Bendix® EC-13™ Trailer AntiLock Controller Assembly

*FIGURE 1 - **EC-13™ TRAILER ANTILOCK CONTROLLER***

DESCRIPTION

GENERAL

Bendix trailer antilock systems utilizing the EC-13™ electronic controller assembly provide AXLE braking control for 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-13™ controller is used in combination with the following components;

- Four, individual wheel speed sensors
- Two M-12R™ remote mount modulator-relay valves or a combination of one M-12™ and one M-12R™ modulator

PHYSICAL

The EC-13™ controller assembly 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.

A single electrical connector is currently used on the EC-13™ controller, for connection to the antilock system components; a 30 pin, Packard Electric, 150 series "Metri-pack."

MOUNTING

The EC-13™ controller can be remote bracket mounted to a frame member or can be mounted directly on a modulator-relay valve assembly, such as the Bendix® M-12™ modulator (reference SD-13-4772). When the EC-13™ controller is mounted on a modulator assembly the resulting assembly receives a different designation. For example when the EC-13™ antilock controller is mounted on the M-12™ modulator the resulting assembly (i.e.; EC-13™ controller plus M-12™ modulator) is known as a MC-13™ modulator controller (see Figure 3). When the EC-13™ controller is bracket mounted to a frame member, and not mounted on the modulator, an M-12R™ modulator is used. The M-12R™ modulator is identical to the M-12™ modulator but has remote mounting capabilities (see Figure 6).

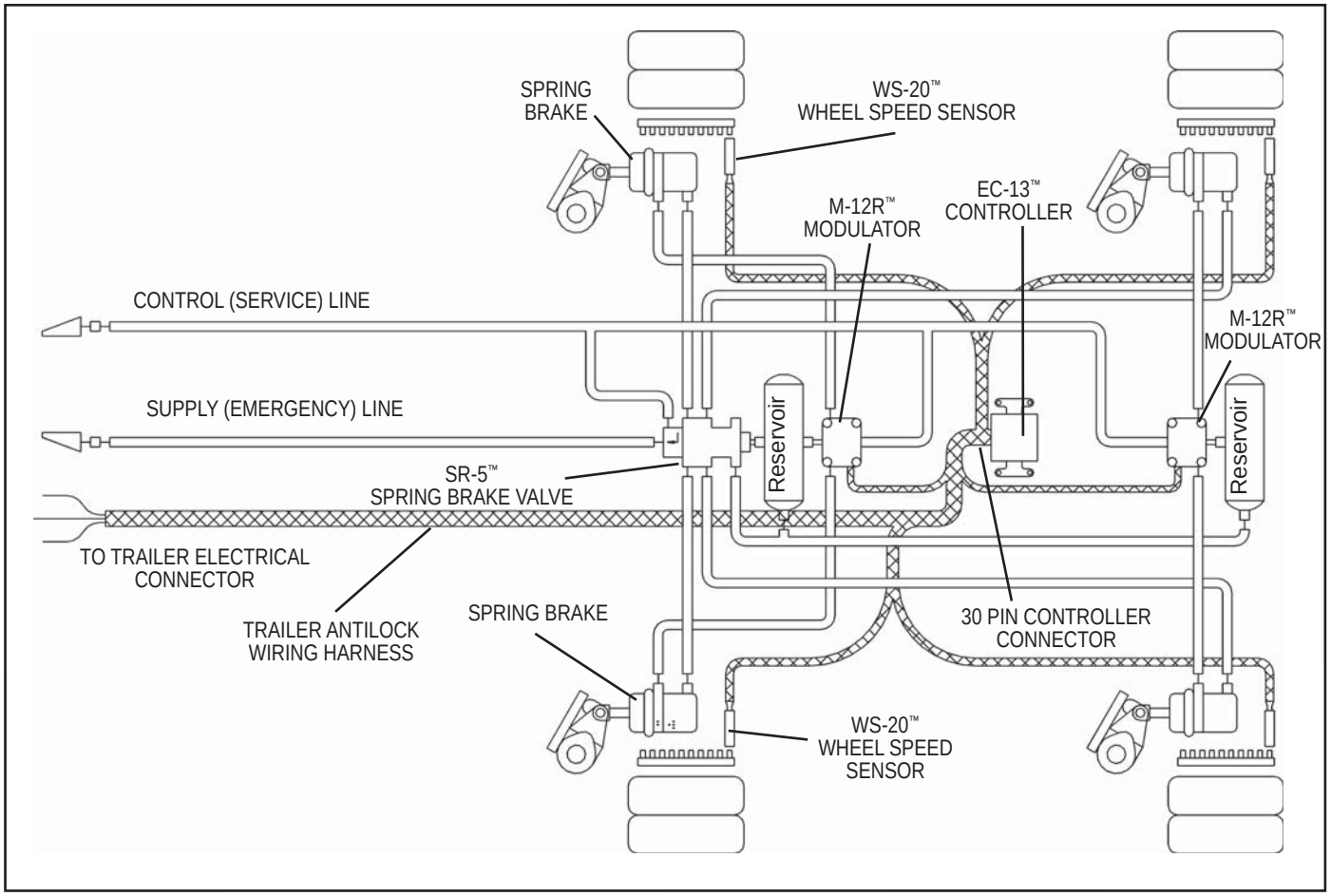


FIGURE 2 - ***TYPICAL EC-13™ TRAILER ANTILOCK SYSTEM***

EC-13™ CONTROLLER INFORMATION INPUTS AND COMMAND OUTPUTS

GENERAL

The EC-13™ 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-13™ controller both receive and deliver commands and information.

INPUTS

Wheel speed information is provided to the EC-13™ 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-13™ 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-13™ 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-13™ 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-13™ controller from the stop light switch. The electrical ground for the EC-13™ controller is from the 7 pin trailer connector and trailer chassis.

