# ReAX Module Replacement Procedure

Electrical Steering Assist System Steering



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## I Symbols used in this document

## **A** DANGER

The signal word DANGER indicates a dangerous situation that, if not prevented, will lead to a severe injury or death. ⇒ Information as to how the danger can be prevented.

## 

The signal word WARNING indicates a dangerous situation that, if not prevented, can lead to a severe injury or death.

 $\Rightarrow$  Information as to how the danger can be prevented.

## **A** CAUTION

The signal word CAUTION indicates a dangerous situation that, if not prevented, can lead to a slight or moderate injury.

 $\Rightarrow$  Information as to how the danger can be prevented.

## NOTICE

The signal word NOTICE indicates a situation that, if not prevented, can lead to property damage.

 $\, \Rightarrow \,$  Information as to how the property damage can be prevented.



This symbol indicates information concerning special workflows, methods, application of aids, etc.

Reference to information on the internet

#### Descriptive text

Action step
Action step 1 (in ascending order)
Action step 2 (in ascending order)
⇒ Consequence of an action

• Listing

## II Information on the document

#### Document overview

The specifications listed in these documents must be observed, because they are a prerequisite for fault free operation of the product and for the warranty granted by ZF Friedrichshafen AG. Please get in touch with your contact if you need binding documents.

#### Purpose of this document

This document is intended to be used by workshops.

#### Choose genuine ZF parts

Genuine ZF parts (including WABCO branded parts) are made of high-quality materials and are rigorously tested before they leave our factories. You also have the assurance that the quality of every ZF product is supported by a powerful customer service network.

As a leading supplier to the industry, ZF collaborates with the world's leading original equipment manufacturers, and utilizes the experience and capabilities at its disposal to satisfy the most stringent production standards. The quality of every genuine ZF part is supported by:

- Tooling made for serial production
- Regular sub-supplier audits
- Exhaustive end-of-line tests
- Quality standards < 50 PPM

## NOTICE

Installing replica parts can cost lives – genuine ZF parts protect your business.

## Information on the document

#### Additional services

The package you will get with a genuine ZF part:

• Technical support from ZF

## ZF Commercial Vehicle Steering Technical Support

Phone: 1-800-879-0899

Email: css.trucksteering@trw.com

## Online product catalogue



https://www.trwaftermarket.com/us/products/heavy-duty/service-literature/

The ZF/TRW Technical Support Center web page provides you with convenient access to the complete technical documentation. All documents are available in PDF format. Please contact your ZF partner for printed versions. Please note that the publications are not always available in all language versions.

\*Language code XX: 01 = English, 02 = German, 03 = French, 04 = Spanish, 05 = Italian, 06 = Dutch, 07 = Swedish, 08 = Russian, 09 = Polish, 10 = Croatian, 11 = Romanian, 12 = Hungarian, 13 = Portuguese (Portugal), 14 = Turkish, 15 = Czech, 16 = Chinese, 17 = Korean, 18 = Japanese, 19 = Hebrew, 20 = Greek, 21 = Arabic, 24 = Danish, 25 = Lithuanian, 26 = Norwegian, 27 = Slovenian, 28 = Finnish, 29 = Estonian, 30 = Latvian, 31 = Bulgarian, 32 = Slovakian, 34 = Portuguese (Brazil), 35 = Macedonian, 36 = Albanian, 97 = German/English 98 = = multilingual, 99 = non-verbal

#### Safety information

#### Observe all required provisions and instructions:

• Read this publication carefully. Adhere to all instructions, information and safety information to prevent injury to persons and damage to property.

information in this publication is adhered to.

- Always abide by the truck manufacturer's specifications and instructions.
- Observe all accident regulations of the respective company as well as regional and national regulations.

#### Make provisions for a safe work environment:

- Only trained and qualified technicians are to perform work on the truck. • Use personal protective equipment if required (protective goggles, respiratory protection, ear
- protectors, etc.)

