Using ADC on Firebird-V Robot

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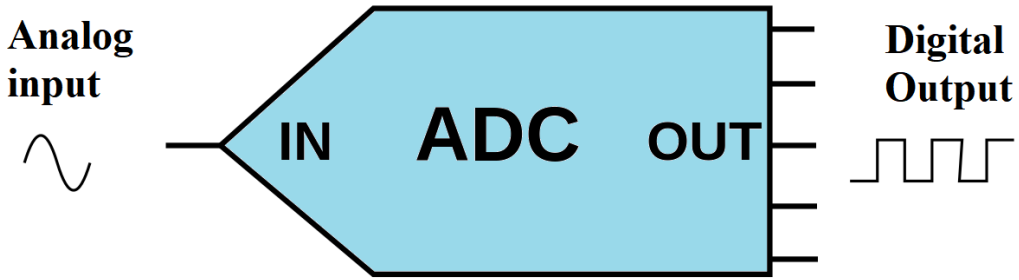
Agenda for Discussion

1. Analog to Digital Conversion
   - What is an ADC
   - Steps in ADC
   - Need for ADC
   - ADC of ATmega2560
   - ADC Channels
2. Coding ADC
   - ADC Initialization
   - ADCSRA
   - ADCSRB
   - ADMUX
   - ACSR
   - Program

What is an ADC

What is an ADC

- Converts a signal from analog (continuous) to digital (discrete) form



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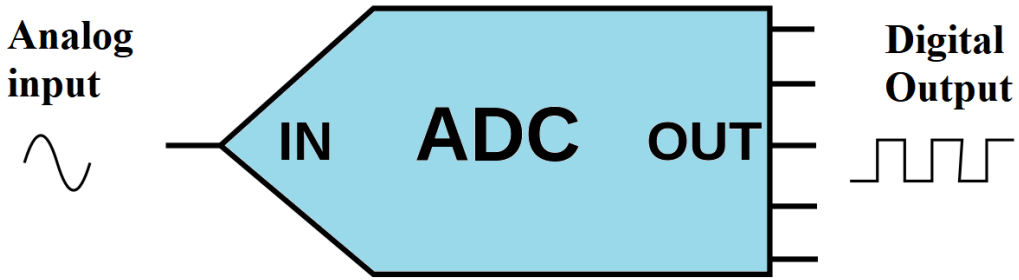

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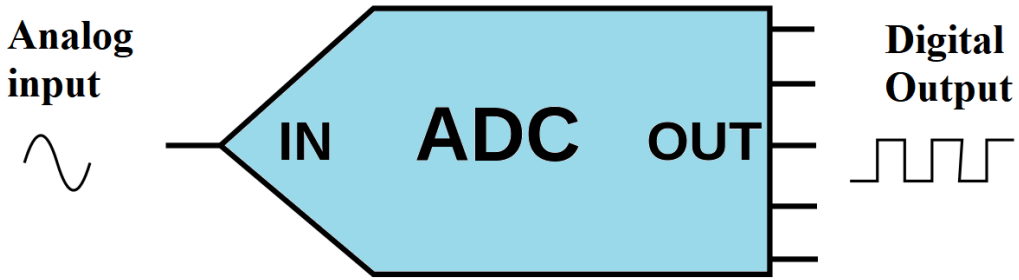

- It samples the input signal periodically
- Conversion involves quantization of the input signal

Steps in ADC

Steps involved in A-D conversion are:

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- **Sampling**
- Quantization
- Encoding

