AVR®

AVR USB ISP

Fast ISP for AVR with JTAG

- **Fast:**
  Uses USB port

- **Flexible:**
  Custom
  Configuration
  for individual
  Programmers

- **Easy operation:**
  Auto-program

- **Comprehensive:**
  Complete fuse
  and lockbit
  programming

- **Convienient:**
  serial numbering
  and controllable
  via DLL

- **Voltage:**
  1.8V - 5V

- **JTAG adapter**
  and software
  included

- **Windows**
  98/2000/ME/XP
  VISTA/WIN7
  32 and 64Bit

Install:

1. Install software
2. Plug in
   programmer
3. Run AVR USB

If this procedure
is followed,
Windows will
automatically
detect program-
mer/programmers.

Order Code
AVRUSB

Why AVRUSB?

Why use the AVRUSB? The USB port can operate at up to 1Mbits/sec giving you vastly increased programming times. Using a hub, multiple units can be run from one PC. The AVRUSB has JTAG programming option and free DLL and comman-dline versions, plus a host of production features - serial numbering, Plug and Prog, Checksums etc.

Serial Programming (ISP) or JTAG

The programmer software gives a choice of programming methods, either using standard ISP - Serial Programming - or JTAG programming. The software installation and PC connection to the programmer remain the same whichever programming method is used.
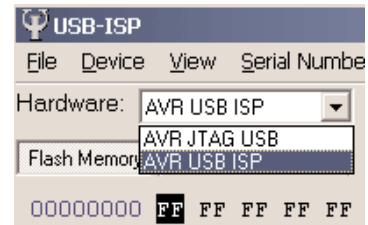
Serial Programming
- Uses standard ISP interface
- All AVR devices are supported including AT90S and ATtiny
- No adapter needed

JTAG Programming
- Uses JTAG interface - same as ICE
- Faster programming speeds
- Only ATmega devices with more than 40 pins are supported
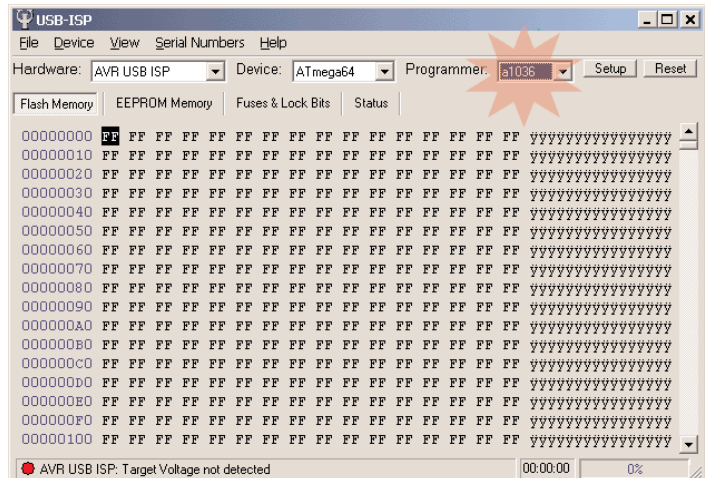
Selecting Programming Method

There is a drop down box at the top left of the screen, shown in the picture. Select the option you require, either ISP or JTAG. If you select JTAG, the adapter supplied with the programmer must be connected to the end of the program-mer lead, NOT directly into the programmer..

The rest of this page and page 2 apply to both methods. Interface descriptions for the two methods are given on page 3.

The User Interface

The user interface has been carefully designed to provide "easy operation". The AVR USB ISP automatically shows all the programmers connected to the USB and you just select the matching ID number in the drop down list. Then select the device type from a list and load flash and EEPROM files (Intel Hex, Motorola S-Record etc.). The status of the programmer is clearly shown, and errors are highlighted in red. The Flash and EPROM buffers are editable in ASCII or Hex and Check Sums are supported.

Fuses and Lockbits

One of the great features of the AVR are the customisable fuses and lockbits. The AVR USB ISP fully supports programming off all lockbits, including the new extensions for self programming in the Atmega163. Most AVR devices also feature fuse bits which can be used to change the behaviour of on-board peripherals, startup times, watchdog configuration, brown-out settings etc. Programming or reading the fuse and lockbits is very simple on the programmer. The fuse and lock bits screen pictured changes to match the selected device, so only the fuses available on that device are displayed. Simple check boxes are used to set or clear Fuses. There is a second Tab on the right for Lockbits.

