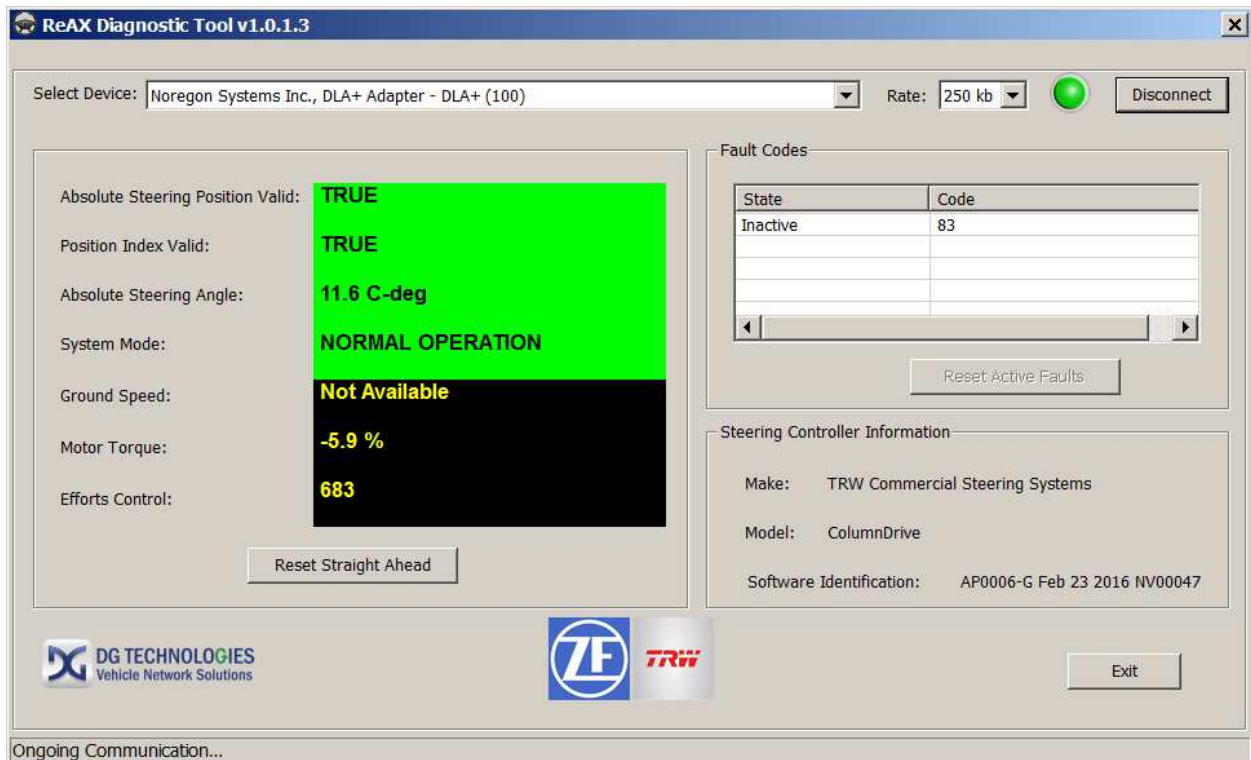


TRW Commercial Steering Diagnostic Tool

Ver. 1.0.1.3



Valid software versions:

- AP0004-I
- AP0004-M
- AP0004-N
- AP0004-R
- AP0006-A
- AP0006-B
- AP0006-E
- AP0006-F
- AP0006-G
- AP9001-A

May 23, 2016

The TRW Torque Overlay Diagnostic Tool is intended to assist a service technician answer the following questions:

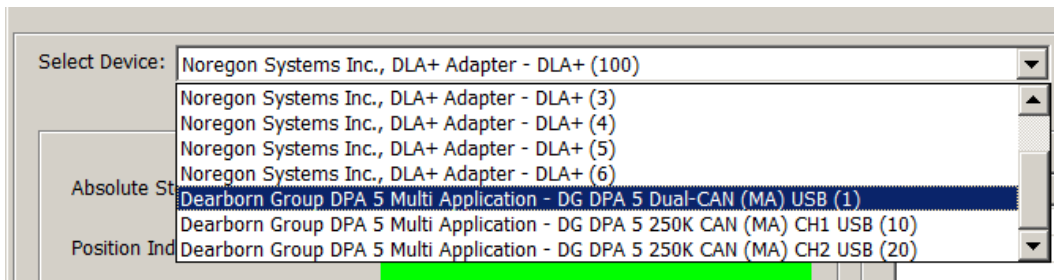
1. Is it wired correctly?
2. Is it operating correctly?
3. Is it installed correctly?
4. Is it calibrated correctly?
5. Are the right messages being sent from the vehicle?

In this document, partial screens will be shown to emphasize the information being discussed.

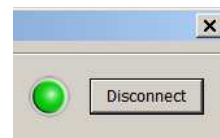
To use the tool, plug your J1939 hardware adapter into your computer and the vehicle diagnostic port.

Start the engine and set the wheels to straight ahead. If the steering wheel was moved more than 90 degrees, stop the engine, wait a few seconds, and restart it. When you turn the ignition on or off, you should hear a definite 'click' from the motor of the ColumnDrive.

Start the tool and select the appropriate hardware adapter from the list of those available on your Windows 7 computer. This program expects you to already have other J1939 diagnostic tools installed so it uses those RP1210A-compatible drivers.

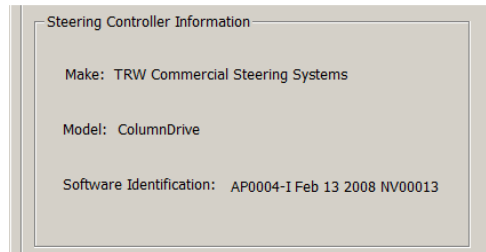


Select the correct communications rate then click 'Connect' to start communication. The tool must be reconnected every time the ignition is turned back on. Click 'Disconnect' if necessary then 'Connect' to restore a broken connection. Note that it is the same button.



1. Is it wired correctly?

To find out if the ColumnDrive is wired correctly, look at the lower right corner of the screen for the Steering Controller Information.



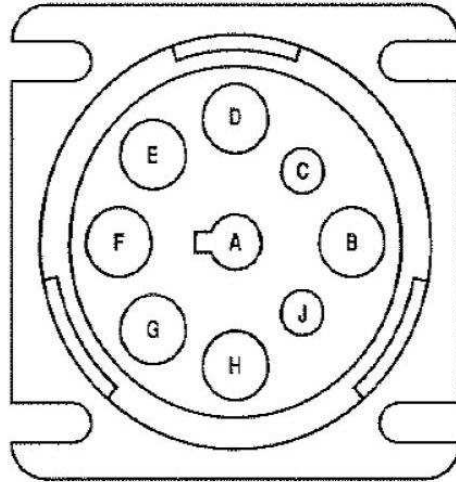
The software identification may be different than shown, depending on the specific settings required by your vehicle.

If this information does not appear, the ColumnDrive is not responding to this tool so the power, ignition, and J1939 wiring must be checked against the OEM wiring instructions. If those are all operating correctly, the column is apparently burned out and must be replaced.

(figures 1-4 here)

| Pin No. | Signal Name | Wire Color | Item | Notes |
|----------------|-------------|-------------------|-------------------------------------|---|
| 1 | V_IGN | Determined by OEM | Ignition switch status input | High requests ColumnDrive power-up. Low requests ColumnDrive power-down. |
| 2, 3, 4, 9, 10 | N/A | N/A | Not used | |
| 5, 7 | CAN_L_BUS | Determined by OEM | CAN low drive interface to vehicle | J1939 CAN network connected. Duplicated CAN pin-out allows for CAN termination components. |
| 6, 8 | CAN_H_BUS | | CAN high drive interface to vehicle | |

| Pin No. | Signal Name | Typical Wire Color | Item | Notes |
|---------|-------------|--------------------|---|---|
| A | VBATT | Red | Positive battery supply to ColumnDrive system | Suitable fuse required at battery (40A when limited to 10 Nm) |
| B | Gnd | Black | Negative battery return to ColumnDrive system | |



| Pin No. | Signal Name |
|------------|----------------|
| A | Battery Ground |
| B | Battery Power |
| C | CAN_H_BUS |
| D | CAN_L_BUS |
| E | Shield |
| F, G, H, J | N/A |

2. Is it operating correctly?

At ignition on after reconnecting the battery, both Absolute Steering Position Valid and Position Index Valid will be false, the Absolute Steering Angle measurement will read zero, and the system should be in normal operation.

| | |
|-----------------------------------|------------------|
| Absolute Steering Position Valid: | FALSE |
| Position Index Valid: | FALSE |
| Absolute Steering Angle: | 0.0 C-deg |
| System Mode: | NORMAL OPERATION |

Moving the steering wheel across straight ahead a few times should make both the Absolute Steering Position Valid and Position Index Valid measurements go true and the Absolute Steering Angle measurement go live. At this point in the diagnosis, that measurement has not yet been proven to be accurate.

| | |
|-----------------------------------|------------------|
| Absolute Steering Position Valid: | TRUE |
| Position Index Valid: | TRUE |
| Absolute Steering Angle: | 1.7 C-deg |
| System Mode: | NORMAL OPERATION |

If the battery has not been disconnected since the last time the ColumnDrive was functioning, Absolute Steering Position Valid will be true and the Absolute Steering Angle measurement will be live when the ignition is turned on, with no movement of the steering wheel necessary.

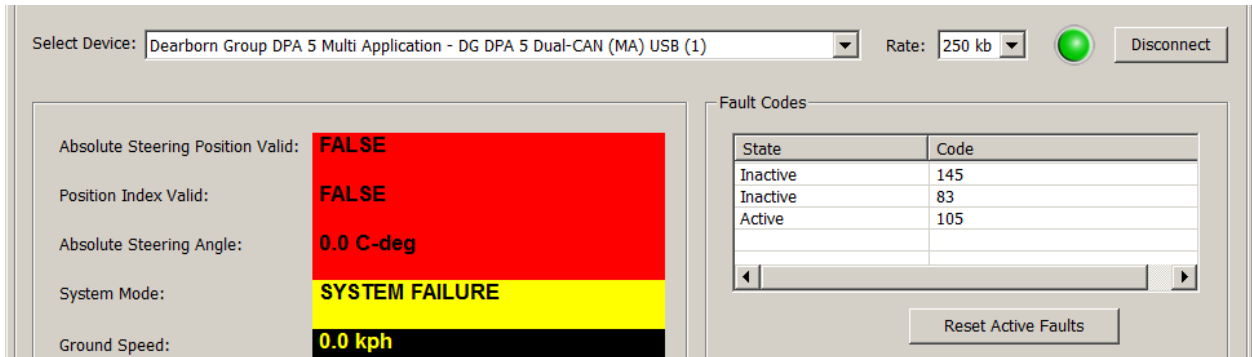
| | |
|-----------------------------------|------------------|
| Absolute Steering Position Valid: | TRUE |
| Position Index Valid: | FALSE |
| Absolute Steering Angle: | 2.0 C-deg |
| System Mode: | NORMAL OPERATION |

When the Absolute Steering Angle measurement becomes live, the ColumnDrive is operating normally.

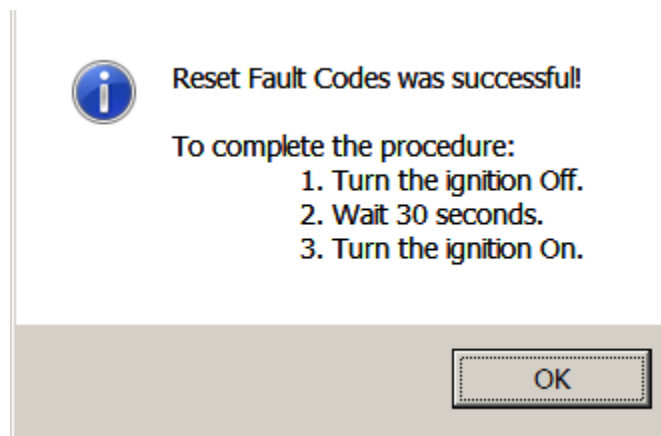
Four conditions are known to exist that cause a ColumnDrive to appear inoperable.