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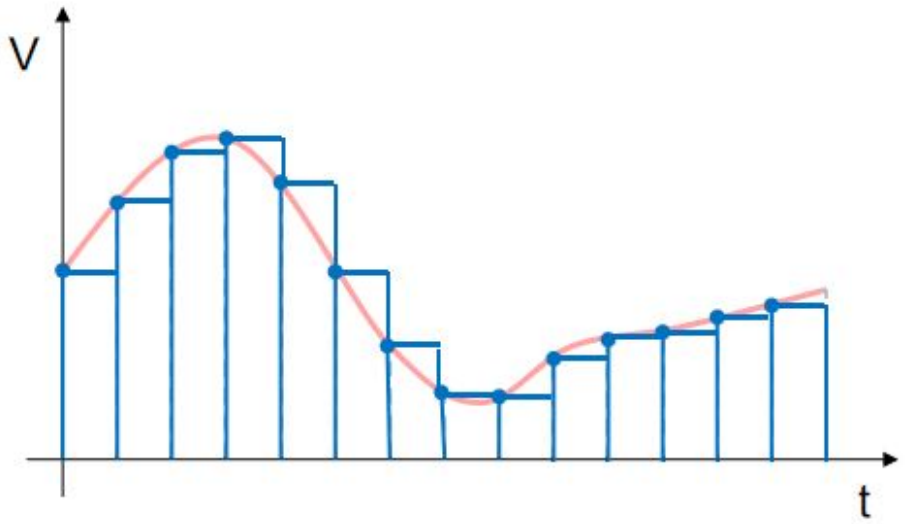

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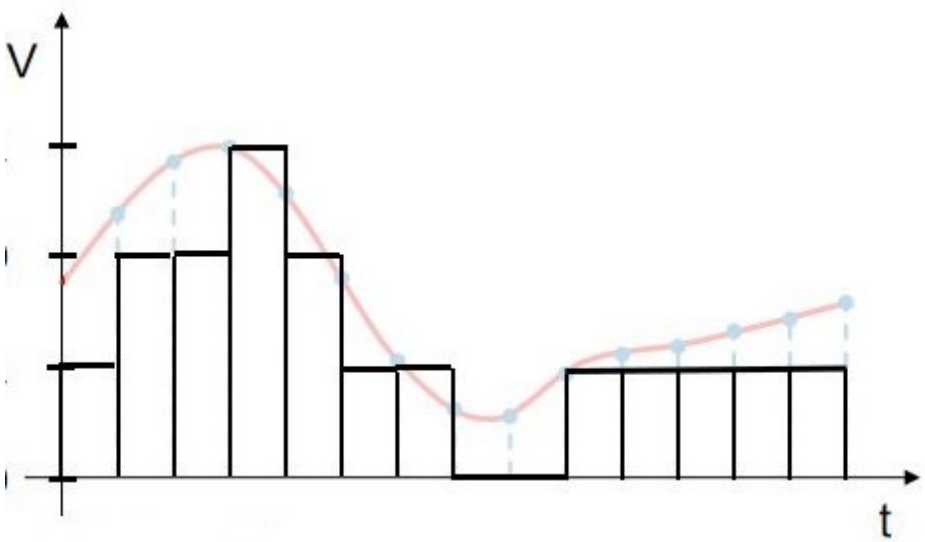

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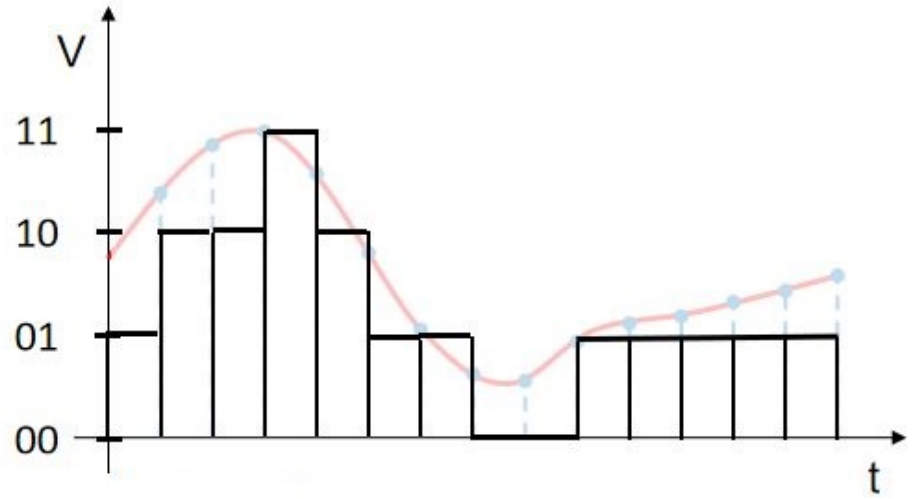

