engcon®

User manual

DC2 QSC

Article 9000405 | Version 1.4

Original Instructions

Preface

Dear Customer,
Thank you for choosing a product from engcon.

engcon is the market leader in tiltrotators and tools for excavators. We represent innovation, knowledge and experience, and we develop our products with a focus on the customer's needs. Please visit our website for contact information and details about the rest of our product range.

www.engcon.com

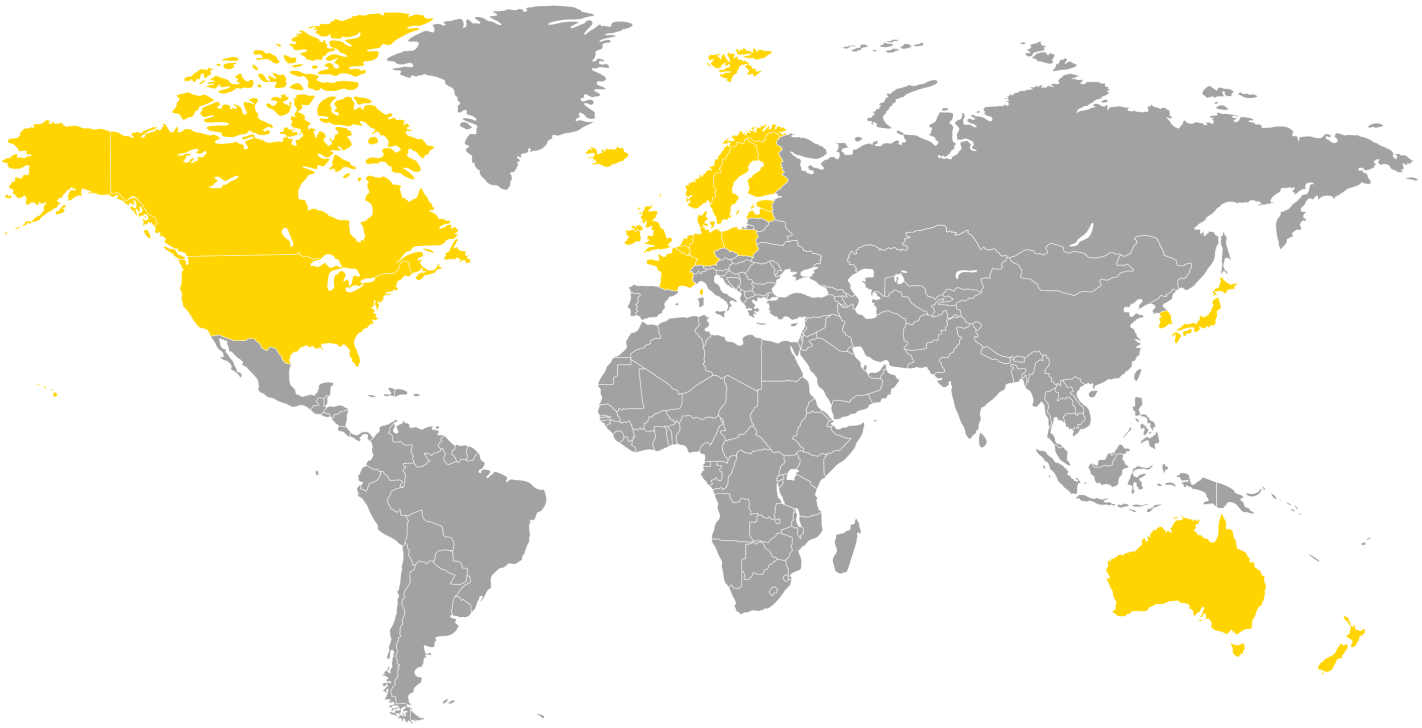


Table of Contents

1. Introduction

1.1. General

This user manual contain important information about your product's functions and characteristics, and how to use it in the best way. Before you begin using the product, it is important that you read and understand the content of these instructions, especially the sections that address safety.

In addition to these instructions, you must study and understand the applicable safety information for the relevant base machine as well as any other equipment involved.

The user manual is supplied with supplementary documentation providing more detailed descriptions of the installation, fitting, operation and maintenance of control systems and custom modifications for your specific product.

Information, images, illustrations and specifications used in the instructions are based on product information that was available at the time of going to press. Images and illustrations used in the instructions are typical examples and not intended to be exact depictions of various part of the product. We reserve the right to make changes without prior notice.

Always store the user manual together with any other supplementary information in a safe manner and such that it is always available.

1.2. Scrapping and recycling

engcon makes constant efforts to reduce its environmental impact. engcon's products comprise at least 99 per cent recyclable material. All assembly and service work must take place in compliance with legislation and ordinances governing the environment, health and occupational safety. This refers to all work with residual materials including handling, storage and processing. To prevent contamination of soil and water, spillages must be avoided. Should a spillage occur, it must be dealt with.

Hazardous waste may only be disposed of by those authorised to do so. All waste produced must be disposed of in compliance with applicable legislation and ordinances:

- Metal and plastics to be recycled.
- Hydraulic hoses are normally used for energy recovery (sort as hazardous waste).
- Oils and greases are normally used for energy recovery (sort as hazardous waste).
- Electronic components to be recycled for materials (sort as hazardous waste).
- Packaging to be sorted at source and recycled for materials.
- Paper to be sorted at source and recycled for materials.

If in doubt, contact the environmental manager at engcon.

1.3. Technical support and spare parts

Contact information for support and spare parts can be found at www.engcon.com.

1.4. Product approval

1.4.1. Declaration of Incorporation

The declaration refers to the engcon DC2 control system.

Upon reasoned request by a national authority, engcon will undertake to provide relevant information about the machine.

The control system may not be put into operation before the machine it will be built into is in conformance with Directive 2006/42/EG.

engcon hereby declares that the control system conforms to the below-mentioned basic safety requirements as described in appendix 1, items1 and 3, in Directive 2006/42/EG, and that the relevant documentation as described in appendix 7, section B has been compiled.

We hereby declare that the control system conforms with 2014/30/EC and 2006/42/EC.

Harmonised standards	Designation
SS-EN ISO 13849-1:2008	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
SS-EN ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction
SS-EN 474-1:2006+A3:2018	Earth-moving machinery – Safety – Part 1: General requirements
SS-EN 474-5:2006+A4:2013	Earth-moving machinery – Safety – Part 5: Requirements for hydraulic excavators
SS-EN 60204-1:2006	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
SS-ISO 15998:2008	Earth-moving machinery – Machine-control systems (MCS) using electronic components – Performance criteria and tests for functional safety
SS-EN 13309:2010	Construction machinery – Electromagnetic compatibility of machines with internal power supply

Stig Engström, CEO

Qualified person authorised to compile the technical documentation:

Fredrik Eklind, Product Owner - engcon Control Systems

2. Safety

REMARKS
The stated safety information is independent of the base machine and is directly concerned with the engcon DC2.

REMARKS
Other safety instructions can be found in the tiltrotator user manual.

2.1. General

It is important that you read and understand all warnings prior to installation work on this product or before you use it and any accessories supplied. The warning texts highlight potential risks and describe how to avoid them. The following warning levels are used in this user manual:

DANGER
Indicates that an accident will occur if the regulation is not followed. Risk of personal injury or death.

WARNING
Indicates that an accident may occur if the regulation is not followed. Risk of personal injury or death.

CAUTION
Indicates that an accident may occur if the regulation is not followed. Risk of personal injury.

IMPORTANT
Indicates that an accident may occur if the regulation is not followed. Risk of damage to property, process or the surroundings.

REMARKS
Specifies additional information that may make performance or understanding of specific operations easier.

2.2. Safety features according to 13849-1

QSC is a safety system that complies with SS EN ISO 13849-1:2008. This means there are risks in the system that are managed with the aid of software.

RISK 1

Risk that one of the system's quick hitch locks opens at the wrong time. This could lead to tool disconnection and cause damage.

The risk is managed by “Safety function 1” (SF1) – blocking power to the quick hitch lock’s solenoids. SF1: SS-EN ISO 13849-1:2008 Category 2 PL d

The following applies in all operating modes:

1 The quick hitch lock’s solenoids for the machine lock must not be powered unless the operator simultaneously depresses both of the machine lock’s activation buttons.

2 The quick hitch lock’s solenoids for the tiltrotator lock must not be powered unless the operator simultaneously depresses both of the tiltrotator lock’s activation buttons.

RISK 2

Risk that the system activates the quick hitch lock’s solenoid without tool release until much later.

The risk is managed by “Safety function 2” (SF2) – monitoring by means of warning signal in the panel module. SF2: SS-EN ISO 13849-1:2008 Category 2 PL c

The safety system must check that the following points are complied with:

1 The warning signal must sound when one of the quick hitch lock’s solenoids 1 or 2 is powered.

2 The warning signal must be activated for at least 1 second at system start-up as a function test.

If any of these points is not satisfied, the power to quick hitch lock solenoid 1 and quick hitch lock solenoid 2 must be blocked until the system is restarted.

RISK 3

Risk that the system unintentionally activates pressure in the machine's extra hydraulics. This risk is managed by “Safety function 3” (SF3) – prevention of unintentional activation of pressure SF3: SS-EN ISO 13849-1:2008 Category 2 PL d

The following applies in all operating modes:

1 When neither of the quick hitch lock’s buttons for opening or closing the machine lock is depressed, pressure may not be activated.

3. Design and function

3.1. DC2

DC2 is a proportional control system with remote support. DC2 meets the requirements placed on all components such as hydraulics, electronics and software. Used together with engcon tiltrotators and Q-Safe, DC2 creates a safer work environment and also enables track control, wheel control and boom slew. The engcon DC2 smartphone app allows remote support to supplement the PC and USB cable connection.

3.2. Symbols


Track control

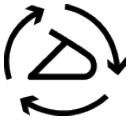

Track control

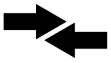

Wheel control


Base machine


Drive forward/reverse

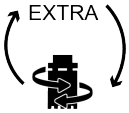

Rotation/slew right/left


Tool change in the tool programme


Feeder Swap


Rotation


Tilt

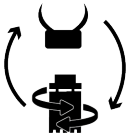


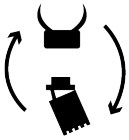
Shift between rotation and Extra 2

Shift between tilt and Extra 2

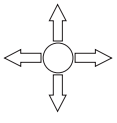

Open grab


Close grab


Shift between rotation and grab


Shift between tilt function and grab

Shift between Extra and grab


Joystick function

Grab

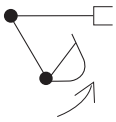
Open grab

Clockwise grab rotation

Grab bucket

Grab bucket open

Grab bucket clockwise rotation

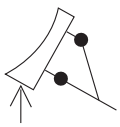


Bucket in

Stick in

Float position

Scissors open



Leveling blade up

Grab rotation

Close grab

Anticlockwise grab rotation

Grab bucket rotation

Grab bucket close

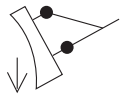
Grab bucket anticlockwise rotation

Bucket out

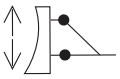
Stick out

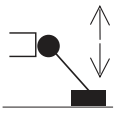
Float position

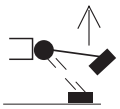
Scissors close

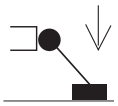


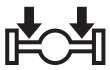
Leveling blade down

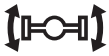

Leveling blade up/ down


Support leg up/down

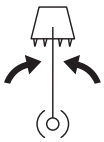

Support leg up


Support leg down


Swing axle locked


Swing axle off


Boom


Boom slew


Boom slew left


Boom slew right


Side-shift


Cruise control

Auto idle


Auto idle

Auto idle


Automatic gas


Quick hitch lock(s)


Quick hitch lock valve


Quick hitch lock(s) (Front loader)

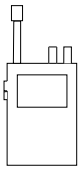
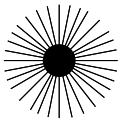
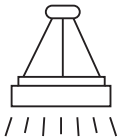

Quick hitch lock(s) (Excavator arm)

12V 12 Volt

F Forward gear

24V 24 Volt

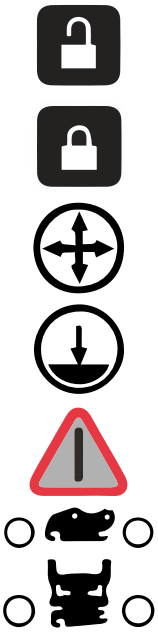
N Neutral gear

15A	15 Amps	R	Reverse gear
EC 15A	EC Tiltrotator	FNR	Driving direction
AUTO	Autotilt	AUX	External circuit
	Open		Locked
	Menu		Communication radio
	Rotating brush		Hammer
	Horn		Parking brake
	Crawler gear		Constant flow
	Low gear		High gear
	Power boost		Power boost
	Windscreen wipers		Main beam/dipped beam
USER 2	User 2	USER 3	User 3
EXTRA 1	Extra function 1	EXTRA 2	Extra function 2
EXTRA A	Extra function Direction A	EXTRA B	Extra function Direction B

EXTRA 2A	Extra function Direction A	EXTRA 2B	Extra function Direction B
SHEAR	User function		

3.3. Control panel - QPM

3.3.1. Symbols on the Control Panel QPM



Opening the quick hitch

Closing the quick hitch

Swing/height restriction

Ground contact

Alarm indicator

Quick hitch for machine

Quick hitch for tiltrotator

3.3.2. Functions QPM - buttons

Symbol	Button press	Steady light indicates that
	Initiates lock opening sequence	Lock opening sequence can be initiated
		Ground contact is required
Or 1	Overrides ground contact	
Or 2	Shows ground contact sensor status	The sensor detects pressure
	Opens the lock	The lock can be opened
	Closes the lock	The lock can be closed

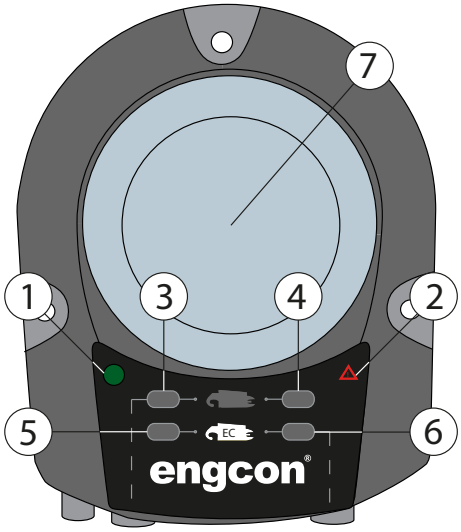
Symbol	Button press	Steady light indicates that
	Confirms machine blocking	Machine blocking is active
Or 1	Cancels machine blocking temporarily	-

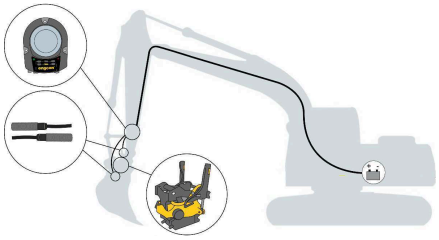
3.4. Q-Safe electronics module QLM

QLM is used in combination with a Q-Safe quick hitch/machine hitch and alerts by means of audible and visual signals if both bucket axles are not locked or in their proper positions. This means QLM will alert when connecting and disconnecting tools or if a tool is not properly connected.

REMARKS
For quick hitches other than Q-Safe, follow the manufacturer's instructions for checking that tools are correctly connected.

3.4.1. QLM overview



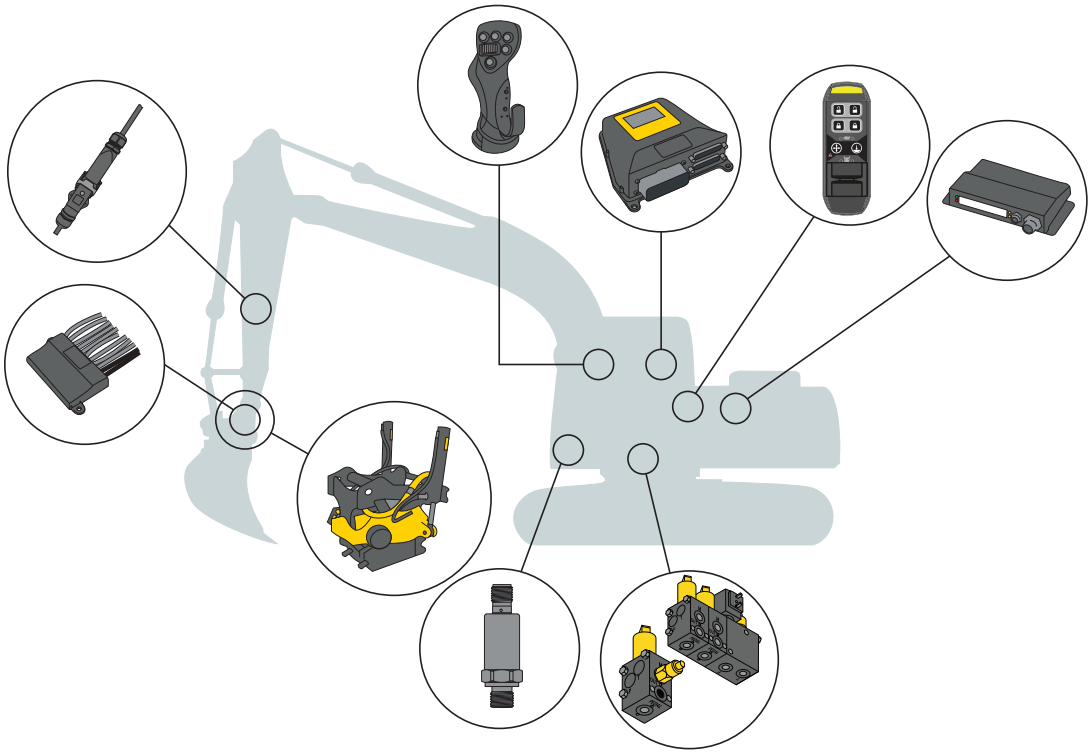


Position	Description
1	Power supply
2	Alarm indication
3	Sensor, machine hitch hook
4	Sensor, machine hitch ejector
5	Sensor, quick hitch hook
6	Sensor, quick hitch ejector
7	Warning lamp

