Understanding European DIN Wiring

By Karl Seyfert

European wiring diagrams may look strange and incomprehensible. But they're not so tough to understand when the underlying standards are explained.

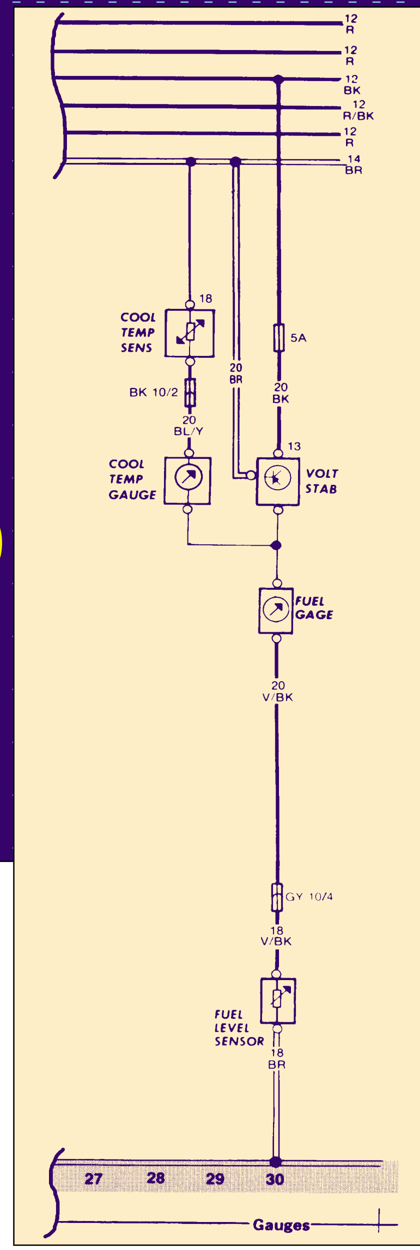


Fig. 1

Over the years, I've heard many explanations for why some technicians choose not to work on European vehicles. For some, it's based on their desire to work only on vehicles built within our borders. For others, the choice may be based on the belief that European cars are just too "foreign" and their systems too unusual or exotic to easily understand.

In today's automotive economy, it has become increasingly difficult to hold onto these attitudes. Many cars sold in this country by European (and Asian) manufacturers are actually assembled right here in the U.S. This blurs the conventional definition of an imported vehicle. At the same time, many "American" cars are actually assembled outside our borders, further confusing the accepted definition of a domestic car.

Auto manufacturing is truly a global enterprise, with all of the major manufacturers conducting business in several countries simultaneously. Even if we ignore the differences of language and culture, isn't it still a difficult problem for a European manufacturer to build vehicles in a different country like the U.S.? To oversimplify the challenges involved, how do you get an American assembly line to crank out parts for a European car? The answer is standards. Standards have been an integral part of the automotive world since the earliest days of the automotive assembly line. Standardization of parts allowed automakers to transform their businesses from a one-at-a-time proposition to a many-at-a-time operation.

In this country, the Society of Automotive Engineers (SAE) is responsible for maintaining order by establishing many of the standards that apply to automobile manufacturing. When you pick a bolt for a domestic vehicle out of the bolt bin, chances are the standards and specifications concerning its thread pitch and hardness were originally defined by SAE. Thanks to standardization, that bolt should thread into any nut made anywhere in the world, as long as it conforms to the same set of standards.

In Europe, the most widely recognized organization responsible for establishing and publishing automotive standards is called *Deutsches Institut für Normung e.V.* Standards established by this organization are often referred to as DIN standards.

DIN standards have been established for a multitude of things, including many outside the automotive world, but we'll limit the focus of this

