TR8 Articles about Fuel Injection

Jim TenCate

There are currently 6 separate "info sheets" imbedded in this file. Click on any box below to read what you might be interested in. To get back to this index, just click in the upper left hand corner of any page. If you've got more articles you'd like to add, let me know!

TR8 Fuel Injection: The Current State of Affairs (ECUs)
(a 1991 article from the TR8 Car Club of America)

An interesting proposal about UK ECUs...

TR8 fuel injection computer repair (missing photos)
(an article from The Vintage Triumph by Jim TenCate, Rod Barman, and Bill Sohl)

Fuel Injection Wiring Diagram (NOT the ECU insides !) 1980 CA

Bosch fuel injector Tech sheet (dimensions, flow rates, etc.)

Bosch fuel injector Cross Reference (i.e., which cars use which injectors)

TR8 Fuel Injection: The Current State of Affairs

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(Submitted: 2 August 1991)

Yes, this is a kind of tongue-in-cheek "technical article" but I couldn't resist. Here's an article/letter that all of you fuel injected TR8 owners will be interested in. The fuel injection set up on the TR8 is pretty robust. Still, in spite of all the components being Bosch, what would you do if your car suddenly wouldn't start one day? Here are some solutions, tips, and a review of current 'research' into the TR8's fuel injection.

In the last TR8 Car Club newsletter, Doug Gold wrote about a fuel injection problem that he had with one of his cars. Well, since that time, my car died too (and has since been fixed). I thought I'd share my story with all the TR8 Fuel Injection owners and fill everyone in on the current state of affairs with '8 fuel injection. I've even got a TR8CCA 'research proposal' in the works. Read on!

HISTORY

Here's a brief history of what happened to me. When my fuel injection died, it was completely unexpected. My wife and I were planning on taking the '8 on a *long* trip (Austin, TX -- Atlanta, GA -- Long Island, NY -- Tennessee -- and back to Austin). I had the car out the night before to run some miscellaneous errands before we left; the car ran great. I was looking forward to the trip. Next morning, we locked the house up, opened the garage door, got in, and crank, crank, crank. Hmmmm. Crank, crank, crank. Nothing. The car fired a little and then died. I was mystified. I popped the hood open and checked to see that the fuel pump was working (you can do this by opening the air flow meter flap with the ignition ON). I fiddled a little while longer (and even resorted to wiggling wires and invoking the name of Joe Lucas) before I gave up. We piled everything into the Taurus and left. I took comfort in the fact that at least the '8 had the sense to die in the garage and hadn't left me stranded somewhere.

After I returned, I started debugging the entire fuel injection with the help of a newly acquired book. For those of you with fuel injected 8's, you really MUST get the following manual: *Bosch Fuel Injection & Engine Management*, Charles O. Probst, SAE. It's published by Robert Bentley Publishers (617) 547-4170, Cambridge, Mass, 1989 (ISBN 0-8376-0300-5). Victoria British (800) 255-0088 also carries it (see page 71 in their TR7/8 Catalog). The price is a little over $35. Even if you're only mildly interested in how your fuel injection works, this is *the* book to get. It's extremely well written. For those of you who don't know, Lucas licensed the L-Jetronic (with lambda) system from Bosch and used it in the TR7, TR8, Jaguar XJ6 & XJS/XJSV12, and numerous Rover models. If you look carefully, you'll discover that almost all the fuel injection parts in your '8 have Bosch part numbers on them (usually underneath a Lucas sticker)!

While debugging, I found it helpful to redo the fuel injection wiring diagram for the 1980 FI since the one in the shop manual is a little hard to read. A copy is attached to this letter/article. I've included all the Bosch alternative part numbers on the diagram as a reference. It's interesting to note that not all the wire colours in the 1980 cars necessarily match the 81's so be warned.

With the book's help, I finally tracked down my problem. Everything in the system checked out except, you guessed it, the Electronic Control Unit (ECU). To be sure I really had a bad ECU, I removed it and took it to Tom Bishop: Tom and I are both members of the Hill Country Triumph Club here in Austin and Tom owns an 81 TR8. We plugged my ECU into his car and the result was the same: car wouldn't start. The ECU was certainly bad. No doubts now. By the way, some of you might be amused to note that the ECU is the only part of the fuel injection that isn't standard Bosch equipment (it's Lucas).

SOLUTIONS

So, what solutions are available to you if you should find yourself in my situation? Here they are.

1. The factory (Lucas) solution: I got on our TR8 network mailing list and asked around. Bill Sohl had already been inquiring about the TR8 ECU earlier in the year. He had found that the current Lucas price on a rebuilt ECU was around $1200. Tom Bishop thought he had heard that price too. I gulped when I heard that. That's ridiculously high. No wonder people convert to carbs. Pity. I tried calling

Lucas myself just to see. What a runaround. No one really knew anything. Evidently, Bill Sohl had actually managed to talk to someone helpful previously. It seems that Lucas has a repair contract with an undisclosed facility. They don't do the repairs themselves. I decided that the Lucas option was out. Lucas, by the way, refuses to release the schematics for the ECU.

