

Agrar-**Pro**-Steer

Electro-hydraulic Positive Steering



Stapel

AgrarPro GmbH

25.01.2021

User Manual **ProSteer**

Version: A.0.3

Electro-hydraulic positive steering

Vehicle type:

Tandem

AP-PS60e-21-A-B0RS; AP-PS60e-21-B-B0RS

Tridem

AP-PS60e-32-A-BSRS; AP-PS60e-32-B-BSRS

Series:

Up from 0001 to - - - -

First edition:

25.01.2021

AgrarPro
Funktioniert einfach



Dear customer,

Congratulations on the purchase of the electro-hydraulic positive steering system **ProSteer** manufactured by AgrarPro GmbH. This product has been designed to considerably improve the driving characteristics of combinations of towing vehicle and trailer. In order to maintain the reliability of the equipment and to ensure a long lifetime, carefully read this manual and submit it to new personnel to be trained as well. Damages arising from inobservance of the instructions provided are not covered by warranty.

This manual must remain accessible to users anytime.

Table of Contents

1	Introduction	6
2	General Information	7
2.1	Working Principle, Functions and Applications.....	7
2.2	Safe and Appropriate Use.....	8
2.2.1	Appropriate Use.....	8
2.2.2	Rules for Prevention of Accidents.....	8
2.2.3	Improper Use	10
2.3	Specification.....	11
2.3.1	Electric Parameters.....	11
2.3.2	Hydraulic Parameters	11
2.3.3	Connectors and Interfaces	11
2.3.4	Fluids	12
2.3.5	Ambient Conditions.....	12
2.3.6	Mechanical Parameters.....	12
2.4	Environmental Protection.....	12
2.5	Expected Lifetime of the Equipment.....	12
2.6	Safety.....	12
3	Start-up	13
3.1	Preliminary Safety Measures.....	13
3.1.1	Connection of the Drawbar Detector.....	13
3.1.2	Adjustment of the Drawbar Detector.....	13
3.1.3	Electric Connections.....	14
3.1.4	Hydraulic Connections	14
3.2	Switching OFF	14
4	Operation.....	15
4.1	Terminal – Type 1	16
4.1.1	Emergency Button / Switching ON and OFF.....	16

4.1.2	Menu Structure	16
4.1.3	Drop-Down Menu	19
4.2	Terminal – Type 2	20
5	Description of Operating Modes	21
5.1	Test Mode.....	21
5.2	Road Mode	23
5.3	Field Mode	23
5.3.1	Slope.....	24
5.3.2	Manual.....	24
5.3.3	Speed Limits in Field Modes.....	25
5.3.4	Errors in Field Modes	25
5.3.5	Safe-Mode	26
5.4	Troubleshooting.....	27
6	Towing away / Manual Override.....	27
7	User Information	30
8	Maintenance	31
8.1	Preliminary Safety Measures.....	31
8.2	Service Points	31
8.3	Adjustment of detectors.....	32
8.4	Exchange of Signal Lamps	32
8.5	Welding	33
8.6	Regular Inspection by Technical Supervisory Association	33
8.7	Adjustment of Parameters	33
8.8	Acknowledgement of Service Message.....	33
9	Disposal.....	35
10	Appendix – Error List.....	37
10.1	Test Report –Tandem A	42
10.2	Test Report – Tridem A.....	43
10.3	Declaration acc. to UN-ECE-R79	44

Table of Figures

Fig. 1 Principle of the electro-hydraulic positive steering.....	7
Fig. 2 Data connector	11
Fig. 3 M12-connector, SUB-D & USB	11
Fig. 4 Hydraulic connections.....	11
Fig. 5 Greasing the K50 drawbar eye.....	13
Fig. 6 Drawbar detector - Drawbar.....	13
Fig. 7 Drawbar detector - Gooseneck.....	13
Fig. 8 Terminal	16
Fig. 9 Tandem - Road.....	23
Fig. 10 Tridem - Road	23
Fig. 11 Tandem – Crab steering	24
Fig. 12 Tridem – Crab steering	24
Fig. 13 Tandem - Manual	24
Fig. 14 Tridem - Manual	24
Fig. 15 Plastic nut.....	29
Fig. 16 Manual override	29
Fig. 17 Bracket of axle angle detector.....	32
Fig. 18 Lamps within the case.....	32
Fig. 19 Controller plug	33

1 Introduction

The system **ProSteer** described in this document represents a valuable aid for improving the driving characteristics of trailers and thus the traffic safety of the entire vehicle combination. Special programs for difficult terrain, so-called Field Programs, are provided as well.

In the following, correct use, set up and operation are handled in detail.

In order not to impair the lifetime of the equipment, the maintenance instructions have to be followed likewise. In any case of doubt, do not hesitate to consult our factory service.

Directions specified (at the front, at the rear, left or right side) always refer to the driving direction.

The system has been developed on the basis of „**UN/ECE R79, appendix 6, chapter 3**“.

2 General Information

The steering system **ProSteer** is intended to support drivers and enhance traffic safety of vehicle combinations comprising trailers in forestry, agricultural and also communal sector.

2.1 Working Principle, Functions and Applications

Besides a standard program particularly adapted to road travel, further programs are included to be used in field applications. Selection takes place by means of the window of the terminal installed in the driver’s cab. The structure of the entire configuration is shown in Fig. 1. (Note that in tandems, the first trailer axle does not exist.)

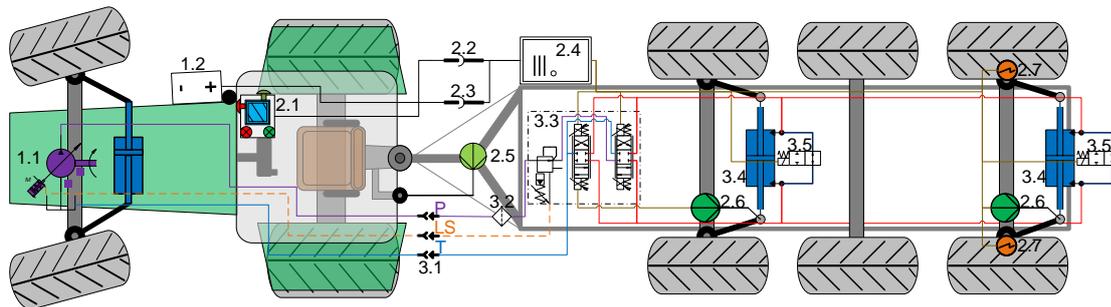


Fig. 1 Principle of the electro-hydraulic positive steering

Main Components		
1.1	Hydraulic supply	3.1 Hydraulic couplings: P = Pressure line LS = Load-Sensing T = Tank line 3.2 Hydraulic pressure filter 3.3 Steering block: Priority valve Proportional valves 3.4 Steering cylinder 3.5 Open 2/2 way directional seat valve Free run valve
1.2	Power supply: Battery + Generator	
2.1	Terminal: Emergency switch	
	Display	
	Signal lamps Release key	
2.2	Plug – Power supply	
2.3	Terminal board	
2.4	Safety-Controller	
2.5	Draw-bar angle detector	
2.6	Axle angle detector	
2.7	Speed sensor	

Working Principle:

The electro-hydraulic positive steering has been designed for trailers -refer to Fig. 1- , and therefore does not feature an own power supply. Hydraulic (1.1) and electric energy (1.2) is supplied from the towing vehicle. Between towing vehicle and trailer, hydraulic couplings (3.1) and plugs (2.2 & 2.3) act as interfaces. The terminal (2.1) installed in the driver’s cab, is used to switch ON and OFF the electro-hydraulic positive steering, and to send release messages to the controller. A display for visualization as well as two signal lamps for warning (integrated within the case), are provided. This way the driver is always informed about the state of the system.

The steering system is connected to the safety controller accommodated within the switch cabinet (2.4). Sensor and detector data obtained from sources (2.5-7) are processed here, in order to properly

adapt the steering angle on the basis of the currently selected program. Note that speed sensors (2.7) are always installed on the last axle of the trailer.

A change of the steering angle is initiated by the steering block (3.3) comprising the priority valve, which mainly supplies hydraulic oil to the steering system, directing residual quantities to other hydraulic systems. The steering angle itself is changed by a proportional valve each, connected to a steering cylinder (3.4). To enhance safety, each steering axle disposes of its own directional control valve. The open valve (3.5), a so-called free run valve, interconnects the two chambers of the steering cylinder. The axle therefore is enabled to move under the influence of external forces, i.e. it is self-steering. The lateral forces are absorbed by the rigid axle.

2.2 Safe and Appropriate Use

This manual must be submitted to all persons involved with the equipment. Safety instructions must be followed!



Warning symbols: Passages within this manual important for safety of the user and persons in the surroundings, are marked by the symbol shown on the left.