ZF will only guarantee the safety, reliability and performance of their products and systems if all the

#### IV List of abbreviations

Abbrev.	Meaning
CAN	Controller Area Network; asynchronous serial bus system for networking control units in vehicles

#### Scope of this document V

This section provides a brief overview of the structure of this document: Chapter 1 - ReAX module replacement Description of the ReAX unit, and how to remove the current unit and replace it with a new unit. Chapter 2 - Tools In this chapter you can find a list of tools required to complete the replacement procedure. Chapter 3 - First Steps Description of preparation steps before beginnin removal procedure.. Chapter 4 - Removal and installation procedure Description of removal of the ReAX unit and installation of a new ReAX unit. Chapter 5 - Appendix Information on ZF Contacts and sample forms..

#### 1 **ReAX module replacement**

ReAX Module is an Electrical Steering Assist Motor that provides additional steering assistance based on the torque input from the steering wheel shaft by the Driver. This procedure will explain the process step by step to remove the ReAX module from the Column and replace it with a new ReAX module as part of the field repair work. Below is the picture of the ReAX Column with components marked up for reference.



#### 2 Tools

This chapter provides an overview of the tools necessary to complete the replacement of the ReAX module.

Tools
13 mm hex socket
9/16 " hex socket
1/2" hex socket
1 ¼ ″ hex socket
5/16" x 24 fine thread tap for steering wheel holes
HF 2 ft breaker bar with 1/2 " drive
Short, long, & flexible bit extenders with PH2 bits
Ratchet with long & short extensions
Cordless impact driver & drill
6 mm allen wrench
Torque wrench (capable of at least 50 ft-lb torque reading
Steering wheel puller kit with bolts
Wire cutter/strippers 18-20Ga
Crimpers & extra 18-gauge wire
Electrical ring connectors 18-20 Ga
Electrical butt connectors 18-20 Ga
Work light, flashlight
Paint marker
ZF Testman DPA06 & associated harnesses
Laptop with ZF Testman



## 3 First Steps

Before beginning ReAX Module replacement, ensure all required connections are complete and correctly installed.

## Verifying with ZF Testman

The ZF Testman Diagnostic tool can be used to verify column function as a first check. Connect the ZF Testman tool to the J1939 diagnostic port and connect to the column. (Follow step 43 below for Testman connection procedure). If connection to the column is established, then column power and column CAN connection is correct. If connection via Testman is not established, ensure that column Power and CAN connection are present by following the steps below

## **Column Power**

Ensure the column power harness is correctly installed and providing 12V of power while ignition is turned on. (An audible click can be heard from the ReAX Module once column receives 12V of power.)

Each column power harness features a 60A fuse that is located behind the side panel to the driver's left. Verify that the fuse is correctly installed and functioning properly.



If column power harness does not provide 12V after verifying installation of 60A fuse, contact tech support for assistance.

## **CAN** Connection

ZF ReAX Column electric torque overlay requires specific CAN signals from the vehicle CAN bus to function correctly. Some buses have had the CAN harness disconnected at the column and others have disconnected the CAN harness at a 3-way Deutsch connector located under the turn signal plate.

The turn signal plate is located to the left of the steering column on the floor and features button-style switches for operating the turn signals. The 3-way connector can often be found under the forward edge of the plate. Verify that the male 3-pin plug is connected to the 3-way connector.



The CAN harness also carries an ignition signal through pin 5 that is critical for ReAX to function. Verify that PIN 5 in on the CAN connector provides 12V when ignition is turned on.



After verifying the CAN harnesses is properly connected to the vehicle, be sure that the CAN harness is correctly connected to ReAX column.

## Verifying Vehicle Wheels are Straight Ahead

Visual inspection of the direction of the road wheels is typically insufficient for the column centering process. It is preferred that the vehicle is driven forward, straight ahead to verify that the road wheels are perfectly positioned straight ahead.

After following the recentering procedure (starting at step 47 below), it may be necessary for a test drive to verify that the column has been centered correctly. Incorrect centering process may lead to the steering column applying torque to the steering wheel while driving straight ahead.

## **Traceability Information Capturing**

Document the following in the excel spreadsheet - "Return Form - ReAX Field Work":

- Date of Repair
- VIN# (Located above the driver's seat, to the left)
- Bus# (Usually can be seen in center of windshield)
- Mileage
- New ReAX Module S/N (15-digit alpha numeric code, printed twice)



#### 4 Removal and installation procedure

## 

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

## 

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

## 

When you work on an electrical system, the possibility of electrical shock exists, and sparks can ignite flammable substances. You must always disconnect the battery ground cable before you work on an electrical system to prevent serious personal injury and damage to components.

