Middle-aged Mercedes Electrical Repairs

Got the day job back, Service Closed 'til further notice!

But feel free to use the information here as you can, and advice is always free.

Tired of your clock, tachometer, cruise control (CC) or automatic climate control (ACC) not working on your 70's–80's Mercedes? These systems often fail due to internal electronic problems. I've repaired quite a few of these for myself now, and thought I'd see if anybody else could benefit from what I have learned. You can get all these items repaired via the dealership or other similar avenues, but it is usually quite expensive as they generally only replace a broken subassembly with a new one. For most of these problems a used unit in unknown condition is just as likely to be broken as yours is. I do *component*-level repairs, usually for a substantial savings.

Here's the deal: If I can't fix it you don't pay for it, other than return shipping for items you have sent me (assuming you want them back). (Be aware that you may lose the 'core' value of items such as cruise control amplifiers, as most commercial repair houses will not accept units that have been tampered with.) I can also do the on-car removal and reinstallation for local vehicles, though I'll charge for that time. The warrantee is 30 days.

Particular items I do (and do not) repair:

Item	Years	Cost *
Mechanical clock	68–early 70's	—
Quartz clock, humming variety	mid-70's	$40
Quartz clock, ticking variety	late 70's and up	$20
Cruise control amplifier, Philco/Ford	75	—
Cruise control amplifier, VDO	76–89	$40
ACC pushbutton array, Chrysler	77–80	—
ACC pushbutton array, VDO, 107/123/early 126	81–89	$30
ACC w/pushbutton array, 124/201/late 126	84–89	$40
Klima (AC compressor) relay	84+	$20
Flickering Low Oil light	84+	$10

* Parts extra. Return shipping extra. (The parts are either cheap, or unobtainable. Luckily, mostly the former.)

Site Shortcuts:

Contact Info
Recognizing repairable items
Locating repairable items
Removing repairable items
Testing repairable items

Why won't I fix some things?

Mechanical clocks I've certainly tinkered with, but they don't seem to respond reliably to my ministrations. I can of course try to fix one for you, but I offer no warrantee at all and will merely bill you for the time. (My usual problem is that it runs fine initially, but slows or stops when it gets cold. I'm sure a big part of my problem is that I do not have a supply of the special lubricants used by clocks.) There are traditional clock repair services out there that know how to fix these, I'd recommend you avail yourself of one of them. Though I believe it can be somewhat expensive, a properly repaired mechanical clock should be good for ten or more years. I've never seen or worked on the early Philco cruise control used in 1975 (on SL's, anyway). The Evil Chrysler Climate Control that Mercedes saw fit to use for a few years is notoriously trouble-prone and hideously expensive to repair. (Chrysler had even dumped it before Mercedes started using it.) So sorry for you if this is your problem, I've never owned one and have no intention of ever doing so or of working on one. Seek help elsewhere for these! (I *can* do installation of replacement parts procured elsewhere for you, for a fee.) Cars newer than about 1990? Never worked on one before. Do you want me to learn on yours?

What's usually wrong with 'em?

This is what I've found to generally be the problem(s) with the various listed items:

Item	Years	Ailment
Mechanical clock	68–early 70's	Gummy; blown internal fuse
Quartz clock, humming variety	mid-70's	Broken plastic axle pin
Quartz clock, ticking variety	late 70's and up	Bad capacitors
Cruise control amplifier, Philco/Ford	75	—
Cruise control amplifier, VDO	76–89	Bad solder joints; blown driver transistors
ACC pushbutton array, Chrysler	77–80	Bad servo unit—bad design!
ACC pushbutton array, VDO, 107/123/early 126	81–89	Bad solder joints
ACC w/pushbutton array, 124/201/late 126	84–89	Bad solder joints
Klima (AC compressor) relay	84+	Bad solder joints
Flickering Low Oil light	84+	Bad solder joints

What else can I do?

The above tables list the things I can fix if you ship me a broken subassembly. For local cars I can do more things in the miscellaneous electrical department, such as curing a flakey tachometer, power windows that sometimes get stuck, etc. I'm asking $20/hour with a half-hour increment, plus parts and materials. I can clean and/or replace flakey switches, sticky power antennae, etc. I can replace rotten foam hoses in the ACC system that result in poor in-cabin temperature regulation. I can lubricate and/or replace aspirator blowers in ACC systems that also result in poor in-cabin temperature regulation. I can clean and/or replace flakey door switches. I can replace in-dash light bulbs, and I can clean and/or replace flakey dash-light dimmers. (I recommend replacement for these.) I can install keyless entry on 1986–1989 cars. I can replace heater fans on 107, 123, and 126 models, though the new blower is not a particularly cheap part. I can do other things I'm sure, please contact me for a specific quote. Skinned knuckles and grease? I have enough of my own cars that need that kind of work, I don't need or want to seek out any more.

Pricing structure

The pricing structure above is based largely upon my hobby labor rate of $20/hour, according to the the complexity of the job. (The ACC pushbutton array in the 124, 201, and late 126 cars, for example, also contains the entire ACC brain, whereas it's separate in the other cars. The Quartz clock in the 114/115 cars is relatively easy to fix, but an absolute bear to get open. I hate it. If it were as easy to open as the mechanical clock it'd probably be a $10 job. The cruise control amplifier is conformally coated, and requires a nasty paint stripper step.)

