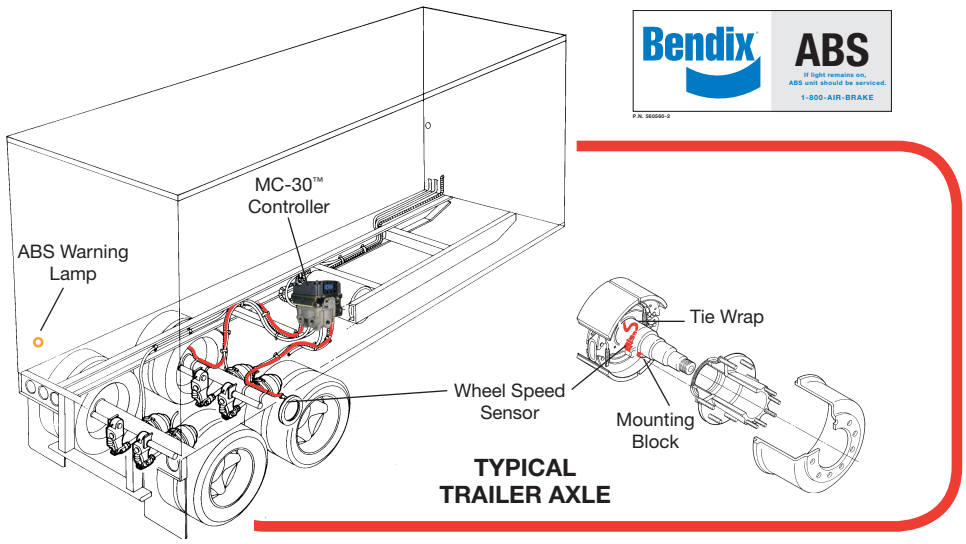
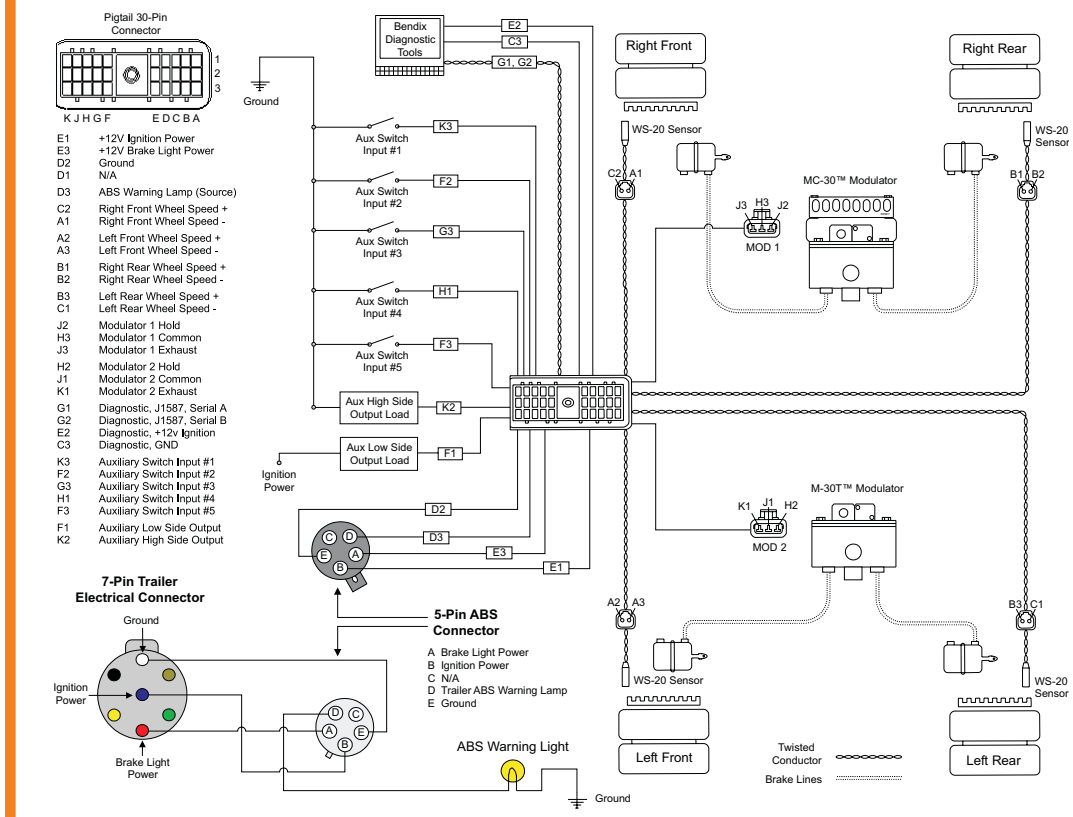
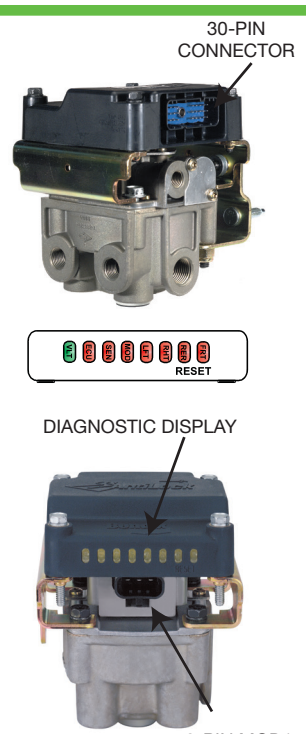
TROUBLESHOOTING THE BENDIX® MC-30™ TRAILER ABS CONTROLLER ASSEMBLY