1. Set the front wheels of the bus straight to facilitate ReAX module installation.

#### Make sure the bus ignition is Off and does not turn On during the procedure until instructed to do so. This is CRITICAL.

- 2. Cover driver's seat with clean work towel to protect seat from stains.
- 3. Remove blank panel (plate) to left of column. On ICE buses, this plate has the large green OBD connector attached to it. This will make it easier to access left side shroud screws.
- 4. Remove lower shroud (close-out) by removing the 8 screws using #2 Philips bit.



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5. Telescope column almost all the way down - pull tilt/tele handle up and push steering wheel straight bolts & nuts).



6. Under the dash, cut horn power wire with plenty of extra length (~ 12" from dash) and remove #2 Phillips screw securing horn ground wire to column. You may have to cut wire ties under dash to get enough wire length



down to lowest position, then pull back up about <sup>3</sup>/<sub>4</sub>" (just enough to access ReAX module attachment

7. eBus Models Only: Disconnect the Steering Angle Sensor (S.A.S.) harness.



- 8. Remove pinch bolt on lower U-joint using 9/16" socket & wrench, then remove U-joint from splined ReAX output shaft.
  - J-JOINT PINCH BOLT 4020584a



9. Disconnect the Power and CAN connectors from the ReAX module (do not disconnect the other connector).



10. Use 6 mm Allen wrench and impact driver with 13 mm socket, loosen ReAX module attachment nuts (do not remove from bolts).



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11. Remove 4 nuts holding column to mounting bracket using 9/16" socket. Support column while removing final nut. Remove column and place it on driver's seat as seen in the below picture. Take care with lower end of assembly where electrical connectors are located.

Do not lift the column by the steering wheel as shaft may rotate. Note the orientation of the ReAX module in the column – the new module must be installed in the same position, with the output shaft to the front of the column.



12. Remove ReAX assembly mounting nuts, nordlock washers, & bolts. Grasp ReAX module and slide it straight up - it will come out of the column very easily with no resistance.



13. Apply supplied grease from the kit to ReAX Module's input shaft. Now assemble new ReAX module to rotating group on interior of column in the same orientation as the old one (refer to step #11). Align ReAX module mounting holes with bracket on end of column.

Note: Do not rotate the ReAX module shaft as it might result in calibration error.



## Understanding Nord-Lock Washers - CRITICAL

Nord-Lock washers have two different faces

- Serrated face
- CAMS face

Always used in pair to have wedge effect to nut/bolt that locks it and prevents from unintentional loosening during application.



14. Note that the bolts should be on the left side and nuts be on the right side when the Column was placed on driver's seat upside down (see picture below). Do not interchange the nuts & bolts orientation. Assemble new sets of bolt and Nord-Lock washers as explained above, in the same orientation on left side and assemble nordlock washers and nut on the right side and finger tighten it to secure it to the column. Repeat for the other mounting hole. Nut/bolt can be torqued after assembling the column to dash.



- 15. Carefully lift column and slide mounting ears onto 4 mounting bracket studs .
- 16. Thread 4 washers and fresh nyloc nuts onto mounting bracket studs provided in the service kit and torque to 37 ft-lbs.
- 17. Torque the ReAX module attachment nut/bolt to 29 ft-lbs. using allen wrench CRITICAL. Repeat for second nut/bolt. To confirm the torque was set per specification, stripe mark the sides of both nut/ bolts using a paint marker.



18. Remove the orange and green connector caps from the replacement ReAX module, connect the Power and CAN connectors and ensure you hear a click for both connectors confirming they are locked. Reuse the connector caps on the replaced ReAX module taken out of the column earlier.



- 19. Reconnect intermediate shaft (U-joint) to ReAX output shaft.
- 20. Insert pinch bolt, washers and fresh nyloc nut in lower U-joint and tighten to 44 ft-lbs.
- 21. Reconnect the horn power wire using the supplied butt connector.
- 22. Reattach the horn ground wire to the mounting bracket using a #2 Phillips screw.
- 23. eBus Models Only: reconnect 6-pin Steering Angle Harness (connection located under left side blank panel)Torque the steering wheel retaining nut to 50 ft-lb.

