

ENGINEERING RESEARCH INSTITUTE
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Data Report

GYROSCOPE ASPECT
AIR FORCE AEROBEE AF-48
LAUNCHED: 14 July 1954, 0655 Hours

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ABSTRACT

The data presented in this report are the results of two instrumentations, each consisting of a single modified Bendix J-8 Attitude Gyroscope mounted in two trial positions. The application of the instrument to use in a missile requires an extensive modification and testing program, viz., the conventional "erector-mechanism" is removed, a suitable mass replaces it, and the entire instrument is balanced in such a way that the center of gravity coincides with the intersection of the two rotation axes. This erector mechanism, in the conventional use of the gyro in aircraft, maintains the axis of the gyrostator normal to the earth's surface.

Of the two instrumentations, one considered by this agency as the conventional unit, is called "Beta-gyro" to connote the position and the scale markings. The other mounting position, called the "Psi-gyro" was an experimental one and was thought to be less favorable to the instrument but more favorable to the data analysis. In the design of the aspect experiment, the Beta-gyro was the primary measure serving to evaluate the performance of the Psi-gyro. Missile evaluation was considered necessary, since the results of simulation tests for gravity effects in the laboratory were inconclusive.

EXPERIMENTAL OBJECTIVE

Aerobee AF-48, fired 14 July 1955, was used in this experiment in an attempt to evaluate the long-term stability of gyroscopes as related to their use as missile-aspect monitors. The data output from two gyroscopes carried by this missile are given in this report for the ultimate purpose of comparison with a conventional photographic aspect system.

REFERENCE FRAMES

The data contained in this report are given as the classical Eulerian Angles with the initial positions chosen by New Mexico A and M College in their aspect experiments. The coordinates are defined in their report as follows:

"Figure 1 demonstrates two right-handed...orthogonal coordinate systems. The reference coordinate system, $X^0Y^0Z^0$, has the origin at the base of the missile; the X^0Y^0 plane is parallel to a plane tangent to the earth at the sub-missile point. X^0 is positive west, Y^0 positive north, and Z^0 vertical.

The missile coordinate system, XYZ , has a common origin to $X^0Y^0Z^0$. Z represents the missile longitudinal axis, X an axis passing through the periphery of the missile in an eastward direction, Y northward. Initially the two systems will be coincident. Any unique orientation of the missile can be described by the three successive counterclockwise angles of rotation (Θ , Φ , Ψ) about specified axes.

Figure 1 represents a missile rotation about the Z axis, displacing X from X^0 by an angle Φ . Figure 2 demonstrates a rotation about the Y axis displacing Z from Z^0 by an angle Θ , the zenith angle. It is seen that X is also displaced from the X^0Y^0 . Φ is thus seen to be the 'heading' or azimuth angle, measured counterclockwise from east. Figure 3 shows a rotation about the Z axis displacing Y from K , the line of intersection of the two planes through Ψ , the 'swivel roll' angle. Thus the three Eulerian angles are demonstrated."

The times given in the report are derived from a calibrated "Counter Clock". This consists of a numerical display system driven by a d-c, governed motor, photographed simultaneously with the gyroscopes. In addition, two timing pulses generated by the telemetry commintator were displayed by two glow lamps in the photo field. These timing pulses, called "half-second-light" and "twelve-second'light", are not to be construed as accurate time bases, but rather as reference marks occurring at a somewhat uniform rate and intended for use in correlating concurrent experiments in the missile. The period between pulses approximates one and one-half seconds and fourteen seconds, respectively. The pulse's presence is indicated by an "x" in the tabular data.

Time is not given for every set of data in the table; however, the counter-clock values are and can be converted into time-after-take-off through the relationship

$$\text{time(sec)} = \frac{\text{Counter Clock number} - 78895}{10.89}$$

EXPERIMENTAL RESULTS

Unfortunately, through an oversight at the last instrument check prior to fueling, a rubber gasket fell against the Beta-gyrostatt in a manner suggesting intermittent contact. The recording camera observed such proximity with the gyrostatt until the time of burn-out (34 seconds), when the interfering gasket left the camera field, allowing the gyro to perform freely. With such a constraint the Beta-gyro could precess; however, an examination of the record in terms of the ψ -gyro indicates the precession to be small due to the constraint. A qualifying remark in regards to ψ -gyro data validity is necessary, since the examination of the recovery instrumentation indicated that the fuse in the ψ -gyro power supply opened during the sampling time or at impact. Physical evidence in addition to the instrument's behavior after x-plus-three-minutes suggests that the fuse failed at take-off, leaving the ψ -gyro without power during the flight. Laboratory observations indicate that such a gyro should perform satisfactorily for approximately 140 seconds in a missile. The total precession at that time should not exceed 3° in any given angle. At times greater than 140 seconds the gyrostatt will have lost so much of its angular momentum as to make the instrument unreliable after 180 seconds. Under these circumstances, where both gyroscopes are suspect, no calculation could be made for the upper bound of the Θ -angle error or the ψ -angle error for values presented in this tabulation. It will be evident that the Φ angle is left undefined; this follows, since its value depends on the Θ - and ψ -angles in a manner requiring precision in these angles for good values of Φ . It was decided to leave the Φ -angle undefined rather than give meaningless values.

CONCLUSIONS

Results derived from this experiment must be considered inconclusive in the light of the malfunctions encountered; however, the data agreement between the ψ -gyro and β -gyro is more than reasonable after making corrections for aberrations of the respective instruments. The agreement is enough to suggest another experiment having only the ψ -gyro for comparison with the photographic aspect system. The long-time stability of the gyroscopes is still undetermined and, as such, should be a major topic in any subsequent experiment. Such an experiment should involve a maximum altitude of over 60 miles and be compared with an aspect system for times of approximately x plus 240 seconds. Use of the ψ -gyro is desirable in aspect applications because of the extensive reduction in data analysis and subsequent relaxation of mechanical specifications imposed in building and testing such gyroscopes.

