



**GLOBAL CRANE TRAINING**



# **AC200-1 OPERATION**

## Steering

# Steering Content



Content	Pg.	Content	Pg.
General description	3		
Monitoring the rear steering	6		
Steering programs	7		
Raising and lowering the lift axle	19		
Steering computer / fault diagnosis and list	20		
Manual emergency steering	26		

## Steering

### General System Description

The steering of the crane chassis consists of a hydraulic two circuit steering system and electro hydraulic rear axle steering (auxiliary steering system).

The direction of travel is mainly determined by the rigidly connected front axles.

The rear axles, controlled by the program, are aligned and are steered electro hydraulically, depending on the speed.

A computer monitors the control of the electro hydraulic rear axle steering. Possible fault codes can be read out there. (For information pertaining to this, see "Steering computer / fault diagnosis / fault list")

Various steering programs are available for road travel and construction site operation.

The oil supply of the hydraulic components consists of two engine dependent driven steering pumps and a driving dependent driven emergency steering pump.

During driving the emergency steering pump which is driven by the moving crane controls the delivery rate from the main pump 2 and deactivates it as soon as the delivery rate is sufficient to supply steering circuit 2.

If a steering circuit fails – or in case of engine failure – during driving, the crane vehicle can still be steered until it comes to a standstill. It does require increased effort, however, to move the steering wheel and the steering reacts slower.

### Safety Instructions

#### Safety instructions for protecting the system

**Adjustments to the steering system may only be carried out by our customer service.**

**Inspections / maintenance work must be carried out by specialist personnel.**

**When working on the vehicle (painting, welding) suitable measures must be put in place to protect the electronic components (protection against overloading and static charging).**

**In particular when carrying out welding work the steering computer must be removed from the vehicle.**

**Never remove live plug connections. Safety instructions for the protection of life and limb for maintenance / service work  
Caution risk of crushing!**

**When working on the steering system (e.g. inspections, maintenance / service work, manual emergency steering) there is an increased risk of crushing in the area of the axles, wheels and crossties.**

**Always ensure that you have sufficient space for safe movement.**

**Unauthorized persons must stay well clear of the turning area of axles, wheels and crossties.**

**For maintenance work in the turning area of axles, wheels and crossties, it must be ensured that these are prevented from turning (switch off engine or deactivate steering system).**

**If servicing is required (e.g. balancing the angle transducers), particular caution is required.**

**It must be ensured that no movements can occur on axles, wheels, or crossties. This can be achieved by switching off the engine or removing the connector at the corresponding non–return valves.**

**Caution following servicing work!**

**Errors in the steering system can lead to axle movements.**

**Keep a distance from the axles when starting the engine; no–one may be in the slewing range of the axles, wheels or crossties.**

**Caution with the manual emergency steering control!**

**Particular care is required in case of manual emergency steering. When actuating the valves for manual emergency steering, the crossties and the wheels on the affected axle will turn.**



### Monitoring functions for all steering programs

The most important components of the steering system (function of the steering / emergency steering pumps and electric hydraulic rear axle steering) are monitored electronically.

Faults are displayed on the "driver's information" screen (43) by means of the following indicator lights:

B2 Fault electric hydraulic rear axle steering

B8 Steering circuit 1 no flow

B9 Steering circuit 2 no flow

B10 Steering circuit 3 (emergency steering) no flow

The indicator lights can be displayed as either pink, white, yellow or red.

The meaning of the different colors is described in detail in section 4 (driver's cab) under "Basic display / meaning of colors".

Each time the ignition is switched on the electronic system checks the signal connections to the instrument board.

Once the dual control signal goes silent (approx. 30 sec.) the function check has been completed.

If there is a pink colored message, the function cannot be monitored as there is an error in the corresponding connection; i.e. a short circuit or a disruption.

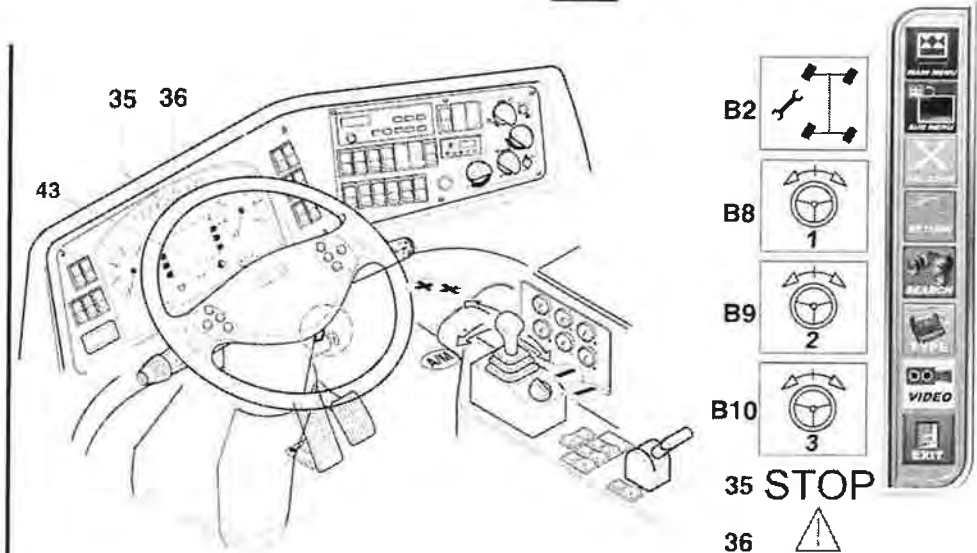
In the case of pink colored messages, the display "caution" (36) automatically lights up as well.

**When an indicator light lights up at the same time as the warning light "caution" (36) there is a malfunction.**

**Determine the cause of the fault and rectify as quickly as possible.**

**If an indicator light lights up at the same time as the red warning light "STOP" (35) there is a serious malfunction.**

**The operational reliability of the vehicle is endangered. Switch off the vehicle immediately and rectify the fault.**



After rectifying the fault the warning display can be reset by switching off the ignition for approx. 10 seconds. This also serves to check that the fault has actually been rectified.

Equally, if an indicator light lights up, the system can be reset to try and remedy the fault. To this end, stop the vehicle, switch off the engine (switch off the ignition approx. 10 seconds) and restart.

### Monitoring the steering / emergency steering pump

The steering / emergency steering pump is monitored by the indicator lights (B8 / B9 / B10) to ensure that it is working correctly. These have the following meaning:

B8: Steering circuit 1 ("main pump 1") no through feed

B9: Steering circuit 2 ("main pump 2") no through feed

B10: Steering circuit 3 (emergency steering pump) no through feed

*In case of error "no flow on the emergency steering pump" (indicator light B10) will only be displayed by the system at driving speeds > approx. 8 km/h (5 mph).*

**The indicator lights (B8, B9 and B10) must not light up as a rule.**

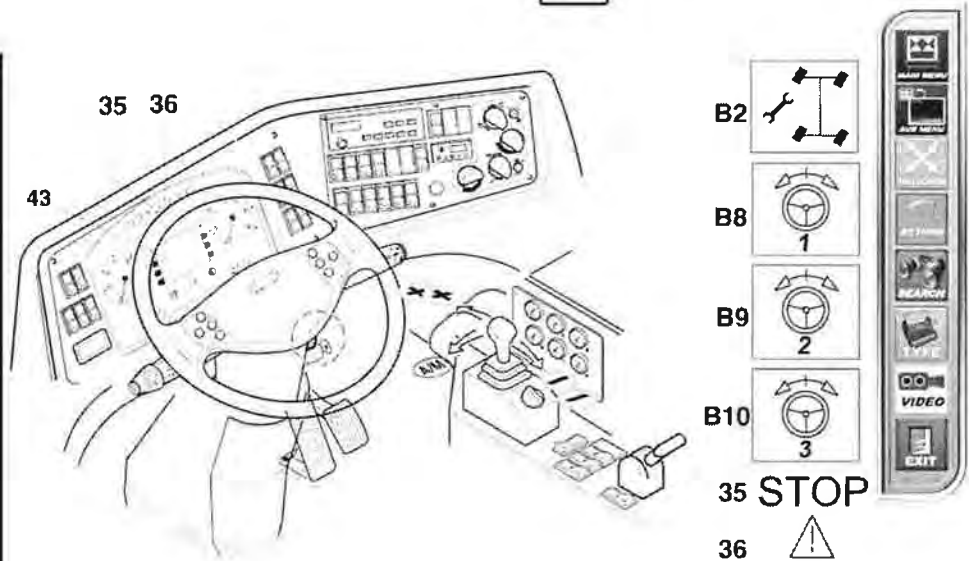
**If one of these indicator lights lights up red (at the same time "STOP" (36) is displayed), there is a dangerous fault in the steering hydraulics.**

**The crane must be stopped immediately and the damage rectified. Never drive with a defective steering system!**

In the case of a pink colored message, a function display is not possible as there is a faulty connection. (See Notes under "Monitoring functions" in this section).

### Function check

Regular inspections must be carried out to ensure that all steering units, control units and monitoring equipment are fully functional. Check for irregularities, e.g. leaks or pink colored indicator lights / changing displays.



### Monitoring the electro hydraulic rear axle steering

The function of the electric hydraulic rear axle steering is monitored during driving by an alarm buzzer and the indicator light (B2).

The **indicator light (B2)** signals an error in the electric hydraulic rear axle steering of the basic unit or an error in the electric hydraulic steering of the optional additional axle (1).

The **warning buzzer sounds additionally for each new fault and** in the event of malfunction during a program change.