Condition 1:

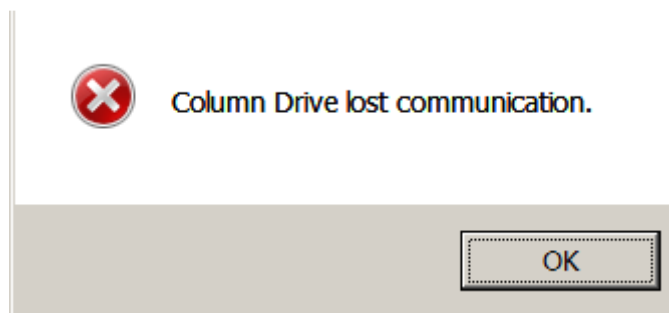
The ColumnDrive will be inoperable if it has detected an internal fault. Most internal faults will be inactivated by turning off the engine then restarting it but code 105 is one of the few that will not self-reset. Code 105 is set when there are too many other faults too often. Active faults will prevent normal operation but for diagnostic purposes, both active and inactive faults are displayed in the upper right part of the screen.



If any internal fault is active, it may be deactivated by clicking 'Reset Active Faults'. When the reset process is completed, this prompt will appear.



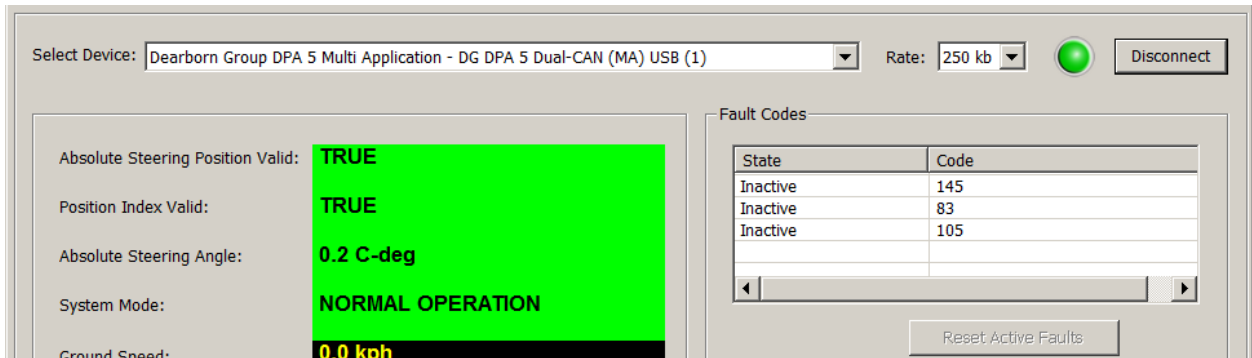
Click 'OK', disconnect the diagnostic program and turn off the ignition for 30 seconds. When you turn the ignition off, you will get the following message:



Click 'OK' to clear the message. After about 30 seconds, restart the engine and reconnect the program.



The active fault should now appear inactive and the system will operate normally.

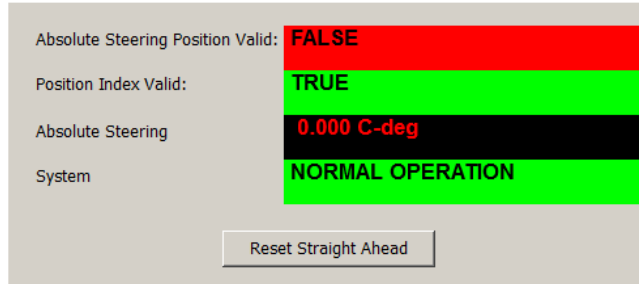


If the fault was temporary, it will remain cleared and normal operation will be restored but if it was a hard fault, it will reappear and the column must be replaced.

