

TRW Automotive Commercial Steering Systems

Service Procedure # CDV-101

TRW ColumnDrive Troubleshooting Guide

March, 2009

NOTE

Take appropriate safety measures before beginning this procedure.

This TRW Commercial Steering Systems' service procedure has been written to help you repair commercial vehicles more efficiently. This procedure should not replace your manuals; you should use them together. These materials are intended for use by properly trained, professional mechanics, NOT "Do-ityourselfers". You should not try to diagnose or repair steering problems unless you have been trained, and have the right equipment, tools and know-how to perform the work correctly and safely.

ColumnDrive Steering System

The steering system consists of the conventional hydraulic power steering gear system connected to a computer controlled device at the bottom of the steering column, called ColumnDrive that guarantees optimum overall performance such as:

- low steering efforts during static steer maneuvers
- higher steering efforts while driving down the highway (proportional to speed)
- consistent steering efforts or "feel" at a given position of the steering wheel
- excellent reversibility from any turn angle at any vehicle speed while going forward or backward
- "pull compensation" to avoid the tiresome task of holding the steering wheel in to a side wind or against the crown of the road.

Possible complaints from the field:

- Hard steering won't turn, locks-up, shuts-down, hangs-up, no assist, won't turn unless moving. ColumnDrive
 would most likely not be a causal factor for this type of complaint. Look for symptoms in the regular hydraulic part
 of the system:
 - Check hydraulic system to insure flows and pressures are to specification
 - Check front tire pressures
 - Check the weight on the front axle
 - Check for binding in the front suspension
- Steering efforts seem the same regardless of vehicle speed Steering Efforts feel heavy at low vehicle speed and light at high vehicle speed but reversibility, pull compensation, etc. seems normal. This is an indication that the ColumnDrive is no longer receiving the speed signal. The ColumnDrive reverts to the default mode which sets the efforts at mid range.
 - To check that the speed signal is coming through the Can bus, check the continuity of the line by measuring the resistance between the "CAN HIGH" and "CAN LOW" pins at the 10 pin Delphi connector. Do this with the ignition OFF. You should see a reading of about 60 ohms. This is half the value of the terminator resistor at each end of the can bus.
 - Again with the ignition switch OFF, check that the polarity/continuity is correct in the CAN circuit. Set one probe of the ohmmeter on the CAN HIGH pin of the 10 pin connector and the other probe on Pin C (CAN HIGH) in the diagnostic connector. If the polarity is correct, it should read less than 0.5

ohms (not 60 ohms). Repeat the procedure but probe the CAN LOW pin of the 10 pin connector and probe Pin D (CAN LOW) in the diagnostic connector. The reading should be less than about 0.5 ohms.

- 3. **Cannot adjust the effort range** This only applies to vehicles equipped with an "efforts knob". The efforts knob allows the operator to select the effort range that suits his/her driving style.
 - You can experience the same condition described above and solve it by following what is written above.
 - In addition, the efforts may still vary with speed (CAN connection OK) but you cannot change the effort range when turning the knob. This would indicate that you have lost the connection between the body controller in the dash (or wherever) and the efforts knob itself. Again check for continuity in the wiring between the controller and the effort knob or the integrity of the efforts knob switch itself.
- 4. **ColumnDrive does not appear to be working** static steer efforts high, speed pro efforts undetectable, reversibility poor, pull compensation non existent (if one feature is not working all the others will not be working either). The easiest test to determine if the ColumnDrive is functioning normally is to drive at a very low speed (about 5 mph) and turn the steering wheel to full lock with one finger in the steering wheel spoke (about 10 in-lbs torque required). If you cannot steer with one finger (and about 60 in-lbs torque is required) the unit is not functioning:
 - Check voltage to the ColumnDrive to insure that it is between 10.0 and 16.0 volts: See Figure 1 for pin locations on the ColumnDrive.

Place the voltmeter probes in pins 1 and 2 on the back of the connector and check for voltage (Figs 2). You should have a reading within the range mentioned with the ignition switch "ON or "OFF". Place the probes in pins 2 and 3 and check for voltage (FIG 3). You should have a reading within the range mentioned with the ignition switch "OFF".