2. Aftermarket fuel injection conversion kits are still expensive, coming in at around $1000. Whew. (Steve Chandler in AZ is thinking about taking this route with his car). I decided against looking into this any further.

3. EightParts (602) 748-8115 in Tucson, AZ presented another possibility. They'll sell you a rebuilt ECU for $850 (with return of your old ECU). Their rebuild is guaranteed for 6 months. I gulped again.

4. TS Imports (800) 543-6648 in Pandora, OH had two possibilities for me. (1) I could buy a used ECU for $500 and get a 30 day guarantee (they also wanted my old one) or, (2) I could buy a rebuild for $750 (again with my old one as exchange). I only swallowed hard this time. Things were getting a *little* cheaper.

5. The Roadster Factory doesn't deal with the TR8 ECU.

6. Victoria British only stocks the TR7 ECU (at about $800).

7. Triumphs Only, Wayne Bier in San Jose, CA (408) 947-7766/7888 offered the cheapest solution. I had read about Triumphs Only in the last TR8CCA newsletter (Doug & Diane Gold's letter). So, I looked up Doug & Diane's phone number and called them. Doug told me that everything I had read in the newsletter was true. On top of that, the cost was only $250. I called Triumphs Only the next day. Wayne said to send my old one down, and he'd send it away. If it could be fixed, I'd get my ECU back C.O.D. If it couldn't be fixed, I'd get it back (and presumably only have to pay shipping). Turn around time was about 1 week. Guarantee? None really although Wayne was reported to be a reputable guy and his business solid.

8. British Parts International of Houston, I'm told, also repairs ECU's but I'm afraid I haven't looked into it yet. If anyone knows more about BPI, please drop me a line.

9. There is another, very promising possibility. I'll discuss it after I tell you what I ended up doing.

MY SOLUTION

OK, what did I do? Well, first, I took my box apart. There are six screws holding it together. Two of them (in opposite corners) are sealed up with metal dish-shaped caps. I pried off the dishes and unscrewed the box. Wow. What a mess! Everything was glued in place. The guy who soldered my particular ECU together was really sloppy. There are two boards inside. Each has loads of discrete parts. Transistors, resistors, capactors everywhere. There were two or three (maybe more) integrated circuits too. A little checking led me to discover that most of the parts are proprietary and have 'house' numbers (meaning that you can't just go down to your local electronics store and buy a replacement part). I decided I didn't have the time to even start to debug the ECU myself. I sent it in to Triumphs Only on a Monday. It came back the following Thursday and my car has been running great ever since! For those of you who are curious: *Yes*, I did take the fixed ECU apart again when I got it back and *No*, I couldn't see what had been fixed/replaced.

THE PROBLEM / AN ALTERNATIVE

I called Wayne Bier after my car was running to thank him and inquire further about exactly who fixed his broken ECU's. Wayne wouldn't give me his name but did say it was a "kid" who fixed them in his garage for fun. The question is, what happens when the "kid" decides he's bored with fixing ECU's? I think we'll be stuck.

There is an interesting alternative which is currently untried (9. above). If you haven't read the "Research Proposal" on the next page or so, do it now. Basically, several of us think that certain of the European Rover ECU's will probably work in our TR8's. Morever, since **NEW** UK ECU's are going for about $500, the Rover ECU route would be *much* cheaper than buying a rebuild here. We need to try it. If you would be willing to kick in $10 to the "research fund," please drop me a postcard with your name, address, and phone number telling me you're interested. (DON'T send $$$ until I actually find a UK ECU.) All I want right now is to see if enough people are interested so we can make this 'experiment' fly. By the way, EightParts and TS Imports both think the European ECU *won't* work (but then, they have rebuilds for sale). I also contacted The Roadster Factory and, alas, they didn't really seem interested either. If any of you are going to the UK soon or have contacts there, please let me know. Any and all suggestions are most welcome.

THE FINAL FRONTIER?

Here's a bit of an update on some interesting FI work being carried out by Rod Barman (a Rover owner with a FI setup). Rod is an electrical engineer in Vancouver who's been dissecting his ECU. He's almost got the whole thing figured out and has been working (with Bill Sohl) on building a substitute ECU for any L-Jetronic system. The substitute will be adjustable and open for tinkering and tuning. Rod's a little busy right now *and* he just got a Healey so he's not done too much on his design lately BUT.... Stay tuned!

ACKNOWLEDGEMENTS

Thanks for a lot of the stuff in this article go to (in no particular order): Rod Barman, Bill Sohl, Steve Cox (UK), and everyone on the TR-8 owner's mailing list.

