9

DRIVING AND STEERING THE VEHICLE

CONTENTS

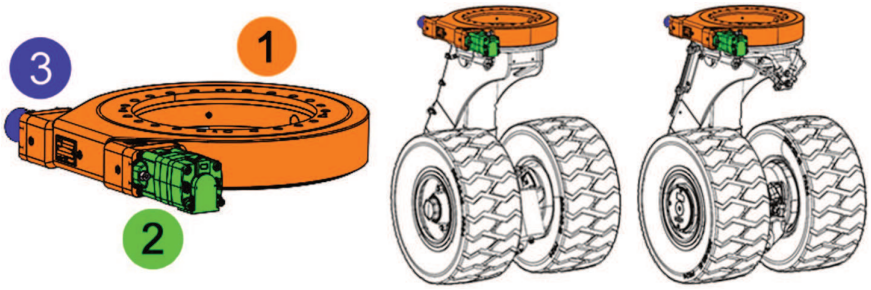
9.1. GENERAL INFORMATION

Preliminary information

The vehicle steering operations are carried out via radio control.

Rotation unit

A slew drive (**1**) driven by a hydraulic motor (**2**) carries out the steering of each suspension: the steering pump deliveries the hydraulic oil to the motor, the latter moves the worm drive inside the slew drive.
The steering potentiometer (**3**) monitors worm's number of rotations.



NOTE
Information about slew drive assembling and maintenance is given in the relevant manual. The manual is available in PDF format in the "Attachments" folder in the attached digital documentation.

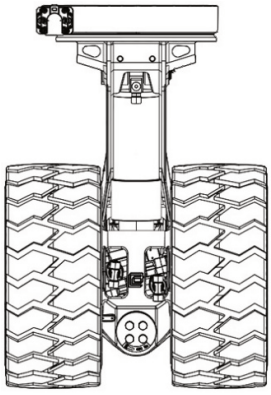
Traction unit

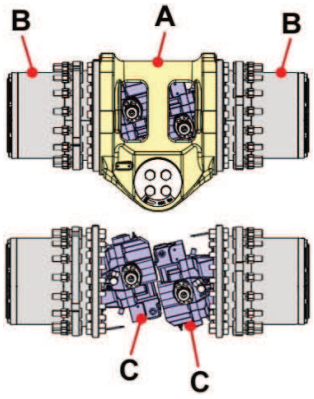
The vehicle is driven by the motorized suspensions, whose number varies according to the vehicle ECO1000 type. The exact amount is given in the classification of the trailer. As for example:

ECO1000	**6**	/	**4**
Vehicle name	N° of axle lines		N° of motorized suspensions

Each motorized suspension is equipped with a traction unit made of:

- A central body (**A**).
- Two gearboxes (**B**).
- Two hydraulic motors (**C**).





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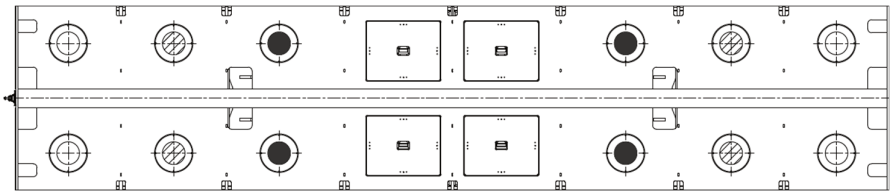
Traction unit

ECO1000 6/4 (6 axle lines / 4 motorized suspensions)



MOTORIZED SUSPENSIONS

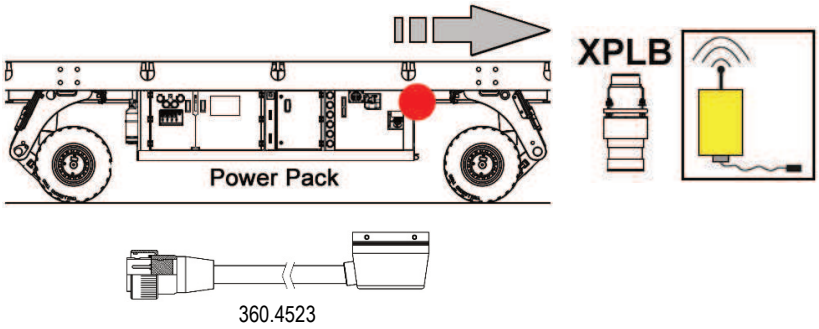
9.2. STEERING VIA RADIO CONTROL

Safety standards

WARNING
The radio control shall only be operated by properly trained personnel.

Connecting the receiver of the radio control

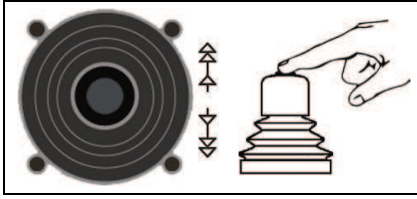
To ensure the operation of the radio control, connect the receiver to the [**XPLB**] connector via cable [**360.4523**].



360.4523

Operating procedure

1	Start the Diesel engine (see chapter 8).
2	Disengage the parking brake: press and hold the button on the end of the joystick ⇦⇨ ⇨⇨ (“Dead man” button) and operate the selector switch Ⓟ (lever down), then release both controls.

