

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594
April 18, 1997

SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

ADDENDUM

Main Rudder PCU Dynamic Testing

A. ACCIDENT DCA-94-MA-076

Location: Aliquippa, Pennsylvania
Date: September 8, 1994
Time: 1904 Eastern Daylight Time
Aircraft: Boeing 737-300, N513AU

B. SYSTEMS GROUP

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National Transportation Safety Board
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Air Line Pilots Association/USAir
Coraopolis, PA

Member: Ken Frey
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C. SUMMARY

On September 8, 1994, at 1904 Eastern Daylight time, USAir flight 427, a Boeing 737-3B7 (B-737-300), N513AU, crashed while maneuvering to land at Pittsburgh International Airport, Pittsburgh, Pennsylvania. The airplane was being operated on an instrument flight rules (IFR) flight plan under the provisions of Title 14, Code of Federal Regulation (CFR), Part 121, on a regularly scheduled flight from Chicago, Illinois, to Pittsburgh. The airplane was destroyed by impact forces and fire near Aliquippa, Pennsylvania. All 132 persons on board were fatally injured.

D. DETAILS OF THE INVESTIGATION

General

The systems group, performed a series of tests at Boeing in Seattle, Washington, on September 16-20, 1996, to examine the effects of dynamic external loads applied to the Boeing 737 main rudder power control unit (PCU).

The testing was designed to explore the response of the main rudder PCU to external loads applied to the PCU output ram while applying different input commands to the manual input crank and the yaw damper system. Normal PCU operation and pressurization failures of the hydraulic system were explored during the tests.

A test fixture was used to hold the PCU for the tests. The test fixture schematic is shown in Figure 1. Five different test series were conducted. They were: (1) wake encounter simulation tests (dynamic load application during yaw damper sinusoidal response with no manual input to the PCU), (2) yaw damper hardover tests, (3) manual input with no yaw damper input, (4) manual input with no yaw damper input along with hydraulic system pressurization failures, and (5) a high load test performed only on the production PCU.

The PCU's input arm position, input arm force, output ram position, output ram force, yaw damper input command, yaw damper response command were continuously recorded during the testing. The hydraulic return system pressure and inlet temperature were manually recorded.

The test results were recorded on a strip-recorder and can be found in Attachment 1-Production Unit Test Data, and Attachment 2-Accident Unit Test Data. The test condition identifiers are noted on the data sheets.

The loads used for the testing came from an estimation¹ that USAir flight 427's main rudder PCU output rod would be subjected to a 600 lb load as a result of its encounter with wake turbulence from a Boeing 727 ahead of its flight path. The 1200 lb load testing was performed to establish a margin of confidence for the test loads by doubling the calculated load. The B-737 main rudder PCU is designed to output a force of about 6000 lbs (with both hydraulic systems pressurized).

The dynamic tests were conducted on the production PCU (s/n 2203A)² and then repeated on the accident PCU (s/n 1596A). Both PCUs responded normally throughout all tests. There were no abnormal motions of either PCU.

Test Matrix

Test matrix column label definitions

Test: test (condition) number, load/direction/type: load applied to ram in lbs./direction of load applied/impulse or delayed input³, y/d command: externally applied yaw damper signal, input: direction of input to PCU input arm, hyd: hydraulic system operation; all = both systems, 2203A: production PCU-test result, 1596A: accident PCU-test result

Wake encounter simulation tests

<u>Test</u>	<u>Load/direction/type</u>	<u>y/d command</u>	<u>input</u>	<u>hyd</u>	<u>2203A</u>	<u>1596A</u>
1	600/ret/imp	±3° @ 3 Hz	none	all	normal	normal
2	600/ext/imp	±3° @ 3 Hz	none	all	normal	normal
3	600/ext/imp	±3° @ 1 Hz	none	all	normal	normal
4	1200/ret/imp	±3° @ 1 Hz	none	all	normal	normal
5	1200/ext/imp	±3° @ 1 Hz	none	all	normal	normal

Yaw damper hardover tests

<u>Test</u>	<u>Load/direction/type</u>	<u>y/d command</u>	<u>input</u>	<u>hyd</u>	<u>2203A</u>	<u>1596A</u>
6	600/ret/imp	right (retract)	none	all	normal	normal
7	600/ext/imp	right	none	all	normal	normal
8	600/ret/imp	left (extend)	none	all	normal	normal
9	600/ext/imp	left	none	all	normal	normal
10	1200/ret/imp	right	none	all	normal	normal
11	1200/ext/imp	right	none	all	normal	normal
12	1200/ret/imp	left	none	all	normal	normal
13	1200/ext/imp	left	none	all	normal	normal

¹ Estimate provided by NTSB performance group evaluation of flight test data

² Identified on data sheet as "engineering unit." This PCU was procured through Boeing engineering and the term engineering unit has no other meaning. The PCU was representative of production stock.

³ Ret=retract load, ext=extend load, imp=impulse load, del=delayed or slowly applied load

Manual input with no yaw damper input

<u>Test</u>	<u>Load/direction/type</u>	<u>y/d command</u>	<u>input</u>	<u>hyd</u>	<u>2203A</u>	<u>1596A</u>
14	600/ext/del	none	ext	all	normal	normal
15	600/ret/del	none	ret	all	normal	normal
16	600/ext/del	none	ret	all	normal	normal
17	600/ret/del	none	ext	all	normal	normal
18	1200/ext/del	none	ext	all	normal	normal
19	1200/ret/del	none	ret	all	normal	normal
20	1200/ext/del	none	ret	all	normal	normal
21	1200/ret/del	none	ext	all	normal	normal

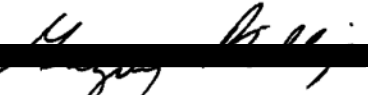
Manual input with no yaw damper and simulated hydraulic system failures (pressure)

<u>Test</u>	<u>Load/direction/type</u>	<u>y/d command</u>	<u>input</u>	<u>hyd</u>	<u>2203A</u>	<u>1596A</u>
22	600/ext/del	none	ext	A only	normal	normal
23	600/ret/del	none	ret	A only	normal	normal
24	600/ext/del	none	ret	A only	normal	normal
25	600/ret/del	none	ext	A only	normal	normal
26	600/ext/del	none	ext	*A 1500	normal	normal
27	600/ret/del	none	ret	*A 1500	normal	normal
28	1200/ext/del	none	ext	*A 1500	normal	normal
29	1200/ret/del	none	ret	*A 1500	normal	normal

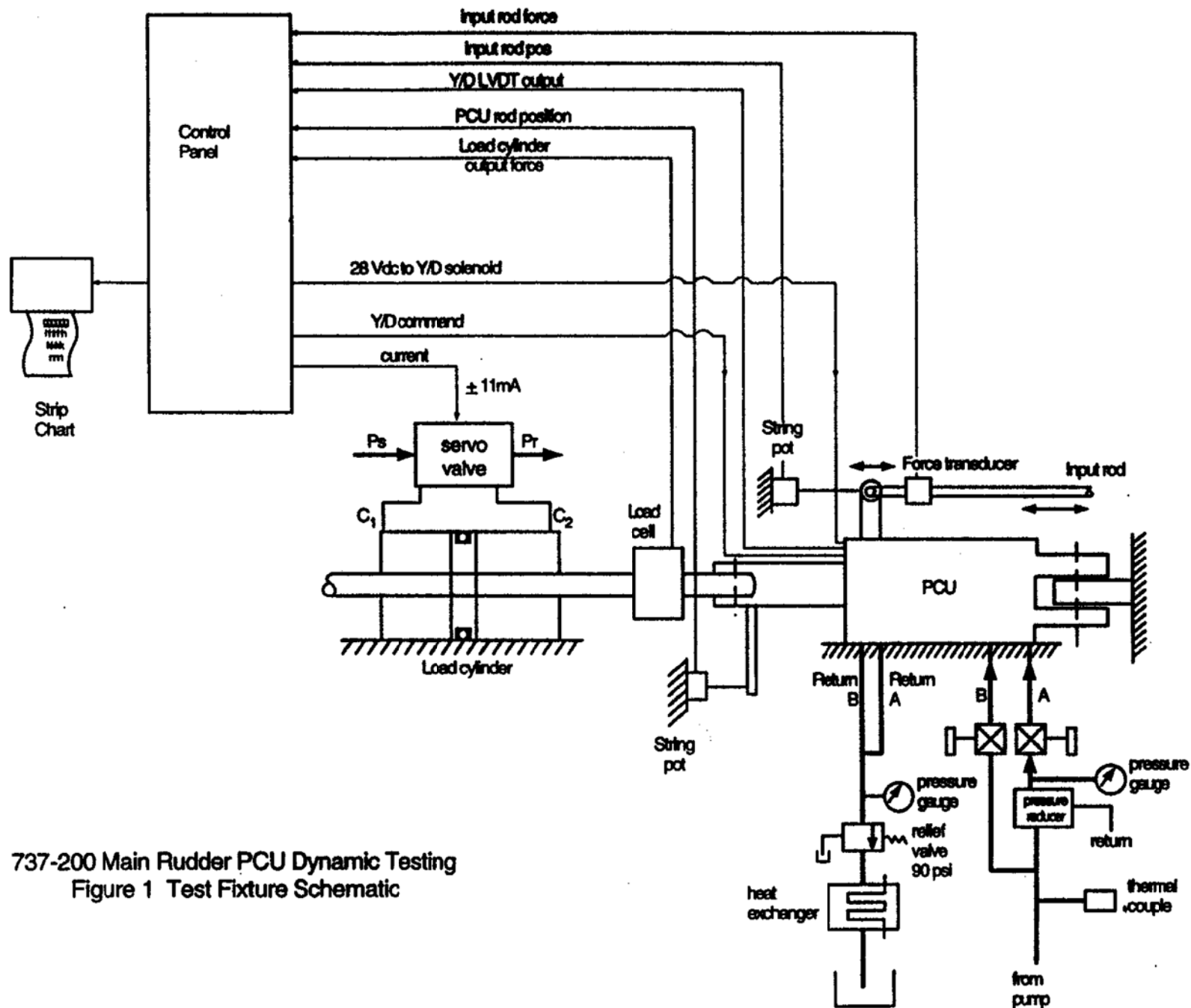
*B system pressure 3000 psi

High load test (performed only on production PCU)

<u>Test</u>	<u>Load/direction/type</u>	<u>y/d command</u>	<u>input</u>	<u>hyd</u>	<u>2203A</u>
30	3500/ext/imp	none	ret	all	normal
31	3500/ext/imp	none	ext	all	normal


Gregory Phillips
Systems Group Chairman
National Transportation Safety Board

per 4/16/97



737-200 Main Rudder PCU Dynamic Testing
Figure 1 Test Fixture Schematic

Attachment 1
Production Unit Test Data

*CH 01: - 3.00 V to + 3.00 V

Channel #1 A/P LYDT SIN/DIV

*CH 02: - 2.00 V to + 2.00 V

Channel #2 Y/D PROGRAM

*CH 03: - 2.24 V to + 2.10 V

Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH 04: - 300 mV to + 300 mV

Channel #4 INPUT LOAD 150LS/DIV

*CH 05: - 4.00 V to + 4.00 V

Channel #5 OUTPUT LOAD 200LS/DIV

*CH 06: - 1.00 V to + 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT 18MA/DIV

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*CH 07: -10.00 V to +10.00 V

Channel #7 Y/D ENGAGE SOLENOID 28 VDC

*CH 08: - 0.03 V to + 4.03 V

Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 09: - 2.50 V to + 2.50 V

Channel #9

*CH 10: - 2.50 V to + 2.50 V

Channel #10

*CH 11: - 2.50 V to + 2.50 V

Channel #11

*CH 12: - 2.50 V to + 2.50 V

Channel #12

*CH 13: - 2.50 V to + 2.50 V

Channel #13

*CH 14: - 2.50 V to + 2.50 V

Channel #14

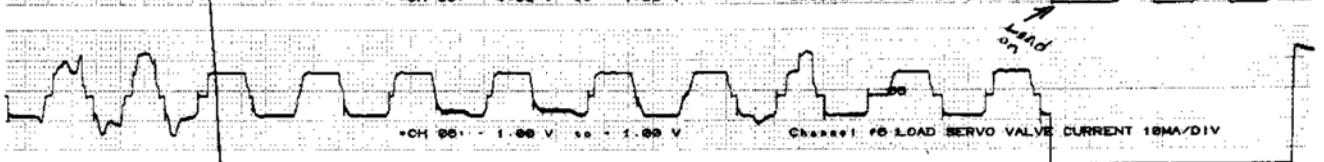
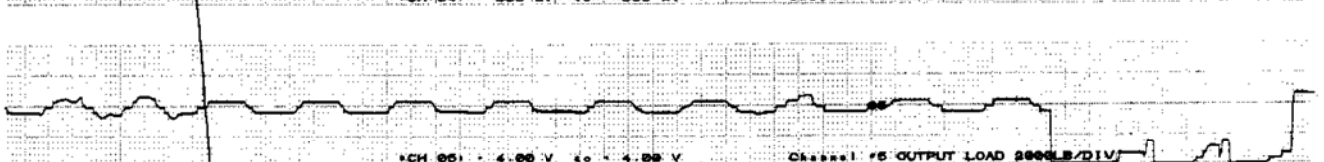
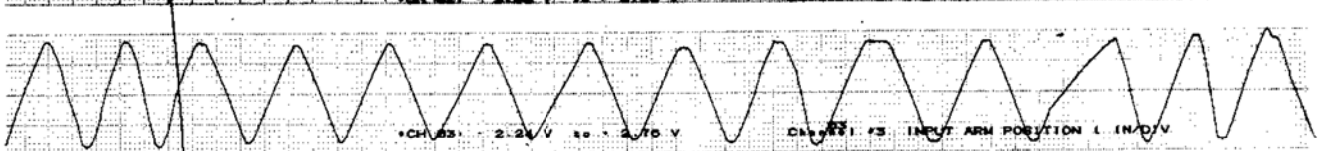
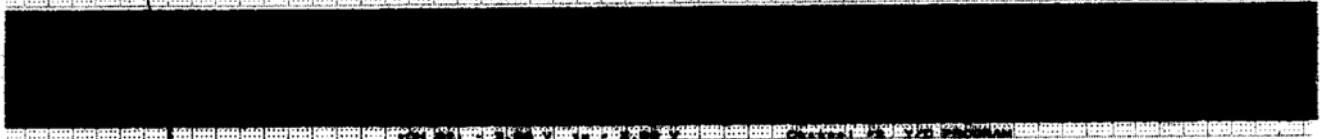
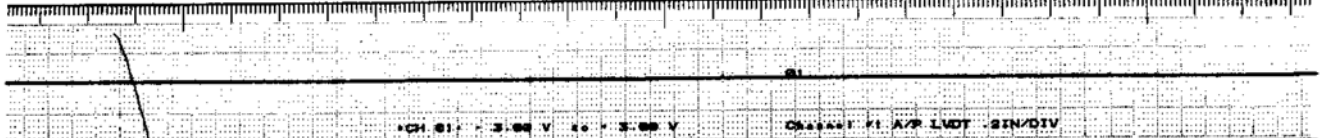
*CH 15: - 2.50 V to + 2.50 V

Channel #15

*CH 16: - 2.50 V to + 2.50 V

Channel #16

DYNAMIC TEST
RUBBER PCU
(ENGINEERING H)

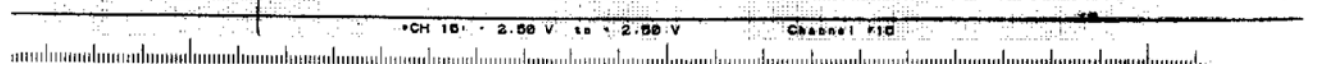
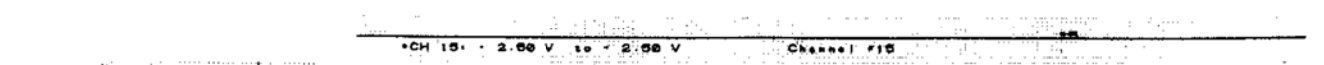
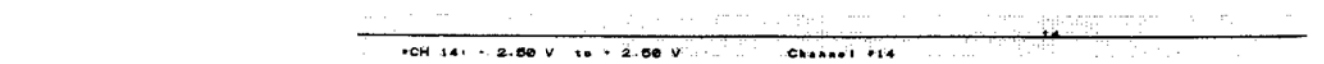
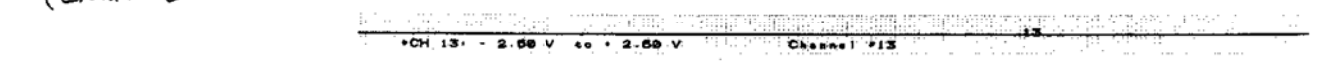
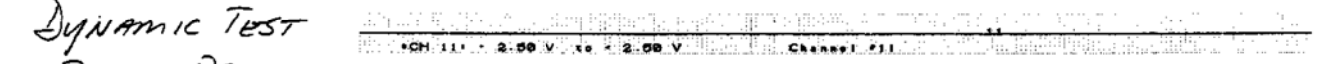
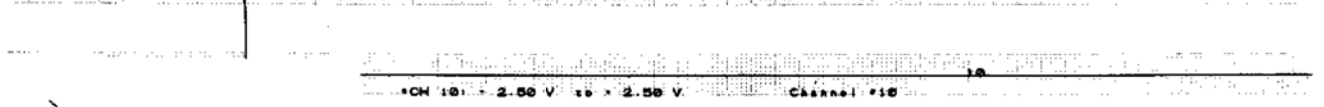
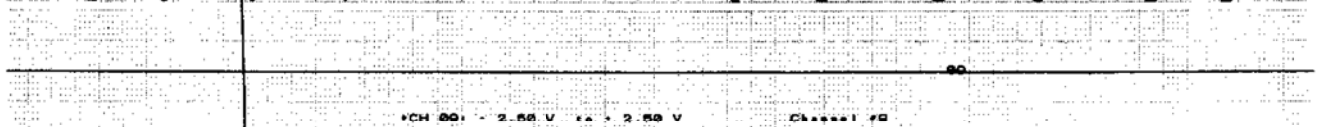
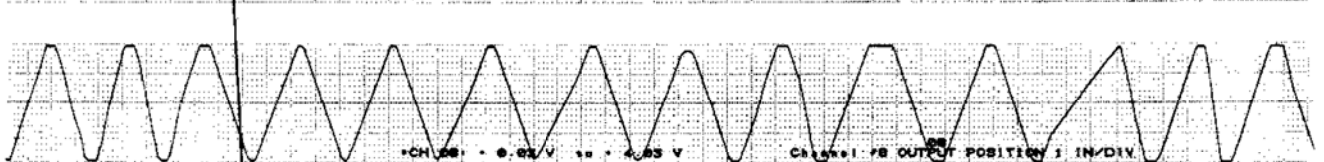
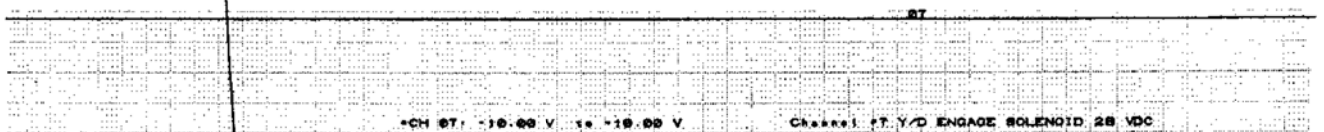


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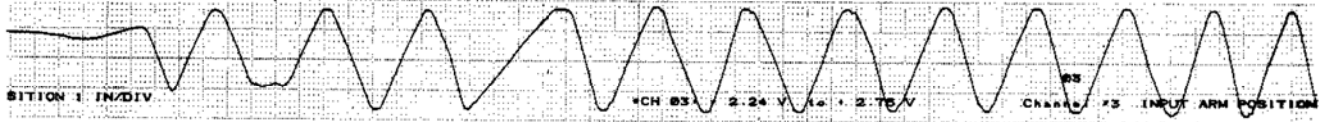
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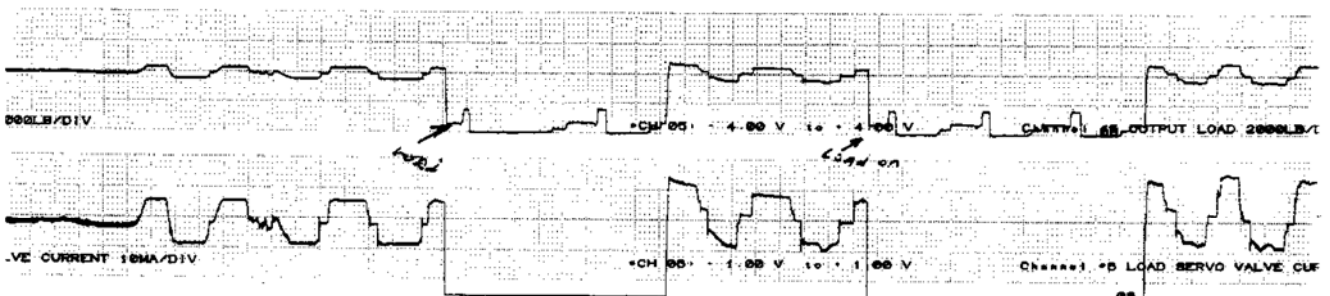
DYNAMIC TEST
RUDDER PCU
(ENGAGE SOLENOID 28VDC)

1/DIV *CH 01: 2.00 V to 2.00 V Channel #1 A/P LVDT 2IN/DIV

*CH 02: 2.00 V to 2.00 V Channel #2 Y/D PROGRAM



0.5E/DIV *CH 04: 300 mV to 300 mV Channel #4 INPUT LOAD 1500LB/DIV

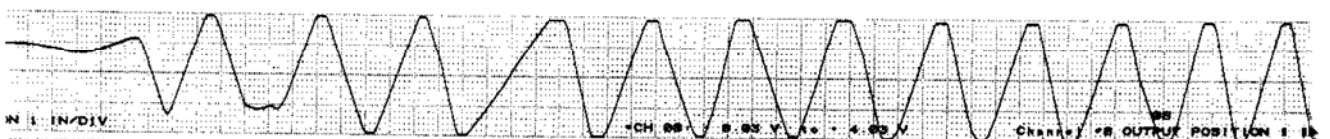


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MT95K2 MULTI-TASK RECORDER

*CH 07: 10.00 V to 10.00 V Channel #7 Y/D ENGAGE SOLENOID



*CH 09: 2.00 V to 2.00 V Channel #9

*CH 10: 2.00 V to 2.00 V Channel #10

*CH 11: 2.00 V to 2.00 V Channel #11

*CH 12: 2.00 V to 2.00 V Channel #12

*CH 13: 2.00 V to 2.00 V Channel #13

*CH 14: 2.00 V to 2.00 V Channel #14

*CH 15: 2.00 V to 2.00 V Channel #15

*CH 16: 2.00 V to 2.00 V Channel #16

DYNAMIC TEST
 RUDDER PCU
 (ENGINEERING UNIT)

CH 01: 5.00 V to 5.00 V Channel #1

CH 02: 5.00 V to 5.00 V Channel #2

CH 03: 2.24 V to 2.70 V Channel #3

CH 04: 300 mV to 300 mV Channel #4

CH 05: 4.00 V to 4.00 V Channel #5

CH 06: 1.00 V to 1.00 V Channel #6

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MT95K2 MULTI-TASK RECORDER

CH 07: 10.00 V to 10.00 V Channel #7

CH 08: 0.03 V to 4.03 V Channel #8

CH 09: 2.00 V to 2.00 V Channel #9

CH 10: 2.00 V to 2.00 V Channel #10

CH 11: 2.00 V to 2.00 V Channel #11

CH 12: 2.00 V to 2.00 V Channel #12

CH 13: 2.00 V to 2.00 V Channel #13

CH 14: 2.00 V to 2.00 V Channel #14

CH 15: 2.00 V to 2.00 V Channel #15

CH 16: 2.00 V to 2.00 V Channel #16

*DYNAMIC TEST
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(ENGINEERING UNIT)*

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Ch1 #1 A/P LVDT .2IN/DIV Channel #1 A/P LVDT .2IN/DIV Channel #1 A/P LVDT .2IN/DIV

Ch1 #2 Y/D PROGRAM Channel #2 Y/D PROGRAM Channel #2 Y/D PROGRAM

Ch1 #3 INPUT ARM POSITION 1 IN/DIV Channel #3 INPUT ARM POSITION 1 IN/DIV Channel #3 INPUT ARM POSITION 1 IN/DIV

Ch1 #4 INPUT LOAD 150LB/DIV Channel #4 INPUT LOAD 150LB/DIV Channel #4 INPUT LOAD 150LB/DIV

→ Scale changed to 2000lb/div

Ch1 #5 OUTPUT LOAD 2000LB/DIV Channel #5 OUTPUT LOAD 2000LB/DIV Channel #5 OUTPUT LOAD 2000LB/DIV

Ch1 #6 LOAD SERVO VALVE CURRENT 10MA/DIV Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV



MT95K2 MULTI-TASK RECORDER

Ch1 #7 Y/D ENGAGE SOLENOID 20 VDC Channel #7 Y/D ENGAGE SOLENOID 20 VDC Channel #7 Y/D ENGAGE SOLENOID 20 VDC

Ch1 #8 OUTPUT POSITION 1 IN/DIV Channel #8 OUTPUT POSITION 1 IN/DIV Channel #8 OUTPUT POSITION 1 IN/DIV

Ch1 #9 Channel #9 Channel #9

Ch1 #10 Channel #10 Channel #10

Ch1 #11 Channel #11 Channel #11

Ch1 #12 Channel #12 Channel #12

Ch1 #13 Channel #13 Channel #13

Ch1 #14 Channel #14 Channel #14

Ch1 #15 Channel #15 Channel #15

Ch1 #16 Channel #16 Channel #16

DYNAMIC TEST
RUDDER PCU
(ENTERING UNIT)

01
to 3.00 V Channel #1 A/P LVDT 2IN/DIV CH 01 3.00 V to



to 3.00 V Channel #2 Y/D PROGRAM CH 02 3.00 V to

03
to 2.75 V Channel #3 INPUT ARM POSITION 1 IN/DIV CH 03 2.24 V to

04
to 300 mV Channel #4 INPUT LOAD 150LB/DIV CH 04 300 mV to

to 2.00 V Channel #5 OUTPUT LOAD 1000LB/DIV CH 05 2.00 V to

to 1.00 V Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV CH 06 1.00 V to

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MT95K2 MULTI-TASK RECORDER

07
to 10.00 V Channel #7 Y/D ENGAGE SOLENOID 28 VDC CH 07 10.00 V to

08
to 4.03 V Channel #8 OUTPUT POSITION 1 IN/DIV CH 08 4.03 V to

09
to 2.50 V Channel #9 CH 09 2.50 V to

10
to 2.50 V Channel #10 CH 10 2.50 V to

11
to 2.50 V Channel #11 CH 11 2.50 V to

12
to 2.50 V Channel #12 CH 12 2.50 V to

13
to 2.50 V Channel #13 CH 13 2.50 V to

14
to 2.50 V Channel #14 CH 14 2.50 V to

15
to 2.50 V Channel #15 CH 15 2.50 V to

16
to 2.50 V Channel #16 CH 16 2.50 V to

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

*CH 01: 3.00 V to 3.00 Channel #1 A/P LVDT .2IN/DIV

*CH

*CH 02: 3.00 V to 3.00 Channel #2 Y/D PROGRAM

*CH

*CH 03: 2.24 V to 2.71 Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH

*CH 04: 300 mV to 300 Channel #4 INPUT LOAD 100LB/DIV

*CH

*CH 05: 2.00 V to 2.00 Channel #5 OUTPUT LOAD 100LB/DIV

*CH

*CH 06: 1.00 V to 1.00 Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

*CH

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*CH 07: 10.00 V to 10.00 Channel #7 Y/D ENGAGE SOLENOID 28 VDC

*CH

*CH 08: 0.03 V to 4.00 Channel #8 OUTPUT POSITION 1 IN/DIV

*CH

*CH 09: 2.00 V to 2.50 Channel #9

*CH

*CH 10: 2.00 V to 2.50 Channel #10

*CH

*CH 11: 2.00 V to 2.50 Channel #11

*CH

*CH 12: 2.00 V to 2.50 Channel #12

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*CH 13: 2.00 V to 2.50 Channel #13

*CH

*CH 14: 2.00 V to 2.50 Channel #14

*CH

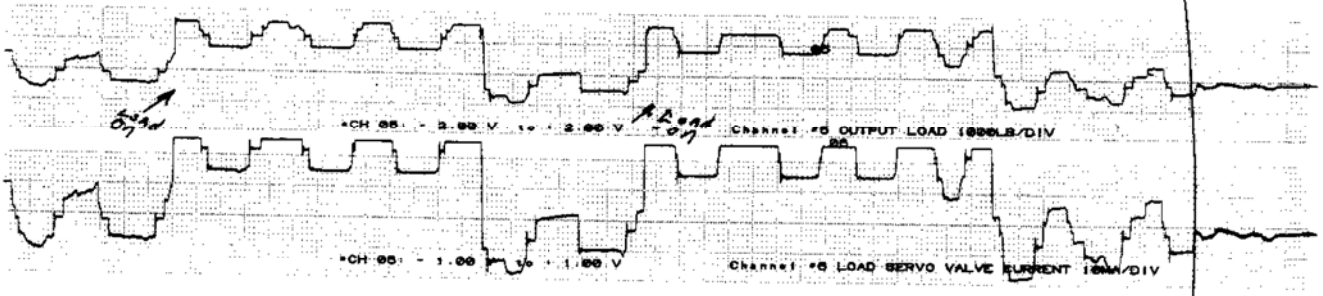
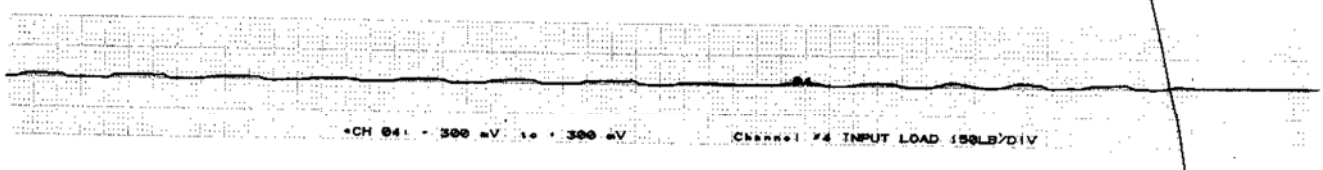
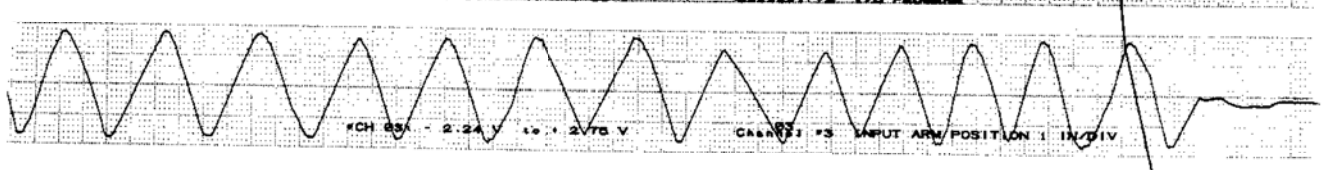
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*CH 16: 2.00 V to 2.50 Channel #16

*CH

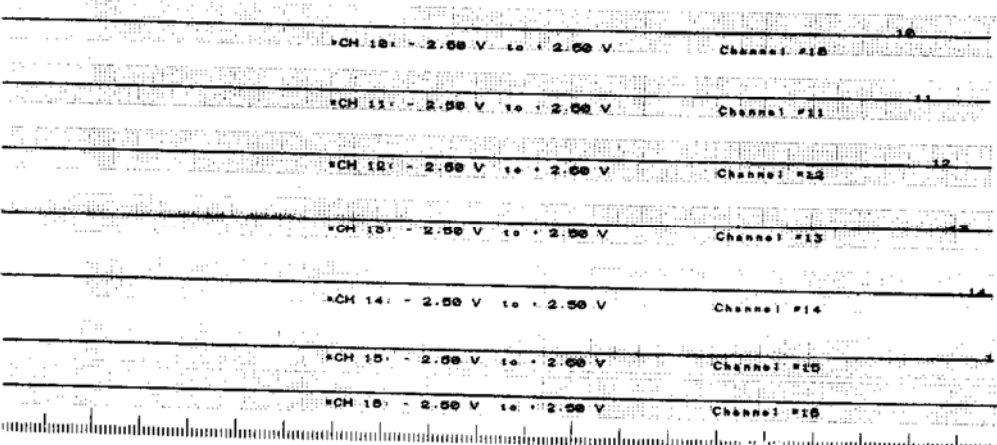
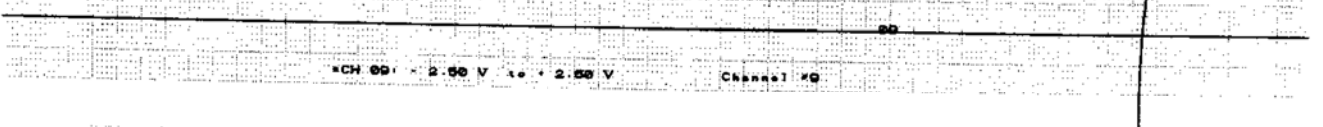
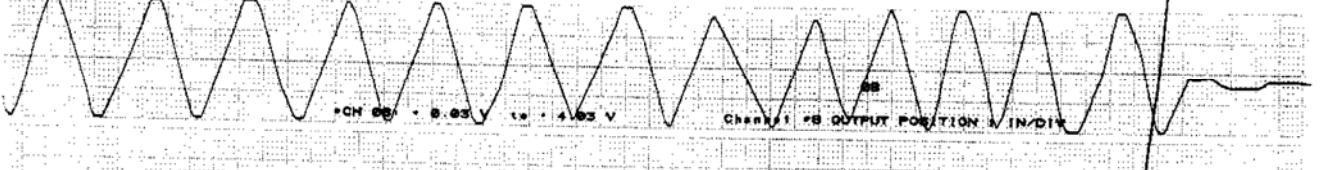
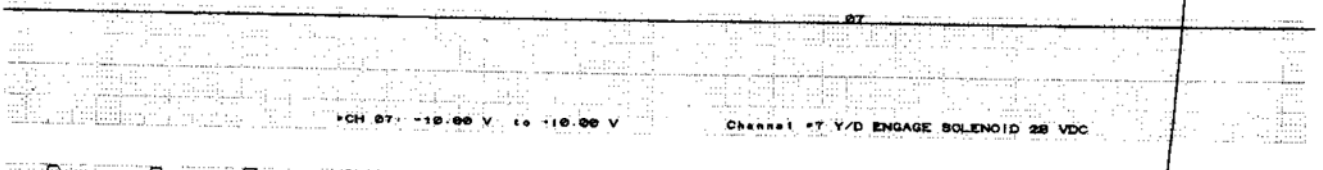
DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



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MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
RUDDER PCU
(ENGINEERING H)

•CH 01: - 3.00 V to + 3.00 V Channel #1 A/P LYDT 2IN/DIV

•CH 02: - 2.00 V to + 2.00 V Channel #2 Y/D PROGRAM

•CH 03: - 2.24 V to + 2.76 V Channel #3 INPUT ARM POSITION 1 IN/DIV

•CH 04: - 300 mV to + 300 mV Channel #4 INPUT LOAD 150LB/DIV

•CH 05: - 2.00 V to + 2.00 V Channel #5 OUTPUT LOAD 1000LB/DIV

•CH 06: - 1.00 V to + 1.00 V Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

•CH 07: - 10.00 V to + 10.00 V Channel #7 Y/D ENGAGE SOLENOID 25 VDC

•CH 08: - 0.03 V to + 4.03 V Channel #8 OUTPUT POSITION IN/DIV

•CH 09: - 2.00 V to + 2.00 V Channel #9

•CH 10: - 2.00 V to + 2.00 V Channel #10

•CH 11: - 2.00 V to + 2.00 V Channel #11

•CH 12: - 2.00 V to + 2.00 V Channel #12

•CH 13: - 2.00 V to + 2.00 V Channel #13

•CH 14: - 2.00 V to + 2.00 V Channel #14

•CH 15: - 2.00 V to + 2.00 V Channel #15

•CH 16: - 2.00 V to + 2.00 V Channel #16

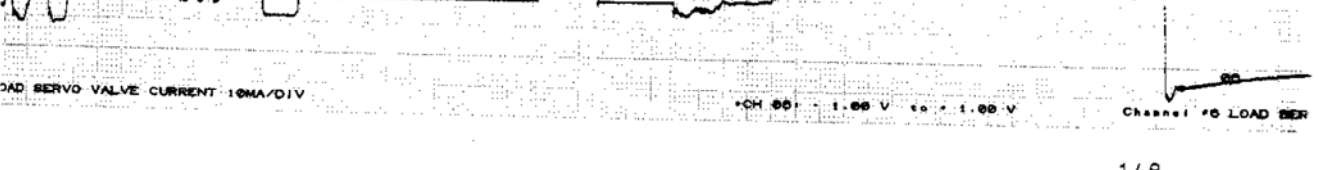
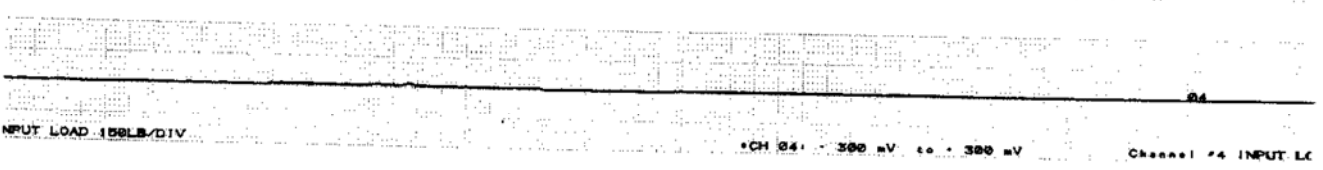
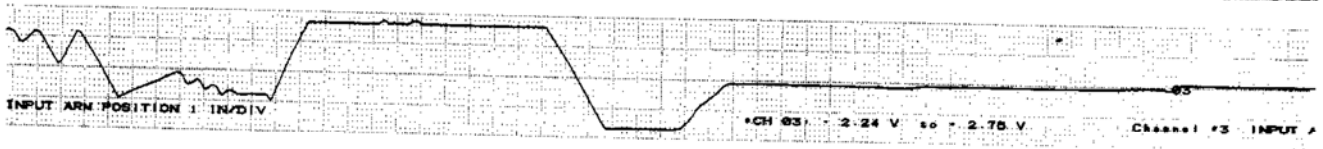
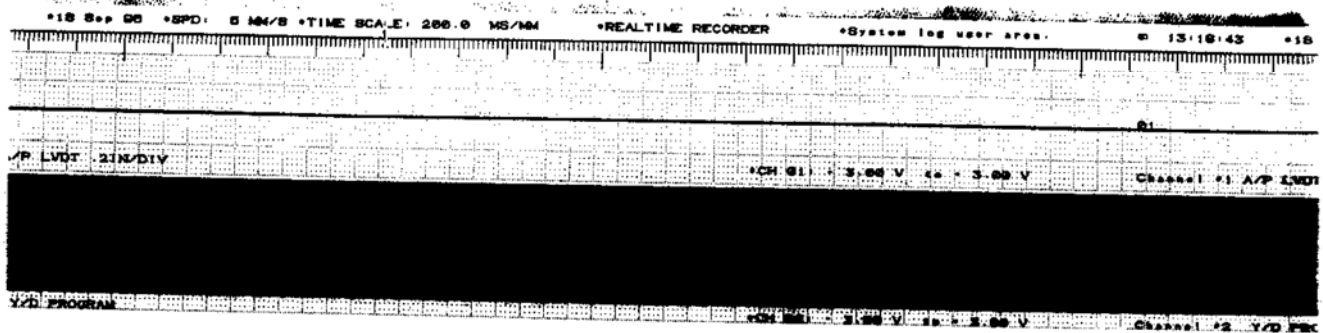
Cond 2f

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MT95K2 MULTI-TASK RECORDER

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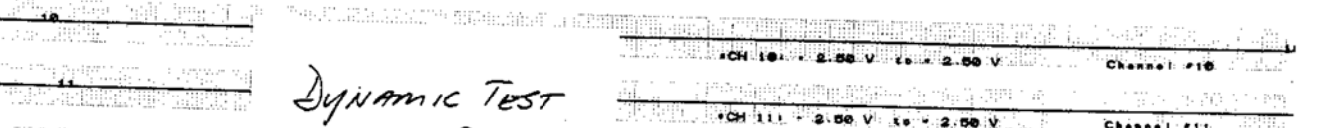
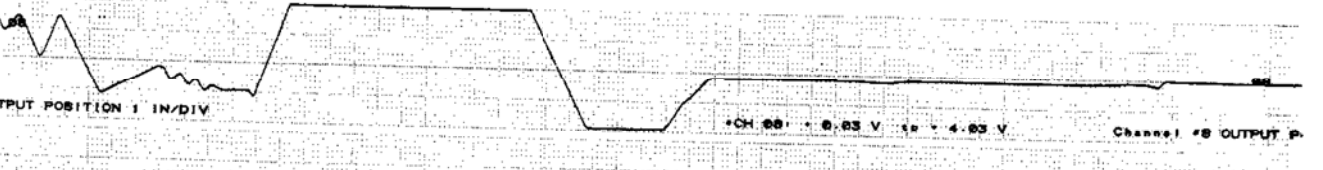
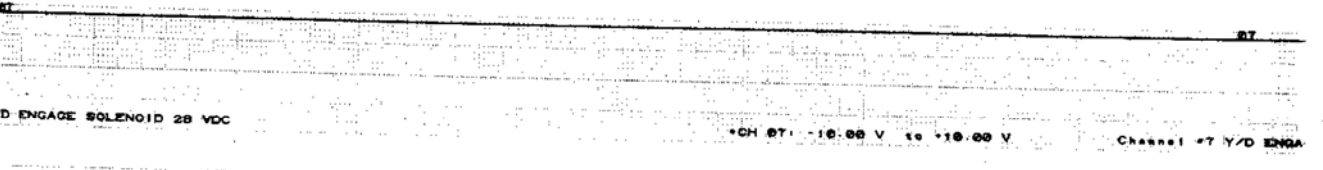
DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



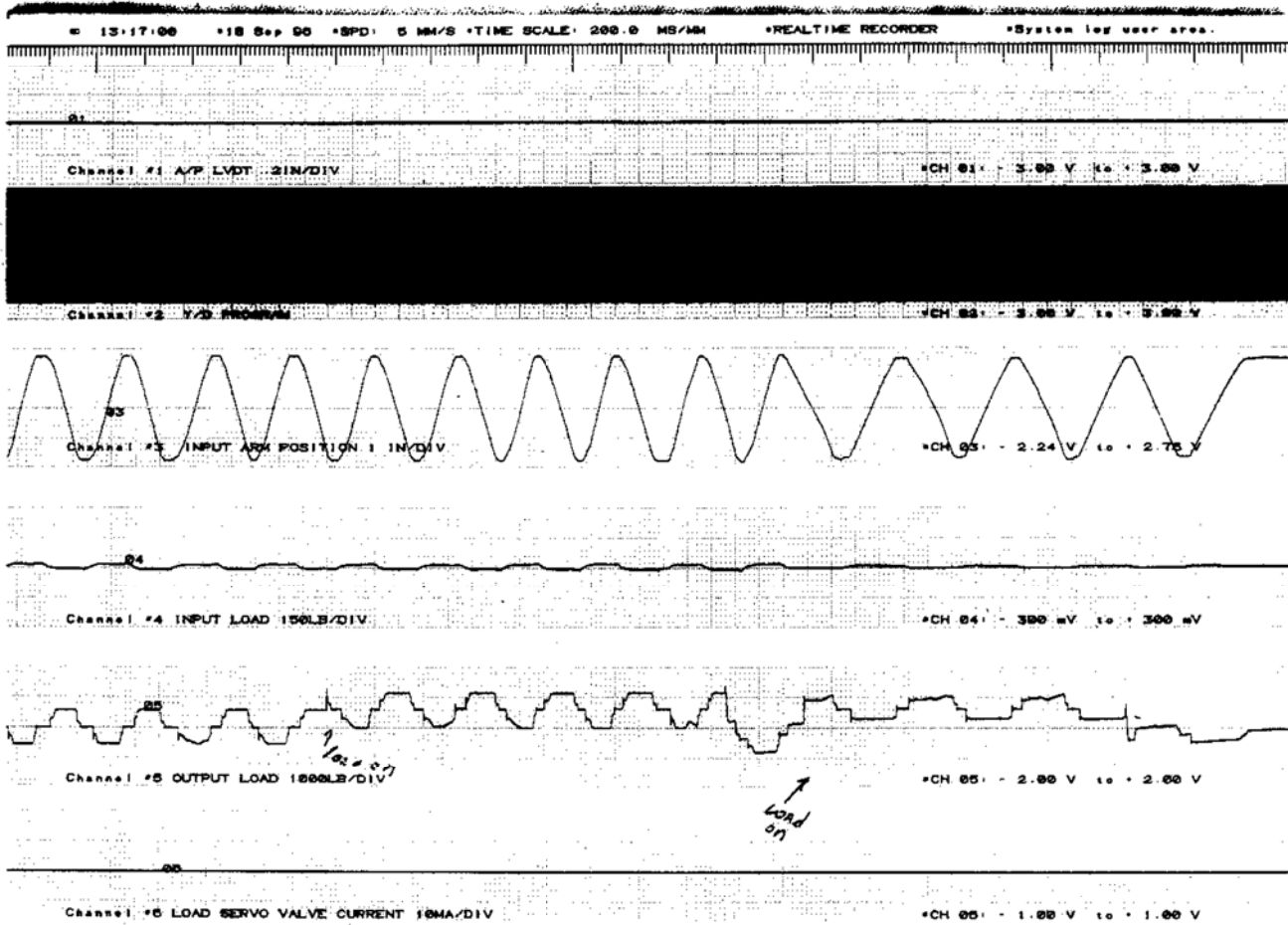
Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

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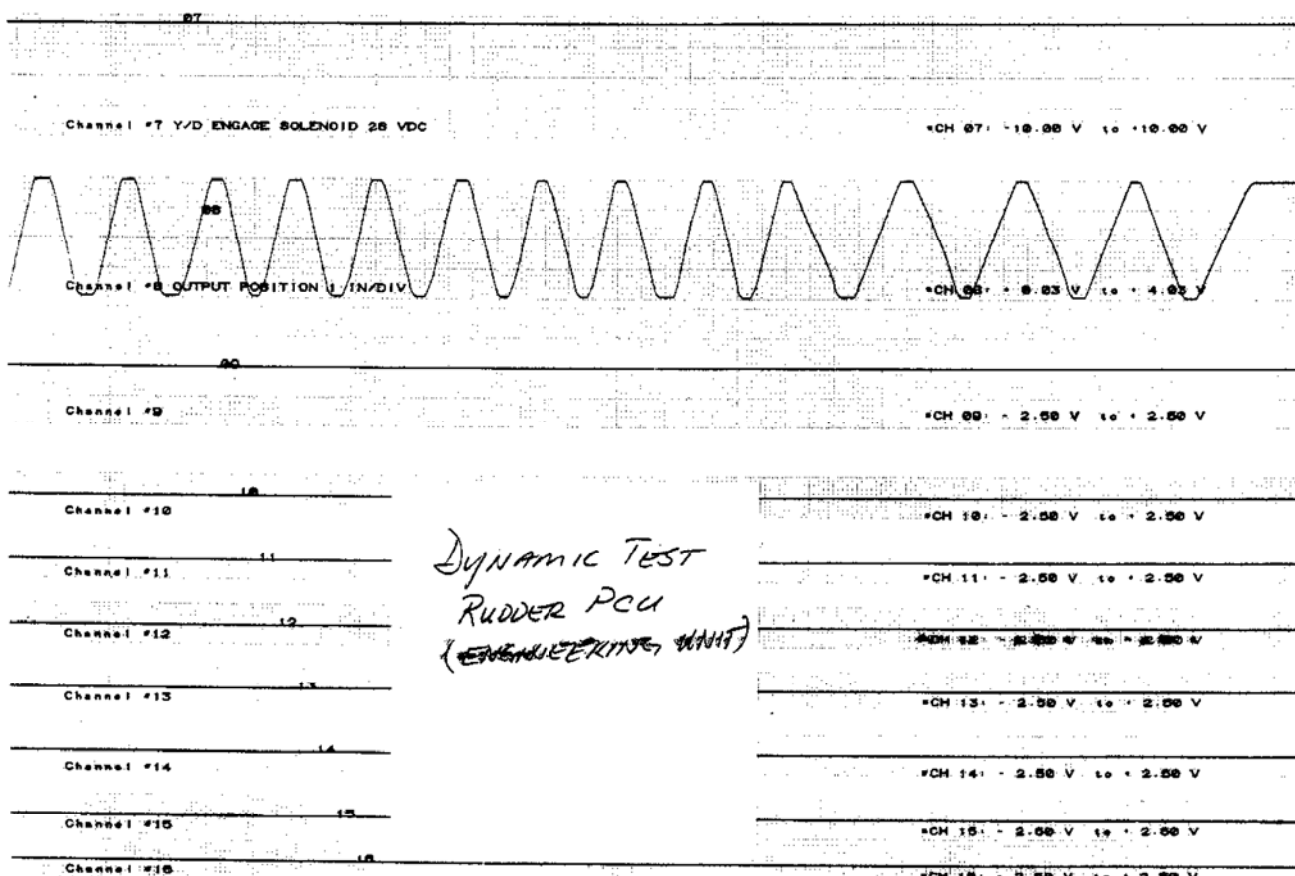
DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



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MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST
RUDDER PCU
(EVENING UNIT)

