Programmers and Debuggers

AVRISP mkII

USER GUIDE

Features

- Atmel® Studio compatible
- Supports all Atmel AVR® devices with ISP, PDI, or TPI interface
- Programs both flash and EEPROM
- Supports fuses and lock bit programming
- Upgradeable to support future devices
- Support target voltages from 1.6V to 5.5V
- Adjustable ISP programming speed (50Hz to 8MHz SCK frequency)
- USB 2.0 compliant (full speed, 12Mbps)
- Powered from USB, does not require external power supply
- Target interface protection
- Short-circuit protection

Table of Contents

1. Introduction

The Atmel AVRISP mkII combined with Atmel Studio can program all Atmel AVR 8-bit RISC microcontrollers with ISP, PDI, or TPI Interface. Consult the Atmel Studio device support section for a full list of devices and interfaces supported by this firmware release.

1.1. Getting Started

Read this section before connecting the Atmel AVRISP mkII to the computer or target.

Follow these steps to get started using the AVRISP mkII:

1. Install Atmel Studio and the USB driver.
2. Connect AVRISP mkII to the computer, and auto-install new hardware (AVRISP mkII) on the computer.
3. Start Atmel Studio and the AVRISP mkII Programming Dialog.
4. Connect AVRISP mkII to the target.

1.1.1. USB Setup

In order to use the Atmel AVRISP mkII it is required to install the Atmel Studio and USB driver first. Do not connect the AVRISP mkII to the computer before running the USB Setup in order to follow this procedure described in Software and USB Setup.

1.1.2. Atmel AVRISP mkII Content

The box contains the following items:

- Atmel AVRISP mkII
- USB cable
- Atmel Technical Library CD-ROM with datasheets, application notes, and software

Figure 1-1. Atmel AVRISP mkII Kit Contents

1.1.3. Atmel Studio Requirements

It is required to use AVR Studio® 4.12 or later in order to use the Atmel AVRISP mkII. Latest version of the Atmel Studio can be found at http://www.atmel.com/tools/atmelstudio.aspx.

Note:
Atmel Studio and the USB driver must be installed before the AVRISP mkII is connected to the computer.

1.2. Connecting Atmel AVRISP mkII

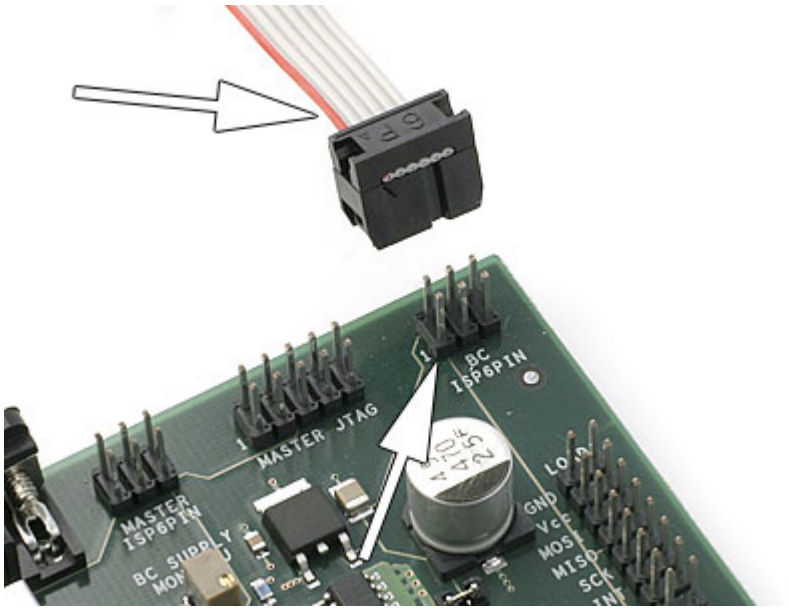
This section describes how to connect the Atmel AVRISP mkII to the host PC and the target device for correct operation. Note that Atmel Studio and the USB driver must be installed. See the Atmel Studio documentation for help. AVRISP mkII must be connected to the computer before connecting it to the target device.