Joystick	Selector
	

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Operating procedure

3	Select a steering mode ➔ see the instructions in chapter 5 – selector switches (**11**), (**12**) and (**13**).

On the radio control display will appear an icon indicating the steering mode currently selected.

	Rear wheel steering.	
	Left side wheel steering.	
	Front wheel steering.	
	Right side wheel steering.	
	Parallel steering.	
	Circular steering.	
	Longitudinal to centre steering.	
	Side to centre steering.	

The selected steering mode is also indicated by the LEDs below the radio control display.
If the LED is flashing, it means that the wheels are moving and the suspensions are being set up for the newly selected steering mode. If the LED is steadily lit, it means that the selected steering mode is on.

H	Rear or left side wheel steering.
I	Front or right side wheel steering.
J	Parallel steering.
K	Circular steering.
L	Longitudinal to centre steering.
M	Side to centre steering.

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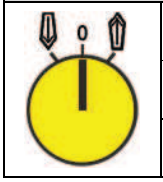
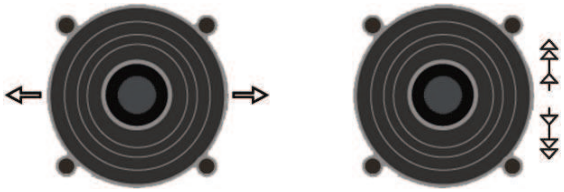
Continued “Steering via radio control” ➔

Operating procedure

4	Select the direction of travel (forward ⇧ / reverse ⇩). **Travel direction selector switch**  ⇩ REVERSE. 0 NEUTRAL GEAR. ⇧ FORWARD GEAR. ***ATTENTION*** ***Do not make travel direction changes or insert the neutral gear with the vehicle in motion! These manoeuvres can cause serious damage to the motorization system.***
5	To change the steering type, you must: 1) Stop the vehicle (release the throttle joystick). 2) Engage the neutral gear ➔ Travel direction selector in position [0]. 3) Enable the “new” steering mode. • For rear wheel steering: Selector ⟩⟨ + Selector ⟩⟨. • For left side wheel steering: Selector ≡ + Selector ≡. • For front wheel steering: Selector ⟩⟨ + Selector ⟩⟨. • For right side wheel steering: Selector ≡ + Selector ≡. • For parallel steering: Selector \\//. • For circular steering: Selector O. • For longitudinal to centre steering: Selector ⟩⟨. • For side to centre steering: Selector ≡. 4) Select the direction of travel (forward ⇧ / reverse ⇩).
6	Use the joystick ⇦◁ ▷⇨ to accelerate or brake the vehicle and the joystick ⇦●⇨ to steer it to the right or to the left.  Drive the vehicle carefully, checking the instrumentation and the pressure of the hydraulic points. **WARNING** **Strictly do not move the vehicle with people on the loading platform.** **WARNING** **Adapt the movement speed while taking into consideration the load transported and the atmospheric, visibility, road and traffic conditions.**

9.2.1 Changing the travel mode

Use and safety precautions

	Very Slow (Inching) travel mode.
	Slow travel mode.
	Fast travel mode.

NOTE
The Slow mode is selected by default when the vehicle starts.

NOTE
Select the travel mode according to the load to be carried and the working area.

To switch from Slow to Fast Travel Mode, and vice versa:

- Stop the vehicle (release the throttle joystick).
- Engage the neutral gear ➔ Travel direction selector in position [**0**].
- Select the (Slow or Fast) travel mode using the corresponding selector.


NOTE
After any stop or gear disengagement, the vehicle starts with the last travel mode selected.

ATTENTION
The switch between Slow and Fast travel modes while the vehicle is in motion is inhibited.

NOTE
It is possible to switch from Slow mode to Very Slow Mode and vice versa, regardless of whether the vehicle is stopped or in motion, by pressing the bypass button  .

	Very Slow (Inching) travel mode.
	Slow travel mode.

If the hydraulic oil temperature is low, the vehicle will not be able to reach the maximum speed set for the selected mode.

	Low hydraulic oil temperature icon.

9.2.2 Routes on road in descent

Use and safety precautions

ATTENTION
The descending routes must be carried out with the Slow Travel Mode selected. By doing so, with the Diesel engine at low regime, the maximum braking effect of the hydrostatic drive can be obtained.

	Slow travel mode.

NOTE
The Slow mode is selected by default when the vehicle starts.

9.3. DRIVING THE VEHICLE IN EMERGENCY CONDITIONS

Preliminary information

When the electronic system does not get activated (failure of the X90 control unit), to drive the vehicle, you must follow the procedure on the following page.

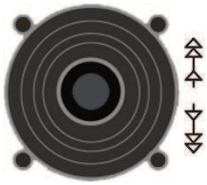
Safety rules

WARNING
The vehicle should be used in emergency conditions only for the time strictly necessary and under the full responsibility of the operator, given that the command and control functions of the vehicle are limited and not safely monitored.

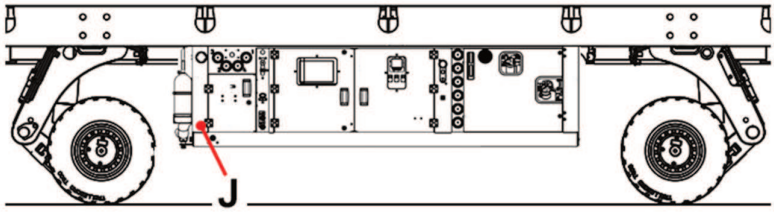
WARNING
Operate the controls very gradually and with extreme caution. The absence of an electronic control does not impose any restrictions on the use of the components, which can be overloaded and damaged, with potential risks for transport and persons and property surrounding the vehicle.