Need for ADC

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- IR Proximity sensors

Need for ADC

- IR Proximity sensors
- Sharp IR Range sensors

Need for ADC

- IR Proximity sensors
- Sharp IR Range sensors
- White line sensors

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- IR Proximity sensors
- Sharp IR Range sensors
- White line sensors
- Battery voltage sensor

Need for ADC

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- Sharp IR Range sensors
- White line sensors
- Battery voltage sensor
- etc..

In-Built ADC of ATmega2560

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- Minimum voltage change (Vref / 2^n)

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- Free Running or Single Conversion Mode

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- Minimum voltage change (Vref / 2^n)
- 13 - 260 μs Conversion Time
- 16 Multiplexed Single Ended Input Channels
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- 0 - VCC ADC Input Voltage Range
- 2.7 - VCC Differential ADC Voltage Range
- Selectable 2.56V or 1.1V ADC Reference Voltage
- Free Running or Single Conversion Mode
- Interrupt on ADC Conversion Complete

ADC Channels

Pin No.	Pin Name	Description
97	PF0/ADC0	ADC input for Battery Voltage Monitoring
96	PF1/ADC1	ADC input for White Line Sensor 3(Right)
95	PF2/ADC2	ADC input for White Line Sensor 2(Center)
94	PF3/ADC3	ADC input for White Line Sensor 1(Left)
93	PF4/ADC4	ADC input for IR proximity analog sensor 1
92	PF5/ADC5	ADC input for IR proximity analog sensor 2
91	PF6/ADC6	ADC input for IR proximity analog sensor 3
90	PF7/ADC7	ADC input for IR proximity analog sensor 4
89	PK0/ADC8	ADC input for IR proximity analog sensor 5
88	PK1/ADC9	ADC input for Sharp IR range sensor 1
87	PK2/ADC10	ADC input for Sharp IR range sensor 2
86	PK3/ADC11	ADC input for Sharp IR range sensor 3
85	PK4/ADC12	ADC input for Sharp IR range sensor 4
84	PK5/ADC13	ADC input for Sharp IR range sensor 5
83	PK6/ADC14	ADC input for Servo Pod 1
82	PK7/ADC15	ADC input for Servo Pod 2

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95	PF2/ADC2	ADC input for White Line Sensor 2(Center)
94	PF3/ADC3	ADC input for White Line Sensor 1(Left)
93	PF4/ADC4	ADC input for IR proximity analog sensor 1
92	PF5/ADC5	ADC input for IR proximity analog sensor 2
91	PF6/ADC6	ADC input for IR proximity analog sensor 3
90	PF7/ADC7	ADC input for IR proximity analog sensor 4
89	PK0/ADC8	ADC input for IR proximity analog sensor 5
88	PK1/ADC9	ADC input for Sharp IR range sensor 1
87	PK2/ADC10	ADC input for Sharp IR range sensor 2
86	PK3/ADC11	ADC input for Sharp IR range sensor 3
85	PK4/ADC12	ADC input for Sharp IR range sensor 4
84	PK5/ADC13	ADC input for Sharp IR range sensor 5
83	PK6/ADC14	ADC input for Servo Pod 1
82	PK7/ADC15	ADC input for Servo Pod 2

ADC Initialization

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- To Program ADC, we have to initialize some register before use it.