TR8 CAR CLUB OF AMERICA

REQUEST FOR EXPERIMENTAL
RESEARCH FUNDING

TITLE	TYPE OF TASK
ECU experiment for North American TR8's (and Rover 3500's)	Experimental

PRIMARY INVESTIGATOR	CAR TO EXPERIMENT ON	CONTACT PHONE NUMBER
Jim TenCate	1980 TR8 (CA FI version)	(512) 835-9474

SUMMARY

Currently, rebuilt fuel injection computers (ECU's) for the TR8 are available but expensive. Typical rebuild prices are from $750 to $850 (with exchange). We fear that soon these ECU's may become rare and prices will rise to outrageous levels. We propose to perform an experiment to see if European specification Rover ECU's will work in the North American cars.

RESEARCH JUSTIFICATION

We have it on pretty good authority that the ECU for the North-American TR8 uses the same basic ECU as some European Rovers. Here is a quote from a letter to Bill Sohl from an engineer at Rover:

> "I double checked the facts and can confirm that the 4CU (ECU) was also used in the same state of tune on pre-1987 low compression (8.13:1) Range Rovers with EFI and European spec Rover Vitesse Sedans (9.75:1). These vehicles did NOT use catalysts, but their ECU's contained the componentry to utilise lambda sensor signals (oxygen sensors), albeit with their internal 'jumper' connections removed. Modifications of these ECU's to suit North American Spec TR-8s and Rover SD1s is, therefore, very straightforward."

PROPOSAL *(attach additional sheets if necessary)*

Let's all chip in and see if we can buy a used (but working) European Rover ECU from a breaker's yard (junkyard) in the UK and try it out on one of our cars here (I'm volunteering mine). NEW ECU's in the UK for the Rovers listed in the letter above are only about $500 (US$) so I'd guess a used one might be about $200 or less. I'd prefer that we get enough people together so that each of us need only put in, say, $10. (I currently have 7 "sponsors.") If the ECU DOES work, then we can all breathe a sigh of relief knowing that a generous supply of ECU's still exists in the UK. In fact, we could even sell our experimental ECU to the first TR8CCA FI member who needs it and our experiment would have cost us nothing. If the ECU DOESN'T work, well, at least we tried (and each of us is out only $10). Furthermore, our ECU may prove helpful to others who may wish to experiment on it in the future.

TR8 fuel injection computer repair

By: Jim TenCate, Rod Barman, and Bill Sohl

Have you ever worried about the fuel injection computer on your TR-8? TR-8's are getting old (in car years). Electronic components are starting to break; in fact, reports of malfunctioning fuel injection computers (ECUs) are appearing almost weekly among TR8 Car Club of America members. Moreover, with emissions testing getting stricter by the day, you can no longer afford to throw a "bad" fuel injection system away and replace it with a carb setup; someday it may even be illegal for you to do so (and you won't be able to get your car "smogged"). Sounds scary doesn't it? Fortunately, there are alternatives. Moreover, with a little skill, you may be able to fix an ailing computer yourself. That's what this article is all about. Even though the repair suggested here is *not* for the novice, most of you probably know someone in your club or at work who's pretty good with a soldering iron. Read on!

HISTORY:

Unlike the Lucas-designed petrol injection (PI) system used on the TR5/TR6, the fuel injection used on late TR7 and TR8's is completely Bosch (L-Jetronic).

Unfortunately, this often-made statement is not quite true. Although all the fuel injection sensors and actuators on both the TR7 and TR8 are Bosch (see accompanying sidebar), the TR8 has a **Lucas**-designed fuel injection computer (or Electronic Control Unit/ECU). Unfortunately, it is exactly this Lucas ECU which gives fuel injected (FI) TR8 owners headaches (and is the subject of this article). For those of you that have looked inside the computer, the problems are compounded by the fact that many of the electrical parts are not standard off-the-shelf parts but custom made. It's just not possible to pull out a suspect transistor, go down to Radio Shack, and look up a replacement. It is reassuring to note that the *rest* of the fuel injection system on the TR8 is trouble free, gives good performance and fuel economy (about 22 mpg city/27 mpg highway), and achieves splendidly low emissions.

Why did BL/JRT choose a Lucas designed ECU for the TR8? Good question. We suspect that at the time Bosch didn't market an ECU with the dual lambda feedback circuits needed for the Rover V8. By the way, you fuel injected TR7 owners can relax; the TR7 uses a standard Bosch ECU.

How many FI Triumph TR8's were made? Currently accepted values for the *total* number of TR8's produced are all close to 2900. This number includes all 1977-79 pre-production coupes (150 or so), the 1982 Canadian models (less than 100), and all UK versions (probably less than 81). Of the 1980 cars, only California TR8's had fuel injection; although the exact number of these cars is unknown, 10% (about 200 cars) is probably a safe estimate. Of the 414 TR8's built for 1981 (which includes the Canadian 82's), all except the UK versions were fuel injected.* That would put the total number of fuel injected cars at about 600 and means that 20 to 25% of all TR8's produced were fuel injected. It's interesting to note that of all the current TR8 Car Club of America TR8's (~300 cars), about 22% are—or used to be—fuel injected.