OUTPUTS

Modulators, like the Bendix® M-12™ and M-12R™ modulators, are the means by which the EC-13™ antilock controller is able to modify driver applied air pressure to the service brakes. The EC-13™ controller is able to simultaneously and independently control two modulators assemblies. The M-12™ and M-12R™ modulators are combination valves consisting of a standard relay valve and solenoid assembly. They replace the standard relay valves used to speed up the application and release of the trailer's rear axle brakes. An external, three pin, wiring harness connects the EC-13™ controller to the M-12™ or M-12R™ modulator solenoid assembly. For additional information and service procedures see Bendix Service Data Sheet SD-13-4772.

As stated previously, the EC-13™ controller is designed to control two modulators. It can be mounted directly on an M-12™ modulator relay valve assembly and control a separate M-12R™ modulator or the EC-13™ controller can itself be remote mounted to the trailer and control two M-12R™ modulators. When mounted directly on a modulator, the two separate components (EC-13™ controller and M-12™ modulator) become a single assembly called the MC-13™ modulator controller.

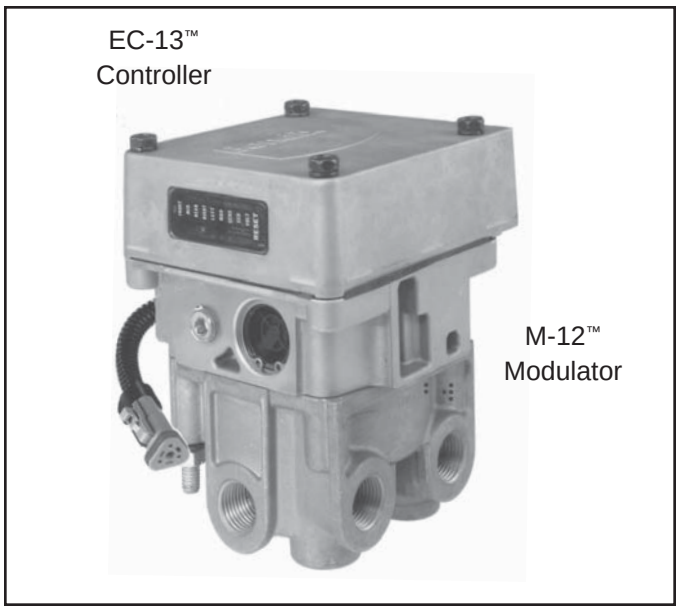


FIGURE 3 - ***TYPICAL MC-13™ MODULATOR CONTROLLER (EC-13™ CONTROLLER & M-12™ MODULATOR)***

Connected to the EC-13™ controller via a wire harness, the 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.

An optional indicator light can be connected to, and controlled by, the EC-13™ controller and serves as a means of advising the driver of the condition of the antilock system.

The data link function enables the EC-13™ controller to "report" its operating condition to a specialized, external computer in response to certain commands it receives. The EC-13™ controller data link configuration conforms to S.A.E. standard J1708 and the protocol, or coded language used, conforms to S.A.E. standard J1587. There are two connections to the EC-13™ controller devoted to the data link. While the EC-13™ 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-13™ controller to be functional.

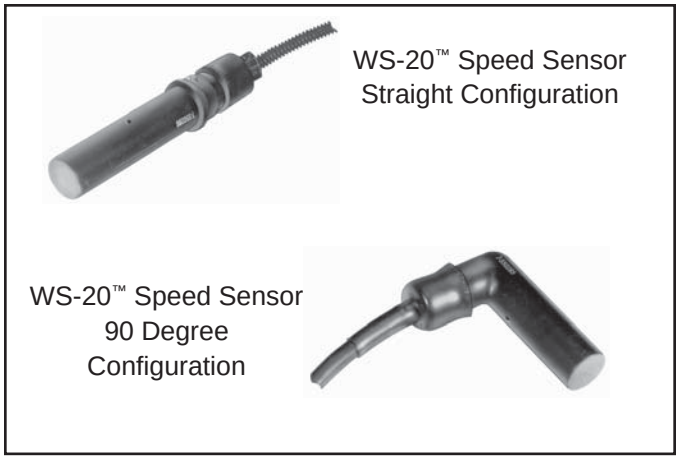


FIGURE 4 - ***WS-20™ WHEEL SPEED SENSORS***

OPERATION

OPERATIONAL PHILOSOPHY

The Bendix® EC-13™ 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-13™ controller is able to provide improved braking while maintaining trailer stability.

The trailer's rear axle brakes are controlled by the EC-13™ controller and two modulators (M-12™ or M-12R™). Like the standard service relay valve it replaces, the modulator delivers brake application pressure to the service chambers on each axle. Two speed sensors on each axle "report" changes in acceleration and deceleration to the EC-13™ controller. If required, the EC-13™ controller adjusts the application pressure to either axle's service brakes, via the modulators, based on the wheel behavior "reported" to it by the speed sensors on each axle.

The EC-13™ controller utilizes a "SELECT SMART" brake control philosophy for the trailer brakes. This means that the EC-13™ controller will initially adjust application pressure to the service chambers on either an axle based on the speed information from the first wheel to approach a locked condition. The initial pressure adjustment will attempt to prevent either wheel on an axle from locking. If a substantial braking difference is detected between two wheels on an axle, the EC-13™ 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. Each of the two axles is treated independent of the other.

NON-ANTILOCK BRAKE APPLICATION

During normal braking, the tractor brake valve simultaneously delivers air to the control port of the two trailer modulators. The modulators function the same as standard service relay valves and apply air to the service brakes. The service brakes are thus applied.

If the speed sensors do not detect an impending wheel lock up, the EC-13™ controller does not initiate any corrective action and the trailer 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-13™ controller will immediately begin modification of the brake application using the antilock modulators at the affected axle(s).

Solenoid valves contained in the modulator are energized and de-energized by the EC-13™ 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 relay valve portion of the modulator and to the brake actuators connected. The solenoids in either the M-12™ or M-12R™ modulator are controlled independently by the EC-13™ controller. By opening and closing the solenoid valves in the appropriate modulator, the EC-13™ controller is actually simulating what the driver does when he "pumps" the brakes.