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2. ADCSRB - ADC Control and Status Register B

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3. ADMUX - ADC Multiplexer Selection Register

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4. ACSR - Analog Comparator Control and Status Register

ADC Initialization

- To Program ADC, we have to initialize some register before use it.

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  1. ADCSRA - ADC Control and Status Register A
  2. ADCSRB - ADC Control and Status Register B
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  4. ACSR - Analog Comparator Control and Status Register

- All these Registers are 8 Bit

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

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This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
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2	ADPS2	ADC Prescaler Select Bits	1

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	1

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	1
0	ADPS0	ADC Prescaler Select Bits	

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	1
0	ADPS0	ADC Prescaler Select Bits	0

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	1
0	ADPS0	ADC Prescaler Select Bits	0

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	1
0	ADPS0	ADC Prescaler Select Bits	0

ADCSRA = 0x86

ADCSRA- ADC Control and Status Register A

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	ADEN	ADC Enable	1
6	ADSC	ADC Start Conversion	0
5	ADATE	ADC Auto Trigger Enable	0
4	ADIF	ADC Interrupt Flag	0
3	ADIE	ADC Interrupt Enable	0
2	ADPS2	ADC Prescaler Select Bits	1
1	ADPS1	ADC Prescaler Select Bits	1
0	ADPS0	ADC Prescaler Select Bits	0

ADCSRA = 0x86

ADC Prescaler Selection Bit

ADC Prescaler Selection Bit

Table 26-5. ADC Prescaler Selections

ADPS2	ADPS1	ADPS0	Division Factor
0	0	0	2
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	64
1	1	1	128

ADC clock frequency = (F_CPU / Division Factor)
= 14745600 / 64
= 230 kHz (approx.)

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

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Bit	Symbol	Description	Bit Value
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Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-
3	MUX5	ADC Channel selection bit-5	

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-
3	MUX5	ADC Channel selection bit-5	0

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-
3	MUX5	ADC Channel selection bit-5	0
2	ADTS2	ADC Auto Trigger Source Bits	0
1	ADTS1	ADC Auto Trigger Source Bits	0
0	ADTS0	ADC Auto Trigger Source Bits	0

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-
3	MUX5	ADC Channel selection bit-5	0
2	ADTS2	ADC Auto Trigger Source Bits	0
1	ADTS1	ADC Auto Trigger Source Bits	0
0	ADTS0	ADC Auto Trigger Source Bits	0

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-
3	MUX5	ADC Channel selection bit-5	0
2	ADTS2	ADC Auto Trigger Source Bits	0
1	ADTS1	ADC Auto Trigger Source Bits	0
0	ADTS0	ADC Auto Trigger Source Bits	0

ADCSRB = 0x00

ADCSRB- ADC Control and Status Register B

This register is Used to control ADC operation

Bit	Symbol	Description	Bit Value
7	-	Reserved Bit	-
6	ACME	Analog Comparator Multiplexer Enable	0
5	-	Reserved Bit	-
4	-	Reserved Bit	-
3	MUX5	ADC Channel selection bit-5	0
2	ADTS2	ADC Auto Trigger Source Bits	0
1	ADTS1	ADC Auto Trigger Source Bits	0
0	ADTS0	ADC Auto Trigger Source Bits	0

ADCSRB = 0x00

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	1

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	1
4	MUX4	ADC Channel selection bit-4	

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	1
4	MUX4	ADC Channel selection bit-4	0
3	MUX3	ADC Channel selection bit-3	0
2	MUX2	ADC Channel selection bit-2	0
1	MUX1	ADC Channel selection bit-1	0
0	MUX0	ADC Channel selection bit-0	0

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	1
4	MUX4	ADC Channel selection bit-4	0
3	MUX3	ADC Channel selection bit-3	0
2	MUX2	ADC Channel selection bit-2	0
1	MUX1	ADC Channel selection bit-1	0
0	MUX0	ADC Channel selection bit-0	0

