

## I think My ECU is bad ? DAG NAB IT ! (Rip Gabby Hayes)



### 1989-98 Suzuki Sidekick's and Geo Tracker's ECU Engine Controller Units

96 to 98 ECU never fail for bad CAPS. ( 96-98 only fail for bad injectors, if at all , ever) [SEE MY ESD warnings.](#)

All 89 to 95 fail for **bad electrolytic Capacitor's** just 1 time, if you replace them with a quality brand, I will call them **CAP's 89 to 95 is Generation 1 cars. GEN1.**

The ECU provides Injection, spark (no spark pre 91's) and many other output devices, that are driven by the ECU, (ISC, relays, VSV's and +5vdcREF supply)

The below solves all the common problems. Some of the drawings are unique ! Made the hard way !

Gen 1 cars and need the CAPS checked, If they are marked **Rubycon, expunge them.** Now.

**This is a nice story about bad caps** ([and my be related to these events? a fish story ?](#))

Do not **run any ECU with a dead +5vdc-Ref pin** . (always check it first, at the TPS "Gray-red wire" pin is easiest) after checking the fuses.

Do not condemn any ECU without:

1. Battery must not ever be allowed to drop below **10 vdc** (ECU will NOT work below that ) Fix battery or charge system first, charge the battery to 12.6v.
2. The **FI , IG-COIL and the DOME** fuse must be good and must be hot KEY ON.
3. The ECU must have power and a good ground. No power, NO JOY !
4. The ECU outputs must NOT BE GROUNDED OR SHORTED OUT. EVER !

**Never** run any old ECU with out at least looking inside for damage ! [IS MINE VIRGIN? \(old caps.etc\)](#)

Smoke signs, acid leaks, and split open main Capacitors. (large can shaped objects)

Replace the CAPS with new RATED 105 degree C. , low ESR rated parts. &50-75vdc [I like NEC or Nichicon parts.](#)

To be accurate as possible, all Electrolytic Caps, don't last 25 years or more like the other ECU parts can, they are the weaker technology.

These cap's all have a short life. (in theory and some are just plain horrible, in reality. )

But the Cap's put in this Gen1 cars, will fail and do fail , at an alarming rate, in fact, not one 1996+ car , has failed yet. For this part. Not one ever reported.

I'd not blame Suzuki, GM or Mitusbushi for this failure, I'd blame the maker of the Cap.

The ECU is ROBUST, but not that little black CAP.

**What should I do? [You are here because.?](#)**

**A Mini Index:**

1. [A FAST ECU test, take the test , it's easy !](#)
2. [How to remove ECU.](#)
3. [ECU Part numbers , ALL.](#)
4. [Repairs or exchanges.](#)
5. [Example , replacing just the MAIN CAP.](#)
6. [Where to buy these CAPS , Digikey or Mouser & MCM.](#)
7. **Blank**
8. [See all 8V pin voltages here](#) [See 16V pin voltages here.](#)
9. [How to find bad power to ECU.](#)
10. [Don't be fooled.](#)
11. [FAQ](#)
12. [The relays, or VSV, ISC all clicking madly](#)
13. [Things the make ECU look bad, but ECU is not bad.](#)
14. [The DIY way to test transistors.](#)
15. [Parts Substitutions \(IC's , SIP'S, DIP'S , SMD, Hybrids and Transistors\)](#)
16. [ALL ECU FAILURE MODES](#)
17. [Is my ECU still virgin "OEM ORIGINAL" \( untouched and in need of CAP changes?\)](#)
18. [See my new 1996 ECU repair page.](#)

Many come here for ECU's with madly [clicking Fuel pump relay and VSV valves.](#) (over and over fast clicks, not 1 time)

Never condemn any ECU (**check the +5vdc REF output pin first !**, if 0 vdc , the ECU is bad) until you make sure inputs and outputs are good.

Never replace any ECU when the target vehicle has shorted Actuators. (outputs of ECU shorted)

This page calls all large Electrolytic capacitors (can shapes) just CAP's for short.

This page covers CAP replacement and all driver failures and the +5vdc internal reference supply. ( the lions share of failures)

Or the ECU keeps blowing the ECU fuses (there are up to 3 fuses, on all early Kicks) "FI or IG coil and DOME"

96 and newer Kicks never have bad CAP's , but can have bad +5vdc REF or a bad drivers (any).

Most (non Cap) failures of ECU are from shorted outputs devices (bad) or untrained service persons hotwiring the ECU or relays.

[Use this page to correct acid damage to the traces.](#)

[How to replace my Caps video?](#)

There are at least, 6 ways to correct a bad ECU.

DIY , FRIEND DIY, LOCAL TV SHOP, DAVID BELOW, NOT ME (grin), EBAY VENDORS GALORE , or OEM at \$1400 each.

Read on for details:

The cost can be 33 cents, DIY, or \$75 for David, or \$200 with pre-ship and your core sent later EBAY. (keep in mind guarantee's, are not free)

If you can do a simple solder job, many repairs are easy. Any TV or electronics repair shop , worth salt can do this, tell them not to put them in backwards.!

**Most failed 89-95 ECU's can be fixed for \$3 and a Walmart soldering iron (grounded tip) and a cheap RadioShack solder sucker. And WireWICK.**

**Nutshell List: (Legacy 89-98 KICKS only!)**

Yes, it is true these early ECU's do like to go bad, on the early USA/Canada SIDEKICKS or TRACKERS. **89-95. (for just 1 part type, by 1 company)**  
Newer 96+ECU's are much better (in fact no CAP fails at all) and so are the foreign ones, that are in the [aluminum heavy cases](#), or [like in Australia!](#)  
All 96 and newer ECU are extremely robust and never go out. (so far).

All 95s and older (N.American) need the Capacitors changed out ***1 time***. See details below for locations and sources of parts.

The below is an **ELECTROLYTIC CAPACITOR** (called CAP from now on) the other technology caps do not fail, (mylar, ceramic, tantalum, etc) Just the CAN type.

Expunge means, in "latin: 1. to delete or erase; blot out; obliterate" We in USA english stole that word, like many others.... Odd, how people ask that....

**Expunge this  
brand NOW!**



**Public Enema #1  
LOL**

The green slim of boric acid based Electrolyte leaking out the bottom (classic!). [See Mr. Ruiz mess.](#)  
Here is the [1989 ECU see caps? replace both CAP.'s on the left side.](#)

You are here, because you have evidence that your ECU is acting weird, no CEL at key on, no code12 when commanded (diag jumper), no idle signals to IAC. CEL lamp on full time (SES not ON) and will never go out, running. (and DTC codes will not flash out) When the happens ECU is in BACKUP mode.

This page is USA vehicle centric. There are 97 markets world wide and hundreds of ECU designs used by Suzuki and GM.

This ECU is OBD1 technology the one that likes to fail.

Your OBD2 (96 + in USA) ECU is most likely in perfect shape. [I do have 96 OBD2 repair data. \(new\)](#)

Let me list the **classic fail symptoms in a list.**

- The CEL will not come on ever, even though the lamp is good.
- The CEL stays on all the time, key on running and the Diagnostic Jumper is dead. NO FLASH codes. [\(first remove the SES\\_NAG switch on all FED48 cars\)!](#)
- The Diagnostic jumper is dead for any reason. (other than the SES nag switch reason)
- The Diagnostic codes start to come out and halt mid stream. (this is the ECU rebooting mid stride)
- Idle controls are dead, and ISC is good and TPS idle switch is good. (a symptom of ECU stuck in Limphome or worse BACKUP)
- Engine runs RICH and ignition advance are RPM are grossly limited, (again ECU is stuck in Limphome or backup and all EFI sensors and Engine are good)
- NO DTC code 12 when commanded via Diagnosis jumper or any other codes.
- The ECU keeps blowing the "FI" fuse over and over. (the CAP above keeps shorting can do so when you hit bumps in the road)
- ECU is flashing Code 53. (other reason for code 53 is putting a CAL ECU in to a FED body! Don't)
- ECU lid under side is covered in black soot.
- ECU CAPs are visibly leaking acid, or are split, cracked or bulging.
- ECU CAP has exploded.

Just because the ECU is stuck in Limphome, does not mean the ECU is bad.

**BACKUP** is ECU failure

Limphome is what ECU does when confused ( conflicting sensors causes that, and if true is normal)

The ECU does go to [Limphome for many reasons. Those reasons must be explored.](#)

If the ECU still has Rubycon in it (orig) then your ECU will fail, and will do so soon, if not already happening.

If the CAP above dries out, the ECU will keep rebooting itself.

This rebooting (resets self) causes, the ECU to work correctly one minute then fail the next.

(end nut shell section)

**ECU Part Numbers:** My PDF LIST, needs Acrobat to view it.

[My ECU SUZUKI part number list crude, \(89-98\) with hard ECU rules list, show why swaps don't work.](#)

All USA and Canada **ECU part numbers:** below: ! {new}

**EPC = Electronic Parts Catalog.**

[Real EPC ECU list, for all 89-95 1.6L cars in N. America.](#)

[Real EPC 96-98 ECUs list for all, 1.6L in North America](#)

**Last is:**

Real EPC ECU list for all Suzuki 1.8L [Sport ECU P/N page 1](#), [Page 2.](#)

No more guessing. !

[Before condemning any 89/90 ECU, read this document and note the different idle speed rules.](#)

I highly recommend the services of **David Ruberg Technical Services (89-94 , I can't do 1995's now, says Dave!)**

## Daids ECU repairs:

See his posts and store on : [His Store is here:](#)

To find a rebuilt or used ECU [via eBay](#)

Search for ECU's or repairs on EBAY. ( 20 vendors or more:

Look for "digitalman" vendor on Ebay, this is no secret, David advertises on many forums, and on Ebay.

Many folks on [Suzuk-forums](#) are happy with his work. (and not one complaint ! ) He can fix 99% of them, in my opinion cheaply.

Join us there and the forum, and lets talk.?

or

<http://www.cardone.com/English/Club/Products/webcat/sbvapp.asp>

Keep in mind not all ECU's are repairable, but most are!

If it burned to a crisp , it may be a total loss, or if the microprocessor, is blown out , it's coffin time. (proprietary to Mitsubishi / Suzuki)

Some of the SIP (single inline package) parts are very hard to find. (example, is my 91 8v drivers for the EGR VSV valve are hard to find!)

### Overview:

( #1 Failure is bad dried out **Electrolytic Capacitors** or leaking acid out the bottom of it, and collateral damage from these caustics leaks)

We call them **Cap's for Short !**

**The early "black Cap's" are junk, they LOVE to leak , crack , blow up and leak acid over the Printed Circuit Board , PCB. (and eat up vital copper traces.)**

**When this happens, the ECU will constantly crash. (and reboot over and over, relays clicking over and over too. or will cause engine misfire.)**

If you are not sure, what **Cap.** to replace?, then only replace just 1 , the one to pick is the biggest one **near the Main Power input connector., in the corner.**

This is the one that is always a **perfect cylinder shape** , and has plastic wrapped over metal aluminum. SEE **C111** Below on 8V ECU.

It will be marked similar, as the below shown Caps. EG: 100uf @ 50v or 63v is typical. Your circuit ID's may be different. or 50uf , just read the side.

Find a replacement, that is the same value and with the lowest **ESR** and the highest temperature rating. See Parts section below.

Do not replace the bright colored plastic looking gum drop caps or flat disc caps. They will be fine, just replace the **Black Piston shaped cylinders ones.!**

Doing this one step , is the best thing you can do for your old 89-95 ECU. [The 1989 ECU looks like this.](#)

Lets replace the one CAP? Read on.

The ECU is designed to last 20 Years or more, but the CAP.s (cheaper) are **NOT**. They are the weakest link in the chain. There ARE better caps made for sure.!!!

(aka: ECU, ECM, PCM, Engine EFI control Unit, or fuel injection processor /controller, or power train control module (modern SAE name))

Can't wait?, then:

[Click here for ECU removal instructions.](#)

**YOU ARE HERE BECAUSE: ( or these are your symptoms) All Fuses above left Knee are good and the ones on the right engine bay fender.**

- [Check engine lamp](#) is dead all the time, even "Key ON". THE CEL never glows.
- I set the [Diagnostic jumper](#) and I do not get code 12 ! code 12 means, ECU is alive and there are no STORED CODES.
- One or more **injectors is not firing.** [THE NOID TEST FAILED ! , this is an Injector test lamp.](#)
- The fuel pump relay will not energize for 3 seconds at first key on , and the relay is good. (91+ swap it with Main relay , next to it)
- I have no spark, but the **CMP** signal is good and . Your [Coil and Igniter](#) are good. **I have no ECU spark signal !**
- Car runs badly all the time and have checked everything else and tested all my sensors. [See here for tests:](#)
- [Check all sensors first.](#)
- The [Freeze timing jumper](#) does not work at all, while trying to set the ignition timing. ( Hot engine, A/C off , all Elect. loads , off for timing freeze to work ).
- The IAC/ISC will not regulate the engine RPM at idle , hot. ( you discover 0 volts or a constant 12vdc on the IAC connections, running) *note 1:*
- The ECU is commanding the EGR valve open all the time ( EGR VSV is always passing vacuum to EGR main valve) Shorted EGR driver transistor.
- You lost the 5vdc Refr. voltage out of the ECU, causing the loss of many sensors. (make sure ECU fails this pin voltage , by disconnecting this load.
- Any other solenoid or sensor dead can be a bad ECU, after proving the sensor or actuator is good.

*note 1:* the ECU has been seen to stop operating the ISC ,When in [Limphome mode](#). "gross sensor errors detected by ECU, even with CEL OFF !"

If a sensor or 2 drift way off calibration but not enough to set a DTC the ECU may drop to Limphome.

Code 51 can do this too. EGR malfunction.

You are not here , to fix [code 51](#), or code anything else unless you find a bad VSV driver, or the like, go [back to here.](#)

Most times the [Limp home mode](#) is not caused by the ECU. ( can be caused by two OUT of CALIBRATION SENSORS)

ECU will be running rich and retard ignition in Limphome. (aka: [failsafe and back up.](#)) Check all sensors before condemning any ECU, on any car.

- Check for 12v Power at the ECU, you will need your schematic and it is different for each car; Check carefully.
- Check CMP output with an LED tester. ([CAS needs a pullup resistor to test it](#))
- Next check the grounds at the ECU with the same schematic. Less than 0.5v at the ECU GROUND to the minus terminal of the battery.

