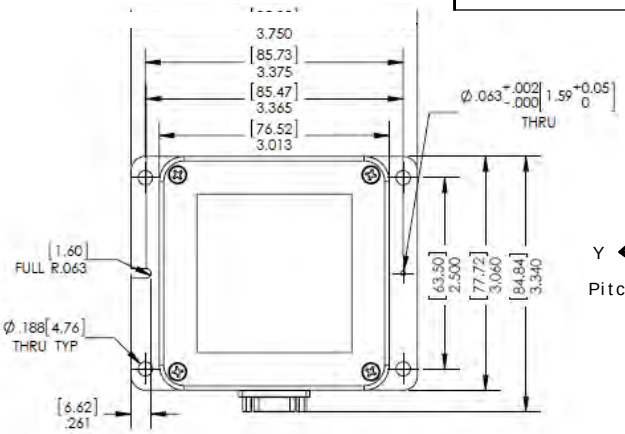
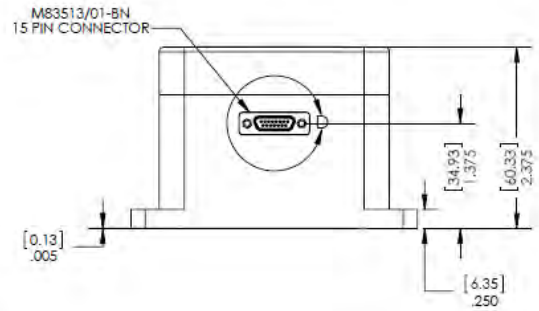
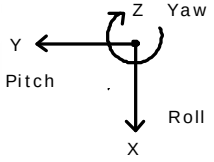
MRM 50 Analog IMU





Axes (Top View)
Right Hand Rule



MRM 50 Analog IMU
MRM50IMU-100-**02**-200 or -**6** or -**10**
MRM50IMU-175-**02**-200 or -**6** or -**10**
MRM50IMU-300-**02**-200 or -**6** or -**10**
MRM50IMU-100-**02**-250 or -**6** or -**10**
MRM50IMU-175-**02**-250 or -**6** or -**10**
MRM50IMU-300-**02**-250 or -**6** or -**10**

Pin No.	Assignment
1	RS-485 A (+)
2	RS-485 B (-)
3	Power Ground
4	Case
5	**+6V to +36V Input Power**
6	External Sync Input (1kHz) Option Connect to ground if not using
7	Temperature = 50mV/° C typical
8	Sig Gnd (-200) or 2.5V Ref (-250)
9	Self Test 3.3V Logic Level
10	Roll Gyro (X) Analog Out ± 5V
11	Pitch Gyro (Y) Analog Out ± 5V
12	Yaw Gyro (Z) Analog Out ± 5V
13	X Accelerometer Analog Out ± 5V
14	Y Accelerometer Analog Out ± 5V
15	Z Accelerometer Analog Out ± 5V

For -200 the analog signals are ±5 volts full scale measured with respect to signal ground pin 8.

For -250 the analog signals are ±2.5 volts full scale measured with respect to 2.5V reference pin 8.

Load > 5K Ohms & <100pf on each signal.

Specification

PARAMETER	*MRM 50 Analog IMU*					
	RATE AXES			ACCEL AXES		
Range	±100°/sec	±175°/sec	±300°/sec	±2 g's	±6 g's	±10 g's
Bias (In Run Stability)	1°/hour	1.5°/hour	2°/hour	0.02mg	0.04mg	0.05mg
	1σ			*1σ*		
Angle Random Walk	0.0009°	0.0025°	0.003°	0.02	0.065	0.07
	/sec/√Hz 1σ			mg/√Hz 1σ		
Bias (Over Temp.)	<0.01°/sec	<0.02°/sec	<0.02°/sec	<1.0mg	<1.3mg	<1.5mg
	2σ			*1σ*		
Scale Factor -200	50mV/°/s	28.6mV/°/s	16.7mV/°/s	2.5V/g	0.83V/g	0.5V/g
Scale Factor -250	25mV/°/s	14.3mV/°/s	8.33mV/°/s	1.25V/g	0.415V/g	0.25V/g
Scale Factor Error %	≤0.06% *(over temperature)*					
Sensor Resolution	0.0005°/sec	0.0012°/sec	0.0015°/sec	0.02mg	0.05mg	0.06mg
Alignment	< 0.5 mrad *1σ*					
G-Sensitivity	<0.002°/sec/g *1σ*					
Self Test On	N/A			Δ 1 ±0.25g	Δ 0.35 ±0.2g	Δ 0.35 ±0.2g
	Logic 1 = 3V to 5V at Pin 9					
Temp Range Operating: Non-Operating:	-40°C to +85°C -55°C to +100°C					
Bandwidth	200 Hz					
Temp Sensors	6 Internal Temperature Sensors					
Start-up Time	< 0.3 sec					
Input Power	**+6.0V to +36V Max. Input (single sided)** **(Input Transient Protection to 80V)**					
Power Consumption	950 mW at +12V *typical* 1100 mW at +12V *maximum*					
Size U.S.: Metric:	3.0 X 3.06 X 2.38 = 21.8 in^3 7.62 X 7.8 X 6.05 = 360 cm^3					
Weight	<500 grams					
Mounting	4ea No.8 or M4 Screws					
Shock	500g's ½ sine 2 msec powered					
Vibration	6 gRMS *(20Hz - 2KHz ~ 10g accelerometers)*					
MTBF	No inherent wear out modes for long life.					

Specification subject to change without notice

Gladiator Technologies
High Performance Inertial MEMS

Gladiator Technologies, Inc.
8022 Bracken Place SE
Snoqualmie, WA 98065 USA

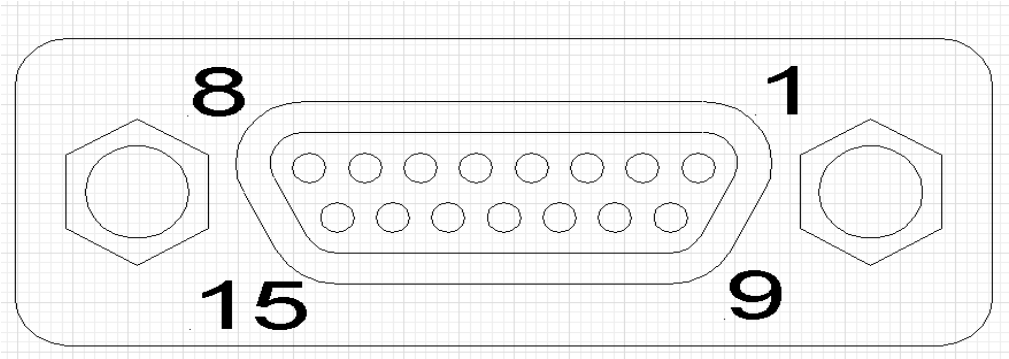
Rev. 14May23
SN: 600

Pin No.	Assignment	Color
1	RS-485 A (+)	Black
2	RS-485 B (-)	Brown
3	Power Ground	Red
4	Case	Orange
5	**+6V to +36V Input Power**	Yellow
6	External Sync Input (1kHz) Option Connect to ground if not using	Green
7	Temperature = 50mV/° C typical	Blue
8	Signal Ground	Violet
9	Self Test 3.3V Logic Level	Gray
10	Roll Gyro (X) Analog Out ± 5V	White
11	Pitch Gyro (Y) Analog Out ± 5V	Black
12	Yaw Gyro (Z) Analog Out ± 5V	Brown
13	X Accelerometer Analog Out ± 5V	Red
14	Y Accelerometer Analog Out ± 5V	Orange
15	Z Accelerometer Analog Out ± 5V	Yellow

Standard -200 Model: The analog signals are ±5 volt scaled maximum measured with respect to signal ground pin 8. Load ≥ 5K Ohms & <100pf on each signal.

Note:

The last 5 pins have duplicate colors of the first 5 pins – DO NOT MIX THEM UP.



15 pin connector as viewed on the front of the MRM

DSPM Industria® sensori & trasduttori
Via Paolo Uccello 4 - 20148 Milano
Tel +39 02 48 009 757 Fax +39 02 48 002 070 info@dspmindustria.it www.dspmindustria.it

SN602 ATP

6/24/2014

MRM50IMU-100-06-250
Rate Spin Test

Test	gyroX	gyroY	gyroZ	accelX	accelY	accelZ	temp X
PX	7200.051	-3.778	0.24	0.3135	-0.357	-0.6605	2595.606
NX	-7199.625	-2.142	-0.004	0.318	-2.875	-3.2855	2596.774
Diff/2	7199.838	-0.818	0.122	-0.00225	1.259	1.3125	-0.584
Ave	0.213	-2.96	0.118	0.31575	-1.616	-1.973	2596.19
PY	-1.707	7199.915	-0.097	-2.616	0.646	-0.3955	2586.907
NY	-2.858	-7200.196	0.411	-0.189	0.754	-3.136	2588.043
Diff/2	0.5755	7200.056	-0.254	-1.2135	-0.054	1.37025	-0.568
Ave	-2.2825	-0.1405	0.157	-1.4025	0.7	-1.76575	2587.475
PZ	-2.592	-2.58	7198.935	-3.445	1.192	1.923	2569.542
NZ	-1.843	-3.185	-7201.007	-5.861	-1.3755	1.9845	2570.788
Diff/2	-0.3745	0.3025	7199.971	1.208	1.28375	-0.03075	-0.623
Ave	-2.2175	-2.8825	-1.036	-4.653	-0.09175	1.95375	2570.165
RSF Norm	0.999978	1.000008	0.999996				Temp ºC 25.85

Gyro Mis-Align deg/sec

				Input Rate
x		0.01	0.00	x
y	-0.01		0.00	y
z	0.00	0.00		z

Gyro Mis-align mrad

				Input Rate
x		0.08	-0.05	x
y	-0.11		0.04	y
z	0.02	-0.04		z

Accepted by:

GTI

DSPM Industria sensori & trasduttori
Via Paolo Uccello 4 - 20148 Milano
Tel +39 02 48 009 757 Fax +39 02 48 002 070 info@dspmindustria.it www.dspmindustria.it