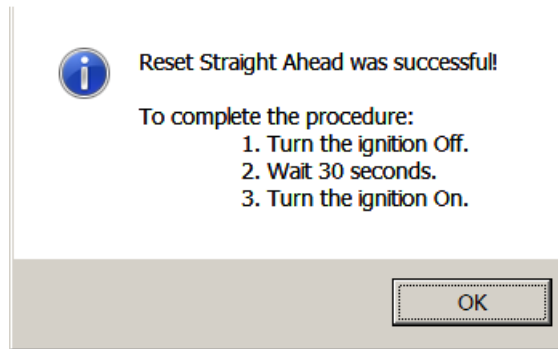
Most faults will clear themselves by turning the ignition off and then back on, which easily clears intermittent faults. If the ratio of faults to successful trips exceeds 3:18, fault 105 occurs, making the unit inoperable until this tool resets it. This tool does not repair whatever damage initially caused the fault, though. If faults continue to occur, the column must be replaced, regardless of the fault code, because there are no repairable parts inside it.

Condition 2:

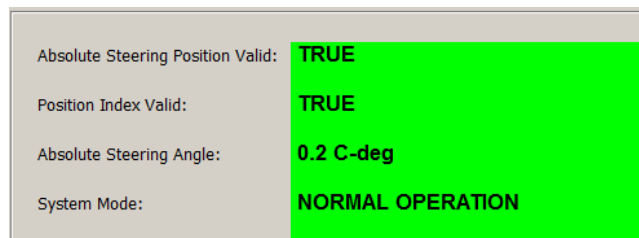
The ColumnDrive will be inoperable as long as Absolute Steering Position Valid remains false. If Position Index Valid is true but Absolute Steering Position Valid remains false after the procedure on page 5, turn the steering wheel to the known straight ahead position and click 'Reset Straight Ahead'. Position Index Valid must be true and the vehicle must not be moving for this to work.



You will then be prompted to complete the reset process.

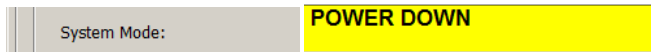
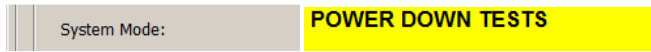
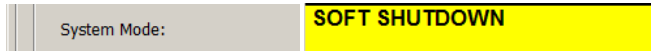


Normal operation should be restored. If you wish to check it with this tool, you must reconnect this diagnostic tool as has already been discussed.

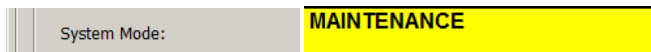


Condition 3:

The ColumnDrive will be inoperable if it is in some system mode other than normal operation. This happens during the normal power up and power down cycles but can also happen if it gets into Maintenance mode, usually caused by a diagnostic tool for some other component.

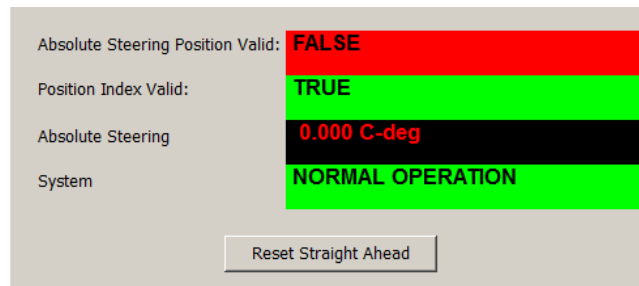


All power up and power down conditions should be temporary, clearing at the end of the cycle.

