DATA SHEET OF GYROSTAR®

MODEL:ENC-03JA ENC-03JB

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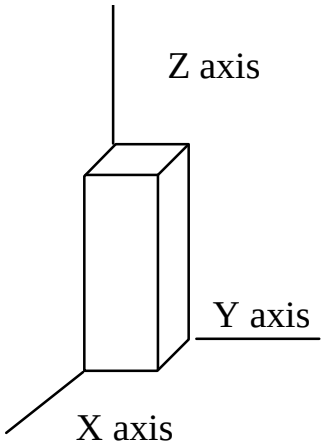
Murata Manufacturing Co., Ltd.
Circuit Products Division
Sensor Module Department
Product Engineering Section

The technical data listed in this data sheet are typical values.

Items	Symbols	Explanations	Units
Angular velocity	ω	Angle change per second	[deg/s]
Null output	V_0	Output at stationary state	[V]
Scale factor	Sv	Output change per angular velocity $\frac{V_\omega - V_0}{\omega}$ V_0: Null output ω : angular velocity V_ω : Output at angular velocity ω	[V/deg/s]

Sensor axes



Glossary of terms

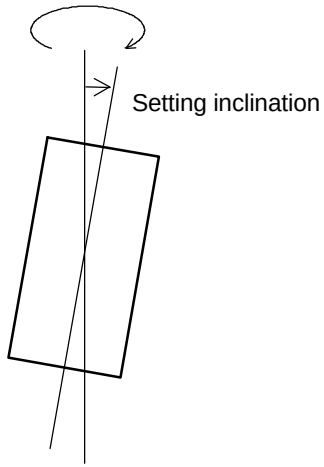
Unless otherwise specified, ambient temperature Ta= 25+/-5°C, Vcc = +3.0 VDC Use a sensor output load resistance of 50kΩ or more.

Comparative voltage (Vref) is grounded with condenser of 4.7µF.

1) Angular velocity vs. output

The relationship between applied angular velocity and output. Output voltage is relative to applied angular velocity.

Output = V_0 + Sv X ω [V]



2) Setting inclination vs. scale factor

Variations in scale factor when setting sensor. $Sv\theta = S_{v\theta=0} \times \cos\theta$

$$\text{Scale factor variation} = \frac{S_{V\theta}}{S_{V\theta=0}} \times 100 \quad (\%)$$

θ : Setting inclination

Sv_θ : Scale factor at setting inclination is θ [deg]

$Sv_{\theta=0}$: Scale factor at setting inclination is 0 [deg]

3) Dependence on supply voltage of null output

Relationship between null output and supply voltage.

4) Dependence on supply voltage of scale factor

Relationship between scale factor and supply voltage.

5) Linearity

Deviation of output from the ideal straight line defined by scale factor. Linearity of clockwise (CW) obeys the following equation.

$$\text{Linearity} = \frac{S_{V\omega} - S_{V\max} \times \dfrac{\omega}{\omega_{\max}}}{S_{V\max}} \times 100 \quad (\%)$$

ω : Angular velocity

ω_{90} : ω_{90} = +90 deg/s

$Sv\omega$: Scale factor at angular velocity is ω [deg/s]

Sv : Scale factor at angular velocity is ω_{90} [deg/s]

6) Temperature drift

Variation in null output with the ambient temperature change. Each sample has individual characteristics.

7) Start-up drift

Variation in null output from the first application of supply voltage 3V. Samples shall be unpowered for a minimum of one hour before the beginning of test Each sample has individual characteristics.

Start-up drift = V_{0t} - $V_{0t=0}$ (mV)

V_{0t} : Null output at "t " seconds after power-on

$V_{0t=0}$: Null output just after power-on

8) Start-up characteristic

Characteristic it takes for the sample to produce a usable output.

9) Temperature coefficient of scale factor

Variation in scale factor with the ambient temperature change. Each sample has individual characteristics. Reference temperature of scale factor variation is 25°C

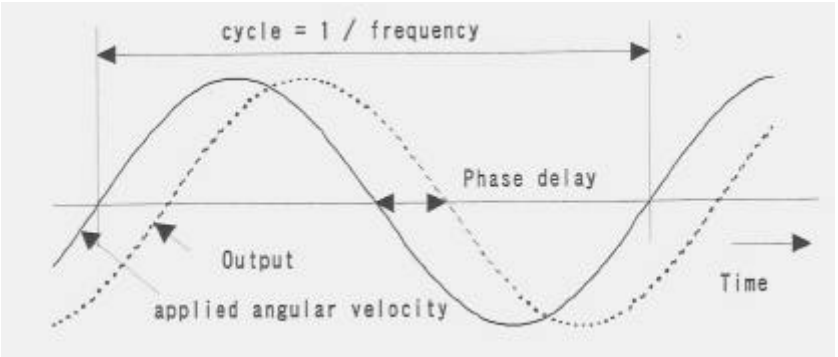
Temperature coefficient of scale factor = $\frac{S_{Vt} - S_{Vt=25}}{S_{Vt=25}} \times 100$ (%)

S_{vt} : Scale factor at ambient temperature is t [deg C]

$S_{vt=25}$: Scale factor at ambient temperature is 25 [deg C]

10) Response (Phase delay)

Phase delay between applied angular velocity and output described in right figure.



11) Response (gain)

Phase delay between applied angular velocity and output.

Response(gain) = $20\log\frac{S_{Vf}}{S_{Vf=10}}$ (dB)

S_{vf} : Scale factor at the frequency of angular velocity is f [Hz]

$S_{vf=10}$: Scale factor at the frequency of angular velocity is 10 [Hz]

12) Transverse sensitivity

Output error against unnecessary rotation with the exception of sensing axis(Z axis).

Transverse sensitivity of X axis obeys the following equation.

Transverse sensitivity = $V_{\omega x} - V_0$ (mV)