[See all my "make run" schematics are here, 89-95 +](#)

[See my fast sensor test page. \(focused !\)](#)

The ECU can fail in at least 4 basic and common, ways: ( in the proper order)

1. The [electrolytic Capacitors dry out ,leak and fail](#), causing the Brain to go crazy. (Noise at the Microprocessor, kills it) This leaking eats up the TRACES!
2. The injector transistors burn up , usually because someone hot wires the Injector (TBI), or by natural causes. Injectors are 1.2 ohms and are Pulse Width Modulated to keep them cool. The ECU will be destroyed or the Injectors by this practice. The Injector wires can NOT be GROUNDED out.
3. The Printed Circuit Board (PCB) gets **cracks on the pads** (due to shaking of car) and need to be re-soldered.
4. The PCB traces burn up due to a shorting out of some component on the board. Check Pin **A23** for 5 volts DC output. The ECU must produce this voltage reference or it is bad or something is grounding it out. If 5.0v is not within 1/4 volt of perfect, the MAP and the TPS will be INOP (or grossly inaccurate). Test with keyon, if it fails , pull the MAP and TPS connectors and retest, if it passes then one of the two sensors [MAP/TPS] (or the wires) are grounding out this critical reference voltage. This voltage is infamous for dropping to zero due to a trace burning up in side the unit. (easy fix ). Email me for details.

It goes without saying , that anything can happen on such a complex board, but the above items, are very common.

Here is the ECU out of my 91 Tracker, not too fancy looking. ( Rumor: if yours is a 89-90 gold case , Some vendors don't like fixing pre 91 ECU's). Typical of all 91's to 95 , and **8 valves ONLY**.

**Drawing #1 (8v typical)**



Located **behind Left FRONT Radio speaker**. remove speaker and look. (all kicks, 89-95)

[See end for removal.](#)

The next picture is of the guts, the main circuit board.  
It is just a simple microprocessor with some RAM and some ROM.

I cured mine by replacing all the black and aluminum CAPS, repairing the grounds and by putting heat sink compound on the power transistors. C101,103,105,111 were replaced with Premium 105 DEGREE CENTIGRADE caps, made in Japan , not China !

I marked the transistors,below, that drive the TBI injector, so you can find them and replace them.

You can try to repair the unit or buy (trade) ECU's on [EBAY, Search "SideKick ECU" bingo. \\$70 exchanged.< a great GUY!](#)

You can buy a new one from Suzuki for \$1400 ( will that be VISA or Mastercard ? No way Jose' ). Never pay more than \$200 !

See my [new](#) parts list for the critical components shown, below:  
We have done this 100's of times on the forums, now, and 99% success rate. Even DIY works most times.

This information below , is available, no where else. Enjoy: !

**8 valve engines only this block:**  
**USA/Canada typical: 91-95 ( but 89/90 are similar)**

[Click HERE, to see my INJECTOR Schematics and Transistor function ID page , for the 8-Valve.](#)

[See here for transistor testing.](#)

[Parts Substitutions.](#)

The PinOuts for those 2 Green and white connectors are:

<a href="#">Page-1</a>	<a href="#">Page-2</a>	<a href="#">Page-3</a>	<a href="#">Page-4</a>
------------------------	------------------------	------------------------	------------------------

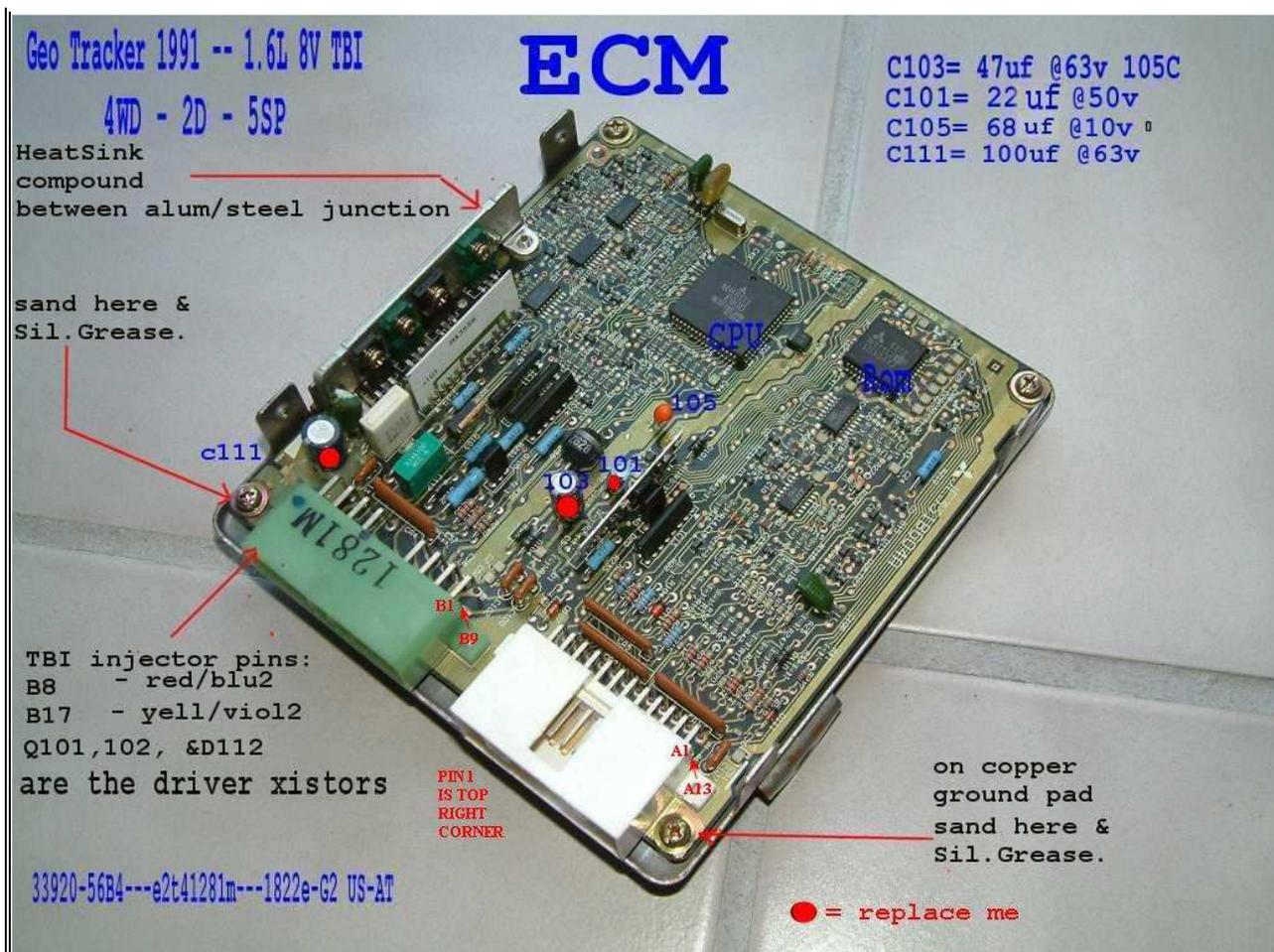
The high power feeds are on the Green and lower power sensors on the white, note gold pins on white conn.

I have all output transistors Identified.

Input usually do not blow out, just outputs.

Typical of all 91's to 95 , and **8 valves ONLY**.

**Drawing 2:**



C111 is the main failure item, about a 100% failure rate after 10years. Costs 33 cents to replace it.

