

AVR Interrupt

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Apa itu interrupt ?



Contoh interupsi (interrupt) pada siding paripurna DPR

Terjemahan

Inggris Bahasa Indonesia Jepang Deteksi bahasa



Bahasa Indonesia Inggris Arab

Terjemahkan

interrupt

ˌɪntəˈreɪpt

Definisi interrupt

verba
stop the continuous progress of (an activity or process).
"the buzzer interrupted his thoughts"
sinonim: cut in (on), break in (on), barge in (on), intervene (in), put one's oar in, put one's two cents in, interject, butt in (on), chime in (with); suspend, adjourn, discontinue, break off, put on hold, stop, halt, cease, end, bring to an end/close, put on ice, put on the back burner

break the continuity of (a line or surface).
"the coastal plain is interrupted by chains of large lagoons"
sinonim: break (up) by, punctuate by/with, pepper with, strew with, dot with, scatter with, sprinkle with

mengganggu



Terjemahan dari interrupt

verba	
■ mengganggu	interfere, bother, disturb, disrupt, interrupt, crimp
■ memutuskan	decide, cut off, fracture, tear up, rupture, interrupt
■ memecahkan	solve, break, resolve, clear up, puzzle out, interrupt
■ menyela	interrupt, vary, intersperse, break in, burst in, catch
■ memotong	cut, cut off, cut out, cut up, break off, interrupt
■ memintas	intercept, take the shortest way, cross, overcome, surmount, interrupt
■ sela	interrupt
■ menyelang	cut in, interrupt, interjacculate, interject, interlard, alternate

Apa yang dimaksud dengan
AVR interrupt ?

Interrupt di AVR

- Kejadian (event) yang membutuhkan perhatian langsung oleh mikrokontroller
- Kejadian tersebut dapat terjadi karena ada trigger dari luar AVR (external) atau dari dalam AVR sendiri (internal)
- Jika terjadi interrupt, program yang sedang berjalan akan dihentikan sementara (pause), dan AVR menjalankan program yang ada pada **Interrupt Service Routine (ISR)**

Interrupt Service Routine (ISR)

- Interrupt Handler
- Potongan program yang harus dijalankan ketika interrupt dipicu
- Harus diakhiri dengan perintah return interrupt (RETI)