$V_{\omega x}$: Output at angular velocity is ω [deg/s] in X axis

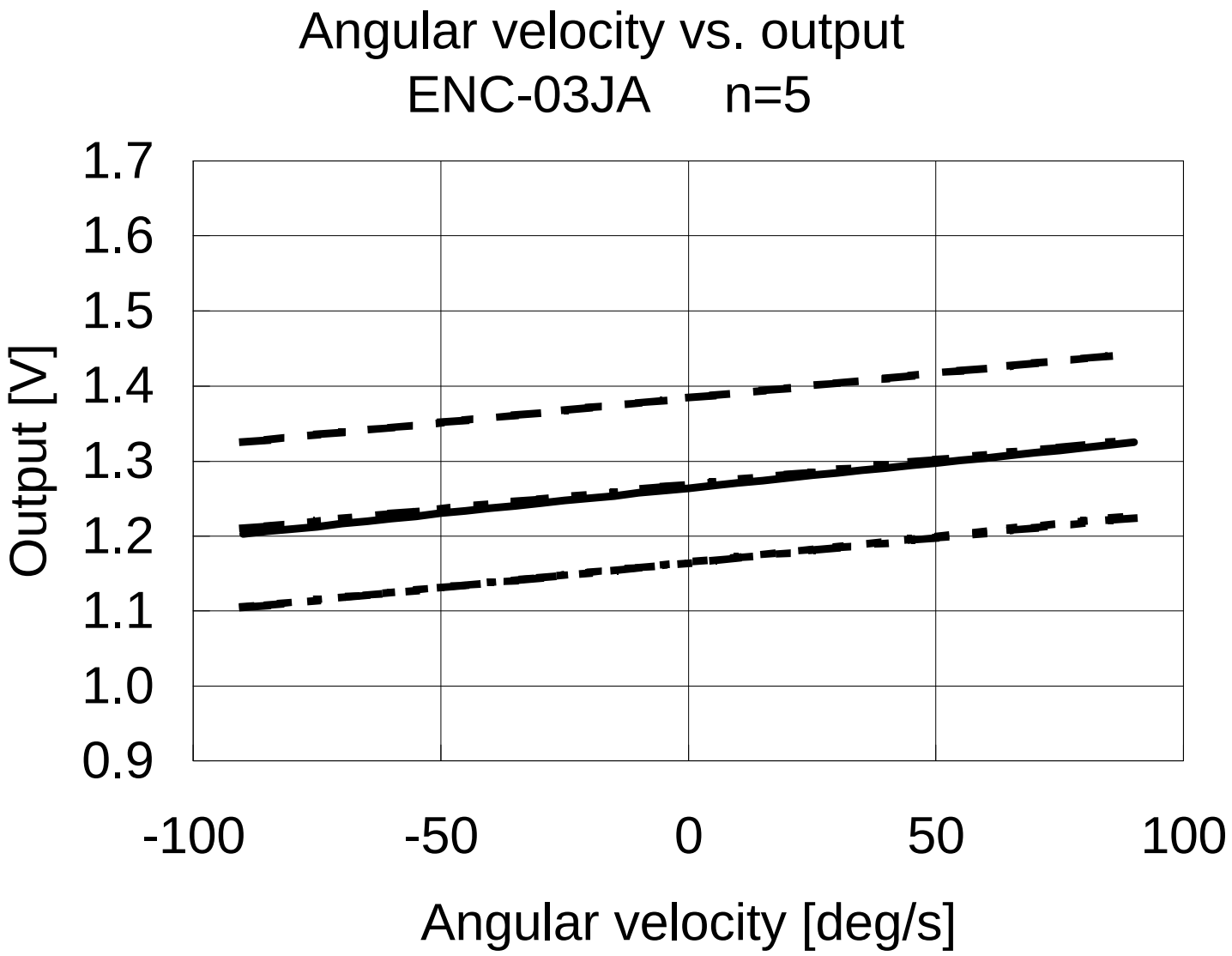
V_0 : Null output

13) Output noise

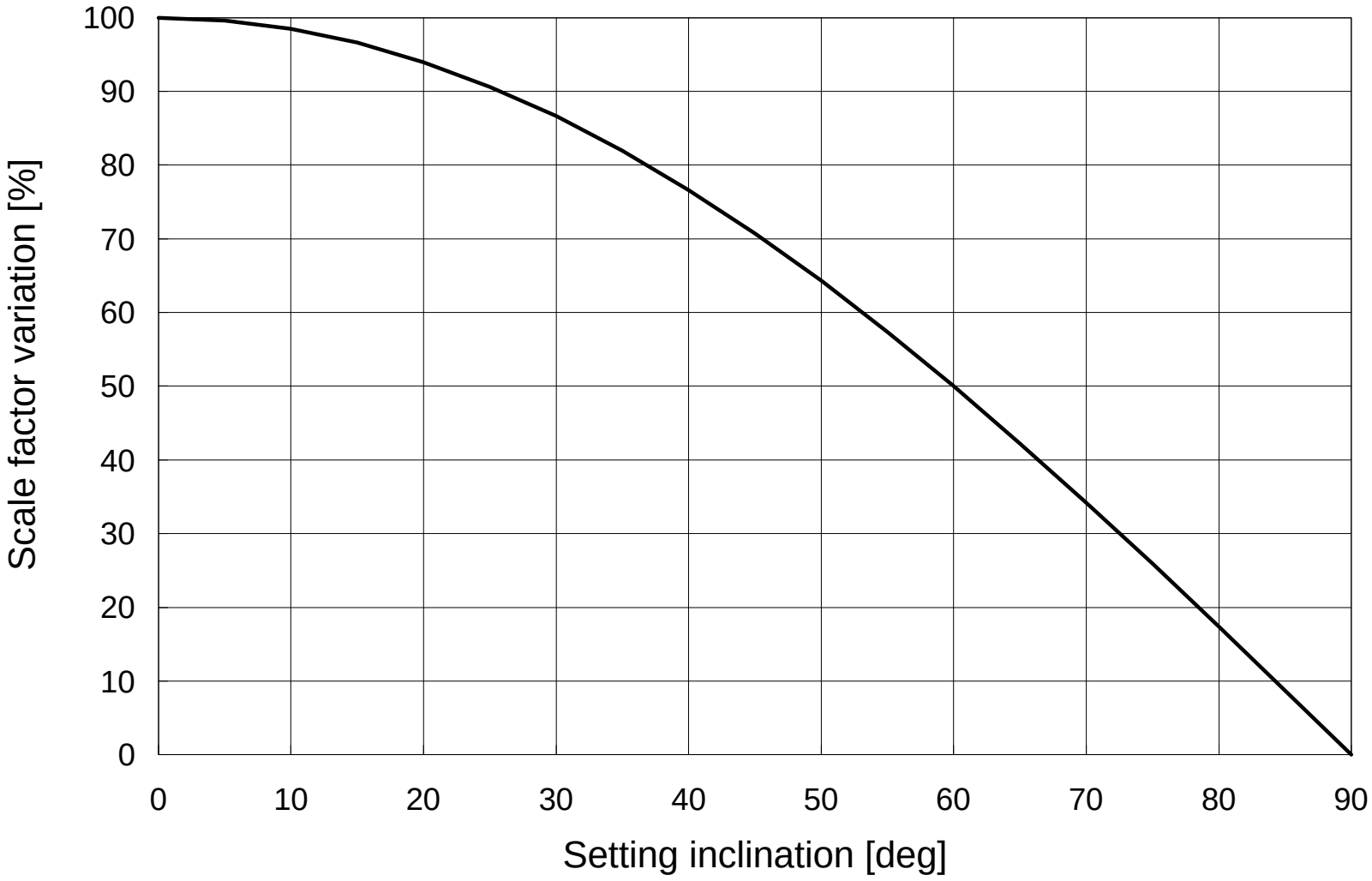
Output noise at stationary state.