Operating instructions

1) Start the Diesel engine in emergency conditions (see chapter 8).
2) Push and hold the joystick (**10**) all forward to set the engine at maximum speed.



3) Close tap [**J**].



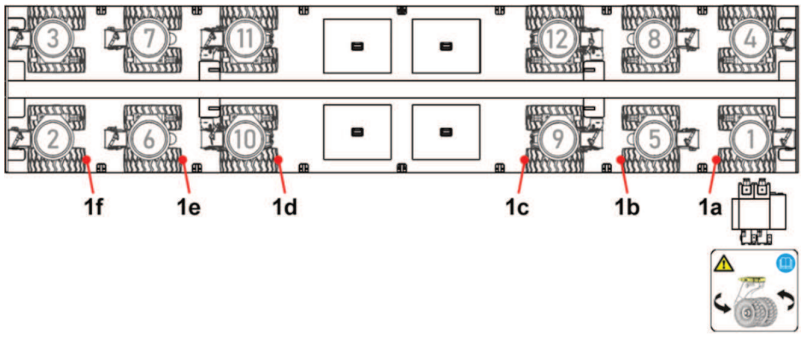
4) Release the parking brake: set the transmitter brake adjustment potentiometer (**19**) to a position approximately equal to or slightly above 0% (when the potentiometer indicator notch is below 0%, the parking brake is applied).

Continued ➔

Continued “Driving the vehicle in emergency conditions” ➔

Operating instructions

5) Set the required steering angle by operating the hydraulic steering blocks located below the loading platform, at each axle line. Every block has two proportional valves, each one steers one of the two suspensions of the corresponding axle line.



INDICATIVE FIGURE

1a	**Hydraulic steering block with 2 proportional valves** (suspensions 1, 4).
1b	**Hydraulic steering block with 2 proportional valves** (suspensions 5, 8).
1c	**Hydraulic steering block with 2 proportional valves** (suspensions 9, 12).
1d	**Hydraulic steering block with 2 proportional valves** (suspensions 10, 11).
1e	**Hydraulic steering block with 2 proportional valves** (suspensions 6, 7).
1f	**Hydraulic steering block with 2 proportional valves** (suspensions 2, 3).

NOTE
The hydraulic steering blocks are always placed on the right side of any vehicle ECO1000, under the loading platform, next to the axle line they control, as shown in the figure above (ECO1000 6/4).
For more information, refer to paragraph 3.1.2.

6) Engage the direction of travel (forward/reverse) using the selector switch (**7**) on the transmitter.
7) By turning the potentiometer ⊣▷⟶▷▷ (**8**) you can now make the vehicle move and adjust its speed.
To activate the service brake, turn the potentiometer ◯ (**19**) clockwise: the greater the rotation, the greater the braking intensity.
Set the selector to approximately 0% to release the service brake; set it below 0% to re-engage the parking brake.

Brake adjustment potentiometer		
	< 0%	Parking brake engaged.
	≈ 0 %	Brake disengaged.
	> 0%	Service brake engaged (intensity adjustment field).

8) Once driving manoeuvres are complete, put the vehicle in full down position: see emergency lifting and lowering procedures in paragraph 10.8.
9) Leave the vehicle in a safe condition:
   - open both taps [**22**] and [**23**] and move the tap [**24**] lever up to engage the emergency brake;
   - return all other taps to normal running conditions.

   See paragraph 3.3 for more information.

9.4. MECHANICAL DISENGAGEMENT OF A MOTORIZED AXLE (in the event of a fault)

Preliminary information

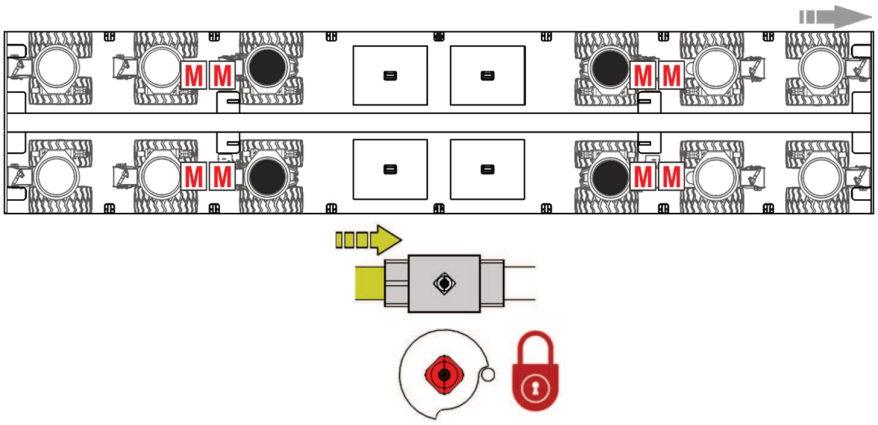
In the event of a fault of a motorized axle, it is necessary to isolate it from the motorization hydraulic circuit and to make it idle by disengaging the gearbox.

ATTENTION
The instructions below must be carried out on both sides of the motorized suspension, even if the faulty axle is just one.

