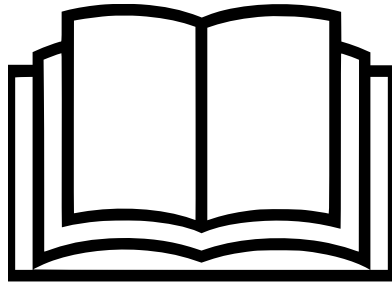


TWINCA DUMPER



Twinca ES models
English operations manual
(translated)

The Danish user manual is the original and all translations is made on the basis of this.

These operating instructions have been prepared by Twinca A/S.

This manual applies to the models:

ES-500
ES-500 Slim
ES-800

If this manual is misplaced, contact Twinca A / S or download the latest edition at www.twincadumper.com.

Changes may occur between the printed version and the uploaded version on www.twincadumper.com.

Twinca A / S reserves the right to change instructions and specifications without obligatory prior notice.

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Introduction

Thank you for choosing a Twinca Dumper. We hope the machine will help you work more efficiently and improve your work environment.

This operations manual contains descriptions and illustrations that apply to all Twinca Dumpers ES models. The illustrations in this operations manual are based on the drawings of the ES-800 and may be different from your chosen model.

Twinca Dumper is intended for transport primarily of soil, granules, stones, concrete, wood and similar materials.

Instructions for use

Read the manual thoroughly. Place it in a safe place and always make it available to the operator.

For proper use and maintenance of the machine, the user must have read and understood the manual. The Executive Order on the Working Environment Act must always be complied with. The operator of the machine is responsible for accidents.

Before starting the machine

The owner is responsible for making sure the operator has read and understood the manual, so the machine is used safely and in accordance with this manual. The operator must therefore have understood:

- The safety instructions given in this manual and on the machine.
- Emergency stop and its significance.
- Operation of the machine.
- Which work tasks the machine is intended for and which tasks the machine may not be used for.
- Machine maintenance.
- What procedures must be followed to prevent personal injury and damage to other equipment.

Modifications

If the owner wants modifications, this can be requested before production. These modifications are attached to the standard documents of the machine.

The machine may not be modified without a written permission from Twinca A/S. If modifications are made without a written permission from Twinca A/S will the owner be responsible for all modifications that are made to the machine after delivery from Twinca A/S. The owner is responsible for implementing the modifications. Modifications can pose new risks to the operator, the machine and the environment. It is the owner's responsibility that modifications made to the machine live up to European standards and laws, or the standards and laws used in the country of use of the machine.

Terms of warranty

Ask your dealer for what conditions apply to your machine.

- Twinca A/S has a 24-month warranty on the entire machine except for the 15-month warranty on the battery.
- The annual statutory inspection must be complied with.
- All maintenance must be carried out by an authorized workshop or dealer, using original parts.
- If a defect occurs, contact your dealer as soon as possible (within five workdays). If this is not maintained all warranty on the defect part will be waived.
- If a defect occurs which causes damage to other parts, this must be reported immediately to the nearest dealer or service workshop. In the event of continuous driving on damaged parts, all warranty will be waived on the part and the affected damaged parts.
- Twinca A/S only commits to Twinca original parts. The obligations are waived if the machine has been involved in an accident, has been modified or used in contrary with this manual and the machines intended purpose.
- Twinca A/S does not compensate for extra costs such as: financial loss, labor, fines, damages due to pollution, etc.
- Regardless of which warranty is claimed, this must be done within Twinca A/S's standard warranty period for new products/parts of 24 months after delivery, or after 1,000 annual operating hours, whichever comes first.
- Twinca A/S's liability includes defects due to design, material or production. These defects must be rectified by a dealer or an authorized service workshop.
- Twinca A/S offers a 24-month warranty on spare parts from the delivery date.
- Twinca A/S's liability does not cover defects arising from normal use. In addition, defects caused by defective or incorrect maintenance, incorrect repairs, incorrect use, defects incurred during transport or incorrect storage are not covered.
- Twinca A/S will only offer replacement or compensation within the specified period for warranty.
- Conditions for warranty must follow §7 in general Terms and Conditions of Sale and Delivery for Twinca A/S.

Twinca A/S can only handle warranty cases with prior agreement per. phone + 45 97 44 85 55 or e-mail rma@twinca.dk, with information about product, error description and contact person. Twinca A/S is only receiving warranty after approval and with RMA identification.

Ordering spare parts

When ordering spare parts is it important to check what modifications there has been made to the machine. Contact your dealer or service workshop to order parts.

Safety instructions




It is important that the operations manual is read and understood for your own safety and the safety of your surroundings.

It is important that you contact the dealer or Twinca A/S if you are unsure about correct use of Twinca Dumper.

- The machine is heavy. Do not attempt to lift the machine alone. Seek help and use a suitable lifting tool.
- Keep the work area clear and make sure that persons without affiliation to the work process are at a safe distance from the machine and the work area.
- Personal Protective Equipment (PPE) must be worn by the operator when required.
- Make sure you know how to turn off the machine before turning it on, in case you run into difficulties while using the machine.
- Always drive the skip down and switch off when you leave, transport, service or repair the machine.
- Never change or remove fitted safety precautions. They are attached for your personal safety. If they are broken or missing THE USE OF TWINCA DUMPER MUST NOT TAKE PLACE until the safety precautions have been re-established or repaired.
- Do not operate the machine if you are ill, feeling tired or are under the influence of alcohol, medicine or narcotics.
- This machine may not be used by children (under 16 years of age) or people with physical or mental disabilities, or lack of experience and knowledge of its use.
- It is not permitted to stand on the machine at any time or use it to transport people or animals.
- When driving on inclines, the operator must always be at the highest point of the incline.
- Walk around the machine in a controlled manner, as the skip has sharp corners.
- The machine is NOT ATEX approved and must therefore NOT be used in explosive environments.
- In case of fire wear self-contained breathing apparatus and use foam or CO₂ extinguisher.

Warning levels








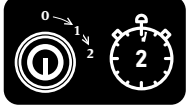

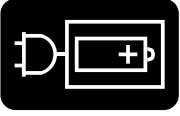
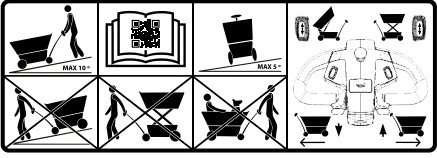
There are three warning levels, and each warning level has its own symbol. The operations manual shows the symbol as well as a description of the danger associated with this warning. Explanations of the three warning levels are shown below:

 WARNING	 IMPORTANT	 NOTE
If an accident occurs, this can result in life-threatening injuries, disabling, amputations and etc.	If an accident occurs, this can result in serious injuries, bone fractures, burns and etc.	If an accident occurs, this may result in minor personal injury or property damage.