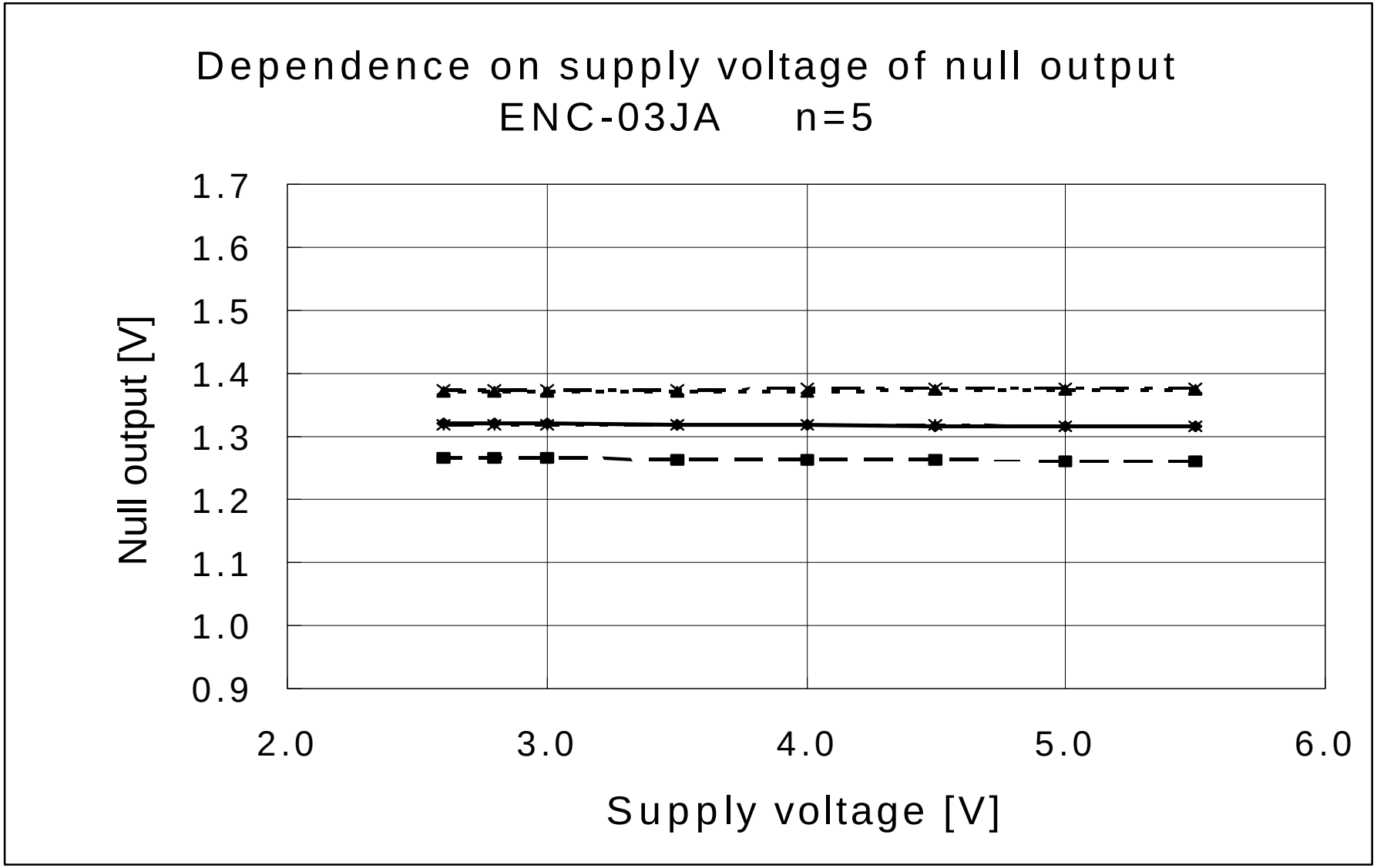
14) Output noise spectrum

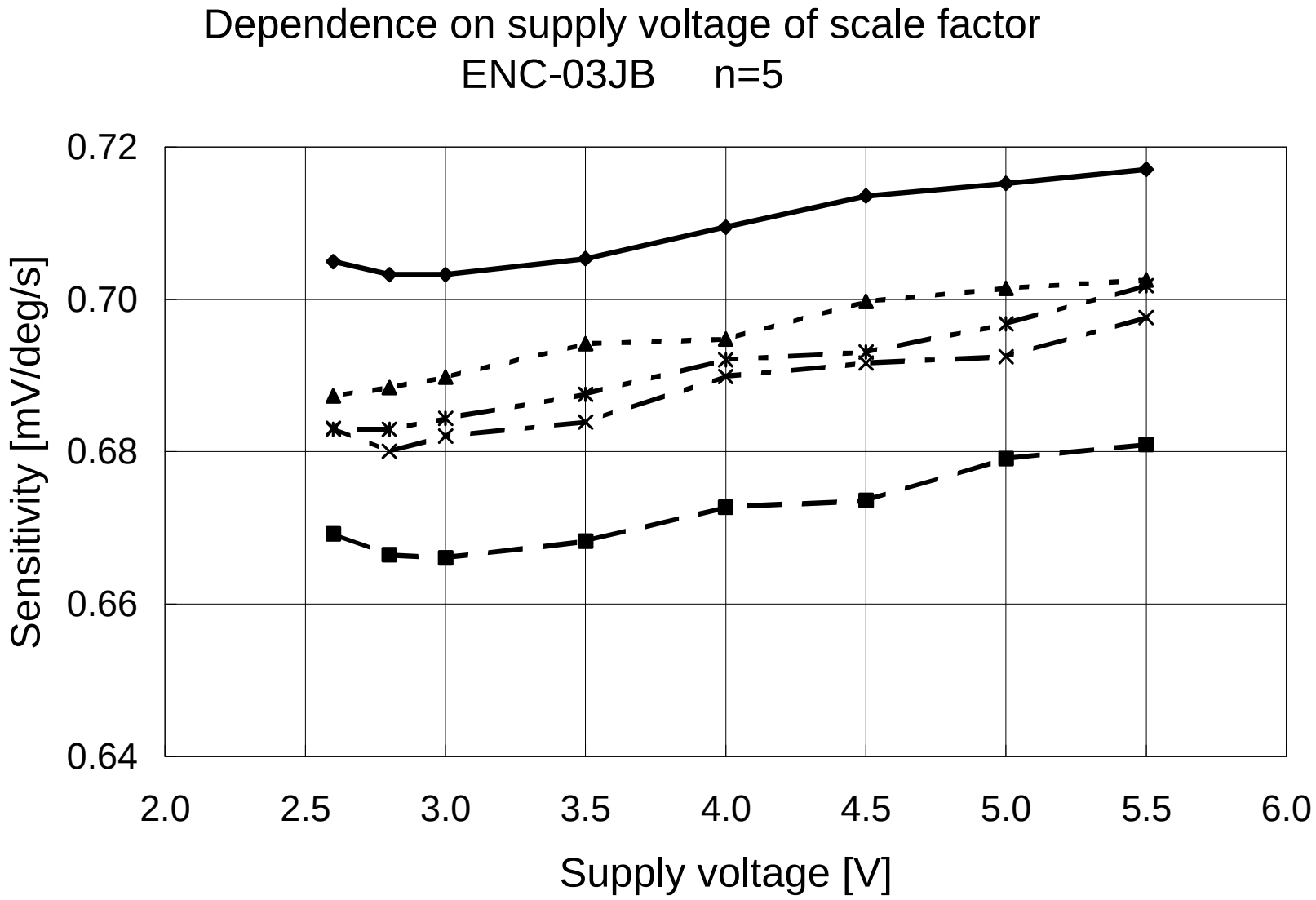
Noise spectrum at stationary state.

