I-CAR ADVANTAGE

TECHNICAL INFORMATION FOR THE COLLISION INDUSTRY

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ADVANCE-TECH

I-CAR's New Video Course

June, 1989 marks the introduction of I-CAR's newest course for collision repair and damage appraisal personnel-*Advance-Tech.* I-CAR has produced this video course so that you can keep up with the latest in collision repair.

Advance-Tech is a new course which covers new material and builds on the foundation of the Unibody Course. It is **not** the Unibody Course on tape. The following topics are covered:

- STRUCTURAL SECTIONING–The use of recycled assemblies in repairing late model, high value vehicles.
- THE KINK VS. BEND ISSUE–How to decide when to repair and when to replace damaged metal.
- MODULAR GLASS–Using special tools and methods to eliminate problems in removing modular glass.
- WELDING TECHNOLOGY–115 volt welders and flux-cored wires.
- REFINISHING–Self-etching primers and *The I-CAR Finish Matching System.*

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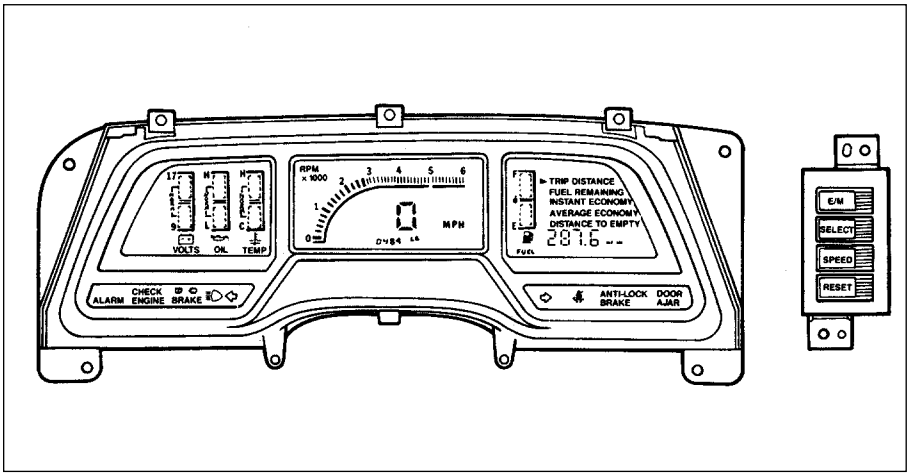
Understanding Electronic Displays



Here is an example of a LCD display. The gauges themselves are electronic digital displays, even though some of the information may be analog.

We have seen a revolution in the area of automotive electronics in recent years. Electronic controls run many of a vehicle's mechanical and passenger comfort functions. There is no doubt that we will see even more electronically controlled systems in the future.

Trend Toward Electronic Displays

One area of change is in electronic instrument displays. These "electronic dashboards" come standard or as options on many vehicles. Some examples include the Cadillac Sedan DeVille and El Dorado, Ford Thunderbird and Probe, Chrysler New Yorker Landau and Le Baron, Dodge Daytona and Laser, and Nissan Maxima SE and 300 ZX.

Electronic displays are also appearing as options on the Ford Taurus/Sable, and Chevrolet Corsica and Cavalier. There are two reasons for this. The technology has become less expensive and more reliable. And many customers like the high-tech, state-of-the-art image of electronic displays.

In collision repair, electronic displays call for some special cautions. These complex and expensive parts need to be handled carefully to avoid damage. This article examines some of the recommendations

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of car makers. It also offers hints and tips for working with electronic displays in collision repair.

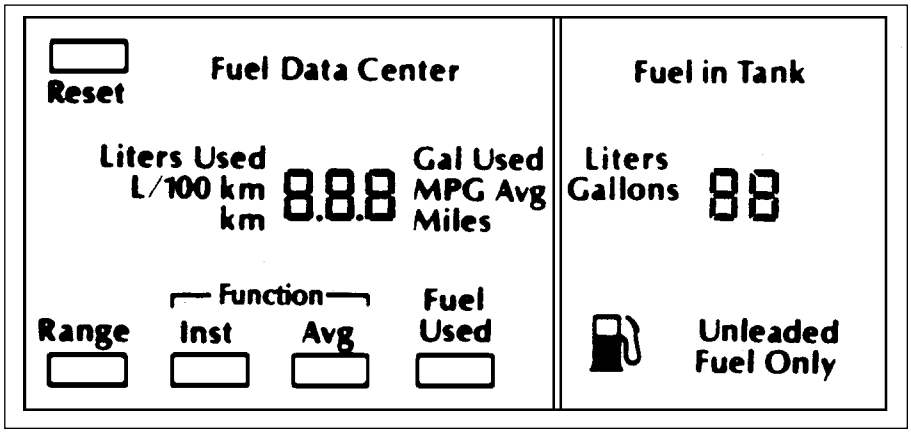
Analog Vs. Digital– Displays And Signals

First, let's define two terms useful in understanding the types of dashboard gauges and how they work- *analog* and *digital.* These terms refer to two different ideas. One is the type of gauge used to show information on the dashboard. The other is the type of electrical signal that is used by the system.

