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# Voltage & Current - Analog

**Tech Spec**

Operating temperature - -40 to +125C

DAC

Integral-non-linearity electrical specification ±5 LSB

Differential-non-linearity electrical specification ±1 LSB

Power-up time 10 ms

Sampling rate 150 µs

Settling time STD 2.2 ms  OPT 1.1 ms,  0.55 ms,  0.286 ms

Resolution 12 bit

Sensor

System INL Deviation from best line fit; 360° maximum angle, no magnet displacement, no zero-programming performed (PWM, I²C) ±1 degree

Orthogonal component for the magnetic field within the specified range (Bz), after 2.2 ms; STD 0.015 degree

Orthogonal component for the magnetic field within the specified range (Bz), after 286 µs, STD  0.043 degree

The PE18  is a Hall-based rotary magnetic position sensor using planar sensors that convert the magnetic field component perpendicular to the surface of the chip into a voltage.

The signals coming from the Hall sensors are first amplified and filtered before being converted by the analog-to-digital converter (ADC). The output of the ADC is processed by the hardwired CORDIC block (Coordinate Rotation Digital Computer) to compute the angle and magnitude of the magnetic field vector.

The intensity of the magnetic field is used by the automatic gain control (AGC) to adjust the amplification level to compensate for temperature and magnetic field variations.

The angle value provided by the CORDIC algorithm is used by the output stage. The user can choose between an analog output and a PWM-encoded digital output. The former provides an output voltage which represents the angle as a ratiometric linear absolute value.

The latter provides a digital output which represents the angle as the pulse width.

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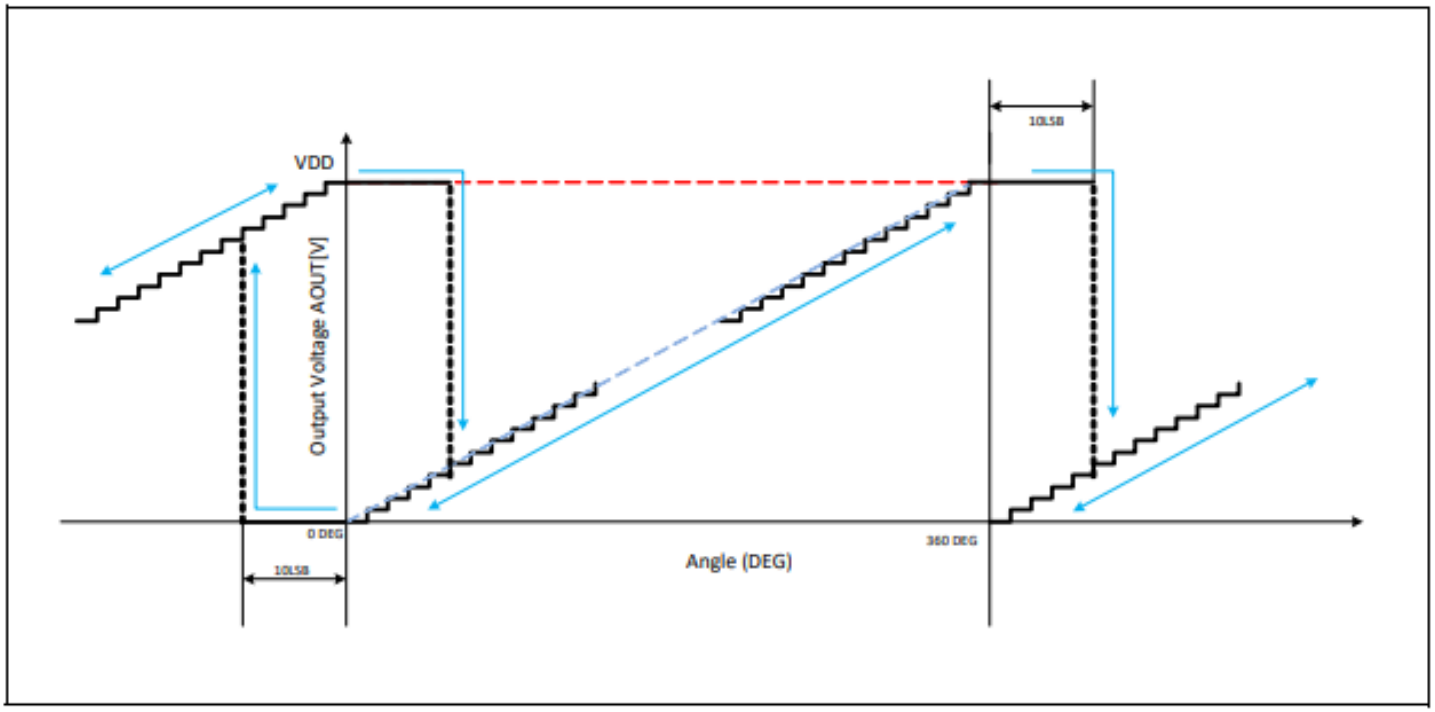
Analog Output Mode By default, the PE18 output stage is configured as analog ratiometric output.
The Digital to Analog Converter (DAC) has 12-bit resolution.
In default mode, the lower reference voltage for the DAC is GND, while the upper reference voltage is VDD.
The output voltage on the OUT pin is ratiometric between GND and VDD.
The maximum angular range can be programmed from 18 degrees to 360 degrees.
The default range is 360 degrees.
As shown below, if the range is 360 degrees, to avoid discontinuity points exactly at the limit of the range, a 10-LSB hysteresis is applied. This hysteresis suppresses toggling the OUT pin when the magnet is close to zero or 360 degrees. Figure 27: Output Characteristic Over a 360° Full-Turn Revolution
The PE18 supports programming both a zero angle as well as the maximum angular range.
As shown in Figure 28, reducing the maximum angular range pushes the non-discontinuity points to the edges, away from the 0 and θmax (where θmax is the maximum angle) by λ, where λ= (360 - θmax)/2.