Figure 1-2. Atmel AVRISP mkII USB Connection

When the AVRISP mkII is connected to the PC, and if the USB driver is installed, the green LED inside the AVRISP mkII close to the USB connector will be lit. The main status LED will be red before the target is detected.

After the AVRISP mkII is connected to the PC, it can be connected to the target. The red stripe on the target cable marks pin 1, and this should be mated with pin 1 on the ISP, PDI, or TPI connector on the target board. See Target Interface on page 8 for a comparison of the different interfaces.

Figure 1-3. Atmel AVRISP mkII ISP Connection



Note:
The AVRISP mkII does *not* provide power on the V_{CC} pin, but uses this pin to sense the voltage on the target circuitry. Your circuit needs to be powered by external means to operate.

When the AVRISP mkII is connected to both the PC and the target board the main status LED should be green indicating that target power has been detected. AVRISP mkII is now ready to be used with Atmel Studio or the programming command line software.

1.3. What's New

1.3.1. October, 2015 - Atmel Studio 7.0 - FW 01.18

- Fixed issue when reading voltage before TPI operations

1.3.2. August, 2013 - Atmel Studio 6.1 Update 2 - FW 01.17

- Bug fixes

1.3.3. April, 2013 - Atmel Studio 6.1 - FW 01.16

- Increased TPI clock speed
- Bug fixes

1.3.4. November, 2011 - AVR Studio 5.1 - FW 01.11

- Improved PDI stability

1.3.5. December 11th, 2009 - AVR Studio 4.18 SP1

- Added TPI support

1.3.6. June 27th, 2008 - AVR Studio 4.14 SP1 - FW 01.0B

- Added PDI support

1.3.7. February 8th, 2008 - AVR Studio installation package - FW 01.09

- Firmware 01.09 fixes the problem on Atmel AVRISP mkII units with production date from 20071012 to 20080130. The production date can be found on the bottom side of the AVRISP mkII enclosure.

Note: This FW will work on all AVRISP mkII units, regardless of production date.

1.3.8. February 15th, 2007 - FW 01.06

- Firmware fixes:
  - Further improved the ISP programming skew problem

1.3.9. January 13th, 2006 - FW 01.05

- Firmware fixes:
  - Made more robust ISP programming to handle skew on ISP lines
  - Fixed bug that Atmel AVRISP mkII reports Int RC calibration success, regardless of the result of the operation. According to Application Note AVR053.

1.3.10. December 8th, 2005 - FW 01.02

- Fixed problem with Atmel AVRISP mkII blinking red after programming target firmware that drives the ISP pins high or low

1.3.11. November 28th, 2005 - FW 01.01

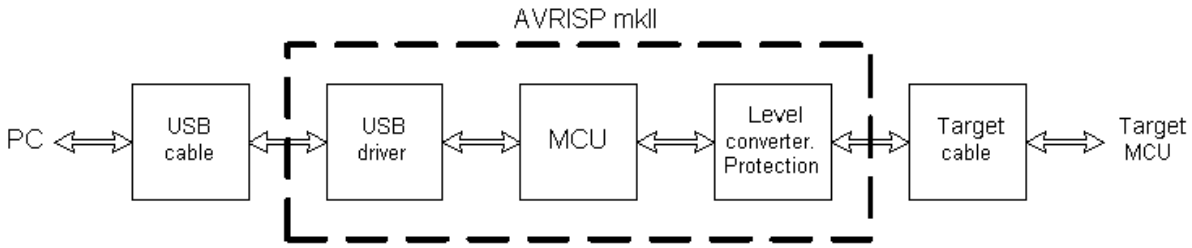
- Fixed problem with Atmel AVRISP mkII reporting reversed target connection when voltage on Reset line is less than $0.9 \times V_{CC}$. Some Atmel AVRs have a pull-up on Reset that only pulls to approximately $0.7 \times V_{CC}$.