FIG. 1

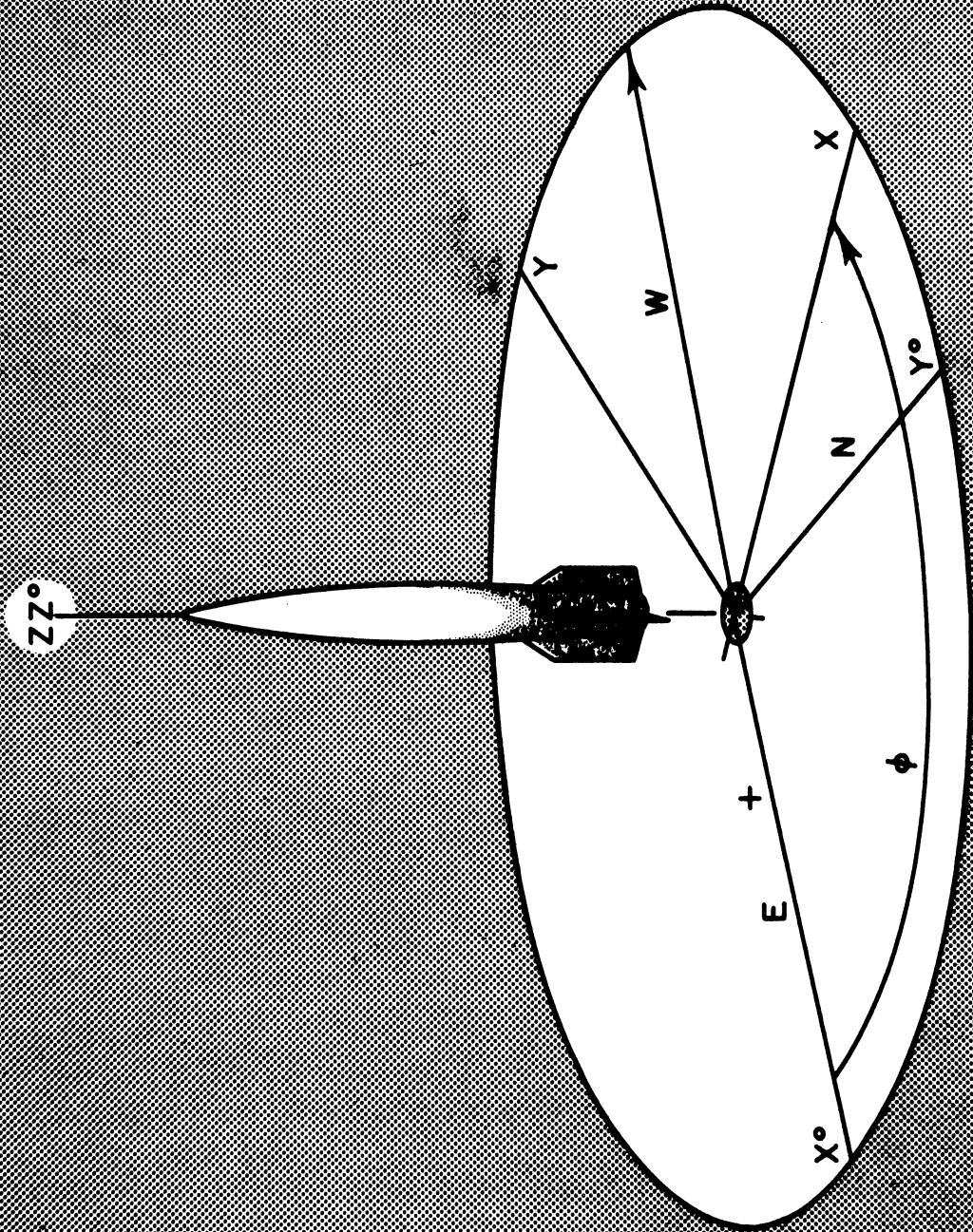


FIG. 2

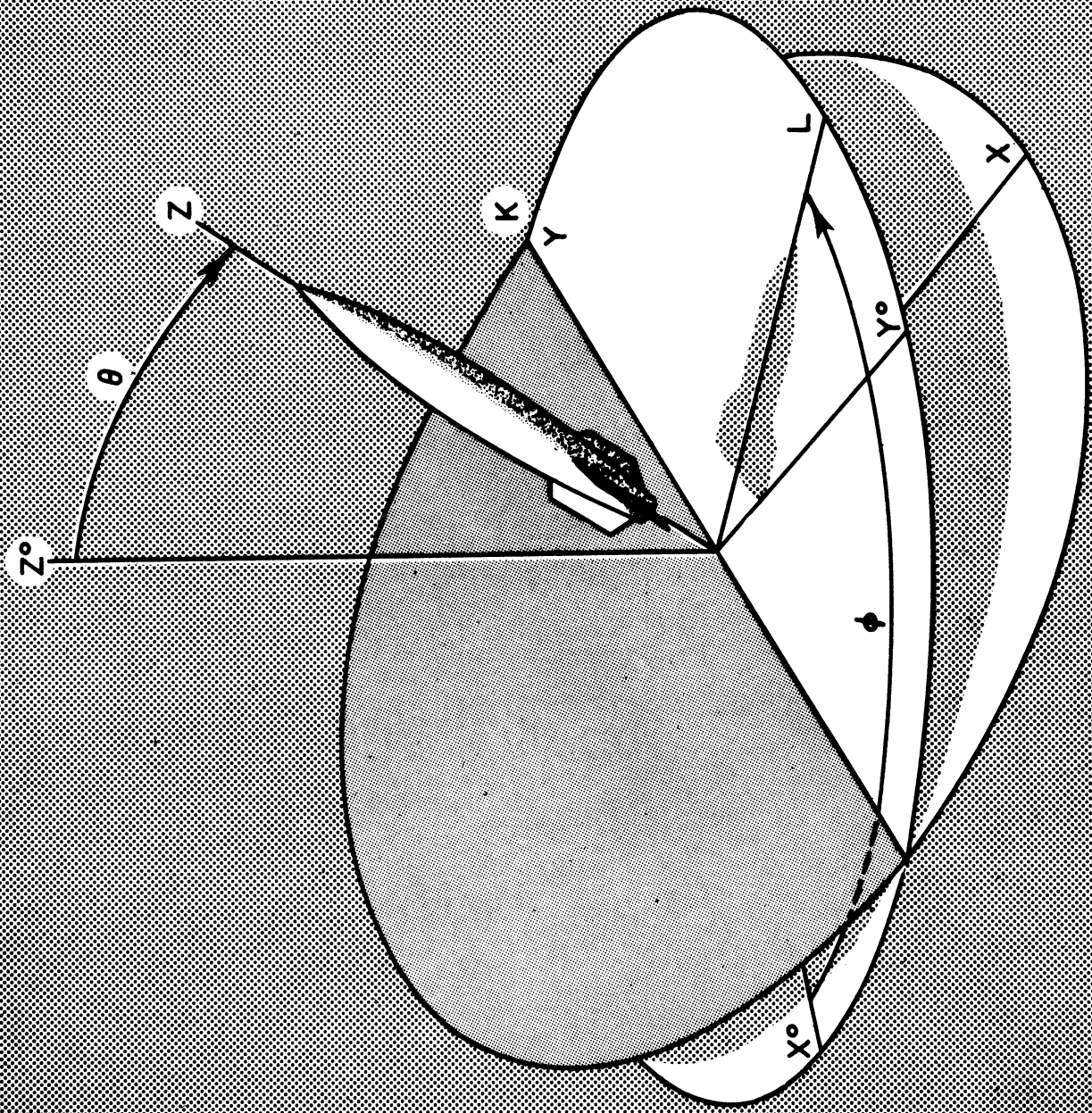
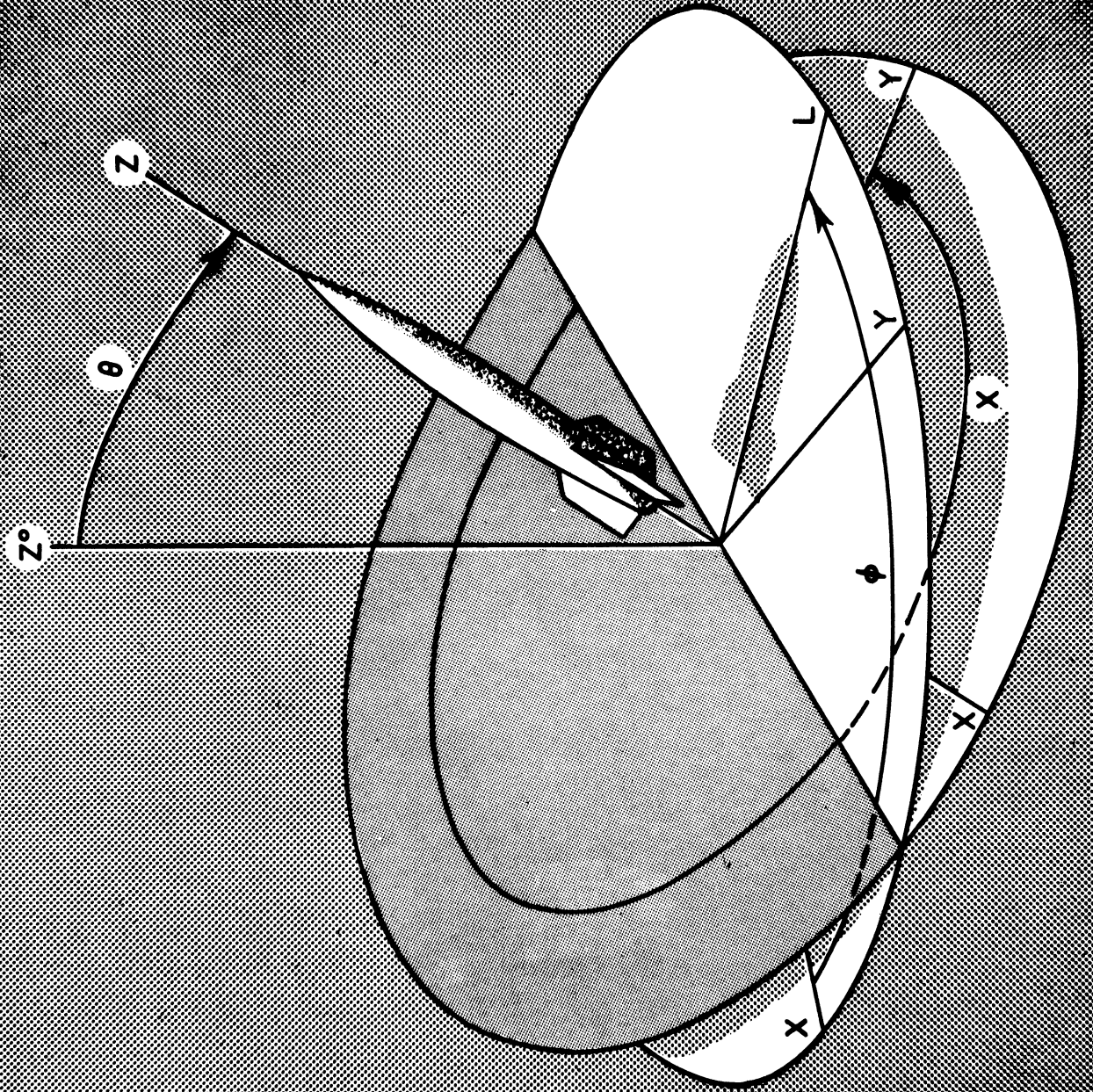
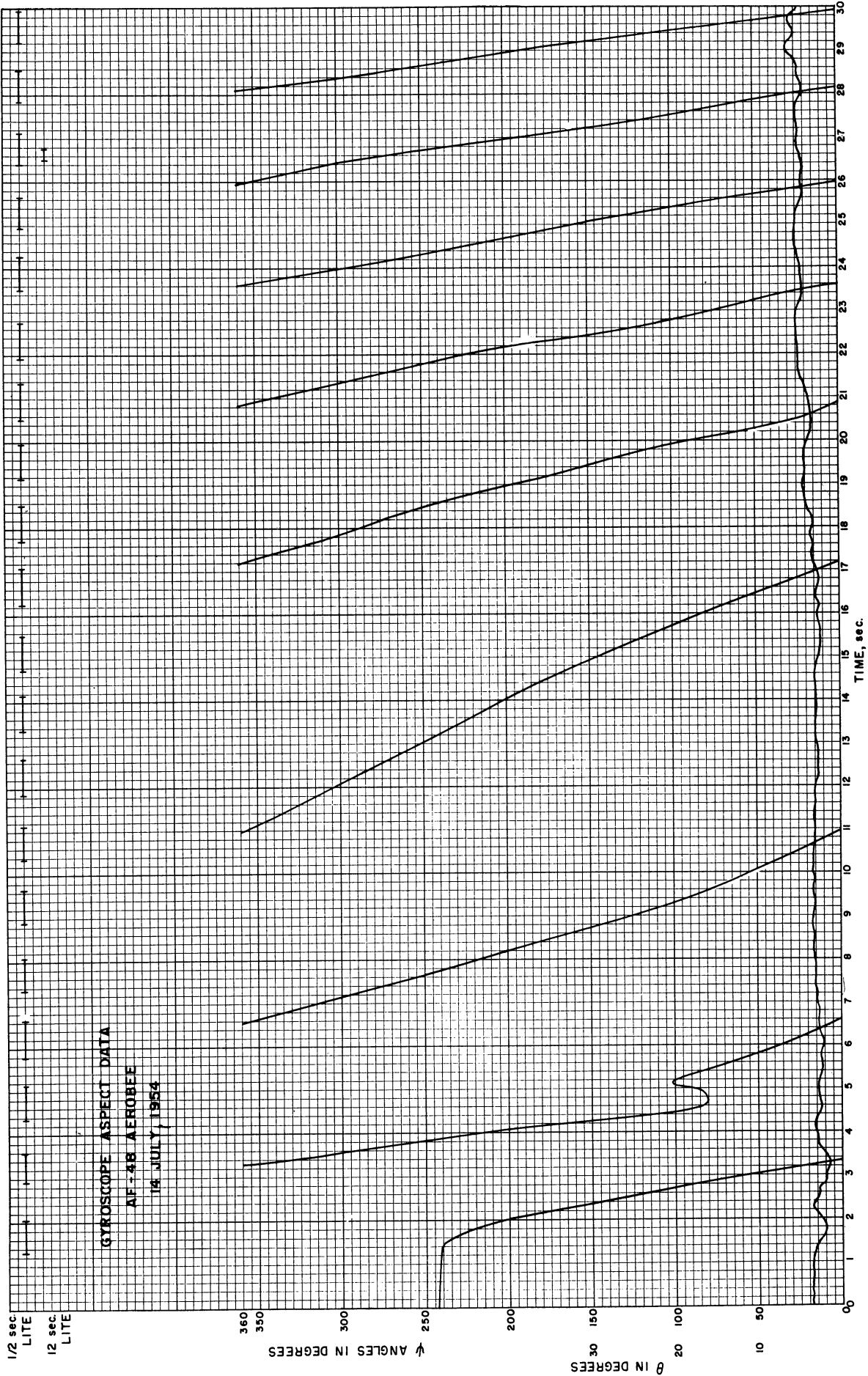
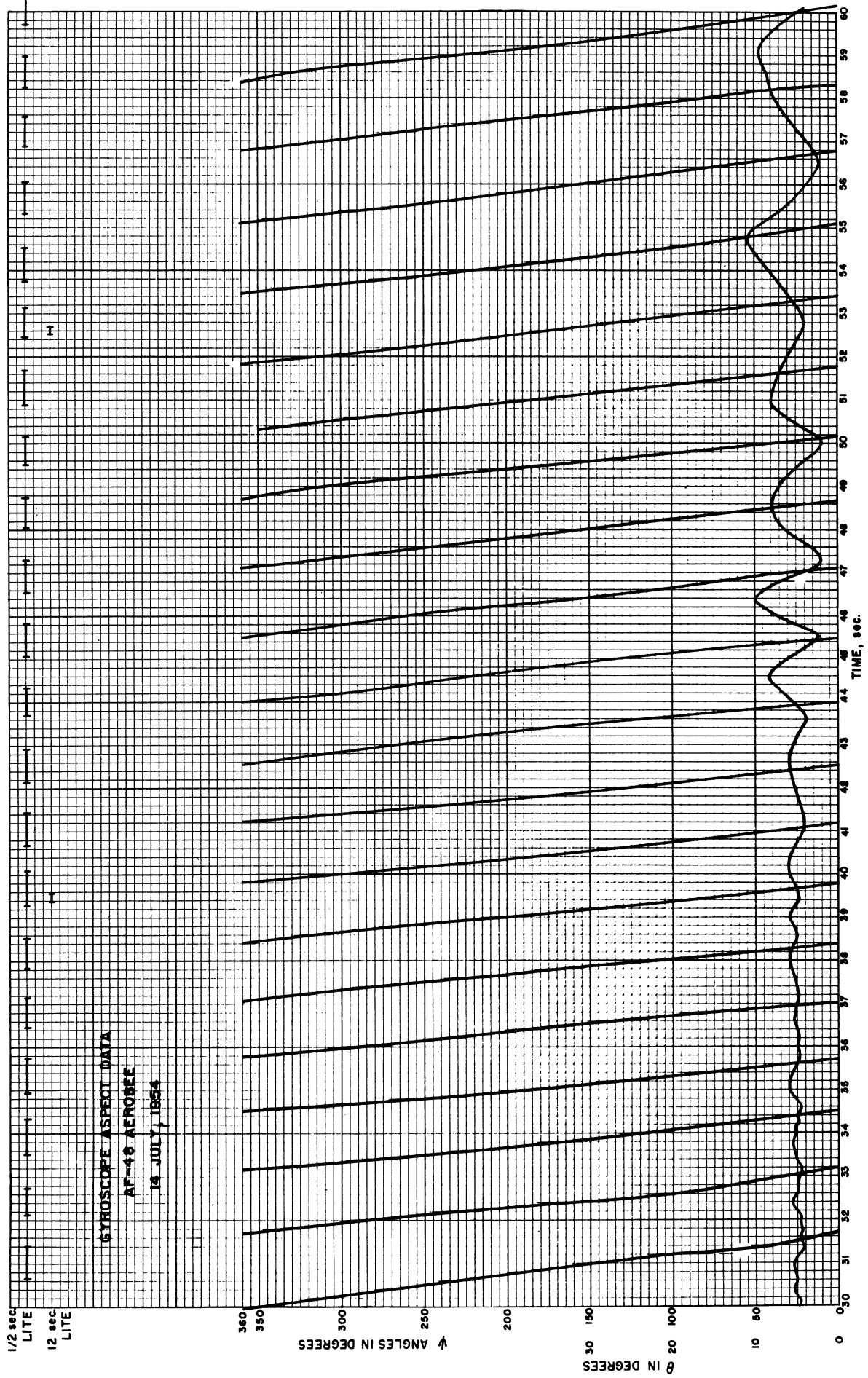


FIG. 3







1/2 sec
LITE

12 sec
LITE

GYROSCOPE ASPECT DATA

AF-48 AEROBEE

16 JULY, 1954

360

350

ψ ANGLES IN DEGREES

θ IN DEGREES

200

150

100

50

0

TIME, sec.