2.2.1 Appropriate Use

The control features different steering programs: For road traffic, the standard mode is mandatory, whereas programs to be used in fields are exclusively admissible in zones not subject to road traffic licensing regulations. The mode should only be changed when the engine has been stopped.

The manufacturer assumes no liability for damages arising from applications contradictory to appropriate use as defined in this manual. This includes described action to be taken for maintenance and repair, as well as observance of additional operating instructions. If the machine is sold, leased, or handed over to another organization, it must be accompanied by this manual and other relevant safety information.

The equipment should never be used by persons unable to understand or to follow the operating instructions, by novice drivers or by persons not disposing of a valid driving license.

These operating instructions have to be considered as a complement to road traffic licensing regulations, to regulations for prevention of accidents, to standards of occupational health and other safety prescriptions, all of them to be respected as well.

⚠ Manipulations and unauthorized modifications of hardware and software are not admissible!

2.2.2 Rules for Prevention of Accidents

Note that these prescriptions are essential not only for the driver himself, but also for third persons.



Warnings and safety labels attached to the equipment must remain clean and in readable state.



Before starting to work, make sure that all functions and operating elements are understood.



Documentation of the vehicle itself (in which the electro-hydraulic positive steering unit is installed) must be observed likewise.

General Information



Operating authorization and operating instructions have to be considered as an integral part of the equipment, and must be available at the place of action anytime. When the machine is sold, leased, or handed over to another organization do not forget to transmit the documents as well.



Pressure supply by the hydraulic system must amount at least to 180 bar, to be adjusted by means of the priority valve. This valve is designed to support a flow of 150 l/min., with a flow of 50 l/min being required by the steering unit. A corresponding type plate is attached in the front of the container.



Before starting repair or maintenance work:

- Personnel must read this manual beforehand.
- The motor of the towing vehicle must be switched off:
 - Apply the brake.
 - Remove the ignition key.
- Separate the towing vehicle from voltage supply.
- Apply the parking brake as well, if provided.
- Wheels must be fixed by wheel chocks at the front axle.
- For vehicles with LS hydraulics: Wait until the hydraulic pressure has decreased.



Whenever the equipment is used in areas subject to road traffic licensing regulations, the road mode (respectively safe mode) must be selected, by means of the terminal in the driver's cab.



Danger of crushing in the movement range of the wheels! During operation or activation of the manual override, take care that other persons in the pivoting range of the wheels are absent.

A corresponding warning label is attached to the container between the tires.



It is important to know that the steering system during selection of another mode, adapts the orientation with respect to the towing vehicle, or runs slightly laterally displaced. It is important that meanwhile other persons are not present in proximity or within the working range of the vehicle.



Risks caused by the hydraulic system:

Fluid splashing off from the hydraulic system may give rise to severe skin irritations or other injuries, infections etc. Call for medical assistance at once.



WARNING! Hot hydraulic lines and fluids may give rise to burns!



Danger of crushing in the pivoting range of the drawbar.

Only during coupling and uncoupling procedures, presence in this danger zone is admissible. After completion, leave the zone immediately.



As the emergency switch represents an essential part of the whole system, it must be accessible without difficulties, and remain operable anytime.

2.2.3 Improper Use

The system is equipped with safety features and devices, which should never be manipulated, bridged or disabled. If one of these items proves to be defective, factory service must be informed without delay.



When driving in field mode and exceeding the speed limit of $30 \frac{km}{h}$ just to change over to road travel mode, safety functions may be impaired. Corresponding action is therefore considered as improper use. Sudden braking action on the other hand changes the behavior of the electro-hydraulic positive steering unit, so the driver may lose control.

Drivers should train braking action beforehand!



Field modes should never be used on normal roads or in other zones subject to road traffic licensing regulations!

The manufacturer assumes no liability for damages caused by improper use.

2.3 Specification

2.3.1 Electric Parameters

- Voltage: 12/24 V
- Current: 20 A max.

2.3.2 Hydraulic Parameters

- Volume flow: min.: $50 \frac{l}{min}$ for the electro-hydraulic positive steering unit
max.: $150 \frac{l}{min}$ for other consumers
- Pressure range: 180 bar max.

As the steering unit itself does not feature a supervision for the temperature of hydraulic fluid, it must be monitored from the towing vehicle - otherwise correct function is not ensured.

In the case of very low temperatures, the steering behavior of the system is sluggish. Wait until the temperature of the hydraulic fluid has sufficiently increased.

2.3.3 Connectors and Interfaces

Device connector at the drawbar console, to be used for terminal.



Fig. 2 Data connector

SUB-D- and USB-connectors (as interfaces for Service/Programming).



Fig. 3 M12-connector, SUB-D & USB

Hydraulic couplings:

LS

P

T



Fig. 4 Hydraulic connections

2.3.4 Fluids

Hydraulic system:

- Oil class: HLP DIN 51524
- Viscosity: 10-380 mm²/s

Lubricants for axles:

- Grease as specified by the manufacturer of axle / drawbar eye

2.3.5 Ambient Conditions

- Temperature range: -20°C to 60°C
- The steering itself does not dispose of a supervision for the temperature of hydraulic fluid. This function must be provided by the towing vehicle.
- In the case of very low temperatures, the steering behavior of the system is sluggish. Wait until the temperature of the hydraulic fluid has sufficiently increased.

2.3.6 Mechanical Parameters

- Steering angle of wheels: Depends on the vehicle structure and the axle specification.
- Maximum speed: 60km/h.
- Tire size: Refer to the vehicle registration.

2.4 Environmental Protection

Environment should not be contaminated by hydraulic fluid, which is based on mineral oil. In the case of a defect, it should be collected as prescribed, spilled oil must be removed.

2.5 Expected Lifetime of the Equipment

- For 1000h / year → **12 years**
 - In the end, technical overhaul by **AgrarPro GmbH** is required.
-  Hydraulic hoses have to be exchanged after **6 years** at the latest.
- Hydraulic filters must be replaced after **1000 h** or at least **once per year!**

2.6 Safety



For maintenance and repair, wear protective gloves.



The equipment meanwhile must be disconnected from power supply.

3 Start-up



Connect the steering system as prescribed. Note that it has to be attached and secured only in the specified positions. Act carefully while coupling and uncoupling the unit.

3.1 Preliminary Safety Measures

Before initial start-up of **ProSteer**, mechanics of the drawbar angle detector must be adapted to the towing machine. This measure should be repeated only after detachment of the coupling points of the towing machine, or when another towing machine is intended to be used.

3.1.1 Connection of the Drawbar Detector

Drawbar with K50-clutch

In order to prevent excessive wear, the ball clutch must be properly greased.

Inspection is necessary every time before establishing the connection!

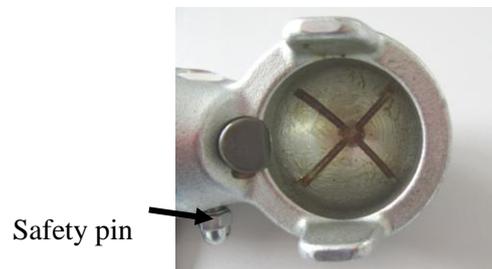


Fig. 5 Greasing the K50-drawbar eye



Fig. 6 Drawbar Detector - Drawbar

Hang up the ball clutch K50 of the drawbar detector, the safety pin must engage.

Gooseneck

Connect towing machine and trailer by means of the two M8-ball joints.

Each time before establishing attachment, check these ball joints for wear!

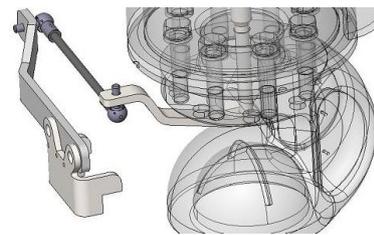
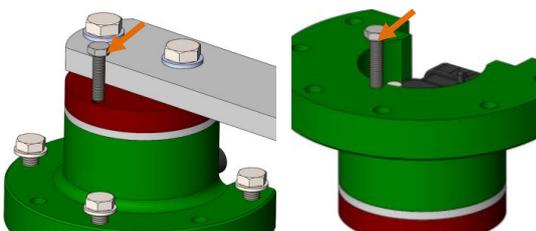


Fig. 7 Drawbar detector - Gooseneck

3.1.2 Adjustment of the Drawbar Detector



1. This adjustment requires alignment of towing vehicle and trailer (i.e. they must be standing in one line).
2. To fix the detector, insert M6 screw (**Arrow**).
3. Set up the detector mechanics by means of the threaded rods.
4. Remove M6 screw (**Arrow**).

3.1.3 Electric Connections

1. Plugs must be in correct state (undamaged, free of contamination).
2. Insert the plug.
3. The plug must properly be locked.

