GRUNDODRILL ACS300

HDD ROCK DRILL RIG

Translation of the
ORIGINAL INSTRUCTIONS



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TRACTO
ADVANCED TRENCHLESS TECHNOLOGY

Manufacturer:

TRACTO-TECHNIK GmbH & Co. KG
Paul-Schmidt-Straße 2
57368 Lennestadt
Tel.: +49 2723 808-0
info@tracto.com
www.tracto.com

This manual is designed for the operating company as well as for the personnel operating or maintaining the unit.

The user of the manual must be able to read and understand the language of this manual.
The user of the manual must know and have understood the safety instructions before any work is carried out on the unit.

To avoid serious injuries or death, please follow the safety instructions in this manual.
Please keep this manual for later reference.
If the machine is sold, this document must be handed over.

Any texts and drawings contained in this manual must not be copied or distributed – neither in full nor in part – without prior written permission from the manufacturer.

TABLE OF CONTENTS

1 Instructions for using this manual 1
1.1 Signal words and danger symbols 1
1.1.1 Signal words 1
1.1.2 Hazard symbols 1
1.1.3 Symbols for personal protective equipment 2
1.1.4 Prohibitive symbols 3
1.1.5 Notice symbols 3
1.1.6 Information symbols 3
1.2 Validity of this manual 4
1.3 Nameplate 4

2 Security 5
2.1 Intended use 5
2.2 Reasonably foreseeable misuse 6
2.3 General safety instructions 7
2.4 Safety instructions for maintenance and troubleshooting 8
2.5 Safety instructions for work on the hydraulic system 9
2.6 Safety instructions for work on the electrical system 11
2.7 Personnel qualification 12
2.8 Safety signs and labels 15
2.9 Safety devices at the machine 31
2.10 Residual risks 35
2.11 Danger due to adjacent lines and pipes 39
2.12 Working in pits 41
2.13 Behaviour in case of an emergency 42
2.14 Behaviour in the event of an accident involving personal injury 42

3 Information about the GRUNDODRILL 43
3.1 Functional principle 43
3.2 Standard components 45
3.3 Accessories 51
3.4 Loading crane 52
3.5 Additional box for rods 53
3.6 Technical data 54

TABLE OF CONTENTS

4 Transport 59
4.1 Transportation on a truck or trailer 59
4.2 Lifting the machine with an external crane 68
4.3 Towing the machine 70

5 Set-up and installation 75
5.1 Planning of the construction site 75
5.2 Site requirements 75
5.2.1 Conditions for the entrance pit 75
5.2.2 Conditions for the starting and target pits or the intermediate pit 76
5.2.3 Securing the construction site 76
5.3 Starting up the machine 78
5.3.1 Unlocking the machine 78
5.3.2 Switching the operating terminal on and off 80
5.3.3 Opening and closing the bonnet 80
5.3.4 Inspections before machine start-up 82
5.3.5 Switching over operation 83
5.3.6 Starting the engine 84
5.3.7 Inspections during machine start-up 85
5.3.7.1 Checking the diesel supply 85
5.3.7.2 Checking the DEF supply 87
5.3.7.3 Checking exhaust gas system cleaning 87
5.3.7.4 Checking the hydraulic oil supply 87
5.3.8 Activating the wireless pit remote control 88
5.3.9 Preparing the machine for traversing 89
5.3.10 Traversing the machine 92
5.3.11 Stopping the machine 94
5.4 Setting the machine up for operation 95
5.4.1 Removing the transport locks 95
5.4.2 Lowering the stabilisers 97
5.4.3 Lowering the anchor plate 98
5.4.4 Lowering the boom 98
5.4.5 Switching off the machine 99

5.5 Installation of the electric shock protection device 100
5.5.1 Checking the electric shock warning device 100
5.5.2 Overview of the electric shock protection device 101
5.5.3 Installing the electric shock protection device 102
5.6 Anchoring the machine in the ground 103
5.7 Swinging the cab 104
5.8 Assembling transmitter and drill head in the transmitter housing (for DCI units) 106
5.8.1 Preparing the transmitter for the rock drilling unit with roller chisel 106
5.8.2 Checking the functioning of the transmitter 107
5.8.3 Calibrating the detection system 107
5.9 Connecting the drilling fluid system 108
5.10 Connecting and using the high-pressure cleaner 109
5.11 Using the drilling fluid pump as a high-pressure cleaner (optional) 110
5.12 Connecting and using the mud pump 112

6 Operation 113
6.1 Safety instructions for operation 113
6.2 Operating elements and their functions 117
6.2.1 Main power switch 117
6.2.2 Left joystick with panel 118
6.2.3 Right joystick with panel 121
6.2.4 Operating terminal (portable) 124
6.2.4.1 Indications in the status line 132
6.2.4.2 "Overlay – Cabin functions" screen 135
6.2.4.3 "Overlay – Admin Tool" screen 138
6.2.4.4 "Overlay – Quick settings" screen 141
6.2.4.5 "Overlay – Operating manual" screen 142
6.2.4.6 "Overlay – TT Digital" screen 143
6.2.4.7 "Overlay – Release notes" screen 144
6.2.4.8 "Overlay – Service" screen 145
6.2.4.9 Menu structure 146
6.2.4.10 "Drive / Setup" screen – drive mode 156
6.2.4.11 "Pilot drill" screen 160
6.2.4.12 Target steering 172

6.2.4.13 "Rod change" screen 179
6.2.4.14 "Expansion drill / Backreaming" screen 182
6.2.4.15 "Bore data" screen 185
6.2.4.16 "Service – Setup/Configure" menu structure 189
6.2.5 Wireless pit remote control 198
6.2.6 Operator seat 199
6.2.7 Further elements in the cab 200
6.2.8 Operating elements for the rod magazine 204
6.2.9 Electrical control cabinet 205
6.2.10 Footstep 206
6.2.11 Emergency operation system with emergency hydraulic system and emergency mode 207
6.2.11.1 Emergency hydraulic system 207
6.2.11.2 Emergency mode 208
6.3 Checks prior to start-up 217
6.4 Start 218
6.5 Connecting the first drill rod to the sub-saver 219
6.6 Pilot drill 221
6.6.1 Adding further drill rods 223
6.6.2 Auto-bore during pilot bore 226
6.6.3 Automatic rod exchange 227
6.7 Inserting rods into the rod box and removing rods 228
6.7.1 Inserting rods into the rod box 228
6.7.2 Removing rods from the rod box 231
6.8 Additional box 234
6.8.1 Attaching and removing the additional box 234
6.8.2 Placing down the additional box 238
6.9 Expansion/pull-in mode 239
6.9.1 Tool change for expanding 240
6.9.2 Connecting the product pipe to the expander head 241
6.9.3 Expanding and installing the product pipe 242
6.9.4 Fully automatic mode for expansion drill/backreaming 246
6.10 Cleaning of the exhaust gas system 248
6.11 Switching off the engine and locking the machine 251

7 Disassembly and de-installation 253

8 Faults and troubleshooting 257
8.1 Indication of errors and faults 257
8.2 Other faults and malfunctions 259

9 Maintenance 261
9.1 Safety instructions for maintenance and troubleshooting 261
9.2 Safety instructions for work on the hydraulic system 263
9.3 Safety instructions for work on the electrical system 265
9.4 Checks by qualified persons 266
9.5 Maintenance intervals 266
9.6 Designations and number of filters on the machine 270
9.7 Lubrication intervals and check of operating supplies 271
9.8 Maintaining the safety devices 273
9.8.1 Visual inspection of the electric shock protection device 273
9.8.2 Functional check of the electric shock protection device 273
9.8.3 Functional check of the emergency stop buttons 273
9.8.4 Checking the safety signs and labels 273
9.9 Maintaining the machine 274
9.10 Maintaining the diesel engine 275
9.10.1 Instructions on daily maintenance 276
9.10.2 Engine operation at temperatures < 0 °C 277
9.10.3 Greasing oils 278
9.11 Changing the battery of the remote control key 279
9.12 Maintaining the drill rods 280
9.13 Maintaining the pipe puller 280
9.14 Maintaining the swivel 281
9.15 Maintaining the expander head 282
9.16 Maintaining the roller chisel 282
9.17 Maintaining the transmitter housing, transmitter and receiver 283
9.18 Retensioning the track chain 284

9.19 Lubrication 285
9.19.1 Lubrication points on the machine 286
9.19.2 Lubricant and greasing oil tables 289
9.19.3 Adjusting the grease quantity of the rod lubrication 290
9.20 Frost protection measures 291

10 Cleaning 295

11 Storage 297
11.1 Storage conditions 297
11.2 Storing hydraulic hoses 297
11.3 Storing lubricants 297

12 Disposal 299
12.1 Disposal of auxiliary material 299
12.2 Disposal of the machine 299

13 Annex 301
13.1 Checklist for construction site planning 301
13.2 Maintenance programme 303
13.3 Declaration according to EC Machinery Directive 2006/42/EC (reproduction of content) 305

1 INSTRUCTIONS FOR USING THIS MANUAL

1.1 Signal words and danger symbols

Text passages marked with signal words and symbols are of particular importance in this manual. Not all signal words and symbols specified below are used in this manual. However, they are all explained for an easier handling.

1.1.1 Signal words

⚠ DANGER

DANGER

... indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING

... indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION

... indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

1.1.2 Hazard symbols



Hazardous voltage!
This symbol indicates a risk of death or injury from hazardous voltage when handling the system.



Crush hazard!
The texts marked with this symbol inform about dangerous situations with a crush hazard for the entire body.



Hand injuries!
The texts marked with this symbol inform about dangerous situations entailing hand injuries from crushing. Tasks described in the corresponding text passages shall be carried out with utmost care to avoid hazardous situations and resulting injuries such as the loss of limbs.



Draw-in hazard!
The texts marked with this symbol inform about dangerous situations with a draw-in or entanglement hazard for clothes or limbs.



Explosion hazard!
The texts marked with this symbol inform about dangerous situations with an explosion hazard.



Danger due to suspended loads!
The texts marked with this symbol inform about dangerous situations due to suspended loads.



Danger of tipping over!
The texts marked with this symbol inform about dangerous situations involving the danger of the machine tipping over.



Trip hazard!
The texts marked with this symbol inform about situations involving a hazard of tripping over obstacles on the floor.



Fall hazard!
The texts marked with this symbol inform about dangerous situations with a fall hazard.



Hot surface!
The texts marked with this symbol inform about dangerous situations with a burn hazard due to hot surfaces.



Danger due to combustible substances!
This sign indicates dangers caused by combustible substances.



Danger due to toxic substances!
This sign indicates dangers caused by toxic substances.



Dangerous for the environment!
This sign indicates that the used substance is environmentally hazardous.

1.1.3 Symbols for personal protective equipment



Wear head protection!
During the activities marked with this symbol it is absolutely necessary to wear head protection.



Wear hand protection!
Wearing hand protection is absolutely necessary for tasks marked with this symbol.



Wear eye protection!
Wearing eye protection is absolutely necessary for tasks marked with this symbol.



Wear protective clothing!
Wearing protective clothing is absolutely necessary for tasks marked with this symbol.



Wear ear protection!
During the activities marked with this symbol it is absolutely necessary to wear ear protection.



Wear foot protection!
During the activities marked with this symbol it is absolutely necessary to wear foot protection.



Wear high-visibility vest!
Wear a high-visibility vest in fluorescent colours when performing activities marked with this symbol.

1.1.4 Prohibitive symbols



Unauthorized access prohibited!
The texts marked with this symbol inform you that the indicated place must not be accessed by unauthorized persons.



Fire, open light and smoking prohibited!
The texts marked with this sign inform that open light, fire and smoking are prohibited.

1.1.5 Notice symbols

NOTICE

NOTICE

... indicates important information (e.g. material damage), but does not indicate hazardous situations.

1.1.6 Information symbols



Info!
Information marked with this symbol helps you to carry out your tasks quickly and safely.

1.2 Validity of this manual

This manual is valid for the following machine:

– GRUNDODRILL ACS 300

The manual applies to the machine including the accessories for drilling.

Please note that the scope of delivery of your machine may vary from the functions described here.

1.3 Nameplate

The nameplate is attached to the side of the machine:

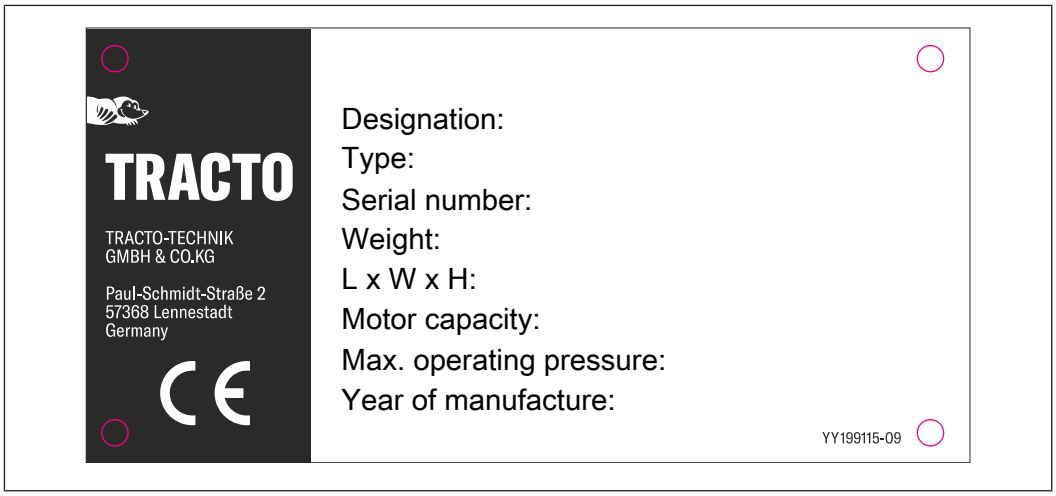


Fig. 1-1 Nameplate

2.1 Intended use

The machine is used for producing a pilot bore and then pulling in a product pipe.

The machine of type ACS300 serves to carry out rock drillings.

The data for the bore length and outer pipe diameter can be gathered from the technical data.

The machine is suitable for the following fields of application:
- parallel installations
- crossings of roads, car parks, train lines, rivers, parks etc.
- culverts
- bores with alternating rock types

The machine is to be used for pipes made of the following materials:
- polyethylene (PE)
- polypropylene (PP)
- polyvinyl chloride (PVC)
- polyethylene HD pipes
- cast iron
- steel

For use of other materials please contact the TRACTO-TECHNIK customer service.

To safeguard your warranty claims and to ensure safe machine operation, only use accessories complying with the specifications of TRACTO-TECHNIK.

The drilling fluid mixing system MA07-D to be applied and the machine with the drive unit establish a complete unit.

Intended use also includes the proper application of the correct accessories.

Operation in closed rooms is permitted only if appropriate extraction systems are used.

When working at slopes or rock spurs, sufficiently secure the entire bore rig against tipping over or falling. Without having taken such measures drilling is prohibited.

Structural modifications of the machine and the accessories are prohibited without prior written permission from the manufacturer.

In order to use the machine as intended, one has to observe all the instructions in this manual.

Any use other than the intended use is regarded as misuse.

2.2 Reasonably foreseeable misuse

Deployment of the unit by insufficiently qualified personnel is regarded as reasonably foreseeable misuse.

TRACTO-TECHNIK is not liable for any damages resulting from reasonably foreseeable misuse.

Other applications such as:

- using stabilisers for pushing soil
- using the machine for pulling/pushing objects other than the pipes to be installed
- loosening or retrieving tools or other objects with the machine outside the work steps specified in the instructions
- using the machine as a vehicle
- Transport of the machine on a vehicle/trailer with mounted additional box
- using the machine while not wearing personal protective equipment
- remote-controlled drilling without following the safety measures described in this manual
- operating the machine underground
- operating the machine in areas with a danger of objects falling from above
- operating the machine in a potentially explosive environment
- exceeding the max. permissible weight and operating distance of the loading crane provided in the technical data (chapter 3.6, page 54)

are regarded as **reasonably foreseeable misuse**.

2.3 General safety instructions

Please always observe the following safety instructions:

- When operating the machine the applicable national health, occupational safety, accident prevention, fire and environmental regulations must be observed. Personnel operating the machine must be familiar with these regulations.
- Always exercise caution when working with the machine.
- Ensure that the manual is available at any time to the personnel operating the machine.
- Determine the responsibilities of the personnel before starting work.
- If there is a change in the operating behaviour of the machine, it must be switched off immediately. Secure it against restart. The site manager must be informed of the change.
- Only use spare parts that conform to the technical requirements set by TRACTO-TECHNIK. This is always ensured when using original spare parts.
- Observe the maintenance intervals stated in the instructions.
- Observe all safety instructions and warnings on the machine.
- Keep all safety instructions and warnings on the machine in a legible condition.
- Unauthorized persons are not allowed in the machine's immediate danger area.
- Modifications, conversions or additions to the machine without prior permission from the manufacturer are prohibited. This also applies to the installation and adjustment of safety devices as well as for welding work on parts.
- Only operate the machine if all safety devices and covers (e.g. panels) are installed.
- Inspect the machine for visible defects before use.
- If you detect safety-related defects, shut the machine down and report all defects to the responsible supervisor.
- Have defects eliminated immediately.
- In case of an emergency press the emergency stop button.

2.4 Safety instructions for maintenance and troubleshooting

⚠ DANGER

All maintenance, repair and troubleshooting activities involve an increased risk of accident!

- Only perform maintenance, repair and troubleshooting activities when the machine is shut down.
- Switch off the engine before starting maintenance, repair or troubleshooting activities.
  Safely store the remote control key so that the engine is not switched on unexpectedly.
- Interrupt the power supply by switching off the main power switch.

  ⇨The hydraulic lines are immediately depressurized.

⚠ WARNING

Risk of injury due to coolant spurting out during maintenance work on the air conditioning system!

Pressurized coolant can injure you when it spurts out.

- Have work on the air conditioning system carried out only by a specialist company or specially trained personnel.

NOTICE

Oils and greases hazardous to the environment!



Danger of environmental pollution!

- Do not let oils and greases penetrate into the soil, waters or the sewage system.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.

NOTICE

Environmental damage caused by coolant!



Coolant leaking out during maintenance work of the air conditioning system can pollute the environment.

- Collect any leaking coolant.
- Observe the safety precautions and regulations in the technical and toxicological data sheet from the coolant manufacturer.

– Carefully read all safety information contained in this manual before starting any maintenance work.
– Maintenance work must only be carried out by appropriately authorised personnel.
– By yourself, only perform the maintenance and adjustment works specified in this manual. For additional works contact the customer service of TRACTO-TECHNIK.

– If necessary, secure a large area around the maintenance zone.
– Clean the machine, in particular the connections and screw fittings, to remove oil, fuel and maintenance products before starting maintenance and repair work.
– Once the maintenance, repair and troubleshooting work is completed, reattach all safety devices and check them for proper functioning.
– Retighten any screw connections that have been loosened for maintenance, repair and troubleshooting activities.
– After completion of maintenance, remove the tools and repair materials from the operating site.

2.5 Safety instructions for work on the hydraulic system

Observe the following when working on the hydraulics and when handling hydraulic oil:

⚠ CAUTION



Contact with hydraulic oil!

Hydraulic oil is a chemical product which, in the case of skin contact over a longer time, may cause skin irritations or allergic reactions. In the case of eye contact, hydraulic oil may damage your eyes.

- When performing maintenance work on the hydraulics, wear protective goggles and gloves.
- Observe the safety precautions and regulations in the technical and toxicological data sheet from the hydraulic oil producer!

⚠ DANGER

Hydraulic oil spurting out!
Residual pressure between cylinder and check valve when the rig boom is inclined or the clamping mechanism closed, as well as at the stabilisers!

Pressurized hydraulic oil can injure you when spurting out.

- Never tighten pressurized screw fittings.
- Depressurize the hydraulic system before starting maintenance, servicing and repair work by switching off the machine!



– When carrying out maintenance work on the hydraulics, fire, open light and smoking are prohibited.
– Work on the hydraulic system may only be performed by persons with special skills and experience in the field of hydraulics.

Hydraulic hose lines

Observe the following when handling hydraulic hose lines:

- Hydraulic hose lines must not be extended.
- Make sure that the connections are correct.
- Comply with the minimum bending radius for hydraulic hose lines as specified by the manufacturer.
- Regularly check all lines, hoses and screw fittings for leakages and visible damage. Rectify the damage immediately.
- Replace defective hydraulic hose lines.
- Exchange hydraulic hoses after expiry of their period of use even if there are no visible safety-related deficiencies on the hose line.
- The maximum period of use of the hydraulic hose lines is 6 years, including a storage duration of 2 years maximum. Notwithstanding this, the period of use can be determined in accordance with available test results, particularly taking into account the operating conditions. Please note the manufacturer's label on the hydraulic hose lines (date of manufacture: quarter and year or month and year).

NOTICE



Environmental damage due to hydraulic oil!

Leaking hydraulic oil will pollute the environment.

- Make sure that the damage is quickly remedied. Hydraulic oil entering the soil requires immediate large-scale excavation of the contaminated ground.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.
- Observe the safety precautions and regulations in the technical and toxicological data sheet from the hydraulic oil producer!

2.6 Safety instructions for work on the electrical system

⚠ DANGER

Danger due to electrical power!



Risk of injury due to electric shock upon contact with live parts.

- Switch off the machine before starting work on the electric system.
- Before carrying out any repair works on the electrical system, disconnect the ground cable from the battery of the drive unit or actuate the main power switch.
- Only allow skilled electricians or instructed persons working under the supervision of a skilled electrician to carry out work on the electrical system in accordance with the electrical engineering rules and regulations.

– Have the machine's electrical equipment checked by trained, skilled electricians regularly.
– Eliminate defects such as loose connections or scorched cables immediately.
– In the event of a short circuit, there is a sparking and fire hazard.
– Only use original fuses with the required current rating and tripping characteristic. When you replace a fuse, first search for the cause of the fault and remedy the fault before replacing the fuse.
– For work on live parts, use insulated tools only.
Work with another person who can switch off the machine via the main power switch in the event of an emergency.
– The battery voltage of the electrical system is 24 V.
– Do not disconnect any cables between the battery, regulator and alternator (e.g. by disconnecting the battery) while the diesel engine is running.
– Keep the battery clean and free from corrosion.
– Dispose of used batteries according to regulations.
– Switch off the main power switch when carrying out repairs (e.g. welding work) and when the machine is not operated for more than 2 days.

2.7 Personnel qualification

Before starting work on the machine all persons charged with work undertake the following:

- They shall respect the basic regulations on work safety and accident prevention.
- They shall read the safety and warning information contained in these instructions and confirm with their signature that they have understood this information.
- They shall use their personal / work-related protective clothing and other means to guarantee operational safety during the operation of the device, provided that this is required for the purpose of ensuring safety.

The machine may only be operated by personnel who have been trained or instructed by TRACTO-TECHNIK and who have read and understood these instructions.

Personnel to be trained or instructed, as well as trainees, may only work with the machine under constant supervision of an experienced person.

Observe the legal regulations valid at the application site regarding the minimum age of the personnel.

The different personnel qualifications are based on the following skills and knowledge:

Tab. 2-1 Personnel qualification – skills and knowledge

Personnel with the qualification	must be able to do the following:
Instructed person	– operate the machine – identify possible damage and recognize possible hazards relating to the machine
Industrial mechanic	– read and understand construction drawings – carry out mechanical maintenance work – ensure the functionality of mechanical components – identify possible hazards when working with mechanical components
Skilled electrician	– read and understand electric circuit diagrams – put electrical systems into service and maintain them – wire switch and control cabinets – install control software – ensure the functionality of electrical components – identify possible hazards when working with electrical and electronic systems
Hydraulic specialist	– read and understand hydraulic circuit diagrams – put hydraulic systems into service and maintain them – mount and disassemble hydraulic hoses – ensure the functionality of hydraulic components – identify possible hazards when working with hydraulic systems

The individual activities on the machine require the following personnel qualifications:

Tab. 2-2 Required personnel qualification

Activities	Instructed persons[1)]	Specialists[2)] with the qualification "industrial mechanic"	TRACTO-TECHNIK service technicians	Site management
Construction site planning				X
Transport	X			
Set-up, assembly	X			
Electrical installation			X	
Start-up, operation, shutdown	X			
Disassembly	X			
Electrical de-installation			X	
Cleaning	X			
Mechanical work: trouble-shooting, repair and maintenance		X		
Work on the electrics: trouble-shooting, repair and maintenance			X	
Work on the hydraulics: trouble-shooting, repair and maintenance			X	
Disposal	X			

1) Instructed persons have been trained by TRACTO-TECHNIK in working with the machine. PC knowledge is required for machines supplied with a PC user interface.

2) A skilled worker is a person who, on the grounds of his/her specialist training, knowledge and experience and based on his/her knowledge of the relevant regulations, is able to assess the work he/she has been entrusted with and to identify possible hazards.

In addition to the training by TRACTO-TECHNIK, the site management must also be able to provide evidence of trainings in the field of "earthwork methods". The person must have knowledge and supervision of:

- potential dangers and hazard prevention
- securing the construction site
- deploying appropriate personnel
- wearing the personal protective equipment
- the correct application of the tools required
- the complete range of functions of the machine
- safety devices
- observing the operating conditions
- observing the maintenance intervals

Besides training by TRACTO-TECHNIK the operators must also have knowledge about:

- potential dangers and hazard prevention
- securing the construction site
- wearing the personal protective equipment
- the correct application of the tools required
- safety devices
- observing the operating conditions

Only personnel having this knowledge or who can operate the machine as intended may be allowed to operate the machine.

2.8 Safety signs and labels

The following safety signs and labels are attached to the machine. Check them on a regular basis. Replace illegible safety signs and labels.

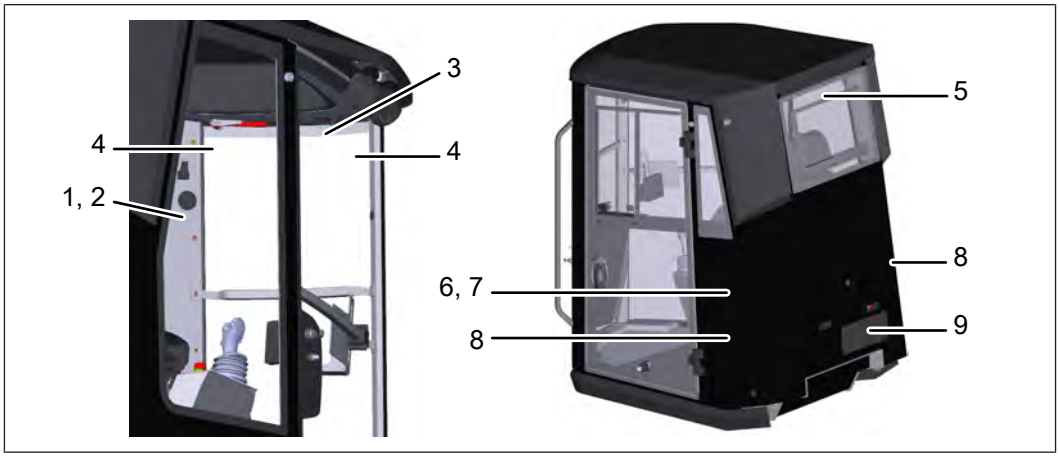
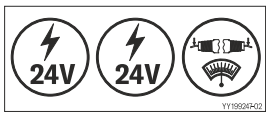
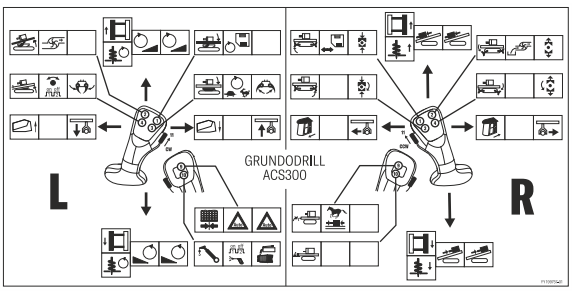
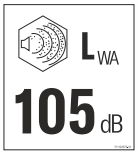
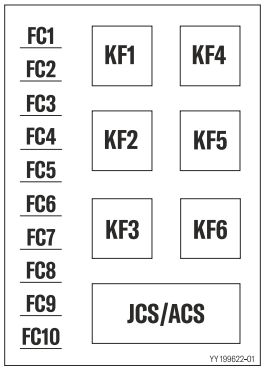


Fig. 2-1 Safety signs and labels inside the cab

Tab. 2-3 Safety signs and labels inside the cab

Item	Safety signs, labels	Meaning
1		The bore radius of the specified drill rod must not be smaller than $R_{min.}$, otherwise there is a danger of drill rod breakage. **Note!** The precise labelling depends on the type of rod.
2	 (sample)	indicates when the next expert check is due
3		indicates the connections for wire-controlled drilling
4		marks the emergency exit (accessible after breaking a window)
5		inside the cab: indicates the functions of the operating elements on the left and right joystick

Item	Safety signs, labels	Meaning
6		Wear ear protection! Wear ear protection while operating the machine.
7		Follow the instructions
8		indicates the guaranteed sound power level outside the machine
9	Cab relay module (behind the service flap): 	Fuse and relay assignment: FC1 = 30 A = positive ignition FC2 = 10 A = I/O-module electronics/locking system FC3 = 10 A = radio / walkie-talkie / tablet FC4 = 10 A = windscreen wiper (KL30) FC5 = 15 A = air conditioning FC6 = 10 A = Zap Alert FC7 = 15 A= sockets top FC8 = 15 A= sockets bottom FC9 = 15 A= I/O-module FC10 = 10 A = operator seat KF1 = ignition (KL15) KF2 = windscreen wiper front KF3 = windscreen wiper side KF4 =radio ignition KF5 = -- KF6 = air conditioning compressor

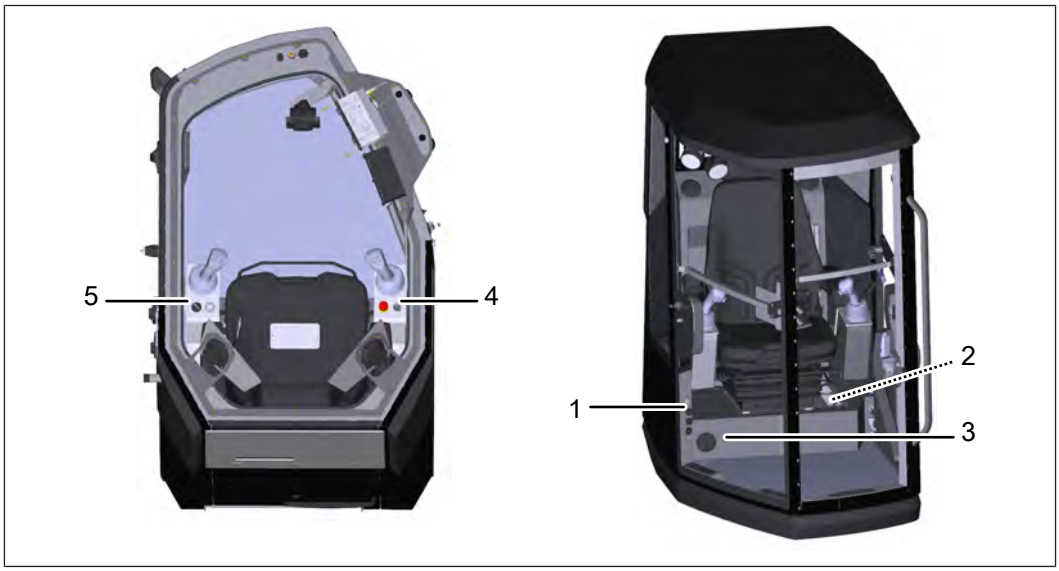
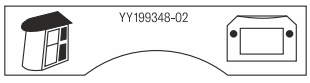
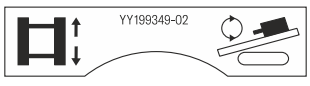


Fig. 2-2 Safety signs and labels inside the cab

Tab. 2-4 Safety signs and labels inside the cab

Item	Safety signs, labels	Meaning
1		indicates the power connections in the cab 1 x USB full-fledged data and charging socket 1 x USB charging socket (5 V) 3 x 24 V
2		indicates the switch used to switch off the alarm of the electric shock warning device
3		Keep fan outlet under the seat clear
4		indicates the switch on the right joystick panel left: operation with joysticks inside the cab right: operation with portable operating terminal
5		indicates the switch on the left joystick panel left: drive mode right: drilling operation / bore mode

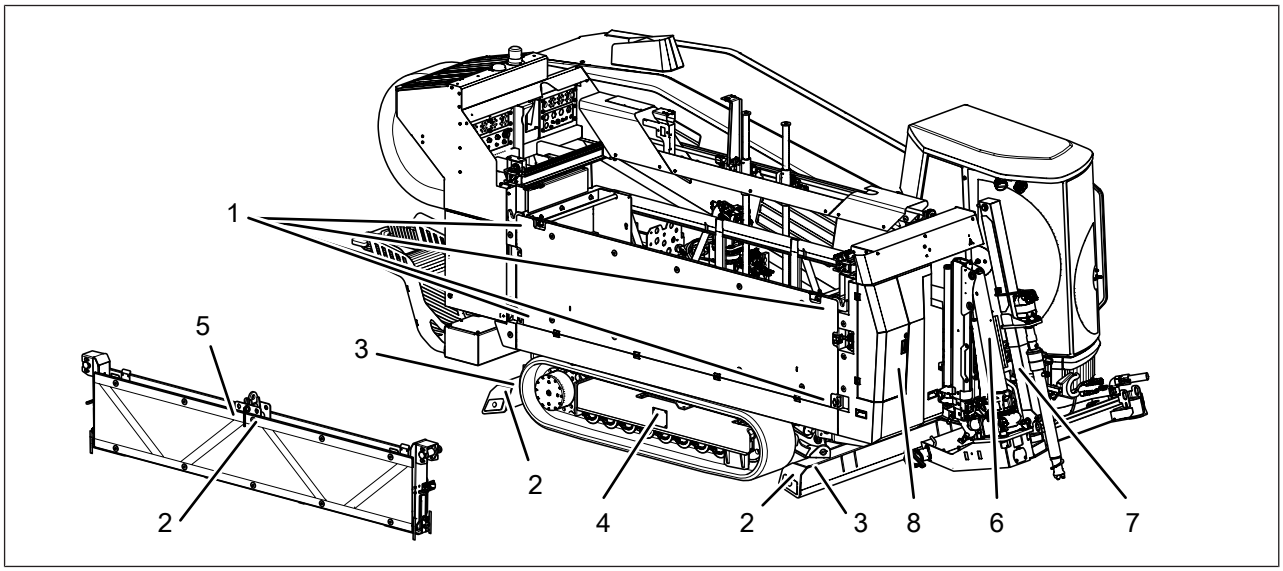
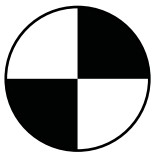
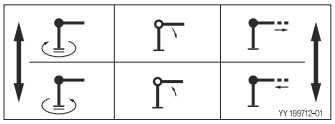


Fig. 2-3 Safety signs and labels on the machine

Tab. 2-5 Safety signs and labels on the machine

Item	Safety signs, labels	Meaning
1		Rod box, compartment for removing individual drill rods, additional box, clamp, thrust rig: warning of hand injury
2		Attachment point (4 x on the stabilisers, 1 x on the additional box) indicates the positions at which lifting means can be attached for lifting the machine
3		Lashing point (4 x on the stabilisers) indicates the lashing eyes for transport on a truck/trailer
4		indicates the centre of gravity
5		indicates the maximum weight of the additional box
6		Loading crane: warning of suspended loads

Item	Safety signs, labels	Meaning
7		rotational drive anchor boring unit, thrust rig: warning of draw-in hazard
8		indicates the functions of the loading crane in the event of a failure of the radio remote control

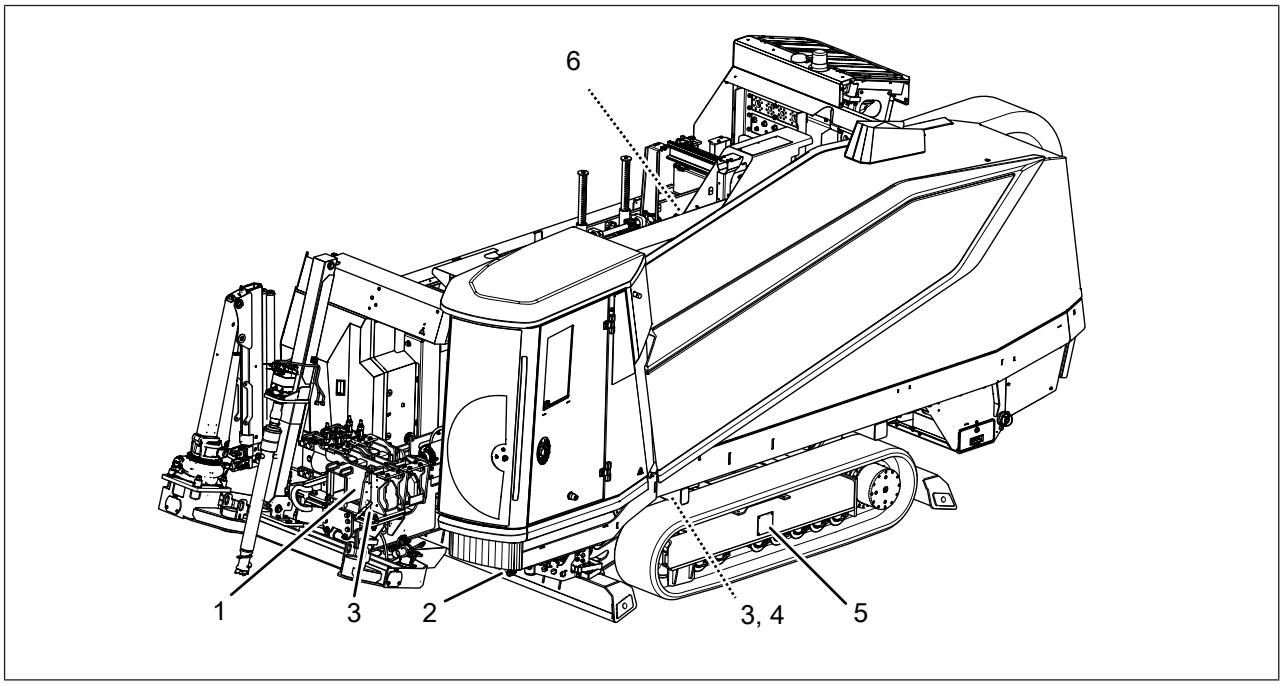
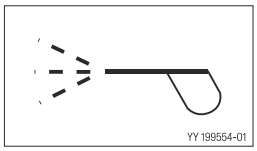
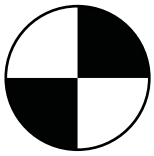


Fig. 2-4 Safety signs and labels on the machine

Tab. 2-6 Safety signs and labels on the machine

Item	Safety signs, labels	Meaning
1		Rod box, compartment for removing individual drill rods, additional box, clamp, thrust rig: warning of hand injury
2		indicates the grounding connection for the electric shock warning device (Zap-Alert)
3		Indicates the connection for the high-pressure cleaner.
4		Drilling fluid connection: At air and ground temperatures of approx. 0 °C and below there is a danger of the water freezing. This might destroy the drilling fluid pump. Protect it with antifreeze.
5		indicates the centre of gravity

Item	Safety signs, labels	Meaning
6	 Laser beams Do not look into the beam. Laser class 2	at the thrust rig: Danger due to laser beams Lasers of class 2 only radiate in the visible range and produce no more than 1 milliwatt (mW) in continuous wave operation (longer-lasting beam). Looking directly into the beam will cause a strong blinding effect but will not cause any damages, even in case that optical aids are used. The reflexive closing of the eyelids must however not be withheld by force.

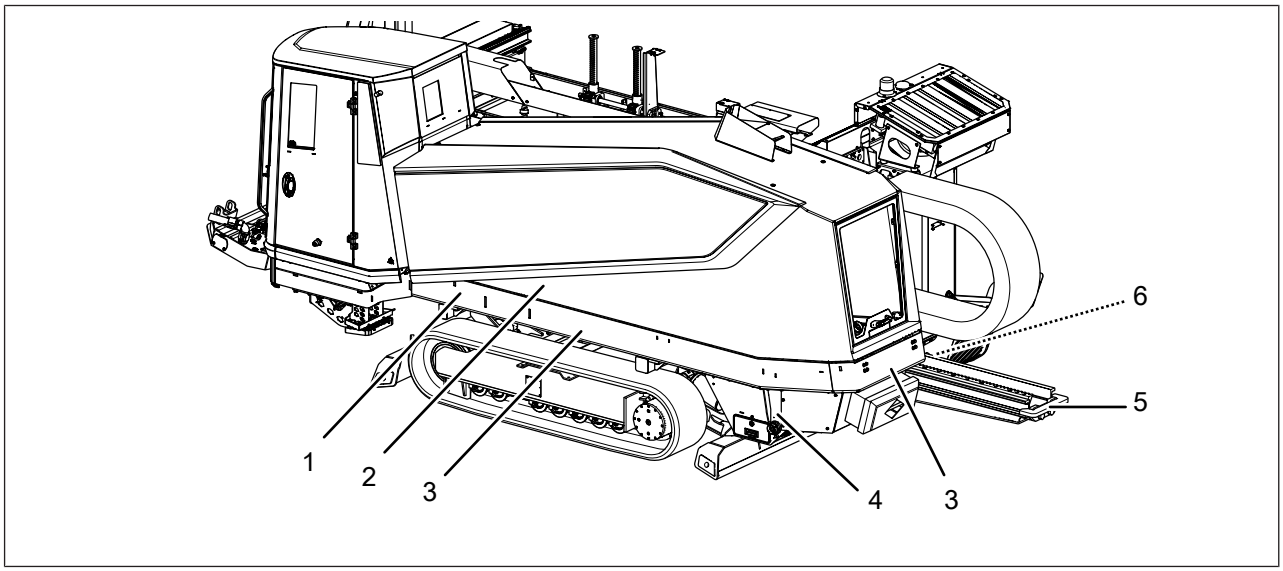
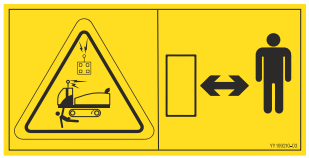
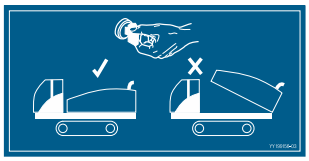
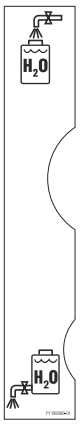
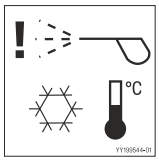


Fig. 2-5 Safety signs and labels on the machine

Tab. 2-7 Safety signs and labels on the machine

Item	Safety signs, labels	Meaning
1		Caution! The machine is remote-controlled. Keep your distance!
2		Only open the bonnet when the engine is not running, otherwise there is a danger of burns.
3		on the anchor boring unit, on the rear, on the side of the machine (frame): It is prohibited to stand in the danger area.
4		indicates the position of the supply (top) and outlet (bottom) of the fresh water tank

Item	Safety signs, labels	Meaning
5		at the rig: Warns of an impact hazard due to protruding machine parts.
6		At air and ground temperatures of approx. 0 °C and below there is a danger of the water freezing. This might destroy the high-pressure cleaner. Protect it with antifreeze.

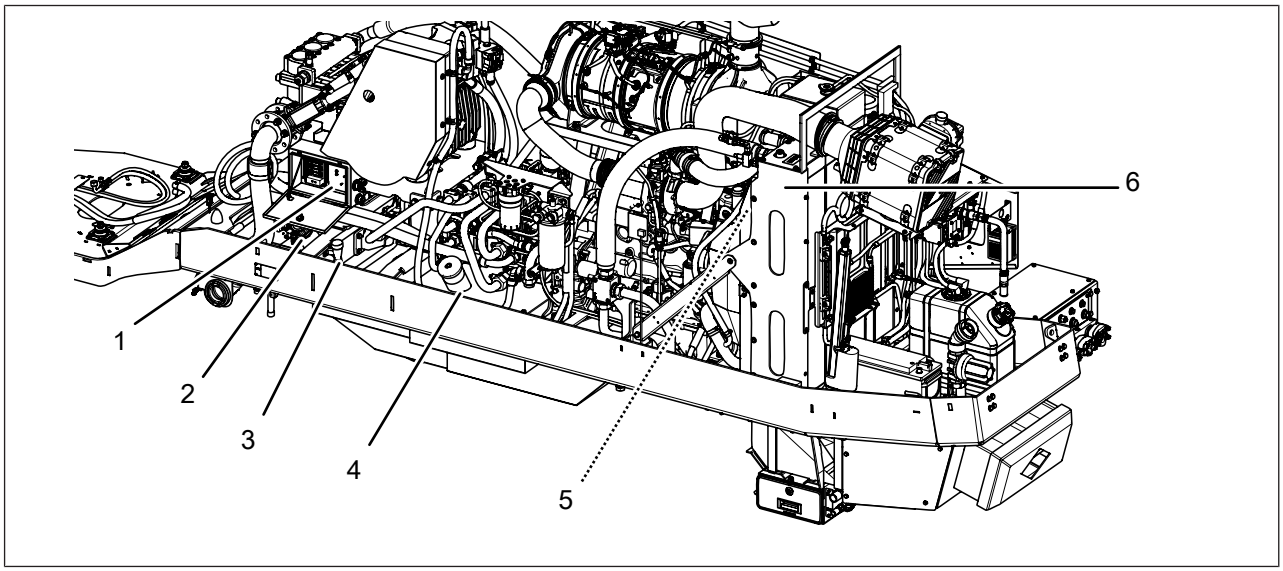
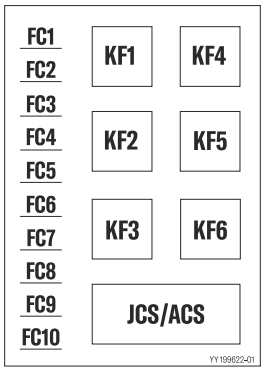
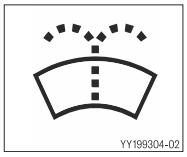
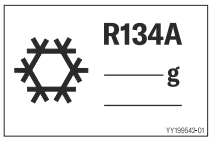


Fig. 2-6 Safety signs and labels in the engine compartment

Tab. 2-8 Safety signs and labels in the engine compartment

Item	Safety signs, labels	Meaning
1	Drive relay module: 	Fuse and relay assignment: FC1 = 5 A = positive ignition FC2 = 20 A = linear motor cab (KL30) FC3 = 30 A = linear motors bonnet (KL30) FC4 = 20 A = diesel fuel pump (KL30) FC5 = 15 A = water pump (KL30) FC6 = 10 A = auxiliary heating system – supply (KL30) FC7 = 3 A = supply relay KF2 – KF4 (KL30) FC8 = 15 A = auxiliary heating system – fan (KL30) FC9 = 5 A = auxiliary heating system – operating unit (KL30) FC10 = -- KF1 = ignition voltage diesel engine KF2 = enable linear motor cab KF3 = enable linear motors bonnet KF4 =enable diesel fuel pump KF5 = water pump KF6 = auxiliary heating system – fan
2		Only use permitted or approved types of hydraulic oil for the hydraulic system in order to prevent any damages to the hydraulic system. Note: The precise labelling depends on the oil grade.
3		indicates the filler neck for the washer water

Item	Safety signs, labels	Meaning
4		indicates the diesel filler neck
5		indicates the type and quantity of coolant used by the air conditioner
6		on the fan casing: warning of draw-in hazard

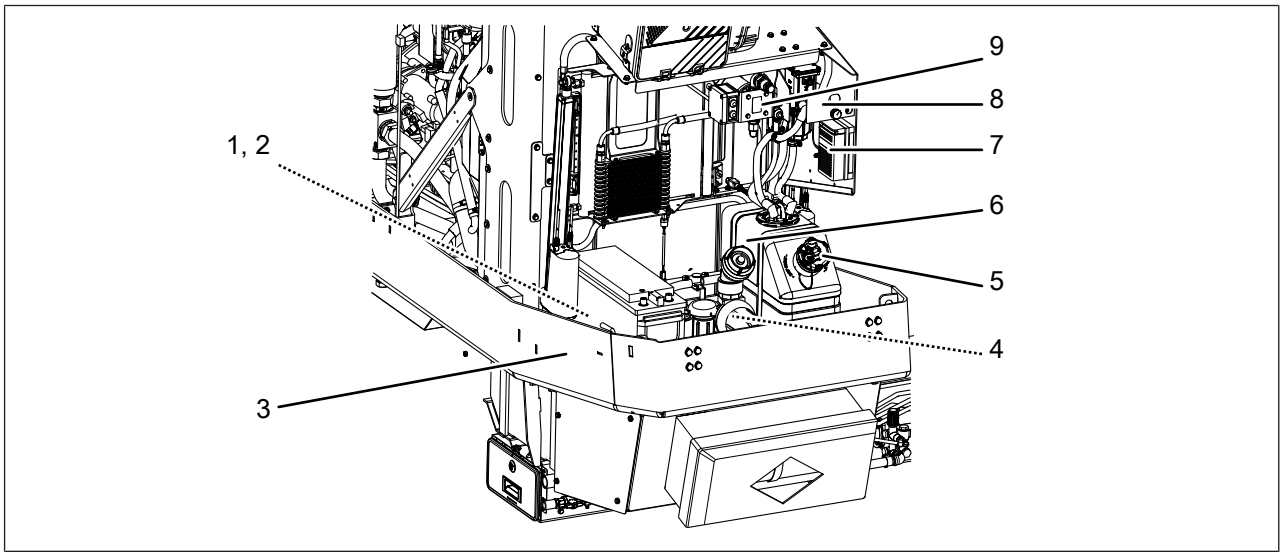
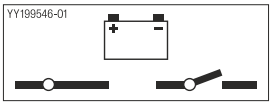
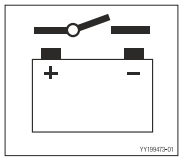
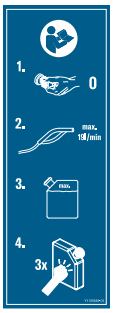
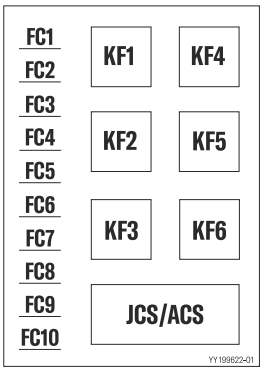
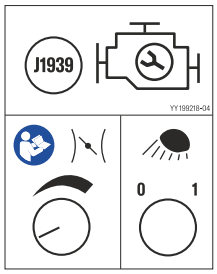


Fig. 2-7 Safety signs and labels on/inside the engine compartment at the rear

Tab. 2-9 Safety signs and labels on/inside the engine compartment at the rear

Item	Safety signs, labels	Meaning
1		Behind the tailgate: Switch position of the main power switch
2		Behind the tailgate: Only operate the main power switch after the LED has gone out, at the earliest after 90 seconds.
3		indicates the main power switch
4		Behind the tailgate: Indicates the connection to fill the fresh water tank
5		Behind the tailgate at the DEF tank: Indicates the filler neck for the diesel exhaust fluid (DEF)

Item	Safety signs, labels	Meaning
6		Behind the tailgate at the DEF tank: Instructions for filling the DEF tank
7		Behind the tailgate, relay module for diesel engine: Assignment of the fuses and relays: FC1 = 5 A = exhaust gas after-treatment - sensor system FC2 = -- FC3 = 15 A = DEF[1)] hose heatings FC4 = 10 A = DEF feed module FC5 = 15 A = exhaust gas after-treatment - sensor system FC6 = 30 A = steady plus engine control unit FC7 = -- FC8 = -- FC9 = -- FC10 = -- KF1 = exhaust gas after-treatment - sensor system KF2 = DEF feed module KF3 = DEF hose heating 1 (pressure line) KF4 = DEF hose heating 2 (return line) KF5 = DEF hose heating 3 (suction line) KF6 = switch lock for starter [1)] DEF = Diesel Exhaust Fluid (e.g. AdBlue®)

Item	Safety signs, labels	Meaning
8		Behind the tailgate: Diagnostic connector diesel engine Grants the service technician direct access to the engine control unit via a standardised communication interface Engine speed potentiometer Is only enabled if the diesel engine does not communicate with the machine control. Through the potentiometer directly connected to the engine control unit, you can adjust the engine speed. Make sure that the potentiometer is at the left stop in normal operation. Otherwise, regeneration of the exhaust gas after-treatment cannot be activated during standstill. Maintenance lights switch Switches the maintenance lights behind the tailgate and under the bonnet on and off Manually switch off the lights after completing maintenance work!
9		Behind the tailgate: Indicates the position of the fuel pump

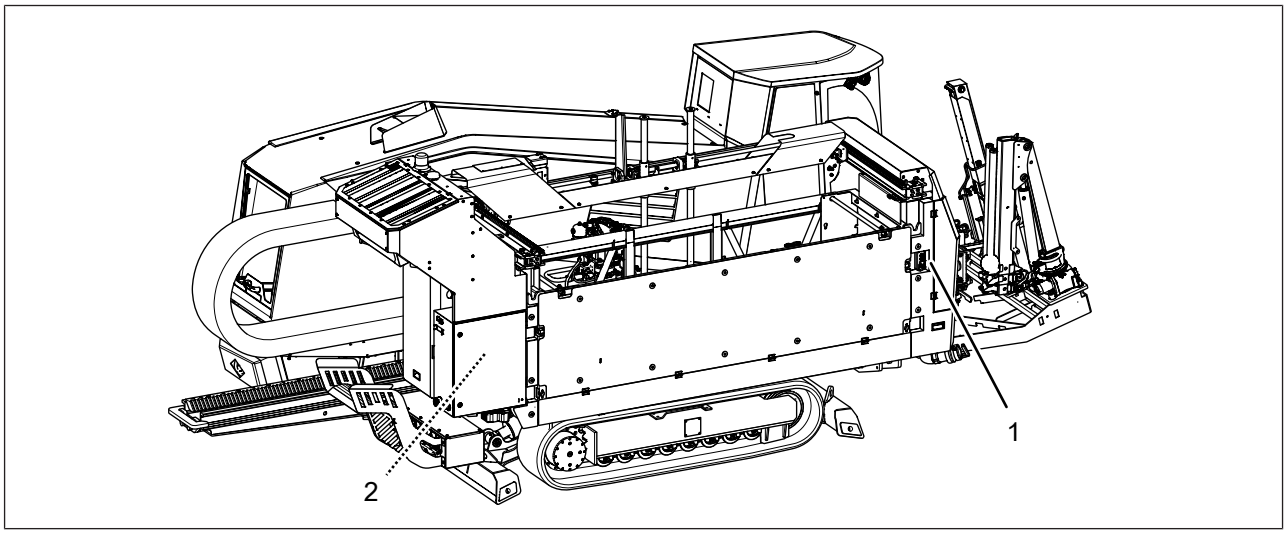
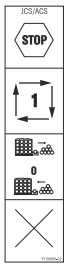
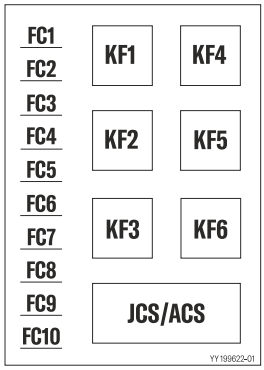


Fig. 2-8 Safety signs and labels on/inside the electrical control cabinet

Tab. 2-10 Safety signs and labels on/inside the electrical control cabinet

Item	Safety signs, labels	Meaning
1		indicates the switches/buttons: Emergency stop button Start loading or unloading Selection of loading or unloading of the rod box
2	inside: relay module for electrical switch cabinet: 	Fuse and relay assignment: FC1 = 30 A = positive ignition FC2 = 15 A = potential distributor permanent positive (KL30) FC3 = 5 A = permanent positive CPU control unit 1 FC4 = 5 A = permanent positive diesel engine indication FC5 = 25 A = supply control 1 FC6 = 25 A = supply control 2 FC7 = 20 A = potential distributor ignition (KL15) FC8 = 5 A = options FC9 = 5 A = rig sensors FC10 = 5 A = drive sensors FC12 = 30 A FC13 = 5 A KF1 = ignition (KL15) KF2 = working lights KF3 = -- KF4 = -- KF5 = enable voltage supply loading crane KF6 = charging indicator alternator

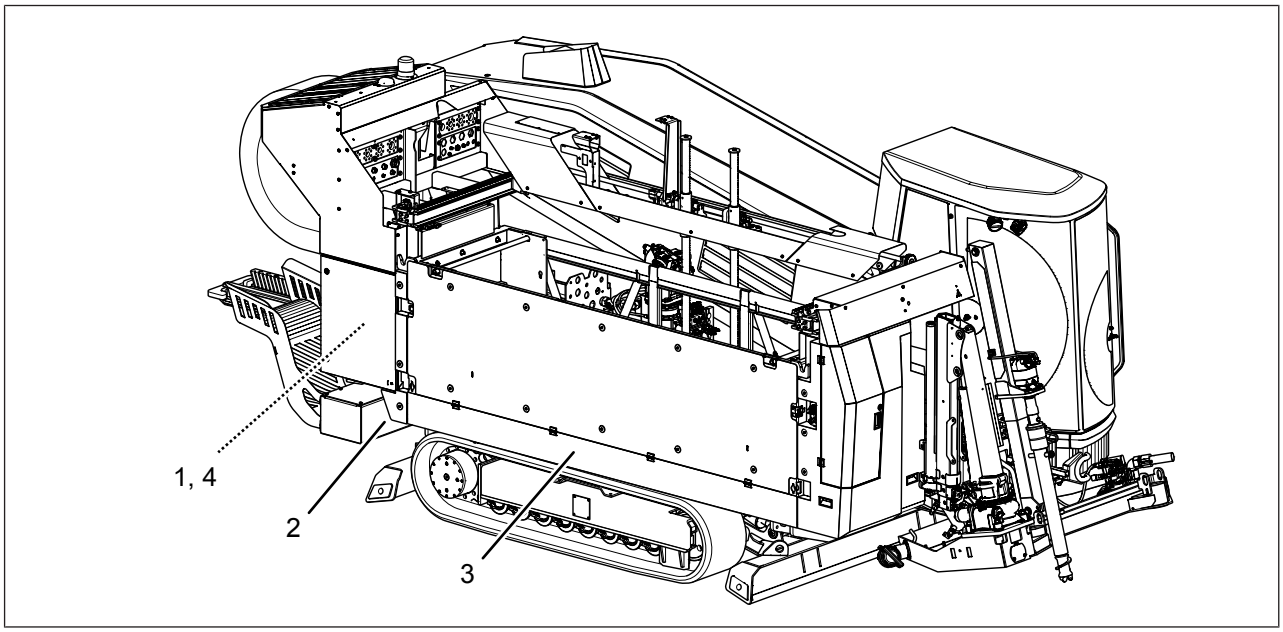
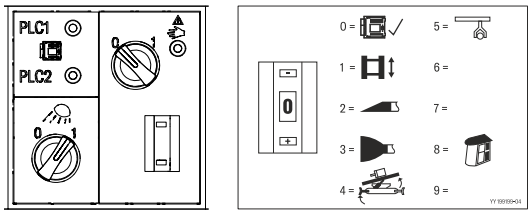
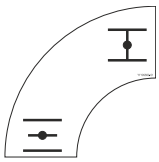
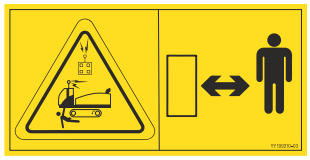
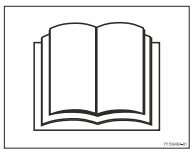
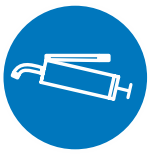


Fig. 2-9 Safety signs and labels on/inside the electrical control cabinet

Tab. 2-11 Safety signs and labels on/inside the electrical control cabinet

Item	Safety signs, labels	Meaning
1	inside: 	left: PLC1: LED status control unit PLC2: LED status control unit "Control cabinet lighting" rotary switch "Emergency mode" rotary switch right: indicates the operating modes for emergency operation
2		indicates the ball valve for connecting a high-pressure cleaner to the rear of the machine horizontal: ball valve open vertical: ball valve closed
3		Caution! The machine is remote-controlled. Keep your distance!
4		indicates the compartment for machine documentation
-		indicates important lubrication points

2.9 Safety devices at the machine

The following safety devices are installed on the machine. Check them for proper functioning prior to start-up. Do not start the machine if the safety devices are not fully functional. Repair or replace defective safety devices before starting to operate the machine.