Note: it is possible to lock the device by setting incorrect options especially on clock bits if the target circuit does not support them.
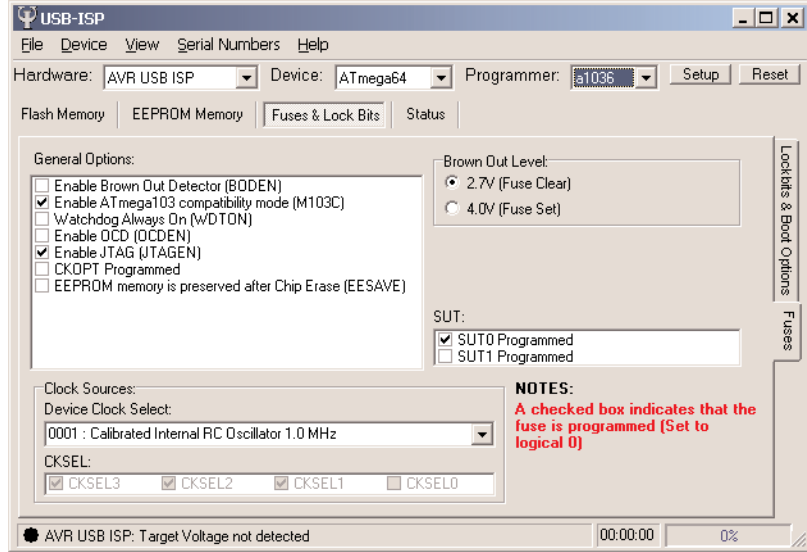
Multiple Programmers

In both the development and production environments, the ability to have more than one programmer connected to a single PC is beneficial. With the AVRUSB, more than one programmer can be run from one PC. Each Programmer is detected automatically by the software and is displayed in a drop-down list. The ID No identifies the programmer and matches the number written on every programmer. Each programmer has its own software interface and can be loaded with separate files or set to support different devices.

Programmers can be run from 1 interface or each can have its own screen. Up to 127 programmers can be theorectically run from one PC, but the practical limit is how many programmer screens can be displayed.
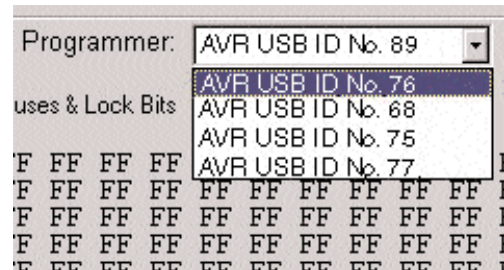
Production Programming

As well as being ideally suited for the development environment the AVRUSB has some added extras for use on a production line.

- Auto-program facility allows you to perform a complete erase/program/verify cycle with a single click
- Auto-detection facility allows the auto-program cycle to begin automatically as soon as the programmer is inserted for faster programming times and less operator intervention.
- User intervention on error - if selected, the user must reset the programmer on the PC if an error occurs, which stops errors being ignored
- Programming errors are shown by a red LED on the programmer and on the PC screen, where more information is given.

Serial Numbers

Serial numbering facilities are included for QA and other purposes. A 2, 4 or 8-byte serial number can be written to a user defined location in Flash or EEPROM. The serial number can be set to auto-increment.

DLL Version

A DLL version of the software is available for integration into existing systems, which use Visual Basic, Delphi, Visual C++, Labview or a Command Line. Please visit support pages and see Software Downloads.

Serial Interface

See Page 5 and 6 for programmer and end of lead views

This is the target view of the ISP interface. Vcc and all GND lines should be connected to the header to provide a voltage reference for the programmer. This enables the programmer to support target voltages from 1.8V to 5V. The target must be powered (from 1.8-5V) as the USB bus cannot supply enough current especially if multiple programmers are connected. The programmer runs at 5V and needs a reference voltage from the target to set programming voltage to match it.