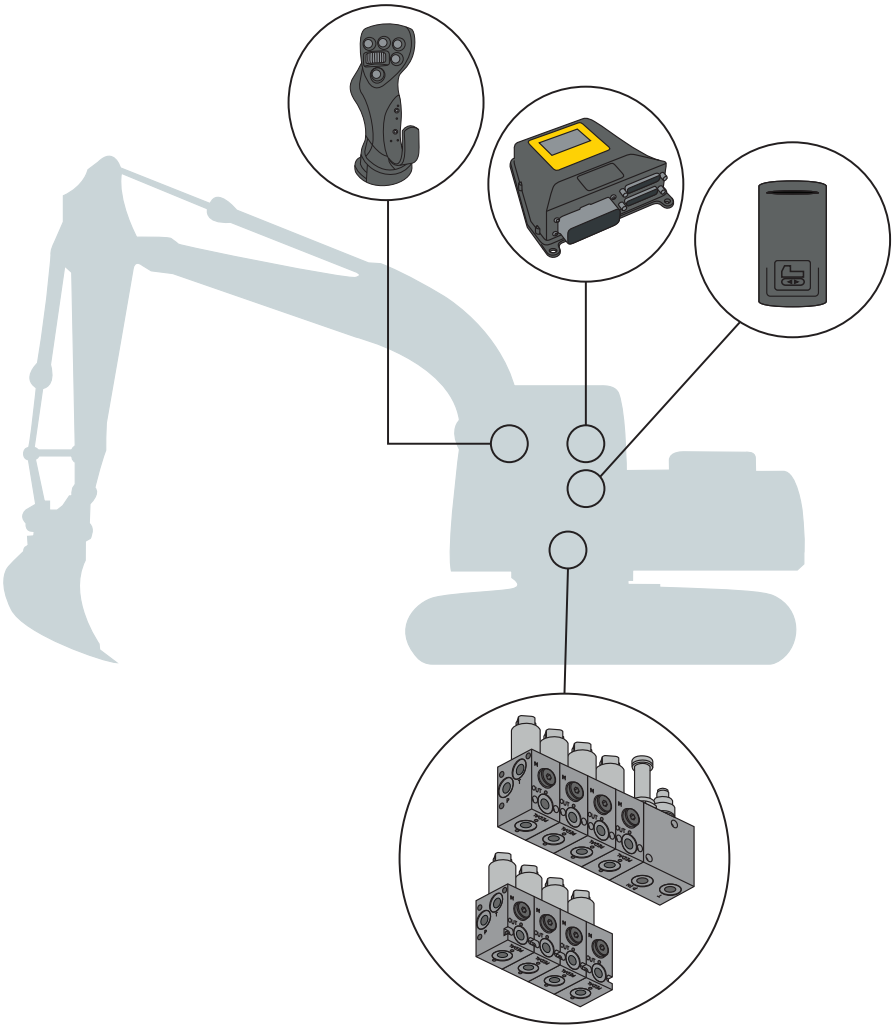
4. Installation

4.1. System overview

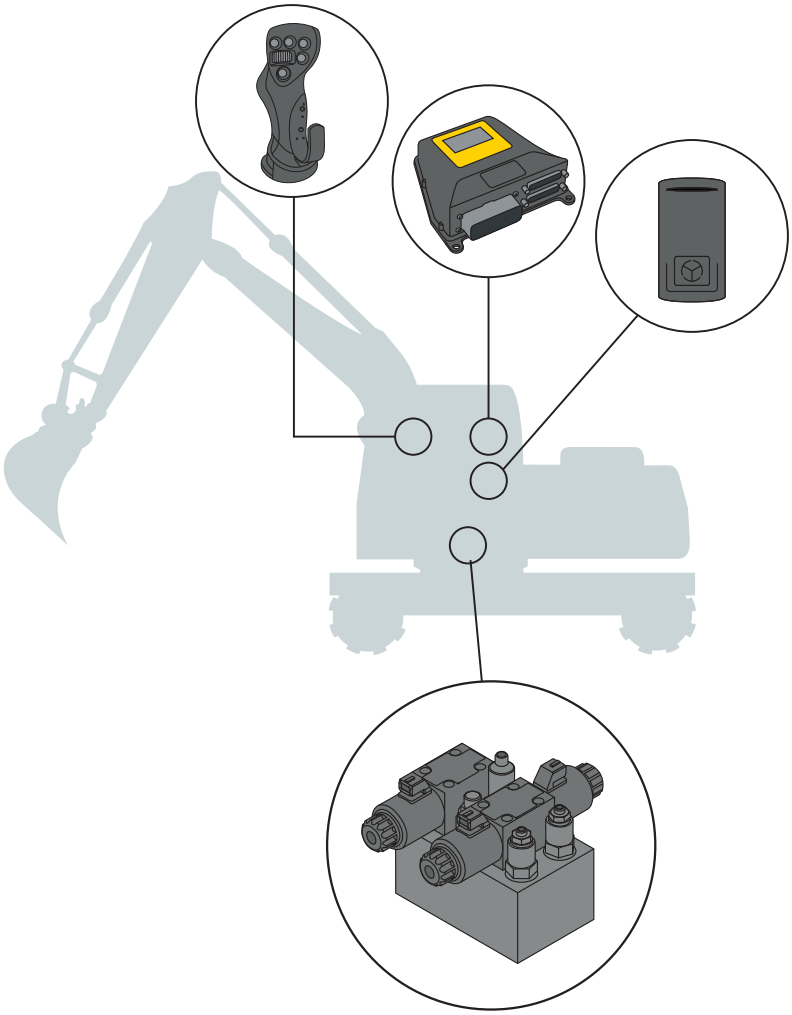
4.1.1. Tiltrotator control



4.1.2. Track control



4.1.3. Wheel control



5. Operation

WARNING
If you have any doubts concerning the safety aspects of your knowledge, the equipment or work, contact a dealer or engcon Nordic AB. Incorrect installation affect safety.

WARNING
Beware of moving parts. A lack of awareness may lead to crush injuries. Risk of personal injury.

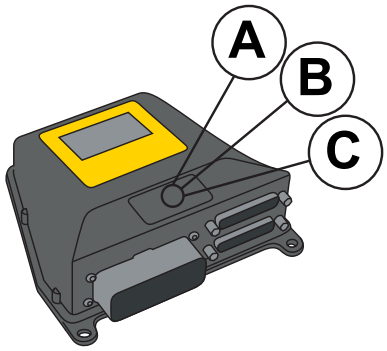
WARNING
Never attempt to increase the maximum capacity of the equipment by modifications not approved by the supplier. Risk of personal injury and damage to property.

WARNING
Do not attempt to install, use or maintain your tiltrotator/rotator and its supplied equipment before reading and understanding all information about the tiltrotator/rotator, its supplementary equipment and the base machine. Pay particular attention to the safety information.

IMPORTANT
Maintenance and repair of the electrical system may only be carried out by professionally qualified persons.

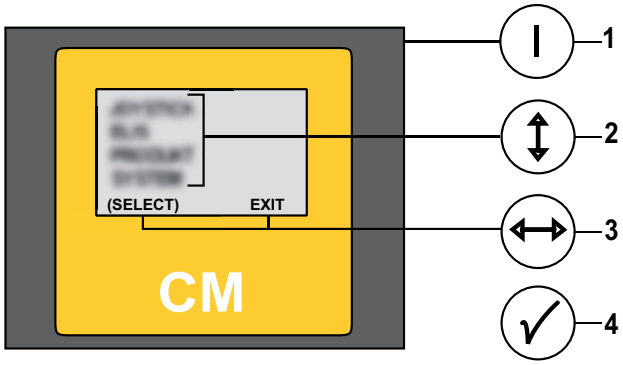
5.1. Cabin module menu system

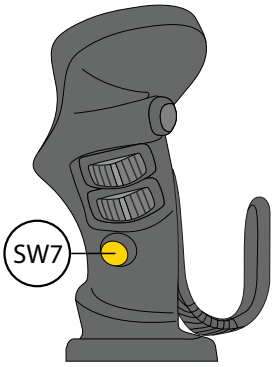
5.1.1. Identification



A: Part number
B: Serial number
C: Manufacturing date

5.1.2. Logging in to the menu

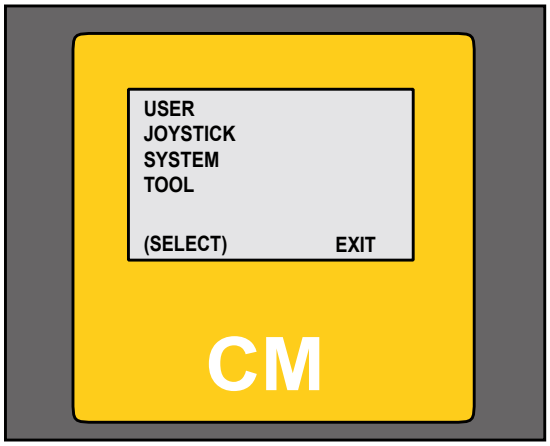




Position	Description
1	Depress and hold down button SW7on the left and right joysticks for 5 seconds.*
2	Thumb roller in right grip.
3	Thumb roller in left grip.
4	Optional switch connected to the system.

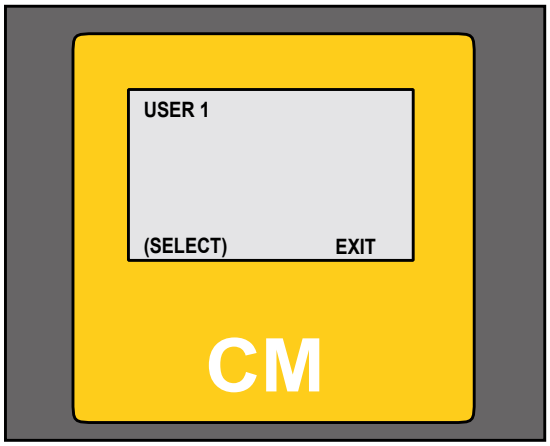
**Applies to the standard configuration*

5.1.3. Menu system

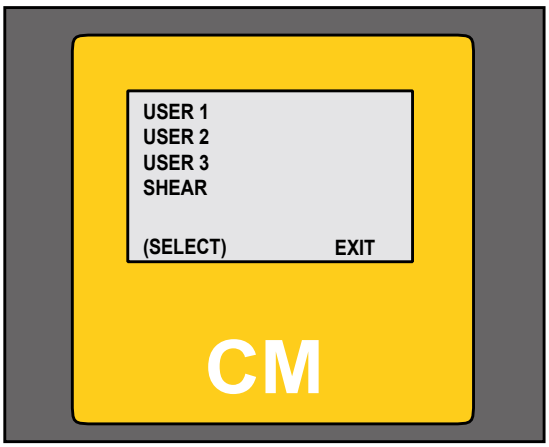


5.1.4. User

5.1.4.1. Standard



5.1.4.2. Multiple users



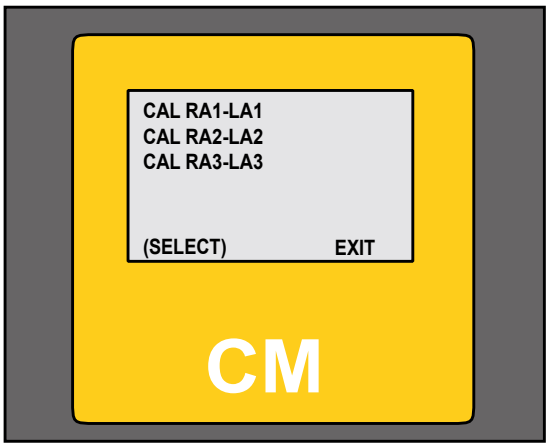
Users 1-3

Optional user banks. These are only available if selected during installation.

Shear

Double feeder. This is only available if selected during installation.

5.1.5. Grip



CAL RA1-LA1

Calibrate analogue pair RA1 and LA1

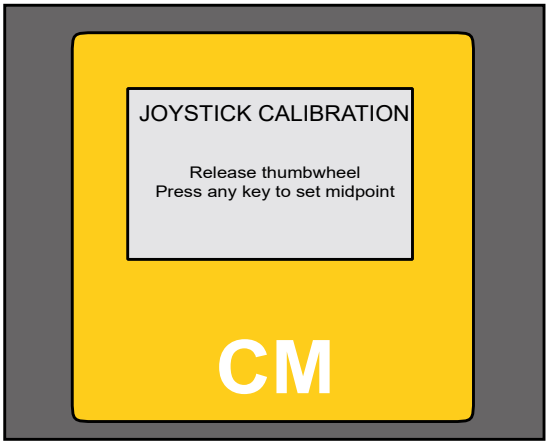
CAL RA1-LA2

Calibrate analogue pair RA2 and LA2

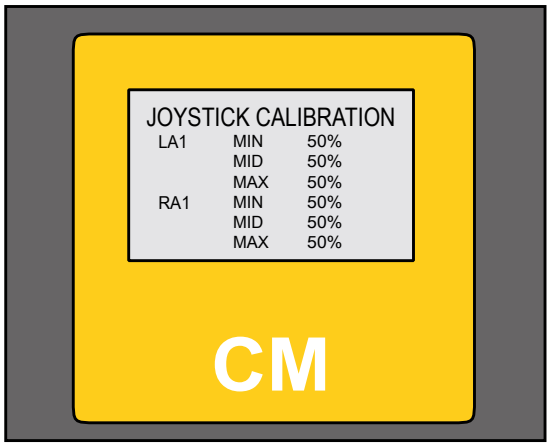
CAL RA1-LA3

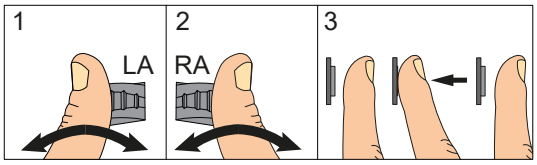
Calibrate analogue pair RA3 and LA3

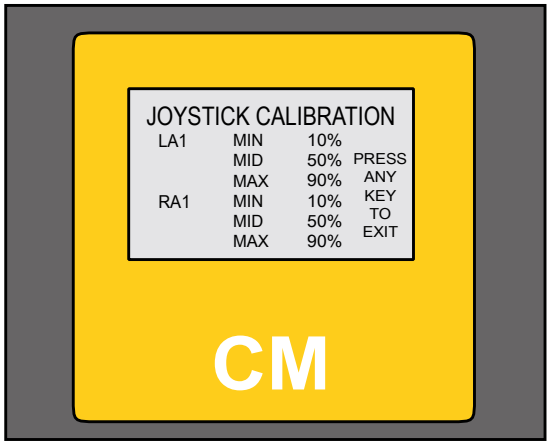
5.1.5.1. Central position



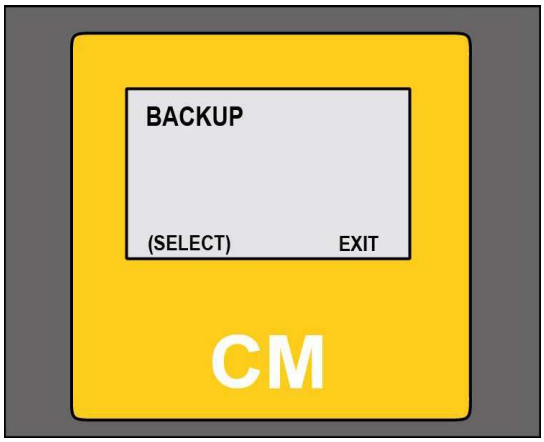
5.1.5.2. End positions and confirmation



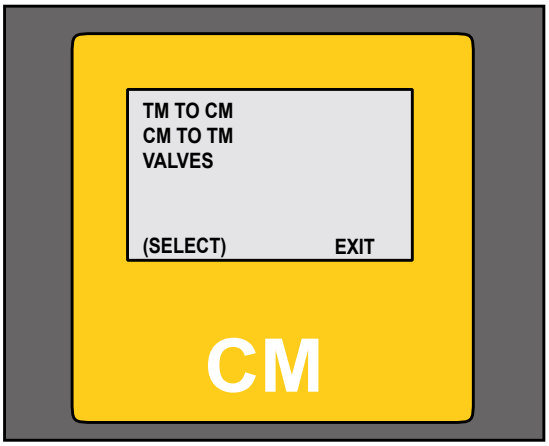




5.1.6. System



5.1.6.1. Backup



TM TO CM

Copy parameters from tiltrotator module to cabin module.

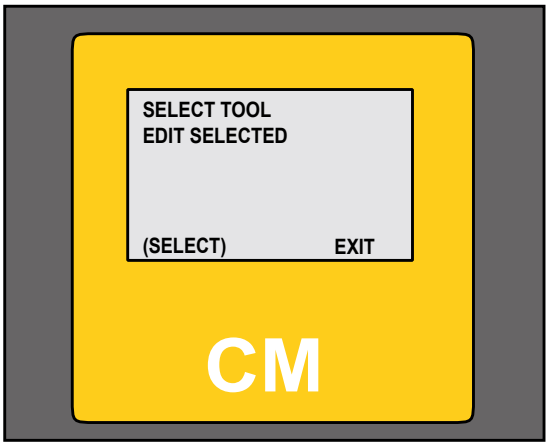
CM TO TM

Copy parameters from cabin module to tiltrotator module.

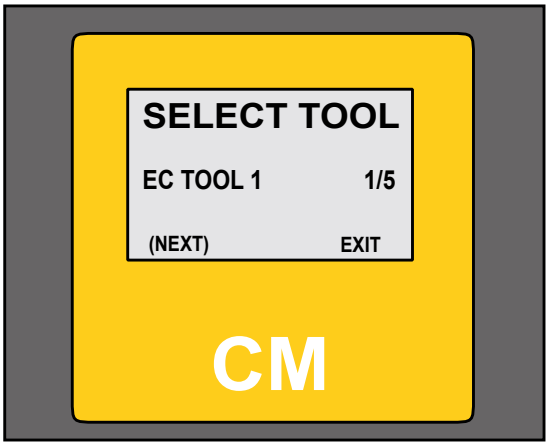
VALVES

Copy calibrated currents from the tiltrotator module to the cabin module.