[Data sheet for above Injector driver for both 8v and 16v ECU.](#)

Where to get parts?:

[Source 1: My favorite:](#)

[Source 2: Match a Knob in NY, has both transistors for the injectors., min. order is 2](#)

[Source 3:](#)

How do I know my ECU is dead. ( easy as 1, 2, 3)

Any test 1 to 3 failing , will mean the ECU is dead , not well or completely crazy (noise induced).

[+5vdc refr. and main 5vdc power supply details.](#)

[See photo of Hybrid module.](#)

If the ceramic hybrid models are bad, I think it's the end of the road. ( Mitsubishi don't return calls)

## TAKE THE BASIC ECU TEST 1989-95:

This is only a very simple test, nothing fancy. In no way, is this an extensive test plan. **Not at all.** (the ECU is complex)  
 ( **First**, be sure all fuses above the left knee fuse box, FI , IG-COIL and DOME fuses, must be not blown out)

**Test 1: (KEY ON , DO NOT START engine, LAMP TEST)**  
 Keyon. the Check engine lamp CEL **must glow** , **it MUST glow** :  
 IF NOT?

- ECU is dead. (this page below covers that fully)
- The CEL lamp is missing (a rotten Prev.owner) or the lamp simply burned out.
- Dead ECUs may not light the CEL, this is a common [See my end zone for all the ways.....](#)

The ECU can enter failsafe or backup mode ( a dead ECU or inputs bad to ECU) In Fail safe, the CEL may work. but in backup mode CEL, may be dead.  
 " Engine is stuck in [Limp Home mode](#), "**Fail Safe**" it is called by Suzuki"

Assuming all the fuses are good and the [MAIN relay is pulled in and full power is applied to the ECU.](#) ( check it) The ECU only has a single diode to pull in MAIN Relay.

**Test 2: ( Commanding up Trouble CODES Test)**

The main front engine bay DLC is the Diagnostic Logic Connector for the ECU , not TCM.

Insert the Diagnostic Jumper in to the DLC [Diagnostic pins of the proper plug. \(keeps moving year by year\)](#)

## Key on , Do not start engine.

Steps:

- The Diagnostic request jumper is inserted.
- Federal body cars, the NAG lamp switch [must not be in NAG mode](#) , that is CEL stuck on, no matter way. (milage nag)
- The ecu will now fash code 12 or some other code, if it does not the ECU is dead.

No starts:

### Test 3: No starts, No spark or no Injection did CMP die ?

- Keyon
- The Diagnostic request jumper is inserted.
- 12 DTC code is flash, (if other codes flash, clear them with DOME fuse pull and replace )
- 12s flashing you then crank engine over 5-10 seconds, no more , no less.
- Release the key do not turn key off. Look at the CEL lamp flashes , now.
- You do not get code 41 or 42 ( the 2 kinds of ignition failure)

Key off, if 12s flash out.

### Test 4: If engine will not start skip this test and go to test 5.

- After starting car the CEL must go out, if not, it has stored codes, if the codes will not flash out?
- them ECU is bad !. or the NAG mileage feature is active. Kill the NAG and repeat this tests,
- The dome fuse pulled , resets the ECU but not the NAG feature, only the NAG switch can reset NAG.
- [NAG, is the mileage exceeded feature. Found on all 89-95 USA only Federal body cars.](#)

### Test 5: Rapid relay clicking (repeats constantly, key on?)

- If relays and VSV don't chatter, go to test 6.
- [Repeated clicking actuators , Relays, and VSV valves on front of engine? or under the dash ?](#)
- Top cause, bad main Cap in ECU , or shorted ISC , shorted fuel pump, or acid damage inside ECU.

### Test 6: (can the ECU actually see errors and report them test?)

- Unplug the [IAT sensor](#) , start car for few minutes, and see if CEL lamp glows.
- Then place the DLC Diagnostic jumper and see if you get code 23.
- If no 23 DTC error code, the ECU is dead.

**Test 7:** [If motor dont start the ECU can be bad. see my no start for dummies to find a bad ECU this way. All the above must pass ,test 1 and 6](#)

If any tests don't work right pull the **dome fuse for 2-5 minutes** and put it back resetting the ECU and repeat the tests.

See my list of [all ECU fails here](#).

**Test 8 :** Attach a scan tool , key on, and if the scan tool can not communicate with the ECU , the ECU is Dead.

**Do not be fooled** by real non ECU problems:

Before replacing the ECU, be sure your CMP is sending pulses and that the TPS is not sending the WOT signal. (a TPS with a broken ground can do that) There is one failure mode for the TPS, that if the wiper arm breaks or makes the voltage goes above 3v to the ECU. This tells the ECU to engage UNFLOOD MODE.

UNFLOOD mode , KILLS ALL INJECTION. ( watch for this possibility! ) ( TPS signal is 1 to 4vdc range typical)

THE WOT has TWO functions. [WOT = WIDE OPEN THROTTLE normal driving ] , go fast or Unflood (starting engine) on all cars made , me thinks! WOT is usually greater than 75% throttle, on many cars.

KEEP IN MIND , just because the car Starts, that **doesn't** mean the ECU is good !!! ( it's in the design, this is a built-in feature)

There are TWO modes mentioned in the FSM, failsafe and limp mode. The [Limp mode](#) it says is special circuit that barely keeps car running.

The FSM explains all these facts.

**Tricks:**

**On the 16v engine, one can disconnect the TPS or the MAF/MAP and start and run, I'm told , but not both.**

You can use a Automatic tranny ECU in the Manual 5sp car but NOT the reverse or the Lockup torque converter will fail. [ECU swaps]

Note, I am running a AT ECU , in may MT Tracker. It runs fair but not perfect. MPG is low by 3-4 MPG. So I corrected this issue. with correct ECU PN.

Many times , there is Spark and no Injection signals ( [NOID LAMP FAILURE](#)), and it is a fact the ECU's from 1990 to 1994 are dying like flies.

Look for leaks of fluid from the Capacitors and the DAMAGE this can cause to PCB traces. [ pop the lid and look !]

Please keep this in mind, if the ECU has weak or bad Capacitors ,the ECU will have huge amounts of NOISE INSIDE (electrical) , this noise will make your computer behave in a totally unpredictable manor, it could run good one minute and be nuts the other, over and over , total chaos. Some times the Fuel Pump relay clicks like mad and one or both VSV valves mounting on top of engine clicking away.

Sometimes the Fuel Pump overloads the ECU power buss, so unplug the Fuel Pump relay and see if the clicking stops. Fuel pump draws 4 amps. not 14.

The caps are always in Aluminum cans , wrapped in colored plastic and the top metal exposed. See them, and REPLACE THEM ALL. A \$5 fix !  
If the tops of the CAPS have an embossed cross on them , they have been changed once. (these are blow out weak points, added in modern times).

[Click here for a list of most USA ECU partnumbers \(89-98\).](#)

**Bad power to ECU:**

I keep replacing my ECU and it still does not act right. ECU keeps resetting or wont show code 12 ,etc.

**First:**

All grounds cables to the engine and body to battery and body to engine must be good, clean them and grease them with silicon grease.

The below tests should be done with the negative voltmeter lead connected to the MINUS - terminal of the battery.

In the first 3 pages , ground is shown as blank, ignore that and measure it with key on, [the voltage should be below 0.5v or ideally way less.](#)

Pins B2, B3 and B10 (A4 for California car only) must be at a perfect ground potential at all times.