## Setting up for Calibration Process

**WARNING!** Make sure that all personnel are clear of vehicle during the following steps. No personnel should be near steering linkages, behind, in front of or under the vehicle for the following steps.

ReAX upon ignition on, may move. So, maintain safe distance as mentioned above.

Appropriately chock vehicle's rear wheels only to avoid vehicle moving during the procedure.

For electric and hybrid powered vehicles, skip to step 27.

Process for Internal Combustion Engines (diesel and CNG).

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## Removal and installation procedure

- 24. Turn on the vehicle's ignition and start the engine, be sure to apply the vehicle's parking brake and leave in neutral gear.
- 25. Be sure high/fast idle is turned off.
- 26. When vehicle engine is turned on the column should wake up and turn to its center position. If column was already in center position and did not move, gently turn the column slightly (5-10°) and witness return to center position.

For internal combustion engine/diesel vehicles, skip to step 44.

## Process for eBus and hybrid vehicles:

#### 27. Be sure the parking brakes are applied.

## 28. Apply firm pressure to the brake pedal and hold.

29. Start the vehicle into normal operation mode. If column was already in center position and did not move, gently turn the column slightly (5-10°) and witness return to center position

## All powertrains (eBus, hybrid, and internal combustion) adhere to the following procedure:

30. Connect ZF Testman DPA06 to the CAN bus diagnostic port on the vehicle using the appropriate harness. Connect the DPA06 to the laptop equipped with ZF Testman

Note: For diesel and CNG vehicles, diagnostic ports are located near the driver's left under the instrument panel or in the overhead compartment.

Note: For eBus vehicles, the diagnostic port is located in the overhead compartment only



- 31. Launch ZF Testman application on laptop
- 32. Select ReAX from the drop-down menu on the left side of the window



33. Verify under the interface tab that the correct cable is selected (Choose the cable interface that you are using to connect the DPA06 to the laptop.).



34. Click the Toggle button to the ON position. When prompted click Accept to establish connection.



35. Once communication is established the CAN link will turn green and the Tree menu will become functional.



Note: If Testman is unable to connect, verify wiring. If connection issues persist, contact customer support.

36. Verify that the correct software is loaded onto the vehicle in the ECU Software Information.



37. STOP - If the ECU Software Number and Tune Variant do not match per table below, contact customer support (see Appendix)

Vehicle Platform	ECU Software Number	Software Tune Variant		
Internal Combustion Engines	s2RX5C14H	s2RX5C14H01		
Battery Electric Vehicle	s2RX5C14H	s2RX5C14H02		
Hybrid Vehicle	s2RX5C14H	s2RX5C14H01		

## Calibration Process (Set Straight-Ahead)

## Overview

Torun the calibration, the vehicle riv	ust be stationary and the following signal
preconditions must be met	
* Vehicle speed < 3 km/h * Engne speed < 800 rpm	
Preconditions	Densing Flexuel
Vehicle speed 0,00 km/h	Handwhwel position 0,00*
Engna speed 600,00 rpm	Column torque: 0,05 tim
Contraction of the local division of the loc	

## Preconditions

To start the Set Straight-Ahead calibration the following preconditions must apply:

Vehicle Speed	< 3 km/h		
Engine Speed	< 800 rpm		
Vehicle Wheels	in centered position		

Vehicle speed and engine speed are permanently read from the steering systems CAN as long there is an active diagnostic connection established.

The read values are shown in the Preconditions section:

ion

#### Attention

The vehicles wheels need to be centered manually. Please confirm this production step by ticking the checkbox "Wheels centered"

Preconditions	
Vehicle speed: 0 km/h	
Engine speed: 650 rpm	
Wheels centered	

## **Steering Result**

Handwheel Position, Column Torque and Absolute Steering Position Valid are permanently read from the steering systems CAN as long there is an active diagnostic connection established.

After a successful calibration Handwheel Position and Column Torque are set to 0. Absolute Steering Position Valid should always be valid (=green).

Steering Result	
Handwheel position: -0,31 *	
Column torque: 4,28 Nm	
Absolute Steering Position valid	

## Attention

If Absolute Steering Position Valid is invalid, the vehicle needs to be checked separately. Contact ZF Technical Support.

Absolute Steering Position INVALID

## Start button

Clicking the Start button starts the calibration.