3.1.4 Hydraulic Connections

1. Switch OFF the machine.
2. Couplings and plugs must be in correct state (undamaged and clean). In case of need, connectors must be replaced.
3. Establish hydraulic connections. Connectors can be identified by shape and size (refer to fig. 4):
 - a. T-Line
 - b. P-Line
 - c. LS-Line.
4.  - It is important that hydraulic lines between the vehicles cannot be squeezed or subjected to abrasion originating from moving parts.

3.2 Switching OFF

Before switching OFF, park the vehicle in a convenient place and wait until hydraulic pressure has decreased. The trailer must be secured against rolling away (the wedges for that purpose always have to be positioned at the rigid axle). In the end, all hydraulic hoses, electric lines and the mechanics of the drawbar detector have to be separated from the towing machine.

Electronic components, e.g. plugs and terminals, should not be exposed to influences of weather.

4 Operation

The electro-hydraulic positive steering unit **ProSteer** together with its software has been developed to offer convenient driving properties for different situations, thus increasing driving comfort and safety.

When traveling on roads, the standard **Road Mode** ensures safe tracking and steering properties meeting the requirements of current speed. The other modes are reserved for zones outside the scope of the road traffic licensing regulations.

In inclined areas, the **Slope Mode** reduces drift when all steering axles are oriented in ascending direction. **Manual Mode** enables all axles to be controlled in any direction in a targeted manner. These modes are described in detail later in this manual, refer to section Description of Operating Mod.

Caution! In Field Mode, the trailer laterally swings out. In case of large working width, check the surroundings - the considerable motion caused by this effect should not give rise to collisions.



Safety information of this manual as well as the regulations for prevention of accidents must be observed. Immediately replace safety labels attached to the vehicle, as soon as they are damaged or no more identifiable.



All elements of the control, including the menu structure, must be known and understood, before drivers are allowed to use the equipment.



During operation, ensure that other persons do not approach the danger zone close to the vehicle.



As the steering behavior is influenced by the electro-hydraulic positive steering system, sufficient space around trailers and optional working equipment in the surroundings must be provided.



Do not underestimate the risk of crushing and injury by shearing caused by externally actuated components (e.g. axles with hydraulic cylinders).



Never remove, disable or manipulate protective devices.



As the system is only admitted to a maximum speed of 60 km/h, it is automatically switched OFF when this limit is reached.



After each restart, the functionality of electro-hydraulic positive steering is verified by the test mode provided. If the vehicle is fully loaded, a certain test travel may be required, due to the increased steering forces at the wheels.



The driving behavior must correspond to weather and road conditions.



The terminal in the driver's cab has to be installed in the field of view of the driver, refer to Fig. 8.

4.1 Terminal - Type 1

The steering systems Tandem and Tridem B are available also without display. In this case however, field modes are not provided. Only emergency button and signal lamps are required

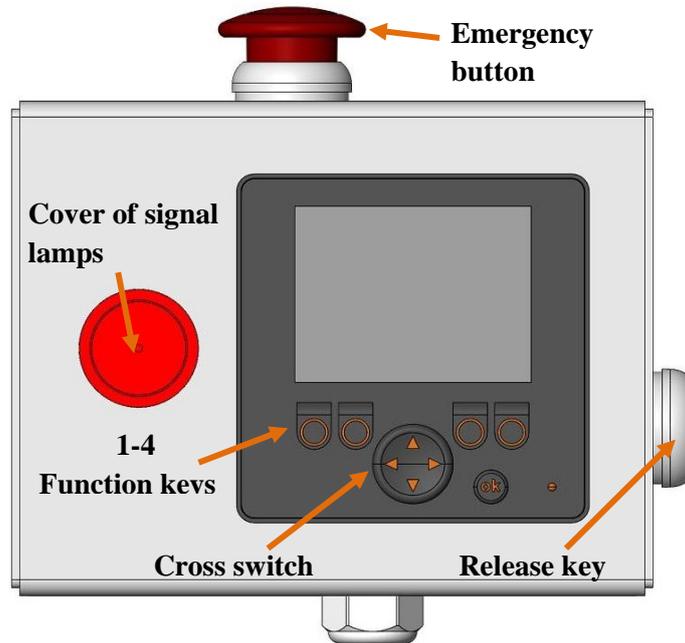


Fig. 8 Terminal

The cover at the left side of the display houses two signal lamps, **Red** and **Green**.

If the system is correctly working, the **green** lamp is lit. **Red** indicates an error condition, so the system has been switched to Safe Mode. An alternating sequence at a frequency of 1 sec. signifies that currently the test mode is active.

By means of the Release Key at the right side of the case, various functions can be activated / released.

4.1.1 Emergency Button / Switching ON and OFF

The emergency button of the **ProSteer**, refer to Fig. 8, is used for both, emergency stop as well as normal switching ON and OFF. When pressing this button, it is latched in lower position, thus enabling the steering system to be switched OFF in a safe manner. For restart, simply press the button again.

After stop, the vehicle together with the trailer can be parked. Discharge of the battery of the towing vehicle caused by the steering unit, is negligible.

As an alternative, the system can be switched OFF by disconnecting it from the power supply. If the unit is not switched OFF by means of the emergency button, restart is accompanied by an error message, which has to be acknowledged by the driver.

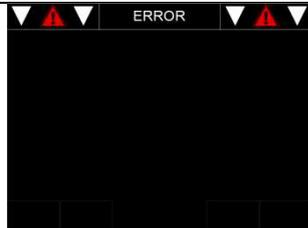
4.1.2 Menu Structure

The menu structure of the display is described in the following:

Initialization

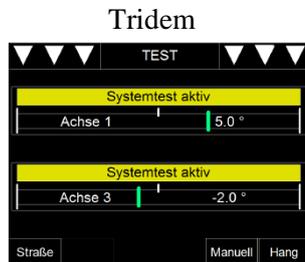
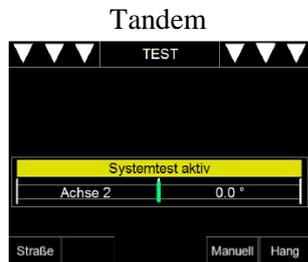


During system start, the controller checks internal functions. The display meanwhile shows INT – Initialization.



In the case of a previous error condition, failure etc., a warning message appears on the screen.

Display – System Test



During verification of the functionality in system test, the axle currently under investigation is displayed, together with the steering angle finally obtained. This way, identified error conditions become obvious at a glance.

From this mode it is also possible to select the driving mode to be used afterwards. Details are handled in chapter Test Mod.

Display - Road-Mode



If no Field Mode has been selected from System Test menu, the Road Mode after completion is opened automatically. For purposes of comparison, the speed value is shown.

Caution! This value is not intended to replace the tachometer of the towing vehicle.

Selection of another mode



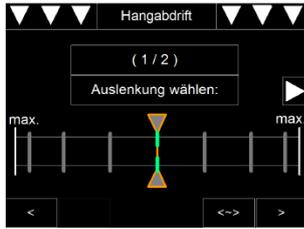
Unsichtbar	
Wenn Freigabe-Taster gedrückt werden soll:	DRÜCKE Betätigt DRÜCKE Nicht betätigt
Wenn Freigabe-Taster gelöst werden soll:	LÖSEN
Wenn Geschwindigkeit zu hoch zum Wechsel:	SPEED
Wenn Timing-Taster nicht i.O.:	TIMING
Wenn Freigabe-Taster erteilt. Grüner Balken zeigt restliche Zeit	WÄHLE

Pressing the Release Key for a duration of 2-4 sec. opens the selection window illustrated here. It appears in the lower zone of the screen. This menu remains enabled for 10 seconds and allows another driving mode to be activated by means of the function keys, 1-4, refer to Fig. 8.

The central picture shows the buttons appearing on the display during the change.

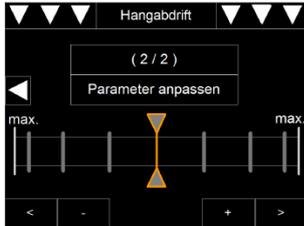
Display – Field Mode – Slope

Deflection



The desired steering angle is set up by means of keys 1 and 4. For this purpose, three deflection points are predefined. Optimum set up takes place by parametrization. The corresponding menu opens, when the right arrow of the cross switch is pressed. The three predefined deflection points may be adapted individually by means of the +/- function. After completion, leave the menu by the left arrow of the cross switch.

Parametrization



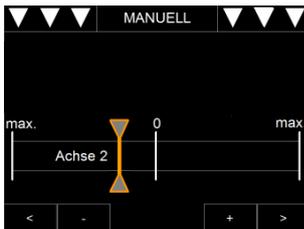
Pressing the double arrow key directs the axles in opposite direction.