**The indicator light (B2) must not light up.**

**If it lights up in red (“STOP” (36) would be indicated at the same time), there is a dangerous error in the electric hydraulic rear axle steering of the basic unit or the optional additional axle.**

**The crane must be stopped immediately and the damage rectified. Never drive with a defective steering system!**

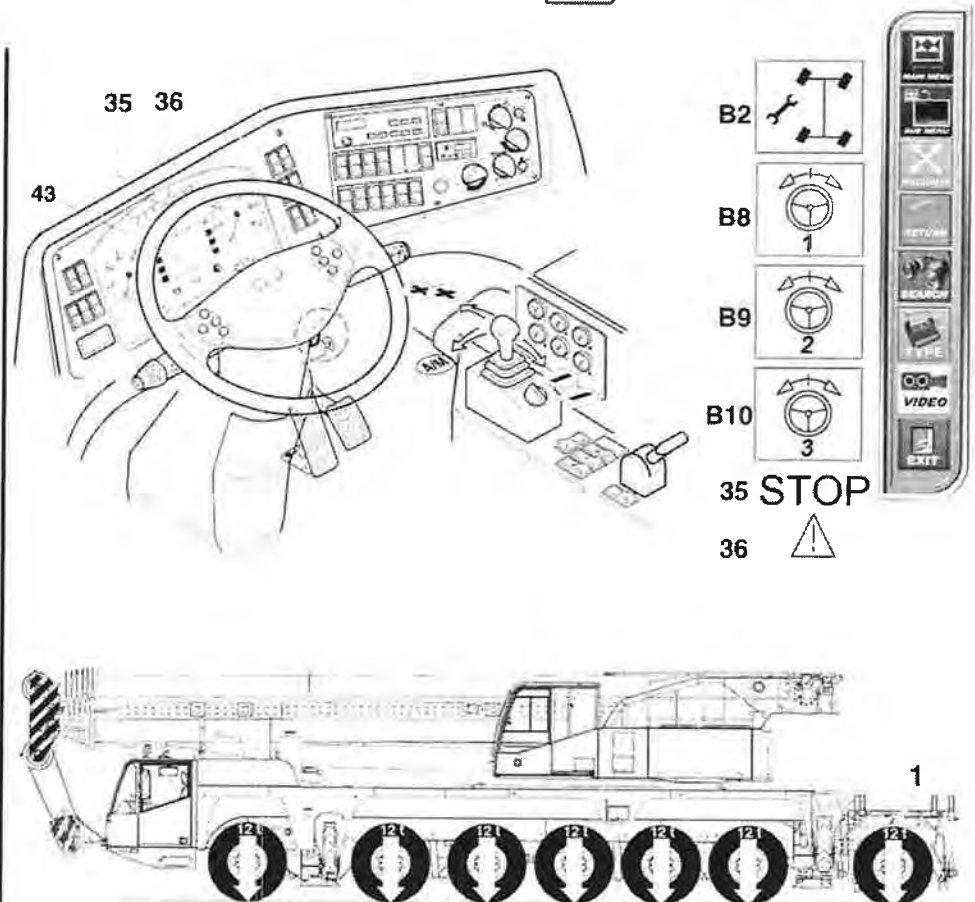
In the case of a pink colored message, a function display is not possible as there is a faulty connection. (see Notes under “Monitoring functions” in this section).

#### Function check

Check all steering components regularly for mechanical damage, corrosion and wear.

In particular pay attention to the angle transducers on the front / rear axles and their steering (fixed properly, no corrosion).

Corroded parts must be replaced.



## Steering programs

### Selection of the Steering Program “Road Travel” or “Construction Site Operation”

With the lockable switch “Enable steering programs” (92) the system can be set to the steering program “road travel” (switch not actuated) or “construction site mode” (switch actuated). For “construction site mode” the indicator light (A6) lights up.

The system can be changed back to the “road travel” program from all steering programs.

For normal **road travel no special measures need to be carried out** (no actuation of switch!).

Briefly, for road travel, the program “**narrow curving travel**” can be used.

For the purpose of road travel, all axles must be in the synchronous position for the steering program “road travel” (information on this available under “synchronization of wheels when changing the program” in this section).

For the special **construction site mode there are various steering programs**

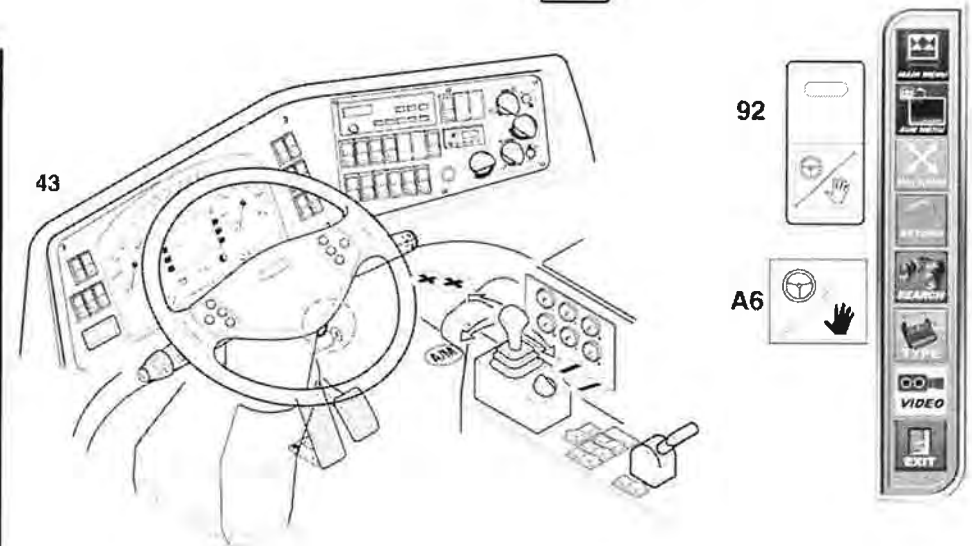
- “**Manual rear axle steering**”,
- “**Narrow curving travel**”,
- “**Driving away from the wall**” and
- “**Diagonal steering**”,

which – using various switches / buttons – need to be selected case by case. The driving speed is limited.

It is only possible to switch from road travel to construction site operation (switch 92) when the speed is below the max. permissible speed of 5 km/h (3 mph) per hour.

‘Road travel’ remains active until a corresponding steering program is selected.

Each selected steering program is assigned to a certain display. The display follows in the form of an indicator light on the screen (43) “Driver’s information”. A **white indicator light shows a preselected steering program**; a **yellow indicator light shows the currently active steering program**.



### Steering program "road travel"

#### Caution, the vehicle swerves out.

The steering program "road travel" must be selected for driving on public highways.

In the program "road travel" the axles are steered as follows:

- Front axles 1 and 2 (rigidly coupled) with the steering wheel.

#### 5-axle-basic unit (A)

- Rear axles 4 and 5 using the electric hydraulic rear axle steering (depending on the driving speed).

(Axle 3 cannot be steered = rigid axle).

#### 6-axle-basic unit (B)

- Rear axles 5 and 6 using the electric hydraulic rear axle steering (depending on the driving speed) (axle 3 cannot be steered = rigid axle; axle 4 is hydraulically locked in the straight-ahead position).

#### Basic unit with fitted additional axle (C)

- Axles of the basic unit: for function of steering, see corresponding description of the basic unit.

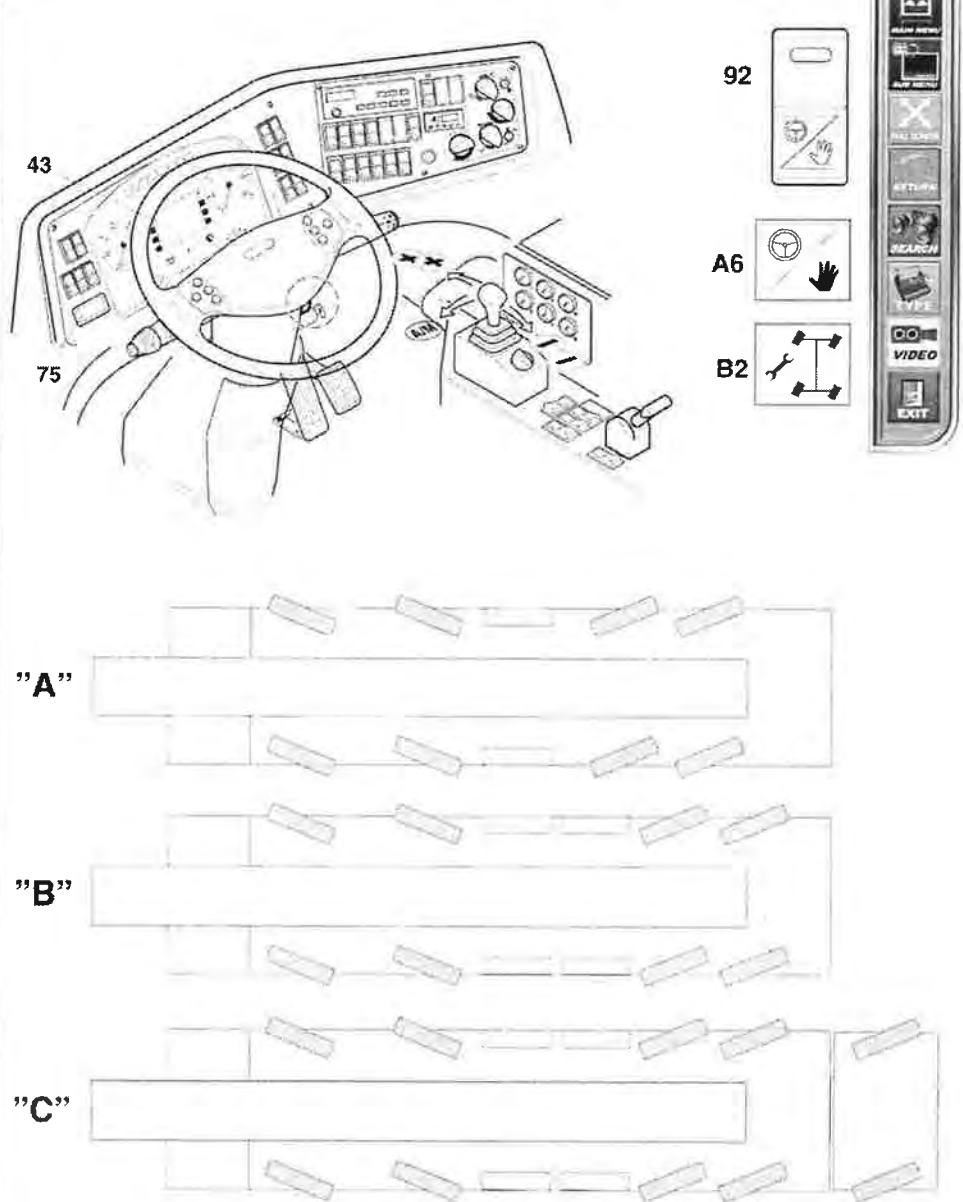
Axle of the additional axle: electric hydraulic.

- Axle of the additional axle: electric hydraulic.

*For driving speeds < 20 km/h (12 mph), the steered rear axles steer around the steering centre of the front axles.*

*For driving speeds > 20 km/h (12 mph) the steering lock of the rear axles is reduced as the speed increases.*

*The rear axles no longer steer for driving speeds > 45 km/h (28 mph).*





**Caution !**

For road travel switch (92) "Enable steering programs" may not be actuated and the related indicator light (A6) must not light up.

In addition the indicator light (B2) "Error electric hydraulic rear axle steering" must not light up.

**Caution RISK OF ACCIDENTS !**

When one of the indicator lights (A6 or B2) lights up together with the "STOP" display (35) and the warning buzzer sounds, the operational reliability of the steering is no longer guaranteed.

Stop vehicle immediately; there is a great risk of accidents. Never drive with a defective steering system!