2. Hardware Description

2.1. Atmel AVRISP mkII Block Schematic

A block schematic of the Atmel AVRISP mkII hardware is shown in the figure below.

Figure 2-1. Atmel AVRISP mkII Block Diagram



2.2. USB

The USB interface is USB 1.1 (USB 2.0 Full Speed) 12Mbits/second.

As the Atmel AVRISP mkII is powered from the USB port it is required that the port can deliver up to 200mA. The ports on a PC, and hubs with separate power usually meets this requirement.

2.3. MCU

The control MCU handles all communication between the target Atmel AVR and the frontend software. The Atmel AVRISP mkII is completely software controlled from Atmel Studio. No manual configuration of the AVRISP mkII is needed.

2.4. Status LED

A 3-color LED indicates the status of the Atmel AVRISP mkII. Check Troubleshooting on page 12 to check for solutions if the there are any errors.

Figure 2-2. AVRISP mkII Status LED

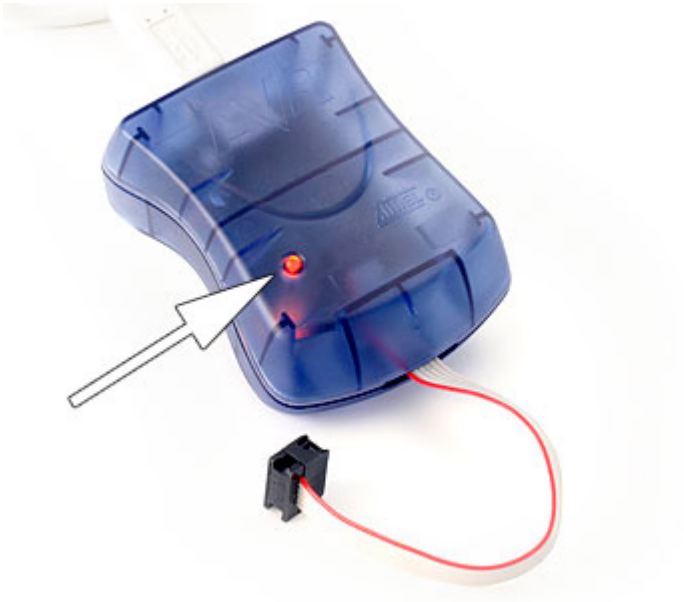


Table 2-1. AVRISP mkII Status LED

LED color	Description
Red	Idle - No target power
Green	Idle - With target power
Orange	Busy - Programming
Orange blinking	Reversed target cable connection, or not correct pull-up on the reset line
Red blinking	Short-circuit on target
Red - Orange blinking	Upgrade mode

There is also a green LED inside the AVRISP mkII enclosure next to the USB connector. This LED indicates USB traffic.

2.5. Target Interface

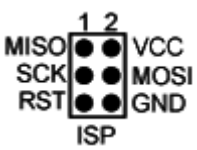
The target connection has level converters and short-circuit protection.

Pin 1 on the connector is found on the RED side of the target cable. Atmel AVRISP mkII supports both the ISP interface and the PDI interface.

2.5.1. ISP Interface

When programming an Atmel AVR with ISP interface, the connector must have the pinout as shown in the figure below.

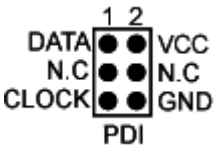
Figure 2-3. ISP Connector



2.5.2. PDI Interface

Atmel AVRISP mkII also supports the PDI interface for programming. The connector is the same as for ISP, but with different signals:

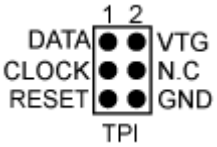
Figure 2-4. PDI Connector



2.5.3. TPI Interface

The TPI interface found on some Atmel tinyAVR® devices, is similar to the PDI interface, with the addition of the RESET pin.

