ANALOG DEVICES

EV-ADE9153ASHIELDZ User Guide
UG-1253

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ADE9153A Energy Measurement Shield with *m*Sure Autocalibration

FEATURES

Arduino-compatible, single-phase energy measurement shield with the ADE9153A
Onboard shunt for line current measurement
Nominal current: 5 A
Maximum current: 10 A
Up to 240 V rms nominal line neutral voltage measurement
Arduino software library
***m*Sure autocalibration and example application sketches**

ADDITIONAL EQUIPMENT NEEDED

Arduino Uno, Arduino Zero, or equivalent
Voltage quick connect leads
USB micro cable
0.250 inch quick connect female connector

DOCUMENTS

ADE9153A data sheet
ADE9153A Technical Reference Manual

SOFTWARE

Arduino IDE 1.8.4 or later
ADE9153A library files

GENERAL DESCRIPTION

The EV-ADE9153ASHIELDZ is an Arduino shield compatible with Arduino Uno, Arduino Zero, or ESP8266. The shield has an on-board shunt resistor for line current measurement and enables quick evaluation and prototyping of energy measurement systems that use the ADE9153A. Arduino library and application examples are provided on the ADE9153A product page to simplify implementation of larger systems. Using *m*Sure® autocalibration, the shield can be calibrated to measure energy with 1% accuracy over the dynamic range without the need for expensive calibration equipment.

HAZARDOUS HIGH VOLTAGE CAUTION

The equipment described in this user guide is connected to hazardous line voltages. Use proper caution when connecting the sensors and voltage leads. Ensure that the system is enclosed in a protective casing.

