

1. A pressure sensor outputs -2mV when the pressure is 30psi and +13mV when the pressure is 150psi. The input range for the analog-to-digital converter is 0-10V, where 0V corresponds to 30psi and 10V corresponds to 150psi.

(a) Design the interface circuit.

Solution:

Gain =

667

Bias =

1.33 V

(b) What does the interface circuit output when the sensor voltage is +6mV?

Solution:

V_{out} =

5.33 V

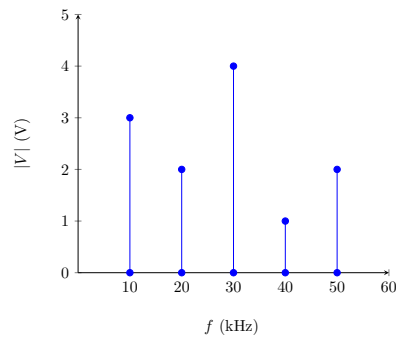
2. An Analog-to-Digital Converter (ADC) has a sampling frequency of 30kHz, what is the maximum input frequency allowed before aliasing occurs?

Solution:

f_{max} =

15 kHz

3. Given the following amplitude spectrum for an analog signal being applied to an ADC, what is the minimum sampling frequency required to avoid aliasing? What V_{\max} and V_{\min} would you recommend to avoid clipping with your ADC?



$$f_s =$$

100 kHz

$$V_{\min} =$$

12 V

$$V_{\max} =$$

-12 V

4. Perform the following number base conversions

(a) $81_{10} \xrightarrow{\text{8-bit binary}}$

0101 0001

Solution:

(b) $65_{10} \xrightarrow{\text{8-bit binary}}$

0100 0001

Solution:

(c) $11110101_2 \xrightarrow{\text{Decimal}}$

245

Solution:

(d) $01101110_2 \xrightarrow{\text{Decimal}}$

110

5. Given a 4-bit ADC with $V_{\min} = 0V$, what V_{\max} is required to get a voltage resolution of $\frac{1}{4}V$?

 $V_{\max} =$

4 V

Solution:

6. Given an ADC with $V_{\max} = 10V$ and $V_{\min} = 0V$, how many bits would be required to get a voltage resolution less than 2mV? Recall this needs to be an integer value.

 $b =$

13 bits

Solution: