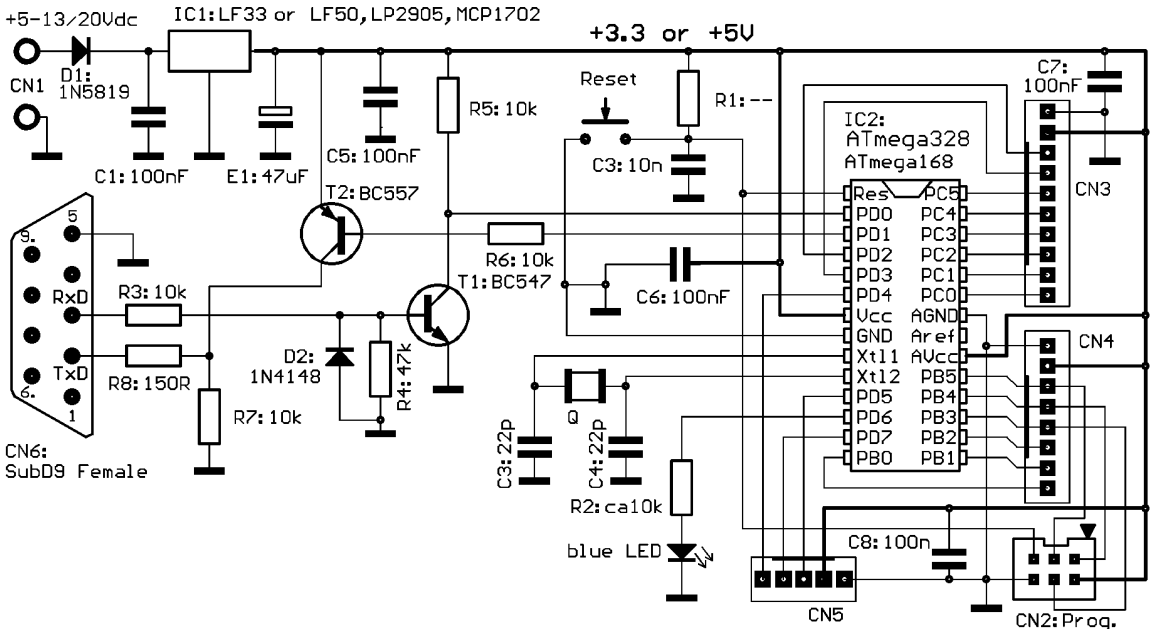
Avise5 DIY Construction Manual

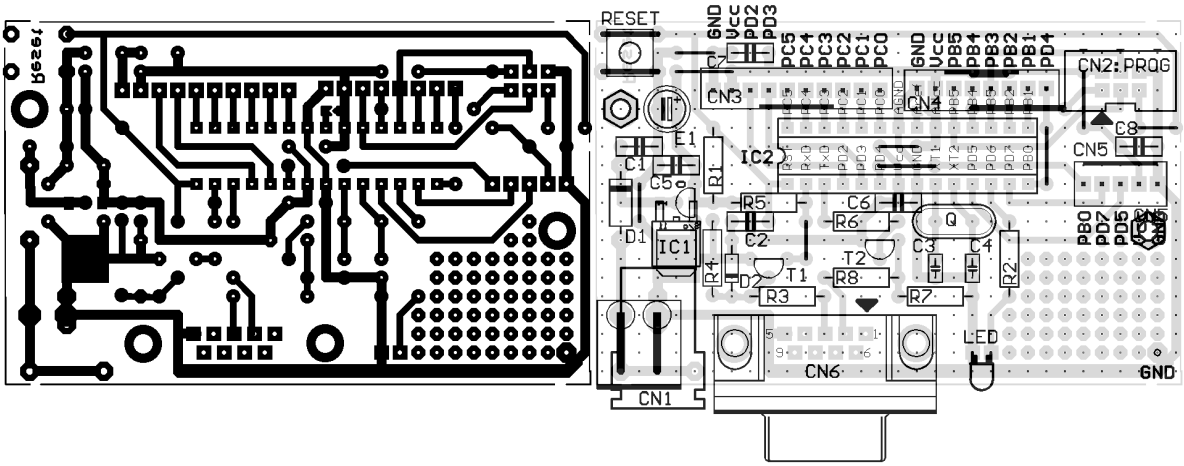
 17 September 2023

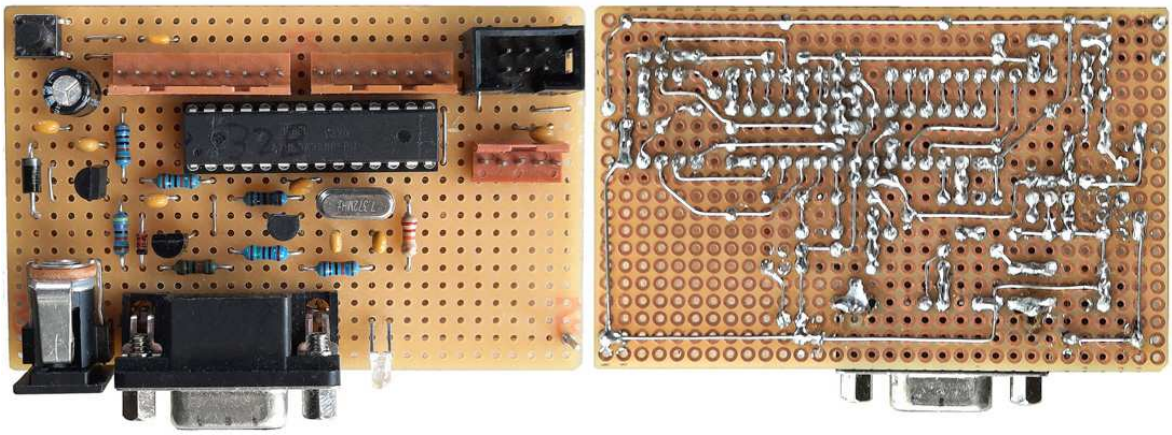
A set of circuits for ATmega168/328 (28p DIL / 32p TQFP) and ATmega644/1284/32 (40pDIL) is described here

Because it is complicated to etch PCBs without appropriate tools, Veroboard compatible layouts are developed, but can be etched as 1 layer PCB, too.

Hardware for ATmega168/328 (28p DIL)