Contact Info

e-mail: jimc@windwireless.net or telephone: (509) 926-7801

USPS (any grade) and UPS are the two preferred shipping methods. I usually return ship via USPS, because that is most convenient for me. We're in the 99016 Zip code (for shipping estimation). Unless you're in a screaming hurry, it's hard to beat the economy of USPS Parcel Post.

How to recognize things I can repair:

Clock:
: Should be obvious. Of course you should have checked and/or replaced the fuse first. (True of *every* electrical problem!) I have also been able to repair the setting knob if it gets broken by ham-handed operation, though the success of this is less certain. The quartz (humming) variety of 114/115 clock says Quartz on the face; the ones that say Kienzle on the face are mechanical. All other clocks are quartz clocks of the ticking variety.

Cruise control amplifier:
: (The VDO system has the familiar column stalk, the Philco/Ford system has a dash-mounted rocker switch.) The system will accelerate when you hold the stalk, but won't hold speed. Other symptoms can also be caused by the amplifier, but the above is pretty definitive. *Most* cruise control failures at this age are caused by a bad amplifier. (If there is no mechanical linkage or vacuum failure under the hood. And if the stalk switch is not obviously damaged.) Another amplifier symptom is surging speed, often followed by an eventual cutoff. (This assumes that the speedometer needle is rock-solid. If it is not you probably need a new speedometer cable, or at least to lubricate the one you have. The 126 cars have electronic speedometers, there is no cable.) If you pass this electrical checklist and the cruise control still doesn't work, then the amplifier is highly likely to be at fault.

ACC control panel:
: (The VDO system has a horizontal row of pushbuttons, the Evil Chrysler system has a vertical row.) System acts spastically, is unable to heat properly. May be accompanied by odd repetitive clicking sounds, or even intermittent screeching sounds behind the pushbuttons. If the system is sensitive to tapping on the control panel or re-selecting a setting it's a good clue that it is at fault. Here are some symptoms that are *not* likely to be the control panel:

- It's merely unable to cool. It is likely that you have a traditional AC failure, such as a leak. Not for me! (Though it could be a Klima relay failure, which *is* something I can deal with. It could also be a sensor failure, see the electrical checklist.)
- Vents that don't operate correctly. The vacuum-driven pods that drive the vent flaps fail eventually. Replacing them is almost never easy, and not something I want to tackle.
- System heats uncontrollably, even on MIN. Could be a monovalve insert failure. This is an easy DIY repair, though I can of course do this for you if the car is local.
- System heats at idle, but doesn't on the highway. Doesn't respond to MAX setting. Most likely a monovalve insert failure. This is an easy DIY repair, ditto.
- System regulates a temperature that doesn't seem to correspond to the cabin temperature. Will obey MIN/MAX settings. Likely a rotted foam hose (or a seized aspirator for cars with them instead) under the dash, resulting in no cabin airflow over the temperature sensor. This is a moderate DIY repair, ditto.
- A blower that cuts in and out. Especially if it responds to bumps, this could be worn-out motor brushes. Depending on the model, this can be an easy to moderate DIY repair, ditto. For those models where it is difficult to near impossible, so sorry for you!
- System cuts in and out, but teasing the key around the ON position affects it. A failing ignition switch (the electrical portion) can cause only some accessories to cut in and out, especially since this switch has nothing to do with keeping a diesel engine running.
- System that won't heat unless DEFROST or DEFOG is first selected. There is a cold-engine lockout on heating that is bypassed on these settings. See the electrical checklist.
- Unplugging the electric auxiliary coolant pump (under the hood) results in normal operation. This pump augments coolant flow through the heater core, resulting in better heating at idle. Some newer

systems can detect if this motor is seizing up and will shut down to protect themselves. Most people never notice the lack of such a pump, assuming it is not blocked, and many European cars didn't have them to begin with. It should be noted that older systems' pushbutton units can be damaged by a seized pump, so you can either test yours before subjecting a repaired unit to it or just unplug it permanently (and thus join the EU in a small way). Many suggest installing an inline 2 A fuse on this pump to protect against seizures.

The more-expensive-to-repair ACC panel (because it contains the brain too) in the late 126 can be recognized as having a full-sized black "AUTO" blower button. The less-expensive-to-repair unit that is only a switch array has a narrow translucent "AUTO" button. I believe the 126 is the only model that had both types during its production run, and that the cutover was in 1986.

AC Klima Relay:

The compressor will not run, yet the system is charged. (There is a pressure safety switch to ensure that it won't run with insufficient refrigerant charge.) Or the compressor runs for some amount of time, then refuses to run again until the car is stopped and started again. You checked all the fuses already, right? The Klima's job is to disengage the compressor if it thinks anything is wrong. Some models also stop the compressor at wide open throttle for better acceleration. Klima's most important job is as an engine belt saver on cars with a single serpentine belt; if it detects that the AC compressor's own tachometer isn't indicating that the compressor is running properly when it should be, it will disengage the compressor permanently until the next time the key is cycled. Without it a seized AC compressor, an all-too-common malady, would cause the engine to throw off the belt, stopping the water pump and cooling fan. Engine destruction would follow soon thereafter if the driver was not alert. Some caveats regarding serpentine belt systems:

- Your belt could be slipping, and the system is working as intended. Check the condition of the belt and its tensioner first.
- The AC compressor's clutch could be slipping, and the system is working as intended. Check that the clutch is not all oily, perhaps flush it out with brake cleaner and let it dry. Clutches also have a 'gap' value that if too large will result in slipping. Wear or improper servicing can cause the gap to be out of specification.
- The AC compressor could be seizing up, and the system is working as intended. Spin the hub of the compressor by hand to see if it is binding.
- The wiring to the AC compressor's tachometer could be compromised, causing the Klima to think that the compressor is slipping when it's not. Examine wiring and connectors, especially down by the compressor (a harsh environment).

