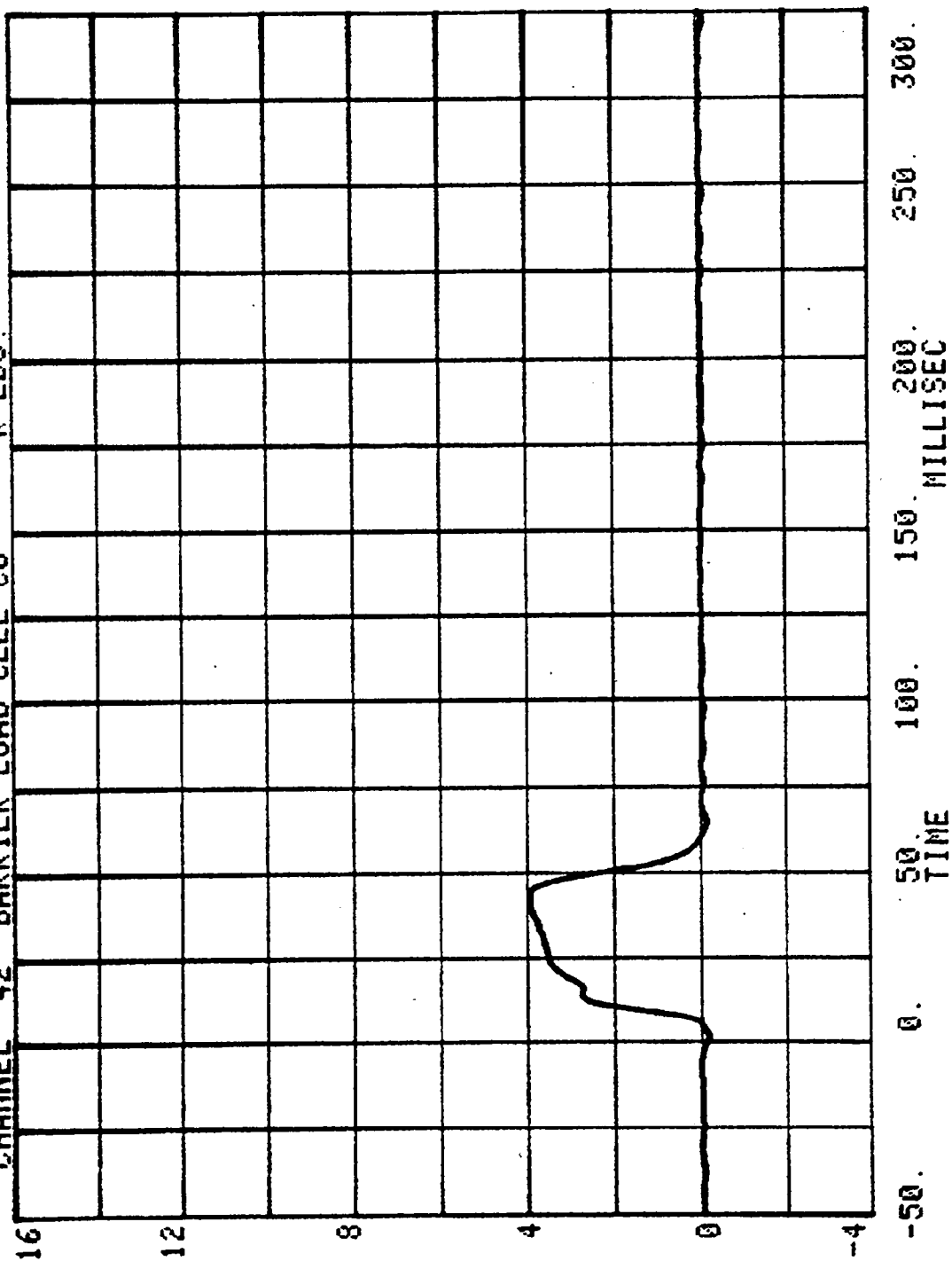
-50. 0. 50. 100. 150. 200. 250. 300.
TIME
MILLISEC

CHANNEL 41 BARRIER LOAD CELL C5 1 K LBS.

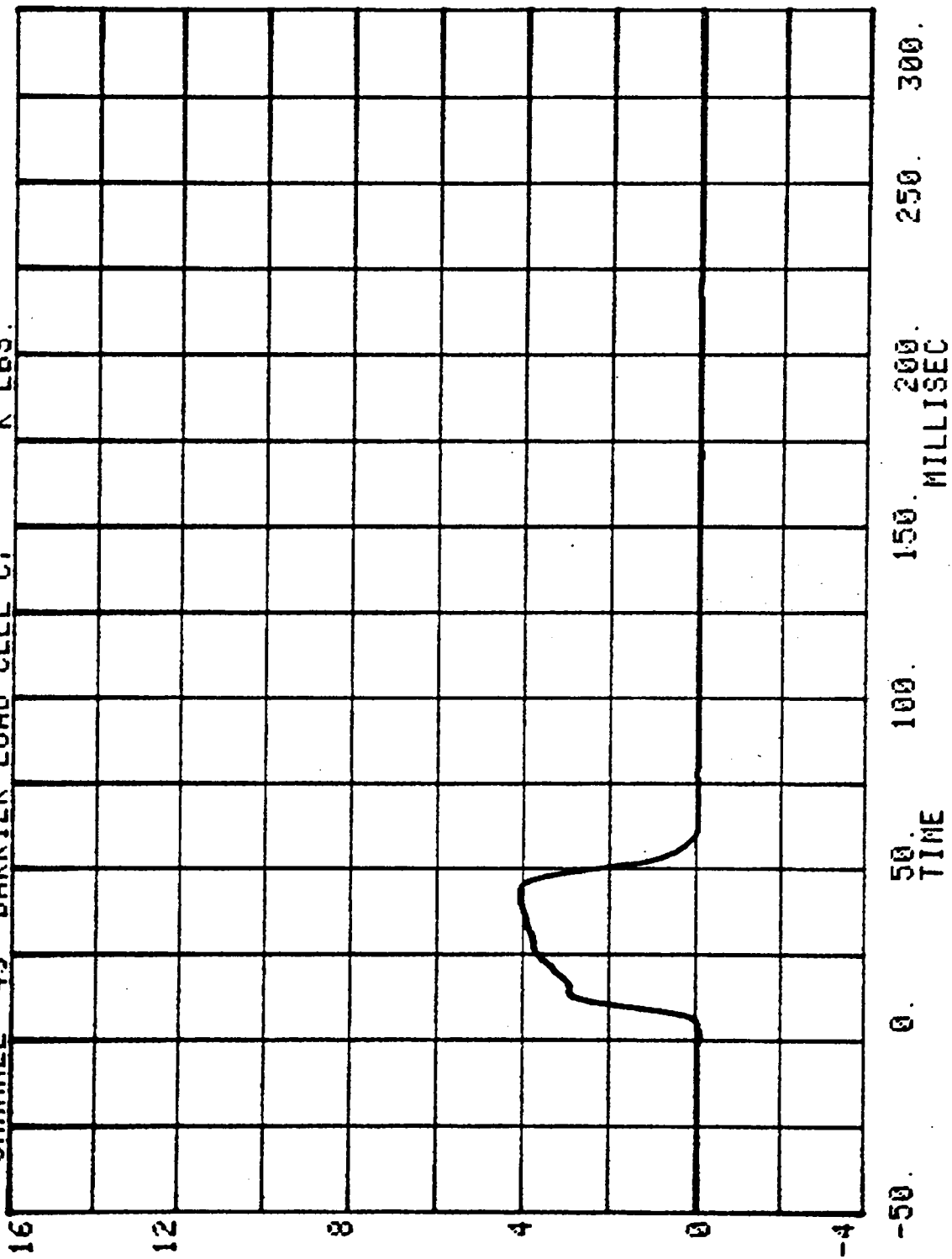
RUN= 537 SERIES=



CHANNEL 42 RUN= 537 SERIES= 1 K LBS.



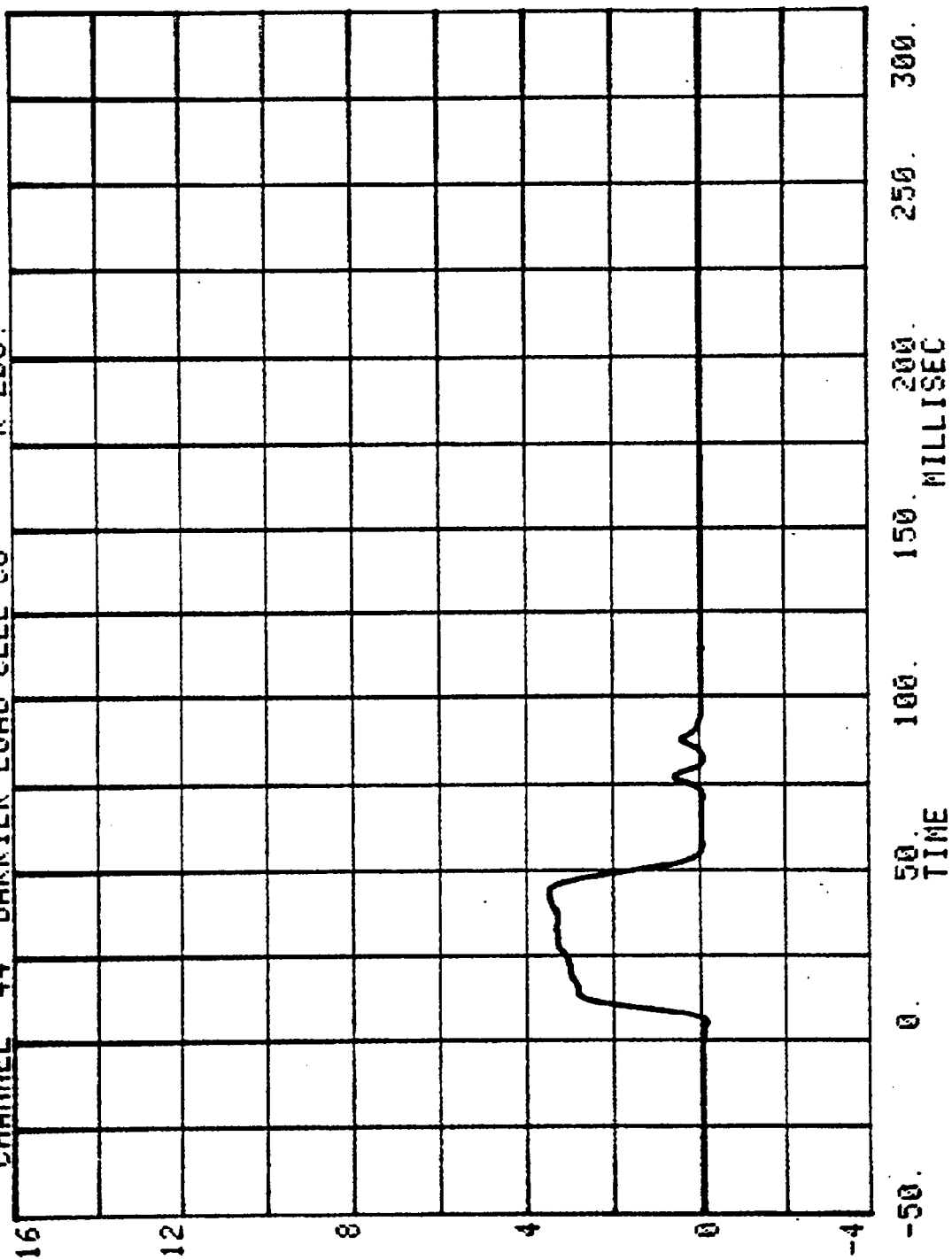
RUN= 537 SERIES= 1
CHANNEL 43 BARRIER LOAD CELL C7 K LBS.



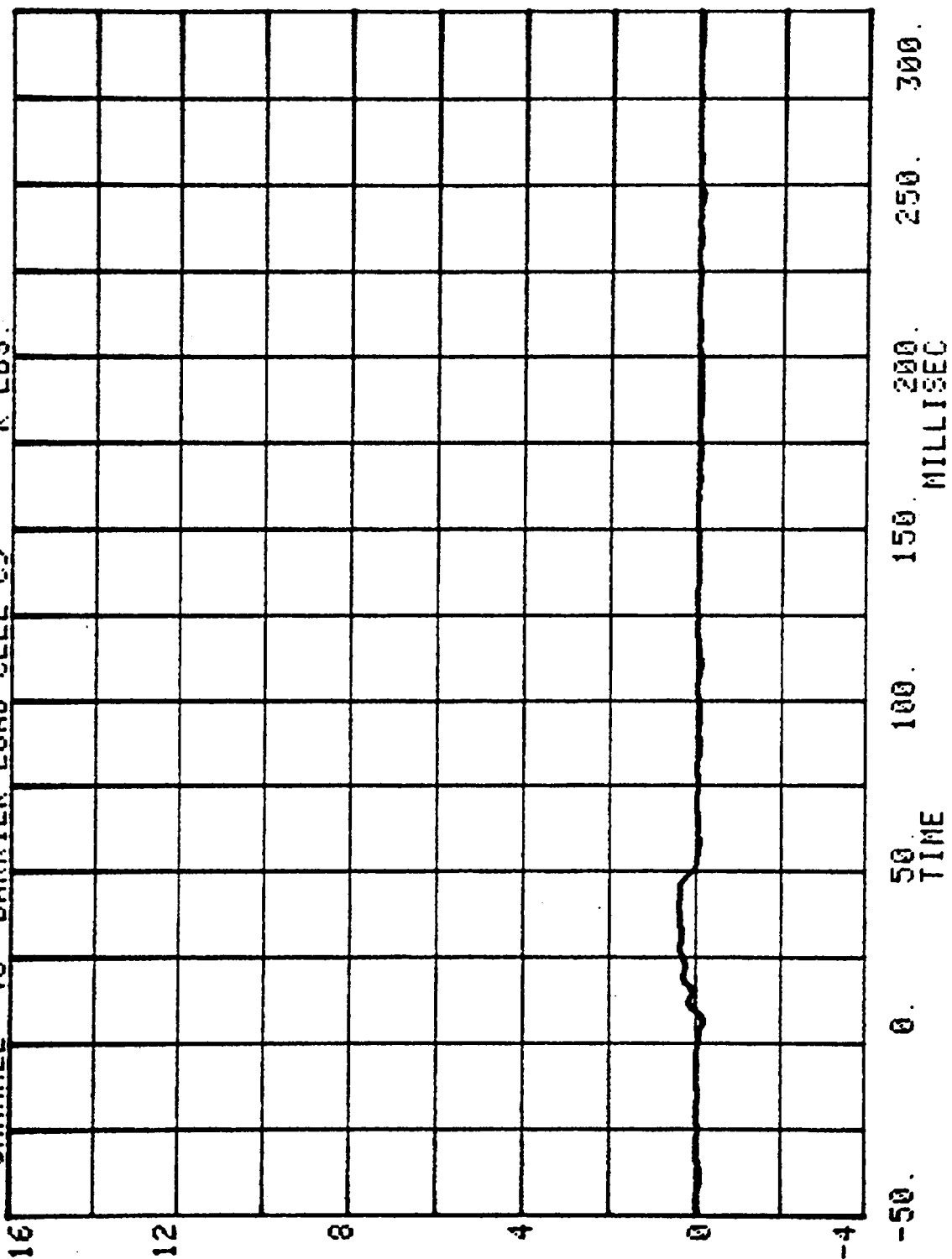
CHANNEL 44 BARRIER LOAD CELL C8

RUN= 537 SERIES= 1

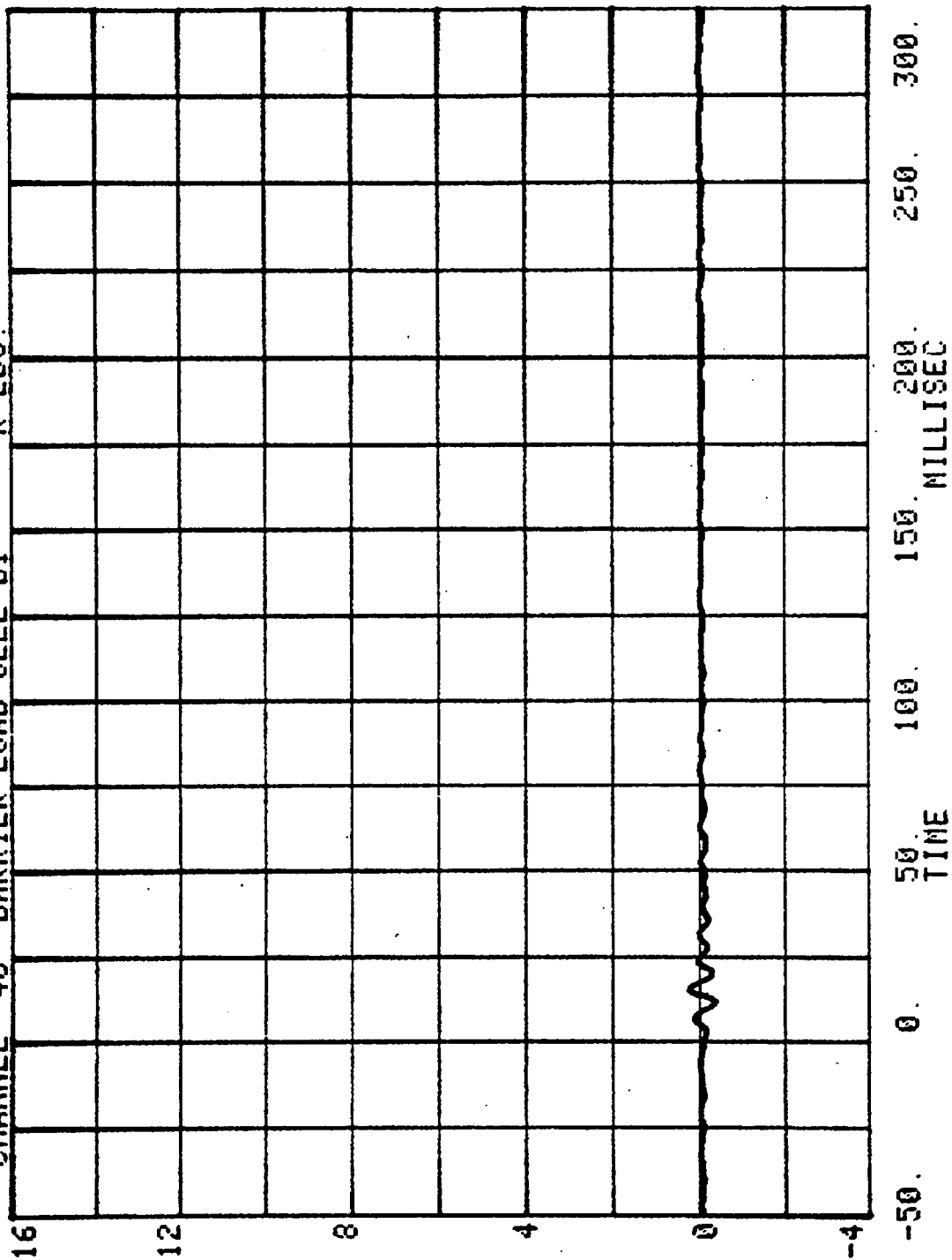
K LBS.



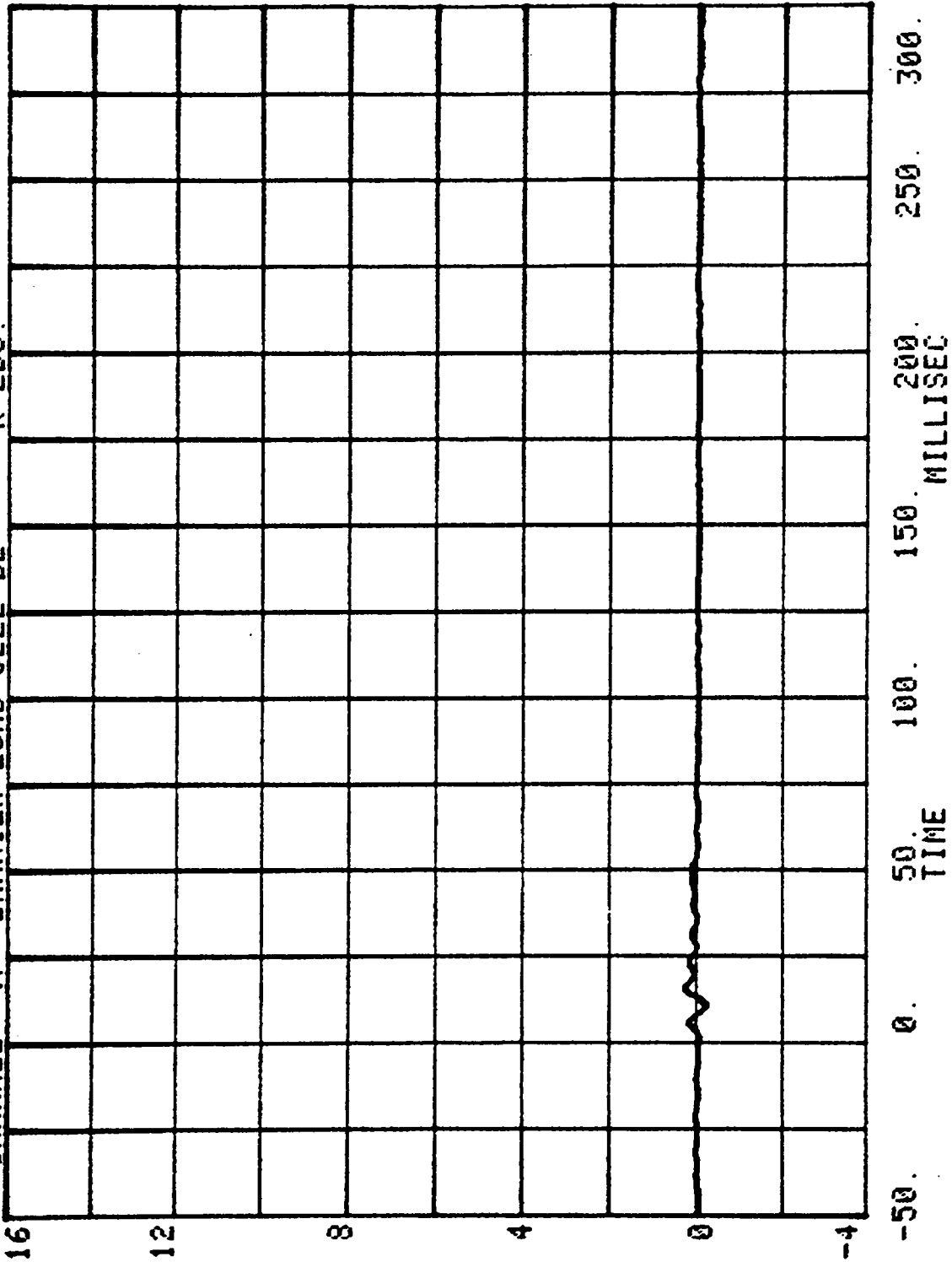
CHANNEL 45 RUN= 537 SERIES= 1 K LBS.



RUN= 537 SERIES= 1
CHANNEL 46 BARRIER LOAD CELL 01 K LBS.



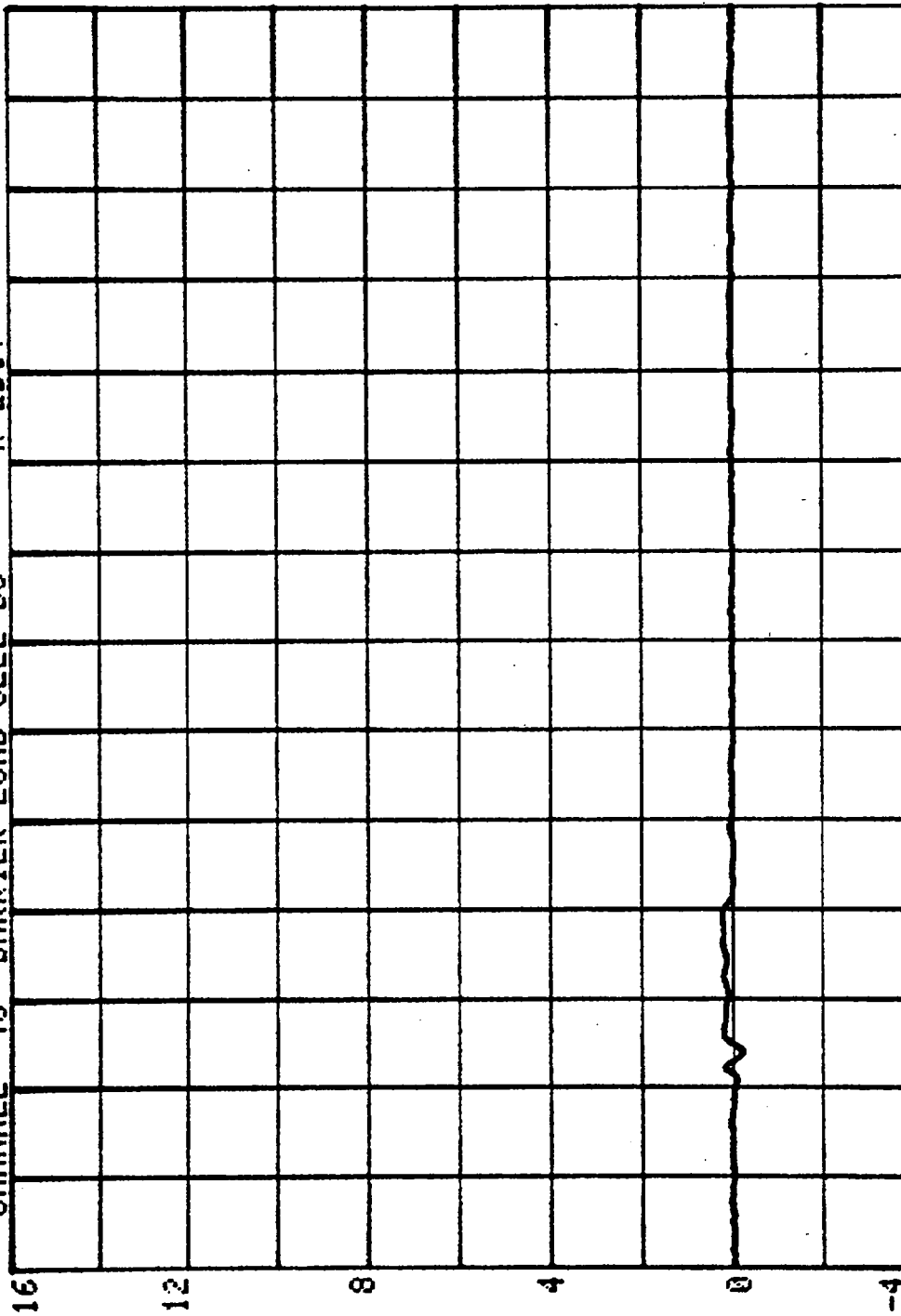
CHANNEL 47 RUN= 537 SERIES= 1 K LBS.
BARRIER LOAD CELL D2



CHANNEL 48 BARRIER LOAD CELL 03

RUN= 537 SERIES= 1

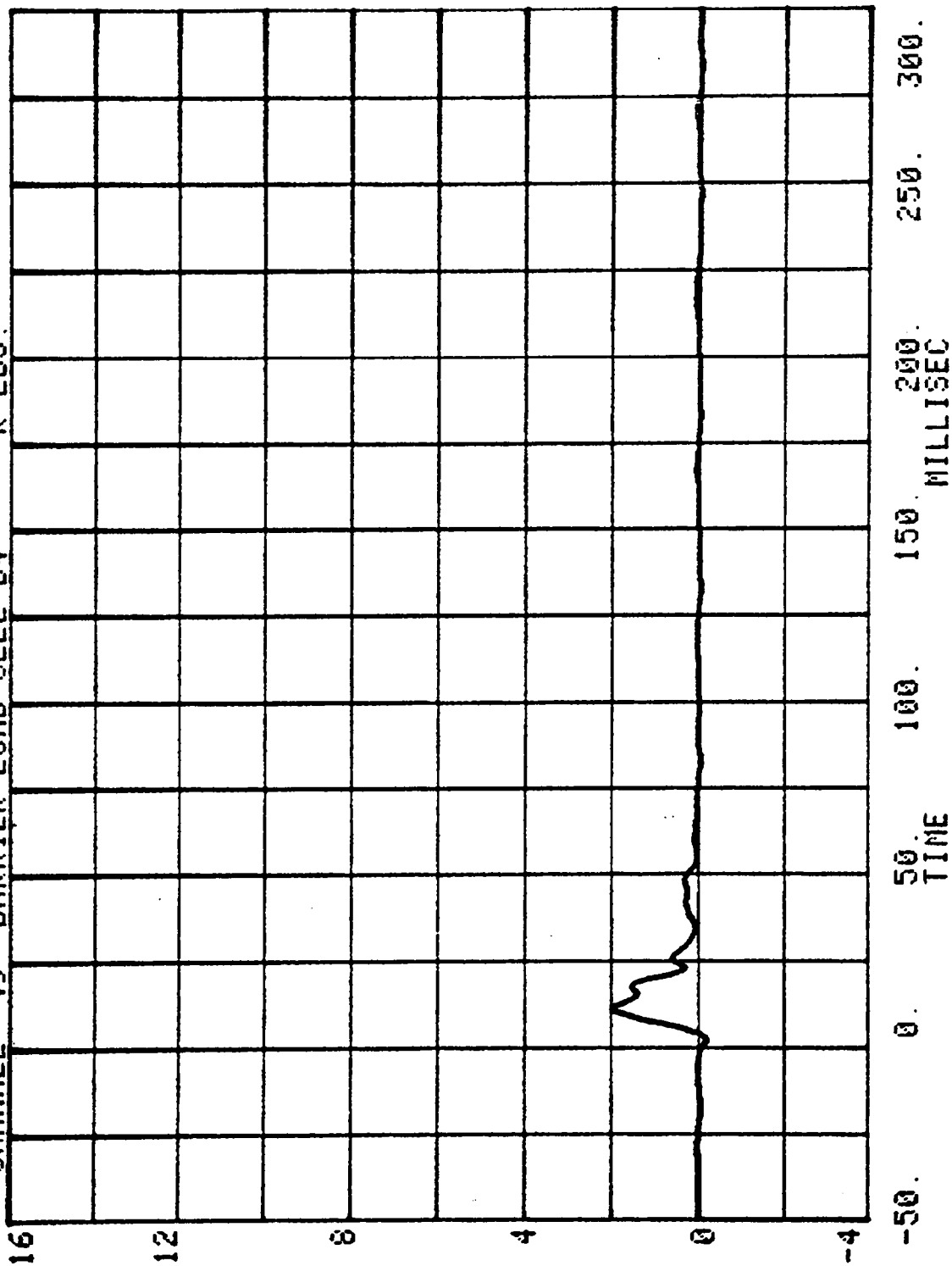
K LBS.



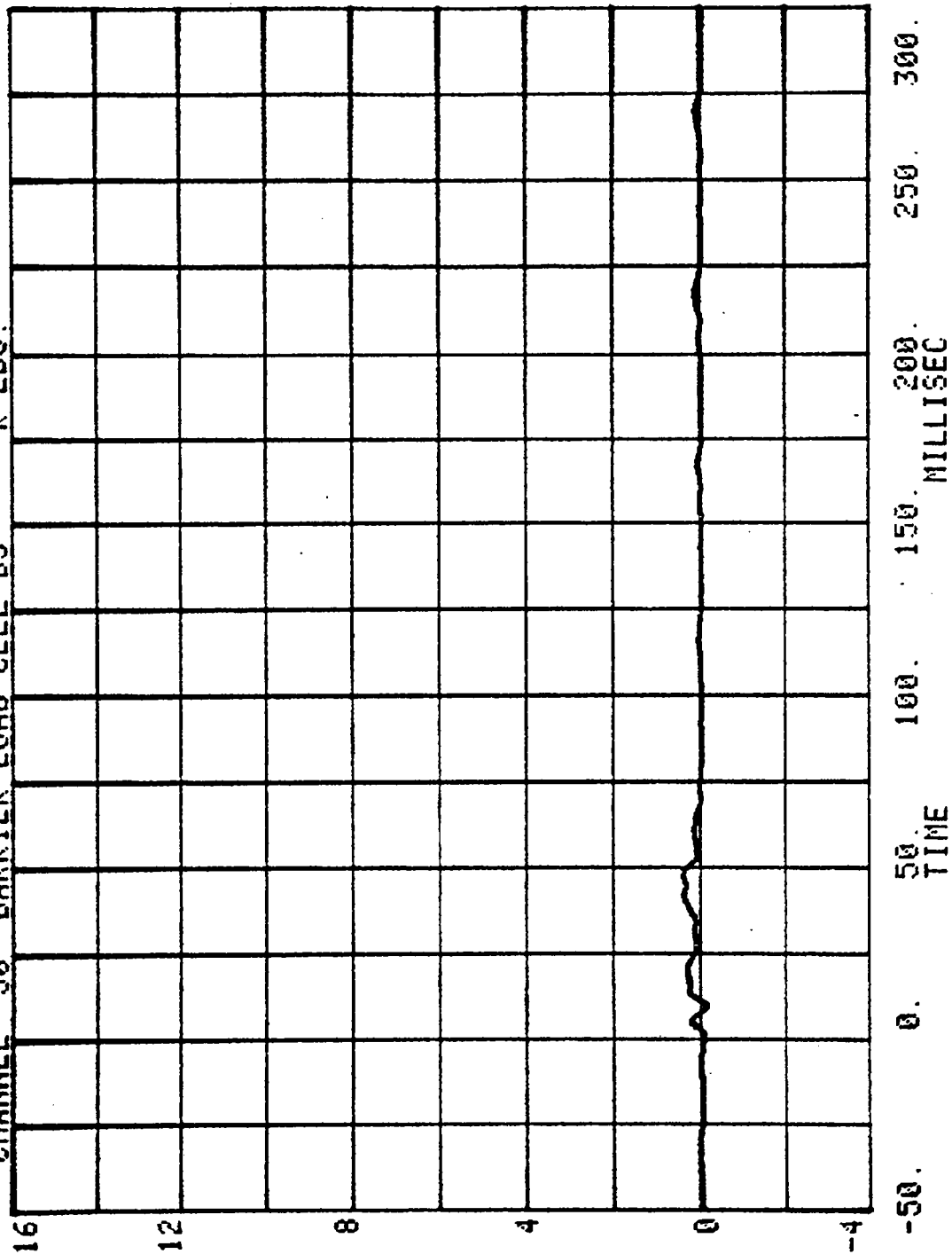
-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

CHANNEL 49 BARRIER LOAD CELL D4 K LBS.

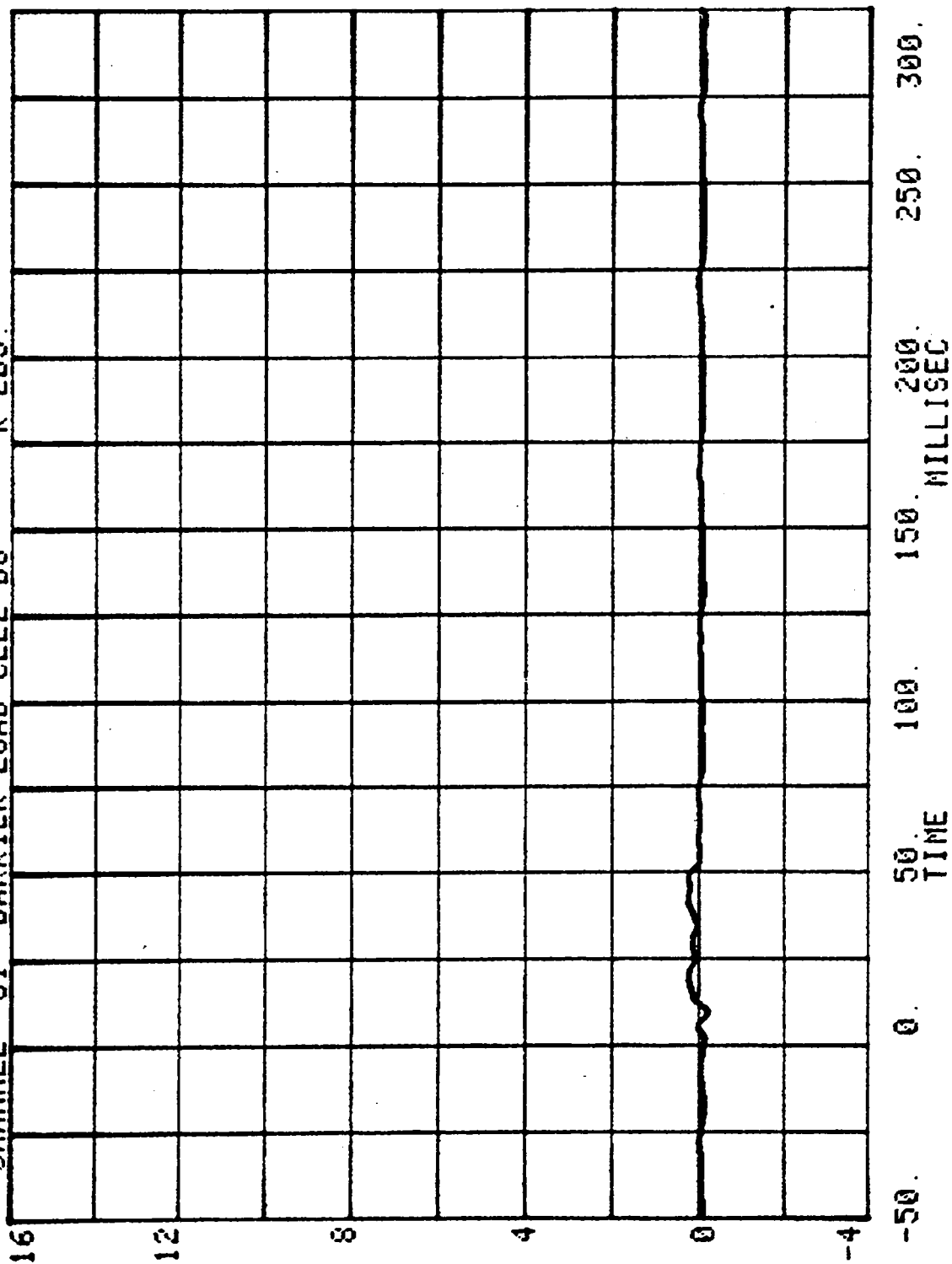
RUN= 537 SERIES= 1



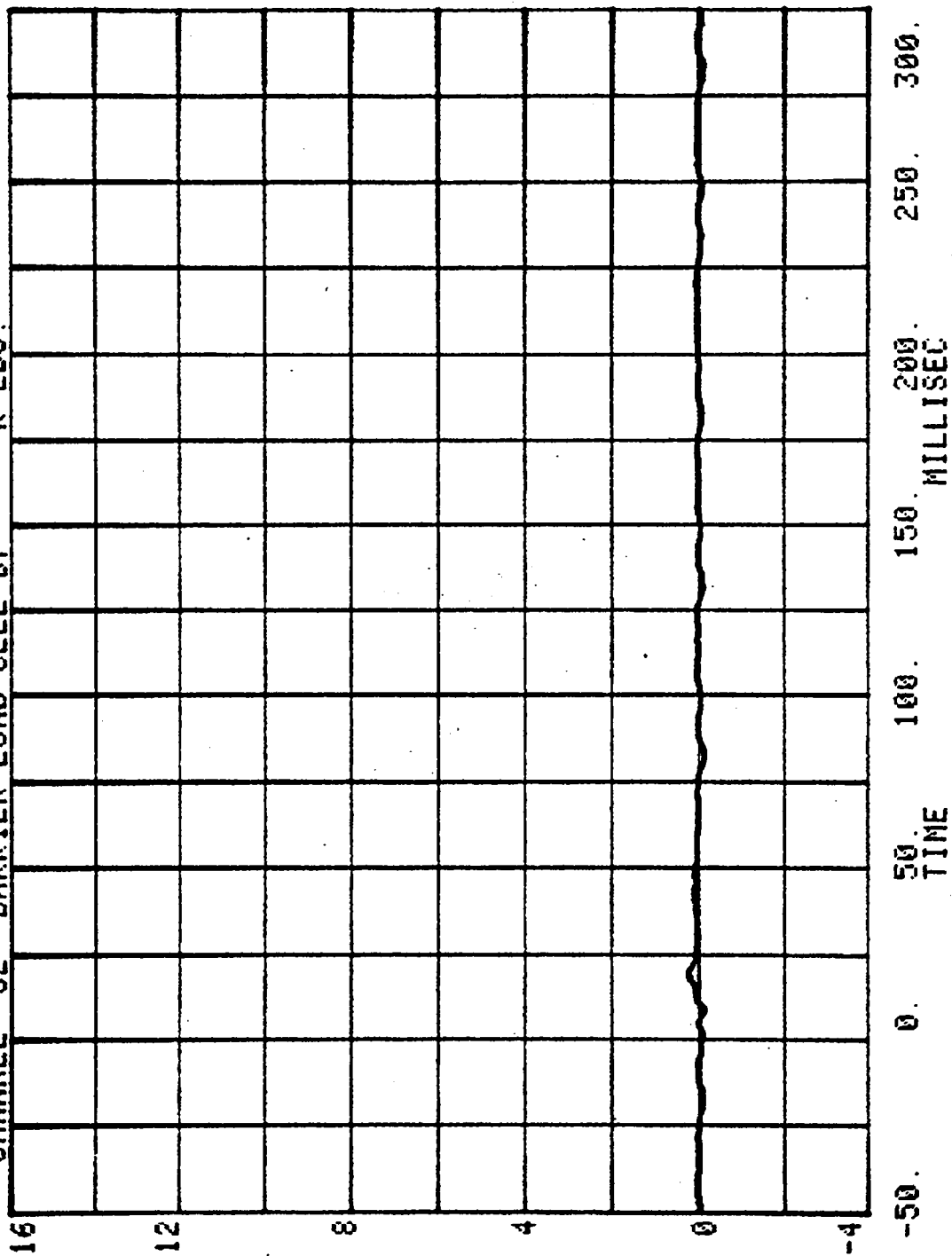
RUN= 537 SERIES= 1
CHANNEL 50 BARRIER LOAD CELL D5 K LBS.



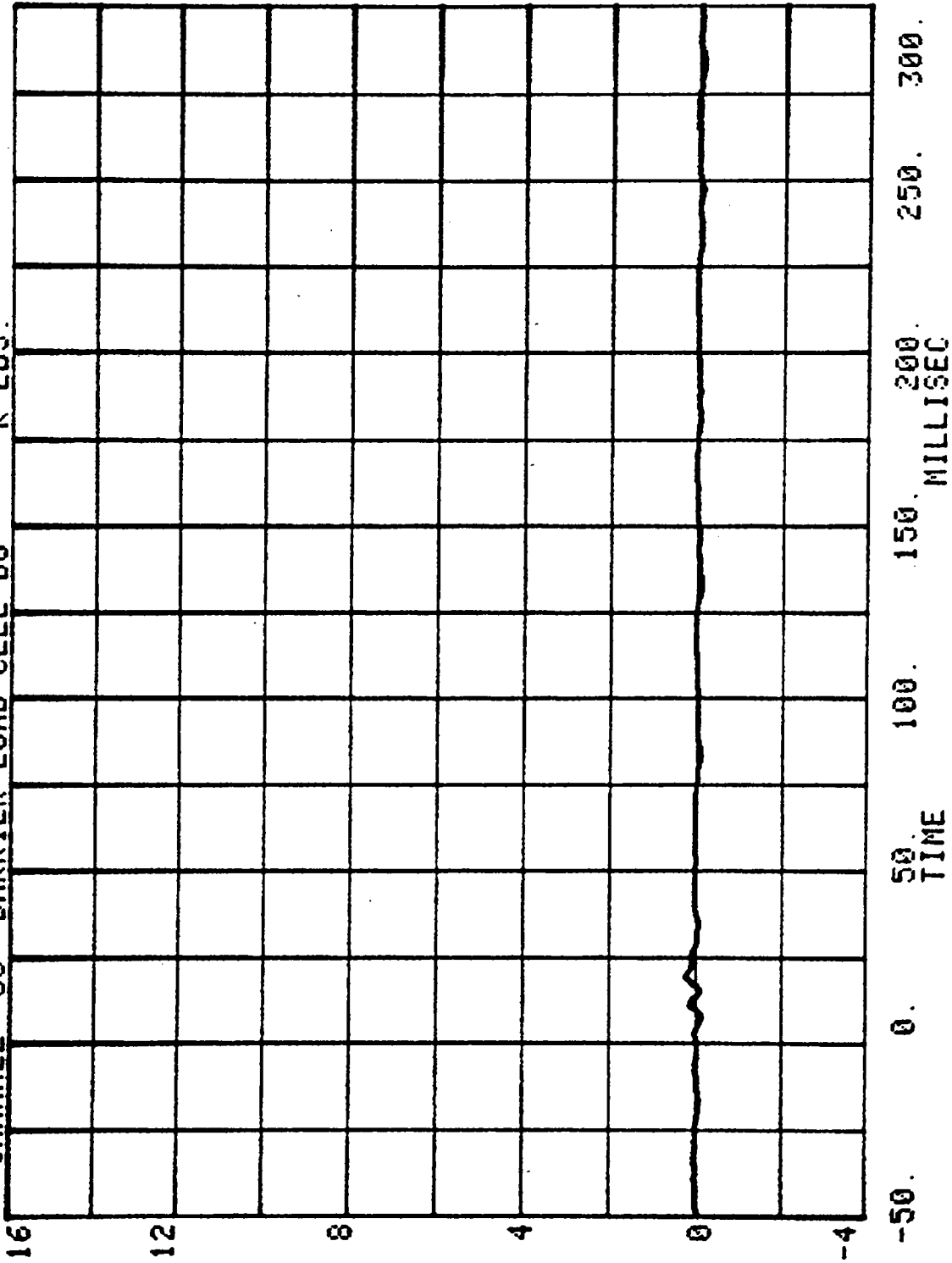
CHANNEL 51 RUN= 537 SERIES= 1 K LBS.
BARRIER LOAD CELL D6



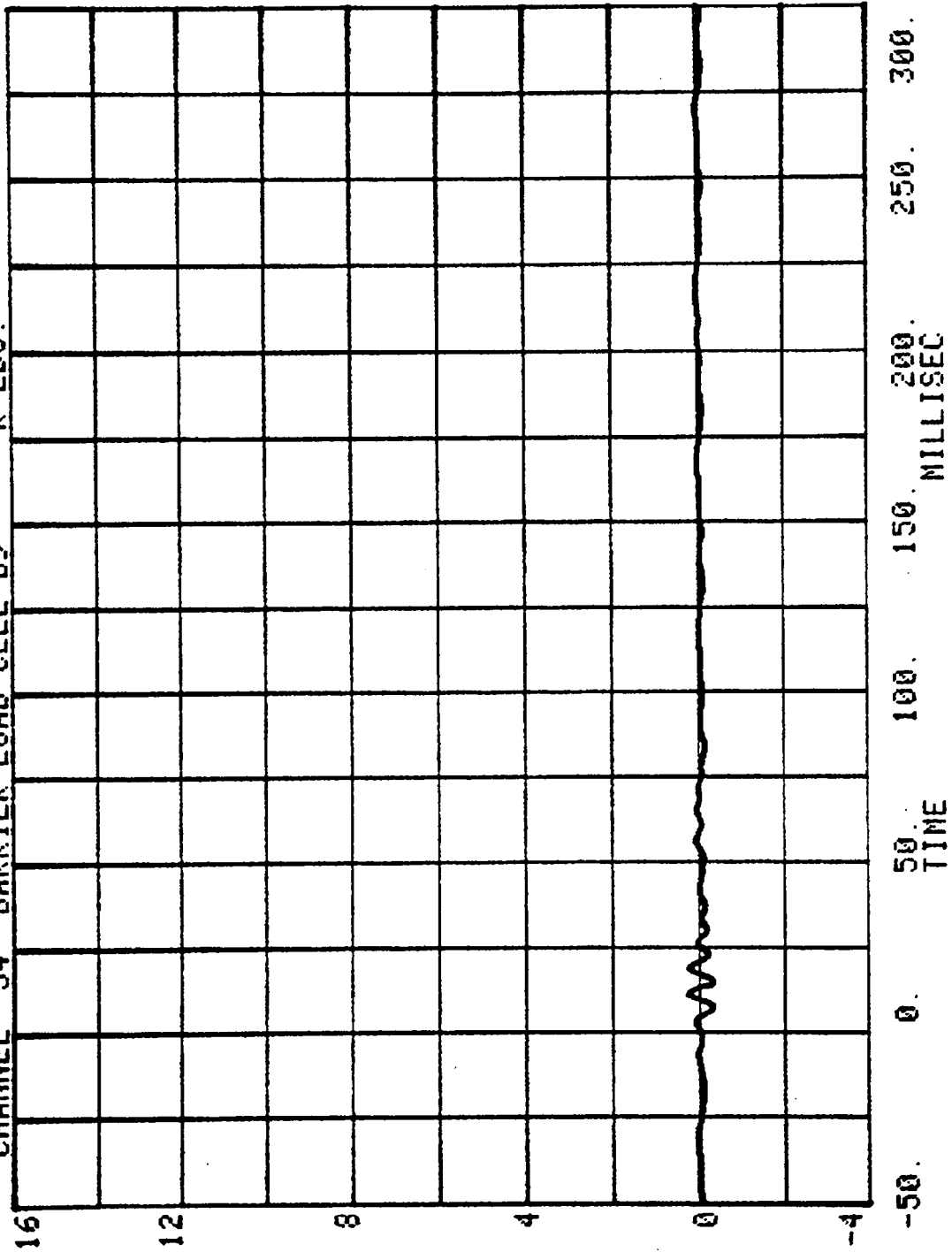
RUN= 537 SERIES= 1
CHANNEL 52 BARRIER LOAD CELL 07 K LBS.

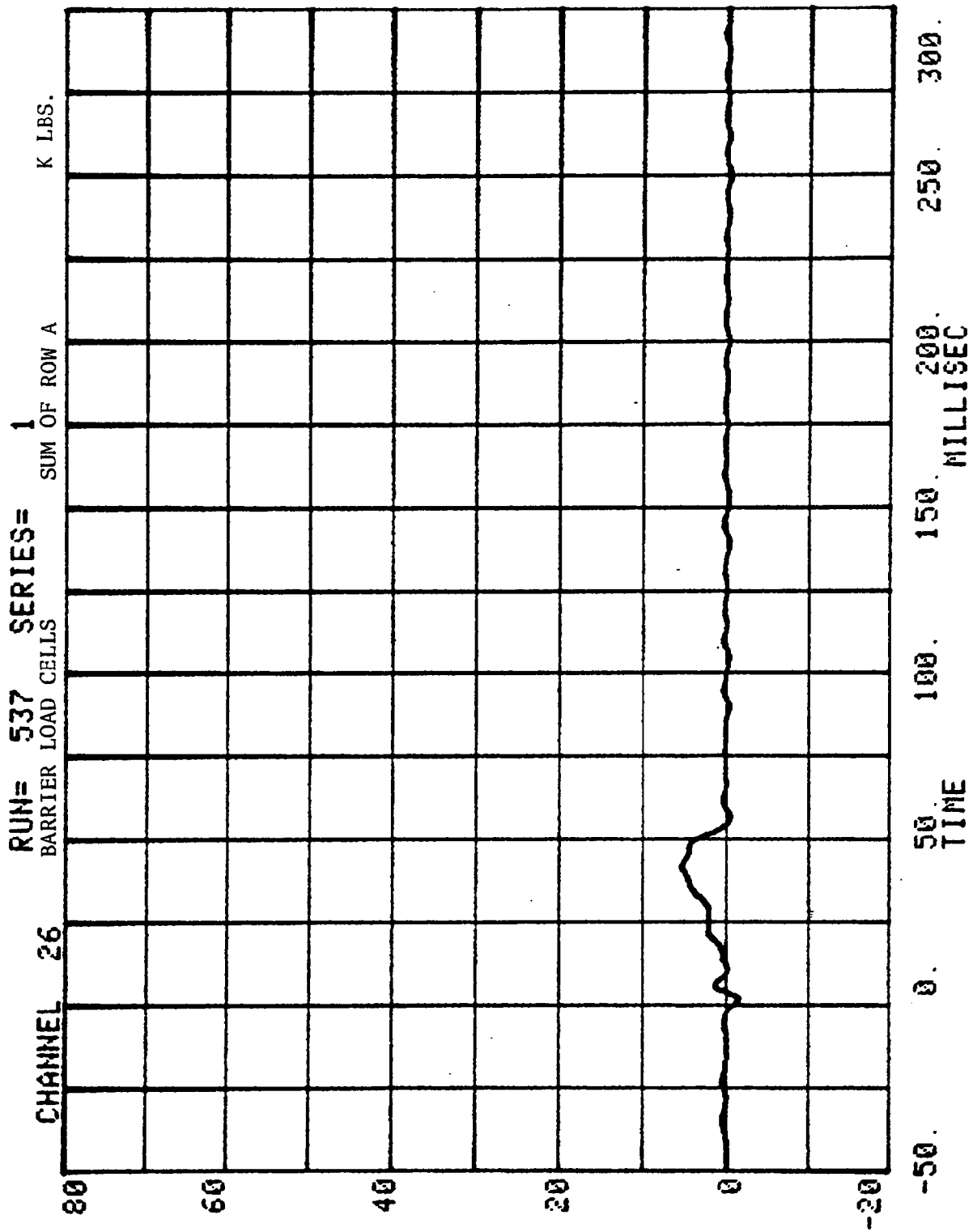


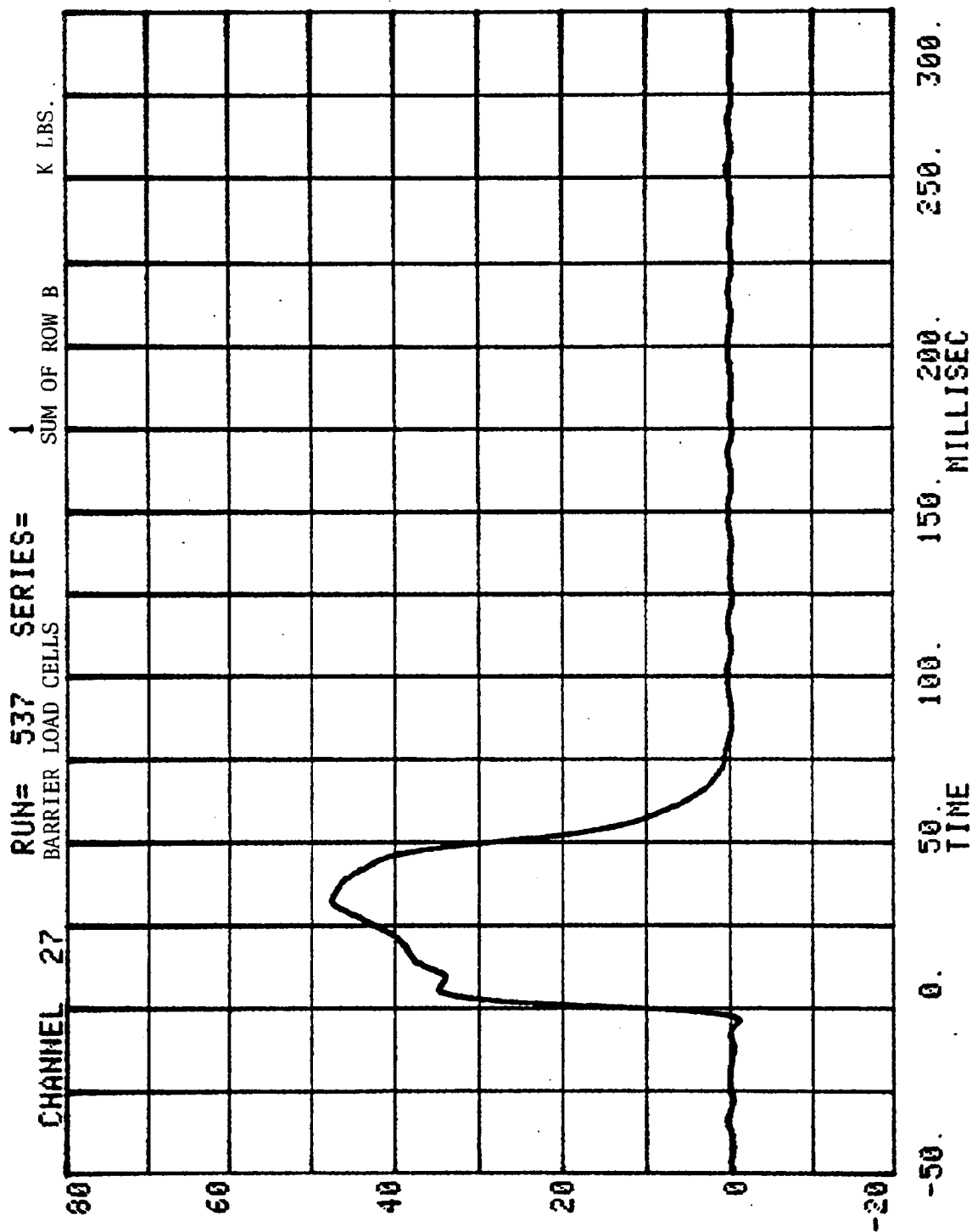
CHANNEL 53 RUN= 537 SERIES= 1 K LBS.

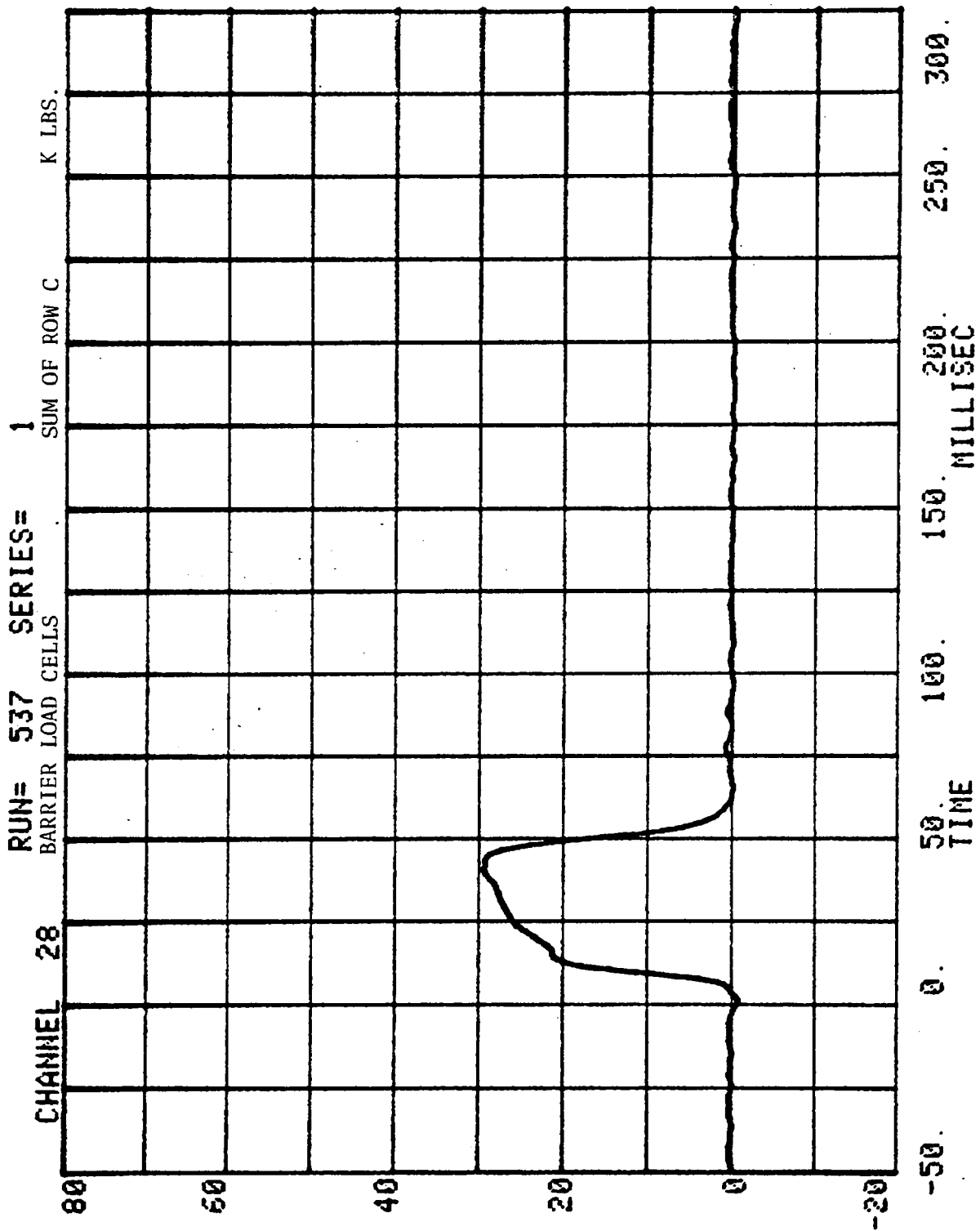


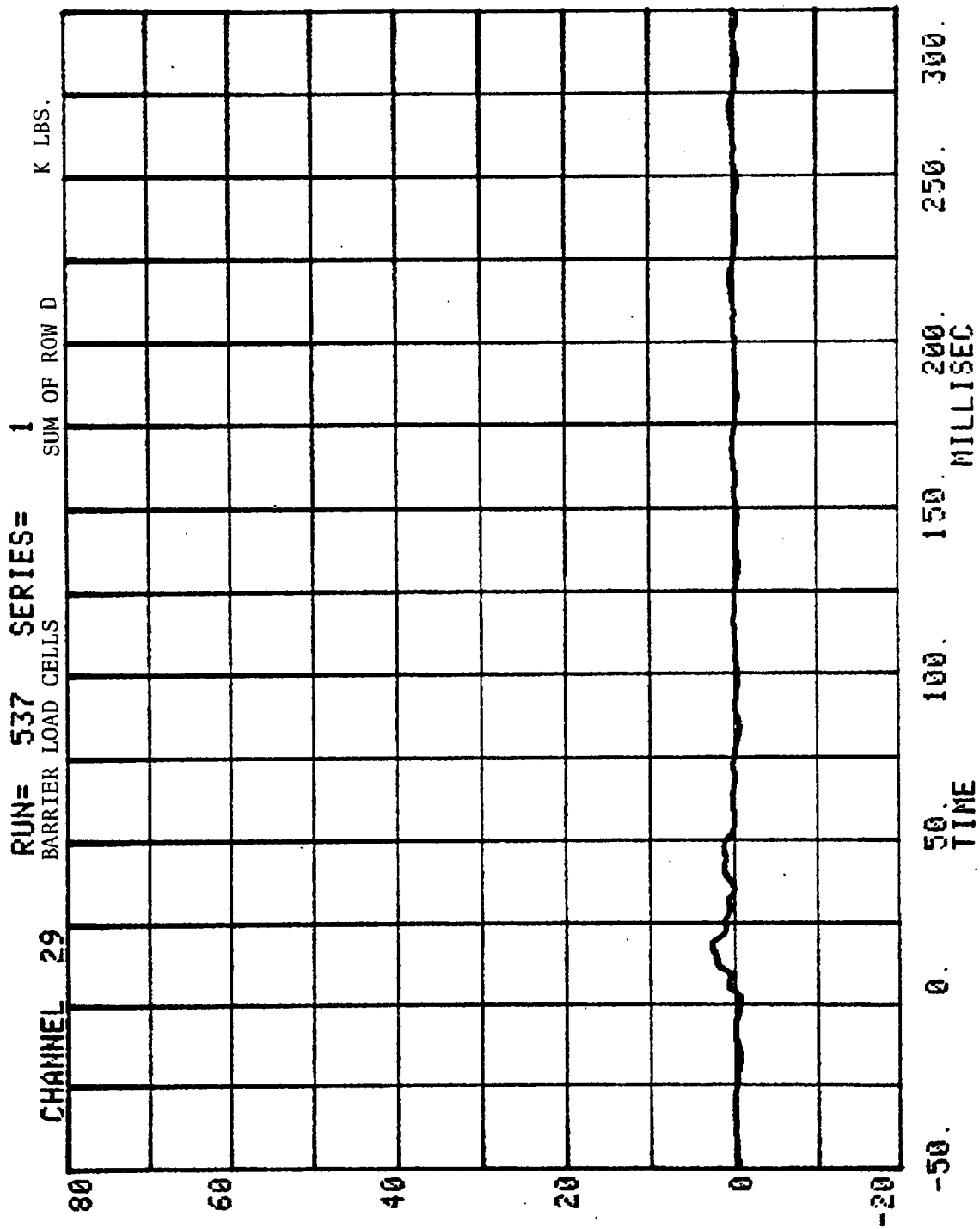
RUN= 537 SERIES= 1
CHANNEL 54 BARRIER LOAD CELL D9 K LBS.

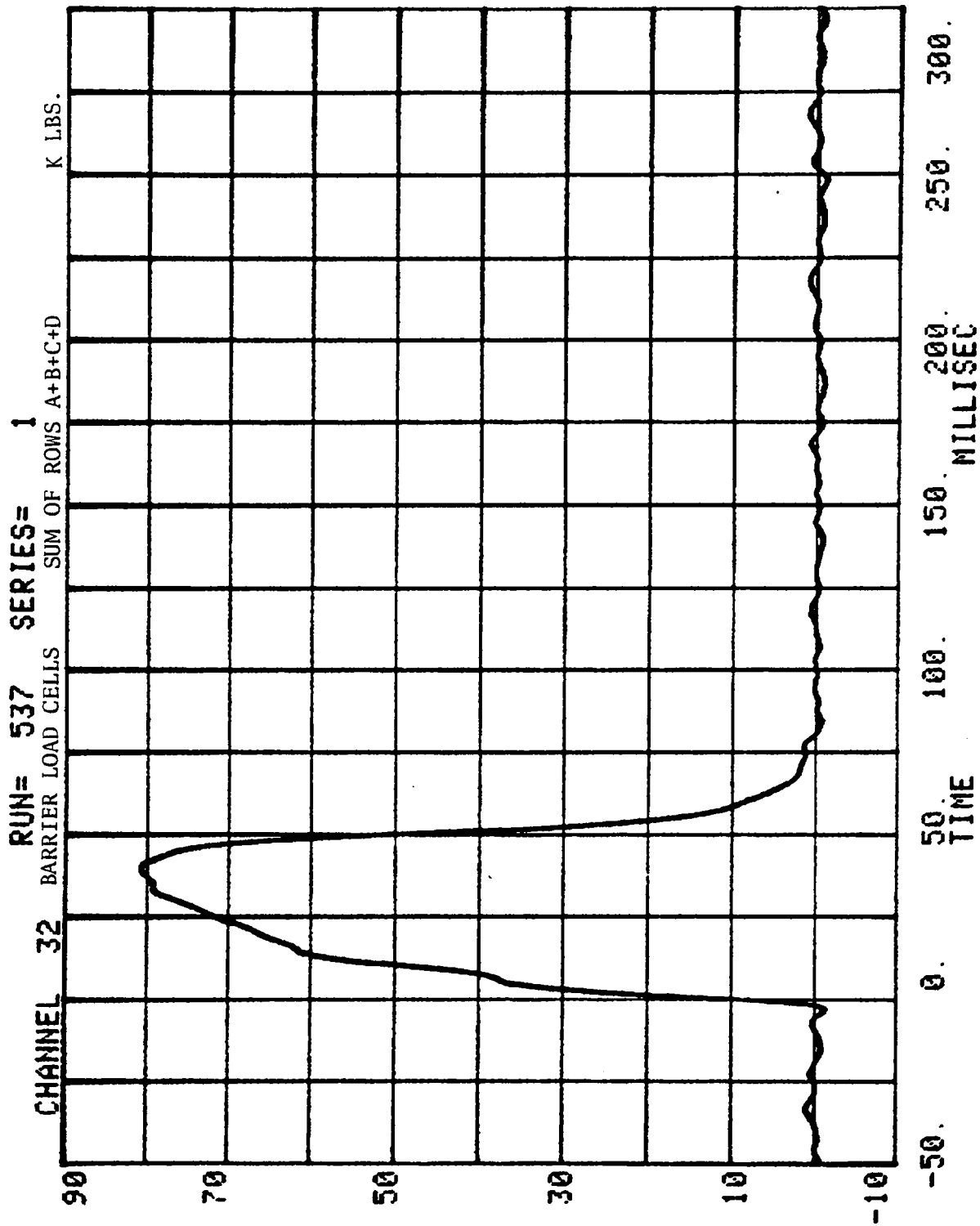








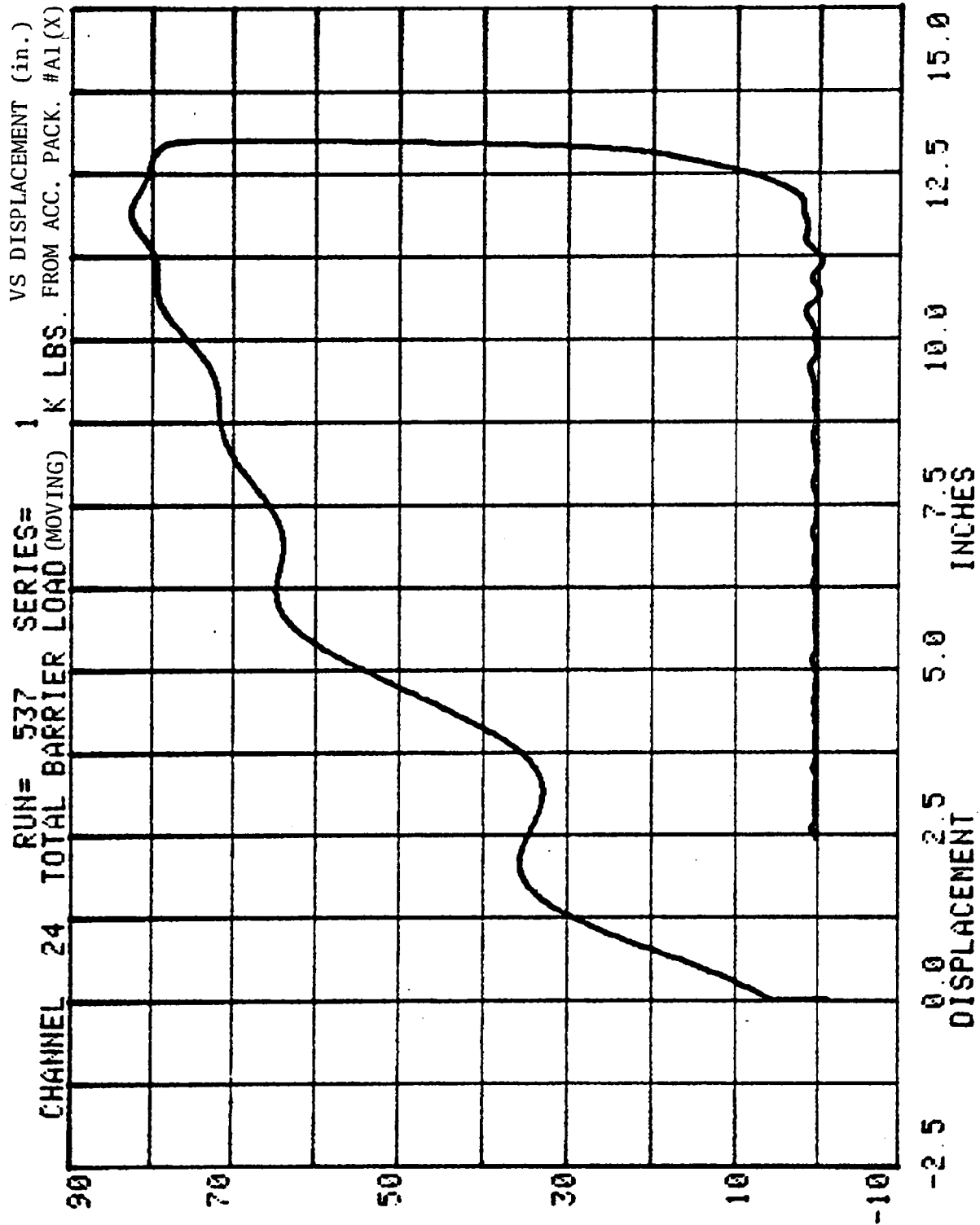




TEST NO. 1

CROSS PLOT OF MOVING BARRIER LOAD

VS. DISPLACEMENT (DERIVED FROM MOVING BARRIER ACCELERATION)

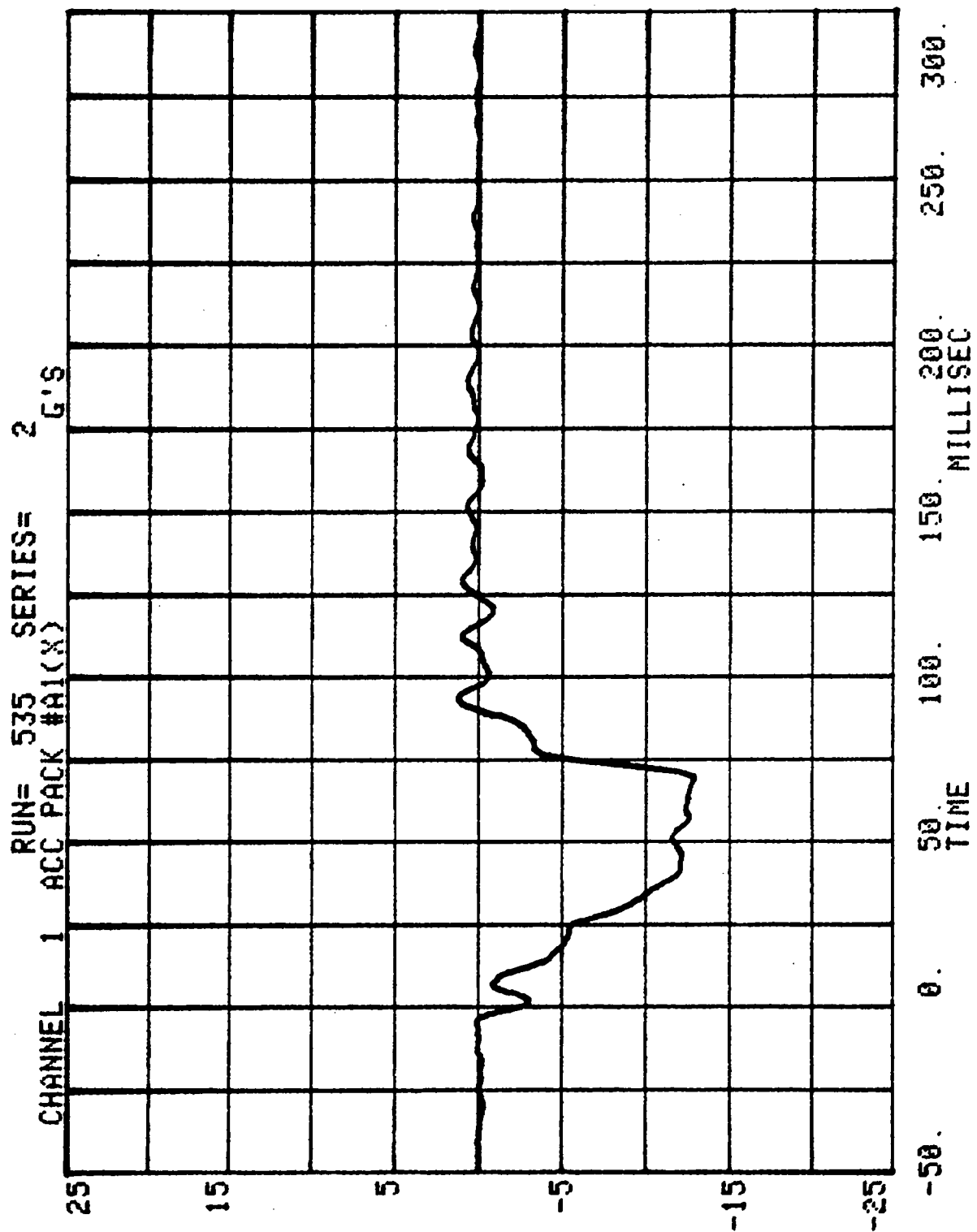


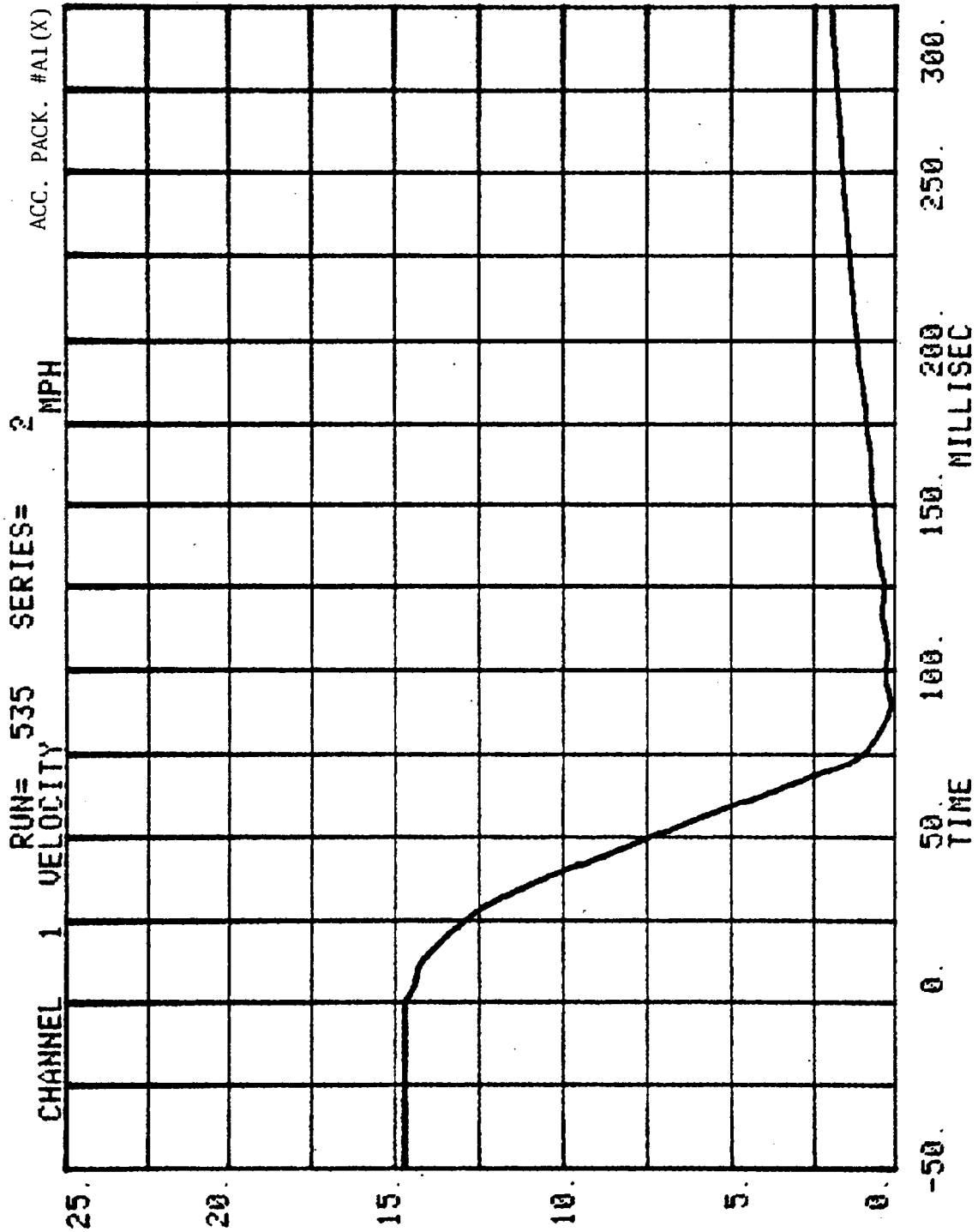
MOVING BARRIER DATA

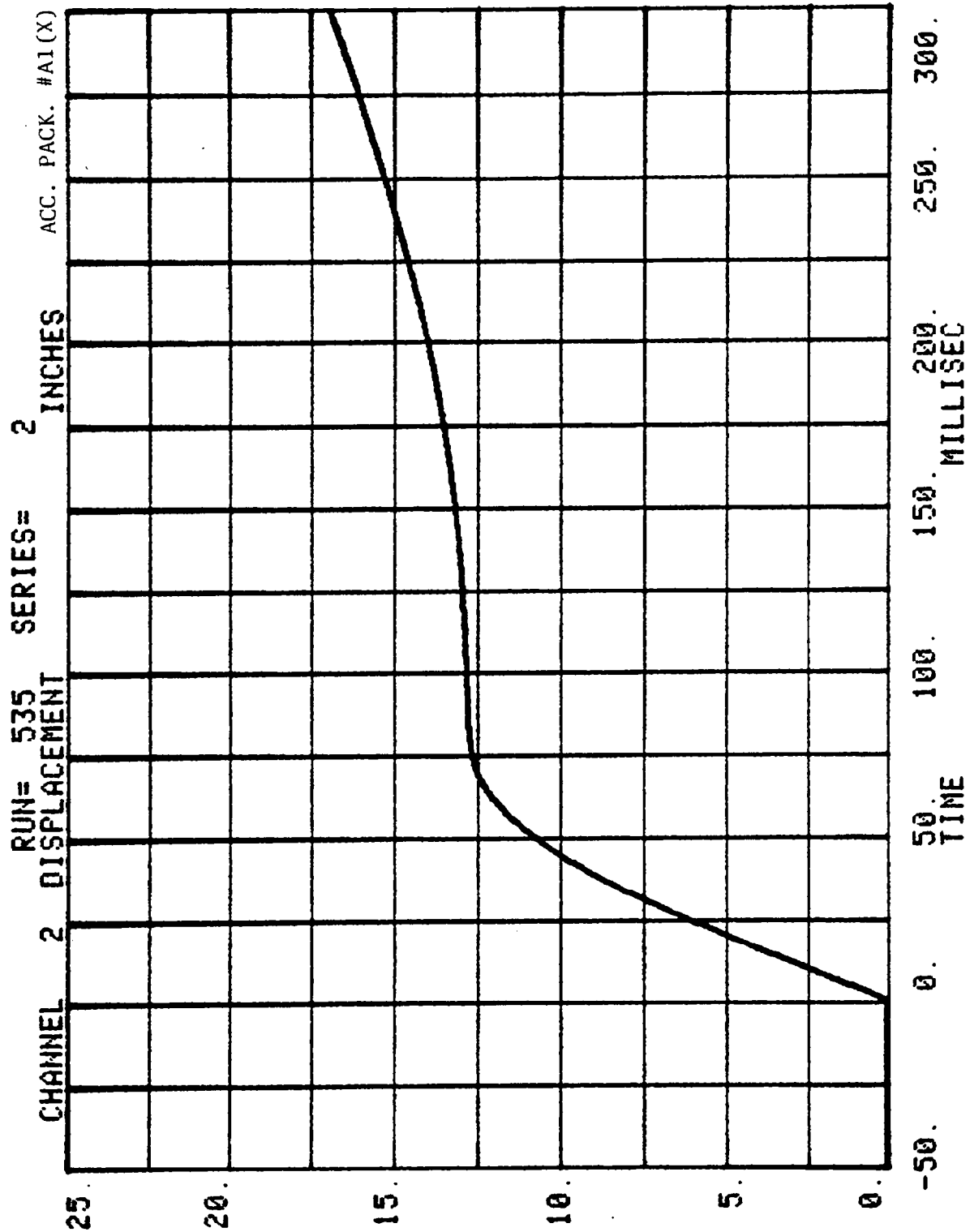
TEST NO. 2

VEHICLE DATA

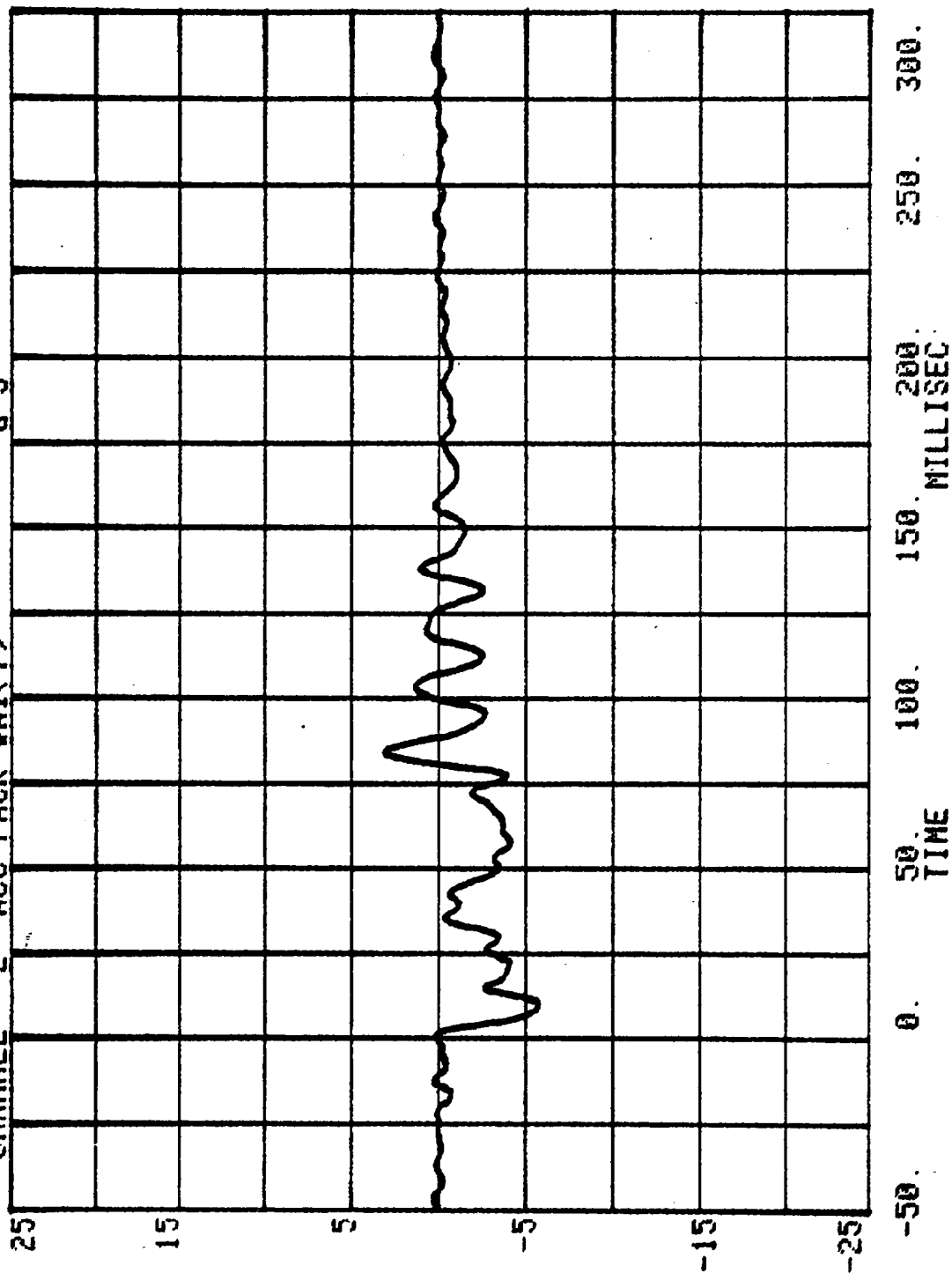
FILTER CLASS 60



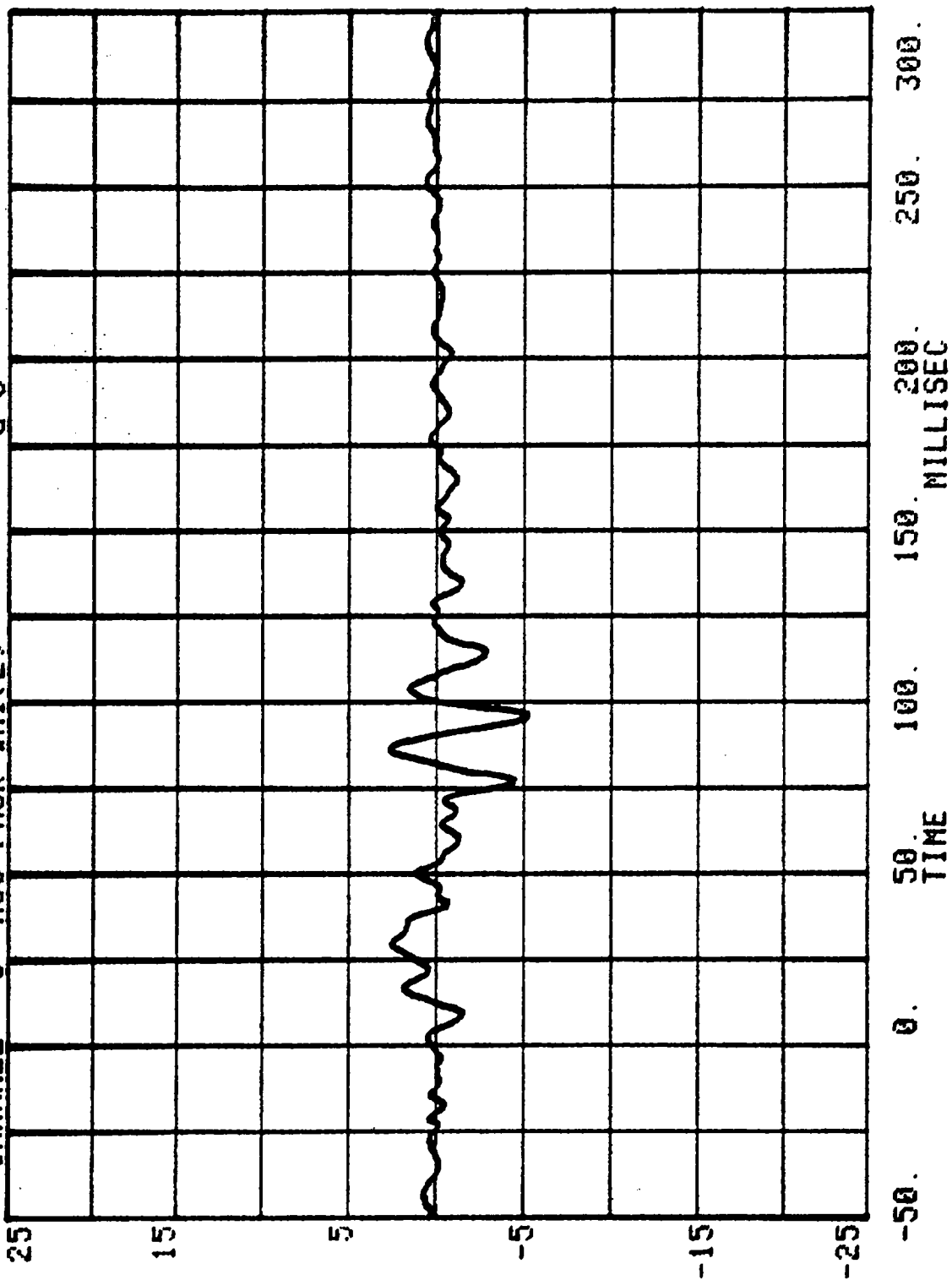




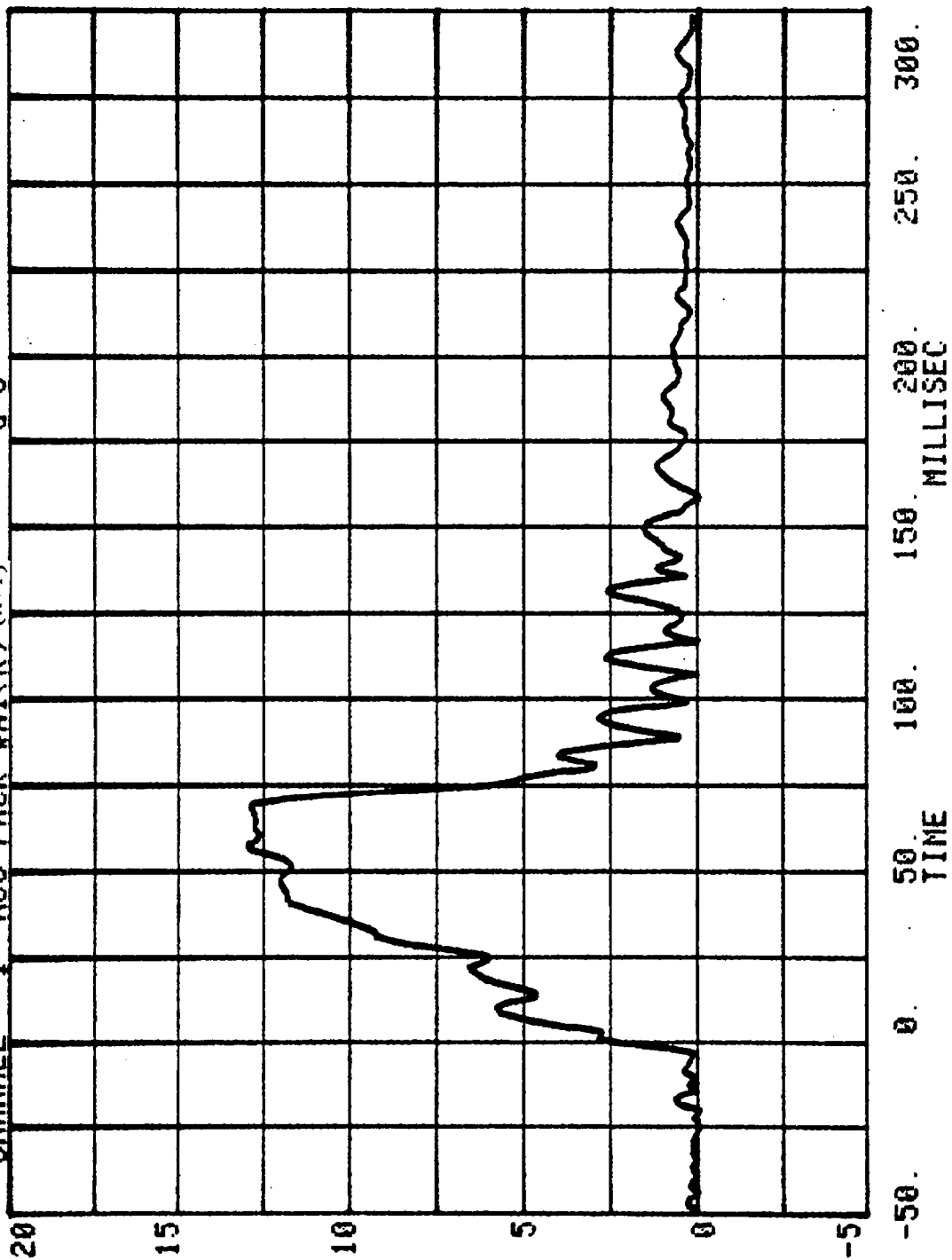
RUN= 535 SERIES= 2 G'S
CHANNEL 2 ACC PACK #A1(Y)



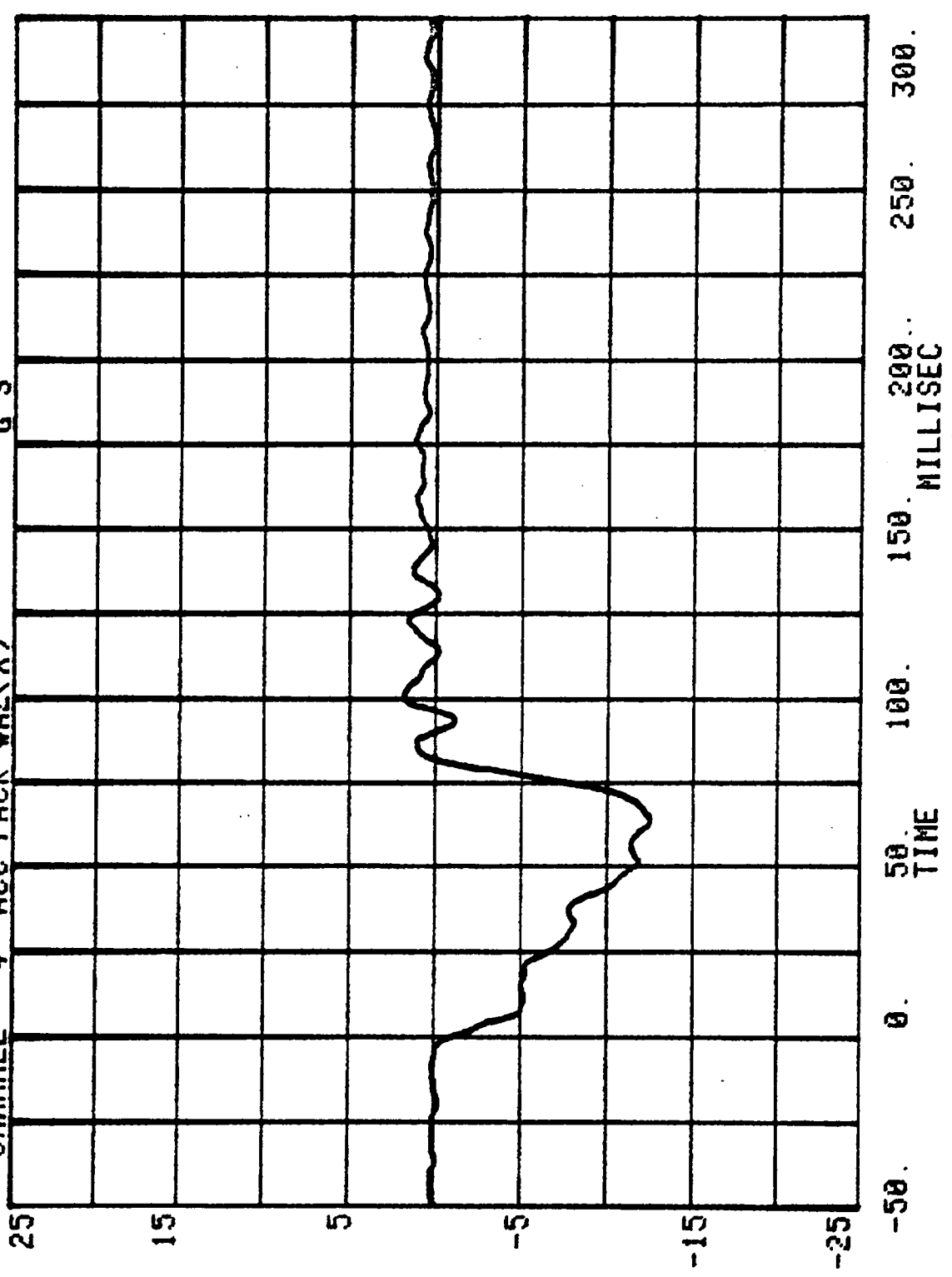
CHANNEL 3 ACC PACK #A1(Z) RUN= 535 SERIES= 2 G'S

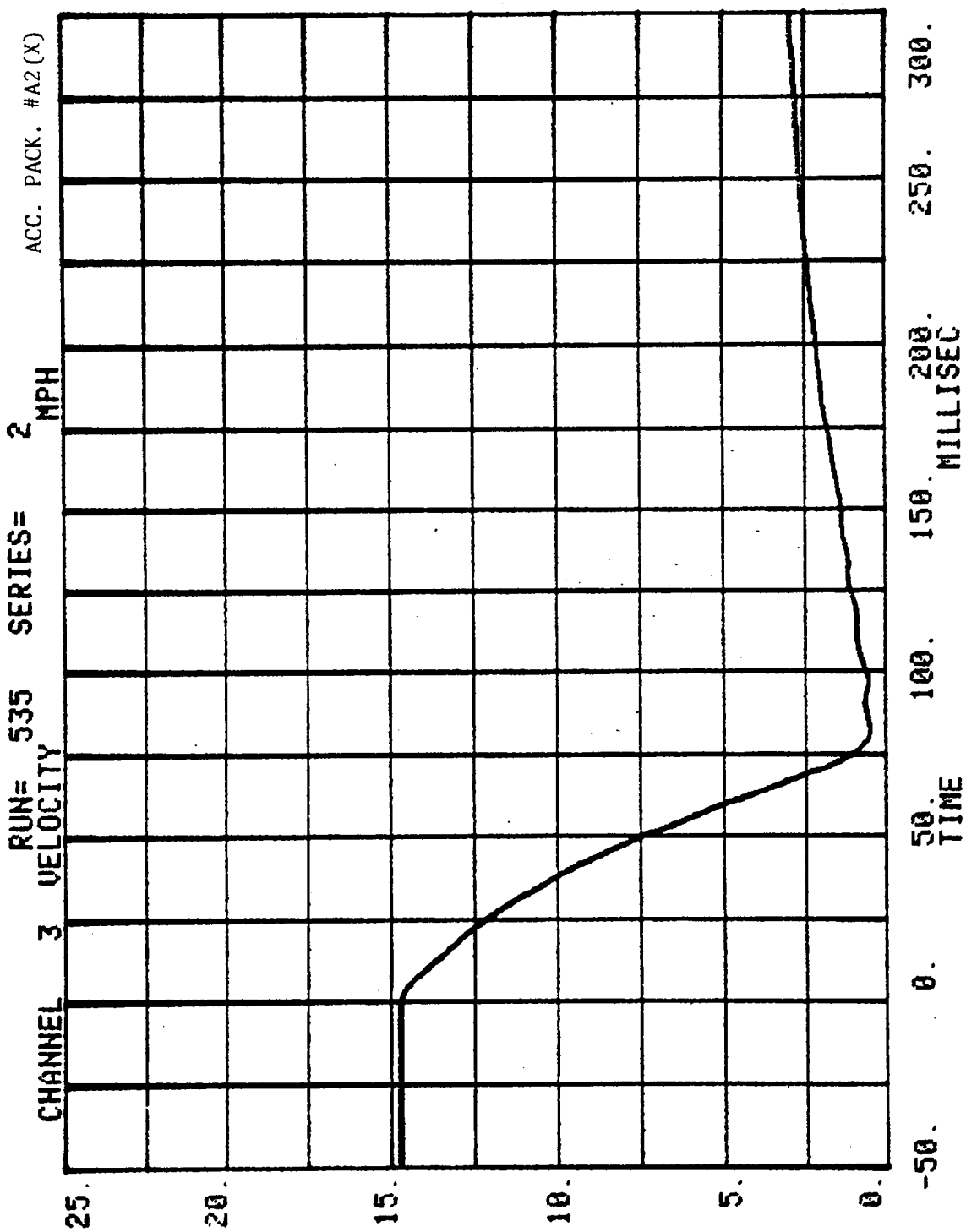


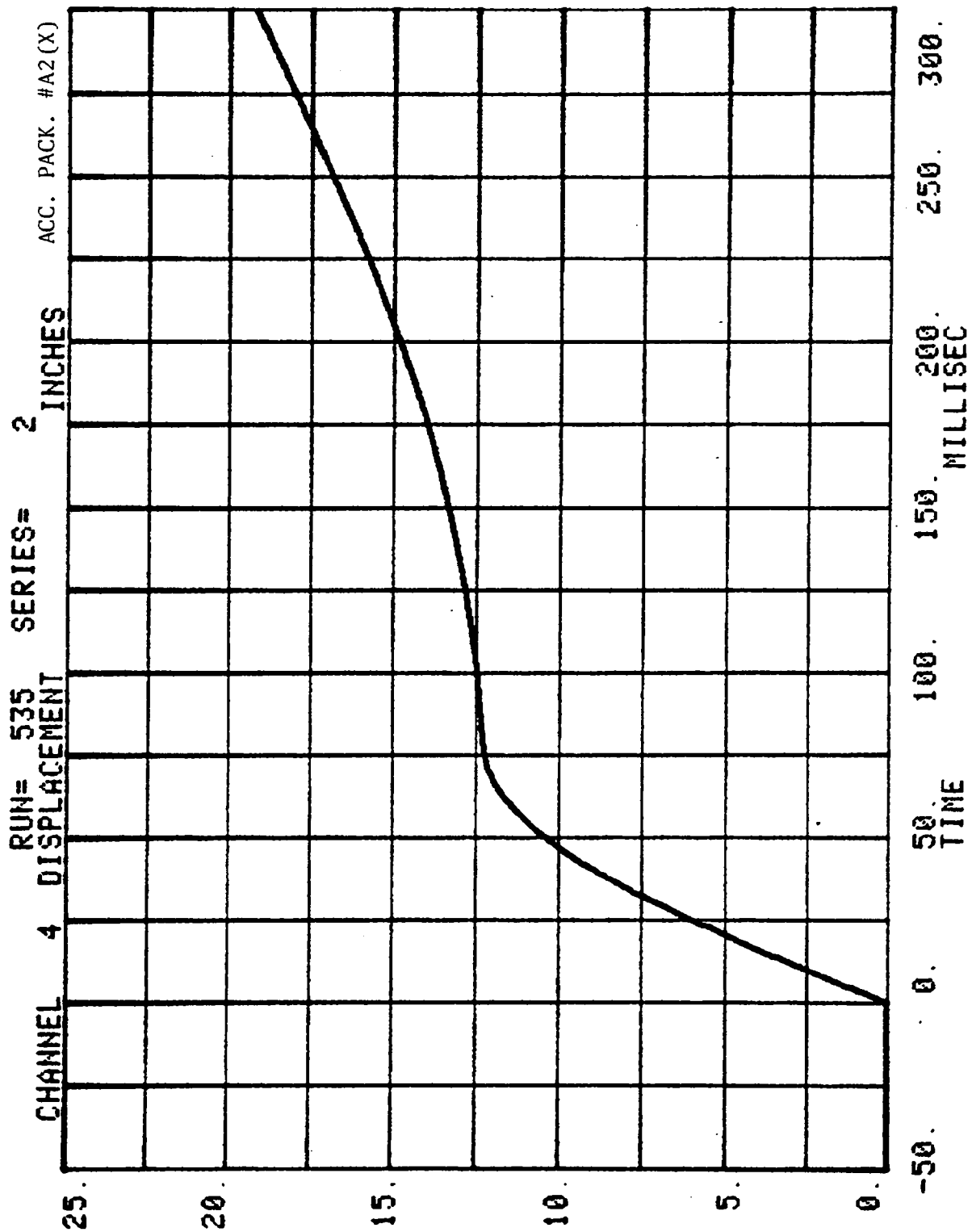
CHANNEL 1 ACC PACK #A1(R) (X+Y) RUN= 535 SERIES= 2 G'S