**"Narrow cornering" for road travel**

When turning/maneuvering through a small radius, for example – as in the road travel mode – the steering program "tight cornering" can be selected when the crane is driven at speeds of  $V < 20 \text{ km/h} / 12 \text{ mph}$  .

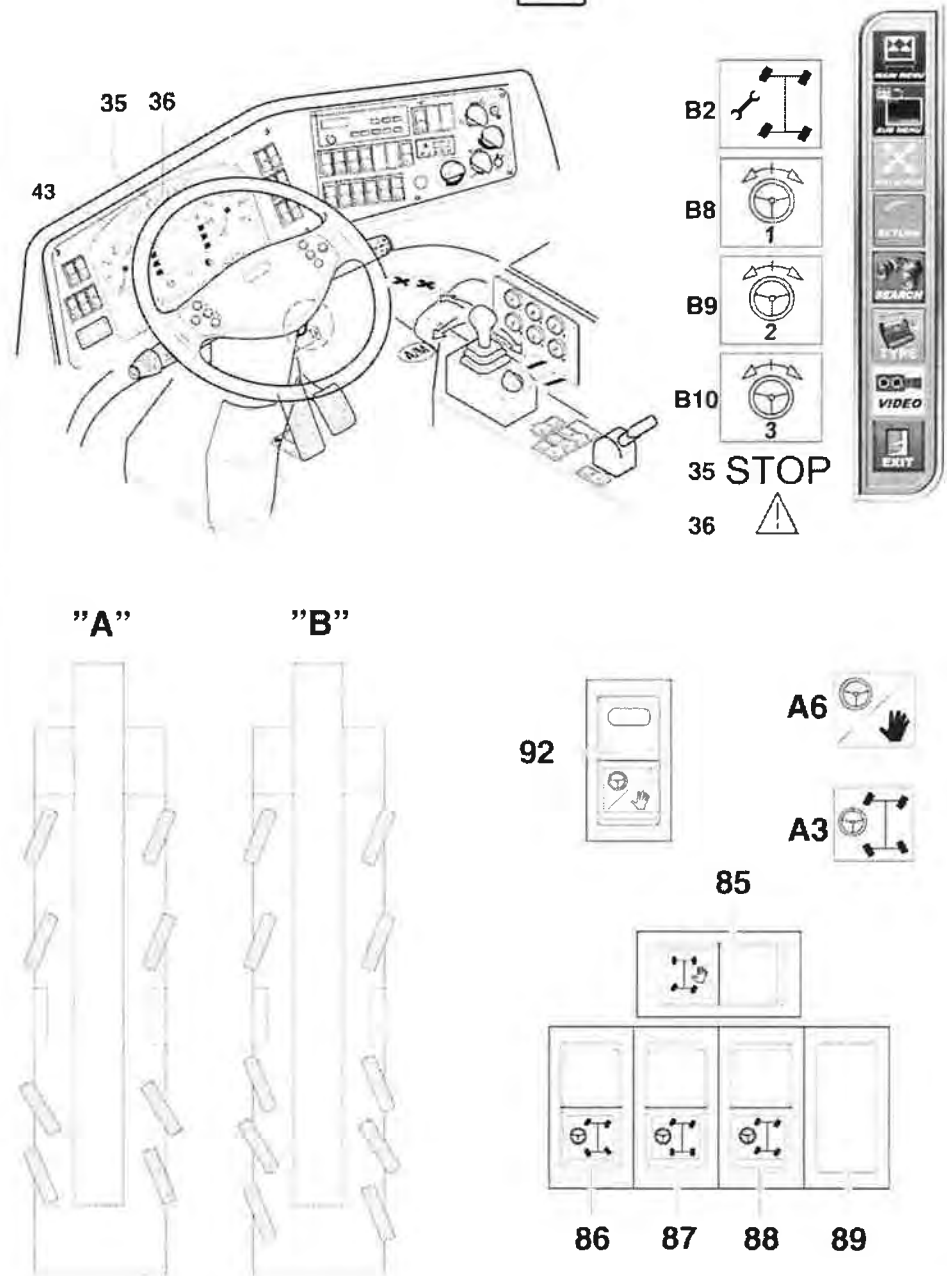
**5-axle-basic unit (A):**

– In the steering program, "Narrow cornering", the 4th axle steers more strongly than during normal road travel (as soon as  $>85\%$  has been achieved in the steering angle at axle 1).

**6-axle-basic unit (B)**

– In the steering program "Narrow cornering", the 5th axle steers more strongly than during normal road travel (as soon as  $> 85\%$  has been achieved in the steering angle at axle 1). The 4th axle aligns itself correctly in the geometric sense to the new steering centre.

This achieves a smaller turning radius – albeit with increased tire wear.



**Switch on steering program “tight cornering”:**

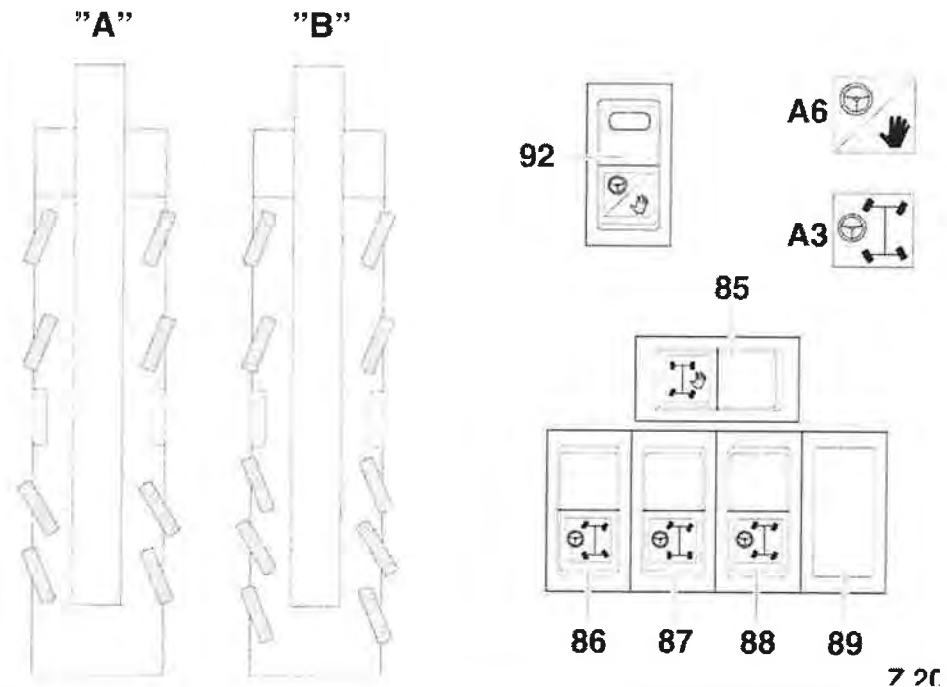
- Reduce driving speed to < 20 km/h (12 mph).
- Press button (86) (“Narrow cornering” is preselected). The indicator light (A3) appears (first in white).
- Continue to reduce driving speed to < 5 km/h (3 mph). The selected program becomes active; the indicator light (A3) changes from the color white to yellow.

*If the driving speed is not reduced to < 5 km/h (3 mph) within 20 seconds of the program being selected, the previously active steering program (“road travel”) is automatically selected.*

**Switch off the steering program “narrow road travel”:**

- Press button (86) again.
- The indicator light (A3) changes from the color yellow to white.
- Synchronize axles (information on this under “Synchronizing the axles during program change” in this section).
- Usually while the unit is rolling, the steering angle of axle 4 (5-axle-basic unit) or axle 5 (6-axle basic unit) is automatically synchronized with the other steering axles after a short stretch.
- As soon as the synchronized position has been achieved, the indicator light (A3) goes out.

*Even when driving speeds > 20 km/h (12 mph) have been achieved, “Narrow cornering” is automatically switched off again; indicator light (A3) goes out.*



### Steering program “construction site mode”

Depending on the selected program, the steered rear axles are steered by the monitoring program, corresponding with the front axles (axles 1 and 2) (computer controlled separate hydraulic circuit).

The nonsteered axle 3 (“Lift axle”) can be raised by the driver from case to case (information on this under “raising / lowering the lift axle”). The pressure gauges assigned to the raised axle (6) and (9) do not display pressure in this case.

Through the various steering programs the following **steering figures are possible:**

5-axle-basic unit; 6-axle-basic unit

(5-axle-basic unit; 6-axle-basic unit)

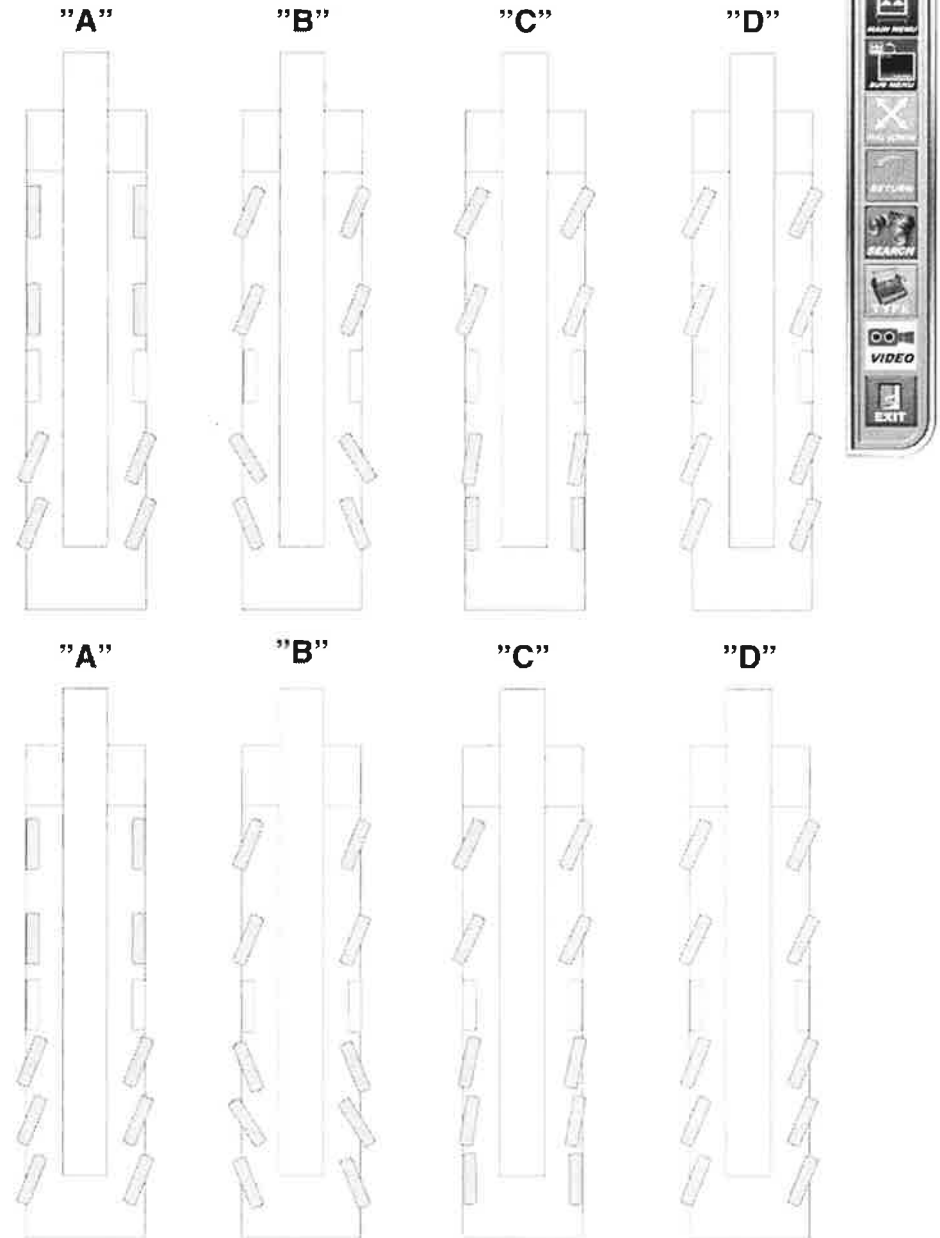
- “Manual rear axle steering” (steering figure “A”)
- “Narrow cornering” (steering figure “B”)
- “Driving away from the wall” (steering figure “C”)
- “Diagonal steering” (steering figure “D”)

**Enabling of the steering program “construction site mode” is only permitted:**

- on construction sites / non public highways
- if the crane is in the transportation state  
(boom set down, axle loads max. 17 t / 37.5 kip)

The **ground conditions must be suitable for driving, i.e. flat and** even ground, no dips or rises in the ground, no obstructions.

The ground must be able to support the individual axle loads (up to 17 t / 37.5 kip) and the overall weight.



The indicator light (B2) “fault electric hydraulic rear axle steering”, with which the electric hydraulic rear axle steering is monitored, must not light up.

When it lights up together with the “STOP” display (35) **DRIVING IS PROHIBITED!**

Remember when using the steering program “Construction site operation”:

Raising the “lift axle” inevitably leads to increased axle loads on the axles remaining on the ground.

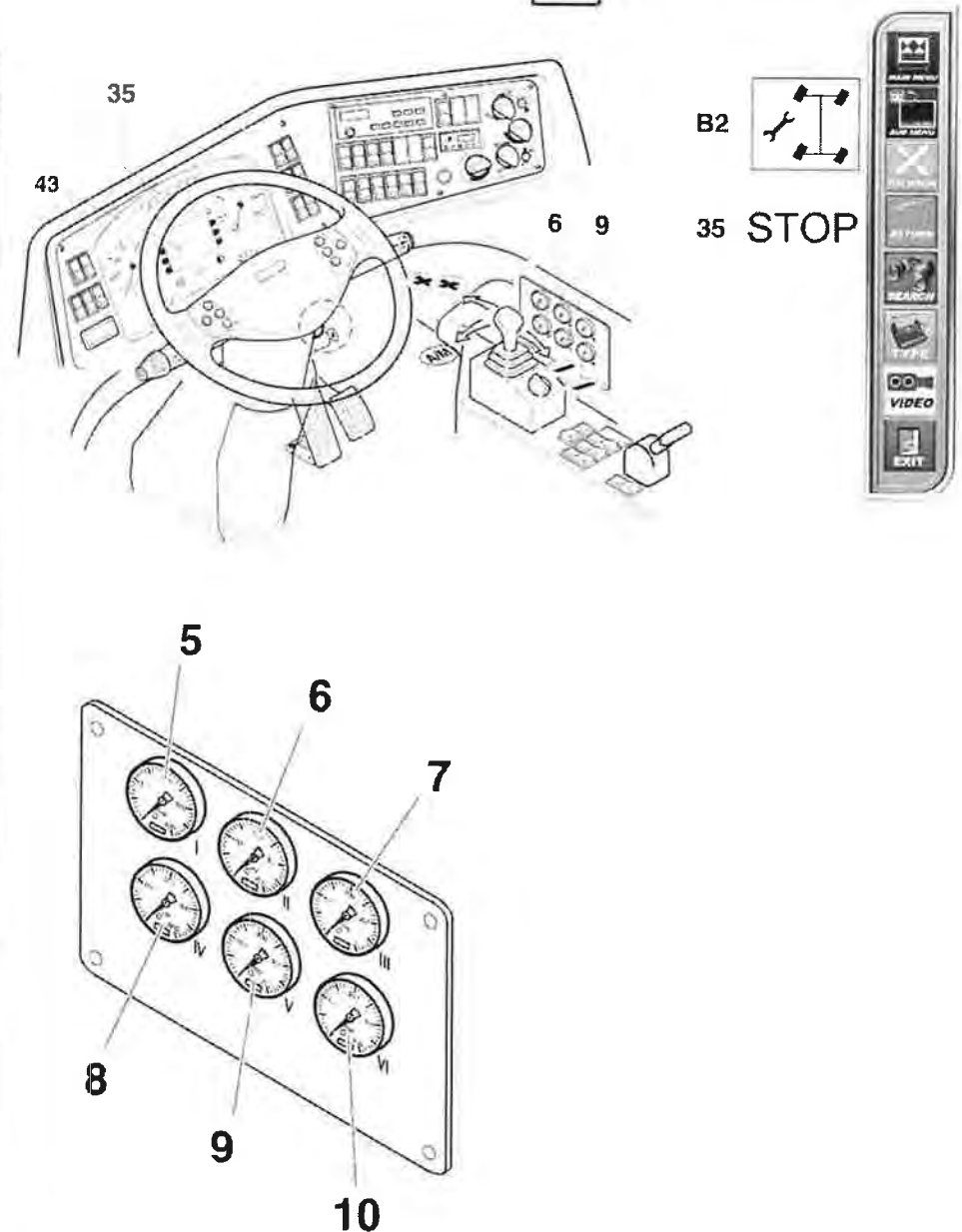
After the “lift axle” is raised – with the vehicle stationary – a pressure of 260 bar (3771 psi) must not be exceeded on any of the pressure gauges (5, 8) and (7, 10).

For reasons of stability, the suspension must be set to the “four circuit system”.

The differential locks must not be actuated in the steering figures “manual rear axle steering” and “diagonal steering”.

With the steering figures “tight cornering” and “driving away from the wall” switching the differential locks on must be avoided.

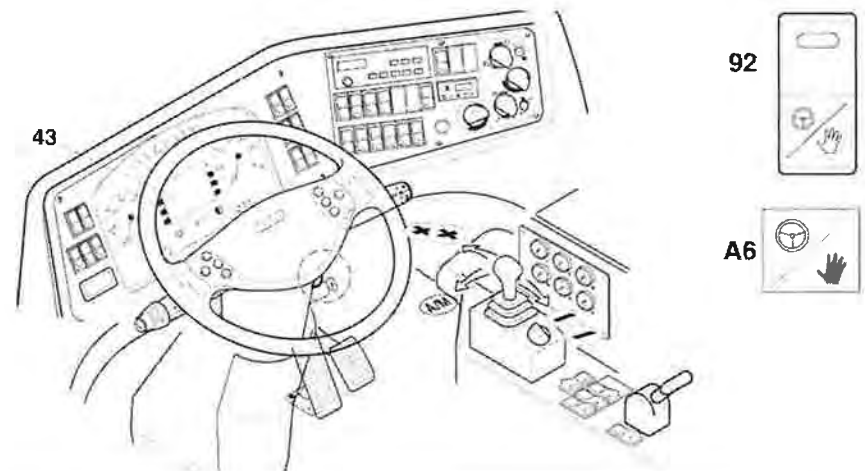
The crane may only be driven at walking speed (max. 5 km/h / 3 mph).



### Shared characteristics of all steering programs for the “construction site mode”

- The basic release of the various steering program “Construction site operation” is done by pressing the switch (92) at speeds < 5 km/h (3 mph). At higher speeds the switch (92) can be activated, however, there will be no release of the steering program ‘Construction site operation’. In this case, the buzzer sounds.
- In steering program “Construction site operation” only driving speeds up to 20 km/h (12 mph) can be achieved (speed lock).
- The speed lock is only effective as long as the wheels are not synchronized (again).
- If the preselected steering program is not active within 20 seconds, the system automatically switches back to the previously active steering program.
- The program can only be selected during slow driving ( $V < 5$  km/h / 3 mph); they only become active when all axles are synchronized.
- Normally “lift axle” (axle 4) remains on the ground; however, it can be raised by the driver, in order to reduce the tire wear. (Information on this under “Raising/lowering the lift axle” in this section.)

- It is only possible to raise / lower the “lift axle” when the vehicle is at a standstill, the hand brake is applied, the vehicle is in the neutral position with activated transmission and pressed switch (92).
- It is only possible to lower the “lift axle” when the steering / wheel angles are within the permissible range (for state “lift axle” not raised); otherwise reduce the steering angles by, for example, turning the steering wheel (wheels straight ahead).
- When the “lift axle” is raised, speed is limited to < 20 km/h (12 mph).
- If the “lift axle” remains on the ground, the steering angles are limited at the steering figures at which the rear axles are automatically steered, i.e. they are not limited for “Manual rear axle steering”.
- If the axles are not synchronized to the selected steering program, for example when limiting the steering angles to protect against high tire wear, each indicator light does not appear in yellow but in white.



### “Manual rear axle steering” (steering figure “A”)

(Af: Principle sketch of the 5-axle-basic unit; As: Principle sketch of the 6-axle-basic unit)

The front axles are steered with the steering wheel.

The lift axle (non-steer) remains on the ground, but it can be raised by the driver.

The rear axles steer according to the position of the front axles and manual activation using the dual button (85). Manual steering of the rear axles enables steering movements to the left or right, independent of the position of the front axles.

The front and rear axles are aligned geometrically correctly (within their combination).

The vehicle speed is limited.

There is no limit of the steering angles to protect against increased tire wear (steering error); not even when the “lift axle” remains on the ground.

### Switch on the steering program “Manual rear axle steering”

- Reduce driving speed to < 5 km/h (3 mph).
- Press switch (92) “Release steering programs”.

The indicator light (A6) lights up.

Speed lock (20 km/h / 12 mph) is effective and indicator light (A18) lights up.

- Press button (85) “Manual rear axle steering”.

The indicator light (A2) appears (first in white).

After the wheels have been synchronized, the selected program becomes active.

The indicator light (A2) changes from white to yellow.