MISO	SCK	RESET	LED	MOSI
9	7	5	3	1
10	8	6	4	2
GND	GND	GND	GND	Vcc
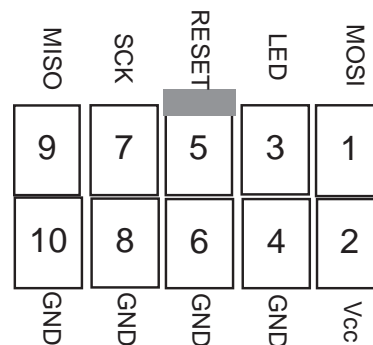
JTAG Interface

This is the target view of the JTAG interface. Vcc and at least one GND line must be connected to the header to provide a voltage reference for the programmer. This enables the programmer to support target voltages from 1.8V to 5V. The target must be powered (from 1.8-5V) as the USB bus cannot supply enough current especially if multiple programmers are connected. The programmer runs at 5V and needs a reference voltage from the target to set programming voltage to match it.

TCK	1	2	GND
TDO	3	4	V Tref
TMS	5	6	nSRST
Vsup	7	8	TRST
TDI	9	10	GND
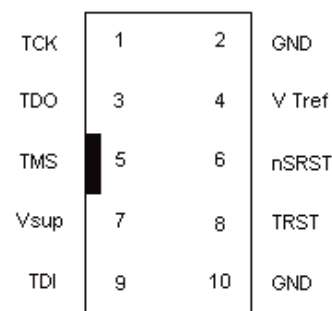
JTAG Adapter

The Adapter supplied is fitted to the end of the programmer 10-way lead, NOT directly into the programmer. Plug the programmer 10-way lead into the box header on the adapter, and plug the other end into your JTAG interface on the target.

JTAG Device Support

Only newer AVR devices with 40 pins or more have the JTAG interface, so other AVR devices will need to be serial programmed. See our website for latest device support.

Supported Devices with JTAG

- AT90CAN128
- ATmega128
- ATmega1280
- ATmega1281
- ATmega16
- ATmega162
- ATmega164

- ATmega165
- ATmega169
- ATmega2560
- ATmega2561
- ATmega32
- ATmega323

- ATmega324
- ATmega325
- ATmega3250
- ATmega329
- ATmega3290
- ATmega64

- ATmega640
- ATmega644
- ATmega645
- ATmega6450
- ATmega649
- ATmega6490

Low Voltage variants are supported down to 1.8V. New devices will be supported as they are released.

JTAG Programming Speeds

	Serial	JTAG
ATmega128 Flash Read	21s	13s
ATmega128 Flash Write	16s	8s
ATmega128 EEPROM Read	1s	2s
ATmega128 EEPROM Write	30s	8s

Windows
98/2000/ME/XP
VISTA/WIN7/WIN8
32 and 64Bit

-USB port required
(win95 and early
Win98 requires
USB update).

The drivers are for
real Plug and Play,
not Virtual Serial
Port

Device Support:
- AT90S
- AT90CAN
- AT90USB
- AT90PWM
- ATtiny
- ATmega

All versions are
supported, down to 1.8
Volts including
L, LS, P, V and PA
Devices

Power Requirements
- Programmer is powered by PC USB port or hub up to a maximum current of 200 mA
- Programmer conforms to USB power requirements, including sleep mode
- Target device must have its own power supply of 1.8 - 5V to match device voltage
- Vcc must be connected to programmer via the programming header Vcc pin to supply voltage level (1.8 - 5V) to programmer as a reference.

USB Specification
- Software drivers are self installed, Plug and Play operation
- Supports USB 1.1 protocol, USB 2.0 Compatible
- Data through-put 1MBit/sec using Direct Driver not Virtual COM Port
- Up to 127 units can be connected to one PC

Physical
- Dimensions Metric: 66 x 66 x 28m, Imperial: 2.6 x 2.6 x 1.1 inches
- Weight: approx 300g (10 oz) complete package
- Programmer USB connector : USB B socket
- Supplied with 1.8m USB A (PC or Hub) to USB B (Programmer) lead
- Can be used with USB extension cables - not supplied
- Programmer target connector: 10-way box header for connecting programming lead
- Supplied with 1m target programming cable with 10-way connector on each end

Software Functions
- Load/Save files in most formats
- Colour coded EEPROM and Flash Buffers can be edited in ASCII or Hex
- Erase, Read, Verify, Program Functions. All Fuse and Lockbits supported
- Comprehensive Check Sum support on EEPROM and Flash - CR16,CR32, XOR16/32
- Auto-program function: select which operations to include in programming cycle
- Serial numbering: user defined locations in Flash or EEPROM with Auto-increment
- Program cycle starts when programmer is connected to powered target
- Full Verify or only Verify pages with data for faster programming cycles

Projects
Projects can be used to save all information in one file- Filenames, fuses, device, serial number, AutoProgram Options and Programmer settings. Projects can be loaded and saved from File menu or called as parameter eg AVRUSB file.prj

Projects can be called via Hyperlinks in programs such as Word.
- Associate .PRJ files with AVRUSB (right click on file and select properties, then Opens with button or double click on file and select AVRUSB in Open With Dialog)
- Create Hyperlink in Word with the project file as target
- Clicking on hyperlink will open AVRUSB and load project.