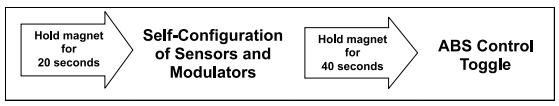
TYPICAL TRAILER AXLE





CAUTION: An incorrect ABS configuration may cause a fault indication or degraded ABS performance. All MC-30™ controller service replacement parts are initially defaulted to 4S/2M side control and may need to be reconfigured upon installation. Before and after activating a self-configuration, always determine the current ABS configuration by monitoring the diagnostic LEDs at power-up or by activating blink code diagnostics.

ABS Configuration	Control Group A		Control Group B
2S/1M	Axle	Toggle	Dolly-Axle
2S/2M	Axle	Toggle	Side
4S/2M	Axle	Toggle	Side



POWER-UP SEQUENCE

WARNING LAMP SEQUENCE: When power is applied, the trailer ABS Warning Lamp will turn on for a 2.5 second bulb check, and then turn off. If a PLC-equipped tractor and PLC-equipped trailer are powered at the same time, the MC-30™ controller will also trigger a 2.5 second bulb check on the tractor dash using PLC.

CHUFF TEST: The MC-30™ controller will perform a modulator "chuff test" at power-up. With brake pressure applied, a properly installed modulator will cause five rapid, audible chuffs of air pressure. If two modulators are installed, the MC-30™ controller activates five chuffs at MOD1 and then MOD2. The chuff sequence is then repeated.

LED SEQUENCE: At power up, the diagnostic LEDs all turn on, then display the current configuration.

MC-30 – LED Power-Up Sequence	
At power-up	All LEDs
1st blink displays number of wheel speed sensors	
2 Sensors	SEN-FRT
4 Sensors	SEN-RER-FRT
2nd blink displays modulator configuration	
1 Modulator (Dolly-Axle control)	MOD
1 Modulator (Axle control)	MOD-FRT
2 Modulators (Axle control)	MOD-RER-FRT
2 Modulators (Side control)	MOD-LFT-RHT
Normal Operation	
No Faults	VLT (green) LED illuminated only

FAULT DETECTION: When a fault is detected, the trailer ABS warning lamp will remain on. If the tractor and trailer are equipped with PLC, the dash mounted trailer ABS lamp will also remain on. The warning lamps notify the driver that all or part of the ABS function has been disengaged and standard air braking is in effect. The faulted component will be identified on the diagnostic display.

FAULT RESET: The MC-30™ controller will automatically reset (self-heal) the active fault code when the fault is corrected. Repeated occurrences of a given fault will cause the fault code to latch. Once the fault code is latched, the fault code will need to be cleared by a magnetic reset or through blink code diagnostics.

