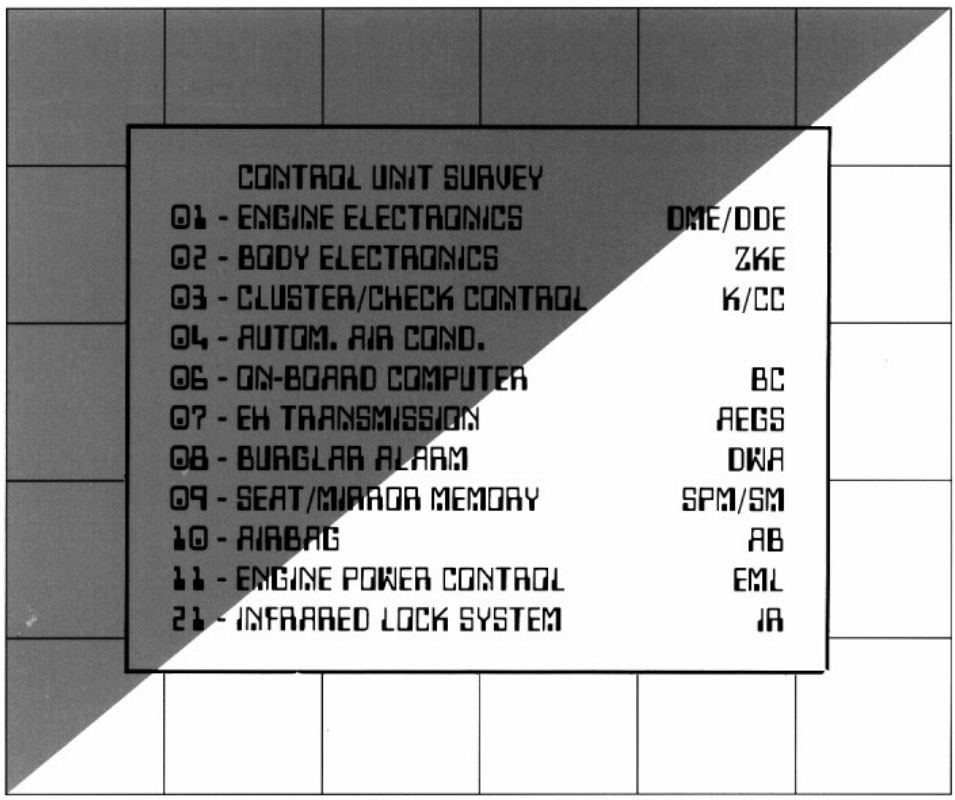
# Diagnostic Module

Training
Reference
Book




BMW of North America, Inc.
**Service Training Department**

## DISCLAIMER

This training reference book is not intended to be a complete and all-inclusive source for repair and maintenance data. It is only part of a training information system designed to assure that uniform procedures and information are presented to all participants at the BMW Service Training Center.

The technician must always refer to and adhere to the following official factory service publications:

1. Service Information
2. Repair Manuals
3. Specifications Microfiche
4. Technical Reference Information
5. Video Bulletins

**Note:** The information contained in the training course materials is solely intended for participants in this training course conducted by the BMW Service Training Center.

Information status January 1989.

For changes/additions to the technical data, please refer to the current information issued by the "Service Division".

## TABLE OF CONTENTS

## INTRODUCTION

In the 1980s BMW made a decision to move in an entirely new direction in the areas of automotive electronics and diagnostic procedures. The goals were twofold: to provide the customer advanced systems that are needed in today's market and provide the technician a system for quick and simple diagnosis. What has resulted from this are the E-32, E-34, future models and the BMW Diagnostic System.

The BMW Diagnostic System has four parts: The Diagnostic Module, the Diagnostic Modules software, the Electrical Troubleshooting Manual (ETM) and the Diagnostic Procedures Manual.

