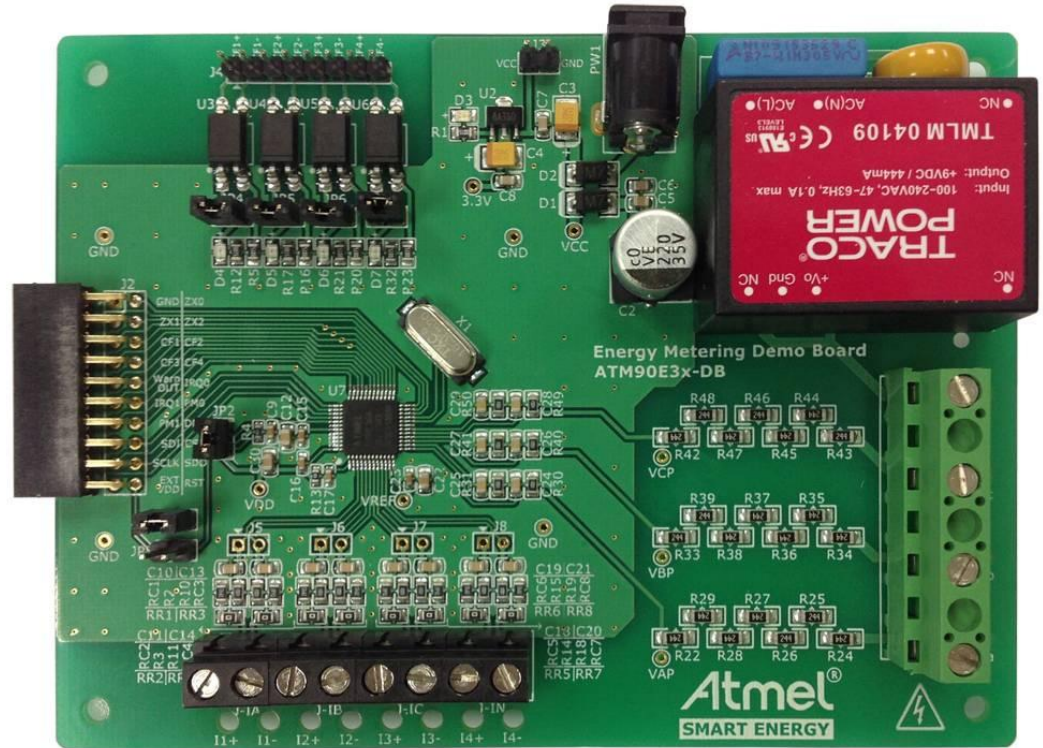


ATM90E3x Poly-Phase Energy Metering Demo Board



Preface

ATM90E3x Poly-Phase Energy Metering Demo Board (hereinafter referred to as ATM90E3x-DB) is used for the demo and testing of ATM90E32AS or ATM90E36A (poly-phase energy metering AFE chip of Atmel), which can sample poly-phase voltage and current, meter active/reactive/apparent/fundamental/harmonic energy and output these energy pulses accordingly, as well as measure parameters such as voltage, current and power.

ATM90E3x-DB needs to access AC high voltage electric and could not be operated by non-professionals.



Table of Contents

1.	INTRODUCTION	3
1.1	FEATURES.....	3
1.2	KIT OVERVIEW	3
2.	GETTING STARTED	5
2.1	CONNECT ATM90E3x-DB TO THE AFE CONTROL BOARD	5
2.2	DESIGN DOCUMENTATION AND RELATED LINKS	5
3.	ATM90E3X-DB	6
3.1	EMBEDDED DEBUGGER	6
3.2	HARDWARE USER GUIDE.....	6
3.2.1	<i>Power Supply</i>	<i>6</i>
3.2.2	<i>Voltage Sampling.....</i>	<i>6</i>
3.2.3	<i>Current Sampling</i>	<i>7</i>
3.2.4	<i>Energy Pulse Output</i>	<i>8</i>
3.2.5	<i>Headers and Connectors.....</i>	<i>9</i>
4.	DEMO BOARD SCHEMATICS	10
5.	REVISION HISTORY	11

