

JTAGcable I

In Circuit Emulator for
Atmel AVR microcontrollers

User's Guide

Introduction

Thank you for buying our JTAGcable I emulator. We hope that the great power it offers will allow you to appreciate fully the virtues of debugging and programming in the system provided by Atmel microcontrollers.

JTAGcable I constitutes a tool for programming, real-time emulation in the target circuit and debugging of processors of the AVR family of Atmel microprocessors equipped with a JTAG interface. It is fully compatible with the original AVR JTAG ICE from Atmel. It forms, together with AVRStudio software, an up-to-date and professional environment for the start-up of programs written both in low-level (Assembler) and high-level (C) languages.

JTAG is a four-wire interface permitting takeover of control of the processor's core and its internal peripherals. The possibilities offered by this interface are, among others, stepped operation, operation at full speed, circuit and software traps, monitoring and modification of register contents and data memories. Moreover, functions offered by ISP programmers are available, such as: programming and read-out of Flash memories, EEPROM, fuse-and-lock bits.

JTAGcable I can co-operate with microcontrollers supplied with voltages from 1.8 to 6 V. Such a broad range of supply voltages was achieved through buffering of signals on the JTAG line, additionally enhancing the immunity of the circuit to interference. The set is provided with AVRStudio software from Atmel, working in the Windows system.

A detailed operating instruction of the emulator and of the AVRStudio program can be found at the website of Atmel: <http://www.atmel.com>

Let us wish you nothing but success and a lot of satisfaction in designing and putting new microprocessor devices to work.

Features

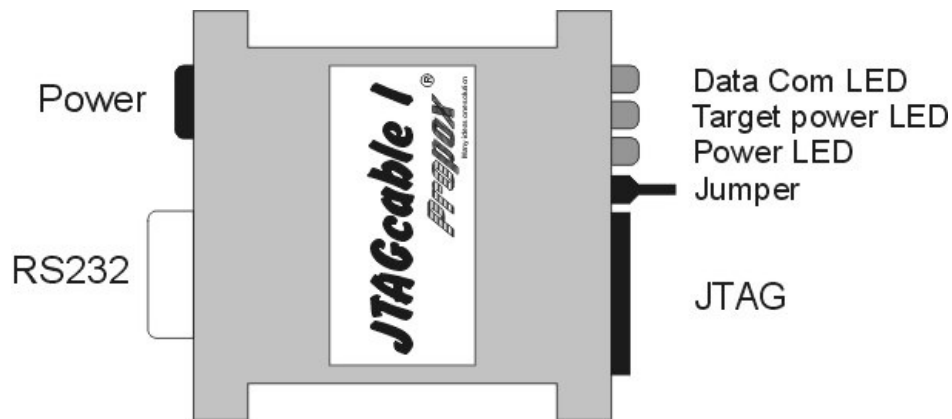
- Compatible with AVR JTAG ICE
- Co-operates with Atmel AVRStudio software
- Allows emulation and programming in AVR microprocessor systems equipped with a JTAG interface
- Allows debugging of a code written both in Assembler- and C-language
- Connected to the RS232 standard serial port
- Supports software up-dating from the AVRStudio level
- Operates with target voltages in the range of 1.8 – 6 V
- Buffering of the JTAG bus, allowing proper operation with systems powered from a broad range of supply voltages and enhancing immunity to external interference
- Standard 10-pin connector to the target circuit in the Atmel standard
- Operation of the emulator signalled by three built-in LED indicators
- The programmer can be supplied from the target circuit or from an external source
- Small dimensions

Supported devices

Below is a list of devices supported by the emulator. As new devices appear, the list is going to be modified. The current list is always available in the AVRStudio program.

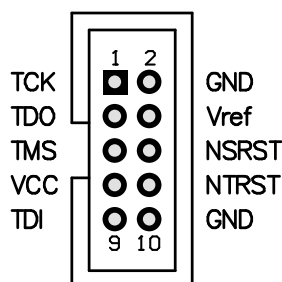
- ATmega128, ATmega128L, AT90CAN128
- ATmega64, ATmega64L
- ATmega32, ATmega32L
- ATmega323, ATmega323L
- ATmega16, ATmega16L
- ATmega162, ATmega162L, ATmega162V
- ATmega165, ATmega165V
- ATmega169, ATmega169L, ATmega169V

Description of the emulator



Power	- External supply for the programmer
RS232	- 9 D-Sub female connector for connection with the serial port of the PC
Power LED	- Signalling the application of supply voltage to emulator
Target Power LED	- Signalling the application of supply voltage to the target device
Data Com LED	- Signalling communication with the target device
Jumper	- Choice of the supply source. Jumper closed when supplying from the target device
JTAG	- 10-pin JTAG connector to the target device