90

89

88

87

86

85

84

83

82

81

80

79

78

77

76

75

74

73

72

71

70

69

68

67

66

65

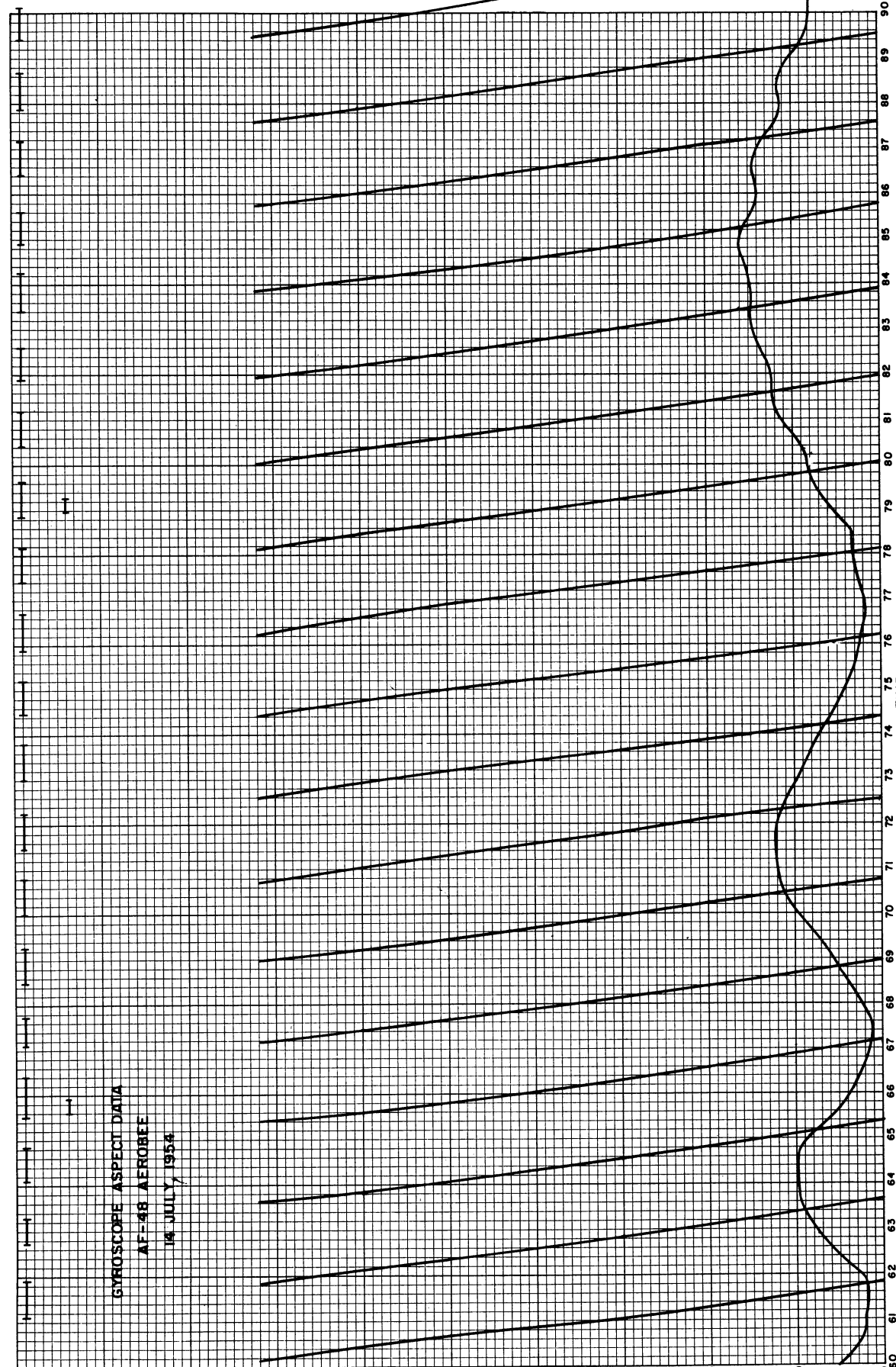
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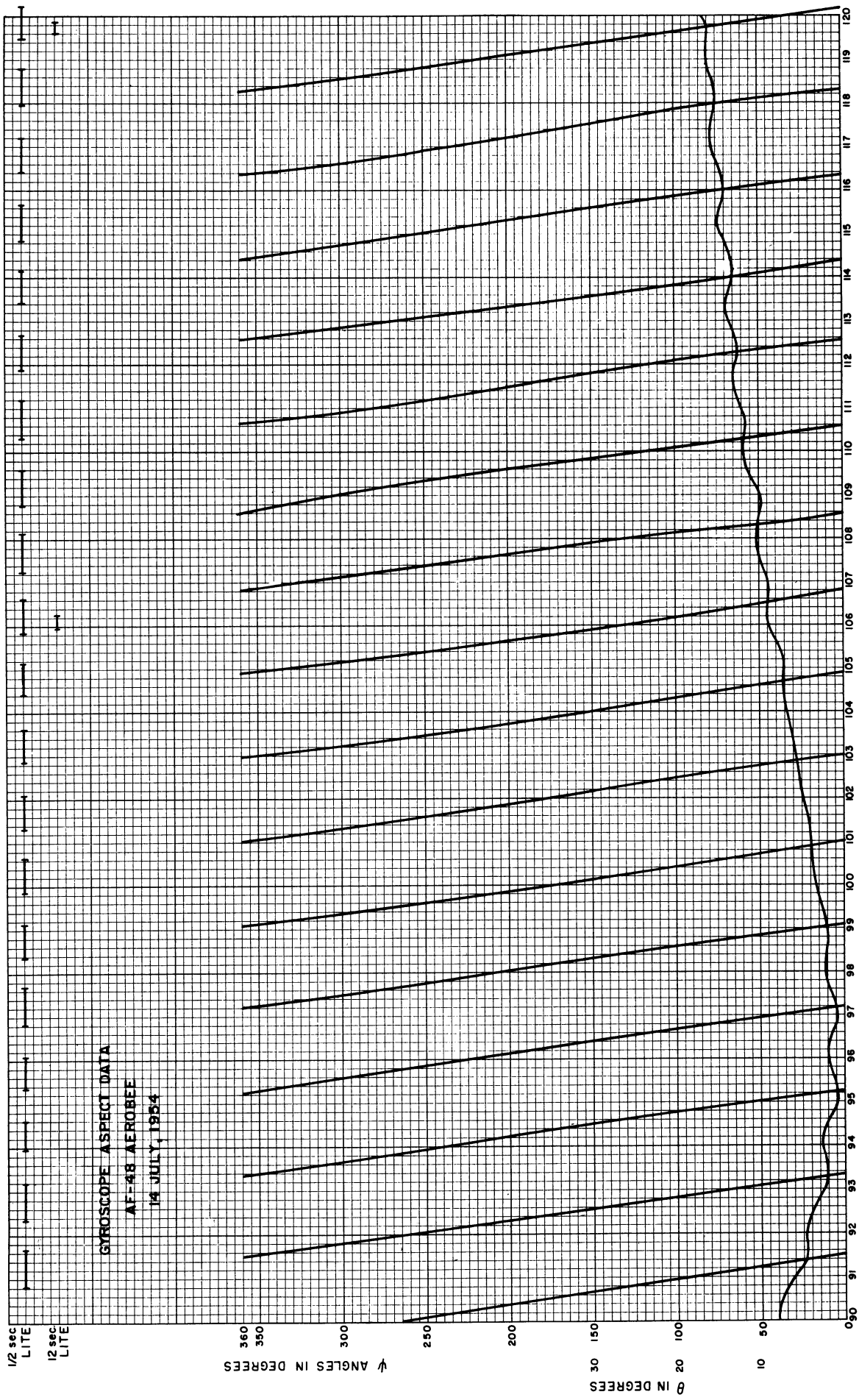
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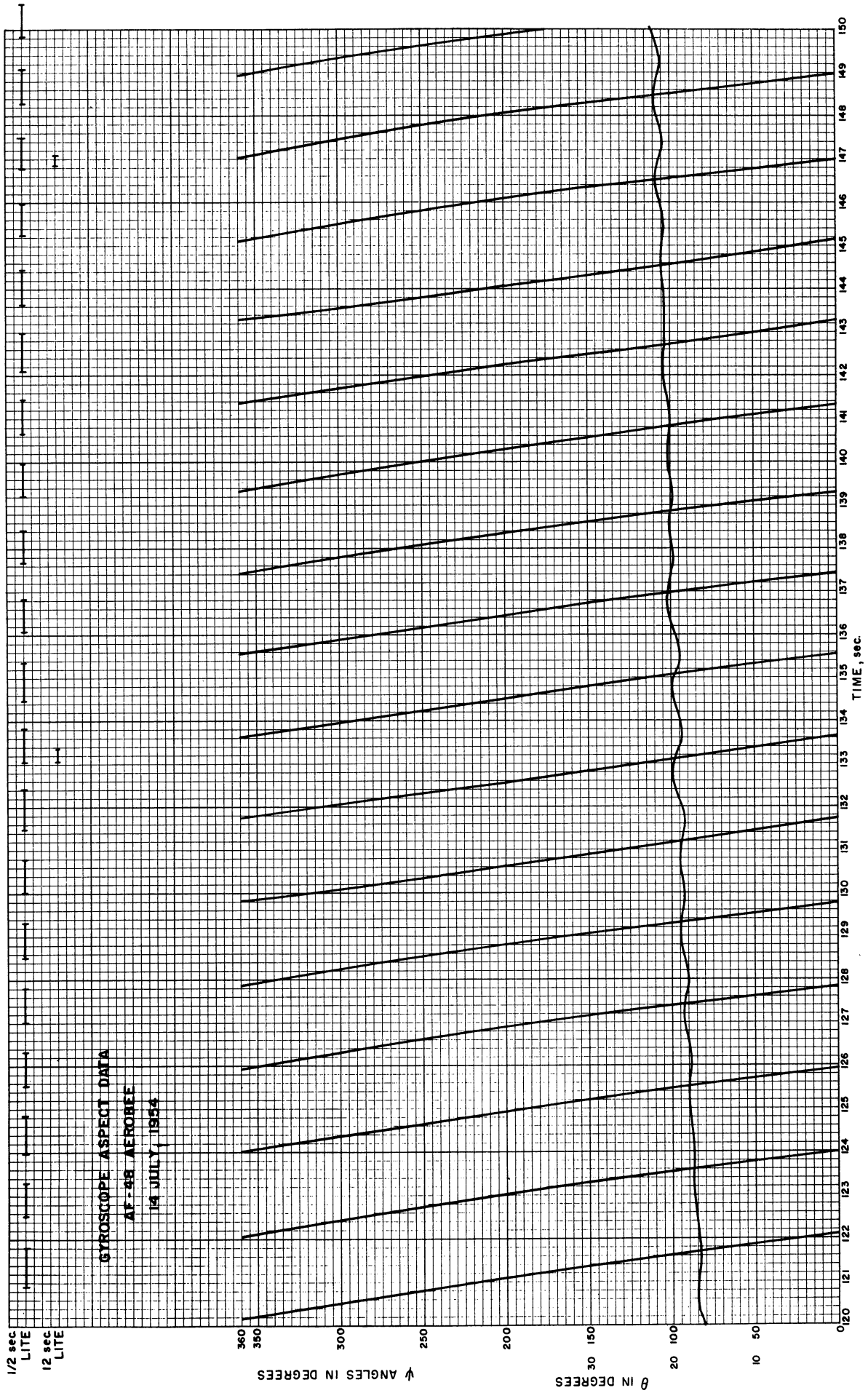
62

61

60







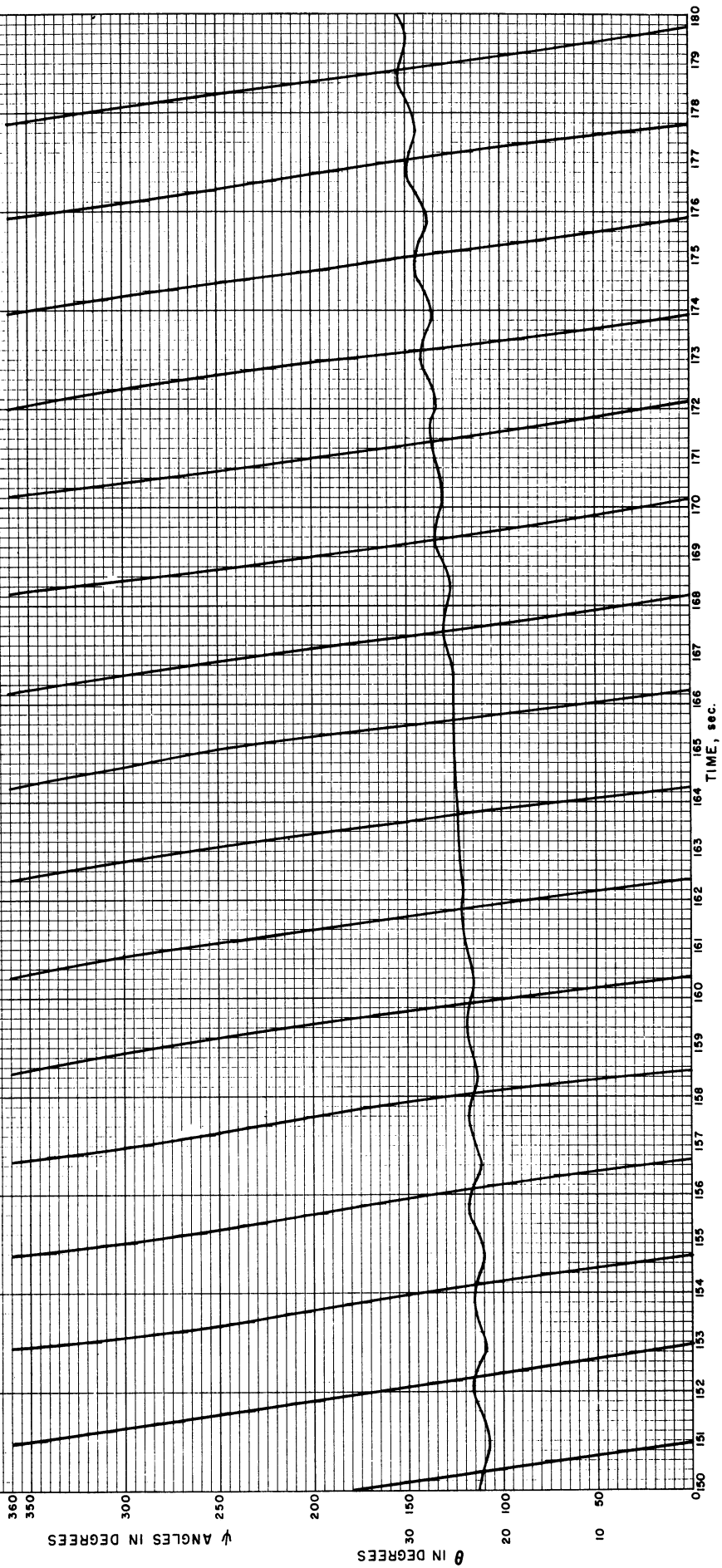
1/2 sec
LITE

12 sec
LITE

GYROSCOPE ASPECT DATA

AF-48 AEROBEE

14 JULY, 1954



Holloman Aerobee AF-48
 GYROSCOPE ASPECT DATA

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
78891				3.5	
2			x	3.5	
3			x	3.5	
4		x	x	3.5	
5	0	x	x	3.5	243.5
6	0.09	x	x	3.5	243.8
7		x	x	3.7	243.6
8	.32	x	x	3.0	242.7
9		x	x	3.4	243.8
78901	.55	x	x	3.7	242.8
1/2		x	x	3.5	242.8
2				3.6	244.1
3	0.73			3.4	243.5
5				3.6	241.7
6	1.01			3.1	240.5
7				3.2	241.6
8	1.19			3.1	241.7
9				3.0	242.3
78910	1.38		x	3.0	241.3
1			x	2.7	238.5
2	1.56		x	2.3	235.3
3			x	2.3	230.4
4			x	2.2	224.5
5	1.84		x	2.4	217.5
6			x	2.4	210.3
7	2.02		x	2.7	201.4
9				3.4	181.5
78920				3.4	167.5
1	2.39			3.1	153.7
2				2.8	139.2
3	2.62			2.7	123.8
5				2.2	107.5
6				2.0	91.5
7	2.94		x	2.0	74.7
8			x	1.8	58.7
9	3.12		x	1.7	41.3
78930			x	1.6	24.3
1	3.31		x	1.7	5.6
2	3.40		x	1.4	345.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
78933			x	2.0	324.7
4	3.58		x	2.2	303.5
5				2.7	285.5
6	3.76			2.8	266.3
7				2.7	246.6
8	3.95			2.9	227.7
9				3.1	209.2
78940	4.13			3.1	186.3
1				3.1	160.0
2	4.32		x	3.0	135.6
3			x	2.9	113.5
4	4.50		x	2.5	95.5
5	4.59		x	2.4	85.0
7	4.77		x	2.5	81.8
8			x	2.6	83.8
9	4.96		x	2.4	87.5
78950	5.05		x	2.4	91.6
1	5.14		x	2.4	101.5
2				2.4	101.5
3	5.32			2.4	91.5
4				2.4	86.5
5	5.51			2.4	79.5
6				2.4	71.5
7	5.69			2.4	64.3
8				2.2	56.5
9	5.88		x	2.2	48.5
78960			x	2.2	40.5
1	6.10		x	2.2	32.2
2			x	2.3	24.5
3			x	2.5	15.5
5	6.43		x	2.5	7.3
6			x	2.5	358.1
7	6.61		x	2.5	349.3
8				2.5	340.3
9	6.79			2.4	331.6
78970				2.4	323.3
1	6.98			2.7	314.3
2				2.7	305.1
3	7.16			2.7	296.6
4				2.7	288.1

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
78975	7.34		x	2.9	279.1
6			x	3.0	270.3
7	7.53		x	3.0	262.3
8			x	3.0	254.5
9	7.76		x	3.0	246.1
78980			x	3.0	237.5
1	7.94		x	3.0	229.5
2			x	3.2	221.0
3	8.09		x	3.2	211.9
5				3.2	203.0
6	8.35			3.2	193.7
7				3.2	183.5
8	8.54			3.2	173.3
9				3.1	163.5
78990	8.72			3.1	154.5
1				3.1	144.6
2	8.90		x	3.1	134.7
3			x	3.0	126.5
4	9.01		x	3.0	118.9
5			x	3.0	111.2
6	9.32		x	3.0	103.3
7			x	3.0	96.4
8	9.46		x	3.3	90.0
9			x	3.3	83.5
79000	9.64		x	3.2	76.5
1				3.1	70.5
2	9.87			3.1	64.8
3				3.3	59.5
5	10.10			3.3	53.5
6				3.3	47.5
7	10.28			3.3	52.1
8	10.37		x	3.3	36.3
9			x	3.3	30.8
79010	10.56		x	3.3	25.5
1			x	3.2	19.5
2	10.74		x	3.2	14.0
3			x	3.2	8.5
4	10.92		x	3.2	3.0
5			x	3.2	357.1