- Using button (85), the rear axles can now be steered:

Press left button = wheel turn to the left

Press right button = wheel turn to the right

### Switch off the steering program “manual rear axle steering”

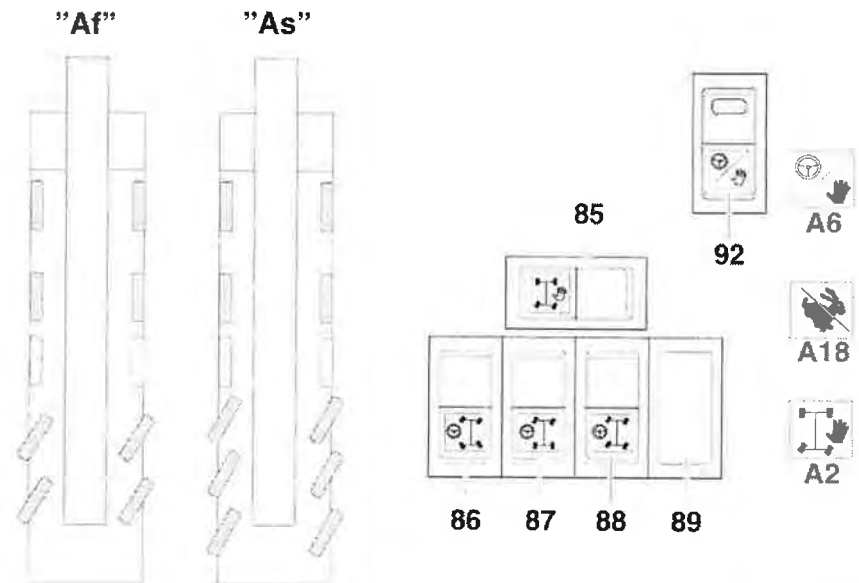
- Lock switch (92) in position “Off”.

The indicator light (A6) goes out.

The indicator light (A2) changes from yellow to white.

- Synchronize axles (see “Synchronizing the axles”).

- As soon as the synchronized position has been achieved, the indicator light (A2) goes out. The steering program “road travel “ is back in action.



### “Tight cornering” (steering figure “B”)

(Bf: Principle sketch 5-axle-basic unit; Bs: Principle sketch 6-axle-basic unit)

The front axles are steered with the steering wheel.

The “lift axle” (non-steered) remain on the ground, but it can be raised by the driver.

The rear axles are steered analogous to the front axles by means of the electric hydraulic rear axle steering. At the end axle 4 (5-axle-basic unit) or axle 5 (6-axle-basic unit) steer more strongly than during normal road travel.

In the 6-axle-basic unit the 4th axle aligns itself correctly in the geometric sense to the new steering centre.

Driving speed is limited.

If the “Lift axle” remains on the ground, the steering lock is limited to prevent excessive tire wear (steering error).

### Switch on steering program “tight cornering”

- Reduce driving speed to < 5 km/h (3 mph).
- Activate switch (92) “Release steering programs”.

The indicator light (A6) lights up.

Speed lock (20 km/h / 12 mph) is effective and indicator light (A18) lights up.

- Press button (86) (“Narrow cornering” is preselected).

The indicator light (A3) appears (first in white).

After the wheels are synchronized, the selected program remains active.

The indicator light (A2) changes in color from white to yellow.

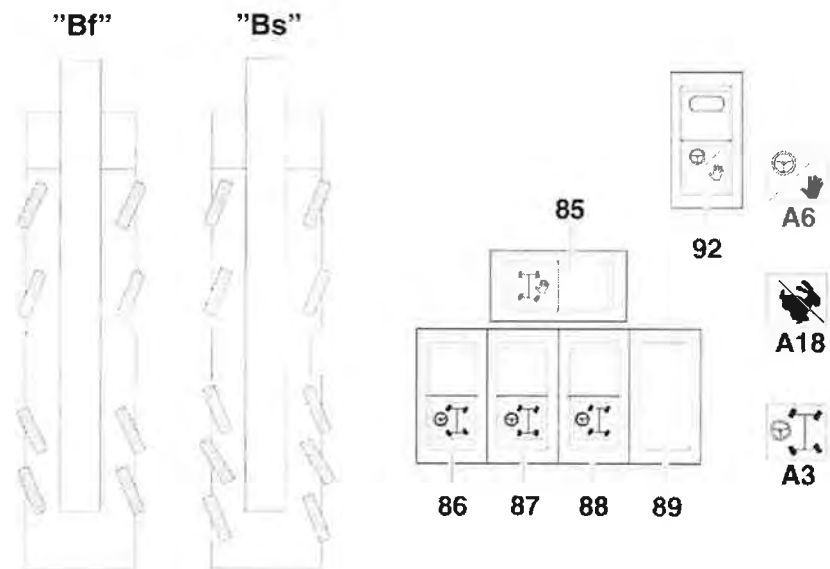
### Switch off the steering program “tight cornering”

- Lock switch (92) in position “Off”.

The indicator light (A6) goes out.

The indicator light (A3) changes from the color yellow to white.

- Synchronize axles (see “Synchronizing the axles”).
- As soon as the synchronized position has been achieved, the indicator light (A3) goes out. The steering program “road travel “ is back in action.



### “Driving away from the wall” (Steering figure “C”)

(Cf: Principle sketch 5-axle-basic unit; Cs: Principle sketch 6-axle-basic unit)

The steering centre is at the vehicle rear, the rear end does not swing out.

The front axles are steered with the steering wheel.

The “lift axle” (nonsteer) remains on the grounds, but it can be raised by the driver.

The rear axles are steered analogously to the front axles by means of the electric hydraulic rear axle steering.

The vehicle speed is limited.

If the “Lift axle” remains on the ground, the steering lock is limited

to prevent excessive tire wear (steering error).

**Do not lock the front axles further once the indicator light (A4) switches from yellow to white.**

**The rear axles have then reached their final position – as specified by the program (no further movement).**

**Further steering leads to a deterioration in the steering figure / system benefits and tires could be separated from the rims.**

**Switch on the steering program “Drive away from the wall”**

- Reduce driving speed to < 5 km/h (3 mph).

- Press switch (92) “Release steering programs”.

The indicator light (A6) lights up. Speed lock (20 km/h / 12 mph) is effective and indicator light (A18) lights up.

- Press button (87) (“Driving away from the wall” is preselected).

The indicator light (A4) appears (first in white).

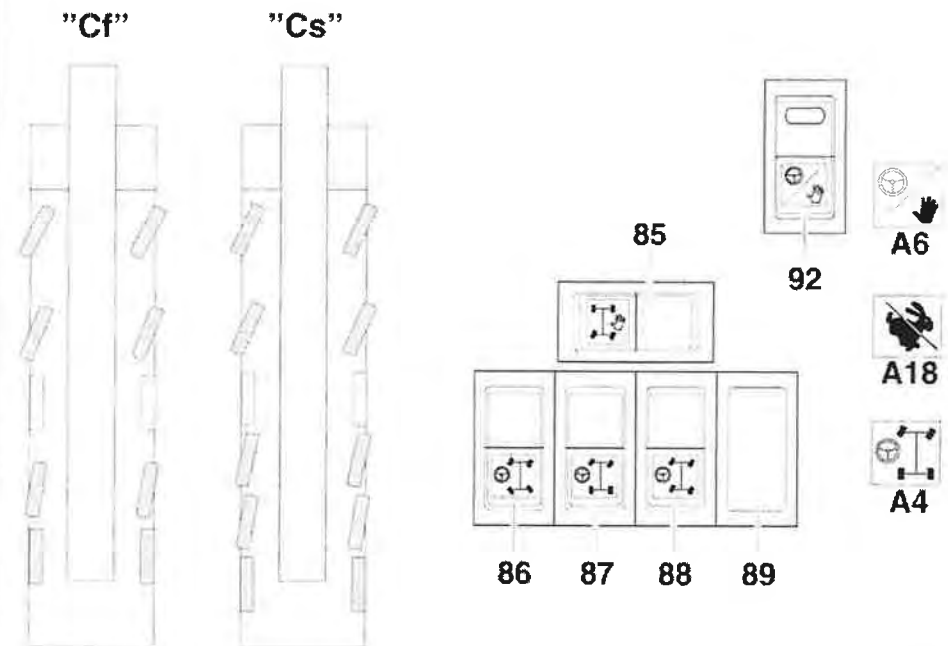
After the wheels have been synchronized, the selected program becomes active.

The indicator light (A2) changes from white to yellow.

**Switch off the steering program “Driving away from the wall”**

- Lock switch (92) in position “Off”. The indicator light (A6) goes out. The indicator light (A4) changes from yellow to white.

- Synchronize axles





– As soon as the synchronized position has been achieved, the indicator light (A4) goes out. The steering program “road travel “ is back in action.

**“Diagonal steering” (steering figure “D” (crab travel))**

(Df: Principle sketch 5-axle-basic unit; Ds: Principle sketch 6-axle-basic unit)

The rear axles are steered analogous to the front axles and with the same angle (parallel). The steering lock is determined by the steering wheel.

The “lift axle” (nonsteer) remains on the ground but can be raised by the driver.

The vehicle speed is limited.

If the “Lift axle” remains on the ground, the steering lock is limited to prevent excessive tire wear (steering error).

**Do not turn front axles further, once the indicator light (A5) changes from yellow to white.**

**The rear axles have then reached their final position – as specified by the program (no further movement).**

**Further steering leads to a deterioration in the steering figure / system benefits and tires could be separated from the rims.**

**Switch on the steering program “diagonal steering”**

- Reduce driving speed to < 5 km/h (3 mph).
- Press switch (92) “Release steering programs”.

The indicator light (A6) lights up.

Speed lock (20 km/h / 12 mph) is effective and indicator light (A18) lights up.

- Press button (88) (“Diagonal steering” is preselected). The indicator light (A5) appears (first in white).
- After the wheels have been synchronized, the selected program becomes active.

the indicator light (A2) changes from white to yellow.

