Door Lock Module Modification

09.10.02

V0.91

Elvis & 6548

There have been many discussion in the past why the power lock system of our Deloreans fail or why the solenoids burn and what you can do to solve this problem. There are replacement modules on the market which may work fine, but especially for us europeans these modules are too expensive with tax, shipping and this bad Euro. And in most cases, if not to say in anycase you can repair this simple module yourself or with the help of your neighbour's son who knows a little about electronics.

The most important thing is to get new relays and to replace them !

They and only they are responsible for your burned solenoids ! I know where to find these relays in germany, but I can't tell you where you can get them in the US. But they shouldn't cost more than $10 both together.

The reason why they fail is simple. When you turn the key in the door look, a switch closes a circuit and one of the big capacitors on the board is discharged. This current flows through the coil of on of the relays. After about one second the capacitor is empty and the relay falls back and opens the circuit. Now the problem with capacitors is, when they are discharged, the current is being reduced with an e-function which means the current is reduced slowly and also the force of the magnet coil in the relay. The very high current flowing through the solenoid and relay's switching-contacts now always burns the contacts a little bit each time they open the circuit. And with the slowly reduced contact-force these contacts may stick together like being welded. Exactly at this point the current through the solenoids will flow until the battery is empty or until you disconnect it if you're still able to open the door!

Imagine what happens inside the solenoids when there are flowing 15A through it for a long time.

15A * 12V = **180W !**

This lets the wires inside the solenoids glow and the paint on the wire will burn away. Even if you repair the door lock module now, the solenoids won't work anymore, as the wires inside make a short ciruit and the force of it is reduced (force depends on I * n ; I = current, n = number of windings). Also there is flowing a much higher current now, but the number of working windings is reduced and therefore there won't be enough power to move the door latch mechanism.

The solenoids need to be reworked, but this is almost as simple as replacing the parts in the following description of how to reduce the stand-by current.

The door lock module was designed somewhen in the late 70s or early 80s and for this age, it isn't so bad. But meanwhile there have been designed better electronic parts which can reduce the stand-by current from 13mA to about 1mA. This means your battery will still start your car after weeks of not being used (shame on you – drive your car !). On the following pages I described this simple modification so you can do it yourself for some few $. **Remember to replace also the relays !!!**

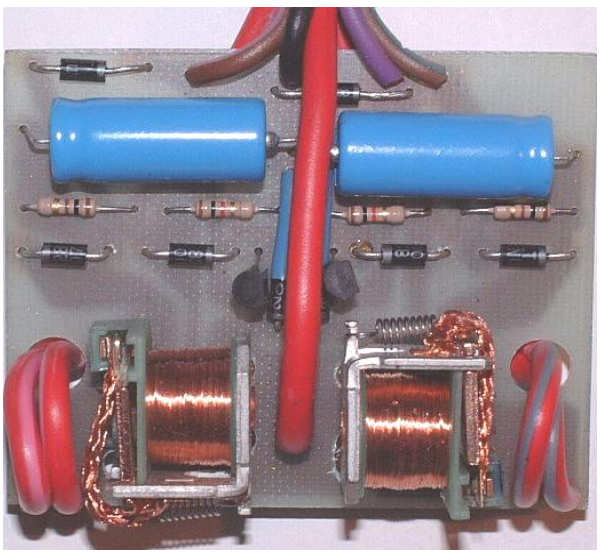
Some other guys talked about replacing the capacitors and the diodes, too. Do it if necessary or if you feel the need of doing it. I modified about 10 modules so far and never had to replace anything else than described here.

Also remember – I am not responsible for anything you do !

