Power System Management Linduino One Shield

DESCRIPTION

The DC2294A Linduino™ Shield is an adapter board enabling use of Linduino PSM (Power System Management) software with off the shelf Linear Technology PSM demonstration boards. For a complete list of compatible demo boards, click this link: http://www.linear.com/search/search.php?q=dc&col=doc-dm&start=&sort=&order=&ci=1800.

Linduino PSM software is a set of libraries meant to facilitate learning and software development for PMBus devices. The portability and flexibility of the Linduino platform makes it ideal for demonstrating a wide variety of applications.

Linduino is an Arduino compatible board with an isolated I^2C interface and a ribbon connector that supports communication with many LTC® demonstration circuit boards. The DC2294A Linduino Shield extends this capability to the PSM demonstration circuits. For more information on Linduino, see:

http://www.linear.com/solutions/linduino

PROGRAMMING: REQUIRED HARDWARE

Varies based on application, but in general:

■ Arduino Software Supported PC with USB

■ Linduino One (DC2026A)

■ USB cable

PROGRAMMING: REQUIRED SOFTWARE

■ Arduino IDE

■ LTC Linduino Sketchbook (http://www.linear.com/solutions/Linduino) – See the QuickStart Tab

DEMONSTRATION: REQUIRED HARDWARE

Varies based on application, but in general:

■ DC2026 Linduino One

■ DC2294A Linduino Shield

■ Target Demo Board (DC1962, etc.)

DEMONSTRATION: NICE TO HAVE

■ Total Phase Beagle I^2C Protocol Analyzer

■ Total Phase Data Center Software

For this getting started manual, we will use the DC1962. The DC1962 demo board has 14 power supply rails: 2X LTC3880, 4X LTC2974 and 8X LTC2977.

SHIELD FEATURES

■ 12 Pin PSM Ribbon Cable Connector

■ 10 Pin Total Phase Beagle Connector

■ LTC4313 Bus Buffer

■ Observe PMBus and SPI with a Beagle

LINDUINO PSM FEATURES

■ A Library of Common PMBus Commands that Supports the Most Recent PMBus Features, Including Group Protocol and Page Plus

■ Demonstration Sketches for the Linduino

Design files for this circuit board are available at http://www.linear.com/demo/DC2294A
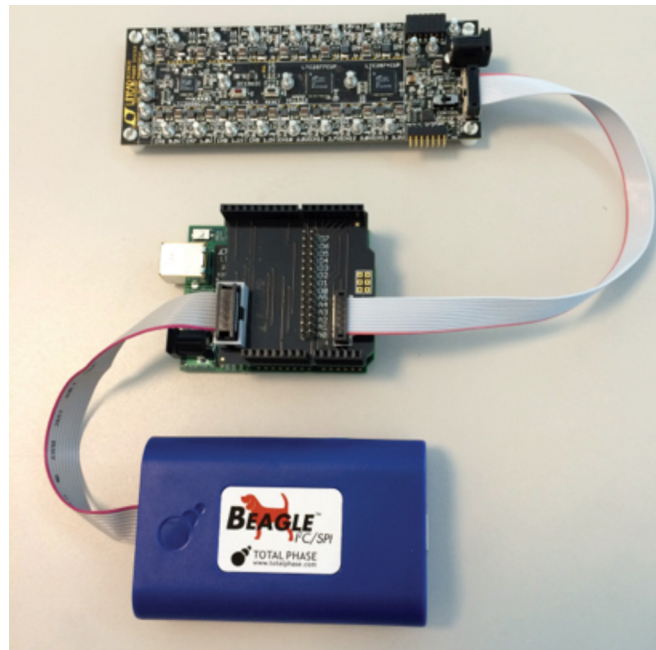
FIRST STEPS

Figure 1. DC1962 (top), DC2026/DC2294A (middle) and Beagle (bottom). DC1962 and Beagle not included with DC2294A.

The DC1962 sketches are the starting point for becoming familiar with the PMBus library.

1. Make sure the Arduino preferences point to the correct Sketchbook as described in the Linduino Demo Manual. http://www.linear.com/solutions/linduino.

2. Be sure to complete the setup described on pages 4/5 of the Linduino Demo Manual to verify the proper setup and operation of the serial port and the monitor before proceeding.