Operating instructions

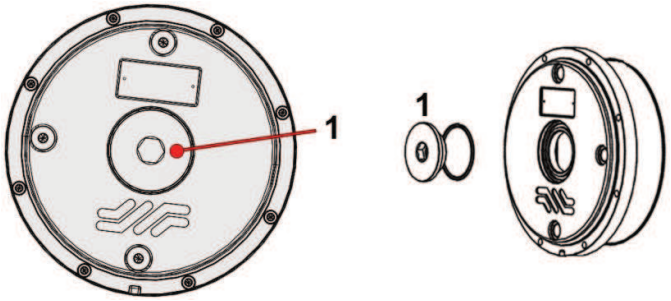
1) Cut the axle off the motorization hydraulic circuit: close both taps [**M**] placed next to the motorized suspension, below the loading platform. The following image shows where the taps are, two per each motorized axle.

INDICATIVE FIGURE



NOTE
*For each motorized suspension of any vehicle ECO1000 there are two taps [**M**], always in the same position in respect to the suspension itself, as shown in the figure above (ECO1000 6/4).*
For more information, refer to paragraph 3.3.

2) Using a 22 mm hex wrench, unscrew the gearbox plug (**1**). Use a clean container to collect the lubricating oil which may pour out.



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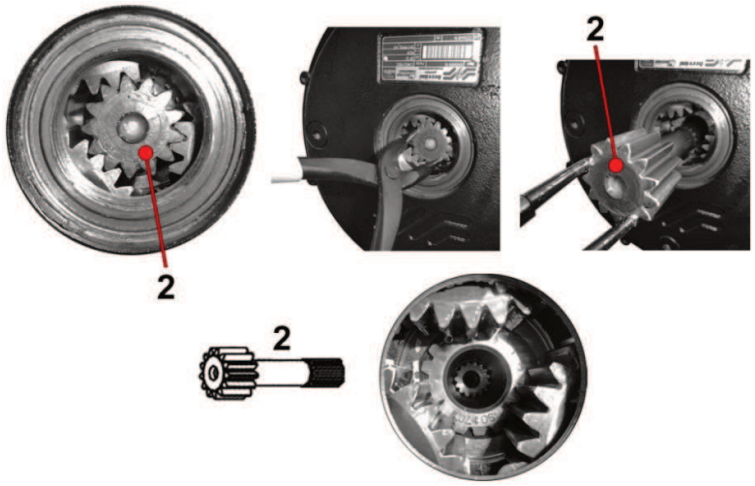
Continued “Mechanical disengagement of a motorized axle (in the event of a fault)” ➔

Operating instructions

3) Take the small shaft (**2**) out.



4) Screw again the plug (**1**). Tightening torque: 182 ÷ 214 Nm.

ATTENTION
While disassembling the gearbox, make sure to keep the inside and all of its parts clean.

9.5. TOWING THE VEHICLE IN THE EVENT OF A FAULT (Diesel engine and/or motor pump not working)

Preliminary information

If the vehicle must be towed due to a fault, the hydraulic drive system must first be bypassed to avoid damaging it when towing, and then the parking brake must be disengaged, as explained below.
According to the components mounted on the power pack, the parking brake release can be done:

a) With the hand pump directly installed on the power pack.
b) With an external auxiliary pump (not provided), by connecting it to the couplings [**M**] and [**S**] on the power pack. The auxiliary external pump can be:
   - A hand pump.
   - An electro-pump complying with the characteristics shown in the table below.

Auxiliary pump characteristics	
Needed pressure	200 - 250 bar
Flow rate	≈ 10 l/min

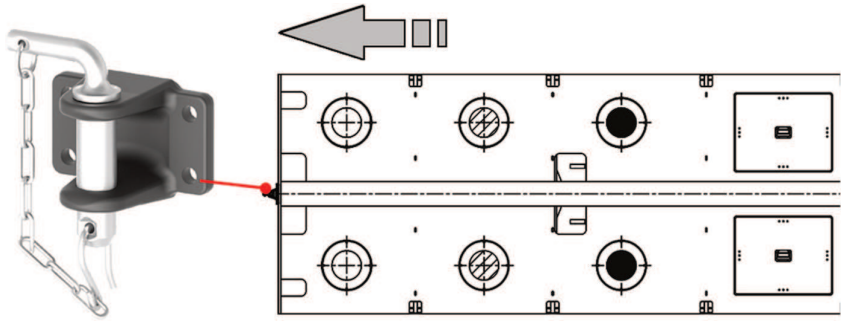
NOTE
The power pack main components are listed at paragraph 3.1.

Safety precautions

ATTENTION
The vehicle can be towed only on short distances (approximately 100 – 200 m), at a maximum speed of 2 km/h.
For longer distances, in addition to by-passing the hydraulic drive system, it will also be necessary to mechanically decouple all driven axles on the vehicle. See the procedure in paragraph 9.4.

NOTE
The vehicle can be towed only unloaded.

NOTE
The vehicle must be towed using the dedicated hook.

