

## General Description

The ICU4 instrument cluster is an individual-gauge cluster with an intelligent light bar that houses the integrated warning and indicator lights on the dash message center (light bar faceplate). See **Fig. 1**. It looks very similar to the ICU2L instrument cluster except for two differences:

- ICU4 gauges sweep 270 degrees
- the ICU4 has a mode/reset switch on the light-bar display to the right of the message display screen
- the ICU4 has an LCD display

**NOTE:** The ICU4 component that houses the dash message center is called the light bar in this manual. The dash message center is also referred to as the light bar faceplate.

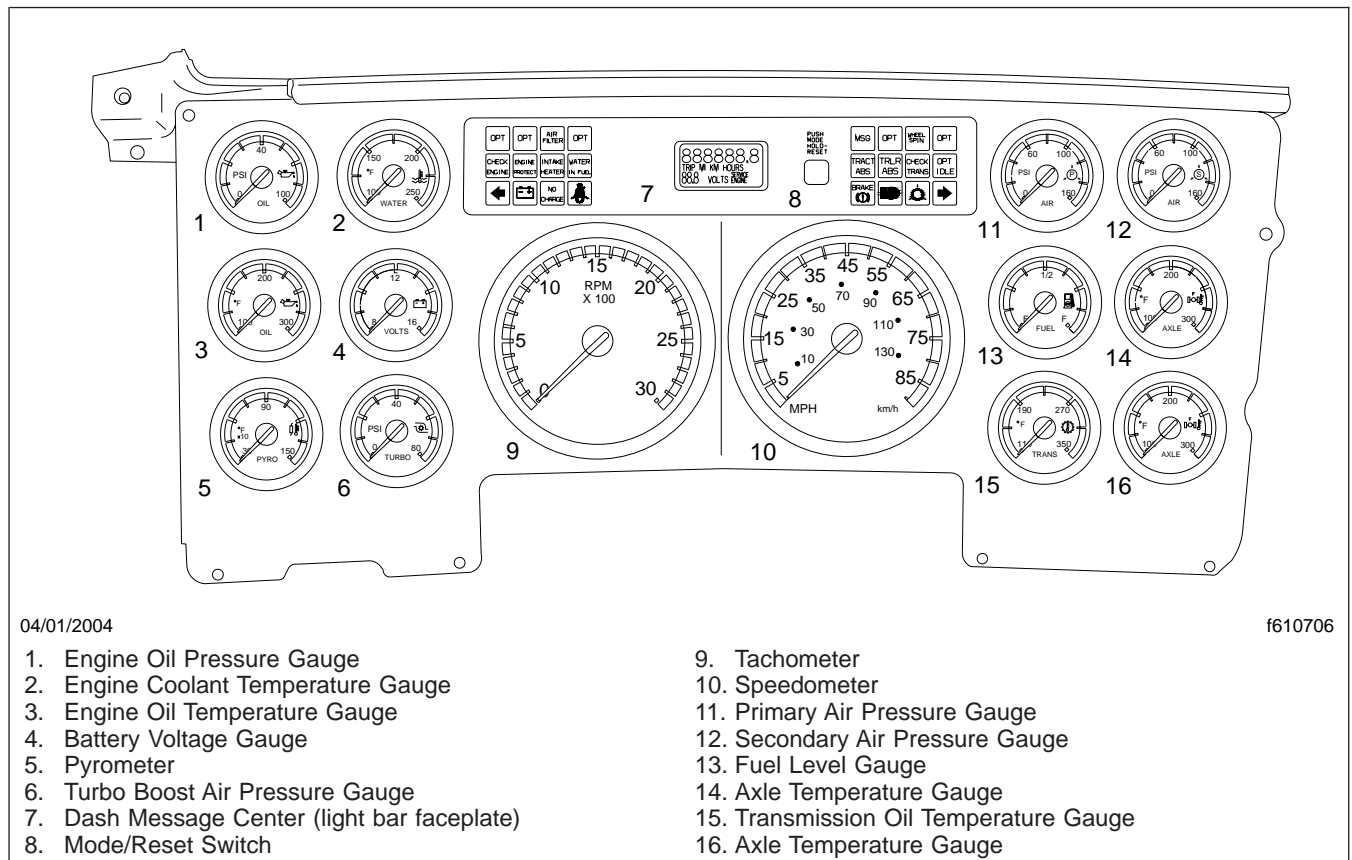
There can be up to 14 removable gauges on the driver's instrument panel. The ICU4 can also drive gauges located on the auxiliary instrument panel.

The ICU4 dash message center includes a set of 24 warning and indicator lights, and a message display screen in the center. See **Fig. 2**.

Standard gauges are:

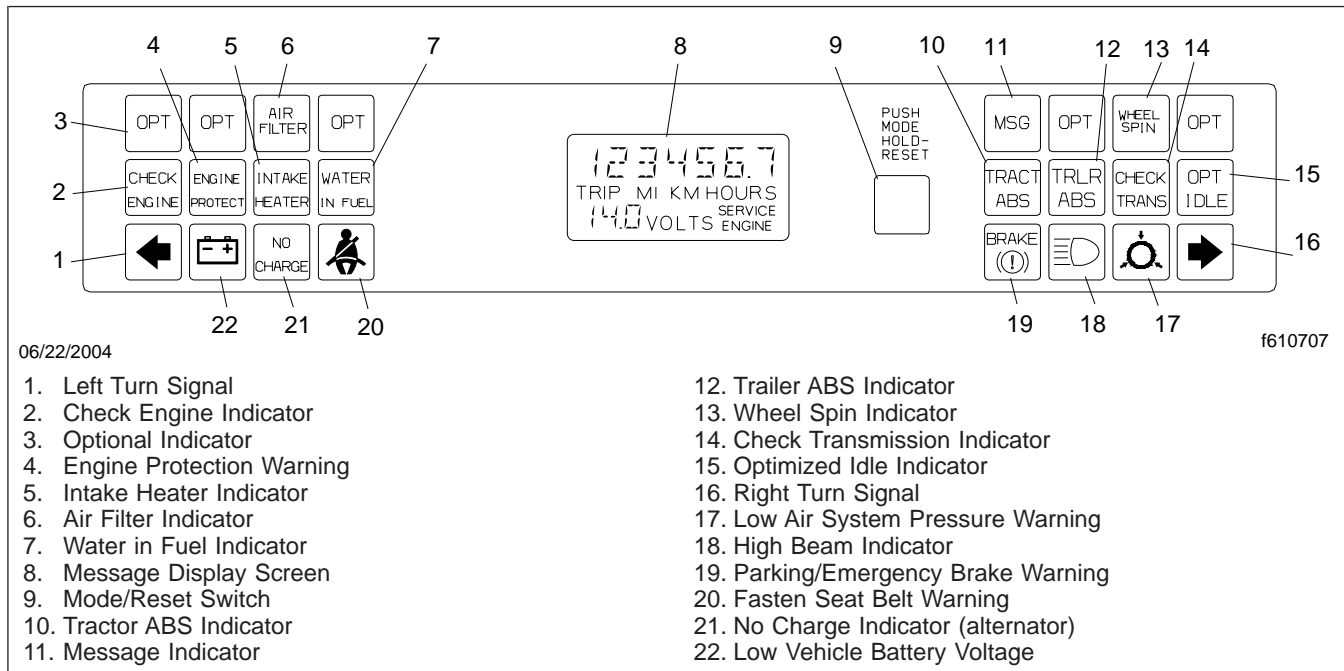
- speedometer
- engine coolant temperature
- engine oil pressure
- battery voltmeter
- fuel level

**NOTE:** Some vehicles may be equipped with a digital display voltmeter integrated into the mes-



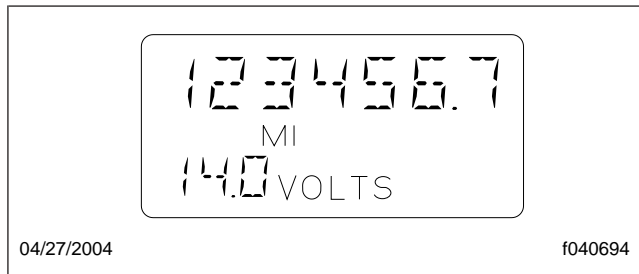
**Fig. 1, ICU4 Instrument Cluster (typical)**

## General Information



**Fig. 2, ICU4 Dash Message Center (typical)**

sage display screen instead of a battery voltage gauge. See **Fig. 3**.



**Fig. 3, Message Display Screen with Integrated Digital Voltmeter**

Gauges with an integrated warning light on the gauge are listed below with an indication of how the warning light is activated:

- engine coolant temperature (high)
- engine oil pressure (low)
- fuel level (low)
- transmission oil temperature (high)

Other available gauges include:

- tachometer

- engine oil temperature
- transmission oil temperature
- axle temperature; forward-rear, and rear-rear
- ammeter
- air pressure; primary, secondary, application, and suspension
- pyrometer
- turbo boost

## Warning and Indicator Lights

Up to 24 warning and indicator lights can be installed in the ICU4; the bottom two rows (16 total) are fixed, and the eight positions in the top row are optional. There may also be up to four gauges with a warning light integrated on the gauge.

The red engine protection (ENGINE PROTECT) light comes on to indicate that the protection system available for the engine has been activated. If the engine coolant temperature, the coolant level, the engine oil pressure, or on some engines, the engine oil temperature or the intake air temperature reach preset levels, the engine will begin a warning and shutdown

process. The engine ECU will begin to reduce the maximum engine torque and speed and, if the condition does not improve, will shut down the engine within 30 seconds of the light illuminating. The driver must safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, the engine can be restarted after turning the key to the OFF position for a few seconds.

The standard warning and indicator lights operate as follows:

- The green right-turn and left-turn signal lights flash on and off whenever the outside turn signal lights are flashing.
- The blue high-beam indicator light comes on when the headlights are on high beam.
- The yellow CHECK ENGINE indicator comes on when an engine fault is detected or recorded. The check engine light is controlled by the engine ECM. See the engine manufacturer's manuals for troubleshooting.
- The red low air pressure warning light (a circle with arrows symbol) and buzzer activate whenever air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa).
- The red high coolant temperature warning light (located on the engine coolant temperature gauge) and buzzer activate whenever the coolant temperature goes above a maximum level whenever the cluster receives a high coolant fault message from the engine (MID 128, PID 110, and FMI 00).
- The red low engine oil pressure warning light (located on the engine oil pressure gauge) and buzzer activate whenever the engine oil pressure goes below a minimum level whenever the cluster receives a low oil pressure fault message from the engine (MID 128, PID 100, and FMI 01).
- The yellow high transmission oil temperature indicator (located on the optional transmission oil temperature gauge) activates when the transmission fluid temperature goes above a maximum level specified by the transmission manufacturer. This telltale is directly controlled by the transmission via hard wire input to the cluster.
- The red parking/emergency brake (BRAKE!) warning light activates whenever the parking brake is engaged. A buzzer also activates when the vehicle is moving at least 2 mph (3 km/h) with the parking brake set.
- The yellow low fuel indicator (located on the fuel gauge) activates when the fuel tank is less than 1/8 full.
- The red fasten seat belt warning symbol illuminates for 15 seconds when the ignition key is turned to the ON position.
- The yellow INTAKE HEATER indicator illuminates to indicate that the intake air heater is active. This telltale is directly controlled by the engine via hard wire input to the cluster.
- The yellow WATER IN FUEL indicator illuminates to indicate that the fuel could contain water. This telltale is directly controlled by the engine via hard wire input to the cluster.
- The yellow tractor ABS (TRACT ABS) indicator illuminates when a problem with the ABS system is detected. This telltale is directly controlled by the ABS via hard wire input to the cluster.
- The yellow check transmission (CHECK TRANS) indicator illuminates when a problem with the electronic transmission is detected. This telltale is directly controlled by the transmission via hard wire input to the cluster.
- The yellow Optimized Idle (OPT IDLE) indicator illuminates on vehicles equipped with a Detroit Diesel engine and the Optimized Idle system when Optimized Idle is active and controlling the engine start and stop functions. This system operates only when the vehicle is stopped and the parking brake is on. This telltale is directly controlled by the engine via hard wire input to the cluster.
- The red low vehicle battery voltage warning light (battery symbol) illuminates when the battery voltage is 11.9 volts or less. This telltale is controlled by the cluster by monitoring the voltage message from the engine.
- The yellow alternator NO CHARGE indicator illuminates to indicate an alternator charge output failure. This telltale is directly controlled by the alternator via hard wire input to the cluster.

## General Information

The yellow trailer ABS (TRLR ABS) indicator operates as follows when a compatible trailer is properly connected to a tractor before the engine is started (PLC trailers only):

- With the ignition key in the ON position, the trailer ABS lamp illuminates momentarily, then turns off.
- If the lamp comes on momentarily during vehicle operation, then shuts off, a fault was detected and corrected.
- If the lamp comes on and stays on during vehicle operation, there is a fault with the trailer ABS. Repair the trailer ABS system immediately to ensure full antilock braking capability.

The trailer ABS lamp will not illuminate unless a compatible trailer is connected to the tractor.

NOTE: When connected to a PLC-equipped trailer, this telltale is directly controlled by the **tractor** ABS ECU via hard wire input to the cluster.

On non-PLC-equipped trailers, this telltale is directly controlled by the **trailer** ABS ECU via hard wire input to the cluster.

The eight warning and indicator light positions on the top row of the light bar are optional. Available optional indicator lights include: low washer fluid, automatic transmission overheat warning, wheel spin warning, impaired air filter warning, ECAS (electronic suspension) transfer indicator, and ECAS failure warning.

## Buzzer and Chime

The buzzer sounds for 3 seconds during the self-test at start-up, and when the following conditions exist:

- low air pressure
- low oil pressure
- high coolant temperature
- the parking brake is applied and the vehicle is moving at a speed of at least 2 mph (3 km/h)

A friendly chime sounds when the parking brake is off and the door is open, or when the headlights are on and the door is open.

## Ignition Sequence

When the ignition key is turned on, the ICU4 begins a self-test. During this process all gauges controlled by the cluster sweep to full scale and return, the buzzer sounds for 3 seconds, the fasten seat belt warning light illuminates for 15 seconds, and the following warning lights illuminate then turn off: battery voltage, low air pressure, parking brake, low oil pressure, high coolant temperature, high transmission temperature, and low fuel level. Then the software revision level of the ICU4 is displayed, followed by active faults, if any, then the odometer display.

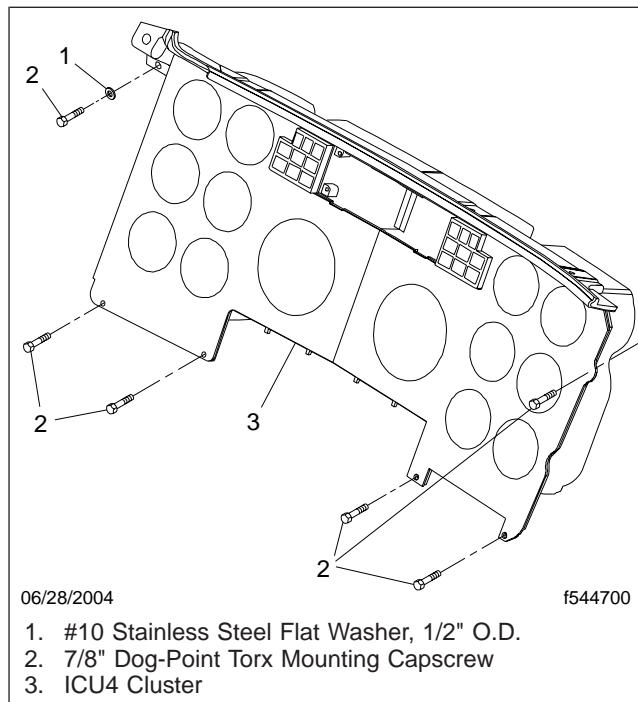
## Replacement

To replace the following components, refer to the indicated subject.

- Individual gauges, see [Subject 110](#)
- Light bar, see [Subject 120](#)
- Light bulbs or telltales, see [Subject 130](#)

## ICU4

1. Remove the left-hand dash panels. Be sure the screws attaching the dash panel trimtop to the upper dash assembly have been removed. For instructions, see [Section 60.08](#), Subject 100.
2. Remove the screw that attaches the dash panel trimtop to the lower dash panel. This screw is located on the far left of the trimtop.
3. Remove the fasteners that secure the driver's instrument panel. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).