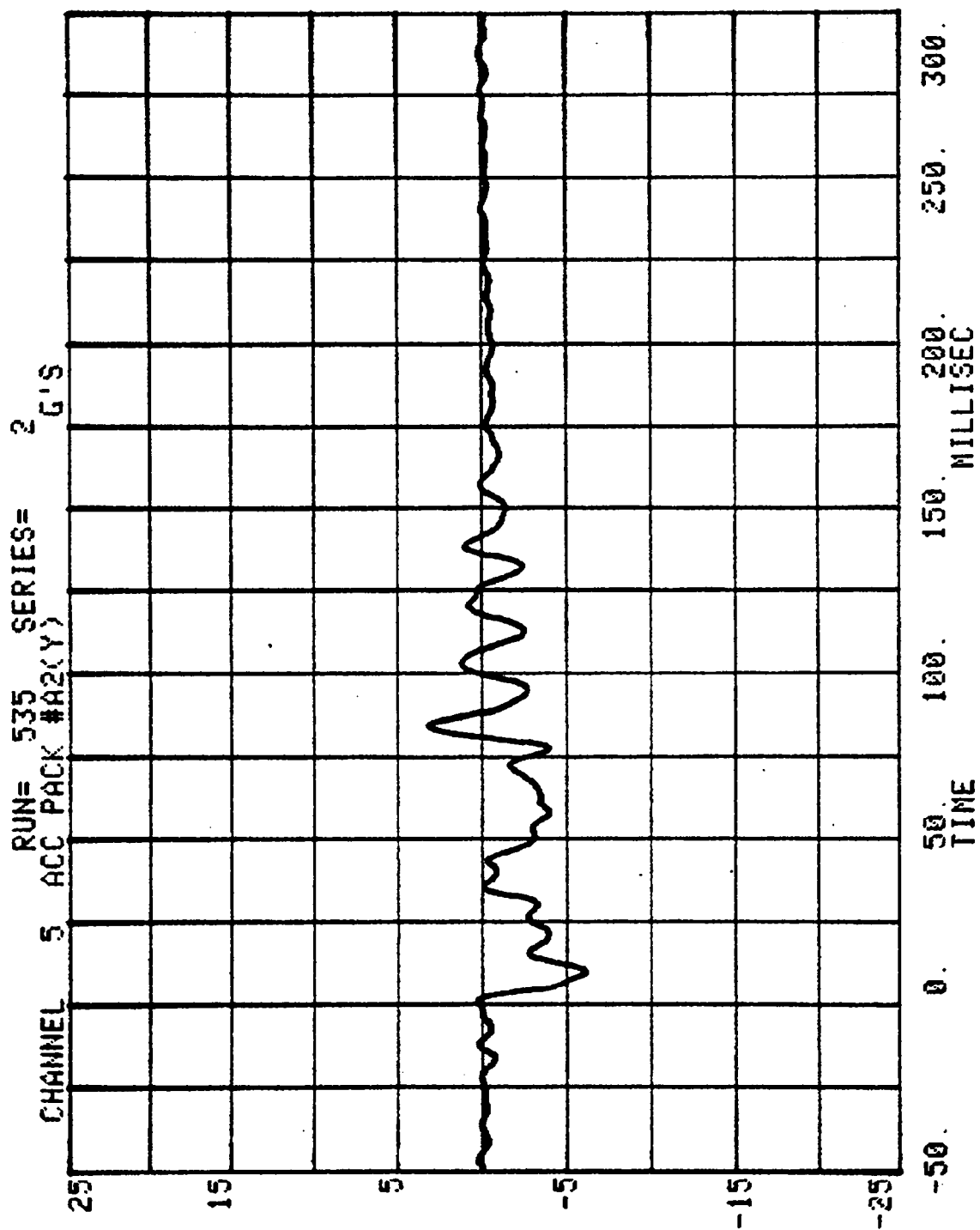


CHANNEL 4 ACC PACK #A2(X) RUN= 535 SERIES= 2 G'S

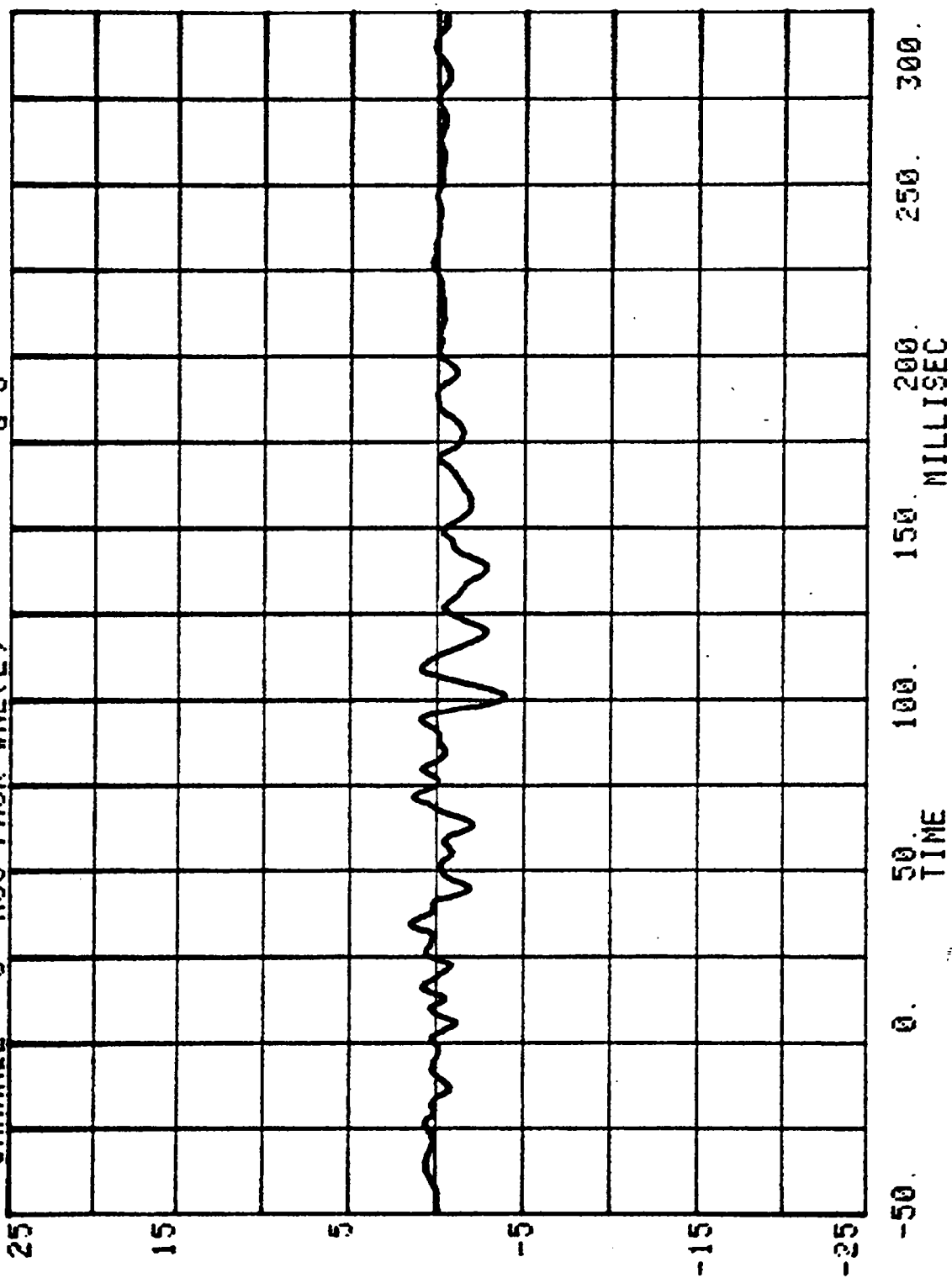




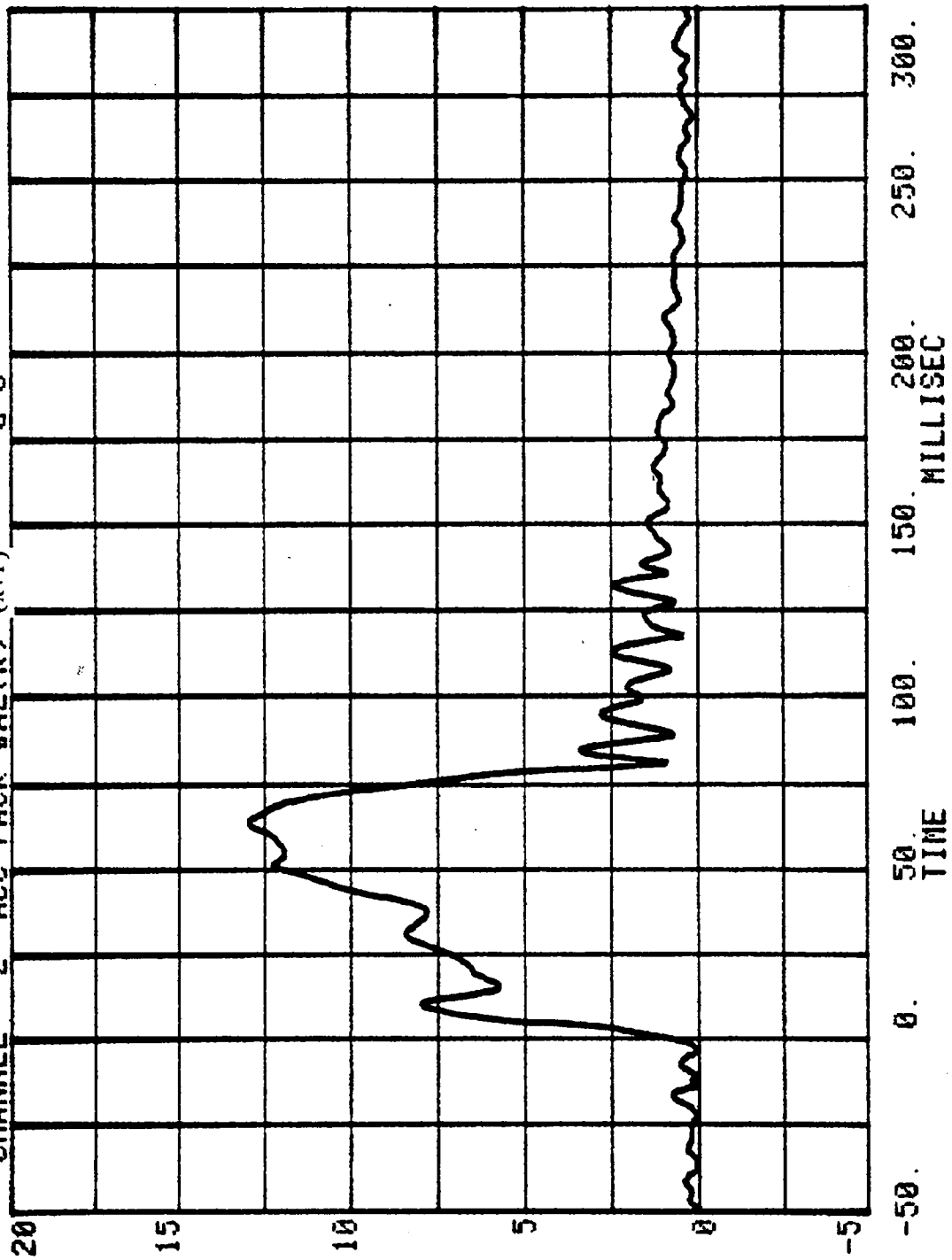


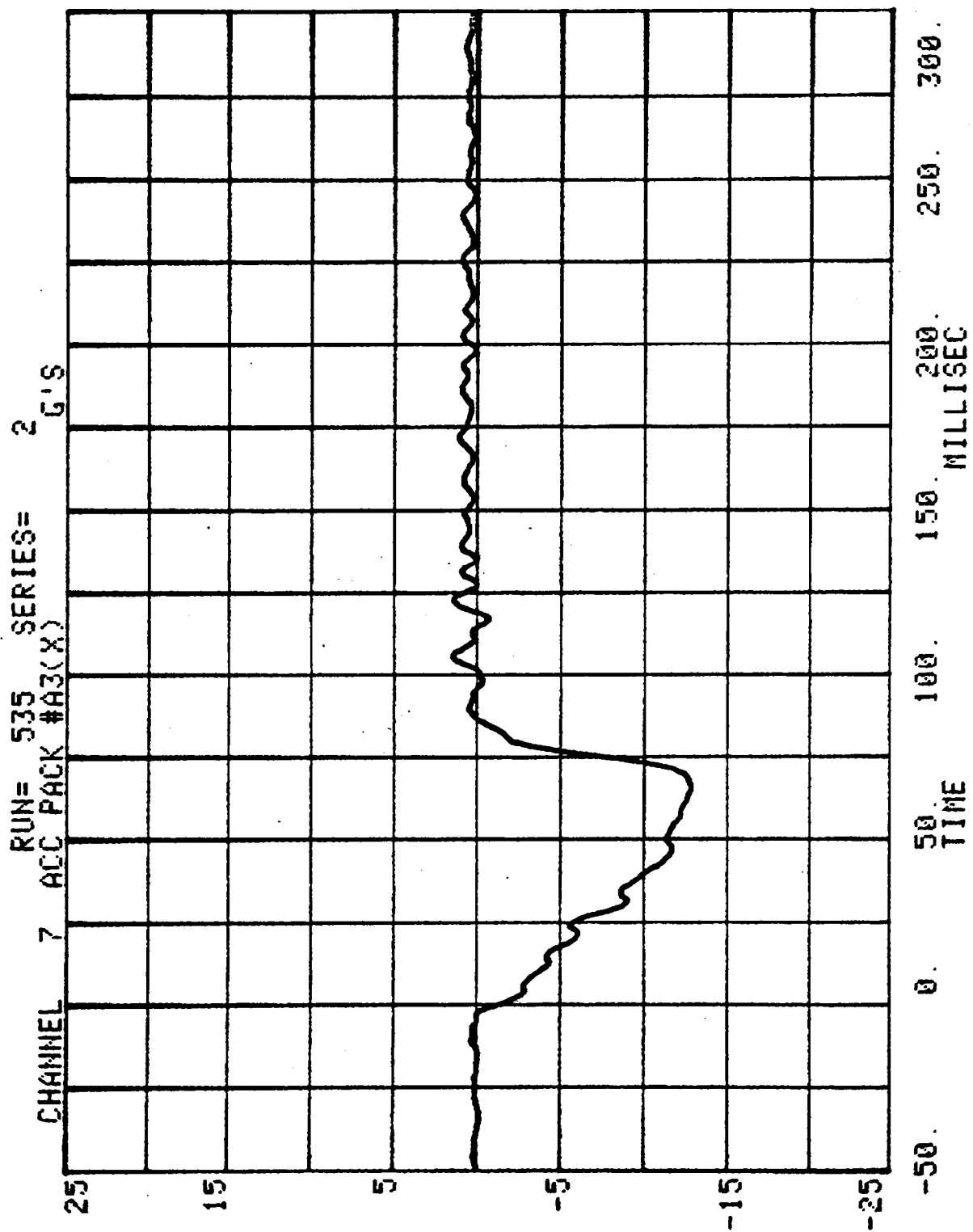


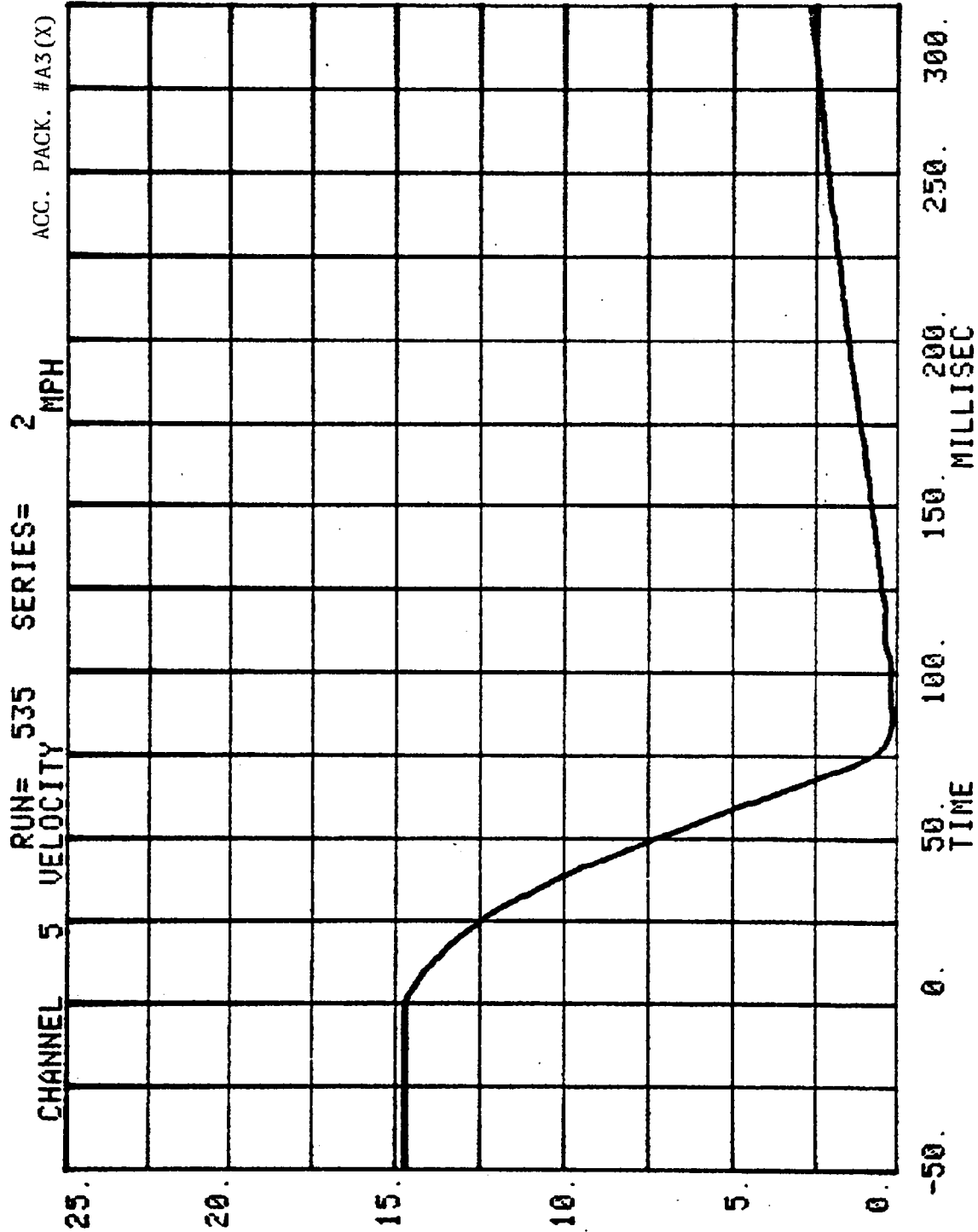
CHANNEL 6 ACC PACK #A2(Z) RUN= 535 SERIES= 2 G'S

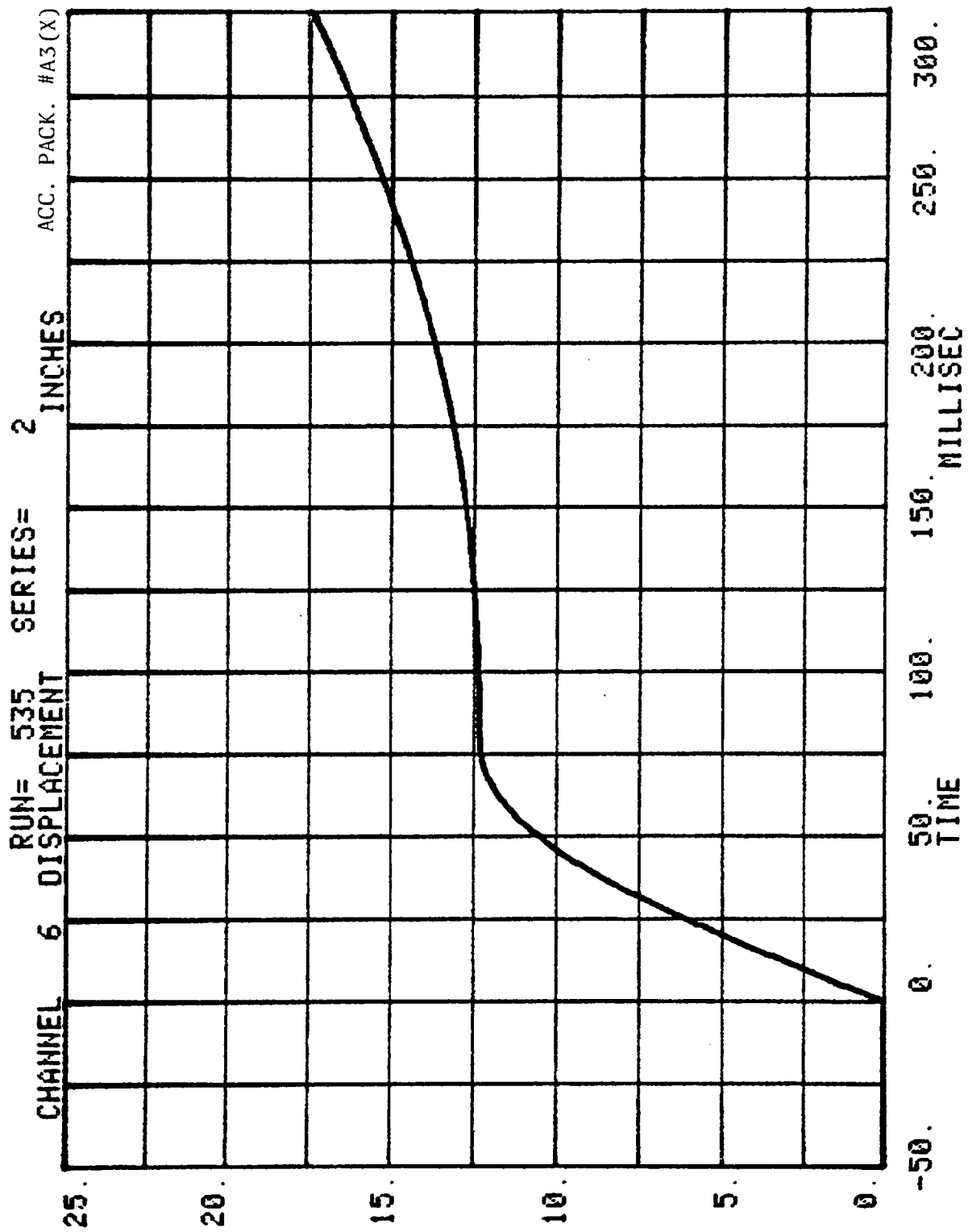


RUN= 535 SERIES= 2
CHANNEL 2 ACC PACK #A2(R) (X+Y) G'S

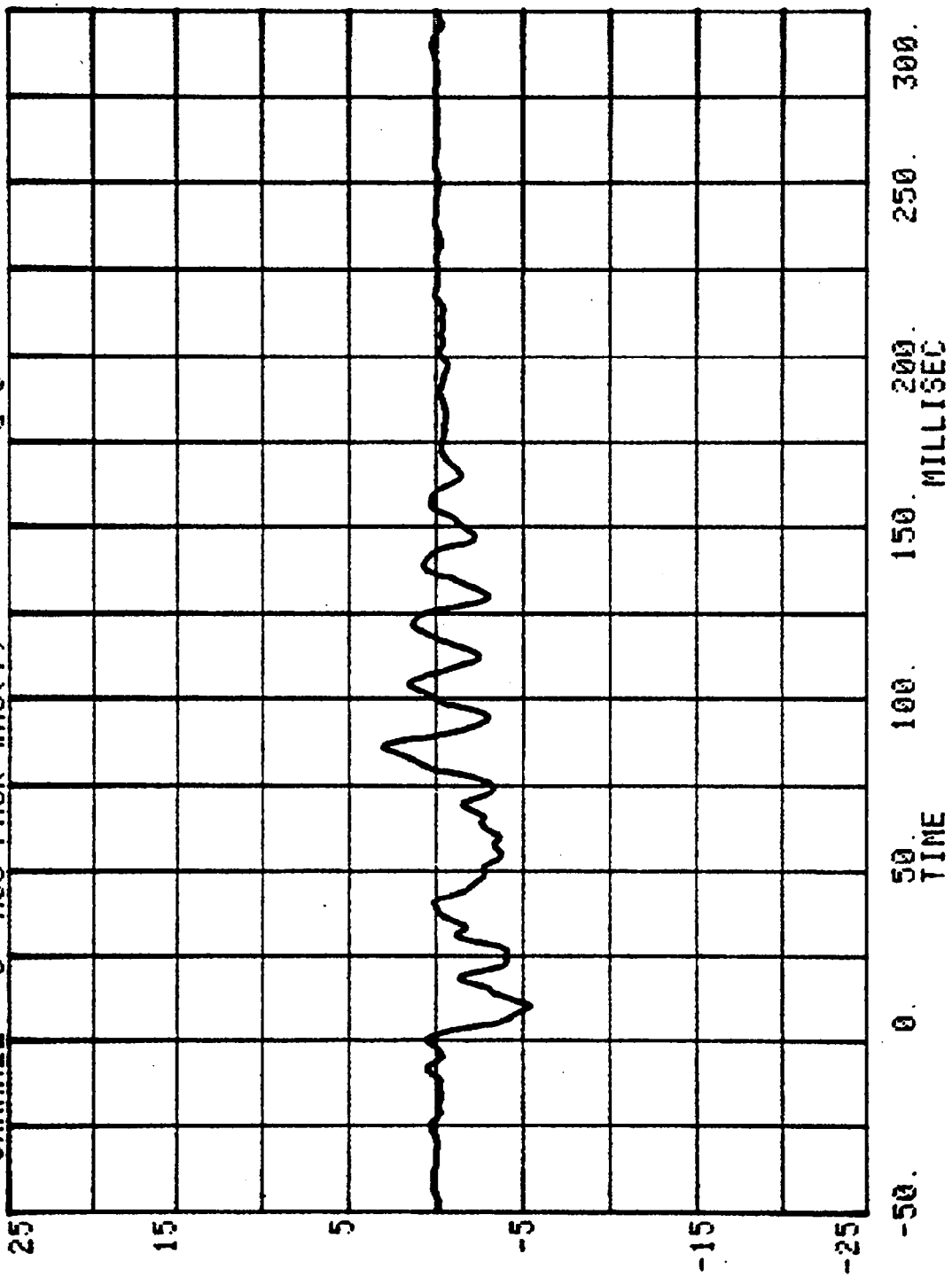




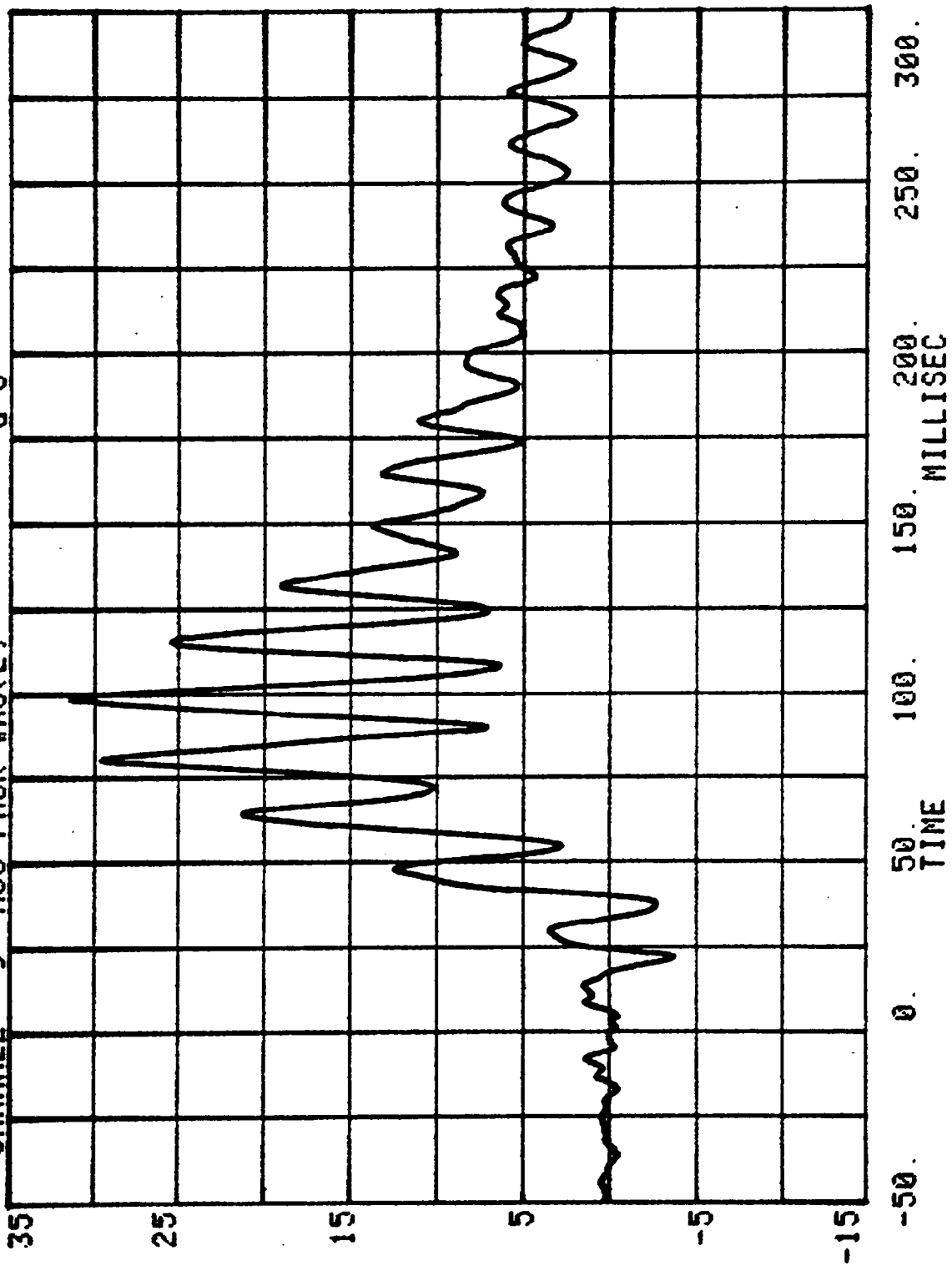




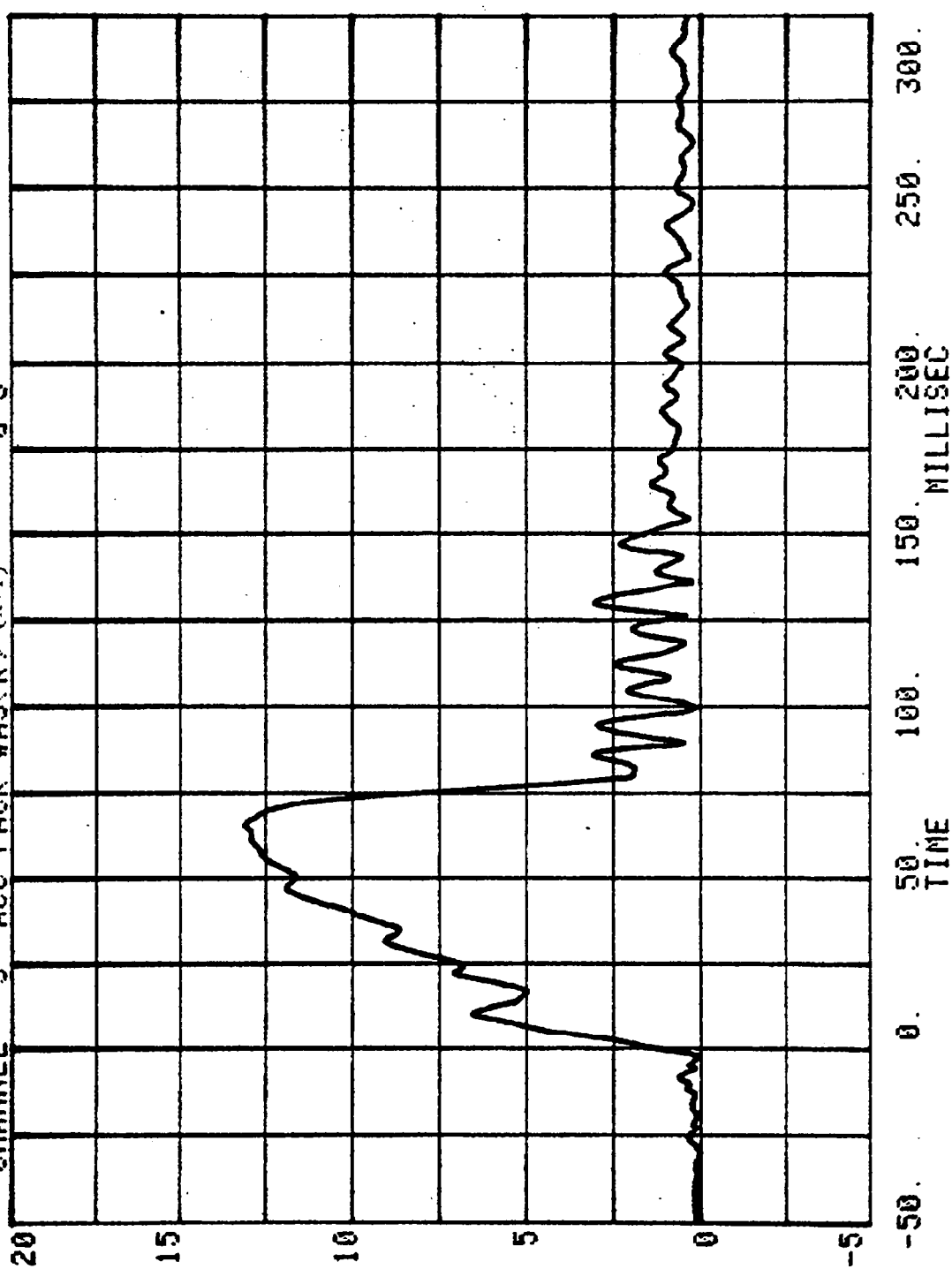
CHANNEL 8 ACC PACK #A3(Y) RUN= 535 SERIES= 2 G'S



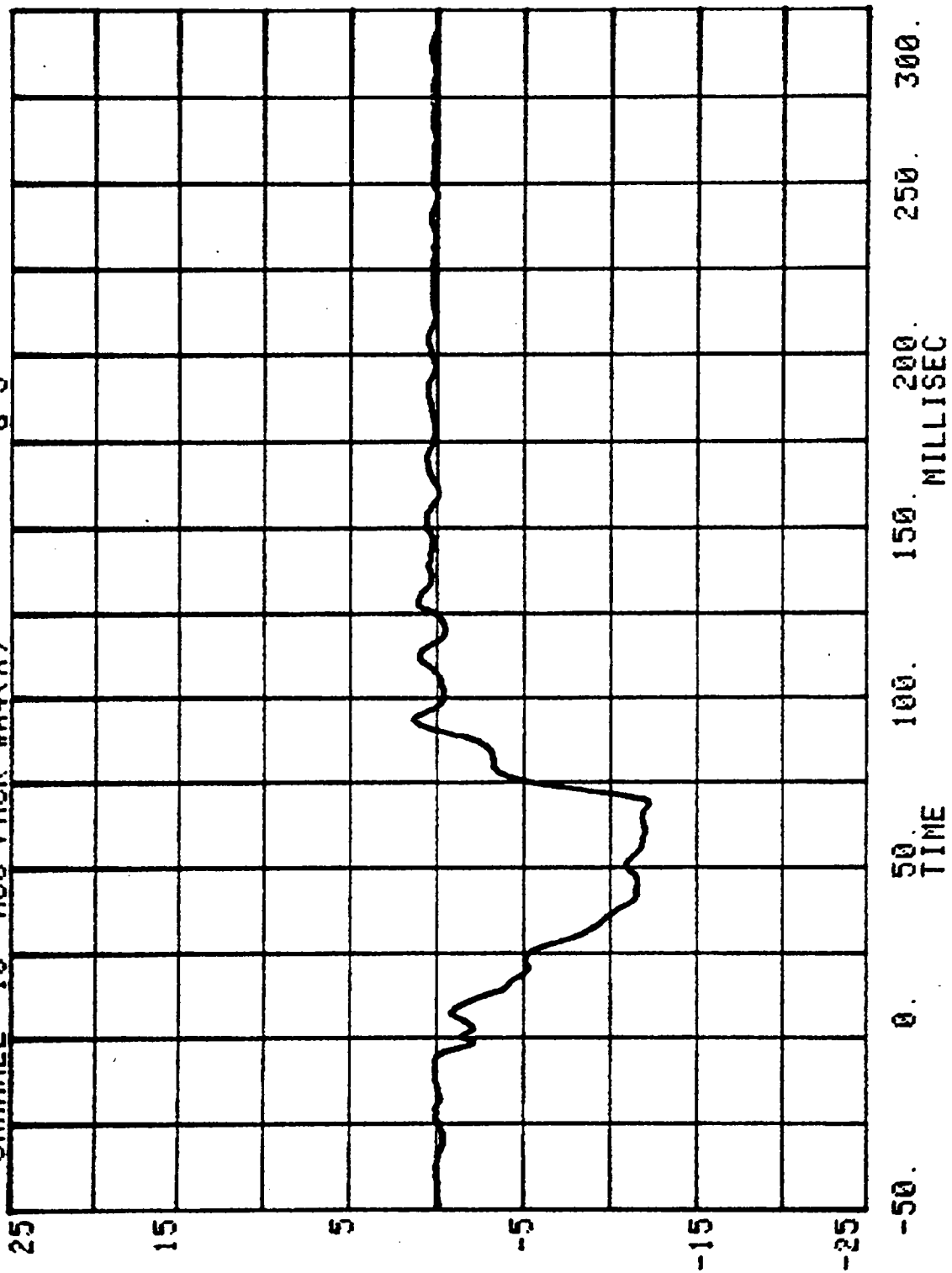
CHANNEL 9 ACC PACK #A3(Z) RUN= 535 SERIES= 2 G'S

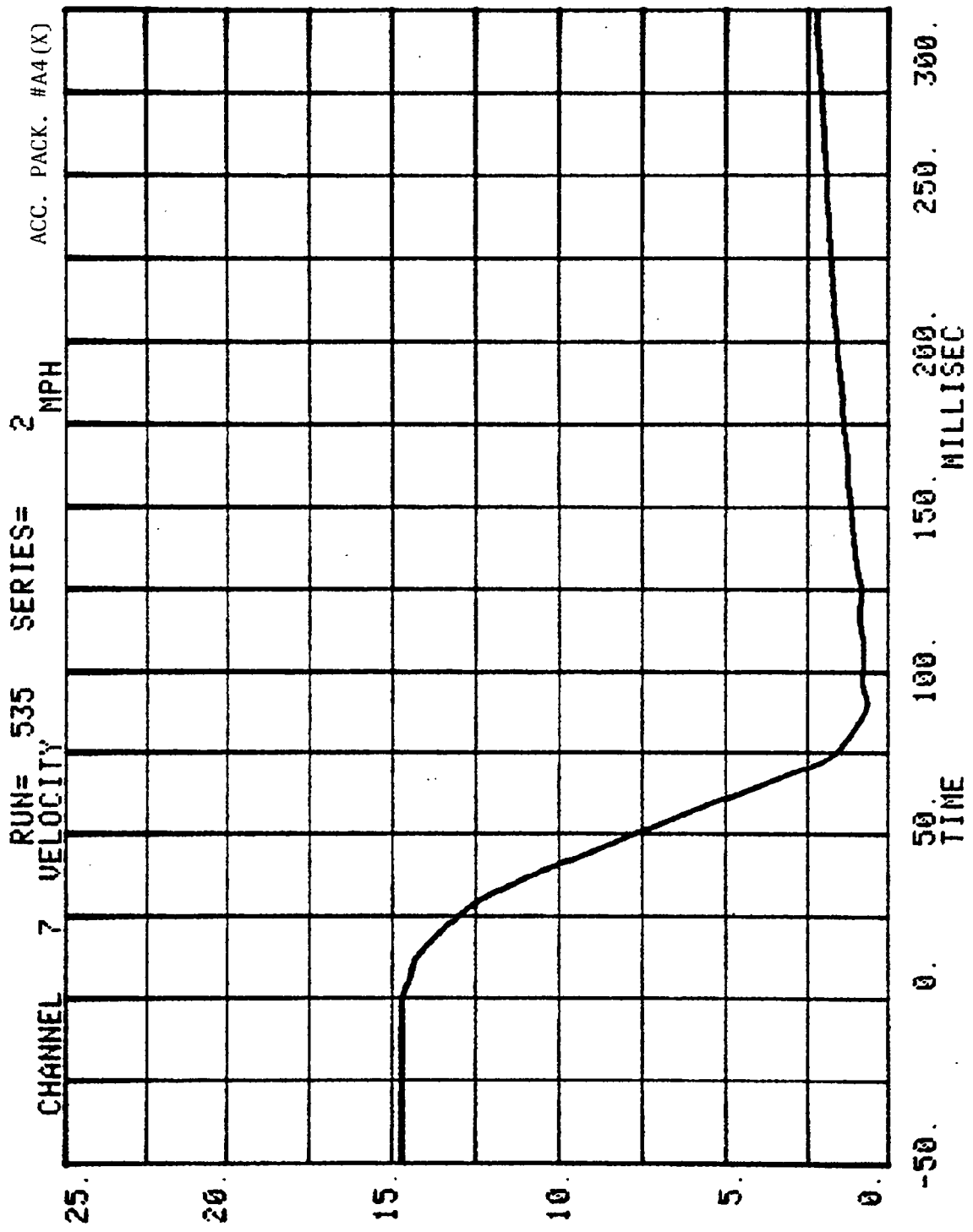


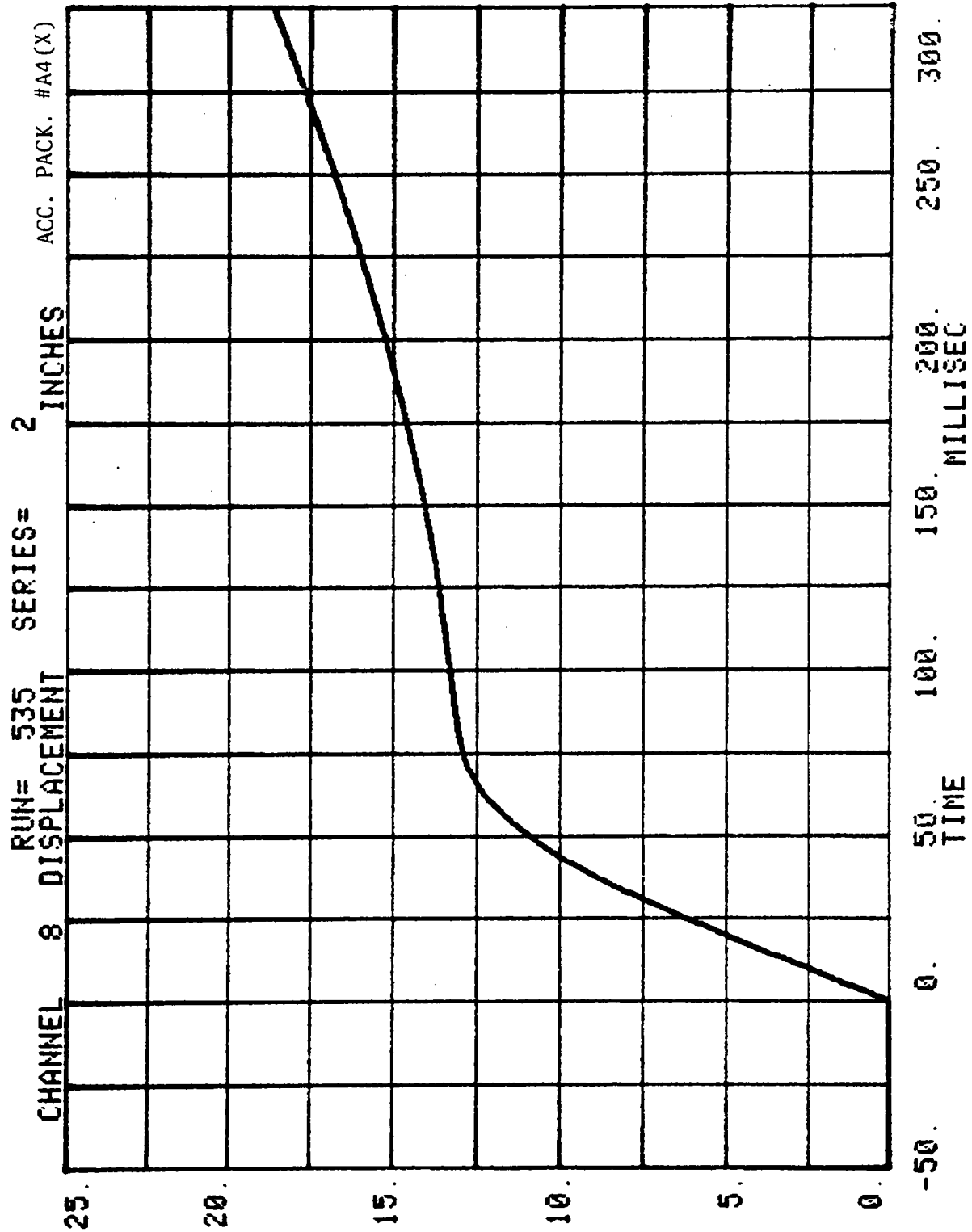
CHANNEL 3 ACC PACK #A3(R) (X+Y) RUN= 535 SERIES= 2 G'S



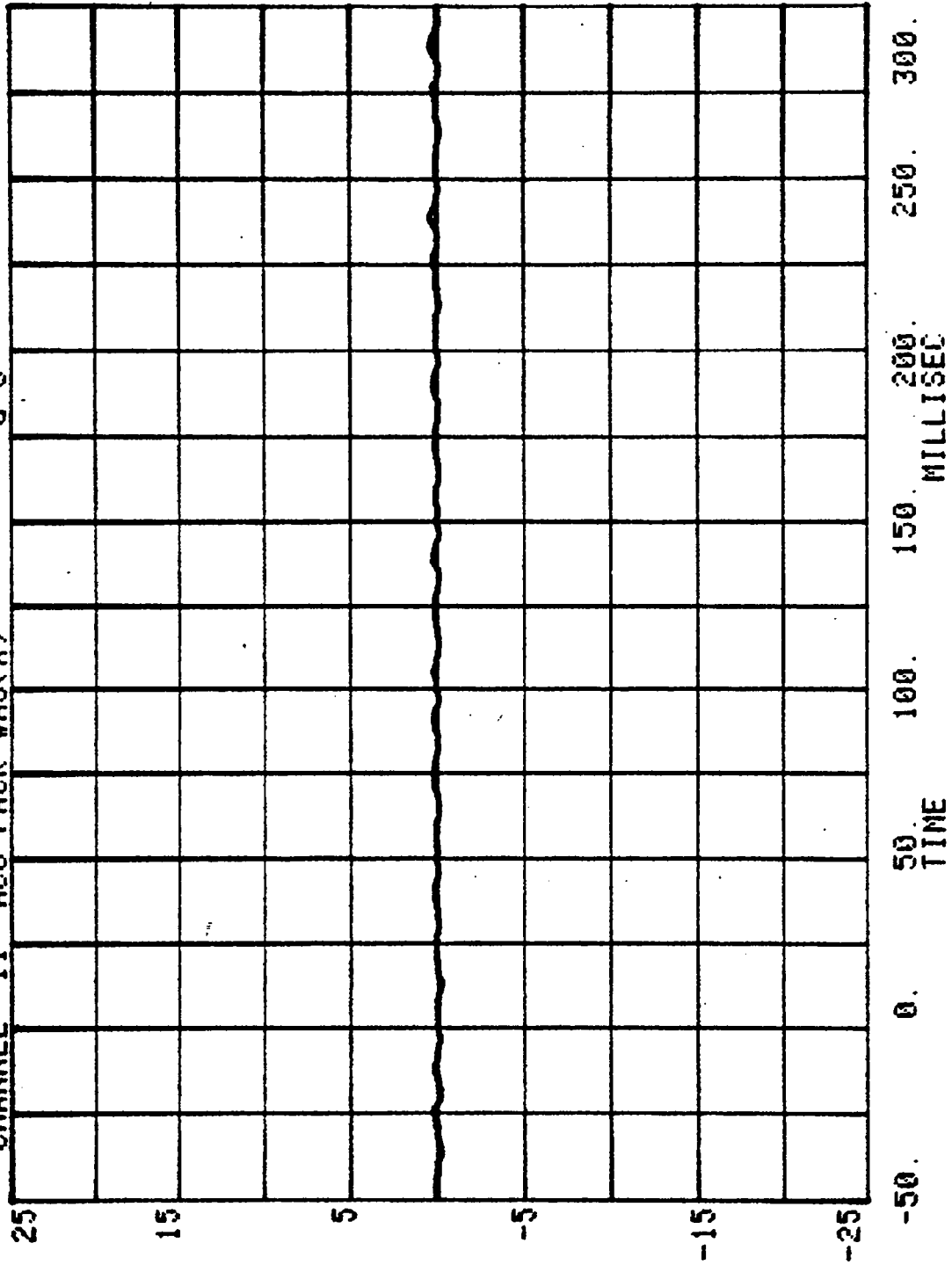
RUN= 535 SERIES= 2
CHANNEL 10 ACC PACK #A4(X) G'S



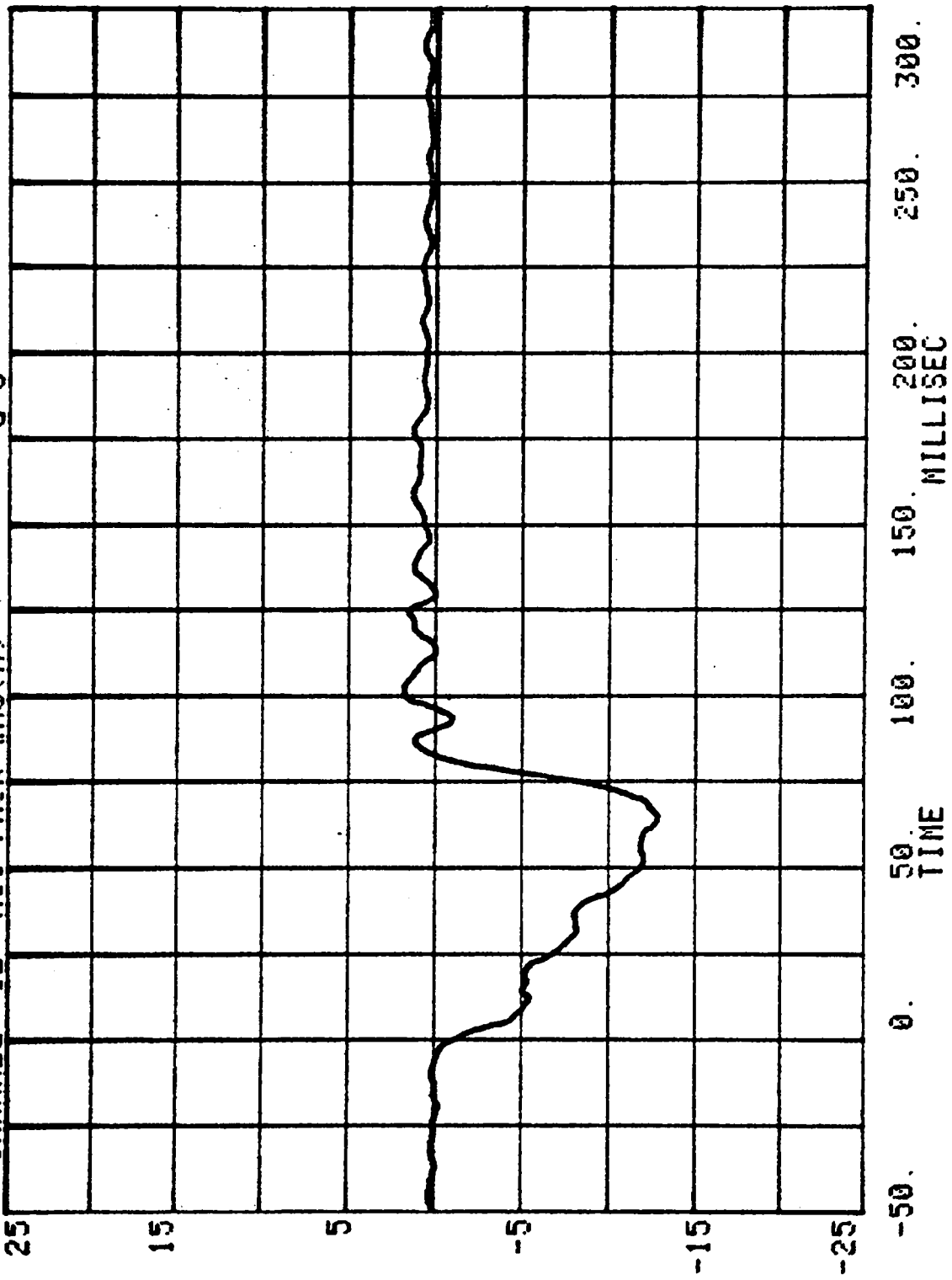


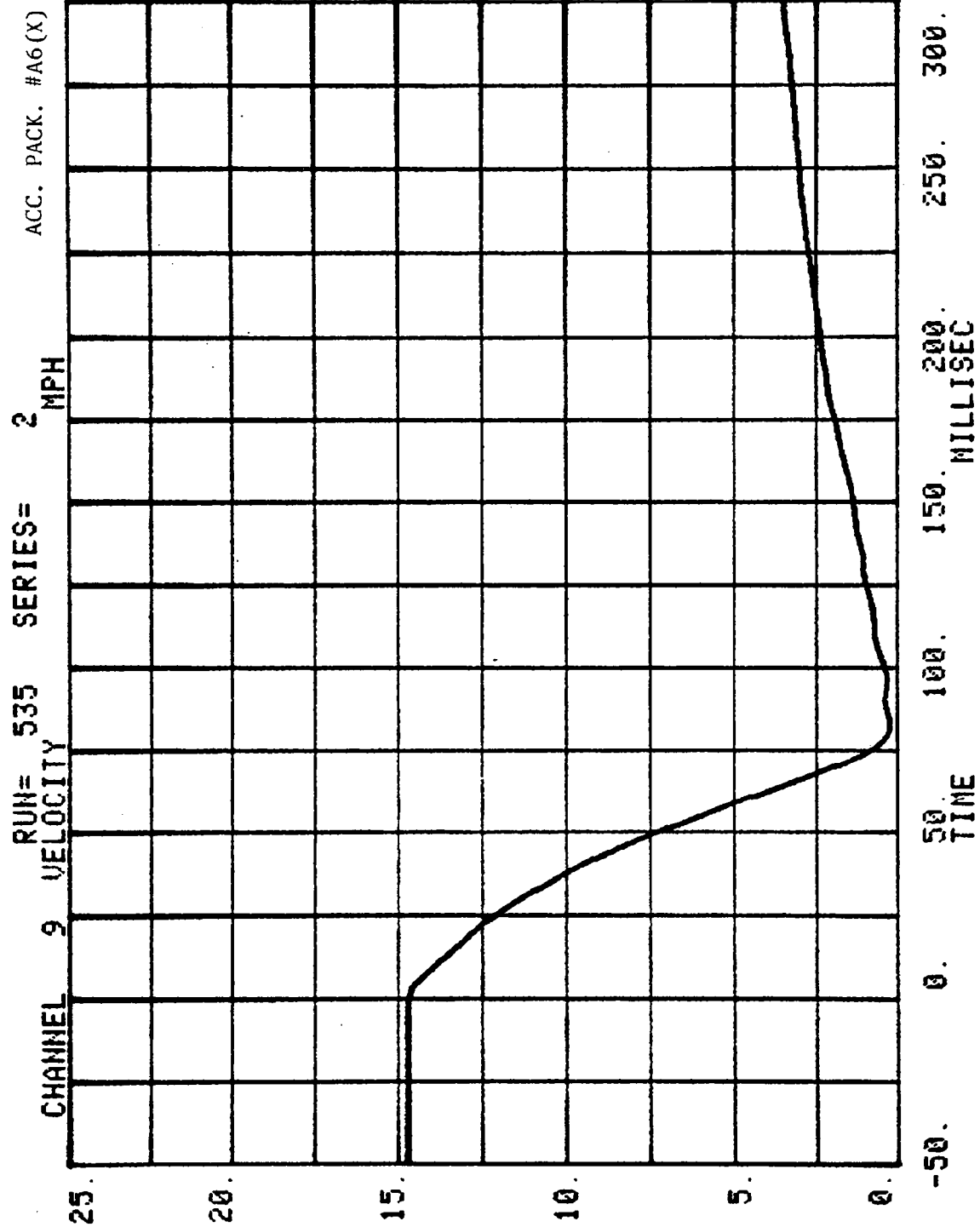


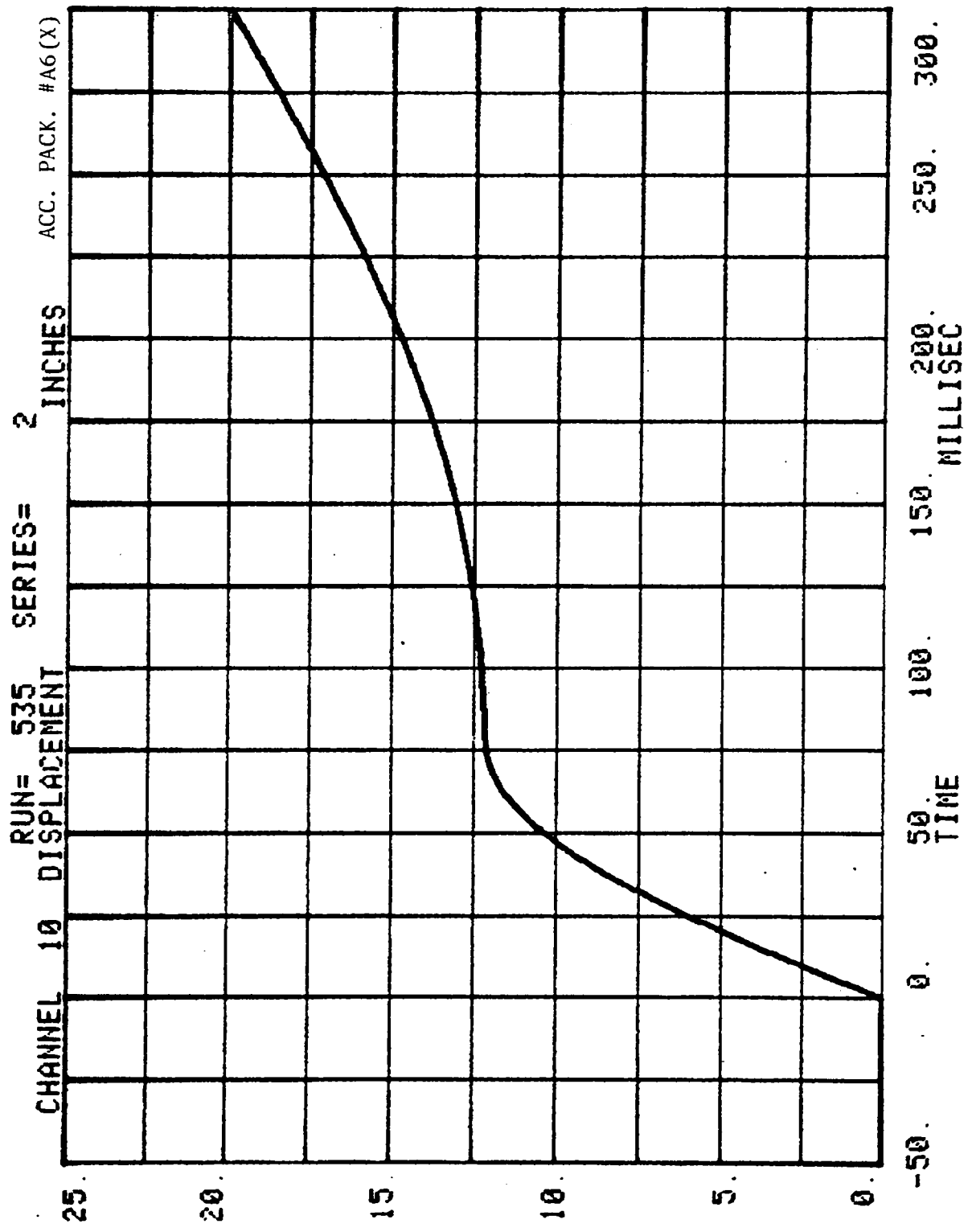
CHANNEL 11 RUN= 535 SERIES= 2 G'S
ACC PACK #A5(X)



CHANNEL 12 ACC PACK #A6(X) RUN= 535 SERIES= 2 G'S





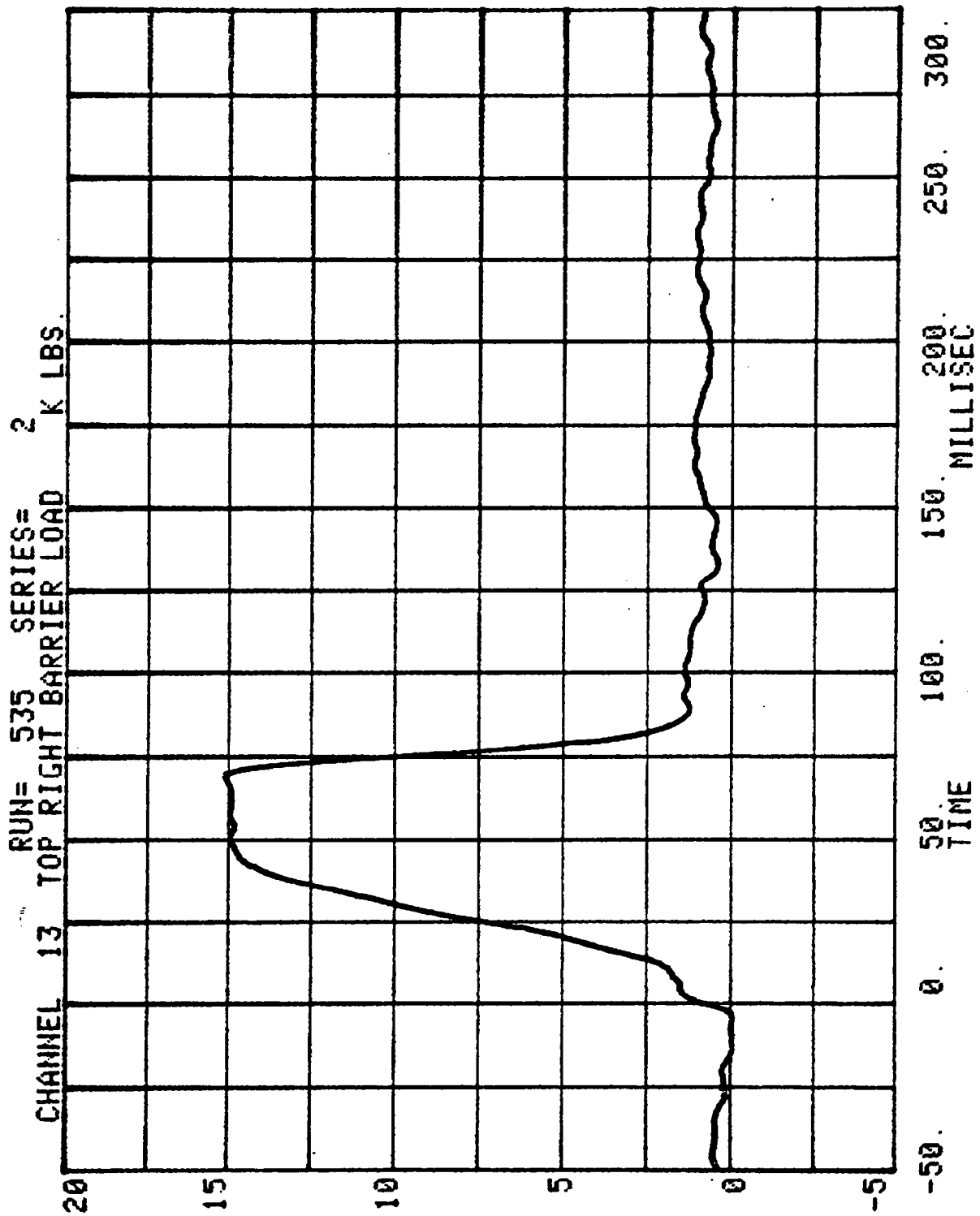


MOVING BARRIER LOAD CELL DATA

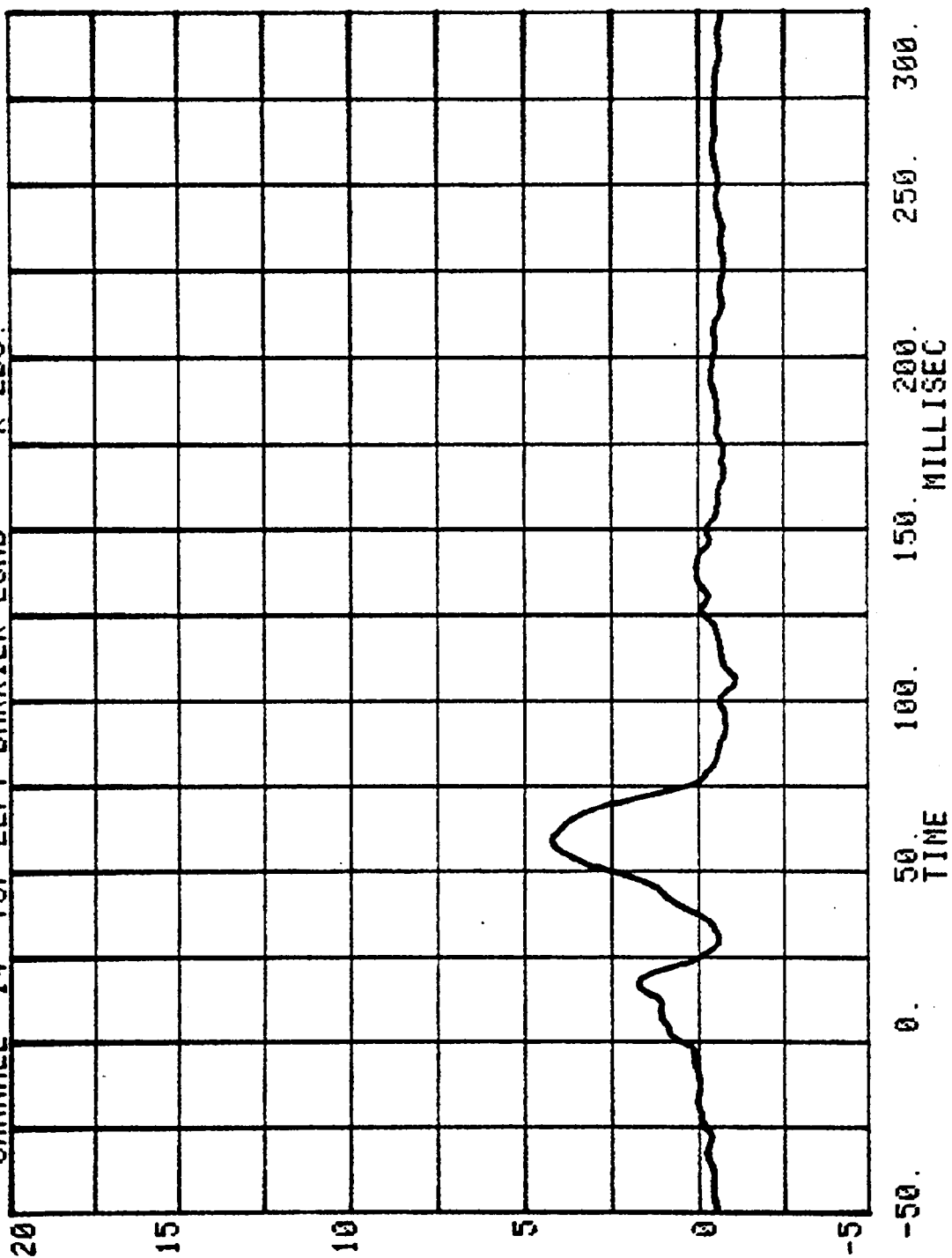
TEST NO. 2

VEHICLE LOAD CELL DATA

FILTER CLASS 60

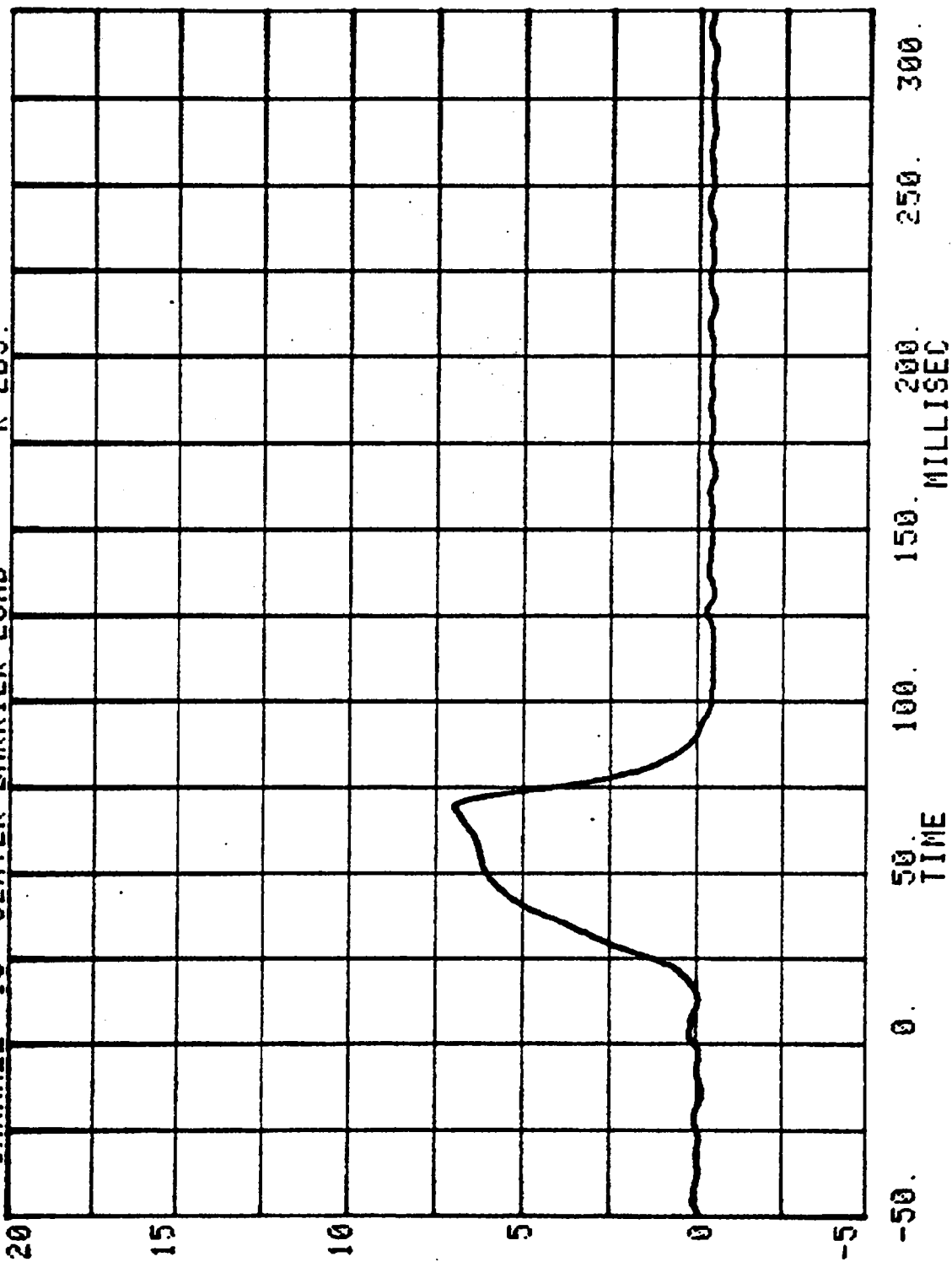


RUN= 535 SERIES= 2
CHANNEL 14 TOP LEFT BARRIER LOAD K LBS.



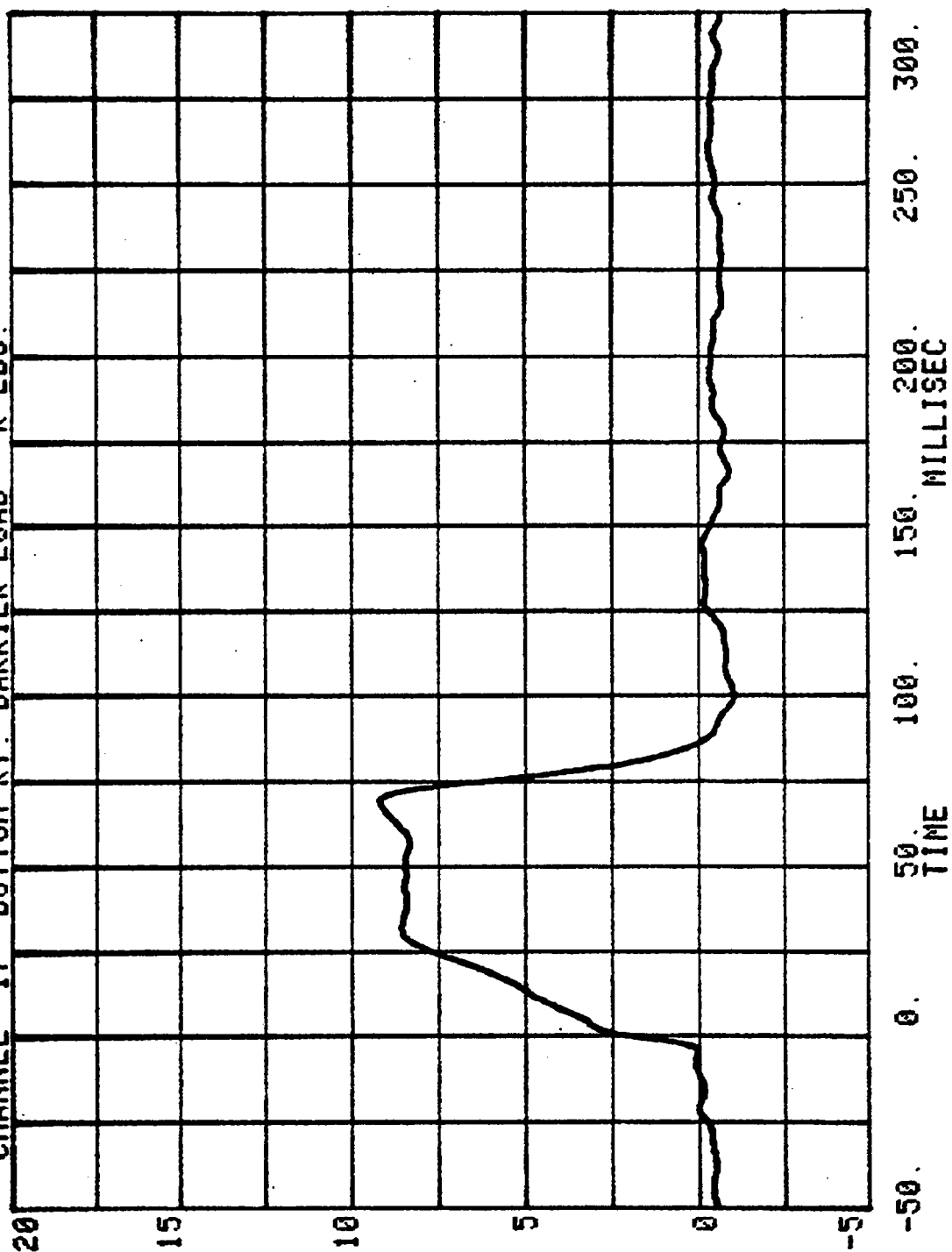
CHANNEL 15 CENTER BARRIER LOAD K LBS.

RUN= 535 SERIES= 2



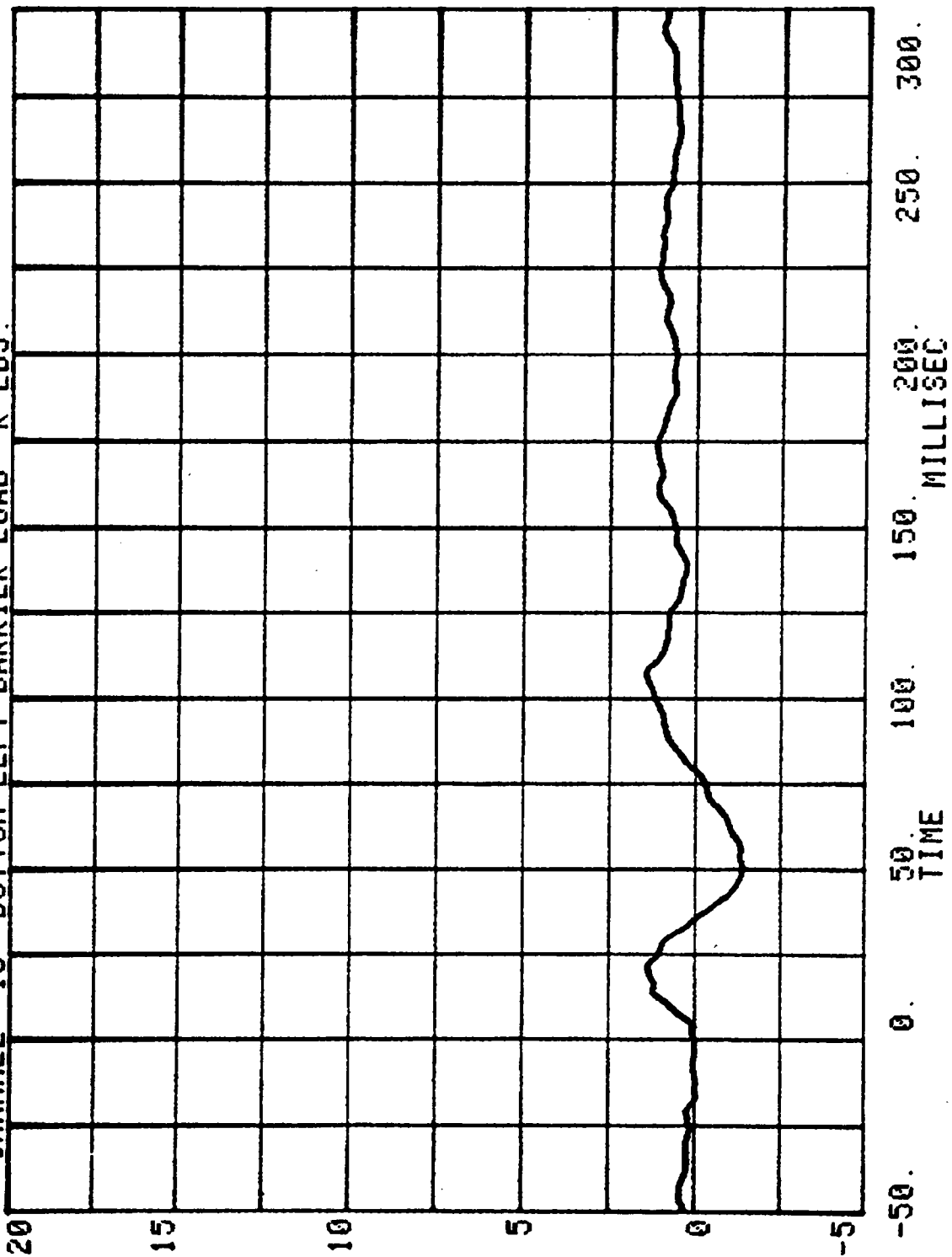
CHANNEL 17 BOTTOM RT. BARRIER LOAD K LBS.

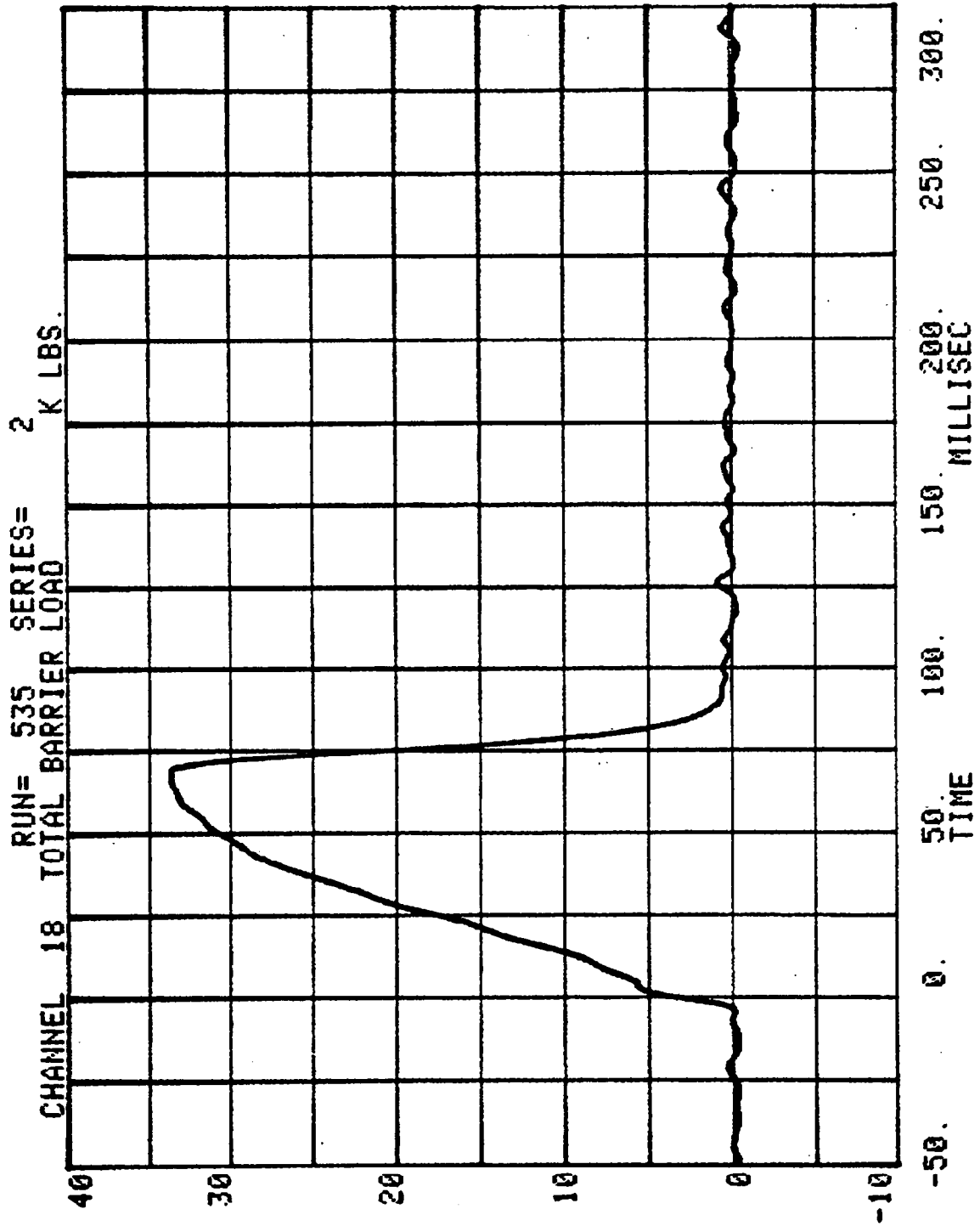
RUN= 535 SERIES= 2



CHANNEL 16 BOTTOM LEFT BARRIER LOAD K LBS.

RUN= 535 SERIES= 2





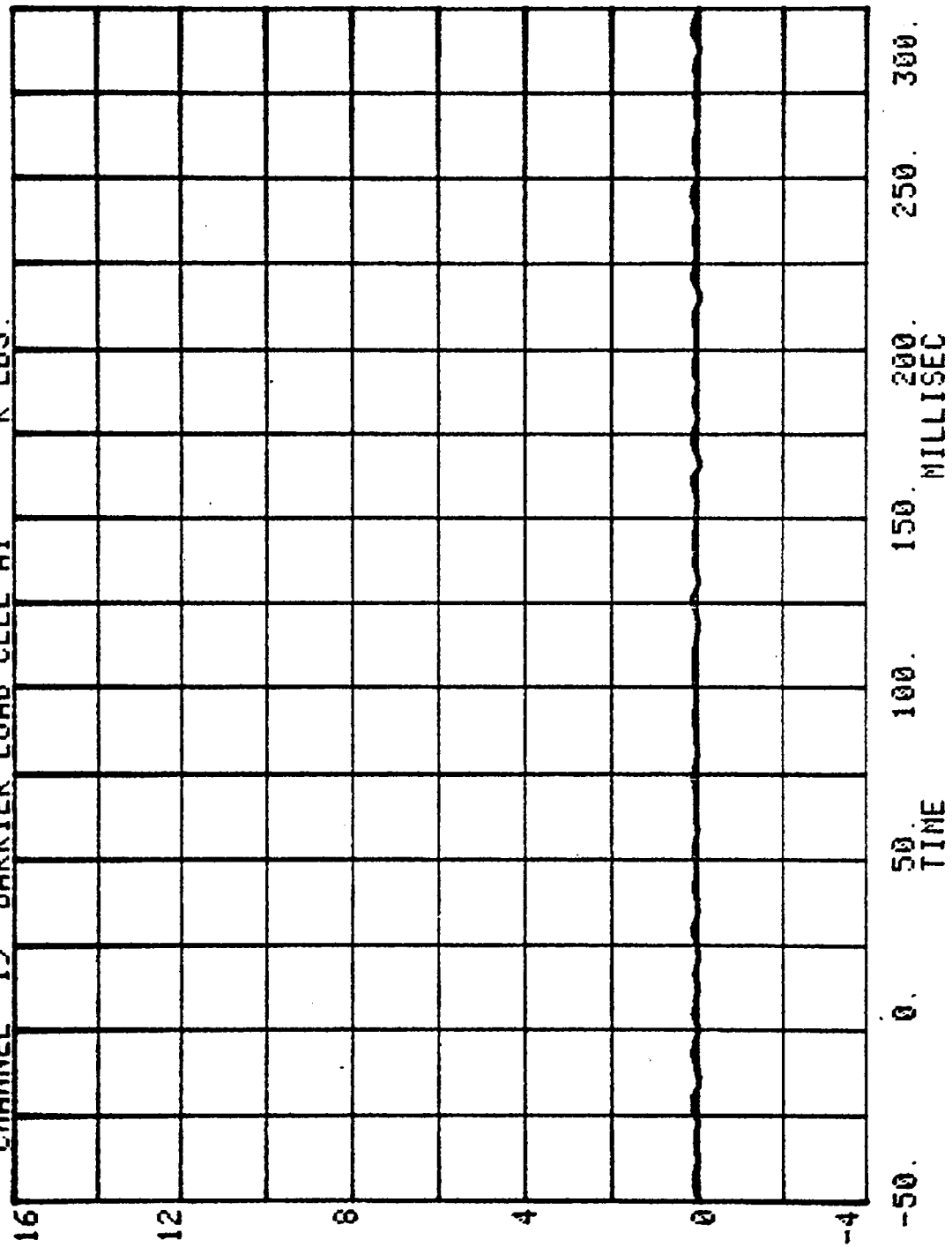
FIXED BARRIER LOAD CELL DATA

TEST NO. 2

FIXED BARRIER LOAD CELL DATA

FILTER CLASS 60

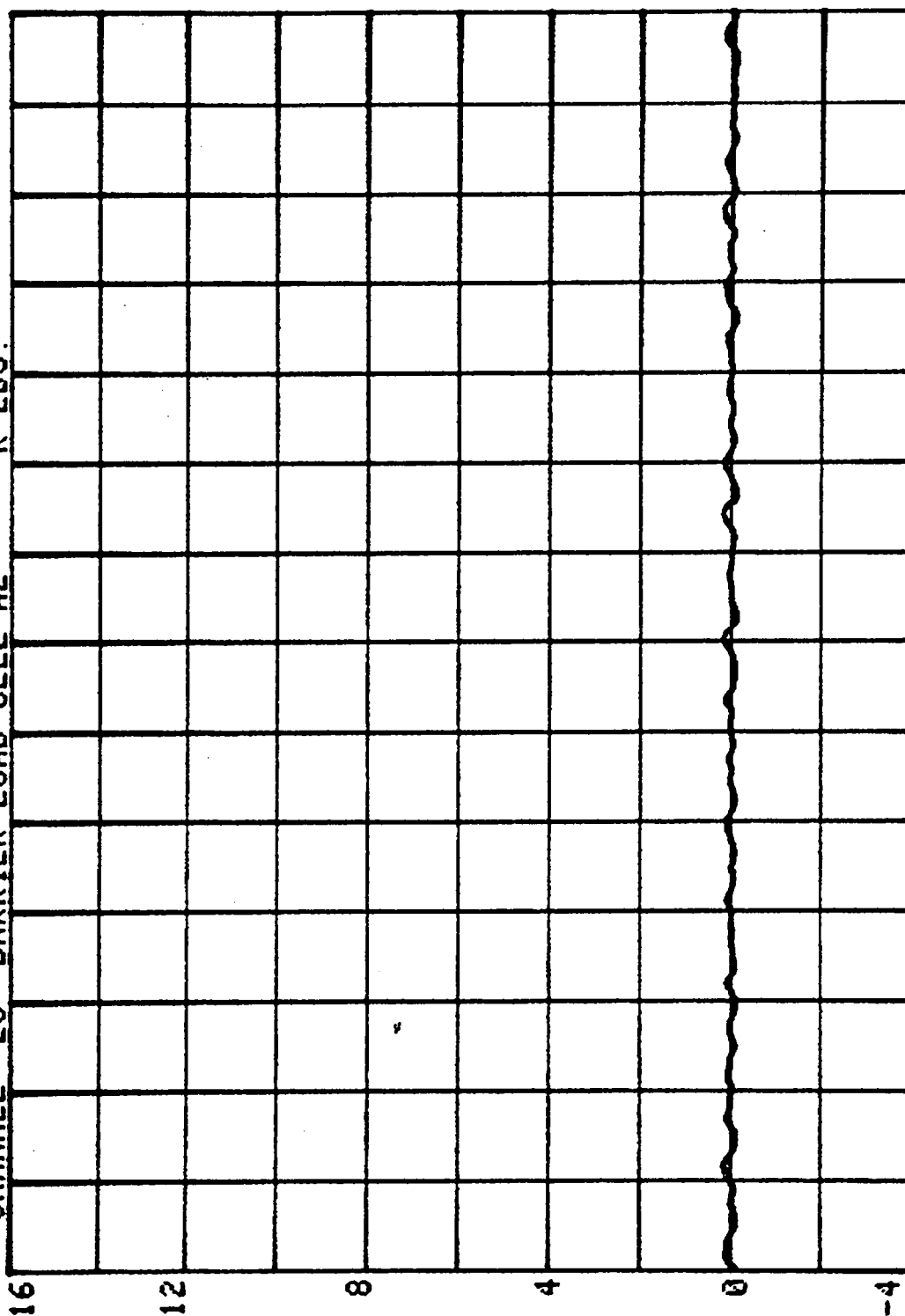
CHANNEL 19 BARRIER LOAD CELL A1 RUN= 535 SERIES= 2 K LBS.



CHANNEL 20 BARRIER LOAD CELL A2

RUN= 535 SERIES=

2 K LBS.

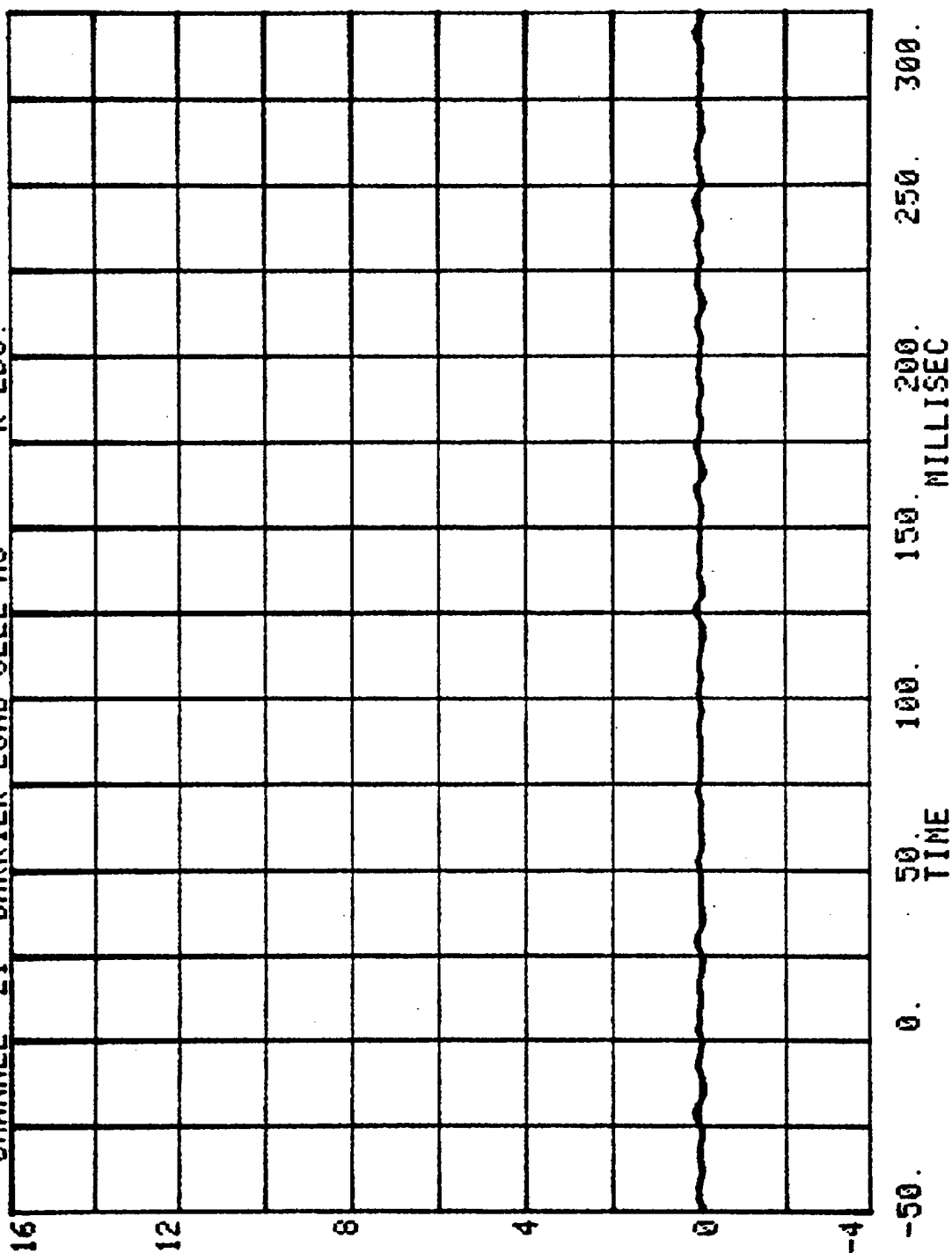


TIME

CHANNEL 21 BARRIER LOAD CELL A3

RUN= 535 SERIES= 2

K LBS.

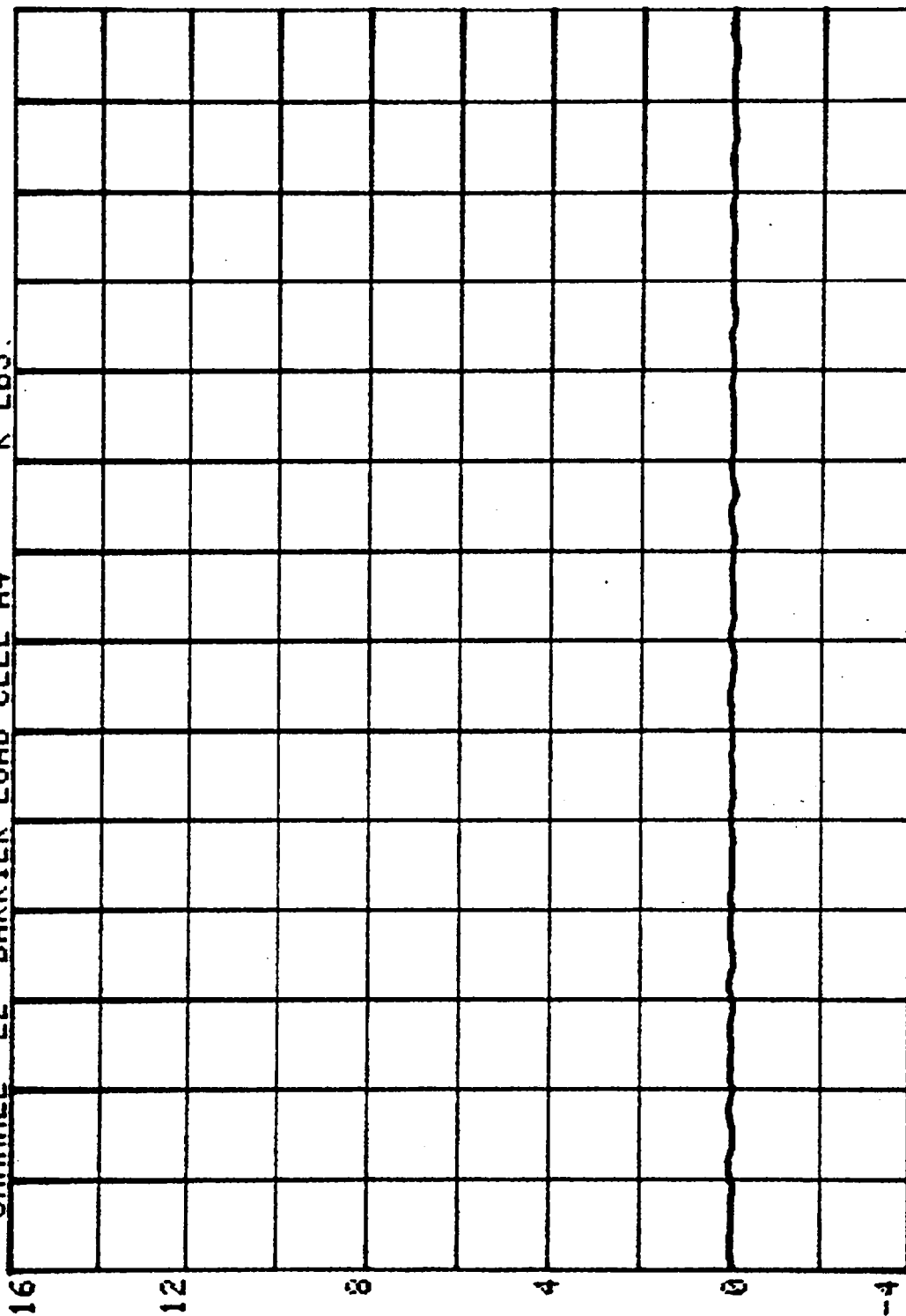


CHANNEL 22 BARRIER LOAD CELL A4

RUN= 535 SERIES=

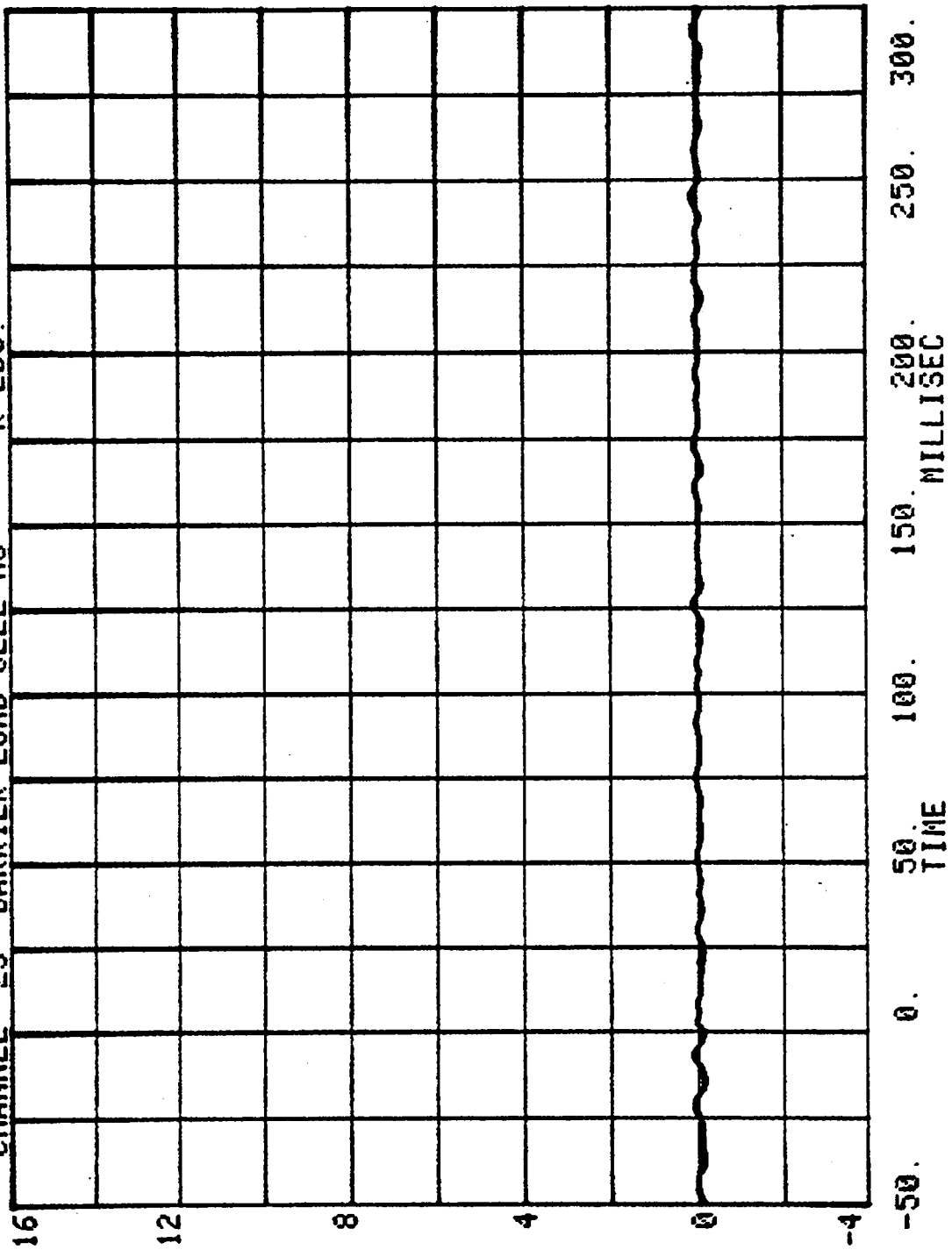
2

K LBS.

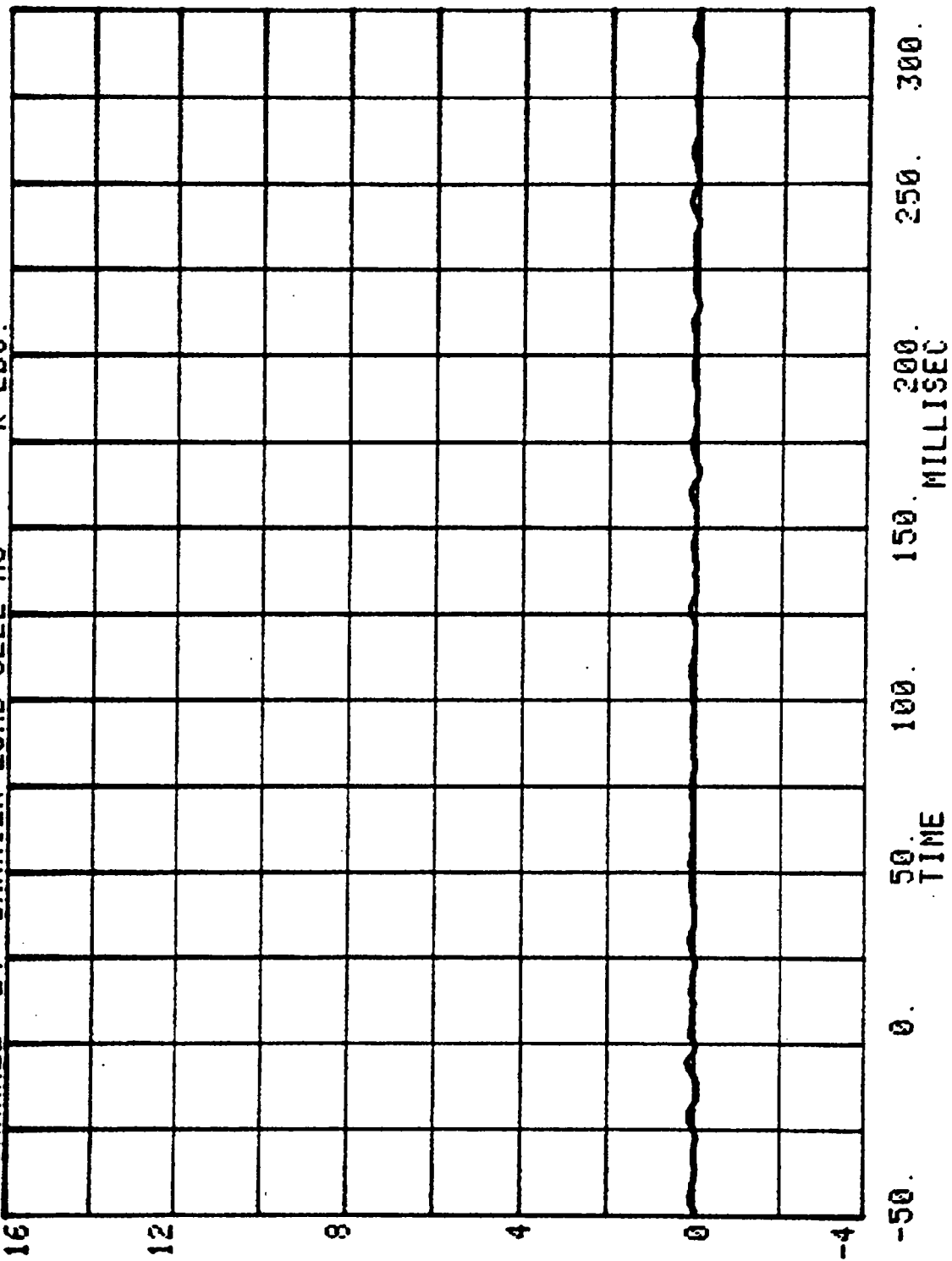


-50. 0. 50. 100. 150. 200. 250. 300.
TIME
MILLISEC

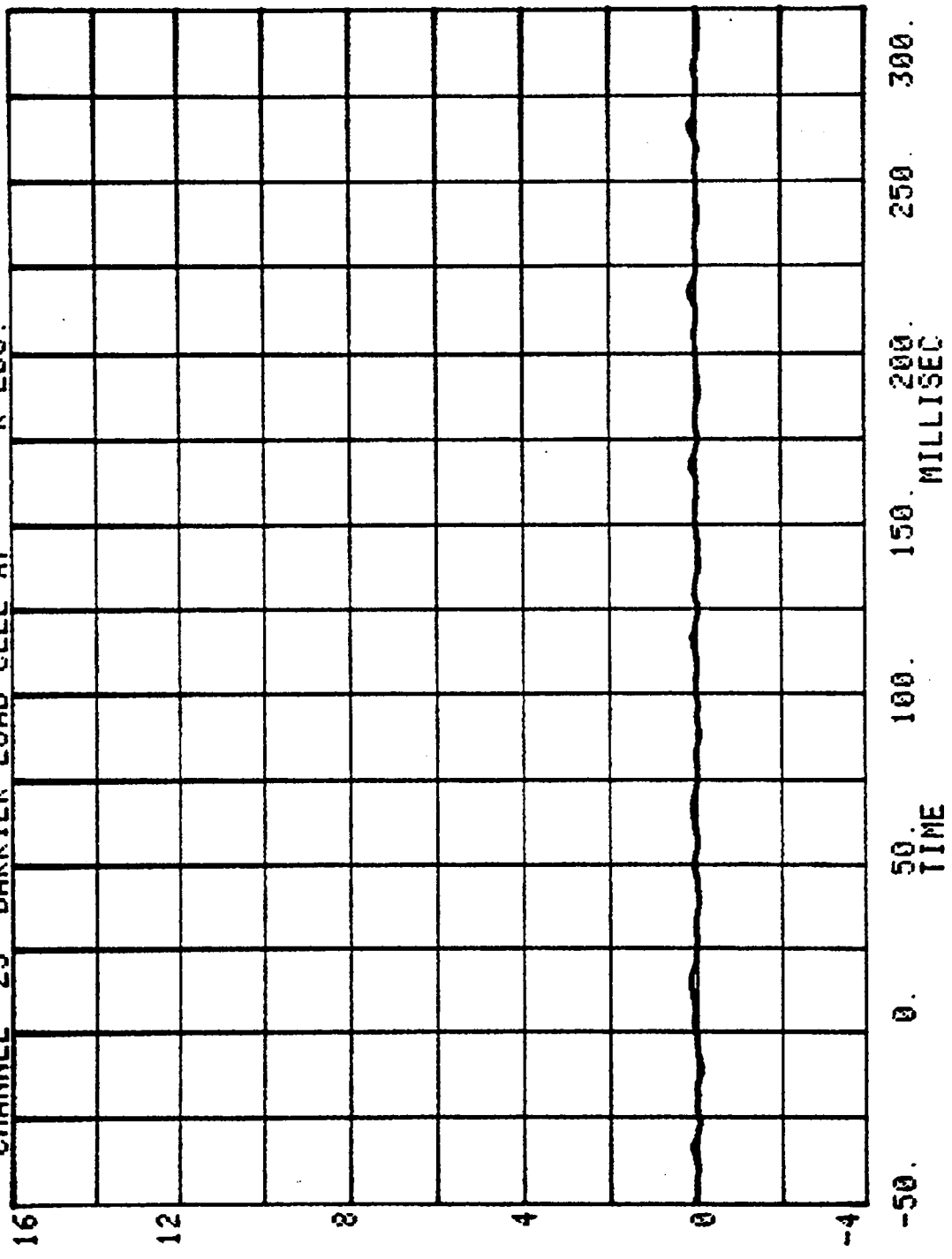
CHANNEL 23 BARRIER LOAD CELL A5 RUN= 535 SERIES= 2 K LBS.



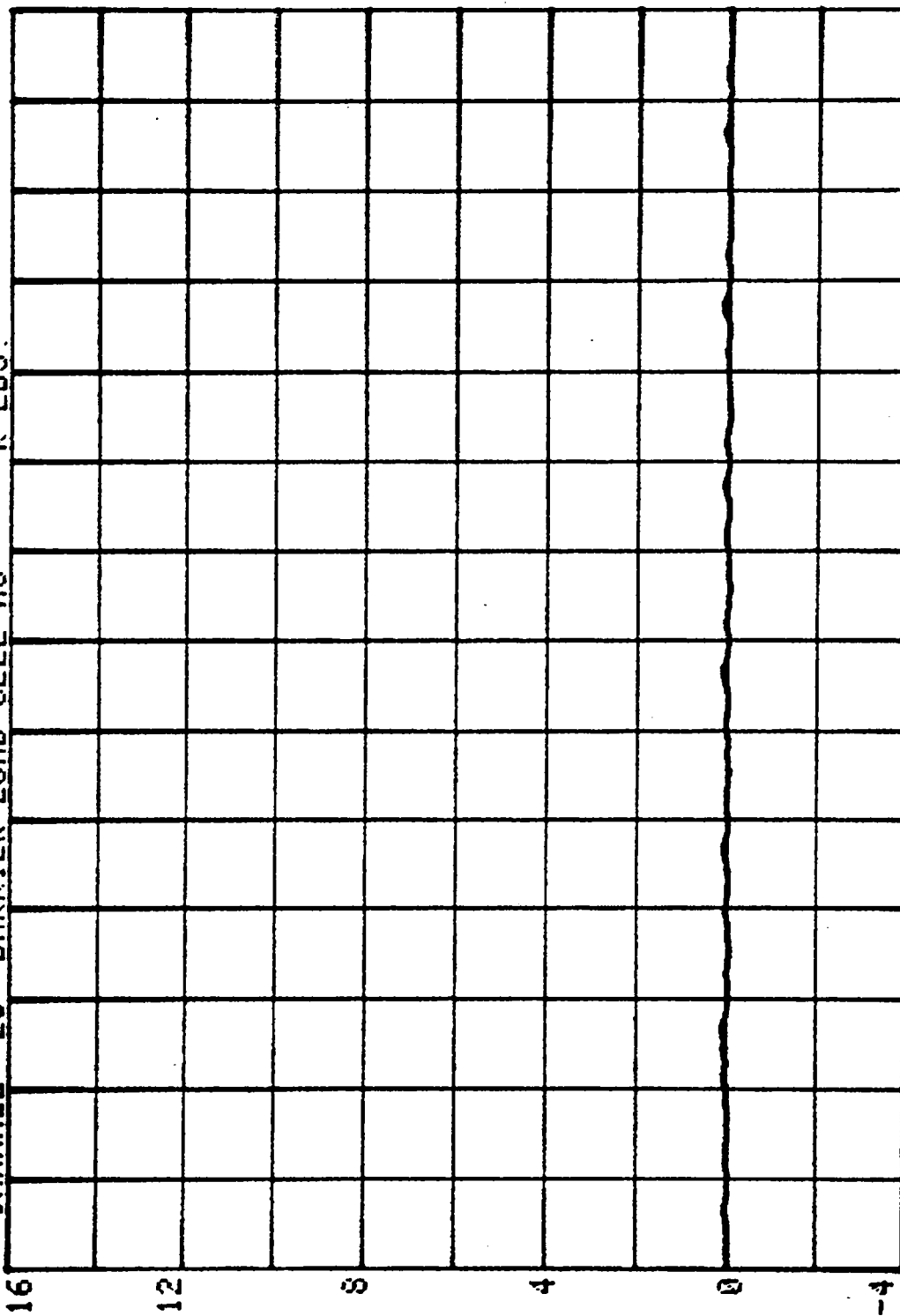
CHANNEL 24 BARRIER LOAD CELL A6
RUN= 535 SERIES= 2 K LBS.



CHANNEL 25 BARRIER LOAD CELL A7 RUN= 535 SERIES= 2 K LBS.

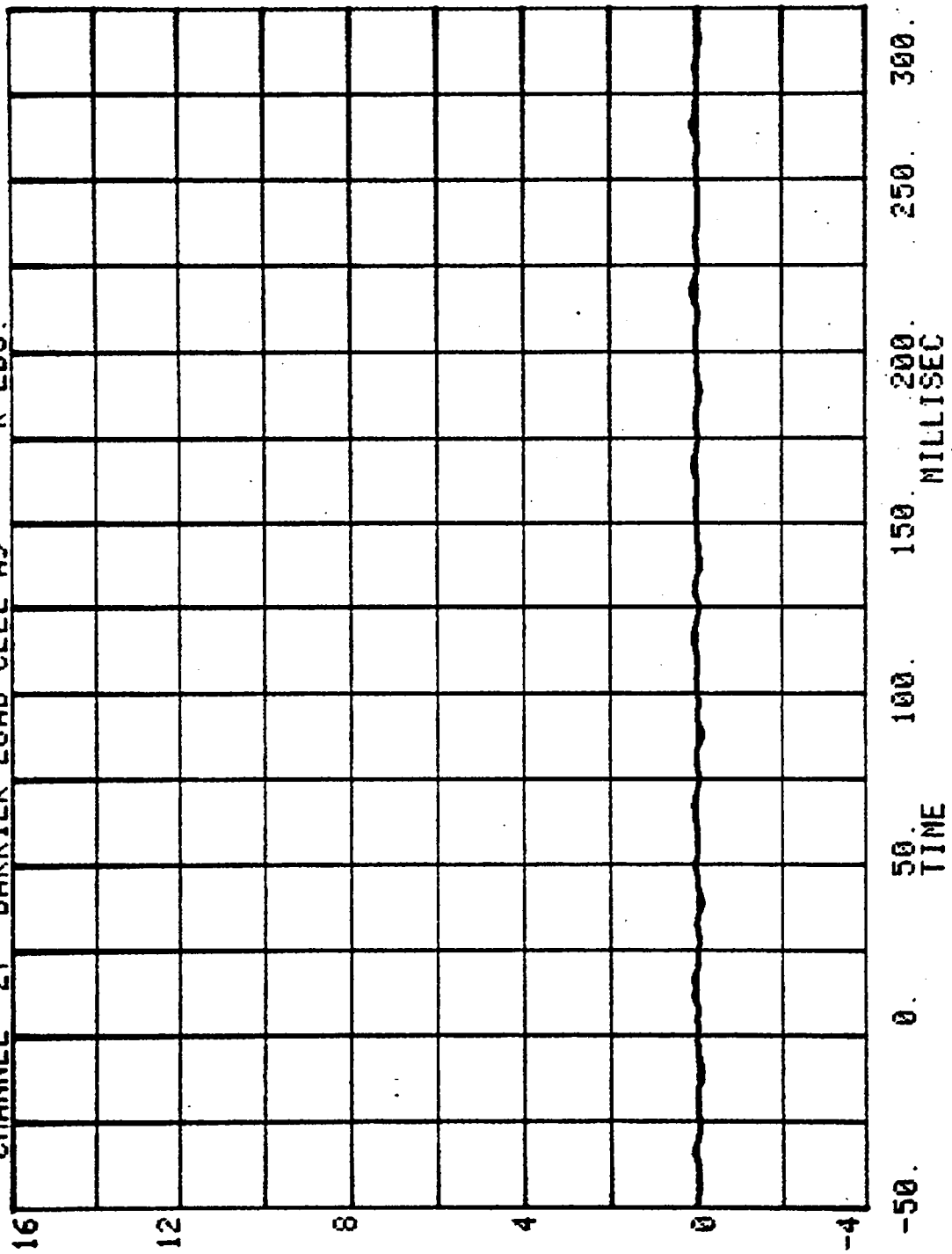


CHANNEL 26 RUN= 535 SERIES= 2
BARRIER LOAD CELL A8 K LBS.

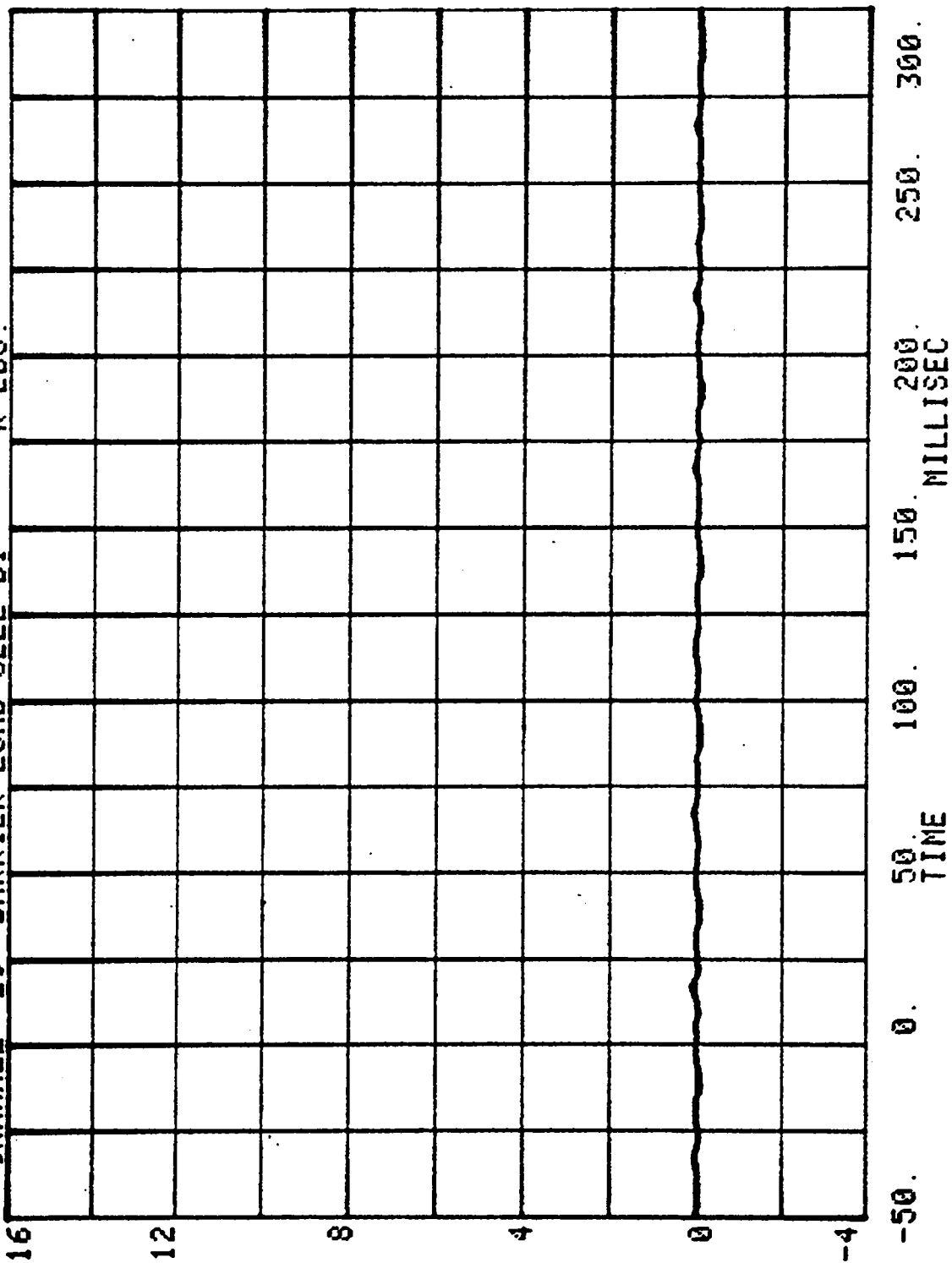


TIME
MILLISEC

CHANNEL 27 BARRIER LOAD CELL A9 RUN= 535 SERIES= 2 K LBS.