Error Handling
- Programmer :
  - No Light - Programmer not found by PC
  - Green light - Ready to program. When programmer is plugged in, light will flash if the device is found. If it stays Green, then there is no power, no device or incorrect insertion of device.
  - Flashing Red/Green - Programming in progress
  - Red light - Programming error. If set in software, this will stay Red until programmer is reset on PC even if programmer is disconnected from target.
- PC:
  - Status indicator and error messages - stored in log
  - Pop-up error message feature can be enabled. This forces operator to reset the programmer on PC if programming error occurs

Order Code
AVRUSB

Connection Information

AVR USB is designed to be fast and easy to use, while being resistant to damage from faulty target systems. But like all programmers, it does have some requirements for successful use.

TARGET CONNECTION

The programming cable is designed to connect to a target system with a standard Kanda 10pin ISP connector: For JTAG, plug adapter supplied into end of lead.

Adapters for 6pin connections are available - 10FLEX6 (flying leads) and 10DIL6

TARGET SYSTEM

Both VCC and GND must be connected to the ISP connector. The programmer requires a reference voltage, in order to drive the programming lines to the correct value. No more than 5mA will be drawn from the target system.

MOSI, MISO, CLK, and RESET. These lines must be free to be controlled without contention from other circuitry Any pull-up/pull-down characteristic present at these device pins should be no stronger than that provided by a 1K resistor to VCC/GND. This assumes a direct connection between the programmer and the device (no components in series). That is:
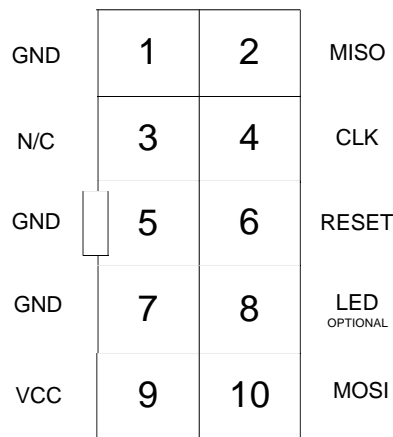
1) The reset pull-up resistor should be 1K or greater in value.
2) Any additional circuitry on port pins used in ISP, should be
   de-coupled by a resistor greater than 1K in value.

Please see APPENDIX B for example circuits.

Connection to the LED pin is optional. It is pulled low by the programmer during programming, so can be used to switch on an indicator LED, or control a multiplexor.

Lead and Programmer connections

If you need to make up you own **cable**, the connection on the programmer is laid out as follows. This is NOT the same as the end of the lead, shown on next page

GND	1	2	MISO
N/C	3	4	CLK
GND	5	6	RESET
GND	7	8	LED OPTIONAL
VCC	9	10	MOSI

TOP VIEW OF THE CONNECTOR ON
THE PROGRAMMER

0.1" PITCH 2*5 BOXHEADER
WITH POLARISING NOTCH

Note that it is rotated, when compared with the target connection.

Kanda.com

web site: www.kanda.com
Phone/Fax: +44 (0)1974 261 273
email: sales@kanda.com

PROGRAMMER CONNECTION FOR JTAG

If you need to make up you own **cable for JTAG Programming**, the connection on the programmer is laid out as follows. This is not the end of the programming lead.

GND	1	2	TDO
TRST	3	4	TMS
GND	5	6	TCK
GND	7	8	NSRST
VCC	9	10	TDI

10-way male connector on Programmer - JTAG Connections.

Note that it is rotated, when compared with the target connection.

End of Lead view for JTAG

If you want to make an adapter for JTAG that connects to the end of the 10-way cable supplied, the pinouts are shown below.