It must be remembered however that unlike the driver, the EC-13™ 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 PROBLEM

The Bendix® EC-13™ controller handles equipment problems using a conservative fail-safe philosophy. Any single electrical problem in a component devoted to antilock braking, results in simultaneous illumination of the antilock condition lamp and a troubleshooting LED on the EC-13™ controller. Depending upon the type of problem and its position of occurrence the EC-13™ controller can continue antilock function at a lower performance level, disable all of the antilock on the trailer or only a portion. When antilock is disabled, the brakes on the affected axle(s) revert to standard air braking.

System Parts Still Operating (Yes / No)

Problem Location	*ABS Lead Axle*	*ABS Rear Axle*
Lead Axle Rt. Sensor	Yes	Yes
Lead Axle Lft. Sensor	Yes	Yes
Rear Axle Rt. Sensor	Yes	Yes
Rear Axle Lft. Sensor	Yes	Yes
Lead Axle Modulator	No	Yes
Rear Axle Modulator	Yes	No
Controller	No	No
Voltage *	No	No

** If electrical power is below or above the 7 to 18 volt operating range the ABS will stop operating. If voltage returns to the 8-17 volt range the ABS is restored.*

A problem in a single speed sensor will not result in disabling of the antilock system. If a speed sensor problem is detected by the EC-13™ 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 trailer 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 condition 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-13™ controller are grouped and terminate at a 30 pin Packard connector which plugs into the EC-13™ 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:

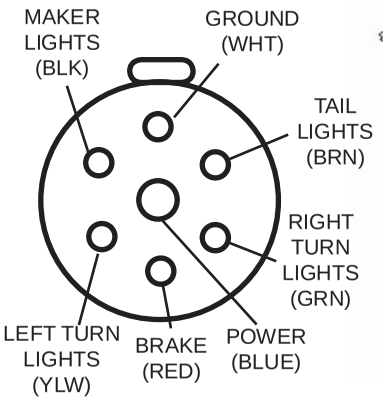
1. It is generally advisable to replace a wire harness rather than repair individual wires in the harness. If a splice repair must be made, it is important that the splice be properly soldered with a rosin flux (not acid based) and the splice made water proof.
2. Do not pierce wire insulation when checking for continuity. Check for power, ground or continuity by disconnecting the connector and testing the individual pins or sockets in the connector(s). Do not overstress sockets.
3. Always check the vehicle hand book for wire and connector identification. Individual wire identification will differ depending upon the type of connectors in use, the trailer manufacturer, and the system features in use.
4. While the serial link connections (2 total) are present on all EC-13™ controllers they are not always used. In addition several connector openings are not used.

PREVENTATIVE MAINTENANCE

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

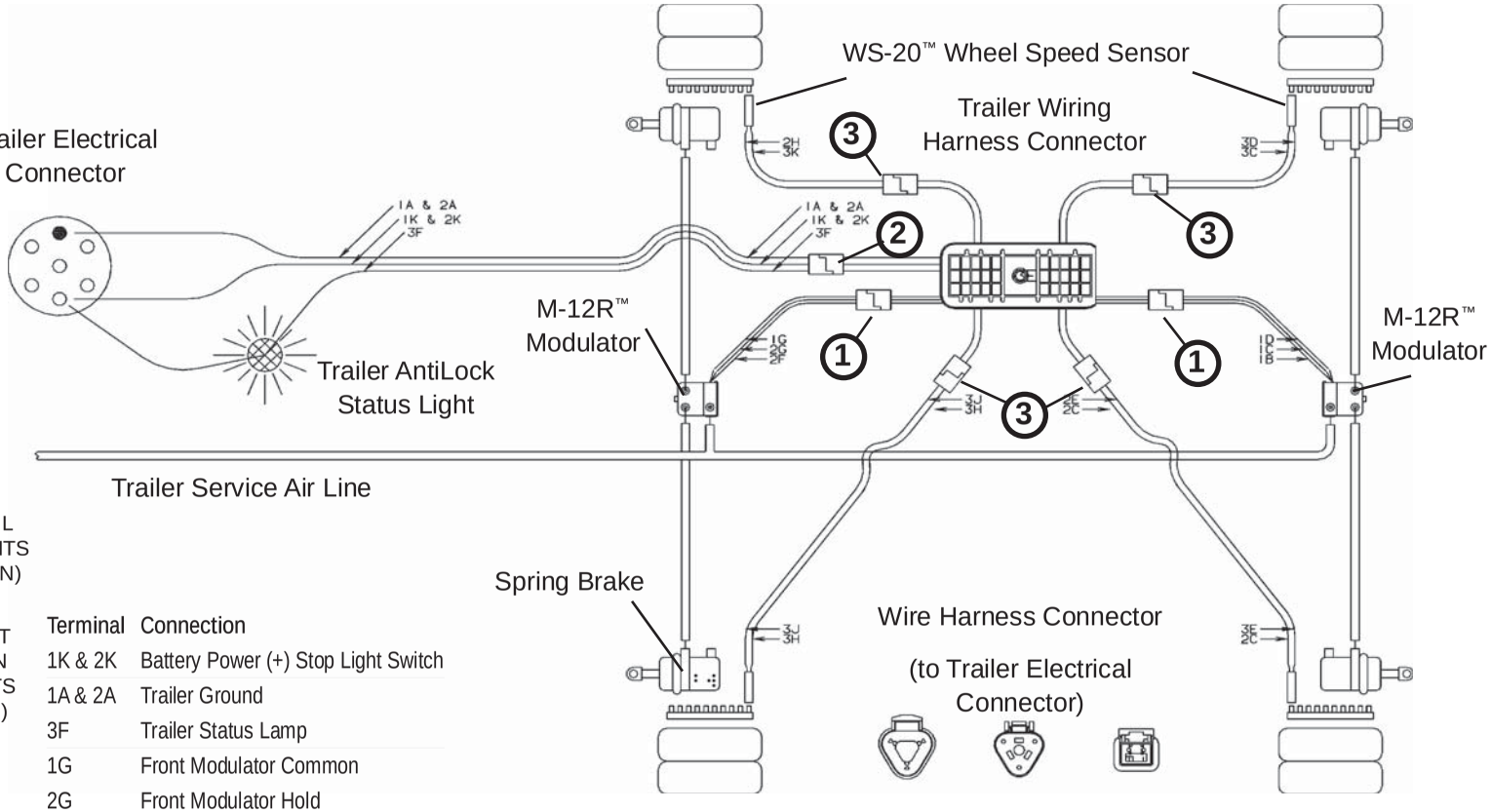
1. Check all wiring and connectors to ensure they are secure and free from visible damage.
2. Although the EC-13™ controller incorporates a self check diagnostics, the LED display should be inspected to ensure that they are functional. With the tractor ignition on and a brake application held applied, 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.