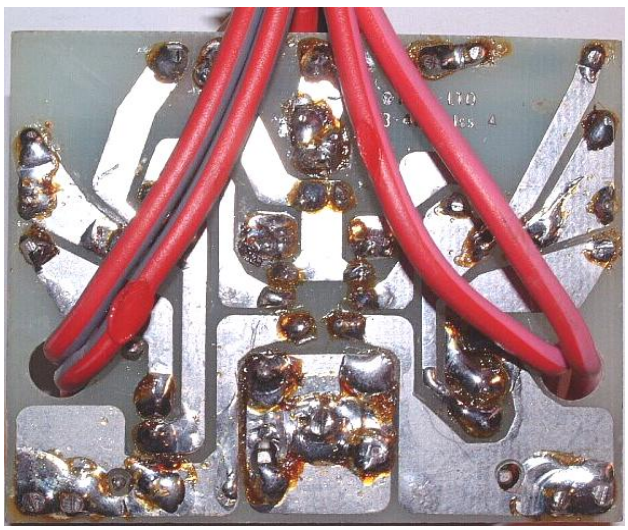
Electrical compartment

Here is where to find the Door-Lock-Module. Simply remove it by unscrewing the two bolts and diconnecting the two connectors. Watch for the large red wire, in most cases it is disconnected from the circuit breaker because the module has already failed in the past. When reconnecting the red wire be sure to **NOT** connect it directly on +12V ! It must always be in series with the circuit breaker !