TDI	1	2	GND
Vsup	3	4	TRST
TMS	5	6	nSRST
TDO	7	8	V Tref
TCK	9	10	GND

10-way female connector on end of lead - JTAG connections

End of Lead view for ISP - Serial Programming

If you want to make an adapter for ISP that connects to the end of the 10-way cable supplied, the pinouts are shown below.

MISO	1	2	GND
CLK	3	4	N/C
RESET	5	6	GND
LED OPTIONAL	7	8	GND
MOSI	9	10	VCC

10-way female connector on end of lead - Serial ISP connections

UPDATING THE PROGRAMMER FIRMWARE

The firmware, and an update utility are included as part of the PC software.
Firmware updates are always released as part of a software update.
If the software detects that the programmer has a different firmware version to the one
included with it, you will be prompted to update the firmware. Normally the only time
that the firmware will need reprogramming is when updating to a new software version.
However, the update utility can be run at any time by selecting "Firmware update" from
the help menu - but please use care with this.

WARNING: A firmware update MUST be allowed to complete once started. So go and
make a cup of tea! If a firmware update is incomplete or otherwise unsuccessful, fur-
ther attempts will not be possible. This will leave the programmer nonfunctional.
Should this happen, please contact **support@kanda.com**

Note: 64-bit systems may need Compatibility Mode set for firmware updater

Appendix A

USING STK300 with AVR USB.

The original design of the STK300 reset circuit does not comply with the requirements
of AVR USB. To use AVR USB with older STK300's , a small modification to the
STK300 is required.
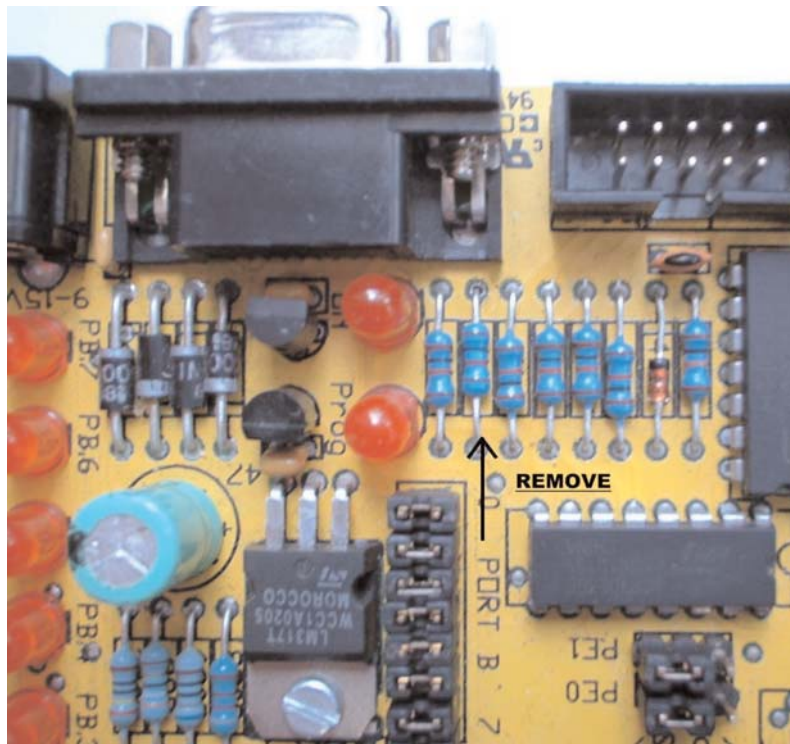
Check the value of the resistor indicated by the arrow.
If the value is 1K, it should be removed.

STK200's require no modification.