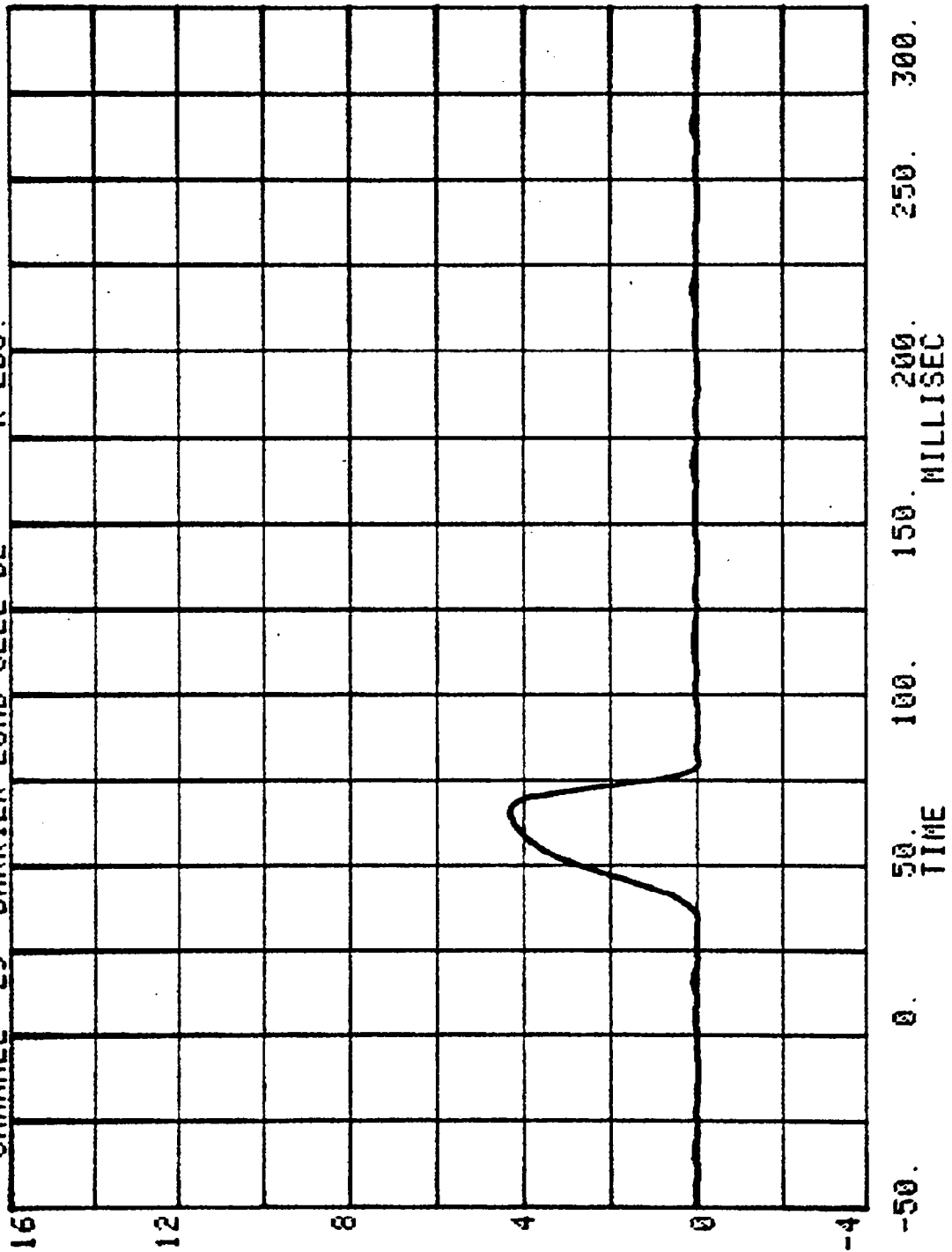
CHANNEL 28 BARRIER LOAD CELL B1
RUN= 535 SERIES= 2 K LBS.



CHANNEL 29 BARRIER LOAD CELL B2

RUN= 535 SERIES= 2

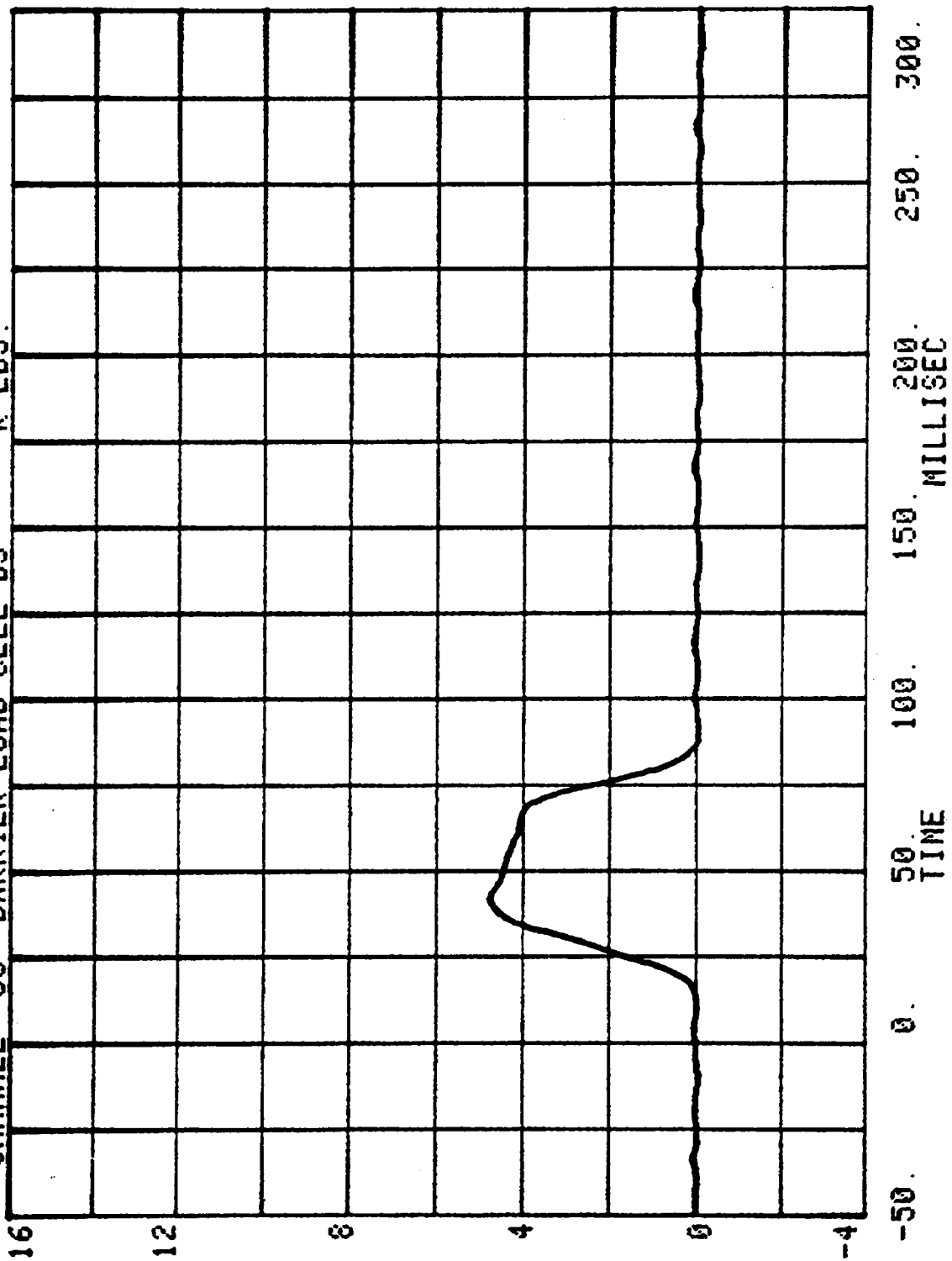
K LBS.



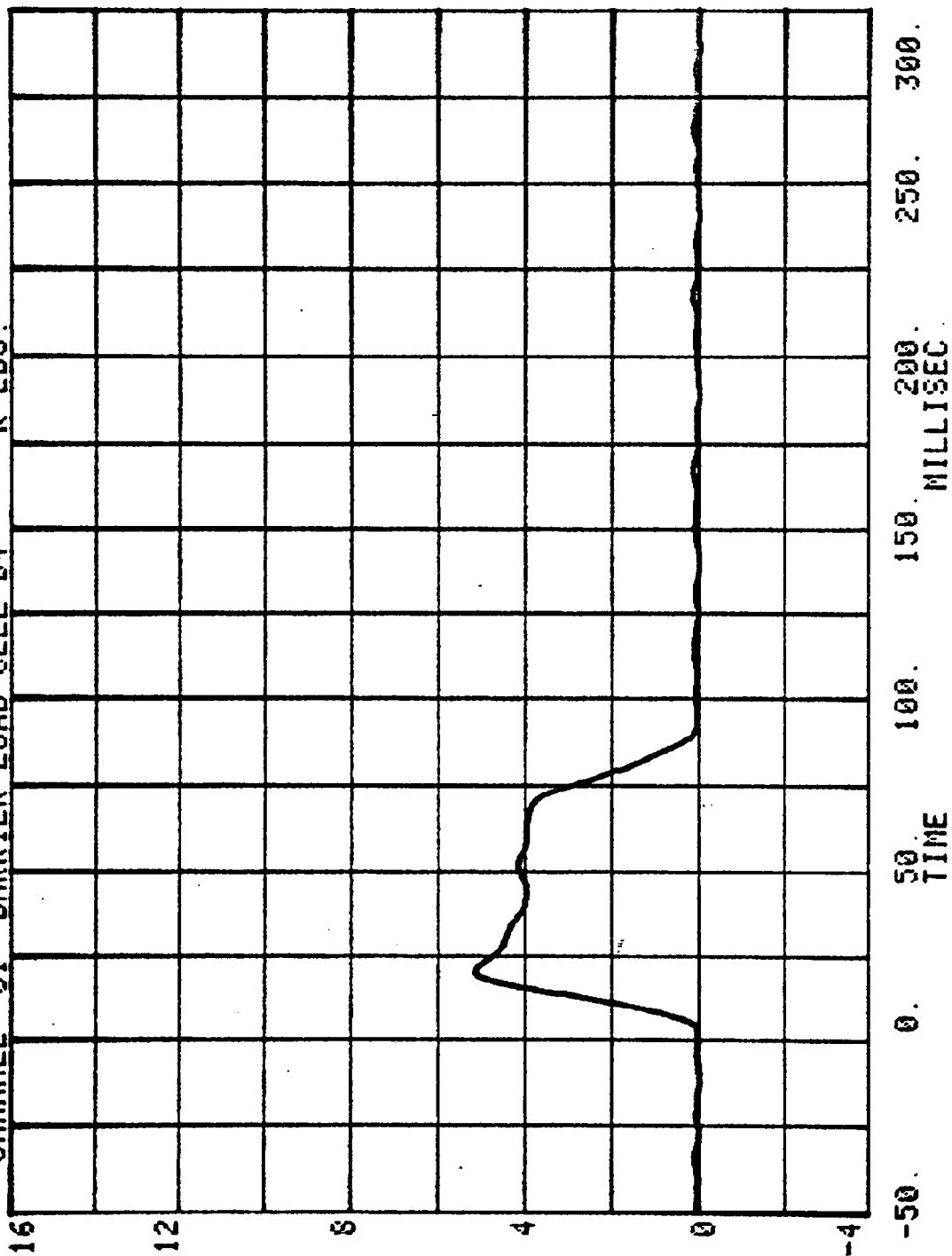
CHANNEL 30 BARRIER LOAD CELL B3

RUN= 535 SERIES= 2

K LBS.



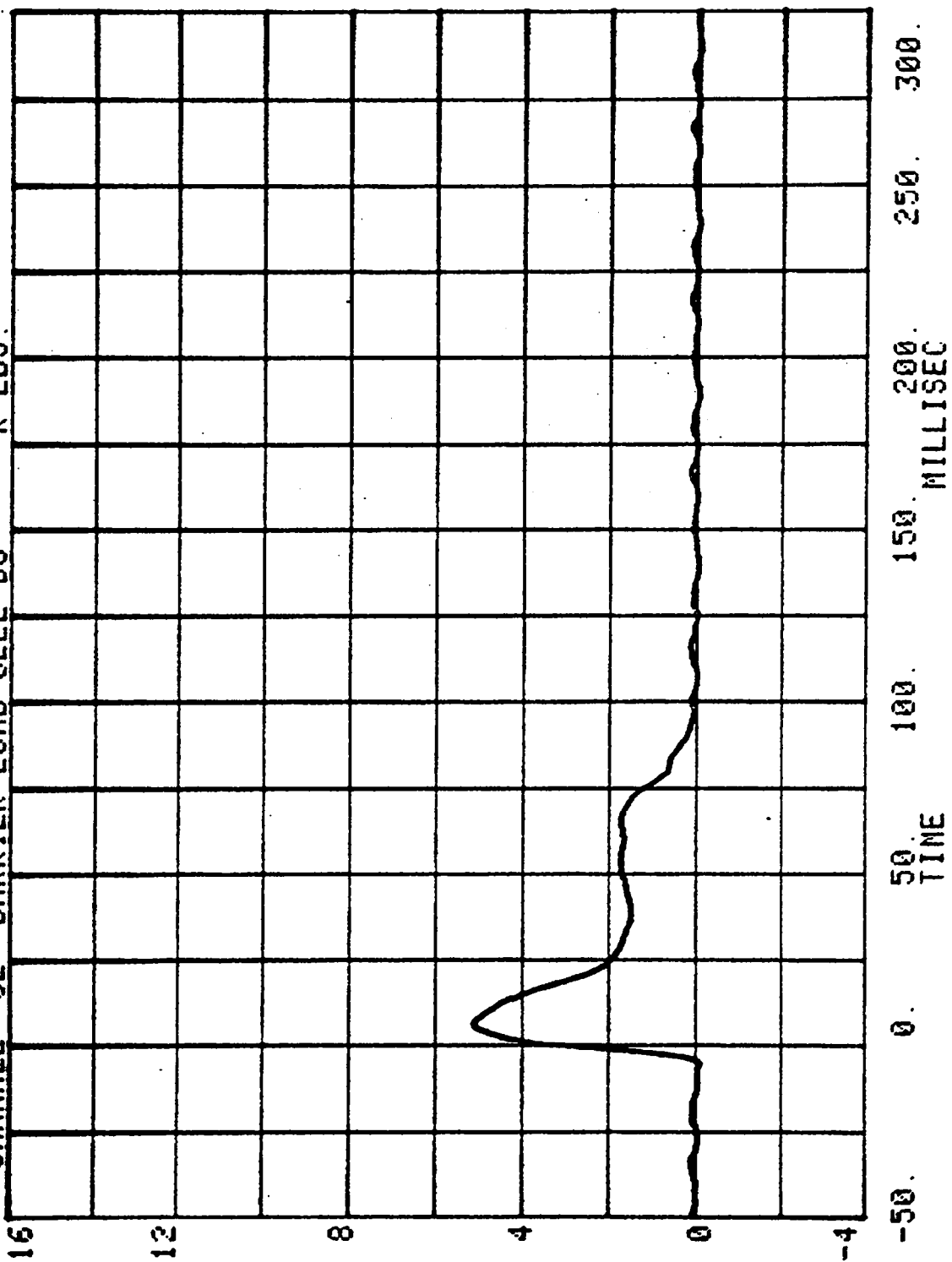
CHANNEL 31 RUN= 535 SERIES= 2
BARRIER LOAD CELL B4 K LBS.



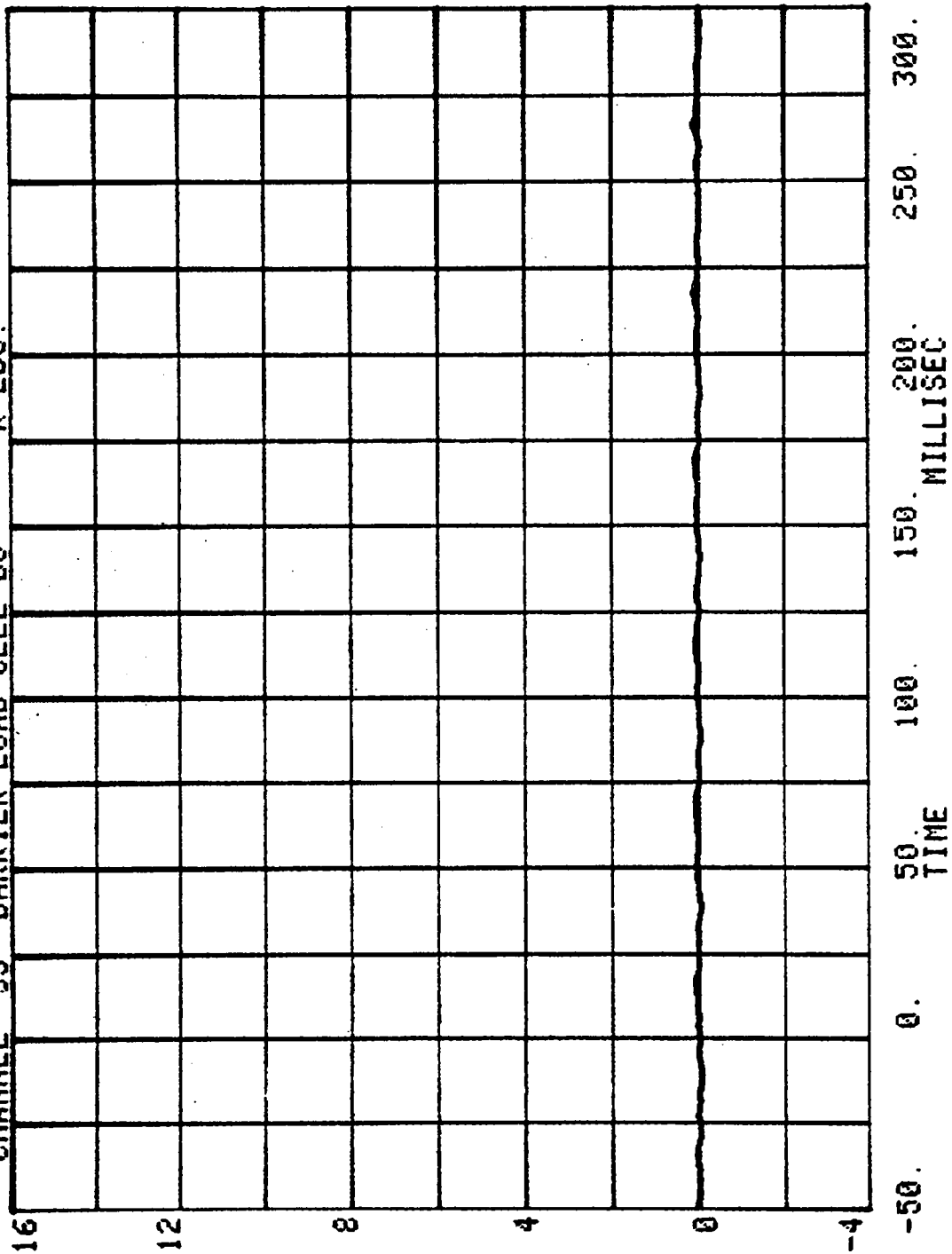
CHANNEL 32 BARRIER LOAD CELL B5

RUN= 535 SERIES= 2

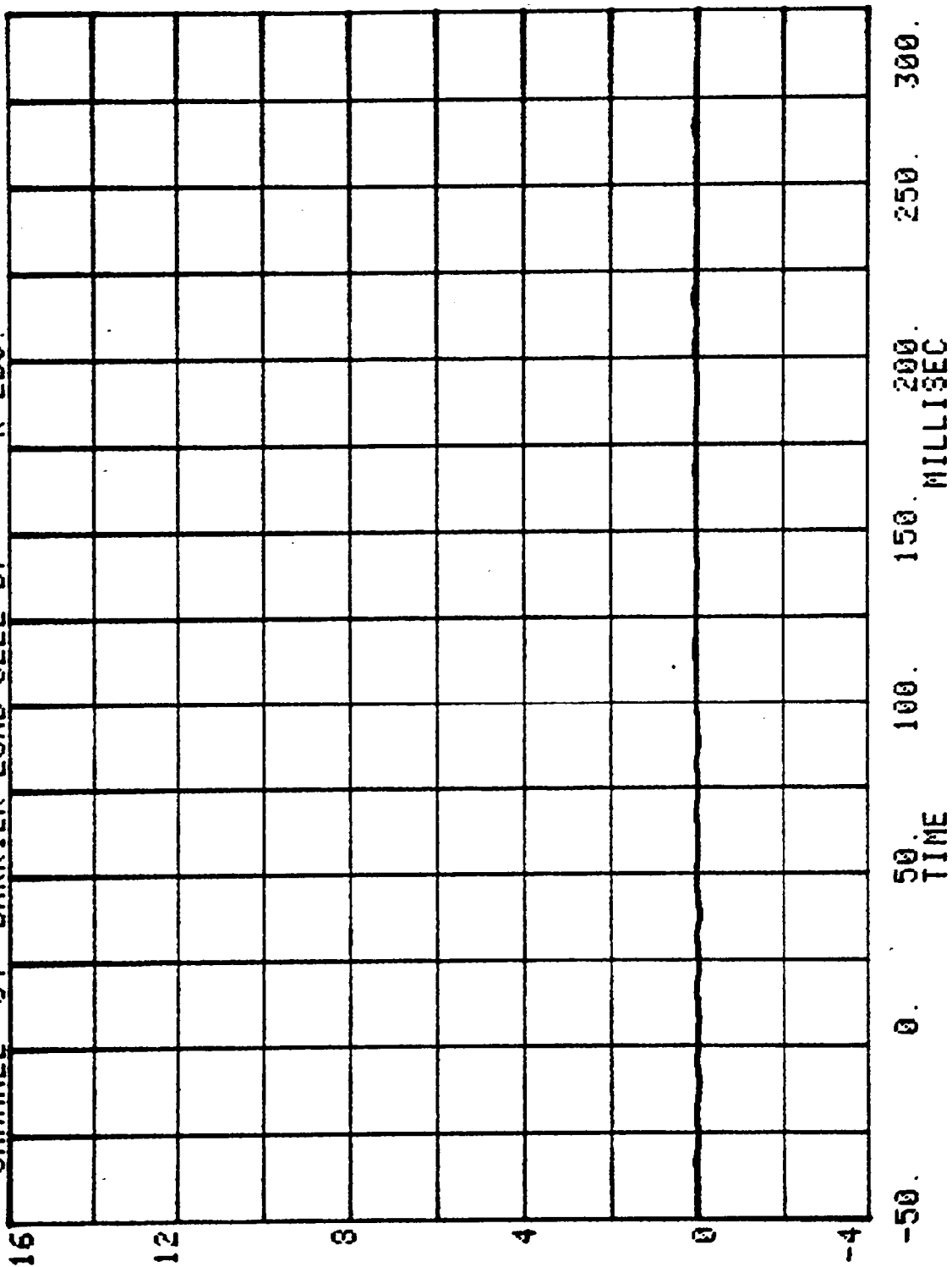
K LBS.



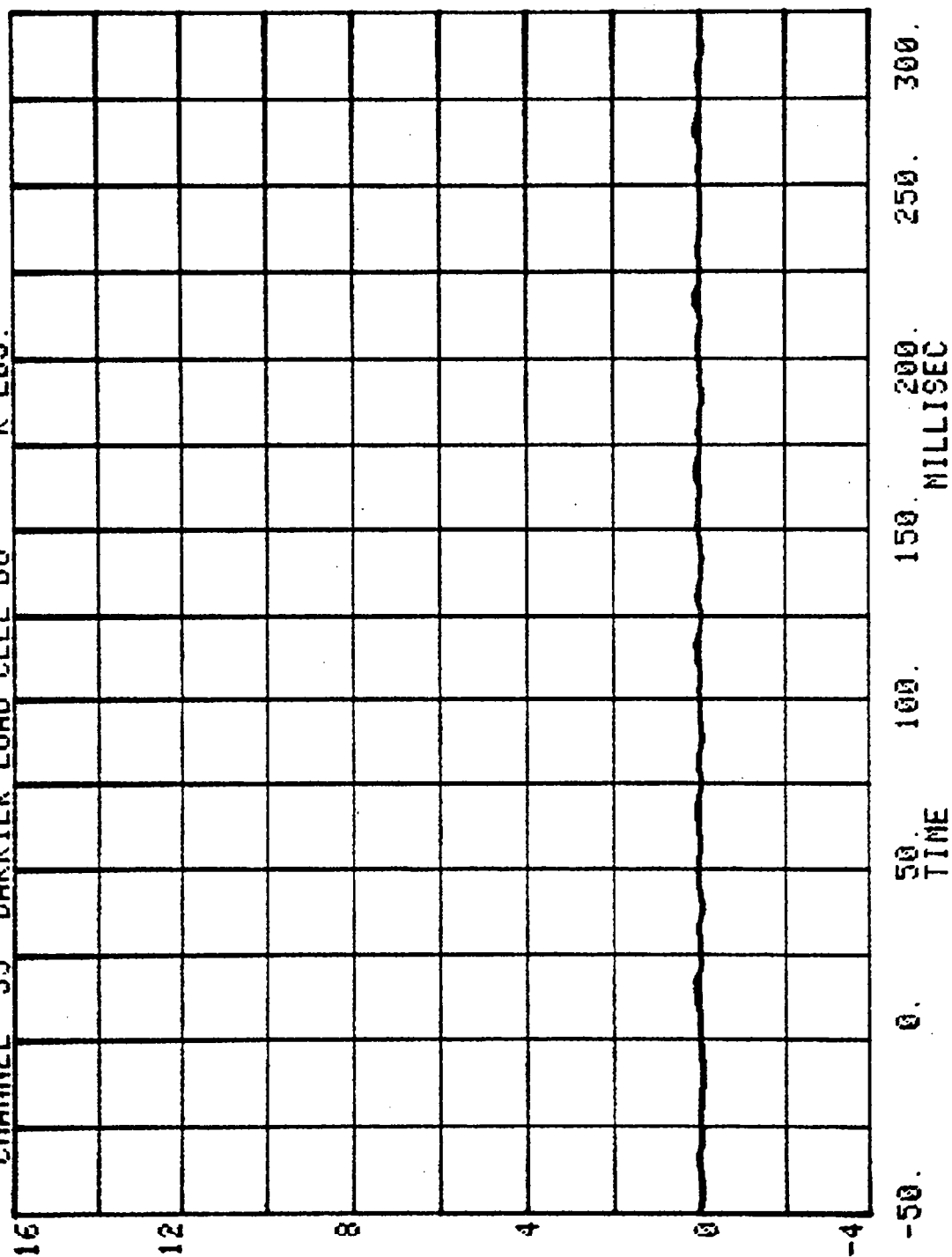
CHANNEL 33 BARRIER LOAD CELL B6
RUN= 535 SERIES= 2 K LBS.



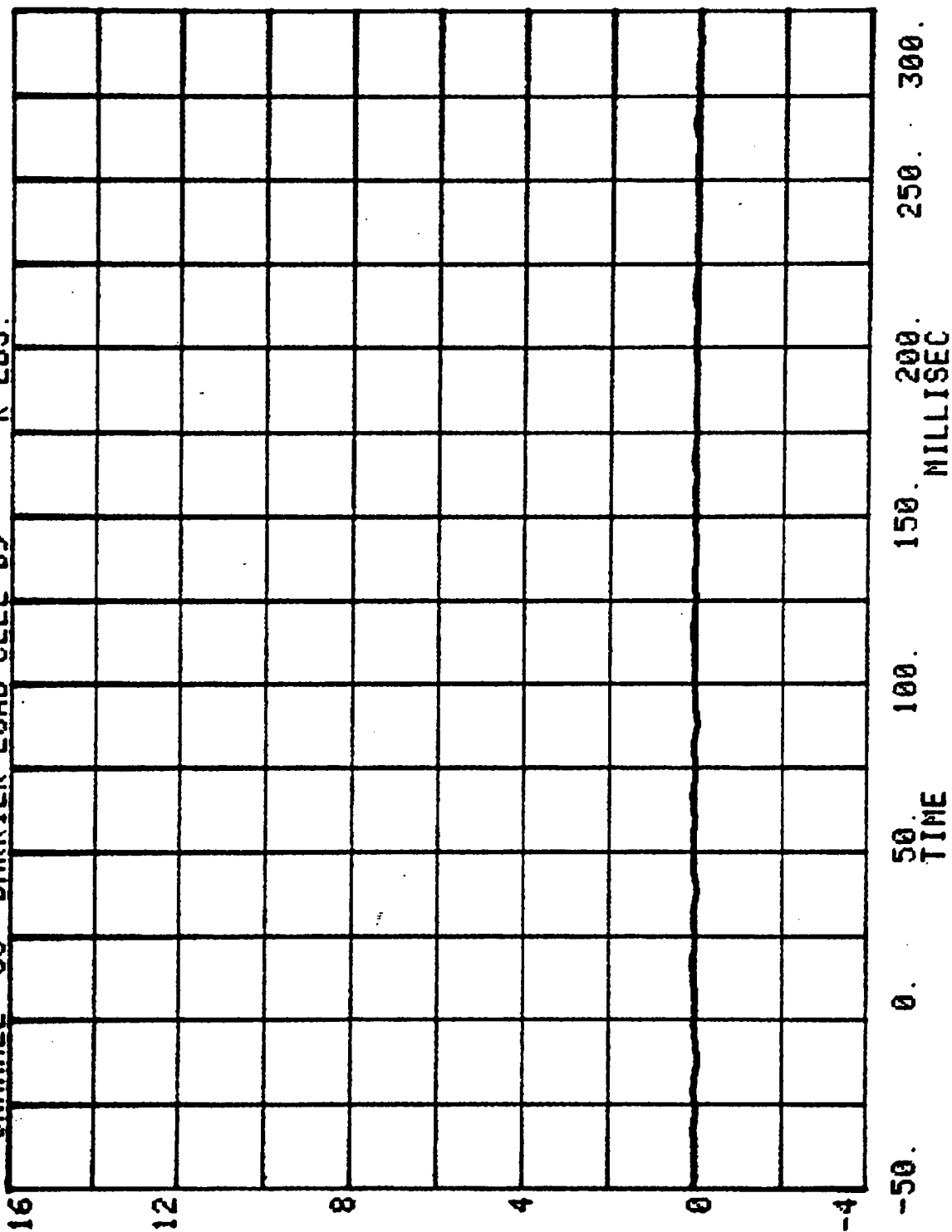
CHANNEL 34 RUN= 535 SERIES= 2
BARRIER LOAD CELL B7 K LBS.



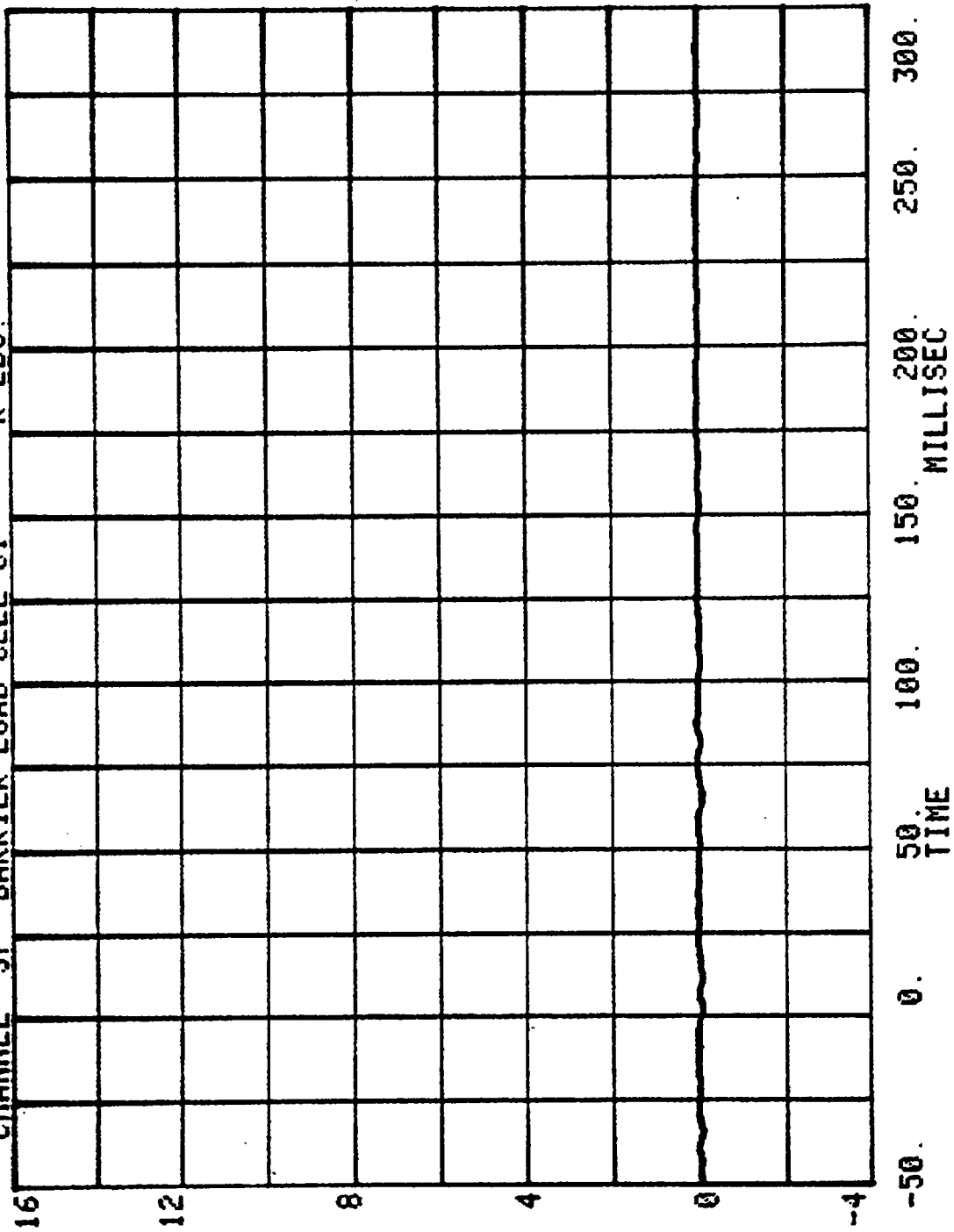
CHANNEL 35 BARRIER LOAD CELL B8 RUN= 535 SERIES= 2 K LBS.



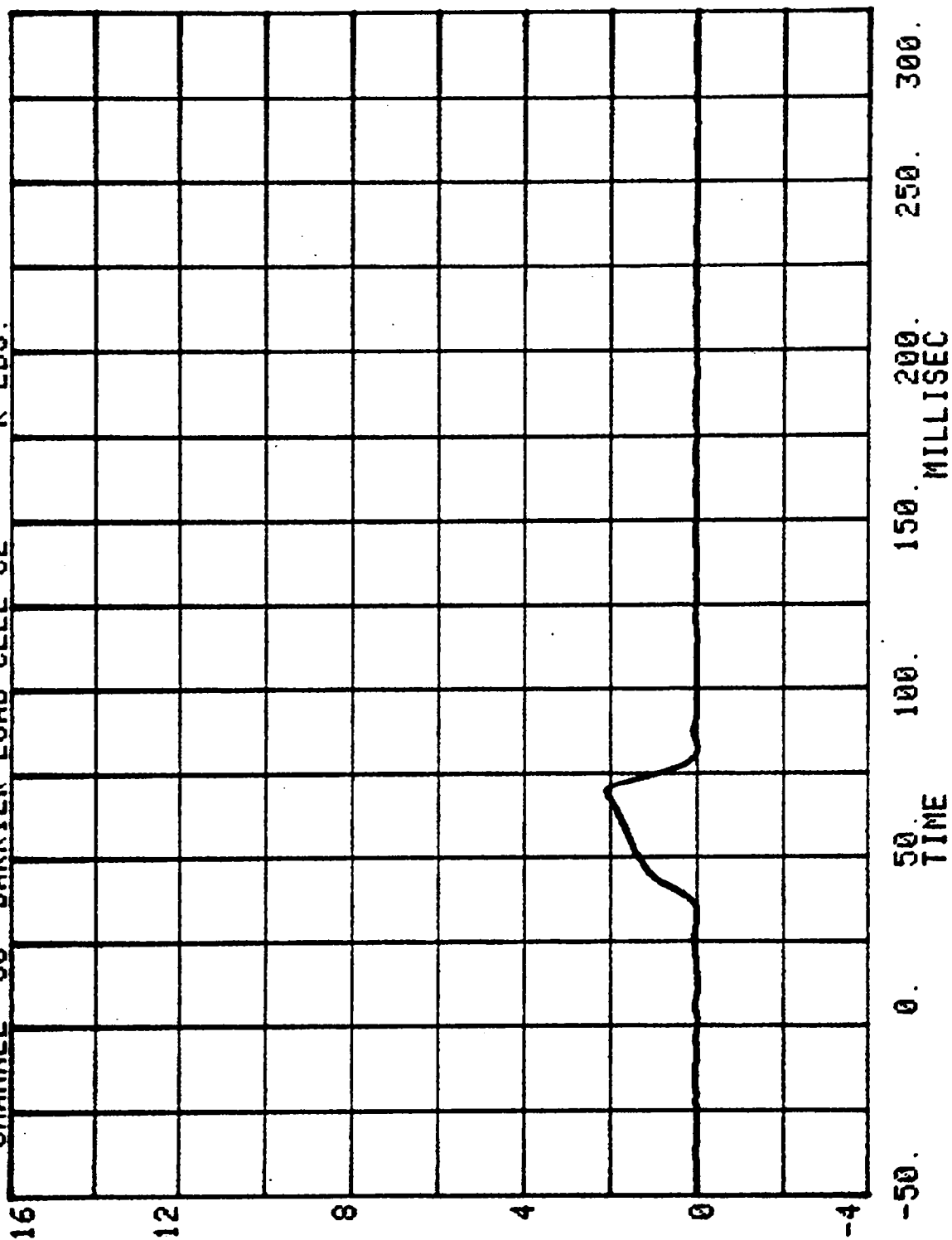
CHANNEL 36 BARRIER LOAD CELL B9 RUN= 535 SERIES= 2 K LBS.

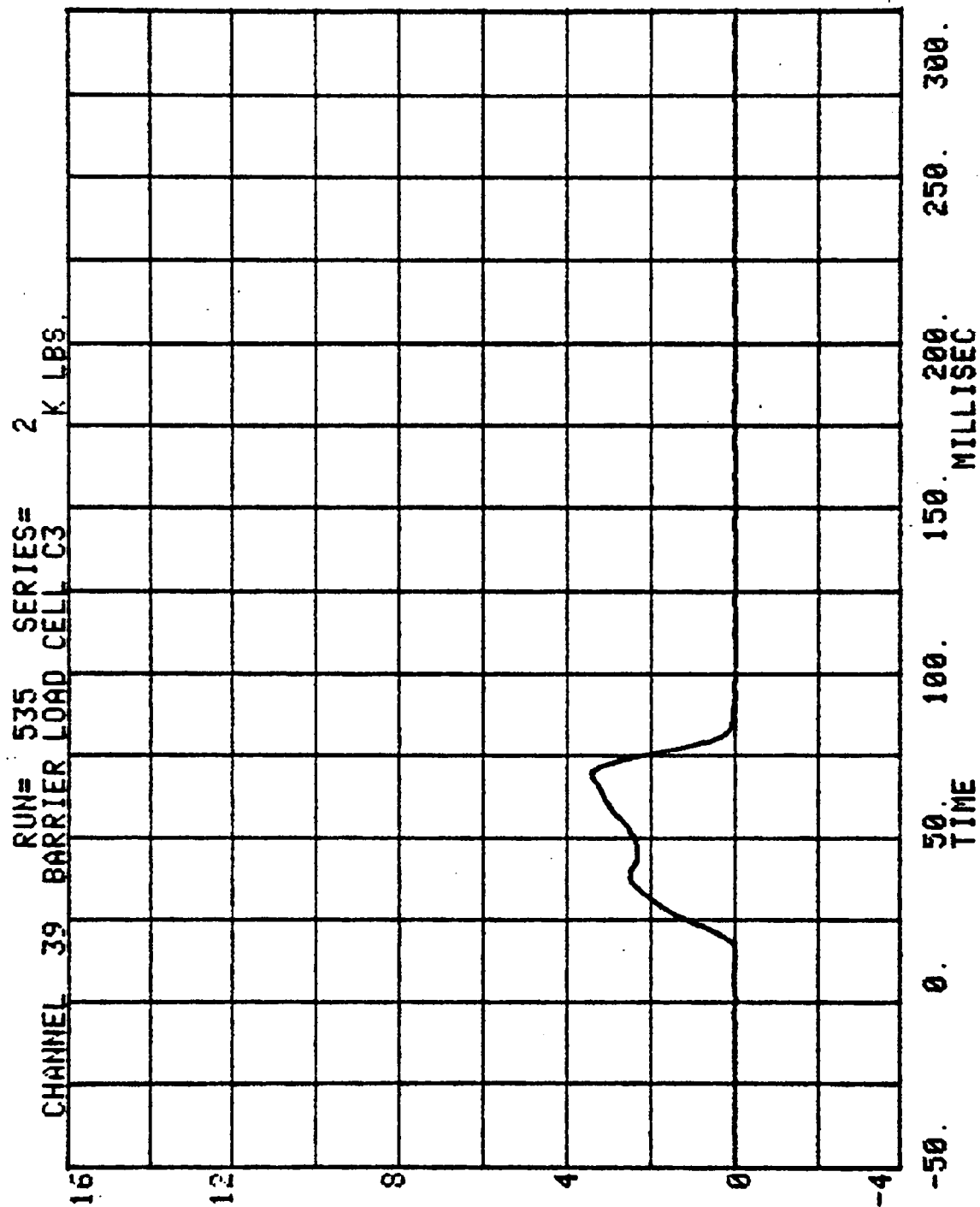


CHANNEL 37 BARRIER LOAD CELL C1 RUN= 535 SERIES= 2 K LBS.

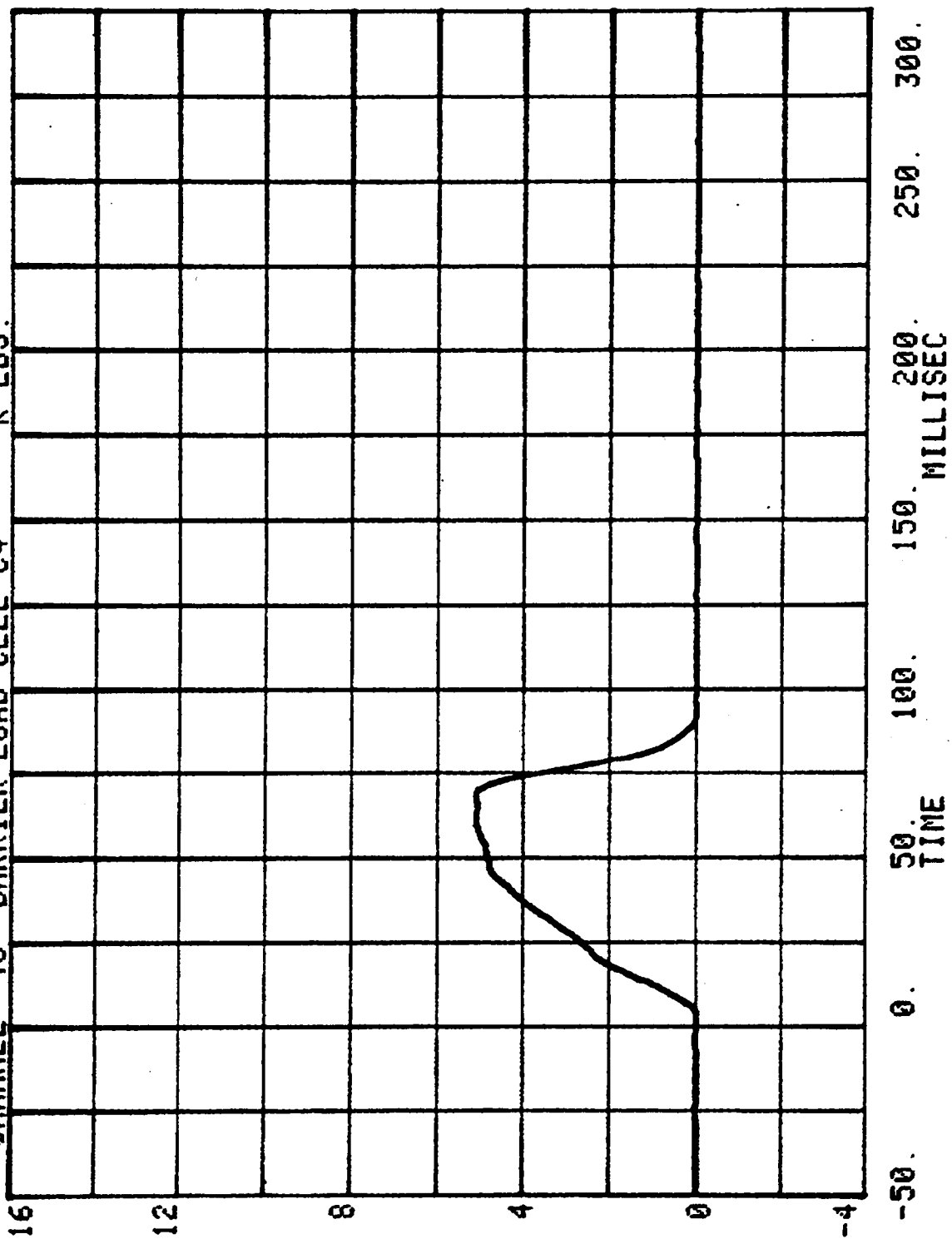


RUN= 535 SERIES= 2
CHANNEL 38 BARRIER LOAD CELL C2 K LBS.

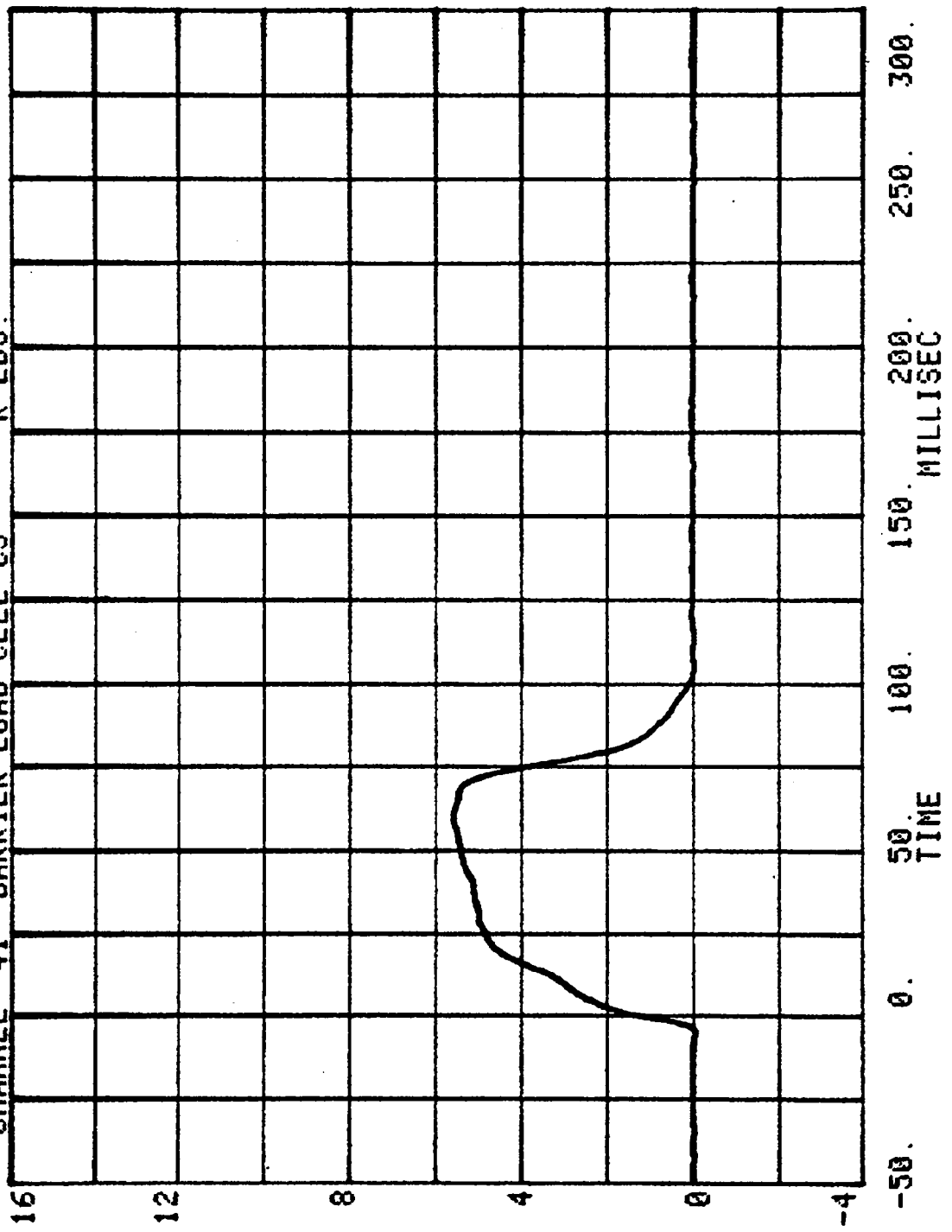




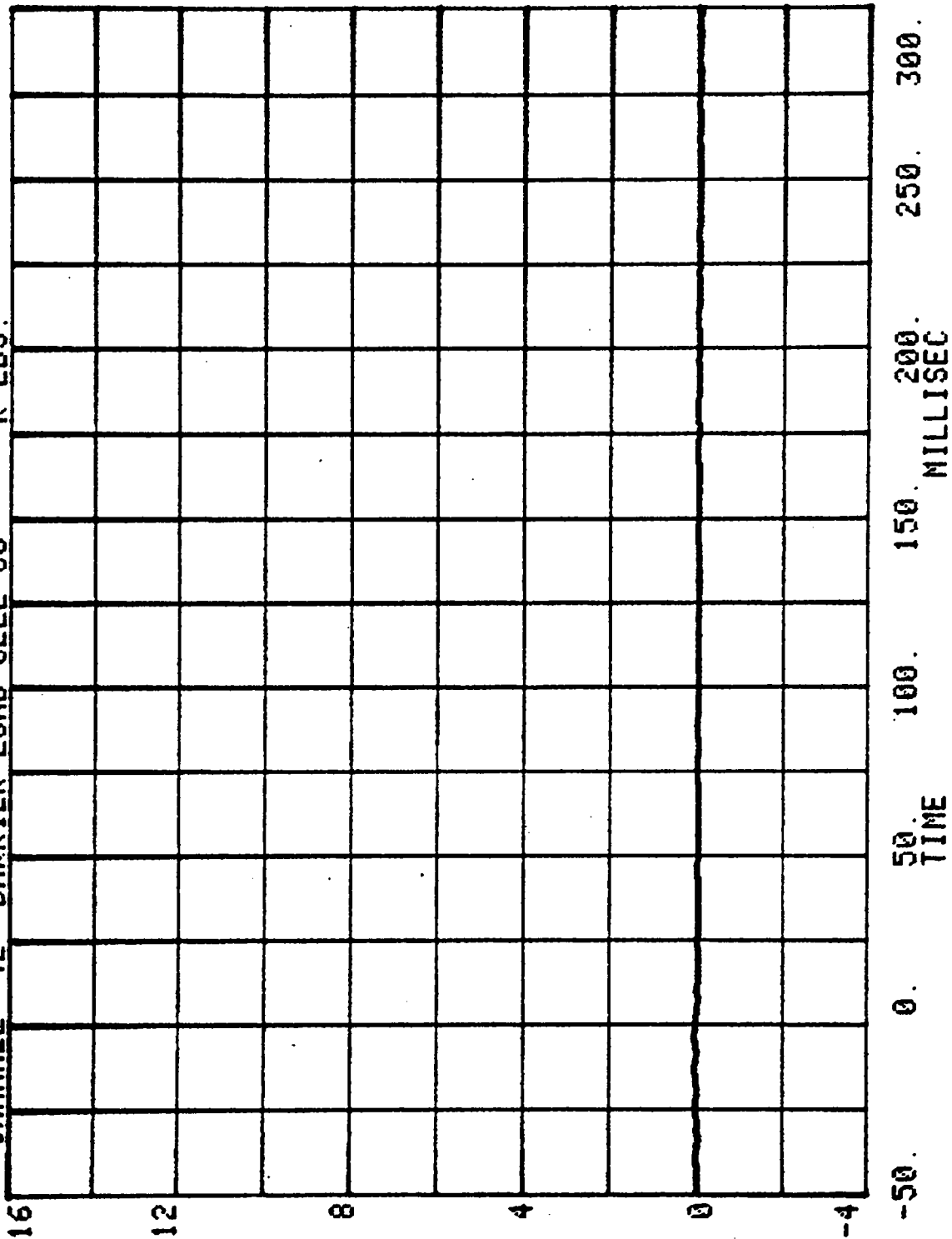
CHANNEL 40 BARRIER LOAD CELL C4 RUN= 535 SERIES= 2 K LBS.



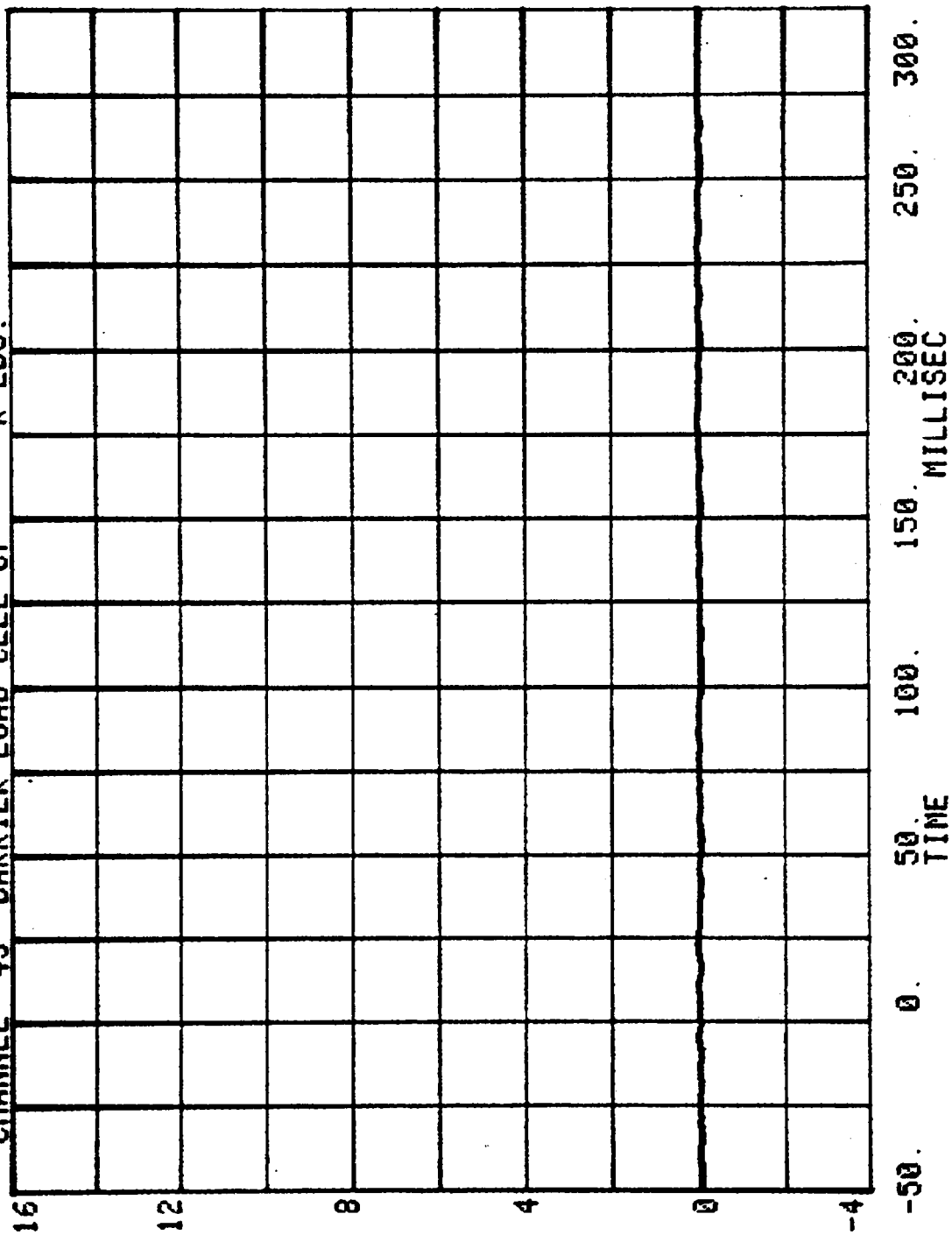
CHANNEL 41 BARRIER LOAD CELL C5 RUN= 535 SERIES= 2 K LBS.



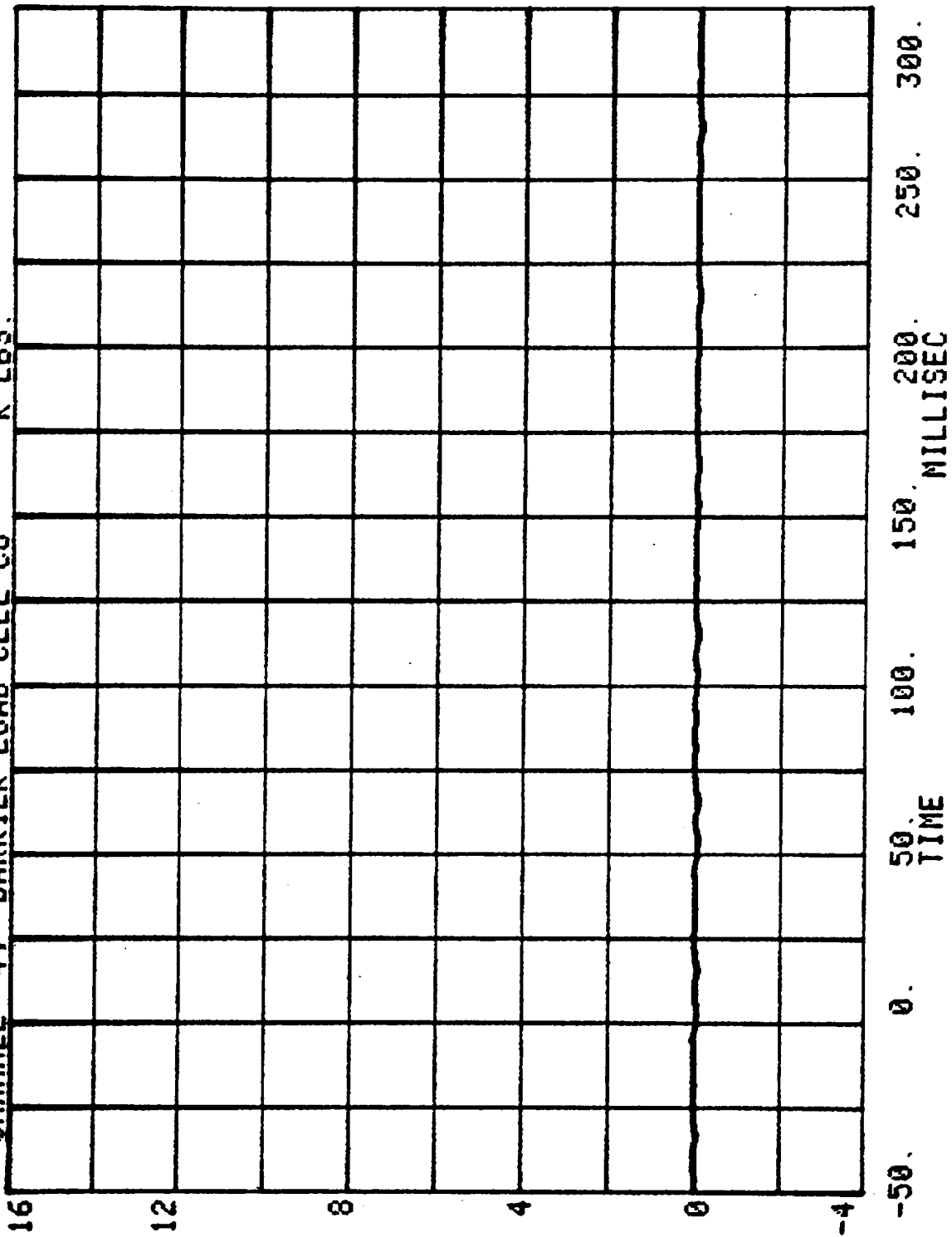
RUN= 535 SERIES= 2
CHANNEL 42 BARRIER LOAD CELL C6 K LBS.



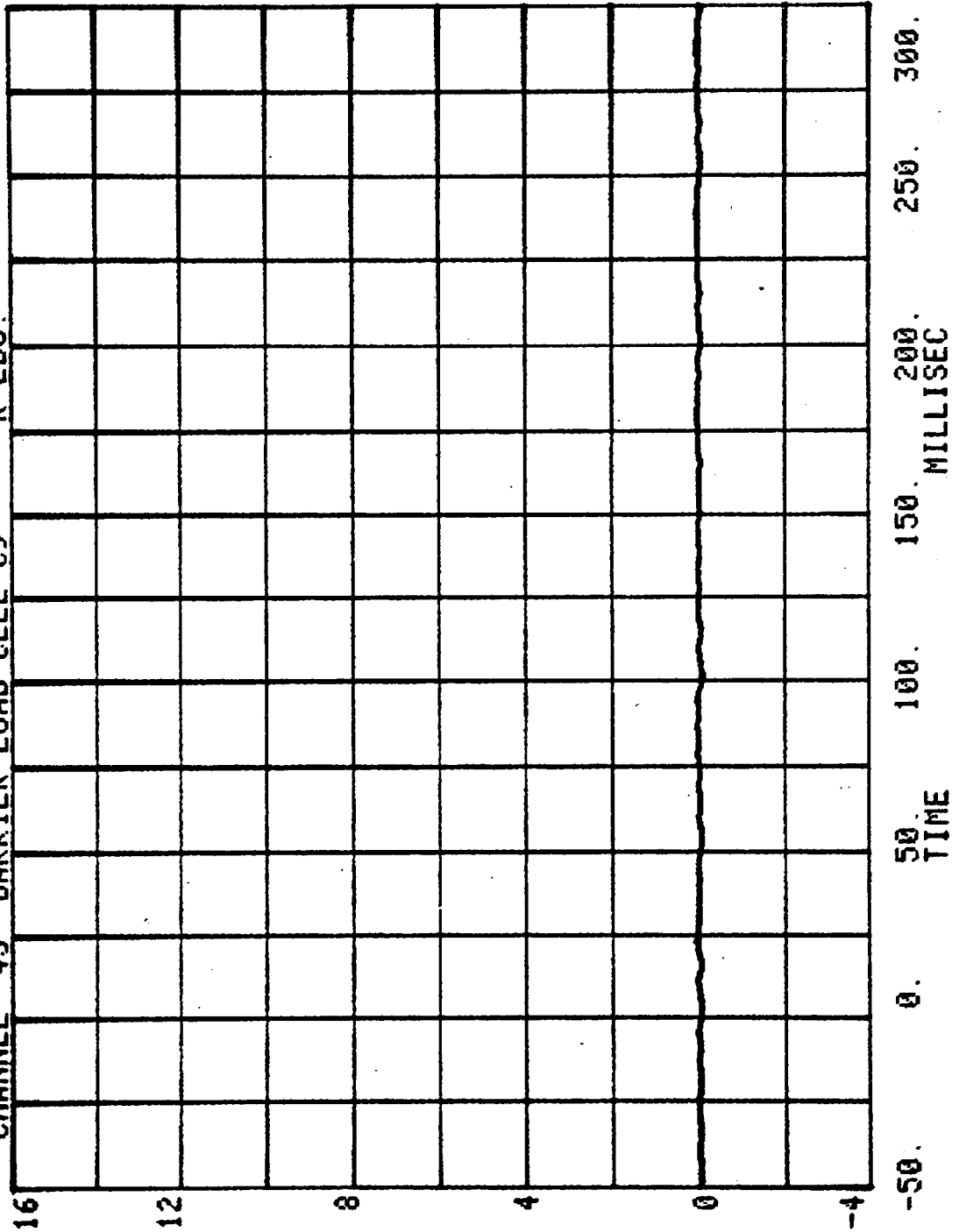
CHANNEL 43 BARRIER LOAD CELL C7 RUN= 535 SERIES= 2 K LBS.



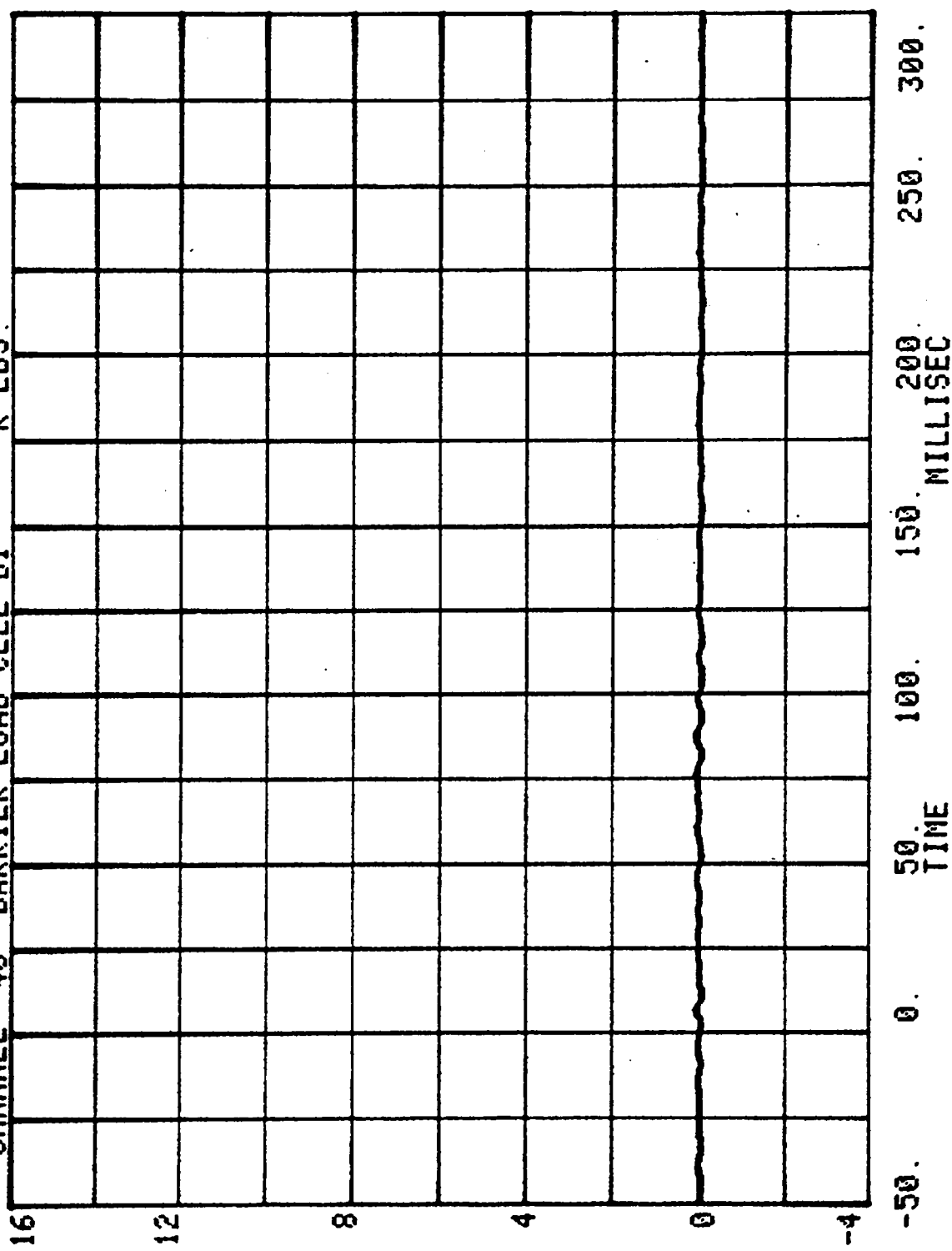
RUN= 535 SERIES= 2
CHANNEL 44 BARRIER LOAD CELL C8 K LBS.



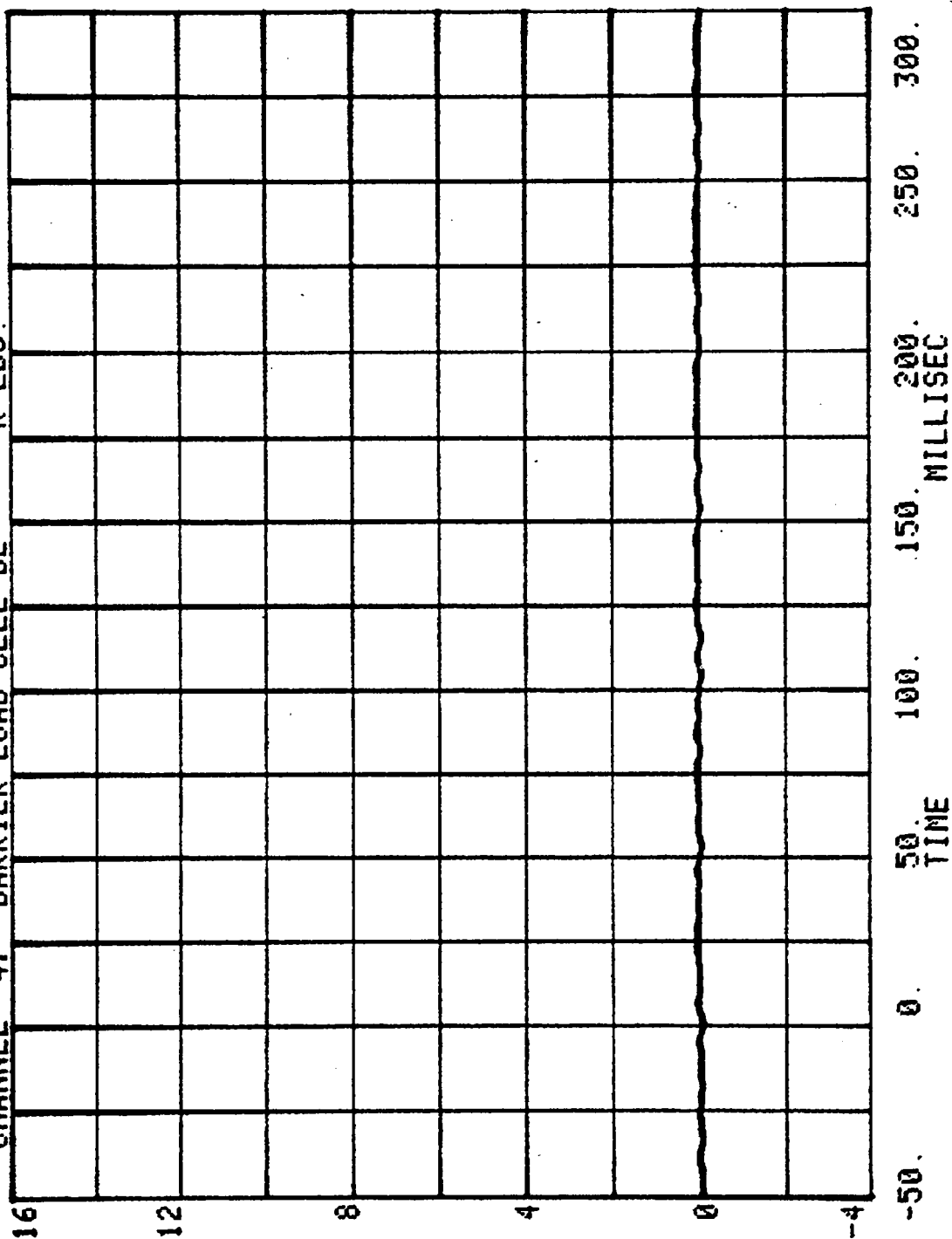
RUN= 535 SERIES= 2
CHANNEL 45 BARRIER LOAD CELL C9 K LBS.



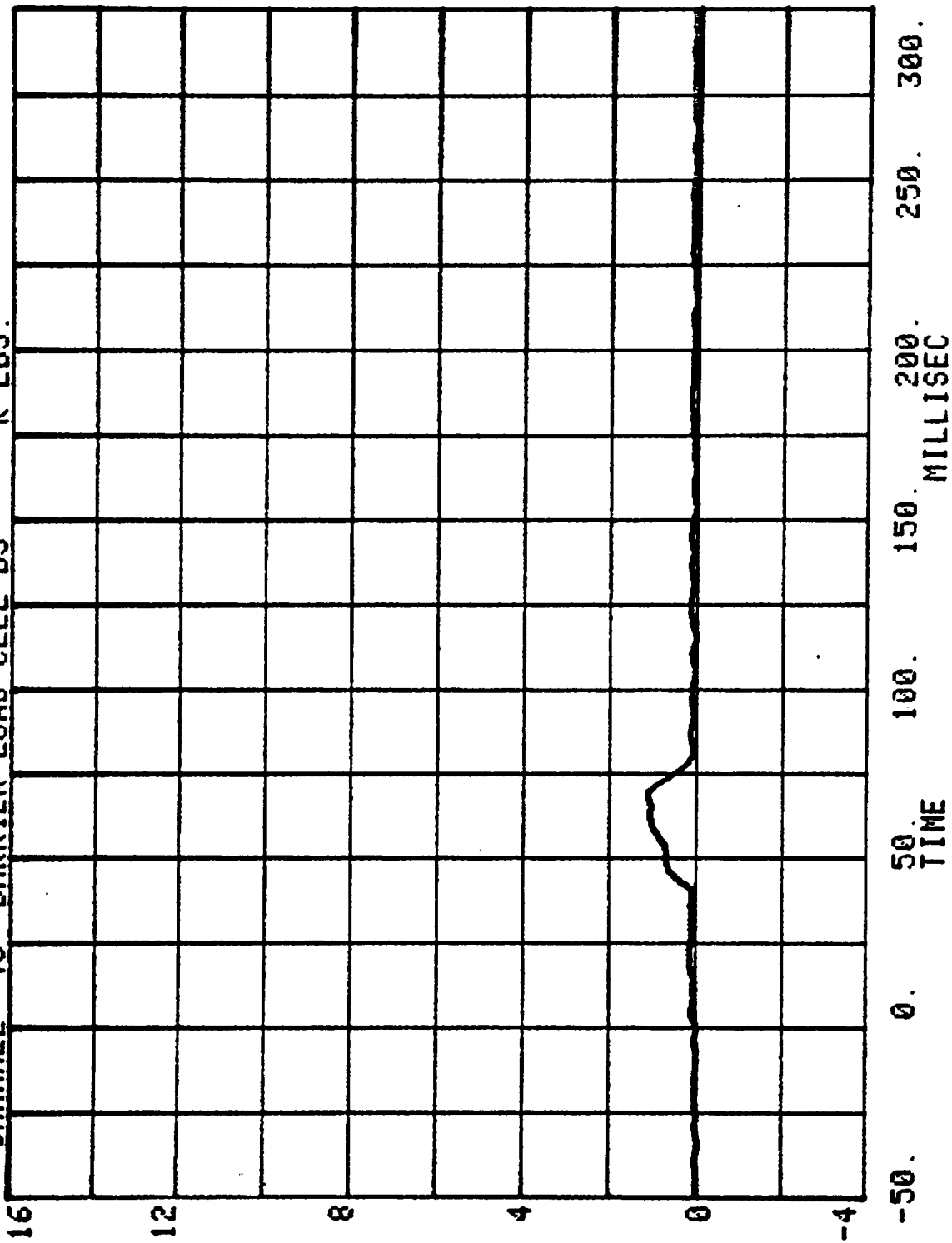
CHANNEL 46 BARRIER LOAD CELL D1 RUN= 535 SERIES= 2 K LBS.

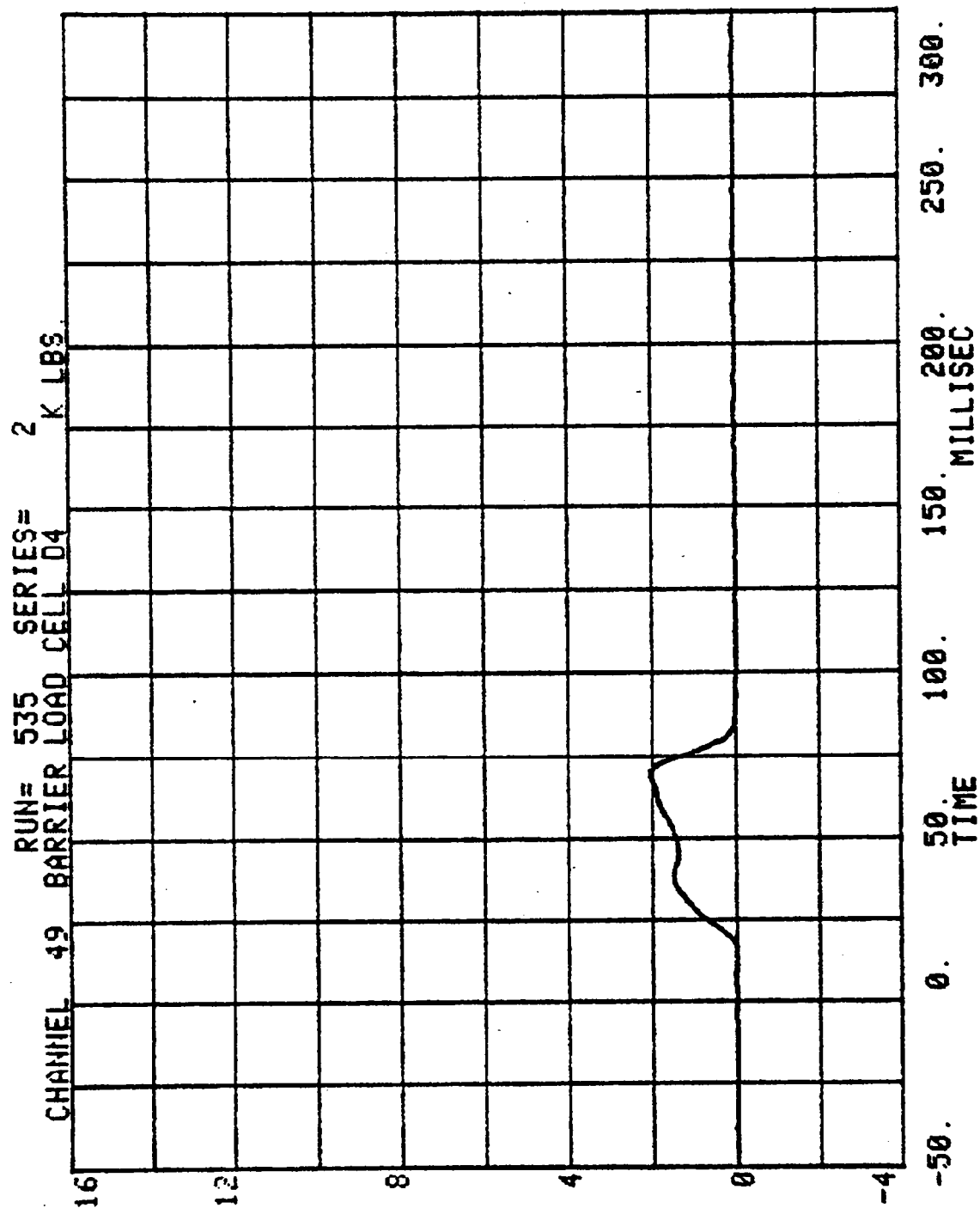


CHANNEL 47 BARRIER LOAD CELL D2 RUN= 535 SERIES= 2 K LBS.

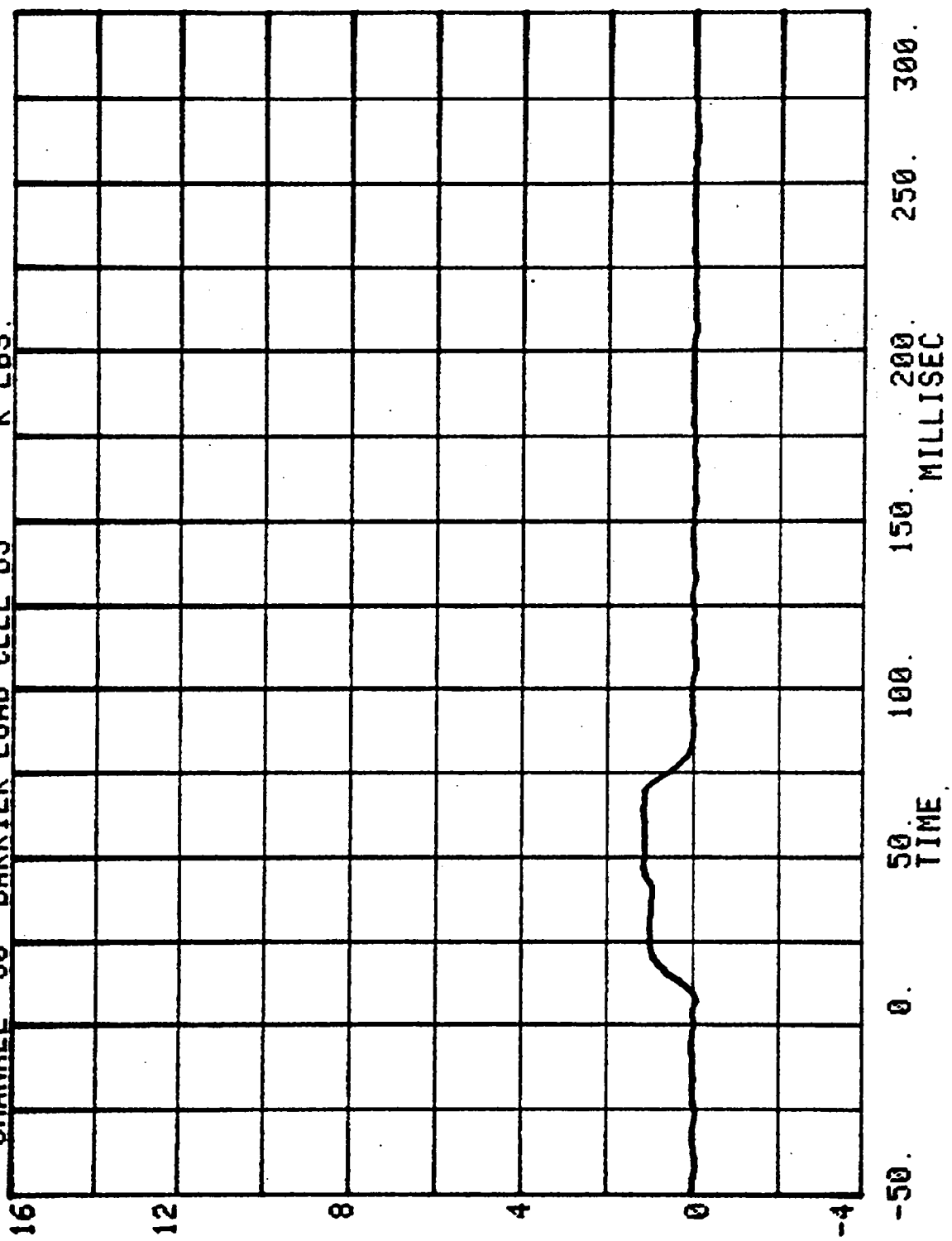


CHANNEL 48 BARRIER LOAD CELL D3 2 K LBS. RUN= 535 SERIES=

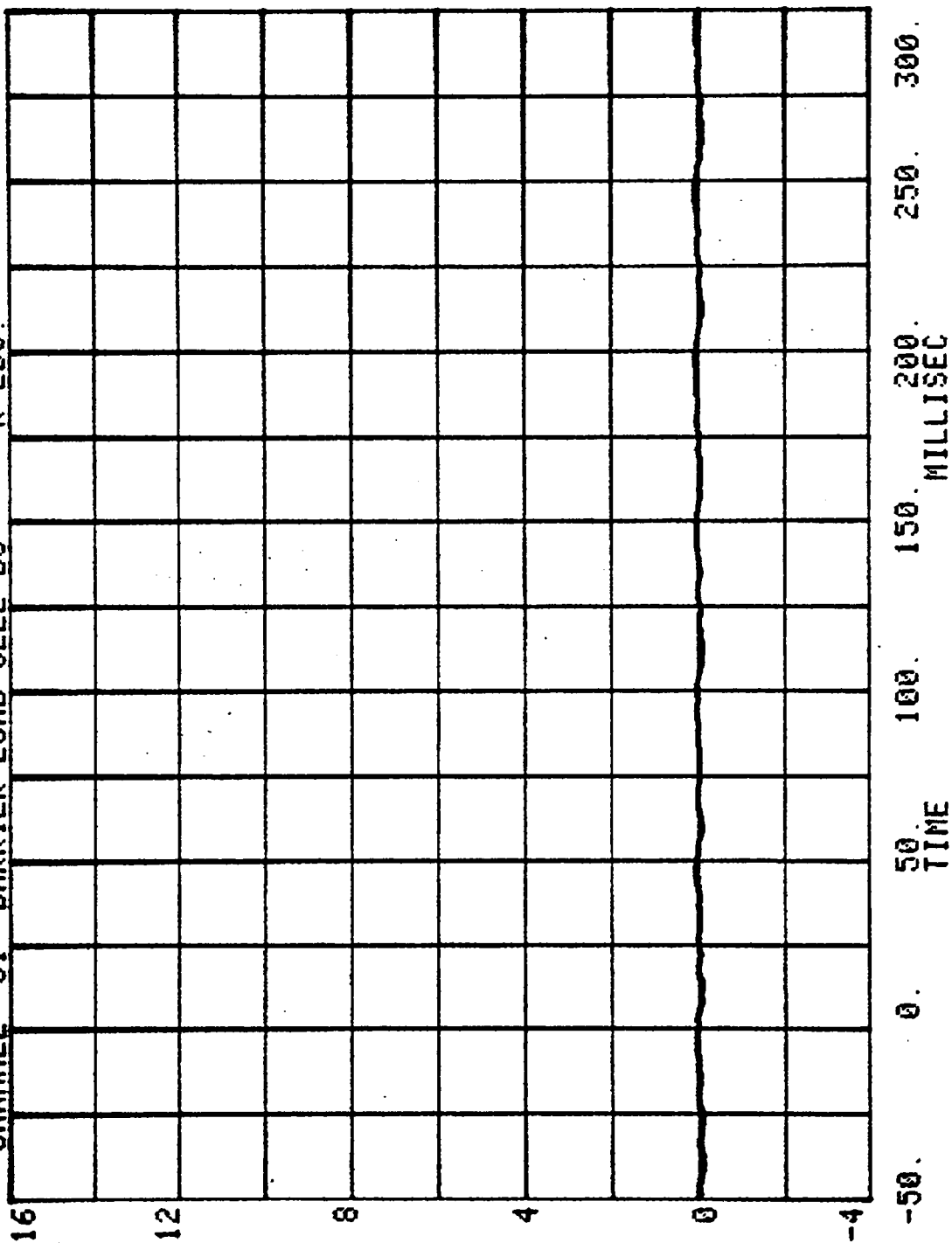




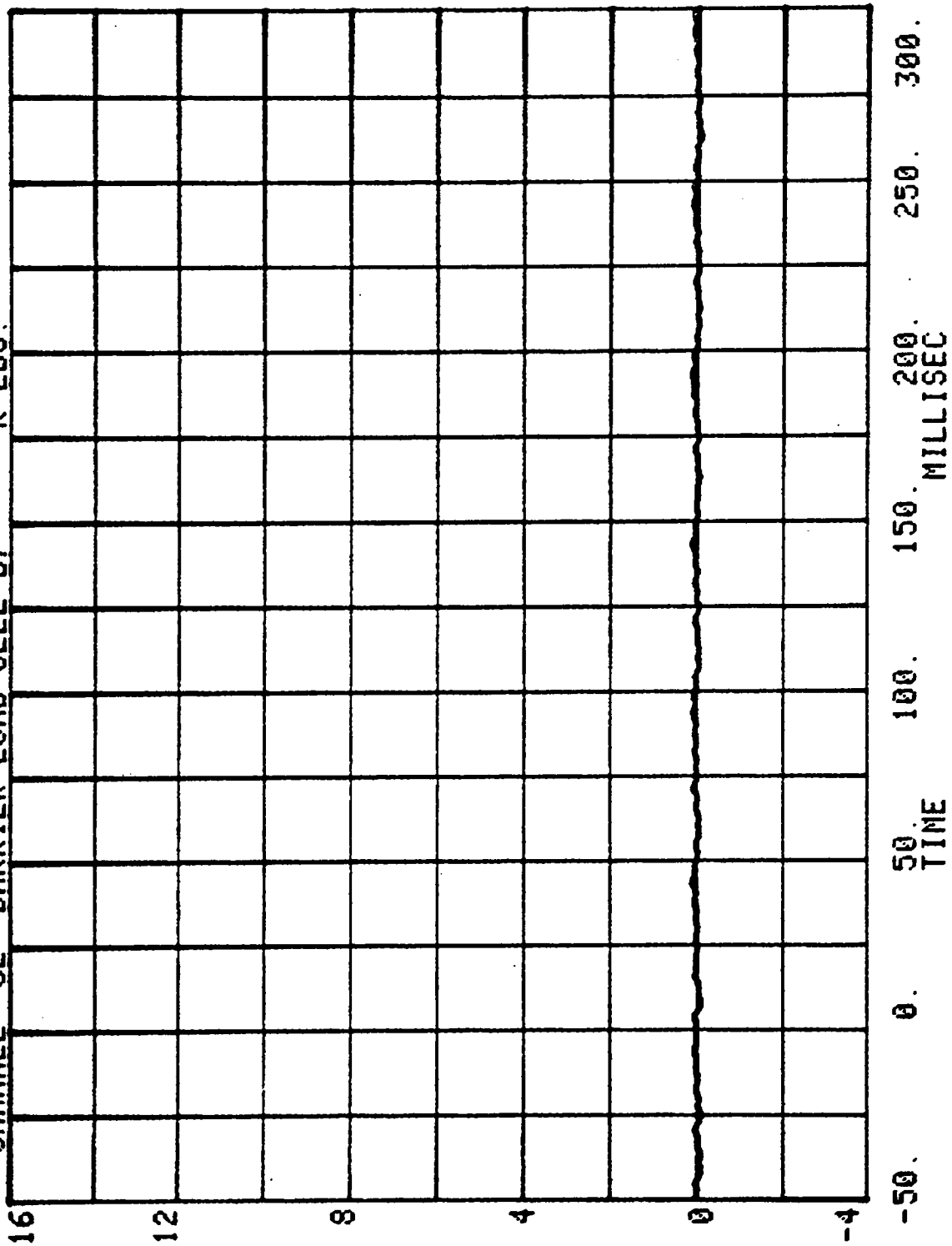
RUN= 535 SERIES= 2
CHANNEL 50 BARRIER LOAD CELL 05 K LBS.



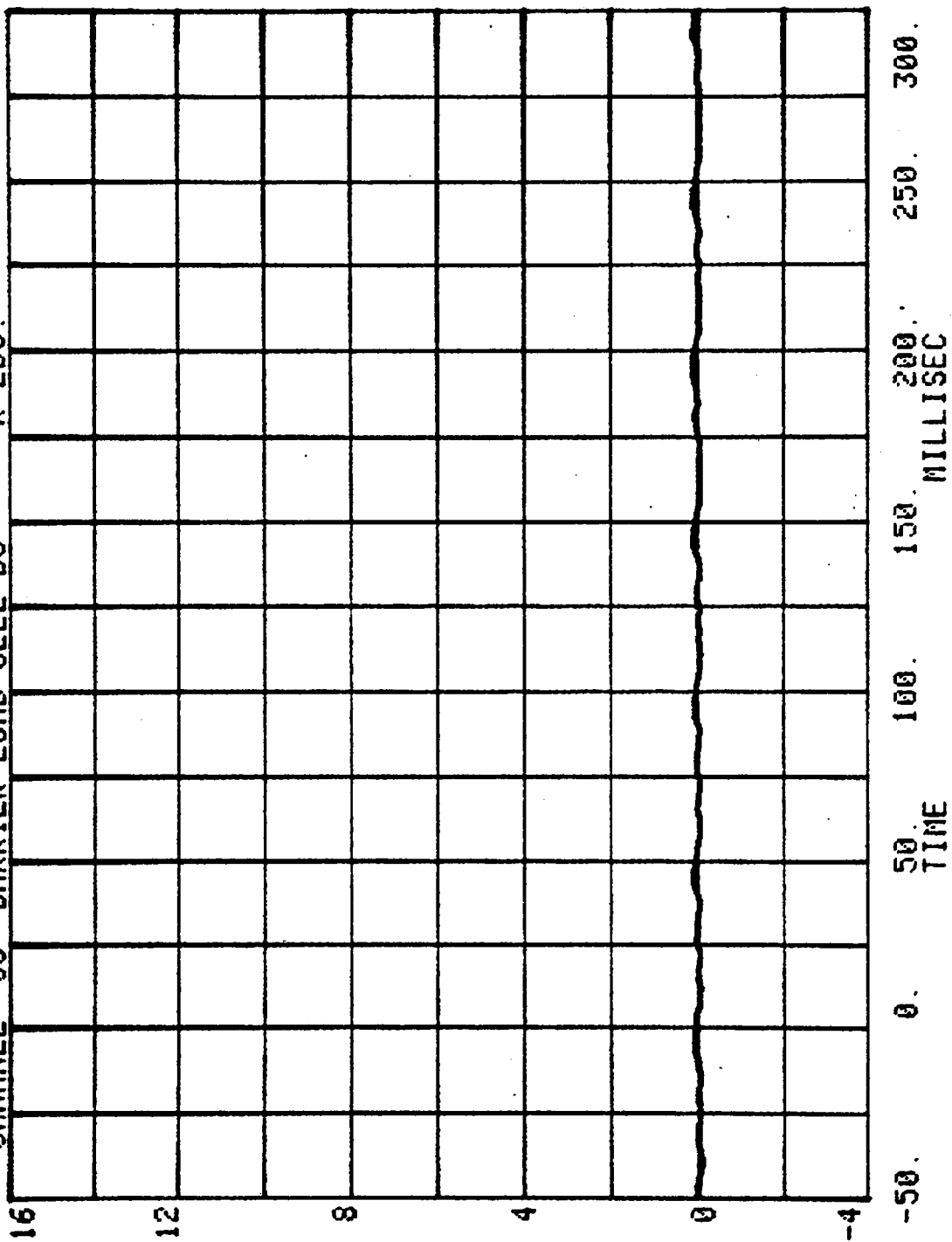
CHANNEL 51 BARRIER LOAD CELL D6 RUN= 535 SERIES= 2 K LBS.



CHANNEL 52 BARRIER LOAD CELL 07 2 K LBS.



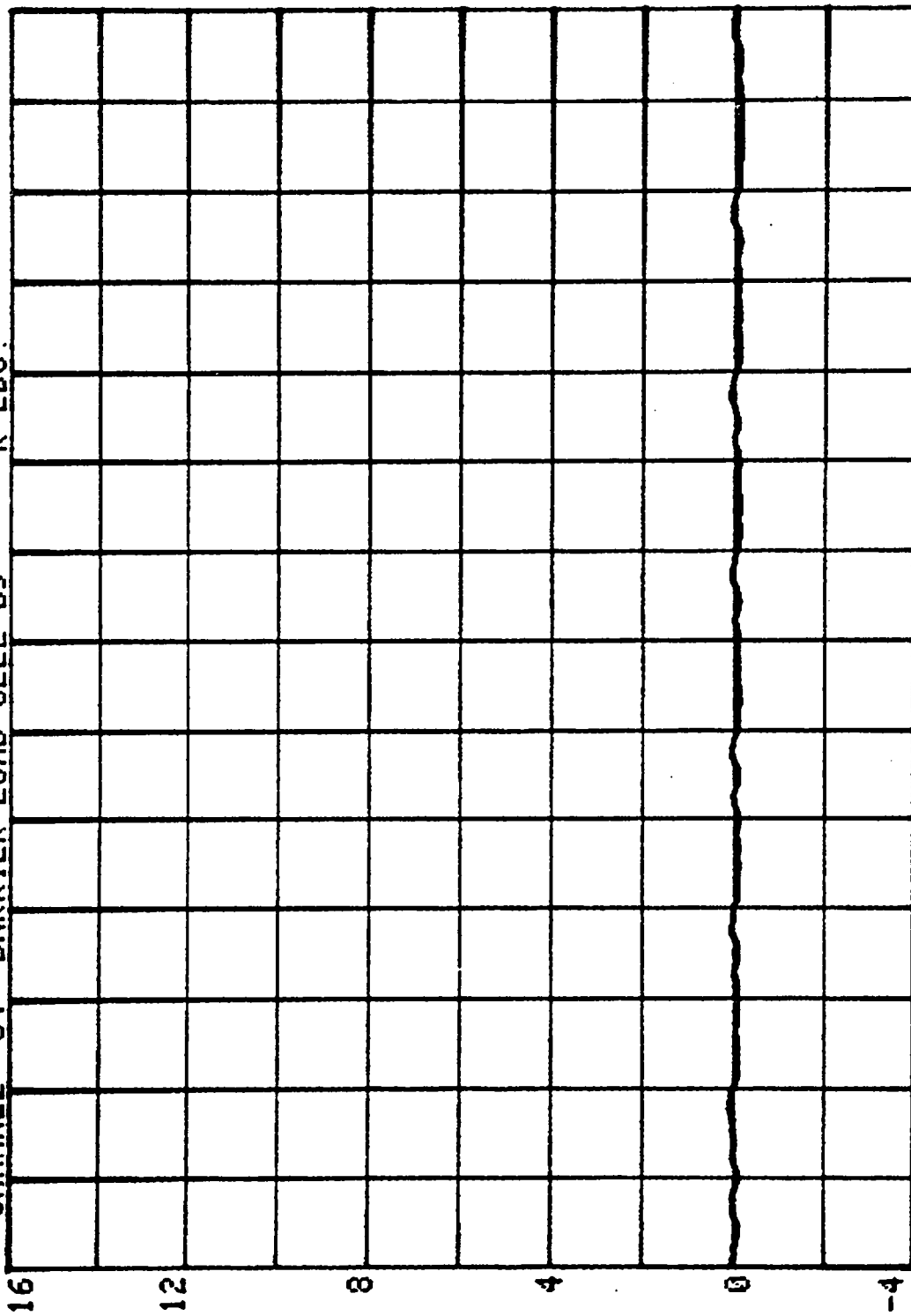
RUN= 535 SERIES= 2
CHANNEL 53 BARRIER LOAD CELL D8 K LBS.



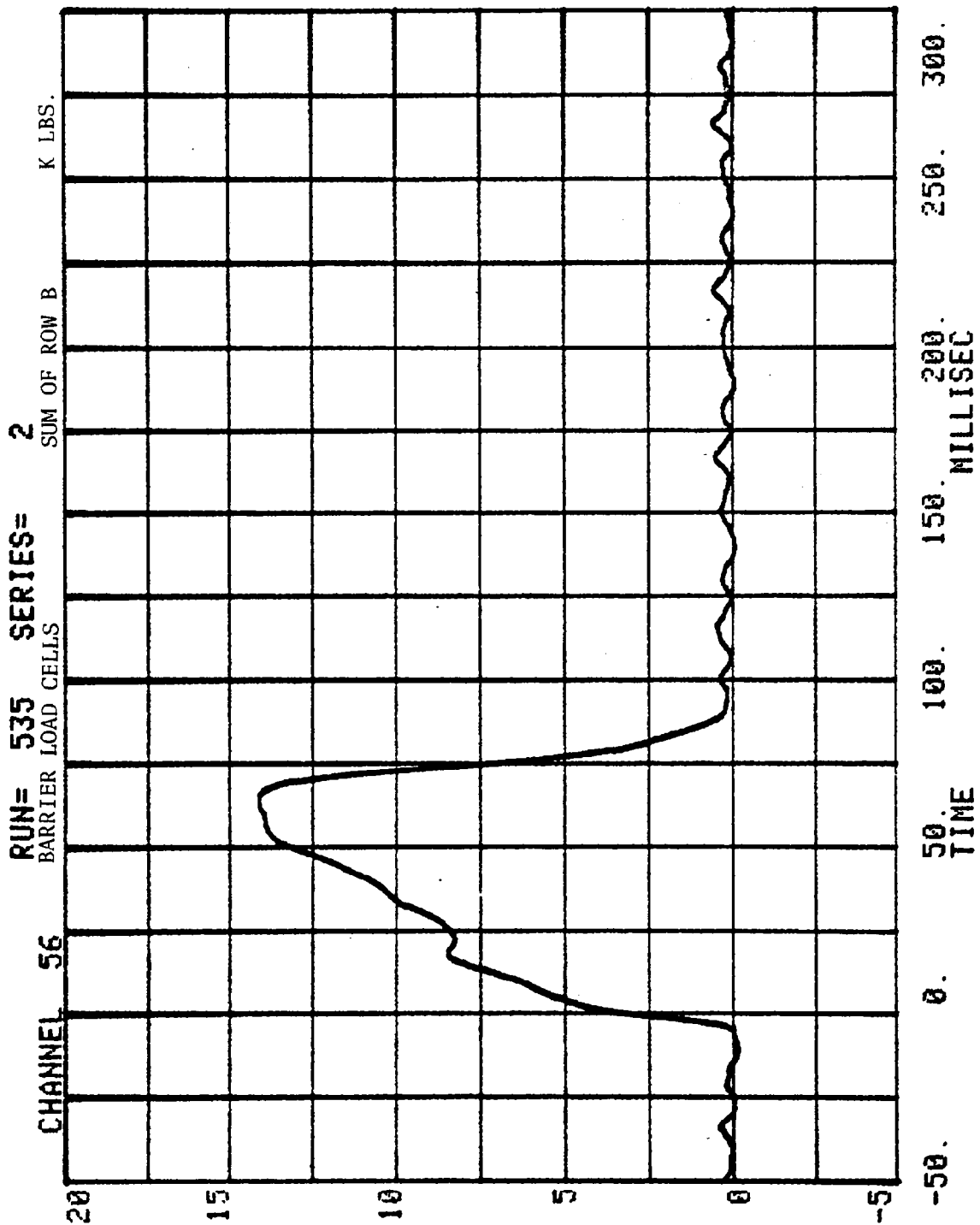
CHANNEL 54 BARRIER LOAD CELL D9

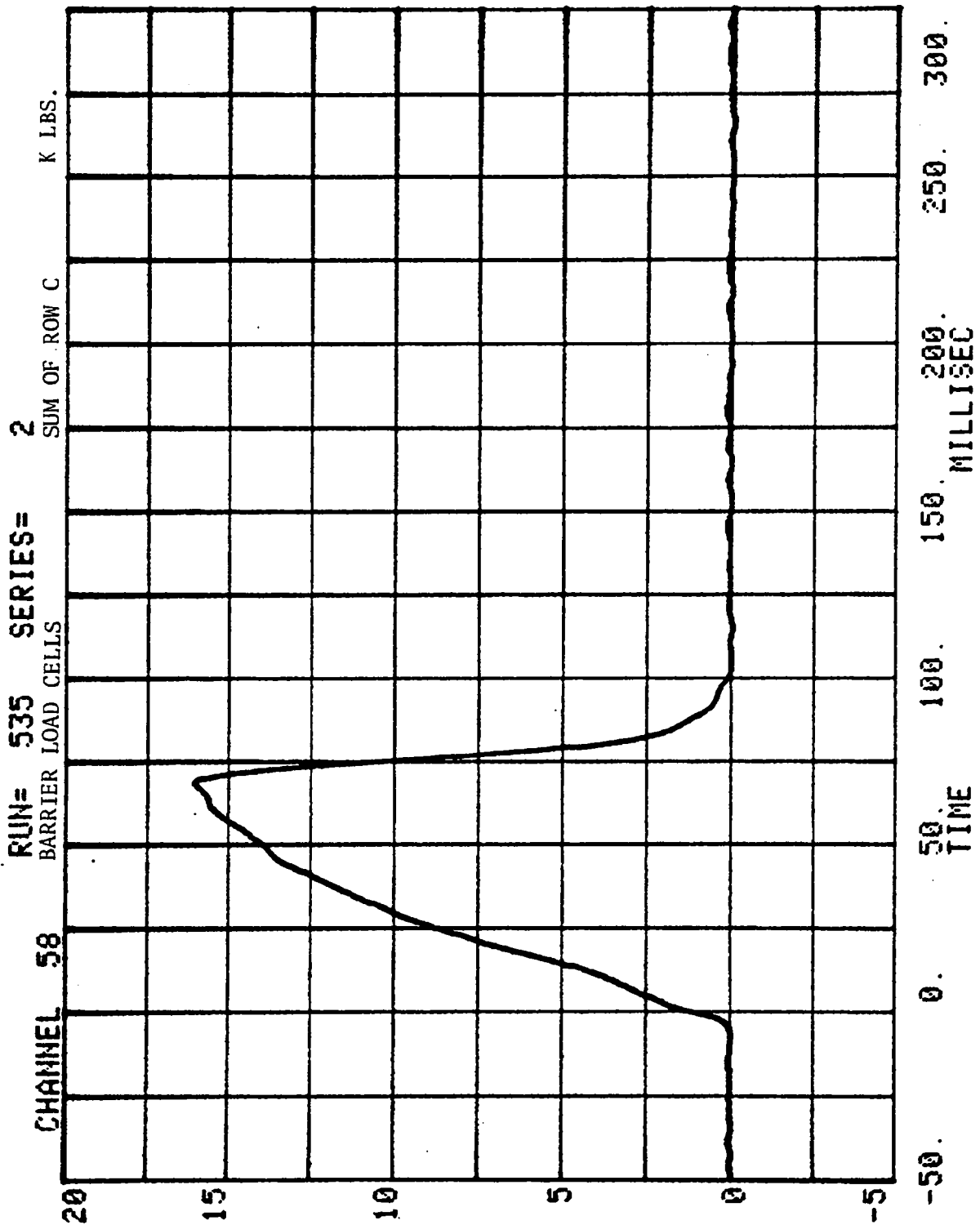
RUN= 535 SERIES= 2

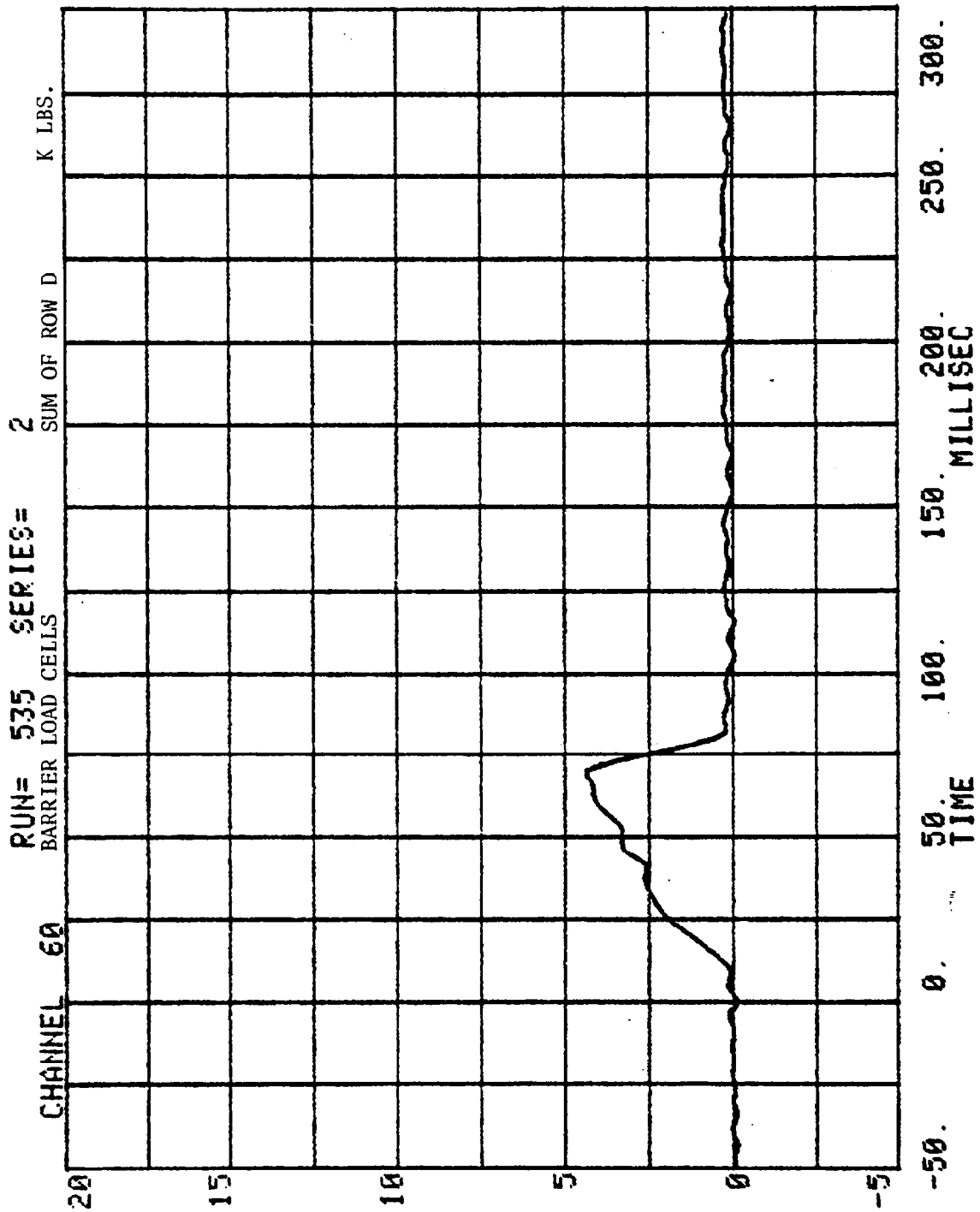
K LBS.

