
AVR4200: Inertial One (ATAVRSBIN1) Hardware Users Guide

Features

- Compatible with all Atmel® AVR® Xplain MCU boards
- Full nine-degree-of-freedom inertial sensing
- InvenSense three-axis MEMS gyroscope (ITG-3200)
- Bosch Sensortec three-axis MEMS accelerometer (BMA150)
- AKM three-axis electronic compass (AK8975)
- All sensor drivers available within the Atmel AVR Software Framework
- Temperature sensing through ITG-3200 or BMA150

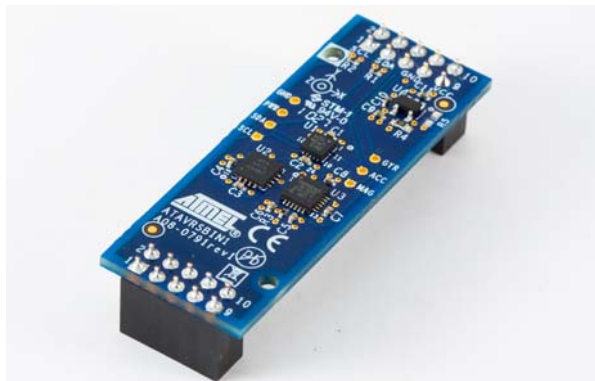
1 Introduction

The Atmel Sensors Xplained series of development boards and software are designed to be plug compatible with all Atmel Xplain MCU boards, providing a wide range of microcontroller performance depending on the application needs.

Atmel has partnered with leading suppliers of accelerometer, gyroscope, compass, pressure, and light sensors to provide a range of sensor boards that enable easy evaluation and development with a wide range of Atmel controller solutions.

To accelerate development with these sensor-based solutions, Atmel has worked with its partners to make the necessary sensor drivers available as part of the Atmel AVR Studio® development environment and the AVR Software Framework. The drivers are available directly from Atmel, and provide basic interface functionality with both raw data and calibrated engineering unit outputs integrated into a standard API.

The Atmel Inertial One sensor board delivers a full nine-degree-of-freedom sensor platform—combining accelerometer, compass, gyroscope, and temperature sensor—that is ideal for developing motion sensing or user interface applications.



8-bit **AVR**[®]
Microcontrollers

Application Note

Rev. 8354A-AVR-11/10





2 Related items

Application notes

- Sensors Xplained – Quick Start Guide (AVR4015)
- Sensors Xplained – Software Users Guide (AVR4016)
- Sensors Xplained – Oscilloscope Demo Application (AVR4017)
- Sensors Xplained – Sensor Top Board Design Notes (AVR4014)

3 Description

The Inertial One Sensors Xplained development board provides full nine-degree-of-freedom sensing capability from a set of three integrated three-axis inertial sensors. The sensors are interfaced via the I²C serial digital interface connected through a common header that is compatible with the full range of Atmel Xplain MCU boards. This sensor cluster is well suited for cell phones, handheld devices, computer peripherals, man-machine interfaces, virtual reality features, and game controllers.

The following sensors are incorporated into this development board, and detailed explanations of their operation can be obtained from the relevant partner's component data sheets.

- **Bosch Sensortec Three-Axis Accelerometer (BMA-150)**

The BMA-150 is a three-axis, low-g MEMS acceleration sensor with digital output for consumer market applications. It allows measurement of acceleration in perpendicular axes as well as tilt, motion, and shock vibration. The BMA-150 also incorporates absolute temperature measurement. The internal circuitry converts the output of the three-channel MEMS acceleration sensing structure to a digital output available through an I²C data bus.

- **InvenSense Three-Axis Gyroscope (ITG-3200)**

The ITG-3200 is a single-chip, digital-output, three-axis MEMS gyro IC optimized for gaming, 3D mice, and 3D remote control applications. The ITG-3200 features three 16-bit analog-to-digital converters (ADCs) for digitizing the gyro outputs, a user-selectable, internal low-pass filter bandwidth, and a fast-mode I²C (400kHz) interface. Additional features include an embedded temperature sensor and a 2% accurate internal oscillator.

