



Service Data

SD-13-4784

Bendix® EC-14™ AntiLock Controller Assembly

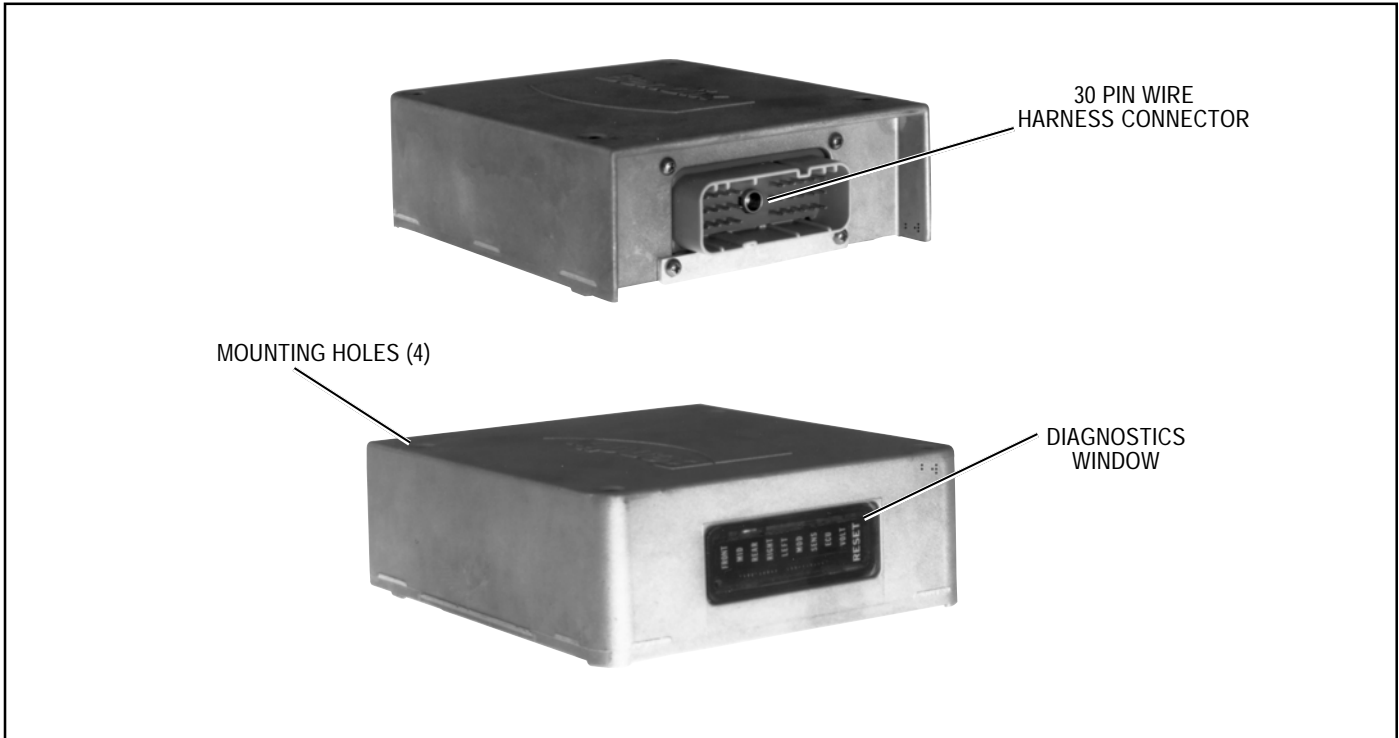


FIGURE 1 - EC-14™ ANTILOCK CONTROLLER ASSEMBLY

DESCRIPTION

GENERAL

Bendix trailer antilock systems utilizing the EC-14™ electronic controller assembly provide *axle* braking control for buses, trucks, and truck trailers. By controlling "wheel lock-up" during aggressive braking, the trailer retains a high degree of stability and steerability while braking, and vehicle stopping distance may be reduced.

In order to provide *axle* control antilock, the EC-14™ controller is used in combination with the following components:

- Four individual wheel speed sensors.
- One combination modulator-relay valve.
- One stand alone modulator valve.
- Antilock condition lamp (dash mounted).

PHYSICAL

The EC-14™ controller electronics, which regulate the function of the antilock system, are contained in a die cast aluminum housing and are environmentally protected by silicone

encapsulation. The metal housing, coupled with the design of the digital electronics, is intended to provide a high degree of protection from radio and electromagnetic interference.

A diagnostics display window with 9 light emitting diodes (LEDs) and a magnetically actuated Reset switch is incorporated in the housing for troubleshooting and diagnostic purposes.

Two electrical connectors are currently used on the EC-14™ controller, one for connection to the antilock system components (30 pin, Packard Electric, 150 series "Metri-pack") and one for connection to a combination modulator-relay valve (4 pin, Molex).

MOUNTING

The EC-14™ controller is specifically designed to be mounted to a modulator-relay valve assembly, such as the Bendix® M-12™ modulator (reference SD-13-4772). When the EC-14™ controller is mounted on a modulator assembly the

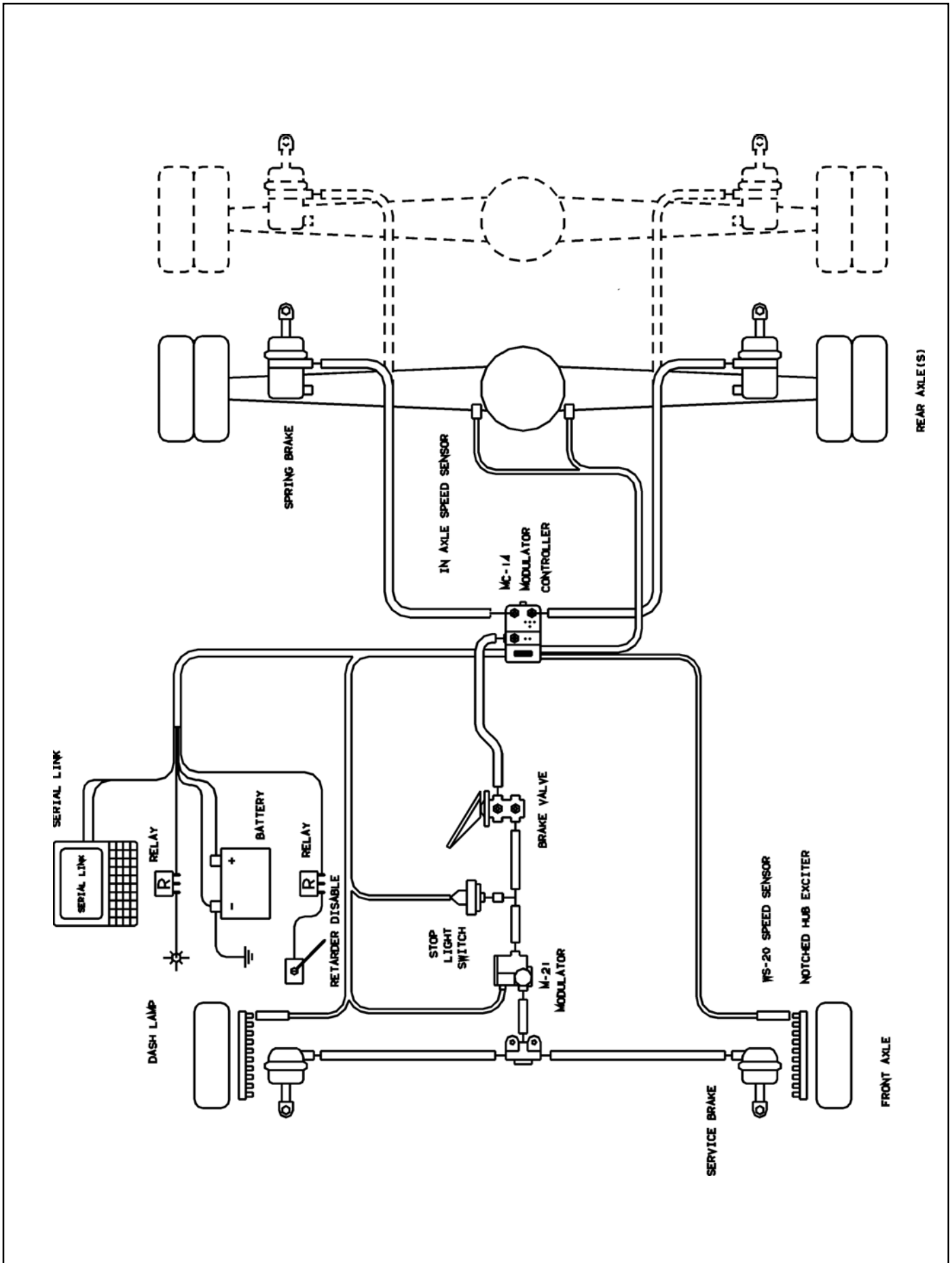


FIGURE 2 - MC-14™ ANTILOCK BRAKE SYSTEM

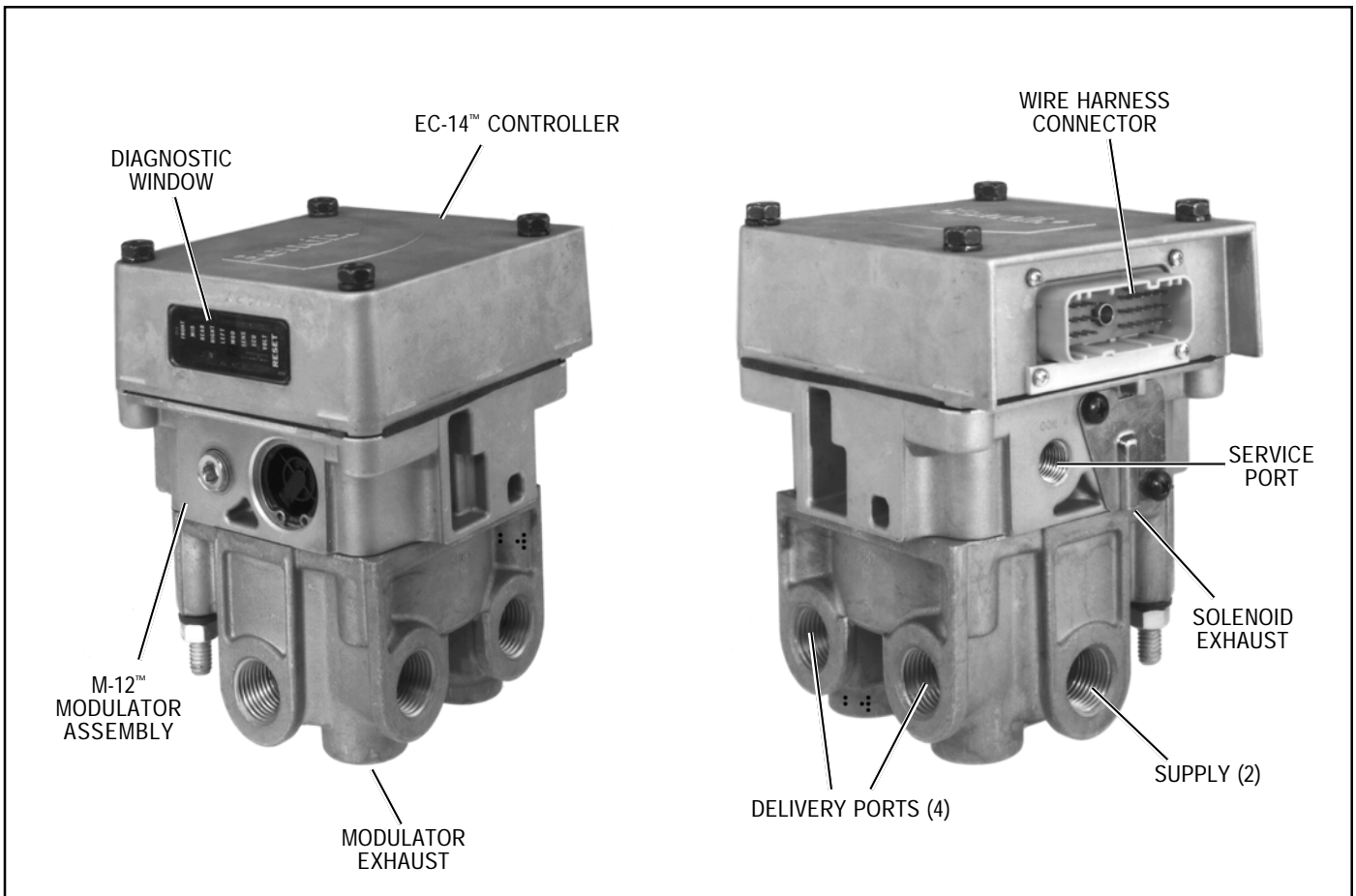


FIGURE 3 - MC-14™ MODULATOR CONTROLLER ASSEMBLY

resulting assembly receives a different designation. For example, when the EC-14™ antilock controller is mounted on the M-12™ modulator the resulting assembly is known as a MC-14™ modulator controller (see Figure 3).