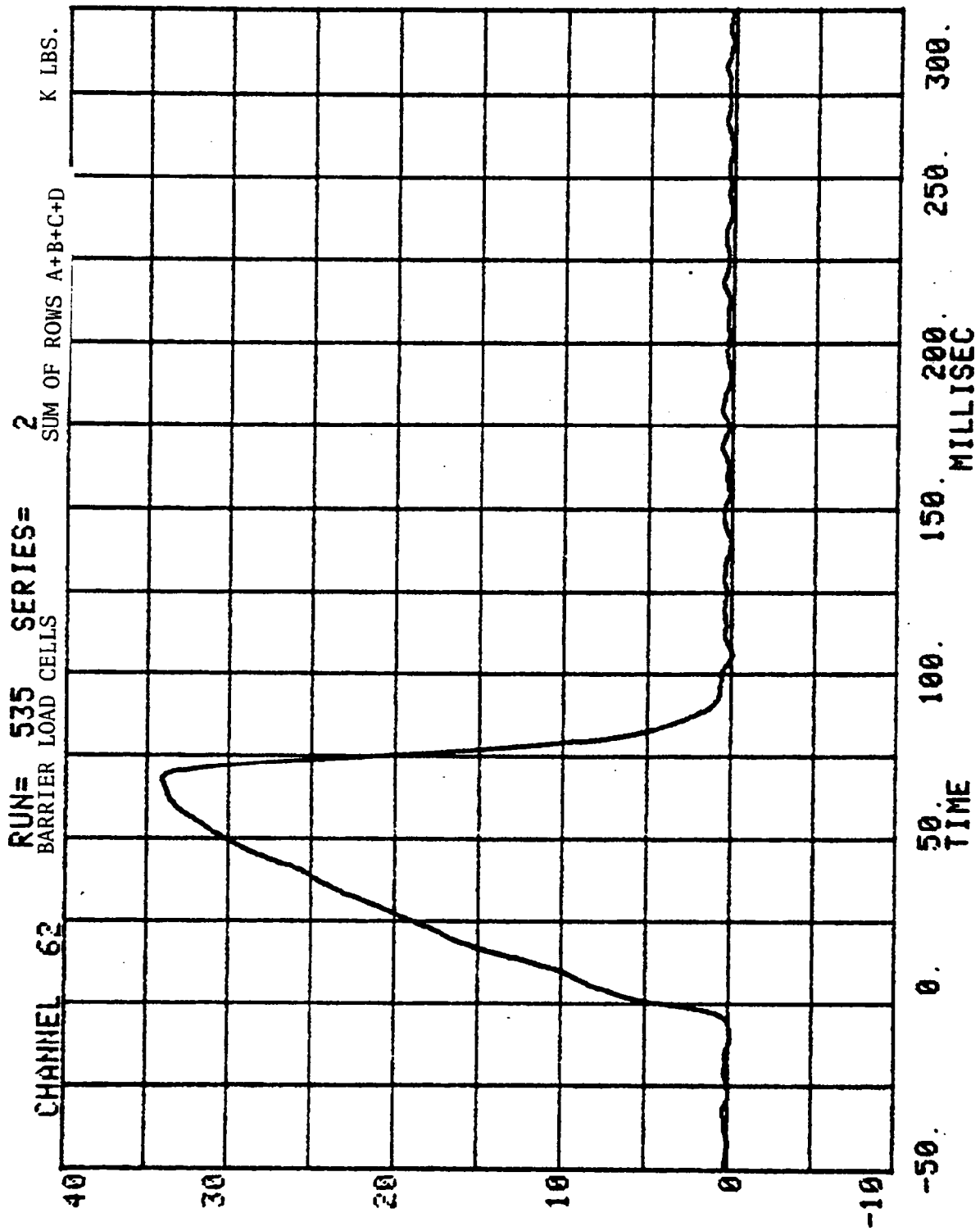


-50. 0. 50. 100. 150. 200. 250. 300.
TIME
MILLISEC



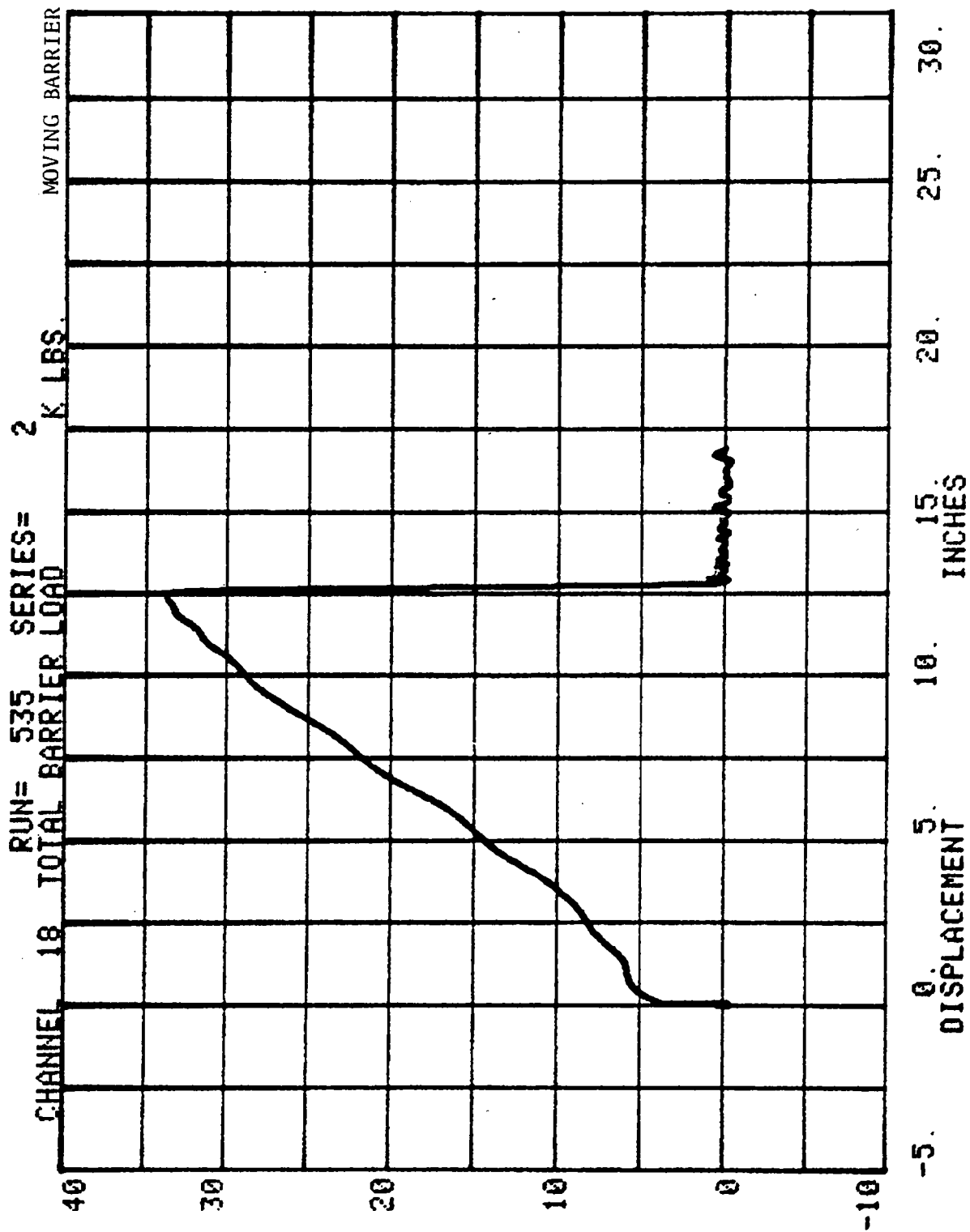






TEST NO. 2

CROSS PLOT OF MOVING BARRIER LOAD
VS. DISPLACEMENT (DERIVED FROM MOVING BARRIER ACCELERATION)



FROM ACC. PACK. #A1 (X)

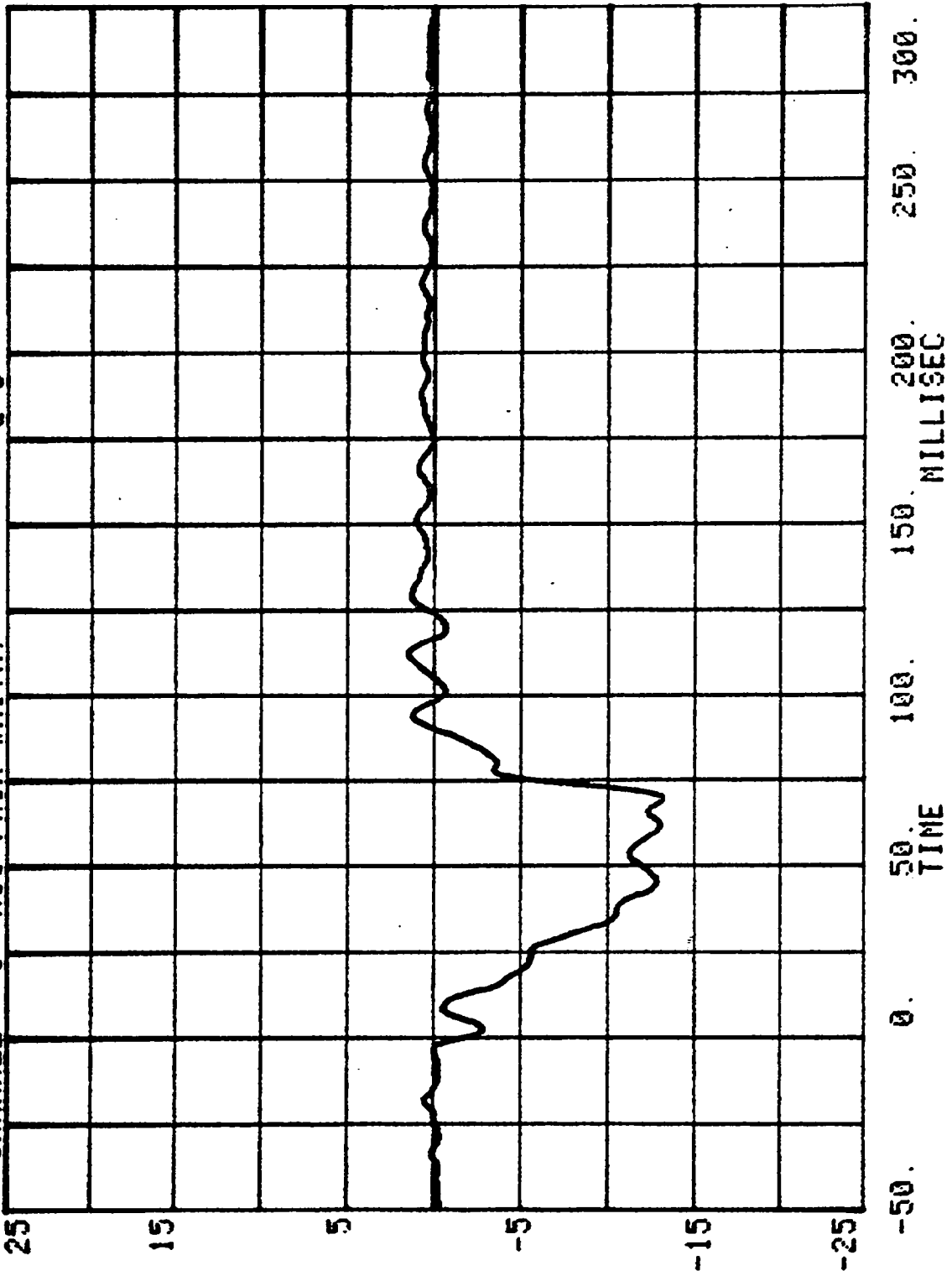
MOVING BARRIER DATA

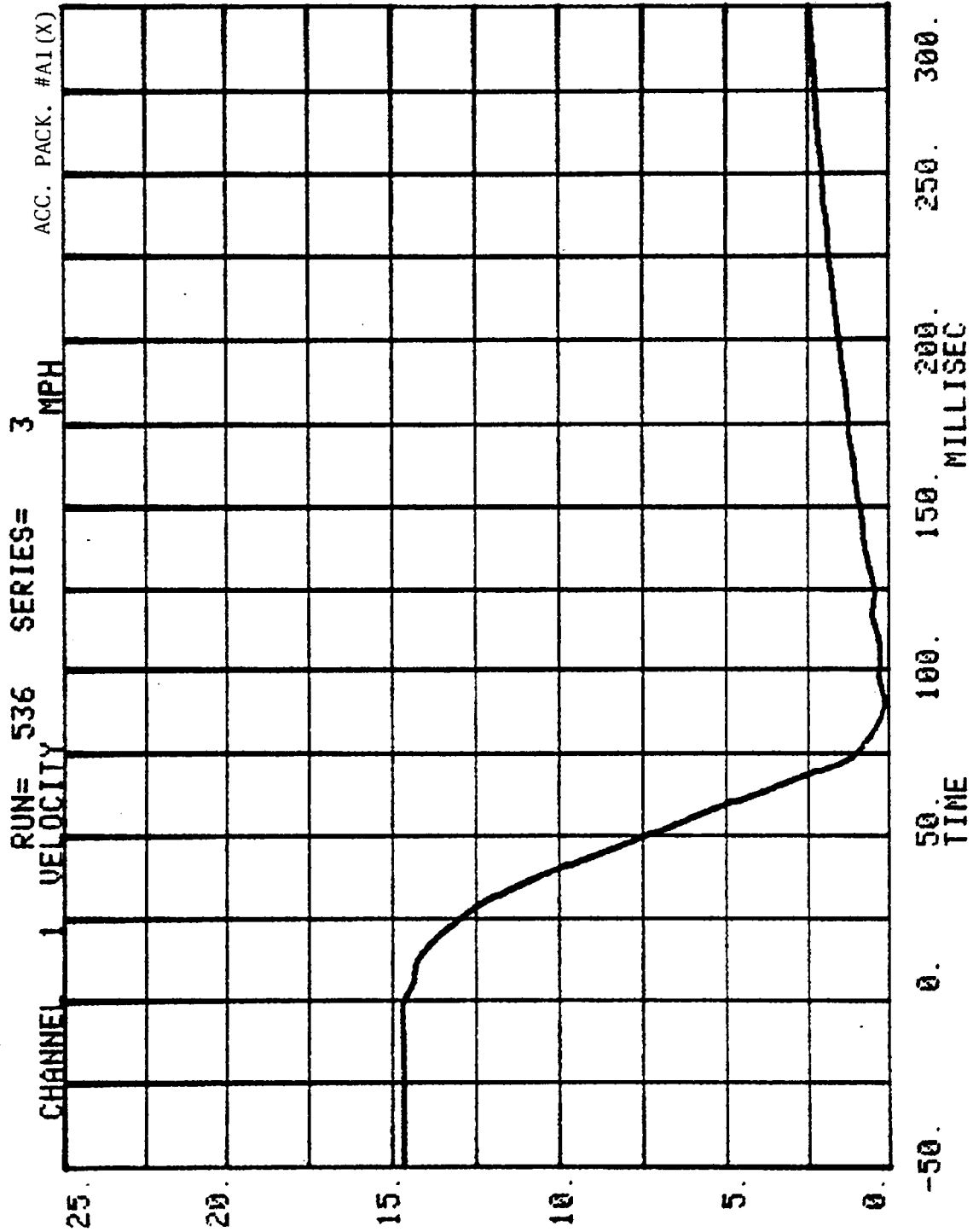
TEST NO. 3

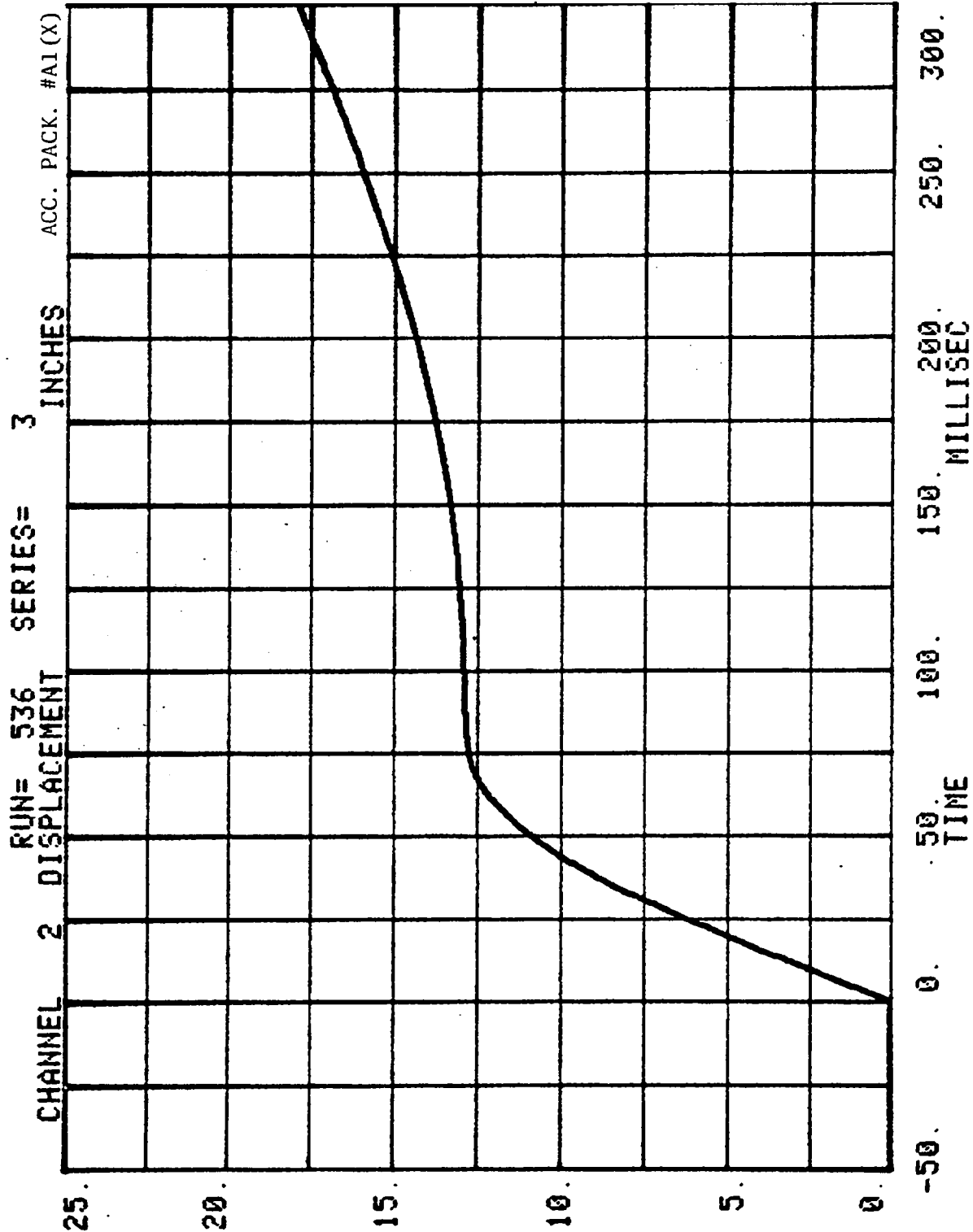
VEHICLE DATA

FILTER CLASS 60

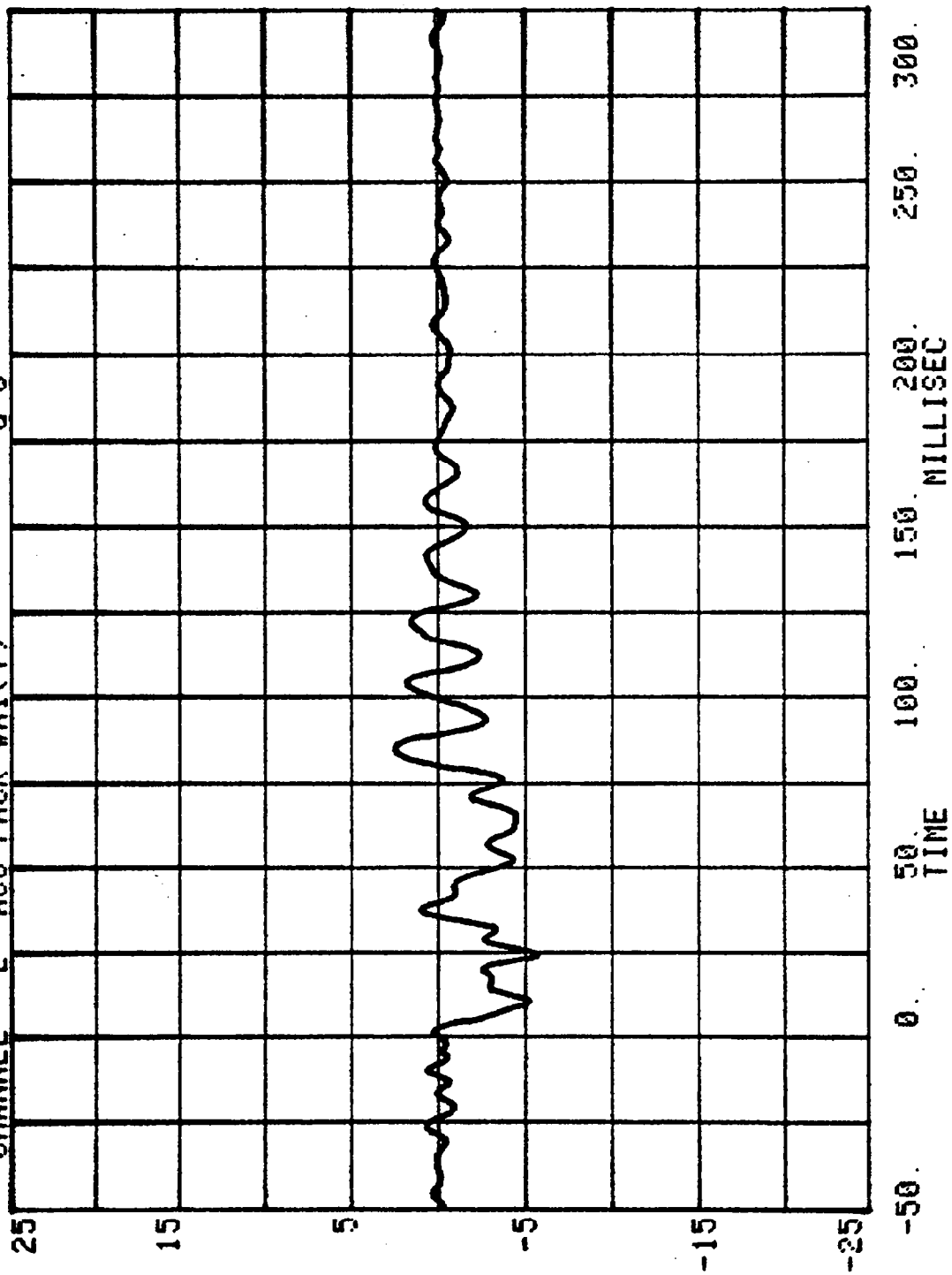
CHANNEL 1 ACC PACK #A1(X) RUN= 536 SERIES= 3 G'S

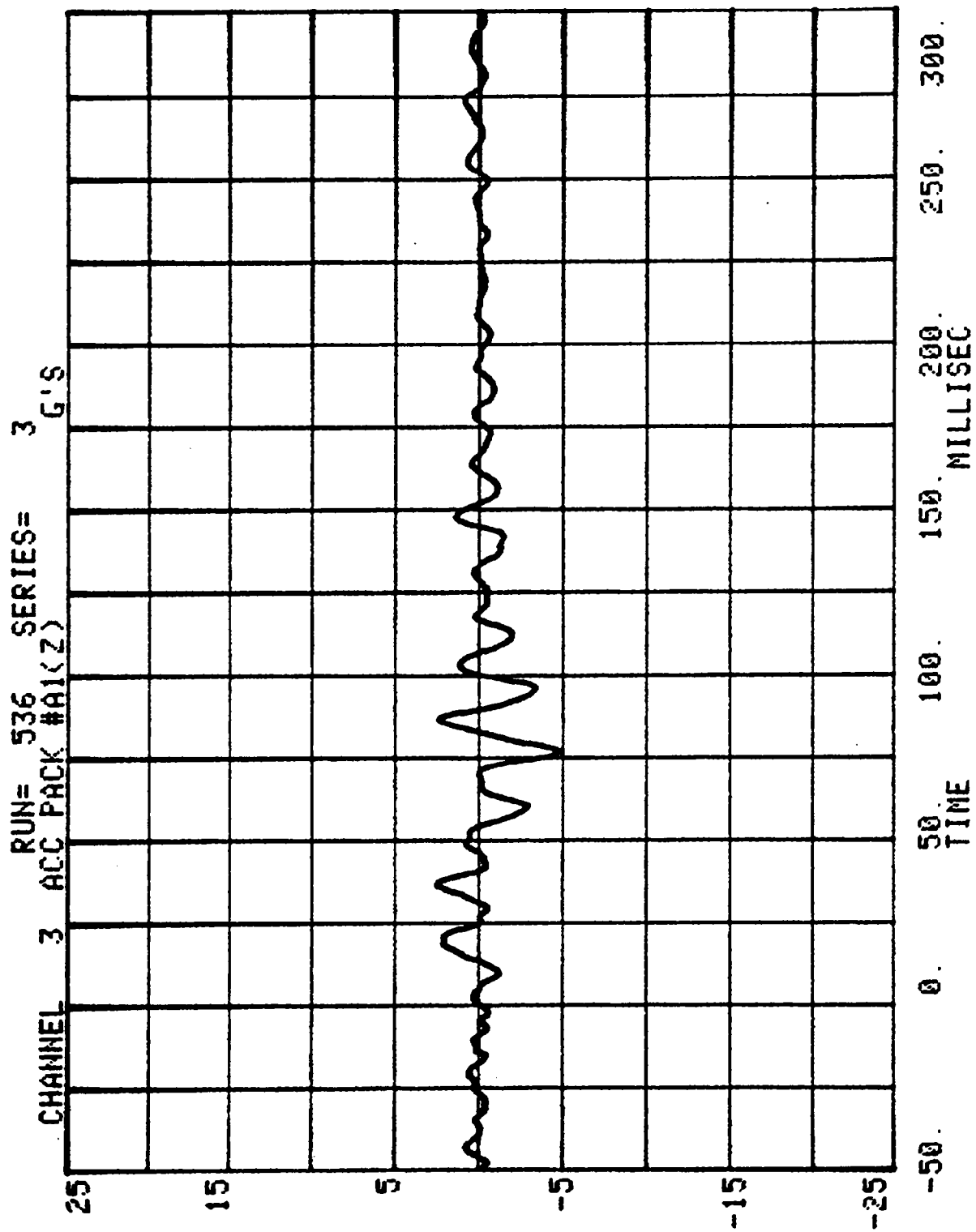




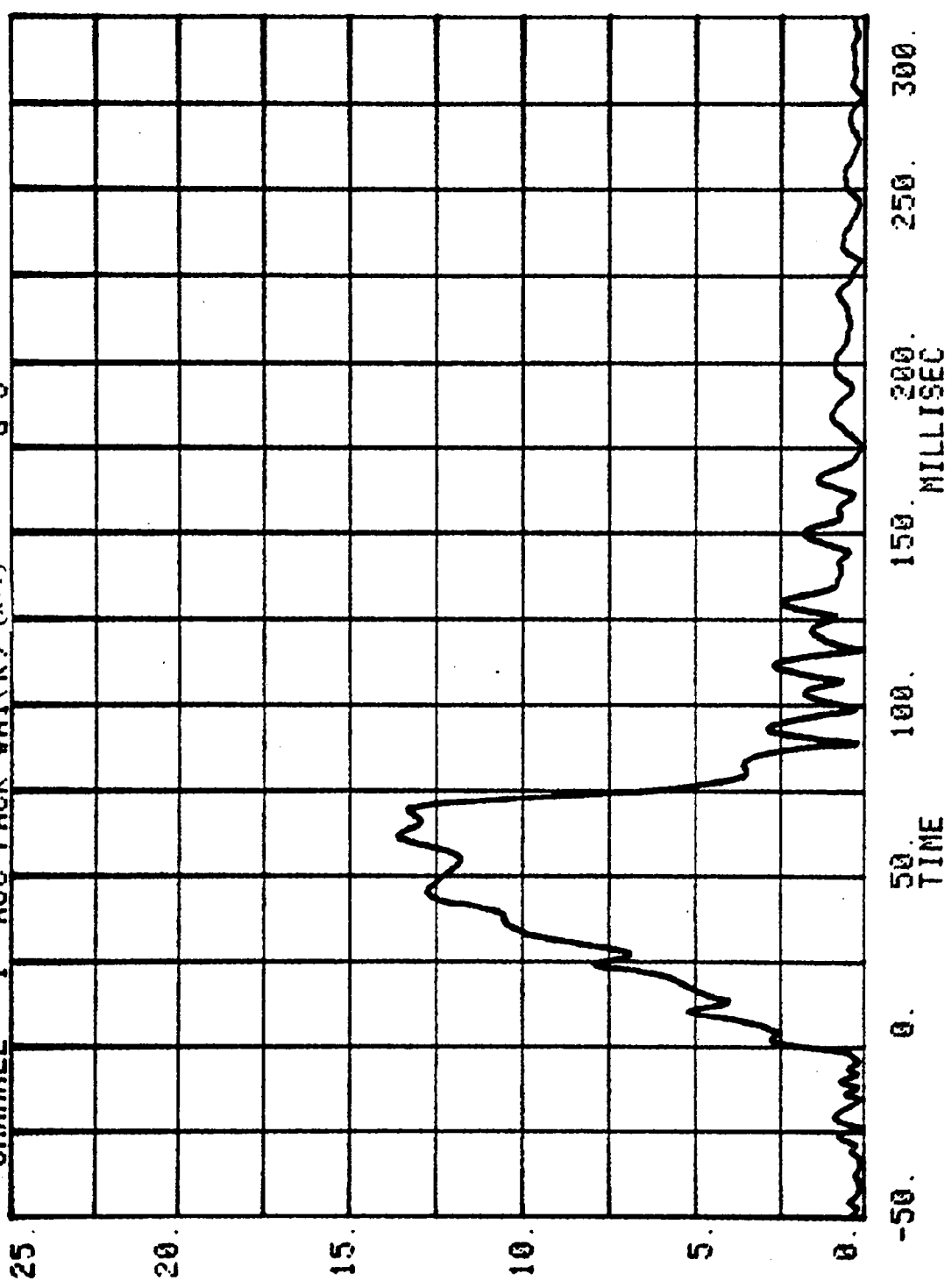


CHANNEL 2 ACC PACK #A1(Y) RUN= 536 SERIES= 3 G'S

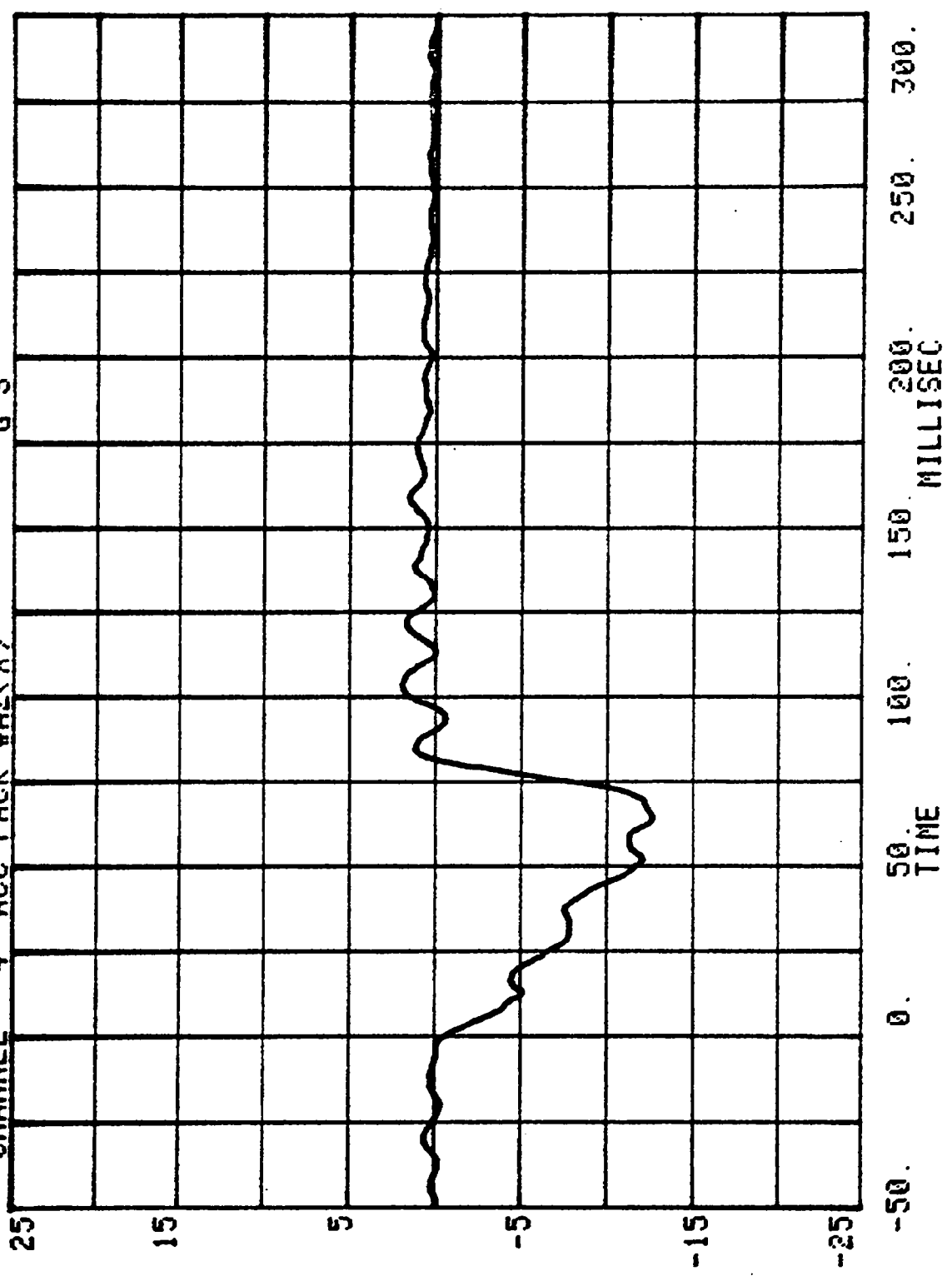


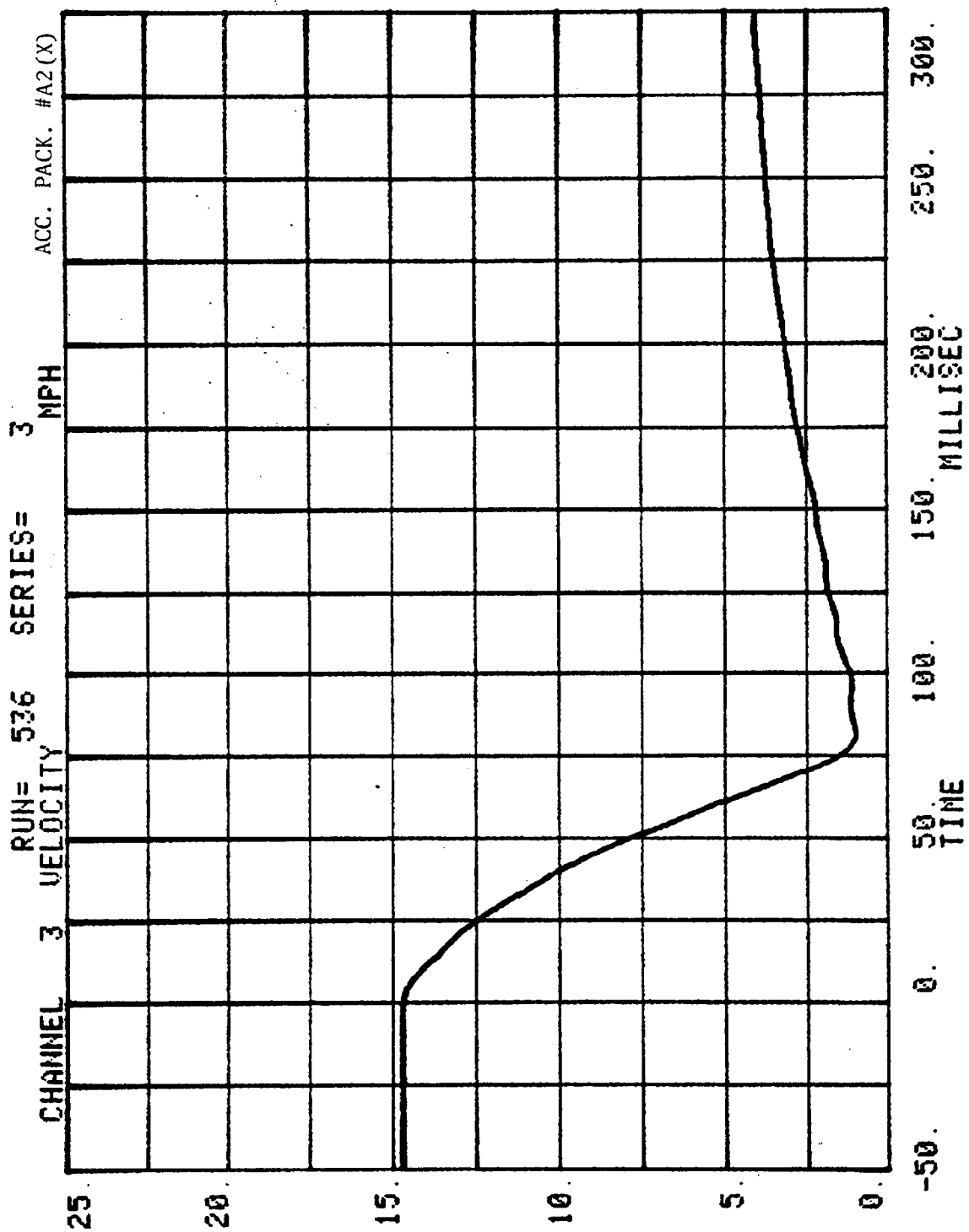


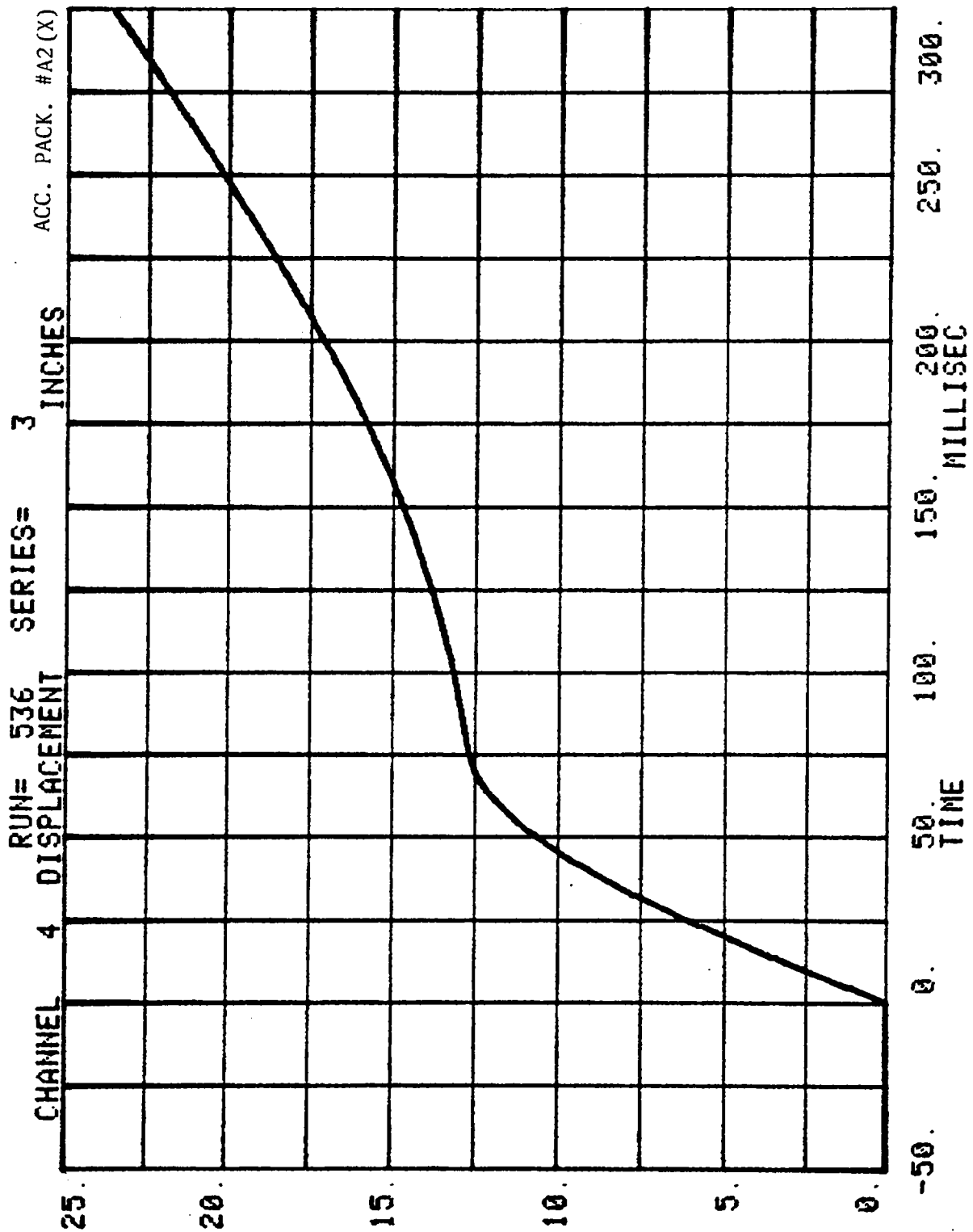
CHANNEL 1 ACC PACK #1(R) (X+Y) RUN= 536 SERIES= 3 G'S



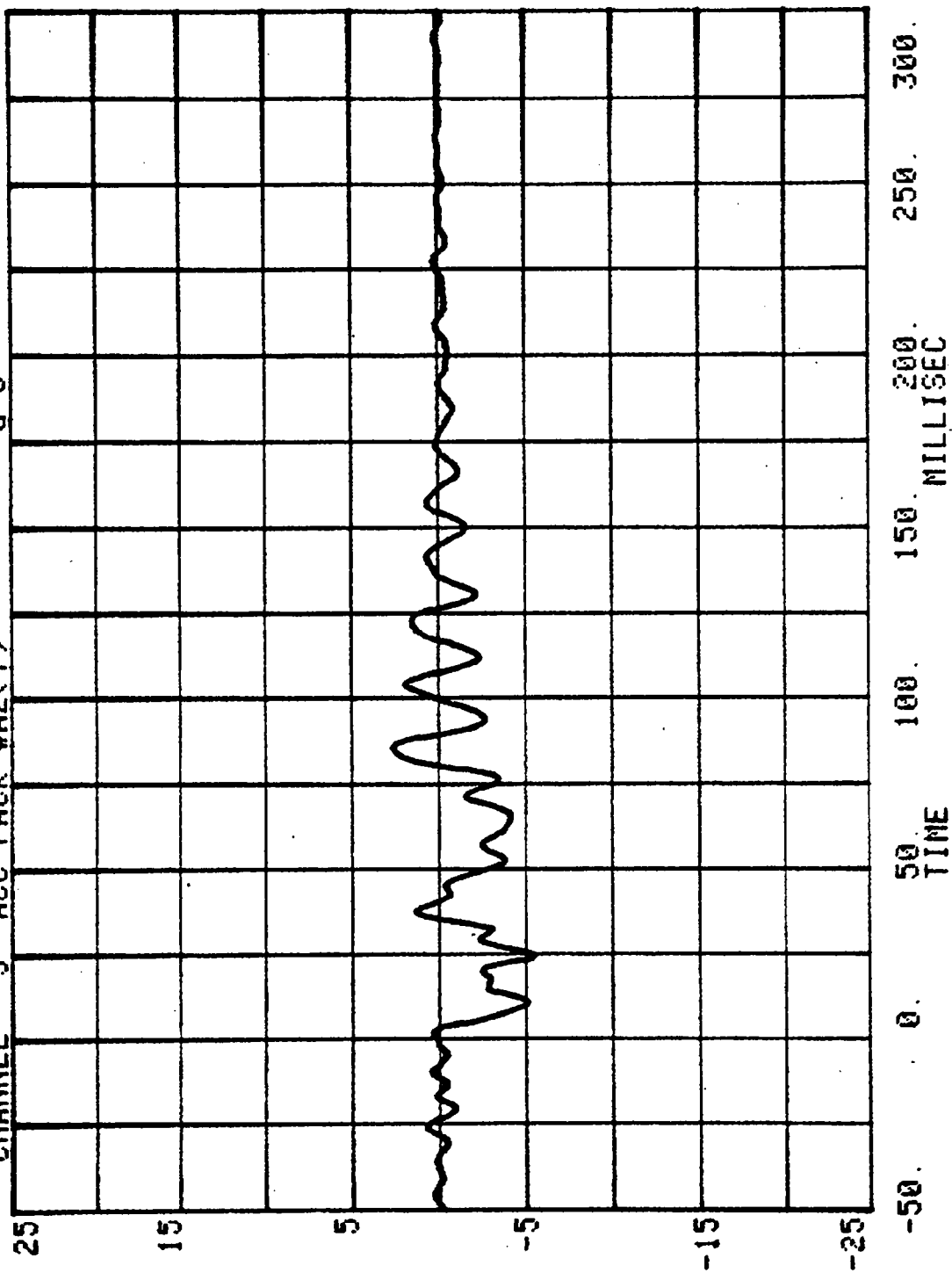
RUN= 536 SERIES= 3
CHANNEL 4 ACC PACK #A2(X) G'S



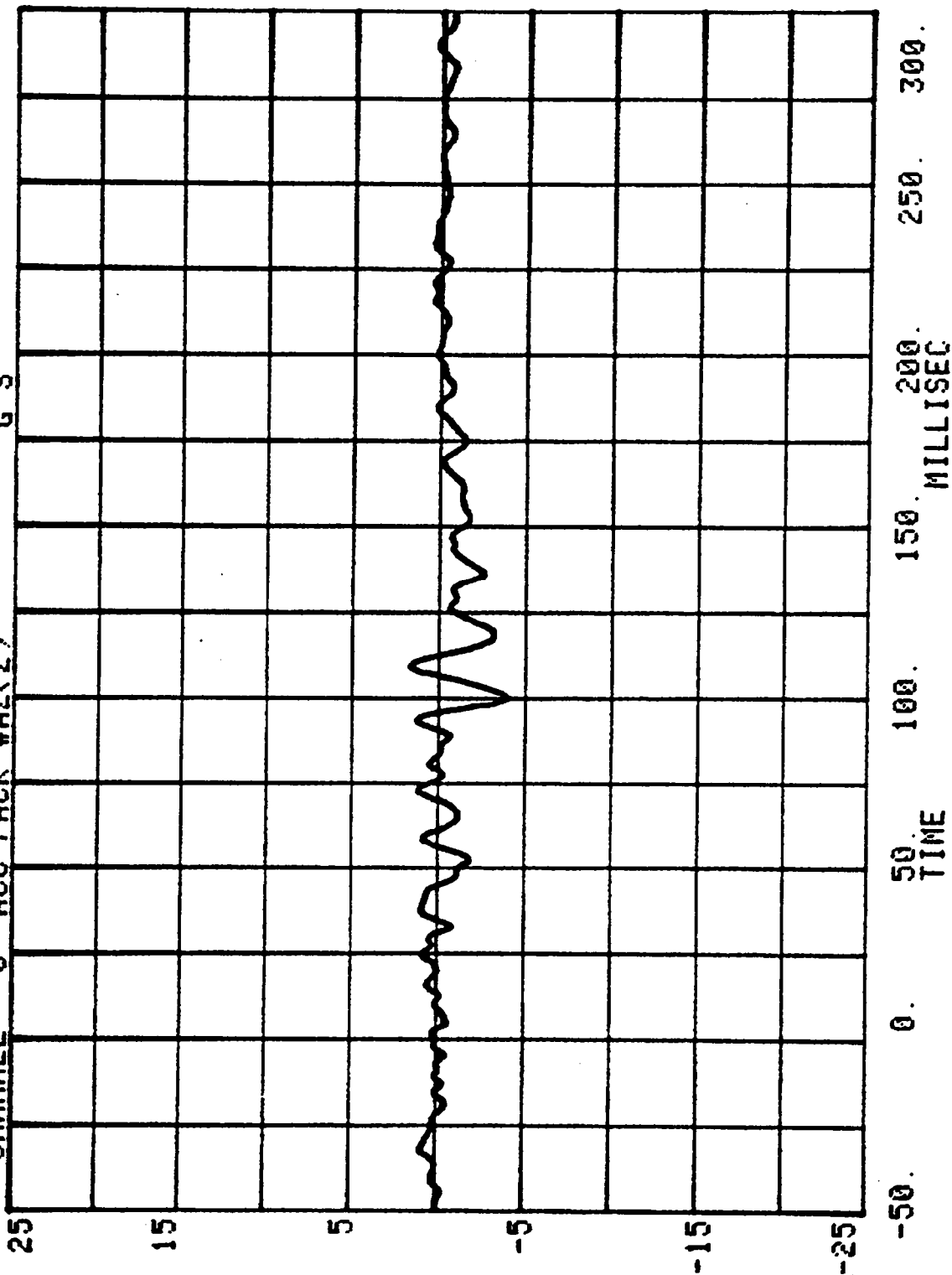




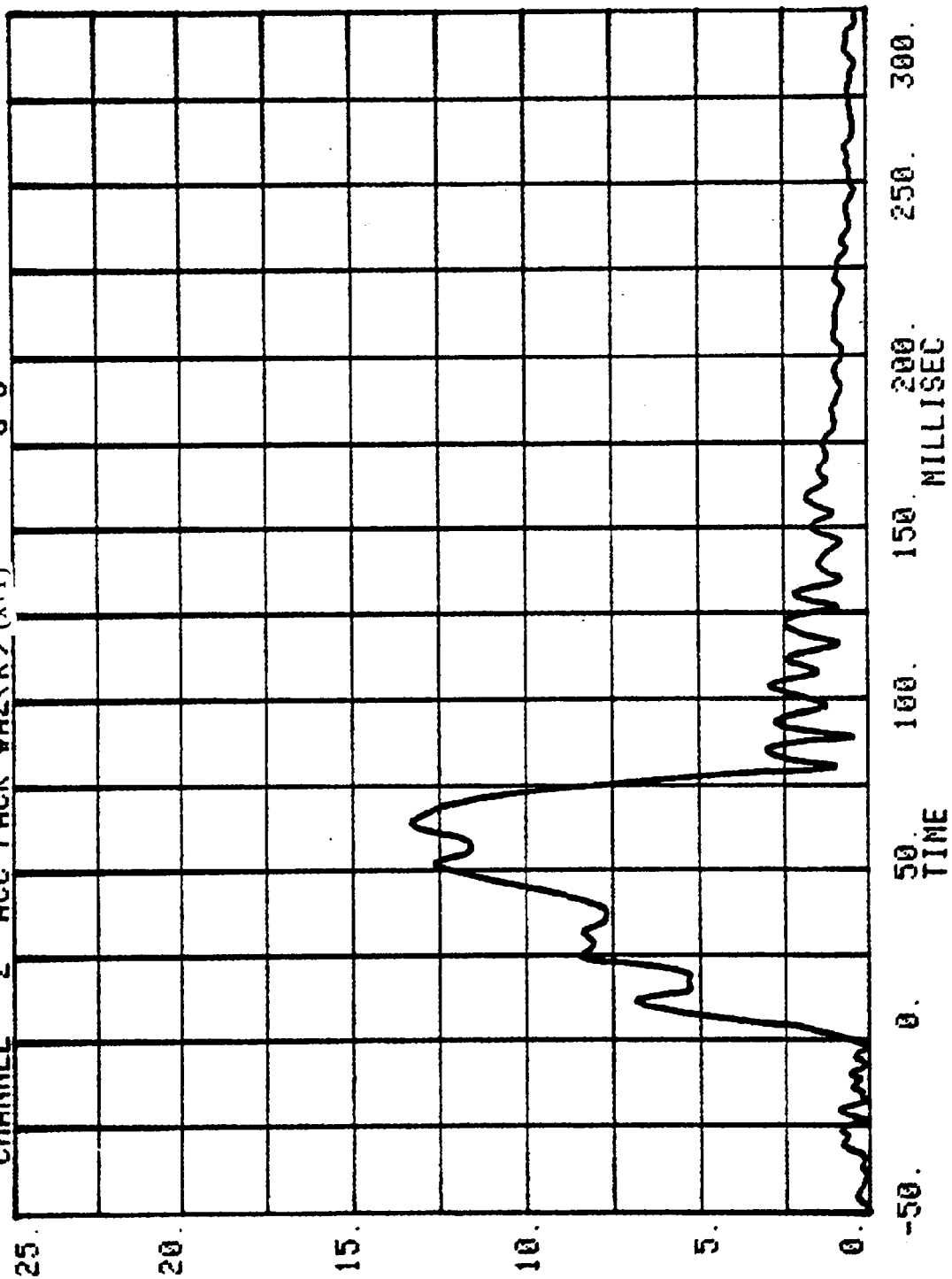
RUN= 536 SERIES= 3
CHANNEL 5 ACC PACK #A2(Y) G'S



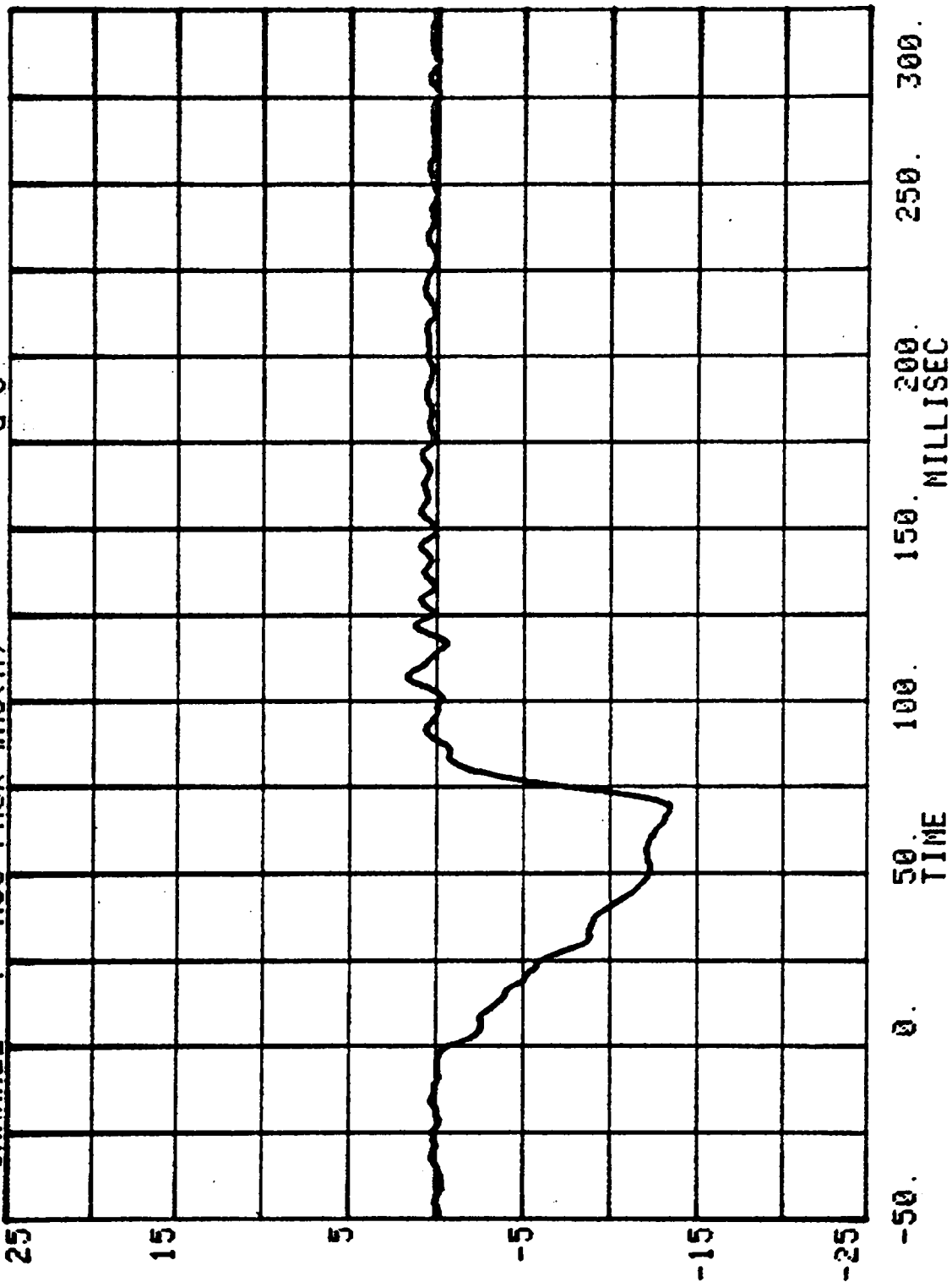
CHANNEL 6 ACC PACK #A2(Z) RUN= 536 SERIES= 3 G'S

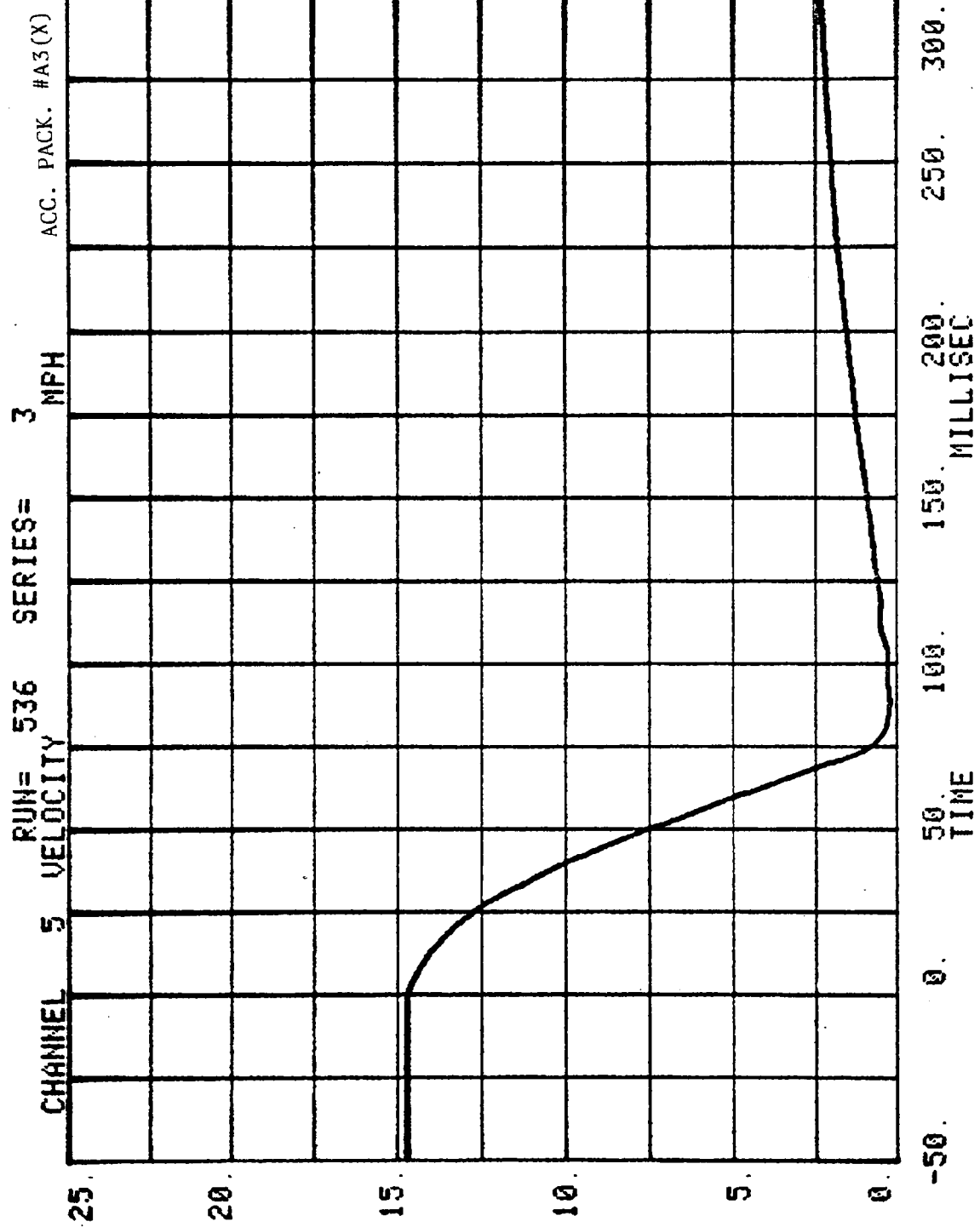


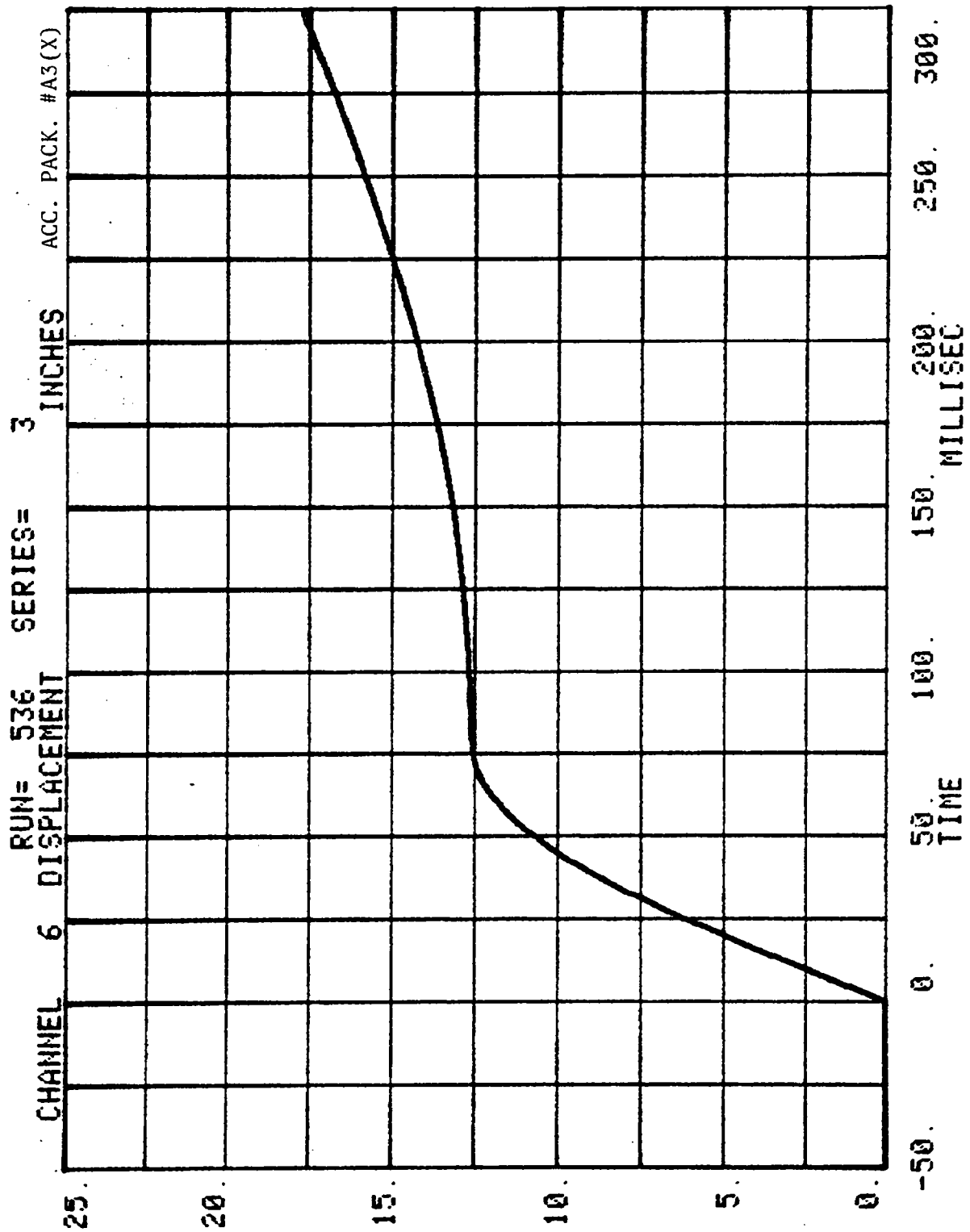
CHANNEL 2 ACC PACK #A2(R) (X+Y) RUN= 536 SERIES= 3 G'S



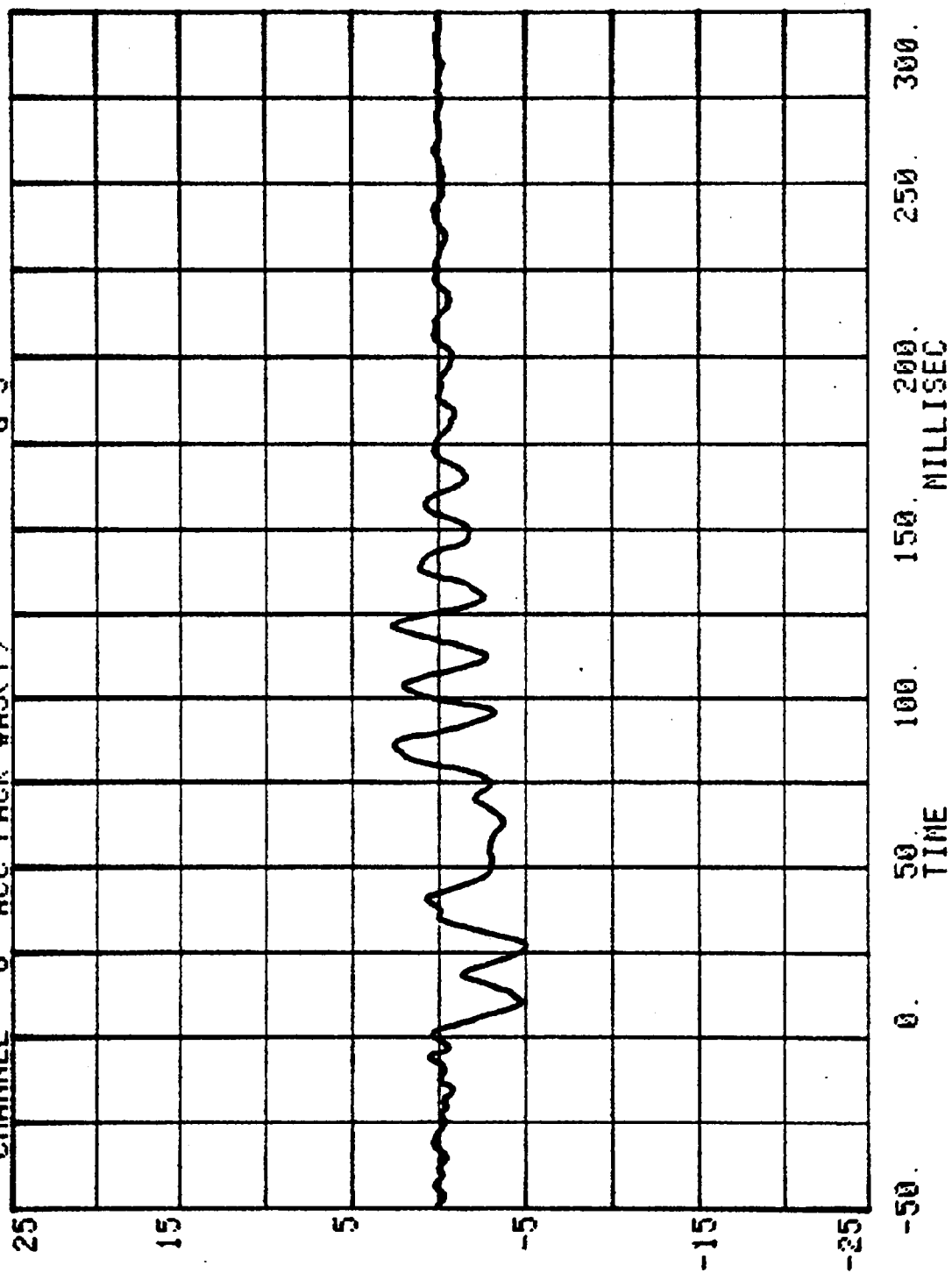
CHANNEL 7 RUN= 536 SERIES= 3
ACC PACK #A3(X) G'S



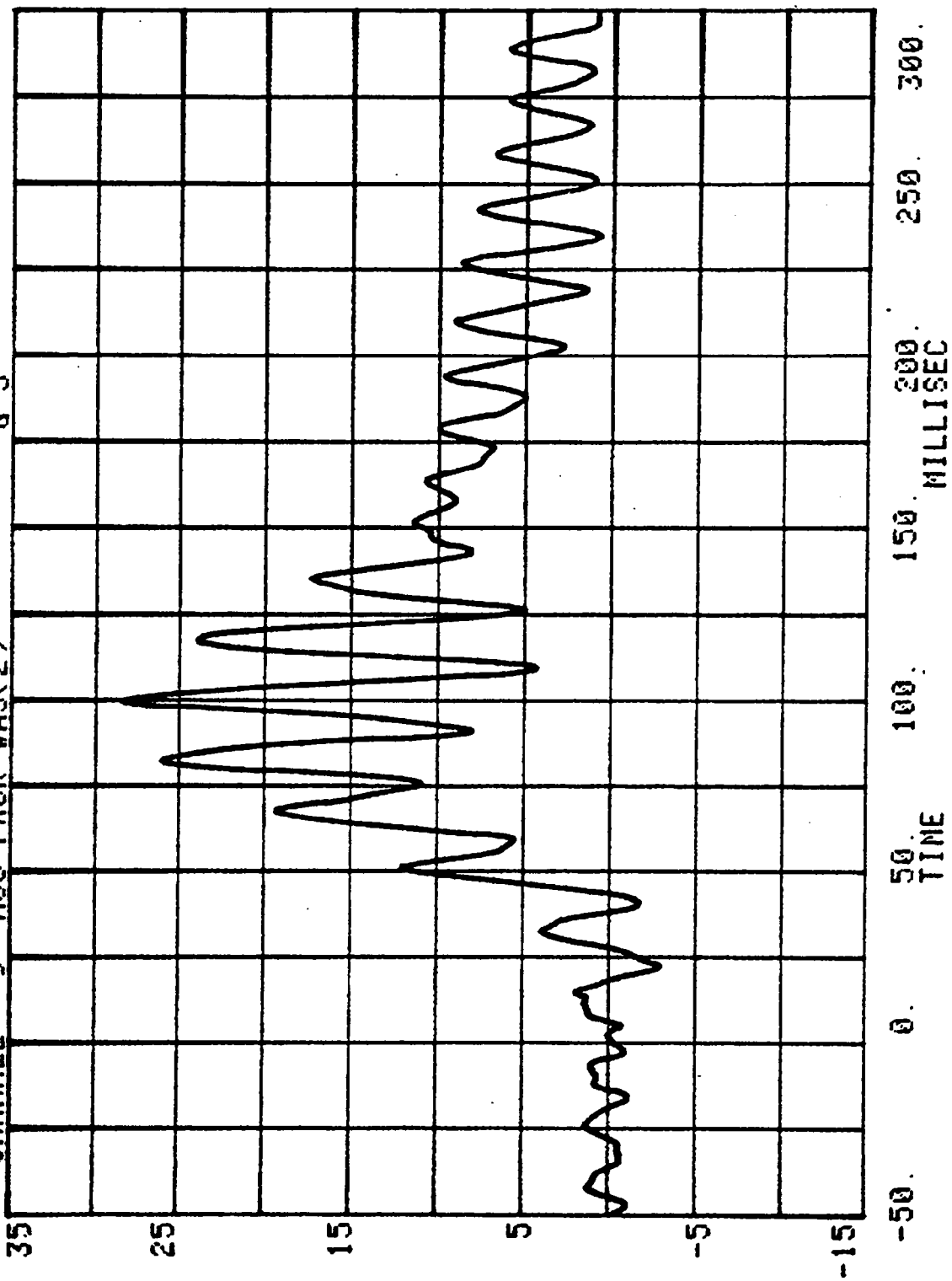




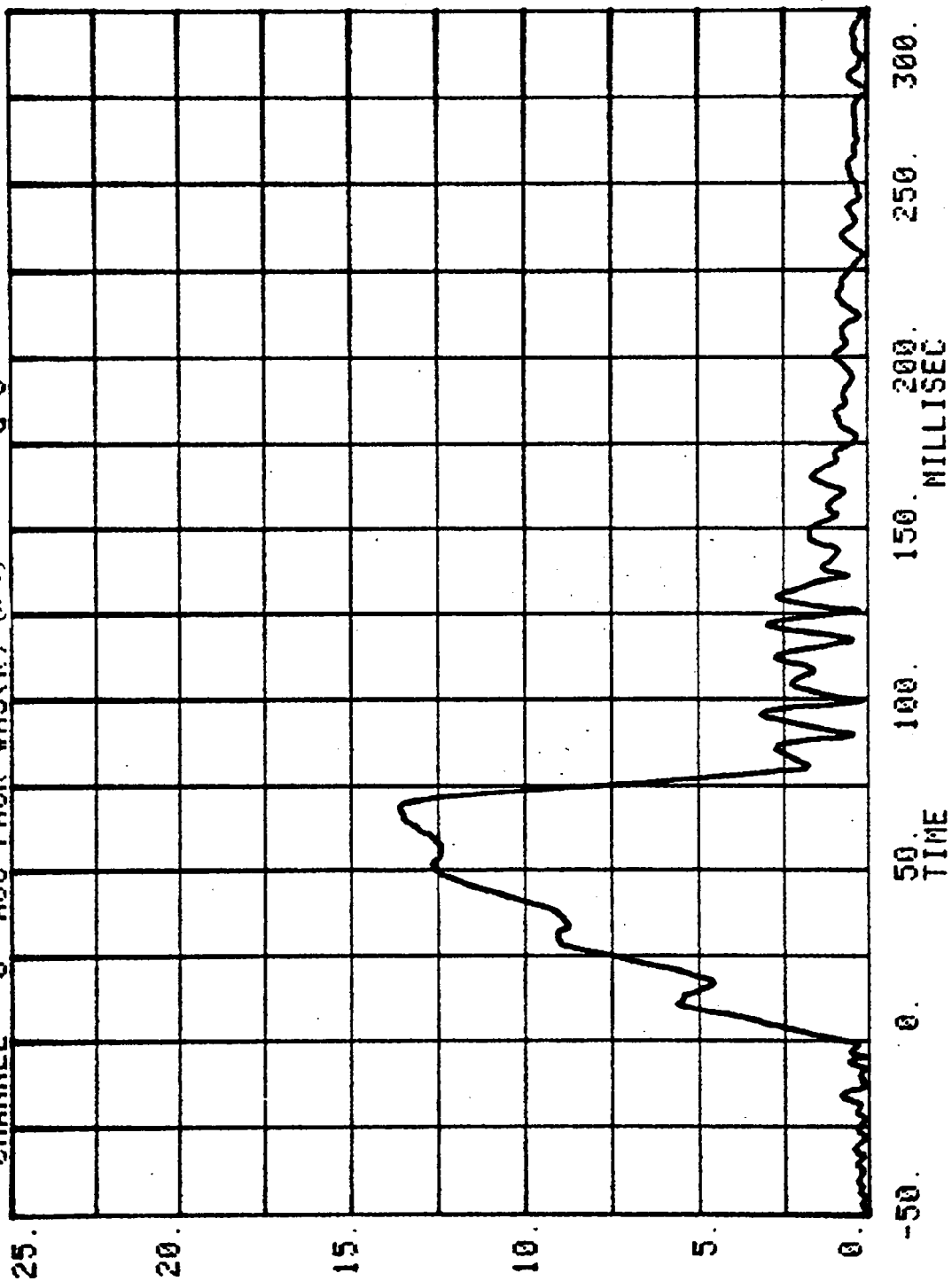
CHANNEL 8 RUN= 536 SERIES= 3
ACC PACK #A3(Y) G'S



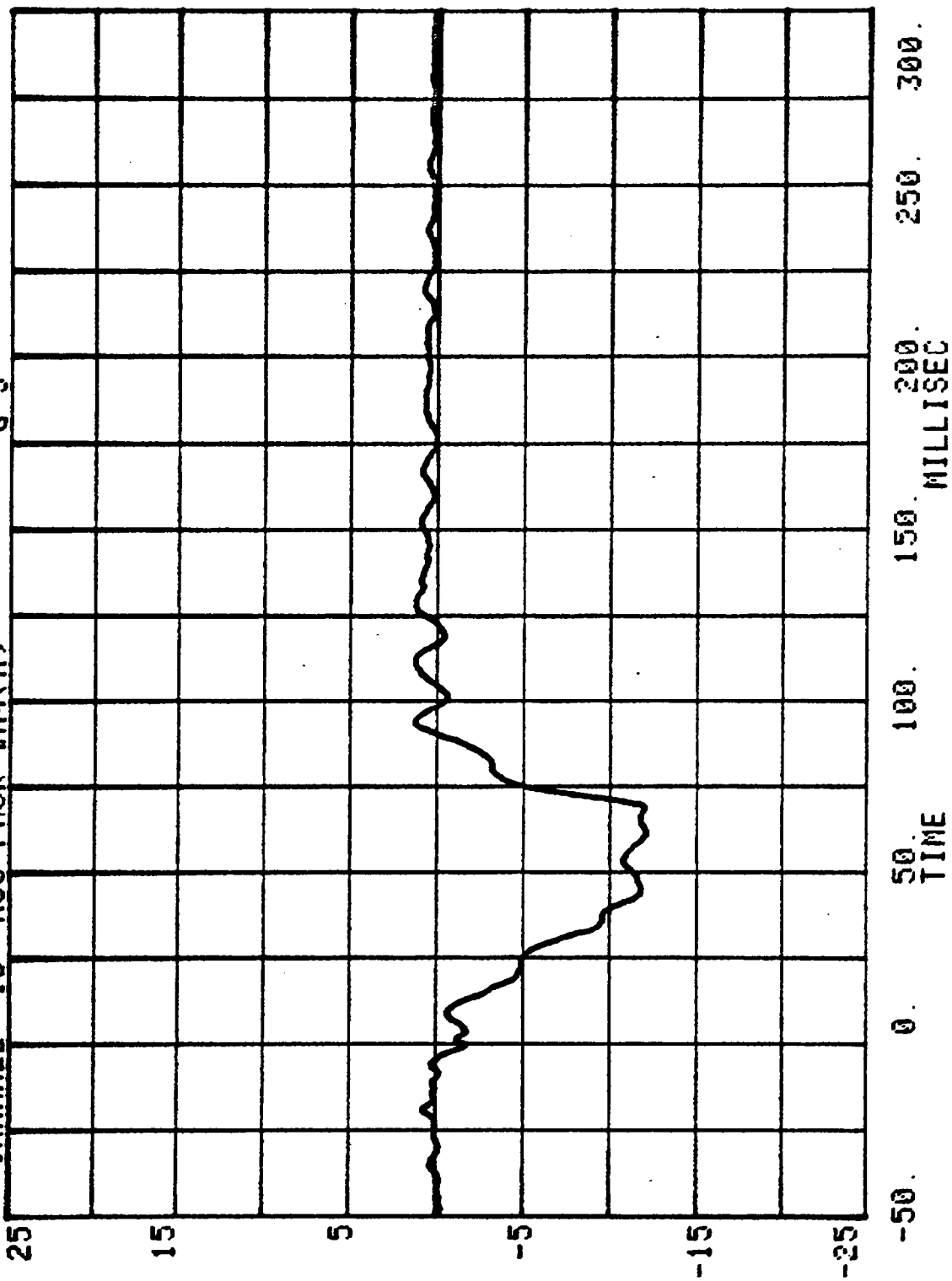
CHANNEL 9 ACC PACK #A3(Z) RUN= 536 SERIES= 3 G'S

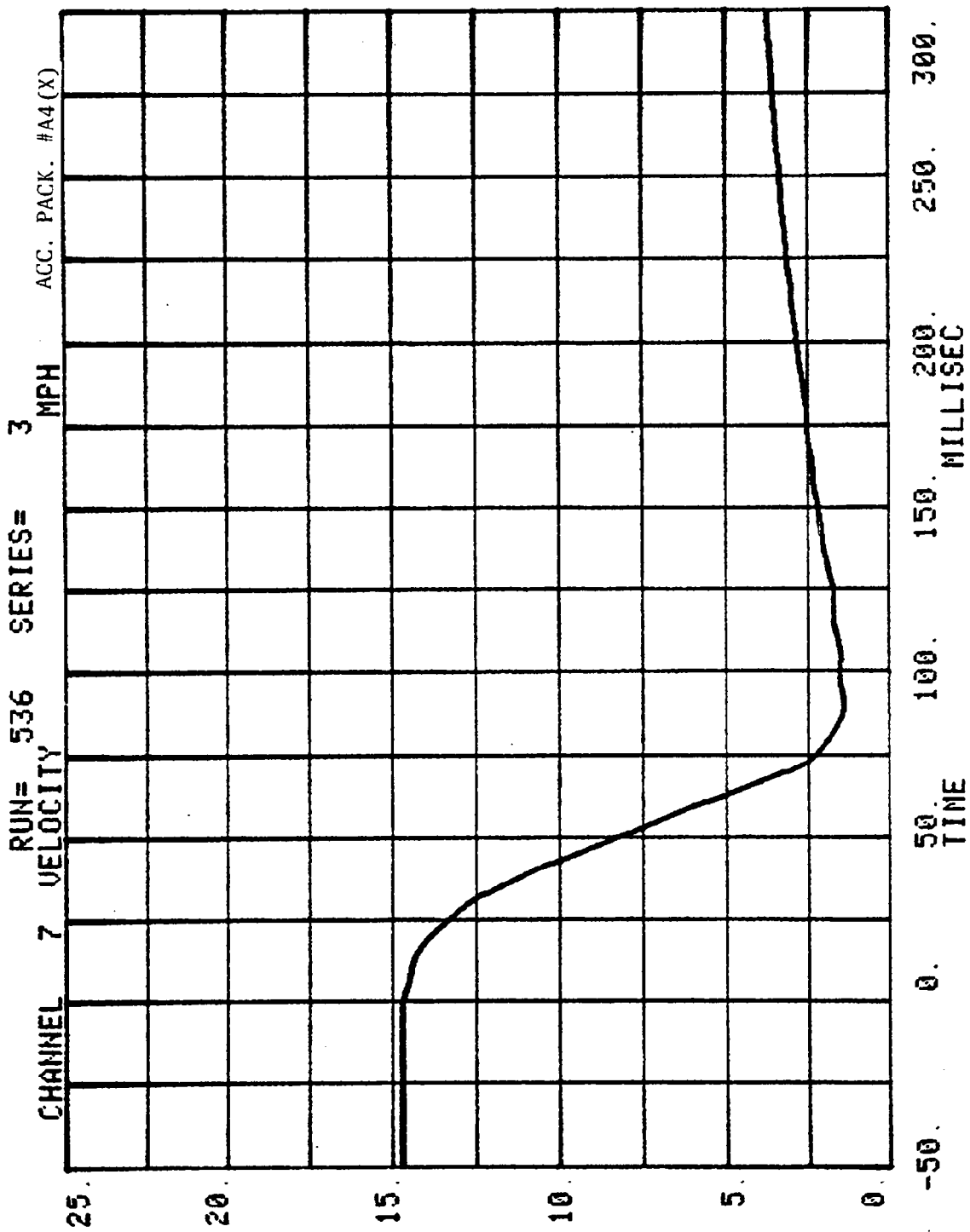


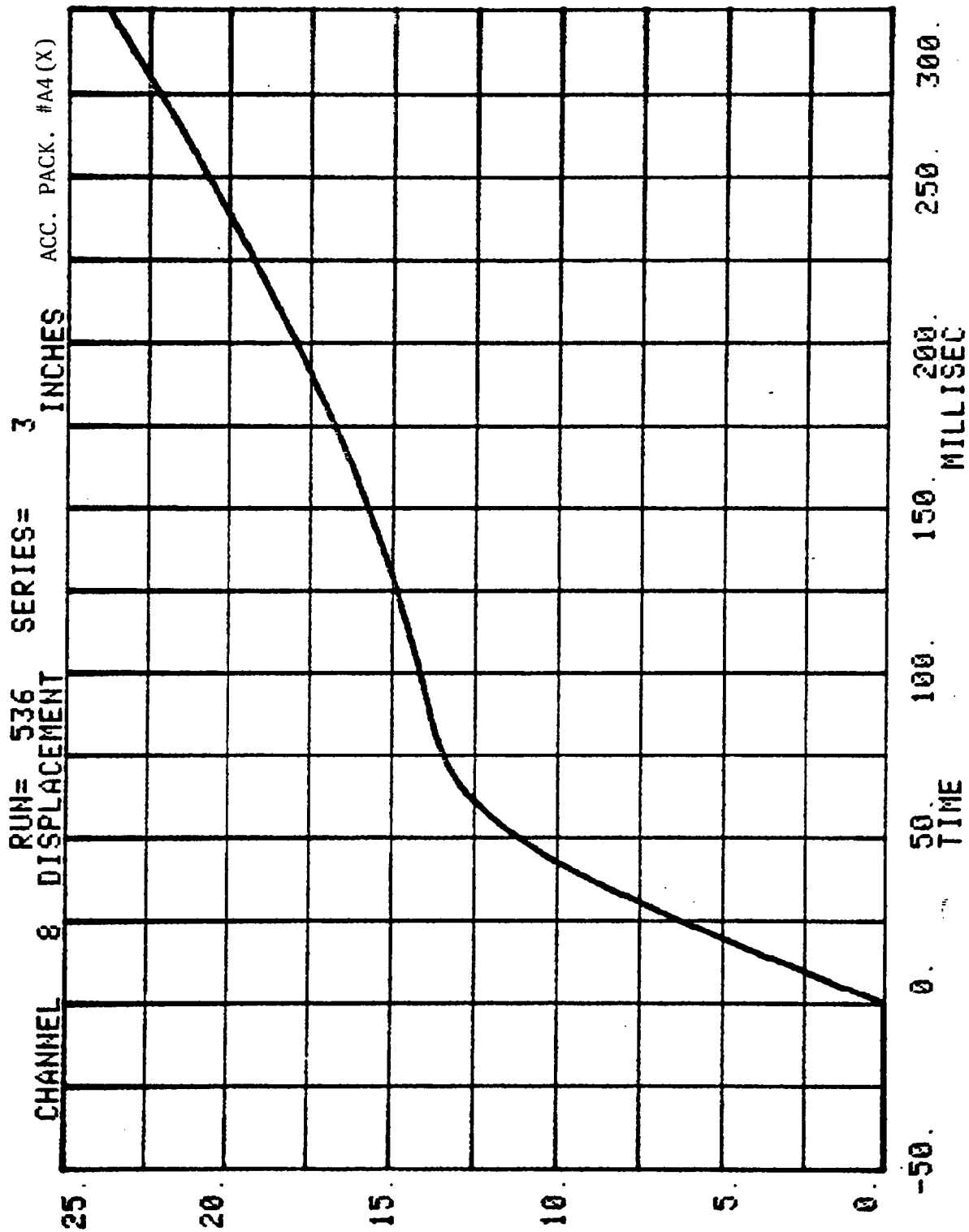
CHANNEL 3 ACC PAK #A3(R) (X+Y) RUN= 536 SERIES= 3 G'S



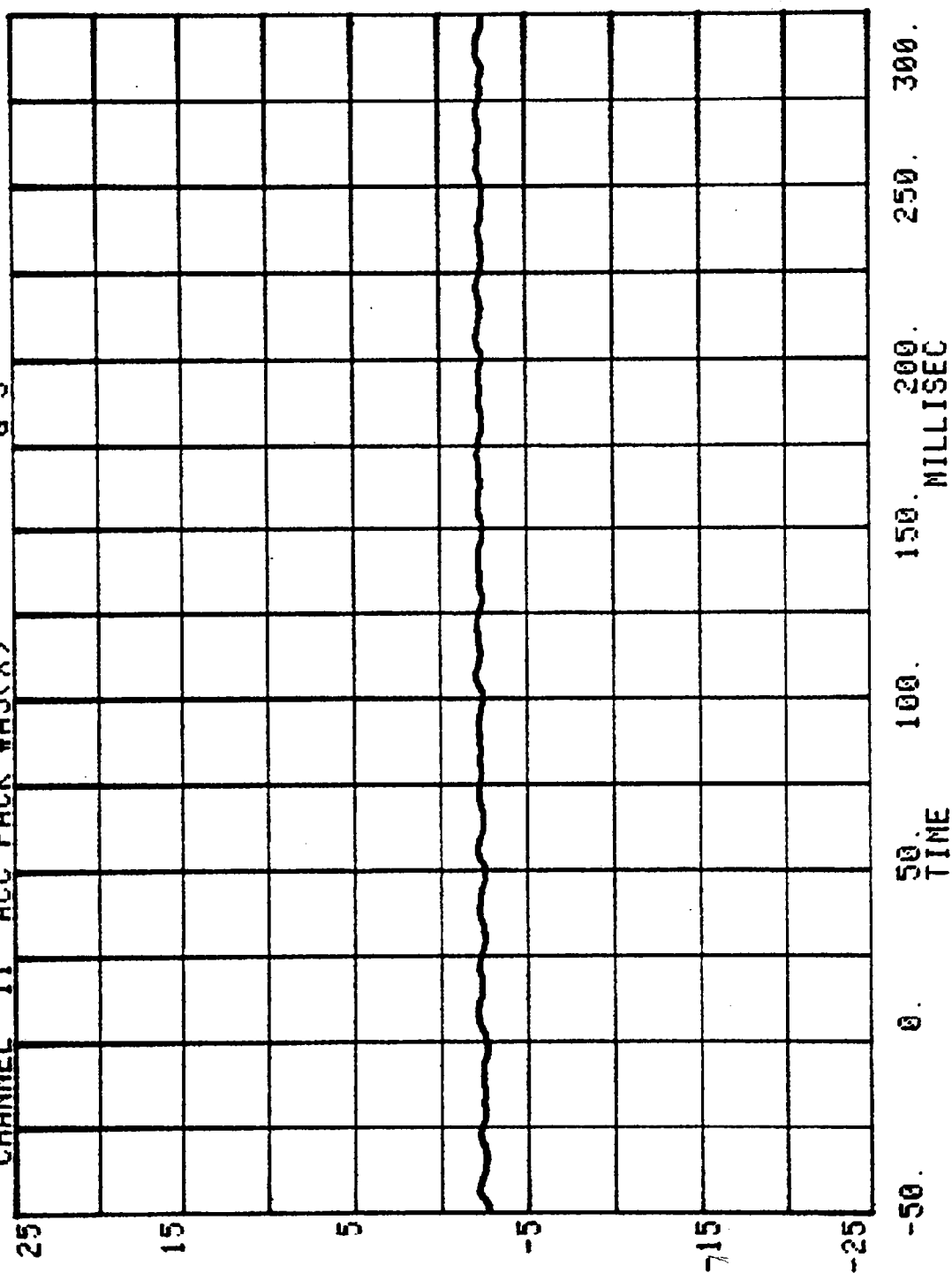
RUN= 536 SERIES= 3
CHANNEL 10 ACC PACK #A4(X) G'S



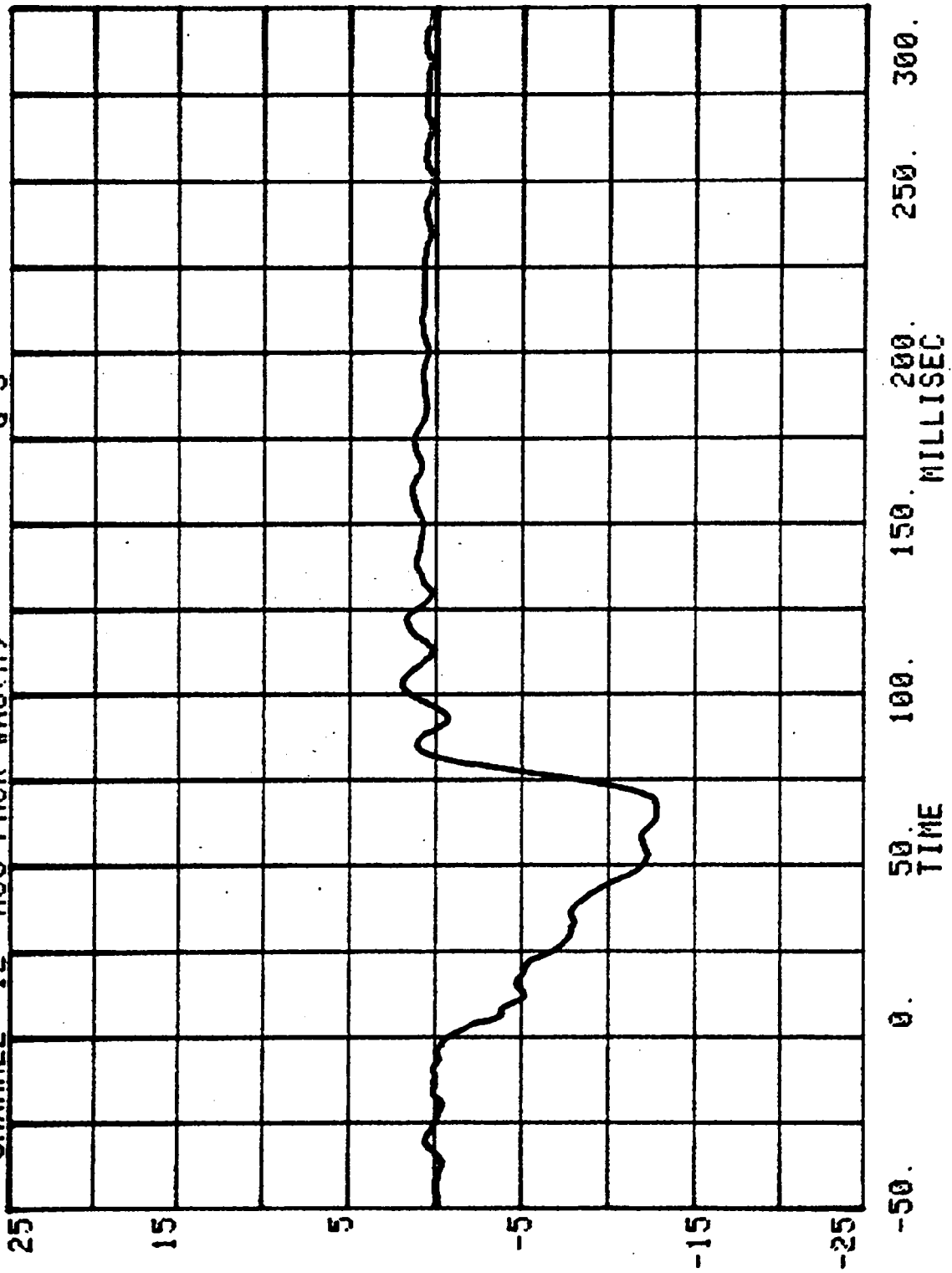


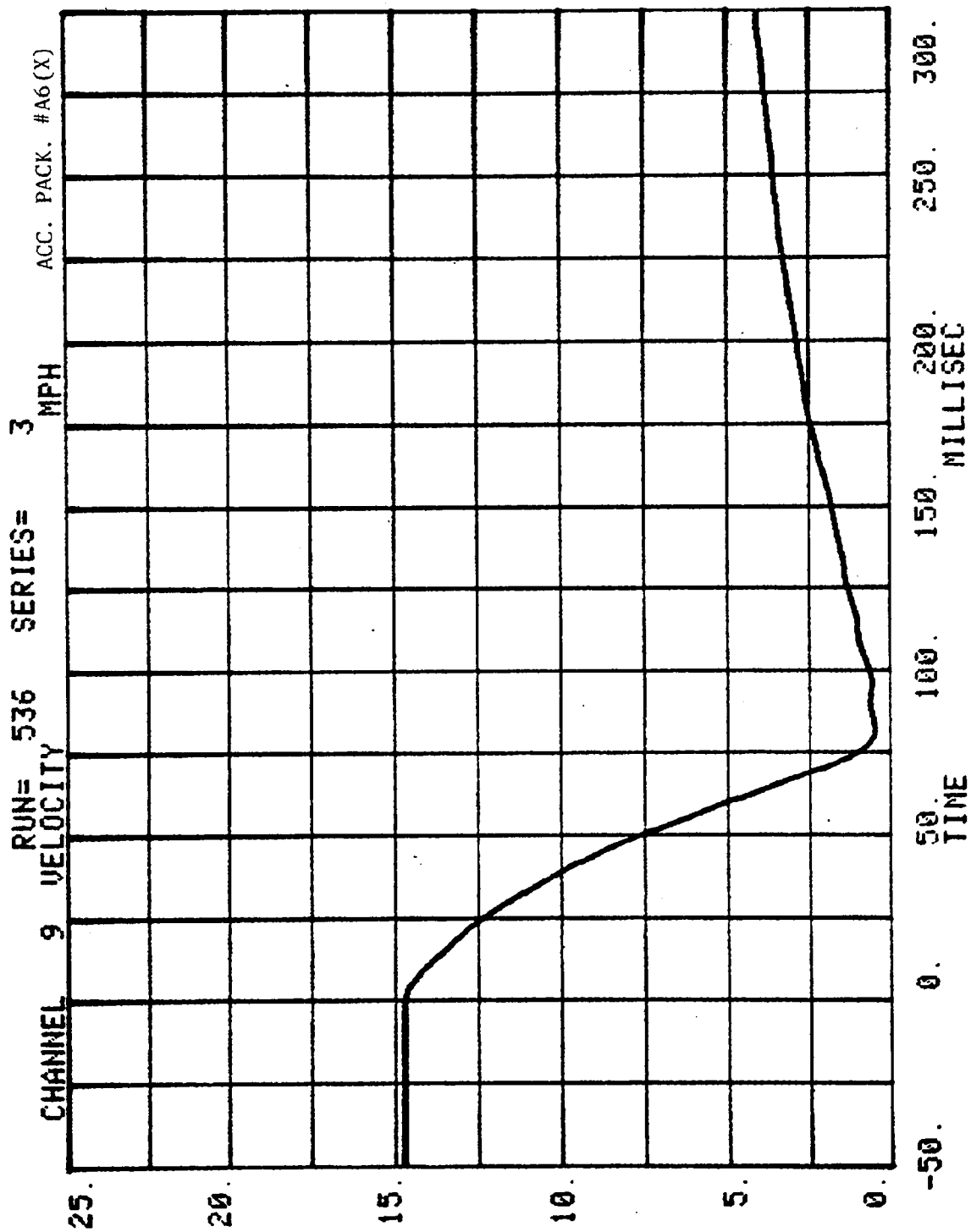


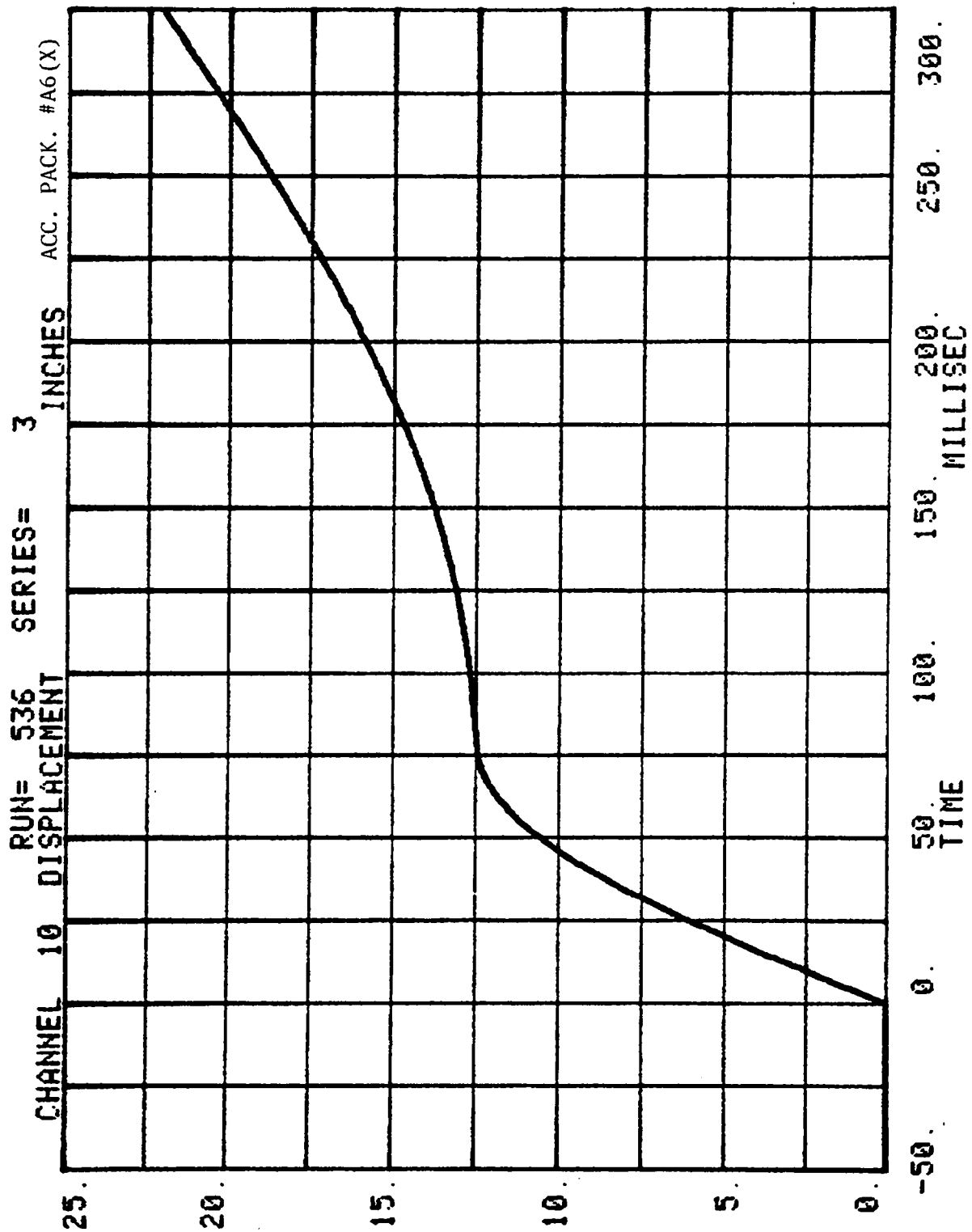
CHANNEL 11 RUN= 536 SERIES= 3 G'S
ACC PACK #A5(X)



CHANNEL 12 ACC PACK #A6(X) RUN= 536 SERIES= 3 G'S





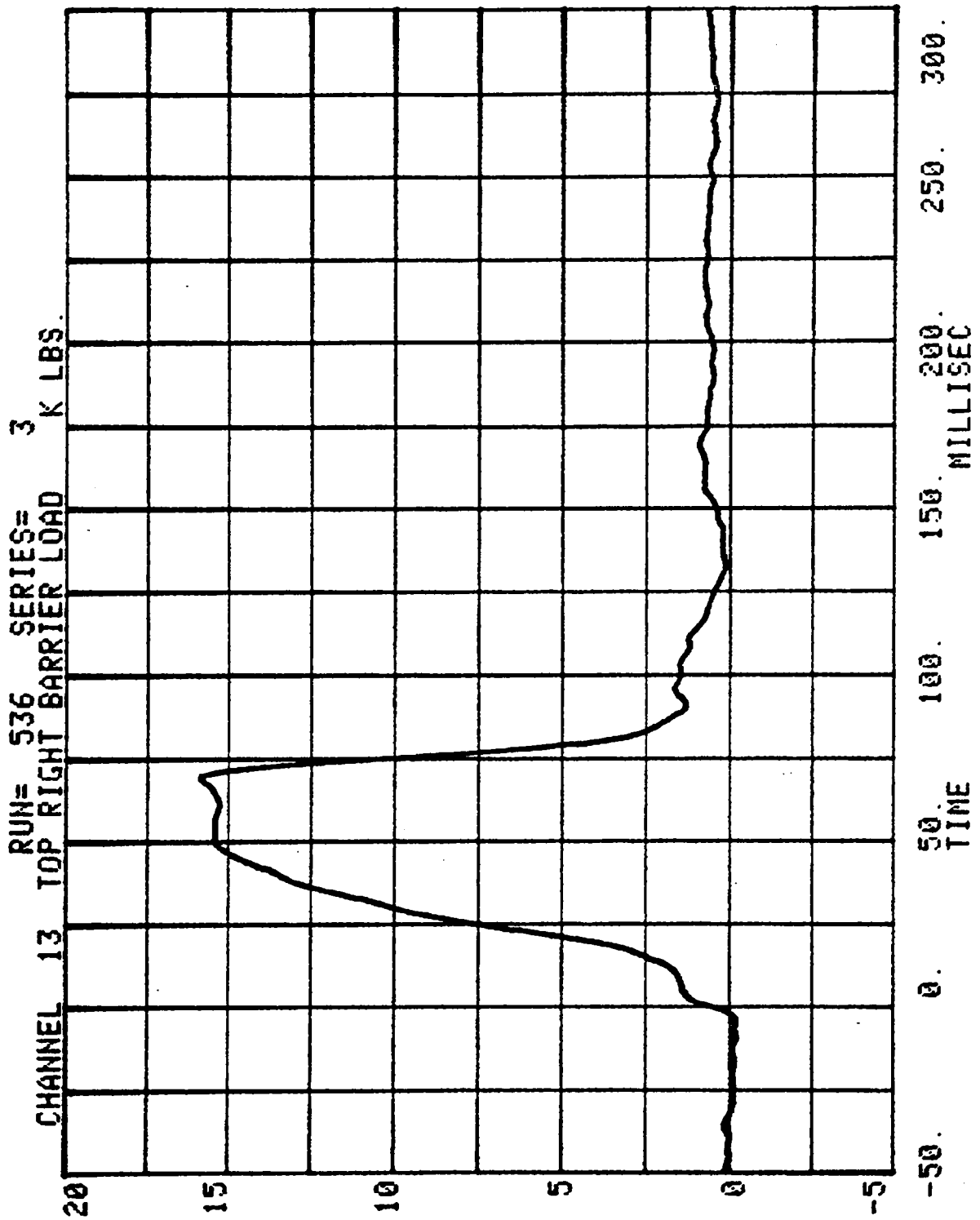


MOVING BARRIER LOAD CELL DATA

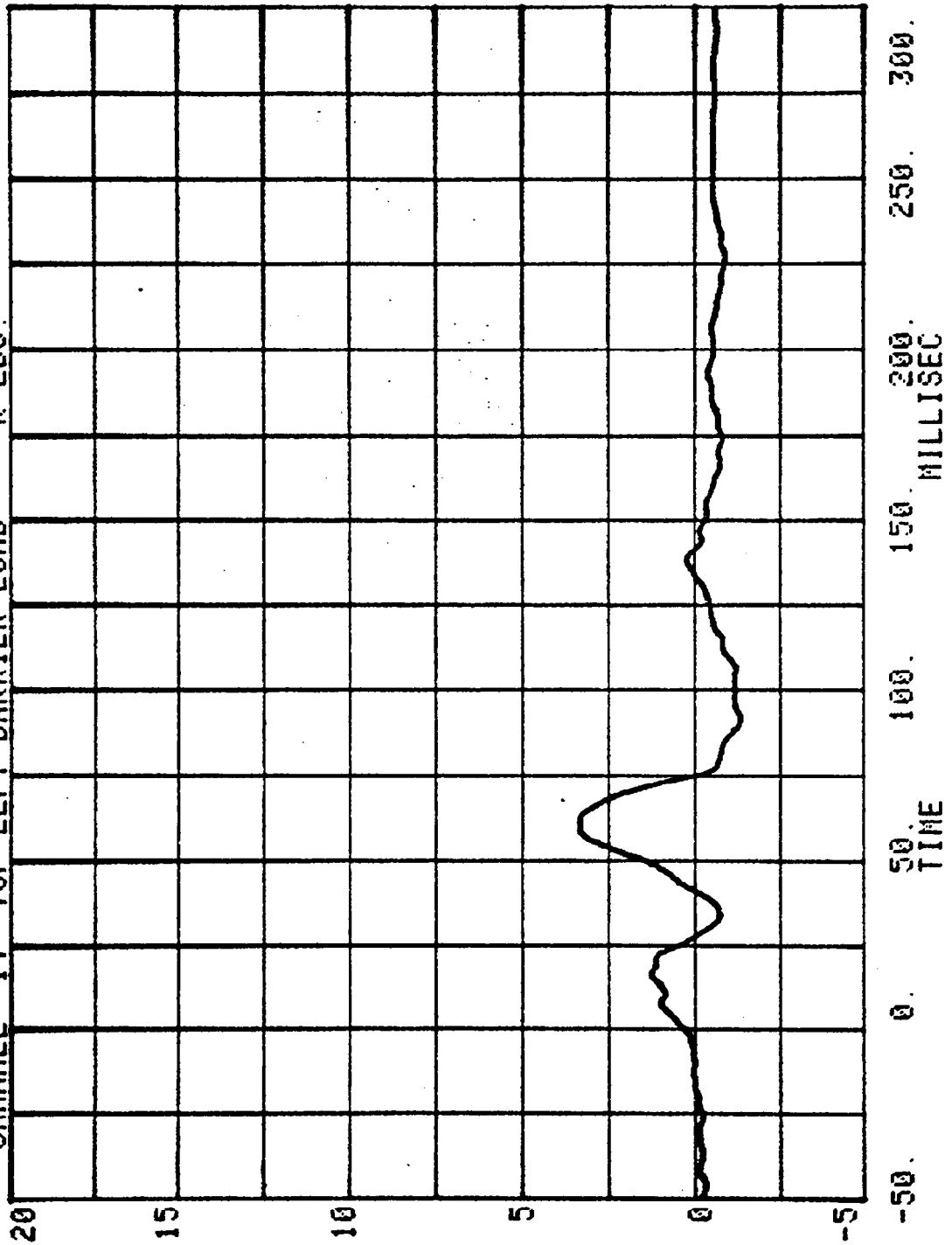
TEST NO. 3

VEHICLE LOAD CELL DATA

FILTER CLASS 60



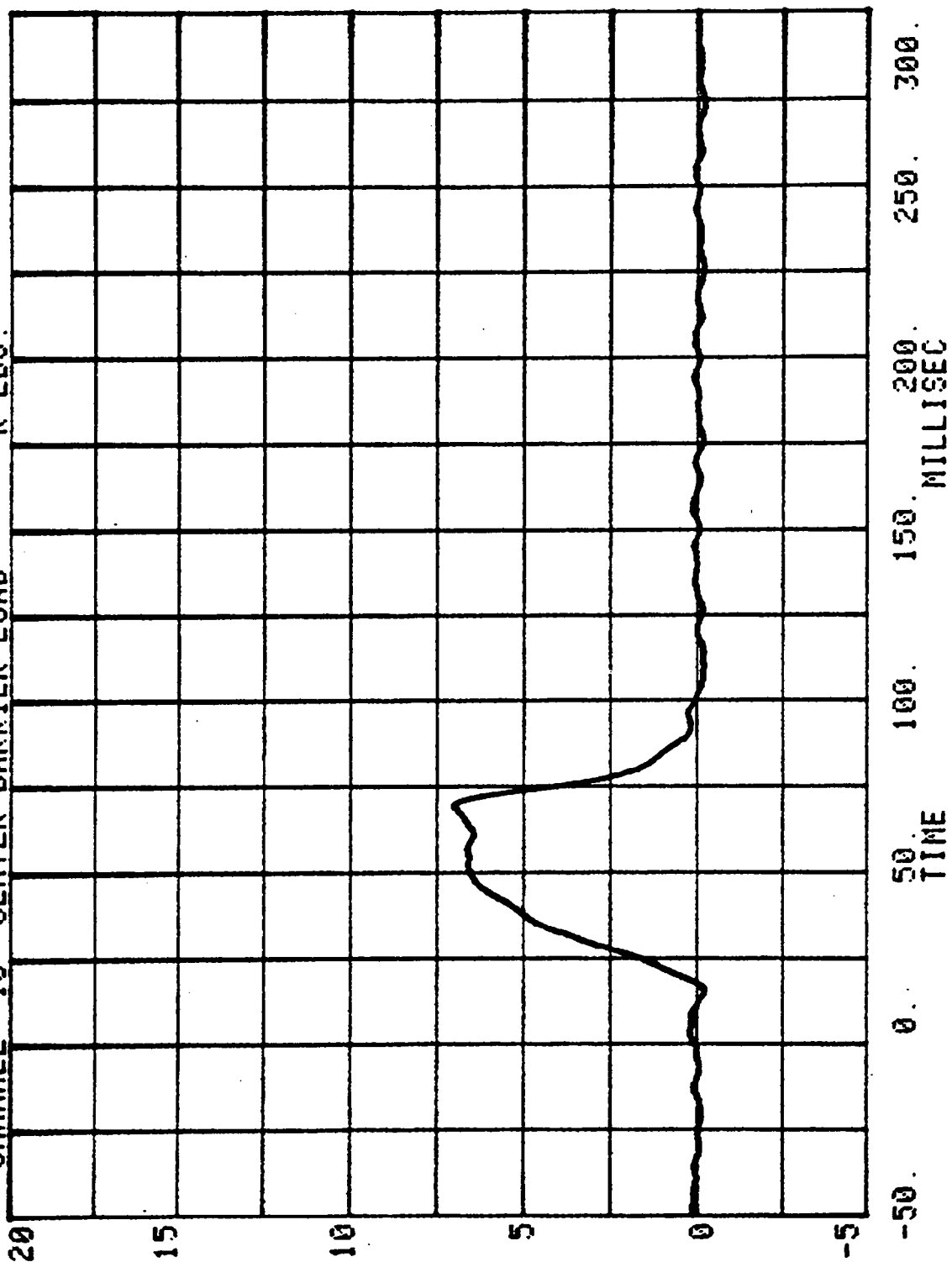
CHANNEL 14 TOP LEFT BARRIER LOAD 3 K LBS.