**Fig. 1, ICU4 Dash Panel Installation**

## CAUTION

**Electronic components of the ICU are vulnerable to damage from static electricity. If available, wear a wrist grounding strap connected to a ground in the cab or workbench. If a grounding strap is not available, touch a grounded component immediately before doing any work which could bring a tool or body part in contact with ICU circuitry.**

4. Disconnect the electrical harness connectors from the back of the light bar. These include the 32-pin light bar connector, the 24-pin light bar connector, and the two 6-pin gauge databus connectors. Also disconnect the 3-pin auxiliary input connector, if so equipped. See [Fig. 2](#).

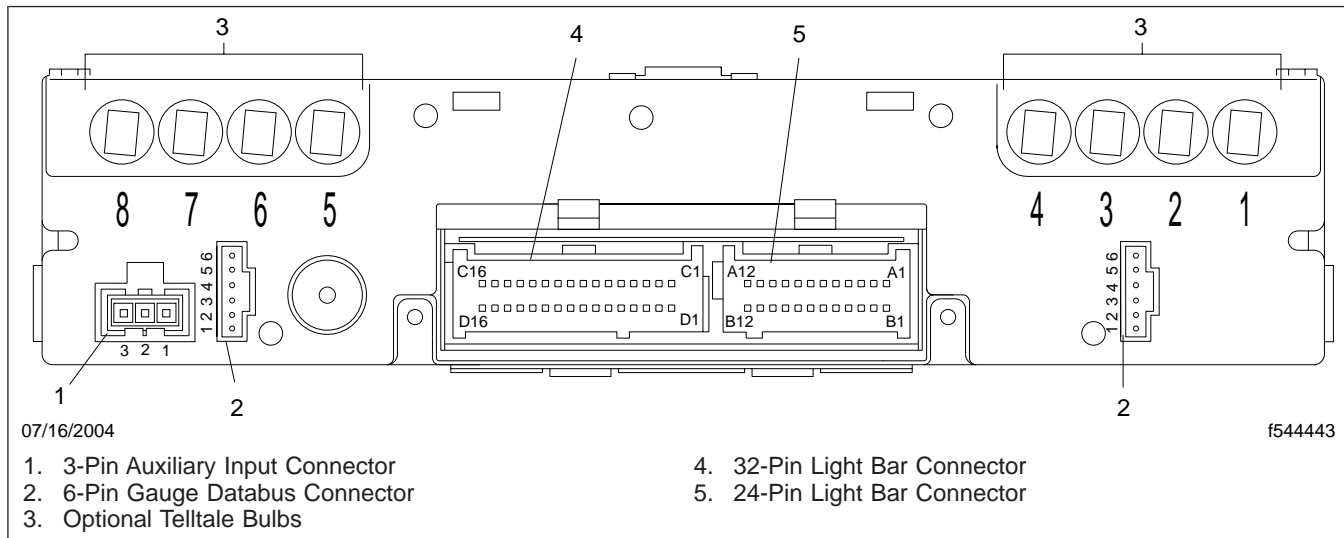
**IMPORTANT:** Bleed off all air before trying to remove the air hoses.

5. Using a paint pen, mark the air hoses for ease of installation. After bleeding all air from the system, disconnect all air gauge hoses.
6. Remove the light bar faceplate by placing a small flat blade under each end near the center and carefully pry it forward to release the locking tabs.
7. When all fasteners and connections between the cluster and the dash have been disconnected, remove the old ICU from the dash. See [Fig. 3](#).
8. Remove the light bar from the back by removing its four Torx mounting capscrews from the front of the ICU4. The top two mounting capscrews also secure the trimtop to the cluster housing.
9. Disconnect each gauge from the others by disconnecting the daisy chain harness connectors.

**NOTE:** Record the location of each gauge before removing them if the same configuration is desired for reinstallation. Gauges must be installed in the appropriate size panel opening, and they must all be connected to each other in daisy-chain fashion in order to work, but a specific location for each gauge is not necessary.

10. Remove all gauges. See [Fig. 4](#).
- 10.1 To remove the speedometer and tachometer, remove the two Torx mounting cap-

## ICU4 Replacement

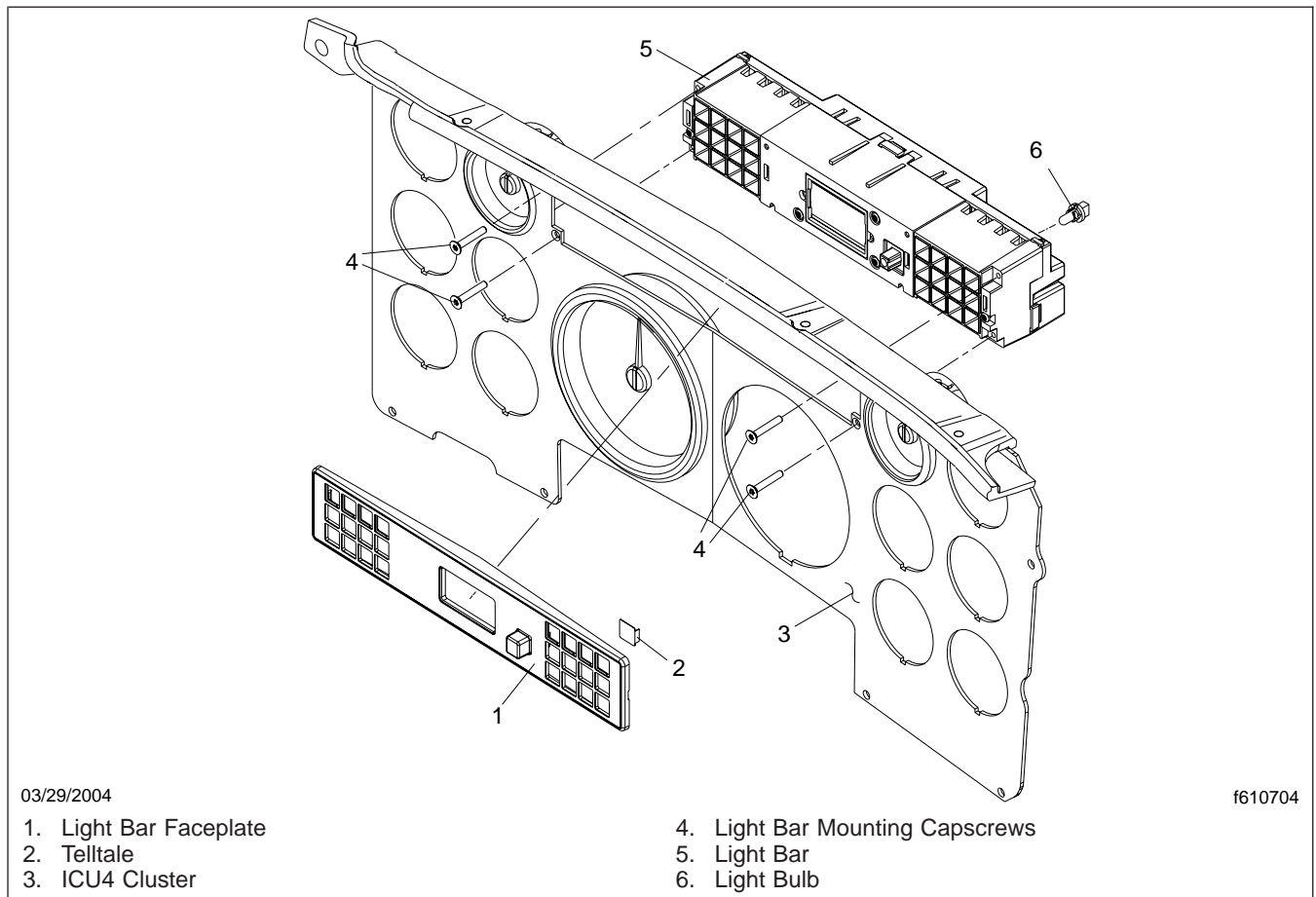


**Fig. 2, Light Bar Connector Pin Locations (rear view)**

screws that secure the mounting bracket and the gauge to the cluster.

- 10.2 For small gauges, push in and twist the black plastic gauge mounting collar counterclockwise slightly until the collar unlocks from the gauge. Remove the gauge through the front of the opening and the collar and wave ring from the back.
11. Remove the remaining screw that attaches the dash panel trimtop to the old ICU.
12. Attach the dash panel trimtop to the replacement ICU cluster housing.
13. Install the gauges in their appropriate openings. See [Fig. 4](#).
  - 13.1 For the speedometer and tachometer, orient the gauge and place it through the opening from the front. Then place the mounting bracket on the back of the gauge and install the two Torx mounting capscrews.
  - 13.2 For small gauges, orient the gauge and place it through the front of the opening, and place the collar and wave ring from the back. Push the gauge mounting collar against the wave ring and twist the collar clockwise until the collar locks in place.
14. Install the light bar. Place it into the opening from the back and install its four Torx mounting capscrews from the front of the ICU4. The top two mounting capscrews also secure the trimtop to the cluster housing. Hold the triptop so its mounting tabs are flush to the cluster, then secure the light bar. See [Fig. 3](#).
15. Install the light bar faceplate by placing it over the front of the light bar, then carefully press it on until its end tabs lock in place.
16. Connect each gauge to the others on each side of the cluster by connecting the harnesses in a daisy-chain fashion.
  - 16.1 Start by connecting the inside harness of one of the two large gauges to the closest 6-pin connector on the light bar. Then connect the harness on the outside of the gauge to the nearest plug at the top of the column of small gauges next to it. Connect the other harness from the small gauge to the one below it. Continue working down, then across the bottom to the column of gauges next to it, then up the column. The final gauge in the chain will connect only to the gauge immediately below it.
  - 16.2 Connect the gauges on the other side of the cluster in similar fashion. Start with the other large gauge, connect it to the nearest 6-pin connector on the light bar, then connect the other harness from the large gauge to the small gauge nearest on the

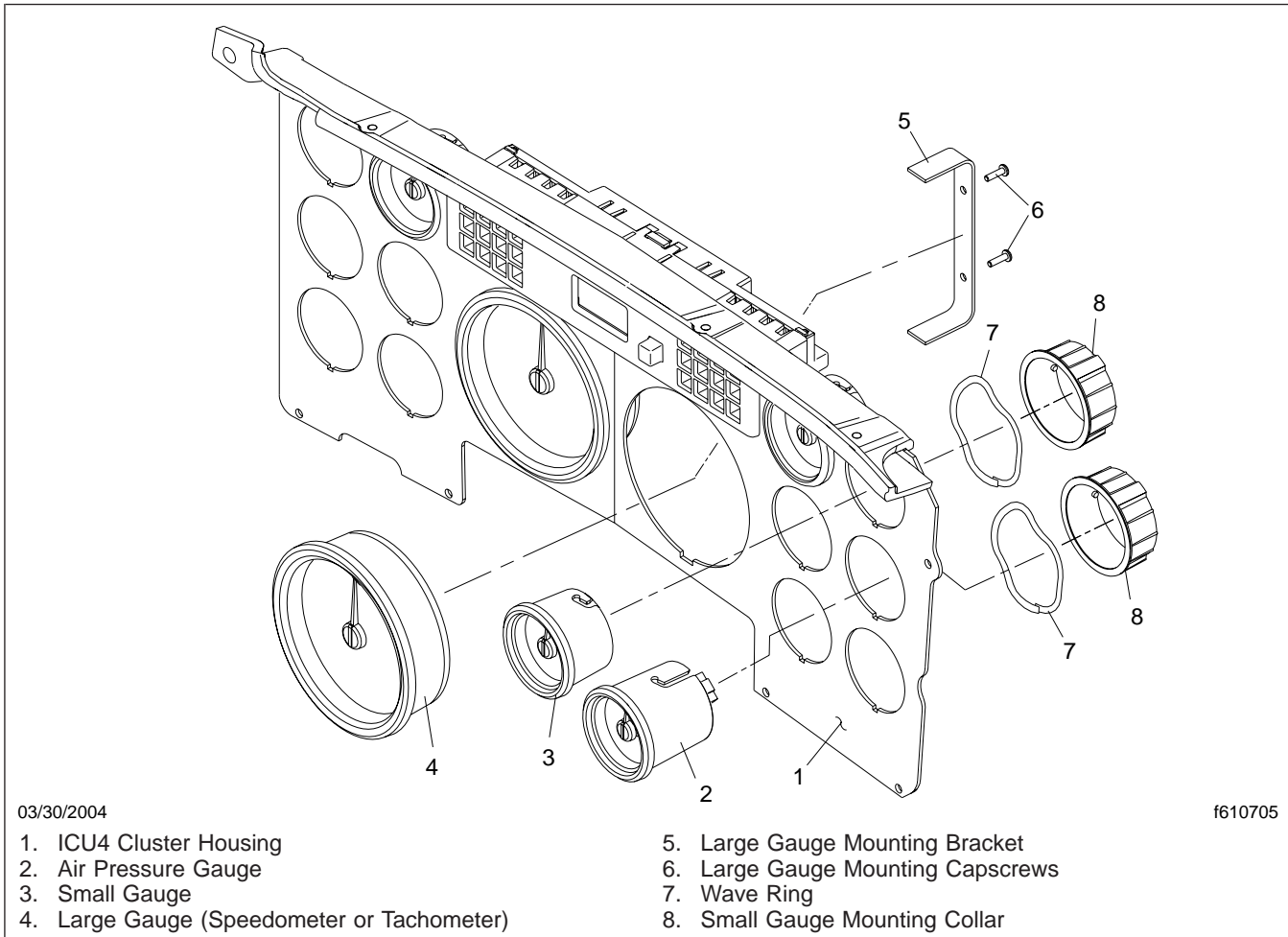




**Fig. 3, Light Bar Replacement**

- top inside column and work similarly down the inside column and up the outside column around so all gauges are connected in the chain.
17. Place the ICU4 cluster close to its dash opening and connect the air hoses to the air gauges as marked on removal.
  18. Connect all remaining electrical harnesses to the back of the light bar. These include the 32-pin light bar harness connector, the 24-pin light bar harness connector, and the 3-pin auxiliary input harness connector, if so equipped. See [Fig. 2](#).
  19. Install the fasteners that secure the cluster to the dash. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).
  20. Install all remaining dash panels. Be sure to install the fasteners that attach the dash panel trimtop to the upper dash assembly and lower dash panel. For instructions, see [Section 60.08](#), Subject 100.
  21. Turn on the ignition and test the operation of the ICU. All gauges controlled by the cluster sweep to full scale and return, the buzzer sounds for 3 seconds, the fasten seat belt warning light illuminates for 15 seconds, and the battery voltage, low air pressure and parking brake warning lights illuminate then turn off.
- If any gauges are not working properly, see [Subject 300](#) for troubleshooting information.

### ICU4 Replacement



**Fig. 4, ICU4 Gauge Installation**



Use the instructions for removing the dash panels that follow to access the back to the ICU4. Then go to the appropriate instructions to replace each type of gauge. Then use the instructions at the end of the subject for installing the dash panels.

## Removing the Dash Panels

1. Remove the left-hand dash panels. Be sure the screws attaching the dash panel trimtop to the upper dash assembly have been removed. For instructions, see [Section 60.08](#), Subject 100.
2. Remove the screw that attaches the dash panel trimtop to the lower dash panel. This screw is located on the far left of the trimtop.
3. Remove the fasteners that secure the driver's instrument panel. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).