EC-14™ CONTROLLER INFORMATION INPUTS AND COMMAND OUTPUTS

GENERAL

The EC-14™ controller receives information from several components in the antilock system and, based on these inputs, issues commands or delivers information. Some portions of the EC-14™ controller both receive and deliver commands and information.

INPUTS

Wheel Speed Information is provided to the EC-14™ controller via a wiring harness from individual speed sensors located in the trailer wheels or axle housing. Working in conjunction with an exciter or tone ring, the speed sensors provide information to the EC-14™ controller in the form of an AC signal which varies in voltage and frequency as the speed of the wheel increases or decreases.

The EC-14™ controller is designed to receive wheel speed information, from various wheel speed sensor models, at the rate of 100 pulses per wheel revolution. The EC-14™ controller is able to simultaneously receive, and individually interpret, speed signals from four wheel speed sensors (2 axles).

Vehicle Power is supplied to the EC-14™ controller from the from the ignition switch through a fuse or circuit breaker. The electrical ground for the EC-14™ controller is the vehicle chassis.

A **Stop Light Switch** connection to the EC-14™ controller is provided and serves to “signal” the EC-14™ controller of all brake applications. Although the stop light switch connection enhances the EC-14™ antilock controller performance, a loss of the stop light switch “signal” will not prevent antilock operation.

OUTPUTS

Modulators, like the Bendix® M-12™ and M-21™ or M-22™, are the means by which the EC-14™ antilock controller is able to modify driver applied air pressure to the service brakes. The EC-14™ controller is able to simultaneously and independently control two modulator assemblies.

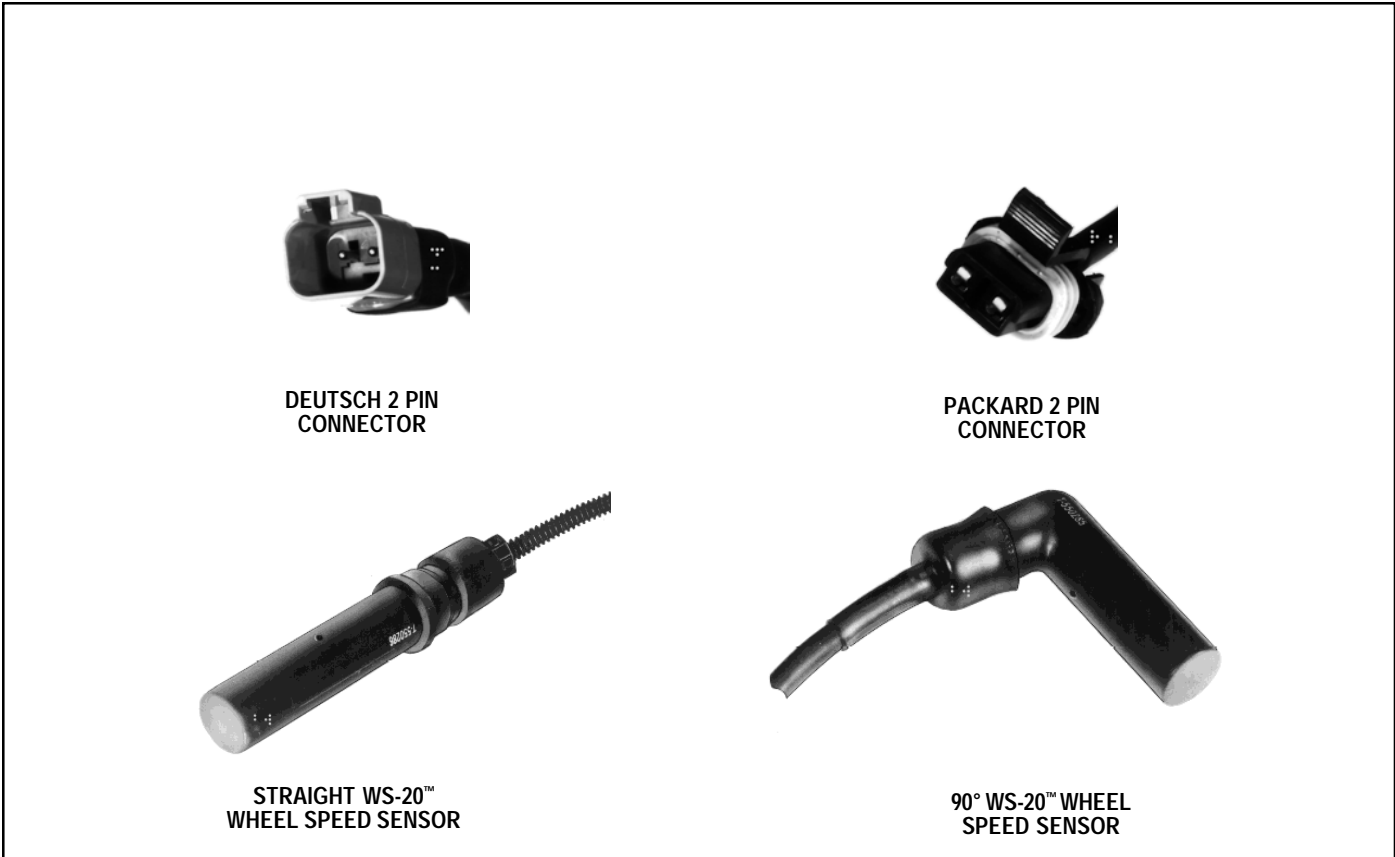


FIGURE 4 - WS-20™ WHEEL SPEED SENSORS & CONNECTORS

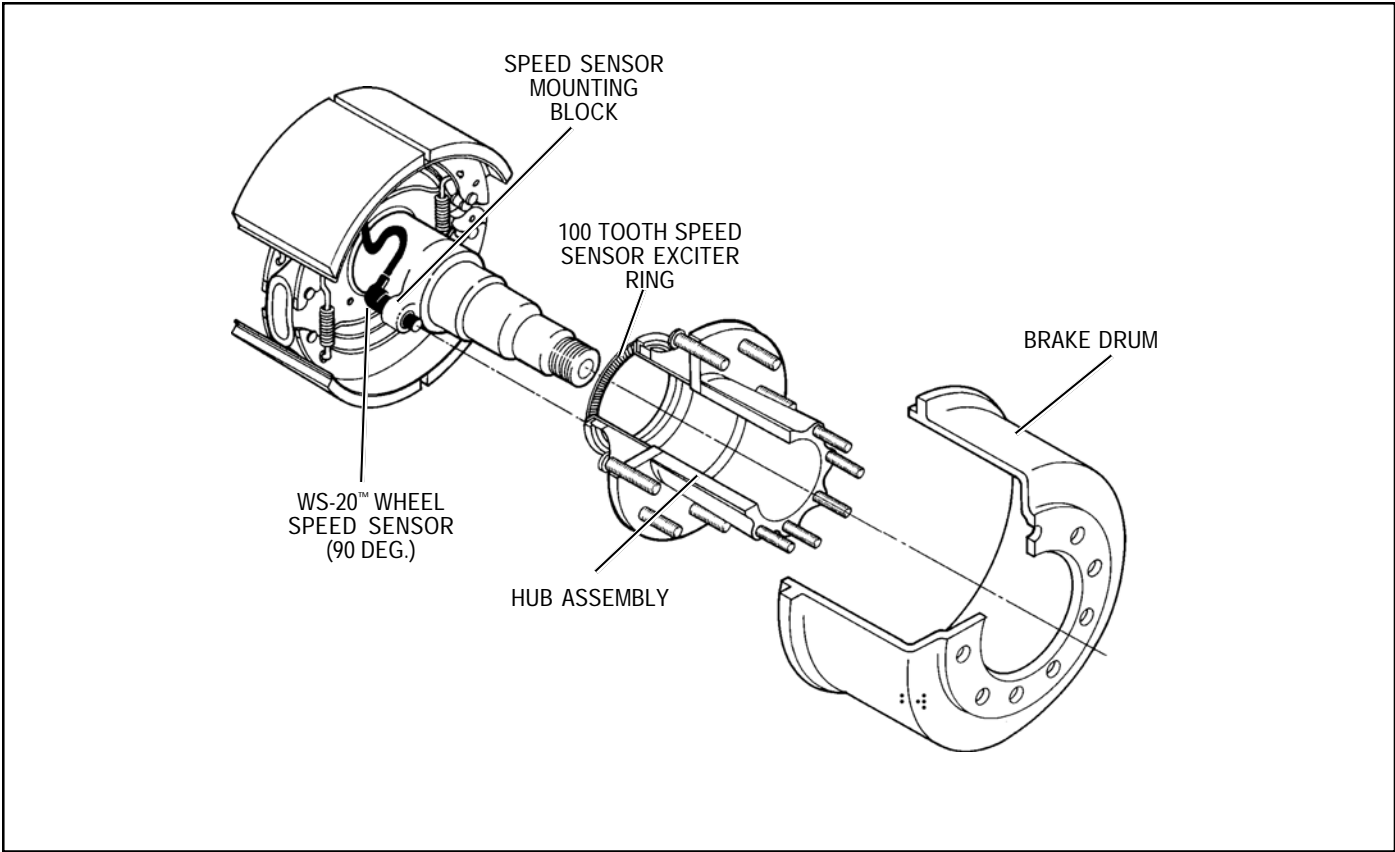


FIGURE 4A - WS-20™ WHEEL SPEED SENSOR INSTALLATION

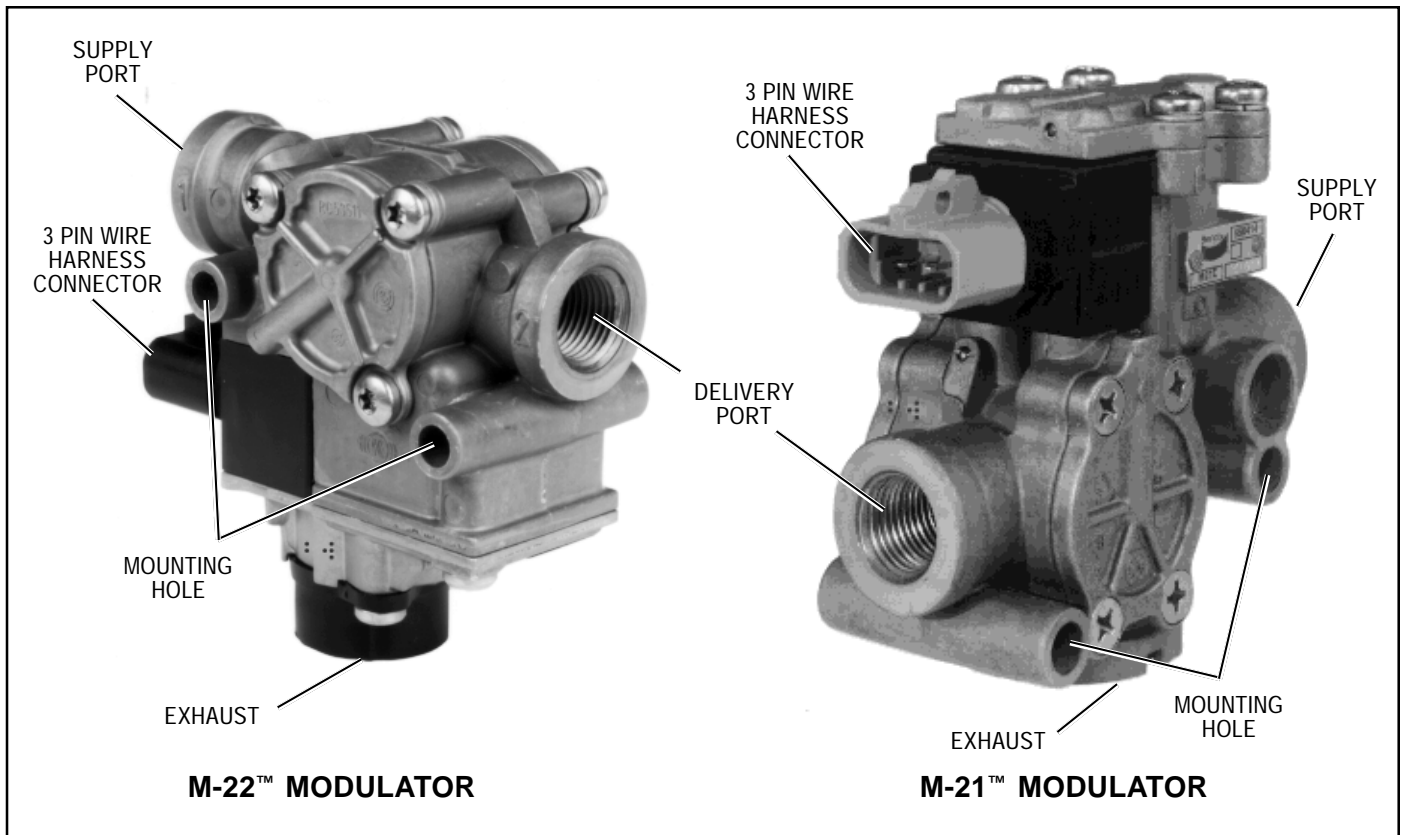


FIGURE 5 - M-21™ & M-22™ MODULATORS

The EC-14™ controller is designed to be mounted directly on a modulator relay valve assembly like the M-12™ modulator. The two separate components (EC-14™ controller and M-12™ modulator) become a single assembly. The M-12™ modulator is a combination valve consisting of a standard relay valve and solenoid assembly. The M-12™ modulator replaces the standard relay valve used to speed up the application and release of the vehicle's rear axle brakes. An internal, four pin, wiring harness connects the EC-14™ controller to the M-12™ modulator solenoid assembly. For additional information and service procedures see Bendix Service Data Sheet SD-13-4772.