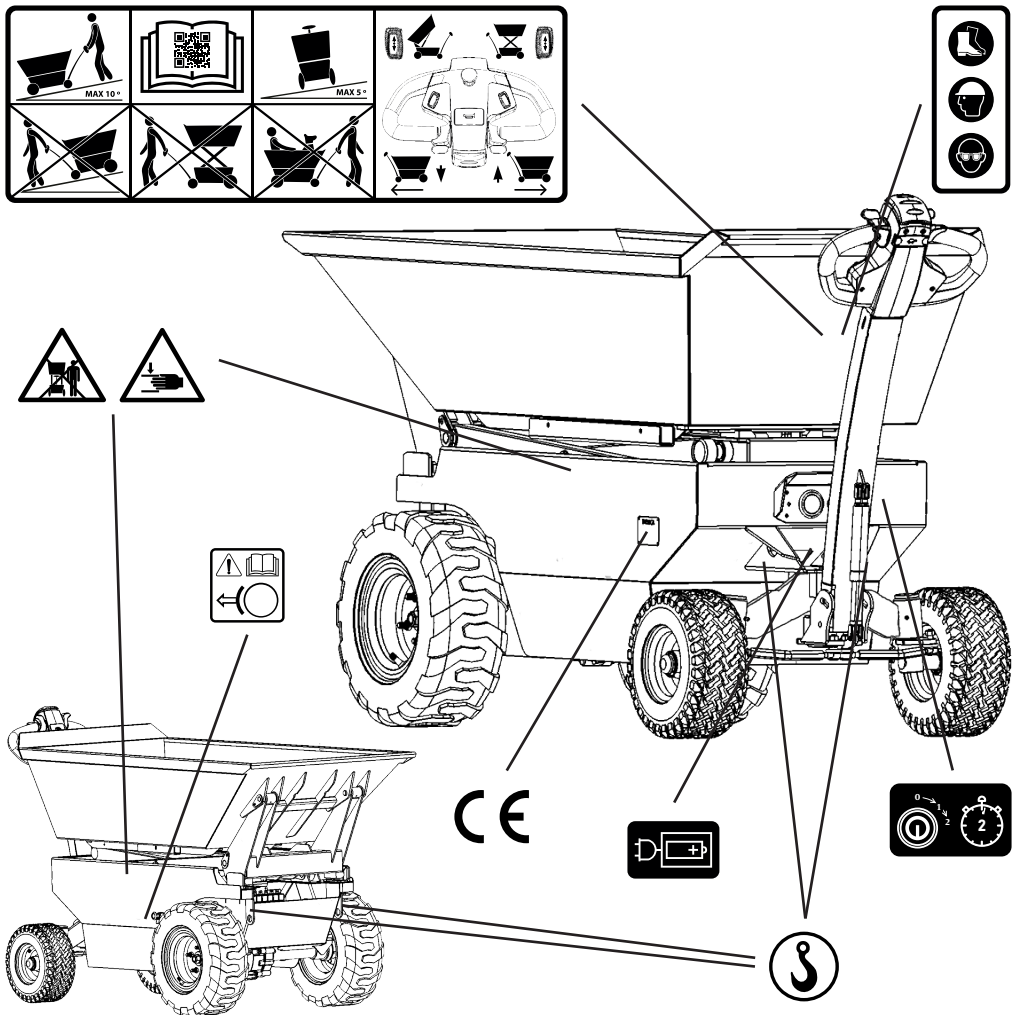
Explanation and overview of pictograms used

The most important pictograms attached on the machine. Always make sure that the machine has the necessary pictograms and that they are visible and in good condition.

Pictogram overview

<p>Read the manual carefully and understand the contents before using the machine.</p>		<p>This product complies with relevant directives and harmonizing standards.</p>	
<p>Mandatory safety shoes</p>		<p>Warning: Danger of crushing</p>	
<p>Mandatory safety helmet</p>		<p>Warning: Do not stand by the side of machine during use</p>	
<p>Mandatory safety glasses</p>		<p>Attachment points</p>	
<p>Turn the key to position 2 and hold for 2 seconds for turn on the machine</p>		<p>Break release. In case of emergency pull the break release.</p>	
<p>Charging of the machine</p>			
<p>The most important information: Read the user manual, Maximum 10 degrees incline, Maximum 5 degrees across an incline, Do not go further down than the machine on inclines, Do not drive with the scissors up, Do not use the machine to transport people or animals. Operation of the machine.</p>			

The location of pictograms and signs on the machine



Maintenance of pictograms and signs on the machine

The machine's pictograms and signs must always be in good and readable condition. In case of damage or missing pictograms or signs, contact Twinca A/S or the nearest dealer.

Personal Protective Equipment (PPE)

Because Twinca A/S' machines are used for many purposes and in many environments, it is always the operator's own responsibility to use the Personal Protective Equipment (PPE) that is associated with the work that is performed and that is directed to where the operator is located. The following personal protective equipment is always required:

- Safety shoes
- Safety helmet
- Safety glasses



IMPORTANT: Wear safety shoes, safety helmet and safety glasses.

It is recommended that long hair be tied up and that all jewelry be removed, and the operator wear approved work clothes, as the operator is at risk of getting caught in the moving parts of the machine.

Machine risk zone

During usage of the machine the operator must be at the control handle and is responsible for ensuring that no persons are in the risk zone and are exposed to potential danger.

When loading material on the machine, it is recommended that the operator walk away from the machine while maintaining the recommended safety distance, 5 meters of the center of the machine (Zone 1 and 2).

When unloading material, the operator must ensure that the machine is kept stable and level and the recommended safety distance is kept. Never walk in front of the machine to loosen material or otherwise remove the contents from the skip when the skip or scissors are up.

The pictograms on the sides of the machine warn of the danger of crushing and warn against standing near the machine during use of the machine. The operator (in Zone 1) must make sure that no one is within 5 meters of the center of the machine when using the machine (Zone 2).



WARNING: Danger of crushing and do not stand by the side of machine during use.

Other risks and emergency safety procedures

The electric motor, hydraulic pump and hydraulics become hot during continuous use. Always make sure that the electric motor, hydraulic pump, tank and cylinders have cooled down before handling these parts.

When driving on inclines, the operator must always be at the highest point of the incline. There is a risk associated with driving on inclines as material may fall off and the stability of the machine may have changed.

Battery Leak procedure: Wear acid-resistant clothing, boots, gloves, and face visor. Stop the leak and absorb the acid with e.g. granules or shavings, if possible neutralize with soda, sodium, pulverized lime and etc. Never drain acid into the nature or sewer. For more information about the battery please contact the manufacturer.

Fire procedure: Due to the components of the machine electric fire may occur, therefore do NOT extinguish the fire with a water or powder extinguisher. Use foam or CO₂ extinguisher.

Procedure for clamping under scissors and skip: It is always recommended, to use the machine's own functions to repair the damage. If this is not possible follow the procedure shown in the "Service and maintenance" section.



WARNING: Removing the pins without supporting the movable parts, scissors and skip will collapse.

Transport and lifting of the machine

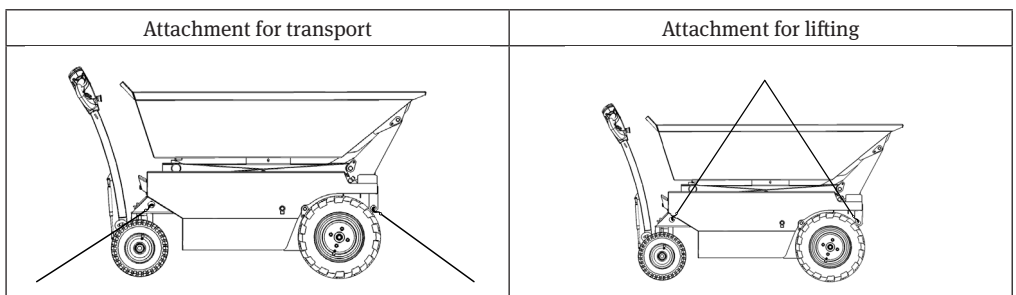
When transporting the machine, it must be fastened to the 4 attachment points in accordance with the applicable lashing rules.

