EWS ATMEGA328P Breakout Board: 
User Guide

I. Summary:

The EWS ATMEGA328P Breakout Board is a microcontroller development board based on the widely popular ATMEGA328P microcontroller. The board is set up for easy programming & UART communication using our FTDI breakout board through a convenient header on the end of the board. The popular Optiboot bootloader used in Arduino programming is pre-loaded in the bootloader section of the chip's memory for programming from your favorite IDE. Or, there's a 6-pin ISP header for programming using an Atmel style programmer. The board has also been designed with a 12-pin header for interfacing with a 4-digit LED display. The board ships with an interface application preloaded to make the board an easy 4-digit LED Display add-on to your current microcontroller application (just send commands via RS232 to the board from your application – see section 6: Using the LED Display).

Additionally, the board is available in 2 speed grades for your specific needs:

1. 8MHz: 3.3V/5V operation
2. 16MHz: 5V operation
   - Note: 3.3V operation is possible with the 16MHz version, but 16MHz is considered overclocking at 3.3V

II. Features:

- Powerful ATMEGA328P MCU
  - 32KB Flash, 2KB RAM, 1K EEPROM
  - 2 – 8-bit timers, & 1 – 16-bit timer
  - 6 PWM channels
  - 8 channel, 10-bit ADC
  - TWI interface
  - 2 serial USARTs
  - SPI interface
  - Programmable Watchdog Timer
  - Interrupt and Wake-up on pin changes

- Program MCU memory via either serial bootloader or ISP from the following IDEs:
  - Arduino
  - AVRStudio
  - Programmer's Notepad/WINA VR

- Full pinout of ATMEGA328P
- 200mA Voltage Regulator on-board
- Choose voltage level (3.3V/5V) w/solder jumper
- Green and Red user LEDs (PB0 & PB1)
- User push button (PB2), and Reset button
- 12-pin LED Display header!
  - Send commands to board from serial port
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IV. Board Diagram/Description: ATMEGA328P Breakout Board

- 6-pin ISP Header
- 500mA Resettable Fuse
- 8MHz/16MHz Board Version Label
- 200mA Voltage Regulator
- ATMEGA328P MCU
- 12-pin LED Display Header
- Reset Button
- FTDI Header
- Mounting Holes
- Sturdy USB Micro Receptacle
- Red LED PWR Indicator
- Solder Jumper: 3.3V/5V Selection soldered = 3.3V
- Full MCU pinout (0.100” spacing, Breadboard friendly!!)
- AVCC solder jumper
- User LEDs: Green LED (PB0) Red LED (PB1)
- User Push Button: Tactile Switch on PB2

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V. Connection/Setup

A. Out of the Box: Thank you for your purchase of the EWS ATMEGA328P Breakout Board! This is a great board to be used either as a breakout board for the atmega328p microcontroller, or also as a LED display to integrate into your project. If you have also purchased the 4 digit **LED display module**, you'd better solder it into the 12 pin header on the board now (see below). Also, there is a handy FTDI-style connection header on the end of the board. It would be a good idea to solder a pin strip there now if you are going to be utilizing it for programming/communicating with the board.

![Image of LED display module being soldered to board]

Now it's time to get started! The first step that you decide is how you are going to load your programs to the board. There are two options for this – bootloader programming and ISP programming.

B. **Bootloader Programming:** If you are using Arduino software for program development, you will want to utilize bootloader programming. If you have one of our wonderful **FTDI breakout boards** (or similar), you can just solder on some header pins and plug into the end of the board (see below). Now, choose the appropriate serial port and board (this board will interface well with the Arduino Pro or Pro Mini w/ATmega 328 board package included in the Arduino software) in Arduino.

Similarly, the Optiboot bootloader used on this board is compatible with any development platform using the AVRDUDE uploader software. You can use the bootloader to upload programs from the WINAVR environment (see the **LED Display Interface example**), and you can also customize Atmel Studio 6 to upload your programs using AVRDUDE.

