B400 R, RM, RH Power Steering Calibration and Testing

standard steering column &
telescopic steering column

This document describes how to put the electric steering control with the associated mechanical steering system into service. Either for the first time in production or after a replacement in the field. This replacement may involve the electric steering control or a mechanical component of the steering system, such as a universal joint.
This procedure is also necessary if the steering control detects a torque error in the measuring system.

1. Determine the Steering Code 3.8.1.1. including subcode:

2. Torque errors require a mechanical adjustment (1) plus calibration (2) and testing with the programmer (3)

3. If the procedure is not successful for a service code 3.8.1.1./19, the steering drive must be replaced due to internal problems with the torque sensor.

Preparatio

a) Switch off Machine

b) Removing the engine cover from the steering column

Before switching on:
CAUTION – RISK OF INJURY: Take your hands off the steering wheel!

Error message	Flash code	Description	Remarks	add. Info	Circuit board + Plug + PIN	Concerned part(s)	Trouble shooting
A1	1x flash	Error current	Current > 30A		A9/B(+)	A9	Check wiring and pins
A2	2x flash	not existing	/		/	/	/
A4	4x flash	Error rotational speed in neutral	Voltage at encoder highside or lowside in neutral	higher or lower 2,2V (12Nm)	A9.J1/2 or A9.J1/4	M26	Check steering geometry, steering encoder and wiring
A5	5x flash	Overtemperature	Controller temperature >90°C		/	A9	Eliminate reason for overheating
A6	6x flash	Error powerstage	Internernal controller error		/	A9	Change controller
A7	7x flash	Overcurrent	Short cut at wiring to, or in motor		A9/M1 or A9/M2	M26	Check motor or wiring
A8	8x flash	Error power supply	no voltage at controller		A9/B(+) or A9/B(-)	A9	Check wiring
A9	9x flash	not existing	/		/	/	/
A10	10x flash	Overvoltage	Battery voltage > 45V		A9/B(+) or A9/B(-)	A9	Check wiring
A11	11x flash	Motor overload	Motor torque > allowed	20A longer than 10s	A9/M1 or A9/M2	M26	Check steering geometry, motor and wiring
A12	12x flash	Motor overtemperature	Temperature switch motor activ	not connected	/	/	/
A13	13x flash	Key switch OFF	Input, key switch is open		A9.J1/15	S1or A9	Check wiring
A14	14x flash	Error EEPROM	EEPROM defect		/	A9	Change controller
A15							unknown
A16							unknown
A17	17x flash	Error torque	Voltage at encoder highside out of range <1,5V or > 3,0V	torque > 28Nm	A9.J1/1 and A9.J1/2	M26	Check steering geometry, steering encoder and wiring
A18	18x flash	Error torque	Voltage at encoder lowside out of range > 3,0V or <1,5V	torque > 28Nm	A9.J1/3 and A9.J1/4	M26	Check steering geometry, steering encoder and wiring
A19	19x flash	Error torque	Voltage deviation between encoder highside and lowside > 0,5V		A9.J1/2 and A9.J1/4	M26	Check steering encoder and wiring
A20	20x flash	Error torque	Short cut between encoder highside and lowside		A9.J1/2 and A9.J1/4	M26	Check wiring

1.1 Relieving mechanical strain in the steering system

(for machines built before April 2022)