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REVISION HISTORY

2/2018—Revision 0: Initial Version

CONECTION DIAGRAM

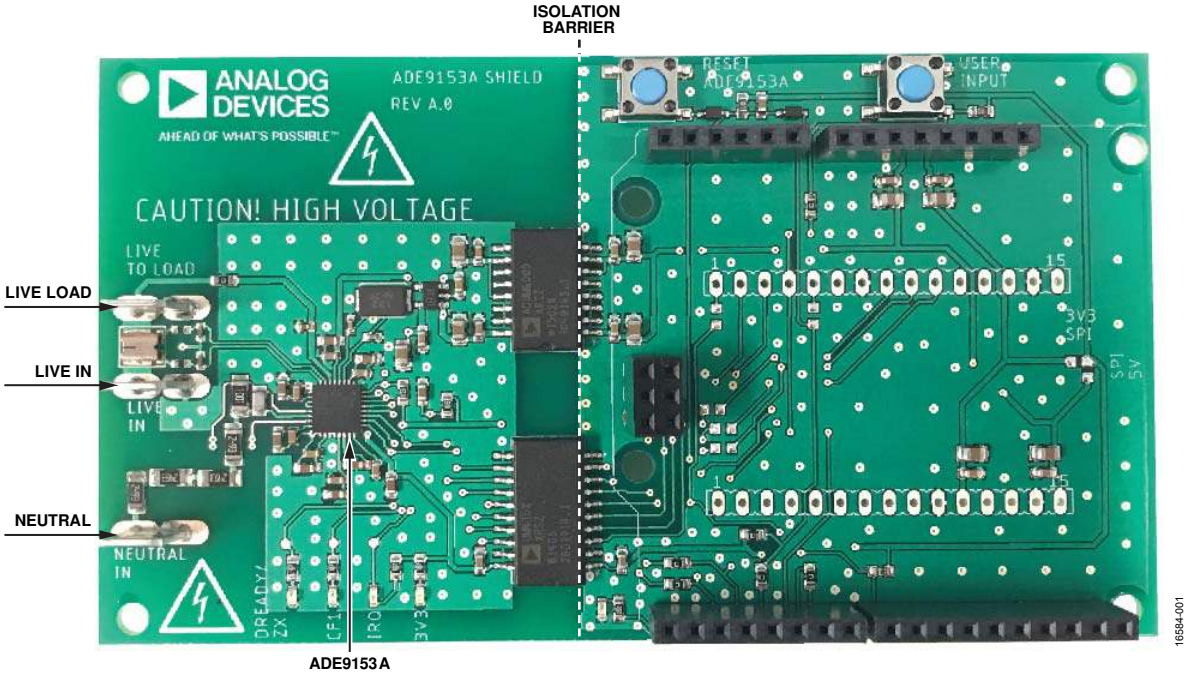

Figure 1. EV-ADE9153ASHIELDZ Connection Diagram

MODULE HARDWARE

POWERING THE ADE9153A SHIELD

The EV-ADE9153ASHIELDZ is powered from 5 V coming from Arduino. By default, the 5 V SPI jumper is connected and the board can be directly connected to Arduino Uno. To use Arduino Zero or any 3.3 V microcontroller unit (MCU), disconnect the 5 V SPI jumper and connect a 3 V SPI jumper to ensure that the correct voltage is applied on the Arduino pins.

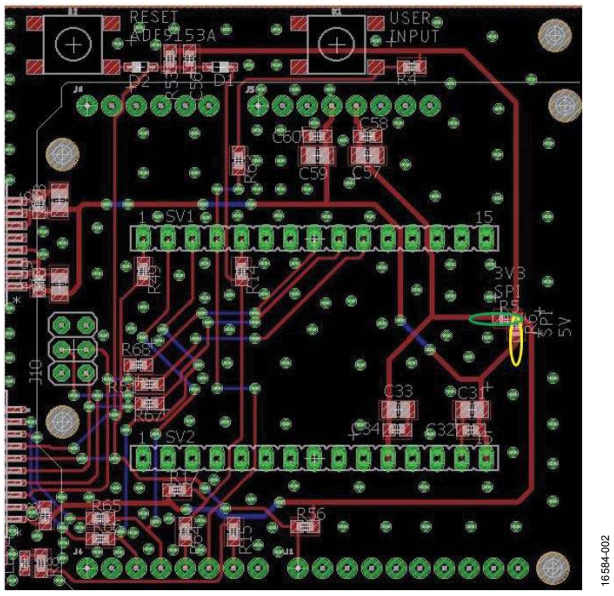

Figure 2. DC Power Supply Selection

ARDUINO UNO AND ARDUINO ZERO

The ADE9153A shield has Arduino R3 headers directly compatible with Arduino Uno and Arduino Zero. The Arduino pins used by the ADE9153A shield are described in Table 1.

Table 1. Arduino General-Purpose Input/Output (GPIO) Connections

Arduino Pin	ADE9153A Signal	Type
ICSP-SCK	SCLK	Serial peripheral interface (SPI)
ICSP-MISO	MISO	SPI
ICSP-MOSI	MOSI	SPI
GPIO 8	$\overline{SS}$ (pulled up)	SPI output
GPIO 4	$\overline{RESET}$	Output
GPIO 5	User button input	Input
GPIO 2	ZX/DREADY/CF2	Input (interrupt)
GPIO 3	$\overline{IRQ}$	Input (interrupt)
5 V	Not applicable	Power
3.3 V	Not applicable	Power

ESP8266 WIFI SYSTEM ON CHIP (SOC)

The shield can also be used with the ESP8266 WiFi SOC. The on-board header makes the shield compatible with the ESP8266 ESP-12E Node MCU. To use the ESP8266, perform the following actions (note that these actions do not need to be performed in order):

- Populate the 15-pin headers, SV1 and SV2.
- Disconnect the 5 V SPI jumper and connect a 3 V SPI jumper to ensure that the correct voltage is applied, as shown in Figure 2.
- Populate 0 Ω resistors on R49, R51, R67, and R68 to establish the SPI connection. Populate R14 to establish the $\overline{RESET}$ connection

The ESP8266 pins used by the EV-ADE9153ASHIELDZ are described in Table 2.