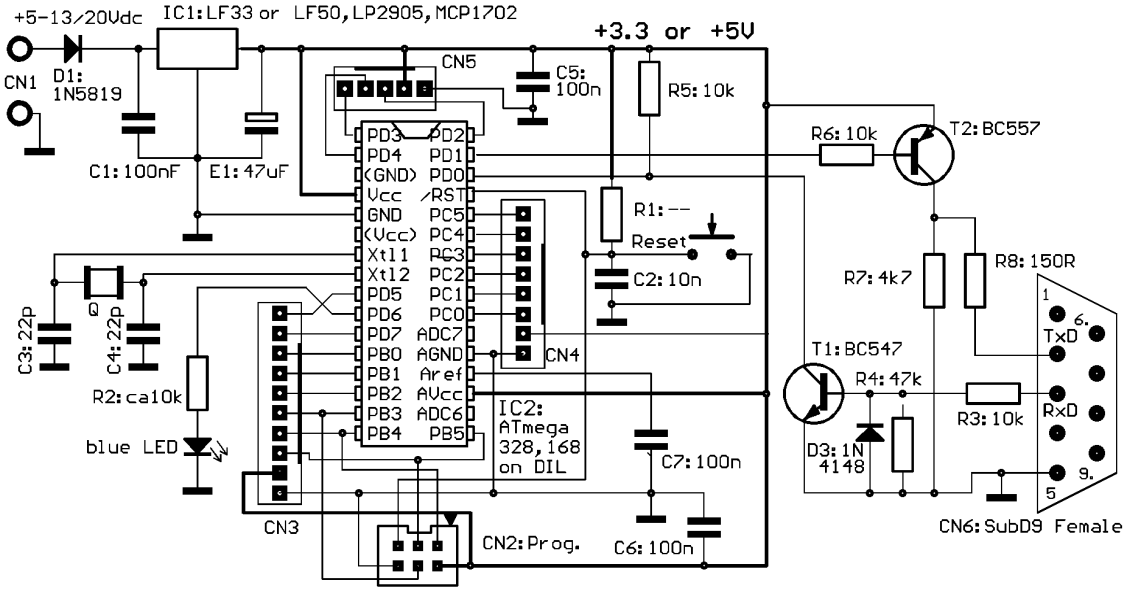


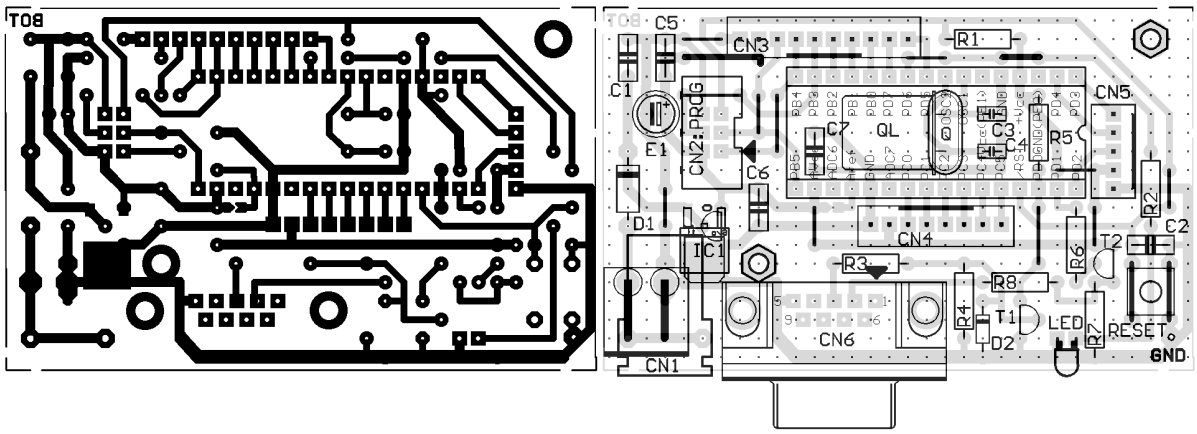


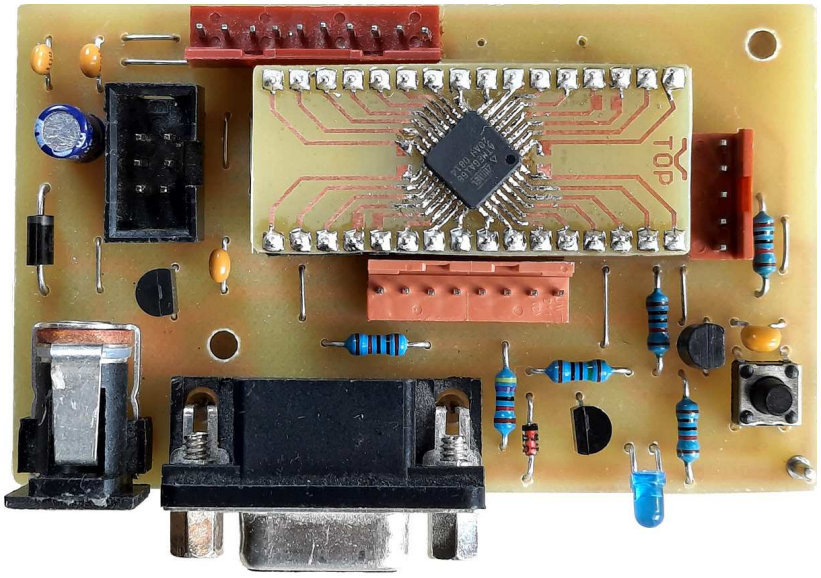


Hardware for ATmega168 and ATmega328 (32p TQFP)

Because DIL devices are hard to get at this time, an alternative with 32p TQFP processor **mounted on 32p DIL breakout socket is presented with Veroboard compatible wiring** layout. The breakout boards are commercially available. So it is not necessary to etch a PCB, though this prototype is built on "bathroom" made PCBs.