1.1.1 Loosen the four bolts (yellow) of the standard steering or the telescopic steering.

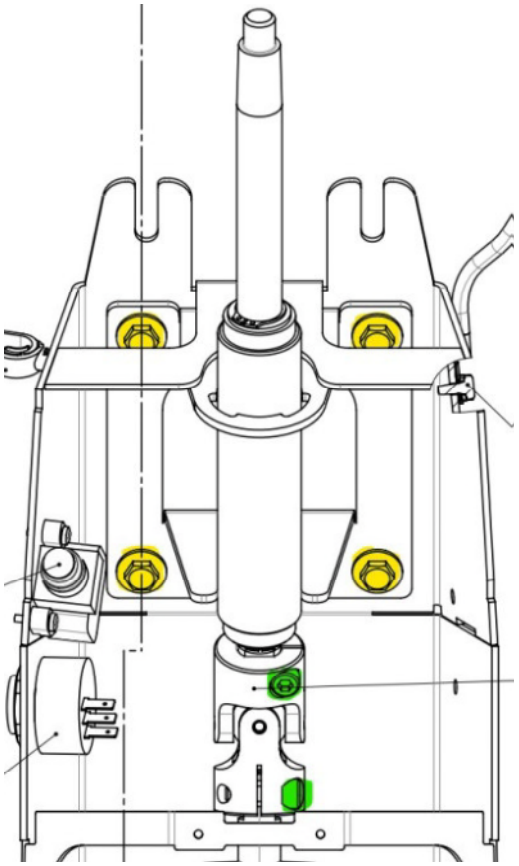
1.1.2 Loosen the two bolts (green) of the upper universal joint (universal joint above the steering motor).

1.1.3 Hand-tighten the four bolts (yellow) of the standard steering or the telescopic steering, ensuring the assembly can just bemoved in the screw-on plane (this is important to avoid exerting pressure on the universal joint when tightening later).

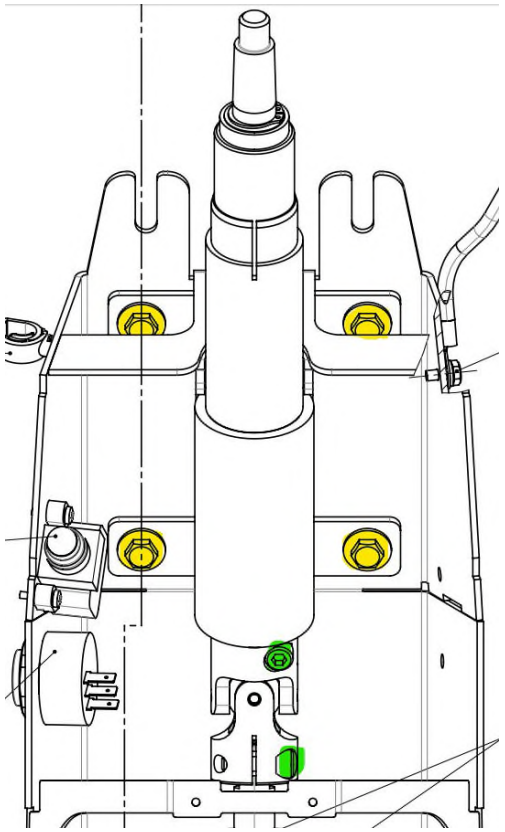
1.1.4 Place the standard steering or the telescopic steering in such a way that it does not rest on the universal joint with its own mass (relieve with manual force).

1.1.5 Tighten the two bolts (green) on the universal joint (torque 20 Nm, Loctite 243).

1.1.6 Tighten the four bolts (yellow) of the standard steering or the telescopic steering. First the bottom two bolts, then the top two.



Standard Steering



Telescopic Steering

1.2 Relieving mechanical strain in the steering system

(for machines built after April 2022)

1.2.1 Loosen the two bolts (green) of the upper universal joint (universal joint above the steering motor).

1.2.2 Loosen the two bolts (blue) that hold the adjustment ring in place.

1.2.3 Make sure that the universal joint can be moved easily. If yes, then continue with 1.2.8. If no, then start again with 1.2.4.

