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Connecting to a target board with the AVR JTAGICE mkII

Introduction

JTAGICE mkII is Atmel's on-chip debugging tool for the AVR® microcontroller family. The JTAGICE mkII supports debugging with AVR's traditional JTAG interface and with the debugWIRE interface. The JTAGICE mkII supports PC communication via RS-232 and USB.

The JTAGICE mkII is supported by AVR Studio version 4.09 and later.

Connecting to target through the debugWIRE interface

The debugWIRE interface uses only one pin, the RESET pin, for communication with the target. To enable the debugWIRE interface on an AVR Device, the debugWIRE Enable fuse, DWEN, must be programmed (DWEN=0).

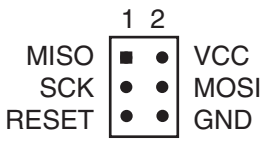
AVR devices with debugWIRE interface are shipped with the DWEN fuse unprogrammed. ISP or High-Voltage Programming is required to enable debugWIRE. Programming the fuse via ISP requires an ISP header on the target board. Using the 6-pin ISP header as shown in Figure 1 is recommended.

The JTAGICE mkII supports ISP as a general programming interface, as well as having built in support for handling the DWEN fuse and performing the Chip Erase when debugging. ISP is also supported by Atmel's STK500 and AVRISP mkII. See the relevant user guides for more information. All user guides are found in the AVR Studio Online help.

The recommended connection when the JTAGICE mkII is used for both debugWIRE and limited ISP, is the ISP6PIN header. See Figure 1, Figure 2 on page 2 and Table 1 on page 2.

Note: When the DWEN fuse is set, the ISP interface is disabled. This is because the debugWIRE must have full control over the RESET pin.

Figure 1. ISP6PIN header pinout



ISP6PIN

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JTAGICE mkII Quick Start Guide

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The connection between the JTAGICE mkII probe and the 6-pin header on the target is described in Table 1.

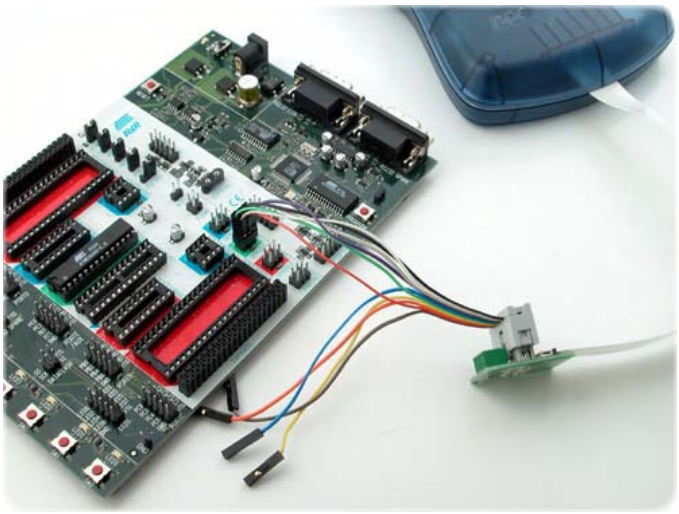
Table 1. Connections required for ISP and debugWIRE

JTAGICE mkII probe	ISP6PIN header	ISP	debugWIRE
Pin 1 (TCK)	Pin 3 SCK	x	
Pin 2 (GND)	Pin 6 GND	x	x
Pin 3 (TDO)	Pin 1 MISO	x	
Pin 4 (VTref)	Pin 2 V_{CC}	x	x
Pin 6 (nSRST)	Pin 5 RESET	x	x
Pin 9 (TDI)	Pin 4 MOSI	x	

Once the DWEN fuse is programmed by ISP, there is only need for the GND, VTref, and RESET lines when using the debugWIRE interface, thus the JTAGICE mkII will set lines TCK, TDO and TDI to high impedance. The user can choose whether to disconnect the three unused lines.

Note: Some precautions regarding the RESET line should be taken to ensure proper communication via the debugWIRE interface. Pull-up resistors on the RESET line must not be smaller than 10KΩ (the pull-up resistor is not required for debugWIRE functionality), and there should be no capacitive load (besides the one created by the line itself). Other logic connected to the RESET line should be removed during debugging.