MAGNETIC RESET: The ECU can be reset by momentarily holding a magnet against the RESET area on the controller. All the LEDs will be on while the magnet is held in place. If faults occur on multiple components, the LEDs will display one fault at a time. When the first fault is cleared and the MC-30™ controller is reset, the next fault will be displayed on the LEDs.

SELF-CONFIGURATION: This is generally performed after replacement of an MC-30™ controller. When activated with a magnet or diagnostic tool, the wheel speed sensor, modulator and ABS control settings can be altered. After holding a magnet on the ECU reset location for 20 seconds, the LEDs will begin to roll and the MC-30™ controller will self-configure. IF IT IS NOT DESIRED TO TOGGLE THE ABS CONTROL, REMOVE THE MAGNET AFTER 20 SECONDS.

ABS CONTROL TOGGLE: The MC-30™ controller ABS control setting can be toggled between axle control, dolly-axle control or side control. To activate an ABS control toggle, continue to hold the magnet in place while the LEDs are rolling, for an additional 20 seconds (a total of 40 seconds). The LEDs will begin to flash rapidly. Remove the magnet. Verify the new ABS configuration by monitoring the LED sequence at power-up or by activation of blink code diagnostics.

MC-30™ TRAILER ABS CONTROLLER BLINK CODE DEFINITIONS

1st Digit	2nd Digit	Fault Description	Repair Information
1	1	No Faults	System Fully Operational - No Faults Detected
Power / ABS Controller			
1	2	Battery Voltage Too High	Check for corrosion or damaged power wiring and connectors. Verify that ABS unit is powered by a 12 volt supply.
1	3	Battery Voltage Too Low	Check for corrosion or damaged power wiring and connectors. Measure voltage under load to ensure proper levels.
1	4	ABS Controller Fault (2)	Check for corrosion or damaged power wiring and connectors. Clear/Reset faults. If fault returns, replace ECU.
1	5	ABS Controller Fault (6)	
1	6	ABS Controller Fault (7)	
1	7	ABS Controller Fault (9)	
1	8	ABS Controller Fault (10)	
1	9	ABS Controller Fault (11)	
1	10	ABS Controller Fault (12)	
1	11	ABS Controller Fault (13)	
1	12	ABS Controller Fault (14)	
1	13	ABS Controller Fault (1)	
1	14	ABS Controller Fault (3)	
1	15	ABS Controller Fault (8)	
Wheel Speed Sensors			
2	1	LF Sensor Start	Sensor output low during low-speed vehicle operation. Adjust speed sensor to contact tone ring. Verify condition of tone ring mounting and teeth. Rotate wheel and verify minimum 0.8 volts AC sensor output @ 1 RPS. Verify condition and retention force of sensor clip. Verify proper sensor lead routing and clamping.
3	1	RF Sensor Start	
4	1	LR Sensor Start	
5	1	RR Sensor Start	
2	2	LF Sensor Intermittent	Intermittent sensor output. Adjust speed sensor to contact tone ring. Verify condition of tone ring mounting and teeth. Rotate wheel and verify minimum 0.8 volts AC sensor output @ 1 RPS. Verify condition and retention force of sensor clip. Verify proper sensor lead routing and clamping.
3	2	RF Sensor Intermittent	
4	2	LR Sensor Intermittent	
5	2	RR Sensor Intermittent	