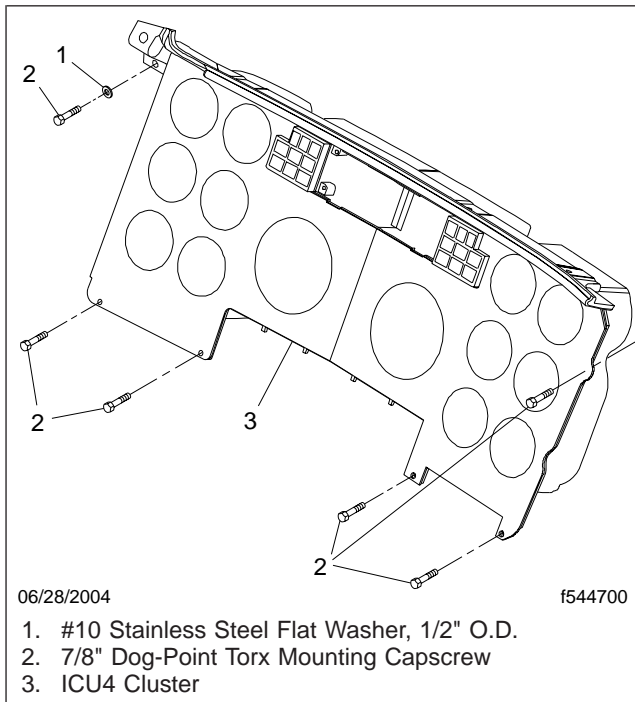


Fig. 1, ICU4 Dash Panel Installation

### CAUTION

Electronic components of the ICU are vulnerable to damage from static electricity. If available,

wear a wrist grounding strap connected to a ground in the cab or workbench. If a grounding strap is not available, touch a grounded component immediately before doing any work which could bring a tool or body part in contact with ICU circuitry.

4. Carefully pull the dash panel forward to gain access to the gauges from behind the panel.

## Speedometer and Tachometer

1. Disconnect the electrical harness connectors from the back of the gauge.
2. Remove the two Torx mounting capscrews that secure the mounting bracket and the gauge to the cluster. See [Fig. 2](#).
3. Orient the replacement gauge and place it through the opening from the front. Then place the mounting bracket on the back of the gauge and install the two Torx mounting capscrews.
4. Connect both wire harnesses to the back of the gauge.
5. See the instructions that follow to install the dash panels.

## Air Pressure Gauges

**IMPORTANT:** Bleed off all air before trying to remove the air hoses.

1. Using a paint pen, mark the air hoses for ease of installation. After bleeding all air from the system, disconnect the air gauge hoses.
2. Unplug both wire harnesses from the back of the gauge.
3. Note the location of each gauge before removing them if multiple gauges are being replaced. To remove the gauge, push in and twist the black plastic gauge mounting collar counterclockwise slightly until the collar unlocks from the gauge. Remove the gauge through the front of the opening and the collar and wave ring from the back. See [Fig. 2](#).
4. Orient the replacement gauge and place it through the front of the opening, and place the collar and wave ring from the back. Push the

## Gauge Replacement

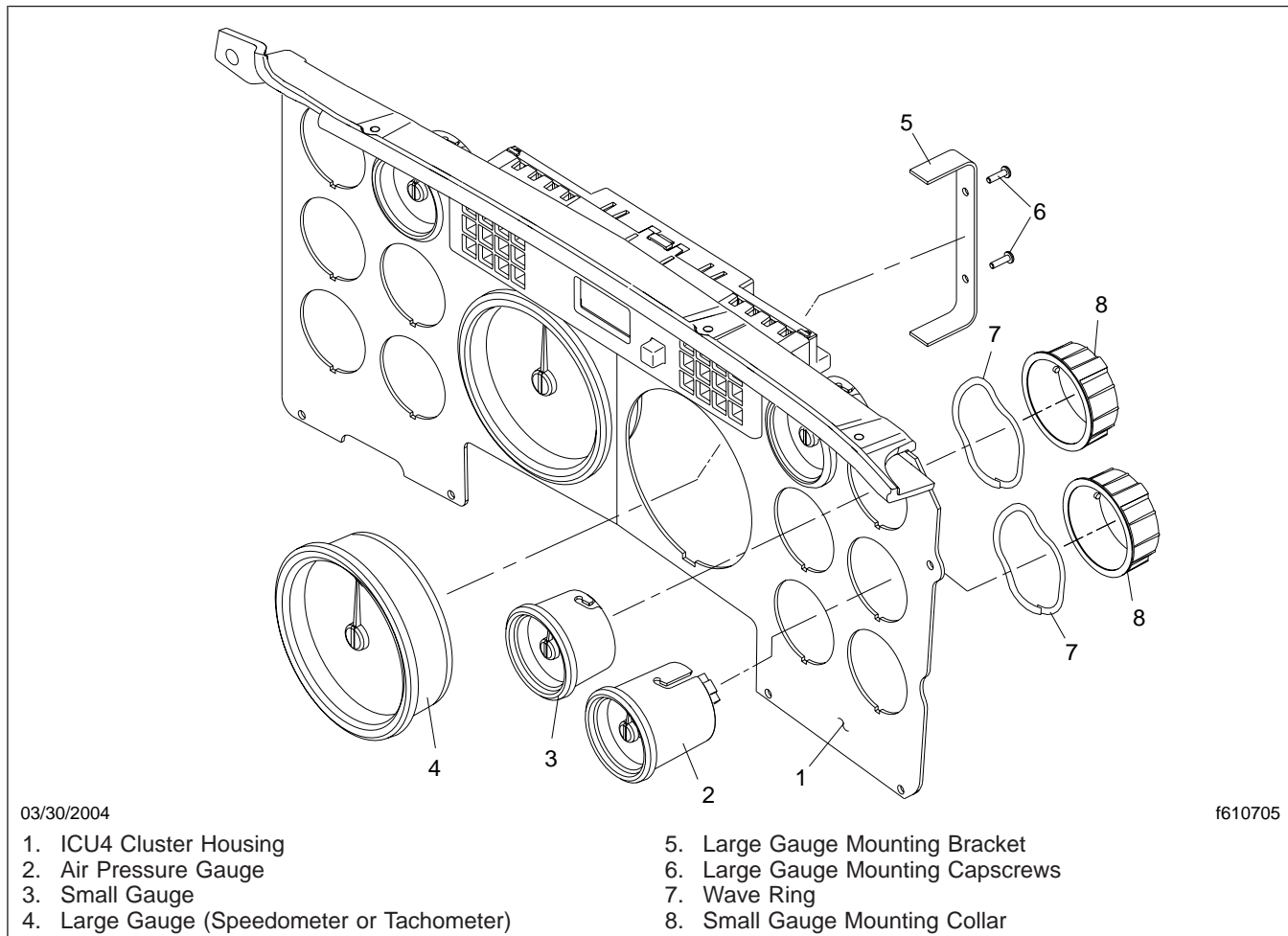


Fig. 2, ICU4 Gauge Installation

gauge mounting collar against the wave ring and twist the collar clockwise until the collar locks in place.

5. Connect both wire harnesses to the back of the gauge.
6. Connect the air gauge hoses.
7. See the instructions that follow to install the dash panels.

## All Other Gauges

1. Unplug both wire harnesses from the back of the gauge.

2. Note the location of each gauge before removing them if multiple gauges are being replaced. To remove the gauge, push in and twist the black plastic gauge mounting collar counterclockwise slightly until the collar unlocks from the gauge. Remove the gauge through the front of the opening, and the collar and wave ring from the back. See [Fig. 2](#).

3. Orient the replacement gauge and place it through the front of the opening, and place the collar and wave ring from the back. Push the gauge mounting collar against the wave ring and twist the collar clockwise until the collar locks in place.
4. Connect both wire harnesses to the back of the gauge.

5. See the instructions that follow to install the dash panels.

## Installing the Dash Panels

1. Install the fasteners that secure the cluster to the dash. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).
2. Install all remaining dash panels. Be sure to install the fasteners that attach the dash panel trimtop to the upper dash assembly and lower dash panel. For instructions, see [Section 60.08](#), Subject 100.
3. Turn on the ignition and test the operation of the ICU. All gauges controlled by the cluster sweep to full scale and return, the buzzer sounds for 3 seconds, the fasten seat belt warning light illuminates for 15 seconds, and the battery voltage, low air pressure and parking brake warning lights illuminate then turn off.

If any gauges are not working properly, see [Subject 300](#) for troubleshooting information.



## Light Bar Replacement

1. Remove the left-hand dash panels. Be sure the screws attaching the dash panel trimtop to the upper dash assembly have been removed. For instructions, see [Section 60.08](#), Subject 100.
2. Remove the screw that attaches the dash panel trimtop to the lower dash panel. This screw is located on the far left of the trimtop.
3. Remove the fasteners that secure the driver's instrument panel. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).

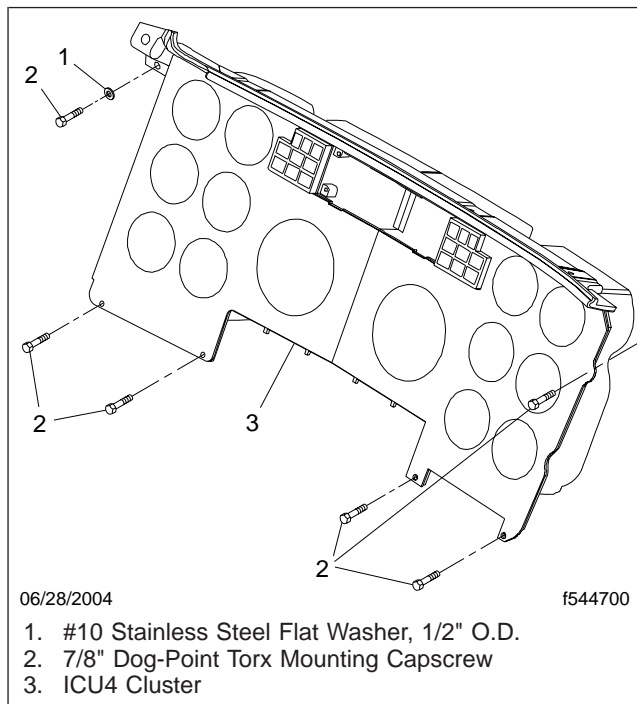


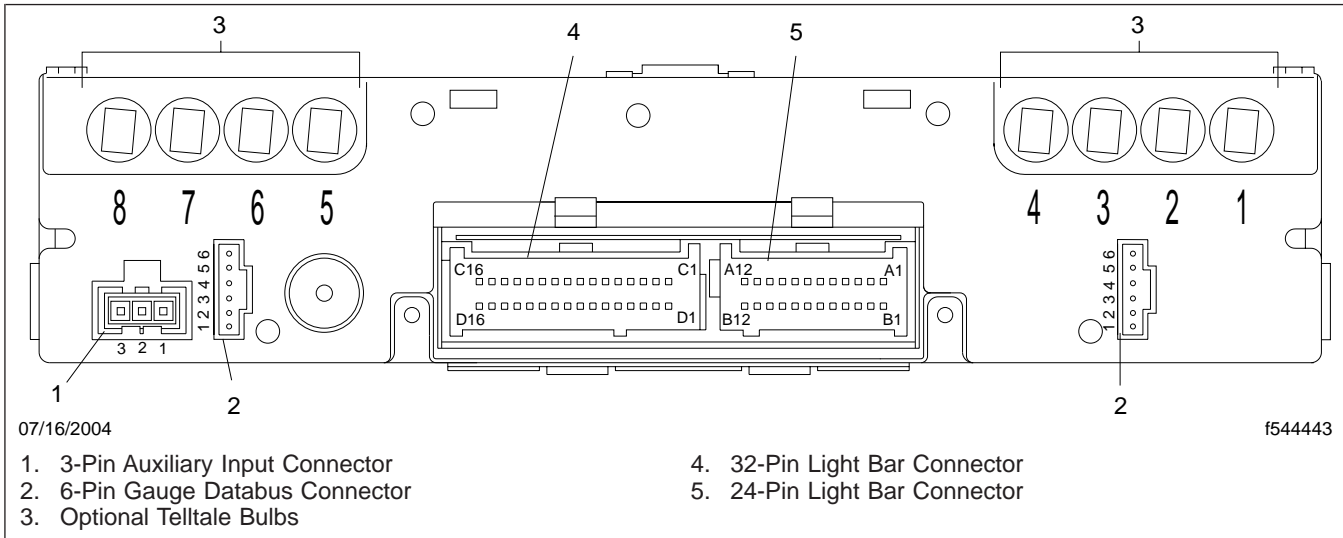
Fig. 1, ICU4 Dash Panel Installation

### CAUTION

Electronic components of the ICU are vulnerable to damage from static electricity. If available, wear a wrist grounding strap connected to a ground in the cab or workbench. If a grounding strap is not available, touch a grounded component immediately before doing any work which could bring a tool or body part in contact with ICU circuitry.

4. Disconnect the electrical harness connectors from the back of the light bar. These include the 32-pin light bar connector, the 24-pin light bar connector, and the two 6-pin gauge databus connectors. Also disconnect the 3-pin auxiliary input connector, if so equipped. See [Fig. 2](#).
5. Remove the light bar faceplate by placing a small flat blade under each end near the center and carefully pry it forward to release the locking tabs.
6. Remove the light bar from the back by removing its four Torx mounting capscrews from the front of the ICU4. The top two mounting capscrews also secure the trimtop to the cluster housing. See [Fig. 3](#).
7. Install the replacement light bar. Place it into the opening from the back and install its four Torx mounting capscrews from the front of the ICU4. The top two mounting capscrews also secure the trimtop to the cluster housing. Hold the trimtop so its mounting tabs are flush to the cluster, then secure the light bar. See [Fig. 3](#).
8. Install the light bar faceplate by placing it over the front of the light bar, then carefully press it on until its end tabs lock in place.
9. Connect the electrical harnesses to the back of the light bar; the 32-pin harness connector, the 24-pin harness connector, the two 6-pin databus harness connectors from the speedometer and tachometer, and the 3-pin auxiliary input harness connector, if so equipped. See [Fig. 2](#).
10. Install the fasteners that secure the cluster to the dash. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).
11. Install all remaining dash panels. Be sure to install the fasteners that attach the dash panel trimtop to the upper dash assembly and lower dash panel. For instructions, see [Section 60.08](#), Subject 100.
12. Turn on the ignition and test the operation of the ICU. All gauges controlled by the cluster sweep to full scale and return, the buzzer sounds for 3 seconds, the fasten seat belt warning light illuminates for 15 seconds, and the battery voltage, low air pressure and parking brake warning lights illuminate then turn off.

## Light Bar Replacement



**Fig. 2, Light Bar Connector Pin Locations (rear view)**

If any gauges are not working properly, see [Subject 300](#) for troubleshooting information.



Light Bar Replacement

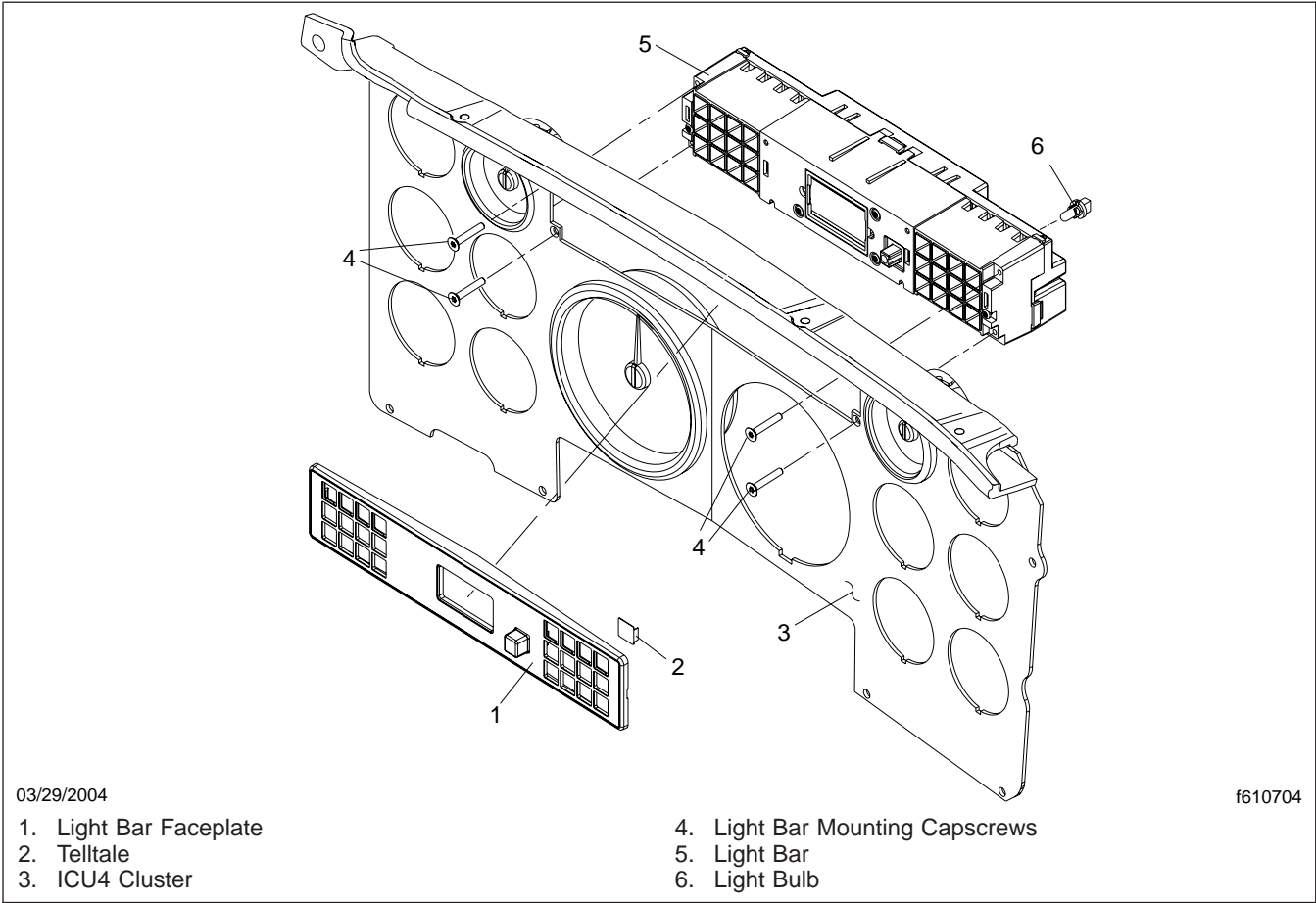


Fig. 3, Light Bar Replacement



## Light Bulb/Telltale Replacement

## Light Bulb Replacement

NOTE: Only the top row of warning and indicator lights have replaceable bulbs. The replaceable bulbs are incandescent. All lights in this row are optional, so not all positions may be in use. See the troubleshooting procedures in [Subject 300](#) to diagnose warning and indicator light problems and solutions.