1.2.4 Loosen the two bolts (yellow) of the upper steering holder.

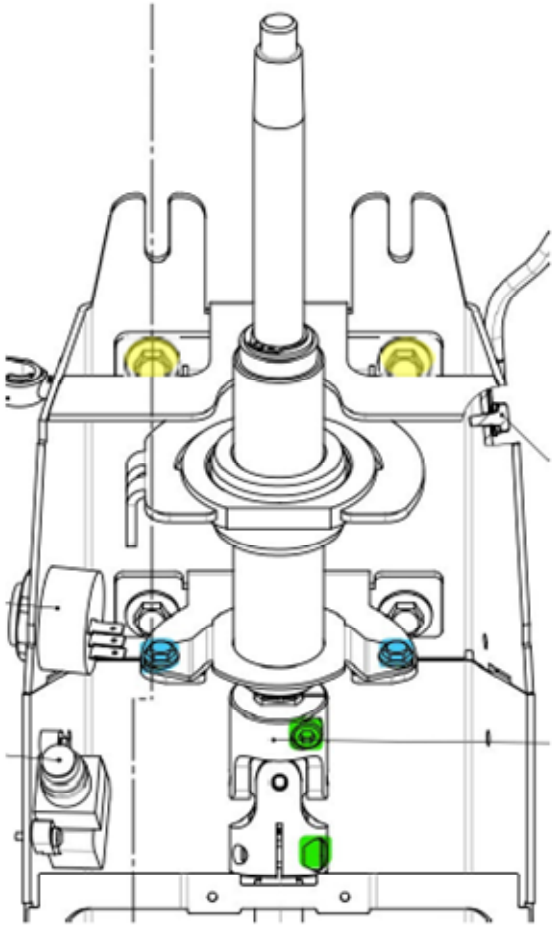
1.2.5 Reduce the strain by moving the steering parts.

1.2.6 Tighten the two bolts (yellow) of the upper steering holder.

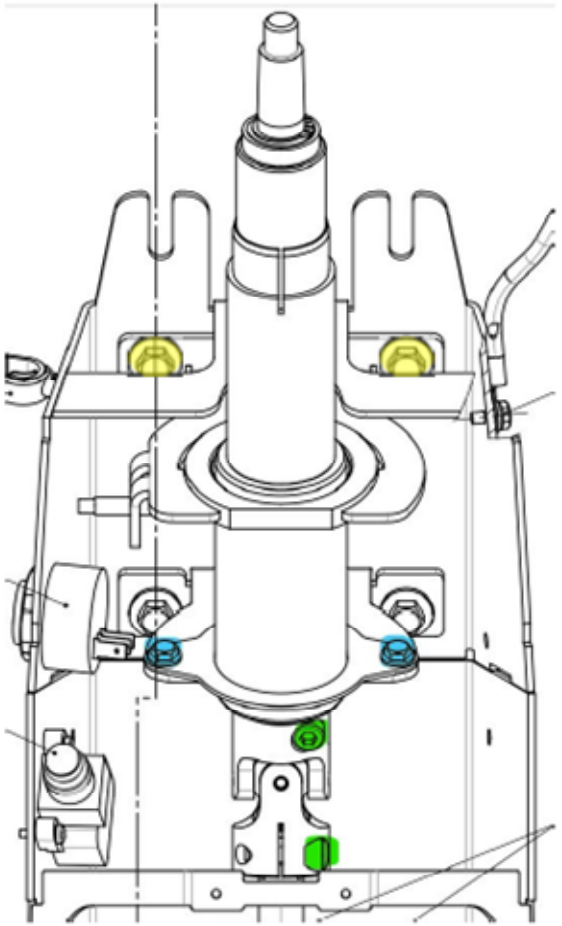
1.2.7 Make sure that the universal joint can be moved easily. If yes, then continue with 1.2.8. If no, then start again with 1.2.4.

1.2.8 Tighten the two bolts (green) on the universal joint (torque 20 Nm, Loctite 243).

1.2.9 Position the adjustment ring to the tube of the standard steering or the telescopic steering, ensuring there is an even distance around the circumference of the two parts. Re-tighten the two bolts (blue) that hold the adjustment ring in place.



Standard Steering



Telescopic Steering

2 Calibration

2.1 Turn off the machine.
2.2 Dismantle the motor cover from the steering column.
2.3 Relieve the strain on the steering wheel (torque sensor must not register any force).