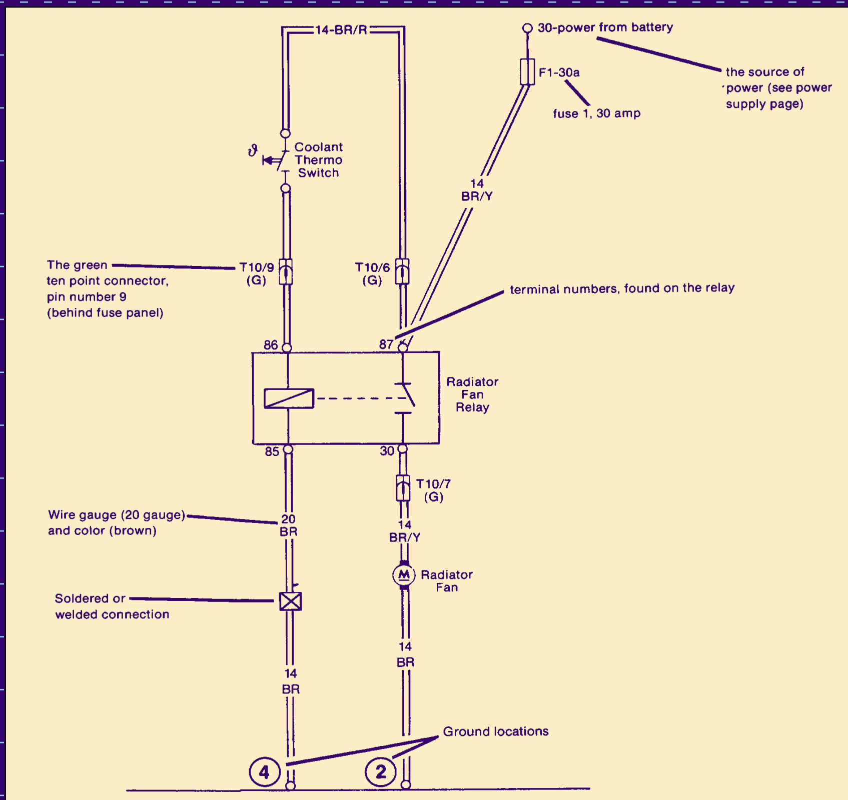


Fig. 2

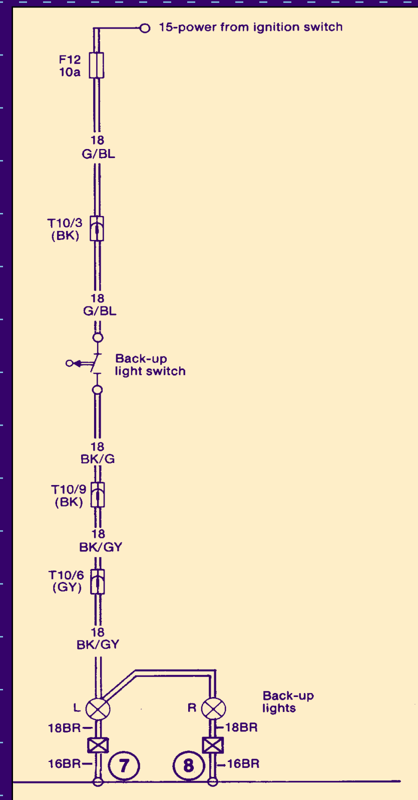


Fig. 3

article to the DIN standards for automotive wiring. Why wiring? Because that's the one thing I've heard the most techs complain about when it comes to working on European vehicles. For some, it's the layout of the electrical components throughout the vehicle. For others, it's understanding the wiring diagrams that map out the position and operation of all those systems and components. The diagrams may look strange and incomprehensible. But when you understand the underlying system and standards that were used to design the vehicles and the diagrams, it's not as tough as it first seems.

Terminal Designations

DIN standard 72 552 establishes the terminal numbering system that's used for any wiring diagram or vehicle wiring that conforms to DIN specifications. The terminal codes are not wire designations, as devices with differing terminal codes can be connected to the opposite ends of a single wire. The chart on pages 42 and 43 outlines many of the common terminal designations described under DIN 72 552. Some of the more obscure numbers, which refer to components on trailers, heavy-duty trucks and such, have been intentionally omitted.

When you've worked with DIN wiring for a while, you'll begin to recognize certain numbers that come into play more often than others. For example, a terminal 31 designation always refers to a direct connection to vehicle ground and a terminal 30 designation always represents a direct connection to the battery positive terminal. And terminal 50 is always battery positive with the key ON or in the CRANK position.