Lifting of the machine should only be done by skilled personnel who has completed a towing course or other relevant training. All attachment points must be used when lifting the machine and only approved lifting gear may be used. Before lifting the machine always check its balance and straps as well as the attachment gear is seated correctly. Check the straps are not jammed and that the machine is not stuck in the ground.



The 4 attachment points are indicated on the machine with this pictogram.

Proper attachment for transport and lifting is shown in the drawing below.



Machine structure and use

The machine is primarily made up of three parts: skip, scissors and chassis.

Proper use of the machine:

- The machine may be used for transporting soil, granules, stones, concrete, wood and similar materials.
- The machine must always be stable and level during loading and unloading.
- The skip and scissors of the machine must be down before driving.
- The operator has full responsibility and must always be at the control handle.

Improper use of the machine:

- The machine must NOT be used for transporting people or animals.
- The machine must NOT be used for driving where there is an incline of more than 10 degrees, or sideways driving on a incline of more than 5 degrees.
- The machine must NOT be used on soft and uneven ground when loading and unloading.
- The machine must NOT be driving with scissors or skip up.
- The machine must NOT be used when driving on inclines where the operator is at the lowest point of the incline.
- The machine must NOT be used for pushing or pulling.
- The machine must NOT be used in an explosive atmosphere. The machine is NOT ATEX approved.
- The machine must NOT be used in wet areas where the amount of water exceeds 1x1 meter and 5 centimeters in depth.
- The skip must NOT be emptied manually of material when the load and scissors are up.
- The machine must NOT be used in weather with a wind speed of more than 12.5 m/s, which corresponds to wind speed 6 on the Beaufort scale.

The most important points related to the use and safety of the machine are shown on the machine with pictograms.

Charging

Electricity must be treated with great respect. Avoid electric shock and explosions.

The power cord is short. Avoid pulling the power cord. Connect an extension cord when charging the machine's batteries. The machine has a built-in charger that automatically shuts off, preventing the batteries from becoming overcharged.

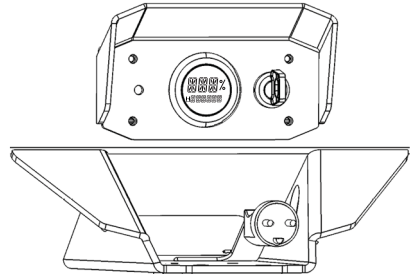
When charging the machine, a lamp next to the LED Display will flash. When fully charged battery, the lamp will light up continuous.

All charging of the machine must take place in a dry and ventilated room with access to a foam or CO₂ extinguisher. Do not use tools there creates sparks near the machine during charging. Never use a wet, defective or worn supply cable and always check that all electronics are properly connected.

The machine is equipped with a multi-input charger so that the machine can be connected to all power sources between 110V and 230V.

The charger plug is located under the display.

Charging time may vary depending on the battery and battery size of the selected model. The batteries are categorized as a wear part and may be replaced during the life of the machine. When replacing batteries to other than the original ones, different terms and conditions of use may apply.



The machine must not be used during charging. A full charge of the original battery takes a minimum of 6 hours.

Batteries

The machine is 100% electrically powered. The machine is powered by two batteries that at full charge, normal driving patterns and temperature conditions, it can hold power for an entire working day (8 hours). The battery that comes with the machine is a maintenance-free lead-acid battery.

Battery Leak procedure: Wear acid-resistant clothing, boots, gloves, and face visor. Stop the leak and absorb the acid with e.g., granules or shavings if possible, neutralize with soda, sodium, pulverized lime etc. Never drain acid into the nature or sewer. For more information about the battery please contact the manufacturer.

Optimal use of the battery

Discharge: -15°C - 50°C (5°F - 122°F)

Charging: 0°C - 40°C (32°F - 104°F)

Storage: -15°C - 40°C (5°F - 104°F)

The batteries are categorized as a wear part and may be replaced during the life of the machine. When replacing batteries other than the original ones different terms and conditions of use may apply.

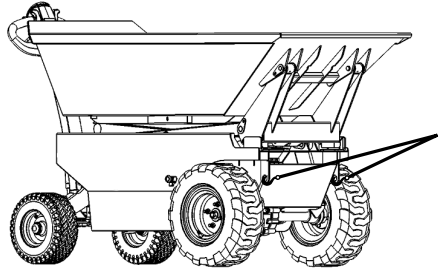
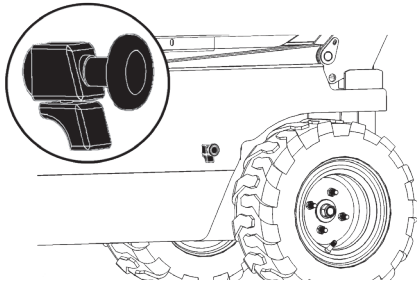
Parking brakes

The parking brake is electric and releases automatically when driving the machine and is activated automatically when the machine stops.

The parking brake can be released manually by watching the procedure under the section freewheeling.

Brake release and towing the machine

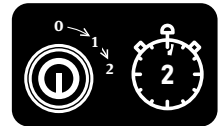
Brake release makes it possible to tow the machine in the event of problems that prevent the machine from running itself. Due to the weight of the machine, it is recommended not to pull the machine without a towing device. Pull the machine in a controlled manner and during towing an operator must steer the machine from the control handle while the towing device is attached to the front attachment points (see section "Transport and lifting of the machine" if necessary). Brake release is located on the right side of the chassis.



Ignition lock

To start the machine, turn the supplied key all the way to the right and hold it until the LED display lights up (approx. 2 sec.).


The machine has an automatic shut-off function. After 15 minutes of not using the machine, the machine switches off automatically. If machine automatically switches off the key must be turned to the neutral position, after which it can be switched on again. The automatic shut-off function after 15 minutes is a safety feature and ensures that the machine's batteries are not discharged if the operator forgets to switch off the machine during breaks or end of use.