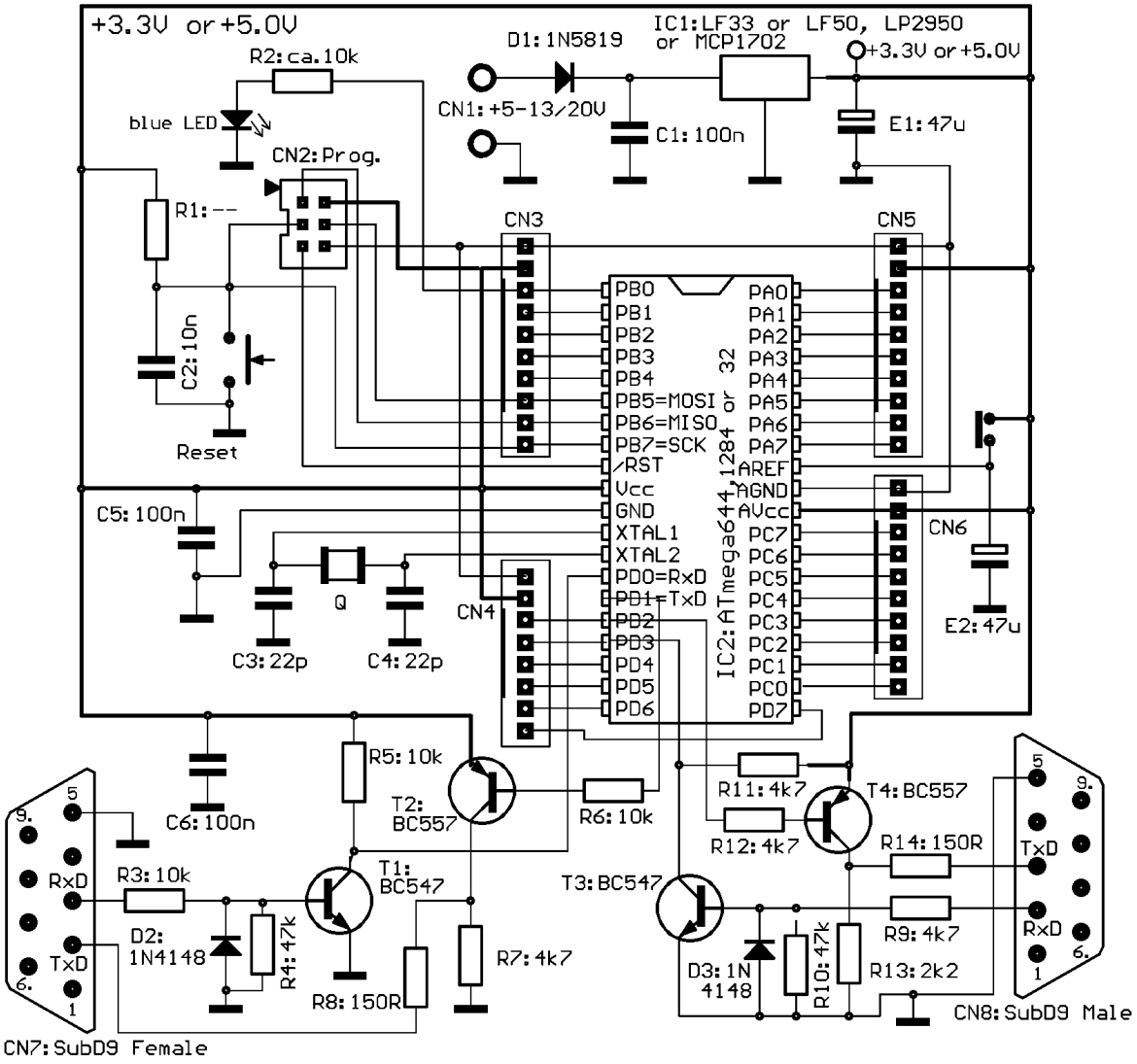




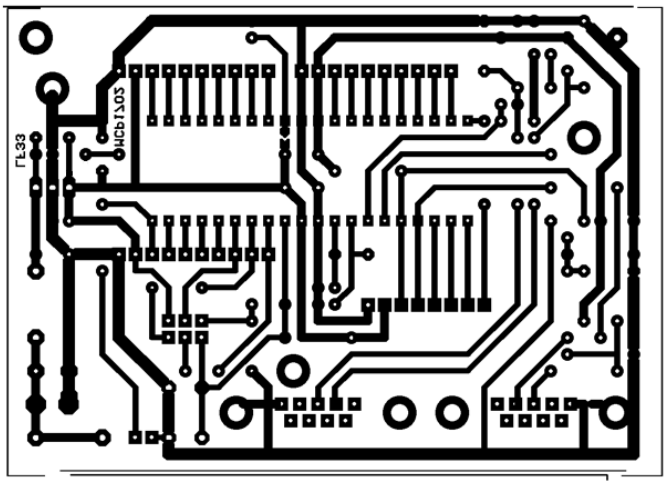


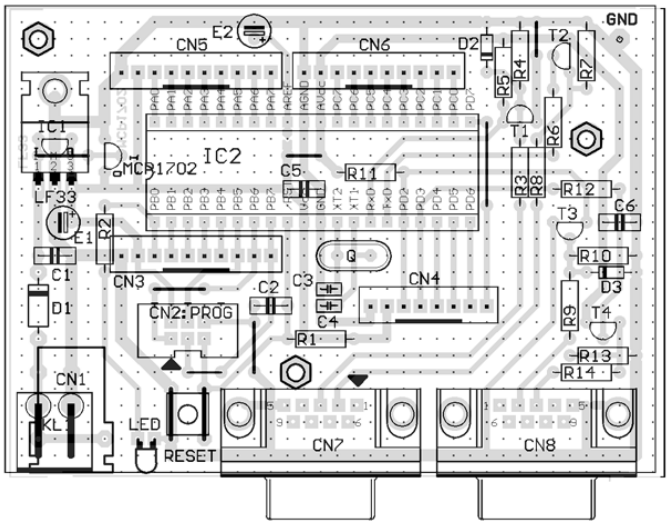
Hardware for ATmega644, ATmega1284 , ATmega32 (40p DIL)