Channel #1 A/P LVDT .2IN/DIV

*CH 01: - 3.00 V

Channel #2 Y/D PROGRAM

*CH 02: - 3.00 V

Channel #3 INPUT ARM POSITION .IN/DIV

*CH 03: - 2.25 V

Channel #4 INPUT LOAD 100LB/DIV

*CH 04: - 300 mV

Channel #5 OUTPUT LOAD 1000LB/DIV

*CH 05: - 2.00 V

A/DIV

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

*CH 06: - 1.00 V

 Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

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Channel #7 Y/D ENGAGE SOLENOID 28 VDC

*CH 07: - 10.00 V

Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 08: - 0.05 V

Channel #9

*CH 09: - 2.50 V

Channel #10

*CH 10: - 2.50 V

Channel #11

*CH 11: - 2.50 V

Channel #12

*CH 12: - 2.50 V

Channel #13

*CH 13: - 2.50 V

Channel #14

*CH 14: - 2.50 V

Channel #15

*CH 15: - 2.50 V

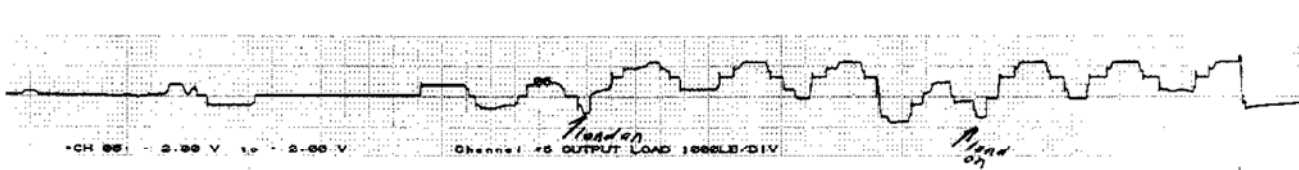
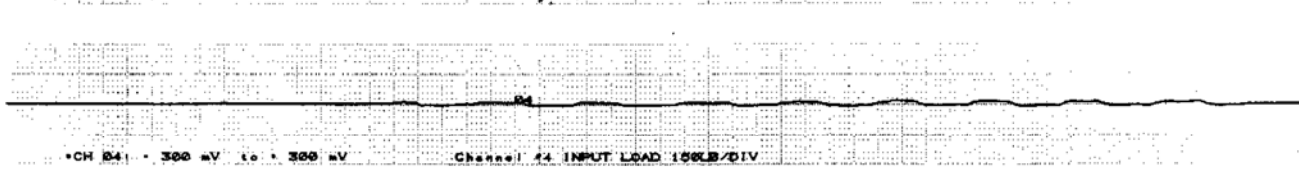
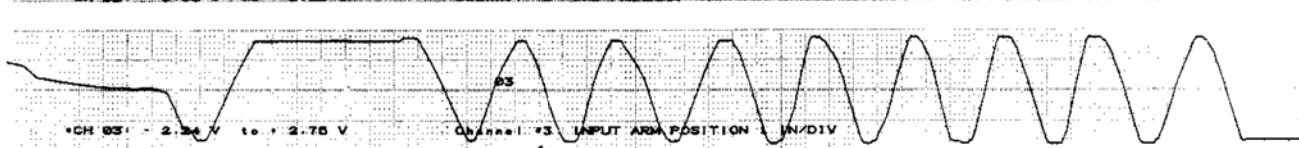
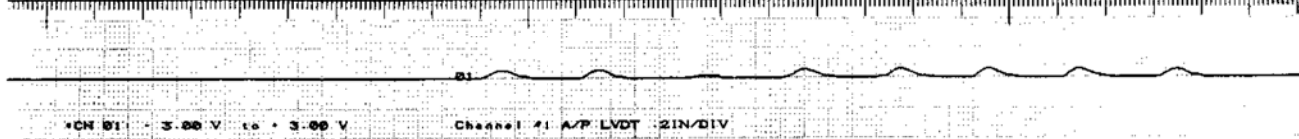
Channel #16

*CH 16: - 2.50 V

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

Channel #10	10 - 2.00 V	Channel #10	10 - 2.00 V
Channel #11	10 - 2.00 V	Channel #11	10 - 2.00 V
Channel #12	10 - 2.00 V	Channel #12	10 - 2.00 V
Channel #13	10 - 2.00 V	Channel #13	10 - 2.00 V
Channel #14	10 - 2.00 V	Channel #14	10 - 2.00 V
Channel #15	10 - 2.00 V	Channel #15	10 - 2.00 V
Channel #16	10 - 2.00 V	Channel #16	10 - 2.00 V

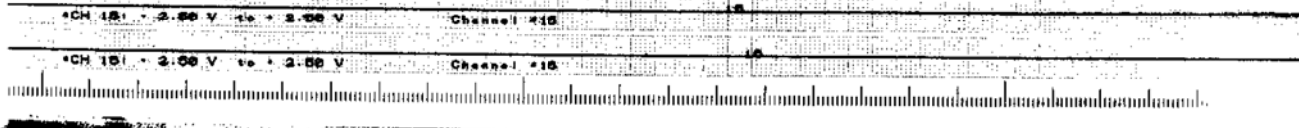
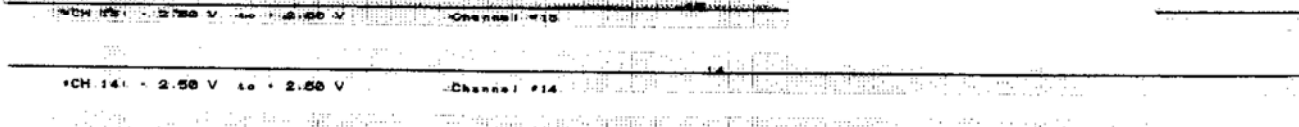
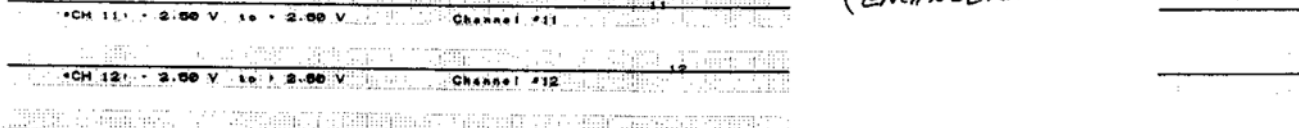
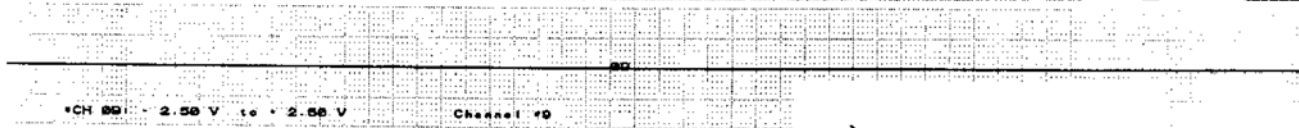
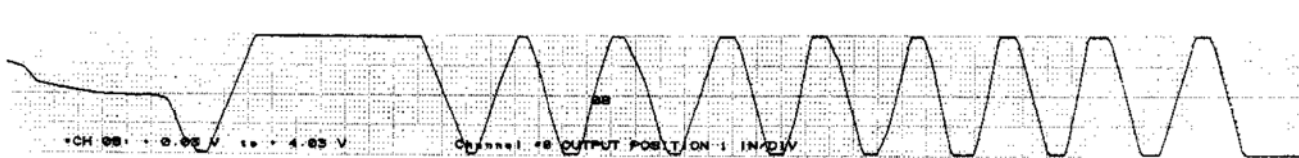
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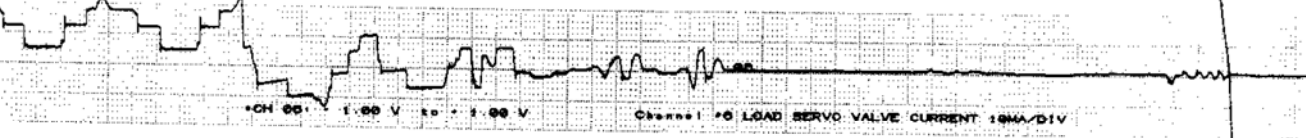
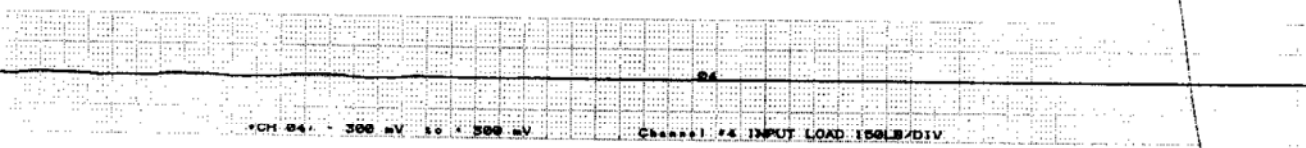
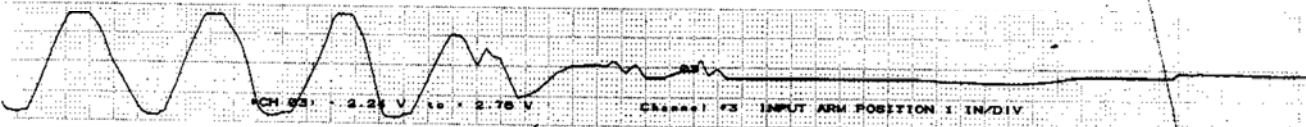
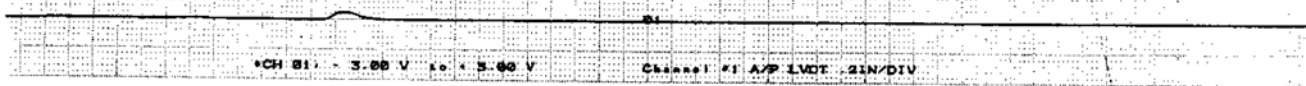
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25

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MT95K2 MULTI-TASK RECORDER



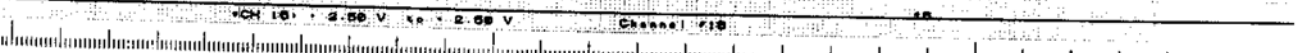
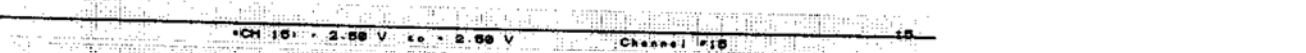
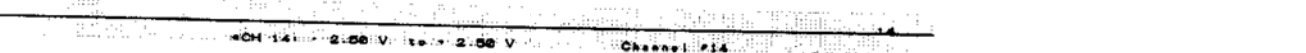
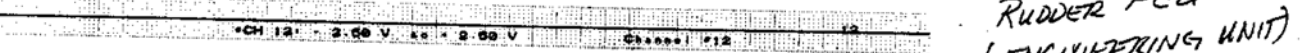
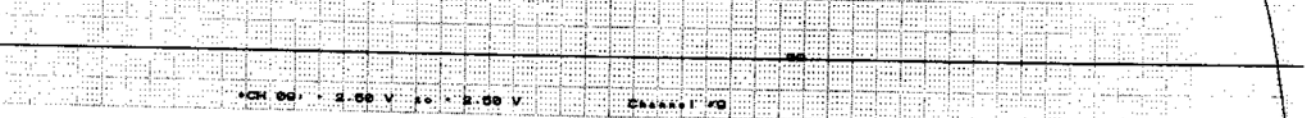
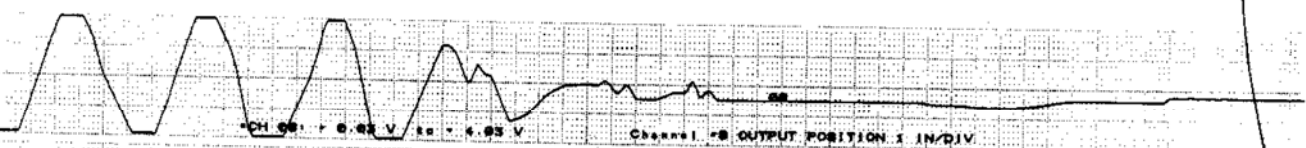
DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



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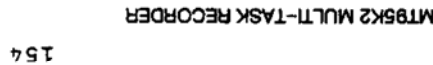
Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

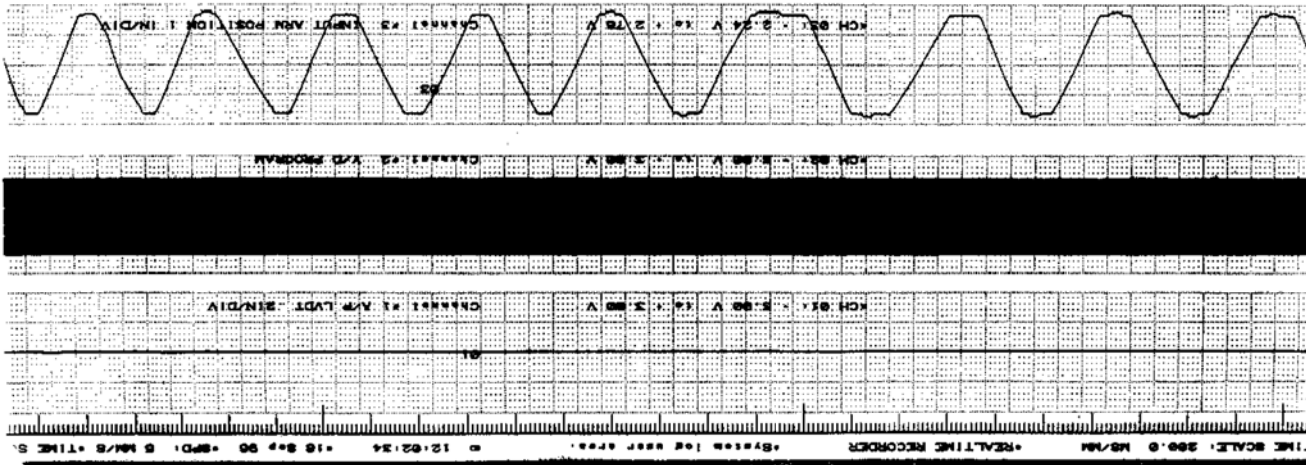


DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

Dynamic Test
Rudder PDU
(ENGINEERING UNIT)



✓ load on



V/DIV *CH 01: 5.00 V to 5.00 V Channel #1 A/P LVDT .2IN/DIV

*CH 02: 5.00 V to 5.00 V Channel #2 Y/D PROGRAM

POSITION 1 IN/DIV *CH 03: 5.24 V to 5.70 V Channel #3 INPUT ARM POSITION

50LB/DIV *CH 04: 300 mV to 300 mV Channel #4 INPUT LOAD (50LB/D

1000LB/DIV *CH 05: 2.00 V to 2.00 V Channel #5 OUTPUT LOAD 1000LB

LIVE CURRENT 10mA/DIV *CH 06: 1.00 V to 1.00 V Channel #6 LOAD SERVO VALVE

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MT95K2 MULTI-TASK RECORDER

LEN01D 28 VDC *CH 07: 10.00 V to 10.00 V Channel #7 Y/D ENGAGE SOLENOID

ON 1 IN/DIV *CH 08: 0.03 V to 4.03 V Channel #8 OUTPUT POSITION

*CH 09: 2.00 V to 2.00 V Channel #9

*CH 10: 2.00 V to 2.00 V Channel #10

*CH 11: 2.00 V to 2.00 V Channel #11

*CH 12: 2.00 V to 2.00 V Channel #12

*CH 13: 2.00 V to 2.00 V Channel #13

*CH 14: 2.00 V to 2.00 V Channel #14

*CH 15: 2.00 V to 2.00 V Channel #15

*CH 16: 2.00 V to 2.00 V Channel #16

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

CH 01: 3.00 V to 3.00 V Channel 1

CH 02: 3.00 V to 3.00 V Channel 2

CH 03: 2.24 V to 2.70 V Channel 3

CH 04: 300 uV to 300 uV Channel 4

CH 05: 2.00 V to 2.00 V Channel 5

CH 06: 1.00 V to 1.00 V Channel 6

CH 07: 10.00 V to 10.00 V Channel 7

CH 08: 0.03 V to 4.03 V Channel 8

CH 09: 2.50 V to 2.50 V Channel 9

CH 10: 2.50 V to 2.50 V Channel 10

CH 11: 2.50 V to 2.50 V Channel 11

CH 12: 2.50 V to 2.50 V Channel 12

CH 13: 2.50 V to 2.50 V Channel 13

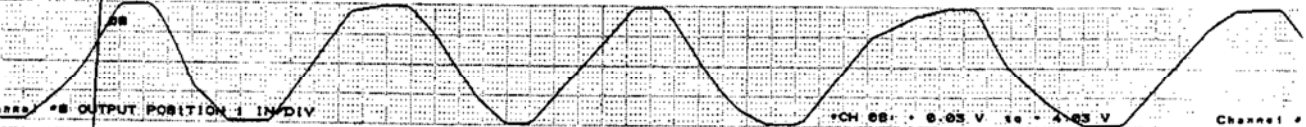
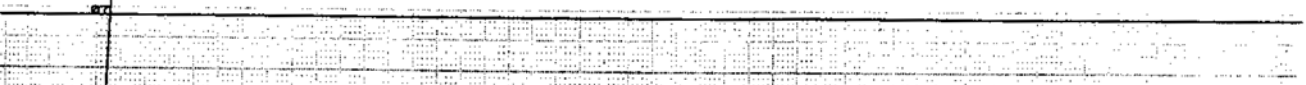
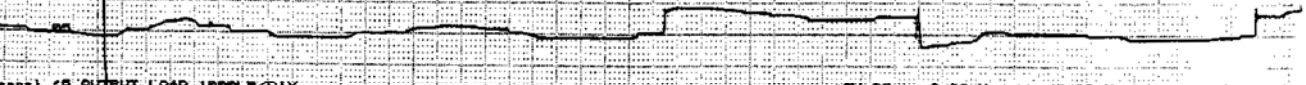
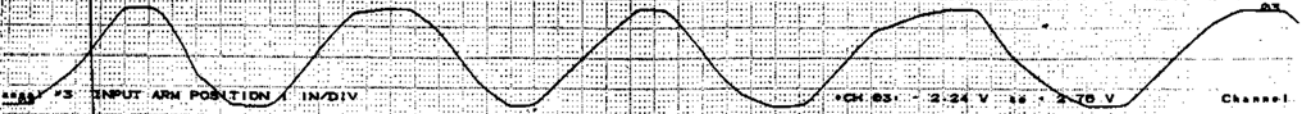
CH 14: 2.50 V to 2.50 V Channel 14

CH 15: 2.50 V to 2.50 V Channel 15

CH 16: 2.50 V to 2.50 V Channel 16

CH 17: 2.50 V to 2.50 V Channel 17

CH 18: 2.50 V to 2.50 V Channel 18



CH 10: 2.50 V to 2.50 V Channel 10
CH 11: 2.50 V to 2.50 V Channel 11
CH 12: 2.50 V to 2.50 V Channel 12
CH 13: 2.50 V to 2.50 V Channel 13
CH 14: 2.50 V to 2.50 V Channel 14
CH 15: 2.50 V to 2.50 V Channel 15
CH 16: 2.50 V to 2.50 V Channel 16
CH 17: 2.50 V to 2.50 V Channel 17
CH 18: 2.50 V to 2.50 V Channel 18

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

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MT95K2 MULTI-TASK RECORDER

Channel #1 A/P LVDT 2IN/DIV

CH 01 - 3.00 V to 3.00 V

Channel #2 Y/D PROGRAM

CH 02 - 3.00 V to 3.00 V

Channel #3 INPUT ADDRESS POSITION 1 IN/DIV

CH 03 - 2.24 V to 2.75 V

Channel #4 INPUT LOAD 1000LB/DIV

CH 04 - 300 mV to 300 mV

Channel #5 OUTPUT LOAD 1000LB/DIV

CH 05 - 2.00 V to 2.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

CH 06 - 1.00 V to 1.00 V

↑ load on

↑ load on

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MT95K2 MULTI-TASK RECORDER

Channel #7 Y/D ENGAGE SOLENOID 28 VDC

CH 07 - 10.00 V to 10.00 V

Channel #8 OUTPUT POSITION 1 IN/DIV

CH 08 - 0.03 V to 4.03 V

Channel #9

CH 09 - 2.50 V to 2.50 V

Channel #10

CH 10 - 2.50 V to 2.50 V

Channel #11

CH 11 - 2.50 V to 2.50 V

Channel #12

CH 12 - 2.50 V to 2.50 V

Channel #13

CH 13 - 2.50 V to 2.50 V

Channel #14

CH 14 - 2.50 V to 2.50 V

Channel #15

CH 15 - 2.50 V to 2.50 V

Channel #16

CH 16 - 2.50 V to 2.50 V

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

*CH 01: 3.00 V to 3 Channel #1 A/P LVDT .2IN/DIV

*CH 01:

*CH 02: 3.00 V to 3 Channel #2 Y/D PROGRAM

*CH 02:

*CH 03: 2.24 V to 2 Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH 03:

*CH 04: 300 mV to 30 Channel #4 INPUT LOAD 100LB/DIV

*CH 04:

*CH 05: 2.00 V to 2 Channel #5 OUTPUT LOAD 1000LB/DIV

*CH 05:

*CH 06: 1.00 V to 1 Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

*CH 06:

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MT95K2 MULTI-TASK RECORDER

*CH 07: 10.00 V to 10 Channel #7 Y/D ENGAGE SOLENOID 28 VDC

*CH 07:

*CH 08: 0.03 V to 4 Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 08:

*CH 09: 2.50 V to 2 Channel #9

*CH 09:

*CH 10: 2.50 V to 2 Channel #10

*CH 10:

*CH 11: 2.50 V to 2 Channel #11

*CH 11:

*CH 12: 2.50 V to 2 Channel #12

*CH 12:

*CH 13: 2.50 V to 2 Channel #13

*CH 13:

*CH 14: 2.50 V to 2 Channel #14

*CH 14:

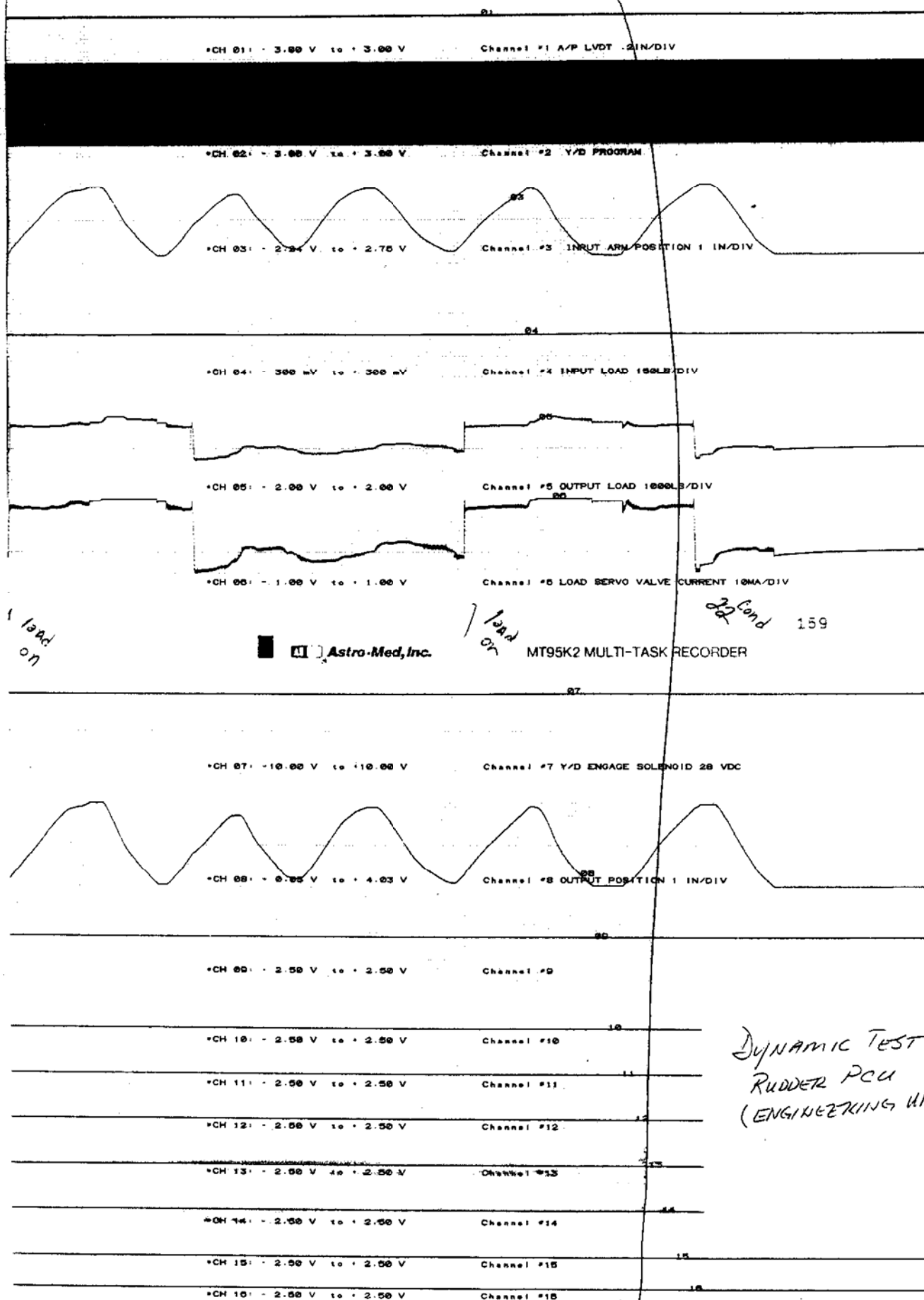
*CH 15: 2.50 V to 2 Channel #15

*CH 15:

*CH 16: 2.50 V to 2 Channel #16

*CH 16:

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



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1/2nd on

MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNI)

ACH 31 3.50 V to 3.50 V

Channel #1 A/P LVDT 2IN/DIV

5	CH	02	1	3	00	V	1	2	00	V
---	----	----	---	---	----	---	---	---	----	---

SEARCHED INDEXED SERIALIZED FILED

CH 831 - 2.24 V to 2.70 V

Channel #3 INPUT ARM POSITION 1 IN DIV

•CH 04: • 300 mV to • 300 mV

Channel 4 INPUT LOAD 1500 E/DIV

• CH 05 • 2.00 V t₂ • 2.00 V

Channel 1: 50 OUTPUT LOAD 1550LB/DIV

•CH 05: 1.00 V to 1.00 V

Channel #8 LOAD SERVO VALVE CURRENT 10MA/DIV

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MT95K2 MULTI-TASK RECORDER

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•CH 07: +10.00 V t: +10.00 V

Channel #7 Y/D ENGAGE SOLENOID 28 VDC

 $\bullet \text{CH}_3\text{OH} + 0.03 \text{ V to } 4.03 \text{ V}$

Channel 1 - 0 OUTPUT POSITION 1 IN/IN

CH 89 2.50 V 1.0 2.50 V

Channel 9D

•CH 10 • 2.00 V 10 • 2.00 V

Chapter 12

•CH 11 • 2.00 V to • 2.00 V

Channel 41

•CH 121 • 2.50 V 10 • 2.60 V

Channel #12

RDH 131 - 2:30 M 40 - 2:30 M

Document ID: 425

*CH 14: 2.00 V 10: 2.00 V

Channel #14

•CH 15: • 2.00 V to • 2.00 V

Channel 410

•CH 101 • 2.50 V to • 2.50 V

Channel #10

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

CH 01: - 3.00 V to + 3.00 V Channel #1 A/P LVDT .2IN/DIV

CH 02: - 3.00 V to + 3.00 V Channel #2 Y/D PROGRAM

CH 03: - 2.24 V to + 2.24 V Channel #3 INPUT ARM POSITION 1 IN

CH 04: - 300 mV to + 300 mV Channel #4 INPUT LOAD 150LB/DIV

CH 05: - 2.00 V to + 2.00 V Channel #5 OUTPUT LOAD 1000LB/DIV

CH 06: - 1.00 V to + 1.00 V Channel #6 LOAD SERVO VALVE CURRENT

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Astro-Med, Inc. MT95K2 MULTI-TASK RECORDER

CH 07: - 10.00 V to + 10.00 V Channel #7 Y/D ENGAGE SOLENOID 28 V

CH 08: - 0.03 V to + 4.03 V Channel #8 OUTPUT POSITION 1 IN/DIV

CH 09: - 2.50 V to + 2.50 V Channel #9

CH 10: - 2.50 V to + 2.50 V Channel #10

CH 11: - 2.50 V to + 2.50 V Channel #11

CH 12: - 2.50 V to + 2.50 V Channel #12

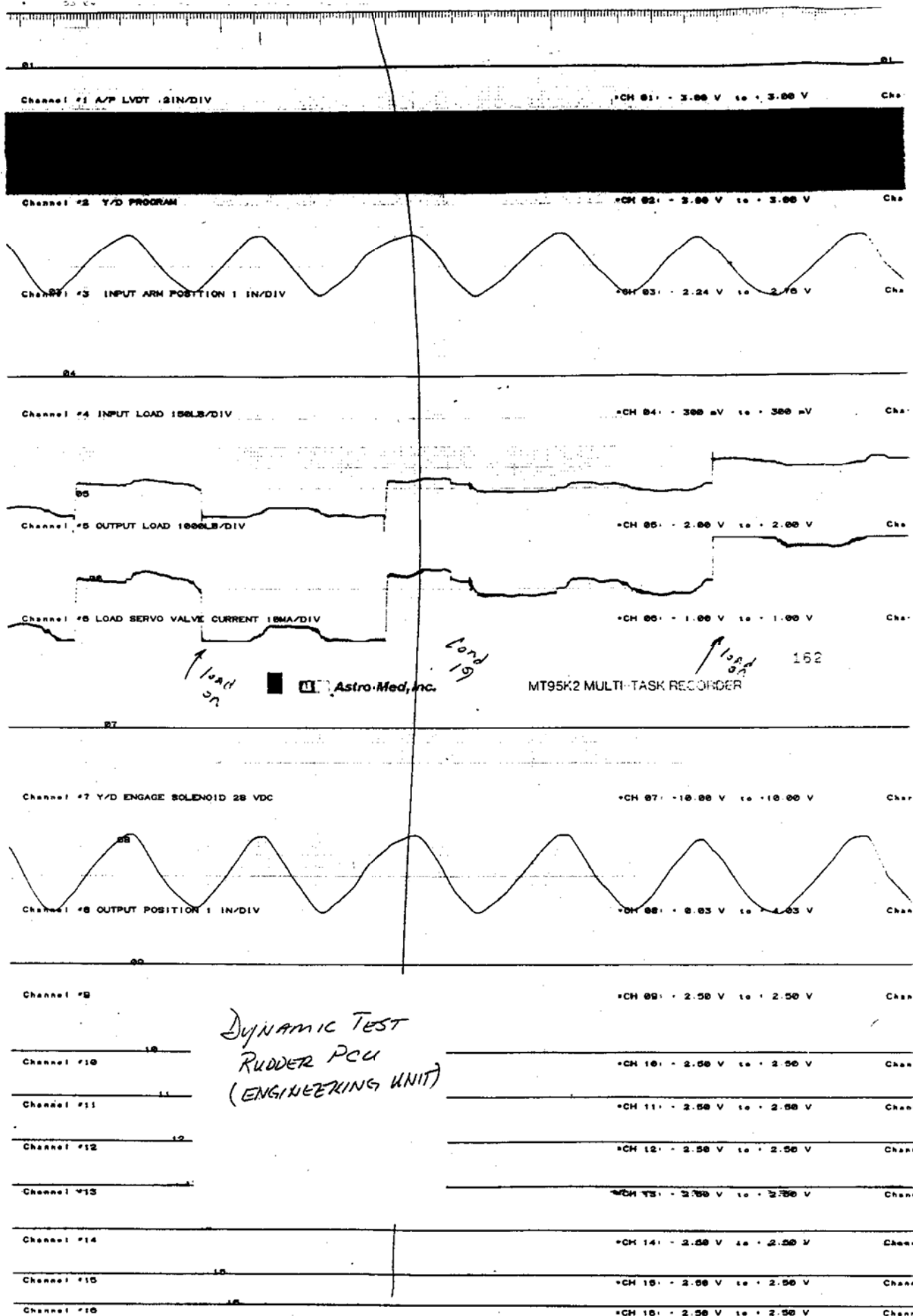
CH 13: - 2.50 V to + 2.50 V Channel #13

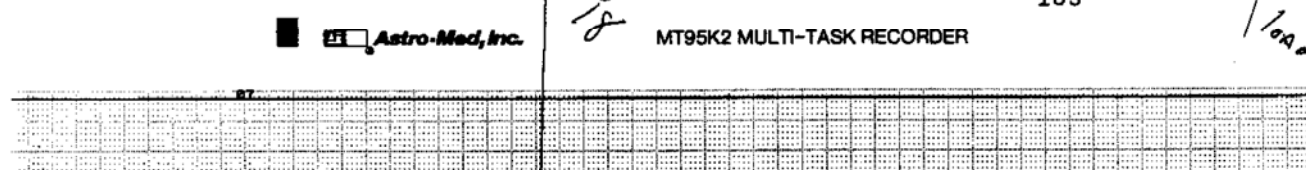
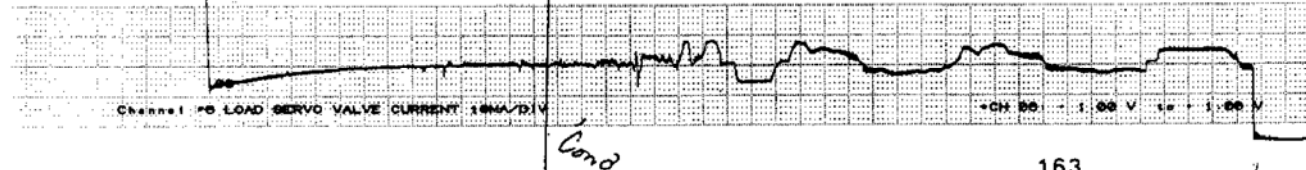
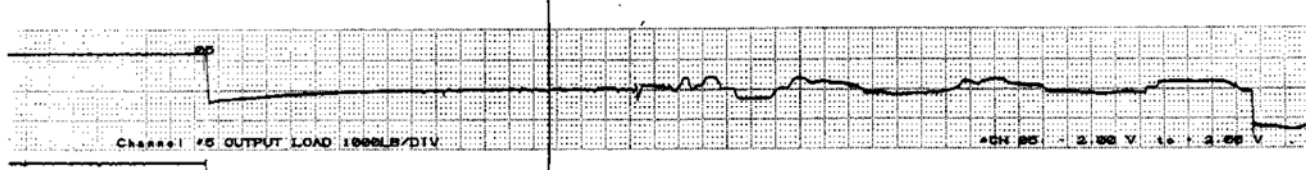
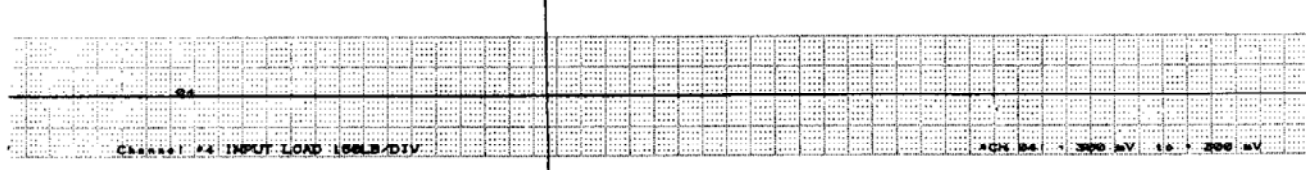
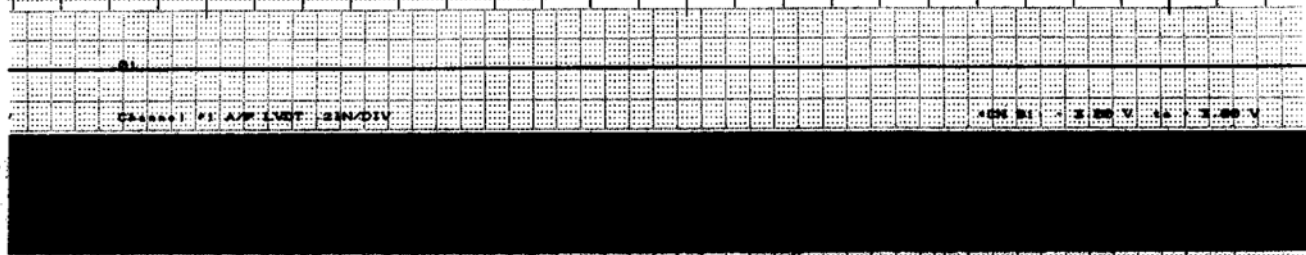
CH 14: - 2.50 V to + 2.50 V Channel #14

CH 15: - 2.50 V to + 2.50 V Channel #15

CH 16: - 2.50 V to + 2.50 V Channel #16

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)





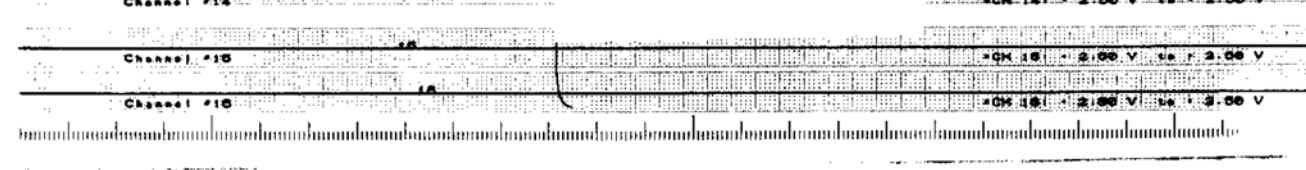
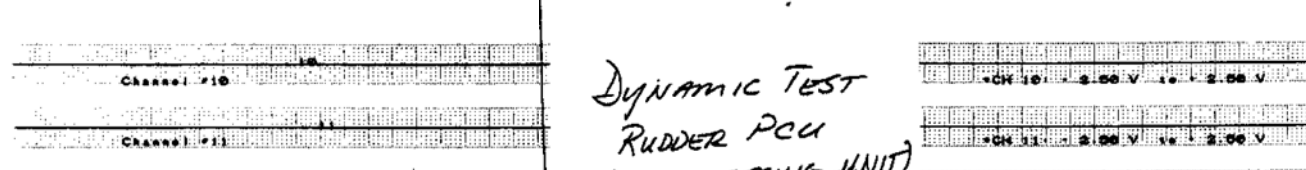
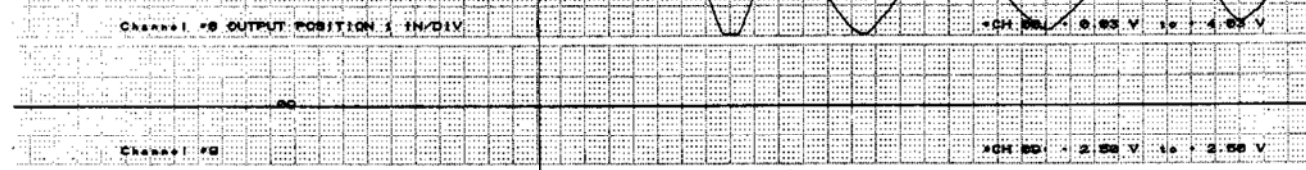
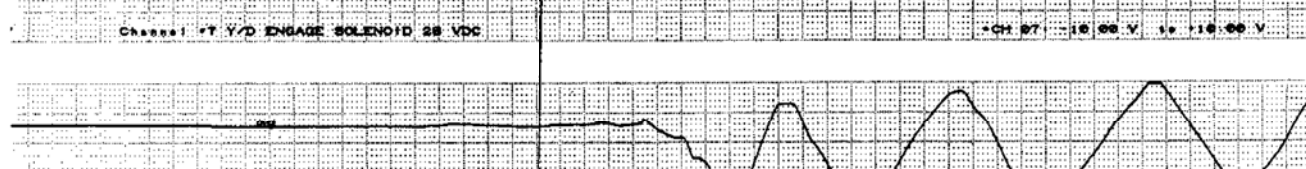
Astro-Med, Inc.

Comp 18

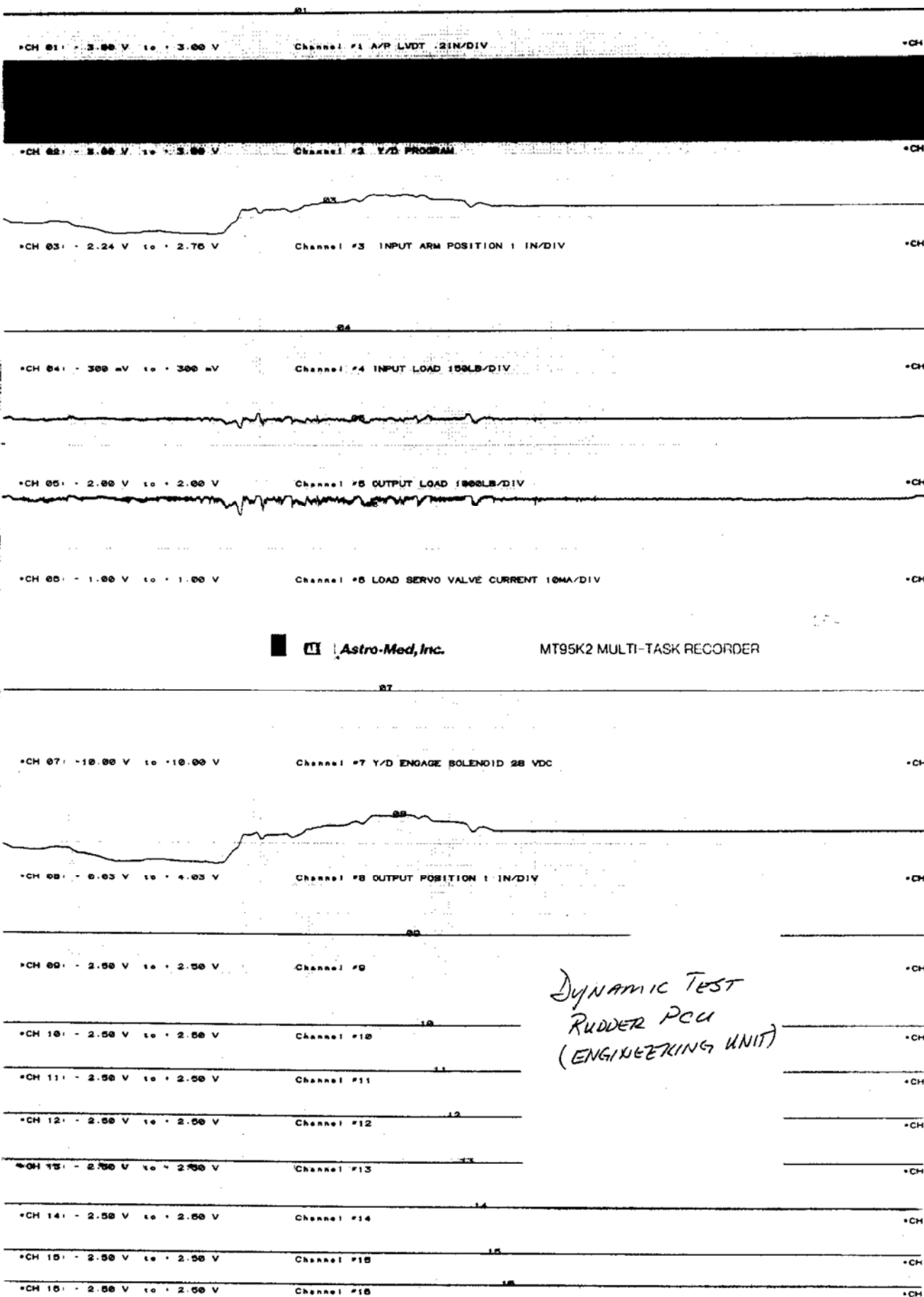
MT95K2 MULTI-TASK RECORDER

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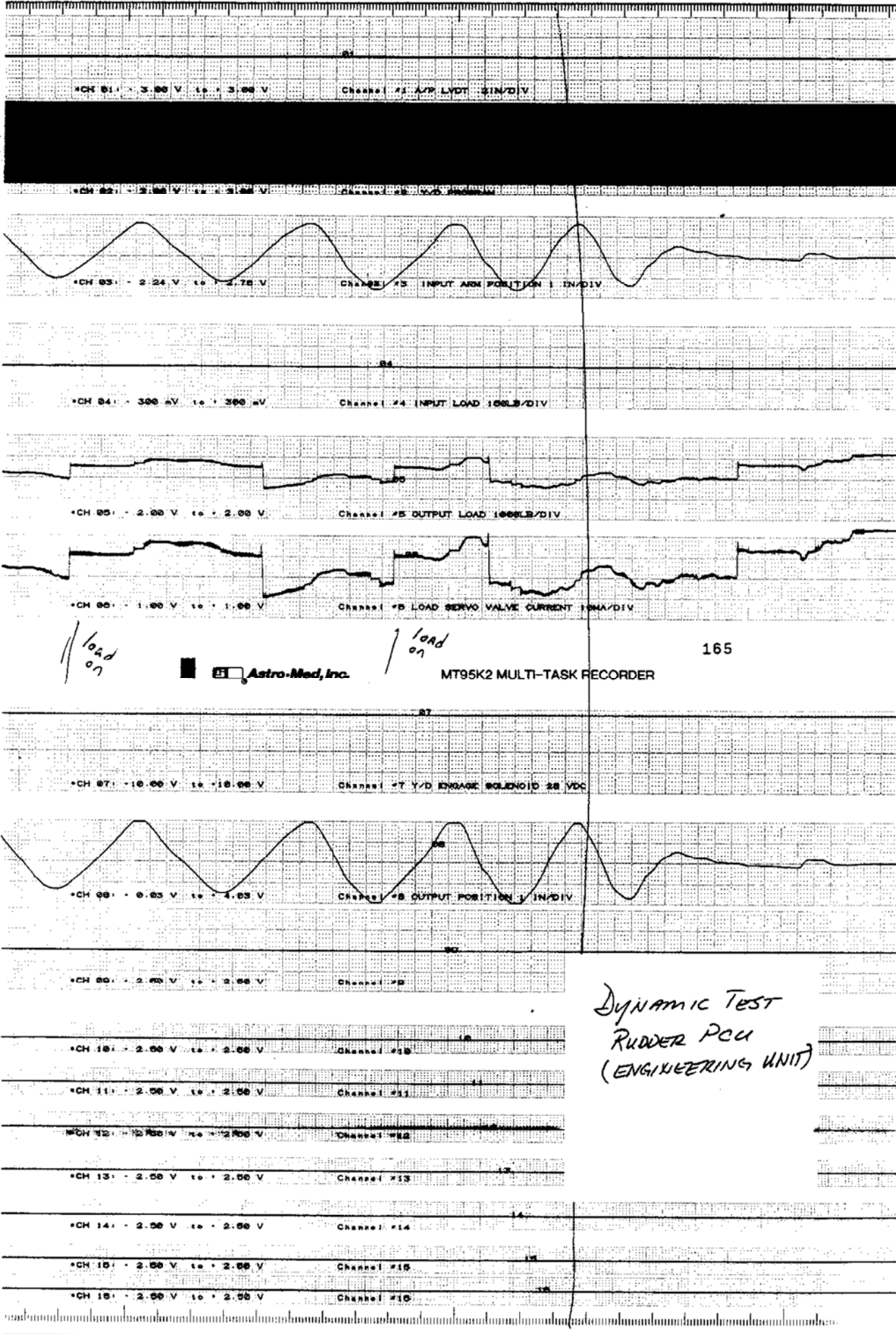


*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*



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MT95K2 MULTI-TASK RECORDER



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MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

CH 01: - 3.00 V to + 3.00 V

Channel #1 A/P LVDT .2IN/DIV

CH 02: - 3.00 V to + 3.00 V

Channel #2 Y/D PROGRAM

CH 03: - 2.24 V to + 2.70 V

Channel #3 INPUT ARM POSITION 1 IN/DIV

CH 04: - 300 mV to + 300 mV

Channel #4 INPUT LOAD 150LB/DIV

CH 05: - 2.00 V to + 2.00 V

Channel #5 OUTPUT LOAD 100LB/DIV

CH 06: - 1.00 V to + 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

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MT95K2 MULTI-TASK RECORDER

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CH 07: - 10.00 V to + 10.00 V