1. Remove the left-hand dash panels. Be sure the screws attaching the dash panel trimtop to the upper dash assembly have been removed. For instructions, see [Section 60.08](#), Subject 100.
2. Remove the screw that attaches the dash panel trimtop to the lower dash panel. This screw is located on the far left of the trimtop.
3. Remove the fasteners that secure the driver's instrument panel. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).

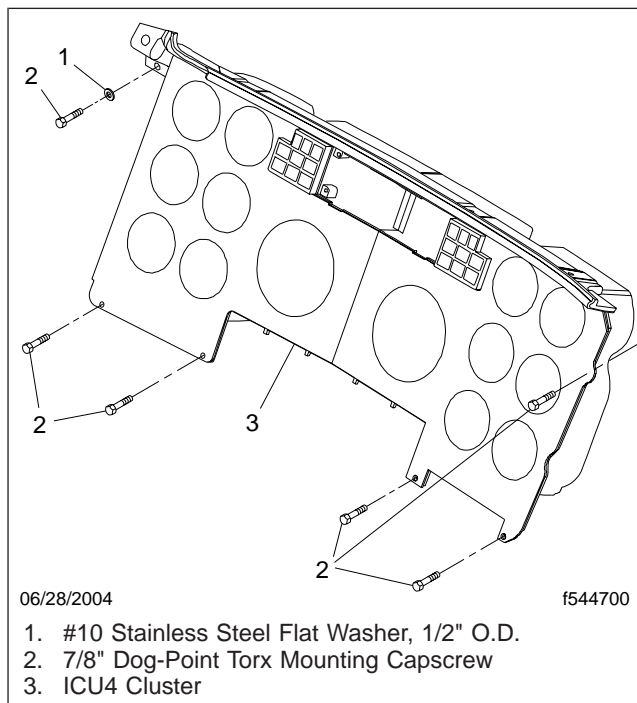


Fig. 1, ICU4 Dash Panel Installation

### CAUTION

Electronic components of the ICU are vulnerable to damage from static electricity. If available, wear a wrist grounding strap connected to a ground in the cab or workbench. If a grounding strap is not available, touch a grounded component immediately before doing any work which could bring a tool or body part in contact with ICU circuitry.

4. Carefully pull the dash panel forward to gain access to the light bar from behind the panel.
5. Twist the burned-out bulb about 1/8-turn counter-clockwise and pull it out from the back of the light bar. See [Fig. 2](#).
6. Insert a new bulb into the opening on the back of the light bar and twist it about 1/8-turn clockwise until it is securely in place.
7. Install the fasteners that secure the cluster to the dash. Fasteners used on the ICU4 are 7/8" Torx pan-head dog-point screws. See [Fig. 1](#).
8. Install all remaining dash panels. Be sure to install the fasteners that attach the dash panel trimtop to the upper dash assembly and lower dash panel. For instructions, see [Section 60.08](#), Subject 100.
9. Turn on the ignition and test the operation of the ICU. All gauges controlled by the cluster sweep to full scale and return, the buzzer sounds for 3 seconds, the fasten seat belt warning light illuminates for 15 seconds, and the battery voltage, low air pressure and parking brake warning lights illuminate then turn off.

If any gauges are not working properly, see [Subject 300](#) for troubleshooting information.

## Telltale Replacement

The term "telltale" refers to the small plastic lens in the top row of the light bar faceplate (dash message center) with a warning or indicator message printed on it. These are replaceable.

### CAUTION

Electronic components of the ICU are vulnerable to damage from static electricity. If available,

## Light Bulb/Telltale Replacement

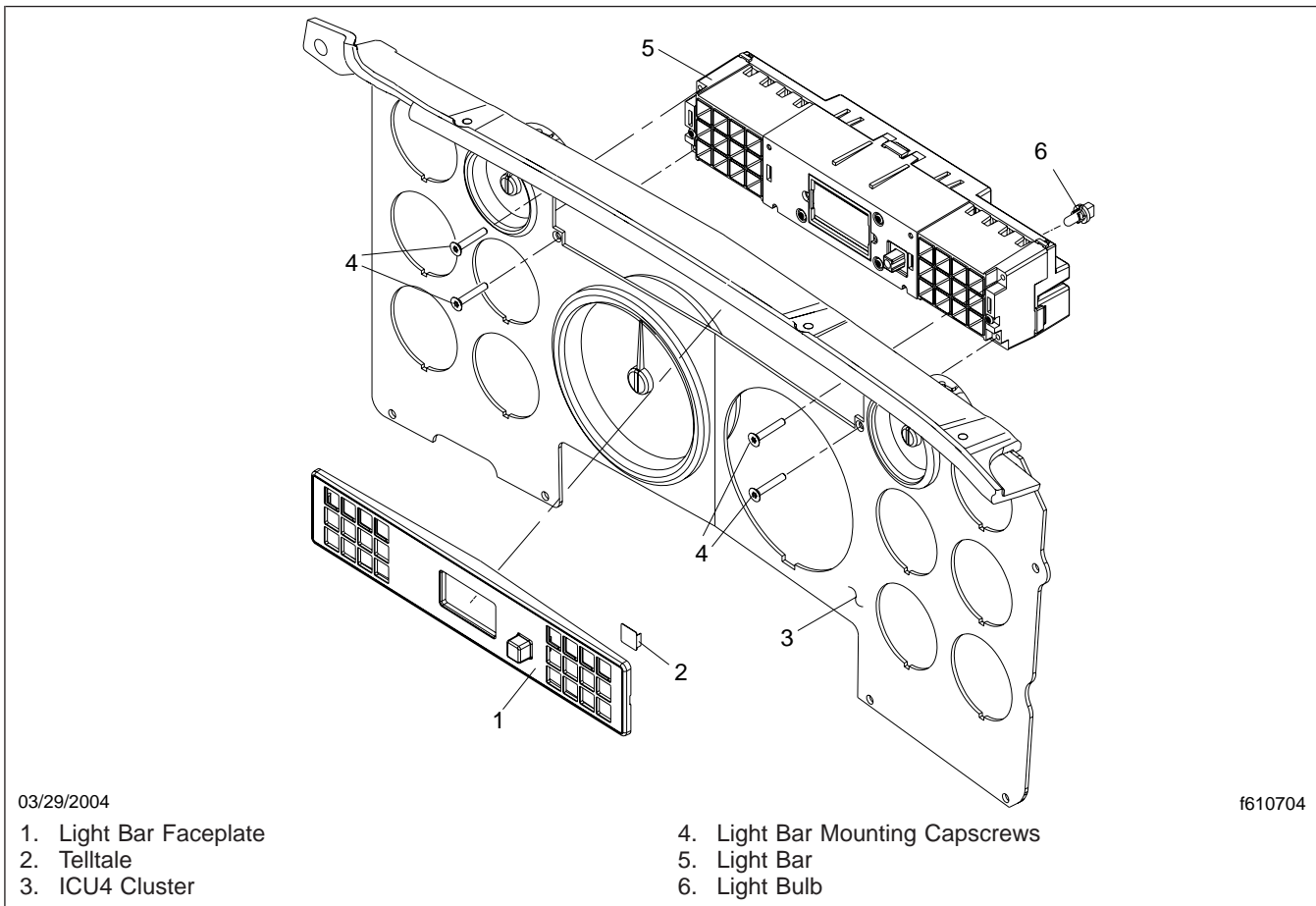


Fig. 2, ICU4 Light Bar Installation

**wear a wrist grounding strap connected to a ground in the cab or workbench. If a grounding strap is not available, touch a grounded component immediately before doing any work which could bring a tool or body part in contact with ICU circuitry.**

Turn on the ignition keyswitch. Check all bulbs and telltales for correct operation.

1. Place a flat blade under each end of the light bar faceplate and carefully pry it off the light bar.
2. Using a pair of needlenose pliers or a similar tool, grab the exposed tab along the side of the telltale slot and carefully slide the telltale out from the slot.
3. Place the replacement telltale in its correct slot the same way it was removed. Properly orient the telltale so the text is readable from the front, then slide the telltale into its slot.

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**Table 19** — Transmission Oil Temperature Sensor (Hi-Stat) Resistance, Standard Gauge (°F)

**Table 20** — Transmission Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge (°C)

**Table 21** — Axle Oil Temperature Sensor (Hi-Stat) Resistance, Standard Gauge (°F)

**Table 22** — Axle Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge (°C)

**Table 23** — Pyrometer Sensor (with voltage amplifier)

**Table 24** — InPower Hall-Effect Current Sensor (DCS25; ammeter sensor)

## | Troubleshooting

## General Information

The Ametek ICU4 replaced the Pollak ICU2L in production on June 7, 2004. The ICU4 consists of individual gauges, a light bar control unit, and a daisy-chain databus. See [Fig. 1](#). The light bar is the brain of the system. It contains the warning lamps as well as an LCD display. The light bar controls all of the individual gauges except the air pressure gauges. The light bar has two input types to drive the gauges: J1587 data from the engine ECM to control the databus-driven gauges, and direct-wired sensor input to control the other gauges. Each gauge has a unique address that the light bar communicates with.

J1587-driven gauges are the:

- speedometer
- tachometer
- oil pressure gauge
- coolant temperature gauge
- oil temperature gauge
- turbo boost pressure gauge
- voltmeter

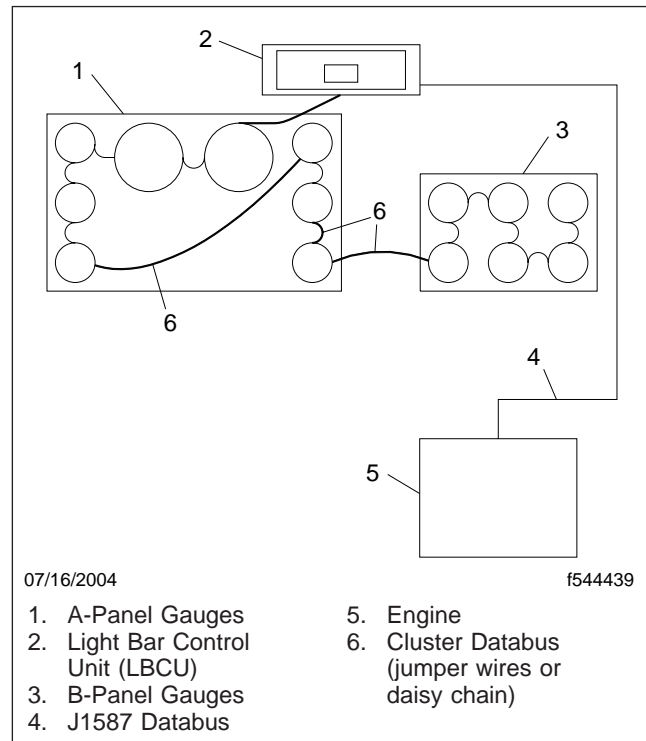
Other gauges are the:

- fuel level gauge
- primary air pressure gauge
- secondary air pressure gauge
- application air pressure gauge
- transmission temperature gauge
- forward-rear axle temperature gauge
- rear-rear axle temperature gauge
- pyrometer
- ammeter
- transmission gear display
- cruise control set speed display

## General Troubleshooting Procedure

For gauge problems do the following:

1. Check for ICU fault codes (MID 140) and address these first. See [Table 1](#) for MID 140 fault



**Fig. 1, Light Bar Control Unit Block Diagram**

code definitions and troubleshooting information. If this solves the problem, no further action is necessary. If the problem is still present, go to the next step.

2. Determine whether a single gauge or multiple gauges are malfunctioning. For a single gauge malfunction, see [Table 2](#). For multiple gauges malfunctioning, see [Table 3](#).

For gauge accuracy problems, see [Table 4](#).

For air pressure gauge problems, see [Table 5](#).

For light bar warning lamp problems, see [Table 6](#).

For in-gauge warning lamp problems, see [Table 7](#).

For backlighting problems, see [Table 8](#).

For a list of possible light bar LCD displayed roll call and power on messages, see [Table 9](#) and [Table 10](#).

## Fault Code Troubleshooting

This section defines fault codes that originate from the instrument cluster light bar (MID 140). Use [Table 1](#) to diagnose all MID 140 fault codes.



J1587 Fault Code Troubleshooting				
MID	PID/SID	FMI	Fault Code Description	Action
140	p168	1	Light bar voltage too low (less than 10.5 volts)	Check voltage supply to light bar. Repair as necessary.
140	s240	12	Light bar program memory failure	Replace the light bar.
140	s254	12	Light bar controller failure	Replace the light bar.

Table 1, J1587 Fault Code Troubleshooting

## Gauge Troubleshooting

The tables in this section detail specific troubleshooting procedures for gauge problems. Use [Table 2](#) for

diagnosing a single gauge that does not work. For multiple gauge failures, use [Table 3](#). For gauge inaccuracy problems, use [Table 4](#). Use [Table 5](#) to troubleshoot air pressure gauges.

Diagnosis for a Single Gauge Not Working			
Test No.	Test Description	Test Result	Action
1	Does the gauge sweep when the ignition is turned on?	Yes	Go to Test 4.
		No	Go to Test 2.
2	Is this particular gauge the last one in the chain from the light bar? (If so, it will be one of the gauges that has only one jumper wire connected to it.)	Yes	Go to Test 3.
		No	Replace the gauge.
3	Remove the jumper wire to this gauge and install a known good wire. Does the gauge now work?	Yes	Replace the jumper wire.
		No	Replace the gauge.
4	Is the gauge driven by direct sensor input to the light bar? (See <a href="#">Table 11</a> for gauge control strategy.)	Yes	If the gauge is just inaccurate, the sensor may be defective. See <a href="#">Table 4</a> for diagnosis.  If the gauge is not working, check the sender and sender wiring to the light bar. See <a href="#">Table 18</a> , <a href="#">Table 19</a> , <a href="#">Table 20</a> , <a href="#">Table 21</a> , <a href="#">Table 22</a> , <a href="#">Table 23</a> , and <a href="#">Table 24</a> for sender specifications.  If no problem is found with the sender or sender wiring, the light bar may be defective.
		No	Go to Test 5.
5	Connect ServiceLink to vehicle and open the Ametek ICU4 Instrument Cluster Datalink Monitor template. Does the gauge work on the template?	Yes	Replace the light bar.
		No	Check the sensor that drives gauge. It will usually be an input to the engine ECM. Repair as necessary.

Table 2, Diagnosis for a Single Gauge Not Working

Diagnosis for Multiple Gauges Not Working (databus-driven gauges)			
Test No.	Test Description	Test Result	Action
1	Do the affected gauges sweep when the ignition is turned on?	Yes	Go to Test 2.
		No	Go to Test 8.