SN602 ATP

6/24/2014

MRM50IMU-100-06-250
Accelerometer Tumble Test

Test	gyroX	gyroY	gyroZ	accelX	accelY	accelZ	temp X
PX	-0.029	0.052	-0.162	998.858	0.5615	0.281	2585.114
NX	-0.012	0.147	-0.13	-1001.228	0.7295	-0.053	2582.594
Diff/2	-0.0085	-0.0475	-0.016	1000.043	-0.084	0.167	1.26
Ave	-0.0205	0.0995	-0.146	-1.18475	0.6455	0.114	2583.854
PY	-0.114	0.223	-0.137	0.2305	998.991	0.3185	2592.398
NY	-0.072	0.144	-0.088	0.055	-1000.9	-0.0325	2594.16
Diff/2	-0.021	0.0395	-0.0245	0.08775	999.9453	0.1755	-0.881
Ave	-0.093	0.1835	-0.1125	0.14275	-0.95425	0.143	2593.279
PZ	-0.084	0.121	-0.105	0.172	-0.6055	1000.656	2593.46
NZ	-0.126	0.257	-0.125	0.273	-0.12	-999.321	2590.084
Diff/2	0.021	-0.068	0.01	-0.0505	-0.24275	999.9885	1.688
Ave	-0.105	0.189	-0.115	0.2225	-0.36275	0.6675	2591.772
Bias °/s,mg	-0.001	0.002	-0.001	0.18	0.14	0.13	25.90
ASF Norm				1.0000	0.9999	1.0000	Temp °C

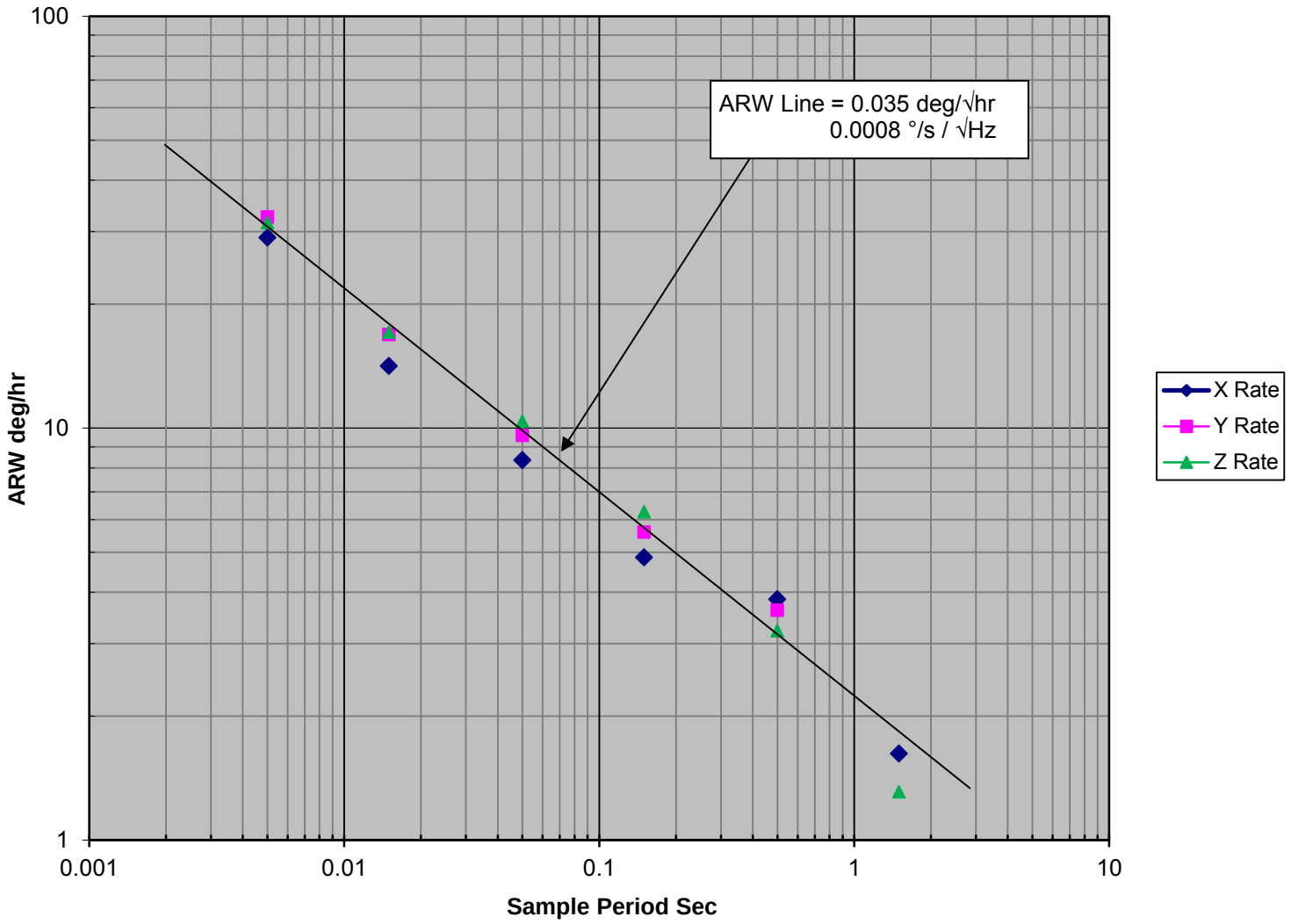
Gyro °/s /g		Input g =			Accel In g's
	x	0.000	0.000	0.000	x
	y	0.000	0.000	-0.001	y
	z	0.000	0.000	0.000	z

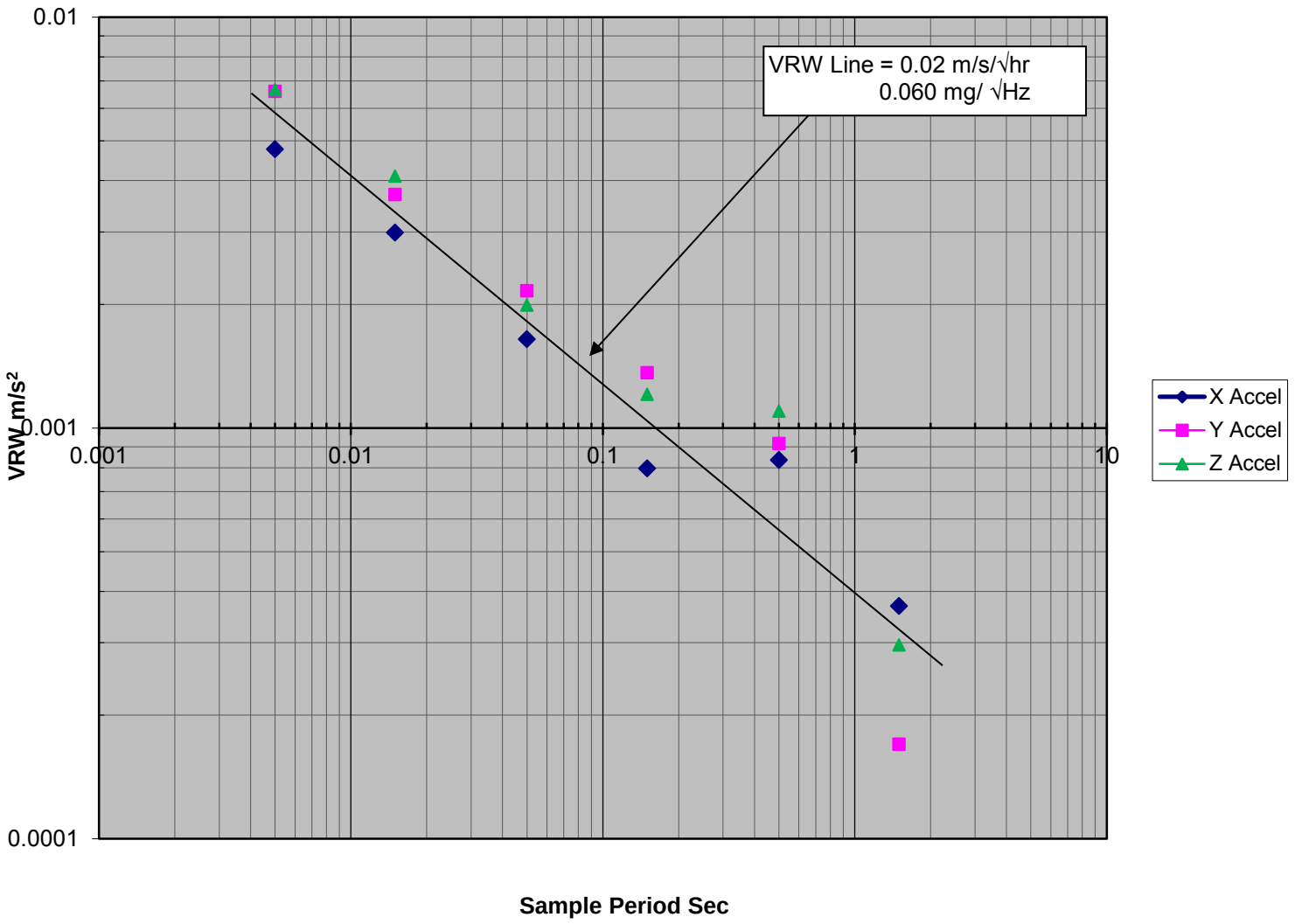
	Accel Mis-Align		
	0.09	-0.05	x
-0.08		-0.24	y
0.17	0.18		z