Engines with a separate AC belt may also have a Klima, but perhaps without a belt safety circuit. More caveats:

- Klima examines engine RPM as one of its inputs, so if the main tachometer is not functional there's a good chance that Klima may not be getting what it needs.
- Klima gets the low-pressure safety switch and engine overtemperature inputs, so if either of these is messed up Klima may not be getting what it needs.
- Some Klimas get the wide open throttle switch, so if this is messed up Klima may not be getting what it needs.

All that said, plenty of Klimas have indeed failed internally, preventing the AC from running. The easiest and best test is to temporarily swap it with a known good one, but for most people this is not an option. If you're handy with a multimeter you can follow this electrical checklist to see that Klima's getting what it needs from the rest of the car, and if it all checks out then it's almost certain that Klima itself is at fault. Obviously swapping in a known good Klima is a lot faster.

Blower resistors

The fan is only able to operate on high speed, some (or all) of the discrete lower speeds are 'dead'. (There are other possible causes. I don't fix these, but you can test them yourself.)

Low Oil light
The low oil light flickers on at times, especially during turns, but the oil level is not low. The oil sensor in the engine routinely reports low oil, especially during turns, but there is a circuit in the instrument cluster that's intended to filter out false reports. This circuit can fail. (If the light is on all the time it's likely that the sender inside the engine has failed, or the wiring to it.)

Where is it?

Clock:
Should be obvious!

Cruise control amplifier:

107/114/115/116/123/124/126	201
Hanging from brake pedal support; Possibly attached to under-dash panel on stickshift models.	Under passenger floorboard.

ACC control panel:
Should be obvious.

AC Klima Relay (a.k.a. AC Compressor relay):

107	126	124/201
Behind glove box. (Above small relays on firewall.)	Next to fuse box.	Behind battery.

Blower Resistors:
A metal box filled with metal coils on the inner passenger-side fender. Not all cars have these. (I don't fix these, but you can test them yourself.)

Low Oil circuit:
In the instrument cluster, as part of the gauge group that includes the fuel gauge.

How do I get it out?

There are a lot of variations, and I don't have the ability to give detailed instructions for all of them. If you proceed carefully and don't force things to the point of breakage you should be OK. Doing this yourself is part of what saves you the big bucks. I have made some notes to help you out:

Clock:

107/116/123/124/126/201	114/115
Remove instrument cluster. Remove screws retaining clock or clock/tachometer assembly and carefully	Pull out instrument cluster. Unscrew two

remove it from the cluster. The speedometer may need to be temporarily removed first if it's in the way.	nuts holding in clock and pull it out from the cluster.

The car is perfectly usable without the clock and/or tachometer. The 114/115 clock is a well-protected assembly that requires no particular care to ship. The others all have exposed hands that will require a little more care to ship safely. Please be careful, I can't do much about ruined cosmetics such as scratched faces or broken hands!

If operating on the instrument cluster is daunting you can of course send the whole thing in. Naturally shipping will be more difficult and expensive, and the car will not be driveable in the interim. Don't do this for the 114/115 cars, the clock comes out trivially and most (if not all) engine temperature gauges are mechanical, not electrical, and are *very* difficult to remove from the car. They are delicate, and expensive.

Cruise control amplifier:

107/114/115/116/123/124/126	**201**
Remove driver's under-dash panel, remove single 10mm bolt that holds the bracket carrying the amplifier to the brake pedal support, unscrew amplifier from bracket. Some stickshift cars have the amplifier attached to the under-dash panel itself.	Pull up passenger floorboard panel, unscrew amplifier from panel.

The car is perfectly usable without the cruise control amplifier. Just remove it and send it in, preferably without extra metal bracketry or items hanging therefrom. It's an aluminum box the size of a paperback book with ten or fourteen pins coming out of it. The newest ones also have a little customization module plugged in to them, leave those attached to the amplifier!

ACC control panel:

107/123/126	**124**	**201**
Remove ashtray and then the trim panel. Unscrew control panel and unplug it. If applicable, you'll have to pull the light string (like Christmas lights) out of its retaining clips.	Remove wood trim (2 screws above stereo). Remove 6 screws (2 sizes) holding ACC panel, etc. in. Pull panel straight out. Unplug it.	Remove ashtray and then the trim panel. Pull down two retaining clips at rear while pushing the control box forward. Unplug it.

The car is probably not usable without the control panel as the system will default to pumping heat out the defroster ducts.

AC Klima Relay:

107	**126**	**124/201**
Remove glove box liner.	Open hood. Look next to fuse box.	Remove flimsy panel behind the battery.

Just unplug it and send it in. The car is perfectly usable without the Klima, though the transmission kickdown function may be disabled and of course AC will be disabled.

Low Oil circuit:

Remove instrument cluster. Remove screws retaining fuel gauge group assembly and carefully remove it from the cluster. The speedometer may need to be temporarily removed first if it's in the way. The car is not usable without this instrument group because the alternator will be disabled and you'll be without a number of important warning instruments.

If operating on the instrument cluster is daunting you can of course send the whole thing in. Naturally shipping will be more expensive.