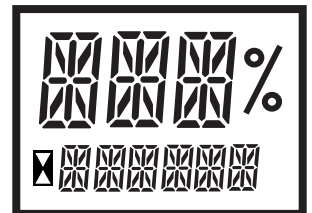


LED display and charging indicator

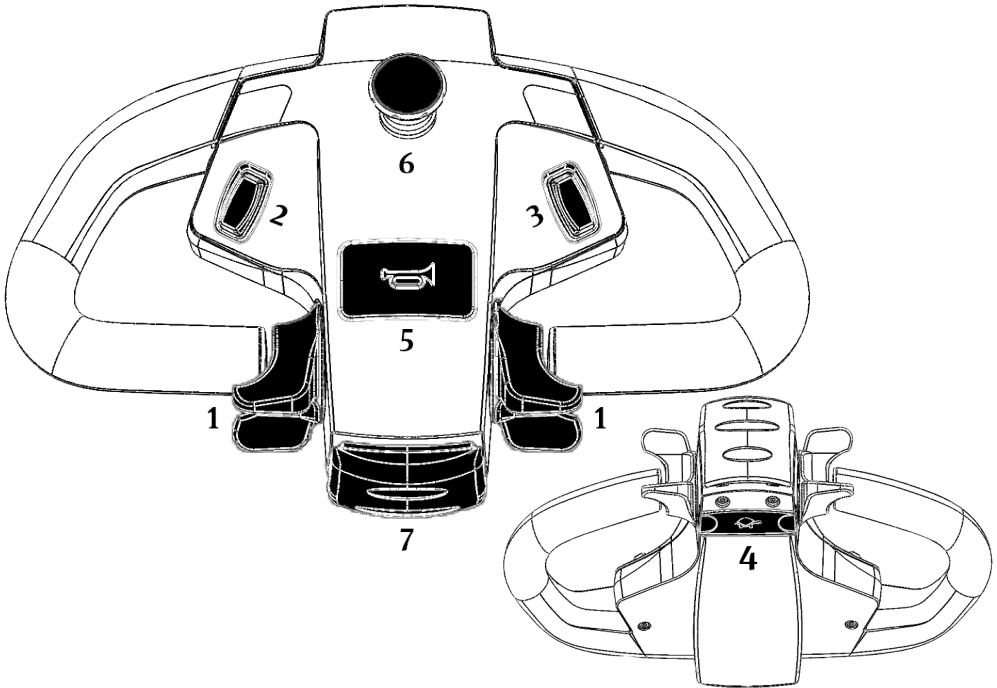
The machine's LED display is only active when the machine is switched on.

The following can be read on the LED display:

- How much power is on the machine in %
- How many hours the machine has been in operation
- When the machine charging it will say *CHARGE*
- In event of an error, a error code is shown. Error code can be found in the troubleshooting section
-  Flashes when the machine is counting operating hours.



Operation of the machine



1. **Tiller:** The two tillers can be operated individually, and the machine can therefore be driven with both left and right hand. The tiller grips provide a step-less adjustment in speed, they are pushed up to drive the machine forward, they are pressed down to drive the machine backward. The maximum speed is 6 km/h. To stop the machine, release the tiller.
2. **Skip up/down:** This switch controls the functions of the skip, up and down.
3. **Scissors up/down:** This switch controls the scissor lifting function, up and down. **NOTE** The machine is programmed to a top speed of 2.5 km/h when the scissors are lifted from the neutral position.
4. **Speed limiter:** This button reduces the speed of the machine to 2.5 km/h.
5. **Horn:** This button allows the operator to signal any danger. It sounds during the time the button is held down.
6. **Emergency stop:** Emergency stop breaks the electrical circuit and switches off the machine completely. To restart the machine, turn the key again.
7. **Belly Button:** This button reverses the driving direction during the time it is held down. The machine stops when the button is released. This button is activated if the control handle is adjacent to the operator or is otherwise activated. Belly Button is not an emergency stop and does not turn off the machine.

Driving with the machine

The machine is 100% electrically driven, and therefore has step-less speed adjustment and can drive up to 6 km/h in both directions. When stopping the machine release the tiller. The machine's parking brake is activated and deactivated automatically. Always walk with the front and face in the same direction as when driving, and never drive with the machine when the scissors are lifted, or the skip is tipped.

Maintenance and servicing

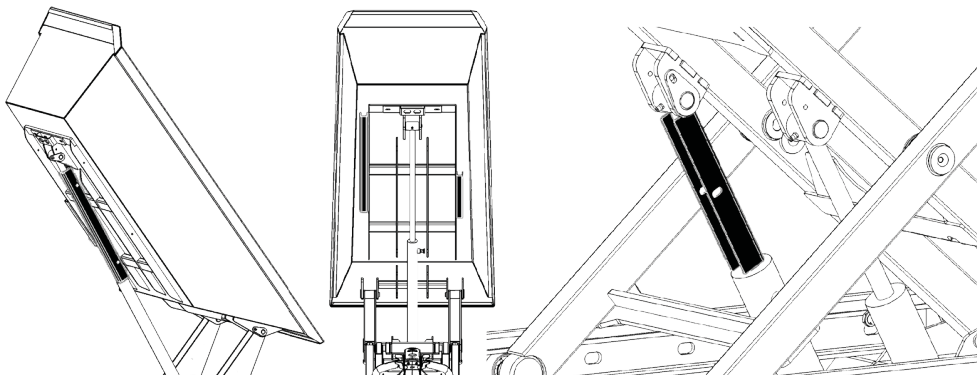
If in doubt contact your dealer, service workshop or Twinca A/S.

We recommend that all service be performed by the dealer where the machine was purchased or by other specialized personnel with a relevant craftsmanship background who possess the maintenance instructions. If you want to carry out service or repairs yourself, please contact Twinca A/S for the maintenance instructions.

Before working with the engine, hydraulics or servicing install the safety brackets. The safety brackets are included and can be found under the skip. Mount the safety brackets over the hydraulic pistons before working on the machine.

When servicing the machine under normal conditions. Always make sure to use the supplied safety brackets.

1. Use the machine's hydraulics to lift the skip and scissors, depending on the task to be solved.
2. Mount the supplied safety brackets.
3. Turn off the machine.
4. Service the machine.
5. Turn on the machine.
6. Remove the supplied safety brackets.
7. Ensure the lifting functions work properly.



It is recommended only to lift the skip manually if absolutely necessary. For normal maintenance use the supplied safety bars. Be careful to lift the load manually, as this can potentially pose a risk of crushing.



WARNING: Danger of crushing and do not stand by the machine during use

Emergencies such as servicing the machine or pinching under scissors and skip in case it is without power or otherwise cannot be activated. It is recommended, as far as possible, to use the machine's own functions to stop the emergency. It is recommended to use Twinca special tools to avoid the potential risk of crushing.



WARNING: This procedure can aggravate the accident if it is not followed exactly! It is important that scissors and skip are supported by a crane or other lifting unit. These parts are heavy and cannot be held up without the use of lifting gear that can carry a minimum of 200 kg.

1. Make sure the machine is turned off and the accident stopped.



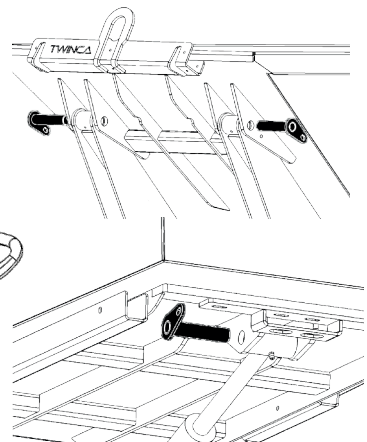
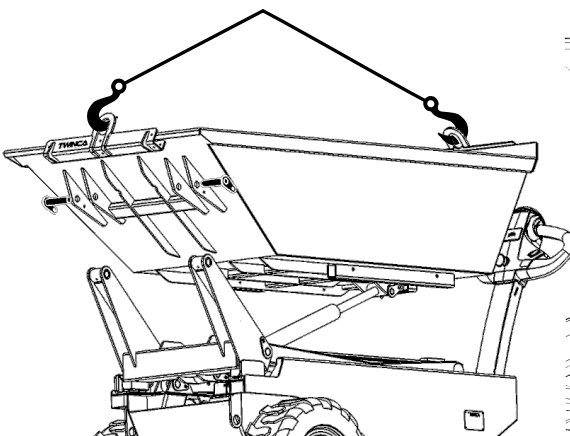
WARNING: If the pins are removed without the supporting, the scissors and skip will collapse.