**Switch off the steering program “diagonal steering”**

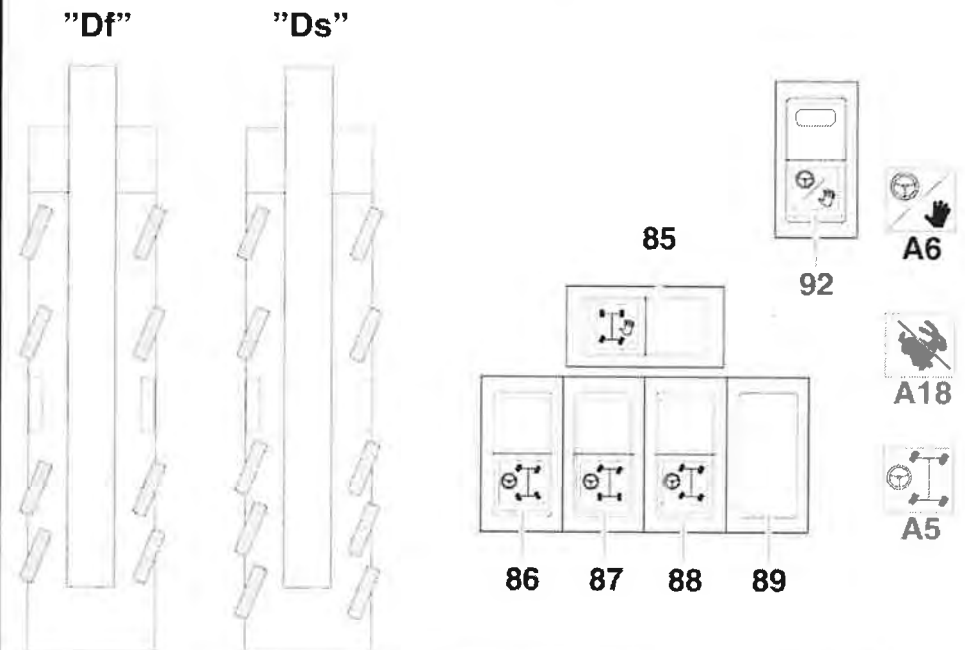
- Lock switch (92) in position “Off”.

The indicator light (A6) goes out.

The indicator light (A5) changes from yellow to white.

- Synchronize axles.

– As soon as the synchronized position has been achieved, the indicator light (A5) goes out. The steering program “road travel “ is back in action.



### **Synchronizing the wheels when changing program**

Synchronization means that the wheels of all steered axles are brought into one specified position in accordance with the individual steering program.

The change to a different steering program is complete once all axles have been synchronized.

The change between the individual steering programs can only be carried out once all axles have been synchronized.

Synchronization can be achieved by:

#### **– Driving off**

Moving the vehicle at speeds over 2 km/h (1 mph).

While the unit is rolling, the steering angle of the rear axles is automatically synchronized with the other steering axles after a short stretch

or

#### **– Button activation while at a standstill**

Continuous activation of the corresponding steering program button while at a standstill; the axles move independently into the corresponding desired position as long as the button remains pressed.

When changing back into the steering program 'Road travel', synchronization to the road travel state can be achieved by continuously pressing the switch 'Narrow cornering' (E 141). To do so, the wheels of the front axles must be aligned in the straight-ahead position.

If the adjustment force of the steering cylinders is not

sufficient to reach the desired position, e.g. if there is an obstacle on the ground, the vehicle must be driven to another spot.

or

#### **– Steering movements when stationary**

Larger steering movements to the front axle when stationary by adjusting the steering wheel (right / left). With this procedure, the so-called "capture" of the electric hydraulic steered axles, these are individually moved along with the front axles. As soon as the front axles are moved, the rear axles begin to synchronize.

*An axle that is not positioned in the specified geometry, is automatically positioned to the value preset by the selected program (synchronized) at the latest when the vehicle starts to move.*

*When synchronizing in a stationary position, the procedure can be assisted by releasing the retaining brake.*



### Raising/Lowering the “Lift Axle”

*It is only possible to raise / lower the “lift axle” when the vehicle is at a standstill, the retaining brake is applied, the transmission is switched to the neutral position and the switch (92) is pressed. With the “lift axle” raised the speed is limited to < 20 km/h (12 mph).*

#### Raise the “Lift Axle”

1. Stop vehicle; apply retaining brake; transmission in “neutral”!
2. Set the engine speed to approx. 1500 U/min (rpm) .
3. Actuate switch (92) “enable steering programs”.  
The indicator light (A6) lights up.
4. Activate switch “Raise lift axle” (102) (unlock); this raises the “lift axle” (axle 3) to the top final position.  
The indicator light (A14) lights up.  
The pressure gauges 6 and 9 display no pressure.
5. Carry out a visual check to make sure that the raised wheels of axle 3 are actually clear of the ground.

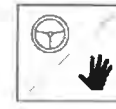
#### Lower the “Lift axle”

*It is only possible to lower the “lift axle” if the steering and wheel angles are within the permissible range (for state “lift axle” not raised); otherwise reduce steering angles by, for example, reducing the steering wheel turns (wheels straight ahead).*

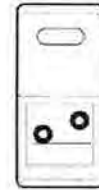
1. Stop vehicle; apply retaining brake; transmission in “neutral”!
2. Switch off the switch “raise lift axle” (102) (lock).  
The raised “Lift axle” is lowered to the ground again.  
The indicator light (A14) goes out.
3. If the “Lift axle” is on the ground, a pressure of 105 bar (1523 psi) is built up automatically again in the separated suspension circuits (II / V) and they are connected again to the individual overall suspension circuit (III or VI).  
(A: 5-axle-basic unit; B: 6-axle-basic unit)
4. The overall level must be checked for road travel (re-level if required).



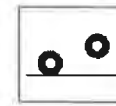
92



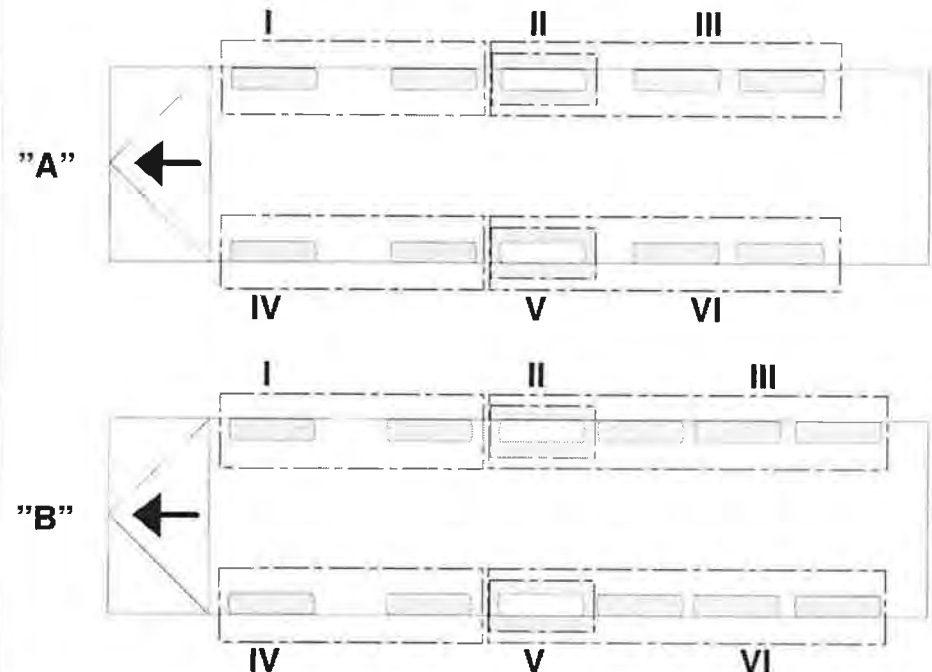
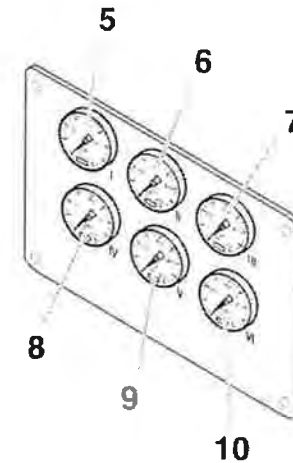
A6



102



A14



### Steering Computer / Fault Diagnosis / Fault List

The steering computers are in the floor of the driver's cab under the passenger seat. In order to get to the steering computers, the entire seat – along with its base plate – must be moved into the most frontal position and then folded up towards the front (against the front window).

#### Risk of injury!

The raised seat must be secured in place with suitable means (e.g. wooden block, strut) to prevent it falling backwards.

#### Operating functions

The display (A) and the 4 function keys (F1 – F4) are directly on the main computer.

The buttons have the following basic functions:

#### ESCAPE button (F1):

- Exit the current menu.
- End without saving.
- Back one entry position.

#### MINUS button (F2):

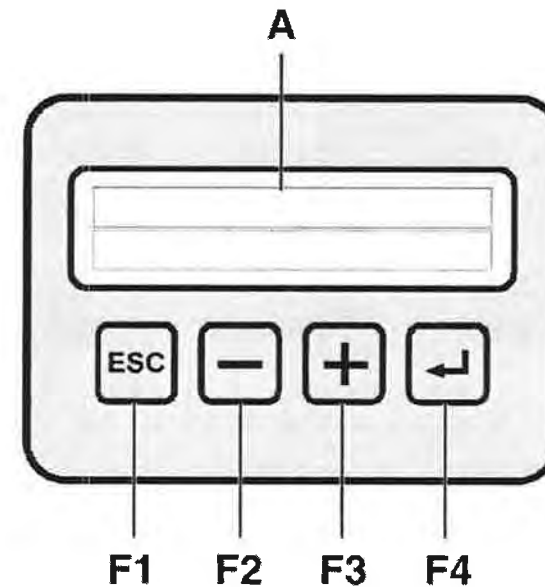
- Back one selection point (e. g. previous fault).
- Reduce value by 1.

#### PLUS button (F3):

- One selection point further (e. g. next fault).
- Increase value by 1.

#### ENTER button (F4):

- Activate selected menu.
- Confirm value.
- Save value.
- One entry position further.



### Registration of a fault

The electric hydraulic rear axle steering has a self-diagnosis system.

When the system recognizes a fault, this is displayed to the driver on the display (43) "driver's information" by the indicator light (B2) and additionally signaled by the warning buzzer.

At the same time, all faults are displayed on the corresponding steering computer, however, the driver cannot see this during driving (main steering computer: display A ; steering computer without display: two digit segment display)

- \* Active faults are always displayed with the indicator light (B2).
- \* If the vehicle is moving when a fault occurs, the warning buzzer also sounds.
- \* The warning buzzer sounds whenever the crane moves off in the faulty condition.
- \* Faults that occur remain active until the ignition is switched off, regardless of whether the fault still exists or not.
- \* An active fault is automatically stored in the error memory.

