

Fig. 2

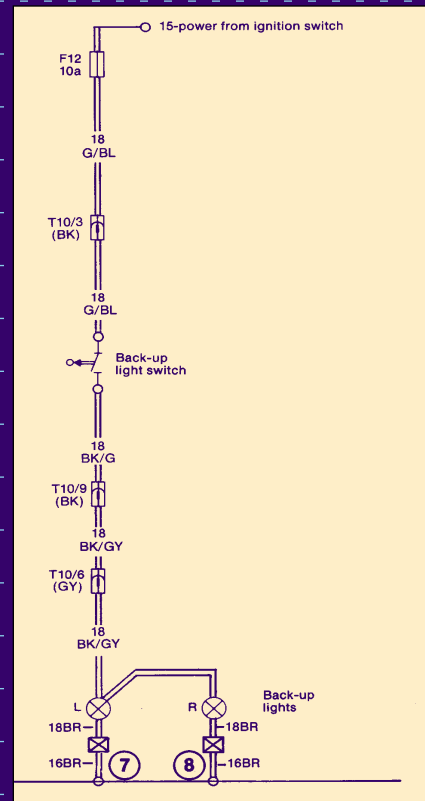


Fig. 3

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

### 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

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 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

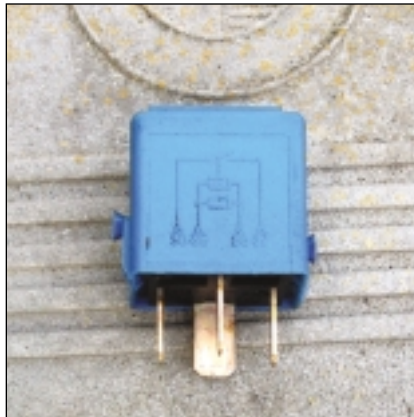
Description of an electrical system or circuit may begin with a *circuit diagram*. This is an idealized representation, rendered in the form of symbols to provide a quick overview of circuit

## Understanding European DIN Wiring

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, com-



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.**

pleting the circuit to the battery.

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.

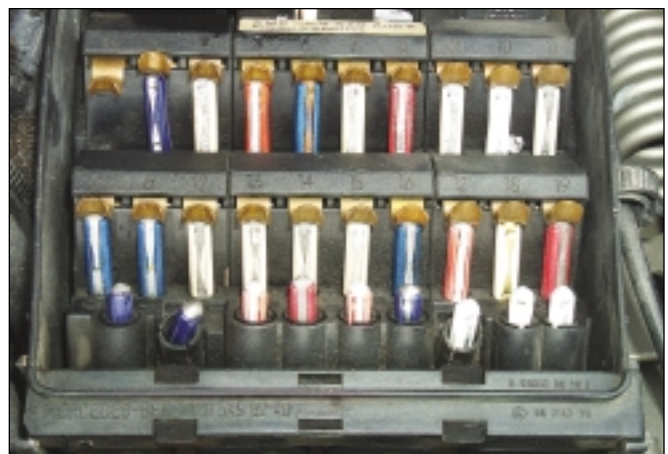
Even if you're fairly familiar with a circuit on a given car, a schematic diagram will help you find the correct location of a ground terminal, or help you identify a specific pin number in a connector.

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.

# Understanding European DIN Wiring

## 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 nor-

mally 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.

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