Figure 2-5. TPI Connector



Note:
As the TPI interface uses the RESET pin, the RESET pin can not be disabled by setting the reset disable fuse. This will prevent further programming of the device using the Atmel AVRISP mkII. The only option is to use a programmer with the capability of driving 12V to the reset line (i.e. Atmel STK®600).

Note:
The TPI interface uses internal pull-ups on the data line. Avoid any pull-downs on the TPI data line.

2.6. Level Converter

The Atmel AVRISP mkII supports target voltages from 1.8V up to 5.5V.

Note:
V_{CC} must be connected to the target board in order to get correct operation and voltages on the ISP/PDI lines. V_{CC} does not draw any power from the target.

2.7. Short Circuit Protection

The short circuit protection will automatically disconnect the target pins from the Atmel AVRISP mkII if the current drawn through the pin is greater than approximately 25mA.

2.8. ESD Protection

The target pins from the Atmel AVRISP mkII are protected with a transient suppressor than can withstand 8kV direct discharge.

2.9. Pull-up Resistors

If any pull-up resistor is needed on the MISO/MOSI/SCK lines, it should not be stronger than 820Ω, i.e. the resistor should have a value of 820Ω or more.

2.10. Reset Line

As part of checking if the target cable is correctly mounted it will, after V_{TARGET} is applied, check if the reset line has the correct voltage and check if it is possible to force this line low.

If there is no pull-up resistor on the line, i.e. if the Atmel AVRISP mkII detects 0V on reset, then the status LED will blink orange.

If the pull-up resistor on the reset line is too strong, the short circuit protection will trigger when the reset is forced low by the AVRISP mkII.

The Reset line should not have a pull-up stronger (i.e. smaller value) than 4.7kΩ. Any decoupling capacitor should not be larger than 10µF. No decoupling capacitor can be present for PDI programming (refer to XMEGA® Schematic Checklist).

Note:
The AT89 devices that are supported by AVRISP mkII has the opposite reset polarity. If the AVRISP mkII has been used with a Atmel AVR and then connected to a AT89, it may start to blink orange indicating error on reset. When AT89 is selected in the programming dialog and e.g. Read Signature is performed the orange blinking will occur. The same applies to the opposite situation where AT89 is used before an AVR.

3. Command Line Utility

Atmel Studio comes with a command line utility called atprogram that can be used to program targets using the Atmel AVRISP mkII. During the Atmel Studio installation a shortcut called Atmel Studio 7.0 Command Prompt were created in the Atmel folder on the Start menu. By double clicking this shortcut a command prompt will be opened and programming commands can be entered. The command line utility is installed in the Atmel Studio installation path in the folder Atmel/Atmel Studio 7.0/atbackend/.

To get more help on the command line utility type the command:

```
atprogram --help
```

4. Troubleshooting

4.1. Troubleshooting Guide

Table 4-1. Troubleshooting Guide

Number	Problem	Reason	Solution
1	Can't connect to Atmel AVRISP mkII from PC, the green USB status LED is not lit.	USB cable is not connected.	Connect an USB cable between Atmel AVRISP mkII and PC.
2	Can't connect to Atmel AVRISP mkII from PC, the green USB status LED is not lit, and point 1 is OK.	USB driver is not installed properly.	Install USB driver as described in USB Setup.
3	AVRISP mkII status LED is blinking orange.	ISP cable is not mounted correctly.	Check that the red stripe on the cable is mating pin 1 on the ISP header. See more in Target Interface on page 8.
4	AVRISP mkII status LED is blinking orange in spite of correct ISP cable connection.	There is a problem on the reset line.	Check that the reset has a proper pull-up. Read more about Reset Line on page 10.
5	AVRISP mkII reports short-circuit on the target.	The ISP cable is not mounted correctly, or some of the target pins are shorted to GND or V_{CC}, or they are too heavily loaded.	Check point 3, and check for short circuits. Also check that the pull-up on the target lines are not to strong. See further details in Target Interface on page 8.
6	Can't detect target.	The SPI interface on the target is disabled because the SPI fuse is not programmed, and/or RSTDSBL or DWEN fuse is programmed.	If the ISP interface is disabled by fuse settings, one have to use another programming interface to reset these fuses. Check the device datasheet for further details on fuse settings and programming interface. Atmel STK500 and Atmel STK600 can be used for High Voltage Parallel Programming, and JTAGICE mkII can be used for JTAG programming.
7	Detects target, but can't enter prog mode or programming fails.	The ISP frequency is high.	Lower the ISP frequency. The ISP frequency is dependent on the target clock. Read more about this in the Atmel Studio user guide.

