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Transitioning from A-Series To F-Series Sensors

PNI's new Sen-XY-f and Sen-Z-f geomagnetic sensors (F-series sensors) represent a significant improvement in magnetic sensing performance when compared with alternative magnetic sensors, including PNI's legacy Sen-XY and Sen-Z sensors (A-series sensors). The new F-series sensors provide lower noise, lower power consumption, improved gain and resolution, and reduced unit-to-unit variability. This document reviews the differences between the sensors, and how to implement F-series sensors into an existing system that currently uses A-series sensors.

Specification Differences

The table below consolidates performance specifications for both sensors. Specifications assume the sensor is mated to PNI's 3D MagIC ASIC.

Table 1: Specification Differences

Parameter		Units	A-Series	F-Series
Inductance		μH	400-600 typ.	500-600 typ.
DC Resistance @ 25C ±15C		Ω	30	same
Resistance vs. Temperature		%/C	0.4 typ.	same
Operating Voltage Range		V	1.6 to 3.3	same
Field Measurement Range*		μT	-1100 to +1100	-800 to +800
Gain @ 200 cycle counts (Resolution = 1/Gain)		counts/μT	45 @ 3.3V	45 @ 3.3V (same) 55 @ 2.8V
Noise @ 200 cycle counts		nT	35	30
Linearity - best fit over ±200 μT		% of ±200 μT	0.6 typ., 1.0 max	same
Average Current per Axis - 35 Hz & 200 Cycle Counts		mA	0.3 @ 3.3V	0.20 @ 2.8V 0.25 @ 3.3V
Recommended Bias Resistance	Linear Regime	Ω	33 + (V-1.6)*35 [1.6V to 2.6V]	60 + (V-1.6)*67 [1.6 V to 2.2V]
	Fixed Regime	Ω	68 [2.6V to 3.3V]	100 [2.2V to 3.3V]
External Timing Resistor (R_{EXT})		Ω	33	same
Circuit Oscillation Frequency		kHz	185	195
Operating Temperature		C	-40 to +85	same

*The F-Series field measurement range can be extended if necessary, but involves trade-offs. Contact PNI if you require >±800 μT range.

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Mechanical Differences

The legacy Sen-XY and new Sen-XY-f have the same footprint and overall mechanical dimensions. And the new Sen-XY-f can be accommodated by the Sen-XY's pad layout. Note that the RM-3000-f & RM2000-f User Manual recommends a different pad layout than the RM-3000 & RM2000 User Manual. The reason for the change is PNI has found the new layout makes rework easier. This is true for either version of the sensor. The legacy layout recommendation, however, is still acceptable and allows for the smallest footprint.

The new Sen-Z-f is available in two versions, a backward-compatible version, pn 13070, and a physically more robust version, pn 13101. The 13070 has the same footprint ,dimensions, and recommend pad layout as the legacy Sen-Z, pn 12779. The 13101 is taller and has a larger solder pad area, which results in a much more robust sensor-to-PCB solder joint and eliminates any need for the Sen-Z shield. Indeed, the Sen-Z shield is uncompatible with the 13101 sensor. Dimensions for the 12779, 13070, 13101, and Sen-Z shield are given below. For additional information and drawings, see the appropriate user manual.

Table 2: Sen-Z and Sen-Z-f Dimensions

Parameter	Units	PN 12779 & 13070	PN 13101	Sen-Z Shield
Height	mm	5.75 max	6.35 max	6.10 typ.
Footprint	mm	3 x 3	3.9 x 3	5.7 x 4.1
Recommended Solder Pad (allowing for rework)	mm	4.0 x 2.4	5.2 x 1.95	6.5 x 4.0

Implementation of F-Series Sensors

If the user wants to implement the new F-Series sensors with minimal effort, then the only required change is to switch the bias resistors. For most users this means changing the bias resistor on all their sensors from 68 Ω to 100 Ω, although if the system is operating at <2.6 V then Table 1 should be consulted. Changing the bias resistors is the one change that absolutely should be made.

If operating at <3 V, then changing to F-series sensors will somewhat increase the gain of the system. In this case it may be desirable to reduce the number of cycle counts in software in order to further decrease power consumption while retaining gain and resolution. Alternatively, if nothing is changed in software, then the gain and resolution of the system will improve.

For the Sen-Z-f, the user may decide to use the more robust 13101, rather than the backward-compatible 13070. In this case, the pad layout should change per the RM-3000-f & RM2000-f User Manual.