

Optimizing AC Drive Control Panel Systems With Logic and Translation Use Cases



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Logic and Voltage Translation

ABSTRACT

Industrial AC inverter and variable frequency motor drive control panels integrate numerous subsystems in a small space. Though the control panels can differ in style and features, they share similar digital interfacing challenges, such as reading in data from a user or interfacing with a wireless module. All of the use cases shown in the [Block Diagram](#) and [Logic and Translation Use Cases](#) sections of this document are commonly seen in AC motor drive control panel designs.

Logic gates, voltage translators, and other logic devices are utilized for many purposes throughout modern electronic systems. This document provides example solutions for common design challenges that can be solved using logic and translation. Not all of the solutions here appear in every system; however, all solutions shown are commonly used and effective.

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1 Block Diagram

For the purpose of this report, a simplified AC motor control panel block diagram is used to illustrate the logic and translation use cases, see [Figure 1-1](#). Each red block has an associated use-case document. Links are provided in [Logic and Translation Use Cases](#). For a more complete block diagram, see the [interactive online end equipment reference diagram for AC drive control panels](#).

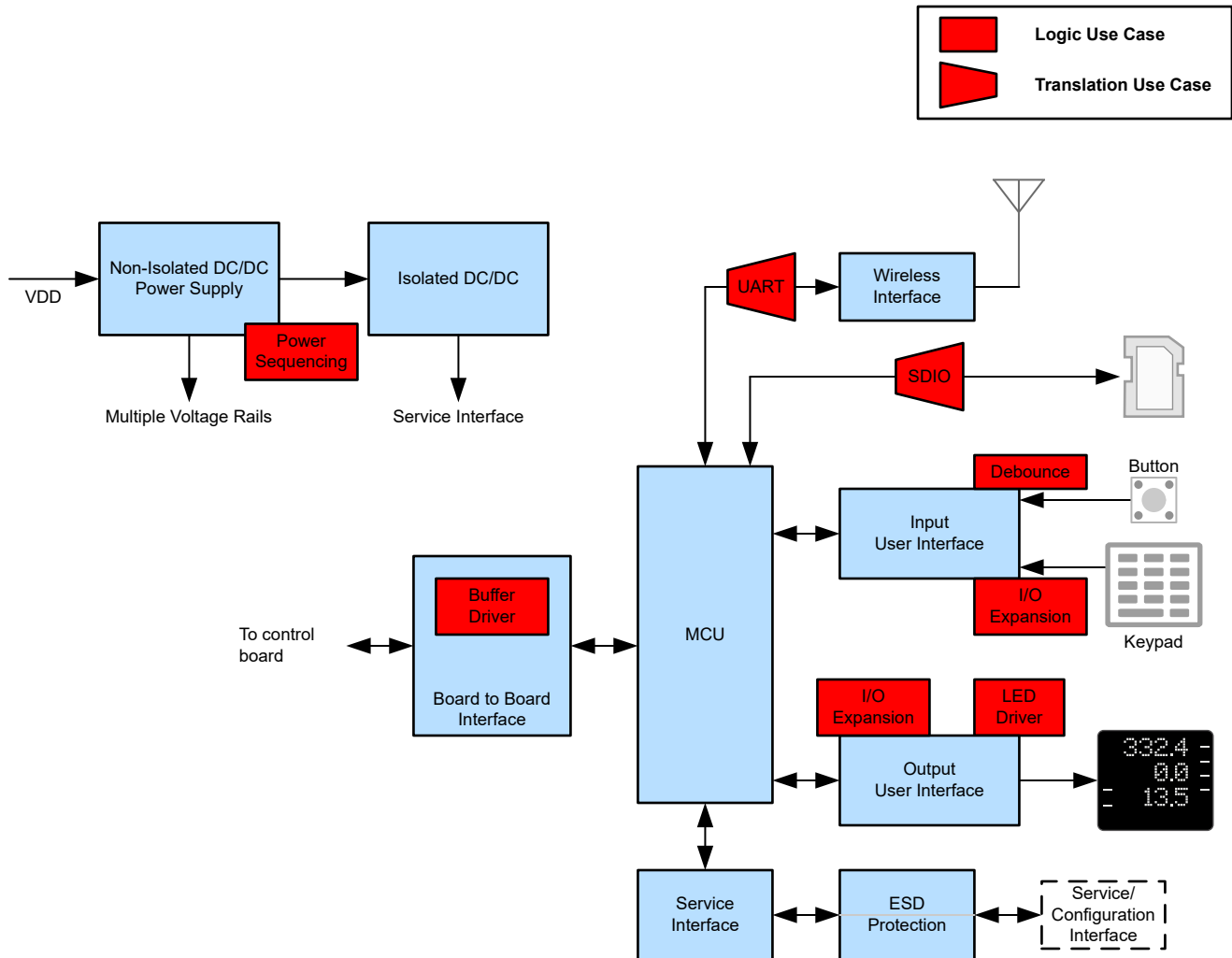


Figure 1-1. Simplified Block Diagram for AC Motor Control Panels

2 Drive Transmission Lines With Logic

It is common to see AC drive control panels communicating via a direct board-to-board connection or through a short cable. Adding a line driver in the form of a logic buffer or transceiver provides additional drive strength; however, this can also result in severe ringing at the receiver. A damping resistor can be added to significantly improve signal integrity at the receiver while maintaining a compact and low-cost design.

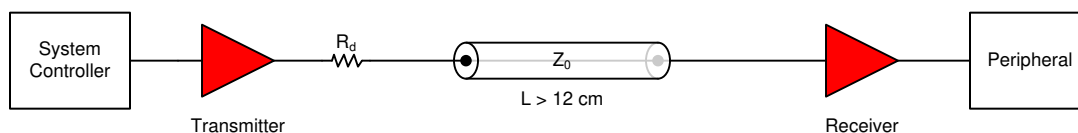


Figure 2-1. Using Logic Buffers to Transmit Over Transmission Lines