Status indication keeps blinking with status "Calibration running" while routine is running.

#### **Status Indicator**

Calibration running.

The status indicator gives feedback of the current calibration state as well as error messages.

Message	Description			
Calibration not started	Calibration is not started yet			
Preconditions not met	One or more preconditions are no calibration.			
Calibration running	Calibration is currently running			
Calibration finished	Calibration has been executed an			
Calibration cancelled by user	Calibration has been cancelled by			
Security Access failed	Security access as part of the calil See additional information for det			
Calibration failed	Calibration routine has failed. See additional information for det			
Calibration not started. CAN message Prop8_F7 not received	Calibration is not possible as the r PropB_F7 is not sent on the CAN			

A good check for column calibration is to turn the steering wheel slightly off center and release. The column should attempt to return to center position without any assist.

Note: After following the recentering procedure, it may be necessary for a test drive to verify that the column has been centered correctly. Incorrect centering process may lead to the steering column applying torque to the steering wheel while driving straight ahead.

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## **Check & Clear Faults**

38. Read the Fault Memory data from Testman by clicking on 1 - "Read fault memory" (see below picture) from the tree menu. To save the fault memory report go to File, click on "save as" and select pdf to store it as a pdf file (see appendix). Use ReAX S/N to name the file.

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- 39. If there are any active faults showing in the fault memory section of the window, it is a good idea to click "Reset Inactive Faults" to clear the ReAX column of any faults.
- 40. Once the faults are cleared and the column is centered, turn the vehicle completely off.
- 41. With the vehicle turned off and the parking brake applied, remove ZF Testman connection and associated harnesses from vehicle diagnostic port.

Note: Many buses were equipped with an 18-in or 20-in steering wheel after powering ReAX column down. ReAX is designed to work with 16-in steering wheels only. Be sure to install only 16-in diameter steering wheels onto operating ReAX steering columns.

## **Steering Wheel Removal Procedure**

- 42. Carefully pry off steering wheel cap to access steering wheel retaining nut.
- 43. Gently pull off the horn wire clip from the steering wheel.
- 44. Remove steering wheel retaining nut using 1 1/4" socket.



- 45. Remove steering wheel using wheel puller kit with 5/16" x 24 thread bolts.
- 46. Align steering wheel to straight ahead and gently wiggle back onto splined shaft.
- 47. Replace steering wheel retaining nut and torgue to 50 ft/lbs. with Loctite thread locker med. str. 242
  - Note: Be sure that horn contact ring is installed correctly to bottom of steering wheel hub and the steering wheel is correctly centered
- 48. Check horn and perform all steering maneuvers to verify column functionalities
  - Tilt/Telescope
  - Easy to steer with ReAX assist \_
  - Return to center move steering wheel off-center and observe it return back to center when released
  - Remove the chocks and test drive for normal operation check Note: In case of functional problem contact customer support
- 49. Mark the mounting bracket with paint marker to confirm ReAX replacement was successfully performed
- 50. Align lower shroud (close-out) holes to the dash and assemble back by using the 8 screws.



51. Put the old part back in the box and return using the supplied shipping label.



## Appendix

## 5 Appendix

## ZF Commercial Vehicle Steering Technical Support

Phone: 1-800-879-0899

Email: <u>css.trucksteering@trw.com</u>

Web: https://www.trwaftermarket.com/us/products/heavy-duty/service-literature/

#### Return Address

ZF Commercial Steering ATTN: Jim Arihood, H1 Lab – ReAX Exchange 1450 N 9th ST Lafayette, IN 47904

## Return Form Excel Spreadsheet

Notes note: 2009 Doto: 71

## Testman Fault Memory Report File

04/11/2022 07:31 51					6
No.	Description	FC"	Counter	Active	Glatus
1	Torque Sensor Fault, FREQ_1	07F802	5	1.62	OxA8
2	Permanent Latched Fault	07#C69	1	No	0168
)	1 sense Fault	07F898	10	Yes	QKA8
4	CAN-Timeout Pault: Vehicle Speed Signal (CCVS)	07FA80	7	Yes	OxA8
5	CAN-Timeout Fault: EEC1	OTFASA	1	7'05	OXA8
	No fault text available	0000A8	1	Yes	OxA8





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