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79016	11.11		x	3.2	352.0
7				3.2	345.6
8	11.29			3.1	340.5
9				3.1	335.3
79020				3.1	329.8
2	11.66			3.1	324.3
3				3.0	318.6
4	11.84		x	3.0	313.6
5			x	3.0	309.1
6	12.02		x	3.0	303.3
7			x	2.8	298.3
8	12.20		x	2.5	293.5
9			x	2.5	288.1
79030	12.39		x	2.5	283.3
1	12.53		x	2.5	279.0
2			x	2.5	274.3
3	12.67		x	2.5	269.3
4				2.5	264.3
5	12.85			2.6	259.8
6				2.8	255.3
7	13.08			2.9	250.8
9				2.9	246.1
79040	13.31	x	x	3.0	237.5
2		x	x	3.0	232.7
3	13.59	x	x	3.0	217.7
4		x	x	2.8	223.2
5	13.77	x	x	2.8	218.5
6			x	2.9	213.5
7	13.95		x	2.9	208.5
8			x	2.9	203.5
9	14.14		x	2.9	198.5
79050				3.0	193.2
1	14.37			3.0	187.5
2				3.0	181.5
3				3.0	176.1
4	14.64			2.8	170.2
5				2.8	163.5
6	14.78		x	2.7	158.5
7			x	2.5	152.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79058	14.96		x	2.4	146.3
79060			x	2.4	140.3
1	15.24		x	2.5	132.5
2			x	2.5	126.5
3	15.42		x	2.5	120.7
4			x	2.4	114.7
5	15.61		x	2.4	108.3
6				2.5	102.2
7	15.79			2.8	95.5
8				2.7	89.5
9	16.02			2.5	83.5
79070				2.4	76.9
1				2.4	71.5
2	16.25		x	2.8	64.7
3			x	2.8	58.7
4	16.43		x	2.7	52.3
6			x	2.6	45.5
7	16.71		x	2.6	38.7
8			x	2.5	32.1
9	16.89		x	2.5	25.5
79080			x	2.5	18.3
1	17.08		x	2.7	10.2
2	17.17			2.9	2.5
3				3.0	355.0
4	17.35			3.0	346.3
5				2.8	338.3
6	17.58			2.9	329.6
7				3.0	321.5
8	17.72		x	3.2	313.3
9			x	3.3	304.5
79090			x	3.1	295.6
1	17.99		x	3.0	287.6
2			x	3.1	279.3
4	18.27		x	3.6	270.3
5			x	3.8	261.6
6			x	3.9	253.5
7	18.54		x	3.9	246.3
8				3.9	236.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79099	18.73			3.9	228.0
79100				4.1	218.8
1	18.91			4.1	210.0
2				4.1	199.8
3				4.1	190.5
4	19.19		x	3.9	180.5
5			x	3.9	170.5
6	19.42		x	3.9	160.0
7			x	4.0	148.3
8	19.60		x	4.0	138.0
9			x	3.9	126.5
79111			x	3.9	115.5
2	19.92		x	3.8	104.9
3				3.8	94.5
4	20.10			3.5	84.0
5				3.5	73.5
6	20.29			3.3	63.3
7				3.2	53.5
8	20.47			3.2	42.7
9				3.2	32.0
79120	20.56		x	3.4	21.2
1	20.75		x	3.4	9.5
2	20.84		x	3.5	357.8
3			x	3.5	345.6
4	21.02		x	3.6	333.3
5	21.16		x	3.6	321.5
6			x	3.8	308.8
8	21.39		x	3.9	296.6
9				4.0	284.8
79130	21.57			4.2	272.6
1				4.2	261.3
2	21.76			4.4	249.3
3				4.6	239.8
4	21.94		x	4.7	227.0
5			x	4.7	215.5
6			x	4.8	202.5
7	22.22		x	4.8	190.0
8			x	4.9	177.0
9	22.44		x	4.8	163.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79140			x	4.8	149.5
1	22.58		x	4.8	135.7
2			x	4.9	123.0
3	22.77		x	4.9	109.5
5				4.7	95.5
6	23.04			4.6	83.0
7				4.3	70.7
8	23.22			4.2	58.5
9	23.32			4.2	44.8
79150				4.2	33.2
1	23.50		x	4.2	20.5
2	23.59		x	4.1	7.0
3			x	4.1	350.5
4			x	4.3	336.9
5	23.87		x	4.3	321.5
6			x	4.3	306.8
7	24.05		x	4.3	292.3
8			x	4.3	277.8
9	24.24		x	4.6	264.6
79160				4.8	251.3
1				4.9	236.8
2	24.56			5.0	223.5
4				5.0	210.3
5	24.79			4.9	195.5
6				4.9	180.0
7	24.97		x	4.9	164.3
8			x	4.9	149.0
9	25.15		x	4.9	132.5
79170			x	4.8	116.0
1	25.34		x	4.6	101.0
2			x	4.4	86.3
3			x	4.1	73.0
4	25.61		x	4.0	57.8
5				4.0	42.5
6				4.0	28.5
7	25.89			4.1	13.0
8				4.1	355.9
9	26.07			4.2	339.3
79180				4.0	322.8

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79182				3.9	306.3
3	26.44	x	x	3.9	289.2
4		x	x	4.1	272.8
5		x	x	4.5	257.9
6	26.71	x	x	4.6	242.5
7			x	4.6	227.0
8	26.90		x	4.5	211.0
9			x	4.4	195.0
79190	27.08		x	4.4	177.5
1				4.6	159.5
2	27.26			4.8	141.5
3				4.7	123.5
4	27.44			4.6	106.0
6				4.5	88.5
7				4.4	72.3
8	27.82		x	4.3	56.5
9			x	4.2	40.3
79200			x	4.1	22.7
1	28.090		x	4.0	5.3
2	28.183		x	4.0	346.8
3			x	4.3	328.3
4	28.37		x	4.6	308.3
5			x	4.8	289.2
6	28.55		x	4.8	271.1
7				4.6	253.5
8	28.73			4.8	235.8
9				5.1	218.0
79210	28.96			5.8	200.0
1				6.1	180.7
3				5.9	160.5
4	29.28		x	5.0	139.7
5			x	4.9	119.5
6	29.47		x	4.9	100.0
7			x	5.2	80.0
8	29.60		x	5.6	61.3
9			x	5.6	43.3
79220			x	4.6	24.0
1	29.93		x	4.7	2.2
2	30.02			4.0	340.8

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79223				4.5	318.5
4	30.25			4.9	296.4
6				5.3	275.3
7	30.48			5.1	254.5
8				5.1	236.5
9	30.66		x	5.1	217.0
79230			x	5.1	195.5
1			x	5.4	173.0
2	30.94		x	5.4	150.7
3			x	5.2	128.5
4	31.12		x	4.9	104.8
5			x	4.6	83.7
6			x	4.2	64.5
7	31.40		x	4.3	42.5
8	31.58			4.5	20.5
9	31.67			4.5	357.3
79240				4.5	335.3
2	31.05			4.6	310.8
3				4.6	285.3
4				4.6	262.0
5	32.13		x	4.8	242.3
6			x	5.1	219.5
7	32.31		x	5.6	195.3
8			x	5.6	170.5
9	32.54		x	5.1	146.0
79250			x	4.9	120.7
1			x	4.8	95.5
2	32.77		x	4.8	71.5
3				4.9	51.3
4				4.9	25.5
6	33.14			4.5	358.1
7				4.5	334.8
8	33.32			4.7	305.7
9				4.9	279.7
79260	33.51		x	5.1	253.3
1			x	5.3	230.1
2			x	5.5	206.0
3	33.78		x	5.3	177.7
4			x	5.3	149.0

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79265	33.97		x	5.2	120.7
6			x	5.2	94.5
7			x	5.0	68.5
9	34.33		x	4.9	41.3
79270	34.42			4.9	13.4
1	34.52			4.6	345.3
2				4.5	316.6
3	34.70			4.9	285.5
4				4.9	258.3
5				5.5	234.3
6	34.98		x	6.0	207.3
7			x	6.0	177.3
8	35.20		x	5.9	147.5
79280			x	5.5	119.5
1	35.43		x	5.2	91.5
2			x	5.0	64.0
3			x	4.9	38.0
4	35.71		x	4.8	11.5
5	35.80			4.7	343.3
6				4.8	312.5
7	36.08			5.0	284.3
8				5.5	259.1
9	36.17			5.9	233.7
79291				6.0	206.5
2	36.44		x	6.0	178.3
3			x	5.9	150.0
4			x	5.8	121.5
5	36.72		x	5.4	92.5
6			x	5.1	66.0
7			x	5.1	41.4
8	37.00		x	5.1	14.0
79300	37.18		x	5.1	344.3
1				5.1	315.3
2				5.0	288.0
3	37.45			5.1	260.3
4				5.1	233.8
5	37.64			5.5	208.0
6				5.6	181.2
7	37.82		x	5.7	151.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79308			x	5.9	121.5
9			x	5.9	94.0
79311	38.19		x	5.8	68.5
2			x	5.6	42.5
3	38.37		x	5.1	15.5
4			x	4.9	346.3
5	38.56		x	5.0	318.3
6				5.1	289.8
7	38.74			5.4	262.1
8				5.8	236.1
9	38.92			5.9	211.5
79321				5.9	184.8
2				5.7	154.8
3	39.29		x	5.3	125.5
4	39.38	x	x	5.0	99.5
5		x	x	4.9	72.5
6	39.57	x	x	4.8	46.3
7	39.66		x	4.9	20.5
8			x	5.1	352.8
79330			x	5.9	324.3
1	40.02		x	6.1	295.1
2				6.1	268.3
3	40.21			6.1	243.3
4				6.0	218.5
5	40.39			5.9	191.5
6				5.3	164.3
7				4.9	137.0
8	40.67		x	4.6	109.5
79340			x	4.4	82.3
1	40.94		x	4.4	57.8
2			x	4.9	34.5
3	41.13		x	5.2	8.2
4			x	5.9	340.1
5			x	6.5	311.8
6	41.40		x	6.8	285.3
7				6.9	260.3
8	41.58			6.4	235.5
9				5.8	210.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79350	41.77			5.0	185.5
2				4.0	158.5
3				3.4	129.8
4	42.14		x	3.0	104.0
5			x	2.9	78.5
6	42.32		x	3.3	55.2
7			x	4.0	30.0
8	42.50		x	5.0	3.7
79360			x	6.0	338.3
1			x	7.0	311.3
2	42.87		x	7.8	284.1
3				8.0	259.3
4	43.05			7.9	236.5
5				7.1	213.3
6	43.24			6.2	186.5
7				5.5	160.5
8	43.42			4.6	135.5
79370				3.8	109.3
1	43.70		x	3.2	84.1
2			x	3.0	61.0
3			x	3.3	38.3
4	43.97		x	4.0	14.7
5			x	5.0	347.3
6	44.16		x	6.0	321.3
7			x	6.8	297.3
8	44.34		x	4.8	273.3
79380				8.3	249.1
1	44.62			8.7	226.3
2				8.6	203.5
3	44.80			7.9	179.7
4				7.0	153.7
5				5.9	128.0
6	45.07		x	4.8	104.5
7			x	3.4	81.0
8	45.26		x	2.7	58.5
9			x	2.1	36.5
79390	45.44		x	2.1	13.7
2			x	2.5	349.3
3			x	3.3	323.1

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79394	45.81		x	4.6	298.3
5				5.9	275.3
6	45.99			7.2	252.5
7				8.4	229.7
8	46.18			9.2	207.5
9				9.9	183.0
79400				10.0	159.3
2	46.54		x	9.6	131.7
3			x	8.8	107.3
4	46.73		x	7.9	85.5
5			x	6.2	63.5
6			x	5.0	40.5
7	47.00		x	3.9	17.8
8			x	2.9	354.3
9			x	2.2	330.3
79410	47.28		x	2.0	304.3
2				2.1	280.8
3	47.55			2.3	259.3
4				3.0	238.0
5	47.74			3.8	215.3
6				4.6	191.7
7				5.4	168.2
8	48.01		x	6.3	143.5
9			x	6.9	117.0
79420	48.20		x	7.5	93.5
1			x	8.1	72.1
3	48.47		x	8.0	50.0
4			x	8.0	27.0
5	48.65		x	8.0	3.3
6	48.75		x	8.0	339.3
7				7.8	314.6
8	48.93			7.4	289.3
9				7.0	266.5
79430	49.11			6.8	245.3
1				6.0	223.5
3				5.1	200.1
4	49.48		x	4.8	176.5
5			x	3.9	153.5
6	49.66		x	3.1	128.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79437			x	2.4	103.5
8	48.85		x	2.0	80.7
9			x	1.8	60.3
79440			x	1.8	37.6
1	50.12		x	2.0	14.8
3	50.31			2.2	351.3
4				3.1	327.6
5	50.49			4.1	303.5
6				5.1	280.3
7	50.67			6.1	257.3
8				7.1	237.5
9	50.86		x	8.1	216.1
79450			x	9.0	191.6
1	51.04		x	9.4	167.7
2			x	9.6	144.2
4	51.32		x	9.5	119.7
5			x	9.0	96.3
6	51.50		x	7.4	73.6
7			x	8.0	54.3
8	51.68		x	7.7	32.5
9				6.6	8.5
79460	51.87			6.0	345.3
1				5.6	322.3
2	52.05			5.0	298.3
4				4.9	275.1
5				4.6	253.3
6	52.42		x	4.4	233.5
7	52.51	x	x	4.2	211.8
8		x	x	4.0	188.5
9	52.69	x	x	4.0	164.9
79470			x	3.9	141.5
1	52.88		x	3.6	117.8
2			x	3.5	94.5
4	53.15		x	3.6	72.8
5				3.9	53.1
6				4.2	31.3
7	53.43			4.9	7.4
8				5.5	342.7
9	53.61			6.2	320.1