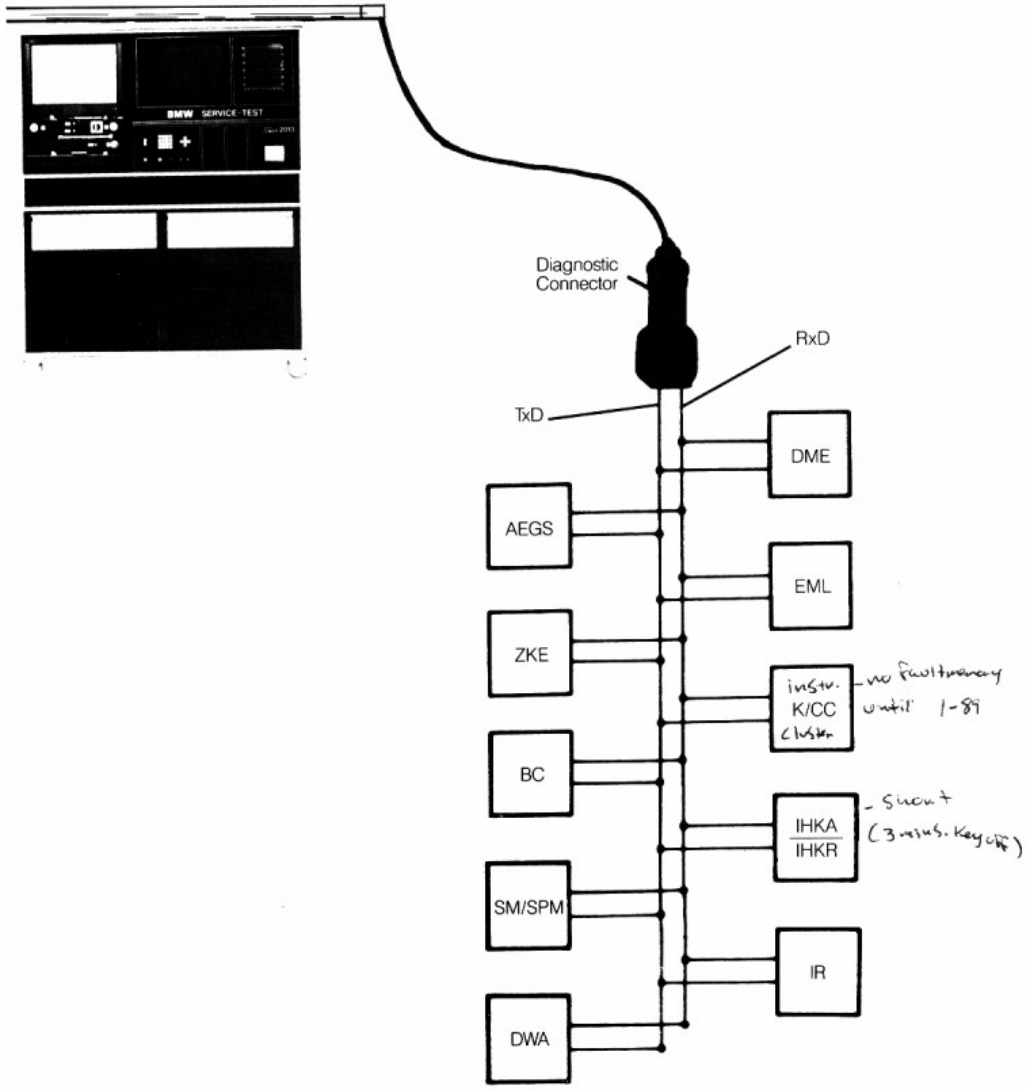
Several of the vehicle control units are equipped with self diagnostic capabilities. These control units are capable of strong defect information, and reporting conditions of inputs and outputs.