Well here is an answer to your TR-8 FI parts dilemma, an almost complete FI cross reference. Handy for junkyard hacking, etc. Also note that Rover 3500/SD1 Fuel Injection parts are identical to the TR-8!

Part name Bosch number	Cross reference (Car and years)
Oxygen Sensor 0 258 001 051	Audi: 87-85 5000, 4000, Coupe Fiat: 85-84 X1/9, 82 Spider VW: 87 Fox, 87-85 Golf Conv, 84-83 Rabbit Conv VW: 84-83 Rabbit GTI, 84 Jetta GL
Cold Start Injector 0 280 170 028	Jaguar: 84-78 XJ6, 83-80 XJS
Auxillary Air valve 0 280 140 217	None available
Thermotime switch 0 280 130 220	De Lorean: 82 DMC 12 Ferrari: 84-80 308 GTBi, GTSi Jaguar: 84-78 XJ6, 83-80 XJS Peugeot: 85-81 505i
Combination Relay 0 332 514 121	Alfa Romeo: 82-81 GTV 6 1/81 to 8/82 BMW: 81-79 528i, 81-78 633 CSi, 733i Fiat: 81-70 Brava, Spider 2000, 80 Strada, 80 X1/9 12/79 to 5/80 Renault: 83-82 Fuego, R18i Triumph: 81-80 TR7 9/79 to 3/80
Air Flow Meter 0 280 202 008	None available
Injectors 0 280 150 105	Alfa Romeo: 82-81 GTV 6 1/81 to 8/82 Jaguar: 83-80 XJS Porsche: 76 912E

*See Ken and Susan Grace's article in Issue 26 of the TR8 Car Club of America's newsletter or the Spring 1992 issue of the Toronto Triumph Club's *Ragtop*.

Other cars used the same Lucas-designed ECU; the TR8's bigger cousin, the North American Rover 3500 (SD1), is a good example. Paul Adkin reports that some of the UK Rovers—European-spec Rover Vitesse Sedans (9.75:1) and pre-1987 low compression (8.13:1) Range Rovers—also use the same ECU, albeit with the jumpers to the feedback circuits disconnected. So, there are plenty of ECU's out there if you want or need a new or rebuilt one. Replacement ECU's are expensive though.

OPTIONS:

What do you do if it turns out *your* ECU is bad? You have several options.

(1) Victoria British (Lexana, KS) will sell you a "new" one for $1400. We haven't gotten a clear answer from anyone there as to whether these are rebuilds or brand new although a sales manager claims they *are* from Lucas.
(2) A Haltech programmable fuel injection conversion (about $1300) might be just the ticket for those of you interested in exceptional performance.
(3) EightParts/Rovers West (Tucson, AZ) will sell you a rebuilt unit for $725 with exchange.
(4) TS Imports (Pandora, OH) will sell you a used unit for $500.
(5) Rover dealers in the UK will sell you a brand new UK-spec ECU (less than $500) for one of the European Rovers Paul Adkin mentioned. All *you* have to do (we think) is to connect up the lambda feedback circuit board jumpers.
(6) J E Motors (England) will fix any ECU for £268.
(7) Triumphs Only (San Jose, CA) has a guy who *may* be able to fix it. Last we heard the cost is around $300—if he's successful.
(8) Fix it yourself.

Option (8) is what this article is all about.

SYMPTOMS:

So, how do you decide if your TR8 has a bad ECU? Here is a short list of symptoms:

(1) car abruptly dies or won't start,
(2) car intermittently loses power, or
(3) car surges under part throttle or idle, warm or cold engine.

Symptom (1), although similar to what happens when the electronic ignition amplifier or coil dies, is caused by loss of power inside the ECU. Symptom (2) is caused by a loss of switching current on one bank of injectors. Symptom (3) is caused by bad feedback loop(s) in the oxygen sensor circuitry. Any one of these symptoms may indicate a bad ECU. However, before assuming the worst, you should first do a cursory check of the *other* parts of the injection system. For that we highly recommend getting the following book: *Bosch Fuel Injection & Engine Management* by Charles O. Probst, Stock Number GFIB, Robert Bentley, Publishers • (617) 547-4170.

If the process of elimination points to a bad ECU, the easiest test you can perform to check your suspect ECU is to take it to a working FI car (get a copy of the TR8CCA membership list!) and plug it in. [N.B. It's always good practice to disconnect the battery before unplugging or plugging in an ECU.] Do *not*, by the way, take a working ECU and plug it into *your* nonworking car. You could damage a good ECU (and a friendship) that way!