- If you have proper voltage to the back of the connectors and the system will not wake-up (wake-up procedure RP001 C described below), disconnect the wiring harness and check the integrity of the pin connections in the terminal where the ColumnDrive is plugged in to the power supply Figs 4A & 4B. See figures 5A & 5B for connector removal hints.
- If you do not have proper voltage:
 - Check for a broken ignition wire

Check for a loose ignition wire. A loose wire could cause an intermittent loss of all features; features are restored when the loose wire touches the terminal again.

Check for a blown ignition fuse

Check for a dead or dying battery. With the voltage from 6.5 to 10.0 volts, the ColumnDrive stops motor control. Again, to the driver it appears to stop working. When the voltage rises above 10.0 volts, it resumes normal control. If the voltage falls below 6.5 volts, the ColumnDrive will shut down completely, losing its center position. When voltage is restored the ColumnDrive will be inactive until its center position is restored per recovery procedure RP001, whereupon it will work normally.

- Loss of battery power while the steering wheel was positioned off straight ahead by more than 1 wheel turn but less than 2 wheels turns. The unit will not "wake-up" until recovery procedure RP001 has been executed.
- Loss of battery power while the steering wheel was positioned off straight ahead by more than 2 wheel turns. When battery power is restored the ColumnDrive will re-energize 2 wheel turns off center. Continuing to steer past the 2 wheel turn mark in the same direction will feel normal; turning back in the other direction will feel normal until about 3 3/4 revolutions of the steering wheel when the column drive shuts off. Follow recovery procedure RP001 to correct the problem.
- Removal and improper re-installation of the ColumnDrive unit, or, removal and improper re-installation of the steering components between the ColumnDrive output shaft and the steering gear input shaft. If joints are reconnected with the ColumnDrive off its electrical/mechanical center between 1 and 2 wheels turns it will not "wake-up" and function normally until recovery procedure RP002 has been executed. A good indicator for this will be a complaint that the features carried by the clockspring may not be functioning either.
- The ColumnDrive keeps track of internal faults and may shut itself down if too many occur between so many ignition key cycles. The unit will not restart under any circumstance and must be replaced.
- Check the column part of the ColumnDrive for excessive friction causing binding of the input to the unit.

- 5. **Steering does not correctly re-center to straight ahead position** This may be due to excessive friction on the steering column rotating group. Friction is the only known problem to cause the re-center feature to not work while other features do.
 - Check for shroud rubbing on the steering wheel.
- 6. **Vehicles auto steers** when the driver lets go of the steering wheel the vehicle wants to turn severely to the left or right.
 - Check the alignment of the electrical/mechanical center of the ColumnDrive with the straight ahead position of the road wheels. In order for this to occur, there had to be a disconnection and improper reinstallation of a joint between the output shaft of the ColumnDrive and the input shaft of the steering gear. Follow recovery procedure RP003 to correct the problem.
- 7. Steering wheel spokes off-center while driving straight down the highway the steering wheel spokes are offset in the left turn or right turn direction. Note: Due to the "pull compensation" feature the wheel will be off-center when driving in a steady cross wind or on a road that is crowned. A good diagnosis of the problem is necessary here to decipher the difference.
 - Check steering wheel alignment with the electrical/mechanical center of the ColumnDrive. Align the vehicle up on a straight line on a fairly flat surface. Turn the ignition switch off, wait 30 seconds and restart the engine with hands off the steering wheel. Drive about 20 ft with hands off and note the steering wheel position. If the coach continues to follow the line and the steering wheel is off straight ahead by more than 5 degrees in either direction, pull the steering wheel and index it to straight ahead (being careful to set the clockspring properly if so equipped).

A WARNING When performing any type of maintenance, repairs, or alignment to the front suspension, tires, brakes, or any item near the road wheels or moving parts of the front suspension, the vehicle ignition must be turned off and the key removed to prevent injury to the person(s) working around these items. This vehicle is equipped with a power steering system that may automatically power the road wheels to the straight ahead position if the ignition switch is in the "ON" position.