2. Install Twinca special tool. Support scissors and load with a lifting unit.



WARNING: Remove only those pins that relate to what is to be lifted. If there is a need to lift scissors, remove the pins in the scissors, if there is a need to lift the skip, remove the pins in the skip.

3. Remove the pins, lift the skip, and remove the hydraulic piston.
4. Move the skip and place it on a flat surface out of harm's way while the machine is being serviced. At emergency remove the emergency reason from the machine.
5. At the end of the service the skip is lifted back into the machine and the hydraulic piston is fitted.
6. Put the skip down on the chassis and remount the pins.



Check before starting and using the machine

If a error is detected do not use the machine until the error has been rectified.

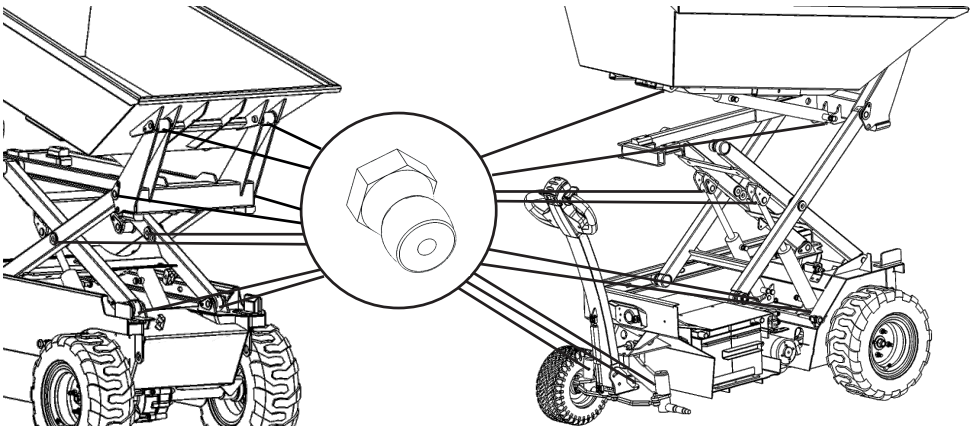
- Check the machine for defects.
- Check all parts are present and work optimally.
- Check tire pressure. The correct tire pressure appears on the side of the tire. This is not to be done if the machine is with solid tires. If in doubt, contact your dealer or Twinca A/S.
- Check power level. We do not recommend driving with the machine if battery levels are below 15%.
- Test emergency stop and belly button.

Maintenance after 20 hours of operation or 3 months

Maintenance after 20 hours of operation or after 3 months of use can be performed by the owner or operator.

- Lubricate lubrication points on the hydraulic cylinder.
- Lubricate lubrication points on the tilt point of the skip.
- Lubricate lubrication points on the scissors.
- Lubricate lubrication points on the steering gear.
- Tighten ball joints
- Tighten wheels

In case of noise lubricate the needed machine part.



Annual maintenance

Annual maintenance consists of the annual main inspection in accordance with the Danish Working Environment Authority's executive order no. 1109 of 15/12/1992. This inspection must be carried out by the dealer where the machine was purchased or by other specialized personnel with a relevant craftsmanship background who possess the maintenance instructions.

The owner of the machine is responsible for compliance with the annual main inspection. The date of the last and next main inspection is indicated on the handlebar.

If the owner wants to do the annual main inspections himself/herself. Contact Twinca A/S to provide maintenance instructions and a checklist for inspections.



Overview of maintenance

Activity	Before starting and use	20 hours / 3 months
Check the machine for defects.	●	●
Check all parts are present and work optimally.	●	●
Check tire pressure	●	●
Check power level	●	●
Test emergency stop and belly button	●	●
Lubricate lubrication points		●
Tighten guide balls		●
Tighten wheels		●

Oil

When changing hydraulic oil, use 832 WRHV. The oil level is checked with the oil indicator. There must be between 5-10 millimeters of oil on the indicator. The oil indicator is attached under the lid. At empty tank add 2 liters of new oil.

When filling gear oil use 80W90. When changing empty the gear and then add 0.3 liters of new oil.

Troubleshooting

In the event of a machine error an error code will appear on the machine's LED Display. The list of error codes and their meaning is only available in English and can be found at the back of the operations manual.

If in doubt, contact your dealer or Twinca A/S.

In the event of damage to the hydraulics or the wiring harness, a drawing of these can be found in the maintenance instructions. Repair and maintenance of these parts is recommended to be performed only by the dealer where the machine was purchased or by other specialized personnel with a relevant craftsman background who possess the maintenance instructions.



WARNING: When repairing and maintaining the electrical parts of the machine, the machine must be turned off and the batteries removed. There is a risk of getting shocked.

Cleaning the machine

The chassis and skip can be rinsed with an ordinary garden hose with low pressure. If necessary, a soft brush can be used. The control handle must only be wiped over with a damp cloth and not exposed to direct water spray.

It is not permitted to use a high-pressure cleaner or anything else that could damage the machine and its electrical parts.

Cleaning of the engine room should only be done with air pressure. In-depth cleaning of parts is described in the maintenance instructions.

The machine is not waterproof and should therefore not be exposed to excessive amounts of water.

Storage of the machine

The machine must be stored dry and in a place that complies with the temperature range specified below the battery storage temperature.

Disposal of the machine

To protect the environment, it is important that discarded machine parts and accessories are handed over to relevant recycling sites, as the machine contains reusable materials.

The batteries must be disposed of as dangerous goods. Take extra care if the battery is leaking or damaged. Battery handling is described in the section Structure and use of the machine.

Be aware that the machine contains electronics and that several machine parts can be recycled. Consult professionals before disposing the machine.

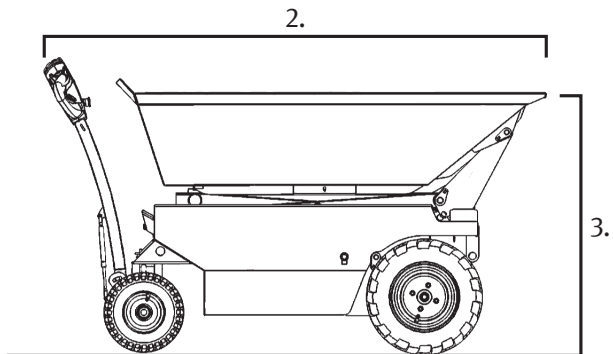
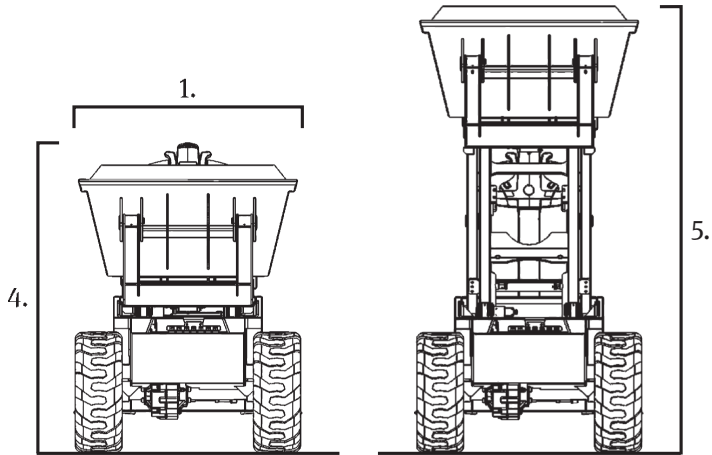
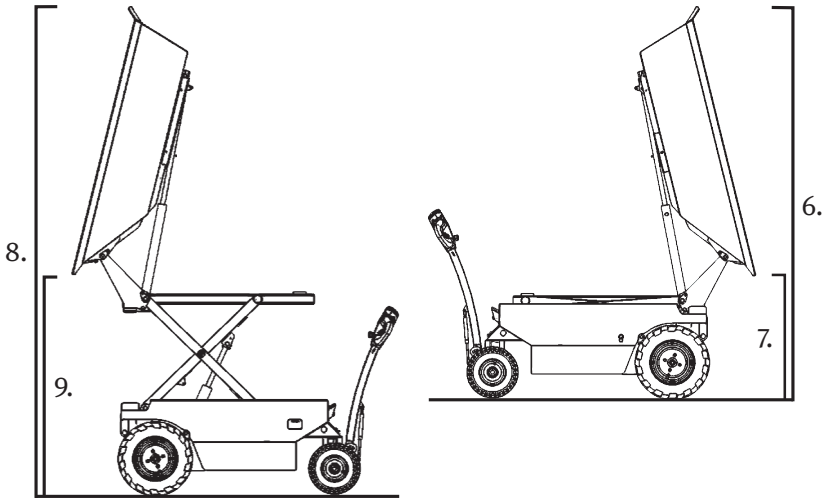
Overview of machine parts