In addition to the M-12™ modulator, the EC-14™ controller also controls a single, external modulator like the M-21™ or M-22™. Connected to the EC-14™ controller via a wire harness, the M-21™ or M-22™ modulator is essentially a high capacity, on/off air valve that incorporates a pair of electrical solenoids for control. The solenoids provide the electric-air link between the antilock controller electronics and the air brake system. Unlike the M-12™, the M-21™ or M-22™ modulator is not combined with a service relay valve. For additional information and service procedures see Bendix Service Data Sheet SD-13-4793.

A **Dash Light** and its electrical relay is connected to, and controlled by, the EC-14™ controller and serves as a means of advising the driver of the condition of the antilock system.

A connection to the **Engine or Transmission Retarder** is provided on the EC-14™ controller which allows the EC-14™ controller to temporarily "disable" the retarder during certain modes of operation. While the EC-14™ controller is capable of this function, and connections are provided, it is not always used. Use of the retarder disable function is not essential but highly recommended for vehicles equipped with a retarder.

The **Data Link** function enables the EC-14™ controller to "report" its operating condition to a specialized, external computer in response to certain commands it receives. The EC-14™ controller data link configuration conforms to S.A.E. standard J1708 and the protocol, or coded language used, conforms to S.A.E. standard J1537. There are two connections to the EC-14™ controller devoted to the data link. While the EC-14™ controller is capable of this function, and connections are provided, it is not always used. Use of the data link is not essential for the EC-14™ controller to be functional.

OPERATION

OPERATIONAL PHILOSOPHY

The Bendix® EC-14™ controller provides axle braking control by using four speed sensors and two modulators. By monitoring the rate of deceleration during braking, and subsequently adjusting the brake application pressure to each axle, the EC-14™ controller is able to provide improved braking while maintaining vehicle stability.

Rear Axle Brakes - The vehicle's rear axle brakes are controlled by the MC-14™ modulator controller (EC-14™ controller and M-12™ modulator). Like the standard service relay valve it replaces, the M-12™ modulator delivers brake application pressure to the service chambers on the rear axle equally. Two speed sensors on the rear axle “report” changes in acceleration and deceleration to the EC-14™ controller. If required, the EC-14™ controller adjusts the application pressure to the rear axle service brakes, via the M-12™ modulator, based on the wheel behavior “reported” to it by the speed sensors. In the case of vehicles equipped with tandem rear axles (6x2, 6x4), the speed sensors are installed on the axle that is most likely to lose traction first. The MC-14™ modulator controller controls all service brakes on the tandem equally.

The EC-14™ controller utilizes a “Select Smart” brake control philosophy for the *rear axle brakes*. This means that the EC-14™ controller will initially adjust application pressure to all rear axle service chambers based on the speed information from the first wheel to approach a locked condition. The initial pressure adjustment will attempt to prevent all wheels on the axle(s) from locking. If a substantial braking difference is detected between the two wheels on the axle equipped with the speed sensors, the EC-14™ controller will override the first air pressure adjustment and allow one wheel to lock. Both wheels including the locked wheel will continue to be monitored for speed and braking difference changes that would require pressure adjustments.

Steering Axle Brakes - The steering axle brakes are controlled by the EC-14™ controller and the M-21™ or M-22™ modulator. Although connected to the EC-14™ controller via a wire harness, the M-21™ or M-22™ modulator is not an integral part of the MC-14™ modulator controller assembly. Brake application air passes through the M-21™ or M-22™ modulator on its way to the front axle service chambers from the foot valve.

Two speed sensors on the front axle “report” changes in acceleration and deceleration to the EC-14™ controller.

The EC-14™ controller uses a “Select Low” brake control philosophy for the *front axle brakes*. It will attempt to prevent wheel lock by adjusting application pressure to both front axle service chambers based on the speed information from the first wheel to approach a locked condition. The M-21™ or M-22™ modulator provides the EC-14™ controller with the means of adjusting front axle service application pressure when required.

NON-ANTILOCK BRAKE APPLICATION

During normal braking, the brake valve simultaneously delivers air to the control port of the M-12™ modulator on the rear axle(s) as well as to and through the M-21™ or M-22™ modulator on the front axle. The M-12™ modulator functions

the same as standard service relay valve and applies air to the rear axle service brakes. Because the M-21™ or M-22™ modulator does not have a relay valve function, service air passes through it to a quick release valve and from there to the front axle service chambers. The service brakes are thus applied.

If the speed sensors do not detect an impending wheel lock up, the EC-14™ controller does not initiate any corrective action and the vehicle comes to a stop in a normal fashion.

ANTILOCK CONTROLLED BRAKE APPLICATION - SYSTEM FULLY OPERATIONAL

If a service brake application is made and the speed sensors detect an impending wheel lockup on an axle, the EC-14™ controller will immediately begin modification of the brake application using the antilock modulator(s) at the affected axle(s).

Solenoid valves contained in the modulator are energized and de energized by the EC-14™ controller in order to modify the brake application. When a solenoid coil is energized its shuttle moves, and depending upon the function of the specific solenoid, it either opens or closes, thereby causing the exhaust or re-application of air pressure to the brake chamber. The solenoids in either the M-12™ or M-21™ modulator are controlled independently by the EC-14™ controller. By opening and closing the solenoid valves in the appropriate modulator, the EC-14™ controller is actually simulating what the driver does when he “pumps the brakes”.

It must be remembered however that unlike the driver, the EC-14™ controller is able to “pump” brakes on either the front or rear axle(s), or both, independently and with far greater speed and accuracy.

ANTILOCK SYSTEM OPERATION - COMPONENT FAULT STRATEGY

The Bendix® EC-14™ controller handles equipment faults using a conservative fail-safe philosophy. Any single electrical problem with a component devoted to antilock braking, results in simultaneous illumination of the antilock condition lamp on the dash and a troubleshooting LED on the EC-14™ controller. Depending upon the type of problem and its position of occurrence the EC-14™ controller can continue antilock function at a lower performance level, disable all of the antilock on the vehicle or only a portion. When antilock is disabled, the brakes on the affected axle(s) revert to standard air braking.

Complete antilock system shut down will occur if:

- Electrical power is below or above the 10 to 17 volt operating range.
- A controller fault is detected.
- Two or more faults, regardless of where, are detected.

- An M-12™ modulator malfunction on the rear axle(s).
- Only front axle antilock will be disabled if a problem with the M-21™ or M-22™ modulator is detected.

A problem in a **single** speed sensor will not result in disabling of the antilock system. If a speed sensor malfunction is detected by the EC-14™ controller, the remaining speed sensor on the axle will be used to continue antilock operation on the axle but at a slightly degraded level of performance.

With the failed component approach described, the antilock system will attempt to provide the vehicle with the best possible braking and stability even after a problem has occurred. It should be remembered that the driver will be advised of any degraded antilock operation via the dash lamp and that standard air braking will still be available on those brakes where the antilock has been disabled.

ANTILOCK WIRING

GENERAL NOTES

The wires that carry information and power into and out of the EC-14™ controller are grouped and terminate at a connector which plugs into the EC-14™ controller. The wiring harnesses and connectors are weather proof and the wires that enter the connector are sealed to the connector. The wire gauge used in the wire harnesses is specific to the task performed.

When diagnosing wiring in the antilock system the following general rules apply and should be followed where applicable:

1. It is generally advisable to replace a wire harness rather than repair individual wires in the harness. If a splice repair must be made, it is important that the splice be properly soldered with a rosin flux (not acid based) and the splice made water proof.
2. Do not pierce wire insulation when checking for continuity. Check for power, ground or continuity by disconnecting the connector and testing the individual pins or sockets in the connector(s).
3. Always check the vehicle handbook for wire and connector identification. Individual wire identification will differ depending upon the type of connectors in use, the vehicle manufacturer, and the system features in use.
4. While the retarder disable and serial link connections (3 total) are present on all EC-14™ controllers they are not always used.

PREVENTATIVE MAINTENANCE

GENERAL

Important: Review the warranty policy before performing any intrusive maintenance procedures. An extended warranty may be voided if intrusive maintenance is performed during this period.

Because no two vehicles operate under identical conditions, maintenance and maintenance intervals will vary. Experience is a valuable guide in determining the best maintenance interval for any one particular operation.

Visually check for physical damage such as broken air lines and broken or missing parts.

Perform the tests and inspections presented at the prescribed intervals. If the EC-14™ controller fails to function as described, it should be repaired or replaced with a genuine Bendix unit, available at any authorized parts outlet.

Every 3 months or 25,000 miles, or 900 operating hours:

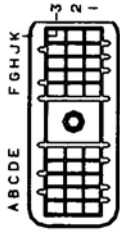
1. Check all wiring and connectors to ensure they are secure and free from visible damage.
2. Although the EC-14™ controller incorporates a self check diagnostics, the LED display should be inspected to ensure that they are functional. With the tractor ignition on and a brake application held applied, hold a magnet (800 gauss; capable of picking up 3 ounces) on the Diagnostic Window Reset Switch and note all of the LEDs illuminate. If one or more of the LEDs **do not illuminate** and the antilock condition lamp on the trailer indicates the system is functioning properly, the non-illuminated LED(s) should be noted for future reference. Although the diagnostic capabilities will be limited, the system will continue to function as designed.
3. Road test the trailer by making an antilock stop from a vehicle speed of 20 miles per hour. When an antilock stop is made, the modulator solenoids pulsate and an audible burst of air can be heard. The wheels should not enter a prolonged "lock" condition.

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.**
2. **Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, **EXTREME CAUTION** should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.**
3. **Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.**

WIRE HARNESS CONNECTOR
(TO EC-14 CONTROLLER)



TERMINAL	FUNCTION
1K, 2K	BATTERY POWER
1A, 2A	VEHICLE GROUND (-)
3F	DASH WARNING LAMP
3G	RETARDER DISABLE
2B	BRAKE SWITCH
3A	SERIAL A
3B	SERIAL B
2F	FRONT MODULATOR EXHAUST
2G	FRONT MODULATOR HOLD
1G	FRONT MODULATOR SOURCE (+)
3J	LEFT FRONT SPEED SIGNAL (+)
3H	LEFT FRONT SPEED SIGNAL (-)
2H	RIGHT FRONT SPEED SIGNAL (+)
3K	RIGHT FRONT SPEED SIGNAL (-)
3E	LEFT REAR SPEED SIGNAL (+)
2C	LEFT REAR SPEED SIGNAL (-)
3D	RIGHT REAR SPEED SIGNAL (+)
3C	RIGHT REAR SPEED SIGNAL (-)
1H	NOT USED
1J	NOT USED
1F	NOT USED
1B	NOT USED
1C	NOT USED
1D	NOT USED
2D	NOT USED
2E	NOT USED
1E	NOT USED
2J	NOT USED