Output Characteristic Over a 360° Full-Turn Revolution




If the maximum angular range is smaller than 360 degrees, the DAC resolution is automatically reduced.
If θmax is the maximum angle, the number of steps N of the output signal OUT is: N = (θmax/360) × 4096
The PE18 also allows selecting the output dynamic characteristics of the OUT signal (consult factory).
By default, the output can cover the full voltage range (0V to VDD),
but a reduced range from 10% to 90% between GND and VDD may be programmed (consult factory).

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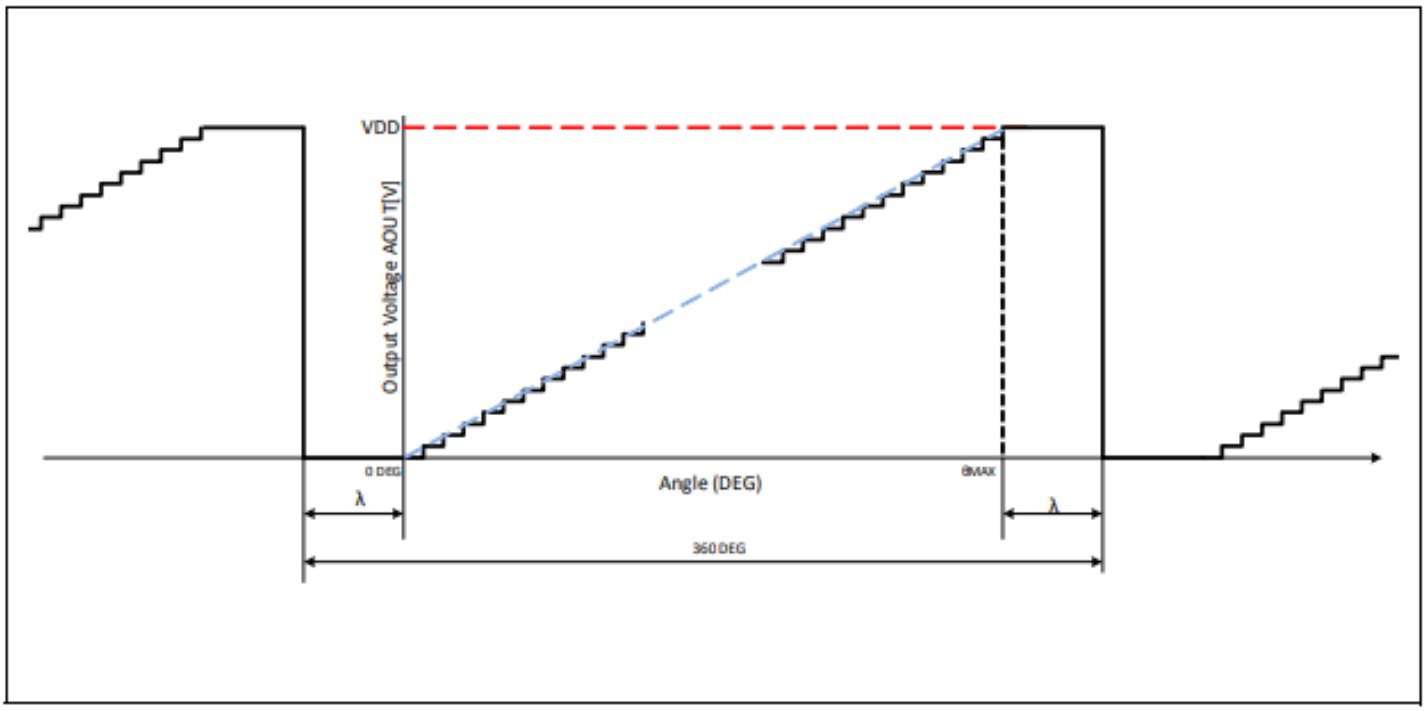
## Output Characteristic Over a Range Smaller Than 360°