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79480				7.1	296.5
1			x	9.0	273.3
3			x	9.0	251.3
4	54.07		x	9.9	231.5
5			x	10.3	209.5
6	54.25		x	10.9	185.3
7			x	11.0	161.5
8			x	10.9	137.7
9	54.53		x	10.9	114.7
79490				10.4	91.3
1	54.71			9.9	69.8
2				9.1	49.5
4				8.8	28.4
5	55.08			8.0	4.5
6				7.6	341.5
7	55.26		x	7.1	318.3
8			x	6.9	295.3
9	55.45		x	6.4	271.4
79500			x	6.0	250.3
1	55.63		x	5.8	230.7
2			x	5.5	209.7
4	55.91		x	5.0	185.7
5			x	4.6	162.5
6	56.09		x	4.0	139.5
7				3.3	116.5
8	56.27			2.8	93.0
9				2.3	71.5
79510	56.46			2.0	51.5
2				1.7	29.8
3	56.73			1.8	6.5
4	56.82		x	2.0	343.3
5			x	2.4	320.3
6	57.01		x	3.0	296.6
7			x	3.8	273.6
8	57.19		x	4.5	252.3
9			x	5.0	233.0
79521			x	5.9	211.3
2	57.56		x	6.2	187.5
3				7.0	165.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79524	57.74			7.3	141.8
5				7.6	119.5
6	57.93			7.9	95.8
7				7.9	75.5
8				8.0	55.2
9	58.20		x	8.0	34.5
79531			x	8.1	11.6
2	58.48		x	8.1	349.3
3			x	8.6	326.4
4	58.66		x	8.9	304.0
5			x	9.0	280.3
6			x	9.1	259.1
7	58.94		x	9.1	239.6
8				9.4	218.3
79540	59.21			9.3	197.4
1				9.1	173.7
2	59.39			8.8	151.5
3				8.0	129.5
4				7.2	105.5
5	59.67		x	6.5	83.5
6			x	5.9	64.5
7			x	5.0	43.5
9	60.04		x	4.2	22.2
79550			x	3.8	359.9
1	60.22		x	3.2	337.9
2			x	3.0	314.5
3			x	2.8	291.4
4	60.50		x	2.6	269.3
5				2.6	250.4
6	60.68			2.6	230.5
8				2.6	208.5
9	60.96			2.4	188.0
79560				2.1	165.8
1	61.14		x	2.1	143.5
2			x	1.9	119.7
3	61.32		x	1.6	98.6
4			x	1.4	78.0
5	61.51		x	1.1	56.6
7			x	1.1	37.4

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79568	61.78		x	1.2	16.7
9			x	1.7	354.3
79570	61.96		x	1.9	332.1
1				2.6	309.3
2	62.15			3.1	286.9
3				4.0	267.1
4	62.33			4.9	246.2
6				5.6	226.1
7				6.1	205.7
8	62.70		x	6.8	184.7
9			x	7.1	162.7
79580	62.88		x	7.5	139.5
1			x	7.8	117.3
2	63.07		x	8.0	96.7
3			x	8.1	76.5
4	63.25		x	8.1	55.5
6	63.434		x	8.8	35.6
7				8.6	15.7
8	63.62			8.9	353.8
9				9.1	330.6
79590	63.80			9.5	303.6
1				10.0	287.1
2	63.98			10.1	266.1
3			x	10.3	245.3
5	64.26		x	10.8	226.0
6			x	10.9	206.5
7	64.44		x	10.9	185.8
8			x	10.3	162.9
9			x	10.0	140.5
79600	64.72		x	9.6	119.4
1			x	9.1	98.8
2	64.90			8.5	77.5
3				7.9	57.8
5				7.1	38.6
6	65.27			6.8	19.0
7				6.1	355.8
8	65.45			5.9	334.3
9			x	5.4	312.9
79610	65.64	x	x	5.2	291.4

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79611		x	x	5.0	270.1
2	65.82	x	x	5.0	250.3
4		x	x	4.9	231.6
5	66.10		x	4.6	213.0
6			x	4.1	191.4
7	66.28		x	3.9	169.3
8			x	3.2	148.5
9				3.0	126.5
79620	66.55			2.4	104.5
1				2.0	83.7
2	66.74			1.5	65.3
4				1.1	45.5
5				0.9	25.5
6	67.11		x	0.6	3.6
7			x	0.6	343.0
8			x	0.9	321.4
9	67.47		x	1.0	299.2
79630			x	1.1	278.0
1	67.56		x	1.5	259.1
3			x	2.0	240.5
4	67.84		x	2.2	219.8
5				2.6	199.7
6	68.02			2.9	178.5
7				3.1	158.4
8	68.21			3.3	135.4
9				3.3	114.5
79640	68.39			3.5	93.7
1			x	3.6	74.5
3	68.67		x	3.8	54.5
4			x	4.0	35.2
5	68.85		x	4.2	15.5
6			x	4.5	353.9
7	69.03		x	5.0	331.3
8			x	5.9	309.5
9	69.22		x	6.5	289.3
79651				7.1	269.3
2	69.49			8.0	249.3
3				8.4	230.7
4	69.68			9.0	211.6

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79655				9.6	191.5
6	69.86			10.0	169.5
7			x	10.2	147.5
8			x	10.3	126.5
79660	70.23		x	10.6	105.5
1			x	10.6	85.2
2	70.41		x	10.6	65.5
3			x	10.6	47.6
4			x	10.6	28.3
5	70.69		x	10.9	6.9
6			x	11.0	345.6
7	70.87			11.1	325.3
8				11.6	304.1
79670	71.14			12.0	282.9
1				12.0	262.8
2	71.33			12.4	245.1
3				12.9	225.5
4	71.51		x	13.0	205.5
5			x	12.9	185.3
6	71.70		x	12.9	164.3
7			x	12.6	142.5
9			x	12.3	121.3
79680	72.06		x	12.0	100.5
1			x	11.7	81.5
2	72.25		x	11.1	64.1
3				10.9	42.5
4				10.5	23.5
5	72.52			10.2	3.5
6				10.0	342.6
8	72.80			9.9	320.8
9				9.8	299.8
79690	72.98		x	9.8	280.3
1			x	9.8	260.8
2	73.16		x	9.8	241.8
3			x	9.8	222.8
4	73.35		x	9.7	203.8
5			x	9.3	184.4
7	73.62		x	8.9	162.8
8			x	8.3	141.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79699			x	7.9	121.5
79700	73.90			7.4	101.1
1				6.8	81.0
2	74.08			6.1	63.5
3				5.8	44.3
4				5.0	25.5
5	74.36			4.9	4.5
7			x	4.5	343.3
8	74.63		x	4.3	323.8
9			x	4.3	302.8
79710	74.82		x	4.2	282.1
1			x	4.2	263.3
2	75.00		x	4.1	245.3
3			x	4.1	227.5
4	75.18		x	4.0	207.4
5				4.0	188.0
6	75.37			3.9	167.6
8				3.4	148.0
9				3.1	126.4
79720	75.74			2.9	106.1
1				2.4	87.0
2	75.92		x	2.0	68.5
3			x	1.7	48.5
4			x	1.2	30.5
5	76.19		x	1.2	11.5
6			x	1.1	351.3
8	76.47		x	1.1	329.3
9			x	1.2	308.8
79730	76.65		x	1.6	289.2
1			x	1.8	270.1
2	76.84			2.0	250.3
3				2.1	232.5
4	77.02			2.4	215.3
5				2.7	196.3
6	77.20			2.9	174.7
8				2.9	154.2
9			x	2.9	133.6
79740	77.57		x	2.9	114.2
1			x	2.4	93.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79742	77.76		x	2.3	74.3
3			x	2.1	57.4
4			x	2.1	38.5
5	78.03		x	2.1	19.2
6			x	2.5	359.2
8	78.30			2.8	339.3
9				3.0	318.0
79750	78.49			3.3	296.9
1				4.0	277.1
2	78.67			4.7	259.1
3				5.0	240.7
4	78.86		x	5.7	221.5
5		x	x	5.9	202.5
6	79.04	x	x	6.1	183.5
8		x	x	6.5	162.9
9		x	x	6.6	141.5
79760	79.41		x	6.8	120.5
1			x	6.9	101.5
2	79.59		x	6.9	82.5
3			x	6.9	63.6
4	79.77			6.9	45.5
5				7.0	27.5
6	79.96			7.4	8.0
8				7.6	346.4
9				8.0	325.3
79770	80.32			8.5	305.8
1			x	9.0	285.9
2	80.51		x	9.4	265.3
3			x	10.1	247.3
4	80.69		x	10.8	230.2
5			x	11.0	211.5
6	80.88		x	11.2	191.5
8			x	11.4	170.9
9			x	11.8	151.4
79780	81.24		x	12.0	130.5
1				12.0	109.7
2	81.34			12.0	90.5
3				12.0	71.7
4	81.61			12.0	54.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79785				12.0	34.5
7	81.89			12.0	15.5
8			x	12.1	355.9
9			x	12.5	335.8
79790	82.16		x	12.9	313.5
1			x	13.2	293.3
2	82.34		x	13.7	274.3
3			x	14.0	255.3
4	82.53		x	14.4	236.5
5			x	14.9	217.7
7	82.80			15.0	199.6
8				15.2	179.7
9				15.1	158.5
79800	83.08			15.1	138.5
1				15.1	118.2
2	83.26			15.0	99.3
3			x	14.9	78.5
4	83.45		x	14.9	59.8
6			x	14.7	42.3
7			x	14.6	23.8
8	83.81		x	14.5	2.8
9			x	14.7	341.5
79810	84.00		x	14.9	321.9
1			x	15.0	301.7
2	84.18		x	15.2	281.3
3				15.7	262.3
5	84.46			15.9	245.3
6				16.0	227.5
7	84.64			16.1	207.9
8				16.1	188.5
9				16.1	169.1
79820	84.91		x	16.1	148.9
1			x	16.0	126.7
2	85.10		x	15.4	107.0
3			x	15.2	88.5
5	85.37		x	15.0	69.5
6			x	14.8	51.5
7			x	14.4	33.3
8	85.649		x	14.1	15.0

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79829				14.1	355.1
79830	85.83			14.1	333.5
1				14.1	313.1
2	86.02			14.1	294.3
3				14.5	274.3
5	86.29			14.8	255.3
6			x	14.8	237.5
7	86.48		x	14.9	219.7
8			x	14.9	201.5
9			x	14.8	180.5
79840	86.75		x	14.5	160.5
1			x	14.1	141.5
2	86.94		x	14.0	120.7
3			x	13.4	100.9
5	87.21		x	13.0	82.4
6				12.6	65.1
7	87.39			12.1	47.3
8				12.0	27.5
9	87.58			11.8	8.3
79850	87.67			11.6	349.1
1				11.6	327.4
2	87.85		x	11.6	307.3
3			x	11.7	287.3
4	88.04		x	11.8	269.1
6			x	11.8	251.3
7	88.31		x	11.9	232.7
8			x	11.8	214.3
9			x	11.6	196.5
79860	88.59		x	11.5	176.5
1			x	11.1	156.3
2	88.77			10.9	135.5
3				10.3	116.5
4	88.95			10.0	97.0
6				9.7	73.9
7	89.23			9.1	59.5
8				8.9	41.5
9			x	8.5	23.5
79870	89.50		x	8.5	3.0
1			x	7.9	353.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79872			x	8.0	323.3
3	89.78		x	8.0	303.3
4			x	8.1	283.3
5			x	8.1	264.3
7	90.15		x	8.1	247.3
8				8.1	229.5
9				8.0	210.5
79880	90.42			8.0	191.5
1				7.9	172.1
2	90.61			7.4	152.3
3				7.1	130.9
4	90.79		x	6.9	110.5
5			x	6.2	92.8
7	91.07		x	5.9	74.5
8			x	5.3	55.5
9			x	5.0	37.6
79890	91.34		x	4.8	19.5
1			x	4.7	0.5
2	91.52		x	4.4	339.0
3			x	4.4	317.8
4	91.71			4.4	297.8
5				4.4	279.3
7	91.98			4.7	259.4
8				4.7	242.5
9				4.7	224.5
79900	92.24			4.7	206.7
1			x	4.6	186.5
2	92.44	x	x	4.4	165.7
3		x	x	4.1	147.5
4	92.63	x	x	3.9	126.5
5		x	x	3.5	106.2
7	92.90		x	3.0	87.4
8			x	2.9	69.6
9			x	2.4	51.6
79910	93.17		x	2.1	33.2
1	93.27			2.0	14.0
2	93.36			1.9	354.3
3				1.9	334.6
4	93.54			2.0	313.4
5				2.1	294.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
79958			x	1.6	269.3
79960	97.77			2.0	252.0
1				2.1	234.5
2	97.95			2.4	216.8
3				2.4	195.5
4	98.13			2.4	177.5
5				2.5	158.5
6	98.32		x	2.5	137.5
7			x	2.4	117.5
8			x	2.1	98.5
9	98.68		x	2.0	80.0
79971			x	1.9	62.8
2	98.87		x	1.8	44.0
3			x	1.6	26.3
4	99.05		x	1.6	7.5
5			x	1.7	348.1
6	99.24			2.0	326.8
7				2.0	306.3
8	99.42			2.5	287.3
9				2.8	269.3
79980	99.60			3.0	250.3
1				3.2	232.8
3	99.88		x	3.7	216.0
4			x	4.0	197.5
5	100.06		x	4.0	177.3
6			x	4.0	157.1
7	100.25		x	4.0	137.8
8			x	3.9	118.5
9			x	3.7	98.2
79990	100.52		x	3.4	79.5
1			x	3.1	63.0
3	100.80			3.1	43.9
4				3.0	26.0
5	100.98			3.1	7.1
6				3.1	347.4
7	101.16			3.6	327.3
8				3.9	307.3
9	101.44		x	4.0	287.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80000			x	4.1	269.3
1	101.53		x	4.8	251.3
2			x	5.0	233.5
4	101.81		x	5.3	216.2
5			x	5.5	197.5
6	101.99		x	5.6	177.5
7			x	5.6	157.5
8			x	5.6	136.6
9	102.36			5.6	117.5
80010				5.3	98.5
1	102.54			5.0	79.5
2				5.0	62.0
4	102.72			5.0	44.0
5				4.9	26.6
6	102.91		x	4.9	6.5
7			x	5.0	346.1
8	103.09		x	5.1	286.3
9			x	5.5	307.3
80020	103.27		x	5.9	287.3
1			x	6.0	267.7
2	103.46		x	6.5	251.3
3			x	6.9	233.5
5	103.73			7.0	214.5
6				7.1	196.5
7	103.92			7.3	176.5
8				7.2	157.0
9				7.2	135.5
80030	104.19			7.1	116.1
1				7.0	97.3
2	104.38		x	6.9	78.8
3			x	6.8	60.5
4			x	6.7	41.9
5			x	6.6	25.3
7	104.84		x	6.6	5.5
8			x	6.9	344.3
9	105.02		x	7.0	324.3
80040	105.11		x	7.1	304.5
1				7.6	286.3
2				8.0	266.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80043				8.1	248.3
4				8.6	231.5
5				8.9	213.5
7				9.0	193.5
8			x	9.0	174.1
9		x	x	9.0	154.4
80050	106.02	x	x	9.0	134.5
1		x	x	8.9	114.0
2		x	x	8.6	95.3
3			x	8.6	77.5
4			x	8.3	60.0
5			x	8.3	40.8
6			x	8.3	22.5
8	106.76			8.3	4.3
9				8.5	344.1
80060	106.94			8.7	323.3
1				9.0	303.5
2				9.1	285.3
3				9.4	266.3
4			x	10.0	247.3
5			x	10.1	230.5
6			x	10.3	212.5
7			x	10.4	194.3
8			x	10.6	173.5
80070	107.86		x	10.5	154.5
1			x	10.3	134.5
2			x	10.3	115.0
3			x	10.0	95.0
4				9.9	77.1
5				9.9	60.1
6				9.8	42.0
7				9.7	23.4
8	108.60			9.9	3.5
80080	108.78			9.9	344.9
1			x	10.0	324.1
2			x	10.1	303.3
3			x	10.6	284.3
4			x	10.9	266.3
5			x	11.1	248.6