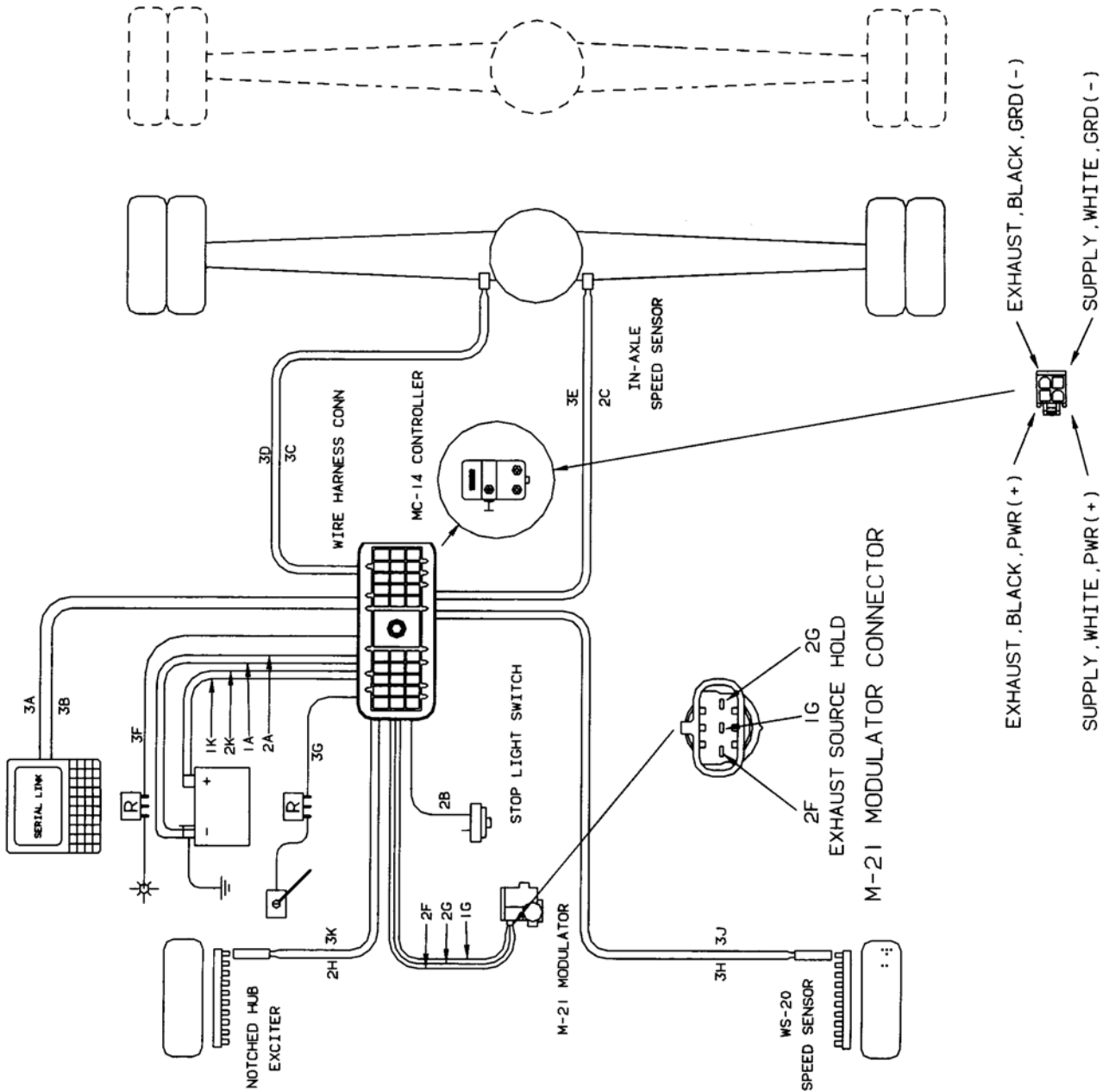


FIGURE 6 - MC-14™ ANTILOCK WIRING SCHEMATIC

4. If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning **ANY** work on the vehicle. If the vehicle is equipped with an AD-IS™ air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.
5. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
6. Never exceed manufacturer's recommended pressures.
7. Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.
8. Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
9. Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
10. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.

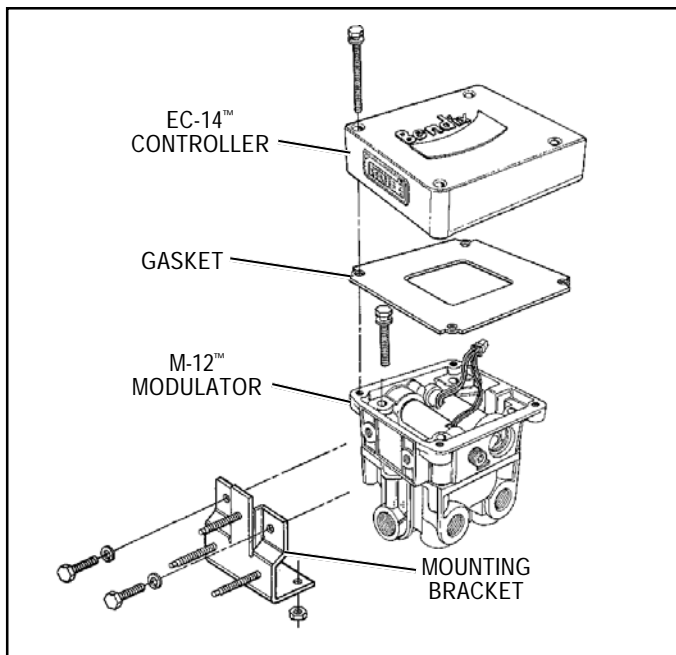


FIGURE 7 - MC-14™ MODULATOR CONTROLLER

REMOVING EC-14™ CONTROLLER ASSEMBLY

Locate the EC-14™ controller on the trailer and determine if it is mounted on a modulator (e.g. M-12™ modulator) or is remote mounted to a trailer frame member using a bracket. Use the appropriate removal procedure below.

Removing the EC-14™ Controller and M-12™ Modulator:

1. Identify and remove all air lines connected to the M-12™ modulator.
2. Disconnect the electrical connector from the EC-14™ controller.
3. Note and mark the mounting position of the MC-14™ modulator-controller assembly on the vehicle. Loosen, remove and save the nuts on the mounting hardware that attaches the MC-14™ modulator controller bracket to the vehicle. Remove the MC-14™ modulator controller assembly from the vehicle.
4. Remove as much contamination as possible from the exterior of the assembly making sure to keep the contamination away from the open ports.
5. Note and mark the position of the EC-14™ controller relative to the M-12™ modulator. Remove and retain the four hex cap screws that secure the EC-14™ controller to the M-12™ modulator. Carefully separate the EC-14™ controller from the M-12™ modulator enough to expose the wire harness that connects both units electrically. Disconnect the wire harness by separating the four pin connector at the EC-14™ controller. Peel the gasket from the EC-14™ controller or M-12™ modulator and retain for reuse. **Note:** Use a new gasket if damaged during removal or if a new gasket is immediately available.

INSTALLING THE EC-14™ CONTROLLER ASSEMBLY

1. After noting the positioning marks made prior to disassembly, reconnect the M-12™ modulator wire harness to the EC-14™ controller, position the gasket on the EC-14™ controller then secure the EC-14™ controller to the M-12™ modulator using the four cap screws. Torque the cap screws to 50-80 lbs. in.
2. Mount the assembled MC-14™ modulator controller on the vehicle and orient it in the position marked prior to removal.
3. Reconnect all air lines.
4. Reconnect the electrical connector to the EC-14™ controller.
5. Test the MC-14™ modulator controller for operation and air leakage prior to placing the vehicle in service.
6. Perform the "Initial Start up Procedure" in the *Troubleshooting* section to assure proper antilock system operation.

DIAGNOSING AND LOCATING A SYSTEM PROBLEM

GENERAL

The EC-14™ controller contains self test and diagnostic circuitry that continuously checks for proper operation of

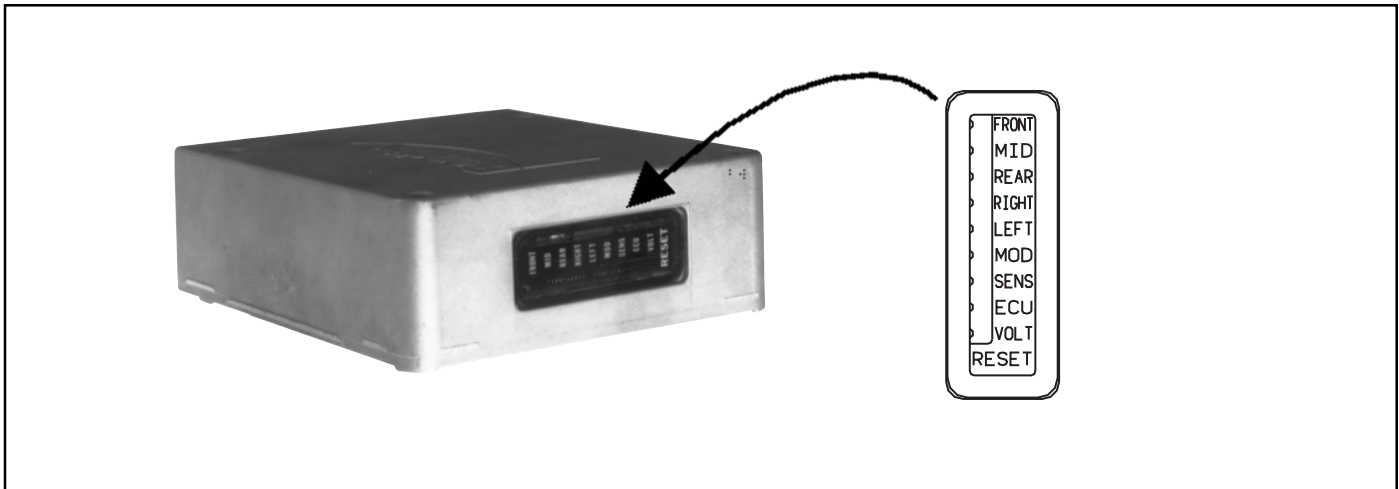


FIGURE 8 - EC-14™ CONTROLLER DIAGNOSTIC WINDOW

the entire antilock system including wiring continuity. A dash lamp, controlled by the EC-14™ controller, advises the driver of the condition of the entire antilock system. The condition of specific antilock components is provided to the mechanic by a series of labeled, light emitting diodes (LED's) displayed through a "window" in the EC-14™ controller housing. No special tools or equipment are needed to read or interpret the EC-14™ controller diagnostics window. It should be noted that the diagnostics display is separate from the antilock condition lamp on the dash. With this separation, the driver is aware of any problems that occur, but is not concerned with in-depth diagnostic information.

A special feature of the EC-14™ controller diagnostic system is its failure latching. Intermittent problems, particularly in the wheel speed sensing area can be difficult to diagnose. When the controller senses an erroneous condition, whether in the controller electronics, the modulator or speed sensing areas, it stores the condition in non-volatile memory, disables the antilock function if necessary, illuminates the dash mounted antilock condition lamp and the appropriate diagnostic LEDs on the EC-14™ controller. The malfunction condition is truly stored and is not cleared by loss of power to the EC-14™ controller. The LEDs will re-light when power is restored and remain illuminated until the problem is corrected. After the actual problem is corrected, maintenance personnel can clear or reset the EC-14™ controller diagnostics by passing a small magnet over the RESET point in the diagnostics window.

DIAGNOSTIC LEDES

There are nine LEDs plus a magnetically actuated reset switch in the EC-14™ controller diagnostic window. The first five LEDs locate a problem to a specific area of the trailer while the last four indicate the problem component or its wiring. The LEDs are computer controlled and are either ON or OFF depending upon their monitor function. (**Note:** Right and left, front and rear are determined from the driver's seat. Left front is therefore the corner closest to the driver.)

LED	o FRONT	Red LED
LED	o MID	Red LED (SEE NOTE)
LED	o REAR	Red LED
LED	o RIGHT	Red LED
LED	o LEFT	Red LED
LED	o MOD	Red LED
LED	o SENS	Red LED
LED	o ECU	Red LED
LED	o VOLT	Green LED
	RESET	No LED

Note: The MID LED shown in the chart above is not used in the diagnostic process for the EC-14™ controller however, it will light when a magnet is placed on the RESET switch in the diagnostic window.

"FRONT" LED

This Red LED illuminates and latches **on** in order to indicate the location of a problem component or its wiring. It will light in conjunction with either the RIGHT or LEFT LED and the SENS LED when indicating a speed sensor problem. The FRONT LED will also light in conjunction with the MOD LED to indicate that the front modulator (M-21™ or M-22™) or its wiring has malfunctioned.

"MID" LED

This red LED is not used in troubleshooting the EC-14™ controller and should light only when a magnet is held on the RESET switch.

"REAR" LED

This red LED illuminates and latches **on** in order to indicate the location of a problem component or its wiring. It will light in conjunction with either the RIGHT or LEFT LED and the SENS LED when indicating a speed sensor problem. The REAR LED will also light in conjunction with the MOD LED to indicate that the rear modulator (M-12™) or its wiring has malfunctioned.

"RIGHT" LED

This red LED illuminates and latches **on** in order to indicate the location of a problem component or its wiring. It will light in conjunction with either the FRONT or REAR LED and SENS LED. This LED **should not light** when a MOD LED is on.