WIRE COLORS

English	DIN (German)
Black	Sw
Blue	Bl
Brown	Br
Green	Gn
Gray	Gr
Orange	Or
Pink	Rs
Purple	Vi
Red	Rt
Turquoise	Tk
White	Ws
Yellow	Ge

Wire Color Codes

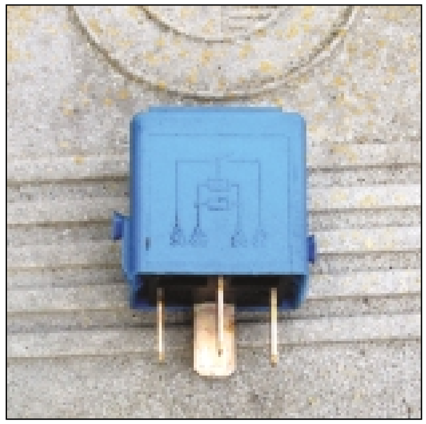
Before we get into some actual DIN wiring diagrams, a word about wire color codes. Most wiring diagrams you're likely to come across will have already been translated into English. Wire colors in those diagrams should be labeled with abbreviations you'll be able to understand. But just in case you run across a diagram with the original wiring color codes, use the "Wire Colors" key at left to sort things out. By the way, color codes for electrical wiring are defined in DIN 47 002.

Circuit, Block & Schematic Diagrams

Description of an electrical system or circuit may begin with a *circuit diagram*. This is an idealized representation, rendered in the form of symbols to provide a quick overview of circuit and device functions. The circuit diagram illustrates the functional interrelationships and physical links that connect various devices. These diagrams may also include illustrations and simplified design drawings, as needed.

A *block diagram* is another simplified representation of a circuit, showing only the most significant elements. It's designed to furnish a broad overview of the function, structure, layout and operation of an electrical system. This format also serves as the initial reference for understanding more detailed schematic diagrams. Squares, rectangles, circles and symbols illustrate the components. Information about wire colors, terminal numbers, connectors, etc., are omitted to keep the diagram as simple as possible.

The *schematic diagram* shows a circuit and its elements in detail. By clearly depicting individual current paths, it also indicates how the electrical circuit operates. Most DIN schematic diagrams are current flow diagrams. They're arranged from top to bottom, so we can clearly see how the current flows through the circuit. In a current flow diagram, a large block or several lines running across the top represent the fuse/relay panel. This is the positive side of the circuit. The numbered line across the bottom represents the chassis ground, completing the circuit to the battery.



Photos: Karl Seyfert

Most DIN relays include a miniature schematic diagram, right on the relay housing. Flip the relay over and you'll find the relay terminals are also numbered. The numbers correspond to the DIN terminal designations.

Occasionally, a wire in a circuit will be continued in another current track. When this happens, a small box with a number inside will send you to the current track where the wire is continued.

Fig. 1 on page 38 is a schematic diagram of the gauge circuits on a Volkswagen. The lines across the top represent the positive feeds to the circuit. The numbers next to the bars define their wire gauge size and color. The individual gauges are mapped out in sequential order below, making it very easy to see how the current flows through the various sections of the circuit.

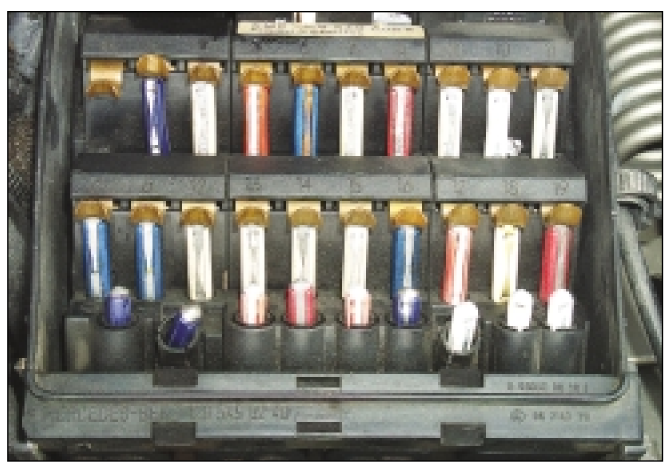
The diagram also includes information on terminal numbers, wire sizes and colors, connector sizes and a basic representation of the internal working of the gauges and sensors. The symbols used to define the components also conform to DIN specifications. A key explaining these symbols will often be included with the schematic diagram.

Even if you're fairly familiar with a circuit on a given car, a schematic diagram will help you find the correct location of a ground terminal, or help you identify a specific pin number in a connector.

Another example of a current flow schematic diagram is shown in Fig. 2 (page 39). This diagram also explains the meanings of some of the letters and numbers in the diagram. The way the components and wires are situated in relation to one another in the diagram usually bears no resemblance to how they're actually arranged on the vehicle.