REMOVAL and DISASSEMBLY:

Let's assume you've decided that you may indeed have a bad ECU. If you haven't already located it, you can find the ECU underneath the glovebox, hidden by a grey plastic cover on the passenger side of the car. After you've got the ECU out of the car (and determined it really *is* bad), take it to a clean workplace with good light. You'll need to do some resoldering so have a small (25 Watt) soldering iron and some rosin core solder handy.

Unscrew the six long "bolts" (maybe "screws" is a better word) holding the top and bottom cover in place and remove the covers. If your ECU has never been opened before, two of the corner screws will have little metal caps that you'll have to pry out before you can get to the screw heads. If your ECU *has* been opened, the metal caps will be missing. With the top off, your ECU should now look like the one in Figure 1 (the *BiC* pen is shown for scale).

If you remove the two boards from the housing (by removing all the little screws on the edges of the boards), you can actually manoever the boards out of the housing. Figure 2 shows the two boards side by side, component sides up. For scale, a coin (US nickel) was placed on one of the boards. Notice the following things:

(1) There are three large power transistors on the silver coloured plate at the right hand edge of the right hand board; the top and bottom transistors are responsible for switching each injector bank on and off, the middle transistor has to do with supplying power to the ECU circuitry.
(2) The large capacitors (the rectangular box-like things) you can see on both boards are surrounded by some brown goo; the brown goo is glue. The large yellow capacitors at the top of the left hand board play an important role in the O_2 feedback circuitry.
(3) There are two ribbon cables connecting the two boards. We've determined that the right hand board contains all the usual fuel injection circuitry and the left hand board is mostly the O_2/lambda feedback circuitry. That begs the following question: is the left hand board completely missing from the European Rover ECU's or is it just the two ribbon cables? We'd love to find out.

Figure 1: ECU with its top off (power transistor board showing)

Figure 2: The two circuit boards inside the ECU

So, what causes the ECU go bad? The answer is simple: vibration and bad solder joints. Small electronic parts are often held in place with just the solder joint. This means the solder is performing a mechanical function as well as an electrical one. However, with larger parts like the power transistors and bigger capacitors, a mechanical solder joint will quickly fail in a vibration-prone environment like a car. That's why the power transistors are screwed in place and the large capacitors are all glued down. Alas, one of the problems with the TR8 ECU is that the solder joints on the large, glued -on capacitors fail anyway. The solder joints on the power transistors are even *more* likely to fail. The rapid switching of the injectors causes repeated heating and cooling of the solder joints which, in turn, causes them to become brittle. Brittle joints will crack much easier than new ones, sometimes even with just wee small vibrations. Once the joint cracks, the area inside the crack oxidizes. The layer of oxidation doesn't conduct well and eventually the joint fails electrically. (By the way, if you ever get a chance, take apart a Bosch ECU and notice how much more carefully everything is assembled on the circuit board!)

FIXING THE ECU

- For symptoms (1) and (2) [injectors not firing] the solution is just to resolder the solder joints connected to the power transistors (you'll have to turn the board over to see the joints). Add some new solder to the joint and make sure to heat the joint until the solder *flows*. (A clean soldering iron with a freshly "tinned" tip is important for this kind of work). For symptom (2) the joints which connect the transistors to ground seem (in our experience) to be the most likely to be bad. However, it can't hurt to "reflow" the other joints while you've got everything apart. It also won't hurt to add more solder and reflow the joints where the traces connect to the pin connector (which, in turn, connects to the wiring harness).
- For symptom (3) [surging], you've got a little more work to do. The solder joints for the two largest yellow capacitors at the top of the left hand board (see Figure 2) are the most likely culprits. However, for good measure just resolder the leads on *all* the large capacitors which are glued onto the board. These are the solder joints most susceptible to vibration damage.

So that's it. If you don't feel comfortable doing this kind of work, find someone in your local club who's adept with a soldering iron and show her (or him) this article. If you don't wish to get into all this, one of the authors of this article (JTC) will fix it for a small fee [membership in VTR and the TR8CCA is strongly encouraged].

WARNING:

One final note. Bob Rowley of EightParts in Tucson, AZ reports that some ECU's have been damaged by charging or jump starting the battery using one of the "Quick Charge" settings found on commercial battery chargers. It's suspected that these chargers burn out the ECU because they charge at a higher voltage. It may be possible to repair these ECU's but *not* with the simple fix we've outlined above. Simply jump starting the car has also caused a few ECU failures. Moral: keep your battery in tip top shape and watch out for those AAA tow truck operators!