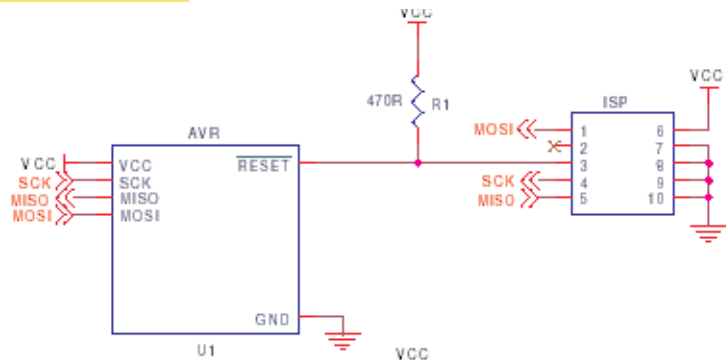## GENERAL

Examples apply to all programming lines
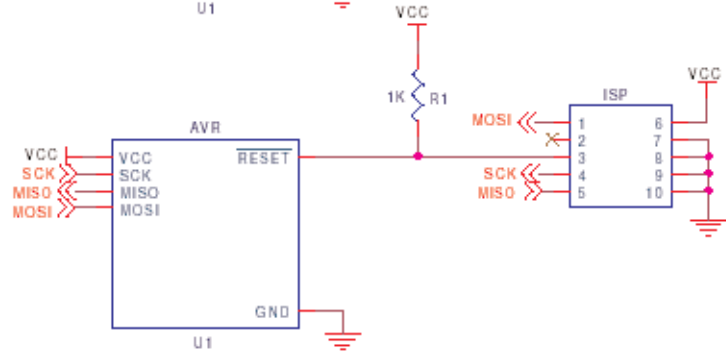(MOSI,MISO,SCK and RESET). Applies
equally to pulldown resistors.

NO

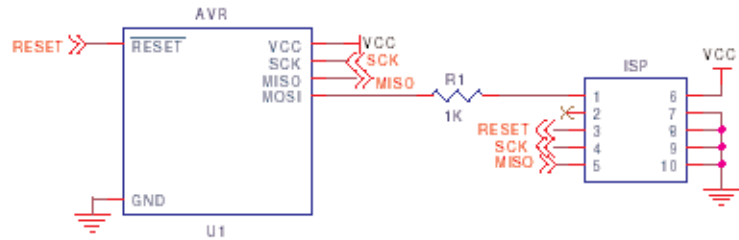The Pull-up resisitor, R1, is too strong.

YES

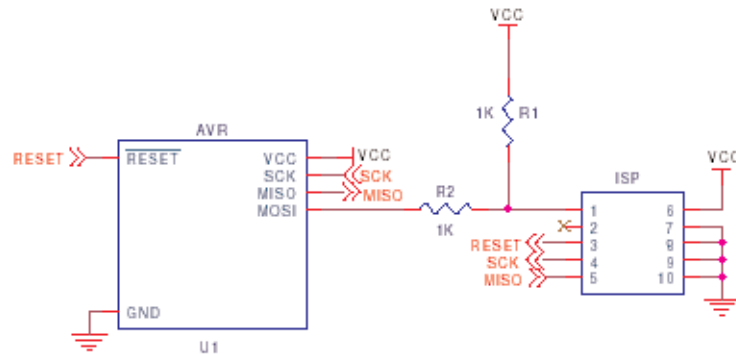The Pull-up resisitor, R1, is no stronger
than 1K

YES

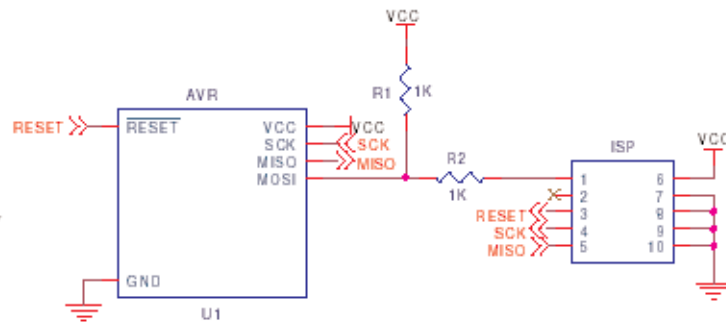A resistor in series; by its's self,
will have no effect.

YES

Again, the series resistor will
have no effect.

NO

This is a potential problem. As the series
resistor will weaken the programmer's ability
to act on the programming line.

web site: www.kanda.com
Phone/Fax: +44 (0)1974 261 273
email: sales@kanda.com

APPLICATION
CIRCUIT USING
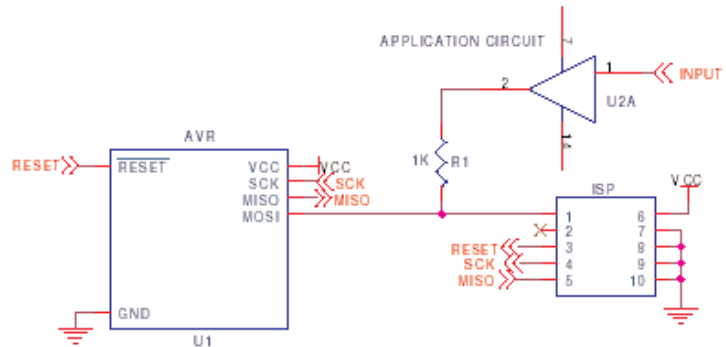# ISP PORT PINS

