

## **ELECTRONIC LOCK SmartCard4**

### **1 SUMMARY**

The electronic lock **SmartCard4** is easy to make and set up, it is small and easy to use. An additional advantage to its safety is the fact that a connector of chip cards is set up on the external part of the door or the garage door, whereas the electronics is set up on the internal part. In this way a physical access to the electronics is not possible. Similar products of other well-known companies have the electronics and the connector of chip cards set up on the external part of the door. In this case the safety is ensured only if a reader of chip cards is connected to a house alarm device, which is then connected with the appropriate security company.



**Key words:** chip, smart card, microprocessor, micro-controller, code lock, door, atmel, avr, laser, welding, welding pattern, polishing, electrodes, acid, polishing panels.

### **2 FUNCTION**

The door is unlocked in a way to enter a chip card. A micro-controller (Atmel AVR) checks a serial number of the chip card, which is different for every chip card produced. You can write the number of one, two, three or four chip cards into the memory of the micro-controller, in its last version there can even be 15 chip cards written down. If the number of the chip card is the same as the serial number written down in the memory of the micro-controller, the electronic lock beeps twice. When you draw the card out, the door unlocks after a second and stay unlocked for two seconds. During this time you can open the door. If the serial card number does not match any of the four serial numbers written in the memory of the micro-controller, you can hear several short beeps. The entered serial numbers of the chip cards are permanently saved in the micro-controller and remain written down even if the micro-controller is without loading voltage. In case when the serial number of the inserted chip card is not correct, which means that it is not written down in the memory of the micro-controller, there are ten short beeps heard.

### **3 PROGRAMME**

The programme for SmartCard4 is written down in a programme language Bascom-AVR. The serial number of the chip card can be either checked through a written record in the micro-controller's eeprom or it is being written down in the micro-controller's eeprom. You can determine the function which will be carried out with a jumper STO (STORE). The entered jumper determines storing of a serial number of the chip card, but if the jumper is drawn out it checks the serial number of the chip card. In case the serial number of the card is correct there are two beeps heard, then the micro-controller waits for the card to be drawn out. When the card is drawn out, the micro-controller waits for a second and then activates a relay for unlocking the door for two seconds. The two beeps also confirm the correct entering of the serial number of the chip card. In case there is a chip card with a wrong serial number entered, you hear ten short beeps.

## 4 MAKING A PRINTED CIRCUIT

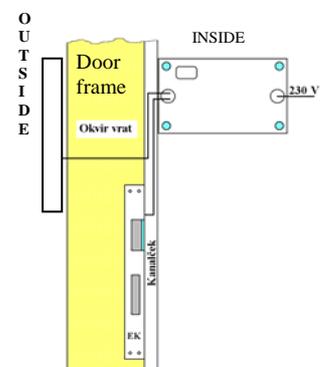
There is a one-sided printed circuit. The order of soldering goes from the lowest to the highest element according to the height of these elements. First we connect a loading voltage to the electronics without a micro-controller. To check the function of the electronics you can use a 12V one-way voltage from a rectifier or an adapter instead of a toroidal transformer, or you can even use the voltage of two 9V batteries, which are linked successively. If everything is in order you can disconnect the loading voltage and only then you can insert the micro-controller IC1 into a base. Now you connect a connector of the chip card and the loading voltage. You insert the chip card which is turned the other way around. The relay must draw it since the micro-controller's memory is empty. The connector of the chip cards, to which we have added a metal front panel with a gap, is set up on the outside part of the door, whereas the electronics is set up on the inside part. The connector of the chip cards is connected to the electronics with 8 or 10 core telephone conductor, which depends on the position of a beeper (or an additional LED diode) that can be put on a casing or on a keyboard. Then you run a little channel from the electronics casing to the nearest voltage source of 230V and to the door strike (electric lock).

## 5 MAKING A FRONT PANEL

The front panel is made of a 2mm inox thin plate. It is cut by a laser because of the narrow gap in the front panel. A holder of the electronics, which is set up on the outside part of the door, is welded on the panel. The front panel and the holder of the electronics are welded under the 90-degree angle. You should use special welding electrodes. You weld with a help of a welding pattern on which the front panel and the holder of the electronics are fixed. After the welding you coat the front panel with acid and wait for 20 minutes. Then you polish the front panel on the polishing machine. With a help of the acid and polishing you remove oxide from the front panel, which resulted of the welding.