### Fault display on the display (43) "driver's information"

#### Caution !

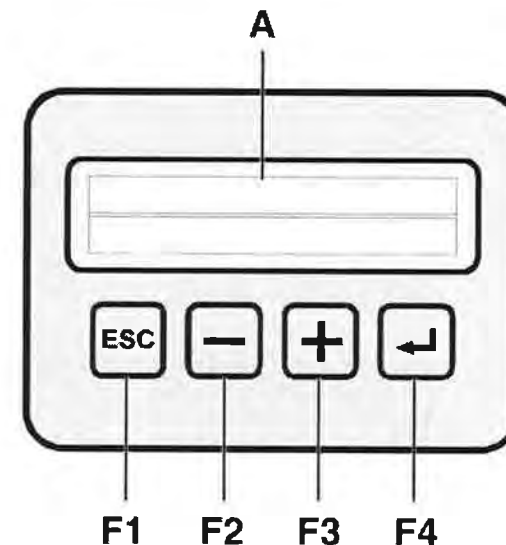
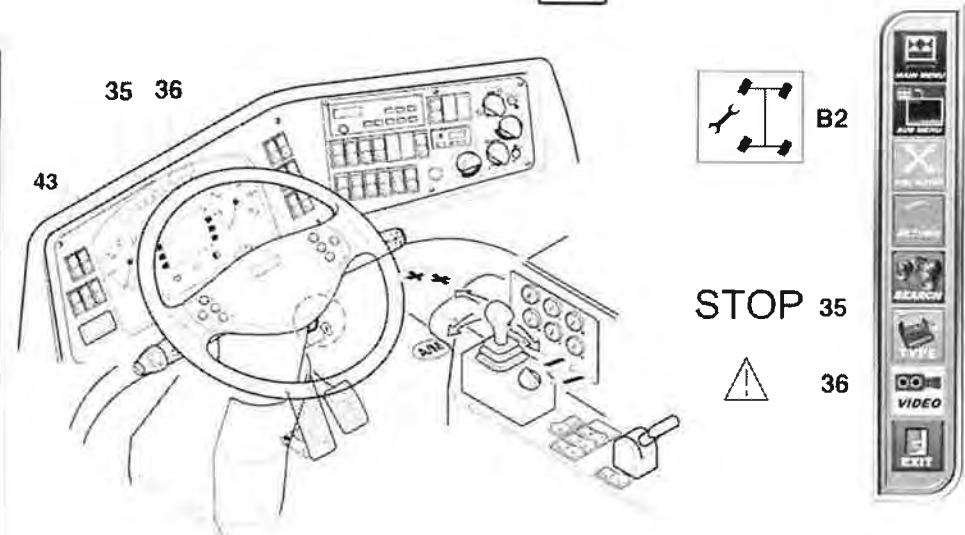
**When the indicator light (B2) lights up together with the warning light "caution" (36) the system has recognized a malfunction. Determine the cause of the fault and rectify as soon as possible.**

An attempt can be made to rectify the fault by resetting the system. To this end, stop the vehicle, switch off the engine (switch off the ignition approx. 10 seconds) and restart.

#### Caution RISK OF ACCIDENTS !

**When the indicator light (B2) lights up together with the "STOP" display (35) and the alarm buzzer sounds, the operational reliability of the steering is no longer guaranteed.**

**Stop vehicle immediately; there is a great risk of accidents. Never drive with a defective steering system!**



See also 6 “Displays on the Driver’s information display (43)”.

### Fault display on screen (A) of the steering computer

#### Display in the fault free condition

In addition to the display “no error” in the second text line a “>” sign moves from left to right. This moving display signals that the steering computer is active and the software is being processed.

#### Display of active faults

As soon as the system has recognized a fault, the display changes to the fault code screen.

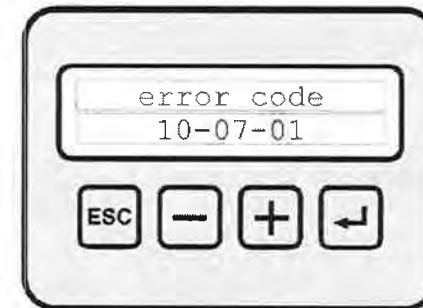
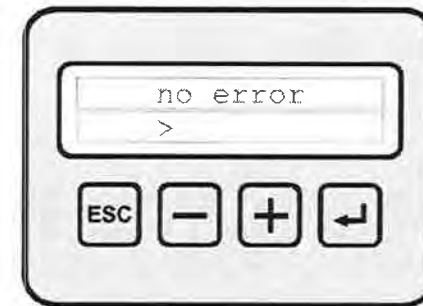
Faults are described according to location of fault, type of fault and category of fault. All three individual codes are displayed.

- Example fault location: 10
- Example fault type: 07
- Example fault class: 01

If several faults exist at the same time, the display automatically

switches to the next fault after 2.5 seconds.

If all faults have been rectified, the display changes back to the fault free state (“no error”, “>” symbol).



### Error memory / fault codes

Up to 32 various faults with 3 fault codes each can be stored in the error memory of each steering computer. If the error memory is full, the first entered fault is overwritten.

The fault codes can be read off the display of the steering computer. They are subdivided according to the location, type and category.

#### Activate / read off error memory

To read off the error memory with the display (A), first the menu point "error memory" must be selected in the menu for special functions.

#### Select menu special functions:

The menu for special functions is activated by pressing the **ESC** and **ENTER** keys (**F1, F4**) at the same time for at least 3 seconds.

The change is made when the screen switches to "i/o data display".

#### Continue to menu point "error memory":

By pressing the **PLUS** key (**F3**) you change from the "i/o data display" to the "error memory".

#### Activate error memory:

By pressing the **ENTER** key (**F4**) the error memory function is activated. The display changes to the first fault that is stored.

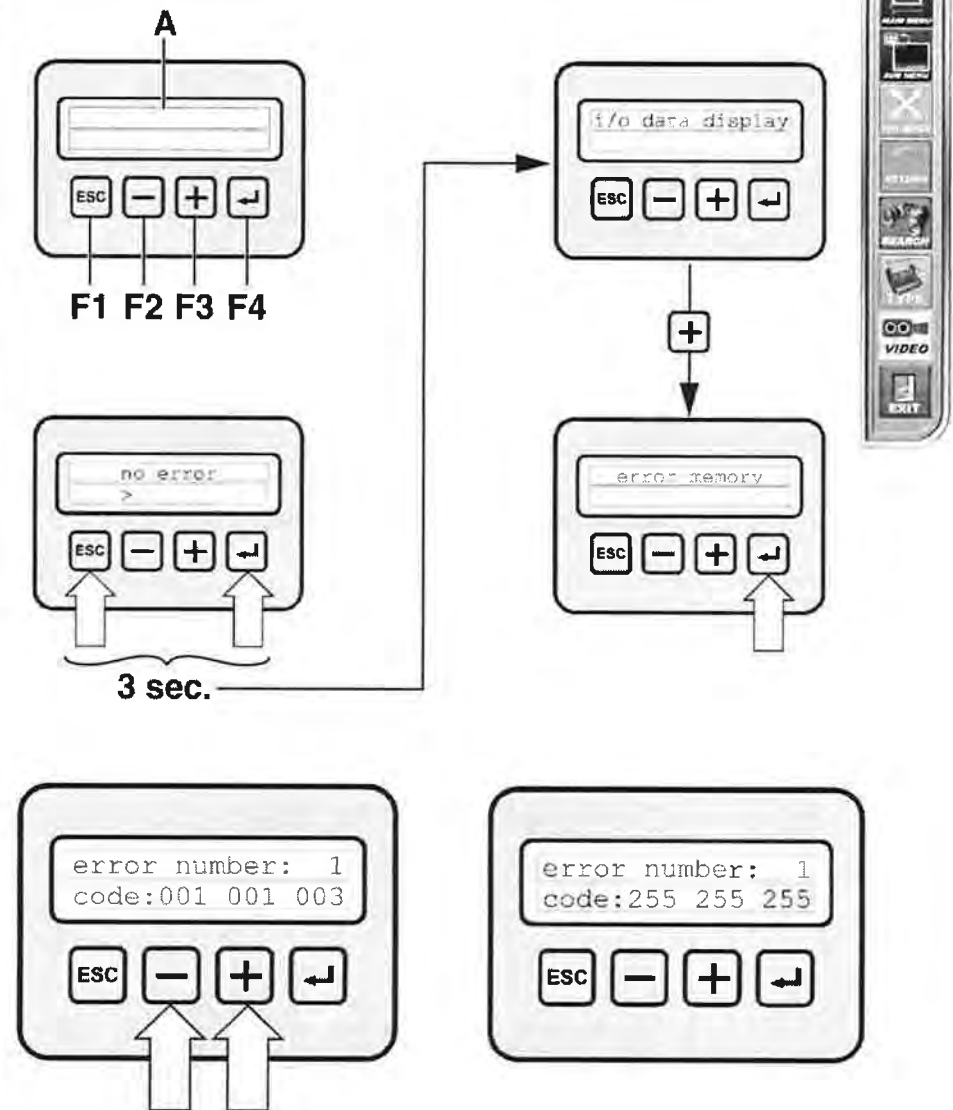
#### Read out fault memory:

Using the **PLUS** and **MINUS** keys (**F2 / F3**) all faults can be read out one after the other. At the end of the error memory (fault 32) the system automatically returns to the beginning (fault 1). As soon as the code display "255, 255, 255" appears on the screen, there are no additional faults in the memory.

The fault before the display "255" is the last entered fault. With a completely deleted error memory only code entries with "255" are maintained.

#### Exit error memory function:

Using the **ESC** key (**F1**), the error memory function can be exited at any time.



### Remote controlled operation:

Individual steering computers of the system do not have their own display. The faults of all steering computers are read off centrally on display screen (A) of the main steering computer.

To this end, the menu point "remote control" must be selected in the "special functions" menu.

1. Select the "special functions" menu (press buttons F1, F4 at the same time for at least 3 seconds).
2. Using the ENTER button (F4) select the menu point "remote control".

Display text: "remote control LCD"

3. With the PLUS- and MINUS button the numbers of the steering computer can be selected.

The display changes to select the desired steering computer.

#### 4. Note:

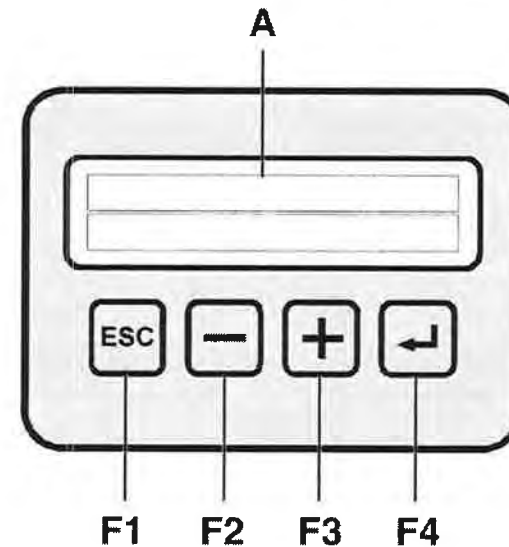
When selecting the desired steering computer the display changes constantly between "choose SLC: ?? and the display contents of the other steering computer. If the selected computer fails to answer, "no connection" appears.