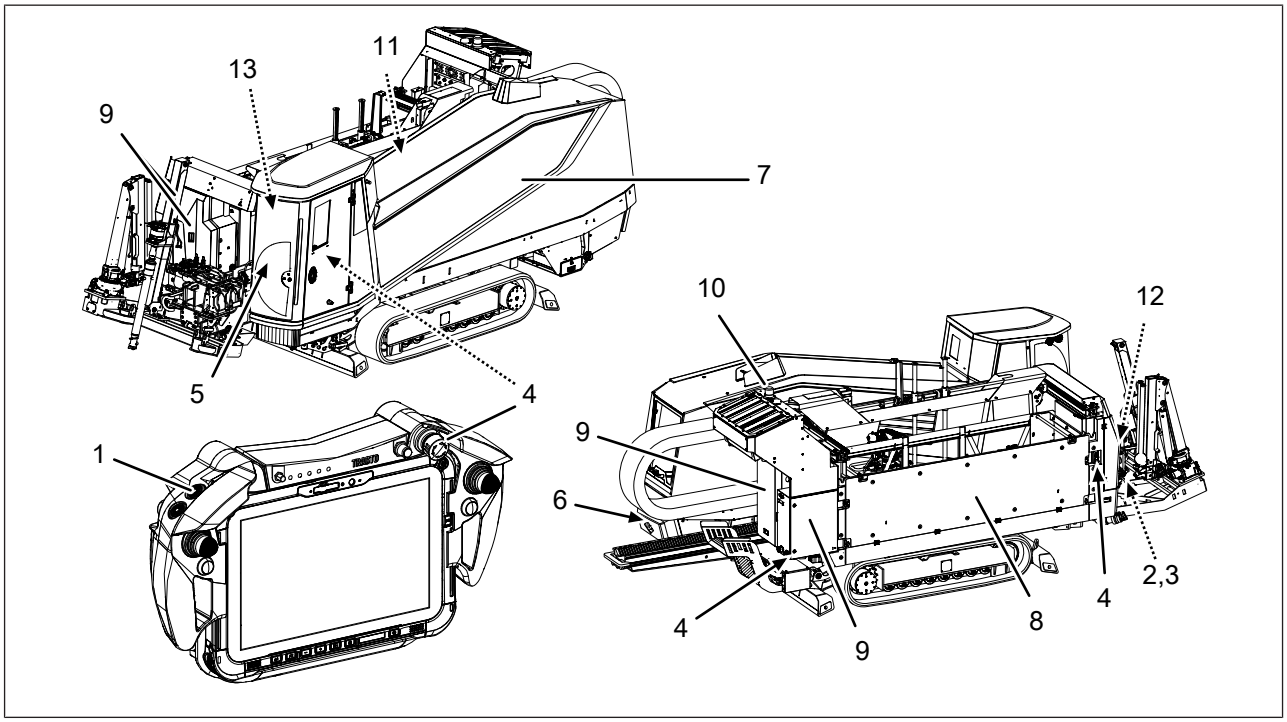


Fig. 2-10 Safety devices at the machine

Tab. 2-12 Safety devices at the machine

Item	Safety device	Function
1	Horn	serves to warn persons and is switched on by means of a button on the operating terminal In drive mode, the horn sounds automatically.
2	Pressure relief of high-pressure cleaning pump	The water pressure can be relieved via a ball valve before the high-pressure cleaner is connected.
3	Drilling fluid pressure relief	is carried out automatically when the clamping tongs are closed
4	Emergency stop button	switches off the machine in an emergency One emergency stop button each is located on the right joystick panel, on the operating terminal and on the electrical control cabinet on the right side of the machine. **Attention!** The emergency stop button on the operating terminal is only enabled (= illuminated in red) if the operating terminal is enabled.
5	Emergency exit	for exiting the cab in an emergency
6	Fire extinguisher	mounting option for a fire extinguisher

Item	Safety device	Function
7	Bonnet	Prevents the operator from reaching into the diesel engine area
8	Protective cover	protects the operator from reaching into the movement range of the rod crane
9	Lockable protective flap	protects the operator from reaching into the control unit
10	Warning light	serves to warn persons in drive mode and is switched on in the menu at the operating terminal
11	Camera monitoring sub-saver	serves to monitor the sub-saver while the rods are screwed on or off The camera image is shown on the operating terminal.
12	Camera monitoring clamping device	serves to monitor the clamping device and the area where the rod enters the ground The camera image is shown on the operating terminal.
13	Emergency hammer	inside the cab: for breaking a window in an emergency in order to exit the cab

Emergency stop button

The emergency stop buttons are located in the following positions:

- on the operating terminal
- on the operator seat
- on the outside of the electrical control cabinet

In case of an emergency press the emergency stop button.

Prior to start-up check the emergency stop buttons for proper functioning as described in chapter 9.8.3, page 273. If the emergency stop button is not fully functional, do not start the machine under any circumstances. Repair the defective emergency stop button first and replace it with a functional one.

Info!
The emergency stop button on the operating terminal is only enabled (= illuminated in red) if the operating terminal is enabled.

Info!
The emergency stop button on the operating panel of the loading crane only switches off the functions of the loading crane.
The machine's diesel engine remains in operation!

Warning light

There is a warning light on top of the machine. Before traversing the machine, switch on the warning light in the menu of the operating terminal.

Warning signals/ horn

The machine is equipped with a horn. You can actuate the horn by pressing the button on the operating terminal.

Protective covers

The engine and the electric control are located behind lockable protective covers. They prevent the operator from reaching into the danger area.

Emergency exit

Inside the cab there is an emergency hammer for breaking the front window. If the cab door cannot be opened, use the emergency hammer to break the front window. Then leave the cab through the hole in the window.

Drilling fluid pressure relief

The drilling fluid pressure relief is carried out manually during operating and prevents the drilling fluid from ejecting at the rod connection. When closing the clamping jaw, the bentonite pressure is automatically relieved.

Camera monitoring

To operate the machine from outside the cab, the operator must be able to monitor the danger areas on the sub-saver and the clamp. This can be achieved through camera monitoring. The camera image is shown on the operating terminal.

Electric shock protection device

The electric shock protection device is to protect the operating personnel from electric shocks, possibly caused by damaging an electric cable during drilling.

The electric shock protection device consists of:

- electric shock warning device (1, located on the left-hand side behind the operator seat)
- grounding stake of the electric shock warning device (2)
- grounding mat (3) with connection cable to the machine
- 1 m grounding cable with grounding stake (4)
- a second optional grounding mat (5)
- test unit for electric shock warning device
- safety boots and gloves

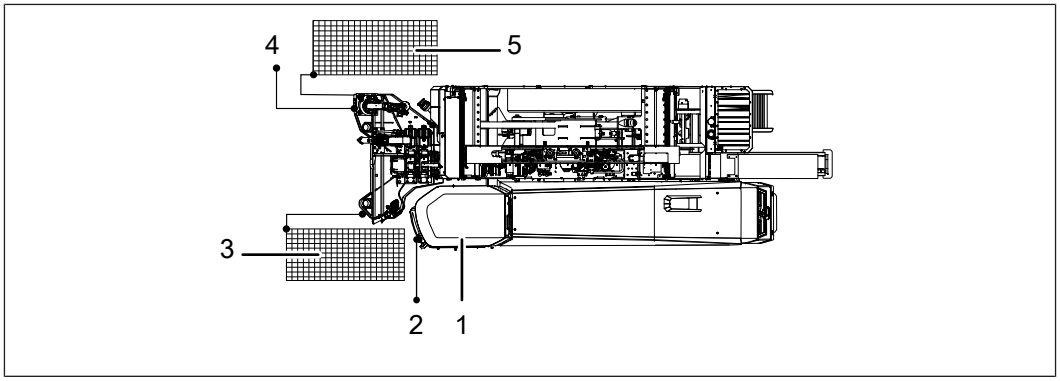


Fig. 2-11 Electric shock protection

The electric shock warning device is **no early-warning device**! It does not switch when slowly approaching an electric cable!

The electric shock warning device triggers an acoustic alarm when an electrical voltage of more than 40 V is present between the machine and the ground. This may be the case, for example, if a live wire is damaged.

In addition, a warning message appears on the display:

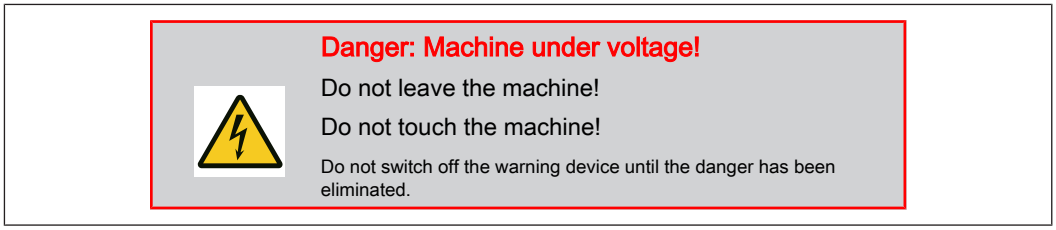


Fig. 2-12 Warning message for danger of electric shock

NOTICE

Short circuit caused by damaged cables!

A short circuit between two individual wires may be caused if a cable is damaged.
If so, no current is conducted into the ground or the drill rods.
The electric shock warning device does not sound.

- Look out for any power failures in the surrounding area.
- Stop the drilling operation if you notice a power failure in the surrounding area.

Check the electric shock warning device for proper functioning before each application (chapter 5.5.1, page 100)!

⚠ DANGER



Danger due to electrical power!

Risk of injury due to electric shock upon contact with live parts.
If the warning signal of the electric shock warning device sounds, there is a risk of death!

- Do not touch the drill rods or try to remove them.
- Reverse the roller chisel or drill head.
- Press the reset button on the enabled electric shock warning device.
- Stay on the grounding mat, as the power could otherwise flow through your body. Operators are safe when standing on the grounding mats.
- Warn people against touching the operators, the rig or the grounding mats.
- Have a non-affected person contact the relevant electric power station immediately.
- Notify the police or the fire brigade if the direct endangerment of persons cannot be immediately eliminated (e.g. by retracting the roller chisel).

2.10 Residual risks

Dangers can arise when working with the machine.

Observe the following warnings:

⚠ WARNING



Risk of injury if personal protective equipment is not worn!

- Always wear your personal protective equipment, including ear protection and a work vest in fluorescent colours.
- During drilling, wear the comprehensive protective equipment included in the scope of delivery of the electric shock warning device.

⚠ DANGER



Crush hazard for hands and fingers!

- at the clamp
- on the rod box/stacking boxes
- in the area of the rod crane of the rod changing system
- at the rod grippers of the rod changing system
- when inclining the boom
- when driving the stabilisers up and down
- when driving the anchor boring rig up and down
- when inclining the anchor plate

⇨ Only personnel required to operate the machine are allowed near the machine.

⇨ Keep out of the danger area!

⚠ DANGER



Draw-in hazard!

- at the rotating rotational drive
- at the rotating drill rods or drilling tools
- at the rotating anchor boring rig

⇨ Only personnel required to operate the machine are allowed near the machine.

⇨ Keep out of the danger area!

⚠ WARNING

Extending energy chain and extending drill rod!

The energy chain extends approx. 1.50 m to the rear. The drill rod extends to the front.
You may be hit.

- Keep out of the movement range of the extending energy chain and keep other persons away.
- Keep out of the movement range of the extending drill rod and keep other persons away.

⚠ DANGER

Rotating parts!

Contact with rotating parts can lead to injuries or death!

- Only start drilling operation if there is nobody in the range of rotating parts.
- Only personnel required to operate the machine are allowed near the machine.
- Keep away from rotating parts.

⚠ DANGER

Risk of injury due to pressurized diesel fuel!

High injection pressure of up to 1600 bar at engines with common rail injection leads to severe injuries when loosening the diesel lines!

- Never loosen the diesel lines within the high-pressure diesel circuit of the drive motors with common rail injection.

⚠ DANGER

Risk of injury due to moving parts during remote-controlled drilling!



Bumping, pulling in and crushing can cause serious injury to yourself and others during remote-controlled drilling.

- Keep out of the danger area marked in red and keep other persons away.
- Maintain visual contact with the danger area at all times during remote-controlled drilling.
- Secure the danger area with an additional separating protection device (e.g. with a fixed fence) if maintaining visual contact with the danger area is not possible.
- Observe the safety measures required on site in the chapter "Securing the construction site".
- In case of emergencies, immediately press the emergency stop button.

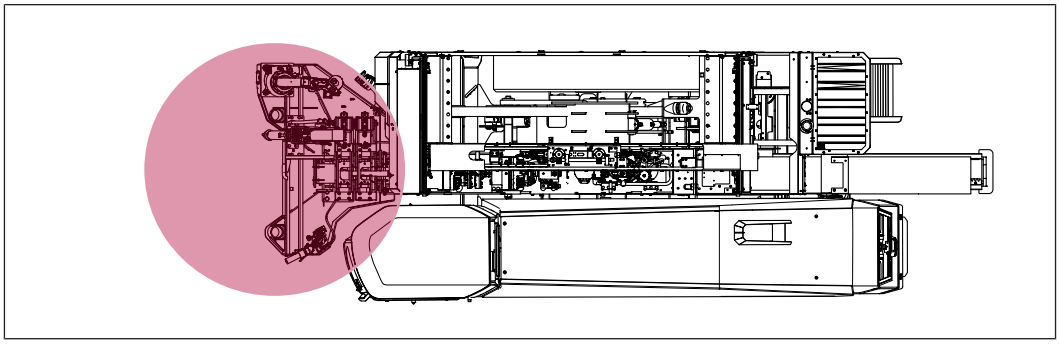


Fig. 2-13 Danger area during remote-controlled drilling

The following dangers can occur when working with the machine in the target pit:

⚠ DANGER

Crush hazard in the target pit:
- when preparing the product pipe to be connected
- when disconnecting the drill head
- when connecting the tool
- when connecting the product pipe
- when pulling accessories into the bore hole



- Completely relieve the machine and the rod string of tension before starting work on the drill head or on the draw-in accessories (e.g. clamping the expander). The rotational drive could cause the release of torsional force!
- Always operate the machine with the wireless pit remote control when working in the target pit (chapter 5.3.8, page 88).

The following dangers apply to the entire site:

⚠ WARNING

Trip hazard on the site:
- over drilling fluid hoses and hydraulic hoses
- over electric cables
- into the pits
- over the product pipe
- over machine accessories



- Always exercise caution when working!
- Watch out for obstacles!
- Watch out for jolting movements of the hoses!

⚠ WARNING

Possible hazard due to the drill head caused by faults during the data transmission from the detection system to the operating terminal!

The accuracy of data generated by the detection system can be influenced by various factors such as signal interference (passive or active) and other environmental conditions, improper use of the detection system by the operator, the non-observance of instructions in the operating manual of the detection system and improper calibration of the detection system.

- Please observe the operating manual of the manufacturer of the detection system!
- Before starting the drilling process, make sure that the detection system has been correctly calibrated.
- Closely observe the drilling process at all times.

⚠ DANGER

Hydraulic oil spurting out!
Residual pressure between cylinder and check valve when the rig boom is inclined or the clamping mechanism closed, as well as at the stabilisers!

Pressurized hydraulic oil can injure you when spurting out.

- Never tighten pressurized screw fittings.
- Depressurize the hydraulic system before starting maintenance, servicing and repair work by switching off the machine!

⚠ DANGER

Danger due to suspended loads when operating the loading crane!



You can be bumped by the load hanging on the loading crane.
The load may fall and injure you.

- Staying under a suspended load is prohibited.
- Keep out of the loading crane's swivel range.
- Adhere to the permissible load capacity of the loading crane.
- Wear head, hand and foot protection.

2.11 Danger due to adjacent lines and pipes

During the pilot bore the drill rod is forced into the ground with the drill head upfront. If the distance to adjacent lines is insufficient, they are in danger of being damaged or severed!

Hazard prevention

To prevent dangers, gather information during the construction site planning phase from the respective institutions regarding adjacent pipes and lines in the construction site area.

Regarding installed ...	you will be able to obtain information from ...
electric cables	power supply companies
telephone cables, data cables	cable network operators
gas lines	gas supply companies
water pipes	municipal utilities
sewage pipes	municipal utilities

NOTICE

Possible damage to underground lines!

The detection system cannot be used to detect underground supply lines!

- Determine and verify the exact position of underground supply lines in the construction site area employing other suitable methods.

What to do in case of danger

Lines in close vicinity to the bore hole can cause various dangers if they are damaged. In case of damage, take the following measures depending on the type of line:

Electrical lines

⚠ DANGER

Risk of death due to electrical power!



Risk of an electric shock when leaving the machine as damage occurs.

- If you are situated on the machine as damage occurs, stay on the machine!
- Observe the cable protection instructions from utility companies.
- Warn people against touching the operators, the rig or the grounding mats!
- Have a non-affected person contact the relevant electric power station immediately!
- Secure the damage area.
- Prevent unauthorized access.
- Notify the police or the fire brigade if the direct endangerment of persons cannot be immediately eliminated (e.g. by retracting the roller chisel).
- Make sure that the fire brigade, ambulance and fault-clearing service have free access.

Fibre optic cables

⚠ WARNING

Risk of eye injuries!

- In the event of damage do not look into defective fibre optic cables.
- Observe the cable protection instructions from the telecommunication company.
- Notify the cable network operator.

Gas lines

⚠ DANGER

Explosion hazard due to leaking gas!



- Do not make use of open fire.
- Extinguish all flames and do not start a new fire.
- Switch off all engines.
- Do not actuate any electrical switches and do not unplug any cable connectors.
- Secure the damage area.
- Prevent unauthorized access.
- Inform the responsible utility company.
- Have the police, fire brigade and ambulance notified.
- Make sure that the fire brigade, ambulance and fault-clearing service have free access.

Water pipes

⚠ WARNING **Risk of injury due to pressurized water!**

- Close the nearest gate valve.
- Inform the responsible utility company.
- Inform the police or fire brigade if persons are endangered.

Sewage pipes

⚠ WARNING **Risk of injury due to water escaping unexpectedly!**

- Always enter manholes or sewage pipes with at least one other person.
- Always enter any manholes or sewage pipes with appropriate protective equipment.
- Inform the pipe owner.

2.12 Working in pits

When working in pits observe the following:

⚠ WARNING **Risk of falling into the pit!**



- Determine the pit depth!
- Only enter the pit under the supervision of an expert!
- Only enter and exit pits and trenches with a depth of more than 1.25 m via appropriate facilities (support walls, stairs, footsteps, ladders, step irons).
- When there is danger of falling into a pit with a depth of > 5 m, always work with an appropriate safety device.

Secure the pits as follows:

– Secure holes in the ground with appliances in a way to prevent people from falling in. Fence off the opening, make it accessible or cover it with an immovable cover.
– Secure working areas near public roads or railway tracks by means of barriers, safety posts or signalling devices.
– When working in pits and trenches, earth and rock faces must be scarped or sheeted in a way that workers are secured against slipping soil. All influences possibly impairing the soil's stability (rain, vibrations etc.) must be taken into consideration.



– Prevent unauthorized access.

2.13 Behaviour in case of an emergency

1. Switch off the machine by pressing one of the emergency stop buttons on the operating terminal, the electrical control cabinet or the right joystick panel yourself or having it pressed by another person.
2. Safely store the remote control key so that the engine is not switched on unexpectedly.
3. Implement suitable measures depending on the type of damage (chapter 2.11, page 39).
4. If a line is affected, notify the operating company/owner of the line.
5. Determine the type and extent of the damage.
6. Warn passers-by and residents. Keep them away from the accident site.

Investigate the cause for actuating the emergency stop button and have the cause eliminated before setting the emergency stop button back.

Only restart the machine after elimination of the emergency. To do so, unlock the emergency stop button by turning it clockwise.

2.14 Behaviour in the event of an accident involving personal injury

Please proceed as follows in the event of an accident involving personal injury:

1. Switch off the machine immediately.
2. Secure the scene of the accident.
3. Take care of your own safety.
4. If possible, remove the person from the danger zone.
5. Report the accident by calling the local emergency number. Provide brief but precise details regarding:
   - ⇨ Place of accident
   - ⇨ Course of events leading to the accident
   - ⇨ Number of injured people
   - ⇨ Types of injuries
   - ⇨ Your own name
6. Please wait for possible further inquiries.
7. Administer first-aid treatment.
8. Notify the company management.

3.1 Functional principle

The bore starts in an entrance pit which facilitates the entry of the drill head.

For the operation of the machine an additional starting pit, intermediate pit or target pit may be prepared on the construction site.

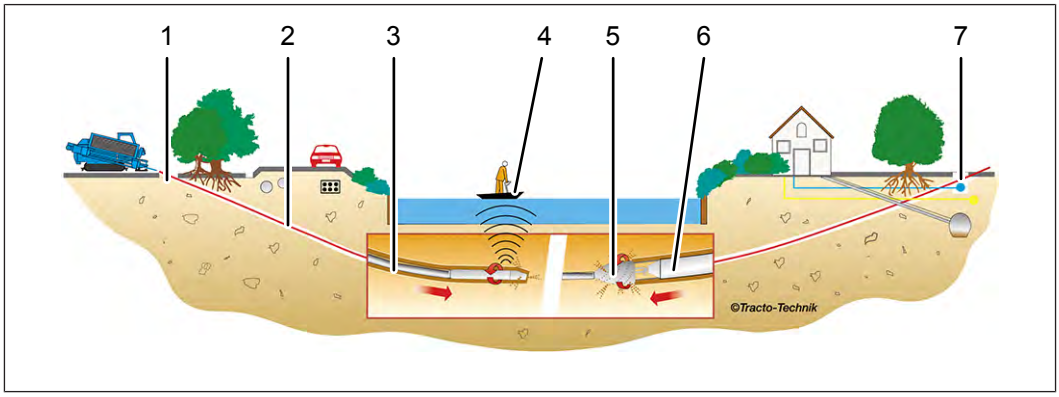


Fig. 3-1 Construction site with entrance pit, target pit and drill rods

1	Entrance pit	5	Expander head
2	Rod string	6	Product pipe
3	Pilot bore	7	Target pit
4	Detection system		

The machine is set up in front of the entrance pit and anchored to the ground via the anchoring unit. The machine is supplied with drive energy via the integrated drive unit.

Whilst drilling under hydraulic pressure, the machine shoves the rod string with the drill head through the ground. This is how a pilot bore is created between entrance pit and target pit.

A rod guidance on the machine prevents the drill rods from bending between the sub-saver and the entrance point in harder ground.

The twin tube rod (standard machine version) consists of an inner and an outer rod. The inner rod serves to carry out the actual drilling process. The outer rod serves to control the drilling direction. The outer rod protects the inner rod from damages and leads the drilling fluid towards the drill head in the front.

By means of the loading crane, individual drill rods are added to the rod box or removed therefrom. The loading crane is also used to hook in and remove the additional box for additional drill rods.

The drill rods are added via a fully automatic rod changing system. For this, the individual drill rods are taken out of the rod box by the rod grippers of the rod crane and positioned in the bore axis.

The thrust rig pushes the drill rod into the clamping jaw, where it is screwed by rotation means to the previous drill rod.

During the pilot bore, i.a. the position, depth and inclination of the drill head are measured by a detection system consisting of a transmitter inside the drill head and a receiver above ground. The operator controls the drilling direction via the thrust and rotation of the drill head.

Generally, a bentonite/water mixture is fed through the rod string to the roller chisel or drill head from an external drilling fluid system. This facilitates the drilling process and minimizes wear as drilling debris is discharged during the drilling process.
Moreover, purging is required to cool down the transmitter.

Once the drill head has arrived inside the target pit, the operator dismantles the rock drilling unit and assembles the expander head as well as the product pipe to the drill rod.

The machine pulls the drill rod along with the expander head and the product pipe back through the bore hole using hydraulic pressure.

The single drill rods are unscrewed in the clamping jaw, pulled back from the thrust rig and disconnected. Two laser sensors are used to check whether the thrust rig and the drill rods have been completely separated. Only then the rod crane moves up, returning the drill rod to the rod box.

If required, one or several intermediate clearances can be carried out before assembling and pulling in the product pipe.

3.2 Standard components

The bore rig consists of the following components:
- GRUNDODRILL ACS300 bore rig
- mixing system with a twin tank system MA07-D

Machine

The machine consists of the following components:
- rig boom (1)
- electrical control cabinet (2)
- rod box (3) which can be filled from the side
- stabilisers (4)
- fully automatic rod changing system (5)
- track-mounted undercarriage (6)
- lashing eyes (7)
- loading crane (8)
- energy chain (9)

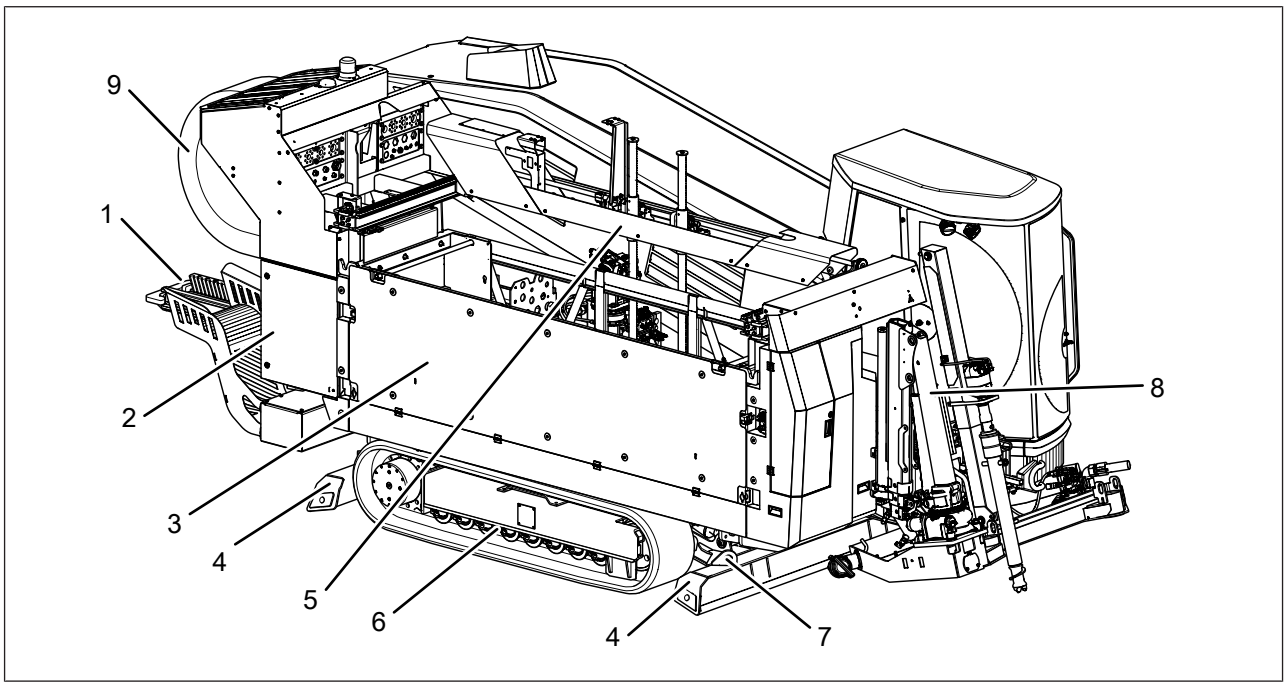


Fig. 3-2 Main components on the right machine side

- cab (1)
- footstep (2)
- bonnet (3)
- diesel engine with drive unit (4, under the bonnet)
- drive frame (5)
- filler neck for fresh water tank (6)
- exhaust system (7)
- fresh water tank (8, below the machine)
- Diesel Exhaust Fluid tank (DEF tank), coolant tank (9, behind the flap)

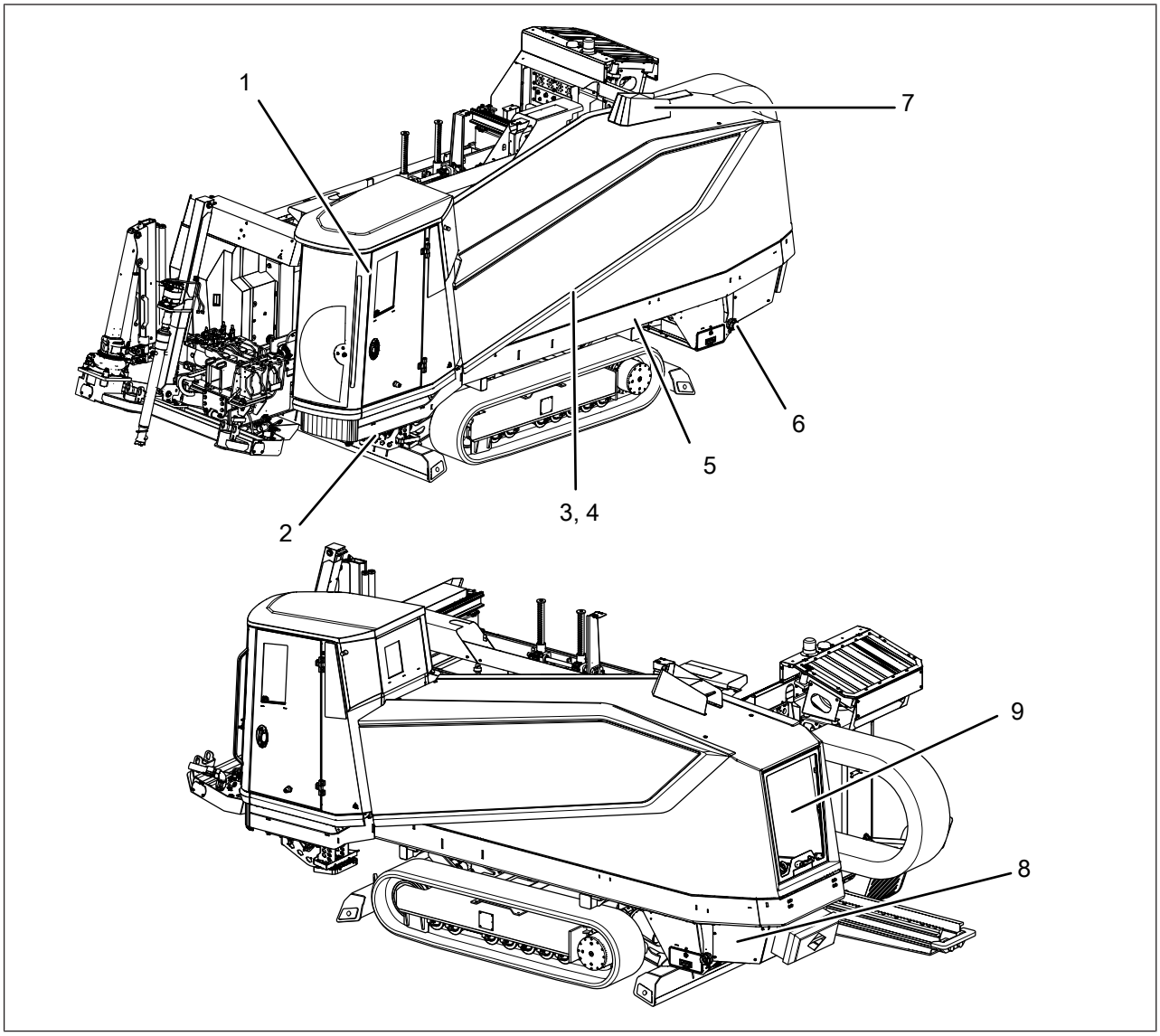


Fig. 3-3 Main components on the left machine side

- working lights (1)
- anchor boring rig (2)
- mud pump (3)
- anchor plate (4)
- connection for discharge of drilling fluid remains (5)

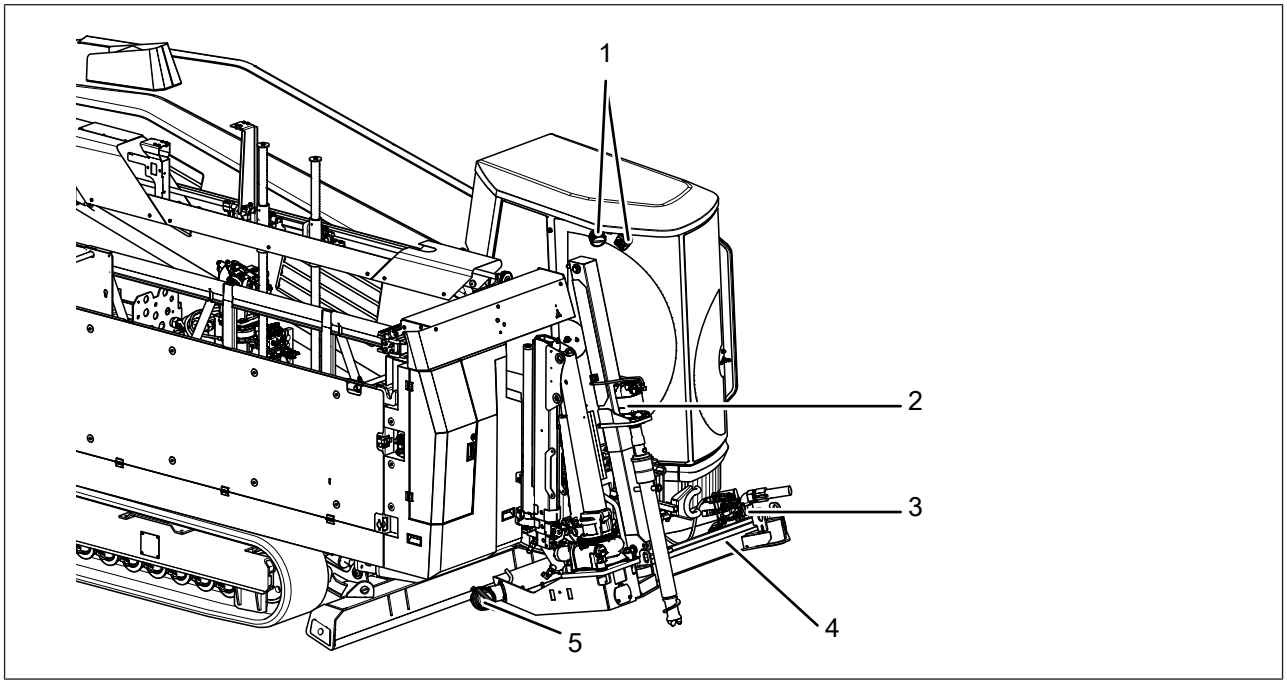


Fig. 3-4 Main components at the front

Thrust

The following components belong to the thrust rig:

- rotational drive (1) with hollow shaft motor
- rotational drive for inner rotation (2) as double rotational drive
- thrust drive (3)

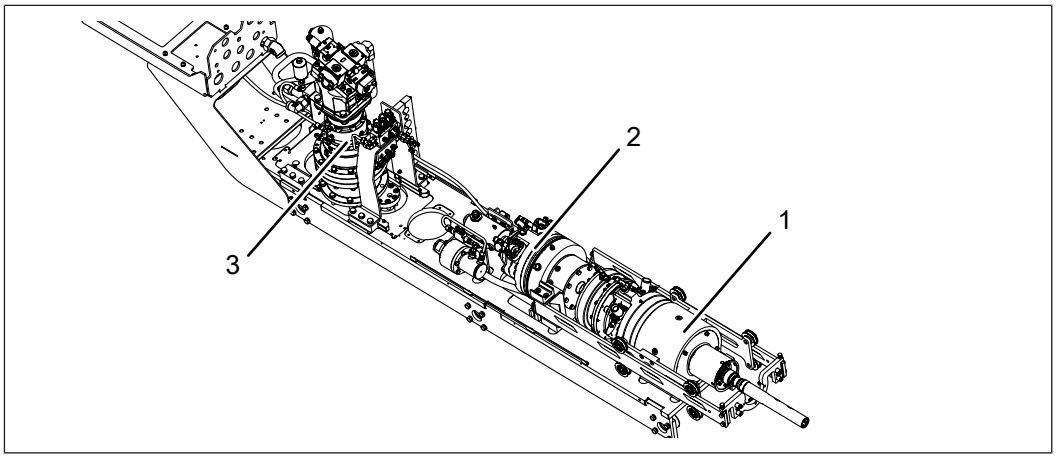


Fig. 3-5 Thrust rig and rod changing system

Integrated drive unit

The integrated drive unit consists of the following components:

- high-pressure feed pump for drilling fluid (1)
- exhaust system cleaning system (2)
- filler neck for hydraulic oil (3)
- hydraulic oil tank level indicator (4)
- filler neck for washer water (5)
- diesel filler neck (6)
- engine oil dipstick (7)
- Fresh water supply connection (8)
- Fresh water tank (9)
- Filler neck for Diesel Exhaust Fluid (DEF) (10)
- DEF tank (11)
- High-pressure cleaning pump (12)

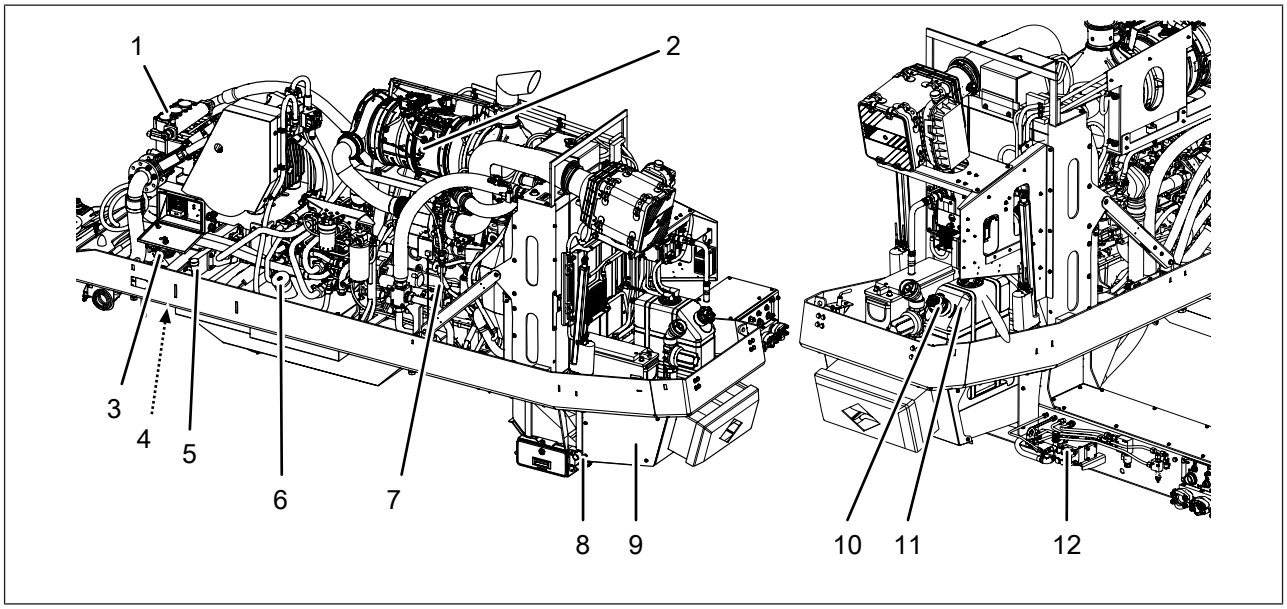


Fig. 3-6 Drive unit

Radio system

The following components are part of the machine's radio system:

- transmitter (operating terminal) (1)
- wireless pit remote control (2)
- receiver (3) in the E-box
- radio antenna (4)
- external WLAN antenna (5)
- combination antenna LTE, GPS, WLAN (6)
- antenna for DCI detection system (7)

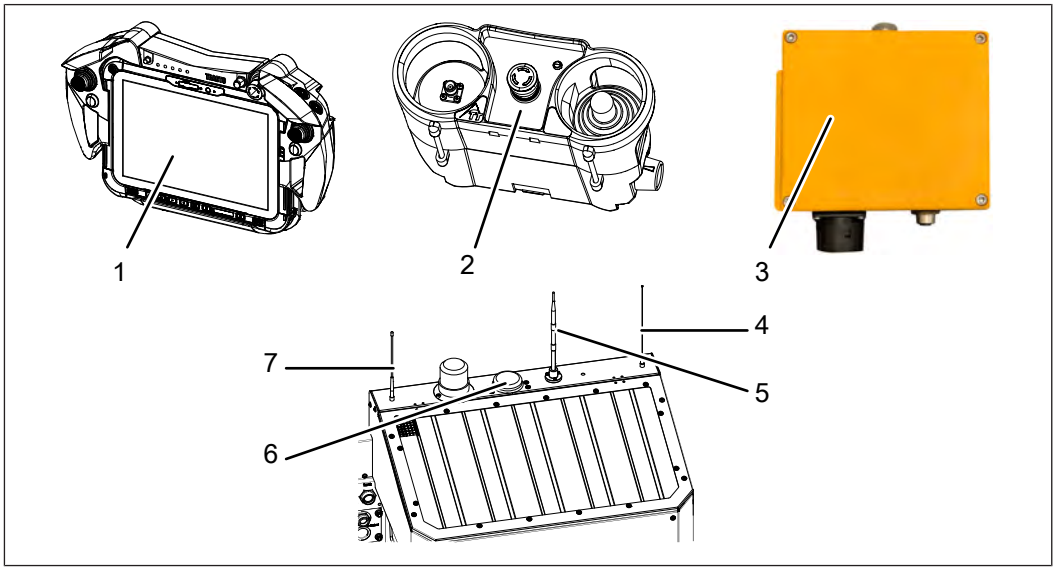


Fig. 3-7 Radio system of the machine

3.3 Accessories

Drill head, transmitter housing

The drill head serves to produce the pilot bore hole in the ground. It is connected to a transmitter housing suitable for EL D104 drill rods.

The angled surface of the drill head enables steering.

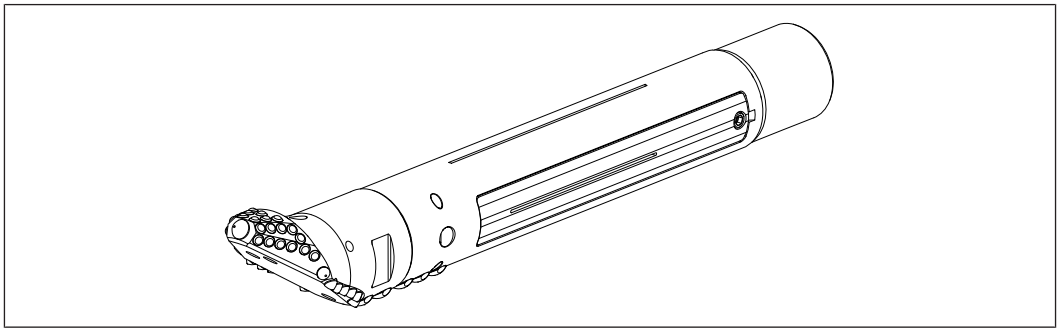


Fig. 3-8 Drill head with transmitter housing

Roller chisel, rock drilling unit

The roller chisel (1) with rock drilling unit (2) serves to produce a pilot bore hole in rock formations. It is driven by means of the twin tube rods.

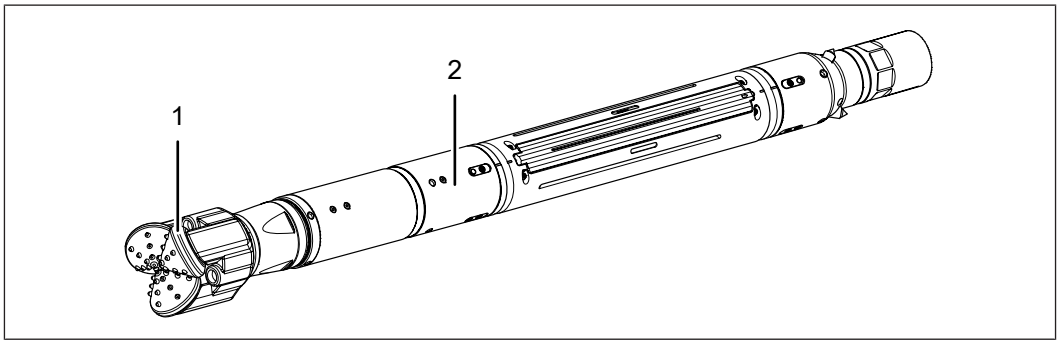


Fig. 3-9 Roller chisel with rock drilling unit (example illustration)

Expander head

The expander head serves to expand bore holes.

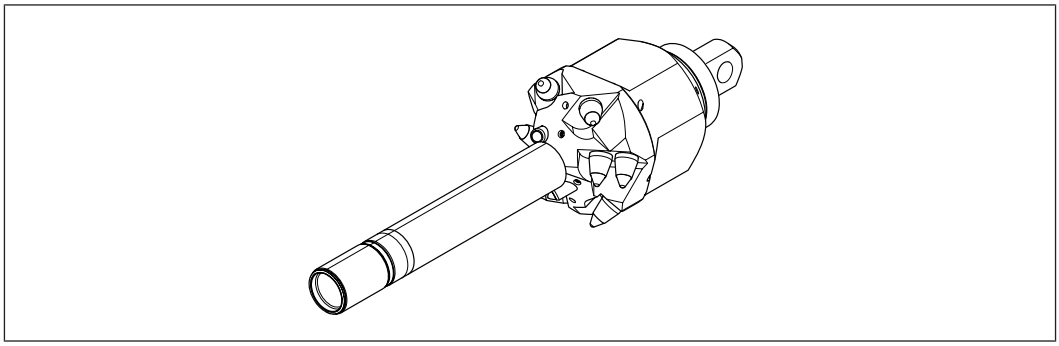


Fig. 3-10 Expander head for rock drilling (example illustration)

The expander head is screwed to the rod string in place of the rock drilling unit.

The pipe puller with the eyelet is connected to the swivel of the expander head. The product pipe is then connected to the pipe puller.

Detection system

The detection system consists of a transmitter inside the rock drilling unit (1) and a receiver on the operating terminal. Alternatively, an external receiver (2) and an additional monitor (3, depending on the model) can be used.

The transmitter emits electromagnetic pulses which are located by the receiver.

The field strength of these pulses is displayed on the operating terminal or the external monitor and compared to the values determined during calibration. With this proviso the distance between transmitter and receiver unit (bore depth) can be determined.

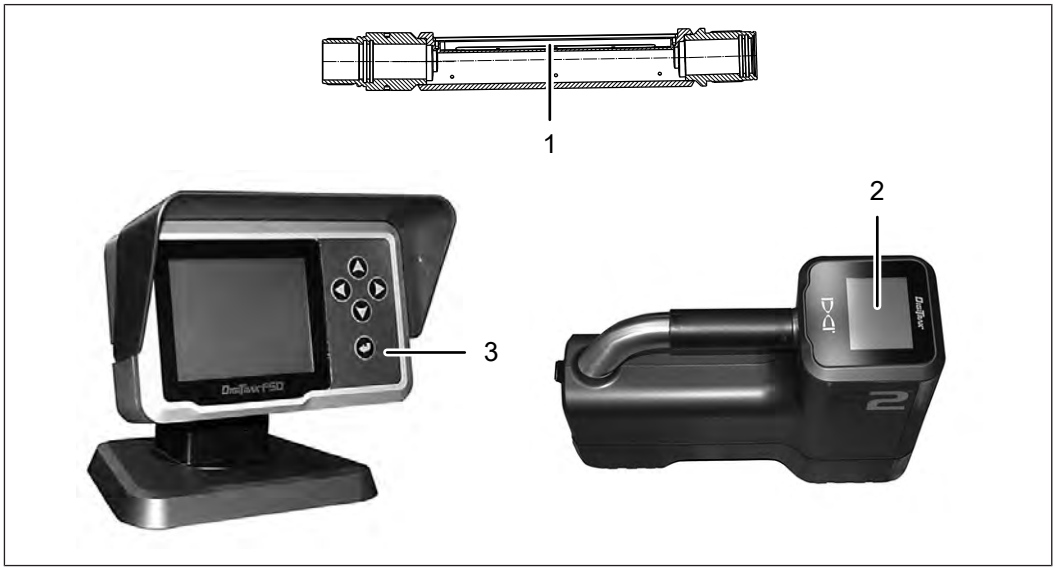


Fig. 3-11 Top: Transmitter housing (rock drilling unit), bottom: external monitor and receiver (examples)

3.4 Loading crane

To attach and remove the additional box, a hydraulically operated loading crane with wireless remote control is available.

Additionally, the loading crane can be used to transport single drill rods when loading or unloading the rod box/stacking boxes.

⚠ DANGER



Danger due to suspended loads when operating the loading crane!

You can be bumped by the load hanging on the loading crane.
The load may fall and injure you.

- Staying under a suspended load is prohibited.
- Keep out of the loading crane's swivel range.
- Adhere to the permissible load capacity of the loading crane.
- Wear head, hand and foot protection.

Info!
Only personnel instructed by TRACTO-TECHNIK is permitted to operate the loading crane.
Additionally, the national qualification requirements for crane operation must be met.

Info!
Only use the loading crane when the anchor plate has been lowered.

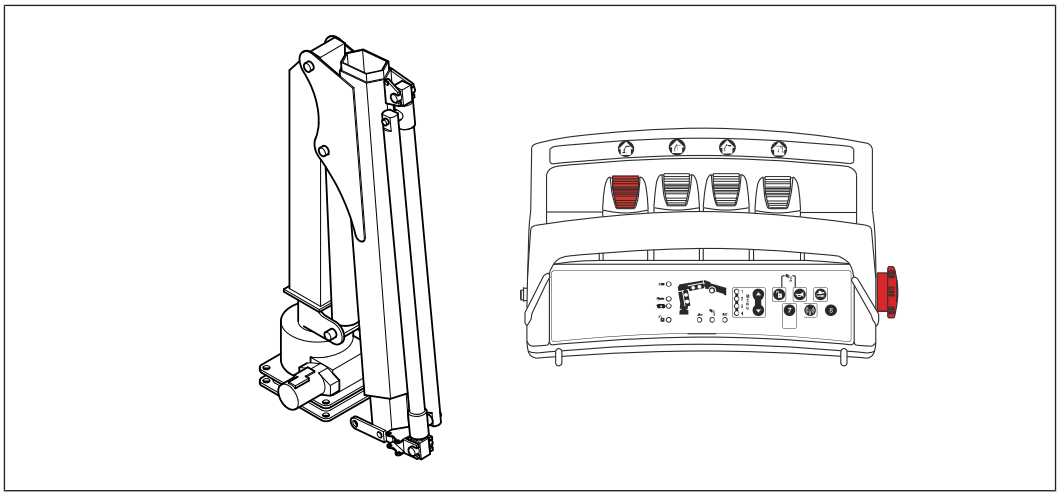


Fig. 3-12 Loading crane with wireless remote control

3.5 Additional box for rods

In case the number of drill rods in the rod box is not sufficient for the planned drilling operation, you can attach an additional box to the outside of the rod box. This additional box can take a maximum of 4 drill rods.

