ANNEX 3

Test Result／Data of the Servo-Drive System

CONTENTS

1. Antenna Drive System

1.1 Summary of Test Result

No.	Survey Item	Results	Photograph
1)	Drive Motor		
1-1	AZ Drive Motors		2-1
	(a) Appearance	- Some dirt adhered	
	(b) Mechnical condition	- Surface of the commutator is threading	
	(c) Electrical condition	- Good	
1-2	EL drive Motors		2-2
	(a) Appearance	- Some paint peeling - Some rust adhered	
	(b) Mechanical condition	- Good	
	(c) Electrical condition	- Slight degradation of insulation resistance	
2)	DCPA		2-3/2-4
	(a) Appearance	- Some rust	
	(b) Mechanical condition	- Good	
	(c) Electrical condition	- Degradation of the AZ 1/2 characteristics - Some of the control functions are not operated	

No.	Survey Item	Results	Photograph
3)	Antenna Control		2-5
	(a) Appearance	- Good	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Control function: Good - Angle Indicator (follow up servo) is not smoothly operated. - Cable Wrap Inidcator is not smoothly operated.	
4)	Servo Control Amplifier		2-6
	(a) Appearance	- Good	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Degradation of some characteristics	
5)	Tracking Demodulator		2-7
	(a) Appearance	- Good	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Good	
6)	Tracking Down Converter		2-8
	(a) Appearance	- Good	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- 4G LNA is substituted for TD AMP	

No.	Survey Item	Results	Photograph
7)	Angle Detectors		
7-1	AZ Angle Detector		2-9
	(a) Appearance	- Some dirt adhered	
	(b) Mechanical Condition	- Slight Eccentricity of bellows coupling	
	(c) Electrical Condition	- Good	
7-2	EL Angle Detector		2-10
	(a) Appearance	- Good	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Good	
8)	Limit Switches		
8-1	AZ Limit Switches and cams		2-11
	(a) Appearance	- Some rust and corrosion	
	(b) Mechanical Condition	- Not operating normally (CW limit)	
	(c) Electrical Condition	- Same as above	
8-2	EL Limit Switches and cams		2-12
	(a) Appearance	- Good	
	(b) Mechanical condition	- Good	
	(c) Electrical condition	- Good	
9)	400 Hz Power Supply		2-3
	(a) Appearance	- Some rust	
	(b) Mechanical Condition	- Cooling Fan has been added	
	(c) Electrical Condition	- Good	

No.	Survey Item	Results	Photograph
10)	Safety Switches		
10-1	Main Reflector Hatch		2-14
	(a) Appearance	- Rust and corrosion	
	(b) Mechanical Condition	- Mechanical degradation	
	(c) Electrical Condition	- Operating Normally	
10-2	Stow Pin Hole		2-15
	(a) Appearance	- Rust	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Operating normally	
10-3	Manual handle		
	(a) Appearance	- Some rust	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Operating normally	
11)	Stow Lock Device		2-16
	(a) Appearance	- Some rust	
	(b) Mechanical Condition	- Good	
	(c) Electrical Condition	- Operating normally	
12)	Dehydrators		
	(a) Appearance	- Good	
	(b) Mechanical Condition	- One of the dehydrator is out of order	
	(c) Electrical Condition	- Same as above	

No.	Survey Item	Result
13)	Servo Loop Characteristics	
13-1	Tachometer loop	- some oscillation appears in the response under Azimuth 1/2 single drive mode due to the degradation of AZ 1/2 DCPA.
13-2	Velocity and Acceleration	
	a) Maximum Velocity (AZ, EL)	- about 0.3 deg/sec
	b) Acceleration (AZ, EL)	- more than 0.3 deg/sec.sec
	c) Minimum Speed (AZ, EL)	- less than 0.002 deg/sec
13-3	Manual Position Loop Transient Response	- some oscillation only appeares in the following combination due to the degradation of SCA characteristics: SCA : A AXIS : EL Servo Type : I Servo Bandwidth : Narrow
13-4	Error Gradient and Crosstalk	
	a) Error Gradient	- approx. 20V/deg
	b) Crosstalk	- not less than -14 dB
13-5	Auto Position Loop Transient Response	- Some symptom as 13-3, due to the degradation of SCA characteristics

1.2 Test Data

(1) AUTO POSITION LOOP TRANSIENT RESPONSE DATE 24th Mar., 1986

Tested by

1. Purpose of the test

To check the degradation of overall system characteristics based on the result of Auto Position transient Response measurement.

2. Test set-up

Refer to the Fig.-1

3. Test Equipment

4 Pen Chart Recorder	YEW 2931 PHOTOCORDER
	YEW 3132 DC AMP
Function Generator	WAVETEK MODEL 111
	Voltage Controlled Generator

4. Test Procedure

Step 1 Setting antenna system automatic tracking mode by using satellite beacon frequency.

Step 2 Applying the square wave form signal at the aproximately ± 0.2 Vp-p to the TEST IN terminal of AZ (EL) gain control panel of Serco Control Amplifier (SCA) by means of function generator, transent response is measured and recorded the tracking angle error at the SCA test output by means of chart recorder.

DATE 25th Mar.,1986

Tested by

5. Test Result

Axis	SCA	TYPE	SERVO BW	Overshoot		Settling Time		Data Sheet
				+	−	+	−	
AZ (SINGLE)	A	I	Wide	21.6 %	59.3 %	6.9sec	6.0sec	1-1
			Medium	22.5 %	47.2 %	7.1sec	4.1sec	1-2
			Narrow	46.7 %	53.3 %	4.8sec	2.2sec	1-3
	B	I	Wide	55.5 %	72.0 %	1.1sec	2.6sec	1-4
			Medium	18.0 %	75.0 %	1.7sec	2.2sec	1-5
			Narrow	34.5 %	54.5 %	2.0sec	2.4sec	1-6
		II	Wide	16.0 %	80.0 %	1.4sec	4.0sec	1-7
			Medium	15.8 %	70.0 %	1.8sec	5.2sec	1-8
			Narrow	18.0 %	9.9 %	1.8sec	2.3sec	1-9
EL	A	I	Wide	0. %	0 %	1.3sec	1.7sec	2-1
			Medium	0 %	0 %	1.7sec	1.3sec	2-2
			Narrow	0 %	0 %	1.1sec	1.4sec	2-3
	B	I	Wide	0 %	0 %	1.3sec	1.4sec	2-4
			Medium	0 %	0 %	1.4sec	1.5sec	2-5
			Narrow	0 %	0 %	1.1sec	1.3sec	2-6
		II	Wide	0 %	0 %	1.1sec	1.3sec	2-7
			Medium	0 %	0 %	1.1sec	1.3sec	2-8
			Narrow	0 %	0 %	1.0sec	1.0sec	2-9

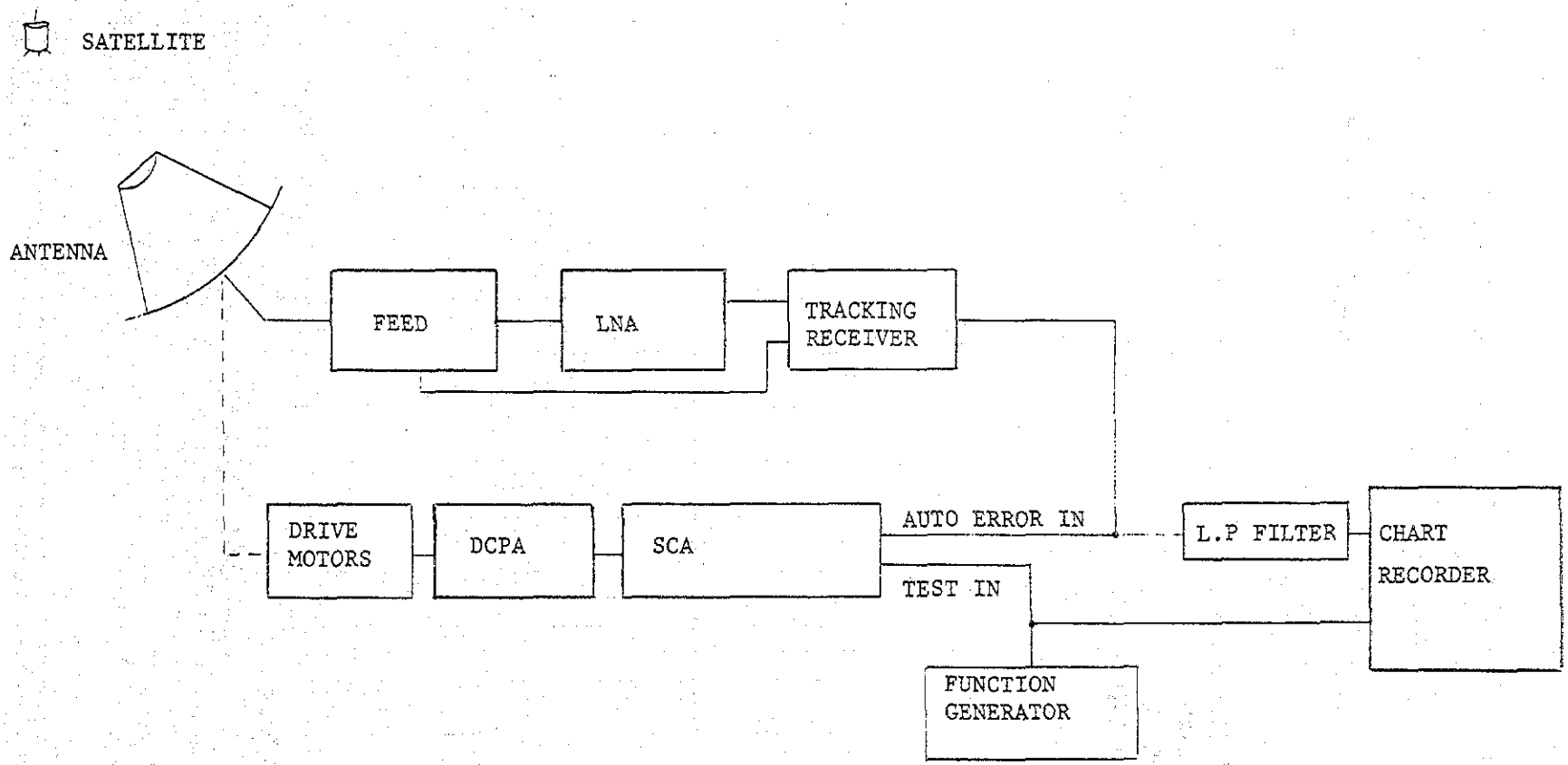


Fig. 1 Auto Position Loop Transient Response Connection Diagram

Data Sheet-1-1

DATE 25th Mar.,1986

Tested by Makiw

AZIMUTH

No.2 DCPA Single Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE

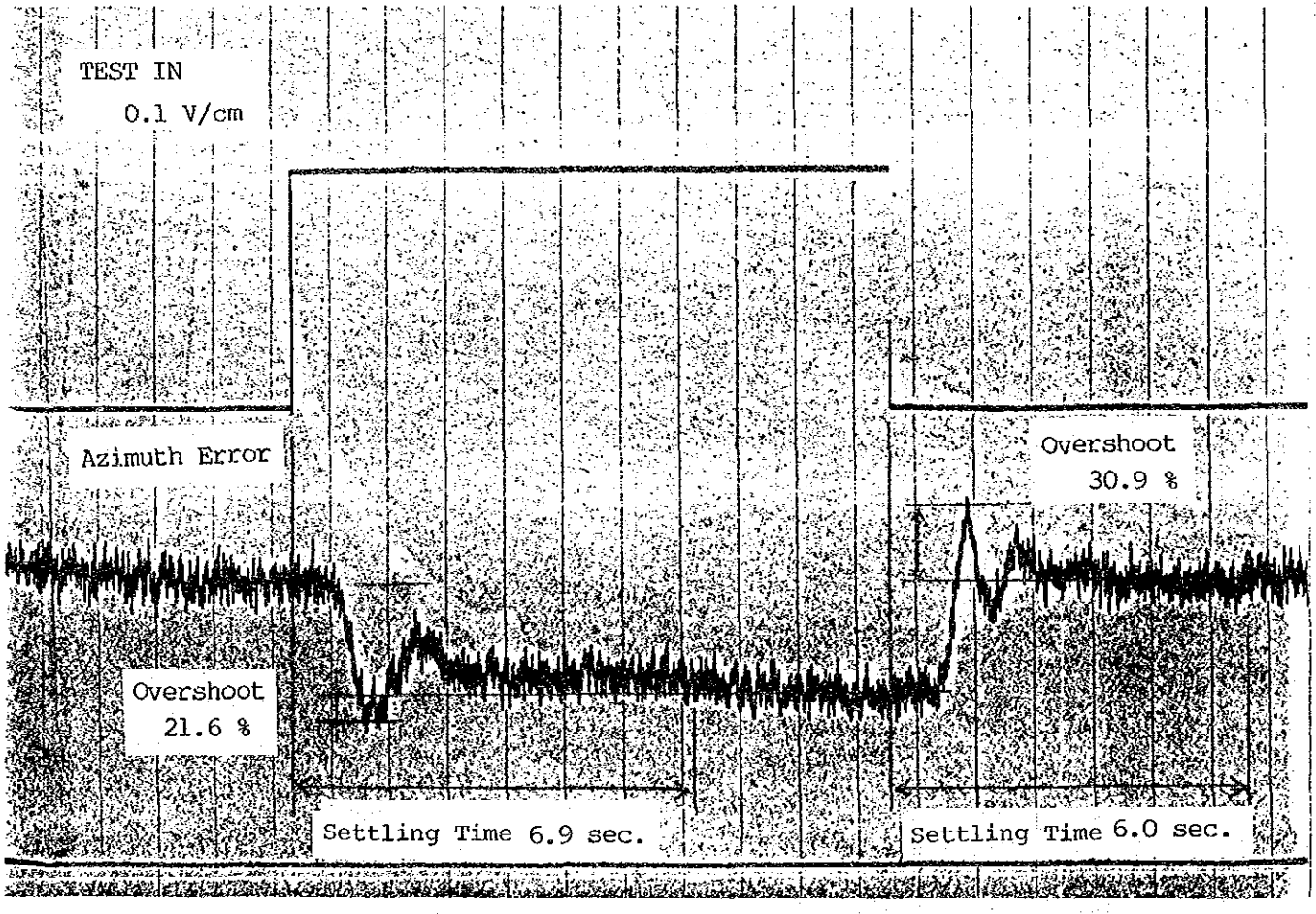


Chart Speed 1 sec/dev.

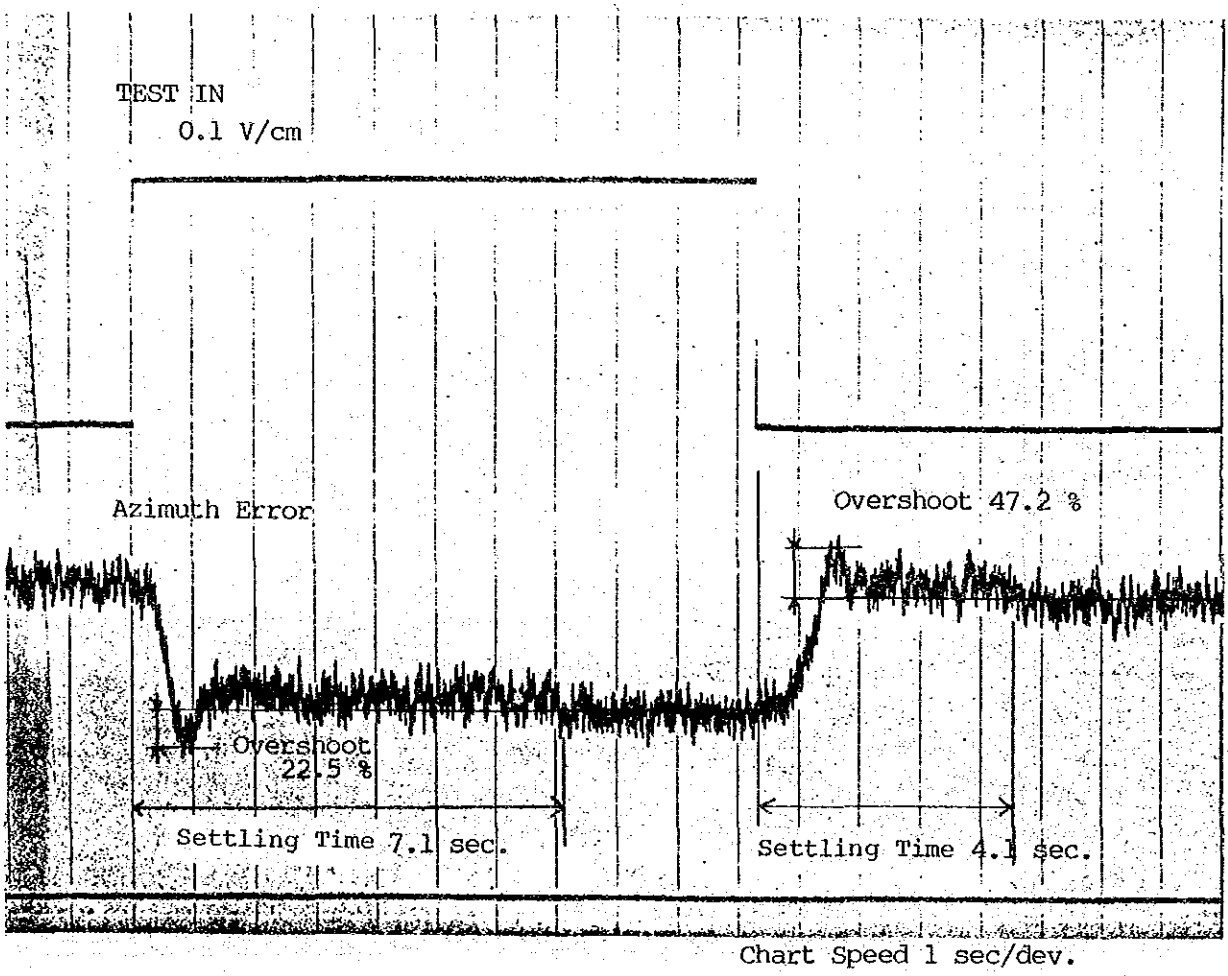
Data Sheet-1-2

DATE 25th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM



Data Sheet-1-3

DATE 25th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW

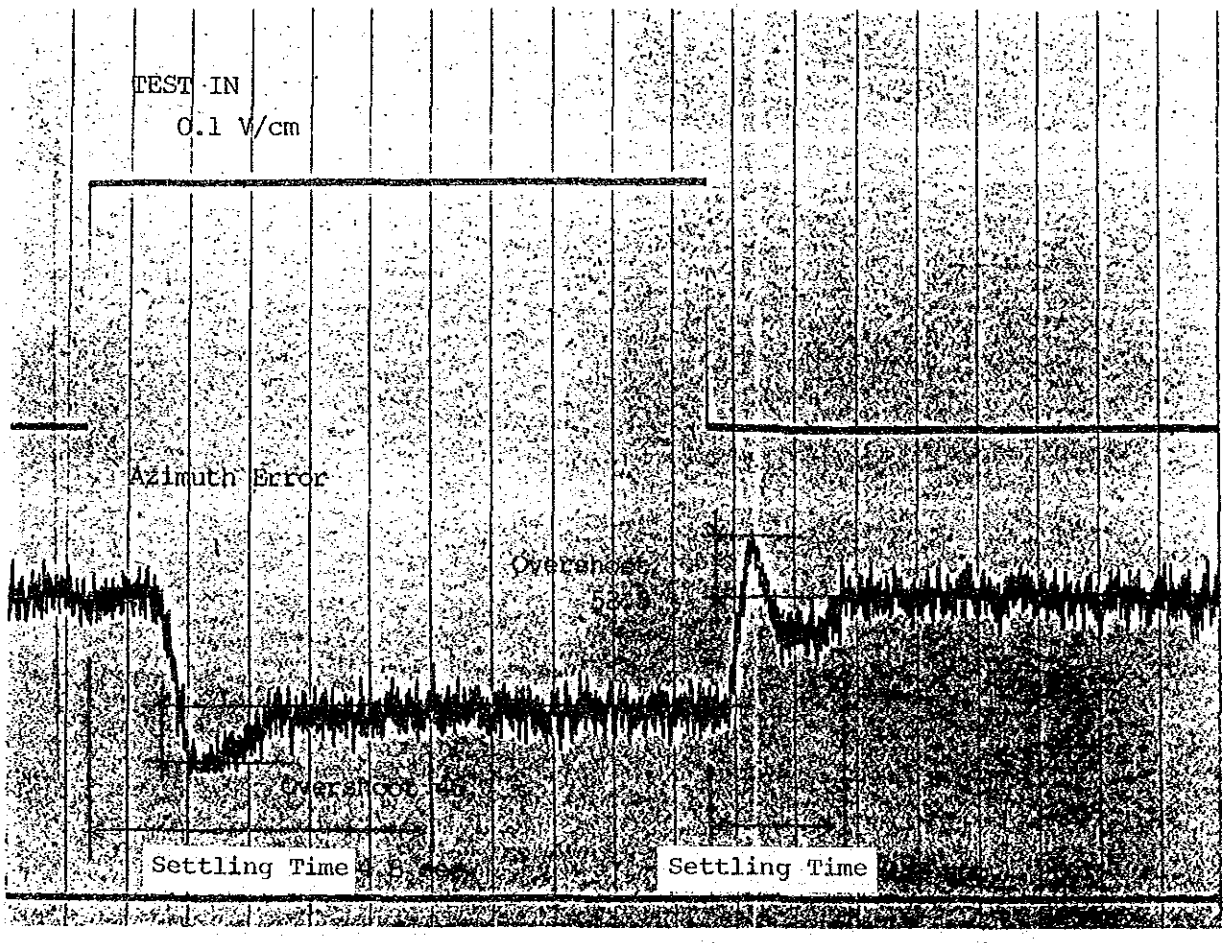


Chart Speed 1 sec./dev.