Break this diagram down and you can see how it can work for you. Four things are needed to have a complete circuit: a source of power, wires or conductors of electricity, a load or a device that uses electricity and a ground. The load needs both voltage and ground. The schematic tells you where they come from, and where they need to go

The main fuse and relay panels on most European cars can be found under the hood. On older vehicles, like this BMW, the panel is protected only by a plastic cover. The panels on more recent models do a better job of protecting fuses and relays from the elements.



Many older European vehicles are equipped with these bullet-style fuses. The exposed fuse is wrapped around the ends of the plastic or ceramic fuse body. The fuse is held in place and makes electrical contact via the spring-loaded terminals at its ends. This fuse type can be the source of intermittent electrical problems, especially in damp climates.

WIRING TERMINAL DESIGNATIONS

Terminal	Definition
1	Ignition Coil, Distributor Low-Tension Circuit
Ignition Distributor With Two Insulated Circuits	
1a	to Ignition Point Set I
1b	to Ignition Point Set II
Ignition Coil, Distributor	
4	High-Tension Circuit
Ignition Distributor With Two Insulated Circuits	
4a	Terminal 4, from Coil I
4b	Terminal 4, from Coil II
15	Switch-Controlled Positive Downstream from Battery (from Ignition Switch)
15a	In-Line Resistor Terminal Leading to Coil & Starter
Glow-Plug Switch	
17	Start
19	Preglow
30	Line from Battery Positive Terminal (Direct)
31	Return Line from Battery Negative Terminal or Ground (Direct)
31b	Return Line to Battery Negative Terminal or Ground Via Switch or Relay (Switch-Controlled Ground)
Electric Motors	
32	Return Line*
33	Main Connection*
33a	Self-Parking Switch-Off
33b	Shunt Field
33f	for Reduced-RPM Operation, Speed 2
33g	for Reduced-RPM Operation, Speed 3
33h	for Reduced-RPM Operation, Speed 4
33L	Rotation to Left (Counterclockwise)
33R	Rotation to Right (Clockwise)
*Polarity Reversal of 32/32 Possible	
Starter	
45	Separate Starter Relay, Output: Starter; Input: Primary Current

Terminal	Definition
Flasher Relay (Pulse Generator)	
51	Input
49a	Output
49b	Output to Second Flasher Relay
49c	Output to Third Flasher Relay
Battery Switching Relay	
50a	Output for Starter Control
Start-Locking Relay	
50e	Input
50f	Output
Start-Repeating Relay	
50g	Input
50h	Output
AC Generator (Alternator)	
51	DC Voltage at Rectifier
51e	DC Voltage at Rectifier with Choke Coil for Daylight Operation
Starter	
52	Starter Control (Direct)
53	Wiper Motor, Input (+)
53a	Wiper (+), End Position
53b	Wiper (Shunt Winding)
53c	Electric Windshield Washer Pump
53e	Wiper (Brake Winding)
53i	Wiper Motor with Permanent Magnet & Third Brush (for Higher Speed)
55	Front Fog Lamp
56	Headlights
56a	High Beam with Indicator Lamp
56b	Low Beam
56d	Headlight Flasher Contact
57	Parking Lamps (in some export markets)
57a	Parking Lamps
57L	Parking Lamps, Left
57R	Parking Lamps, Right

to reach the load terminals. It also tells you which switching devices are used to control the ON or OFF state of the circuit. The schematic diagram is laid out so you can quickly find the parts of a circuit and test them. For example:

•If there's no power at the coolant thermo switch, the diagram shows that fuse 1 is the source of power.

•If the fuse is good, the next step is to check the connections between the fuse and the thermo switch.

•The diagram shows two connections—terminal 87 at the relay and pin 6 of the green 10-point connector. Voltage testing at these points will help you determine where the break in the circuit is located.

Let's look at one more schematic diagram, this time the backup light circuit in Fig. 3 (page 39). Again, it's a current flow diagram, with all of the circuit components laid out end to end. All of the wires, connectors and other components are clearly labeled and identified. At the bottom of the diagram, note the circled numbers 7 and 8. These refer to the actual locations of the ground connections indicated in the diagram. An accompanying vehicle diagram shows you where the grounds are located.

The schematic diagrams used here are admittedly on the basic side. When the system involved is more complicated, several circuits may be included in the same diagram. Just remember, these more complicated schematic diagrams are assembled using the same basic building blocks and DIN conventions found in the simpler diagrams. When you're troubleshooting a specific circuit problem, learn to home in on the part of the circuit that's involved, and tune out all the clutter around it. If necessary, make a disposable copy of the diagram, then mark it up with colored pens or pencils until you understand how the circuit works.