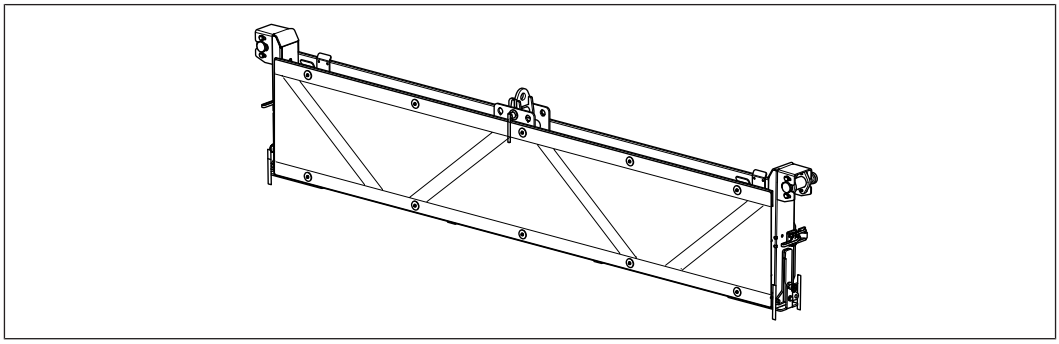


Fig. 3-13 Additional box for drill rods

3.6 Technical data

Tab. 3-1 Technical data – GRUNDODRILL ACS300

Parameter	Additional information	Value
Designation		GRUNDODRILL ACS300
Transport position	length[1)] width[1)] height	7,620 mm 2,550 mm 2,835 mm
Working position	length[1)] width[1)] height	7,462-8,490 mm 2,550–3,223 mm 3,406 mm with additional box 3,753–5,030 mm
Machine weight	incl. EL D104 drill rods, filled hydraulic and diesel tanks (empty fresh water tank)	23,180 kg
Tank capacities		
Diesel tank	capacity	268 l
DEF tank	capacity	37.9 l
Fresh water tank	capacity	170 l
Hydraulic tank	capacity	Filling quantity approx. 151 l
Drilling data		
Angle of inclination		0–30°
Max. thrust force		300 kN
Max. tensile force		300 kN
EL D104		
Max. torque (static)	outer drill rod	13000 Nm
	internal drill rod	2800 Nm
Max. speed	outer drill rod	210 rpm
	internal drill rod	350 rpm

Parameter	Additional information	Value
Drill rods EL D104 ACS	drill rod diameter	104 mm / 93 mm
	effective length	3000 mm
	weight	92 kg
	bending radius	75 m
	rod box capacity	70
	capacity of additional box	4
	Flush drilling (depending on the soil)	
	pilot bore diameter	150–190 mm
	expander diameter pipe diameter bore length	max. 900 mm max. 710 mm max. 500 m
	Rock drilling (depending on the soil)	
	pilot bore diameter	6.5" (165 mm)
	expander diameter or bore length	max. 20'' (508 mm) max. 350 m
General		
Max. detection depth (depending on the system)		3–35 m
Max. drilling fluid flow rate, continuously adjustable	Bentonite pump P80–650	650 l/min
Max. drilling fluid pressure	Bentonite pump P80–650	80 bar
Hydraulic power rotation circuit	at 420 bar	340 l/min
Hydraulic power Bentonite circuit	at 360 bar	265 l/min
Hydraulic power LS circuit (thrust and auxiliary functions)	at 310 bar	265 l/min
Max. hydraulic pressure	counter-clockwise rotation	420 bar
Max. travel speed	1. step	2.3 km/h
	2. step	3.6 km/h
Rig inclination		0–30°
Max. inclination during operation	to all sides	6°
Max. inclination when traversing	to all sides (depending on the soil)	15°
Emission sound pressure level L_{pA} [2)]	measured 0.8 m ±0.05 m above the centre of the seating surface of the driver's seat in accordance with ISO 11201	78 dB
	uncertainty K_{pA}	3 dB
Guaranteed sound power level L_{WAd} [2)]	as defined in 2000/14/EC	105 dB

Parameter	Additional information	Value
Permissible temperature range		-10 °C to +45 °C
Highest permissible wind speed	under operating conditions	< wind force 12 (33 m/s)
Max. ground pressure	under operating conditions	14.4 N/cm^2
LED working lights, 4 pcs.	illuminance	30 lx each
Whole body or hand / arm vibrations during work		< 0.5 m/s^2
Software versions	PLC1 PLC2	as of 02.03.00 as of 02.03.00
	Gateway	from 2.6.1
	HMI	from 2.6.1
	data point structure	as of 2.5.3.0
WLAN	frequency band	2.4 GHz
	max. transmitting power	100 mW
	max. transmission range	70 m[3)]
Wireless remote control	frequency band	434 MHz
	max. transmitting power	10 mW
	max. transmission range	300 m[3)]
Remote control key	max. range	8 m
	temperature range	0 °C to +60 °C
Coolant		
Type		ALPINE C40 (CES 14603)
Quantity		25.5 l
Mixing ratio		1 : 1
Engine		
Engine manufacturer / engine type		Cummins diesel engine B6.7 Stage V
Max. engine speed		2,200 rpm
Drive power	at 2,200 rpm	231 kW
Torque	at 1,500 rpm	1,288 Nm
Consumption	at 1,500 rpm	204 g/kWh
Starting unit		24 V DC

[1)] Depending on the inclination of the boom and the swivel angle of the cab

[2)] The noise emission values were determined during a standardized test cycle. Accordingly, these values are not necessarily representative of all conditions arising during intended use. Certain operating or ambient conditions can cause higher noise levels than specified, examples are the type of earth or stone on which the machine is operated or the presence of sound-reflecting surfaces in close proximity.

[3)] with clear view

Tab. 3-2 Technical data of the loading crane

Parameter	Range	Loading capacity
Permissible bearing load at an operating distance	1.2 m 2.2 m 3.2 m	max. 990 kg max. 990 kg max. 680 kg

4.1 Transportation on a truck or trailer

Safety

For safe loading and unloading of the machine onto/from the truck/trailer, observe the following safety instructions:

⚠ WARNING



Danger of falling, tripping and slipping on/off the loading surface of the truck/trailer!

- Pay attention to obstacles and slippery surfaces on the loading surface. Move cautiously.
- Make sure that the loading surface is broom-clean and free from oil and dirt.
- If necessary, de-ice the loading surface in the winter.
- Nobody is allowed on or in the machine when driving it onto or off the loading surface.
- Always load and unload the truck/trailer on a stable, horizontal surface.

⚠ WARNING



Crush hazard between bore rig and walls of the truck/trailer loading surface!

- Dismantle the additional box from the machine before driving the machine onto the loading surface.
  Transporting the machine with the additional box attached is prohibited!
- Keep a distance from the machine!
- Standing between a wall and the machine is prohibited.

⚠ DANGER



Machine or transport vehicle tipping over!

You can get buried under the bore rig or the transport vehicle!

- Observe the max. permissible total weight of the transport vehicle.
- Make sure that the machine is loaded onto the trailer correctly, in accordance with the trailer size and type.
- Observe the safety instructions of the truck manufacturer as well as the regulations regarding the transportation of loads.
- Only transport empty mixing/water tanks. Full tanks can cause an overload of the transport vehicle. Full mixing tanks/water tanks cause a reduced brake performance of the truck and a shift of the centre of gravity during cornering. This entails a longer brake distance as well as an increased danger of the truck or trailer tipping over.
  Using the truck in road traffic with a full mixing tank is permitted only if the admissible maximum axle loads are observed. A strongly one-sided load is impermissible.

⚠ DANGER

Danger due to falling drill rods!

If the rod box bays are filled to a level that rods are positioned above the locking hoop during drilling operation, these rods could fall out during transport and cause serious injury to you and others.

- Before transporting the machine of the truck/trailer, make sure that the permissible number of rods in the rod box is not exceeded.

Transport locks

⚠ DANGER

Danger due to falling drill rods in case of uneven ground!

During transport on a vehicle, there is a risk of rods falling out of the top of the rod box due to unevenness of the road. This can cause serious injury to you and others.

- Before transporting the machine of the truck/trailer, make sure that the transport locks are mounted at both ends of the rod box.

Mount the transport locks for the rods as follows:

1. Place the transport lock rod (1) over the front and rear of the rod box and insert the pin (2) into the hole in the rod box.
2. Slide the locking sleeve (3) onto the transport lock rod so that the pin (4) fits in the hole in the rod box.
3. Secure the locking sleeve against slipping out using the linchpin (5).

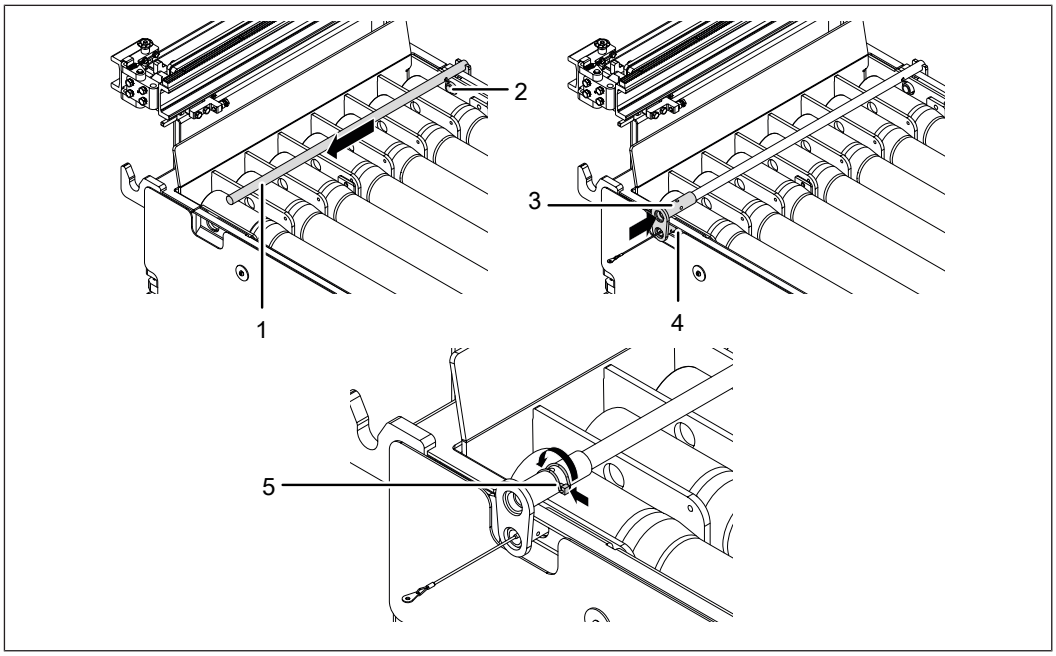


Fig. 4-1 Fitting the transport lock for the rod box (here: rear)

Info!
Loading instructions for the machine can be obtained from the TRACTO-TECHNIK customer service.

⚠ DANGER

Risk of injury due to moving machine!
It is prohibited to ride on the bore rig!



The moving machine can cause fatal injuries to you and other persons.

- Before traversing the machine, secure the loading crane as indicated in the figure below.
- Maintain a safety distance of at least 5 m.
- Walk behind or diagonally behind the bore rig when traversing it.
- Ensure good visibility.
- Make sure that you can oversee the travel range.

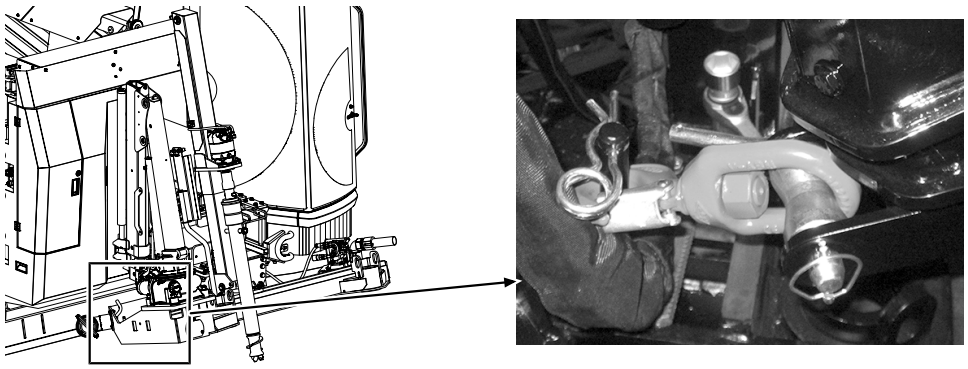


Fig. 4-2 Securing the loading crane before traversing the machine

As standard, the entire drilling system is transported on a truck. Depending on space availability, an additional trailer may be required.

During the drilling operation, the drilling fluid mixing system remains on the truck.

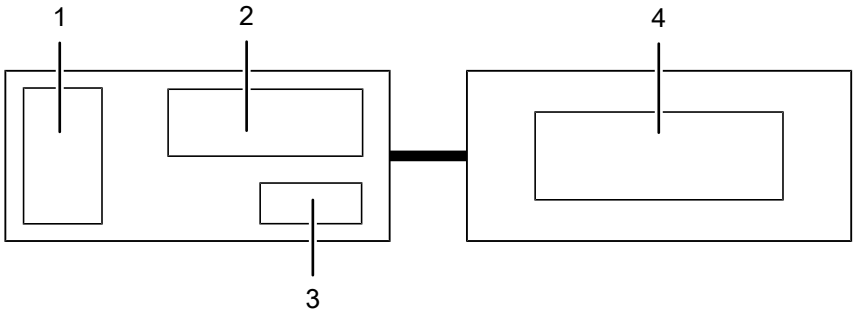


Fig. 4-3 Example set-up on the truck or trailer

1	Drilling fluid mixing system	3	Accessories and assembly tool boxes
2	Workbench and bentonite pallet	4	Machine

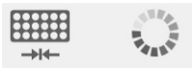
Driving onto the trailer

1. Ensure a sufficient maximum permissible weight of the truck (chapter 3.6, page 54).
2. Make sure that the trailer is properly connected to the towing vehicle.
3. Align the ramps of the trailer to the machine's track width and make sure that the ramps are firmly mounted.
4. Start the machine (chapter 5.3, page 78).
5. Switch the "Drive mode/bore mode" rotary switch over to bore mode on the left joystick panel.
6. Access the "Rod change — Pilot drill" screen.
7. Open the rod gripper by pressing the outer push button at the top right (1) of the "Rod change" screen.
8. Move the rod grippers to the top position by pushing the left joystick (2) outwards.



Fig. 4-4 Opening and moving up the rod gripper

9. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.
10. Press the >>Approach transport position<< (1) push button on the "Drive / Setup" screen of the operating terminal.
11. Press the push button at the front right (2, automatic button).
    - ⇨ The thrust rig and the rod crane move to the transport position.
    - ⇨ During travel into the transport position, the checkbox next to the >>Approach transport position<< button rotates.
    - ⇨ As soon as the transport position has been reached, the checkmark appears in the checkbox (3).



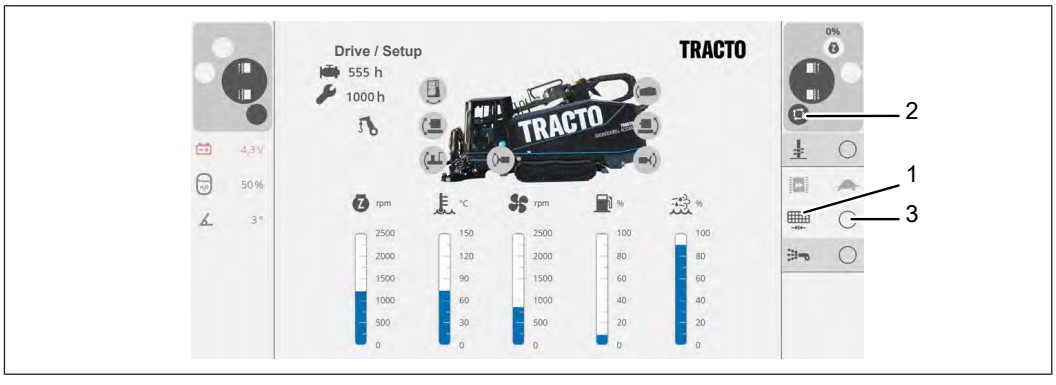


Fig. 4-5 Approaching the rod crane's transport position

12. If necessary, deselect the anchor boring rig in the right action panel.

Info!
If the machine is not in transport position, you can only move/align it with the remote control for 10 seconds. The function automatically stops after 10 seconds. Move the joysticks to their resting position to restart the function for 10 seconds.

Swivel the anchor plate upwards to the topmost position.

13. Press the symbol on the anchor plate (1) in the “Drive / Setup” screen.
    ⇨ The symbol is shown in blue.
14. Actuate the outer push button on the left (2, arrow pointing upwards) until the anchor plate has reached the upper position.



Fig. 4-6 Lifting the anchor plate

Move the rig boom into the horizontal position:

15. Tap the corresponding tilt cylinder (1, 2) on the "Drive / Setup" screen to select it.
    ⇨ The symbol is shown in blue.
16. Actuate the outer push buttons on the left or at the front left (3, 4, arrow buttons) to adjust the rig boom.



Fig. 4-7 Adjusting the inclination angle of the rig boom

⚠ DANGER

Risk of injury due to moving machine!
It is prohibited to ride on the bore rig!

The moving machine can cause fatal injuries to you and other persons.

- Maintain a safety distance of at least 5 m.
- Walk behind or diagonally behind the bore rig when traversing it.
- Ensure good visibility.
- Make sure that you can oversee the travel range.

⚠ DANGER

Machine tipping over!



When driving the machine on ramps or slopes, there is a risk of the machine tipping over and crushing your body.

- Reduce the danger of the machine tipping over by lowering the stabilisers.
- Maintain a safety distance of at least 5 m!
- Be mindful of weight shifts when driving up the ramp!
- Only traverse the machine in the lowest gear step.
  To do so, set the button for the speed level to "tortoise".
- Traverse/park and operate the machine only up or down a slope.
  The max. permissible inclination on slopes is 20°.

Info!
If you do not actuate any function for approx. 3 seconds, the engine speed will automatically be reduced to approx. 850 rpm (idle running).
The engine speed will increase as soon as a function has been actuated.

Lift the stabilisers:

17. Tap the corresponding stabiliser (1, 2) on the "Drive / Setup" screen to select it.
    ⇨ The symbol is shown in blue.
18. Actuate the outer push button on the left (3, arrow pointing upwards) until the stabiliser has reached the upper position.



Fig. 4-8 Lifting the stabilisers

19. Drive the machine onto the trailer using the two joysticks (4, 5) on the operating terminal.

20. Bring the machine into the correct position on the trailer. Load the machine in a way that its centre of gravity is ideally located above the longitudinal centre line of the trailer so that the load is evenly distributed on both vehicle axles.

Lower the stabilisers in the following situations:
- for transport on a truck/trailer
- when stopping/parking on a sloping surface.
- for drilling and pulling-in operation

⚠ WARNING



Danger of crushing when raising and lowering the stabilisers!

- Keep a sufficient distance from the stabilisers!

21. Tap the corresponding stabiliser (1, 2) on the "Drive / Setup" screen to select it.
    ⇨ The symbol is shown in blue.
22. Actuate the push button at the front left (3, arrow pointing downwards) until the stabiliser has reached the floor.



Fig. 4-9 Lowering the stabilisers

23. Switch off the engine with the remote control key.

Lashing the machine down

Before lashing the machine down, ensure the following:

- Observe the total weight of the machine specified in the technical data.
- The lashing points of the vehicle are suitable for the weight of the load. If you use lashing points of a lower lashing capacity, take additional safety measures.
- Check the lashing forces of all lashing means for every loading process.
- Attach the lashing means to the provided lashing points.
- To muster the remaining securing force, use lashing means attached diagonally.
- In case of diagonal lashing adhere to the following lashing angles, as possible:
  - angle α (vertical): 10° to 65°
  - angle β (horizontal): 10° to 50°

1. Lash the machine (3) down diagonally via the four lashing eyes to the stabilisers (two each at the front and rear stabiliser, (1), (4)) using one type of lashing means (2), (5) each.

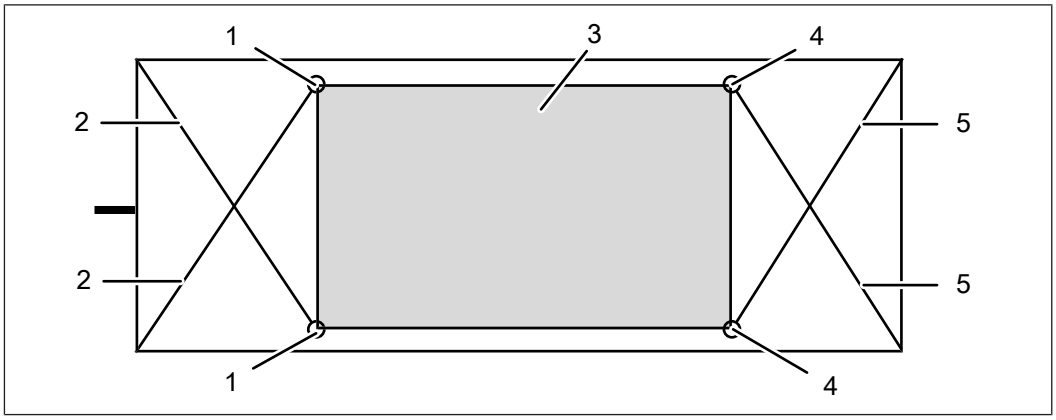


Fig. 4-10 Standard fastening on the truck or trailer

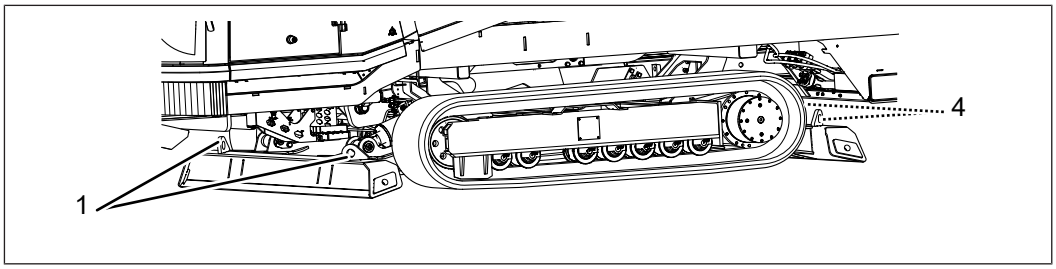


Fig. 4-11 Lashing eyes

2. Attach the lashing means to the trailer as firmly as possible. Always take the on-site conditions into account when determining the tension angle of the lashing means. Also pay attention to the positioning of the machine on the trailer.
   Observe the loading instructions of the machine.

⚠ WARNING

Falling parts!



During transport, there is a risk of loose parts falling off the truck/trailer and causing injuries.

- Make sure that the loading surface is free of loose parts.
- Load all individual components safely and lash them down.

3. Place all tools and drilling accessories at the provided storage places. Lock all doors and covers.

Driving off the trailer

⚠ DANGER

Machine tipping over!



When driving the machine on ramps or slopes, there is a risk of the machine tipping over and crushing your body.

- Reduce the danger of the machine tipping over by lowering the stabilisers.
- Maintain a safety distance of at least 5 m!
- Be mindful of weight shifts when driving up the ramp!
- Only traverse the machine in the lowest gear step.
  To do so, set the button for the speed level to "tortoise".
- Traverse/park and operate the machine only up or down a slope.
  The max. permissible inclination on slopes is 20°.

1. Make sure that the trailer is properly connected to the towing vehicle.
2. Remove the lashing means.
3. Align the ramps of the trailer to the machine's track width and make sure that the ramps are firmly mounted.
4. Start the machine (chapter 5.3, page 78).
5. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.



Info!
If you do not actuate any function for approx. 3 seconds, the engine speed will automatically be reduced to approx. 850 rpm (idle running).
The engine speed will increase as soon as a function has been actuated.

Lift the stabilisers:

6. Tap the corresponding stabiliser (1, 2) on the "Drive / Setup" screen to select it.
   ⇨ The symbol is shown in blue.
7. Actuate the outer push button on the left (3, arrow pointing upwards) until the stabiliser has reached the upper position.



Fig. 4-12 Lifting the stabilisers

8. Drive the machine off the cargo area using the two joysticks (4, 5) on the operating terminal.

4.2 Lifting the machine with an external crane

When lifting the machine with a crane, observe the following safety instructions:

- Before lifting the machine, contact the TRACTO-TECHNIK customer service (chapter 8, page 257).
- Observe the instructions for the lifting device, especially the safety information.
- Observe the specifications from the manufacturer of the lifting device, these always have priority.
- Make sure that the lifting device is placed on sufficiently stable ground when lifting the machine.
- Make sure that the lifting device is sufficiently stable.
- Prior to lifting, dismount or remove the additional box if installed.
- Only use lifting beams approved for the machine weight and loading direction.
- Only use lifting beams where the minimum distance between the lower lifting eyes is large enough to prevent damage to the bore rig.
- The minimum width of the lifting beam must be 3,200 mm. The minimum distance between the lifting beam and the footprint of the machine is 3,600 mm.
- Use lifting means of sufficient length so that the machine hangs balanced in the crane.
- Make sure that the lifting means are intact.

Info!
For the precise dimensions of lifting beam and lifting means please contact the TRACTO-TECHNIK customer service.

1. Empty the fresh water tank.

⚠ DANGER

Risk of death due to falling loads!

Loads can fall down or crush you.

- Only use Starpoint ring screws type VRS-M42 with a nominal load capacity of 9,000 kg (cross load). Please also observe the instructions of the lifting means.
- Only lift the machine if the ring screw threads and the threaded holes in the stabilisers are intact and free from corrosion! The exact procedure for the application of Starpoint ring screws type VRS-M42 may vary.
- Contact the TRACTO-TECHNIK customer service (chapter 8, page 257).

2. Screw one Starpoint ring screw of type VRS-M42 (1) (nominal load capacity 9,000 kg) into each of the four lateral threaded bores of the stabilisers.

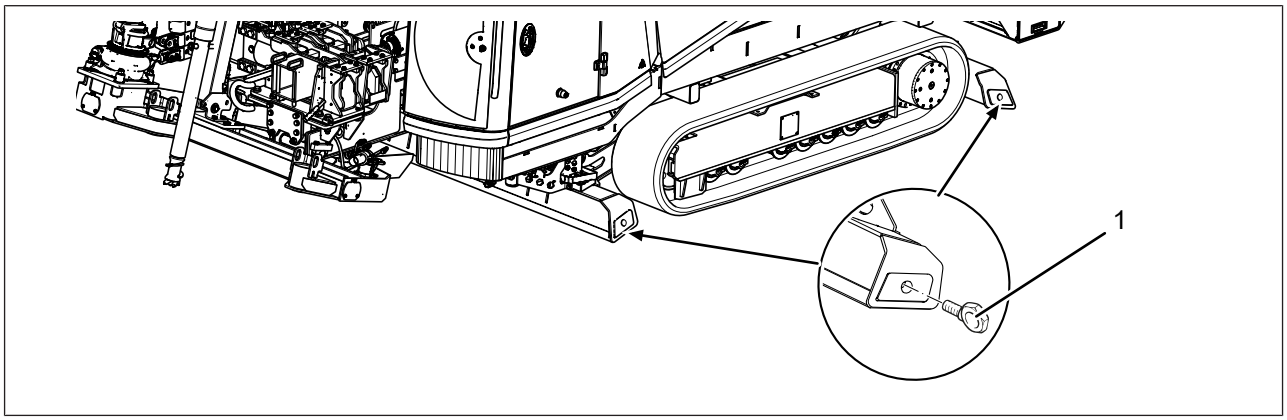


Fig. 4-13 Screwing in Starpoint ring screws

⚠ DANGER

Risk of death due to falling loads!

Loads can fall down or crush you.

- In the case of a different distance between lifting beam and footprint of the machine, change the front and rear lifting means proportionally to keep the centre of gravity in the middle during the lifting process.
- Avoid chafing the lifting means against the drive frame or other machine parts when lifting the machine.

3. Have lifting means with a nominal load capacity of at least 90 kN ready.

4. Fasten the shorter lifting means (1) to the front Starpoint ring screws and the longer ones (2) to the rear Starpoint ring screws. Fasten the other ends of the lifting means to the lifting beam (3).
5. Slowly lift the machine.
6. Make sure that the machine is hanging precisely balanced.
7. Transport the machine slowly and carefully.

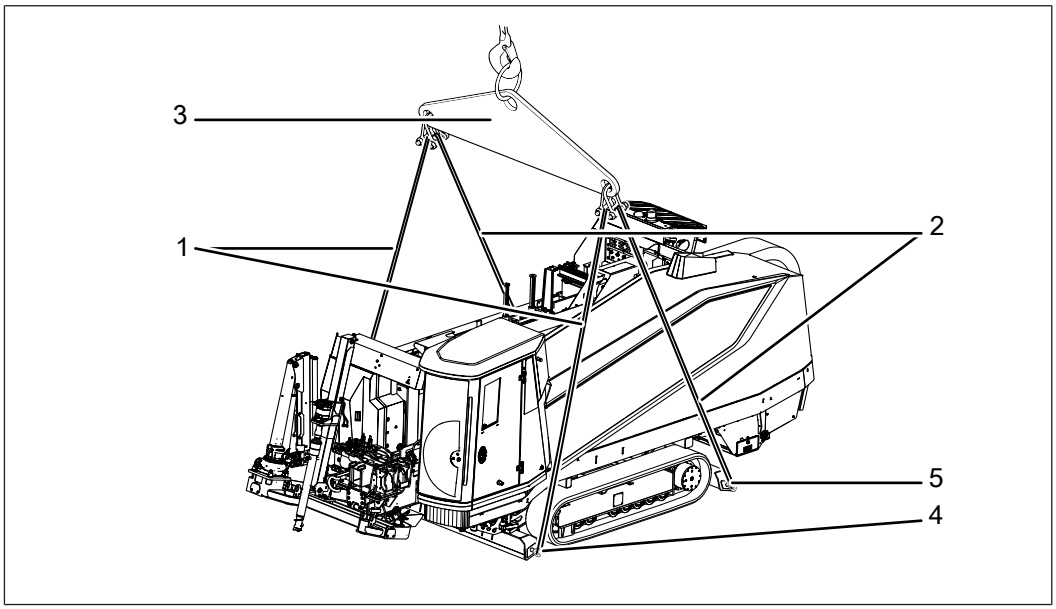


Fig. 4-14 Attaching the lifting means to the lifting beam and transport eyelets

4.3 Towing the machine

When towing the machine, please observe the following safety instructions:

- Only use sufficiently dimensioned towing means!
- Only connect the towing means to the lashing eyes of the front stabiliser.
- Nobody is allowed near the towing device!
- Only tow over short distances (up to approx. 1 km) and with a speed of less than 1.6 km/h!

Do not tow the machine unless it has broken down and is getting in the way in the working area or it is situated in a danger area.

Preparations for towing

To be able to tow the machine, pull the sun gear off the gearbox.

1. Prepare a collection container for the gear oil.
2. Open the screw plugs and drain as much hydraulic oil as possible.
3. Loosen the snap ring on the cover and pull off the cover.
   Catch the leaking hydraulic oil in the collection container and properly dispose.
4. Loosen the snap ring on the sun gear.
5. Pull out the sun gear and put aside.
6. Push the cover of the gearbox housing back on and secure with the snap ring.
7. Screw the screw plugs back in.

If you have any doubt, please contact the TRACTO-TECHNIK customer service.

Towing

1. Start the machine (chapter 5.3, page 78).
2. In the "Settings -> Bore parameters -> Engine speed" menu, tap >>Set value by wheel on right joystick<<.
   ⇨ The "Adjust engine speed by wheel" pop-up window opens.
3. Switch on the function by pressing the >>Switching on<< button (1).

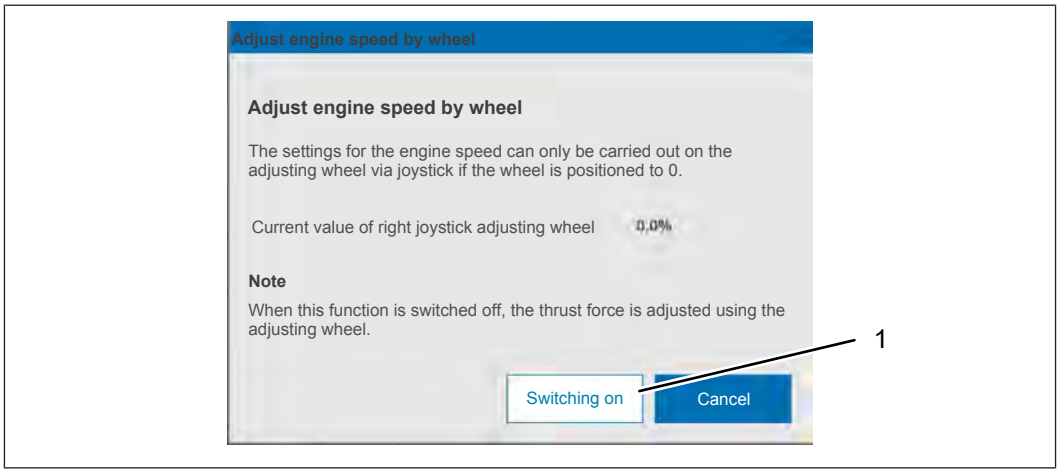


Fig. 4-15 Adjust engine speed by wheel

4. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.
5. Open the "Drive / Setup" screen on the operating terminal.

6. Use the right setting wheel (1) on the operating terminal to set the engine speed to approx. 1,500 rpm.
   The function must be enabled in the "Settings -> Bore parameters -> Engine speed" menu.



Fig. 4-16 Setting the engine speed

Info!
If you do not actuate any function for approx. 3 seconds, the engine speed will automatically be reduced to approx. 850 rpm (idle running).
The engine speed will increase as soon as a function has been actuated.

Move the rig boom into the horizontal position:

7. Tap the corresponding tilt cylinder (1, 2) on the "Drive / Setup" screen to select it.
   ⇨ The symbol is shown in blue.
8. Actuate the outer push buttons on the left or at the front left (3, 4, arrow buttons) to adjust the rig boom.



Fig. 4-17 Adjusting the inclination angle of the rig boom

Swivel the anchor plate upwards to the topmost position.

9. Press the symbol on the anchor plate (1) in the “Drive / Setup” screen.
   ⇨ The symbol is shown in blue.
10. Actuate the outer push button on the left (2, arrow pointing upwards) until the anchor plate has reached the upper position.



Fig. 4-18 Lifting the anchor plate

11. Connect a sufficiently dimensioned towing means (1, e.g. chain, rope) to the two lashing eyes of the front stabiliser.

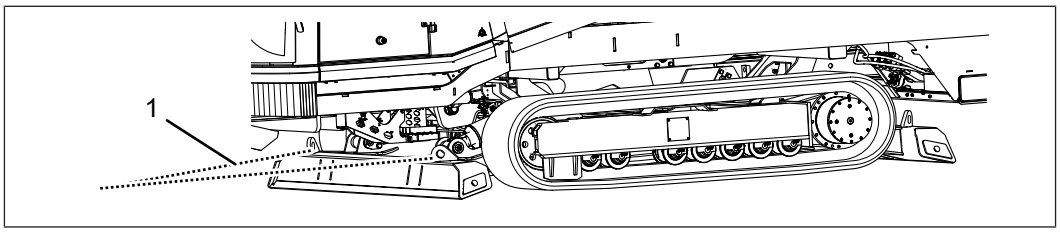


Fig. 4-19 Attaching the towing means (example illustration)

12. Start driving slowly.

⚠ DANGER

Risk of death due to machine rolling away!

The machine could roll away and run you over!

- After the towing process, secure the machine against rolling away. For this purpose, use e. g. brake chocks.

13. Tow the machine to the desired location and secure it against rolling away.

5.1 Planning of the construction site

Plan the site carefully. The checklist in the annex can be helpful for this purpose.

Find out about safety-related regulations at the construction site, e.g.:
- DGUV V38 Bauarbeiten (Regulation governing construction work)
- Construction Site Ordinance
- Technical regulations for operational safety (TRBS)
- Operational Safety Ordinance (BetrSichV)

5.2 Site requirements

⚠ DANGER



Danger of falling or tripping!

- Cordon off the entire site against unauthorized access.
- Put up a sign reading: "CONSTRUCTION SITE – Unauthorized access prohibited!".

A minimum of two persons is required for machine set-up.

An operating area of 10 m x 4.5 m is required for the machine for surface start, including securing the installation surfaces.

Only use the machine in areas where there is no danger of any objects falling from above.

Illuminate the drilling site with at least 100 lux during night-time operation.
(In night mode, both working lights on the cab emit approx. 30 lux within a distance of 7 m.)

5.2.1 Conditions for the entrance pit

The entrance pit is required for the starting phase and helps the drill head to penetrate the ground.

The entrance pit generally has the following dimensions:
- length x width: 50 cm x 60 cm
- depth: 20 cm

5.2.2 Conditions for the starting and target pits or the intermediate pit

The size of the pits basically depends on the depth of the bore path, the outer pipe diameter and the number of pipes to be installed.

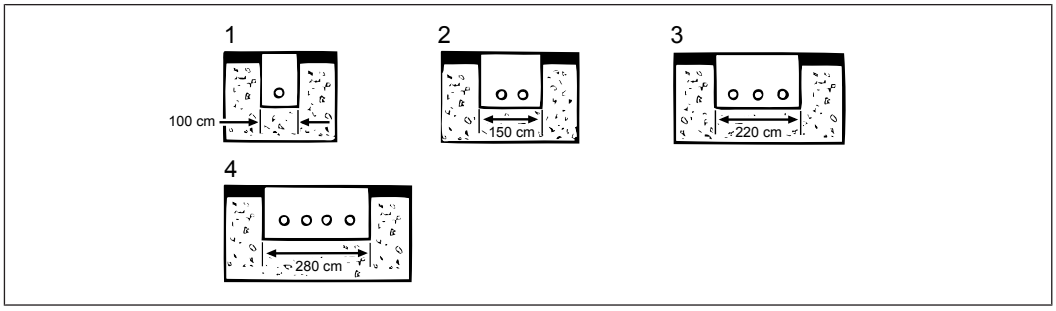


Fig. 5-1 Example cross-section of a starting or target pit (outer pipe diameter 100 mm)

5.2.3 Securing the construction site

⚠ DANGER



Danger of tripping or falling into the pits!
Risk of injury due to machine movements!

- Presence in the machine's immediate danger area is prohibited.
- Secure the installation surface or pit against unauthorized access!
- Secure holes in the ground with appliances in a way to prevent people from falling in.
  The opening is to be fenced off, made accessible or covered with an immovable cover.
- Secure the operating surface using traffic cones, barrier tape and warning signs reading: "Presence in the danger area is prohibited!".
- Secure working areas near public roads or railway tracks by means of barriers, safety posts or signalling devices.
- Observe a minimum distance of 1.50 m between the drilling system and the barriers.
- In pedestrian areas the product pipes are to be cordoned off by means of traffic cones!
- When working in pits and trenches, earth and rock faces must be scarped or sheeted in a way that workers are secured against slipping soil. All influences possibly impairing the soil's stability (rain, vibrations etc.) must be taken into consideration.

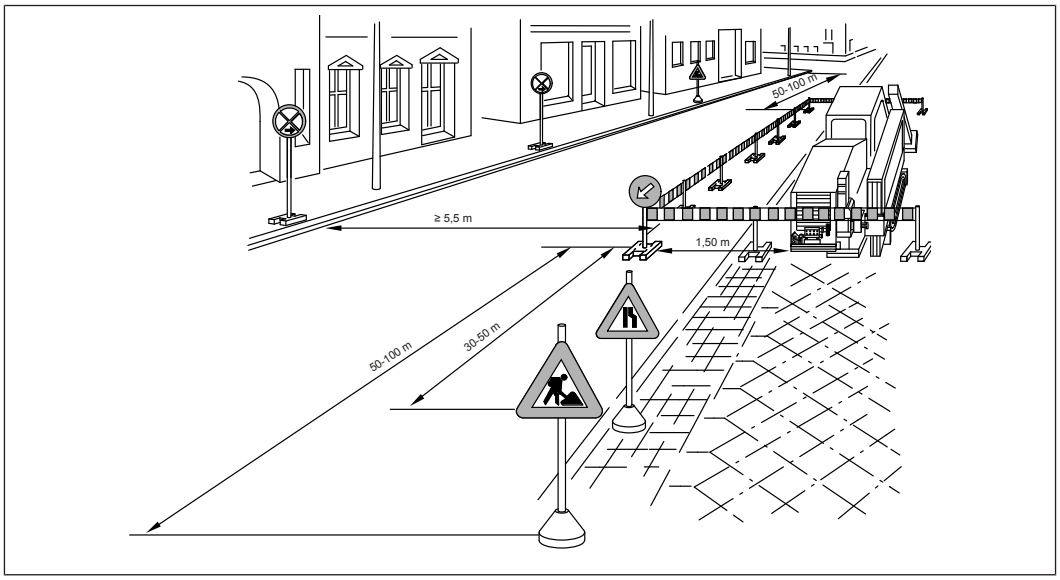


Fig. 5-2 Example for securing pits

Remote-controlled drilling

⚠ DANGER



Risk of injury due to moving parts during remote-controlled drilling!

Bumping, pulling in and crushing can cause serious injury to yourself and others during remote-controlled drilling.

- Keep out of the danger area marked in red and keep other persons away.
- Maintain visual contact with the danger area at all times during remote-controlled drilling.
- Secure the danger area with an additional separating protection device (e.g. with a fixed fence) if maintaining visual contact with the danger area is not possible.
- Observe the safety measures required on site in the chapter "Securing the construction site".
- In case of emergencies, immediately press the emergency stop button.

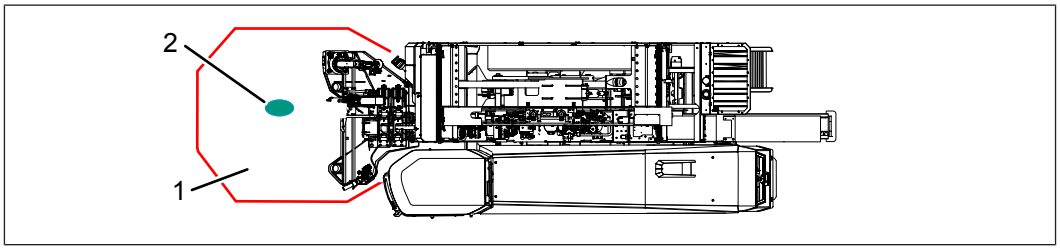


Fig. 5-3 Fence for remote-controlled drilling when maintaining visual contact with the danger area is not possible

1	Fence	2	Entrance point of the drill rod

5.3 Starting up the machine

5.3.1 Unlocking the machine

Unlocking the machine

The following elements on the machine are locked:

- the cab door
- the bonnet
- the louvre at the rear
- the control cabinet (2 locks)

All locks on the machine can be locked and unlocked with a remote control key. The locks of the cab door, bonnet and louvre can be (un)locked both manually with the key blade folded out and via a radio signal by pressing the corresponding button on the remote control key.

The locks of the control cabinet are opened manually with the key blade folded out.

Info!
The radio signal of the remote control key is encrypted and only fits for the corresponding machine. The machine can only be unlocked and switched on with the correctly encoded remote control key. Only TRACTO-TECHNIK is aware of the encryption.

In the event that the central locking system fails, open the locks manually with the key blade folded out. The ignition and engine cannot be started in this case.

Remote control key

Please note the following for handling the remote control key:

- The optimum temperature range for operating the remote control key is between 0 °C and 60 °C. Temperatures below or above this range will have a negative effect on the function of the key.
- The range of the remote control key is approx. 8 m. The local conditions and the position of the logic box in the machine can have an influence on the range.
- Protect the remote control key from direct sunlight, moisture and exposure to dust. Otherwise, the function may be impaired by the ingress of moisture. Always close the key for transport.
- The remote control key requires no maintenance except for a battery change (chapter 9.11, page 279). Have any repair work carried out by a specialist.

The remote control key comes with the following operating elements and functions:

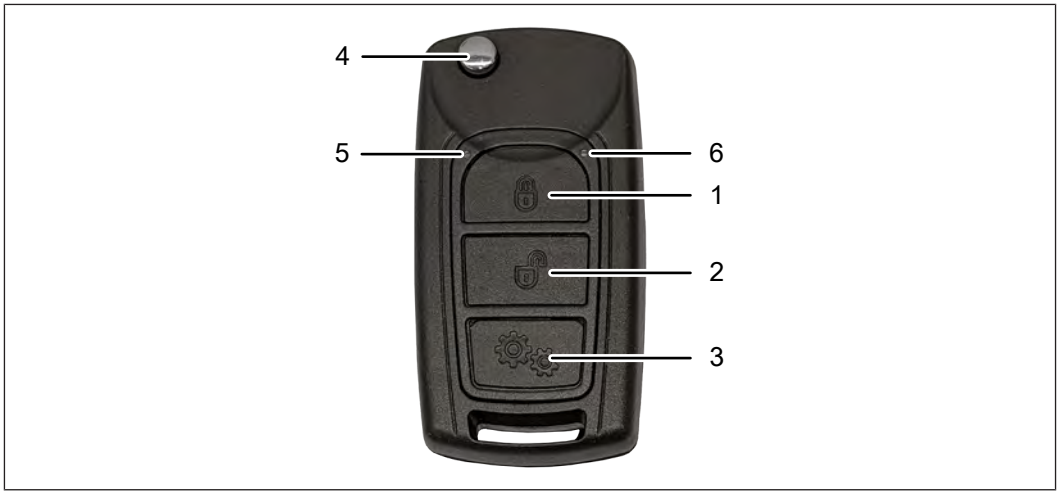


Fig. 5-4 Remote control key

Tab. 5-1 Operating elements and functions of the remote control key

Item	Operating element	Function
1	"Lock" push button	push briefly: locks all remote controlled locks and switches off the ignition Thus, when the machine is being locked, the ignition will be switched off automatically. Button 3 works independently of this.
2	"Unlock" push button	push briefly: unlocks all remote controlled locks
3	"Gear wheels" push button	push briefly: switches the ignition on or off
4	Fold out	folds out the key blade
5	Left LED	together with the right LED, indicates the button being pressing: Button 1 "Lock": left LED = red, right LED = green Button 2 "Unlock": left LED = green, right LED = green Button 3 "Gear wheels": left LED = yellow, right LED = green
6	Right LED	lights up green whenever the vehicle is within the key's radio range during use and has understood the radio command During a battery change (Reset + Power on), both LEDs light up 2 times in red, 2 times in green, 2 times in blue consecutively. This can also be the case when the battery is almost empty and a radio button is pressed.

Info!
The locking system works independently of the machine control as a stand-alone system. You can also operate the locks when the machine control is not started. The machine control starts when the ignition is switched on.

5.3.2 Switching the operating terminal on and off

Switching on the operating terminal

Switch on the operating terminal as follows:

1. Make sure that the emergency stop button (1) is unlocked.
2. Make sure that the key switch (2) is attached.
3. Turn the key switch 90° clockwise.
4. Wait until the buzzer sounds twice after approx. 3 seconds.
5. Turn the key switch further to the stop and hold it there until the emergency stop button lights up red. Release the key switch.
   ⇨ The operating terminal is switched on.
6. Switch on the tablet of the operating terminal with the on/off button (3).

Switching off the operating terminal

Switch off operating terminal as follows:

1. Switch off the tablet of the operating terminal with the on/off button (3).
2. Turn the key switch (2) 90° counter-clockwise back to its initial position.
   ⇨ The emergency stop button goes out. The operating terminal is switched off.

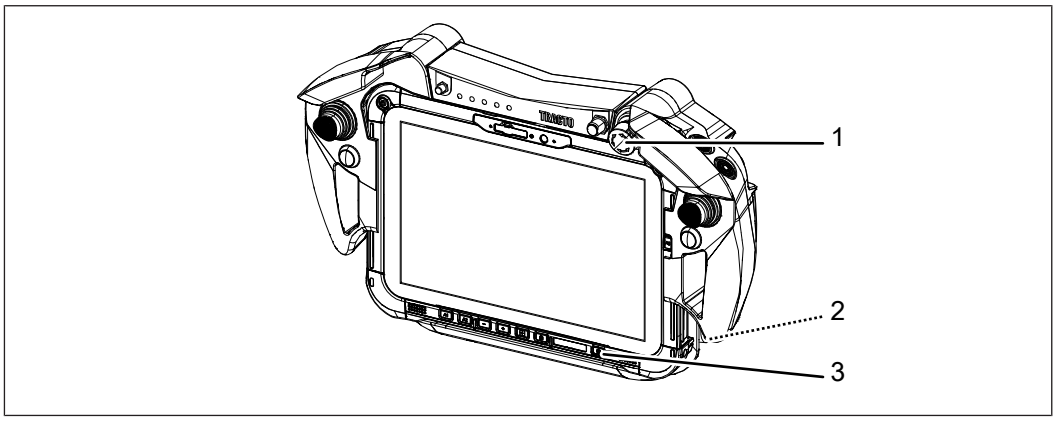


Fig. 5-5 Switching the operating terminal on and off

5.3.3 Opening and closing the bonnet

Requirements

– The ignition is switched on.
– The operating terminal is switched on.

Open the machine's bonnet as follows:

1. Open the "Drive / Setup" screen on the operating terminal.

2. Tap on the symbol with the bonnet (1).
   ⇨ The symbol is shown in blue.
3. Press the outer push button on the left (2, arrow pointing upwards).
   ⇨ The bonnet moves until you release the arrow or until the end position is reached.
   ⇨ Once the end position is reached, the arrow disappears.



Fig. 5-6 Opening the bonnet

Close the machine's bonnet as follows:

1. Open the "Drive / Setup" screen on the operating terminal.
2. Tap on the symbol with the bonnet (1).
   ⇨ The symbol is shown in blue.
3. Press the push button at the front left (2, arrow pointing downwards).
   ⇨ A warning message is displayed.
4. Make sure that nobody is put at risk by closing the bonnet and confirm the warning message with "OK" (3).
5. Press and hold the push button at the front left (2) again until the bonnet is closed.
   ⇨ Once the end position is reached, the arrow disappears.

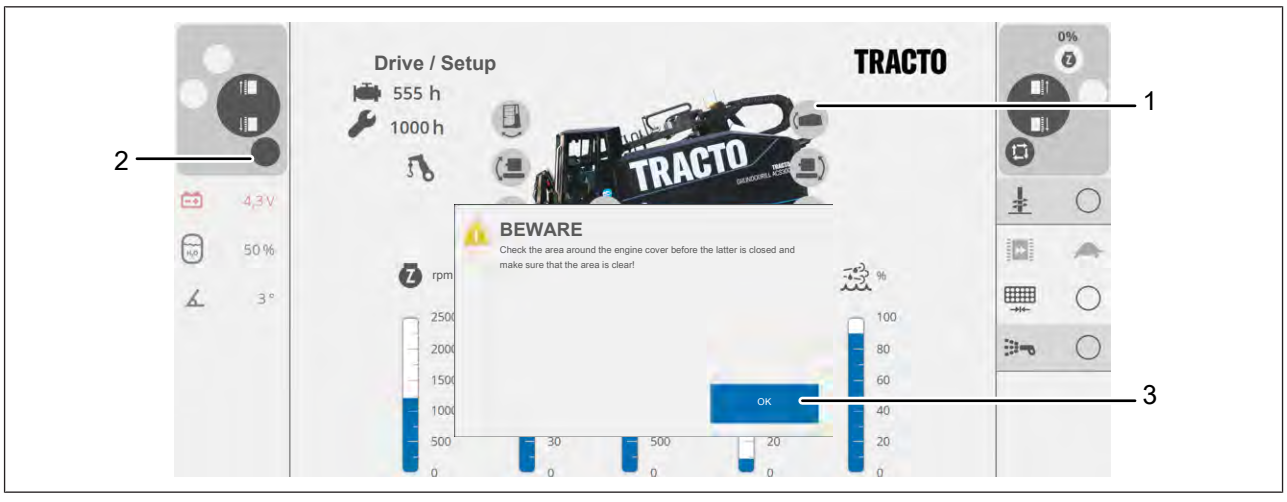


Fig. 5-7 Closing the bonnet

5.3.4 Inspections before machine start-up

Carry out the following tests before starting to operate the machine (see also instructions provided by the engine manufacturer):

Requirements

– The machine is positioned horizontally.
– The engine is switched off.

1. Switch on the ignition.
2. Switch on the operating terminal.
3. Open the "Drive / Setup" screen on the operating terminal.
4. Open the bonnet.
5. Check the engine oil level via the oil dipstick (1).
6. Remove the water in the fuel filter by use of the drain plug (2).
7. Close the bonnet.

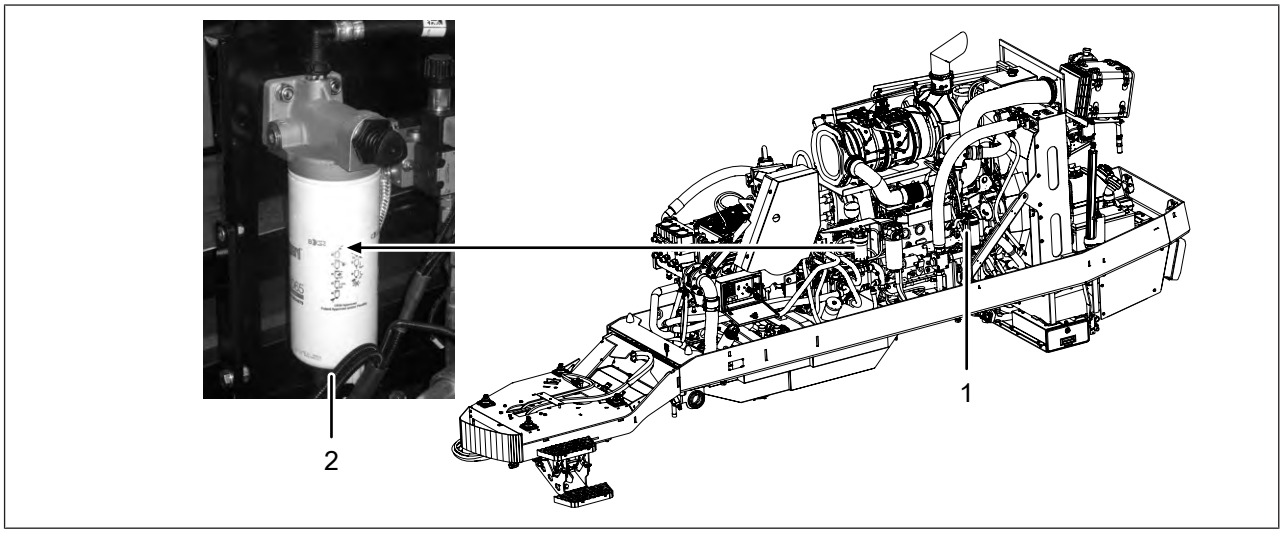


Fig. 5-8 Checks prior to start-up

5.3.5 Switching over operation

Info!
The machine can be operated either from the operator seat using the joysticks at the operator seat and on the operating terminal positioned in the holder inside the cab (drilling) or directly using the portable operating terminal while standing outside the cab (traversing).

Activate the portable operating terminal as follows:

1. Turn the >>Switch-over operation<< rotary switch (1) on the right joystick panel to "operating terminal".
   - ⇨ The emergency stop button, joysticks, buttons and screens of the operating terminal are activated.
   - ⇨ The joystick panels at the operator seat are deactivated.
   - ⇨ The emergency stop button in the cab remains active.
2. Take the operating terminal out of the holder.
3. Leave the cab and close the cab door.
4. Fold up the footstep.

Activate the joystick panels at the operator seat as follows:

1. If necessary, fold down the footstep.
2. Open the cab door and climb into the cab.
3. Fold down the left joystick panel.
4. Hang the operating terminal into the holder.
5. Turn the >>Switch-over operation<< rotary switch (1) on the right joystick panel to "operator seat".
   - ⇨ The emergency stop button, joysticks and buttons of the operating terminal are deactivated.
   - ⇨ The joystick panels and buttons at the operator seat are activated.
   - ⇨ The screens of the operating terminal remain active.

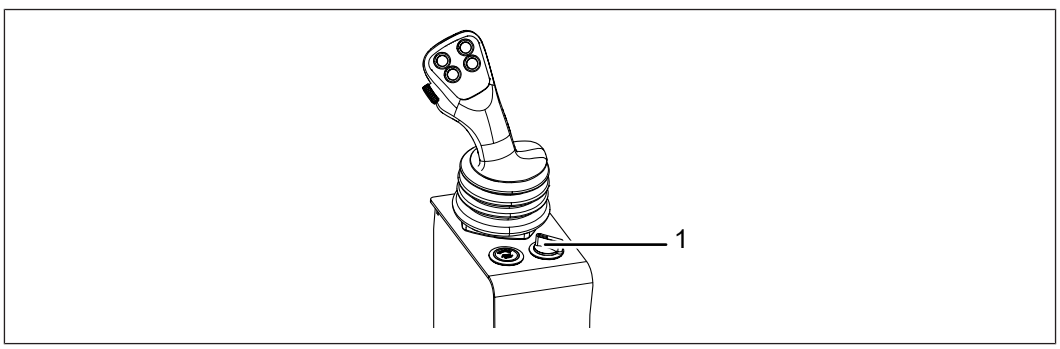


Fig. 5-9 >>Switch-over operation<< rotary switch

Info!
Moving the machine from the operator seat is only permitted for aligning the machine. The function automatically stops after 10 seconds. Only after having moved the joysticks to their resting position you can execute the function again for maximally 10 seconds.