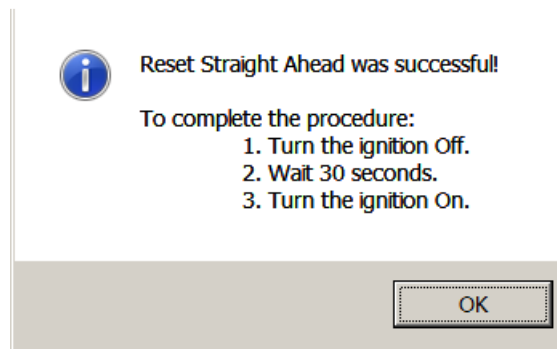


If the ColumnDrive gets into Maintenance,

The ColumnDrive will be inoperable as long as Absolute Steering Position Valid remains false. If Absolute Steering Position Valid remains false after the procedure on page 3, turn the steering wheel to the known straight ahead position and click 'Reset Straight Ahead'. Position Index Valid must be true and the vehicle must not be moving for this to work.



You will then be prompted to complete the reset process.



Normal operation should be restored. If you wish to check it with this tool, you must reconnect this diagnostic tool as has already been discussed.

| | |
|-----------------------------------|-------------------------|
| Absolute Steering Position Valid: | TRUE |
| Position Index Valid: | TRUE |
| Absolute Steering Angle: | 0.2 C-deg |
| System Mode: | NORMAL OPERATION |

Condition 4:

The ColumnDrive will appear to be inoperable if the hydraulic steering system is not providing sufficient torque to steer the vehicle.

| | |
|---------------|----------------|
| Motor Torque: | 100.0 % |
|---------------|----------------|

If the vehicle is hard to steer but the motor torque is 100%, the problem is in the hydraulic system. Please use the normal hydraulic troubleshooting tools and techniques to solve this issue.

3. Is it installed correctly?

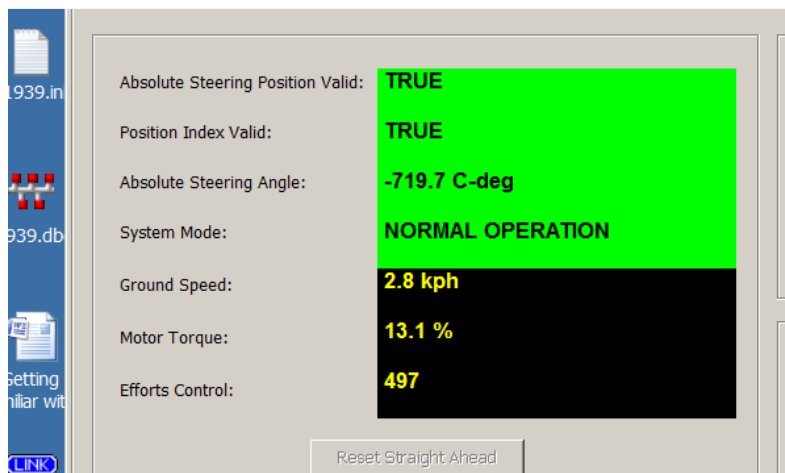
To determine if the ColumnDrive is installed correctly, start the engine, connect the tool, and watch the Position Index Valid value as you slowly turn the steering wheel back and forth within about 90 degrees of straight ahead. It will be false between the time the ignition is first turned on and the steering wheel is moved across the position index.



If the ColumnDrive is installed perfectly, the Position Index Valid value will turn true within 5 degrees of the actual straight ahead of the vehicle.



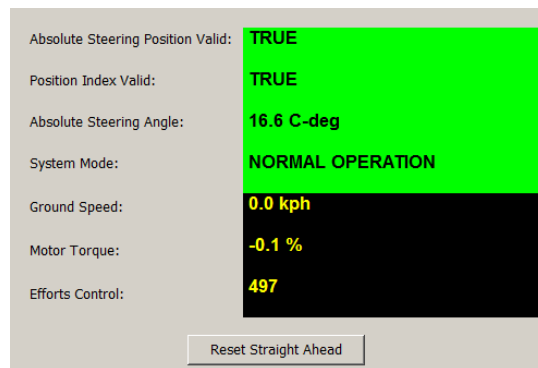
If the Absolute Steering Angle is reading somewhere close to 720 degrees in either direction when the steering wheel and road wheels are straight, the ColumnDrive has been started with the steering wheel two turns off-center. To test this, drive in a straight line at low speed or otherwise insure the road wheels and steering wheel are at straight ahead.