Machine parts	Material
Chassis, Scissors and Skip	Iron
Controller, charger and wiring	Electronic
Battery (original)	Lead battery
Motor	Iron and copper
Hydraulic pump	Iron and aluminum
Drive shafts	Iron and aluminum
Control handle and buttons	Plastic
Hydraulic oil and gear oil	Oil

Specifications

The specifications are made based on our standard models, the ready can vary according to the choice of tires for the selected model.

	ES-500	ES-500 SLIM	ES-800
1. Width	800 mm	750 mm	860 mm
2. Length	1790 mm	1770 mm	2070 mm
3. Height	980 mm	980 mm	1060 mm
4. Height max lowered skip	1170 mm	1170 mm	1170 mm
5. Height max let skip	1590 mm	1590 mm	1710 mm
6. Height let skip top	2160 mm	2160 mm	2460 mm
7. Height let skip bottom	470 mm	470 mm	780 mm
8. Height scissors and let skip top	2710 mm	2720 mm	3090 mm
9. Height scissors and let skip bottom	1304 mm	1307 mm	1394 mm
Maximum speed - forward	6 km/h	6 km/h	6 km/h
Maximum speed - backwards	6 km/h	6 km/h	6 km/h
Let capacity - content volume	250 L	250 L	400 L
Load capacity - maximum content weight	500 kg	500 kg	800 kg
The weight of the machine	417 kg	463 kg	448 kg
Noise level	>70 dB(A)	>70 dB(A)	>70 dB(A)
Hand to arm vibration level			
Battery	2 X 12 V /112 Ah	2 X 12 V /112 Ah	2 X 12 V /150 Ah



EC declaration of conformity

The EC declaration of conformity on this page has been made in accordance with the Annex to the Danish Machinery Directive II.

Manufacturer:
Company name : Twinca A/S
Addresses : Nr.Bjertvej 14
Zip code/city : 7830 Vinderup
Country : Denmark
VAT.no. : 25804929
Phone : +45 9744 8555
Website : twincadumper.com



We declare as sole responsible that:
Twinca Dumper, model ES-500
Twinca Dumper, model ES-500 Slim
Twinca Dumper, model ES-800

Carried out in accordance with the following directives and harmonized standards:
The Machinery Directive 2006/42/EF
DS/EN ISO 12100:2011

Vinderup, d. 18/1/2021

CEO
Klaus S. Kristensen

Technical documentation by:
Twinca A/S
Nr. Bjertvej 14
DK-7830 Vinderup

Error codes

Troubleshooting chart index

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
0X12	Controller Over current	<ol style="list-style-type: none"> 1. External short of phase U, V, or W motor connections. 2. Speed encoder noise problems. 3. Motor parameters are mistuned. 4. Controller defective. 	Set: Phase current exceeded the current measurement limit. Clear: Reset Controller
0X13	Current Sensor	<ol style="list-style-type: none"> 1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective. 	Set: Controller current sensors have invalid offset reading. Clear: Reset Controller
0X14	Precharge Failed	<ol style="list-style-type: none"> 1. An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 	Set: The precharge failed to charge the capacitor bank. Clear: Cycle Interlock or Reset Controller
0X15	Controller Severe Undertemperature	<ol style="list-style-type: none"> 1. Controller is operating in an extreme environment. 2. See Programmer » System Monitor menu » Controller » Controller Temperature. 	Set: Heatsink temperature below -40°C . Clear: Bring heatsink temperature above -40°C and then Reset Controller
0X16	Controller Severe Overtemperature	<ol style="list-style-type: none"> 1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. See Programmer » System Monitor menu » Controller » Controller Temperature. 	Set: Heatsink temperature above $+95^{\circ}\text{C}$. Clear: Bring heatsink temperature below $+95^{\circ}\text{C}$, and then Reset Controller.
0X17	Severe B+ Undervoltage	<ol style="list-style-type: none"> 1. Non-controller system drain on battery. 2. Battery resistance too high. 3. Battery disconnected while driving. 4. Blown B+ fuse or main contactor did not close. 5. Battery parameters are misadjusted. 6. See Programmer » Monitor menu » Controller » Capacitor Voltage. 	Set: When Main is closed and FET Bridge enabled: Either the undervoltage drive current cut back = 0 % for 64 ms or the Brownout Voltage is reached. Clear: Undervoltage drive current cut back > 0 % for 100 ms and capacitor voltage > brownout voltage.

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
0X17	Severe KSI Undervoltage	<ol style="list-style-type: none"> 1. Non-controller system drain on battery/keyswitch circuit wiring. 2. Resistance in low power (KSI) circuit is too high. 3. KSI disconnected while driving. 4. Blown fuse. 5. See Programmer » System Monitor menu » Battery » Keyswitch Voltage. 	<p>Set: When below Brownout Voltage for 2 seconds. Clear: Bring KSI voltage above Brownout Voltage.</p>
0X18	Severe B+ Overvoltage	<ol style="list-style-type: none"> 1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 	<p>Set: Capacitor bank voltage exceeded the Severe Overvoltage limit with FET bridge enabled. Clear: Bring capacitor voltage below Severe Overvoltage limit, and then Reset Controller.</p>
0X18	Severe KSI Overvoltage	<ol style="list-style-type: none"> 1. Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit. 2. See Programmer » Monitor menu » Battery » Keyswitch Voltage. 	<p>Set: KSI voltage exceeded the Severe Overvoltage limit. Clear: Bring KSI voltage below the Severe Overvoltage limit, and then Reset Controller.</p>
0X19	Speed Limit Supervision	<ol style="list-style-type: none"> 1. Motor speed detected exceeding the limit set by the Max Speed Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu. 	<p>Set: Motor rpm has exceeded the Max Speed Limit setting for the Max Speed Time Limit setting's duration. Clear: Reset Controller.</p>
0X1A	Travel Control Supervision	<ol style="list-style-type: none"> 1. With the vehicle in the stopped state, the motor frequency and/or phase current detected exceeding the limit set by the Travel Control Supervision parameter. 2. Misadjusted Travel Control Supervision parameters. 3. See: Programmer » Application Setup » Travel Control Supervision menu. 	<p>Set: The motor frequency and/or and phase-current are above their Travel Control Supervision settings when in the stopped state. Clear: Reset Controller.</p>