A24 is the ground sense pin and must be very low in voltage ( I do not have a spec for it). it provides ground to most of the sensors.

8V ECU voltage and ohmic test points: [page1.](#) [page2.](#) [page3.](#) [page4.](#) [ALL-4-Pages.](#)

The body/battery minus ground strap behind the battery is very critical. It must be good, so starting current does not pass through the ECU. **VITAL !**  
**Make sure the battery main large black (biggest) minus cable goes to the starter and is clean and tight on both ends,**  
**if not, you risk sending starter currents through the ECU. This would be very bad.**

**16 valve engines only on this block 92-95 Shown, USA/Canada typical:**

[ALL 16V Critical ECU pin voltages and FSM full pin lists and voltages are here.:](#)

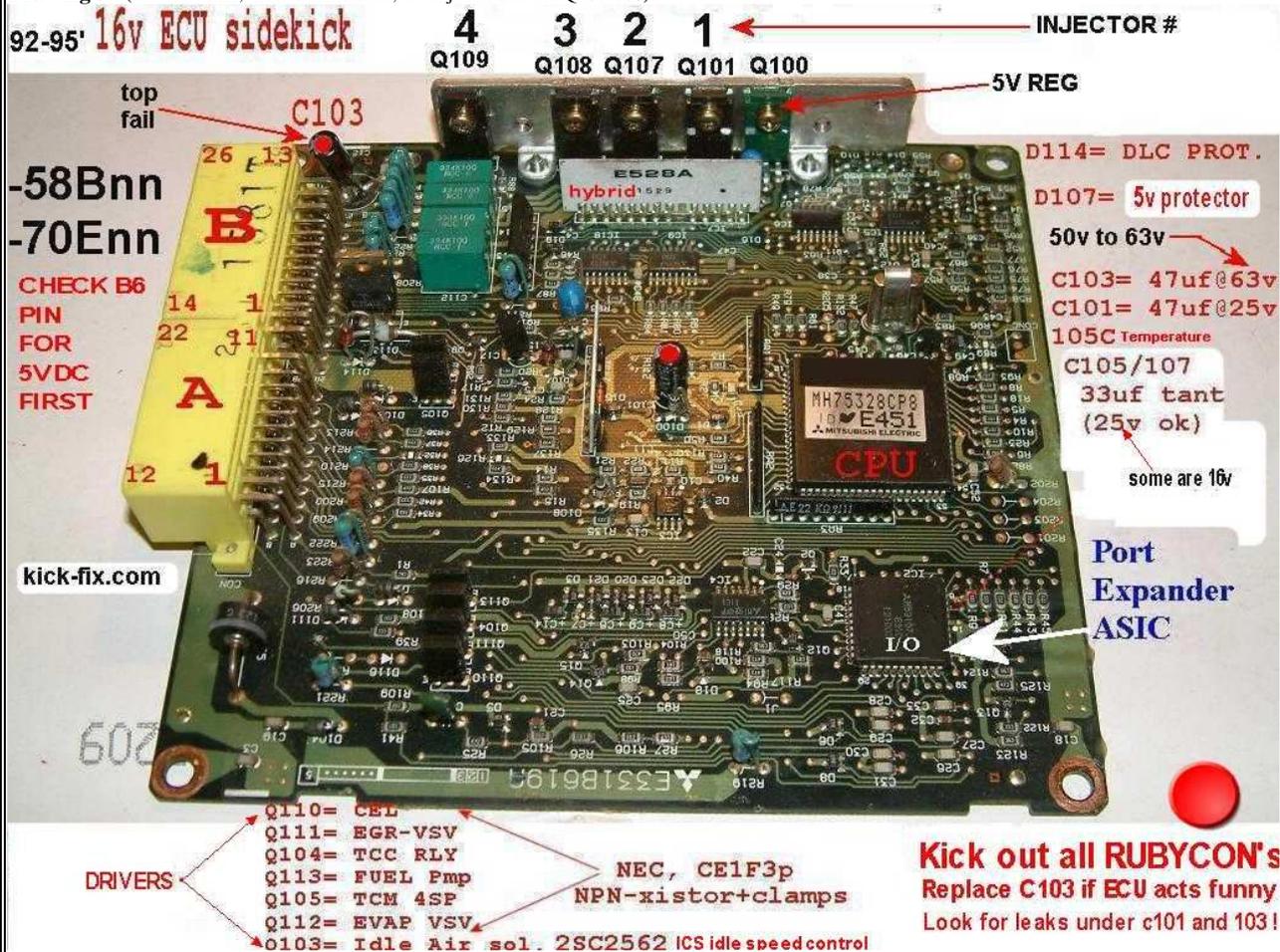
[See here for transistor testing.](#)

[Parts Substitutions.](#)

My 16V ECU photo below, shows all major ECU actuator driver transistors too !

Below is Typical of all 92's to 95 , and 16 valves typ. of USA and Canada, other countries, may be different.

**Drawing 3:** ( see heat sink, those 5 transistors, are Injector Drivers Q101-108)



**Secrets!**

Usually, only outputs blow up, all inputs are protected with resistors and filter cap.'s..

The transistors above with Qnn ID. have numbers/letters, on the side. Q103 has C2562 on the side. so...

For example the p/n becomes, 2SC2562 at Q103 ( just add 2S and the full JAPAN p/n is created).

Lets say, the fuel pump relay is dead and Q113 is dead (cause) the transistor is marked. CE1F3P (the whole row are same pn) [Fast data for same](#)

IC-15 (not a transistor but looks like it) is a 10 vdc regulator. [TA78DS-10BP](#) That supplies power to IC17

Q105 is missing on mine, due to its being a M/T ECU.

IC-14 ( dual driver SIP [m6269L pin1&7](#)) connects to ECU pin B23 Heater O2 driver. All parts starting with "M" for Mitsubishi are impossible to find. The Main Relay Driver on pin A10 is connected to Diode **D102** and to B1 Ground. ([not truly driver, just a single diode see it here](#)) The injector drivers are [2SD1415](#); (before ordering this part , be sure its in a 100% plastic package, no metal on backside or mount tab.) Q100 is a [2SB1018 PNP Transistor, it too, must be in plastic 100%](#) [Q103 the 2SC2562](#) ISC driver. NPN power transistor. Easy to buy it is.

The CE1F3p  
is here

[Parts Substitutions.](#)

**2 new schematics :**

**[My Injector schematic.](#)**

**[+5vdc refr. and main 5vdc power supply details.](#)**

If the 2 white ceramic hybrid modules (eg IC-7) are bad?, I think it's the end of the road. (Mitsubishi don't return calls)

IC 1 the processor is programmed and is not sold anywhere in that form. IC2 is a custom Mitsu, ASIC, and is not an over the counter part.