Channel #7 Y/D ENGAGE SOLENOID 28 VDC

CH 08: - 0.03 V to + 4.03 V

Channel #8 OUTPUT POSITION 1 IN/DIV

CH 09: - 2.50 V to + 2.50 V

Channel #9

CH 10: - 2.50 V to + 2.50 V

Channel #10

CH 11: - 2.50 V to + 2.50 V

Channel #11

CH 12: - 2.50 V to + 2.50 V

Channel #12

CH 13: - 2.50 V to + 2.50 V

Channel #13

CH 14: - 2.50 V to + 2.50 V

Channel #14

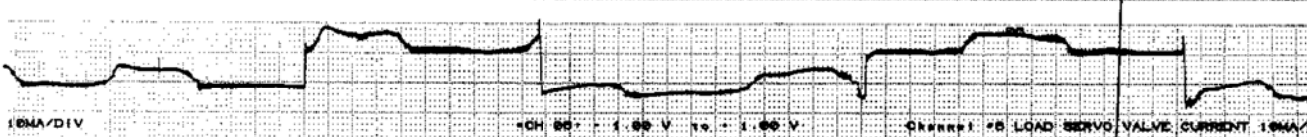
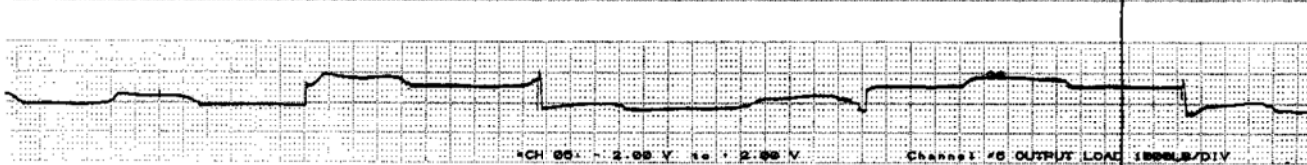
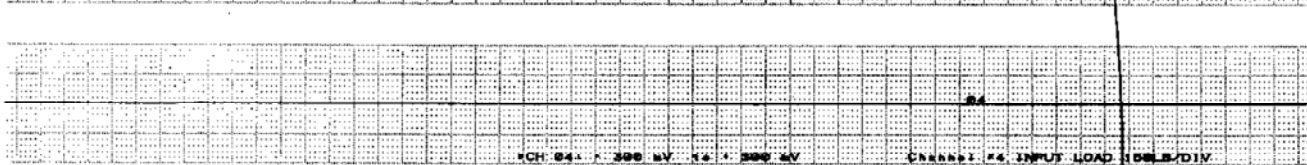
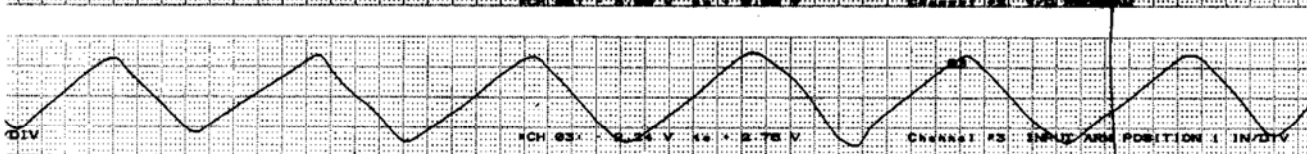
CH 15: - 2.50 V to + 2.50 V

Channel #15

CH 16: - 2.50 V to + 2.50 V

Channel #16

*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*



load on

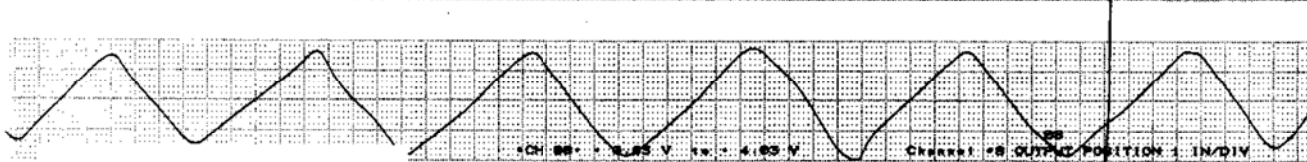
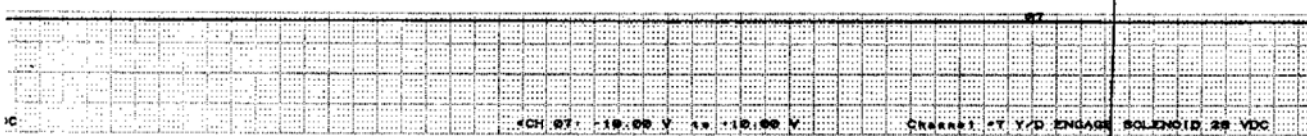
Astro-Med, Inc.

load on

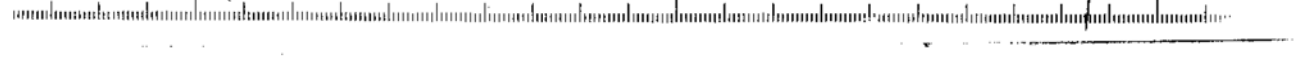
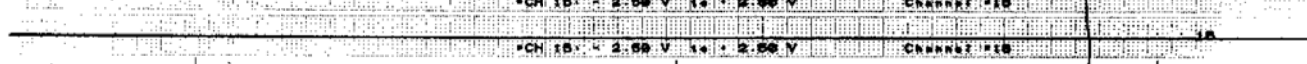
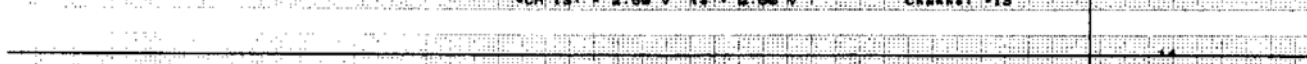
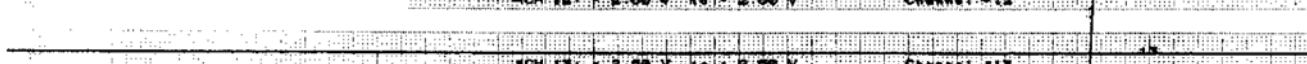
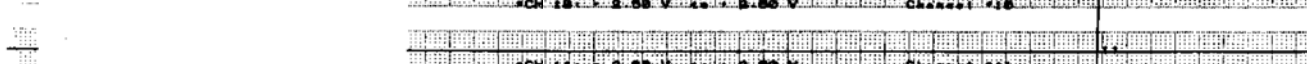
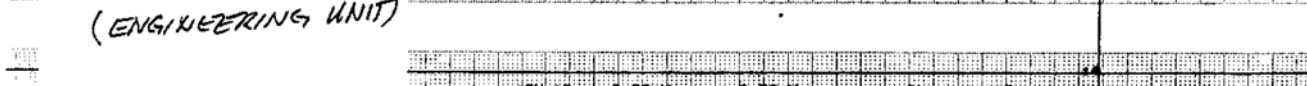
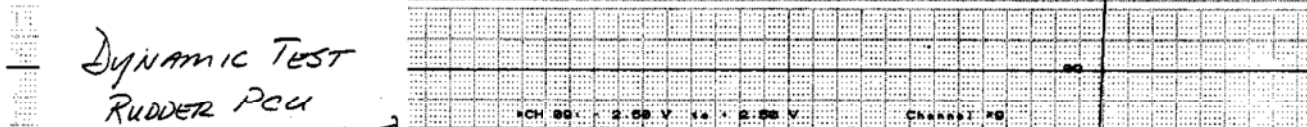
MT95K2 MULTI-TASK RECORDER

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Cond 16



DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



#1 A/P LVDT .2IN/DIV

*CH 01: - 3.00 V to + 3.00 V

Channel #1 A/T

#2 Y/D PROGRAM

*CH 02: - 3.00 V to + 3.00 V

Channel #2 Y/

#3 INPUT ARM POSITION 1 IN/DIV

*CH 03: - 2.24 V to + 2.76 V

Channel #3 I/T

#4 INPUT LOAD 150LB/DIV

*CH 04: - 300 mV to + 300 mV

Channel #4 IN/

#5 OUTPUT LOAD 1000LB/DIV

*CH 05: - 2.00 V to + 2.00 V

Channel #5 OU/

#6 LOAD SERVO WAVE CURRENT 10MA/DIV

*CH 06: - 1.00 V to + 1.00 V

Channel #6 LO/

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MT95K2 MULTI-TASK RECORDER

#7 Y/D ENGAGE SOLENOID 28 VDC

*CH 07: - 10.00 V to + 10.00 V

Channel #7 Y/D

#8 OUTPUT POSITION 1 IN/DIV

*CH 08: - 0.03 V to + 4.03 V

Channel #8 OUT

#9

*CH 09: - 2.50 V to + 2.50 V

Channel #9

#10

*CH 10: - 2.50 V to + 2.50 V

Channel #10

#11

*CH 11: - 2.50 V to + 2.50 V

Channel #11

#12

*CH 12: - 2.50 V to + 2.50 V

Channel #12

#13

*CH 13: - 2.50 V to + 2.50 V

Channel #13

#14

*CH 14: - 2.50 V to + 2.50 V

Channel #14

#15

*CH 15: - 2.50 V to + 2.50 V

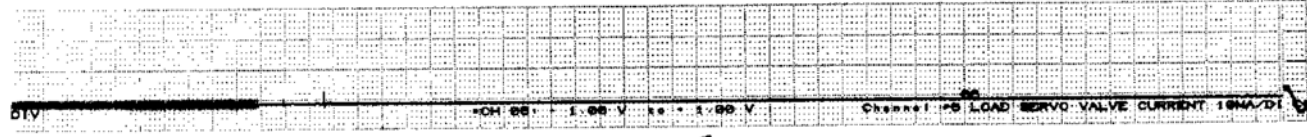
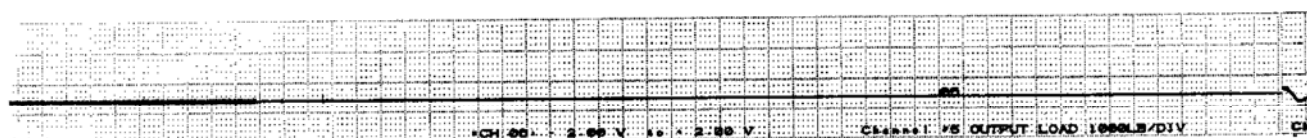
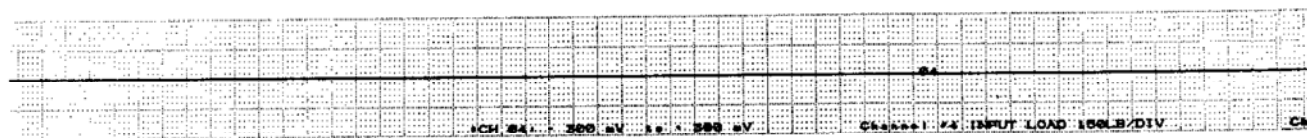
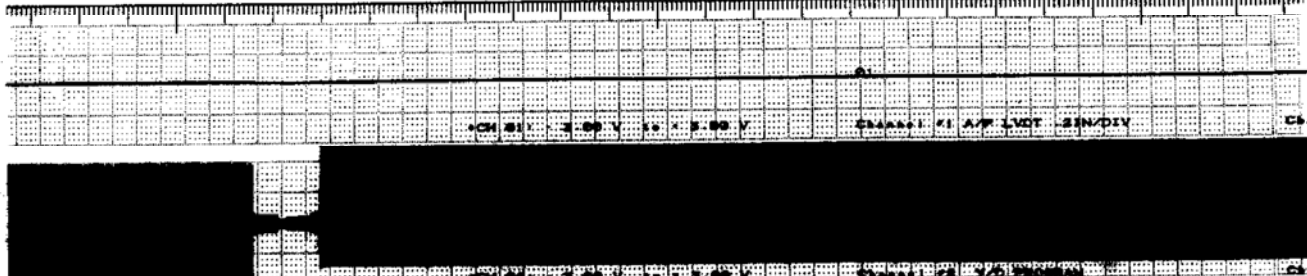
Channel #15

#16

*CH 16: - 2.50 V to + 2.50 V

Channel #16

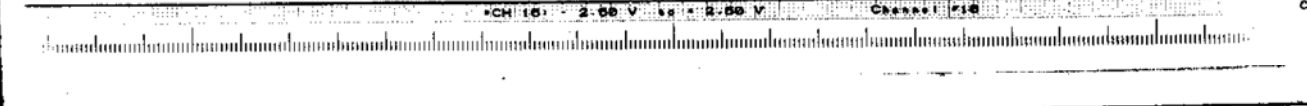
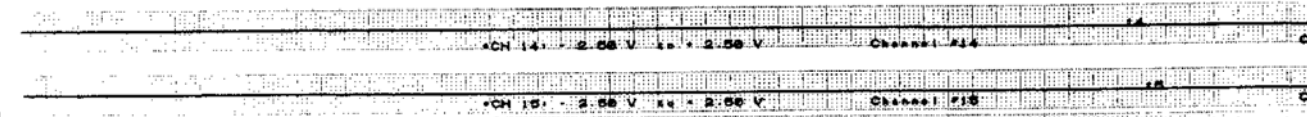
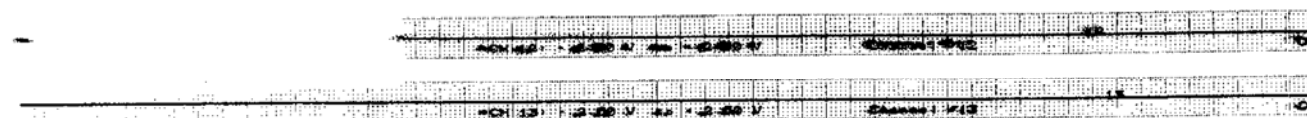
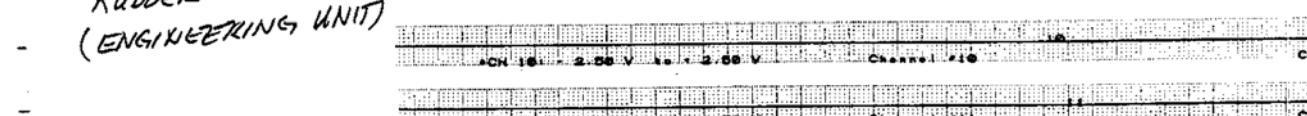
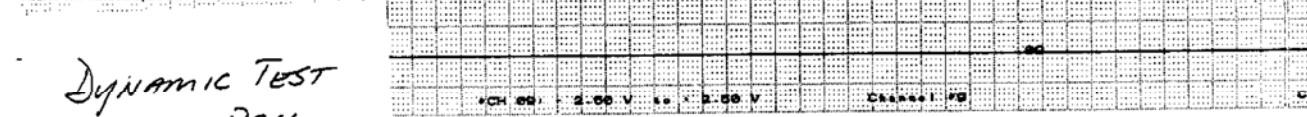
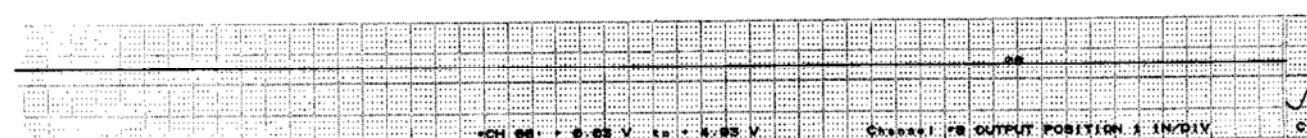
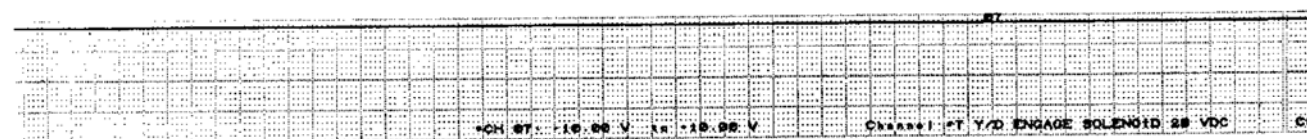
*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*



Cond 14



MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

V/P LVDT .2IN/DIV

*CH 01: - 3.00 V to + 3.00 V

Channel #1 A/P LV

INPUT ARM POSITION 1 IN/DIV

*CH 03: - 2.24 V to + 2.75 V

Channel #3 INPUT

INPUT LOAD 150LB/DIV

*CH 04: - 300 mV to + 300 mV

Channel #4 INPUT

OUTPUT LOAD 1000LB/DIV

*CH 05: - 2.00 V to + 2.00 V

Channel #5 OUTPUT

LOAD SERVO VALVE CURRENT 10MA/DIV

*CH 06: - 1.00 V to + 1.00 V

Channel #6 LOAD S

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MT95K2 MULTI-TASK RECORDER

Setup

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Y/D ENGAGE SOLENOID 28 VDC

*CH 07: -10.00 V to +10.00 V

Channel #7 Y/D EN

OUTPUT POSITION 1 IN/DIV

*CH 08: - 0.03 V to + 4.03 V

Channel #8 OUTPUT

*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*

*CH 09: - 2.50 V to + 2.50 V

Channel #9

*CH 10: - 2.50 V to + 2.50 V

Channel #10

*CH 11: - 2.50 V to + 2.50 V

Channel #11

*CH 12: - 2.50 V to + 2.50 V

Channel #12

*CH 13: - 2.50 V to + 2.50 V

Channel #13

*CH 14: - 2.50 V to + 2.50 V

Channel #14

*CH 15: - 2.50 V to + 2.50 V

Channel #15

*CH 16: - 2.50 V to + 2.50 V

Channel #16

CH 01: A/P LVDT 2IN/DIV

CH 01: 3.00 V to 3.00 V

Channel

Y/D PROGRAM

CH 03: INPUT ARM POSITION 1 IN/DIV

CH 03: 2.24 V to 2.76 V

Channel

CH 04: INPUT LOAD 100LB/DIV

CH 04: 300.0 V to 300.0 V

Channel

CH 05: OUTPUT LOAD 1000LB/DIV

CH 05: 2.00 V to 2.00 V

Channel

CH 06: LOAD SERVO VALVE CURRENT 5MA/DIV

CH 06: 1.00 V to 1.00 V

Channel

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MT95K2 MULTI-TASK RECORDER

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CH 07: Y/D ENGAGE SOLENOID 20 VDC

CH 07: 10.00 V to 10.00 V

Channel

CH 08: OUTPUT POSITION 2 IN/DIV

CH 08: 0.00 V to 4.00 V

Channel

CH 09

CH 09: 3.00 V to 3.00 V

Channel

CH 10

CH 10: 2.00 V to 2.00 V

Channel

CH 11

CH 11: 3.00 V to 3.00 V

Channel

CH 12

CH 12: 2.00 V to 2.00 V

Channel

CH 13

CH 13: 2.00 V to 2.00 V

Channel

CH 14

CH 14: 2.00 V to 2.00 V

Channel

CH 15

CH 15: 2.00 V to 2.00 V

Channel

CH 16

CH 16: 2.00 V to 2.00 V

Channel

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

Channel #1 A/P LVDT .2IN/DIV

*CH 01: - 3.00 V

Channel #2 Y/D PROOF

Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH 03: - 2.24 V

Channel #4 INPUT LOAD 150LB/DIV

*CH 04: - 300 mV

Channel #5 OUTPUT LOAD 1000LB/DIV

*CH 05: - 2.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

*CH 06: - 1.00 V

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MT95K2 MULTI-TASK RECORDER

Channel #7 Y/D ENGAGE SOLENOID 20 VDC

*CH 07: - 10.00 V

Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 08: - 0.03 V

Channel #9

*CH 09: - 2.50 V

Channel #10

*CH 10: - 2.50 V

Channel #11

*CH 11: - 2.50 V

Channel #12

*CH 12: - 2.50 V

Channel #13

*CH 13: - 2.50 V

Channel #14

*CH 14: - 2.50 V

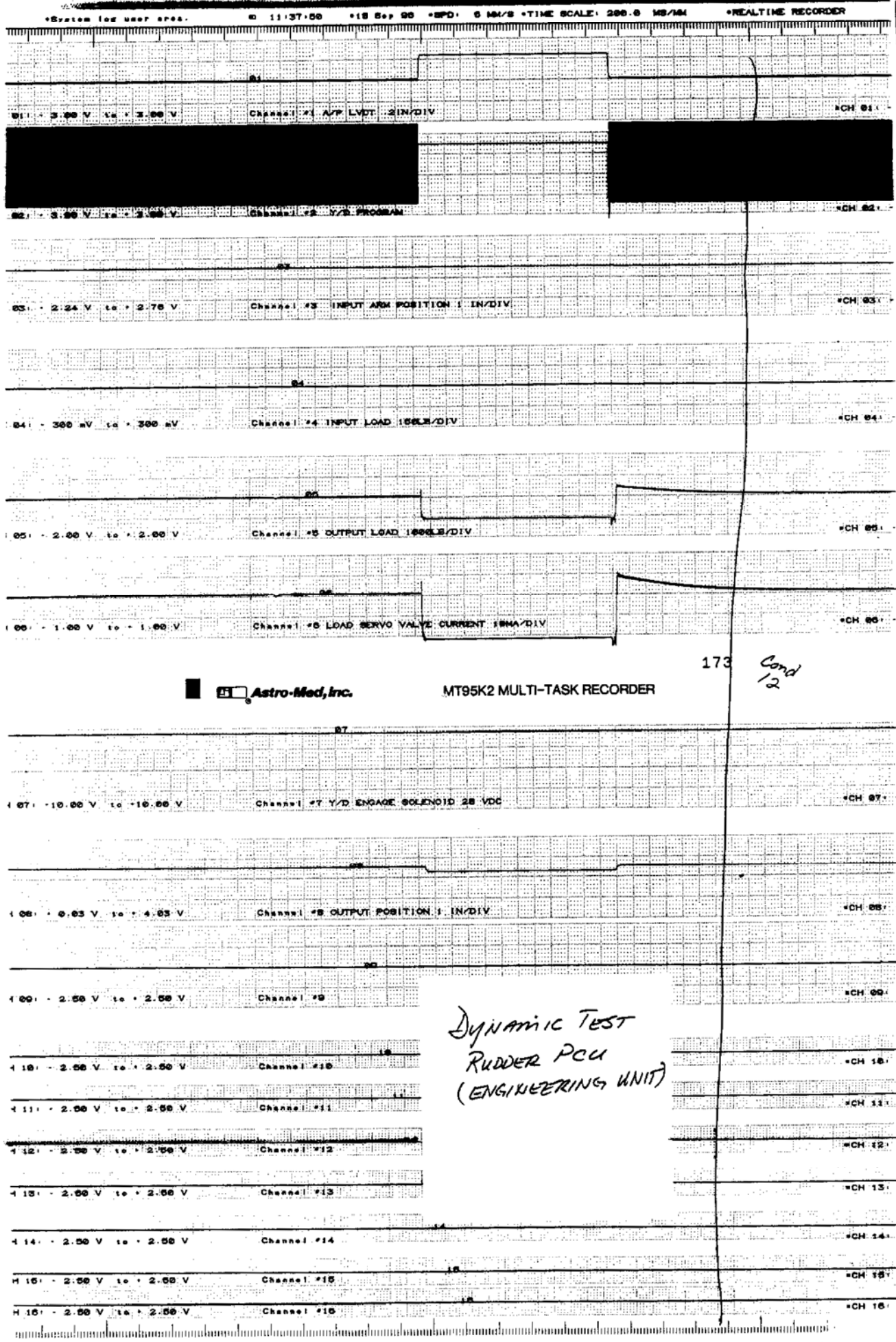
Channel #15

*CH 15: - 2.50 V

Channel #16

*CH 16: - 2.50 V

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



Channel #1 A/P LVDT .2IN/DIV

Channel #1 A/P LVDT .2IN/DIV

Channel #2 Y/D PROGRAM

Channel #2 Y/D PROGRAM

Channel #3 INPUT ARM POSITION 1 IN/DIV

Channel #3 INPUT ARM POSITION 1 IN/DIV

Channel #4 INPUT LOAD 100LB/DIV

Channel #4 INPUT LOAD 100LB/DIV

Channel #5 OUTPUT LOAD 1000LB/DIV

Channel #5 OUTPUT LOAD 1000LB/DIV

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

Cond
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MT95K2 MULTI-TASK RECORDER

Channel #7 Y/D ENGAGE SOLENOID 20 VDC

Channel #7 Y/D ENGAGE SOLENOID 20 VDC

Channel #8 OUTPUT POSITION 1 IN/DIV

Channel #8 OUTPUT POSITION 1 IN/DIV

Channel #9

Channel #9

Channel #10

Channel #10

Channel #11

Channel #11

Channel #12

Channel #12

Channel #13

Channel #13

Channel #14

Channel #14

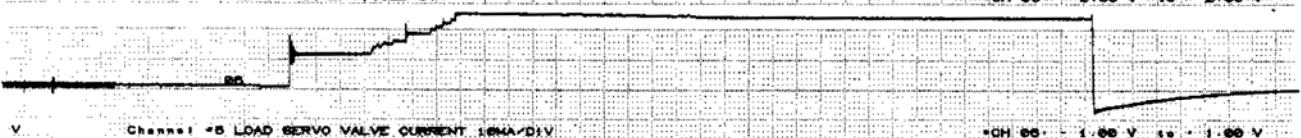
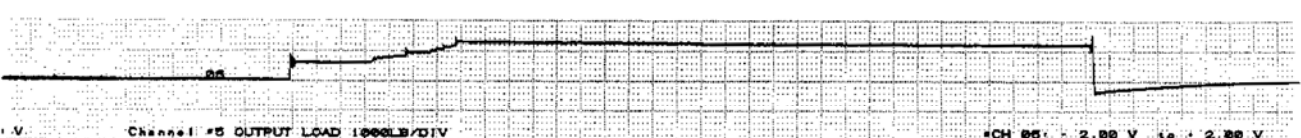
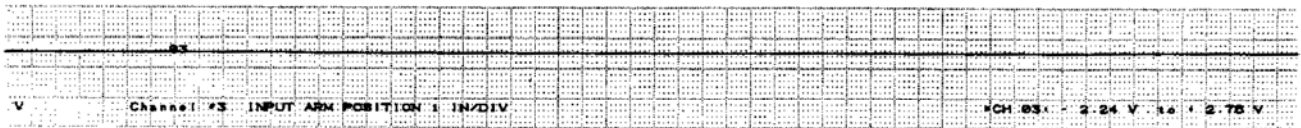
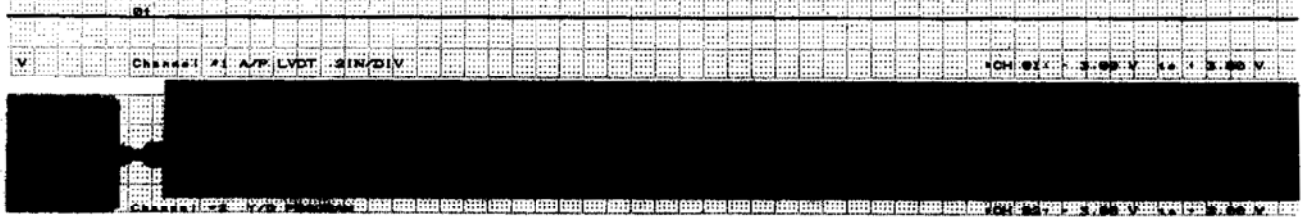
Channel #15

Channel #15

Channel #16

Channel #16

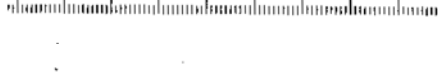
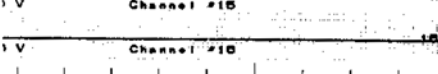
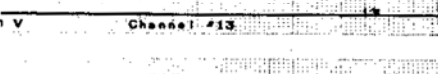
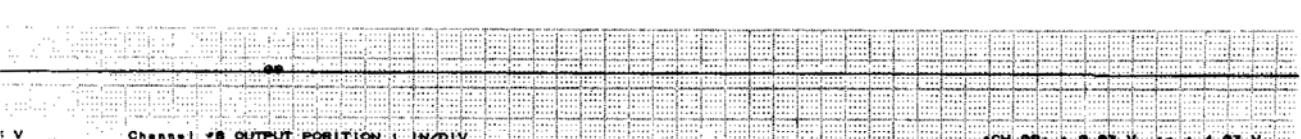
DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



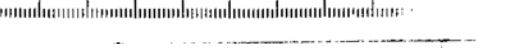
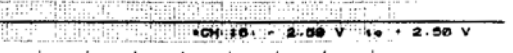
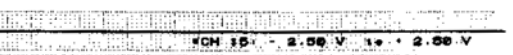
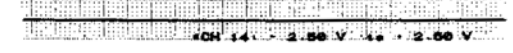
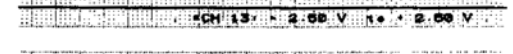
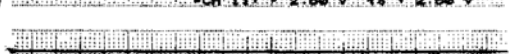
Setup

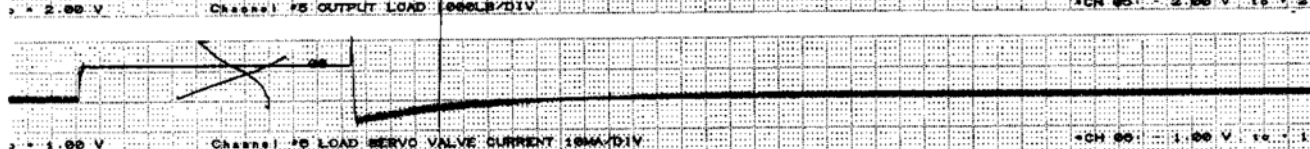
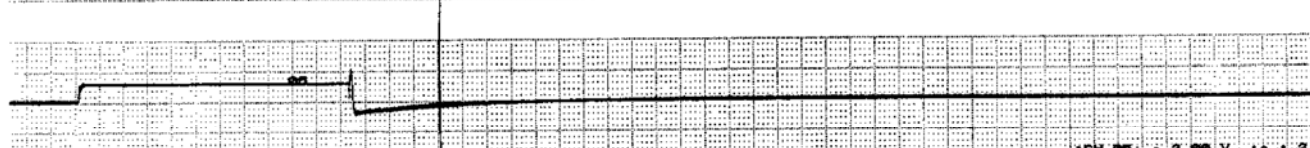
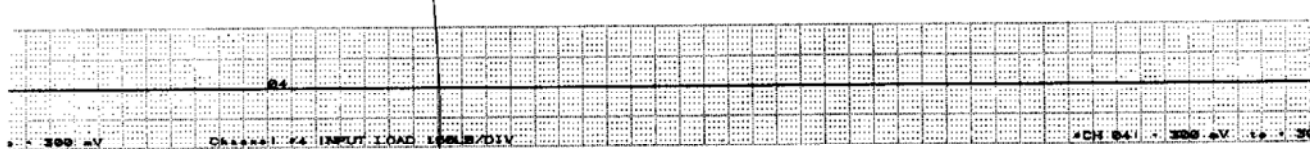
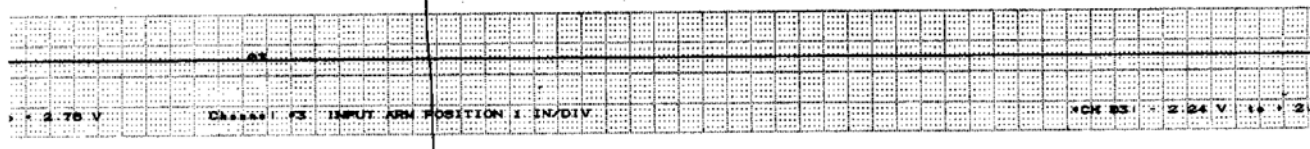
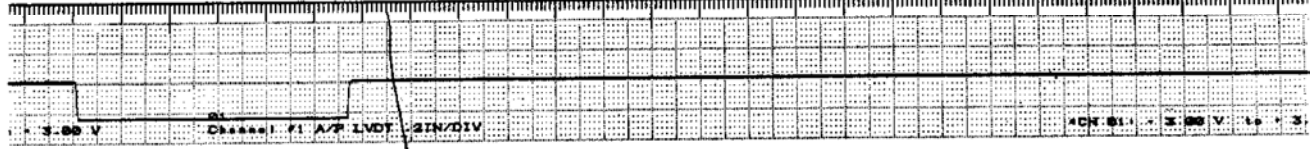


MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

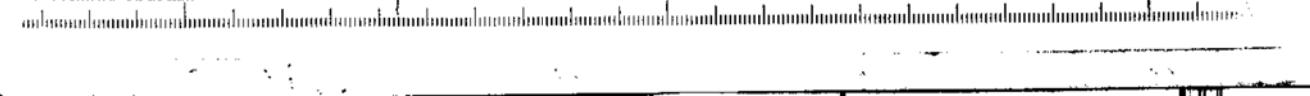
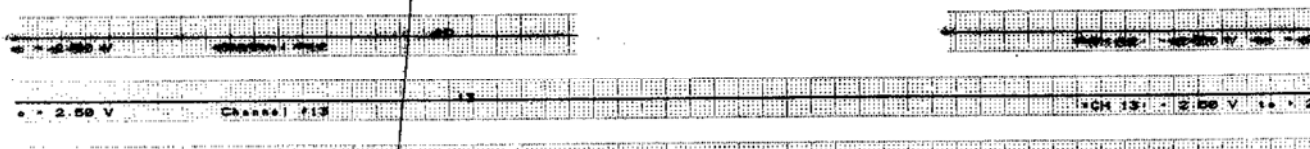
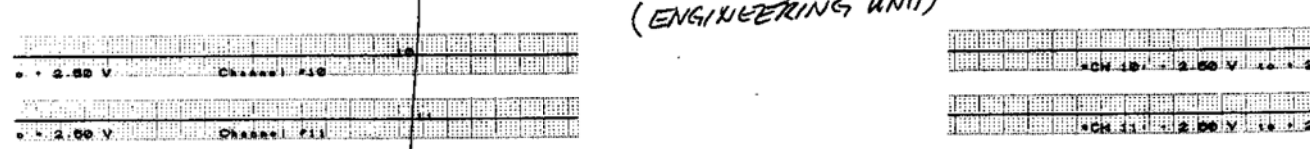
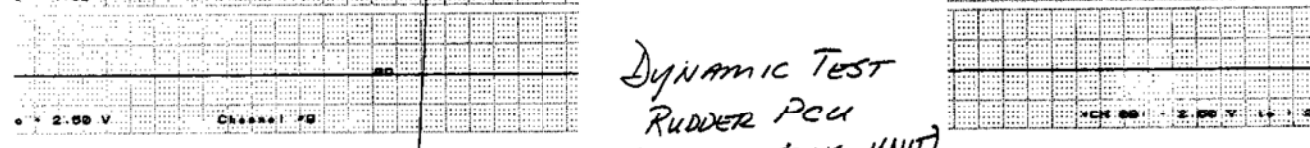
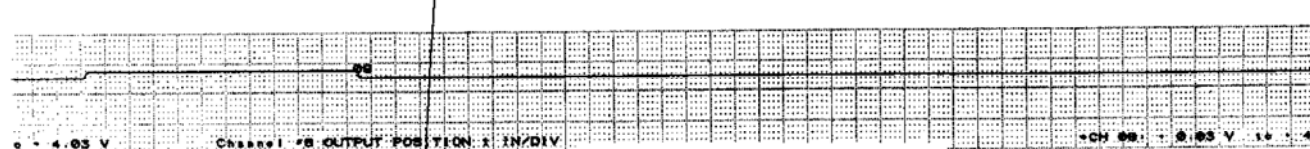
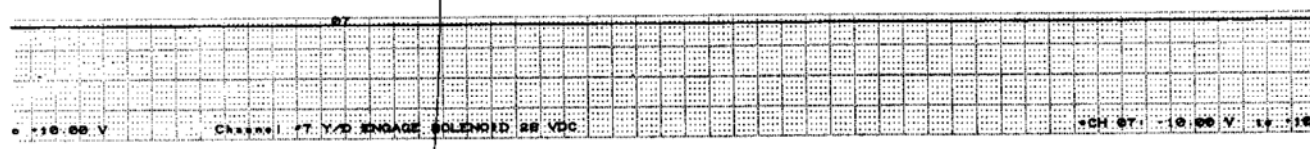




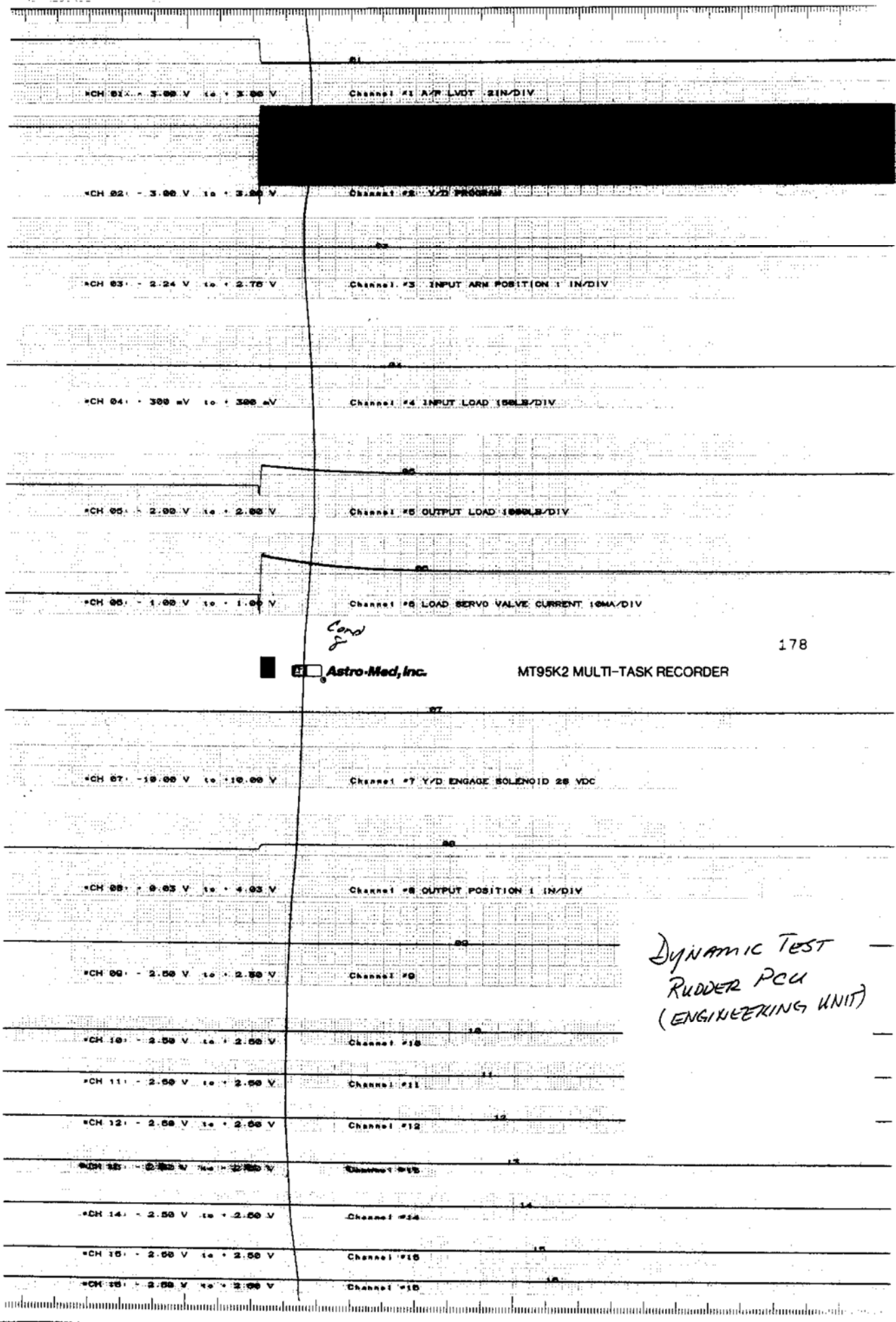
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MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



*CH 01: - 3.00 V to + 3.00 V

Channel #1 A/R LVDT 2IN/DIV

*CH 02: - 3.00 V to + 3.00 V

Channel #2 Y/D PROGRAM

*CH 03: - 2.24 V to + 2.76 V

Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH 04: - 300 mV to + 300 mV

Channel #4 INPUT LOAD 100LS/DIV

*CH 05: - 2.00 V to + 2.00 V

Channel #5 OUTPUT LOAD 100LS/DIV

*CH 06: - 1.00 V to + 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

*Cond
f*

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MT95K2 MULTI-TASK RECORDER

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*CH 07: - 10.00 V to + 10.00 V

Channel #7 Y/D ENGAGE SOLENOID 28 VDC

*CH 08: - 0.03 V to + 0.03 V

Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 09: - 2.50 V to + 2.50 V

Channel #9

*CH 10: - 2.50 V to + 2.50 V

Channel #10

*CH 11: - 2.50 V to + 2.50 V

Channel #11

*CH 12: - 2.50 V to + 2.50 V

Channel #12

*CH 13: - 2.50 V to + 2.50 V

Channel #13

*CH 14: - 2.50 V to + 2.50 V

Channel #14

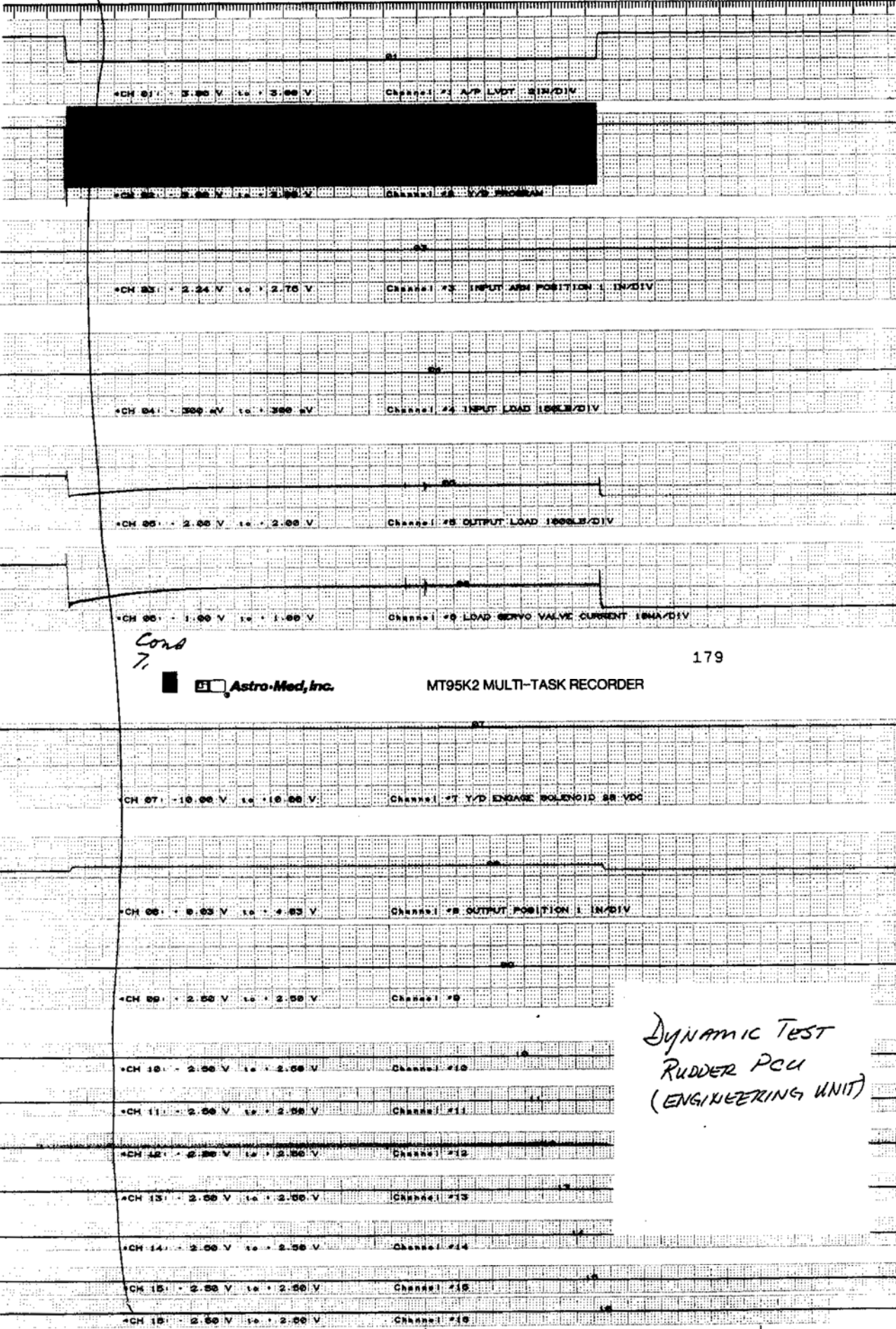
*CH 15: - 2.50 V to + 2.50 V

Channel #15

*CH 16: - 2.50 V to + 2.50 V

Channel #16

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



Cond
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Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

1 #1 A/P LVDT .2IN/DIV

*CH 01: Channel #1 A/P LVDT .2IN/DIV

1 #2 Y/D PROGRAM

*CH 02: Channel #2 Y/D PROGRAM

1 #3 INPUT ARM POSITION 1 IN/DIV

*CH 03: Channel #3 INPUT ARM POSITION 1 IN/DIV

24

1 #4 INPUT LOAD 150LB/DIV

*CH 04: Channel #4 INPUT LOAD 150LB/DIV

25

1 #5 OUTPUT LOAD 1000LB/DIV

*CH 05: Channel #5 OUTPUT LOAD 1000LB/DIV

26

1 #6 LOAD SERVO VALVE CURRENT 10MA/DIV

*CH 06: Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

 Astro-Med, Inc.Cond
P
MT95K2 MULTI-TASK RECORDER

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1 #7 Y/D ENGAGE SOLENOID 28 VDC