CHANNEL 15 CENTER BARRIER LOAD

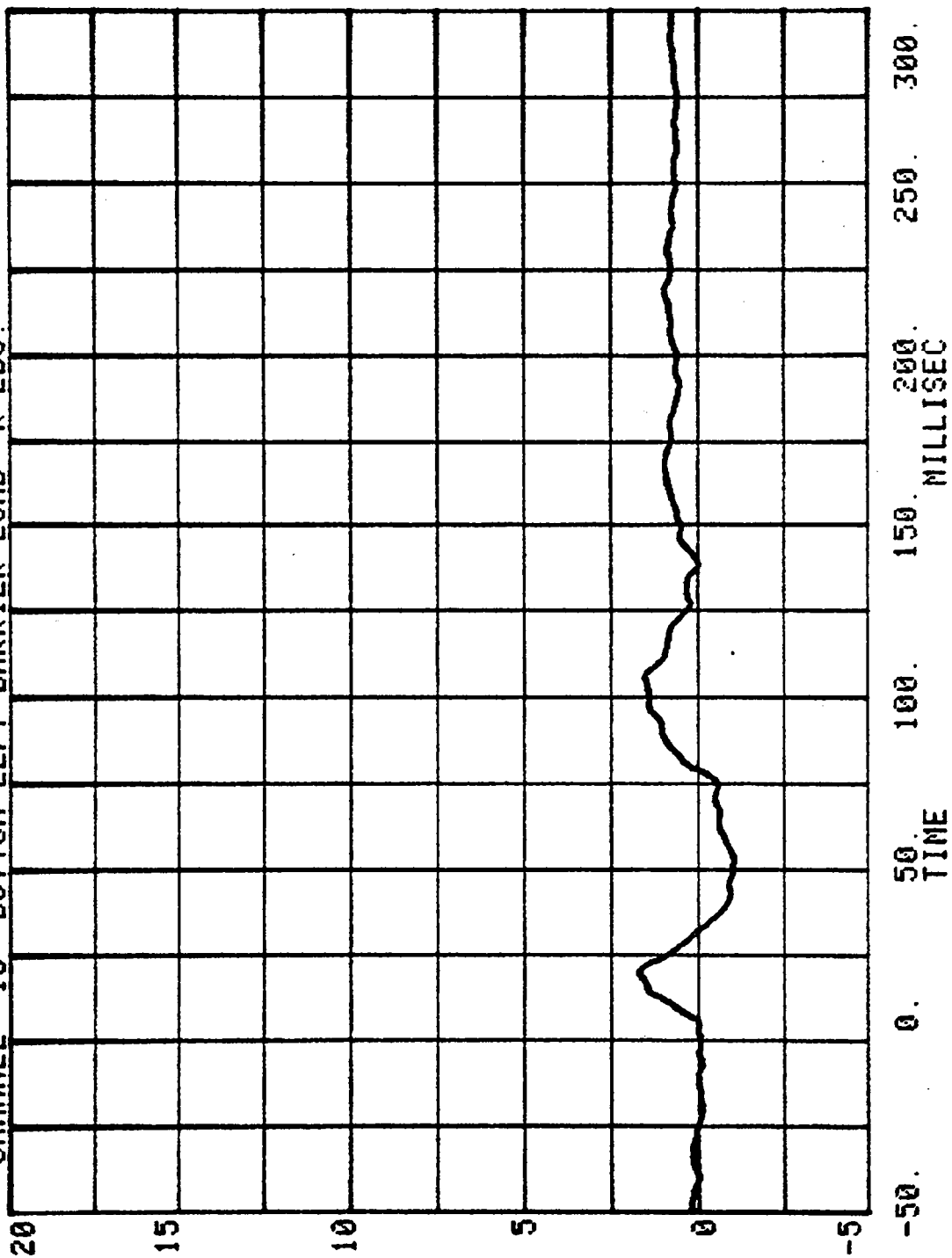
RUN= 536 SERIES=

3 K LBS.

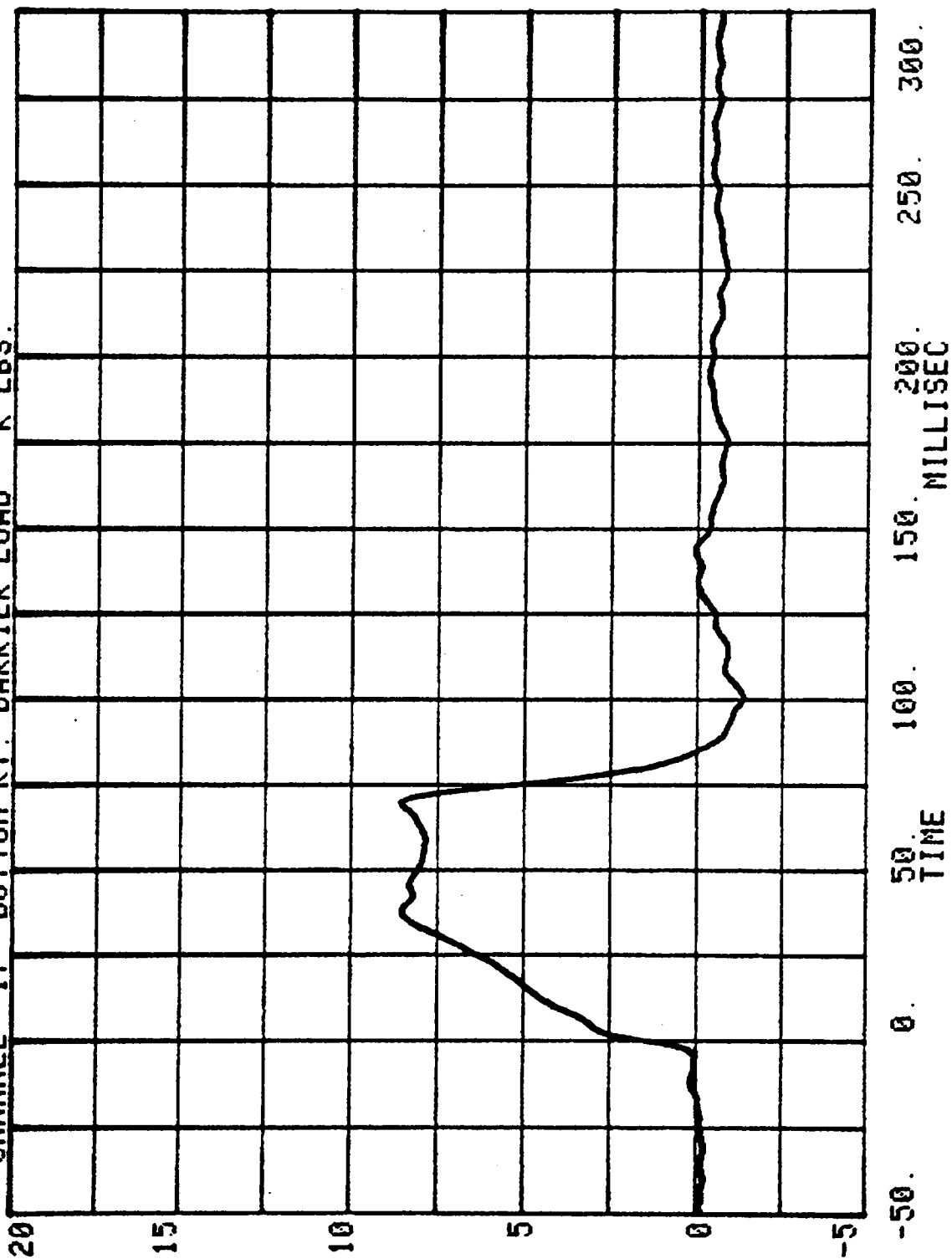


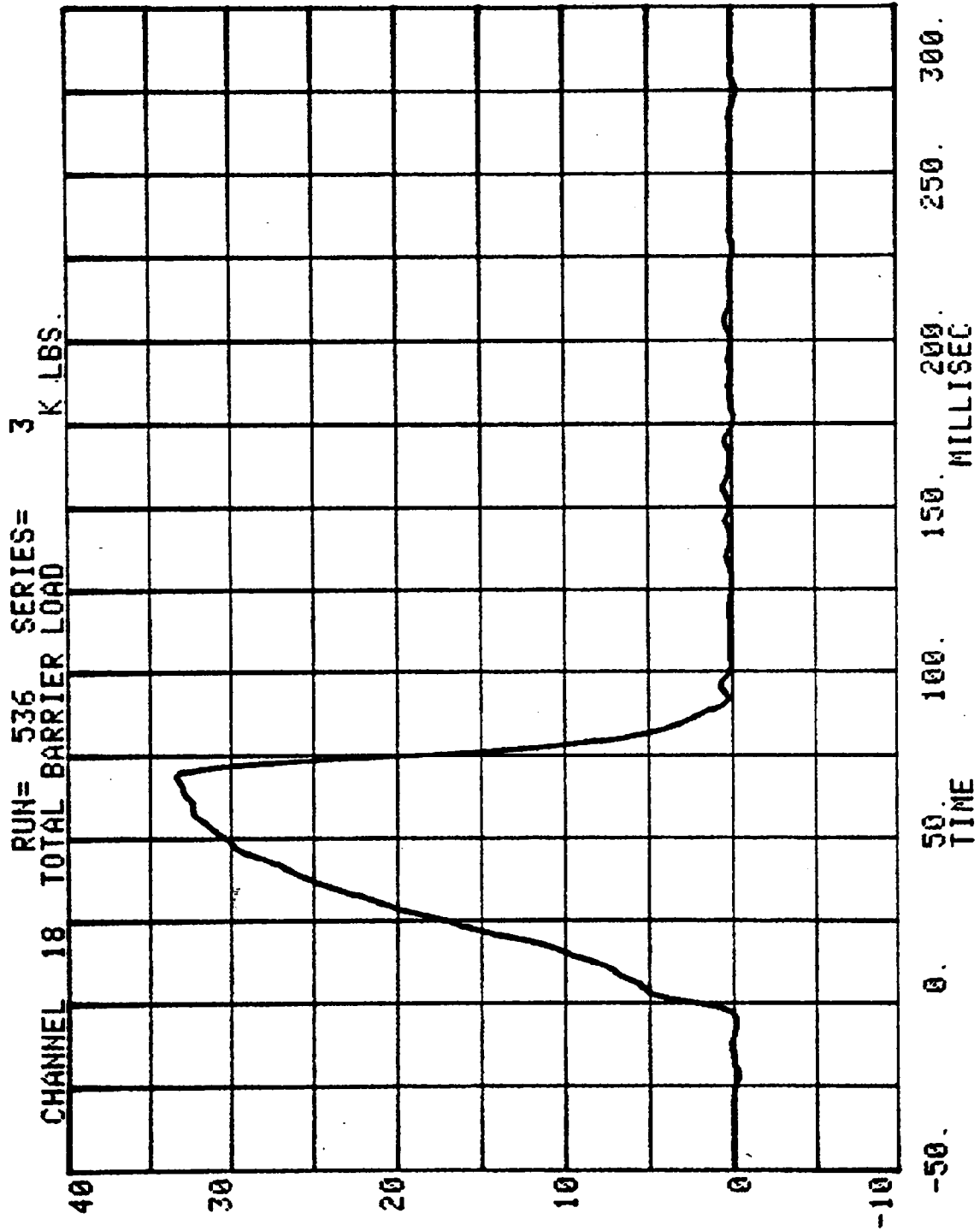
CHANNEL 16 BOTTOM LEFT BARRIER LOAD K LBS.

RUN= 536 SERIES= 3



RUN= 536 SERIES= 3
CHANNEL 17 BOTTOM RT. BARRIER LOAD K LBS.





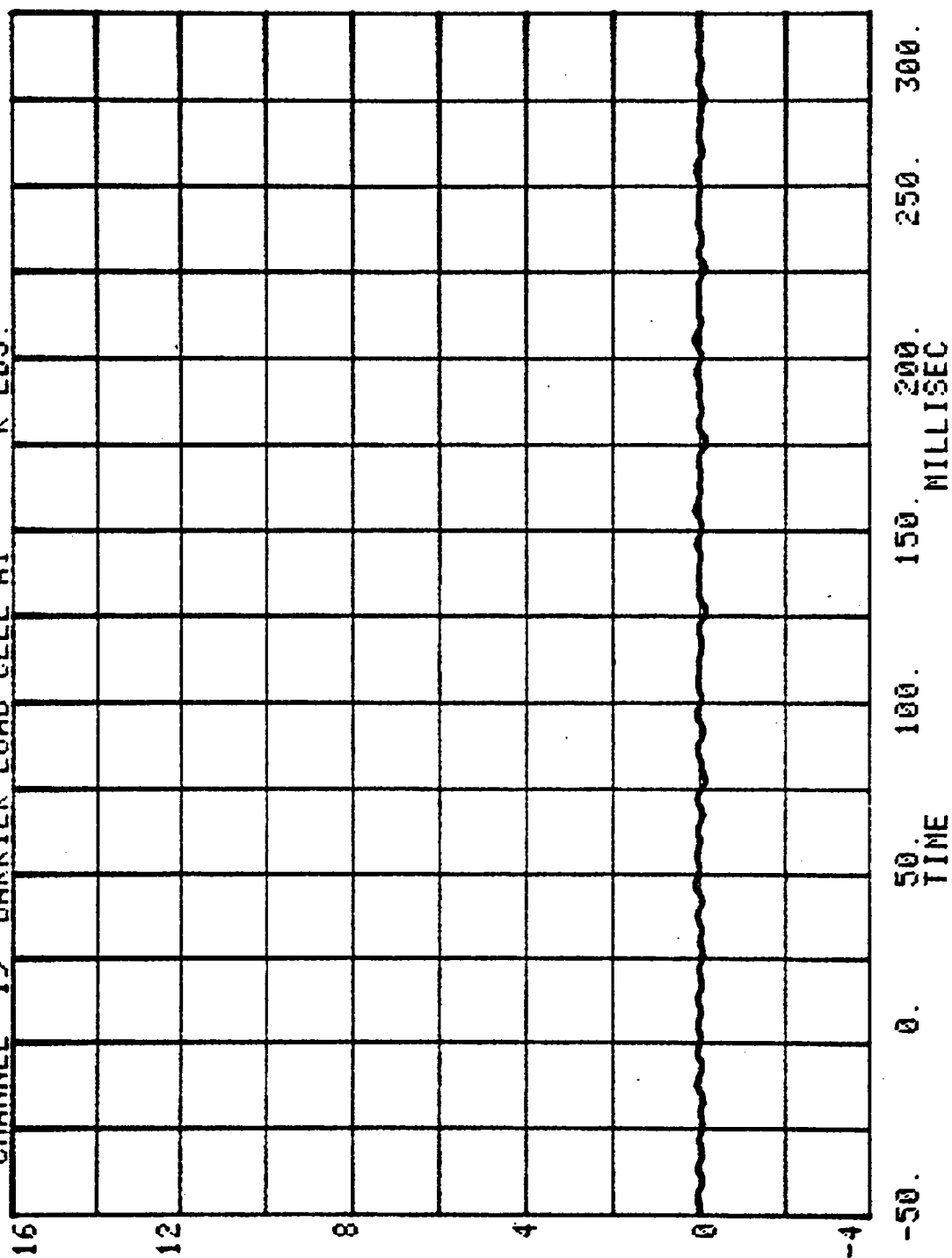
FIXED BARRIER LOAD CELL DATA

TEST NO. 3

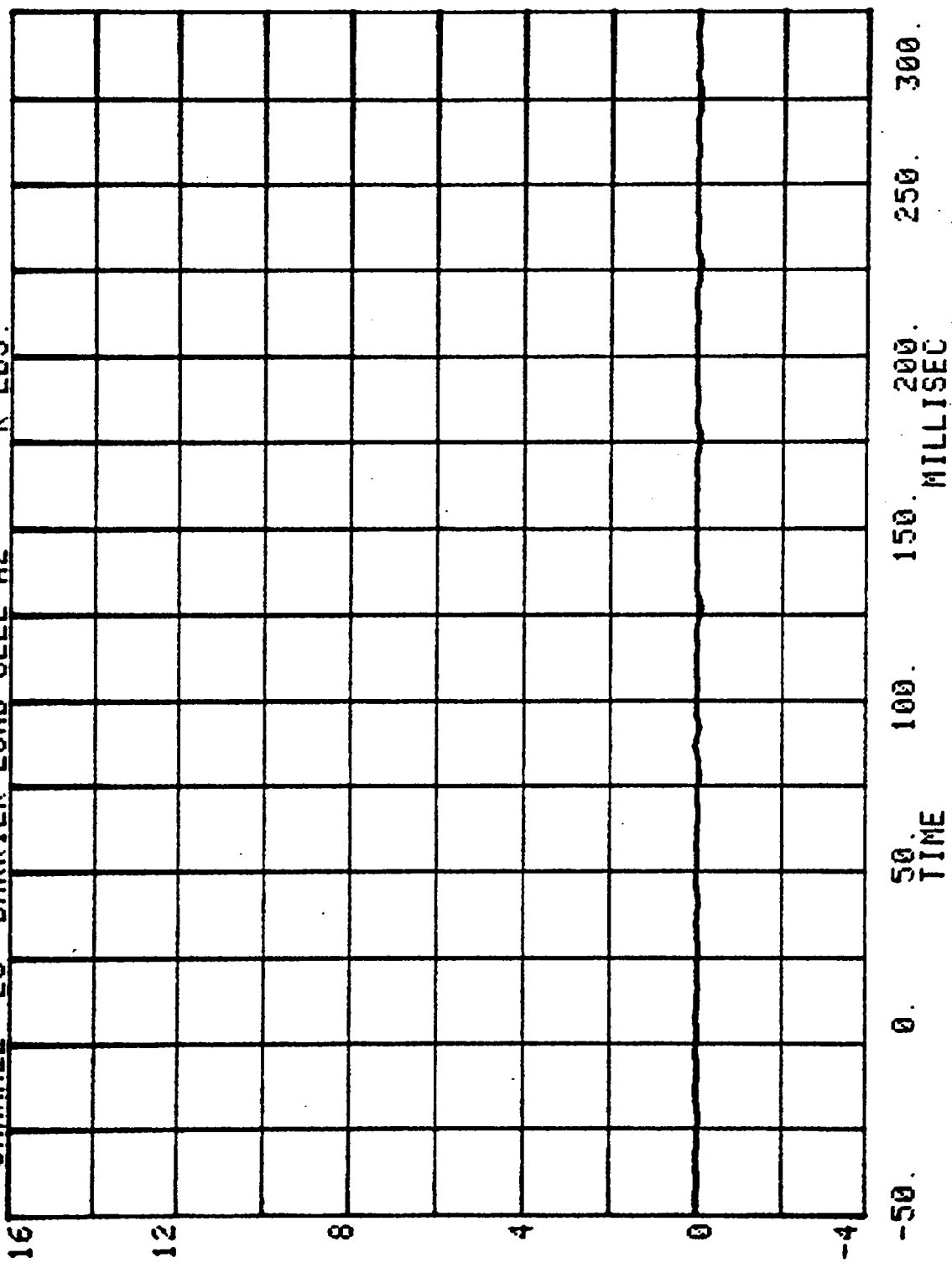
FIXED BARRIER LOAD CELL DATA

FILTER CLASS 60

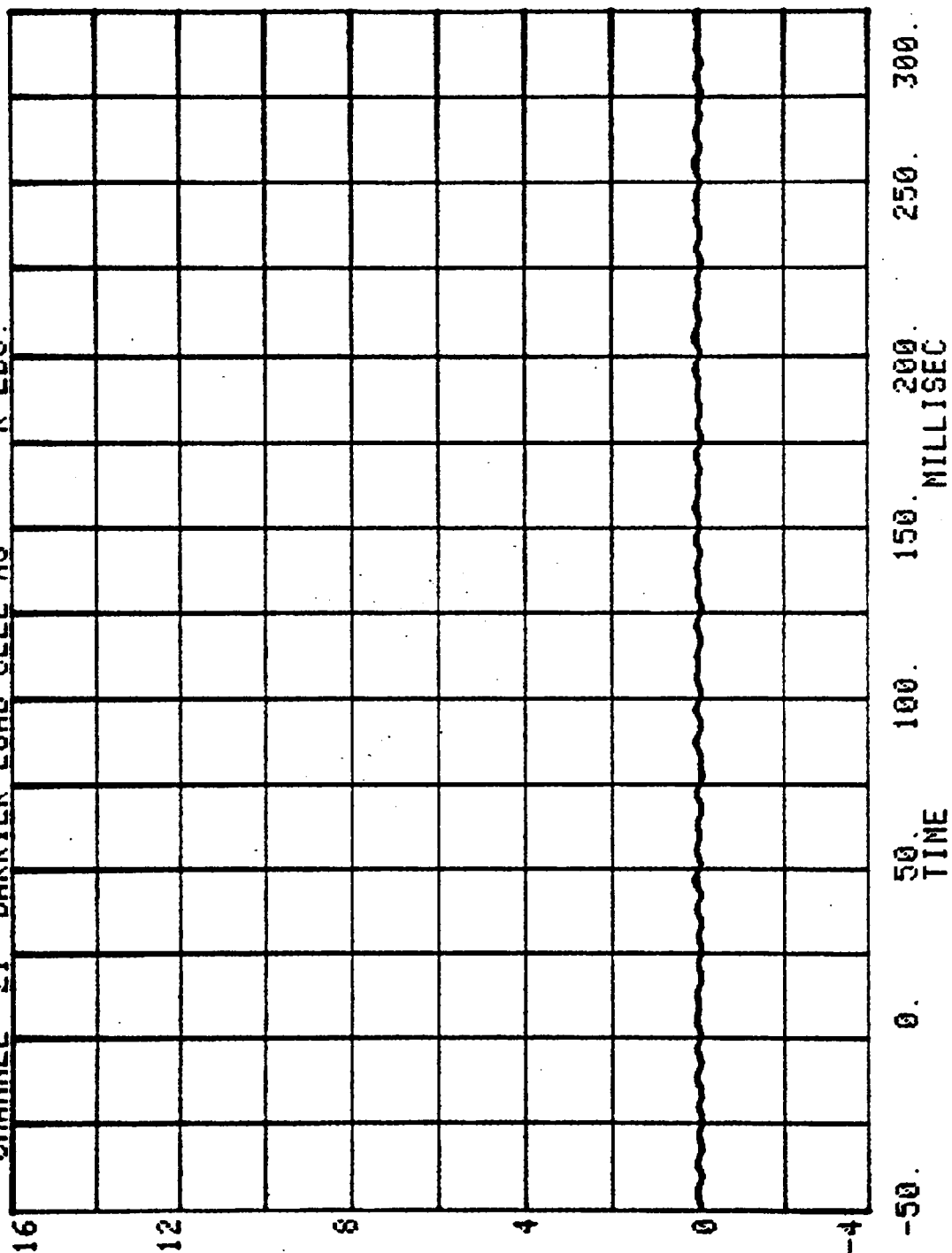
CHANNEL 19 BARRIER LOAD CELL A1 RUN= 536 SERIES= 3 K LBS.



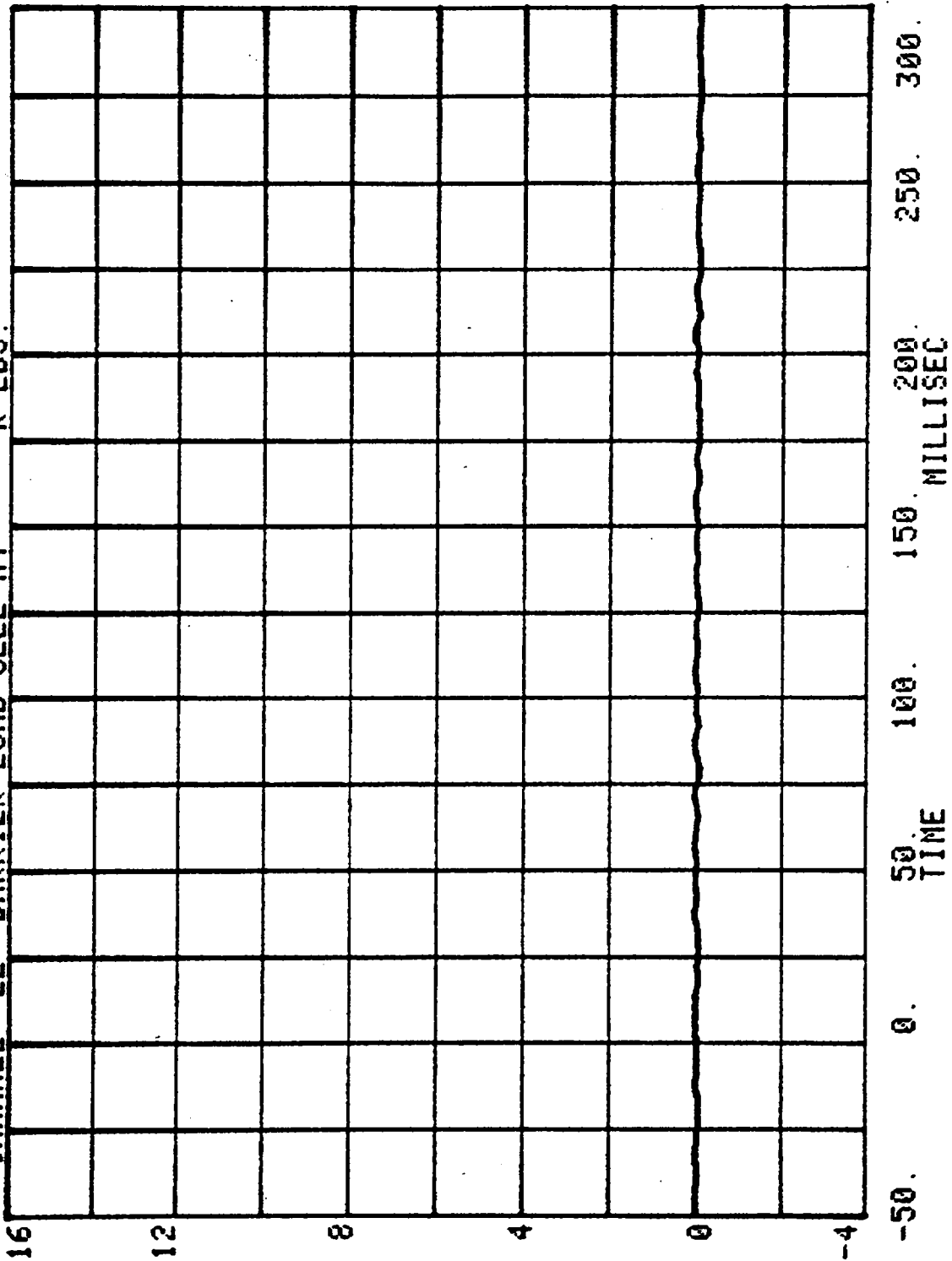
CHANNEL 20 BARRIER LOAD CELL A2 RUN= 536 SERIES= 3 K LBS.



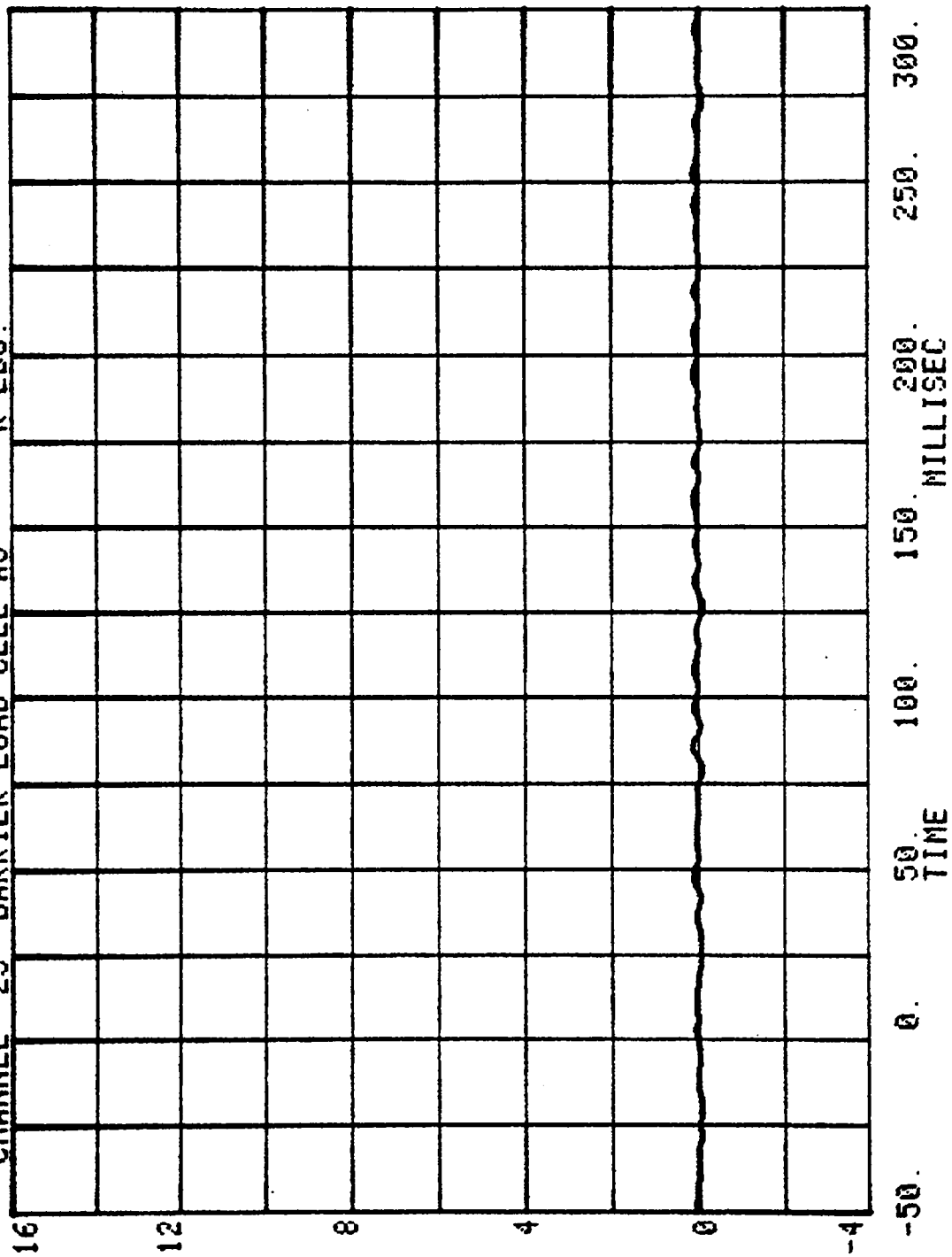
CHANNEL 21 BARRIER LOAD CELL A3 RUN= 536 SERIES= 3 K LBS.



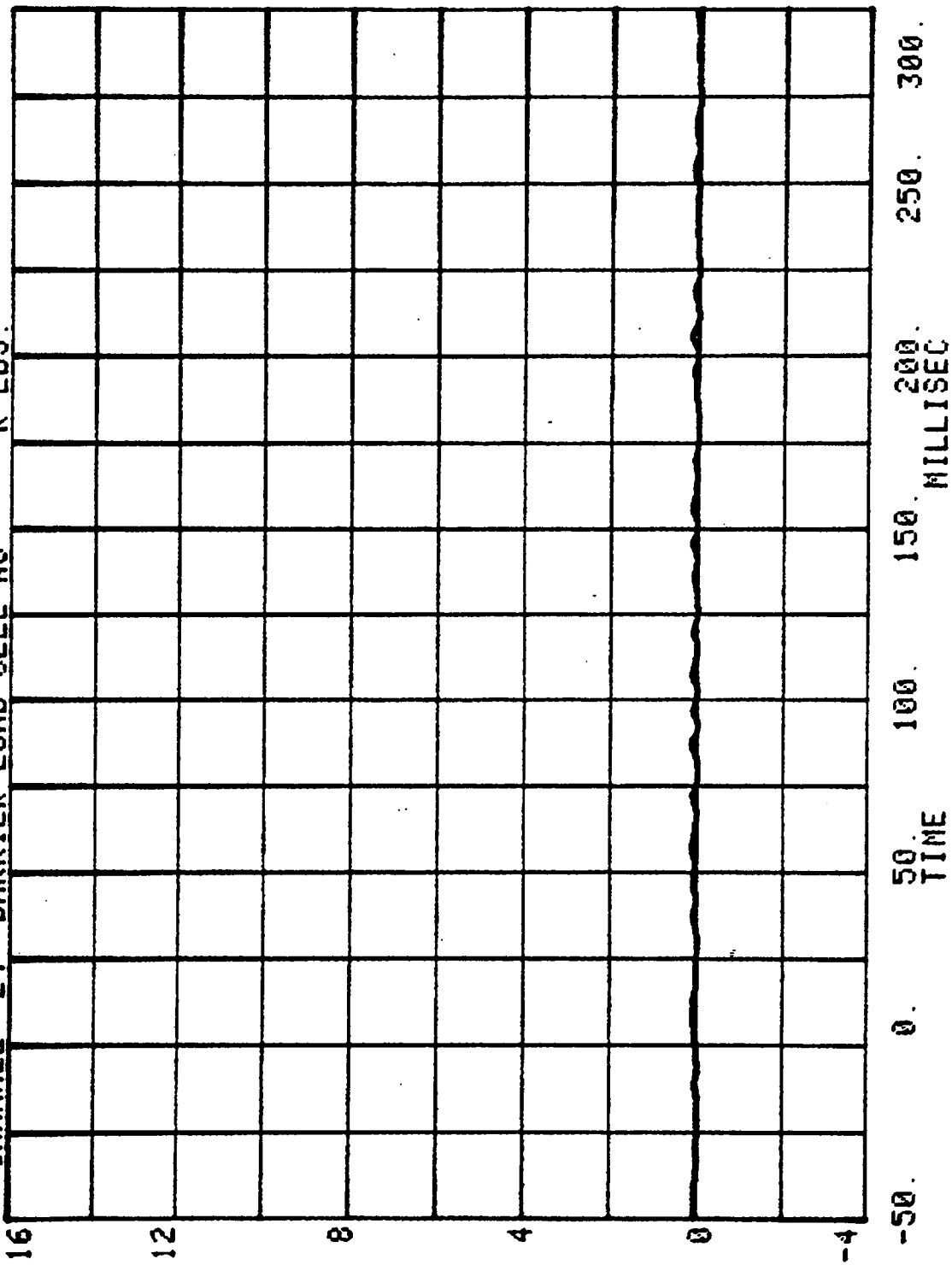
RUN= 536 SERIES= 3
CHANNEL 22 BARRIER LOAD CELL A4 K LBS.



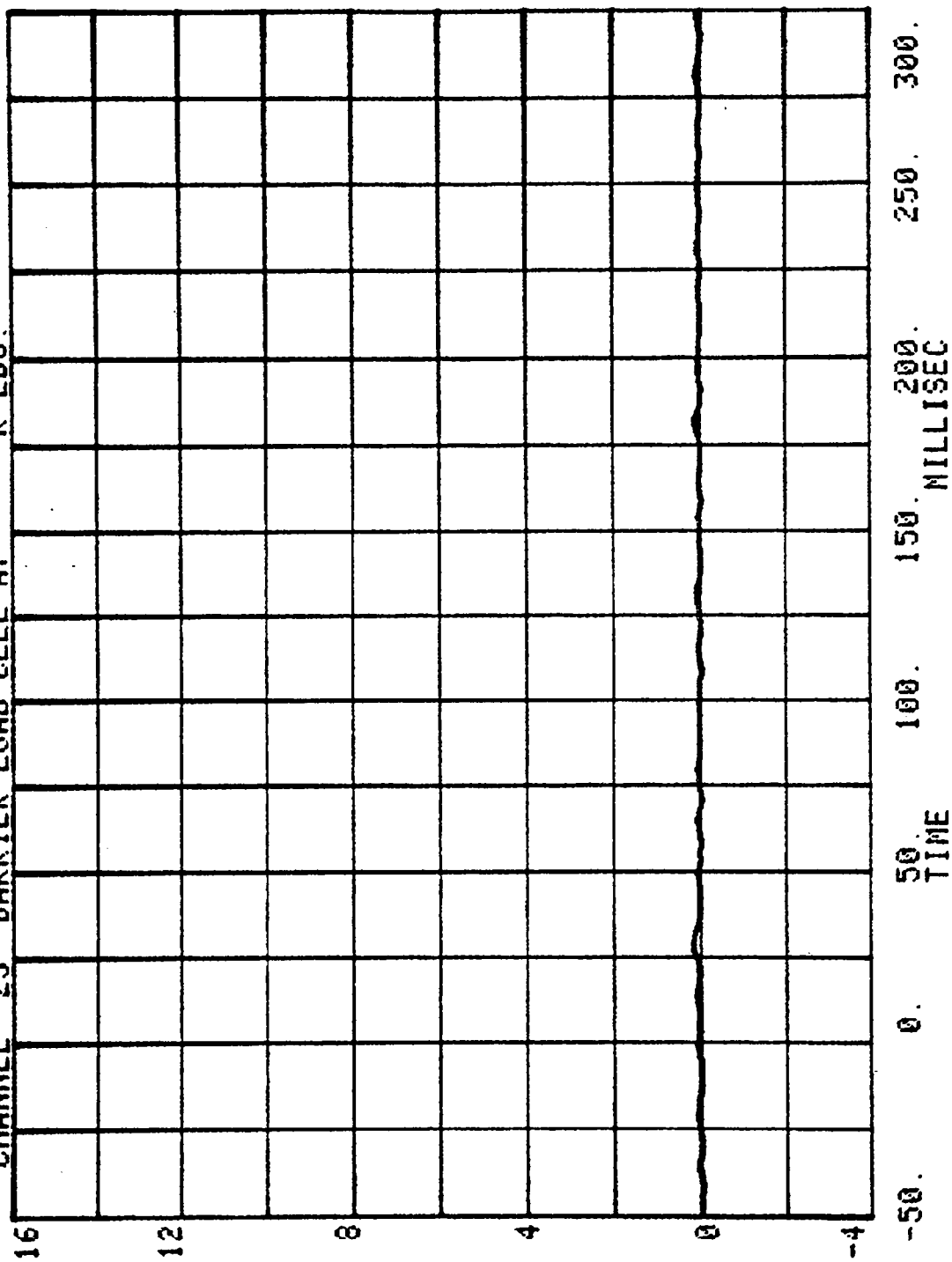
CHANNEL 23 BARRIER LOAD CELL A5 RUN= 536 SERIES= 3 K LBS.



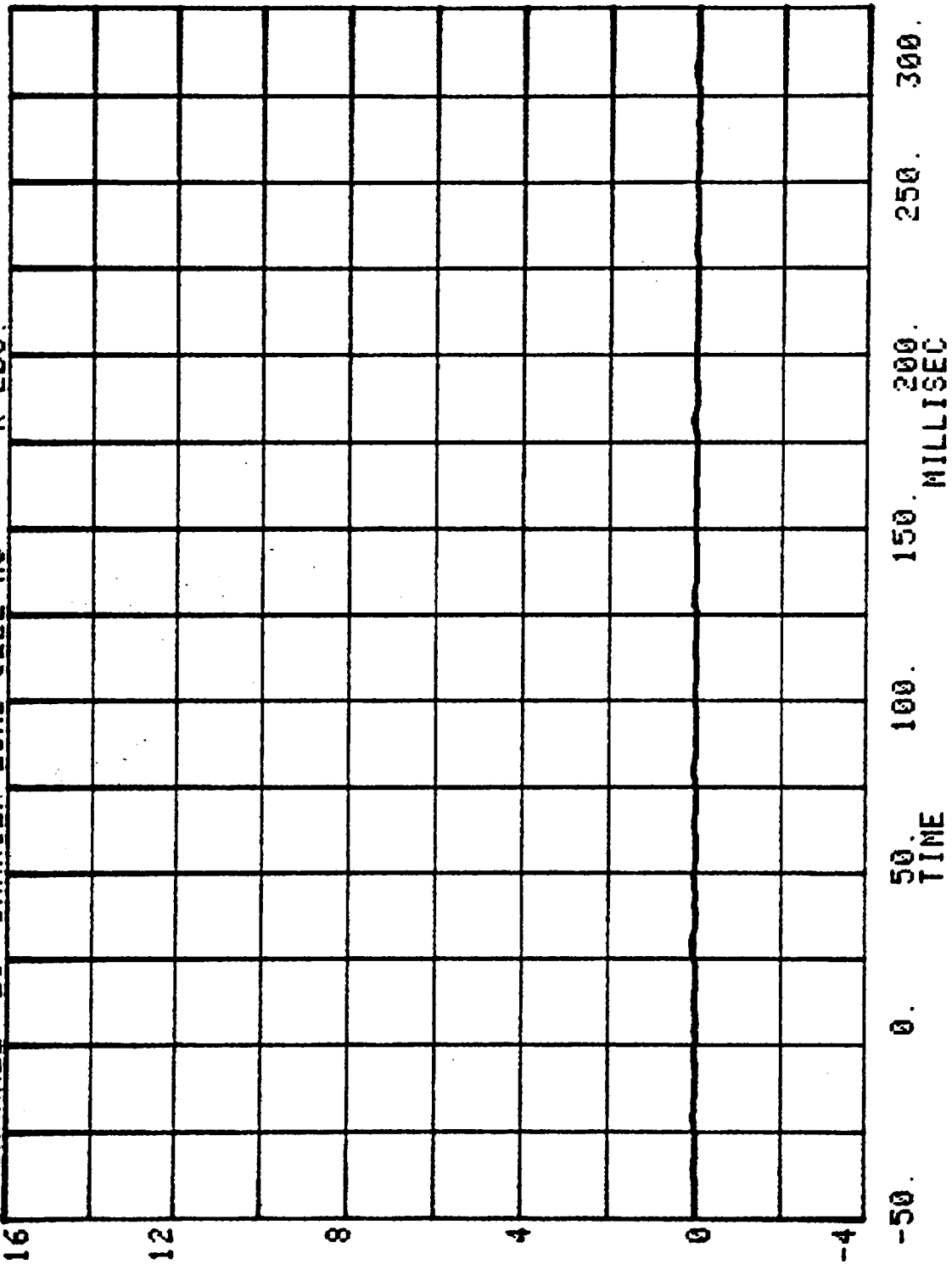
CHANNEL 24 BARRIER LOAD CELL A6
RUN= 536 SERIES= 3 K LBS.



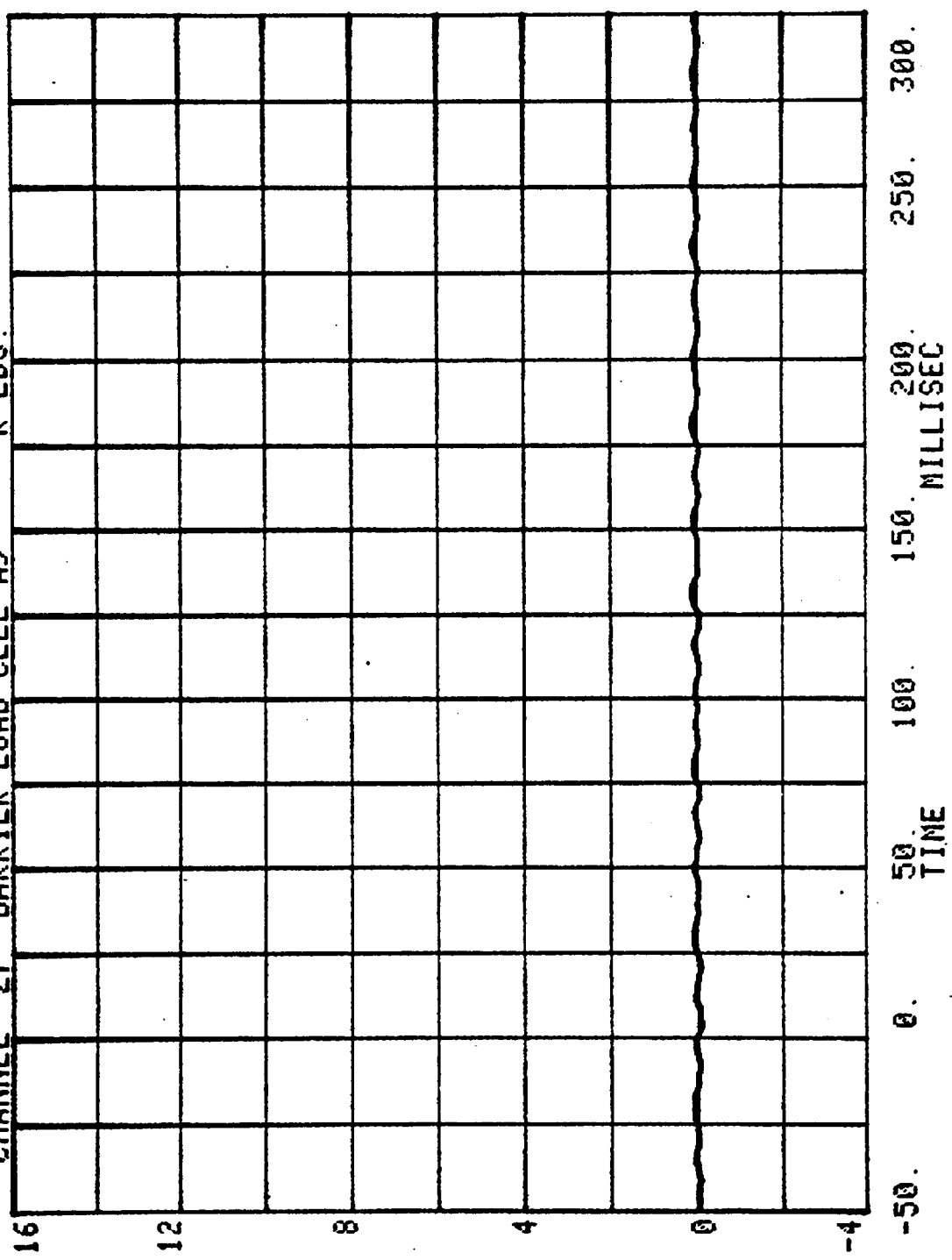
CHANNEL 25 RUN= 536 SERIES= 3 K LBS.
BARRIER LOAD CELL A7



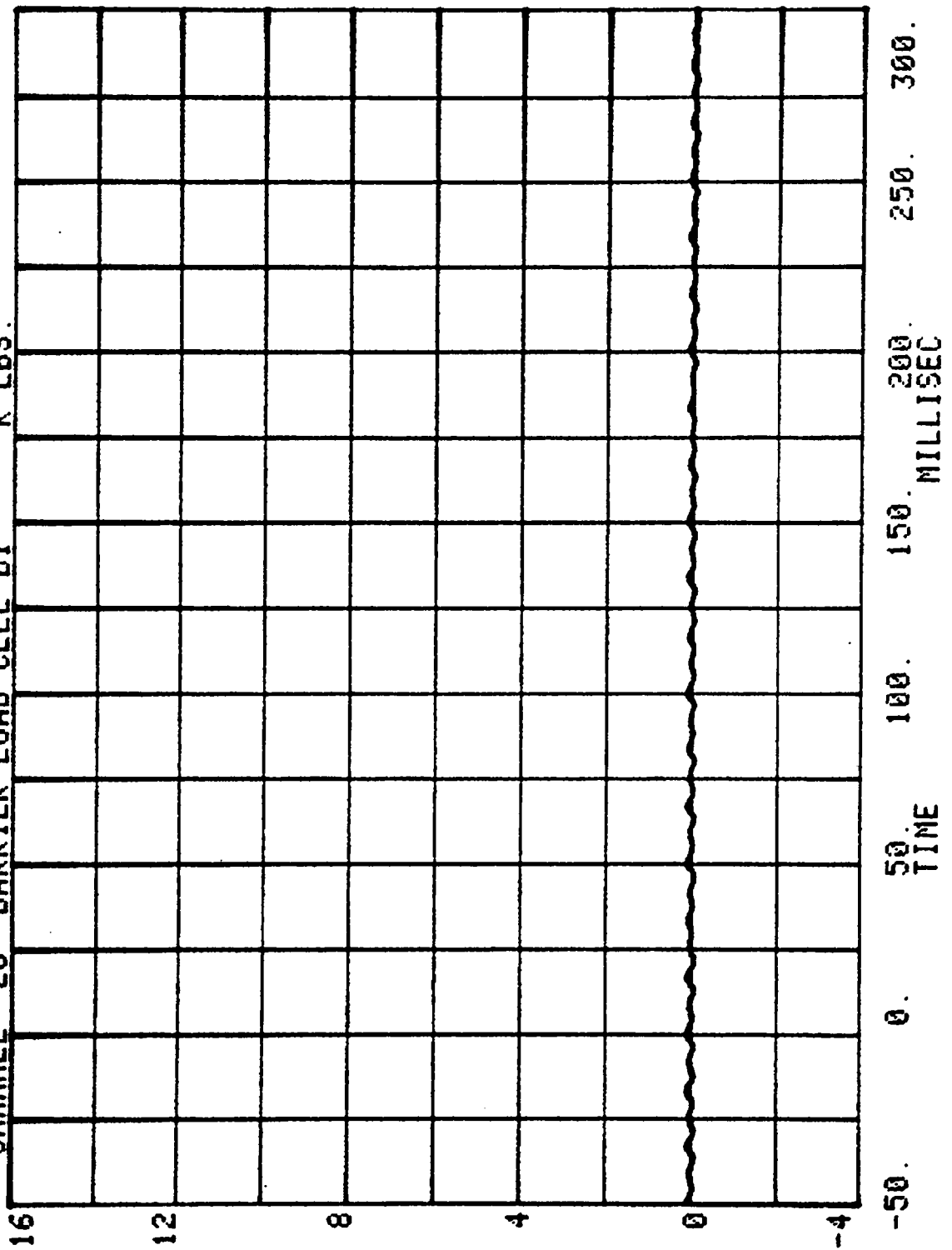
CHANNEL 26 RUN= 536 SERIES= 3 K LBS.
BARRIER LOAD CELL A8



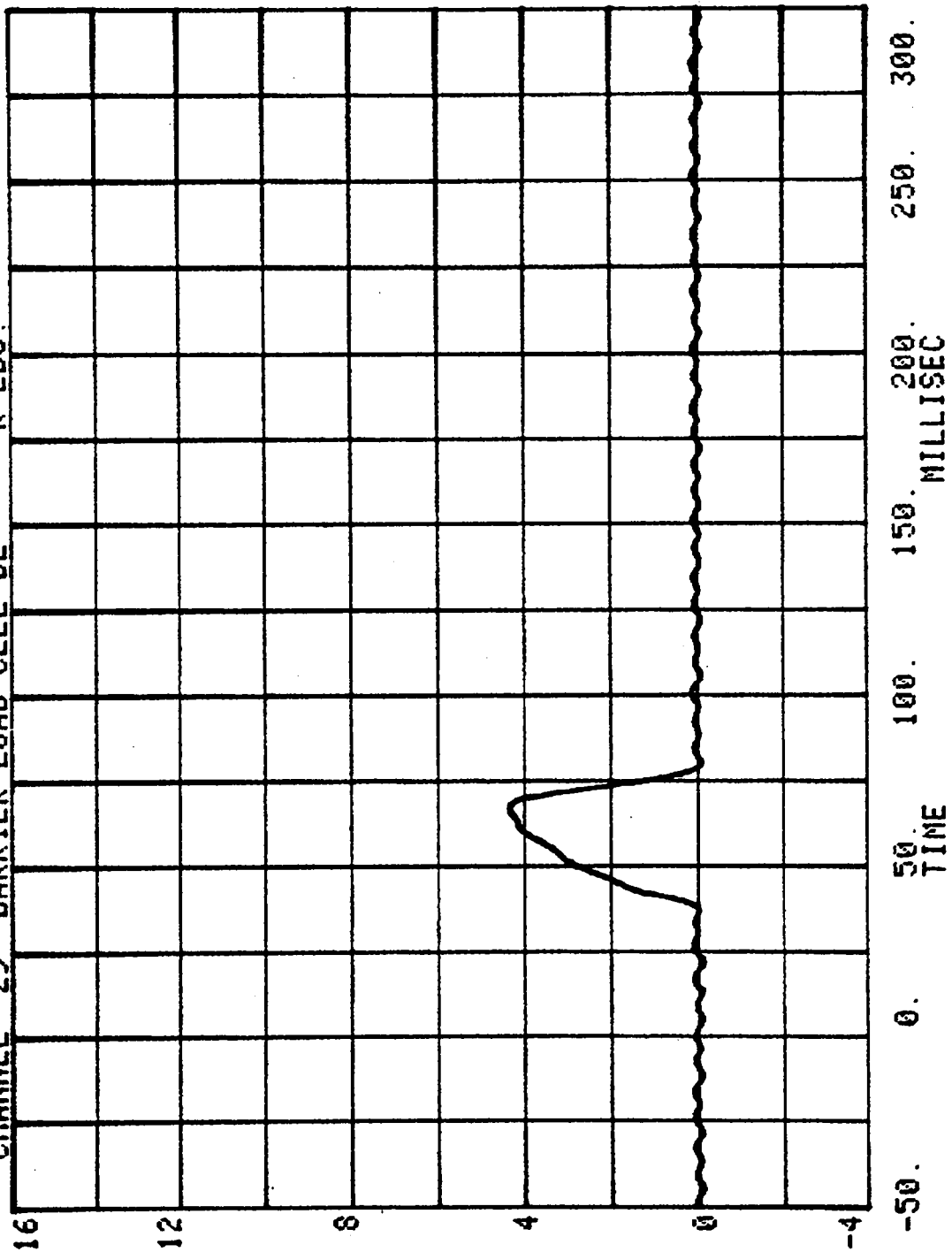
CHANNEL 27 RUN= 536 SERIES= 3 K LBS.
BARRIER LOAD CELL A9



CHANNEL 28 BARRIER LOAD CELL B1 RUN= 536 SERIES= 3 K LBS.

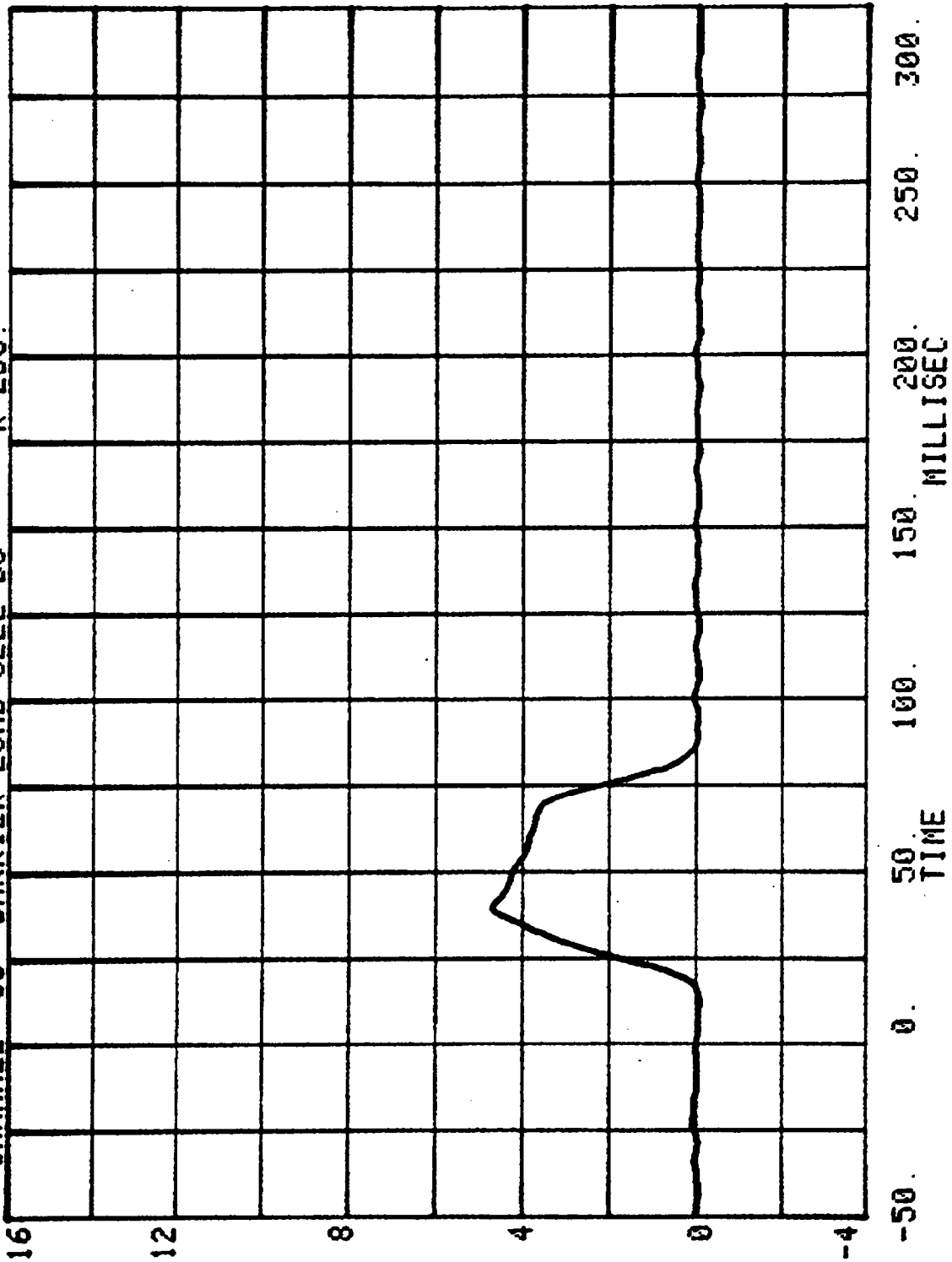


CHANNEL 29 RUN= 536 SERIES= 3 K LBS.
BARRIER LOAD CELL B2

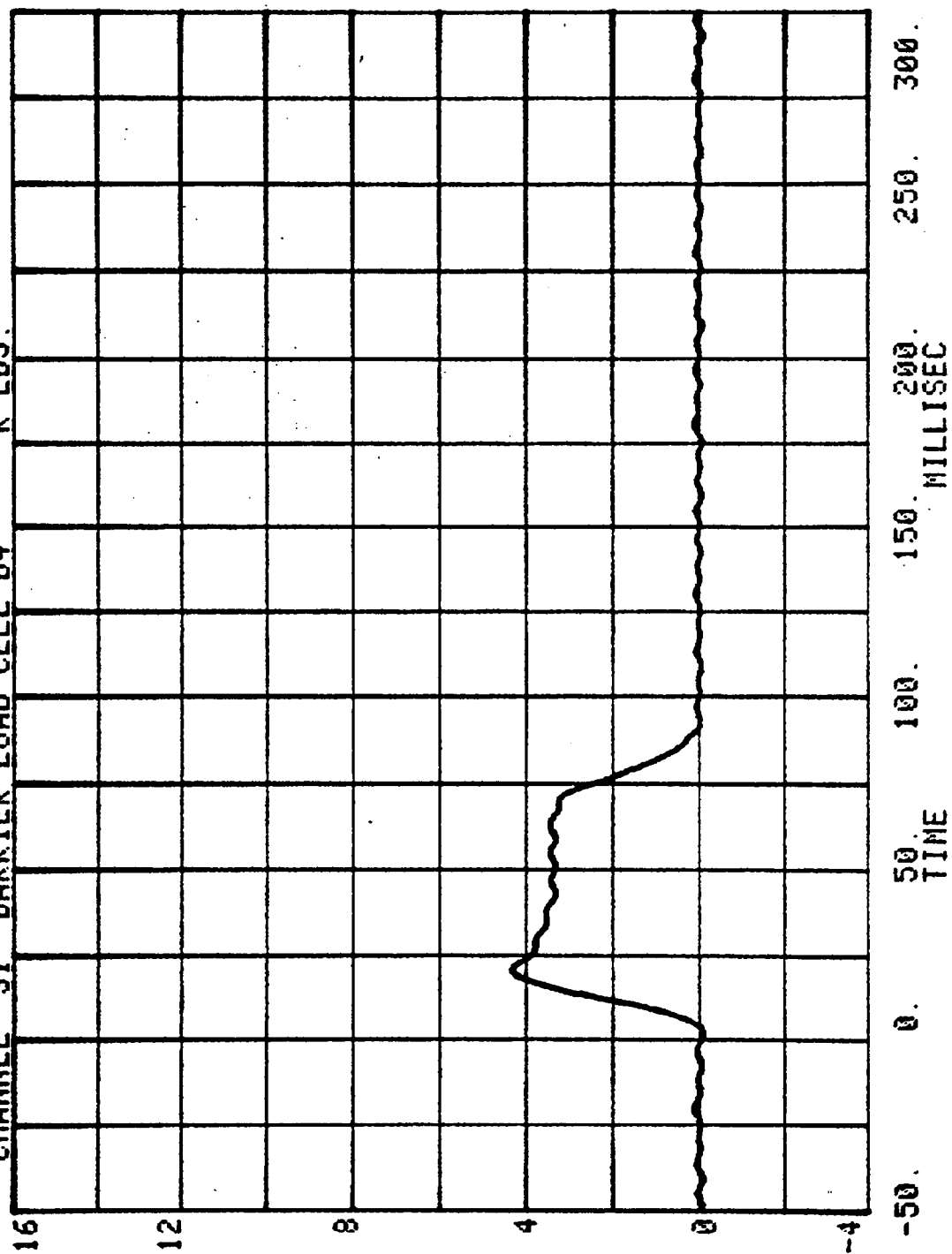


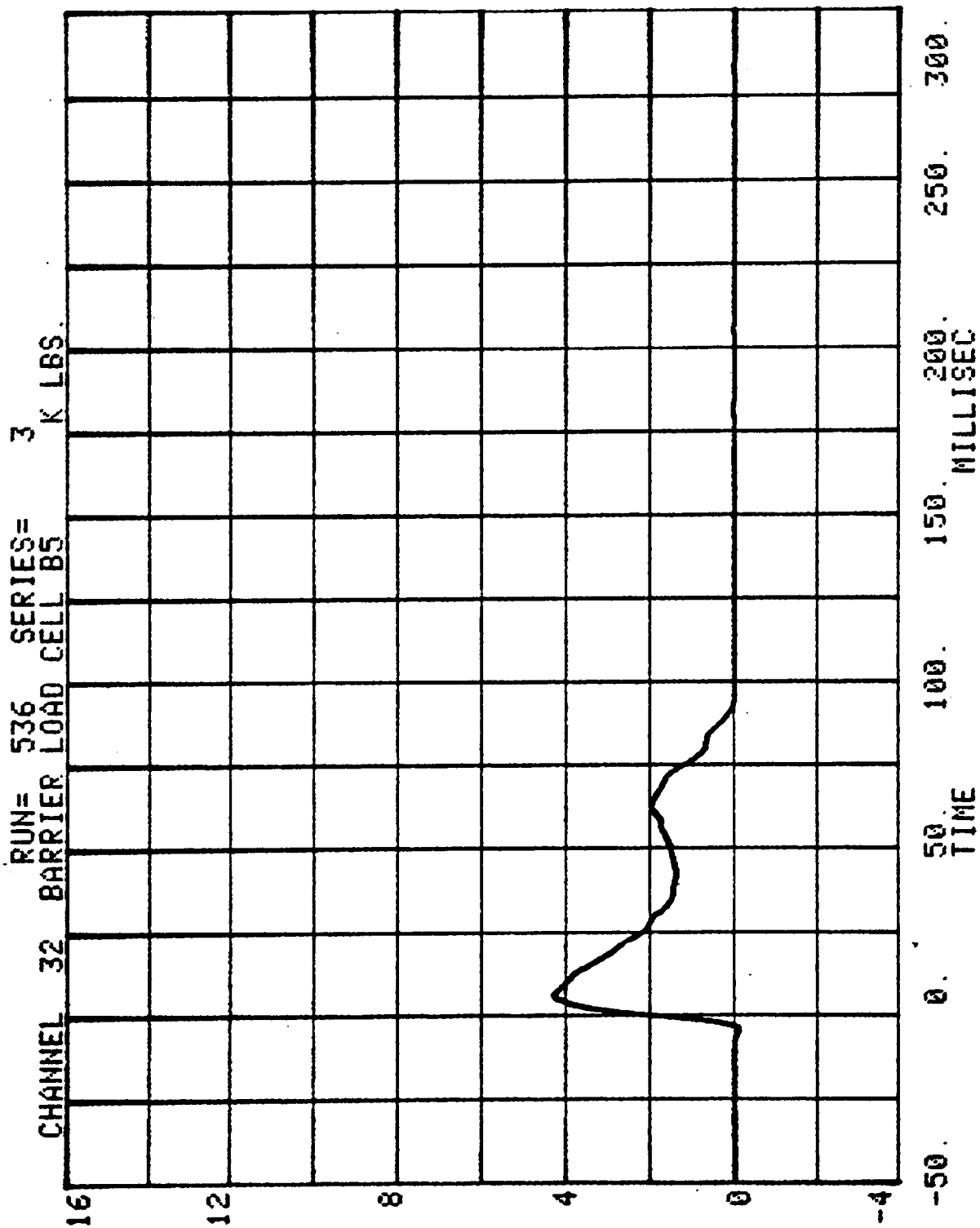
CHANNEL 30 BARRIER LOAD CELL 83 K LBS.

RUN= 536 SERIES= 3

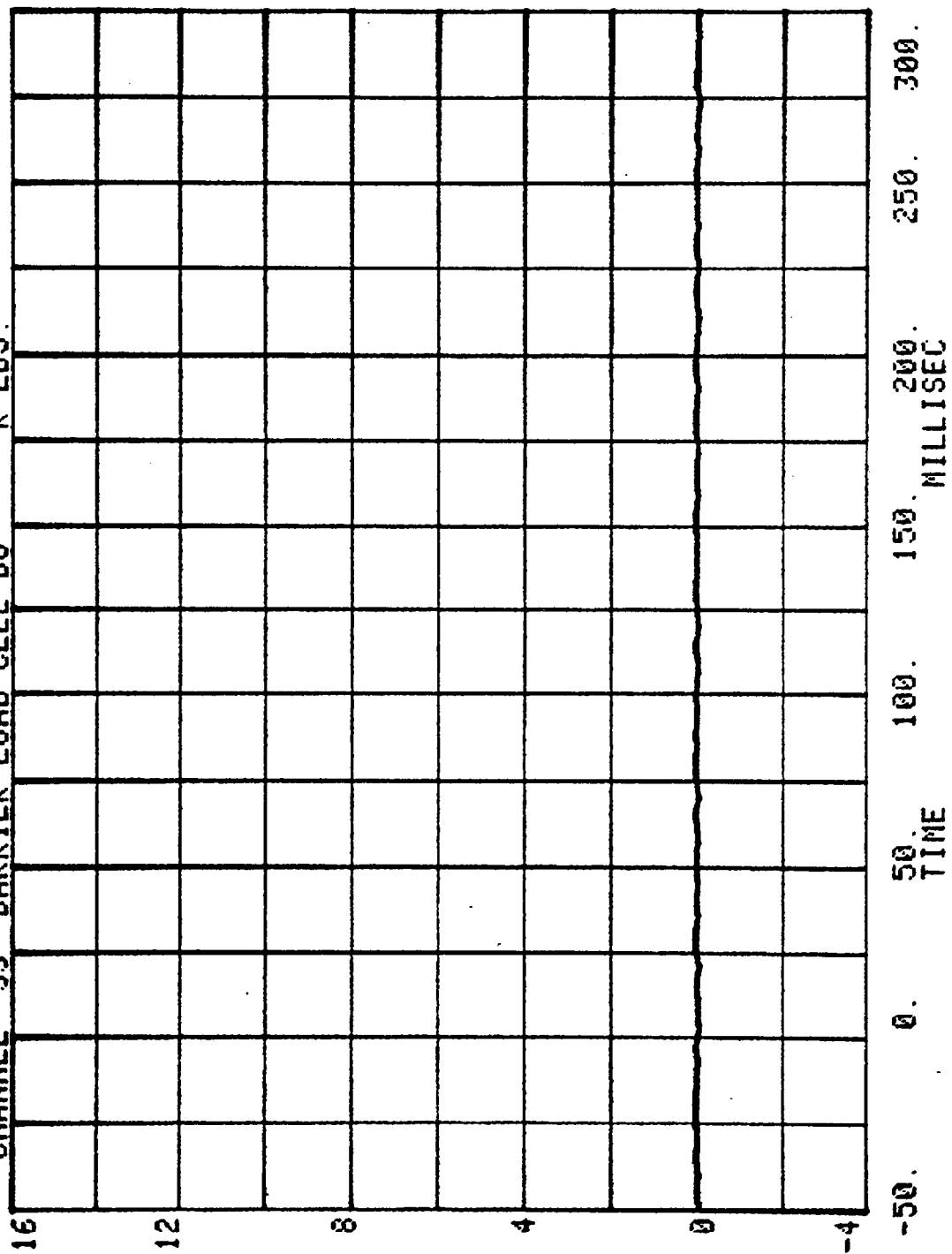


CHANNEL 31 RUN= 536 SERIES= 3 K LBS.
BARRIER LOAD CELL B4





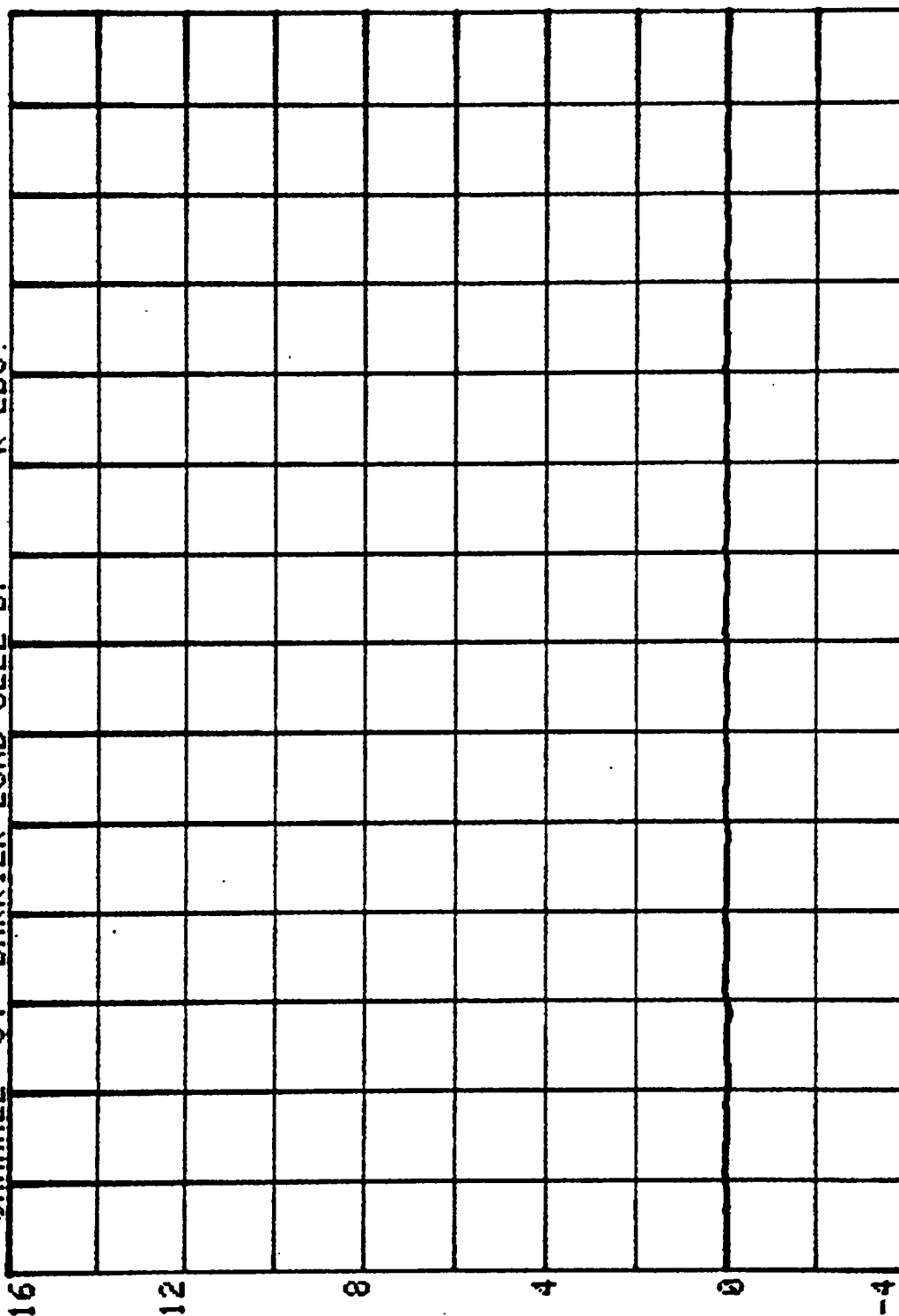
CHANNEL 33 BARRIER LOAD CELL B6 RUN= 536 SERIES= 3 K LBS.



CHANNEL 34 BARRIER LOAD CELL B7

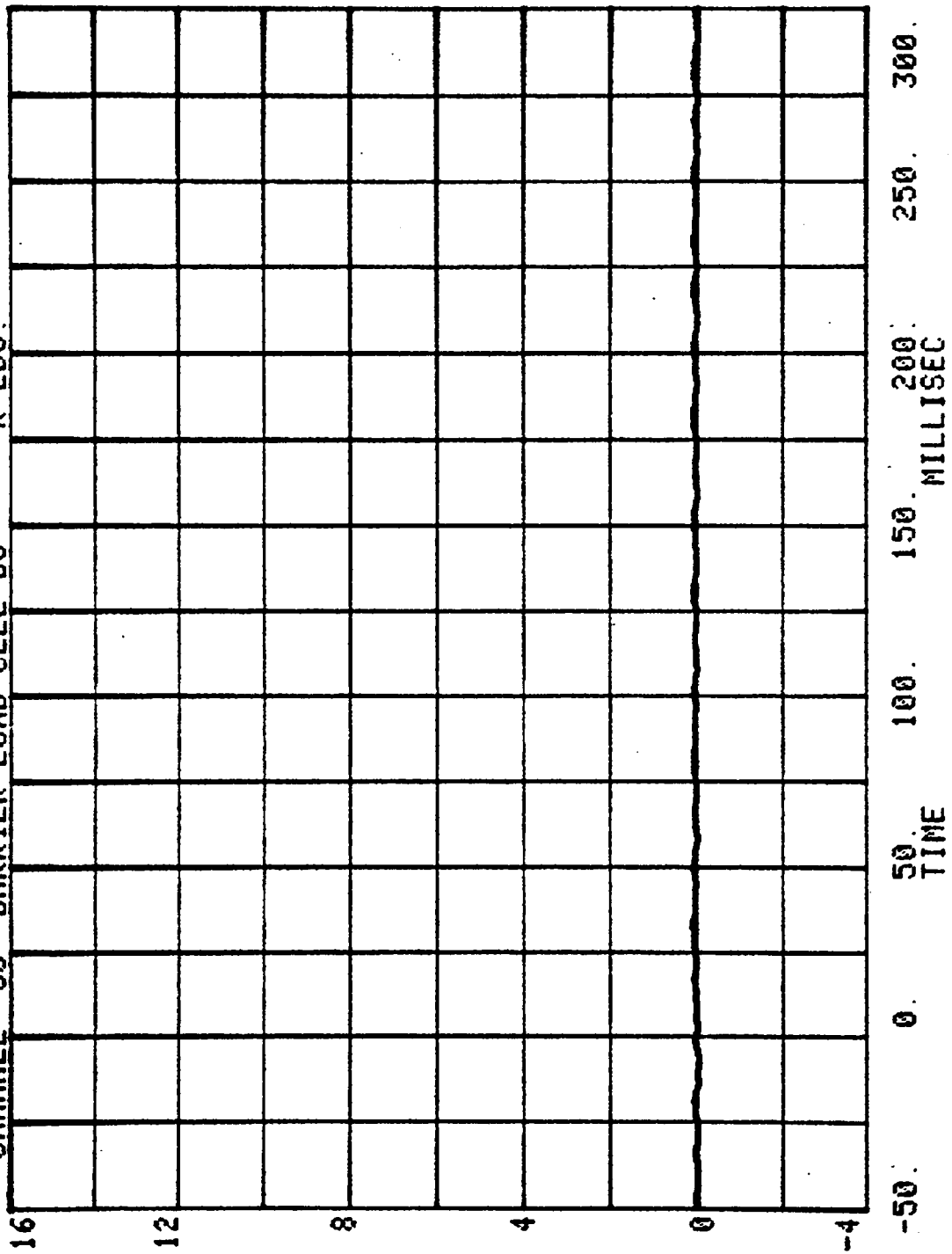
RUN= 536 SERIES= 3

K LBS.

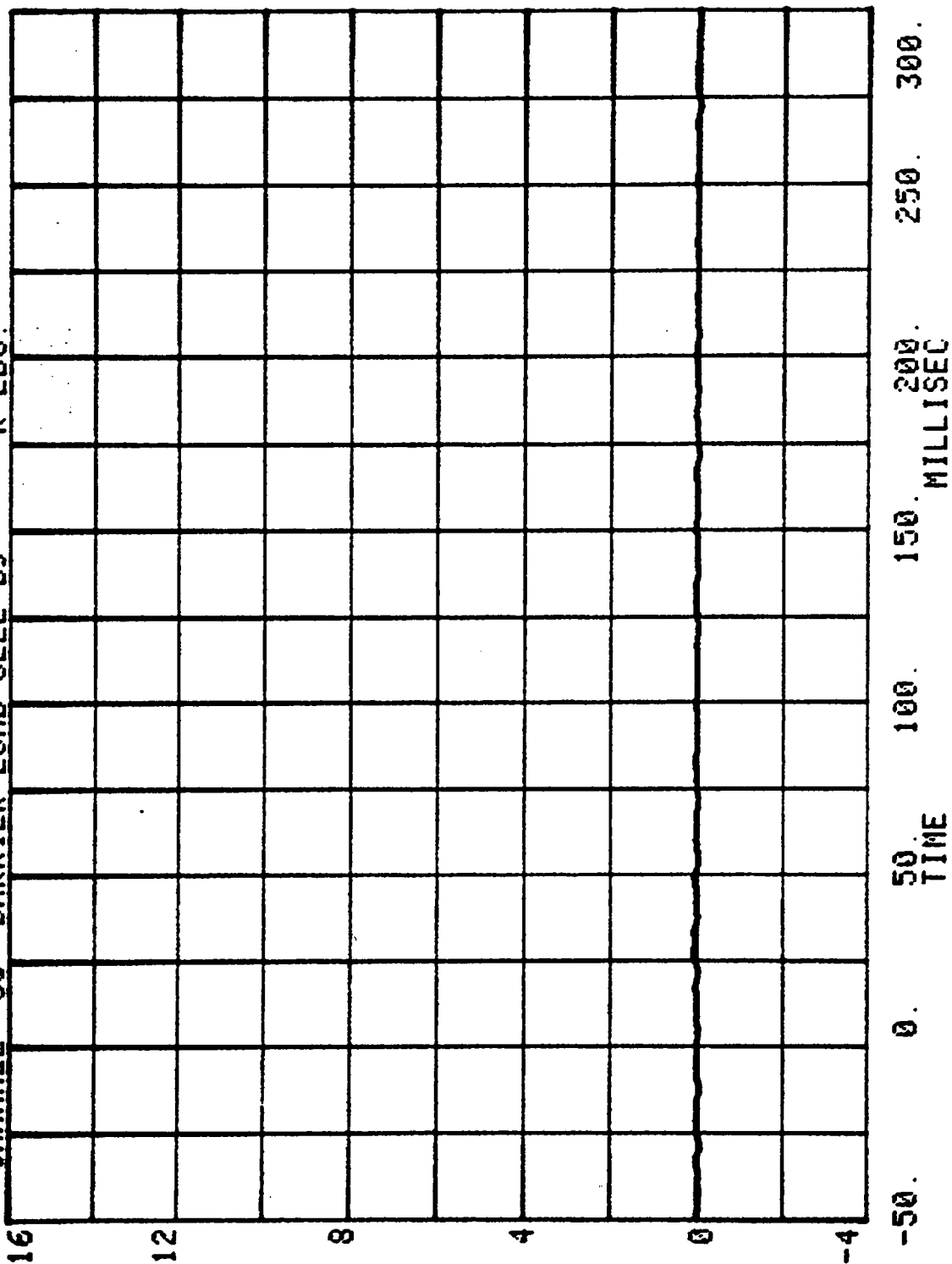


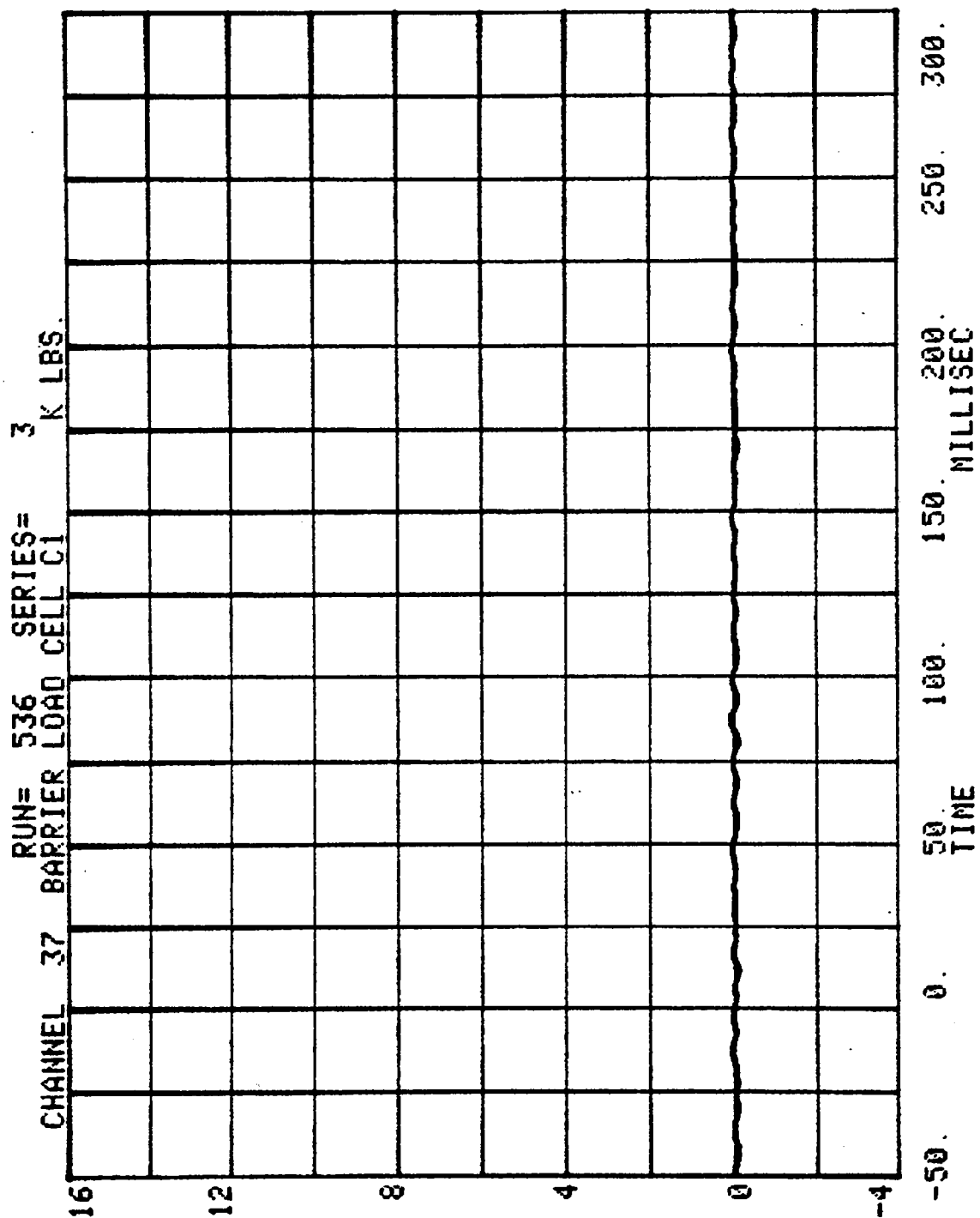
-50. 0. 50. 100. 150. 200. 250. 300.
TIME

CHANNEL 35 BARRIER LOAD CELL B8 RUN= 536 SERIES= 3 K LBS.

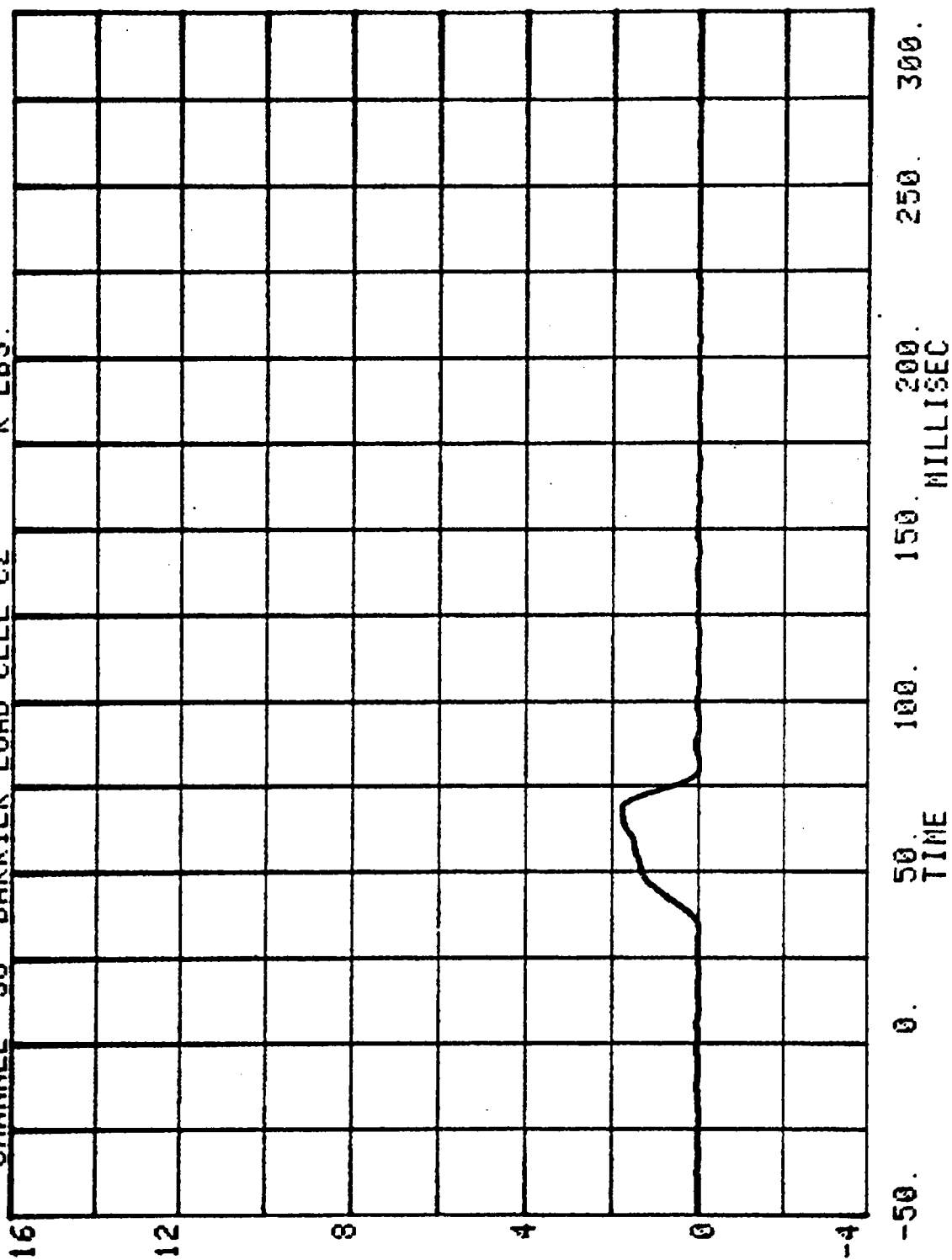


RUN= 536 SERIES= 3
 CHANNEL 36 BARRIER LOAD CELL B9 K LBS.

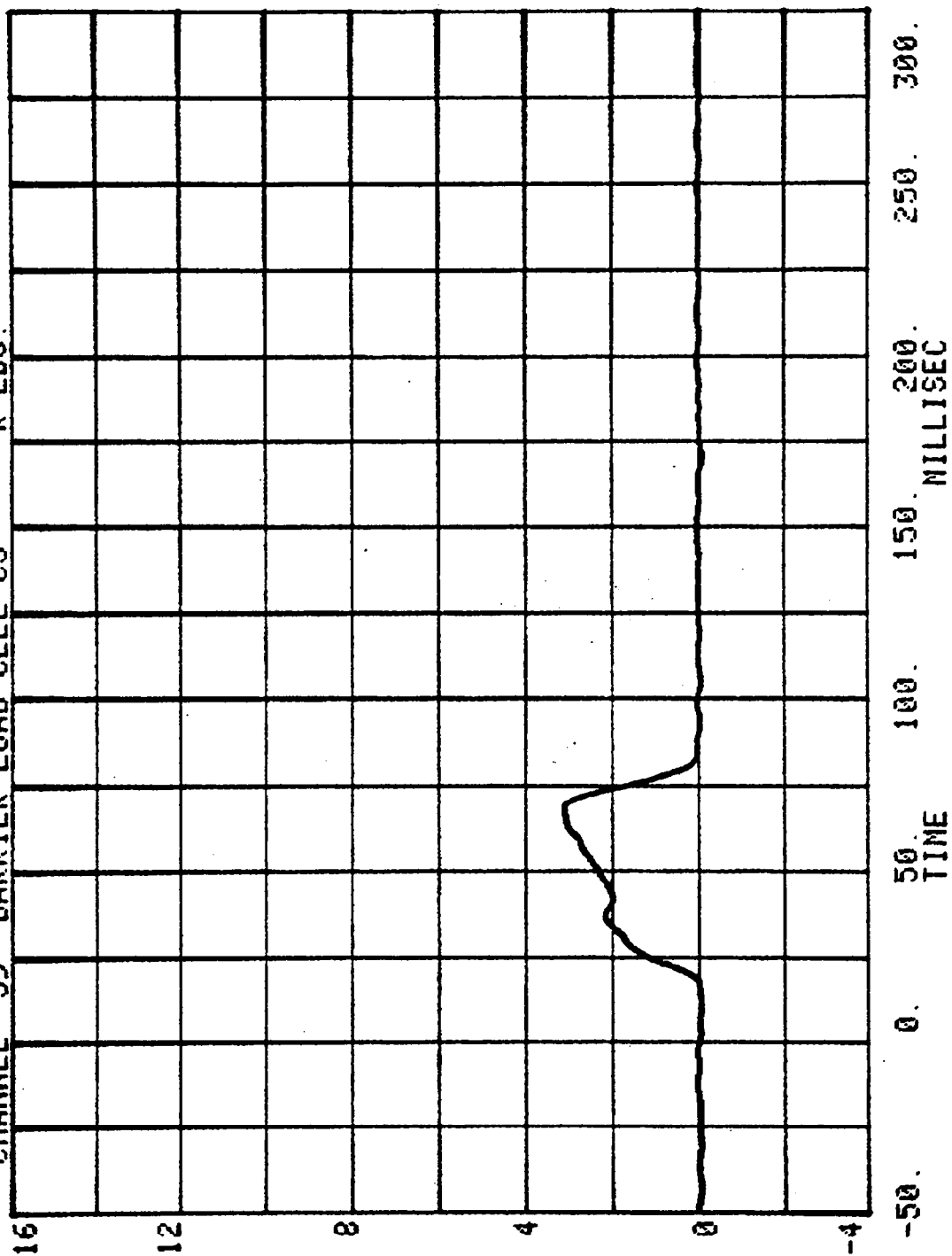




CHANNEL 38 BARRIER LOAD CELL C2 RUN= 536 SERIES= 3 K LBS.



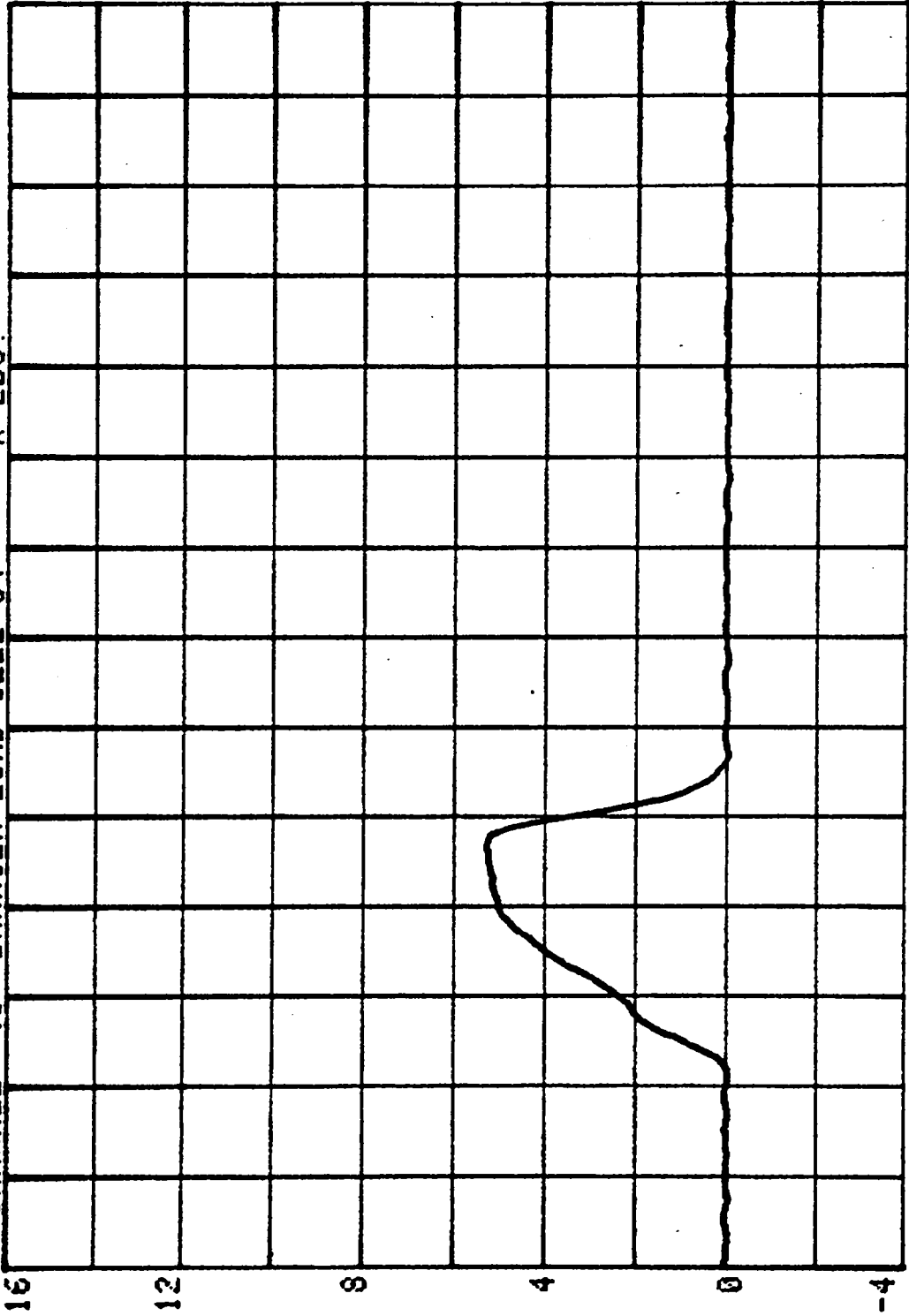
CHANNEL 39 BARRIER LOAD CELL C3
RUN= 536 SERIES= 3 K LBS.



CHANNEL 40 BARRIER LOAD CELL C4

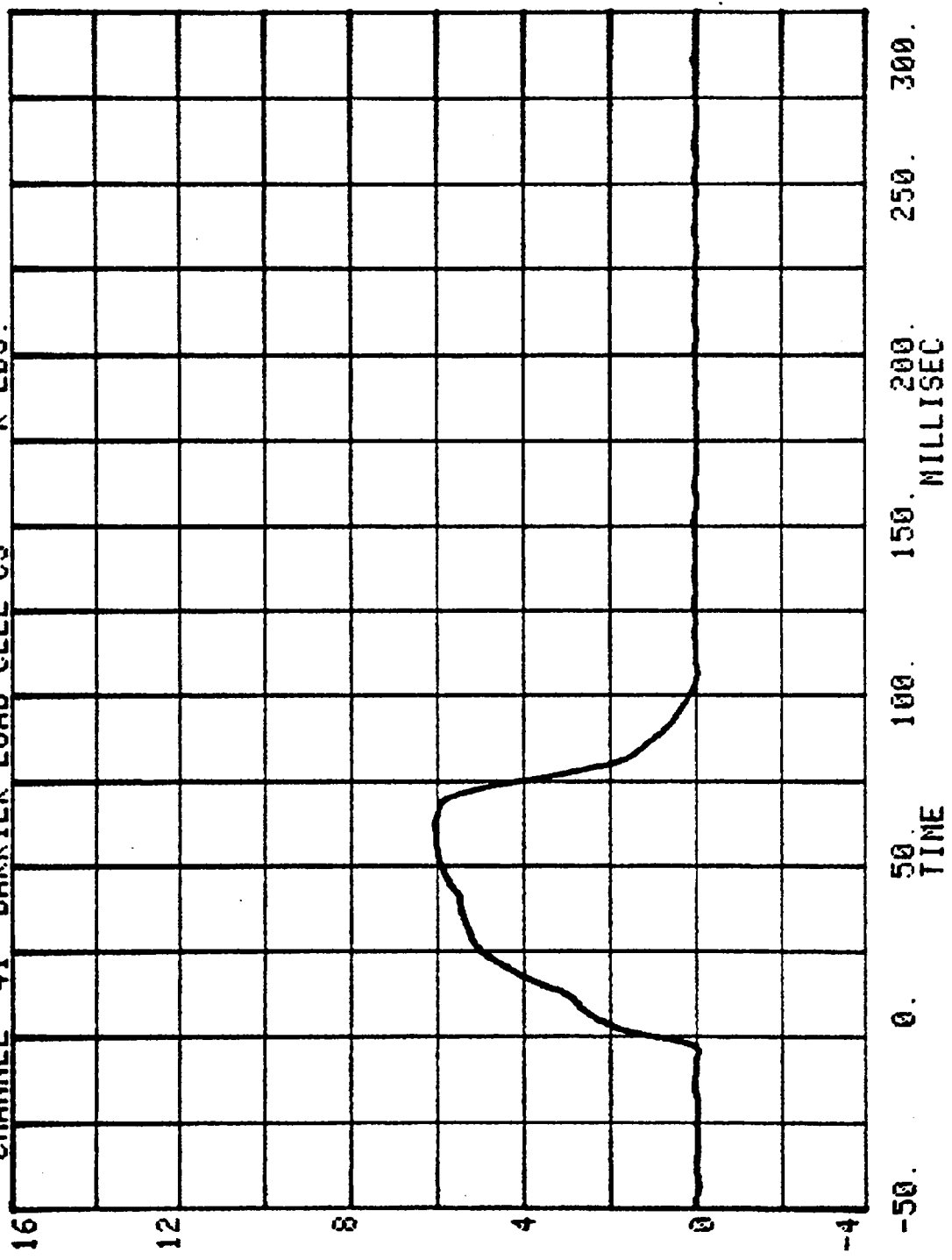
RUN= 536 SERIES= 3

K LBS.

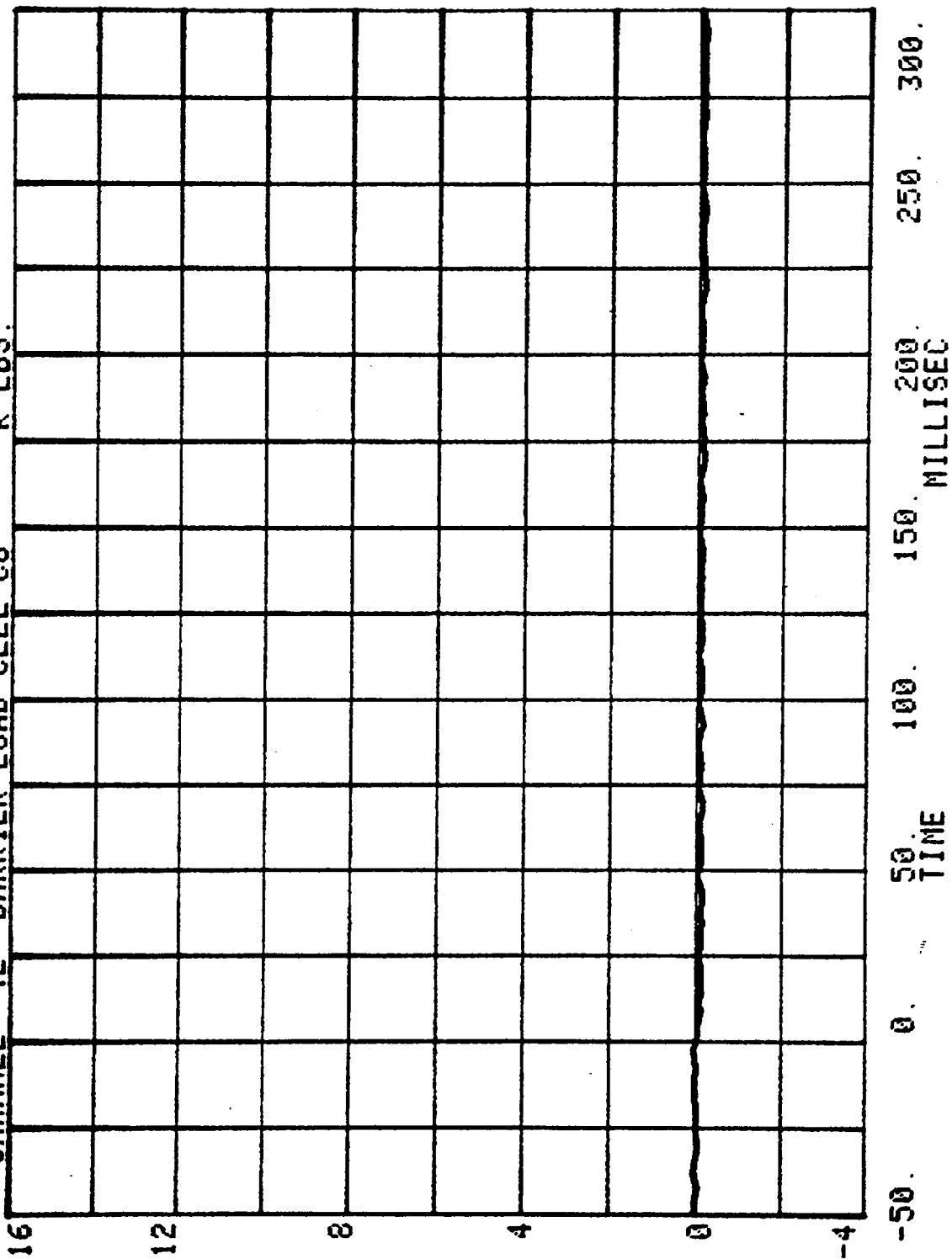


-50. 0. 50. 100. 150. 200. 250. 300.
TIME
MILLISEC

CHANNEL 41 BARRIER LOAD CELL C5 RUN= 536 SERIES= 3 K LBS.



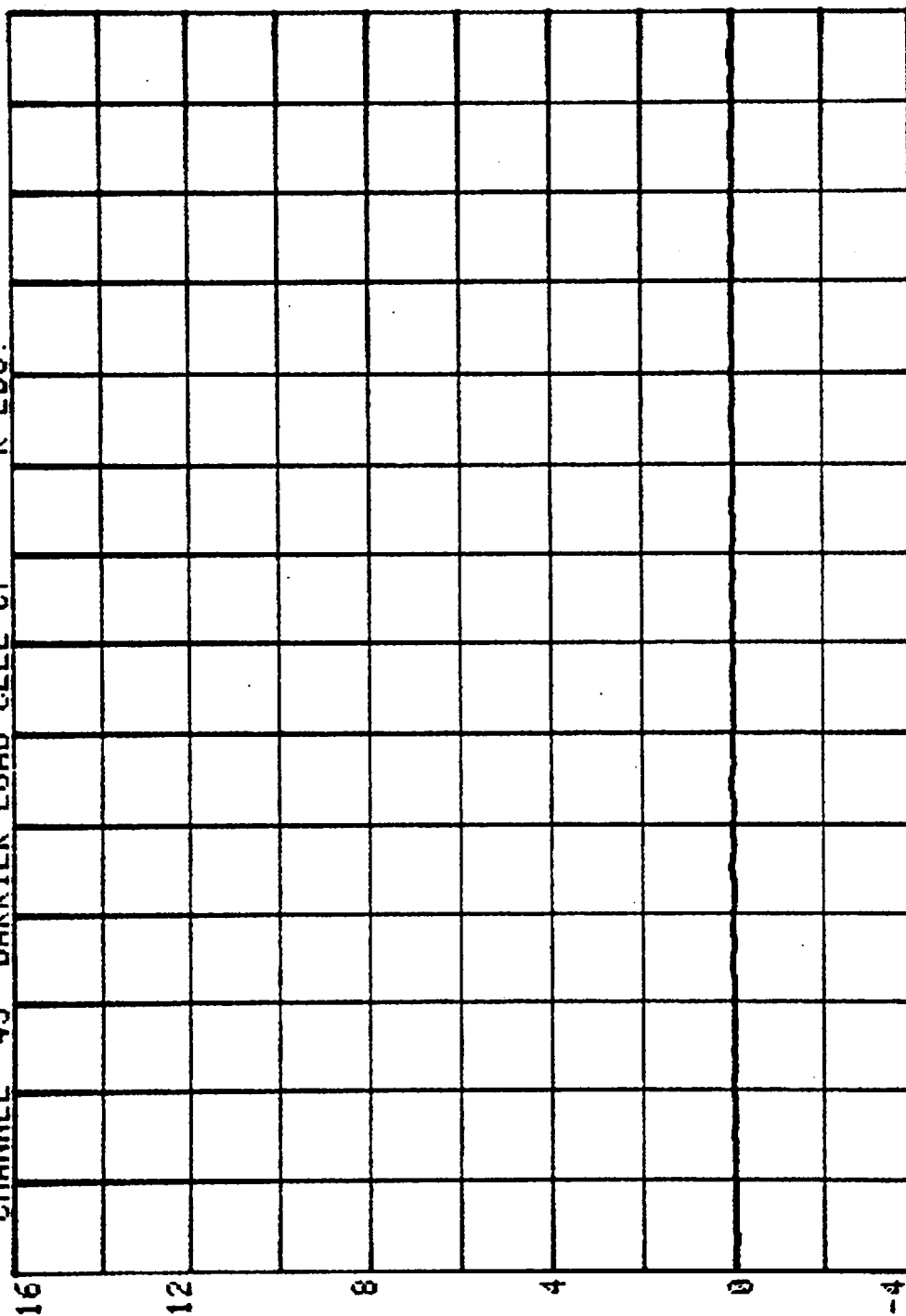
CHANNEL 42 BARRIER LOAD CELL C6 3 K LBS.



CHANNEL 43 BARRIER LOAD CELL C7

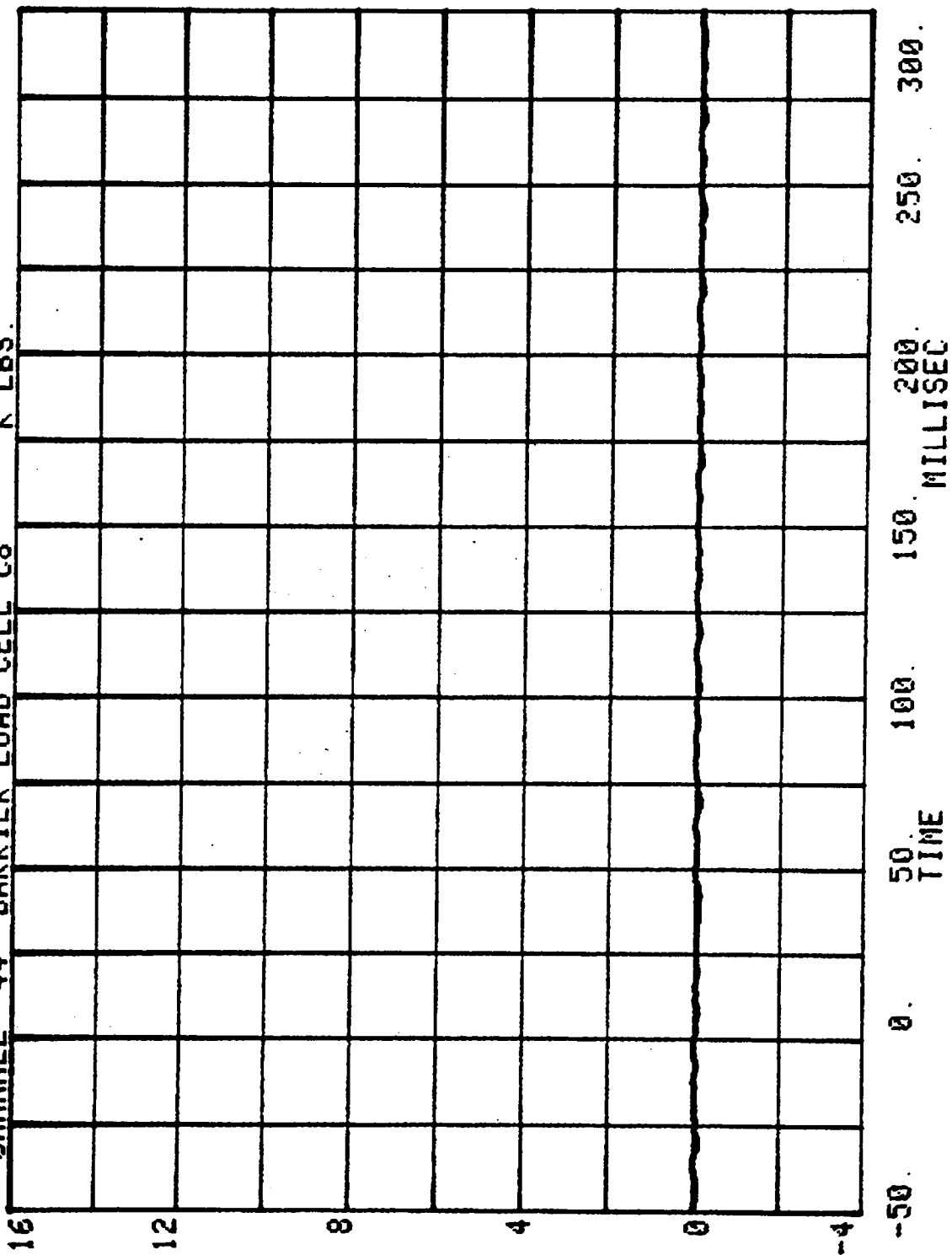
RUN= 536 SERIES= 3

K LBS.

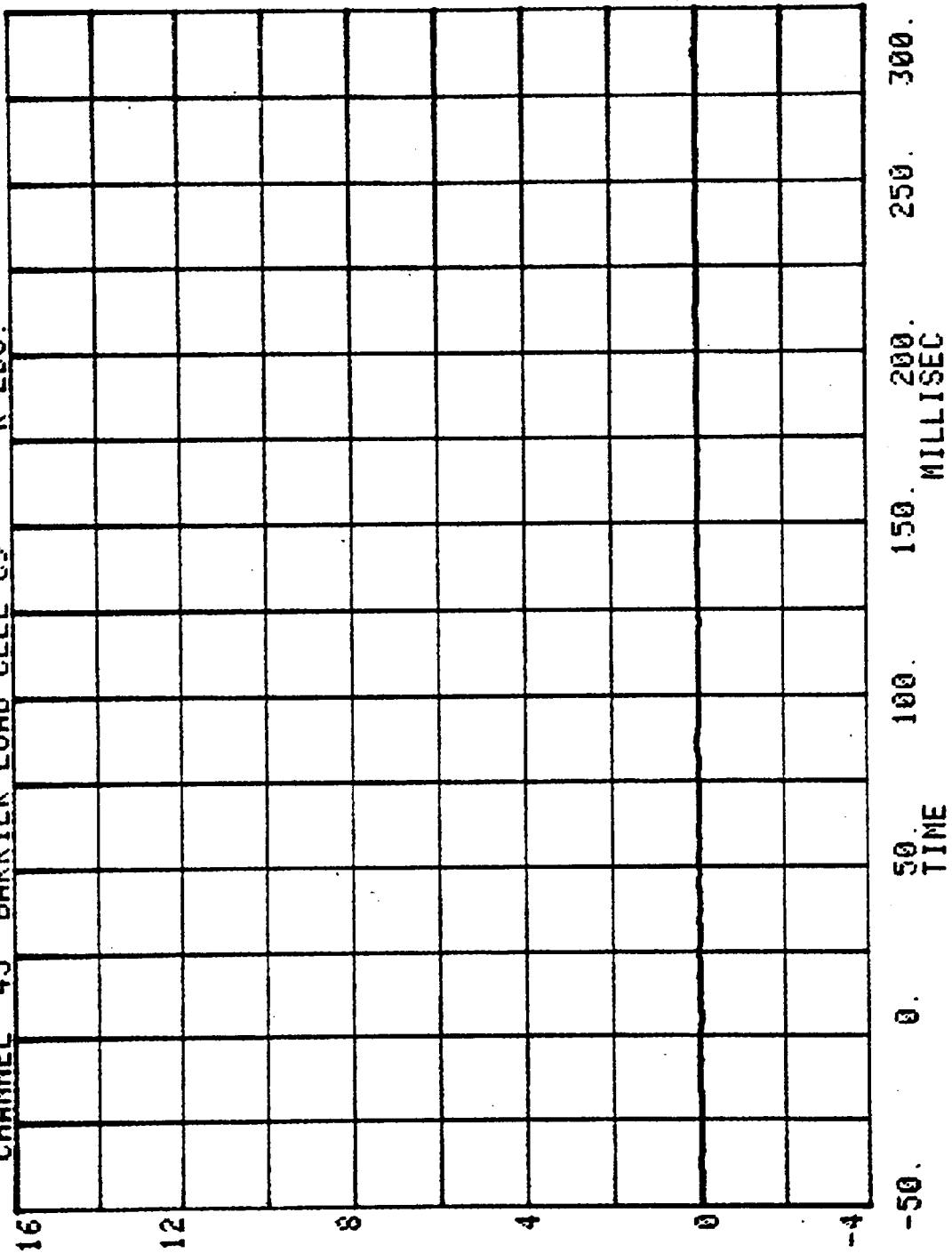


-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

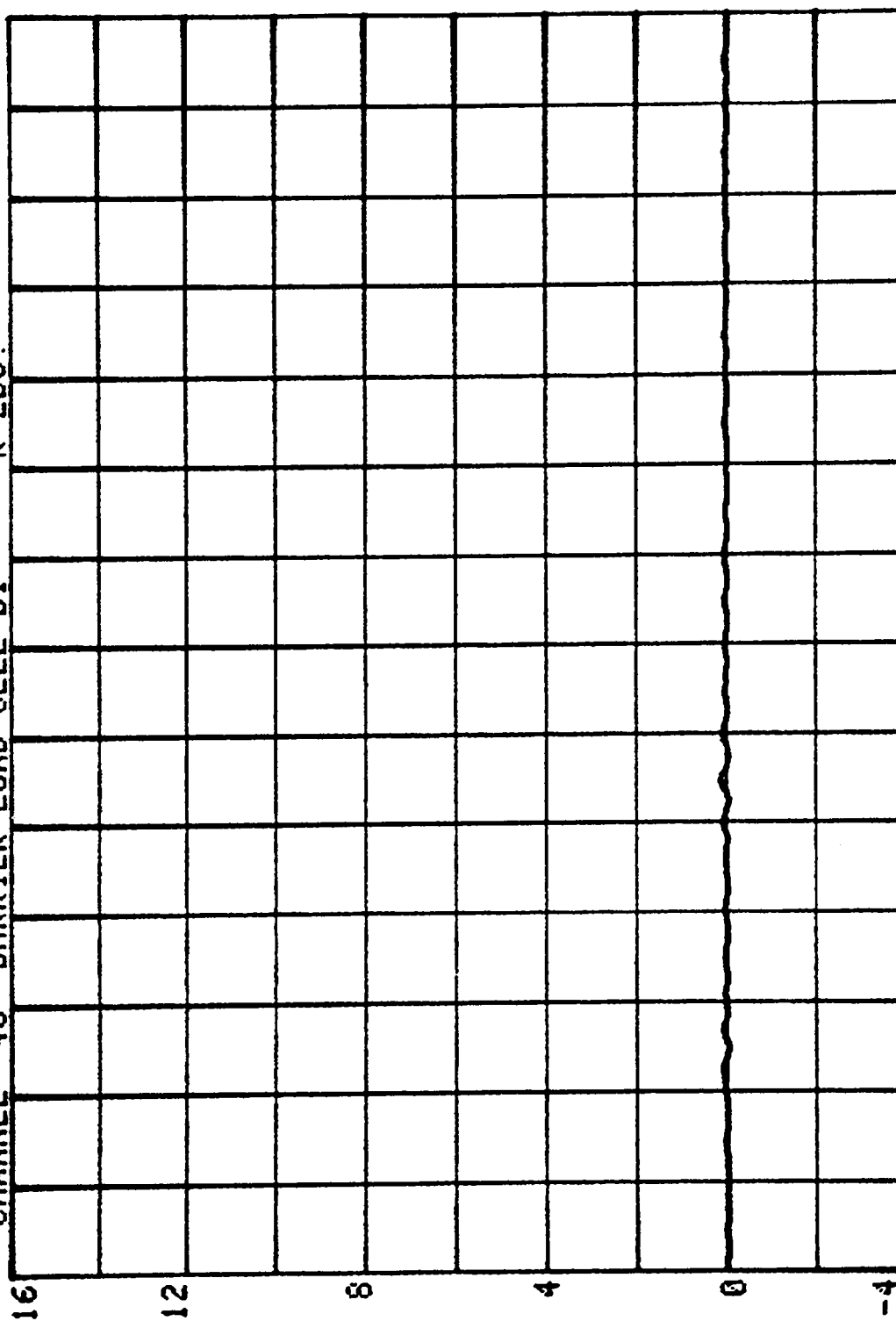
CHANNEL 44 BARRIER LOAD CELL C8
RUN= 536 SERIES= 3 K LBS.