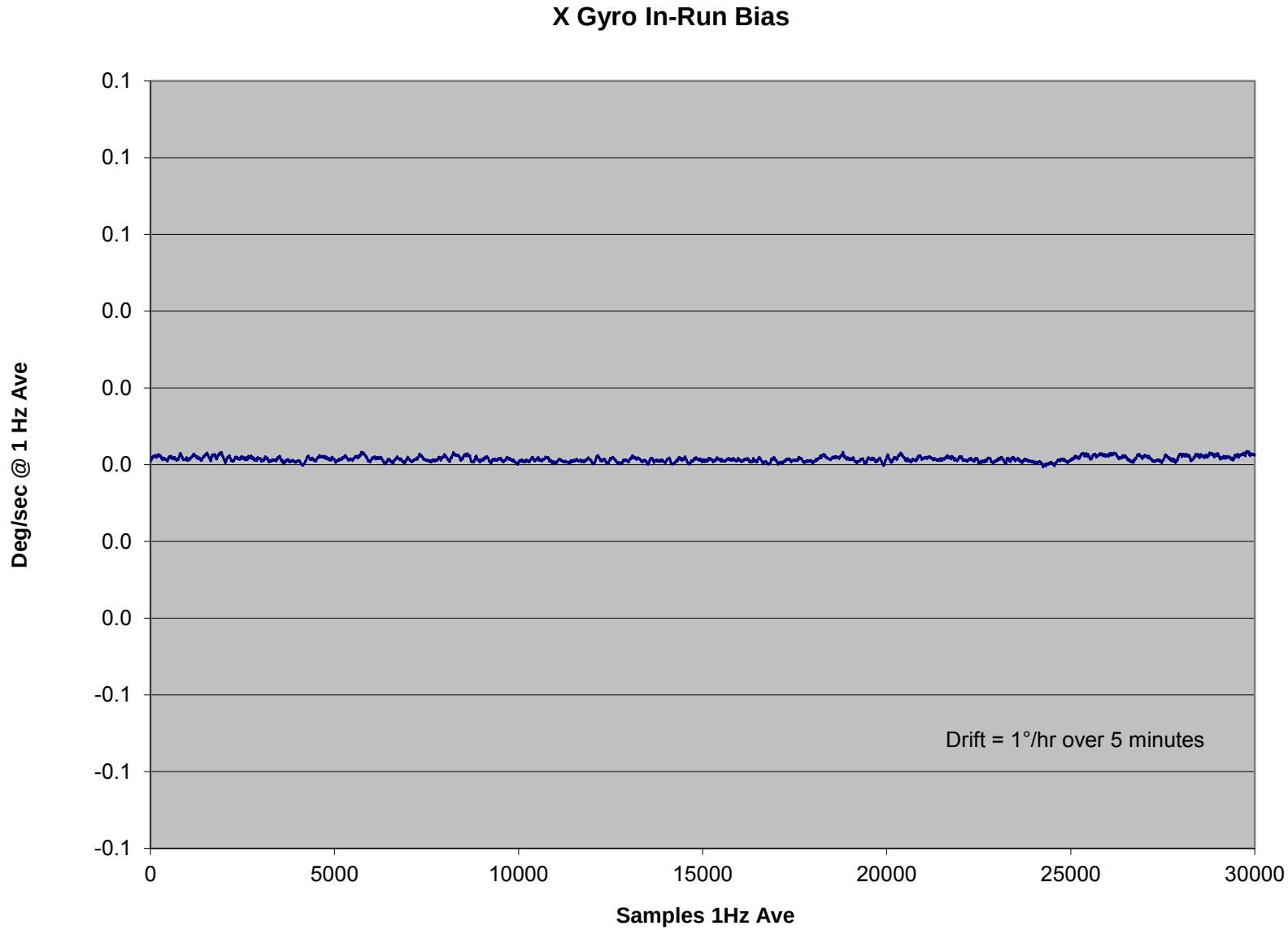
Accepted by:

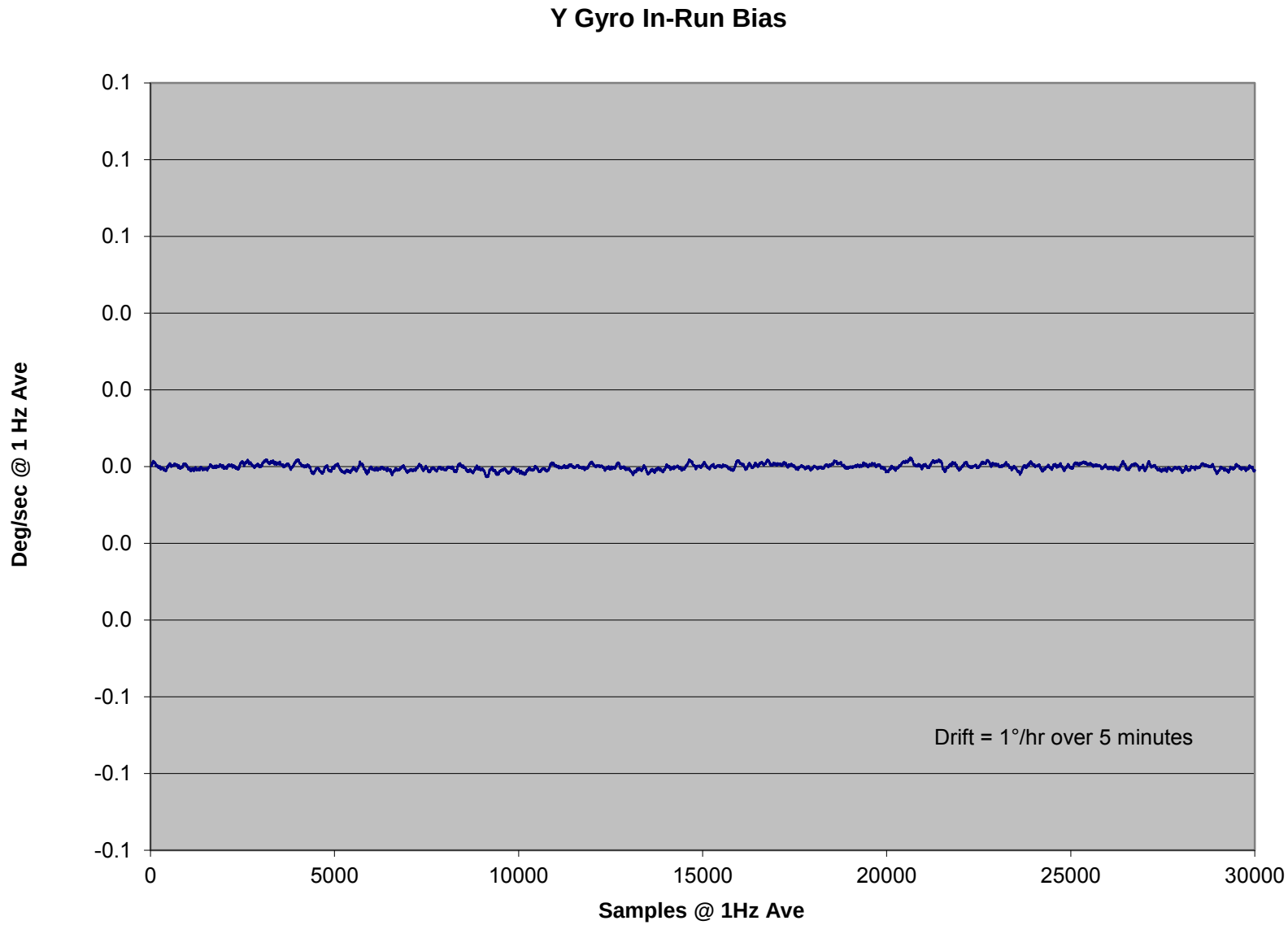
GTI

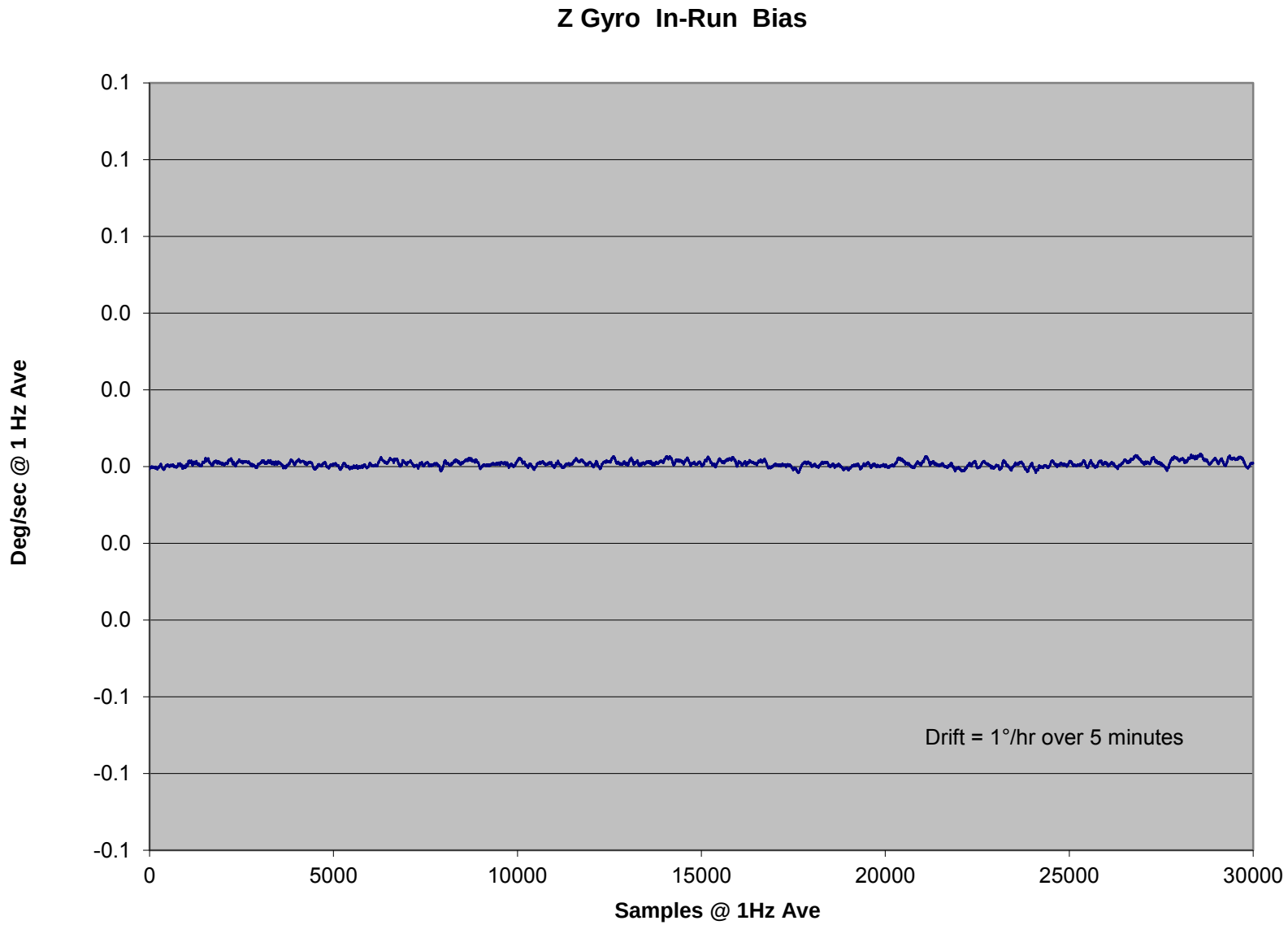
DSPM Industria sensori & trasduttori
Via Paolo Uccello 4 - 20148 Milano
Tel +39 02 48 009 757 Fax +39 02 48 002 070 info@dspmindustria.it www.dspmindustria.it