Interrupt



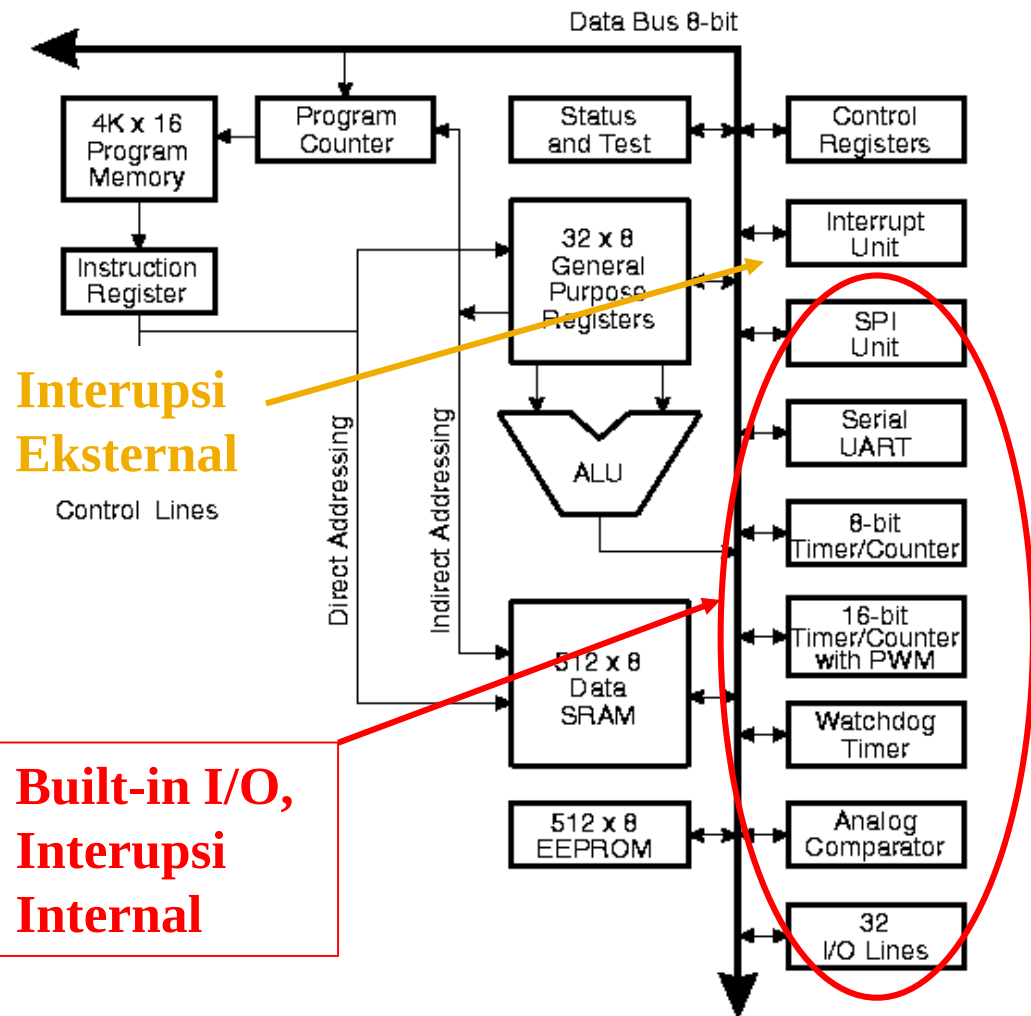
RETI



Jenis Interrupt

Yang Dibahas di POK

1. External Interrupt
2. Internal Interrupt / Timer Interrupt



Alamat I/O

Address	Hex Name	Function
\$3F (\$5F)	SREG	Status Register
\$3E (\$5E)	SPH	Stack Pointer High
\$3D (\$5D)	SPL	Stack Pointer Low
\$3B (\$5B)	GIMSK	General Interrupt Mask Register
\$3A (\$5A)	GIFR	General Interrupt Flag Register
\$39 (\$59)	TIMSK	Timer/Counter Interrupt Mask Register
\$38 (\$58)	TIFR	Timer/Counter Interrupt Flag Register
\$35 (\$55)	MCUCR	MCU general Control Register
\$33 (\$53)	TCCR0	Timer/Counter 0 Control Register
\$32 (\$52)	TCNT0	Timer/Counter 0 (8-bit)
\$2F (\$4F)	TCCR1A	Timer/Counter 1 Control Register A
\$2E (\$4E)	TCCR1B	Timer/Counter 1 Control Register B
\$2D (\$4D)	TCNT1H	Timer/Counter 1 High Byte
\$2C (\$4C)	TCNT1L	Timer/Counter 1 Low Byte
\$2B (\$4B)	OCR1AH	Output Compare Register A High Byte
\$2A (\$4A)	OCR1AL	Output Compare Register A Low Byte
\$29 (\$49)	OCR1BH	Output Compare Register B High Byte
\$28 (\$48)	OCR1BL	Output Compare Register B Low Byte
\$25 (\$45)	ICR1H	T/C 1 Input Capture Register High Byte
\$24 (\$44)	ICR1L	T/C 1 Input Capture Register Low Byte
\$21 (\$41)	WDTCR	Watchdog Timer Control Register

Alamat I/O Cont.

Address	Hex Name	Function
\$1B (\$38)	PORTA	Data Register, Port A
\$1A (\$3A)	DDRA	Data Direction Register, Port A
\$19 (\$39)	PINA	Input Pins, Port A
\$18 (\$38)	PORTB	Data Register, Port B
\$17 (\$37)	DDRB	Data Direction Register, Port B
\$16 (\$36)	PINB	Input Pins, Port B
\$15 (\$35)	PORTC	Data Register, Port C
\$14 (\$34)	DDRC	Data Direction Register, Port C
\$13 (\$33)	PINC	Input Pins, Port C
\$12 (\$32)	PORTD	Data Register, Port D
\$11 (\$31)	DDRD	Data Direction Register, Port D
\$10 (\$30)	PIND	Input Pins, Port D
\$0F (\$2F)	SPDR	SPI I/O Data Register
\$0E (\$2E)	SPSR	SPI I/O Status Register
\$0D (\$2D)	SPCR	SPI I/O Control Register
\$0C (\$2C)	UDR	UART I/O Data Register
\$0B (\$2B)	USR	UART Status Register
\$0A (\$2A)	UCR	UART Control Register
\$09 (\$29)	UBRR	UART Baud Rate Register
\$08 (\$28)	ACSR	Analog Comparator Control and Status Register