Additional testing

As a unit, even if found to be defective and repaired by me, could be hampered by other on-car problems I have made some notes on testing the parts that remain on the car. It is to your advantage to conduct such tests before shipping anything to me, there is a small chance that the electronics do not actually need repair. These tests are exactly the ones I'd make if I were working on your car in person.

Clock:

The red/yellow wire to the back of the clock should read +12V on it at all times. (The 114/115 clock plugs into a socket in the instrument cluster, this socket should be 'hot' at all times. The clock will probably have to be removed to test this, but that is easy.) The metal frame of the instrument group (or the mounting screws in the case of the 114/115 clock) needs to be grounded. An ohmmeter test of this to the chassis should show little/no resistance.

Cruise control amplifier:

For these tests you will need a multimeter and two or three clip leads (or pieces of stiff wire) that can plug into the socket that has been removed from the amplifier. 12-gauge Romex (house) wire works well, you only need a few inches of it. You can wad up other types of wire to fit in there as well, but I find the Romex to be particularly suitable. (I also have a bunch of it.)

The (12-pin) connector that plugs into the (10-pin) vacuum unit amplifier looks something like this (facing the little sockets):

o	2	O	1	o
o	4		3	o
o	6		5	o
o	8		7	o
o	10		9	o
o	12		11	o

2		1	
4	Decel	3	Actuator +
6	Brake	5	Power
8	Cancel	7	Actuator –
10	Resume	9	Accel
12	Ground	11	Speedometer

The first series of tests is done with the key off. The resistance between Pins 7 and 3 should be

The connector that plugs into the servomotor unit amplifier looks something like this (facing the little sockets):

o	2	O	1	o
o	4		3	o
o	6		5	o
o	8		7	o
o	10		9	o
o	12		11	o
o	14		13	o

2	Decel	1	Power
4	Accel	3	Cancel
6	Resume	5	Clutch
8	Brake	7	Motor +
10	Motor –	9	Feedback Pot
12	Ground	11	Speedometer
14	Ground	13	Feedback Wiper

approximately 12 ohms and there should be no continuity to power or ground. If it's substantially more than this the actuator under the hood is broken, it's unplugged, its connector is extremely dirty, or the wiring to it is broken. Find out what's wrong and correct it. Pin 12 should be grounded, a resistance test of it to the car's chassis should show little/no resistance. (Leave the ground lead of the meter in this socket for the next series of tests.)

The next series of tests is done with the key on (though the engine need not be running). Pin 5 is power, it should register +12 volts. (Battery voltage, that is, the exact value will vary with the circumstances.) Pin 6 is the brake lights, it should register 0 V normally, and +12 volts when the brakes are applied. Pin 8 should register +12 V unless the stalk switch is moved to Cancel. Pin 10 should register +12 V when the stalk switch is moved to Resume. Pin 9 should register +12 V when the stalk switch is moved to Accel. Pin 4 should register +12 V when the stalk switch is moved to Decel.

The next test is done with the engine running. Connect one jumper between pins 6 and 7, and another between pins 9 and 3. When the Accel switch is activated the engine should rev up; releasing the switch or pressing the brakes should return the engine to idle. Be particularly careful on gasoline cars as there is no governor to prevent the engine from over-revving. If this doesn't work check the vacuum supply to the actuator, or its mechanical linkage to the throttle before suspecting the servo itself, it seems to be pretty reliable.

The last tests are done while driving the car. Pin 11 is the signal from the speedometer, an AC voltmeter between it and ground (pin 12) should show a voltage that rises with speed. (And if your meter also measures frequency, like mine does, it *certainly* should show a rise in frequency with speed; frequency, in fact, is what the circuit is actually reacting to.)

An inadequate supply of vacuum can cause strange problems with sinking set speeds, surging, etc. If this is your problem tee a vacuum gauge (a common vacuum/fuel pressure gauge or a MityVac will do nicely) into the black/yellow line that feeds the actuator, as close to the actuator as you can make it, and place the gauge where you can see it safely *while driving*. (A long hose can be used to snake the gauge into the passenger compartment,

The first series of tests is done with the key off. Pins 12 and 14 should be grounded, a resistance test of them to the car's chassis should show little/no resistance. The servomotor's clutch unfortunately has a series diode, so its resistance is difficult to measure. You can either connect an ammeter between Pins 1 and 5 and see approximately 300 mA, or you can defer testing it to a later step. (If it's broken the feedback resistance test will fail.) If you have a diode test range on your meter you can test it as a diode, though you won't see the actual resistance of the clutch coil. The resistance between Pins 7 and 10 (the motor) should be approximately 5 ohms, and there should be no continuity to power or ground. The resistance between Pins 9 and 14 should be approximately 3000 ohms, as should be the value between Pins 13 and 14, and likewise there should be no continuity to power or ground. If any value is substantially more than specified the actuator under the hood is broken, it's unplugged, its connector is extremely dirty, or the wiring to it is broken. Find out what's wrong and correct it.

The next series of tests is done with the key on (though the engine need not be running) and the ground lead of the meter in Pin 12. Pin 1 is power, it should register +12 volts. (Battery voltage, that is, the exact value will vary with the circumstances.) Pin 8 is the brake lights, it should register 0 V normally, and +12 volts when the brakes are applied. Pin 3 should register +12 V unless the stalk switch is moved to Cancel. Pin 6 should register +12 V when the stalk switch is moved to Resume. Pin 4 should register +12 V when the stalk switch is moved to Accel. Pin 2 should register +12 V when the stalk switch is moved to Decel.