Door Lock Module inside

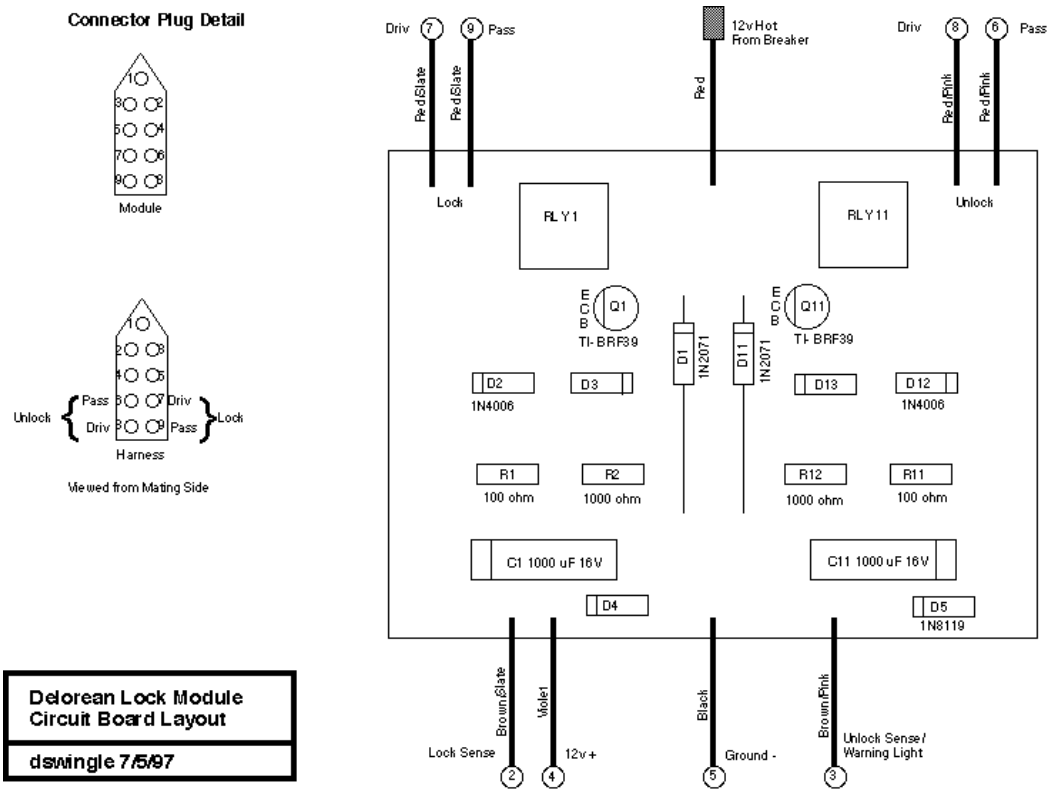


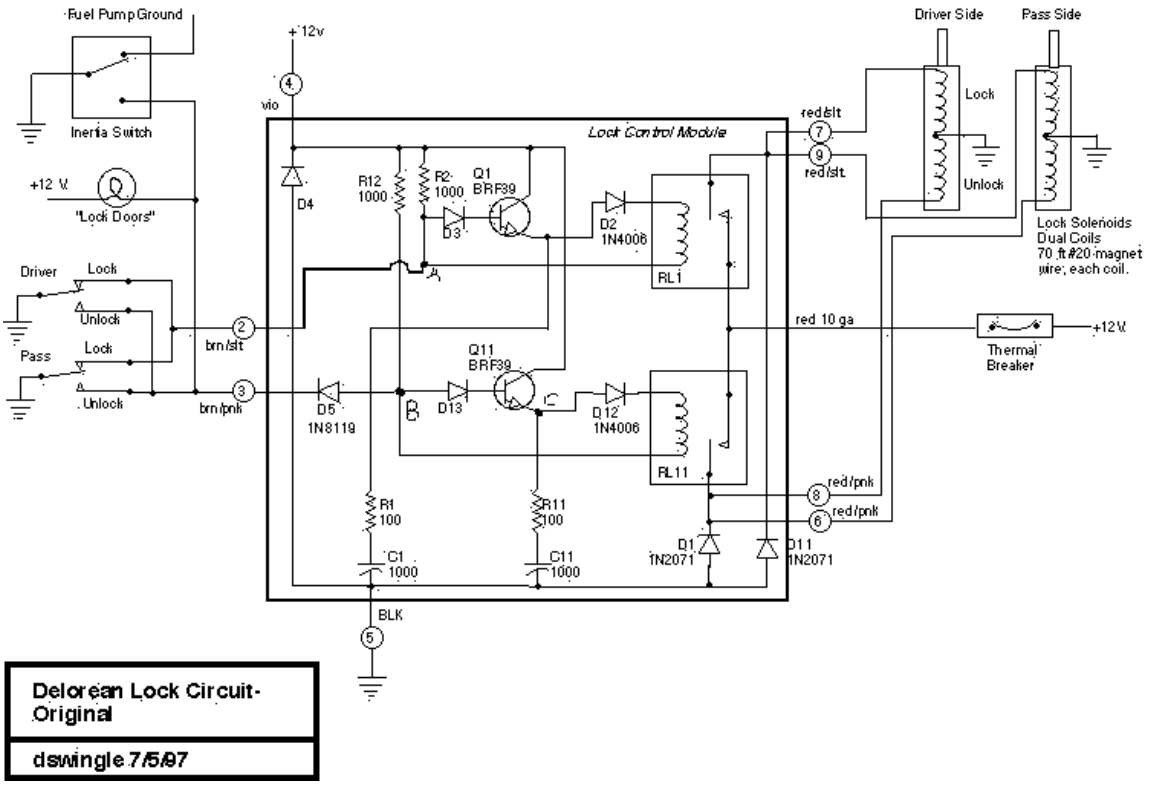
Solder side



Schematic

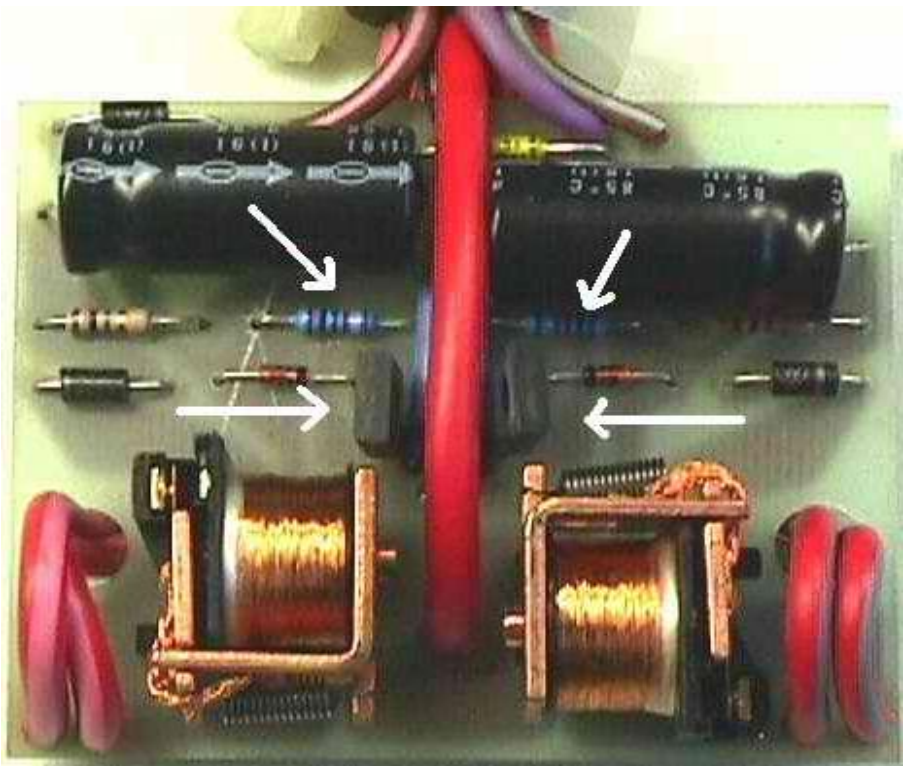
Thanks to Dave Swingle and the dmcnews list for this schematic and also for some other guys for correcting it.