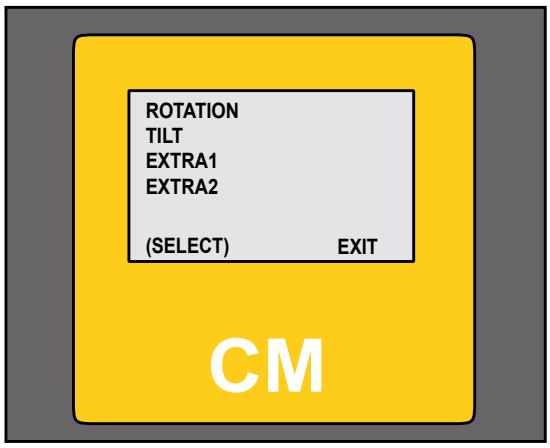
5.1.7. Tool



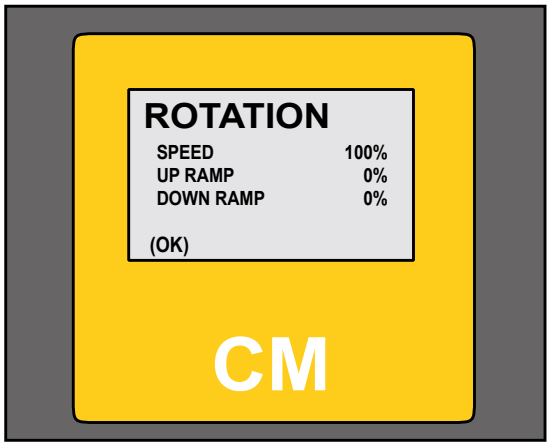
5.1.7.1. Select tool



5.1.7.2. Edit selected



5.1.7.3. Rotation



5.2. Tiltrotator quick hitch (QH)

5.2.1. Connecting the tool, hydraulic lock

5.2.1.1. Opening the tiltrotator quick hitch (QH)

REMARKS
Machine hydraulics must be activated in order for the QSC opening and closing function to work.

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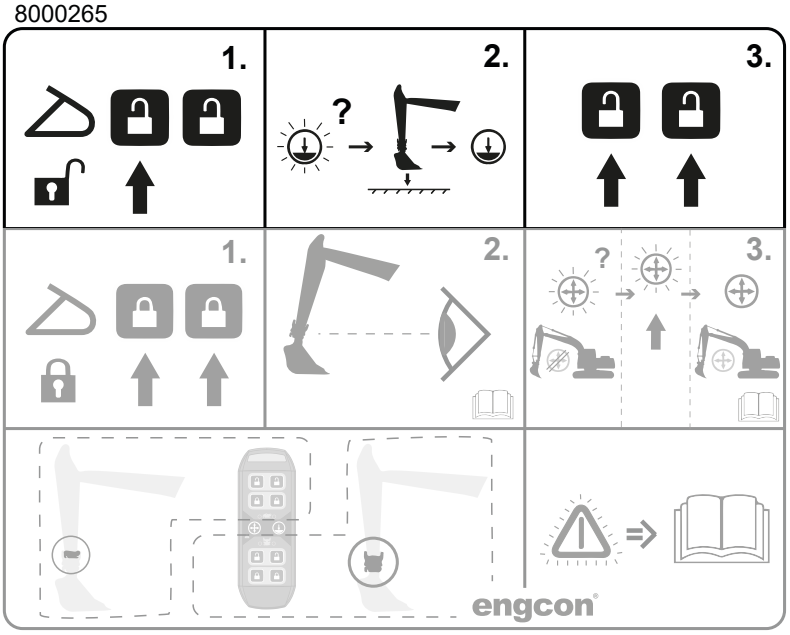


1. Place the tool with the locking bolts pointing away from the cab.

2. Press  to initiate the sequence.

3. If the ground pressure symbol lights up, place the tool on the ground until the ground pressure symbol is extinguished.

Ground pressure can be overridden by pressing and holding it down for 10 seconds.

4. Hold down + to open the quick hitch.
Hold them down until the quick hitch is fully open.

5.2.1.2. Connecting the tool, hydraulic lock

REMARKS
Follow the manufacturer's instructions for connecting and disconnecting tools if you do not use a Q-Safe quick hitch.

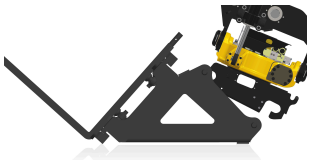
1. In the case of Q-Safe, check that the orange indicator rod is out.

In the case of ECPUP, check that the red hook is in the open position.

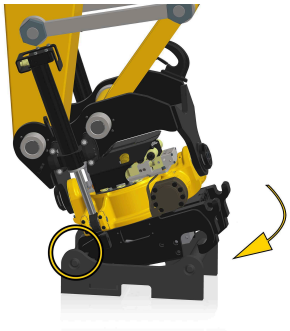
In the case of engcon's other quick hitches, check that the blue indicator rod is out. Indicator rod location may vary depending on the tiltrotator model.

2. Move the quick hitch towards the tool.

If EC-Oil is fitted, make sure the tool is located so that the shaft with the EC-Oil block is positioned closest to the base machine. If the tool is positioned correctly, the block will be visible on the left side of the shaft as seen from the cab.



To avoid overloading when connecting the pallet forks, the quick hitch locking pins must be turned away from the forklift tines.



3. Connect the tool by moving one axle towards the quick hitch.

If fitted, Q-Safe activates the stick’s sound and light signals.

CAUTION
Use hearing protection when close to or handling the Q-Safe quick hitch when it is connected. Risk of hearing damage.

4. Raise the tiltrotator very slightly above the ground so that the tool moves towards the quick hitch.

IMPORTANT
The machine may only be operated with the quick hitch lock switch in the activated position when connecting and disconnecting tools.

5.2.1.3. Close the tiltrotator quick hitch (QH)

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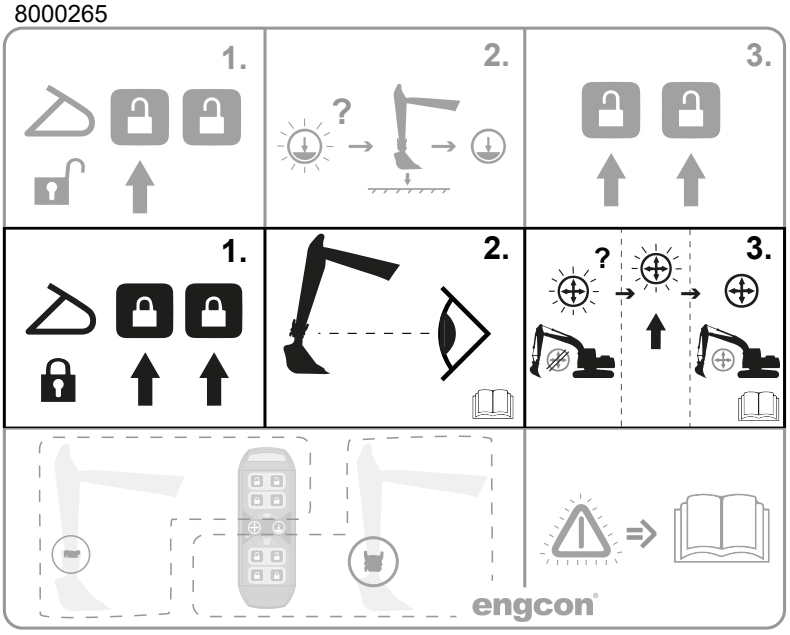
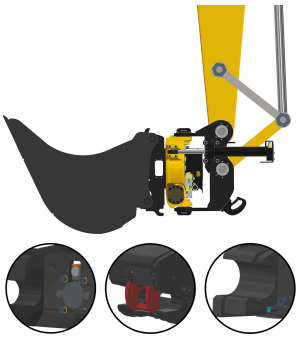


1. Hold down + to close the quick hitch.

WARNING
Make doubly sure that the quick hitch is properly locked in place. Can cause injury or death.

WARNING
Make sure the product's latches lock correctly according to the user manual. Risk of personal injury and damage to property.



2. Check that the quick hitch lock's lock function has engaged:

In the case of Q-Safe , the closed position is achieved when the orange indicator rod no longer protrudes from the quick hitch. The sound and light signals will be deactivated if the hitch is correctly connected.

WARNING
Stop work immediately and begin troubleshooting if the system warns of a faulty tool connection during operation. Risk of personal injury and damage to property.

REMARKS
For quick hitches other than Q-Safe, follow the manufacturer's instructions for checking that tools are correctly connected.

In the case of ECPUP, closed position is achieved when the red hook is in the closed position.

In the case of engcon's other quick hitches, the blue indicator rod will no longer protrude from the hitch. Indicator rod location may vary depending on the tiltrotator model.

If you have a different quick hitch, check that the lock function has engaged as specified for the quick hitch concerned.

5.2.2. Disconnecting the tool, hydraulic lock

5.2.2.1. Opening the tiltrotator quick hitch (QH)

REMARKS
Machine hydraulics must be activated in order for the QSC opening and closing function to work.

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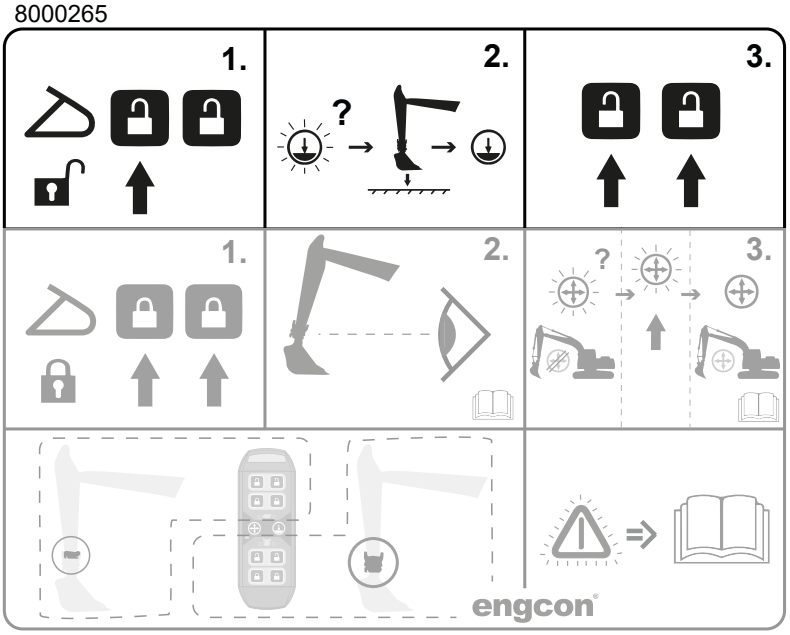
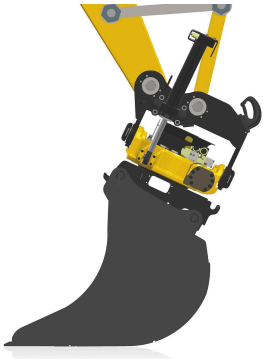




1. Place the tool on the ground, with the locking bolts pointing away from the cab.

2. Press  to initiate the sequence.

3. If the ground pressure symbol  lights up, place the tool on the ground until the ground pressure symbol is extinguished.

Ground pressure can be overridden by pressing  and holding it down for 10 seconds.

4. Hold down + to open the quick hitch.
Hold them down until the quick hitch is fully open.

5.2.2.2. Disconnecting the tool, hydraulic lock

REMARKS
Follow the manufacturer's instructions for connecting and disconnecting tools if you do not use a Q-Safe quick hitch.

1. The locking cylinders are activated.
In the case of Q-Safe , the closed position is achieved when the orange indicator rod no longer protrudes from the quick hitch. The sound and light signals are activated.

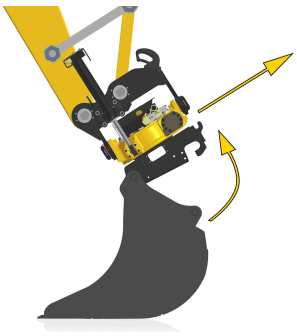
CAUTION
Use hearing protection when close to or handling the Q-Safe quick hitch when it is connected. Risk of hearing damage.

In the case of ECPUP, open position is achieved when the red hook is in the open position.

In the case of engcon's other quick hitch locks, the open position is achieved when the blue indicator rod is visible. Indicator rod location may vary depending on the tiltrotator model.

If you have a different quick hitch, check that the lock function has engaged as specified for the quick hitch concerned.

In this position the tool is free !



2. The locking bolts are now in the open position and the tool is free. Carefully raise the tiltrotator from the tool.

IMPORTANT
The machine may only be operated with the quick hitch lock switch in the activated position when connecting and disconnecting tools.

5.2.2.3. Close the tiltrotator quick hitch (QH)

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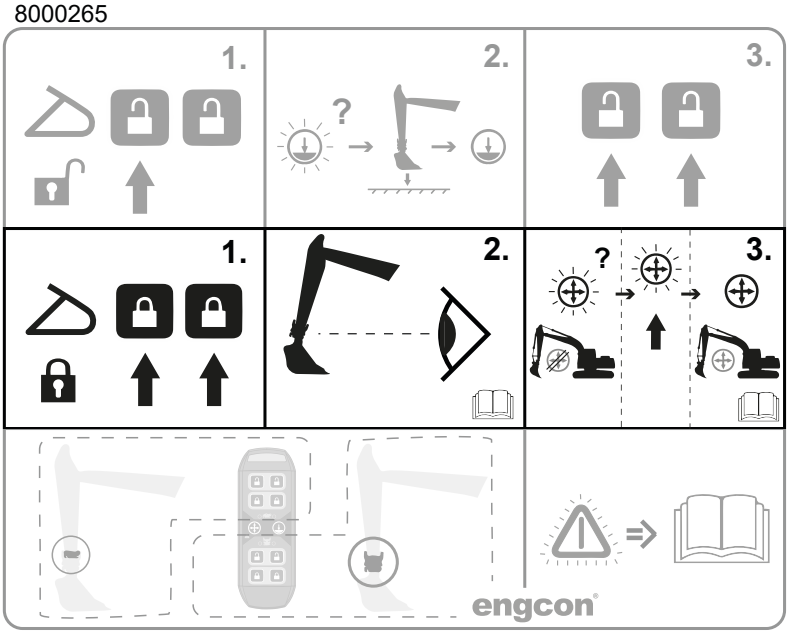

1. Hold down + to close the quick hitch.

WARNING
Make doubly sure that the quick hitch is properly locked in place. Can cause injury or death.

WARNING
Make sure the product's latches lock correctly according to the user manual. Risk of personal injury and damage to property.

5.3. Option – slew/lift limitation

You can choose between slew limitation, slew and lift limitation or neither.

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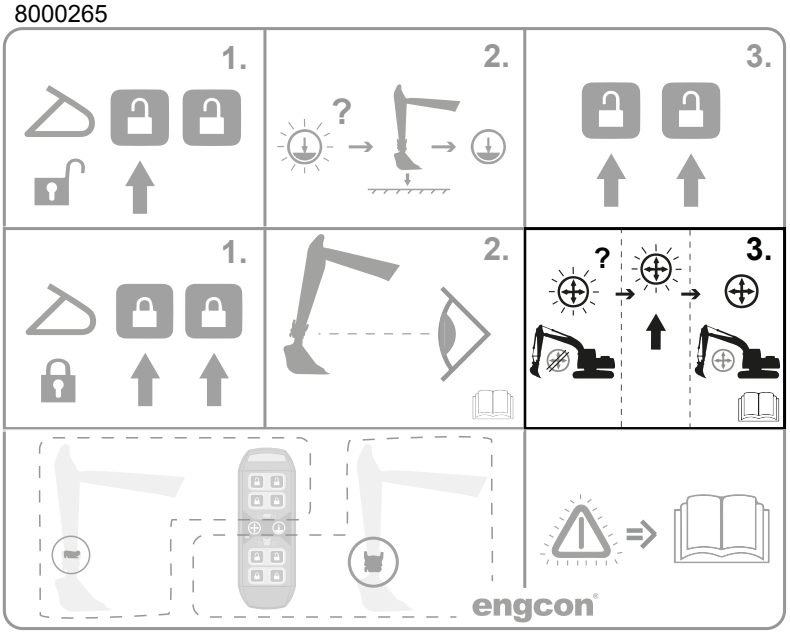
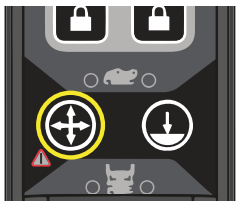




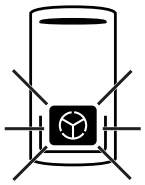
The slew/lift limitation symbol lights up during tool connection and disconnection. If the symbol lights up at other times, check that the quick hitch is correctly connected, then press the pressure symbol to reset.

Slew/lift limitation can be temporarily overridden by pressing and holding down the button. If the quick hitch is not correctly connected, slew/lift limitation is activated when the button is released.

5.4. Wheel control

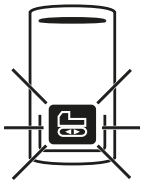
WARNING
When wheel control is active, speed should not exceed 20 km/h.

Press the activation switch to switch on wheel control.
Operate wheel control using the roller that was configured upon installation.



5.5. Track control

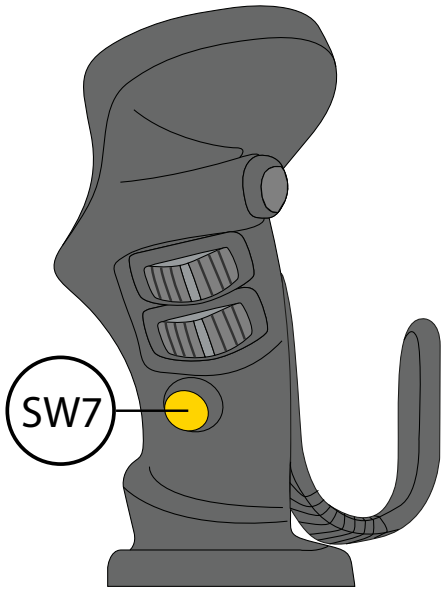
Press the activation switch to switch on track control.
Operate track control using the roller that was configured upon installation.



5.6. Switching users

Use button SW7 to switch users from User 1 to Shear.