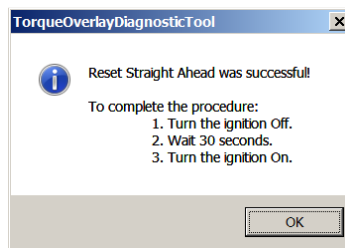
1. Steer to each end of travel then back to the real straight ahead position, which should clear the erroneous center and force the Absolute Steering Position Valid to be false.
2. Follow the instructions for on page 8 above.

4. Is it calibrated correctly?

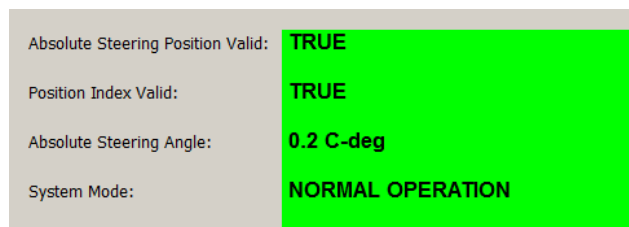
The only calibration required is for the Absolute Steering Angle measurement to be zero when the vehicle is at straight ahead. This is supposed to be an inevitable result of a correct installation, but this tool can check and rezero the measurement if necessary. To test it, drive the vehicle in a straight line, holding the steering wheel against a pull if necessary. The Absolute Steering Angle measurement should then read close to zero while driving straight. In this example, the system is off by 16.6 degrees CW. If the error is in the range of 5 to 30 degrees in either direction, stop the vehicle, hold the steering wheel at the position required to drive in a straight line, and click the Reset Straight Ahead control.



You will then be prompted to complete the process.



Calibrated operation should be restored. If you wish to check it with this tool, you must reconnect the program as has already been discussed.



4. Are the right messages being sent from the vehicle?

While not part of the ColumnDrive itself, tests for the required J1939 messages are provided in this tool to aid overall installation and diagnostics.

Ground speed:

The ColumnDrive requires J1939 message PGN 65265 for ground speed in order to provide speed-proportional handwheel efforts.

Correct readings:

A screenshot of a digital display. On the left, the text "Ground Speed:" is shown in a light gray box. To its right, the value "0.0 kph" is displayed in yellow text on a black background.

When standing still, the Ground Speed measurement should read 0.0 kph.

A screenshot of a digital display. On the left, the text "Ground Speed:" is shown in a light gray box. To its right, the value "17.8 kph" is displayed in yellow text on a black background.

When moving, the Ground Speed measurement should read the correct speed. Note that speed is measured in kph. If your speedometer is calibrated only in mph, the conversion is 1.6 kph = 1.0 mph.

Incorrect readings:

If the message is missing, the measurement will read Not Available. The handwheel efforts will be too heavy at low speed and too light at highway speed. The cure for this is to find out why the message is missing, using the diagnostic tools for the controller sending the message.

If multiple controllers are sending conflicting speed values, the measurement will flicker and cause erratic steering efforts. The cure for this is to resolve the conflict.

Driver-controllable high-speed efforts:

An optional ColumnDrive feature in some vehicles is for the driver to be able to make the system feel heavier or lighter at high speed at his discretion. This control has no effect while standing still. If the option is enabled, the Efforts Control measurement from J1939 message 65530 is displayed.

Correct readings:



The value should be within the range of 101 to 921.

Incorrect readings:

Values larger than 940 or smaller than 75 will cause the ColumnDrive to assume a failure of the external device and operate with a constant value of 512. This will make the driver's control ineffective. The cure for this condition is to repair the controller that is making the faulty message.



If the ColumnDrive expects the message but it is missing, the displayed measurement will read 'Not Available'. The cure for this is to discover why the controller that is supposed to generate this message is not doing its job using the diagnostic procedure for that device.

To leave the diagnostic program, click 'Disconnect' then 'Exit'.