"LEFT" LED

This red LED illuminates and latches **on** in order to indicate the location of a problem component or its wiring. It will light in conjunction with either the FRONT or REAR LED and SENS LED. This LED **should not light** when a MOD LED is on.

"MOD" LED

This red LED illuminates and latches **on** to indicate a permanent or intermittent open or short circuit in the solenoids of one of the two modulators or the wiring connecting them to the system. The MOD LED will illuminate in conjunction with either the FRONT or REAR LED.

"SENS" LED

This red LED illuminates and latches **on** to indicate permanent or intermittent problem. The faults indicated are; open or shorted wheel speed sensor, open or shorted wheel speed sensor wiring, wheel speed signal not present or does not conform to design criteria. The SENS LED will illuminate in conjunction with either the FRONT or REAR and either the RIGHT or LEFT LED.

"ECU" LED

This red LED, when illuminated, indicates that the controller itself has failed. It is latched **on** for all EC-14™ controller faults except low voltage. For voltages less than 9 vdc, the LED illuminates to indicate the controller is inoperative, however when the voltage again exceeds 9 vdc the LED will go **out** by itself.

"VOLT" LED

This green LED illuminates and remains **on** during vehicle operation to indicate that vehicle power is reaching the controller. If vehicle power is out of range for proper operation (below 10 vdc or above 17 vdc) this LED will flash until power is brought into range. This LED may also flash indicating that a "marginal" low voltage condition existed at the time of an antilock event.

"RESET"

Beneath the RESET area of the window display is a magnetically sensitive switch that is used to reset the diagnostic system. The device will respond to a magnet which has strength sufficient to lift a three (3) ounce weight. Holding a magnet against the RESET will cause all LEDs to light during the time the magnet is against it.

TROUBLESHOOTING

GENERAL

While the EC-14™ controller diagnostic display locates a specific problem area, it is still necessary to confirm whether the problem resides in the component itself or the wiring. Basically the troubleshooting procedure that follows is devoted to narrowing the problem to either the wiring or a specific antilock component. It should be noted that **all troubleshooting begins by observing the antilock status lamp on the dash while performing the "Initial Start-up Procedure"** and following the directions contained in the procedure.

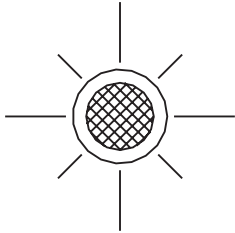
IMPORTANT - TROUBLESHOOTING TIPS

1. **Record all findings and the action taken** during the troubleshooting process. The record sheet should be filed in the trailer maintenance folder for future reference and comparison.
2. **No voltage or resistance tests are performed into the EC-14™ controller.** All voltage and resistance tests are performed by beginning at the wire harness half of the connector and moving **away** from the EC-14™ controller toward an antilock system component (modulator, wheel speed sensor, etc.).

TROUBLESHOOTING INITIAL START-UP PROCEDURE

START HERE

Turn ignition ON and observe dash antilock condition lamp.
Note: If brakes are applied when ignition is turned on, a short exhaust of air will be heard at front and rear modulators.



**AMBER STATUS LAMP
BLINKS ONCE,
THEN GOES OUT:
SYSTEM - OK**



**AMBER DASH LAMP OFF:
SYSTEM - OK**

Is dash lamp illuminated?

NO

Go to Section I
"Dash Lamp Testing"

YES

Dash lamp does not blink, comes on and remains illuminated?

YES

Go to Section II
"Inspection for Illuminated LEDs"

NO

Dash lamp comes on, flashes and stays on. Increase vehicle speed to above 10 mph for at least 30 seconds and observe the dash lamp.

Dash lamp remains on?

YES

Go to Section III
"Inspection for illuminated LEDs"

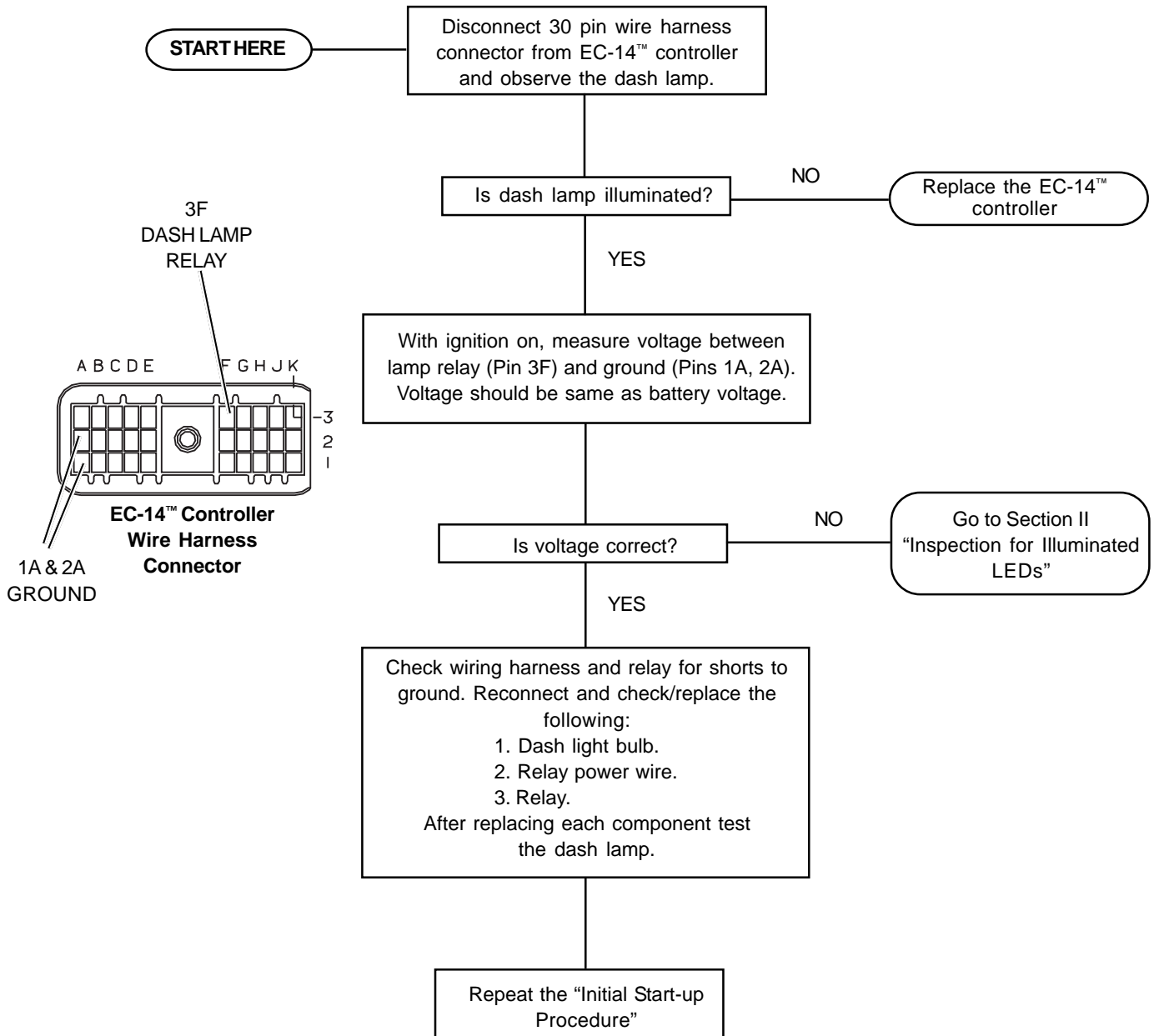
NO

The system is functioning normally. Make notes of the parts replaced or repaired and steps taken.