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80086			x	11.5	230.5
7			x	11.7	212.5
8			x	11.7	194.5
9	109.70		x	11.7	175.3
80090				11.8	154.1
2				11.5	133.5
3				11.4	114.8
4				11.3	96.3
5				11.2	78.1
6				11.1	60.5
7			x	11.0	42.5
8			x	11.1	24.5
9	110.62		x	11.2	3.5
80100			x	11.5	343.3
1	110.71		x	11.7	324.8
3			x	11.9	305.1
4			x	12.0	284.5
5			x	12.1	266.3
6			x	12.4	249.3
7				12.6	231.5
8				12.9	212.7
9	111.54			13.0	193.8
80110				13.0	174.5
1				12.9	156.5
3				12.9	134.5
4			x	12.9	115.0
5			x	12.6	96.9
6			x	12.6	78.5
7			x	12.4	59.8
8			x	12.4	41.5
9	112.46		x	12.4	23.6
80120			x	12.4	4.1
1	112.64		x	12.6	344.3
2			x	12.9	323.4
3				12.9	304.2
5				13.0	285.3
6				13.3	265.7
7				13.7	248.3
8				13.8	231.4

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80129				13.9	213.4
80130	113.37		x	14.0	193.7
1			x	14.0	173.4
2			x	13.9	155.0
3			x	13.9	134.5
5			x	13.9	114.5
6			x	13.6	95.5
7			x	13.4	78.0
8			x	13.2	61.0
9			x	13.2	41.5
80140	114.29			13.2	23.4
1				13.2	4.6
2	114.48			13.5	344.0
3				13.8	322.9
5				13.9	303.3
6				14.1	284.3
7			x	14.2	266.1
8			x	14.5	247.3
9			x	14.8	229.5
80150	115.21		x	14.9	212.5
1			x	15.0	193.7
2			x	15.0	172.5
3			x	14.9	153.7
5			x	14.9	133.3
6			x	14.9	113.5
7				14.5	94.0
8				14.5	75.5
9				14.1	59.5
80160	116.13			14.1	41.5
1				14.1	22.0
2	116.31			14.1	2.5
3			x	14.3	353.3
4	116.49		x	14.6	323.3
5			x	14.9	302.3
7			x	15.0	283.2
8			x	15.1	265.2
9			x	15.5	247.5
80170	117.04		x	15.8	229.0

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80171			x	15.9	210.8
2			x	15.9	192.2
3				16.0	172.8
4				15.9	152.5
5				15.9	131.7
6				15.4	113.5
8				15.3	93.5
9				15.2	75.5
80180	117.96		x	15.1	57.5
1			x	15.0	40.7
2			x	15.0	22.5
3	118.24		x	15.0	1.5
4			x	15.0	341.3
5	118.42		x	15.1	321.3
6			x	15.6	301.5
8			x	15.9	281.3
9			x	16.0	263.3
80190	118.88			16.0	246.3
1				16.5	228.5
2				16.7	210.3
3				16.7	190.5
4				16.6	172.5
5				16.6	152.3
6			x	16.2	130.5
7		x	x	16.1	111.5
8		x	x	16.0	93.3
80200	119.80	x	x	16.0	74.5
1		x	x	16.0	56.5
2			x	15.9	37.5
3			x	15.9	20.5
4	120.17		x	16.0	0.9
5				16.0	340.3
6	120.35			16.0	319.3
7				16.9	299.8
8				16.9	281.3
80210	120.72			17.0	262.3
1				17.0	244.5
2				17.0	227.5
3			x	17.1	209.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80214			x	17.2	188.8
5			x	17.3	169.5
6			x	17.2	149.5
7			x	17.1	130.3
9			x	16.9	109.4
80220	121.64		x	16.8	90.4
1			x	16.8	72.5
2				16.6	54.7
3				16.3	36.5
4	122.00			16.2	17.5
5				16.6	357.6
6	122.19			16.6	338.3
7				16.8	316.8
9			x	17.0	296.8
80230	122.55		x	17.1	279.3
1			x	17.4	259.8
2			x	17.8	241.7
3			x	17.8	223.5
4			x	18.0	206.5
5			x	17.9	186.8
6			x	17.9	165.6
7			x	17.9	146.2
8				17.7	127.4
80240	123.47			17.2	107.5
1				17.1	88.5
2				17.0	70.5
3				17.0	53.1
4				17.0	34.9
5	123.93		x	17.0	15.5
6			x	17.0	355.4
7	124.11		x	17.0	336.6
8			x	17.1	315.9
80250	124.39		x	17.6	295.5
1			x	17.9	276.5
2			x	18.0	259.0
3			x	18.0	242.3
4			x	18.1	223.0
5				18.3	205.2
6				18.3	185.7

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80257				18.2	166.5
8				18.1	145.5
80260	125.31			18.0	125.6
1				17.9	106.7
2			x	17.9	88.4
3			x	17.6	69.5
4			x	17.6	51.5
5			x	17.4	33.7
6	125.86		x	17.3	15.8
7			x	17.4	355.3
8			x	17.7	335.3
9	126.22		x	17.9	315.3
80270			x	17.9	295.6
2				18.0	276.3
3				18.1	257.8
4				18.5	241.6
5				18.8	223.6
6				18.8	205.0
7				18.9	185.5
8			x	18.8	165.7
9	127.14		x	18.6	145.8
80281			x	18.2	125.5
2			x	18.2	106.1
3			x	18.0	88.3
4			x	18.0	70.5
5			x	17.9	52.3
6			x	17.9	34.4
7	127.79		x	17.9	16.5
8				17.9	357.0
9	128.06			18.0	336.1
80290				18.1	316.1
1				18.1	296.3
2				18.3	277.8
4				18.7	259.0
5			x	18.9	241.7
6			x	19.0	223.5
7			x	19.0	206.0
8			x	19.0	185.5
9	129.98		x	18.9	164.9

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80300			x	18.9	145.9
1			x	18.8	125.5
2			x	18.5	105.8
4			x	18.3	87.5
5				18.2	70.5
6				18.1	52.5
7				18.1	33.5
8	129.71			18.1	15.5
9				18.1	356.2
80310	129.90			18.3	336.3
1			x	18.4	315.3
2			x	18.8	295.5
3			x	18.9	277.3
5			x	19.0	259.3
6			x	19.1	241.5
7			x	19.2	222.5
8			x	19.2	205.5
9			x	19.2	185.7
80320	130.82		x	19.1	165.5
1				19.1	145.5
2				19.0	125.7
3				18.9	107.0
5				18.8	87.5
6				18.6	69.5
7				18.5	53.4
8			x	18.5	35.3
9	131.64		x	18.4	15.5
80330	131.73		x	18.4	355.6
1			x	18.6	337.2
2			x	18.9	316.0
3			x	19.0	296.3
4			x	19.1	277.5
5			x	19.1	260.3
7			x	19.3	242.7
8				19.5	223.5
9				19.6	206.3
80340	132.65			19.8	187.5
1				19.5	167.5
2				19.4	146.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80343				19.2	126.3
4			x	19.1	108.5
5		x	x	19.0	89.5
6		x	x	18.9	71.5
7		x	x	18.9	54.3
9		x	x	18.8	36.5
80350	133.57		x	18.7	18.0
1			x	18.9	357.3
2	133.75		x	18.9	338.3
3			x	19.0	318.9
4				19.0	299.3
5				19.2	279.5
6				19.3	261.3
7				19.8	244.3
8				19.9	227.5
9	134.47			19.9	207.7
80361			x	19.9	189.3
2			x	19.9	170.5
3			x	19.9	150.5
4			x	19.9	129.5
5			x	19.6	110.5
6			x	19.3	92.7
7			x	19.1	74.6
8			x	19.0	56.5
9	135.40		x	19.0	38.5
80370				19.0	21.5
1				19.0	2.1
3				19.0	341.5
4	135.77			19.1	321.7
5				19.2	302.3
6				19.6	284.1
7			x	19.9	264.8
8			x	20.0	246.6
9	136.32		x	20.0	229.7
80380			x	20.0	212.3
1			x	20.1	192.5
2			x	20.1	173.2
3			x	20.1	154.3
5			x	20.0	133.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80386			x	20.0	113.6
7				19.9	95.4
8				19.8	77.6
9				19.2	60.5
80390	137.24			19.1	41.7
1				19.0	24.0
2				19.0	5.5
3				19.1	346.3
4	137.61		x	19.1	325.3
6			x	19.4	305.3
7			x	19.9	287.3
8			x	20.0	269.3
9			x	20.0	250.3
80400	138.16		x	20.0	233.0
1			x	20.6	215.5
2			x	20.8	197.4
3				20.9	177.3
4				20.8	157.5
5				20.4	137.6
6				20.3	118.0
8				20.0	98.8
9				19.9	80.5
80410	139.08			19.8	63.5
1			x	19.5	46.0
2			x	19.4	27.5
3			x	19.3	8.8
4			x	19.4	349.3
5	139.54		x	19.8	329.3
6			x	19.9	309.3
7			x	20.0	289.5
8			x	20.0	272.2
80420	140.00		x	20.1	254.2
1				20.5	236.5
2				20.9	218.7
3				21.0	200.8
4	140.36			21.0	181.5
5				21.0	161.4
6				20.9	141.5
7			x	20.7	122.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80428			x	20.4	103.5
9	140.91		x	20.2	84.5
80430			x	20.0	66.8
1			x	19.9	50.0
2			x	19.9	31.6
4			x	19.8	12.9
5	141.37		x	19.8	353.3
6			x	19.8	334.6
7				20.0	315.0
8				20.1	294.3
9	141.83			20.2	275.3
80440				20.7	258.1
1				20.9	241.4
2				21.0	222.1
3			x	21.0	204.3
4			x	21.1	185.5
6			x	21.3	165.5
7			x	21.1	145.5
8			x	21.0	125.3
9			x	20.7	106.9
80450	142.75		x	20.6	88.4
1			x	20.5	69.5
2			x	20.1	52.8
3				20.1	34.7
4				20.0	16.1
6	143.30			20.0	356.0
7				20.0	337.1
8				20.1	317.3
9				20.1	297.3
80460	143.67		x	20.7	277.3
1			x	21.0	259.3
2			x	21.0	242.0
3			x	21.4	224.5
4			x	21.5	206.0
5			x	21.8	186.9
6			x	21.8	168.1
8			x	21.5	147.5
9			x	21.5	127.3
80470	144.58			21.0	108.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80471				20.9	89.9
2				20.8	72.4
3				20.6	53.7
4				20.4	35.5
5	145.04			20.3	17.9
6			x	20.2	358.3
7			x	20.2	337.7
9			x	20.6	317.3
80480	145.50		x	20.8	298.3
1			x	21.0	279.5
2			x	21.1	260.5
3			x	21.4	242.5
4			x	21.8	225.5
5			x	21.9	207.5
6				22.0	187.7
7				22.0	168.5
8				21.9	148.7
9	146.42			21.8	129.2
80491				21.5	108.6
2				21.2	89.6
3				21.0	73.3
4			x	20.9	55.2
5		x	x	20.8	35.5
6	146.97	x	x	20.7	17.7
7		x	x	20.7	357.5
8			x	20.7	338.3
9	147.34		x	20.9	317.3
80501			x	21.0	297.3
2			x	21.3	279.8
3				21.4	261.3
4				21.8	243.4
5				22.0	225.4
6				22.0	206.9
7				22.0	188.5
8				22.0	167.8
9	148.26			22.1	148.0
80510			x	21.9	128.5
1			x	21.8	108.7
3			x	21.5	88.5
4			x	21.1	71.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80515			x	21.0	53.2
6			x	21.0	36.1
7	148.90		x	20.9	16.8
8			x	21.0	356.5
9	149.18			21.0	337.4
80520				21.1	317.3
1	149.27			21.3	296.3
3				21.7	277.4
4				21.9	260.3
5				22.0	242.7
6				22.1	223.5
7			x	22.2	205.4
8			x	22.3	186.5
9	150.09		x	22.4	167.4
80530			x	22.4	145.5
1			x	22.3	125.7
2			x	22.0	107.5
4			x	21.9	88.6
5			x	21.6	69.5
6				21.4	51.5
7				21.2	34.2
8	150.83			21.1	15.5
9	151.01			21.1	355.3
80540				21.2	335.2
1				21.3	315.3
2				21.6	295.8
4			x	21.9	275.9
5			x	22.1	257.9
6			x	22.3	241.3
7			x	22.6	222.6
8			x	22.8	203.5
9	151.93		x	22.9	184.5
80550			x	22.9	164.7
1			x	22.8	145.0
2				22.7	123.8
4				22.2	104.5
5				22.0	86.9
6				21.9	68.5
7				21.7	49.6

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80558				21.6	32.1
9	152.85			21.6	13.5
80560			x	21.6	354.3
1	152.94		x	21.8	333.3
2			x	21.9	313.3
3			x	22.0	294.3
5			x	22.2	275.4
6			x	22.6	256.3
7			x	22.9	239.5
8			x	23.0	222.2
9			x	23.0	203.5
80570	153.76			23.0	183.5
1				23.0	163.4
2				22.9	143.5
3				22.9	123.6
4				22.6	103.5
6				22.6	85.7
7			x	22.1	67.7
8			x	22.0	50.0
9			x	21.9	31.4
80580	154.68		x	21.9	13.4
1			x	21.9	352.3
2			x	22.0	333.3
3	154.96		x	21.1	311.5
4			x	22.1	293.1
6			x	22.6	275.2
7				23.0	257.1
8				23.0	237.7
9				23.2	219.7
80590	155.60			23.2	202.5
1				23.2	183.5
2				23.3	181.6
3			x	23.2	141.5
4			x	23.1	122.5
5			x	22.9	103.5
7			x	22.9	83.9
8			x	22.4	65.7
9			x	22.3	49.2
80600	156.52		x	22.1	31.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80601			x	22.1	11.5
2			x	22.1	351.2
3	156.79			22.3	331.4
4				22.5	311.3
5				22.9	291.6
7				23.0	271.6
8				23.1	245.3
9				23.2	237.1
80610	157.44		x	23.4	218.1
1			x	23.6	199.3
2			x	23.8	180.5
3			x	23.9	160.5
4			x	23.7	139.5
5			x	23.5	119.5
6			x	23.2	101.0
8			x	23.0	82.8
9			x	22.6	64.5
80620	158.36			22.6	45.6
1				22.6	28.0
2				22.6	9.5
3				22.6	348.8
4	158.72			22.8	328.3
5				23.0	309.3
6			x	23.0	290.3
7			x	23.2	271.3
9			x	23.6	253.3
80630	159.27		x	23.9	235.5
1			x	24.0	217.7
2			x	24.1	198.0
3			x	24.3	178.1
4			x	24.2	159.7
5			x	24.1	138.9
6				24.0	117.5
8				23.8	99.2
9				23.5	81.1
80640	160.19			23.1	63.5
1				23.0	44.5
2				23.0	26.5
3			x	22.8	8.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80644	160.56	x	x	22.9	348.3
5		x	x	23.0	327.4
6		x	x	23.1	307.3
7		x	x	23.3	289.2
8			x	23.6	269.8
80650	161.10		x	24.0	251.3
1			x	24.2	233.7
2			x	24.8	216.2
3				24.9	197.9
4				24.9	177.1
5				24.8	157.5
6				24.6	137.5
7				24.5	117.9
8				24.2	97.5
80660	162.03		x	24.0	79.4
1			x	23.7	62.5
2			x	23.6	44.5
3			x	23.3	25.8
4			x	23.3	6.8
5	162.49		x	23.3	347.3
6			x	23.5	327.3
7			x	23.8	306.3
8			x	24.0	287.3
9	162.94			24.2	268.8
80671				24.8	251.3
2				24.9	232.5
3				25.0	214.4
4				25.1	196.0
5				25.1	176.8
6			x	25.1	156.5
7			x	25.0	135.5
8			x	24.9	116.3
9	163.86		x	24.8	97.5
80681			x	24.6	78.2
2			x	24.3	60.5
3			x	24.0	43.3
4			x	24.0	25.4
5			x	23.9	5.4
6	164.41			24.0	345.2