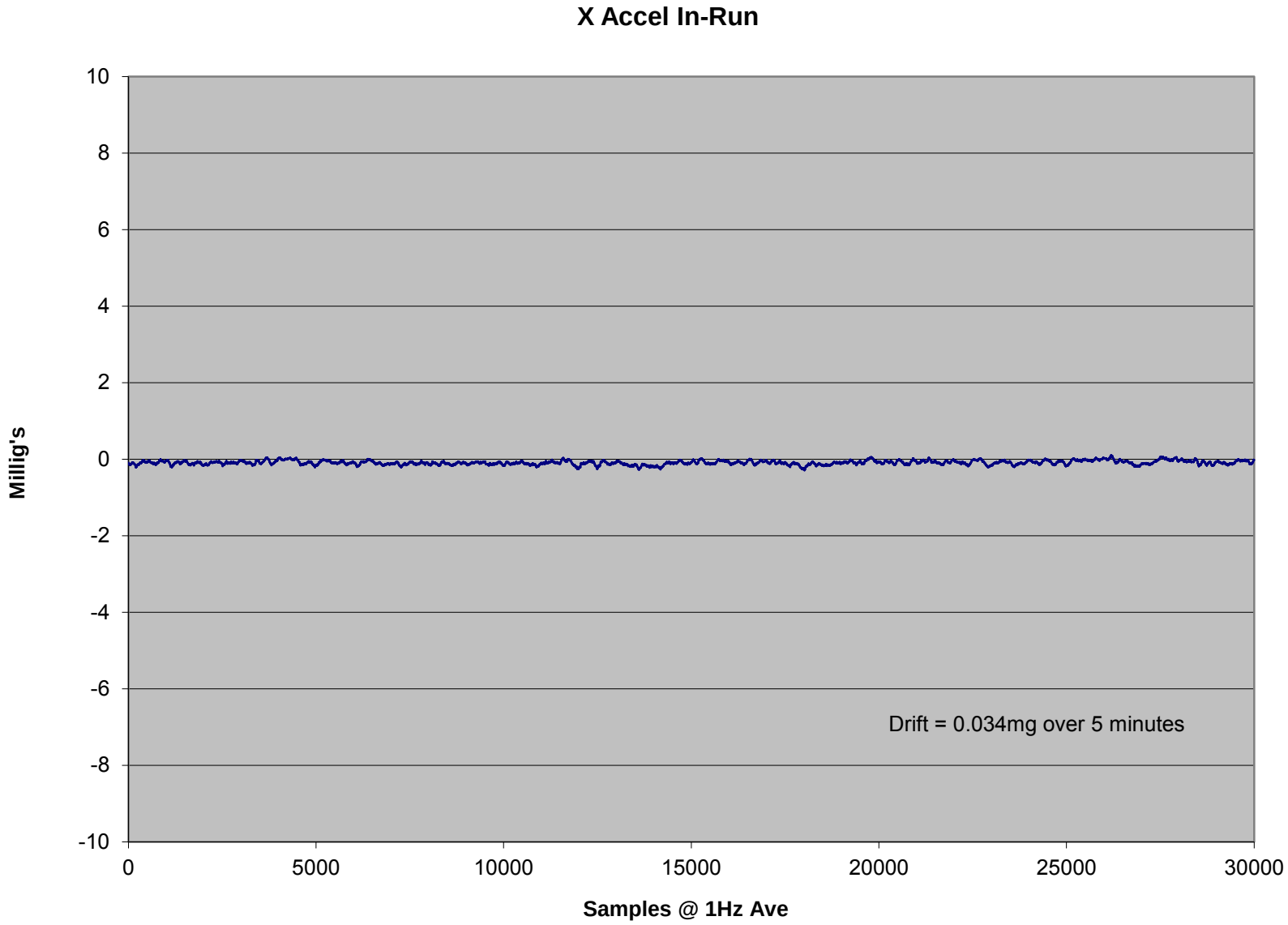

ARW Line = 0.035 deg/√hr
0.0008 °/s / √Hz
ARW deg/hr
100
10
1
0.001
0.01
0.1
1
10
Sample Period Sec
X Rate
Y Rate
Z Rate

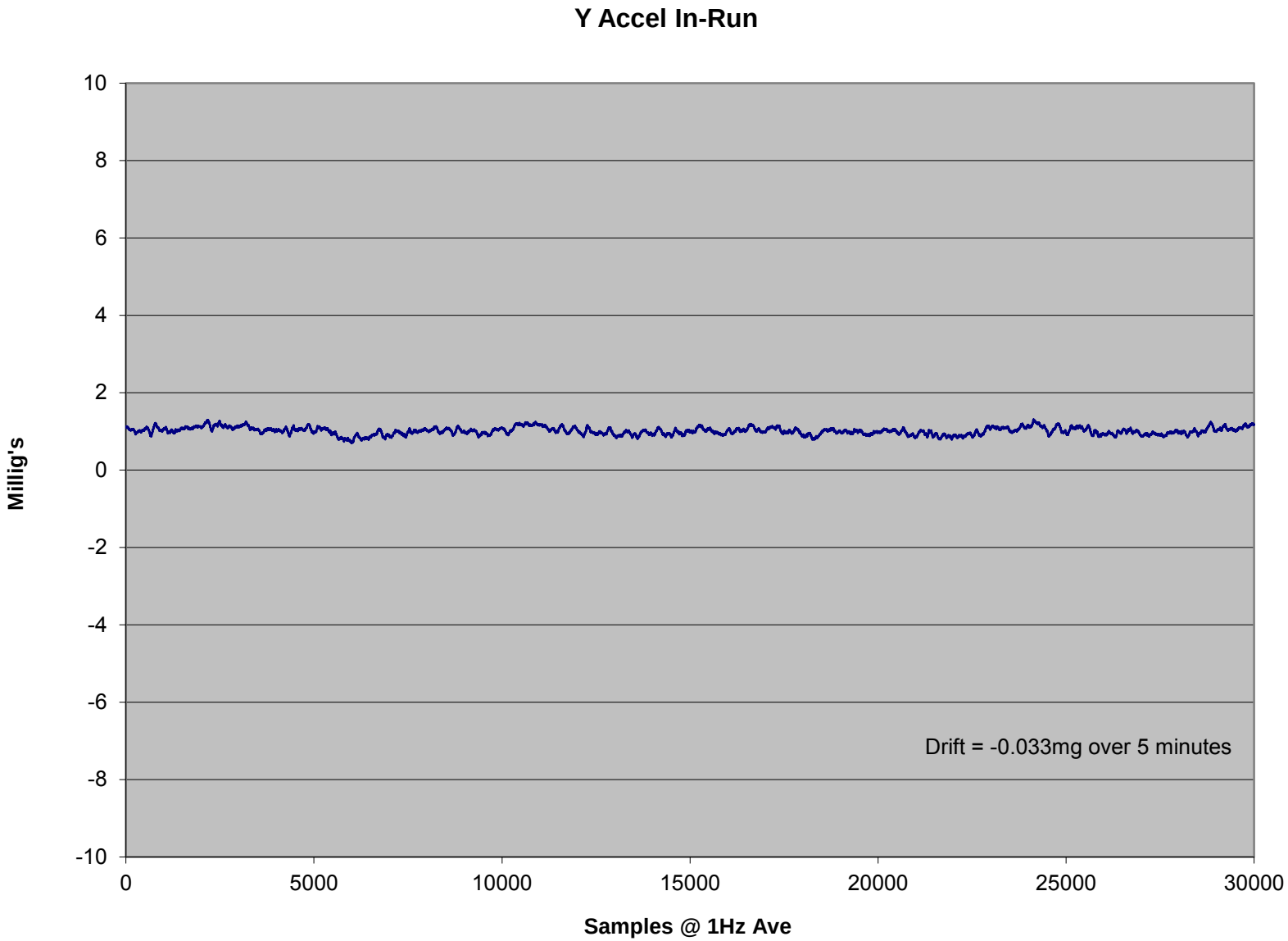

VRW Line = 0.02 m/s/√hr
0.060 mg/ √Hz
0.01
0.001
0.0001
VRW m/s²
0.001
0.01
0.1
1
10
X Accel
Y Accel
Z Accel
Sample Period Sec

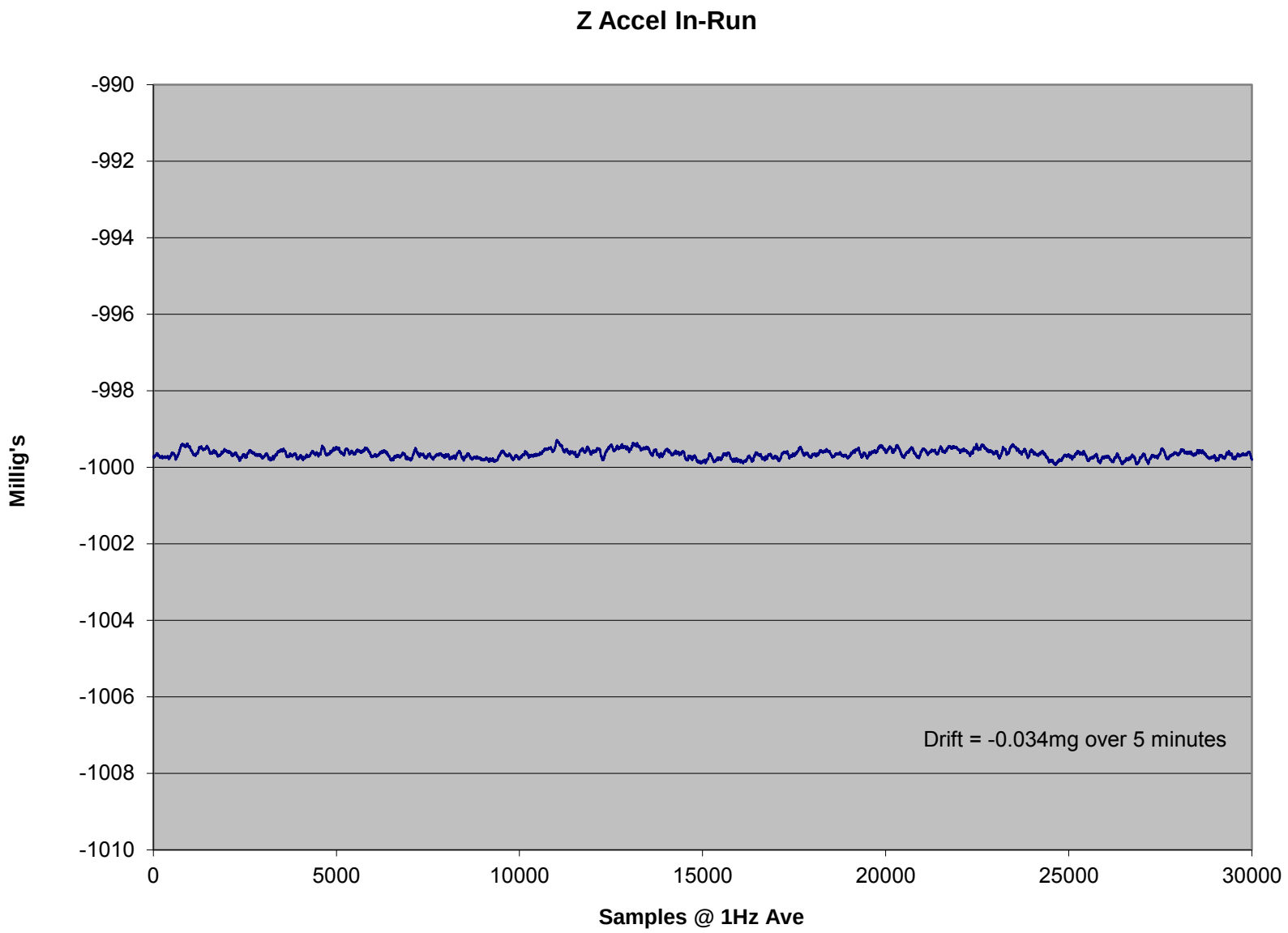

X Gyro In-Run Bias
Deg/sec @ 1 Hz Ave
0.1
0.1
0.1
0.0
0.0
0.0
0.0
0.0
-0.1
-0.1
-0.1
0
5000
10000
15000
20000
25000
30000
Samples 1Hz Ave
Drift = 1°/hr over 5 minutes