5.3.6 Starting the engine

Info!
When moving a joystick axis or actuating a joystick button while the ignition is being switched on, the actuated component will be disabled.
If, for example, the left joystick is pushed forward while the ignition is being switched on, the left track chain (in drive mode) or the rotation (in bore mode) cannot be controlled.

- To rectify the fault, switch off the ignition.
- Always set the ignition lock to the centre position when you switch off the ignition. This prevents the battery from being deeply discharged.
- Only switch the ignition back on when it is sure that, in doing so, no operating element is actuated.

Start the engine as follows:

1. Switch on the ignition by briefly pressing the push button (1) on the remote control key.
2. Start the engine by briefly pressing either the start/stop button (2) on the left joystick panel or the start/stop button (3) on the operating terminal.

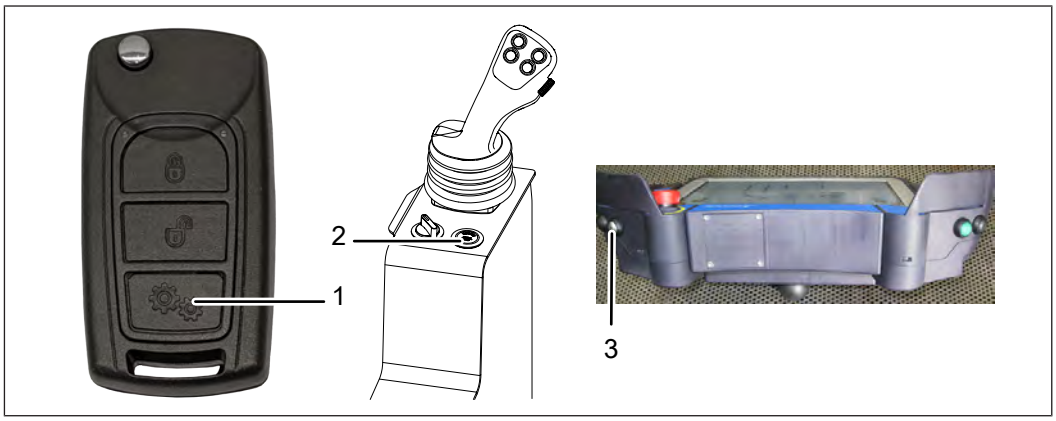


Fig. 5-10 Starting the engine

The previously used screen is shown on the operating terminal (here: the "Drive / Setup" screen).

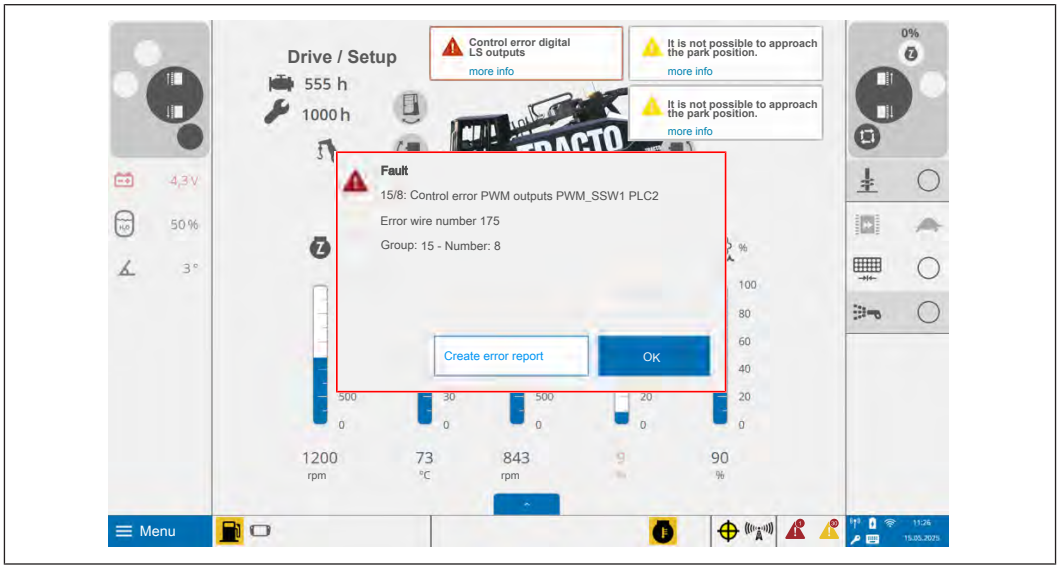


Fig. 5-11 "Drive / Setup" screen with error messages

If a machine error occurs, it will be displayed as a pop-up on the screen.

NOTICE

Engine performance can deteriorate with prolonged idling!

- Only allow the engine to run at idle for a short time. If the idle time is too long, this may lead to a poor engine performance.

5.3.7 Inspections during machine start-up

Carry out the following inspections at the operating terminal while starting up the machine:

5.3.7.1 Checking the diesel supply

Check the diesel supply via the diesel tank indicator (1).
Reserve starts from a tank level of 10 %. A respective fault message is displayed in the status line.

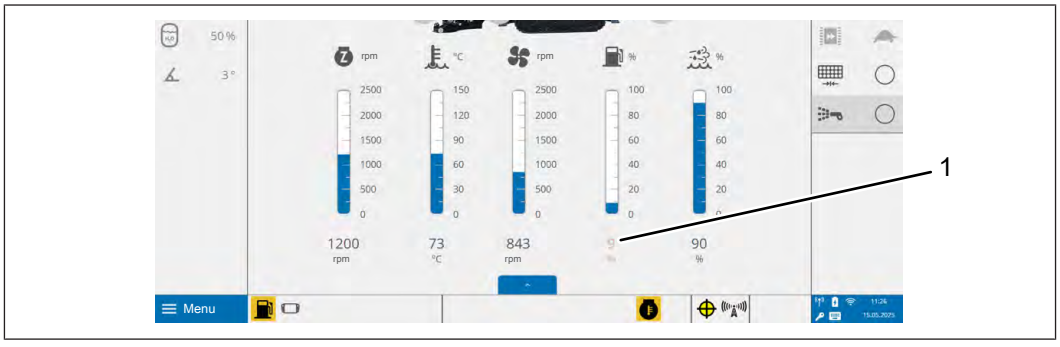


Fig. 5-12 Checking the diesel level

Refilling diesel

If there is a diesel supply in the reserve area, refill the diesel tank by means of the fuel pump as follows:

⚠ DANGER



Fire hazard due to fuel!

Leaking or spilled fuel might ignite on hot motor parts and lead to severe burns.

- Only refuel when the engine is switched off.
- Never refuel in the vicinity of open fire or sparking.
- Make sure not to spill any fuel.
- Smoking is prohibited.

Info!

The fuel pump only works if the filling level of the diesel tank is < 90 %. The fuel pump is switched off when the tank level is ≥ 95 %.

Prerequisites

– The machine is positioned horizontally.
– The ignition is switched off.

1. Connect the suction hose (1) to the plug-in coupling (2).
2. Connect the other end of the suction hose to the fuel container (not shown).
3. Switch on the fuel pump by pressing the green push button (3).
   ⇨ When the diesel tank is full, the pump stops automatically.
   ⇨ If the fuel tank is empty before the diesel tank is full, the fuel pump continues running.
   In this case, stop the fuel pump by pressing the red push button (4).
4. Disconnect the suction hose and stow it away safely.

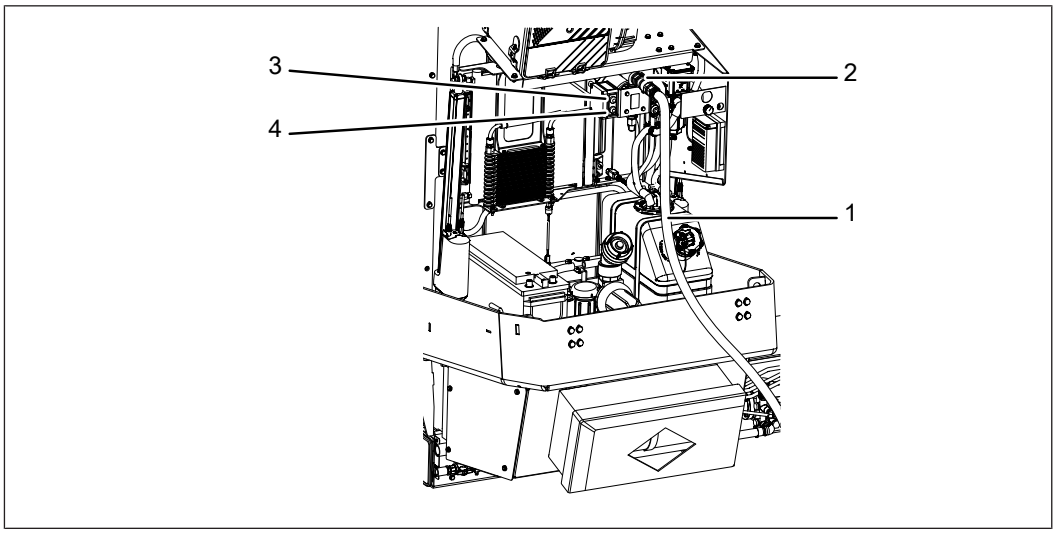


Fig. 5-13 Refilling the diesel tank by means of the fuel pump

5.3.7.2 Checking the DEF supply

Check the DEF supply on the DEF fuel indicator (1).
Reserve starts from a tank level of 10 %. A respective fault message is displayed in the status line.

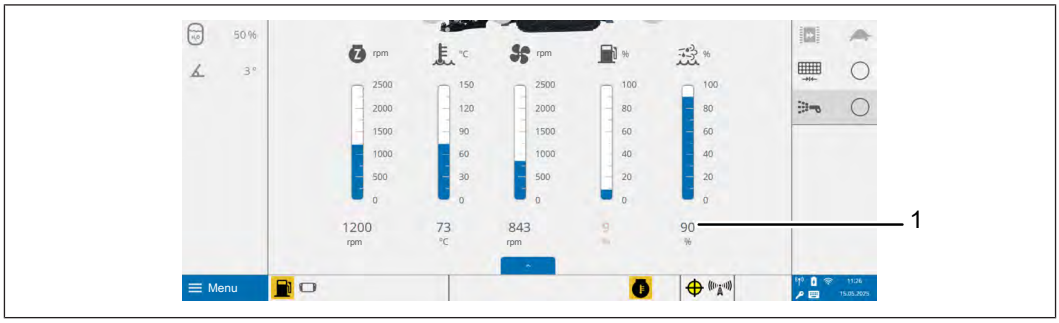


Fig. 5-14 Checking the DEF supply

Refilling diesel exhaust fluid

If there is DEF supply in the reserve range, refill the DEF tank as follows:

Prerequisites

- The machine is positioned horizontally.
- The ignition is switched off.

1. Fill the DEF into the tank (1) with a maximum of 19 l/min.
2. Fill the tank to the lower edge of the filler neck at the maximum.
3. After filling, tap the side of the tank with the flat of your hand or a rubber mallet until the air bubbles adhering to the wall and sensor are released.

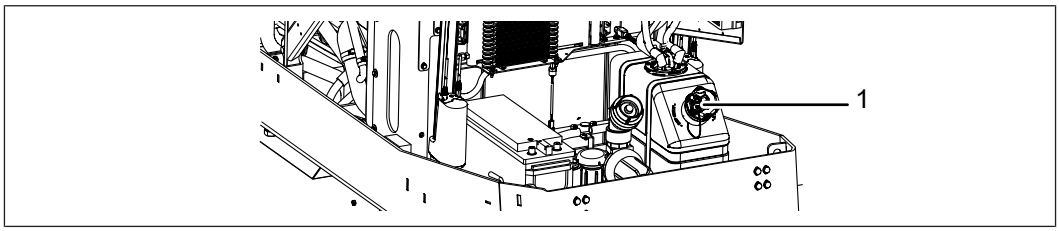


Fig. 5-15 DEF tank

5.3.7.3 Checking exhaust gas system cleaning

Make sure that the "Cleaning of exhaust gas system" warning indicator is not illuminated in the status line (chapter 6.2.4.1, page 132). Otherwise start to clean the exhaust gas system manually (chapter 6.10, page 248).

5.3.7.4 Checking the hydraulic oil supply

Make sure that the "Hydraulic tank minimum" indicator (chapter 6.2.4.1, page 132) is not illuminated in the status line.
Reserve starts from a tank level of 10 %. If necessary, refill hydraulic oil.

5.3.8 Activating the wireless pit remote control

The wireless pit remote control has a range of up to 300 m. The machine will be switched off as soon as the signal is disturbed or interrupted.

Info!
Objects between the machine and the pit, e.g. trees, buildings or vehicles, can interfere with the radio signal and reduce the range of the wireless pit remote control.

Requirements

Conditions for the operation of the wireless pit remote control:

- The operator at the machine is sitting on the operator seat inside the cab of the machine.
- The left joystick panel is folded down.
- The operator and his skilled colleague in the target pit can communicate with one another via radio.

Operator inside the cab

1. Set the "Drive mode/bore mode" rotary switch on the left joystick panel to "bore mode".
2. Set the "Switch-over operation" rotary switch on the right joystick panel to "operating terminal".
3. Stop the engine but leave the ignition on.
4. Switch off the operating terminal.
5. Inform the operator in the target pit that he can restart and operate the machine with the wireless pit remote control.

Operator in the target pit

1. Make sure that the emergency stop button (1) is unlocked.
2. Turn the key in the key switch (2) 90° clockwise and wait until the buzzer sounds twice.
3. Continue turning to the stop until the emergency stop button is illuminated in red.
4. Release the key switch.
   ⇨ The machine starts.
   ⇨ The status LED (3) lights up when there is a connection to the receiver.
5. Use the joystick (4) to carry out the desired drilling functions. While the drilling functions are controlled via the wireless pit remote control, a warning signal will be emitted at the machine.

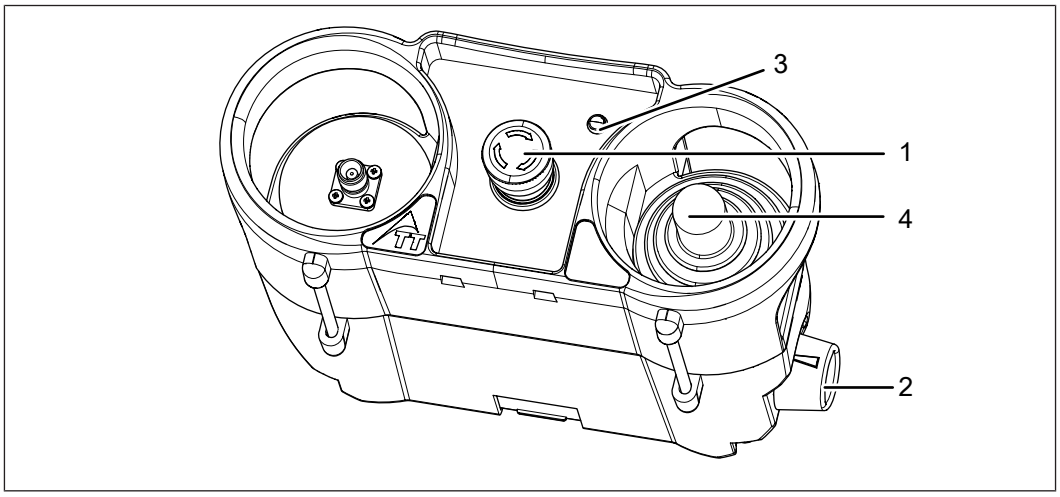


Fig. 5-16 Activating the wireless pit remote control

6. After completion of the work in the target pit, switch off both the machine and the wireless pit remote control by turning the key counter-clockwise.
7. Inform the operator at the machine that the machine can now again be started and operated from the operator seat.

Info!
Operation of the machine can be interrupted at any time by pressing the emergency stop button. The machine's engine will be switched off then.

5.3.9 Preparing the machine for traversing

For traversing the machine, the cab, the thrust rig and the gantry crane must be in transport position and the step grid must be folded in.

⚠ CAUTION

Impact hazard! Swivelling cab!

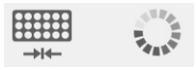
- When swivelling the cab make sure that no other person is put at risk.

1. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.
2. Turn the >>Switch-over operation<< rotary switch on the right joystick panel to "operating terminal".
3. Remove the operating terminal from the holder and leave the cab.
4. Close the cab door.
5. Fold the upper footstep downwards and swing the whole footstep underneath the cab.

6. When the cab has been swung out, tap on the cab (1) symbol in the "Drive / Setup" screen on the operating terminal.
   ⇨ The symbol is shown in blue.
7. Press the push button at the front left (2, arrow pointing inwards).
   ⇨ A warning message is displayed.
8. Make sure that nobody is put at risk by swinging out the cab and confirm the warning message with "OK" (3).
9. Press and hold the front left push button (2) again.
   ⇨ The cab moves until you release the push button or until the end position is reached.
   Once the end position is reached, the push button disappears.



Fig. 5-17 Swinging the cab in



10. Press the >>Approach transport position<< (1) push button on the "Drive / Setup" screen of the operating terminal.
11. Press the push button at the front right (2, automatic button).
    - ⇨ The thrust rig and the rod crane move to the transport position.
    - ⇨ During travel into the transport position, the checkbox next to the >>Approach transport position<< button rotates.
    - ⇨ As soon as the transport position has been reached, the checkmark appears in the checkbox (3).
12. Lift the front and rear stabiliser by tapping the corresponding stabiliser (4, 5) on the operating terminal and moving it upwards with the outer left push button (6, arrow pointing upwards).
13. Select the respective tilt cylinder (8, 9) and tap the push buttons (6, 7) to horizontally adjust the rig boom.

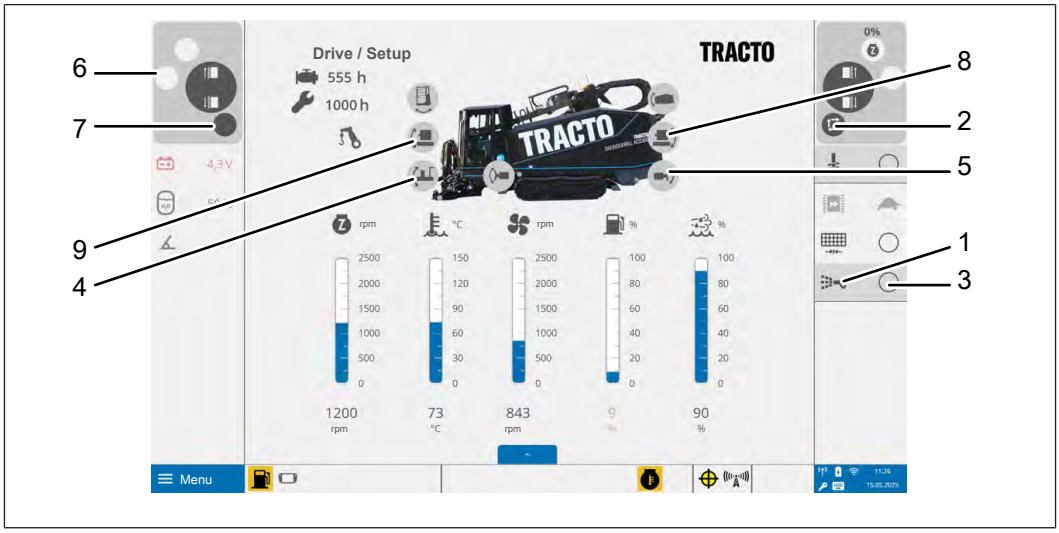


Fig. 5-18 Approaching the transport position

5.3.10 Traversing the machine

When traversing the machine, please observe the following safety instructions:

⚠ DANGER

Risk of injury due to moving machine!
It is prohibited to ride on the bore rig!



The moving machine can cause fatal injuries to you and other persons.

- Before traversing the machine, secure the loading crane as indicated in the figure below.
- Maintain a safety distance of at least 5 m.
- Walk behind or diagonally behind the bore rig when traversing it.
- Ensure good visibility.
- Make sure that you can oversee the travel range.

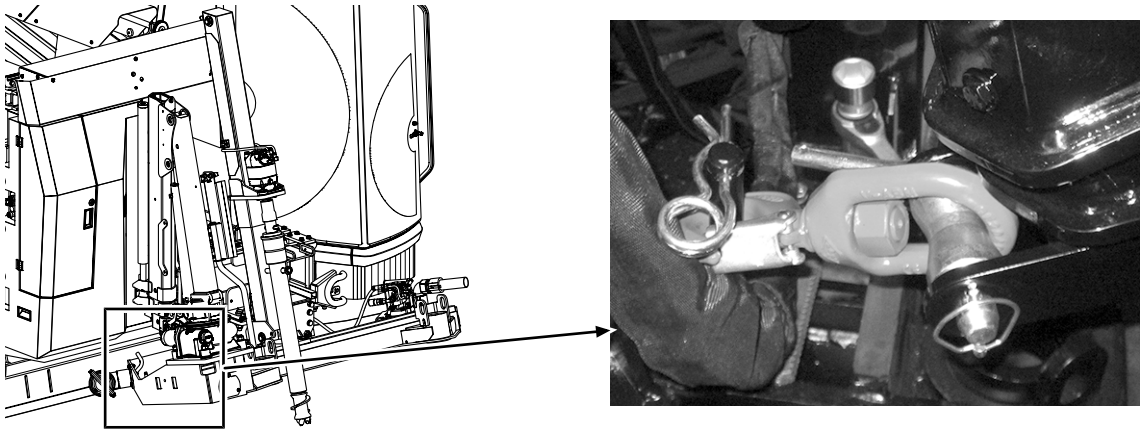


Fig. 5-19 Securing the loading crane before traversing the machine

NOTICE

Potential damage to hose and control lines!

When running over hydraulic hoses, drilling fluid hoses or control cables, use hose bridges to protect the hoses and cables against damage.

⚠ DANGER

Machine tipping over!



When driving the machine on ramps or slopes, there is a risk of the machine tipping over and crushing your body.

- Reduce the danger of the machine tipping over by lowering the stabilisers.
- Maintain a safety distance of at least 5 m!
- Be mindful of weight shifts when driving up the ramp!
- Only traverse the machine in the lowest gear step.
  To do so, set the button for the speed level to "tortoise".
- Traverse/park and operate the machine only up or down a slope.
  The max. permissible inclination on slopes is 20°.

Info!

Moving the machine from the operator seat is only permitted for aligning the machine. The function automatically stops after 10 seconds. Only after having moved the joysticks to their resting position you can execute the function again for maximally 10 seconds.

– Use the portable operating terminal to traverse the machine.
– Check the ground of the operating site to ensure the required stability.
– Stop operating the machine from a wind speed of 33 m/s (wind force 12).
– Only traverse the GRUNDODRILL with the cab locked.

NOTICE

When manoeuvring or transporting the machine, please observe the following to avoid excessive wear of the crawler tracks:

- The rubber coating of the crawler tracks serves to protect sensitive surfaces (asphalt, paving etc.) and is subject to natural wear when traversing the machine with the crawler drive. Manoeuvring the machine on unstable ground (e.g. gravel, rock etc.) can lead to significantly increased wear.
- If possible, avoid pivot turning the machine during manoeuvring (opposed rotation of the crawler tracks). This is particularly important in case of high outside temperatures.
- If possible, transport the machine on a low loader (see also information regarding transport provided in the crawler track instructions).

1. Make sure that all preparations for traversing have been completed (chapter 5.3.9, page 89).

2. Use the left (1) and right (2) joysticks on the operating terminal to select a direction of travel. To drive the machine forward, push both joysticks forward.



Fig. 5-20 Traversing the machine using the operating terminal

5.3.11 Stopping the machine

To stop the machine, let go of the two joysticks of the operating terminal, they will spring back automatically into their centre position.

Lower the stabilisers in the following situations:
- for transport on a truck/trailer
- when stopping/parking on a sloping surface.
- for drilling and pulling-in operation

⚠ WARNING



Danger of crushing when raising and lowering the stabilisers!

- Keep a sufficient distance from the stabilisers!

1. Tap the corresponding stabiliser (1, 2) on the "Drive / Setup" screen to select it.
   ⇨ The symbol is shown in blue.
2. Actuate the push button at the front left (3, arrow pointing downwards) until the stabiliser has reached the floor.



Fig. 5-21 Lowering the stabilisers

5.4 Setting the machine up for operation

Requirement The machine is positioned in the starting position at the entrance pit (chapter 5.3.10, page 92).

5.4.1 Removing the transport locks

NOTICE

Potential damage to the rod crane!

If the transport locks of the rods are still installed during drilling, you cannot take the rods out of the rod box. This will cause damage to the rod crane.

- Before starting drilling operation, make sure that the transport locks of the rods are disassembled and stored away safely in its parking position.

Remove the transport locks as follows:

1. Pull the tube linchpins (1) out of the locking sleeves (2).
2. Pull the two locking sleeves out of the rod box.
3. Remove the transport lock rods (3) from the rod box.

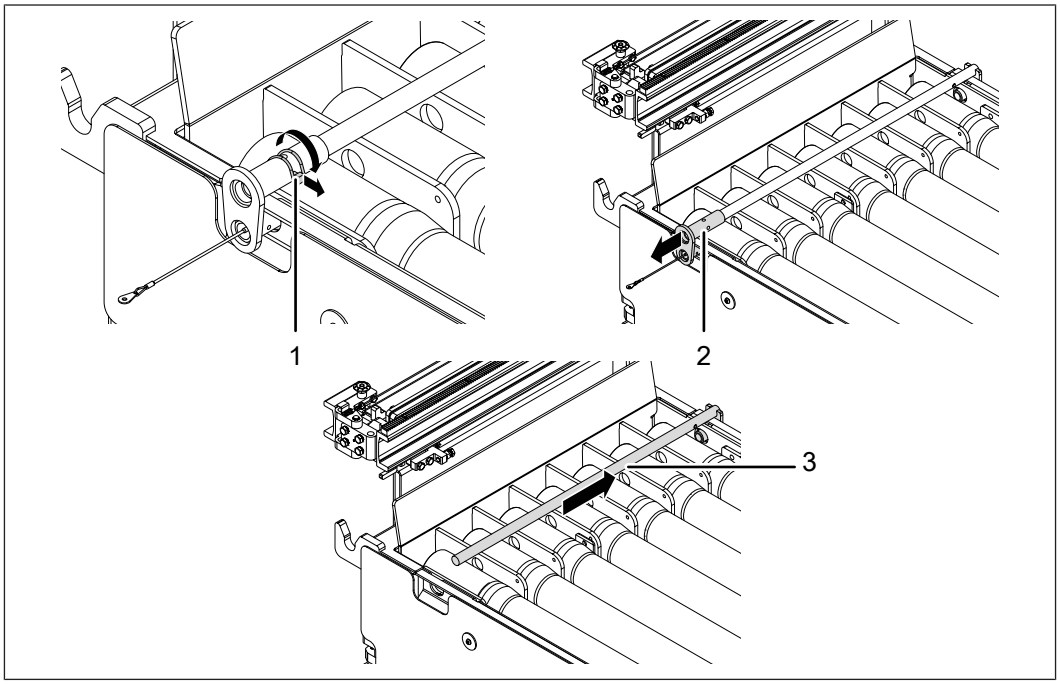


Fig. 5-22 Detaching the transport lock for the rod box (here: rear)

4. Detach the tube linchpin (1) and pull the locking sleeve (2) off the transport lock rod.
5. Detach the transport lock rod (3) from the rod box.
6. Slide the locking sleeve onto the transport lock rod with the tab first until it reaches the other side.
7. Slide the transport lock into the retainer (4) in the rod box and secure the transport lock with the tube linchpin.

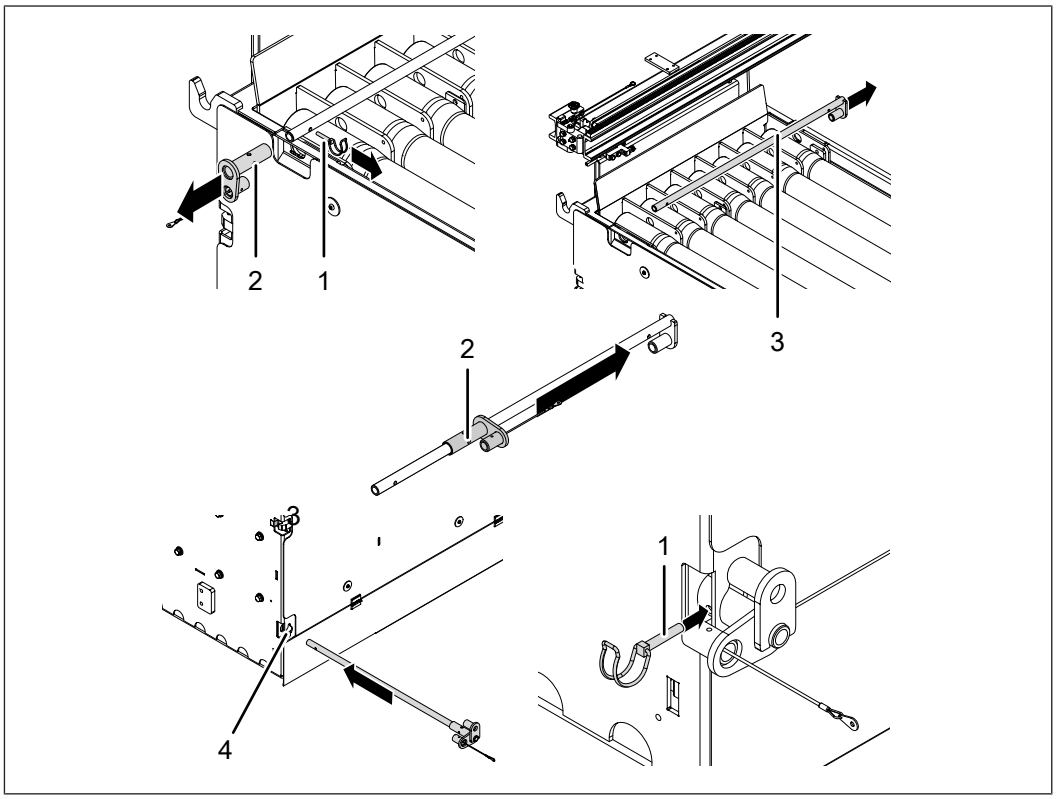


Fig. 5-23 Transport safety device in parking position

5.4.2 Lowering the stabilisers

Lower the stabilisers in the following situations:

- for transport on a truck/trailer
- when stopping/parking on a sloping surface.
- for drilling and pulling-in operation

1. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.
2. Open the "Drive / Setup" screen on the operating terminal.

⚠ WARNING



Danger of crushing when raising and lowering the stabilisers!

- Keep a sufficient distance from the stabilisers!

3. Tap the corresponding stabiliser (1, 2) on the "Drive / Setup" screen to select it.
   ⇨ The symbol is shown in blue.
4. Actuate the push button at the front left (3, arrow pointing downwards) until the stabiliser has reached the floor.



Fig. 5-24 Lowering the stabilisers

5.4.3 Lowering the anchor plate

⚠ WARNING



Lowering anchor plate!

Danger of crushing your feet.

- Wear foot protection.
- Keep a sufficient distance from the anchor plate.

1. Press the symbol on the anchor plate (1) in the “Drive / Setup” screen.
   ⇨ The symbol is shown in blue.
2. Actuate the push button at the front left (2, arrow pointing downwards) until the anchor plate has reached the floor.
   ⇨ Once you let go of the push button, the anchor plate stops.



Fig. 5-25 Lowering the anchor plate using the operating terminal

5.4.4 Lowering the boom

⚠ WARNING



Danger of crushing under the lowering boom!

Keep a sufficient distance from the boom.

Align the rig boom so that the anchor plate rests on the ground flush and evenly.

1. Tap the corresponding tilt cylinder (1, 2) on the "Drive / Setup" screen to select it.
   ⇨ The symbol is shown in blue.
2. Actuate the outer push buttons on the left or at the front left (3, 4, arrow buttons) to adjust the rig boom.



Fig. 5-26 Adjusting the inclination angle of the rig boom

5.4.5 Switching off the machine

Switch the machine off as follows:

1. Stop the engine by briefly pressing either the start/stop button (1) on the left joystick panel or the start/stop button (2) on the operating terminal.
2. Switch off the ignition by briefly pressing the "Gear wheels" push button (3) on the remote control key.

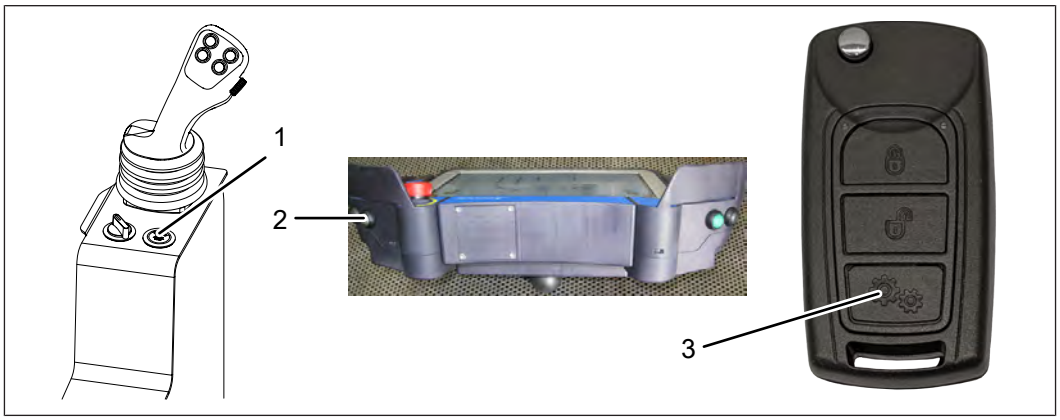


Fig. 5-27 Stopping the engine

5.5 Installation of the electric shock protection device

5.5.1 Checking the electric shock warning device

Info!
The ignition must be switched on when checking the electric shock warning device.

The electric shock warning device is located in the cab.

1. Connect one cable of the testing device (1) to the grounding stake (4) and the other cable to an unpainted metal part of the machine (3).
   Make sure that the grounding stake does not touch the machine.
2. Switch on the ignition by briefly pressing the push button on the remote control key.
3. Press the button of the testing device.
   If the warning signal is triggered, the electric shock warning device (2) has passed the check.
4. Disable the alarm by pressing the reset button (5) on the electric shock warning device.

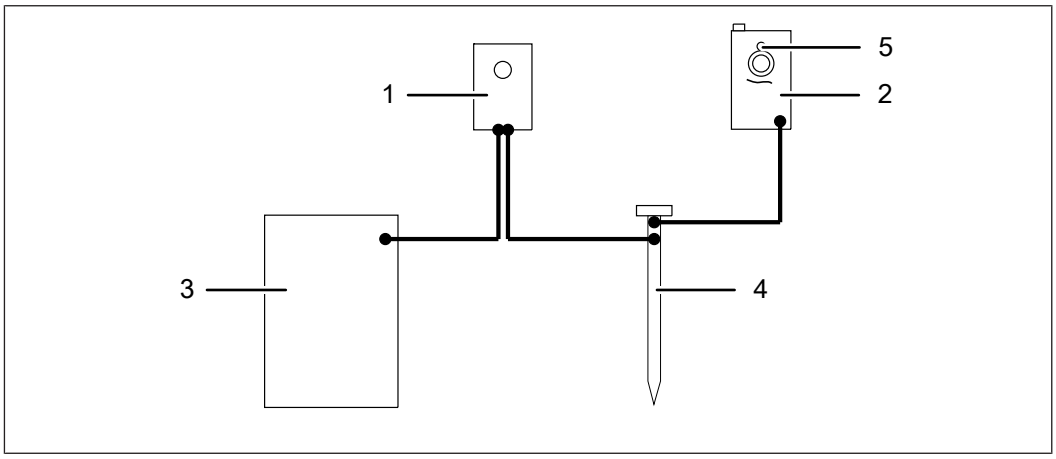


Fig. 5-28 Checking the electric shock warning device

5.5.2 Overview of the electric shock protection device

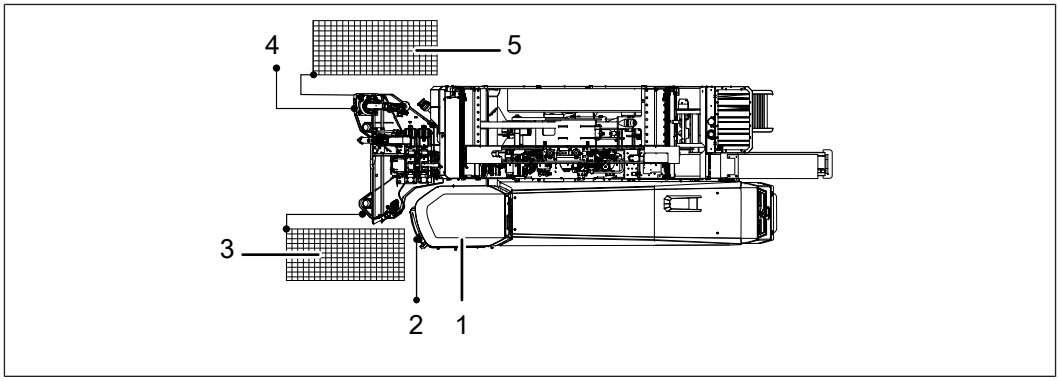


Fig. 5-29 Overview of the electric shock protection device

Tab. 5-2 Overview of the electric shock protection device

Item	Safety device	Function
1	Electric shock warning device	Emits a warning signal when bypassing live wires, i.e. when the machine has become a conductor.
2	Grounding stake of the electric shock warning device	Discharges electricity in case the machine has become a conductor due to work taking place near power cables. The electric shock warning device only works in connection with the grounding stake.
3, 4	Step grid / grounding mat	Discharge electricity to the ground. During works around the machine, the drilling personnel should stand on these mats. The second grounding mat (4) is optional.
5	Grounding cable with grounding stake	Discharges electricity from the machine.

5.5.3 Installing the electric shock protection device

After the machine has been set up for operation (chapter 5.4, page 95), install the electric shock protection device for the machine before anchoring the bore rig and starting any drilling operations.

⚠ DANGER



Risk of death due to electric shock!

If you hit a line while striking the grounding stake into the ground, there is a risk of death due to electric voltage.

- Wear the comprehensive protective equipment included in the scope of delivery of the electric shock warning device.
- **Do not move away!**
- Keep on standing with both feet on the ground until the current flow is interrupted and safe operating conditions are restored.
  If the current flow is not interrupted correctly,

⇨ an automatically resetting circuit breaker could supply the power cable with power or

⇨ the contact between the machine and the power cable might be re-established.

1. Drive the grounding stake of the electric shock warning device into the ground **at a distance of approx. 1.5 to 2 m from the machine and perpendicular to the bore path**.
   It is important to place the grounding stake in conductive soil! In case of extremely dry ground or tarmac first water the ground.

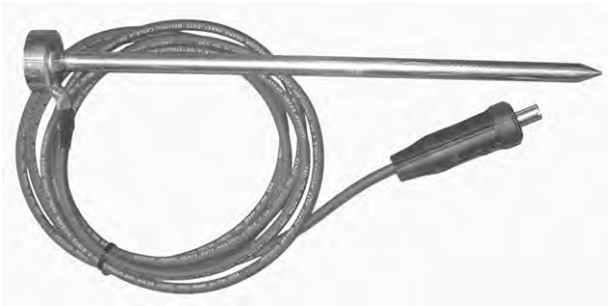


Fig. 5-30 Grounding stake with connected cable

⇨ If the grounding stake hits an electrical cable and electricity flows through both the machine and the ground, a warning signal will be emitted.

2. Connect the grounding stake to the grounding connection underneath the front of the cab (1).

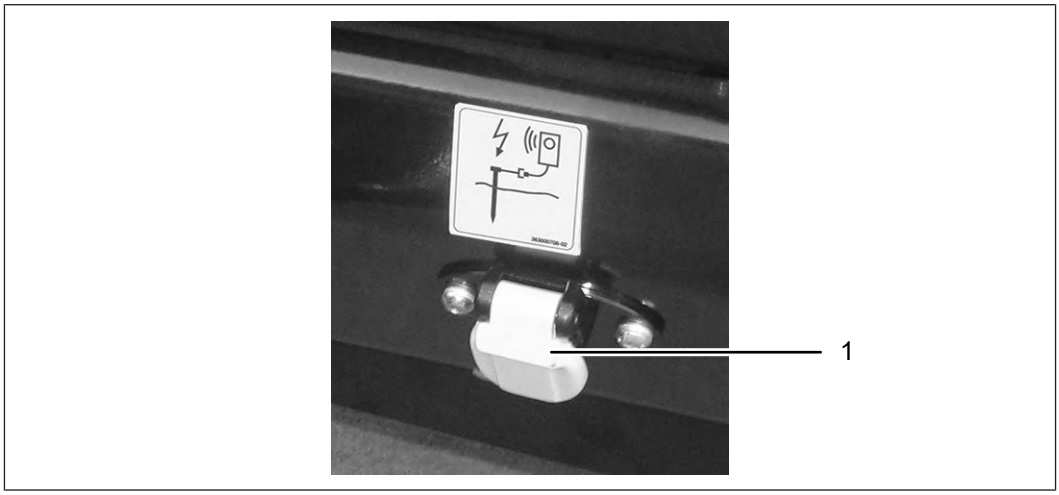


Fig. 5-31 Grounding connection underneath the cab

3. Lay out the grounding mat(s) parallel to the machine and connect the cables to the sockets (1) on the clamp.

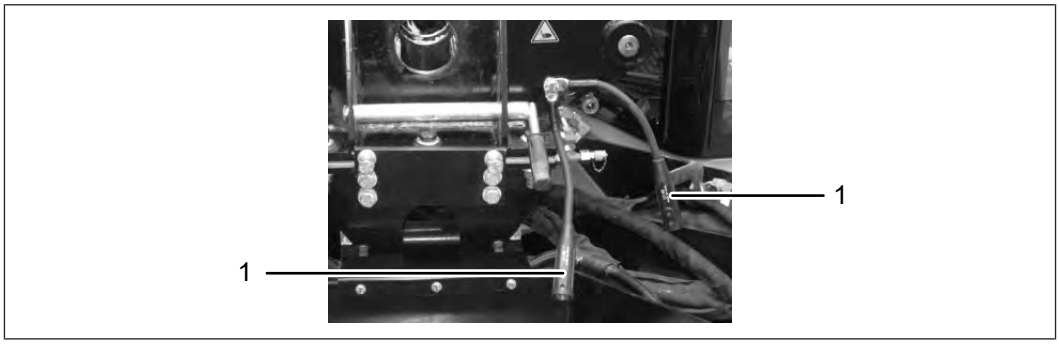


Fig. 5-32 Sockets for connecting the grounding mats

5.6 Anchoring the machine in the ground

Before starting the anchoring process, make sure
– that the anchor plate lines up precisely with the ground.
– that there are no lines or cables in the anchoring area above- or underground.

⚠ DANGER

Rotating drill anchor!
In case your clothing comes into contact with the drill anchor, there is a risk that you will be pulled in.



- Wear tight-fitting clothing.

1. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.

2. Open the "Drive / Setup" screen on the operating terminal.
3. Select the anchor boring rig with the checkbox (1) in the right action panel.
4. Move the anchor boring rig to the desired position on the anchor plate.
5. Push up both joysticks (2, 3) to lower the anchor boring rig with the rotating drill.

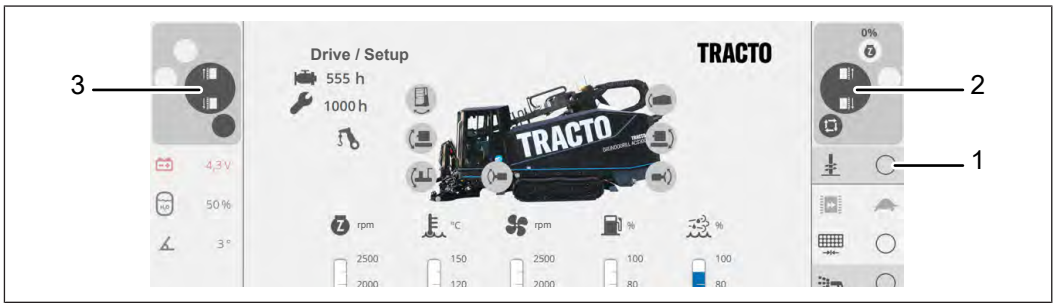


Fig. 5-33 Anchoring the machine with drills

Info!
During the anchoring of the machine, the guiding sleeve of the drill anchor may be pushed up through drilled ground.

Once the guiding sleeve (1) has been pushed so far up that the marking groove (2) is visible,

- stop the anchoring process
- pull the guiding sleeve out of the anchor plate
- remove the soil from the annular gap between anchor plate and drill anchor
- reinsert the guiding sleeve into the anchor plate and continue the anchoring process

5.7 Swinging the cab

To obtain a better view of the clamping area when drilling/expanding from the cab, you can swing the cab out. Swinging can be performed if the following conditions are met:

- Either from the operator seat with the left joystick panel folded down
- or from outside with the operating terminal while simultaneously activating the dead man button.
- The machine is in transport or drilling position.

NOTICE

Possible damage to the cab when hitting the anchor plate

If the rig is raised horizontally, the cab may hit the anchor plate when swivelling and be damaged.

- Before swivelling the cab, make sure that the machine is in transport position or in drilling position.

⚠ CAUTION

Impact hazard! Swivelling cab!

- When swivelling the cab make sure that no other person is put at risk.

1. Open the "Drive / Setup" screen on the operating terminal.
2. Tap on the symbol of the cab (1).
   ⇨ The symbol is shown in blue.
3. Press the outer push button on the left (2, arrow pointing outwards).
   ⇨ A warning message is displayed.
4. Make sure that nobody is put at risk by swinging out the cab and confirm the warning message with "OK" (3).
5. Press and hold the outer push button on the left (2) again.
   ⇨ If you are outside the cab, press and hold the dead man button on the operating terminal and simultaneously press the arrow button.
   ⇨ The cab moves until you release the arrow button or until the end position is reached.
   ⇨ Once the end position is reached, the arrow disappears.
6. To swing the cab back into transport position after completion of the drilling process, press the front left push button (4, arrow pointing inwards) in the same way.



Fig. 5-34 Swinging the cab out

5.8 Assembling transmitter and drill head in the transmitter housing (for DCI units)

Info!
This chapter applies to bores with battery-powered transmitter for:
– rock drilling units in case of rock drilling

5.8.1 Preparing the transmitter for the rock drilling unit with roller chisel

Components of the rock drilling unit

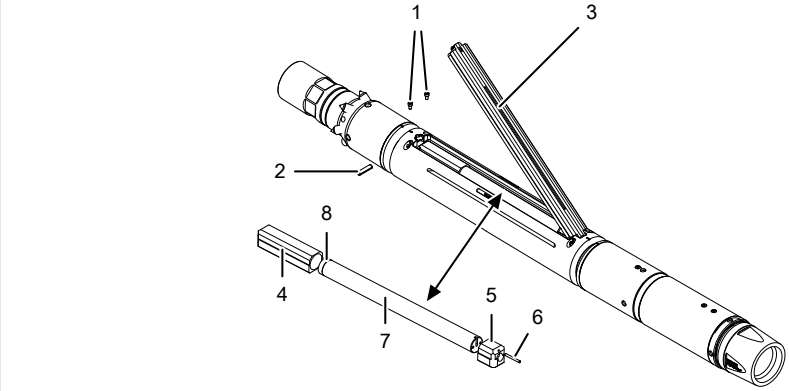


Fig. 5-35 Rock drilling unit with transmitter

1	Safety screws for flap cover lock pin	5	Front probe holder
2	Lock pin for flap cover rock drilling unit	6	Anti-twist protection
3	Flap cover rock drilling unit	7	Transmitter
4	Rear probe holder	8	Screw connection battery compartment

To prepare the transmitter and the rock drilling unit, proceed as follows:

1. Remove the two safety screws (1) for the lock pin (2) of the flap cover (3) on the cover end marked with "=>".
2. Drive out the lock pin (ø 10 mm) using a suitable tool.
3. Open the flap cover.
4. Pay attention to the battery conditions and correct polarity! Open the screwing of the transmitter's battery compartment (8) and insert two or four batteries (size C) depending on the model.
5. Ensure the intactness of the seal rings.
6. Close the screwing of the battery compartment tight again.
7. Insert the transmitter (7) into the two probe holders (4, 5).
   ⇨ In doing so, make sure that the transmitter is in 12 o'clock position by inserting the anti-twist protection (6) from the front through the lock pin opening of the front probe holder (5) into the probe guidance of the transmitter (front).
   ⇨ The locking pin will only fit into the probe guidance when the transmitter is in 12 o'clock position.

8. Insert the mounted transmitter into the rock drilling unit.
9. Close the flap cover.
10. Reinsert the lock pin for the flap cover.
11. Secure the lock pin of the flap cover with the two screws.
12. Screw the roller chisel (1) onto the rock drilling unit (2).

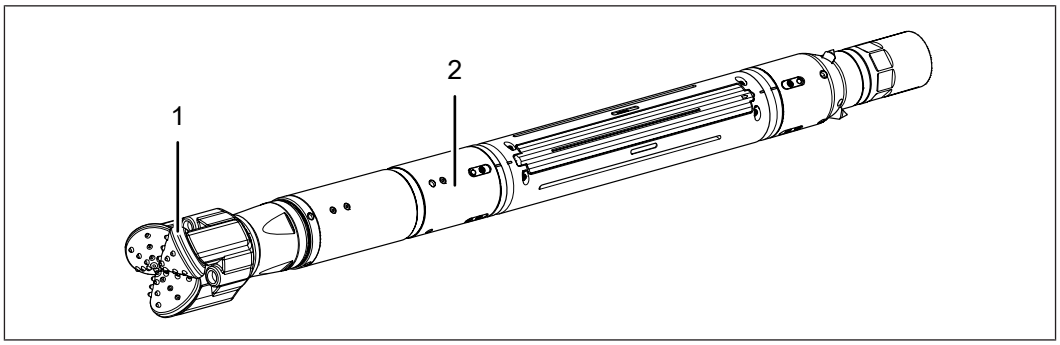


Fig. 5-36 Roller chisel with rock drilling unit

13. Screw the complete rock drilling unit onto the first drill rod.

5.8.2 Checking the functioning of the transmitter

The functional check of the transmitter depends on the transmitter type.

Please read the manufacturer's instructions.

5.8.3 Calibrating the detection system

The calibration of the detection system can vary depending on the manufacturer.
Please read the manufacturer's instructions.

Info!
During calibration please make sure that no cables, steel pipes or reinforced concrete are located in the ground and that there are no metal surfaces and high voltage lines nearby!
Otherwise incorrect calibration results could be determined!

5.9 Connecting the drilling fluid system

The following drilling fluid mixing system can be used with the machine:

– MA07-D

Connect the drilling fluid hose to the drilling fluid mixing system (1) and to the machine's suction connection (2).

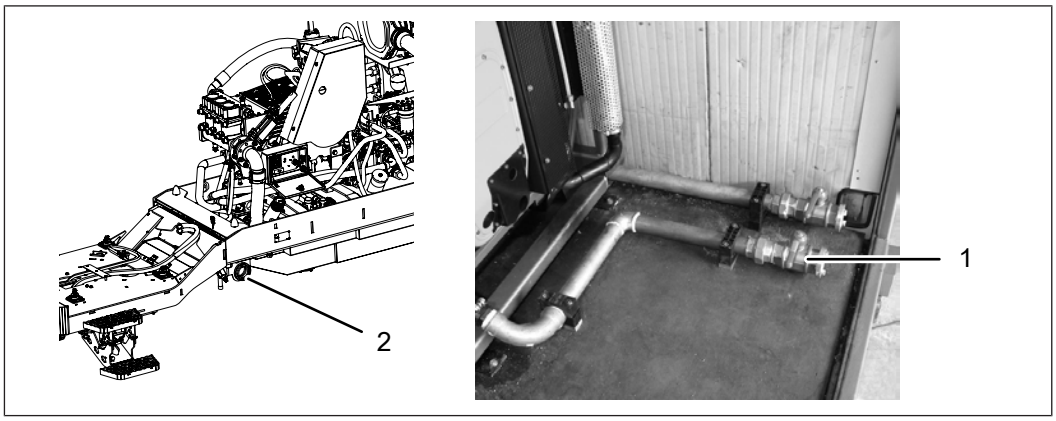


Fig. 5-37 Drilling fluid mixing system, connecting the supply connections

5.10 Connecting and using the high-pressure cleaner

NOTICE

Potential damage to the high-pressure cleaning pump due to particles in fresh water!

- Before filling up the fresh water tank, you have to make sure that the integrated water filter on the fresh water connection is free from dirt.

Info!
Relieve the water pressure on the quick connection before connecting the high-pressure cleaning gun.

1. Make sure that the water filter (1) on the fresh water connection has been cleaned.
2. Re-fill fresh water if necessary.
3. Connect the ball valve (2) to the quick connection (3).
4. Disconnect the hose of the rod cleaning system at the quick connection.
5. Connect the hose of the high-pressure cleaning gun to the quick connection.
6. Open the ball valve at the quick connection again to use the high-pressure cleaning gun.

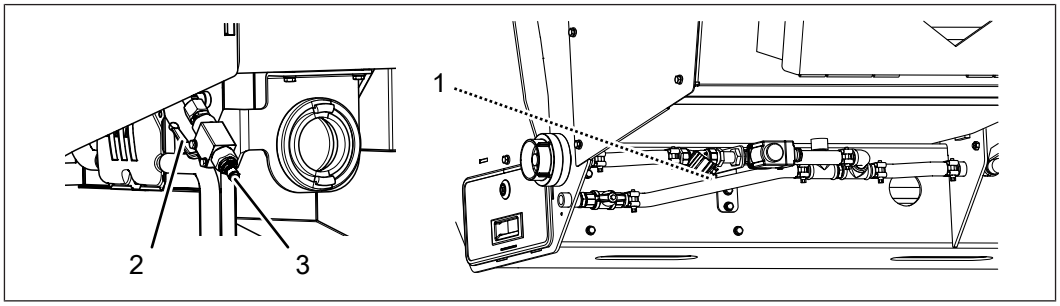


Fig. 5-38 Fresh water connection, connecting the high-pressure cleaning gun

Using the high-pressure cleaner



7. To use the high-pressure cleaner, access the "Pilot drill" screen or the "Expansion drill / Backreaming" screen.
8. On the right action panel, check the checkbox next to the high-pressure cleaner icon to switch on the high-pressure cleaner.
   ⇨ The high-pressure cleaner remains switched on until you uncheck the checkbox.

Info!
Information on cleaning the machine can be found in the "Cleaning" chapter.

5.11 Using the drilling fluid pump as a high-pressure cleaner (optional)

To use the drilling fluid pump as a high-pressure cleaner in combination with an optional large cleaning lance, please proceed as follows:

1. Disconnect the supply connection for the drilling fluid from the mixing system (see instructions for the mixing system).
2. Connect a fresh water hose (e.g. from a hydrant) to the machine's drilling fluid connection (1).

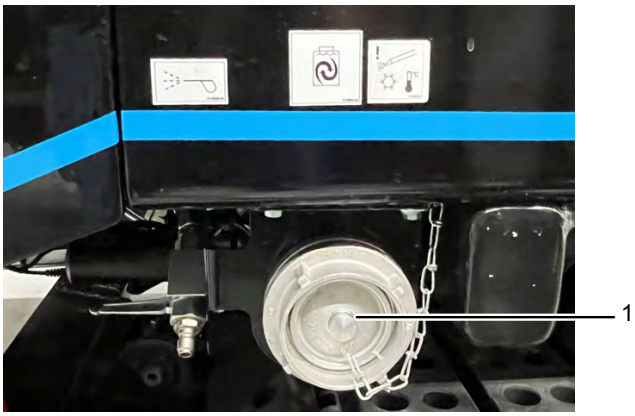


Fig. 5-39 Drilling fluid connection



3. Set the drilling fluid flow rate to 5–10 % using the left setting wheel.



4. Push the front left push button to switch on the drilling fluid pump.
5. Rinse the drilling fluid pump until only fresh water comes out of the rod.