CHANNEL 45 BARRIER LOAD CELL C9 RUN= 536 SERIES= 3 K LBS.

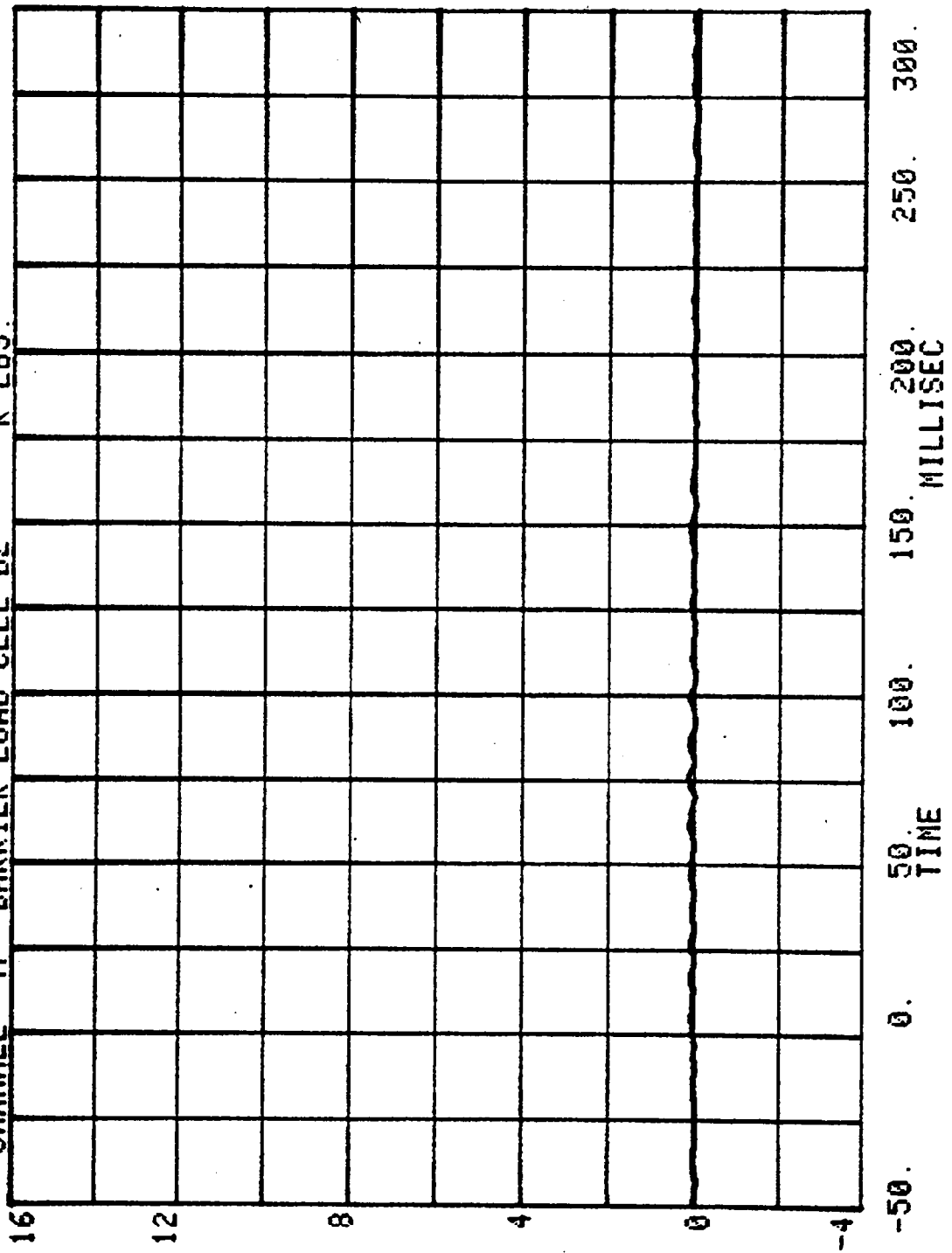


CHANNEL 46 BARRIER LOAD CELL D1
RUN= 536 SERIES= 3
K LBS.



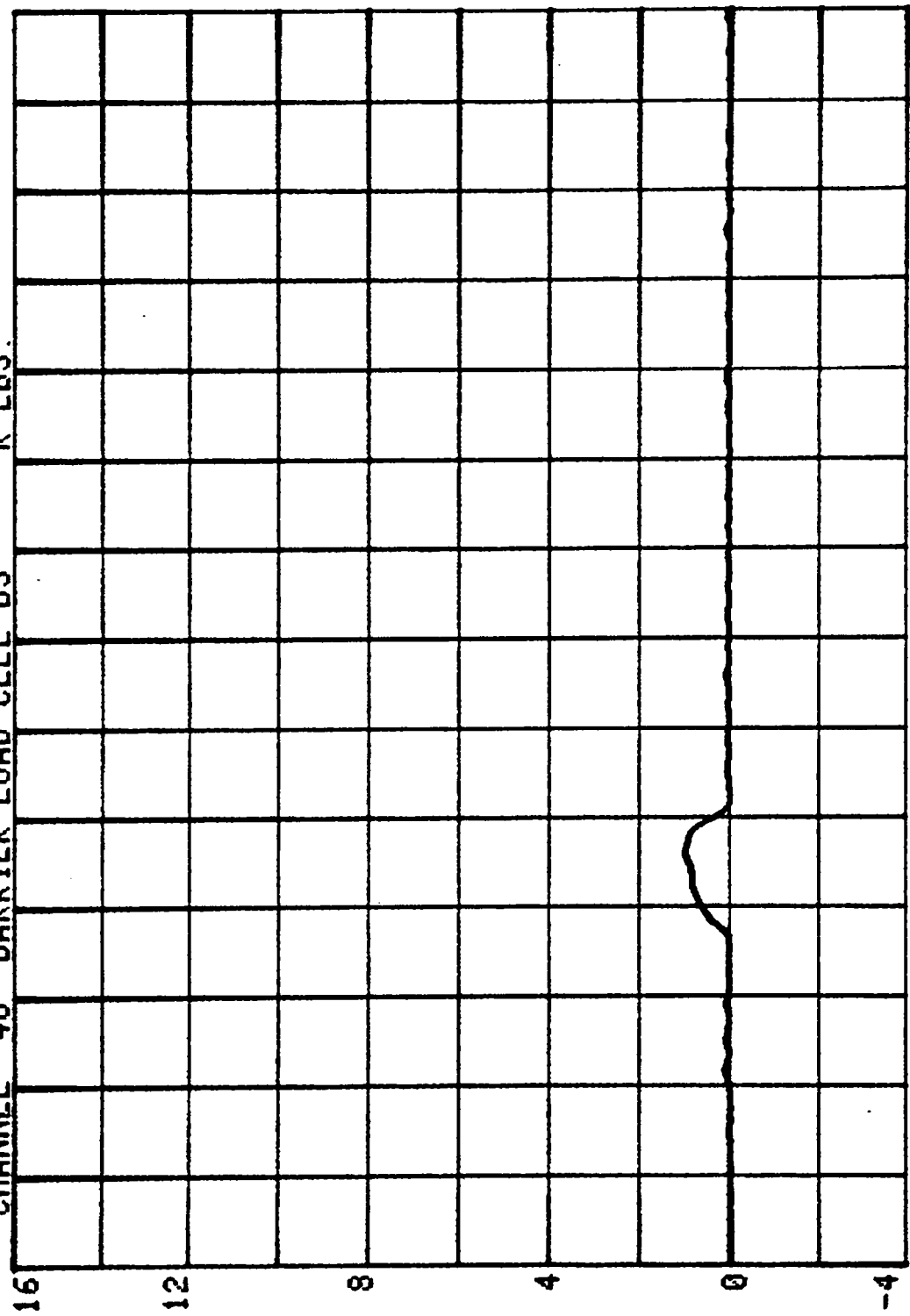
TIME
-50. 0. 50. 100. 150. 200. 250. 300.
MILLISEC

CHANNEL 47 BARRIER LOAD CELL D2 RUN= 536 SERIES= 3 K LBS.



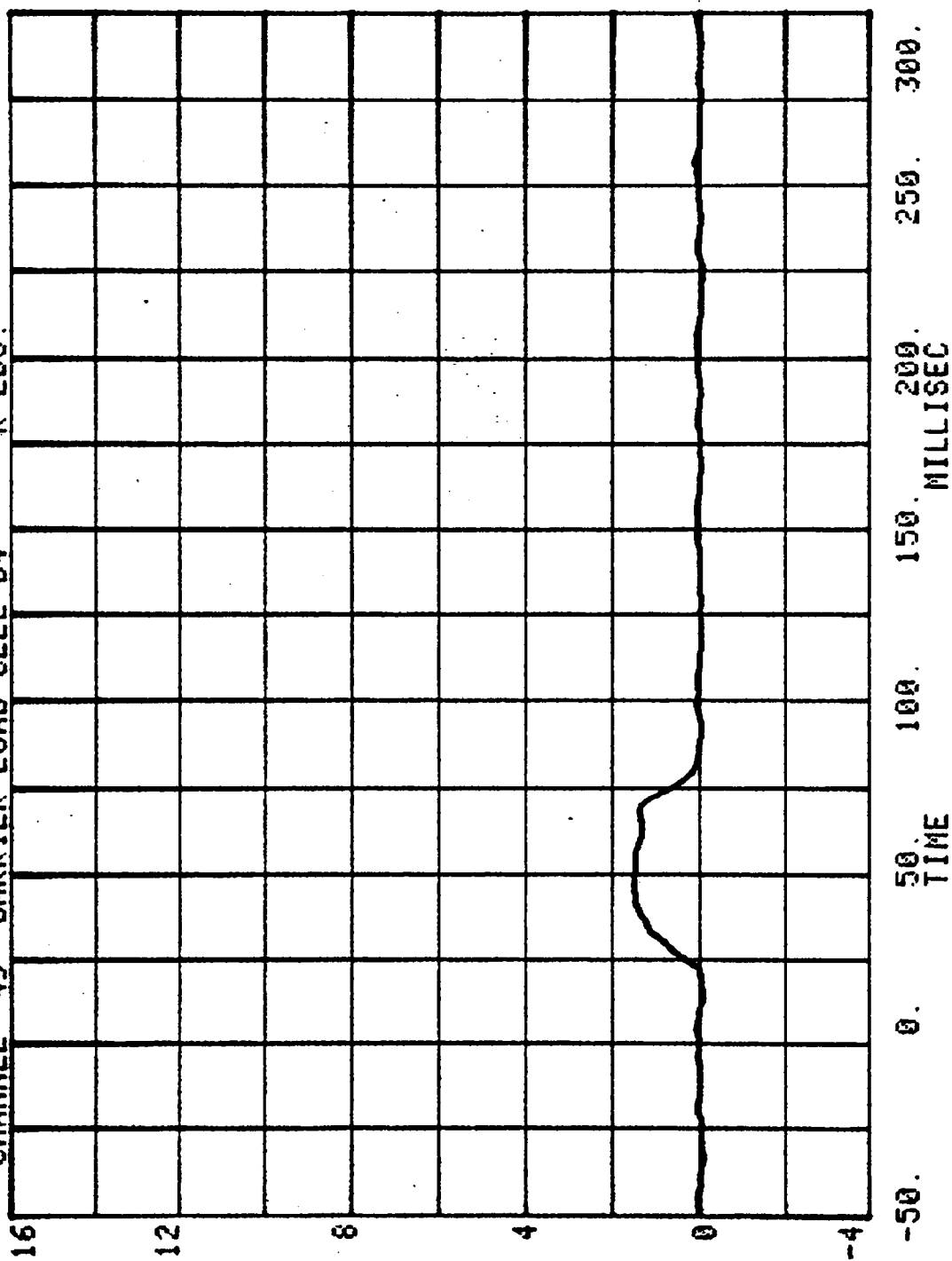
CHANNEL 48 BARRIER LOAD CELL D3 3 K LBS.

RUN= 536 SERIES=



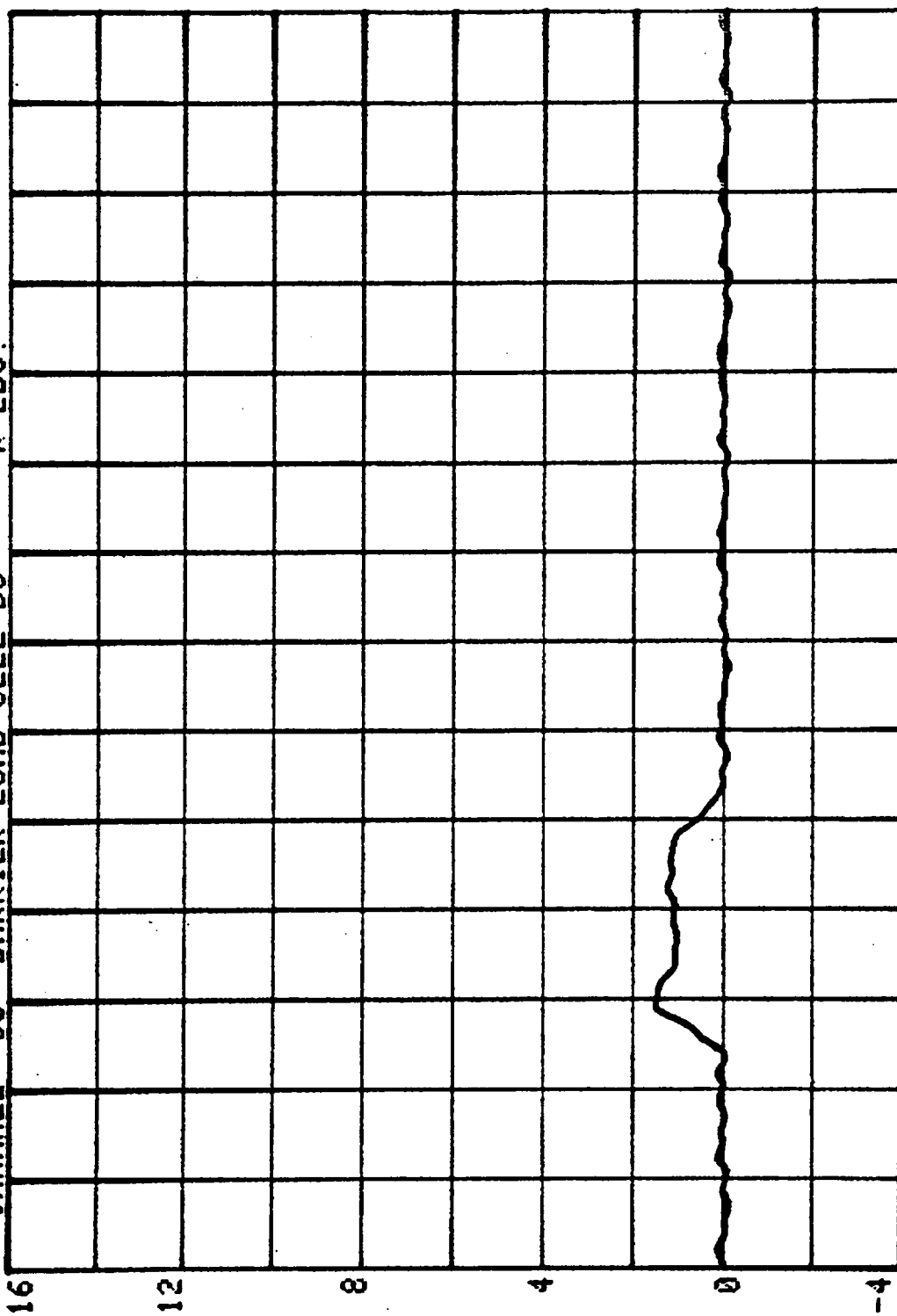
TIME
-50. 0. 50. 100. 150. 200. 250. 300.
MILLISEC

CHANNEL 49 BARRIER LOAD CELL D4 RUN= 536 SERIES= 3 K LBS.



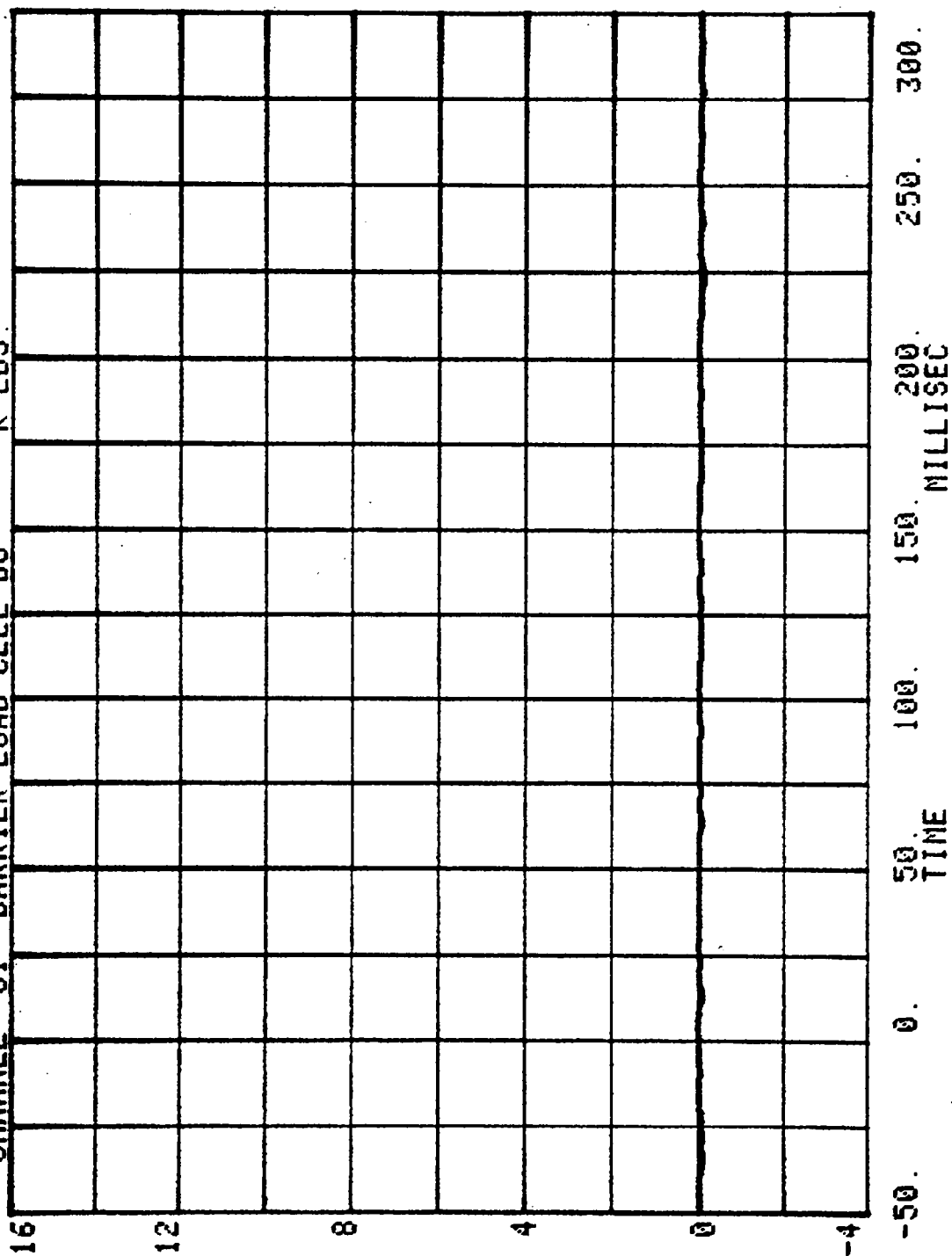
CHANNEL 50 BARRIER LOAD CELL D5 3 K LBS.

RUN= 536 SERIES=



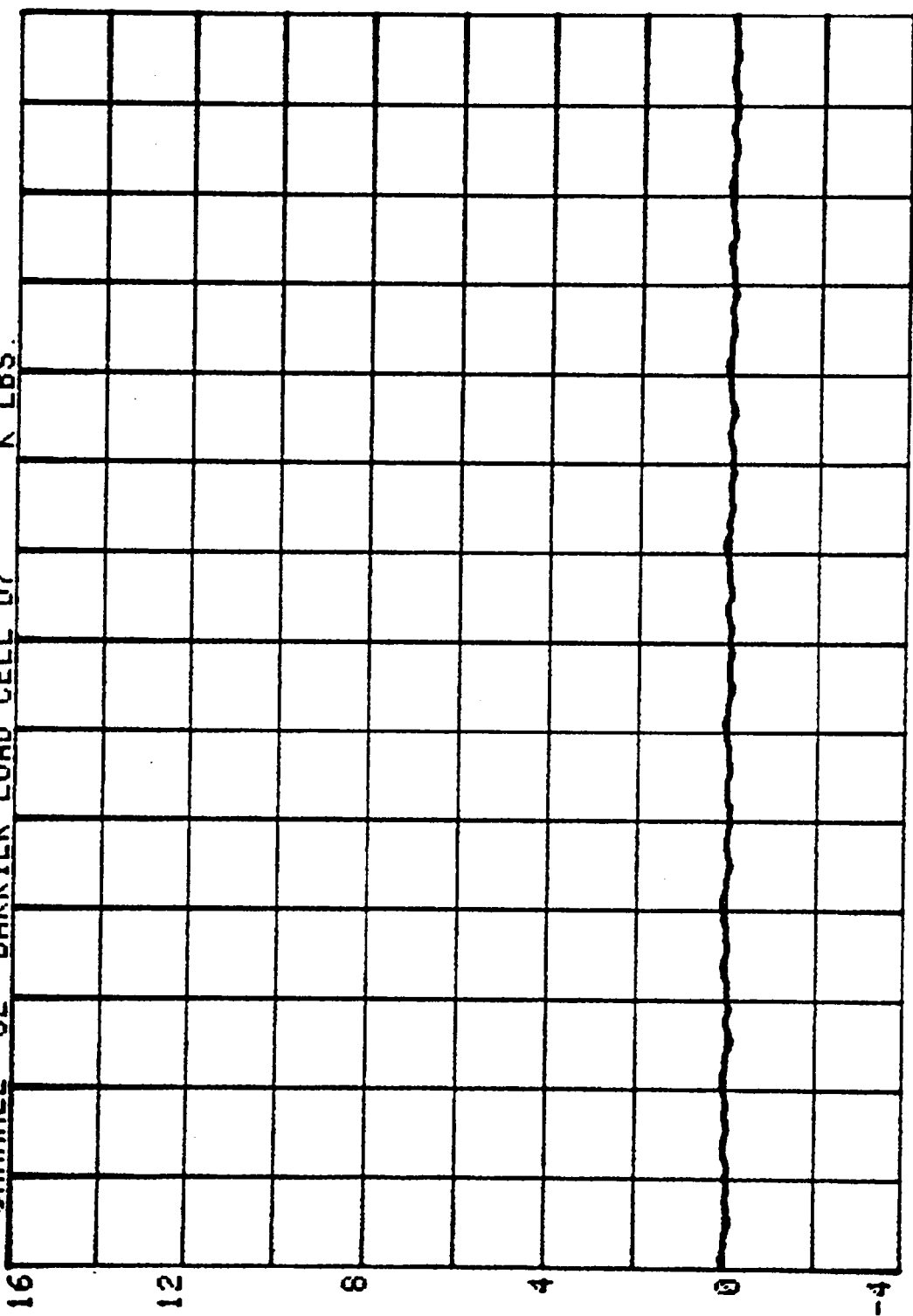
-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

CHANNEL 51 RUN= 536 SERIES= 3 K LBS
BARRIER LOAD CELL D6

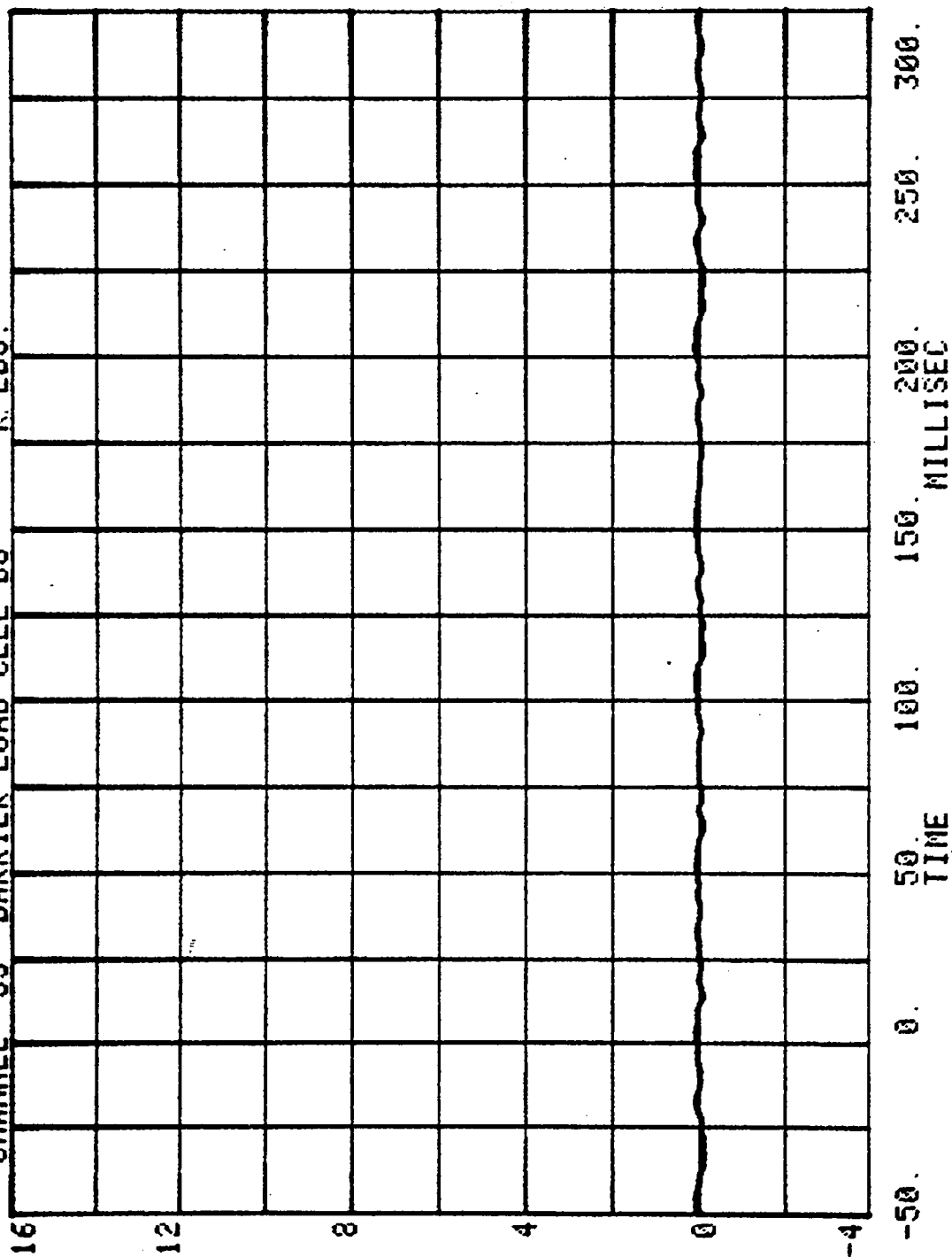


CHANNEL 52 BARRIER LOAD CELL 07 3 K LBS.

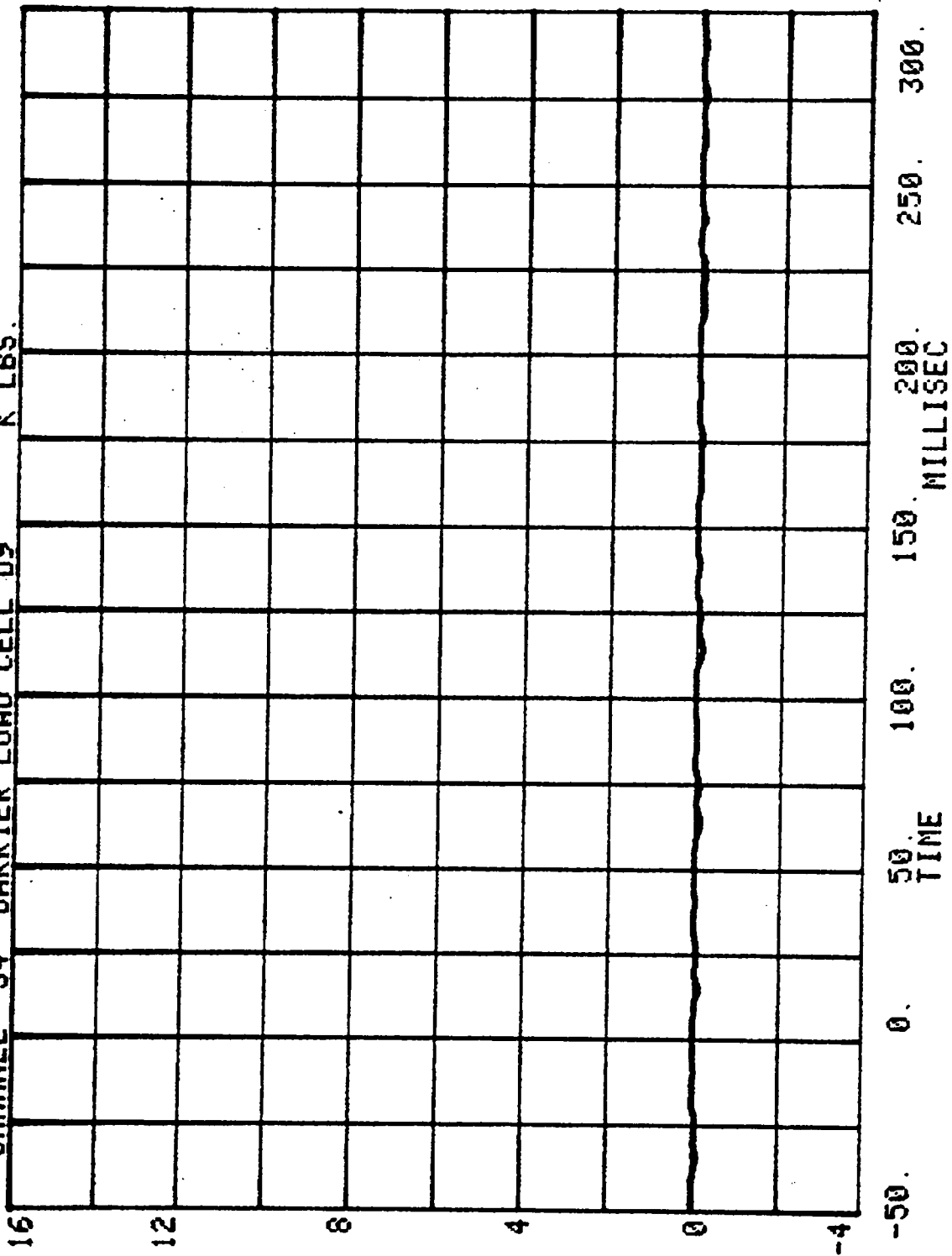
RUN= 536 SERIES=

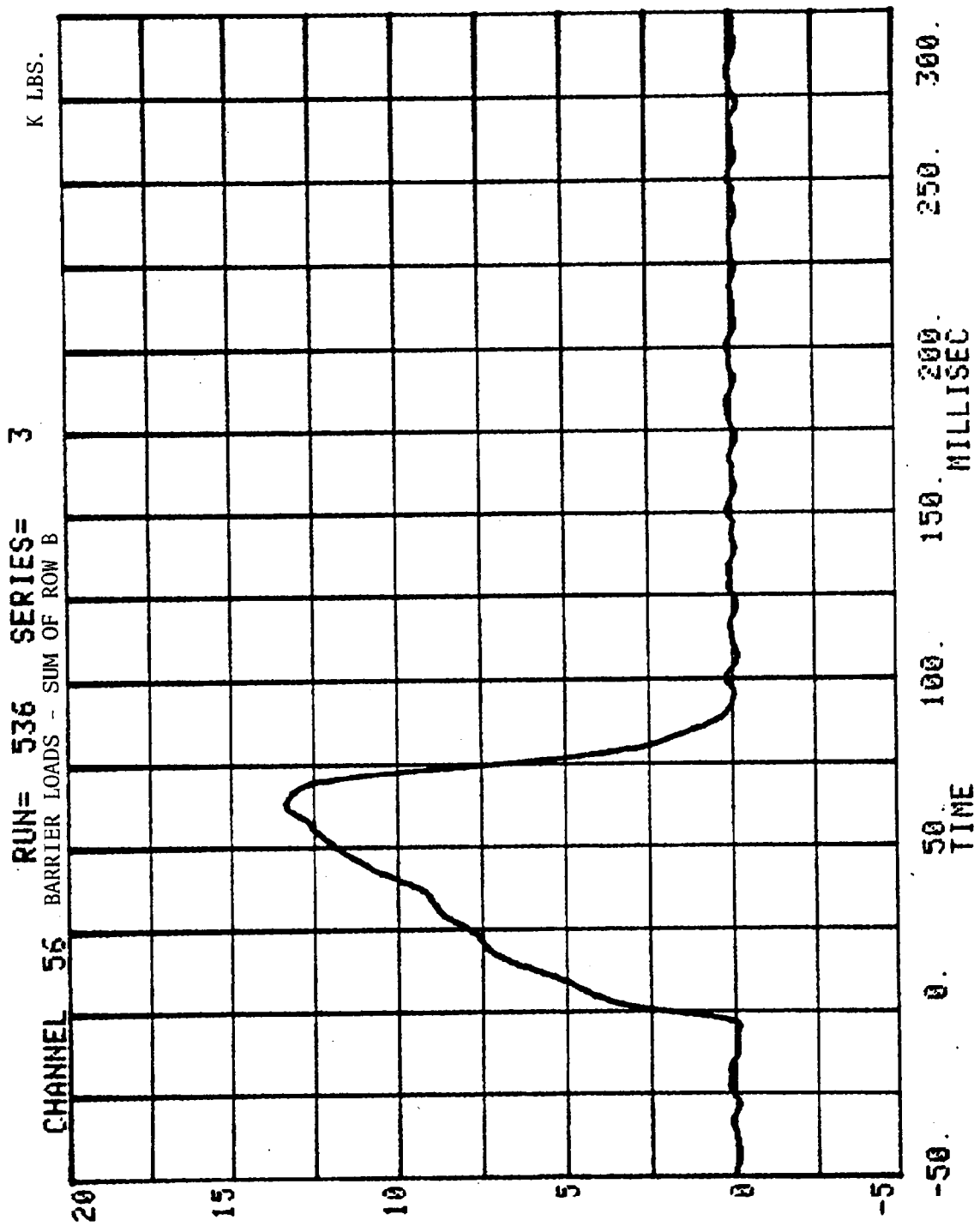


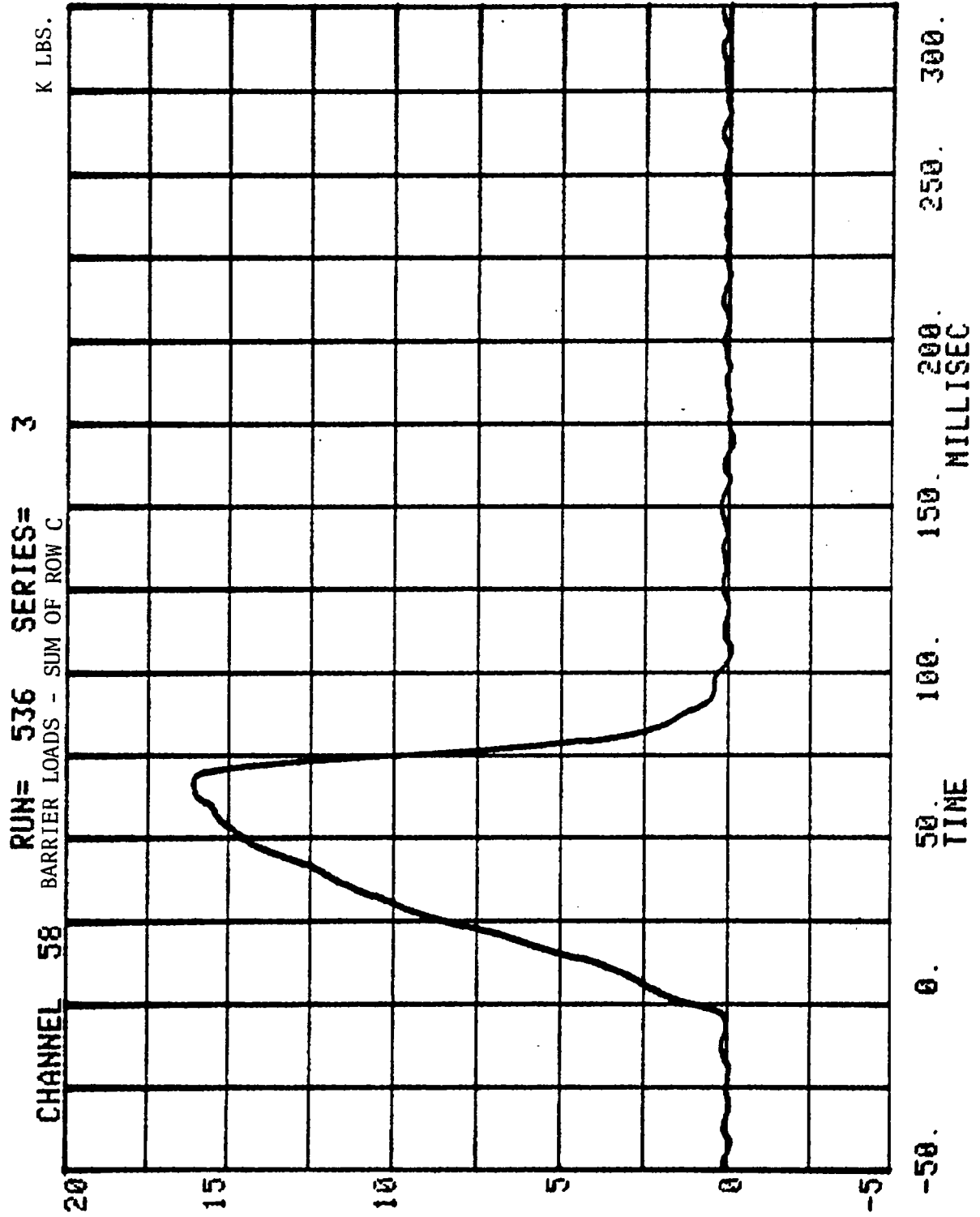
CHANNEL 53 RUN= 536 SERIES= 3 K. LBS.
BARRIER LOAD CELL D8



CHANNEL 54 BARRIER LOAD CELL D9 RUN= 536 SERIES= 3 K LBS.



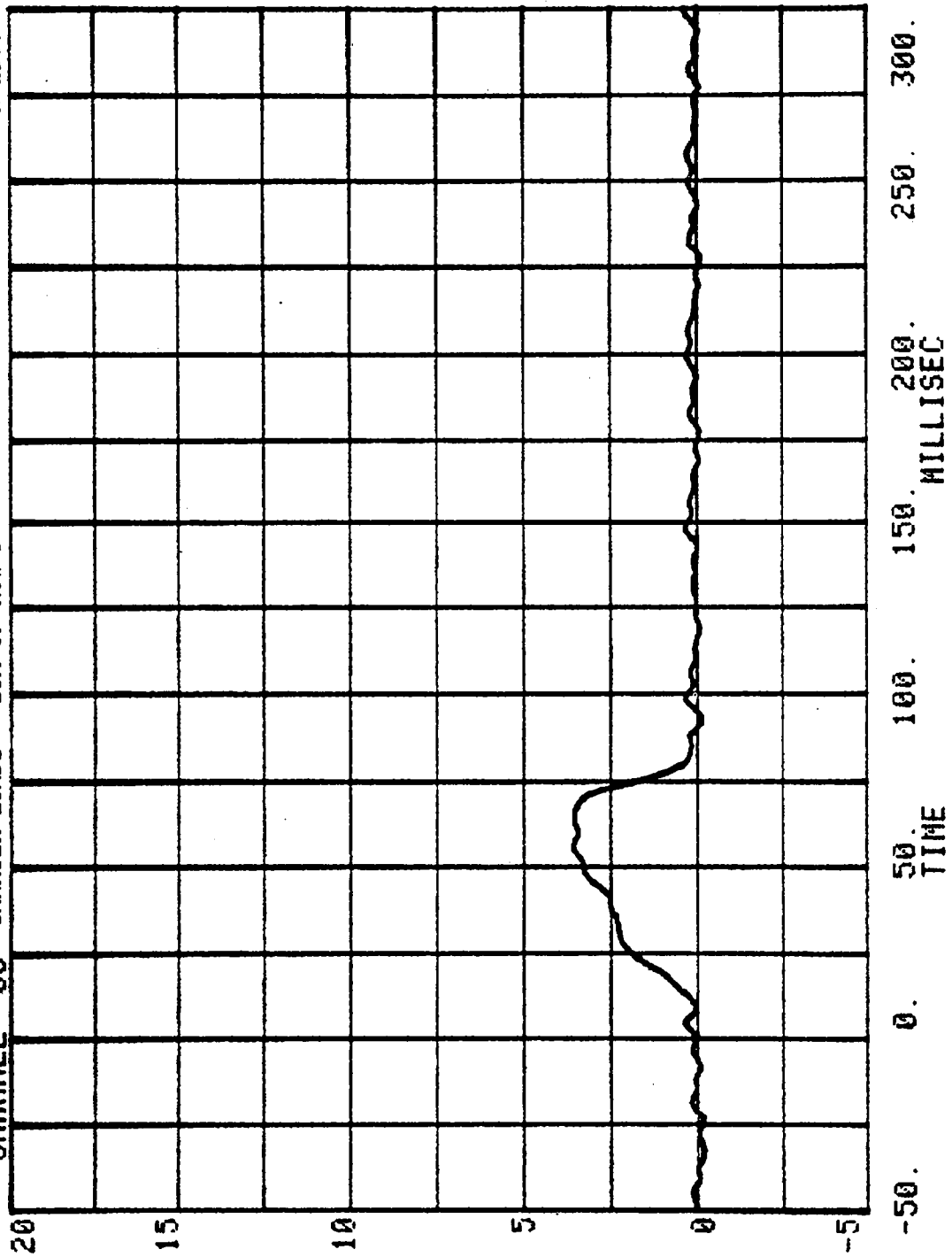




3

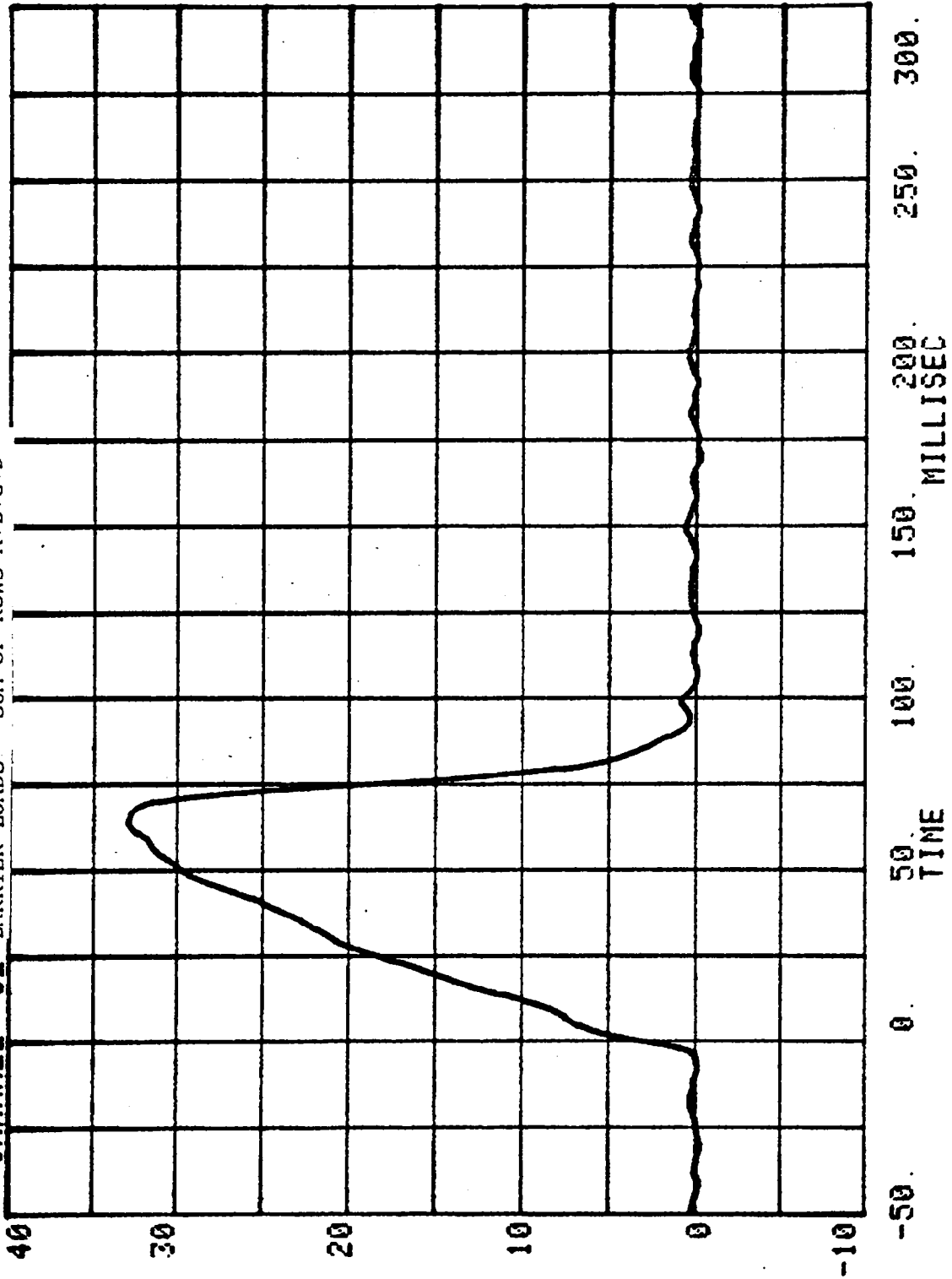
CHANNEL 60 RUN= 536 SERIES= 3
BARRIER LOADS - SUM OF ROW D

K LBS.



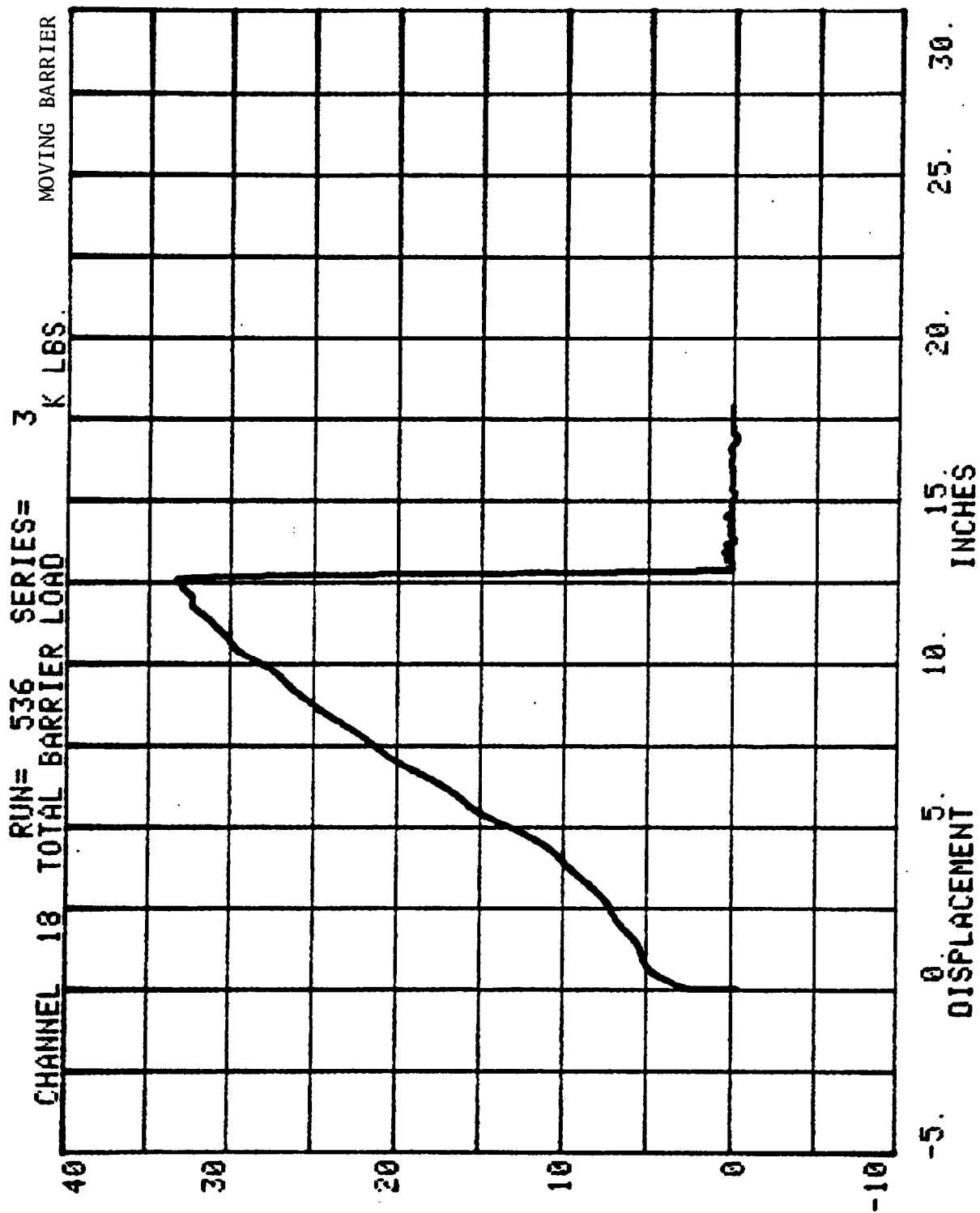
CHANNEL 62 RUN= 536 SERIES= 3
BARRIER LOADS - SUM OF ROWS A+B+C+D

K LBS.



TEST NO. 3

CROSS PLOT OF MOVING BARRIER LOAD
VS. DISPLACEMENT (DERIVED FROM MOVING BARRIER ACCELERATION)



FROM ACC. PACK. #A1 (X)

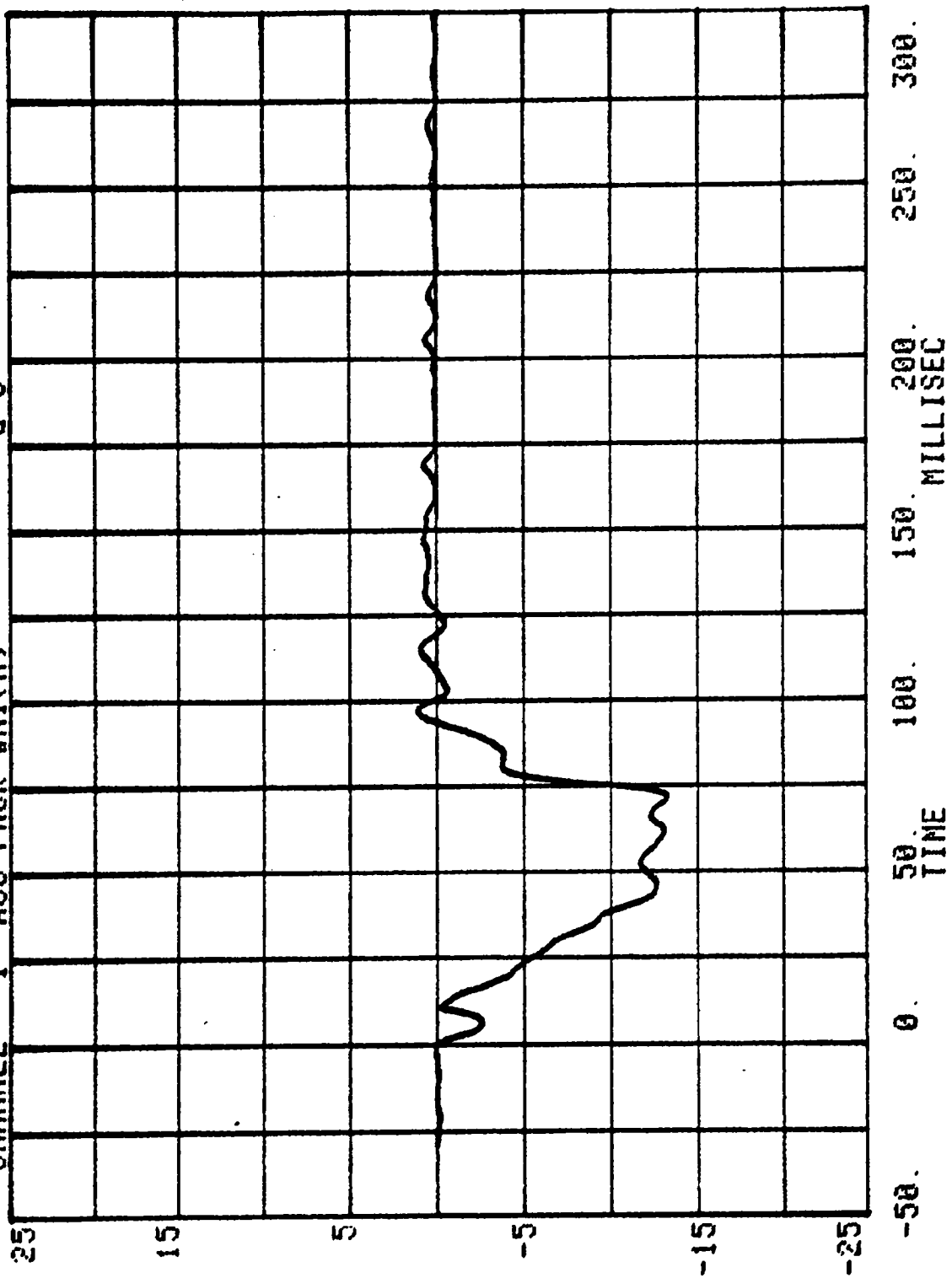
MOVING BARRIER DATA

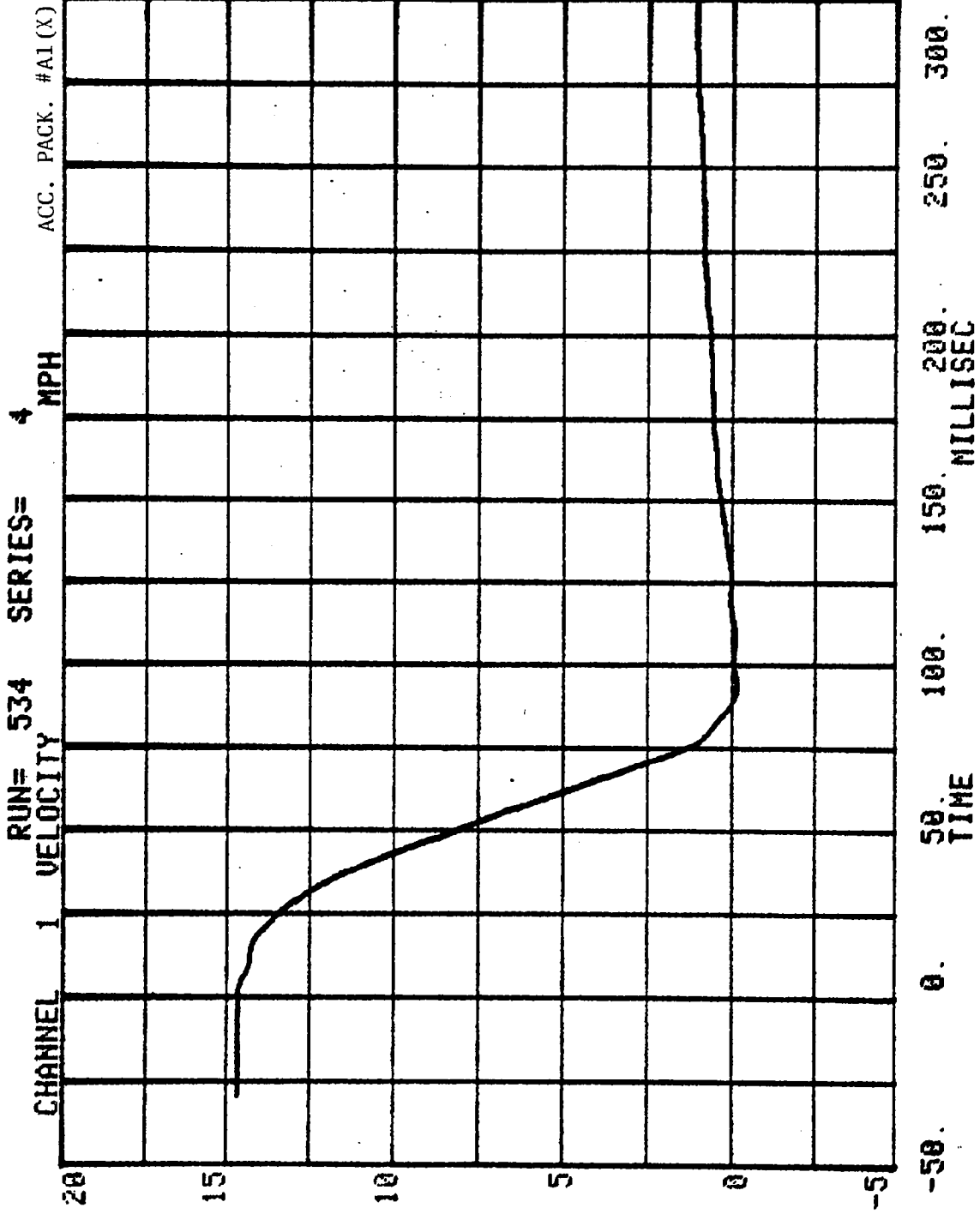
TEST NO. 4

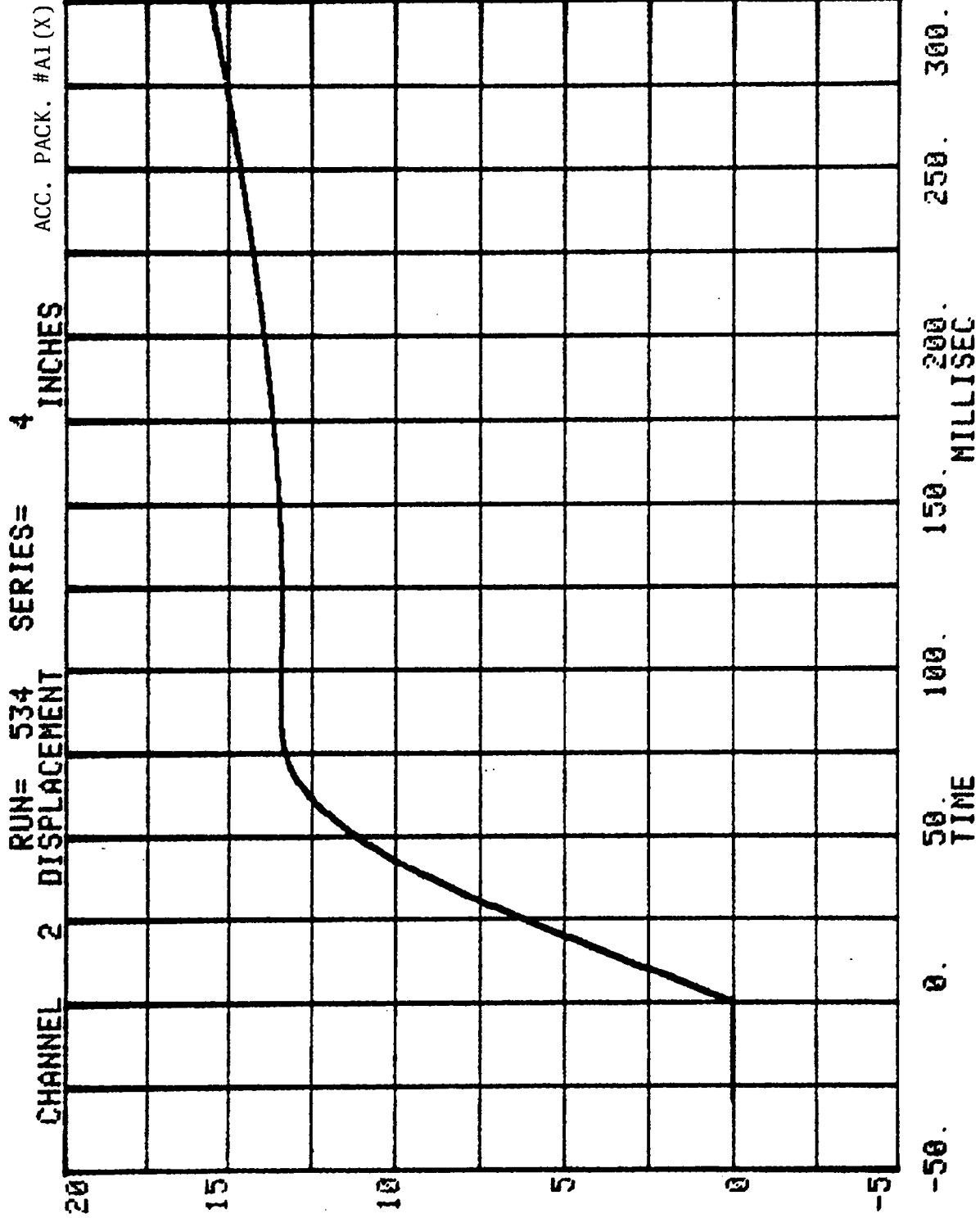
VEHICLE DATA

FILTER CLASS 60

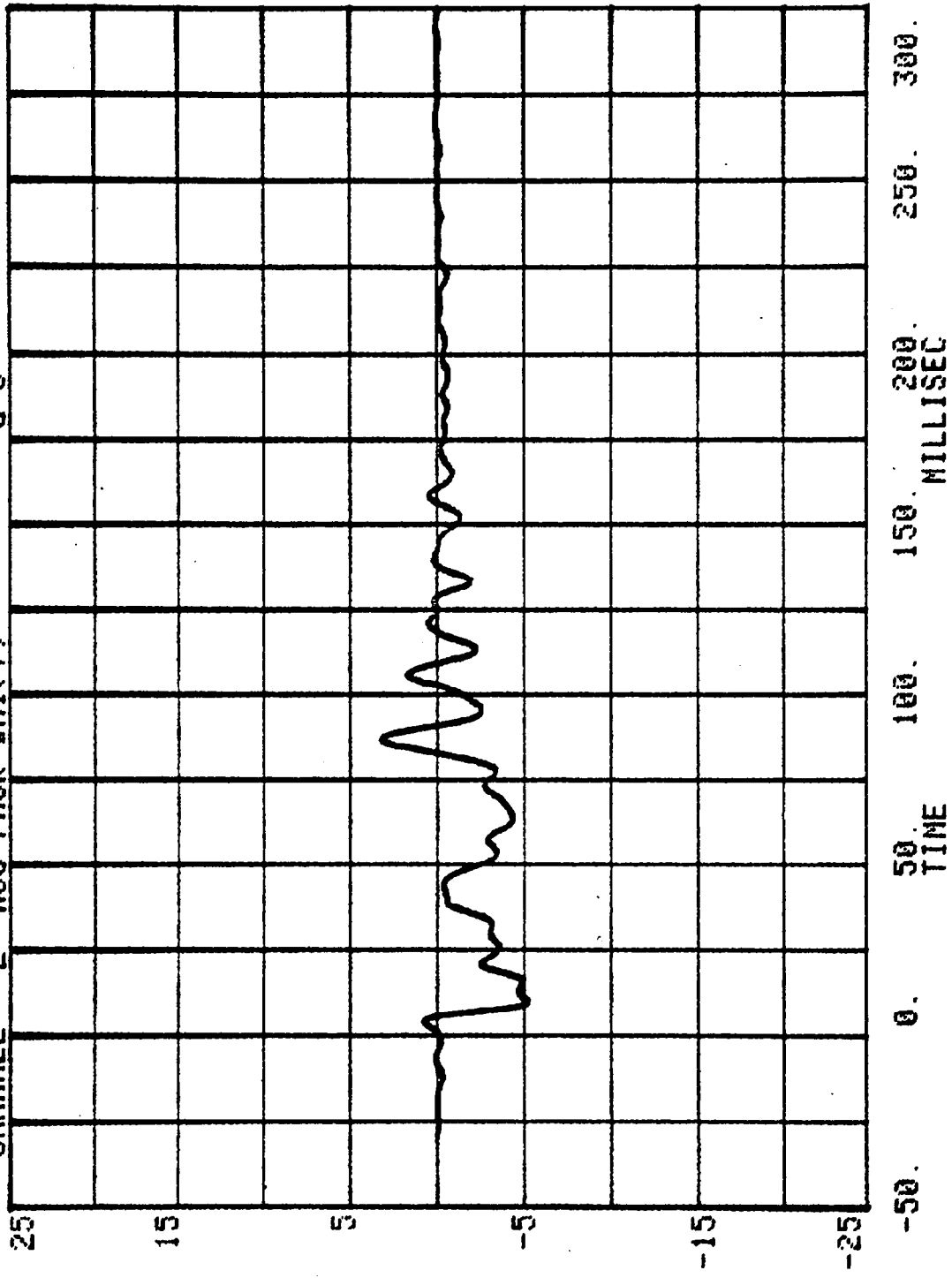
RUN= 534 SERIES= 4
CHANNEL 1 ACC PACK #A1(X) G'S



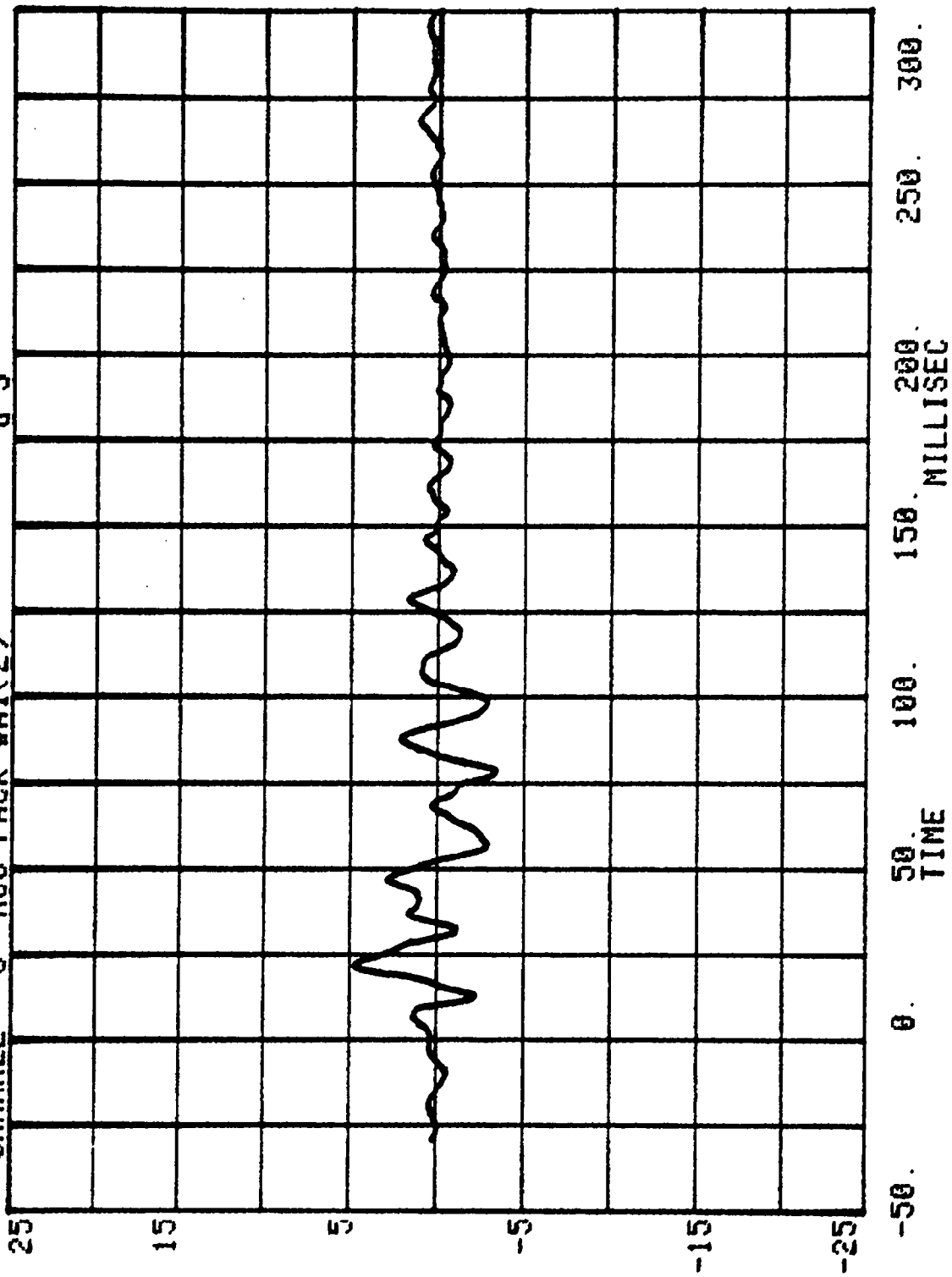




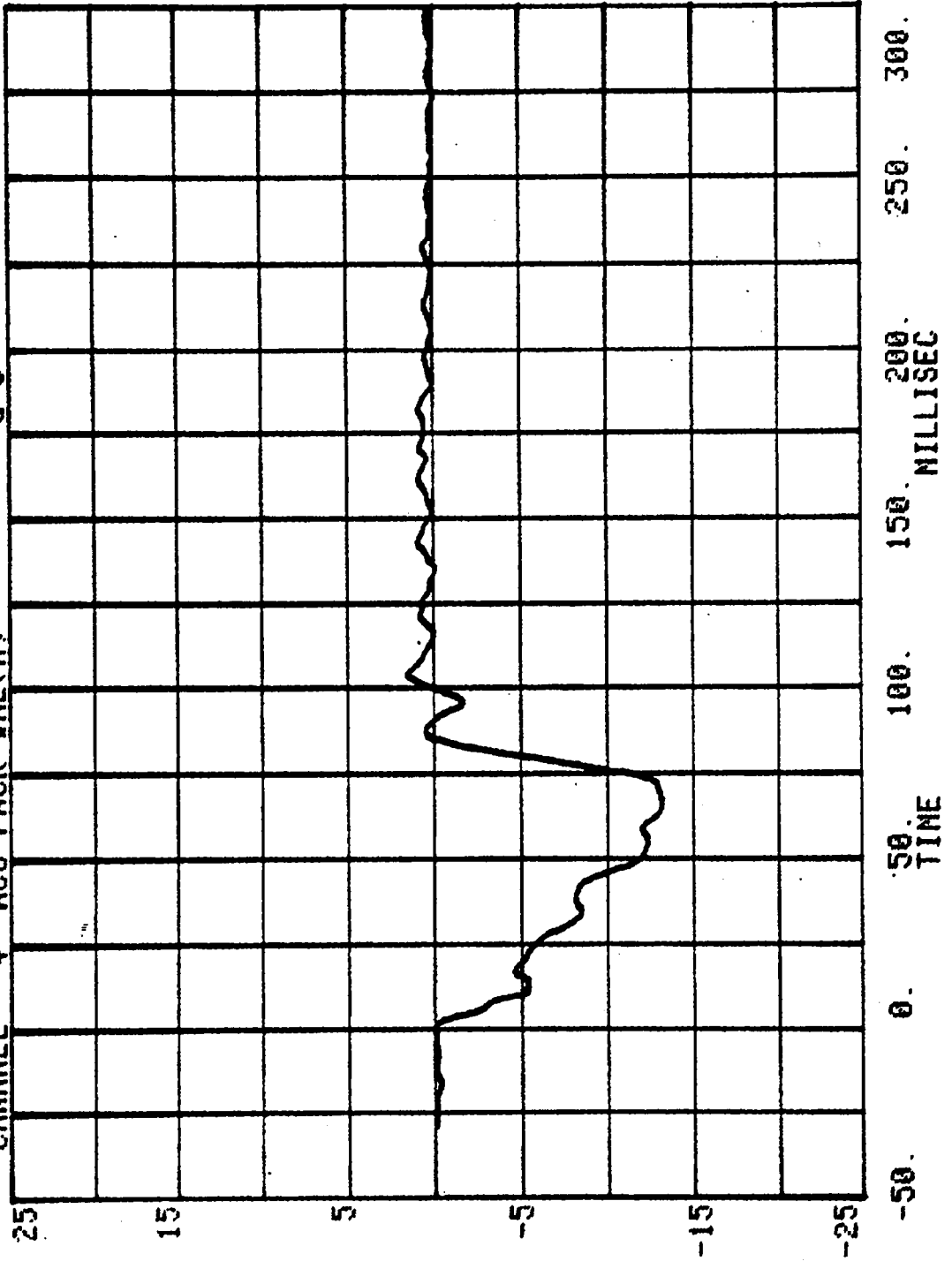
RUN= 534 SERIES= 4
CHANNEL 2 ACC PACK #A1(Y) G'S

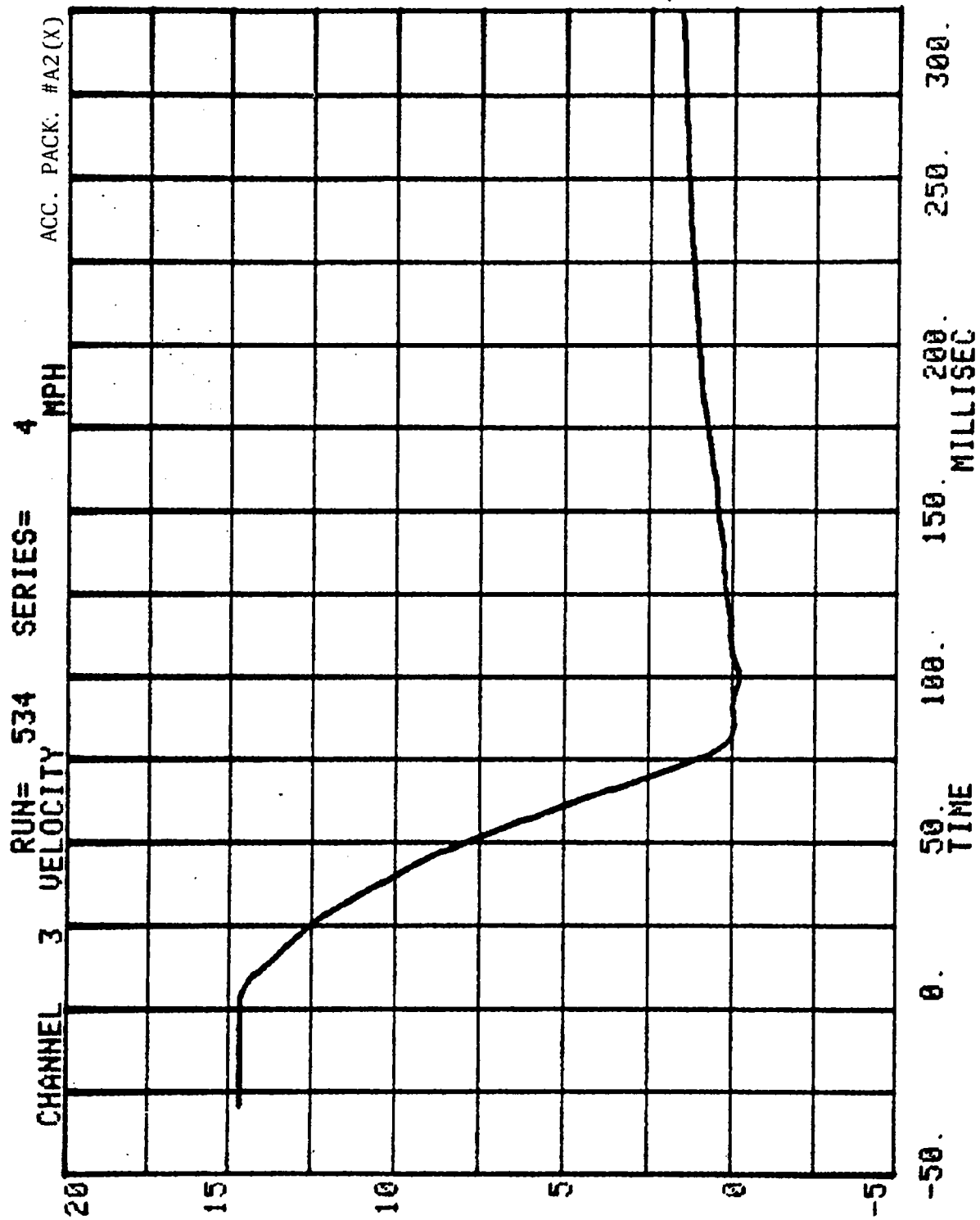


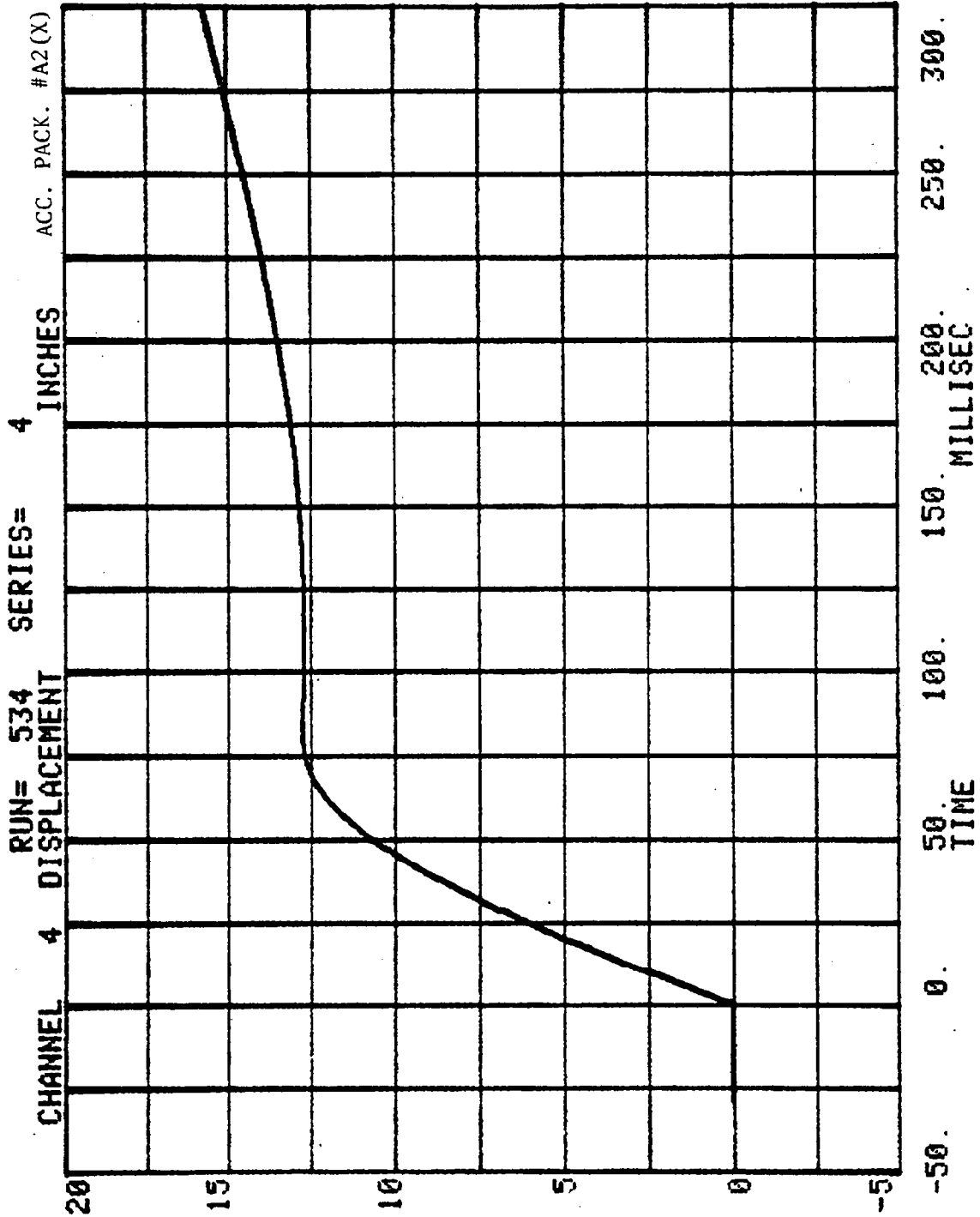
RUN= 534 SERIES= 4
CHANNEL 3 ACC PACK #A1(Z) G'S



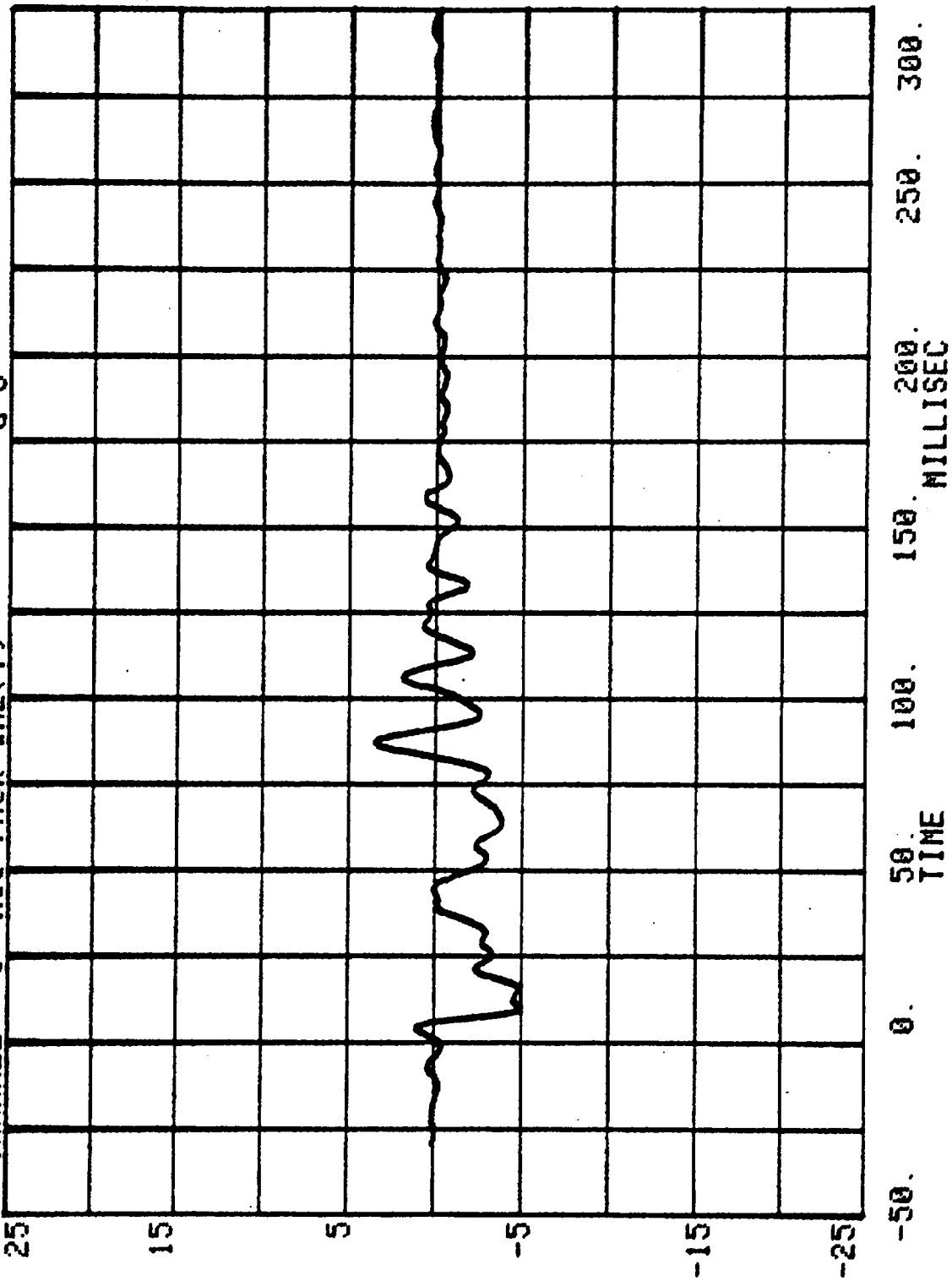
RUN= 534 SERIES= 4
CHANNEL 4 ACC PACK #A2(X) G'S



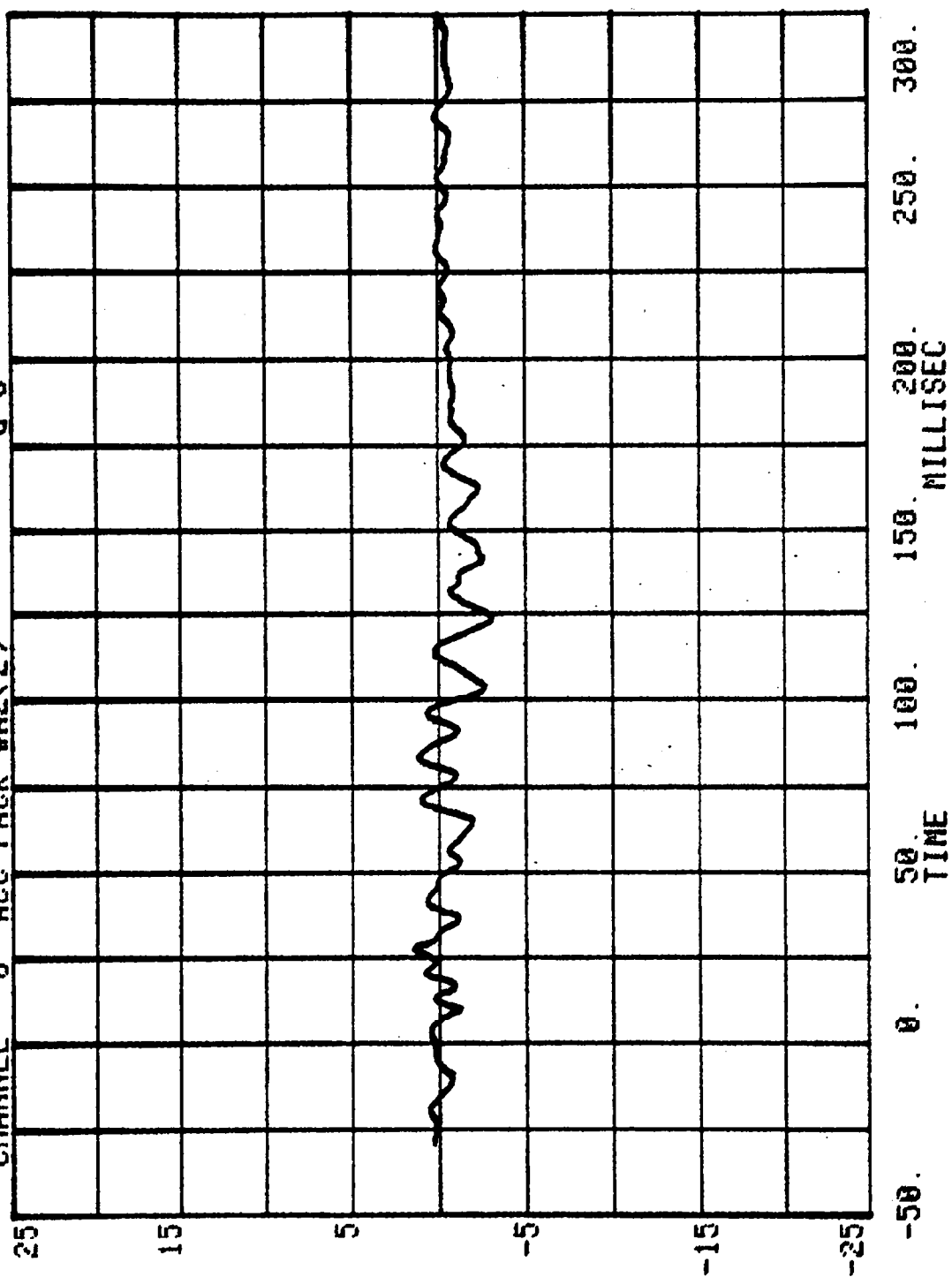




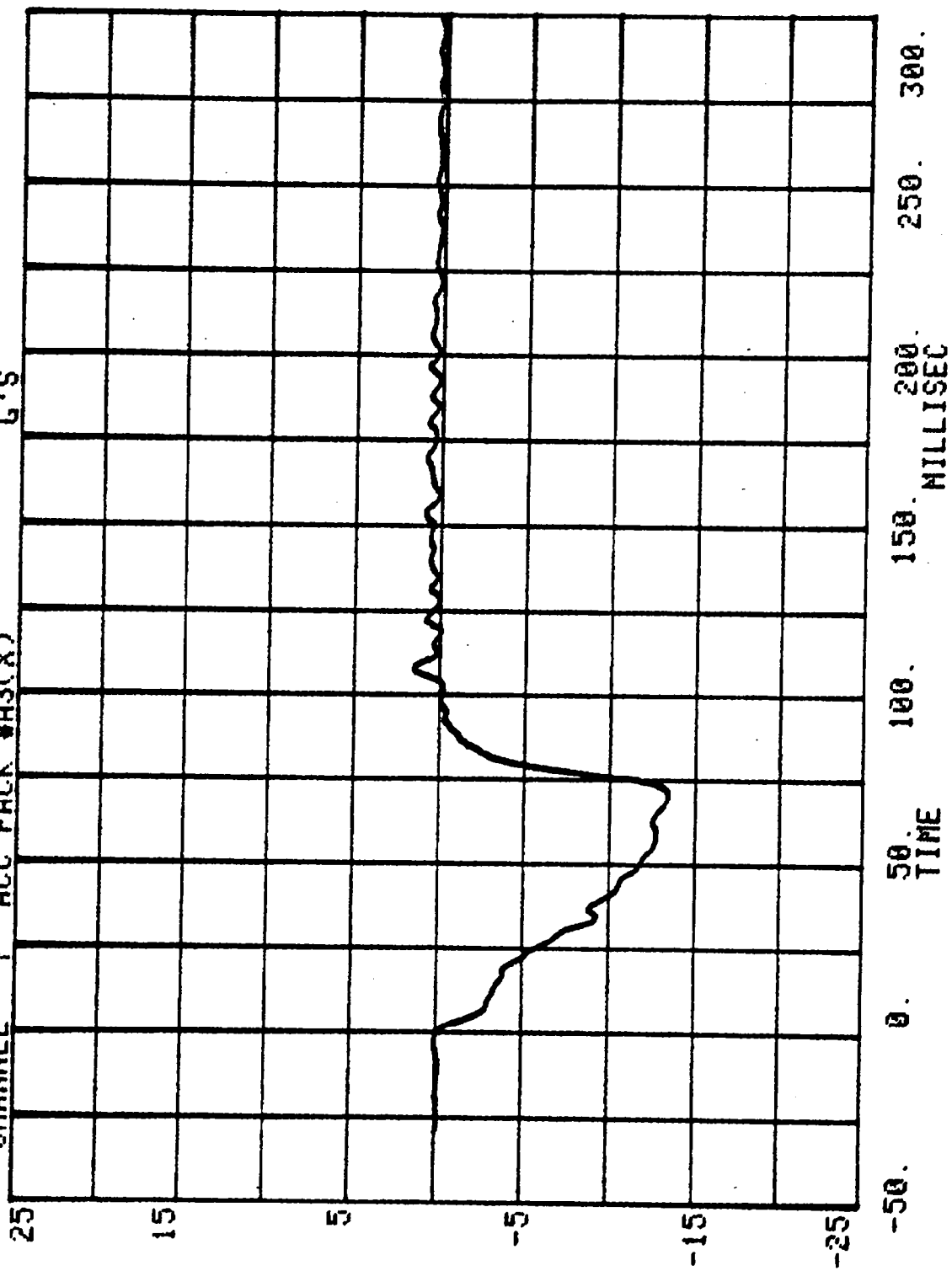
RUN= 534 SERIES= 4
CHANNEL 5 ACC PACK #A2(Y) G'S

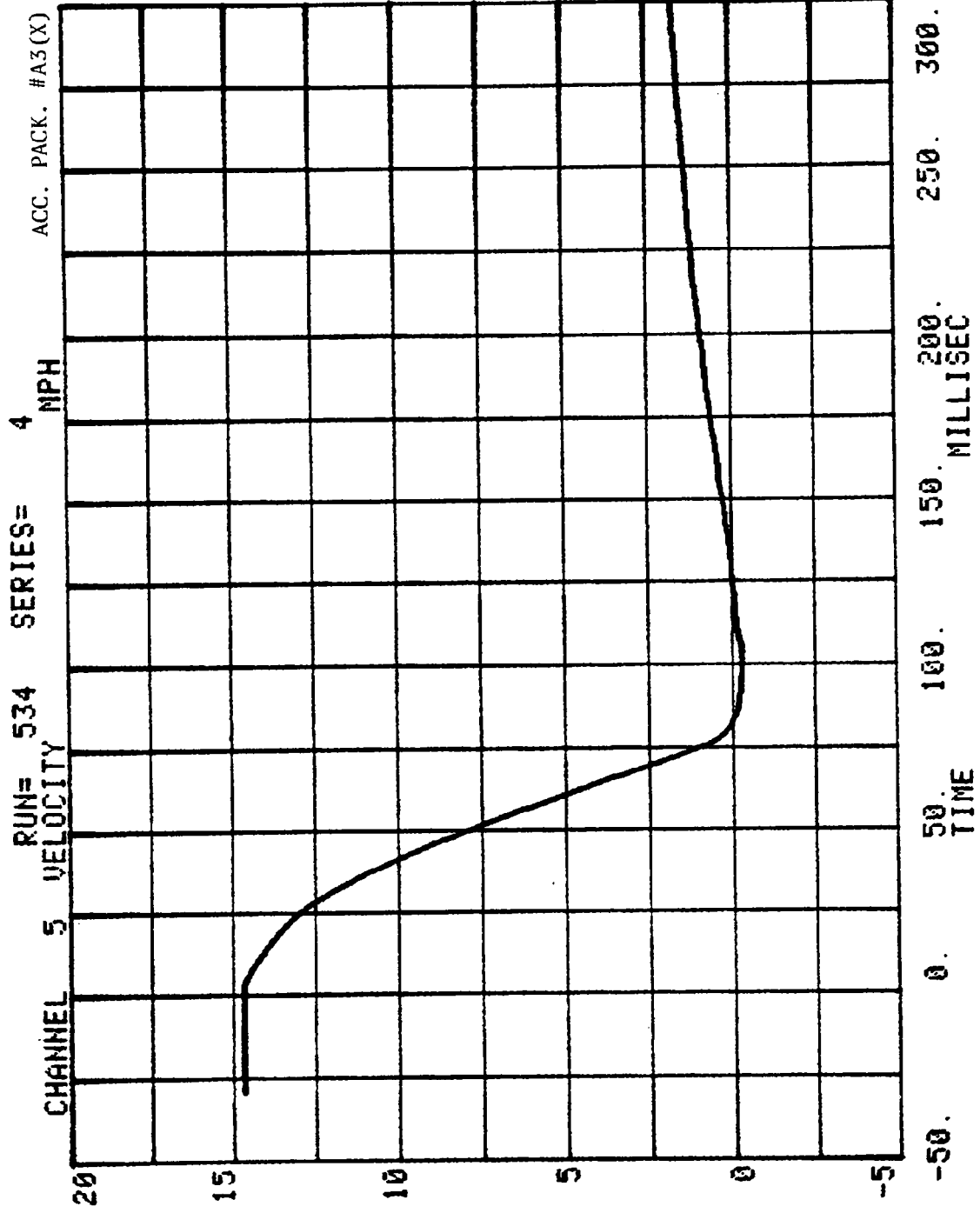


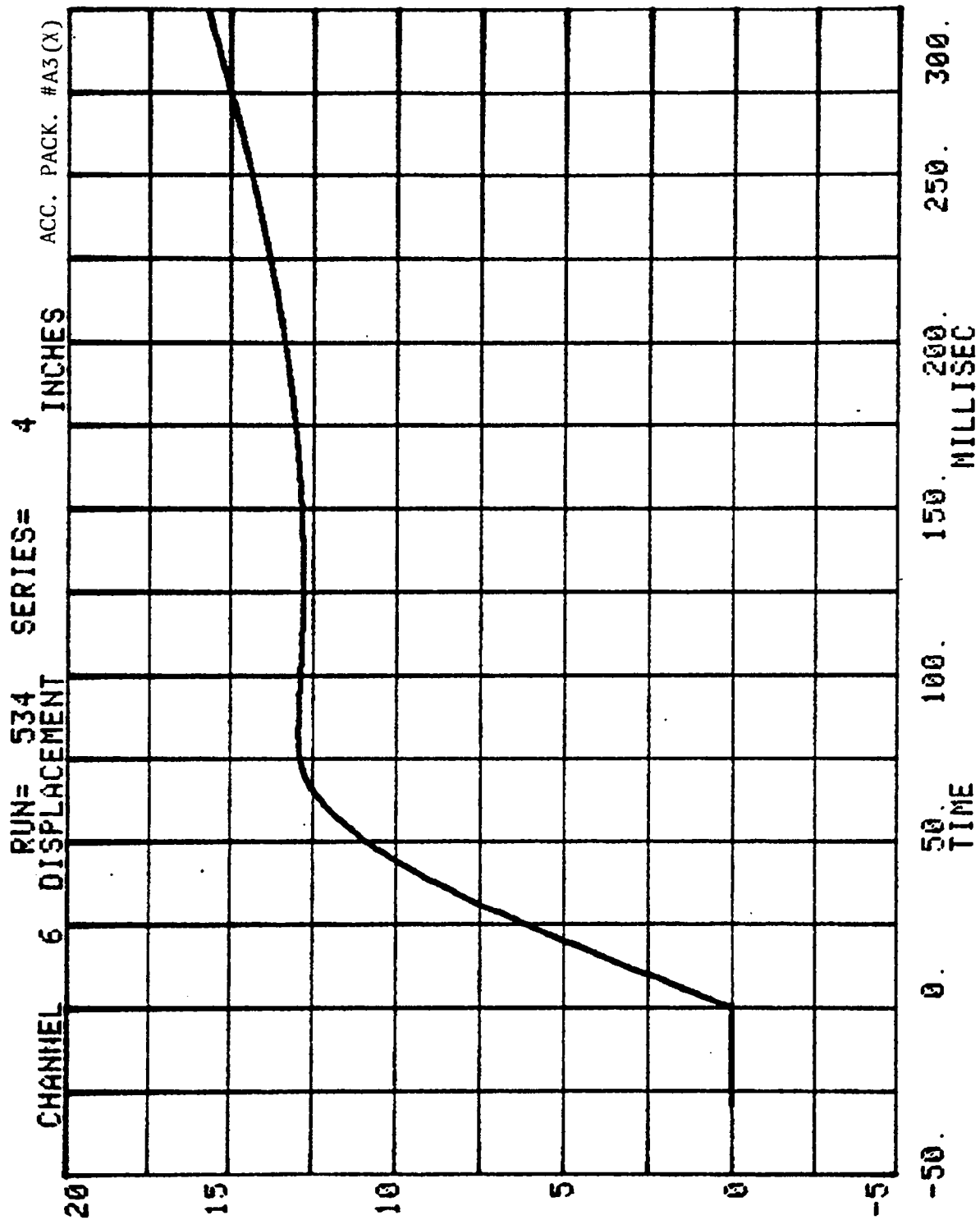
CHANNEL 6 RUN= 534 SERIES= 4 G'S
ACC PACK #02(Z)



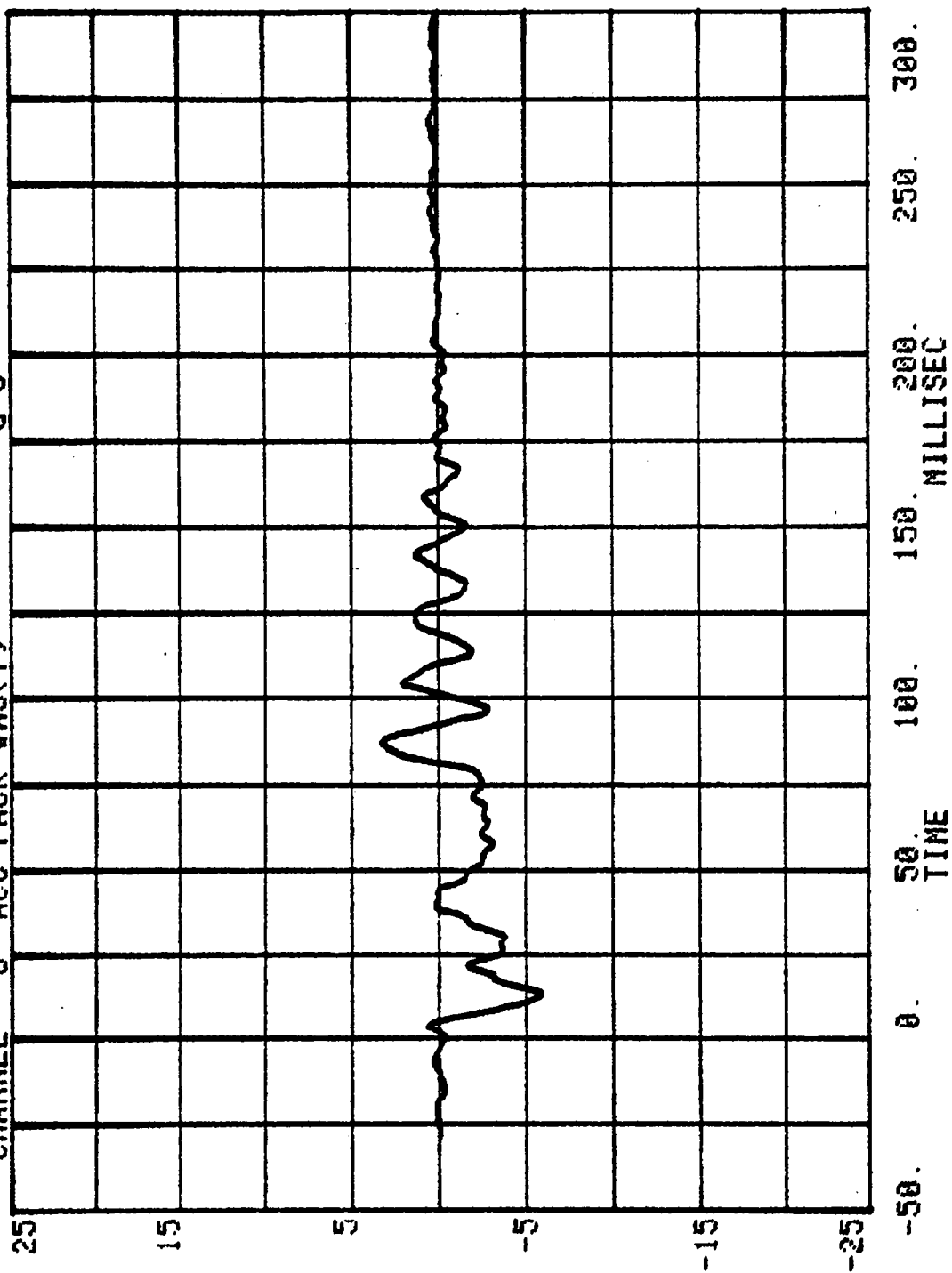
CHANNEL 7 ACC PACK #A3(X) RUN= 534 SERIES= 4 G'S



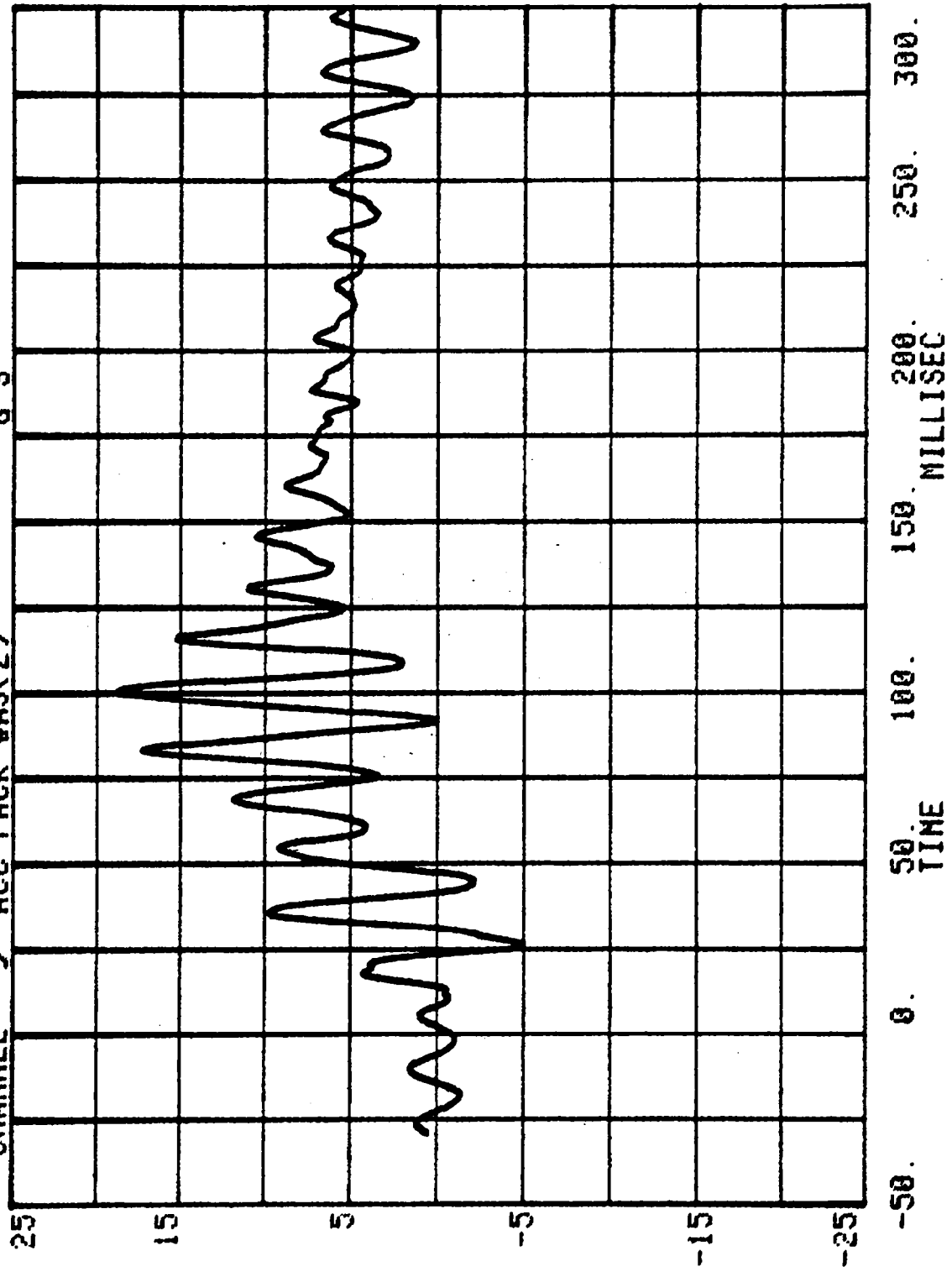




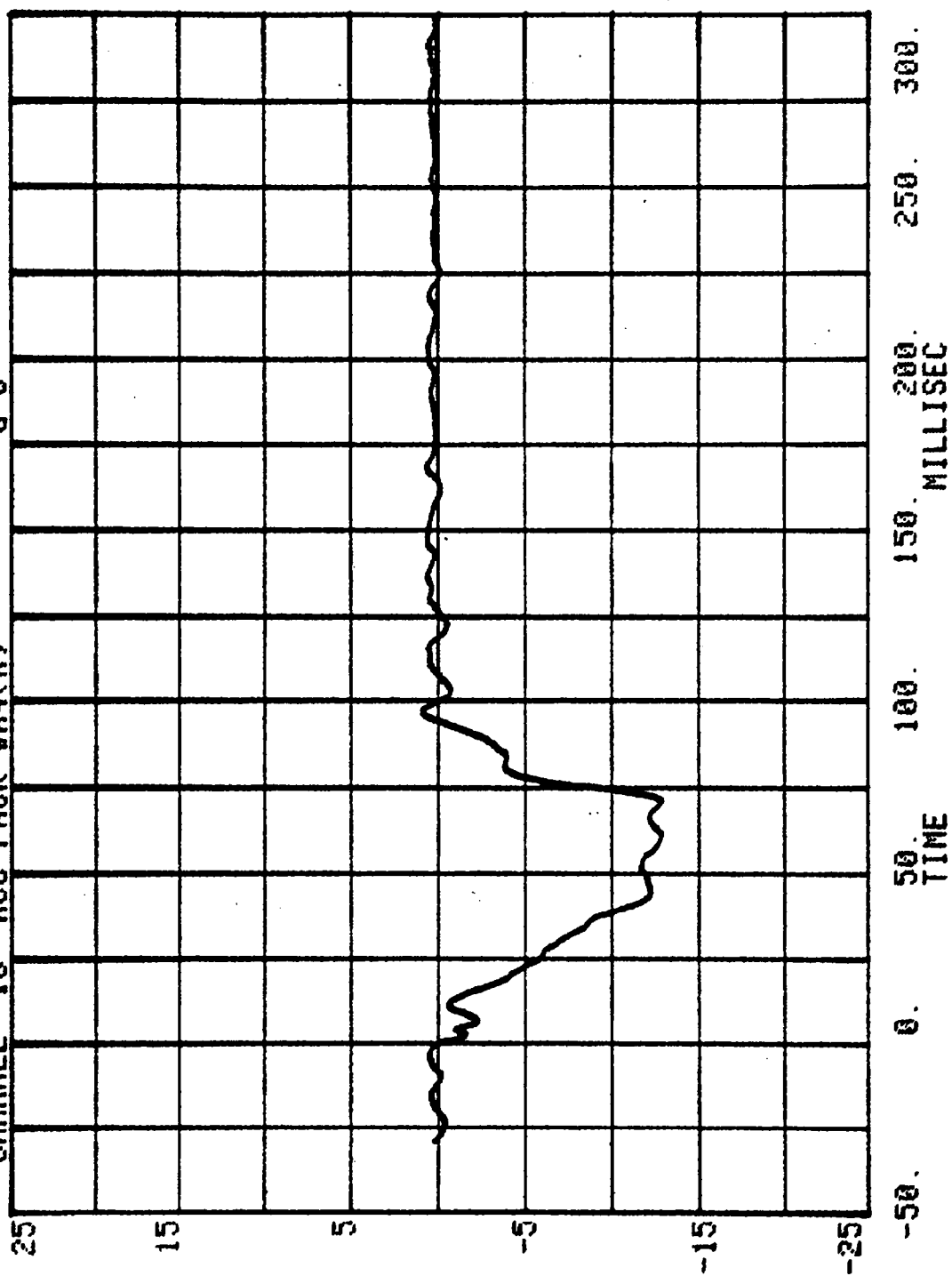
RUN= 534 SERIES= 4
CHANNEL 8 ACC PACK #A3(Y) G'S