DESCRIPTION OF TERMINALS



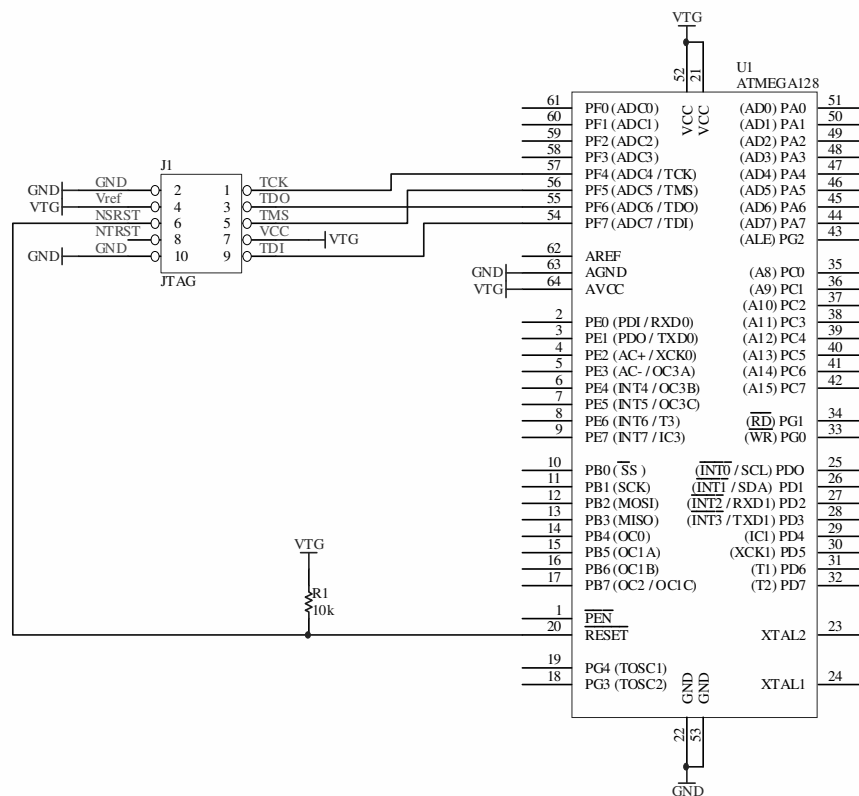
Emulator JTAG connector

TCK	Test Clock – clock signal for the target circuit
TDO	Test Data Output – data signal for the target circuit
TMS	Test Mode Select – switching signal for the target circuit
VCC	Power supply from target circuit
TDI	Test Data Input – data signal from the target circuit
Vref	Line signalling the presence of supply voltage in the target circuit
NSRST	Reset input/output of target circuit
NTRST	Not used
GND	Programmer ground

The JTAG connector is compatible with the 10-pin standard from Atmel.

Connection with the target circuit

The connection to the target circuit should be realized through the attached 10-lead ribbon cable, terminated with standard IDC plugs with 2.54 mm raster. In case of using another cable it should be kept in mind that it should not be longer than 30 cm (~12 inches). The target device should be equipped with a JTAG connector with lead-out identical to that of the emulator JTAG connector. We connect the JTAG bus lines with their corresponding JTAG bus lines of the microcontroller as shown in the figure below.



Connection with the ATmega128 microcontroller

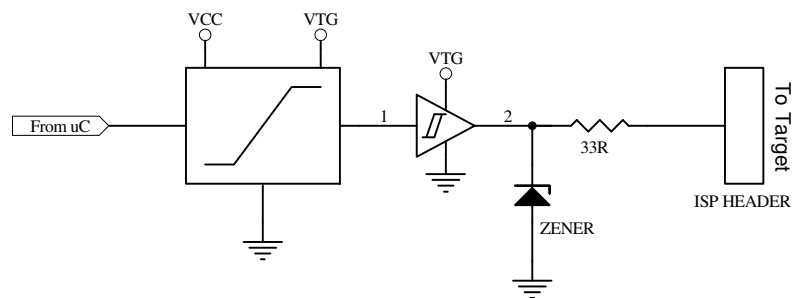
It is necessary to make a suitable adapter, when connecting the JTAGcable I emulator to a target device having a JTAG connector in another standard.

Level converter of JTAG signals

In order to assure proper operation of the emulator when the supply voltages of the target circuit differ from the emulator's supply voltage, level converters of JTAG signals come into use. The conversion circuits have been designed for operation with a target circuit supplied from a voltage between 1.8 and 6 V.

