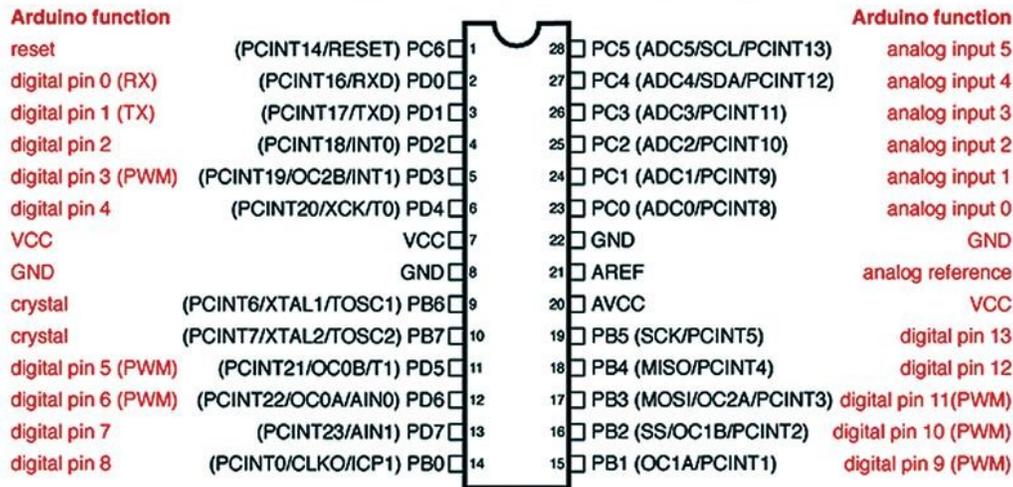


Arduino - Assembly code reference

Keywords used in Arduino for Assembly language programming:

Keyword	Example	Function
ldi	ldi r16, 0b00001000	Loads the binary value into the register
out	out PORTB, r16	Sends the value of r16 to PORTB
in	in r16, PORTB	Reads the value of PORTB and stores it in r16
rjmp	rjmp AddressLabel	Jumps to the AddressLabel
rcall	rcall AddressLabel	Calls the AddressLabel
mov	mov r16, r17	Moves the value from r17 to r16
clr	clr r16 or clr PORTB	Clears the value stored in the register
and	and r16, r17	Performs bitwise AND operation and stores result in r16
or	or r16, r17	Performs bitwise OR operation and stores result in r16
eor	eor r16, r17	Performs bitwise XOR operation and stores result in r16
lsl	lsl r16	Performs left shift in a loop on the value stored in r16
dec	dec r16	Decrements the value stored in r16 by 1
brne	brne AddressLabel	Go to the AddressLabel if zero flag is not set
ret	ret	Exits the subroutine loop
sbi	sbi r16, 4	Sets the 5 th bit of register 16 to 1
breq	breq AddressLabel	Goes to the AddressLabel if zero flag is set

Arduino ATmega328 Pin Mapping



Digital Pins 11, 12 & 13 are used by the ICSP header for MISO, MOSI, SCK connections (Atmega168 pins 17, 18 & 19). Avoid low-impedance loads on these pins when using the ICSP header.

1) Atmega328 to Arduino Pin Mapping

The above diagram depicts the manner in which the pins of the **ATmega328** are mapped to the pins on the **Arduino** board. The red text represents the names you can see on the **Arduino** board. The black text represents the pins on the **ATmega328**.

ATmega328 has a total of three ports namely **Port B (PB)**, **Port C (PC)** and **Port D (PD)**. Each of these ports has eight bits corresponding to the function according to pin out. There are lot of registers in the Atmega board which tells the board how to function essentially. The registers used in our programs are mainly **DDRX**, **PORTX**, **TCCR0B** where X being the port name such as B,C or D.

2) DDRX Register

This register has 8 bits corresponding to 8 pins of that respective port. For example **DDRB** corresponds to **PORT B** and controls the function of Port B pins. Making a bit of **DDRB** as high makes the corresponding pin of PORT B as output and vice versa.

Before using the pins as input or output in the assembly code, it is essential to always set this register according to our exact function i.e., input or output.

3) PORTX Register

This register has 8 bits corresponding to 8 pins of that respective port. For example **PORT B** corresponds to port B and controls the value of Port B pins. Making a bit of PORT B as high makes the corresponding pin of PORT B as high and vice versa.

If PORT B is set as a output, then “out PORTB, r16” will write the value of r16 into PORT B register making it high or low according to the value of r16.

If PORT B is set as a input, then “in r16, PORTB” will read the value from PORT B and write the corresponding value into r16.

4) TCCR0B

This register has 8 bits and first three bits that is bit0, bit1 and bit2 together acts as a prescaler settings. Depending on what is written in these bits, the crystal frequency is manipulated to get clock of different frequency. The method of doing this manipulation is called prescaling.

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The procedure to Install AVRdude on Windows: (Intermediate Level)

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1. To follow the installation procedure, you need to be connected to the Internet.
2. Download the latest version of **WinAVR** package from the given link.
<https://sourceforge.net/projects/winavr/>
3. Click on **Download** button to download the **WinAVR** package.
4. Click on the save button to save the file.
5. Locate the file that you have downloaded. Right click on it and select **Run as administrator**.
6. **User Account Control** popup window will appear. Click on **Yes**.
7. **Installer Language** dialog box will appear. Select **English** and click on **OK**.
8. In the **Setup Wizard**, click on **Next**.
9. In the **License Agreement** window, click on **I Agree**.
10. In **Choose Install Location** dialog box, keep the default installation location and click on **Next**.

11. In **Choose Components** dialog box, check all three check boxes and then click on **Install**. This will start the installation.
12. After the installation is successfully completed, click on **Finish** to close the wizard.
13. Now open command prompt. To do so, in the search bar type command prompt and click on the command prompt application.
14. Run the following commands in the command prompt to make sure all the required utilities are available. You will see the version number.

>**Avr-gcc -v**

>**avr-objcopy -v**

>**make -v**

>**avrdude**