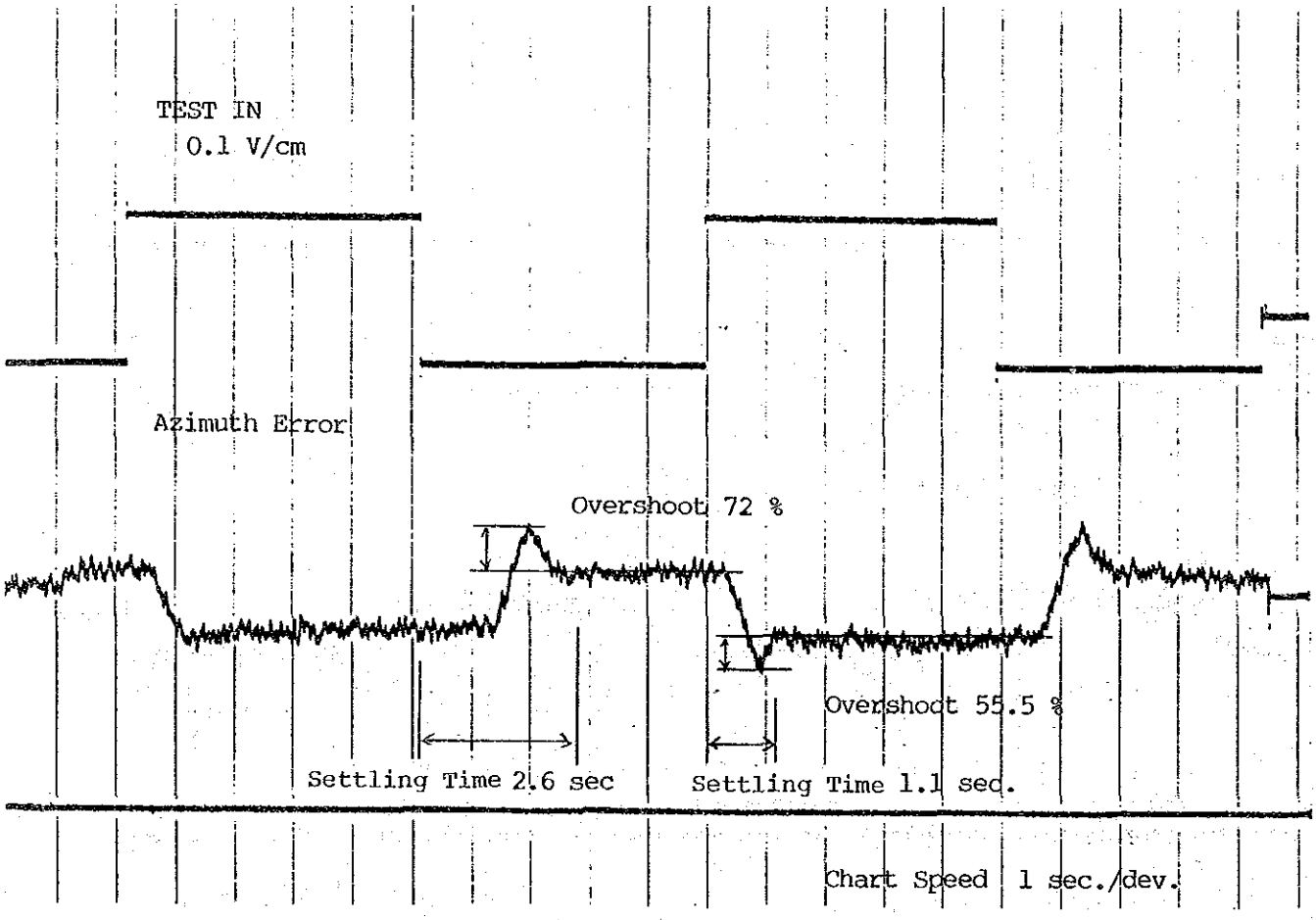
Data Sheet-1-4

DATE 25th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE



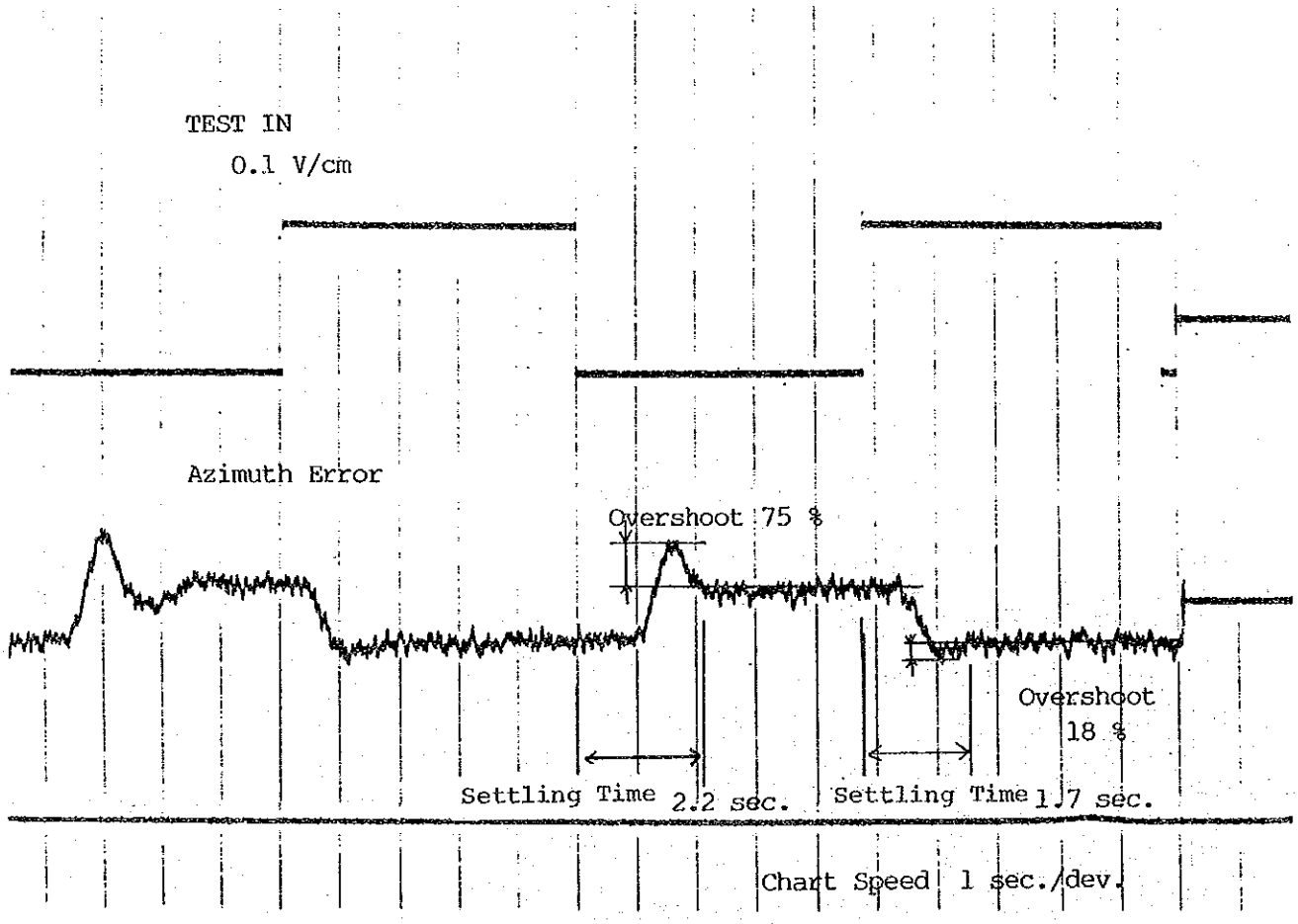
Data Sheet-1-5

DATE 25th Mar.,1986

Tested by Makino

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM



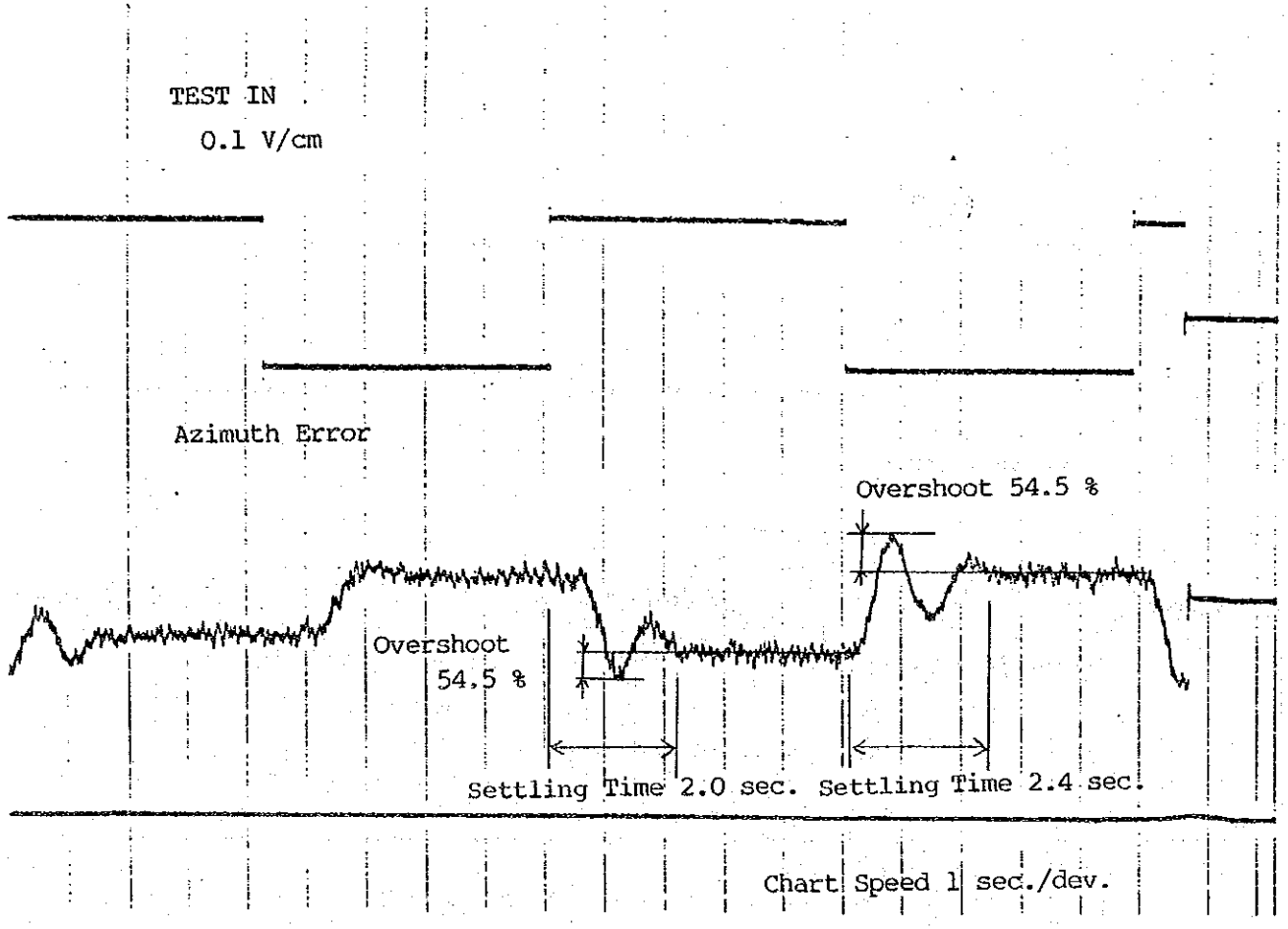
Data Sheet-1-6

DATE 25th Mar., 1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW



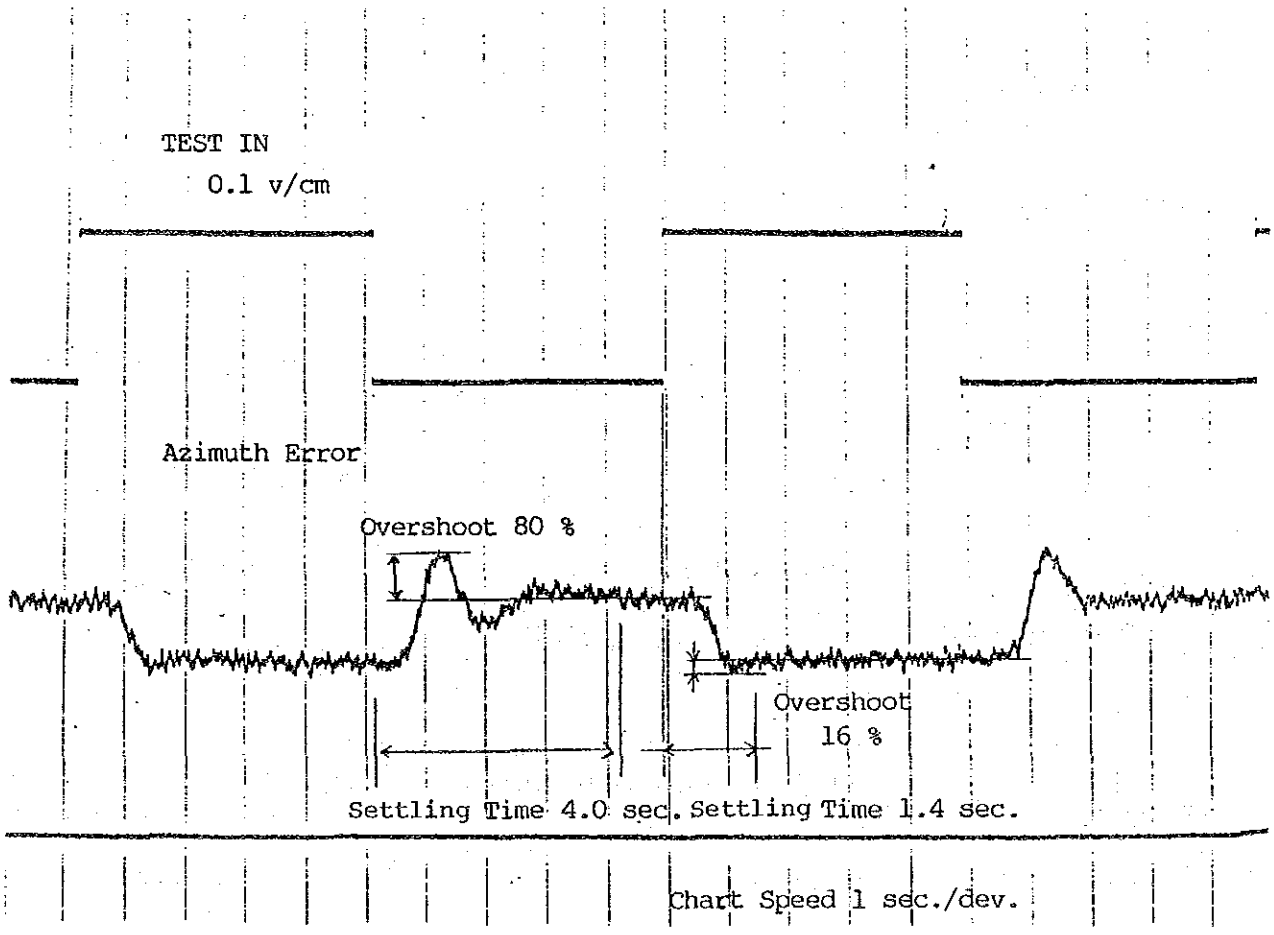
Data Sheet-1-7

DATE 25th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : WIDE



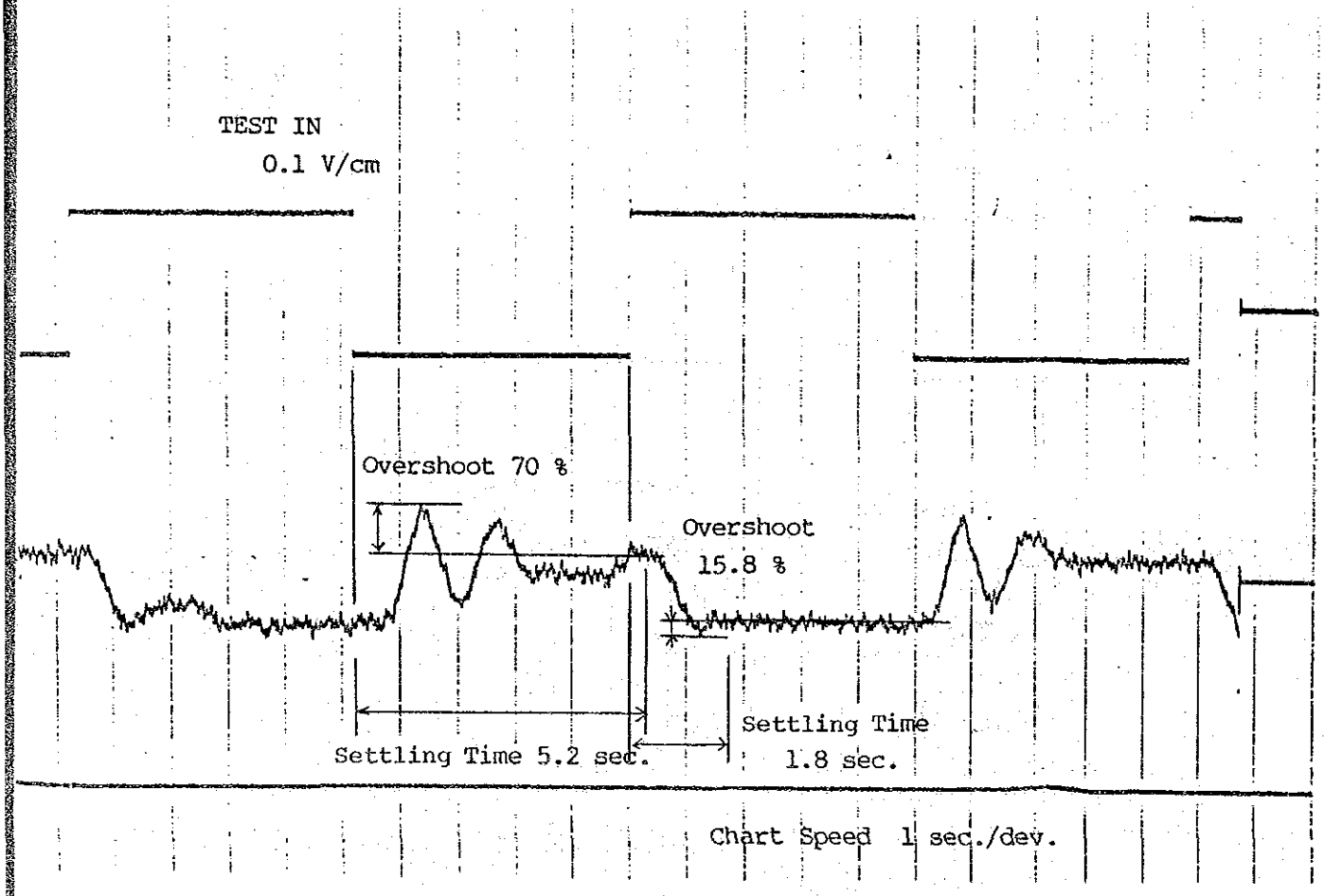
Data Sheet-1-8

DATE 25th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : MEDIUM



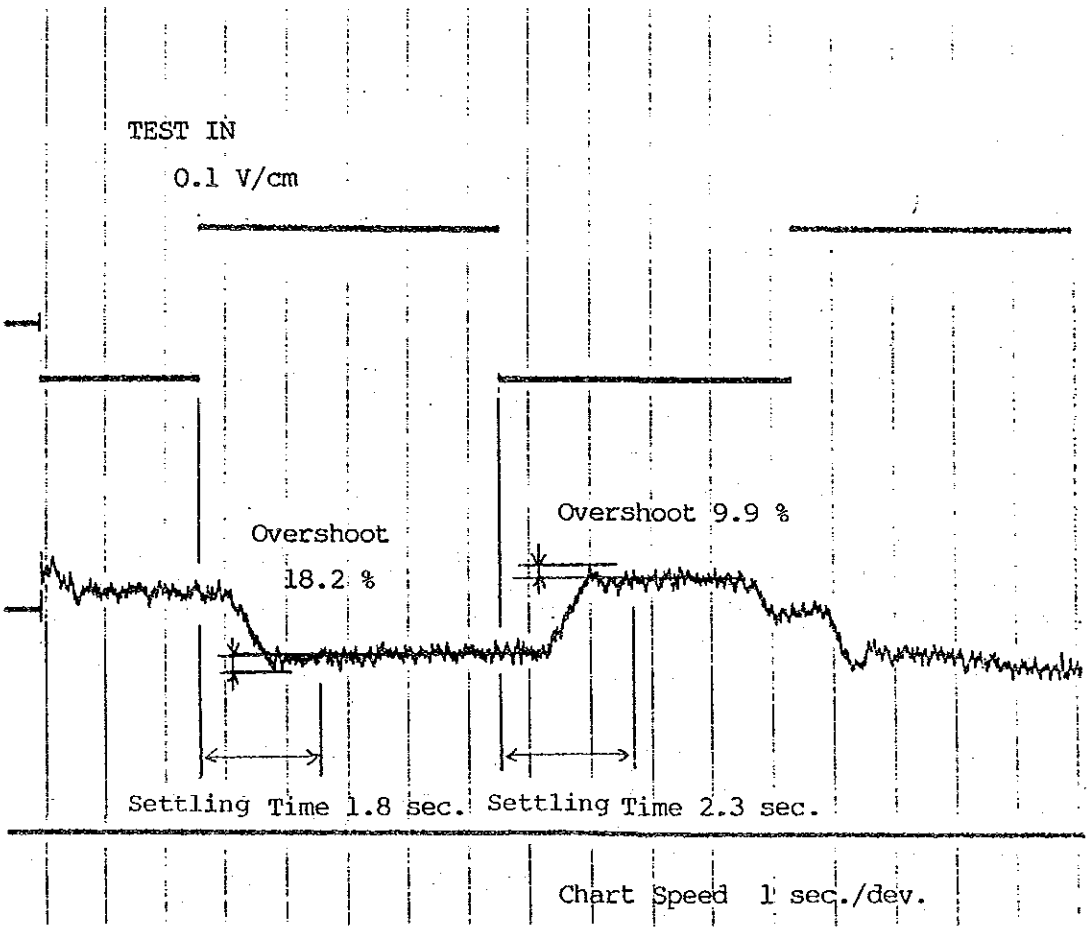
Data Sheet-1-9

DATE 25th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : NARROW



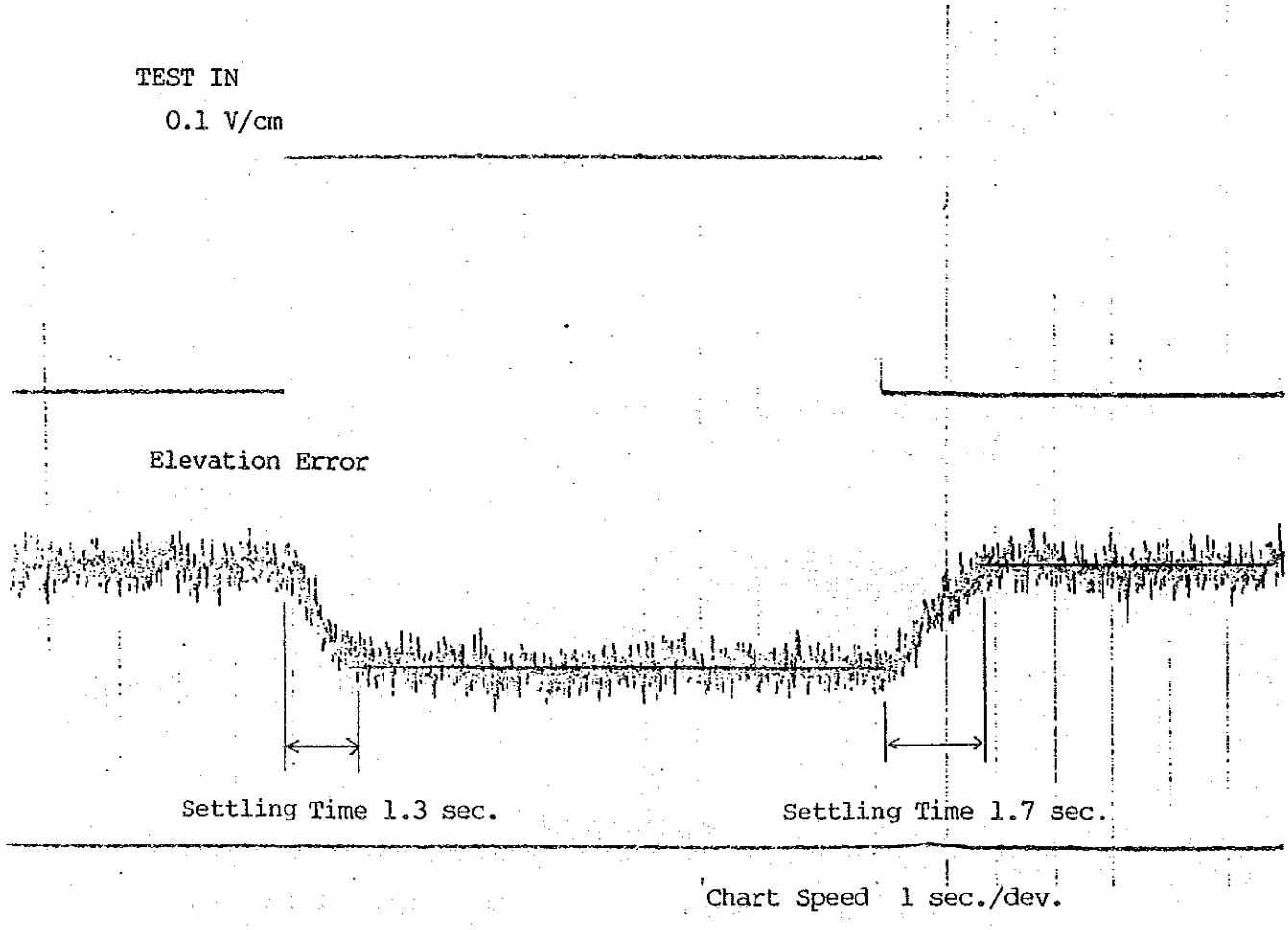
Data Sheet-2-1

DATE 25th Mar.,1986

Tested by Makio

ELEVATION

DCPA Dual Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE



Data Sheet-2-2

DATE 25th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM

TEST IN
0.1 V/cm

Elevation Error

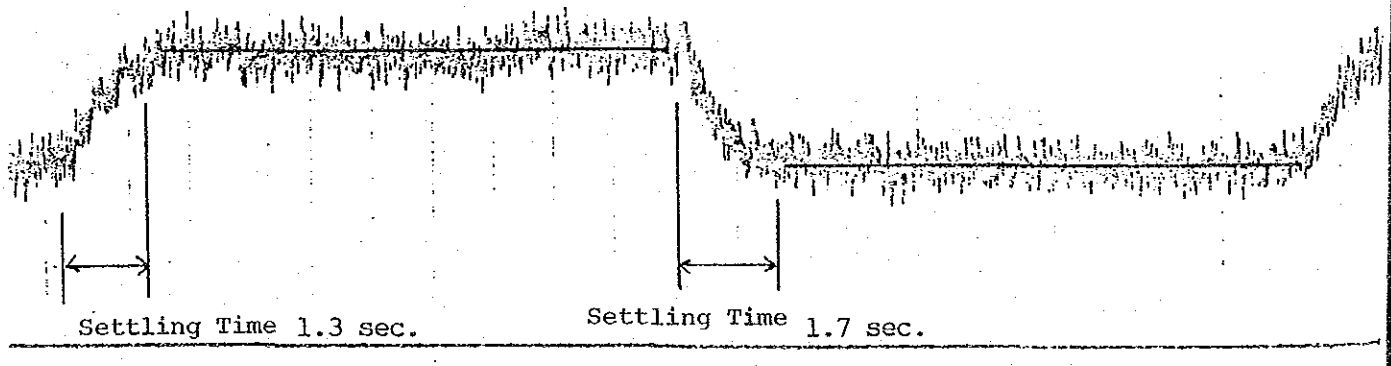


Chart Speed 1 sec./dev.