### | Troubleshooting

Diagnosis for Multiple Gauges Not Working (databus-driven gauges)			
Test No.	Test Description	Test Result	Action
2	Are the only affected gauges sensor driven by direct input to the light bar (gauges not J1587 databus driven)?  See <b>Table 11</b> for gauge control strategy.	Yes	If the affected gauges are one or more of the following: transmission temp, ammeter, and axle temp #3, then check the common sensor ground that connects to pin C12. If okay, the light bar is probably faulty.  If the gauges above are not affected, then the light bar is probably faulty. Repair as necessary.
		No	Go to Test 3.
3	Are only J1587 driven gauges affected?  See <b>Table 11</b> for gauge control strategy.	Yes	Go to Test 4.
		No	Replace the light bar.
4	Connect PC to vehicle and start Servicelink. Will Servicelink connect?	Yes	Go to Test 5.
		No	Assuming Servicelink and the vehicle adapter are working correctly, the most likely cause is something taking the entire J1587 databus down (short, etc.). Repair as necessary.
5	In Servicelink, does the ICU4 show up in the ECU list (MID 140)?	Yes	Go to Test 6.
		No	Check the J1587 databus to the ICU. If okay, the light bar is probably faulty. Repair as necessary.
6	In Servicelink, does the engine ECM show up in the ECU list (MID 128)?	Yes	Go to Test 7.
		No	Check the J1587 databus to the engine ECM. If okay, the engine ECM is probably faulty. Repair as necessary.
7	In Servicelink, open the Ametek ICU4 Instrument Cluster Datalink Monitor template. Do the affected gauges work on the template?	Yes	Replace the light bar.
		No	The engine ECM sensor wiring or the engine ECM itself is probably faulty. Repair as necessary.
8	Do any of the gauges sweep when the ignition is turned on?	Yes	Go to Test 9.
		No	Check power and ground to the light bar. If okay, the light bar is probably faulty. Repair as necessary.
9	Are all of the affected gauges in sequence with one another on the daisy chain?	Yes	Go to Test 10.
		No	Replace the light bar.
10	Locate the faulty gauge that is closest to the light bar in the daisy chain. Replace the jumper wire between this gauge and the next gauge closest to the light bar that works (or the light bar itself). Do the gauges now work?	Yes	Replace the jumper wire.
		No	Replace the light bar.

**Table 3, Diagnosis for Multiple Gauges Not Working (databus-driven gauges)**

Diagnosis for Inaccurate Gauges			
Test No.	Test Description	Test Result	Action
1	Is the gauge controlled by the J1587 databus? See <a href="#">Table 11</a> to determine gauge control strategy.	Yes	Go to Test 2.
		No	Go to Test 3.
2	Using the Ametek ICU4 Instrument Cluster Datalink Monitor template within Servicelink, check if the template gauge reads the same as the cluster gauge. Does the template gauge read the same as the cluster gauge?	Yes	The gauge is okay. The sensor connected to the engine ECM may be faulty. See engine manufacturer's literature for troubleshooting information.
		No	Try a known good gauge. If this does not correct the problem, replace the light bar.
3	For sensor driven gauges, check if gauge sensor resistance or (voltage for ammeter, and early production pyrometers) matches the specified values for a given temperature (or amperage for ammeter). See <a href="#">Table 18</a> , <a href="#">Table 19</a> , <a href="#">Table 20</a> , <a href="#">Table 21</a> , <a href="#">Table 22</a> , <a href="#">Table 23</a> , and <a href="#">Table 24</a> .  NOTE: An accurate thermometer or ammeter will have to be used to determine appropriate sensor values.  Does the sensor resistance (or voltage for the ammeter, and early production pyrometers) match the published values?	Yes	Go to Test 4.
		No	Replace the sensor.
4	Repeat Test 3, except take the readings at the light bar connector (disconnect the connector). See <a href="#">Fig. 2</a> , and <a href="#">Table 14</a> and <a href="#">Table 15</a> . See <a href="#">Table 18</a> , <a href="#">Table 19</a> , <a href="#">Table 20</a> , <a href="#">Table 21</a> , <a href="#">Table 22</a> , <a href="#">Table 23</a> , and <a href="#">Table 24</a> for sensor values.  Does the sensor resistance (or voltage for the ammeter, and early production pyrometers) match the published values?	Yes	Try a known good gauge. If this does not correct the problem, replace the light bar.
		No	Repair sensor wiring as necessary.

Table 4, Diagnosis for Inaccurate Gauges

Air Pressure Gauge Diagnosis			
Test No.	Test Description	Test Result	Action
1	Which air pressure gauge is not functioning correctly?	Primary or secondary	Go to Test 2.
		Application	Go to Test 3.
		Suspension	Go to Test 4.

## Troubleshooting

Air Pressure Gauge Diagnosis			
Test No.	Test Description	Test Result	Action
2	Drain the air tanks. Connect an accurate pressure gauge to the primary or secondary air tank (whichever one corresponds with the problem gauge).	Yes	No problem found.
	Start the engine and build air pressure until the compressor cuts out. Is the air pressure gauge in the cluster within 6 psi (41 kPa) of the test gauge?	No	Check for kinked air lines to the gauge. If OK, replace the gauge.
3	Connect an accurate pressure gauge to a delivery port on the foot valve. Make a 90 psi (620 kPa) brake application while observing the application air pressure gauge in the cluster and the test gauge.	Yes	No problem found.
	Is the air pressure gauge in the cluster within 3 psi (21 kPa) of the test gauge?	No	Check for kinked air lines to the gauge. If OK, replace the gauge.
4	Connect an accurate pressure gauge to the air suspension. Is the air pressure gauge in the cluster within 3 psi (21 kPa) of the test gauge?	Yes	No problem found.
		No	Check for kinked air lines to the gauge.. If OK, replace the gauge.

Table 5, Air Pressure Gauge Diagnosis

## Warning Lamp Troubleshooting

Use [Table 6](#) to diagnose light bar warning lamp problems, and [Table 7](#) for in-gauge warning lamp problems.

Diagnosis for Warning Lamps in the Light Bar			
Test No.	Test Description	Test Result	Action
1	What is the problem with the warning lamp?	Stays on	Go to Test 8.
		Does not turn on	Go to Test 2.
2	Is the warning lamp one of the following? <ul style="list-style-type: none"> <li>• Park Brake/Brake Warning</li> <li>• Low Air Pressure</li> <li>• Low Battery Voltage</li> <li>• Fasten Seatbelt</li> </ul>	Yes	Go to Test 3.
		No	Go to Test 4.

Diagnosis for Warning Lamps in the Light Bar			
Test No.	Test Description	Test Result	Action
3	Does the warning lamp turn on when the ignition is turned on?	Yes	No problem found.
		No	Replace the light bar.
4	Is the warning lamp activated by a ground input or +12V input? See <a href="#">Table 12</a> .	12V activated	Go to Test 5.
		Ground activated	Go to Test 6.
5	<p>Disconnect the light bar connector that contains the circuit for the warning lamp that is not working (see <a href="#">Fig. 2</a>, and <a href="#">Table 14</a> and <a href="#">Table 15</a>).</p> <p>Turn the ignition on and activate the circuit that controls the warning lamp (for example, turn on the left turn signal for the left turn warning lamp). See <a href="#">Fig. 2</a>, and <a href="#">Table 14</a> and <a href="#">Table 15</a>.</p> <p>Check for voltage at the light bar connector pin that corresponds to that warning lamp. What is the voltage?</p> <p>NOTE: For turn signal circuits, the voltage will alternate between 12V and 0V.</p>	12V	Replace the light bar.
		0V	Check circuit that controls warning lamp and repair as necessary.
6	Is the warning lamp one of the optional warning lamps (top row of light bar)?	Yes	Check the bulb and replace if necessary. If the bulb is okay, go to Test 7.
		No	Go to Test 7.
7	<p>Locate the light bar connector and circuit that controls the warning lamp (see <a href="#">Fig. 2</a>, and <a href="#">Table 14</a> and <a href="#">Table 15</a>).</p> <p>Using a jumper to ground, backprobe the pin that corresponds to the problem warning lamp.</p> <p>Does the warning lamp turn on?</p>	Yes	Problem is in the circuit that controls the warning lamp, repair as necessary.
		No	Replace the light bar.
8	Is the warning lamp that stays on the Low Air Pressure warning lamp?	Yes	Go to Test 11.
		No	Go to Test 9.
9	Is the problem with the Low Battery Voltage warning lamp?	Yes	Within Servicelink, open the Ametek ICU4 Instrument Cluster Datalink Monitor template and start the engine. Check the voltmeter voltage on the template. If the voltage is below 11.9V, check and repair the vehicle charging system or power and ground circuits to the engine ECM. If the voltage is above 11.9V, replace the light bar.
		No	Go to Test 10.
10	Is the problem with the Fasten Seatbelt warning lamp?	Yes	If the Fasten Seatbelt warning lamp does not turn off approximately 15 seconds after the ignition is turned ON, then replace the light bar.
		No	Go to Test 12.

### | Troubleshooting

Diagnosis for Warning Lamps in the Light Bar			
Test No.	Test Description	Test Result	Action
11	Turn the ignition ON. Using a jumper to ground, backprobe pin A3 of the 24-pin light bar connector. Does the Low Air Pressure warning lamp turn off?	Yes	Either the air brake system pressure is too low or the problem is in the low air pressure warning circuit that controls the warning lamp. Repair as necessary.
		No	Replace the light bar.
12	Is the warning lamp activated by a ground input or +12V input? See <a href="#">Table 12</a> .	12V activated	Go to Test 13.
		Ground activated	Go to Test 14.
13	Disconnect the connector that contains the circuit for the warning lamp that stays on (see <a href="#">Fig. 2</a> , and <a href="#">Table 14</a> and <a href="#">Table 15</a> ). Turn the ignition ON. Check for voltage at the light bar connector pin that corresponds to the warning lamp. What is the voltage?	12V	The problem is not with the light bar. Check the system that controls the warning lamp for faults (the light may be on for a reason other than a faulty warning lamp circuit). Otherwise, check warning lamp circuit for short to power and repair as necessary.
		0V	Replace the light bar.
14	Disconnect the connector that contains the circuit for the warning lamp that stays on (see <a href="#">Fig. 2</a> , and <a href="#">Table 14</a> and <a href="#">Table 15</a> ). Turn the ignition ON. Check for voltage at the light bar connector pin that corresponds to the warning lamp by connecting the positive meter lead to battery (+) and the negative lead to the connector pin that corresponds to the warning lamp. What is the voltage?	12V	The problem is not with the light bar. Check the system that controls the warning lamp for faults (the light may be on for a reason other than a faulty warning lamp circuit). Otherwise, check warning lamp circuit for short to ground and repair as necessary.
		0V	Replace the light bar.

**Table 6, Diagnosis for Warning Lamps in the Light Bar**

Diagnosis for In-Gauge Warning Lamps			
Test No.	Test Description	Test Result	Action
1	Does the warning lamp illuminate during the ignition on gauge sweep?	Yes	Go to Test 2.
		No	Replace the gauge.
2	Is the problem with either one of the following gauge warning lamps? <ul style="list-style-type: none"> <li>• Low Oil Pressure</li> <li>• High Coolant Temperature</li> </ul>	Yes	Go to Test 3.
		No	Go to Test 5.



Diagnosis for In-Gauge Warning Lamps			
Test No.	Test Description	Test Result	Action
3	Is the problem that the warning lamp stays on?	Yes	Go to Test 4.
		No	The warning lamp is probably not illuminating because it is not receiving an active fault code from the engine ECM: <ul style="list-style-type: none"> <li>• 128 p100 01 (oil pressure too low)</li> <li>• 128 p110 00 (coolant temp too high)</li> </ul> If the appropriate code is active and the warning lamp does not work, then the light bar is probably faulty.
4	Check for either of the following engine fault codes: <ul style="list-style-type: none"> <li>• 128 p100 01 (oil pressure too low)</li> <li>• 128 p110 00 (coolant temp too high)</li> </ul> Are either of these faults active?	Yes	Check for a problem in the engine's lubrication or cooling system. Repair as necessary.
		No	Replace the light bar.
5	Is the problem with the High Transmission Temperature warning lamp?	Yes	Go to Test 6.
		No	Go to Test 9.
6	Is the problem that the warning lamp stays on?	Yes	Go to Test 8.
		No	Go to Test 7.
7	Using a jumper to ground, backprobe pin A4 of the 24-pin connector. Does the High Transmission Temperature warning lamp turn on?	Yes	The problem is in the circuit that controls the warning lamp. Repair as necessary.
		No	Replace the light bar.
8	Disconnect the 24-pin light bar connector. Turn the ignition ON. Check for voltage at the 24-pin light bar connector pin A4 by connecting the positive meter lead to battery (+) and the negative lead to pin A4.	12V	The problem is not with the light bar. Check the transmission for faults (the light may be on for a reason other than a faulty warning lamp circuit). Otherwise, check warning lamp circuit for short to ground and repair as necessary.
		0V	Replace the light bar.
9	Is the problem that the Low Fuel Level warning lamp stays on?	Yes	Go to Test 10.
		No	Go to Test 11.
10	Does the fuel gauge read below 1/8?	Yes	Normal condition; no further action is necessary.
		No	Replace the light bar.
11	Does the fuel gauge read below 1/8?	Yes	Replace the light bar.
		No	The warning lamp should not turn on until the fuel level is 1/8 or less for at least 60 seconds. No problem found.

Table 7, Diagnosis for In-Gauge Warning Lamps

### | Troubleshooting

### Backlighting Troubleshooting

For backlighting problems, see [Table 8](#).

NOTE: The backlighting signal to the light bar is a pulse-width-modulated (PWM) signal at approximately 320 Hz.

Backlighting Troubleshooting (gauges and light bar)			
Test No.	Test Description	Test Result	Action
1	Does any of the backlighting work (i.e. panel switches, etc.)?	Yes	Go to Test 2.
		No	Check the panel lamp dimmer switch, and panel lighting circuit. Repair as necessary.
2	Is all the cluster backlighting dead (light bar LCD and all gauges)?	Yes	Go to Test 3.
		No	Go to Test 5.
3	Disconnect the light bar 24-pin connector (see <a href="#">Fig. 2</a> ). Turn the headlamps ON, and the panel lamp dimmer switch to full bright. Measure the voltage at connector pin A1; it should be approximately +12V. What is the voltage?	12V	Go to Test 4.
		0V	Check backlighting circuit 29A for open between the instrument cluster and splice to other dash components. Repair as necessary.
4	Disconnect both the light bar 24-pin and 32-pin connectors (see <a href="#">Fig. 2</a> ). Turn the headlamps ON, and the panel lamp dimmer switch to full bright. Measure the voltage between pin A1 (24-pin connector) and pin D3 (32-pin connector). What is the voltage?	12V	Replace the light bar.
		0V	Check panel lamp ground circuit. Repair as necessary.
5	Is the light bar LCD backlighting the only thing with dead backlighting?	Yes	Replace the light bar.
		No	Go to Test 6.
6	Is only one gauge backlight dead?	Yes	Go to Test 7.
		No	Go to Test 8.
7	Is the gauge with dead backlighting the last gauge in the daisy chain (farthest from the light bar)?	Yes	Try a known good jumper wire to the gauge. If backlight now works on this gauge, this solved the problem. If the backlighting still does not work, replace the gauge.
		No	Replace the gauge.
8	Are all the gauges with dead backlighting in sequence with one another in the daisy-chain?	Yes	Try a known good jumper wire between the gauge with dead backlighting that is closest to the light bar and the next good gauge (one closer to light bar). If all backlighting now works, the jumper solved the problem. If not, replace all gauges with dead backlighting.
		No	Go to Test 9.

Backlighting Troubleshooting (gauges and light bar)			
Test No.	Test Description	Test Result	Action
9	Is one of the dead gauges the last gauge in the daisy-chain (farthest from the light bar)?	Yes	Try a known good jumper to the last gauge. If the last gauge now works, the jumper solved the problem to this gauge. Replace all other gauges with dead backlighting.  If the jumper did not correct the backlighting to the last gauge in the daisy-chain, replace all gauges with dead backlighting.
		No	Replace all gauges with dead backlighting.