Prioritas dan Alamat Tujuan Interrupt di ATmega8515

Prioritas Tertinggi



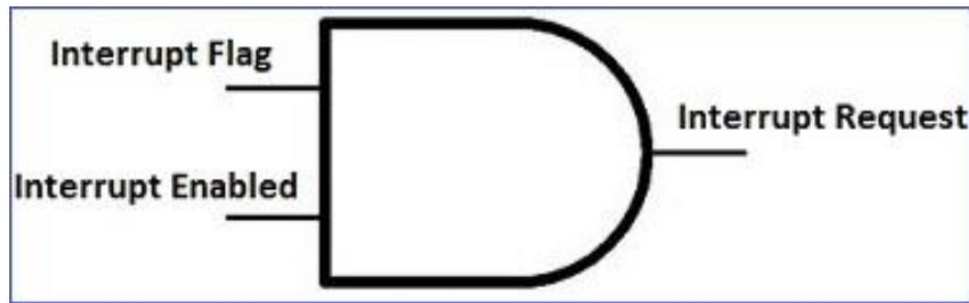
Vec No	Prg Adr	Source	Interrupt Definition
1	\$000	RESET	Hardware Pin, Power-on Reset and Watchdog Reset
2	\$001	INT0	External Interrupt Request 0
3	\$002	INT1	External Interrupt Request 1
4	\$003	TIMER1 CAPT	Timer/Counter1 Capture Event
5	\$004	TIMER1 COMPA	Timer/Counter1 Compare Match A
6	\$005	TIMER1 COMPB	Timer/Counter1 Compare Match B
7	\$006	TIMER1 OVF	Timer/Counter1 Overflow
8	\$007	TIMER0 OVF	Timer/Counter0 Overflow
9	\$008	SPI, STC	Serial Transfer Complete
10	\$009	UART, RX	UART, RX Complete
11	\$00A	UART, UDRE	UART Data Register Empty
12	\$00B	UART, TX	UART, TX Complete
13	\$00C	ANA_COMP	Analog Comparator

Inisialisasi Interrupt Vector

Address	Code	Comments
\$000	rjmp RESET	; Reset Handler
\$001	rjmp EXT_INT0	; IRQ0 Handler
\$002	rjmp EXT_INT1	; IRQ1 Handler
\$003	rjmp TIM1_CAPT	; Timer1 Capture Handler
\$004	rjmp TIM1_COMPA	; Timer1 CompareA Handler
\$005	rjmp TIM1_COMPB	; Timer1 CompareB Handler
\$006	rjmp TIM1_OVF	; Timer1 Overflow Handler
\$007	rjmp TIM0_OVF	; Timer0 Overflow Handler
\$008	rjmp SPI_STC	; SPI Transfer Complete Handler
\$009	rjmp UART_RXC	; UART RX Complete Handler
\$00a	rjmp UART_DRE	; UDR Empty Handler
\$00b	rjmp UART_TXC	; UART TX Complete Handler
\$00c	rjmp ANA_COMP	; Analog Comparator Handler

Interrupt Flag dan Enable Bit

- **Interrupt flag** adalah penanda adanya kejadian interrupt, akan berisi nilai 1 ketika ada interrupt dan berisi nilai 0 jika sebaliknya. **Contoh : Flag akan bernilai 1 secara otomatis jika button yang tersambung ke pin interrupt aktif (ditekan)**
- **Interrupt enable** adalah penanda diaktifkannya interrupt. **Perlu di-setting terlebih dahulu interrupt mana saja yang akan diaktifkan**