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
0X22	Controller Overtemperature Cutback	<ol style="list-style-type: none"> 1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller which is preventing controller cooling. 4. Controller is performance-limited at this temperature. 5. See Programmer » System Monitor menu » Controller: Temperature. 	<p>Set: Controller's Heatsink temperature exceeded 85 °C. Clear: Bring heatsink temperature below 85 °C.</p>
0X23	Undervoltage Cutback	<ol style="list-style-type: none"> 1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system-drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. Blown B+ fuse or main contactor did not close. 7. See Programmer » System Monitor menu » Controller » Currents » UnderVoltageCutback. 8. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 	<p>Set: Capacitor bank voltage dropped below the UnderVoltageCutback limit with the FET bridge enabled. Clear: Bring the capacitor voltage above the controller's UnderVoltageCutback limit.</p>
0X24	Overvoltage Cutback	<ol style="list-style-type: none"> 1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Programmer » System Monitor menu » Controller » Currents » OverVoltageCutback. 6. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 	<p>Set: The controller's capacitor bank voltage exceeded the OverVoltageCutback limit with the FET bridge enabled. Clear: Bring controller's capacitor voltage below the OverVoltageCutback limit.</p>

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
OX25	Ext 5V Supply Failure	<ol style="list-style-type: none"> External load impedance on the +5 V supply (pin 16) is too low. See Programmer » System Monitor menu » Outputs: Ext_5V_Supply, Ext_5V_Current. 	Set: (1) The 5 V Supply (pin 16) is outside 5 V±10 % (2) The current is outside limits defined by: Ext_5V_Supply_Min Ext_5V_Supply_Max Clear: Reset Controller, or Re-set using VCL variable Ext_5V_Output_Enable
OX26	Ext 12V Supply Failure	<ol style="list-style-type: none"> External load impedance on the +12 V supply (pin 23) is too low. See Programmer » System Monitor menu » Outputs: Ext_12V_Supply, Ext_12V_Current. 	Set: (1) The 12 V supply (pin 23) is outside 12 V ± 15 % (2) The current is outside the limits defined by: Ext_12V_Supply_Min Ext_12V_Supply_Max Clear: Reset Controller. Or Re-set using VCL variable Ext_12V_Output_Enable.
OX28	Motor Temp Hot Cutback	<ol style="list-style-type: none"> Motor temperature is at or above the programmed Temperature Hot setting—resulting in a reduction of controller drive current. The motor temperature and sensor control parameters are misadjusted. See Programmer » AC Motor Setup » Temperature Sensor. 	Set: Motor temperature is at or above the Temperature Hot parameter setting. Clear: Bring the motor temperature within range.
OX29	Motor Temp Sensor	<ol style="list-style-type: none"> Motor thermistor is not connected properly. sensor polarity (between Pin 9 and Pin 12) is incorrect. The motor temperature and sensor parameters are misadjusted. See Programmer » System Monitor menu » AC Motor » Temperature. 	Set: Motor thermistor input (pin 9) is at the voltage rail. Clear: Bring the motor thermistor input voltage within range.
OX31	Main Driver	<ol style="list-style-type: none"> Open or short on driver load. Dirty connector pins at controller or contactor coil. Bad connector crimps or faulty wiring. 	Set: Main Contactor driver is either open or shorted. This fault can be set only when Main Enable = On. Clear: Restore/repair any external wiring or device-coil to their correct state, then Reset Controller.

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
OX32	EM Brake Driver	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 	<p>Set: Electromagnetic brake driver (pin 4) is either open or shorted. This fault can be set only when EM Brake Type >0.</p> <p>Clear: Restore/repair any external wiring or device-coil to their correct state, then Reset Controller.</p>
OX35	Proportional Driver	See Driver 1 Fault (OXA1)	
OX36	Encoder Fault	<ol style="list-style-type: none"> 1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Programmer » System Monitor menu » AC Motor: Motor RPM. 4. See Programmer » AC Motor Setup » Quadrature Encoder » Encoder fault Setup. 	<p>Set: Motor encoder phase failure detected.</p> <p>Clear: Either Reset Controller, or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Encoder Fault is cleared and Encoder LOS fault (flash code 9-3) is set, allowing limited motor control.</p>
OX37	Motor Open	<ol style="list-style-type: none"> 1. Motor phase is open. 2. Bad crimps or faulty wiring. 	<p>Set: Motor phase U, V, or W detected open.</p> <p>Clear: Cycle KSI.</p>
OX38	Main Contractor Welded	<ol style="list-style-type: none"> 1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal). 	<p>Set: Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded (via the motor) for a short time and the voltage did not discharge indicating a direct-contact to the battery (i.e., Main tips are welded closed).</p> <p>Clear: Reset Controller</p>

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
0X39	Main Contractor Did Not Close	Type1: 1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging. 4. Blown B+ fuse. 5. Main Contactor parameters mistuned Main Pull In Voltage, Main Holding Voltage. Type2: 1. Main opened during operation (while commanded closed). 2. Driver wiring to contactor's coil (e.g., pin 3 wiring) removed during operation. 3. Contactor/coil defective.	Set: With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+. Clear: Reset Controller.
0X42	Throttle Input	1. Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. 2. See Programmer » Controller Setup » Analog Inputs » Analog 1 Type. 3. See Programmer » Controller Setup » Analog Inputs » Configure.	Set: Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. Clear: Bring throttle input voltage within the Min and max thresholds. Reset Controller.
0X46	NV Memory Failure	1. Failure to read or write to nonvolatile (NV) memory. 2. Internal controller fault.	Set: Controller operating system tried to read or write to EEPROM memory and failed. Clear: Download the correct software and matching parameter default settings into the controller and Reset Controller.