TROUBLESHOOTING

SECTION I

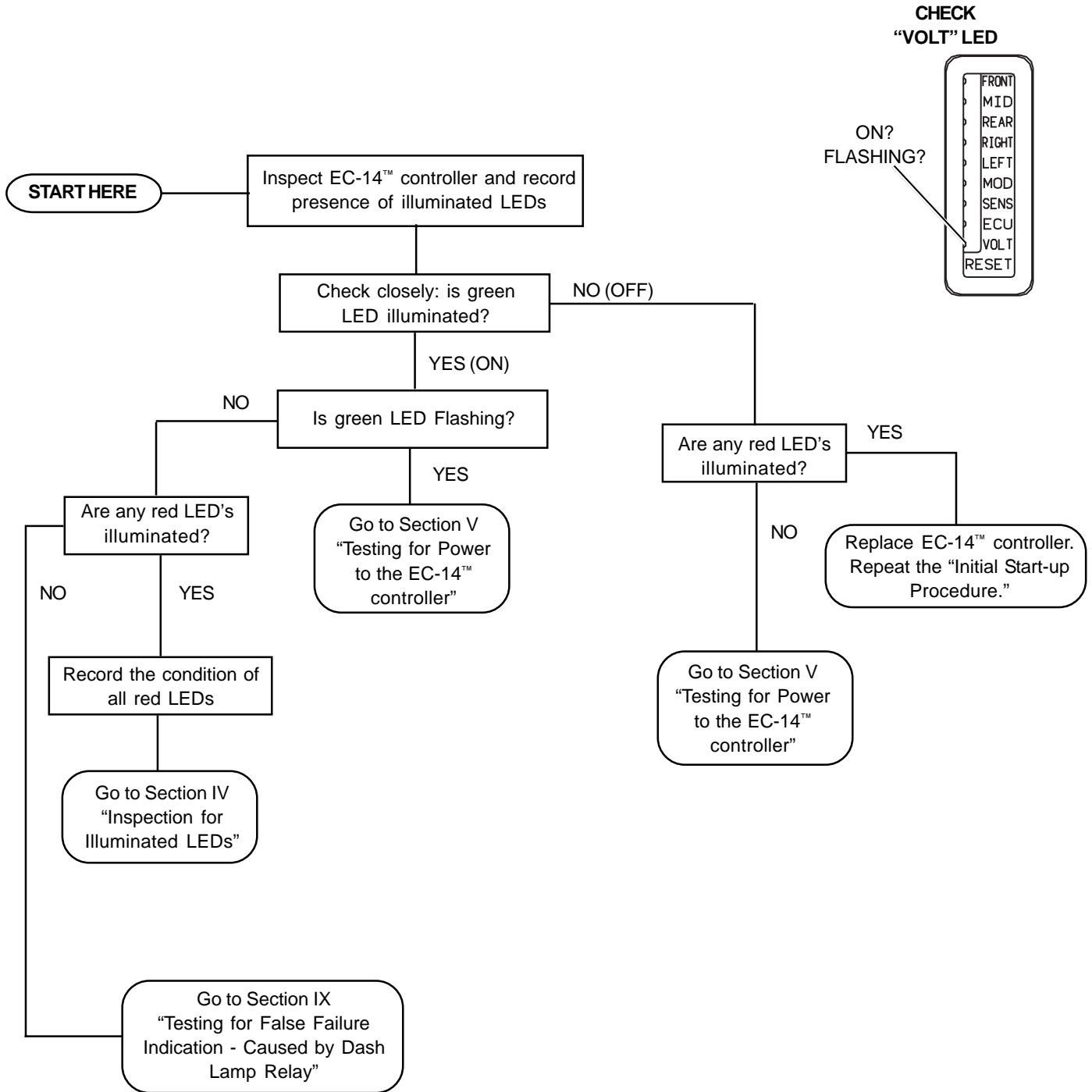
DASH LAMP TESTING



TROUBLESHOOTING

SECTION II

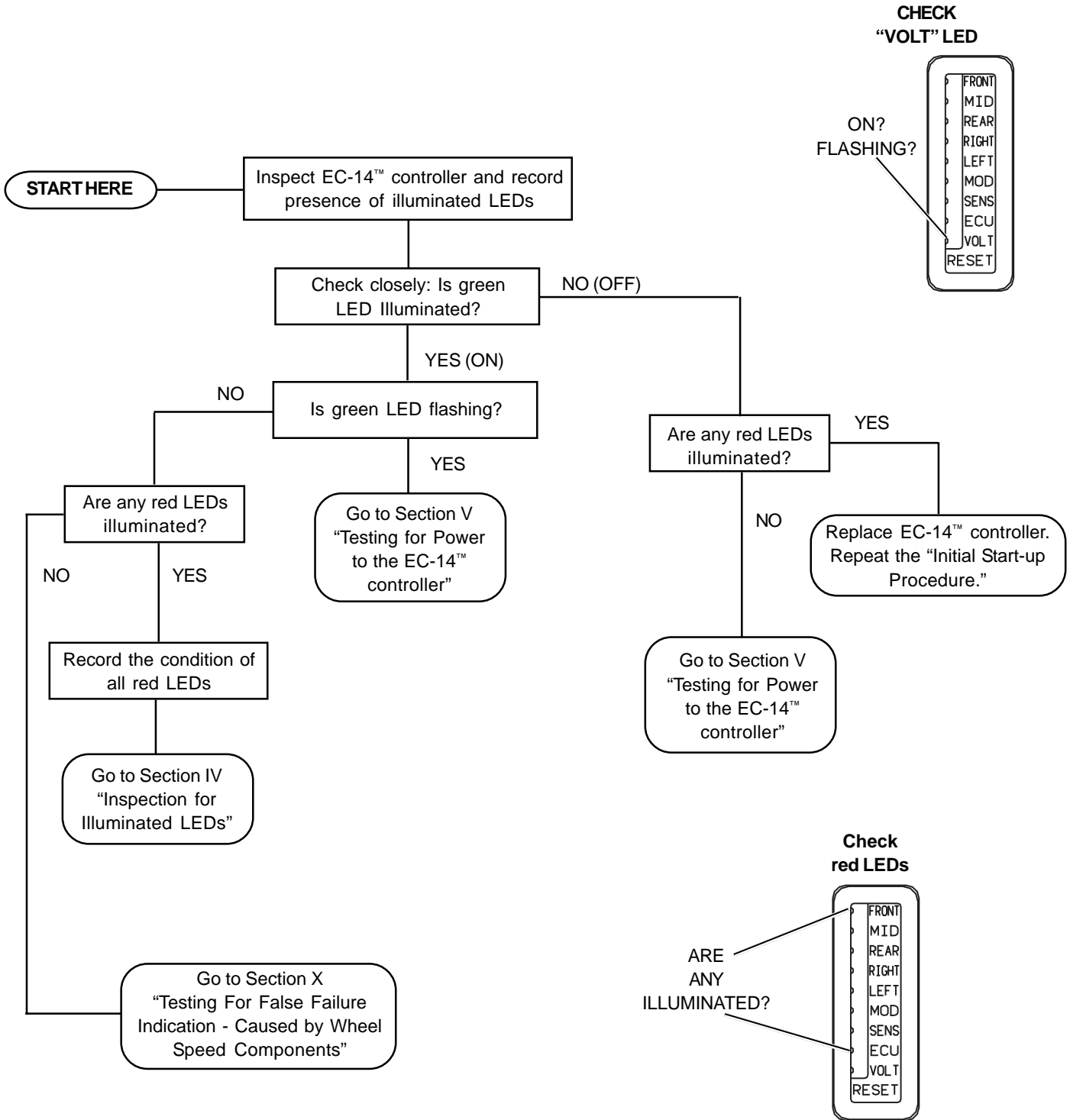
INSPECTION FOR ILLUMINATED LEDs



TROUBLESHOOTING

SECTION III

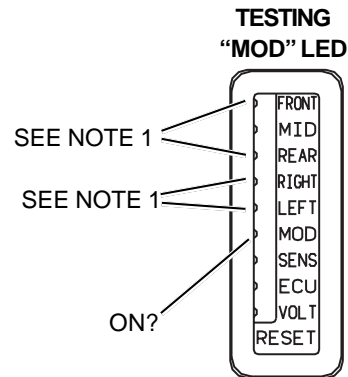
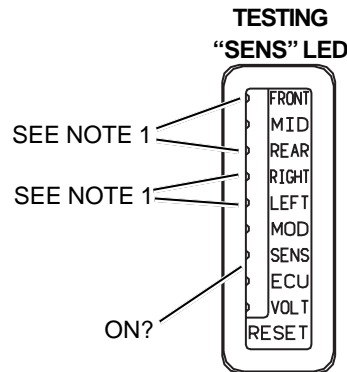
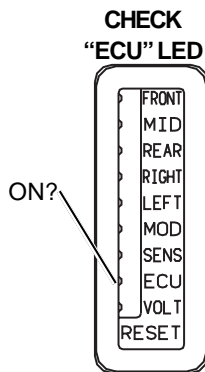
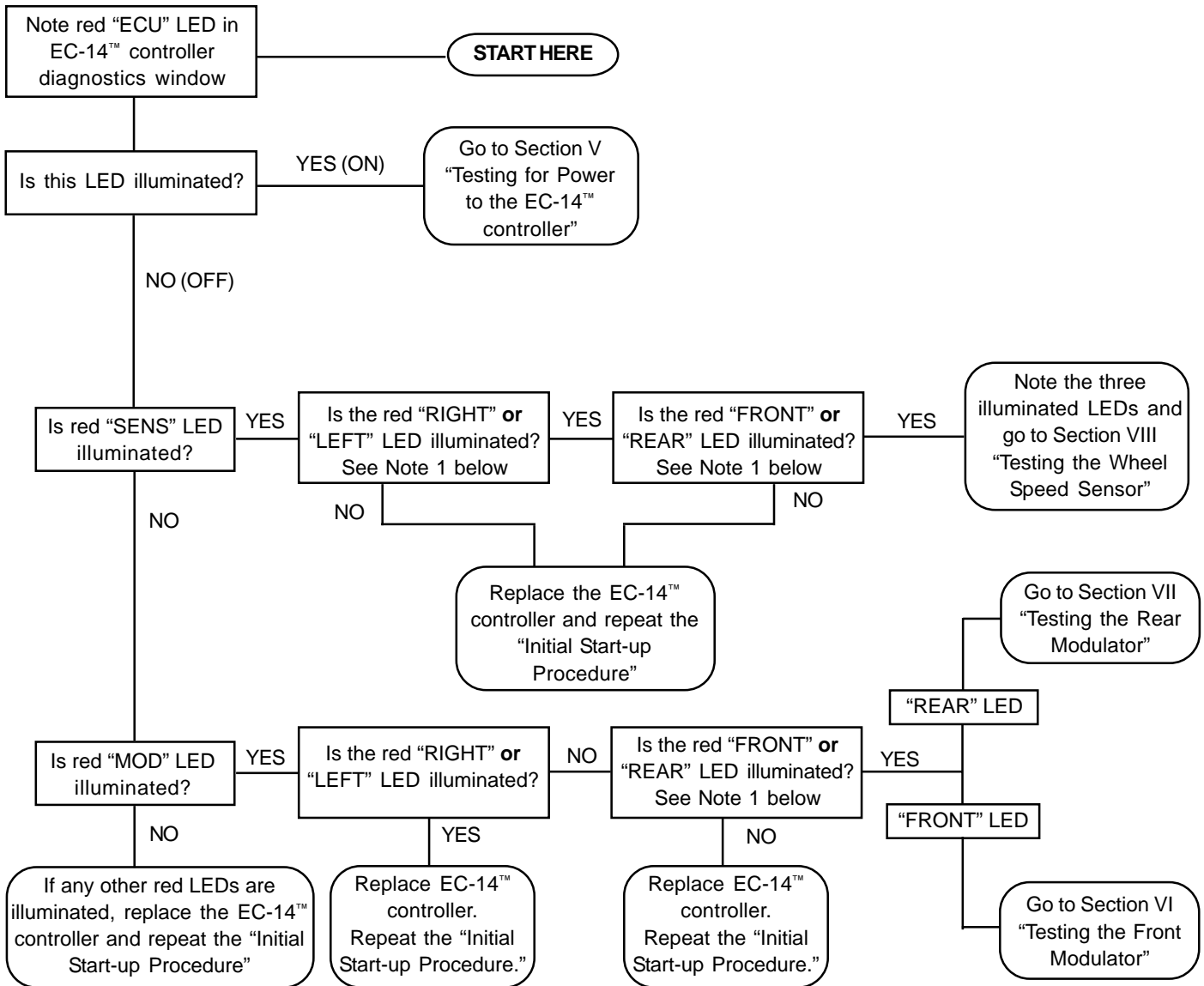
INSPECTION FOR ILLUMINATED LEDs