3. Place the DC2294A Linduino Shield on the DC2026 Linduino. All the pins should go into the corresponding sockets. Refer to Figure 1 for the correct orientation.

4. Connect the PC to the DC2026 using the supplied USB cable.

5. Plug one end of the 12-pin ribbon cable into the corresponding 12-pin connector (J2) of the DC1962. Plug the other end into the 12-pin connector of the DC2294A Linduino Shield.

6. In the Arduino IDE File menu, select: Sketchbook | User Contributed | DC1962 | hello_world.

7. Select the Serial port: Tools | Serial Port | COM#.

8. Select the board: Tools | Board | Arduino Uno.

9. In the Arduino IDE File menu, upload the sketch to the Linduino: File | Upload.

10. Open the Serial Monitor to begin the demo: Tools | Serial Monitor.

11. Set the baud rate to 115200 at the bottom right of the window.

12. Set the termination to Carriage Return to the left of the baud rate.

13. If you have a Total Phase Beagle sniffing tool, attach it and observe the I^2C/PMBus traffic produced by this demo.

dc2294af

DEMO SKETCH – DC1962 (POWERSTICK)

HELLO_WORLD SKETCH

The hello_world sketch demonstrates how to perform basic PMBus commands. Upload the sketch and then open the Serial Monitor (Refer to Page 2, Steps 6 and 7).

The main menu (Figure 2) demonstrates enabling/disabling Packet Error Checking (PEC) communication, bus probing, and resetting the device. The Basic Commands menu (Figure 3) demonstrates reading telemetry data (Figure 4), altering voltage outputs, sequencing, and margining.

To operate the menu, enter a number on the command line at the top of the window and press return. Stretching the window vertically to see the results will help.

The hello_world sketch can be used as a template for new sketches. Any standard PSM demo board may be used.

VIEWING PMBUS WITH THE BEAGLE

To observe PMBus traffic on the I^{2}C bus, connect a Beagle to the DC2294A as shown in Figure 1 and follow these steps:

1. Download the latest TotalPhase Data Center Software and USB drivers from http://www.totalphase.com/downloads/ and install them using the instructions supplied by Total Phase. If you do not want to create a Total Phase login and account, you can use an older version of Data Center and USB driver.

2. Connect the PC to the Beagle with the supplied USB cable.

3. Start Data Center, Connect Data Center to the Beagle using the toolbar and start data collection with the toolbar (refer to Beagle documentation).

4. Load the hello_world sketch and press 1 to get the secondary menu, followed by a 1 to measure voltage telemetry.

5. Look at the results in the Data Center menu.

6. Compare the PMBus traffic displayed in Data Center with the code in the hello_world sketch and correlate the observed behavior with the PMBus commands in the code.

SUMMARY

The DC2026 Linduino, and DC2294A Linduino Shield, when combined with a DC1962 demo board is an excellent way to learn PMBus and prototype firmware in a safe environment where nothing can be damaged. The PMBus library may be ported into a commercial platform, or in some cases it can be reused "as is" using the same ATmega processor found on the Linduino. The software is fully compatible with Arduino One and Arduino Mega 2560. The software has also been used on a Galileo Gen 2 (see factory).

Linear Technology also has drivers for Linux (user mode) and various RTOS application examples (see factory).

Have fun prototyping and if you need help, just call your local Linear Technology Field Application Engineer. If you make something cool and want to contribute to the Linduino Sketchbook, also give us a call.