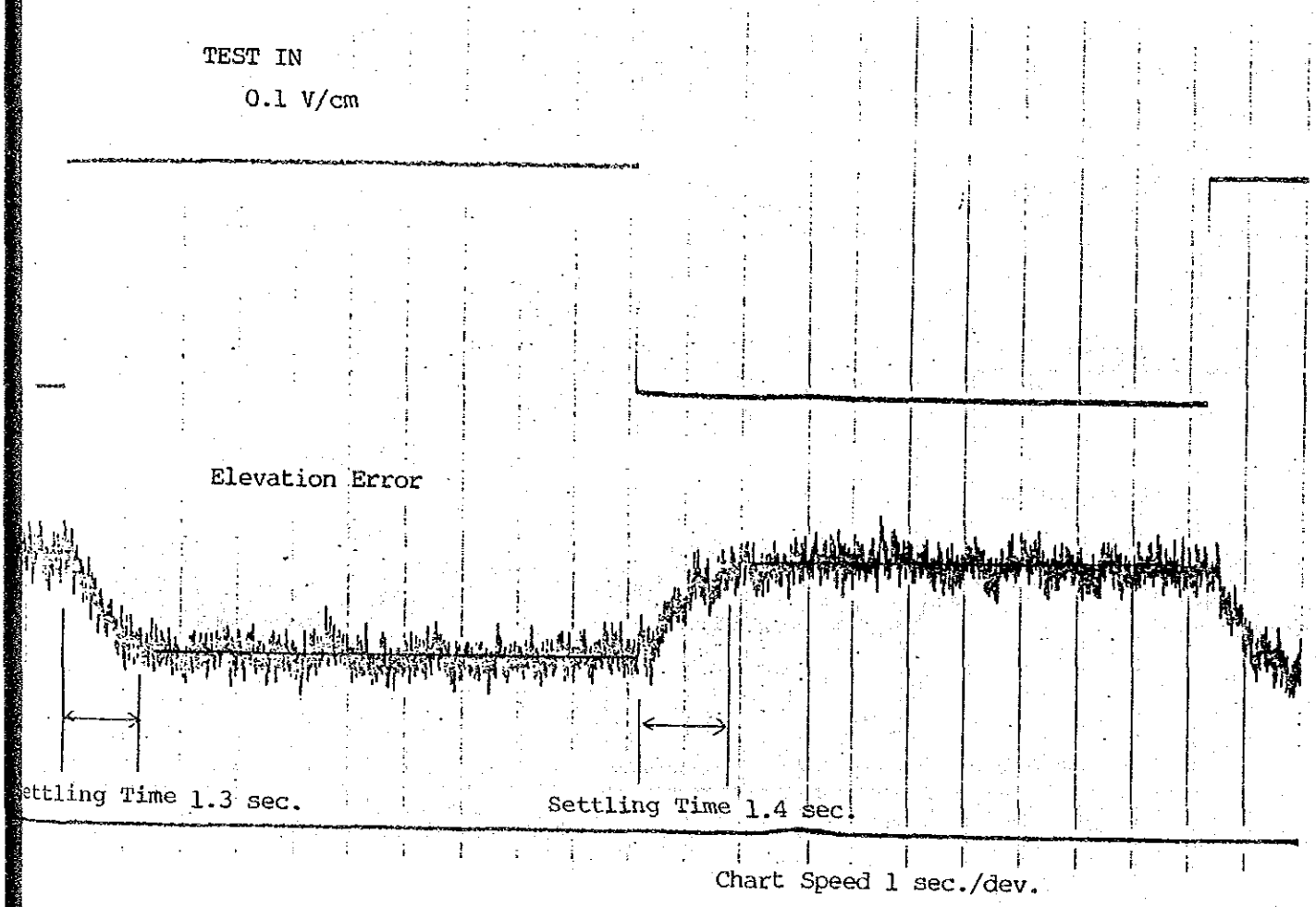
Data Sheet-2-3

DATE 25th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW



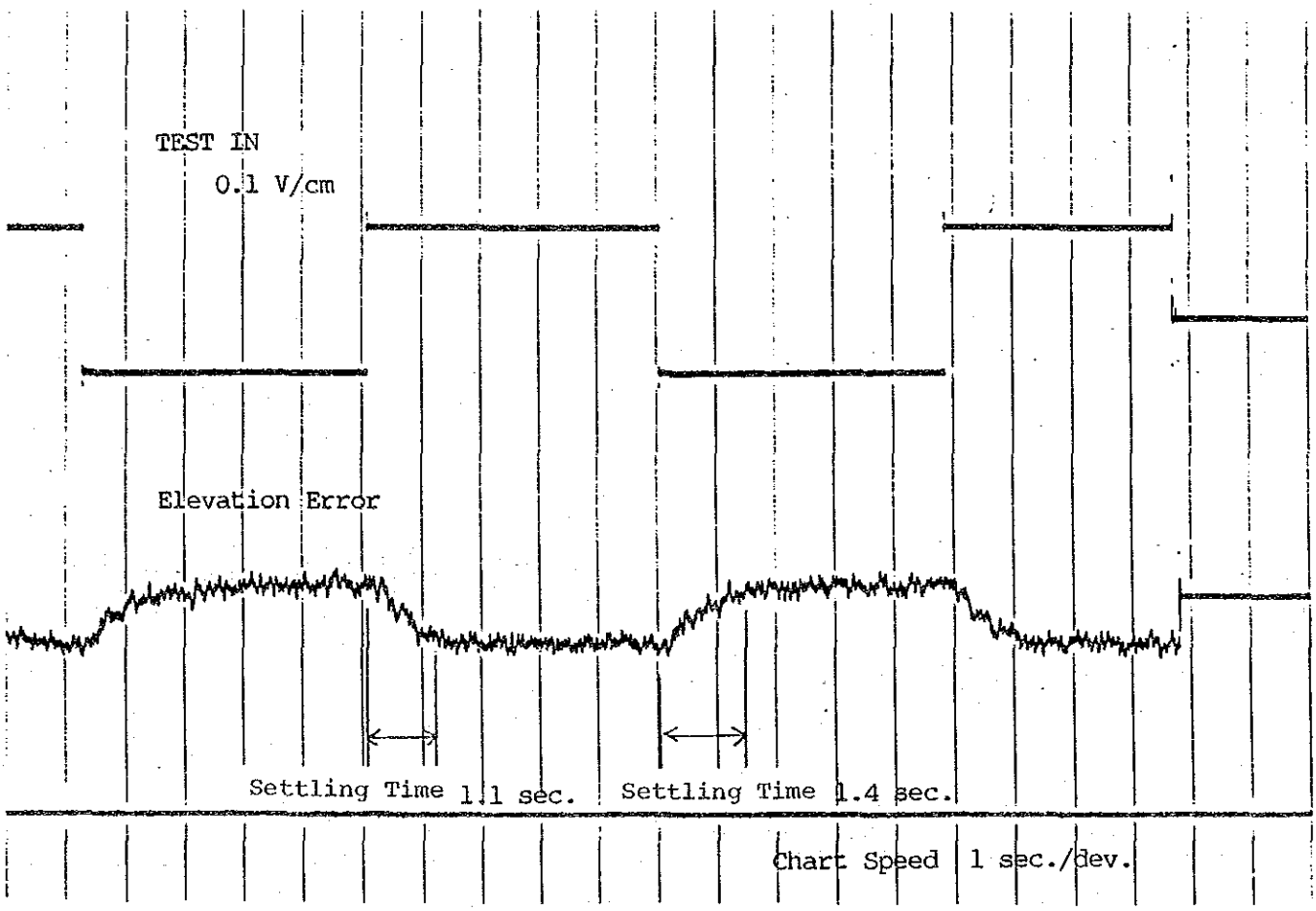
Data Sheet-2-4

DATE 25th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE



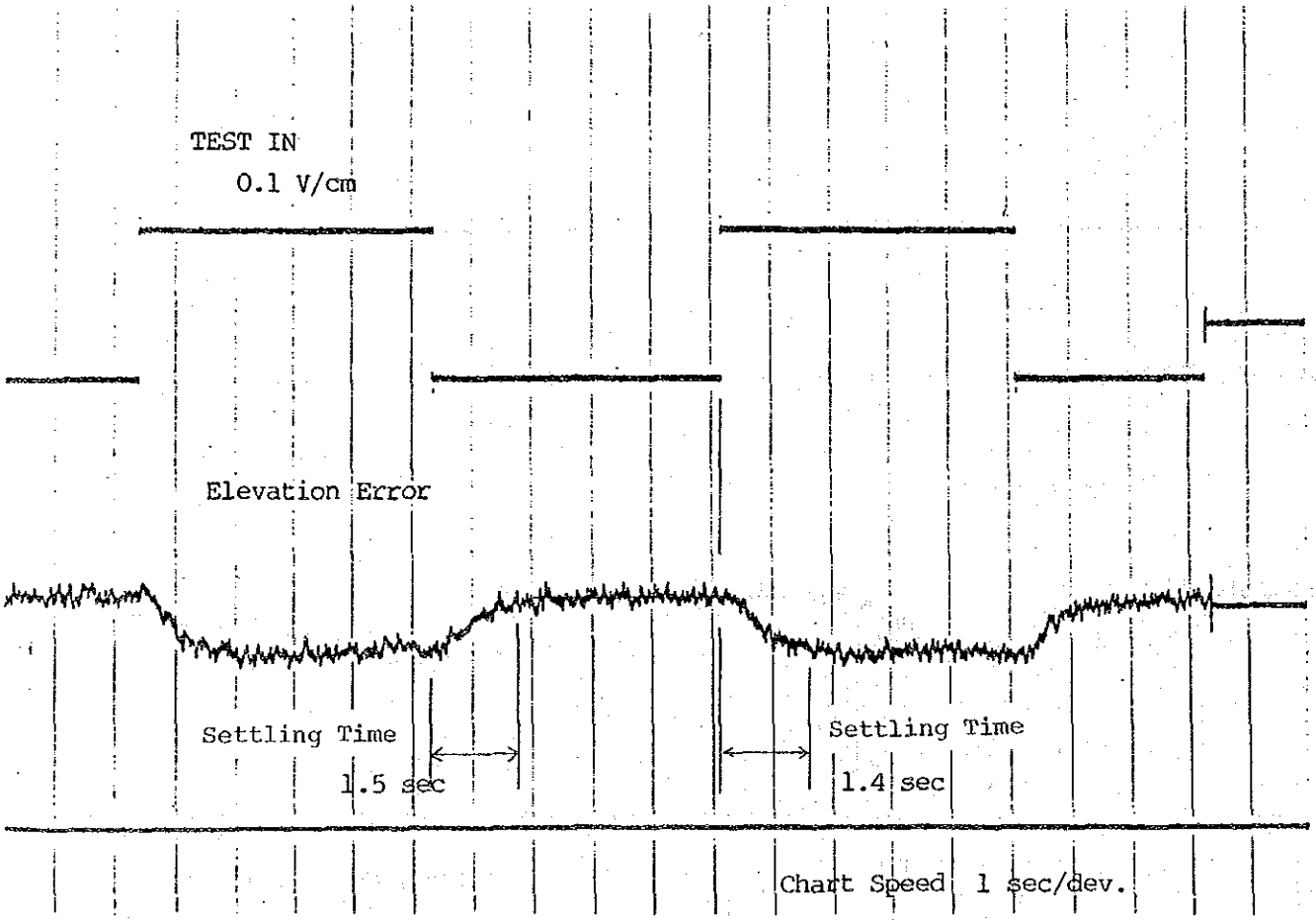
Data Sheet-2-5

DATE 25th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM



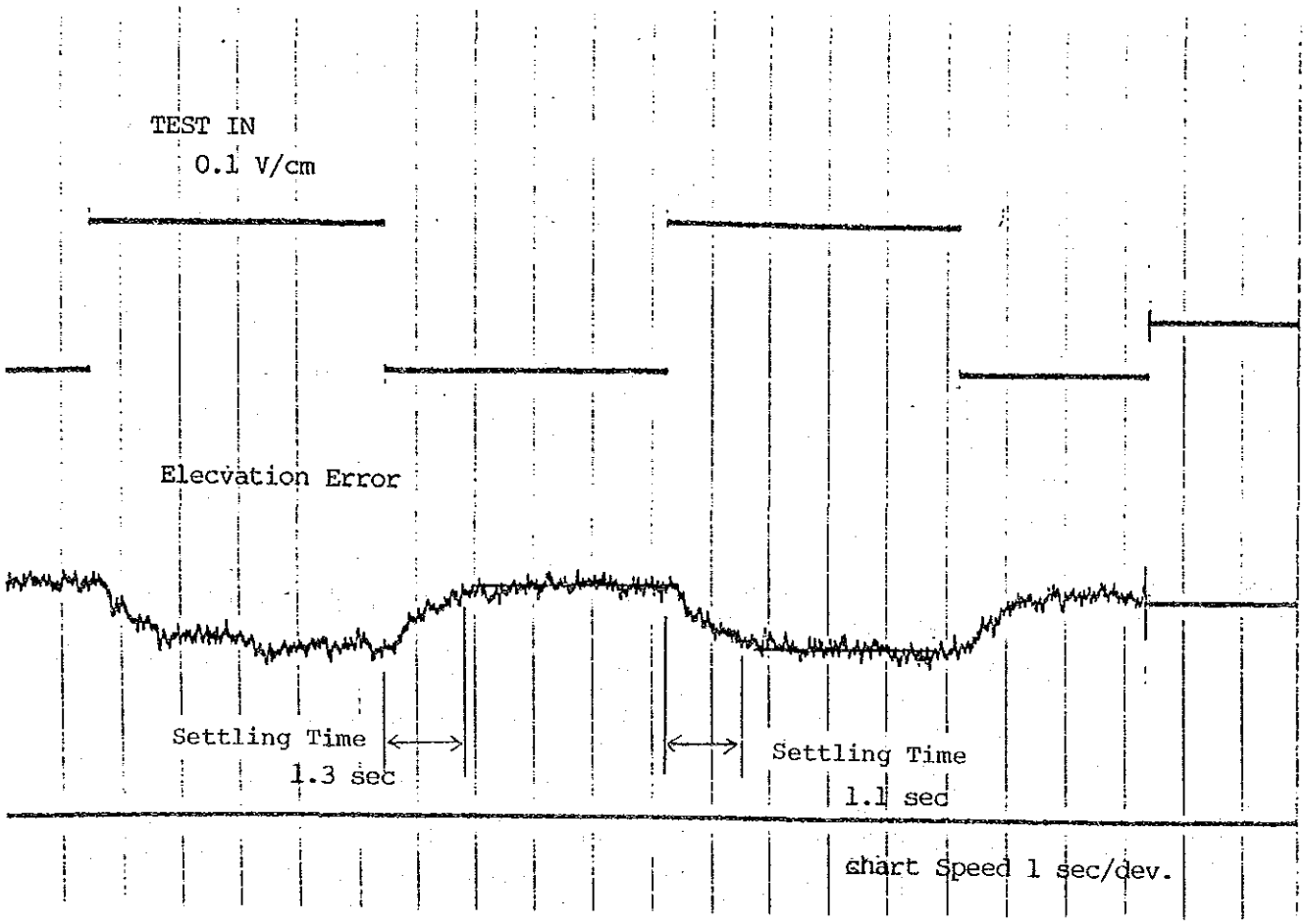
Data Sheet-2-6

DATE 25th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW



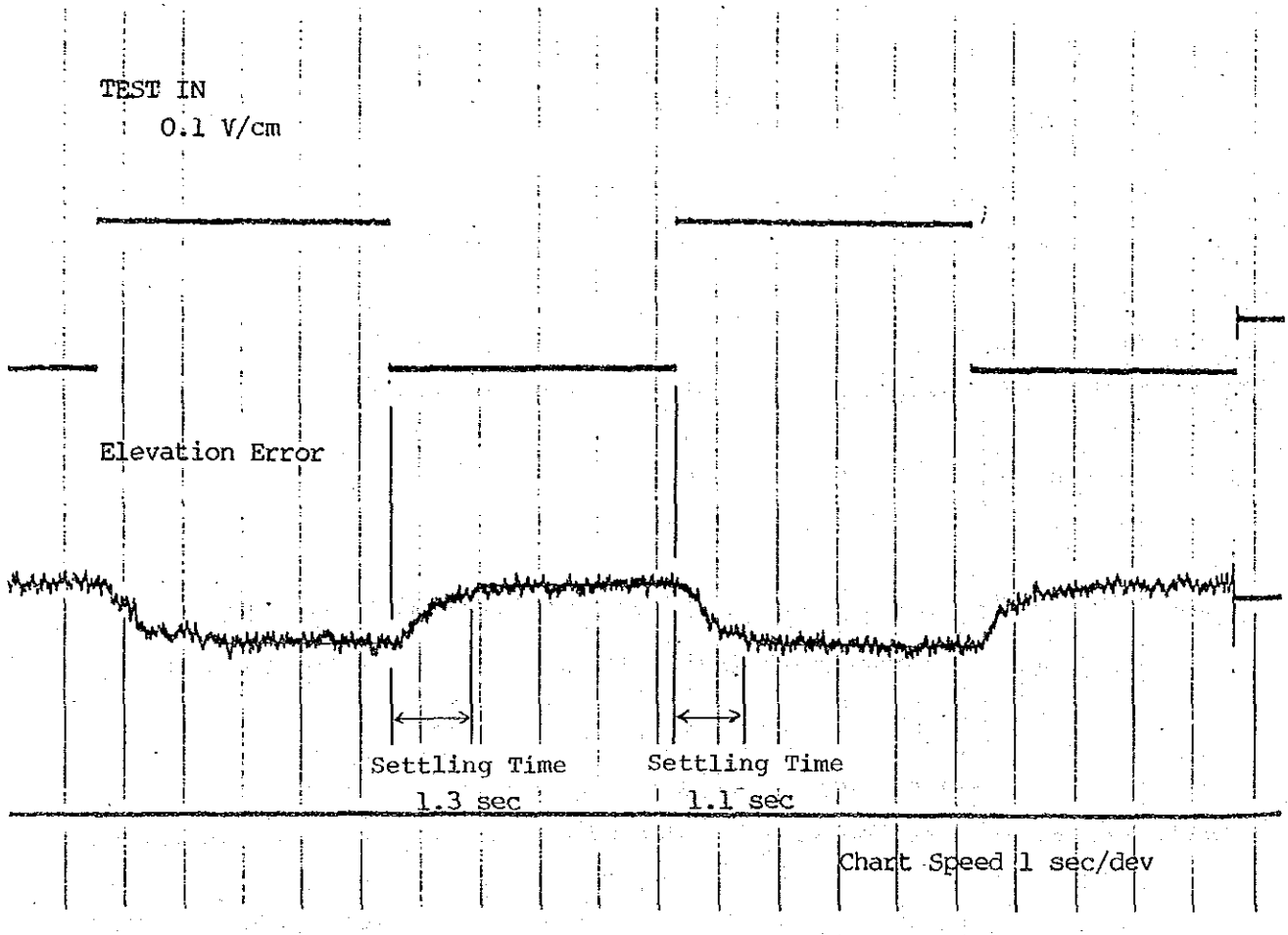
Data Sheet-2-7

DATE 25th Mar., 1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : WIDE



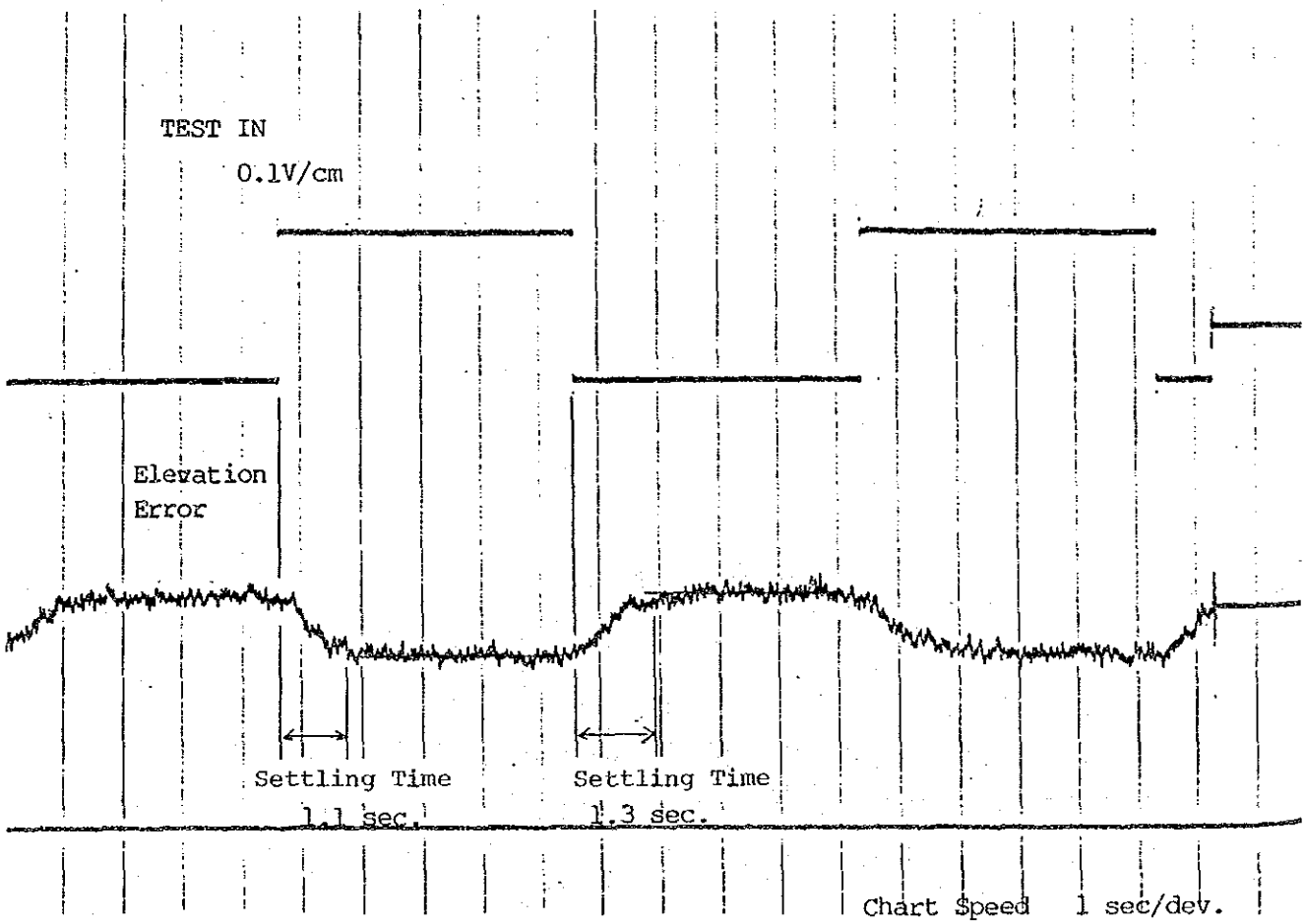
Data Sheet-2-8

DATE 25th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : MEDIUM



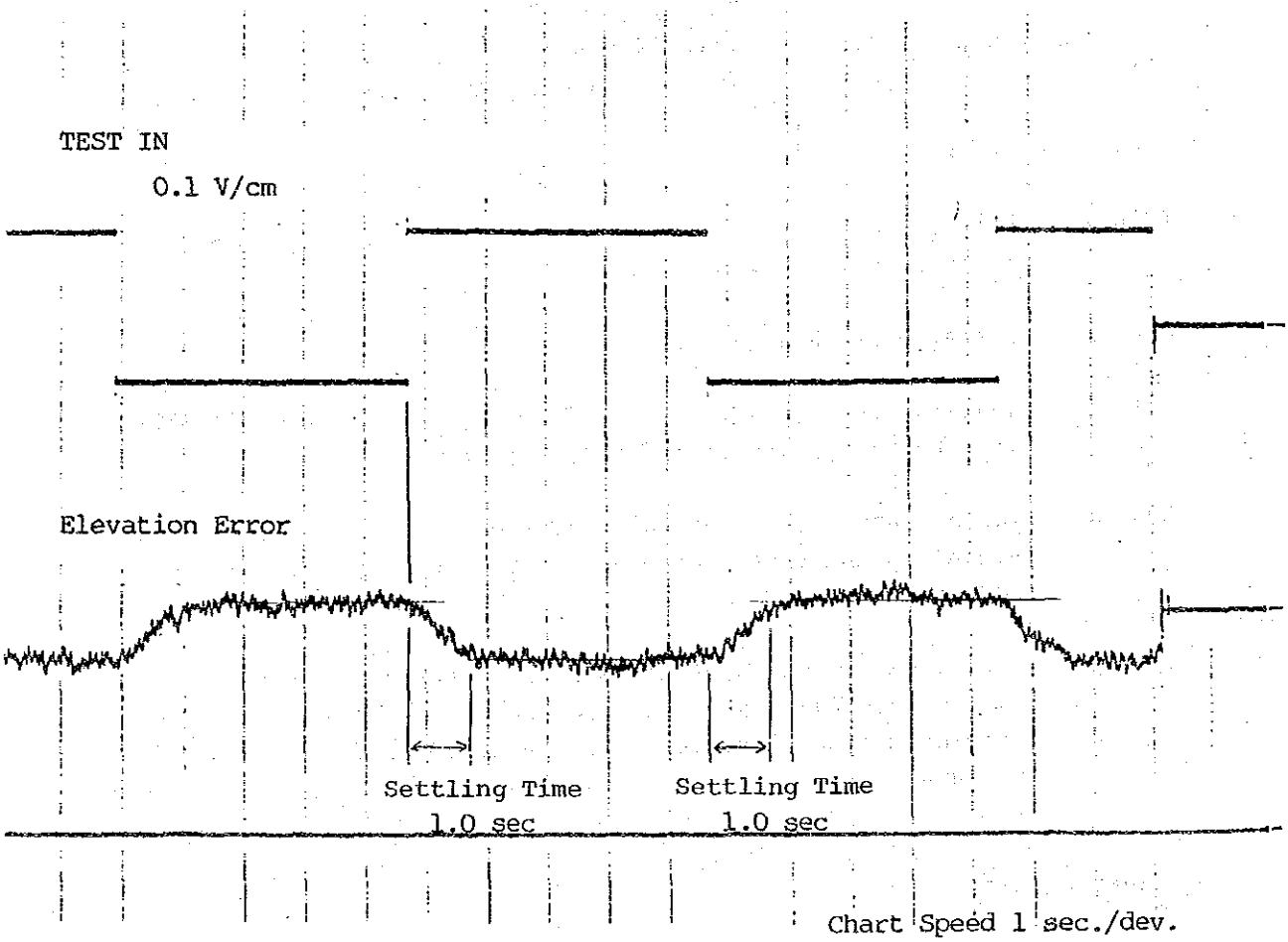
Data Sheet-2-9

DATE 25th Mar., 1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : NARROW



(2) ERROR VOLTAGE GRADIENT AND CROSSTALK OF TRACKING RECEIVER

DATE 24th Mar.,1986

Tested by

1. Purpose of the test

   To check the degradation of error voltage gradients and cross-talk of tracking receiver output using satellite.

2. Test set-up

   Refer to the Fig.-2

3. Test Equipment

4 Pen Chart Recorder	YEW 2931 PHOTOCORDER YEW 3132 DC AMP
Function Generator	WAVETEK Model 111 Voltage Control Generator

4. Test Procedure

   Step 1 Pointing antenna to the direction of satellite precisely by means manual position mode.

   Step 2 Fixing azimuth angle firmly.

   Step 3 Applying the triangular wave form signal to SCA of EL TEST IN terminal by means of function generator.

   Step 4 The azimuth angle crosstalk and error voltage gradients for elevation angle are measured and recorded by means of chart recorder.

   Step 5 The elevation angle cross-talk and error voltage gradients for azimuth angle are measured and record as well as above procedure when elevation angle is fixed firmly instead of azimuth angle.

5. Test Result

Azimuth	Refer to the Data Sheet-3
Elevation	Refer to the Data Sheet-4

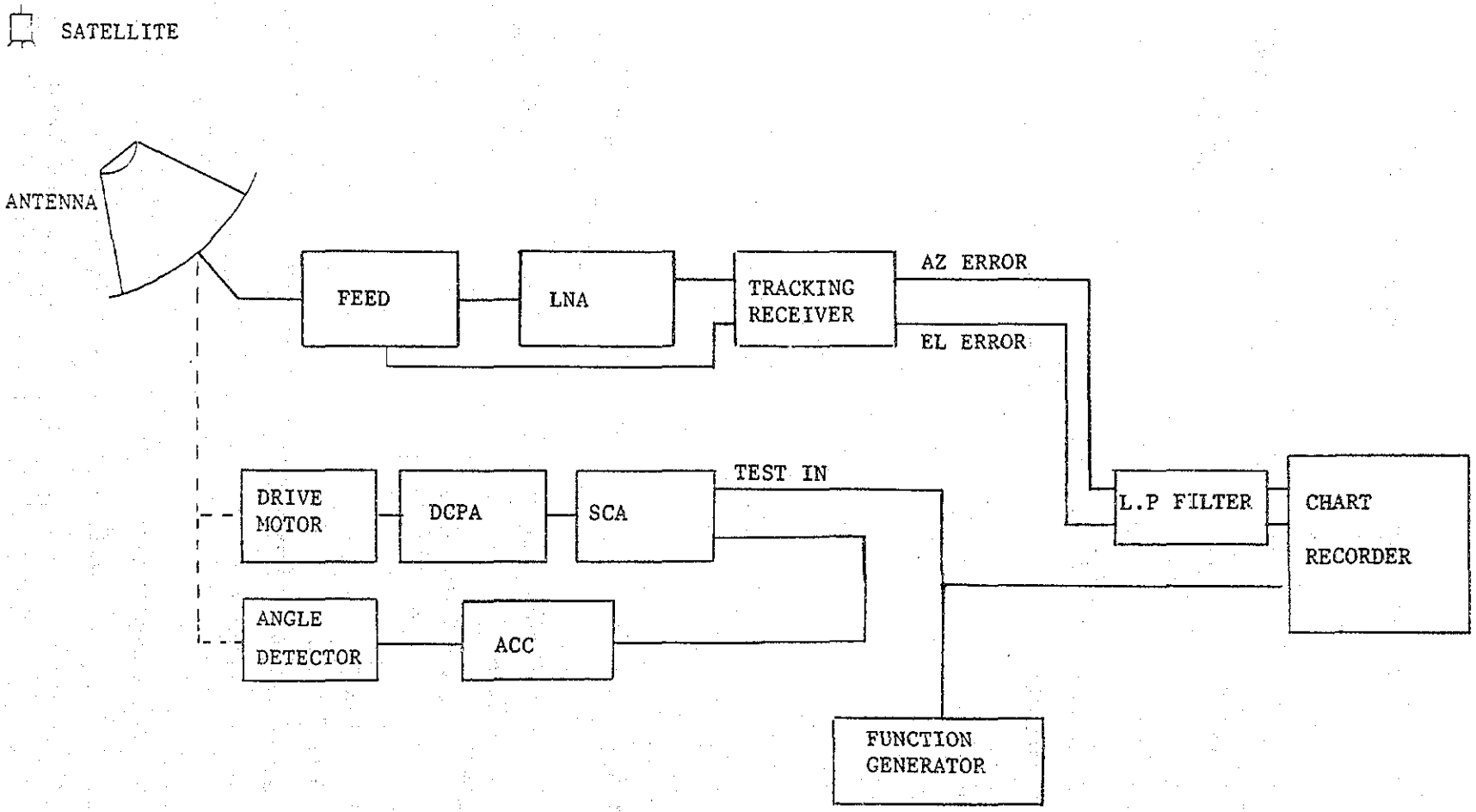


Fig. 2 Error Voltage Gradient and Crosstalk of Tracking Receiver Connection Diagram

Data Sheet-3

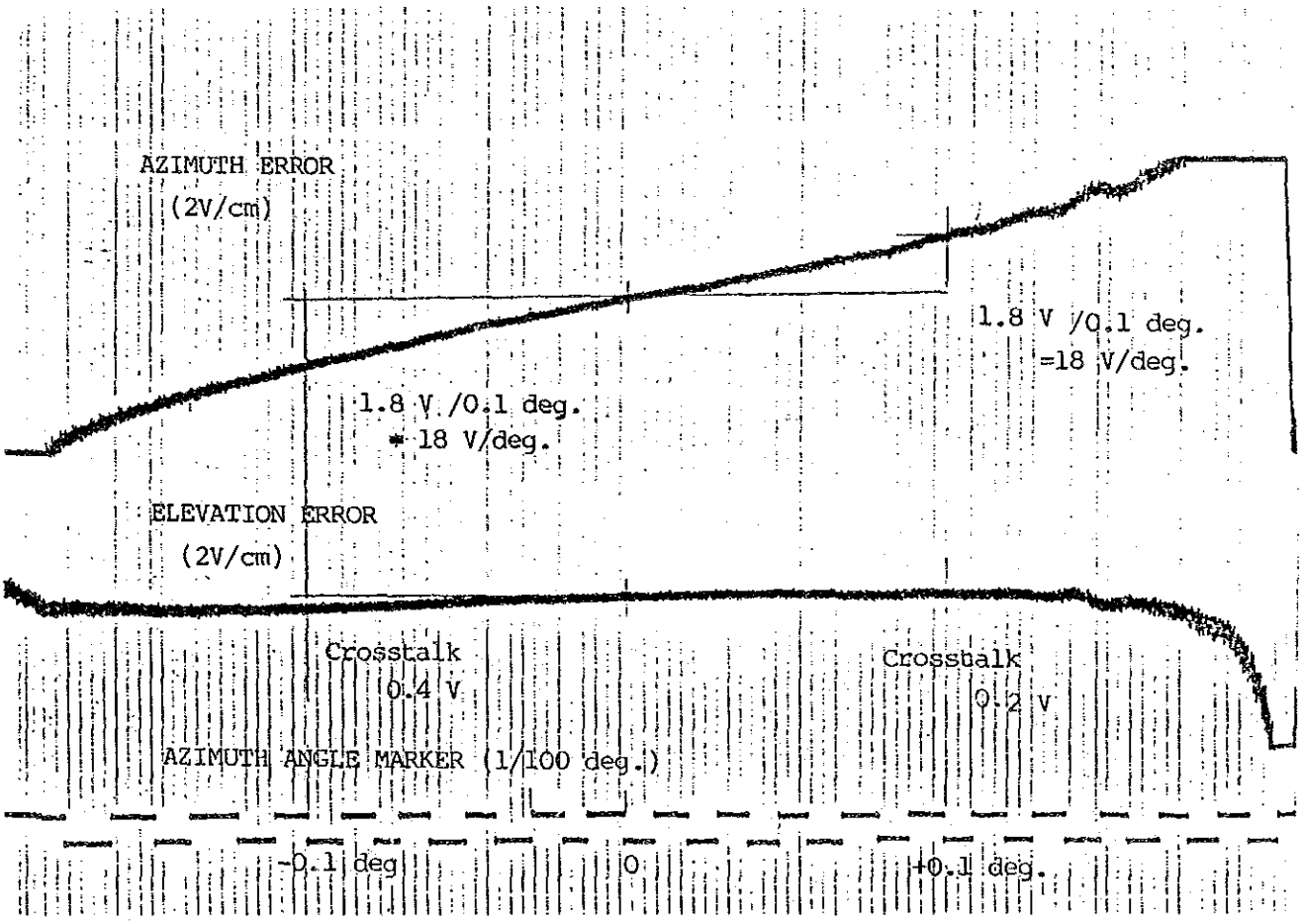
DATE 24th Mar., 1986

Tested by

AZIMUTH

Beacon Frequency F1 3947.5 MHz

Lna A On-line



Data Sheet-4

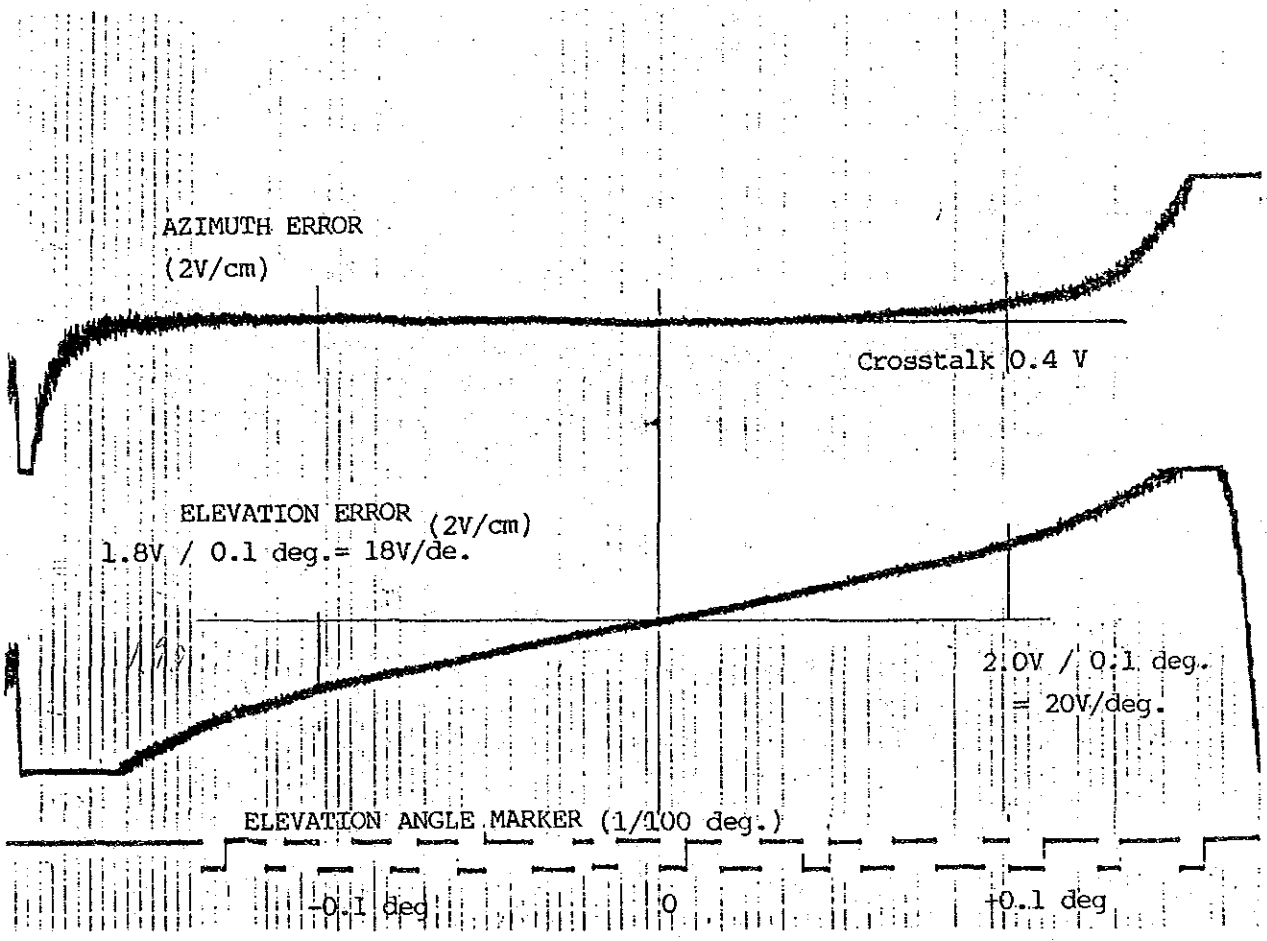
DATE 24th Mar. 1986

Tested by

ELEVATION

Beacon Frequency F1 3947.5 MHz

LNAV-A ON-LINE



(3) MANUAL POSITION LOOP STEP RESPONSE

DATE 24th Mar.,1986

Tested by

1. Purpose of the test

To check closed loop step responce of position loop (SCA-DCPA -ANG DET-ACU) and confirm the stability of the response.

2. Test set-up

Refer to the Fig.-3

3. Test Equipment

4 Pen Chart Recorder	YEW 2931 PHOTOCORDER
	YEW 3132 DC AMP
Function Generator	WAVETEK Model 111
	Voltage Controlled Generator

4. Test Procedure

Step 1 Setting antenna system to Manual Position mode .

Step 2 Applying the square wave form signal at the aproximately ±0.1Vp-p to the TEST IN terminal of AZ (EL) Servo Control Amplifier (SCA) in the stage succeeding to demodulator by means of function generator, transient response is measured and recorded the demodulator output by means of chart recorder.

