

## Options and Solutions for a High Speed or Low Power Signal and Power Isolated RS-485 Fieldbus

by Richard Anslow

### INTRODUCTION

The Analog Devices, Inc., portfolio of *iCoupler*® digital isolators and RS-485 transceivers addresses two common needs in industrial applications: higher data rates and lower power operating modes.

Higher data rates, smaller RS-485 transceiver packages, and IEC 61000-4-2 ESD protection are required for high performance motor control encoder applications. The [ADM3065E/ADM3066E](#) 50 Mbps transceivers are available in space saving, 10-lead LFCSP packages and offer ±12 kV contact and ±12 kV air IEC 61000-4-2 ESD protection, which provide a reliable solution for EnDat encoders (see the [AN-1397 Application Note](#) for more information). Adding high speed robust signal and power isolation to the [ADM3065E/ADM3066E](#) is possible with the *isoPower*® [ADuM6401](#), or the *isoPower* [ADuM6000](#) and *iCoupler* [ADuM241D](#), as explained in this application note.

Lower power operating modes are in high demand for battery powered systems, downhole applications (for example, mining),

and process control systems that operate in 4 mA to 20 mA loops. Analog Devices offers a micropower digital isolator, the [ADuM1441](#), which consumes <23 μA of quiescent current in shutdown mode. The [ADM3483](#) 3.3 V, 250 kbps RS-485 transceiver offers extremely low quiescent current, with typically only 2 nA required for shutdown mode.

Figure 1 shows an isolated, robust, low power RS-485 solution for downhole applications. The [ADM3483](#) and [ADuM1441](#) together provide a robust low power link to the remote underground measurement node. The system interface card includes an ARM® Cortex® microcontroller unit (MCU), [ADuCM3027](#), and an integrated analog front end (AFE), [AD7124-4](#), for remote temperature and pressure measurements. Firmware updates to the system interface card are provided via the long distance RS-485 cabling, which is capable of low data rate transmission (for example, 9.6 kbps) over long distances of up to 1 km.