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	1
4	MUX4	ADC Channel selection bit-4	0
3	MUX3	ADC Channel selection bit-3	0
2	MUX2	ADC Channel selection bit-2	0
1	MUX1	ADC Channel selection bit-1	0
0	MUX0	ADC Channel selection bit-0	0

ADMUX = 0x20

ADMUX - ADC Multiplexer Selection Register

This register is Used to select ADC channel

Bit	Symbol	Description	Bit Value
7	REFS1	Reference Selection Bit	0
6	REFS0	Reference Selection Bit	0
5	ADLAR	ADC Left Adjust Result	1
4	MUX4	ADC Channel selection bit-4	0
3	MUX3	ADC Channel selection bit-3	0
2	MUX2	ADC Channel selection bit-2	0
1	MUX1	ADC Channel selection bit-1	0
0	MUX0	ADC Channel selection bit-0	0

ADMUX = 0x20

ADC Reference Voltage Selection Bit

ADC Reference Voltage Selection Bit

Table 26-3. Voltage Reference Selections for ADC

REFS1	REFS0	Voltage Reference Selection(1)
0	0	AREF, Internal V_{REF} turned off
0	1	AVCC with external capacitor at AREF pin
1	0	Internal 1.1V Voltage Reference with external capacitor at AREF pin
1	1	Internal 2.56V Voltage Reference with external capacitor at AREF pin

ADC Left Adjustment Bit

ADC Left Adjustment Bit

The ADC Data Register – ADCL and ADCH

ADLAR = 0

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	ADC9	ADC8	ADCH
	ADC7	ADC6	ADC5	ADC4	ADC3	ADC2	ADC1	ADC0	ADCL
	7	6	5	4	3	2	1	0	
Read/Write	R	R	R	R	R	R	R	R	
	R	R	R	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	

ADLAR = 1

Bit	15	14	13	12	11	10	9	8	
	ADC9	ADC8	ADC7	ADC6	ADC5	ADC4	ADC3	ADC2	ADCH
	ADC1	ADC0	–	–	–	–	–	–	ADCL
	7	6	5	4	3	2	1	0	
Read/Write	R	R	R	R	R	R	R	R	
	R	R	R	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	

MUX5:0 Channel Selection

MUX5:0 Channel Selection

MUX5:0	ADC Channel
000000	ADC0
000001	ADC1
000010	ADC2
000011	ADC3
000100	ADC4
000101	ADC5
000110	ADC6
000111	ADC7

MUX5:0 Channel Selection

MUX5:0	ADC Channel
000000	ADC0
000001	ADC1
000010	ADC2
000011	ADC3
000100	ADC4
000101	ADC5
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000100	ADC4
000101	ADC5
000110	ADC6
000111	ADC7

MUX5:0	ADC Channel
100000	ADC8
100001	ADC9
100010	ADC10
100011	ADC11
100100	ADC12
100101	ADC13
100110	ADC14
100111	ADC15

ACSR - Analog Comparator Control and Status Register

This register is Used for Analog Comparator

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Bit	Symbol	Description	Bit Value

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This register is Used for Analog Comparator

Bit	Symbol	Description	Bit Value
7	ACD	Analog Comparator Disable	

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This register is Used for Analog Comparator

Bit	Symbol	Description	Bit Value
7	ACD	Analog Comparator Disable	1

ACSR - Analog Comparator Control and Status Register

This register is Used for Analog Comparator

Bit	Symbol	Description	Bit Value
7	ACD	Analog Comparator Disable	1
6	ACBG	Analog Comparator Bandgap Select	0
5	ACO	Analog Comparator Output	0
4	ACI	Analog Comparator Interrupt Flag	0
3	ACIE	Analog Comparator Interrupt Enable	0
2	ACIC	Analog Comparator Input Capture Enable	0
1	ACIS1	Analog Comparator Interrupt Mode Select	0
0	ACIS0	Analog Comparator Interrupt Mode Select	0