- **AKM Three-Axis Electronic Compass (AK8975)**

The AK8975 contains highly sensitive Hall sensor technology that incorporates magnetic sensors for detecting terrestrial magnetism in the X-axis, Y-axis, and Z-axis; a sensor driving circuit; a signal amplifier chain; and an arithmetic circuit for processing the signal from each sensor. It is suitable for map heading purposes in GPS-equipped products to realize pedestrian navigation functionality.

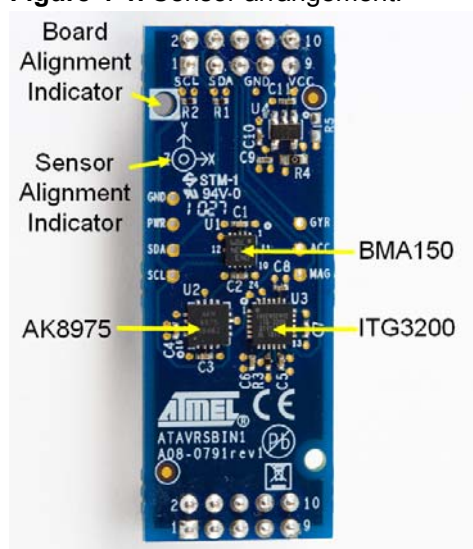
4 Hardware layout

NOTE

Figure 4-1 shows the physical arrangement of the Inertial One Sensors Xplained development board.

All three sensors have their X, Y, and Z axes aligned, and a symbol is provided to indicate their directional alignment.

Figure 4-1. Sensor arrangement.



The Inertial One Sensors Xplained development board must be attached to the correct headers on the Xplain MCU board to ensure proper operation. All the Sensors Xplained development boards attach to headers J1 and J2 on the MCU boards, and a board alignment indicator is printed on the board to provide to aid correct alignment. As an example, Figure 4-2 shows the orientation of the Pressure One Sensors Xplained development board when attached to the UC3-L0 Xplained MCU board.

Figure 4-2. Correct board attachment orientation.

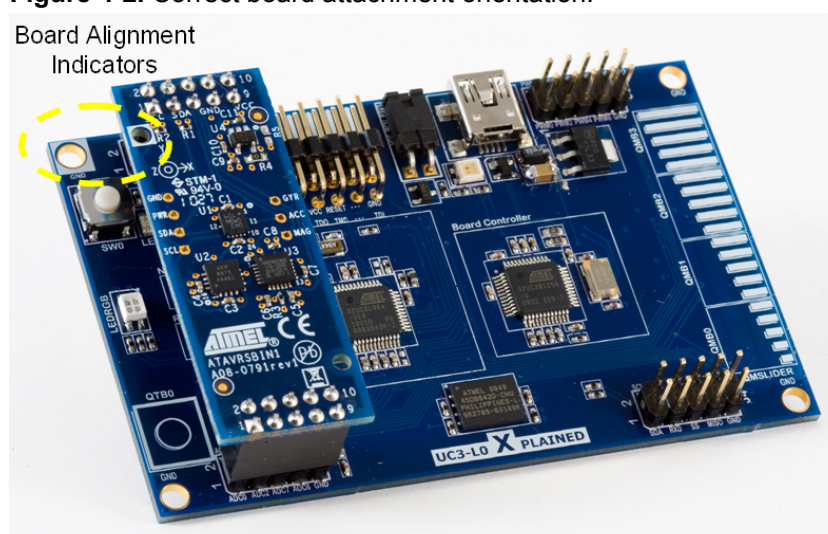


Table 5-1. Sensor I²C addresses.

| Sensor | I ² C address |
|----------|--------------------------|
| AK8975 | 0x0C |
| BMA-150 | 0x38 |
| ITG-3200 | 0x68 |

5.1 Circuit configuration options

A number of hardware options are available on the Inertial One Sensors Xplained development board to allow investigation of the sensors' functioning. These options are described below.