![Image of Setup for Bootloader Programming]

C. **ISP Programming:** If you are going to upload your programs using an Atmel style ISP programmer, there is a 6-pin ISP header on the board next to the USB socket designed for this purpose. Remember, uploading programs via ISP will overwrite the bootloader resident on the chip. To utilize bootloader programming later, you'll have to re-load the bootloader.
VI. Using the LED Display

The board has been designed with a 12 pin header to interface with an LED Display module. The display that we offer on our website is a clock display with 4 numerical digits and a colon (colon only – no decimal digits). The MCU is preloaded with a user interface program to easily configure the LED Display. Basic common usage commands are provided, including:

- change data on display
- turn on/off the two on-board LEDs
- turn on/off the display colon
- adjust the brightness of the display

A. SPECS:
   i. Communication: serial port
   ii. Serial port settings: 9600, 8, N, 1
   iii. bootloader upload rate: 57600
   iv. Input Voltage:
      a) 8MHz version: 2.7-5V
      b) 16MHz version: 5V

B. COMMANDS & USAGE – The user can get familiarized with the board's command functionality through an RS232 terminal session between a PC and the board. Here are usage examples (user interface terminal session, and results of the command on the board):

   i. display
ii. redled

iii. greenled

iv. colon

v. brightness

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[www.goEWS.com](http://www.goEWS.com)

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vi. help & info

**WELCOME TO THE EWS ATMEGA328P BREAKOUT BOARD!**

EWS> help

-------------EWS ATMEGA328P BOARD COMMANDS-------------
display <arg> - displays "arg" on the LED display
geredled <arg> - turns on/off the red led
greenled <arg> - turns on/off the green led
colon <arg> - turns on/off the LED display colon
brightness <arg> - adjusts brightness of display
("y" brightest, "0" dimmest)
help - displays this help menu
info - displays device information

EWS> info

--------------DEVICE INFORMATION--------------
ATMEGA328 Breakout Board/LED DISPLAY BOARD v1.0
Device: ATMEL ATMEGA328P
Clock Frequency: 16MHz
Bootloader: Optiboot
<2013 Embedded Wireless Solutions LLC

EWS>
VII. Miscellaneous:

A. Arduino Pin Mapping:

Here is a copy of the arduino pin mapping of the ATMEGA328P:

![Atmega328P – Arduino Pin Mapping](image)

<table>
<thead>
<tr>
<th>Mega328P Arduino Function</th>
<th>Arduino Function</th>
<th>Mega328P</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC6</td>
<td>reset</td>
<td>PC5</td>
</tr>
<tr>
<td>PD0</td>
<td>digital pin 0 (RX)</td>
<td>PC4</td>
</tr>
<tr>
<td>PD1</td>
<td>digital pin 1 (TX)</td>
<td>PC3</td>
</tr>
<tr>
<td>PD2</td>
<td>digital pin 2</td>
<td>PC2</td>
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<tr>
<td>PD3</td>
<td>digital pin 3 (PWM)</td>
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<tr>
<td>PD4</td>
<td>digital pin 4</td>
<td>PC0</td>
</tr>
<tr>
<td>GND</td>
<td>GND</td>
<td>ADC7</td>
</tr>
<tr>
<td>VCC</td>
<td>VCC</td>
<td>ADC6</td>
</tr>
<tr>
<td>GND</td>
<td>GND</td>
<td>VCC</td>
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<tr>
<td>VCC</td>
<td>analog reference</td>
<td>AREF</td>
</tr>
<tr>
<td>PB6</td>
<td>crystal</td>
<td>ADC6</td>
</tr>
<tr>
<td>PB7</td>
<td>crystal</td>
<td>VCC</td>
</tr>
<tr>
<td>PD5</td>
<td>digital pin 5 (PWM)</td>
<td>digital pin 13</td>
</tr>
<tr>
<td>PD6</td>
<td>digital pin 6 (PWM)</td>
<td>digital pin 12</td>
</tr>
<tr>
<td>PD7</td>
<td>digital pin 7</td>
<td>digital pin 11 (PWM)</td>
</tr>
<tr>
<td>PB0</td>
<td>analog input 8</td>
<td>digital pin 10 (PWM)</td>
</tr>
</tbody>
</table>

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