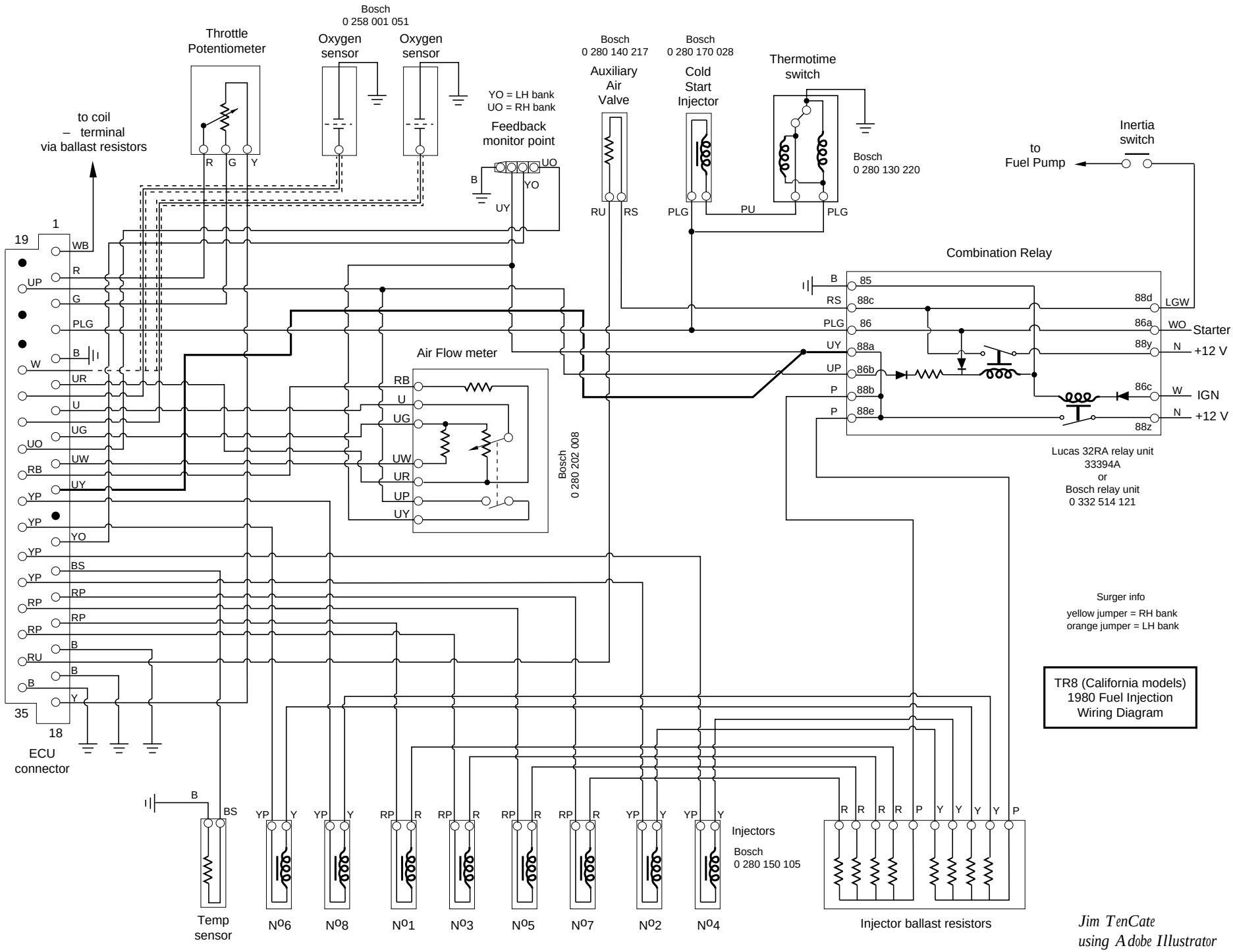
ACKNOWLEDGEMENTS:
Thanks to numerous folks in the TR8 Car Club of America. Thanks especially to TS Imports and Campbell's Classics for donating "broken" ECU's for experiments!

Seat Belt Recall

For those of you who missed the December issue of *British Car* magazine, the seatbelts on 1977-1980 TR7s and TR8s may have defective Kangol seatbelts. Evidently the belts will not retract on some cars or are stuck and cannot be extended on others. If you think your car's belts may be defective, contact John Retkowski, Jaguar Cars Inc., 555 MacArthur Blvd., Mahwah, NJ 07430-2327. Be sure to include you car's VIN number.

If you car qualifies for new belts, response time is quick—typically new belts arrive within 3 or 4 weeks. Photos of both old and new retraction mechanisms are shown below. Installation instructions (most useful for coupe models) are enclosed with the new belts along with instructions for returning the defective belts (return shipping charges are refunded).