Table 2. ESP8266 GPIO Connections

ESP8266 Pin	ADE9153A Signal	Type
D5 (GPIO 14)	SCLK	SPI
D6 (GPIO 12)	MISO	SPI
D7 (GPIO 13)	MOSI	SPI
D0 (GPIO 16)	$\overline{SS}$ (pulled up)	SPI output
D4 (GPIO 2)	$\overline{RESET}$	Output
D1 (GPIO 5)	$\overline{IRQ}$	Input
D2 (GPIO 4)	ZX/DREADY/CF2	Input
D3 (GPIO 0)	User button input	Input
5 V	Not applicable	Power
3.3 V	Not applicable	Power

CURRENT SENSORS

The EV-ADE9153ASHIELDZ has an on-board, 1 mΩ shunt resistor. The nominal current through the shunt is 5 A rms and the maximum allowed current is 10 A rms with a programmable gain amplifier (PGA) gain value of 16.

VOLTAGE SENSORS

The EV-ADE9153ASHIELDZ has on-board resistor dividers to attenuate the incoming input voltage. The attenuation factor is 1001. Do not exceed a 240 V rms nominal line to neutral voltage.

LIBRARIES

The EVAL-ADE9153ASHIELD Arduino libraries provide basic functions to access the ADE9153A. Use the calibration sketch to calibrate the ADE9153A using an accurate source.

INSTALLING THE LIBRARIES

To install the libraries,

1. Download **ADE9153AAPI.zip**.
2. Install the ADE9153A Arduino library as shown in Figure 3.

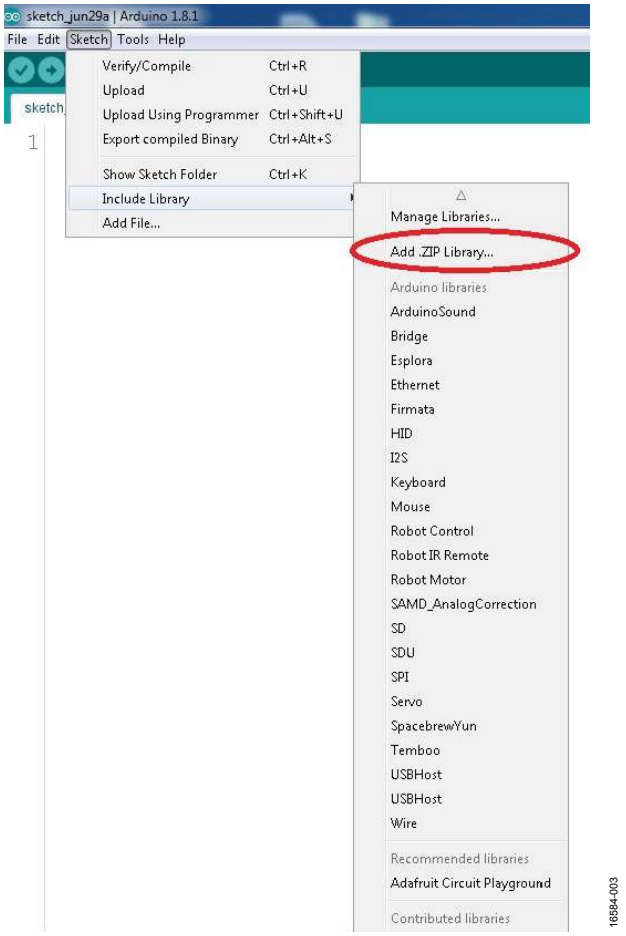

Figure 3. Installing the Arduino Library

ADE9153A ARDUINO LIBRARY

ADE9153AAPI.cpp

The **ADE9153AAPI.cpp** file contains functions to communicate, initialize, and read calculated parameters from the chip.

ADE9153AAPI.h

The **ADE9153AAPI.h** file contains register constants that are written into the device by the set up ADE9153A function.

ADE9153A Application Examples

The application examples demonstrate the use of functions in the **ADE9153AAPI.cpp** and **ADE9153AAPI.h** library files to obtain the parameters calculated by the ADE9153A. Connect Arduino Zero and compile and load the application examples to start energy and power quality measurements.

LINE VOLTAGE CONNECTIONS

HAZARDOUS HIGH VOLTAGE

The equipment described in this user guide is connected to hazardous line voltages. Exercise proper caution when connecting the sensors and voltage leads. Ensure that the system is enclosed in a protective casing.

