



TRADITIONAL CONTACT-BASED CONTROLLER FUNCTIONS WEARING YOU DOWN? EXTEND PLAYTIME WITH NON-CONTACT MAGNETIC SOLUTIONS

By Wade Bussing, Product Marketing Engineer, Allegro MicroSystems

INTRODUCTION

Repair, replacement, and reputation costs can add up for game manufacturers in the event of premature controller wear or failure of gaming products. Common points of failure for many games include contact-based controller functions such as joysticks, triggers, d-pads, rotary knobs, selection knobs, and buttons. Fortunately, a wide array of non-contact sensing solutions for many human-machine interface (HMI) functions can enhance the long-term reliability of gaming products.

Implementing controller functions through non-contact solutions provides both performance and reliability advantages over typical contact-based input methods. Reliable operation is most critical for the long-term satisfaction of end users. Magnetic sensing methods are immune to the wear and tear of traditional contact-based input methods and the “drift” associated with traditional potentiometer-based methods. Controller designs using magnetic sensing can help ensure a lifetime of gaming enjoyment.

CONTROLLER FUNCTIONS

A wide variety of magnetic sensor combinations is available to address the desired feature set for a particular controller design. Whether the goal is to provide an all-digital interface, low-power management, analog control, or a combination of these capabilities, magnetic sensors combined with advanced motor drive solutions are a perfect fit. Figure 1 shows several popular HMI and haptic functions used in a game controller.



Figure 1: Common controller functions enabled by magnetic sensors.

Figure 2 presents a typical game controller block diagram, and Table 1 lists examples of sensor products from Allegro MicroSystems that support specific game controller functions.

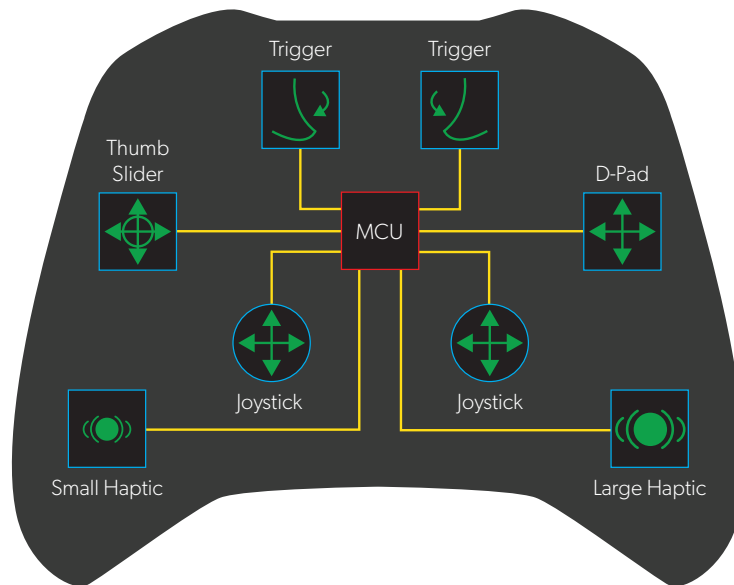


Figure 2: Typical game controller block diagram.

Table 1: Controller functions, popular Allegro ICs and their features

IC	Functions	Features
ALS31300 3D Linear Sensor	<ul style="list-style-type: none"> • Joysticks • Thumb-slide joystick • Triggers • Rotary knobs • Selection knob • D-pads • Gimbals 	<ul style="list-style-type: none"> • Tiny 3 mm × 3 mm DFN • 3D sensing • I²C interface • Low power modes • Wake on motion • Interrupt pin • 2.5 to 3.3 V supply
A139x 1D Linear Sensor	<ul style="list-style-type: none"> • Joysticks • Triggers • Gimbals 	<ul style="list-style-type: none"> • Tiny 2 mm × 3 mm DFN • Low power / sleep pin • Analog interface • Settable VREF pin
A1304 1D Linear Sensor	<ul style="list-style-type: none"> • Joysticks • Triggers • Gimbals 	<ul style="list-style-type: none"> • Tiny 2 mm × 3 mm SOT23 • Analog interface
A3918 Low Voltage DC Motor Driver	<ul style="list-style-type: none"> • Rumble / Haptics 	<ul style="list-style-type: none"> • Tiny 2 mm × 3 mm DFN • Sleep feature • Thermal protection

MAGNETIC SENSORS IMPROVE TRIGGER AND JOYSTICK RESPONSE

In traditional mechanical potentiometer systems, a “dead zone” is typically deployed to hide joystick or trigger “drift” from the player as the potentiometers wear out over time. Drift occurs when the controller receives a signal from the input device while left in a neutral position. This phantom signal may be due to contamination of the wiper mechanism or wearing of the contact material. Drift can manifest in games as a character moving inadvertently or randomly applying the brakes in a racing game, which are frustrating experiences for the player.