Trailer Electrical Connector



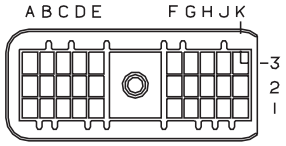
Typical Trailer Connector Terminal Allocation

Terminal	Connection
1K & 2K	Battery Power (+) Stop Light Switch
1A & 2A	Trailer Ground
3F	Trailer Status Lamp
1G	Front Modulator Common
2G	Front Modulator Hold
2F	Front Modulator Exhaust
1D	Rear Modulator Common
1C	Rear Modulator Hold
1B	Rear Modulator Exhaust
3J	Left Front Wheel Speed Signal
3H	Left Front Wheel Speed Signal
2H	Right Front Wheel Speed Signal
3K	Right Front Wheel Speed Signal
3E	Left Rear Wheel Speed Signal
2C	Left Rear Wheel Speed Signal
3D	Right Rear Wheel Speed Signal
3C	Right Rear Wheel Speed Signal
3A	Serial A
3B	Serial B



Trailer Wiring Harness Connector

(Connects to EC-13™ Controller)



Note:
Connector terminals not listed in the chart are currently not in use.

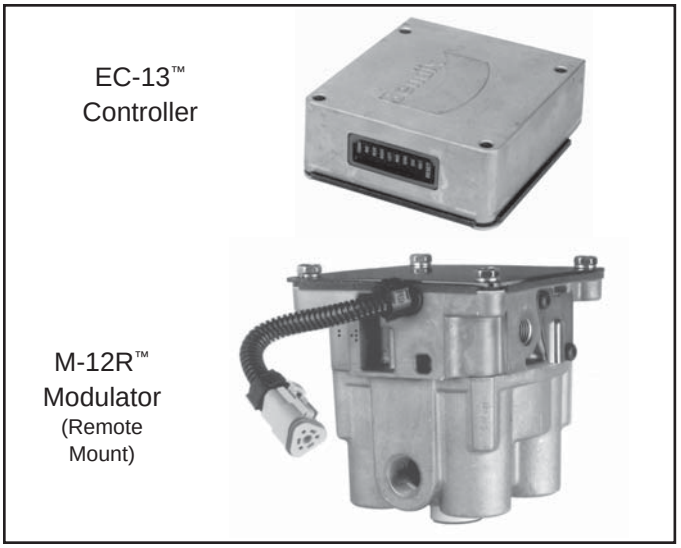


FIGURE 6 - ***EC-13™ CONTROLLER AND M-12R™ MODULATOR ASSEMBLY***

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.**
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.**
11. **For vehicles with Antilock Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.**

REMOVING EC-13™ CONTROLLER ASSY

Locate the EC-13™ 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-13™ Controller and M-12™ Modulator:

1. Identify and remove all air lines connected to the M-12™ modulator.
2. Disconnect the electrical connector (on the vehicle wiring harness) from the EC-13™ controller.
3. Note and mark the mounting position of the MC-13™ modulator - controller assembly on the trailer. Loosen, remove and save the nuts on the mounting hardware that attaches the MC-13™ modulator controller bracket to the trailer. Remove the MC-13™ modulator - controller assembly from the trailer.
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-13™ controller relative to the M-12™ modulator. Remove and retain the four hex cap screws that secure the EC-13™ controller to the M-12™ modulator. Carefully separate the EC-13™ 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-13™ controller. Peel the gasket from the EC-13™ 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.

Removing a Bracket Mounted Remote EC-13™ Controller:

1. Disconnect the electrical connector (on the vehicle wiring harness) from the EC-13™ controller.
2. Note and mark the mounting position of the EC-13™ controller assembly on the trailer. Loosen, remove and save the mounting hardware that attaches the EC-13™ controller bracket to the trailer. Remove the EC-13™ controller and bracket assembly from the trailer.

INSTALLING EC-13™ CONTROLLER ASSY

Installing the EC-13™ Controller and M-12™ Modulator:

1. After noting the positioning marks made prior to disassembly, reconnect the M-12™ modulator wire harness to the EC-13™ controller, position the gasket on the EC-13™ controller then secure the EC-13™ 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-13™ modulator controller on the trailer and orient it in the position marked prior to removal.
3. Reconnect all air lines.
4. Reconnect the electrical connector (on the vehicle wiring harness) to the EC-13™ controller.
5. Test the MC-13™ modulator controller for operation and air leakage prior to placing the trailer in service.
6. Perform the "Initial Start-up Procedure" in the TROUBLESHOOTING section to assure proper antilock system operation.

INSTALLING A BRACKET MOUNTED REMOTE EC-13™ CONTROLLER

1. Using the mounting hardware retained in step 2 of the removal mount the EC-13™ controller in the position noted during removal.
2. Reconnect the electrical connector (on the vehicle wiring harness) to the EC-13™ controller.