1. Depress and hold down button SW7 for at least 3 seconds until the cabin module beeps.
2. When the signal ceases, the user switch is completed.



6. Starting the system

WARNING
Before starting and calibrating the system, make sure there is sufficient room to manoeuvre as there is a risk of the machine moving in unexpected ways. Risk of injury and damage to property.

WARNING
If you have any doubts concerning the safety aspects of your knowledge, the equipment or work, contact a dealer or engcon Nordic AB. Incorrect installation affect safety.

IMPORTANT
Assembly and installation may only be carried out at a workshop authorised by the manufacturer. Changes to the assembly may not be carried out without the manufacturer's consent.

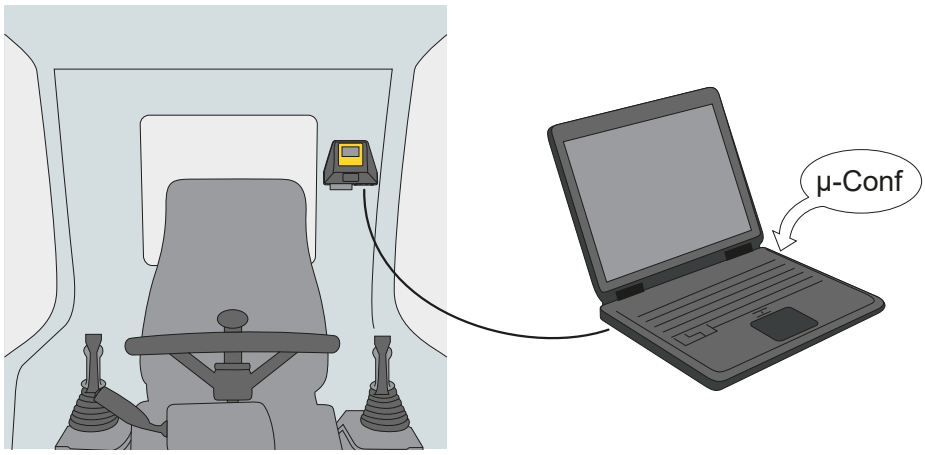
IMPORTANT
Maintenance and repair of the electrical system may only be carried out by professionally qualified persons.

6.1. Download the latest version of MicroConf

engcon DC2 is configured using a computer and the MicroConf DC2 software. The software can be downloaded at *https://software.engcon.com*

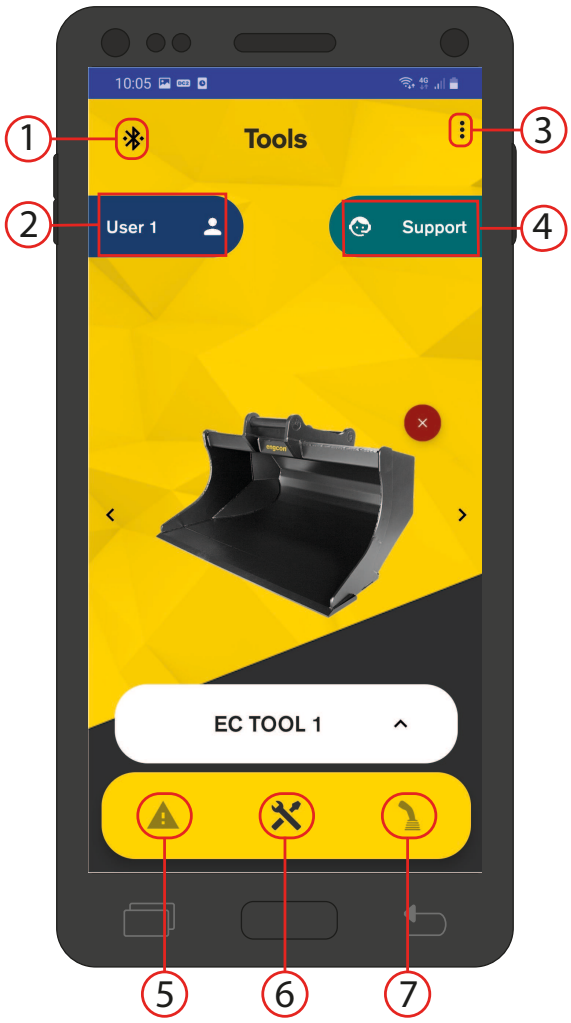
6.2. Connect the system to a computer

The system can be connected to a computer with a USB cable or via Bluetooth.



6.3. Using your engcon DC2 Android application

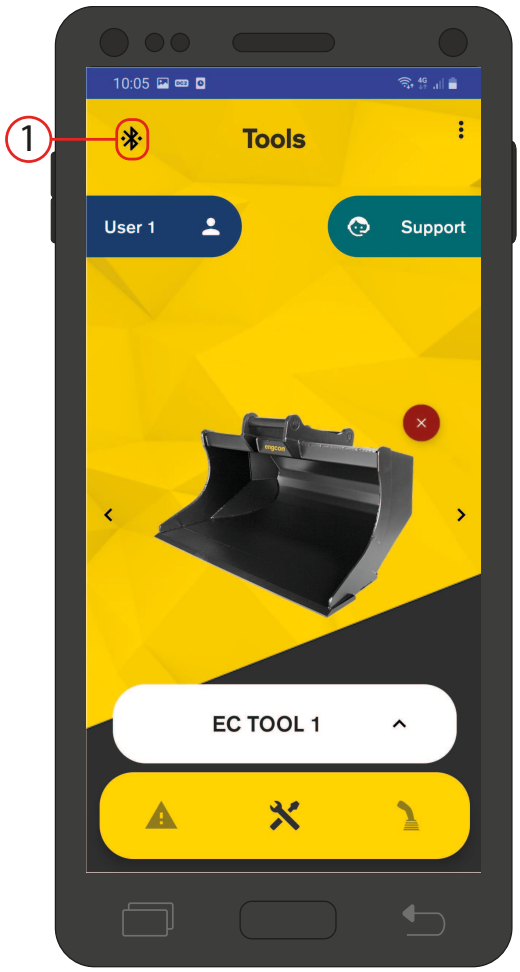
6.3.0.4. Overview



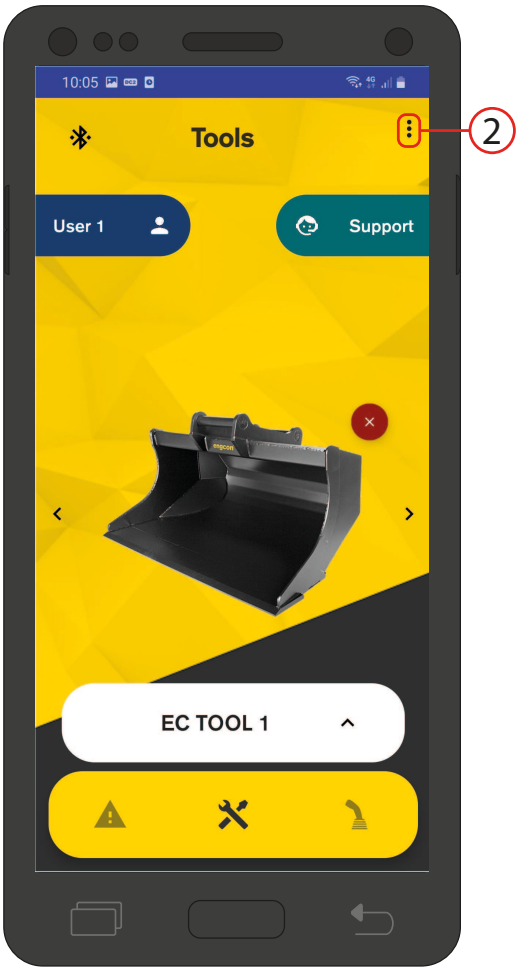
Position	Description
1	Bluetooth
2	Users
3	Menu
4	Support
5	Alarm
6	Tool(s)
7	Grip

6.3.0.5. Connect your device

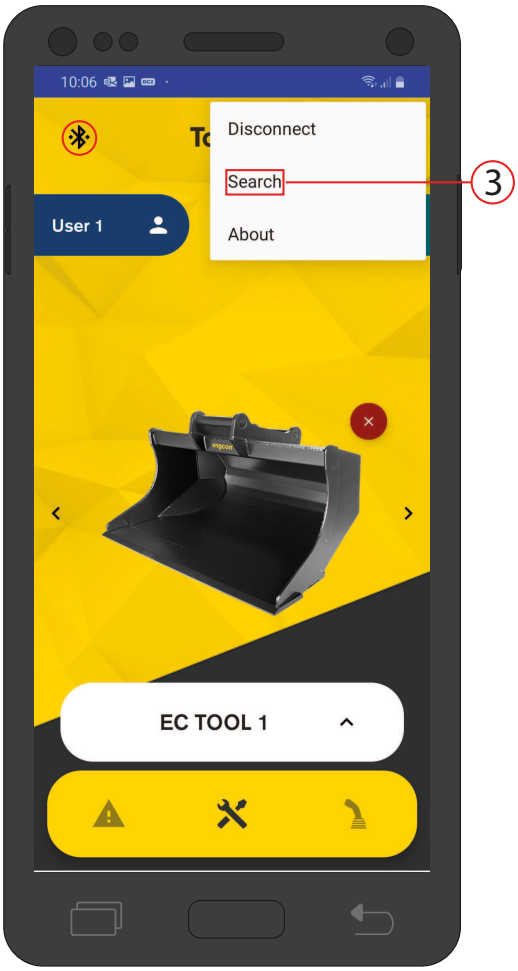
1. Activate Bluetooth on your smartphone to pair with your device.



2. Click the three dots in the right hand corner to reach the menu.

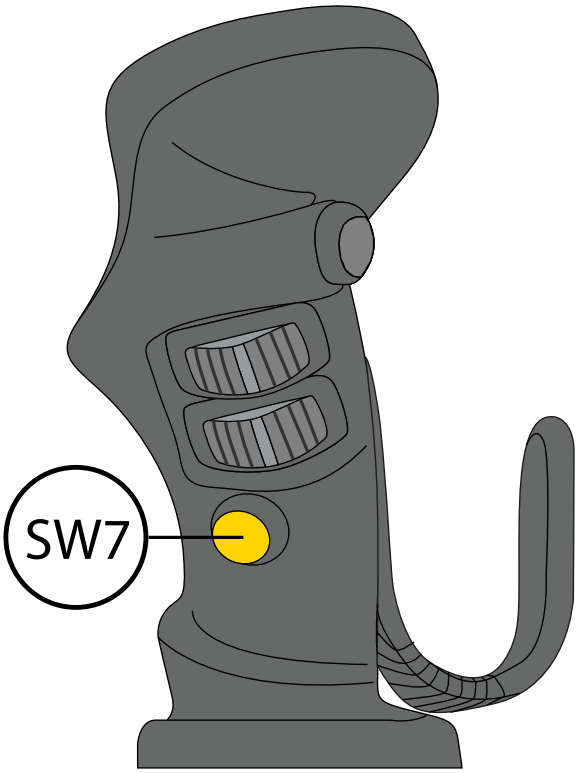


3. Click Search to find a device to pair with.



4. Select a device to pair with.

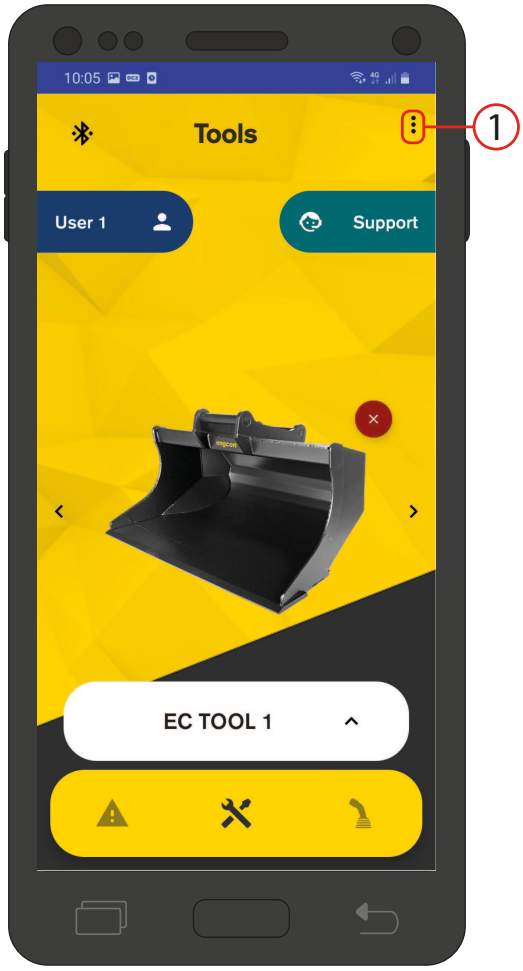
5. Hold down the quick hitch lock button on the grip to pair with the device.



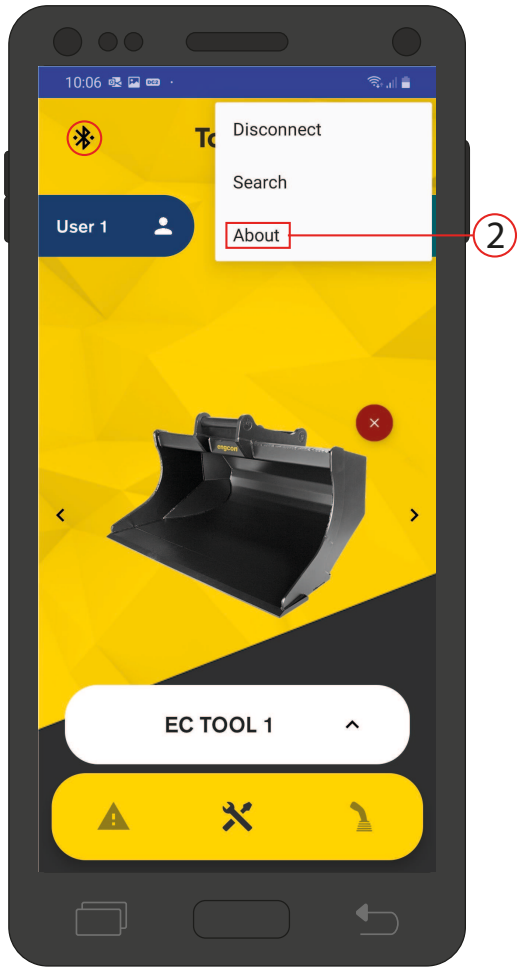
6.3.0.6. Information about the system

Information about the system is available here. You can use this information for e.g. troubleshooting.

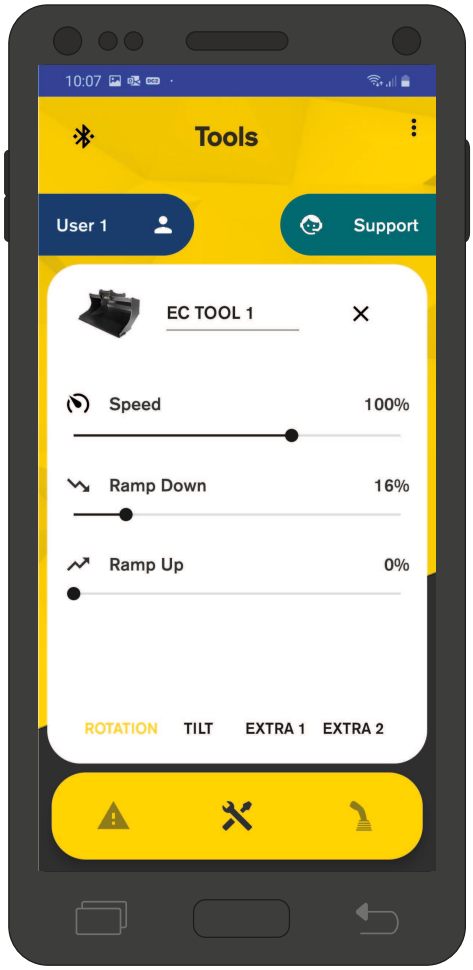
1. Click the three dots in the right hand corner to reach the menu.



2. Click About in the menu.



3. Click About to call up information on e.g. the cab module you are connected to. This illustration is purely for informational purposes.