*CH 07: Channel #7 Y/D ENGAGE SOLENOID 28 VDC

28

1 #8 OUTPUT POSITION 1 IN/DIV

*CH 08: Channel #8 OUTPUT POSITION 1 IN/DIV

29

1 #9

*CH 09: Channel #9

30

1 #10

*CH 10: Channel #10

31

1 #11

*CH 11: Channel #11

32

1 #12

*CH 12: Channel #12

33

1 #13

*CH 13: Channel #13

34

1 #14

*CH 14: Channel #14

35

1 #15

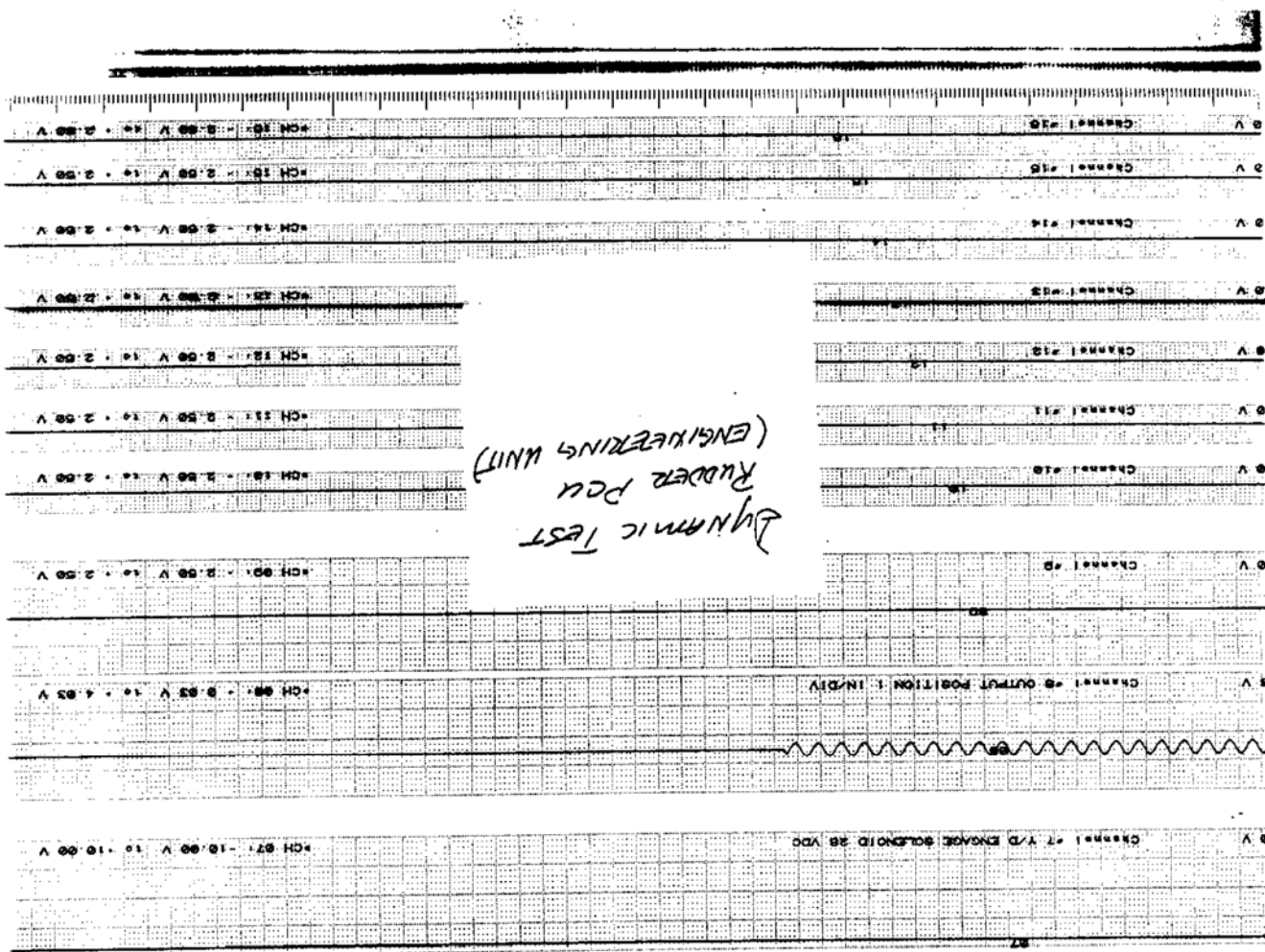
*CH 15: Channel #15

36

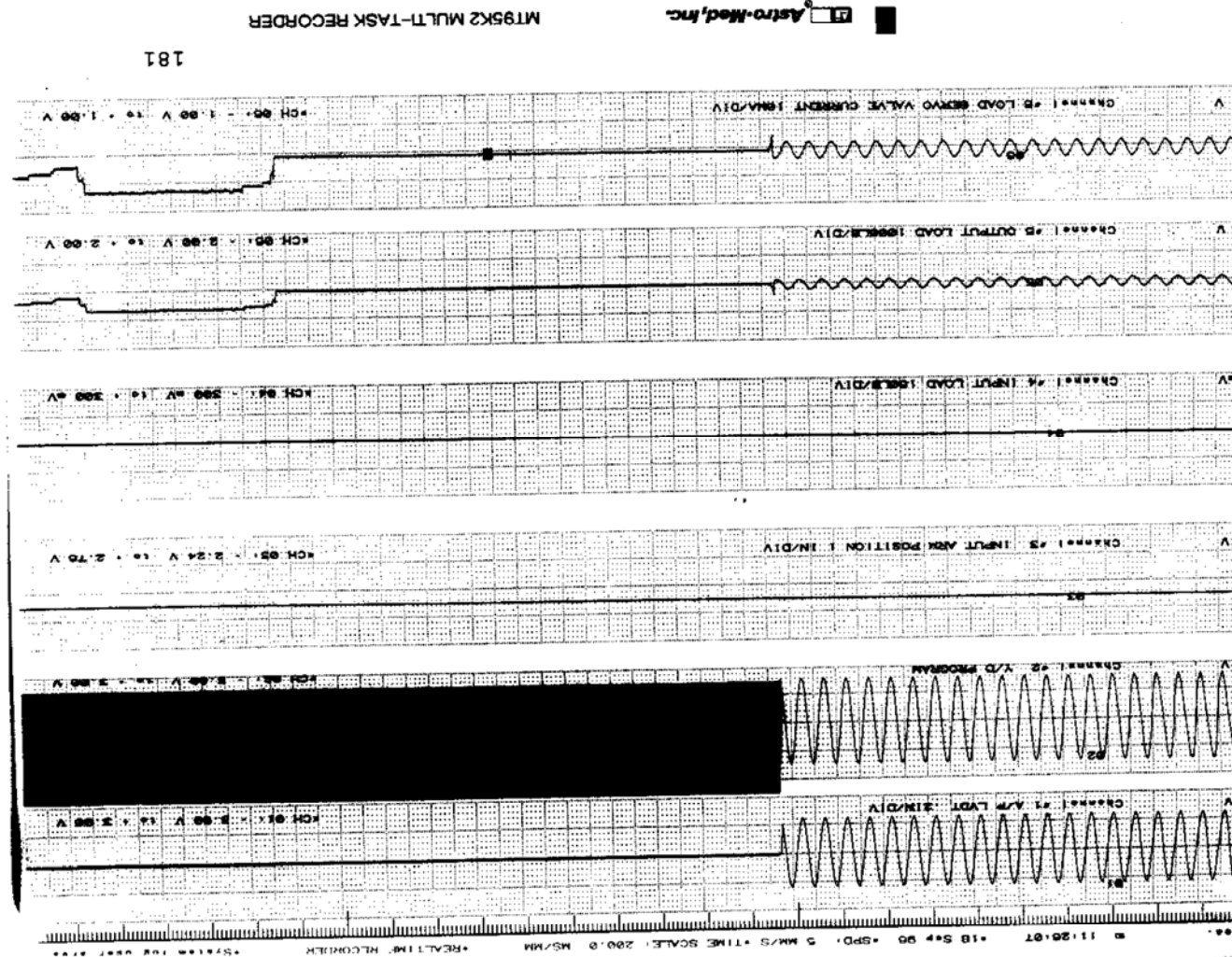
1 #16

*CH 16: Channel #16

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



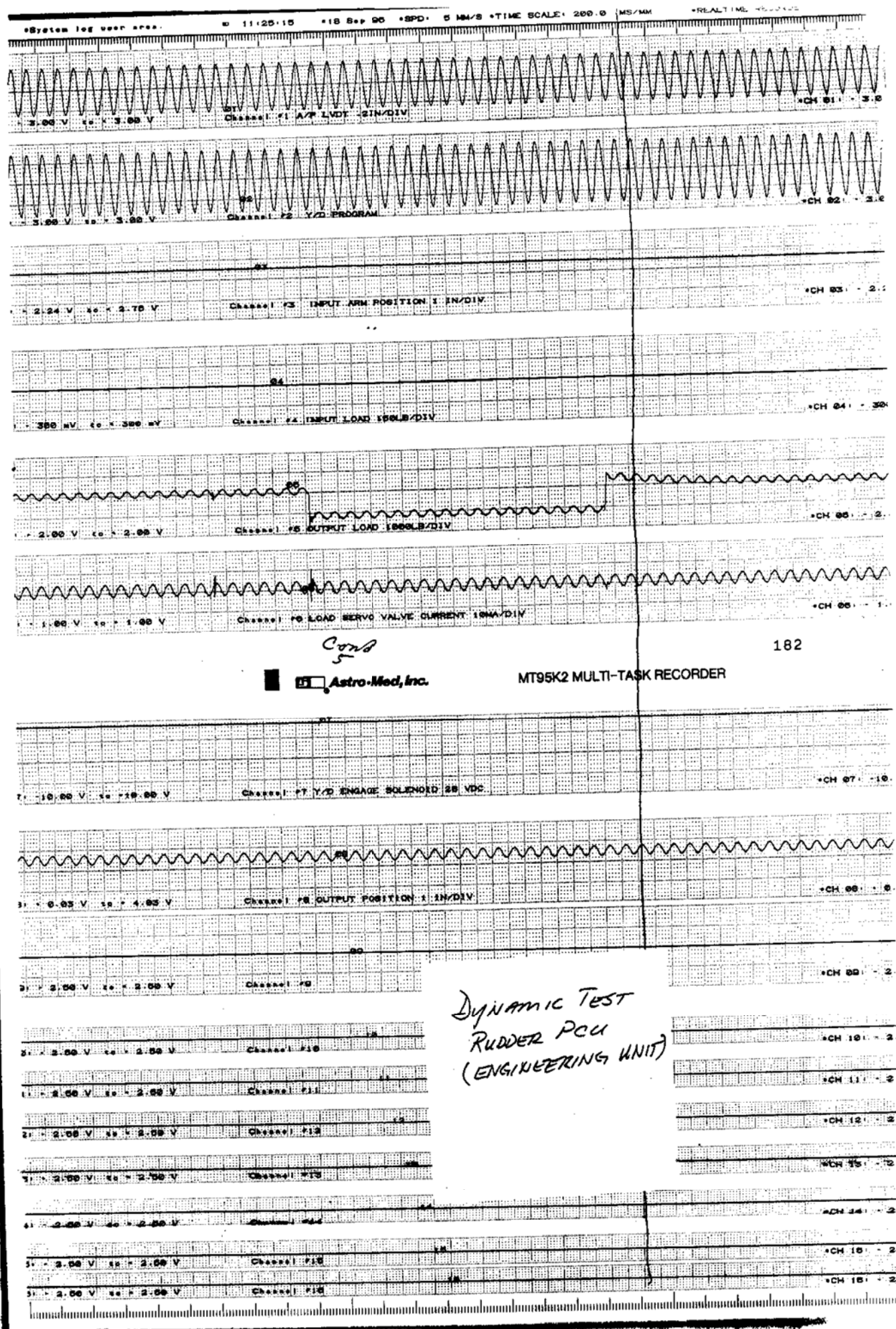
DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



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MT95K2 MULTITASK RECORDER

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System log user area

11:25:15 18 Sep 90 SPD 5 MM/S TIME SCALE 200.0 MS/MM

REALTIME

3.00 V to 3.00 V

Channel 01 A/P LVDT 2IN/DIV

CH 01 3.0

3.00 V to 3.00 V

Channel 02 Y/D PROGRAM

CH 02 3.0

2.24 V to 2.70 V

Channel 03 INPUT ARM POSITION 1 IN/DIV

CH 03 2.2

300 mV to 300 mV

Channel 04 INPUT LOAD 150LB/DIV

CH 04 300

2.00 V to 2.00 V

Channel 05 OUTPUT LOAD 150LB/DIV

CH 05 2.0

1.00 V to 1.00 V

Channel 06 LOAD SERVO VALVE CURRENT 10mA/DIV

CH 06 1.0

Comp

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MT95K2 MULTI-TASK RECORDER

10.00 V to 10.00 V

Channel 07 Y/D ENGAGE SOLENOID 20 VDC

CH 07 10.0

0.05 V to 4.05 V

Channel 08 OUTPUT POSITION 1 IN/DIV

CH 08 0.0

2.00 V to 2.00 V

Channel 09

CH 09 2.0

2.00 V to 2.00 V

Channel 10

CH 10 2.0

2.00 V to 2.00 V

Channel 11

CH 11 2.0

2.00 V to 2.00 V

Channel 12

CH 12 2.0

2.00 V to 2.00 V

Channel 13

CH 13 2.0

2.00 V to 2.00 V

Channel 14

CH 14 2.0

2.00 V to 2.00 V

Channel 15

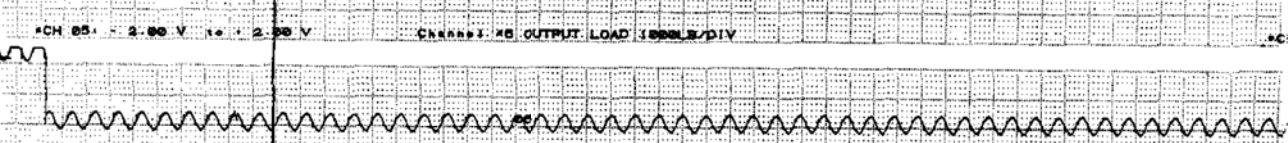
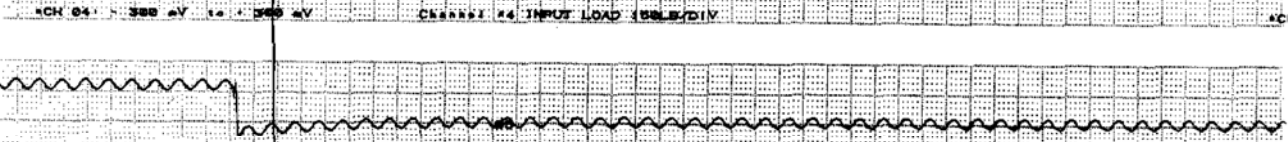
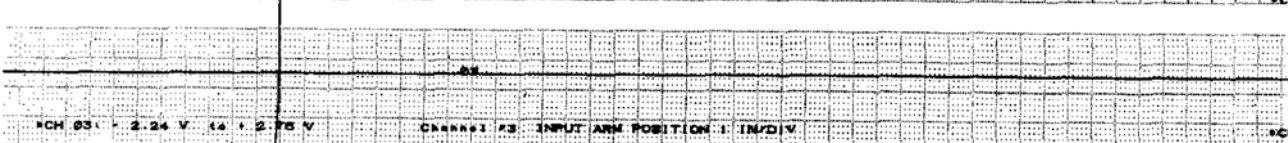
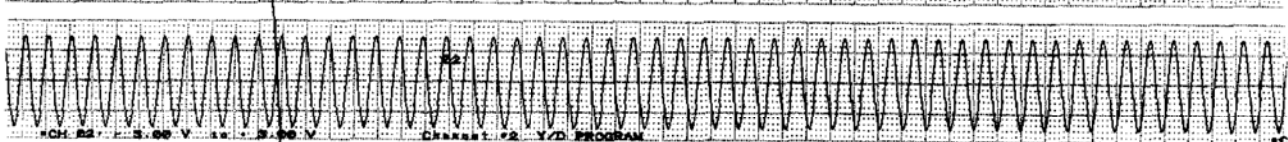
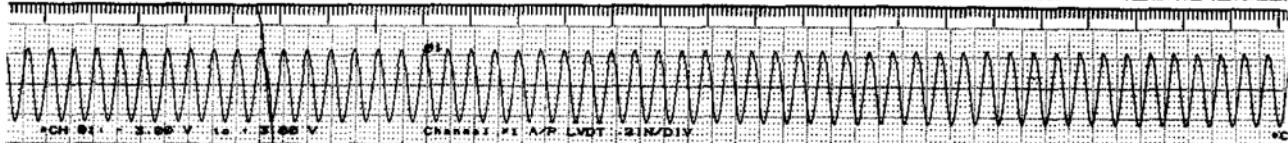
CH 15 2.0

2.00 V to 2.00 V

Channel 16

CH 16 2.0

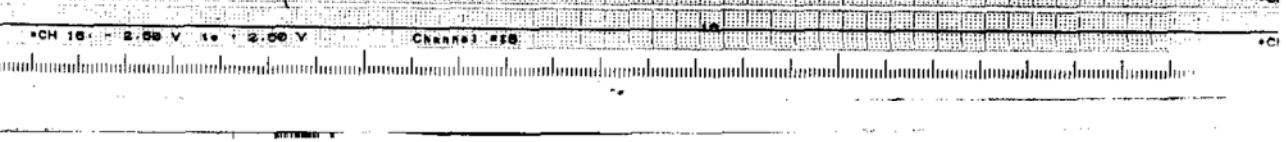
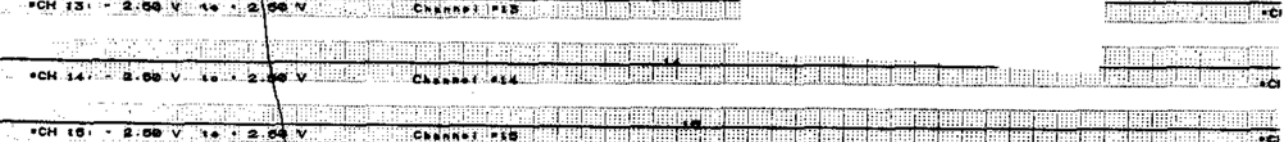
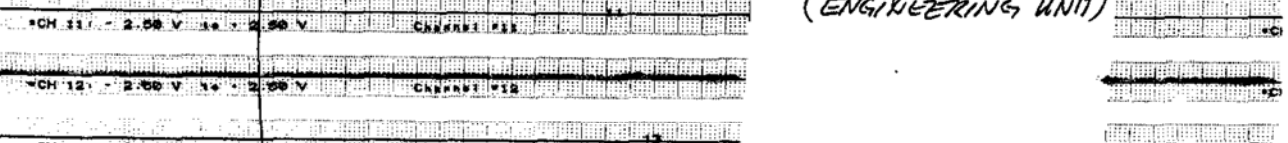
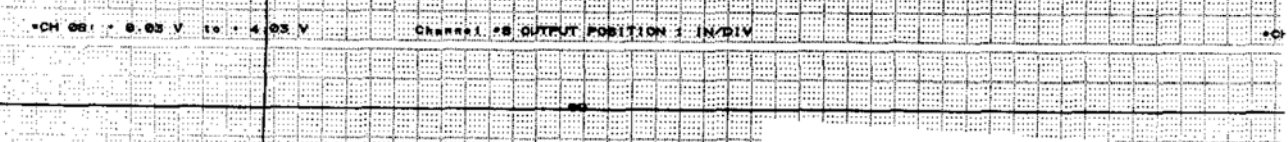
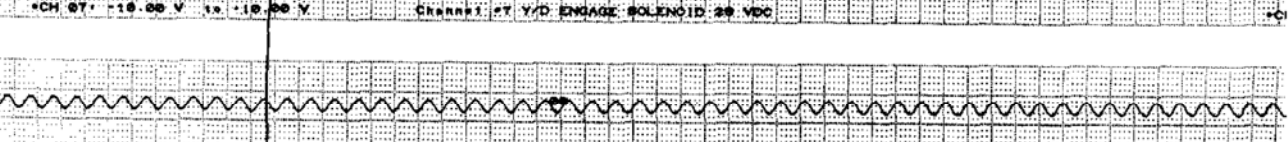
*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*



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Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

01

*CH 01: - 3.00 V to + 3.00 V

Channel #1 A/P LVDT .2IN/DIV



*CH 02: - 2.00 V to + 2.00 V

Channel #2 Y/D PROGRAM

03

*CH 03: - 2.24 V to + 2.76 V

Channel #3 INPUT ARM POSITION 1 IN/DIV

04

*CH 04: - 300 mV to + 300 mV

Channel #4 INPUT LOAD 150LB/DIV

05

*CH 05: - 2.00 V to + 2.00 V

Channel #5 OUTPUT LOAD 1000LB/DIV

06

*CH 06: - 1.00 V to + 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

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MT95K2 MULTI-TASK RECORDER

07

*CH 07: -10.00 V to +10.00 V

Channel #7 Y/D ENGAGE SOLENOID 28 VDC

08

*CH 08: - 0.03 V to + 4.03 V

Channel #8 OUTPUT POSITION 1 IN/DIV

09

*CH 09: - 2.50 V to + 2.50 V

Channel #9

10

*CH 10: - 2.50 V to + 2.50 V

Channel #10

11

*CH 11: - 2.50 V to + 2.50 V

Channel #11

12

*CH 12: - 2.50 V to + 2.50 V

Channel #12

13

*CH 13: - 2.50 V to + 2.50 V

Channel #13

14

*CH 14: - 2.50 V to + 2.50 V

Channel #14

15

*CH 15: - 2.50 V to + 2.50 V

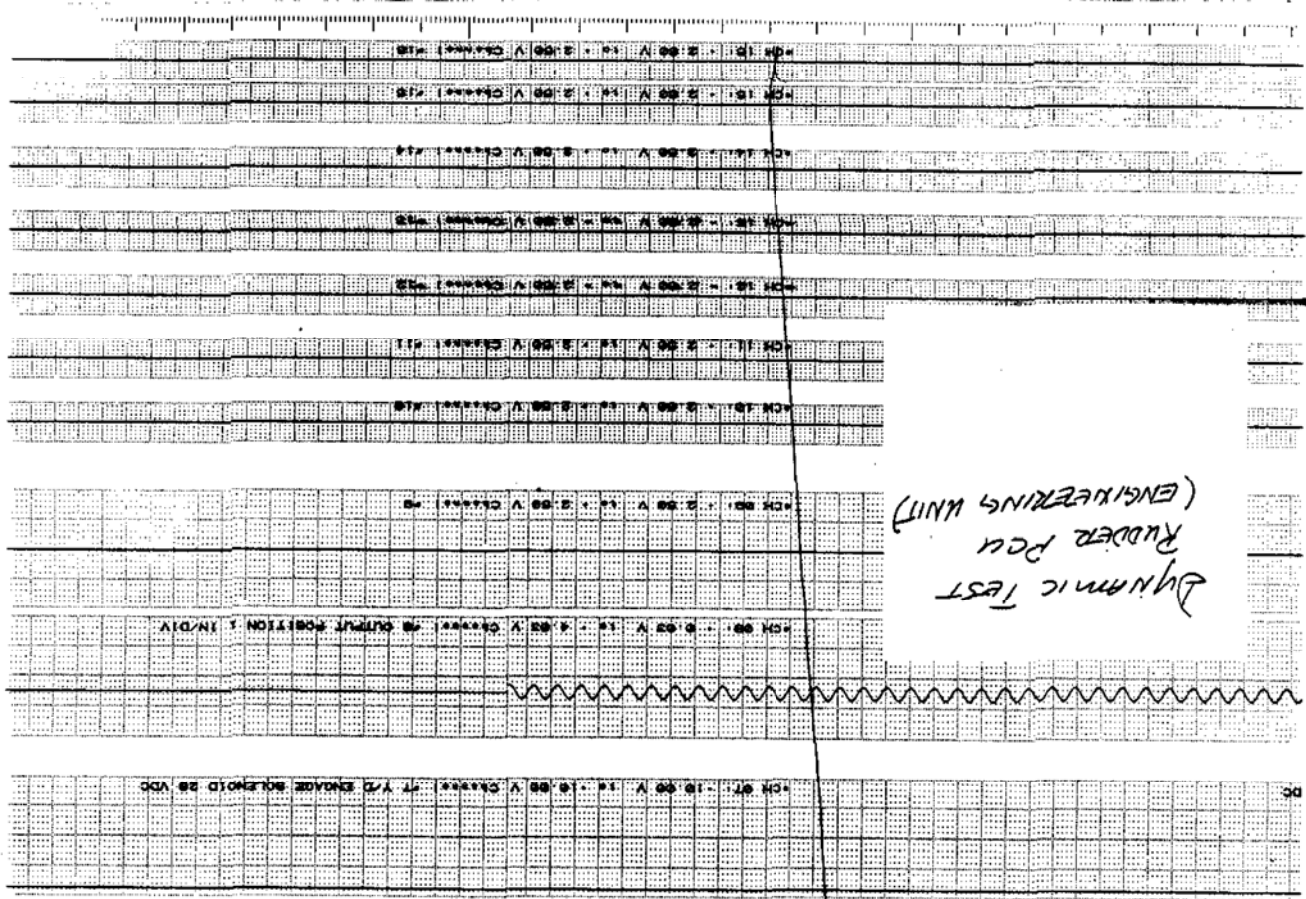
Channel #15

16

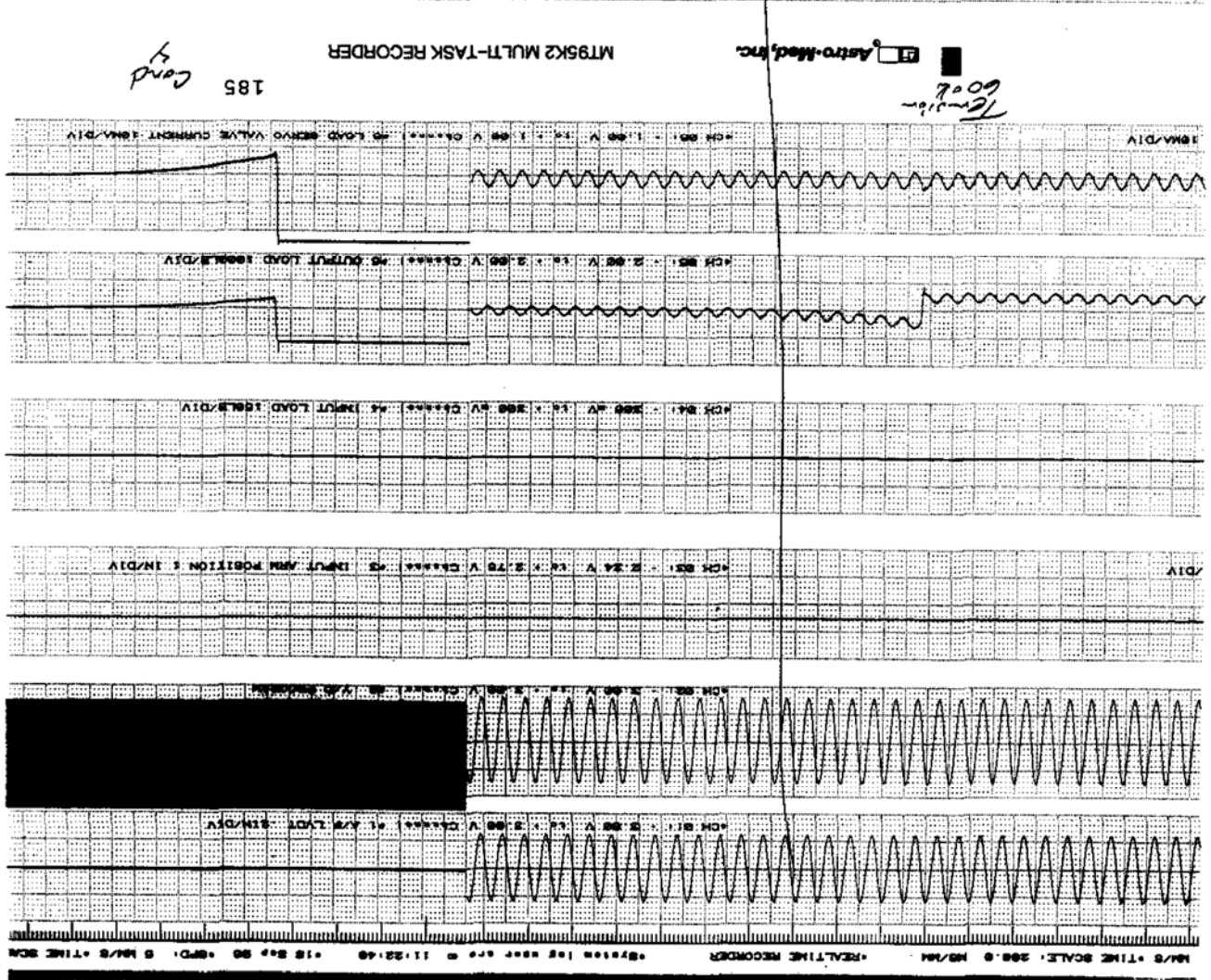
*CH 16: - 2.50 V to + 2.50 V

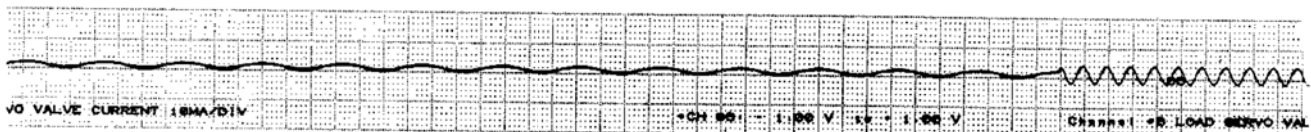
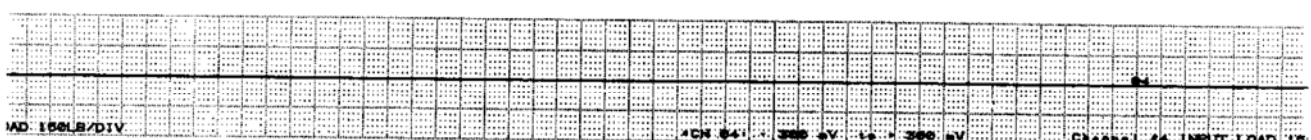
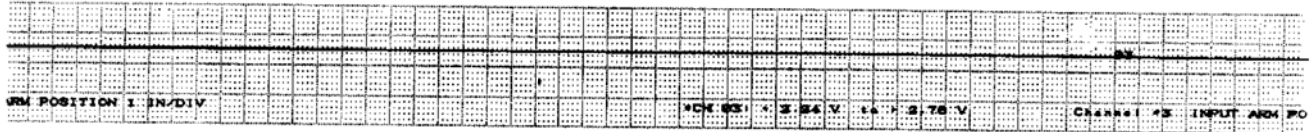
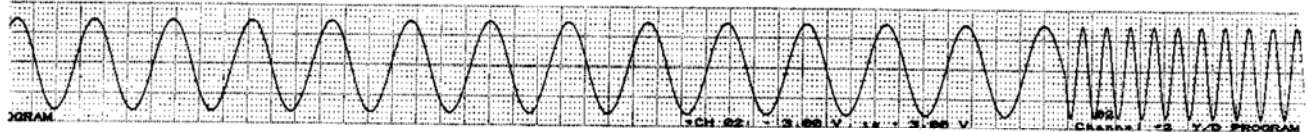
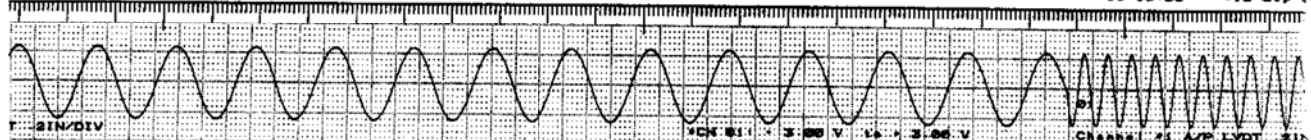
Channel #16

DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

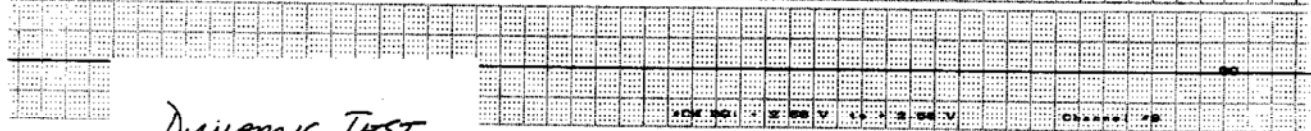
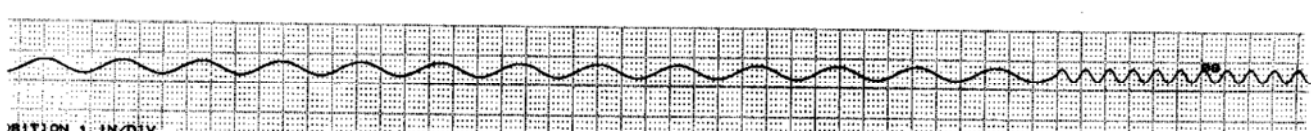
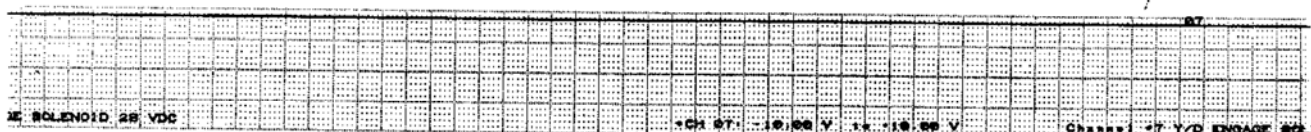




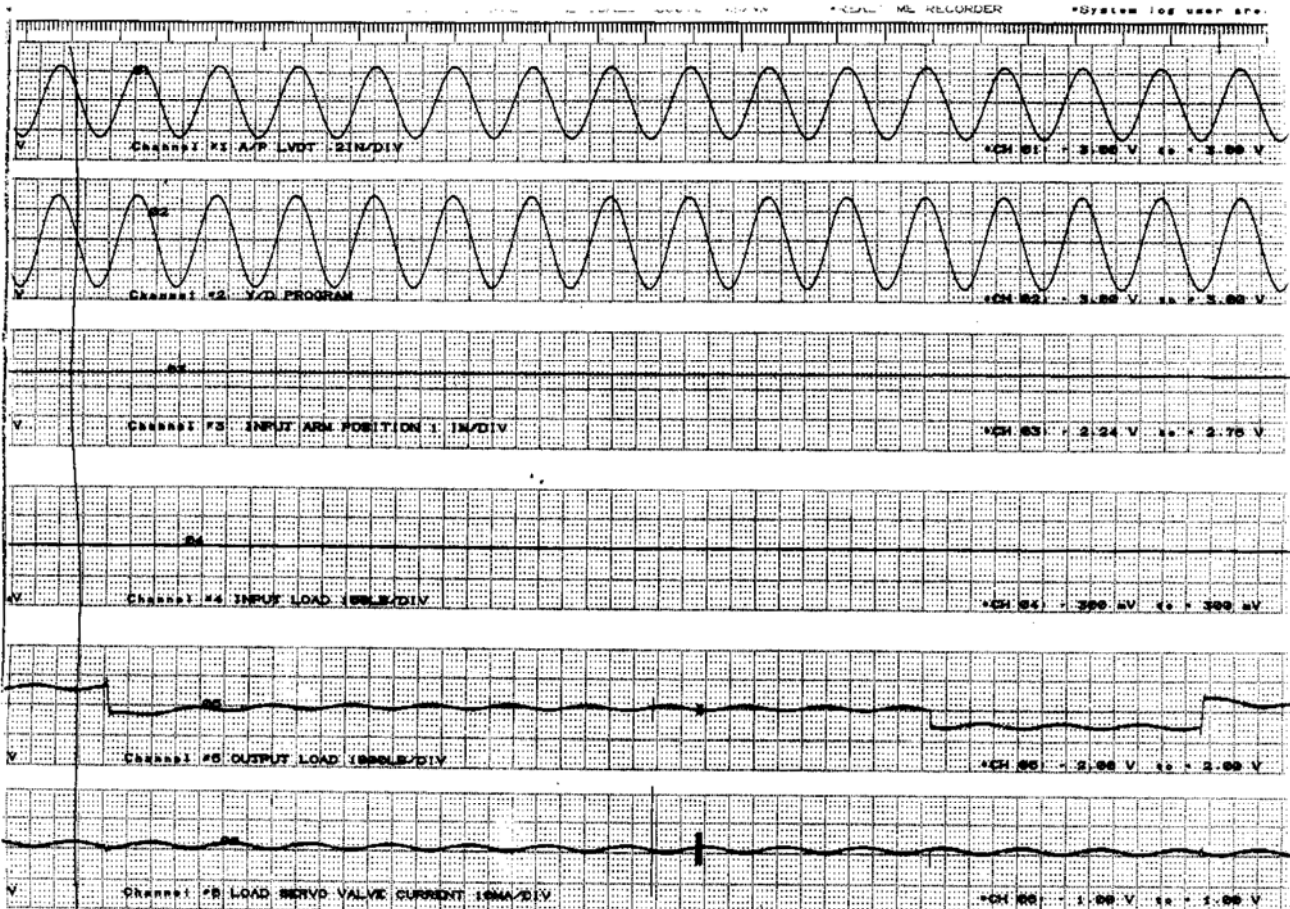
Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

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*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*

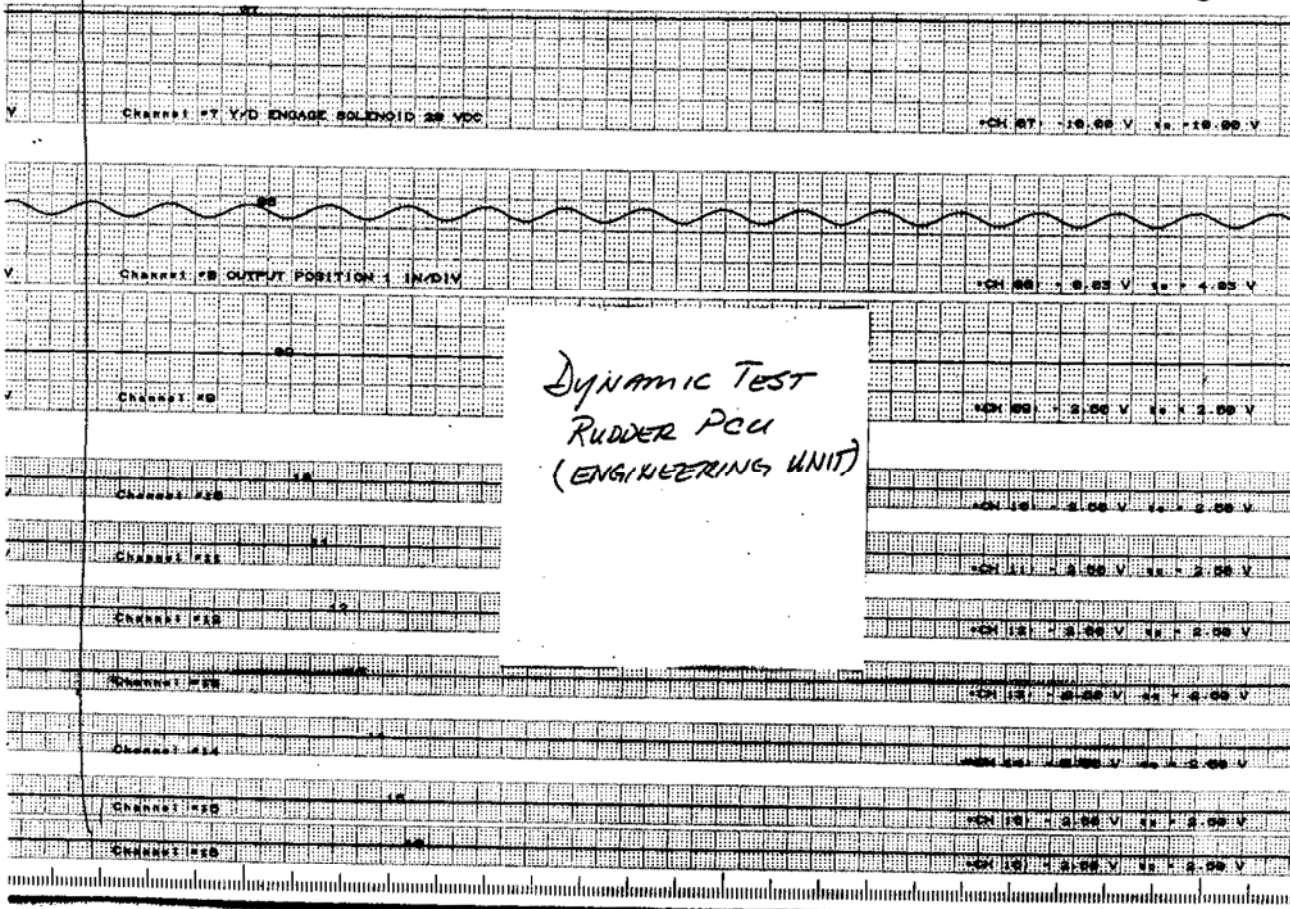


Cond 2

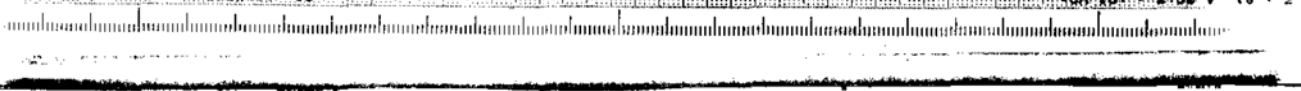
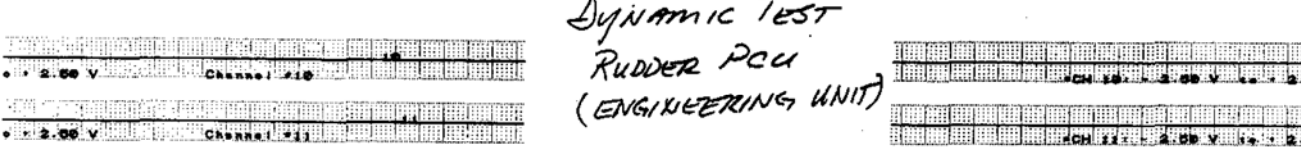
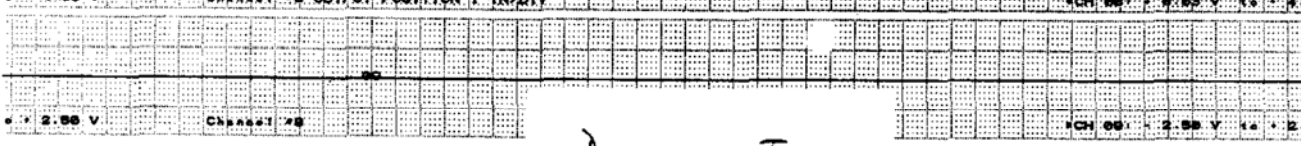
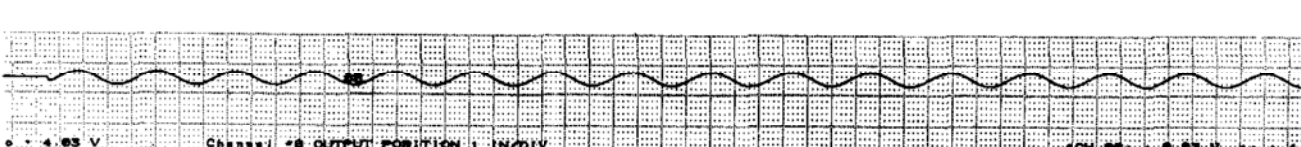
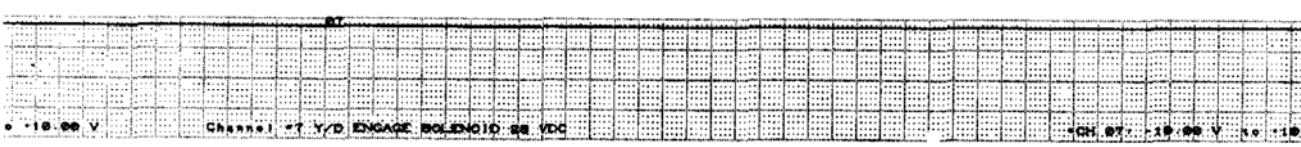
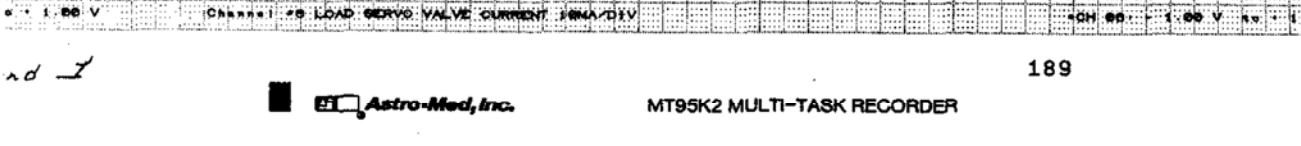
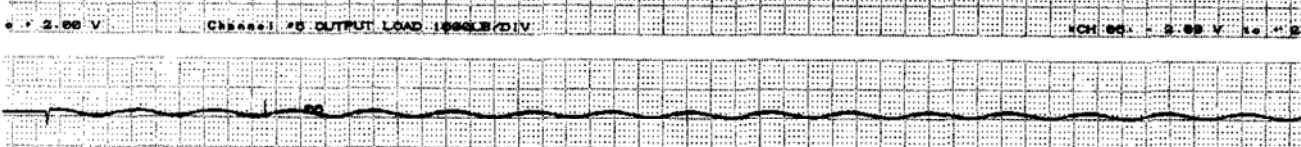
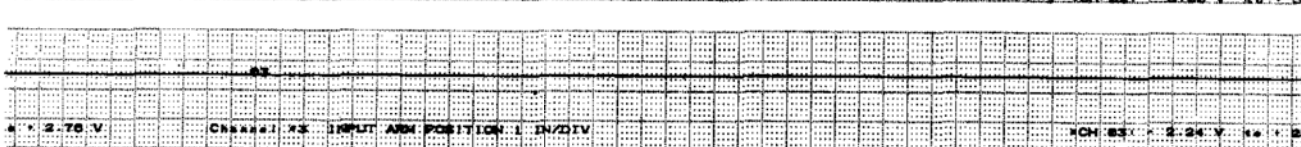
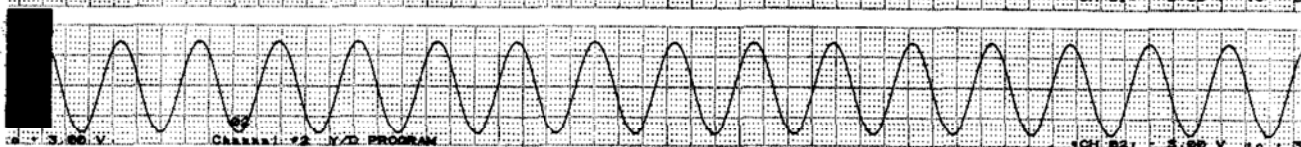
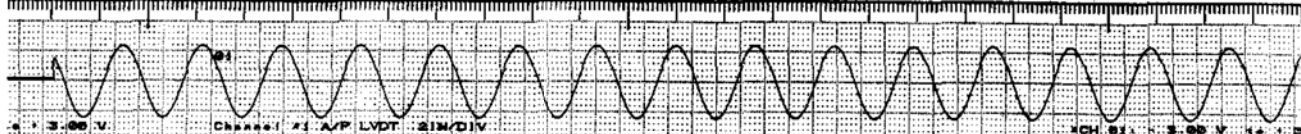
Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

188
Tension
600%



DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)



nd 1

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MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)

*CH 01 Channel #1 A/P LVDT .2IN/DIV

*CH 02 Channel #2 Y/D PROGRAM

*CH 03 Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH 04 Channel #4 INPUT LOAD 100LB/DIV

*CH 05 Channel #5 OUTPUT LOAD 1000LB/DIV

IV

*CH 06 Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

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 Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

*CH 07 Channel #7 Y/D ENGAGE SOLENOID 28 VDC

*CH 08 Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 09 Channel #9

*CH 10 Channel #10

*CH 11 Channel #11

*CH 12 Channel #12

*CH 13 Channel #13

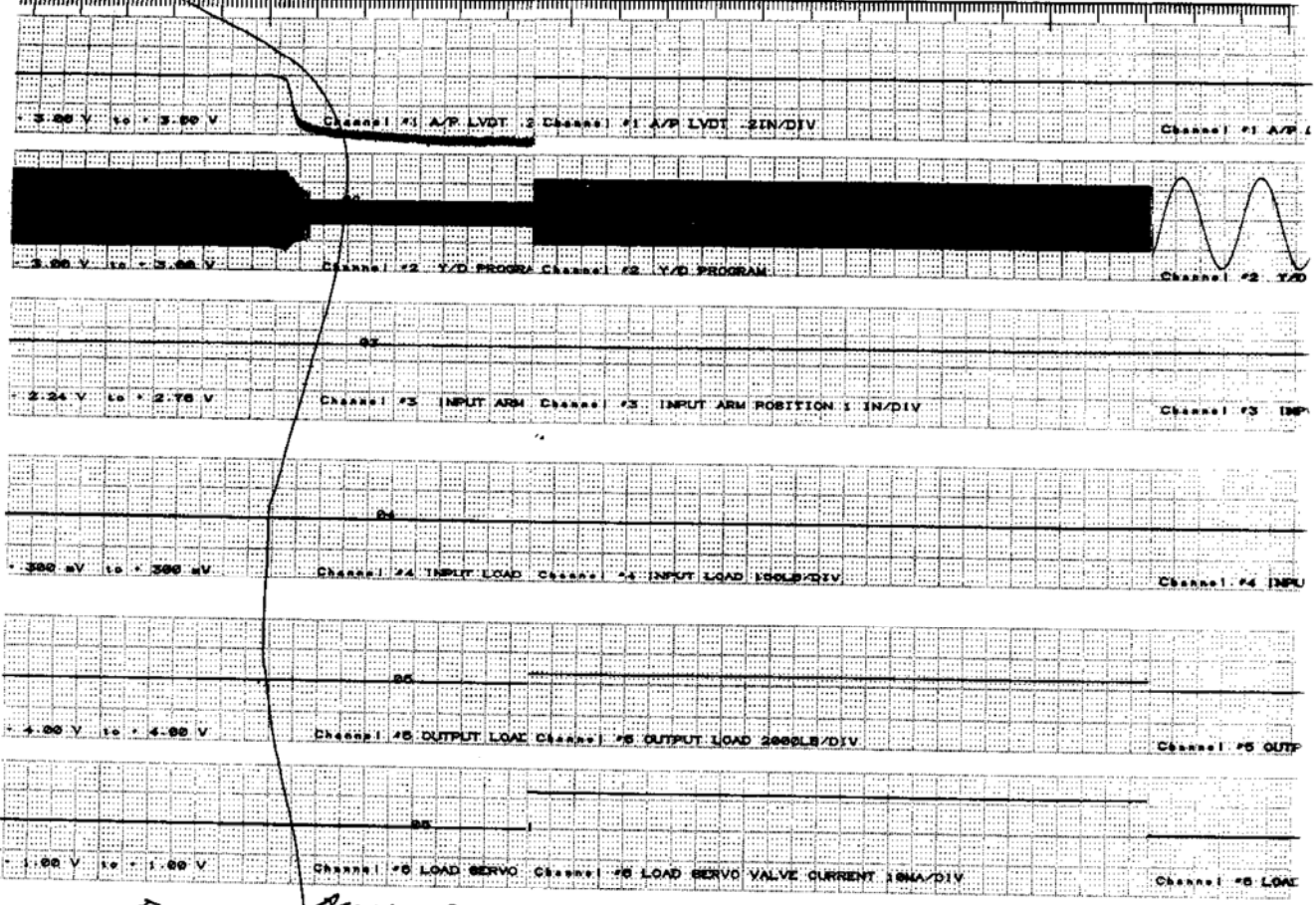
*CH 14 Channel #14

*CH 15 Channel #15

*CH 16 Channel #16

*DYNAMIC TEST
RUDDER PCU
(ENGINEERING UNIT)*

Attachment 2
Accident Unit Test Data



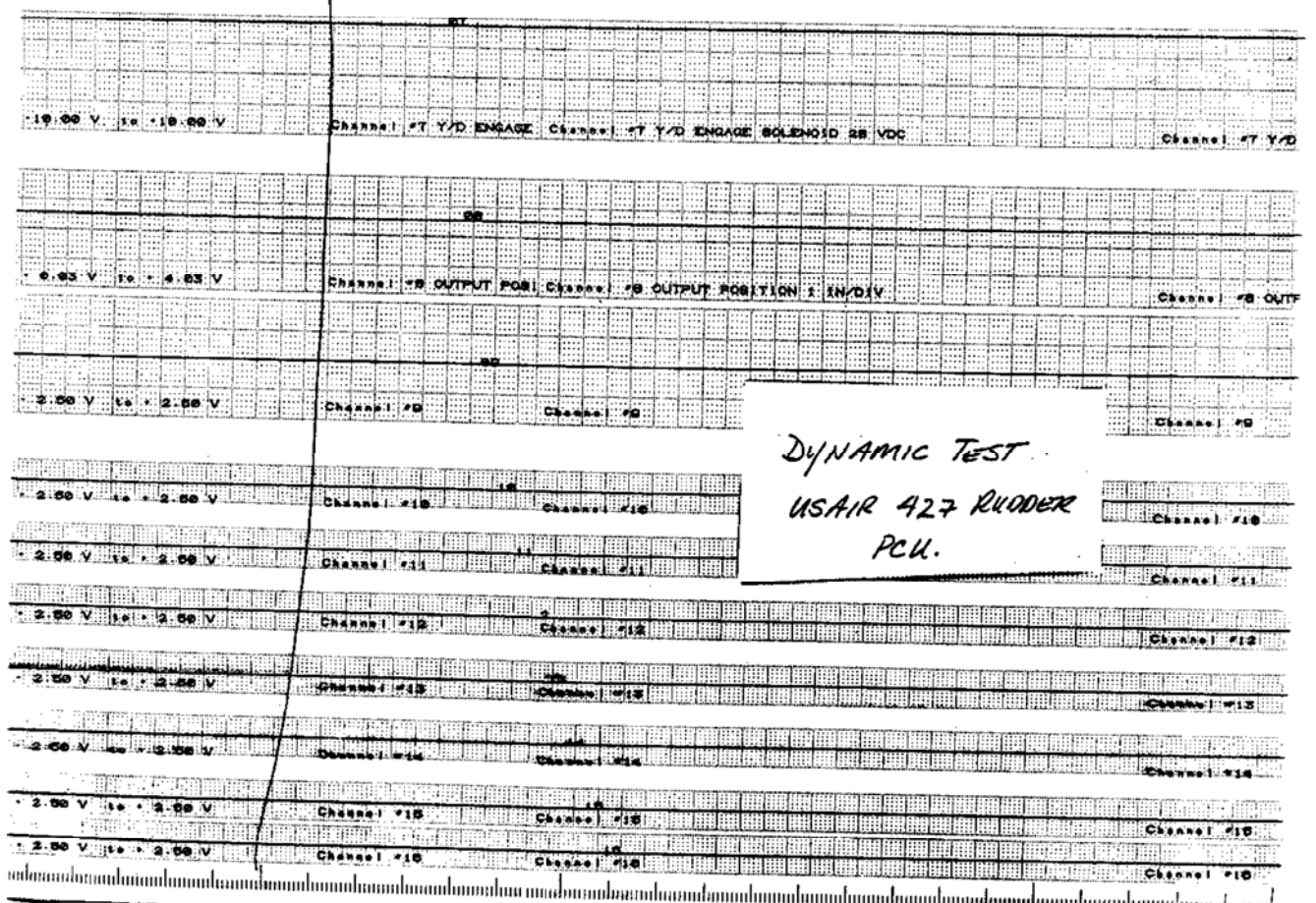
Engineering Unit

Accident Unit

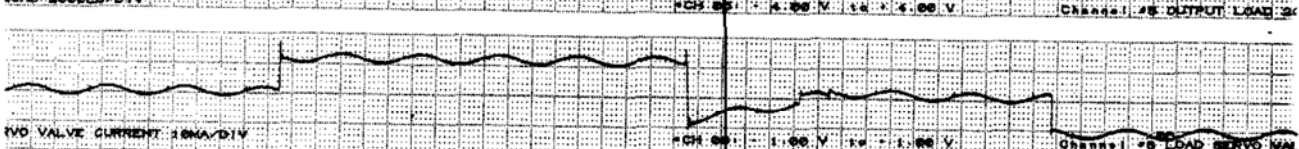
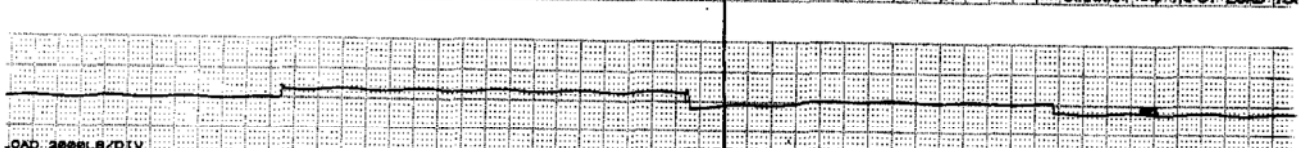
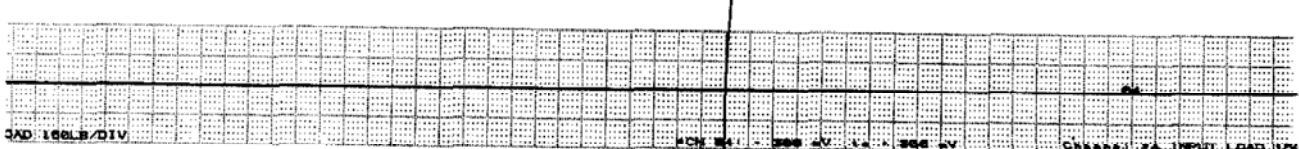
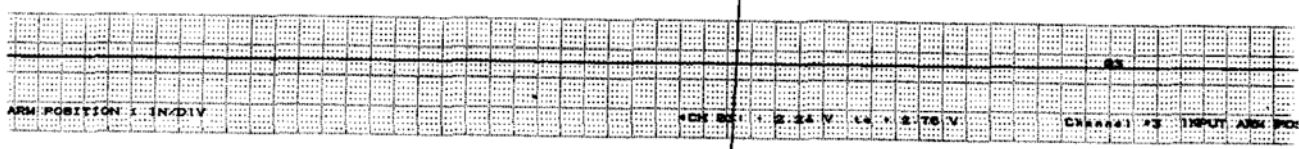
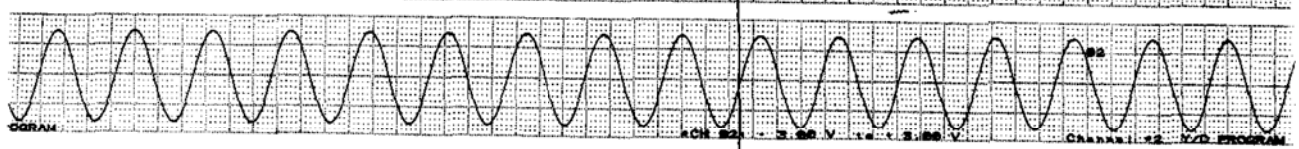
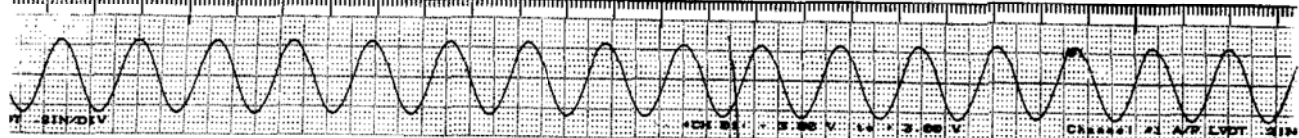
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MT95K2 MULTI-TASK RECORDER

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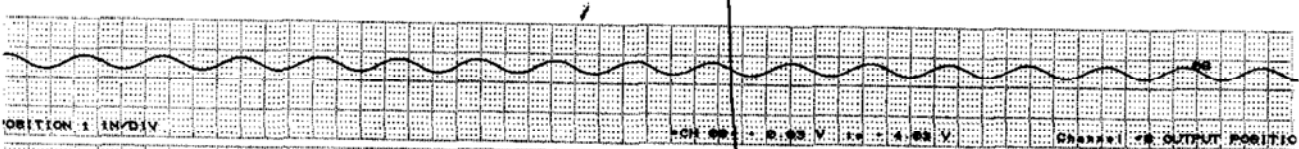
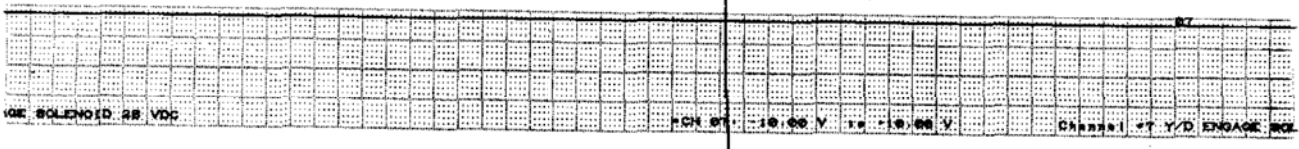
DYNAMIC TEST
USAIR 427 RUDDER
PCU.