They are able to transmit and receive information or data through the Diagnostic Module. This data exchange takes place on two wires called the Diagnostic Link. The two wires, referred to as TxD (Transmit Data) and RxD (Receive Data), are connected in parallel to all control units with self diagnostic capabilities. These wires are then connected to the Diagnostic Plug and from here the connection is made to the Diagnostic Module.

Diagnostic module = Service tester

15-20 Pin diagnostic connector

## BMW SERVICE TESTER WITH BMW DIAGNOSIS SYSTEM



## DIAGNOSTIC MODULE CONCEPT

The diagnostic module is a computer system. The physical operation is covered under a separate section. Here we will discuss its functions as a diagnostic tool.

The Diagnostic Module and vehicle control units communicate through digital signals. Each control unit has a numerical "address" which the Diagnostic Module can call. The Diagnostic Module communicates with the control units through commands entered on the keyboard. The actual digital signals are taken from the program (or software) which is contained in a magnetic disk.

All diagnostic programs have a similar configuration and essentially permits the following diagnostic functions:

- Read status
- Drive components
- Read defect code memory
- Clear defect code memory

## DIAGNOSTIC FUNCTIONS

### Read Status

With this function, it is possible to read out, at the tester, current status and values applied at the inputs and outputs of the control unit. This display must be compared with the actual status at the vehicle or its plausibility checked. If a signal is found to be defective or if the status detected by the control unit deviates from the actual status on the vehicle, troubleshooting must be carried out at the associated input or output. In the majority of cases, a defect can be localized by way of simple measurement (voltage, resistance etc.)

### Drive Components

With this function, components can be activated without the control-unit-internal switch-on conditions being set. The actual status at the inputs of the control unit are ignored. In this way, to locate defects, the function of components can be checked without disassembly.

### Read Defect Code Memory

The majority of control units are capable of automatically detecting a defect and storing it permanently. The contents of the defect code memory can be read out with the BMW DIAGNOSTIC SYSTEM. In part, additional information is also stored when storing a defect code. This additional information indicates the operating conditions under which the defect occurred. More extensive troubleshooting is then carried out in accordance with the instructions provided in the diagnostic program or in the diagnostic procedure manual.

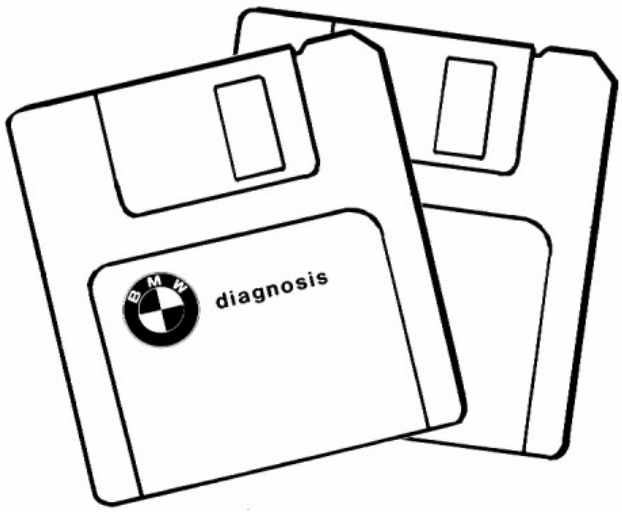
### Clear Defect Code Memory

After all defects of a system have been rectified, the defect code memory must be cleared.

***Note:** All defects and troubleshooting procedures should be called up (displayed) and printed prior to performing any troubleshooting. Defects and troubleshooting procedures can be cancelled by disconnecting components or power to the systems.

## DIAGNOSTIC SOFTWARE

The instructions that the BMW Diagnostic Module needs to operate are stored as magnetic impulses on diskettes, which are placed in the Diagnostic Module. The computer, or hardware, reads the information and allows the technician to communicate with the control units as described previously. As new systems are developed new software (or program diskettes) are produced. This allows the Diagnostic Module to be continuely updated, to be able to diagnosis any new systems.