Step Response and Filter Settings
The PE18 has a digital post-processing programmable filter which can be set in fast or slow modes.
The fast filter mode can be enabled by setting a fast filter threshold(consult factory).
If the fast filter is OFF, the step output response is controlled by the slow linear filter.
The step response of the slow filter is programmable by factory.
Figure shows the tradeoff between delay and noise for the different SF bit settings

For a fast step response and low noise after settling, the fast filter can be enabled.
The fast filter works only if the input variation is greater than the fast filter threshold, otherwise the output response is determined only by the slow filter.
The fast filter threshold is programmed at factory.
As shown, the step response stays within an error band after two full sampling periods to settle to the final value determined by the slow filter.

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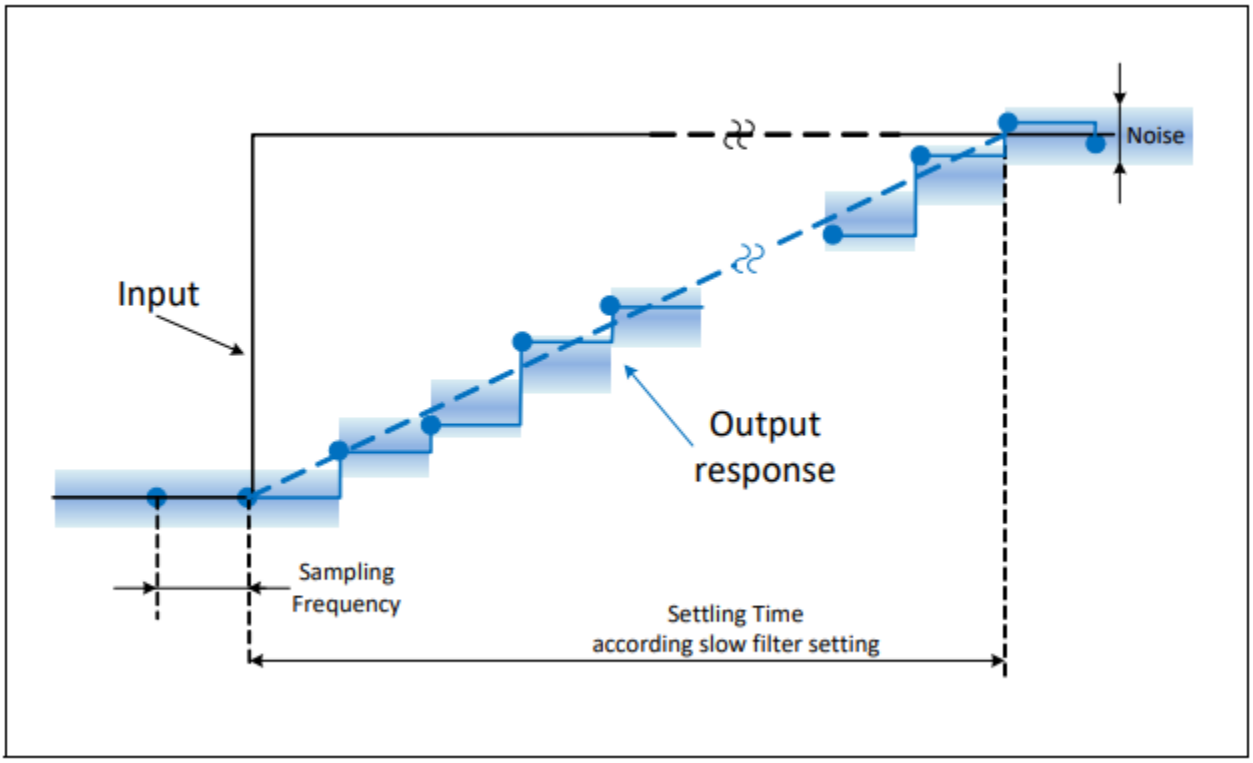
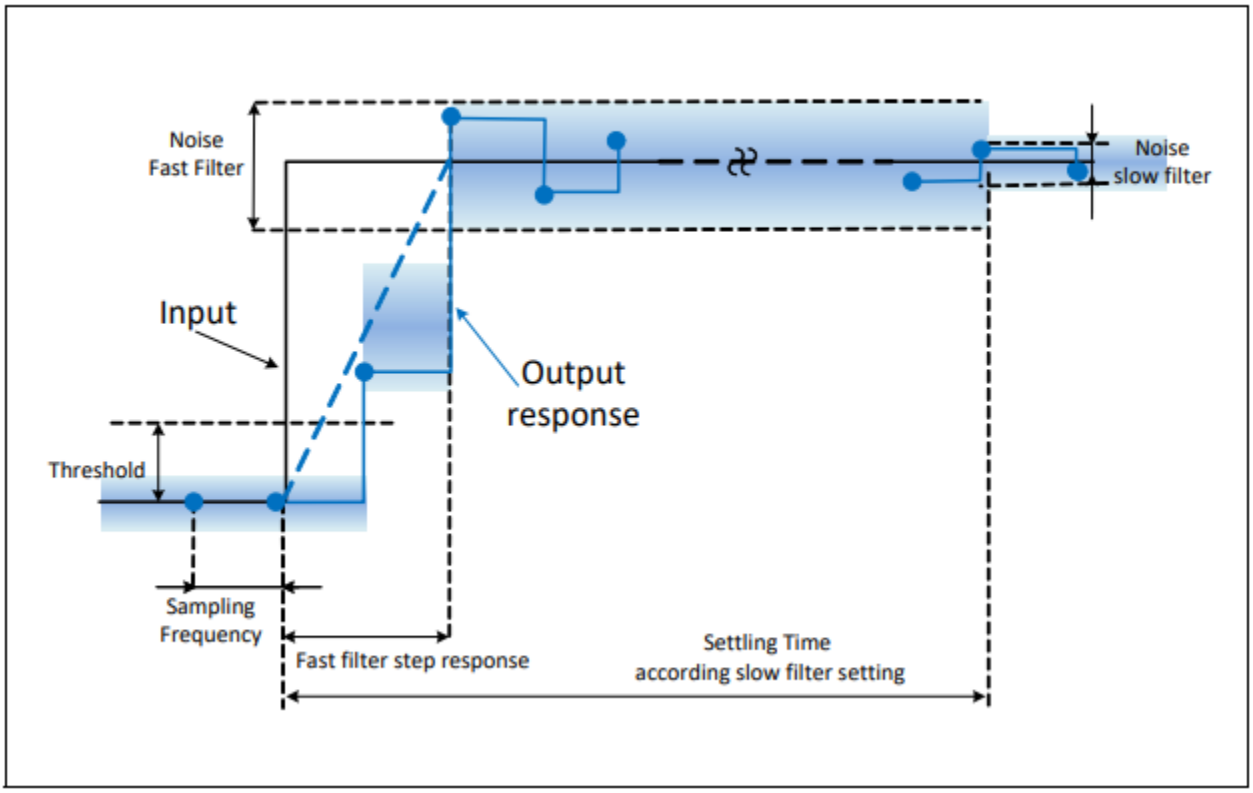
Step Response (fast filter OFF)




Step Response (fast filter ON)



**Hysteresis (Consult Factory)**

To avoid any toggling of the output when the magnet is not moving, a 1 to 3 LSB hysteresis of the 12-bit resolution can be enabled.