TROUBLESHOOTING

SECTION IV

INSPECTION FOR ILLUMINATED LEDs



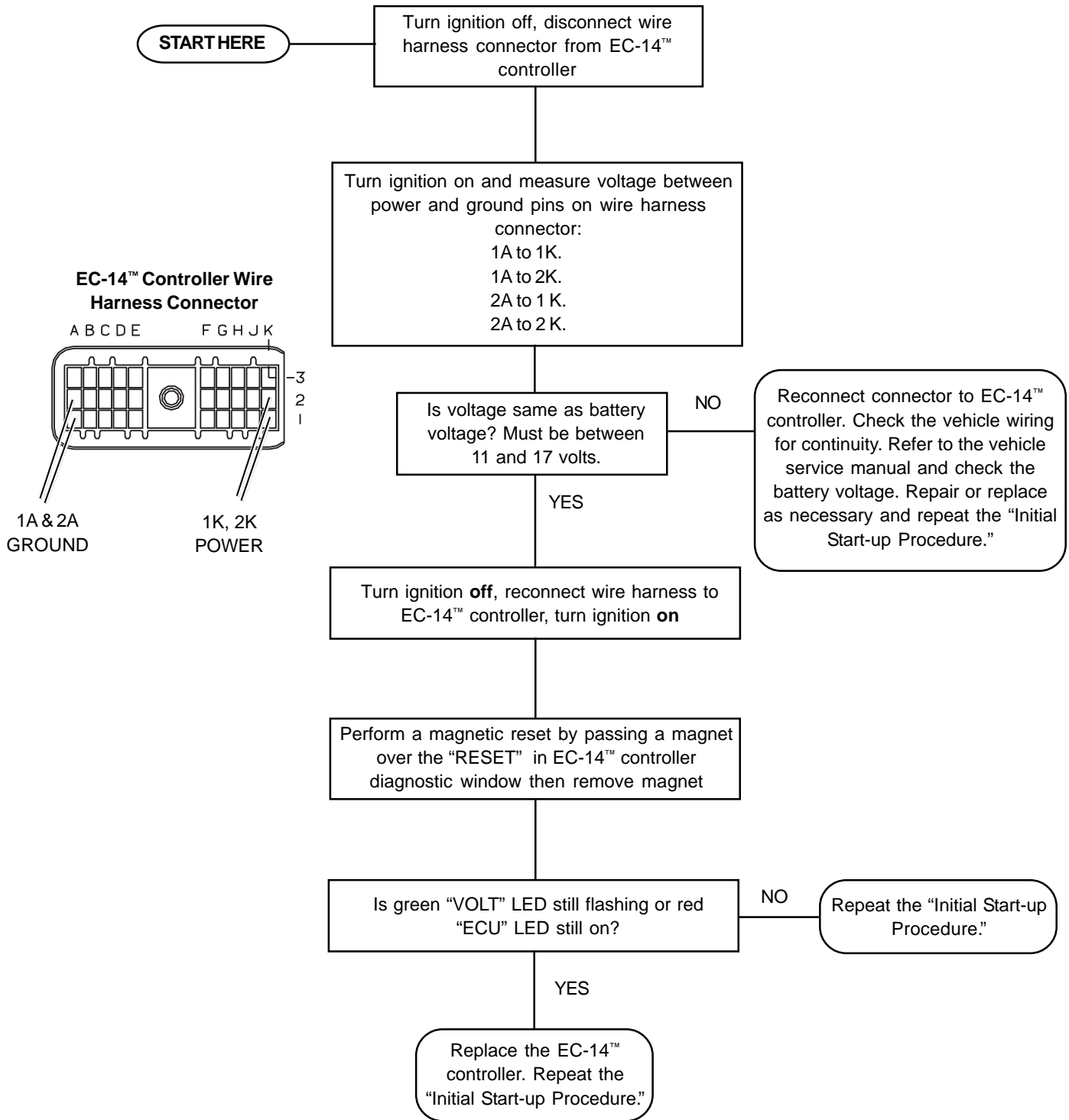
NOTE

1. If **both** of these LEDs are illuminated, replace the EC-14™ controller.

TROUBLESHOOTING

SECTION V

TESTING FOR POWER TO THE EC-14™ CONTROLLER



TROUBLESHOOTING

SECTION VI A

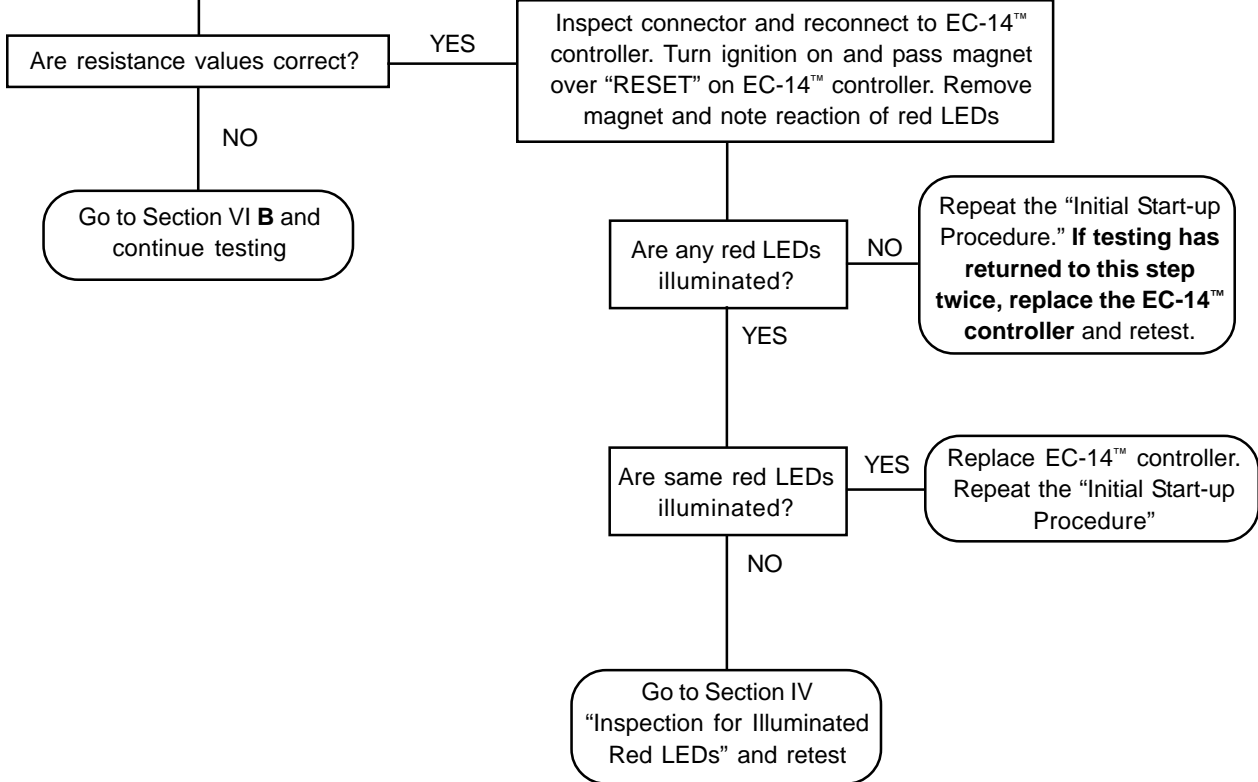
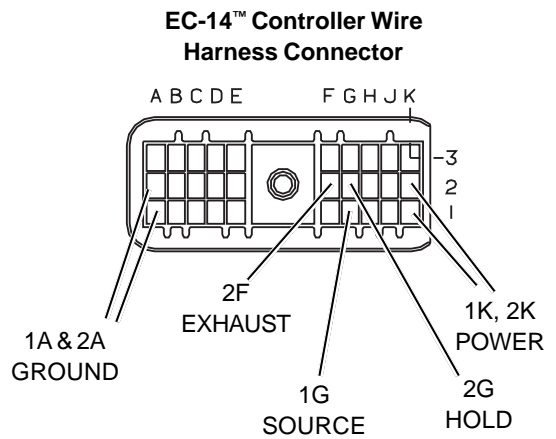
TESTING FOR THE FRONT MODULATOR

START HERE

Turn ignition **off**, disconnect wire harness connector from EC-14™ controller.

Probe connector with volt/ohm meter and not that proper resistance values are obtained for modulator being tested. Resistance values here for Bendix® M-21™ modulator.

Hold to Source (2G to 1G):	Read 3.5 to 5 Ohms
Exhaust to Source (2F to 1G):	Read 3.5 to 5 Ohms
Exhaust to Hold (2F to 2G):	Read 7 to 10 Ohms
Source to Power (1G to 1K, 2K):	No Continuity
Source to Ground (1G to 1A, 2A):	No Continuity
Hold to Power (2G to 1K, 2K):	No Continuity
Hold to Ground (2G to 1A, 2A):	No Continuity
Exhaust to Power (2F to 1K, 2K):	No Continuity
Exhaust to Ground (2F to 1A, 2A):	No Continuity

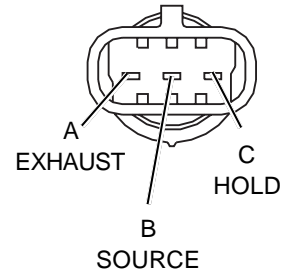


TROUBLESHOOTING

SECTION VI B

TESTING FOR THE FRONT MODULATOR

**Connector on M-21™
Front Modulator**



START HERE
from Section VI A

Go to modulator, inspect wiring connector. Disconnect connector and test resistance between pins on modulator. Resistance values here for Bendix® M-21™ modulator.
 Hold to Source (C to B): Read 3.5 to 5 Ohms
 Exhaust to Source (A to B): Read 3.5 to 5 Ohms
 Exhaust to Hold (A to C): Read 7 to 10 Ohms
 Test each pin to vehicle ground and note **no continuity**

Are resistance values correct?

NO → Replace the front (M-21™) modulator

YES

Reconnect connector to modulator. Turn ignition on and pass magnet over "RESET" on EC-14™ controller and remove. Note reaction of red LEDs

Are any red LEDs illuminated?

NO → Repeat the "Initial Start-up Procedure"

YES

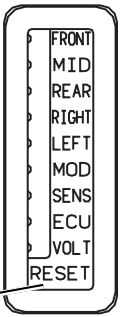
Are same red LEDs illuminated?

YES → Repair or replace modulator wire harness

NO

Go to Section IV "Inspection for Illuminated red LEDs" and retest

**RESETTING
EC-14™ CONTROLLER**

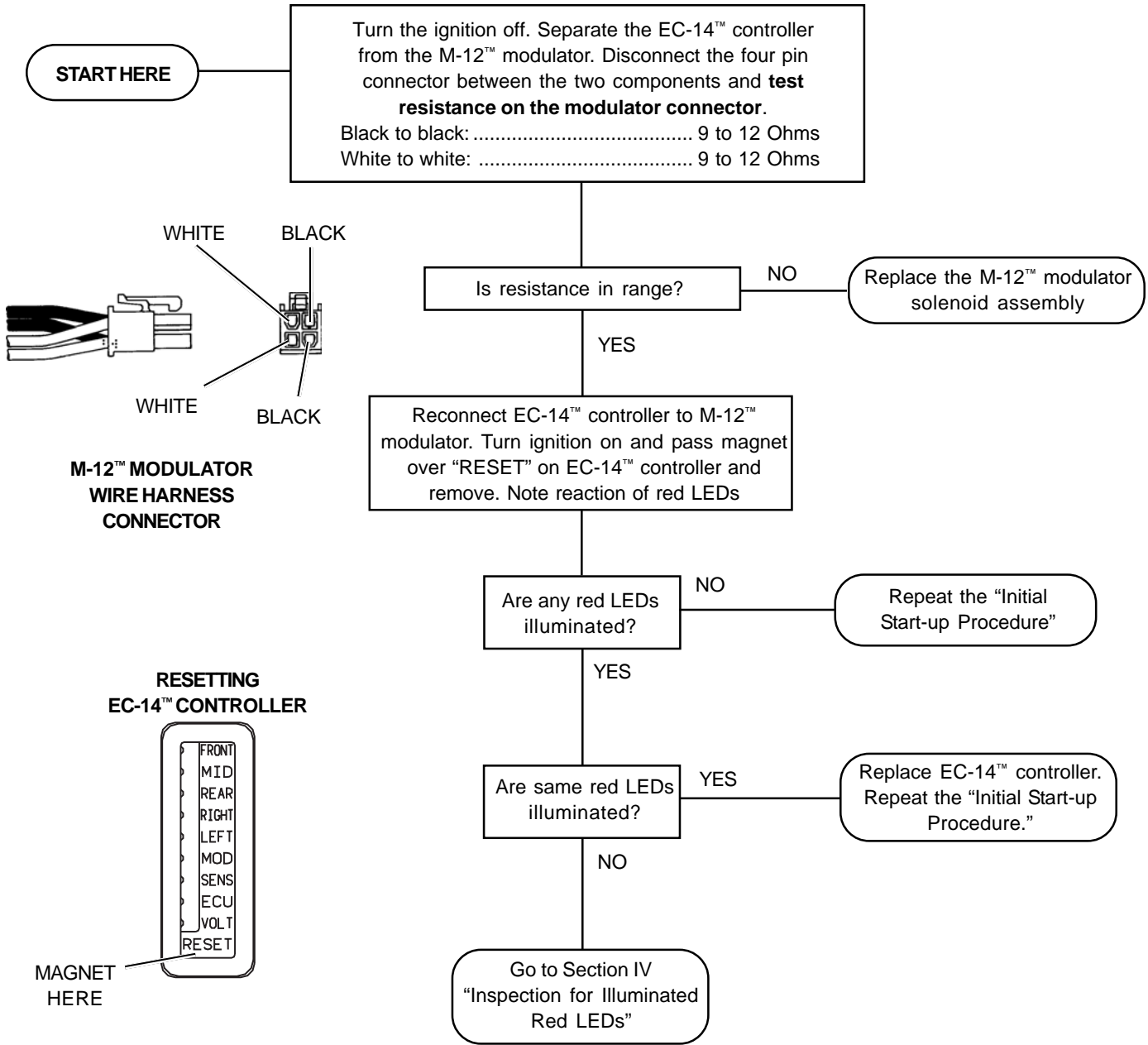


MAGNET
HERE

TROUBLESHOOTING

SECTION VII

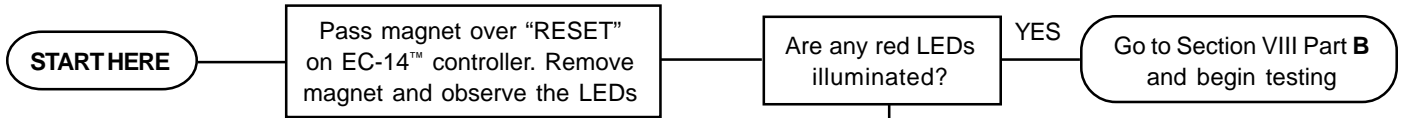
TESTING FOR THE REAR (M-12™) MODULATOR



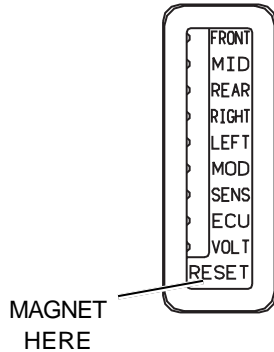
TROUBLESHOOTING

SECTION VIII PART A

TESTING THE WHEEL SPEED SENSOR



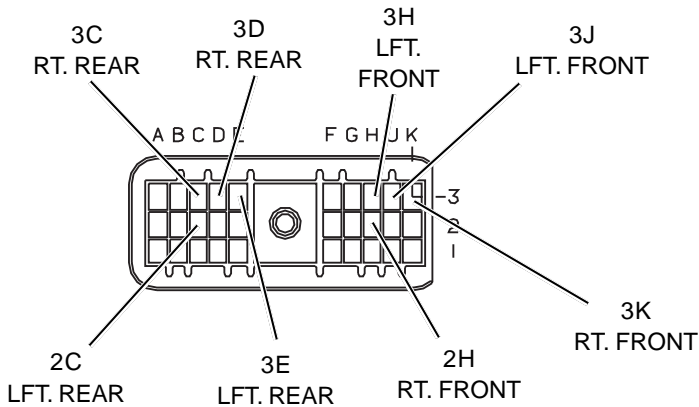
RESETTING EC-14™ CONTROLLER



Turn ignition off and check the following:

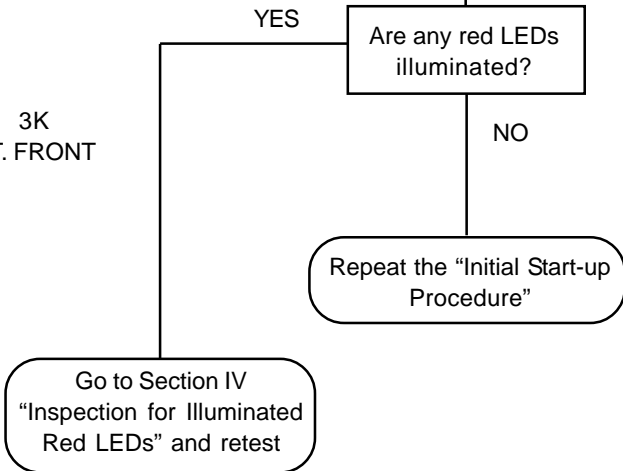
- A. Remove connector(s) from EC-14™ controller and measure resistance between appropriate speed sensor signal (+) and signal return (-). Resistance for Bendix® WS-20™ speed sensor should be between 1500-2500 ohms. Refer to vehicle maintenance manual if other than the **WS-20™ speed sensor** is in use. If resistance not correct, disconnect connector **at speed sensor**. Inspect connector, then check resistance between pins **on sensor**. If resistance is not correct (between 1500-2500 ohms for the Bendix® WS-20™ speed sensor), replace sensor, otherwise proceed to step B.
- B. Check "gap" between speed sensor and exciter or tone ring. (Gap for Bendix® WS-20™ speed sender is between 0 - .015 inches.) If sensor gap must be adjusted, check for loose or worn wheel bearings **before** re-gapping sensor. Refer to vehicle maintenance manual for worn bearings.
- C. If sensor gap is correct check wheel bearing for free play to verify it complies to manufacturer's recommendations.
- D. Make certain exciter or tone ring is in place and inspect condition. Check for missing or damaged teeth and that it runs true and perpendicular to sensor face.
- E. Check wiring harness and connectors that run to sensor.
- F. Check for dragging brakes (over-adjusted, trapped air in actuator, out-of-round drums, faulty return springs, parking brake system faults, etc.) and correct. Retest.