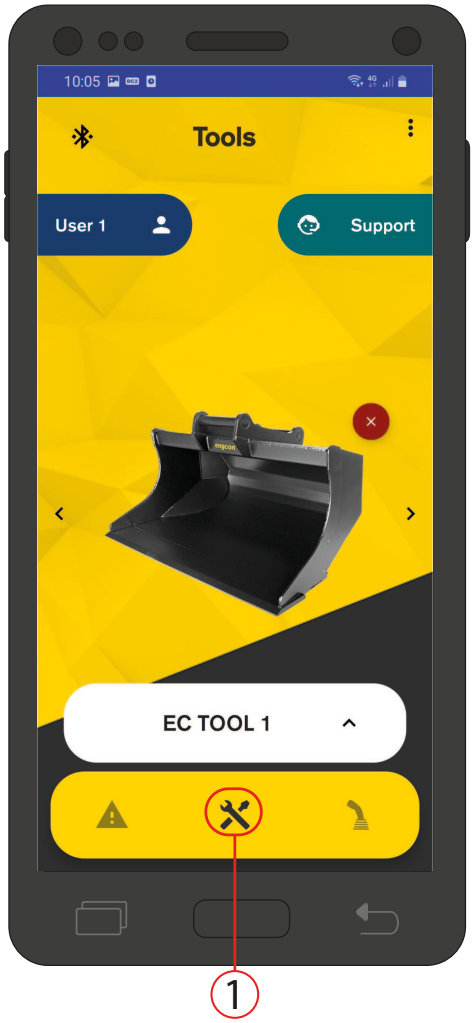


6.3.0.7. Tool programme

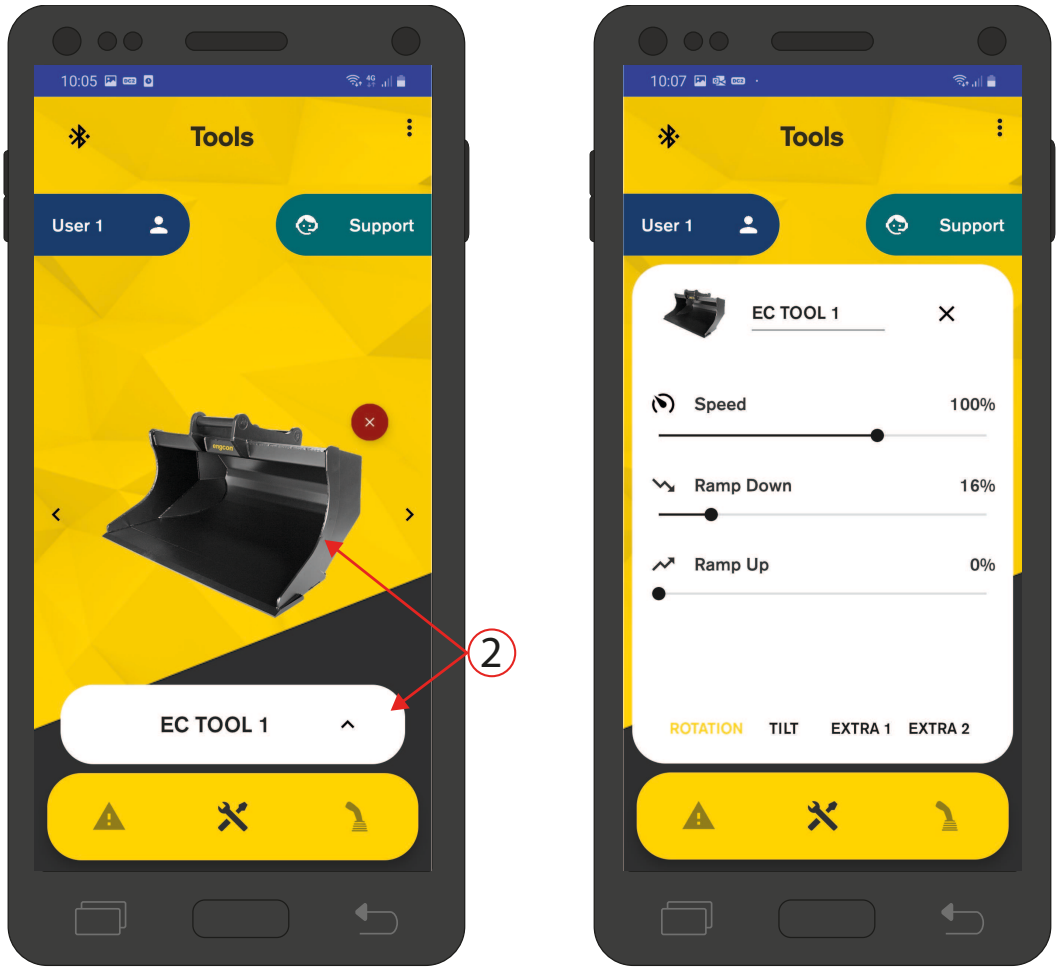
Essentially, there are always two tools, NO TOOL and EC TOOL 1. NO TOOL refers to standard settings and EC TOOL 1 refers to user-selected settings. NO TOOL is always available and cannot be changed.

Information on tools

1. Click the Tool icon for information on tools.

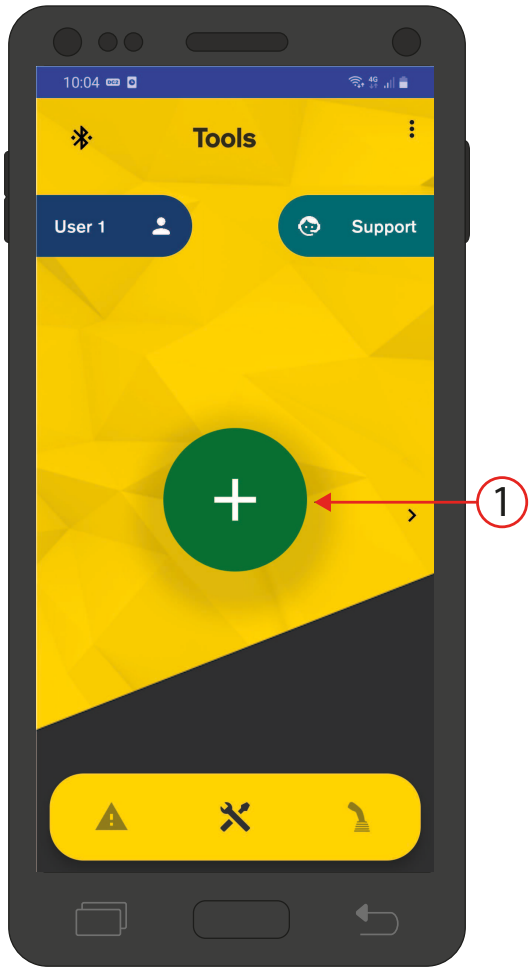


2. Click on the tool or the tool name to edit a tool. Every tool has 4 parts (rotation, tilt, extra 1 and extra 2), all of which can be set at different speeds and ramp times according to user preferences.



Adding tools

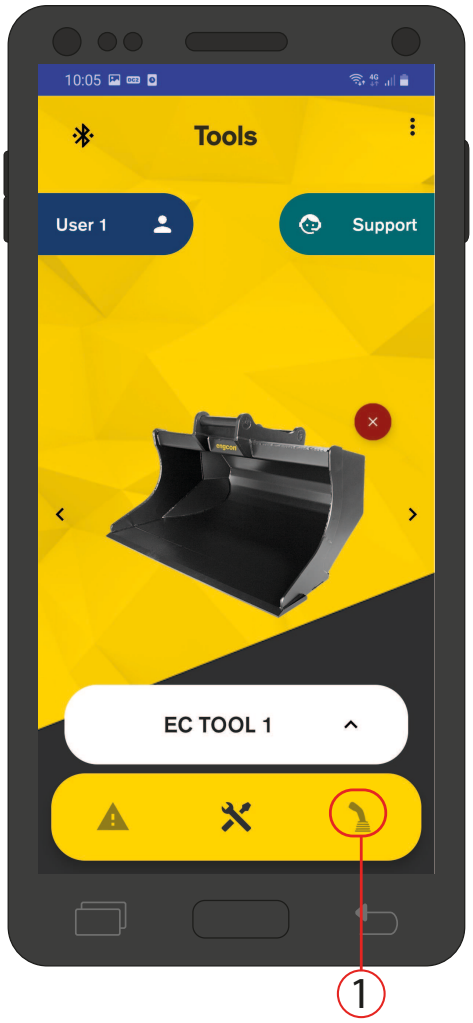
1. To add a tool, swipe right to left and click on the green plus sign.



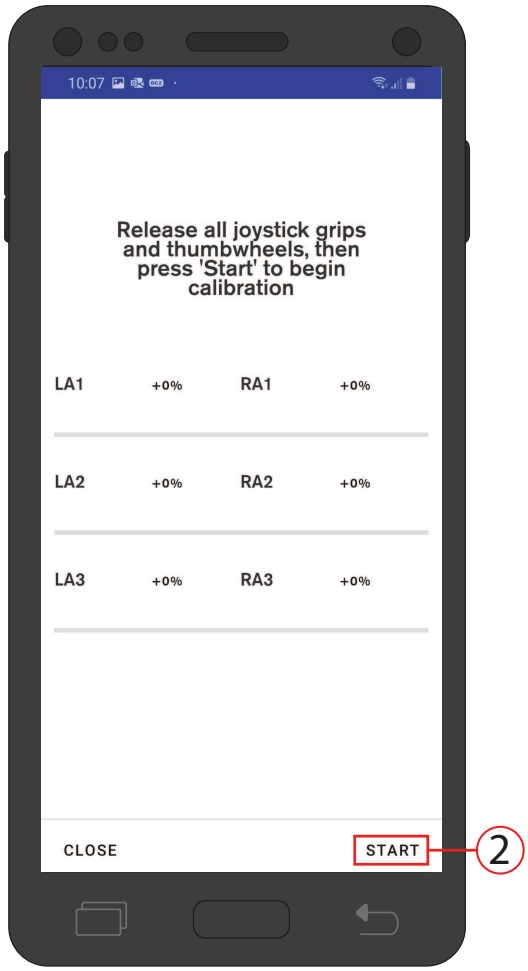
6.3.0.8. Calibrating grips

Use this function if e.g. a thumb roller is replaced.

1. Click the Grip icon.

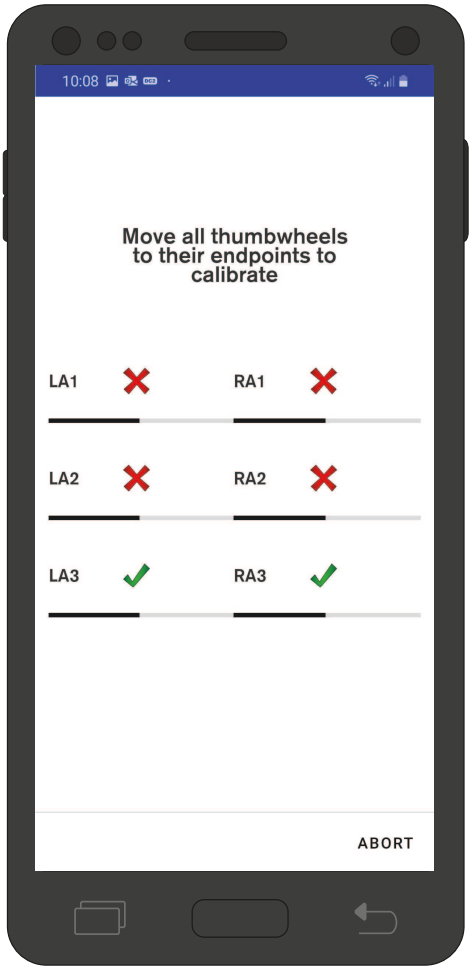


2. Click Begin to start calibrating.

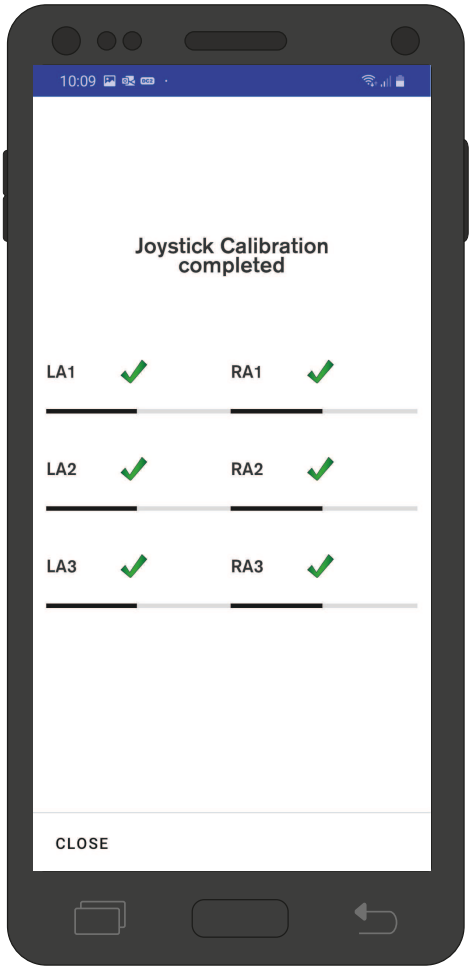


3. A red X will show in the image until calibration is complete. The red X will be replaced by green ticks when calibration is complete.

Before calibration



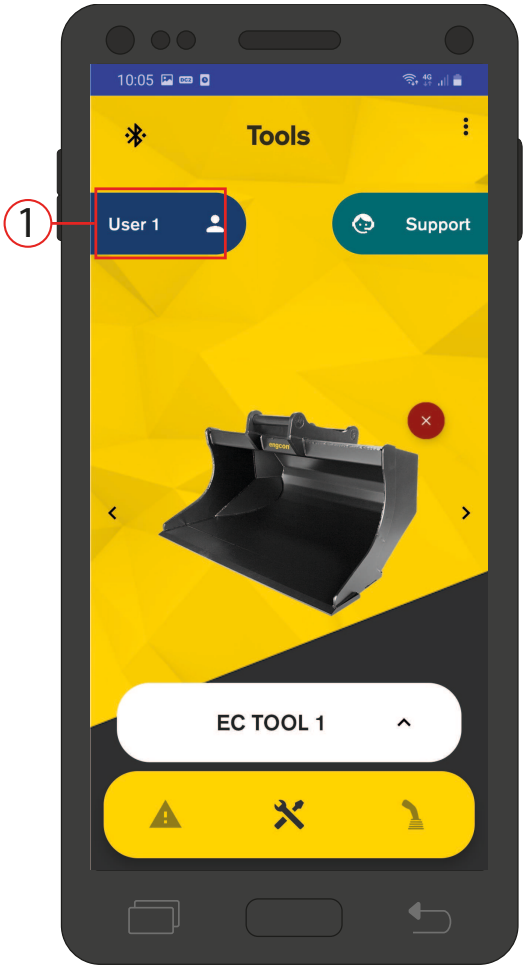
After calibration



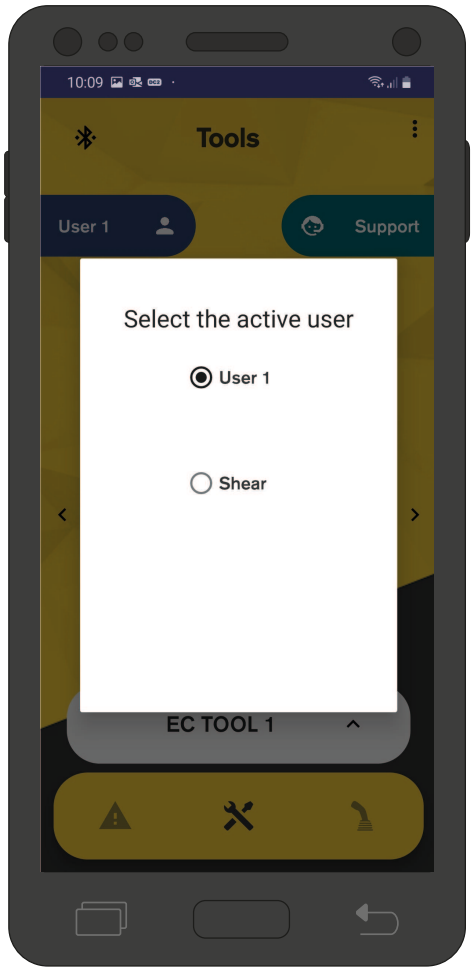
6.3.0.9. Switch user (users 1-3, shear)

Use this function to switch between the user banks calibrated in the system. Note that user banks only switch functions in the grips. If a change of speed is required, do this in the tool programme.

1. Click the User icon.



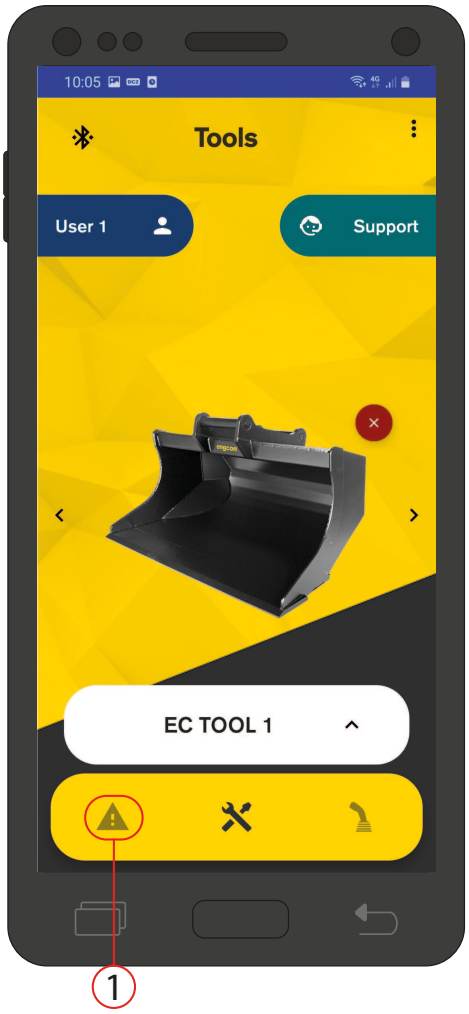
2. Select one of the alternatives to switch to the user you wish to use.



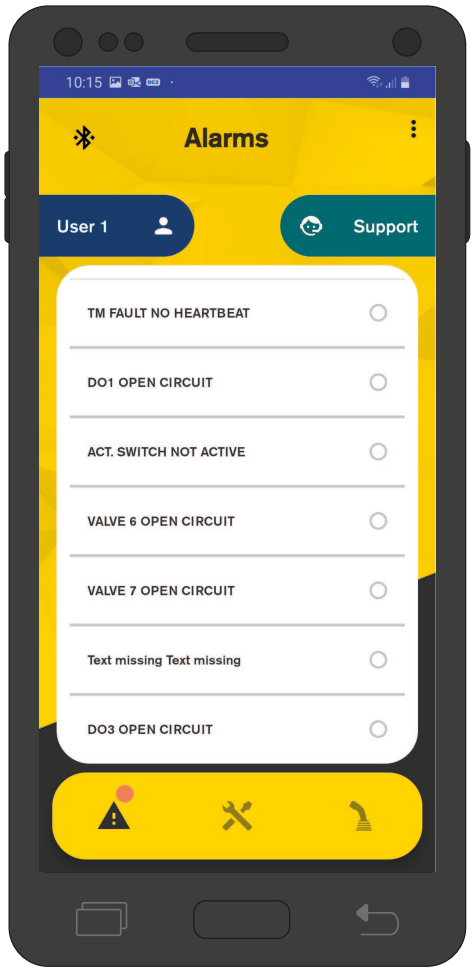
6.3.0.10. Troubleshooting

Use this information for troubleshooting, e.g. for checking the alarm log.