It is important to know, that up from a speed of 20 km/h, the steering angle is reduced, as detailed in chapter

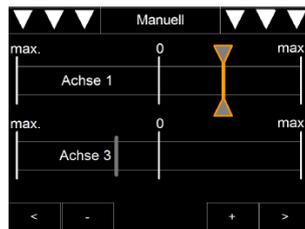
Field Mod. This limitation of the steering angle can only be suspended by pressing **OK Key**.

Display – Field-Mode – Manual

Tandem



Tridem



The Manual Mode enables the steering angle of each axle to be adapted individually by means of the +/- keys, regardless of the drawbar angle.

Use function keys 1 and 4 to specify the axle intended to be configured.

Automatic Change to Road Mode

Up from a certain speed, the system automatically changes to Road Mode, due to reasons of safety. The limit speed varies according to the different modes, as specified in chapter 5.3.3.



ACHTUNG!

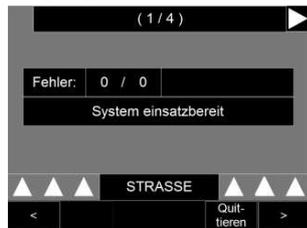
- Never use Field Modes when driving in areas subject to road traffic licensing regulations!
- **ALWAYS** change over to Road Mode when entering corresponding zones. This change has preferably to be performed, when the engine is in standstill!
- Do not use the speed limit to change over to Road Mode. This feature is intended merely as a safety feature. Performing a corresponding action when traveling on a road, has to be considered as negligent behavior.

4.1.3 Drop-Down Menu

Apart from driving programs, the software features a drop-down menu (present in any driving mode), accessible by the lower arrow on the cross switch. Leave this menu again by pressing the upper arrow.

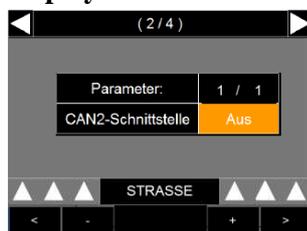
This menu grants access to different functions provided by Left and Right arrow keys of the cross switch.

Display – Errors



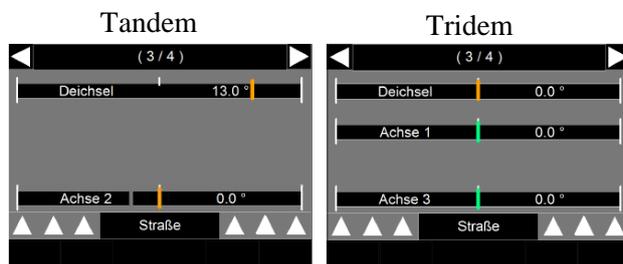
The first menu point opens the Error Memory. Errors contained can be acknowledged (*Quittieren*), provided that they are no more active.

Display – CAN2



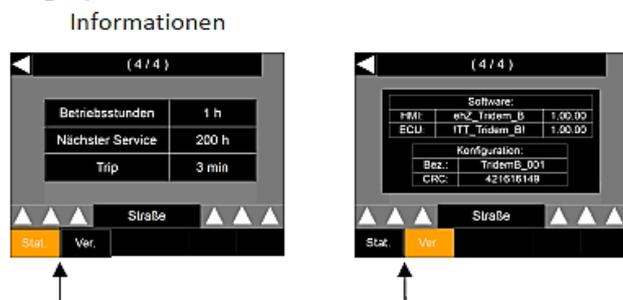
By means of the second menu, the CAN2-interface can be opened, so that data may be transmitted from the steering unit to other controls.

Display – Information



The third menu „Information“ is used to display in real-time axle and drawbar angles, sometimes useful for identification of errors and for set-up of detectors, e.g. the drawbar detector.

Display – Service Menu



Stat. – Status:

The fourth menu informs about operating hours and maintenance counter. ‘Trip‘ indicator specifies the operating time of the unit, since start-up.

Ver. – Verification:

Software version as well as the type currently used are displayed.

4.2 Terminal - Type 2

Additional option: Not yet available.

5 Description of Operating Modes

Four main modes are provided, as described in the following:

1. Test Mode
2. Road Mode
3. Field Mode
 - a. Slope
 - b. Manual
4. Safe Mode

5.1 Test Mode

For reasons of safety, a test routine is launched during each start-up, to verify functionality of safety controller, general actuators, valves, sensors and detectors including their specific mechanic actuators. In case of an error, the assigned error number is displayed, so the reason of the problem can be localized.

Before Test Mode is initiated, the control is in Safe Mode. Unintentional test routines are prevented by specific start conditions. Test Mode however can be selected also after restart. It is important that the trailer beforehand is in standstill. Then the routine can be launched either by accelerating to a speed of 1 km/h or by pressing the Release Key for a duration of 3 s.

In case of an error, the routine is aborted. The system switches over to Safe Mode, and up from that moment, only emergency functions are available.



CAUTION!

Check the surroundings before start-up. Unexpected presence of unauthorized persons may give rise to injuries.

The same is valid when launching a test routine in the course a travel. Persons in the path of the trailer are not admitted.

The run of the test routine is visualized by the signal lamps (red and green lamp alternately lit at a frequency of 1 s) and the display – refer to chapter 4.1. Do not leave the driver's cab meanwhile. In case of need, quick reaction may be required.

For internal test, the vehicle should be in standstill (or moving at a speed of 3 km/h max.).

To ensure a trouble-free test procedure, the following conditions must be met:

1. The routine can be launched in standstill or during a travel.
2. In the case of a loaded vehicle (with full axle loading), test execution during a travel may be advantageous, in order to reduce steering forces.
3. The following points must be known:
 - a. In the case of a test in the course of a travel, the trailer temporarily may move slightly laterally displaced to the towing vehicle.
 - b. Excessive steering movements meanwhile should be avoided.
 - c. Optimum driving speed amounts to 3km/h.



If an error is discovered during test, no more active steering movements are possible – only self-steering.

Description of Test Procedure

This description may be useful to detect errors in the course of the routine. To each step, a specific duration is assigned, during which the requirements have to be met. If the requirement cannot be met within due time, Safe Mode is activated.

1. Test of Free Run Axle.

1.1. Initial pause.

Activation shortly after the locking axle.

1.2. Free run function, the axle is intended to be steered via centering – Free run valve in rest position.

Steering movement of $< 2,5^\circ$ detected -> jump to 2.4.

Steering movement of $> 2,5^\circ$ detected -> go on with point 2.3.

1.3. Free run function, the control steers in opposite direction to 2.2 – Free run valve in rest position.

Steering angle in identical direction to 2.2 -> **No error**

Steering angle in opposite direction to 2.2 -> **Error**.

1.4. Steering function, the control steers 3° beyond the centering (overshooting).

Steering movement is put into effect -> **No error, $< 3^\circ$ or $> 4^\circ$ -> Error.**

1.5. Steering function, the control centers the axle.

Steering movement is put into effect -> **No error, < -1 or $> 1^\circ$ -> Error.**

5.2 Road Mode

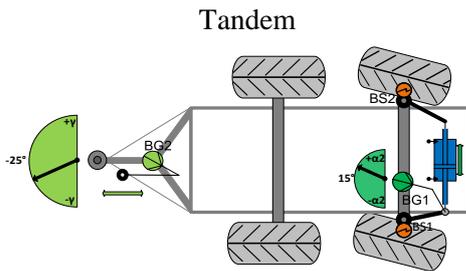


Fig. 9 Tandem – Road

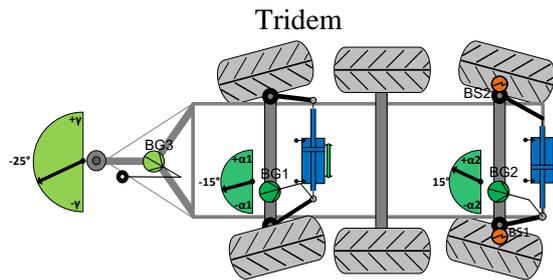


Fig. 10 Tridem – Road

If during the test neither an error has been discovered by the system, nor a field mode activated by the user, Road Mode opens automatically, and the steering angle of free run axle(s) is adjusted in conformity with the drawbar angle.

Active steering this way achieved contributes to improve maneuverability on roads and the behavior of the vehicle during shunting. Furthermore, thanks to permanent optimum orientation of the wheels, wear of axles and wheels is reduced.

In order to prevent vibration of the trailer caused by steering movement, the steering angle is reduced. Up from 20 km/h the steering angle with increasing speed is linearly lowered, so at 30 km/h the axles are centered. When decelerating again, the angle automatically re-increases.



ACHTUNG!

When slowing down from 30 km/h to 20 km/h, the complete steering angle is released.

Whenever changing the steering mode (Road → Field or Field → Road), check the surroundings beforehand to avoid accidents, as tracking of the trailer will change.

5.3 Field Mode



CAUTION!

Field modes should not be used on normal roads or in other zones subject to road traffic licensing regulations!

Before selection these modes, the vehicle always should be in standstill.