## ELECTRICAL TROUBLESHOOTING MANUAL

The Electrical Troubleshooting Manual (ETM) consists of electrical schematics (wiring diagrams), systematic troubleshooting methods and component information. This information is in the same format as other BMW ETMs.

The schematics use standard symbols which are explained in the beginning of the ETM. The wiring is drawn in a simplified way, to show system operation. Power and ground distribution circuits are included on their own pages. The individual electrical systems are listed according to Main Group numbering sequence.

The Systematic troubleshooting procedure explains how the technician may perform simple electrical tests. It includes a basic five step procedure which should always be followed. There are also instructions on how to perform tests using various electrical meters (including the BMW Service Test 2013).

Components, such as connectors, and control units are detailed at the back of the ETM. Other information, such as harness splice locations, is also included.

The following is a listing of the main sections of the ETM:

## DIAGNOSTIC PROCEDURES MANUAL

The Diagnostic Procedures Manual is the key component in using the BMW Diagnostic System. The manual contains information for troubleshooting systems found on the Diagnostic Link and those which do not perform self-diagnosis. As in the ETM, the individual electrical systems are contained in separate sections. These sections are listed in the Main Group numbering sequence.

Each of these individual sections is divided into separate parts. These are: Functional Description, Notes on the BMW Diagnostic System, Abbreviations, Pin assignments, Troubleshooting, and Component Testing. The next few pages will explain just what is found in each of these sections. Examples are given to illustrate what the BMW Service Technician will see as they use the manual.

### Functional Description

This section provides a basic explanation of how the individual system works. BMW Service Technicians should refer to this section during diagnosis to gain a better understanding of system operation. The example given, Antitheft System (DWA), first explains the purpose of the system. Then a list of the individual components that are part of the system is given. The next heading, "Function", provides a detailed explanation of the system's operation. Sometimes information about vehicles from other countries is listed or a feature not found on U.S. models. This is because both the vehicles and the Diagnostic Manual have many common systems throughout the world.

## ANTITHEFT SYSTEM (DWA) 6575.0A-01

### Functional description

The task of the antitheft system is to detect attempts to break into the vehicle, give acoustic and visual warnings and to prevent the engine from being started by a start blocking facility. The antitheft system is armed (switched on) and disarmed (switched off) by means of the door locks and (if installed) the infrared locking system.

### System Components

The antitheft system consists of:

- control unit
- status LED
- antitheft horn
- external switches
- rear window defogger grid

### Function

The control elements of the system are the door locks and the infrared locking system. The command to arm/disarm is given at these control elements. The system monitors the rear defogger (closed-circuit current loop), driver's/passenger's door, rear doors, engine hood (front lid), radio, rear lid, battery access, rear seat, vehicle towing, glove compartment, ignition lock.

If an element to be monitored is not in the rest position at the start of the arming procedure, the status LED flashes until either all triggers are at rest or the flashing time (tB=10s +/−1s) has elapsed. The trigger inhibit time (tTS=10s +/−1s) is started with the transition to the "armed" status. After the inhibit time has elapsed, all triggers are included in the alarm monitoring system. During the trigger inhibit time, a signal change at a trigger input results in the inhibit time being restarted. If, after the inhibit time has elapsed, a trigger is moved out of the active position into the rest position, then the trigger inhibit is started once again. In this case, the trigger inhibit applies only to this one particular trigger. Unwanted alarms (e.g. lids not closed correctly) are prevented in this way. After the system has been armed, the status LED lights continously for 36 h. If an alarm is triggered, an acoustic alarm (antitheft horn) is given for a duration of (t=30s +/−1s (ECE: interval tone; CH: continous tone). A visual alarm is also given with t=299s +/−1s (ECE: hazard warning lights + low beam light, FRG: hazard warning lights in compliance with revised StVZO (Federal motor vehicle safety standards).