Mengaktifkan Interrupt

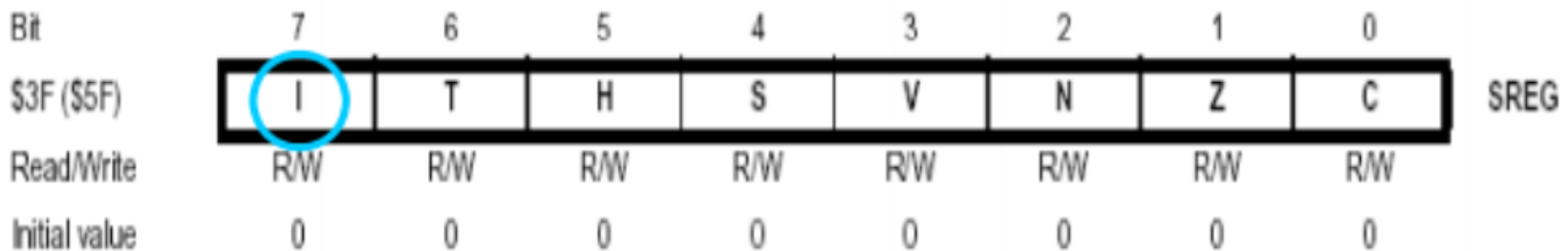
- Sebelum digunakan, interrupt harus diaktifkan terlebih dahulu.
 - SEI: Perintah untuk mengaktifkan interrupt
 - CLI: Perintah untuk menonaktifkan interrupt
- Aktif/tidaknya interrupt ditandai dari nilai Global Interrupt Enabled Bit.

Bit	7	6	5	4	3	2	1	0	
\$3F (\$5F)	I	T	H	S	V	N	Z	C	SREG
Read/Write	RW	RW	RW	R/W	R/W	RW	RW	RW	
Initial value	0	0	0	0	0	0	0	0	

- Ketika terjadi interrupt, Global Interrupt Enable Bit akan otomatis berubah menjadi 0.

Mengaktifkan Interrupt Cont.

- Sebelum digunakan, interrupt harus diaktifkan terlebih dahulu.
 - SEI: Perintah untuk mengaktifkan interrupt
 - CLI: Perintah untuk menonaktifkan interrupt
- Aktif tidaknya interrupt dapat diamati melalui SREG, pada nilai Global Interrupt Enabled Bit.



- Ketika terjadi interrupt, Global Interrupt Enable Bit akan otomatis berubah menjadi 0.

Mengaktifkan Interrupt Cont.

- Ada beberapa jenis interrupt, bisa dipilih mana yang digunakan mana yang tidak. Untuk mengaturnya, perlu dilakukan konfigurasi pada register berikut :
- **GICR** (General Interrupt Control Register) Digunakan untuk memilih jenis eksternal interrupt yang akan diaktifkan.
- **MCUCR** (MCU Control Register) Digunakan untuk mengaktifkan mode aktivasi interrupt.
- **TIMSK**(Timer/Counter Interrupt Mask Register) Digunakan untuk memilih jenis timer/counter interrupt yang akan diaktifkan
(Jika anda menggunakan Timer Interrupt)
- Setelah semua konfigurasi dilakukan, tinggal tambahkan perintah **SEI** pada program

Mengaktifkan Interrupt Cont.

- **GICR** (General Interrupt Control Register)

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – INT₁: External Interrupt Request 1 Enable
- Bit 6 – INT₀: External Interrupt Request 0 Enable
- Bit 5 – INT₂: External Interrupt Request 2 Enable

Mengaktifkan Interrupt Cont.

- **GICR** (General Interrupt Control Register)

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – INT₁: External Interrupt Request 1 Enable
- Bit 6 – INT₀: External Interrupt Request 0 Enable
- Bit 5 – INT₂: External Interrupt Request 2 Enable

Mengaktifkan Interrupt Cont.

■ MCUCR (MCU Control Register)

Bit	7	6	5	4	3	2	1	0	
	SRE	SRW10	SE	SM1	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Cukup Perhatikan Bit 3-0

Table 40. Interrupt 1 Sense Control

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.



**Bit 3&2
For INT₁**

Table 41. Interrupt 0 Sense Control

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.



**Bit 1&0
For INT₀**

Mengaktifkan Interrupt Cont.