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80687				24.1	326.8
8				24.4	307.1
9	164.78			24.6	286.3
80690				25.0	267.8
1				25.1	250.3
2				25.2	233.3
4			x	25.4	213.5
5			x	25.8	195.6
6			x	26.0	177.2
7			x	25.9	157.6
8			x	25.8	136.7
9	165.70		x	25.5	116.6
80700			x	25.1	97.5
1			x	25.0	79.4
2			x	24.9	61.0
4				24.8	42.7
5				24.6	25.5
6				24.4	6.5
7	166.34			24.5	345.4
8				24.5	325.4
9				24.9	306.3
80710	166.62		x	25.0	287.4
1			x	25.2	267.4
2			x	25.3	249.3
3			x	25.8	233.3
5			x	26.1	215.2
6			x	26.1	195.5
7			x	26.1	176.5
8			x	26.1	157.5
9			x	26.1	136.5
80720	167.54			26.0	116.5
1				25.8	96.4
2				25.4	78.8
3				25.1	61.4
5				25.0	42.0
6				25.0	23.5
7			x	25.0	5.3
8	168.27		x	25.0	345.3
9			x	25.0	324.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80730	168.45		x	25.2	304.3
1			x	25.5	285.8
2			x	26.0	267.3
3			x	26.5	248.6
4			x	26.8	231.2
5			x	26.9	213.5
7				26.9	195.5
8				27.0	174.5
9				26.9	154.5
80740	169.37			26.9	134.7
1				26.8	114.6
2				26.7	95.5
3			x	26.1	77.1
4			x	26.0	59.3
5			x	25.8	41.4
7	170.01		x	25.6	21.5
8			x	25.6	2.3
9			x	25.7	343.3
80750	170.29		x	26.0	323.2
1			x	26.0	302.3
2			x	26.3	282.3
3				26.8	264.3
4				27.0	257.3
5				27.1	228.5
6				27.3	210.0
8				27.5	191.6
9				27.5	172.5
80760	171.21		x	27.4	152.0
1			x	27.3	131.5
2			x	27.1	112.5
3			x	27.0	93.5
4			x	26.9	74.5
5			x	26.8	54.5
6			x	26.7	39.3
8	171.94		x	26.7	21.3
9			x	26.7	359.6
80770	172.12			26.7	341.2
1				26.8	321.2
2				26.9	301.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80773				27.0	280.8
4				27.2	262.5
5				27.6	245.3
6			x	27.9	225.5
8			x	28.0	208.2
9			x	28.3	189.5
80780	173.04		x	28.3	170.3
1			x	28.3	150.3
2			x	28.3	129.0
3			x	28.0	110.1
4			x	27.8	91.6
5			x	27.4	73.2
6				27.3	54.5
7				27.1	36.8
8	173.78			27.1	19.0
80790	173.96			27.1	358.8
1				27.1	338.8
2				27.3	317.3
3			x	27.5	298.3
4		x	x	27.8	279.3
5		x	x	28.2	259.3
6		x	x	28.8	242.1
7		x	x	28.9	224.5
8			x	29.0	206.5
80800	174.88		x	29.0	186.0
1			x	29.0	166.5
2			x	29.2	148.5
3				29.0	127.5
4				28.8	107.0
5				28.7	87.5
6				28.4	70.5
7				28.2	53.5
8				28.0	33.5
80810	175.80		x	27.7	15.4
1			x	28.0	356.1
2	175.98		x	28.2	335.1
3			x	28.4	314.3
4			x	28.7	294.3
5			x	28.9	275.9

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80816			x	29.1	257.3
8			x	29.3	238.5
9			x	29.6	221.4
80820	176.72			29.7	202.5
1				30.0	193.5
2				29.7	162.5
3				29.9	141.5
4				29.5	122.7
5				29.4	103.4
6			x	29.2	83.5
8			x	29.0	65.5
9			x	29.0	48.5
80830	177.63		x	28.9	29.6
1			x	28.8	10.3
2			x	28.9	350.6
3	177.91		x	29.0	330.3
4			x	29.1	310.3
5			x	29.3	289.1
6				29.6	270.2
7				30.0	252.3
9				30.5	234.5
80840	178.55			30.8	215.5
1				30.8	196.8
2				31.0	177.3
3			x	30.9	157.7
4			x	30.9	136.3
5			x	30.8	116.2
6			x	30.5	97.5
7			x	30.3	79.1
9			x	30.1	59.8
80850	179.49		x	30.0	42.2
1			x	29.7	25.3
2			x	29.7	5.5
3				29.8	344.3
4				30.0	323.5
5				30.3	304.3
6				30.6	285.3
8				31.0	265.3
9				31.1	247.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80860	180.39		x	31.3	229.5
1			x	31.8	211.6
2			x	32.0	192.1
3			x	32.0	171.6
4			x	32.0	152.5
5			x	31.9	131.5
6			x	31.8	111.0
8			x	31.3	92.4
9			x	31.1	73.7
80870	181.30			31.0	56.5
1				30.9	37.4
2				30.9	18.8
3				30.9	359.3
4				31.0	339.4
5				31.1	318.3
6			x	31.4	298.5
7			x	31.8	279.6
9			x	32.1	261.3
80880	182.22		x	32.6	242.8
1			x	32.9	224.5
2			x	33.0	206.8
3			x	33.0	187.5
4			x	33.1	166.7
5			x	33.0	145.7
6				33.0	126.2
8				33.0	106.4
9				32.8	86.5
80890	183.14			32.5	68.1
1				32.3	51.0
2				32.1	32.5
3			x	32.1	13.3
4			x	32.3	352.8
5			x	32.5	332.8
7			x	32.8	312.5
8			x	33.0	292.3
9			x	33.1	273.3
80900	184.06		x	33.4	255.2
1			x	34.0	237.0
2			x	34.3	217.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80903				34.6	199.5
4				34.6	179.4
5				34.7	159.5
7				34.7	137.8
8				34.6	117.5
9				34.2	99.5
80910	184.98		x	34.0	79.5
1			x	34.0	60.5
2			x	33.8	42.3
3			x	33.8	24.5
4			x	33.8	4.8
6			x	33.8	343.3
7			x	34.2	322.3
8			x	34.8	302.6
9			x	34.8	283.1
80920	185.90			35.1	263.3
1				35.2	245.3
2				35.8	227.5
3				35.8	209.5
5				36.8	189.5
6				37.1	169.5
7			x	37.5	151.5
8			x	38.0	132.0
9			x	38.6	113.3
80930	186.81		x	38.9	93.7
1			x	39.1	78.0
2			x	39.5	60.5
4			x	40.0	42.5
5			x	40.5	25.5
6			x	41.0	7.5
7				41.5	348.3
8				42.3	328.7
9	187.64			43.1	309.3
80940				44.0	291.3
1				44.9	273.3
3				45.5	255.3
4			x	46.5	237.5
5		x	x	47.5	222.5
6		x	x	48.0	205.6

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80947		x	x	48.8	186.5
8		x	x	49.0	167.5
9	188.65		x	49.5	149.5
80950			x	50.0	129.7
1			x	50.5	110.5
3			x	51.0	92.5
4				51.5	76.1
5				51.5	59.5
6				52.0	41.5
7				52.5	24.5
8				53.0	6.5
9	189.48			54.0	347.5
80960			x	54.5	327.5
2			x	55.0	308.8
3			x	56.0	291.3
4			x	57.0	273.3
5			x	58.0	255.1
6			x	58.8	238.3
7			x	60.0	222.5
8			x	60.3	205.3
9	190.39		x	61.0	186.3
80971				61.5	167.5
2				62.0	149.4
3				62.5	130.5
4				63.0	111.2
5				63.3	93.5
6				63.8	77.0
7			x	64.0	60.5
8			x	65.0	42.5
80980	191.40		x	65.3	26.5
1			x	65.7	7.7
2			x	66.5	351.9
3			x	67.0	329.3
4			x	68.0	310.7
5			x	68.8	293.2
6			x	70.0	274.7
7				70.5	257.2
8				71.5	239.5
80990	192.32			72.2	223.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
80991				73.0	207.3
2				74.0	188.5
3				74.5	169.5
4			x	75.3	151.5
5			x	75.5	133.5
6			x	76.0	114.5
7			x	76.5	96.5
8			x	77.0	80.5
81000	193.24		x	77.5	64.5
1			x	78.0	47.5
2			x	78.5	31.4
3			x	79.3	15.2
4				80.0	356.3
5				80.5	338.3
6				81.0	320.3
7				82.3	303.4
9				83.1	286.0
81010	194.16			84.2	268.5
1			x	85.5	253.3
2			x	86.0	239.2
3			x	86.5	223.7
4			x	87.0	208.7
5			x	87.7	195.0
6			x	88.0	182.4
8			x	88.5	168.0
9			x	88.8	155.8
81020	195.08		x	89.0	144.7
1				89.0	135.5
2				89.0	125.5
3				89.0	117.4
4				89.0	109.0
5				89.0	100.5
7				88.5	92.0
8			x	88.0	81.5
9			x	87.5	70.5
81030	195.99		x	86.8	59.5
1			x	86.5	47.5
2			x	85.5	33.2
3			x	85.0	18.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81034			x	84.0	3.5
6			x	83.7	346.8
7				83.0	328.8
8				82.5	311.3
9				82.0	293.5
81040	196.91			81.5	277.5
1				81.0	259.5
2				80.5	243.8
3				79.8	228.8
4			x	79.0	212.5
6			x	78.0	194.5
7			x	77.5	177.3
8			x	76.5	159.5
9			x	75.5	141.5
81050	197.83		x	74.5	123.0
1			x	73.8	104.7
2			x	73.3	87.5
3				71.3	72.0
4				70.3	54.5
6				69.0	38.0
7				68.3	21.5
8				67.2	3.5
9				66.5	343.9
81060	198.75			66.0	325.3
1			x	65.0	306.6
2			x	64.5	288.6
3			x	64.0	270.3
5			x	63.3	253.3
6			x	63.0	237.5
7			x	62.0	221.5
8			x	61.0	203.5
9	199.57		x	60.5	184.5
81070	199.66			59.5	167.3
1				58.5	148.5
2				57.0	128.0
3				56.0	109.8
5				55.0	92.9
6				54.0	75.7
7				53.0	58.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81078			x	51.5	41.5
9	200.49		x	51.0	24.5
81080			x	50.0	7.5
1			x	49.0	347.3
2			x	48.0	328.8
3			x	47.0	310.3
5			x	46.5	291.5
6			x	46.0	273.3
7				45.0	255.3
8				44.5	239.7
9				43.5	222.8
81090	201.50			43.5	204.5
1				42.0	187.5
2				41.0	168.8
3				40.0	150.0
5			x	39.0	130.0
6		x	x	37.8	111.7
7		x	x	36.8	94.7
8		x	x	35.2	77.5
9		x	x	34.3	59.5
81100	202.42			33.0	42.5
1				32.0	26.1
2			x	31.0	7.7
3				30.0	347.6
5				29.1	328.7
6				28.5	310.8
7				27.5	292.3
8				27.0	273.3
9				26.3	256.3
81110	203.34			25.5	239.5
1			x	25.0	222.6
2			x	23.9	205.4
4			x	23.0	186.0
5			x	22.0	168.5
6			x	21.0	149.3
7			x	19.9	129.5
8			x	18.5	111.4
9			x	17.5	93.5
81120	204.26			16.5	75.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81121				15.0	59.2
2				14.0	41.3
4				13.0	24.5
5				12.0	6.5
6				11.0	346.4
7				10.1	327.8
8			x	9.3	309.3
9	205.08		x	8.9	290.9
81130			x	8.0	272.3
1			x	7.2	254.8
2			x	6.5	237.6
4			x	5.9	221.5
5			x	4.9	203.5
6			x	4.0	185.5
7				3.0	166.9
8				2.0	147.9
9	206.00			0.9	128.5
81140				0.1	109.6
1				1.1	93.4
2				2.5	75.5
4				3.9	57.7
5			x	4.8	41.0
6			x	5.8	24.5
7			x	6.8	6.3
8			x	7.8	345.5
9	206.92		x	8.3	326.8
81150			x	9.1	308.3
1			x	10.0	290.3
2			x	10.5	271.3
4				11.1	254.3
5				12.0	237.7
6				12.8	221.1
7				13.6	202.5
8				14.5	184.5
9	207.84			15.3	165.5
81160				16.3	145.8
1			x	17.4	126.8
2			x	18.8	107.5
4			x	19.5	90.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81165			x	20.9	73.3
6			x	21.8	55.5
7			x	23.0	38.3
8			x	23.8	21.5
9			x	24.8	3.0
81170	208.84			25.5	342.8
1				26.5	323.8
2				26.9	304.8
3				27.5	287.3
5				28.0	268.4
6				28.8	249.9
7				29.1	233.7
8			x	30.0	217.0
9	209.67		x	30.8	198.3
81180			x	31.5	179.4
1			x	32.4	160.5
2			x	33.2	141.6
4			x	34.4	121.7
5			x	35.0	103.0
6			x	36.0	85.5
7			x	37.0	68.3
8				37.8	50.0
9				38.8	32.6
81190	210.68			39.5	14.5
1				40.0	355.4
2				40.5	335.4
3				41.0	315.4
5			x	41.5	298.3
6			x	41.9	278.3
7			x	42.1	260.2
8			x	42.3	243.3
9			x	42.5	227.0
81200	211.60		x	43.5	209.1
1			x	44.0	189.5
2			x	44.3	169.5
3			x	44.8	151.0
5				45.0	131.2
6				45.8	111.0