Number	Problem	Reason	Solution
8	AVRISP mkII will not work correctly with STK500.	Pull-up on STK500 is to strong.	The pull-up on STK500 is too strong. Remove the reset jumper on STK500.
9	AVRISP mkII reports that the ISP cable is not mounted correctly, and the LED is blinking orange.	A parameter is not set in the AVRISP mkII firmware.	Upgrade to firmware revision higher than 01.06 if production date of AVRISP mkII is from 20071012 to 20080130. The production date can be found on the bottom side of the AVRISP mkII enclosure as shown in February 8th, 2008 - AVR Studio installation package - FW 01.09 on page 6.

4.2. Manual Firmware Upgrade

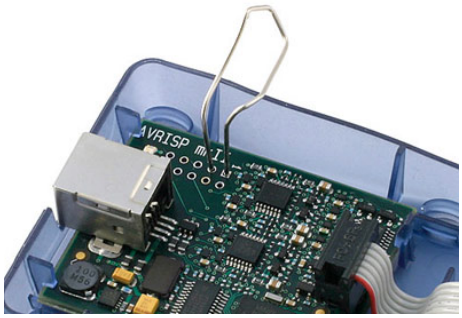
Firmware upgrade is handled automatically by Atmel Studio, if the firmware distributed with Atmel Studio is newer than the firmware loaded into the Atmel AVRISP mkII.

However, the AVRISP mkII can stop responding to firmware upgrading if the firmware on the AVRISP mkII is corrupted. Corruption of the firmware can happen if the communication between the AVRISP mkII and the PC is broken during firmware upgrading or if the firmware in the AVRISP mkII is re-programmed with the wrong file. Read more on this issue in Atmel Studio Firmware Upgrade.

Follow the steps below to manually upgrade the AVRISP mkII. This procedure should work in all cases:

1. Disconnect the AVRISP mkII from target.
2. Unplug the USB cable.
3. Open the AVRISP mkII by pressing on the four plastic clips that holds the top and bottom parts of the enclosure together.
4. Short-circuit pin 1 and pin 3 on the pinholes next to the AVRISP mkII silk-print on the PCB. See Figure 4-1 Manual Firmware Upgrade Jumper on page 14.
5. Insert the USB cable. The AVRISP mkII should now start blink red and orange.
6. Proceed with a firmware upgrade as described in Atmel Studio Firmware Upgrade.
7. When the upgrade is finished, remove the short circuit between pin 1 and pin 3 on the AVRISP mkII.
8. Toggle AVRISP mkII power by unplug and re-insert the USB cable.
9. Press the "Close" button.

Figure 4-1. Manual Firmware Upgrade Jumper



4.3. Technical Support

For technical support contact avr@atmel.com. When requesting technical support for Atmel AVRISP mkII include the following information:

- Version number of Atmel Studio. This can be found in Atmel Studio menu "Help → About".
- PC processor type and speed
- PC operating system and version
- What target Atmel AVR device is used (Complete part number)
- Fuse settings on the AVR
- Target clock frequency
- If `CLKPR` (Clock Prescaler Register) is used (for AVRs with this feature)
- Target voltage
- Programming speed, ISP frequency
- A detailed description of the problem, and how to recreate it
- Any error or waring information generated by Atmel Studio when the error occurred

5. Revision History

Doc. Rev	Date	Comments
42093B	01/2016	Completely reworked user guide
42093A	07/2013	Initial document release

6. Evaluation Board/kit Important Notice

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