The next test is done with the key on and the engine definitely *not* running. Connect one jumper between pins 5 and 3, another between pins 8 and 10, and another between pins 7 and 4. The ohmmeter should be connected between pins 13 and 14. When the Accel switch is activated the measured resistance should decrease smoothly to zero. Moving the switch to Cancel or pressing the brakes should return the resistance to the approximately 3000 ohms value. Repeat this test several times, especially trying to 'tease' it slowly. If the resistance jumps to a large value at any time the actuator itself has suffered internal damage to its feedback potentiometer, usually due to wear. I have heard of this being repaired by painting conductive substances on the damaged resistance or you could try strapping the gauge to the wipers.) Try to use the cruise control normally. If the vacuum supply drops below 5" (Hg) during operation the cruise control *cannot* work properly: the value should normally be twice this number in operation. A low vacuum supply can be caused by leaks or occlusions in the piping feeding the actuator, and must be corrected before suspecting electrical problems. (A bad diesel vacuum pump will usually also exhibit problems with other vacuum-driven systems such as brake boost, ACC HVAC flaps, door locks, or even the ability to shut off the car with the key.) Of note is that the cruise system consumes the most vacuum while holding a set speed, not while accelerating, so the ability of the system to accelerate well does not prove that the vacuum supply is good.

track, but I have never done so. Procuring another actuator (used?) may be the best option at this point.

Next start the engine, leaving the preceding three jumpers in place. When the Accel switch is activated the engine should rev up; moving the switch to Cancel or pressing the brakes should return the engine to idle. Be particularly careful on gasoline cars as there is no governor to prevent the engine from over-revving. If this doesn't work check the actuator and its mechanical linkage to the throttle.

The last test is done while driving the car. Pin 11 is the signal from the speedometer, an AC voltmeter between it and ground (pin 12) should show a voltage that rises with speed. (And if your meter also measures frequency, like mine does, it *certainly* should show a rise in frequency with speed; frequency, in fact, is what the circuit is actually reacting to.)

If your car passes all these tests and the cruise control still doesn't work right, then the amplifier is definitely at fault. Send it in! (If you wish to read about some of my personal trials with these systems, refer to here and the 240D's log starting here for about two weeks for the vacuum system; refer to here and the 380 SL's log starting here for the servomotor system.)

ACC:

First remove the ACC panel from the car.

The connectors that plug into the late-model 126 and 124 cars' ACC panel look something like this (facing the little sockets):

Left (X1)

o	13		14	o
o	11		12	o
o	9		10	o
o	7		8	o
o	5		6	o
o	3		4	o
o	1	O	2	o

13	Power	14	Lamps
11	Recirc. LED	12	Fan Speed
9	Monovalve (–)	10	Aux Pump
7	Klima	8	Short DEF Flap (–)
5	Long DEF Flap (–)	6	Diverter Flap (–)
3	Leg Flap (–)	4	Center Flap (–)
1	Short Fresh Flap (–)	2	Long Fresh Flap (–)

13		14	
11	(Aux Fan)	12	Ground
9	Outside Temp	10	Sensor Ground
7	Heater Temp	8	Coolant Temp
5	Recirc. OFF	6	Recirc. ON
3	Speedometer	4	Evaporator Temp
1	(Diagnostic)	2	Cabin Temp

Right (X2)

o	13		14	o
o	11		12	o
o	9		10	o
o	7		8	o
o	5		6	o
o	3		4	o
o	1	O	2	o

The connectors that plug into the 201 ACC panel look something like this (facing the little sockets):

Left (Xh)

o	11		12	o
o	9		10	o
o	7		8	o
o	5		6	o
o	3		4	o
o	1	O	2	o

11	Blend Flap Ref.	12	Lamps
9	Cabin Temp	10	Outside Temp
7	Evaporator Temp	8	
5	Blend Flap Pos.	6	Klima
3		4	Blend Flap, Warm
1	Blend Flap, Cold	2	Heater Valve

11		12	Ground
9	Power/Ground	10	Power
7	Aux Pump	8	Fan, High
5	Leg Flap	6	Long DEF Flap
3	Short DEF Flap	4	Fan, Low
1	Long Fresh Flap	2	Short Fresh Flap

Right (Xj)

o	11		12	o
o	9		10	o
o	7		8	o
o	5		6	o
o	3		4	o
o	1	O	2	o

This checklist is only for the late-model 126 and 124 cars. (These are the ones with the black AUTO blower switch, where the control panel contains the entire ACC system. This is not true of the earlier panels that have the narrow translucent AUTO blower switch, see below for its test procedure.)

If any of the sensor inputs are incorrect the ACC system will not be able to work correctly. For example, if the evaporator temperature sensor lies and indicates that the evaporator is freezing, the ACC system will shut off the AC compressor. So, a quick check of the inputs to the ACC system is in order:

First connect your multimeter's ground lead to the right-hand connector's (X2's) pin 12, then measure the resistance to chassis ground. It should be extremely low. Next switch the meter to DC volts and measure the voltage at X1 pin 13 with the key on, it should read battery voltage. If this all passes, the system is getting good power and ground.

Next measure the resistance to Sensor Ground (X2 pin 10) of the five temperature sensors (X2 pins 9, 8, 7, 4, and 2). For best results this test should be done in the morning after the car has sat in a garage all night, because this will allow temperatures to equalize. (It's difficult to know what the temperatures *ought* to be otherwise.) Compare the readings to these tables:

(kΩ)

°C	Cabin X2-2	Outside X2-9	Evap. X2-4	Heater X2-7
0			30.0–35.0	
5			23.4–27.4	
10	18.3–21.5	5.0–6.0	18.3–21.5	18.3–21.5

This checklist is only for the 201 cars.