ACSR - Analog Comparator Control and Status Register

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7	ACD	Analog Comparator Disable	1
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5	ACO	Analog Comparator Output	0
4	ACI	Analog Comparator Interrupt Flag	0
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1	ACIS1	Analog Comparator Interrupt Mode Select	0
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ACSR = 0x80

ACSR - Analog Comparator Control and Status Register

This register is Used for Analog Comparator

Bit	Symbol	Description	Bit Value
7	ACD	Analog Comparator Disable	1
6	ACBG	Analog Comparator Bandgap Select	0
5	ACO	Analog Comparator Output	0
4	ACI	Analog Comparator Interrupt Flag	0
3	ACIE	Analog Comparator Interrupt Enable	0
2	ACIC	Analog Comparator Input Capture Enable	0
1	ACIS1	Analog Comparator Interrupt Mode Select	0
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ACSR = 0x80

Syntax for C-Program

ADC Initialization

Syntax for C-Program

ADC Initialization

ADC Port Pin Config

Syntax for C-Program

ADC Initialization

ADC Port Pin Config

```
void adc_pin_config (void)  // Configure ADC Ports
{

  // Port K and Port F must be defined AS Input

}
```

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ADC Initialization

ADC Port Pin Config

```
void adc_pin_config (void)  // Configure ADC Ports
{

  // Port K and Port F must be defined AS Input

}
```

ADC Initialization

```
void adc_init()  // Set Register Values for starting ADC
{

   ADCSRA =
   ADCSRB =
   ADMUX  =
   ADCSRA =
   ACSR   =
}
```

Syntax for C-Program

ADC Initialization

ADC Port Pin Config

```
void adc_pin_config (void)  // Configure ADC Ports
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void adc_init()  // Set Register Values for starting ADC
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   ADCSRB =
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   ADCSRA =
   ACSR   =
}
```

Syntax for C-Program

Program

Syntax for C-Program

Program

Main Program

Syntax for C-Program

Program

Main Program

```
int main(void)
{
  adc_pin_config();
     adc_init();
  lcd_init();
  while(1)
  {
    print_sensor(1,1,3);  // Left WL sensor
    print_sensor(1,4,2);  // Center WL sensor
    print_sensor(1,8,1);  // Right WL sensor
  }
}
```

Syntax for C-Program

Program

Main Program

```
int main(void)
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  adc_pin_config();
     adc_init();
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Print ADC Value on LCD

Syntax for C-Program

Program

Main Program

```
int main(void)
{
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     adc_init();
  lcd_init();
  while(1)
  {
    print_sensor(1,1,3);  // Left WL sensor
    print_sensor(1,4,2);  // Center WL sensor
    print_sensor(1,8,1);  // Right WL sensor
  }
}
```

Print ADC Value on LCD

```
void print_sensor(char row, char column, unsigned char channel)
{
   unsigned char ADC_Value;
   ADC_Value = ADC_Conversion(channel);
   lcd_numeric_value(row, column, ADC_Value, 3);

}
```

Syntax for C-Program

Program

Syntax for C-Program

Program

ADC Conversion Function

Syntax for C-Program

Program

ADC Conversion Function

```
unsigned char ADC_Conversion(unsigned char Ch)
{
  unsigned char a;
    if(Ch>7)
   {
    ADCSRB = 0x08;   // Set MUX5 bit if channel is greater than 7
   }
     Ch = Ch & 0x07;
     ADMUX= 0x20 | Ch;
     ADCSRA = ADCSRA | 0x40;  // Set start conversion bit
     while((ADCSRA&0x10)==0);  // Wait for ADC conversion to complete
     a=ADCH;
     ADCSRA = ADCSRA|0x10;  // Clear ADIF (ADC Interrupt Flag) by writing 1 to it
     ADCSRB = 0x00;   // Reset MUX5 bit
     return a;

}
```

Thank You!

Post your queries on: support@e-yantra.org