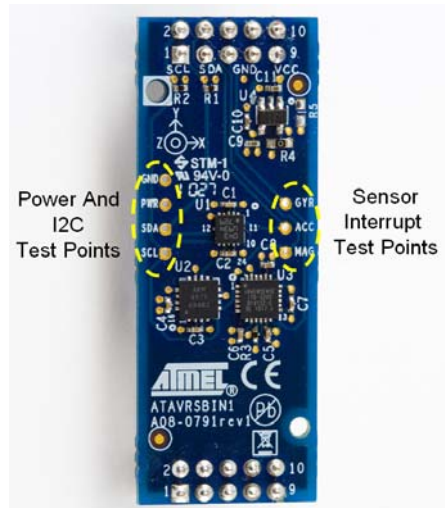
5.1.1 Power supply options

The power supplied to the digital header on the Xplained series of sensor boards is nominally set to 3.3V. The Inertial One Sensor Xplained development board has an on-board 2.5V regulator to supply power to all three sensors. The current from the regulator is supplied to the sensors through R4, a zero-ohm resistor. This resistor can be removed and replaced with a current monitor, if required, to investigate sensor power consumption. If it is desired to bypass the on-board regulator, R4 can be removed and a zero-ohm resistor placed in position R10. This will now supply the sensors directly from the 3.3V Xplain MCU board supply.

5.1.2 Test points

A number of test points are available for use with an oscilloscope to investigate the functioning of the sensors. The locations of the test points are indicated on the schematic, and [Figure 5-2](#) shows the physical locations of the test points on the board.

Figure 5-2. Locations of test points.



IMPORTANT

THE SDA, SCL, GND AND VCC MARKS NEAR THE UPPER HEADER ARE FOR TEST POINTS USED IN THE MANUFACTURING PROCESS, AND DO NOT REFER TO THE PINS ON THE HEADER.





6 EVALUATION BOARD/KIT IMPORTANT NOTICE

This evaluation board/kit is intended for use for **FURTHER ENGINEERING, DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY**. It is not a finished product, and may not (yet) comply with some or any technical or legal requirements that are applicable to finished products, including, without limitation, directives regarding electromagnetic compatibility, recycling (WEEE), FCC, CE, or UL (except as may be otherwise noted on the board/kit). Atmel supplied this board/kit "AS IS," without any warranties, with all faults, at the buyer's and further users' sole risk. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Atmel from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge and any other technical or legal concerns.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER USER NOR ATMEL SHALL BE LIABLE TO EACH OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

No license is granted under any patent right or other intellectual property right of Atmel covering or relating to any machine, process, or combination in which such Atmel products or services might be or are used.

Mailing Address: Atmel Corporation, 2325 Orchard Parkway, San Jose, CA 95131



Atmel Corporation
2325 Orchard Parkway
San Jose, CA 95131
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
Parkring 4
D-85748 Garching b. Munich
GERMANY
Tel: (+49) 89-31970-0
Fax: (+49) 89-3194621

Atmel Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chou-ku, Tokyo 104-0033
JAPAN
Tel: (+81) 3523-3551
Fax: (+81) 3523-7581

© 2010 Atmel Corporation. All rights reserved. / Rev.: CORP072610

Atmel®, Atmel logo and combinations thereof, AVR® and others are registered 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 product 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.

AMEYA360

Components Supply Platform

Authorized Distribution Brand :



Website :

Welcome to visit www.ameya360.com

Contact Us :

➤ Address :

401 Building No.5, JiuGe Business Center, Lane 2301, Yishan Rd
Minhang District, Shanghai , China

➤ Sales :

Direct +86 (21) 6401-6692

Email amall@ameya360.com

QQ 800077892

Skype ameyasales1 ameyasales2

➤ Customer Service :

Email service@ameya360.com

➤ Partnership :

Tel +86 (21) 64016692-8333

Email mkt@ameya360.com