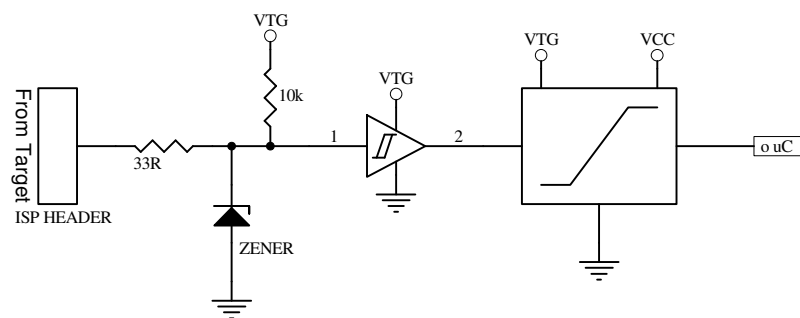
The JTAGcable I can be supplied from an external source or directly from the target circuit. In the last case, the supply voltage should have a value between 4.5 and 5.5 V.

Signals between the programmer and the target circuit can be divided into three groups: input signals (TDO), output (TCK, TMS, TDI) and input/output (NSRST). Besides regenerating JTAG bus signals, the signal level converter buffers limit the input and output currents. Buffering has been applied on all signal lines of the emulator. The implementation of a signal level converter for output lines has been shown in the figure below.



Voltage level converter (outputs)

The implementation of a signal level converter in the input line of the MISO programmer is shown below.



Voltage level converter (input)

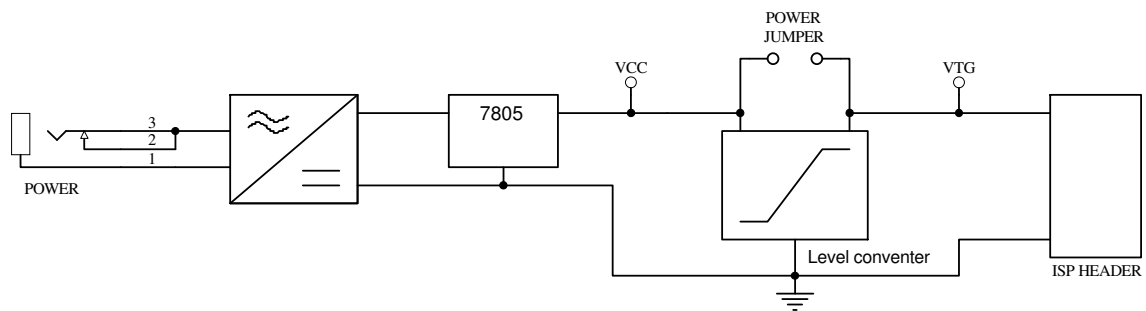
The implementation of a bi-directional level converter is a combination of solutions shown above.

Supplying the emulator

The emulator can be supplied in two ways:

- Through the JTAG connector. In this case the supply voltage of the VTG system should be contained in the range 4.5 to 5.5 V. The jumper inside the programmer should be closed, and the external power supply should be disconnected. The supply current drawn by the programmer is max. 50 mA.
- Through the POWER connector on the emulator. In this case the supply voltage of the target system should be contained in the range 1.8 to 6 V. The jumper inside the programmer remains open. The programmer should be supplied through a 2.5 mm plug with a voltage of 9 – 15 V DC or 7 – 13 V AC. When feeding the programmer from a DC source, the polarization is irrelevant.

The implementation of the supply circuit of the emulator is shown below.



Supply circuit of the emulator

Technical data

Dimensions	: 55 x 53 x 16 mm
Weight	: about 0.1 kg
Connection to the PC	: Serial port 9-pin SUB, female
Transmission speed	: max. 115200 bps
Programming cable	: length 30 cm
JTAG clock frequency	: max. 250 kHz
Target circuit supply voltage	: VTG 1.8 – 6.0 V
Supply voltages	: requires feeding from the target circuit or externally
	from the target circuit
	VTG 4.5 – 5.5 V I_s max. 50 mA
	from an external supply source
	V_{power} 9 – 15 V DC; 7 – 12 V AC, I_p max. 50 mA
	VTG 1.8 – 6.0 V I_s max. 5 mA

Contents of delivery package

- JTAGcable I emulator
- Cable terminated with IDC 10 plugs for connection of the emulator with the target circuit
- RS232 cable for connection of the emulator with a PC
- CD with documentation and software

Technical assistance

In order to obtain technical assistance, please contact support@propox.com

Please provide the following data:

- Clock frequency and type of processor in the PC
- Version of the operating system
- Processor type (complete number of the device) and oscillator's frequency
- Detailed description of the problem