## NOTES ON THE BMW DIAGNOSTIC SYSTEM

This section provides the service technician with specific information concerning the use of the Diagnostic System. In the example given, Central Body Electronics (ZKE), instructions are provided on how to select the ZKE program. Further information regarding various ZKE versions, how defects are processed by the system, and other details specifically related to the ZKE system diagnosis is included.

## CENTRAL BODY ELECTRONICS (ZKE)

### Notes on the BMW Diagnostic System

The central body electronics (ZKE) program is selected with the digit 2. The BMW DIAGNOSTIC SYSTEM checks automatically whether a ZKE or a ZVM (central locking module) is installed and prepares the corresponding program.

In versions 4.2 and 4.3, the defect code memory is cleared when ZKE is selected (reason: incorrect storage during operation). The defect code memory is no longer cleared as of version 5.0.

The actuated relay is stored as defective during simulation of the outputs. For this reason, the defect code memory is cleared automatically after simulation (in all versions). The defect codes are registered once again when the systems are operated from the vehicle.

Current defects are indicated by the text display *current defect* or *blocking protection active*. These defect codes cannot be cleared from the memory.

Different country-specific versions apply to the power/sunroof system only. Refer to diagnostic procedure power windows (FH) 5133.0.

The version types "emulator" or "ROM" indicate two ZKE versions. Version "emulator" can be replaced by "ROM".

"★" indicates whether a part system is installed. If a defect code is stored for the system, it is displayed inversely (white background).

Defect codes can be stored when installing and removing the general module and relay module. For this reason, clear the defect code memory with D 999 installation.

## ABBREVIATIONS

As the heading suggests, here the BMW Service Technician may find a table of abbreviations. This is an aid in clarifying the acronyms for a particular system. Very often, this list corresponds to a similar list which may be found in the Diagnostic Software.

| | |
|---|---|
| ZKE | Central body electronics |
| SWS | Windscreen wiper control |
| ADV | Windscreen wiper pressure control |
| SRA | Headlight washer system |
| TSH | Door lock heating |
| IB | Interior lighting control |
| FH | Power windows |
| SHD | Sunroof |
| GM | General module |
| RM | Relay module |
| GM-A | General module connector A, 5-pole, color white |
| GM-B | General module connector B, 26-pole, color green |
| GM-C | General module connector C, 26-pole, color white |
| GM-D | General module connector D, 26-pole, color yellow |
| RM-A | Relay module connector A 20-pole, color white |
| RM-B | Relay module connector B, 20-pole, color black |
| E | Input |
| A | Output |

## PIN ASSIGNMENTS

This section may contain several types of information. In the example Headlight Washer (SRA), the connector numbers are given first. This tells us two things: 1) the abbreviation for that particular connector and 2) the actual number assigned to it. the abbreviation, described previously, is used in the text of the actual troubleshooting procedures. The connector number is found on the ETM schematic drawings.

The specific function of a control unit pin may also be given. The actual plug and pin number are listed first followed by its function, type (input or output) and the connection at the wire's opposing end in the example given. This information is helpful in analyzing a circuit by focusing the attention of the technician to a specific few pins.

## PIN ASSIGNMENTS

### Connector Numbers:

GM-A X 332 ( 5-pole, white)
GM-B X 253 (26-pole, green)
GM-C X 254 (26-pole, white)
GM-D X 255 (26-pole, yellow)

X 254 (white) is installed only when the vehicle is equipped with power windows.