ANALOG VS. DIGITAL DISPLAYS

Most gauges are driven by some type of electrical signal. These gauges can either be analog or digital.

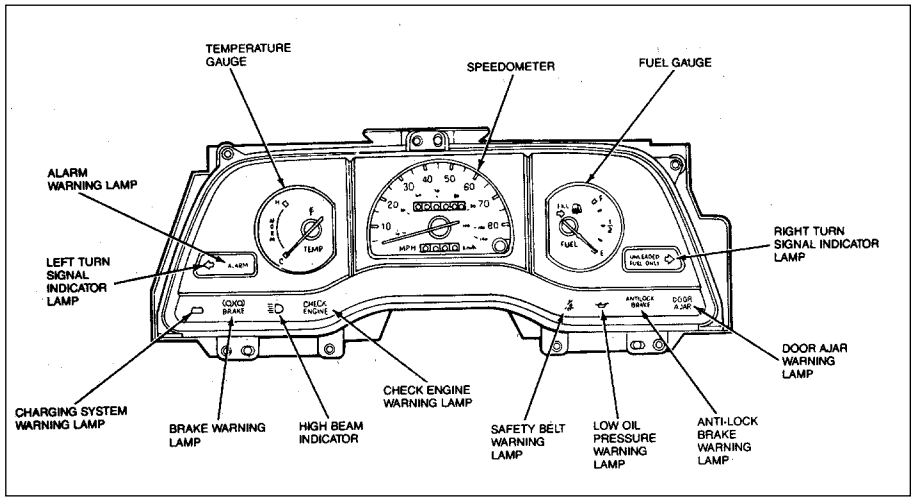
A digital display uses numbers instead of a needle or graphic symbol. In an analog display, an indicator moves in front of a fixed scale to give variable readout. The indicator is often a needle but it can also be a liquid crystal or graphic display. An example is a speedometer in which the speed is shown by a set of vertical bars which light up or dim as the speed changes.



The fuel data display, available on Cadillac DeVille/Fleetwood models, provides vacuum fluorescent displays of fuel data. The driver can access different types of information, such as fuel economy, fuel used since last fill up, and the expected number of miles before more fuel is needed.

The advantage of analog displays is that they show relative change better than digital displays. They are useful when the driver needs to see something quickly, and the exact amount of change is not important. For example, an analog tachometer shows the rise and fall of the engine speed better for shifting than a digital display. Here the driver does not need to know exactly how many rpm's the engine is running. The most important thing is how fast the engine is reaching the "red line" on the gauge.

A digital display is better for showing exact data such as miles or operating hours. Many speedometer-odometer combinations are examples of both analog (speed) and digital (distance). The choice of display types is a matter of designer and buyer preferences.



This is a typical, traditional dashboard display. The temperature gauge, speedometer, and fuel gauge are all analog displays.

ANALOG VS. DIGITAL SIGNALS

An analog electrical signal is continuously variable. An analog current is like the water flowing from a faucet which is gradually turned up and down. Sometimes it flows a lot, sometimes only a little and sometimes not at all.

As an example, a temperature sensor causes the current to change as the temperature changes. As the temperature rises,

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the resistance decreases. This causes an increase in the circuit current. As the sensor cools, the current decreases.

The changing current is used to drive a gauge. The higher the temperature, pressure, etc., the more current flows in the gauge circuit. The current creates a magnetic field which moves the pointer. In a temperature gauge, the higher the current (temperature), the greater the magnetic field and the more the pointer moves. These are called magnetic gauges, and are widely used.

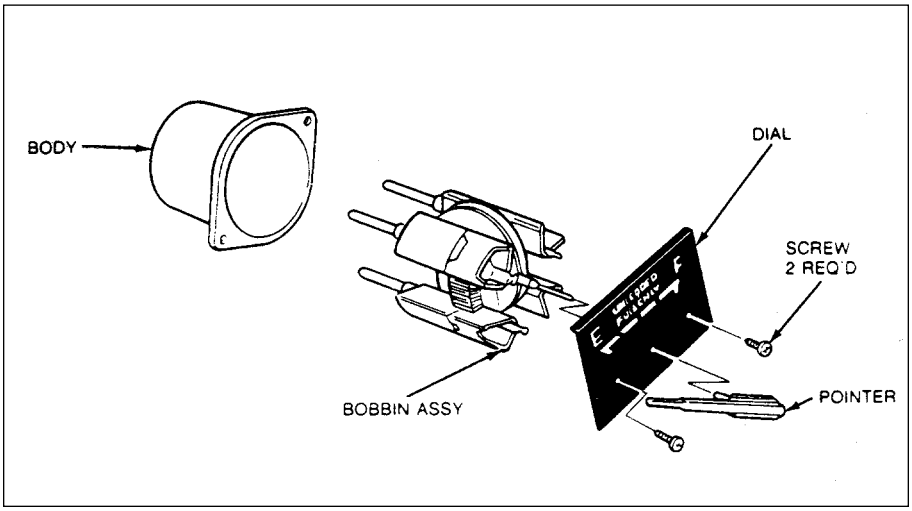
A digital signal has only two states. It is either "on" or it is "off." If a switch is turned on and off many times, the number of pulses can be counted. For example, a sensor can be made to turn on and off each time a wheel moves a certain distance. The number of pulses that are counted in a given period of time allows the computer to display the speed. The pulses can also be used by the computer to change the odometer reading.