CAUTION – RISK OF INJURY: Take your hands off the steering wheel!

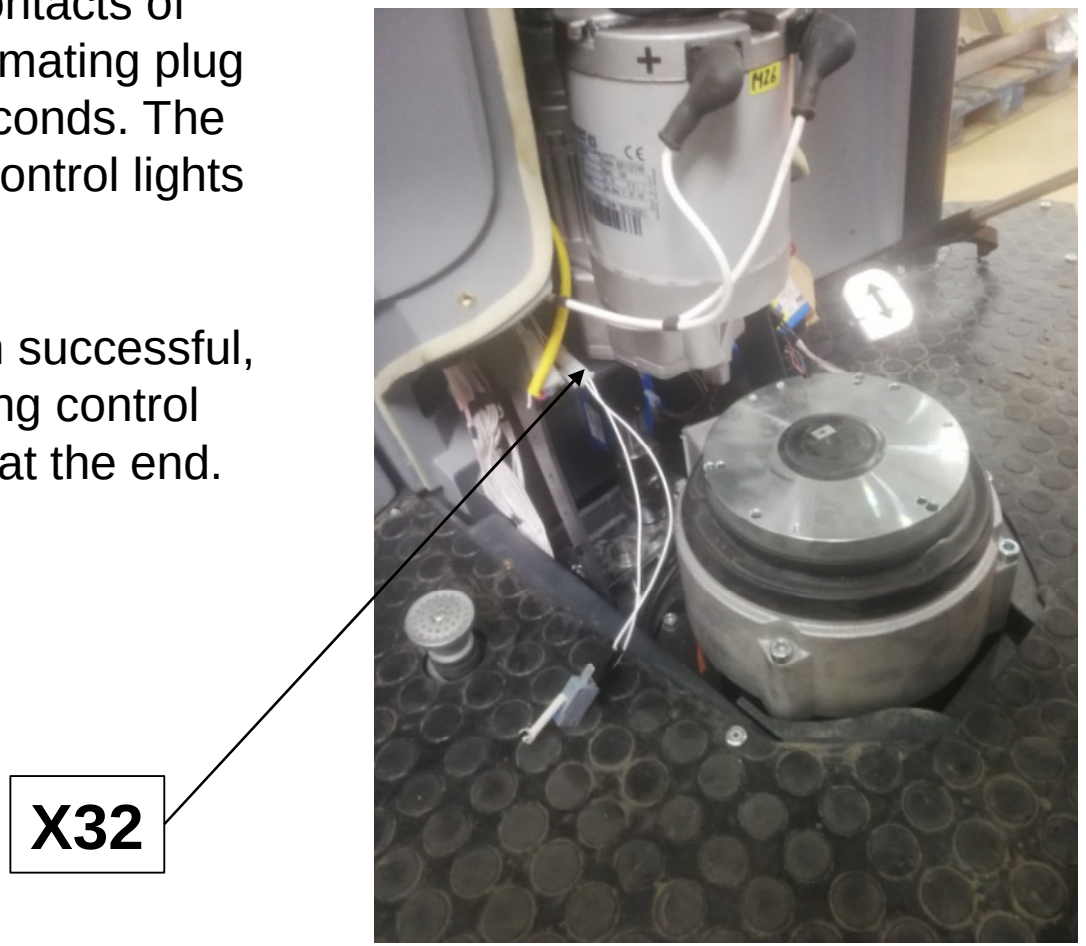
2.4 Turn on the machine.

If the steering wheel starts to turn by itself, turn off the machine immediately with the key switch. The reason for this is that the power connections on the steering motor are connected the wrong way round. In this case, exchange the power connections on the motor and start again with 2.3.

2.5 Connect / short the contacts of the open plug **X32** with a mating plug four times within three seconds. The red LED on the steering control lights up briefly each time.