EC-14™ Controller Wire Harness Connector



Testing Speed Sensor Resistance

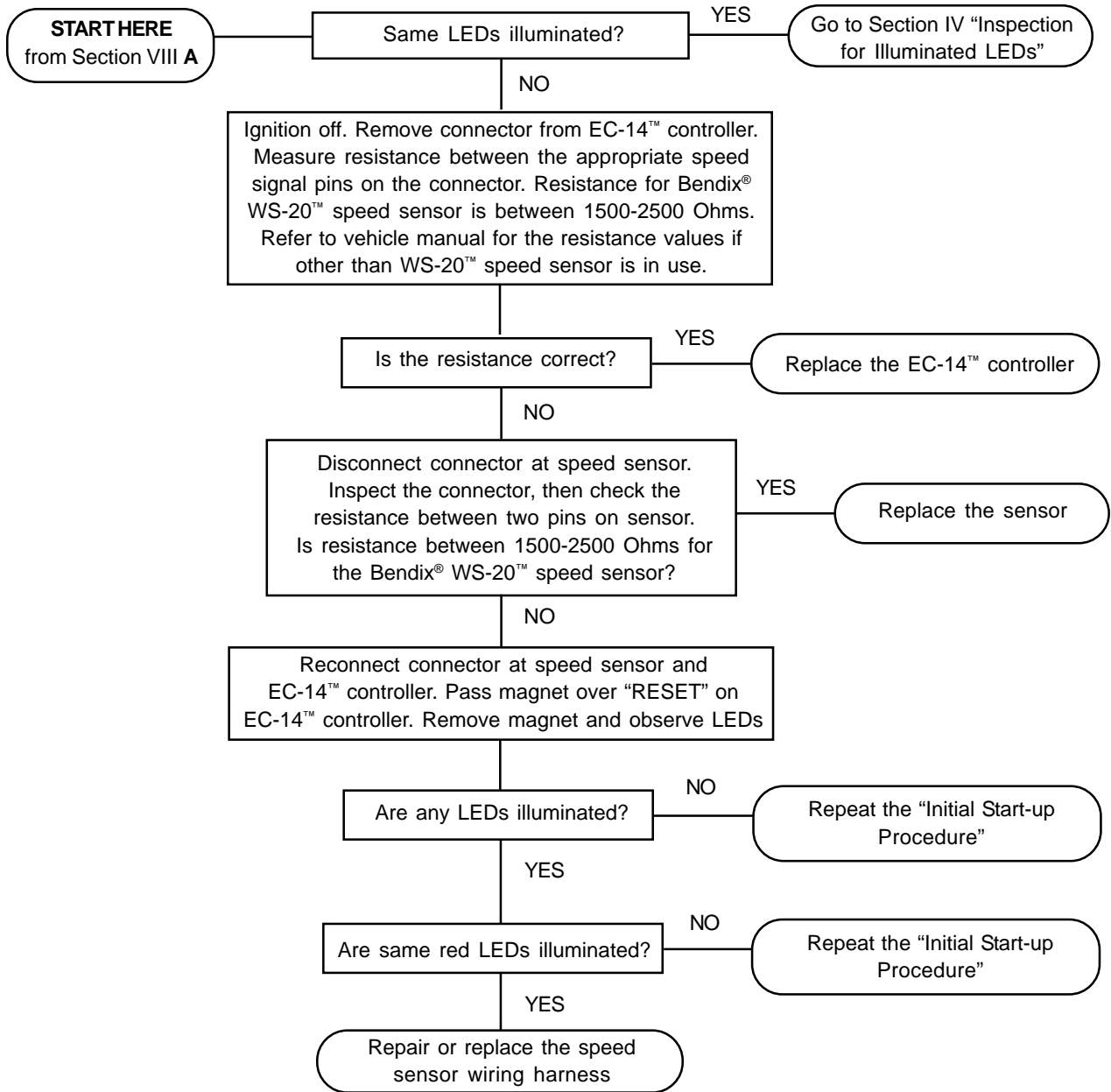
Reconnect EC-14™ controller connector, turn ignition on and pass magnet over "RESET" on EC-14™ controller and remove. Observe LEDs



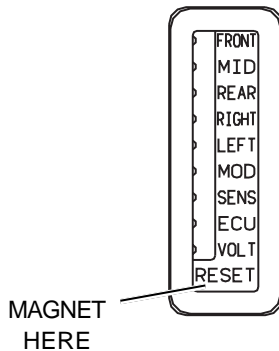
TROUBLESHOOTING

SECTION VIII PART B

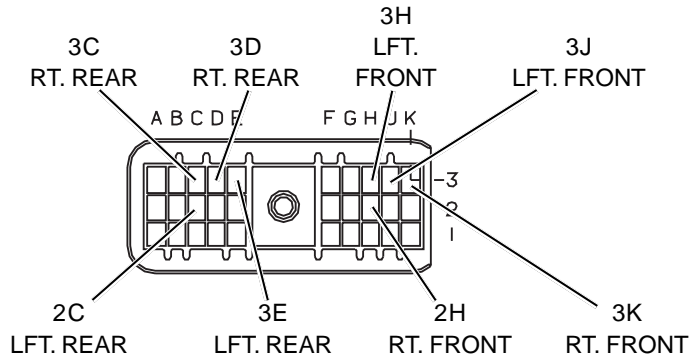
TESTING THE WHEEL SPEED SENSOR



RESETTING EC-14™ CONTROLLER



EC-14™ Controller Wire Harness Connector



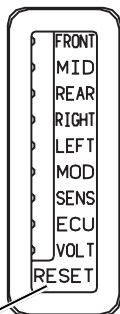
Testing Speed Sensor Resistance

TROUBLESHOOTING

SECTION IX

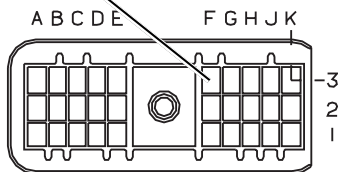
TESTING FOR FALSE INDICATION CAUSED BY DASH LIGHT RELAY

TESTING EC-14™ CONTROLLER LEDs

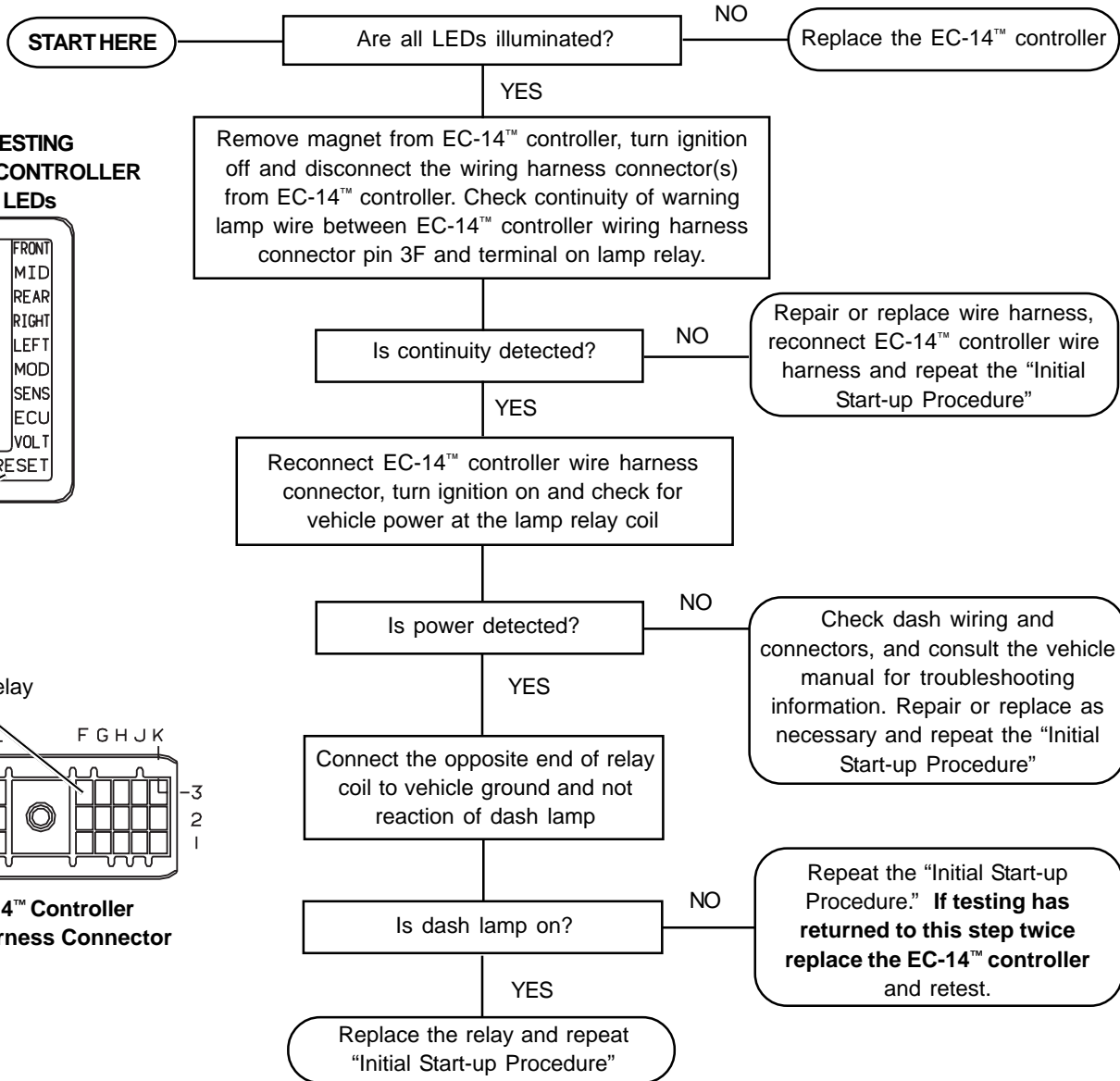


MAGNET HERE

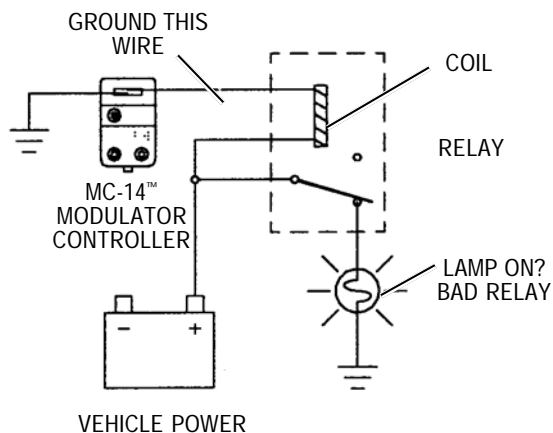
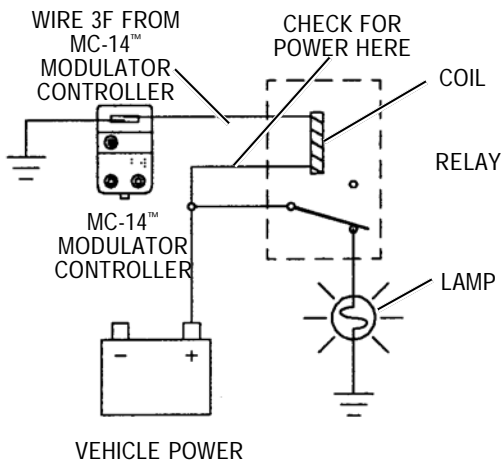
3F Lamp Relay



EC-14™ Controller Wire Harness Connector



TESTING THE LAMP RELAY



TROUBLESHOOTING

SECTION X

TESTING FOR FALSE INDICATION CAUSED BY WHEEL SENSOR COMPONENTS