Types Of Electronic Displays

There are three types of electronic displays used today. They are light emitting diode (LED), liquid crystal (LCD), and vacuum fluorescent.

LED DISPLAYS

LEDs are used as either single indicator lights, or they can be grouped to show a set of letters or numbers. LED displays are commonly red, yellow, or green. Many GM radio displays, as well as fuel gauges use LED displays.



Here is a typical magnetic gauge. The bobbin assembly creates a magnetic field. The pointer is attached to a magnet which reacts to the strength of that field.

LED displays use more power than other displays. They can also be hard to see in bright light.

LCD DISPLAYS

LCDs have become very popular for many uses, including watches, calculators and dash gauges. They are made of sandwiches of special glass and liquid. That's where the term "liquid" comes from. A separate light source is required to make the display work.

The display has wires on the glass. When there is no voltage, light cannot pass through the fluid. When voltage is applied the light passes through the segment.

LCDs do not like cold temperatures, and the action of the display slows down in cold weather. These displays are also very delicate, and must be handled with care. Any rough handling or force on the display can damage it.

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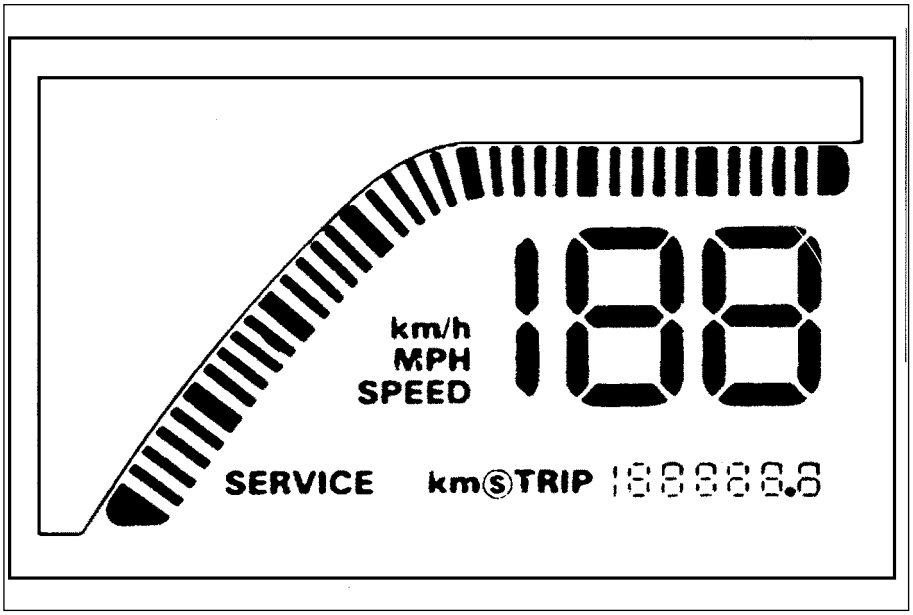
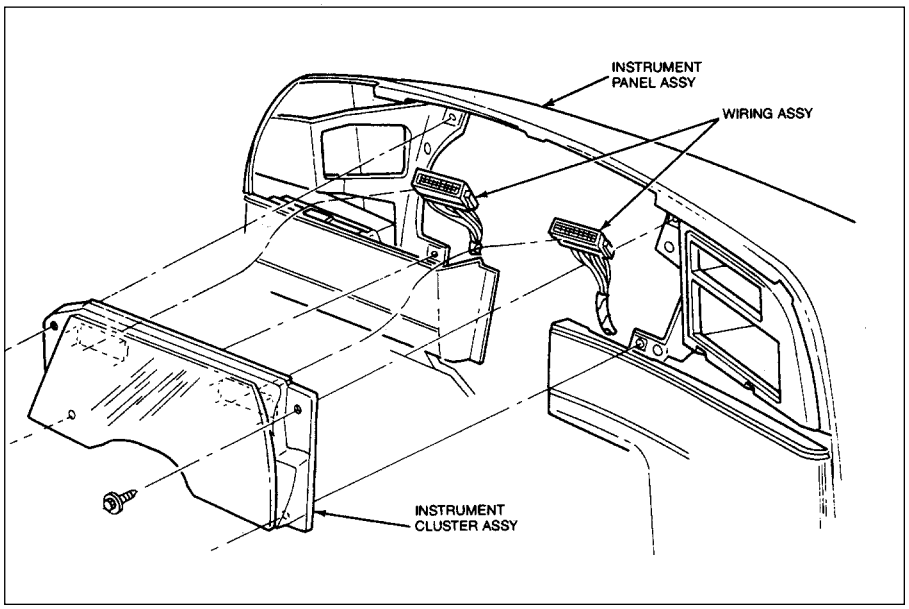


Upon key-on during start-up, most digital electronic displays will conduct a self-test to check for display function. All features will light briefly during this test.