1996 ECU exposed. (the 1997 ECU now has the TCM moved into the ECU, so is different)

**[My 96 ECU DATA . \(my driver map shows parts and functions\)](#)**

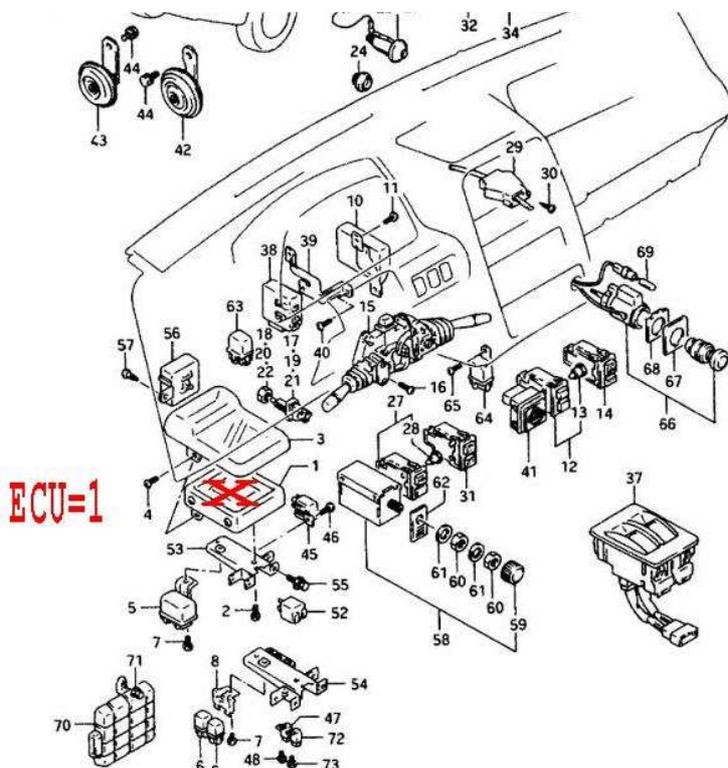
I dont have information on the 97 /98 PCM with internal TCM.

**Removal of ECU: 89-95 .**

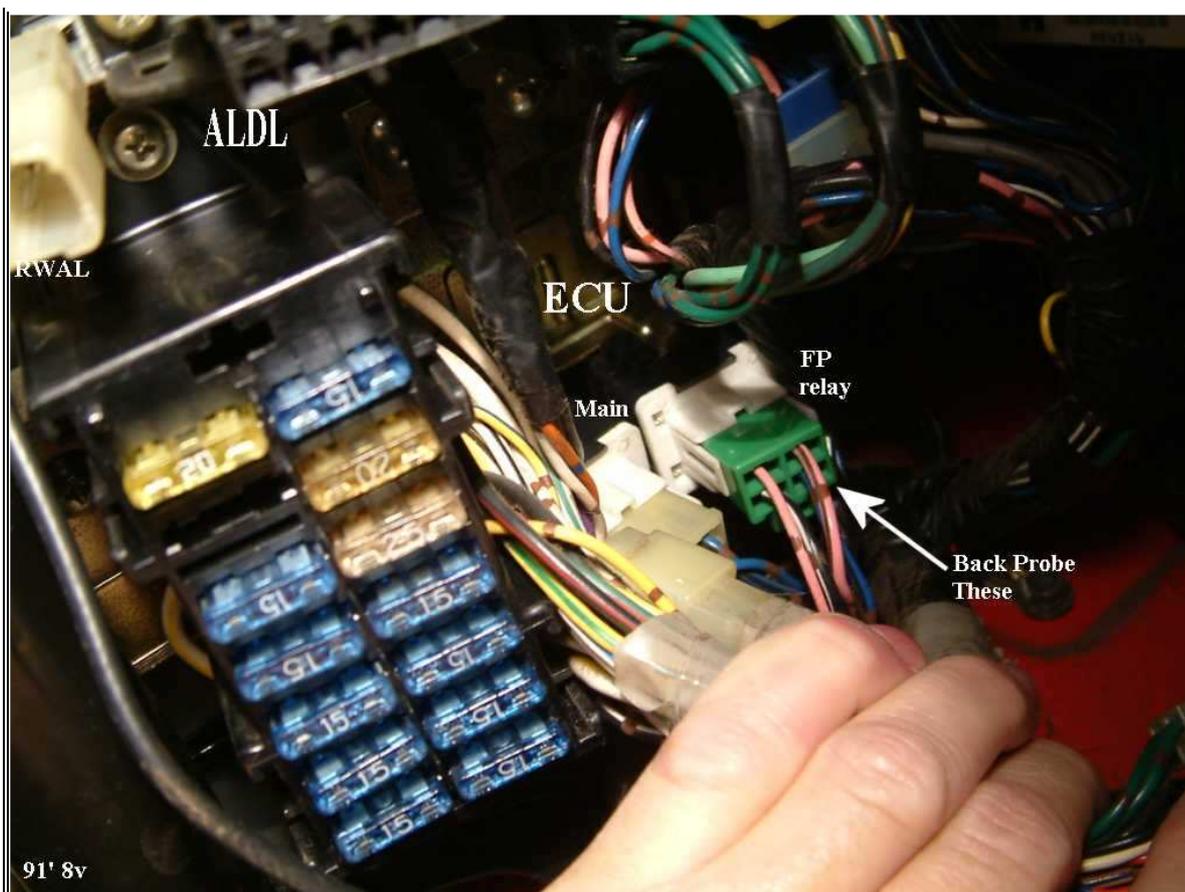
I can remove ECU in 10mins now. (2nd time, is way easier) Use a **number #3 Phillips** large screw driver, or you will fail.

ECU: removal: (left hand drive cars). { **ALL SUZUKI** connectors are locked, Never ever force them, depress the lock lever and wiggle gently)

- **Disconnect** battery neg. terminal, black color. so you don't deploy air bags (many cars have them ,maybe not yours) and you dont blow up ECU, if pins cross because that is a real risk. Air bags can be lethal. Most USA cars this year range have no Air Bags, but other markets might. I do not know .
- **Remove** speaker left front, cover with 4 screws.
- **Remove** speaker and unplug it.
- **Look** inside speaker hole, see **ECU?**
- Some can **remove** the connectors on ECU now, but the Conn. locks are on top. if not skip this step until later.
- From the bottom **remove** at least 2 screws, on ECU, that have there heads pointing down. (can be real hard to remove, need large #3 or 4 Phillips driver)
- The screws can be **tight** and you may need to remove the whole mount, I replaced the 2 bottom centerline screws with hex head. Problem solved.
- **Slide** ECU to the front of car (firewall). (loosen wire ties or remove them as necessary.
- Next ! , **depress** the connectors locks and wiggle out the connectors on the rear of ECU, one white and 1 green on 8v. **DO NOT FORCE THEM.**
- ECU is now **free**. remove it.
- To put back ECU, reverse the above.



1991 shown. (89-95 similar) The Pink wires are Fuel Pump Relay , on Green socket, Main is to the left.



[WHERE TO GET NEW CAPACITORS ?](#) << click me.!

Where to get parts?: **Digikey, Mouser, or MCM are the top 3 sources here in the USA. Mouser ships lightning fast.**

[Source 1: My favorite MCM electronics](#)

[Alt Source 2: Match a Knob in NY, has both transistors for the injectors., min. order is 2](#)

[Source 3:](#)

This kit, above, will work for both 8v and 16v ECU's.

Some CAPS are tagged, 63-64vdc or the like, and the same P/N ECU, will have 50vdc, so use either. voltage.

If you have time, look at all the cap's at Mousers and try to find the Lowest "ESR: type and Higher Temperature rating.

ESR is equiv. series resistance, and get 105 degree rated caps,

Size, Capacitance, Voltage, Temperature rating and ESR rating. (there is no factory ESR spec.).

Just make sure the Capacitance is equal or greater and the working voltage rating too and still make it fit the case.

I have never seen an ECU malfunction with the above new quality replacement Cap.'s.