DATE 24th Mar.,1986

Tested by

5. Test Result

Axis	SCA	TYPE	SERVO BW	Overshoot		Settling Time		Data Sheet
				+	−	+	−	
AZ (SINGLE)	B	I	Wide	0 %	0 %	2.4sec	2.7sec	5-1
			Medium	0 %	0 %	2.2sec	2.2sec	5-2
			Narrow	0 %	0 %	2.3sec	2.1sec	5-3
		II	Wide	0 %	0 %	2.3sec	3.5sec	5-4
			Medium	0 %	0 %	2.3sec	3.1sec	5-5
			Narrow	0 %	0 %	2,2sec	1,4sec	5-6
AZ (DUAL)	B		Wide	0 %	0 %	1,2sec	1.1sec	5-7
EL	A	I	Wide	0 %	0 %	1.3sec	1.3sec	6-1
			Medium	0 %	0 %	1.3sec	1.4sec	6-2
			Narrow	-	-	∞	∞	6-3
	B	I	Wide	3.3 %	3.3 %	1.0sec	1.1sec	6-4
			Medium	5.3 %	6.6 %	2.4sec	2.8sec	6-5
			Narrow	4.8 %	4.8 %	1.2sec	0.9sec	6-6
		II	Wide	3.2 %	3.2 %	1.0sec	1.3sec	6-7
			Medium	4.6 %	4.6 %	1.0sec	1.1sec	6-8
			Narrow	4.6 %	4.6 %	1.0sec	1.0sec	6-9