Care must be used when removing an electronic dashboard display. Avoid pressing on the display itself, and use care when handling the electrical connectors.

VACUUM FLUORESCENT DISPLAYS

Vacuum fluorescent displays use glass tubes filled with argon or neon gas. The segments of the display are little fluorescent lights, like the ones in a fluorescent fixture.

When current is passed through the tubes they glow very brightly. These displays are both durable and bright.

Use Of Sensors

All gauges require input from a sensor. However, with modem computer controlled displays, we are seeing two uses of the sensor's output. The engine control computer needs the same information as the electronic display, so the information passes through the computer first. It then goes on to the gauge.

As an example, let's compare the temperature sensor on the vehicle of 10 years ago with a modem vehicle. On the car of 10 years ago, the temperature gauge was connected directly to a sensor which checked the engine temperature. A rise in temperature resulted in increased current in the gauge circuit. This caused the pointer in a magnetic gauge to move, showing the temperature to the driver on an analog scale.

On the modern vehicle the system works identically, with one very important exception. The information from the sensor is first fed through the vehicle's engine control computer. The computer uses the information to manage a variety of systems, including air/fuel ratio, spark timing, and switching of emission control system components. In addition, it uses the information to operate the temperature gauge whether digital, analog or just a temperature warning lamp (a form of digital display).

Self-Diagnostic Capabilities Of The Display Electronics

Most of the electronic displays have some sort of built in diagnostics. These differ with vehicle make and year. However we have seen a trend toward more on-board checks. Each time the key is turned to the ON position, the system does a self-check. The self check makes sure that all of the bulbs, fuses, and electronic modules are working. If the self-check finds a problem, it might store a code for later servicing. It may also instruct the computer to turn on a trouble light to show that service is needed.

As an example, on the Ford Aerostar (see related article), the system runs an instrument cluster self-test on start-up. It goes through a series of nine tests, called "prove out," checking for function of the display, connectors to the sensors, and the condition of the LCD displays themselves.

During proof out, all illuminated parts of the display are briefly lighted. Passing all parts of this test tells that the display is working properly.

If portions of the display do not light, there is a problem. The technician should check whether he has properly re-installed all of the connectors to the back of a replacement display.

REPAIR AND REPLACEMENT

Other than replacing bulbs and fuses and repairing damaged wires, the only "fix" is to replace the unit. Repairs to the instrument cluster cannot be done in the collision shop. However, the assembly is often divided into units that can be replaced individually. For example, the odometer/speedometer unit on the Ford Taurus can be replaced without replacing the rest of the display.

Replacing a module is a straightforward operation. Before ordering the replacement module, find out if any data needs to be transferred from the old unit. For instance, when replacing the odometer, check the

manufacturer's information for dealing with the mileage.

On some systems this information is kept in the body computer, and will automatically appear on the new display when the key is turned to the "ON" position. On other models, the mileage has to be supplied when ordering the replacement. The mileage is then entered before the replacement module is shipped.

The service manual will provide the needed information or check with the dealership parts or service department.

Tips On Working With The Systems

Electronic displays must be handled like any sensitive electronic part. Here are some tips to keep you out of trouble:

- Always disconnect the negative battery terminal before working on an electronic display.
- Static electricity may cause problems. Avoid it by grounding yourself before handling new displays. One way is to touch a good ground with one hand before handling the display with the other hand. Another way is to use a grounding strap which attaches to your wrist and then to the vehicle. You should choose the type which has a one meg ohm resistor in line.
- Avoid touching bare metal contacts. Oils from the skin can cause corrosion and poor contacts.
- Be careful about the placement of welding cables when welding. Keep the electrical path in the body short by placing the ground clamp near the point of welding. Also, don't let welding cables run close to the display.

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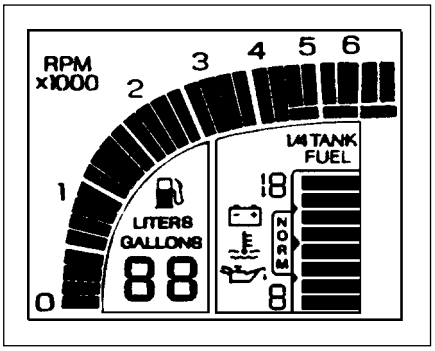
Working With The Ford Aerostar Electronic Instrument Panel

The Aerostar Electronic Instrument Panel consists of two separate modules and a group of warning bulbs. One module is for the speedometer. The other one includes the tachometer and a multi-function gauge which monitors several vehicle functions. Both of these display modules are LCD (liquid crystal display) and are capable of self diagnosis. Here are some things to keep in mind when working with this instrument panel.

