

AVR087: Migrating between ATmega8515 and ATmega162

Introduction

This application note is a guide to help current ATmega8515 users convert existing designs to ATmega162. The information given will also help users migrating from ATmega162 to ATmega8515. AT90S8515 users should also read the application note “AVR085: Replacing AT90S8515 by ATmega8515”.

In addition to the differences described in this document, the following features are available on ATmega162:

- JTAG Interface (enabled by default)
- Extra USART
- Clock divider
- Timer 2 - 8-bit Timer with asynchronous 32 kHz Oscillator
- Timer 3 - 16-bit Timer
- Pin-change interrupts
- “Clock out”-pin – PB0

The electrical characteristics of the two devices are also different. Check the data sheets for detailed information.

Memory Sizes

Some memories are bigger in the ATmega162. Table 1 is a comparison of the individual memories.

Table 1. Memory Sizes

	ATmega8515	ATmega162
Flash	8k bytes	16k bytes
RAM	512 bytes	1k bytes
EEPROM	512 bytes	512 bytes

The Boot Loader area is also changed. The following must be considered:

- Flash page size is 64 words instead of 32 words.
- The No-Read-While-Write section starts at word address 0x1C00 instead of 0xC00.



8-bit **AVR**[®]
Microcontroller

**Application
Note**

Rev. 2536B-AVR-07/03



Interrupt Vectors and Relative Jumps/Calls

The ATmega8515 uses 1-word Interrupt Vectors while the ATmega162 uses 2-word Interrupt Vectors. 1-word Vectors can only contain RJMP instructions, which can not reach the entire 8k word memory range of ATmega162.

Since RJMP/RCALL can only jump 2k words in any direction, it wraps around the start or end of the 4k word Flash of the ATmega8515 to reach the entire memory range. Wrapping RJMP/RCALLs must be changed to JMP/CALLs when using the ATmega162.

The compiler or assembler will take care of most of these differences. It will either use the correct instruction or issue an error message.

The ATmega162 has different interrupt table from ATmega8515. Table 2 compares the interrupt tables for the two devices.

Table 2. Interrupt Table

Vector #	ATmega8515	ATmega162
1	RESET	RESET
2	INT0	INT0
3	INT1	INT1
4	TIMER1 CAPT	INT2
5	TIMER1 COMPA	PCINT0
6	TIMER1 COMPB	PCINT1
7	TIMER1 OVF	TIMER3 CAPT
8	TIMER0 OVF	TIMER3 COMPA
9	SPI, STC	TIMER3 COMPB
10	USART, RXC	TIMER3 OVF
11	USART, UDRE	TIMER2 COMP
12	USART, TXC	TIMER2 OVF
13	ANA_COMP	TIMER1 CAPT
14	INT2	TIMER1 COMPA
15	TIMER0 COMP	TIMER1 COMPB
16	EE_RDY	TIMER1 OVF
17	SPM_RDY	TIMER0 COMP
18		TIMER0 OVF
19		SPI, STC
20		USART0, RXC
21		USART1, RXC
22		USART0, UDRE
23		USART1, UDRE
24		USART0, TXC
25		USART1, TXC

Table 2. Interrupt Table (Continued)

Vector #	ATmega8515	ATmega162
26		EE_RDY
27		ANA_COMP
28		SPM_RDY

Fuse Bits

The Fuse bits have different locations. In addition, the ATmega162 has an extended fuse byte. Table 3 shows the Fuse bit locations.

Table 3. Fuse Bit Locations

Bit #	ATmega8515	ATmega162
Extended Fuse Byte	7 N/A	Reserved
	6 N/A	Reserved
	5 N/A	Reserved
	4 N/A	M161C
	3 N/A	BODLEVEL2
	2 N/A	BODLEVEL1
	1 N/A	BODLEVEL0
	0 N/A	Reserved
Fuse High Byte	7 S8515C	OCDEN
	6 WDTON	JTAGEN
	5 SPIEN	SPIEN
	4 CKOPT	WDTON
	3 EESAVE	EESAVE
	2 BOOTSZ1	BOOTSZ1
	1 BOOTSZ0	BOOTSZ0
	0 BOOTRST	BOOTRST
Fuse Low Byte	7 BODLEVEL	CKDIV8
	6 BODEN	CKOUT
	5 SUT1	SUT1
	4 SUT0	SUT0
	3 CKSEL3	CKSEL3
	2 CKSEL2	CKSEL2
	1 CKSEL1	CKSEL1
	0 CKSEL0	CKSEL0

Miscellaneous

The following applies to ATmega162:

- Extra V_{CC-} and GND-pins on TQFP and MLF packages (should be connected for better performance with high clock frequencies).
- Extended I/O memory, moving internal SRAM start address from 0x0060 to 0x0100.
- Internal RC Oscillator fixed to 8 MHz operation (can be divided down by software).
- Be aware that EEPROM write access must be completed before entering power-down sleep mode. Otherwise the system oscillator will continue to run, drawing additional current.

ATmega161 Compatibility Mode

The M161C Fuse on the ATmega162 can be used to set the part in ATmega161 Compatibility mode. When programming the M161C Fuse, the following must be considered:

- The interrupt table is changed.
- USART double buffering is disabled.
- Watchdog Safety Level 1 is disabled, making it impossible to secure the Watchdog prescaler settings while keeping the possibility of disabling the Watchdog.
- No extended I/O memory.
- Timer3 is not available.
- Pin-change interrupts are not available.
- System clock prescaler is not available.



Atmel Corporation

2325 Orchard Parkway
San Jose, CA 95131
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

Regional Headquarters

Europe

Atmel Sarl
Route des Arsenalux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
Tel: (41) 26-426-5555
Fax: (41) 26-426-5500

Asia

Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimshatsui
East Kowloon
Hong Kong
Tel: (852) 2721-9778
Fax: (852) 2722-1369

Japan

9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

Atmel Operations

Memory

2325 Orchard Parkway
San Jose, CA 95131
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

Microcontrollers

2325 Orchard Parkway
San Jose, CA 95131
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
Tel: (33) 2-40-18-18-18
Fax: (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards

Zone Industrielle
13106 Rousset Cedex, France
Tel: (33) 4-42-53-60-00
Fax: (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
Tel: (44) 1355-803-000
Fax: (44) 1355-242-743

RF/Automotive

Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
Tel: (49) 71-31-67-0
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/ High Speed Converters/RF Datacom

Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
Tel: (33) 4-76-58-30-00
Fax: (33) 4-76-58-34-80

e-mail

literature@atmel.com

Web Site

<http://www.atmel.com>

Disclaimer: Atmel Corporation makes no warranty for the use of its products, other than those expressly contained in the Company's standard warranty which is detailed in Atmel's Terms and Conditions located on the Company's web site. The Company assumes no responsibility for any errors which may appear in this document, reserves the right to change devices or specifications detailed herein at any time without notice, and does not make any commitment to update the information contained herein. No licenses to patents or other intellectual property of Atmel are granted by the Company in connection with the sale of Atmel products, expressly or by implication. Atmel's products are not authorized for use as critical components in life support devices or systems.

© Atmel Corporation 2003. All rights reserved. Atmel® and combinations thereof, AVR® and AVR Studio® are the registered trademarks of Atmel Corporation or its subsidiaries.

Other terms and product names may be the trademarks of others.



Printed on recycled paper.