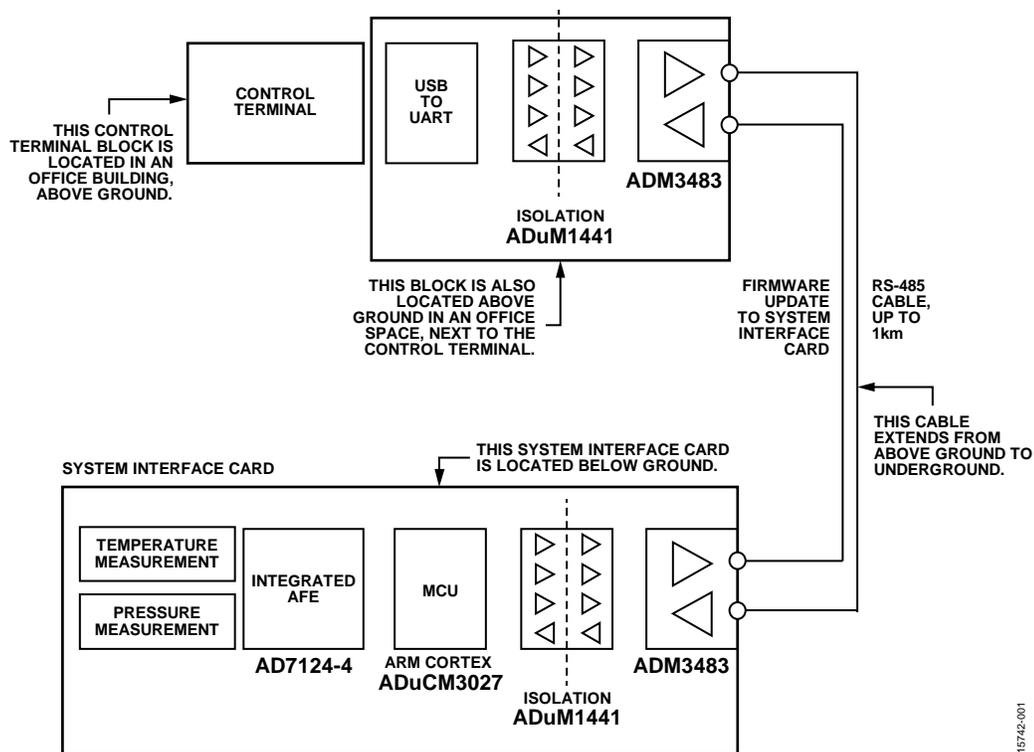


Figure 1. Robust, Low Power, Isolated RS-485 Solution for Downhole Applications

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**REVISION HISTORY**

7/2017—Revision 0: Initial Version





## ISOLATED LOW POWER RS-485

Figure 4 shows the combination of the **ADuM1441** micropower, quad-channel, digital isolator and the low power **ADM3483** half-duplex RS-485 transceiver.

When the **ADM3483** is operated in shutdown mode (driver enable **DE** pin is low and receiver enable **RE** pin is high), the quiescent supply current is typically only 2 nA, with a maximum 1  $\mu$ A specification. Figure 4 shows Pin 7 and Pin 10 of the **ADuM1441** tied to **GND<sub>1</sub>** and **GND<sub>2</sub>**, respectively. This means that the **ADuM1441** isolator operates with <23  $\mu$ A of quiescent current in shutdown mode with no active bus communication. Overall, this solution provides a low quiescent current of <24  $\mu$ A.

If Pin 7 and Pin 10 of the **ADuM1441** are wired directly to **V<sub>DD1</sub>** and **V<sub>DD2</sub>**, respectively, the **ADuM1441** operates with only 1.2  $\mu$ A of quiescent current. This is accomplished by a jumper connection on the PCB, which allows the user to connect Pin 7 to **V<sub>DD1</sub>** or **GND<sub>1</sub>**, and also Pin 10 to **V<sub>DD2</sub>** or **GND<sub>2</sub>**. Adding the 1.2  $\mu$ A of quiescent current from the **ADuM1441** to the **ADM3483** quiescent supply provides a fully isolated RS-485 node that consumes only 2  $\mu$ A of current in shutdown or standby mode. For normal isolator operation, Pin 7 and Pin 10 of the **ADuM1441** must be tied to **GND<sub>1</sub>** and **GND<sub>2</sub>**, respectively.

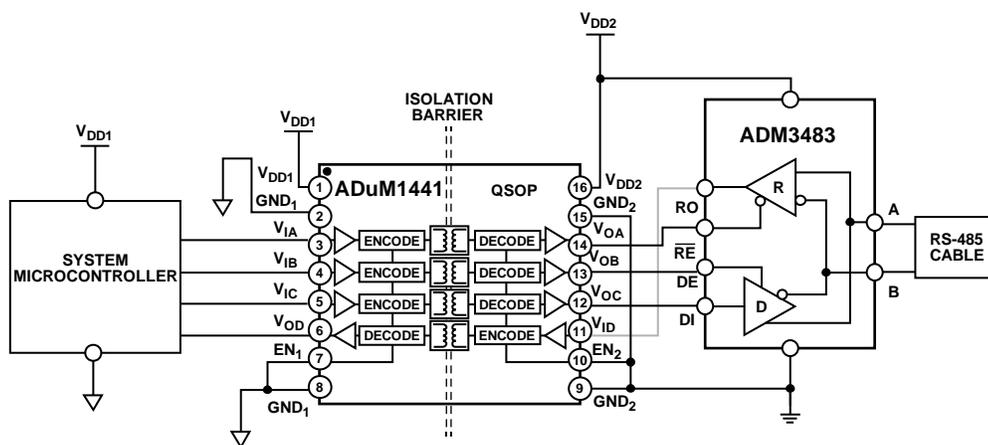


Figure 4. Low Power, Isolated, RS-485 Node

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