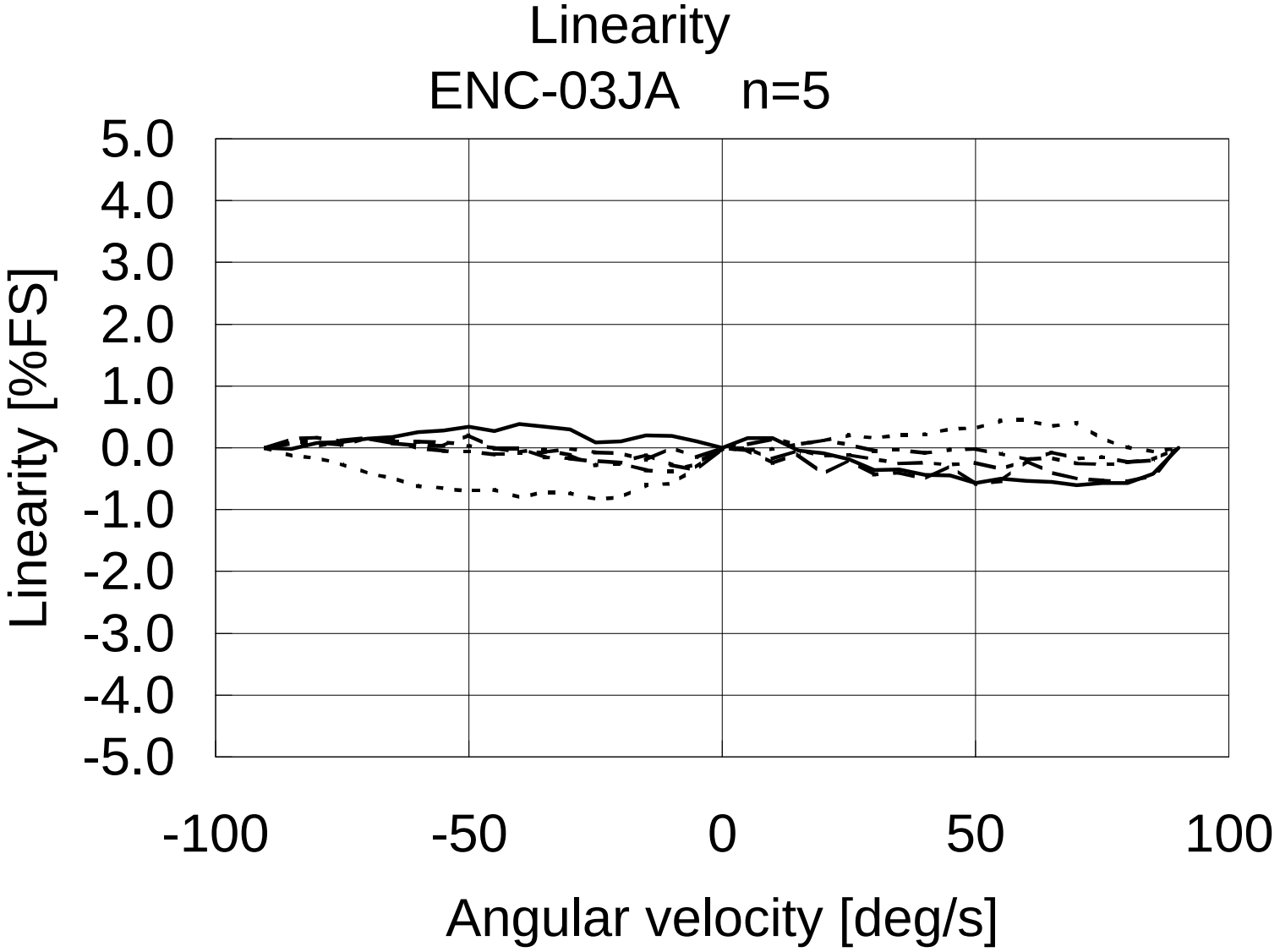

Angular velocity vs. output
ENC-03JA n=5
Output [V]
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
-100
-50
0
50
100
Angular velocity [deg/s]

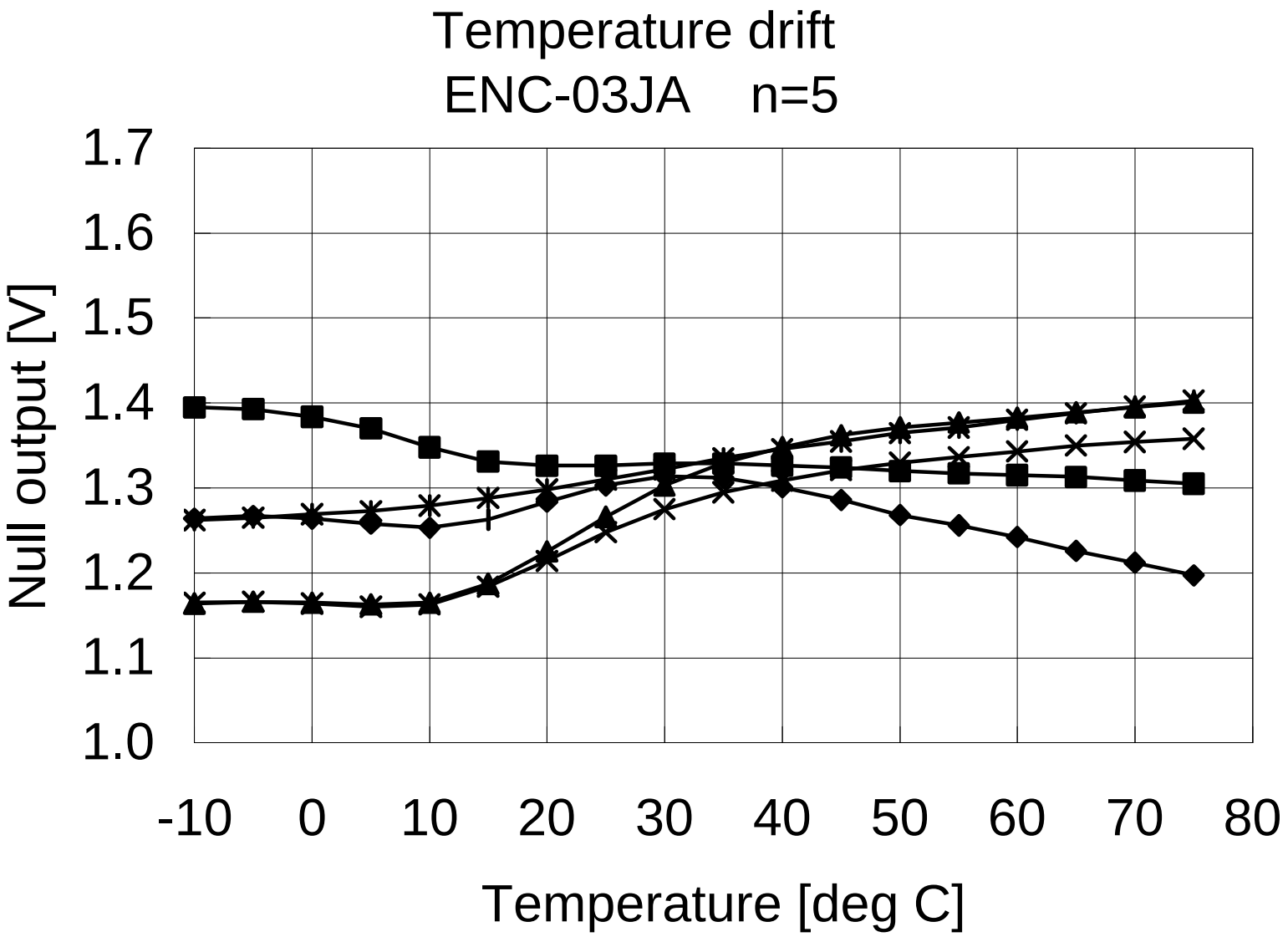
Setting inclination vs. scale factor
ENC-03JA/JB