- When the ignition key is turned to the "Run" position, the computer completes a self-check "prove-out" sequence. If there is a problem, portions of the display will not light up.
- The odometer total is updated to a computer "chip" every 10 miles or when the ignition is shut off. This chip is "nonvolatile," meaning that power loss will not affect the stored reading, nor can it be easily erased or reset. If replacement of the module is necessary, a door jamb sticker must be placed on the vehicle with the last known reading recorded on it. The replacement cluster will have a letter "S" in the upper right hand comer.
- Also providing information to the dash are switch inputs for doors, washer level, and coolant overheating. The module will turn "ON" the warning light when these areas need attention.
- When there is a problem with any dash function, always check fuses and ground circuits first to determine if there are open or shorted circuits.
- The system can be put into self test by depressing the "gauge select" button, then turning the ignition switch to "ON." Advance through the tests by pressing the "gauge select" button. Refer to the service manual for test results and diagnostic procedures. A



This is how the Aerostar display appears during one stage of "prove out."

Contributed by Stuart A. Kidder-Autoline Telediagnosis Systems

Understanding Electronic Displays
–Continued From Page 5

- Take care when handling displays and gauges. Never press on the gauge faces as this could cause damage to them.

No Need To Fear Electronic Displays

Electronic displays are an item which the collision repair industry will need to know better. They are here, and will increase in popularity.

There is no need to shy away from working with them, as long as we apply a little common sense and use the information supplied by the vehicle manufacturer. A service manual is required for diagnosing and repairing these systems. A

Advance-Tech*–Continued From Page 1*

- AIRBAG PASSIVE RESTRAINTS–How they work and what to keep in mind when working with them.
- ANTI-LOCK BRAKES–Operating principles and service tips for collision repair.
- FOUR WHEEL AND ELECTRIC STEERING SYSTEMS–Types of systems and tips for working with them.
- SERVICING ELECTRONICS–The basics of getting started working with electronics in collision repair.

Besides including many of the hottest topics in collision repair technology today, the course provides a convenient new format for in-house use. Advance-Tech allows completing studies in small groups, with a flexible scheduling format to meet student needs. Here's how I-CAR's Advance-Tech course works.

- All the instruction is included on video tapes to be used with the assistance/guidance of a Group Leader. The videos contain presentations by a video instructor. Also included are selected tape segments from various industry sources.
- There is a Student Manual/Workbook, which:
  –summarizes the key points covered in the videos
  –provides discussion questions
  –includes a Completion Exercise and Registration Form
- Students follow along in their workbooks during the video segments. At the end of each Unit, the Leader stops the video. The Leader and the students then discuss the information, using questions provided at the end of the unit. When all the units are completed, the students do the Completion Exercise. This is designed as a learning and review tool. The Group Leader also has a manual which guides the effective delivery of the material.
- On completion, the Registration Forms are sent in to I-CAR by the Group Leader. I-CAR then enters the students' records in the computer and mails their Certificates of Completion.

The Advance-Tech Course Kit is available for $200 plus $5 shipping and handling per order. The kit includes two video tapes, the Leader's Guide and five Student Workbooks and Registration Forms enough for five participants to complete the course and receive a certificate. Additional workbooks and registrations are available at $25 each.

The course is ideal for small work groups in shops and insurance companies who wish to provide in-house training opportunities for their employees. A

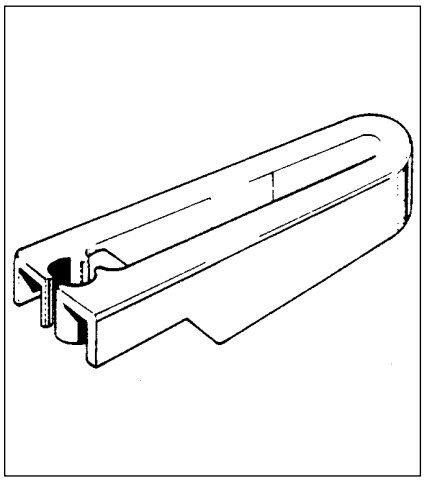
Steve Nagy–Editor

GM Converts To Nylon Fuel Lines

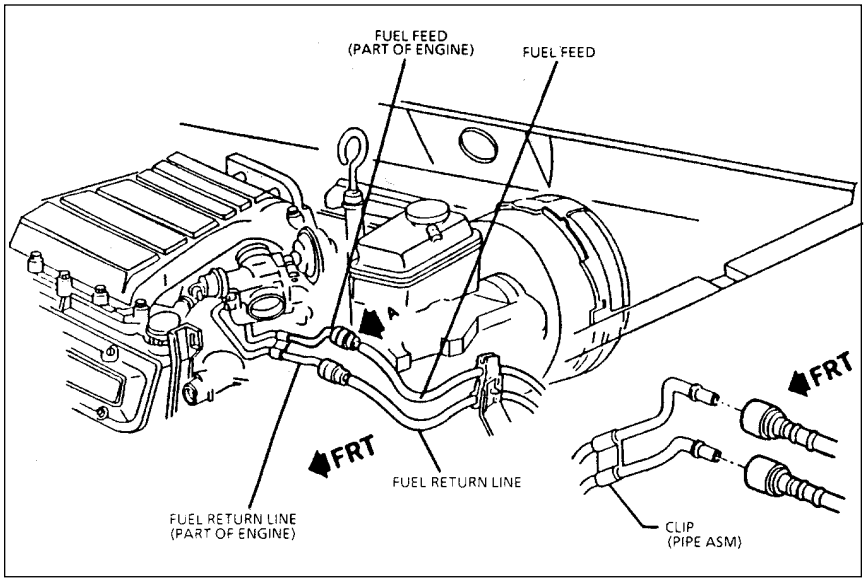
General Motors has announced that beginning with the 1990 model year, they will be using nylon fuel lines and fuel filters on A, L, B, and D bodies, as well as the APV (U body). Nylon fuel lines are currently on 1989 A bodies.