### Technical data:

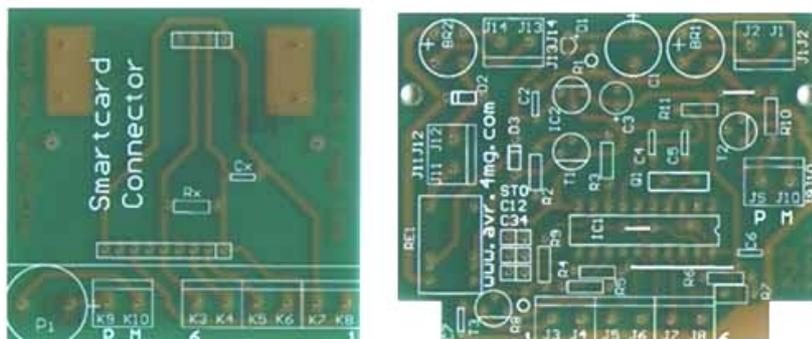
- Operating voltage: 10-18V of direct-current voltage or 8-13V of alternating voltage
- Current consumption: stand-by position = 4mA, relay switched on = 25mA.
- A relay single-pole changeover switching contacts 2A/48V DC
- The four user combinations codes. Each code is 32 bytes long.
- The time of switching on the relay is 2 seconds.