Y Gyro In-Run Bias
Deg/sec @ 1 Hz Ave
0.1
0.1
0.1
0.0
0.0
0.0
0.0
0.0
-0.1
-0.1
-0.1
0
5000
10000
15000
20000
25000
30000
Samples @ 1Hz Ave
Drift = 1°/hr over 5 minutes


Z Gyro In-Run Bias
Deg/sec @ 1 Hz Ave
0.1
0.1
0.1
0.0
0.0
0.0
0.0
0.0
-0.1
-0.1
-0.1
0
5000
10000
15000
20000
25000
30000
Samples @ 1Hz Ave
Drift = 1°/hr over 5 minutes


X Accel In-Run
Millig's
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
5000
10000
15000
20000
25000
30000
Samples @ 1Hz Ave
Drift = 0.034mg over 5 minutes


Y Accel In-Run
Millig's
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
5000
10000
15000
20000
25000
30000
Samples @ 1Hz Ave
Drift = -0.033mg over 5 minutes


Z Accel In-Run
Millig's
-990
-992
-994
-996
-998
-1000
-1002
-1004
-1006
-1008
-1010
0
5000
10000
15000
20000
25000
30000
Samples @ 1Hz Ave
Drift = -0.034mg over 5 minutes

MRM50IMU-100-06-250
Rate Spin Test

SN602 Rate Range 100 Spin 72 °/s Initial Temp 25.8 C
Scan rate: 0.001 seconds Number of scans: 10,000

Row	Time	X Rate	X Ref	Y Rate	Y Ref	Z Rate	Z Ref	X Accel	A Ref	Y Accel	A Ref	Z Accel	A Ref	Temp	open	ST	V In	Head C
PXSF		4.2976	2.4980	2.4891	2.4980	2.4979	2.4980	2.4972	2.4980	2.4972	2.4980	2.4994	2.4980	3.1389	3.1488	-0.0187	0.0323	25.8
	RSF V dps	1.7996	0.0250	-0.0089	-0.0001	0.0000	0.0000											
NXSF		0.6992	2.4980	2.5052	2.4980	2.4978	2.4980	2.4972	2.4980	2.4973	2.4980	2.4994	2.4980	3.1392	3.1489	-0.0187	0.0309	25.8
	RSF V dps	-1.7988	-0.0250	0.0072	0.0001	-0.0002	0.0000											
	X RSF=	V/°/sec	0.0250															
	Align to X	radians	1.0000		-0.0045		0.0000											
		degrees	57.2958		-0.2564		0.0025											
PYSF		2.5056	2.4980	4.2971	2.4980	2.4979	2.4980	2.4958	2.4980	2.4982	2.4980	2.4994	2.4980	3.1413	3.1515	-0.0187	0.0316	25.8
	RSF V dps	0.0076	0.0001	1.7991	0.0250	-0.0001	0.0000											
NYSF		2.4894	2.4980	0.6990	2.4980	2.4981	2.4980	2.4958	2.4980	2.4982	2.4980	2.4994	2.4980	3.1416	3.1506	-0.0187	0.0314	25.8
	RSF V dps	-0.0086	-0.0001	-1.7990	-0.0250	0.0000	0.0000											
	Y RSF=	V/°/sec			0.0250													
	Align to Y	radians	0.0045				0.0000											
		degrees	0.2592				-0.0022											
PZSF		2.4992	2.4980	2.4974	2.4980	4.2965	2.4980	2.4951	2.4980	2.4973	2.4980	2.5017	2.4980	3.1427	3.1523	-0.0187	0.0320	25.8
	RSF V dps	0.0012	0.0000	-0.0006	0.0000	1.7985	0.0250											
NZSF		2.4959	2.4980	2.4971	2.4980	0.6986	2.4980	2.4980	2.4980	2.4973	2.4980	2.5017	2.4980	3.1431	3.1529	-0.0187	0.0309	25.9
	RSF V dps	-0.0021	0.0000	-0.0009	0.0000	-1.7994	-0.0250											
	Z RSF=	V/°/sec					0.0250										Ave Temp	25.8
	Align to Z	radians	0.0009		0.0001													
		degrees	0.0532		0.0053													

Summary V/°/sec
X RSF= 0.02499
Y RSF= 0.02499
Z RSF= 0.02499

Alignment Matrix in radians — Corrected

X =	1.0000	-0.0045	-0.0009
Y =	0.0045	1.0000	-0.0001
Z =	0.0000	0.0000	1.0000

Abs Ave = 0.002
Std Dev= 0.0029

Measured

Xin	0.00	0.26	0.05
Yin	-0.26	0.00	0.01
Zin	0.00	0.00	0.00

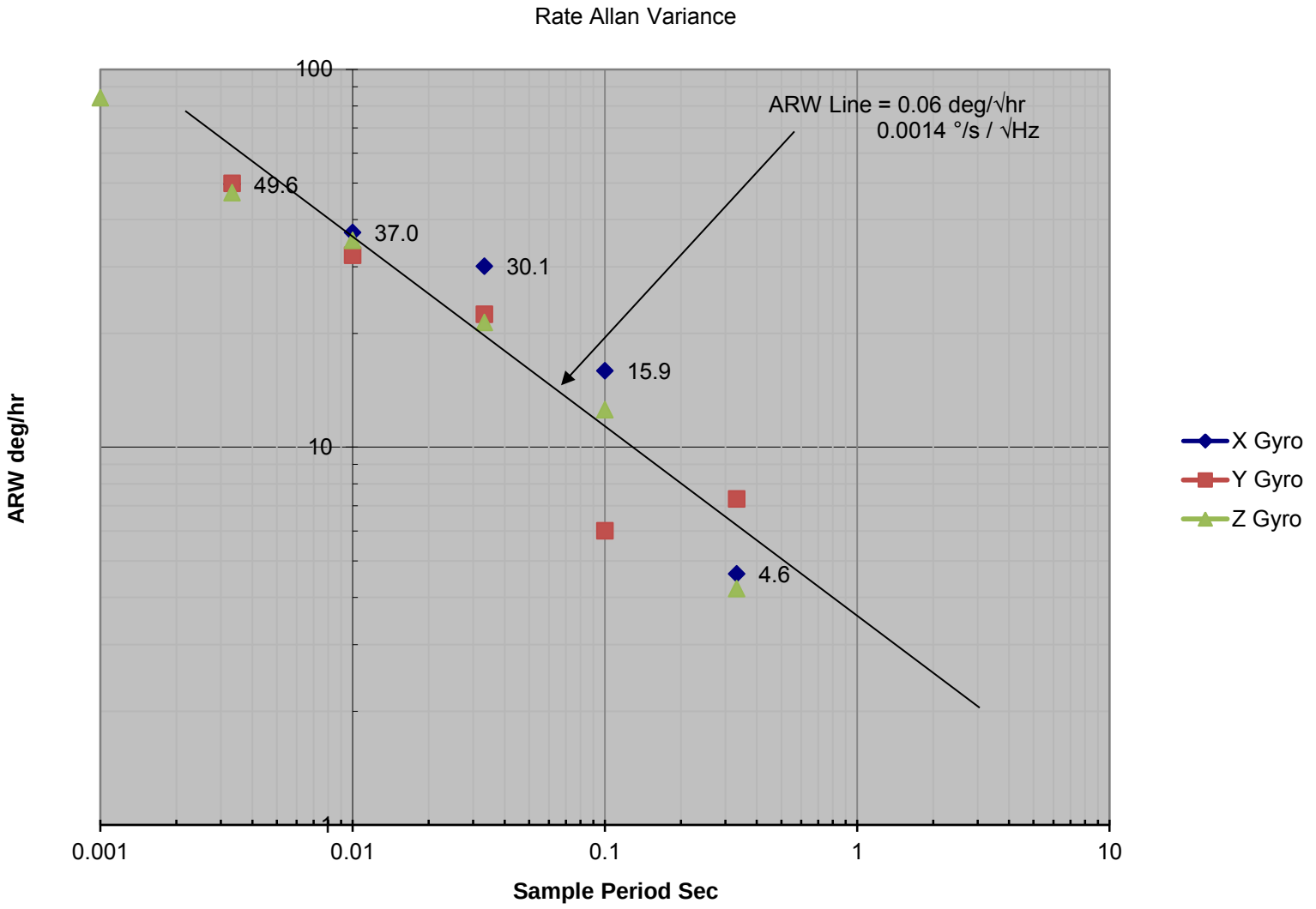
Uncorrected Error in degrees
Abs Ave = 0.096 degrees
Std Dev= 0.16 degrees