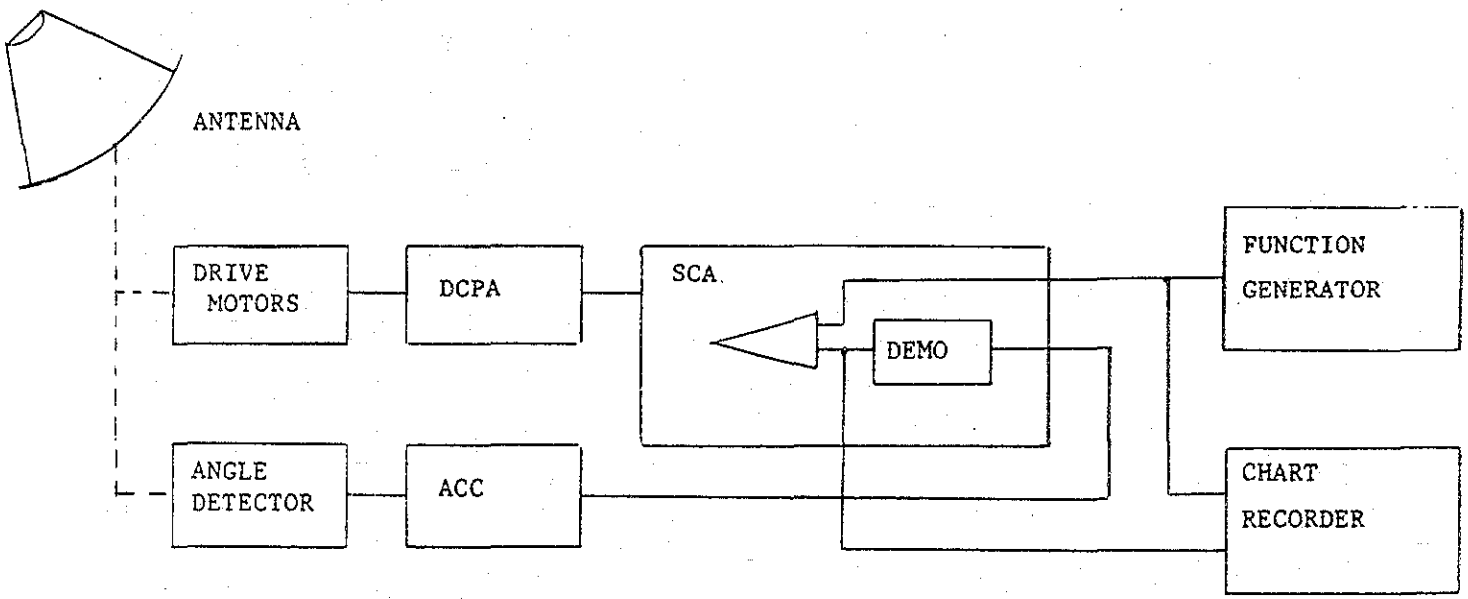


Fig.3 Manual Position Loop Step Response Connection Diagram

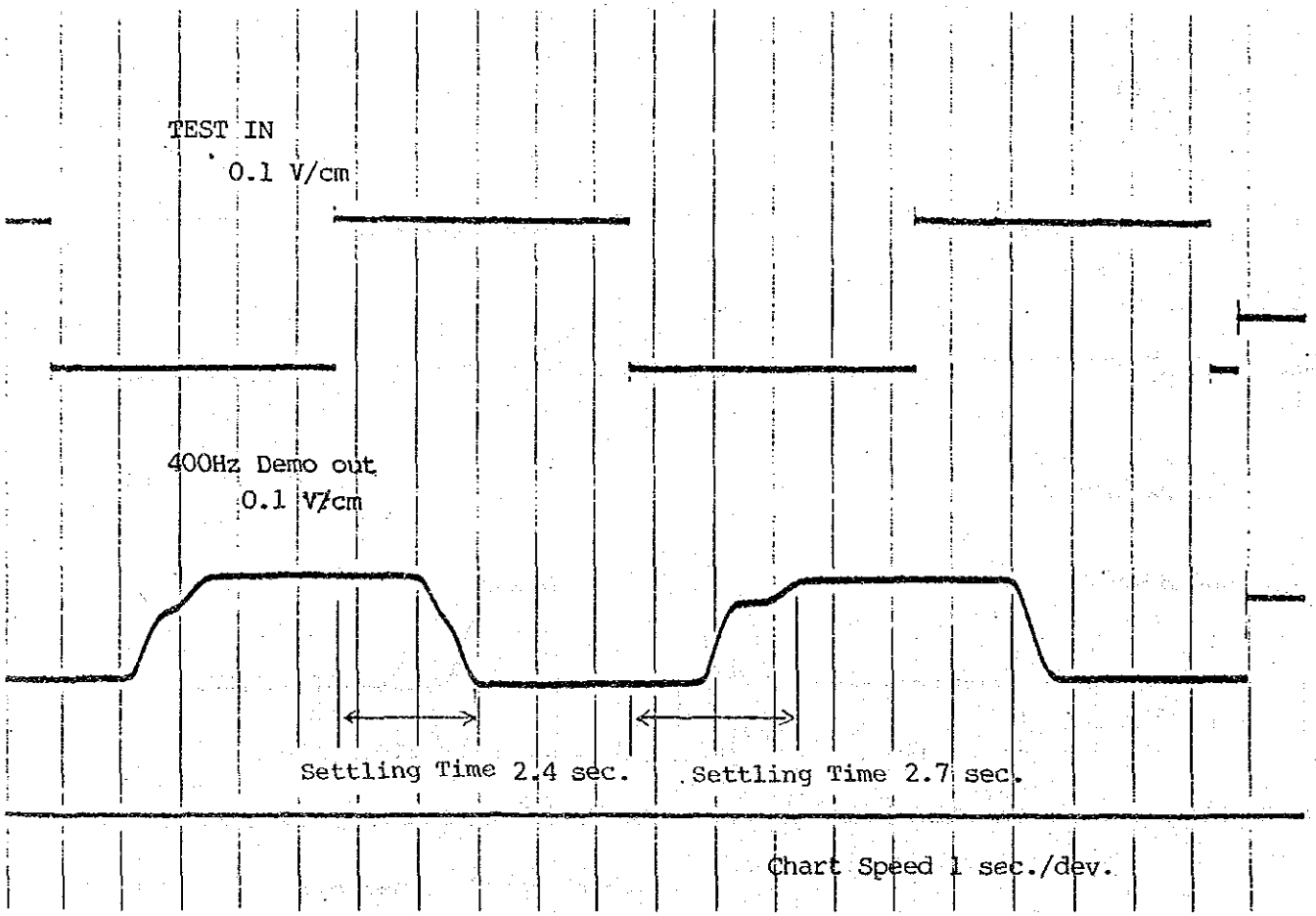
Data sheet-5-1

DATE 24th Mar.,1986

Tested by Makio

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE



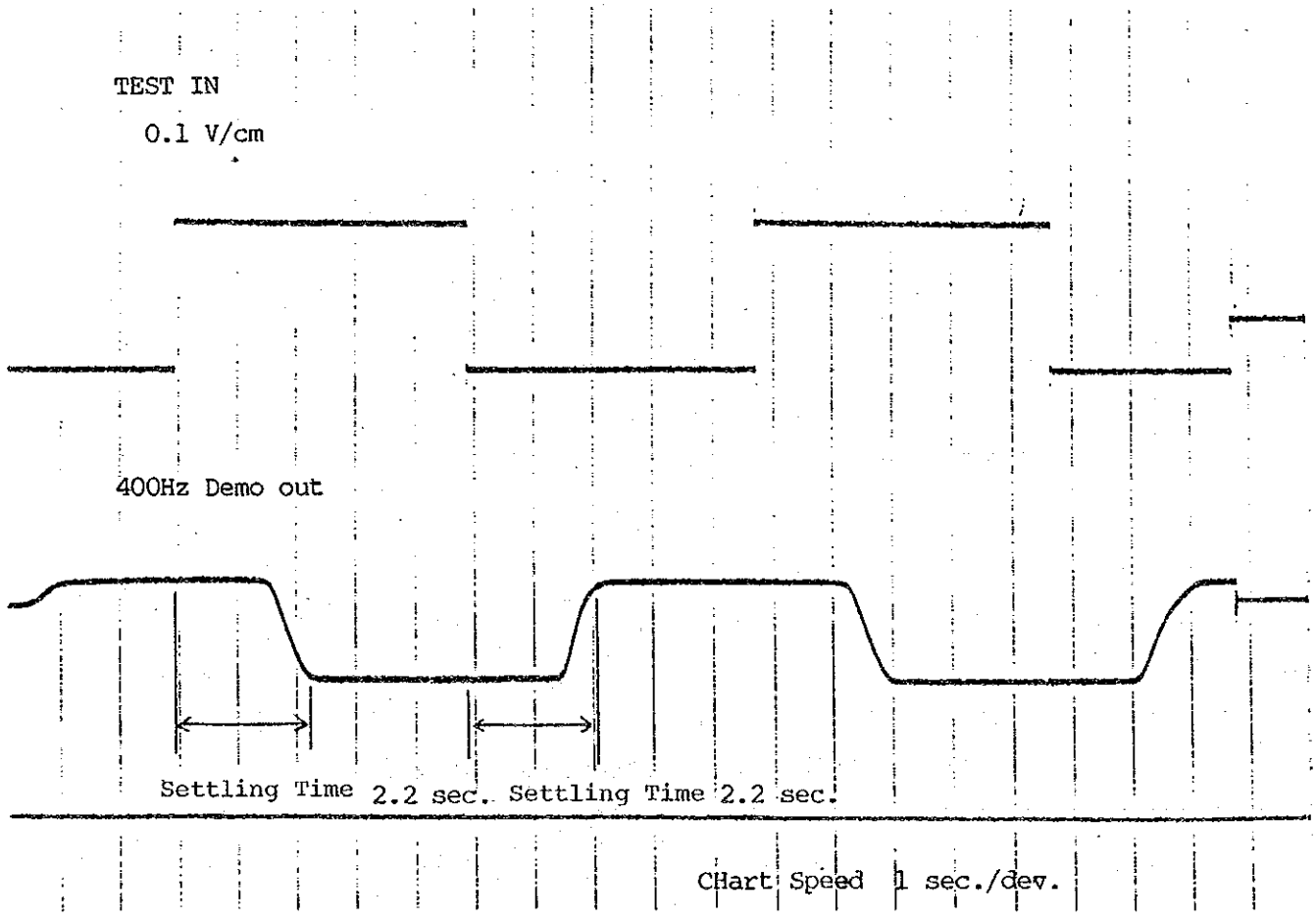
Data sheet-5-2

DATE 24th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM



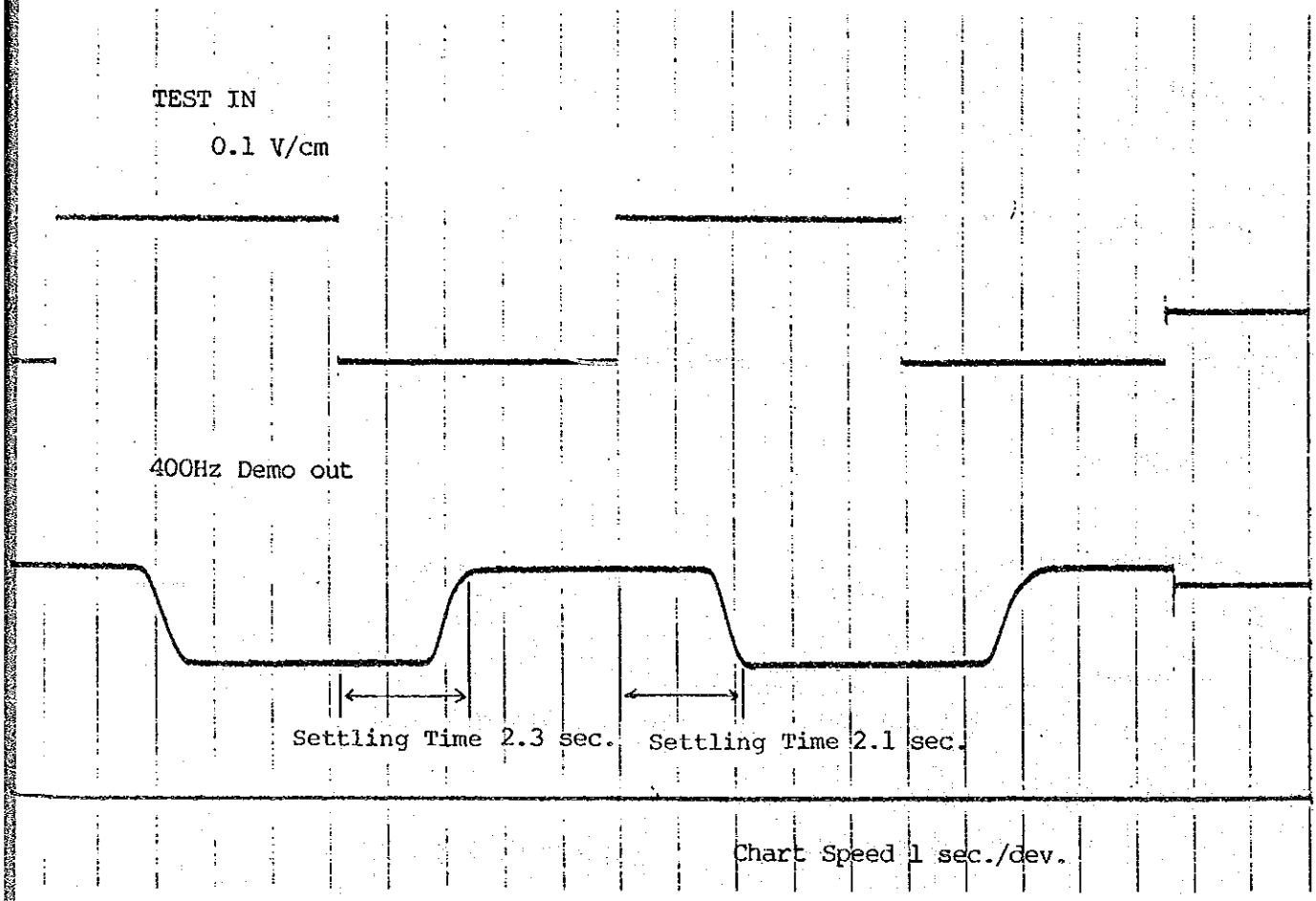
Data sheet-5-3

DATE 24th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW



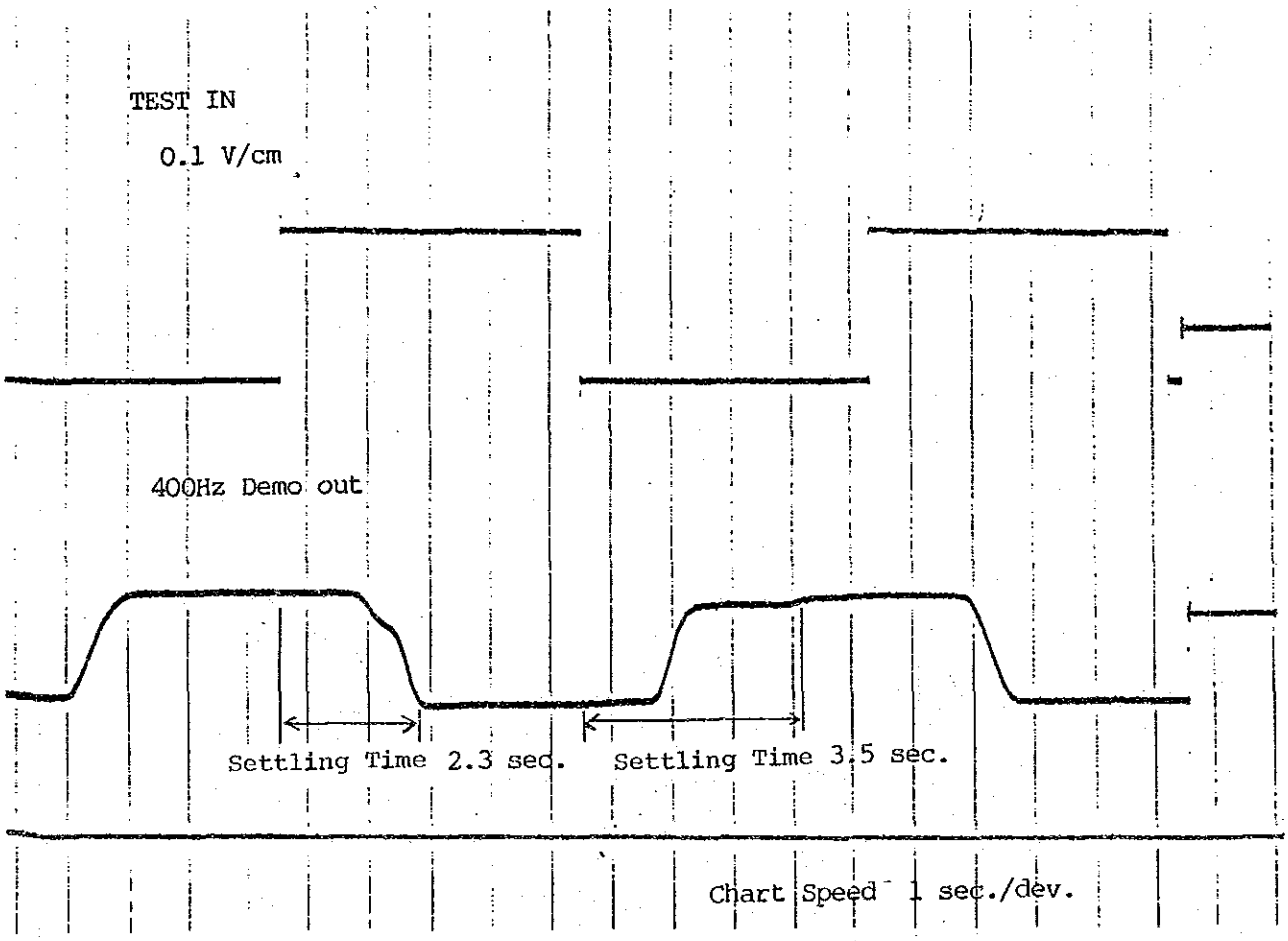
Data sheet-5-4

DATE 24th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : WIDE



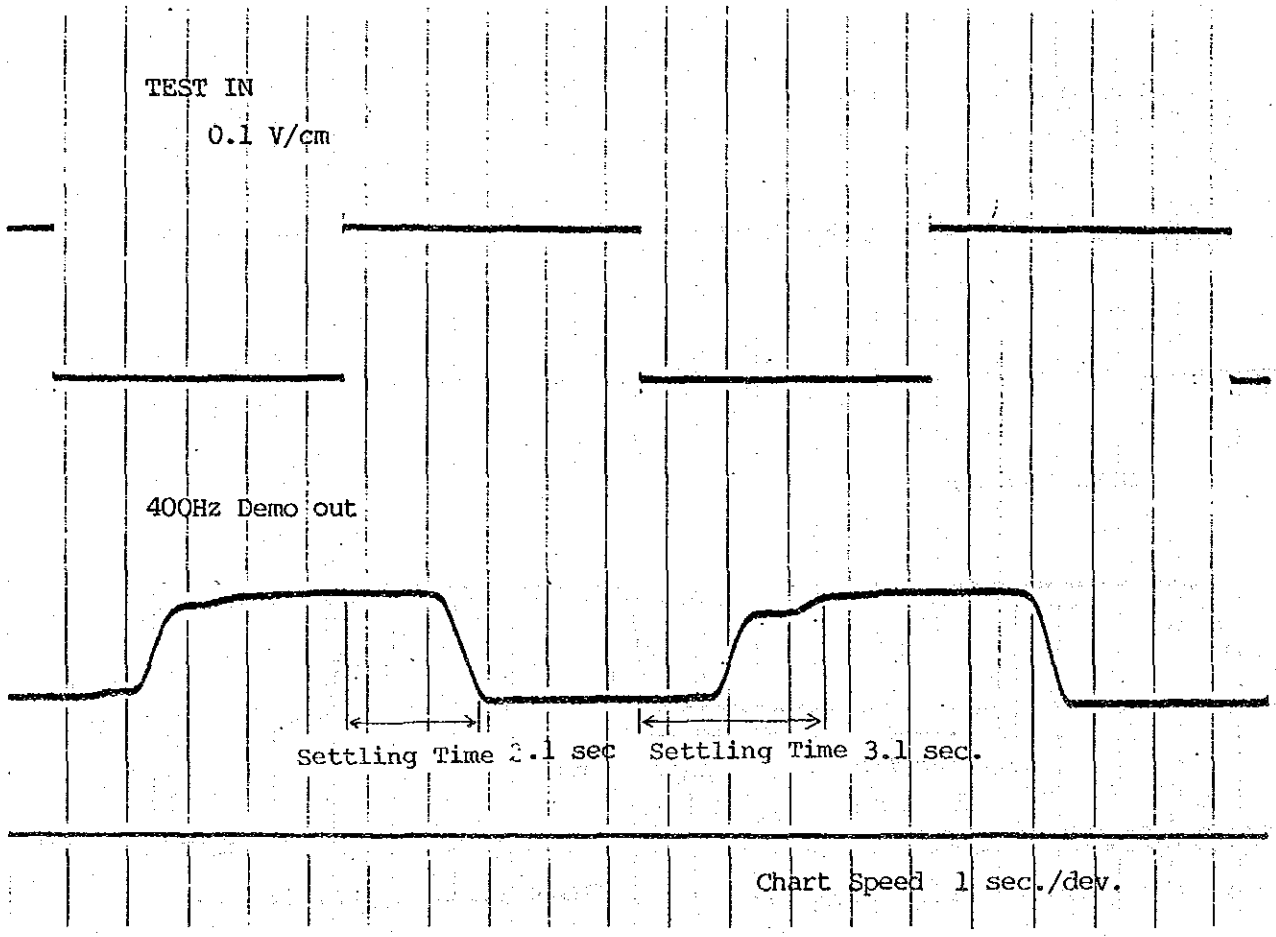
Data sheet-5-5

DATE 24th Mar., 1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : MEDIUM



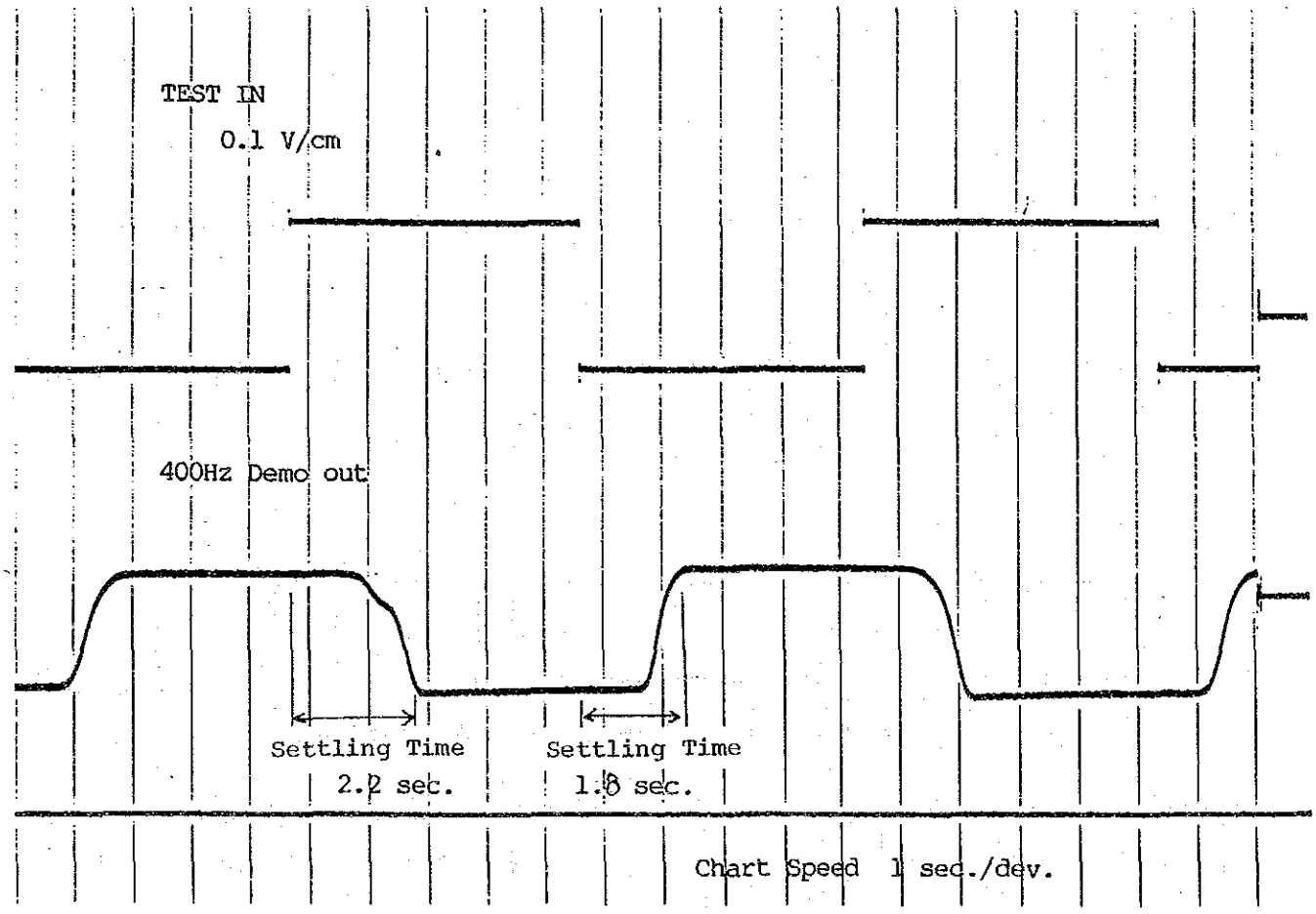
Data sheet-5-6

DATE 24th Mar.,1986

Tested by

AZIMUTH

No.2 DCPA Single Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : NARROW



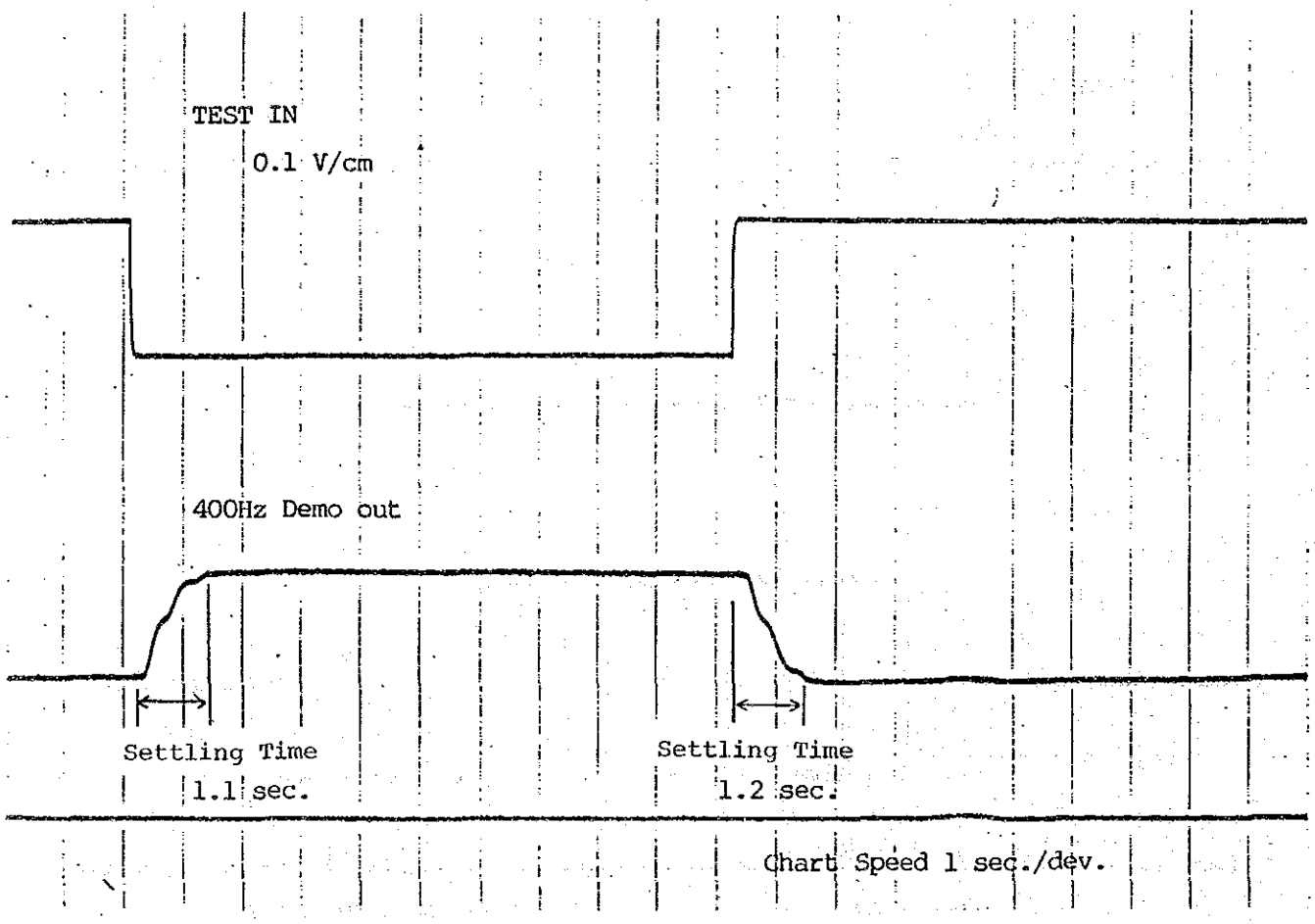
Data sheet-5-7

DATE 24th Mar.,1985

Tested by

AZIMUTH

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : WIDE



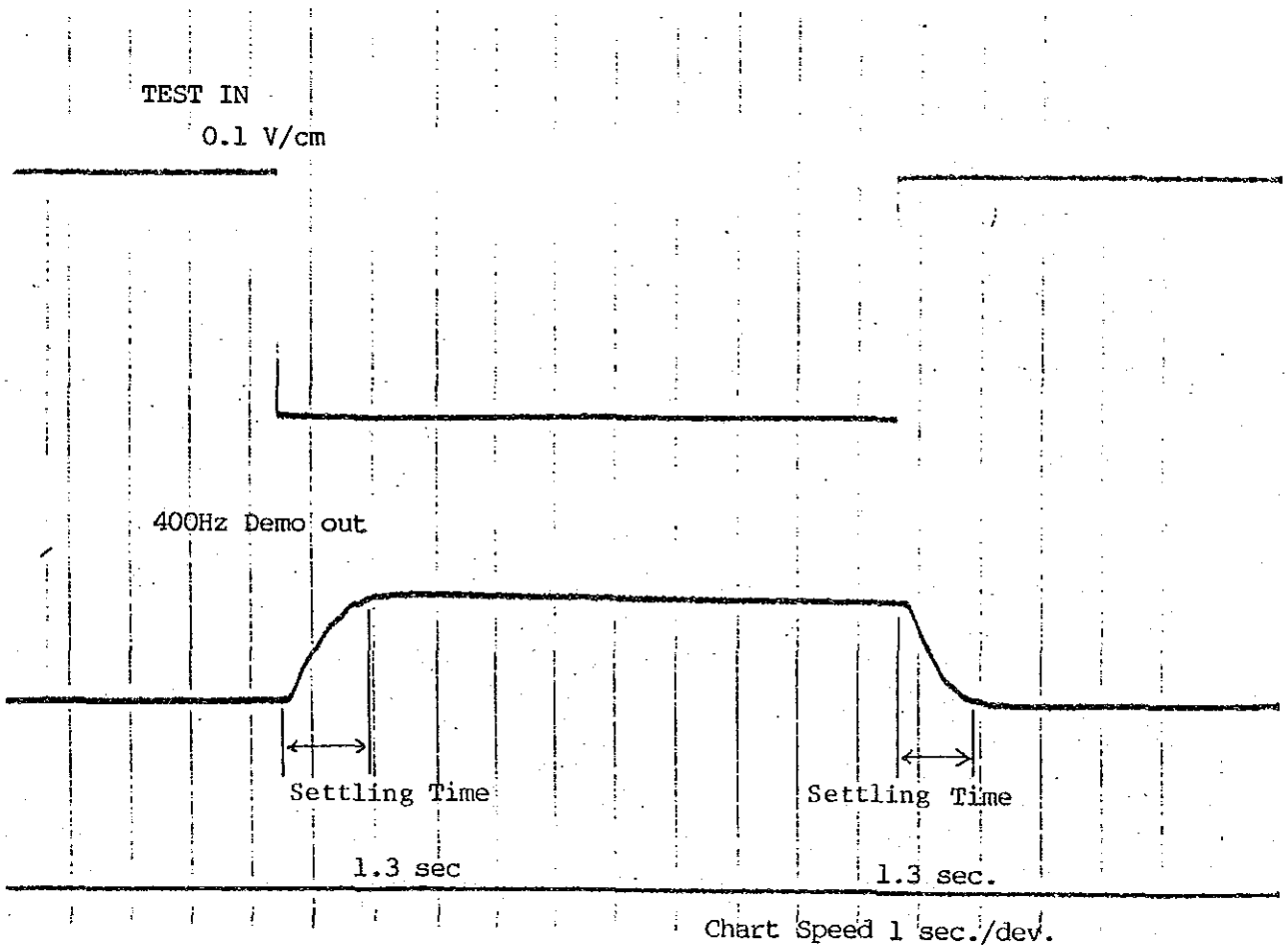
Data sheet-6-1

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE



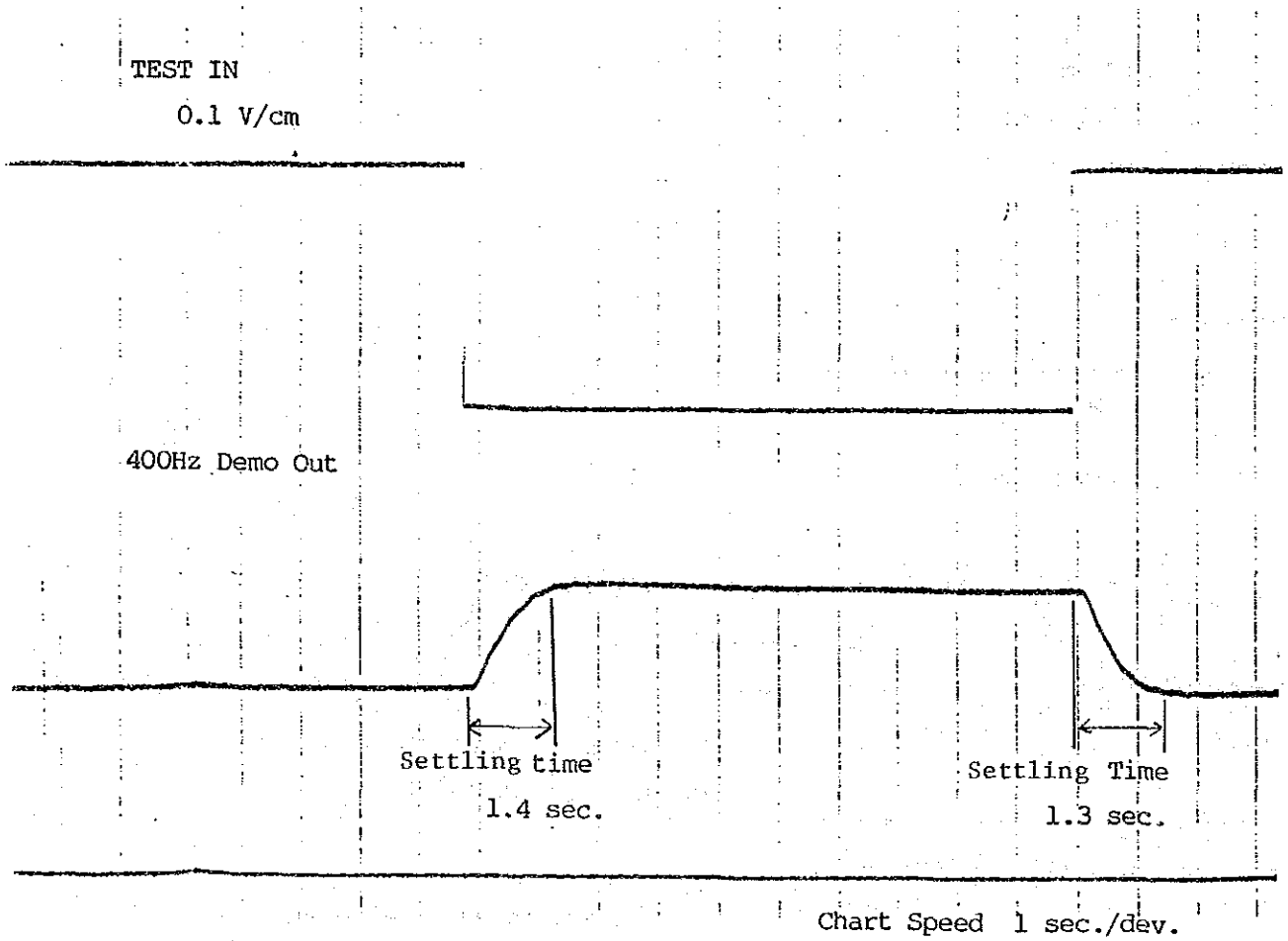
Data sheet-6-2

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM



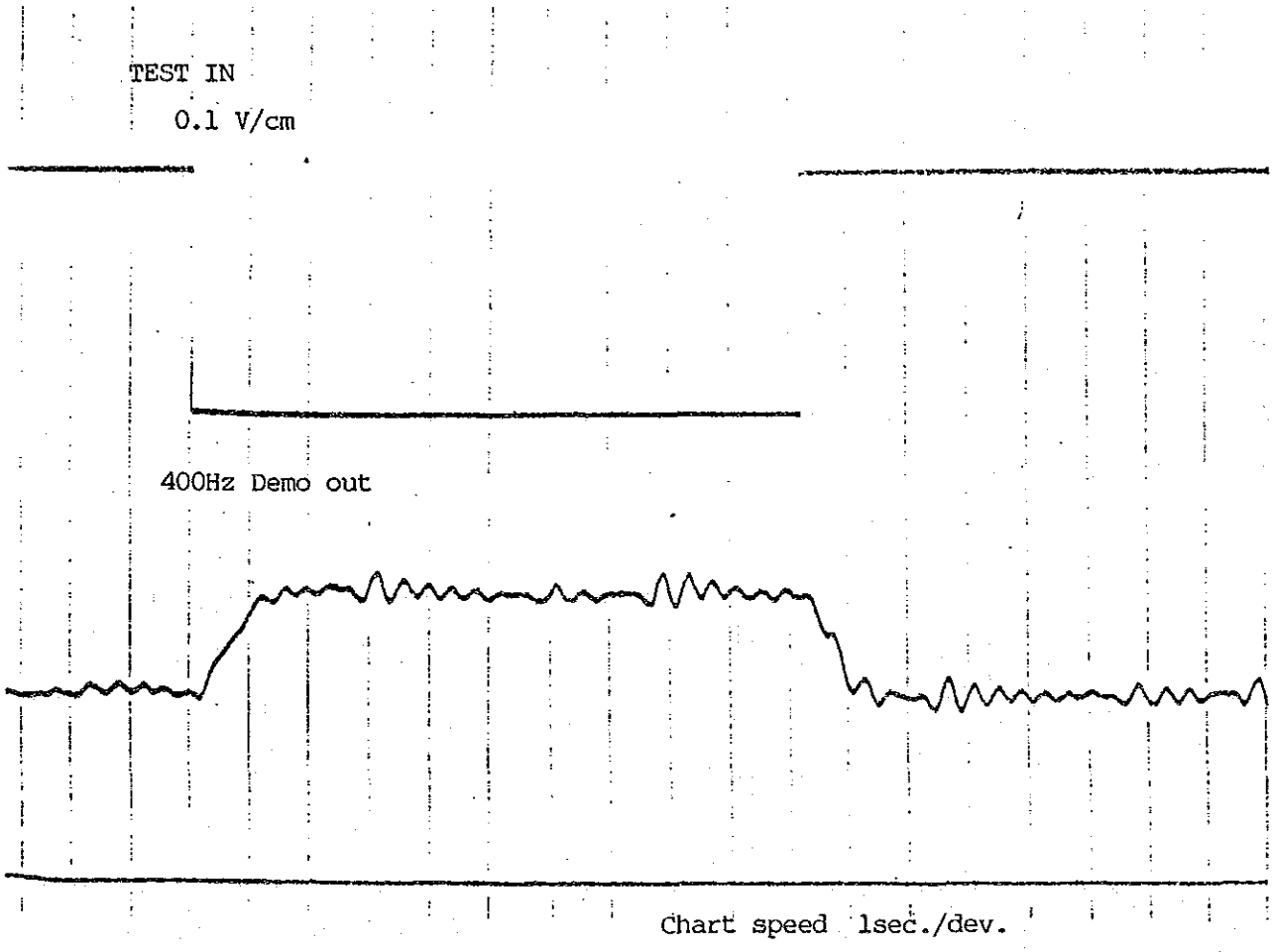
Data sheet-6-3

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA A ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW



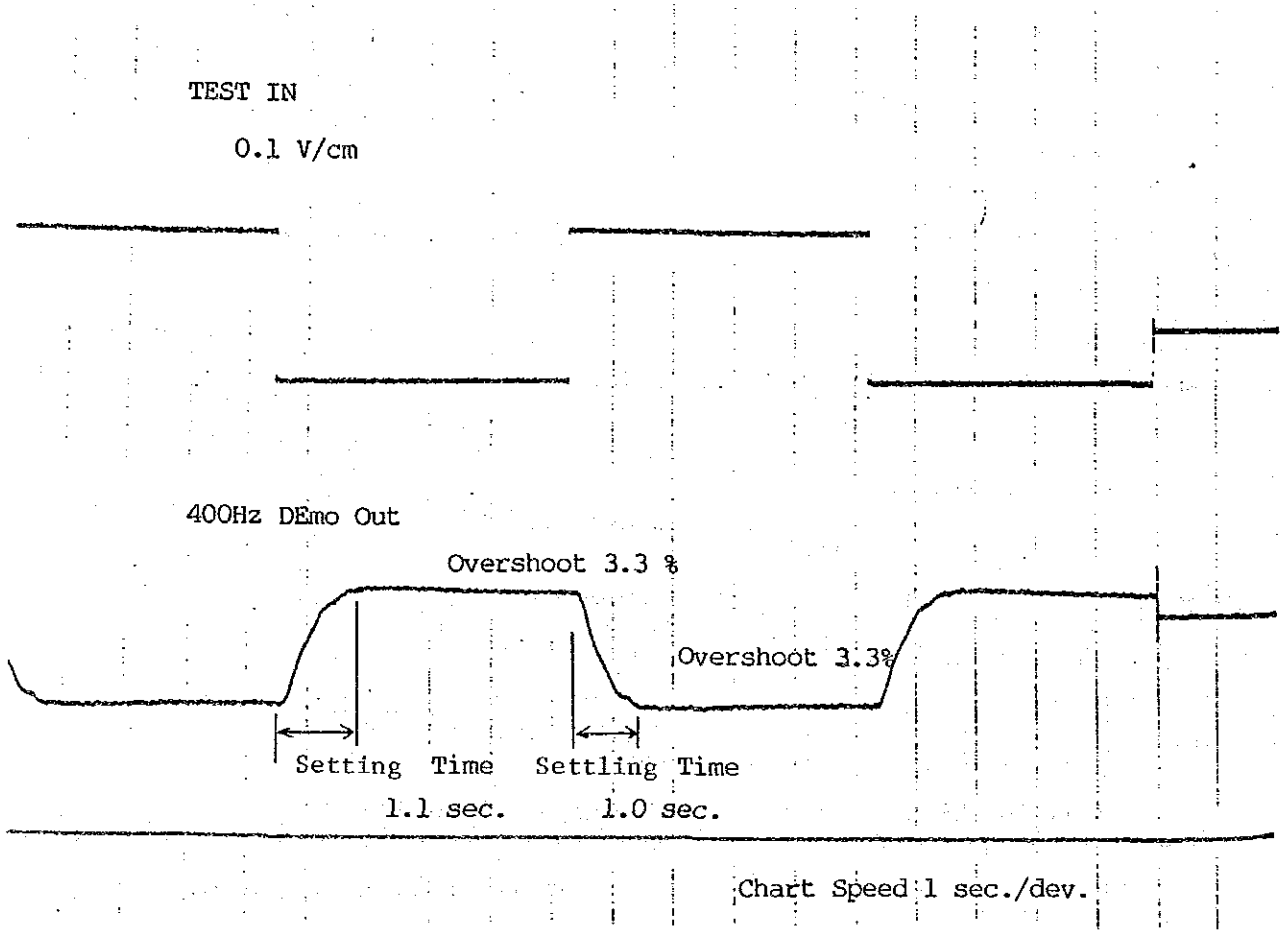
Data sheet-6-4

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : WIDE



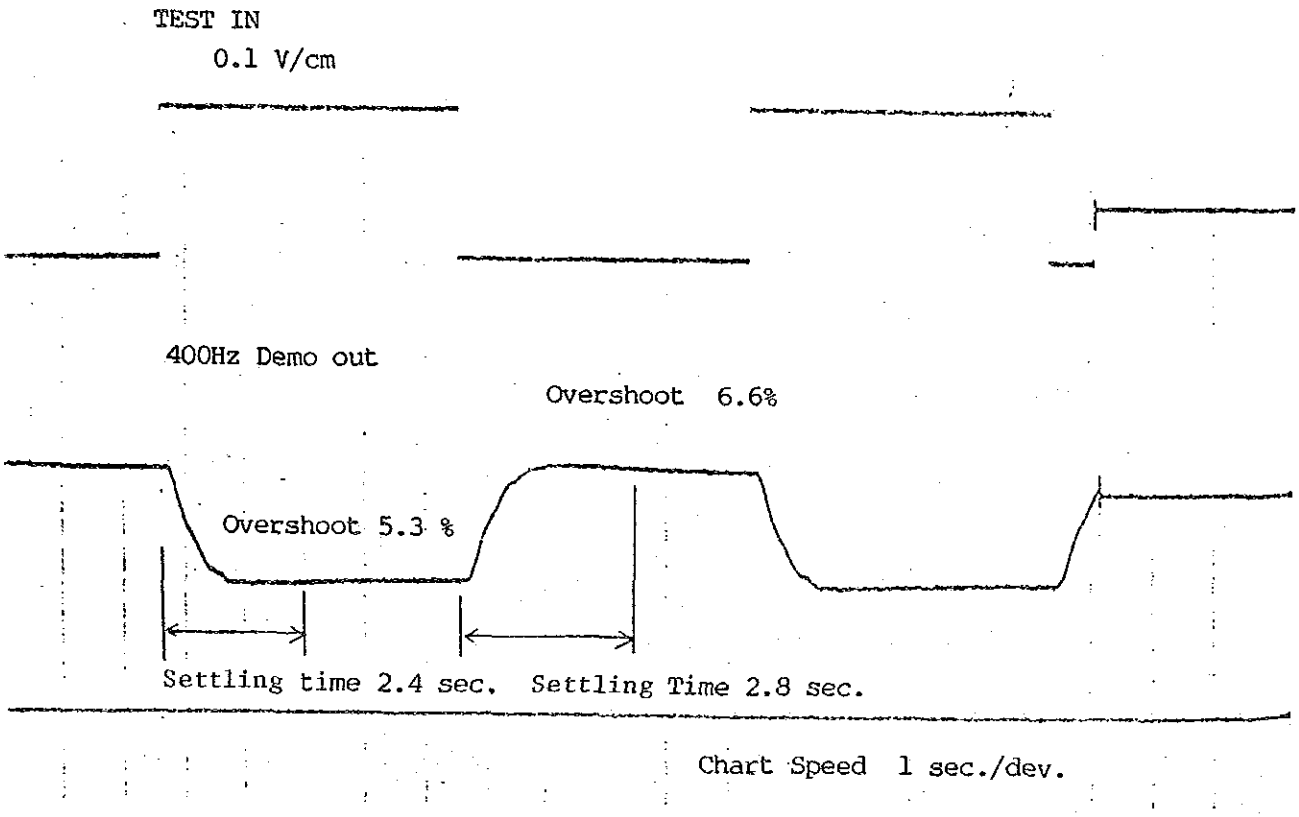
Data sheet-6-5

DATE 24th Mar., 1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : MEDIUM



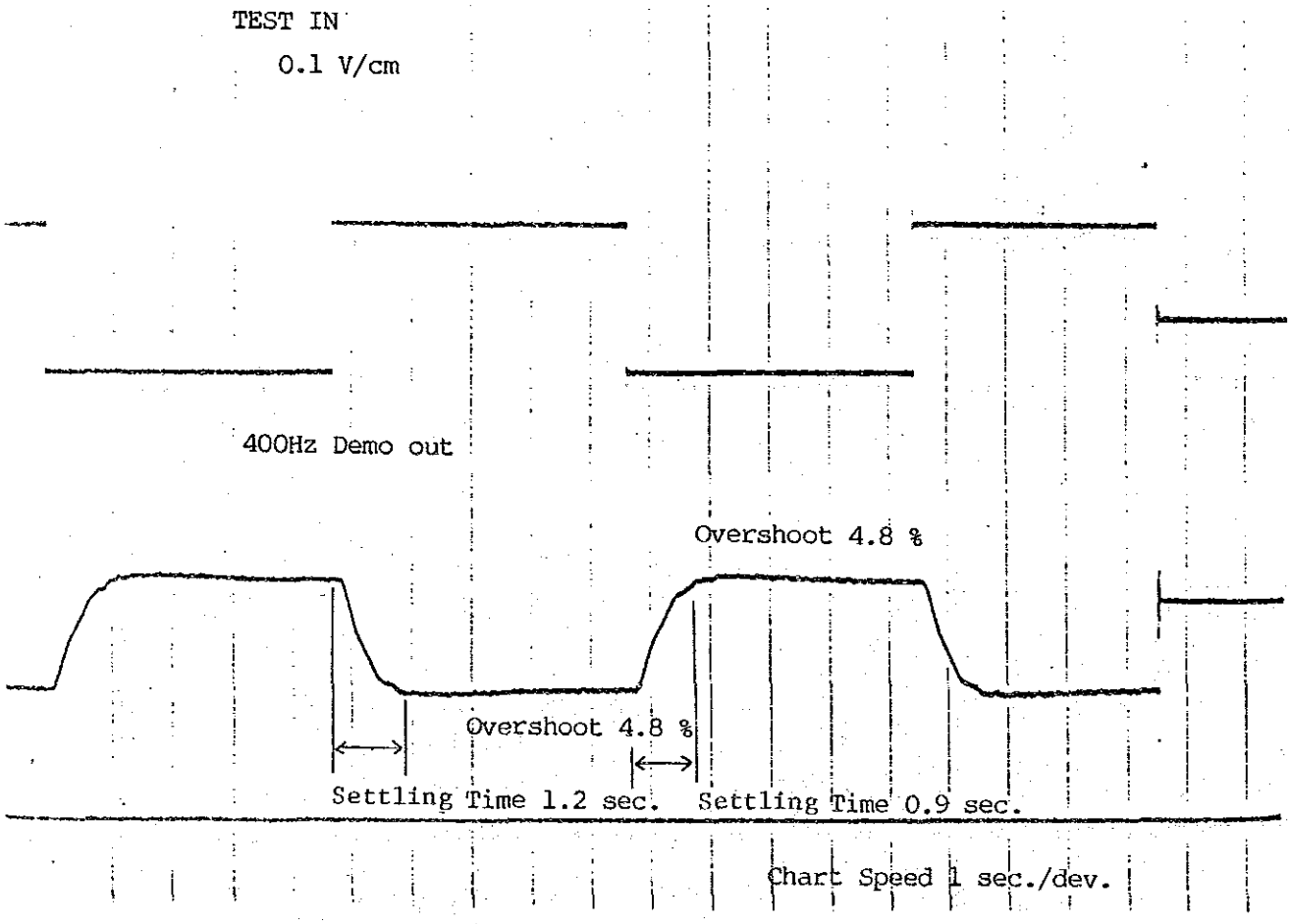
Data sheet-6-6

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: I
SERVO BANDWIDTH : NARROW



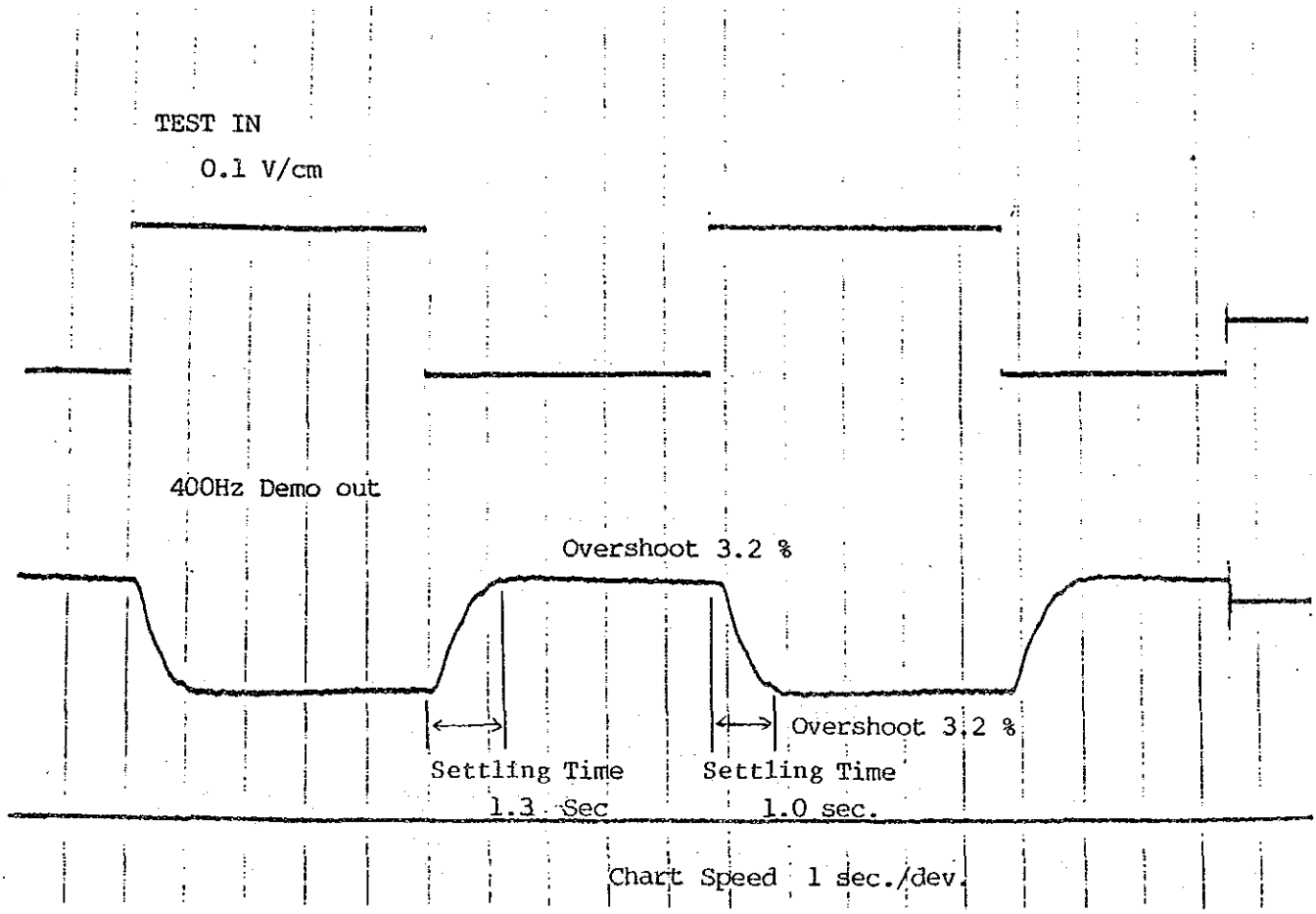
Data sheet-6-7

DATE 24th Mar., 1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : WIDE



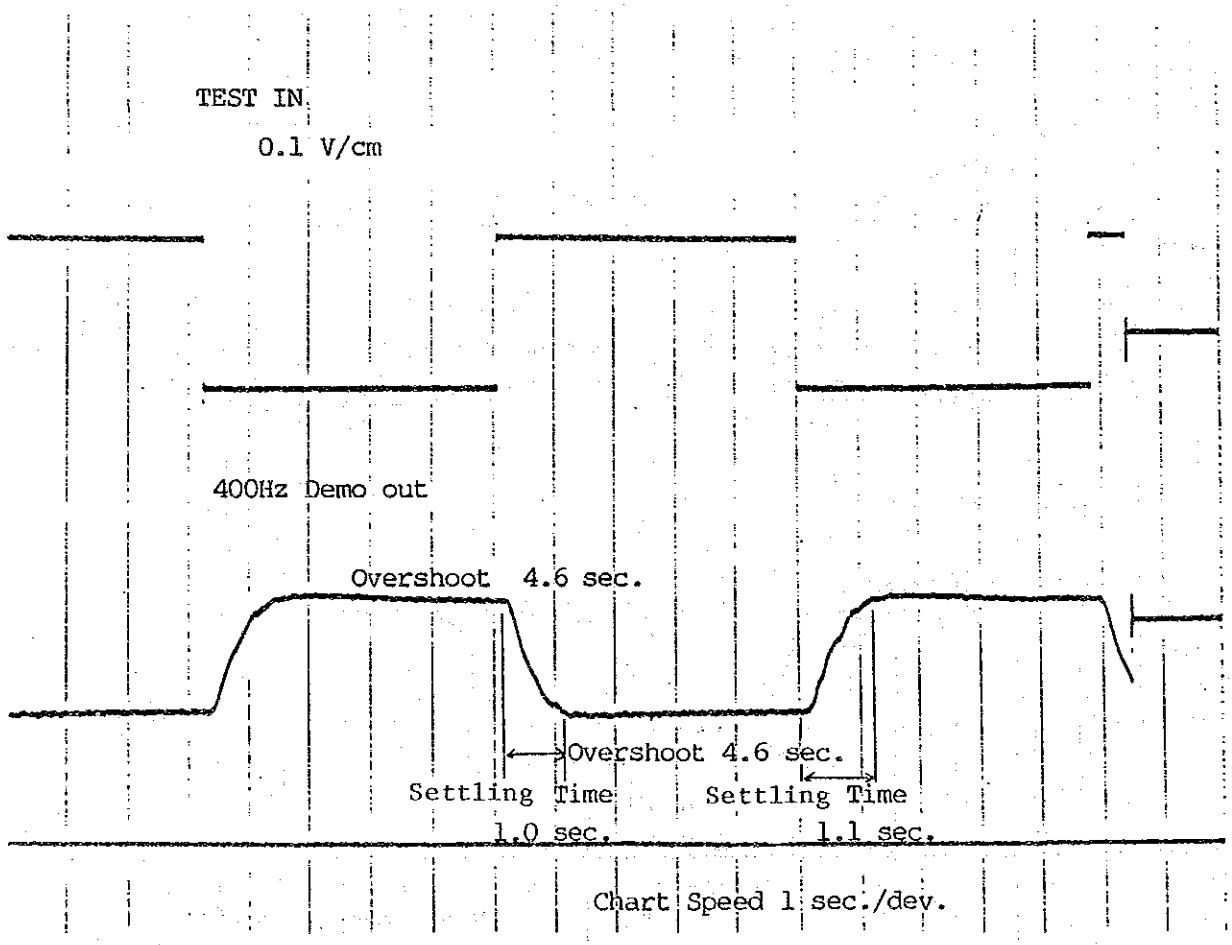
Data sheet-6-8

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : MEDUIM



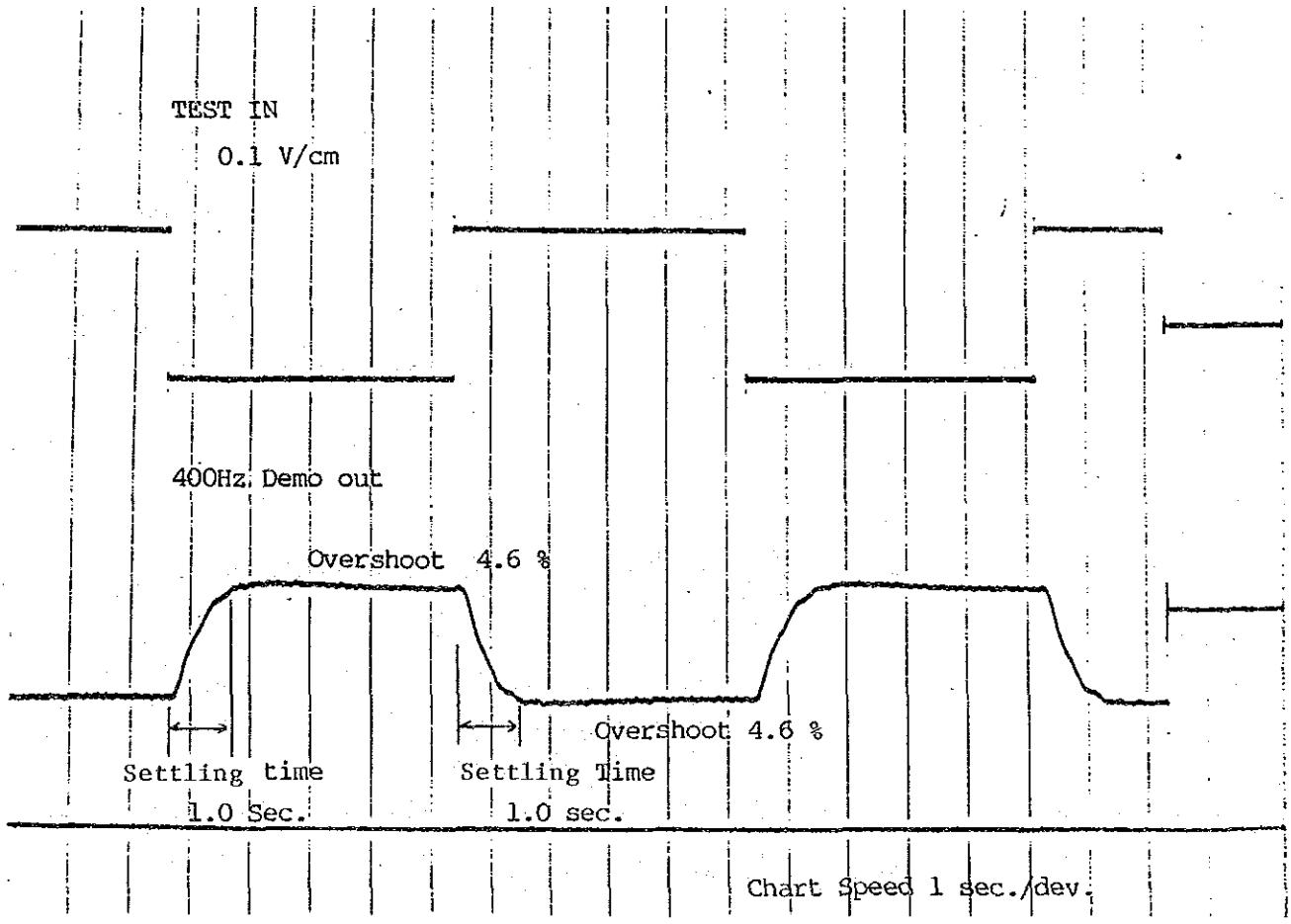
Data sheet-6-9

DATE 24th Mar.,1986

Tested by

ELEVATION

DCPA Dual Drive
SCA B ON-LINE
SERVO TYPE: II
SERVO BANDWIDTH : NARROW



(4) TACHOMETER LOOP FREQUENCY RESPONSE

DATE 24th Mar., 1986

Tested by

1. Purpose of the test

To check the degradation of closed loop (DCPA - DRIVE MOTOR - TACHOMETER) frequency response.