### Pin Assignments at General Module

| Pin | Function | Type | Connection |
|---|---|---|---|
| B7 | SRA relay drive, headlights | A | Headlight washer module (SRA) pin 6/SR |
| B19 | SRA relay drive, fog light | A | Headlight washer module (SRA) pin 9/MV |
| D21 | Diagnostic line for SRA relay | E | Headlight washer module (SRA) pin 7/DS |
| D18 | Parking light detection | E | Light switch |
| D26 | Fog light detection | E | Fog light switch |
| D6 | Switch position wash | E | Wiper switch |

### Pin Assignments at Headlight Washer Module (SRA) (Connector X61)

| Pin | Function | Type | Connection |
|---|---|---|---|
| 4 | Terminal 30 | E | Fuse |
| 8 | 31, Ground | E | Ground |
| 6 | SR, Relay drive | E | General module pin B7 |
| 9 | MV, Relay drive | E | General module pin B19 |
| 7 | DS, Diagnostic line for relay | A | General module pin D21 |
| 2 | PN, Headlight washer pump drive | A | Headlight washer pump pin 1 |
| 5 | PS, Headlight washer pump drive | A | Headlight washer pump pin 2 |

## TROUBLESHOOTING

The troubleshooting section provides test steps for diagnosis. Usually this section begins with details regarding this procedure. Such as minimum battery voltage and in some cases references to other related sections of the manual. If necessary, a listing of fuses by number and the failure symptom is then given. The technician may be able to pinpoint the cause of a complaint by referring to this table. The [D] symbol indicates that the voltage supply from that fuse may be checked by use of the Diagnostic Module. This greatly simplifies circuit testing and in many cases is much quicker than conventional test methods.

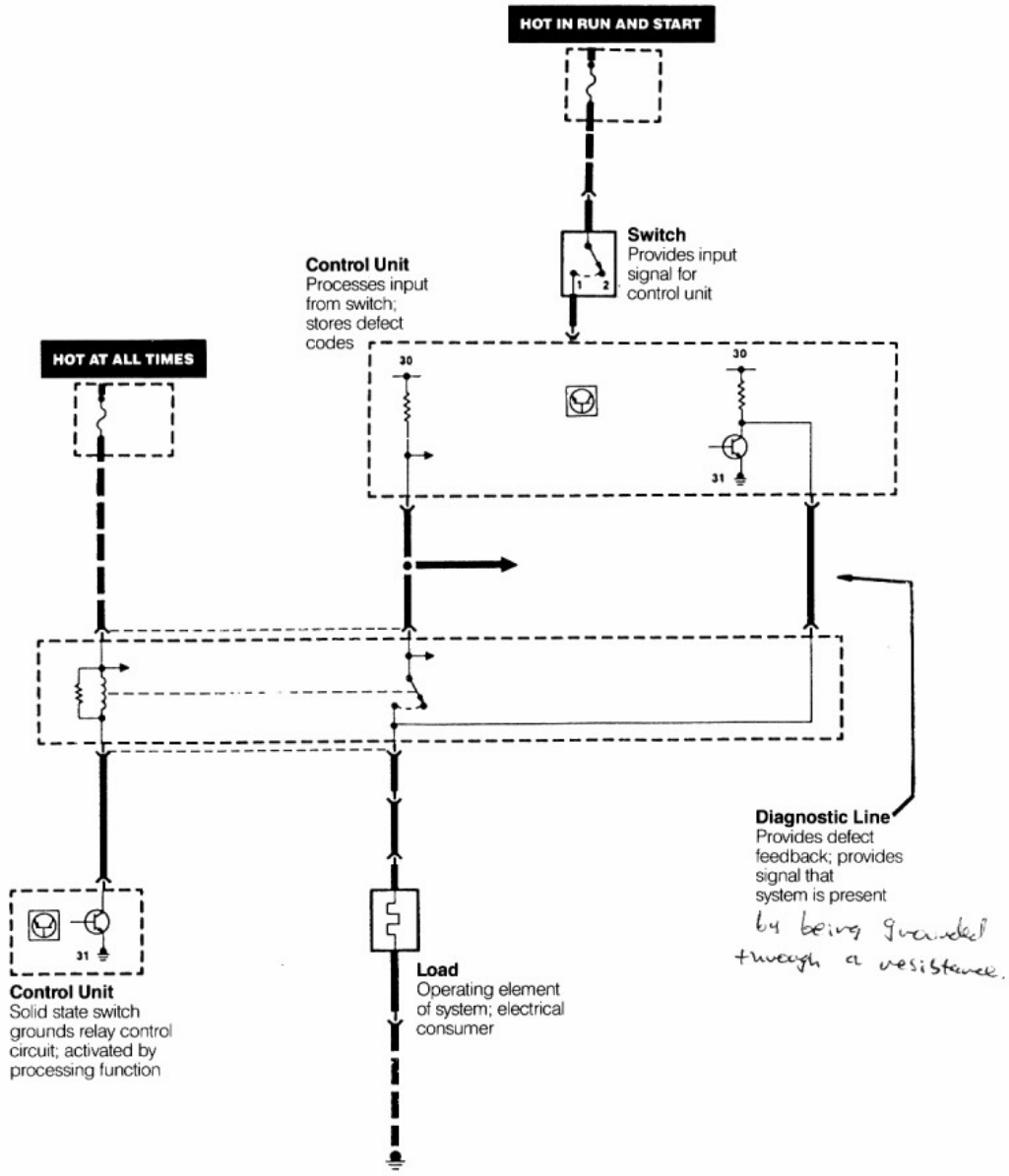
The defect code table is the last section of the troubleshooting procedures. In most cases there are two type of codes listed. The first type is a defect code that may be called up from the control unit's defect memory by using the Diagnostic Module. The second is listed under the heading "Malfunction" and is not stored in the defect memory.