A significant change occurred in 1985, where the heavy current drivers of the ACC system (particularly the auxiliary coolant pump) changed from sourcing to sinking current. As a result, pin Xj-9 changed from power ('84) to ground ('85+), and the control panels are *not* interchangeable.

If any of the sensor inputs are incorrect, the ACC system will not be able to work correctly. For example, if the evaporator temperature sensor lies and indicates that the evaporator is freezing, the ACC system will shut off the AC compressor. So, a quick check of the inputs to the ACC system is in order:

First connect your multimeter's ground lead to the right-hand connector's (Xj's) pin 12, then measure the resistance to chassis ground. It should be extremely low. In '85+ cars, pin 9 should also be grounded. Next switch the meter to DC volts and measure the voltage at pin 10 with the key on, it should read battery voltage. In '85+ cars, you should definitely measure power on pin 9 as well. (I haven't tried it, but pin 10 might not be powered on '84 cars, as it might get power through the [missing] ACC module.) If this all passes, the system is getting good power and ground.

Next measure the resistance to ground of the three temperature sensors (Xh pins 10, 9, and 7). For best results this test should be done in the morning after the car has sat in a garage all night, because this will allow temperatures to equalize. (It's difficult to know what the temperatures *ought* to be otherwise.) Compare the readings to this table:

(kΩ)

15	15.2–17.2	4.0–4.6	15.2–17.2	15.2–17.2
20	11.5–13.5	3.1–3.9	11.5–13.5	11.5–13.5
25	9.5–10.5	2.4–3.0	9.5–10.5	9.5–10.5
30	7.5–8.5	1.9–2.3	7.5–8.5	7.5–8.5
35	6.0–7.0	1.6–2.0	6.0–7.0	6.0–7.0
40	4.5–5.5	1.4–1.6	4.5–5.5	4.5–5.5
45	3.5–4.5	1.1–1.3	3.5–4.5	3.5–4.5

(Ω)

Through 8/87		From 9/87	
°C	**Coolant X2-8**	**°C**	**Coolant X2-8**
20	100–120	20	5000–8000
60	60–70	60	900–1800
85	30–45	85	460–650
100	15–25	100	300–400
110	12–18	110	230–290
120	9–15	120	180–230
130	5–10	130	135–175

Next we'll check some of the outputs. The vacuum flap valves, X1 pins 1–6 & 8, should all measure 50–80 ohms to power (X1 pin 13). The Monovalve, X1 pin 9, should measure 11–19 ohms to power. Depending upon the system, a too-heavy load on any of these could cause the ACC system to shut itself down in order to protect itself.

Next, the auxiliary coolant pump, X1 pin 10, should draw only about 0.8 A when power is drawn from it. This can be a bit of a tricky test, because the easy method of directly using a multimeter's 10 A scale can result in blowing the meter's fuse if the pump is seized, an all-too-common occurrence. A better, though more tedious, method involves a 21 W (2 A) brake lamp. Using jumpers you tie X2 pin 12 (ground) to the lamp, and the other pin of the lamp to X1 pin 10. If the lamp does not light brilliantly then it's safe to use the current meter between X2-12 and X1-10. When powered, you also should be able to hear/feel the motor running.

The blower can be tested by feeding power (X1 pin 13) to X1 pin 12, the blower fan should run on high.

Finally, the AC compressor output can be tested. X1 pin 7 may be grounded by a jumper (X2 pin 12 is handy) to force the compressor on when the

°C	**Cabin Xh-9**	**Outside Xh-10**	**Evaporator Xh-7**
0			57–67
5			46–54
10	18.3–21.5	5.0–6.0	37–45
15	15.2–17.2	4.0–4.6	31–36
20	11.5–13.5	3.1–3.9	24–28
25	9.5–10.5	2.4–3.0	20–24
30	7.5–8.5	1.9–2.3	14–16
35	6.0–7.0	1.6–2.0	13–15
40	4.5–5.5	1.4–1.6	
45	3.5–4.5	1.1–1.3	

Next we'll check some of the outputs. The vacuum flap valves, Xh pins 1, 2 & 4, and Xj pins 6, 5, 3, 2, and 1 should all measure 60–70 ohms to ground. Depending upon the system, a too-heavy load on any of these could cause the ACC system to shut itself down in order to protect itself.

Next, the auxiliary coolant pump, Xj pin 7, should draw only about 0.8 A when power is drawn from (or fed to) it. This can be a bit of a tricky test, because the easy method of directly using a multimeter's 10 A scale can result in blowing the meter's fuse if the pump is seized, an all-too-common occurrence. A better, though more tedious, method involves a 21 W (2 A) brake lamp. Using jumpers you tie Xj pin 9 (power or ground) to the lamp, and from the lamp to Xj pin 7. If the lamp does not light brilliantly then it's safe to use the current meter directly between Xj-9 and Xj-7. When powered, you also should be able to hear/feel the motor running. (The key has to be on for this test.)

The blower can be tested by feeding power (Xj pin 10) to Xj pin 8, the blower fan should run on high. Feed power to Xj pin 4, the blower fan should run on low.