Recovery Procedure RP001:

- A. With the engine running, steer to full wheel lock in both directions and back to where the road wheels are straight ahead. The ColumnDrive power assist may or may not be felt during this exercise but that is not a problem.
- B. With the road wheels still in the straight ahead position turn the ignition switch off and wait at least 30 seconds.
- C. Turn the ignition switch back on and rotate the steering wheel back and forth slowly at least plus or minus a 1/2 turn until the ColumnDrive "wakes up" and will power to center (powering to center means that when you let go of the steering wheel after turning about a half turn the wheel will reverse back to straight ahead on its own). The steering wheel and road wheels will once again be aligned with one another.

Recovery Procedure RP002:

- A. Drive the vehicle down a straight line or set the front wheels in the straight ahead position on an alignment rack. Turn the ignition key off.
- B. Check the position of the cross bolt on the yoke at the output shaft of the ColumnDrive unit. It should be parallel to and facing the large flat surface adjacent to the shaft Fig 6 but will probably be one wheel turn off or so if the ColumnDrive will not wake-up.
- C. Disconnect the joint at the opposite end of the ColumnDrive output shaft and rotate the steering wheel 1 revolution in either direction until the cross bolt is aligned as in step B.
- D. Turn the ignition switch on and wake-up the ColumnDrive by rotating the steering wheel back and forth slowly about 1/2 a turn in each direction. Once again a live ColumnDrive will re-center by itself when you let go of the steering wheel. Let the wheel find center and turn the ignition key off. This should be a two man operation, one to steer and one to watch that the opposite end of the shaft is not damaging anything under the coach during rotation.
- E. Re-connect the yoke at the opposite end of the ColumnDrive being careful not to rotate the shaft more than +- 5 degrees to align the serrations. Torque the yoke cross bolt nut to the recommended level. The ColumnDrive electrical/mechanical center will now be aligned with the road wheels and the ColumnDrive will wake-up at every ignition key cycle.

F. If equipped, check the functions of the clockspring to see if it has been damaged. If so, replace it following the instructions printed on the part to restore those functions. Rotating the spring excessively in one direction will destroy the part.

Recovery Procedure RP003:

- A. Drive the vehicle down a straight line or set the front wheels in the straight ahead position on an alignment rack. Turn the ignition key off while holding the road wheels in the straight ahead position.
- B. Check the position of the cross bolt on the yoke at the output shaft of the ColumnDrive unit. It should be parallel to and facing the large flat surface adjacent to the shaft Fig 6 but probably is not if the vehicle auto steers.
- C. Disconnect the joint at the opposite end of the ColumnDrive output shaft.
- D. Turn the ignition switch on and wake-up the ColumnDrive by rotating the steering wheel back and forth slowly about 1/2 turn in each direction (do not exceed 1 wheel turn as the clockspring could be damaged if so equipped). Once again, a live ColumnDrive will re-center by itself when you let go of the steering wheel. Let the wheel find center and turn the ignition key off. This should be a two man operation, one to steer and one to watch that the opposite end of the shaft is not damaging anything under the coach during rotation.
- E. Re-connect the yoke at the opposite end of the ColumnDrive being careful not to rotate the shaft more than +- 5 degrees to align the serrations. Torque the yoke cross bolt nut to the recommended level. The ColumnDrive electrical/mechanical center will now be aligned with the road wheels and the auto steer will be eliminated.

Pin Number Diagram



Pin No.	Signal Name	Wire Color	ltem	Notes
1	VBATT	Red	Positive battery supply to ColumnDrive system	Suitable fuse (40A) required at battery when limited to 10 Nm
2	OVBATT	Black	Negative battery return to ColumnDrive system	
3	V_IGN		Ignition switch status input	





Fig. 4A



Vehicle wire harness to power source and CPU





Wire harness connection terminals on reverse side of ColumnDrive unit

ColumnDrive Unit







Flat Surface_

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