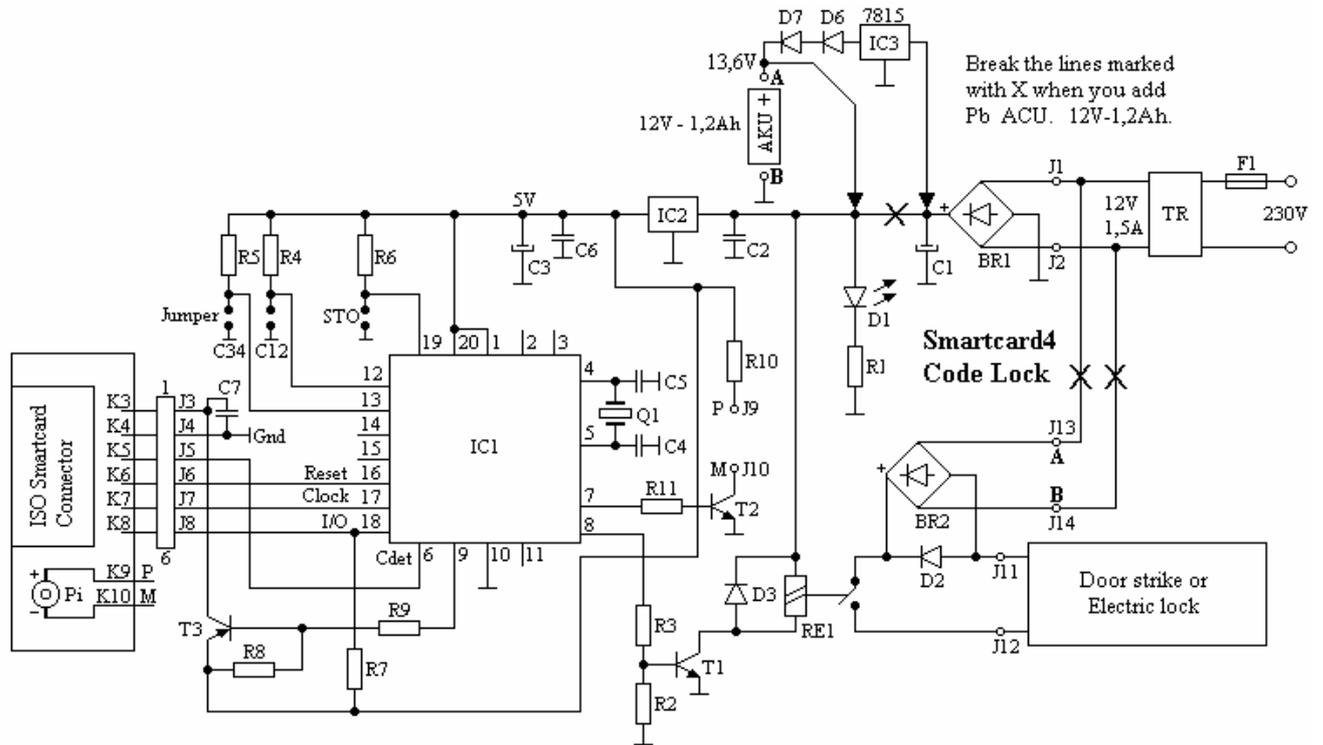
### A list of used elements

Piece	Typ	Value	Reference
1	Resistor	1 k $\Omega$	R1, R10
2	Resistor	22 k $\Omega$	R2, R8
3	Resistor	4,7 k $\Omega$	R3, R9, R11
3	Resistor	10 k $\Omega$	R4, R5, R6
1	Resistor	3,3 k $\Omega$	R7
1	El.capacitor	220 uF / 35 V	C1
1	El.capacitor	22 uF / 35 V	C3
2	Capacitor	33 pF	C4, C5
4	Capacitor	100 nF ML	C2, C6, C7, Cx
2	Transistor NPN	BC 547 C	T1, T2
1	Transistor PNP	BC 557 C	T3
1	Diode	1N 4007	D2, D6, D7
1	LED diode, red	3 mm	D1
4	Diode	1N 4148	D3
2	Greatz	B80C1500	BR1, BR2
1	Micro controller	AT90S2313	IC1
1	IC socket	20 PIN	IC1
1	IC	78L05	IC2
1	Fuse	100 mA	F1
1	Fuse socket	Isolated!	F1
1	Quartz	4 MHz	Q1
1	Relay	12 V DC	RE1
1	Transformer, toroidal, 20VA	230 V / 12V / 20VA	TR
1	Beeper	SEP 2240	Pi
22	Pcb terminal block	Pitch 5,08 mm	J1 to J14, 1 to 6, P and M
3	Jumper	Pitch 5,08 mm	For: STO, C12, C34
6	Pcb terminal spikes	Pitch 5,08 mm	Jumper: STO, C12, C34
1	ISO Smartcard connector	ISO Smartcard connector	Conrad Nr: 730521
1	Housing	(87 x 127 x 60) mm	
1	Front plate	(32 x 120 x 2) mm	Inox 18/10
2	PCB	Pcb1, Pcb2	<a href="http://www.avr.4mg.com">www.avr.4mg.com</a>
1	Door strike, voltage (8 do 12)V	NUOVA-FEB, ISEO or sim.	Door strike or electric lock

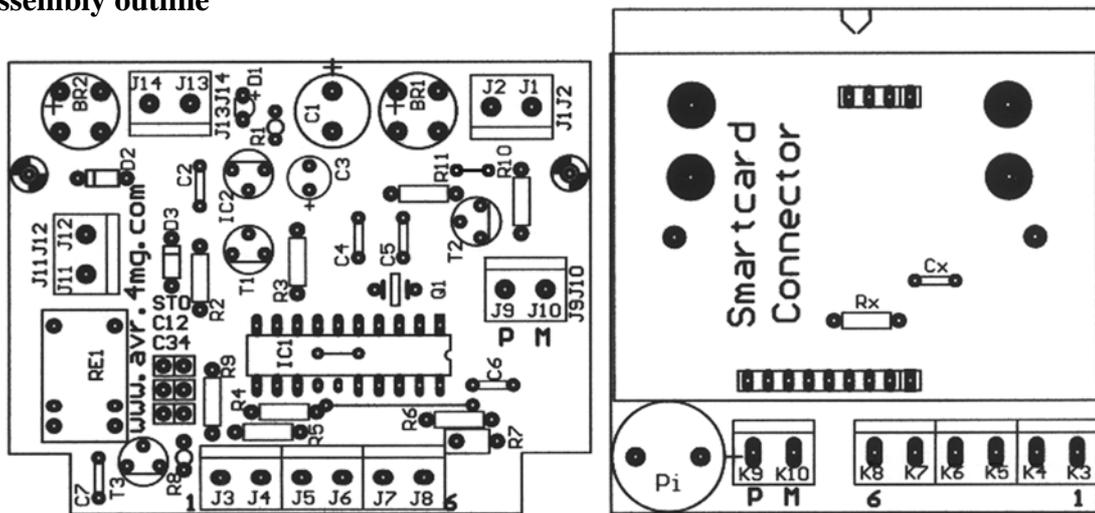
### A picture of the printed circuit



**An electric outline**



**An assembly outline**



**A picture of the front panel and the electronics holder**