1. Introduction

1.1 Features

- ATM90E32AS or ATM90E36A: poly-phase energy metering AFE chip
- Voltage sampling: resistor divider network
- Current sampling: Current Transformer (CT) or Rogowski Coil for current sensor
- Energy pulses
 - Active energy pulse indicator and isolated output
 - Reactive energy pulse indicator and isolated output
 - Apparent energy pulse indicator and isolated output
 - Fundamental energy pulse indicator and isolated output
 - Harmonic energy pulse indicator and isolated output
- One communication connector
- Crystal: 16.384MHz
- Power supply for demo board
 - AC 100-240V line voltage input
 - DC 9V input
 - External 3.3V input

1.2 Kit Overview

The whole kit contains two boards: the ATM90E3x-DB and the AFE Control Board. The ATM90E3x-DB is a poly-phase energy metering board designed with Atmel's ATM90E32AS or ATM90E36A chip (ATM90E36A is taken for example in the following texts). The ATM90E3x-DB communicates with the AFE Control Board through the extended communication connector (J2). For details of the AFE Control Board, please refer to the separate user guide.

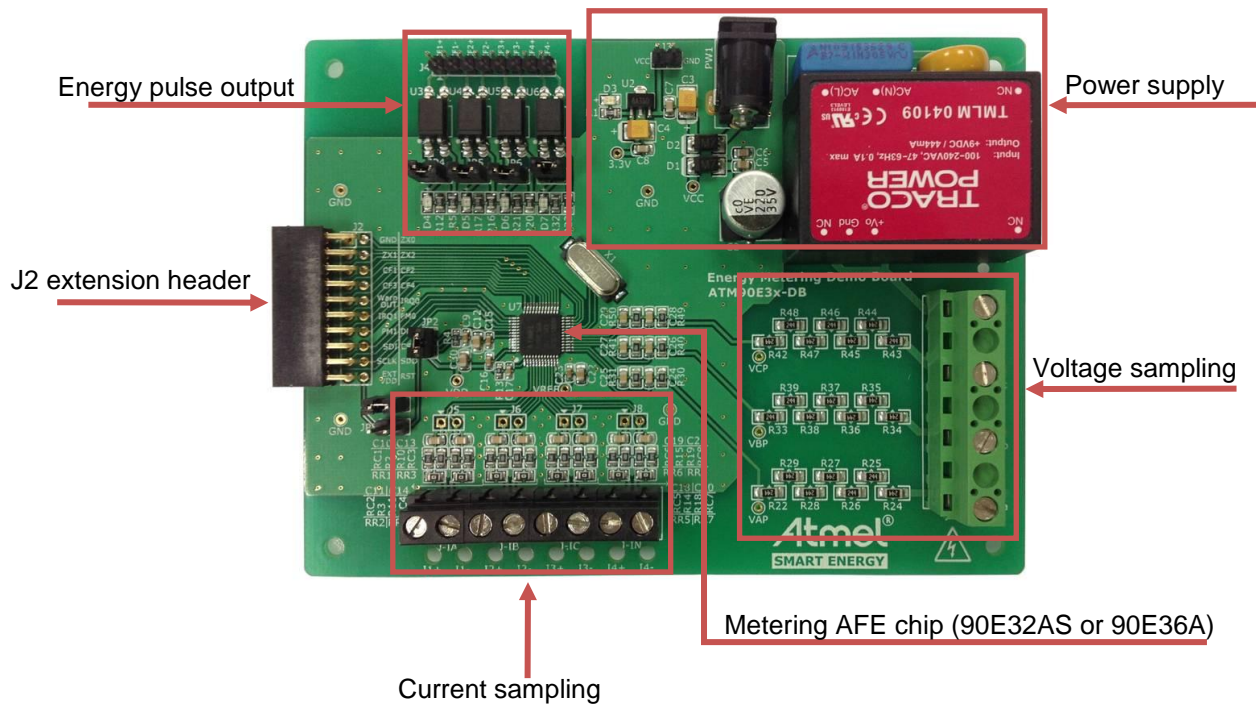


Figure 1-1 ATM90E3x-DB (Top View)