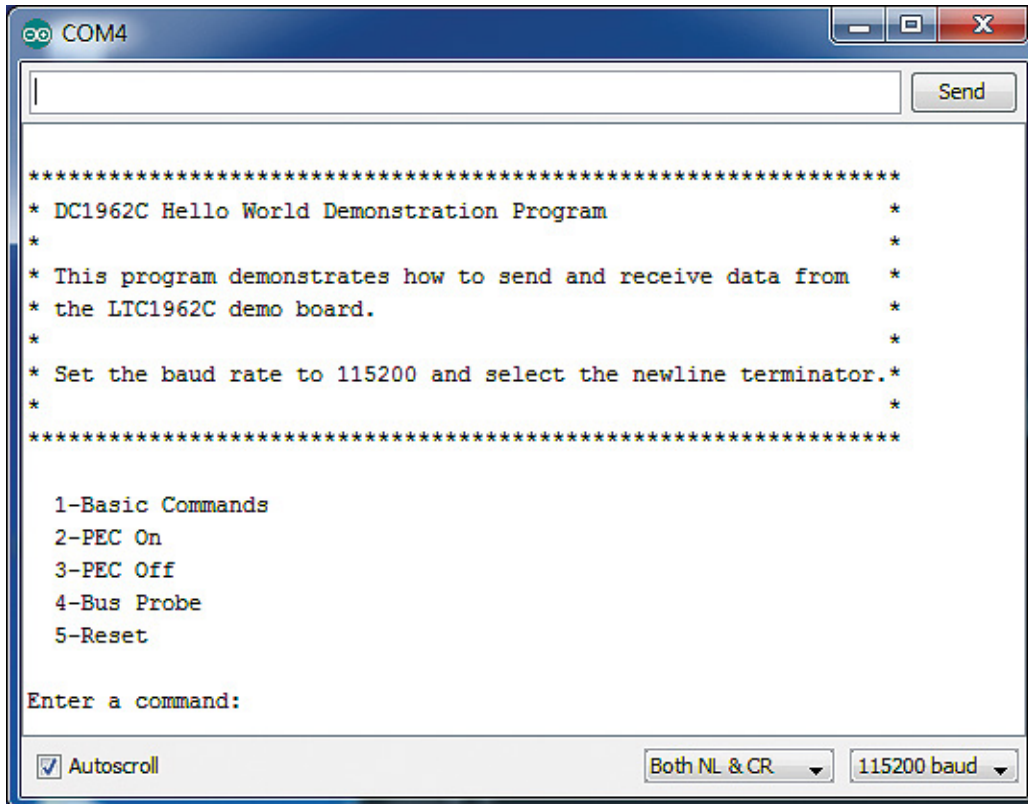# DEMO SKETCH – DC1962C (POWERSTICK)
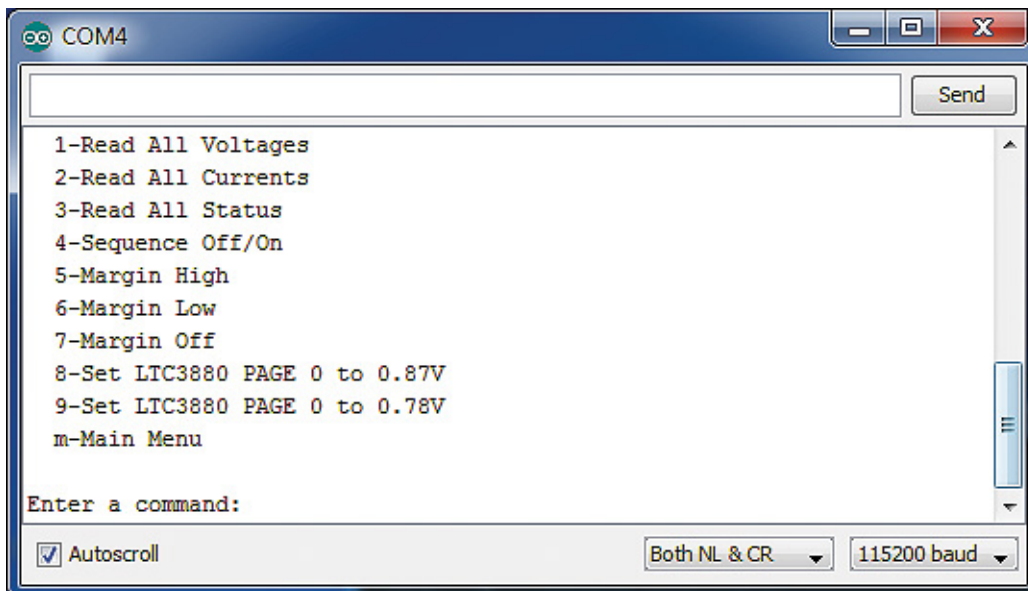