DIAGNOSING AND LOCATING A SYSTEM PROBLEM

GENERAL

The EC-13™ controller contains self test and diagnostic circuitry that continuously checks for proper operation of the entire antilock system including wiring continuity. An optional condition lamp, controlled by the EC-13™ 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 (LEDs) displayed through a "window" in the EC-13™ controller housing. No special tools or equipment are needed to read or interpret the EC-13™ controller diagnostics window. It should be noted that the diagnostics display is separate from the antilock condition lamp on the trailer. With this separation, the driver is aware of any problems that occur but is not confused by the diagnostic information.

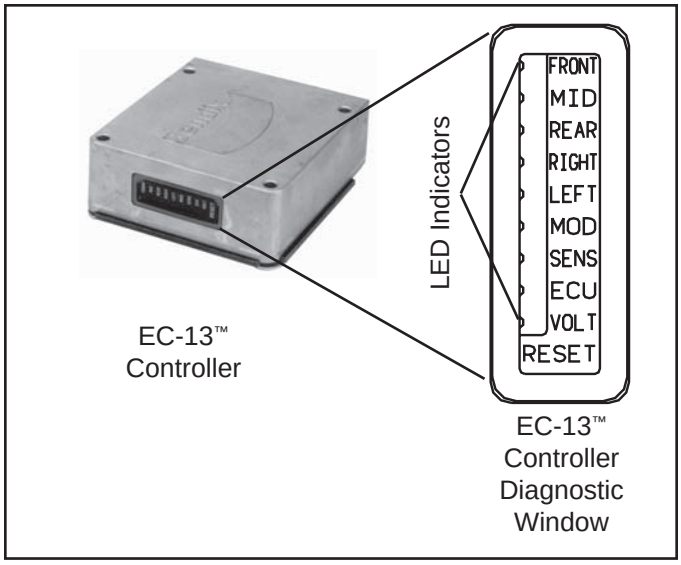


*FIGURE 7 - **EC-13™ CONTROLLER DIAGNOSTIC WINDOW***

A special feature of the EC-13™ controller diagnostic system is its problem indication 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 condition lamp and the appropriate diagnostic LEDs on the EC-13™ controller. The condition is truly stored and is not cleared by loss of power to the EC-13™ 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-13™ controller diagnostics by passing a small magnet over the RESET point in the diagnostics window.

DIAGNOSTIC LEDS

There are nine LEDs plus a magnetically actuated reset switch in the EC-13™ 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 BELOW)
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 on the previous page is not used in the diagnostic process for the EC-13™ 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-12™ or M-12R™) or its wiring has malfunctioned.

"MID" LED

This red LED is not used in troubleshooting the EC-13™ 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 failures 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-13™ controller failures except low voltage. For voltages less than 6 vdc, the LED illuminates to indicate the controller is inoperative, however when the voltage again exceeds 6 vdc the LED will go OUT by itself.

"VOLT" LED

This green LED illuminates and remains ON during trailer operation to indicate that vehicle power is reaching the controller (LED ON only when a brake application is made). If vehicle power is out of range for proper operation (below 7 vdc or above 18 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.

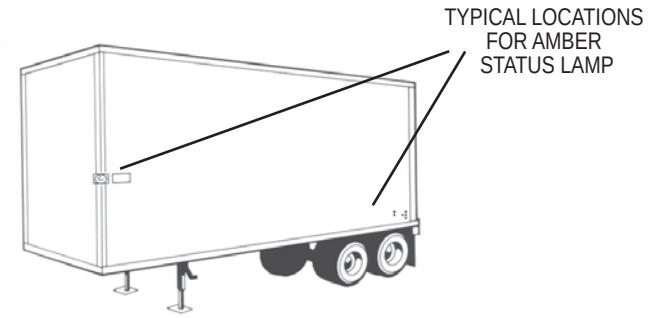
TROUBLESHOOTING

GENERAL

While the EC-13™ 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 TRAILER 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-13™ controller. All voltage and resistance tests are performed by beginning at the wire harness half of the connector and moving AWAY from the EC-13™ controller toward an antilock system component (modulator, wheel speed sensor, etc.)



Troubleshooting

INITIAL START-UP PROCEDURE

START HERE

WITH TRAILER CONNECTED TO TRACTOR, TURN IGNITION ON, APPLY TRAILER SERVICE BRAKES AND OBSERVE STATUS LAMP MOUNTED ON TRAILER.

DID STATUS LAMP ILLUMINATE?

NO

ARE STOP LAMPS ILLUMINATED

NO

TEST FOR POWER TO THE TRAILER AT 7 PIN CONNECTOR

YES

GO TO SECTION I “STATUS LAMP TESTING”

YES

STATUS LAMP DOES NOT BLINK, COMES ON AND REMAINS ILLUMINATED

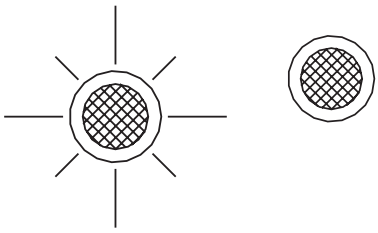
YES

GO TO SECTION II “INSPECTION FOR ILLUMINATED LEDS ”.

NO

STATUS LAMP COMES ON, BLINKS AND GOES OUT.

THE SYSTEM IS FUNCTIONING NORMALLY. MAKE NOTES OF THE PARTS REPLACED OR REPAIRED AND STEPS TAKEN .



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

Troubleshooting

SECTION I

TRAILER STATUS LAMP TESTING

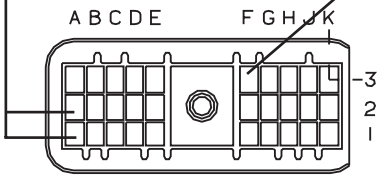
START HERE

WITH TRACTOR IGNITION OFF, DISCONNECT 30 PIN WIRE HARNESS CONNECTOR FROM EC-13™ CONTROLLER THEN TURN TRACTOR IGNITION ON AND MAKE AND HOLD A BRAKE APPLICATION.