1st Digit	2nd Digit	Fault Description	Repair Information
Wheel Speed Sensors (continued)			
2	3	LF Sensor Shorted to VBAT	Check for corroded or damaged sensor and ECU wiring and connectors. Verify +12V is not measured at either sensor lead.
3	3	RF Sensor Shorted to VBAT	
4	3	LR Sensor Shorted to VBAT	
5	3	RR Sensor Shorted to VBAT	
2	4	LF Sensor Shorted to Ground	Check for corroded or damaged sensor and ECU wiring and connectors. Verify no continuity from sensor leads to ground.
3	4	RF Sensor Shorted to Ground	
4	4	LR Sensor Shorted to Ground	
5	4	RR Sensor Shorted to Ground	
2	5	LF Sensor Open	Check for corroded or damaged sensor and ECU wiring and connectors. Verify 1500-2500 OHMS across sensor leads.
3	5	RF Sensor Open	
4	5	LR Sensor Open	
5	5	RR Sensor Open	
2	6	LF Sensor Shorted Across Sensor	Check for corroded or damaged sensor and ECU wiring and connectors. Verify 1500-2500 OHMS across sensor leads.
3	6	RF Sensor Shorted Across Sensor	
4	6	LR Sensor Shorted Across Sensor	
5	6	RR Sensor Shorted Across Sensor	
2	7	LF Sensor Lock Time Out	Sensor output low or missing during vehicle operation above 10 MPH. Verify condition of tone ring mounting. Adjust speed sensors to contact tone ring. Rotate wheel and verify minimum 0.8 volts AC sensor output @ 1 RPS. Verify condition and retention force of sensor clips. Verify proper sensor lead routing and clamping.
3	7	RF Sensor Lock Time Out	
4	7	LR Sensor Lock Time Out	
5	7	RR Sensor Lock Time Out	
2	8	LF Sensor Frequency Doubling	Verify condition and retention force of sensor clips. Check for corroded or damaged sensor and ECU wiring and connectors. Verify no continuity from sensor leads to ground. Verify sensor leads are twisted pair.
3	8	RF Sensor Frequency Doubling	
4	8	LR Sensor Frequency Doubling	
5	8	RR Sensor Frequency Doubling	

MC-30™ TRAILER ABS CONTROLLER BLINK CODE DEFINITIONS

1st Digit	2nd Digit	Fault Description	Repair Information
Wheel Speed Sensors (Continued)			
2	9	LF Sensor High Frequency Noise	Verify condition and retention force of sensor clips. Check for corroded or damaged sensor and ECU wiring and connectors. Verify no continuity from sensor leads to ground. Verify sensor leads are twisted pair.
3	9	RF Sensor High Frequency Noise	
4	9	LR Sensor High Frequency Noise	
5	9	RR Sensor High Frequency Noise	
2	10	LF Sensor Wobble Run	Sensor output intermittent or excessive wobble in exciter ring. Verify condition of tone ring mounting and teeth. Verify proper adjustment of wheel bearings. Adjust speed sensor to contact tone ring. Rotate wheel and verify minimum 0.8 volts AC sensor output @ 1 RPS. Verify condition and retention force of sensor clip. Verify proper sensor lead routing and clamping.
3	10	RF Sensor Wobble Run	
4	10	LR Sensor Wobble Run	
5	10	RR Sensor Wobble Run	
4	11	LR Sensor Gross Mismatch	Tire Size Mismatch. Verify correct tire size as desired. Verify proper tire inflation. Verify proper number of tone ring teeth per sensed wheel. Verify proper wheel rolling radius setting in ECU.
5	11	RR Sensor Gross Mismatch	
2	12	LF Sensor Abnormal Speed	Adjust speed sensor to contact tone ring. Verify proper number of tone ring teeth per sensed wheel. Rotate wheel and verify minimum 0.8 volts AC sensor output @ 1 RPS. Verify condition and retention force of sensor clip. Verify proper sensor lead routing and clamping.
3	12	RF Sensor Abnormal Speed	
4	12	LR Sensor Abnormal Speed	
5	12	RR Sensor Abnormal Speed	
ABS Modulators			
6	1	Mod 1 Lock Time Out	No wheel response to ABS command. Verify proper modulator activation with brake pressure applied, at power-up (Chuff Test) and/or using diagnostic tool. Wiring to modulator may be reversed. Possible slow brake release. Check for dragging brakes, dry bearings, faulty return springs, parking brake system faults, restricted brake air lines, over adjusted slacks, out of round drums or damaged loose tone rings.
6	7	Mod 2 Lock Time Out	
6	2	Mod 1 Open / Shorted to GND	Check for corroded or damaged modulator wiring and connections. Verify 7.0 to 10.0 OHMS across HOLD/COMMON. Verify 7.0 to 10.0 OHMS across EXHAUST/ COMMON. Verify 14.0 to 20.0 OHMS across EXHAUST/HOLD. Verify no continuity from modulator leads to ground.
6	2	Mod 2 Open / Shorted to GND	