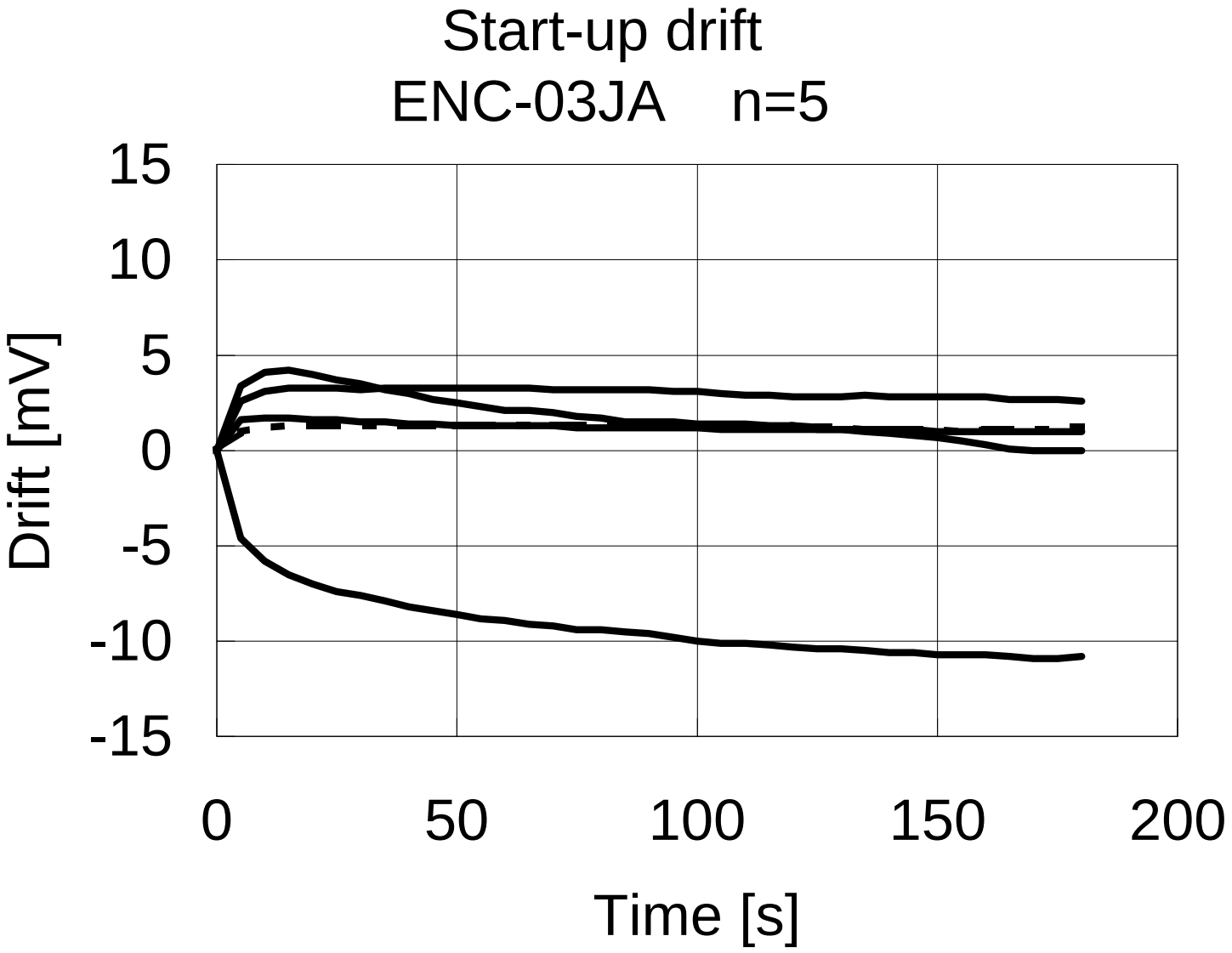


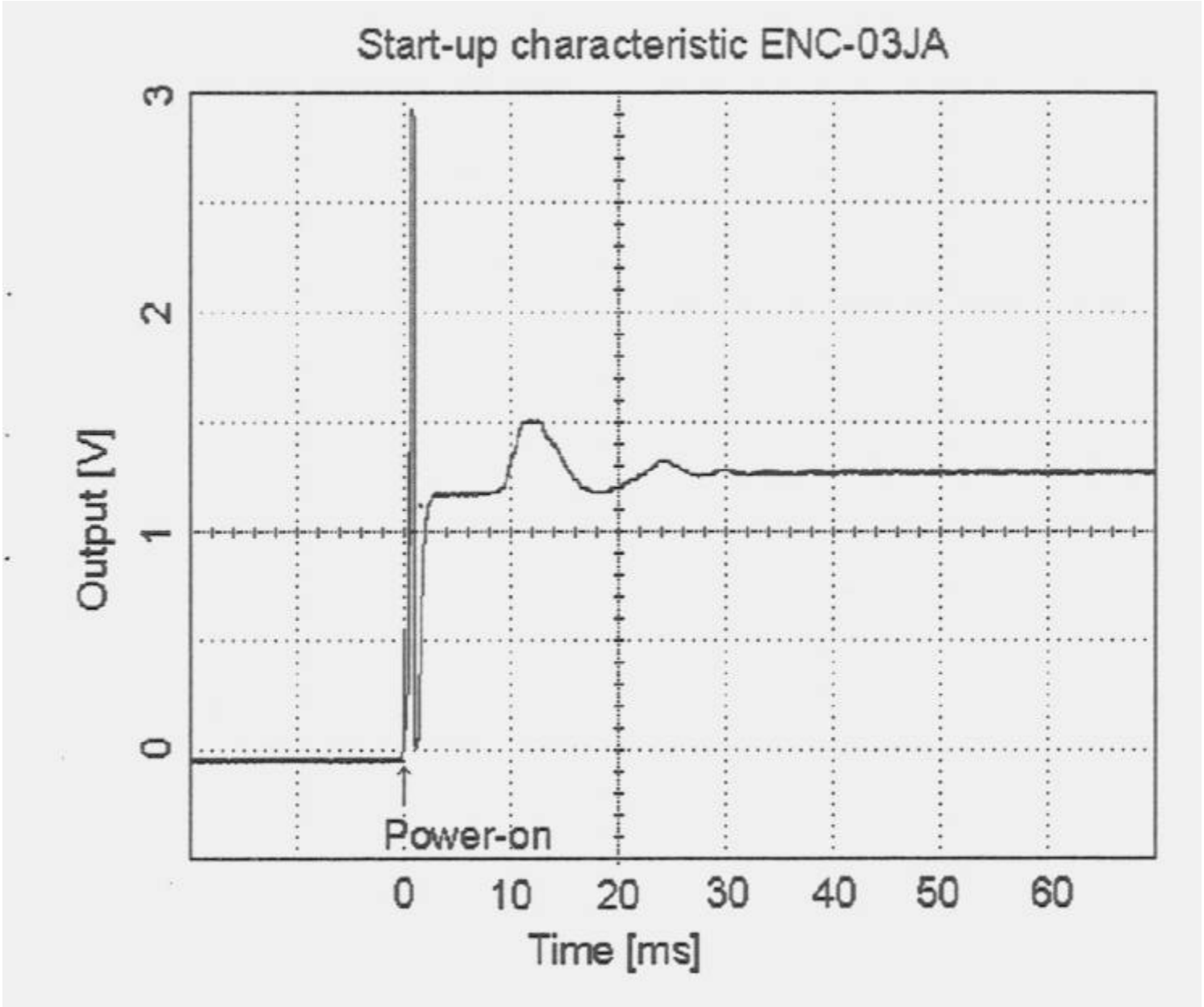

Dependence on supply voltage of null output
ENC-03JA n=5
Null output [V]
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
2.0
3.0
4.0
5.0
6.0
Supply voltage [V]