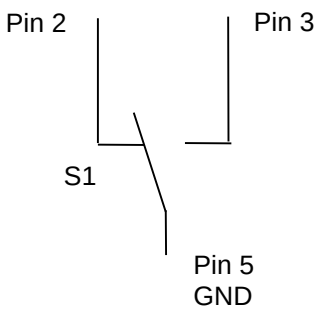


Modified Module

In this picture you can see the already modified module with a drastically reduced stand-by current consumption. The four parts cost less than $2. The two blue parts on the top (R2 and R12) are 10k Ohm resistors which replace the original 1k Ohm types. These are responsible for the high and unnecessary stand-by current.
The circuit won't work without the two better transistors (Q1 and Q11) with a higher amplification. In this case I used two BD679 NPN Darlington transistors which I have on stock. Any other NPN Darlington transistor may do it, too. I just had no time to look for other types, as these work fine and reliable.
I included the datasheet in this description to make it easier to find a replacement type if the BD679 is not available. It is also not necessary to use a 80V and 4A type, just make sure the pin configuration is the same and the amplification is >500.

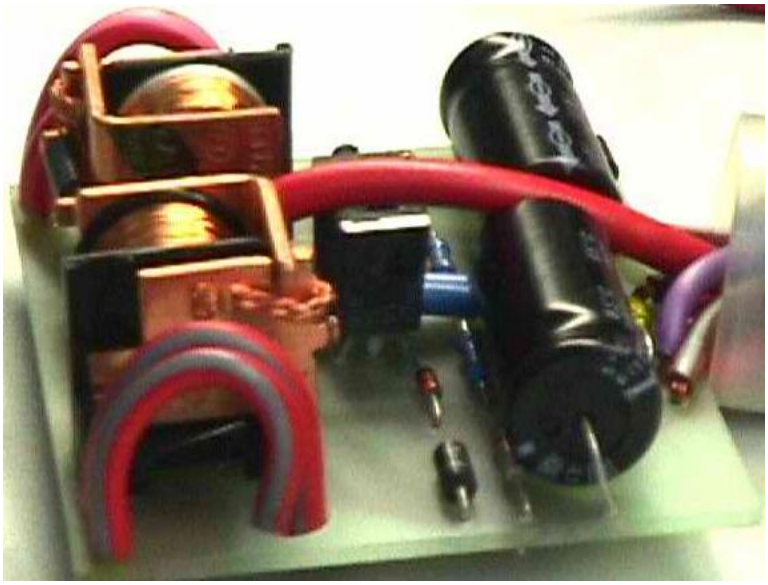


You can test your module before putting it back into the car. Take a switch with two positions (how do you call an „Um-Schalter" in english ? A toggle-switch ?)
Connect Pin 4 to +12V and the rest like following:

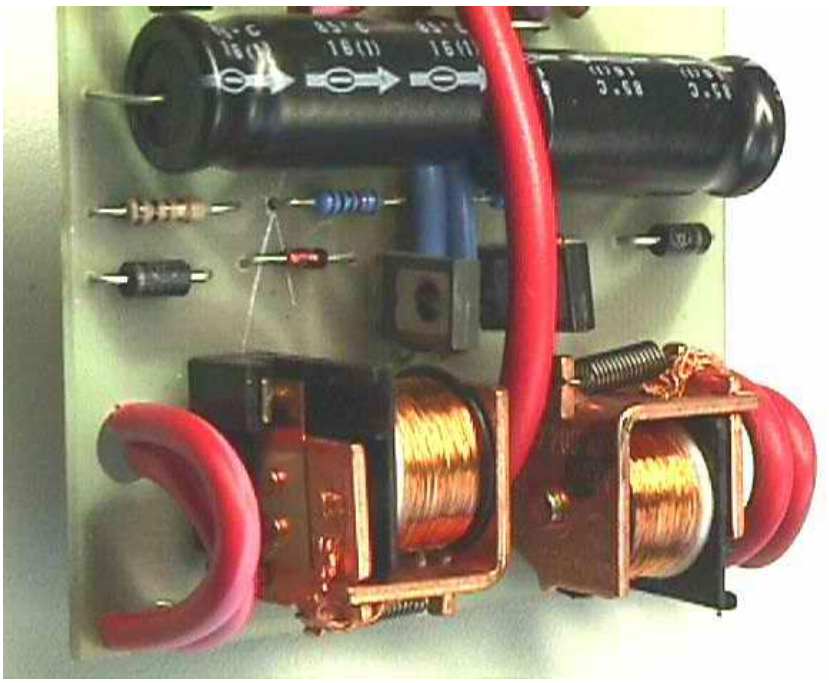


When toggling the switch, you should hear the relay closing and reopening the contact after about one second.

Modified parts, both frontsides of the transistors facing towards you



Another view with the new resistors



And take a look at these brand new relays with perfect contacts !
They will last some more years till you replace them again because they will be worn again !

Door Lock Protector

If you think, that the circuit breaker is not really protecting your solenoids from burning, then you're right. I developed this little item to make sure, that there won't flow the necessarry high current of about 20...30A for more than a few secondes. This high current is needed to open and close the door latch mechanism of both doors. But it only needs an impulse of 1s. Only when the relay contacts stick together this will last longer, and then these 5 PTCs will reduce the current to some few hundred mA. The solenoids won't burn anymore, but as long as the relay is sticking, the power door locks won't work and these PTCs will get very hot ! **So make sure they are insulated and not touching anything that could burn !**
This PTC protection is connected between the large red wire and the circuit breaker. Run the cable with a loop behind the module in the relay compartment and it will work fine. I tested several of these PTC items and they work fine as long as the door latch mechanism is working smoothly. If the mechanism is running hard, the also reduced peak current won't be enough to move the mechanism. But this is also a sign for you to lubricate the whole mechanism in the door.

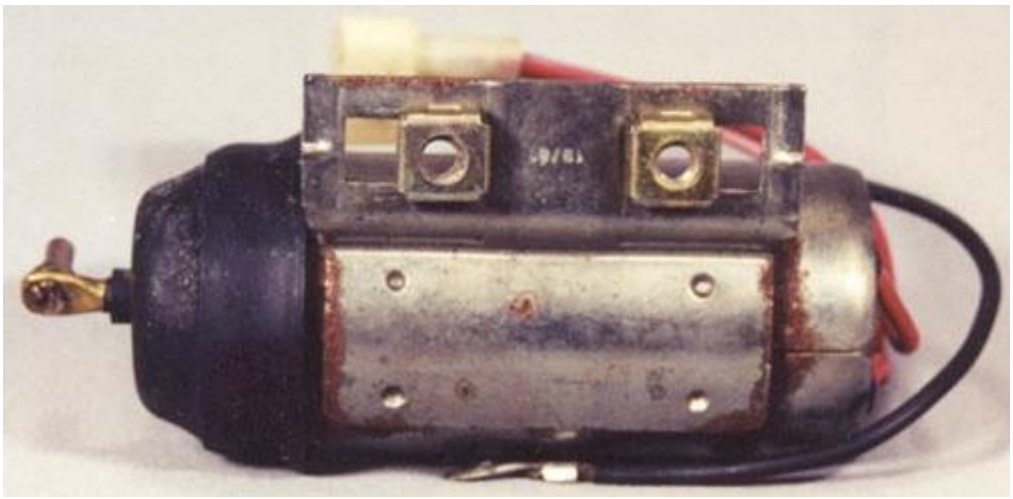
The PTCs are also called overload protection discs and sold by Siemens Matsushita.
I used five parallel of the type C955 (B59955-C120-A70) with 0.8Ohm and a peak current of 5.5A.
The more you use, the higher gets the short circuit current, I wouldn't use more than six of them. If you can't find them, send me an email.