1st Digit	2nd Digit	Fault Description	Repair Information
ABS Modulators (continued)			
6	3	Mod 1 Shorted to Ground	Check for corroded or damaged modulator wiring and connections. Verify no continuity from modulator leads to ground. Verify 7.0 to 10.0 OHMS across HOLD/COMMON. Verify 7.0 to 10.0 OHMS across EXHAUST/COMMON. Verify 14.0 to 20.0 OHMS across EXHAUST/HOLD.
6	9	Mod 2 Shorted to Ground	
6	4	Mod 1 Shorted Solenoid	Check for corroded or damaged modulator wiring and connections. Verify 7.0 to 10.0 OHMS across HOLD/COMMON. Verify 7.0 to 10.0 OHMS across EXHAUST/ COMMON. Verify 14.0 to 20.0 OHMS across EXHAUST/HOLD.
6	10	Mod 2 Shorted Solenoid	
6	5	Mod 1 Shorted to VBAT	Check for corroded or damaged modulator wiring and connections. Verify +12V is not measured at any modulator lead. Verify 7.0 to 10.0 OHMS across HOLD/COMMON. Verify 7.0 t 10.0 OHMS across EXHAUST/COMMON. Verify 14.0 to 20.0 OHMS across EXHAUST/HOLD
6	11	Mod 2 Shorted to VBAT	
6	6	Mod 1 Shorted Between	Check for corroded or damaged modulator wiring and connections. Verify 7.0 to 10.0 OHMS across HOLD/COMMON. Verify 7.0 t0 10.0 OHMS across EXHAUST/ COMMON. Verify 14.0 to 20.0 OHMS across EXHAUST/HOLD.
6	12	Mod 2 Shorted Between	
ABS Warning Lamp			
7	1	Trailer ABS - Warning Lamp Shorted to VBAT	Check ABS warning lamp wiring and connections. Verify proper illumination of warning lamp at power-up.
7	2	Trailer ABS Warning Lamp Open	
7	3	Trailer ABS Warning Lamp Shorted to Ground	

MC-30™ Controller Configuration Blink Code Display

1st Digit	Sensor
2	2 Sensors
3	4 Sensors
2nd Digit	**Modulators**
1	1 Modulator (Dolly-Axle control)
2	1 Modulator (Axle control)
3	2 Modulators (Axle control)
4	2 Modulators (Side control)

BLINK CODE DIAGNOSTICS

The MC-30™ controller provides diagnostic and configuration information through blink code diagnostics. Blink code diagnostics are activated by providing constant power to the ignition circuit and toggling the brake light power input to the MC-30™ controller.

When blink code mode is activated, the MC-30™ controller will blink the trailer mounted ABS warning lamp to display active fault codes, fault code history, ABS configurations, and odometer mileage. Blink code diagnostics can also be used to reset active fault codes.

With Ignition Power Applied, Cycle Brake Light Power	Blink Code Action
3 times	Display Active Fault Codes
4 times	Display Fault Code History
5 times	Reset Active Fault Codes
6 times	Display EC-30T Configuration
7 times (If Equipped)	Display of Odometer Mileage (x1000)

- If wheel speeds are detected during blink code diagnostics mode, the MC-30™ controller will exit blink code diagnostics and return to normal operating mode.
- Blink code diagnostics can only be activated following a power-up, where wheel speeds have not been detected.
- Blink code diagnostics must be activated within 15 seconds of ignition power being applied.
- If brake light power is continuously applied for greater than 5 seconds, blink code diagnostics will be disabled until ignition power is cycled.

Lamp Behavior During Blink Code Display

Following activation, there will be a 5 second delay followed by the blink code display. Following a single display of all available messages, the ABS warning lamp will remain on for 5 seconds and then return to normal operating mode.