2. Test set-up

Refer to the Fig.-4

3. Test Equipment

4 Pen Chart Recorder	YEW 2931 PHOTOCORDER
	YEW 3132 DC AMP
Function Generator	WAVETEK Model 111
	Voltage Controlled Generator

4. Test Procedure

Step 1 Select Maintnance position of azimuth (or elevation) DCPA MAINTENANCE/REMOTE switch.

Step 2 Applying sine waveform signal to DCPA at the frequency from 0.1 Hz to approximately 10 Hz by means of function generator ,the tachometer are measured and recorded by means of chart recorder.

5. Test Result

Azimuth Refer to the Data Sheet-7-1 ,7-3

Elevation Refer to the Data Sheet-8 -1,8-3

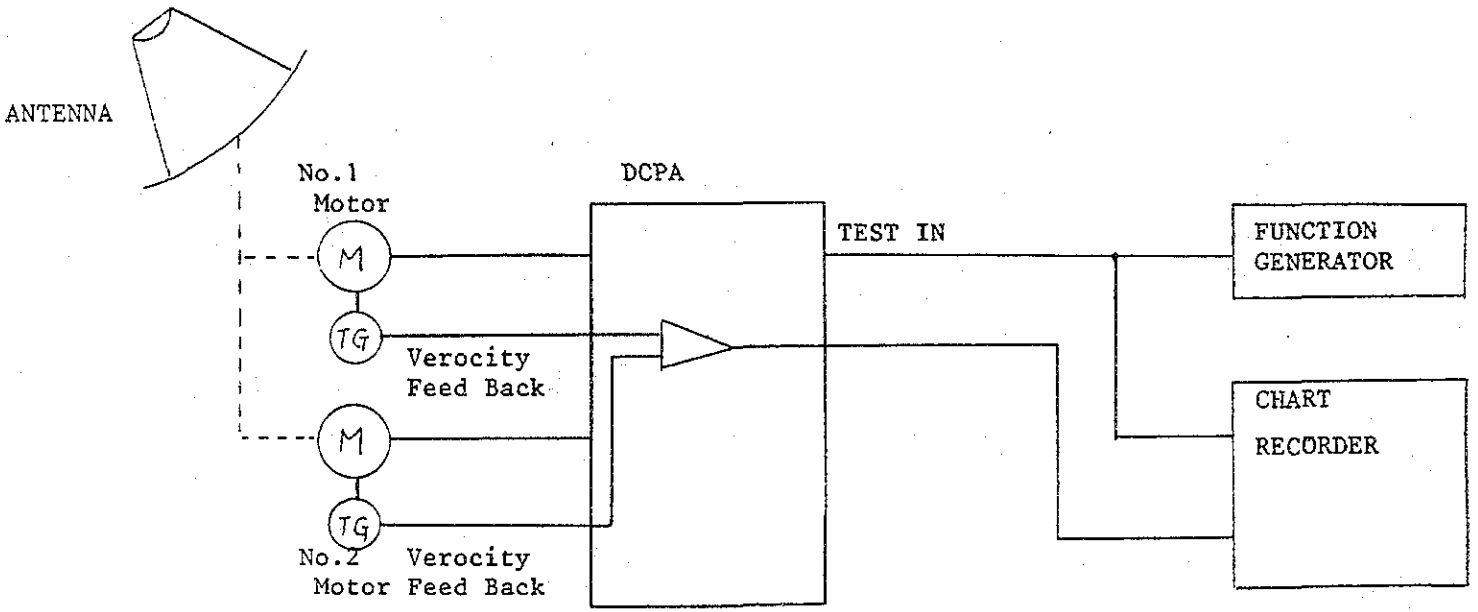


Fig. 4 Tachometer Loop Frequency / Step Transient Response Connection Diagram

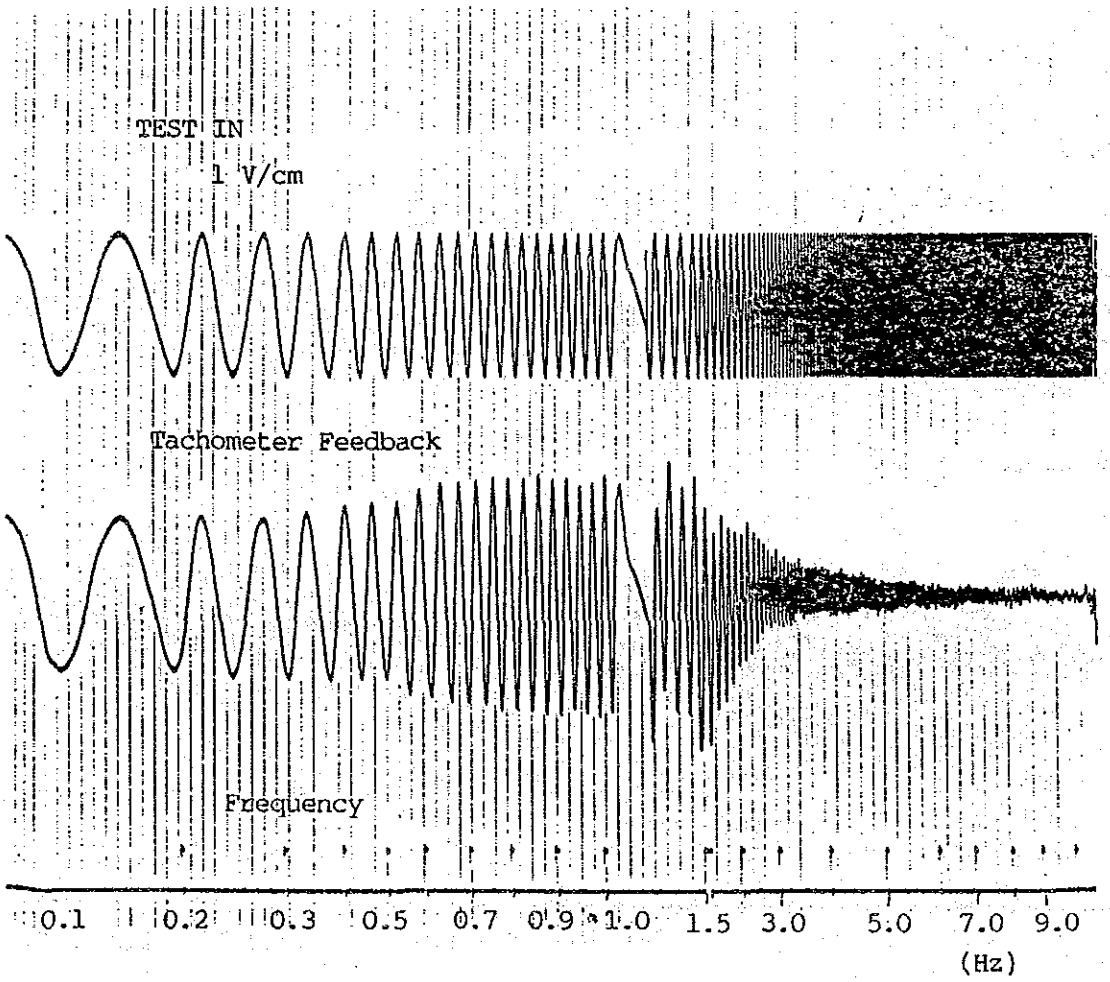
Data Sheet-7-1

DATE 24th MAR., 1986

Tested by

AZIMUTH

DUAL DRIVE MODE



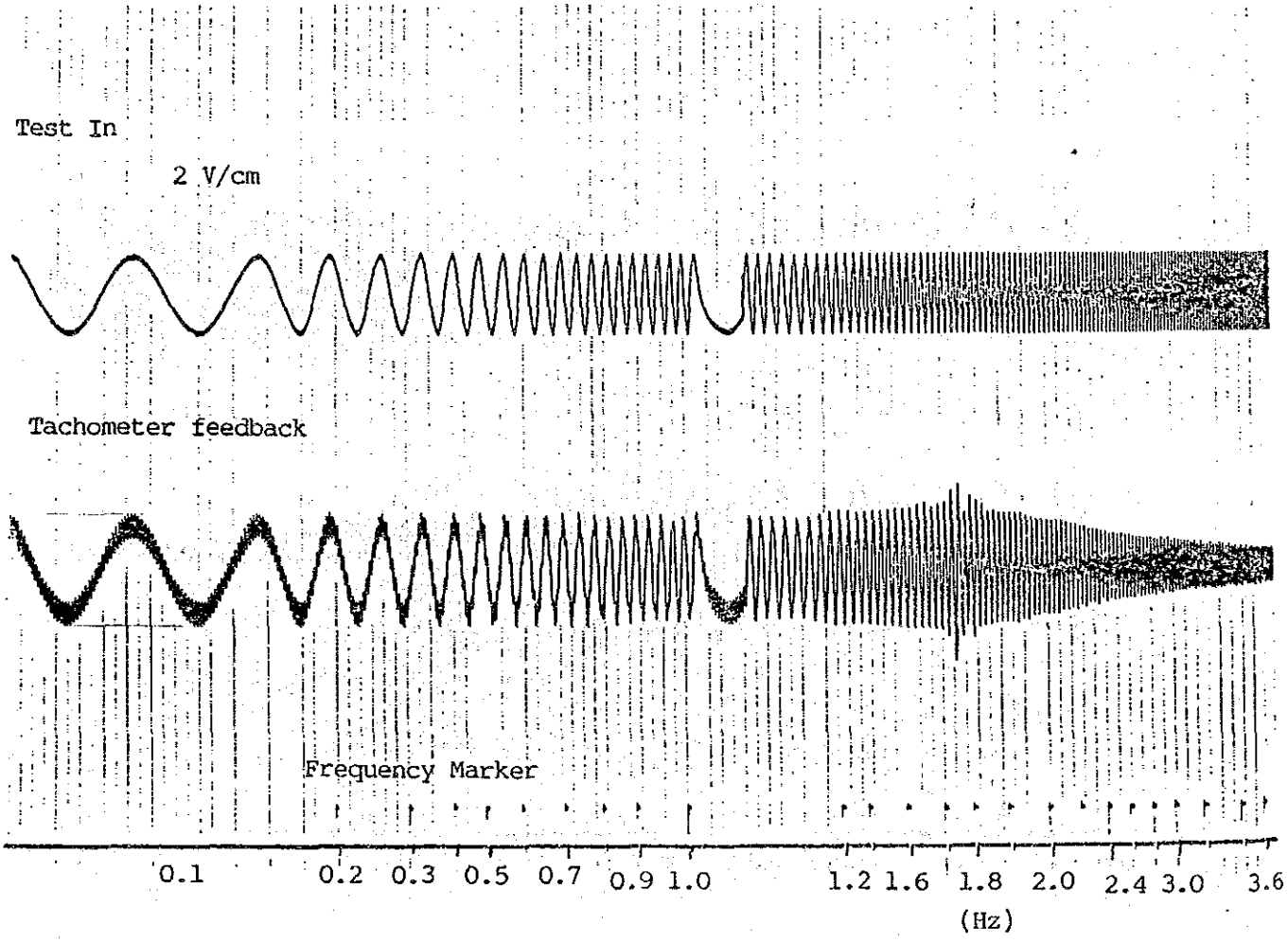
Data Sheet-7-2

DATE 24th MAR., 1986

Tested by

AZIMUTH

No.1 SINGLE DRIVE MODE



Data Sheet-7 -3

DATE 24th MAR.,1986

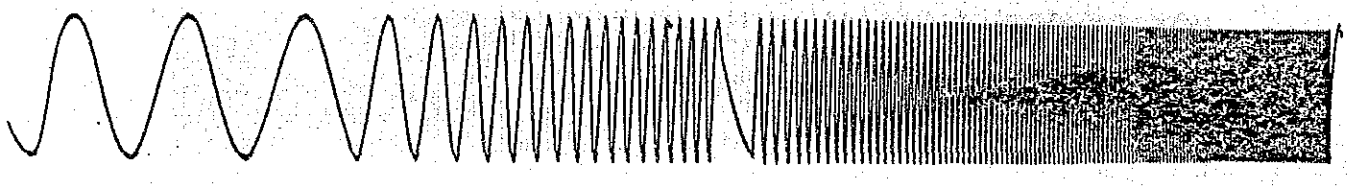
Tested by

AZIMUTH

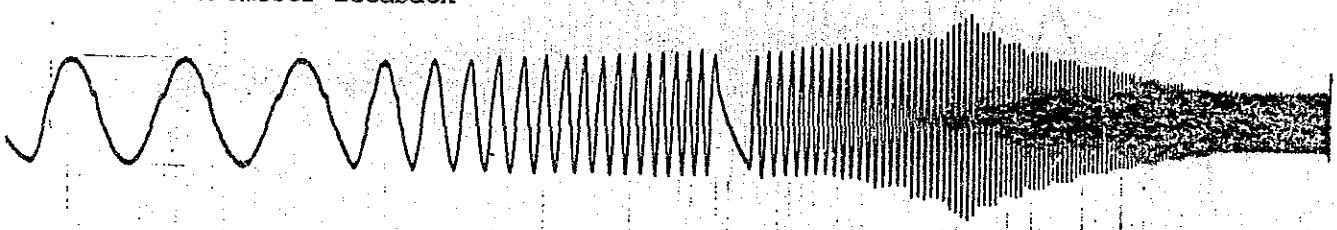
No.2 SINGLE DRIVE MODE

Test In

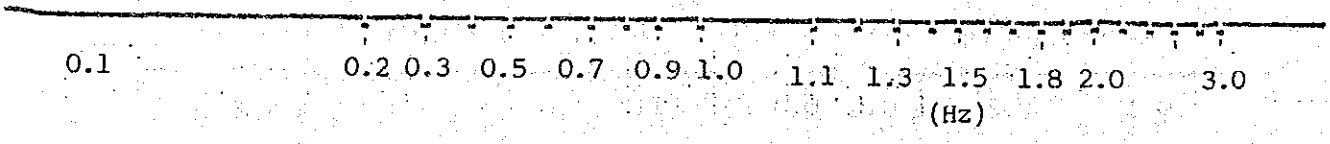
1 V/cm



Tachometer feedback



Frequency Marker



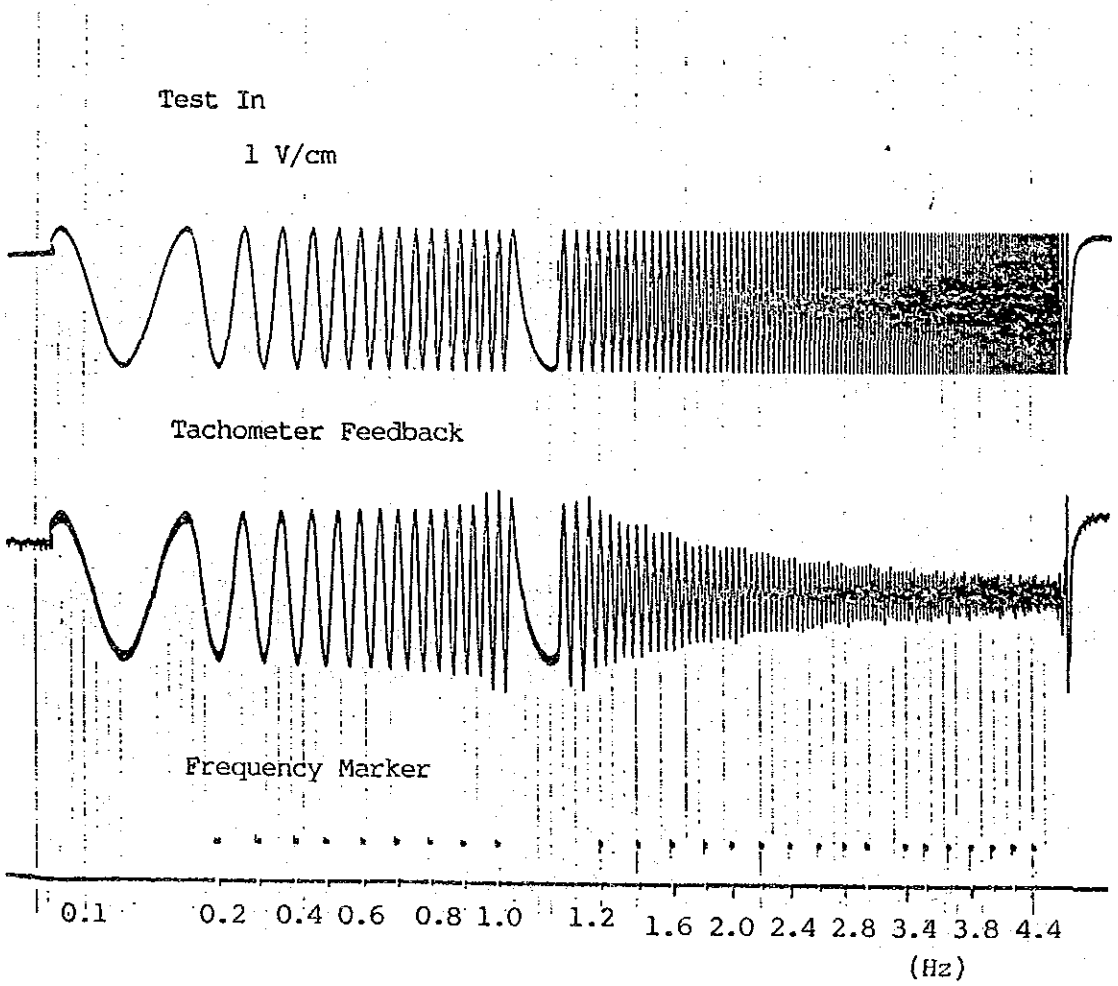
Data Sheet-8 - 1

DATE 24th Mar., 1986

Tested by

ELEVATION

No.2 SINGLE DRIVE MODE



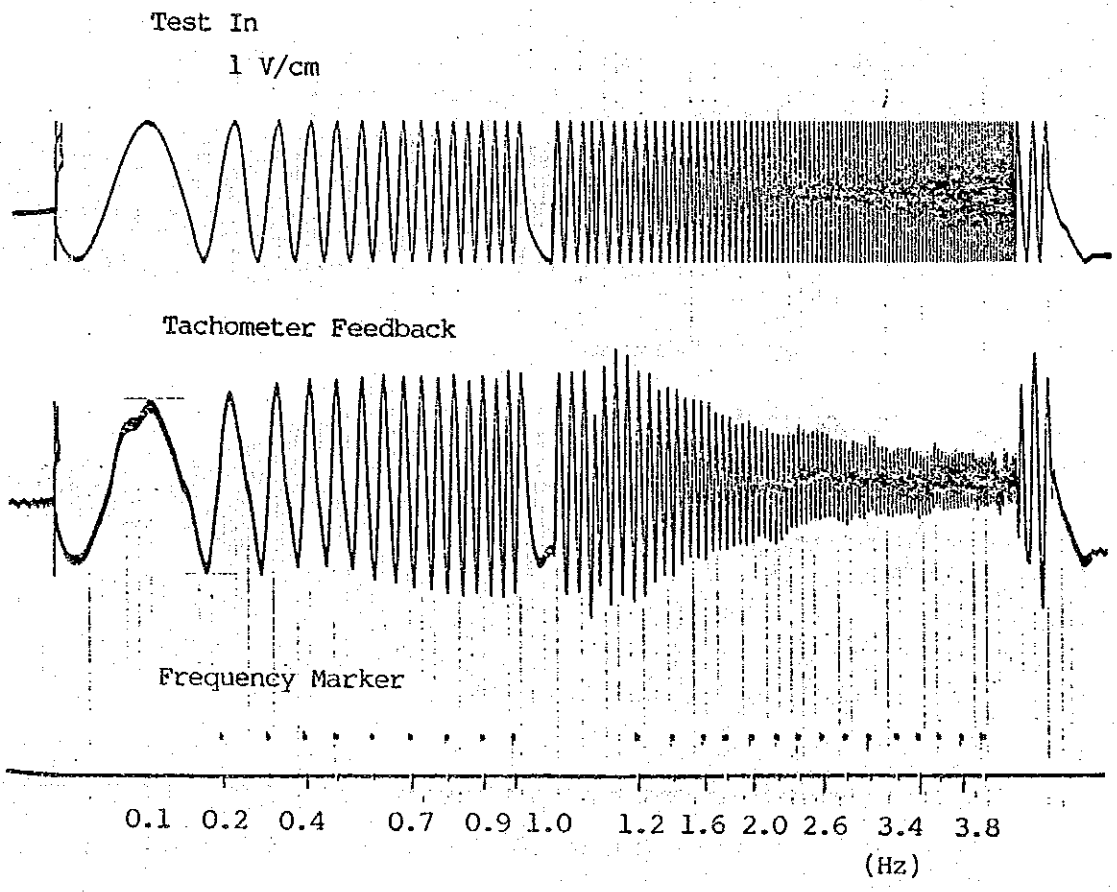
Data Sheet-8 -2

DATE 24th Mar., 1986

Tested by

ELEVATION

DUAL DRIVE MODE



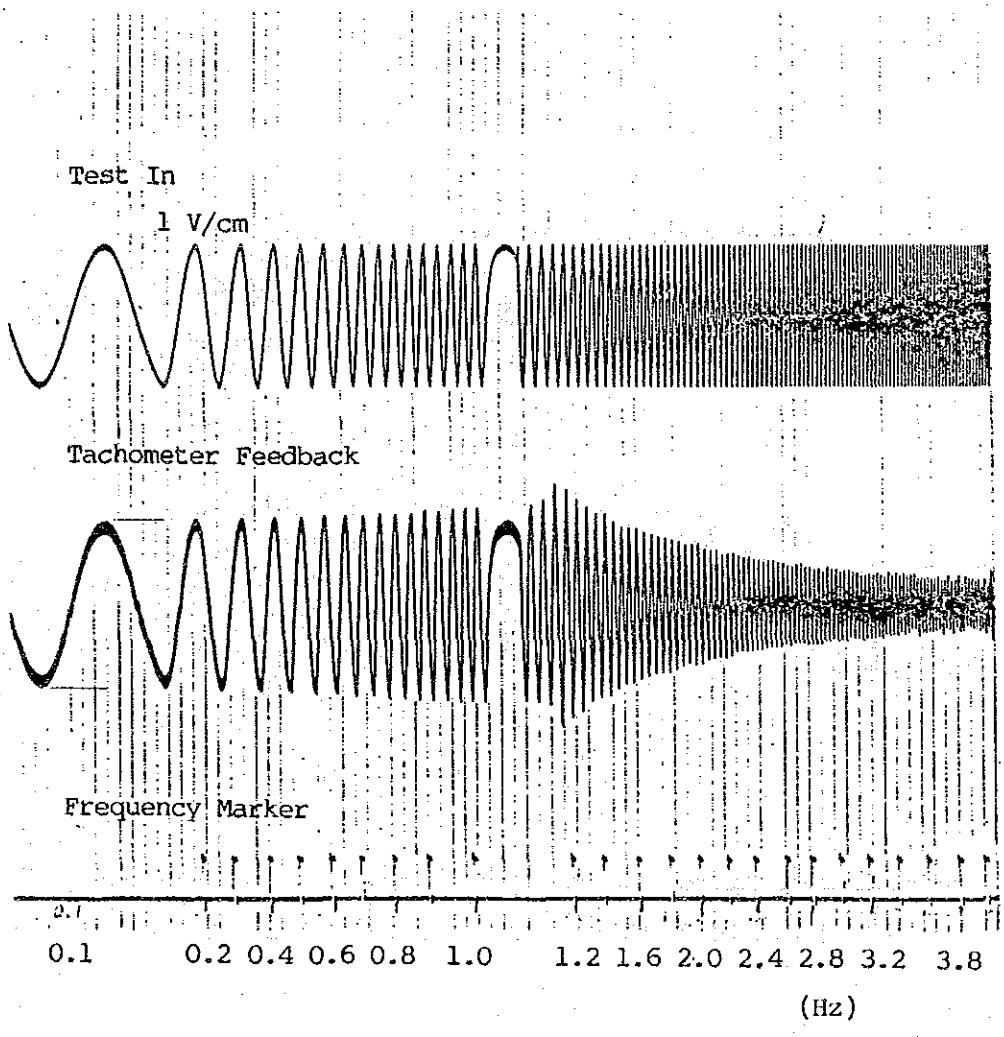
Data Sheet-8 -3

DATE 24th Mar.,1986

Tested by

ELEVATION

No.1 SINGLE DRIVE MODE



(5) TACHOMETER LOOP STEP TRANSIENT RESPONSE DATE 24th Mar., 1986

Tested by

1. Purpose of the test

To check the degradation of closed loop (DCPA - DRIVE MOTOR - TACHOMETER) step transient response.

2. Test set-up

Refer to the Fig.-4

3. Test Equipment

4 Pen Chart Recorder	YEW 2931 PHOTOCORDER YEW 3132 DC AMP
Function Generator	WAVETEK Model 111 Voltage Controlled Generator

4. Test Procedure

Step 1 Select Maintnance position of azimuth (or elevation) DCPA MAINTENANCE/REMOTE switch.

Step 2 Applying square waveform signal to DCPA at the ±1 V (equivalent to±0.03 deg./sec.) by means of function generator ,the tachometer are measured and recorded by means of chart recorder.

5. Test Result

Axis	DCPA	Direction	Overshoot	Settling Time	Data sheet
Azimuth	DUAL	CW	38.5%	2.6 sec.	9-1
		CCW	108 %	∞	
	No.1	CW	174 %	0.6 sec.	9-2
		CCW	64 %	3.7 sec.	
	No.2	CW	50 %	1.3 sec.	9-3
		CCW	52 %	1.4 sec.	

Axis	DCPA	Direction	Overshoot	Settling Time	Data sheet
Elevation	DUAL	UP	24 %	4.4 sec.	10-1
		DOWN	48 %	4.8 sec.	
	No.1	UP	34 %	1.0 sec.	10-2
		DOWN	27 %	1.3 sec.	
	No.2	UP	24 %	1.0 sec.	10-3
		DOWN	25 %	1.0 sec.	