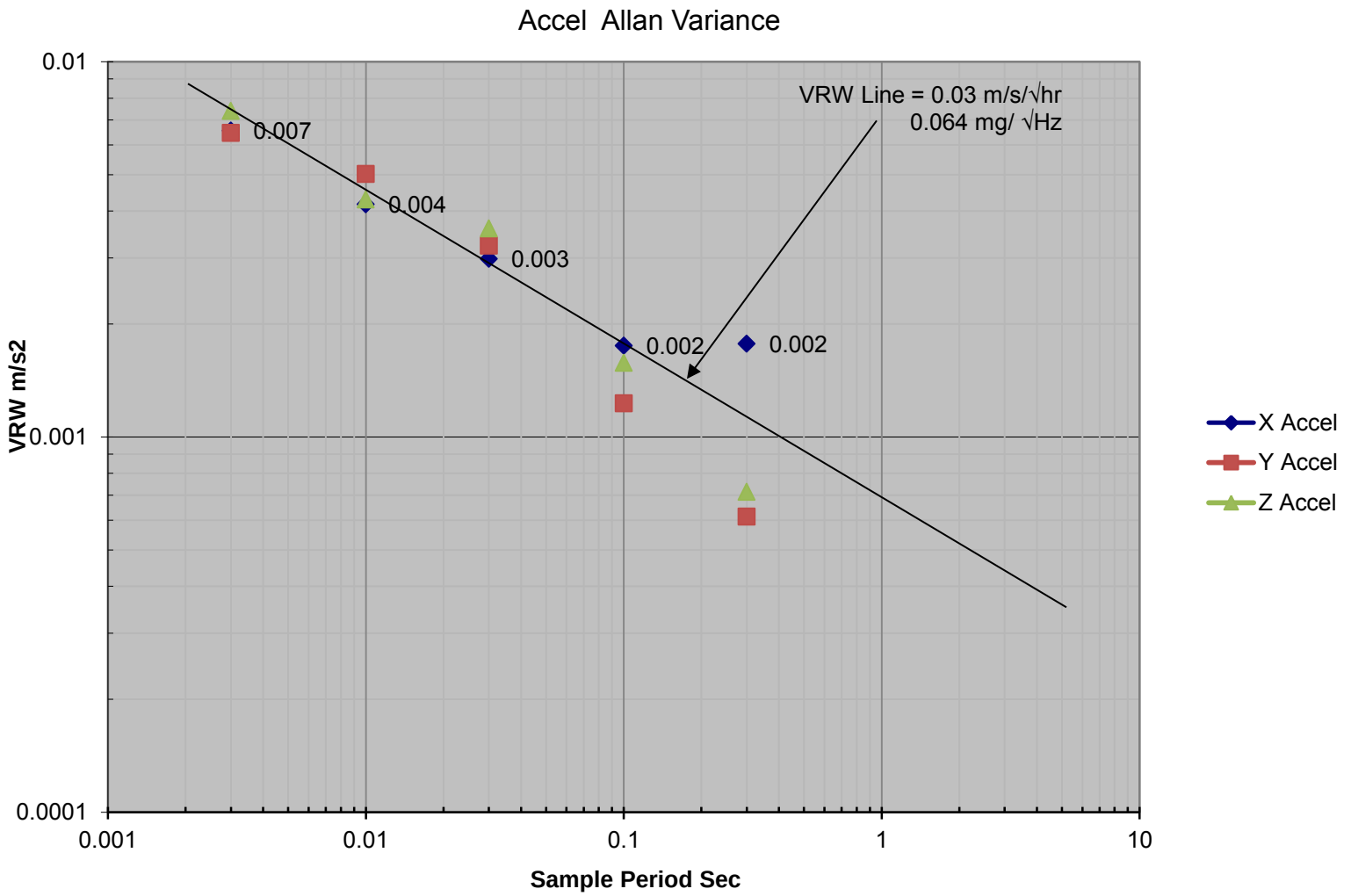
MRM50IMU-100-06-250
Accelerometer Tumble Test

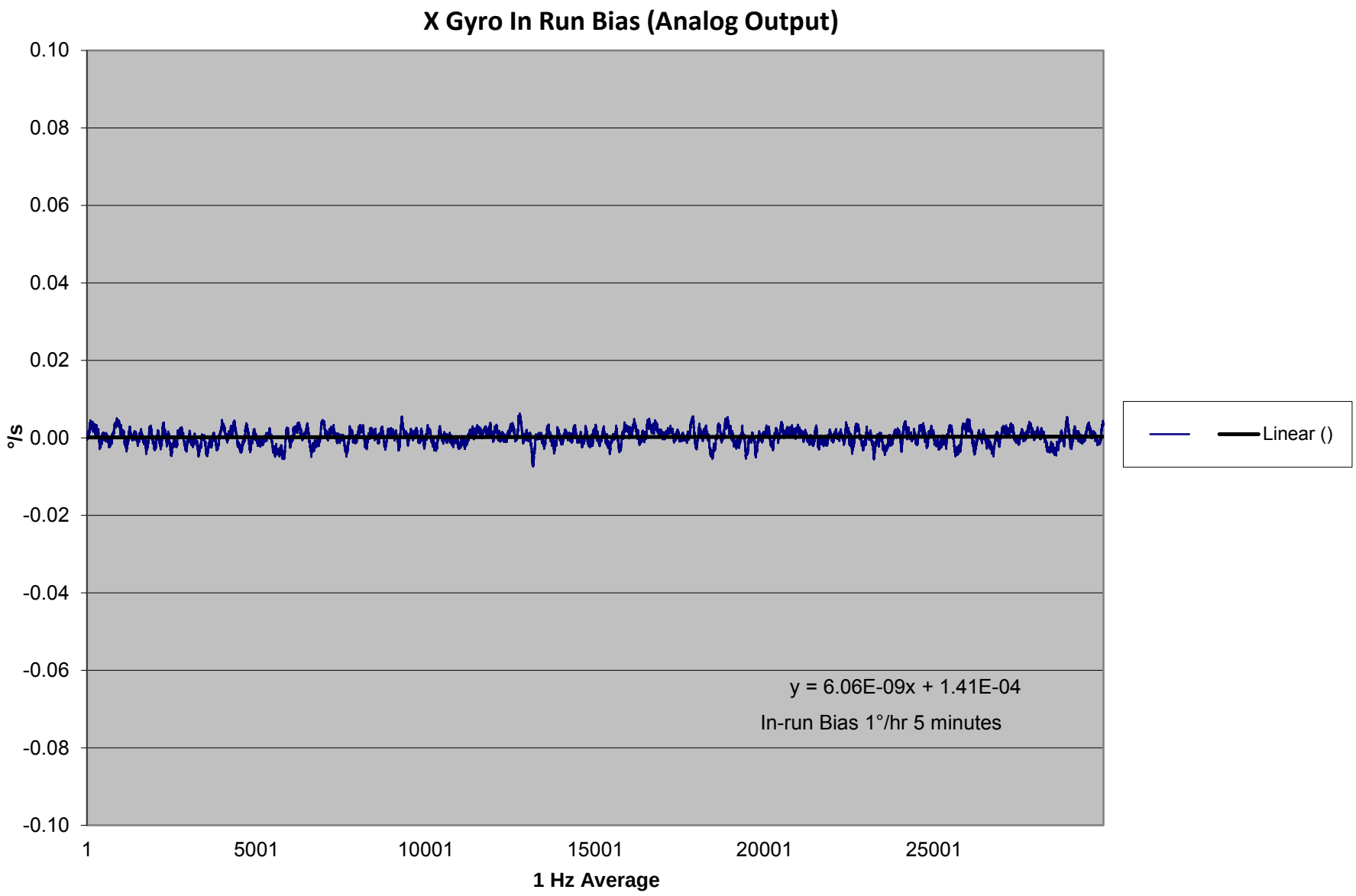
SN602 Rate Range 100 Spin 72 °/s Initial Temp 25.8 C
Scan rate: 0.01 seconds Number of scans: 1000

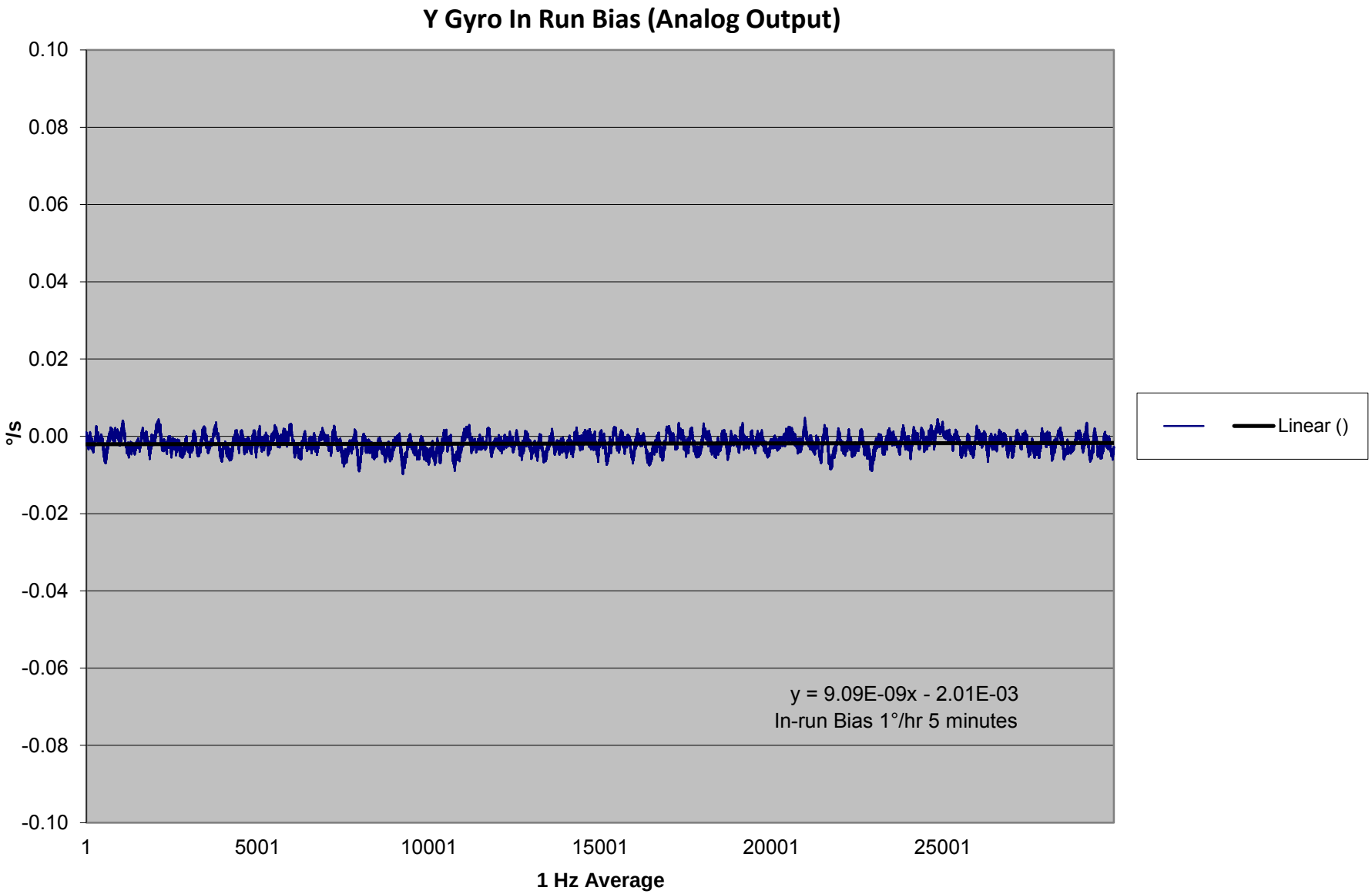
Row	Time	X Rate	X Ref	Y Rate	Y Ref	Z Rate	Z Ref	X Accel	A Ref	Y Accel	A Ref	Z Accel	A Ref	Temp	open	ST	V In	Head C
+X Accel	Ave	2.4981	2.4980	2.4981	2.4980	2.4979	2.4980	2.9126	2.4980	2.4963	2.4980	2.5007	2.4980	3.1409	3.1507	-0.0187	0.0316	25.8
-X Accel	Ave	2.4981	2.4980	2.4982	2.4980	2.4979	2.4980	2.0799	2.4980	2.5001	2.4980	2.5005	2.4980	3.1405	3.1502	-0.0187	0.0316	25.8
	SF V/g	0.0000		0.0000		0.0000		0.4164		-0.0019		0.0001						
X Data	Bias V		0.0001		0.0001		-0.0001		-0.0018		0.0002		0.0026	3.1407	3.1504	-0.0187	0.0316	25.8
+Y Accel	Ave	2.4982	2.4980	2.4981	2.4980	2.4979	2.4980	2.4991	2.4980	2.9139	2.4980	2.5009	2.4980	3.1379	3.1476	-0.0187	0.0317	25.8
-Y Accel	Ave	2.4982	2.4980	2.4981	2.4980	2.4978	2.4980	2.4953	2.4980	2.0807	2.4980	2.5005	2.4980	3.1384	3.1481	-0.0187	0.0315	25.8
	SF V/g	0.0000		0.0000		0.0000		0.0019		0.4166		0.0002						
Y Data	Bias V		0.0002		0.0001		-0.0002		-0.0008		-0.0007		0.0026	3.1382	3.1478	-0.0187	0.0316	25.8
+Z Accel	Ave	2.4981	2.4980	2.4981	2.4980	2.4978	2.4980	2.4971	2.4980	2.4973	2.4980	2.9172	2.4980	3.1382	3.1481	-0.0187	0.0317	25.8
-Z Accel	Ave	2.4982	2.4980	2.4981	2.4980	2.4978	2.4980	2.4973	2.4980	2.4977	2.4980	2.0844	2.4980	3.1375	3.1461	-0.0187	0.0319	25.8
	SF V/g	0.0000		0.0000		0.0000		-0.0001		-0.0002		0.4164						
Z Data	Bias V		0.0002		0.0001		-0.0002		-0.0008		-0.0005		0.0028	3.1378	3.1471	-0.0187	0.0318	25.8