If no error during test mode becomes obvious, the Field Mode becomes available as well, ready for use.

Two possibilities are provided to activate Field Mode:

- Already in the course of the Test Mode launched during restart. A selection menu is opened, and after corresponding selection, the field mode automatically opens after completion of the routine.
- During operation. To open the selection menu, the controller requires a signal of 2-4 s from the Release Key. If the key is pressed for too long or not long enough, the menu remains closed. Press the button again. Once opened, the menu remains accessible for 10 s. During this period, select one of the Field Modes by means of Function Keys 3 & 4. For details, refer to chapter 4.1.

The following submenus are available:

- **Slope**
- **Manual**

Note that the possibility of selection is restricted by the driving speed. If the vehicle is driving too fast for the corresponding mode, the selection is locked. Slow down before attempting to open the mode again. If no mode is selected within 10 s, the window is closed, and a new release is required.

5.3.1 Slope

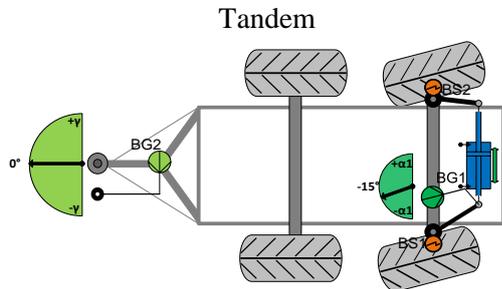


Fig. 11 Tandem – Crab Steering

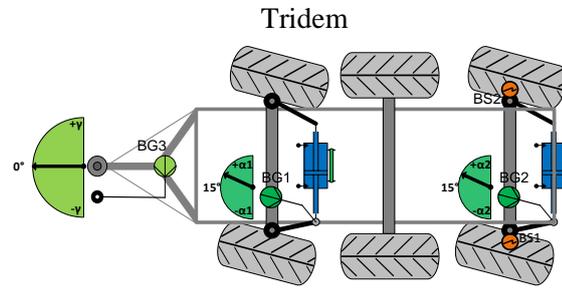


Abbildung 12 Tridem – Crab Steering

The Slope Mode is useful to reduce drift in inclined areas, by orienting the wheels of steering axle in parallel to each other, with respect to the towing vehicle. The adjustment of steering angle of the wheels takes place regardless of the drawbar angle by means of the display, refer to chapter 4.1.

As it is not possible to drive along curves in this mode, the change to Road Mode in corresponding situations is always required. After completion of the turning manoeuvre, the Slope Mode may be enabled again. After turning, the axles must be steering in opposite direction. This is possible by means of function key 3 (double arrow symbol).

⚠ Caution:

- Meanwhile no persons should approach the danger zone.
- The trailer may move slightly displaced to the towing vehicle.
- The chassis may be subjected to warping, as soon as the steering axles are adjusted and the rigid axle absorbs all lateral forces.
- When this mode is left, always the current steering angle remains stored. After reactivation, the system returns to the stored initial position.
- Note that in case of breakdown of the steering system – **Safe-Mode** – no axle is actively directed towards the slope.
- In case of breakdown of the steering system – **Safe-Mode** – the trailer aligns behind the towing vehicle.

5.3.2 Manual

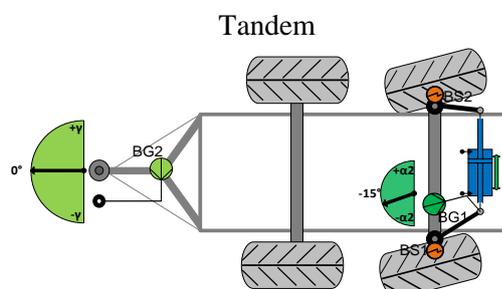


Fig. 13 Tandem – Manual

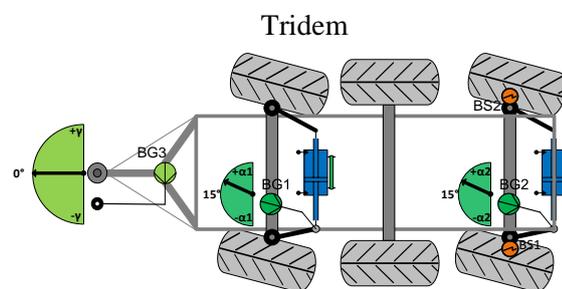


Fig. 14 Tridem Manual

This mode allows free orientation of the axles. Wheels may be adjusted independently and regardless of the drawbar detector by means of the display, refer to 4.1.

This mode is reserved to extremely difficult situations impossible to handle by other modes, e.g. in direct proximity to an embankment or a tree, or if the vehicle is blocked and must be exempted while wheels are oriented in an inconvenient position.

It is essential however not to exert excessive stress on the chassis of the trailer during travel, caused by inconvenient adjustment of the axles.

5.3.3 Speed Limits in Field Modes

To both Field Modes, speed limits are assigned, i.e. these modes are restricted to defined speed ranges. If the field mode by mistake is still left active after acceleration, it is automatically disabled, and the system switches over to Road Mode.

 **Caution:** This function is a pure safety feature, not intended to replace regular change → refer to chapter 4.1.

In order to prevent sudden change of the drive mode when unintentionally exceeding the limit speed, the steering angle of the wheels is linearly reduced.

Road:

Up from 20 km/h the steering angle with increasing speed is linearly reduced, and at 30 km/h all axles are centered. As soon as the control detects a speed value above 30km/h, the steering axles are no more subjected to control. When slowing down, this restriction is suspended and the complete steering angle becomes available again.

Slope Mode:

Up from 20 km/h the steering angle with increasing speed is linearly reduced, and at 30 km/h all axles are centered. In this case however, the restriction during deceleration remains in force, and the current steering angle is not changed. In order to return to initial steering angle, two possibilities are provided: a) Pressing OK button on the display reestablishes the former steering angle, depending on the driving speed. b) Use normal functions on the display to select a new steering angle. As soon as the control detects a speed value above >30km/h, the Slope Mode automatically ends, and the system returns to Road Mode.



The speed limit of 20 km/h must be respected - otherwise drift effect may be increased, due to the reduction of the steering angle.

When simultaneously braking at a speed above **20 km/h** and suspending the limitation of the steering angle (OK key), the trailer instantaneously starts to run in a trace laterally displaced to the towing vehicle.

Manual:

In Manual Mode, speed limits become active up from >4 km/h. The steering angle is lowered, and at 6 km/h all axles are centered. When increasing speed further, the system switches over to Road Mode.

 When slowing down in Manual Mode, the steering starts to return to initial position.

5.3.4 Errors in Field Modes

An error occurring in Field Modes causes the system to switch over to Safe Mode automatically. The free run axles up from that moment are subjected to self-steering. When working in inclined zones, none of the axles is actively directed towards the slope anymore. This must be taken into

consideration. The knuckles of the steering axles cannot absorb lateral forces before arriving at the limit stop, otherwise the trailer always aligns behind the towing vehicle.



In slope mode, it is important to know that after activation of the safety function, only one axle remains actively steered towards the slope. **This means:** Slope drift can only be used to a limited degree. (The rigid axle is required to keep the vehicle in its trace.)

5.3.5 Safe-Mode

In the case of system failure or breakdown, the controller automatically enables the Safe Mode, to exclude risks for the driver himself and persons in proximity.

Significance of the Safe-Mode:

The Safe Mode can be considered as a fallback level defining a safe state, so the vehicle remains always under control of the driver even in the case of an error. For this reason, the control ceases all steering functions by switching back hydraulic valves to rest position. The green lamp is disabled, and red warning lamp is lit.

As the CAN interface is located outside the system range, this communication with CAN bus remains active, provided that this was not the origin of the problem. For this reason, error numbers may still be displayed and used for determination of the source of the problem.

The recording of sensor and detector data may be continued as well, in order to maintain supply of data to external controls. (**Additional option**).

Driving Behavior in Safe-Mode:

The safe state is established automatically. In order not to lose control in the case of an error, each axle is subjected to self-steering – free run axle. During road travel, the tracking behavior of the trailer remains identical, since track guidance up from that moment is ensured by the rigid axle. In Field Mode, the tracking behavior corresponds to the state in Road Mode. In either case, no more axle is actively steered.

The driver must be able to recognize the activation of the safety function at once. **For this reason, the signal lamps must be installed in his field of view.**

Canceling the safety function:

1. Read out the error number from display or error list.
2. Switch OFF the steering system.
3. Localize and correct the error state.
4. Restart the system and acknowledge the error on the display.
5. Perform system test to check whether the problem is really solved.
 - a. Yes – The electro-hydraulic positive steering can be used again.
 - b. No – Consult factory service.

Activation of safety function:

For a list describing errors causing a change to Safe Mode, refer to the A of this manual. The numbers specified correspond to the numbers appearing in the display for purposes of troubleshooting.