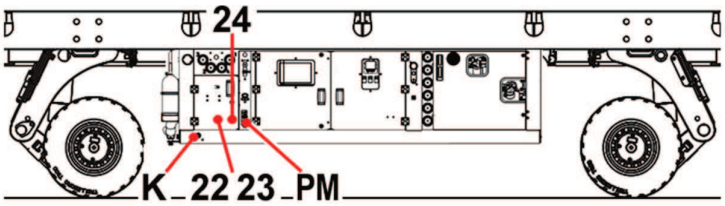


INDICATIVE FIGURE

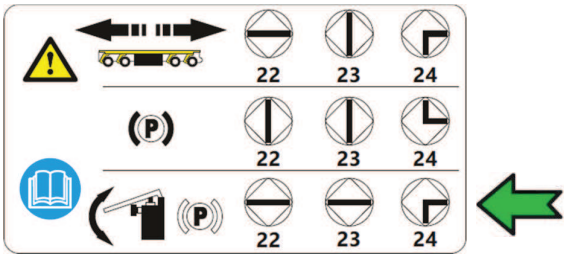
Continued ➔

Continued "Towing the vehicle in the event of a fault (Diesel engine and/or motor pump not working)" ➔

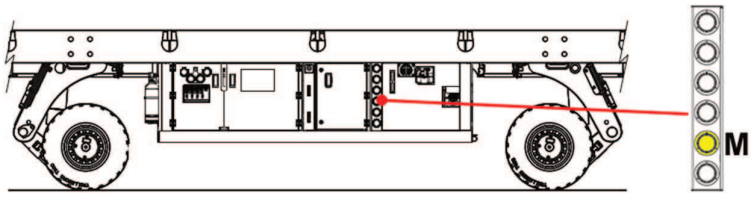
a) Power pack hand pump procedure



1) Open tap [**K**] to bypass the hydraulic drive system.
   In normal use conditions, tap [**K**] must always be closed.
2) Release the brake of the vehicle:
   a. Close taps [**22**] and [**23**].



   b. Close the handwheel of the hand pump (**PM**).
   c. Open tap [**24**] as shown in the plate (lever down).
   d. Pump using the hand pump (**PM**); the hydraulic oil will reach the hydraulic brake circuit. The brakes are released when the pressure raises to about 200 bar. Check the pressure level on the pressure gauge [**M**] or on the pressure indicator on the electric panel [**EB1**] display.



	Electric panel [**EB1**] display: indicator of pressure in the hydraulic system brake circuit [bar].

3) Tow the vehicle.

NOTE
Under these conditions, the vehicle cannot be steered, lifted or lowered.

4) Once handling is complete, put the vehicle in full down position: see emergency lifting and lowering procedures in chapter 10.
5) Leave the vehicle in a safe condition:
   - open both taps [**22**] and [**23**] and move the tap [**24**] lever up to engage the emergency brake;
   - return all other taps to normal running conditions.

   See paragraph 3.3 for more information.

ATTENTION
Before normal use of the vehicle make sure the tap [K] is closed and turn the tap [24] back to the starting position (lever up).

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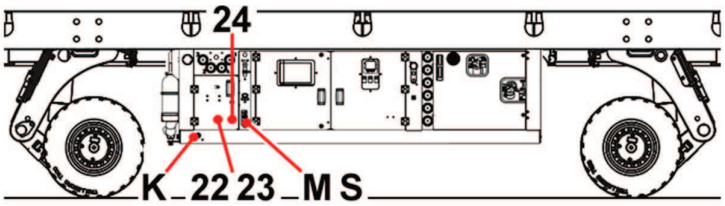
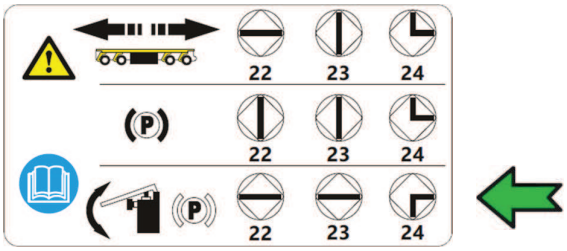
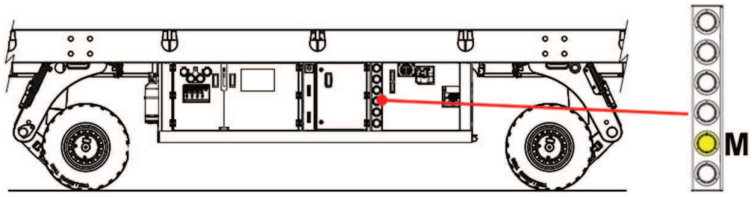
b) External auxiliary pump procedure



1) Connect the auxiliary pump to the quick couplings [**M**] and [**S**]: the outlet to [**M**], the inlet to [**S**].
2) Open tap [**K**] to bypass the hydraulic drive system.
   In normal use conditions, tap [**K**] must always be closed.
3) Release the brake of the vehicle:
   a. Close taps [**22**] and [**23**].



   b. Set tap [**24**] as shown in the plate (lever down).
   c. Start the pump: the oil will reach the hydraulic brake circuit. The brakes are released when the pressure raises to about 200 bar. Check the pressure level on the pressure gauge [**M**], on the pressure indicator on the electric panel [**EB1**] display or on the pressure gauge of the external auxiliary pump.



	Electric panel [**EB1**] display: indicator of pressure in the hydraulic system brake circuit [bar].

4) Tow the vehicle.

NOTE
Under these conditions, the vehicle cannot be steered, lifted or lowered.

