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avr isp mk2 programmer user s manual

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AVR ISP MK2 Programmer User Manual

Welcome to the definitive guide for the AVR ISP MK2 programmer. Whether you're a seasoned embedded engineer, a hobbyist tinkering with microcontrollers, or a student learning the fundamentals of AVR programming, this manual will walk you through every aspect of using the AVR ISP MK2. From a quick overview of the hardware to detailed instructions on installation, configuration, and troubleshooting, you'll find everything you need to get the most out of this versatile programmer.

Table of Contents

- Overview of the AVR ISP MK2
- Hardware Components and Specifications
- Initial Setup and Software Installation
- Connecting the Programmer to Your Target Board
- Programming AVR Devices
- Debugging and Troubleshooting
- Advanced Features and Customization
- Maintenance, Safety, and Best Practices
- Frequently Asked Questions
- Conclusion

Overview of the AVR ISP MK2

The AVR ISP MK2 is a compact, low-cost In-System Programmer (ISP) designed to interface with Atmel AVR microcontrollers. It supports a wide range of AVR devices, from the classic ATmega328p used in Arduino boards to high-end AVR32 cores. The programmer offers a USB interface for easy connection to modern computers and a 10 pin ISP connector that matches the standard AVR header. Its small footprint makes it ideal for both professional development kits and DIY projects.

Key features include:

- USB 2.0 Full Speed connectivity
- 10 pin ISP header for standard AVR programming
- Support for AVR bootloader, flash, EEPROM, and fuse programming
- Low power consumption (typical 0.5 /W when idle)
- Compact 35 /mm /× /35 /mm footprint
- Compatible with popular IDEs: Atmel Studio, AVRDUDE, Arduino IDE, and more

Hardware Components and Specifications

The AVR ISP MK2 comprises several essential components that work together to provide reliable programming capability. Understanding these parts will help you diagnose issues and appreciate the design.

USB Interface

The programmer uses a standard USB Type A connector for power and data. The USB controller is an FTDI FT232RL chip, which provides a virtual COM port. This port is used by most programming software to communicate with the device. The USB interface supplies 5 V to the programmer and can also power the target board if needed.

ISP Connector

The 10 pin ISP header follows the AVR standard layout:

1. Reset (RST)
2. MISO (Master In Slave Out)
3. VCC (Target power)
4. GND (Ground)
5. MOSI (Master Out Slave In)
6. SCK (Serial Clock)
7. AVCC (Analog VCC)
8. GND (Analog Ground)
9. Optional: Unused or dedicated pins for future expansion
10. Optional: Unused or dedicated pins for future expansion

When connecting to a target board, match the pins exactly. The VCC pin supplies power to the target, so ensure you use the correct voltage (3.3 /V or 5 /V) for your AVR device.

Power Management

The programmer includes a voltage regulator that steps down the USB 5 V to the required supply for the target AVR. It also features a current limit circuit that protects both the programmer and the target from overcurrent situations.

LED Indicators

Two status LEDs provide immediate visual feedback:

- Green LED – Indicates USB power and active communication.
- Red LED – Signals an error or programming failure.

Initial Setup and Software Installation

Before you can program any AVR device, you need to install the necessary drivers and software. The AVR ISP MK2 is compatible with Windows, macOS, and Linux, but the setup steps vary slightly across operating systems.

Step 1: Install USB Drivers

1. Connect the programmer to your computer using a standard USB cable.
2. Windows: The FTDI drivers usually install automatically. If they don’t, download the FTDI Virtual COM Port Drivers and run the installer.
3. macOS: The FTDI drivers are included in the macOS kernel. If you encounter issues, install the FTDI macOS drivers.
4. Linux: Most distributions include the FTDI driver by default. If not, install the FTDI Linux drivers or use the built in kernel module.

Step 2: Install Programming Software

The AVR ISP MK2 works seamlessly with a variety of programming environments. Below are the most common options:

- Atmel Studio – Full-featured IDE for AVR and ARM development.
- AVRDUDE – Command line utility that supports a wide range of devices.
- Arduino IDE – Great for beginners and quick bootloader installations.
- AVRFlash – Lightweight GUI for simple flashing tasks.

Download and install the software that best suits your workflow.

Step 3: Verify Connection

Open your chosen programming tool and verify that the AVR ISP MK2 is detected. In Atmel Studio, navigate to *Tools !' Device Programming* and select the appropriate COM port. In AVRDUDE, use the command:

avrdude -c avrisp2 -p m328p -P COM3 -U flash:verify\\n\\nReplace **COM3** with the correct port on your system. If the connection is successful, you should see a status message indicating that the device was found.

Connecting the Programmer to Your Target Board

Proper connection is crucial for reliable programming. Follow these steps to ensure a correct setup.

Choosing the Right Voltage

AVR microcontrollers come in both 3.3 V and 5 V variants. The AVR ISP MK2 can supply both voltages, but you must select the appropriate one in your programming software. Most IDEs allow you to choose the target voltage in the device programming settings.

Pin Alignment

Align the 10 pin ISP header on the programmer with the corresponding header on your target board. Double check each pin to avoid miswiring. A common mistake is swapping the MISO and MOSI pins, which can lead to communication failures.

Power Considerations

If you plan to power the target board directly from the programmer, ensure the board's voltage rating matches the programmer's output. Some boards have separate power rails for analog and digital circuits; in such cases, connect only the required rails.

Grounding

Ground is critical. Connect both the digital ground (GND) and analog ground (GND) pins on the programmer to the target board's ground. A solid ground connection prevents voltage fluctuations that can corrupt the programming process.

Programming AVR Devices

Once the hardware is set up, you're ready to flash firmware onto your AVR microcontroller. This section covers the core programming workflow, including bootloader installation, firmware flashing, and fuse configuration.

Bootloader Installation

Bootloaders allow you to program the AVR over serial or USB, simplifying future updates. To install a bootloader using the AVR ISP MK2, follow these steps:

1. Open your IDE and load the bootloader source code (e.g., optiboot for ATmega328p).
2. Compile the bootloader to produce a binary file (.hex).
3. In the device programming dialog, select Write for the Flash section and browse to the .hex file.

4. Click Start to begin the programming process.
5. Once the process completes, verify the flash to ensure data integrity.

Flashing Application Firmware

After installing a bootloader, you can flash application firmware using the bootloader's serial interface. Alternatively, you can flash directly via ISP for faster updates. The steps are similar to bootloader installation, but you'll use the compiled application binary instead.

Fuse Configuration

Fuses control fundamental aspects of the AVR, such as clock source, brown out detection, and reset behavior. Incorrect fuse settings can render a device inoperable. The AVR ISP MK2 makes fuse programming straightforward:

1. Navigate to the Fuse tab in your programming software.
2. Select the desired fuse byte (High, Low, Extended, or Lock).
3. Choose the appropriate value from the dropdown or enter a custom value.
4. Write the fuse settings to the device.
5. Verify the fuses to confirm the new configuration.

Always double check fuse settings before writing, as an incorrect configuration can lock you out of the device.

EEPROM Programming

EEPROM holds non volatile data such as configuration settings. To program EEPROM:

1. Open the device programming dialog and navigate to the EEPROM section.
2. Choose Write and browse to the .hex file containing EEPROM data.
3. Click Start and wait for the process to complete.
4. Verify the EEPROM content to ensure accuracy.

Debugging and Troubleshooting

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