If none of the signal lamps is lit, this has to be regarded as an error as well!

It is recommended to reduce the speed to **30 km/h max.**, as no more active steering is possible and free run axles may start to vibrate.

5.4 Troubleshooting

Error:	The trailer runs in a trace displaced to the towing vehicle, even though Road Mode has been selected. Immediately press emergency button and stop the vehicle.
Action:	Setting of axle or drawbar angle detectors may be incorrect.

Error:	Excessive steering angle of rear axle when driving along curves. The vehicle swerves.
Action:	Readjust angle detectors.

Error:	Defective signal lamp: Required information concerning the state of the system for the driver not available. Error message: 0_0_31/32_X
Action:	Order and exchange signal lamps, refer to chapter Fehler! Verweisquelle konnte nicht gefunden werden.

Error:	Emergency switch does not latch, and the system cannot be switched OFF.
Action:	Separate data plug or power supply, and move to next workshop.

Error:	The system switches OFF completely; restart is impossible.
Action:	Fuse or NO contact of the emergency switch may be damaged and has to be replaced.

Error:	Even though the vehicle is moving, no speed value is shown in Road Mode.
Action:	Signal from speed sensors absent. Drive to next workshop at once.

6 Towing away / Manual Override

Following situation: The steering system malfunctions and cannot be restarted. When attempting to move the trailer backwards, the free run axles move in opposite directions and are therefore subjected to warping. In this case, the manual override provided at the hydraulic valves, may solve the problem.

Before using this feature:

Press the emergency switch at the display, or separate the vehicle from power supply. Towing vehicle and trailer must be secured against rolling away. In order to be able to adjust the steering angle, the hydraulic supply must remain active, otherwise the axles cannot be adjusted.



ACHTUNG!

Manual override is reserved to really critical situations. It is recommended to attempt to solve the actual problem before making use of this feature.

No persons should approach the pivoting range of the trailer meanwhile.

Risk of burn – Hydraulic valves are hot, wear protective clothing.

In order to prevent unauthorized adjustment, after completion do not forget to reset the manual override at the proportional valves and remove it from directional control valves.

For the positions mentioned in the following procedure, refer to the overview drawing, Fig. 1.

Procedure:

Secure the towing vehicle, the motor however must still be running.



CAUTION!



Components during operation may warm up.

Wear protective gloves!



Fig. 15 Plastic nut

1. Step – Preparing the action:

Take out the manual override from switch cabinet, as shown in Fig. 16.

Unscrew the plastic nut from solenoid (Pos. 3.5).

2. Step – Unlocking directional control valve:

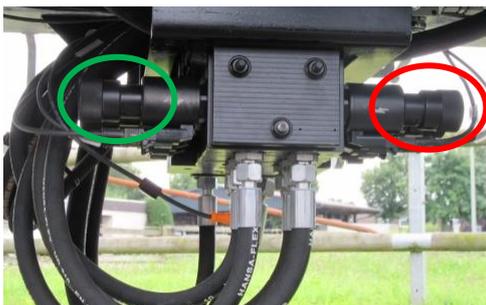
Unscrew the manual override, and turn in the set screw down to the stop by means of a **3 mm Allen wrench**.

Do not tighten!

Repeat this procedure for all axles intended to be adjusted.



Fig. 16 Manual override



3. Step – Adjusting the steering angle:

Set the desired steering angle by means of the proportional valves (Pos. 3.3).

- Manual override to **A** -> Axle is directed to the **left**.
- Manual override to **B** -> Axle is directed to the **right**.

4. Step:

Remove the manual override, and refix the magnets by means of the plastic nut, as shown in Fig. 15, Place the manual override back into the switch cabinet.

7 User Information

The general state of the **ProSteer** is visualized by two signal lamps provided at the terminal.

If the system is correctly working, the **green** lamp is lit.

Red indicates an error condition, so the system has been switched to Safe Mode (the same is valid when both LED's remain dark).

An alternating sequence at a frequency of 1 sec. signifies that currently the test mode is active.

For further information concerning the display, refer to chapter **Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden..**

Errors occurred remain stored in an error list, which can be viewed any time by customer service, for purposes of diagnosis.

8 Maintenance



CAUTION!

During maintenance and repair work, regulations for prevention of accidents must be observed.

Never use high-pressure cleaners for electrical equipment like detectors or switch cabinet.

A corresponding label is attached to the switch cabinet.

Before starting to work, switch OFF power supply.

In case of injuries caused by hydraulic fluid, call for medical assistance at once!

8.1 Preliminary Safety Measures

The following conditions must be met:

- The measure takes place in a safe and appropriate working area.
- Vehicles are secured against rolling away.
- The hydraulic system is unpressurized.
- Steering system and towing vehicle are disconnected from power supply.
- When working at the hydraulic system, oil is collected by a convenient container.

8.2 Service Points

For replacement of damaged items, exclusively use spare parts released by **AgrarPro**.

Daily measures, also during initial start-up:

No.	Task	Description
1.	Lubrication	Axles must regularly be greased in conformity with the specification of their manufacturer.
2.	Angle detectors	Adjustment of detectors has to be checked: Vehicle and trailer standing in one line → <ul style="list-style-type: none"> - Axle and drawbar angle must be set to 0°. - Wheels in straight orientation.

Service and annual maintenance

No.	Task	Description
3.	Electronic components	Absence of damages: 1) Check the case of the components for cracks and other damage. 2) Cables should not be damaged or worn. 3) No corrosion should be visible on seals of plugs and contacts.
4.	Hydraulic equipment	Check all hydraulic components: 1) Leak tightness of filters, hoses, tubes, couplings and valves must be ensured. 2) Verify hydraulic hoses for cracks or excessive wear. Hoses should be replaced at the latest after six years. 3) No corrosion on hydraulic tubes. 4) Steering cylinders must be vented. 5) Replace pressure filters in the P line.
5.	Angle detectors	Mechanics of the detectors must be inspected: 1) Absence of corrosion 2) Deformation 3) Worn bearings
6.	Axles	The steering system must be checked for wear, according to the specification of the manufacturer of the axles: 1) Spherical heads 2) Knuckles

8.3 Adjustment of detectors

Detector for axle angle:

1. Use the manual override to orient the axle in straight direction, refer to chapter 6.
2. Detach mechanic assembly - 1.
3. Fix the detector by means of screw (M6x40mm) - 2.
4. Adjust and refix mechanic assembly - 1.
5. Remove fixing screw - 2.

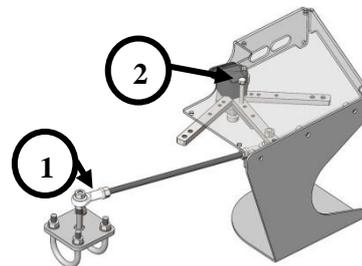


Fig. 17 Bracket of axle angle detector

Detector for drawbar angle:

This procedure is described in chapter 3.1.2.

8.4 Exchange of Signal Lamps

The two signal lamps in the terminal can be identified by a red and a green sticker, refer to Fig. 18. A damaged lamp must be replaced as soon as possible.



Fig. 18 Lamps within the case



Only use lamps admitted for the steering system.

8.5 Welding

The following conditions must be met:

1. Welding is reserved to qualified welders.
2. Disconnect the control from power supply.
3. Detach the main plug from the controller, refer to Fig. 19.
4. Detach the plugs from speed sensor, axle angle and drawbar angle detectors.
5. Attach the earth terminal of the welding unit directly at the position to be welded.
6. Contact between welding electrode or earth terminal and control elements of the electronics must be prevented.
7. The control elements must be protected against welding spatters as well.



Fig. 19 Controller plug

8.6 Regular Inspection by Technical Supervisory Association

During periodical inspection of the vehicle itself, the electro-hydraulic positive steering unit must be inspected by the corresponding institution as well.

8.7 Adjustment of Parameters

Corresponding procedures are reserved to the customer service of **AgrarPro GmbH**.

8.8 Acknowledgement of Service Message

After start-up of the electro-hydraulic positive steering unit, the following message appears:



CAUTION!

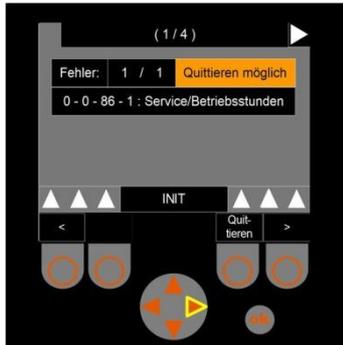
During maintenance and repair work, regulations for prevention of accidents must be observed.