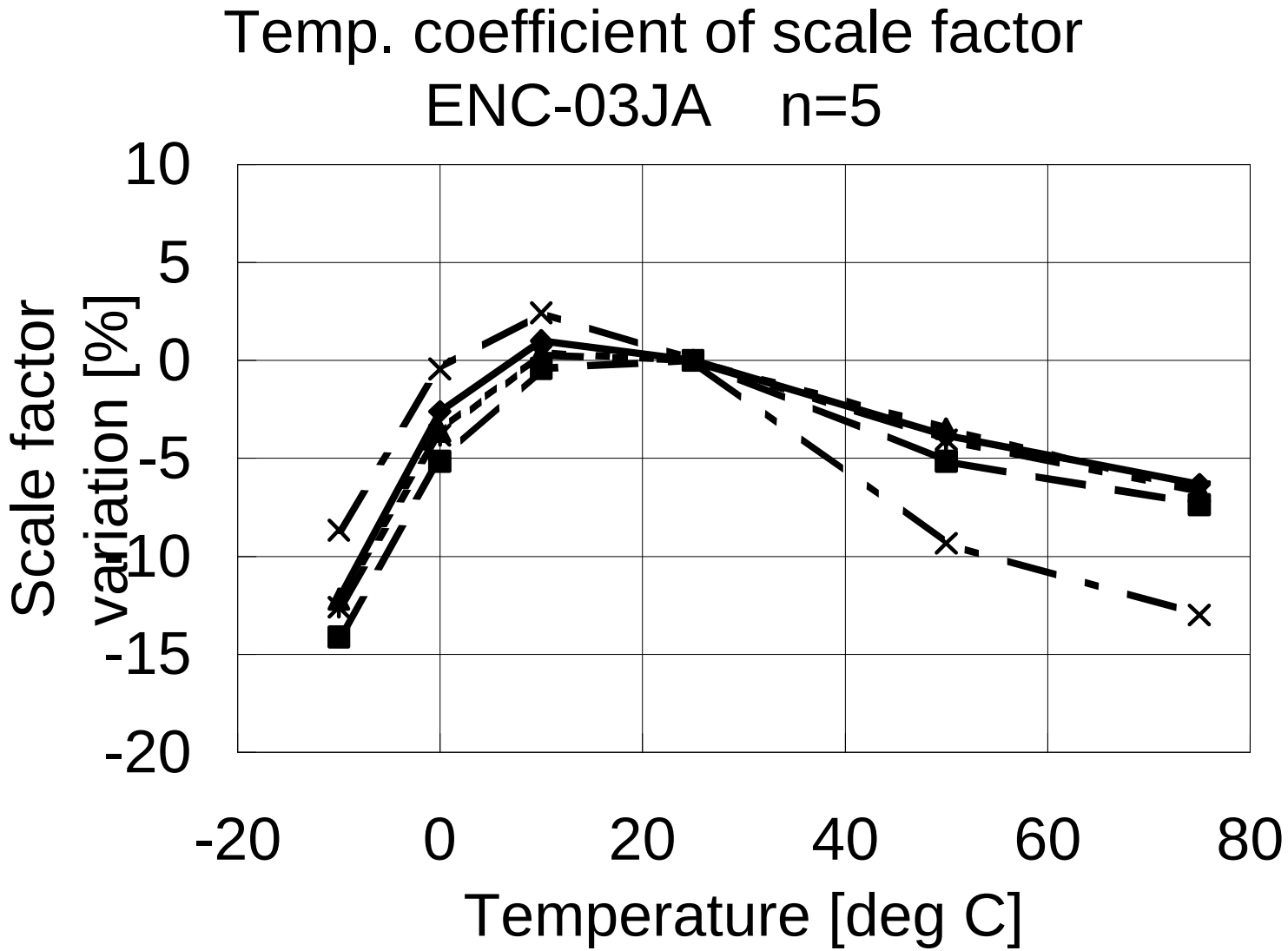

Dependence on supply voltage of scale factor
ENC-03JB n=5
Sensitivity [mV/deg/s]
0.72
0.70
0.68
0.66
0.64
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Supply voltage [V]

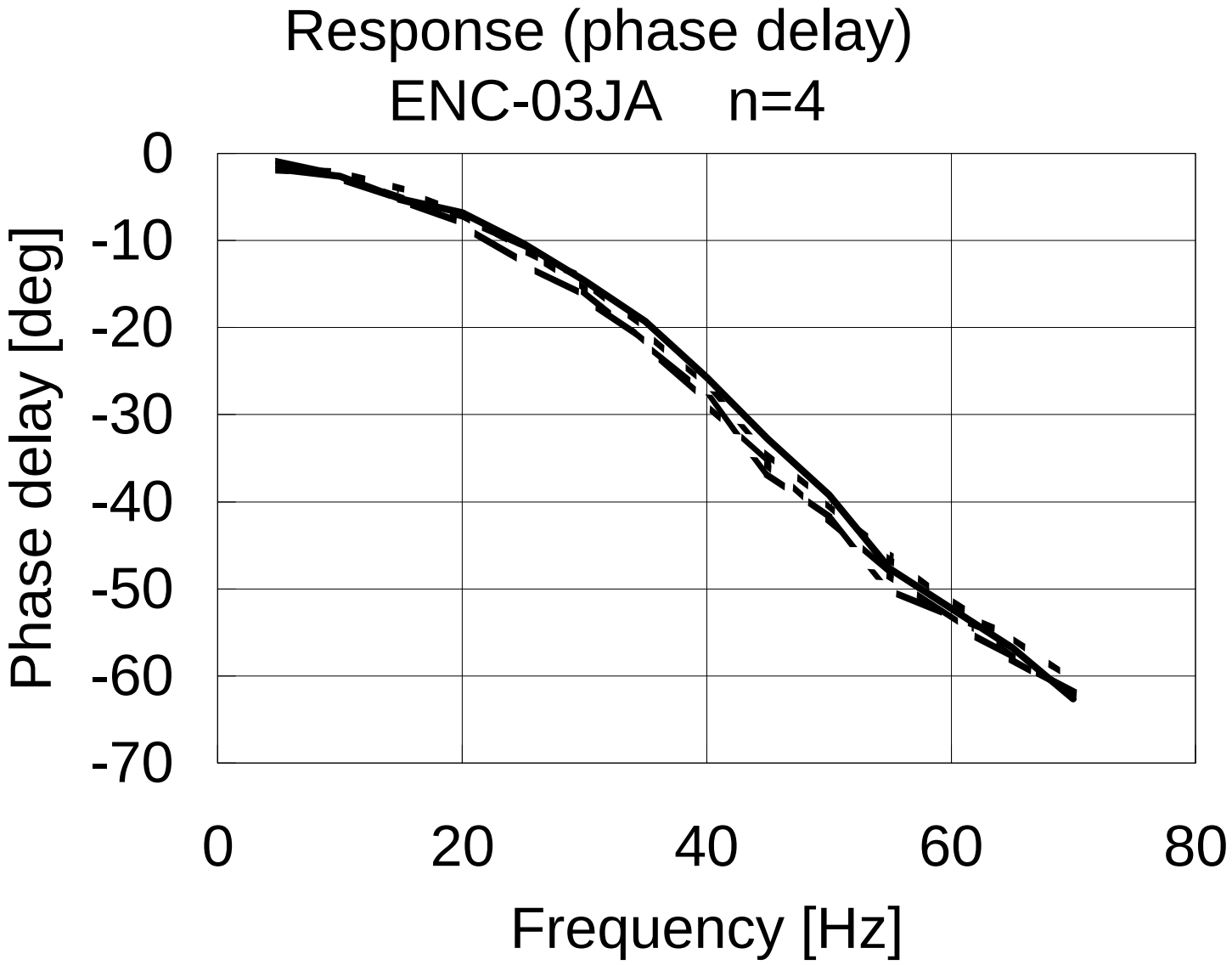

Linearity
ENC-03JA n=5
Linearity [%FS]
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-100
-50
0
50
100
Angular velocity [deg/s]