DIN Relays

Suppose you're diagnosing a relay in an electrical circuit. Perhaps the wiring diagram shows only a square box, with no information about what's going on in-

Terminal	Definition
58	Side-Marker Lamps, Taillamps, License Plate & Instrument Illumination
58d	Rheostatic Instrument Illumination, Tail- & Side-Marker Lamps
58L	Left
58R	Right, License Plate Lamps
AC Generator (Alternator) (Magneto Generator)	
59	AC Voltage Output, Rectifier Input
59a	Charging-Armature Output
59b	Taillamp Armature, Output
59c	Stop-Lamp Armature, Output
61	Charge Indicator Lamp
Tone-Sequence Controller	
71	Input
71a	Output to Horns I & II (Bass)
71b	Output to Horns 1 & 2 (Treble)
75	Radio, Cigarette Lighter
76	Speakers
77	Door Valve Control
Switches, Normally Closed (NC) Contacts & Changeover Contacts	
81	Input
81a	First Output on NC-Contact Side
81b	Second Output on NC-Contact Side (NO Contacts)
82	Input
82a	First Output
82b	Second Output
82z	First Input
82y	Second Input
	Multiple-Position Switch
83	Input
83a	Output (Pos. 1)
83b	Output (Pos. 2)
83L	Output (Left)
83R	Output (Right)
Current Relay	
84	Input: Actuator & Relay Contacts
84a	Output: Actuators
84b	Output: Relay Contacts

Terminal	Definition
Switching Relay	
85	Output: Actuator (Negative Winding End or Ground)
	Input: Actuator
86	Start of Winding
86a	Start of Winding or First Winding Coil
86b	Winding Tap or Second Winding Coil
Normally Closed (NC) Relay Contact & Changeover Contacts	
87	Input
87a	First Output (NC-Contact Side)
87b	Second Output
87c	Third Output
87z	First Input
87y	Second Input
87x	Third Input
Normally Open (NO) Relay Contact	
88	Input
88z	First Input
88y	Second Input
88x	Third Input
Normally Open (NO) Relay Contact & Changeover Contacts (NO Side)	
88a	First Output
88b	Second Output
88c	Third Output
Generator/Alternator & Voltage Regulator	
B+	Battery Positive Terminal
B−	Battery Negative Terminal
D+	Generator Positive Terminal
C−	Generator Negative Terminal
DF	Generator Field Winding
DF1	Generator Field Winding 1
DF2	Generator Field Winding 2
Alternator	
U, V, W	Three-Phase Terminals
Turn Signals (Turn-Signal Flasher)	
C	Indicator Lamp 1
C0	Main Terminal Connection for Indicator Lamp Not Connected to Turn-Signal Flasher
C2	Indicator Lamp 2
L	Left-Side Turn Signals
R	Right-Side Turn Signals

side the relay. Or maybe you need to bench-test the relay or jumper the connector but can't see the wire colors. If the vehicle uses DIN standards, the relay will provide you with information about its inner workings, just by looking at its terminal numbers. And for a more thorough explanation, many DIN relays even include a tiny schematic diagram on the outside of the housing.

Relays are electrically controlled switches. The switch inside the relay will be in one of two positions, depending on whether the electromagnetic relay coil is energized or deenergized. In basic relays, there's one input and either one or two outputs. Relays are either normally open (NO) or normally closed (NC). In either case, the relay switch input is always connected to pin 30. Pin 30 not only designates the input to the relay switch, but in accordance with DIN standards, we also know that it's connected to battery positive. The relay outputs on the other side of the relay switch are designated either 87, 87a or 87b.

The two remaining relay terminals are connected to the relay coil. Applying current to the coil is what makes the relay close or open. According to DIN standards, pin 85 should be connected to ground (usually controlled by another switch) and pin 86 should be connected to battery positive (usually protected by a fuse). This one is not a hard and fast rule, apparently, as you may encounter relays where the polarities of terminals 85 and 86 have been reversed.

How does DIN pin number information help in the real world? By using pin information, you may be able to reduce the amount of time spent with locator manuals. When you remove a relay or look at a connector, you should be able to figure out how it works just by looking at the pin assignments. M

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