Data Sheet-9-1

DATE 24th Mar., 1986

Tested by

AZIMUTH

DUAL DRIVE MODE

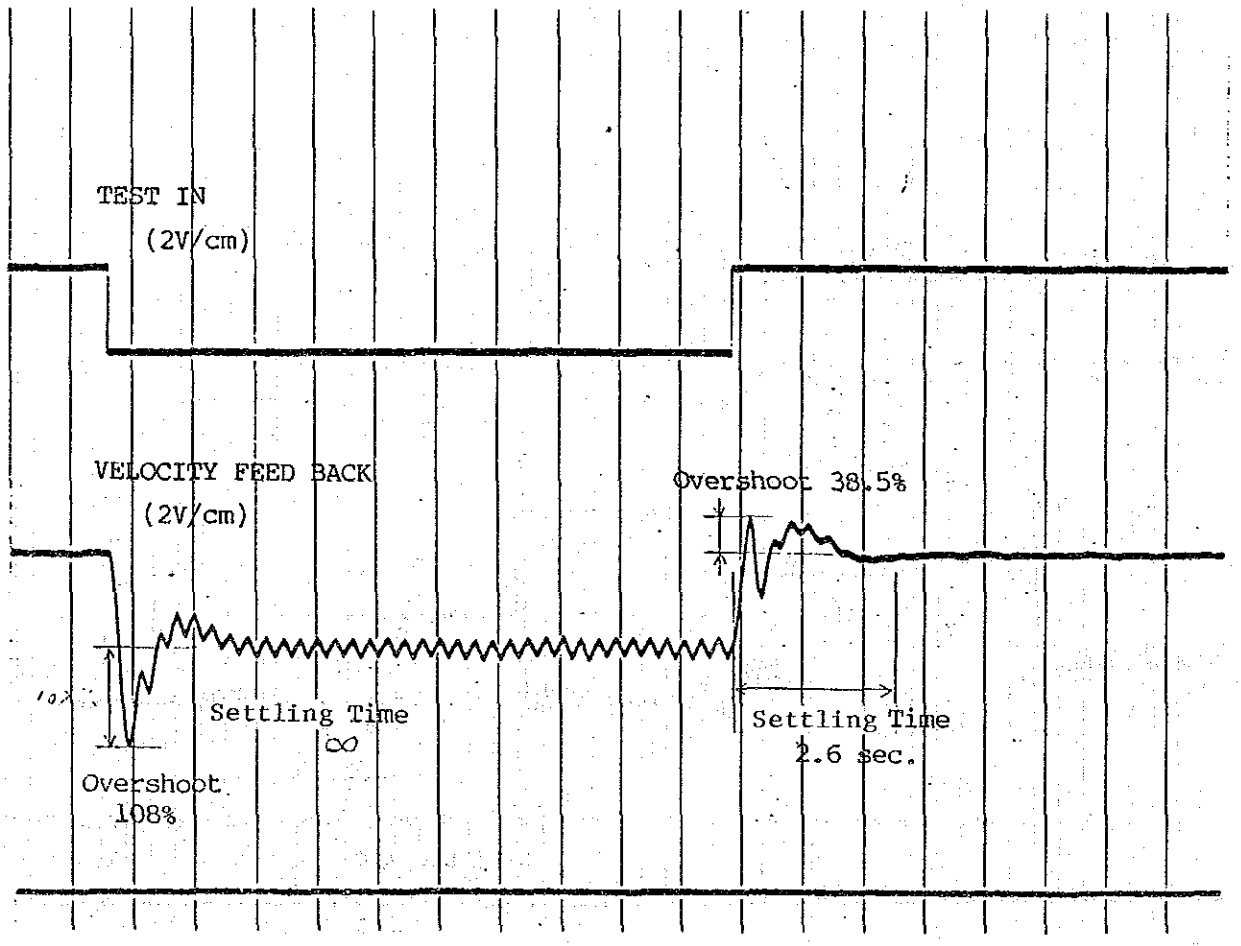


Chart Speed 1sec/dev.

Data Sheet-9-2

DATE 24th Mar.,1986

Tested by

AZIMUTH

No.1 SINGLE DRIVE MODE

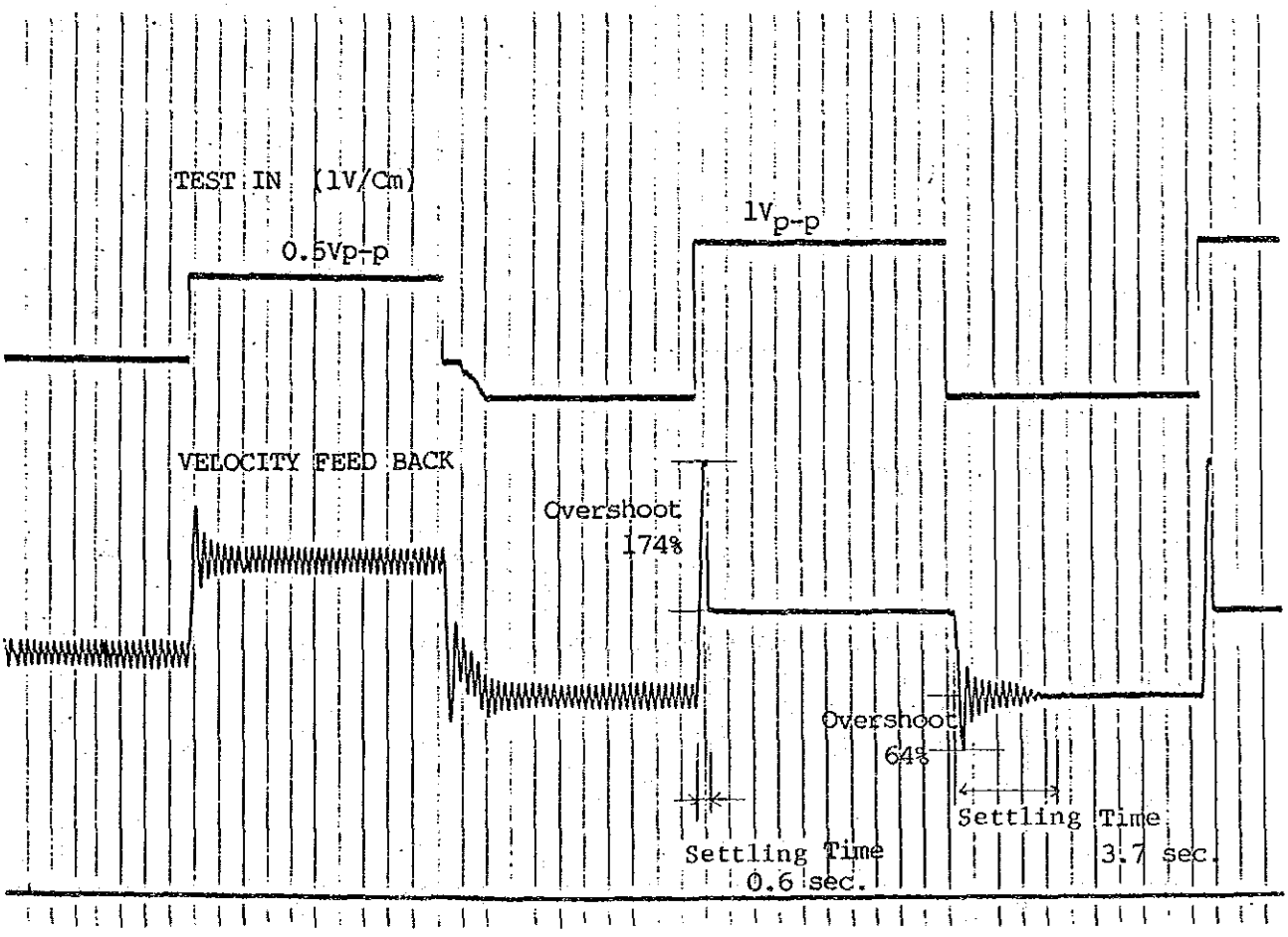


Chart Speed 1sec/dev.

Data Sheet-9 -3

DATE 24th Mar.,1986

Tested by

AZIMUTH

No.2 SINGLE DRIVE MODE

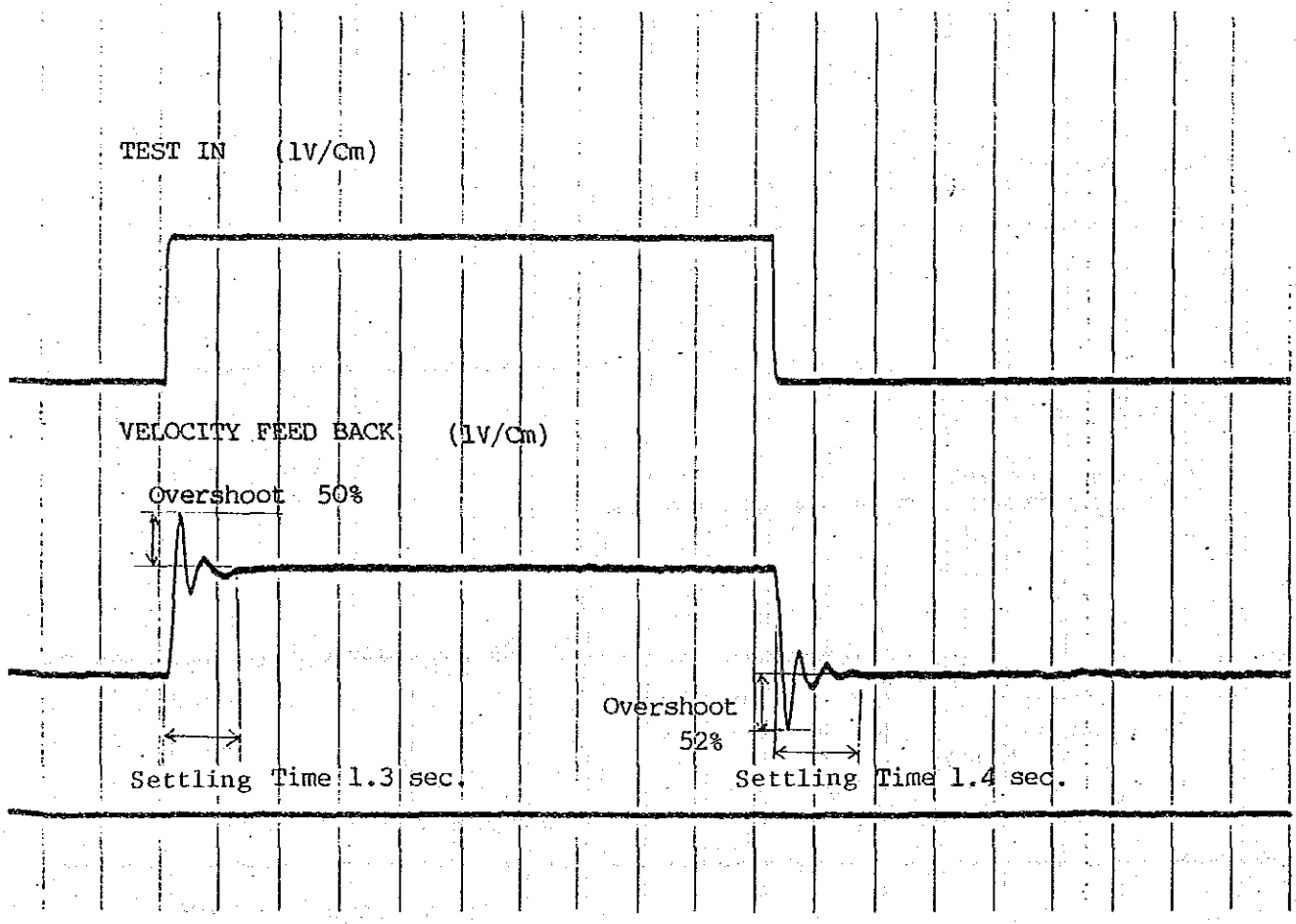


Chart Speed 1 sec./dev.

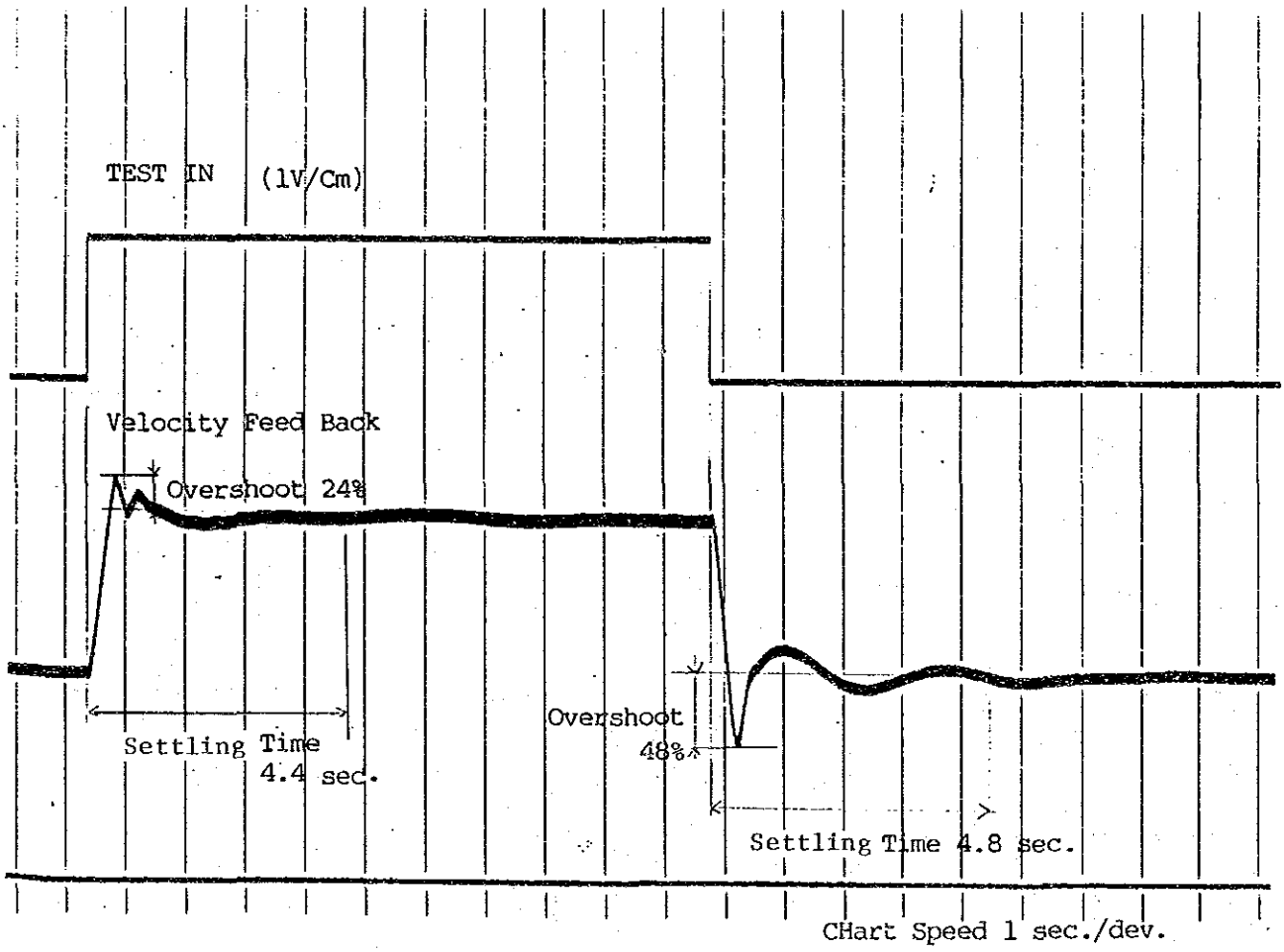
Data Sheet-10-1

DATE 24th Mar.,1986

Tested by

ELEVATION

DUAL DRIVE MODE



Data Sheet-10-2

DATE 24th Mar.,1986

Tested by

ELEVATION

No.1 SINGLE DRIVE MODE

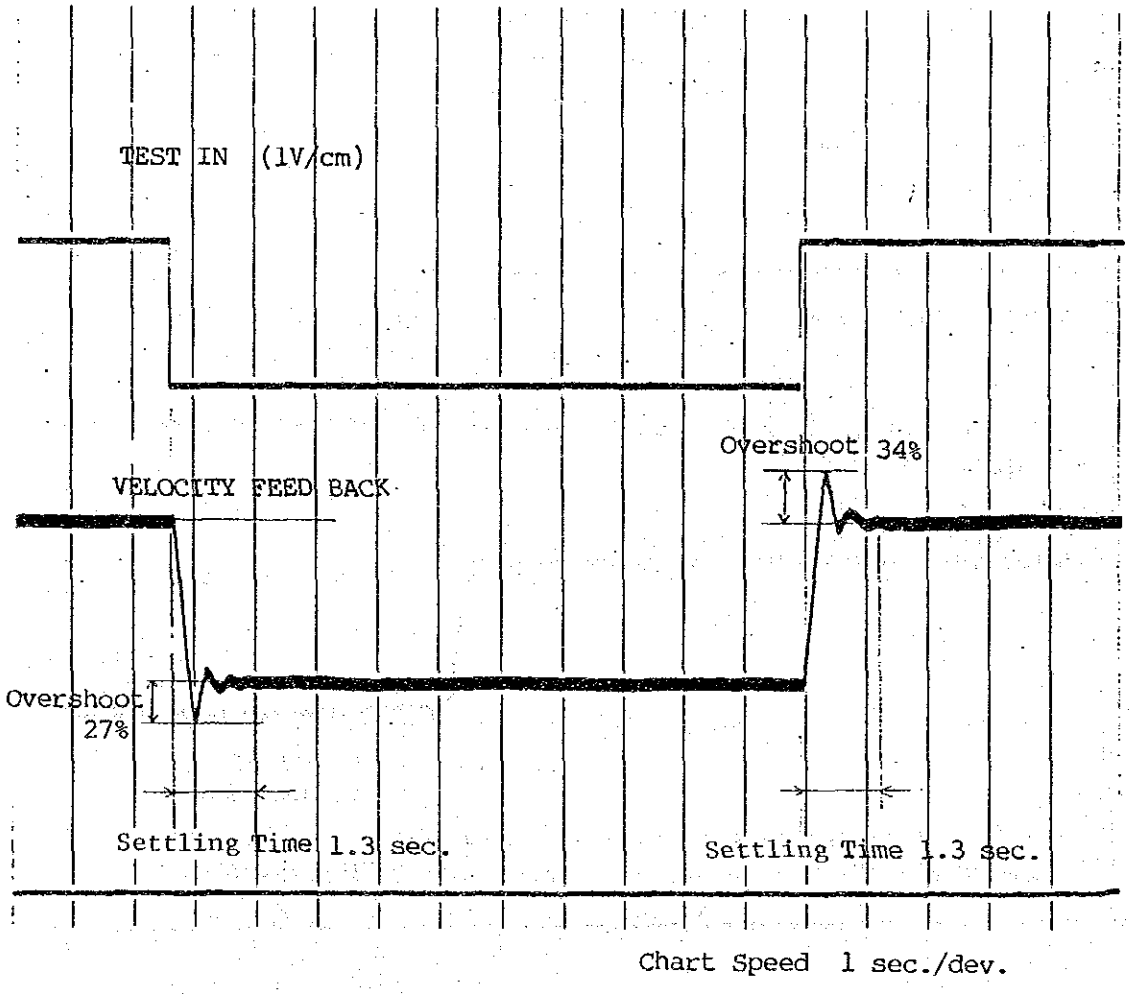


Chart Speed 1 sec./dev.

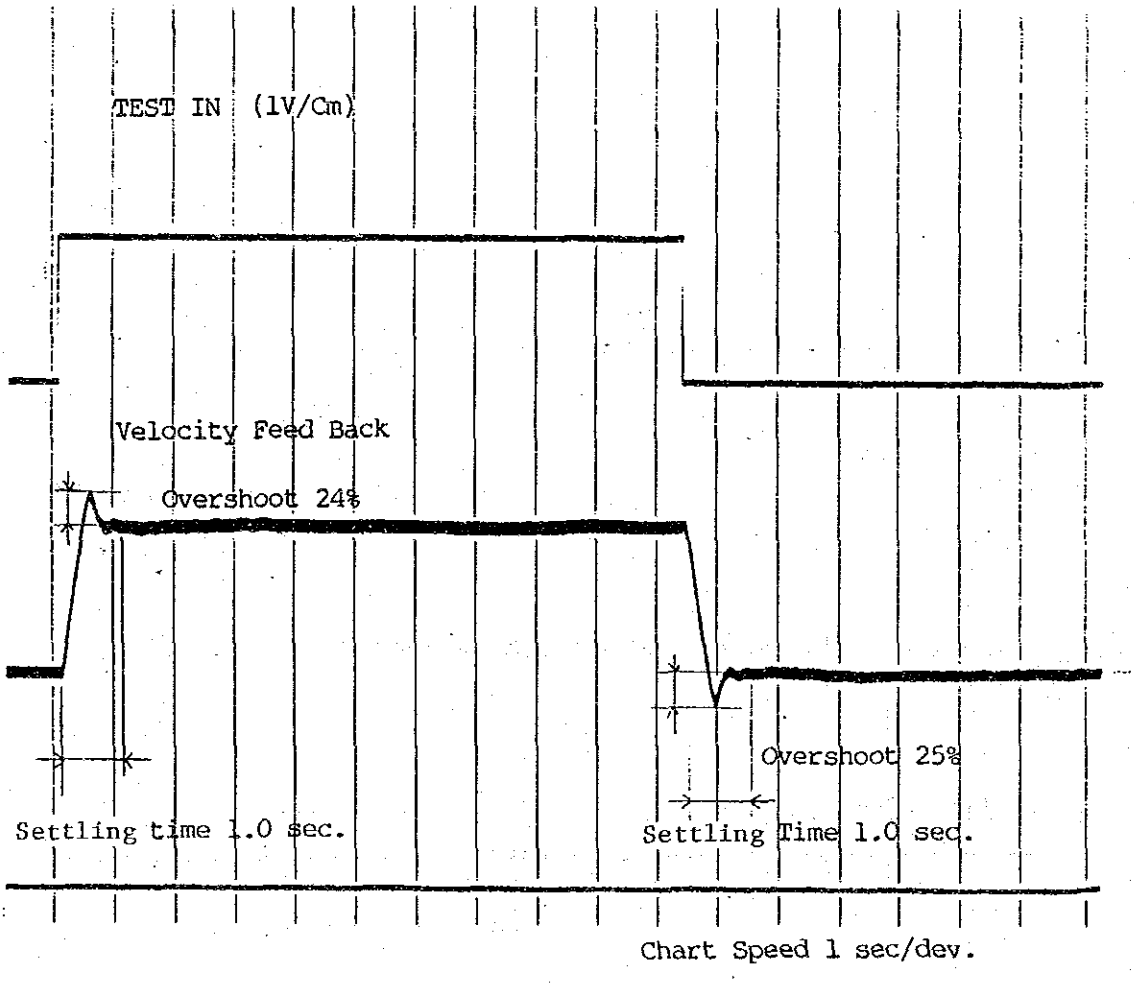
Data Sheet-10 -3

DATE 24th Mar., 1986

Tested by

ELEVATION

No.2 SINGLE DRIVE MODE



(6) VELOCITY AND ACCELRATION TEST

DATE 25th Mar.,1986

Tested by

1. Purpose of the test

To check the driving velocity range (Maximum and Minimum speed) and confirm the function of DCPA and Drive Motor.

2. Test set-up

Acceleration	Refer to the Fig.-5
Minimum Velocity	Refer to the Fig.-6

3. Test Equipment

4 Pen Chart Recorder	YEW 2931 PHOTOCORDER YEW 3132 DC AMP
Function Generator	WAVETEK Model 111 Voltage Controlled Generator

4. Test Procedure

Maximum Speed

Step 1 Select Maintenance position of azimuth (or elevation) DCPA MAINTENANCE/REMOTE switch.

Step 2 Setting the potentionmeter of DCPA to maximum (aprox. 10 V).

Step 3 The antenna driving velocity per certain period is measured and recorded by observing the Angle Indicator and Time-code Generator or stop-watch.

Acceleration

Step 1 Select Maintenance position of azimuth (or elevation) DCPA MAINTENANCE/REMOTE switch.

Step 2 Appying the ±5 Vp-p square wave form signal to the DCPA by means of function generator,the tachometer are measured and recorded by means of chart recorder.

DATE 25th Mar.,1986

Tested by

Minimum Speed

Step 1 Setting antenna system to Manual Position mode.

Step 2 Applying the triangle wave form signal(e.g.0.01 Hz,0.6 Vp-p) to SCA of TEST IN terminal by means of function generator.

Step 3 The response through the angle detector is measured and recorded by means of chart recorder.

5. Test Result

Azimuth

Maximum Velocity CW 0.31 deg./sec.

CCW 0.33 deg./sec.

Accelaration

CW 0.70 deg./sec.

CCW 0.50 deg./sec.

Refer to the Data Sheet-11.

Minimum Velocity Refer to the Data Sheet-12

Elevation

Maximum Velocity UP 0.27 deg./sec.

DOWN 0.27 deg./sec.

Accelaration

UP 0.43 deg./sec.

DOWN 0.54 deg./sec.