USING A JUMPER WIRE CONNECT PIN 3F TO 1A AND/OR 2A. WITH THE CONNECTION IN PLACE NOTE THE CONDITION OF TRAILER STATUS LAMP.

GROUND 1A & 2A

TRAILER STATUS LAMP 3F



EC-13™ CONTROLLER WIRE HARNESS CONNECTOR

TRAILER STATUS LAMP ON?

YES

REPLACE EC-13™ CONTROLLER AND RETEST.

NO

CHECK THE FOLLOWING IN THE ORDER PRESENTED AND AFTER REPLACING OR TESTING EACH COMPONENT, TEST THE STATUS LAMP OPERATION:

1. CHANGE TRAILER STATUS LAMP BULB
2. CHECK TRAILER STATUS LAMP WIRING-GROUND
3. CHECK CONTINUITY OF WARNING WIRE BETWEEN PIN 3F ON THE 30 PIN CONNECTOR AND THE TRAILER STATUS LAMP SOCKET

REPEAT THE “INITIAL START-UP PROCEDURE”.

Troubleshooting

SECTION II

INSPECTION FOR ILLUMINATED LED's

START HERE

WITH TRACTOR IGNITION ON AND BRAKES HELD APPLIED, INSPECT EC-13™ CONTROLLER FOR PRESENCE OF ILLUMINATED LEDS AND RECORD.

IS GREEN, VOLT, LED ILLUMINATED?

NO

ARE ANY RED LED's ILLUMINATED?

NO

GO TO SECTION IV "TESTING FOR POWER TO THE EC-13™ CONTROLLER".

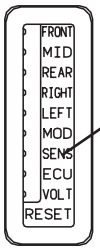
YES

REPLACE THE EC-13™ CONTROLLER

CHECKING "VOLT" LED

YES

ON? FLASHING?



GO TO SECTION IV "TESTING FOR POWER TO THE EC-13™ CONTROLLER".

YES

IS GREEN LED FLASHING

NO

ARE ANY RED LED's ILLUMINATED?

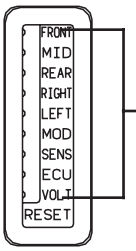
NO

GO TO SECTION I "TRAILER STATUS LAMP TESTING".

YES

NOTE AND RECORD THE CONDITION OF ALL RED LEDS

GO TO SECTION III "INSPECTION FOR ILLUMINATED LEDS".



RED LEDs ANY ILLUMINATED?

Troubleshooting

SECTION III

INSPECTION FOR ILLUMINATED LEDS

NOTE RED "ECU" LED IN EC-13™ CONTROLLER DIAGNOSTICS WINDOW.

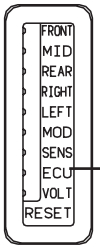
START HERE

IS THIS LED ILLUMINATED?

YES

GO TO SECTION IV "TESTING FOR POWER TO THE EC-13™ CONTROLLER".

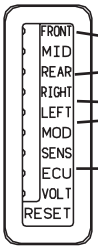
INSPECTING "ECU" LED



ON?

NO

TESTING "SENS" LED



SEE NOTE 1

SEE NOTE 1

ON

IS RED "SENS" LED ILLUMINATED?

YES

IS THE RED "RIGHT" **OR** "LEFT" LED ILLUMINATED? SEE NOTE 1 BELOW

YES

IS THE RED "FRONT" **OR** "REAR" LED ILLUMINATED? SEE NOTE 1 BELOW

YES

NOTE THE THREE ILLUMINATED LEDS AND GO TO SECTION VI "TESTING THE WHEEL SPEED SENSOR"

NO

NO

NO

REPLACE THE EC-13™ CONTROLLER AND REPEAT THE "INITIAL START-UP PROCEDURE"

YES

NO

IS RED "MOD" LED ILLUMINATED?

YES

IS THE RED "RIGHT" **OR** "LEFT" LED ILLUMINATED? SEE NOTE 2 BELOW

NO

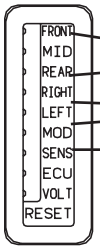
IS THE RED "FRONT" **OR** "REAR" LED ILLUMINATED? SEE NOTE 1 BELOW

YES

GO TO SECTION V "TESTING THE MODULATOR"

NO

TESTING "MOD" LED



SEE NOTE 1

SEE NOTE 2

ON

IF ANY OTHER RED LEDs ARE ILLUMINATED, REPLACE THE EC-13™ CONTROLLER AND REPEAT THE "INITIAL START-UP PROCEDURE"

NOTES:

1. IF **BOTH** OF THESE LEDs ARE ILLUMINATED, REPLACE THE EC-13™ CONTROLLER
2. IF **EITHER** OF THESE LEDs ARE ILLUMINATED, REPLACE THE EC-13™ CONTROLLER

Troubleshooting

SECTION IV

TESTING FOR POWER TO THE EC-13™ CONTROLLER

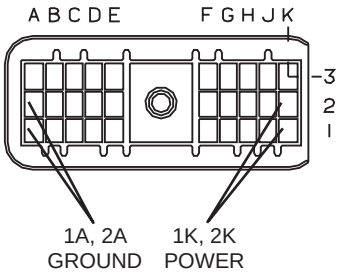
START HERE

TURN IGNITION OFF, DISCONNECT WIRE HARNESS CONNECTOR FROM EC-13™ CONTROLLER

TURN IGNITION ON, MAKE & HOLD A BRAKE APPLICATION AND, MEASURE VOLTAGE BETWEEN POWER AND GROUND PINS ON WIRE HARNESS CONNECTOR

1A TO 1K
1A TO 2K
2A TO 1K
2A TO 2K

WIRE HARNESS CONNECTOR



VOLTAGE SAME AS BATTERY VOLTAGE? MUST BE BETWEEN 8 AND 17 VOLTS.