5. Using the ENTER button (F4) change to the selected steering computer.
6. Activating / reading out the selected steering computers: Carry out process "Activating / reading out error memory" (as described on the previous page).
7. Exiting the selected steering computer:

By switching the ignition off.

### Delete error memory

The error memory may only be deleted in consultation with our customer service department.





### Fault categories / fault reaction

The faults are divided into the fault categories 0 to 3 and are entered in the error memory of the steering computer.

The fault category determines the reaction of the steering to the fault and the subsequent effect on steering operation.

#### Fault category 0

**Display on display (43): No**

**reaction of the steering system: warning; steering behavior is not limited.**

**Effect: unlimited driving operation is possible.**

#### Fault category 1

**Display on display (43): indicator light (B2) + “caution” (36) + single warning signal.**

**Reaction of the steering system: steering of the axles / of the system up to the next straight-ahead position.**

**Effect: speed lock partially effective.**

#### Fault category 2

**Display on display (43): indicator light (B2) + “caution” (36) + single warning signal or indicator light (B2) + “STOP” (35) + multiple warning signal.**

**Reaction of the steering system: independent steering in the straight-ahead position.**

**Effect: speed lock effective.**

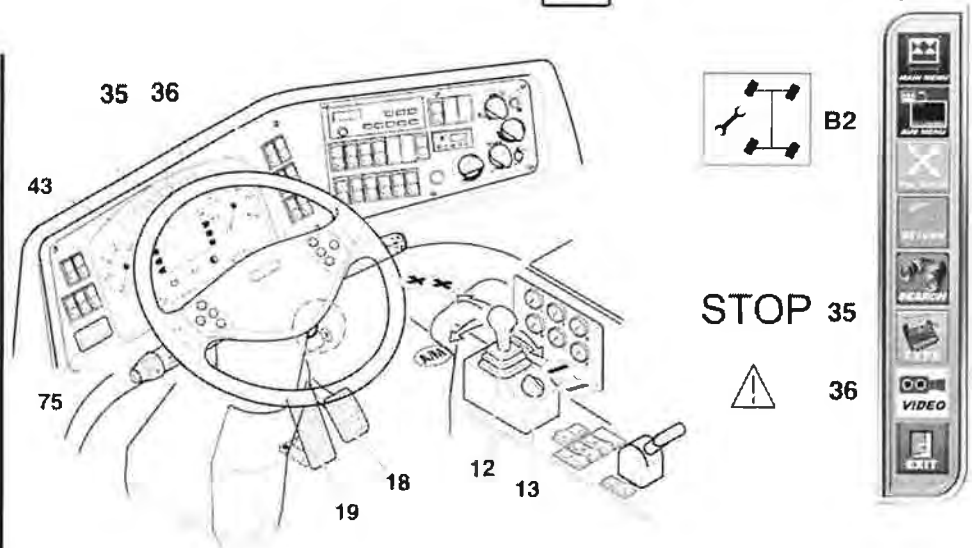
#### Fault category 3

**Display on display (43): indicator light B2 + “STOP” (35) + multiple warning signal.**

**Reaction of the steering system: self centering or locking of the axle (safe state).**

**Effect: speed lock effective.**

**If faults of categories 1, 2 and 3 are present in the error memory, these codes must be provided to our customer service department; they will then determine the causes of the fault and issue suitable measures to be taken.**



### Manual emergency steering

**Caution, increased risk of crushing!**

**When the valves for the manual emergency steering control are actuated the crossties and the wheels move on the affected axle. In the case of manual emergency steering, particular caution is therefore required.**

**Make sure that you have sufficient space to move in freely.**

If the steering computer fails, all valves are without current; i.e. the steered rear axles are locked in the current position.

To be able to adjust these axles without the computer being active, the steering system is equipped with a manual emergency steering control. This enables the non-return valves (Y) to be moved from their locked position, thus releasing the axles.

Subsequently, each individual axle can be moved into a useable position by manual actuation of the solenoid valves (X1 / X2), for example to move the vehicle out of a hazardous area. The requirement for this is that the steering hydraulics are available (vehicle engine running).

Each axle has its own valve block with non-return valve (Y) and solenoid valve (valve tappet X1 / X2) assigned to it. The valve block is at point "A" of the undercarriage under the aluminum cover.

There are two types of manual emergency activation devices of the non-return valve:

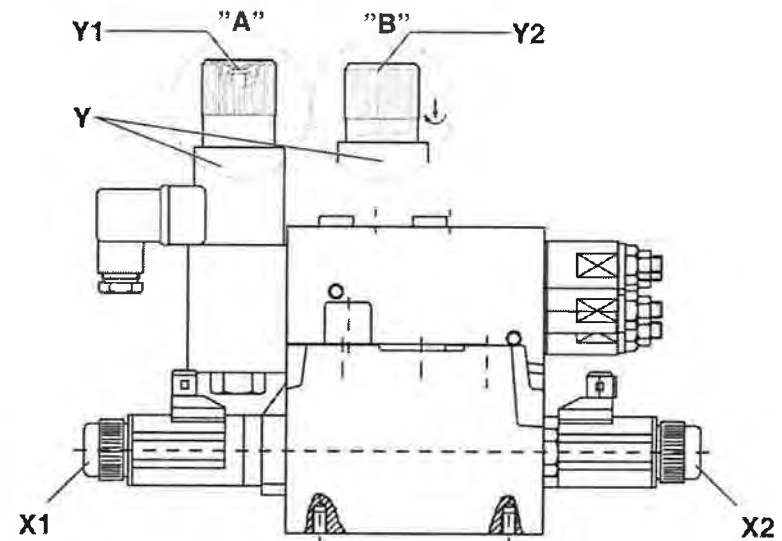
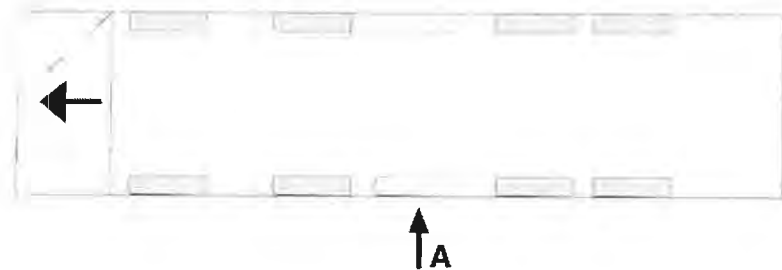
#### Type A:

activating the non-return valve (Y) by pressing the key (Y1) in the blue anodized knurled nut. After the key has been released, the key jumps back into its original position.

#### Type B:

activating the non-return valve (Y) by pressing the turning the black plastic rotating knob. The rotating knob locks into the activated position.

After manual emergency activation of the axle the rotating knob must be brought back into its original position manually. To do so, the rotating knob is pressed and turned back at the same time.



**Caution RISK OF ACCIDENTS !**

For normal operation, the non-return valves must not be actuated manually.

It may only be used in case of emergency, e.g. in order to move the vehicle from a dangerous area. The non-return valves must then spring back into their original position immediately (type A) or turned back (type B).

If the non-return valves do not spring back into their original position or are not turned back because they are blocked, for example, the steering system is no longer safe. The axles can change position in an uncontrolled fashion. **Safety risk!**

**Steps for positioning an axle**

**Type A:**

1. Stop vehicle; apply retaining brake; secure against rolling away; transmission in "neutral"; running engine.

**2. Unlock axle:**

activate non-return valve (Y) by pressing the key (Y1) in the blue anodized knurled nut; hold button down.

The axle is no longer locked as long as this button is pressed.

**3. Move axle:**

– to the left: valve tappet, press left (X1).

– to the right: valve tappet, press right (X2).

**4. Lock axle:**

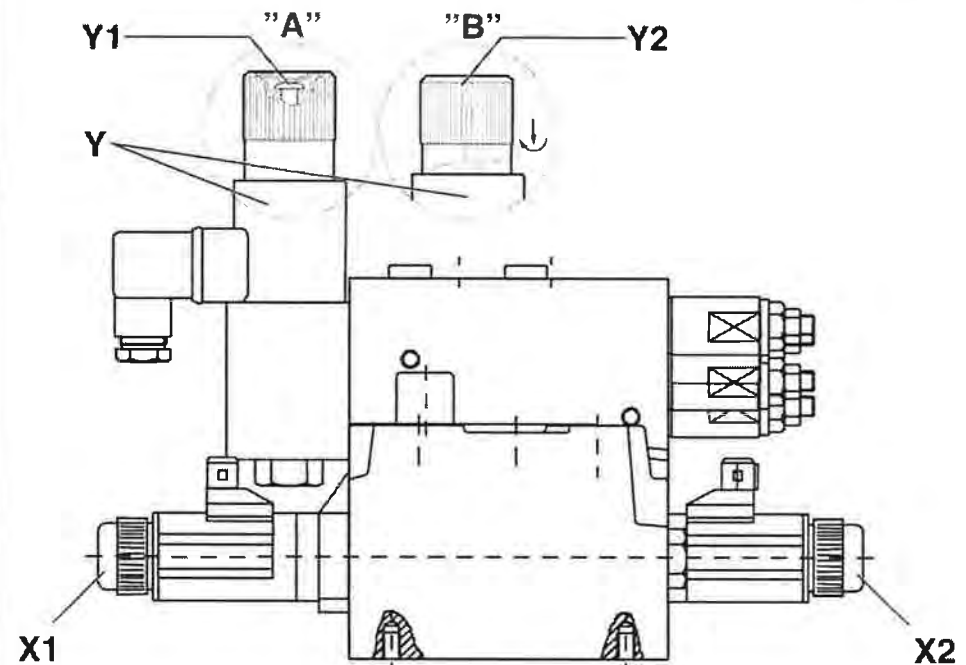
if the axle is in the desired position (usually the straight-ahead position):

\* Release the valve tappet (X1 / X2).

The axle no longer moves.

\* Release the button (Y1); the valve rotor springs back into its original position.

The axle is locked again.





**Type B:**

1. Stop vehicle; apply retaining brake; secure against rolling away; transmission in "neutral"; running engine.

**2. Unlock axle:**

activate non-return valve (Y) by pressing and turning the black plastic rotating knob at the same time. The rotating knob locks into the activated position.

The axle is no longer locked as long as the rotating knob is locked in place.

**3. Move axle:**

- to the left: valve tappet, press left (X1).
- to the right: valve tappet, press right (X2).

**4. Lock axle:**

if the axle is in the desired position (usually the straight-ahead position):

- \* Release the valve tappet (X1 / X2).

The axle no longer moves.

- \* Bring the rotating knob (Y2) back into its original position:

to do so the rotating knob is pressed lightly and turned back at the same time.