The defect code in memory is only a guide to a potential fault. Further testing to isolate the actual cause is always necessary. The Diagnostic Module is in some sense a digital universal adaptor. Just as the universal adaptor can only isolate a malfunctioning circuit, the Diagnostic Module is limited to finding the problem input or output and not a specific break in a harness or a corroded connector.

The illustration shows a circuit which incorporates a diagnostic (feedback) line. This line is what allows the control unit to set and store defect codes. This diagnostic line has two functions and should not be confused with the Diagnostic Link Lines TxD & RxD.

The first function is to "tell" the control unit that the particular system is installed. For example, some vehicles are equipped with headlight/foglight washers and others are not. The diagnosis line provides a ground circuit that tells the control unit that the system is installed.

The second function is to provide the defect code information. In the example, when the switch is closed, battery voltage is sent to the control unit. This input signal is processed or analyzed by the control unit as a request for a certain system to be activated. The system is activated when the control unit grounds the control circuit of the relay. The relay's work circuit should then close providing power to operate the component. When this work circuit is energized, it also sends power back through the diagnosis line. This function is referred to as feeback recognition and it is what will cause a defect code to be stored in memory.


HOT IN RUN AND START
Switch
Provides input signal for control unit
Control Unit
Processes input from switch; stores defect codes
HOT AT ALL TIMES
30
30
31
Diagnostic Line
Provides defect feedback; provides signal that system is present
by being grounded through a resistance.
31
Control Unit
Solid state switch grounds relay control circuit; activated by processing function
Load
Operating element of system; electrical consumer

## SYSTEMS WITH NO SELF-DIAGNOSIS

For electrical systems which are not connected to the diagnostic link, the Diagnostic Procedures Manual and ETMs are based to troubleshoot the systems.

In addition to the information, in the diagnostic procedures manual, for systems on the link, the manual also contains defect code tables. These tables list faults which could occur with the systems and a corresponding defect code for the fault. The trouble shooting procedures list the steps to follow to isolate the problem for each code. The example listed here is the defect code table for the cruise control system.

## DEFECT CODE TABLE

Complete failure to cruise control (tempomat) → Defect code 01

Failure/malfunction during ACCELERATE → Defect code 02

Failure/malfunction during DECELERATE→ Defect code 03

Failure/malfunction during CALL → Defect code 04

Failure/malfunction at OFF → Defect code 05

Failure/malfunction of one of the automatic cut-out functions → Defect code 01 as of test step 7.