CALIBRATION OF NON-STANDARD WHEEL SIZES

The MC-30™ controller allows for tire rolling radius and tone ring tooth count parameters to be set for each axle using a diagnostic tool. These adjustments may be necessary for the MC-30™ controller to accurately calculate the vehicle velocity and odometer mileage. Wheels of the same axle must be set to the same rolling radius and tone ring tooth count. In most cases, these parameters are set by the trailer OEM and do not need to be adjusted. In the case of a service replacement unit, these parameters will need to be adjusted if the default settings do not match the vehicle.

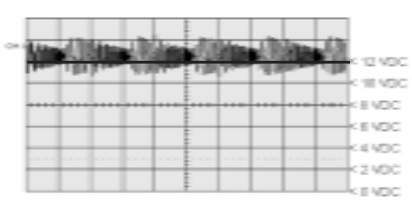
Parameter	Default Settings	Available Settings
Rolling Radius	500 revs/mile	300 to 700 revs/mile
Tone Ring Tooth Count	100 teeth	80, 86, 100, 120 teeth

WHEEL SPEED SENSOR ADJUSTMENT

Speed sensors are properly adjusted by gently pushing (not striking) the sensor into the clip until it makes contact with the face of the tone ring. The wheel speed sensor will automatically adjust as the wheel rotates. If rotating the wheel causes a gap of 0.020 in. or greater, check for excessive wheel bearing play or tone ring run-out. Proper wheel speed sensor installation is critical to proper ABS operation.

PLC4Trucks

An MC-30™ controller with Power Line Carrier (PLC) communication will continuously broadcast PLC messages that indicate trailer ABS status. At power-up or during a trailer fault condition, the MC-30™ controller will signal the tractor ABS unit to illuminate the dash mounted trailer ABS lamp. An oscilloscope can be used to verify the presence and strength of a PLC signal on the power line. Suggested oscilloscope settings are AC coupling, 1 volt/div, 100 sec/ div. Diagnostic tools are available that detect the presence of a PLC signal.



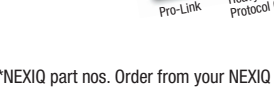
Power Line with PLC

DIAGNOSTIC LED REFERENCE

If the LEDs shown below are illuminated...

Sensor Fault

The example shown is a Right Front Sensor fault.



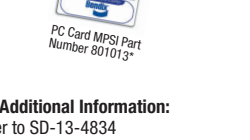
Static Wheel Speed Sensor Fault

Verify 1500-2500 OHMs across sensor connector pins

Dynamic Wheel Speed Sensor Fault

Rotate wheel and verify a minimum of 0.8VAC sensor output @1RPS across wheel speed sensor pins. A properly positioned sensor can output more than 2.0VAC @1RPS.

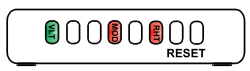
30-Pin Connector



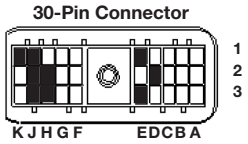
C2 Right Front WS+
A1 Right Front WS-
A2 Left Front WS+
A3 Left Front WS-
B1 Right Rear WS+
B2 Right Rear WS-
B3 Left Rear WS+
C1 Left Rear WS-
E1 Ignition Power
E3 Brake Light Power
D2 Ground

Modulator Fault

The example shown is a MOD1 fault.



30-Pin Connector



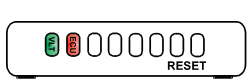
Static ABS Modulator Fault

* Verify 7.0 to 10.0 OHMs across Hold and Common Pins
* Verify 7.0 to 10.0 OHMs across Exhaust and Common Pins
* Verify 14.0 to 20.0 OHMs across Exhaust and Hold pins

J2 Mod1 Hold
H3 Mod1 Common
J3 Mod1 Exhaust
H2 Mod2 Hold
J1 Mod2 Common
K1 Mod2 Exhaust
E1 Ignition Power
E3 Brake Light Power
D2 Ground

ECU Fault

The example shown is an ECU fault. The red ECU LED indicates a fault internal to the EC-30T. Reset the MC-30™ controller with a magnet. If the fault returns, replace the EC-30T. If the red ECU LED is on and the green VLT LED is off, the MC-30™ controller may have very low voltage.