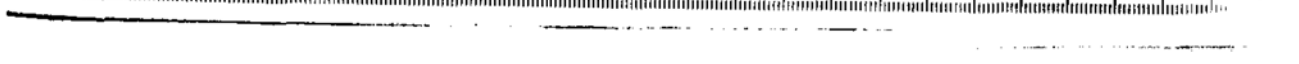
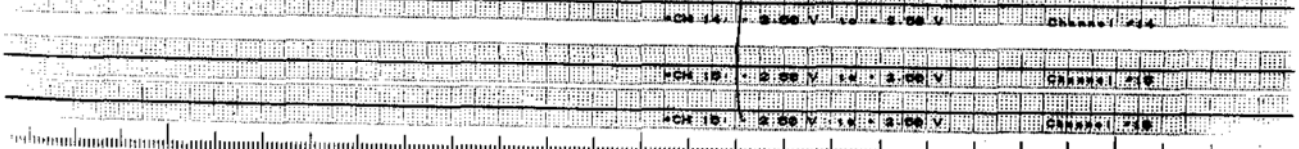
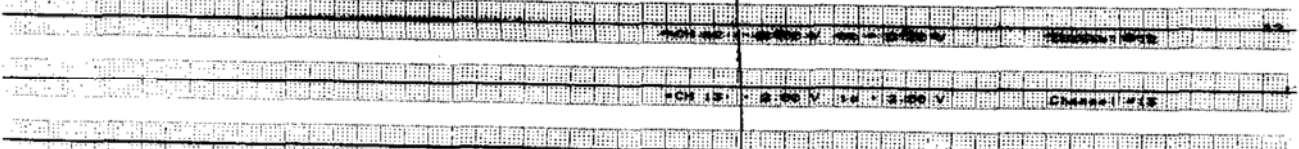
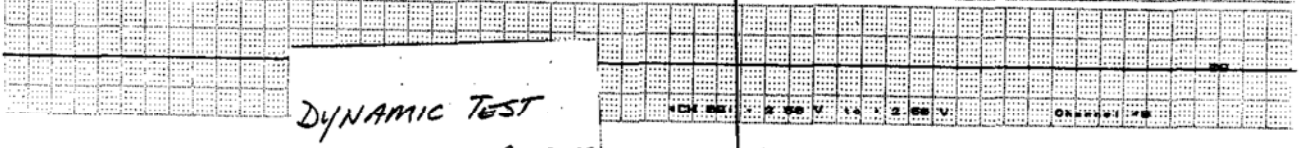
Astro-Med, Inc.

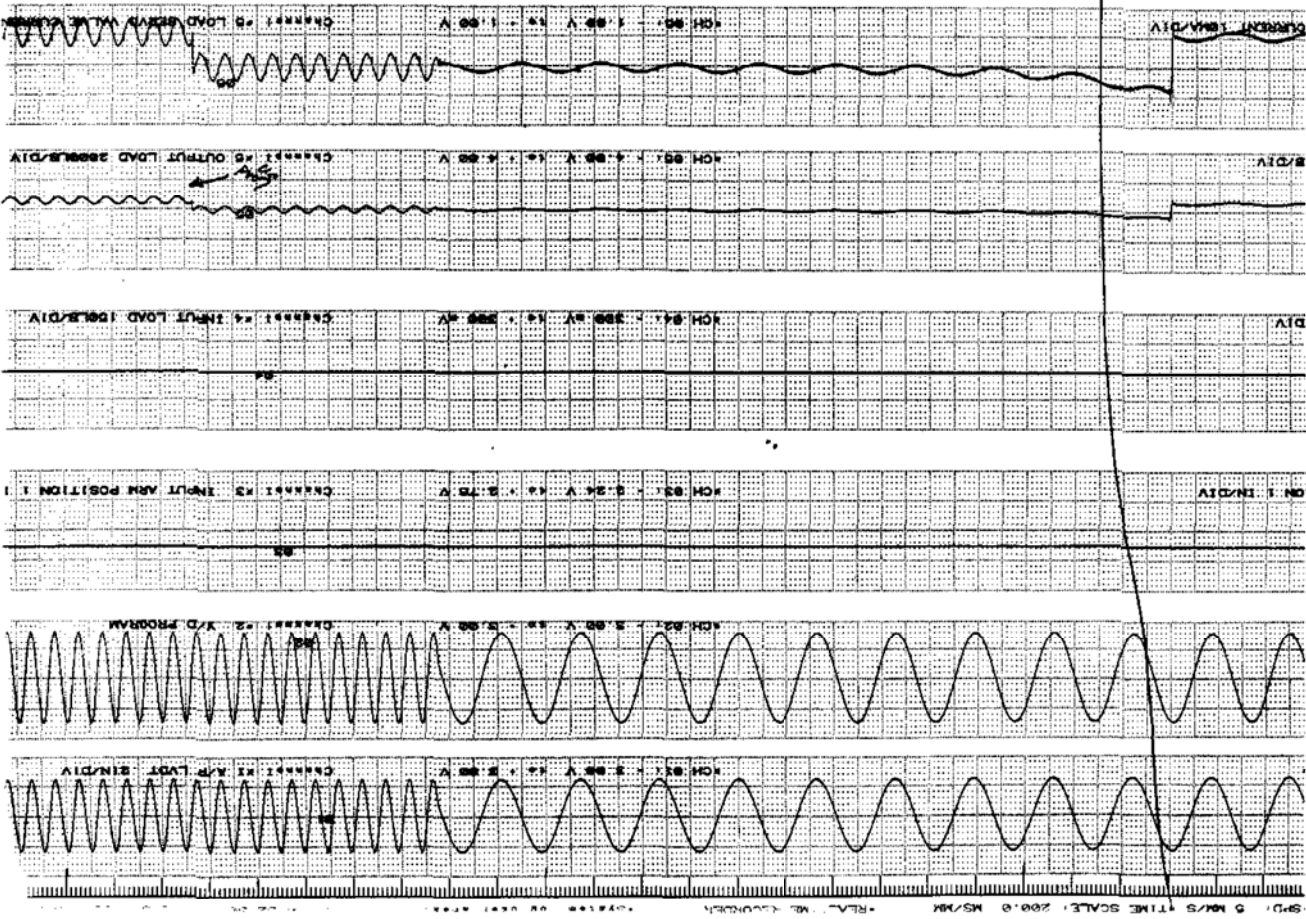
MT95K2 MULTI-TASK RECORDER

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*DYNAMIC TEST
USAIR 427 RUDDER
PCH.*

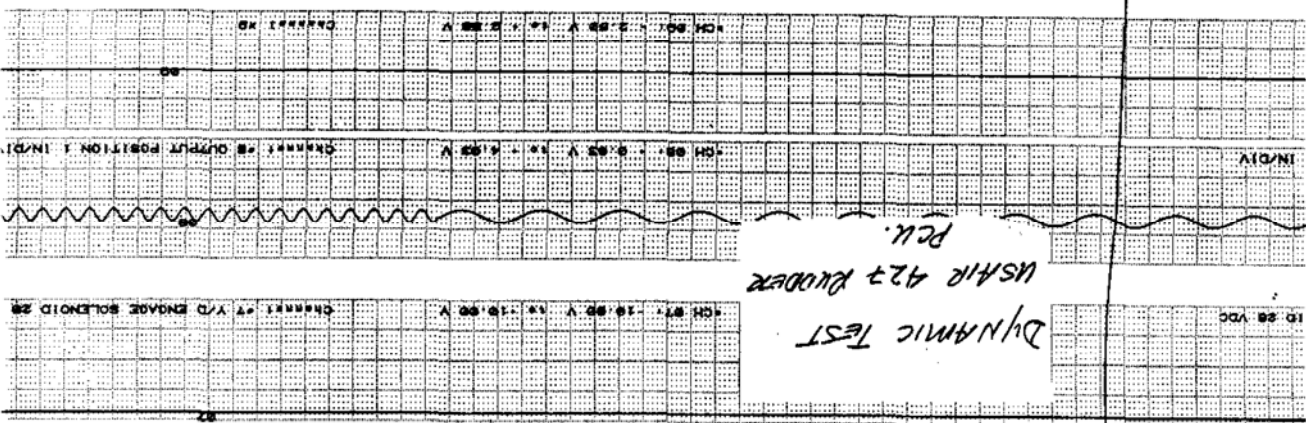




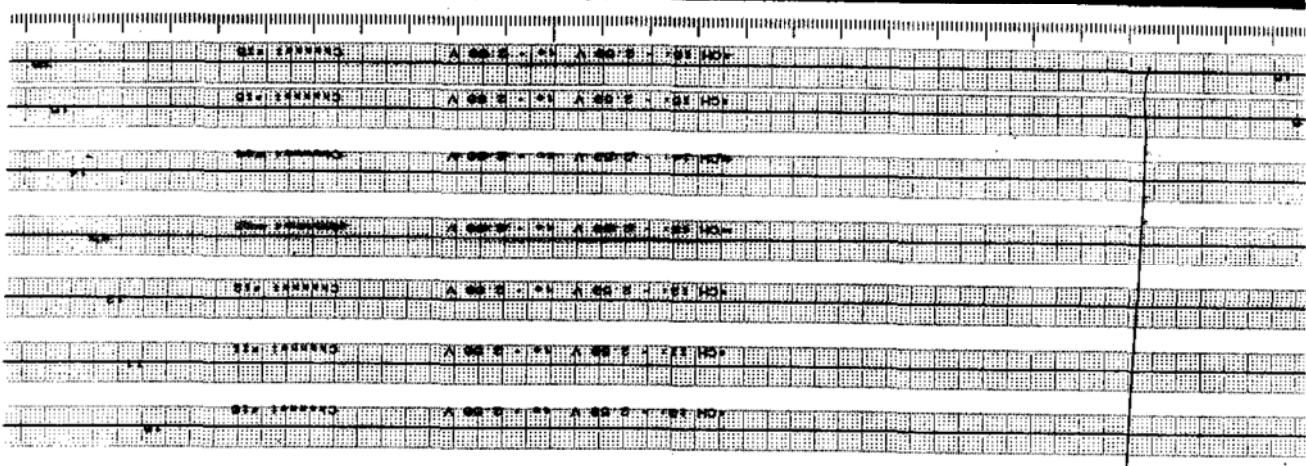
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MT95K2 MULT-TASK RECORDER

Astro-Med, Inc.



DYNAMIC TEST
USAF 427 RUDDER
PCU.



MT96K2 MULT-TASK RECORDER

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And 1

0 LOAD MOVING VALVE SUR CHARGE 0 LOAD MOVING VALVE 0 LOAD MOVING VALVE SUR CHARGE 0 LOAD MOVING VALVE SUR CHARGE

0 OUTPUT LOAD 0000.0/D CHARGE 0 OUTPUT LOAD 0000.0/D CHARGE 0 OUTPUT LOAD 0000.0/D CHARGE 0 OUTPUT LOAD 0000.0/D CHARGE

0 INPUT AND POSITION CHARGE 0 INPUT AND POSITION CHARGE 0 INPUT AND POSITION CHARGE 0 INPUT AND POSITION CHARGE

0 1/2 T/OT SIN/DIV CHARGE 0 1/2 T/OT SIN/DIV CHARGE 0 1/2 T/OT SIN/DIV CHARGE 0 1/2 T/OT SIN/DIV CHARGE

REALTIME RECO = 14:33:37 018 80p 90 020 0 14:34:07 018 80p 90 010 0 14:34:30 018 80p 90 010 0 14:34:57 018 80p 90 010 0 14:35:24 018 80p 90 010 0 14:35:51 018 80p 90 010 0 14:36:18 018 80p 90 010 0 14:36:45 018 80p 90 010 0 14:37:12 018 80p 90 010 0 14:37:39 018 80p 90 010 0 14:38:06 018 80p 90 010 0 14:38:33 018 80p 90 010 0 14:39:00 018 80p 90 010 0 14:39:27 018 80p 90 010 0 14:39:54 018 80p 90 010 0 14:40:21 018 80p 90 010 0 14:40:48 018 80p 90 010 0 14:41:15 018 80p 90 010 0 14:41:42 018 80p 90 010 0 14:42:09 018 80p 90 010 0 14:42:36 018 80p 90 010 0 14:43:03 018 80p 90 010 0 14:43:30 018 80p 90 010 0 14:43:57 018 80p 90 010 0 14:44:24 018 80p 90 010 0 14:44:51 018 80p 90 010 0 14:45:18 018 80p 90 010 0 14:45:45 018 80p 90 010 0 14:46:12 018 80p 90 010 0 14:46:39 018 80p 90 010 0 14:47:06 018 80p 90 010 0 14:47:33 018 80p 90 010 0 14:48:00 018 80p 90 010 0 14:48:27 018 80p 90 010 0 14:48:54 018 80p 90 010 0 14:49:21 018 80p 90 010 0 14:49:48 018 80p 90 010 0 14:50:15 018 80p 90 010 0 14:50:42 018 80p 90 010 0 14:51:09 018 80p 90 010 0 14:51:36 018 80p 90 010 0 14:52:03 018 80p 90 010 0 14:52:30 018 80p 90 010 0 14:52:57 018 80p 90 010 0 14:53:24 018 80p 90 010 0 14:53:51 018 80p 90 010 0 14:54:18 018 80p 90 010 0 14:54:45 018 80p 90 010 0 14:55:12 018 80p 90 010 0 14:55:39 018 80p 90 010 0 14:56:06 018 80p 90 010 0 14:56:33 018 80p 90 010 0 14:57:00 018 80p 90 010 0 14:57:27 018 80p 90 010 0 14:57:54 018 80p 90 010 0 14:58:21 018 80p 90 010 0 14:58:48 018 80p 90 010 0 14:59:15 018 80p 90 010 0 14:59:42 018 80p 90 010 0 15:00:09 018 80p 90 010 0 15:00:36 018 80p 90 010 0 15:01:03 018 80p 90 010 0 15:01:30 018 80p 90 010 0 15:01:57 018 80p 90 010 0 15:02:24 018 80p 90 010 0 15:02:51 018 80p 90 010 0 15:03:18 018 80p 90 010 0 15:03:45 018 80p 90 010 0 15:04:12 018 80p 90 010 0 15:04:39 018 80p 90 010 0 15:05:06 018 80p 90 010 0 15:05:33 018 80p 90 010 0 15:06:00 018 80p 90 010 0 15:06:27 018 80p 90 010 0 15:06:54 018 80p 90 010 0 15:07:21 018 80p 90 010 0 15:07:48 018 80p 90 010 0 15:08:15 018 80p 90 010 0 15:08:42 018 80p 90 010 0 15:09:09 018 80p 90 010 0 15:09:36 018 80p 90 010 0 15:10:03 018 80p 90 010 0 15:10:30 018 80p 90 010 0 15:10:57 018 80p 90 010 0 15:11:24 018 80p 90 010 0 15:11:51 018 80p 90 010 0 15:12:18 018 80p 90 010 0 15:12:45 018 80p 90 010 0 15:13:12 018 80p 90 010 0 15:13:39 018 80p 90 010 0 15:14:06 018 80p 90 010 0 15:14:33 018 80p 90 010 0 15:15:00 018 80p 90 010 0 15:15:27 018 80p 90 010 0 15:15:54 018 80p 90 010 0 15:16:21 018 80p 90 010 0 15:16:48 018 80p 90 010 0 15:17:15 018 80p 90 010 0 15:17:42 018 80p 90 010 0 15:18:09 018 80p 90 010 0 15:18:36 018 80p 90 010 0 15:19:03 018 80p 90 010 0 15:19:30 018 80p 90 010 0 15:19:57 018 80p 90 010 0 15:20:24 018 80p 90 010 0 15:20:51 018 80p 90 010 0 15:21:18 018 80p 90 010 0 15:21:45 018 80p 90 010 0 15:22:12 018 80p 90 010 0 15:22:39 018 80p 90 010 0 15:23:06 018 80p 90 010 0 15:23:33 018 80p 90 010 0 15:24:00 018 80p 90 010 0 15:24:27 018 80p 90 010 0 15:24:54 018 80p 90 010 0 15:25:21 018 80p 90 010 0 15:25:48 018 80p 90 010 0 15:26:15 018 80p 90 010 0 15:26:42 018 80p 90 010 0 15:27:09 018 80p 90 010 0 15:27:36 018 80p 90 010 0 15:28:03 018 80p 90 010 0 15:28:30 018 80p 90 010 0 15:28:57 018 80p 90 010 0 15:29:24 018 80p 90 010 0 15:29:51 018 80p 90 010 0 15:30:18 018 80p 90 010 0 15:30:45 018 80p 90 010 0 15:31:12 018 80p 90 010 0 15:31:39 018 80p 90 010 0 15:32:06 018 80p 90 010 0 15:32:33 018 80p 90 010 0 15:33:00 018 80p 90 010 0 15:33:27 018 80p 90 010 0 15:33:54 018 80p 90 010 0 15:34:21 018 80p 90 010 0 15:34:48 018 80p 90 010 0 15:35:15 018 80p 90 010 0 15:35:42 018 80p 90 010 0 15:36:09 018 80p 90 010 0 15:36:36 018 80p 90 010 0 15:37:03 018 80p 90 010 0 15:37:30 018 80p 90 010 0 15:37:57 018 80p 90 010 0 15:38:24 018 80p 90 010 0 15:38:51 018 80p 90 010 0 15:39:18 018 80p 90 010 0 15:39:45 018 80p 90 010 0 15:40:12 018 80p

*REALTIME RECORD = 14:32:37
*18 SEP 90 *RPD = 14:34:07
*18 SEP 90 *I = 14:36:49
*18 SEP 90 *CDE = 14:37:11

MAR/MAY

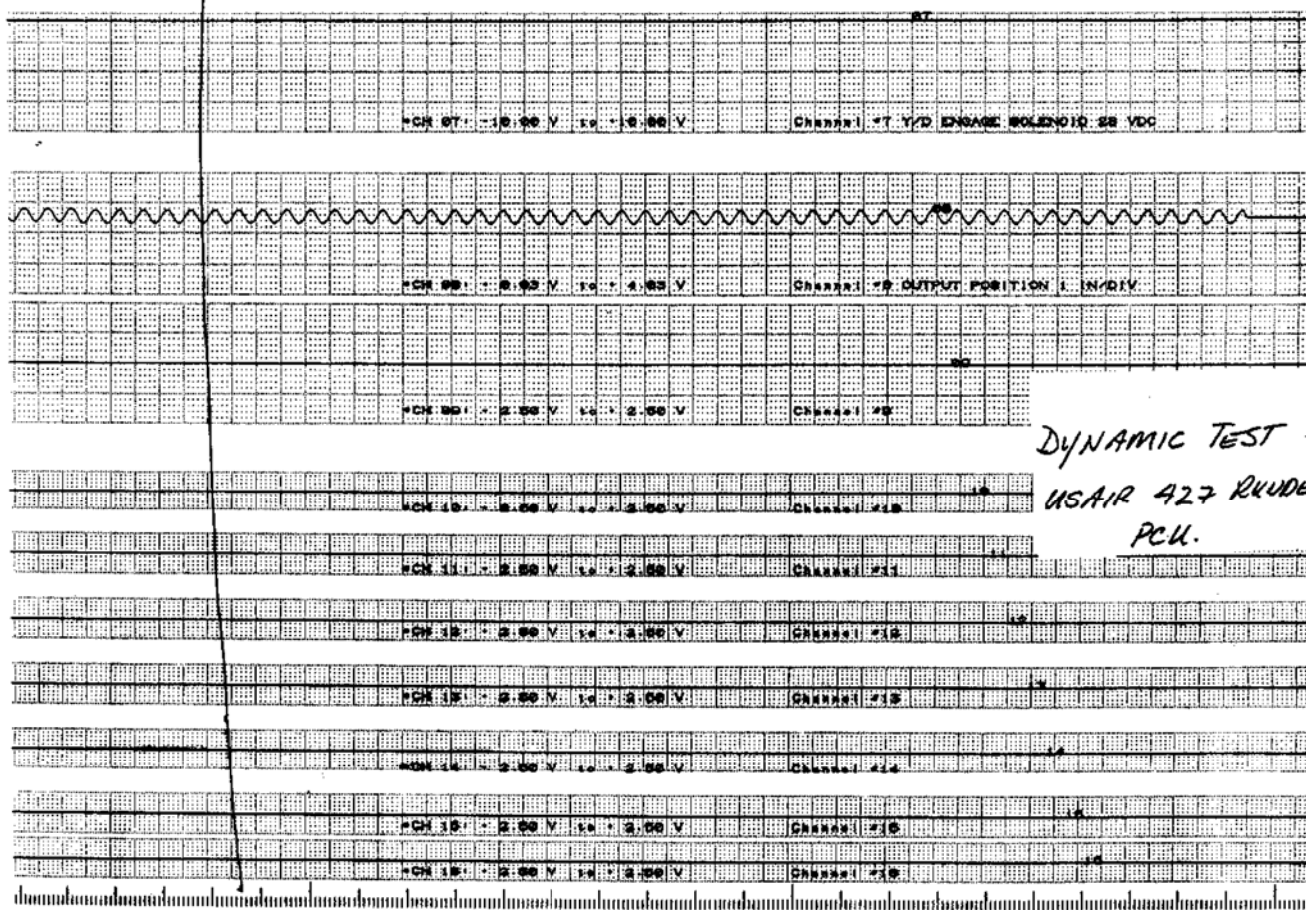


cont

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 **Astro-Med, Inc.**

MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST
USAIR 427 RUDE
PCU.

CH 01: 2.00 V 1s 2.00 V CHANNEL 01 A/P LVDT 2IN/DIV
CH 02: 2.00 V 1s 2.00 V CHANNEL 02 A/P LVDT 2IN/DIV

CH 03: 2.00 V 1s 2.00 V CHANNEL 03 INPUT ARM POSITION 1 IN/DIV
CH 04: 300 mV 1s 300 mV CHANNEL 04 INPUT LOAD 1000L/DIV

CH 05: 4.00 V 1s 4.00 V CHANNEL 05 OUTPUT LOAD 8000L/DIV
CH 06: 1.00 V 1s 1.00 V CHANNEL 06 LOAD SERVO VALVE CURRENT 100mA/DIV

CH 07: 10.00 V 1s 10.00 V CHANNEL 07 Y/D ENGAGE SOLENOID 20 VDC
CH 08: 0.05 V 1s 0.05 V CHANNEL 08 OUTPUT POSITION 1 IN/DIV

CH 09: 2.00 V 1s 2.00 V CHANNEL 09
CH 10: 2.00 V 1s 2.00 V CHANNEL 10

CH 11: 2.00 V 1s 2.00 V CHANNEL 11
CH 12: 4.00 V 1s 4.00 V CHANNEL 12

CH 13: 2.00 V 1s 2.00 V CHANNEL 13
CH 14: 2.00 V 1s 2.00 V CHANNEL 14

CH 15: 2.00 V 1s 2.00 V CHANNEL 15
CH 16: 2.00 V 1s 2.00 V CHANNEL 16

CH 17: 2.00 V 1s 2.00 V CHANNEL 17
CH 18: 2.00 V 1s 2.00 V CHANNEL 18

CH 19: 2.00 V 1s 2.00 V CHANNEL 19
CH 20: 2.00 V 1s 2.00 V CHANNEL 20

CH 21: 2.00 V 1s 2.00 V CHANNEL 21
CH 22: 2.00 V 1s 2.00 V CHANNEL 22

CH 23: 2.00 V 1s 2.00 V CHANNEL 23
CH 24: 2.00 V 1s 2.00 V CHANNEL 24

CH 25: 2.00 V 1s 2.00 V CHANNEL 25
CH 26: 2.00 V 1s 2.00 V CHANNEL 26

CH 27: 2.00 V 1s 2.00 V CHANNEL 27
CH 28: 2.00 V 1s 2.00 V CHANNEL 28

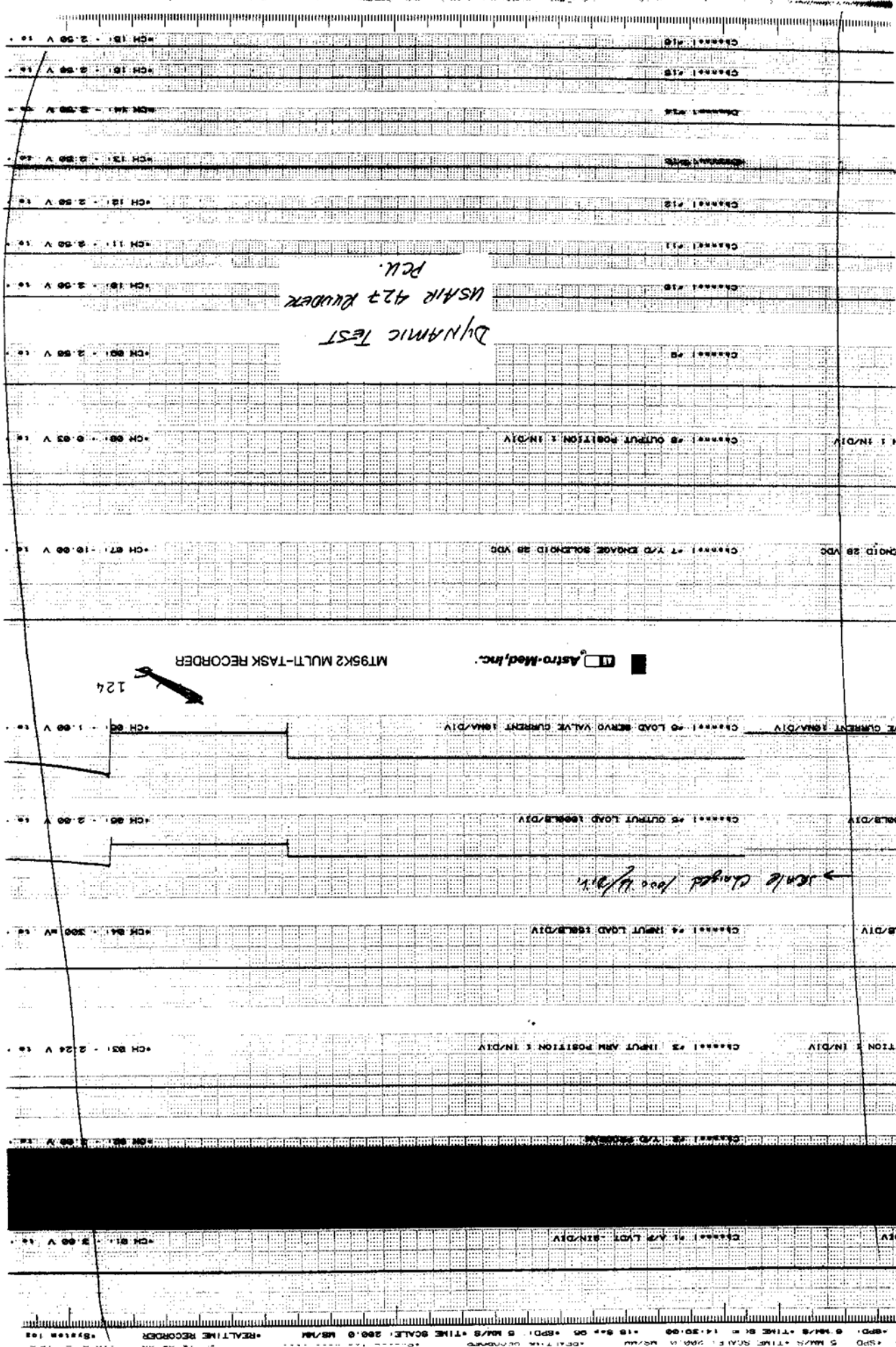
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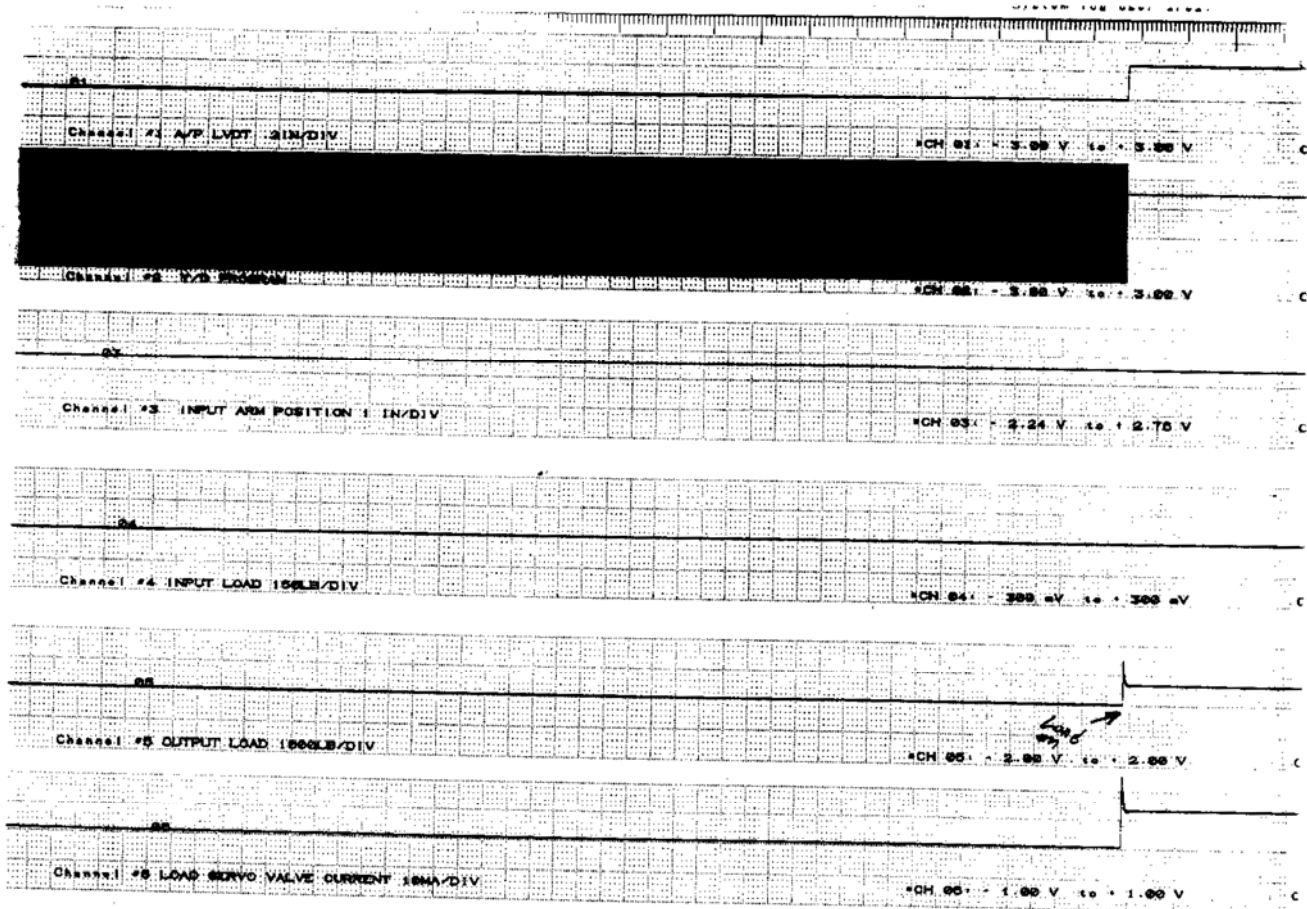
Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

125

DYNAMIC TEST
USAIR 427 RHODER
PCU.

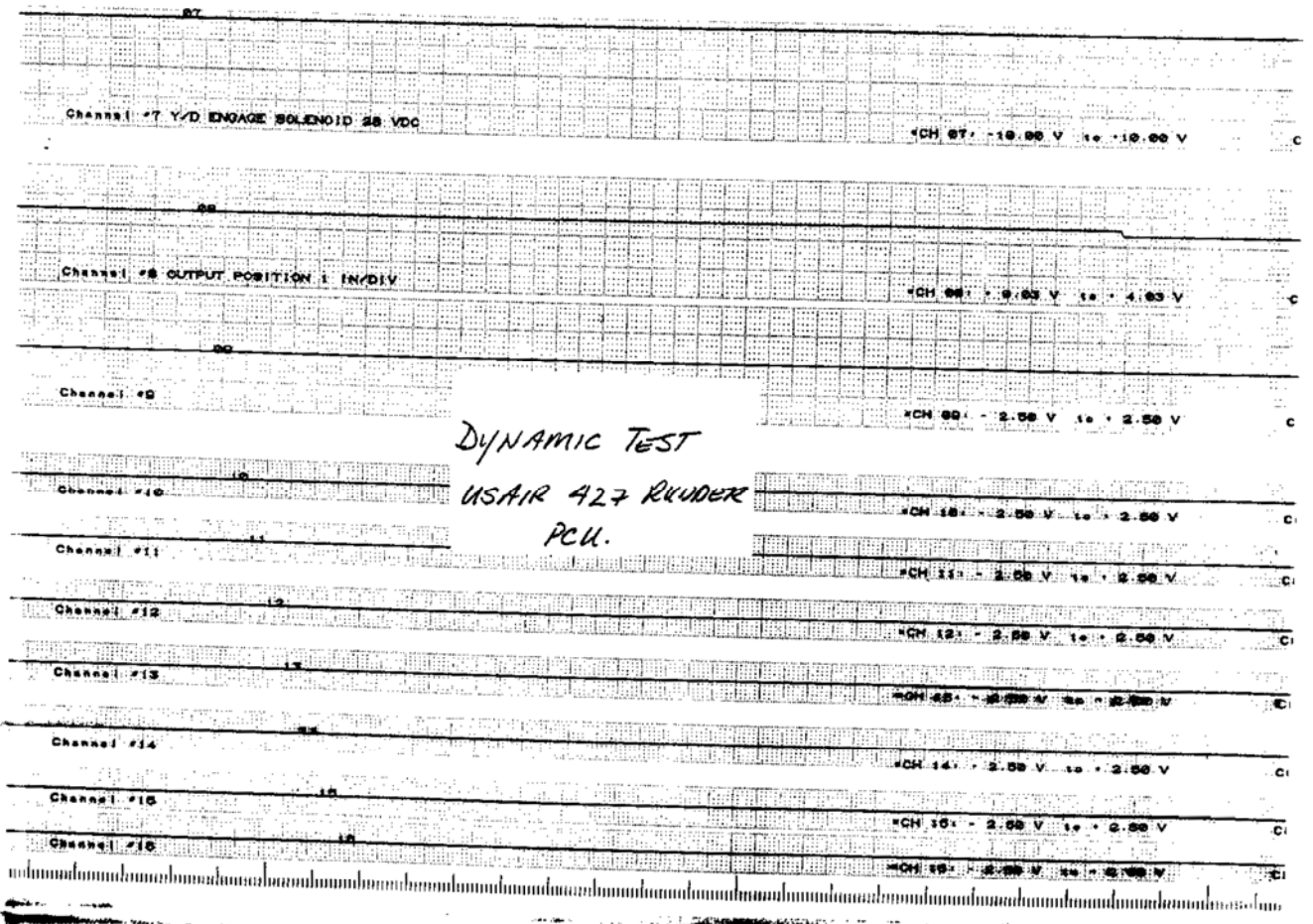




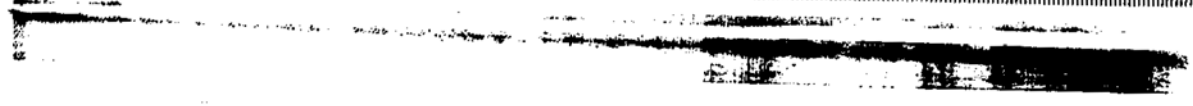
 Astro-Med, Inc.

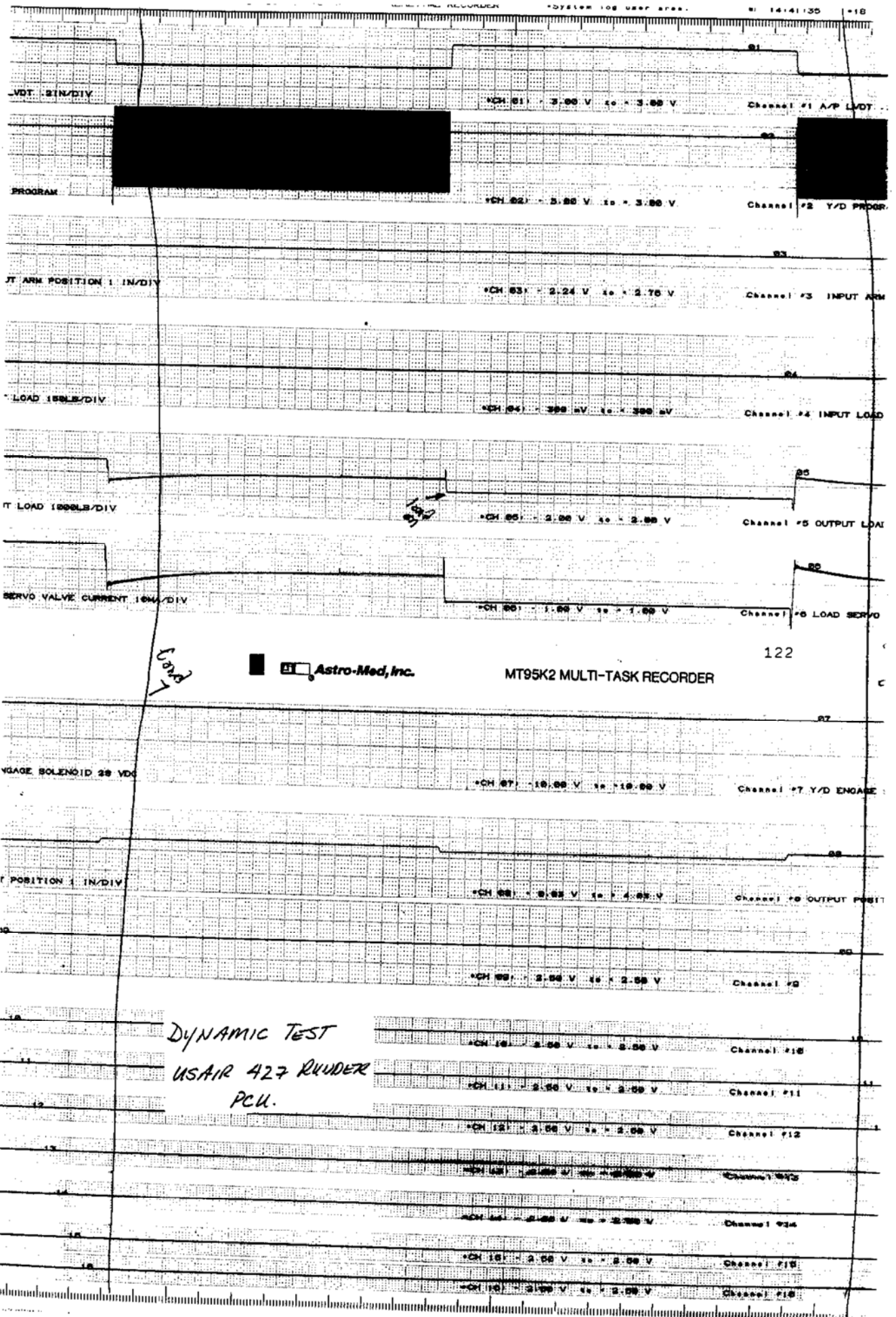
MT95K2 MULTI-TASK RECORDER

123



DYNAMIC TEST
USAIR 427 RUDDER
PCU.



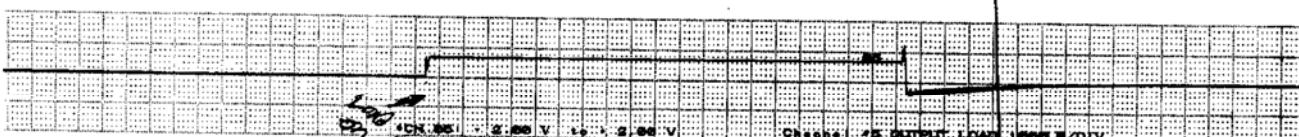
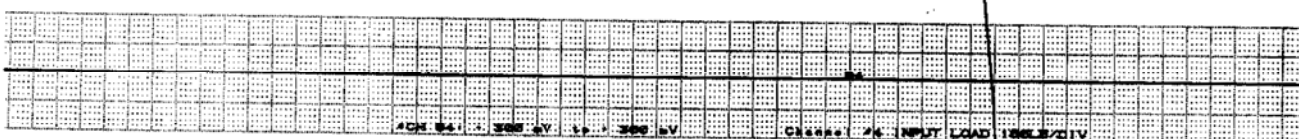
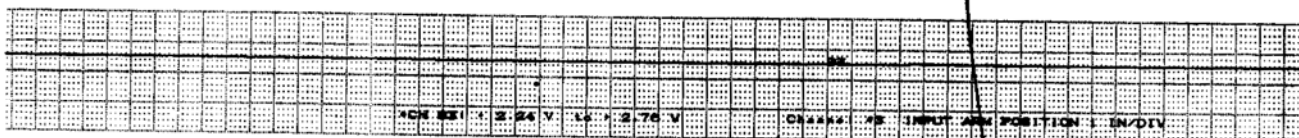
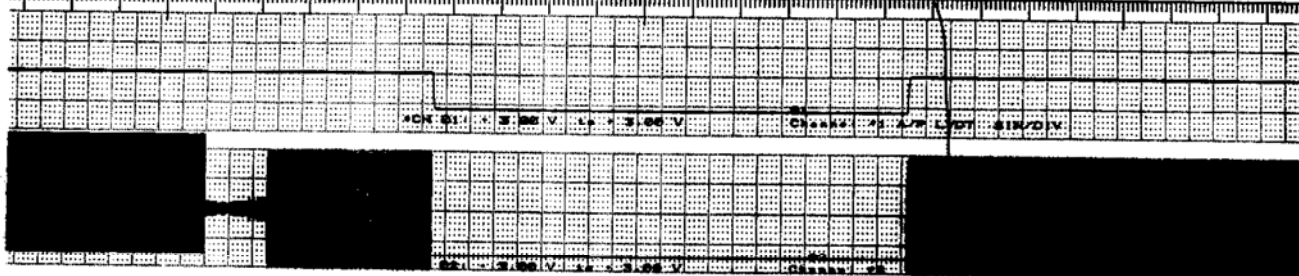


 Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

122

DYNAMIC TEST
USAIR 427 RUINER
PCU.