Refer to the Data Sheet-13

Minimum Velocity Refer to the Data Sheet-14

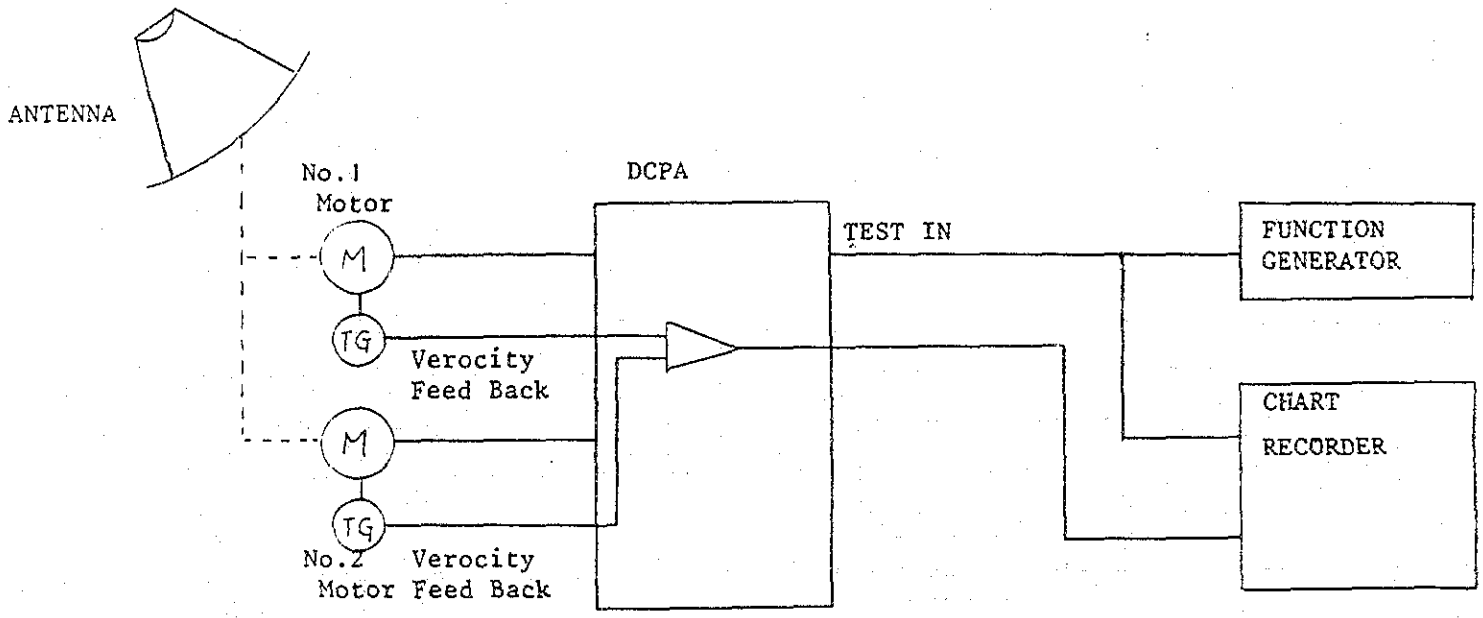


Fig.5 Velocity and Acceleration Connection Diagram

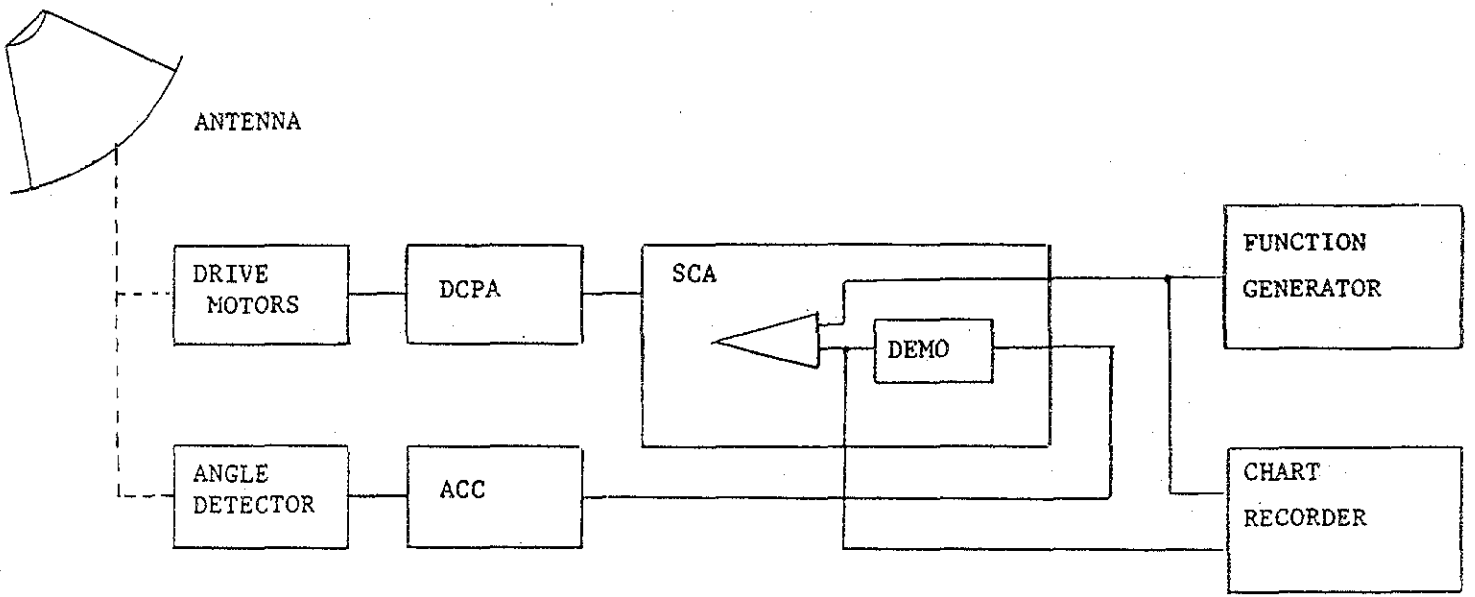


Fig. 6 Velocity and Accelaration Connection Diagram

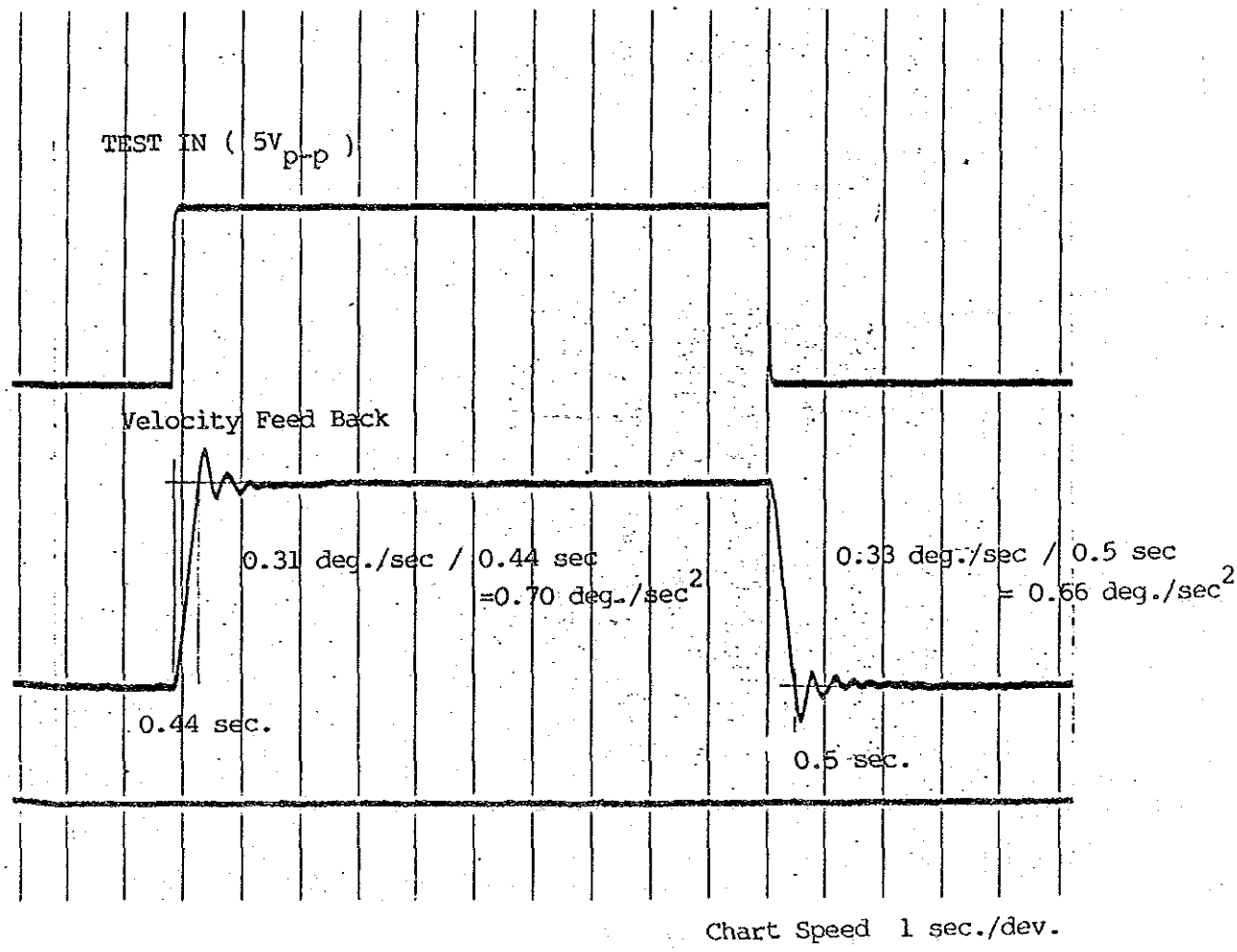
Data Sheet-11

DATE 25th Mar., 1986

Tested by

AZIMUTH ACCELARATION

AZ NO.2 DCPA Single Drive



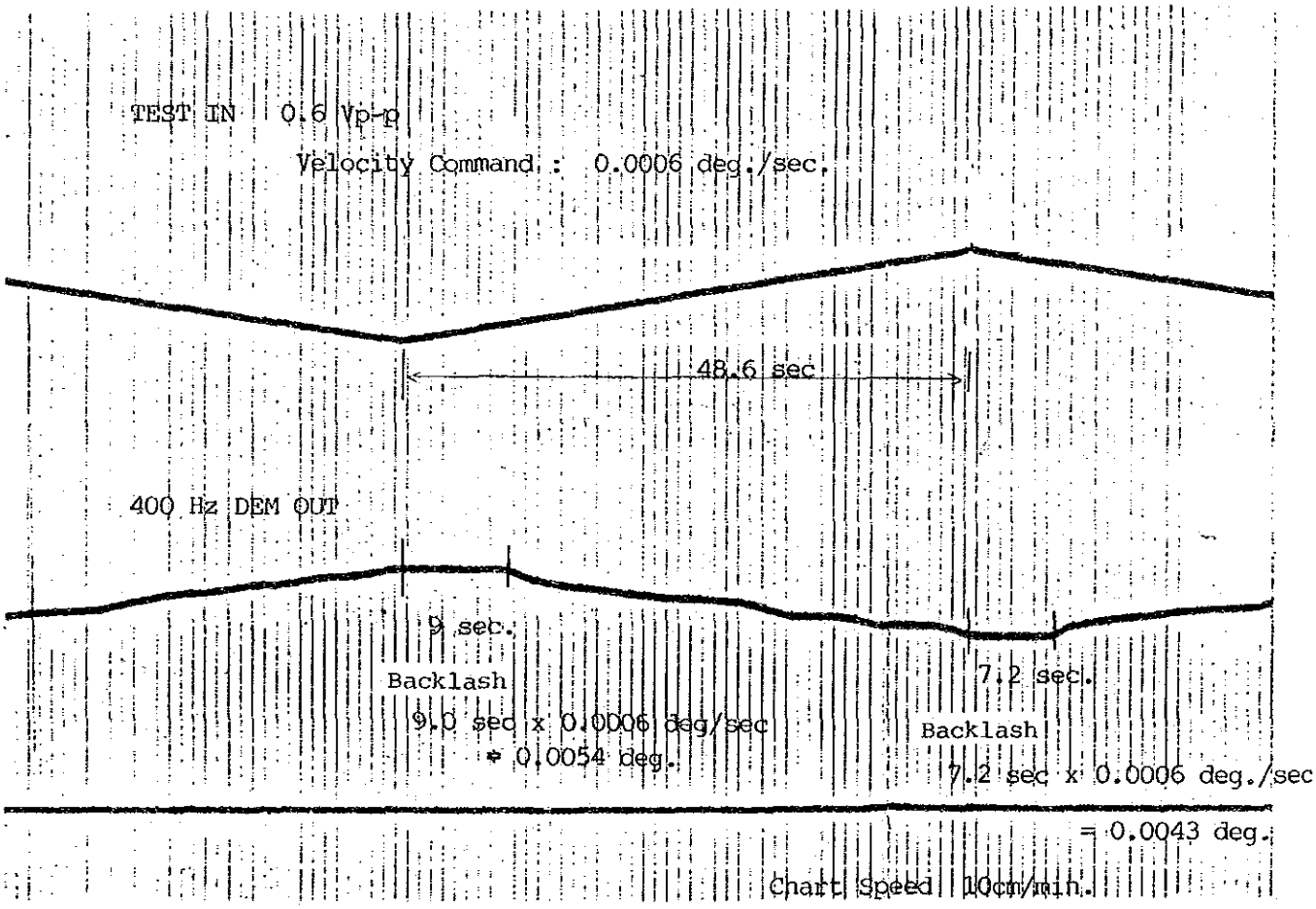
Data Sheet-12

DATE 25th Mar.,1986

Tested by

AZIMUTH MINIMUM VELOCITY

AZ No.2 DCPA Single Drive



Data Sheet-13

DATE 25th Mar.,1986

Tested by

ELEVATION ACCELARATION

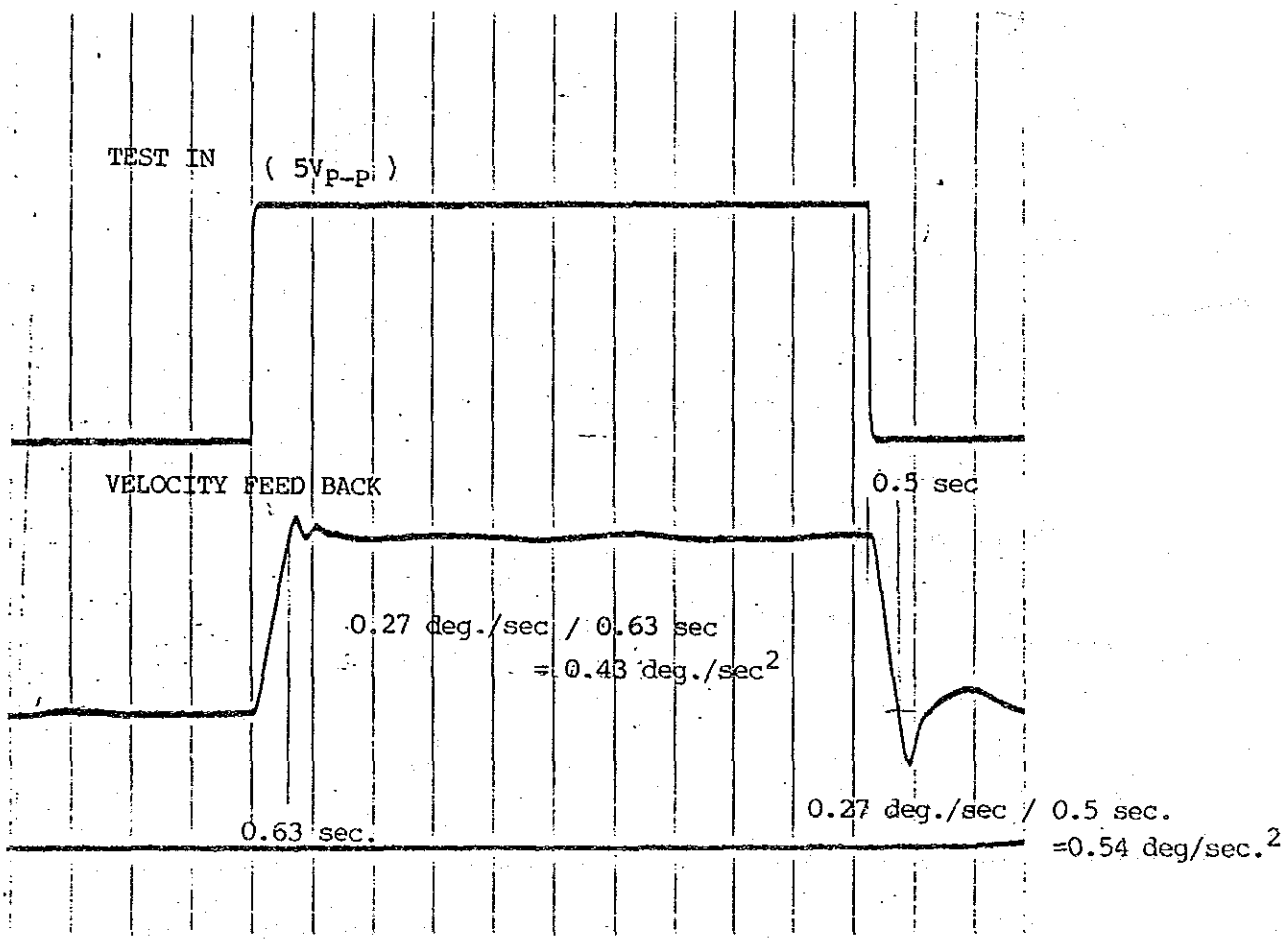


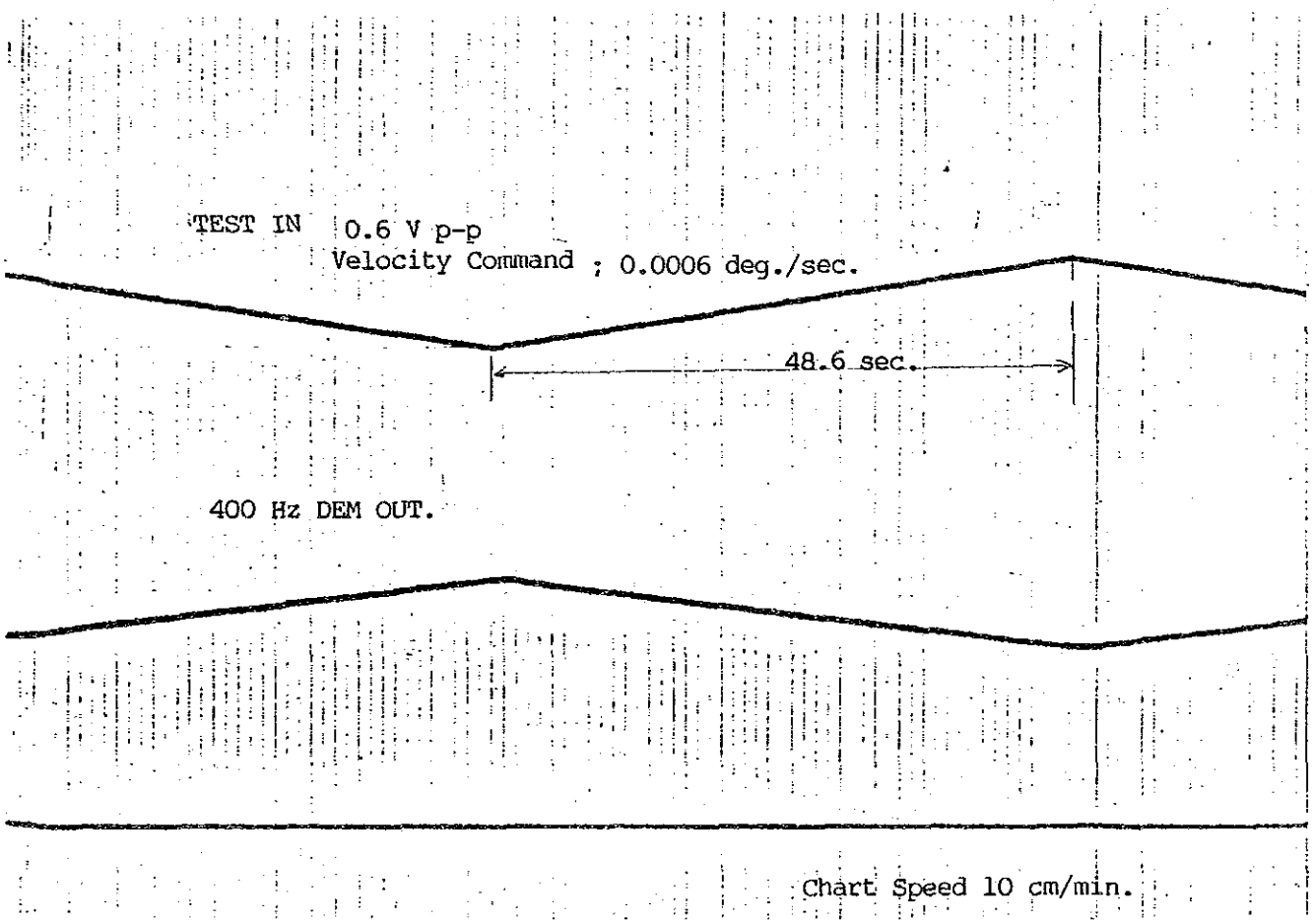
Chart Speed 1 sec./dev.

Data Sheet-14

DATE 25th Mar.,1986

Tested by

ELEVATION MINMUM VELOCITY



(7) DRIVE TEST

DATE 25th Mar., 1986

Tested by

1. Purpose of the test

To confirm that the antenna is able to be driven without any problem for wide angle range.

2. Test set-up

None

3. Test Equipment

None

4. Test Procedure

Step 1 Setting antenna system to Slew mode .

Step 2 Turning the slew mode volume to maximum, it is confirmed visually that all the drive mechanisms are smoothly driven while the antenna is travelling from 0° to 90 ° for EL angle and from -180 ° to +180 ° for AZ angle respectively.

5. Test Result

Azimuth

AZ Limit Switches and Cams are not operating normally .
Abnormal Sound on AZ Drive Mechanism .

Elevation

Good

(8) DEGRADATION OF DRIVE MOTOR

DATE 26th Mar.,1986

Tested by

1. Purpose of the test

To check the degradation of Azimuth and Elevation Drive Motor in the view of mechanical point.

2. Test set-up

None

3. Test Equipment

Insulation Tester YEW 3213 500V 1000MΩ Meggar

4. Test Procedure

Step 1 Opening the cover for commutator of drive motor,the wering of brushes,damage of commutator and apperance of sparks are checked visually.

STep 2 The insulation between rotator and stator of drive motor is checked by means of insulation tester .

Step 3 The insulation between rotator and ground ,stator and ground of drive motor are checked by means of insulation tester.

DATE 26th Mar.,1986

Tested by

5. Test Result

Azimuth No.1 Drive Motor

Appearance	Good
The wearing of brushes	Good
Damage of commutator	Threading
The classification of the Sparks	No sparks
Insulation Resistance between rotator and ground	35M Ω
Insulation Resistance between stator and ground	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between Tachogenerator and ground	More than 1000M Ω

Azimuth No.2 Drive Motor

Appearance	Good
The wearing of brushes	Good
Damage of commutator	Threading
The classification of the Sparks	No sparks
Insulation Resistance between rotator and ground	30M Ω
Insulation Resistance between stator and ground	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between Tachogenerator and ground	More than 1000M Ω

DATE 26th Mar.,1986

Tested by

Azimuth No.3 Drive Motor

Appearance	Good
The wearing of brushes	Good
Damage of commutator	Threading
The classification of the Sparks	No sparks
Insulation Resistance between rotator and ground	150M Ω
Insulation Resistance between stator and ground	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between Tachogenerator and ground	More than 1000M Ω

Azimuth No.4 Drive Motor

Appearance	Good
The wearing of brushes	Good
Damage of commutator	Threading
The classification of the Sparks	No sparks
Insulation Resistance between rotator and ground	100M Ω
Insulation Resistance between stator and ground	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between Tachogenerator and ground	More than 1000M Ω

DATE 26th Mar., 1986

Tested by

Elevation No.1 Drive Motor

Appearance	Good
The wearing of brushes	Good
Damage of commutator	None
The classification of the Sparks	No sparks
Insulation Resistance between rotator and ground	6M Ω
Insulation Resistance between stator and ground	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between Tachogenerator and ground	More than 1000M Ω

Elevation No.2 Drive Motor

Appearance	Good
The wearing of brushes	Good
Damage of commutator	None
The classification of the Sparks	No sparks
Insulation Resistance between rotator and ground	12M Ω
Insulation Resistance between stator and ground	More than 1000M Ω
Insulation Resistance between rotator and stator	More than 1000M Ω
Insulation Resistance between Tachogenerator and ground	More than 1000M Ω

(9) DEGRADATION OF ANGLE DETECTOR

DATE 26th Mar., 1986

Tested by

1. Purpose of the test

To check the degradation of angle detector due to utilization in many years.

2. Test set-up

None

3. Test Equipment

None

4. Test Procedure

Step 1 Open the cover of angle detector .

STep 2 It is confirmed visually that the mechanical degradation of angle detector are not discovered.

5. Test Result

Azimuth Angle Detector

Rusting	Slightly
Wiring (frayed,Loose and burnt wire)	None
Cracks	None
Backlash of gears	None
Parts (loose and burnt)	None
Fitting	Slight Eccentricity

DATE 26th Mar.,1986

Tested by

Elevation Angle Detector

Rusting	None
Wiring (frayed,Loose and burnt wire)	None
Cracks	None
Backlash of gears	None
Parts (loose and burnt)	None
Fitting	None

(10) CONTROL/MONITOR AND ALARM FUNCTION TEST DATE 26th Mar.,1986

Tested by

1. Purpose of the test

To confirm that the control,monitor and alarm function in antenna control console are operating normally.

2. Test set-up

None

3. Test Equipment

None

4. Test Procedure

Every volt/current meters,indicator lamps and control and alarm function of each equipment such as Operation Mode Select,Antenna Position Control, Alarm and Status, VCO Control etc are checked visually.

DATE 26th Mar.,1986

Tested by Mokio

5.Test Result

No.	INDICATIOIN	UNIT NAME	CONDITION	RESULT
1	AZ,EL ANGLE INDICATION	ANTENNA POSITION	Angle of AZ and EL of the antenna is indicated.	Refere Note-1
2	System Power ON/OFF	ALARM & STATUS	1. ACC Main power on/off 2. 400Hz PS power on/off 3. SCA A power on/off 4. SCA B power on/off 5. AZ Lubricating on/off 6. EL Lubricating on/off	Good
3	EL Stow		1. The stow pin is engaged 2. The stow pin is released	Good
4	DCPA		1. Normal 2. Maintenance 3. Failt	Good
5	Elevator		Fault	Good
6	SCA		1. On line 2. Standby 3. Maintenance 4. Fault	Good
7	Low EL Cut Off		EL angle is lower than 8 deg.	8 °
8	Lubricating		Out of order	—
9	Prelimit		The antenna reached pre limit Position	AZ CCW 93.93° CW 269.38° EL UP 88.1 ° DOWN 3.5°

DATE 26th Mar.,1986

Tested by

No.	INDICATIOIN	UNIT NAME	CONDITION	RESULT
10	Limit	ALARM & STATUS	The antenna reached limit position	AZ CCW 90.0 ° CW 269.38° EL UP 92.2 ° DOWN 0.08°
11	DISABLE		Manual Handle is pushed .	Good
12	400 Hz PS		1. Normal 2. Maintenance 3. Fault	Good
13	Cable Wrap-up	CABLE WRAP -UP	The angle indicator for twisted angle of cable.	Refer Note-2
14	AZ Velocity		AZ axis drive velocity	Good
15	EL Velocity		EL axis drive velocity	Good
16	Servo Bandwidth	ANTENNA POSITION CONTROL	Bandwidth selection of SCA NARROW,MEDIUM and WIDE	Good
17	Servo Type		Servo type selection of I or II	Good
18	Alarm/Enable	OPERATIONAL MODE SELECT	A time delay to warning for antenna tower.	Refer Note-3
19	Brake/Release		To be switched on even while test mode	Good
20	Test		Controlled by Antenna Local Control Unit	—

DATE 26th Mar.,1986

Tested by

No.	INDICATIOIN	UNIT NAME	CONDITION	RESULT
21	Auto Track	OPERATIONAL MODE SELECT	Auto tracking mode	Good
22	Manual Position		Manual Position mode	Good
23	Slew		Slew mode	Good
24	Manual Override		When manual override is off,even if Manual Position is selected while the auto enable is off. Auto enable is on,the tracking mode is changed to auto.	Good
25	AZ RF cut off		When the azimuth points to approx.±60° from true north.	Good
26	Down Converter	ALARM & STATUS	1. Normal 2. Maintenance 3. Fault	Good
27	Demodulator		1. Normal 2. Maintenance 3. Fault	Good
28	Console		1. Narmal 2. Fault	Good
29	Dry Air		Dehydrator fault	Good
30	Pressure		Pressure is lower than the specified value	—
31	Phase Adj	Tracking Angle Error	Adjuster for the reference channel signal.	Good

DATE 26th Mar.,1986

Tested by

No.	INDICATIOIN	UNIT NAME	CONDITION	RESULT
32	Gain Cont	Gain & Polarization Control	AGC: The agc of Demodulator is normal. MGC: Manual Gain Control	Good
33	AGC Time Constant		The agc time constant is changed by this switch.	Good
34	Phase-lock Loop Select	VCO CONTROL	1. Open Loop Manual 2. Closed loop Manual 3. Closed Loop Auto	Good
35	Auto Enable		A beacon signal of sufficient level is applied to the Tracking Receiver.	Good
36	Buzzer off	CONSOLE		Good
37	Lamp Check			Good

Note-1 Some delay between Angle Indicator and actual Antenna pointing angle.

Note-2 Some delay between Angle indicator and actual Cable Wrap-up Angle.

Note-3 Warning Audible Alarm for antenna tower dose not operate.

(11) MEASURED VALUE AT CHECK POINT

DATE 21st Mar.,1986

Tested by

EQUIPMENT TRACKING DEMODULATOR

Measured Point		Meter Range	Measured Value
Panel Name	Check Point		
31967B ALM CONT	AC 230 V	250 V	220 V
	DC - 24 V	50 V	- 24 V
	- 24 V	50 V	- 25 V
	+ 18 V	25 V	+ 18.0V
	- 18 V	25 V	- 18.0V
	+ 18 V CUR	2.5 A	+ 0.28A
	- 18 V CUR	2.5 A	+ 0.52A
30571A +18V STB	CHECK	25 V	18.0V
30572A -18V STB	CHECK	25 V	- 18.0V

DATE 21st Mar.,1986

Tested by Matsu

EQUIPMENT TRACKING DOWN CONVERTER

Measured Point			Meter Range	Measured Value
Panel Name	Check Point			
32770B ALM CONT	AC 230 V		250 V	220 V
	DC - 24 V		50 V	22 V
	STB - 18 V		25 V	18 V
	STB -18V Cur		2.5 A	1.2 A
	1st MIX CUR (REF CH)	FO 1	5	—
		FO 2	5	2.6
	1st MIX CUR (REF CH)	FO 1	5	—
		FO 2	5	2.5
	1st MIX CUR (ERR CH)	FO 1	5	—
		FO 2	5	2.5
	1st MIX CUR (ERR CH)	FO 1	5	—
		FO 2	5	2.9
	2nd MIX CUR (REF CH)		5	2.5
	2nd MIX CUR (REF CH)		5	1.0
	2nd MIX CUR (ERR CH)		5	3.2
	2nd MIX CUR (ERR CH)		5	3.1
10869B - 18V STB	- 18 V		25 V	18.0 V
	- 21 V		50 V	21.0 V

DATE 21st Mar.,1986

Tested by

EQUIPMENT SERVO CONTROL AMPLIFIER

1. A Route

Measured Point		Meter Range	Measured Value
Panel Name	Check Point		
32778A MAINT CONT	AC IN	250 V	225 V
	400Hz IN (A)	50 V	25 V
	400Hz IN (B)	50 V	24 V
	+ 24V	50 V	+ 26 V
	- 24V	50 V	- 24.5 V
	+ 18V	25 V	+ 18 V
	- 18V	25 V	- 18 V
	+ 18V Current	1 A	+ 0.29 A
	- 18V Current	1 A	- 0.22 A
30571A + 18V STB	CHECK	25 V	+ 18 V
30572A - 18V STB	CHECK	25 V	- 18 V

DATE 21st Mar.,1986

Tested by

EQUIPMENT SERVO CONTROL AMPLIFIER

2. B Route

Measured Point		Meter Range	Measured Value
Panel Name	Check Point		
32778A MAINT CONT	AC IN	250 V	225 V
	400Hz IN (A)	50 V	25 V
	400Hz IN (B)	50 V	24.5 V
	+ 24V	50 V	+ 26 V
	- 24V	50 V	- 24.5 V
	+ 18V	25 V	+ 18 V
	- 18V	25 V	- 18 V
	+ 18V Current	1 A	0.31 A
	- 18V Current	1 A	0.24 A
30571A + 18V STB	CHECK	25 V	+ 17.5 V
30572A - 18V STB	CHECK	25 V	- 18.0 V

ANNEX 4

List of Equipment to be Refurbished

1. Antenna Structure and Mechanical Drive System

No.	Item	5 years	10 years
1.	Subref. Support Structure	Whole Structure replace	Same as left
2.	Panel Support and Connection Bolt sets	-	All to be replaced
3.	Backup Structure	-	Repair Some Joint
4.	Connection bolts sets of Back up Structure and Center hub	-	100% of total Q'ty All to be replaced
5.	EL bearing	-	Oil seals to be replaced
6.	AZ/EL Bearing and Speed Reducers	To Grease and Oil	Same as left
7.	AZ/EL Speed Reducers	Brakes to be replaced	Same as left
8.	Others	Oil pump unit to be replaced	Same as left Buffers and Stow device to be replaced

2. Servo-Drive System

Item	For five years'	For ten years'
1. AZ Drive Motor	mending	replace
2. EL Drive Motor	cleaning	replace
3. DCPA	replace with new model	replace with new model
4. ACU	Supply some electrical parts for follow up servo	replace with new model *1
5. Servo Control Amp	readjustment	functions will be included to new ACU
6. Tracking DEM	-	replace with new model *2
7. Tracking D/C	-	replace with new model
8. 400 Hz Power Supply	-	Not used
9. AZ Angle Detector	readjustment	replace with new model
10. EL Angle Detector	-	replace with new model
11. AZ Limit Switches and cams	-	replace with new one
12. EL Limit Switches	-	replace with new one

Item	For five years'	For ten years'
13. Safety Switches (i) Main ref Hatch (ii) Stow pin Hole (iii) Manual Handle	replace with new ones	replace with new ones
14. Stow Lock Device	checking	replace with new one
15. Dehydrator	replace with new one	replace with new one
16. Others		
(1) Filter boxes	replace with new gasket	replace with new gasket
(2) Plica tube	replace with new one	replace with new one

*1: Component of new Antenna Control Console

(1) Antenna Control Panel
- digital angle display
- mode selection
- status indication
- servo cont Amp function

(2) Power Supply

(3) Time Code Generator

*2: New Tracking Demodulator will be installed in the ACU
The function of existing Tracking Angle Erro Panel and VCO Control Panel are included in the new Tracking Demodulator.

- : No work required

3. Communication Equipment

No.	Item		5 years	10 years
1.	High Power Amplifier		-	1 lot
(1)	400W TWT HPA	2 sets		
(2)	1+1 Switching Sys.	1 set		
(3)	Rack	1 set		
2.	Linearizer			
(1)	Linearizer	2 sets	-	1 lot

ANNEX 5

Rough Cost Estimations

The expected cost of renovation work can be estimated as follows.
(1U$=170 yen)

		5 years	10 years
1.	Antenna Structure	176,000 US$	388,000 US$
2.	Dehydrator	12,000	12,000
3.	Antenna Tracking System	-	94,000
4.	Antenna Control System	-	118,000
5.	Drive System	159,000	218,000
6.	HPA System (Including Linearizers)	-	294,000
7.	Antenna Construction/ Refurbishment Works	159,000	606,000
8.	Equipment Installation	141,000	182,000
9.	Testing	29,000	53,000
10.	Project Management	94,000	200,000
	Total	770,000 US$	2,165,000 US$