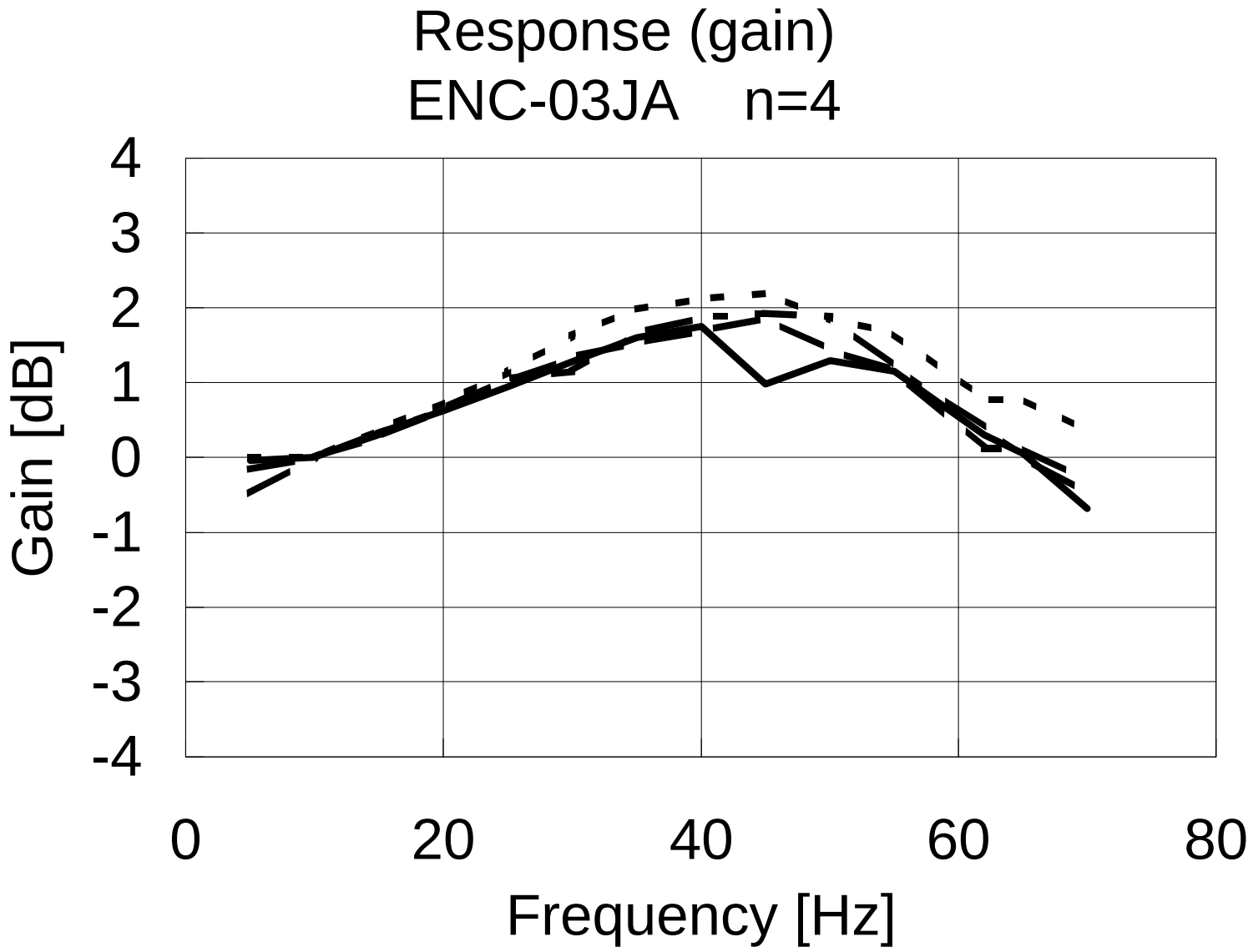

Temperature drift
ENC-03JA n=5
Null output [V]
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
-10
0
10
20
30
40
50
60
70
80
Temperature [deg C]

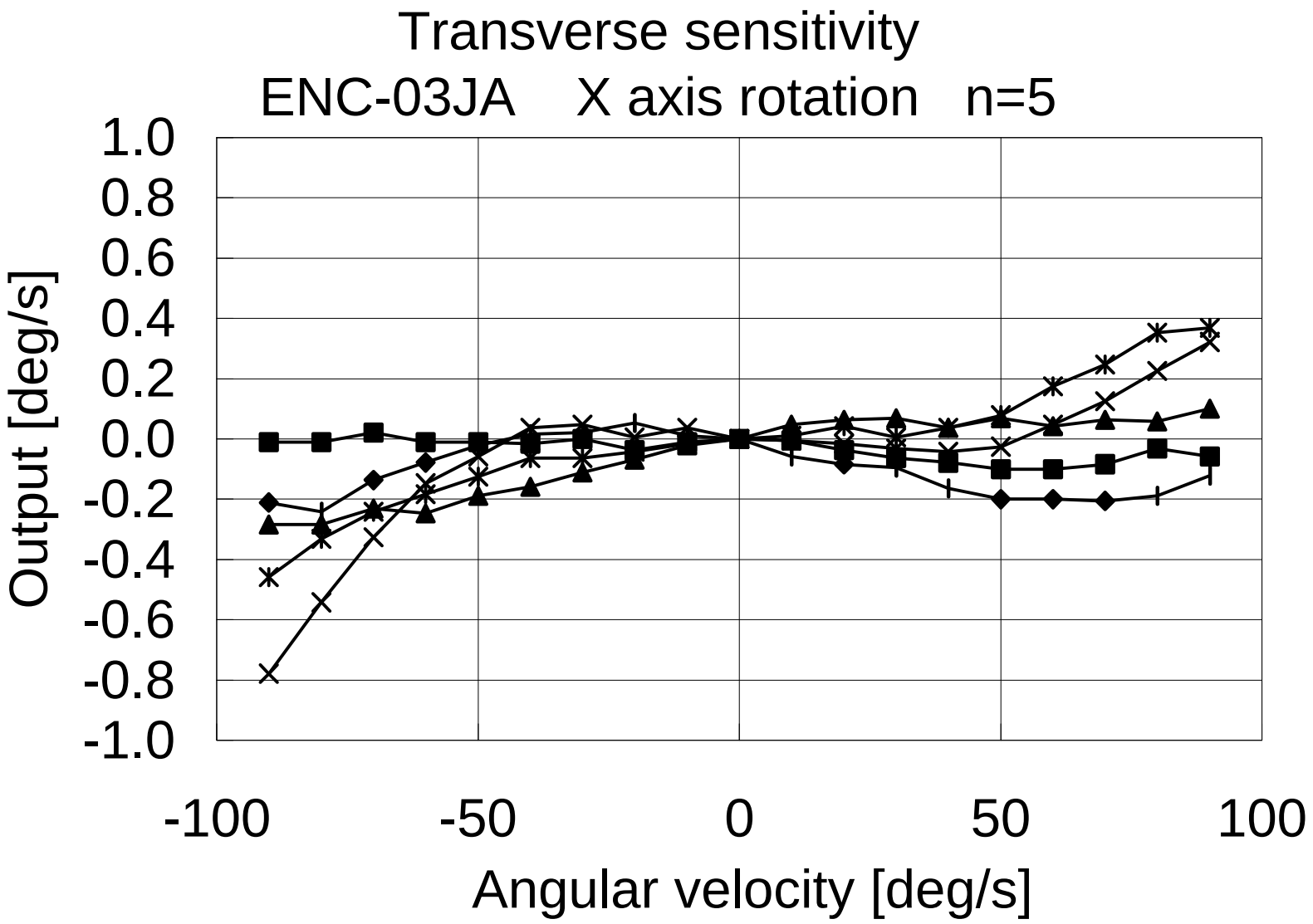

Start-up drift
ENC-03JA n=5
Drift [mV]
15
10
5
0
-5
-10
-15
0
50
100
150
200
Time [s]