A certain amount of wear is expected over a controller’s lifetime with potentiometer solutions, but the severity of drift will vary from unit to unit. An overly large dead zone must be considered to encompass the distribution of wear on potentiometer-based joysticks and triggers.

Figure 3 illustrates a typical dead zone technique where any signal observed in the center of the coordinate system is largely ignored. The magnitude of the response increases as the joystick moves out from the center.

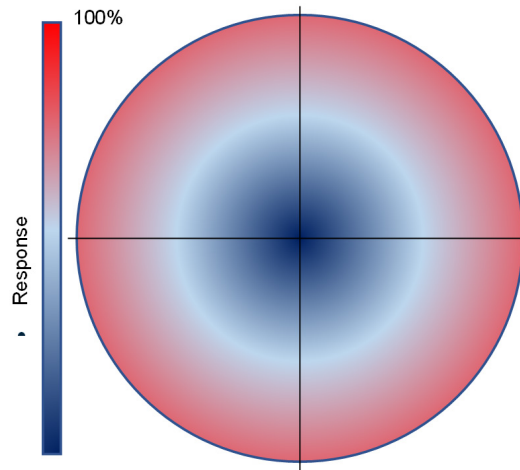


Figure 3: Common joystick dead zone technique.

Some competitive games provide a dead zone setting within the game’s menus, allowing players to set their preferred size of dead zone. A small dead zone is generally preferred to enhance responsiveness.

This level of control is a feature of some games but is quite different from the dead zone baked into the controller to account for drift over time caused by inferior mechanical solutions. Large dead zones can prolong the life of a traditional trigger or joystick while reducing responsiveness for the user.

With magnetic sensing solutions, there are no wipers to wear out or contacts to degrade over time. Magnetic joysticks and triggers are immune to these common wear-out mechanisms. Designers can achieve smaller dead zones with magnetic-based joysticks and triggers, which leads to a more responsive feel that every gamer craves. Figure 4 compares relative dead zones of magnetic and potentiometer-based joysticks. Note that some amount of dead zone is still valuable even with magnetic joysticks to avoid an overly sensitive response in gaming situations requiring precision control.

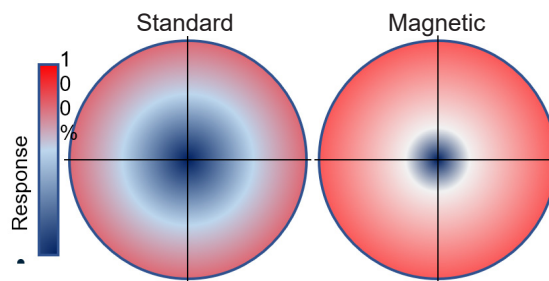


Figure 4: Typical dead zones for standard and magnetic joysticks.

CONCLUSION

When designing a game controller interface, look for magnetic sensing solutions that provide low-power control, wide sensing ranges, and digital or analog interfaces tailored for common HMI and controller functions. With today’s market-proven non-contact magnet sensing solutions, your trigger, joystick, directional-pad, and haptic designs will exceed expectations for reliability and responsiveness and offer years of heavy gameplay over traditional contact-based methods.

For more information on Allegro’s magnetic sensors for gaming applications, visit www.allegromicro.com.

Revision History

Number	Date	Description	Responsibility
-	November 12, 2020	Initial release	W. Bussing

Copyright 2020, Allegro MicroSystems.

The information contained in this document does not constitute any representation, warranty, assurance, guaranty, or inducement by Allegro to the customer with respect to the subject matter of this document. The information being provided does not guarantee that a process based on this information will be reliable, or that Allegro has explored all of the possible failure modes. It is the customer's responsibility to do sufficient qualification testing of the final product to insure that it is reliable and meets all design requirements.

Copies of this document are considered uncontrolled documents.