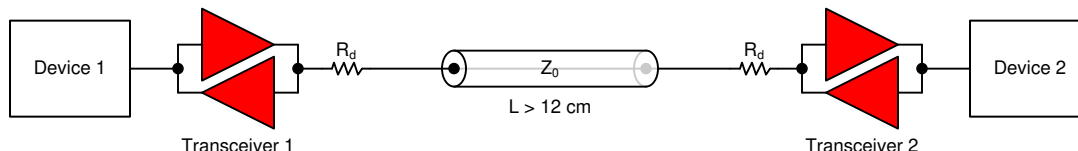


Figure 2-2. Using Logic Transceivers to Transmit and Receiver Over Transmission Lines

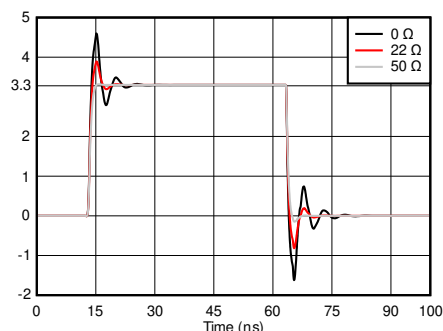


Figure 2-3. Simulated Signal Received From an HCS Family Logic Buffer or Transceiver

- Redrive a single-ended logic signal
- Add a series resistor, R_d , near the transmitter to reduce ringing from impedance mismatches
- Find the right buffer or transceiver through the [online parametric search tool](#)

Table 2-1. Recommended Parts

Part Number	Automotive Qualified	V _{CC} Range	Type	Features
SN74HCS244-Q1	✓	2 V to 6 V	Buffer	Schmitt-trigger inputs improve noise immunity 3-State outputs 8 channels
SN74HCS245-Q1	✓	2 V to 6 V	Transceiver	Schmitt-trigger inputs improve noise immunity 3-State outputs Direction control 8 channels
SN74HC244		2 V to 6 V	Buffer	3-State outputs 8 channels
SN74HC245		2 V to 6 V	Transceiver	3-State outputs Direction control 8 channels
SN74LVC244A		1.65 V to 3.6 V	Buffer	24-mA output drive with 3-V supply 3-State outputs Overvoltage tolerant inputs support up to 5.5-V input signals 8 channels
SN74LVC244A-Q1	✓			

3 Logic and Translation Use Cases

Each use case is linked to a separate short document that provides additional details including a block diagram, design tips, and part recommendations. The nearest block and use-case identifiers are listed to match up exactly to the use cases shown in the provided [simplified block diagram](#).

Table 3-1. Logic Use Cases

Nearest Block	Use-Case Identifier	Use Case
Non-Isolated DC/DC Power Supply	Power Sequencing	Combine Power Good Signals
Board to Board Interface	Buffer Driver	Drive Transmission Lines With Logic
Input User Interface	Debounce	Debounce a Switch
	I/O Expansion	Increase the Number of Inputs on a Microcontroller
Output User Interface	I/O Expansion	Increase the Number of Outputs on a Microcontroller
	LED Driver	Drive Indicator LEDs

Table 3-2. Translation Use Cases

Nearest Block	Use-Case Identifier	Use Case
Wireless Interface	UART	Translate Voltages for UART
SD Card	SDIO	Translate Voltages for SDIO

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