5) Once handling is complete, put the vehicle in full down position: see emergency lifting and lowering procedures in chapter 10.
6) Leave the vehicle in a safe condition:
   - open both taps [**22**] and [**23**] and move the tap [**24**] lever up to engage the emergency brake;
   - return all other taps to normal running conditions.

   See paragraph 3.3 for more information.

ATTENTION
Before normal use of the vehicle make sure the tap [K] is closed and turn the tap [24] back to the starting position (lever up).

9.6. REPLACEMENT AND ELECTRICAL CALIBRATION OF A STEERING POTENTIOMETER

Preliminary information

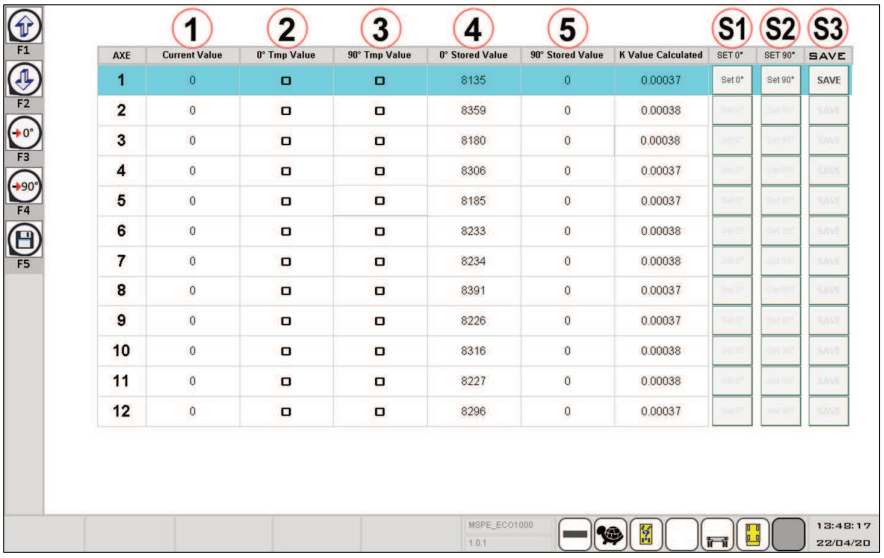
Steering potentiometers must be recalibrated or replaced and calibrated when on the display of the [**EB1**] electric panel appears an icon indicating that the potentiometer is out of range, as shown below:

Operating procedure

1) Start the Diesel engine (see chapter 8).

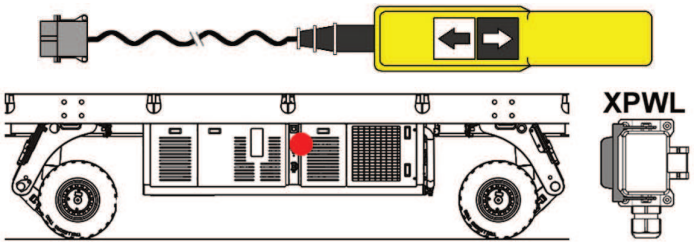
2) Open the “Suspension reset” page of the electronic program. From the main page displayed on the [**EB1**] electric panel, use the following procedure:
F2 ➔ Password ➔ Enter ➔ Login ➔ Date&time ➔ F4 ➔ F3 ➔ F1.

3) Use the **F1** and **F2** keys to select on the screen the suspension corresponding to the potentiometer to be replaced.



INDICATIVE FIGURE

4) Connect the manual steering pushbutton panel to the [**XPWL**] socket.



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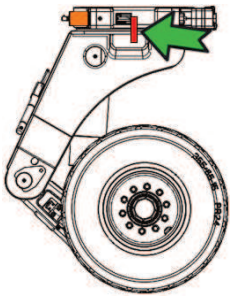
Operating procedure

5) Use the pushbutton panel to steer the suspension. The correct alignment is indicated by the matching of the two 0° reference notches on the suspension.

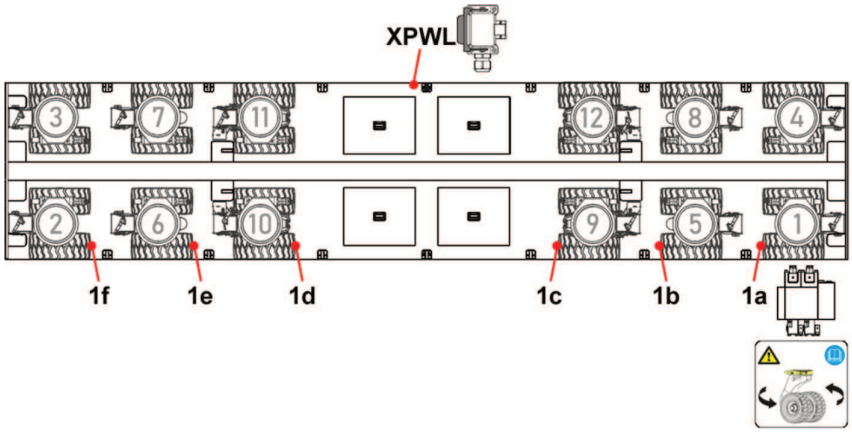


WARNING
Use the steering procedure below only if unable to use the steering pushbutton panel.

ATTENTION
It is always recommended to use the steering pushbutton panel since it allows the operator to stay at a safe distance from the suspension while it is steering.
Also, the pushbutton panel can be used to steer each of the vehicle suspensions without losing sight of the reference notches or the display of the [EB1] electric panel.