Old (above) and new (below) seat belt mechanisms


Bosch
0 258 001 051
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YO = LH bank
UO = RH bank
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Lucas 32RA relay unit
33394A
or
Bosch relay unit
0 332 514 121
Air Flow meter
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0 280 202 008
1
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ECU
connector
Surger info
yellow jumper = RH bank
orange jumper = LH bank
TR8 (California models)
1980 Fuel Injection
Wiring Diagram
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Injectors
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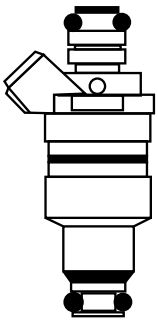
Temp
sensor
No6
No8
No1
No3
No5
No7
No2
No4
Injector ballast resistors
Jim TenCate
using Adobe Illustrator

DISC INJECTOR FLOW PROFILE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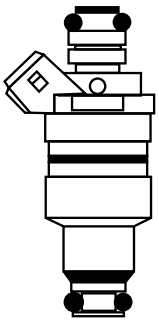
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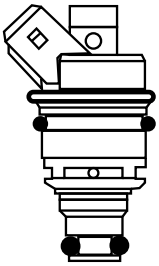
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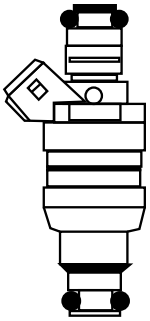
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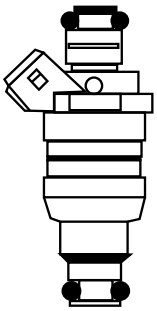
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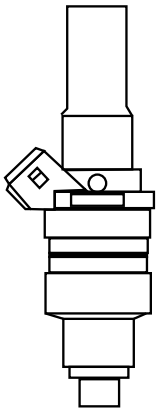
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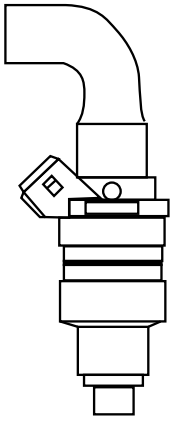
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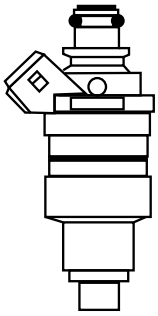
TYPE 8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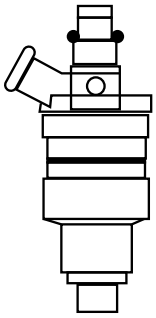
TYPE 10

	PART NO.	INJECTOR TYPE	DRIVE CIRCUIT TYPE	COIL RES. (OHMS)	DYNAMIC FLOW SET *	STATIC FLOW **	POUNDS PER HOUR	PRESSURE ***
	5201200	1	SATURATED	16.2	3.15	150.00	19.82	2.5 BAR
	5201201	4	SATURATED	15.9	4.58	150.00	19.82	3.0 BAR
	5202001	7	PEAK & HOLD	2.2	4.62	137.20	18.13	2.5 BAR
	5202003	8	SATURATED	16.2	4.03	137.20	18.13	2.5 BAR
	5202004	4	SATURATED	15.9	3.30	158.00	20.90	3.0 BAR
	5202005	4	SATURATED	15.9	3.57	120.20	15.89	3.0 BAR
	5203000	4	PEAK & HOLD	2.4	5.33	161.00	21.28	3.0 BAR
	5204001	6	PEAK & HOLD	2.2	4.62	137.20	18.13	2.5 BAR
	5205000	1	PEAK & HOLD	2.4	4.13	203.00	26.83	3.0 BAR
	5205001	5	SATURATED	15.9	8.63	286.00	37.80	3.0 BAR
	5206001	9	BALLASTED	2.2	4.47	154.70	20.44	2.5 BAR
	5206002	9	BALLASTED	2.2	4.00	137.20	18.13	2.5 BAR
	5206004	6	BALLASTED	2.2	5.66	190.10	25.12	2.5 BAR
	5206005	4	PEAK & HOLD	2.4	5.08	150.00	19.84	2.5 BAR
	5207002	2	SATURATED	16.2	4.05	137.20	18.13	2.5 BAR
	5207003	2	SATURATED	16.2	3.22	120.00	15.86	3.0 BAR
	5207006	2	PEAK & HOLD	2.2	7.92	236.00	31.19	2.7 BAR
	5207007	2	PEAK & HOLD	2.2	3.07	107.00	14.14	2.7 BAR
	5207008	2	PEAK & HOLD	2.2	9.03	268.40	35.47	2.7 BAR
	5207009	2	SATURATED	16.2	6.10	218.50	28.88	2.5 BAR
	5207010	10	PEAK & HOLD	2.2	10.90	308.10	40.72	2.7 BAR
	5207011	2	SATURATED	16.2	4.83	181.00	23.92	3.0 BAR
	5207013	4	SATURATED	16.2	3.99	146.80	19.40	2.7 BAR
#	5207600	8	PEAK & HOLD	2.2	10.11	277.00	36.64	2.7 BAR
#	5207601	8	PEAK & HOLD	2.2	11.36	367.00	48.55	2.7 BAR
#	5207602	8	PEAK & HOLD	2.2	12.68	394.00	52.12	2.7 BAR
	5208001	6	PEAK & HOLD	2.2	4.62	137.20	18.13	2.5 BAR
	5208003	6	PEAK & HOLD	2.2	4.62	137.20	18.13	2.5 BAR
	5208004	2	PEAK & HOLD	2.2	6.10	173.30	22.90	2.5 BAR
	5208005	6	PEAK & HOLD	2.2	6.10	173.30	22.90	2.5 BAR
	5208006	2	SATURATED	16.2	3.74	120.00	15.86	3.0 BAR
	5208007	2	BALLASTED	2.2	4.20	137.20	18.13	2.5 BAR
	5208008	1	SATURATED	16.2	8.13	271.00	35.81	2.7 BAR
	5208009	4	SATURATED	15.9	9.96	320.00	42.29	3.0 BAR
	5208010	1	PEAK & HOLD	2.4	11.80	394.00	52.07	3.0 BAR