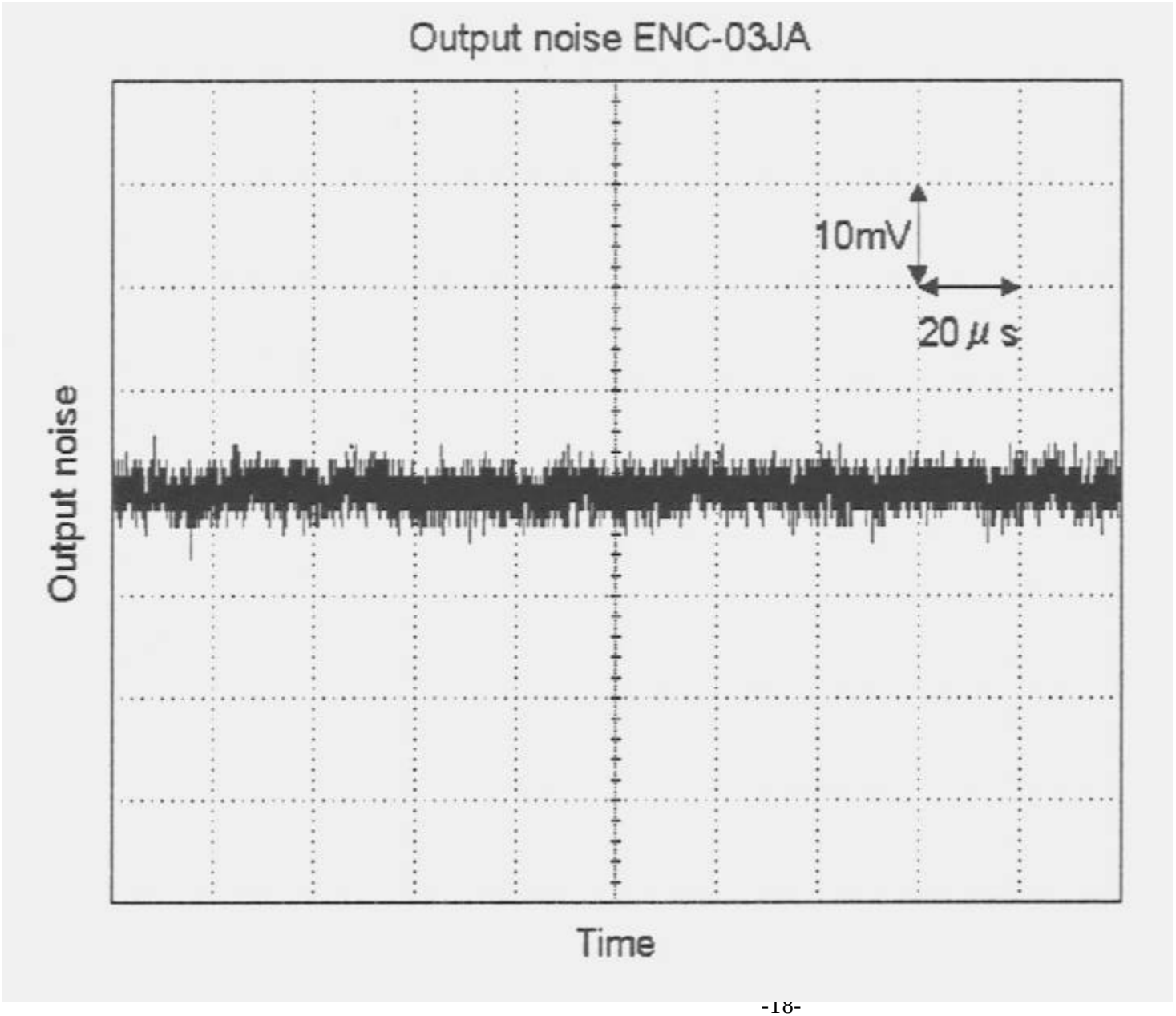

Start-up characteristic ENC-03JA
Output [V]
0
1
2
3
Power-on
0
10
20
30
40
50
60
Time [ms]

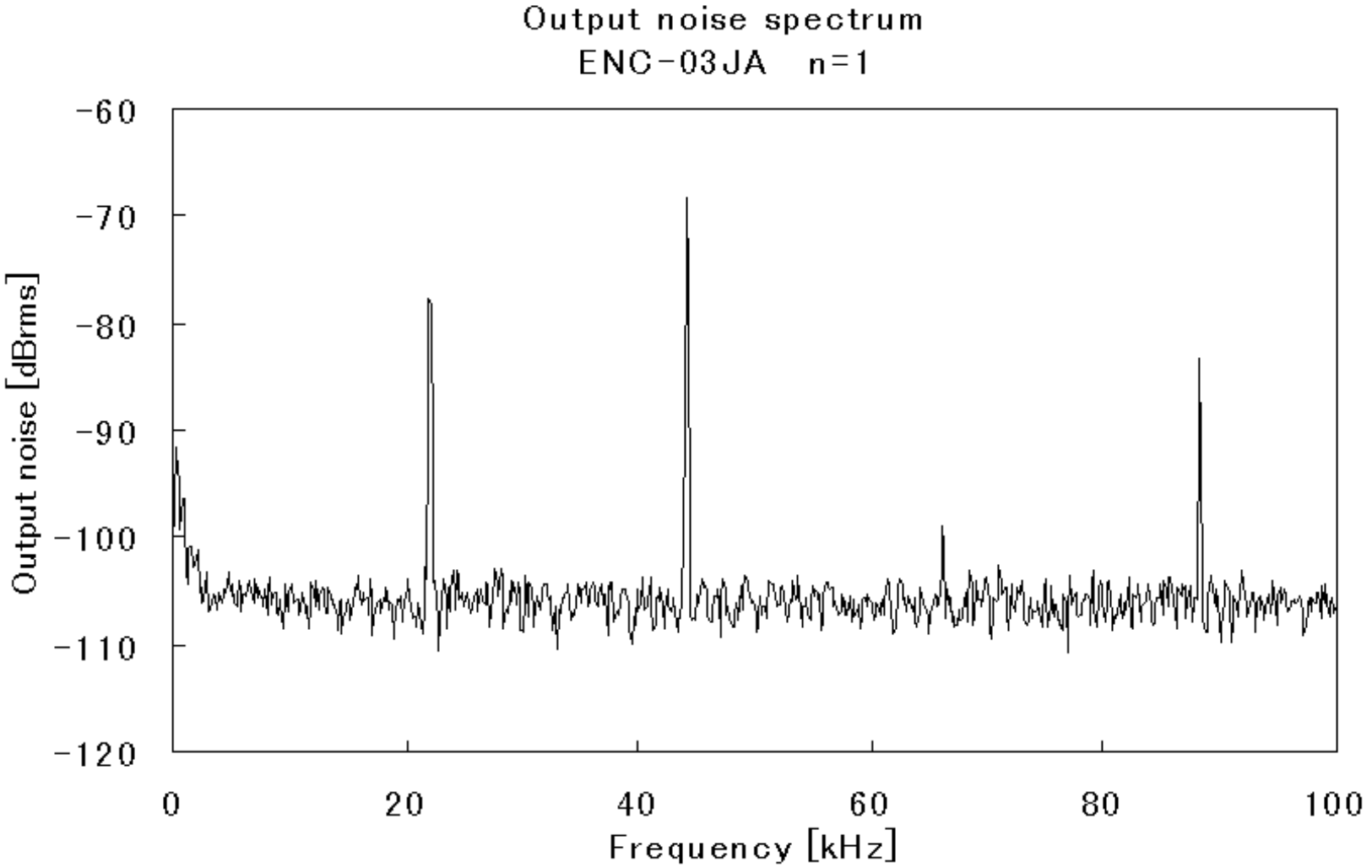

Temp. coefficient of scale factor
ENC-03JA n=5
Scale factor variation [%]
10
5
0
-5
-10
-15
-20
-20
0
20
40
60
80
Temperature [deg C]


Response (phase delay)
ENC-03JA n=4
Phase delay [deg]
0
-10
-20
-30
-40
-50
-60
-70
0
20
40
60
80
Frequency [Hz]


Response (gain)
ENC-03JA n=4
Gain [dB]
4
3
2
1
0
-1
-2
-3
-4
0
20
40
60
80
Frequency [Hz]


Transverse sensitivity
ENC-03JA X axis rotation n=5
Output [deg/s]
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-100
-50
0
50
100
Angular velocity [deg/s]


Output noise ENC-03JA
10mV
20 μ s
Output noise
Time


Output noise spectrum
ENC-03JA n=1
Output noise [dBrms]
-60
-70
-80
-90
-100
-110
-120
0
20
40
60
80
100
Frequency [kHz]