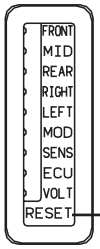
NO

RECONNECT CONNECTOR TO EC-13™ CONTROLLER. CHECK THE VEHICLE WIRING FOR CONTINUITY. REFER TO THE VEHICLE SERVICE MANUAL AND CHECK THE BATTERY VOLTAGE. REPAIR OR REPLACE AS NECESSARY AND REPEAT THE "INITIAL START-UP PROCEDURE"

YES

TURN IGNITION **OFF,** RECONNECT WIRE HARNESS TO EC-13™ CONTROLLER, TURN IGNITION **ON**

RESETTING EC-13™ CONTROLLER



MAGNET HERE

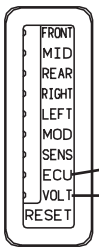
PERFORM A MAGNETIC RESET BY PASSING A MAGNET OVER THE "RESET" IN EC-13™ CONTROLLER DIAGNOSTIC WINDOW THEN REMOVE MAGNET

IS THE GREEN, "VOLT" LED STILL FLASHING OR RED "ECU" LED STILL ON?

NO

YES

CHECKING "VOLT" LED



ON ?

ON OR FLASHING?

REPLACE EC-13™ CONTROLLER

REPEAT THE "INITIAL START-UP PROCEDURE".

Troubleshooting

SECTION V PART A

TESTING THE MODULATOR

TURN IGNITION OFF. DISCONNECT 30 PIN WIRE HARNESS CONNECTOR FROM EC-13™ CONTROLLER.

START HERE

PROBE CONNECTOR WITH VOLT/OHM METER AND NOTE THAT PROPER RESISTANCE VALUES ARE OBTAINED FOR MODULATOR BEING TESTED. RESISTANCE VALUES HERE FOR A BENDIX® M-12™ MODULATOR.

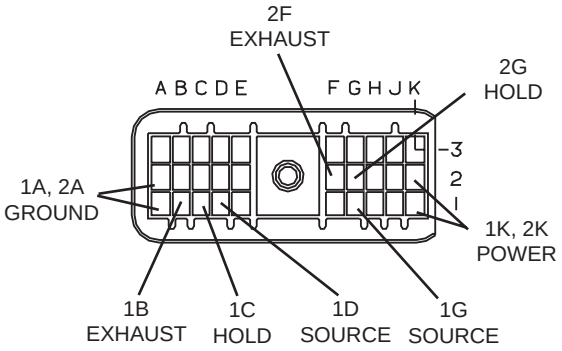
FRONT MODULATOR

HOLD TO SOURCE (2G TO 1G):	READ 9 TO 12 OHMS
EXHAUST TO SOURCE (2F TO 1G):	READ 9 TO 12 OHMS
EXHAUST TO HOLD (2F TO 2G):	READ 18 TO 24 OHMS
SOURCE TO POWER (1G TO 1K, 2K):	NO CONTINUITY
SOURCE TO GROUND (1G TO 1A, 2A):	NO CONTINUITY

REAR MODULATOR

HOLD TO SOURCE (1C TO 1D):	READ 9 TO 12 OHMS
EXHAUST TO SOURCE (1B TO 1D):	READ 9 TO 12 OHMS
EXHAUST TO HOLD (1B TO 1C):	READ 18 TO 24 OHMS
SOURCE TO POWER (1D TO 1K, 2K):	NO CONTINUITY
SOURCE TO GROUND (1D TO 1A, 2A):	NO CONTINUITY

WIRE HARNESS CONNECTOR

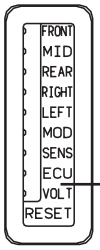


ARE RESISTANCE VALUES CORRECT?

NO

GO TO SECTION V **B** AND CONTINUE TESTING

YES



RESETTING EC-13™ CONTROLLER

MAGNET HERE

INSPECT CONNECTOR AND RECONNECT TO EC-13™ CONTROLLER. TURN IGNITION ON AND PASS MAGNET OVER "RESET" ON EC-13™ CONTROLLER. REMOVE MAGNET AND NOTE REACTION OF RED LEDS.

ARE ANY RED LED's ILLUMINATED?

NO

REPEAT "INITIAL START-UP PROCEDURE". IF TESTING HAS RETURNED TO THIS STEP TWICE - **REPLACE THE EC-13™ CONTROLLER.**

YES

SAME RED LED's ILLUMINATED?

YES

REPLACE EC-13™ CONTROLLER

NO

GO TO SECTION III "INSPECTION FOR ILLUMINATED LEDS" AND RETEST.

IF FAILURE PERSISTS, REPLACE THE EC-13™ CONTROLLER.

Troubleshooting

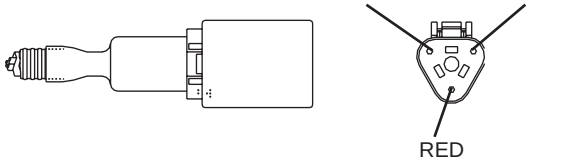
SECTION V PART B

TESTING THE MODULATOR

START HERE

TURN THE IGNITION OFF. DISCONNECT THE MODULATOR (M-12™ OR M-12R™) CONNECTOR FROM THE VEHICLE WIRE HARNESS TO EXPOSE THE THREE PIN CONNECTOR LEADING TO THE M-12™ MODULATOR AND TEST RESISTANCE **BETWEEN THE PINS ON THE MODULATOR CONNECTOR.**

RED TO BLACK	9 TO 12 OHMS
RED TO WHITE	9 TO 12 OHMS



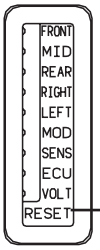
M-12™ MODULATOR WIRE HARNESS CONNECTOR

RESISTANCE IN RANGE?