SINGLE-PHASE LINE AND NEUTRAL CONNECTIONS

The single-phase connection is shown in Figure 4. Do not exceed a nominal voltage of 240 V rms (line to neutral) in this configuration.

EVALUATION BOARD SCHEMATIC

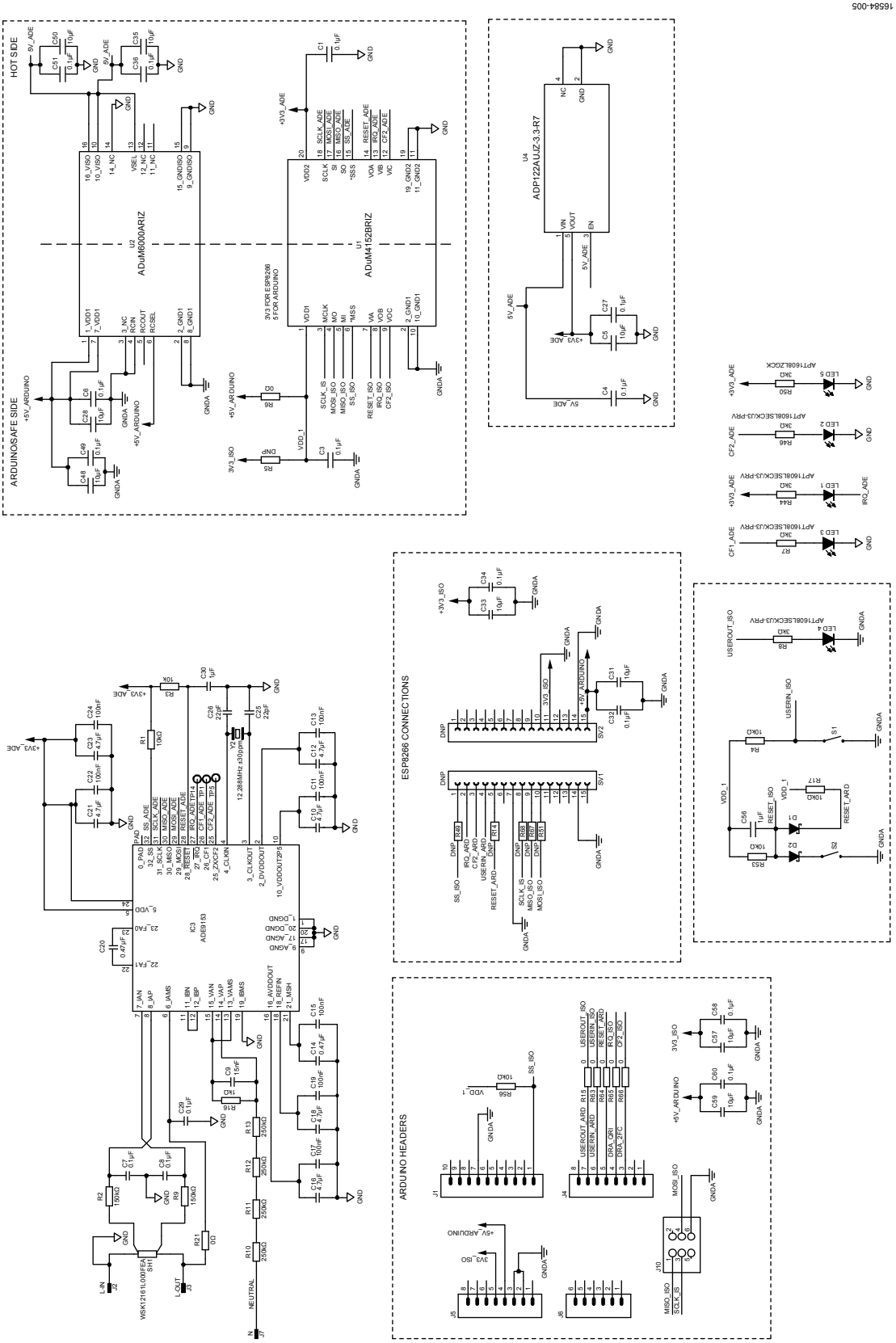

Figure 4. EV-ADE9153ASHIELDZ Schematic

NOTES

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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