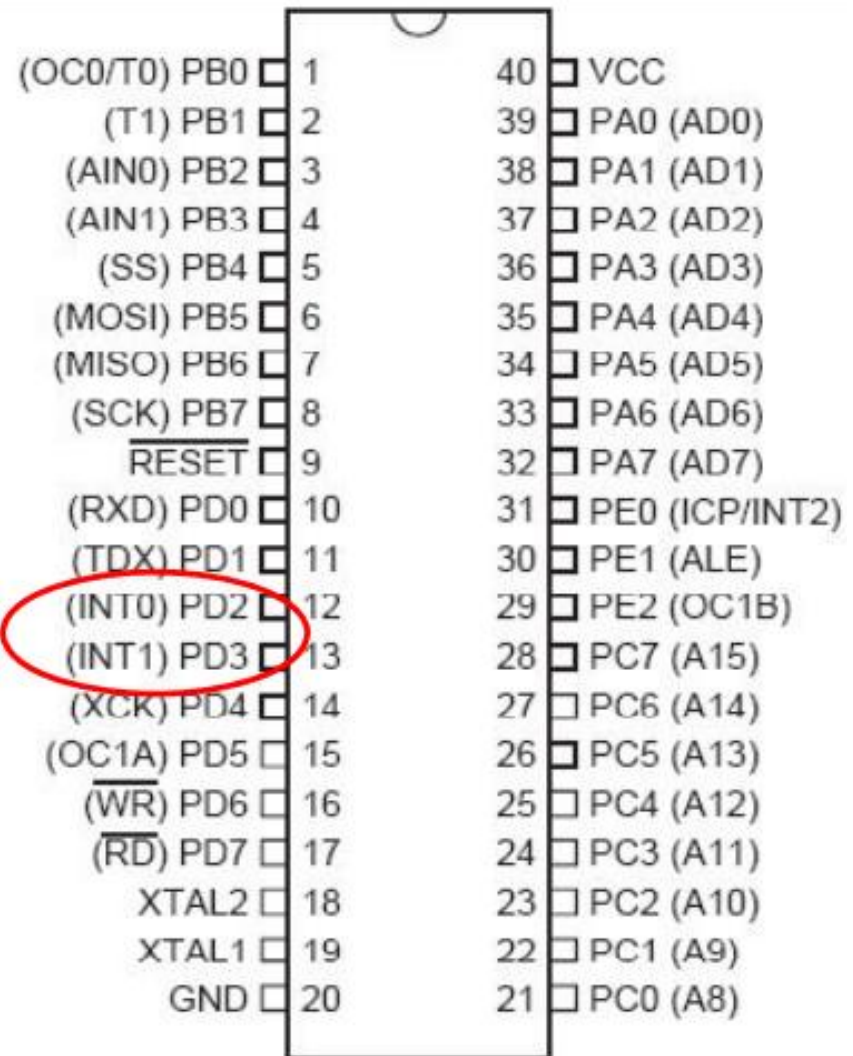
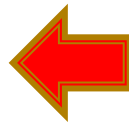
- **TIMSK**(Timer/Counter Interrupt Mask Register)

Bit	7	6	5	4	3	2	1	0	
	TOIE1	OCIE1A	OCIE1B	–	TICIE1	–	TOIE0	OCIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- **TOIEx** : Timer Counter Overflow x
- **TOCIEx** : Timer Counter Output Compare x
- Perlu di-setting jika anda menggunakan timer interrupt
- Jika hanya menggunakan external interrupt, maka register ini tidak perlu di-setting

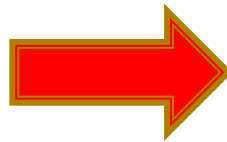
Lokasi Pin External Interrupt di AVR ATMega 8515

Biasanya
disambungkan
dengan perangkat
Button



Contoh Setting External Interrupt

```
ldi r17,0b11000000
out GICR,r17
ldi r17,0b00001010
out MCUCR,r17
sei
```



AVR menggunakan external interrupt1 (INT1) dan external interrupto (INT0). INT1 dan INT0 aktif pada falling edge

	1	1	0	0	0	0	0	0
Bit	7	6	5	4	3	2	1	0
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0

	0	0	0	0	1	0	1	0
Bit	7	6	5	4	3	2	1	0
	SRE	SRW10	SE	SM1	ISC11	ISC10	ISC01	ISC00
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0