Finally, the AC compressor output can be tested. Xh pin 6 may be grounded by a jumper (Xj pin 12 is handy) to force the compressor on when the engine is running. This should not be done for long, as the mechanism to prevent the evaporator from icing up will not be operating. The evaporator temperature can be watched via the resistance to ground of Xh pin 7, once it reaches the freezing point you shouldn't let it run more than another minute or so. If the compressor doesn't start you may have a Klima relay problem, engine is running. This should not be done for long, as the mechanism to prevent the evaporator from icing up will not be operating. The evaporator temperature can be watched via X2 pin 4, once it reaches the freezing point you shouldn't let it run more than another minute or so. If the compressor doesn't start you may have a Klima relay problem, a problem with the refrigerant pressure switch (or insufficient refrigerant), or a bad AC compressor clutch.

a problem with the refrigerant pressure switch (or insufficient refrigerant), or a bad AC compressor clutch.

The connectors that plug into the early-model 126 and late-model 107/123 cars' ACC panel, the ones that have the narrow translucent AUTO blower switch, look something like this (facing the little sockets):

Left (X2)

o	11		12	o
o	9		10	o
o	7		8	o
o	5		6	o
o	3		4	o
o	1	O	2	o

11	Leg Flap	12	Power
9	Cold Lockout	10	Aux Pump
7	Center Flap (–)	8	Blower Spd 6
5	Blower Speed	6	Center Flap Ctrl
3	Spd/Tmp Ref	4	Monovalve Ctrl
1	Temp Setting	2	Sensor Ground

11		12	Blower Spd 2–5
9	Recirc Flap Ctrl	10	DEF Flap
7	Recirc Flap	8	
5	Heating Enable	6	Klima
3	Ground	4	Monovalve (–)
1	Blower Spd 1	2	Cabin Temp

Right (X1)

o	11		12	o
o	9		10	o
o	7		8	o
o	5		6	o
o	3		4	o
o	1	O	2	o

This checklist is only for these cars with the narrow translucent AUTO blower control switch. Because the ACC brain is located elsewhere it is not possible to test the car's other ACC components from these connectors as thoroughly as the others described earlier.

Before beginning testing of the car's components you can use the multimeter's resistance function to do some quick checking of the pushbutton array itself. This is *not* definitive, but if it fails these it's definitely bad. With the Normal (center) button depressed, measure the resistance between the right-hand connector's (X1's) pin 11 and the left-hand connector's (X2's) pin 10. It should be very low, and should be constant even with flexing and tapping on the connector pins. Similarly, there should be continuity between X2 pin 12 and X1 pin 6. With the OFF button depressed, there should be continuity between X1 pin 4 and X1 pin 3.

For testing the car's components, first connect your multimeter's ground lead to the right-hand connector's (X1's) pin 3, then measure the resistance to chassis ground. It should be extremely low. Next measure the resistance to X2 pin 2, it should also be extremely low. Next switch the meter to DC volts and measure the voltage at X2 pin 12 with the key on, it should read battery voltage. If this all passes, the system is getting good power and ground.

Next measure the resistance to Sensor Ground (X2 pin 2) of the cabin temperature sensor (X1 pin 2). For best results this test should be done in the morning after the car has sat in a garage all night, because this will allow temperatures to equalize. (It's difficult to know what the temperatures *ought* to be otherwise.) Compare the readings to this table:

	(kΩ)	
°C	**Cabin X1-2**	**Lockout X2-9**
15	15.7	∞
25	10.0	∞
35	6.5	0
60	2.5	0
80	1.5	0

Unfortunately the temperature controller is also wired to this pin at this time, so the reading will *not* match the table, it will be lower. I measured about 7.5 kΩ on a 60 °F morning. To get readings that match the table you can unplug the temperature regulator, usually buried deeply behind the glove box, but that may not be particularly easy to do.

Next we check the cold engine lockout switch. When the engine is warmer than about 100 °F the resistance between X2 pin 9 and ground should be very low, otherwise it should be very high.

Next we'll check some of the outputs. The vacuum flap valves, X1 pins 7 & 10, and X2 pin 11, should all measure 35–80 ohms to ground (X1 pin 3). One additional flap valve is referenced to power, the resistance betwen X2 pin 7 and X2 pin 12 should also be in this range. The Monovalve, X1 pin 4, should measure 11–19 ohms to power (X2 pin 12). Depending upon the system, a too-heavy load on any of these could cause the ACC system to malfunction.

Next, the auxiliary coolant pump, X2 pin 10, should draw only about 0.8 A when power is fed to it. This can be a bit of a tricky test, because the easy method of directly using a multimeter's 10 A scale can result in blowing the meter's fuse if the pump is seized, an all-too-common occurrence. A better, though more tedious, method involves a 21 W (2 A) brake lamp. Using jumpers you tie X2 pin 12 (power) to the lamp, and from the lamp to X2 pin 10. If the lamp does not light brilliantly then it's safe to use the current meter between X2-12 and X2-10. When powered, you also should be able to hear/feel the motor running.

The blower can be tested by feeding power (X2 pin 12) to X1 pin 12 and grounding X2 pin 8, the blower fan should run on high.

Finally, the AC compressor output can be tested. X1 pin 6 may be fed power by a jumper (X2 pin 12 is handy) to force the compressor on when the engine is running. If it doesn't go on you may have a Klima relay problem, a problem with the refrigerant pressure switch (or insufficient refrigerant), or a bad AC compressor clutch.

If you get all through this and there are no failures and the system's symptoms (as described above) indicate that the ACC control panel is possibly to blame, then it probably is at fault. Send it in!