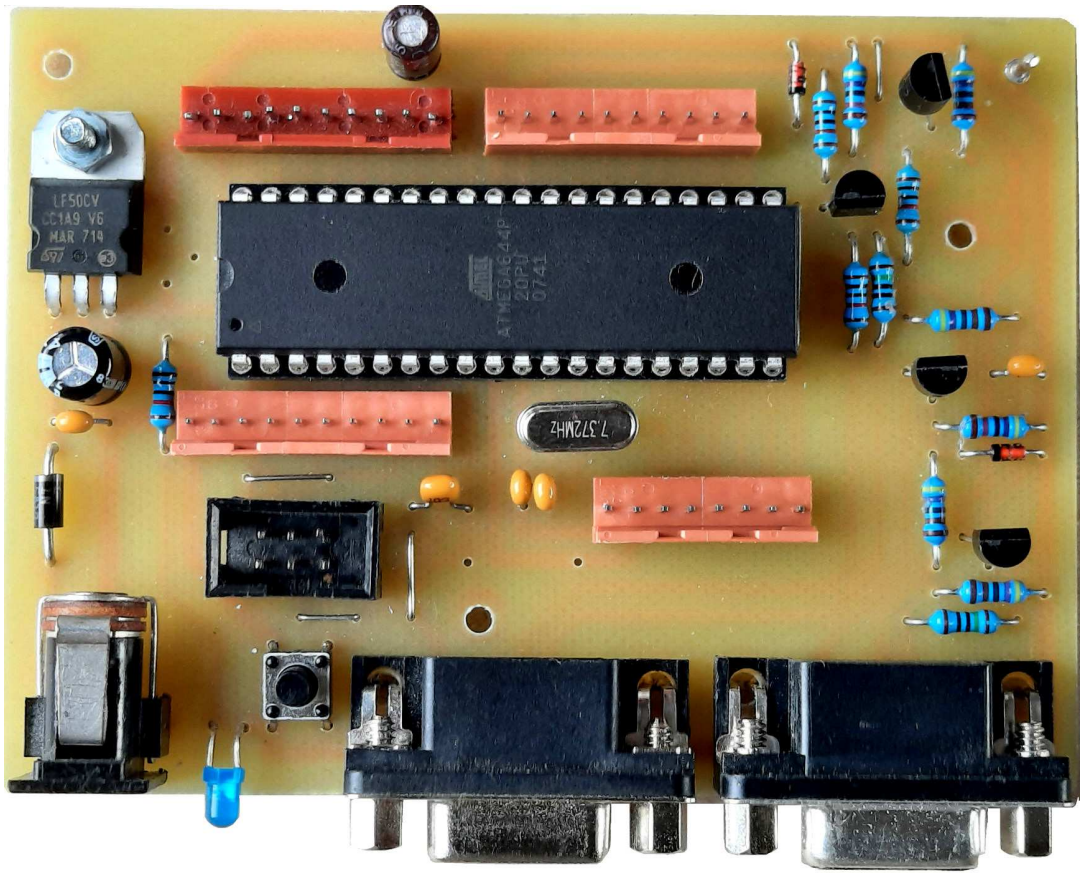
Though quite different stages in ATmega history and rather different register organisation, these three models fit into the same PCB with same pin arrangement.