1. Click the Troubleshooting icon.



2. This calls up a list of possible alarmed faults.



6.3.0.11. Support

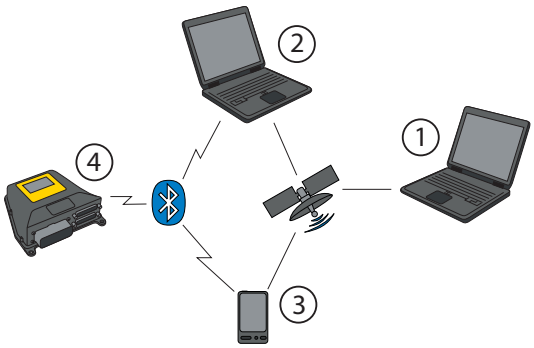
Remote support

The DC2 is equipped with a unique function that offers remote support via a smartphone (Android 4.0 or later). Because fault codes can be read off and adjustments made via the mobile telephone network, the function removes the need for service personnel to travel out to the excavator.

The DC2 can also be adjusted using a PC connected to the cabin module via USB.

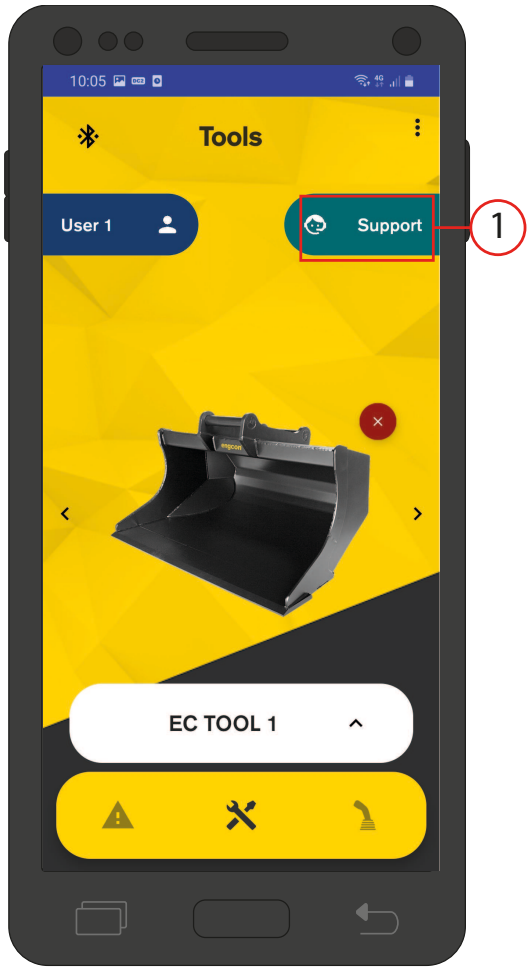
For a description of the various functions, see below.

1. Support PC
2. PC
3. Android smartphone
4. engcon DC2

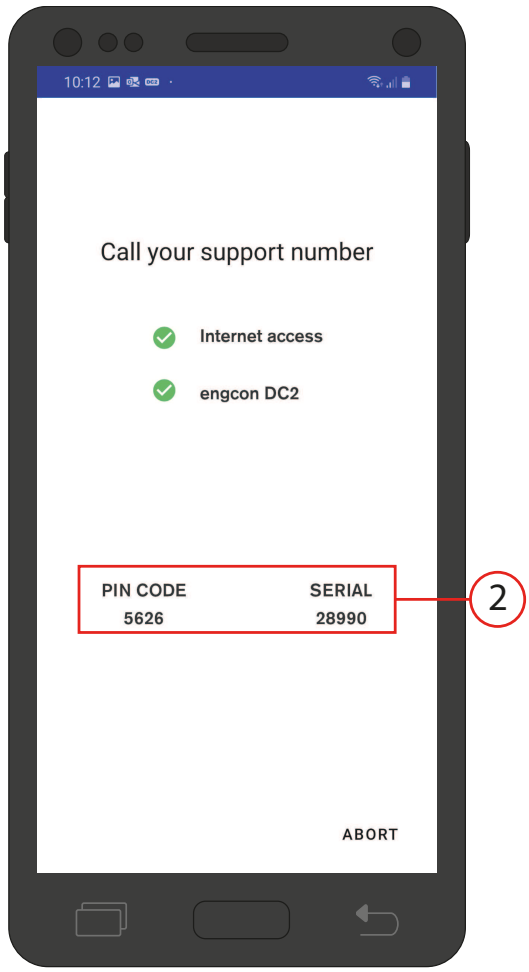


Call your support personnel

1. Click the Support icon to reach support; call your support personnel (dealer, bodybuilder or engcon) and ask them to connect you to remote support.

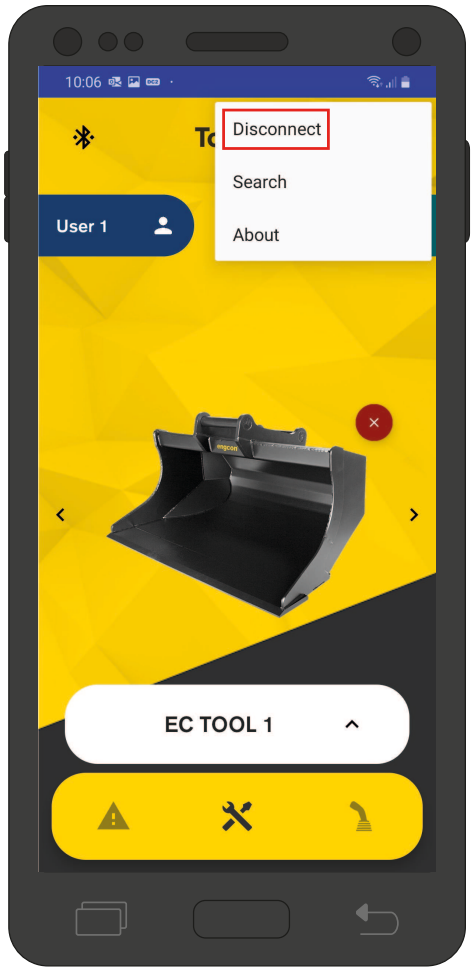


2. Provide your PIN code and serial number to your support personnel. They will then be able to enter all the settings for the machine. However, note that certain settings (such as moving joystick functions) may not be entered via remote support but must be done by personnel who are able to update the machine's documentation.



6.3.0.12. Disconnect your device

To disconnect your device, click the three dots in the right corner and then click Disconnect.



7. Maintenance

7.1. Electrical compound

We recommend the application of electrical compound on all electrical contacts to prevent corrosion. Remove any contamination before application.

Recommended compound:
We recommend the use of electrical compound without harmful or caustic properties; intended for the prevention of corrosion.

8. Troubleshooting

WARNING
In the case of alarms that cannot be remedied, contact an authorized service provider ASAP. The fault must be remedied before the machine may be used again. Risk of injury and damage to property.

WARNING
Stop work immediately and begin troubleshooting if the system warns of a faulty tool connection during operation. Risk of personal injury and damage to property.

WARNING
The hydraulic system must be de-pressurised before work on the system is begun. Risk of personal injury and damage to property.

WARNING
Never use your hands to search for leaks in the hydraulic system. Use the necessary protective equipment. Pressurised hydraulic oil can penetrate the skin. Risk of personal injury.

WARNING
Avoid contact with hydraulic oil. Risk of burns.

WARNING
Switch off power when working on the electrical system and remove any live objects before starting work Risk of personal injury.

WARNING
Beware of moving parts. A lack of awareness may lead to crush injuries. Risk of personal injury.

8.1. Alarm list QSC-panel (QPM)

Symbol	Indication	Description	Action
	Constant light	Machine limitation active	Confirmation 1: Confirm by pressing the button. Confirmation is only possible when no configured quick hitch lock indicates an incorrectly connected lock. Confirmation 2: Confirm temporarily by holding in the button to enable machine movement when lock incorrectly connected.
	Extinguished	No active machine limitation	
	Fast Flashes 10 times per second (10 Hz)	Excess current on limiting valve 1 or 2 (has priority over an open load). More than 3500 mA passes to the activated limiting valve. The output will be turned off.	Automatic if less than 3500 mA passes through the affected limiting valve when it is reactivated.
	Slow Flashes 1 time per second (1 Hz)	Open load on limiting valve 1 or 2. Less than 200 mA passes through the activated limiting valve.	Automatic when more than 200 mA passes through the affected limiting valve when it is activated.
	*Button not pressed* Steady light	Once ground pressure is configured and required. Before lock can be opened.	Confirmation 1: Take ground pressure by moving the quick hitch lock to the ground. Confirmation 2: Force ground pressure by holding the button for 10 seconds.
	*Button not pressed* Extinguished	No significance.	
	*Button not pressed* Slow Flashes 10 times per second (10 Hz)	Activated 1: Pressure sensor process error. One of the quick coupler locks has been activated and deactivated without the ground pressure sensor losing the ground pressure signal. Activated 2: The ground pressure sensor indicates ground pressure at start-up.	Raises the quick hitch lock off the ground. Cause: The fault may be caused by an incorrect ground pressure sensor setting.

Symbol	Indication	Description	Action
	*Button not pressed*Slow Flashes 1 time per second (1 Hz)	Ground pressure sensor defect. Alt 1: Wrong type of ground pressure sensor selected. Alt 2: (Digital ground pressure sensor): NO and NC signals show the same value. Alt 3: (Analogue ground pressure sensor): Sensor value is outside the permissible range. Alt 4: (CAN Sensor): Data from the machine is corrupt or incorrect or no data received in the last 250 ms.	Alt 1: Configure the QSC to use the type of ground pressure sensor installed on the machine. Alt 2: NO and NC signals indicate different states. Cause: Short-circuit, cable break or disconnected ground pressure sensor.
	*Button pressed* Steady light	The ground pressure sensor is indicating ground pressure. Used for testing and troubleshooting the ground pressure sensor.	
	*Button pressed* Extinguished	The ground pressure sensor is not indicating ground pressure. Used for testing and troubleshooting the ground pressure sensor.	
	Constant light	Machine lock selected via configuration.	
	Extinguished	Machine lock deselected via the configuration. The lock will not be activated.	
	Fast Flashes 10 times per second (10 Hz)	Activated 1: Excess current on machine lock valve (has priority over open load). More than 3500 mA passes to the activated machine lock valve. The output will be turned off. Activated 2: One of the machine lock outputs is short-circuited either to earth or system voltage while the machine lock is turned off.	Confirmation 1: Automatic if less than 3500 mA passes through the machine lock valve when it is reactivated. Confirmation 2: When the system is restarted.
	Slow Flashes 1 time per second (1 Hz)	Open load on machine lock valve. The current is less than 200 mA when the machine lock is activated.	Automatic when more than 200 mA passes through the machine lock valve when it is activated.

Symbol	Indication	Description	Action
	Steady light (both)	Machine lock is active. Coil is energised.	
	Extinguished (both)	Machine lock is inactive.	
	Left indicator flashes at 10 times per second (10 Hz)	The hook sensor indicates it is 'not coupled'. Takes priority over steady light. Insecure coupling	Automatic when both sensors indicate the same state, 'coupled' or 'not coupled'.
	Right indicator flashes 10 times per second (10 Hz)	Ejector sensor indicates that it is 'not coupled'. Takes priority over steady light. Insecure coupling	Automatic when both sensors indicate the same state, 'coupled' or 'not coupled'.
	Both flash once per second (1 Hz)	Process fault in machine lock sensors. The machine lock has been activated and deactivated without any of the sensors having indicated 'not hitched'.	One of the machine lock sensors indicates 'not coupled'. Cause: The sensors have been disconnected or have a damaged cable.
	Constant light	Tiltrotator lock is selected via configuration.	
	Extinguished	Tiltrotator lock is deselected via configuration. The lock will not be activated.	
	Fast Flashes 10 times per second (10 Hz)	Activated 1: Excess current on the tiltrotator lock valve (has priority over open load). More than 3500 mA passes to activated tiltrotator lock valve. The output will be turned off. Activated 2: One of the tiltrotator lock outputs is short-circuited either to earth or system voltage while the tiltrotator lock is turned off.	Confirmation 1: Automatic if less than 3500 mA passes through the tiltrotator lock valve when it is reactivated. Confirmation 2: When the system is restarted.
	Slow Flashes 1 time per second (1 Hz)	Open load on tiltrotator lock valve. The current is less than 200 mA when the tiltrotator lock is activated.	Automatic when more than 200 mA passes through the tiltrotator lock valve when it is activated.
	Steady light (both)	Tiltrotator lock is active.	
	Extinguished (both)	Tiltrotator lock is inactive.	

Symbol	Indication	Description	Action
	Left indicator flashes at 10 times per second (10 Hz)	The hook sensor indicates it is ‘not coupled’. Takes priority over steady light.	Automatic when both sensors indicate the same state, ‘coupled’ or ‘not coupled’.
	Right indicator flashes 10 times per second (10 Hz)	Ejector sensor indicates that it is ‘not coupled’. Takes priority over steady light.	Automatic when both sensors indicate the same state, ‘coupled’ or ‘not coupled’.
	Both flash once per second (1 Hz)	Process fault in the tiltrotator lock sensors. The tiltrotator lock has been activated and deactivated without any of the sensors having indicated ‘not coupled’.	One of the tiltrotator lock sensors indicates ‘not coupled’. Cause: The sensors have been disconnected or have a damaged cable.

Symbol	Number of flashes	Name	Description	Confirmation
	1	DC2 Tiltmodule Timeout (TM)	Communication with the QS-compliant DC2 tilt module has been established and ceased.	Automatic when communication is restored or when the panel module cover is in the lower position.
	2	Pressure activation Sensor (PA. CVP)	The system has detected an affected pressure sensor for more than 3 seconds when the pressure impact is inactive OR when the system has NOT detected an affected pressure sensor for 8 seconds when pressure impact is active.	When restarting the system.
	3	Pressure activation Valve 1 Open Load (PA)	The current is less than 200 mA through pressure activating valve 1 when pressure activation is active.	Automatic when more than 200 mA passes through pressure activating valve 1 when it is active.
	4	Pressure activation Valve 2 Open Load (CV)	The current is less than 200 mA through pressure activating valve 2 when pressure activation is active.	Automatic when more than 200 mA passes through pressure valve 1 when it is active.

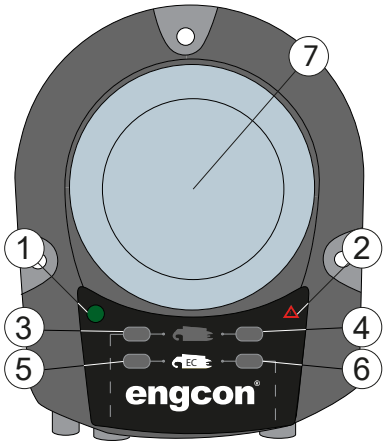
Symbol	Number of flashes	Name	Description	Confirmation
	5	QLM Timeout	QLM is selected and communication with the QLM module ceases.	Automatic when communication with the QLM module is restored.
	6	Tool Lock Short Circuit	One of the outputs for the two quick hitch lock valves is short-circuited either to earth or system voltage when the quick hitch locks are inactive.	When restarting the system.
	7	QPM Timeout	Communication with QPM ceases.	Automatic when communication with QPM is restored.
	8	Pressure activation Valve 1 Over current	The current is more than 3500 mA through pressure activating valve 1 when pressure activation is active. The output will be turned off.	Automatic if less than 2500 mA passes through pressure activating valve 1 when it is reactivated.
	9	Pressure activation Valve 2 Over current	The current is more than 3500 mA through pressure activating valve 2 when pressure activation is active. The output will be turned off.	Automatic when less than 2500 mA passes through pressure activating valve 2 when it is reactivated.
	10	Tiltrotator Sensor supply short circuit	Supply voltage out to the tiltrotator lock sensors is less than 50% of system voltage.	Automatic when the supply voltage to the tiltrotator lock sensors exceeds 50% of system voltage.
	11	Machine Sensor supply short circuit	Supply voltage out to the tiltrotator lock sensors is less than 50% of system voltage.	Automatic when the supply voltage to the machine sensors exceeds 50% of system voltage.

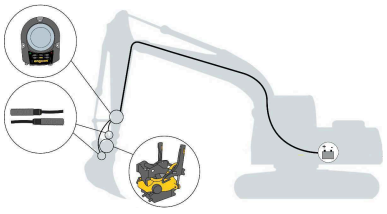
Symbol	Number of flashes	Name	Description	Confirmation
	12	DC2 TM Sensor supply short circuit	Supply voltage out to the tiltrotator lock sensors is less than 50% of system voltage.	Automatic when the supply voltage to the tiltrotator lock sensors no longer is shorted to earth.
	13	QCM X7/X8 Supply over current	More than 3500 mA passes to modules connected to X7 and/ or X8. Supply voltage out to X7 and X8 will be turned off.	The system is restarted.
	14	Machine Tool Lock Feedback Fault	Internal feedback for the machine lock outputs does not correspond with expected value.	The system is restarted. If the fault persists, return the QCM2 module.
	15	Tiltrotator Tool Lock Feedback Fault	Internal feedback for the tiltrotator lock outputs does not correspond with expected value.	The system is restarted. If the fault persists, return the QCM2 module.
	16	Buzzer error	Buzzer in QPM interpreted as defective; boot test at system start-up not performed. Buzzer in QPM interpreted as defective; does not sound at activated quick hitch lock.	The system is restarted. If the fault persists, return the QPM module.
	17	EWDT error	Internal communication fault in QCM2 module.	The system is restarted. If the fault persists, return the QCM2 module.
	18	MCSE error	Communication fault between QCM2 and QPM. Button pressed on QPM at start-up.	The system is restarted.

Symbol	Number of flashes	Name	Description	Confirmation
	19	SS9-2 timeout	Communication with SS9 is selected in the configuration and communication ceases.	Automatic when communication with SS9 is restored.
	20	Sensor Configuration Fault	The machine lock sensors are deselected in the configuration, but the system discovers that both sensors indicate 'not coupled'. The tiltrotator lock sensors are deselected in the configuration, but the system discovers that both sensors indicate 'not coupled'.	The system is restarted. If a sensor for one of the locks is to be used, these must be selected via the configuration.
	21	QLM Configuration Fault	QLM is deselected in the configuration, but the system detects communication with QLM.	The system is restarted. If QLM is present, it should be selected via configuration.