As an alternative to the pushbutton panel, it is possible to operate the hydraulic steering blocks of each axle line, located below the loading platform. Each block has two proportional valves; each valve controls the steering of one of the suspensions of the corresponding axle line.

INDICATIVE FIGURE



1a	**Hydraulic steering block with 2 proportional valves** (suspensions 1, 4).
1b	**Hydraulic steering block with 2 proportional valves** (suspensions 5, 8).
1c	**Hydraulic steering block with 2 proportional valves** (suspensions 9, 12).
1d	**Hydraulic steering block with 2 proportional valves** (suspensions 10, 11).
1e	**Hydraulic steering block with 2 proportional valves** (suspensions 6, 7).
1f	**Hydraulic steering block with 2 proportional valves** (suspensions 2, 3).

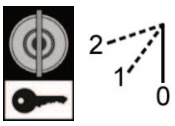
NOTE
The hydraulic steering blocks are always placed on the right side of any vehicle ECO1000, under the loading platform, next to the axle line they control, as shown in the figure above (ECO1000 6/4).
For more information, refer to paragraph 3.1.2.

Continued ➔

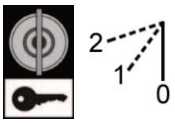
Continued "Replacement and electrical calibration of a steering potentiometer" ➔

Operating procedure

6) Switch off the Diesel engine and the control board: general key in position 0.

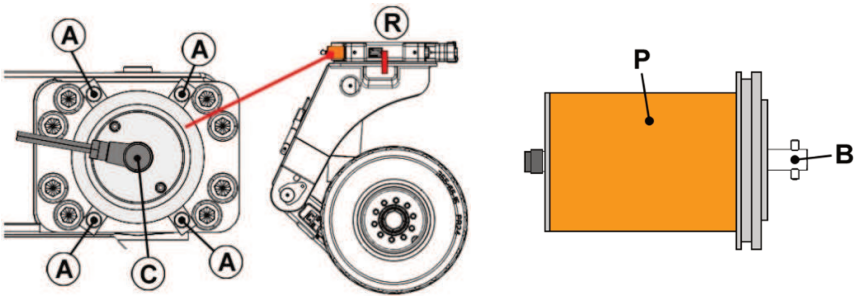


7) Remove the potentiometer.
8) Install the new potentiometer (**P**) on the rotation unit (**R**). Do not tighten the four screws (**A**) yet.
9) Connect the connector (**C**) to the new potentiometer.
10) Power the vehicle: general key in position "1".



11) The button ⏻ (INIT) starts flashing and the buzzer emits a warning sound/light indicating that the system is operational. Once the system is operational, press the button ⏻ (INIT); the button light is steadily lit.

12) Open the "Suspension reset" page again and select the suspension whose potentiometer has been replaced. Check that the value in column (**1**) "Current value" is about **8000**. If not, turn the pin (**B**) until the field more or less displays the above mentioned value: this will prevent the potentiometer going out of range during operation.
13) Secure the potentiometer to the rotation unit: tighten now the four screws (**A**).



14) If, for the selected suspension, the value displayed in column (**1**) "Current Value" differs from that in column (**4**) "0° Stored Value":
    - Click on the "Set 0° " button in column (**S1**) (or press **F3**).
    - The value in column (**1**) will now appear in column (**2**) "0° Temporary Value".
    - To confirm the 0° alignment, press "SAVE" in column (**S3**): the value in column (**2**) – "0° Temporary Value" will now appear in column (**4**) "0° Stored Value".
15) Start the Diesel motor again and use the pushbutton panel to steer the suspension whose potentiometer has been replaced. Rotate it by 90° clockwise: the correct alignment is indicated by the matching of the two 90° reference notches on the suspension .

Continued ➔

Continued ➔

Operating procedure

16) If, for the selected suspension, the value displayed in column (**1**) “Current Value” differs from that in column (**5**) “90° Stored Value”:
    - Click on the “Set 90° ” button in column (**S2**) (or press **F4**).
    - The value in column (**1**) will now appear in column (**3**) “90° Temporary Value”.
    - To confirm the 90° alignment, press “SAVE” in column (**S3**): the value in column (**3**) – “90° Temporary Value” will now appear in column (**5**) “90° Stored Value”
17) In order to save the suspension alignment and the full calibration of the potentiometer, click on **F5** button.
    The program exits the “Suspension reset” screen to confirm operation success.

ATTENTION
In case of failure to save the new calibration, the program will restore the values stored prior to new potentiometer calibration.

18) Click on the date/time filed at the bottom right corner of the screen or rotate the logo knob on keyboard **F_** until the electronic program's home screen is displayed.
19) After approx. 5 seconds, switch off the control board ➔ General key in position “0”.

NOTE
*When the save **F5** button is pressed without switching off the Diesel engine, the suspensions might still move slightly; this is not an issue since suspension alignment is considered complete when the **F5** button is pressed.*

9.7. BYPASS OF A FAULTY SUSPENSION

Preliminary information

If, despite errors/faults to one or more components of one or more rotation units, the vehicle has to be kept operational or the issue cannot be promptly solved, it is possible to bypass the affected suspension(s) in the steering program.