Nylon fuel lines require some special handling. Here are some cautions which should be kept in mind:

- Do not try to repair plastic fuel lines. Damaged lines should be replaced. Deformed parts which are questionable should be replaced.
- Nylon fuel lines are sensitive to heat. GM says they must not be exposed to temperatures exceeding 239° for more than one hour. Nor should they be exposed to temperatures greater than 194° for an extended period of time.



Service tool required to disconnect the engine-end metal connectors.



You cannot rely on an audible click or visual check when assembling quick connectors. Fittings must be pushed on and then pulled back to check them.

- Take care when heating, cutting, or welding near plastic fuel lines.
- These lines can be pressurized. They must be purged before disconnecting. Follow the procedure outlined in the service manual.
- GM recommends cleaning quick connect fittings before disconnecting. Turn each connector 1/4 turn in both directions. This will loosen any dirt in the fitting. Then blow the dirt out of the fitting.
- The metal connector in the engine compartment requires a special service tool to disconnect. These are available from many tool companies.
- Before reassembly, check the male ends of the fittings, and remove any dirt or burrs. This will prevent damage to the O-ring sealing surface in the coupling. A few drops of clean motor oil applied to the fittings will make connecting them easier.
- Do not pinch the fuel line to check for system pressure, as this will damage the lines. A service tool is available which will check for system pressure and performance. A

"Finesse Finishing" Of Modern Paint Systems

Modem finishes offer much improved vehicle appearance and a dramatic resistance to oxidation and the effects of ultra-violet rays. To properly handle the final finishing steps on these high tech finishes, a whole new generation of products, tools, and techniques has been developed. The correct use of these tools and materials is important so that a refinish job can match the high standards set by the factory finishes.

Why Finesse Finishing?

You know that the first thing the customer will notice is the appearance of the repaired area. How the finish looks will influence the customer's overall opinion of the quality of the repair. The finish has a big impact on customer satisfaction.

What Are High Tech Finishes?

When we speak of high-tech finishes, we are talking about the large variety of base/clear finishes now available on almost all vehicles.

These new finishes are much glossier and smoother than the finishes of just a few years ago. The modern base coat/clearcoat finish is extremely thin—about 3.5 mils. This means that they show the conditions in or beneath the paint more easily. The clearcoat magnifies the imperfections in the base coat. Dirt nibs, scratches, orange peel, dry spray, and so on, which are visible before the clearcoat is applied, will become even more visible after the clearcoat is added.

Basecoat/clearcoat finishes make up the majority of the finishes we will be working on in the future, but some of the techniques discussed can also be used on older types of finishes.

What Is Finesse Finishing?

Finesse finishing refers to the procedures and products needed to do the finish steps required for high tech finishes. The objective of finesse finishing is to remove any defects in the refinish paint without damaging the surrounding surface, while keeping the repair area as small as possible.

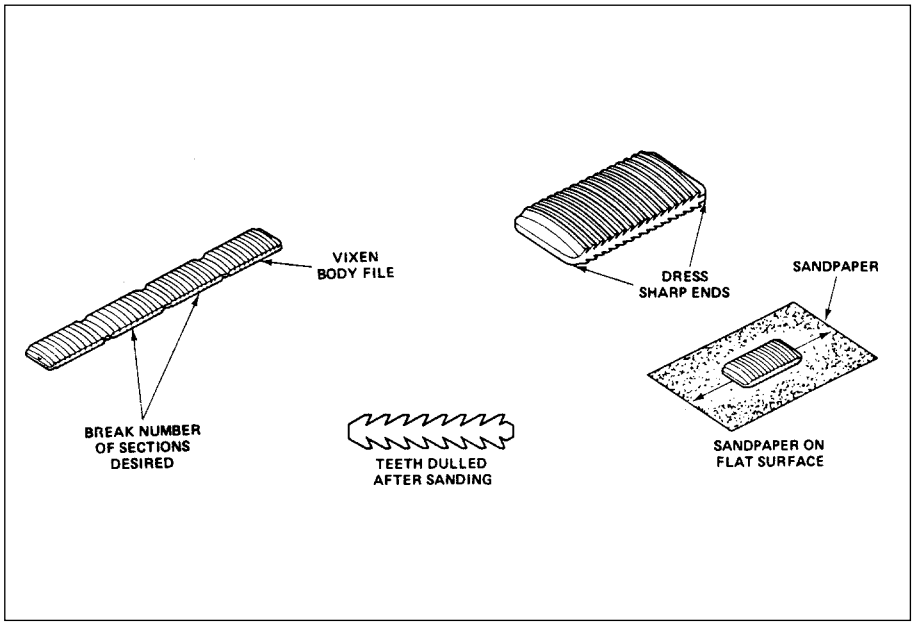
Some of the procedures may be familiar to you. You will need to use all of your past experience. However, you will be applying that experience to a group of ultra-fine products which are different than what you used before.