Table 8, Backlighting Troubleshooting (gauges and light bar)

## Light Bar LCD Display Fault Messages

possible roll call faults and [Table 10](#) lists possible power on fault messages. Roll call faults are ECUs that do not respond during power up.

This section defines possible fault messages displayed on the light bar LCD display. [Table 9](#) lists

Roll Call Faults (displayed on the LCD display)	
Displayed Message	Description
NO ENG	The ICU is unable to communicate with the engine ECM on the J1587 databus. Check databus wiring, repair as necessary.
NO ABS	The ICU is unable to communicate with the ABS on the J1587 databus. Check databus wiring, repair as necessary.
NO DATA	The light bar is not communicating with the J1587 databus.

Table 9, Roll Call Faults (displayed on the LCD display)

Display Messages After Power-On Sweep			
Message	System With Active Fault	Message	System With Active Fault
ICU 140	Instrumentation Control Unit (ICU4)	TCU 130	Transmission Control Unit
AC 146	Air Conditioning system (front unit)	TSU 223	Transmission Shift Unit
ECU 128	Engine Control Unit (engine ECM)	AC 200	Air Conditioning system (rear unit)
ABS 136	Anti-lock Brake System	SBU 232	Seat Belt Unit (SPACE/Airbag system)
CDU 219	Collision Detection Unit (VORAD)	SYS ###	Generic—system not defined in this table.
SAT 181	Satellite communications (Qualcomm)	—	—

Table 10, Display Messages After Power-On Sweep

## Gauge Control Strategy

This section defines how each individual gauge, standard or optional, is controlled. Some gauges are

J1587 databus-driven, meaning the information is sent to the instrument cluster from the engine ECM. Other gauges are controlled by a sensor wired directly to the instrument cluster light bar. [Table 11](#)

## | Troubleshooting

identifies each standard and optional gauge, and its method of control.

Standard and Optional Gauges—Input Types		
Gauge	Input Type to Light Bar to Drive Gauge	Standard/Optional
Speedometer	J1587 databus—from engine (MID 128)	Standard
Engine Coolant Temperature	J1587 databus—from engine (MID 128)	Standard
Engine Oil Pressure	J1587 databus—from engine (MID 128)	Standard
Fuel Level	Sensor input	Standard
Tachometer	J1587 databus—from engine (MID 128)	Standard
Voltmeter	J1587 databus—from engine (MID 128)	Standard
Primary Air System Pressure	NA—air line is connected directly to gauge	Standard
Secondary Air System Pressure	NA—air line is connected directly to gauge	Standard
Transmission Oil Temperature	Sensor input	Optional
Forward Rear Axle Temp	Sensor input	Optional
Rear Rear Axle Temp	Sensor input	Optional
Engine Oil Temperature	J1587 databus—from engine (MID 128)	Optional
Turbo Boost Pressure	J1587 databus—from engine (MID 128)	Optional
Pyrometer	Sensor input*	Optional
Application Air Pressure	NA—air line is connected directly to gauge	Optional
Suspension Air Pressure	NA—air line is connected directly to gauge	Optional
Ammeter	Sensor input	Optional
















\* Pyrometer sensors used in initial production use a voltage amplifier and supply a voltage input to the light bar.

**Table 11, Standard and Optional Gauges—Input Types**



## Warning Lamp Control Strategy

This section defines how each individual warning is controlled. Not all warning lamps are standard. Some in-gauge warning lamps are J1587 databus-driven, meaning the information is sent to the instrument cluster from the engine ECM (see [Table 13](#)). The light bar warning lamps are controlled directly by a hardwire to the instrument cluster light bar (see [Table 12](#)). Other warning lamps are controlled by decisions made by the light bar (see [Table 12](#) and [Table 13](#)).

NOTE: In [Table 12](#), the warning lamps that are indicated as having a bulb check after the ignition is turned on are controlled by the light bar. Other direct-wired warning lamps may have a bulb check that is controlled by the device they are connected to (e.g. the engine ECM). These externally controlled bulb checks are not indicated in [Table 12](#).

Light Bar Warning Lamp Control						
Warning Lamp	Legend	Bulb Check	Buzzer Operation	Power Source	Warning Lamp Operation/Control	Control Pin
Left Turn Signal		—	—	12V external	12V (activates)	C8
Right Turn Signal		—	—	12V external	12V (activates)	D8
Highbeam		—	—	12V external	12V (activates)	A12
Park Brake/ Brake System Warning		Yes	When vehicle is moving over 2 mph with brake set.	12V Ign (internal)	Ground (activates)	C5
Low Air Pressure		Yes	Coincides with operation of this warning lamp	12V Ign (internal)	Ground (deactivates)	A3
Low Battery Voltage		Yes	—	Internal	Controlled by light bar. If light bar receives battery voltage message from the engine less than 11.9V, the warning lamp will illuminate.	NA
Fasten Seat Belt		Yes	—	Internal	Controlled by light bar. On for approximately 15 sec after ignition is turned on.	NA
Check Engine		No*	—	12V Ign (internal)	Ground (activates)	C15
Engine Protection		No*	—	12V Ign (internal)	Ground (activates)	C16
Tractor ABS		No*	—	12V Ign (internal)	Ground (activates)	B11
Trailer ABS		No*	—	12V Ign (internal)	Ground (activates)	D12
Check Trans		No*	—	12V Ign (internal)	Ground (activates)	D10
Water in Fuel		No*	—	12V Ign (internal)	Ground (activates)	C10
Intake Heater		No*	—	12V Ign (internal)	Ground (activates)	A5
No Charge		No	—	12V Ign (internal)	Ground (activates)	A9

## | Troubleshooting

Light Bar Warning Lamp Control						
Warning Lamp	Legend	Bulb Check	Buzzer Operation	Power Source	Warning Lamp Operation/Control	Control Pin
Optimized Idle		No	—	12V Ign (internal)	Ground (activates)	C1
Opt. #1 (Stop Engine)		No*	—	12V Ign (internal)	Ground (activates)	C14
Opt. #2	—	No	—	12V Batt (internal)	Ground (activates)	A6
Opt. #3	—	No	—	12V Ign (internal)	Ground (activates)	A7
Opt. #4	—	No	—	12V Ign (internal)	Ground (activates)	A8
Opt. #5	—	No	—	12V Ign (internal)	Ground (activates)	B1
Opt. #6	—	No	—	12V Ign (internal)	Ground (activates)	A2
Opt. #7	—	No	—	12V Ign (internal)	Ground (activates)	C11
Opt. #8	—	No	—	12V (external)	12V (activates)	D4

\* Bulb check is not controlled by the lightbar. The controlling device (engine, ABS, transmission, etc.) may perform a bulb check.

**Table 12, Light Bar Warning Lamp Control**

Gauge Warning Lamp Control (warning lamps in gauge)				
Gauge Warning Lamp	Gauge	Bulb Check	Warning Lamp/Buzzer Operation	Warning Lamp/Buzzer Control
Low Oil Pressure	Oil Pressure	Yes	Warning lamp and buzzer will remain on for a minimum of 30 seconds and will stay on as long as the fault remains active.	Light bar controls this gauge warning lamp when the engine sends low oil pressure fault MID 128, PID 100, FMI 01.
High Coolant Temperature	Engine Coolant Temperature	Yes	Warning lamp and buzzer will remain on for a minimum of 30 seconds and will stay on as long as the fault remains active.	Light bar controls this gauge warning lamp when the engine sends high coolant temperature fault MID 128, PID 110, FMI 00.
High Transmission Temperature	Transmission Temperature	Yes	On when input to light bar is grounded.	Ground activated from hard wire input to light bar pin A4.
Low Fuel Level	Fuel Level	Yes	The light bar turns this warning lamp on if the fuel level is less than 1/8 of a tank for at least 60 seconds.	Light bar compares fuel level sensor input to programmed resistance values to determine when to illuminate this warning lamp.

**Table 13, Gauge Warning Lamp Control (warning lamps in gauge)**

## Pin and Circuit Descriptions

See [Fig. 2](#) for a rear view of the light bar, showing connector pin locations. See [Table 14](#) for 24-pin connector pin descriptions, [Table 15](#) for 32-pin connec-

tor pin descriptions, [Table 16](#) for 6-pin gauge data-bus connector pin descriptions, and [Table 17](#) for 3-pin light bar auxiliary input connector pin descriptions.

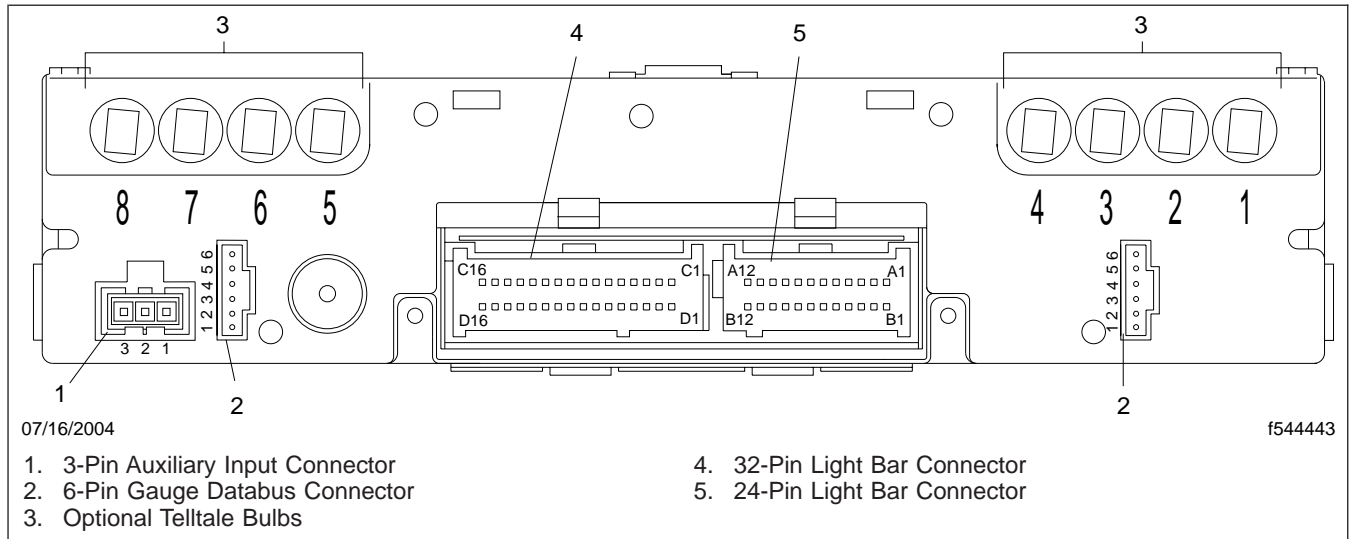


Fig. 2, Light Bar Connector Pin Locations (rear view)

24-Pin Light Bar Connector Pin Descriptions			
Pin	Description	Pin	Description
A1	(+) Panel Backlight Power (PWM)*	B1	Optional Warning Lamp # 5—ground activated
A2	Optional Warning Lamp # 6—ground activated	B2	(+) Rear Rear Axle Temp Sensor
A3	Low Air Pressure Warning Lamp—ground activated	B3	J1587 databus (-)
A4	High Trans Temp Warning Lamp—ground activated	B4	(-) Rear Rear Axle Temp Sensor
A5	Intake Heater Warning Lamp—ground activated	B5	—
A6	Optional Warning Lamp #2—ground activated	B6	—
A7	Optional Warning Lamp #3—ground activated	B7	—
A8	Optional Warning Lamp #4—ground activated	B8	—
A9	No Charge Warning Lamp—ground activated	B9	—
A10	(+) Forward Rear Axle Temp Sensor	B10	J1587 databus (+)
A11	(-) Forward Rear Axle Temp Sensor	B11	Tractor ABS Warning Lamp—ground activated
A12	High Beam Warning Lamp—12V activated	B12	Optional Buzzer Input—ground activated

\* PWM = Pulse Width Modulation

Table 14, 24-Pin Light Bar Connector Pin Descriptions

32-Pin Light Bar Connector Pin Descriptions			
Pin	Description	Pin	Description
C1	Optimized Idle Warning Lamp—ground activated	D1	(+) Fuel level Sensor
C2	Opt. Low Current Output (gnd)—Starter Lockout	D2	(-) Fuel level Sensor



## | Troubleshooting

32-Pin Light Bar Connector Pin Descriptions			
Pin	Description	Pin	Description
C3	Opt. Low Current Output (gnd)—Key Illumination	D3	(-) Panel Backlight Ground
C4	Opt. 12V Input (Door Open)*	D4	Optional Warning Lamp # 8—12V activated
C5	Park Brake Warning Lamp—ground activated	D5	—
C6	(+) Pyrometer	D6	(-) Pyrometer
C7	—	D7	—
C8	Left Turn Warning Lamp—12V activated	D8	Right Turn Warning Lamp—12V activated
C9	—	D9	—
C10	Water In Fuel Warning Lamp—ground activated	D10	Check Trans Warning Lamp—ground activated
C11	Optional Warning Lamp #7—ground activated	D11	—
C12	(-) Sensor common (trans temp, axle #3 temp, ammeter)	D12	Trailer ABS Warning Lamp—ground activated
C13	(+) Transmission Oil Temp	D13	Ground
C14	Optional Warning Lamp #1—ground activated	D14	(+) Battery Power
C15	Check Engine Warning Lamp—ground activated	D15	(+) Ignition Power
C16	Engine Protection Warning Lamp—ground activated	D16	(+) Headlamp Power Input 12V—used to control LCD brightness

\* Pin C4 (door open input) is used for the Door Open/Park Brake Not Set chime. If the park brake is off, and the door is open, then the light bar will sound a chime.

**Table 15, 32-Pin Light Bar Connector Pin Descriptions**

6-Pin Gauge Databus Connector Pin Descriptions		
Pin	Description	Jumper Wire Color
1	(+) Gauge Power	Blue
2	(-) Gauge Ground	Green
3	Gauge Databus (+)	Black
4	Gauge Databus (-)	Violet
5	Gauge Backlighting (-)	Red
6	Gauge Backlighting (+)	Yellow

**Table 16, 6-Pin Gauge Databus Connector Pin Descriptions**

3-Pin Light Bar Auxiliary Input Connector Pin Descriptions	
Pin	Description
1	(+) Ammeter Input, 0.5 to 4.5V from ammeter sender
2	(+) Axle #3 Temperature Input

3-Pin Light Bar Auxiliary Input Connector Pin Descriptions	
Pin	Description
3	—

**Table 17, 3-Pin Light Bar Auxiliary Input Connector Pin Descriptions**

## Sensor Specifications

Fuel Level Sensor Resistance (Stewart-Warner)		
Gauge Reading	Sensor Resistance (Ohms)	
	Acceptable Range	Nominal
Empty Stop	244.0 to 249.0	246.5
Empty	232.0 to 239.2	235.6
1/8	190.8 to 196.9	193.8
1/4	149.6 to 154.5	152.1
3/8	126.1 to 129.0	127.5
1/2	102.5 to 103.5	103

Fuel Level Sensor Resistance (Stewart-Warner)		
Gauge Reading	Sensor Resistance (Ohms)	
	Acceptable Range	Nominal
5/8	84.4 to 85.7	85
3/4	66.2 to 67.8	67
7/8	47.8 to 49.2	48.5
Full	29.4 to 30.6	30

Table 18, Fuel Level Sensor Resistance (Stewart-Warner)

NOTE: If the fuel level sender is below the minimum resistance (short to ground) or above the maximum (open), the fuel gauge will read empty. Shorting the sender wires **will not** test the gauge circuit.