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS															
OX47	HPD Sequencing	<ol style="list-style-type: none"> 1. Incorrect sequence in application of Keyswitch, Interlock, Direction, or Throttle. 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle. 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state. 4. Verify input switch status. See Programmer » System Monitor menu » Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Inputs » Throttle Command. 	<p>Set: HPD (High Pedal Disable) or SRO (Static Return to Off) sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs.</p> <p>Clear: Reapply inputs in correct sequence.</p>															
OX47	Emer Rev HPD	<ol style="list-style-type: none"> 1. Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral. 	<p>Set: At the conclusion of Emergency Reverse, the fault was set because various inputs were not returned to neutral.</p> <p>Clear: If EMR_Interlock = On, clear the interlock, throttle, and direction inputs. If EMR_Interlock = Off, clear the throttle and direction inputs.</p>															
OX49	Parameter Change	<ol style="list-style-type: none"> 1. When Interlock is On, changing a safety-based parameter. Parameters with this property are marked with a [PCF] (Parameter Change fault) in the Parameter menu listings. 	<p>Set: Adjustment of a parameter setting that requires cycling of KSI.</p> <p>Clear: Reset Controller.</p>															
OX4A	EMR Switch Redundancy	<ol style="list-style-type: none"> 1. Either or both Emergency Reverse input switches are inoperative, resulting in an invalid state. <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>NO</th> <th>NC</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>On</td> <td>Off</td> <td>valid</td> </tr> <tr> <td>Off</td> <td>On</td> <td>valid</td> </tr> <tr> <td>On</td> <td>On</td> <td>invalid</td> </tr> <tr> <td>Off</td> <td>Off</td> <td>invalid</td> </tr> </tbody> </table> 2. Ingress of dirt or moisture in switch(s). 	NO	NC	State	On	Off	valid	Off	On	valid	On	On	invalid	Off	Off	invalid	<p>Set: Emer Rev Switch NO input does not agree with the Emer Rev Switch NC input.</p> <p>Clear: Correct switch states. Reset Controller.</p>
NO	NC	State																
On	Off	valid																
Off	On	valid																
On	On	invalid																
Off	Off	invalid																
OX68	VLC Run Time Error	<ol style="list-style-type: none"> 1. Runtime errors are defined using the VCL Error Module and VCL Error. See the System Information file: • Curtis Integrated Toolkit™ » VCL Studio » Help 2. Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match. 	<p>Set: VCL Run Time Error detected</p> <p>Clear: Edit VCL application software to fix this error condition; flash the new compiled software and matching parameter settings; Reset Controller.</p>															

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
0X72	PDO Timeout	<ol style="list-style-type: none"> 1. The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups. 	<p>Set: Time between CAN PDO messages received exceeded the PDO Timeout Period.</p> <p>Clear: Receive CAN NMT message, or Reset Controller.</p>
0X73	Stall Detected	<ol style="list-style-type: none"> 1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Programmer » System Monitor menu » AC Motor » Motor RPM. 	<p>Set: No motor encoder movement detected.</p> <p>Clear: Either Reset Controller, or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Stall Detected fault is cleared and the Encoder LOS fault (flash code 9-3) is set, allowing limited motor control.</p>
0X77	Supervision	<ol style="list-style-type: none"> 1. Internal controller fault. 	<p>Set: Internal controller failure</p> <p>Clear: Reset Controller.</p>
0X79	Supervision Input Check	<ol style="list-style-type: none"> 1. Internal controller fault. 	<p>Set: Damaged Controller.</p> <p>Clear: Reset Controller.</p>
0X82	PDO Mapping Error	<ol style="list-style-type: none"> 1. The PDO Map has too many data bytes assigned or has objects mapped that are not compatible. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups. 	<p>Set: Incorrect PDO map detected.</p> <p>Clear: Reset Controller.</p>
0X83	Internal Hardware	<ol style="list-style-type: none"> 1. Internal controller fault detected. 	<p>Set: Internal controller fault detected.</p> <p>Clear: Reset Controller.</p>
0X87	Motor Characterizations Error	<ol style="list-style-type: none"> 1. Motor characterization failed during characterization process. See fault type for cause. 	<p>Set: Motor characterization failed during the motor characterization process.</p> <p>Clear: Reset Controller.</p>
0X88	Encoder Pulse Error	<ol style="list-style-type: none"> 1. Encoder Steps parameter does not match the actual motor encoder. 2. Verify parameter settings: AC Motor Setup » Quadrature Encoder » Encoder Steps. 3. Motor lost IFO control and accelerated without throttle command. 	<p>Set: Detected wrong setting of the Encoder Steps parameter.</p> <p>Clear: Ensure the Encoder Steps parameter matches the actual encoder; Reset Controller.</p>
0X89	Parameter Out of Range	<ol style="list-style-type: none"> 1. Parameter value detected outside of the limits. 2. Use CIT to view and write parameter value and range. 	<p>Set: Parameter detected outside of limits</p> <p>Clear: Bring parameter within its limits.</p>

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
OX91	Bad Firmware	The firmware in the controller is incorrect. 1. The CRC of the application or OS do not match. 2. The application was built with an incompatible OS version.	Set: The Loaded software is not compatible with the controller hardware Clear: Load the matching software. Verify that the controller model matches the cdev file for the project and the VCL Studio application.
OX92	EMBrake Out of Range	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	Set: After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. Clear: 1. Activate the Throttle (EM Brake type 2). 2. Activate the Interlock (EM Brake type 1).
OX93	Encoder LOS	1. Limited Operating Strategy (LOS) control mode has been activated; as a result of either an Encoder Fault (flash code 3-6) or a Stall Detected fault (flash code 7-3). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle is stalled.	Set: Encoder Fault (flash code 3-6) or Stall Detected (flash code 7-3) was activated, if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Encoder LOS (flash code 9-3) control mode is activated, allowing limited motor control. Clear: Cycle KSI or, if LOS Mode was activated by the Stall Detected fault, clear by ensuring encoder senses proper operation, Motor RPM = 0, and Throttle Command = 0.
OX94	Emer Rev Timeout	1. Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On.	Set: Emergency Reverse was activated and ran until the EMR Timeout timer expired. Clear: Turn the emergency reverse input (switch) to Off.
OX99	Parameter Misnatch	1. Incorrect position feedback type chosen for motor technology in use. 2. Dual drive is enabled in torque mode. 3. Dual drive enabled on only one controller.	Set: 1. When the Dual Drive software is enabled, the controller must be set to either Speed Mode Express or Speed Mode; otherwise this fault is set. 2. Motor Technology = 1 must be paired with Feedback Type = 2; otherwise this fault is set. 3. Motor Technology = 0 must be paired with Feedback Type = 1; otherwise this fault is set. Clear: Adjust parameters to appropriate values and then Reset Controller.

FLASH CODE	FAULT NAME	POSSIBLE CAUSES	SET/CLEAR CONDITIONS
OX9A	Interlock Braking Supervision	<ol style="list-style-type: none"> 1. During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters. 2. See Programmer » Application Setup » Interlock Braking » Supervision Enable. 3. See Programmer » Application Setup » Interlock Braking » Interlock Braking Supervision. 	<p>Set: During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters.</p> <p>Clear: Reset Controller.</p>
OX9B	EMR Supervision	<ol style="list-style-type: none"> 1. During an EMR event, the motor speed exceeded the limit set by the Emergency Reverse Supervision parameters. 2. See Programmer » Application Setup » Emergency Reverse » Emergency Reverse Supervision. 	<p>Set: During an interlock braking event, the motor speed exceeded the limit set by the Emergency Reverse Supervision parameters.</p> <p>Clear: Reset Controller.</p>
OXA1	Driver 1 Fault	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 1 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 1 » Driver 1 Overcurrent. 	<p>Set: Driver 1 is either open or shorted. Or Driver 1 exceeded its overcurrent setting.</p> <p>Clear: Correct open or short, and then Reset Controller.</p>
OXA2	Driver 2 Fault	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 2 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 2 » Driver 2 Overcurrent. 	<p>Set: Driver 2 is either open or shorted. Or Driver 2 exceeded its overcurrent setting.</p> <p>Clear: Correct open or short, and then Reset Controller.</p>
OXA3	Driver 3 Fault	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 3 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 3 » Driver 3 Overcurrent. 	<p>Set: Driver 3 is either open or shorted. Or Driver 3 exceeded its overcurrent setting.</p> <p>Clear: Correct open or short, and then Reset Controller.</p>