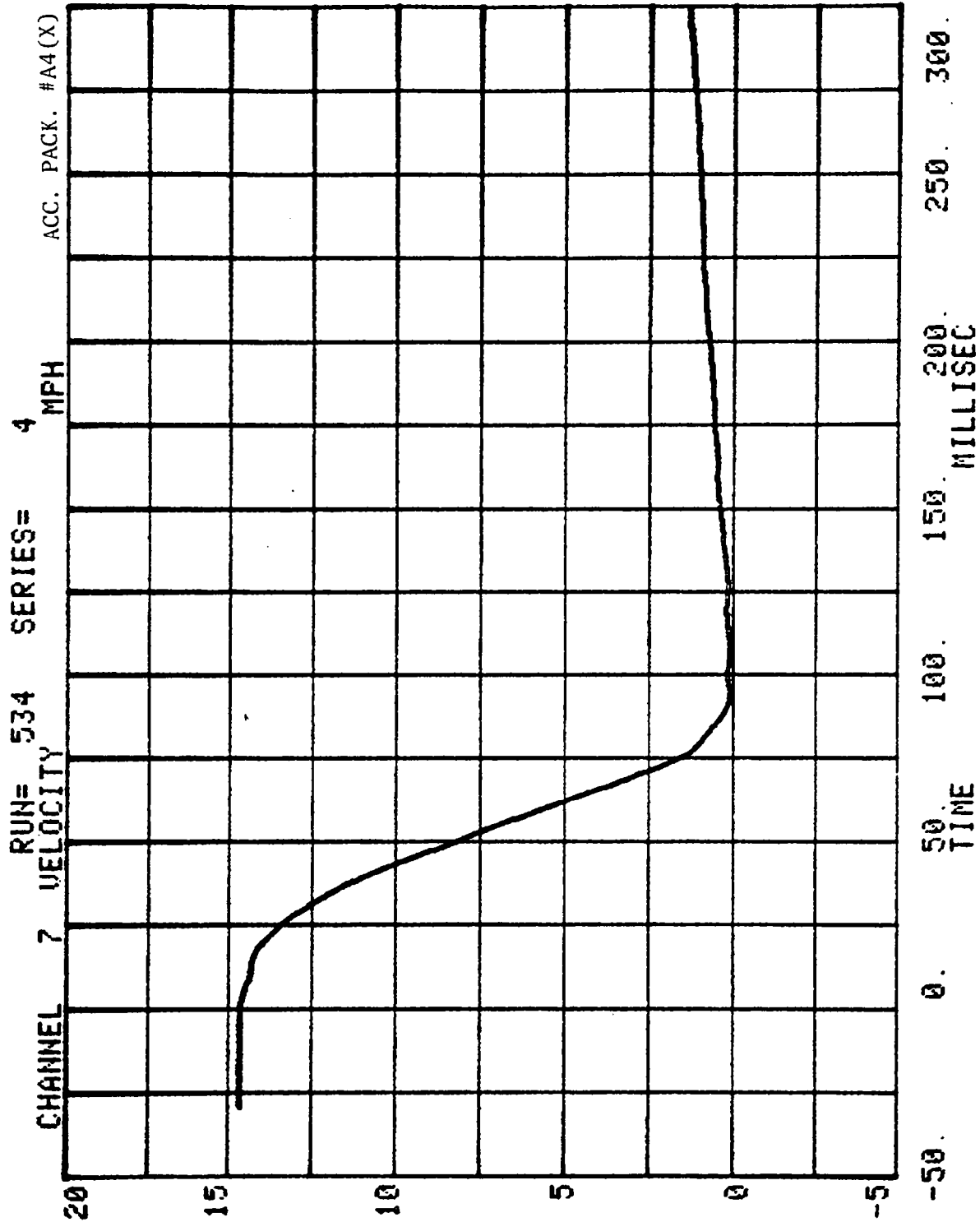


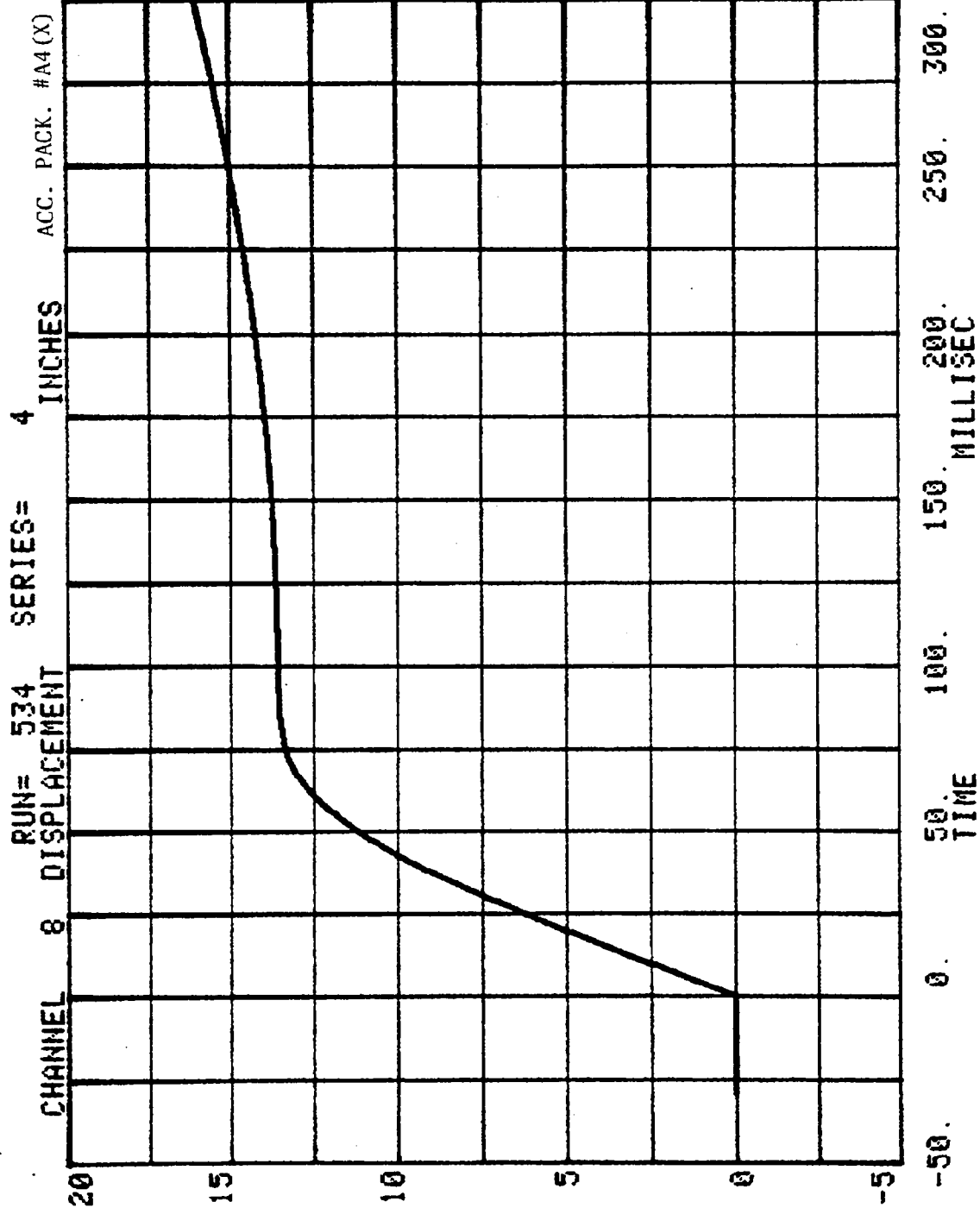
CHANNEL 9 ACC PACK #A3(Z) RUN= 534 SERIES= 4 G'S



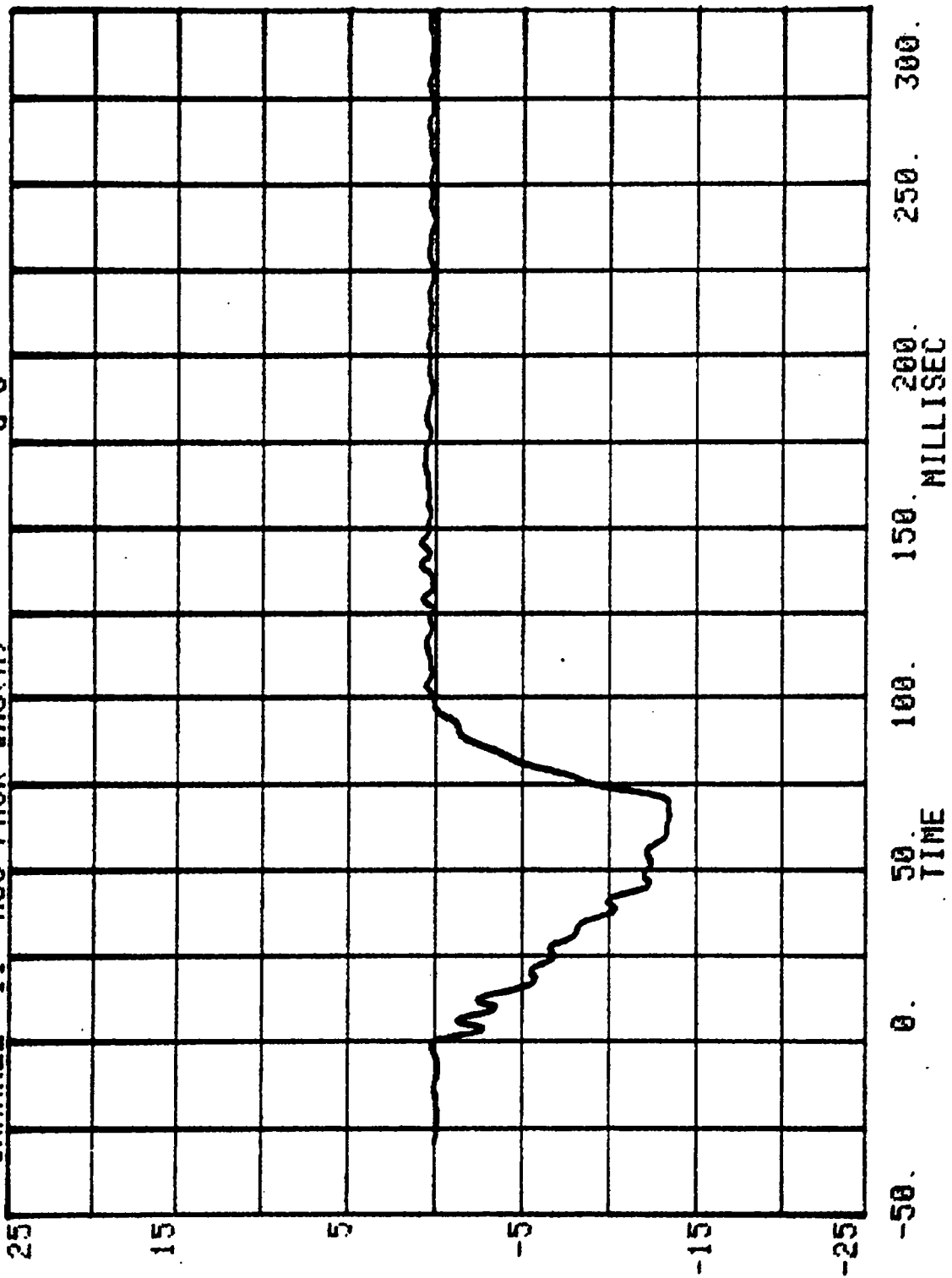
CHANNEL 10 ACC PACK #A4(X) RUN= 534 SERIES= 4 G'S

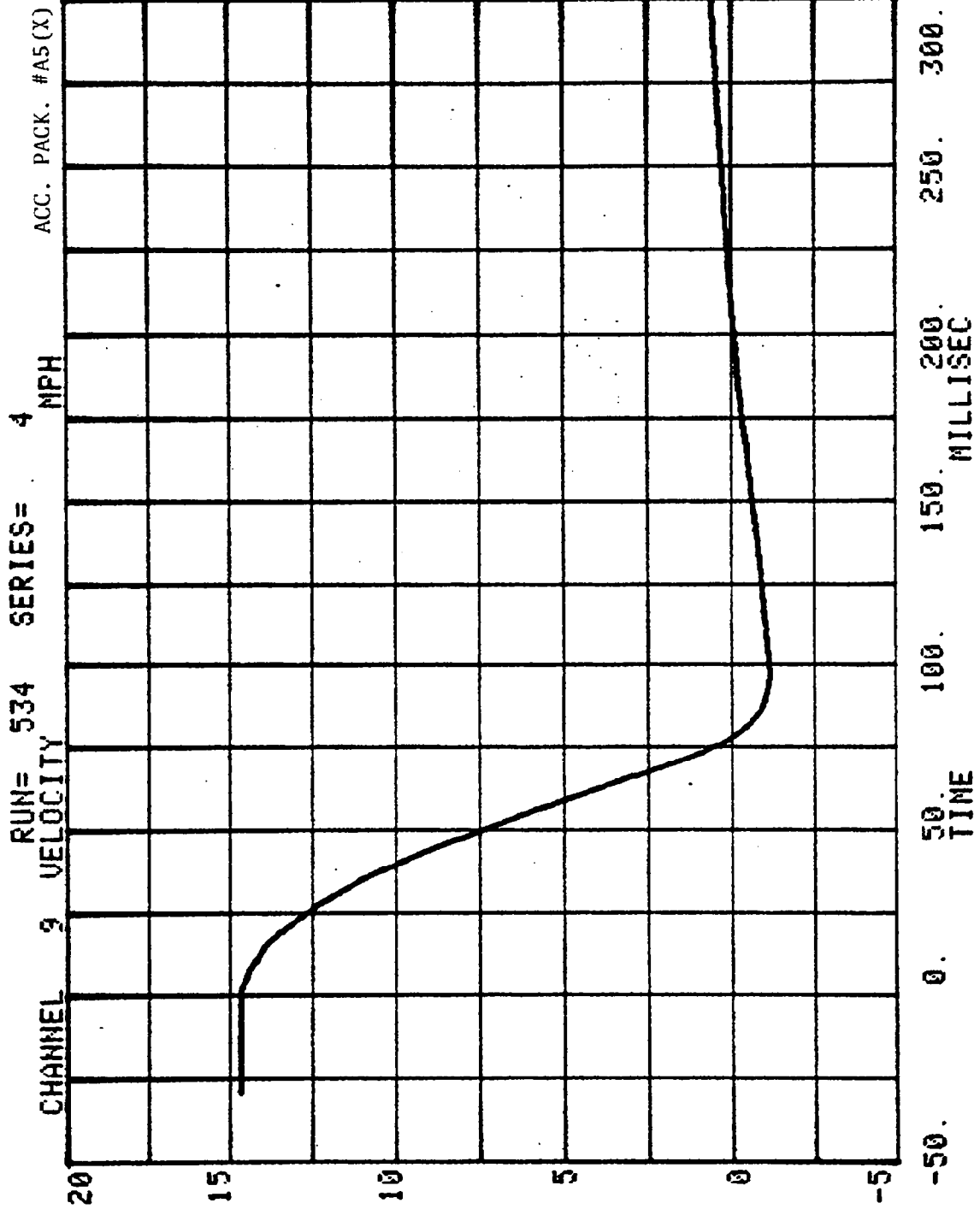


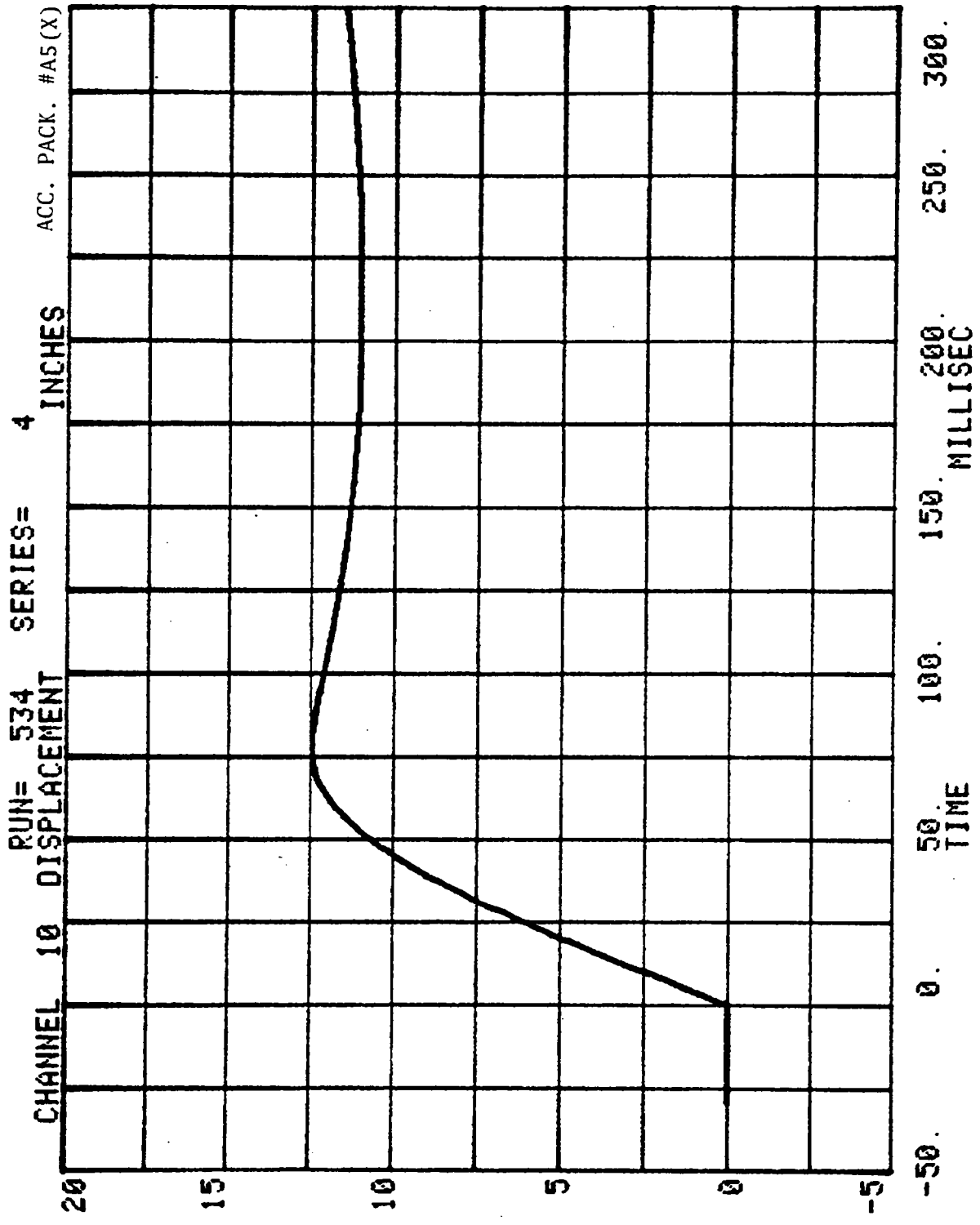




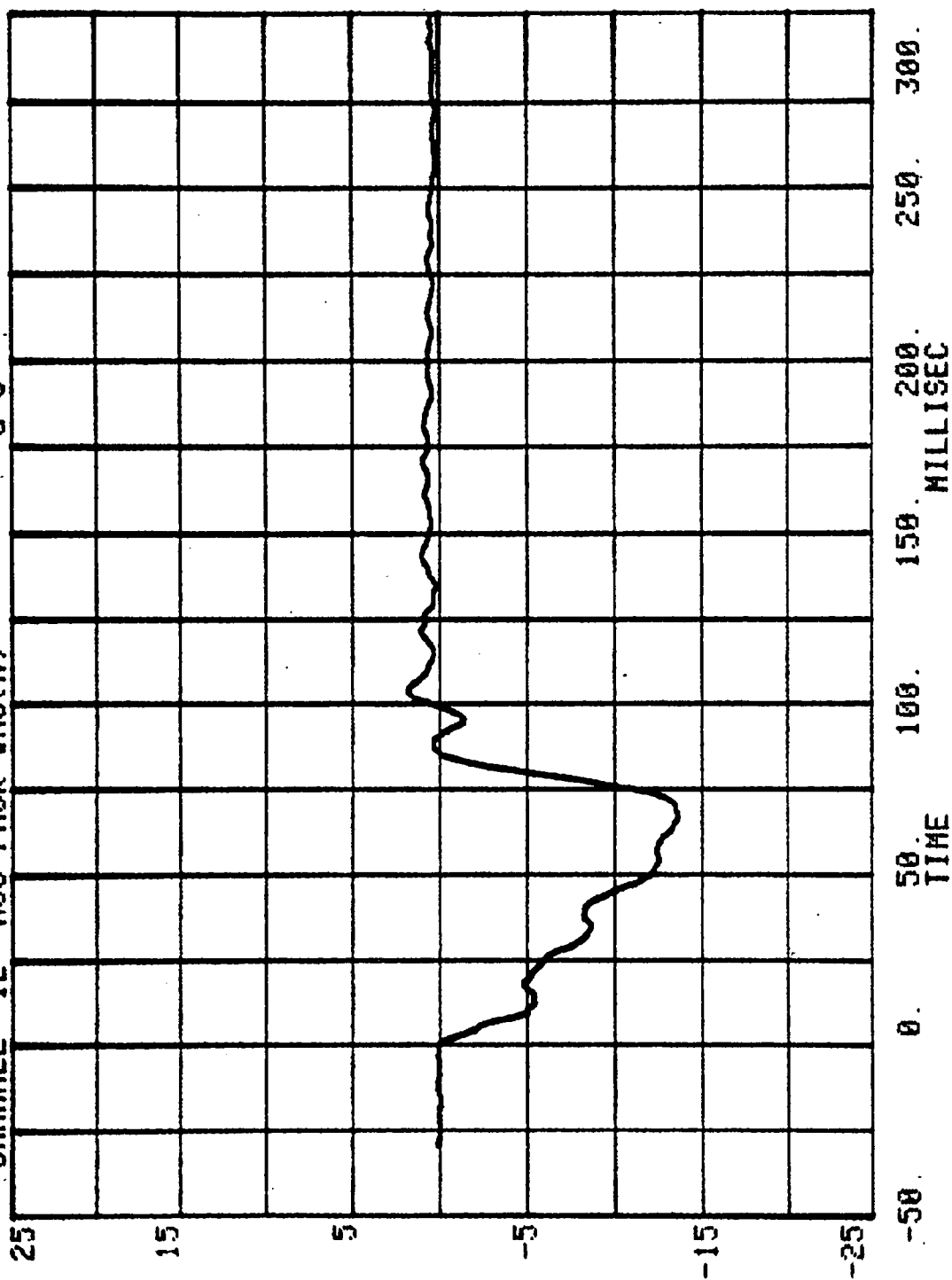
RUN= 534 SERIES= 4
CHANNEL 11 ACC PACK #A5(X) G'S

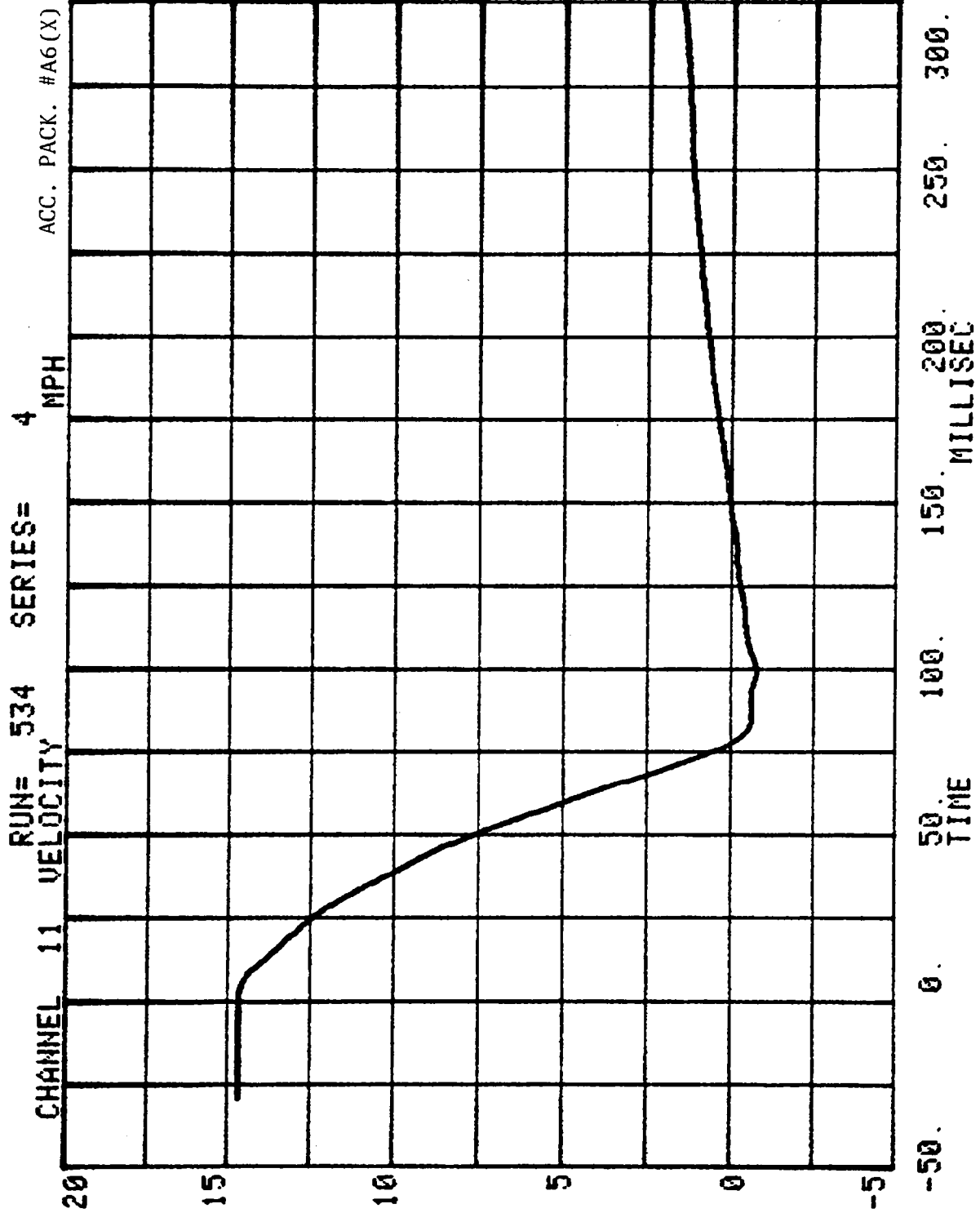


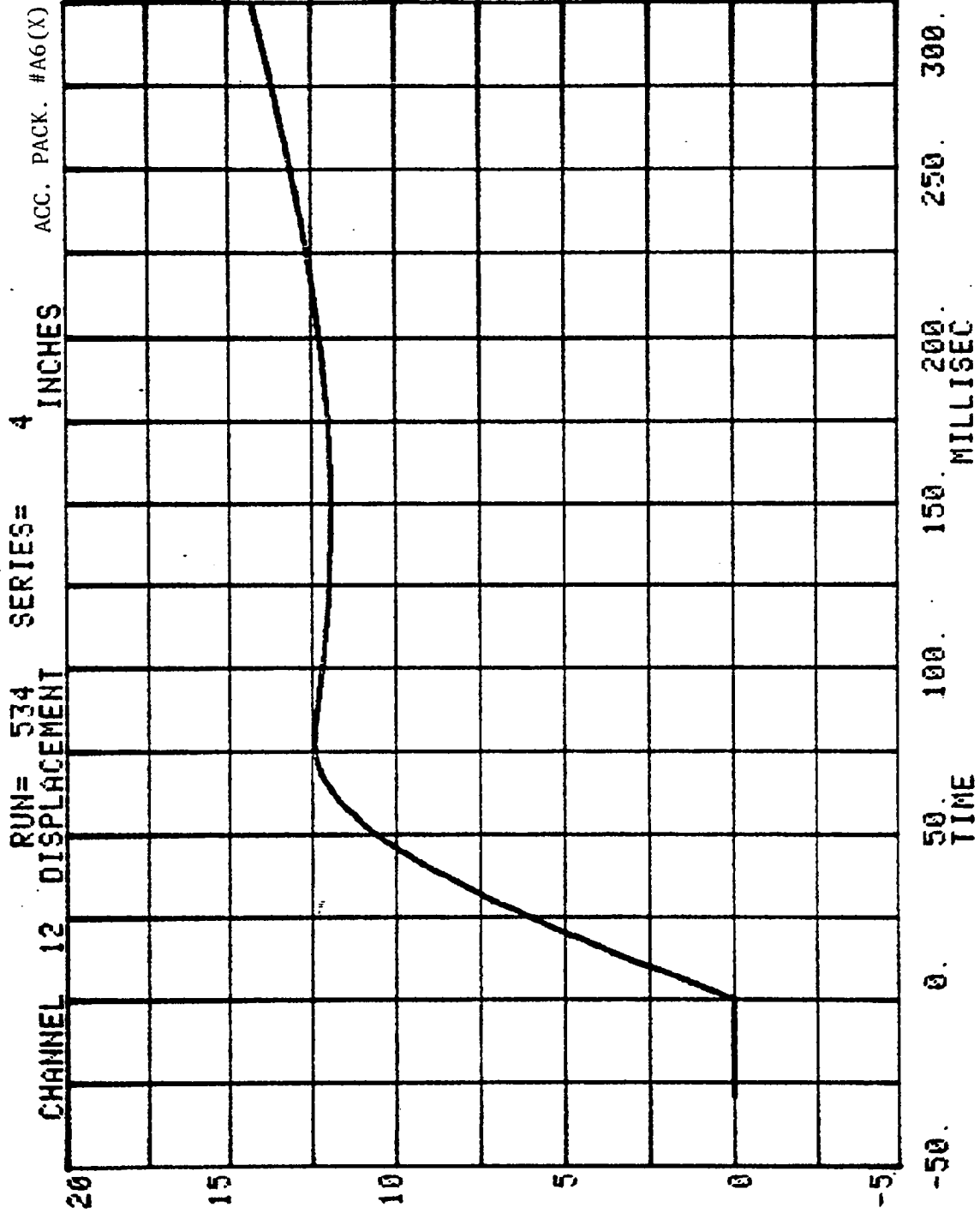




CHANNEL 12 ACC PACK #A6(X) 4 G'S







MOVING BARRIER LOAD CELL DATA

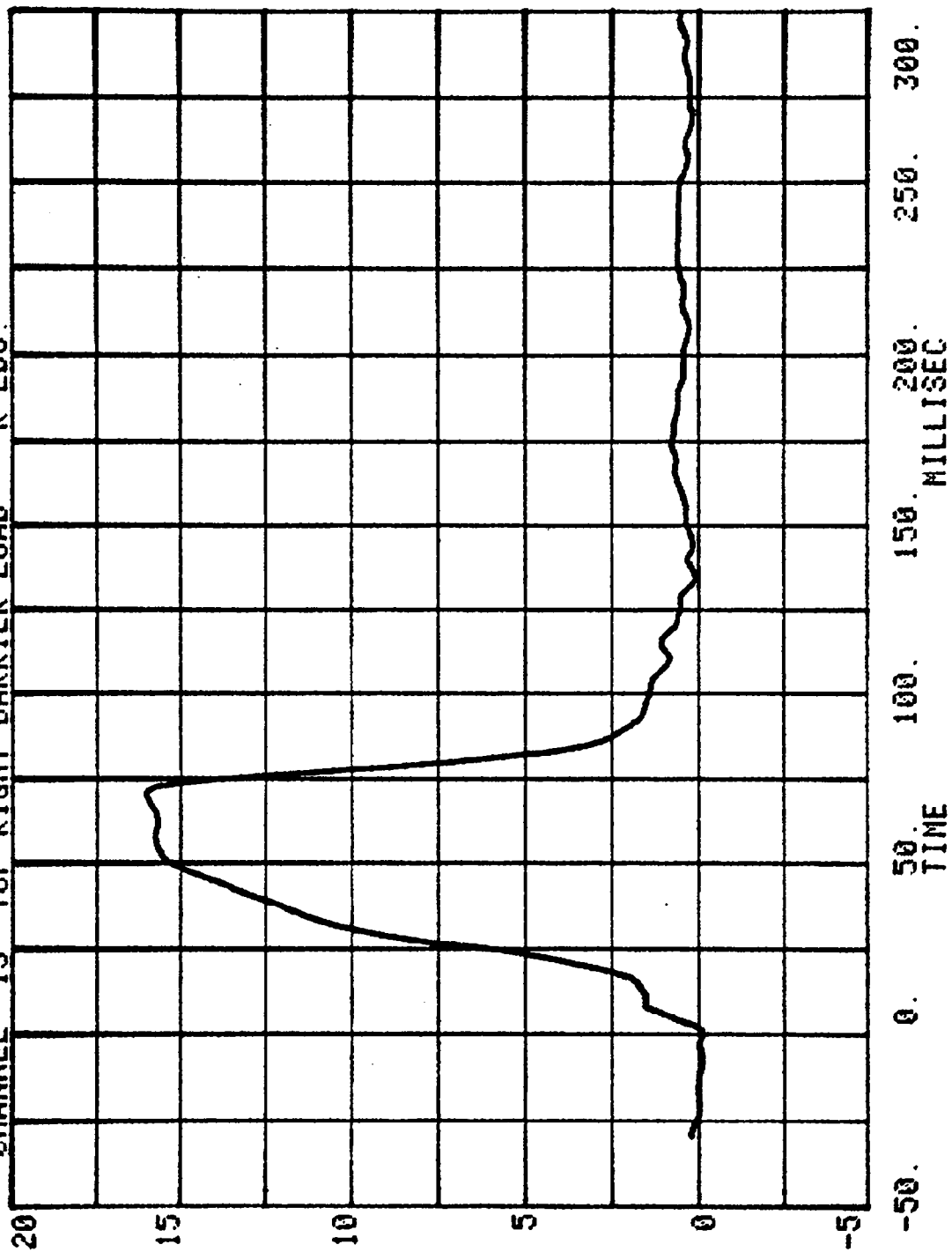
TEST NO. 4

VEHICLE LOAD CELL DATA

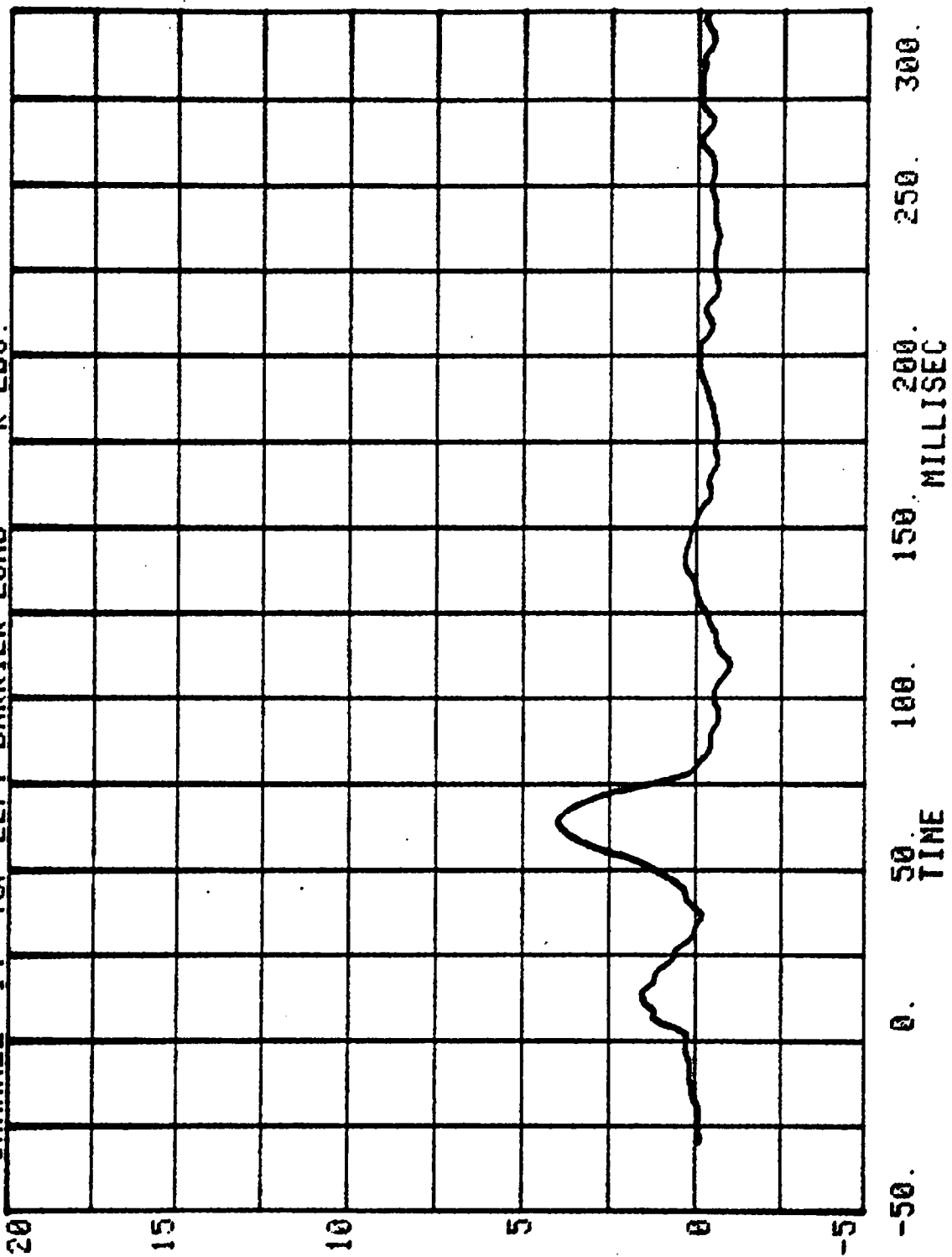
FILTER CLASS 60

CHANNEL 13 TOP RIGHT BARRIER LOAD 4 K LBS.

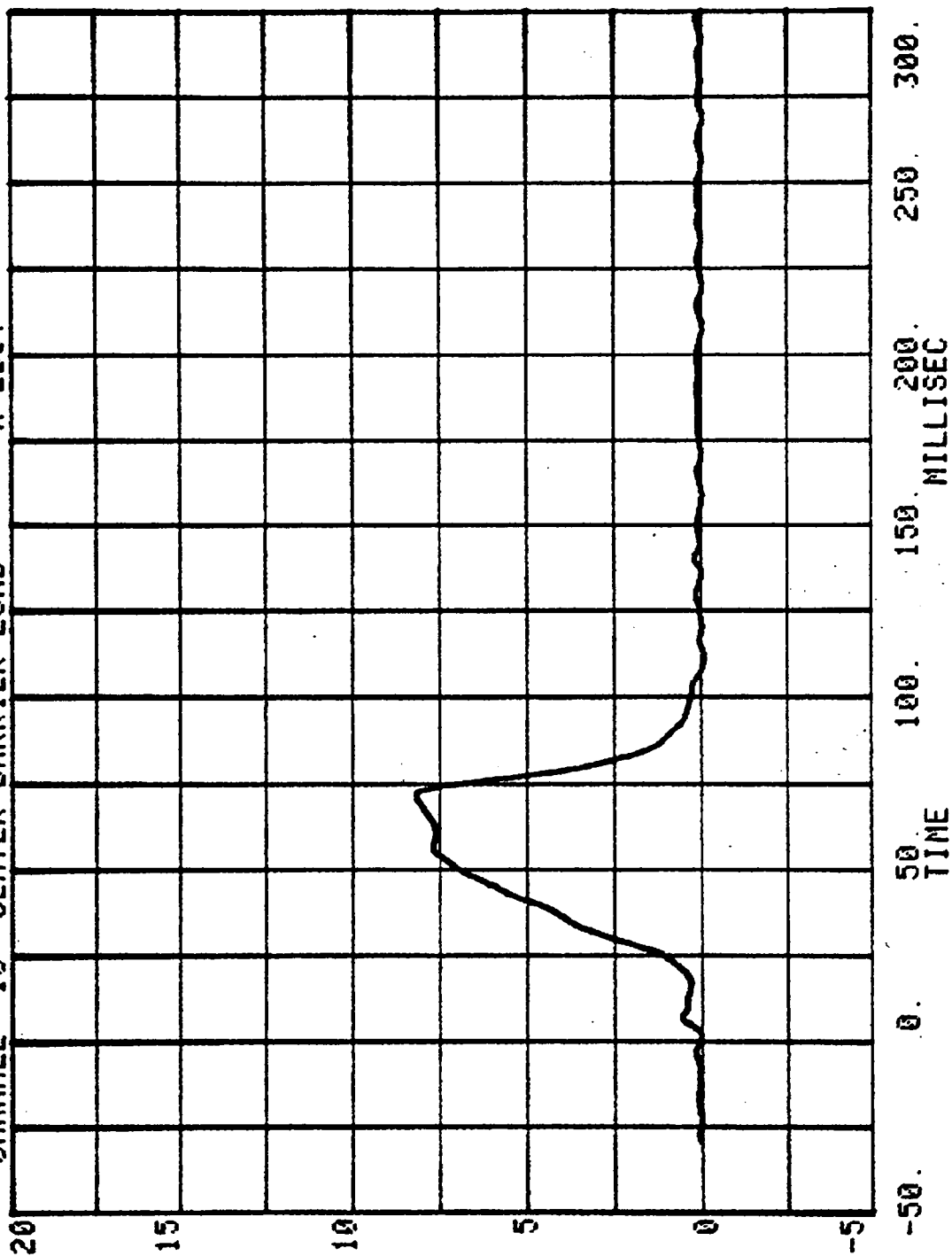
RUN= 534 SERIES= 4



RUN= 534 SERIES= 4
CHANNEL 14 TOP LEFT BARRIER LOAD K LBS.

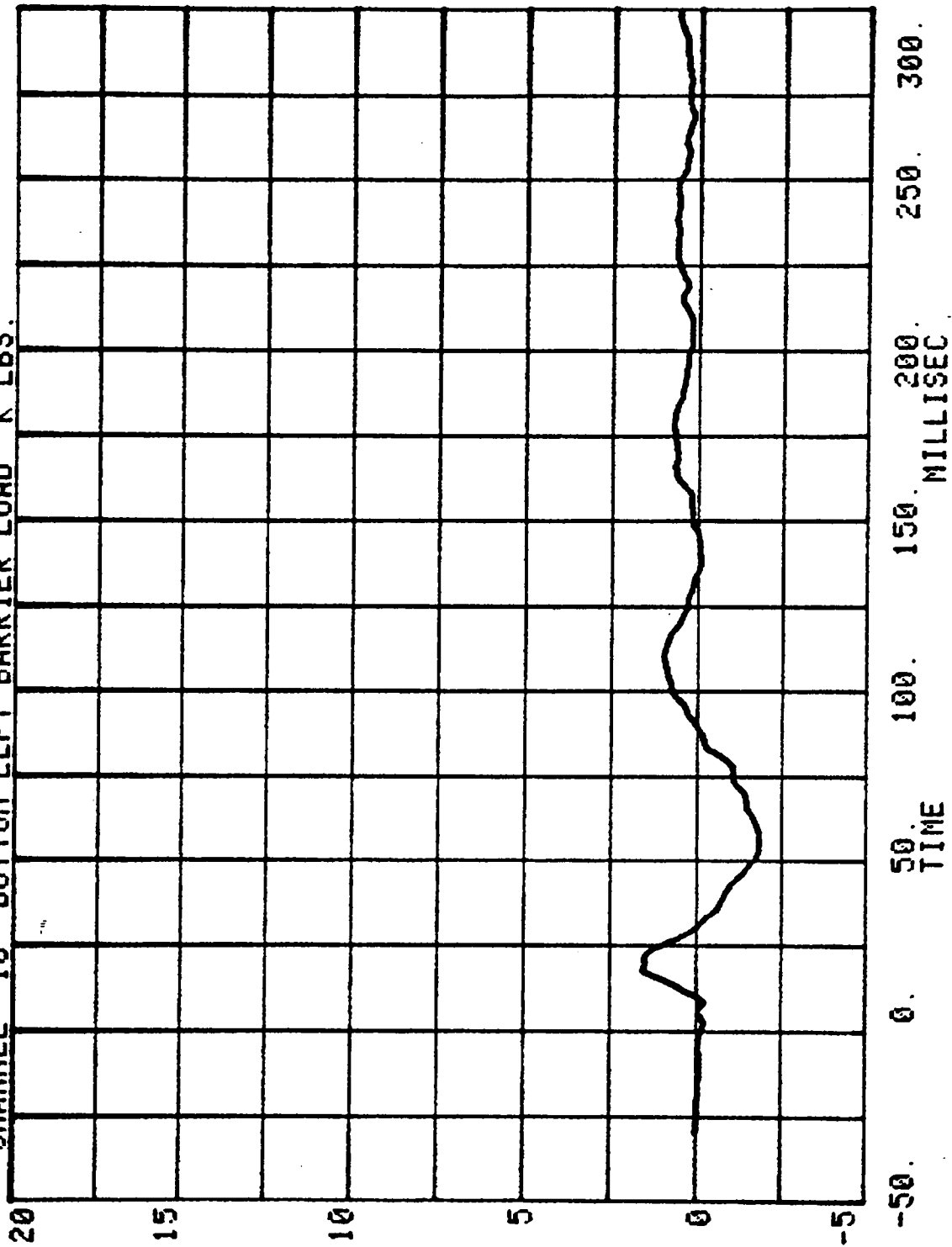


CHANNEL 15 CENTER BARRIER LOAD RUN= 534 SERIES= 4 K LBS.



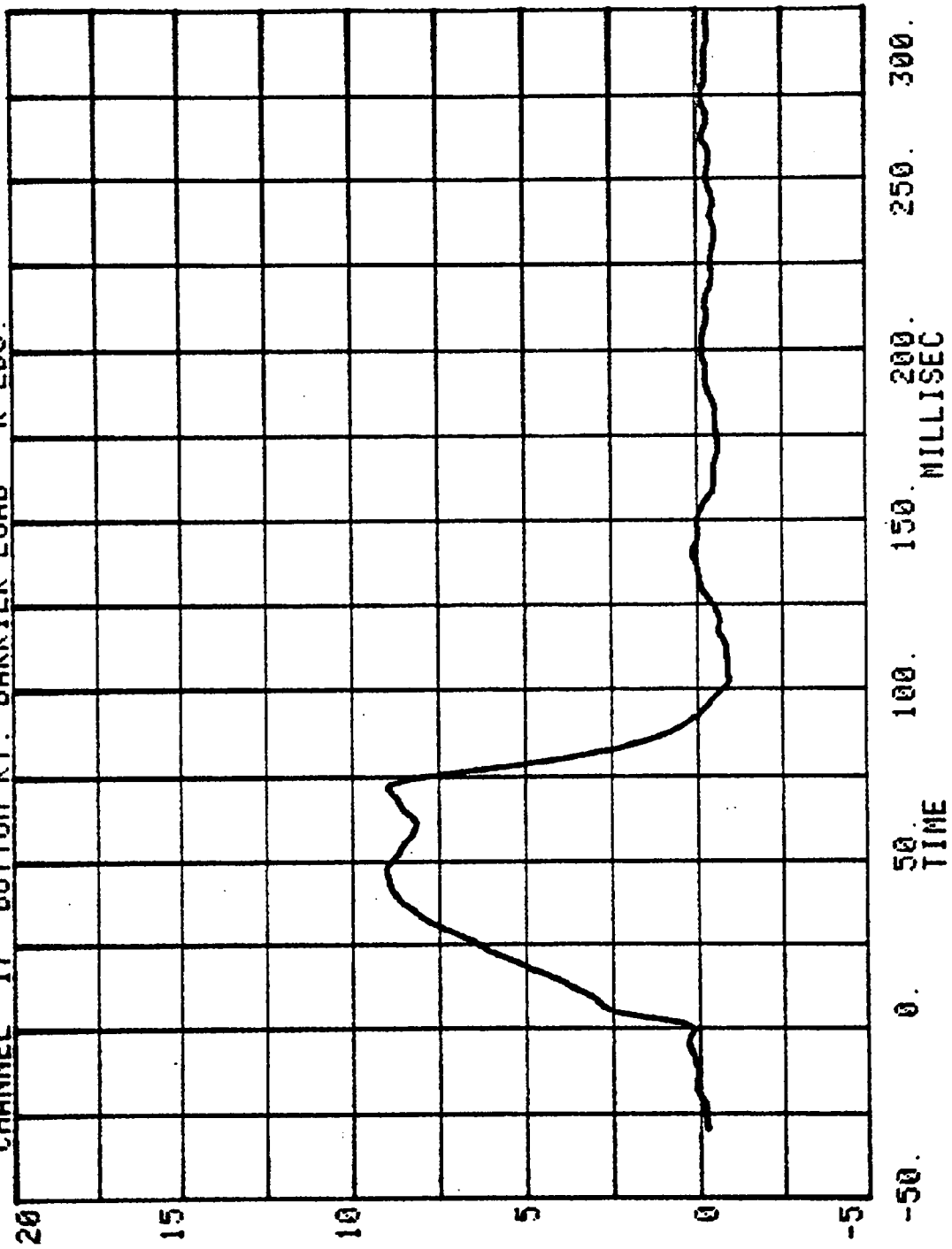
CHANNEL 16 BOTTOM LEFT BARRIER LOAD K LBS.

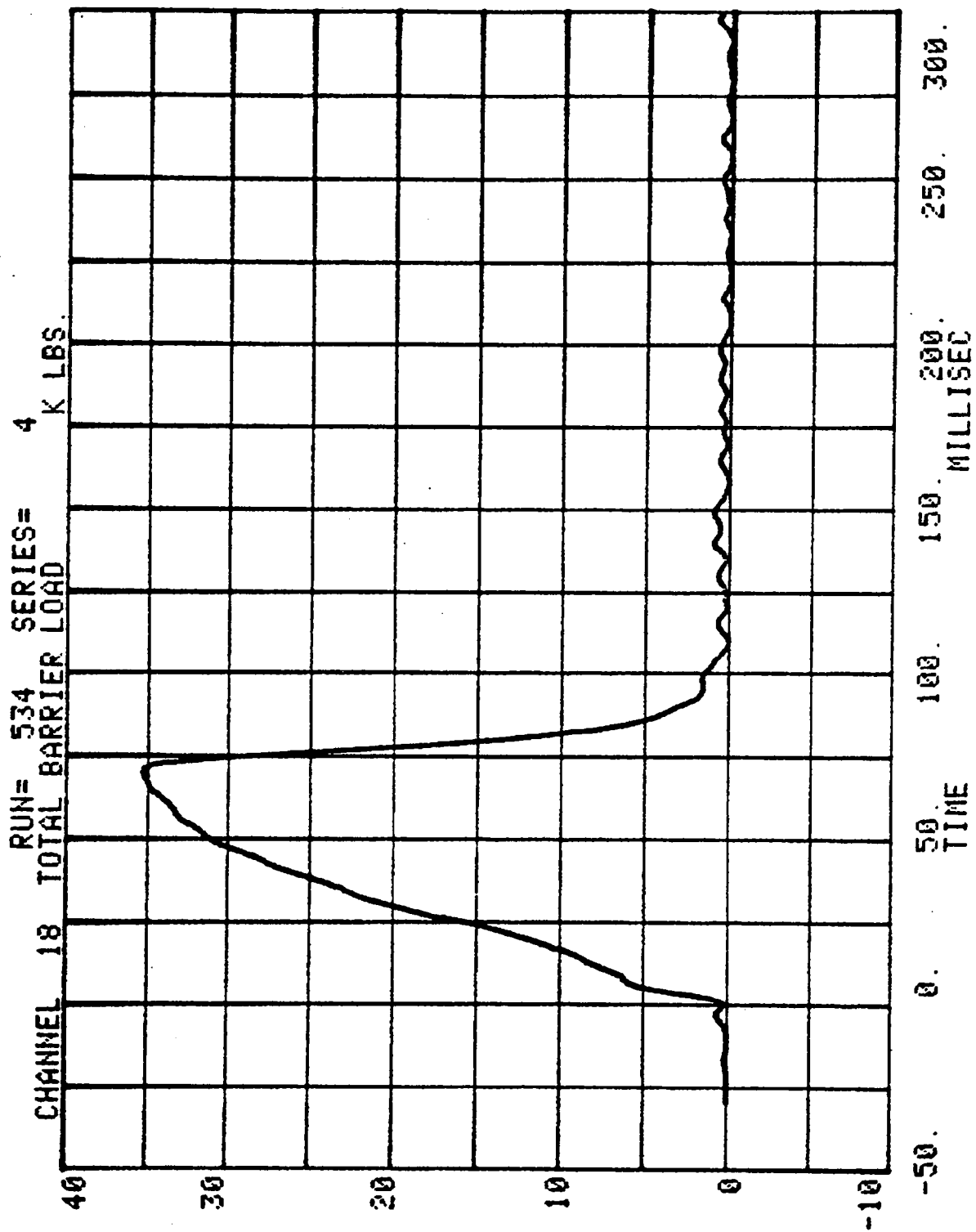
RUN= 534 SERIES= 4



CHANNEL 17 BOTTOM RT. BARRIER LOAD 4 K LBS.

RUN= 534 SERIES= 4





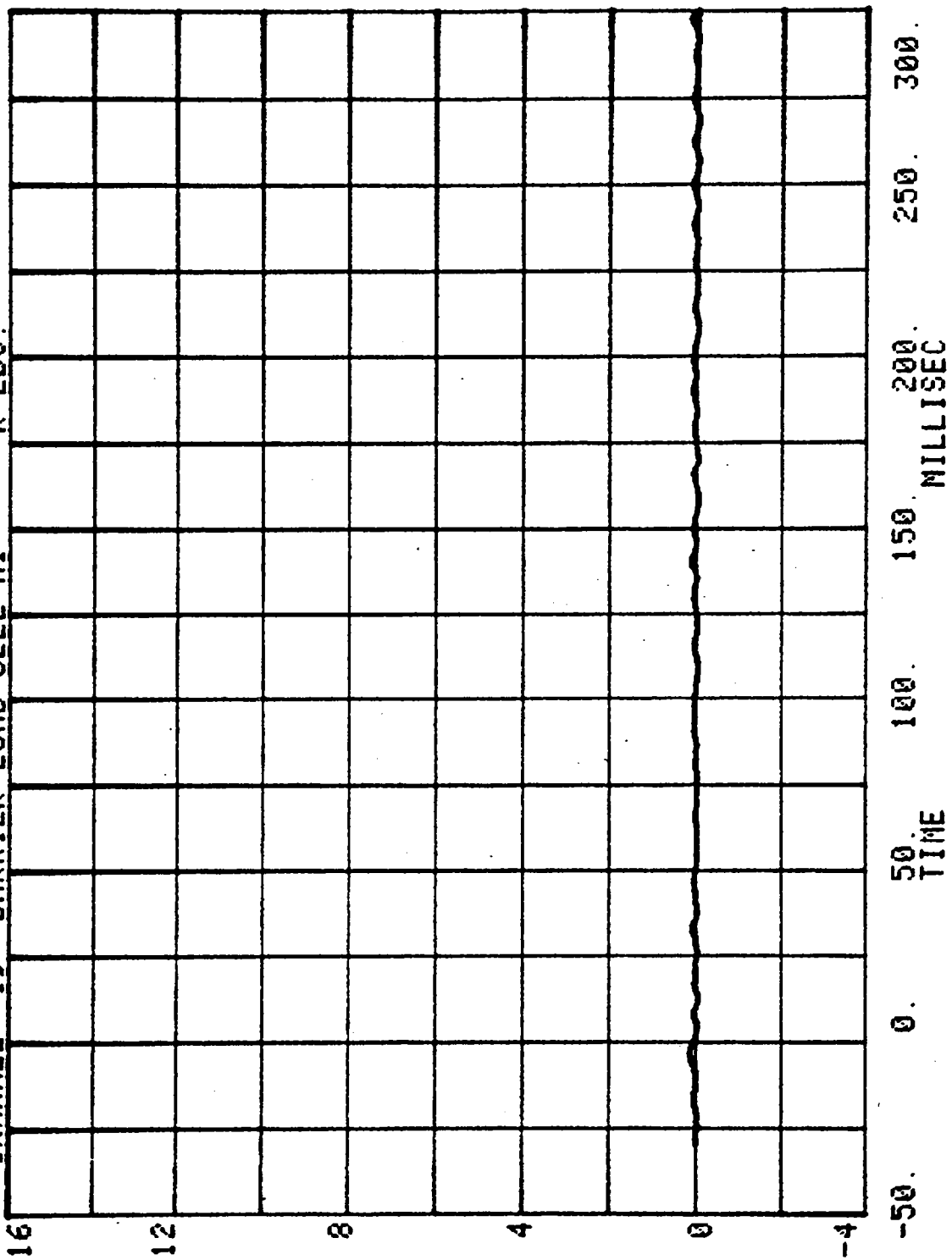
FIXED BARRIER LOAD CELL DATA

TEST NO. 4

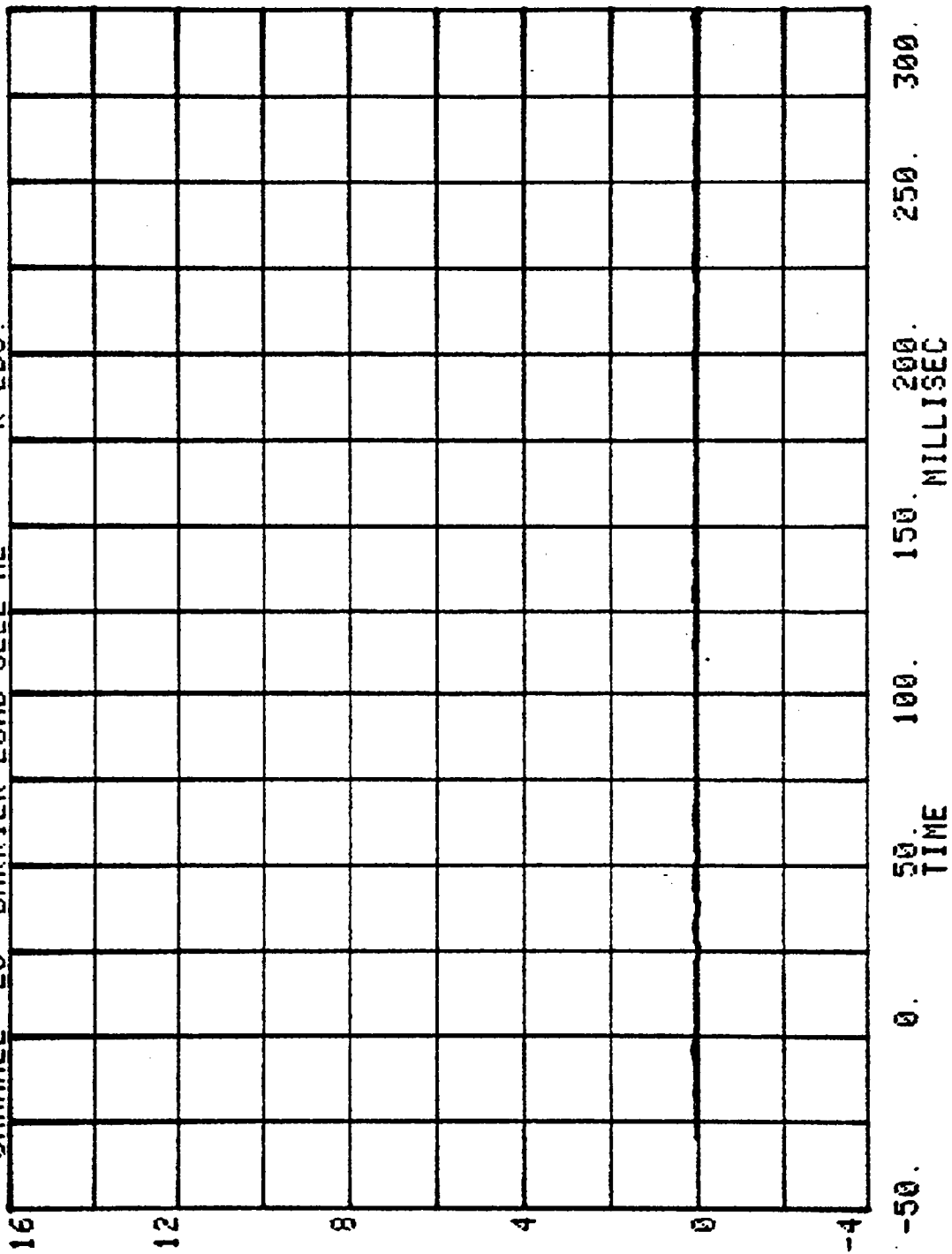
FIXED BARRIER LOAD CELL DATA

FILTER CLASS 60

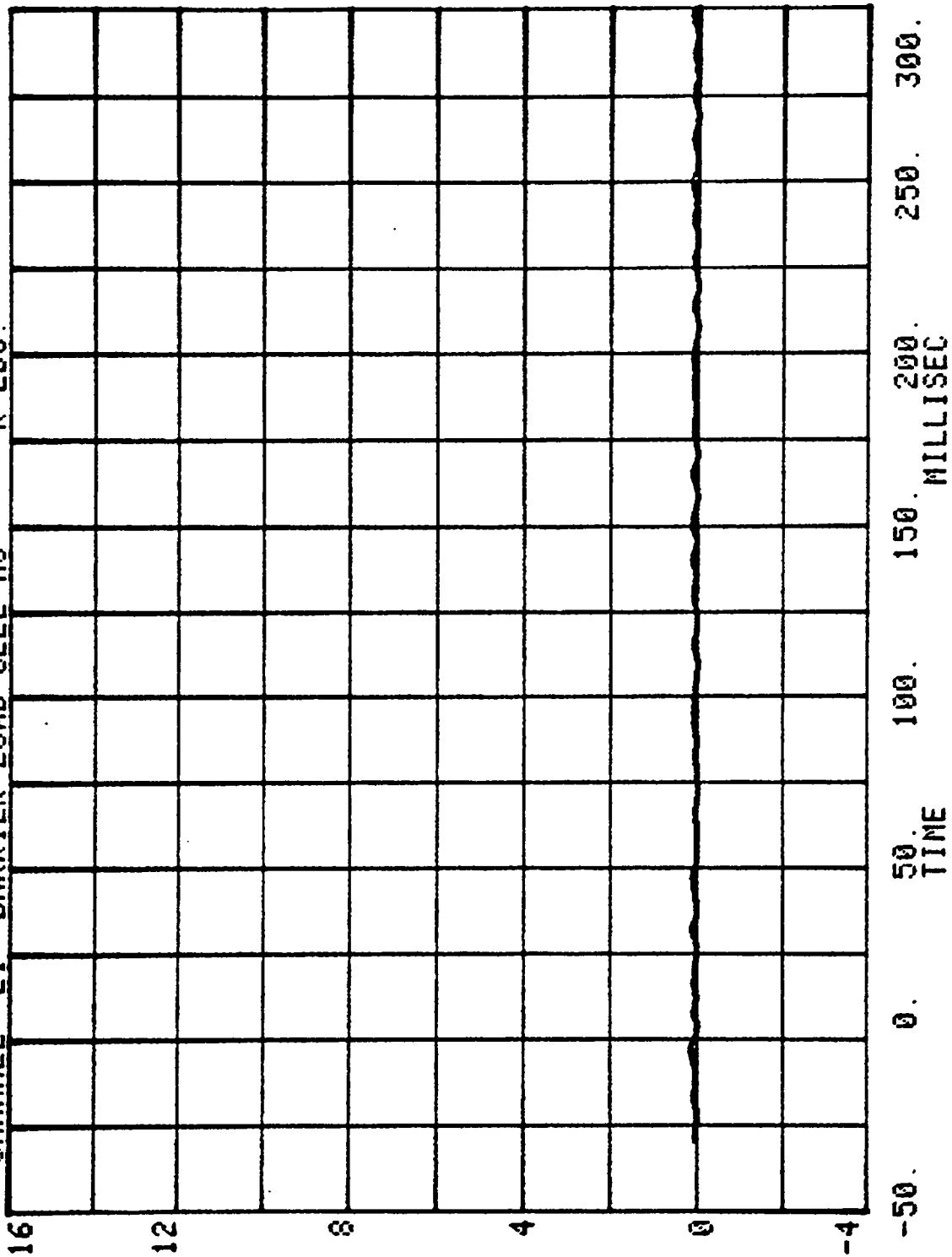
CHANNEL 19 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL A1



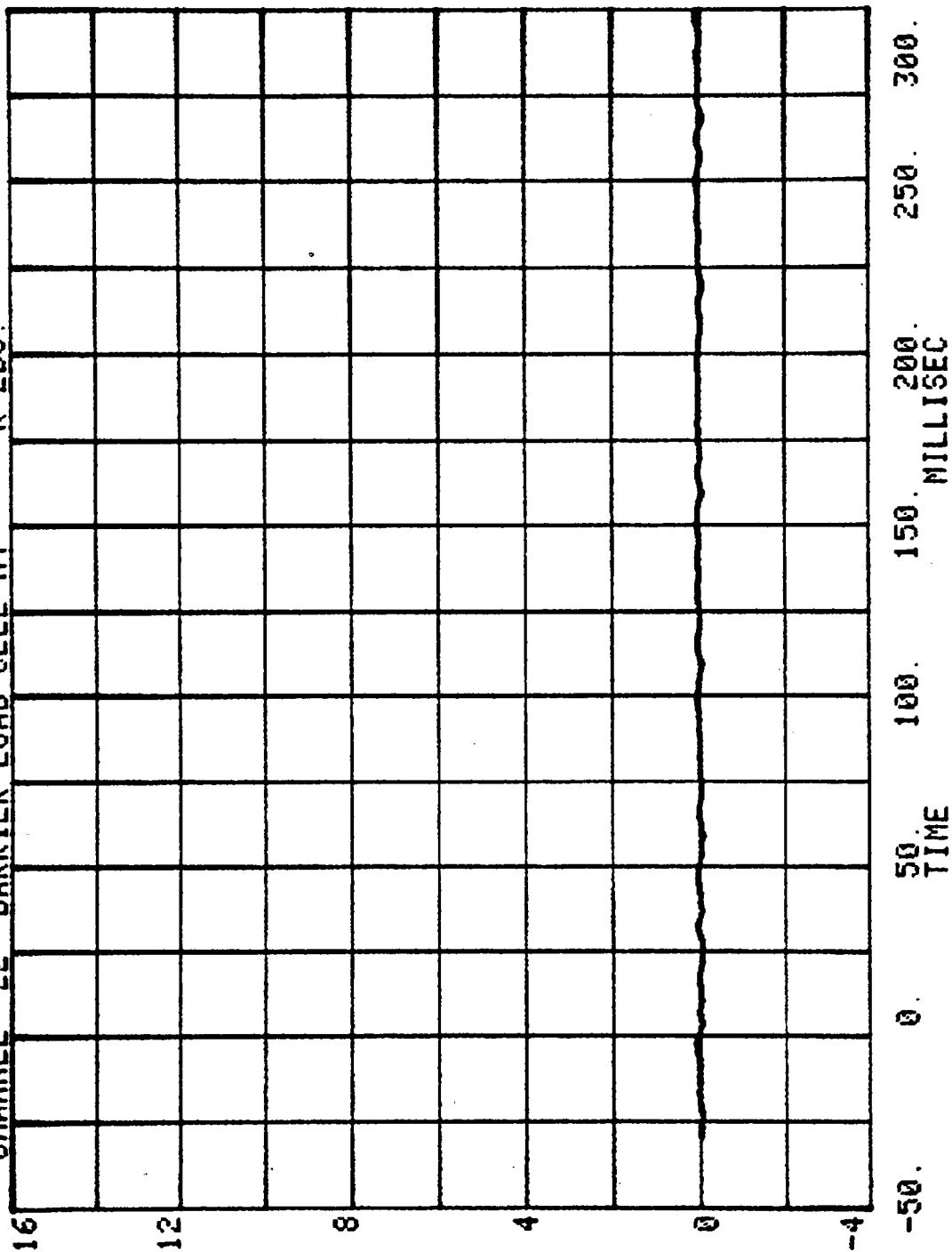
CHANNEL 20 BARRIER LOAD CELL A2 RUN= 534 SERIES= 4 K LBS.



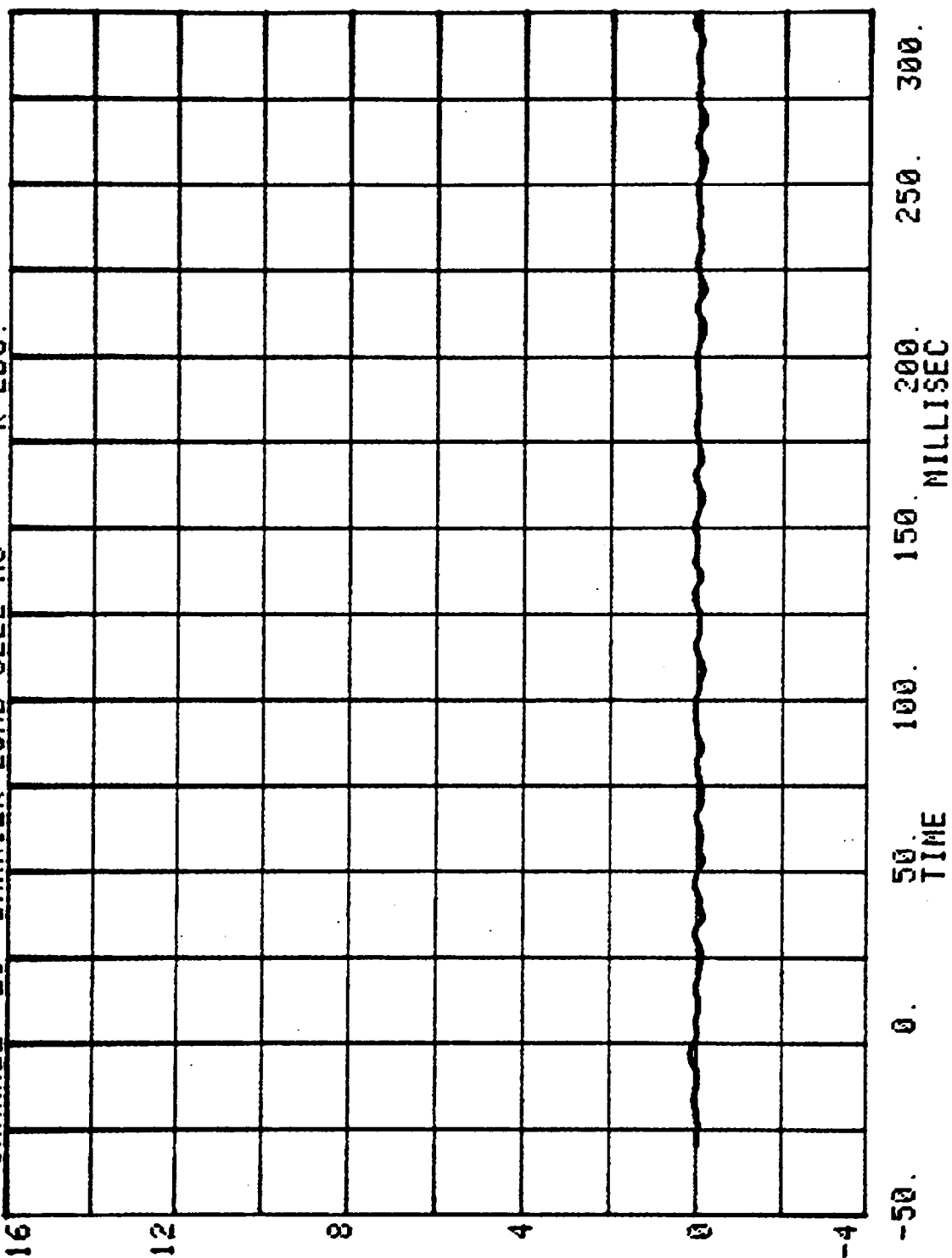
CHANNEL 21 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL A3



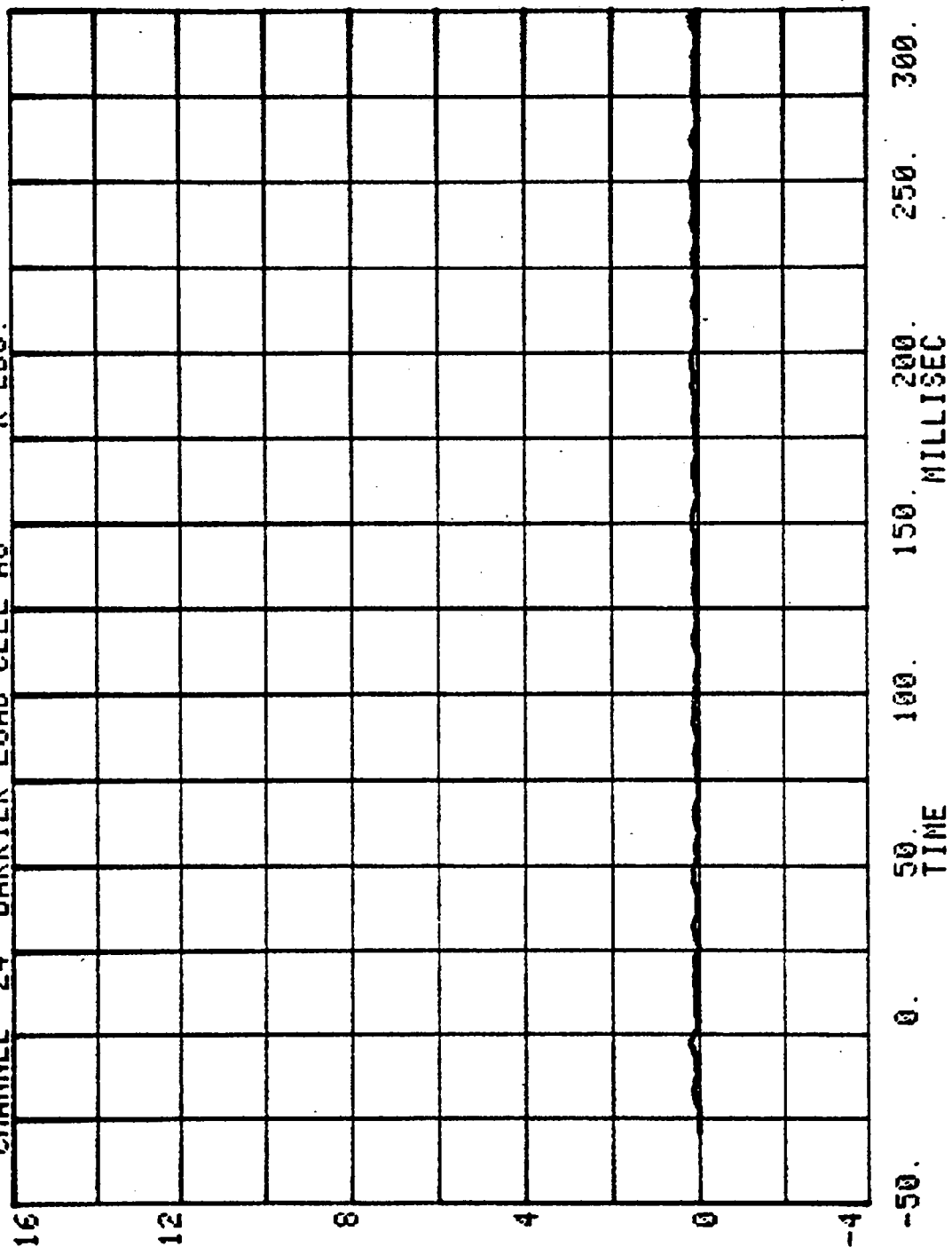
CHANNEL 22 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL A4

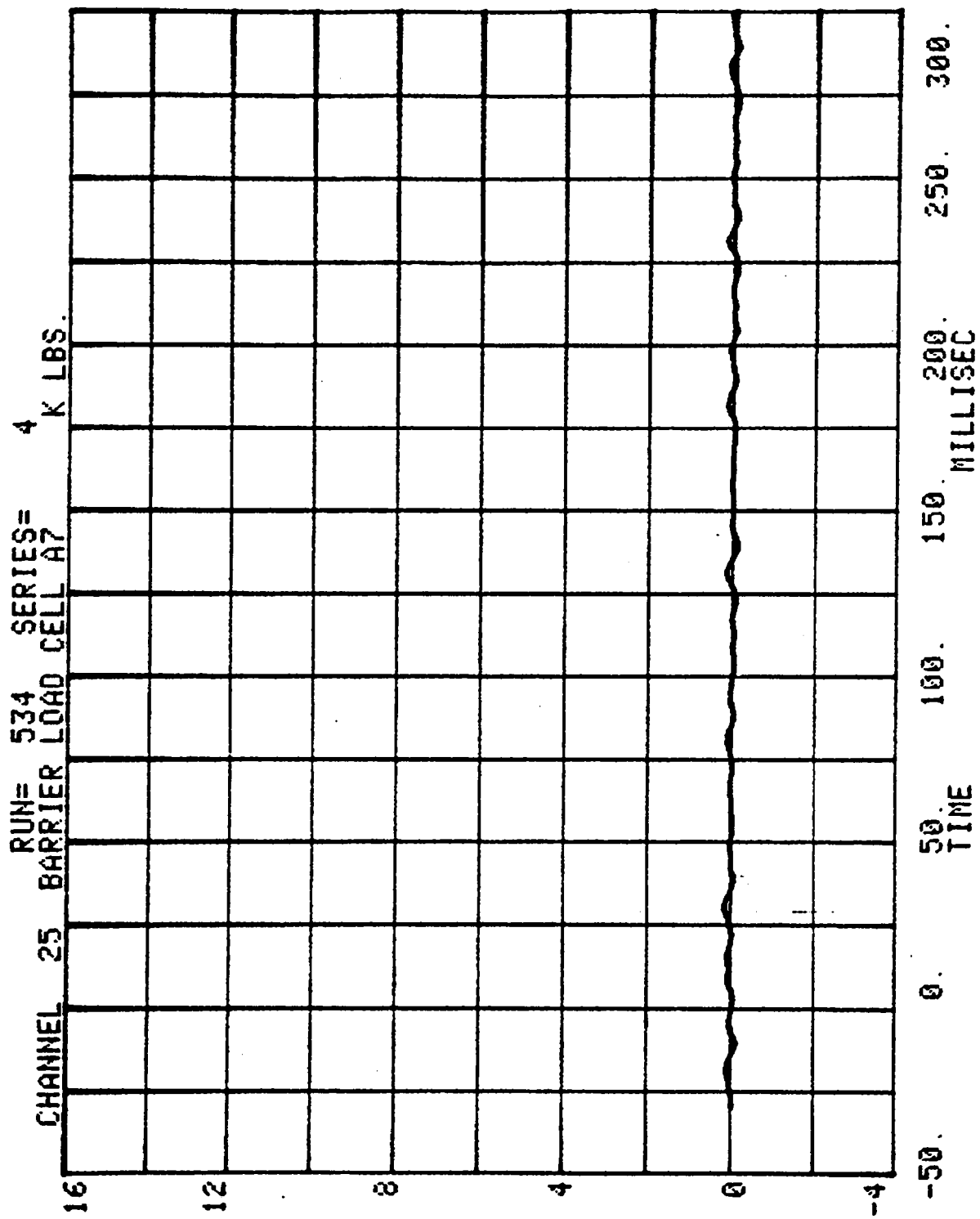


CHANNEL 23 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL A5

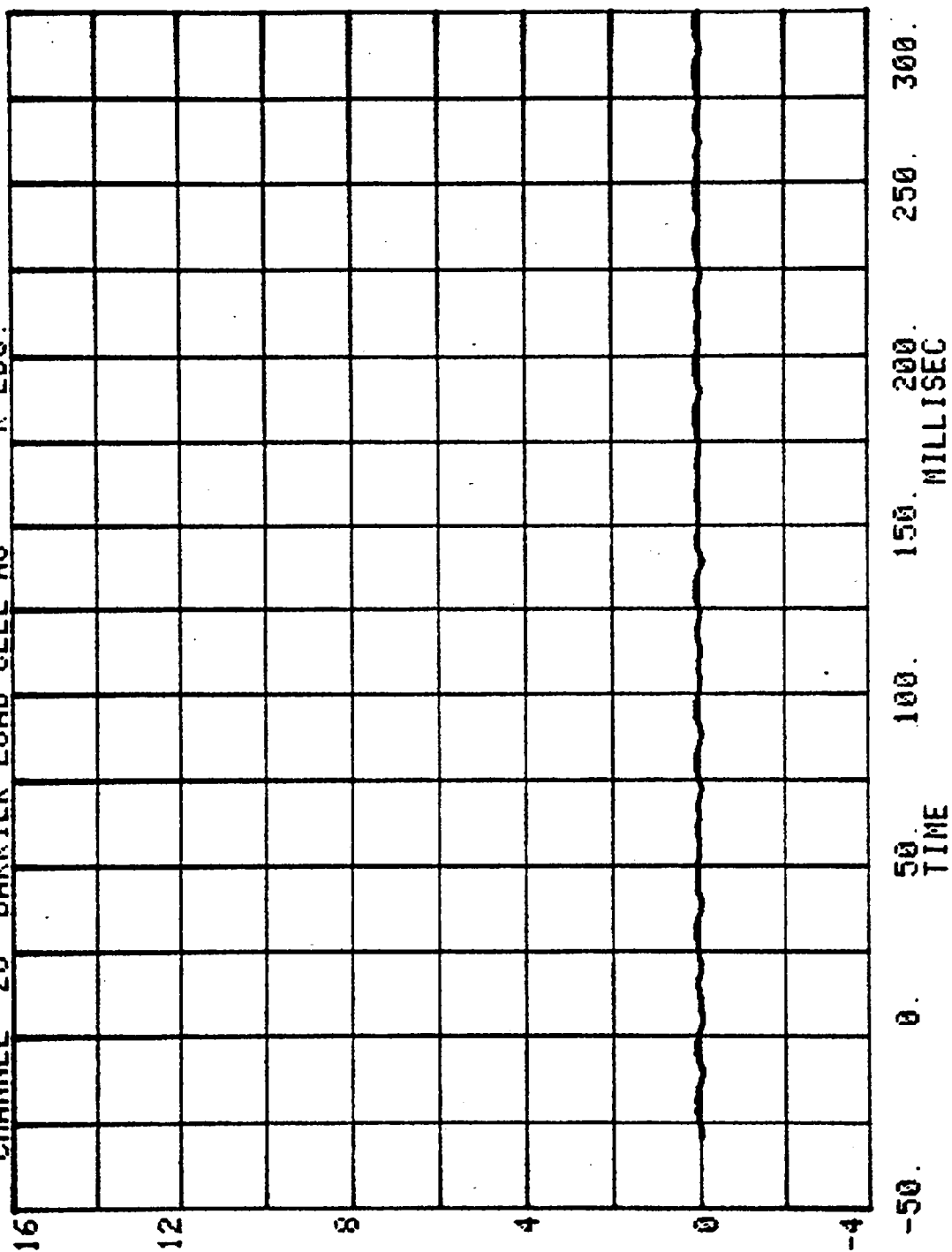


CHANNEL 24 BARRIER LOAD CELL A6 RUN= 534 SERIES= 4 K LBS.

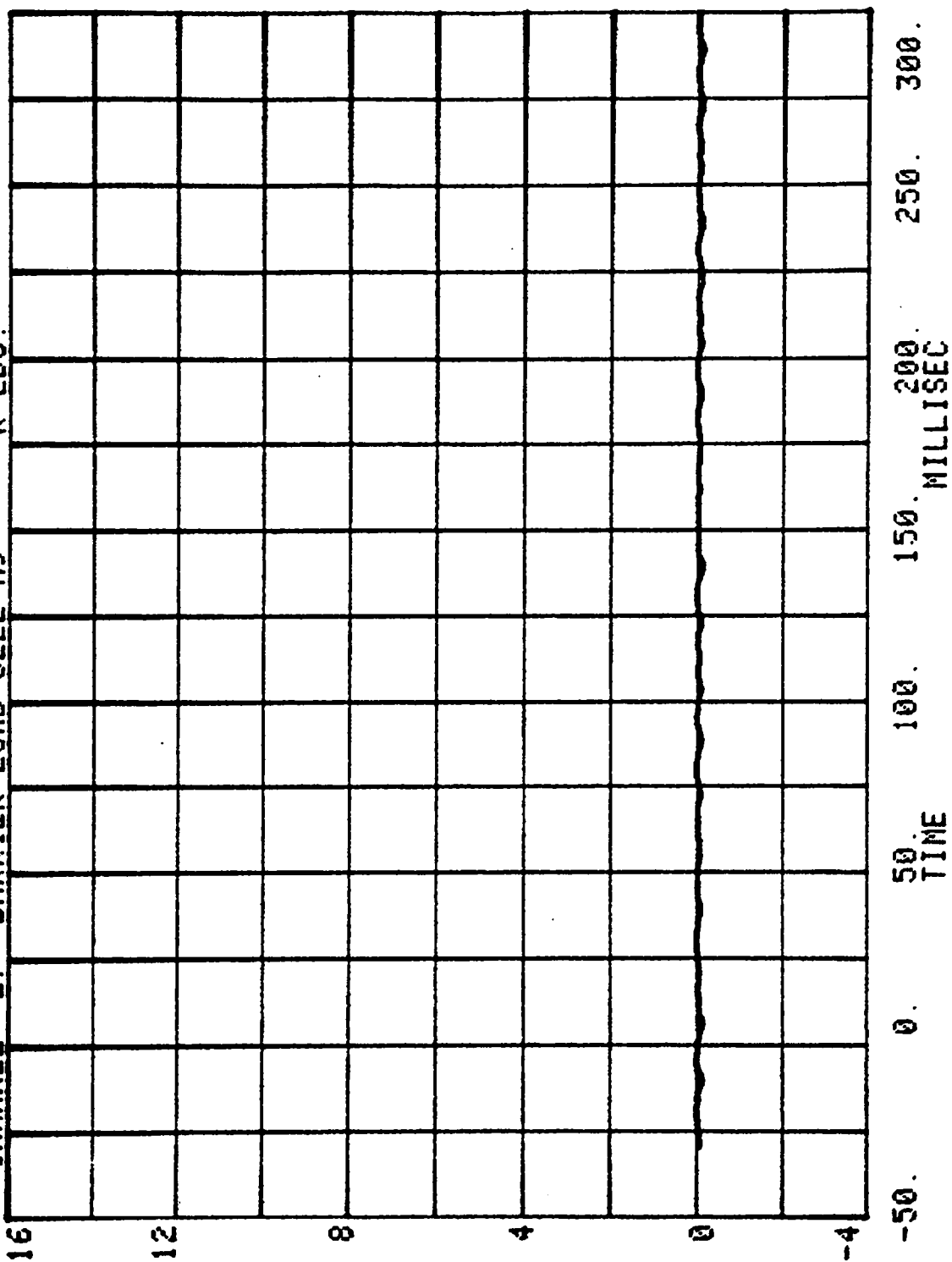




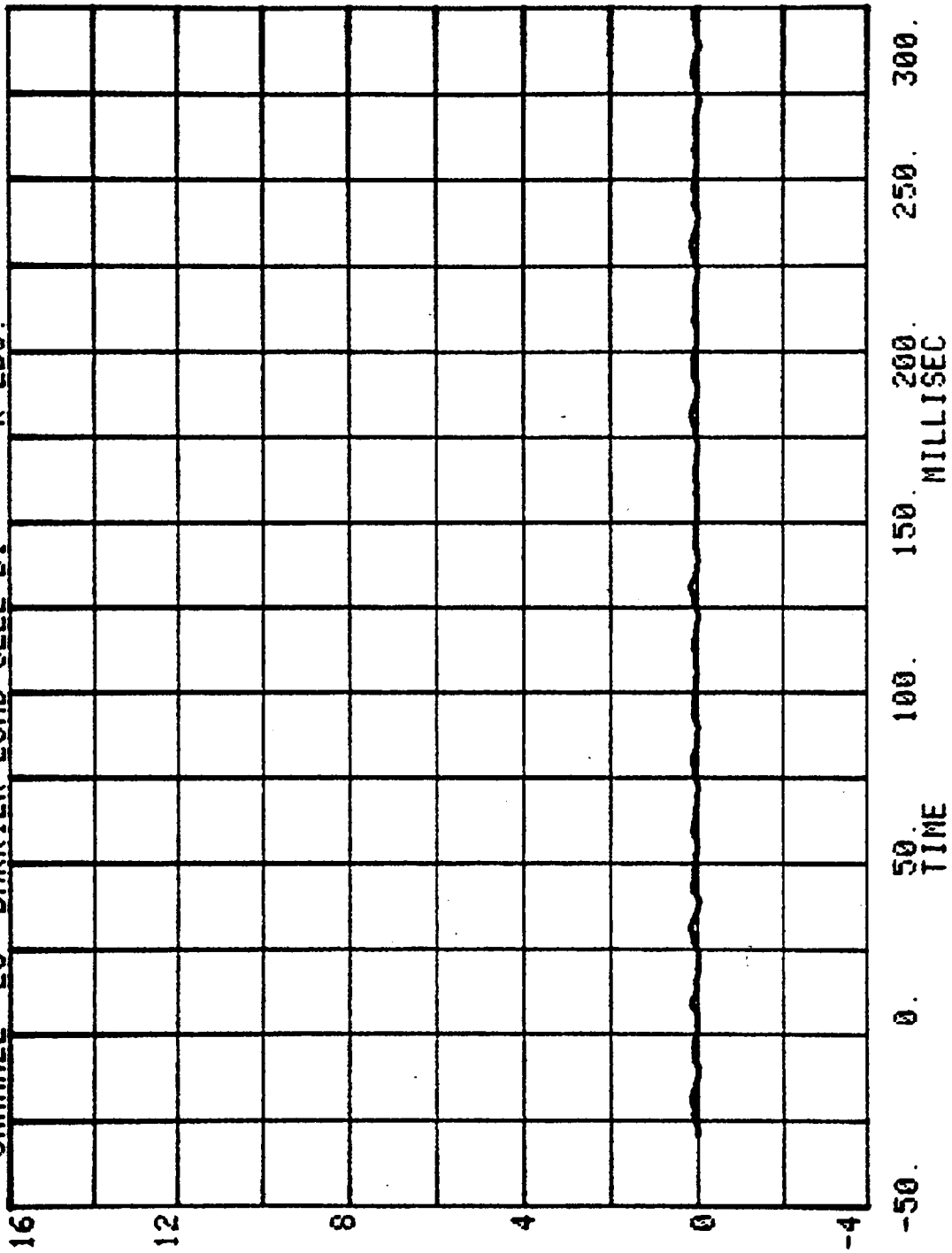
CHANNEL 26 BARRIER LOAD CELL A8 RUN= 534 SERIES= 4 K LBS.



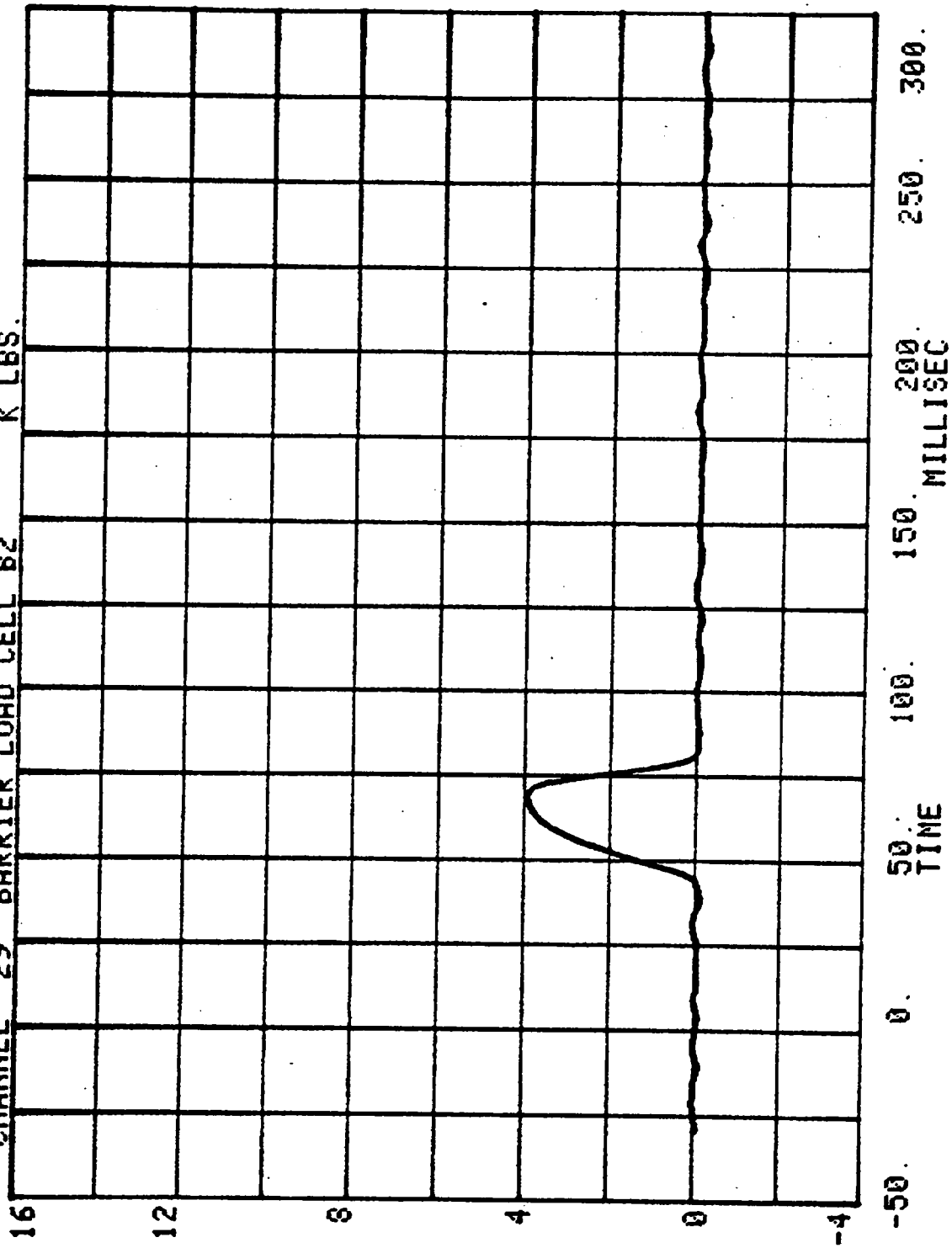
CHANNEL 27 BARRIER LOAD CELL A9 RUN= 534 SERIES= 4 K LBS.



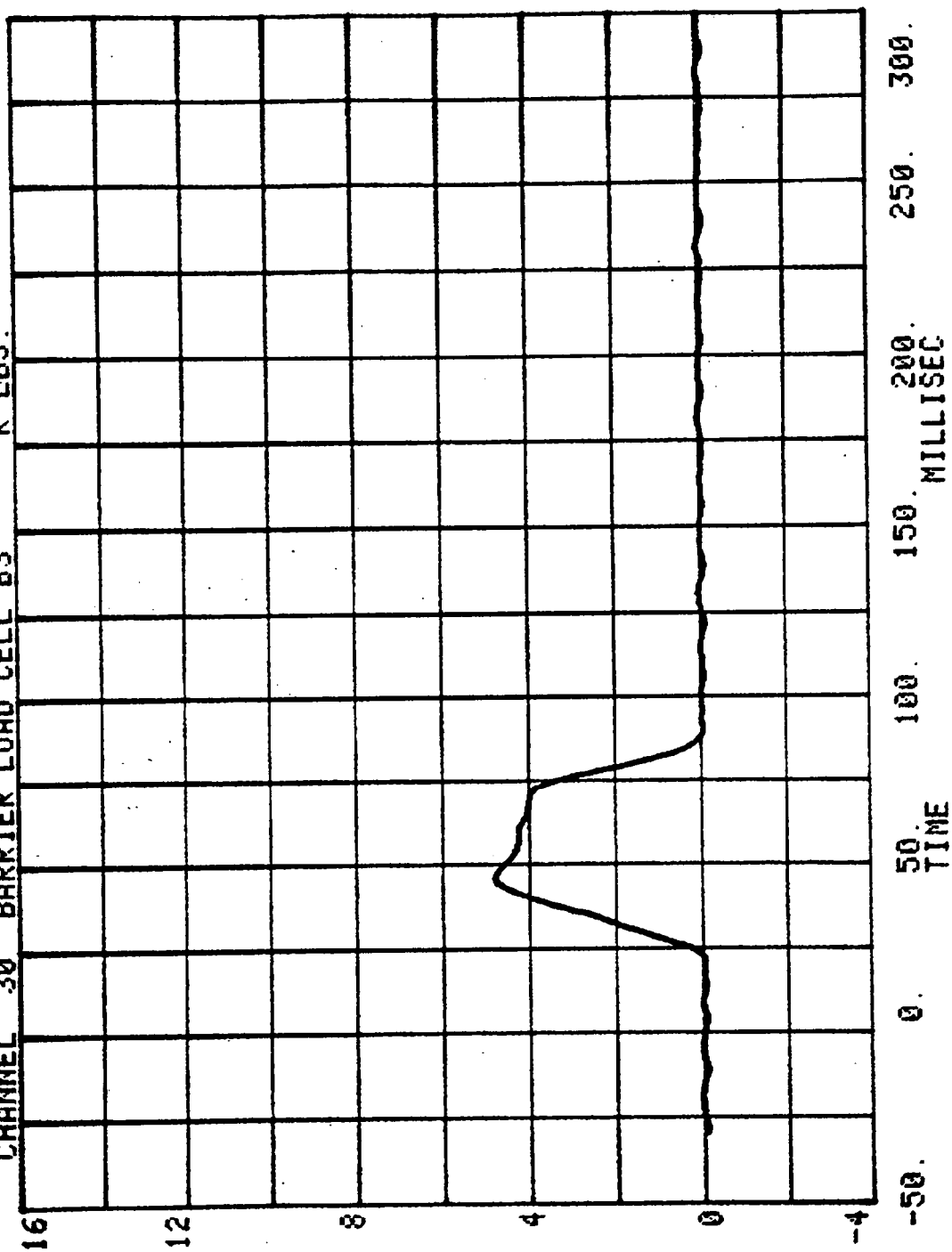
CHANNEL 28 BARRIER LOAD CELL B1
RUN= 534 SERIES= 4 K LBS.



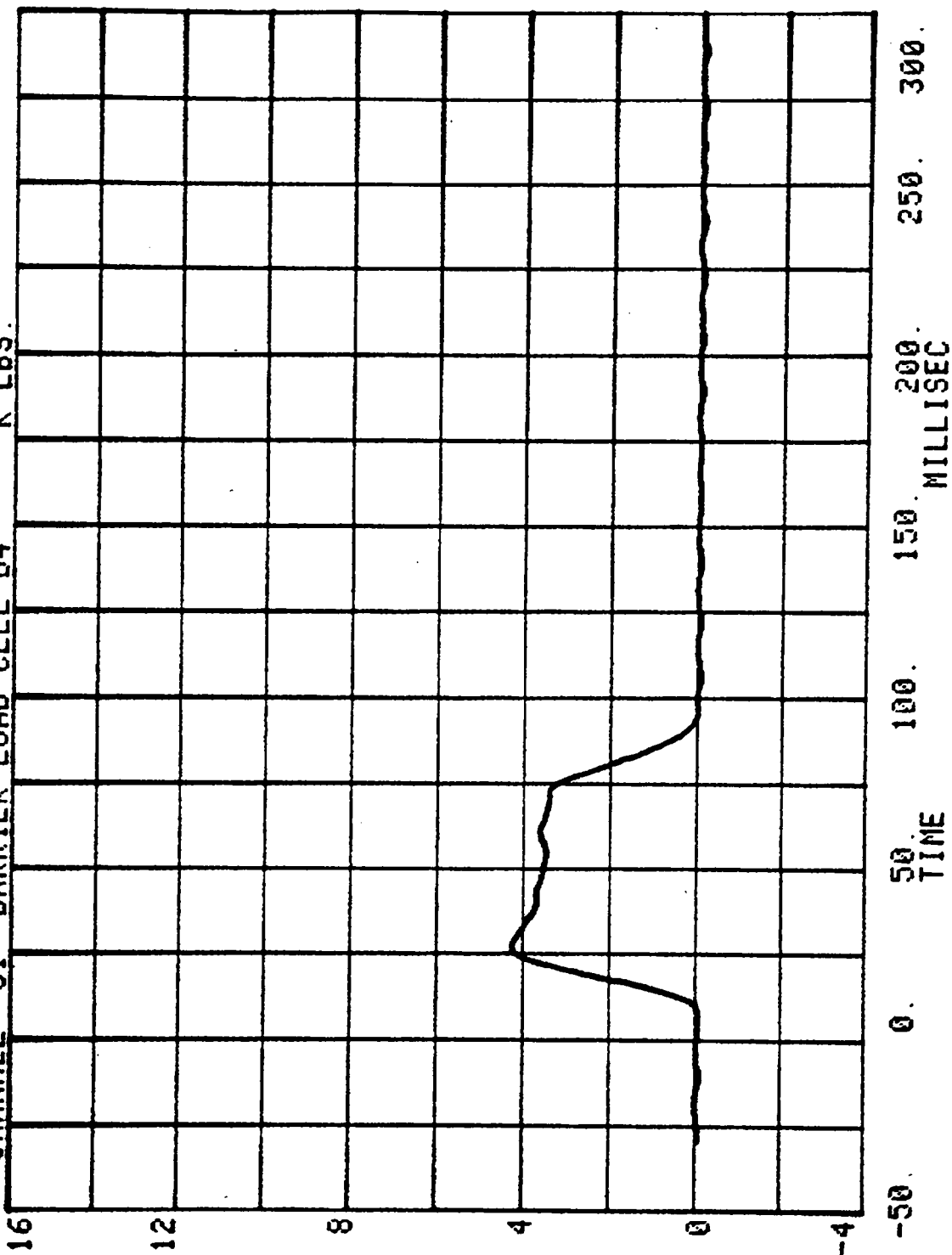
CHANNEL 29 RUN= 534 SERIES= 4
BARRIER LOAD CELL B2 K LBS.

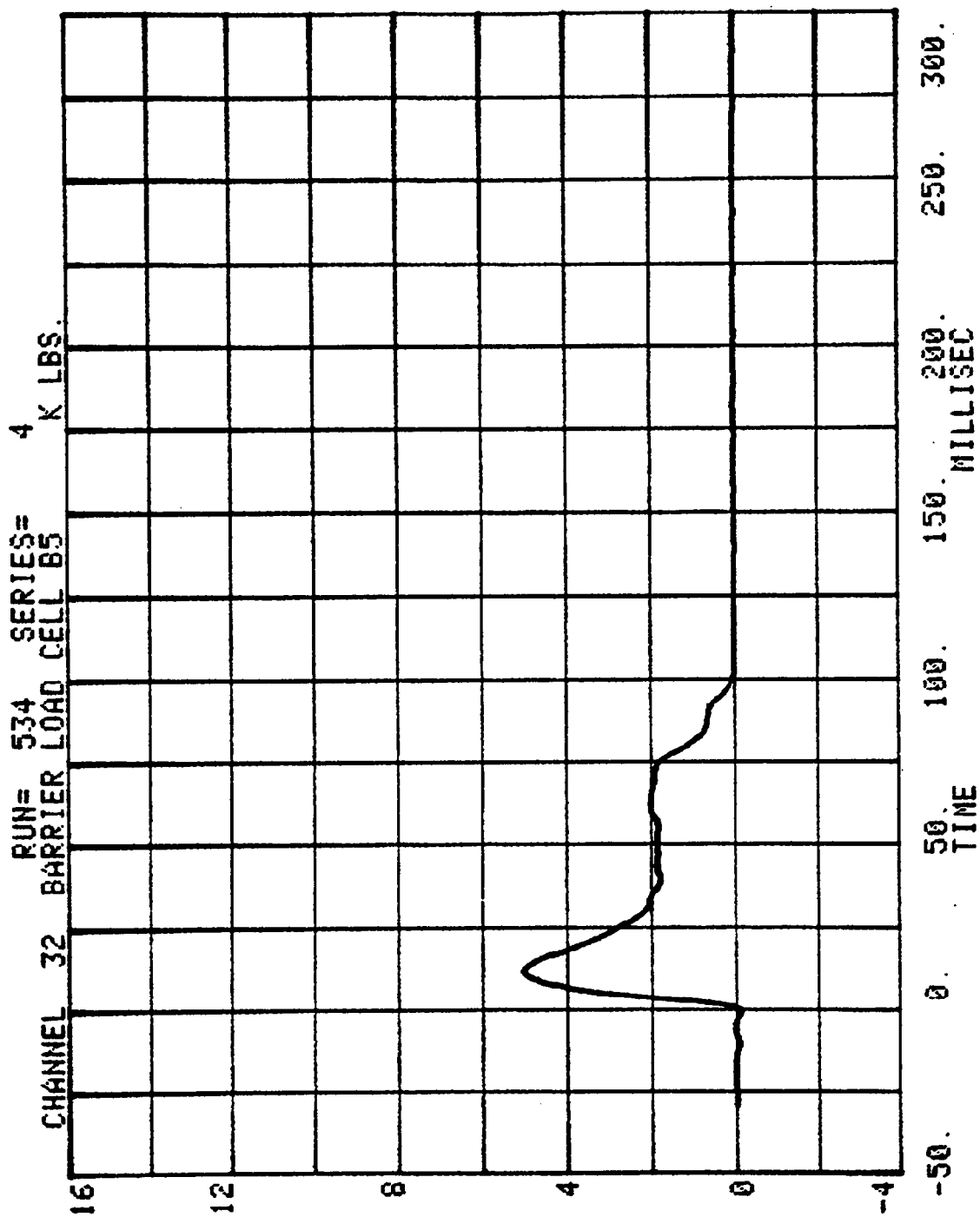


CHANNEL 30 BARRIER LOAD CELL B3 RUN= 534 SERIES= 4 K LBS.



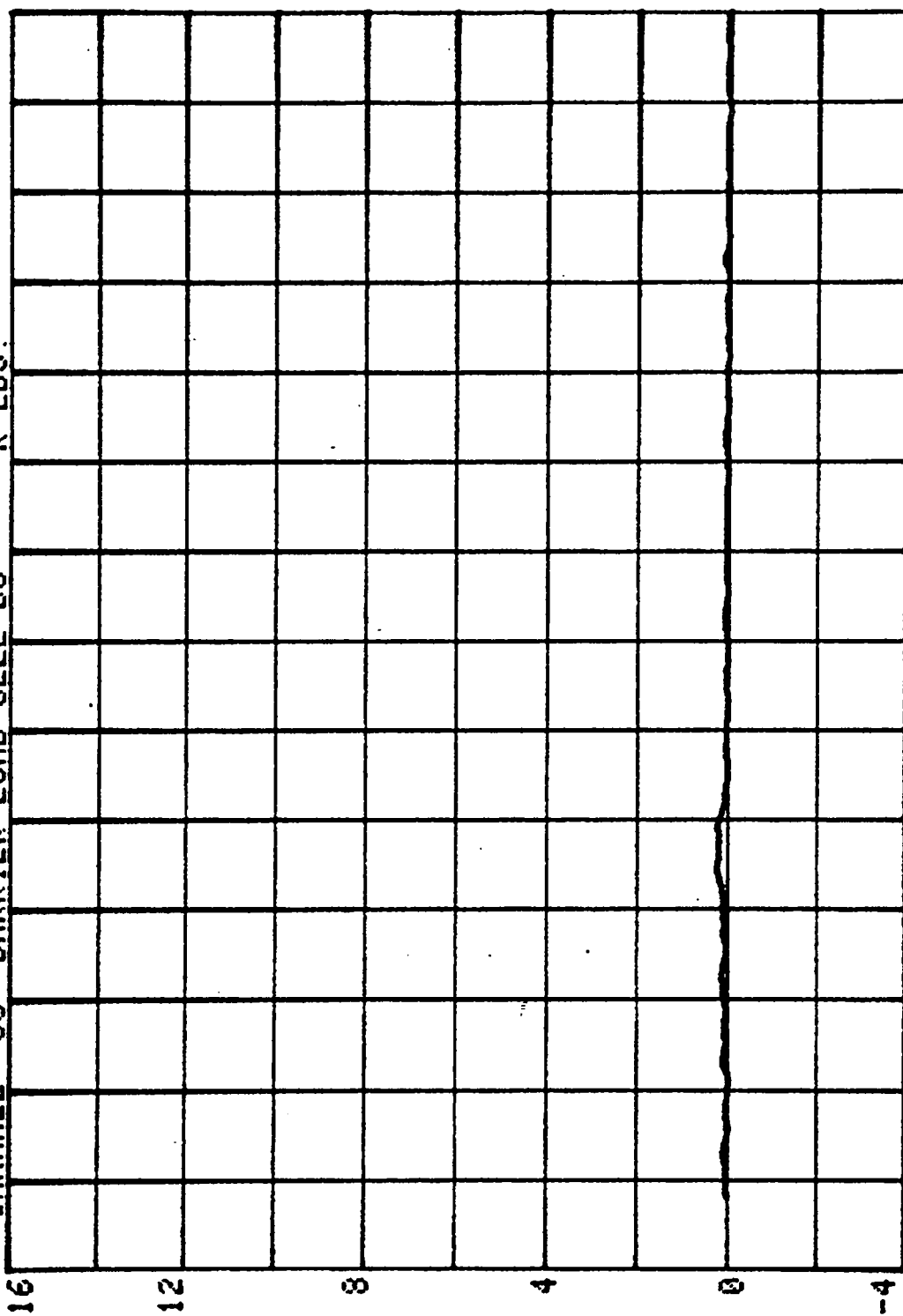
CHANNEL 31 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL B4





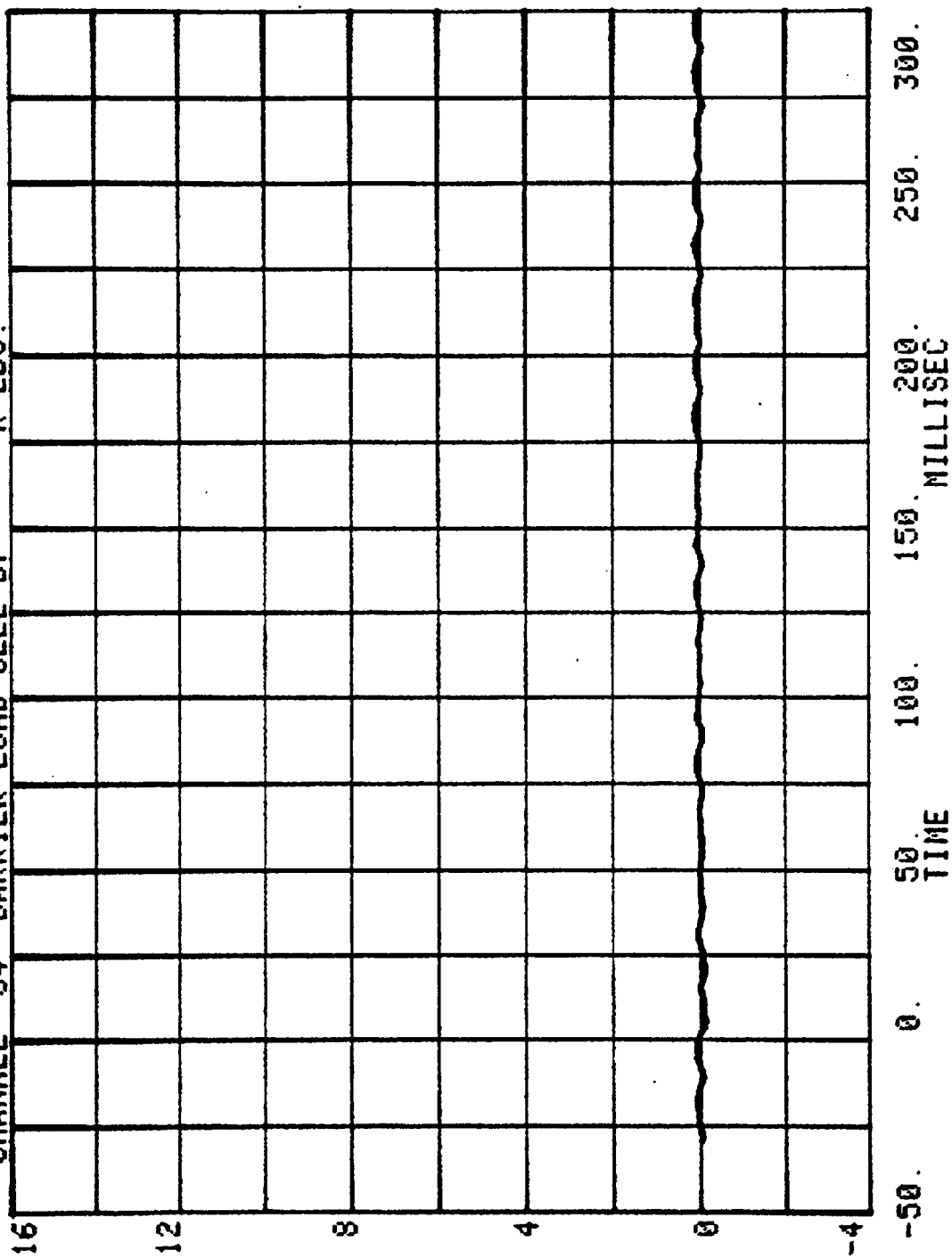
CHANNEL 33 BARRIER LOAD CELL B6 4 K LBS.