Transmission Oil Temperature Sensor (Hi-Stat) Resistance, Standard Gauge (°F)	
Gauge Temperature (°F)	Sensor Resistance (Ohms)
110	4752
150	2079
190	991
230	510
270	285
310	167
350	102

Table 19, Transmission Oil Temperature Sensor (Hi-Stat) Resistance, Standard Gauge

Figure 3 — Transmission Oil Temperature Sensor Resistance (°F)

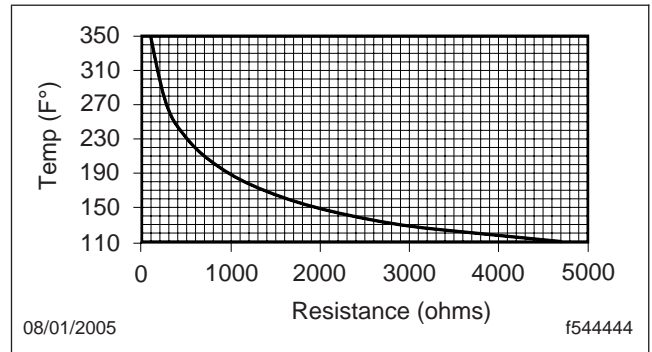


Fig. 3, Transmission Oil Temperature Sensor Resistance (°F)

Transmission Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge (°C)	
Gauge Temperature (°C)	Sensor Resistance (Ohms)
60	2490
80	1255
100	680
120	390
140	234
160	145
180	95

Table 20, Transmission Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge

Figure 4 — Transmission Oil Temperature Sensor Resistance (°C)

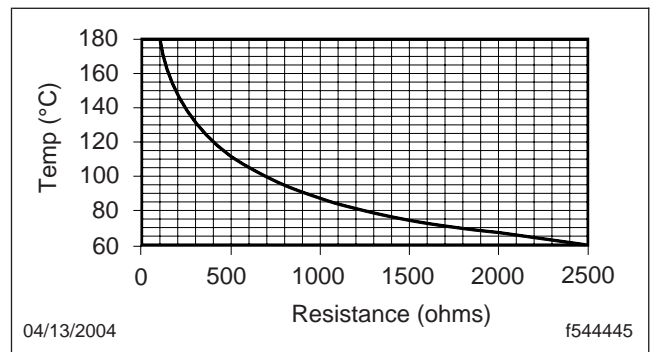


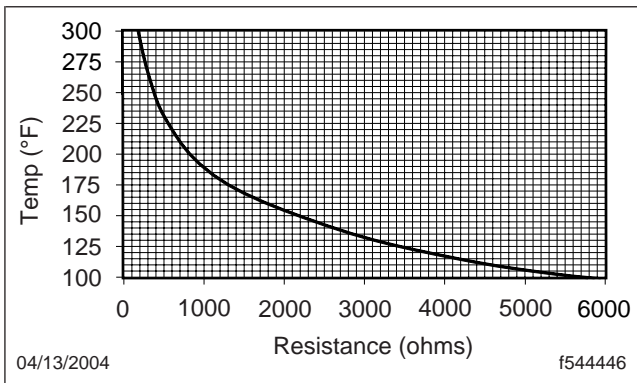
Fig. 4, Transmission Oil Temperature Sensor Resistance (°C)

### Troubleshooting

Axle Oil Temperature Sensor (Hi-Stat) Resistance, Standard Gauge (°F)	
Gauge Temperature (°F)	Sensor Resistance (Ohms)
100	5933
125	3419
150	2079
175	1283
200	837
225	557
250	380
275	267
300	190

**Table 21, Axle Oil Temperature Sensor (Hi-Stat) Resistance, Standard Gauge**

**Figure 5** — Axle Oil Temperature Sensor Resistance (°F)



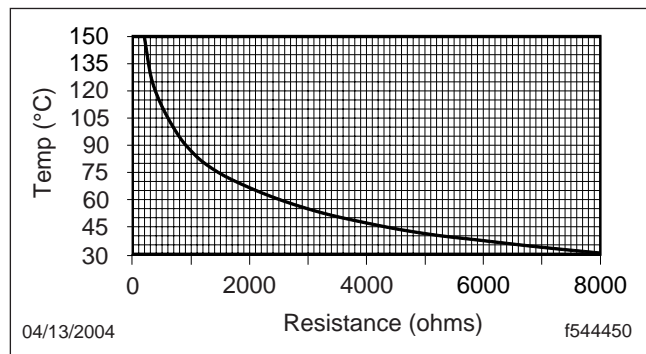
**Fig. 5, Axle Oil Temperature Sensor Resistance (°F)**

Axle Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge (°C)	
Gauge Temperature (°C)	Sensor Resistance (Ohms)
30	8060
45	4465
60	2490
75	1503
90	915
105	595
120	390
135	267

Axle Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge (°C)	
Gauge Temperature (°C)	Sensor Resistance (Ohms)
150	185

**Table 22, Axle Oil Temperature Sensor (Hi-Stat) Resistance, Metric Gauge**

**Figure 6** — Axle Oil Temperature Sensor Resistance (°C)



**Fig. 6, Axle Oil Temperature Sensor Resistance (°C)**

Pyrometer sensors used on initial production use a voltage amplifier. This amplifier supplies a voltage signal (0.45V to 6.7V) to the instrument cluster.

Pyrometer Sensor (with voltage amplifier)		
Thermocouple Temperature (°F)	Input (millivolts)	Output (Volts)
300	5.0	0.46
360	6.4	0.75
420	7.6	1.05
480	9.0	1.35
540	10.4	1.66
600	11.9	1.96
660	13.2	2.28
720	14.6	2.59
780	16.2	2.90
840	17.6	3.22
900	18.8	3.54
960	20.3	3.85
1020	21.8	4.17
1080	23.2	4.48

Pyrometer Sensor (with voltage amplifier)		
Thermocouple Temperature (°F)	Input (millivolts)	Output (Volts)
1140	24.5	4.81
1200	25.9	5.12
1260	27.3	5.44
1320	28.6	5.75
1380	30.0	6.06
1440	31.5	6.37
1500	32.8	6.68

Table 23, Pyrometer Sensor (with voltage amplifier)

InPower Hall-Effect Current Sensor (DCS25; ammeter sensor)	
Amps (Gauge)	Sensor Output (Volts)
-300	0.5
-100	1.833
-75	2.0
-50	2.166
-25	2.333
0	2.5
25	2.666
50	2.833
75	3.0
100	3.166
300	4.5

Table 24, InPower Hall-Effect Current Sensor (DCS25; ammeter sensor)

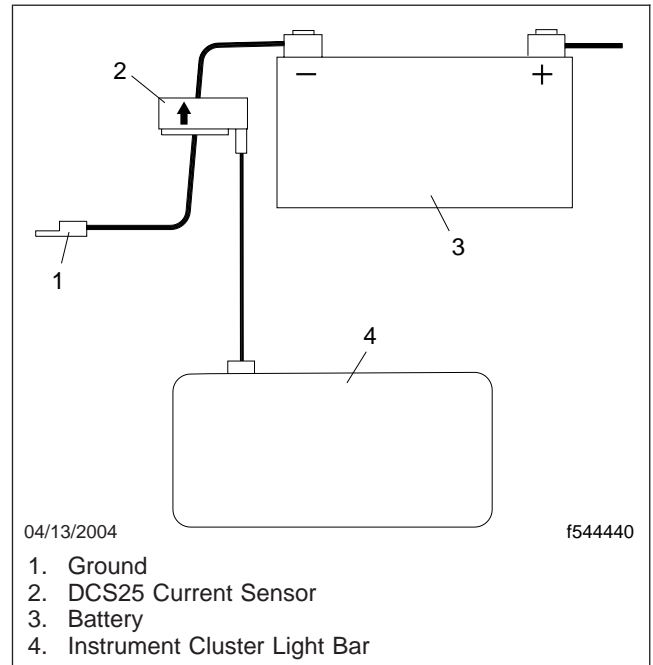


Fig. 7, Ammeter Current Sensor Wiring Diagram (InPower)

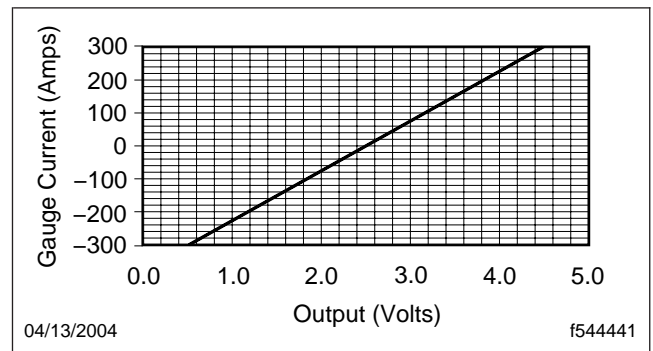


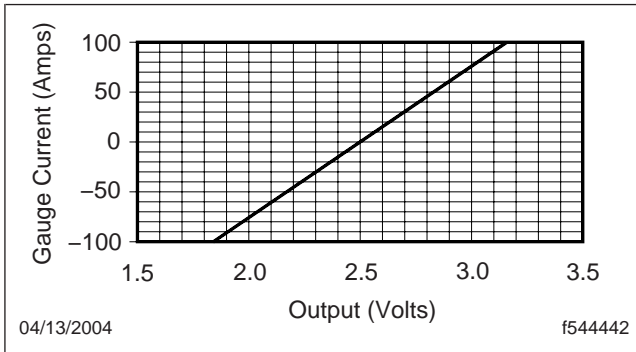
Fig. 8, Ammeter Current Sensor Output Voltage (-300 to +300 Amp Range)

**Figure 7** — Ammeter Current Sensor Wiring Diagram (InPower)

**Figure 8** — Ammeter Current Sensor Output Voltage (-300 to +300 Amp Range)

**Figure 9** — Ammeter Current Sensor Output Voltage (-100 to +100 Amp Range)

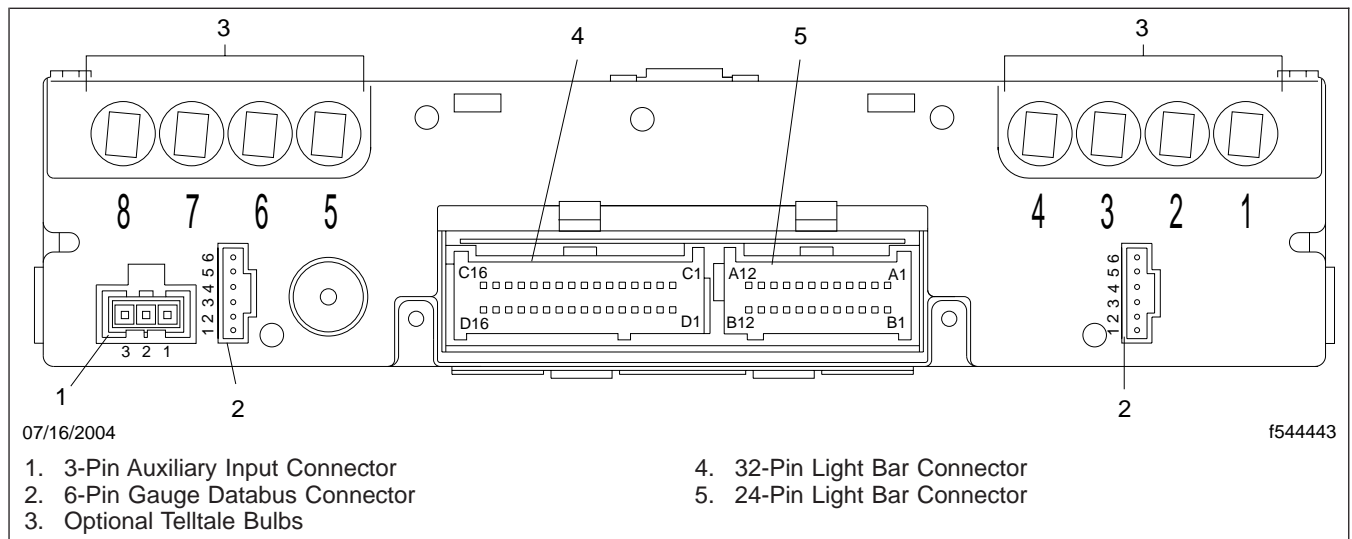
### | Troubleshooting



**Fig. 9, Ammeter Current Sensor Output Voltage (-100 to +100 Amp Range)**

## Pin and Circuit Descriptions

See **Fig. 1** for a rear view of the light bar, showing connector pin locations. See **Table 1** for 24-pin connector pin descriptions, **Table 2** for 32-pin connector pin descriptions, **Table 3** for 6-pin gauge databus connector pin descriptions, and **Table 4** for 3-pin light bar auxiliary input connector pin descriptions.



**Fig. 1, Light Bar Connector Pin Locations (rear view)**

24-Pin Light Bar Connector Pin Descriptions			
Pin	Description	Pin	Description
A1	(+) Panel Backlight Power (PWM)*	B1	Optional Warning Lamp # 5—ground activated
A2	Optional Warning Lamp # 6—ground activated	B2	(+) Rear Rear Axle Temp Sensor
A3	Low Air Pressure Warning Lamp—ground activated	B3	J1587 databus (-)
A4	High Trans Temp Warning Lamp—ground activated	B4	(-) Rear Rear Axle Temp Sensor
A5	Intake Heater Warning Lamp—ground activated	B5	—
A6	Optional Warning Lamp #2—ground activated	B6	—
A7	Optional Warning Lamp #3—ground activated	B7	—
A8	Optional Warning Lamp #4—ground activated	B8	—
A9	No Charge Warning Lamp—ground activated	B9	—
A10	(+) Forward Rear Axle Temp Sensor	B10	J1587 databus (+)
A11	(-) Forward Rear Axle Temp Sensor	B11	Tractor ABS Warning Lamp—ground activated

## Specifications

24-Pin Light Bar Connector Pin Descriptions			
Pin	Description	Pin	Description
A12	High Beam Warning Lamp—12V activated	B12	Optional Buzzer Input—ground activated

\* PWM = Pulse Width Modulation

**Table 1, 24-Pin Light Bar Connector Pin Descriptions**

32-Pin Light Bar Connector Pin Descriptions			
Pin	Description	Pin	Description
C1	Optimized Idle Warning Lamp—ground activated	D1	(+) Fuel level Sensor
C2	Opt. Low Current Output (gnd)—Starter Lockout	D2	(-) Fuel level Sensor
C3	Opt. Low Current Output (gnd)—Key Illumination	D3	(-) Panel Backlight Ground
C4	Opt. 12V Input (Door Open)*	D4	Optional Warning Lamp # 8—12V activated
C5	Park Brake Warning Lamp—ground activated	D5	—
C6	(+) Pyrometer	D6	(-) Pyrometer
C7	—	D7	—
C8	Left Turn Warning Lamp—12V activated	D8	Right Turn Warning Lamp—12V activated
C9	—	D9	—
C10	Water In Fuel Warning Lamp—ground activated	D10	Check Trans Warning Lamp—ground activated
C11	Optional Warning Lamp #7—ground activated	D11	—
C12	(-) Sensor common (trans temp, axle #3 temp, ammeter)	D12	Trailer ABS Warning Lamp—ground activated
C13	(+) Transmission Oil Temp	D13	Ground
C14	Optional Warning Lamp #1—ground activated	D14	(+) Battery Power
C15	Check Engine Warning Lamp—ground activated	D15	(+) Ignition Power
C16	Engine Protection Warning Lamp—ground activated	D16	(+) Headlamp Power Input 12V—used to control LCD brightness

\* Pin C4 (door open input) is used for the Door Open/Park Brake Not Set chime. If the park brake is off, and the door is open, then the light bar will sound a chime.

**Table 2, 32-Pin Light Bar Connector Pin Descriptions**

6-Pin Gauge Databus Connector Pin Descriptions		
Pin	Description	Jumper Wire Color
1	(+) Gauge Power	Blue
2	(-) Gauge Ground	Green
3	Gauge Databus (+)	Black
4	Gauge Databus (-)	Violet
5	Gauge Backlighting (-)	Red

6-Pin Gauge Databus Connector Pin Descriptions		
Pin	Description	Jumper Wire Color
6	Gauge Backlighting (+)	Yellow

**Table 3, 6-Pin Gauge Databus Connector Pin Descriptions**



3-Pin Light Bar Auxiliary Input Connector Pin Descriptions	
Pin	Description
1	(+) Ammeter Input, 0.5 to 4.5V from ammeter sender
2	(+) Axle #3 Temperature Input
3	—

**Table 4, 3-Pin Light Bar Auxiliary Input Connector Pin Descriptions**



## General Information

The mode/reset switch controls the display of the odometer, trip miles and hours, engine miles and hours, service cycle screens, fault code screens, and oil level screens (on some Mercedes engines; if equipped and enabled).

Push the switch to scroll through mode selections, and hold the switch to reset trip miles or hours while they are displayed. See [Fig. 1](#). With the parking brake released, only the odometer, trip miles, and trip hours can be accessed. Park the vehicle and set the parking brake to access additional screen functions. See [Fig. 2](#) and [Fig. 3](#).