For low-freq crystals (1.84MHz) ATmega644 oscillator startup is critical. Then **for C3 and C4 check 33pf or 47pf or 68pF**. Check different oscillator start conditions (CPU flags). Sometimes another crystal works.







USART1 (PD2,3) is only provided at ATmega644 and ATmega1284 CPU and is intended to operate external serial equipment by Avise. This is optional and blocks other I/O at PD2,3. Very high data transfer rates cannot be expected. ATmega32 supports only one USART.

Some general DIY information:

1:1 TIF files with the PCB bottom layer and assembly diagram of all prototypes are available for download at my webpage <www.midi-and-more.de/more/cforth-lowpower.htm>

On my prototypes, the crystals are not directly soldered, but plugged on a small socket. This way, operating speed can be changed easily.

R1 is layouted on PCB, but usually not necessary. An internal pull-up resistor (ca.30-60kOhm) is part of the ATmega. In cases of repeated unexpected reset, insert 10kOhm.

Special parts: (cited suppliers are examples where private consumers can buy in Germany)
ATmegaprocessors: Reichelt, Mouser, tme.eu et.al.
TQFP to DIL32 breakout board: e.g. Adafruit 1163, voelkner.de, conrad.de, (kt-micro.de, botland.de dimensions?)
LED: blue or white high efficient LED. Adjust R2 if brightness is not appropriate for your taste.
C3 and C4: most times 22pF are good. If the crystal oscillator does not start, try 33pF or 15pF.
R3, R5, R6, R7 are optimized for baud rates up to 38400 Baud. May work with higher baud rates, but half values (4k7,2k2) are are recommended then.

5 pin peripheral connectors: source Reichelt PS 25/5G BR Conrad 741230
8 pin peripheral connectors: source Reichelt PS 25/8G BR Conrad 741256
10 pin peripheral connector: source Reichelt PS 25/10G BR Conrad 741264
Recommended drill diameters for etched PCB:
resistors, capacitors, diodes D2,D3, transistors, ICs, jumper wires: 0.8mm; LED, connectors, diode D1: 1.0mm; CN1: 1.5 mm

Hints for Veroboard assembly

It is useful to print a mirrored version of the placement drawing to get a view from bottom=solder side.

The diameter of the wire should be 0.4 or better 0.54 mm for easy bending and diagonal wiring between the neighboured copper dots. A set of "adjustment" pliers with small flat tips (or stable tweezers) is recommended for bending and positioning the wires.

The correct positioning of parts is essential, because there is almost no reserve for alternative positioning. The final solder process is less complicated than it looks. So it is recommended first to place all parts and solder them as slightly as possible only to fix them provisionally. Next cut longer wires of fixed components about 1 mm above the Veroboard for later final soldering. At this stage, parts with more than two contacts like connectors should be soldered only at 2 diagonal edge pins. In some cases jumper wires must be placed before IC sockets. Length and position of all wires (except USB data lines) is uncritical. So if something goes wrong, forgotten or non-placeable wires can be put later directly with isolated wire.

Try to organize the solder sequence in a way that one alreay soldered point is connected with another yet unsoldered, if possible. Points wit 2.5 mm distance are not soldered with a wire, but with a dot of solder instead. If you are connecting points with 3.6 or 5mm distance, becareful not to unsolder the already soldered point due to much heat on the wire. Length and position of all wires is uncritical. So if something goes wrong, forgotten or non-placeable wires can be put later directly with isolated wire.

Programming

Generally, all user programmed code is lost after programming a new firmware.

Even if - depending on programmer model - only specific Flash pages, EEProm can be erased or not, it is not recommended to retain existing user machine code into a new firmware. Even minor changes will make the user code faulty. So **it is recommended, to develop user code with a text editor** and upload it more or less automatically. This way different projects can be uploaded (Flash survives ca. 10.000 programming cycles).

Hex codes provided for download **will only work with correct settings of ATmega processor FUSE**S !
On a new processor, the programmed hex code will not work before fuses are programmed correctly (may be a frustrating experience)

The recommended values (listed in download area at "avise.htm") are optimized for the declared CPU speed and range of use. In many cases they will work with other speed settings, too. In case, change the fuse setting for your crystal speed. Fuse values else should not be modified.

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