Miscellaneous

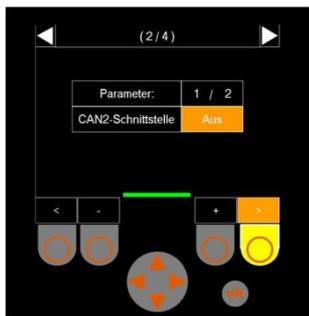
After completion of service points, the service interval can be updated, as follows:



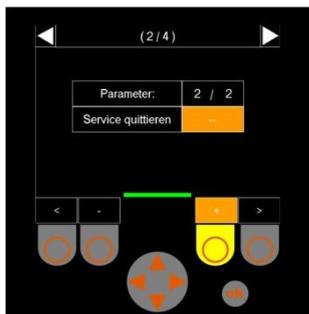
From the yellow triangle (cross switch), access to the Drop-Down menu is possible.



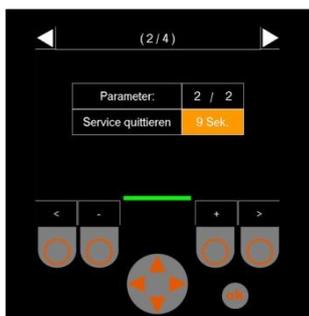
Within this menu, service message 0-0-86-1 is issued. For acknowledgement, use the cross switch to enter the parameter menu.



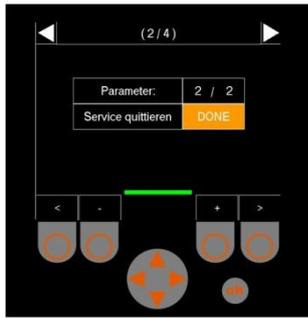
Within the Parameter Menu, change over to 'Acknowledge Service' by means of the **fourth circular button**.



Now press the **third circular button** once.



A counter starts to run for 10 s. If the maintenance counter is not yet intended to be updated, abort the procedure by means of the **third circular button**.



As soon as the message „DONE“ appears, the maintenance counter is updated.

9 Disposal

At the end of the lifetime of the equipment, observe local legislation for disposal.

Due to technical progress, **AgrarPro GmbH** reserves the right to introduce modifications with respect to illustrations and descriptions in this manual, without incurring obligation to alter machines previously delivered.

Technical specifications and dimensions are not binding. Errors excepted.

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10 Appendix – Error List

If both error cause and error source are Zero, the error must be application specific. The following errors can be determined by the software:

1.Byte: Error Cause	2.Byte: Error Source	3.Byte: Application-specific Error Code	4.Byte: Error Class	Significance of Error Code
0	0	1	2	Sensor system – Detector for travel direction (left wheel) – IN00
0	0	2	2	Sensor system – Speed sensor (left wheel) – IN01
0	0	3	2	Sensor system – Angle transmitter axle 1 – Signal A– IN02
0	0	4	2	Sensor system – Angle transmitter axle 2 – Signal A– IN03
0	0	5	2	Sensor system – Angle transmitter axle 3 – Signal A– IN04
0	0	6	2	Sensor system – Angle transmitter drawbar – Signal A– IN05
0	0	7	2	Sensor system – Release key – IN06
0	0	8	2	Sensor system – Reserve IN07
0	0	9	2	Sensor system – Detector for travel direction (right wheel) – IN08
0	0	10	2	Sensor system – Speed sensor (right wheel) – IN09
0	0	11	2	Sensor system – Angle transmitter axle 1 – Signal B– IN10
0	0	12	2	Sensor system – Angle transmitter axle 2 – Signal B– IN11
0	0	13	2	Sensor system – Angle transmitter axle 3 – Signal B– IN12
0	0	14	2	Sensor system – Angle transmitter drawbar – Signal B– IN13
0	0	15	2	Sensor system – Proximity switch – IN14
0	0	16	2	Sensor system – Hydraulic pressure IN15
0	0	17	2	Actuator system – Lift valve – OUT00
0	0	18	2	Actuator system – Holding valve – OUT01
0	0	19	2	Actuator system – Holding valve – OUT02
0	0	20	2	Actuator system – Reserve OUT03
0	0	21	2	Actuator system – Check valve A – OUT04
0	0	22	2	Actuator system – Check valve B – OUT05
0	0	23	2	Actuator system – Proportional valve locking axle A – OUT06

Appendix

0	0	24	2	Actuator system – Proportional valve locking axle B – OUT07										
0	0	25	2	Actuator system – Free run valve, front axle – OUT08										
0	0	26	2	Actuator system – Proportional valve, front axle A – OUT09										
0	0	27	2	Actuator system – Proportional valve, front axle A – OUT10										
0	0	28	2	Actuator system – Free run valve, rear axle – OUT11										
0	0	29	2	Actuator system – Proportional valve, rear axle A – OUT12										
0	0	30	2	Actuator system – Proportional valve, rear axle A – OUT13										
0	0	31	2	Actuator system – Control lamp red – OUT14										
0	0	32	2	Actuator system – Control lamp green – OUT15										
0	0	40	2	Communication – CAN1-Initialization										
0	0	41	2	Communication – CAN1-Reception of messages										
0	0	42	2	Communication – CAN1-Evaluation of received messages										
0	0	43	2	Communication – CAN2-Initialization										
0	0	44	2	Communication – CAN2- Reception of messages										
0	0	45	2	Communication – CAN2- Evaluation of received messages										
0	0	46	2	Communication – CAN3-Initialization										
0	0	47	2	Communication – CAN3- Reception of messages										
0	0	48	2	Communication – CAN3- Evaluation of received messages										
0	0	50	2	Real process data – Hydraulic Pressure										
0	0	51	2	Real process data – Release key <ul style="list-style-type: none"> Key pressed for too long (>20s) 										
0	0	52	2	Real process data – speed <ul style="list-style-type: none"> Signals of travel direction do not match Frequencies of wheel detectors do not match Speed to high (>70km/h) 										
0	0	53	2	<table border="1"> <thead> <tr> <th>3.Byte</th> <th>Angle transmitter</th> </tr> </thead> <tbody> <tr> <td>53</td> <td>Drawbar</td> </tr> <tr> <td>54</td> <td>Axle 1</td> </tr> <tr> <td>55</td> <td>Axle 2</td> </tr> <tr> <td>56</td> <td>Axle 3</td> </tr> </tbody> </table> <p>Evaluation angle transmitter</p> <ul style="list-style-type: none"> Signal A differs from set range (500mV < Signal < 4500mV) Signal B differs from set range (500mV < Signal < 4500mV) Signals A+B do not match Angle outside tolerance Angle change speed to high 	3.Byte	Angle transmitter	53	Drawbar	54	Axle 1	55	Axle 2	56	Axle 3
3.Byte	Angle transmitter													
53	Drawbar													
54	Axle 1													
55	Axle 2													
56	Axle 3													
0	0	54	2											
0	0	55	2											
0	0	56	2											
0	0	56	2											

Appendix

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58	Axle 1														
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60	Axle 3														
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0	0	59	2												
0	0	60	2		Evaluation Steering/Drawbar angle <ul style="list-style-type: none"> • Angle outside tolerance • Angle change speed to high 										
0	0	61	2		<table border="1"> <thead> <tr> <th>3.Byte</th> <th>Angle transmitter</th> </tr> </thead> <tbody> <tr> <td>61</td> <td>Axle 1</td> </tr> <tr> <td>62</td> <td>Axle 2</td> </tr> <tr> <td>63</td> <td>Axle 3</td> </tr> </tbody> </table>	3.Byte	Angle transmitter	61	Axle 1	62	Axle 2	63	Axle 3		
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63	Axle 3														
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0	0	63	2												
0	0	70	2		Evaluation Lift axle <ul style="list-style-type: none"> • Wildcard 										
0	0	71	2		<table border="1"> <thead> <tr> <th>3.Byte</th> <th>Angle transmitter</th> </tr> </thead> <tbody> <tr> <td>70</td> <td>Axle 1</td> </tr> <tr> <td>71</td> <td>Axle 2</td> </tr> <tr> <td>72</td> <td>Axle 3</td> </tr> </tbody> </table>	3.Byte	Angle transmitter	70	Axle 1	71	Axle 2	72	Axle 3		
3.Byte	Angle transmitter														
70	Axle 1														
71	Axle 2														
72	Axle 3														
0	0	72	2		Calculation of set angle <ul style="list-style-type: none"> • Improper configuration • Invalid operating mode requested 										
0	0	73	2		<table border="1"> <thead> <tr> <th>3.Byte</th> <th>Angle transmitter</th> </tr> </thead> <tbody> <tr> <td>73</td> <td>Axle 1</td> </tr> <tr> <td>74</td> <td>Axle 2</td> </tr> <tr> <td>75</td> <td>Axle 3</td> </tr> </tbody> </table>	3.Byte	Angle transmitter	73	Axle 1	74	Axle 2	75	Axle 3		
3.Byte	Angle transmitter														
73	Axle 1														
74	Axle 2														
75	Axle 3														
0	0	74	2		Logical management of axle in operation (acc. to axle type) <table border="1"> <tbody> <tr> <td> Locking axle: <ul style="list-style-type: none"> • Centering of axle could not be met • Centering point could not be reached in time • Intended axle movement could not be accomplished • Axle in motion in spite of disabled actuation </td> </tr> <tr> <td> Free run axle: <ul style="list-style-type: none"> • Intended axle movement could not be accomplished </td> </tr> <tr> <td> Rigid lift axle: <ul style="list-style-type: none"> • Lifting procedure could not be completed • Lowering procedure could not be completed • Position of lift axle not clear </td> </tr> </tbody> </table>	Locking axle: <ul style="list-style-type: none"> • Centering of axle could not be met • Centering point could not be reached in time • Intended axle movement could not be accomplished • Axle in motion in spite of disabled actuation 	Free run axle: <ul style="list-style-type: none"> • Intended axle movement could not be accomplished 	Rigid lift axle: <ul style="list-style-type: none"> • Lifting procedure could not be completed • Lowering procedure could not be completed • Position of lift axle not clear 							
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Free run axle: <ul style="list-style-type: none"> • Intended axle movement could not be accomplished 															
Rigid lift axle: <ul style="list-style-type: none"> • Lifting procedure could not be completed • Lowering procedure could not be completed • Position of lift axle not clear 															
0	0	75	2												