Door Lock Protector close up

Don't forget to insulate them with a heat shrinkable tubing or with some tape. But watch out, in case that the relays fail, this item will get very hot, about 160°C (320°F ?) ! That's the way they work.

Solenoid

This is how a door lock solenoid looks like. Most of them are defect and must be repaired. This is a easy job and can be done by yourself within one or two hours. It's at least not worth to pay several hundred dollars for this simple job. Instead get yourself about 50m of 0.8mm insulated copper wire for about $5 which should be enough to rebuild both coils of one solenoid.



I forgot to take some pictures when I rebuilt mine and those of a friend, but next time I will.

This chapter will be continued sometime.

Datasheet of the replacement transistor

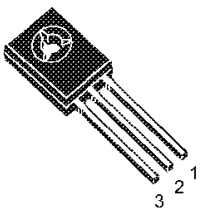
It's not necessary to use exactly this transistor, any other darlington type will do it, too. Just make sure it has the same pin configuration as this one. I used this one, because we have thousands of them on stock and it works fine. If somebody finds a replacement transistor with the same housing as the original – let me know and I will put it in this description.

BD677/A/679/A/681
BD678/A/680/A/682

COMPLEMENTARY SILICON POWER DARLINGTON TRANSISTORS

- STMicroelectronics PREFERRED SALESTYPES
- COMPLEMENTARY PNP - NPN DEVICES
- MONOLITHIC DARLINGTON CONFIGURATION
- INTEGRATED ANTIPARALLEL COLLECTOR-EMITTER DIODE

APPLICATION
- LINEAR AND SWITCHING INDUSTRIAL EQUIPMENT



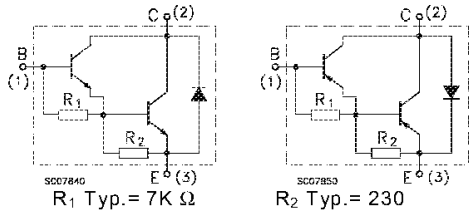
SOT-32

DESCRIPTION
The BD677, BD677A, BD679, BD679A and BD681 are silicon epitaxial-base NPN power transistors in monolithic Darlington configuration mounted in Jedec SOT-32 plastic package.

They are intended for use in medium power linar and switching applications

The complementary PNP types are BD678, BD678A, BD680, BD680A and BD682 respectively.

INTERNAL SCHEMATIC DIAGRAM



R_1 Typ.= 7K Ω R_2 Typ.= 230

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value			Unit
		NPN	BD677/A	BD679/A	BD681	
		PNP	BD678/A	BD680/A	BD682	
V_{CBO}	Collector-Base Voltage (I_E = 0)		60	80	100	V
V_{CEO}	Collector-Emitter Voltage (I_B = 0)		60	80	100	V
V_{EBO}	Emitter-Base Voltage (I_C = 0)		5			V
I_C	Collector Current		4			A
I_{CM}	Collector Peak Current		6			A
I_B	Base Current		0.1			A
P_{tot}	Total Dissipation at $T_c \leq 25$ °C		40			W
T_{stg}	Storage Temperature		-65 to 150			°C
T_j	Max. Operating Junction Temperature		150			°C

For PNP types voltage and current values are negative.