Figure 2. Main Menu

Figure 3. Basic Commands
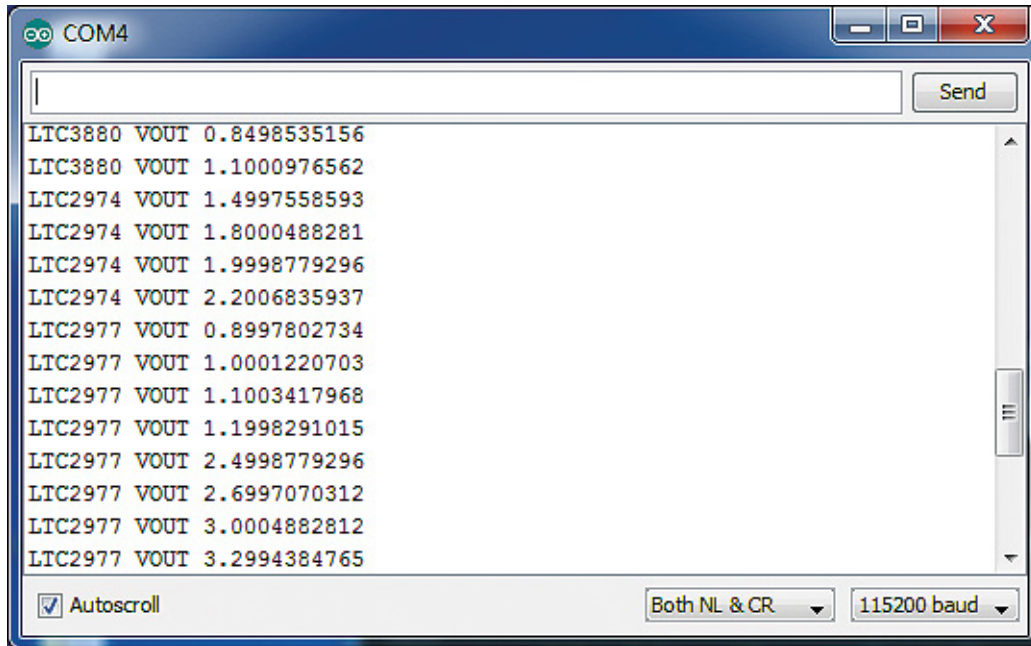
DEMO SKETCH – DC1962C (POWERSTICK)


```
COM4                                                    [_] [□] [✕]

|                                                              [ Send ]

LTC3880 VOUT 0.8498535156
LTC3880 VOUT 1.1000976562
LTC2974 VOUT 1.4997558593
LTC2974 VOUT 1.8000488281
LTC2974 VOUT 1.9998779296
LTC2974 VOUT 2.2006835937
LTC2977 VOUT 0.8997802734
LTC2977 VOUT 1.0001220703
LTC2977 VOUT 1.1003417968
LTC2977 VOUT 1.1998291015
LTC2977 VOUT 2.4998779296
LTC2977 VOUT 2.6997070312
LTC2977 VOUT 3.0004882812
LTC2977 VOUT 3.2994384765

[✓] Autoscroll              [ Both NL & CR ▼ ]  [ 115200 baud ▼ ]
```

Figure 4. Read All Voltages

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	C35	CAP CER, 0.1µF 16V 5% X7R 0603	MURATA, GRM188R71C104JA01D
2	4	R62, R63, R64, R65	RES 20kΩ 1/10W 1% 0603 SMD	PANASONIC, ERJ-3EKF2002V
3	1	JP1	CONN HEADER LOW-PRO 10POS GOLD	ASSMANN WSW COMPONENTS, AWHW-10G-0202-T
4	1	J2	CONN HEADER 12POS 2mm STR DL PCB	FCI, 98414-G06-12ULF 4 TBS
5	1	U29	2-WIRE BUS BUFFERS WITH HIGH NOISE MARGIN	LINEAR, LTC4313IMS8-2#PBF
6	1	JP2	HEADER CONN 28POS 0.100" STR TIN	MOLEX, 90131-0134
7	1	J1-A	HEADER CONN 6POS 0.100" STR TIN	782-A000084
8	2	J1-B	HEADER CONN 8POS 0.100" STR TIN	782-A000085
9	1	J1-C	HEADER CONN 10POS 0.100" STR TIN	782-A000086
10	1	J1-D	HEADER CONN 6POS(2X3) 0.100" STR TIN	CON3DIL25

SCHEMATIC DIAGRAM

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged**.

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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