Klima:

The connector that the Klima plugs into looks something like this (facing the little sockets):

o	2		1	o
o	4		3	o
o	6	O	5	o
o	8		7	o
o	10		9	o
o	12		11	o

2 (GM+) Engine Tach.	1 (31) Ground
4 (VL) WOT	3 (TD)
6 (87k) Kickdown Enb.	5 (15) Power
8	7 (87) Compr. Clutch
10 (KL) Engage (–)	9 (GK+) Compr. Tach +
12 (T) Engine Overtemp.	11 (GK–) Compr. Tach –

This checklist is specifically for a 300 SDL, with a Klima labeled "D-Klima Kickdown", but other cars are similar.

1. Remove the Klima relay, start the car and set it so that the AC ought to be running.
2. Attach the meter's ground lead to Klima's socket pin 1, labeled 31 on the Klima itself. Switch to Ohms, there should be nearly zero resistance to the battery's negative terminal. Switch to DC Volts. Attach the meter's positive lead to Klima's socket pin 5, labeled 15 on the Klima. You should measure battery voltage (>12 V). If not, you have a fuse or other power supply problem to find.
3. Attach the meter's positive lead to Klima's socket pin 10, labeled KL on the Klima, and switch to Ohms. You should measure low resistance. If not, the Klima has not been told to turn on the compressor and you have an ACC problem or the refrigerant safety switch (or wiring thereto) is at fault.
4. Attach the meter's positive lead to Klima's socket pin 12, labeled T on the Klima. You should not measure low resistance. If you do, the Klima has been told that the engine is overheated, check the engine's temperature switch. (Some cars don't have this function.)

5. Attach the meter's positive lead to Klima's socket pin 4, labeled VL on the Klima. You should not measure low resistance. If you do, the Klima has been told that the throttle is fully applied, check the WOT switch. (Some cars don't have this function.)
6. Attach the meter's positive lead to Klima's socket pin 2, labeled GM+ on the Klima, and switch to AC volts. You should measure some voltage. If not, the Klima is not getting an engine tachometer signal. (For gasoline engines use a DC scale, you should measure about 8.5 volts at idle.)
7. Jumper pins 5 & 7, labeled 15 and 87 on the Klima itself, together temporarily to see if the compressor runs. If not, then something in the compressor clutch wiring is wrong and it's not Klima's fault.
8. With the compressor running attach the meter's leads to Klima's socket pins 9 & 11, labeled GK+ and GK– on the Klima. You should measure some small AC voltage. If not, the Klima is not getting the compressor tachometer signal. (Cars without serpentine belts don't have this function.)
9. With the car off, the resistance between the Klima's socket pins 9 & 11, labeled GK+ and GK– on the Klima, should be 530–650 ohms.

If you get all through this and there are no smoking guns, then the Klima is probably at fault. Send it in!

Oh, and the official test of the Klima's serpentine belt-saver circuit is to slop some water on the compressor's clutch and belt when it is running, it should stop and stay stopped. (The water causes slipping which the Klima detects and reacts to.) Stopping and restarting the engine should result in normal operation again.

Blower Resistors:

On pre-1986 cars automatic blower speed variation is accomplished by placing selected power resistors in series with the motor. (The switching is done by a dedicated relay box.) This resistor bank is physically somewhat large, due to the large amount of waste heat thereby generated, its form is a perforated metal box filled with metal coils. They are often located on the inner fender where engine compartment airflow will cool them. (Earlier cars had them inside the air intake plenum, but these instructions are not for those though analogous tests can be conducted.) Though not really repairable, it is possible to test them. They are physically simple and robust devices, they do not fail often.

With the blower resistor pack disconnected you should be able to measure resistances between pins according to this table:

Pins	Ω
5–3	1.4
3–1	1.4
1–6	1
6–4	0.8
4–2	0.4

As all resistors are actually in series you should be able to measure the sum of the resistances between non-electrically-adjacent pins. For example, between pins 5–2 you should be able to measure 5Ω, the sum of all the resistances. There should be no continuity to ground. Because of the low values you may have difficulty accurately measuring these resistances with inexpensive test equipment. Fortunately the typical failure is an open circuit (rather than a change in bulk resistance of the coiled metal), and even the most pathetic excuse for an ohmmeter will show you that. (I'm not even sure a resistance change such as I describe is possible.) Also possible, though rare, is a full or partial physical short due to damage (overheating?) of the coils. This might be difficult to distinguish via inexpensive test equipment, but should be visible through the vent holes in the side of the resistor pack.

Non-automatic blower speed change systems (regardless of year) use some variation of the resistor pack along with a manual switch and the appropriate tests are similar, though the number of resistors and their values may not match the above.

For 1986 and beyond automatic blower speed variation is accomplished by an electronic regulator, colloquially called the 'porcupine' due to the large number of metal cooling spines on it. Currently I have no particular tests recorded for that, though it *is* testable.

Low-oil light:

The oil sender is on the left side of the oil pan on the engine. Disconnect the wire to it and measure the continuity (Ohms) of the sender's terminal to ground. With sufficient oil in the car the sender's pin should be grounded, and should not exhibit a high resistance.

Using a long wire clipped to the sender's wire (still disconnected from the sender), start the car and sit where you can see the low-oil light. The light should come on at about 60 seconds. If you ground the wire continuously for two seconds the light should go out. If you unground the wire again the light should come back on in 60 seconds. This behavior should be very consistent. If the light reacts instantly to the wire's state instead of exhibiting these delays the low-oil board is definitely bad. Send it in! (It's probably the solder joints in the oscillator circuit.)

Return to Site Home