Figure 2. Connecting JTAGICE mkII probe to 6-pin ISP header using the squid cable



Enabling debugWIRE interface with JTAGICE mkII

Enabling the debugWIRE interface is either done via ISP or High-Voltage programming. JTAGICE mkII supports DWEN handling via ISP only.

Connect the JTAGICE mkII to the target. When starting a debugWIRE debugging session, the JTAGICE mkII assumes that debugWIRE is enabled. If debugWIRE is not enabled (DWEN fuse disabled), a dialog window in AVR Studio will offer you to enable the interface via JTAGICE mkII. Note that this requires all six pins connected as described in Table 1. Once the DWEN fuse is programmed, only three pins are needed for further debugging the microcontroller.

Connecting to the target through the ISP Interface

Connecting to the ISP interface is described in the section documenting the debugWIRE connection.

Re-enabling the ISP interface

When the DWEN fuse is enabled the ISP interface is disabled in order to have full control over the RESET pin. Enabling the ISP interface again will disable the debugWIRE interface:

1. Connect the JTAGICE mkII to the target ISP header.
2. From within a debug session, open "JTAGICE mkII Options" found in the “Debug”-menu in AVR Studio and select the "Connections" tab
3. Click on the button "disable debugWIRE". Now the ISP interface is enabled and debugWIRE interface disabled.

Connecting to the target through the JTAG interface

At least 6 wires are required to connect the JTAGICE mkII to the target application. These signals are TCK, TDO, TDI, TMS, VTref and GND.

Optional line is the nSRST. The nTRST signal is not used, and is reserved for compatibility with other equipment.

nSRST is used to control and monitor the target reset line - this is not necessary for correct emulation. However if the application code sets the JTD bit in the MCUCSR, the JTAG interface will be disabled. In order for the JTAGICE mkII to be able to re-program the target AVR, it will need to have control of the RESET Pin. Note that the nSRST line is pulled high internally by a 10 KΩ load.

Figure 3 and Table 2 on page 4 show which JTAG lines should be connected to the target AVR to ensure correct operation. To avoid drive contention on the signal lines it is recommended that series resistors are placed between the JTAG lines and any external circuitry. The value of the resistor should be chosen so that the external circuitry and the AVR do not exceed their maximum ratings (i.e. sink or source too much current).

Figure 3. JTAG10PIN connector

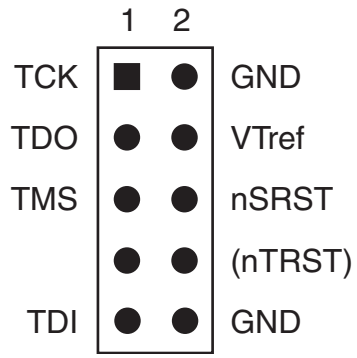


Table 2. JTAG Connections

Pin	Signal	I/O	Description
1	TCK	Output	Test Clock, clock signal from JTAGICE mkII to target JTAG port
2	GND	-	Ground
3	TDO	Input	Test Data Output, data signal from target JTAG port to JTAGICE mkII
4	VTref	Input	Target reference voltage. Also used to power level converter inputs.
5	TMS	Output	Test Mode Select, mode select signal from JTAGICE mkII to target JTAG port
6	nSRST	Out-/In-put	Open collector output from adapter to the target system reset. This pin is also an input to the adapter so that the reset initiated on the target application board may be reported to the JTAGICE mkII
7	-	-	Not connected
8	nTRST	NC(Output)	Not connected, reserved for compatibility with other equipment (JTAG port reset)
9	TDI	Output	Test Data Input, data signal from JTAGICE mkII to target JTAG port
10	GND	-	Ground

Connecting the JTAGICE mkII to AVR Studio

Before starting AVR Studio, the JTAGICE mkII must be connected between the front end PC and the target board. All connections must be made before starting AVR Studio to ensure correct auto-detection by AVR Studio.

The JTAGICE mkII uses a standard RS-232 port for communication. Connect the RS-232 cable between the JTAGICE mkII and a free COM port on the PC. The power supply voltage should be between 9 and 12 Volts.

Alternatively, the JTAGICE mkII can be connected to the PC with a USB cable, making an external power supply superfluous.

Supported Devices

See the JTAGICE mkII “Related devices” list on www.atmel.com/avr, or use the AVR Studio On-line Help for the most updated device list.

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