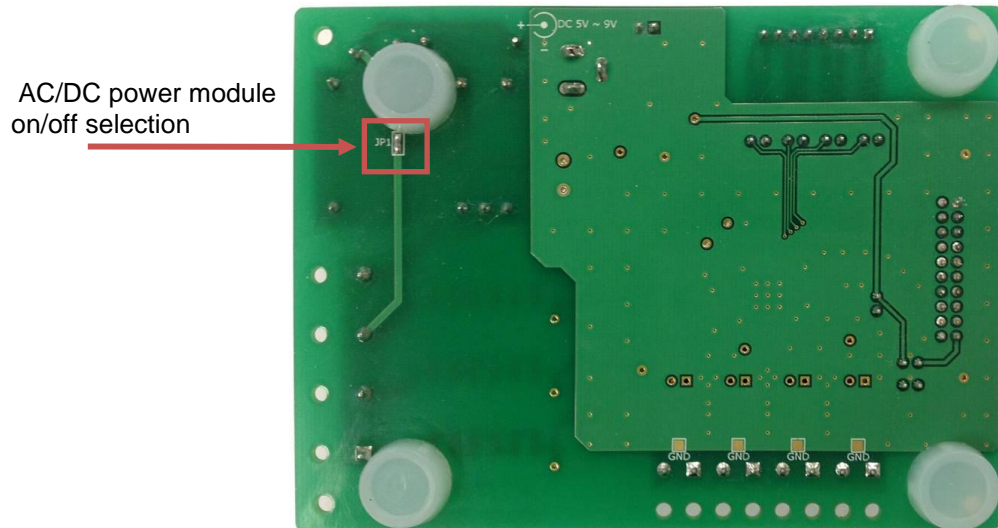


Figure 1-2 ATM90E3x-DB (Bottom View)

2. Getting Started

2.1 Connect ATM90E3x-DB to the AFE Control Board

The extension header J2 on the ATM90E3x-DB is used for communication with the AFE Control Board. Refer to Figure 1-3 for overview of the ATM90E2x-DB and the AFE Control Board after connection.

For details about J2 description, please refer to section 3.2.5.

When ATM90E3x-DB is powered on, LED D3 will be turned on, and the AFE Control Board will auto detect ATM90E3x-DB without any external program or debugger tool.

