Application Note

Use of I/Os on AVL Devices

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Intellectual Property

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Revision History

Date	Rev.	Comments
January 2015	1.0.0	Initial version.
January 2015	1.0.1	Renamed: PAID-FEATURES to PREMIUM-FEATURES
October 2019	A	Initial Lantronix document. Added Lantronix document part number, logo, contact information, and links.

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1 ABOUT THIS DOCUMENT

The engineering of the FOX3 device is built with the same technology combining both versions of the FOX-IN/EN devices with some additional PREMIUM-FEATURES (former "PAID Features") to allow their use when needed. The CAN-Bus is also a PREMIUM-feature in the FOX3 and it is hard-faced on its PCB that can be remotely enabled when needed. When enabling the CAN-Bus-interface, the FOX3 remains with less I/O as the CAN-Bus disables the use of I/O2 and I/O3 in general and uses them as communication interface for itself as CAN-Low and CAN-High signals. When using these with disabled CAN-Bus-interface a parasitic current may be available on these I/Os that may alter the proper functioning of a buzzer or LED or other peripherals.

This application note will provide you some information and recommendations about using of these I/O pins in the FOX3 when the internal CAN-Bus interface is disabled.

Prior showing how to use these I/O in the FOX3 device, you will find in the next 2 chapters two tables listing the amount of current flowing through the I/O when they are in the inactive state. This current is known as parasitic current.

1.1 FOX-EN/IN I/O characteristics

The table below shows the parasitic current flowing through the IO in the inactive state in the FOX-IN/EN devices due to the input impedance.

External power source	Parasitic current in the inactive state		
	I/O1 in [µA]	I/O2 in [µA]	I/O3 in [µA]
12 V	300	300	300
24 V	500	600	600
32 V	700	800	800

1.2 FOX3 I/Os characteristics

The table below shows the the parasitic current flowing through the IOs in the inactive state in the FOX3 due to the input impedance.

External power source	Parasitic current in the inactive state		
	I/O1 in [µA]	I/O2 in [µA]	I/O3 in [µA]
12 V	78	900	900
24 V	150	1800	1800
32 V	200	2400	2400

1.3 How to use the I/O2 and I/O3 in the FOX3 with deactivated CAN-Bus-interface?

The I/O2 and I/O3 can operate either as digital inputs/outputs or analogue inputs. This section explains the behaviour of the I/O2 and I/O3 when used as general purposes input or output.

Here below some general recommendations when using these I/Os:

A) Use a voltage source with low impedance on I/O2 and I/O3.
B) Voltage sources with high impedance can be used on I/O1.
C) Use the IOBOX-MINI or IOBOX-CAN instead of I/O2 and I/O3.
D) The absolute maximum power drawn from any single I/O pin is 100 mA.

1) Digital/Analogue inputs:

If both I/O are intended to be used as digital or analogue inputs, then use a voltage source with low impedance for instance: car battery.

2) Digital outputs:

When using an I/O as digital output there might be flowing parasitic current on the I/O2 and I/O3 due to input impedance. This parasitic current may alter the proper functioning of a buzzer or LED when connected to the I/O2 or I/O3 lines. A relay would not be enabled in such a case, as it needs much more current for activation as the parasitic current on the output is. Unfortunately, a buzzer is more sensible and it can be activated even if a small current is flowing through it. To avoid as much as possible this behaviour and to ensure proper operation of the buzzer, the best practice is to add a resistor (R_L) between positive and negative leads of the buzzer that will drop the voltage across the buzzer under the minimum operating voltage when the digital output is in the inactive state or set low.

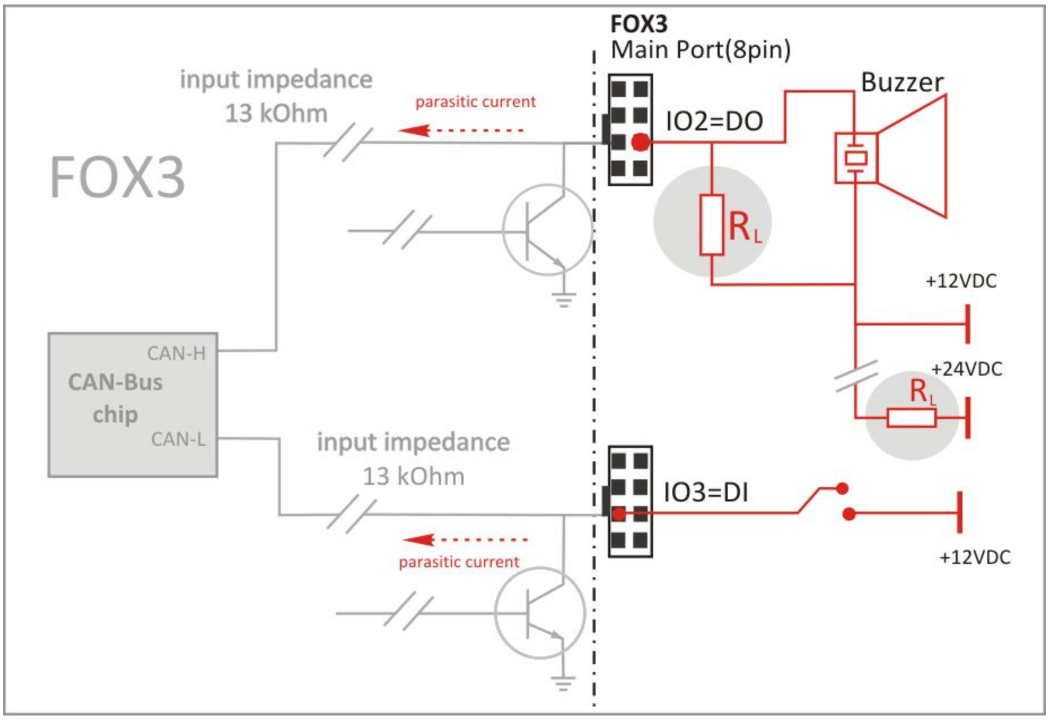

Figure 1: Adding a resistor to drop the voltage across the buzzer under the low voltage threshold when the digital output is set low.

In order to properly calculate the size of the required resistor (R_L), you can use the following formula:

$$R_L = \frac{R_I \times V_R}{V_{INB}}$$

where:

- R_L = Required resistor to the buzzer.
- R_I = Input impedance (13kOhm)
- V_R = Min. operating voltage of the Buzzer (e.g. 1.5 VDC, refer to the buzzer datasheet)
- V_{INB} = Input voltage to the Buzzer (e.g. 12 VDC)

$$R_L = \frac{13\ \text{kOhm} \times 1.5\ \text{VDC}}{12\ \text{VDC}} = 1.62\ \text{kOhm}$$

So now you know that for a 12VDC buzzer with 1.5 VDC min. operating voltage you can use a 1.62 kOhm resistor to keep the voltage across the buzzer dropped under its minimum operating voltage, so that the buzzer does not sounds while it is set low. But what kind of resistor should be used for a 24VDC buzzer with 1.5 VDC min. operating voltage?
If you are going to use a 24VDC buzzer, you could put an additional resistor to the 24VDC line with the same size in series with the first one (as shown in diagram above).

Keep in mind that you never draw more than the 100mA absolute max rating to an output pin.