6. Push the front left push button to switch the drilling fluid back off.
7. Close the stop cock (1) for the drilling fluid to the rod at the rear of the machine.

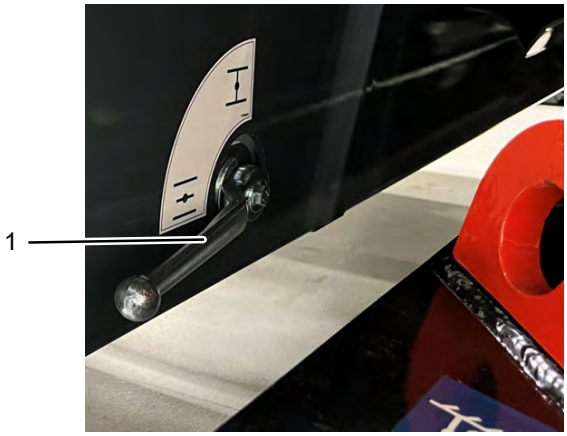


Fig. 5-40 Stop cock for drilling fluid to the rod

8. Connect the large cleaning lance with the corresponding high-pressure hose to the high-pressure connection (1) at the front of the machine.
9. Open the high-pressure stop cock (2).

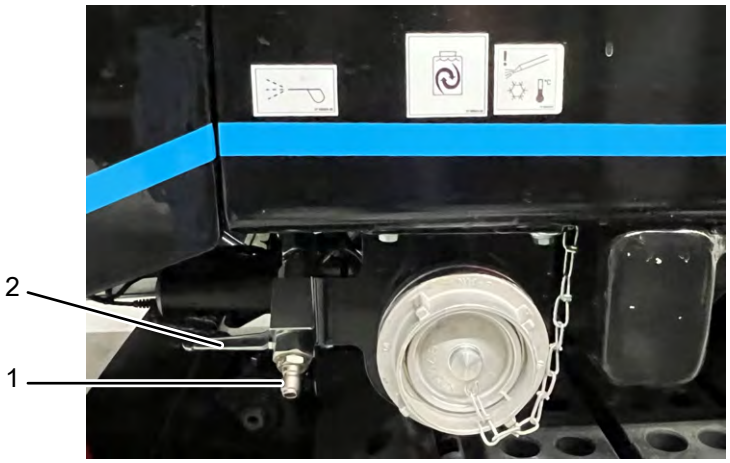


Fig. 5-41 High-pressure connection

10. Switch the drilling fluid pump back on to use the large cleaning lance as a high-pressure cleaner.

5.12 Connecting and using the mud pump

The purpose of the mud pump is to pump the bore mud out of the anchor plate.

1. Connect a hose with a DIN 4307 rigid C-coupling to the quick connection (1) of the mud pump.
2. Install the other end of the hose into the bore hole.

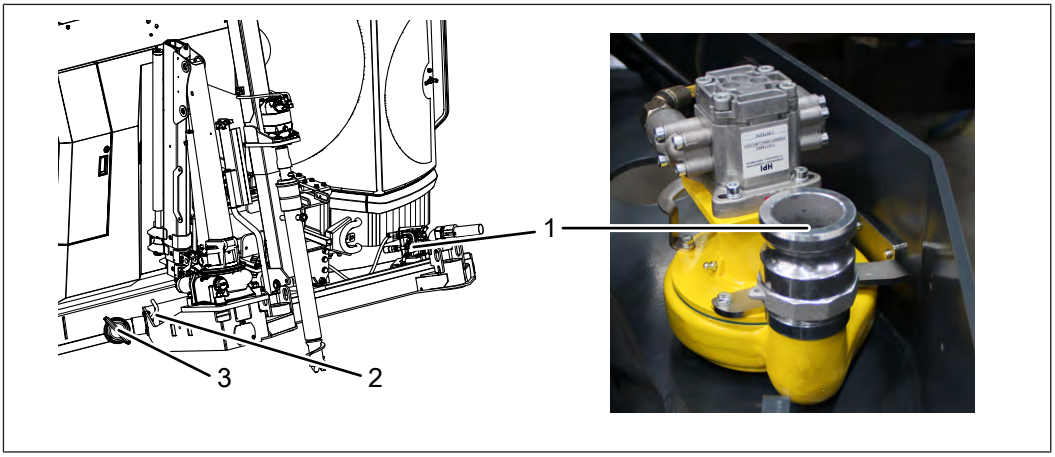


Fig. 5-42 Connecting the mud pump, cleaning the anchor plate

Cleaning the anchor plate

1. To clean the anchor plate, open the cover (3) using the lever (2).
2. Switch the "Drive mode/bore mode" rotary switch over to bore mode on the left joystick panel.
3. Access the "Pilot drill" screen or the "Expansion drill / Backreaming" screen.



4. Switch on the mud pump to pump out the bore mud. To do so, tap the icon or the checkbox on the right action panel.

   ⇨ The mud pump remains switched on until you uncheck the checkbox.
5. After cleaning close the opening of the anchor plate with the cover.
6. Lock the cover with the lever.

6.1 Safety instructions for operation

Observe the following safety information for a secure operation of the machine:

- Personnel working with the machine must have fully read and understood the instructions, especially the "Safety" chapter, before starting to operate the machine. It is too late during operation! This fact is particularly important for personnel only occasionally working on the machine, e.g. during set-up or maintenance work.
- Only qualified and trained personnel is allowed to work on the machine.
- New staff or personnel to be trained may only work on the machine under constant supervision of a qualified person.
- Observe the legal regulations valid at the application site regarding the minimum age of the personnel.
- Seal the working area off against unauthorized access.
- Always carry out a visual inspection of all hoses, lines and safety screws before starting the machine.
- Only work with the machine when you are fully concentrated!
- Immediately eliminate any impairments to safety.
- Only use oil and grease recommended by the manufacturer.
- Always operate the machine with the electric shock warning device installed.

Observe all information in chapter 2.3, page 7.

⚠ DANGER



Moving machine parts!

Risk of injury from draw-in and crushing.

- Keep away from movable parts.
- Never touch the rod while the rod or the rotational drive are rotating (neither during the clamping)!
- Only open the protective covers, doors etc. when the machine is switched off and at a complete standstill.
- In case of emergencies, immediately press the emergency stop button.

⚠ DANGER



Risk of injury due to moving parts during remote-controlled drilling!

Bumping, pulling in and crushing can cause serious injury to yourself and others during remote-controlled drilling.

- Keep out of the danger area marked in red and keep other persons away.
- Maintain visual contact with the danger area at all times during remote-controlled drilling.
- Secure the danger area with an additional separating protection device (e.g. with a fixed fence) if maintaining visual contact with the danger area is not possible.
- Observe the safety measures required on site in the chapter "Securing the construction site".
- In case of emergencies, immediately press the emergency stop button.

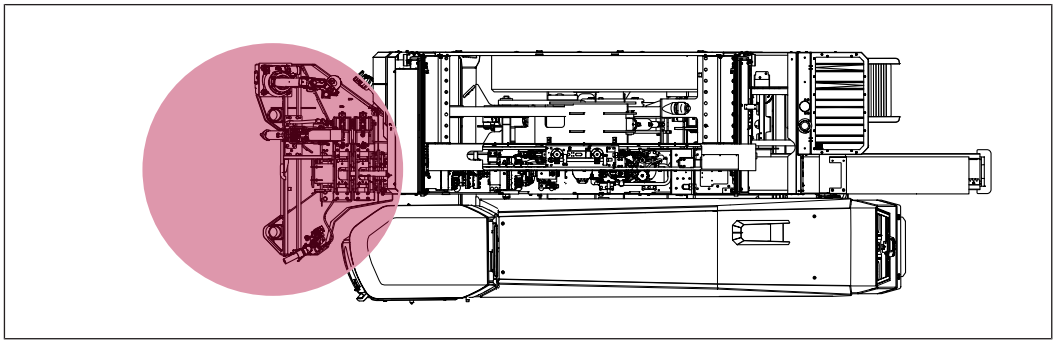


Fig. 6-1 Danger area during remote-controlled drilling

⚠ DANGER



Danger of electric shock caused by power cable damage!

Risk of injury due to electric shock upon contact with live parts.

- Always install the entire safety package before starting a drilling operation!
- When the acoustic warning signal can be heard, the operator MUST NOT UNDER ANY CIRCUMSTANCES leave the bore rig, the operator seat or the grounding mat until the power flow has been interrupted and safety is guaranteed.

⇨ **WARNING!** If the current flow is not interrupted correctly, an automatically resetting circuit breaker could supply the power cable with power or the contact between the machine and the power cable might be re-established.

⚠ WARNING



Risk of injury if personal protective equipment is not worn!

- Always wear your personal protective equipment, including ear protection and a work vest in fluorescent colours.
- During drilling, wear the comprehensive protective equipment included in the scope of delivery of the electric shock warning device.

The comprehensive personal protective equipment included in the scope of delivery of the electric shock protection device includes the following items:

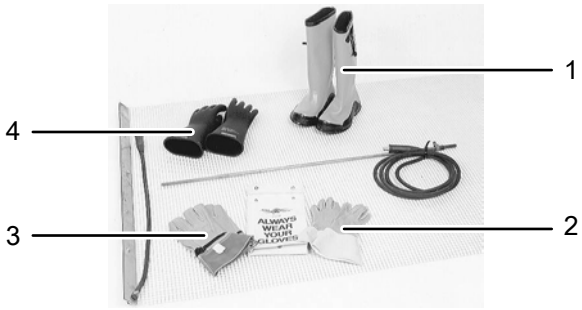


Fig. 6-2 Comprehensive personal protective equipment for electric shock protection device

1	Safety boots	3	Protective gloves GP 4
2	Inner gloves GL	4	Rubber gloves

Put on the three pairs of gloves in the following order:

– Inner gloves GL (2)
– Rubber gloves (4)
– Protective gloves GP 4 (3)

⚠ WARNING

Explosion hazard due to leaking battery fluid in the bore head assembly!



When exceeding the battery's maximum operating temperature indicated by the battery manufacturer, the battery may pass toxic gases into the sealed battery compartment and may explode.

- If you use lithium batteries for the detection system, make sure you avoid drilling conditions exceeding the manufacturer's recommended maximal operating temperature.
- Make sure that the maximum operating temperature indicated by the battery manufacturer is at least 100 °C.
- Follow all safety instructions from the battery manufacturer.
- If the overheating sensor goes black, the probe has exceeded the maximum temperature of 104 °C.
  Keep the battery end cap closed as toxic gases or dangerous chemicals could otherwise escape (see instructions provided by the manufacturer of the detection system).
- The detection system is not designed for use in areas with danger of explosions and must never be used near inflammable or explosive substances.
- Only use oil and grease recommended by the manufacturer to avoid overheating.

⚠ WARNING

Possible hazard due to the drill head caused by faults during the data transmission from the detection system to the operating terminal!

The accuracy of data generated by the detection system can be influenced by various factors such as signal interference (passive or active) and other environmental conditions, improper use of the detection system by the operator, the non-observance of instructions in the operating manual of the detection system and improper calibration of the detection system.

- Please observe the operating manual of the manufacturer of the detection system!
- Before starting the drilling process, make sure that the detection system has been correctly calibrated.
- Closely observe the drilling process at all times.

6.2 Operating elements and their functions

6.2.1 Main power switch

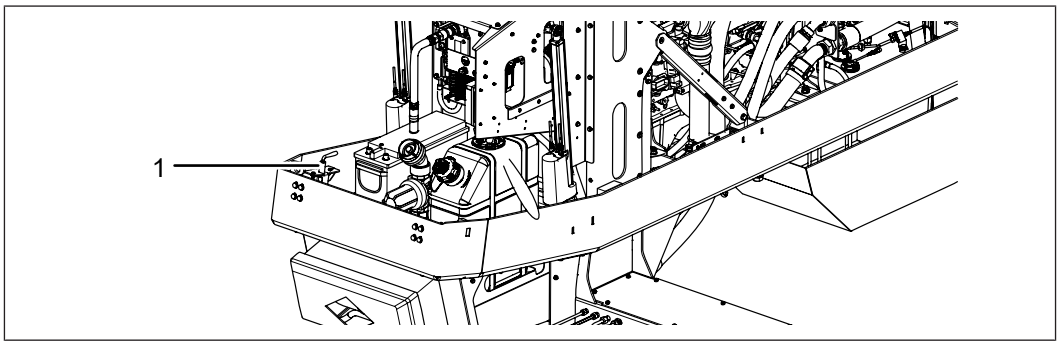


Fig. 6-3 Main power switch

The main power switch (1) is to be used for switch-off in case of maintenance activities, work on the control unit and after longer periods of non-use. It is not required for normal operation. The location of the main power switch is indicated by a corresponding sign (see chapter "Safety signs and labels").

NOTICE

Possible data loss when switching the machine off by the main power switch!

If the machine has been switched off by the main power switch, the sensors may have to be newly configured after a restart.

- Only switch off the machine by means of the Start/Stop button and the remote control key.
- Never switch off the machine by the main power switch.
- After turning off the engine with the ignition key, wait until the indicator light next to the main power switch goes off, ensuring that process for pumping the DEF lines empty has been completed. Only then actuate the main power switch.

6.2.2 Left joystick with panel

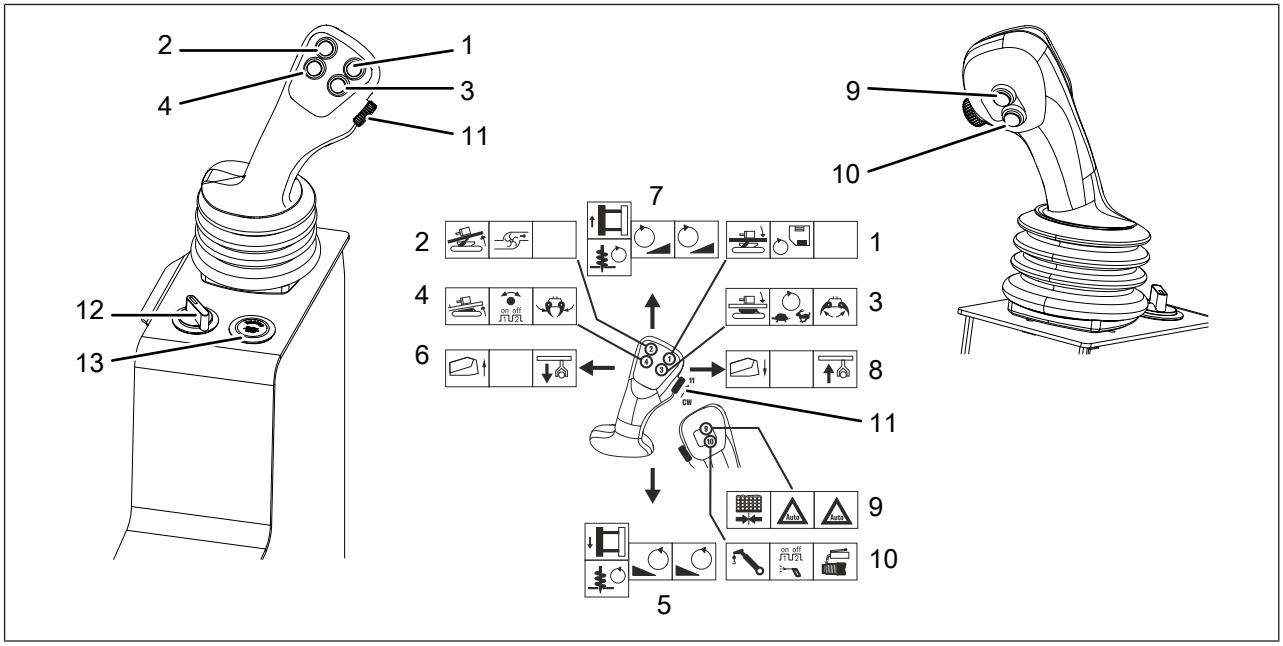


Fig. 6-4 Left joystick

Tab. 6-1 Operating elements of the left joystick

Item	Operating element	Symbol	Function
1	Front right push button		Drive mode: lifts the rig boom at the front
			Bore mode (pilot bore/expansion drill): switches the memory function for the rotation or off.
			Without function
2	Front left push button		Drive mode: lowers the rig boom at the front
			Bore mode (pilot bore/expansion drill): switches the drilling fluid pump on or off
			Without function
3	Rear right push button		Drive mode: lowers the rig boom at the rear
			Bore mode (pilot bore/expansion drill): switches the rotation level between slow and fast
			Bore mode (rod change): opens the rod grippers

Item	Operating element	Symbol	Function
4	Rear left push button		Drive mode: lifts the rig boom at the rear
			Bore mode (pilot bore/expansion drill): switches the inner rotation on or off
			Bore mode (rod change): closes the rod grippers
5	Joystick backwards		Drive mode: drives the left track backwards.
			When the anchor boring rig is selected: the anchoring unit rotates in clockwise direction
			Bore mode: starts counter-clockwise rotation
6	Joystick to the left		Drive mode: lifts the bonnet
			Moves the gripper arm of the rod changing system down.
7	Joystick forward		Drive mode: drives the left track forward.
			When the anchor boring rig is selected: the anchoring unit rotates in counter-clockwise direction
			Bore mode: starts clockwise rotation
8	Joystick to the right		Drive mode: lowers the bonnet
			Bore mode: moves the gripper arm of the rod changing system up
9	Upper front push button		drive mode: moves the rod crane into transport position
			Automatic mode/paddle mode/clock mode Bore mode (pilot bore/expansion drill): switches the automatic functions on or off
			Automatic mode Bore mode (rod change): switches the automatic functions on or off
10	Lower front push button		Drive mode: switches the loading crane on or off
			Bore mode (pilot bore/expansion): switches the high-pressure cleaner into normal operation when pressed once and held, switches to continuous operation when pressed twice and held, switches the high-pressure cleaner off when pressed once and then let go of
			Bore mode (rod change): starts rod lubrication

Item	Operating element	Symbol	Function
11	Left setting wheel	-	serves to adjust selected values and is assigned differently depending on the operating mode
12	"Drive mode/bore mode" rotary switch	-	serves to switch over between drive mode and bore mode left: drive mode right: drilling operation / bore mode
13	>>Engine start/stop<< push button	-	starts and stops the diesel engine The ring around the push button lights up as follows: red: engine error green: engine can be started

Info!
The air conditioning is designed for the climate zones in the European Union.
Run the air conditioning for 15 minutes at least once a month to prevent damage to the compressor.

Info!
When moving a joystick axis or actuating a joystick button while the ignition is being switched on, the actuated component will be disabled.
If, for example, the left joystick is pushed forward while the ignition is being switched on, the left track chain (in drive mode) or the rotation (in bore mode) cannot be controlled.

- To rectify the fault, switch off the ignition.
- Always set the ignition lock to the centre position when you switch off the ignition. This prevents the battery from being deeply discharged.
- Only switch the ignition back on when it is sure that, in doing so, no operating element is actuated.

6.2.3 Right joystick with panel

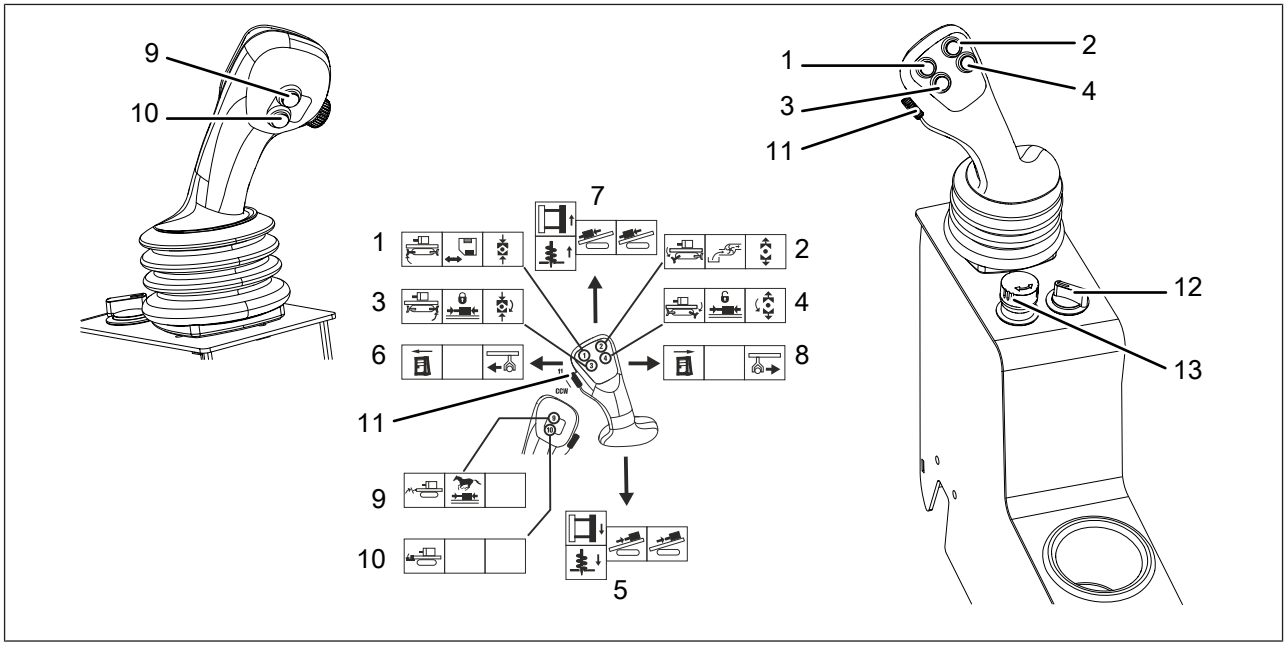


Fig. 6-5 Right joystick

Tab. 6-2 Operating elements of the right joystick

Item	Operating element	Symbol	Function
1	Front left push button		Drive mode: lifts the front stabiliser
			Bore mode (pilot bore/expansion drill): switches the memory function for the thrust or off.
			Bore mode (rod change): closes the clamping tongs
2	Front right push button		Drive mode: lowers the front stabiliser
			Bore mode (pilot bore/expansion drill): switches the pump for the anchor plate on or off
			Bore mode (rod change): opens the clamping tongs
3	Rear left push button		Drive mode: lifts the rear stabiliser
			Bore mode (pilot bore/expansion drill): locks the hoop length compensation
			Bore mode (rod change): closes the break-away clamp

Item	Operating element	Symbol	Function
4	Rear right push button		Drive mode: lowers the rear stabiliser
			Bore mode (pilot bore/expansion drill): unlocks the hoop length compensation
			Bore mode (rod change): closes the break-away clamp
5	Joystick backwards		Drive mode: drives the right track backwards.
			When the anchor boring rig is selected: the anchoring unit moves downwards
			Bore mode: reverses the thrust rig
6	Joystick to the left		Drive mode: swings the cab outwards.
			Bore mode: moves the gripper arm of the rod changing system towards the bore axis.
7	Joystick forward		Drive mode: drives the right track forwards.
			When the anchor boring rig is selected: the anchoring unit moves upwards
			Bore mode: drives the thrust rig forwards.
8	Joystick to the right		Drive mode: swings the cab inwards.
			Bore mode: moves the gripper arm of the rod changing system towards the rod box.
9	Upper front push button		Drive mode: lifts the anchor plate
			Bore mode (pilot bore/expansion drill): starts rapid motion for the thrust rig
			Without function
10	Lower front push button		Drive mode: lowers the anchor plate
			Without function
			Without function
11	Right setting wheel	-	serves to adjust selected values and is assigned differently depending on the operating mode

Item	Operating element	Symbol	Function
12	>>Switch-over operation<< rotary switch	-	serves to switch over the operation to the portable operating terminal and back to the joysticks of the operator seat
13	Emergency stop button	-	shuts down the machine immediately.

6.2.4 Operating terminal (portable)

Info!
The machine can be operated either from the operator seat using the joysticks at the operator seat and on the operating terminal positioned in the holder inside the cab (drilling) or directly using the portable operating terminal while standing outside the cab (traversing).

The components and operating elements of the operating terminal are described below.

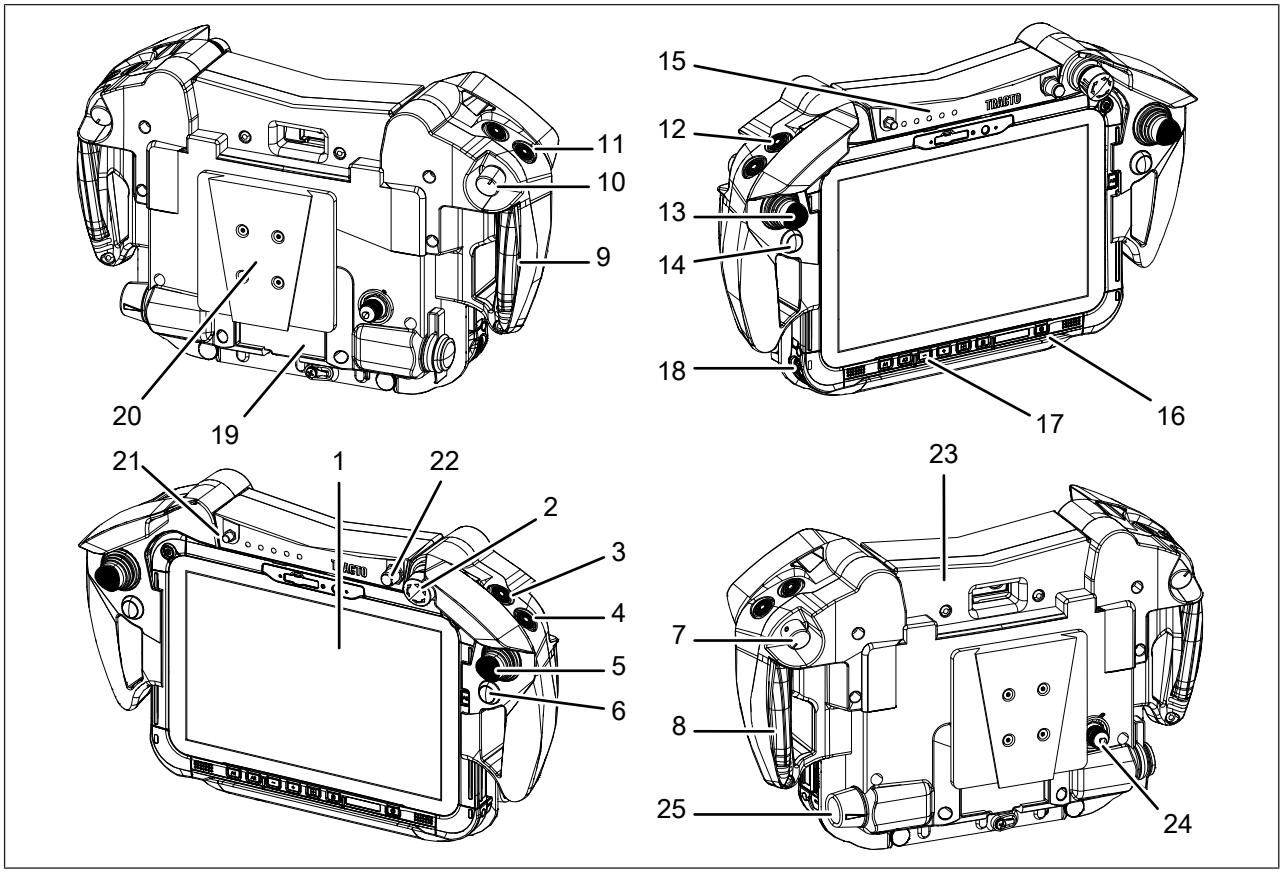


Fig. 6-6 Operating terminal

Tab. 6-3 Components and operating elements of the operating terminal (general)

Item	Component/ operating element	Function
1	Touch screen	– indication of screens for operating the machine – indication of information – selection of functions – activation of non-safety-related functions – adjustment of values

Item	Component/ operating element	Function
2	Emergency stop button	shuts down the machine immediately **Attention!** The emergency stop button on the operating terminal is only enabled (= illuminated in red) if the operating terminal is enabled.
3	Start/stop button	starts the engine if the ignition is switched on, and stops the running engine
4	Outer push button on the right	serves to switch selected functions on/off and is assigned differently depending on the operating mode
5	Right joystick	serves to move the machine/the machine's hydraulic axes and is assigned differently depending on the operating mode The movement is carried out as long as you operate the joystick. When you let go of the joystick, it returns to its zero position and the movement stops.
6	Front right push button	serves to switch selected functions on/off and is assigned differently depending on the operating mode
7	Right setting wheel	serves to adjust selected values and is assigned differently depending on the operating mode
8	Right dead man's switch	One of the two dead man's switches must always be actuated while the machine is operated from outside the cab. If none of the two dead man's switches is pressed while a remote control function is used, the machine functions are blocked.
9	Left dead man's switch	
10	Left setting wheel	serves to adjust selected values and is assigned differently depending on the operating mode
11	Outer push button on the left	serves to switch selected functions on/off and is assigned differently depending on the operating mode
12	Horn push button	operating the horn to warn others of machine movements
13	Left joystick	serves to move the machine/the machine's hydraulic axes and is assigned differently depending on the operating mode The movement is carried out as long as you operate the joystick. When you let go of the joystick, it returns to its zero position and the movement stops.
14	Front left push button	serves to switch selected functions on/off and is assigned differently depending on the operating mode
15	Status LEDs	serve to indicate the current status of the operating terminal and the system states (see below)
16	On/off switch	serves to switch the tablet on/off
17	Function buttons	for TRACTO-TECHNIK customer service only: serve to access the operating system
18	Power cable socket	behind a cover: connection for the power cable for operation from inside the cab
19	Battery of the receiver and transmitter module	serves to supply power to the operating terminal
20	Retainer plate	serves to attach the operating terminal in the holder inside the cab
21	Connection for external WLAN antenna	serves to improve the connection between the operating terminal and the machine
22	Antenna connection	improves the transmission of the radio signal between operating terminal and machine Always connect the antenna when operating the machine from outside.

Item	Component/ operating element	Function
23	Receiver and transmitter module	ensures a stable radio connection between the operating terminal and the machine
24	Connection for cable in emergency mode	serves to directly connect the transmitter and receiver
25	On/off switch (key switch)	switches the operating terminal on or off
-	Holder for carry strap	serves to attach the carry strap for operation from outside the cab When operating the machine from outside the cab, **always** use the carry strap!

Status LEDs

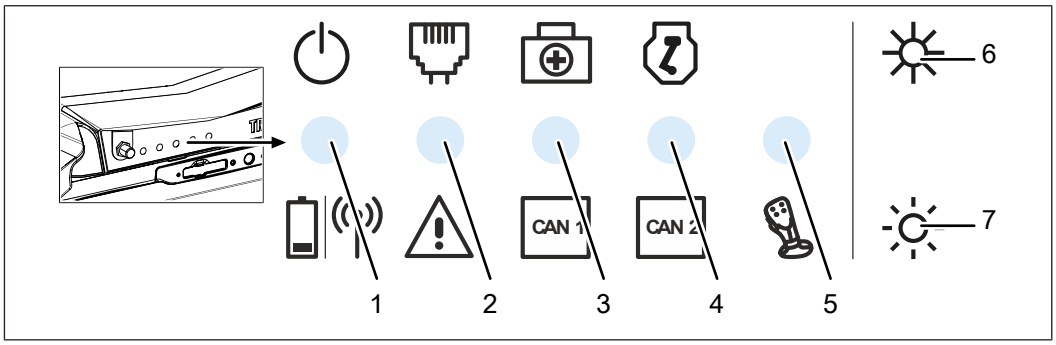


Fig. 6-7 Status LED icons

Tab. 6-4 Meaning of the status LEDs on the operating terminal

Item	LED	Function
1	LED 1	Continuous light (red): Switch-on initialisation continuous light (green): Start-up process flashing (green): Start of normal operation flashing (green)/flashing slowly (red): Battery power low flashing (green)/flashing quickly (red): Battery power very low flashing (green)/flashing at random (red): Connection between remote control and control unit established
2	LED 2	Continuous light (blue): Network connection error between control unit PLC1 and mobile PC for cloud connection flashing (blue) 1 Hz: Control unit PLC2 in safe state, restart of the ignition necessary
3	LED 3	Continuous light (green): Emergency mode via the switch in the E-box activated flashing (green) 1 Hz: Data transmission 1 between inputs/outputs of control unit PLC2 disturbed
4	LED 4	Continuous light (green): Warning or error in the diesel engine flashing (green) 1 Hz: Data transmission 2 between control unit PLC1 and control unit PLC2 disturbed
5	LED 5	Flashing (green) 1 Hz: no communication with the joysticks inside the cab
6	-	Continuous light icon
7	-	Flashing light icon

Info!
To ensure proper operation of the machine, charge the battery of the transmitter and receiver module or replace the battery at the latest when the LED1 flashes green and slowly flashes red.
If the battery is too weak, the operating terminal and thus the diesel engine switch off, and machine operation is no longer possible.

Start-up of the software

When the terminal is started for the first time, the latest release notes for the software are displayed:

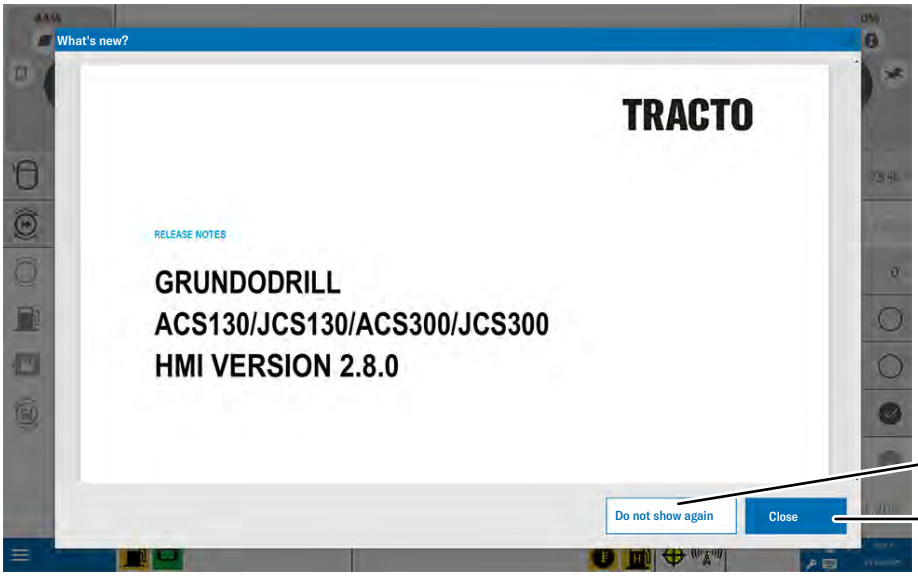


Fig. 6-8 "What's new?" screen

Tab. 6-5 "What's new?" screen

Item	Indicators and operating elements	Function
1	"Close" button	The window is closed and will reappear the next time the programme is started.
2	"Do not show again" button	The window is closed. The last screen used will be displayed the next time the programme is started. (chapter 5.3.6, page 84).

Operating elements of the screen

The touch screen displays the individual screens for operating the machine. To execute a function or to change the screen, tap the corresponding touch surface.

The figure below illustrates the operating elements on the screen by taking the "Pilot drill" screen in remote mode as an example.

Info!
You can find these operating elements and their respective functions in various screens.

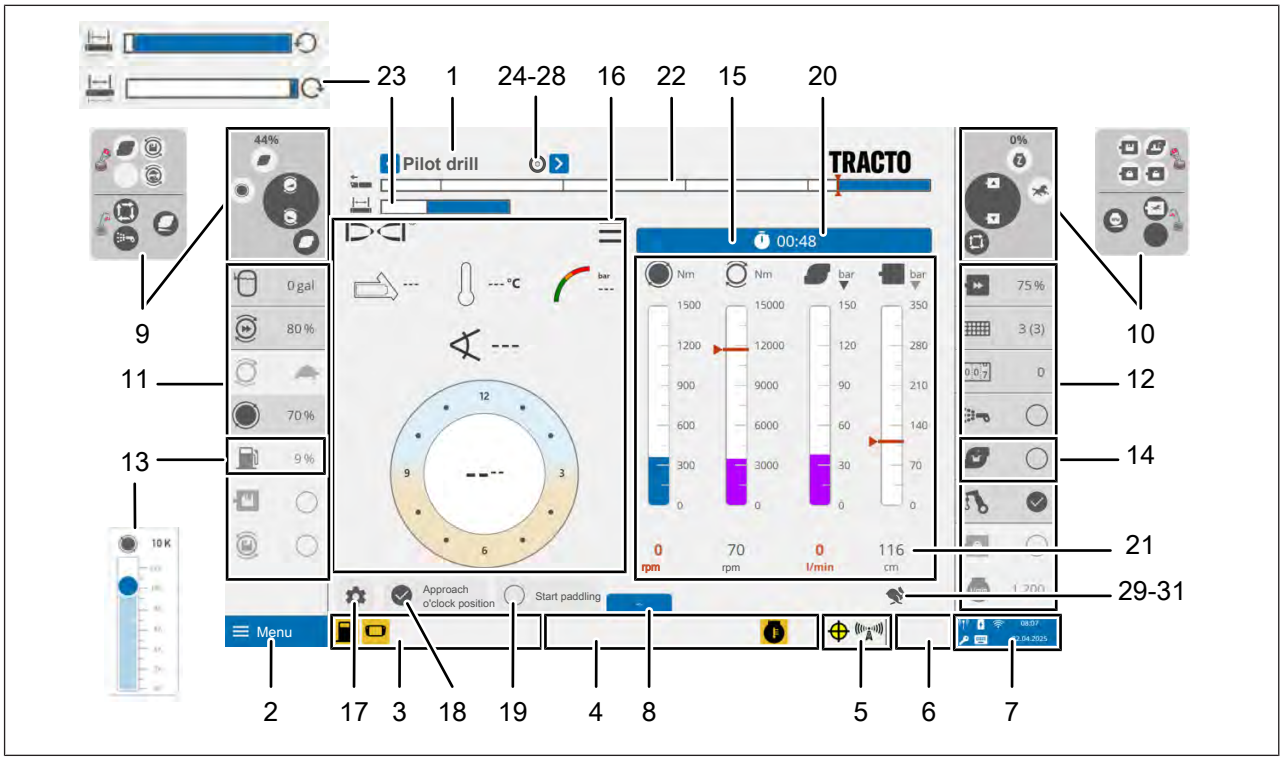


Fig. 6-9 Operating elements: "Pilot drill" sample screen (here: remote mode)

Tab. 6-6 Explanation of the indicators and operating elements on the screen (general)

Item	Indicators and operating elements	Function
1	Screen title	-
2	Menu button	opens the main menu From there you can open other submenus.
3	Icons indicating machine states	serve to indicate the current status of a function (chapter 6.2.4.1, page 132)
4	Icons indicating engine states	
5	Icons indicating the detection system	
6	Error and warning messages	indicates the type and number of error and warning messages Tap the corresponding icon to show the error/warning messages.

Item	Indicators and operating elements	Function
7	Wi-Fi signal strength	indicates the strength of the radio connection to the machine
	LTE signal strength	indicates the strength of the radio connection to the LTE network
	Battery status	indication of the battery status of the operating terminal (chapter 6.2.4.1, page 132)
	Ignition on/off	indicates whether the ignition is switched on or off
	Date and time	indicates the current date and time
8	"Overlay" button	displays a screen with the following overlay functions: – Cabin functions (chapter 6.2.4.2, page 135) – Quick settings (chapter 6.2.4.4, page 141) – Admin Tool (chapter 6.2.4.3, page 138) – Operating manual ("Instructions" screen) – TRACTO digital platform (chapter 6.2.4.6, page 143) – Release notes (chapter 6.2.4.7, page 144) – Service (chapter 6.2.4.8, page 145)
9	Indication of assignment of left hardware operating elements	indicates the current assignment of the two push buttons, the setting wheel and the joystick on the left side of the operating terminal The function depends on the operating mode and the selection on the screen. In cab mode, the joystick functions are displayed in a modified way.
10	Indication of assignment of right hardware operating elements	indicates the current assignment of the two push buttons, the setting wheel and the joystick on the right side of the operating terminal The function depends on the operating mode and the selection on the screen. In cab mode, the joystick functions are displayed in a modified way.
11	Left action panel	left part of the screen for selecting functions and adjusting values Active buttons are grey and highlighted with a line. In cab mode, the action panel is displayed in a modified way.
12	Right action panel	right part of the screen for selecting functions and adjusting values Active buttons are grey and highlighted with a line. In cab mode, the action panel is displayed in a modified way.
13	Icon and value	Press the icon or the value to show a slider. Use this slider to adjust the value.
14	Icon and checkbox	Press the checkbox to switch the function displayed by the icon on or off.
15	Scales	indicate current values and limit values for machine functions The icon above the scale indicates the function and the unit used. The grey arrow below the unit next to the icon is used to change the scale range. The red arrow on the scale is used to set the limit value. The current value is displayed below each scale.
16	Display area for the detection system	only available on the "Pilot drill" screen if the option is selected in the settings: indicates information regarding the detection system
17	Settings button	only available on the "Pilot drill" screen: opens a dialogue to set the carving mode and the clock mode
18	"Clock mode" checkbox	only available on the "Pilot drill" screen: selects the function without carrying it out The function is started via the upper push button on the right joystick in this case.
19	"Start paddling" checkbox	

Item	Indicators and operating elements	Function
20	Stop watch	only for pilot bore and expansion drill: indicates the drilling time per drill rod
21	green text	only for pilot bore and expansion drill: indicates that the rod breakaway position has been reached
22	Thrust progress bar	Drag indicator for drilling and expansion
23	Length compensation progress bar	Length compensation An icon for screwing and unscrewing is shown each for the first and last 10 % of the path (5 cm).
24	"Rod change" icon 	indicates that "rod change" mode is activated As soon as the operator interface is switched to "rod change", this mode is activated. In this mode, the behaviour of the rotation is set to guarantee an optimum rod change.
25	"Jet drilling" icon 	indicates that "jet drilling" mode is activated In "jet drilling" mode, the inner rotation is deactivated. The outer rotation has full power and can be switched between the slow and fast levels. This mode is used both when drilling with a bore head assembly and for expansion/backreaming with any drilling tool.
26	"Rock drilling" icon 	indicates that "rock drilling" mode is activated In "rock drilling" mode, the inner rotation can be activated while the outer rotation can only be controlled slowly. This mode is only used for operation with the rock drilling unit. Select this mode manually if necessary: -> Settings -> Bore parameters -> Double rotation: Rock drilling
27	"Safety state" icon 	indicates that operation is currently blocked Operating the machine from the cab is only possible with all functions if the operator is on the operator seat and the left joystick panel is folded down at the same time. Operation of the machine via the portable operating terminal is only possible if one of the two dead man's switches is activated by holding the remote control by one of the two handles. If this is not the case, most machine functions are locked, including rotation.
28	"Switching state" icon 	indicates that the mode is being switched Switching between the above modes sometimes takes a few seconds due to the necessary valve switching. The duration can vary depending on the prevailing hydraulic pressures and the bore length. During this time, operation of the rotation is blocked.

Item	Indicators and operating elements	Function
29	"Tortoise" icon 	status indicator for the thrust speed during pilot bore and expansion drill/backreaming The speed can be changed in the cab using the push button at the top front of the right joystick or, in remote mode, using the push button on the outside right of the operating terminal: – double-click: switch between slow (tortoise) and additional speed (rabbit) – press and hold: fast speed (horse)
30	"Rabbit" icon 	
31	"Horse" icon 	

Info!
If the emergency mode is active, a red border will appear around the screen's display area (chapter 6.2.11.2, page 208) and the "Emergency operation" icon ( ) is displayed in the status line.

6.2.4.1 Indications in the status line

In the five sections of the status line, the current system condition is indicated by means of icons. The following icons can be displayed individually or in combination.

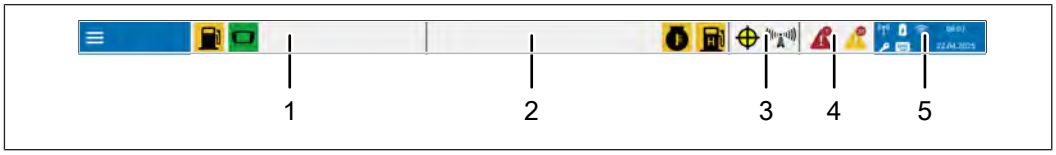
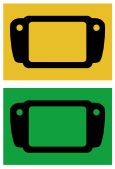
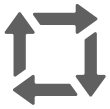


Fig. 6-10 Sections of the status line on the operating terminal

Tab. 6-7 Status indicators of the machine (section 1)

Icon	Meaning
	Diesel tank in reserve
	yellow: the operating terminal is enabled green: at least one dead man's switch is actuated If the icon is not visible, operation from the cab is enabled.
	The automatic mode is activated.
	indicates the condition of the clamping tongs or the break-away clamp
	indicates that emergency mode is activated

Tab. 6-8 Status indicators of the engine (section 2)

Icon	Meaning
	"Stop engine" icon critical error in the engine system; immediately stop the engine
	"Engine warning" icon non-critical error; maintenance may be required
	"Engine oil pressure" icon oil pressure of the diesel engine too low
	"Cleaning of exhaust gas system" icon cleaning of the exhaust gas system required
	"Cleaning of exhaust gas system disabled" icon in the settings, the cleaning of the exhaust gas system is switched off; neither automatic nor manual regeneration is possible
	"DEF filling level too low" icon refill diesel exhaust fluid
	"Increased temperature exhaust gas system" icon increased temperature in the exhaust gas system due to active cleaning — cleaning in progress
	"Engine warm-up phase" symbol is displayed while the diesel engine is in the warm-up phase adjusting the engine speed is not possible
	"Hydraulic tank minimum" symbol is displayed if the filling level in the hydraulic tank has reached the minimum level refill hydraulic tank.

Tab. 6-9 Status indicators of the detection system (section 3)

Icon	Meaning
	detection system enabled
	signal strength of the transmitter

Tab. 6-10 Error indicators (section 4)

Icon	Meaning
	warning (incl. number)
	fault message (incl. number)

Tab. 6-11 Status indicators of the operating terminal (section 5)

Icon	Meaning
	WLAN signal strength
	no WLAN available
	LTE signal strength
	no LTE signal available
	battery charged to 100 %
	battery charged to 50 %
	battery charged to 10 %
	battery is being charged
	ignition is switched on
	ignition is switched off
	opens a virtual keyboard

6.2.4.2 "Overlay – Cabin functions" screen

Depending on the machine equipment, one of the following screens is displayed if you tap the blue button above the status line.

Machine with automatic AC system

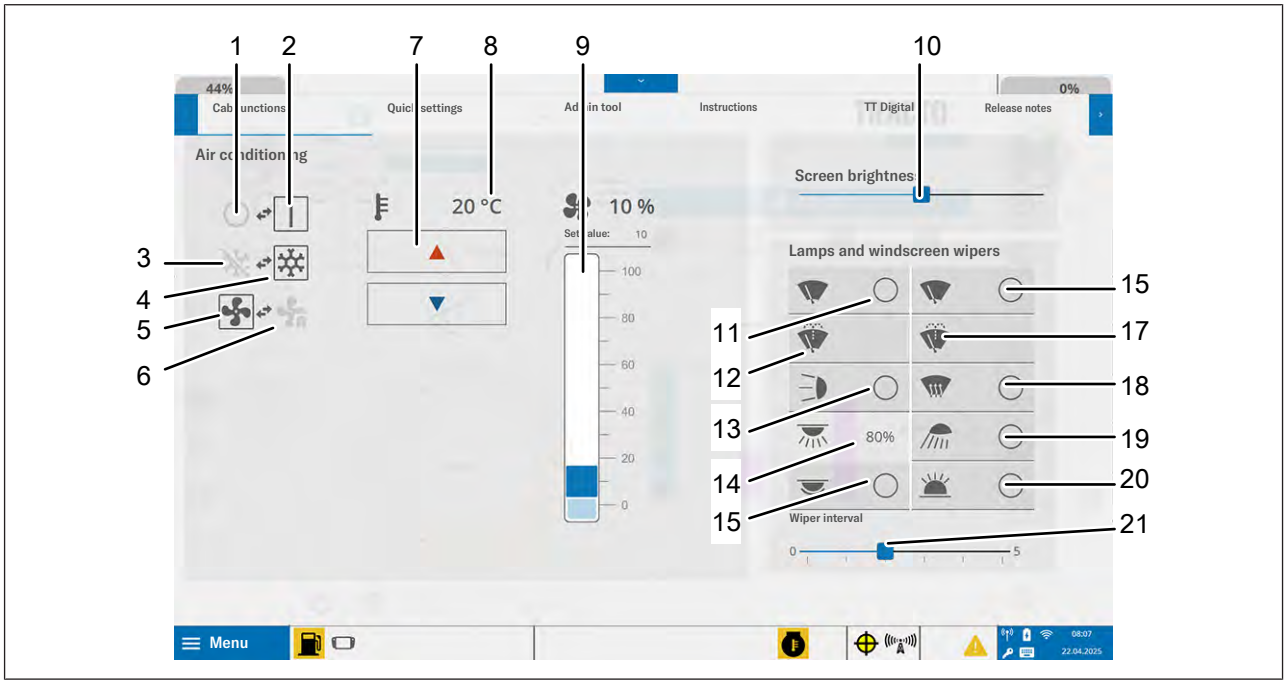
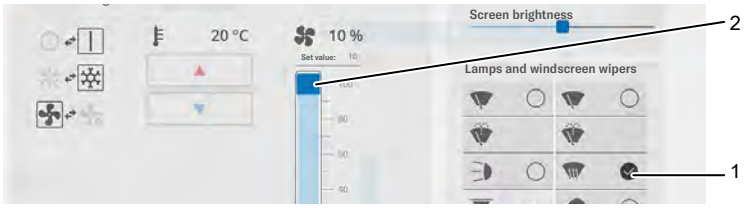


Fig. 6-11 "Cab functions" screen – automatic AC system

Tab. 6-12 Indicators and operating elements in the "Cab functions" screen – automatic AC system

Item	Operating element	Function
1	Air conditioning off	switches the air conditioning off
2	Air conditioning on	switches the air conditioning on
3	ECO mode off	switches the air conditioning compressor on
4	ECO mode on	switches the air conditioning compressor off
5	Manual ventilation	The rotational speed of the ventilation is controlled with the slider (item 9).
6	Automatic ventilation	The rotational speed of the fan is automatically controlled.
7	Heating system (automatic AC system)	shows the currently set temperature Tap the red upward arrow to increase the temperature. Tap the blue downward arrow to reduce the temperature.
8	Climate mode	indicates the currently set climate mode options: automatic AC system (temperature indication), cool-down mode (LO), heat-up mode (HI) – automatic AC system: 16 – 29 °C, indicates the current temperature – cool-down mode: below 16 °C, indicates "LO" and switches air conditioning to full power – heat-up mode: above 29 °C, indicates "HI" and switches heating to full power

Item	Operating element	Function
9	Ventilation	shows the currently set level in % Shift the slider to adjust the value.
10	Screen brightness	serves to adjust the screen brightness
11	Windscreen wiper side window	switches the windscreen wiper of the side window on and off
12	Washing water side window	enables the windscreen washer function for the side window The washing water is sprayed on the window for as long as you press the icon.
13	Headlights	switches the headlights on and off
14	Dimmer interior lighting	serves to switch on the interior lighting and to adjust the illuminance Levels: 0 %, 80 %, 100 %.
15	Interior lighting	serves to switch on the ambient lighting After every switch-on, the ambient lighting is switched on for 30 seconds and then goes off automatically, or after the 30 seconds the last settings of the interior lighting are adopted before switch-off.
16	Windscreen wiper front window	switches the windscreen wiper of the front window on and off
17	Washing water front window	enables the windscreen washer function for the front window The washing water is sprayed on the windscreen for as long as you press the icon.
18	Windscreen heater	switches the windscreen heater on and off If the windscreen heater is switched on (1), all other functions except air conditioning are deactivated and the fan is switched to 100 % (2). After switching the windscreen heater off, the original values of the automatic AC system are restored. 
19	Working lights	switches the working lights on and off
20	Rotating light	switches the rotating light on and off
21	Wiper interval	serves to adjust the wiper interval in five steps

Info!
The air conditioning is designed for the climate zones in the European Union.
Run the air conditioning for 15 minutes at least once a month to prevent damage to the compressor.

Machine with manual air conditioning

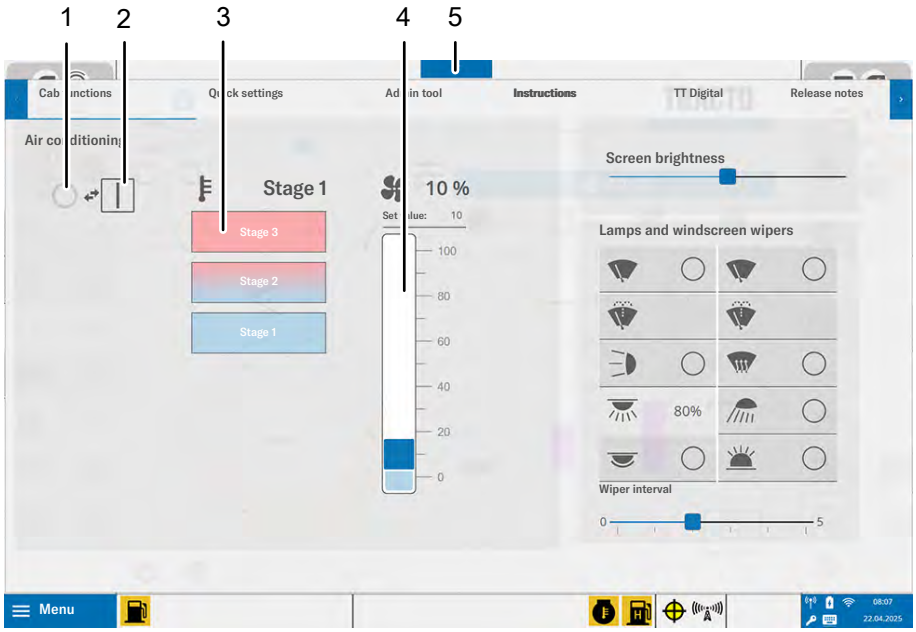


Fig. 6-12 "Cab functions" screen – manual air conditioning

Tab. 6-13 Indicators and operating elements in the "Cabin functions" screen – manual air conditioning

Item	Operating element	Function
1	Air conditioning off	switches the air conditioning off
2	Air conditioning on	switches the air conditioning on
3	Heating system (manual, in stages)	shows the currently set temperature Tap the level 1–3 to adjust the heating system. Level 1 is a low temperature, level 3 a high temperature.
4	Ventilation	shows the currently set level in % Shift the slider to adjust the value.
5	"Hide cabin functions" button	hides the screen for adjusting the cabin functions

Info!
The air conditioning is designed for the climate zones in the European Union.
Run the air conditioning for 15 minutes at least once a month to prevent damage to the compressor.

6.2.4.3 "Overlay – Admin Tool" screen

Info!
In the "Admin tool" screen, you can view the status (1) of various machine components. The service personnel can make different settings various settings and activate a VPN connection.

To open the start screen of the admin tool, tap the blue button above the status line and switch to the "Admin tool" (2) tab.

Press the "Hide cabin functions" (3) button to hide the screen again.