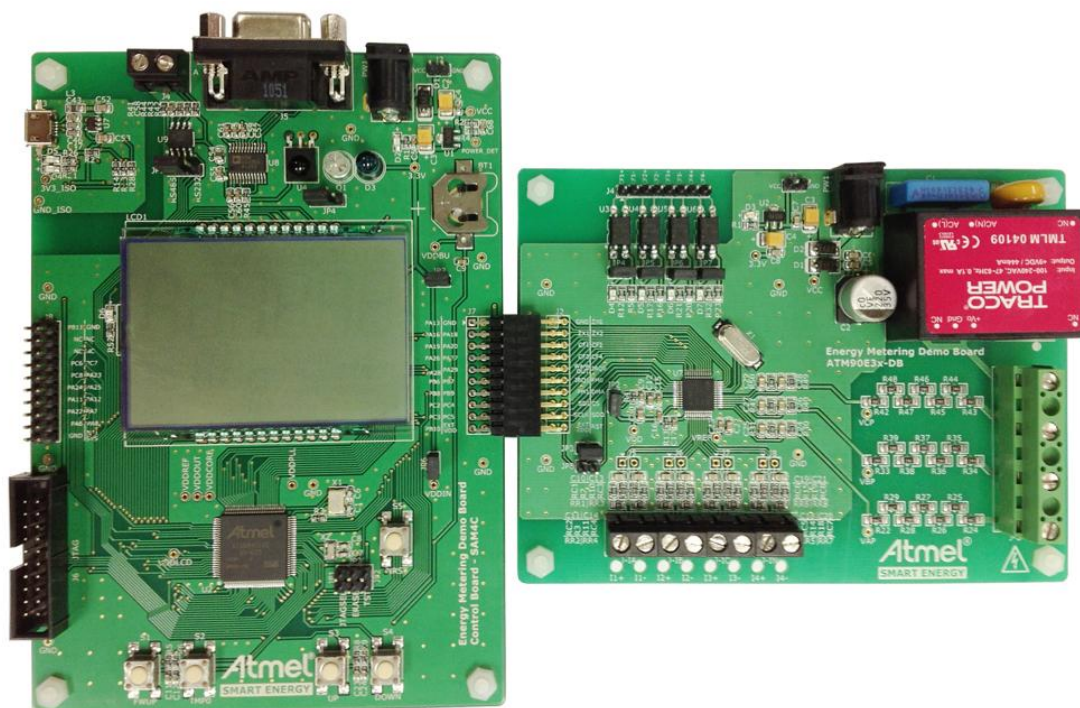


Figure 1-3 ATM90E3x-DB and AFE Control Board

2.2 Design Documentation and Related Links

The following is a list of the most relevant documents and software for the ATM90E3x-DB.

1. ATM90E32AS Datasheet -Enhanced Poly-Phase High-Performance Wide-Span Energy Metering IC.
2. ATM90E36A Datasheet - Poly-Phase High-Performance Wide-Span Energy Metering IC.
3. ATM90E32AS Application Note - AN648: Poly-Phase Energy Metering IC Application Note.
4. ATM90E36A Application Note - AN644: Poly-Phase Energy Metering IC Application Note.
5. ATM90E3x Demo Board User Guide – PDF version of this user guide.
6. Atmel Software Framework (ASF) – Free Atmel Software Framework for development of C/C++ code for Atmel microcontrollers.

3. ATM90E3x-DB

3.1 Embedded Debugger

- ATM90E3x-DB uses extension header J2 for on-board debugging.
- Customers can use other MCU control board for debugging by connecting to J2.

3.2 Hardware User Guide

3.2.1 Power Supply

3.2.1.1 Board Power Supply

There are three possible power sources for supplying board power. Detailed information is as shown in Table 3-1.

Table 3-1 Power Supply

Power Supply	Input Voltage	Description
External AC	AC 100V~240V	The power is from line voltage input that is connected to the screw terminal (J-U). The power input can be disabled by not soldering J1.
External DC	DC 9V	Plug a DC 9V power adapter to the power supply jacket (PW1).
External Board	3.3V	The system power (3.3V) is got from the external board through the extension header J2.

3.2.1.2 Operating Voltage (VDD) Supply

When JP2 is connected, AFE chip is powered by 3.3V. User can measure power consumption by connecting to an ammeter serially.

When JP3 is connected, the on-board 3.3V power route is connected to external power through the EXT_VDD pin of the extension header J2. For details about J2 description, please refer to section 3.2.5.



Figure 3-1 Power Selection

3.2.2 Voltage Sampling

There are three voltage channels on the ATM90E3x-DB. Line voltage (AC) is connected to the screw terminal (J-U) directly. Resistor divider network is used for voltage sampling. Please refer to Figure 3-2 for details.