**ESD Warnings: AVOID HANDLING DAMAGE** (dont touch pins or circuits unless replacing parts)

ESD?, ever touch a door knob?, on a cold winter day and see a spark?, that is an ESD event!, 10 times less, unseen, will kill semiconductor electronics.

Legacy systems are far worse for ESD, some parts have zero protection inside. (we called it naked MOS, back the..)

Be sure to handle your ECU carefully (even the FSM has warnings) and to observe **ALL** [Electro-static discharge procedures](#). (ESD)

( [DIY in a pinch](#))

You can work on the ECU using a damp cotton towel or a sheet of aluminum foil, keep your body touching the foil, or towel with your elbow, then lay the ECU down on the foil and work on it. This will keep you from generating static, as you work in the ECU.

Never work on any Plastic or Varnished wood, or Formica tops. Bare wood is much better (not perfect).

Wear cotton jeans and a cotton shirt, and natural leather shoes. Avoid all plastic near electronics and your clothing.

If your shop is below freezing or is air conditioned and the humidity is below 20%, your shop may be bad for electronics work.

If it is very dry in your work area, this is a heads up, on ESD conditions. (extreme)

A professional shop has a [3M grounded desk pad](#), a [3M wrist ground strap](#), an [antistatic chair seat and back \(carbon fibers\)](#), [floor tile with carbon](#).

A pro grade carbon fiber based, solder sucker. (black case) My shop has all this and more.

The soldering iron needs to be one, with a 3 wire AC line and the tip must be grounded. (no 2 wire soldering tools)

**Walmart** sells dirt cheap ground soldering pencil.

In a pinch: (desperate?)

You can just warp some spare wire (grounded) to the upper shank of the soldering iron and then the other end to the foil or damp towel.

This prevents the ESD events from damaging fragile circuits of the ECU.

These are crude methods here, and is only for emergency repairs. (car stranded at Mother-in-laws house, so sorry !)

I have a professional ESD work station at work (retired now) and home, but it set me back \$200. (even my tools are ESD rated).

**In a pinch , radio shack has Cap's that will work just fine. Put them in and then buy nicer ones later. No hurry.  
Not all Radio Shack's sell electronic parts, and some need to special order them. (this web page shows far [better sources](#))  
I don't personally buy anything there, but *we* have them in every city and desperation can win out , over DEAD in the Pavement!**

**This topic, ESD ? , is an endless topic, I will stop here.**

#### HOW to tell if my ECU is factory virgin or has been rebuilt?

1: Evidence of shop soldering methods (not factory wave or vapor phase reflow soldering ) Hand soldering looks very unique.  
2: Warranty stickers on case. "Joe's ECU rebuilders , LLC) < I made that up. Or here is a real one, "[CARDONE](#)." lots more companies exist.  
3: The [Conformal coating in bottom or top was breached by hand soldering](#).  
4: Acid damage obviously corrected, I use litmus strips to detect for, "is that spill acid or not?". I can tell if the last tech corrected, that spill.  
5: Non Rubycon caps , (all or part) some ECU do have non Ruby caps, in the center section, but ruby in corners. Replace all found Rubycons.  
6: Cap's with blowout cross on top ( this in non 89-95 caps) the cross top says to you , NEW CAP.  
7: Evidence of the black soot on lid, someone tried to clean, it but didn't get it all off, obvious to any tech.  
8: Corrected burn up damage, a transistor was replaced and the old burn mark soot in till on heat sink or on PCB. "Signs?"  
It takes seeing a virgin ECU to detect changes. 1 time. (virgin is, OEM factory stock and unmolested)  
So, not knowing what is normal, makes it hard for people to discover differences, No?  
A trained tech knows what is normal in a generic sense. But experience ,tells us what parts are non OEM.

NOW , how to replace the main CAP: eg:: C111 (or equiv) ?

**Any TV electronics shop can do this. (Arcade game repair shop, home electronics repair shop, ham radio nut, and lots of GEEKSetc.)**

1. Pull ECU out , see [above instructions](#).
2. Lid off , Remove the 4 screws on sides of ECU.
3. Look for smoke stains under lid ! Not good. Carbon smoke on lid ,underside ?
4. Look at each CAP and for Acid damage below it ! (electrolyte leakage, it is called)
5. Remove the 4 corner PCB screws. Printed circuit board.
6. See heat sink? On drawing 2 , remove 2 screws at each end. The PCB is now free.
7. Lift out PCB , keep left hand on metal case , never put PCB on plastic of any kind (Use anti static procedures)
8. Using solder wick , wick the solder from the bottom of C111, or use a solder sucker. (\$5 tools) A solder sucker tool, excels at this.
9. Use a grounded soldering pencil (30watts or so) (or a 100w soldering station set to 700F) Both have a 3 prong power plug.
10. Remove solder, then wiggle the pins until they are free of the PCB pads, then pull it ,the CAP noting the alignment of the MINUS STRIP on the cap.
11. Clean up any acid under the Cap with backing soda and water mix.
12. Repair any trace damage at this local area, look carefully for damage ! to the traces !
13. Put in new CAP in same spot and get the Minus Strip back to the correct orientation (polarity)
14. Solder it back with 60/40 Tin lead solder , no acid core , only rosin core. "electronics only solder"
15. Clean flux with alcohol , and then Reverse all above removal instructions.

In a pinch, lay PCB on Kitchen Aluminum foil. and keep it there. A DIY , anti static work station.

Sounds hard ,but it is 1 hour job.

I can remove ECU in 10mins now. (2nd time, is way easier) Use a **number 3 Phillips** large screw driver, or you will fail.

Only the aluminum CAN shaped CAPS are subject to leaking, (max 4 on each board, in USA).

End:

#### A common Question: FAQ

I get asked this over and over , so her are my answers:

Do the other non electrolytic caps go bad?, NO. Do not touch the ceramic disc, or gum drop Tantalum Caps.

If the acid eats up a ceramic cap "SMD" below the main Electro cap , then get a new cap with 0.1Uf 50v and replace it. even a ceramic cap with leads will work.

There are no internal schematics for ECU's ,nor have I seen any or heard of any, but I have one [for the Injectors as listed above., 8v](#).

except my schematics here. I have Driver schematics only. Because drivers blow out.

So, if any output goes bad, you now have the transistor location and PN. So just replace the transistor by function that is failing.

I have not done this, for all Sidekicks just the old 8v and the old 16v ECU's. 56B and 58B series. (no 57Bs or 60s, sorry )

If you look at the 16v photo above , all output transistors are identified. I did this for you. It exists no where else.

Someone helped me with the 16v ECU on line, in fact ,lots of things here, are from the many nice people at the Suzuki Forum.

I discovered all this 8v stuff , doing a custom ECU project. So I decided to share this information.

I have car and engine electrical schematics, [that are right here below](#):

I also made up a ECU part number list here. [See my PDF Parts list for 89-98 ECU's. \(PCM\)](#)

#### Fast facts on repairs: (do's and don't)

**Q: can all ECU's be fixed?**

**Not all ECU's are repairable.**

If the processor blows up or CAP ACID burns a huge hole through the board ,or the acid burns and the PCB carbonizes it, then she my be END OF LIFE.