It used to be fairly common to use 600 grit paper on paint. But with modern finishes, anything coarser than 1500 grit paper should rarely be used. We are seeing finer and finer products, both sandpapers and polishes or compounds. Sanding papers of 2500 and 3000 grit are not uncommon.

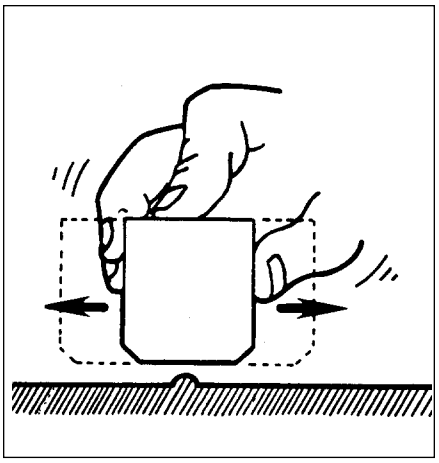
The defects we are concerned with correcting are the same ones we always have been. They are dirt-nibs, paint sags or runs, orange peel, overspray, dry spray, and scratches.

The process is:

- Determine what type of finish is on the car.
- File and/or sand to remove the defect.
- Polishing or compounding to remove scratches



Special finishing tools such as the dirt-nib file are especially useful for high tech finishes.



Ultra fine sanding blocks can be used to remove surface defects.

- Buffing or glazing to restore the gloss.

USE ONE SYSTEM

For the best results, choose a single product line and stay with it through all of the repair steps. You will find that this method is better for several reasons.

First, the manufacturer has designed all of the products to work together as a system. Substituting products, even from the same manufacturer's line, can result in more time and effort to complete the job.

Second, the manufacturer has a lot of product information available for each defect and paint type. It will tell you which specific products to use, and in what order they should be used.

FILING AND SANDING

Filing and sanding will remove dirtnibs, runs and sags. Tools include the dirt-nib file, ultra-fine paper, and ultra-fine sanding blocks.

DIRT-NIB FILE

The dirt-nib file is a tool which has been used in car factories for years.

Yet it is new to the collision industry. This tool is useful for removing dirtnibs, runs and sags, and other defects which are on or above the paint surface. They are available commercially, or can be made from a body file, as shown on Page 8.

Be aware that body files are made from hardened steels. You may not be able to break off a piece. Files must be cut with an abrasive saw or plasma arc/cutting torch. Also the ends of the file must be dressed. The sharp edges of the teeth must also be carefully dressed down so that you have smooth, flat teeth resting against the paint.

The file can be glued to a wooden block for better grip. It can be sharpened or de-burred by gently running the length of the file across a piece of 1200 to 1500 grit sandpaper held flat on a hard, smooth surface.

Use the dirt-nib file with short, straight strokes in one direction only. One or two strokes should remove any defect. When used properly, the file will quickly shave off any defect, without causing much damage to the surrounding paint. However, the spot must be sanded to remove any remaining portion of the defect.

SANDPAPER AND SANDING BLOCKS

Sanding blocks are used to remove defects at the surface of the paint, while sandpaper is used to correct defects below the surface of the paint.

Manufacturers have gone to great lengths to make their sandpapers more uniform in grit. In the past, sandpaper grit size was not very uniform. Some grit particles were 4 to 6 times as large as others. This resulted in deep scratches which then had to be removed with rubbing compound.

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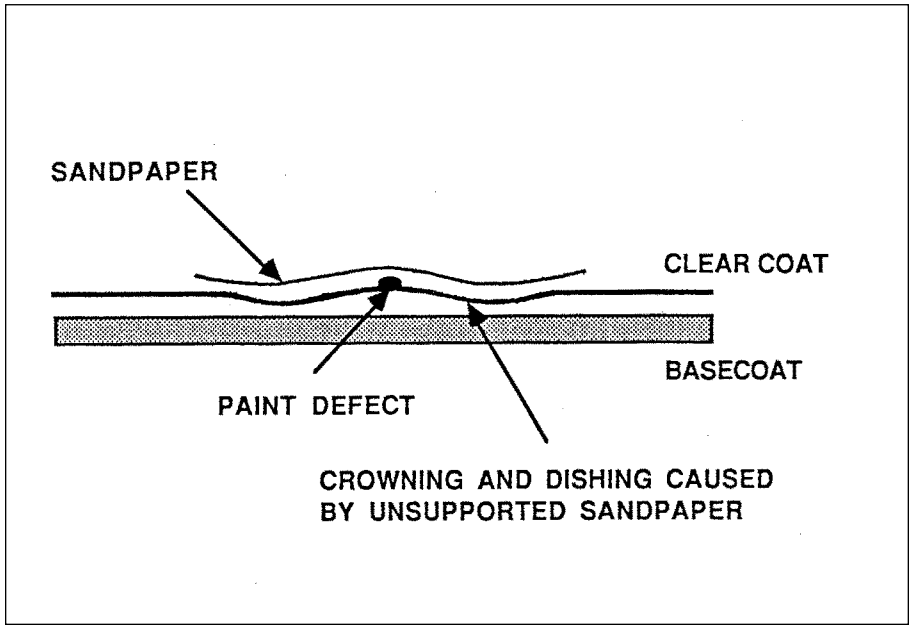

To avoid "crowning" a backing is required when sanding.