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81207				46.5	92.5
8				47.0	74.8
9				47.5	57.5
81210	212.52			48.3	38.5
1			x	48.6	21.1
2			x	48.8	3.1
3			x	49.0	342.6
5			x	49.4	322.6
6			x	49.3	303.1
7			x	49.3	284.8
8			x	49.0	266.3
9			x	48.9	247.5
81220	213.44		x	48.9	230.5
1				48.9	213.6
2				48.8	195.5
3				48.8	175.5
4				48.5	155.5
6				48.5	135.6
7				48.8	116.5
8			x	49.0	96.5
9			x	49.2	78.2
81230	214.35		x	49.2	62.1
1			x	49.2	44.0
2			x	49.2	26.0
3			x	49.0	7.4
4			x	49.0	349.3
5			x	48.5	329.3
7			x	48.0	309.3
8				47.3	291.1
9				47.0	273.4
81240	215.27			46.2	255.8
1				46.0	238.5
2				45.0	221.5
3				45.0	204.5
4			x	44.3	186.5
5		x	x	44.0	165.5
7		x	x	43.5	147.0
8		x	x	43.0	128.5
9		x	x	42.5	109.4

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81250	216.19		x	42.1	90.5
1			x	42.0	73.3
2			x	41.9	56.5
3			x	41.5	39.5
4				41.0	21.6
6				40.0	3.3
7				39.3	344.7
8				38.7	325.8
9				37.8	305.3
81260	217.11			36.8	288.3
1			x	35.7	271.3
2			x	34.9	253.9
3			x	33.9	236.7
4			x	33.0	220.5
5			x	32.0	204.5
7			x	31.0	187.0
8			x	30.2	165.5
9			x	29.2	147.5
81270	218.02		x	28.8	129.5
1				28.0	111.0
2				27.2	92.5
3				26.9	75.5
4				26.0	59.5
6				25.1	42.5
7				24.3	24.5
8			x	23.4	7.5
9			x	22.3	348.8
81280	218.94		x	21.0	330.3
1			x	19.9	310.3
2			x	18.7	292.8
3			x	17.3	275.3
4			x	16.0	258.8
5			x	14.8	241.5
7			x	13.5	224.0
8				12.2	208.2
9				11.0	190.3
81290	219.86			9.8	170.7
1				8.8	152.0
2				7.9	133.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81293				7.0	115.4
4			x	6.0	96.4
6			x	5.0	79.3
7			x	4.0	63.4
8			x	3.0	45.7
9			x	2.0	27.5
81300	220.78		x	0.9	10.4
1			x	0.1	352.3
2			x	1.6	333.3
3			x	3.0	313.1
4				4.3	295.3
6				5.7	277.5
7				7.0	260.1
8				8.3	243.4
9				9.9	225.6
81310	221.70			11.0	209.7
1			x	12.1	191.5
2			x	13.2	172.0
3			x	14.5	153.5
4			x	15.5	134.5
6			x	16.5	115.7
7			x	17.4	97.0
8			x	18.3	79.2
9			x	19.1	63.1
81320	222.62		x	20.0	46.6
1				21.0	28.5
2				22.0	10.5
3				23.0	351.3
4				24.7	332.3
6				28.5	311.3
7				27.0	293.2
8			x	28.5	275.3
9			x	29.5	257.5
81330	223.53		x	31.0	240.2
1			x	32.5	222.0
2			x	33.5	205.5
3			x	34.8	186.7
5			x	35.7	165.8
6			x	36.8	146.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81337			x	37.3	127.5
8				38.2	109.0
9				39.0	89.7
81340	224.45			39.7	72.5
1				40.5	55.1
2				41.0	37.5
3				41.8	18.2
5			x	42.8	359.3
6			x	43.5	340.3
7			x	44.5	320.3
8			x	45.3	300.3
9	225.28		x	46.2	280.8
81350			x	47.0	263.2
1			x	47.9	245.3
3			x	48.2	226.5
4			x	49.0	209.4
5				49.5	191.5
6				50.0	171.5
7				50.3	149.5
8				50.3	130.0
9	226.20			50.3	111.5
81360				50.0	93.5
1			x	50.0	74.5
3			x	50.0	56.5
4			x	49.8	40.5
5			x	49.5	22.5
6			x	49.0	2.5
7			x	49.0	342.7
8			x	49.0	324.8
9	227.11		x	49.0	305.3
81370			x	49.0	286.3
2				48.5	267.9
3				48.3	251.3
4				48.0	234.5
5				47.9	216.7
6				47.5	199.5
7				47.0	181.2
8			x	46.5	162.5
9	228.03		x	45.3	143.0

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81381			x	44.6	123.5
2			x	43.5	106.9
3			x	42.8	89.6
4			x	41.5	71.7
5			x	40.5	55.5
6			x	39.5	39.5
7			x	38.9	23.6
8				37.6	5.5
9	288.95			36.5	347.3
81390				35.7	330.3
2				35.0	311.8
3				34.0	294.3
4				33.0	277.8
5			x	32.0	261.4
6		x	x	31.1	245.8
7		x	x	30.2	230.5
8		x	x	29.0	216.5
9	229.87	x	x	28.2	198.4
81401			x	27.0	181.0
2			x	25.5	162.5
3			x	24.0	144.3
4			x	22.5	127.4
5				21.0	110.0
6				19.5	92.5
7				18.0	76.0
9				16.3	61.5
81410	230.88			14.9	45.3
1				13.3	28.5
2			x	12.0	12.0
3			x	10.5	355.3
4			x	9.5	337.8
5			x	8.0	318.1
6			x	7.0	301.0
8			x	5.7	283.9
9			x	4.5	267.9
81420	231.80		x	3.3	250.9
1			x	2.1	235.5
2				1.0	220.7
3				0.1	204.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81424				1.5	186.7
5				3.0	169.3
7				4.3	151.5
8				5.8	133.5
9			x	7.5	115.3
81430	232.71		x	9.0	98.0
1			x	10.5	81.5
2			x	12.0	65.5
3			x	13.7	48.7
5			x	15.0	32.3
6			x	16.5	16.5
7			x	17.8	359.2
8			x	19.0	340.0
9				19.8	321.3
81440	233.63			20.9	303.8
1				21.3	287.3
2				22.5	269.3
3				23.0	252.6
5				23.5	237.6
6			x	24.0	222.5
7			x	24.5	205.5
8			x	25.0	188.0
9			x	25.5	171.5
81450	234.55		x	25.9	154.3
1			x	26.9	135.5
2			x	26.8	117.7
3			x	27.0	102.3
5			x	27.2	85.5
6				27.2	68.7
7				27.1	53.0
8				27.0	38.5
9	235.38			26.5	23.0
81460				26.0	5.6
1				25.3	347.6
3			x	24.5	331.1
4			x	23.5	313.2
5			x	22.5	295.4
6			x	21.0	279.4
7			x	19.5	264.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81468			x	18.2	249.2
9	236.29		x	16.7	228.4
81470			x	15.0	219.3
1				13.5	204.3
3				12.0	188.0
4				10.5	171.3
5				9.0	155.3
6				7.5	139.1
7				6.0	122.5
8			x	4.5	106.5
9	237.21		x	3.5	90.5
81480			x	1.8	76.5
2			x	0	62.5
3			x	1.4	46.7
4			x	3.0	31.5
5			x	4.5	17.5
6			x	6.0	1.4
7			x	8.0	343.8
8				10.0	327.3
9	238.13			11.5	311.3
81491				13.5	294.9
2				15.5	278.3
3				17.5	263.2
4				19.0	249.1
5			x	21.0	234.0
6			x	23.0	219.5
7			x	24.9	203.5
8			x	26.5	187.5
81500	239.14		x	28.0	171.2
1			x	29.8	153.5
2			x	31.1	136.8
3			x	32.7	120.5
4			x	33.9	104.8
5				35.0	88.3
6				36.5	73.5
7				37.1	59.6
9				38.3	44.5
81510	240.06			39.0	29.5
1				39.5	15.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81512			x	40.2	359.2
3			x	40.6	343.3
4			x	41.0	327.3
5			x	41.1	310.8
7			x	41.1	296.1
8			x	41.1	281.3
9			x	41.0	266.5
81520	240.98		x	40.6	252.4
1			x	39.8	238.6
2				39.0	225.5
3				37.8	211.4
4				36.8	196.5
5				35.0	181.5
7				33.5	165.6
8				32.0	149.7
9			x	30.0	134.5
81530	241.89		x	27.8	119.7
1			x	25.5	104.5
2			x	23.1	90.5
3			x	21.0	77.1
5			x	19.0	64.3
6			x	16.8	50.5
7			x	14.5	36.3
8			x	12.5	23.0
9				10.5	9.3
81540	242.81			8.8	355.2
1				6.7	339.3
2				4.5	324.3
4				3.0	309.8
5				1.0	295.8
6			x	0.8	281.6
7			x	2.5	267.7
8			x	4.2	254.5
9			x	6.0	242.5
81550	243.73		x	8.0	228.1
1			x	10.0	215.5
2			x	11.9	202.3
4			x	13.5	188.6
5			x	15.3	173.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81556				17.0	158.7
7				18.7	143.7
8				20.0	129.5
9	244.56			21.1	114.3
81560				22.3	100.5
1				22.9	87.0
3			x	23.1	73.5
4			x	23.1	59.5
5			x	23.0	46.5
6			x	22.5	32.5
7			x	21.5	18.8
8			x	20.8	3.0
9	245.47		x	19.0	347.3
81570			x	18.3	333.3
2			x	15.3	317.9
3				13.0	303.2
4				10.5	289.1
5				8.0	275.5
6				5.7	263.2
7				3.0	249.4
8				0.7	237.4
9	246.39		x	1.5	225.5
81581			x	4.2	213.5
2			x	6.0	199.5
3			x	8.3	186.5
4			x	10.3	173.2
5			x	12.3	160.0
6			x	14.5	145.5
7			x	16.5	131.9
9			x	18.5	119.5
81590	247.40			20.5	106.7
1				22.5	93.9
2				24.9	81.7
3				27.0	70.8
4				29.0	59.7
5				31.0	48.3
6			x	32.5	36.7
8			x	33.8	25.7
9			x	35.0	13.5

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81600	248.32		x	35.8	359.4
1			x	36.2	347.5
2			x	36.5	335.3
3			x	36.5	322.1
4			x	36.0	307.7
5			x	35.1	295.3
7				34.2	283.1
8				32.9	270.3
9				31.0	257.2
81610	249.24			28.9	245.1
1				26.9	233.5
2				24.8	221.0
3			x	22.4	208.0
5			x	20.3	195.4
6			x	18.2	181.7
7			x	16.2	168.5
8			x	14.0	153.7
9			x	12.0	140.5
81620	250.16		x	10.0	128.3
1			x	8.0	113.5
2			x	6.0	102.0
3				3.8	90.5
5				1.6	78.5
6				0.6	67.0
7				2.9	55.2
8				5.1	43.8
9				7.1	33.5
81630	251.07		x	9.2	22.0
1			x	11.0	9.6
2			x	12.5	357.3
4			x	13.0	346.3
5			x	13.2	334.1
6			x	12.8	322.0
7			x	12.0	311.3
8			x	11.2	300.5
9	251.90		x	10.0	291.3
81640				8.5	281.2
1				7.1	272.6
3				5.9	265.1

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81644				4.2	256.8
5				2.8	249.3
6				1.5	242.4
7			x	0	235.3
8			x	1.1	229.2
9	252.82		x	2.5	221.9
81651			x	3.4	215.4
2			x	4.2	209.6
3			x	5.0	203.6
4			x	6.0	197.5
5			x	6.8	191.5
6			x	7.2	186.2
7				8.0	181.3
8				8.8	175.5
9	253.74			9.5	171.3
81661				10.1	167.6
2				11.1	165.5
3				12.0	163.3
4			x	13.0	162.5
5			x	14.0	162.5
6			x	14.9	163.7
7			x	15.9	165.8
9			x	16.4	168.5
81670	254.74		x	17.0	171.4
1			x	17.5	173.8
2			x	17.9	177.6
3			x	18.0	181.8
4				18.0	275.4
5				17.9	278.5
6				17.5	192.5
8				17.8	196.7
9				18.0	200.3
81680	255.66			18.3	204.3
1			x	19.0	208.0
2			x	20.0	211.5
3			x	20.6	213.0
4			x	21.6	215.7
	Record blank between 81685 and 81710				
81710	258.42			1.8	240.0

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81711				4.0	243.4
2				6.2	243.3
4				8.2	244.3
5			x	9.7	247.3
6			x	10.9	249.3
7			x	11.4	253.5
8			x	11.5	258.6
9	259.24		x	11.2	266.2
81720			x	10.9	273.4
1			x	10.0	283.5
3			x	8.9	294.8
4			x	7.9	307.1
5				6.5	320.3
6				4.8	336.7
7				3.0	351.1
8				0	6.2
9	260.16			3.0	21.0
81731				7.1	35.0
2			x	12.0	48.0
3			x	17.2	61.5
4			x	23.0	73.6
5			x	28.8	88.5
6			x	33.0	103.0
7			x	35.8	118.5
8			x	36.3	136.0
81740	261.17		x	33.5	153.5
1			x	28.7	167.8
2				22.0	182.0
3				13.9	194.9
4				4.3	206.7
5				4.0	219.3
6				11.9	223.0
7				18.0	248.7
9			x	22.2	268.5
81750	262.09		x	23.0	291.2
1			x	20.8	312.3
2			x	15.1	335.8
3			x	6.9	356.3
4			x	2.8	15.3

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Counter Clock	Time Seconds	Timing Pulses		θ	ψ
		12-Sec	1/2-Sec		
81755			x	13.0	31.5
6			x	23.0	47.7
8			x	32.8	66.7
9				39.0	88.0
81760	263.01			41.1	111.0
1				38.7	136.5
2				31.0	160.8
3				20.3	181.3
5				8.8	198.5
6	Not readable				
7	Not readable				
8	Not readable				
9			x	26.0	282.3
81770	263.92		x	23.8	309.2
1			x	17.2	338.6
2			x	6.2	0.7
4			x	6.8	19.5
5	Not readable				
6	Not readable				
7				42.0	87.5
8				43.5	117.6
9	264.75			37.2	149.6
81781				24.5	177.5
2			x	9.1	199.5
3			x	6.0	219.6
4			x	20.0	242.5
5			x	30.0	271.3
6	265.39			29.8	303.3