Assume the line voltage is U_n , the voltage sampling signal is as follows:

$$V_{\text{sample}} = (1/1681K) \times U_n$$

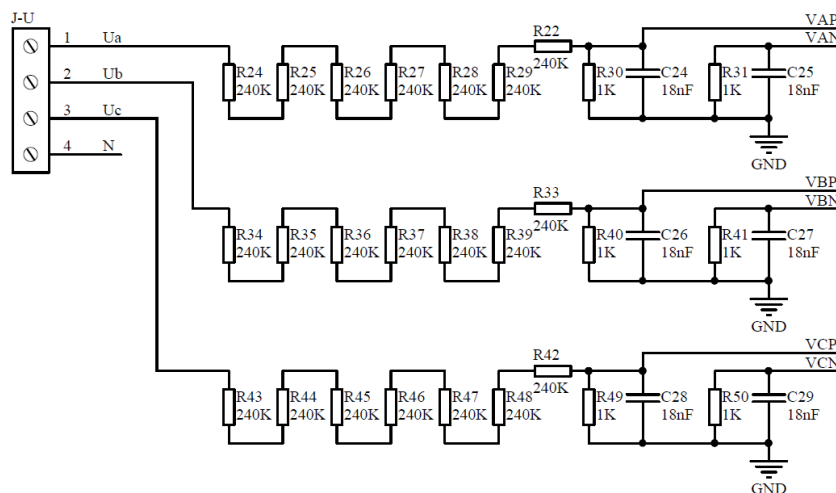


Figure 3-2 Voltage Sampling

3.2.3 Current Sampling

There are four current channels (phase A/B/C and N line) on the ATM90E3x-DB. Current is sampled over Current Transformer (CT) or Rogowski Coil. CT and Rogowski Coil are external devices connecting to current terminals (J-IA/J-IB/J-IC or J-IN).

For phase A/B/C/N: either CT or Rogowski Coil can be selected for sampling, and different circuits are designed for CT or Rogowski Coil. Please refer to Figure 3-3 for details.

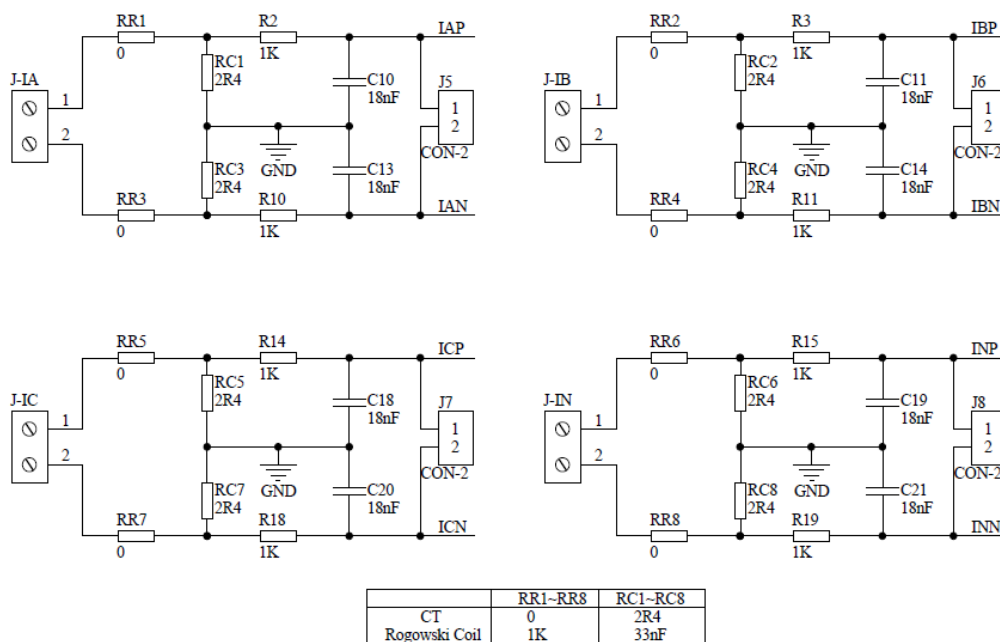


Figure 3-3 Current Sampling

3.2.4 Energy Pulse Output

ATM90E3x-DB can output energy pulses through the connector J4, including active, reactive, apparent, fundamental and harmonic energy, indicated by LED D4, D5, D6 and D7. Table 3-2 shows the definition of J4.