## Trip Miles, Trip Hours

When the odometer is displayed, push the mode/reset switch once to display trip distance. Push it again to display trip hours. Both numbers are calculated from the last time the value was reset. Hold the switch when each number is displayed to reset trip miles or hours to zero.

## Diagnostic Screens

During vehicle start-up, with the parking brake on, the ICU4 displays any active fault codes for three seconds each until the parking brake is released. With active fault codes on display, push the mode/reset switch once to display the initial diagnostic screen (DIAG) and the total number of active faults. If service cycle screens are enabled, and service distance or time has been exceeded, the text SERVICE will be displayed with the other fault messages. This will inform the vehicle operator that the service interval has been exceeded and vehicle service is required.

Specific fault code information can be displayed only with the vehicle parked and the parking brake set. If the odometer screen is displayed, push the mode/reset switch until the DIAG screen is displayed, then hold the switch to enter the fault code screen sequence. Once the initial fault code is displayed, push the switch to cycle through additional diagnostic codes relating to the first fault. Hold the switch to display additional faults or return to the DIAG screen. If service cycle screens are enabled, service interval information is displayed before fault code information is displayed.

If the word SERVICE appears on the DIAG message display screen, service cycle screens are enabled. Hold the mode/reset switch at the DIAG screen to display miles or hours remaining until the next scheduled service. If MI appears on the DIAG screen, service miles are enabled; if HOURS appears on the screen, service hours are enabled. Either service miles or hours can be enabled, but not both. If service miles or hours has been exceeded, the number flashes to indicate service is overdue.

## Engine Screens

Push the mode/reset switch once following the DIAG screen and the word ENGINE is displayed in the lower right corner of the digital display. Hold the switch to display total engine miles. Hold it again to display total engine hours. If OIL LVL is displayed earlier with ENGINE (on Mercedes vehicles only; if equipped and enabled) hold the switch again to access oil level screens.

## Oil Level Screens (optional)

If OIL LVL is displayed with ENGINE, hold the switch twice to display total engine miles and total engine hours, respectively, then hold again to access oil level screens.

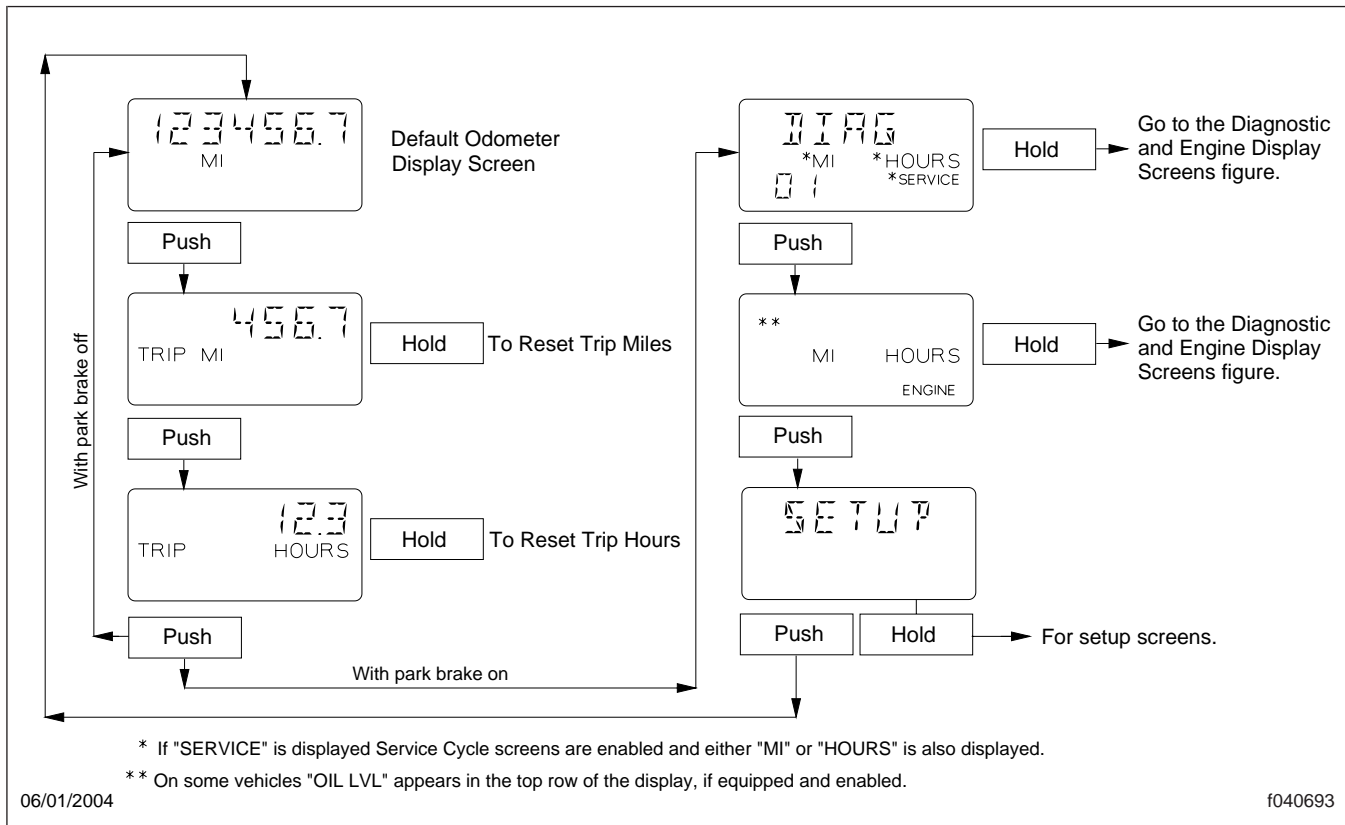
The display will read OIL OK, or it will display OIL LVL and indicate in the lower left hand corner of the display whether the level is high (HI) or low (Lo). Hold the switch again to display the amount, in quarts (QTS) or liters (LTS), by which the oil level is high or low. If the oil level is low or OK the amount will be displayed with a minus sign in front of it (-). If the oil level is high the amount will be displayed as a whole number. If the oil level is OK, the level will display -0 QTS (quarts) or -0 LTS (liters).

The maximum range of quarts or liters too low or high is from -9 to 9.

Hold the button again to return to the OIL LVL/ENGINE screen, or push the button to go to the SETUP screen.

If the engine oil level message is not received from the engine for 25 seconds, the text Lo, HI, or blank displays as hyphens (- -) while the OIL LVL text appears on the display. The hyphens indicate that the engine oil level message communication was received at one time, but now has a problem. The en-

## Mode/Reset Switch Functions



**Fig. 1, Mode/Reset Switch Basic Functions**

engine oil amount screen will not be displayed if the oil level message is not received.

To change units of measure between quarts and liters, go to the the SETUP display screen, hold the switch to advance to the SELECT screen, then hold again to toggle between MI (miles) and KM (kilometers). When set to miles the oil level amount screens will display the unit of measure in quarts (U.S. customary). When set to kilometers the amount screens will display liters (metric).

## Setup Screens

Setup screens allow the technician to:

- Change between U.S. customary and metric units
- Turn the LCD display lamp on and off
- Set a service interval to miles or hours, or turn it off

- Reset service interval counters
- Set service interval values

See [Fig. 3](#) for a flowchart of the setup screens.

## Service Interval Tables

For service interval miles look-up values, see [Table 1](#).

For service interval hours look-up values, see [Table 2](#).

Mode/Reset Switch Functions

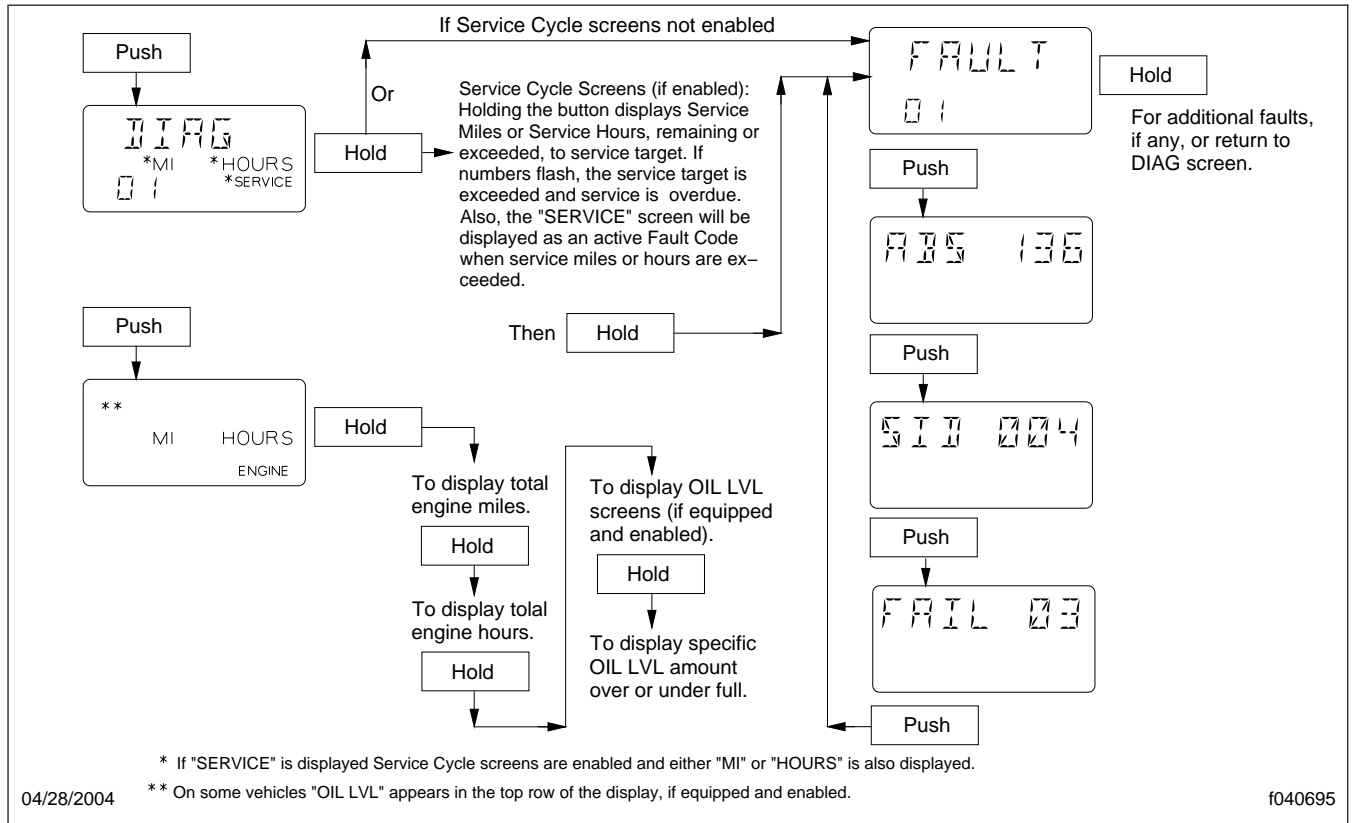


Fig. 2, Mode/Reset Switch Diagnostic and Engine Display Screens

Service Interval Distance Settings		
Number	Miles	Kilometers
1	1000	1610
2	1500	2415
3	2000	3220
4	2500	4025
5	3000	4830
6	3500	5635
7	4000	6440
8	4500	7245
9	5000	8050
10	5500	8855
11	6000	9660
12	6500	10465
13	7000	11270
14	7500	12075

Service Interval Distance Settings		
Number	Miles	Kilometers
15	8000	12880
16	8500	13685
17	9000	14490
18	9500	15295
19	10000	16100
20	11000	17710
21	12000	19320
22	13000	20930
23	14000	22540
24	15000	24150
25	16000	25760
26	17000	27370
27	18000	28980
28	19000	30590

| **Mode/Reset Switch Functions**

<b>Service Interval Distance Settings</b>		
<b>Number</b>	<b>Miles</b>	<b>Kilometers</b>
29	20000	32200
30	21000	33810
31	22000	35420
32	23000	37030
33	24000	38640
34	25000	40250

| **Table 1, Service Interval Distance Settings**

<b>Service Interval Hours Settings</b>	
<b>Number</b>	<b>Hours</b>
1	50
2	75
3	100
4	125
5	150
6	175
7	200
8	225
9	250
10	300
11	350
12	400
13	450
14	500
15	550
16	600
17	650
18	700
19	750
20	800
21	850
22	900
23	950
24	1000

| **Table 2, Service Interval Hours Settings**

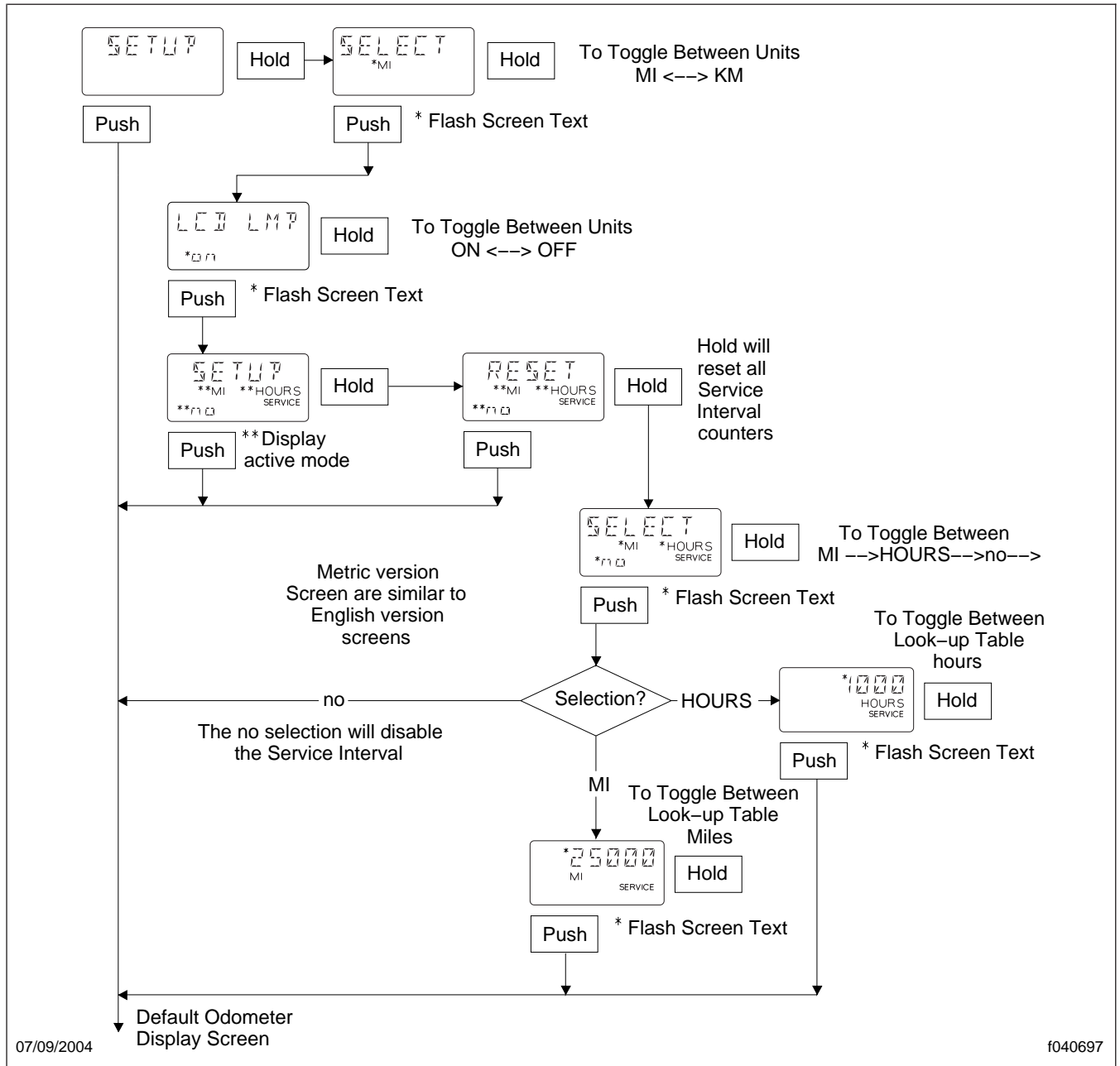


Fig. 3, Mode/Reset Switch Setup Screens