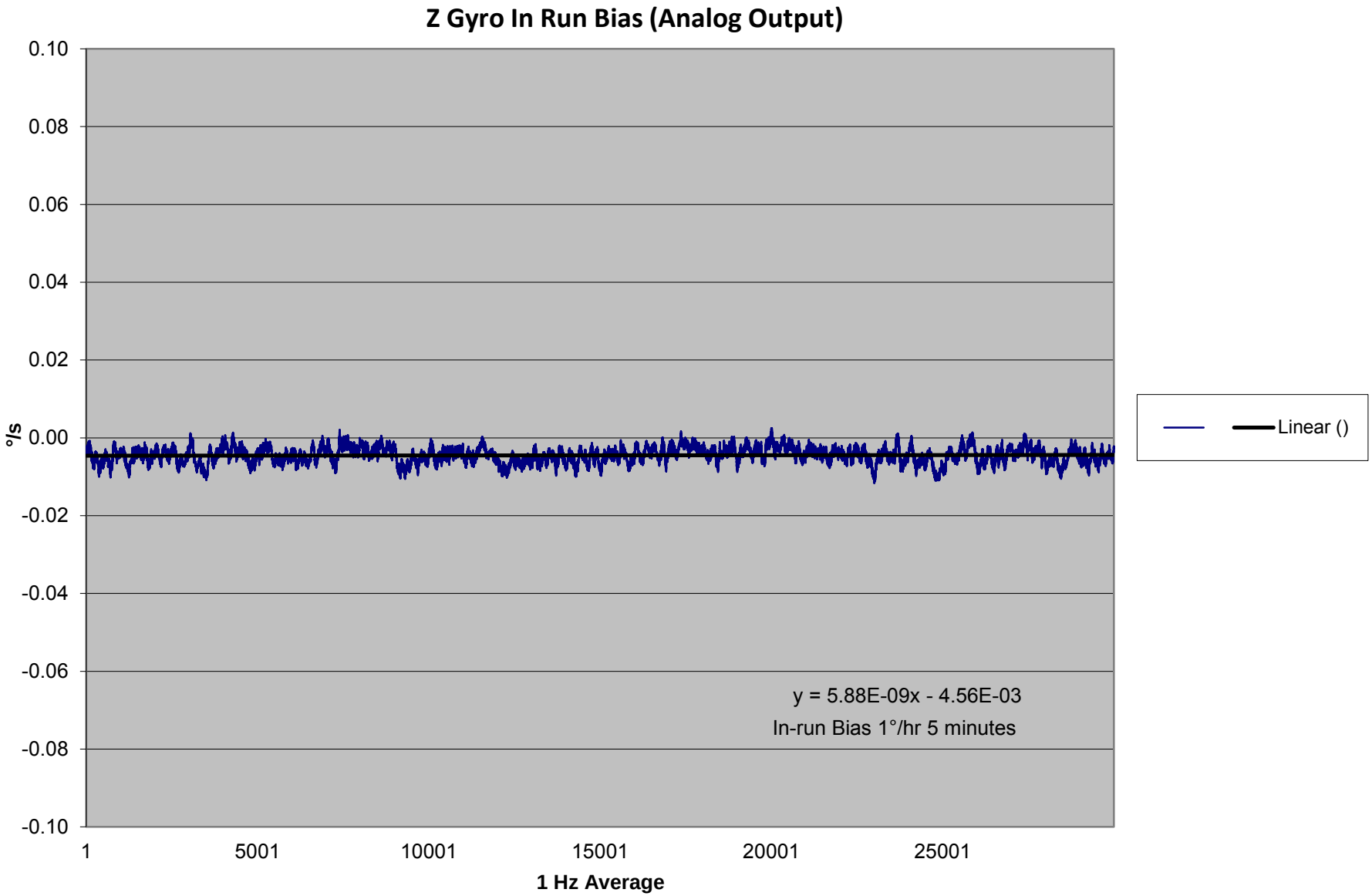
Summary		X Rate	Y Rate	Z Rate			X Accel	Y Accel	Z Accel								
	Bias V	0.0002	0.0001	-0.0002		**Bias V**	-0.0011	-0.0004	**0.0026**				3.139		-0.019	0.032	25.8 Temp C
						SF V/g	0.4164	0.4166	0.4164				Temp Sensor		ST	Vin	
					g Input	Align				Accel In							
G-Sens	°/sec/g	0.000	-0.001	0.000	x	Xcor rad	1.0000	-0.0046	0.0001	x							
	°/sec/g	0.000	0.001	0.000	y	Ycor rad	0.0044	1.0000	0.0004	y							
	°/sec/g	0.000	0.000	0.000	z	Zcor rad	-0.0002	-0.0005	1.0000	z							
		Abs Ave =	0.001	°/sec/g			Abs Ave =	0.0017	0.1	degrees							
		StdDev =	0.001	°/sec/g			StdDev =	0.0029	0.2	degrees							
								radians									

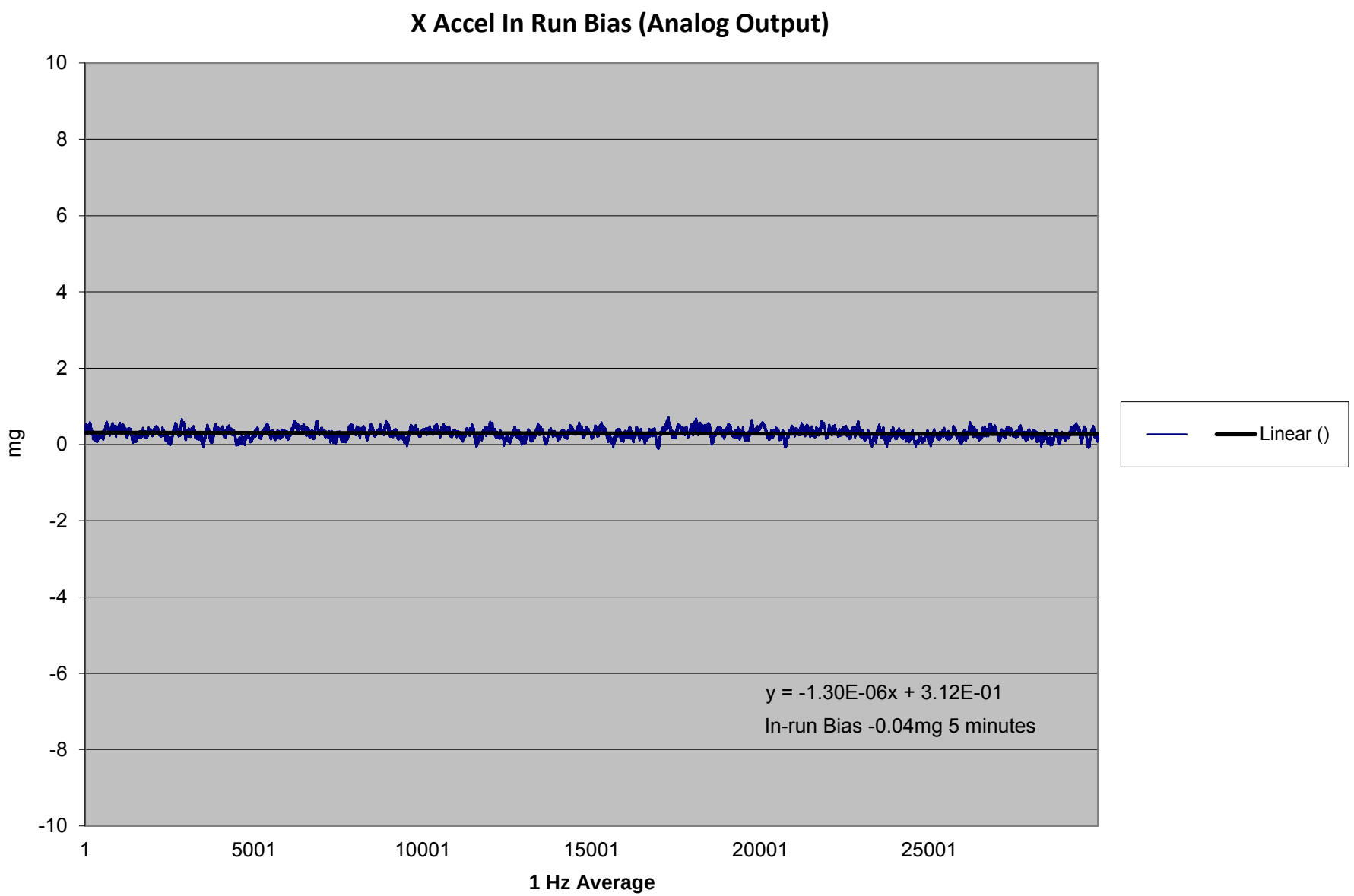

Rate Allan Variance
ARW Line = 0.06 deg/√hr
0.0014 °/s / √Hz
49.6
37.0
30.1
15.9
4.6
100
10
1
0.001
0.01
0.1
1
10
ARW deg/hr
Sample Period Sec
X Gyro
Y Gyro
Z Gyro