Table 3-2 Definition of J4

Pin Number	Pin Name	Description
1	CF1+	Active energy pulse isolated output. The pulse is indicated by LED D4.
2	CF1-	
3	CF2+	Reactive or apparent energy pulse isolated output. The pulse is indicated by LED D5. The output of reactive or apparent energy pulse is determined by the configuration of the AFE chip.
4	CF2-	
5	CF3+	Fundamental energy pulse isolated output. The pulse is indicated by LED D6.
6	CF3-	
7	CF4+	Harmonic energy pulse isolated output. The pulse is indicated by LED D7.
8	CF4-	

3.2.5 Headers and Connectors

Extension Header J2 is a dual-row, 20-pin female connector. The AFE control board has the male counterparts.

J2 is an Xplained Pro Standard Extension Header. This header makes it possible to connect the AFE demo board to any Atmel's Xplained Pro MCU board. The pin assignment for J2 is shown in Table 3.3.

Table 3-3 Extension Header (J2) Pin Assignment

Pin Number	Pin Name	Description
1	GND	Power Ground
2	ZX0	Zero-crossing signal output0
3	ZX1	Zero-crossing signal output1
4	ZX2	Zero-crossing signal output2
5	CF1	Active energy pulse output
6	CF2	Reactive/ Apparent energy pulse output
7	CF3	Fundamental energy pulse output
8	CF4	Harmonic energy pulse output
9	Warn Out	Warn out signal output
10	IRQ0	Interrupt request signal output0
11	IRQ1	Interrupt request signal output1
12	PM0	Power Mode Configuration 0
13	PM1	Power Mode Configuration 1
14	DMA	DMA enable
15	SDI	SPI Serial Data Input (MOSI)
16	CS	SPI Chip Select Input
17	SCLK	SPI Serial Clock Input
18	SDO	SPI Serial Data Output (MISO)
19	EXT_VDD	Power supply. Controlled by the Jumper J1. Please refer to 3.2.1.2 for J1 description.
20	RST	Chip Reset. Active low.

Atmel



5. Revision History

Doc. Rev.	Date	Comments
1.0	09/09/2013	Initial release.

**Atmel Corporation**

1600 Technology Drive
San Jose, CA 95110
USA

Tel: (+1)(408) 441-0311

Fax: (+1)(408) 487-2600

www.atmel.com

Atmel Asia Limited

Unit 01-5 & 16, 19F
BEA Tower, Millennium City 5
418 Kwun Tong Road
Kwun Tong, Kowloon
HONG KONG

Tel: (+852) 2245-6100

Fax: (+852) 2722-1369

Atmel Munich GmbH

Business Campus
Parking 4
D-85748 Garching b. Munich
GERMANY

Tel: (+49) 89-31970-0

Fax: (+49) 89-3194621

Atmel Japan G.K.

16F Shin-Osaki Kangyo Bldg.
1-6-4 Osaki, Shinagawa-ku
Tokyo 141-0032
JAPAN

Tel: (+81)(3) 6417-0300

Fax: (+81)(3) 6417-0370

© 2013 Atmel Corporation. All rights reserved. / Rev.: 1.0

Atmel®, Atmel logo and combinations thereof, SAM4C®, SAM4C Studio®, BitCloud®, Enabling Unlimited Possibilities®, STK®, XMEGA®, ZigBit®, and others are registered trademarks or trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.

Disclaimer: The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. EXCEPT AS SET FORTH IN THE ATMEL TERMS AND CONDITIONS OF SALES LOCATED ON THE ATMEL WEBSITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS AND PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and products descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.