NO

Here, the aplication uses PB5 as an INPUT to read the output of U2. The state of the line is held by U2.
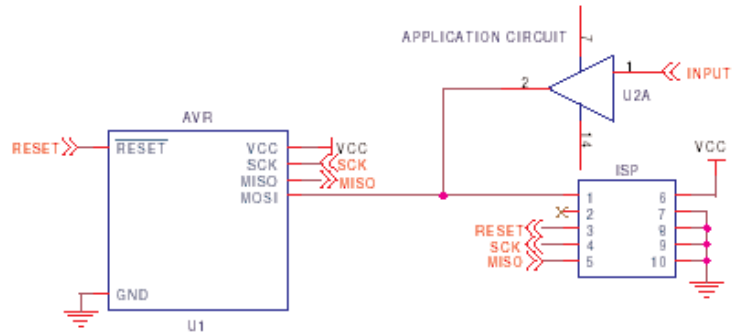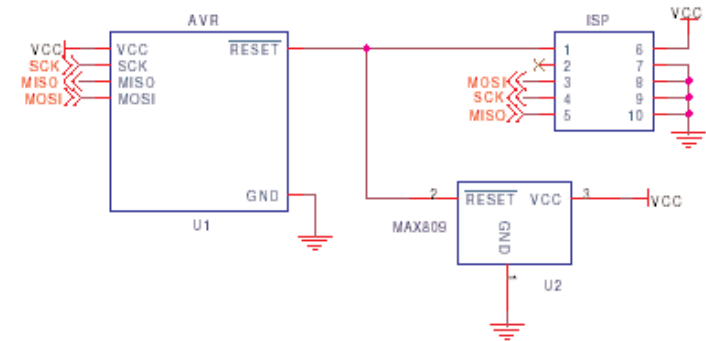
YES

Again, PB5 is used as an INPUT to read the output of U2, but this time; The output of U2 is sufficiently decoupled by R1
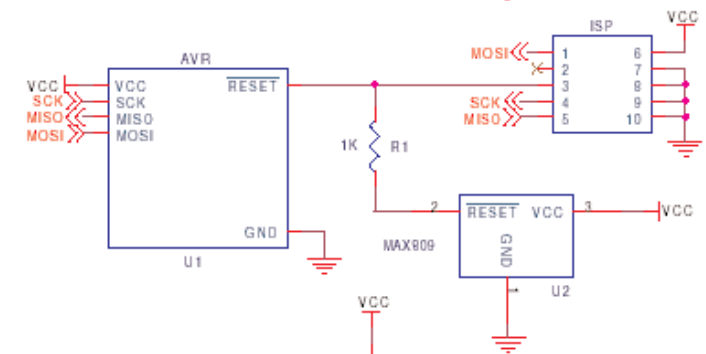
RESET IC's

NO

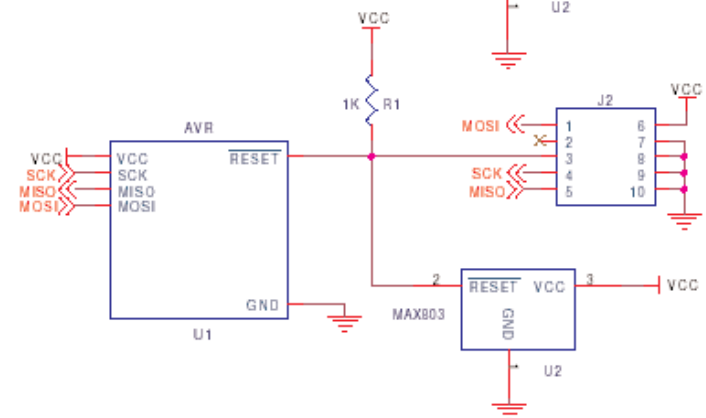The commonly used brown-out IC MAX809 as a PUSH-PULL output. It will hold the RESET line high.

YES

YES

The MAX803 IC is equivalent to the MAX809 - BUT as an OPEN DRAIN output.