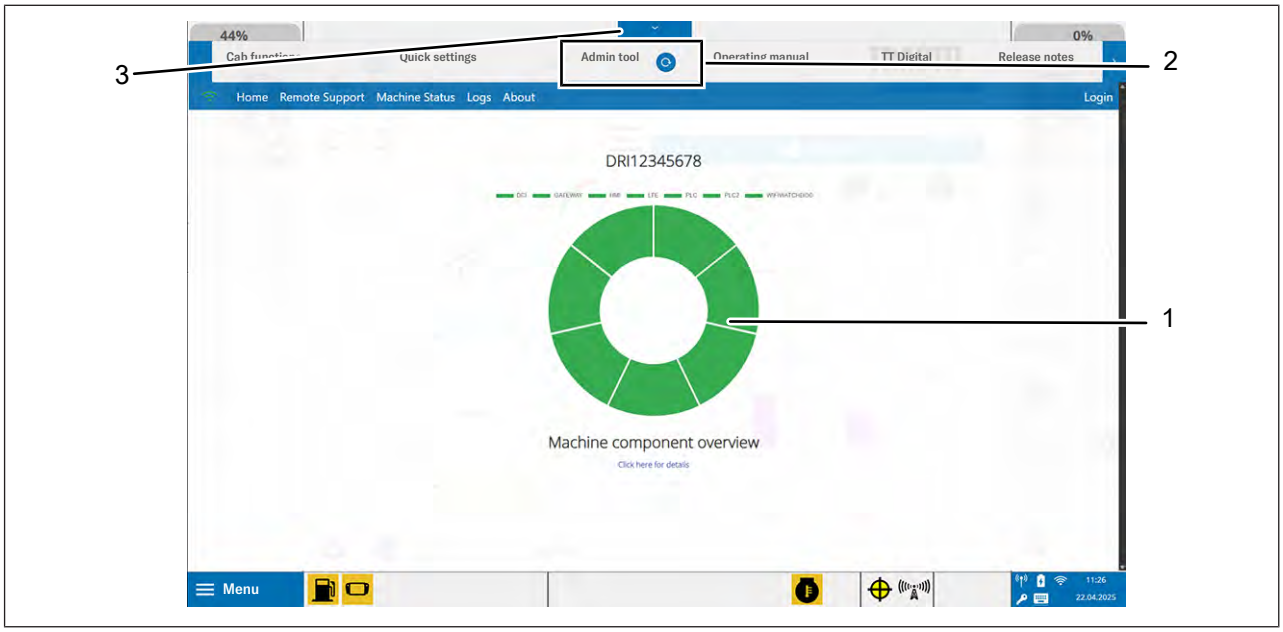


Fig. 6-13 "Admin tool" start screen

Tab. 6-14 "Admin tool" screen menu

Menu item	Function
Home	returns you to the start screen of the Admin tool
Remote Support	Starting and stopping the remote connection to the TRACTO-TECHNIK customer service
Machine status	indicates the connection status, date and time of the last connection and the version numbers for the various connections to the machine
Logs	opens a screen where you can display the log files for the control unit (PLC)
About	indicates information about the Admin tool

The individual screens of the Admin tool are indicated below as examples:

Remote support

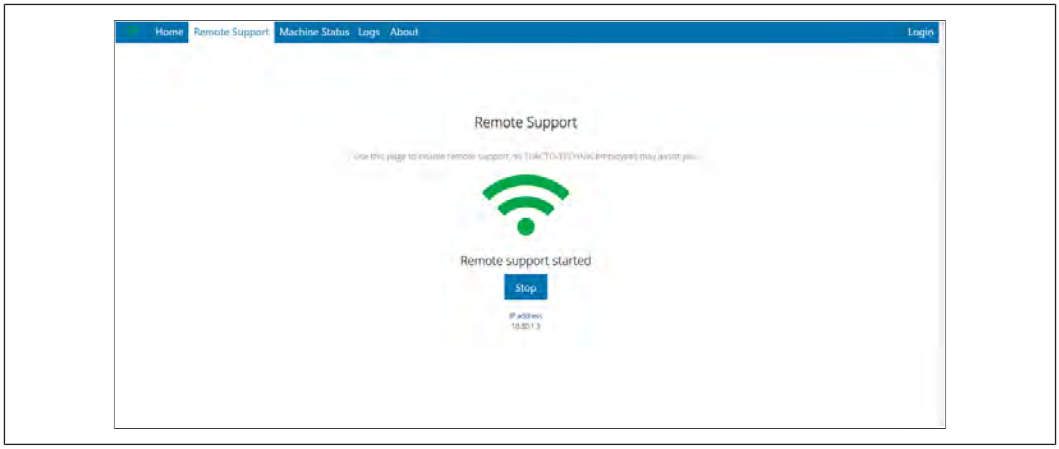


Fig. 6-14 Admin tool – Remote support

Machine status

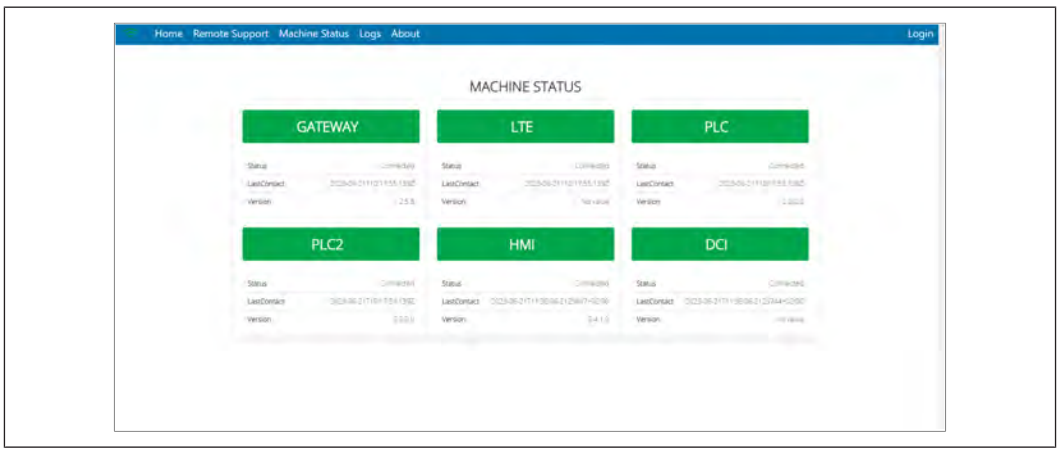


Fig. 6-15 Admin tool – Machine status

Logs

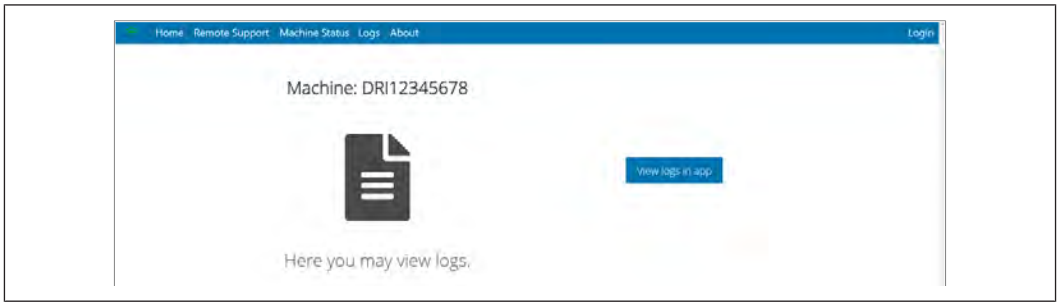


Fig. 6-16 Admin tool – logs

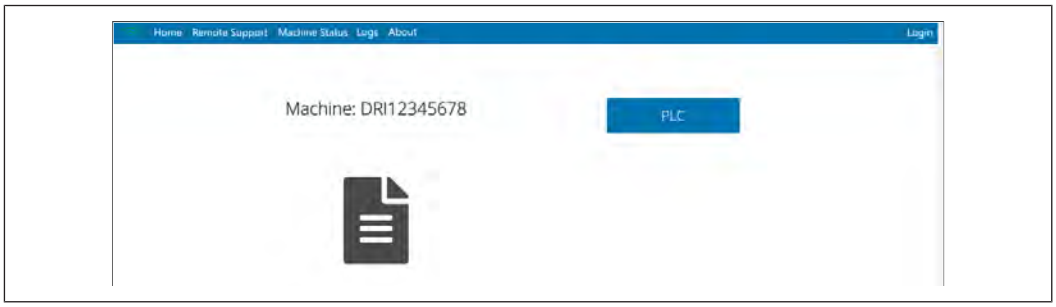


Fig. 6-17 Admin tool – PLC logs

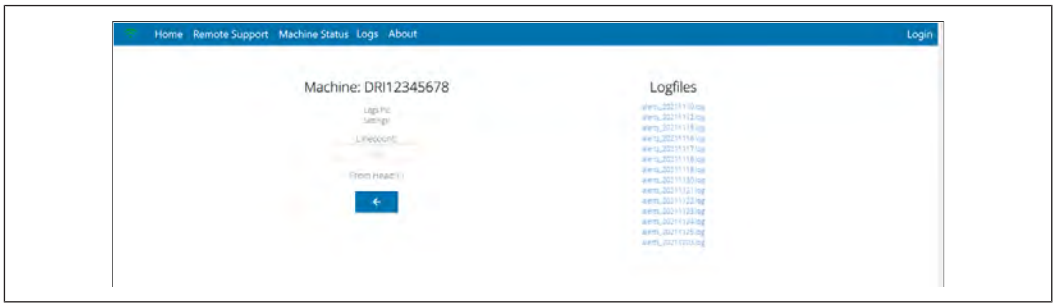


Fig. 6-18 Admin tool – log files

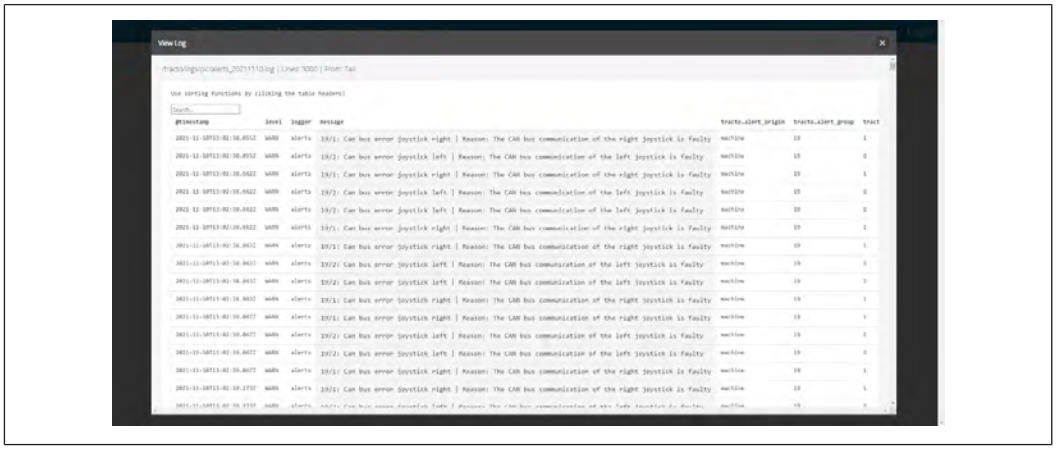


Fig. 6-19 Admin tool – log file example

About

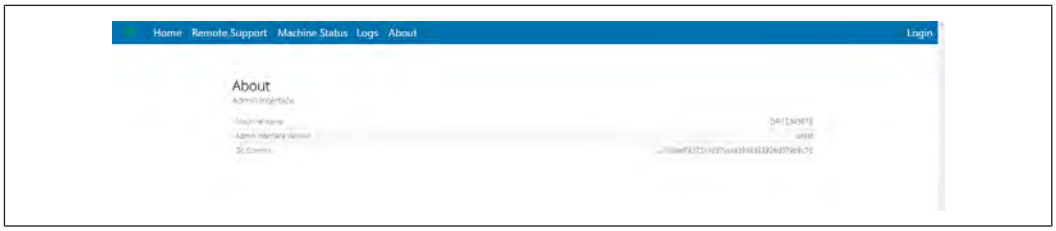


Fig. 6-20 Admin tool – About

6.2.4.4 "Overlay – Quick settings" screen



Fig. 6-21 "Quick settings" screen

Tab. 6-15 Displays and operating elements of the "Quick settings" screen

Menu item	Subitem 1	Function
High pressure cleaner	Distance [cm]	Use the slider to determine after how many centimetres of drill rod the high-pressure rod cleaning system will be switched on. The set value is displayed as a number.
	Time [s]	Use the slider to determine for how long high-pressure rod cleaning will be switched on. The set value is displayed as a number.
Double rotation	Drilling without inner rotation drive (all but Rockbreaker)	indicates that "jet drilling" mode is activated In "jet drilling" mode, the inner rotation is deactivated. The outer rotation has full power and can be switched between the slow and fast levels. This mode is used both when drilling with a bore head assembly and for expansion/backreaming with any drilling tool.
	Drilling with inner rotation drive (using Rockbreaker)	indicates that "rock drilling" mode is activated In "rock drilling" mode, the inner rotation can be activated while the outer rotation can only be controlled slowly. This mode is only used for operation with the rock drilling unit.
Bore parameters	Delay for auto pull [s]	Use the slider to set the time to wait before pull-in starts. This is done to ensure that bentonite arrives at the backreamer and pull-in does not take place dry.
Machine	Water supply fresh water tank	Activate the switch if the machine is equipped with an external fresh water tank. As soon as the tank is filled to 95 %, the pump switches off. When the level drops below 50 %, the pump is switched on again.

6.2.4.5 "Overlay – Operating manual" screen

Info!
The instructions are only displayed if the internet connection is working.

To open the instructions for the machine, tap the blue button above the status line and switch to the "Instructions" (1) tab.

Press the "Hide cabin functions" (2) button to hide the screen again.

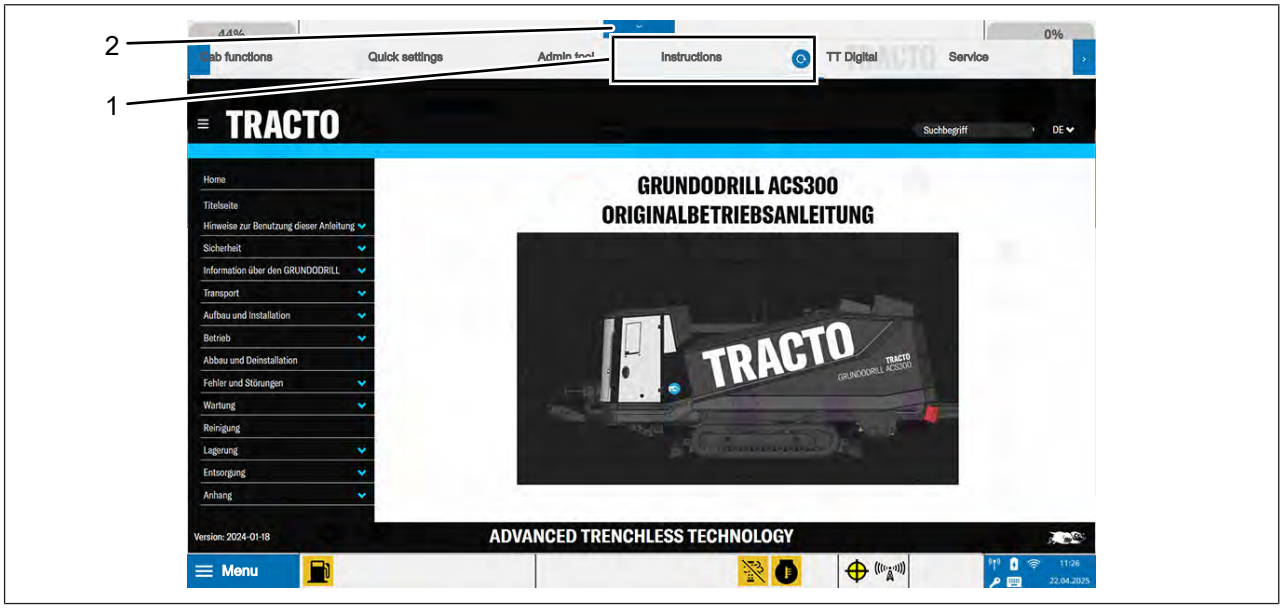


Fig. 6-22 "Instructions" screen

6.2.4.6 "Overlay – TT Digital" screen

To open the digital platform of TRACTO-TECHNIK, tap on the blue button above the status line and switch to the "myTracto" tab (1).

To log in, enter your e-mail address (2) and password (3) and confirm your entry by clicking on the "Sign in" button (4). If you do not have a user account yet, create one by tapping "Sign up now" (5).

Press the "Hide cabin functions" (6) button to hide the screen again.

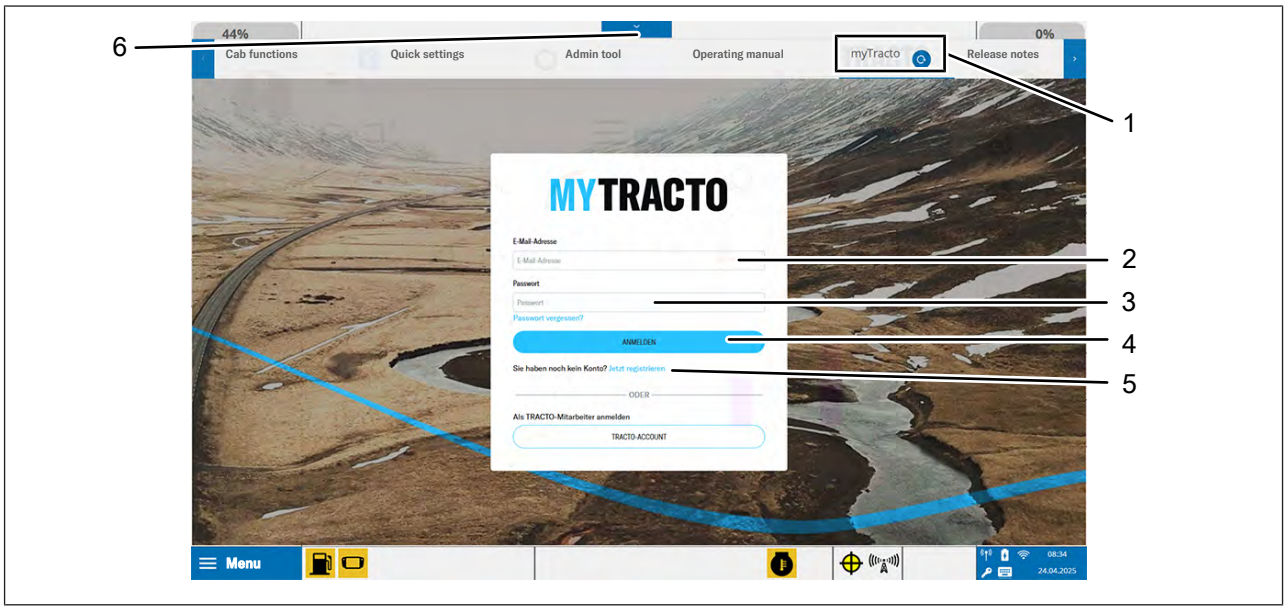


Fig. 6-23 "TT Digital platform" screen

6.2.4.7 "Overlay – Release notes" screen

Info!
The release notes are only displayed if the internet connection is working.

To open the release notes for the software of the operating terminal, tap the blue button above the status line and switch to the "Release notes" tab (1).

Press the "Hide cabin functions" (2) button to hide the screen again.

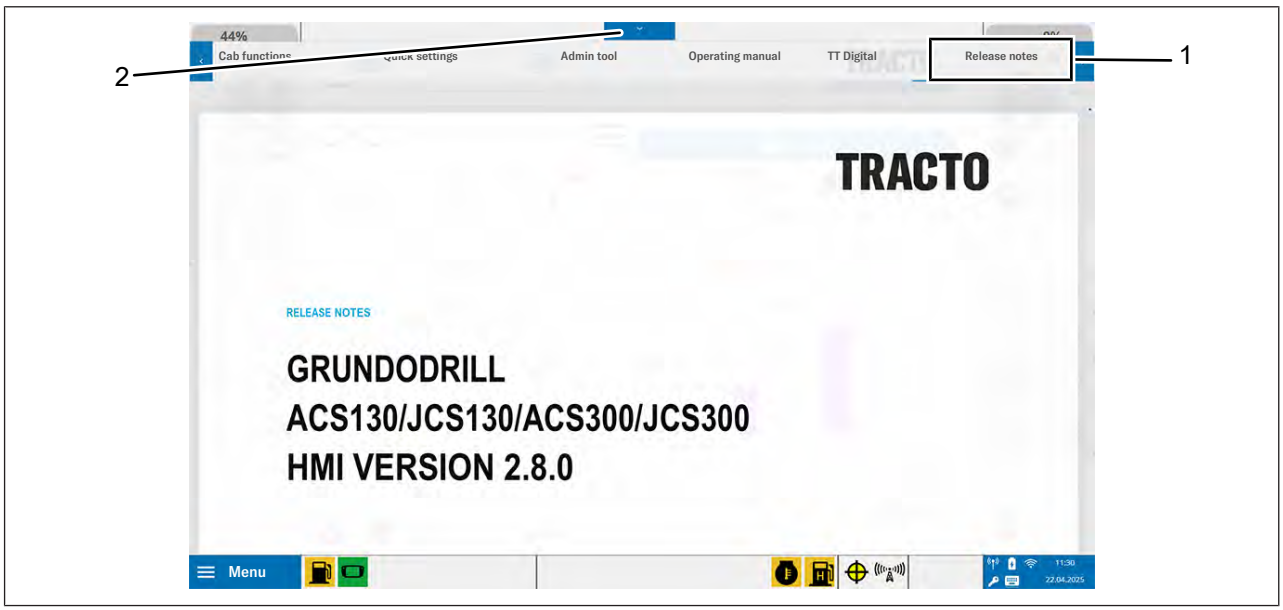


Fig. 6-24 "Overlay – Release notes" screen

6.2.4.8 "Overlay – Service" screen

Info!
You can find the responsible customer centre in Germany in the "Service" screen. This option is only available in Germany and only with an active LTE connection.

To indicate the service screen, tap on the blue button above the status bar and then switch to the "Service" tab (1).

Enter your postcode (2) and confirm your entry by clicking on the "Kundencenter ermitteln" (Find customer centre) button (3). The customer centre closest to your postcode is now displayed with its address and contact details.

Press the "Hide cabin functions" (4) button to hide the screen again.

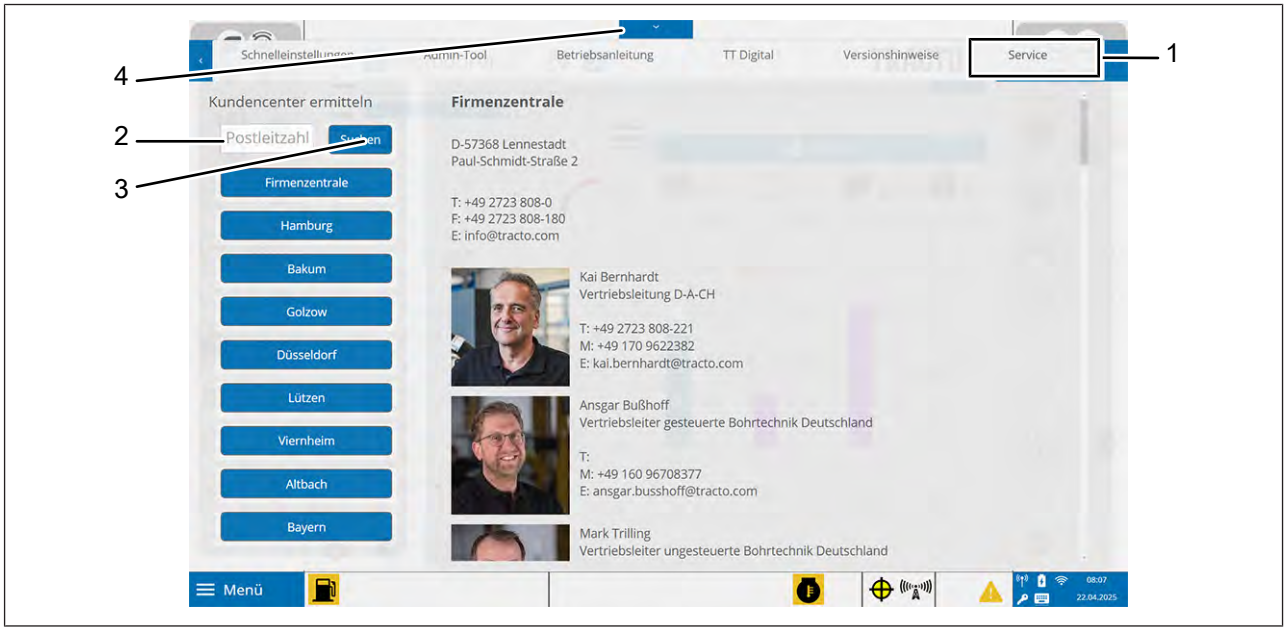


Fig. 6-25 "Service" screen

6.2.4.9 Menu structure

Main

Press the >>Menu<< button on the screen of the operating terminal to open the main menu. The main menu will be displayed:



Fig. 6-26 Main

Tab. 6-16 Main

Item	Display, menu item	Function
1	Machine designation	displays the machine's designation
2	Drive / Setup	only for drive mode opens the "Drive / Setup" screen
3	Pilot drill	only for bore mode opens the "Pilot drill" screen
4	Rod change	only for bore mode opens the "Rod change" screen
5	Expansion drill / Backreaming	only for bore mode opens the "Expansion drill / Backreaming" screen
6	Bore data	opens the "Bore Data" screen
7	Service	after a password request opens a screen for the TRACTO-TECHNIK service personnel
8	Preferences	opens the "Settings" submenu
9	Arrow to the left	closes the menu
10	QR code	indicates the machine number

"Settings" submenu

In the "Settings" submenu you can determine the parameters for the operator interface, the machine, for drilling and the detection system.

General, Machine

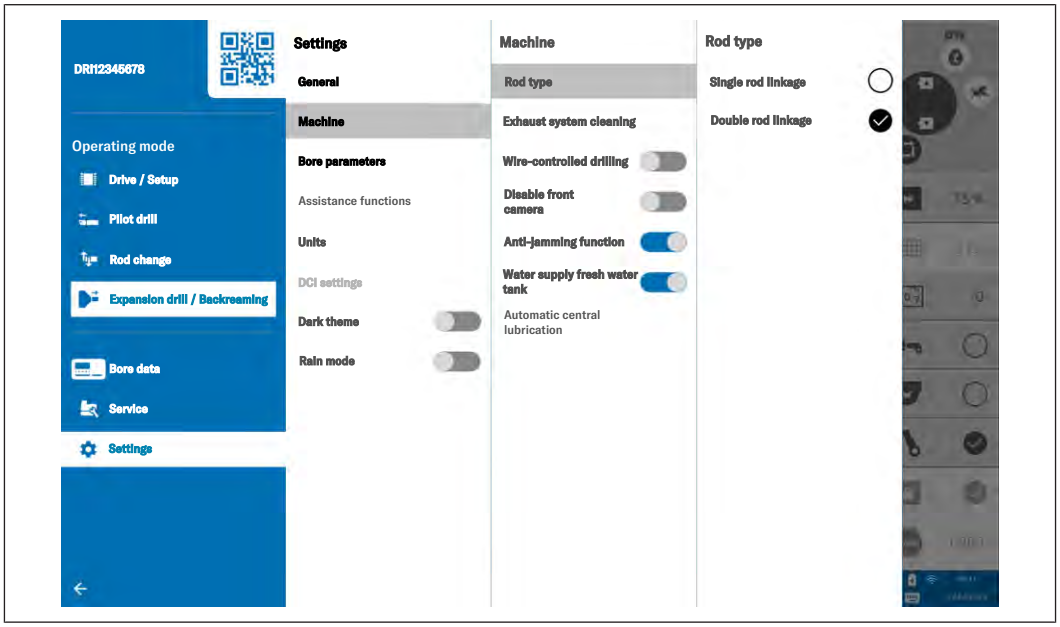


Fig. 6-27 "Settings" submenu – machine

Tab. 6-17 "Settings" submenu – machine

Menu item	Subitem 1	Subitem 2	Function
General	Language	English, German, Danish, ...	Select the checkbox next to the respective language to change the display language of the operator interface.
Machine	Rod type	Single rod linkage	Select the checkbox to change the rod type to single rod linkage (for jet drilling).
		Double rod linkage	Select the checkbox to change the rod type to double rod linkage.
	Exhaust system cleaning	-	Tap the text to open a pop-up window where you can lock or start automatic exhaust system cleaning (regeneration; chapter 6.10, page 248).
	Cable-guided boring (wire-controlled drilling)	-	Activate the switch if you want to carry out a wire-controlled drilling operation. The machine must be equipped for wire-controlled drilling. The automatic sequences are adapted accordingly.
	Disable front camera	-	Activate the switch if you want to disable the front camera on the clamping device.

Menu item	Subitem 1	Subitem 2	Function
Machine	Anti fixed drilling (anti-jamming function)	-	Use this switch to switch the anti-jamming function on/off. The anti-jamming function serves to reduce the thrust pressure if the rotation pressure exceeds 70 % of the maximum pressure. This prevents the rotation from coming to a standstill. As soon as the rotation pressure drops, the thrust pressure is increased again.
	Water supply fresh water tank	-	Activate the switch if the machine is equipped with an external fresh water tank. As soon as the tank is filled to 95 %, the pump switches off. When the level drops below 50 %, the pump is switched on again.

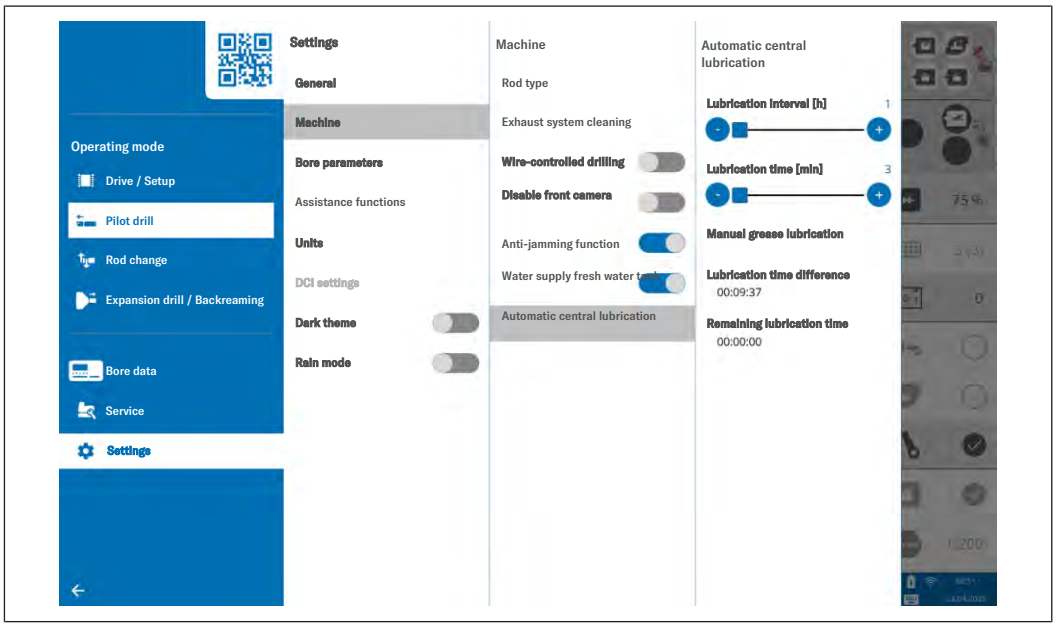


Fig. 6-28 "Settings" submenu – Machine – Automatic central lubrication

Tab. 6-18 "Settings" submenu – Machine – Automatic central lubrication

Menu item	Subitem 1	Subitem 2	Function
Machine	Automatic central lubrication	Lubrication interval [h]	Use the slider to determine after how many operating hours the system is to be lubricated.
		Lubrication time [min]	Use the slider to determine the respective lubrication time.
		Manual grease lubrication	Use this button to actuate the central lubrication system.
		Lubrication time difference	indicates the remaining time until the next lubrication
		Remaining lubrication time	indicates the remaining time of the lubrication currently being carried out

Bore parameters

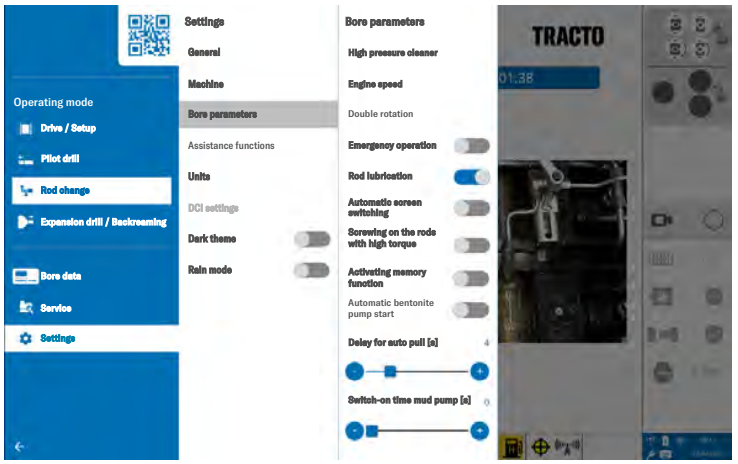


Fig. 6-29 "Bore parameter settings" submenu

Tab. 6-19 "Bore parameter settings" submenu

Menu item	Subitem 1	Subitem 2	Function
Bore parameters	High pressure cleaner	Distance [cm]	Use the slider to determine after how many centimetres of drill rod the high-pressure rod cleaning system will be switched on. The set value is displayed as a number.
		Time [s]	Use the slider to determine for how long high-pressure rod cleaning will be switched on. The set value is displayed as a number.
	Engine speed	Drive / Setup [%] Rod change [%] Pilot bore [%] Backreaming [%]	Use the corresponding slider to adjust the engine power (engine speed) for the operating mode. The set value is displayed as a number. There are lower limits for the values.
		Adjust engine speed by wheel on/off	Tap the text to open a pop-up where you can activate or deactivate engine speed adjustment via the setting wheel on the right joystick. When switched off, the engine power is controlled automatically.
	Double rotation	Drilling without inner rotation drive (all but Rockbreaker)	indicates that "jet drilling" mode is activated In "jet drilling" mode, the inner rotation is deactivated. The outer rotation has full power and can be switched between the slow and fast levels. This mode is used both when drilling with a bore head assembly and for expansion/backreaming with any drilling tool.
		Drilling with inner rotation drive (using Rockbreaker)	indicates that "rock drilling" mode is activated In "rock drilling" mode, the inner rotation can be activated while the outer rotation can only be controlled slowly. This mode is only used for operation with the rock drilling unit.

Menu item	Subitem 1	Subitem 2	Function
Bore parameters	Emergency mode	-	Activate the switch to operate the machine in emergency mode.
	Rod grease	-	Activate the switch to enable rod lubrication.
	Automatic screen switching	-	Activate the switch so that the screen automatically switches to the required function (e.g. from expansion drill to rod change and back to expansion drill after changing).
	High torque screwing	-	Set to "High torque screwing on" by default.
	Activate memory function	-	Activate the switch to enable the memory function for the joysticks. The assignment of the buttons of the right joystick is adjusted ("Pilot drill" screen).
	Automatic bentonite pump start	-	Activate the switch to automatically start the bentonite pump after changing the rod.
	Delay for auto pull	-	Use the slider to set the time to wait before pull-in starts. This is done to ensure that bentonite arrives at the backreamer and pull-in does not take place dry.
	Switch-on time mud pump	-	Use the slider to set the time for which the mud pump should run automatically after the clamping device is opened (max. 20 seconds). If the slider is set to 0, automatic mode is deactivated.

Assistance functions



Fig. 6-30 "Settings" submenu – Assistance functions

Tab. 6-20 "Settings" submenu – Assistance functions

Menu item	Subitem 1	Subitem 2	Function
Assistance functions	Anti fixed drilling (anti-jamming function)	-	Use this switch to switch the anti-jamming function on/off. The anti-jamming function serves to reduce the thrust pressure if the rotation pressure exceeds 70 % of the maximum pressure. This prevents the rotation from coming to a standstill. As soon as the rotation pressure drops, the thrust pressure is increased again.
	Stabilize rolling	-	Use this switch to switch the rolling stabilisation on/off. The function prevents the outer rotation from turning due to another function, e.g. mud motor (JCS) or inner rotation friction (ACS).

Units



Fig. 6-31 "Unit settings" submenu

Tab. 6-21 "Unit settings" submenu

Menu item	Subitem 1	Subitem 2	Function
Units	Thrust force	Bar Kilonewton Pound Metric ton	Select one of the checkboxes to select the corresponding unit.
	Rotation	Newtonmeter Bar Foot-pound	
	Flow rate	Liter per minute Gallon per minute (EN) Gallon per minute (US)	
	Pressure	Bar Psi Kilopascal	
	Angle	Degree Percent	
	Distance	Centimeter Meter Inch Feet	
	Temperature	Degree Celsius Degree Fahrenheit	
	Volume	Gallons (EN) Gallons (US) Litres	

DCI settings



Fig. 6-32 "DCI settings" submenu

Tab. 6-22 "DCI settings" submenu

Menu item	Subitem 1	Subitem 2	Function
DCI settings	Telemetry channel	Channel 1 to channel 4	Check one of the checkboxes to select the corresponding channel. Select the channel with the least signal interference. This varies from one construction site to another. More bars in the signal strength symbol indicate better reception. The settings for the telemetry channel on the screen and on the detection system must be the same.
	Receiver type	Falcon F5 Falcon F2 Falcon F1	Check one of the checkboxes to select the corresponding receiver type.
	Telemetry region	United States, Great Britain, Australia, Netherlands, Switzerland, China (high), China (low), Spain, Russia, Portugal, Japan	Check one of the checkboxes to select the corresponding country. The detection system must be set for use in the same region at the factory.
	Transmitter alarms	Temperature Warning Temperature critical Pressure Warning Pressure critical	Use the sliders to adjust the threshold for alarm triggering. Warning thresholds are marked yellow, critical values are marked red. Drag the slider to change the settings. For temperature alarms, the warning threshold (yellow) is set to 40 °C and the critical value (red) to 48 °C. For pressure alarms, the maximum warning threshold and the critical value are set to 17.2 bar. Measured values exceeding the maximum value are indicated by +OL (overload) on the screen.

Dark theme

You can switch between a light and dark background for the screens via the "Dark theme" button.

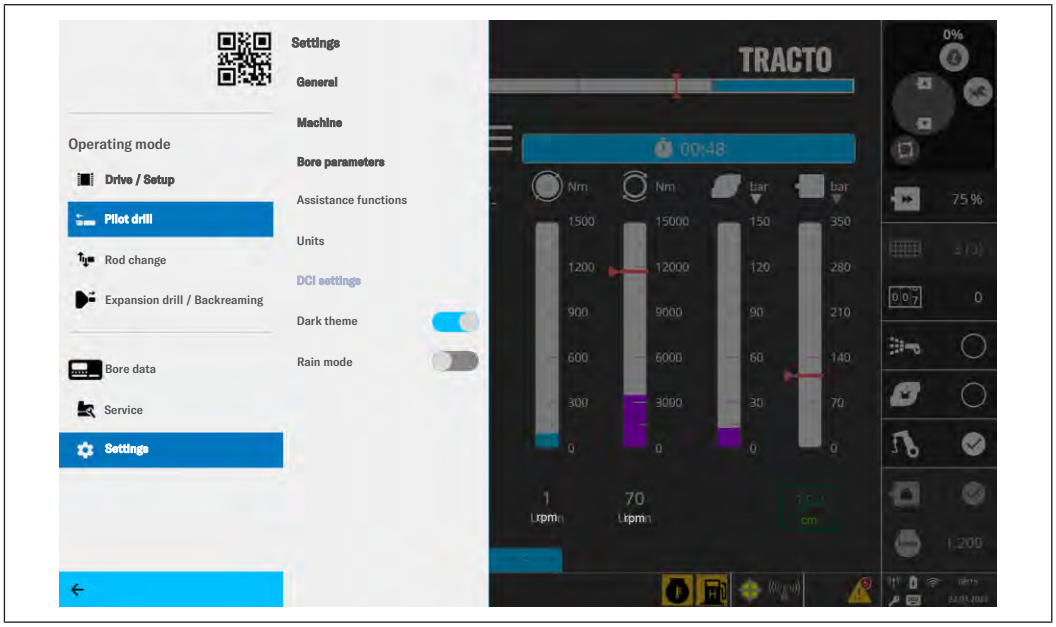


Fig. 6-33 Submenu "Settings" – dark theme

Rain mode

Activate "rain mode" if you are using the operating terminal outside in the rain. The rain mode makes the touchscreen less sensitive to unintentional touches, e.g. by water drops.

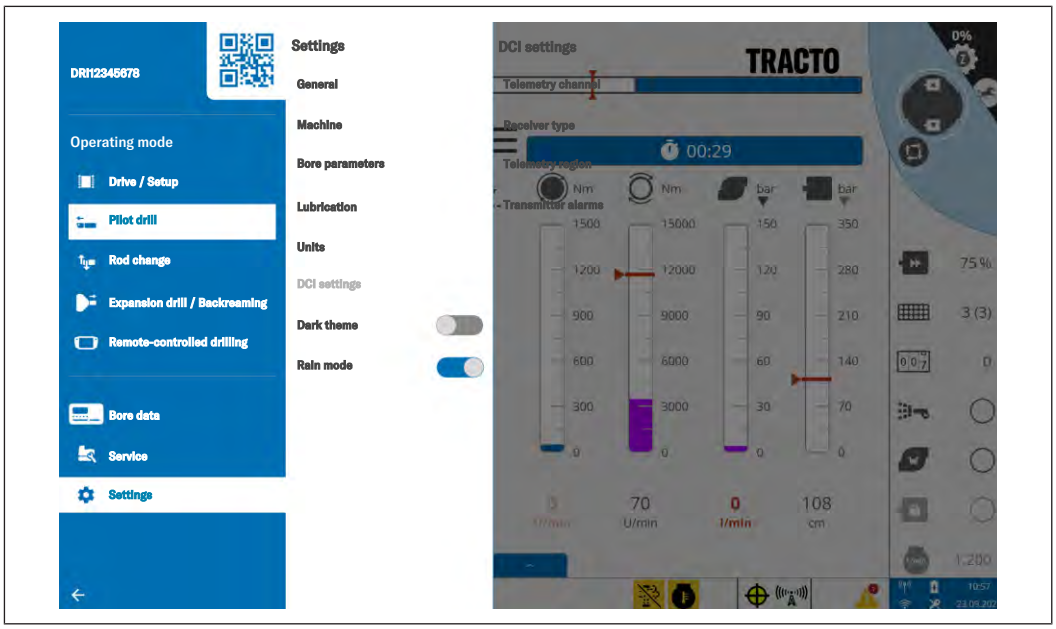


Fig. 6-34 "Settings" submenu – rain mode

"Service" submenu

In the "Service" submenu you can view the software version and machine ID by selecting "View system status". Select "Report error" to create and send an error report. All other menu items can only be accessed by service personnel after entering a PIN.

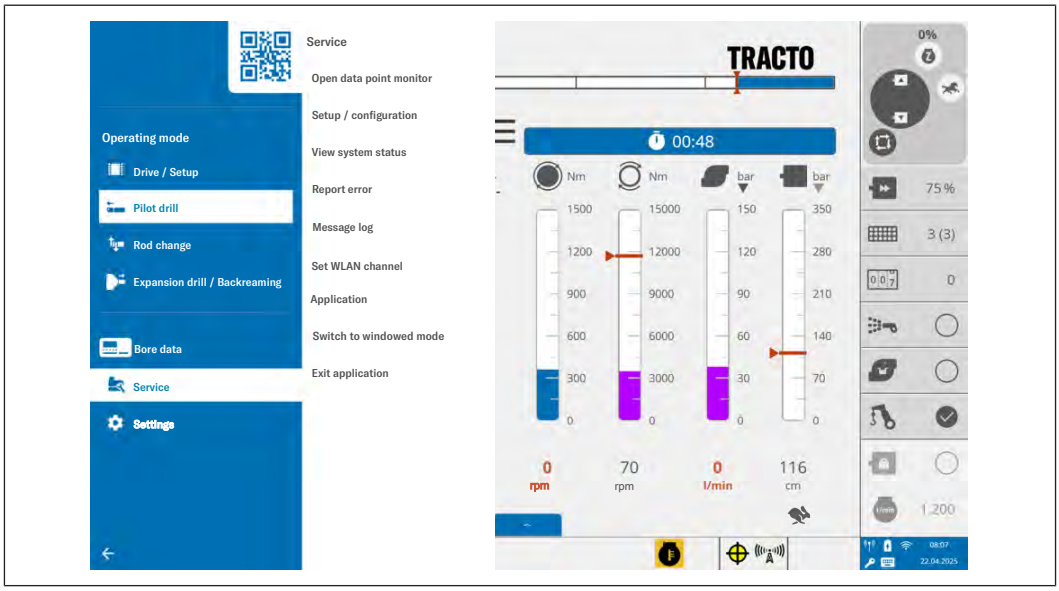
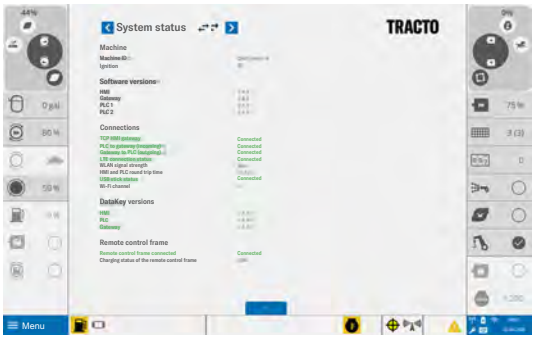


Fig. 6-35 "Service" submenu

Tab. 6-23 "Service" submenu

Menu item	Subitem	Function
Service	Open data point monitor	only for service personnel
	Setup / configuration	only partially for operators (chapter 6.2.4.16, page 189)
	View system status	displays the software versions and system states installed on the machine 
	Report error	to create an error message (see chapter 8.1, page 257)
	Message log	only for service personnel
	Set WLAN channel	
Application	Application	
	Switch to windowed mode	
	Exit application	

6.2.4.10 "Drive / Setup" screen – drive mode

This screen is displayed if the drive mode is switched on and you tap the "Drive / Setup" item in the main menu.

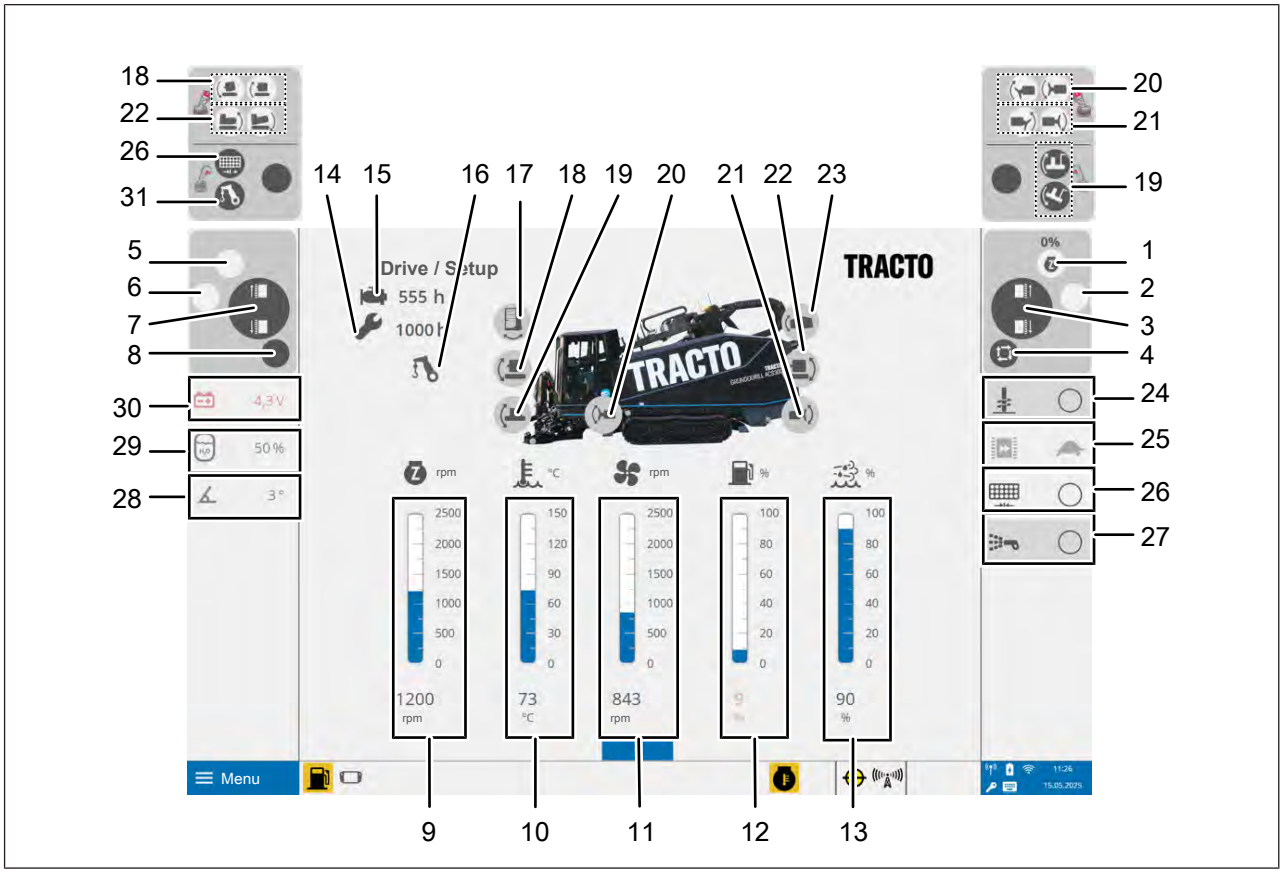
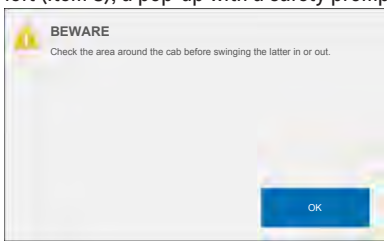
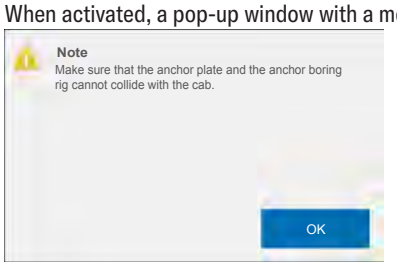


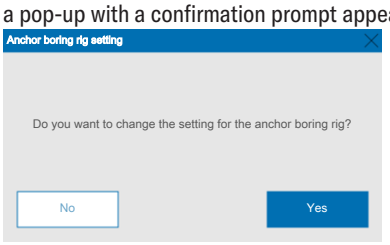
Fig. 6-36 "Drive / Setup" screen - drive mode (schematic diagram)

Tab. 6-24 Indicators and operating elements in the "Drive / Setup" screen

Item	Indicator/operating element	Function
1	Right setting wheel	Serves to set the engine speed The option "Set value by wheel on right joystick" must be previously activated in the “Settings->Bore parameters->Engine speed" menu, otherwise the value will be controlled automatically.
2	Outer push button on the right	switches the speed level for the tracks between slow (tortoise) and fast (rabbit)
3	Right joystick	forward: moves the right track forwards back: moves the right track backwards With the anchor boring rig activated: forward: lifts the anchor boring rig back: lowers the anchor boring rig
4	Front right push button	starts the automatic mode for the previously selected function
5	Left setting wheel	none

Item	Indicator/operating element	Function
6	Outer push button on the left	Arrow button upwards or arrow button outwards Moves the element selected in the symbol image of the machine (Item 16–22). The movement stops when you let go of the push button.
7	Left joystick	for switched off loading crane only: forward: moves the left track forwards down: moves the left track back backwards With the anchor boring rig activated: forward: drills the drill of the anchor boring rig into the ground back: drills the drill of the anchor boring rig out of the ground
8	Front left push button	Arrow button downwards or arrow button inwards Moves the element selected in the symbol image of the machine (Item 16–22). The movement stops when you let go of the push button.
9	Engine speed scale	indicates the engine speed in rpm Below the scale, the value is shown as a number.
10	Coolant temperature scale	Indicates the coolant temperature in °C (or °F) Below the scale, the value is shown as a number.
11	Fan speed scale	indicates the fan speed in rpm Below the scale, the value is shown as a number.
12	Diesel level scale	indicates the filling level of the diesel tank in % Below the scale, the value is shown as a number. Reserve starts from a tank level of 10 %. A corresponding warning as well as an indication symbol are then displayed in the status line. When the filling level is <10 %, the value flashes red.
13	Scale DEF supply	Indicates the filling level of the DEF tank in % Below the scale, the value is shown as a number. Reserve starts from a tank level of 10 %. A corresponding warning as well as an indication symbol are then displayed in the status line.
14	Service hours	indicates the number of hours remaining until the next service
15	Operating hours	indicates the number of operating hours
16	"Loading crane" symbol	displayed when the loading crane is switched on

Item	Indicator/operating element	Function
17	Swinging the cab	selects the cab when pressing the outer push button at the left (Item 6) or the push button at the front left (Item 8), a pop-up with a safety prompt is shown:  Confirm this prompt with "Yes" to swing the cab. Swinging the cab can be performed either from the operator seat with the with the left joystick panel folded down or from outside via the operating terminal while simultaneously pressing the dead man's switch.
18	Lift/lower rig boom at front	Remote mode: enables the illustrated machine element – The colour of the element changes to blue. – Only one icon can be enabled at a time. – Only activated elements can be moved with the push buttons (Items 6 + 8). Cab mode: the respective pair of push buttons performs the function
19	Lift/lower anchor plate	When activated, a pop-up window with a message appears:  Confirm the message with "OK" to execute the function. Remote mode: enables the illustrated machine element – The colour of the element changes to blue. – Only one icon can be enabled at a time. – Only activated elements can be moved with the push buttons (Items 6 + 8). Cab mode: the respective pair of push buttons performs the function
20	Lift/lower stabiliser at the front	Remote mode: enables the illustrated machine element – The colour of the element changes to blue. – Only one icon can be enabled at a time. – Only activated elements can be moved with the push buttons (Items 6 + 8). Cab mode: the respective pair of push buttons performs the function
21	Lift/lower stabiliser at the rear	
22	Lift/lower rig boom in the rear	

Item	Indicator/operating element	Function
23	Open/close the bonnet	selects the bonnet when pressing the push button at the front left (Item 8), a pop-up with a safety prompt is shown:  Confirm this prompt with "OK" to close the bonnet with the arrow button.
24	Anchor boring rig	selects the anchor boring rig a pop-up with a confirmation prompt appears:  Confirm this prompt with "Yes" to move the anchor boring rig by means of the joysticks. All other functions of the "Drive / Setup" screen are disabled when the anchor boring rig is selected.
25	Tracks speed level	only if used with operating terminal: Switches the speed level for the tracks between slow (tortoise) and fast (rabbit). In cab mode, the slow speed level is always active.
26	Gantry crane transport position	in combination with the automatic mode button (item 4), this button is used to move the gripper arm of the rod changing system to the transport position or back out of the transport position Tap the icon and then the automatic mode button to move the thrust and the gantry crane to the transport position. As soon as the transport position has been reached, the checkbox is checked. Tap the checked checkbox and then the automatic mode button to move the gripper arm of the rod changing system back out of the transport position. The gripper arm of the rod changing system moves up and stops in the top position.
27	High-pressure cleaner	switches the high-pressure cleaner on or off
28	Rig inclination	displays the tilt angle of the rig (only for machines with cameras from Arc Vision Systems)
29	Fresh water tank filling level	indicates the filling level of the fresh water tank in %
30	Battery voltage	indicates the battery voltage
31	Lower front push button	Cab mode: switches the loading crane on or off When the loading crane is switched on, the icon (item 16) is displayed on the screen.

6.2.4.11 "Pilot drill" screen

This screen is displayed if the bore mode is switched on and you tap the "Pilot drill" item in the main menu.