RUN= 534 SERIES=

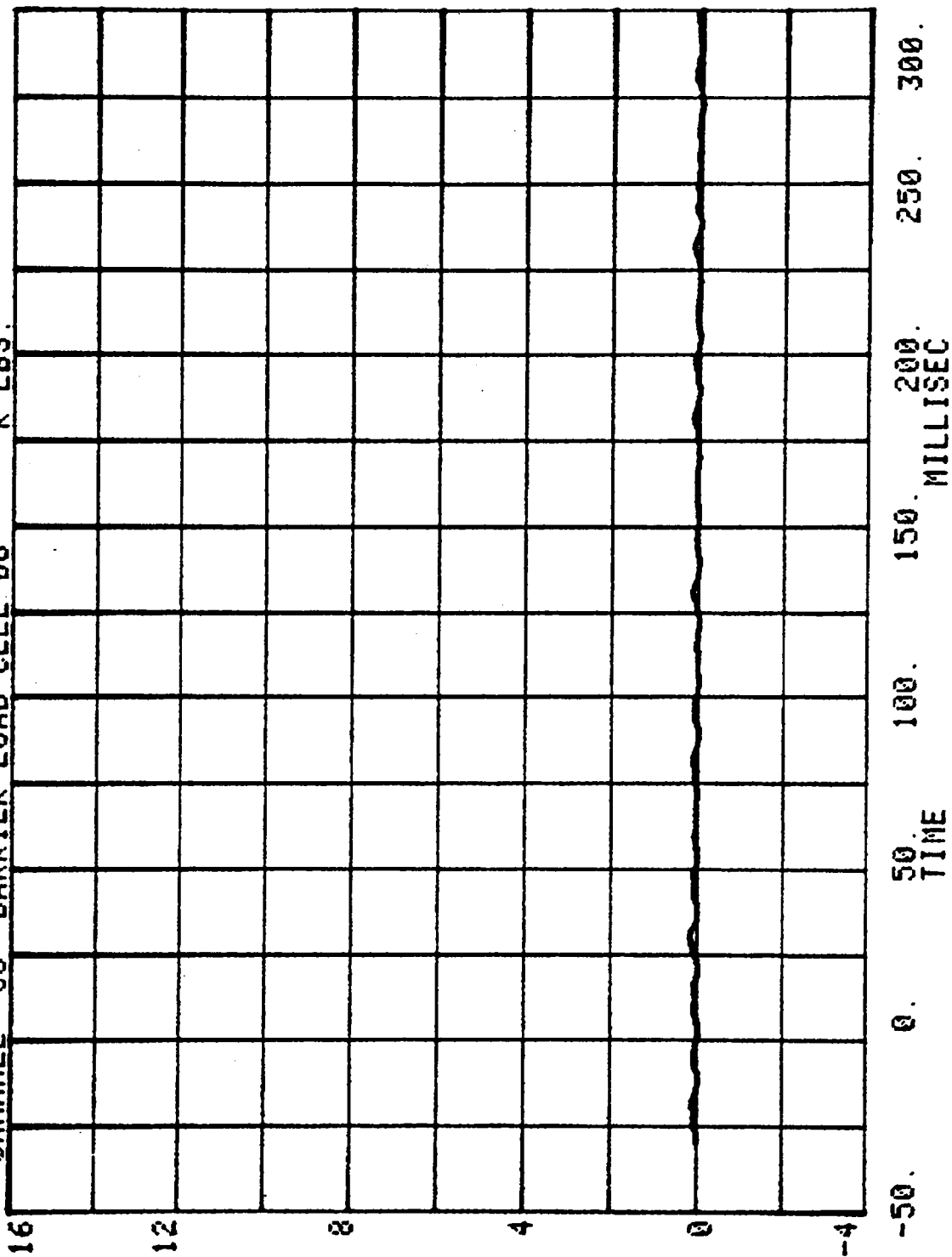


-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

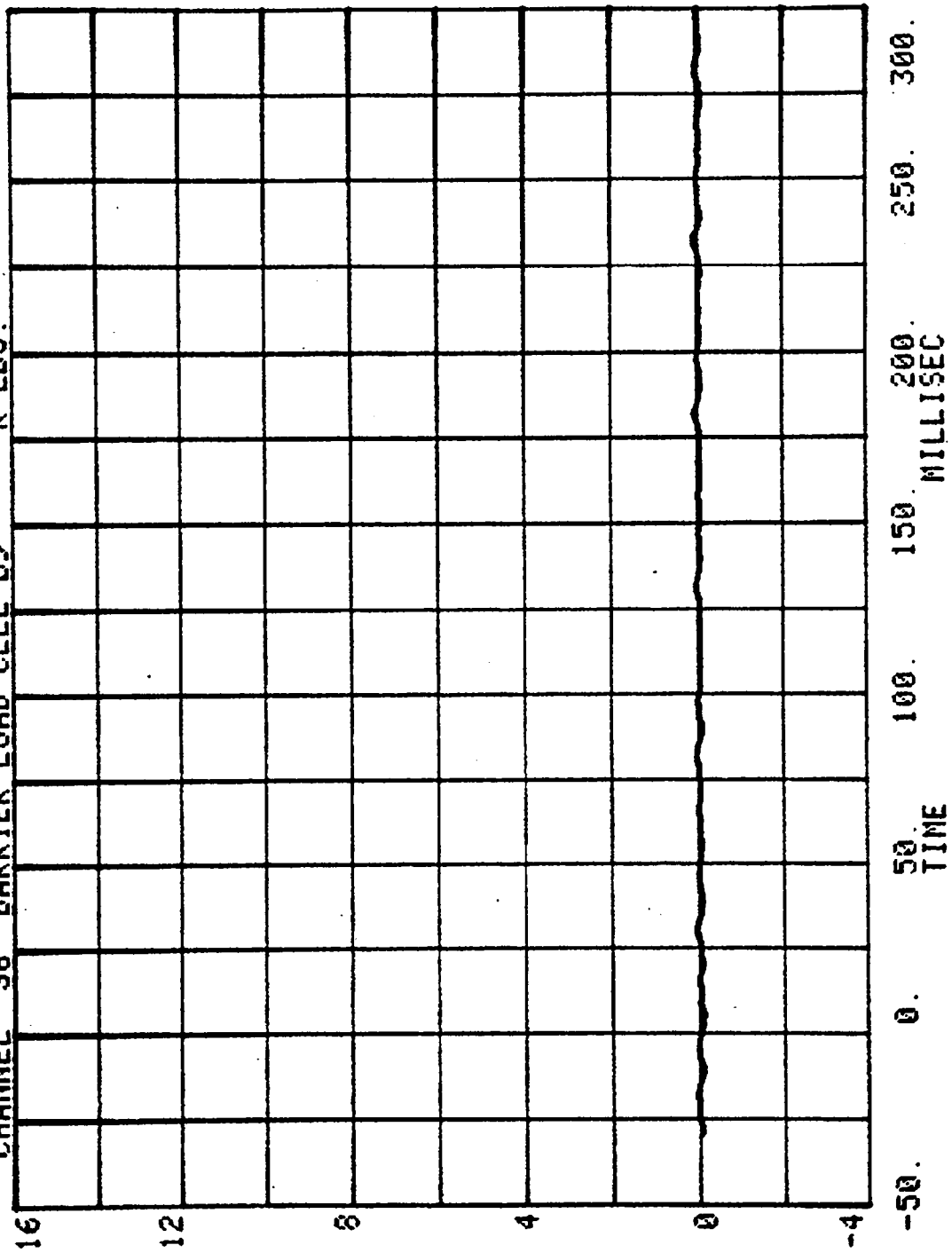
CHANNEL 34 BARRIER LOAD CELL B7
RUN= 534 SERIES= 4 K LBS.



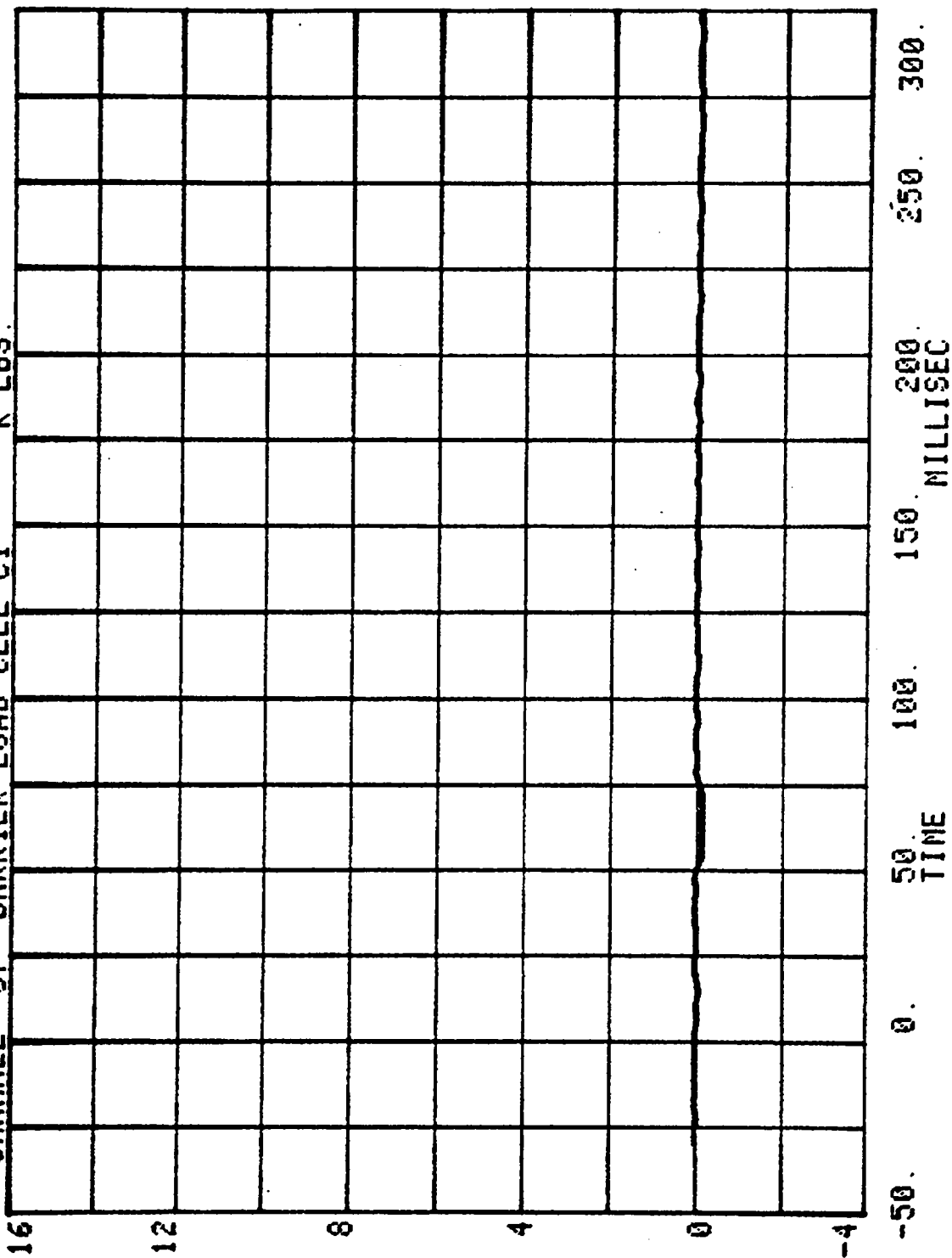
CHANNEL 35 RUN= 534 SERIES= 4
BARRIER LOAD CELL B8 K LBS.



CHANNEL 36 BARRIER LOAD CELL B9 RUN= 534 SERIES= 4 K LBS.



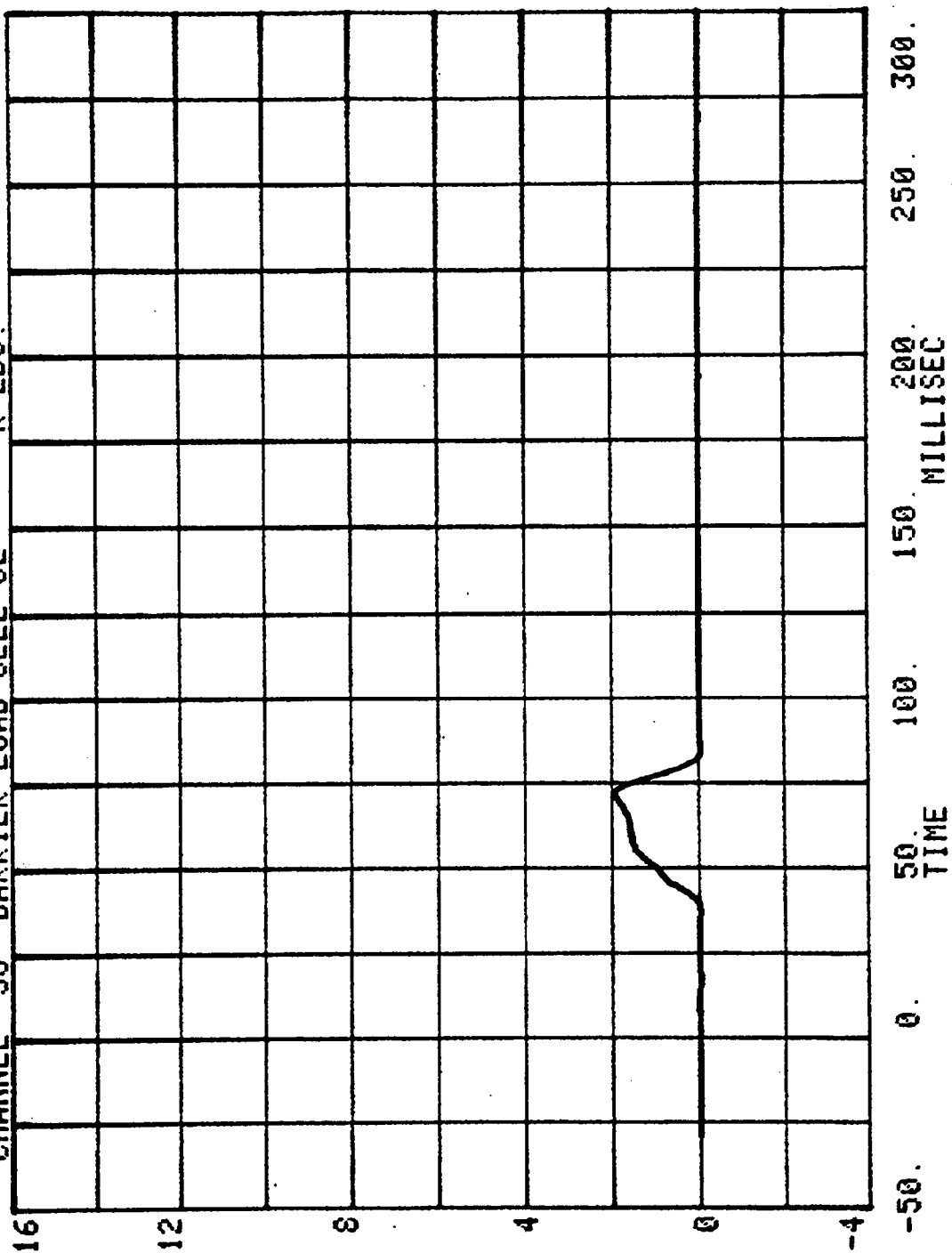
CHANNEL 37 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL C1



CHANNEL 38 BARRIER LOAD CELL C2

RUN= 534 SERIES= 4

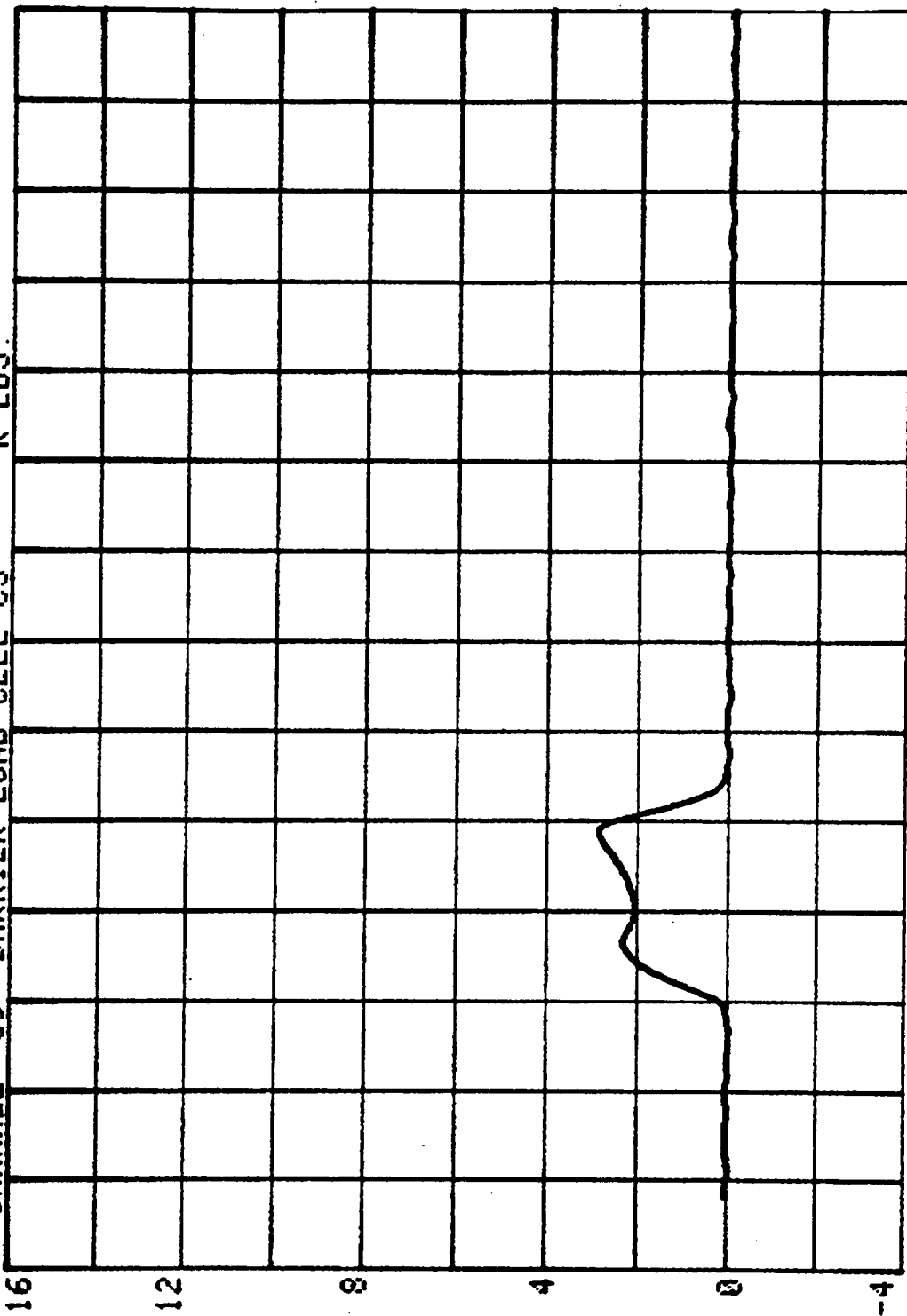
K LBS.



CHANNEL 39 BARRIER LOAD CELL C3

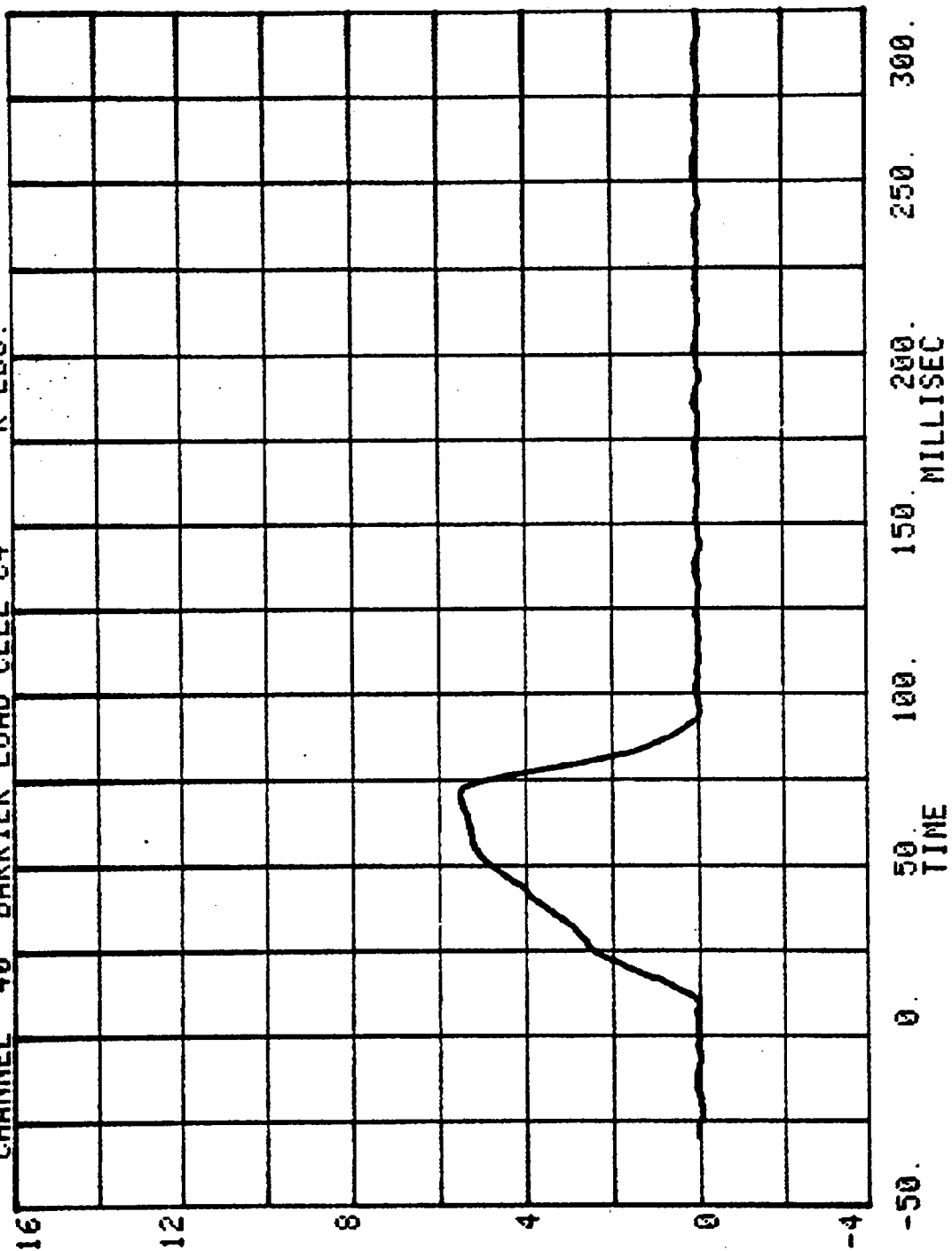
RUN= 534 SERIES= 4

K LBS.

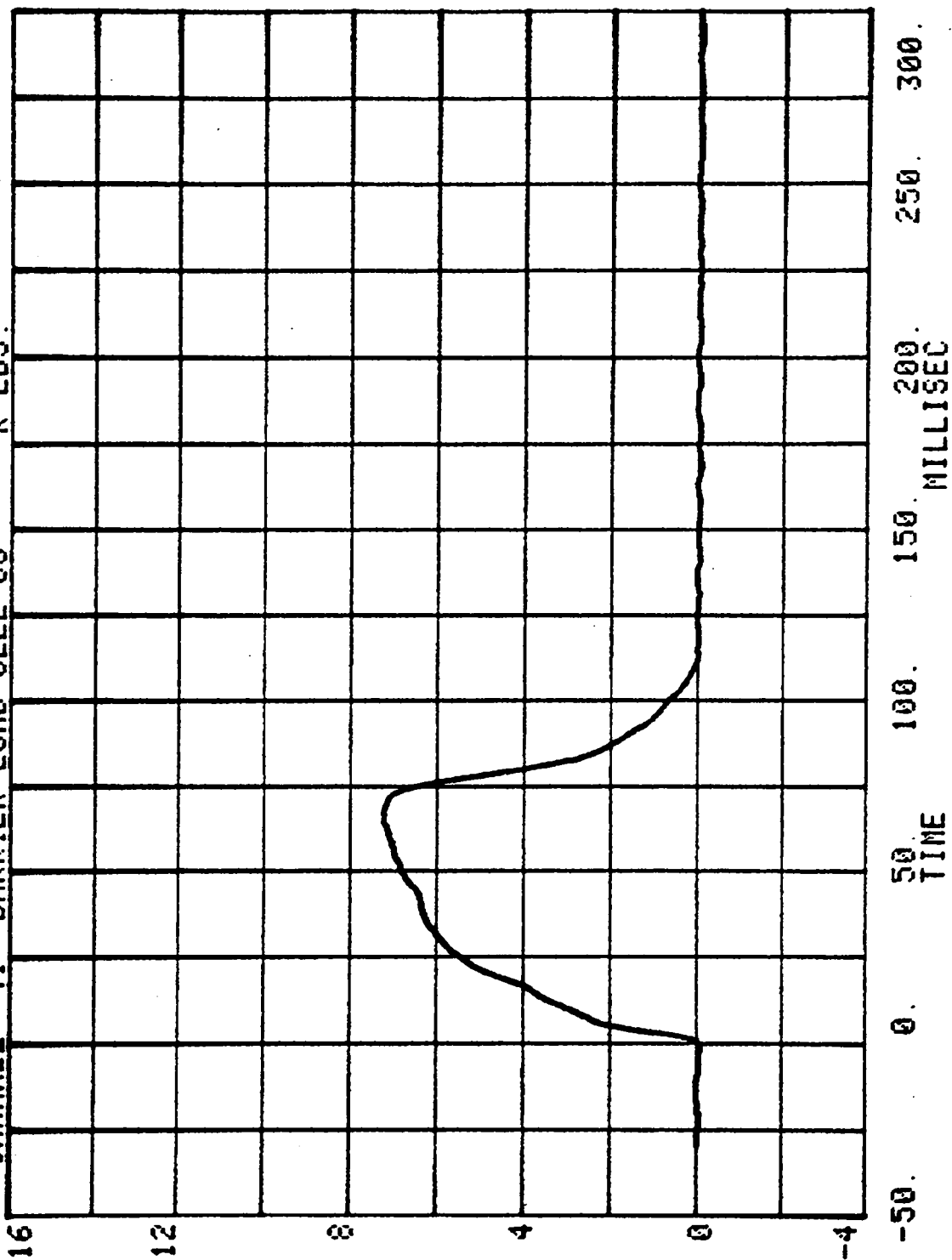


-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

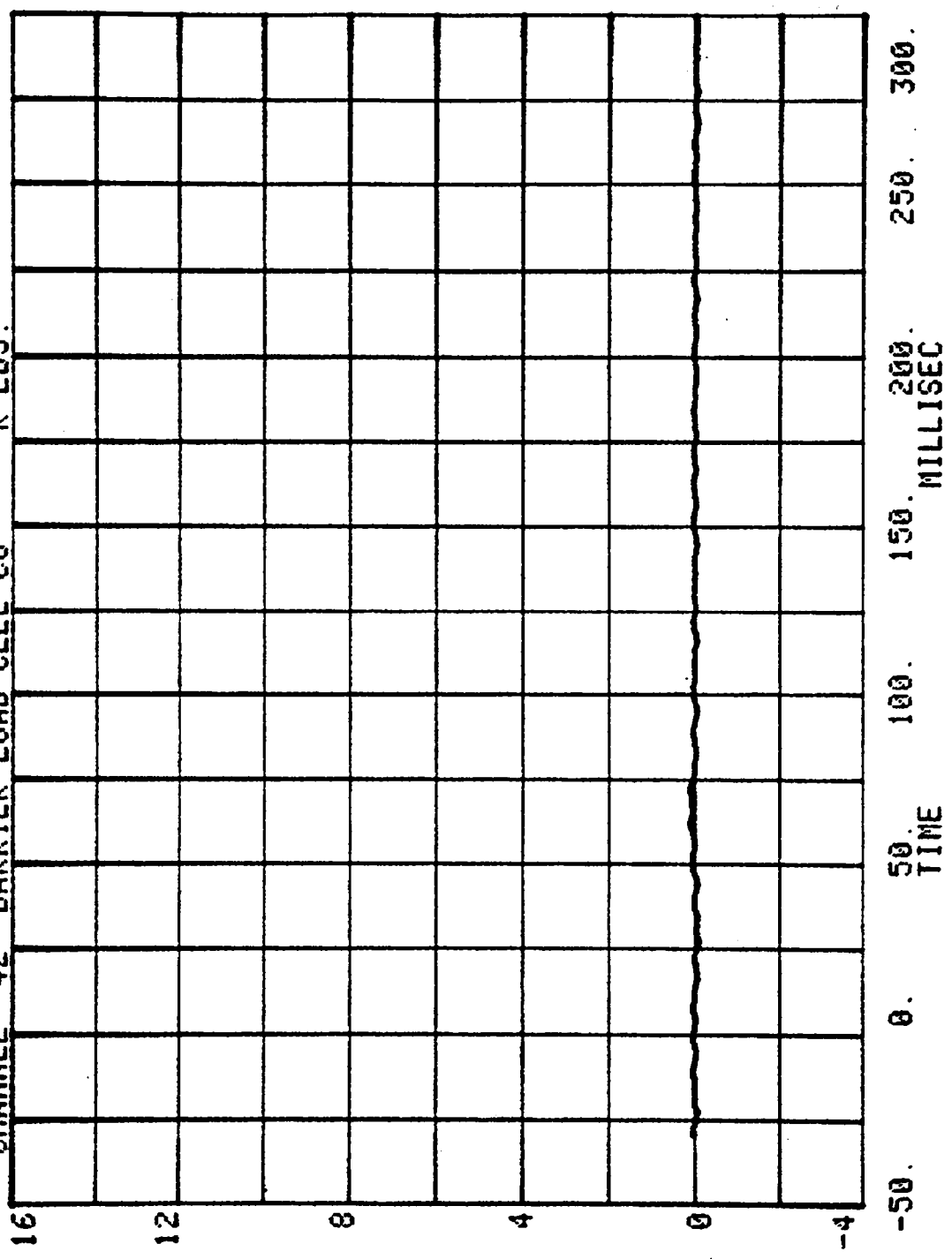
RUN= 534 SERIES= 4 K LBS.
CHANNEL 40 BARRIER LOAD CELL C4



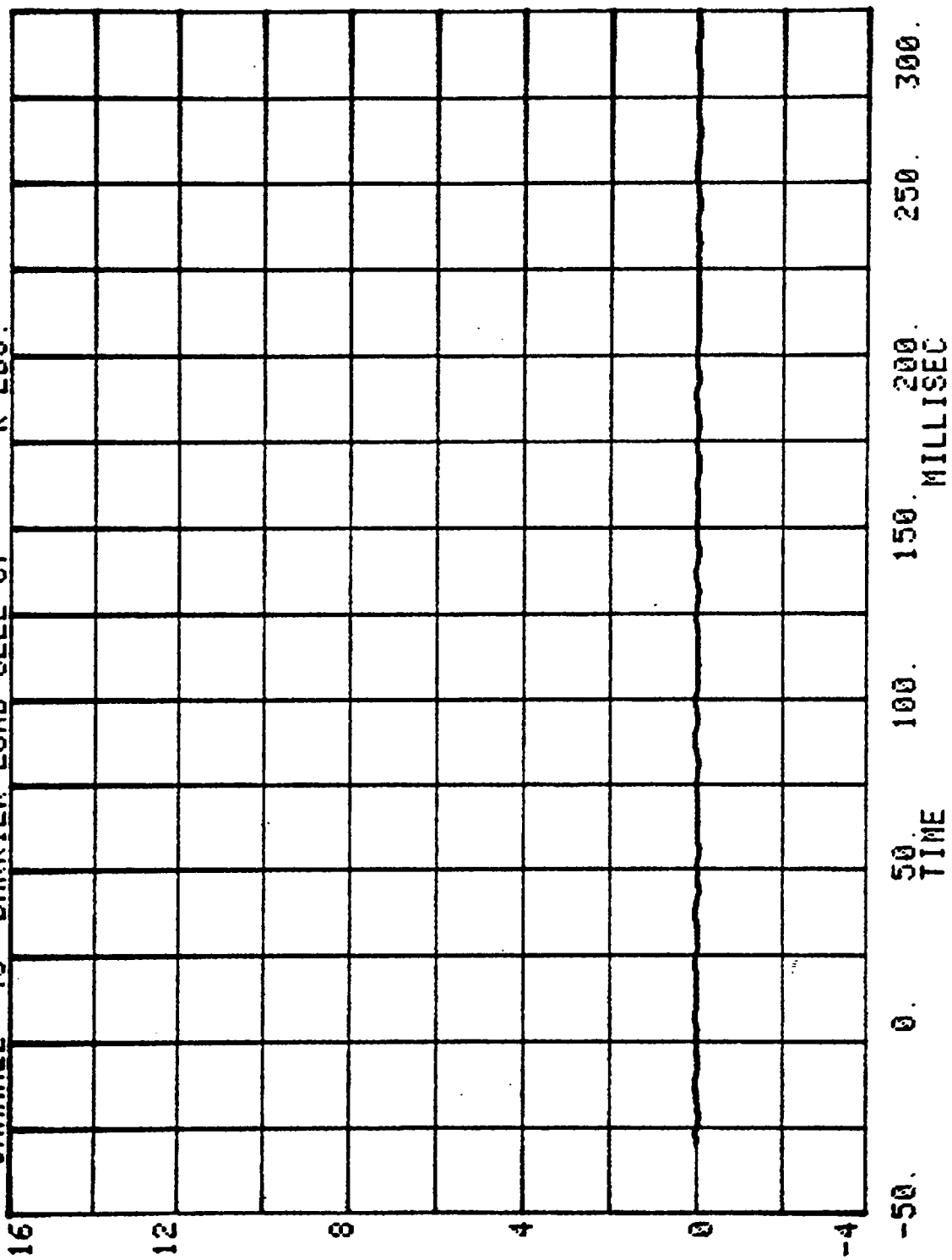
CHANNEL 41 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL C5



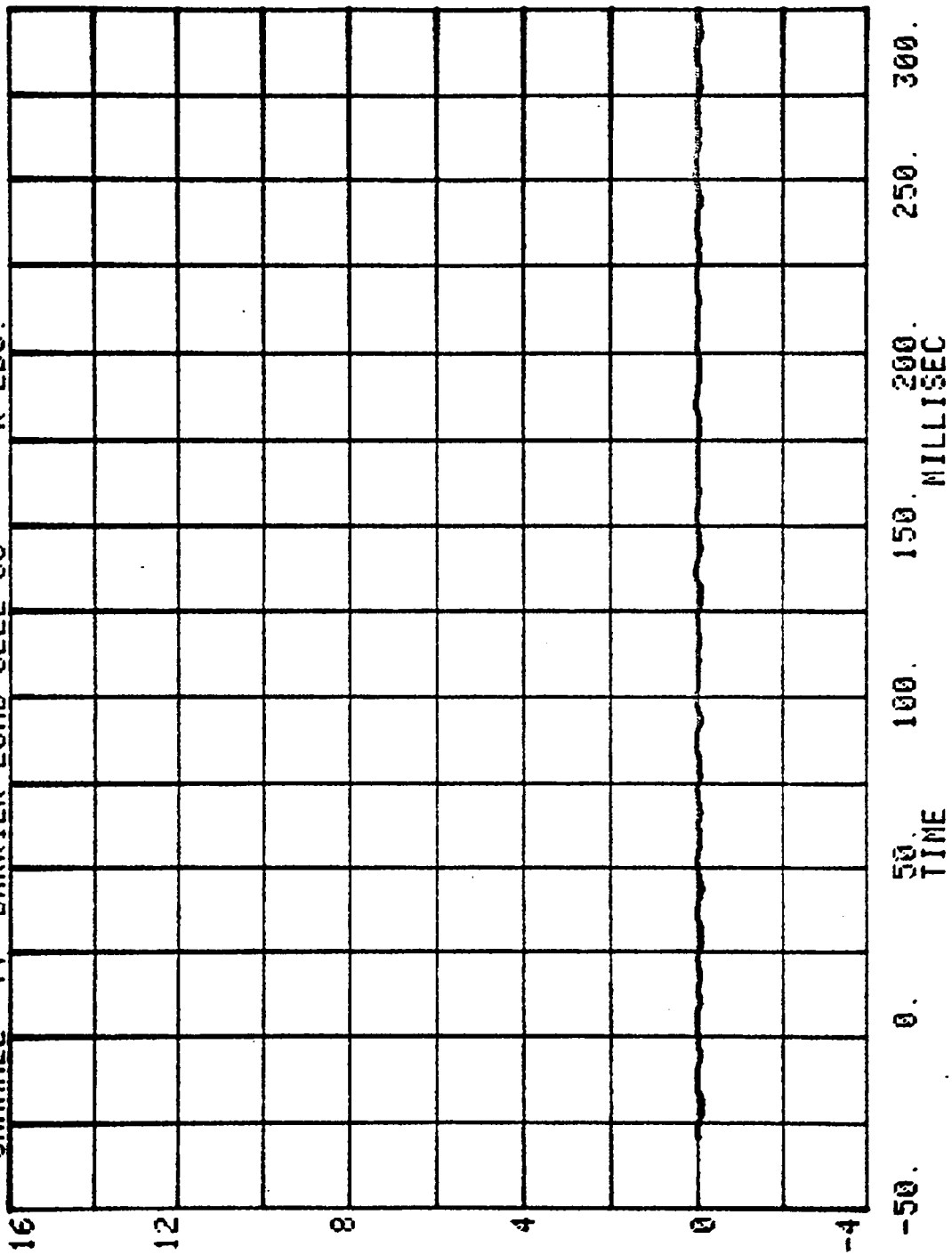
CHANNEL 42 BARRIER LOAD CELL C6 RUN= 534 SERIES= 4 K LBS.



CHANNEL 43 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL C7



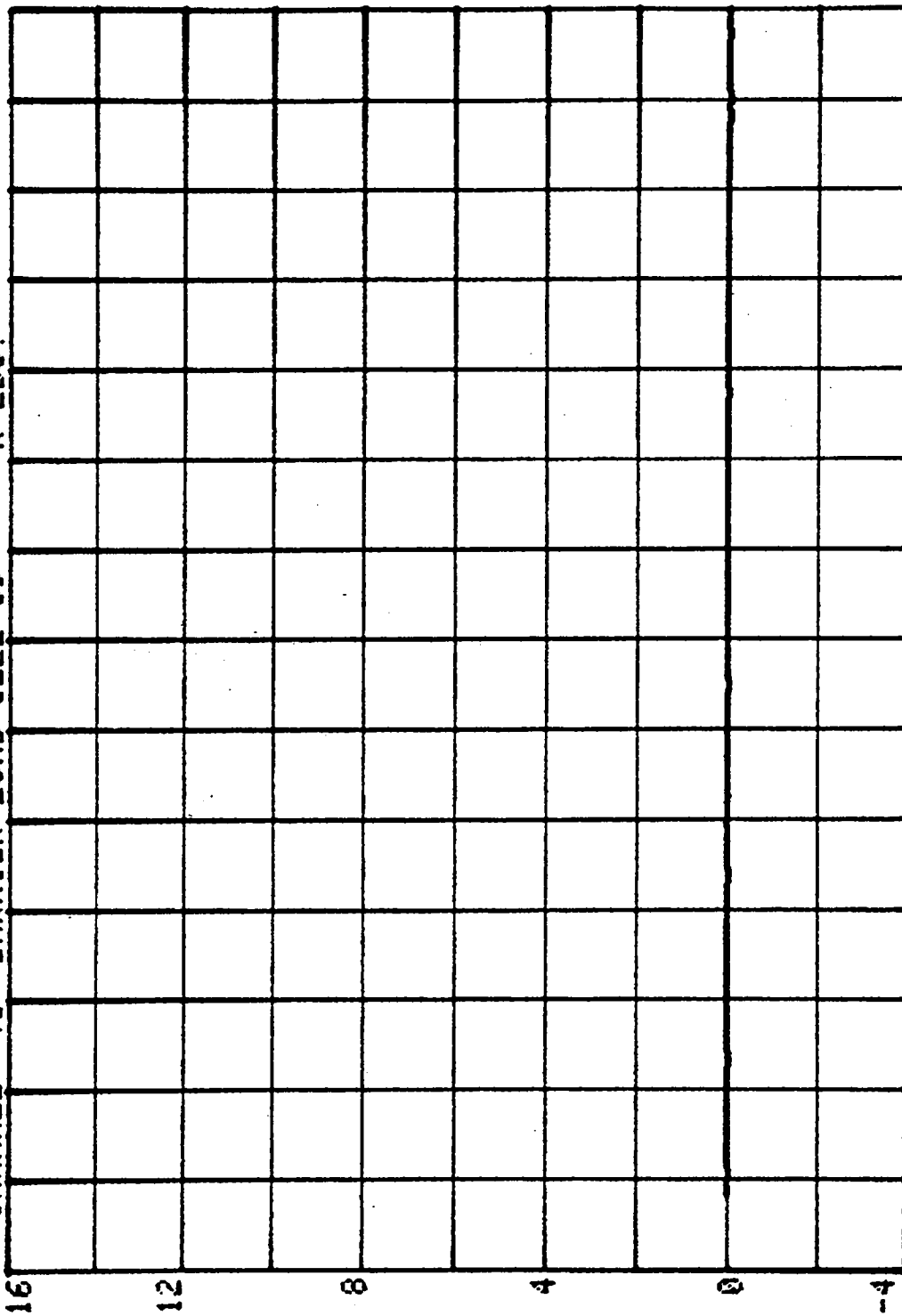
CHANNEL 44 BARRIER LOAD CELL C8 RUN= 534 SERIES= 4 K LBS.



CHANNEL 45 BARRIER LOAD CELL C9

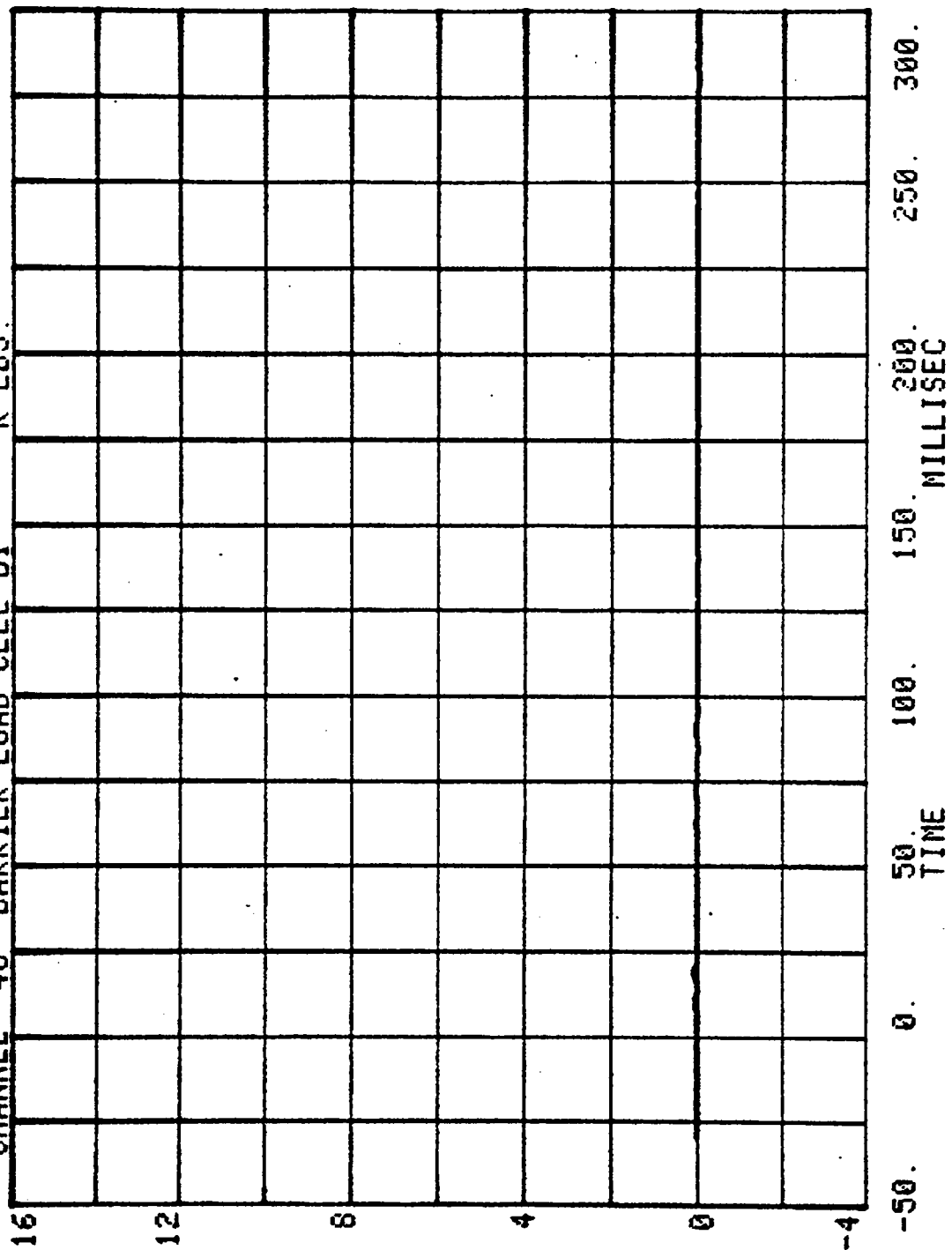
RUN= 534 SERIES= 4

K LBS.

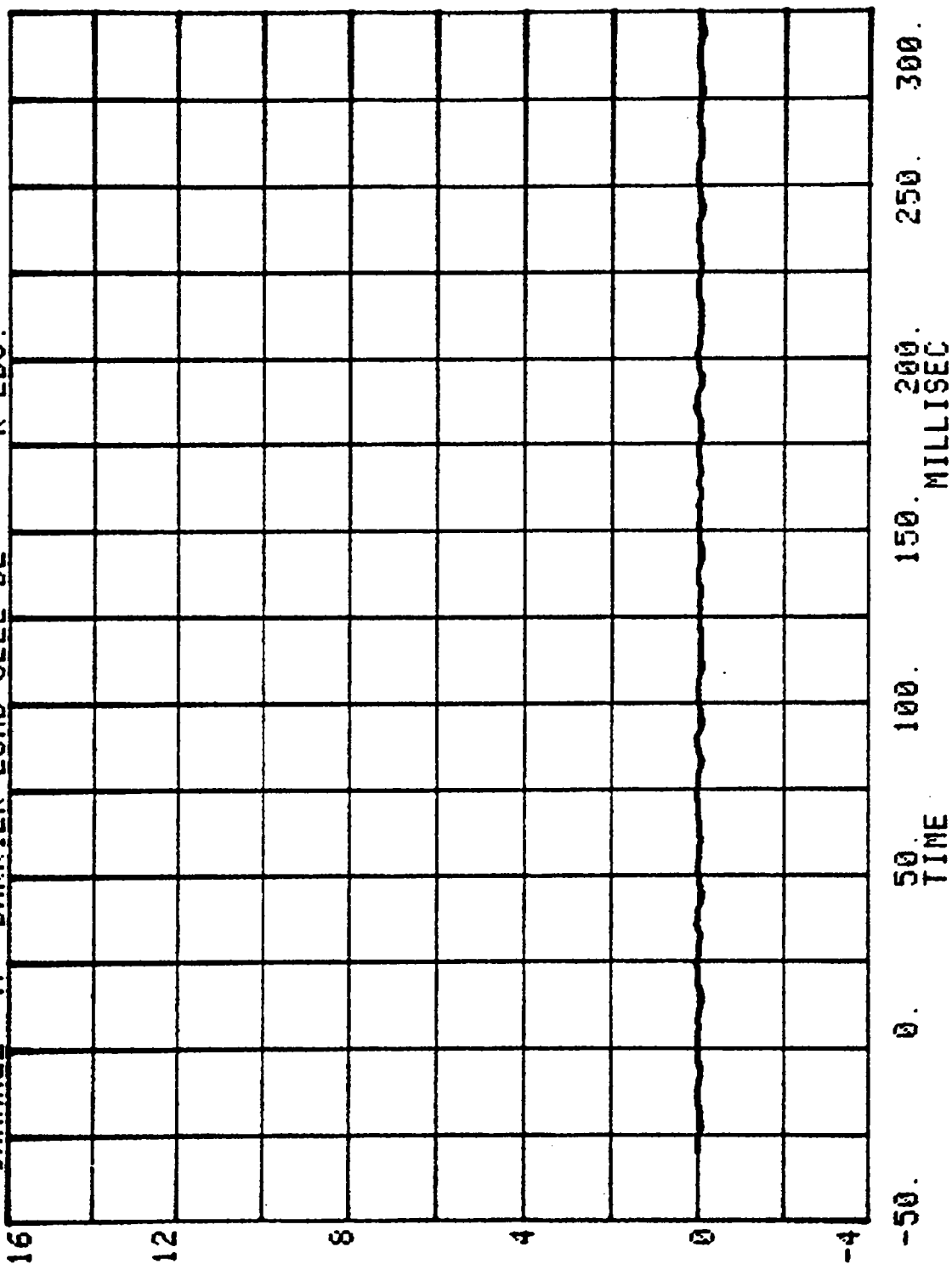


TIME
MILLISEC

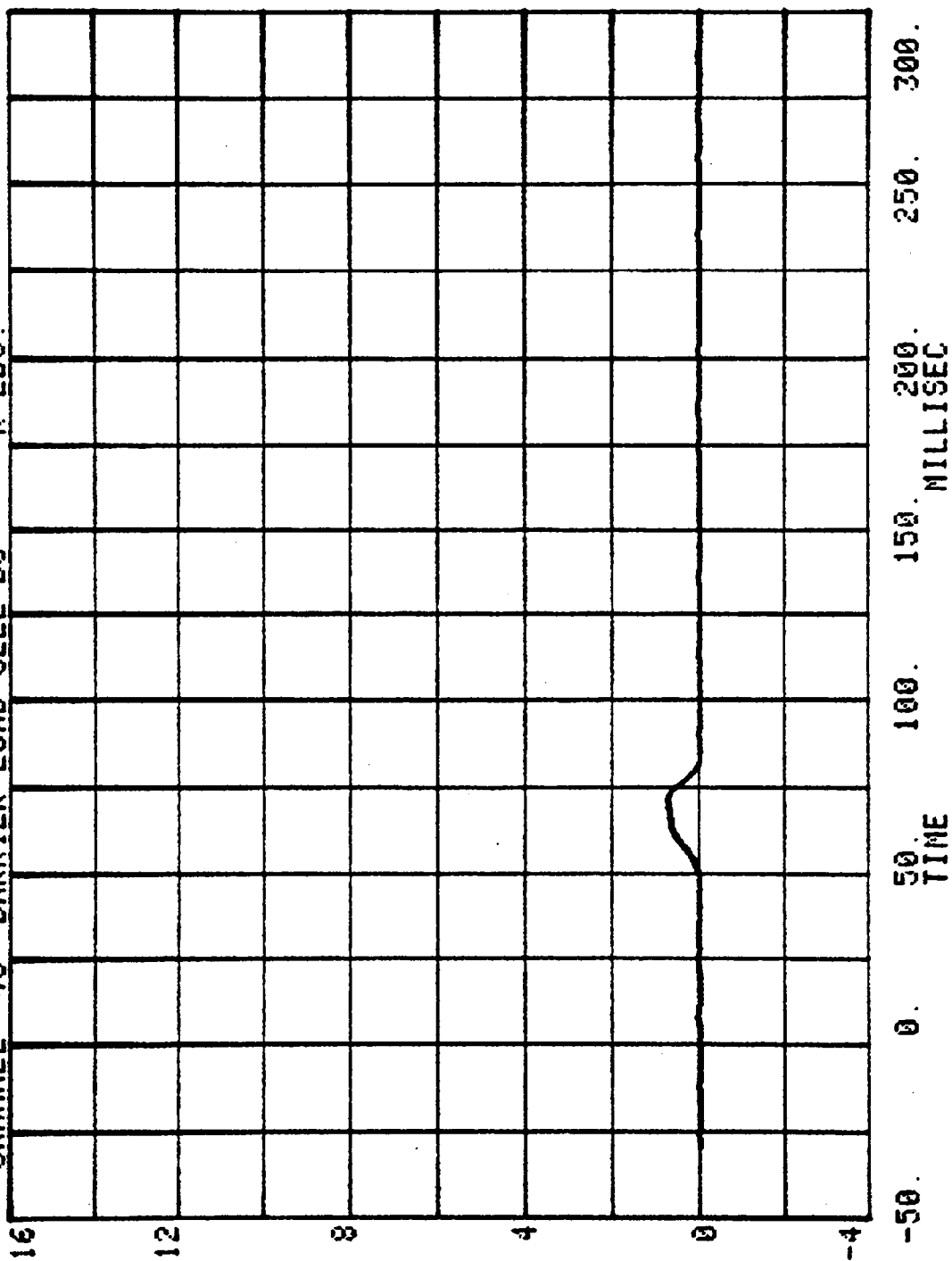
CHANNEL 46 BARRIER LOAD CELL D1 RUN= 534 SERIES= 4 K LBS.



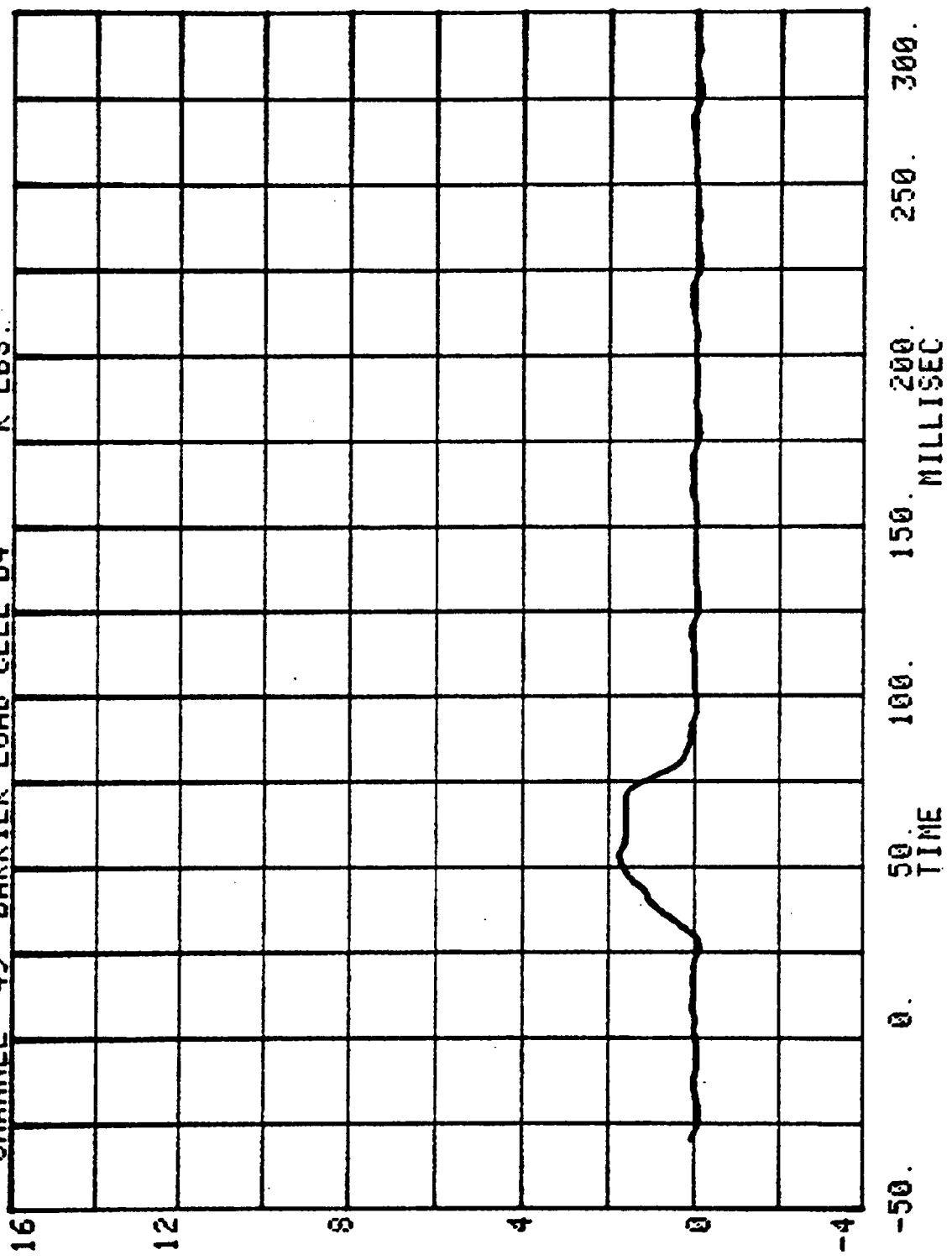
CHANNEL 47 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL D2



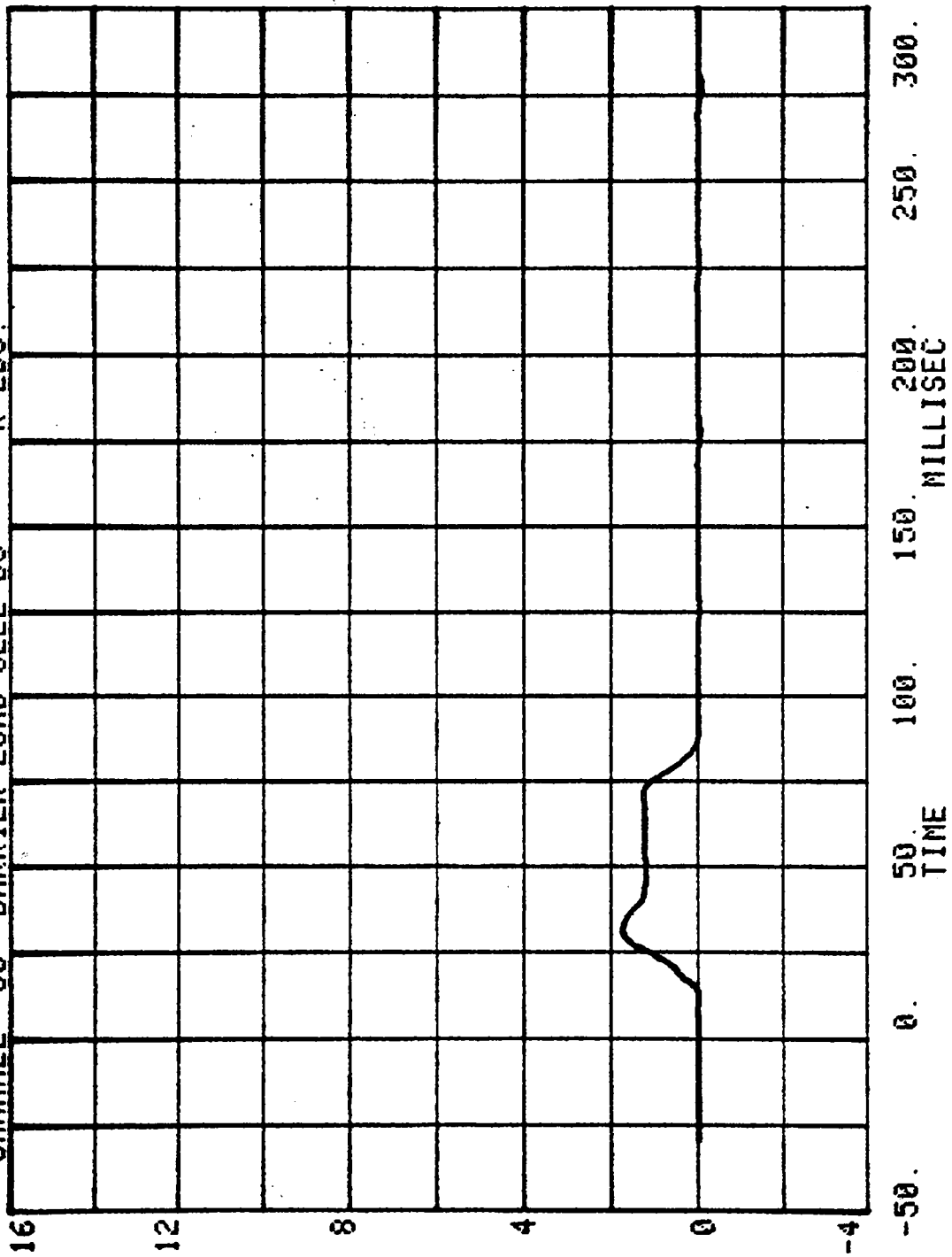
CHANNEL 48 BARRIER LOAD CELL D3 RUN= 534 SERIES= 4 K LBS.



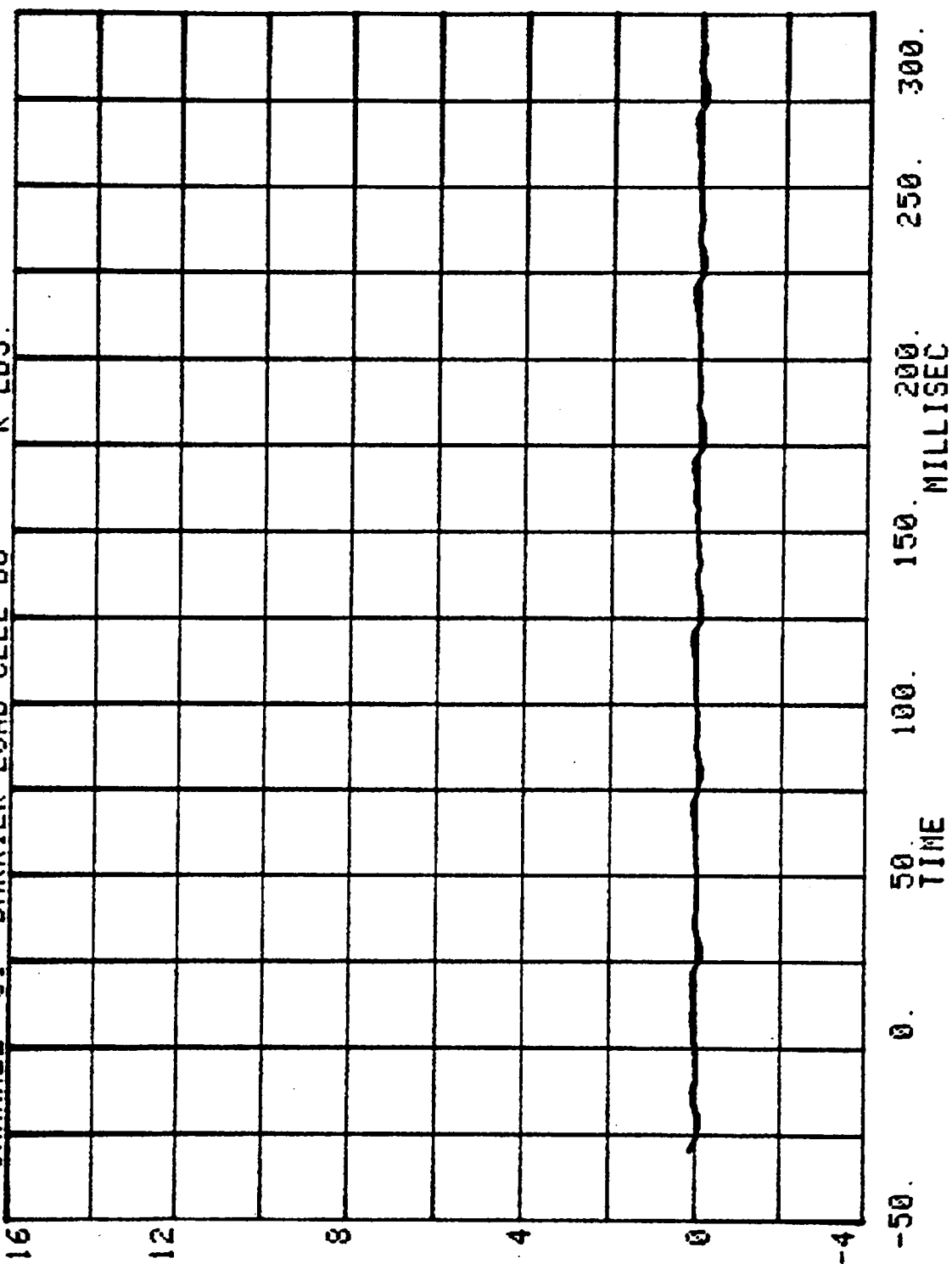
CHANNEL 49 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL D4

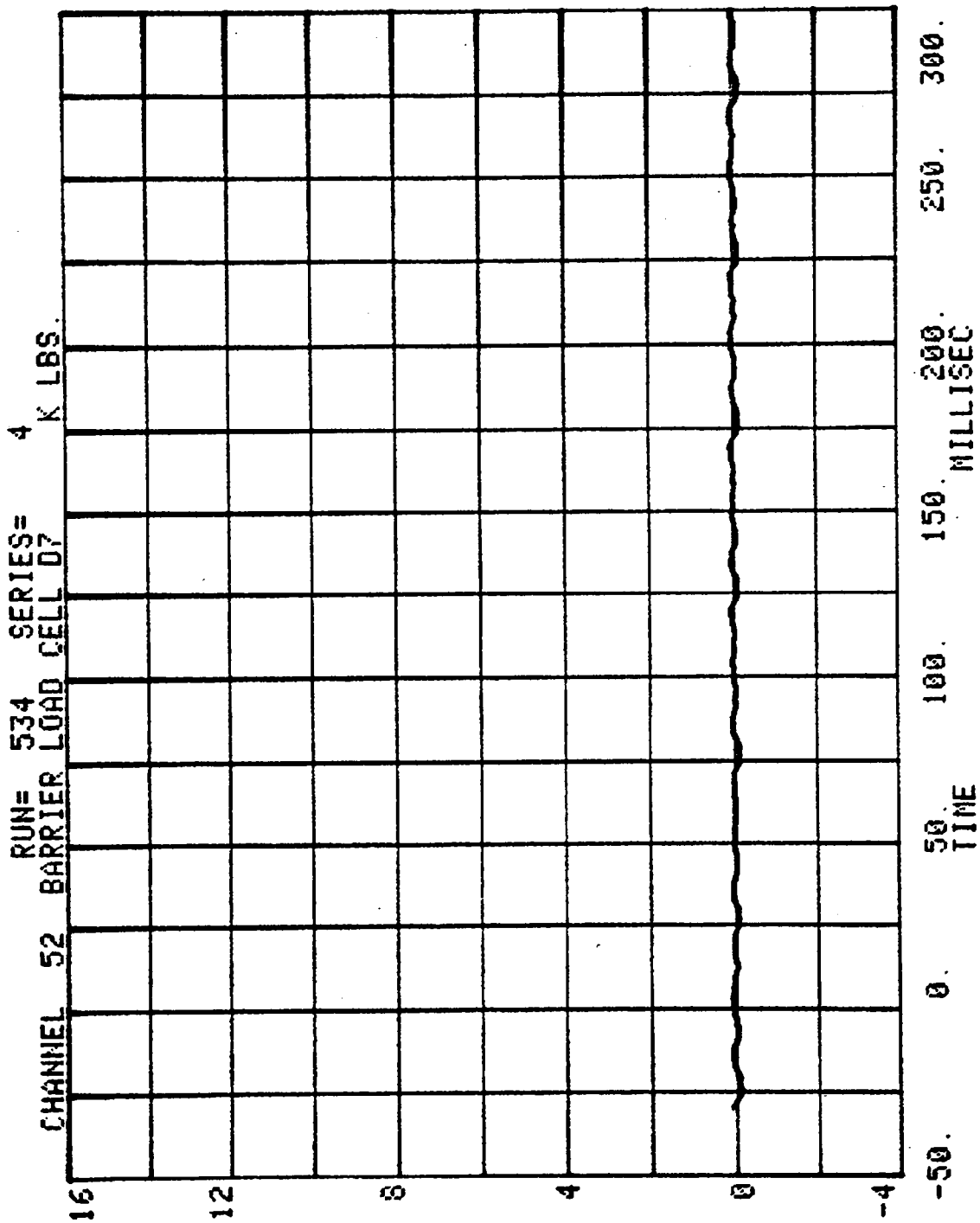


CHANNEL 50 BARRIER LOAD CELL D5 RUN= 534 SERIES= 4 K LBS.

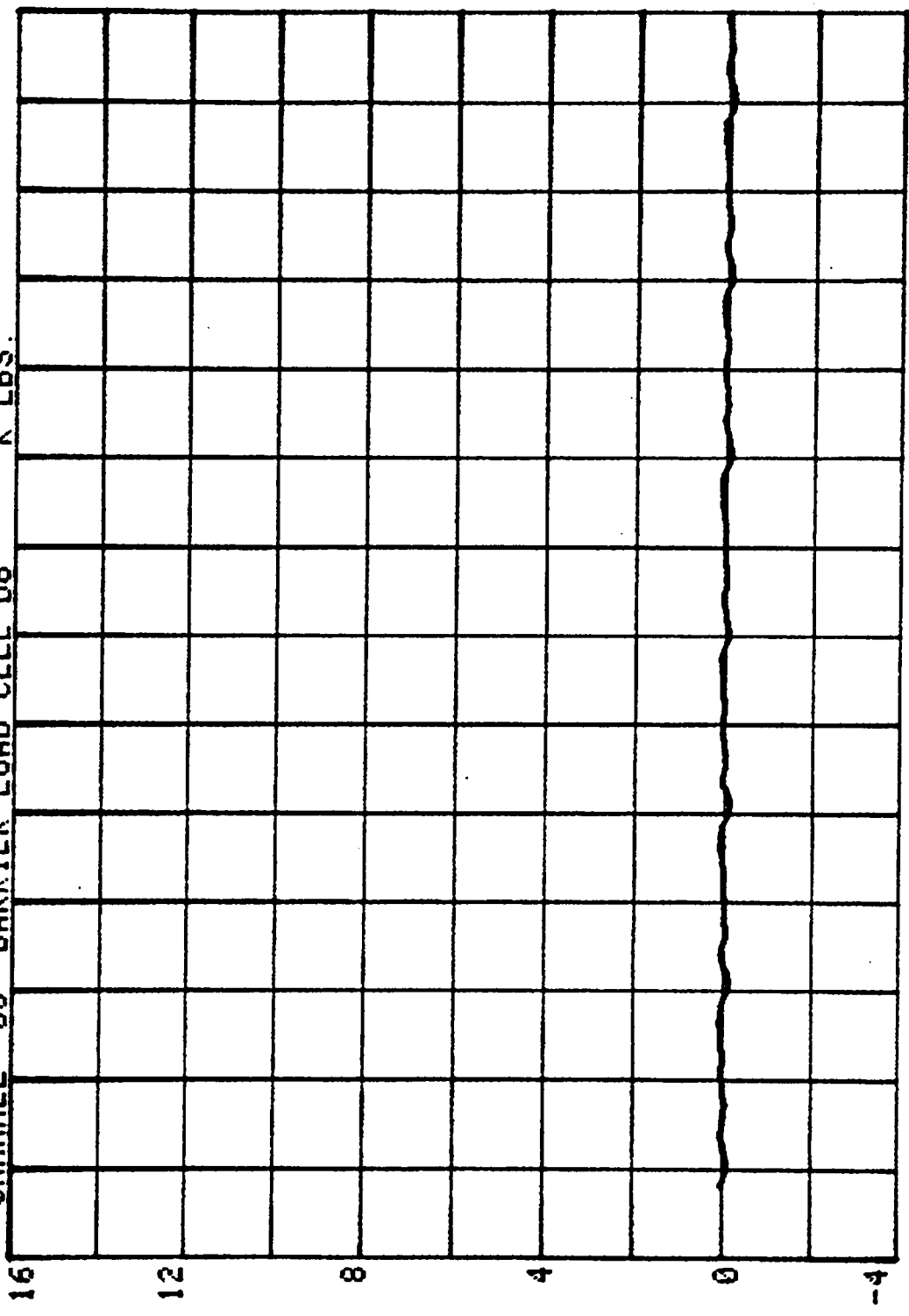


CHANNEL 51 RUN= 534 SERIES= 4
BARRIER LOAD CELL D6 K LBS.



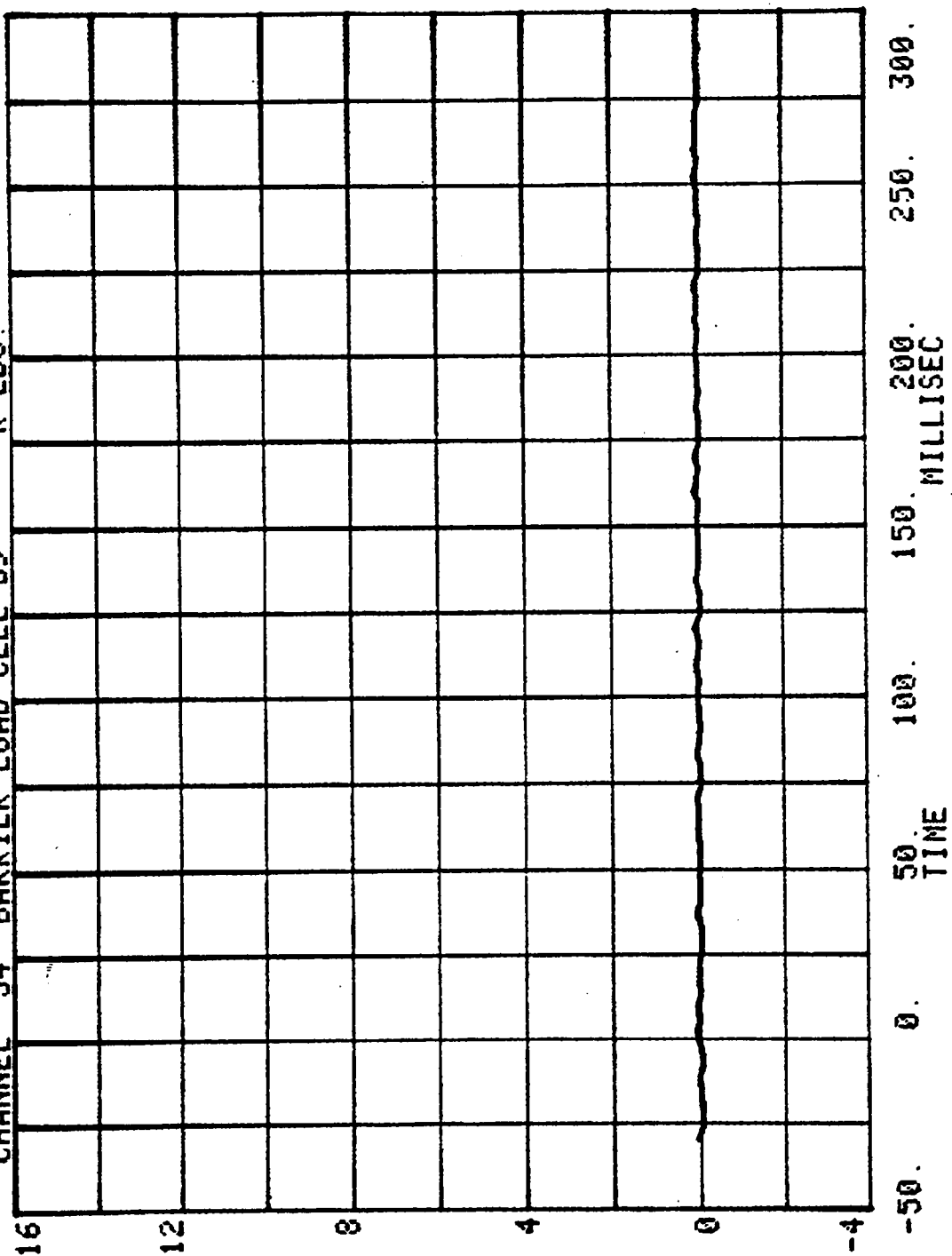


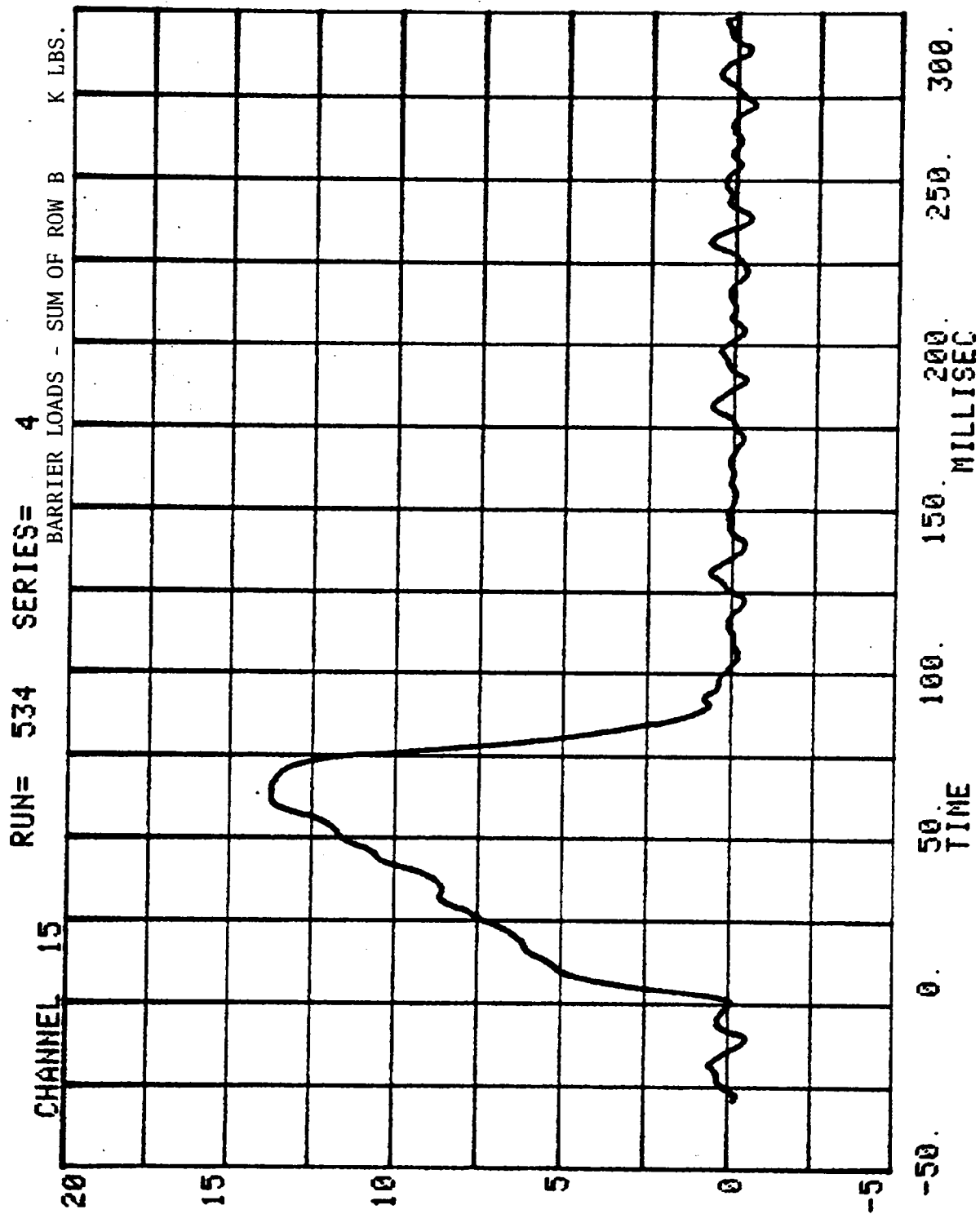
CHANNEL 53 RUN= 534 SERIES= 4 K LBS.
BARRIER LOAD CELL 08

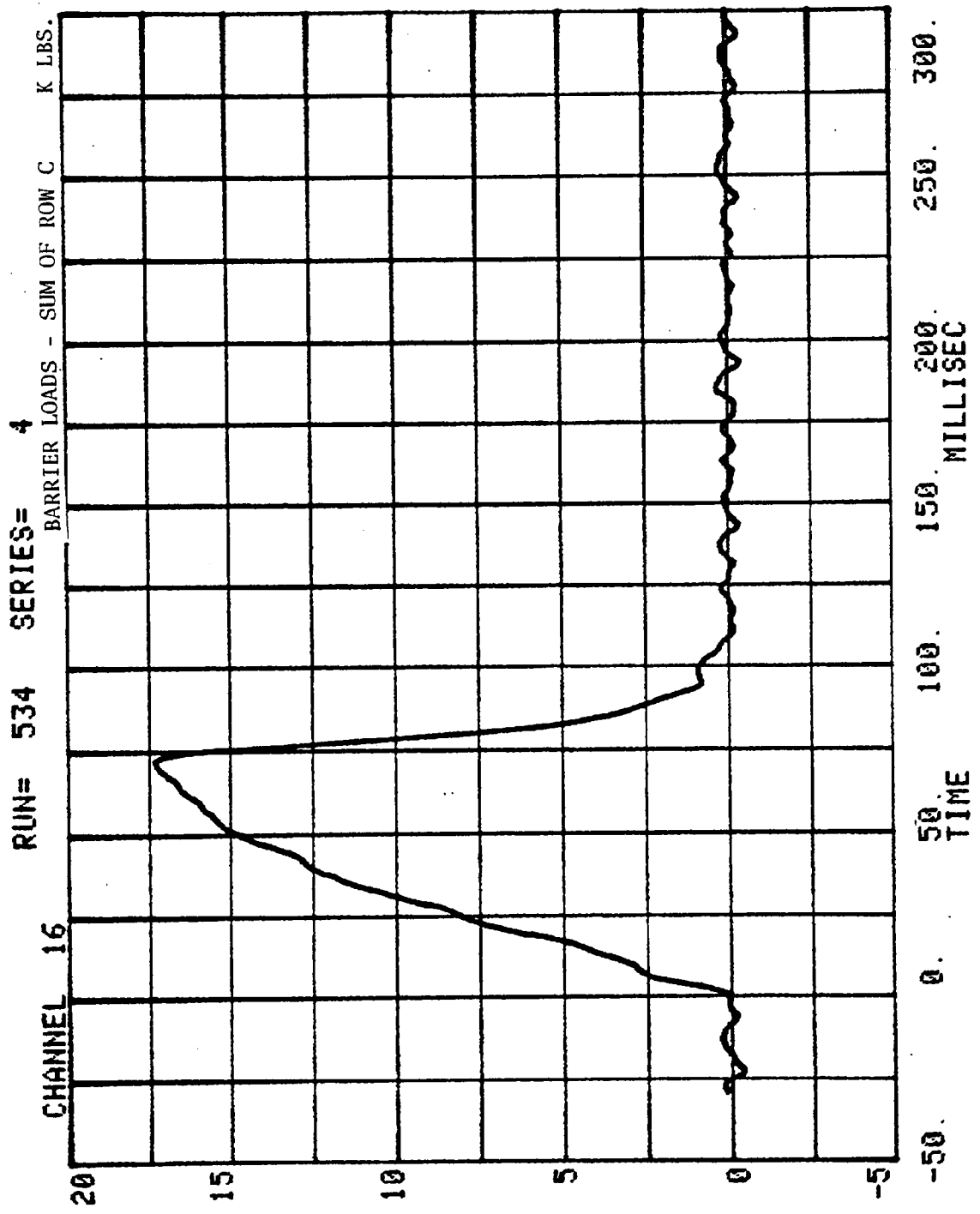


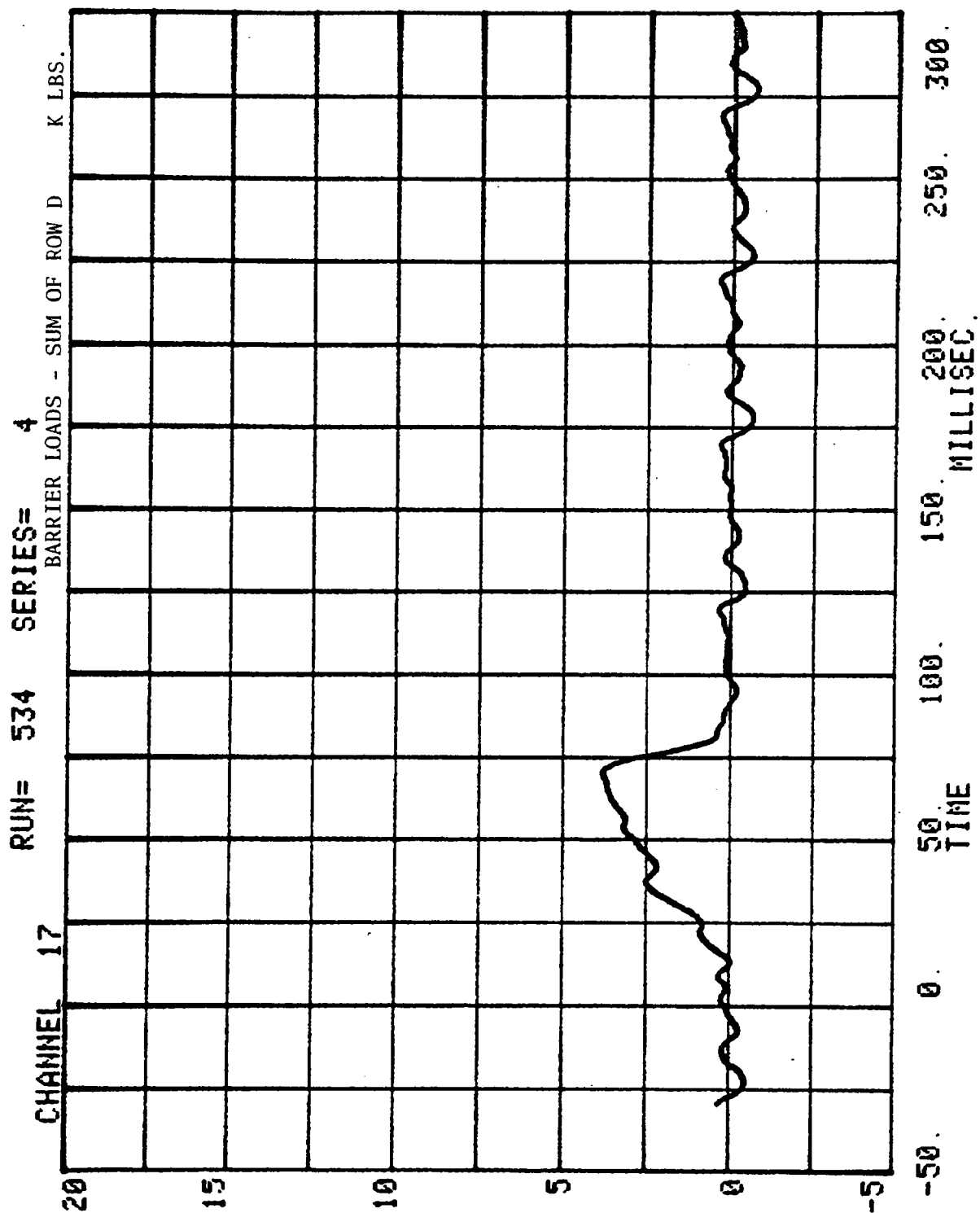
TIME
MILLISEC

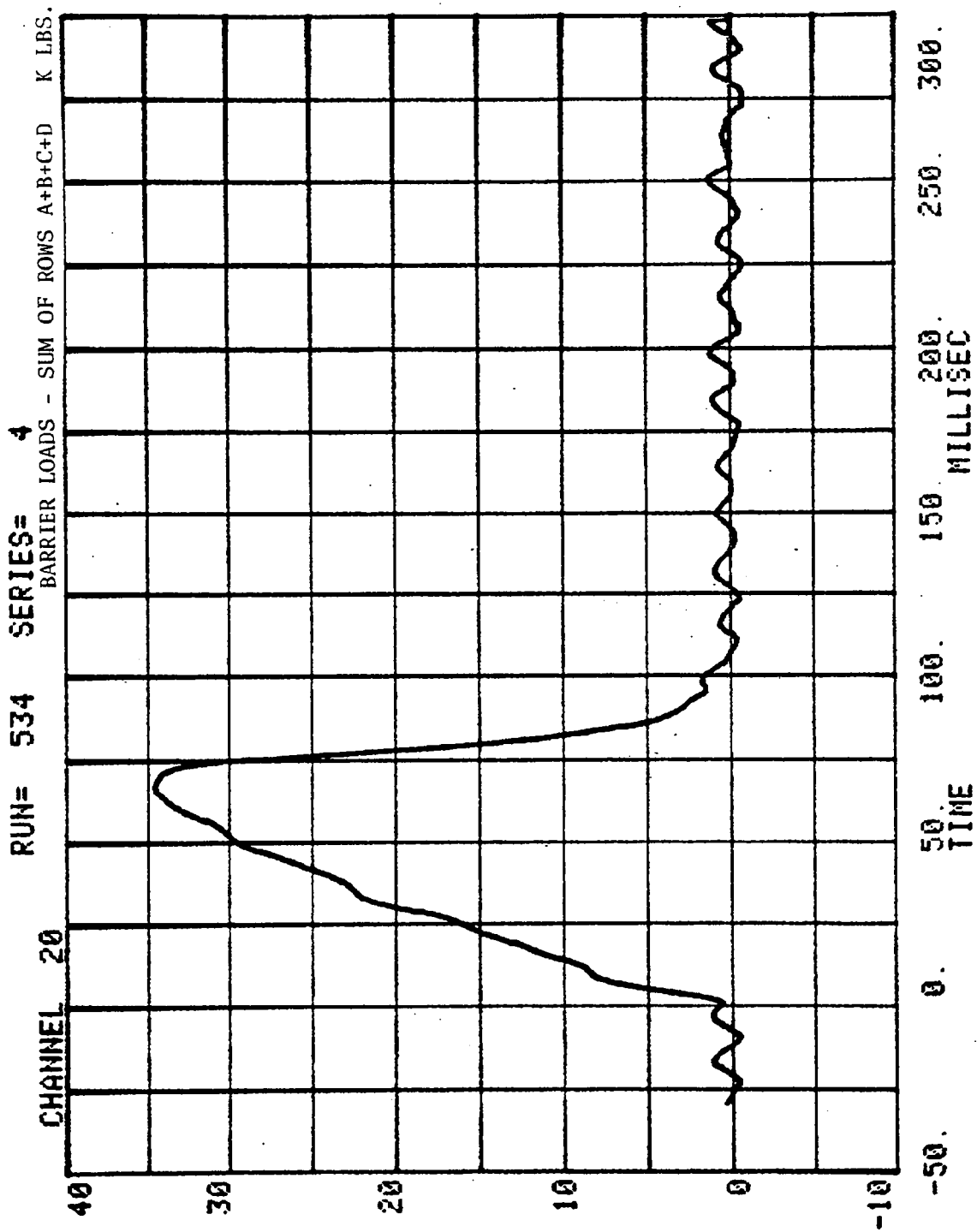
CHANNEL 54 BARRIER LOAD CELL D9 RUN= 534 SERIES= 4 K LBS.







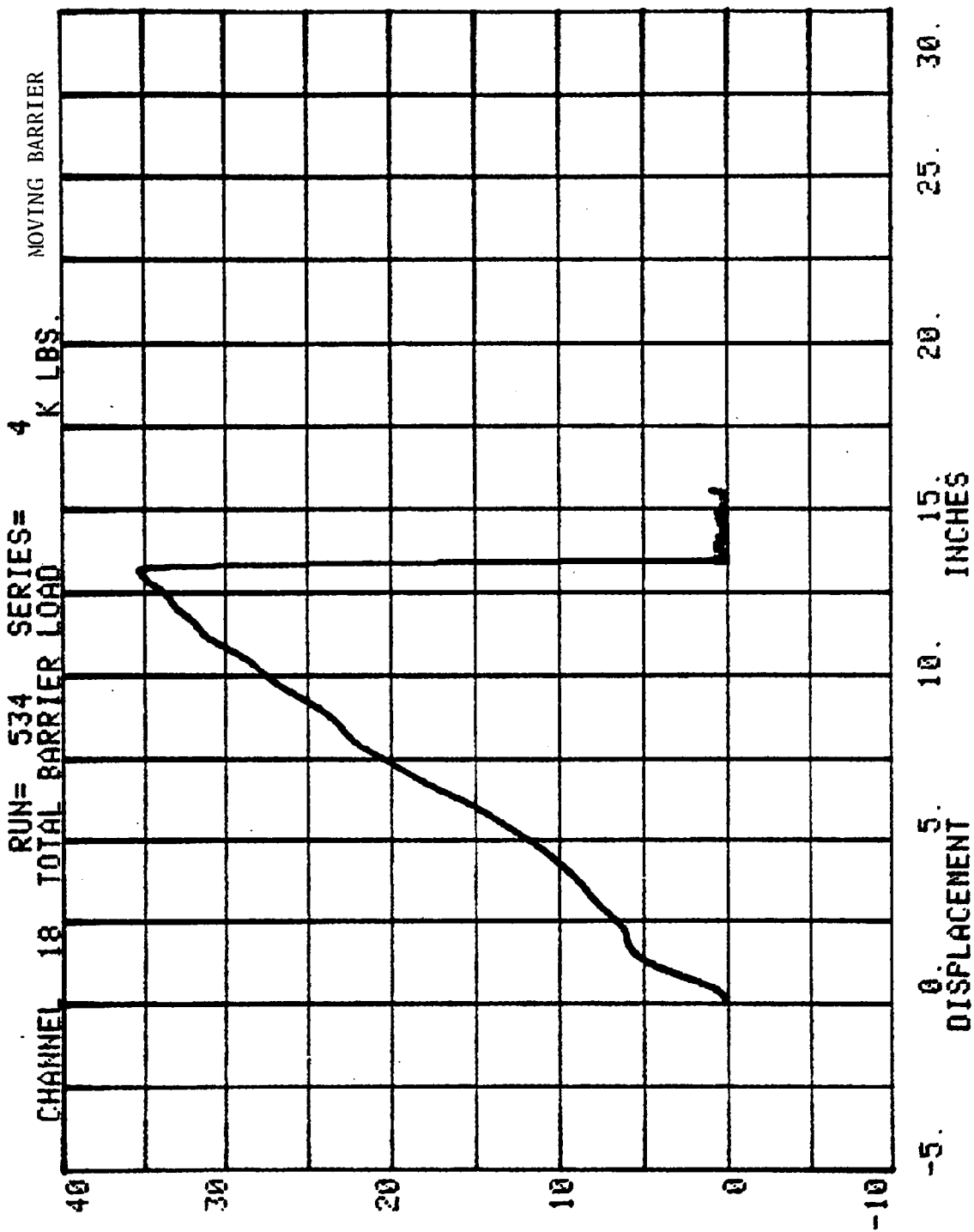




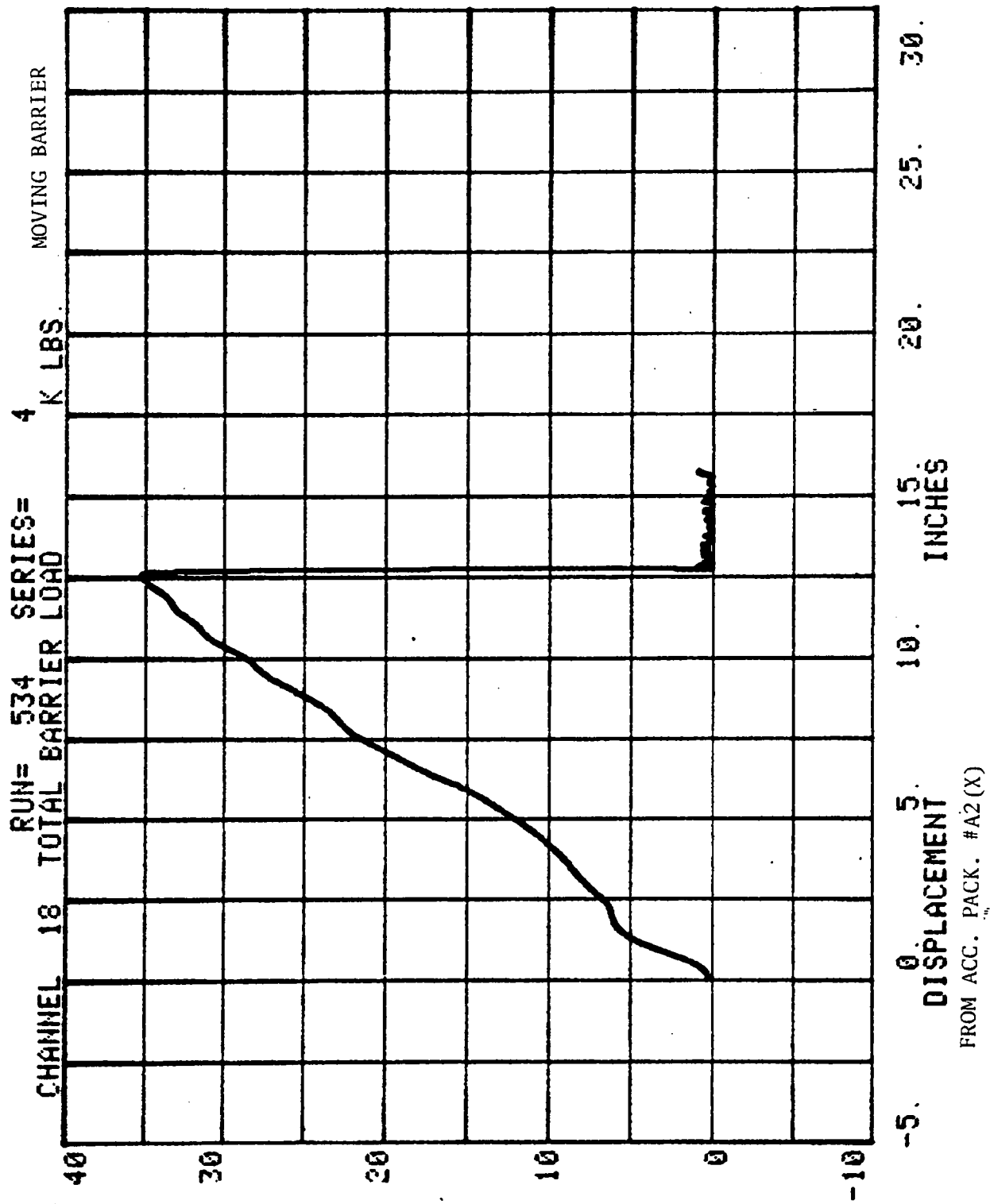
TEST NO. 4

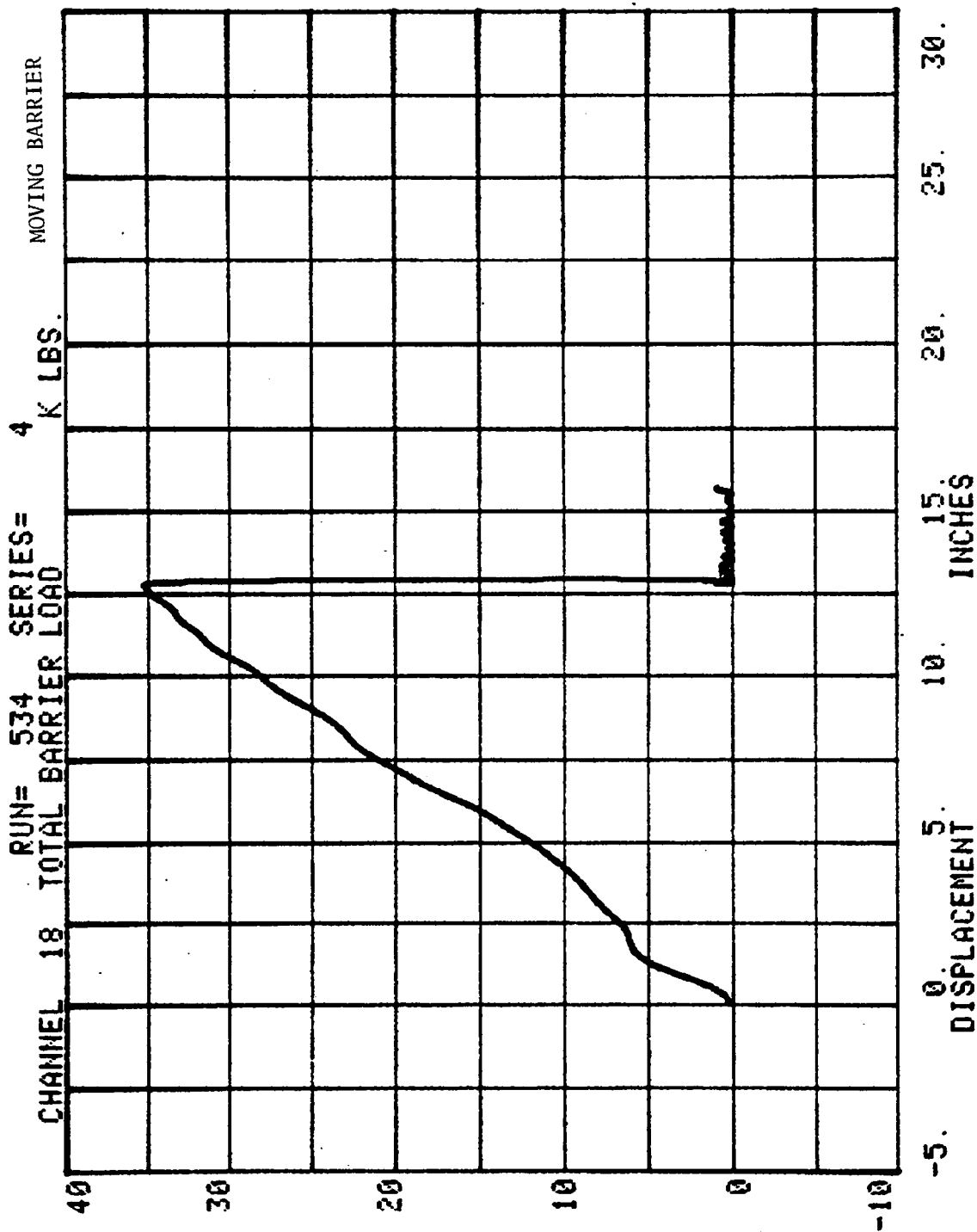
CROSS PLOTS OF MOVING BARRIER LOAD VS. DISPLACEMENT

(DERIVED FROM MOVING BARRIER ACCELERATION)

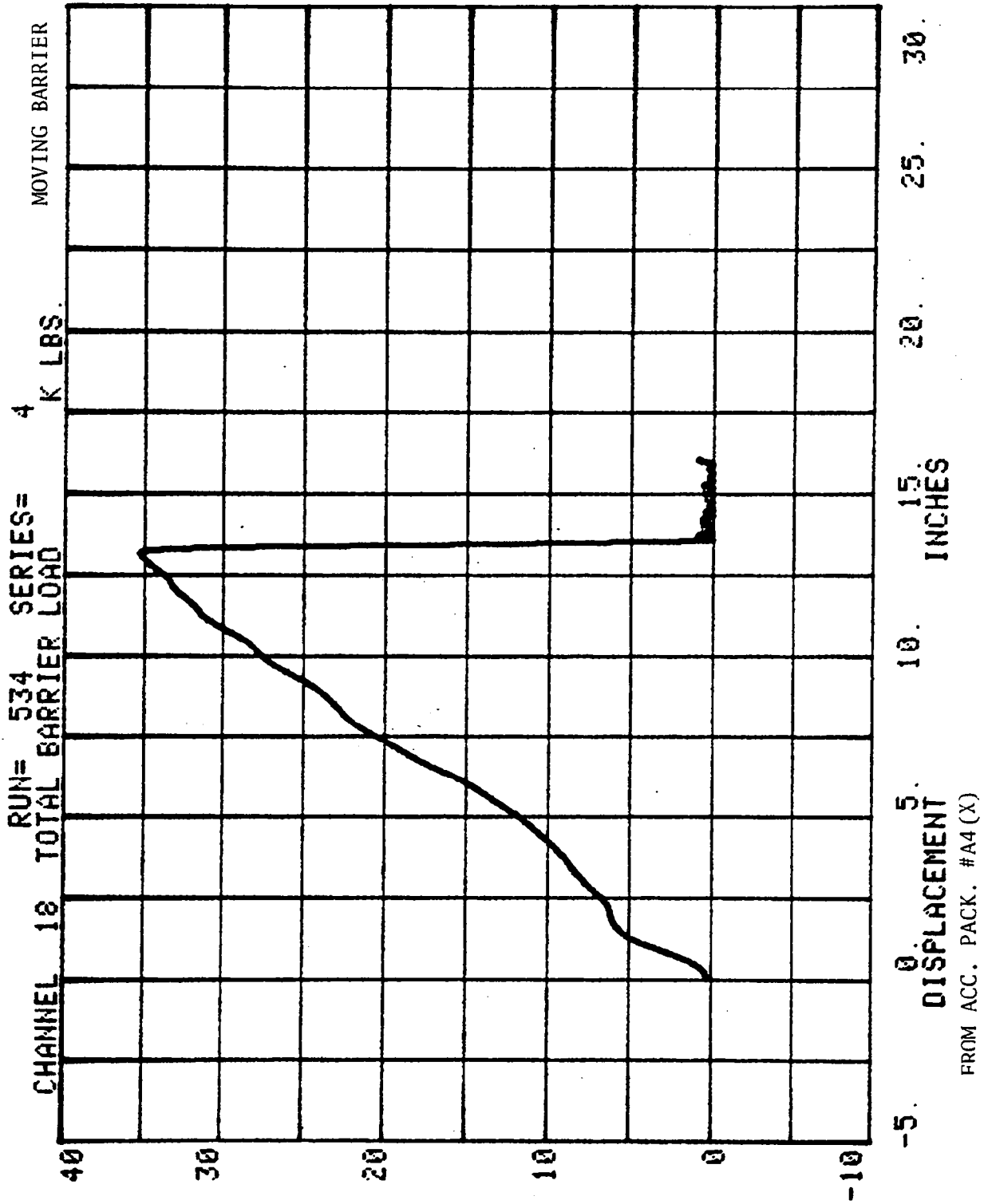


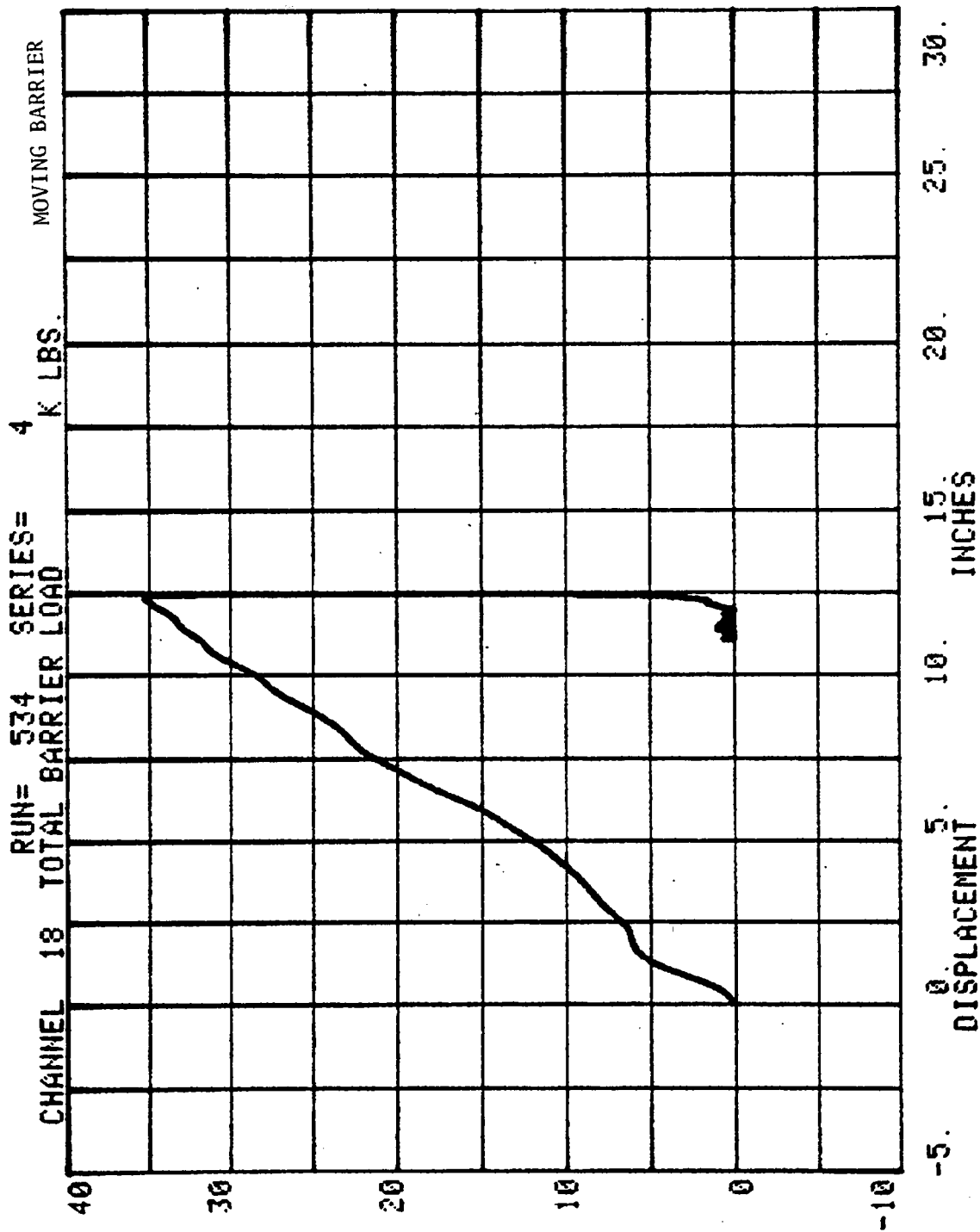
FROM ACC. PACK. #A1(X)

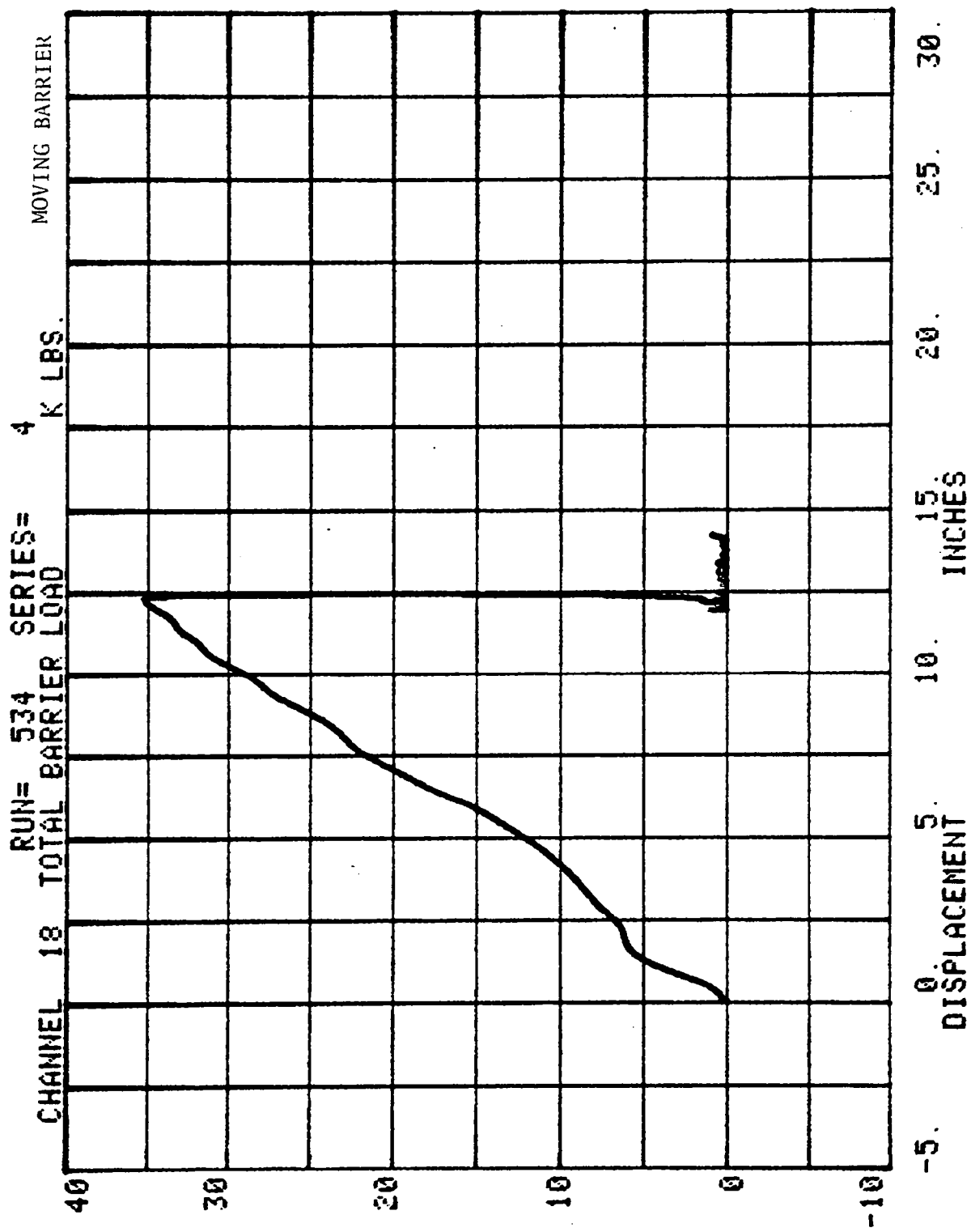




FROM ACC. PACK. #A3(X)







FROM ACC. PACK. #A6(X)