On or more of the icons reported here below appear on the [**EB1**] electric panel and radio control displays when a steering error/fault occurs:

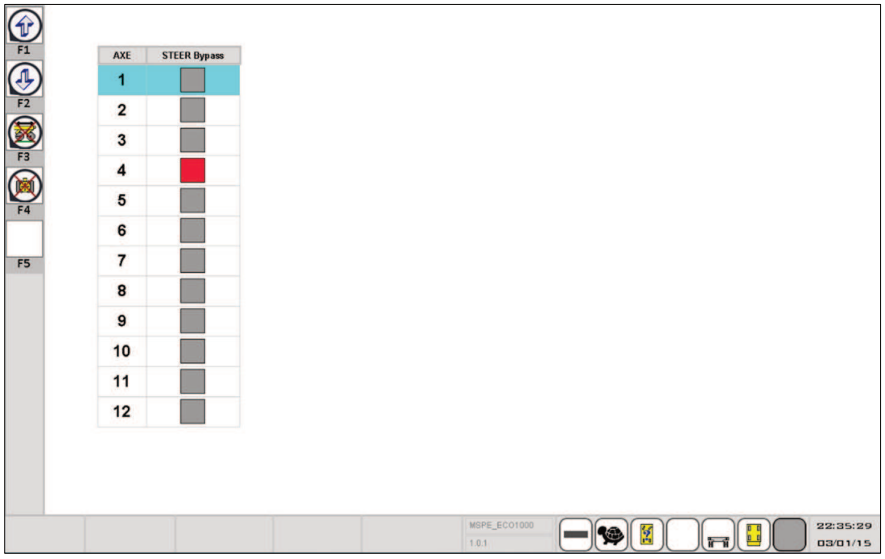
ATTENTION
Restore the vehicle normal working conditions as soon as possible.

Operating procedure

1) Start the Diesel engine (see chapter 8).

2) Open the “Steering bypass” page of the electronic program. From the main page displayed on the [**EB1**] electric panel, use the following procedure:
F2 ➔ Password ➔ Enter ➔ Login ➔ Date&time ➔ F4 ➔ F3 ➔ F5.

3) Use the **F1** and **F2** keys to select on the screen the suspension to bypass.



INDICATIVE FIGURE

4) Press the **F4** button to bypass the suspension: the corresponding square turns red.

From now on, by operating the radio control steering joystick or by changing the steering mode, the suspension will not turn. The following icon is displayed in the main screen of the [**EB1**] electric panel display:

To undo the bypass, press again **F4**: the square turns back grey.

Continued ➔

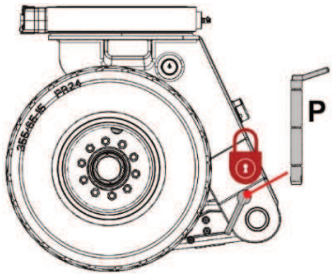
Continued ➔

Operating procedure

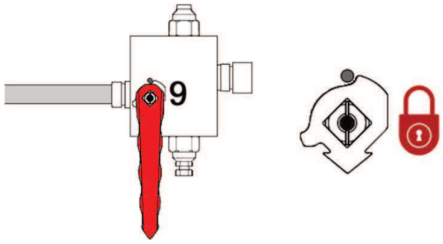
To prevent damages to the bypassed suspension while driving and manoeuvring the vehicle, isolate it also mechanically and hydraulically. Do as follows:

5) Set the vehicle to fully low position (see chapter 10).

6) Block the suspension with the lock pin (**P**).

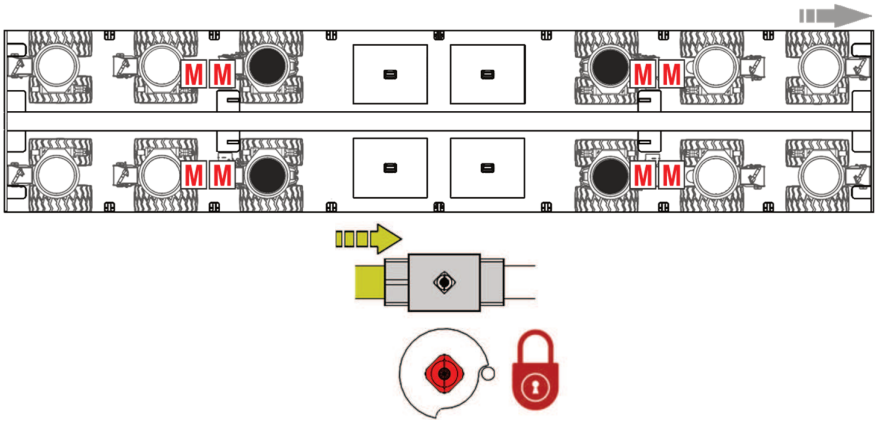


7) Close the tap [**9**] of the suspension: the suspension is now closed off from the hydraulic lifting circuit.



In the case the bypassed suspension is motorized, cut the corresponding axle off the motorization hydraulic circuit: close both taps [**M**] placed next to the motorized suspension, below the loading platform. The following image shows where the taps are, two per each motorized axle.

INDICATIVE FIGURE



NOTE
*For each motorized suspension of any vehicle ECO1000 there are two taps [**M**], always in the same position in respect to the suspension itself, as shown in the figure above (ECO1000 6/4).*
For more information, refer to paragraph 3.3.

8) Set the vehicle to operating height.

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