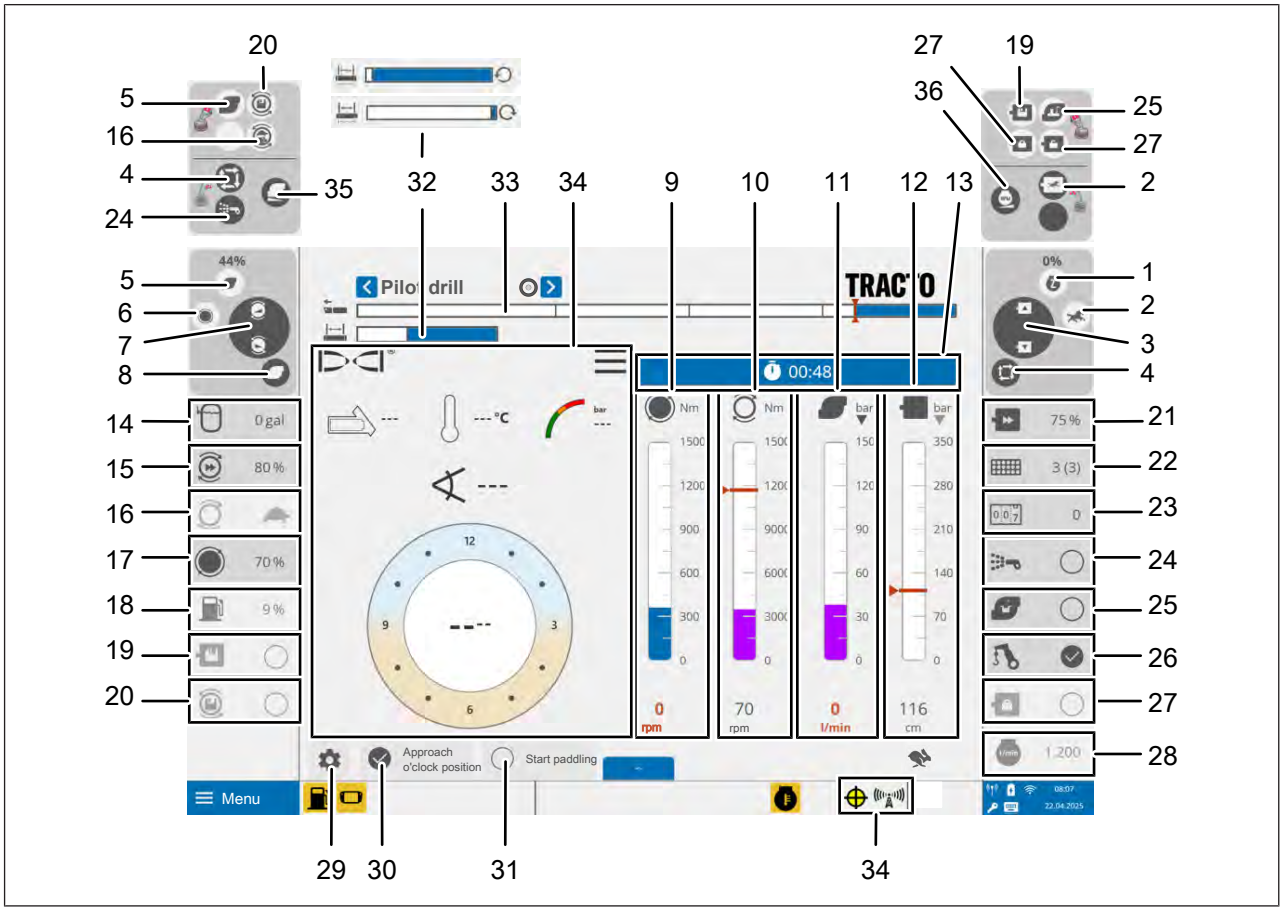
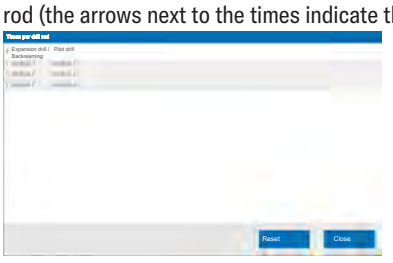
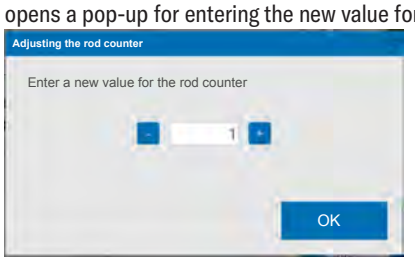


Fig. 6-37 "Pilot drill" screen

Tab. 6-25 Indicators and operating elements of the "Pilot drill" screen

Item	Operating element	Function
1	Right setting wheel	serves to set the engine speed The option "Adjust engine speed by wheel" must be previously activated in the "Settings->Bore parameters->Engine speed" menu, otherwise the value will be controlled automatically.
2	Outer push button on the right	starts rapid motion for the thrust rig – double-click: switch between slow (tortoise) and additional speed (rabbit) – press and hold: fast speed (horse) The status is displayed below the thrust scale.
3	Right joystick	forward: advances the thrust rig back: reverses the thrust rig

Item	Operating element	Function
4	Front right push button	pressing once initiates an automatic rod exchange pressing twice within 1.5 s starts automatic drilling for the pilot drill if the Clock mode checkbox is checked: pressing once starts the roll if the Carving mode (paddle mode) checkbox is checked: pressing the button twice starts the paddle mode
5	Left setting wheel	serves to set the drilling fluid flow rate
6	Outer push button on the left	serves to switch internal rotation on/off
7	Left joystick	forward: starts clockwise rotation back: starts counter-clockwise rotation
8	Front left push button	switches the drilling fluid pump on or off
9	Scale torque internal rotation	ACS machines only: indicates the torque for internal rotation Below the scale, the internal rotation speed in rpm is shown. If the performance is too low, the scale is highlighted in colour (magenta).
10	Scale torque outer rotation	indicates the torque for outer rotation By shifting the red arrow, you alter the limit value. Below the scale, the outer rotation speed in rpm is shown. If the performance is too low, the scale is highlighted in colour (magenta).
11	Scale pressure drilling fluid pump	indicates the drilling fluid pressure By means of the black arrow below the unit bar, you reduce the scale range to 25 %. Click again to enlarge the scale range back to 100 %. Below the scale, the flow rate of the drilling fluid pump is shown. The value display flashes red if the flow rate is 0 l/min and at the same time the valve of the gate valve is opened. If the performance is too low, the scale is highlighted in colour (magenta).
12	Scale thrust force	indicates the thrust force By shifting the red arrow you can alter the limit value. Below the scale, the position of the thrust rig is shown. The value display appears in green and bordered when the thrust rig reaches the front or rear break position. If the performance is too low, the scale is highlighted in colour (magenta).
13	"Times per drill rod" indication	opens a pop-up to indicate the times for pilot bore and expansion drill/backreaming per drill rod (the arrows next to the times indicate the reading direction)  Close: the pop-up is closed, the values are saved Reset: the pop-up is closed, the values are deleted
14	Filling level mixing tank	indicates the filling level in the mixing tank in litres Use the slider to adjust the filling quantity of the mixing tank.

Item	Operating element	Function
15	Rotation sensitivity	serves to set the sensitivity of the joystick for the rotation Alter the values for manual operation and automatic operation by means of the double slider (see below, "Function of the double slider").
16	Rotation level (tortoise/rabbit) for outer rotation	switches the rotation level between slow (tortoise) and fast (rabbit)
17	Internal rotation speed	serves to set the speed of the internal rotation Alter the value using the slider.
18	Diesel tank filling level	indicates the filling level of the diesel tank in percent
19	Memory function for the thrust	indicates the status of the memory function for the thrust system
20	Memory function for the rotation	indicates the status of the memory function for the rotation system
21	Thrust sensitivity	serves to set the sensitivity of the thrust Alter the values for manual operation and automatic operation by means of the double slider (see below, "Function of the double slider").
22	Rod bay selection	changes the rod bay selected Alter the value by means of the slider.
23	Rod counter	opens a pop-up for entering the new value for the rod counter  Confirm the entry with "OK".
24	Rod cleaner	switches the rod cleaner on or off
25	Mud pump	switches the mud pump on or off
26	Loading crane	activates or deactivates the loading crane
27	Length compensation lock	switches the lock for the length compensation on or off
28	Engine speed	Indicates the rotational speed of the diesel engine.
29	Settings button	opens a pop-up (see below, "Roll, paddle mode settings") to set the paddle mode and probe time (roll)
30	"Clock mode" checkbox	selects the function without executing it The function is started via the push button at the front right (Item 4).
31	"Start paddling" checkbox	
32	Length compensation progress bar	Length compensation An icon for screwing and unscrewing is shown each for the first and last 10 % of the path (5 cm).
33	Thrust progress bar	Drag indicator for drilling and expansion
34	Detection system	see Fig. 6-42 and Tab. 6-27

Item	Operating element	Function
35	Drill fluid flow (drilling fluid quantity)	Cab mode: potentiometer joystick left: controls the drilling fluid quantity
36	Engine speed	Cab mode: potentiometer joystick right: controls the engine speed

Function of the double slider

When setting the rotation sensitivity (1) and thrust sensitivity (2), a double slider is shown below the button in each case. Use the slider on the left (3) to set the sensitivity for the automatic mode and the slider on the right (4) to set the sensitivity for manual operation.
Use the +/- keys or the slider to make the settings.

In the case of values < 2 %, the scale changes for the thrust in automatic mode (3) allowing you to set smaller values more precisely.

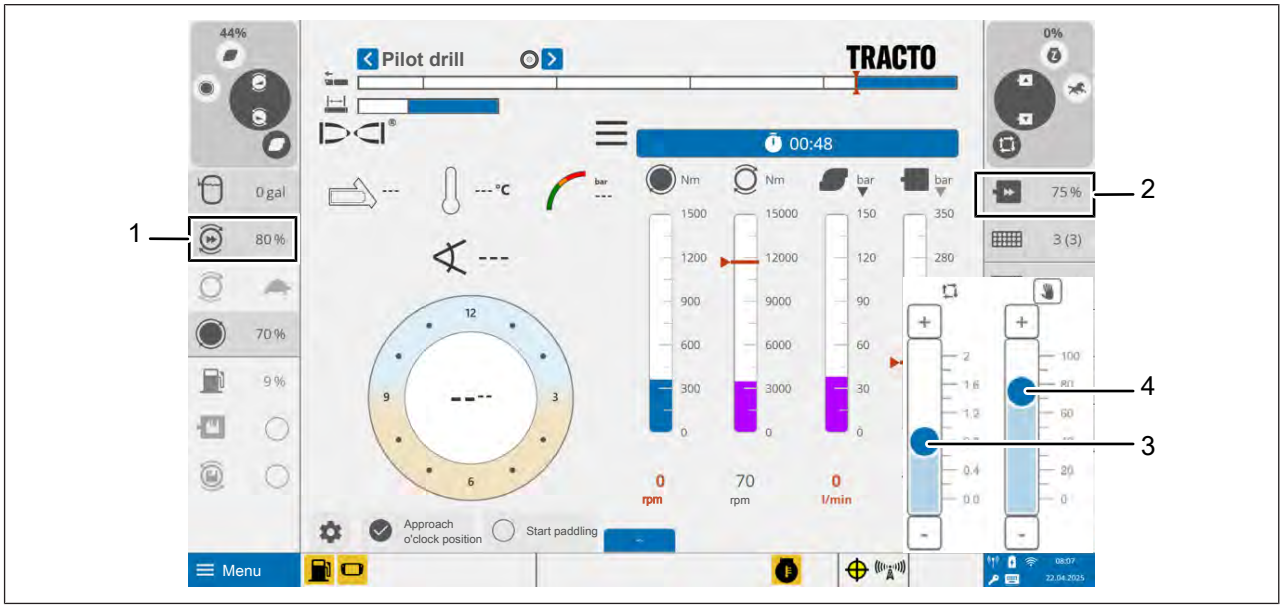


Fig. 6-38 Double slider shown for the thrust motion

In automatic mode, only the menu items "Bore data" (1) and "Service" (2) are available.



Fig. 6-39 Double slider – menu in automatic mode

Roll, paddle mode settings

This pop-up is displayed when you press the "Settings" button in the "Pilot drill" screen.



Fig. 6-40 "Settings" pop-up

Tab. 6-26 Indicators and operating elements of the "Pilot drill" screen

Item	Operating element	Function
1	Clock	serves to set the probe o'clock position (roll) to be approached
2	Matching	serves to enter the current probe o'clock position (roll) of the drill head
3	Adjustable angle	serves to adjust the angle around which the paddling motion is to be executed in clockwise and counter-clockwise direction
4	Steering rotation left	serves to set the paddle speed in counter-clockwise direction
5	Steering rotation right	serves to set the paddle speed in clockwise direction
6	Close	closes the pop-up

Time settings

By means of the time settings you can set a specific probe time (roll) of the sub-saver at the push of a button.

1. Use the "Matching" slider to set the probe time (roll) of the drill head, which is shown in the display.
2. Use the "O'clock position" slider to set the desired start-up probe time (roll).
3. Close the pop-up and activate the "Set time" checkbox.
4. Start the function via the push button at the right front.

Paddle settings

By means of the paddle mode you can make the sub-saver rotate automatically around the probe time (roll) set before, between an adjusted angle in counter-clockwise and clockwise direction.

1. Use the "Adjustable angle" slider to adjust the angle around which the paddle motion is to be executed in counter-clockwise and clockwise direction.
2. Use the "Steering rotation left/right" sliders to set the paddle speed.
3. Close the pop-up and activate the "Paddle" checkbox.
4. Start the function via the push button at the right front.

Memory function

When the memory function (chapter 6.2.4.9, page 146) is activated, the assignment of the right joystick and the "Pilot drill" screen are altered in the following way:

– The push button on the very right (1) becomes the memory button with the floppy disk icon.
– Rapid motion for the thrust rig changes to the push button at the front right (2).
– The scale for the internal rotation torque (3) becomes inactive.

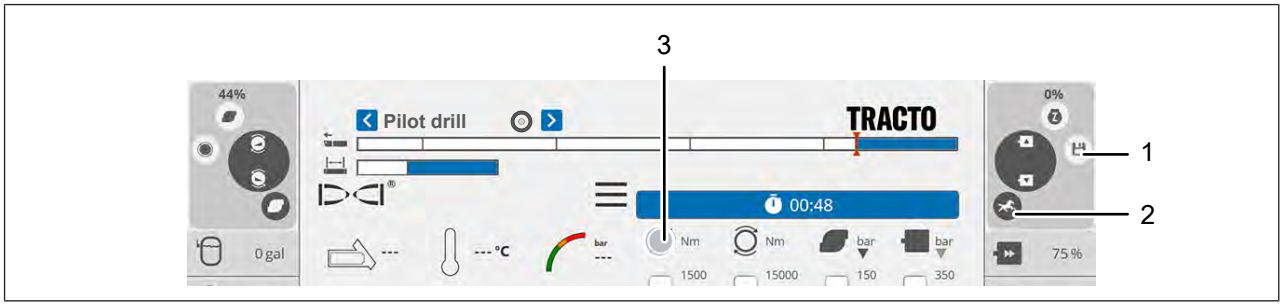


Fig. 6-41 "Pilot drill" screen with activated memory function

To start the memory function, press the memory button with the joystick deflected (left and/or right).

– The joystick's/joysticks' deflection is saved.
– The rotation and/or the thrust are continued with the same torque even if you've let go of the joystick, until the rod break position is reached.

By pressing the memory button again, you exit the memory function before the rod break position has been reached. After it has been exited, the function can be started again at any time by double-clicking on the memory button.

Detection system The detection system is displayed if the machine is equipped with the "Detection with DCI interface on the operating terminal" option. The display contains all specifications required for drilling such as depth, transmitter inclination and o'clock position for the probe (roll).

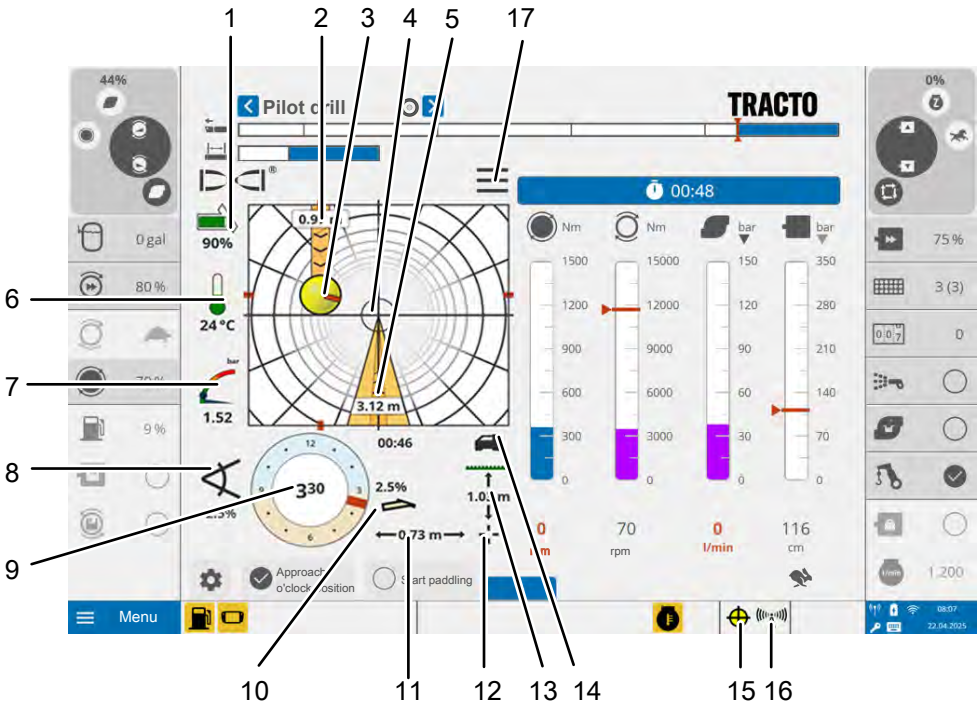


Fig. 6-42 Indicators and operating elements for the detection system

Tab. 6-27 Indicators and operating elements for the detection system

Item	Operating element/ indicator	Function
1	Battery state of charge	indicates the state of charge of the battery of the detection system in %
2	Depth	indicates the current drill head depth below the detection system
3	Control indication	indicates the current target point of the drill head with reference to the final target (Item 4) The red bar in the control indication shows the current probe time of the drill head (Item 5).
4	Target	shows the target depth for a point located directly beneath, which is entered in the locating device
5	Horizontal distance	shows the horizontal distance of the drill head to the target
6	Probe temperature	indicates the current probe temperature
7	Drilling fluid pressure	indicates the current drilling fluid pressure at the probe
8	Inclination	indicates the inclination of the probe
9	Probe time (roll)	indicates the probe time The probe time is shown as a red line on the clock and in the form of a numerical value.

Item	Operating element/ indicator	Function
-	Roll offset	if applicable, it is shown below the o'clock position for the probe: electronic adjustment to adjust the 12-o'clock position of the transmitter to that of the drill head
10	Transmitter icon	indicates the inclination of the drill head
11	Distance	shows a scale indicating the distance between drill head and receiver
12	Point of the precalculated depth	see below
13	Depth	shows a scale with the probe's depth
14	Receiver icon	indicates detection data
15	Status indicator	is displayed if the detection system is enabled
16	Signal strength	indicates the signal strength of the detection system
17	Menu	selection of probe data, self test, system information, contact details and safety notes (see below)

Menu

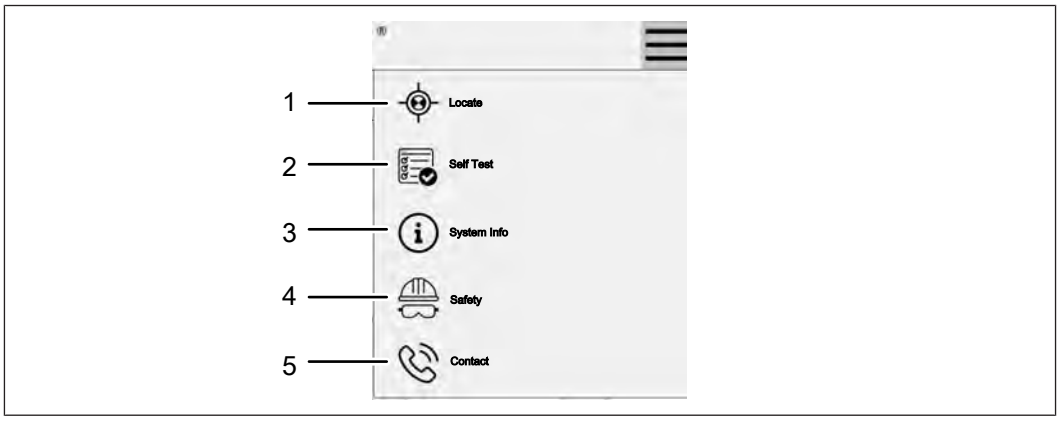
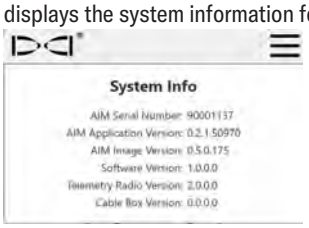
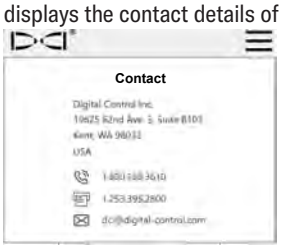


Fig. 6-43 Menu of the detection system

Tab. 6-28 Menu of the detection system

Item	Menu item	Function
1	Locate	shows the data view such as illustrated above for the "Pilot drill with detection system" screen
2	Self Test	opens a pop-up to conduct a self test of the DCI integration If the self test results green, there is an operational connection between the AIM (Aurora Interface Module) and the HMI (human machine interface). 
3	System Info	displays the system information for the detection system 
4	Safety	displays safety instructions for handling the detection system 
5	Contact	displays the contact details of the detection system manufacturer 

Temperature

All Digitrak transmitters, including the TensiTrak®, are equipped with a built-in digital thermometer. During drilling, the temperature of the drill head usually ranges between 18 °C and 40 °C.
The temperature icon on the screen slowly flashes orange if the temperature reaches the warning threshold. It flashes red fast if a critical value is reached.
You can set warning thresholds and critical values in the "Settings -> DCI settings -> Transmitter alarms" menu (chapter 6.2.4.9, page 146).

NOTICE

Potential damage caused by too high probe temperature!

If the probe temperature during pilot drilling is too high, permanent damage to the probe can result.

- Interrupt drilling if the drill head temperature rises to above 48 °C so that the drill head can cool.
- Since the digital thermometer is located inside the transmitter, it takes a while until rises in temperature caused by external drilling conditions are transmitted to the transmitter and the thermometer. Immediately react to rises in temperature to avoid permanent damage.

Drilling fluid pressure

If a fluid pressure transmitter (FPT) or TensiTrak is used, the current drilling fluid pressure is displayed on the screen.
The pressure icon on the screen slowly flashes yellow if the pressure reaches the warning threshold. It flashes red fast if a critical value is reached.
A blue ball on the screen marks the maximum recorded pressure. This value is reset when the detection system is rebooted.
Measured values which exceed the maximum value of 17.2 bar are indicated as +OL (overload).
You can set warning thresholds and critical values in the "Settings -> DCI settings -> Transmitter alarms" menu (chapter 6.2.4.9, page 146).

Signal strength

The number of bars of the icon for the telemetry signal strength indicates the signal strength of the detection system. If the detection system is located at a great distance from the operating terminal, fewer signal bars are possibly displayed in the icon.

- A grey icon indicates that the detection system does not have any reception. In such case, all transmitter information disappears (for a wire-controlled transmitter, only the depth disappears).
- A permanently black icon indicates that the operating terminal is connected to a detection system which does not transmit any data.
- A flashing blue background behind the icon indicates that the DCI interface is receiving new data from the detection system.

Depth

If the detection system measures a depth value on the locate line (LL), the scale with the blue background for the depth is displayed indicating the current value.
The blue background is displayed during ten seconds to indicate new data. After ten seconds, the blue background changes to white. However, the data are displayed during five minutes. This duration is displayed in the icon of the receiver.
After a new depth measurement by the detection system, there is a new depth scale highlighted in blue and the depth time meter is reset. The depth scale also indicates whether "height above ground" (HAG) has been set on the detection system.
In the figure above, the arrow between the icon of the receiver and the ground level (green line) indicates that HAG has been set.

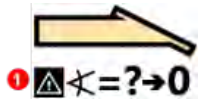
Precalculated depth

The indicator of the precalculated depth is displayed when the detection system measures the depth at the front locate point (FLP).

When a depth measurement is conducted at the rear locate point (RLP), the precalculated depth is still displayed because the detection system does not differentiate between FLP and RLP. However, the data are inaccurate.

When the detection system conducts a measurement of the precalculated depth at the FLP, the scales for depth and distance are displayed with a blue background. The values in the arrows indicate the depth and the distance to the point of the precalculated depth. Below the icon of the drill head, the inclination angle is displayed.

The blue background is displayed during ten seconds to indicate new data. After ten seconds, the blue background changes to white. However, both bars are displayed during five minutes. This duration is displayed in the icon of the receiver.
A new measured value of the precalculated depth from the detection system results in a new depth and distance scale with a blue background. The time meter for the precalculated depth is reset.



If no transmitter inclination data are received due to range restrictions or signal interference, the detection system for the depth and the precalculated depth assumes zero inclination for the transmitter. In this case, "Assumed transmitter inclination is zero" is displayed below the transmitter icon:

Info!
If the drilling angle had been zero or close to zero before the inclination loss, a precalculated depth can still be relatively accurate.
If the last known inclination had not been approximately zero, the precalculated depth is inaccurate.
In both cases, the precalculated depth is growing increasingly inaccurate with every rod drilled without inclination data. The safest procedure is to interrupt drilling until the inclination data are displayed again. To improve the signal reception between transmitter and detection system, you can for example try to change the transmitter frequency (as far as it is compatible), to conduct the detection on the side of the path and to use the target steering function.

Settings

To receive the measuring data, adjust the DCI interface to the used detection system model, the telemetry channel and the region. Set the values in the "Settings -> DCI settings" menu (chapter 6.2.4.9, page 146).

6.2.4.12 Target steering

Requirement

The detection system has been set up for Target Steering® as per the operating manual of the detection system.

In this section, the use of the target steering data on the HMI display is explained.

Info!
The target steering function is used to maintain a drilling path. It is not used to steer a strongly deviated drilling procedure back to the path. If the drill head has already considerably deviated from the path, employ the procedures for front and rear detection to steer the drilling procedure back to the path (see the operating manual of the detection system).

Familiarise yourself with the basics of target steering and practise the usage prior to the practical use on the construction site. On the following YouTube channel, you find an animation of the look-ahead detection:
www.YouTube.com/DCIKent.
The target steering function requires stable signals from the transmitter and the detection system.

For further support, please contact the DCI customer service.

Steering toward the target

After you have entered the target depth on the detection system, the following section is displayed in the "Pilot drill with detection system" screen:

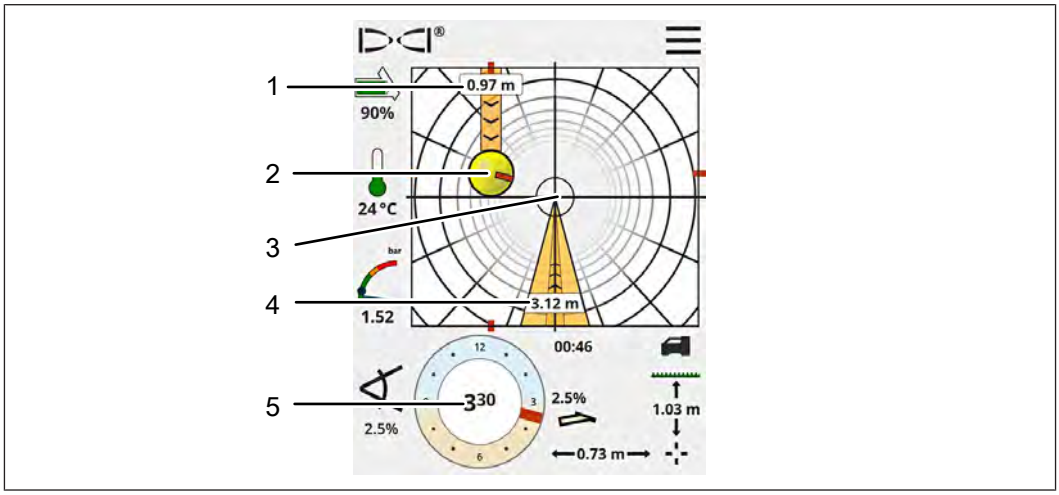


Fig. 6-44 "Target steering" screen

Tab. 6-29 Indicators and operating elements in the "Pilot drill with detection system" screen

Item	Indicator	Function
1	Depth	indicates the current drill head depth below the detection system
2	Control indication	indicates the current target point of the drill head with reference to the final target (Item 4) The red bar in the control indication shows the current probe time of the drill head (Item 5).
3	Target	shows the target depth for a point located directly beneath, which is entered in the locating device
4	Horizontal distance	shows the horizontal distance of the drill head to the target
5	Probe time (roll)	indicates the probe time The probe time is shown as a red line on the clock and in the form of a numerical value.

The screen shows that the drill head is currently located approx. 1.0 m below the horizontal pane of the detection system and that the target is located approx. 3.1 m in front of the drill head. The graphic illustration of the described situation is as follows:

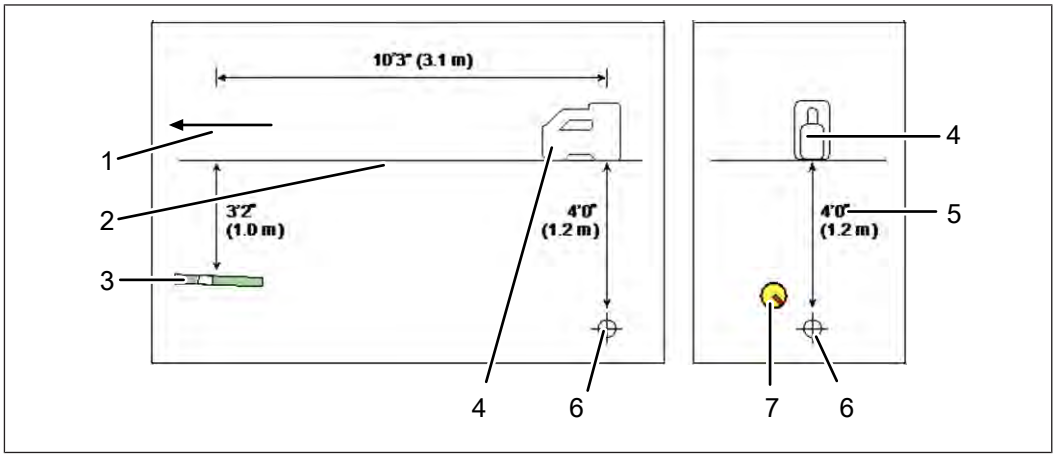


Fig. 6-45 Transmitter, target and detection system (side and rear view)

1	The arrow points towards the bore rig.	5	Target depth
2	Terrain surface	6	Control indication
3	Transmitter inside the drill head	7	Target
4	Detection system		

The steering indicator on the screen shows that the drill head points to the top left next to the target. The following example illustrates the procedure to adjust the drill head with the detection system (1) before the drill head reaches the target.

1. To bring the steering indicator (2)/the projected path (4) back to the intended path (5), rotate the drill head (7) so that the red bar (o'clock position for the probe) points to the target (3) in the steering indicator (left figure).
   ⇨ The drill head steers toward the intended drilling path and thus in the direction of the target.
2. Reduce the rotation when the steering indicator approaches the target (centre figure).
3. During drilling, closely observe the yellow steering indicator.
4. Adjust the direction in small steps and wait until you see the result.
   The closer the drill head comes to the detection system, the more sensitive reacts the steering indicator.
   ⇨ When the steering indicator is located in the centre of the target and surrounded by a green ring, the drill head is correctly positioned on the intended drilling path to drill in the direction of the target (right figure).

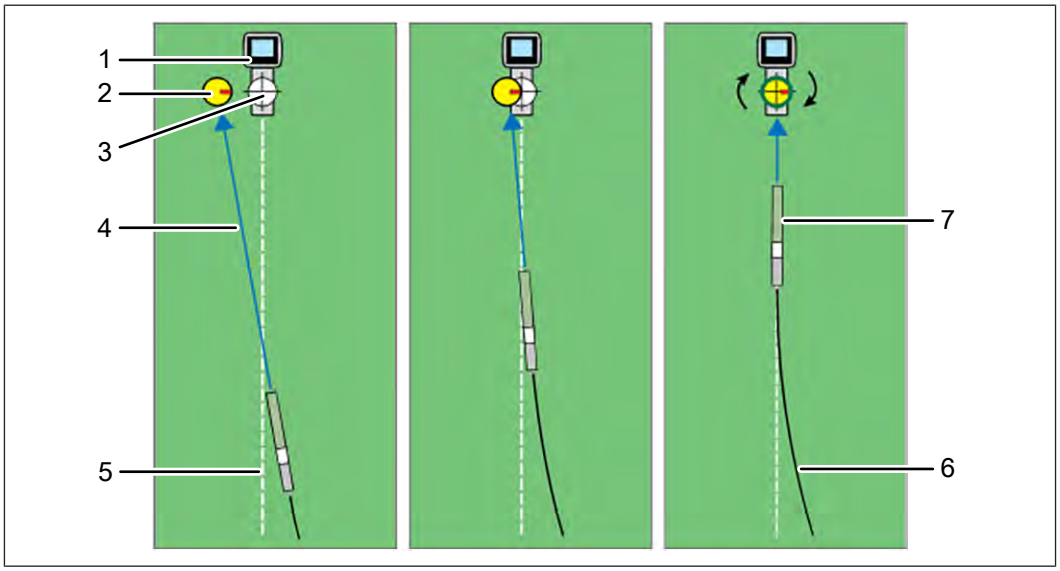


Fig. 6-46 Target steering and steering indicator (top view)

The following figure shows the correct adjustment of the drill head to approach the target at a distance of 2.34 m. The drill head is currently located 0.58 m below the horizontal pane of the detection system.

The closer the inclination (1) is to 0 (zero) at this point, the smaller is the tendency of the indicator to move to above or below the target. From the red adjustment markers (2) you can see when the drill head is precisely aimed at the target.

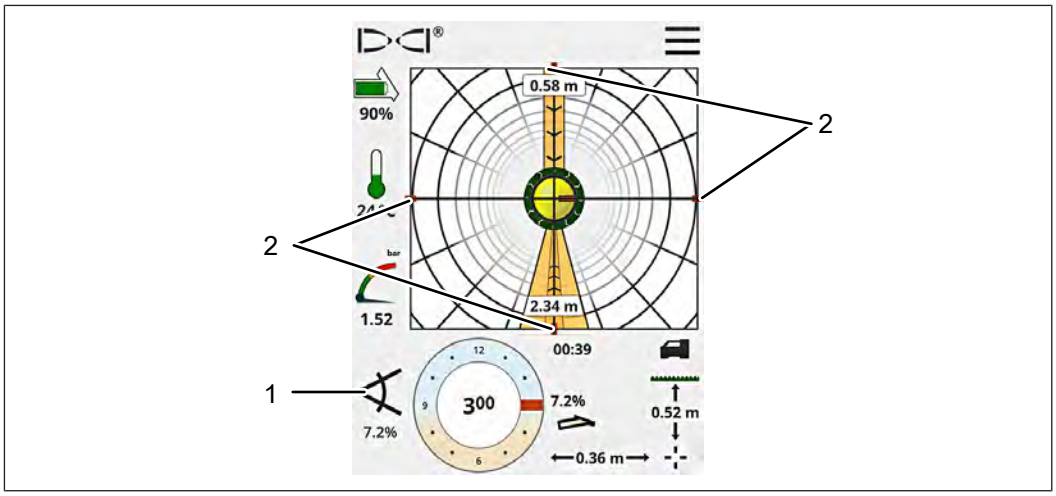


Fig. 6-47 Target steering screen, drill head aimed at the intended drilling path

Info!
The yellow steering indicator can only show the steering corrections within the limits of the target steering screen. If the steering indicator reaches the screen edge or "freezes", any further deviation of the drilling process from the drilling path is not illustrated on the screen.
Correct the steering as required and reduce the rotation when the ball approaches the target.

Target steering function in surroundings with signal interference

In surroundings with passive and/or active signal interference, it may help to lift the detection system above ground. In the below illustrated example, the detection system has been set up 1 m above ground. To even this out, consider the additional height when you enter the target depth (e.g.: 1 m + 1.1 m = 2.1 m).

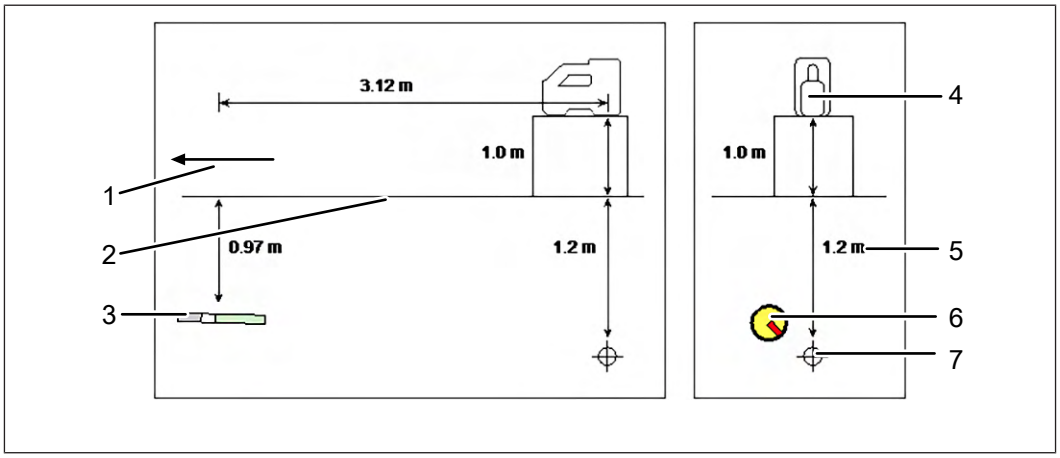


Fig. 6-48 Transmitter, target and elevated detection system (side and rear view)

1	The arrow points towards the bore rig.	5	Target depth
2	Terrain surface	6	Control indication
3	Transmitter inside the drill head	7	Target
4	Detection system		

Explanation of the steering indicator

In the above example, the yellow steering indicator (projected target) is located to the left of the target. However, this does not necessarily mean that the drill head is currently also located to the left of the target. All three drill heads in the following figure require a different value and also a different duration of the steering correction. However, they must all steer in the same direction: to the right and down.
During drilling, pay particular attention to the steering of the last three drill rods before you make further adjustments. You might already be drilling in the direction specified through the target steering function.

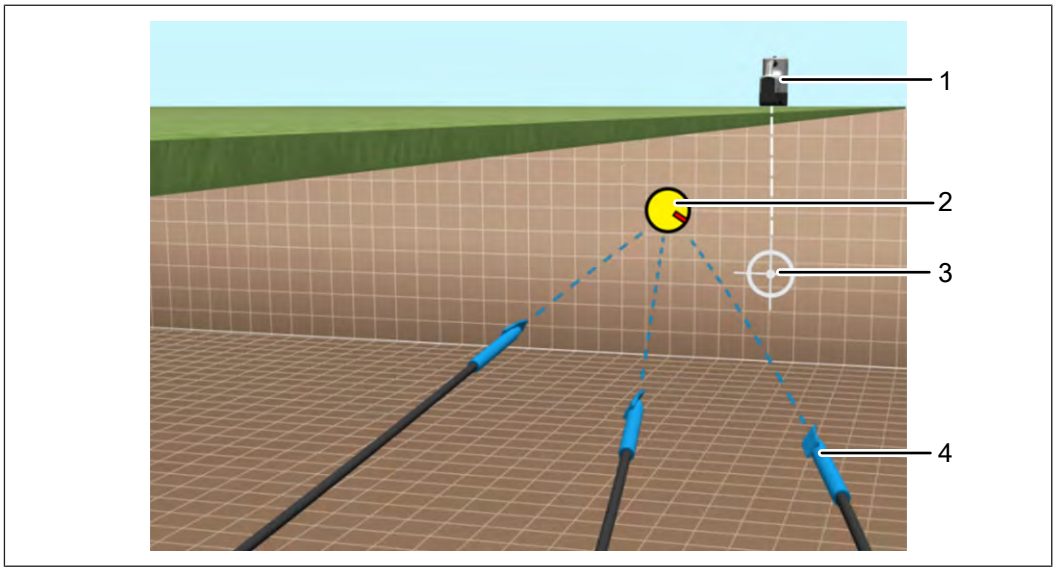


Fig. 6-49 Exemplary drill head positions during target steering

1	Detection system	3	Target
2	Control indication	4	Drill head with transmitter

Switching off the target steering function

The flashing target steering icon in the status bar shows that target steering data are being received. If the target steering screen is displayed while the HMI stops receiving target steering data from the detection system, no further data are displayed. The target steering function remains loaded until the HMI is switched off. When target steering data are available again, they are further processed without interrupting the current task.

6.2.4.13 "Rod change" screen

This screen is displayed if the bore mode is switched on and you tap the "Rod change" item in the main menu.

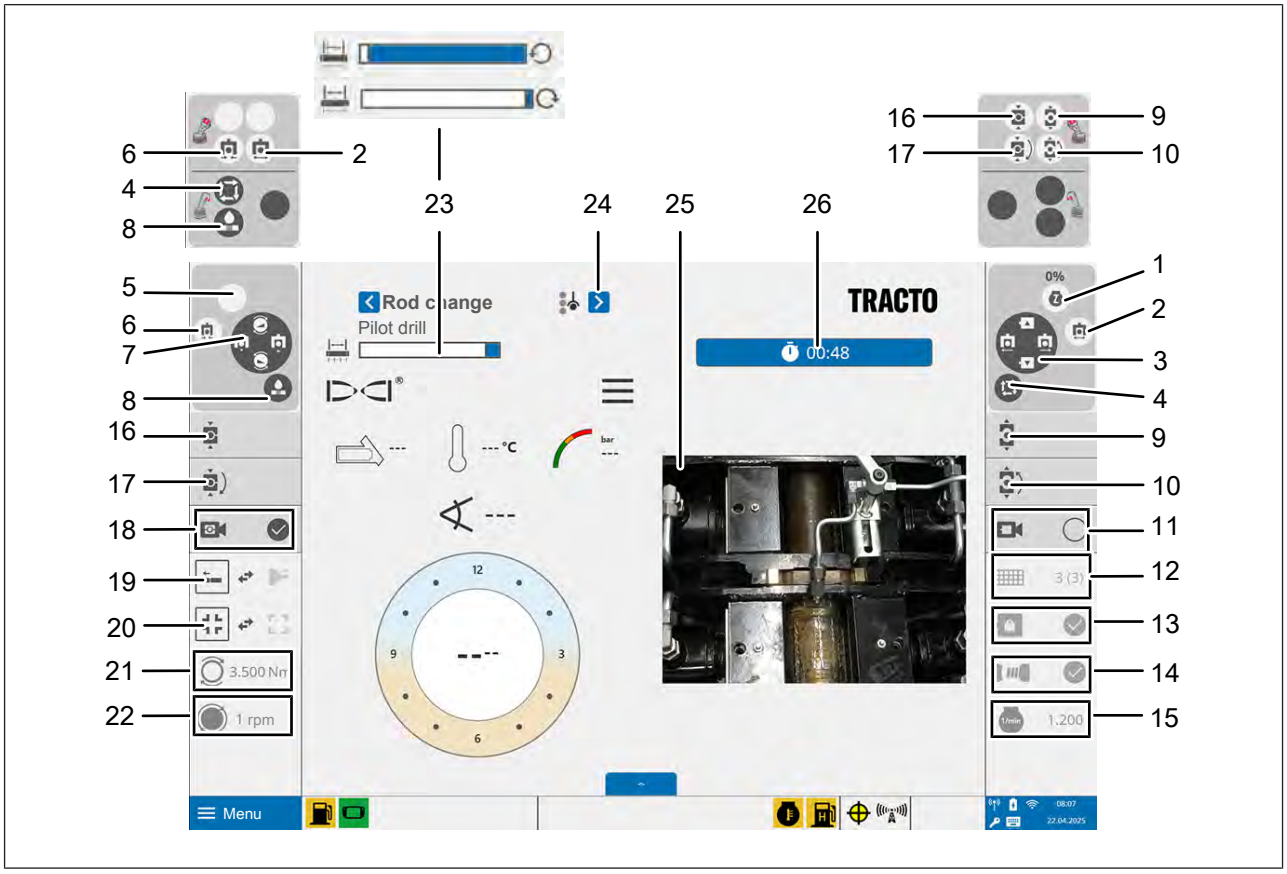
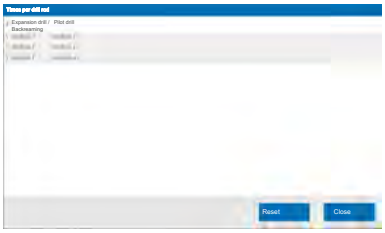


Fig. 6-50 "Rod change" screen

Tab. 6-30 Indicators and operating elements in the "Rod change" screen

Item	Operating element	Function
1	Right setting wheel	none
2	Outer push button on the right	opens the rod gripper
3	Right joystick	forward: advances the thrust rig back: reverses the thrust rig outwards: moves the gripper arm of the rod changing system toward the rod box inwards: moves the gripper arm of the rod changing system toward the bore axis
4	Front right push button	starts the automatic rod gripper
5	Left setting wheel	none
6	Outer push button on the left	closes the rod gripper
7	Left joystick	forward: starts clockwise rotation back: starts counter-clockwise rotation outwards: lowers the gripper arm of the rod changing system inwards: lifts the gripper arm of the rod changing system

Item	Operating element	Function
8	Front left push button	starts rod lubrication
9	Open clamping tongs	opens the clamping tongs
10	Open break-away clamp	opens the break-away clamp Prolonged pressing (3 s) retracts the pivoting cylinder.
11	Rear camera	transmits the camera image of the rear camera on the sub-saver of the rotation motor to the operating terminal Only one camera image can be shown at a time. If no camera has been selected, it is automatically switched on and off depending on the position of the thrust rig.
12	Rod bay selection	changes the rod bay selected Alter the value by means of the slider.
13	Length compensation lock	indicates the status of the hoop length compensation lock
14	Rear rod loosened	indicates whether the rear rod is screwed together or unscrewed
15	Engine speed	Indicates the rotational speed of the diesel engine.
16	Close clamping tongs	closes the clamping tongs
17	Close break-away clamp	closes the break-away clamp Prolonged pressing (3 s) triggers the pivoting mechanism. The rod connection is broken.
18	Front camera (optional)	transmits the camera image of the front camera on the clamping device to the operating terminal Only one camera image can be shown at a time. If no camera has been selected, it is automatically switched on and off depending on the position of the thrust rig.
19	Selecting Pilot drill or Expansion drill / Backreaming	switches between Pilot drill and Expansion drill / BackreamingIn pilot drill mode, a new rod is removed from the rod box and screwed on. In Expansion drill / Backreaming mode, the rod is disconnected and stored in the rod box.
20	DCI on/off	Displays or hides the DCI interface
21	Torque outer rod	Indicates the torque of the outer rod
22	Rotational speed inner rod (ACS only)	Indicates the value of the speed of the inner rod
23	Length compensation progress bar	Length compensation An icon for screwing and unscrewing is shown each for the first and last 10 % of the path (5 cm).
24	Changing the menu	switches between pilot bore/expansion drill/rod change
25	Camera image	Image of the selected camera (point 11 or 15) empty screen section if cameras are deselected

Item	Operating element	Function
26	Times per drill rod	opens a pop-up to indicate the times for pilot bore and expansion drill/backreaming per drill rod (the arrows next to the times indicate the reading direction)  (close the pop-up with "Close". Please note: the values in the table are not saved!)

6.2.4.14 "Expansion drill / Backreaming" screen

This screen is displayed if the bore mode is switched on and you tap the "Expansion drill / Backreaming" item in the main menu.

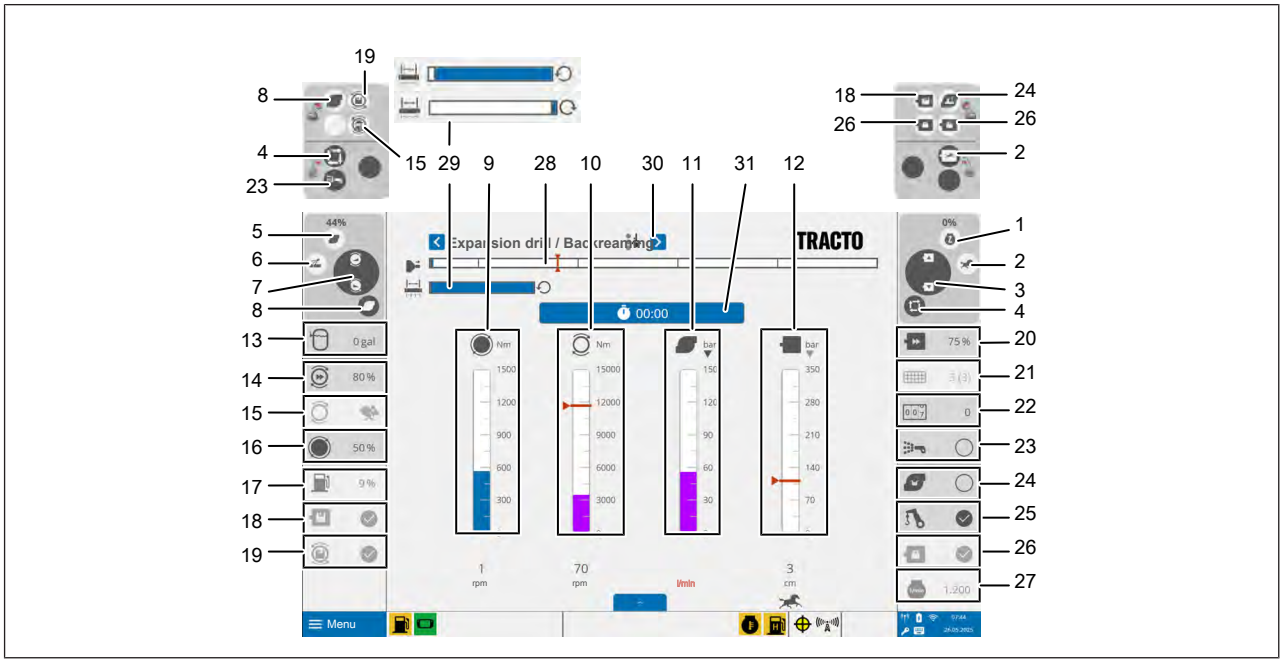
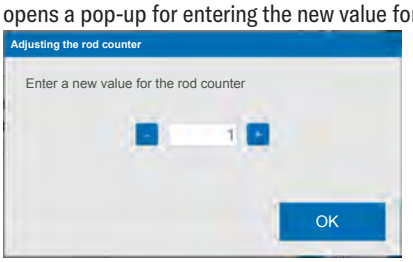
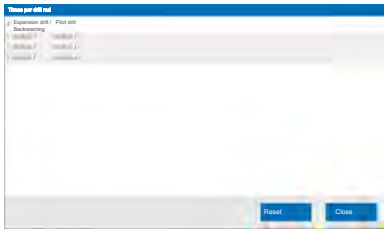


Fig. 6-51 "Expansion drill / Backreaming" screen

Tab. 6-31 Indicators and operating elements in the "Expansion drill / Backreaming" screen

Item	Indicator/operating element	Function
1	Right setting wheel	serves to set the engine speed or the retraction force The option "Set value by wheel on right joystick" must be previously activated in the "Settings->Bore parameters->Engine speed" menu, otherwise the value will be controlled automatically.
2	Outer push button on the right	starts rapid motion for the thrust rig available as soon as the retracted rod has been released from the bore axis – double-click: switch between slow (tortoise) and additional speed (rabbit) – press and hold: fast speed (horse) The status is displayed below the thrust scale.
3	Right joystick	forward: advances the thrust rig back: reverses the thrust rig
4	Front right push button	starts automatic pulling-in
5	Left setting wheel	serves to set the drilling fluid flow rate
6	Outer push button on the left	switches rod cleaning on or off
7	Left joystick	forward: starts clockwise rotation back: starts counter-clockwise rotation

Item	Indicator/operating element	Function
8	Front left push button	switches the drilling fluid pump on or off
9	Scale torque internal rotation	indicates the torque for inner rotation Below the scale, the outer rotation speed in rpm is shown.
10	Scale torque outer rotation	indicates the torque for outer rotation By shifting the red arrow, you alter the limit value. Below the scale, the outer rotation speed in rpm is shown.
11	Scale pressure drilling fluid pump	indicates the drilling fluid pressure By means of the black arrow you reduce the scale range to 25 %. By clicking again, the scale range is increased to 100 % again. Below the scale, the flow rate of the drilling fluid pump is shown. The value display flashes red if the flow rate is 0 l/min and at the same time the valve of the gate valve is opened.
12	Scale thrust force	indicates the thrust force By shifting the red arrow you alter the limit value. Below the scale, the position of the thrust rig is shown. The value display appears in green and bordered when the thrust rig reaches the front or rear break position.
13	Filling level mixing tank	indicates the filling level in the mixing tank in litres Use the slider to adjust the filling quantity of the mixing tank.
14	Rotation sensitivity	Serves to set the sensitivity of the joystick in the rotation process Alter the value using the slider.
15	Rotation level (tortoise/rabbit) for outer rotation	serves to switch over the rotation level between slow (tortoise) and fast (rabbit)
16	Internal rotation speed	serves to set the speed of the internal rotation Alter the value using the slider.
17	Diesel tank filling level	indicates the filling level of the diesel tank in percent
18	Memory function for the thrust	indicates the status of the memory function for the thrust system
19	Memory function for the rotation	indicates the status of the memory function for the rotation system
20	Thrust sensitivity	serves to adjust the sensitivity of the thrust Change the value by moving the slider.
21	Rod bay selection	serves to change the rod bay selected Alter the value using the slider.
22	Rod counter	opens a pop-up for entering the new value for the rod counter  Confirm the entry with "OK".

Item	Indicator/operating element	Function
23	Rod cleaner	switches the rod cleaner on or off
24	Mud pump	switches the mud pump on or off
25	Loading crane	activates or deactivates the loading crane
26	Length compensation lock	indicates the lock for the length compensation
27	Engine speed	Indicates the rotational speed of the diesel engine.
28	Thrust progress bar	Drag indicator for drilling and expansion
29	Length compensation progress bar	Length compensation An icon for screwing and unscrewing is shown each for the first and last 10 % of the path (5 cm).
30	Changing the menu	switches between pilot bore/expansion drill/rod change
31	Times per drill rod	opens a pop-up to indicate the times for pilot bore and expansion drill/backreaming per drill rod (the arrows next to the times indicate the reading direction)  (close the pop-up with "Close". Please note: the values in the table are not saved!)

6.2.4.15 "Bore data" screen

This screen is displayed if you tap the "Bore data" item in the main menu.

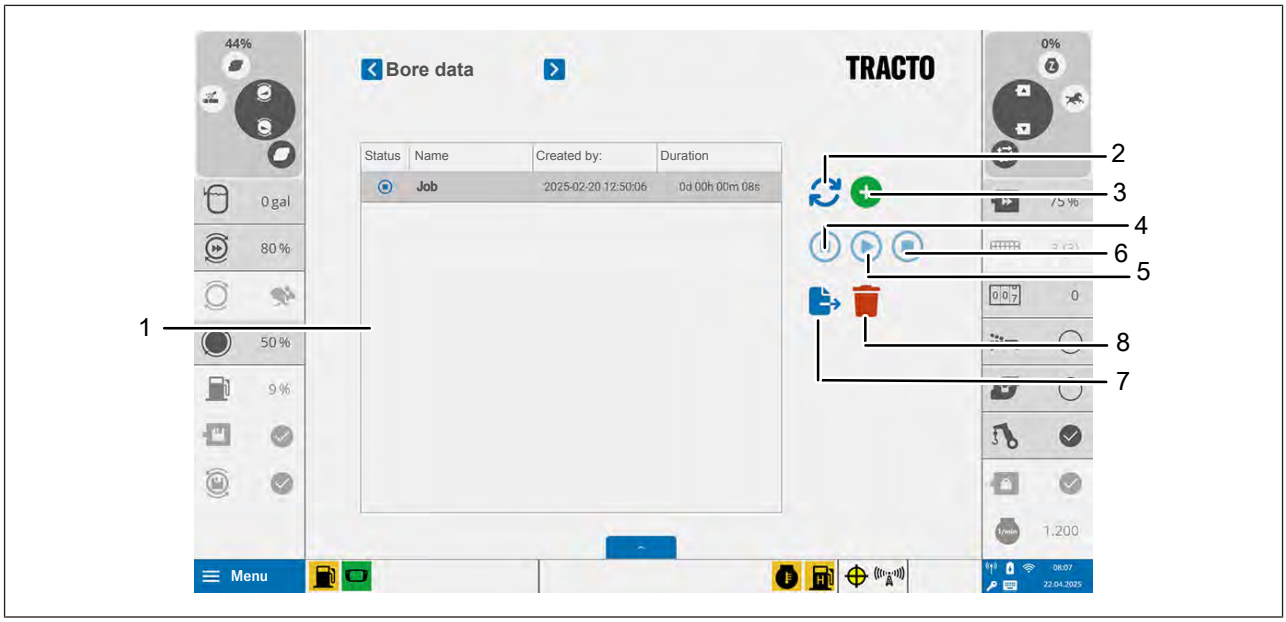


Fig. 6-52 "Bore data" screen

Tab. 6-32 Indicators and operating elements in the "Bore data" screen

Item	Indicator/ operating element	Function
1	Table	displays the recorded bore data: - the 10 most recent data records are displayed - the most recent data record is the first on the list - state, name, date and time as well as the duration of the recording are displayed
2	Refresh	refreshes the table
3	New	adds a new line to the table and immediately starts recording the bore data
4	Pause	pauses the recording
5	Start	restarts a paused recording
6	Stop	stops a recording ATTENTION! A stopped recording cannot be restarted.
7	Export	exports a recording selected from the table to a connected USB stick
8	Delete	deletes a recording selected from the table

Recording bore data

To record the bore data, press the "New" button (1).