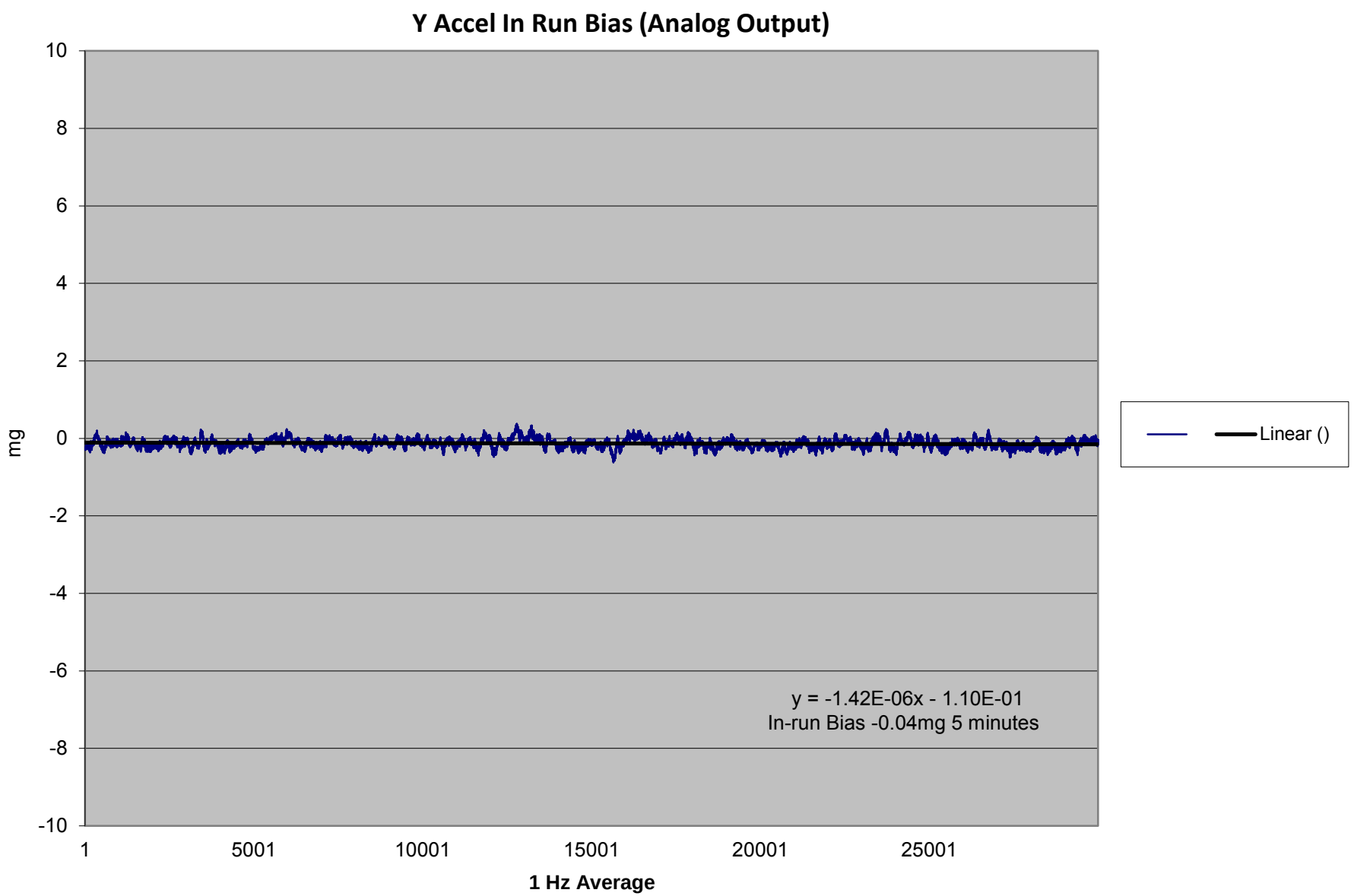

Accel Allan Variance
VRW Line = 0.03 m/s/√hr
0.064 mg/ √Hz
0.007
0.004
0.003
0.002
0.002
VRW m/s2
0.01
0.001
0.0001
0.001
0.01
0.1
1
10
Sample Period Sec
X Accel
Y Accel
Z Accel

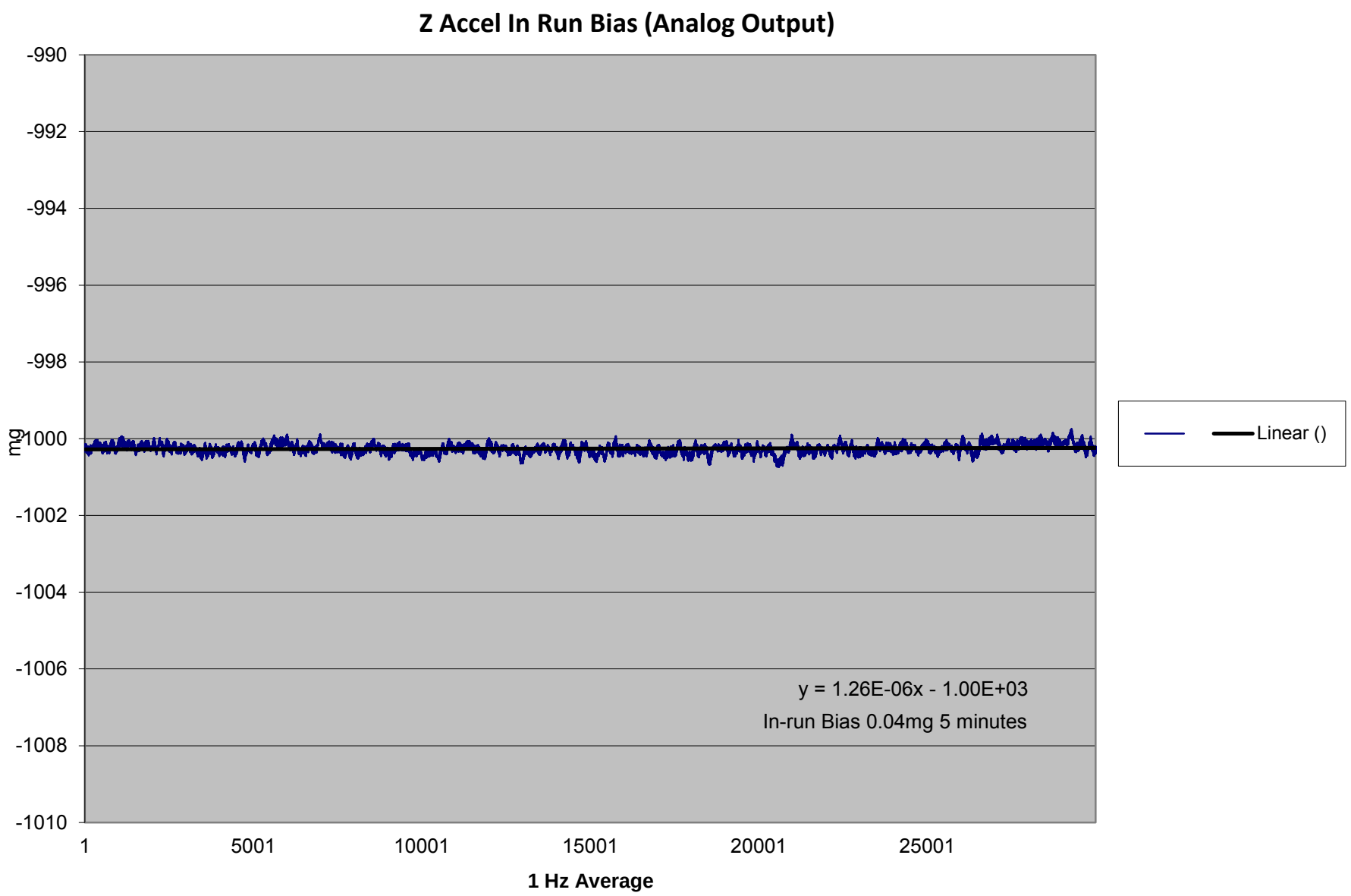

X Gyro In Run Bias (Analog Output)
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
°/s
1
5001
10001
15001
20001
25001
1 Hz Average
Linear ()
y = 6.06E-09x + 1.41E-04
In-run Bias 1°/hr 5 minutes


Y Gyro In Run Bias (Analog Output)
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
°/s
1
5001
10001
15001
20001
25001
1 Hz Average
y = 9.09E-09x - 2.01E-03
In-run Bias 1°/hr 5 minutes
Linear ()


Z Gyro In Run Bias (Analog Output)
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
°/s
1
5001
10001
15001
20001
25001
1 Hz Average
y = 5.88E-09x - 4.56E-03
In-run Bias 1°/hr 5 minutes
Linear ()


X Accel In Run Bias (Analog Output)
10
8
6
4
2
0
-2
-4
-6
-8
-10
mg
1
5001
10001
15001
20001
25001
1 Hz Average
y = -1.30E-06x + 3.12E-01
In-run Bias -0.04mg 5 minutes
Linear ()


Y Accel In Run Bias (Analog Output)
10
8
6
4
2
0
-2
-4
-6
-8
-10
mg
1
5001
10001
15001
20001
25001
1 Hz Average
y = -1.42E-06x - 1.10E-01
In-run Bias -0.04mg 5 minutes
Linear ()



DSPM Industria® sensori & trasduttori
GTI
Via Paolo Uccello 4 - 20148 Milano
Tel +39 02 48 009 757 Fax +39 02 48 002 070 info@dspmindustria.it www.dspmindustria.it