2.6 If calibration has been successful, the red LED on the steering control lights up for two seconds at the end.

2.7 Turn off the machine.



3. Testing

Testing sequence to check whether the mechanical steering system has been mounted free of tension:

3.1 Plug the Italsea programmer tool into the 4-pin socket of the steering control.

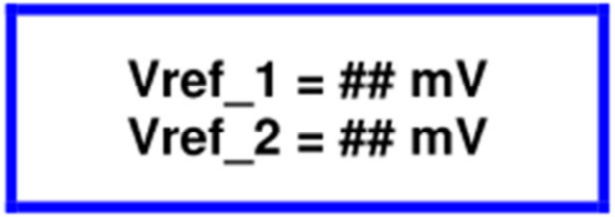
3.2 Turn on the machine and select the respective menu [ ] with UP and DOWN on the programmer tool.

3.3 **Check the current software version** (target: # > 0.**8**)

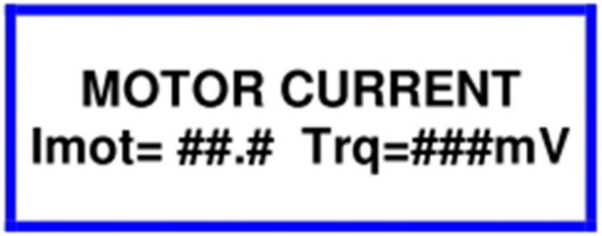
SW RELEASE
7CH4Q45S_#

3.4 **Check the speed reference voltage** (target: **2000 ... 2500 mV**)

To do so, raise the front of the machine so that the front wheel can turn freely.



3.5 **Check for strain** in the mechanical part of the steering system (target: **I = 0.0**)

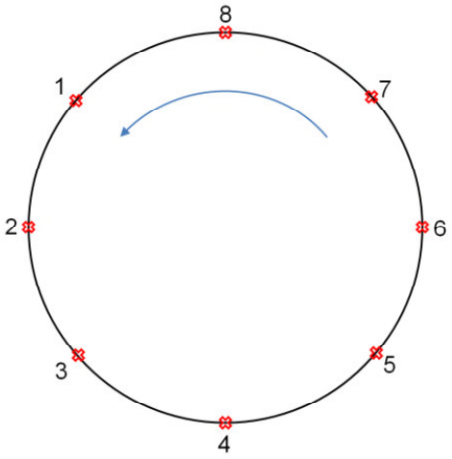


3.5.1 On machines with height-adjustable steering, move the steering wheel to the lower position and tighten it.

3.5.2 Align the steering wheel, ensuring the front wheel points straight ahead in the direction of travel (front wheel is on the ground).

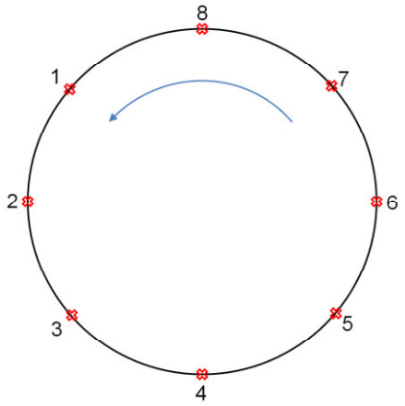
3.5.3 Turn the steering wheel one eighth of a turn to the left and let go of it. Motor current must be **I = 0.0** again.

3.5.4 Repeat point 3.5.3 seven times, thus completing one full turn of the steering wheel.
Test points during one turn of the steering wheel:



3.5.5 Turn the steering wheel one eighth of a turn to the right and let go of it. Motor current must be **I = 0.0** again.

3.5.6 Repeat point 3.5.5 seven times, thus completing one full turn of the steering wheel.
Test points during one turn of the steering wheel:



3.5.7 On machines with height-adjustable steering, move the steering wheel to the upper position and tighten it. Then start again with point 3.5.3.

If a current is measured after letting go of the steering wheel in one of the eight positions (motor current **I > 0.0**), the mechanical steering system is strained and must be readjusted (see point 1).