Appendix

0	0	76	2	3.Byte		Angle transmitter
				76	Axle 1	
				77	Axle 2	
				78	Axle 3	
Logical management of axle during system test (acc. to axle type)						
0	0	77	2	Locking axle:		
				<ul style="list-style-type: none"> • Check valve A and/or B defective • Proportional valve defective 		
0	0	78	2	Free run axle:		
				<ul style="list-style-type: none"> • Free run valve defective • Proportional valve defective 		
0	0	78	2	Rigid Lift axle:		
				<ul style="list-style-type: none"> • Holding valves defective • Proportional valve defective • Sensor elements of axle defective 		
0	0	80	2	System – Operating mode		
				<ul style="list-style-type: none"> • Requested operating mode currently locked • Change of operating mode not clear • Request for mode change active for too long • Invalid operating mode active 		
0	0	81	2	System – Error management		
				<ul style="list-style-type: none"> • Internal calculation error 		
0	0	82	2	System – PLC internal elements		
				<ul style="list-style-type: none"> • Control not switched OFF correctly • Supply voltage too high/too low 		
0	0	83	2	System – Connection to control lamps		
				Wildcard		
0	0	84	2	System – Public parameters		
				<ul style="list-style-type: none"> • One/several parameters outside tolerance • Parameter to be changed does not exist • Internal calculation error 		
0	0	85	2	System – Internal parameters		
				<ul style="list-style-type: none"> • Internal calculation error 		
0	0	86	1	System – Service/Operating hours		
				<ul style="list-style-type: none"> • Operating hours 		
0	0	87	2	System – Data logger		
				<ul style="list-style-type: none"> • Access to invalid memory range 		
0	0	88	2	System – Release of operating modes		
				Wildcard		
0	0	90	2	Communication – CAN1-Package of messages		
				Wildcard		

Appendix

0	0	91	2	<p>Communication – CAN1-Transmission of messages</p> <ul style="list-style-type: none"> • Message not successfully sent • Message could not be successfully sent within intended timeframe
0	0	92	2	<p>Communication – CAN2-Package of messages</p> <ul style="list-style-type: none"> • Wildcard
0	0	93	1	<p>Communication – CAN2-Transmission of messages</p> <ul style="list-style-type: none"> • Message not successfully sent • Message could not be successfully sent within intended timeframe
0	0	94	2	<p>Communication – CAN3-Package of messages</p> <ul style="list-style-type: none"> • Wildcard
0	0	95	2	<p>Communication – CAN3-Transmission of messages</p> <ul style="list-style-type: none"> • Wildcard
0	0	150	2	INTERNAL – Function „Fun-Report-Error-CI1“
0	0	151	2	INTERNAL – Function „Fun-Report-Error-CI2“
0	0	152	2	INTERNAL – Function „Fun-Report-Init“
0	0	153	2	INTERNAL – Function „Fun-Check-Init“
0	0	154	2	INTERNAL – Function „Fun-Check-Enable“
0	0	155	2	INTERNAL – Function „Fun-Set-Enable“
0	0	156	2	INTERNAL – Function „Fun-Checkbounds“
0	0	157	2	INTERNAL – Function „Fun-Round“
0	0	170	2	INTERNAL – Function block „FB_CALCULATE_DELAY_MilliSek“
0	0	171	2	INTERNAL – Function block „FB_CALCULATE_DELAY_MikroSek“
0	0	172	2	INTERNAL – Function block „FB_DERIVATE_REAL“
0	0	173	2	INTERNAL – Function block „FB_PT1_Filter“
0	0	174	2	INTERNAL – Function block „FB_PWM_Calculate“

10.1 Test Report - Tandem A

Prüfbericht / Test Report
Nr. / No.: 8115393230-el
vom / of 06.03.2018

IFM - Institut für
Fahrzeugtechnik
und Mobilität



Typ / Type : ProSteer
Hersteller / Manufacturer : Stapel GmbH, D-48324 Sendenhorst - Albersloh

4. Schlussbescheinigung Statement of conformity

Der in den Herstellerunterlagen beschriebene Typ entspricht der oben angegebenen Prüfspezifikation.

The type described with the information documents is in compliance with the Test Specification mentioned above.

Dieser Prüfbericht darf nur vom Auftraggeber und nur in vollem Wortlaut vervielfältigt und weitergegeben werden. Eine auszugsweise Vervielfältigung und Veröffentlichung des Prüfberichtes ist nur nach schriftlicher Genehmigung des Instituts zulässig.

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Die Prüfungen wurden entsprechend den relevanten Anforderungen der DIN EN ISO/IEC 17025:2005 durchgeführt.

The tests were carried out in accordance with the relevant requirements of EN ISO/IEC 17025:2005.

Dieser Prüfbericht umfasst die Seiten 1 bis 9.

The Test Report comprises pages 1 to 9.

TÜV NORD Mobilität GmbH & Co. KG
IFM - Institut für Fahrzeugtechnik und Mobilität
Schönscheidtstr. 28, 45307 Essen

DIN EN ISO/IEC 17025, 17020
Benannt als Technischer Dienst / Designated as Technical service
Vom Kraftfahrt Bundesamt / by Kraftfahrt-Bundesamt: KBA - P 00004-96

Geschäftsstelle Hannover, 06.03.2018



Dipl.-Ing. Ameling

Auftragsnummer 8115393230-el
E-Mail TAmeling@tuev-nord.de
Telefon +49511 998-61254
Fax +49511 998-61998

10.2 Test Report – Tridem A

Prüfbericht / Test Report
Nr. / No.: 8115935661-el
vom / of 08.04.2019

IFM - Institut für
Fahrzeugtechnik
und Mobilität



Typ / Type : ProSteer - Tridem
Hersteller / Manufacturer : Stapel GmbH, D-48324 Sendenhorst - Albersloh

4. Schlussbescheinigung Statement of conformity

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Geschäftsstelle Hannover, 08.04.2019



Dipl.-Ing. Ameling

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Fax +49511 998-61998

10.3 Declaration acc. to UN-ECE-R79

ProSteer

Funktions- und Sicherheitserklärung der elektro-hydraulischen Zwangslenkung *ProSteer* anhand der UN/ECE R79 Anhang 6

Hiermit erklärt die Firma Stapel GmbH, dass die nachfolgend bezeichnete Lenkanlage für Anhängemaschinen, genannt ProSteer, für die Nutzung innerhalb und außerhalb des StVZO Bereichs, die Anforderungen an Aufbau und der Sicherheit, der Regelung Nr. 79, Anhang 6 der Wirtschaftskommission der Vereinten Nationen für Europa erfüllt.

Bei einer nicht mit uns abgestimmten Änderung, an der elektro-hydraulischen Zwangslenkung oder Umbau an ein anderes Anhängfahrzeug, verliert diese Erklärung die Gültigkeit!

Angaben zum Lenksystem ProSteer

Tandem A: AP-PSe60-22-X-A_0SS

Tandem B: AP-PSe60-21-X-B_0RS

TriTa A: AP-PSe60-33-X-A_[H]SSS

TriTa B: AP-PSe60-32-X-B_SLS

Tridem A: AP-PSe60-33-X-A_SSS

Tridem B: AP-PSe60-32-X-B_SRS

Fahrgestell Nummer des Fahrzeuges:

Typ Nummer der Lenkung

ab 0 0 0 0

Sonstige Angaben:

Angewandte Norm:

UNECE R79

Albersloh 23.11.2018

Stapel GmbH / AgrarPro GmbH

Ort Datum

Hersteller