NO → REPLACE M-12™ MODULATOR ASSEMBLY

YES

RECONNECT EC-13™ CONTROLLER TO M-12™ MODULATOR. TURN IGNITION ON AND PASS MAGNET OVER "RESET" ON EC-14™ CONTROLLER AND REMOVE. NOTE REACTION OF RED LEDS.



RESETTING EC-13™ CONTROLLER

MAGNET HERE

ARE ANY RED LEDs ILLUMINATED?

NO → REPEAT THE "INITIAL START-UP PROCEDURE"

YES

ARE THE SAME RED LEDs ILLUMINATED?

YES → REPLACE THE EC-13™ CONTROLLER.

NO

GO TO SECTION III - "INSPECTION FOR ILLUMINATED LEDs"

Troubleshooting

SECTION VI PART A

TESTING THE WHEEL SPEED SENSOR

START HERE

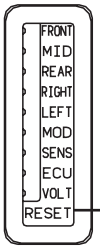
PASS MAGNET OVER "RESET" ON EC-13™ CONTROLLER. REMOVE MAGNET AND OBSERVE THE LEDs.

ANY RED LED's ON?

YES

GO TO SECTION VI PART B AND BEGIN TESTING

NO



RESETTING EC-13™ CONTROLLER

MAGNET HERE

TURN IGNITION OFF AND CHECK FOLLOWING:

A. REMOVE CONNECTOR(S) FROM EC-13™ 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™ 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™ 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.

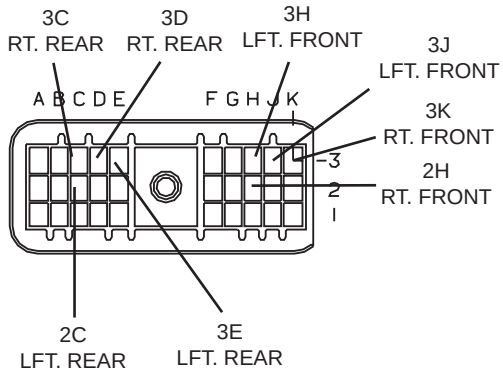
C. IF SENSOR GAP IS CORRECT CHECK WHEEL BEARING FOR FREE PLAY TO VERIFY IT COMPLIES TO MANUFACTURER'S RECOMMENDATIONS.

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.

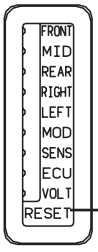
E. CHECK WIRING HARNESS AND CONNECTORS THAT RUN TO SENSOR.

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 AND RETEST.

EC-13™ CONTROLLER WIRE HARNESS CONNECTOR



TESTING SPEED SENSOR RESISTANCE



RESETTING EC-13™ CONTROLLER

MAGNET HERE

RECONNECT EC-13™ CONTROLLER, TURN IGNITION **ON.** PASS MAGNET OVER "RESET" ON EC-13™ CONTROLLER. REMOVE MAGNET AND OBSERVE LEDs

ARE ANY RED LEDs ILLUMINATED?

YES

GO TO SECTION III - "INSPECTION FOR ILLUMINATED LEDs"

NO

REPEAT THE "INITIAL START-UP PROCEDURE

Troubleshooting

SECTION VI PART B

TESTING THE WHEEL SPEED SENSOR

START HERE FROM SECTION VI **PART A**

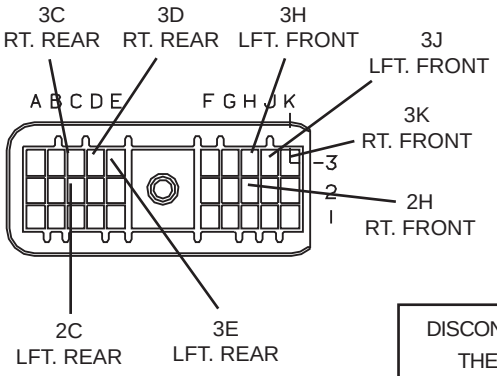
SAME LED's ILLUMINATED?

NO → GO TO SECTION III "INSPECTION FOR ILLUMINATED LED's"

YES

IGNITION OFF. REMOVE 30 PIN CONNECTOR FROM EC-13™ CONTROLLER. MEASURE RESISTANCE BETWEEN THE **APPROPRIATE** SPEED SIGNAL PINS ON THE CONNECTOR. RESISTANCE FOR BENDIX® WS-20™ SENSOR IS BETWEEN 1500-2500 OHMS. REFER TO VEHICLE MANUAL FOR THE RESISTANCE VALUES IF OTHER THAN WS-20™ SENSOR IS IN USE.

EC-13™ CONTROLLER WIRE HARNESS CONNECTOR



TESTING SPEED SENSOR RESISTANCE

CORRECT RESISTANCE?

YES → REPLACE THE EC-13™ CONTROLLER

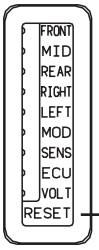
NO

DISCONNECT CONNECTOR AT SPEED SENSOR. INSPECT THE CONNECTOR, THEN CHECK THE RESISTANCE BETWEEN TWO PINS ON SENSOR. RESISTANCE BETWEEN 1500-2500 OHMS FOR THE BENDIX® WS-20™ SENSOR

NO → REPLACE THE SENSOR

YES

RESETTING EC-13™ CONTROLLER



MAGNET HERE

RECONNECT CONNECTOR AT SPEED SENSOR AND EC-13™ CONTROLLER. PASS MAGNET OVER "RESET" ON EC-13™ CONTROLLER. REMOVE MAGNET AND OBSERVE LEDs

ARE ANY LED's ILLUMINATED?

NO → REPEAT THE "INITIAL START-UP PROCEDURE".

YES

ARE SAME RED LEDS ILLUMINATED?

NO → GO TO SECTION III "INSPECTION FOR ILLUMINATED LED's"

YES

REPAIR OR REPLACE SPEED SENSOR WIRING HARNESS AND REPEAT THE "INITIAL START-UP PROCEDURE".