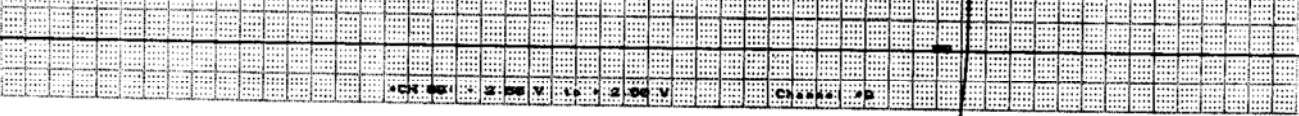
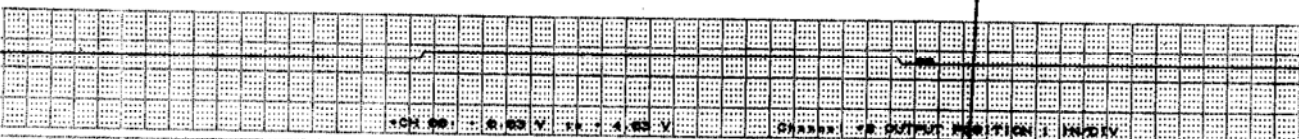
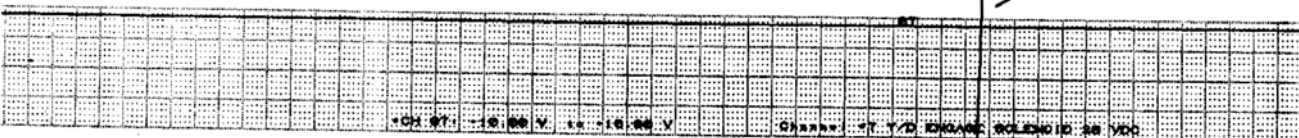


Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

121

Cond 9

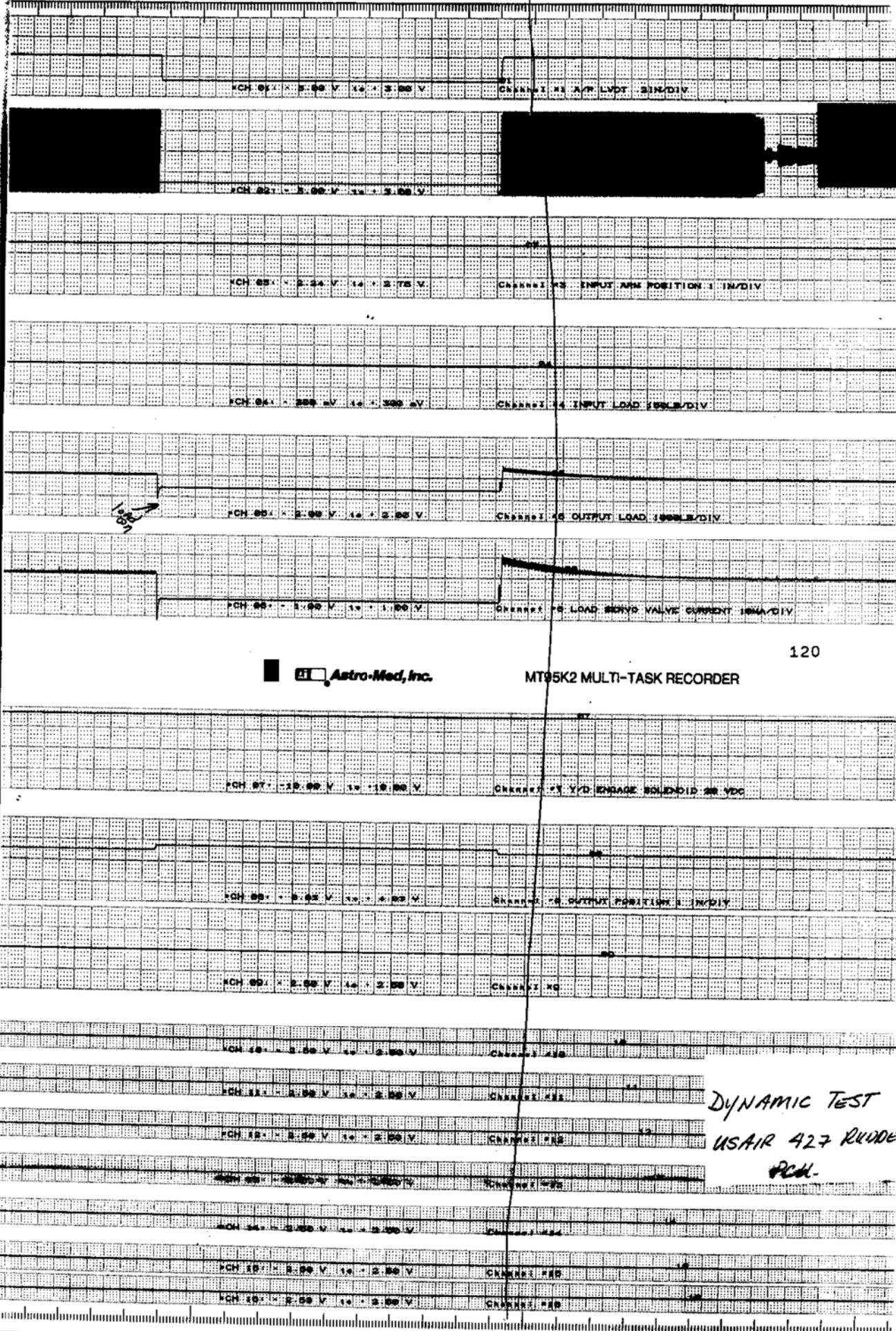


DYNAMIC TEST

55AIR 427 RUBBER

PCU.



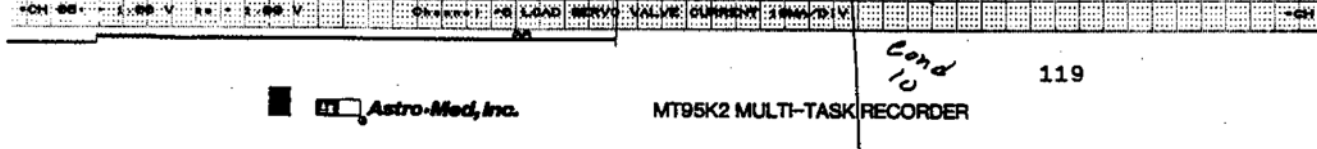
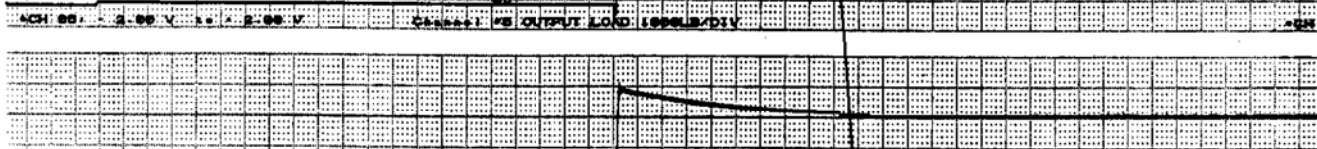
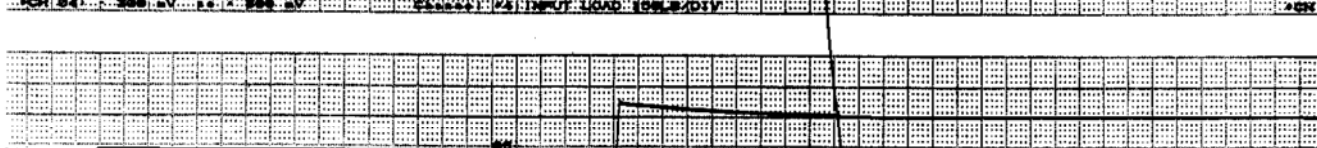
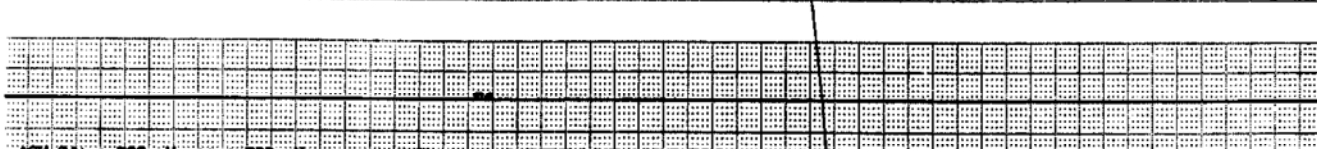
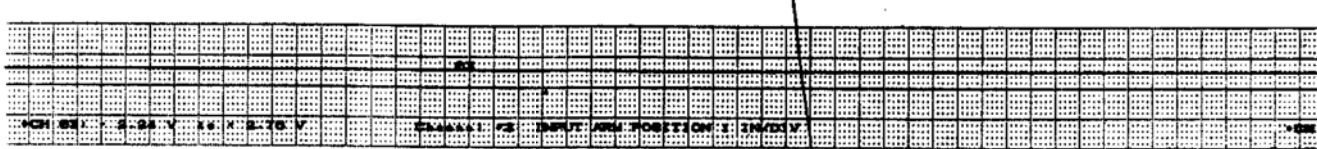
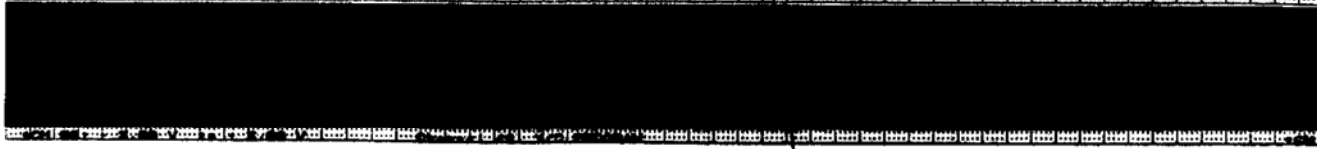
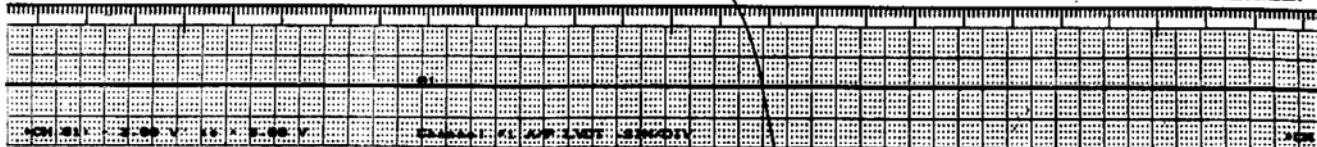


ET Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

120

DYNAMIC TEST
USAIR 427 RUDE
PCH.

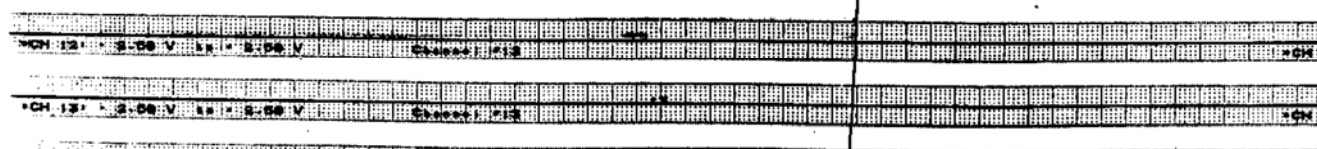
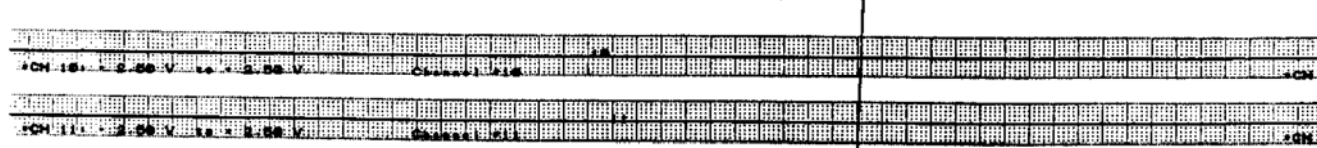
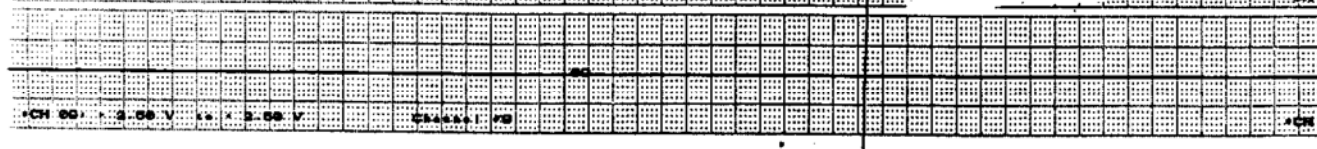
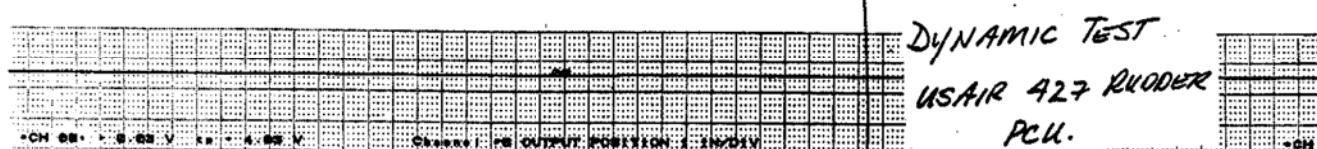
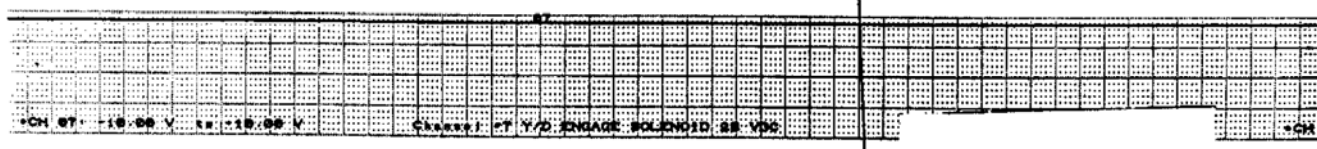


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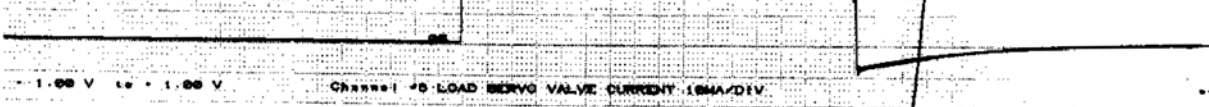
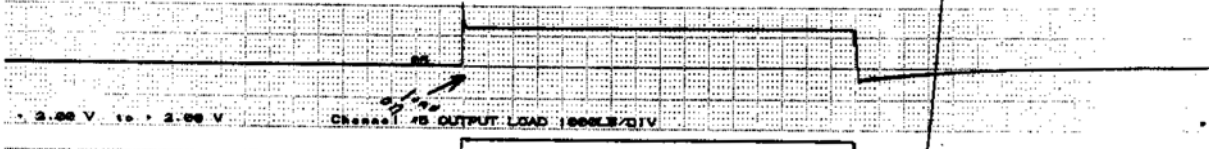
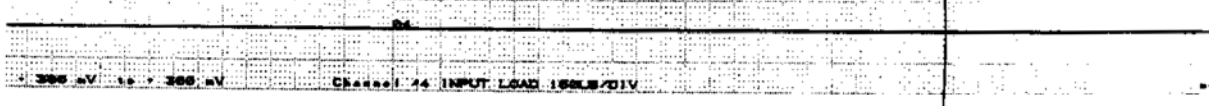
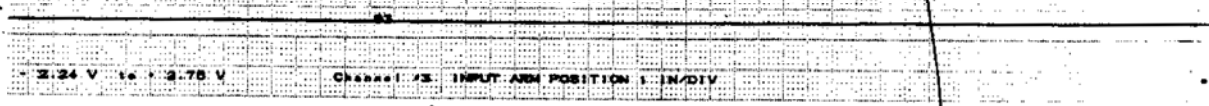
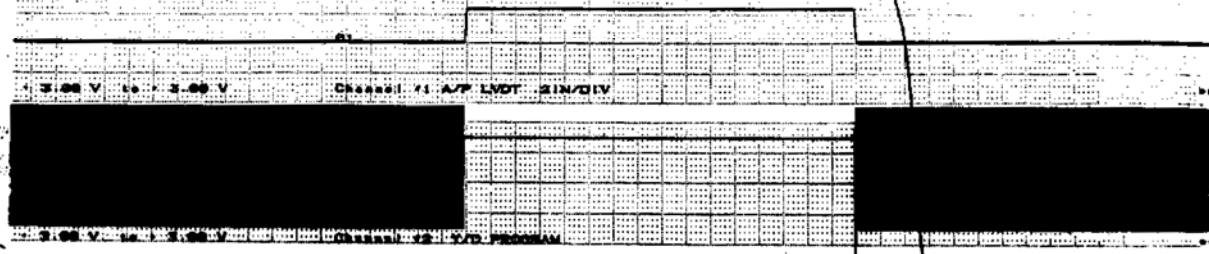
MT95K2 MULTI-TASK RECORDER

Cond 10

119



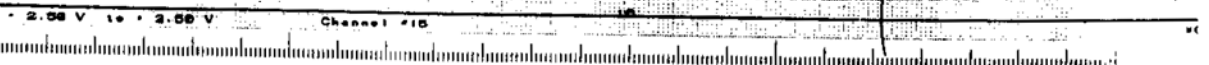
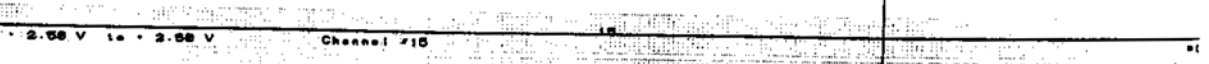
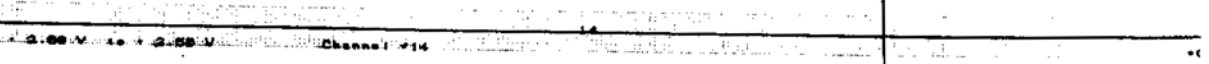
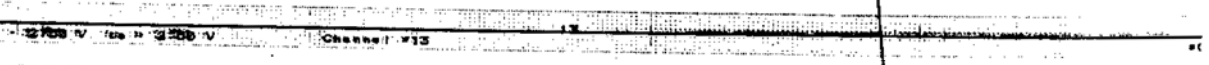
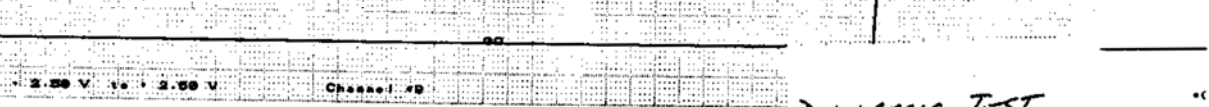
DYNAMIC TEST
US AIR 427 RUDDER
PCH.



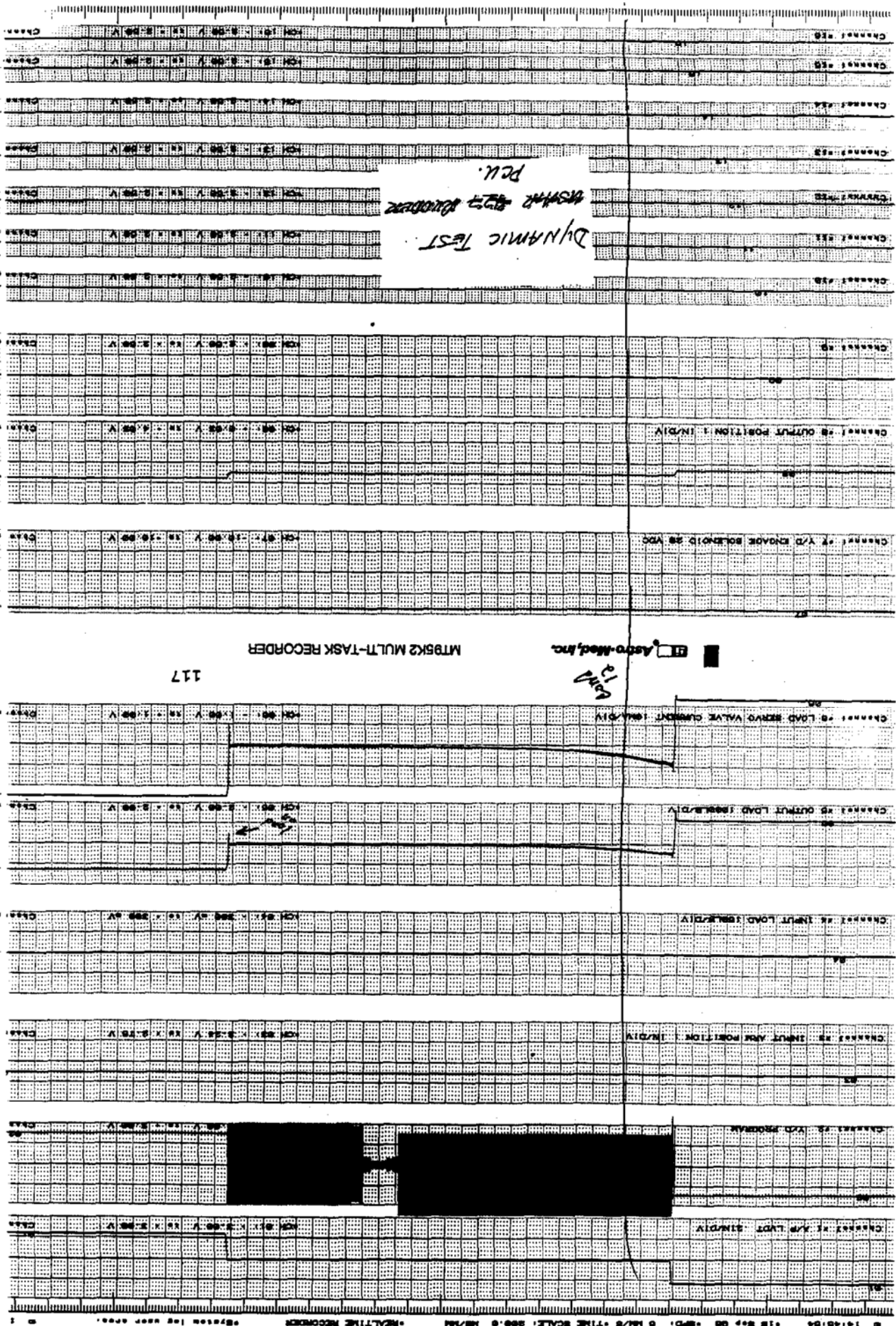
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MT95K2 MULT-TASK RECORDER

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DYNAMIC TEST
USAIR 427 RUUDER
PCU.



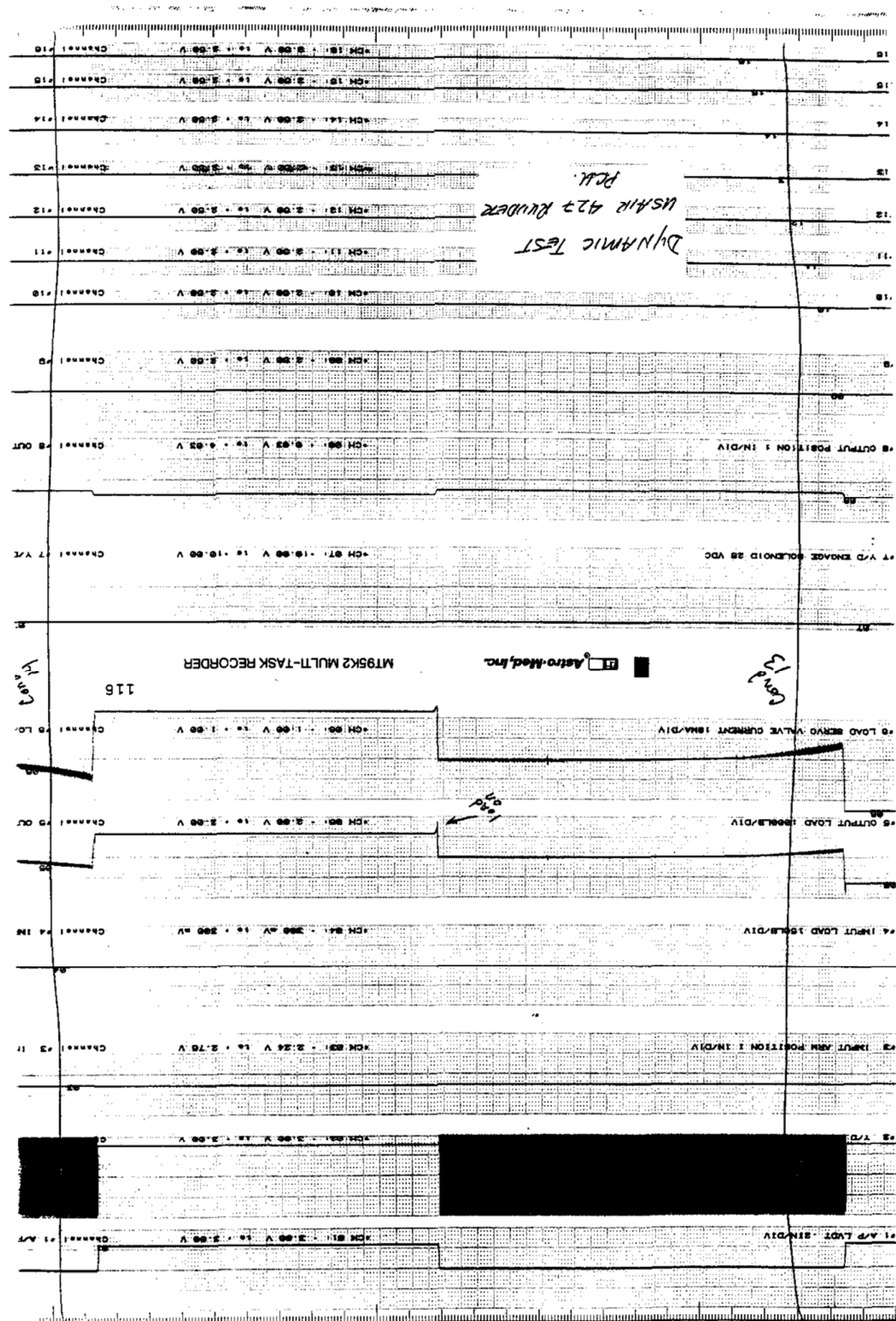
DYNAMIC TEST
PCU

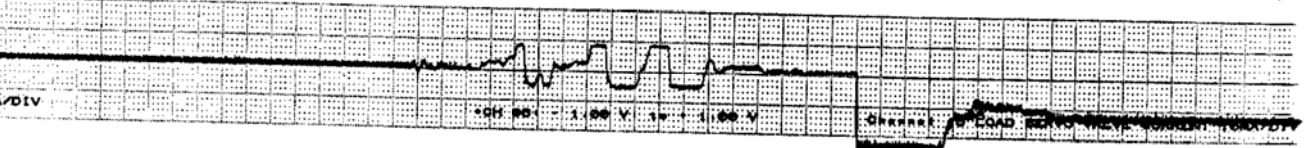
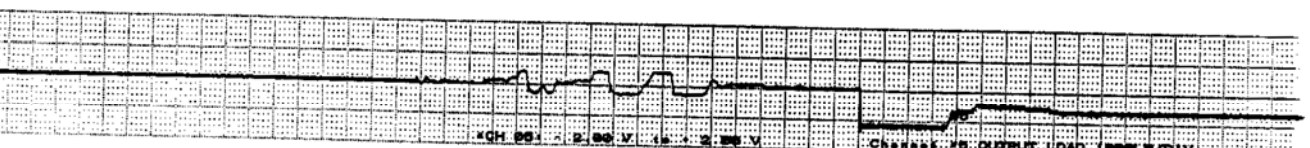
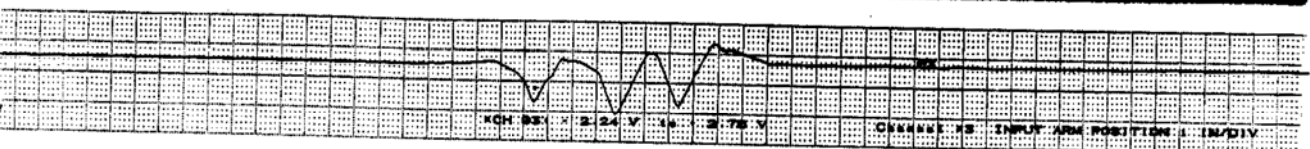
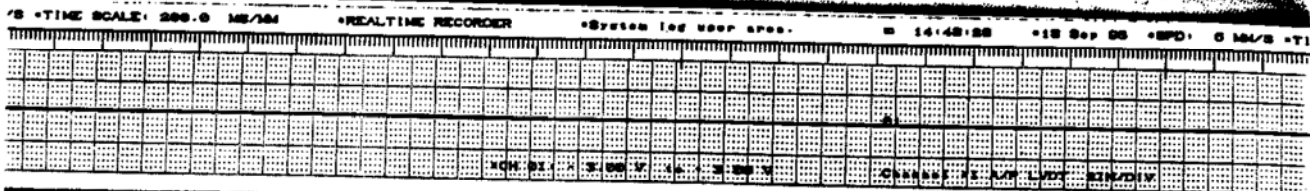
MT95K2 MULT-TASK RECORDER

Astro-Med, Inc.

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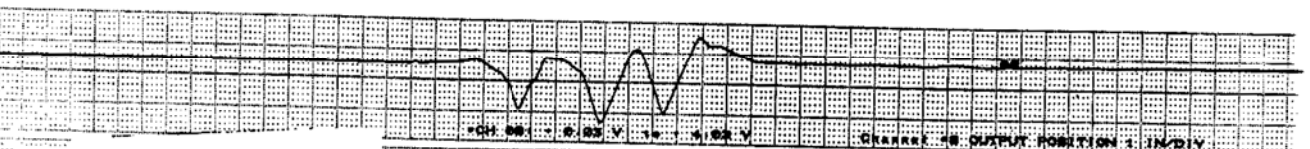
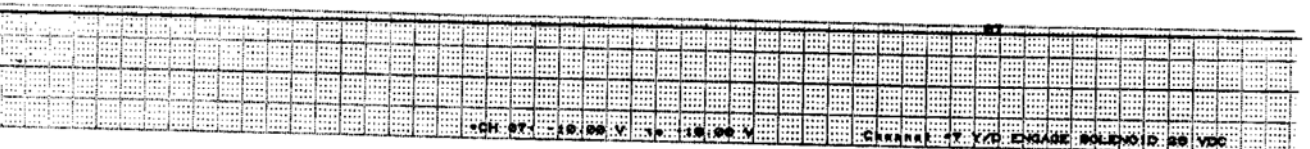




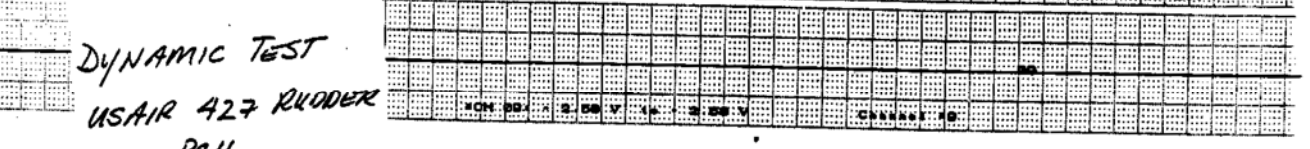
Astro-Med, Inc.

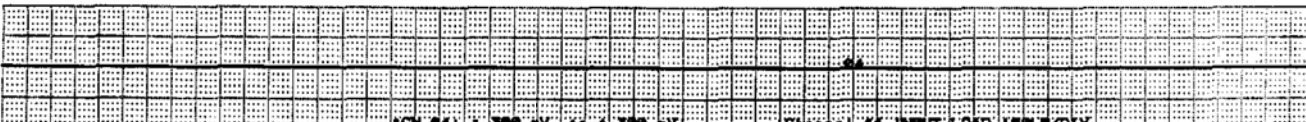
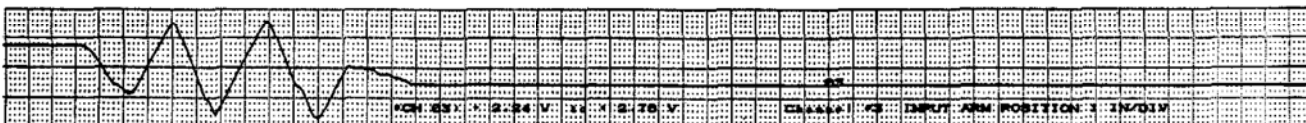
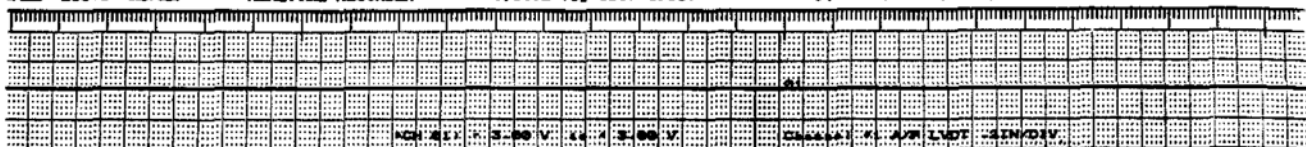
MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
USAIR 427 RHODEX
PCU.

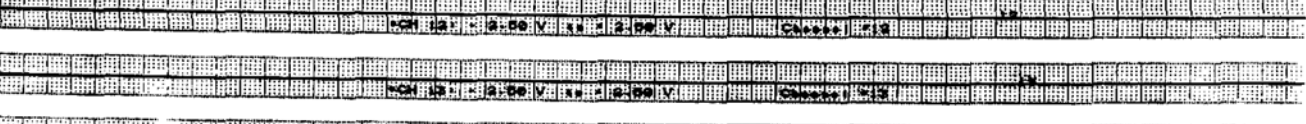
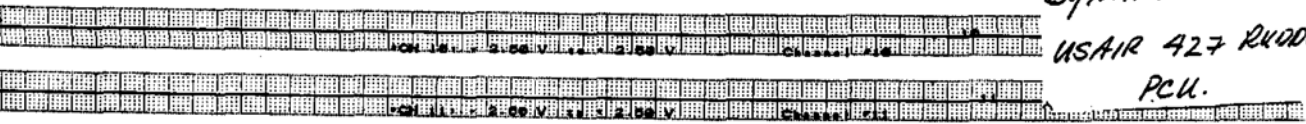
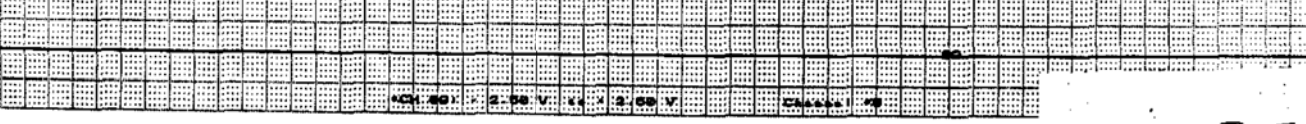
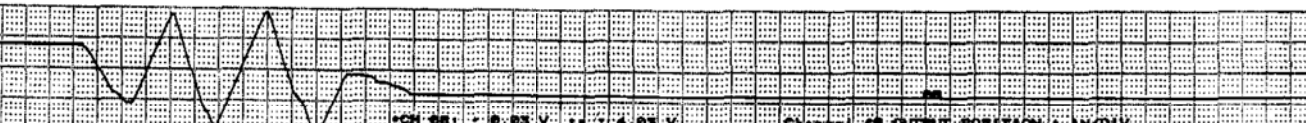
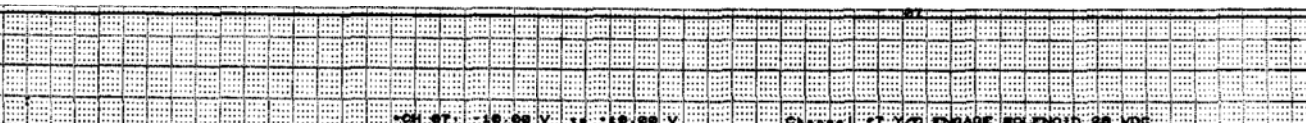




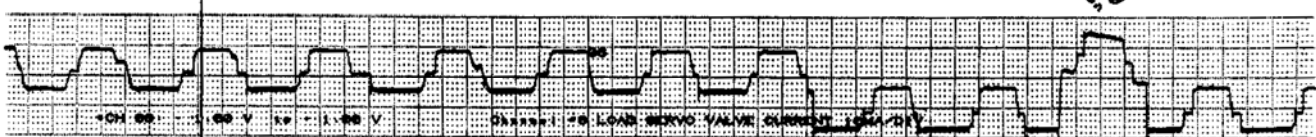
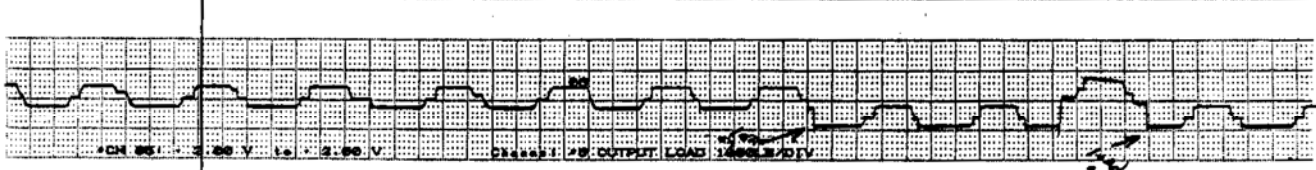
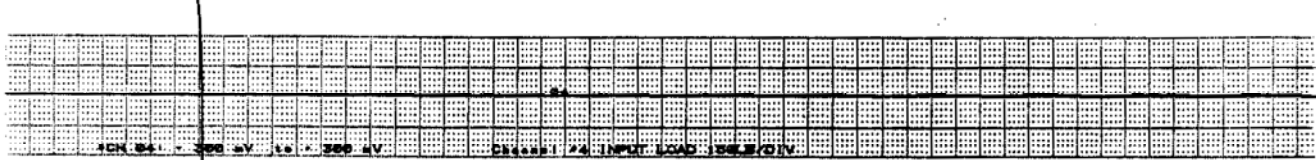
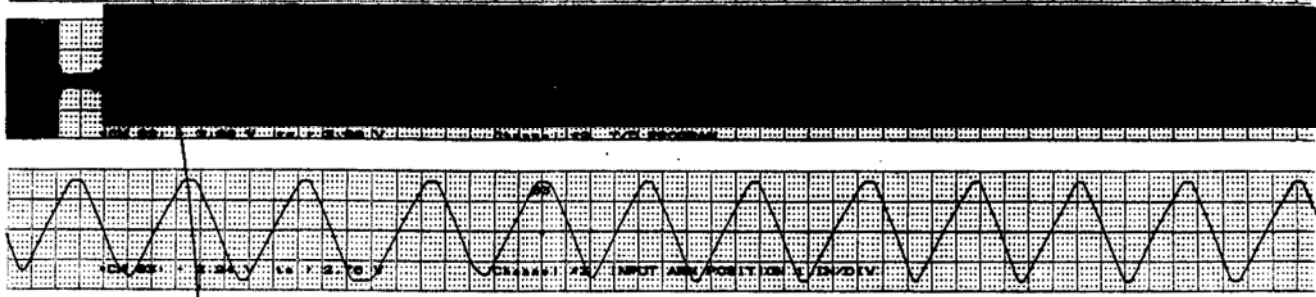
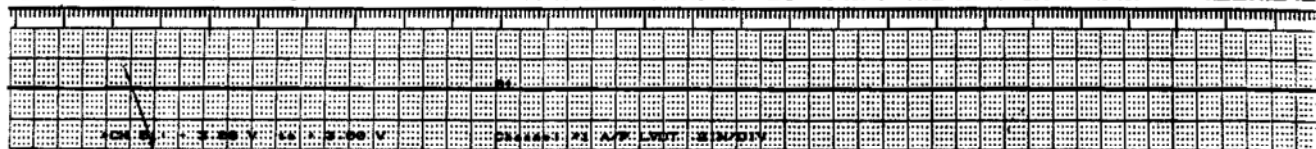
114

Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER



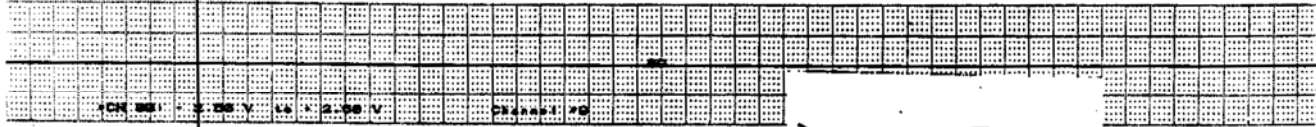
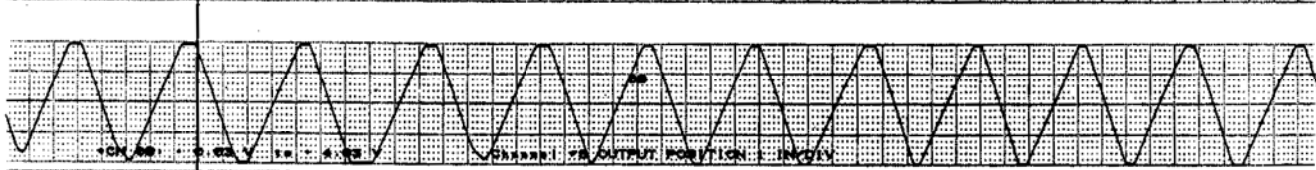
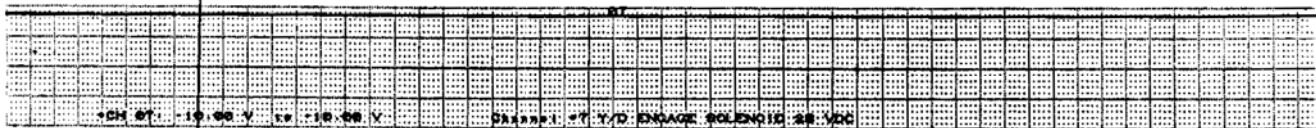
DYNAMIC TEST
USAIR 427 R400.
PCU.



Handwritten note: "1/1000"

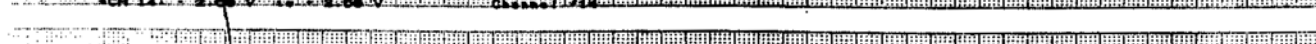
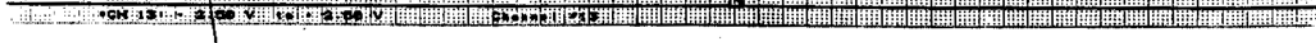
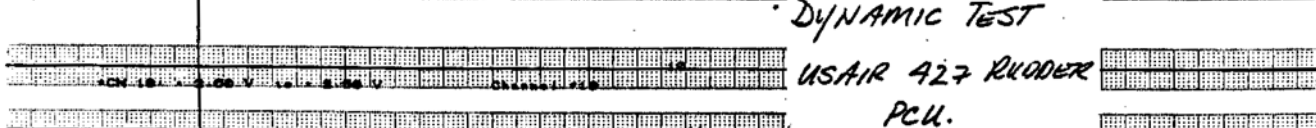


MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST

USAIR 427 RUDDER PCU.



CH 01: 2.00 V to 2.00 V

Channel #1 A/P LVDT 2IN/DIV

CH 01

CH 02: 2.00 V to 2.00 V

Channel #2 V/D PROGRAM

CH 02

CH 03: 2.24 V to 2.70 V

Channel #3 INPUT ARM POSITION 1 IN/DIV

CH 03

CH 04: 300 mV to 300 mV

Channel #4 INPUT LOAD 100LS/DIV

CH 04

CH 05: 2.00 V to 2.00 V

Channel #5 OUTPUT LOAD 100LS/DIV

CH 05

CH 06: 1.00 V to 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV

CH 06

Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

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Cond
in

CH 07: -10.00 V to -10.00 V

Channel #7 V/D ENGAGE SOLENOID 20 VDC

CH 07

CH 08: 0.03 V to 4.03 V

Channel #8 OUTPUT POSITION 1 IN/DIV

CH 08

CH 09: 2.00 V to 2.00 V

Channel #9

CH 09

CH 10: 2.00 V to 2.00 V

Channel #10

CH 10

CH 11: 2.00 V to 2.00 V

Channel #11

CH 11

CH 12: 2.00 V to 2.00 V

Channel #12

CH 12

CH 13: 2.00 V to 2.00 V

Channel #13

CH 13

CH 14: 2.00 V to 2.00 V

Channel #14

CH 14

CH 15: 2.00 V to 2.00 V

Channel #15

CH 15

CH 16: 2.00 V to 2.00 V

Channel #16

CH 16

DYNAMIC TEST
USAIR 427 RUDDER
PCU.

US AIR 427 RUDDER
PCU.

The image shows a two-channel oscilloscope waveform. The top channel, labeled 'IN', displays a square wave with a period of 10 divisions and a pulse width of 5 divisions. The bottom channel, labeled 'OUT', displays a triangular wave with a period of 10 divisions and a peak-to-peak amplitude of 4 divisions. The horizontal scale is 10 divisions per 100 ns, and the vertical scale is 1 division per 1 V.

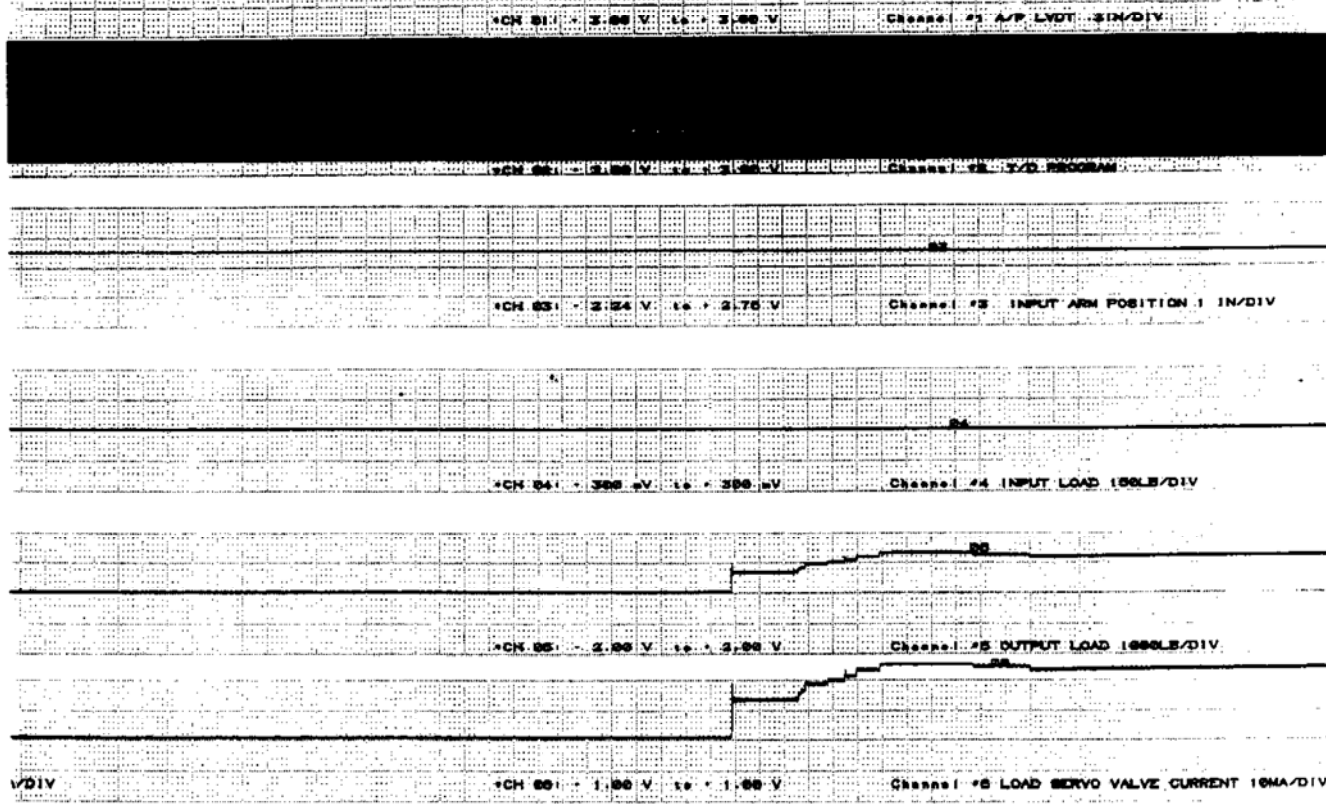
ASTRO-MED, INC.

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AIGM I P

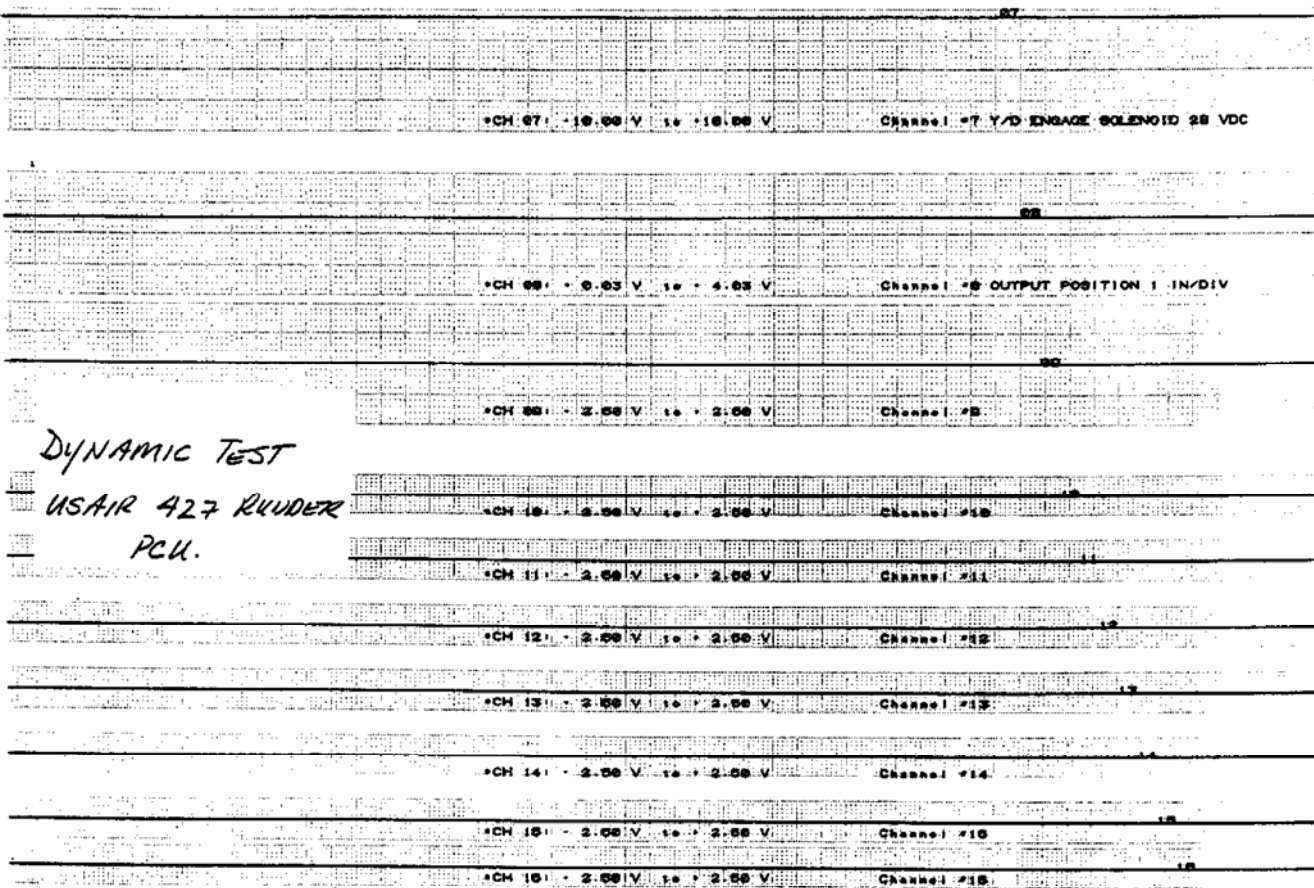
Q: 5 MIN/5 TIME SCALE: 200.0 MS/IN REALTIME RECORDER
System for user apps: M 14:54:31 10 Sep 80 00:00



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 Astro-Med, Inc.

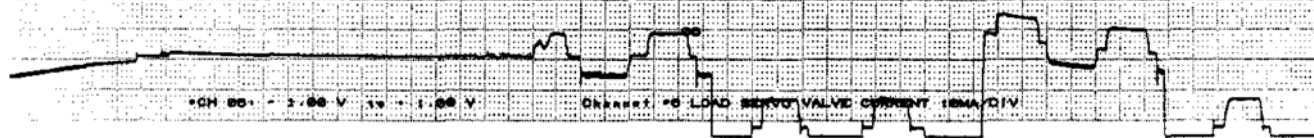
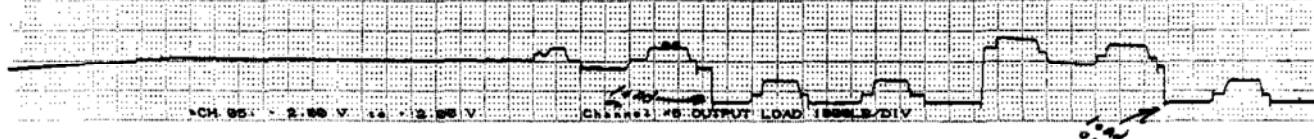
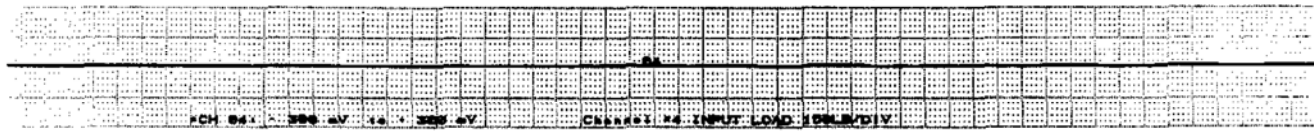
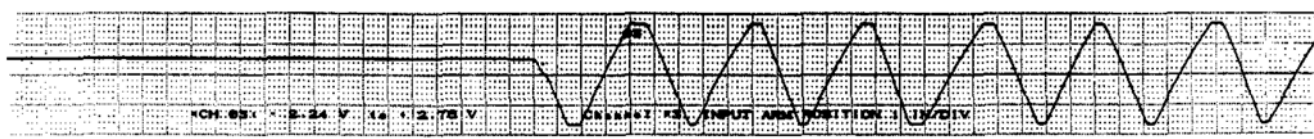
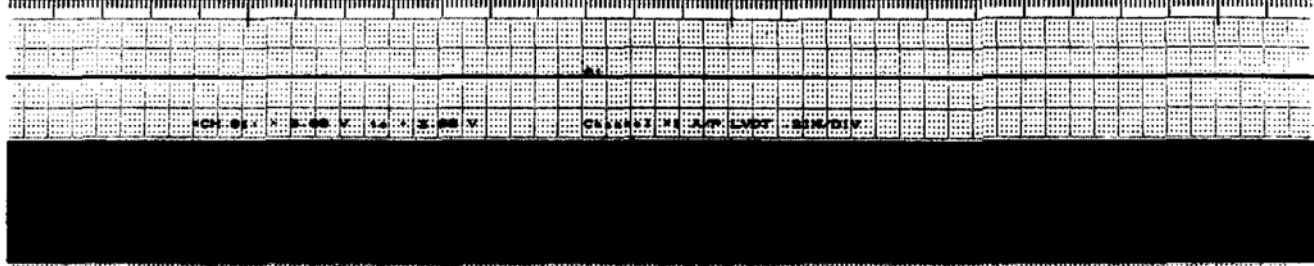
MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST

USAIR 427 RUDDER

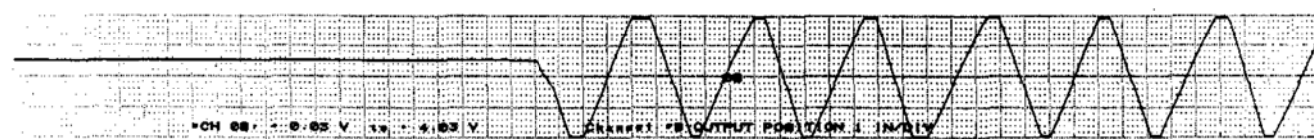
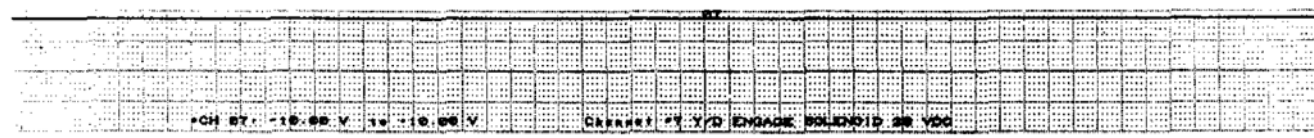
PCU.



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MT95K2 MULTI-TASK RECORDER



DYNAMIC TEST
USAIR 427 RUDDER
PCU.

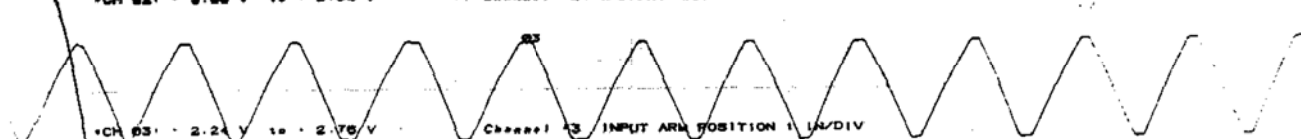
CH 01 - 3.00 V to 3.00 V

Channel #1 A/F LVDT 2IN/DIV



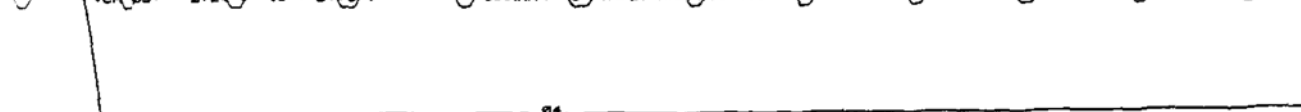
CH 02 - 3.00 V to 3.00 V

Channel #2 V/D PROGRAM



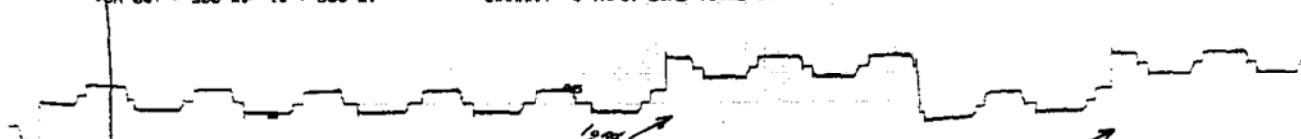
CH 03 - 2.25 V to 2.75 V

Channel #3 INPUT ARM POSITION 1 IN/DIV



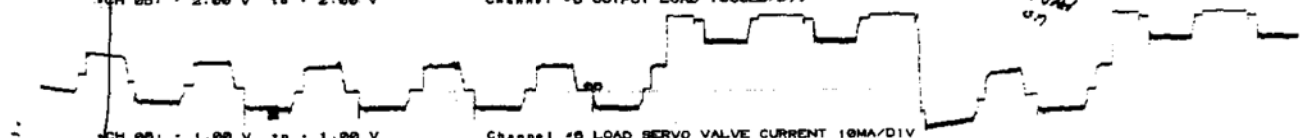
CH 04 - 300 mV to 300 mV

Channel #4 INPUT LOAD 100LB/DIV



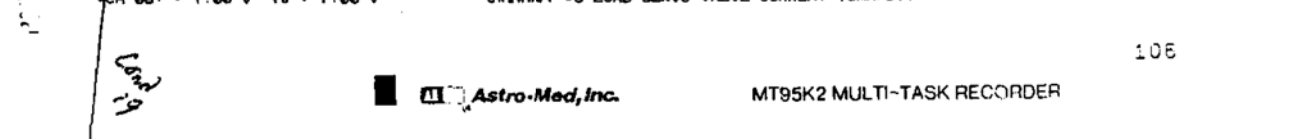
CH 05 - 2.00 V to 2.00 V

Channel #5 OUTPUT LOAD 1000LB/DIV



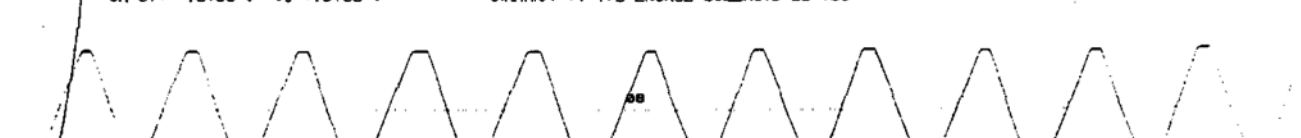
CH 06 - 1.00 V to 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV



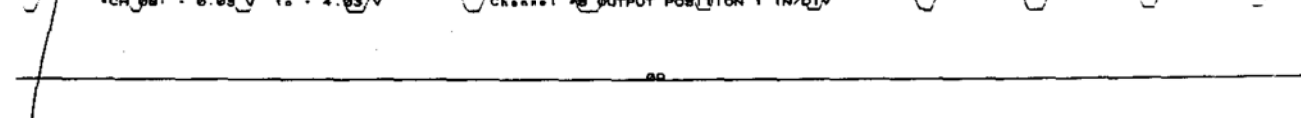
CH 07 - 10.00 V to 10.00 V

Channel #7 Y/D ENGAGE SOLENOID 28 VDC



CH 08 - 0.00 V to 4.00 V

Channel #8 OUTPUT POSITION 1 IN/DIV



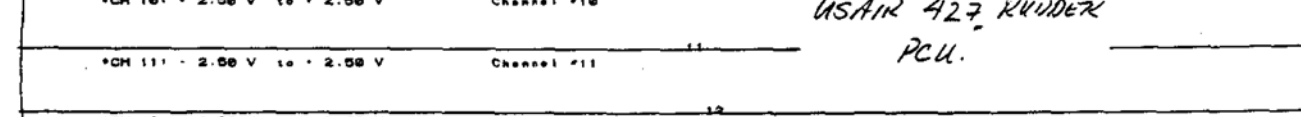
CH 09 - 2.50 V to 2.50 V

Channel #9



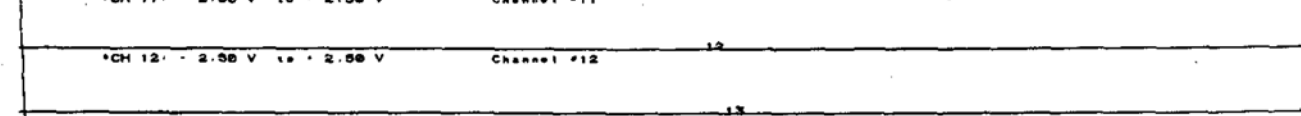
CH 10 - 2.50 V to 2.50 V

Channel #10



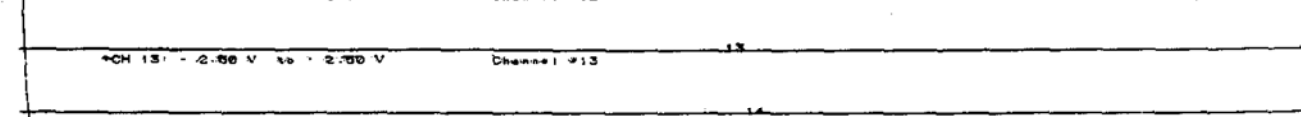
CH 11 - 2.50 V to 2.50 V

Channel #11



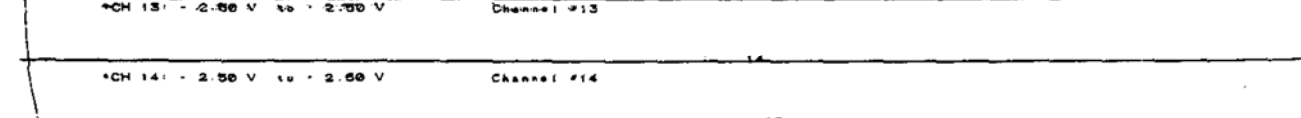
CH 12 - 2.50 V to 2.50 V

Channel #12



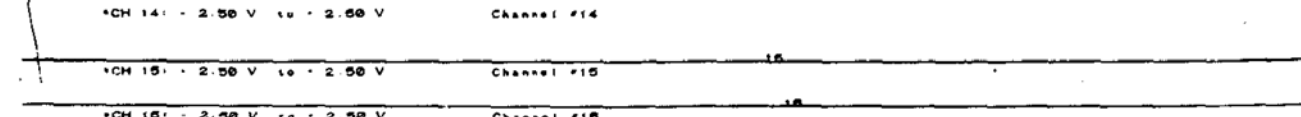
CH 13 - 2.50 V to 2.50 V

Channel #13



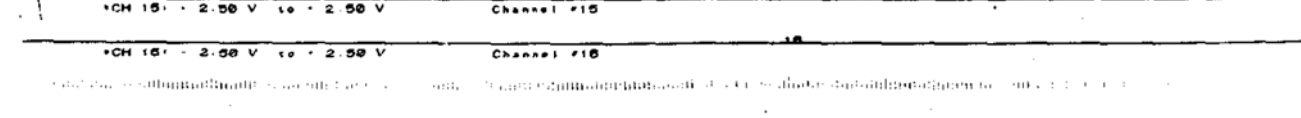
CH 14 - 2.50 V to 2.50 V

Channel #14



CH 15 - 2.50 V to 2.50 V

Channel #15



CH 16 - 2.50 V to 2.50 V

Channel #16

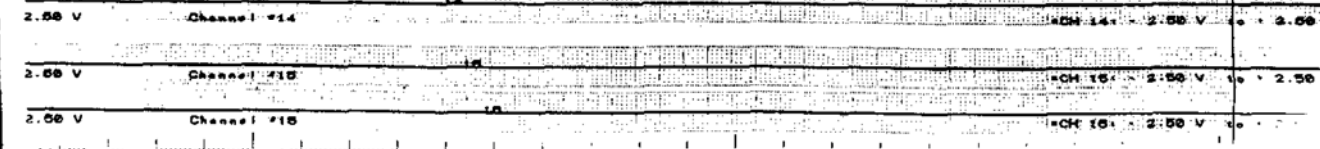
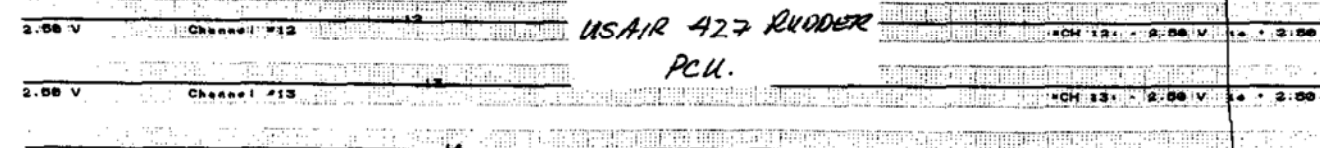
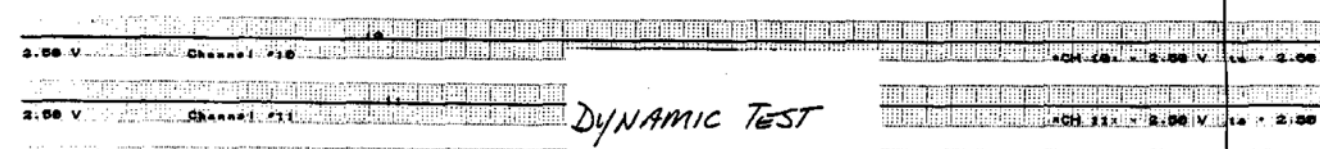
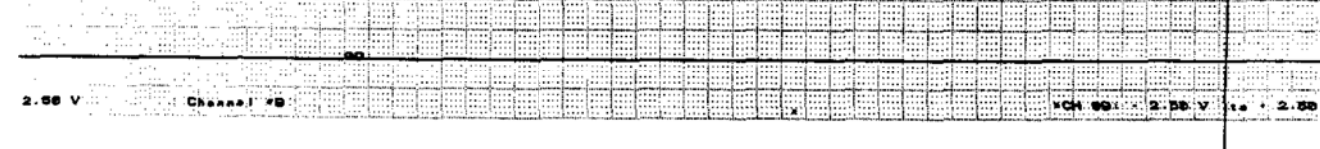
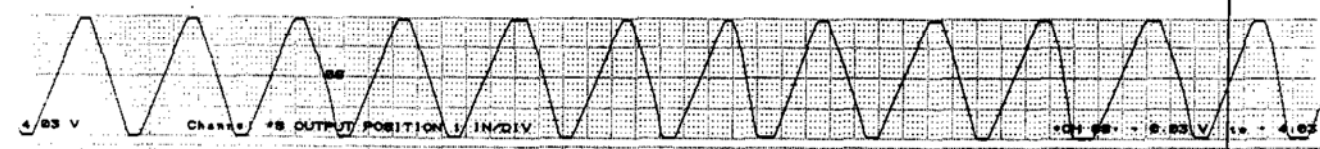
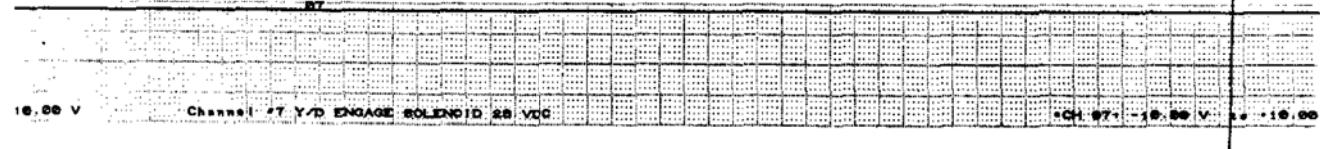
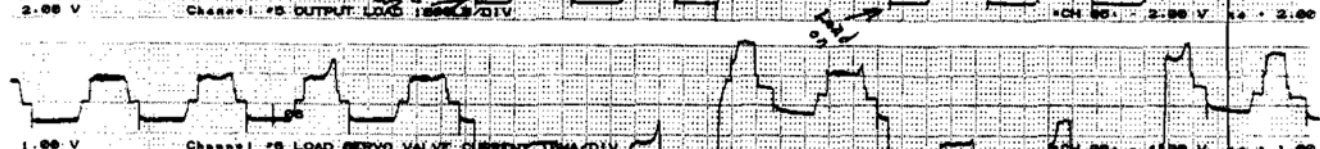
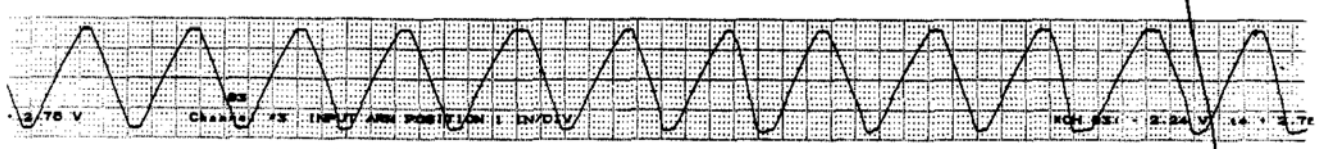
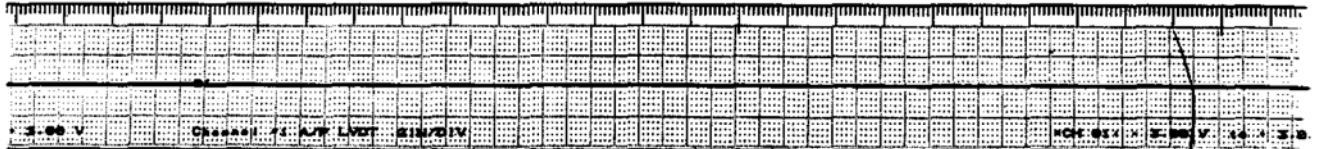
Load

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MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
USAIR 427 RUINER
PCU.



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MT95K2 MULTI-TASK RECORDER

105

Com 2/2

DYNAMIC TEST
USAIR 427 RUDDER
PCU.

C Channel #1 A/P LVDT .2IN/DIV

*CH 01: - 3.00 V to - 3.00 V

C Channel #2 Y/D PROGRAM

*CH 02: - 3.00 V to - 3.00 V

C Channel #3 INPUT ARM POSITION 1 IN/DIV

*CH 03: - 2.24 V to - 2.76 V

C Channel #4 INPUT LOAD 100LB/DIV

*CH 04: - 300 mV to - 300 mV

C Channel #5 OUTPUT LOAD 1000LB/DIV

*CH 05: - 2.00 V to - 2.00 V

C Channel #6 LOAD SERVO VALVE CURRENT 10mA/DIV

*CH 06: - 1.00 V to - 1.00 V

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C Channel #7 Y/D ENGAGE SOLENOID 20 VDC

*CH 07: - 10.00 V to - 10.00 V

C Channel #8 OUTPUT POSITION 1 IN/DIV

*CH 08: - 0.03 V to - 4.03 V

C Channel #9

*CH 09: - 2.50 V to - 2.50 V

C Channel #10

*CH 10: - 2.50 V to - 2.50 V

C Channel #11

*CH 11: - 2.50 V to - 2.50 V

C Channel #12

*CH 12: - 2.50 V to - 2.50 V

C Channel #13

*CH 13: - 2.50 V to - 2.50 V

C Channel #14

*CH 14: - 2.50 V to - 2.50 V

C Channel #15

*CH 15: - 2.50 V to - 2.50 V

C Channel #16

*CH 16: - 2.50 V to - 2.50 V

DYNAMIC TEST
USAIR 427 RUDDER
PCU.

IN/DIV *CH 01: 5.00 V 10: 5.00 V Channel 01 A/P LVDT SIN/DI

*CH 02: 5.00 V 10: 5.00 V Channel 02 V/D PROGRAM

POSITION 1 IN/DIV *CH 03: 2.24 V 10: 2.75 V Channel 03 INPUT ARM POSIT

1500LS/DIV *CH 04: 2.00 V 10: 2.00 V Channel 04 INPUT LOAD 1500LS

1500LS/DIV *CH 05: 2.00 V 10: 2.00 V Channel 05 OUTPUT LOAD 1500LS

VALVE CURRENT 1MA/DIV *CH 06: 1.00 V 10: 1.00 V Channel 06 LOAD SERVO VALVE

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MT95K2 MULTI-TASK RECORDER

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SOLENOID 28 VDC *CH 07: 15.00 V 10: 15.00 V Channel 07 V/D ENGAGE SOLID

POSITION 1 IN/DIV *CH 08: 2.00 V 10: 2.00 V Channel 08 OUTPUT POSITION

*CH 09: 2.00 V 10: 2.00 V Channel 09

*CH 10: 2.00 V 10: 2.00 V Channel 10

*CH 11: 2.00 V 10: 2.00 V Channel 11

*CH 12: 2.00 V 10: 2.00 V Channel 12

*CH 13: 2.00 V 10: 2.00 V Channel 13

*CH 14: 2.00 V 10: 2.00 V Channel 14

*CH 15: 2.00 V 10: 2.00 V Channel 15

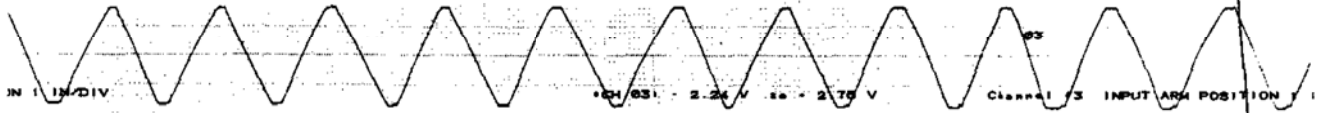
*CH 16: 2.00 V 10: 2.00 V Channel 16

CH 01: - 3.00 V to + 3.00 V

Channel #1 A/P LVDT .21V/DIV

CH 02: - 3.00 V to + 3.00 V

Channel #2 Y/D PROGRAM



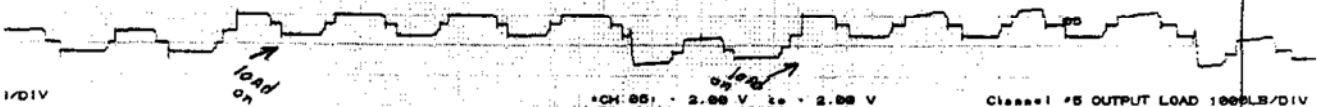
CH 03: - 2.25 V to + 2.25 V

Channel #3 INPUT ARM POSITION 1

DIV

CH 04: - 300 mV to + 300 mV

Channel #4 INPUT LOAD 100LB/DIV



CH 05: - 2.00 V to + 2.00 V

Channel #5 OUTPUT LOAD 1000LB/DIV



CH 06: - 1.00 V to + 1.00 V

Channel #6 LOAD SERVO VALVE CURRENT

102

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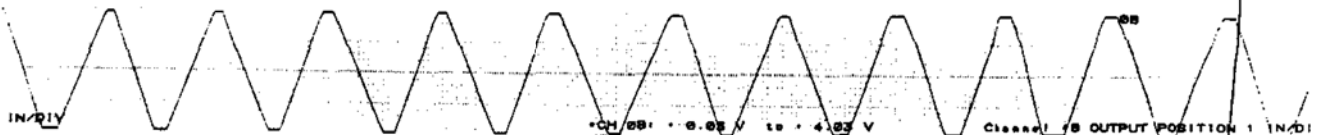
MT95K2 MULTI-TASK RECORDER

Card 24

ID 25 VDC

CH 07: - 10.00 V to + 10.00 V

Channel #7 Y/D ENGAGE SOLENOID 2B



CH 08: - 0.00 V to + 4.00 V

Channel #8 OUTPUT POSITION 1 IN/DIV

CH 09: - 2.00 V to + 2.00 V

Channel #9

CH 10: - 2.00 V to + 2.00 V

Channel #10

CH 11: - 2.00 V to + 2.00 V

Channel #11

CH 12: - 2.00 V to + 2.00 V

Channel #12

CH 13: - 2.00 V to + 2.00 V

Channel #13

CH 14: - 2.00 V to + 2.00 V

Channel #14

CH 15: - 2.00 V to + 2.00 V

Channel #15

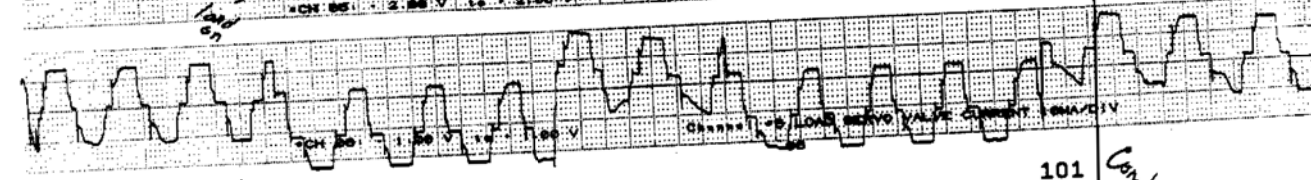
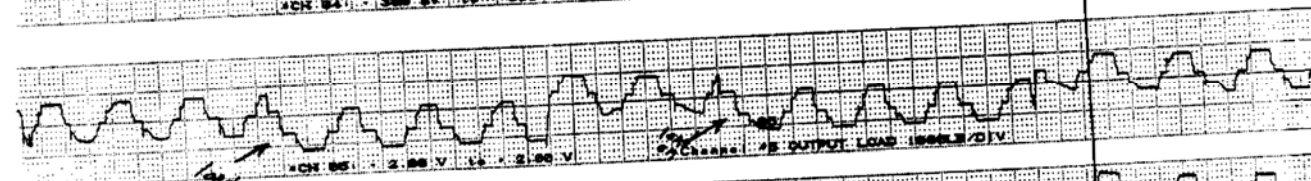
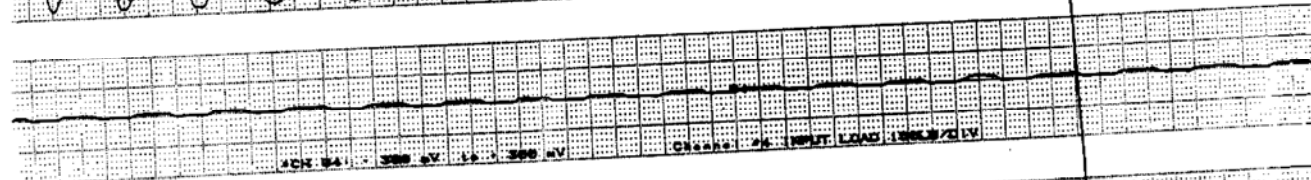
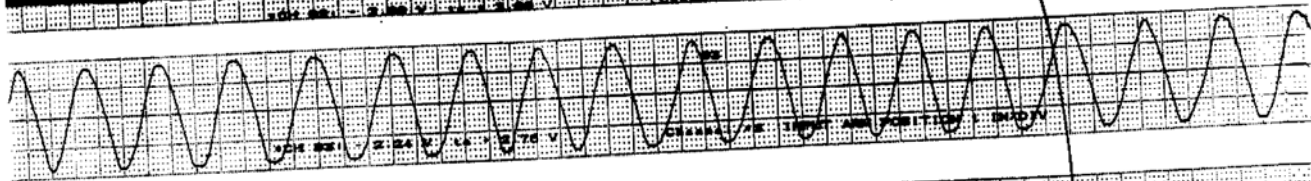
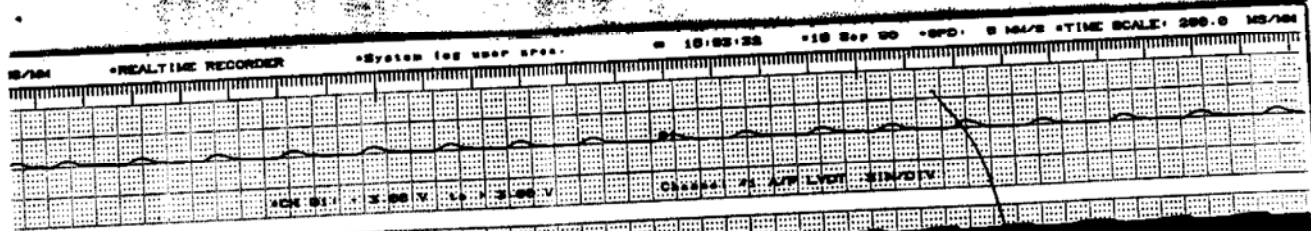
CH 16: - 2.00 V to + 2.00 V

Channel #16

DYNAMIC TEST

USAIR 427 RUDDER

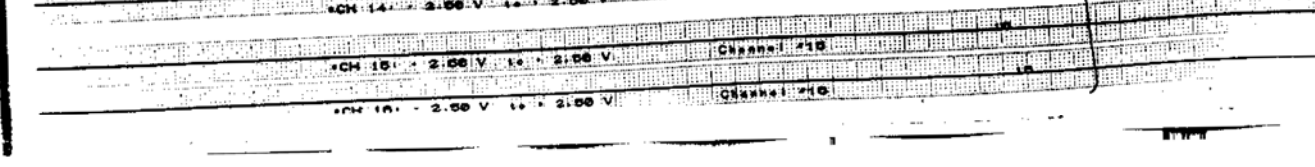
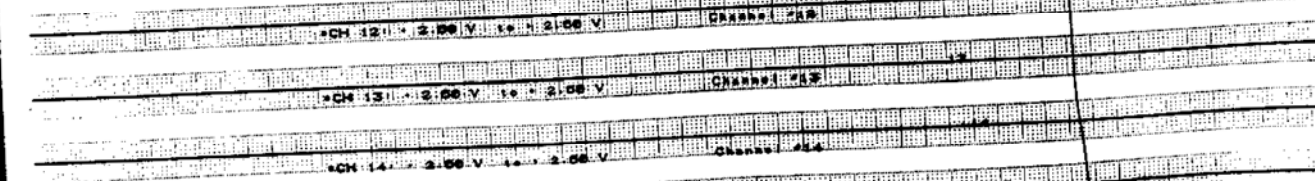
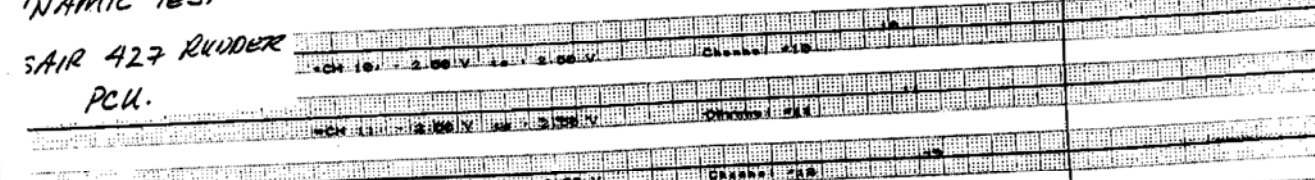
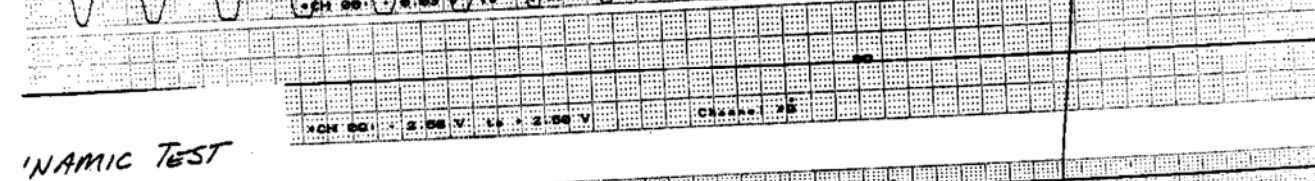
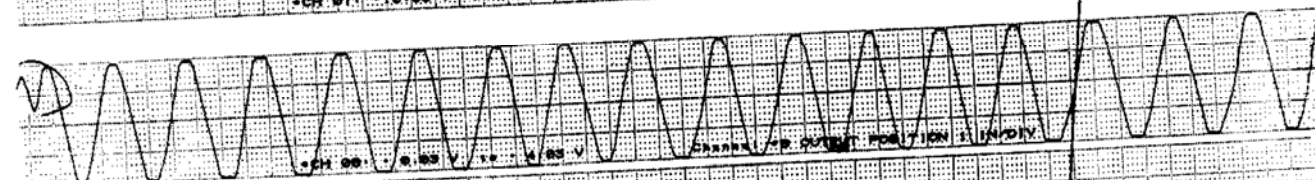
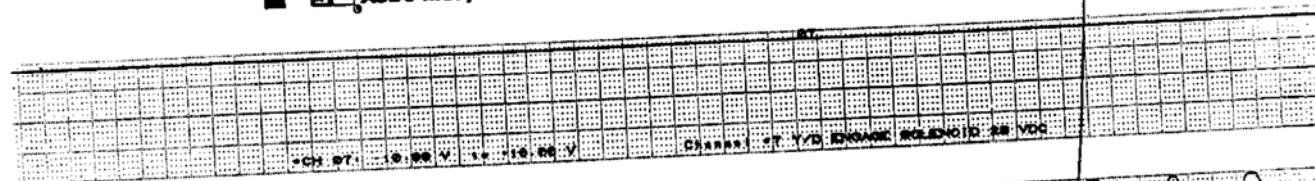
PCU.



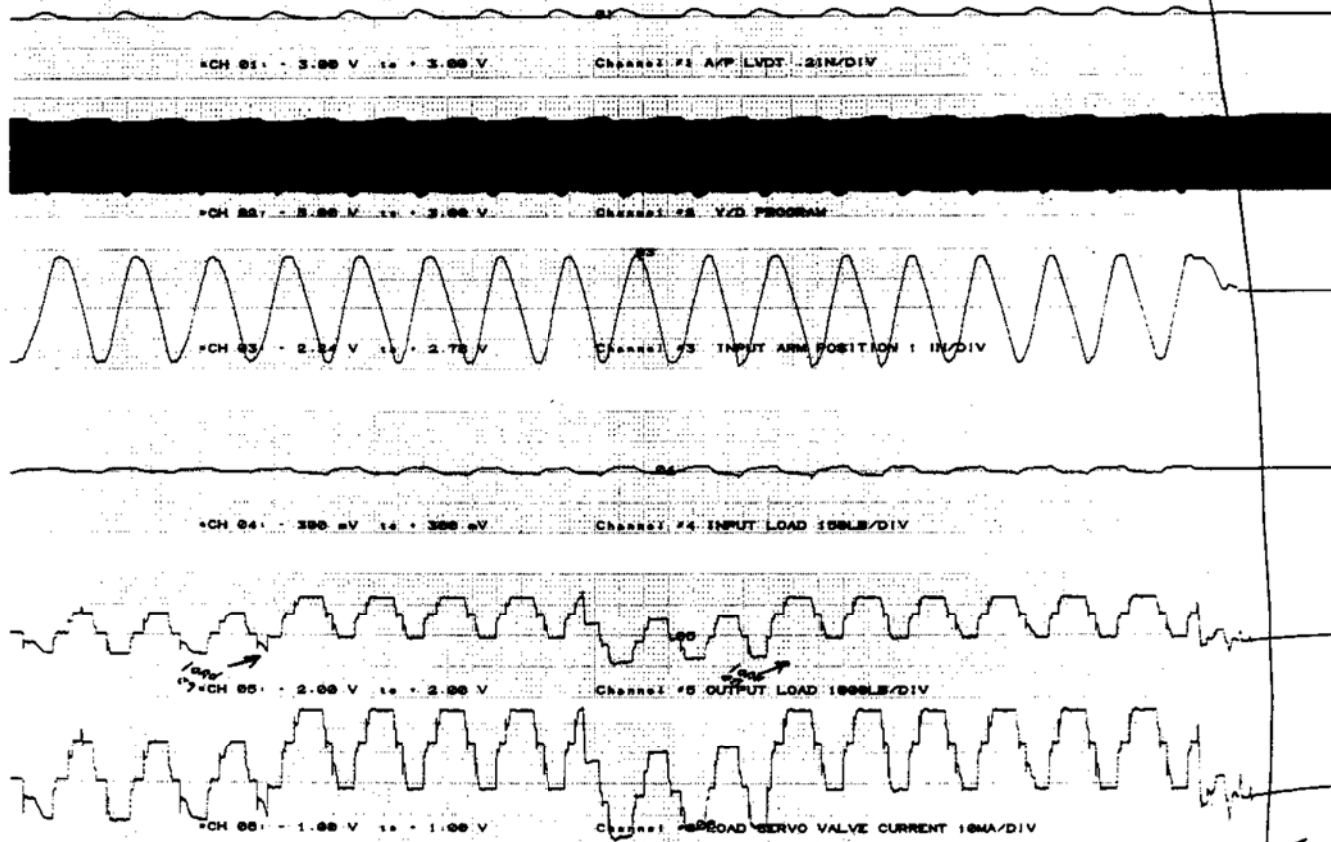
ET Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER

101 Cont 25



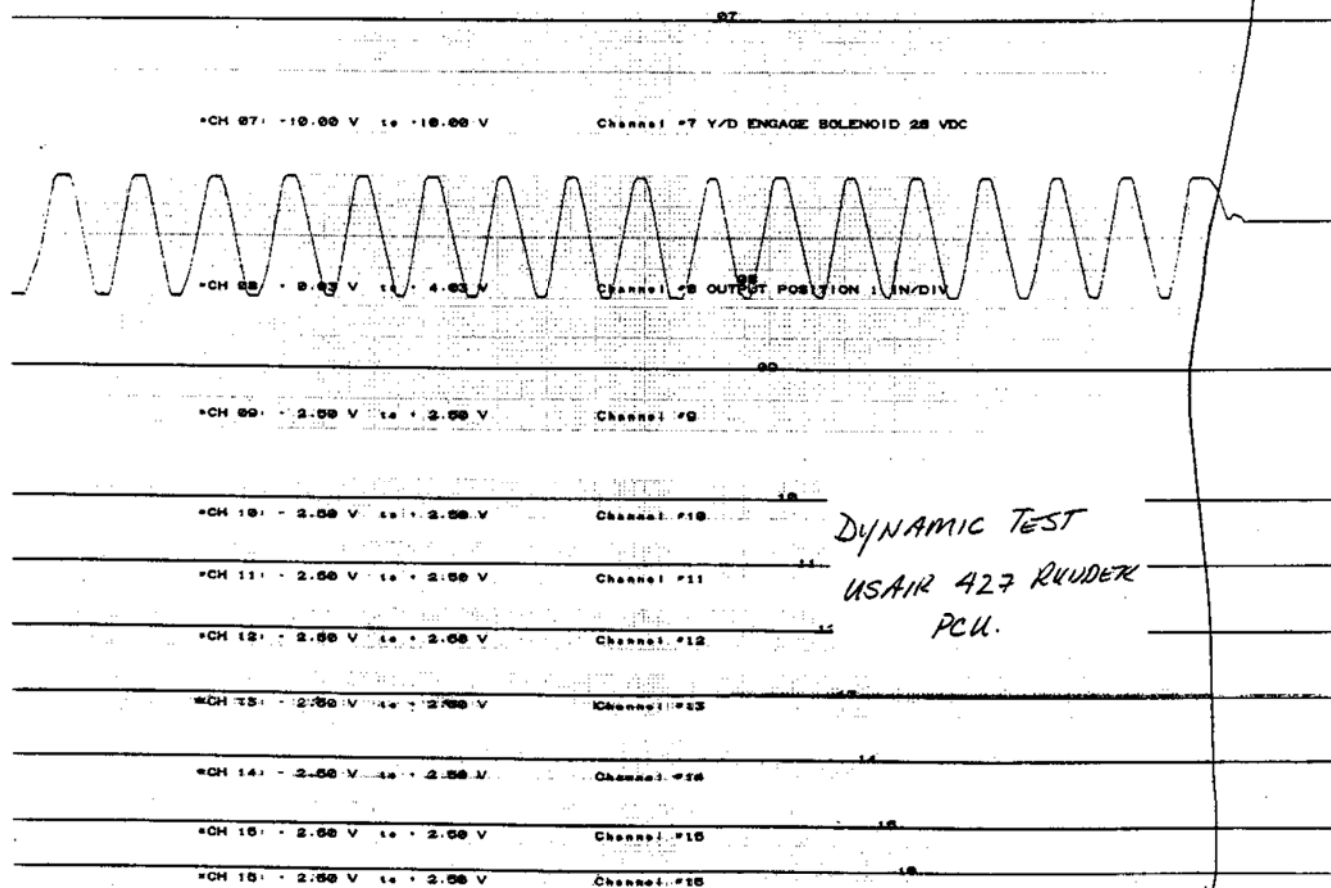
DYNAMIC TEST
SAIR 427 RUDDER
PCU.



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MT95K2 MULTI-TASK RECORDER

100



DYNAMIC TEST
USAIR 427 RUDEK
PCU.

Channel #1 A/P LADT 1IN/DIV *CH 01: 2.00 V to 2.00 V Channel

Channel #2 Y/D PROGRAM *CH 02: 2.00 V to 2.00 V Channel

Channel #3 INPUT ARM POSITION 1 IN/DIV *CH 03: 2.00 V to 2.00 V Channel

Channel #4 INPUT LOAD 100LB/DIV *CH 04: 200 mV to 200 mV Channel

Channel #5 OUTPUT LOAD 1000LB/DIV *CH 05: 2.00 V to 2.00 V Channel

Channel #6 LOAD SERVO VALVE CURRENT 10MA/DIV *CH 06: 1.00 V to 1.00 V Channel

099

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MT95K2 MULTI-TASK RECORDER

Channel #7 Y/D ENGAGE SOLENOID 28 VDC *CH 07: -10.00 V to -10.00 V Channel

Channel #8 OUTPUT POSITION 1 IN/DIV *CH 08: 2.00 V to 2.00 V Channel

Channel #9 *CH 09: 2.00 V to 2.00 V Channel

Channel #10 *CH 10: 2.00 V to 2.00 V Channel

Channel #11 *CH 11: 2.00 V to 2.00 V Channel

Channel #12 *CH 12: 2.00 V to 2.00 V Channel

Channel #13 *CH 13: 2.00 V to 2.00 V Channel

Channel #14 *CH 14: 2.00 V to 2.00 V Channel

Channel #15 *CH 15: 2.00 V to 2.00 V Channel

Channel #16 *CH 16: 2.00 V to 2.00 V Channel

*DYNAMIC TEST
USAIR 427 RUDDER
PCH.*

1 A/P LVDT 2 IN/DIV

CH 01: - 3.00 V to + 3.00 V

Channel #1 A/P

2 Y/D PROGRAM

CH 02: - 3.00 V to + 3.00 V

Channel #2 Y/D

3 INPUT ARM POSITION 1 IN/DIV

CH 03: - 2.24 V to + 2.75 V

Channel #3 IN

4 INPUT LOAD 500LB/DIV

CH 04: - 300 mV to + 300 mV

Channel #4 IN

5 OUTPUT LOAD 1000LB/DIV

CH 05: - 2.00 V to + 2.00 V

Channel #5 OUT

6 SERVO VALVE CURRENT 10MA/DIV

CH 06: - 1.00 V to + 1.00 V

Channel #6 LC

Cond 27
B sys
off

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MT95K2 MULTI-TASK RECORDER

098

7 Y/D ENGAGE SOLENOID 28 VDC

CH 07: -10.00 V to +10.00 V

Channel #7 Y

8 OUTPUT POSITION 1 IN/DIV

CH 08: - 0.03 V to + 4.03 V

Channel #8 OUT

9

CH 09: - 2.50 V to + 2.50 V

Channel #9

DYNAMIC TEST
USAIR 427 RUDDER
PCU.