Voltage Out of Range Fault

A flashing green VLT LED indicates ECU voltage below 8.0 VDC or above 16.0 VDC. The VLT LED will blink until power is brought into normal range.

DIAGNOSTIC TOOLS

The MC-30™ controller uses the Bendix® ABS Diagnostic Software (PN 5009089) for advanced troubleshooting on PC's. The Bendix® ABS Diagnostic Software requires an RP1210A* adapter. These adapters are available from MPSI (Serial data module - PN 129037* and Parallel data module - PN 126032*). Additional diagnostic tools are available through SPX. A Bendix PCMCIA card is available for the Pro-Link tool. It can be used with EC-15™, EC-16™, EC-17™, EC-30™ tractor ABS units and MC-30™ trailer ABS units.

Pro-Link Heavy Duty Multi Protocol Cartridge

PC Card MPSI Part Number 801013*

*NEXIQ part nos. Order from your NEXIQ supplier.

For Additional Information:
Refer to SD-13-4834
Call: 1-800-AIR-BRAKE (1-800-247-2725)
Visit: www.Bendix.com

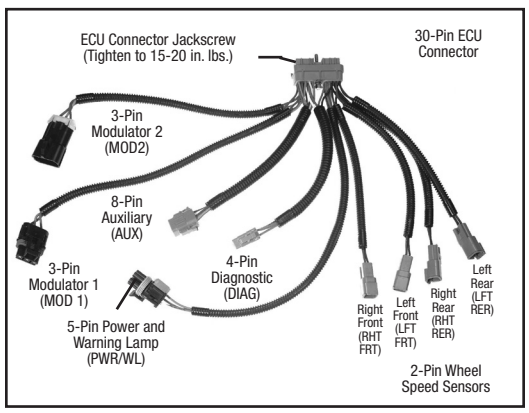
POWER AND GROUND

Trailer electrical power is supplied to the MC-30™ controller from the ignition and brake light circuits.

Circuit	7-Pin Trailer Electrical Connector	5-Pin ABS Power Connector	30-Pin ECU Connector
Ignition Power (PLC) (Blue Wire)	Pin 7	B	Pin E1
Brake Light Power (Red Wire)	Pin 4	A	Pin E3
Ground (White Wire)	Pin 1	E	Pin D2
Warning Lamp (White/Green Wire)	N/A	D	Pin D3
Function Mode	**Value**		
Operating Range	8.0 to 16.0 VDC		
ECU Active	383 mA		
ABS Active (1 modulator)	2.4 A @ 12 VDC		
ABS Active (2 modulators)	4.5 A @ 12 VDC		

MC-30™ CONTROLLER WIRING HARNESS (PIGTAIL)

The EC-30T utilizes a pigtail wiring harness to interface with ABS and other trailer system components. The following connectors are optional and may not be present on all pigtail harnesses: Modulator 2, auxiliary, diagnostic, and rear axle wheel speed sensors.



MOST COMMONLY ENCOUNTERED PROBLEMS THAT RESULT IN LEDS BEING ILLUMINATED

1. Abraded or cut wires in the convoluted tubing near frame clamps.
2. Damaged wires near frame members and frame mounted modulators.
3. Wire jacket worn through from overlapping sensor and modulator wires near frame members and frame mounted modulators.
4. Corroded connectors or seal damage.
5. Damaged connector latches or connectors not completely seated.
6. Terminals not completely latched or seated into connectors.
7. Excessive sensor air gap, sensor clip tension, or excessive bearing end play (gently push sensor against wheel hub, or readjust bearings).
8. Damage to exposed wires exiting or entering the convoluted tubing.
9. Worn, chipped or damaged sensor or modulator.
10. Non-functioning antilock controller.

ADDITIONAL SERVICING TIPS

1. Do not pierce wires with probes when troubleshooting harnesses.
2. Gently probe terminals when checking for resistances, do not deform contacts.
3. Apply nonconductive dielectric grease to any and all connectors if inspecting or disconnecting connectors.
4. Bundle and tie wrap excess cable neatly to adjacent air lines or framing members.