Finesse Finishing–*Continued From Page 9*

Sanding requires a sanding block or backing pad to obtain a smooth, even cutting action. There are a number of new types of backing pads available for finesse sanding. There are also small sanding blocks used with half-dollar sized wafers of sandpaper. These wafers have adhesive on the back for mounting to the sanding block.

When wet sanding, always keep the area being sanded very wet. A small dab of polishing compound can also be used as lubricant. Use light, even strokes, and sand in a circular motion. As you sand, wipe or squeegee the area frequently to check your progress.

CLEANING/COMPOUNDING

Polishing and compounding products are also available in finer grades than ever before. Some products are actually designed to break down during use, leaving only lubricant on the surface. This produces a finer, more uniform finish.

Several different products may be available from a single manufacturer. For instance, there may be four different compounding products, each designed for a different type of finish or problem. This is why it is so important to follow the manufacturer's literature for each type of paint surface. There are also new types of buffing pads. Wool may be too coarse. Inspect and clean or replace the pads and bonnets often to avoid residue buildup.

Keep the buffing pad flat or at a slight angle (about 5°) to the surface, and let the weight of the wheel do the work. Panel edges and contour lines must be polished carefully to avoid burning through. Check the repair area often and apply more polish as needed.

When the sand scratches have been removed and there is a uniform glossy finish, move on to the orbital buffing stage. Orbital buffing is also new, although detailers have been using it for some time.

BUFFING/GLAZING

As with compounding materials, there is a variety of machine and hand glazes available from each manufacturer. There are several products of differing coarseness. You must match the product to the condition and paint finish you are working on.

Use material sparingly; it won't take much to do the job. Use the buffing wheel to distribute the material evenly over the area to be buffed before running the wheel. Keep the pad flat against the surface, directly over the spot to be buffed. Use a slow, circular motion and continue on into the surrounding area to blend in the repair.

To hide the finest scratches may require a sealer/glaze. These are applied by hand using a clean terry cloth. Rub thoroughly into the surface, and wipe dry with a clean cloth. Be careful, though. Glazes can fill and cover up some fine scratches which should be buffed out. But this is a temporary disappearing act. The scratches will show after a few washes. So be sure you're ready for the glaze before you use it.

How To Avoid Problems

It is always best to prevent problems at the source rather than to try and correct a defect. It makes much more sense to take the time to do a thorough job of preparing the car. Make sure the surface is clean. Prepare the equipment. Keep it in good working order and properly adjusted. The I-CAR Finish Matching System is a good way to make sure you've covered each step.

Remember that finesse finishing is not a cure-all. It certainly is not a substitute for careful and thorough vehicle preparation. Finesse finishing cannot turn an unacceptable paint job into an acceptable one. However, you may be able to salvage a job which otherwise may have to be redone.

Learn more about Finesse Finishing and the I-CAR Finish Matching System. Attend the *I-CAR Finish Matching* course in your area. A

Helpful Hints For Finesse Finishing

Here are some helpful hints and tips to keep in mind when finesse finishing.

1. **Pick one product line.** Choose a single manufacturer's product line, and learn all you can about their products. Get the product literature and follow the manufacturer's recommendations.

2. **Limit the repair area.** The number one mistake is to let the repair area get too big. Remember to keep the repair area as small as possible.

3. **Limit the abrasives.** Remember, the key to finesse finishing is finer products. Use the finest product possible. By using a finer product, it may initially take a little longer to remove the defect, but it will generally require less time to complete the job. More abrasive products cause more scratches and swirls, which will need to be removed later.

4. **Avoid swirl marks.** Do this by avoiding abrasive products, coarse wool and synthetic buffing pads. Most manufacturers offer special pads designed to be swirl-free. Keep them clean, and replace as needed. As with other tools, if you take care of them, they will take care of you.

5. **Limit heat build-up.** Excessive heat may cause swirl marks. Warping or discoloration of the finish is also possible. If the area is too hot to touch, there is too much heat. Cool the area with a solution of water and 25% rubbing alcohol.

6. **Limit rpm's.** One way to reduce heat build-up is to limit the rpm's of the buffing machine. Speeds of between 1200 and 1700 rpm's are best. A variable speed machine can be a big advantage.

7. **Avoid static.** Higher heat levels and high rpm's will create static. This causes the product to cling to the surface. You may need to ground the car body to avoid this problem, even on fiberglass. The alcohol in the water solution which is used to cool the surface will also help control the static.

8. **Use different pads for different products.** Use separate pads for each product. Do not mix the abrasives from different products, such as compounds and glazes. Using specially designed finesse finishing pads is important. So is keeping the pads clean.