10

CH 10: - 2.50 V to + 2.50 V

Channel #10

11

CH 11: - 2.50 V to + 2.50 V

Channel #11

12

CH 12: - 2.50 V to + 2.50 V

Channel #12

13

CH 13: - 2.50 V to + 2.50 V

Channel #13

14

CH 14: - 2.50 V to + 2.50 V

Channel #14

15

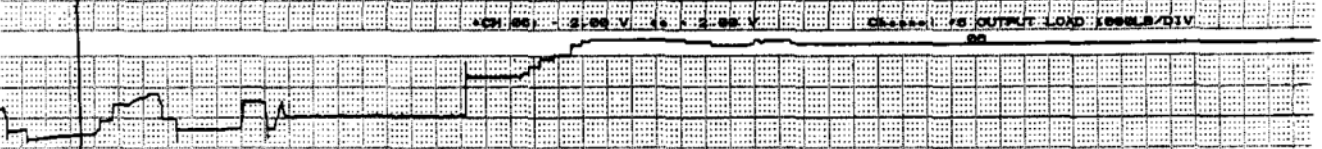
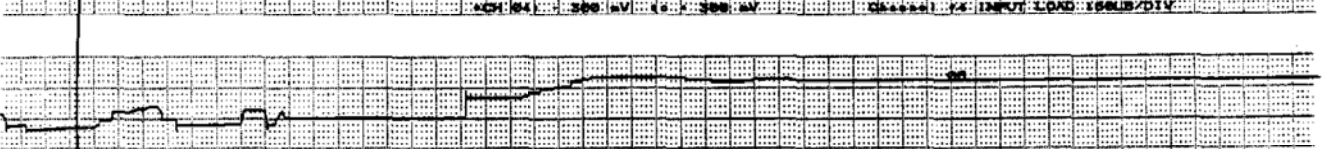
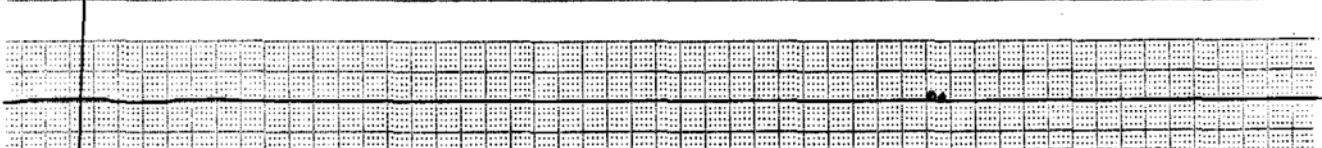
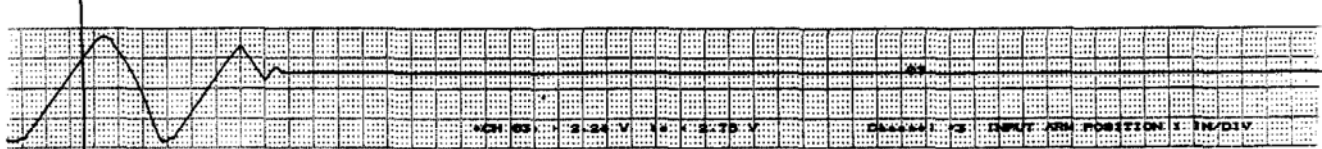
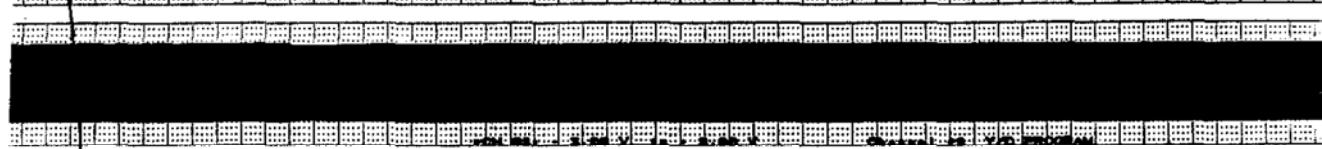
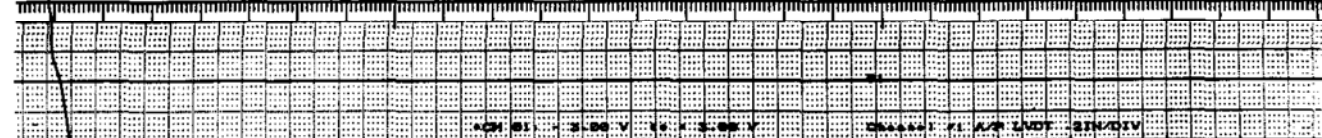
CH 15: - 2.50 V to + 2.50 V

Channel #15

16

CH 16: - 2.50 V to + 2.50 V

Channel #16



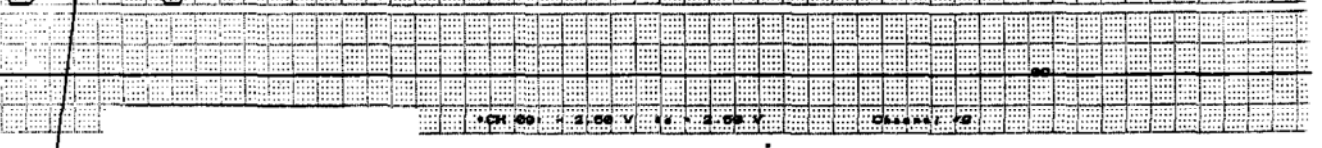
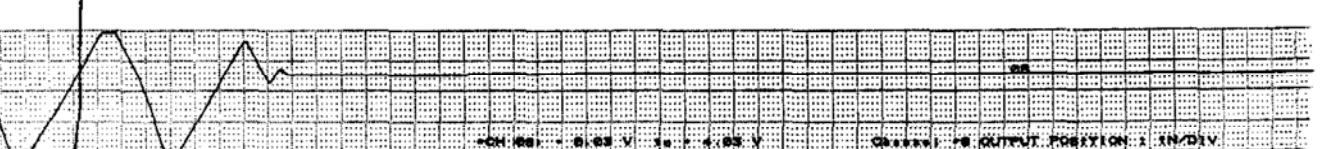
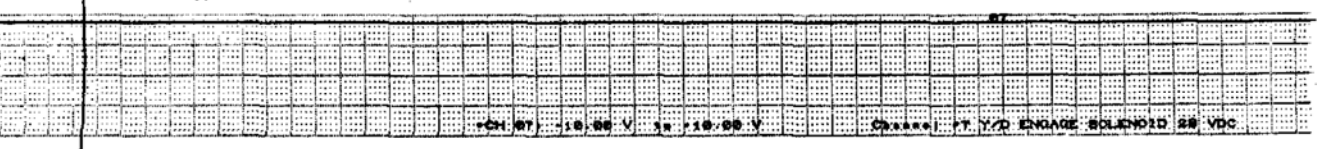
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B-57
9/10/90

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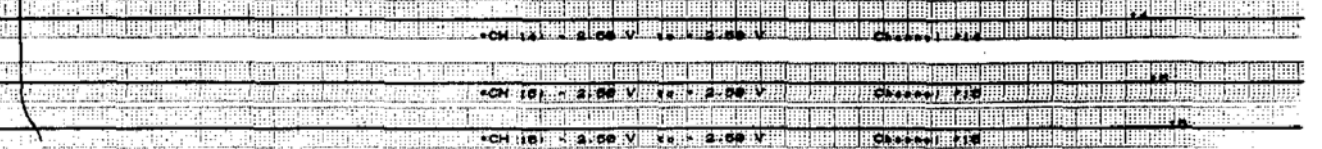
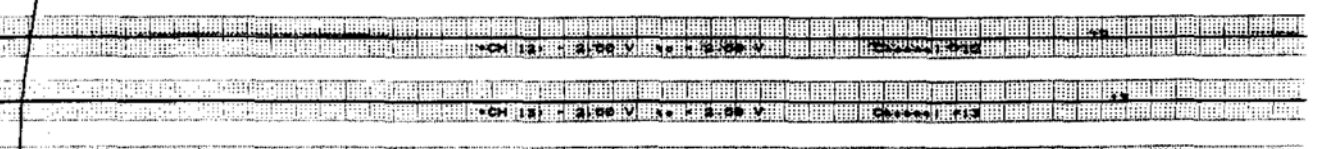
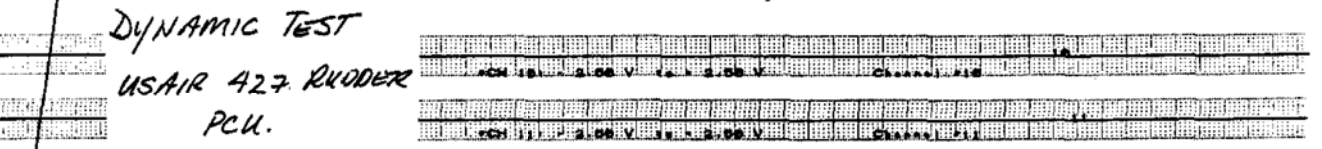
MT95K2 MULTI-TASK RECORDER

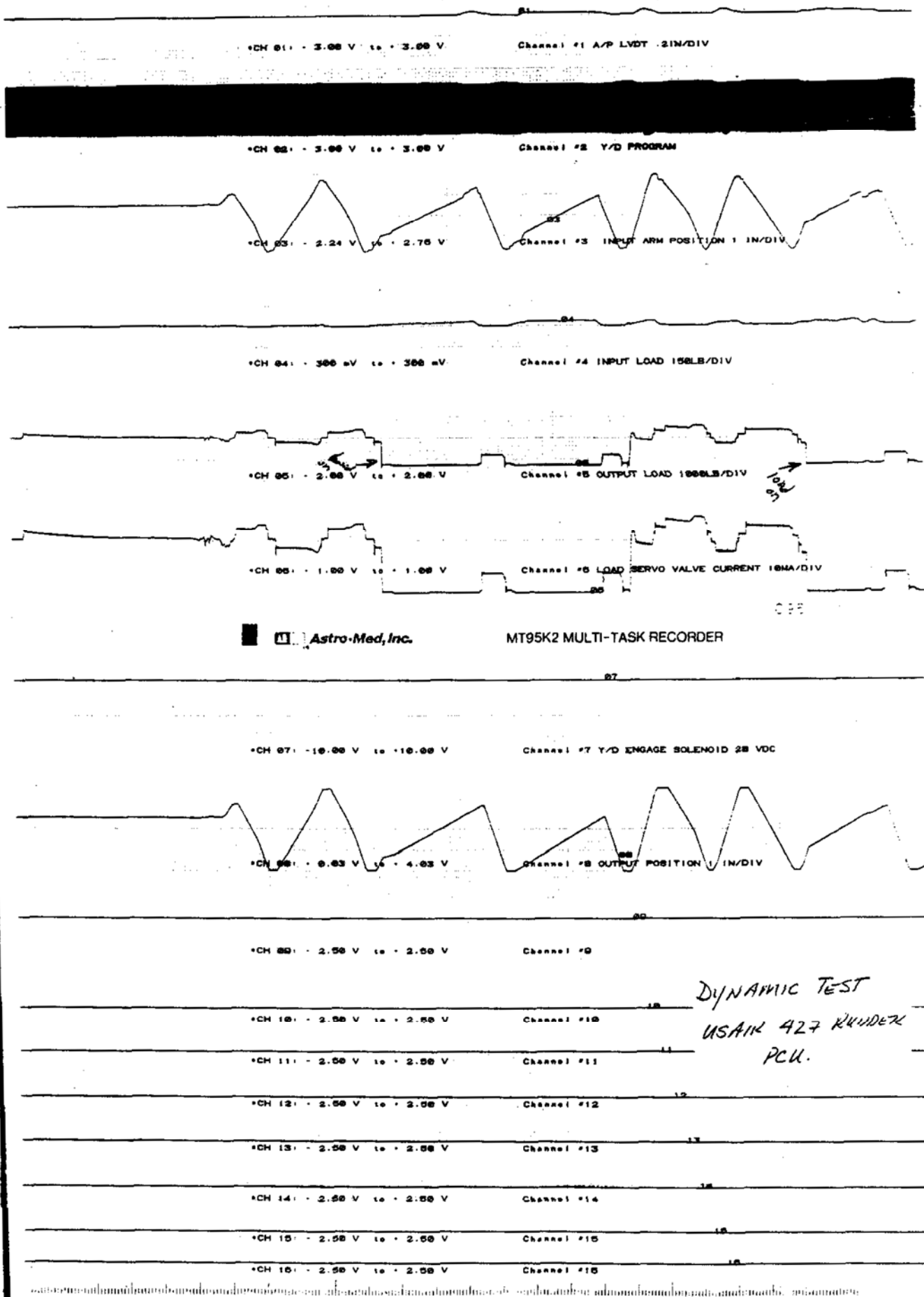
097

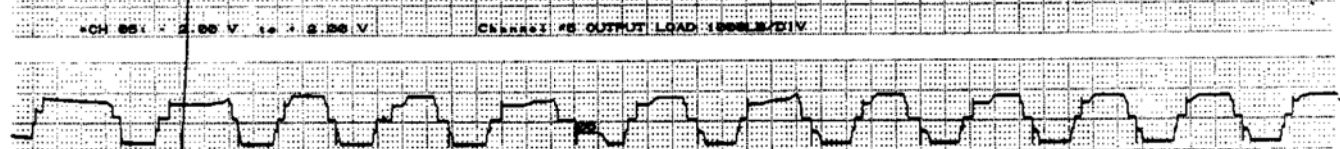
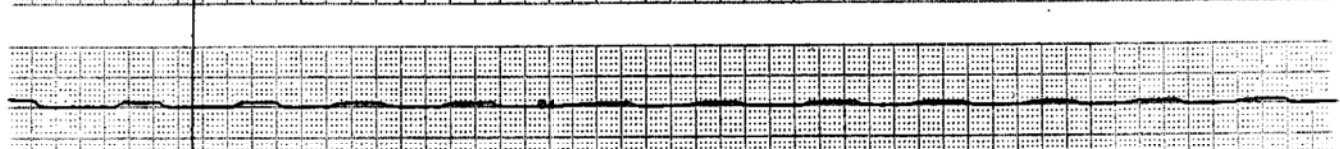
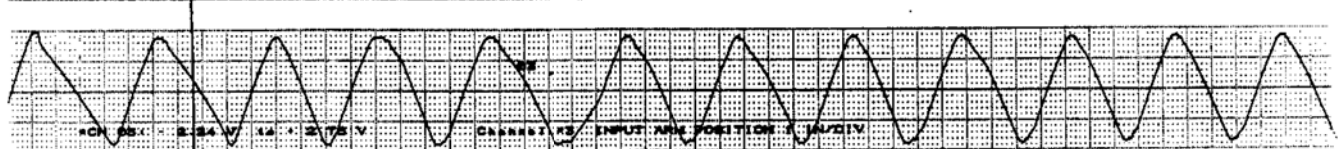
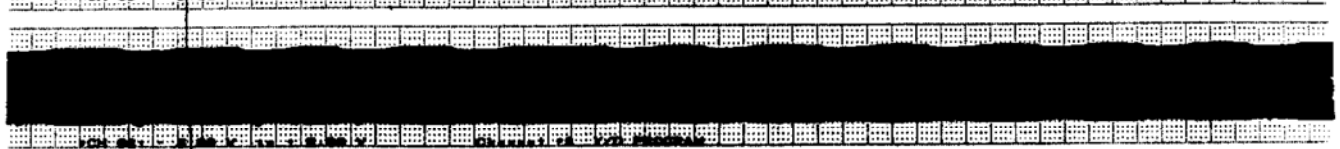
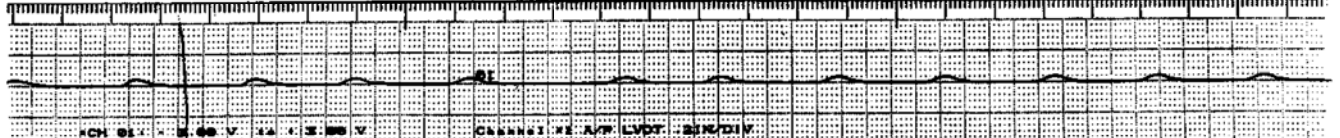
Set up



DYNAMIC TEST
USAIR 427 RUDDER
PCU.





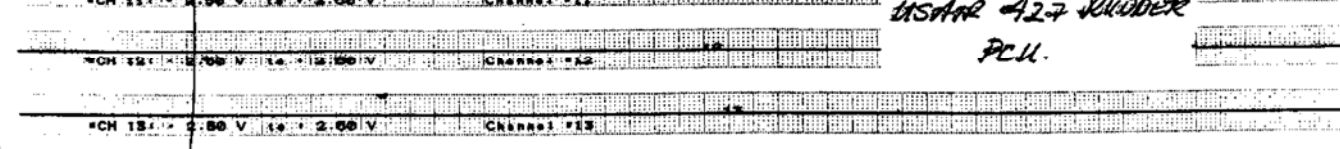
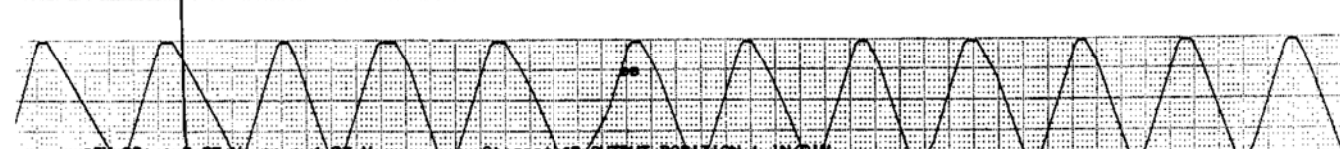
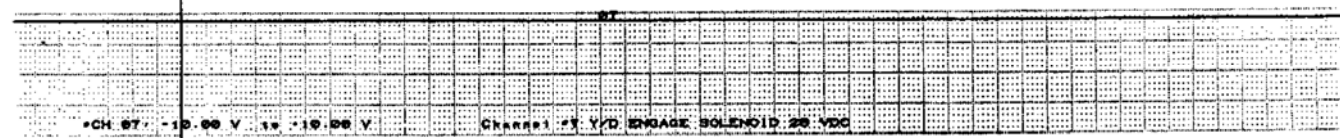


Long

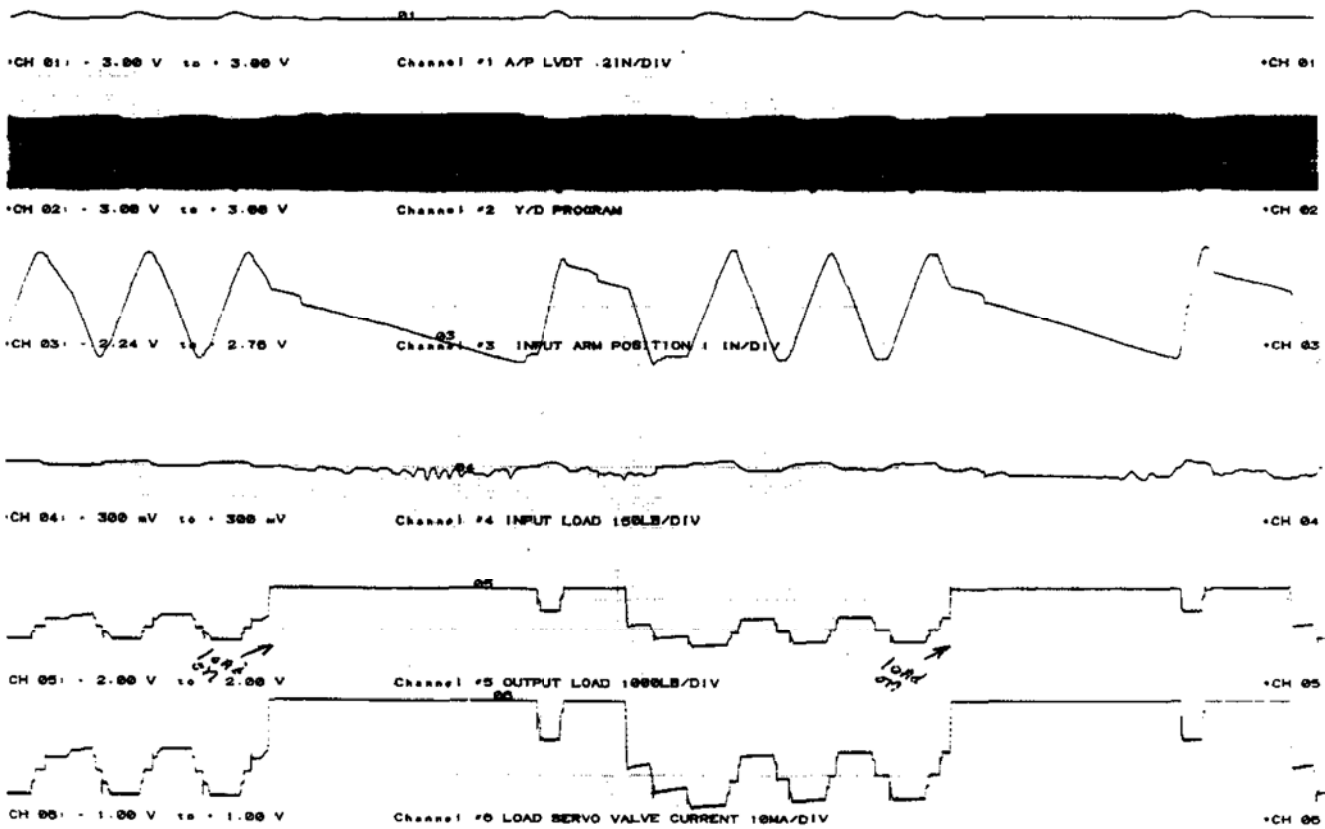
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MT95K2 MULTI-TASK RECORDER

095



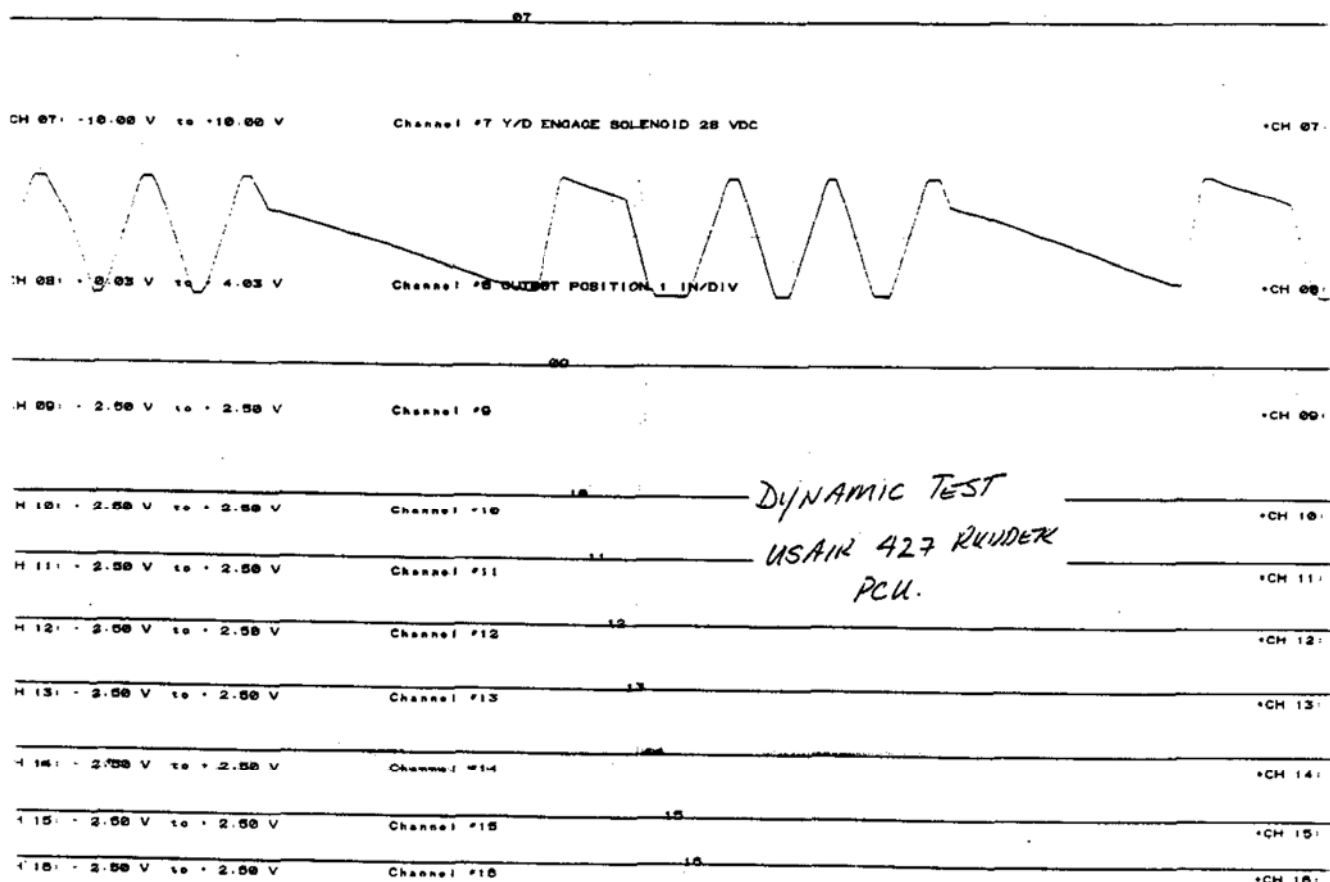
DYNAMIC TEST
USAR 427 RUDDER
PCU.

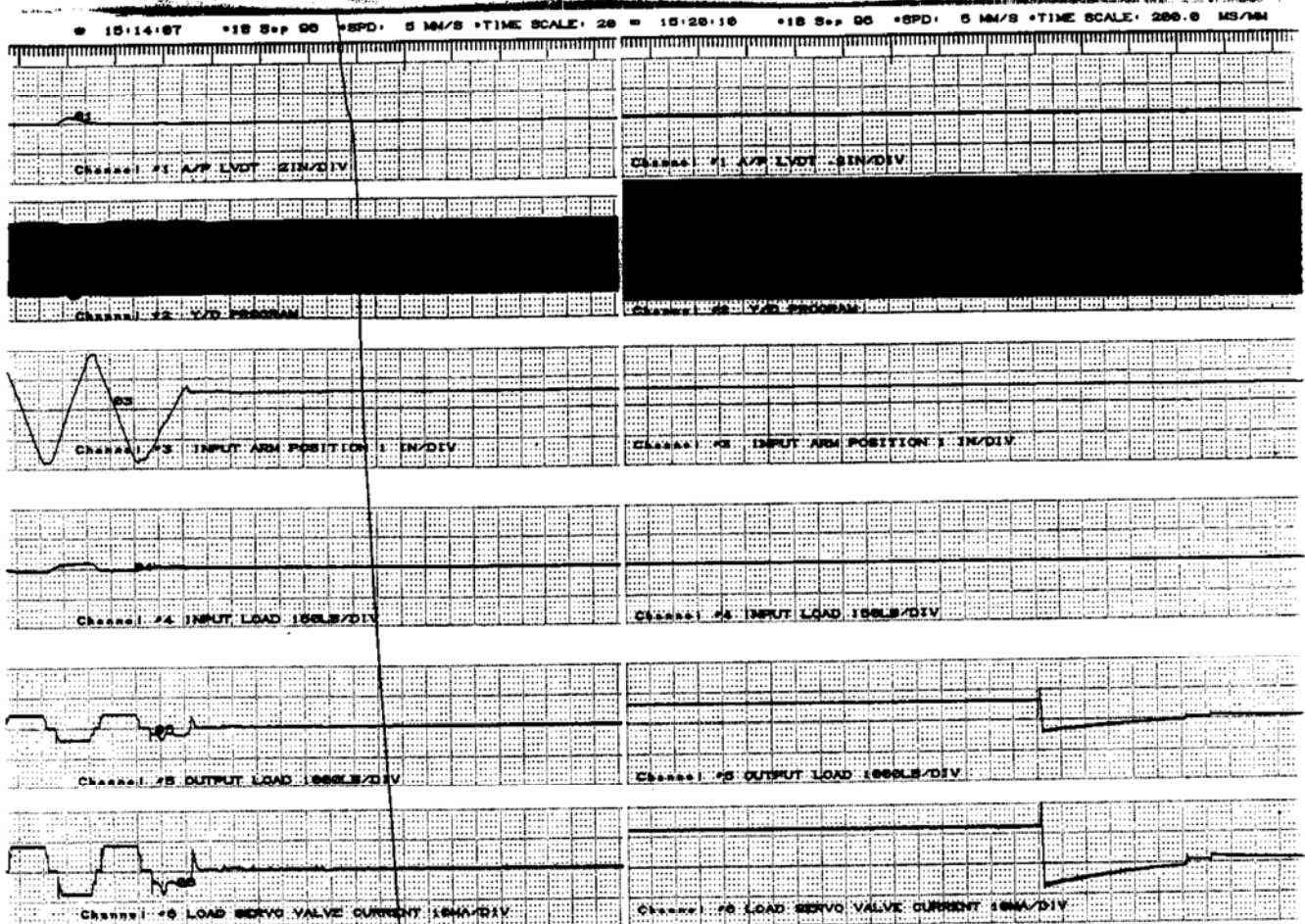


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 Astro-Med, Inc.

MT95K2 MULTI-TASK RECORDER



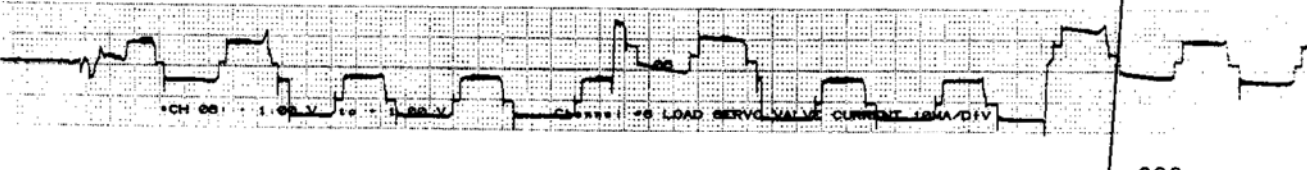
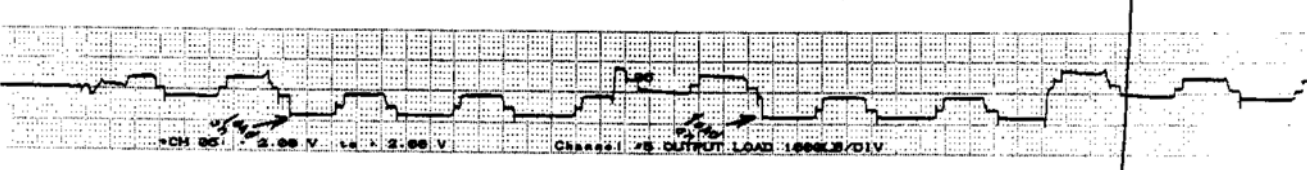
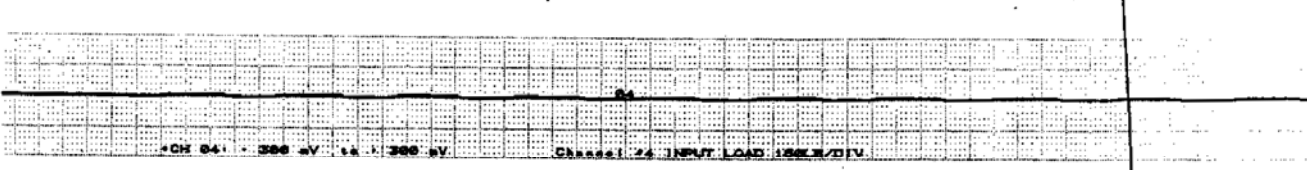
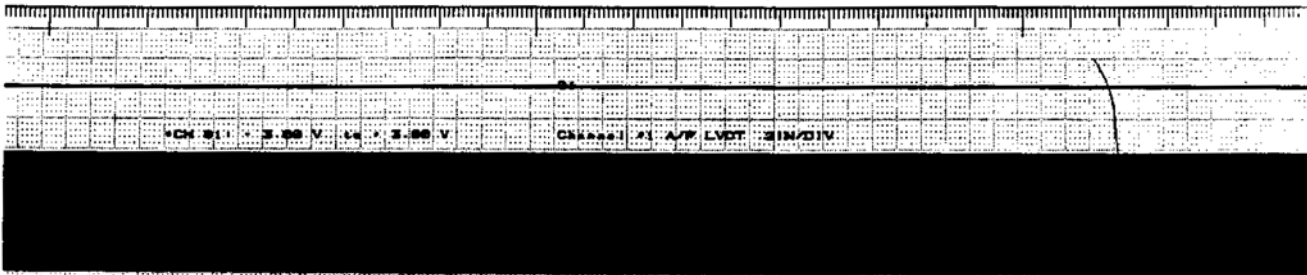


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MT95K2 MULTI-TASK RECORDER

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DYNAMIC TEST
USAF 427 RUDDER
PCU.

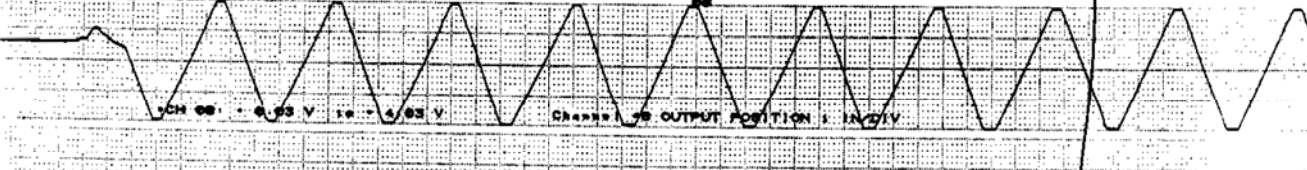


 Astro-Med, Inc.

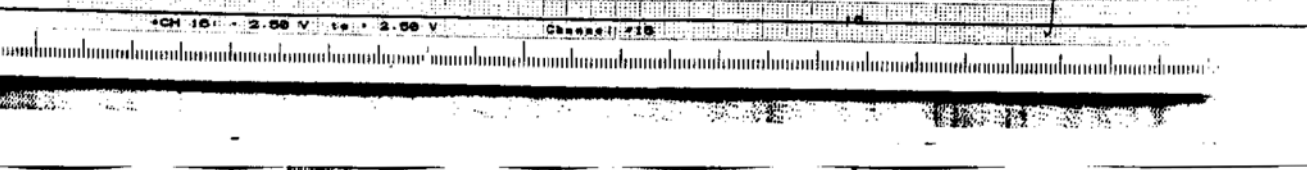
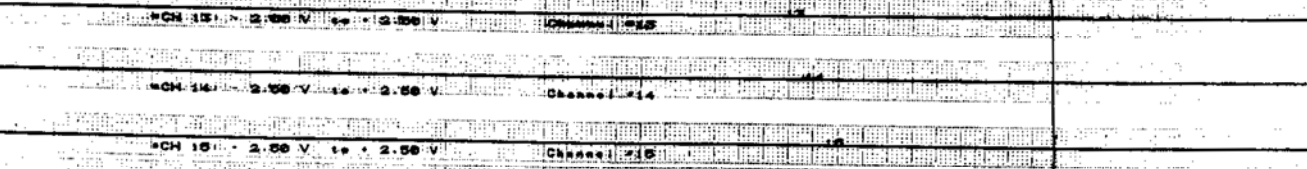
MT95K2 MULTI-TASK RECORDER

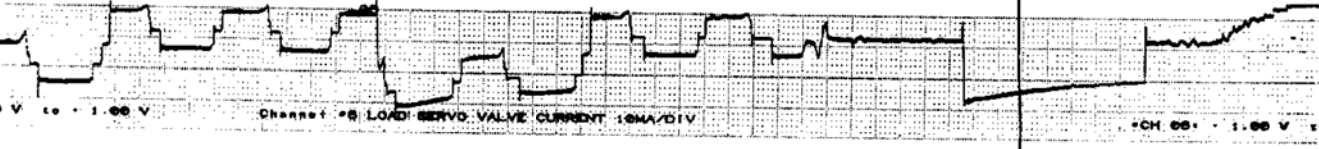
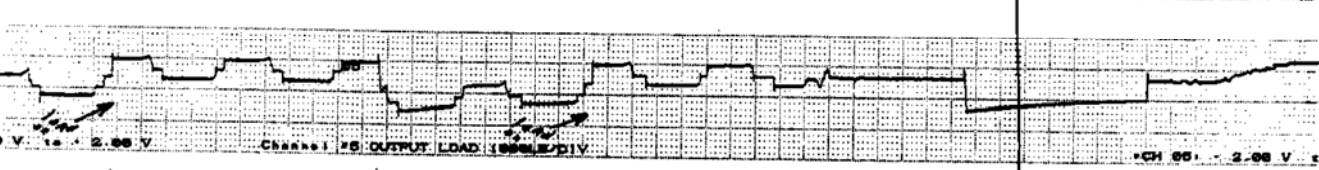
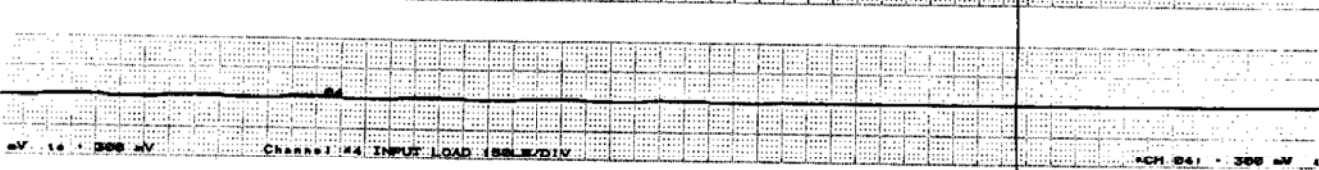
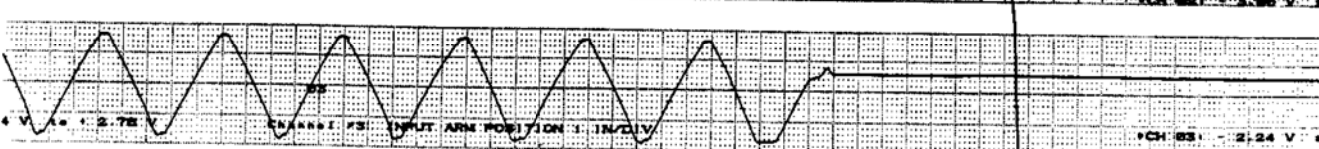
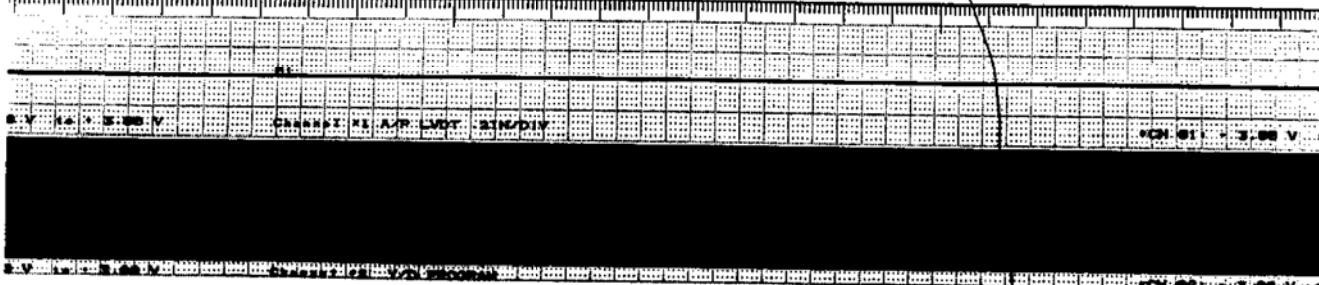
092

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DYNAMIC TEST
USAIR 427 RUDDER
PCU.

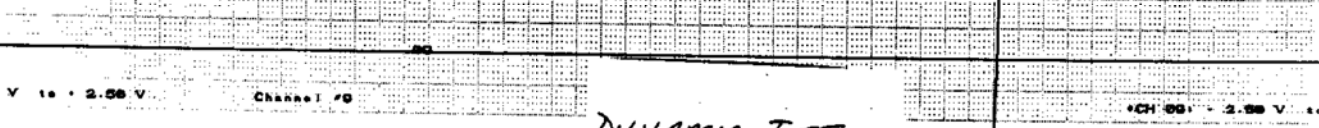
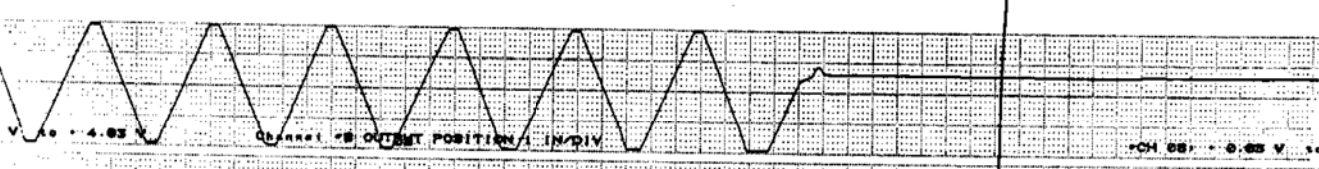
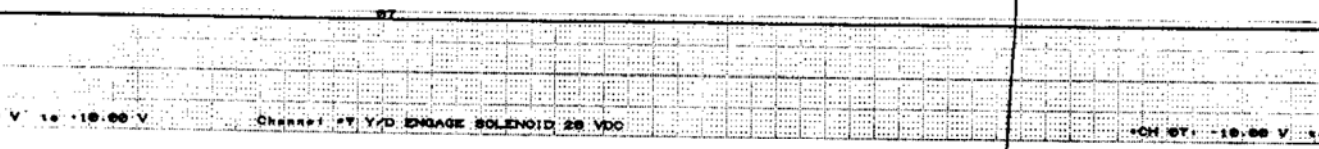




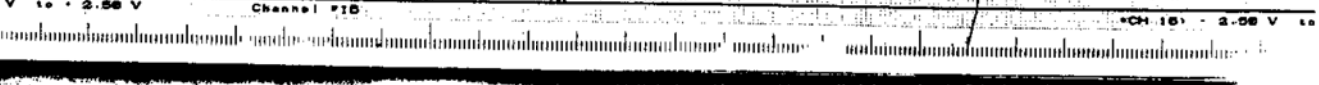
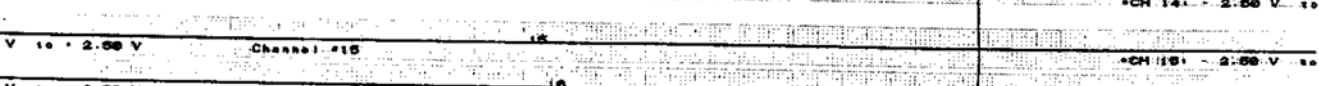
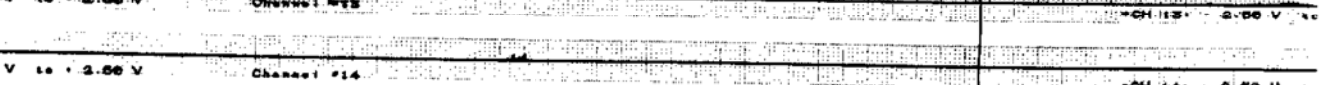
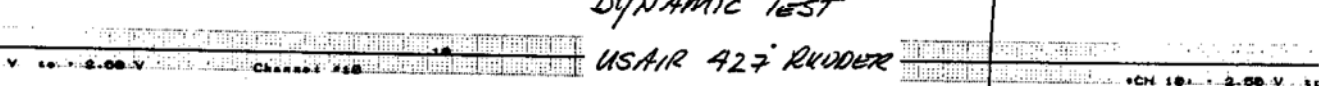
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MT95K2 MULTI-TASK RECORDER

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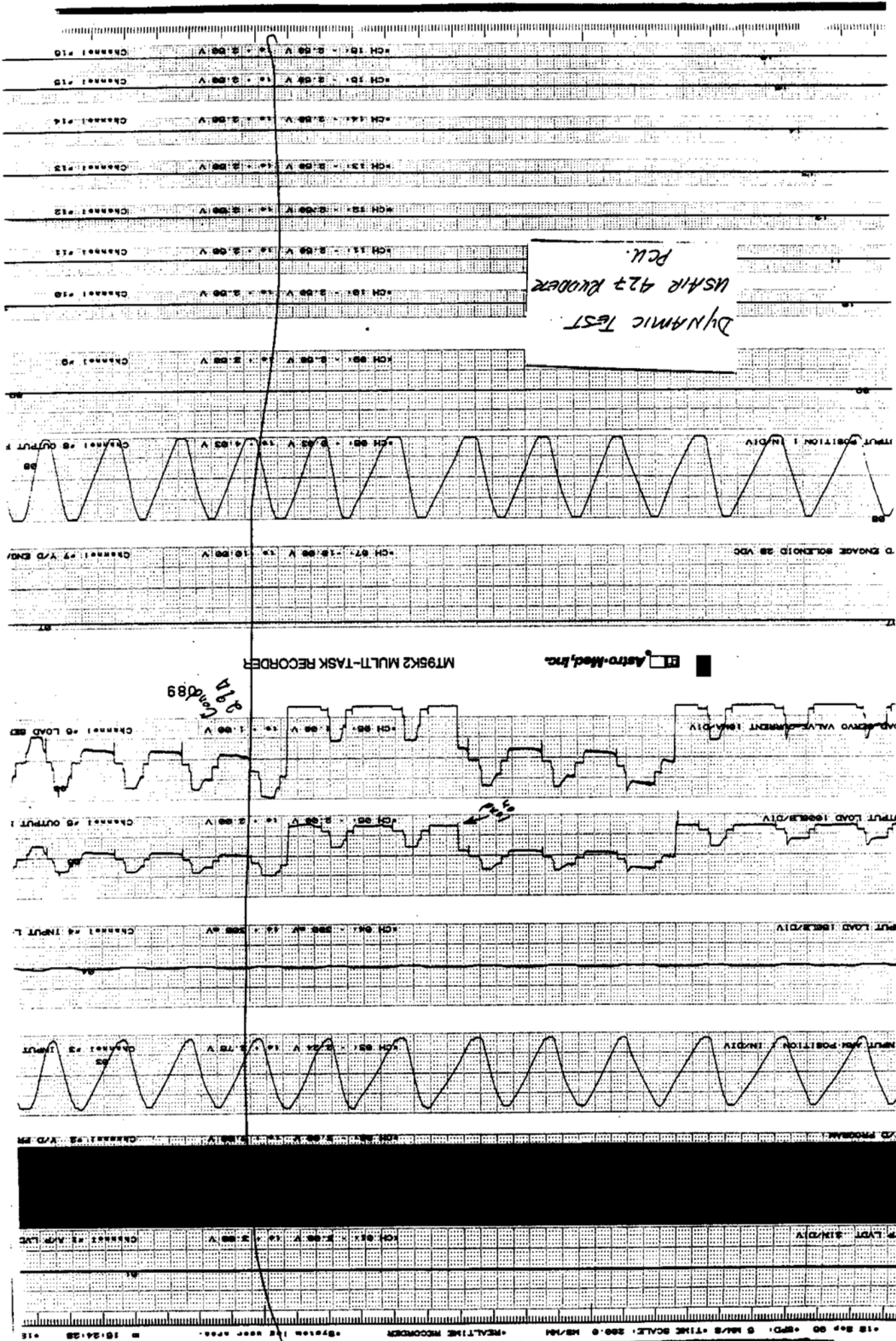
DYNAMIC TEST
USAIR 427 RUDDER
PCU.

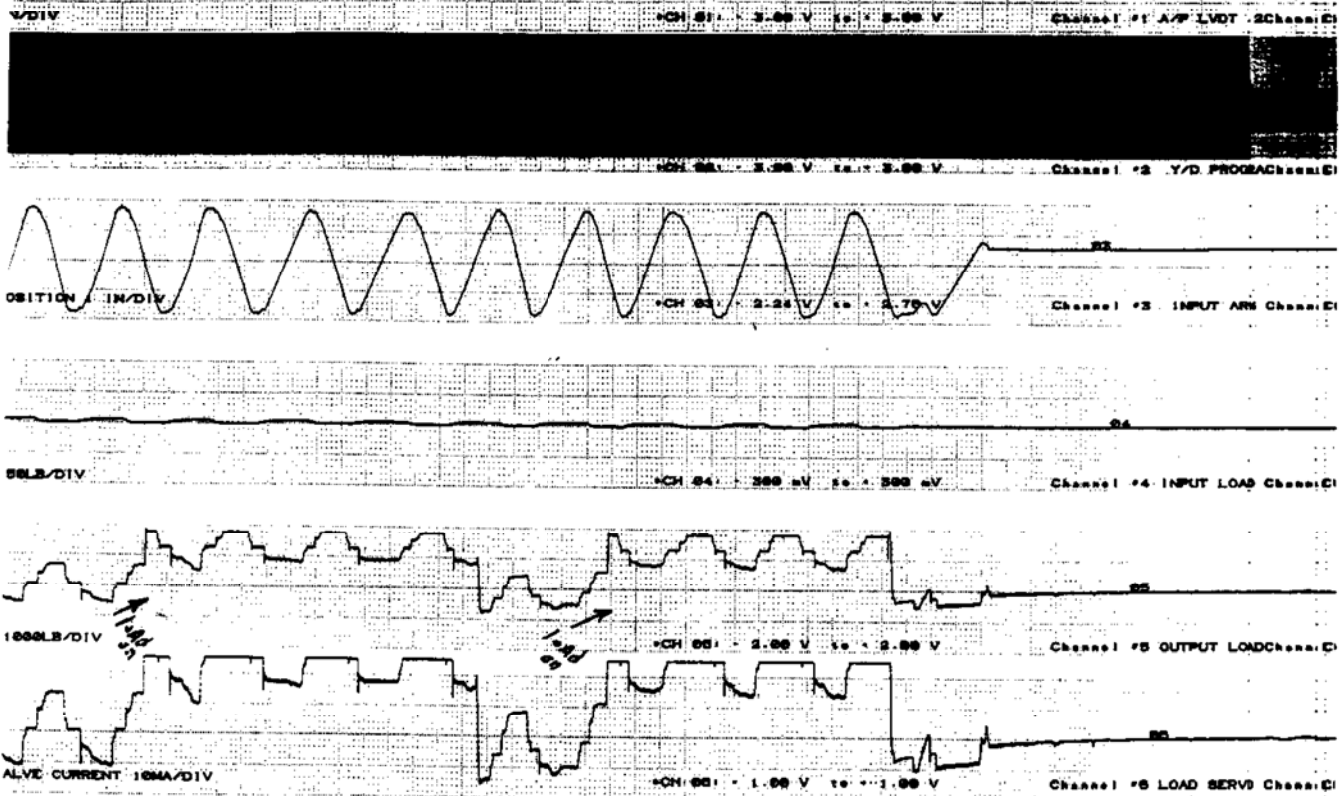


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DYNAMIC TEST
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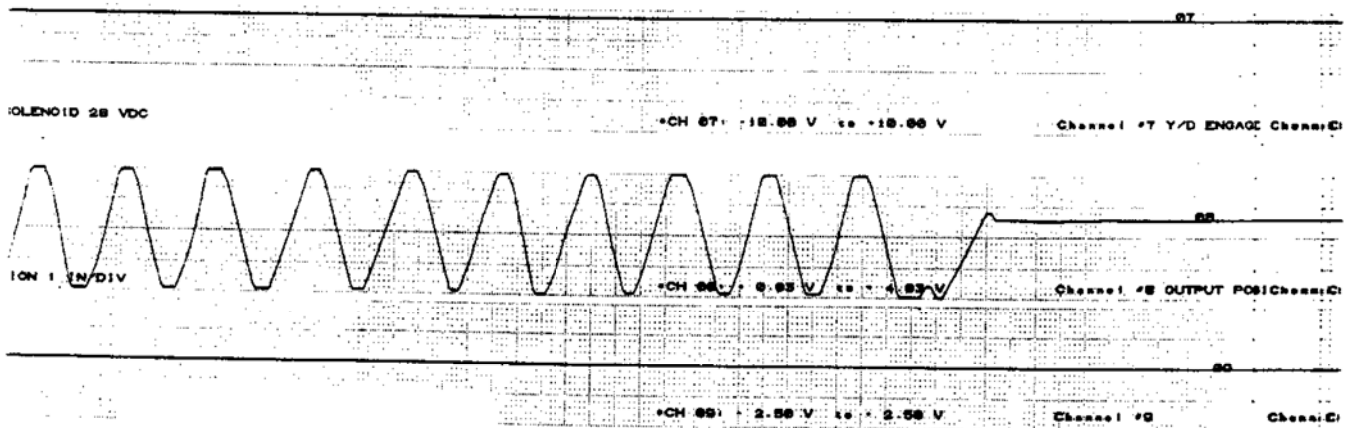




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