8.2. Q-Safe electronics module QLM

8.2.1. Indications





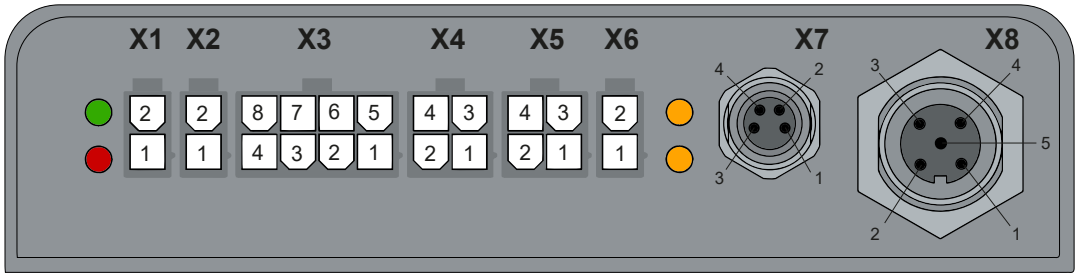
Position	Behaviour	Indicates	Remarks
1	1 flash * _ * _ * _	Power supply OK	Applies to DC2 without QSC
	2 flashes ** _ ** _ ** _	Power supply OK	Applies to QSC
	Constant light	Power supply OK	Applies to SS0-SS9 without QSC
2	1 flash * _ * _ * _	CAN time out	Applies to QSC
	2 flashes ** _ ** _ ** _	Short circuit, power to sensor in EC	Applies to SS0-SS9 without QSC and QSC during start
	3 flashes *** _ *** _ *** _	Short circuit, power to sensor in RF	Applies to SS0-SS9 without QSC and QSC during start
	3 flashes *** _ *** _ *** _	Short circuit, power to sensor in EC	Applies to DC2
	Inactive	No fault	
3	Constant light	Connected tool	Sensor, hook for quick hitch on machine
4	Constant light	Connected tool	Sensor, ejector for quick hitch on machine
5	1 flash * _ * _ * _	Tiltrotator removed	Applies to DC2
	Constant light	Connected tool	Sensor, hook for quick hitch underneath tiltrotator
6	1 flash * _ * _ * _	Tiltrotator removed	Applies to DC2
	Constant light	Connected tool	Sensor, ejector for quick hitch underneath tiltrotator
7	Flashing white and intermittent siren (normal behaviour during the connection sequence)	Unsafe tool connection	Check attachment

8.2.2. Alarm

The system has an audible alarm that warns when there is a fault in the system. The sensors work in pairs so that sensors 1 or 2 monitor the RF hitch and sensors 3 and 4 monitor the EC hitch.

Alarm	Description	Action
Alarm off	Correctly connected quick hitch or fully disconnected tool	
Flashing/beeping alarm	Possible faults: Incorrectly connected RF or EC bracket Sensor fault Cable fault	1. Check cables and connectors. 2. Check sensors for external damage. 3. Check LEDs 2-5 for further troubleshooting.

8.3. Description of electronics module QCM



LED	Description
Green	Shows if supply voltage is activated.
Red	Repeats QPM warning blinkers.
Orange - upper	QPM CAN communications on X7.
Orange - lower	QCM CAN communications on X8.

Output	Name
X1:1	+9-32VDC
X1:2	GND
X2:1	EC Quick hitch
X2:2	EC Quick hitch
X3:1	Supply PA CVP QSC
X3:2	Activation valve POS
X3:3	Control valve
X3:4	Machine quick hitch POS
X3:5	Signal PA CVP QSC
X3:6	Activation valve NEG
X3:7	GND
X3:8	Machine quick hitch NEG

Output	Name
X4:1	Ground contact, supply
X4:2	Ground contact, supply, NO
X4:3	Ground contact, supply, NC
X4:4	GND
X5:1	Blocking valve 1
X5:2	Blocking valve 2
X5:3	GND
X5:4	GND
X6:1	CAN H
X6:2	CAN L
X7:1	Supply QPM
X7:2	CAN H
X7:3	GND
X7:4	CAN L
X8:1	N.C.
X8:2	VCC 3 A
X8:3	GND
X8:4	CAN H
X8:5	CAN L

9. Decals

Machine instructions, decals and warning signs must be kept clearly legible. Contact your supplier to order replacements.

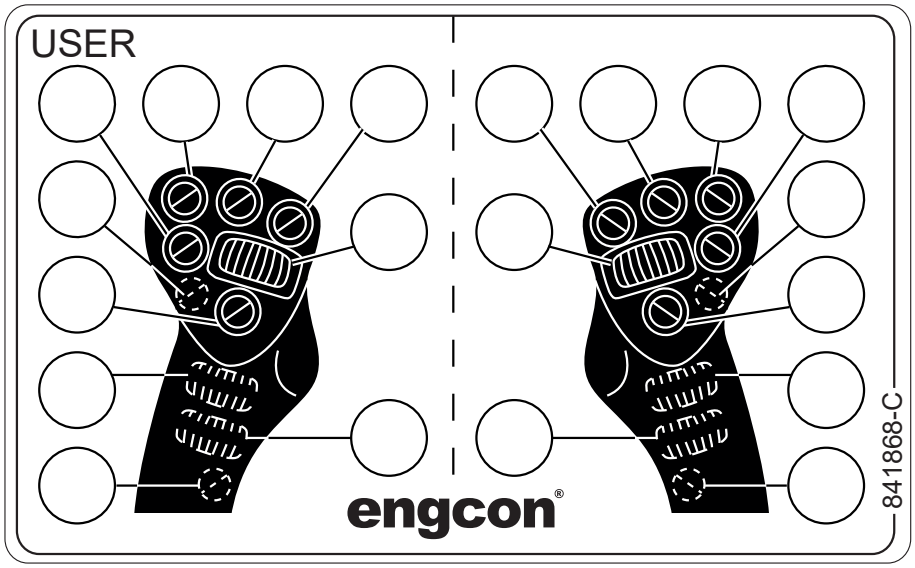
WARNING
Replace damaged or illegible signs and decals before using the machine. Risk of personal injury and damage to property.

WARNING
Before starting and calibrating the system, make sure there is sufficient room to manoeuvre as there is a risk of the machine moving in unexpected ways. Risk of injury and damage to property.

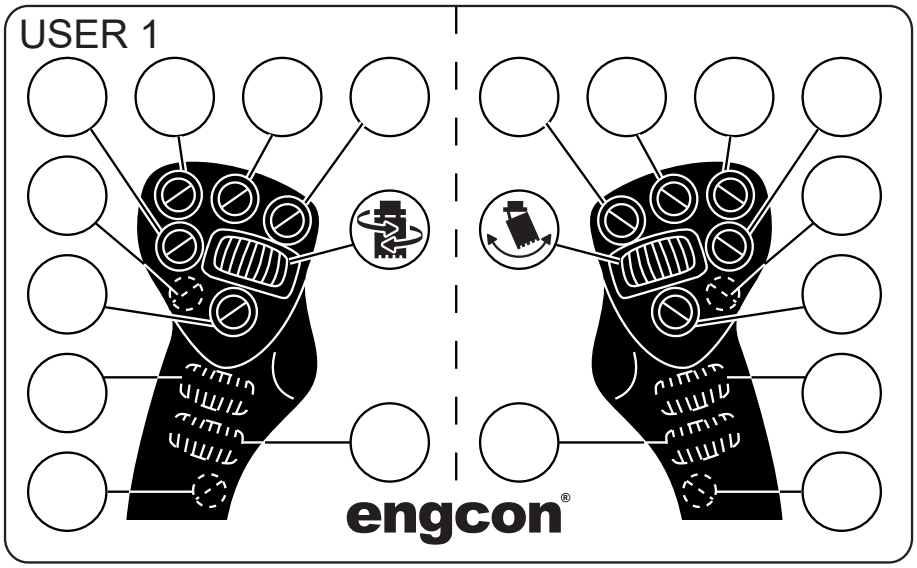
WARNING
Check that the function decals correspond to the machine functions before starting work. Risk of personal injury.

9.1. Grip MIG2

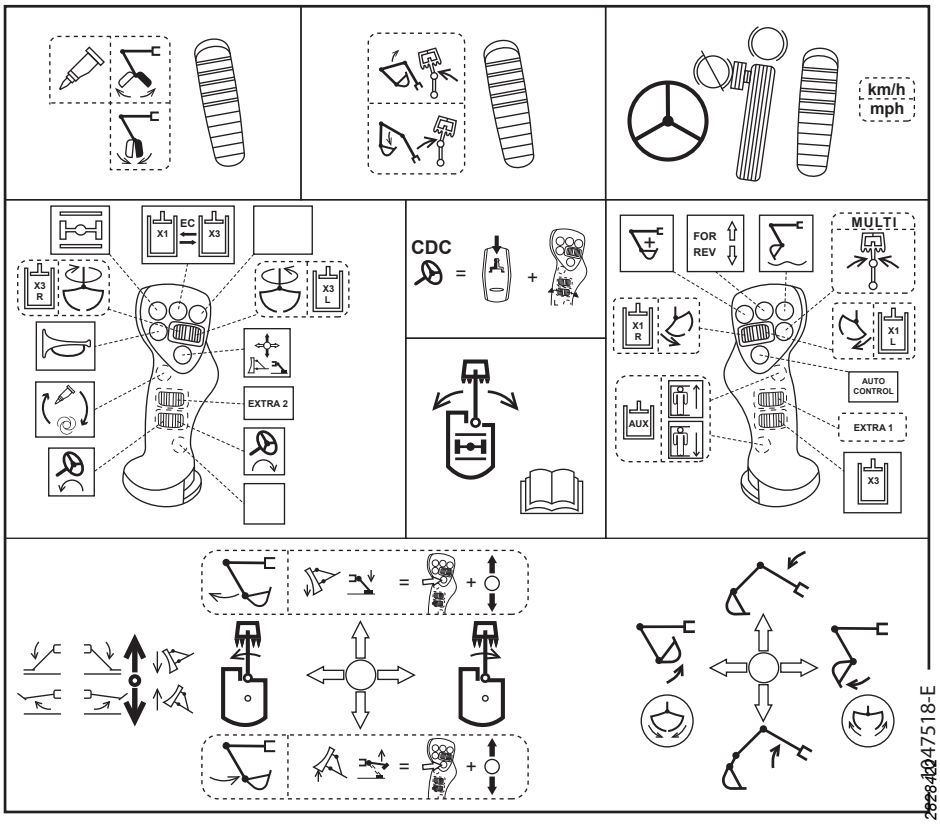
9.1.1. 841868



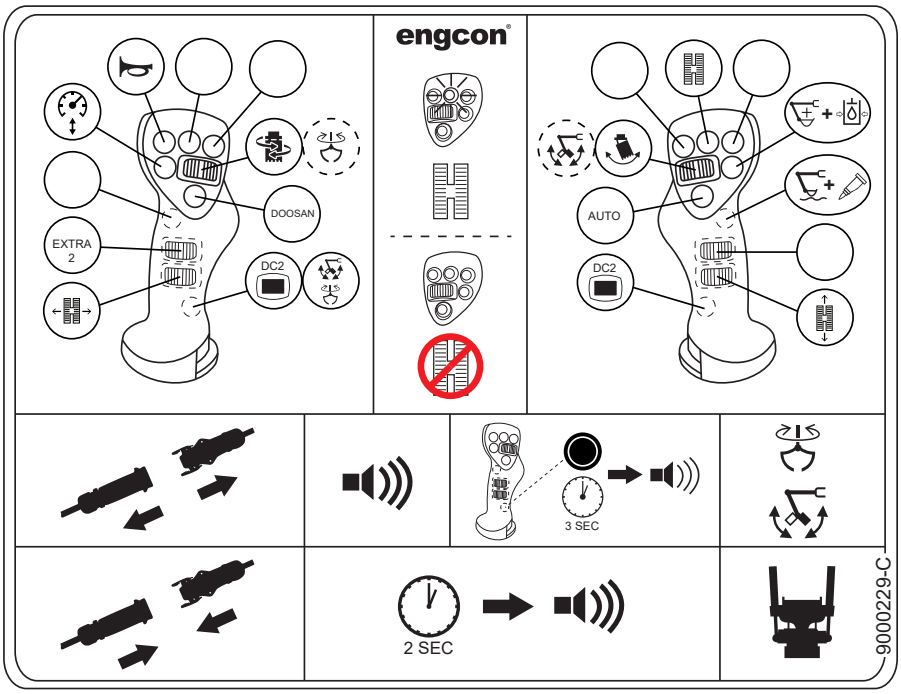
9.1.2. 841869



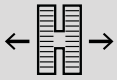
9.1.3. 1047518

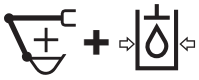


9.1.4. 9000229

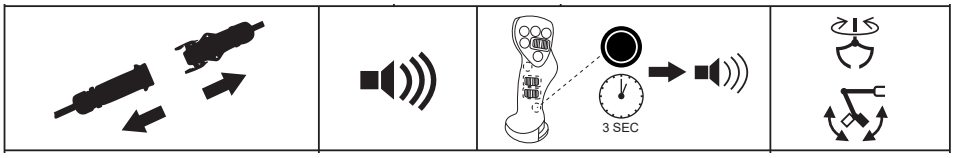


9.1.4.1. Description of decal symbols

Symbol	Description	Symbol	Description
	Track control		Doosan - One Touch Deceleration Button
	Track control activated		Track control deactivated
	Track control – forward/ reverse		Track control – left/right
AUTO	Autotilt	EXTRA 2	Extra function 2
	Grab rotation		Scissors – open/close
	Horn	DC2 	Menu DC2
	Tilt		Rotation

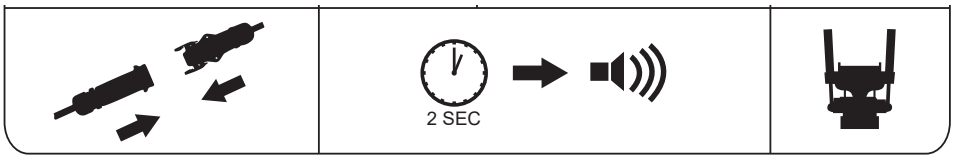
Symbol	Description	Symbol	Description
	Power boost		Float position + hammer
	Tiltrotator control		Double-acting function

9.1.4.2. How to activate double-acting function



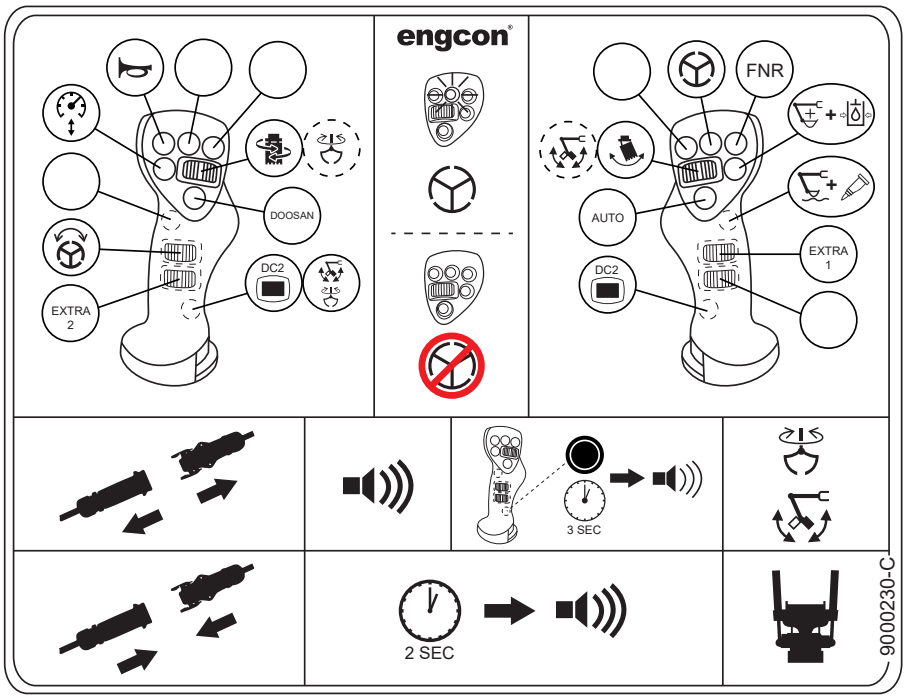
Box	Description
1	Disconnect the connector on the stick.
2	Buzzer sounds.
3	Hold down the button in the MIG2 grip for 3 seconds (until a constant tone switches to short beeps).
4	Double-acting function activated.

9.1.4.3. How to activate tiltrotator control

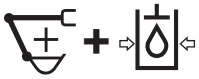


Box	Description
1	Connect the connector on the stick.
2	A buzzer will sound after 2 seconds.
3	Tiltrotator control activated.