An end of life ECU is just like an old rusted out car, so don't criticize **any man** who can NOT do what even a Deity **can not do!** **Please !**

**Q: Can I use just any injector driver transistor.?**

Do not use metal backed heat sink driver transistors (injectors) use the all plastic package ( special suffix pn) Do use heat sink compound as appropriate to the drivers.

**Q: Can I use any type solder.?**

Do not use acid core solder only rosin.

**Q: Are all CAPS bad? NO!**

If the CAP tops have a STAR EMBOSS mark ,they are new. ( these are; modern top blow out caps and are not old and are most likely good if not made in China)

If the caps are not black plastic covered then they may be ok.

If the caps are marked as "RUBYcon", then get them out now. (black plastic wrap)

IF you see acid leaking, bulging , cracking , or tiny volcano's on the caps , they are BAD. ( they can be measured easy when removed) Ask a technician. (or just swap them)

Do neutralize the acid with Arm&Hammer backing soda. Sodium Bicarb.

Do correct any acid damage to the traces near the caps, with jumper bridges of 20 gage wire .  
Do practice anti static procedures at all times.

**Q: Can I solder the CAP in just any old way? NO.**

Do put the caps back in , using the **same polarity** as the original or as the silk screen marks clearly show. ( if acid killed the silk screen marks make your own)

Do Clean off your solder rosin with alcohol after you are done, avoid alcohol else where's as the board is **conformal coated** top and bottom, looks like shellac.

**Q: Are all transistors the same, NO.**

Do make sure your new transistors have the same Pin ID's E, B, and C. (D,S,G) check the data sheet carefully, or even use a transistor checker to be sure.

Transistor test shows [low beta {HFE} that means it has reversal , E<C ,emitter to collector reversal ]

Transistors come in different packages, and pin locations.!

Do not use metal backed transistors for all plastic type. (yes, it can be done, but takes mica kits and lots of patience with metal backed To-220 cases)

Any questions on this , just post me. See feed back above.

**Q: How do I replace this CAP?** Answer : [http://www.afrotechmods.com/groovy/capacitor\\_replacement/capacitor\\_replacement.htm](http://www.afrotechmods.com/groovy/capacitor_replacement/capacitor_replacement.htm)

**Q: Is there a full schematic for my ECU, Answer: NO.**

**Q: Why do I say some parts are Unobtainium , Answer1:** they are NO LONGER MADE, or need programming.

Answer 2: sure find another old ECU and cannibalized it. or use substitutions. (ask for help)

**Q: Do I fix ECU's for a business,** Answer :NO not any more , Thank you, I am retired, this page is for DIY. Time to give back !

**CLICKING RELAYS under dash below ECU:**

[See my click and FI blowing page here.](#)

**more ECU photos;**

Here are responses, to such a call:

Here is the [1989 ECU see caps? replace both CAP.'s on the left side. PN: -60A32/42 MT/AT](#)

Here is another: [Vitara Australian ECU. 57B30 . very diff. design and far better than any USA , of this era.](#)

**Things that make ECU look bad, but ECU is not bad.**

- Bad 12vdc electric power feed to the ECU. (below 10vdc the ECU will go NUTS)
- Shorted Fuel Pump (normal draw is 4 Amps.)
- Shorted ISC (6 to 12ohms , 89/90 can be good at 6 Ohm's no less)
- Shorted wiring , off ECU.
- Shorted RELAY's , off ECU.
- Shorted VSV coils. (up to 5 on some years)
- Shorted Injector coils. (1 to 6)
- Shorted 5vdc power lines to TPS and other places.
- Shorted inputs to ECU (sensors shorted)

Never replace an ECU, until you **remove your shorts**. My wife slaps me, with I do that.

**THE END ZONE:**

All the things I have seen (and repaired) with ECU/ECM/PCM and TCM's go bad .

**Engine controllers or tranny controllers,etc.**

Not just stall the engine dead, as some my think.

The ECU is not Hamster in a box with a bottle of Whiskey and a push button. LOL !

1: The ECU can go to [backup mode](#)

(a dead main ECU section and a back up chip with fixed PARAMETERS, that run a motor , in the most horrible possible way !! "BLACK CLOUD"

2: ECU goes to [limphome](#), CEL on or off, all other facts or tests are useless you must find the cause of limphome. now. 15mph is typical.

3: ECU will not [glow the CEL](#) (lamps is present and not burned out, and all fuses are good above left knee) The ECU self test FAILED.

4: ECU glows CEL and will never turn it off , no matter what you do. ([we assume the Federal Nag switch is OFF.](#))

5: ECU flashes, a DTC code and mid stream, it aborts. ( ECU is crashing, bad main cap's or a bad internal powersupply)

6: ECU will not even flash 12s, but CEL comes on. (Nag switch off , this is bad ECU)

7: Scan tool keeps, WARNING , "lost communications".. a bad ECU.

8: Injectors cut out. (ECU is rebooting , interrupting normal injection flows) (ECU internal power loss issues, bad CAPS, loss of CMP, loss of spark cuts fuel)

10: Any ECU connected **actuator** output ports dead, see my transistor page (above) for that.

11: Any ECU **input ports** dead (very rare) inputs have very good protection on these ECU. "bullet proof , i'd say" Listed for completeness !

12: **BAD caps YAH. Symptoms very ! #1 FAIL !**

13: Ignition drop outs, the CMP is 100 % ok. but ECU is not ok. CMP is the CAM angle sender. CMP drops must fail for 3 seconds for ECU to report them.

14: Any of 1000s of other problems , incredibly rare.....? 100,000 transistors in all , no joke.

15: Vibration sensitive fails of any kind . Loose PCB parts?

16: Cold solder joints on the PCB. (shoddy past work?)

17: Cracked traces on PCB (printed circuit board)

18: Acid damage to parts or copper PCB traces (guess who did that... ?)

19: Water damage (Someone Fording streams? knee high?, or running with broken windshield have you.)

20: Invasion of bugs, nests and POOP, dung, bug snot, spider guts.webs,etc.... seen it all. Even had a spider plug up the on PCB BARO, and BARO was ok but failed.

21: Collision damage, vibration damage. Inertial damage.

22: Either of the internal power supplies, inside bad , there are two 5vdc power supplies, one can be checked at the TPS power pin. Dead, noisy, or loss of regulation.

Any of the 100s odd parts on the PCB bad. Not one is extra or useless.

**Feed Back:**

Questions: <http://www.suzuki-forums.com/suzuki-sidekick-escudo-vitara-geo-tracker/>

**Comments:**

This page is complex and so is the ECU , as I have only lightly touched the surface.

The ECU can fail in 1000's of ways.

Parting shots: Bogus CAP's'

[The Capacitor \*\*Plague\*\* is documented here.](#)

[And here At IEEE ! See artical there, called BOGUS](#)

[See this SAE Jargon here.](#)

more jargon ?

PN or P/N is part number

CEL , check engine Lamp.

SES, service engine soon.

VSV, vacuum solenoid valve.

SMD , surface mount devices.

Search content="ECU,ecu,PCM,pcm,ECM,ecm,injection controller,spark controller,engine controller,engine brain,engine puter">

rev 25 added an index at the top. page is too big. so.... 5-12-11 , added wav file 9-29-11 (for young people)

Usage of , dagnabbit line from his 1942 movie, *Sunset on the Desert*, starring Roy Rogers.

(then later by Deputy Dawg Cartoons and Andy Devine, Slim Pickens, Walter Brennan, Deputy Dawg, Elmer Fudd, and Yosemite Sam.)