* MILLIGRAMS FUEL/PULSE, PULSE = 2.5 MILLISECOND
** GRAMS FUEL/MINUTE
*** BAR X 14.5 = P.S.I.
\# T.B.I. INJECTOR

Interesting tidbits for fuel injected TR8 owners from Rich Goldstein, a member of the TR8 Internet mailing list. (Rich just traded a silver anniversary edition TR7 for a Lotus Esprit!) He was kind enough to scan the following page of specs to go with this letter and electronically mail it to me. I enhanced it with Adobe Illustrator and printed it out for everyone.

A local Lucas dealer here in Costa Mesa, CA (Import Car Warehouse 714-645-0521) was gratious enough to GIVE me a Lucas tune-up component catalog. Interesting stuff in there! The following list can provide guidance in the wrecking yard.

FUEL INJECTOR APPLICATIONS
5204001, 5208001, & 5208003 (Rover 3500, TR7/8)

Make	Model	Engine	Years	Injector	
Alfa Romeo	GTV6	2.5L	86-80	5208001	
	Milano	3.0L	86	5208001	
Fiat	Brava, Spyder	2.0L	83-79	5204001	
	Strada, X1/9	1.5L	83-80	5208001	
Isuzu	All	2.0L	87-83	5208001	
Nissan-Datsun	Maxima	VG30E	86-85	5208001	
	Maxima	L24E	84-81	5208001	
	Pulsar,Turbo	E15T	84-83	5208001	
	200SX, Stanza	CA20E	87-84	5208001	
	200SX	Z22(20)E	83-80	5208001	
	280ZX	L28E	83-75	5208001	
	300ZX (16603-01P10)	VG30	86-84	5208001	
	810	L24E	80-77	5208001	
Opel	Manta,1900	1.9L	75	5208001	
Porsche	912E	2.0L	76	5208001	
Renault	Fuego, Turbo, R18i	1.6L,1.7L	83-75	5208001	Bosch
Rover	Range Rover	3.5L	87	5208001	0 280 150 105
	3500 SD1	3.5L	80	5208001	
Triumph	TR7	2.0L	81-80	5208003	
	TR8	3.5L	81-80	5208001	
Volkswagen	Type II (Cal '74)	1.8L,2.0L	79-75	5208001	
	Type IV	1.8L	74	5208001	
	Vanagon	2.0L	83-80	5208001	

Notes:
5208001 has 70mm hose,
5204001 has 90mm hose,
5208003 has 115mm hose;
they can be interchanged by cutting hose to length.

Here is an exerpt from the Flow Profile table (shown on the following page) that has some interesting specs.

DISC INJECTOR FLOW PROFILE

P/N	Drive Circuit	Coil Res (Ohms)	Dynamic Flow Set *	Static Flow **	Pounds Per Hour	Pressure ***
5204001	peak & hold	2.2	4.62	137.20	18.13	2.5 BAR
5208001	peak & hold	2.2	4.62	137.20	18.13	2.5 BAR
5208003	peak & hold	2.2	4.62	137.20	18.13	2.5 BAR
5208005	peak & hold	2.2	6.10	173.3	22.90	2.5 BAR

* Milligrams fuel/pulse, pulse=2.5 millisecond
** Grams fuel/minute
*** BAR x 14.5 = P.S.I.

The injectors listed above all fall into the same physical configuration catagory "Type 6", which is basically an injector with a straight hose crimped to the inlet nozzle. As you notice, our Rover 3500, TR7, and TR8 applications utilized a "peak & hold" drive circuit. A local Rover 3500 owner friend of mine, Chris Kwan of Huntington Beach, CA, has purchased and installed the 5208005 injectors with good results. He claims that the car has more power, although he hasn't dyno'd it. Seems like the flow of fuel might be increased enough to take advantage of a hotter cam.

L8TR,
Rich