9.1.5. 9000230

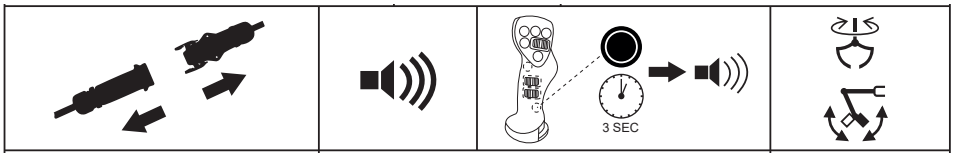


9.1.5.1. Description of decal symbols

Symbol	Description	Symbol	Description
	Wheel control		Wheel control – left/right
	Wheel control activated		Wheel control deactivated
AUTO	Autotilt	FNR	Driving direction
EXTRA 1	Extra function 1	EXTRA 2	Extra function 2
	Grab rotation		Scissors – open/close
	Horn	DC2 	Menu DC2
	Tilt		Rotation
	Power boost		Float position + hammer

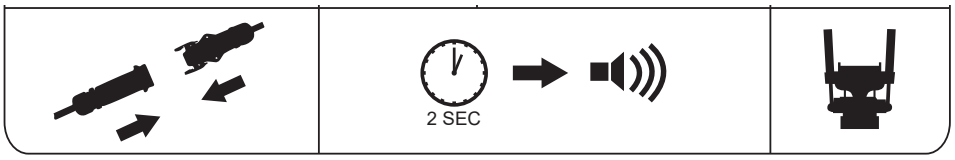
Symbol	Description	Symbol	Description
	Tiltrotator control		Double-acting function
	Doosan - One Touch Deceleration Button		

9.1.5.2. How to activate double-acting function



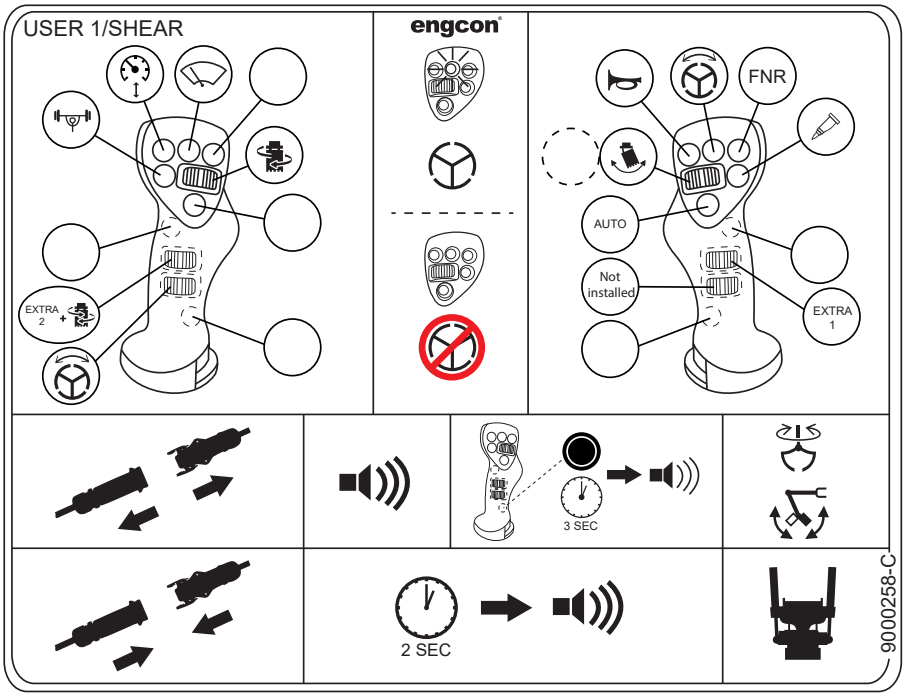
Box	Description
1	Disconnect the connector on the stick.
2	Buzzer sounds.
3	Hold down the button in the MIG2 grip for 3 seconds (until a constant tone switches to short beeps).
4	Double-acting function activated.

9.1.5.3. How to activate tiltrotator control

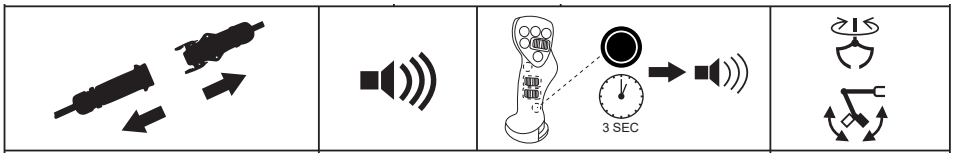


Box	Description
1	Connect the connector on the stick.
2	A buzzer will sound after 2 seconds.
3	Tiltrotator control activated.

9.1.6. 9000258

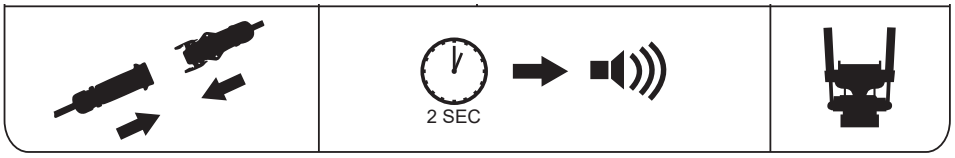


9.1.6.1. How to activate double-acting function



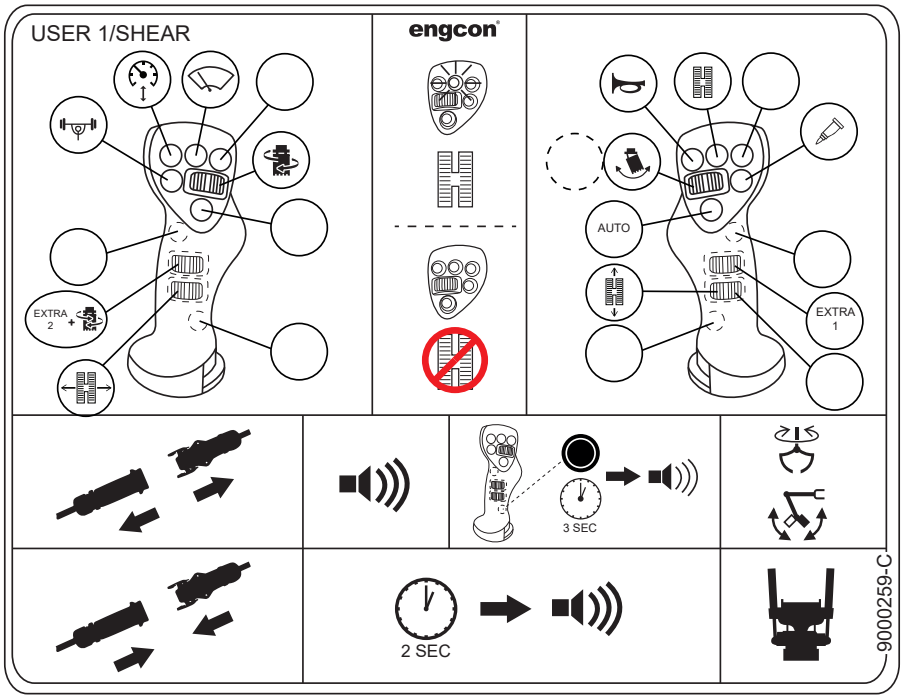
Box	Description
1	Disconnect the connector on the stick.
2	Buzzer sounds.
3	Hold down the button in the MIG2 grip for 3 seconds (until a constant tone switches to short beeps).
4	Double-acting function activated.

9.1.6.2. How to activate tiltrotator control

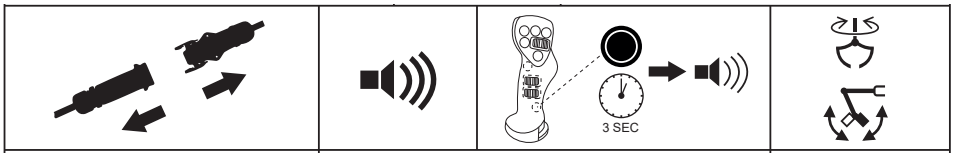


Box	Description
1	Connect the connector on the stick.
2	A buzzer will sound after 2 seconds.
3	Tiltrotator control activated.

9.1.7. 9000259

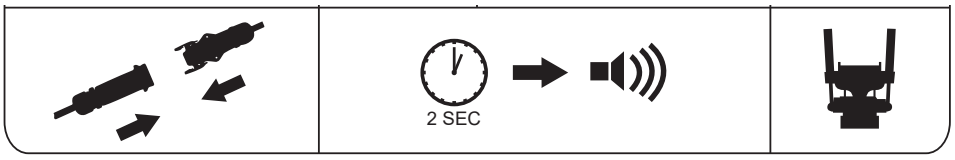


9.1.7.1. How to activate double-acting function



Box	Description
1	Disconnect the connector on the stick.
2	Buzzer sounds.
3	Hold down the button in the MIG2 grip for 3 seconds (until a constant tone switches to short beeps).
4	Double-acting function activated.

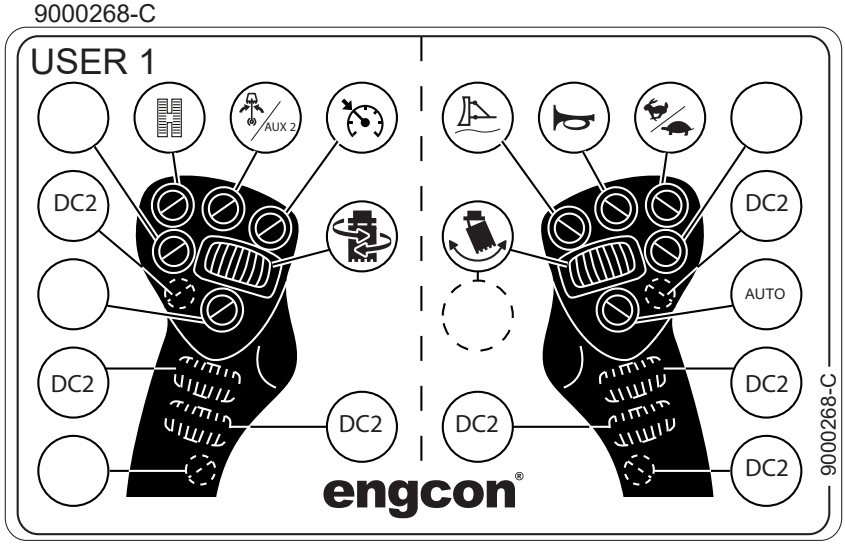
9.1.7.2. How to activate tiltrotator control



Box	Description
1	Connect the connector on the stick.
2	A buzzer will sound after 2 seconds.
3	Tiltrotator control activated.

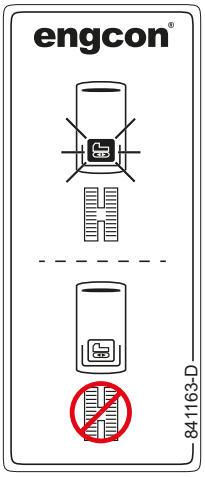
9.1.8. 9000268

9000268-C



9.2. Track control

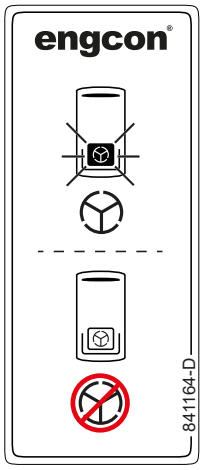
9.2.1. 841163



Symbol	Function	Symbol	Function
	Track control, activated		Track control, deactivated

9.3. Wheel control

9.3.1. 841164

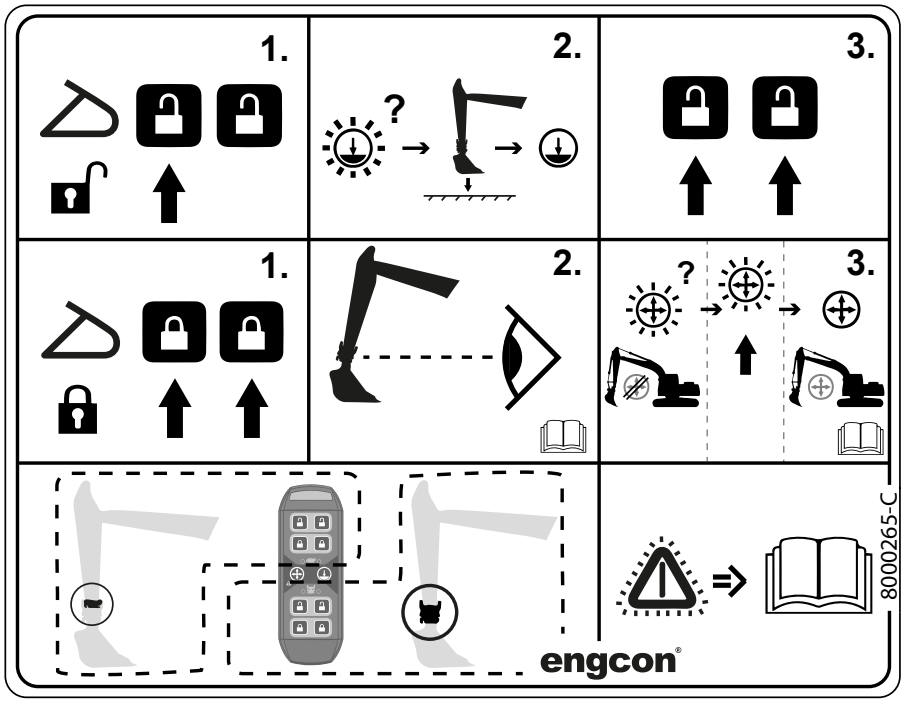


Symbol	Function	Symbol	Function
	Wheel control, activated		Wheel control, deactivated

9.3.2. 9000574

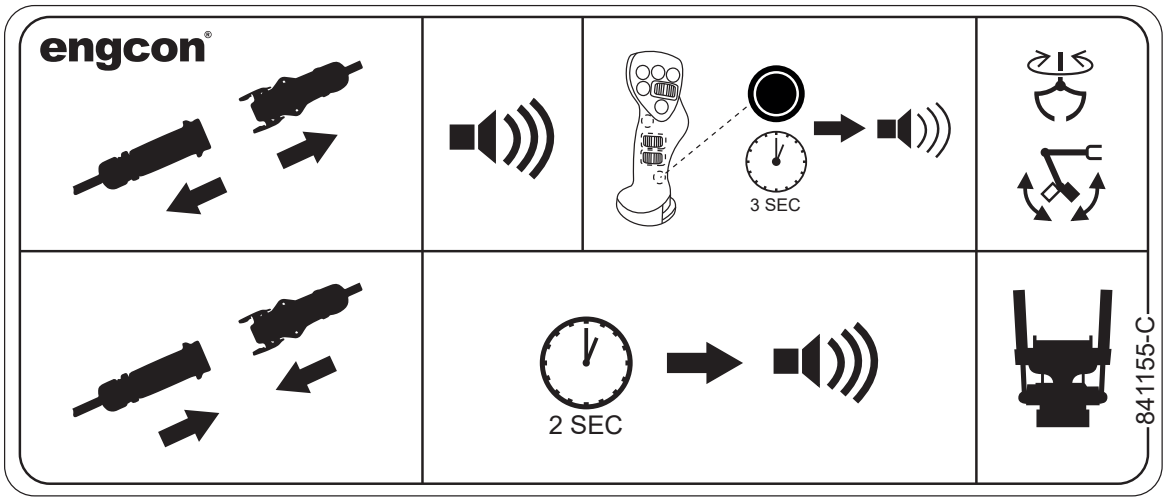
Max recommended speed with activated wheel control.

9.3.3. 8000265

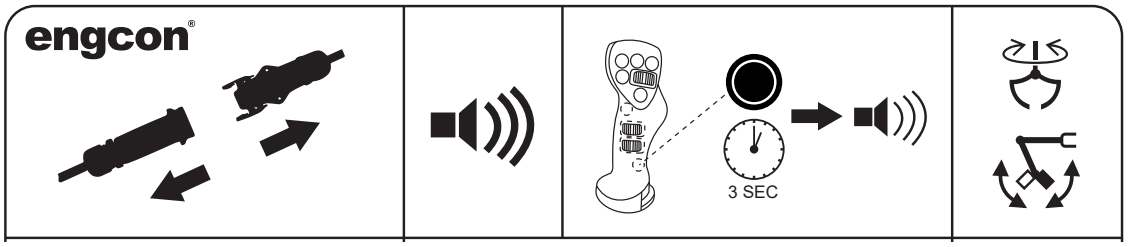


9.4. Activation double acting function and tiltrotator control

9.4.1. 841155

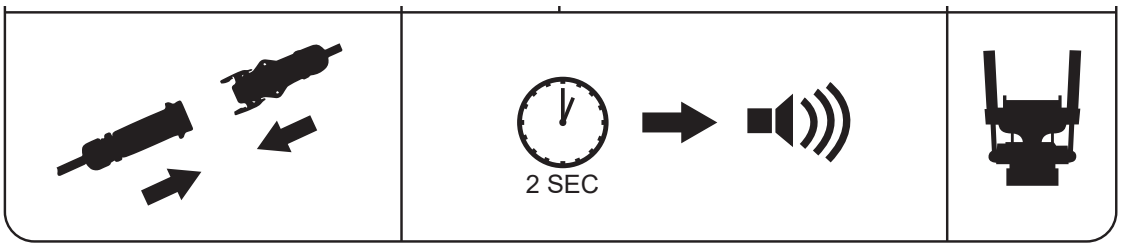


9.4.1.1. How to activate double-acting function



Box	Description
1	Disconnect the connector on the stick.
2	Buzzer sounds.
3	Hold down the button in the MIG2 grip for 3 seconds (until a constant tone switches to short beeps).
4	Double-acting function activated.

9.4.1.2. How to activate tiltrotator control



Box	Description
1	Connect the connector on the stick.
2	A buzzer will sound after 2 seconds.
3	Tiltrotator control activated.

10. Glossary

10.1. Designations

Term	Designations
Base machine	The machine carrying the equipment concerned. Excavator or backhoe loader.
Decal	Sticker with a symbol or logo that informs or warns.
Double feeder or double pressure reducer	Valve providing a double-acting function and used e.g. to obtain a tilt function on a tilt bucket on a single-acting extra outlet.
Grip	The grip gripped by the operator to execute excavator movements and control the tiltrotator and other tools.
Quick hitch lock	Locks a tool in the tiltrotator.
Stick	The 'arm' at the very front of the excavator.
Control systems	That which controls the tiltrotator and its functions. In certain cases, the control system also control certain excavator functions.
Tiltrotator	A type of rotating and tilting quick hitch for excavators.

10.2. Abbreviations

Term	Description
CM	Cabin module.
EC	Tiltrotator
TM	Tiltrotator module.
QSC	Quick Hitch Standard Control is engcon's standardised locking system. It is able to control all types of quick hitches on the excavator and beneath the tiltrotator.
QCM	QSC Q-safe cabin module
QLM	Q-Safe electronics module
QPM	QSC control panel
QH	Machine quick hitch
PA	Pressure activation (PA)
PA. CV	Control valve for pressure activation
PA. CVP	Push-button for control valve for pressure activation

11. Installation checklist

- [ ] Delivery contents checked.
- [ ] Checked: hoses and cables are not at risk of pinching, cutting or stretch damage.
- [ ] Function check completed.
- [ ] Document check completed.

Machine model:

.....

Machine serial number:

.....

Tiltrotator serial number:

.....

Machine hitch serial number:

.....

Part number, machine electrical kit:

.....

Part number and version number of the installation instructions used for installation:

.....

.....

Machine owner, company:

.....

Date:

.....

Company installing equipment on the machine:

.....

Place:

.....

Date:

.....

Other remarks:

.....

.....

.....

.....

.....

.....

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