- A new line is added and the recording started immediately.
- At "State", the "Play" icon (2) is displayed.
- You can pause or stop the recording.

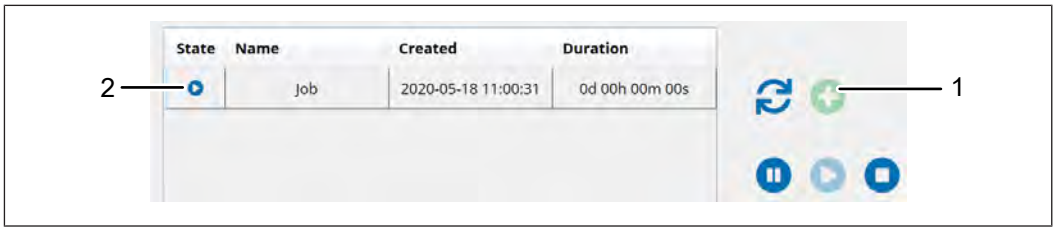


Fig. 6-53 Recording bore data

Pausing a recording

1. Click "Yes" to confirm that you want to stop recording.

To pause the recording, press the "Pause" button (1).

- At "State", the "Pause" icon (2) is displayed.
- You can restart or stop the recording.

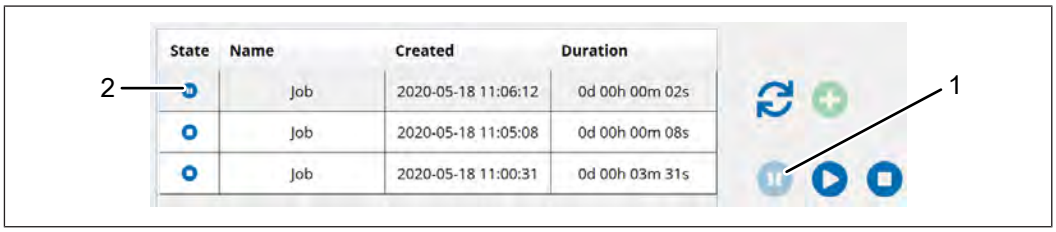


Fig. 6-54 Pausing a bore data recording

Stopping a recording

Info!

Please note that a stopped recording cannot be restarted!

1. To stop the recording, press the "Stop" button (1).

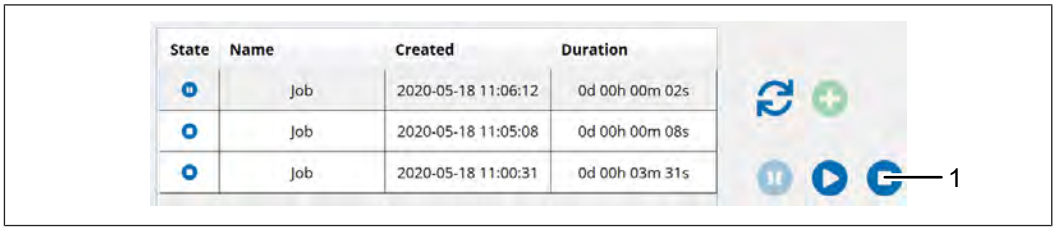


Fig. 6-55 Bore data recording stopped

⇨ A pop-up with a query appears:

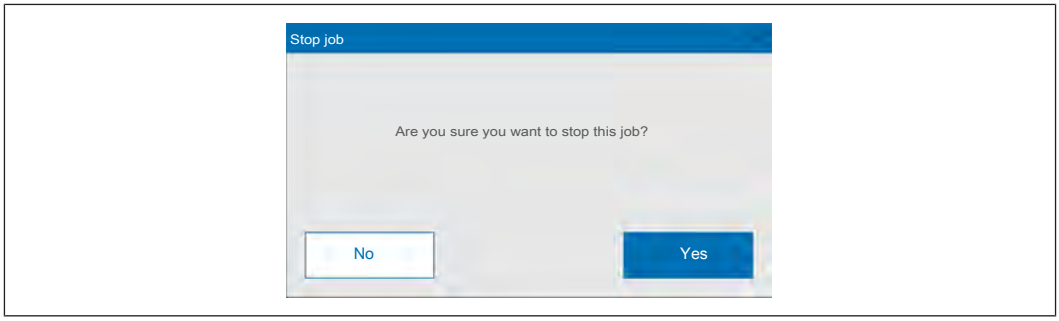


Fig. 6-56 Stop job pop-up

2. Click "Yes" to confirm that you want to stop recording.

– At "State", the "Stop" icon (1) is displayed.
– You can export or delete the stopped recording.

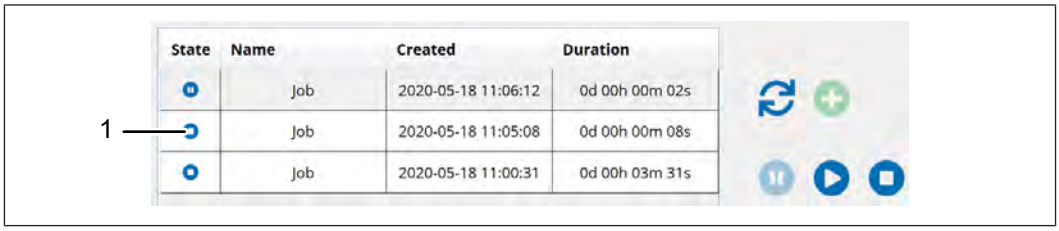


Fig. 6-57 Bore data recording stopped

Exporting a recording

As soon as a recording has been stopped, you can select and export or delete it.

Info!
The bore data are exported to a USB stick in the USB socket (1) of the E-box.



Fig. 6-58 USB socket

1. Tap the recording in the table which you want to edit.
   ⇨ The line is highlighted in grey.
2. Tap the "Export" button to save the recording to the USB stick in the E-box.
   ⇨ A successful export is indicated by means of a pop-up.

3. Tap "OK" to close the pop-up.

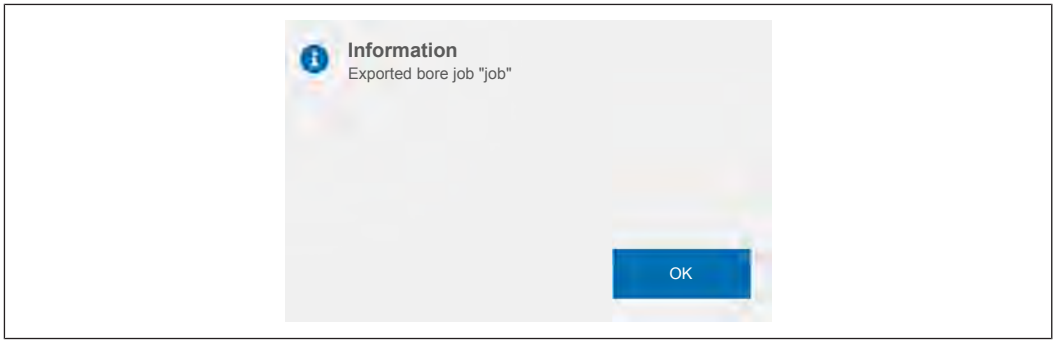


Fig. 6-59 Bore data export pop-up window

Deleting bore data

1. Tap the recording in the table which you want to edit.
   ⇨ The line is highlighted in grey.
2. Tap the "Delete" button to delete the recording.
3. In the following pop-up, confirm the deletion with "Yes".

6.2.4.16 "Service – Setup/Configure" menu structure

"Setup/ configuration"

The "Setup/configuration" menu is partly only accessible to service personnel. There are three different authorisation levels with different options, some of which require a PIN. Tap the lock icon (1) to enter the PIN.

- Free: no PIN required, accessible for customers
- Service: service PIN required to have basic settings performed by service staff
- Admin: admin PIN required for setting options and displaying the data point monitor

In the "Setup/configuration" menu, you can set parameters for the operating hours/ rotation and configure the sensors. Tap the icon for the operating hours/rotation (2) or the sensor configuration (3) to open the respective menu.

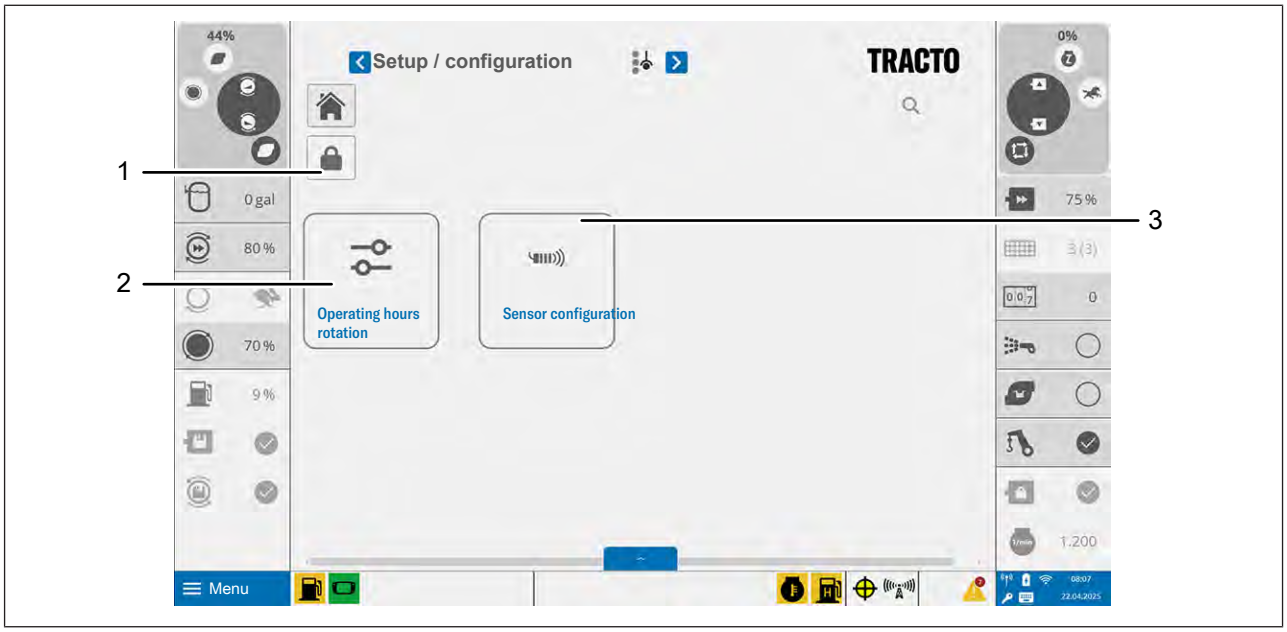


Fig. 6-60 "Service" submenu – "Setup/configuration" – Main menu

Operating hours Rotation (Rotation Timer)

In the "Operating hours rotation" submenu, you can view parameters for the operating hours of the drill head.

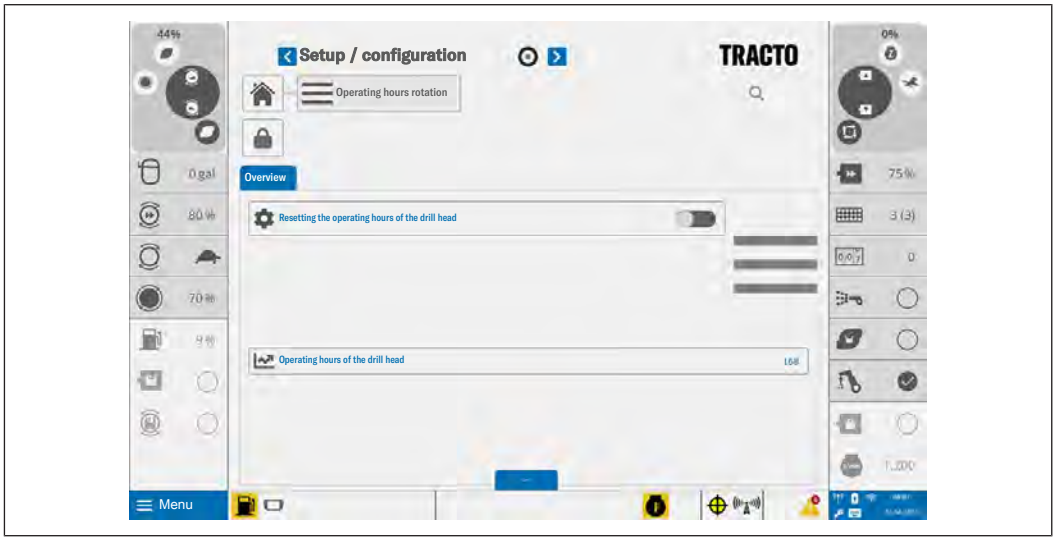


Fig. 6-61 "Service" submenu – "Setup/configuration" – Operating hours rotation

Tab. 6-33 "Service" submenu – "Setup/configuration" – Operating hours rotation

Menu item	Subitem 1	Function
Overview	Resetting the operating hours of the drill head	Activate on the switch to reset the counter for the operating hours drill head to zero.
	Operating hours of the drill head	indicates the operating hours of the drill head since the last reset

Sensor configuration

In the "Sensor configuration" submenu, you can view and set parameters for the thrust (1), the rod crane (2), the parking position (3), the cab (5) and the bonnet (4). Tap the respective icon to open a submenu.

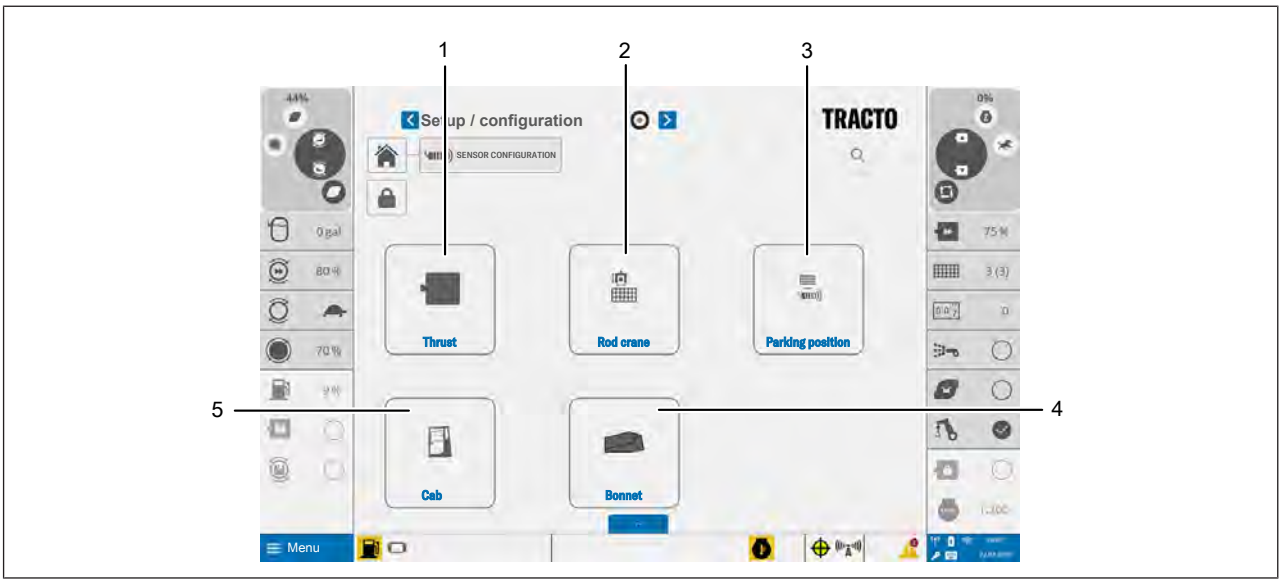


Fig. 6-62 "Service" submenu – "Setup/configuration" – Sensor configuration

Sensor configuration – Cab

In the "Cab" submenu, you can set parameters for the cab and view the positions in the "Overview" menu item. You can view further information about the cab in the "Data" menu item.

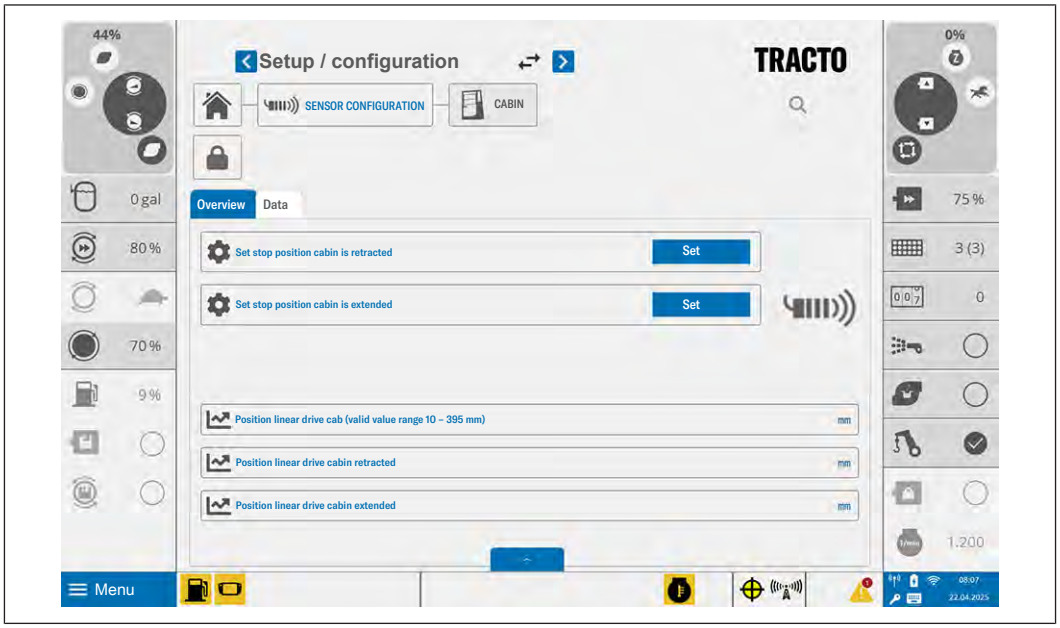


Fig. 6-63 "Service" submenu – "Setup/configuration" – Sensor configuration – Cab – Overview

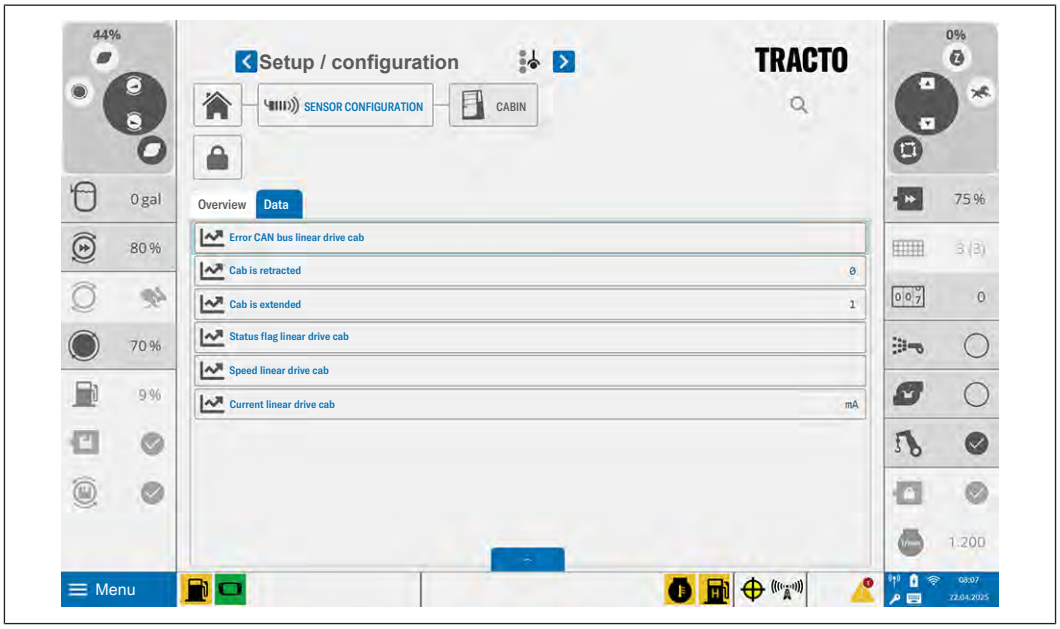


Fig. 6-64 "Service" submenu – "Setup/configuration" – Sensor configuration – Cab – Data

Tab. 6-34 "Service" submenu – "Setup/configuration" – Sensor configuration

Menu item	Subitem 1	Function
Overview	Set stop position cabin is retracted	Tap "Set" and enter the value for the position at which the retracted cab should stop.
	Set stop position cabin is extended	Tap "Set" and enter the value for the position at which the extended cab should stop.
Data	Error CAN bus linear drive cab	indicates whether there is a communication fault with the linear drive (0 = no, 1 = yes)
	Cab is retracted	indicates whether the cab is retracted (0 = no, 1 = yes)
	Cab is extended	indicates whether the cab is extended (0 = no, 1 = yes)
	Status flag linear drive cab	indicates the status of the flag in linear cab drive
	Speed linear drive cab	indicates the speed of the linear cab drive
	Current linear drive cab	indicates the previous power consumption of the linear cab drive

Sensor configuration – Bonnet

In the "Bonnet" submenu, you can set parameters for the bonnet and view the positions in the "Overview" menu item. You can view further information about the bonnet in the "Data" menu item.

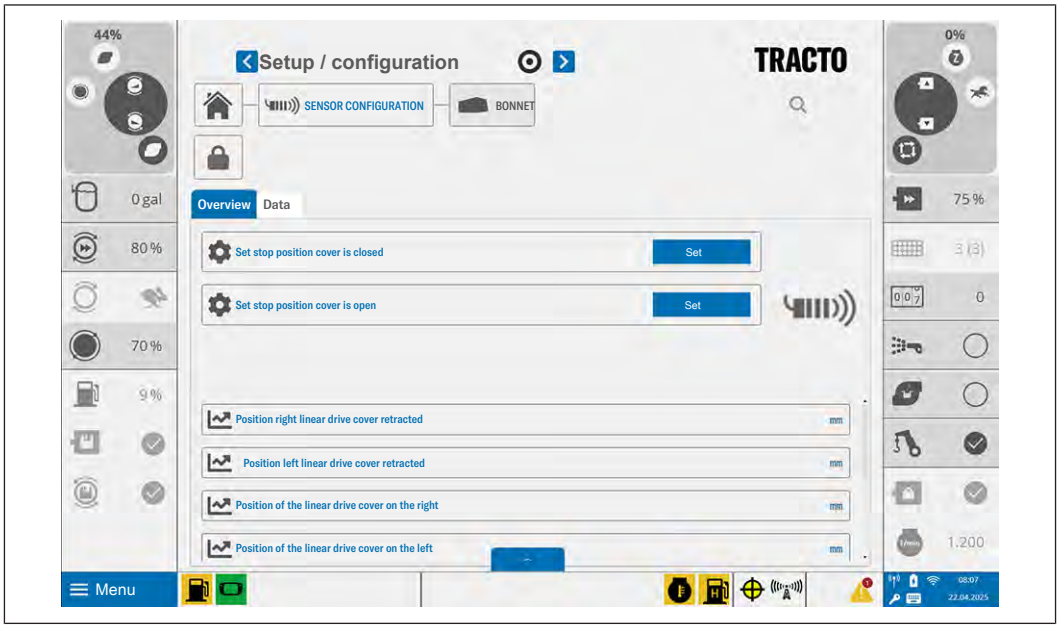


Fig. 6-65 "Service" submenu – "Setup/configuration" – Sensor configuration – Bonnet – Overview

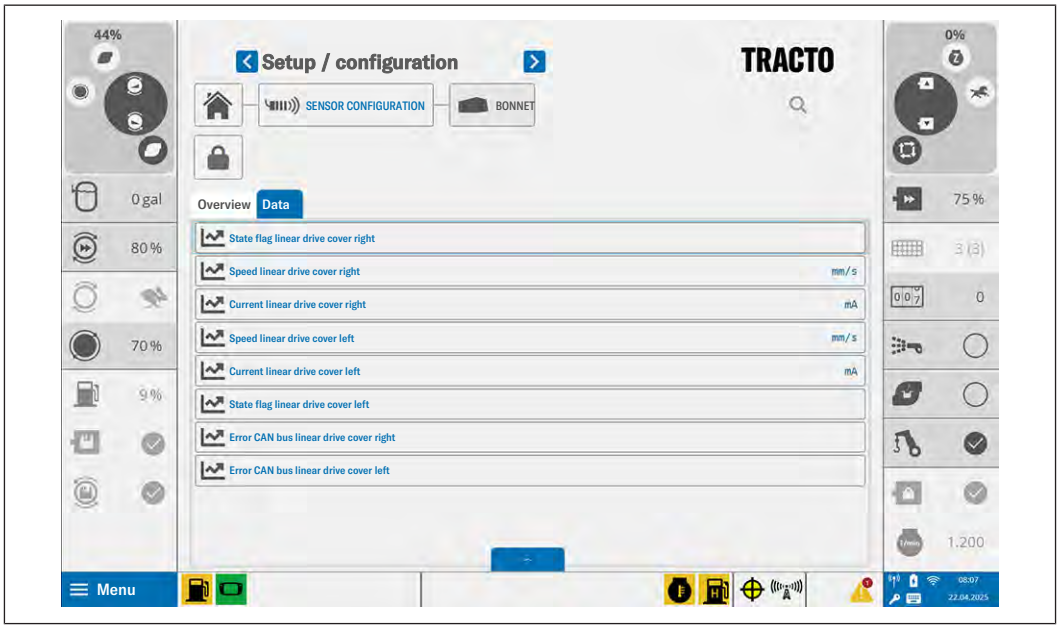


Fig. 6-66 "Service" submenu – "Setup/configuration" – Sensor configuration – Bonnet – Data

Tab. 6-35 "Service" submenu – "Setup/configuration" – Sensor configuration – Bonnet

Menu item	Subitem 1	Function
Overview	Set stop position cover is closed	Tap "Set" and enter the value for the position at which the closed bonnet should stop.
	Set stop position cover is open	Tap "Set" and enter the value for the position at which the open bonnet should stop.
Data	State flag linear drive cover right	indicates the status of the right linear drive of the bonnet
	Speed linear drive cover right	indicates the speed of the right linear drive of the bonnet
	Current linear drive cover right	indicates the previous power consumption of the right linear drive of the bonnet
	Speed linear drive cover left	indicates the speed of the left linear drive of the bonnet
	Current linear drive cover left	indicates the previous power consumption of the left linear drive of the bonnet
	State flag linear drive cover left	indicates the status of the left linear drive of the bonnet
	Error CAN bus linear drive cover right	indicates whether there is a communication fault with the right linear drive (0 = no, 1 = yes)
	Error CAN bus linear drive cover left	indicates whether there is a communication fault with the left linear drive (0 = no, 1 = yes)

Sensor configuration – Rod crane

In the "Rod crane" submenu, you can set parameters for the rod crane and view the positions in the "Overview" menu item.

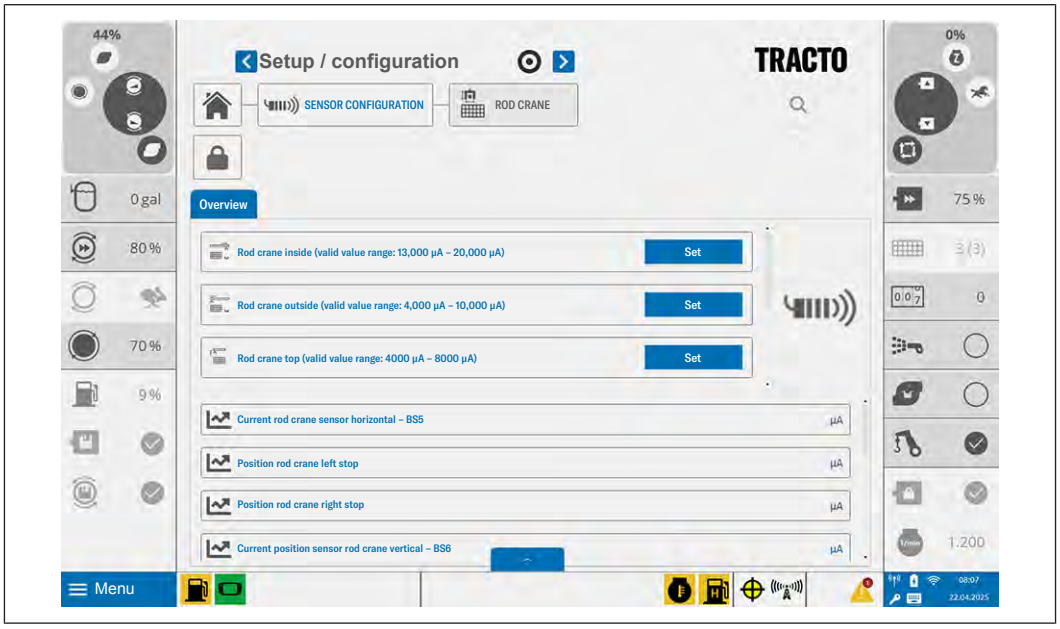


Fig. 6-67 "Service" submenu – "Setup/configuration" – Sensor configuration – Rod crane – Overview

Tab. 6-36 "Service" submenu – "Setup/configuration" – Sensor configuration – Rod crane

Menu item	Subitem 1	Function
Overview	Rod crane inside (valid value range: 13,000 µA – 20,000 µA)	Tap "Set" and enter the value for the rod crane inside (values in the range 13,000-20,000 µA are permitted).
	Rod crane outside (valid value range: 4,000 µA – 10,000 µA)	Tap "Set" and enter the value for the rod crane outside (values in the range 4,000-10,000 µA are permitted).
	Rod crane top (valid value range: 4000 µA – 8000 µA)	Tap "Set" and enter the value for the rod crane at the top (values in the range 4,000-8,000 µA are permitted).
	Rod crane at the bottom of the bay (valid value range: 12,000 µA-20,000 µA)	Tap "Set" and enter the value for the rod crane at the bottom of the bay.
	Rod crane in the topmost bay position	Tap "Set" and enter the value for the rod crane in the topmost bay position.
	Rod crane in bore axis	Tap "Set" and enter the value for the rod crane in the bore axis

Sensor configuration – Parking position

In the "Parking position" submenu, you can set parameters for the parking position of the rod crane and view the positions in the "Overview" menu item. You can view further information about the parking position in the "Data" menu item.

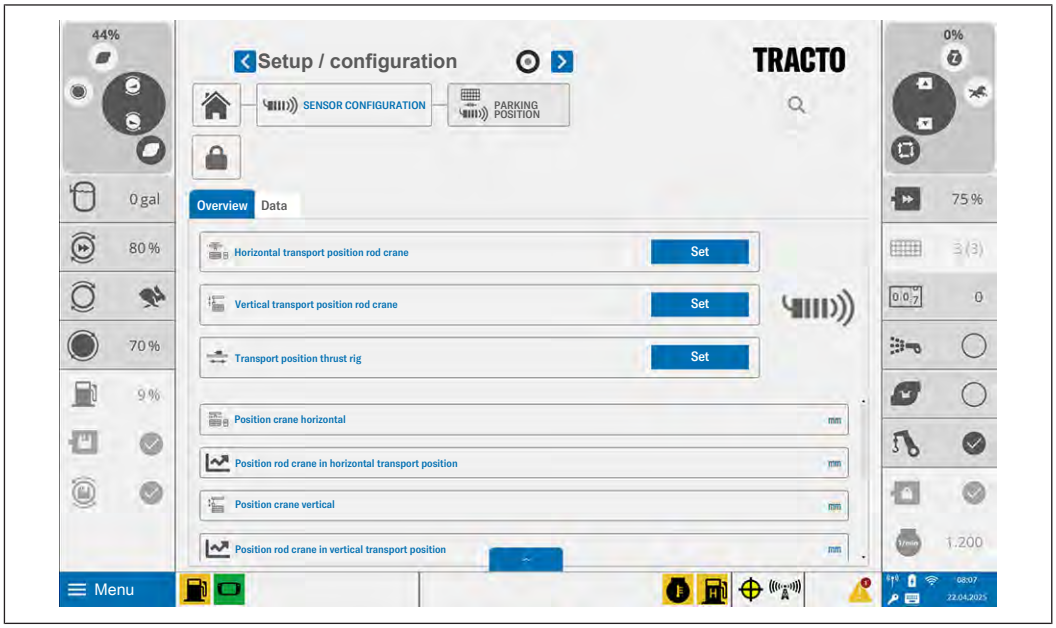


Fig. 6-68 "Service" submenu – "Setup/configuration" – Sensor configuration – Parking position – Overview

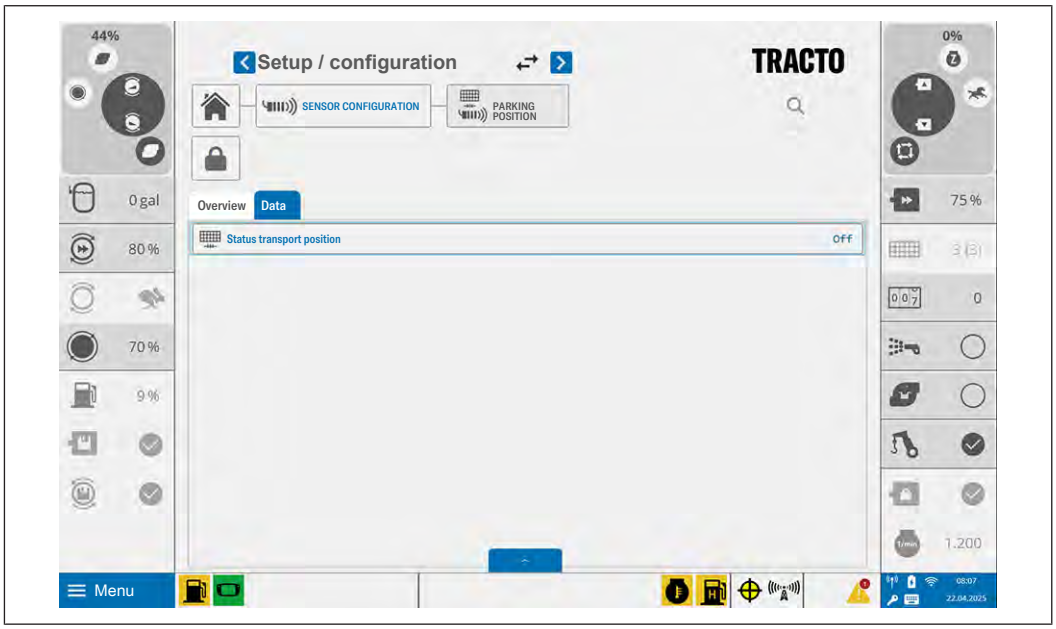


Fig. 6-69 "Service" submenu – "Setup/configuration" – Sensor configuration – Parking position – Data

Tab. 6-37 "Service" submenu – "Setup/configuration" – Sensor configuration – Parking position

Menu item	Subitem 1	Function
Overview	Horizontal transport position rod crane	Tap "Set" and enter the value for the horizontal position the rod crane should take up for transport.
	Vertical transport position rod crane	Tap "Set" and enter the value for the vertical position the rod crane should take up for transport.
	Transport position thrust rig	Tap "Set" and enter the value for the position the thrust rig should take up for transport.
Data	Status transport position	indicates whether the settings for the transport position are active (on) or inactive (off)

Sensor configuration – Thrust

In the "Thrust" submenu, you can set parameters for the thrust and view the positions in the "Overview" menu item.

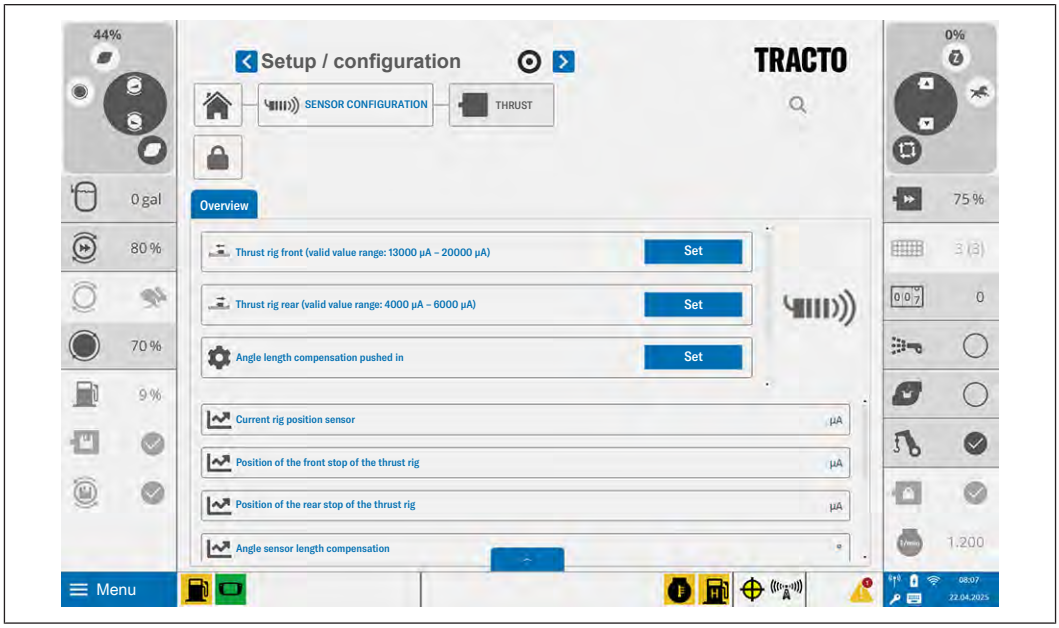


Fig. 6-70 "Service" submenu – "Setup/configuration" – Sensor configuration – Thrust – Overview

Tab. 6-38 "Service" submenu – "Setup/configuration" – Sensor configuration – Thrust

Menu item	Subitem 1	Function
Overview	Thrust rig front (valid value range: 13000 µA – 20000 µA)	Tap "Set" and enter the value for the front thrust rig (values in the range 13,000-20,000 µA are permitted).
	Thrust rig rear (valid value range: 4000 µA – 6000 µA)	Tap "Set" and enter the value for the rear thrust rig rear (values in the range 4,000-6,000 µA are permitted).
	Angle length compensation pushed in	Tap "Set" and enter the angle for the rear length compensation to push the rig against the stop.
	Set angle length compensation front (pull rig against the stop)	Tap "Set" and enter the angle for the front length compensation to pull the rig against the stop.

6.2.5 Wireless pit remote control

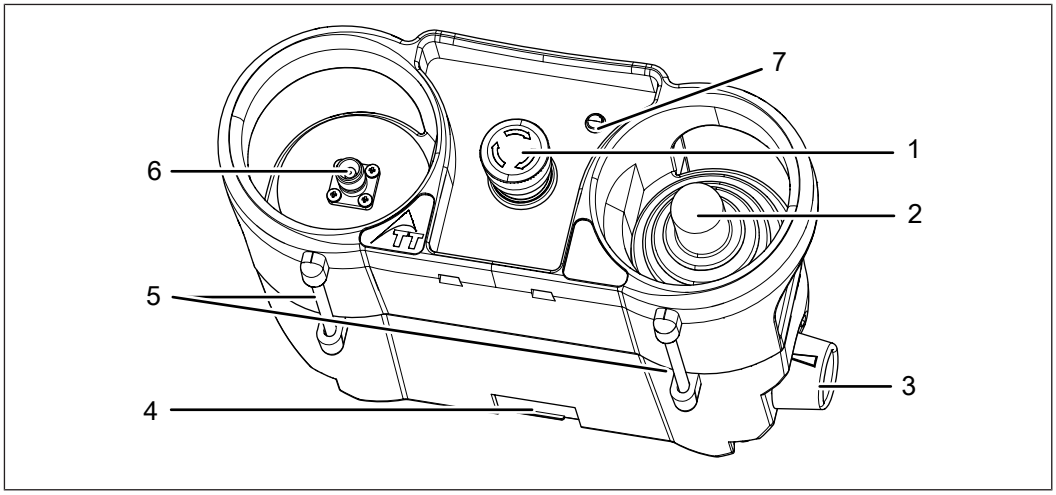


Fig. 6-71 Wireless pit remote control

Tab. 6-39 Operating elements on the wireless pit remote control

Item	Operating element	Function
1	Emergency stop button	switches off the machine and the wireless remote control in an emergency The emergency stop button is illuminated in red when it is activated.
2	Joystick	serves to control the thrust and rotation: ←: rotation to the left: starts and stops counter-clockwise rotation at reduced speed →: rotation to the right: starts and stops clockwise rotation at reduced speed ↑: thrust forward: advances the thrust at reduced speed ↓: thrust back: reverses the thrust at reduced speed
3	"Start" key switch	serves to switch the wireless remote control (and the machine) on/off Switch-on: Turn the key 90° clockwise and wait until the buzzer sounds twice. Continue turning to the stop until the emergency stop button is illuminated in red. Release the key switch. Switch-off: Turn the key counter-clockwise to the left up to the stop.
4	Battery of the receiver and transmitter module	serves as power supply for the wireless pit remote control
5	Holder for carry strap	serves to attach the carry strap **Always** use the carry strap!
6	Antenna connection	serves to improve the connection between the wireless pit remote control and the machine
7	Status LED	lights up when there is a connection to the receiver

6.2.6 Operator seat

A comfortable seat is mounted inside the cab.

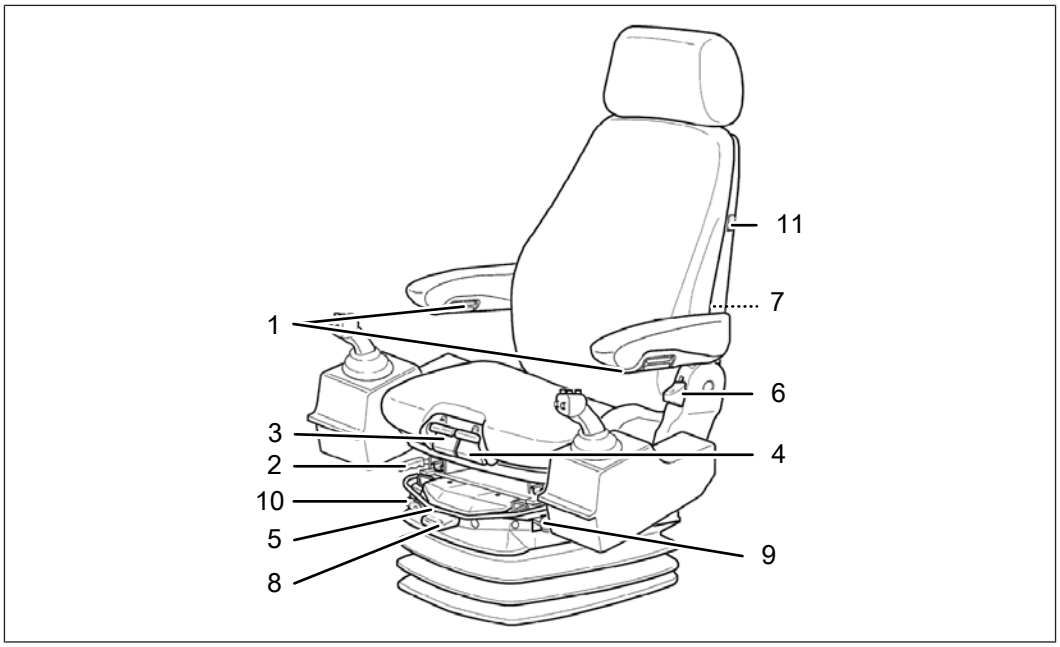


Fig. 6-72 Operator seat (comfortable seat)

Tab. 6-40 Operating elements at the operator seat

Item	Operating element	Function
1	Armrest adjustment	adjusts the inclination of the armrests.
2	Seat adjustment forward / backward	adjusts the seating surface and backrest in relation to the joysticks.
3	Seating surface adjustment forward / backward	adjusts the seating surface forward / backward.
4	Seat inclination adjustment	adjusts the inclination of the seat.
5	Seat adjustment forward / backward	adjusts the seat incl. joysticks forward / backward.
6	Backrest adjustment	adjusts the inclination of the backrest.
7	Lumbar support adjustment	adjusts the lumbar support.
8	Adjustment of weight-dependent seat suspension and seat height	adjusts the seat suspension or the seat height (pneumatically).
9	Horizontal suspension	switches the horizontal suspension on or off.
10	Shock absorption adjustment	adjusts the shock absorption in 3 levels
11	Seat heating	switches the seat heating on or off.

Info!
To easily enter or exit the cab, the left armrest and the left joystick panel can be folded up. The joystick panel can only be folded up if the armrest of the seat had been folded up first.

6.2.7 Further elements in the cab

The following elements are installed in and on the cab:

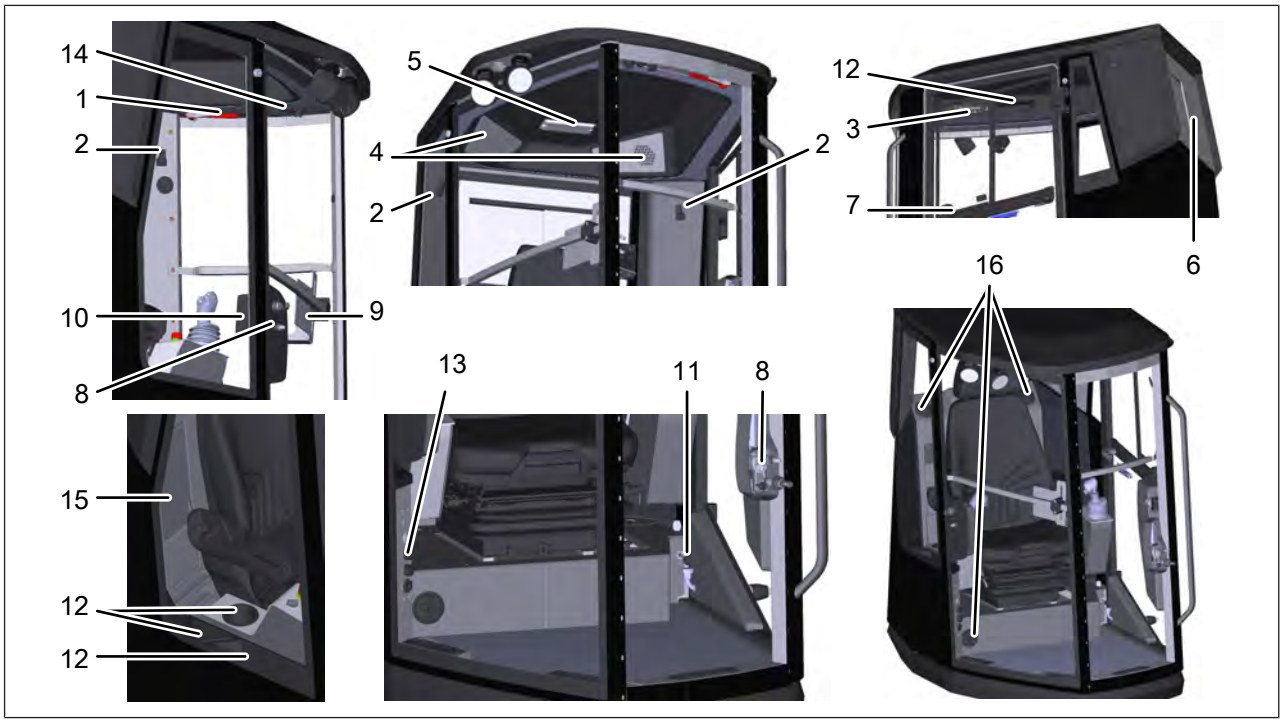


Fig. 6-73 Elements in and on the cab

Tab. 6-41 Elements in and on the cab

Item	Element	Function
1	Emergency hammer	for breaking the front window in an emergency in order to exit the cab
2	Clothes hook	for hanging up clothes
3	Radio	information and entertainment
4	Speaker	radio signal output
5	Interior lighting	serves to light the cab Is switched on/off via the operating terminal.
6	Rear slide window	can be opened for the purpose of ventilation
7	Slide window in the door	can be opened for the purpose of ventilation
8	Windscreen wiper	serves to clean the window Is operated via the operating terminal.
9	Monitor fixture	serves to attach an additional monitor
10	Swivel arm with holder for the operating terminal	serves to fasten the operating terminal when operating the machine in the cab
11	Door lock	for unlocking the opened cab door Pull the ball handle to unlock the opened cab door.

Item	Element	Function
12	Storage compartments or operating element for auxiliary heating system (optional)	for storing loose parts for operating the optional auxiliary heating system
13	Connection panel on the right	electrical interfaces
14	Connections at the top right	electrical interfaces
15	Air-conditioned beverage compartment	for storing a beverage bottle
16	Ventilation flaps	serve to regulate the air flow of the heating/air conditioning system

Auxiliary heating system (option)

The cab can optionally be equipped with an auxiliary heating system. In this case, the operating element is located above the right-hand window. For detailed information on the auxiliary heating system, please refer to the manufacturer's operating manual provided.



Fig. 6-74 Auxiliary heating system operating panel (option)

Tab. 6-42 Auxiliary heating system operating element

Item	Connection	Meaning/function
1	Display	The display shows the following parameters: – Operating status – Inside temperature – Operating mode – Timer slots – Settings – Error codes
2	Control knob	used for operating, selecting and programming all functions and values: – rotate: select/increase/decrease values, – press briefly: confirm value/selection, activate display, show operating time – press for 2 s: start/stop heating
3	LED ring	serves as a status indicator of the operating mode: – red ring: heating operation – blue ring: fan operation – orange ring: residual heat operation – white ring: system configuration – red ring flashing: error
4	>>Back<< button	serves to cancel the current setting or return to the higher-level menu

Starting the auxiliary heating system

Please proceed as follows to switch on the auxiliary heating system and start the heater:

1. Press the control knob or the >>Back<< button.
   - ⇨ The start screen appears on the display.
   - ⇨ The heating icon (1) flashes.
   - ⇨ The current room temperature is displayed (2).
2. Press the control knob for approx. 2 seconds to start heating operation with the last used operating time.



Fig. 6-75 Starting the auxiliary heating system

Air-conditioned beverage compartment

The air current of the heating system/air conditioner passes through the beverage compartment behind the seat. Adjust the temperature using the ventilation flap.

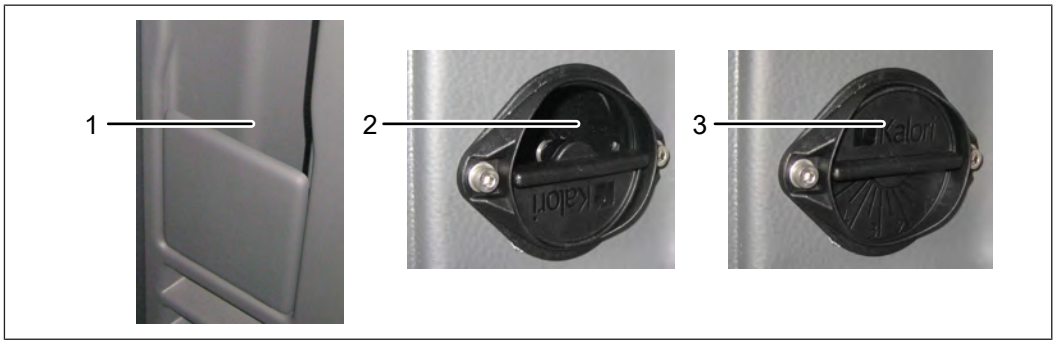


Fig. 6-76 Air-conditioned beverage compartment behind the seat

1	Beverage storage compartment for storing a beverage bottle	3	Ventilation flap closed
2	Ventilation flap open		

Connection panel on the right

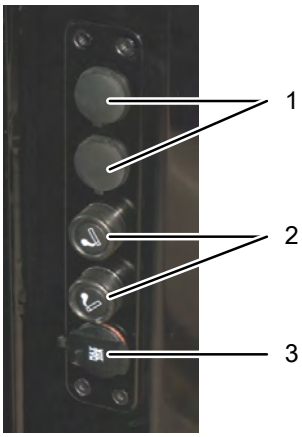


Fig. 6-77 Connection panel on the right

Tab. 6-43 Connection panel on the right

Item	Connection	Meaning/function
1	USB charging socket	Serves to load accessories via USB and the data transmission to an USB stick
2	Cigarette lighter	Serves as 24 V voltage supply (European plug system)
3	24 V connection	Serves as 24 V voltage supply (American plug system)

Info!
The USB connections supply a max. power input of 7.5 W (5 V DC with 1.5 A) in each case. The total current of the five sockets at the connection console on the right is 15 A with 24 V DC.

Connections at the top right

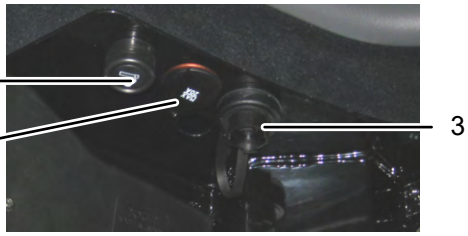


Fig. 6-78 Connections at the top right

Tab. 6-44 Connections at the top right

Item	Connection	Meaning/function
1	Cigarette lighter	Serves as 24 V voltage supply (European plug system)
2	24 V connection	Serves as 24 V voltage supply (American plug system)
3	Connection wire-controlled measuring system	To connect the wire-controlled measuring system

Info!
The total current of the three sockets at the top right is 15 A with 24 V DC.

6.2.8 Operating elements for the rod magazine

The following operating elements are located at the front right of the rod magazine:

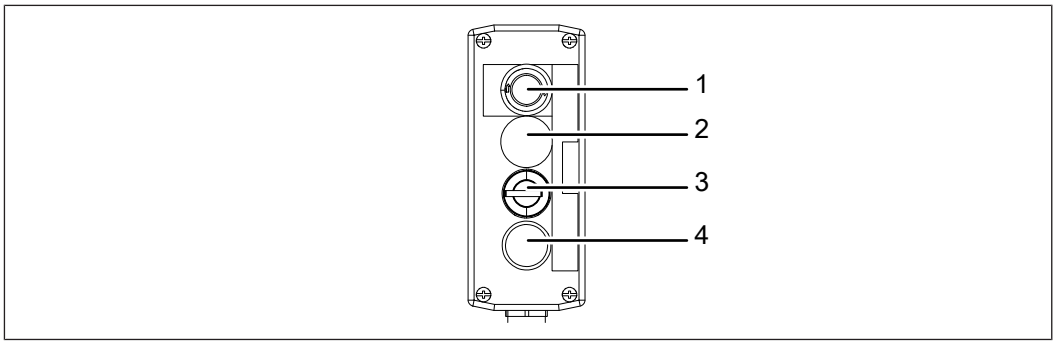


Fig. 6-79 Operating elements on the rod magazine

Tab. 6-45 Operating elements on the rod magazine

Item	Operating element	Function
1	Emergency stop button	Switches the machine off in an emergency
2	Black push button	Serves to start loading or unloading of a rod (chapter 6.7, page 228)
3	Key switch	left: clearance for the insertion of rods centre position: no selection, no clearance right: clearance for taking out rods
4	-	Blind plug

6.2.9 Electrical control cabinet

The following indicators and operating elements as well as connections are located on the electrical control cabinet:

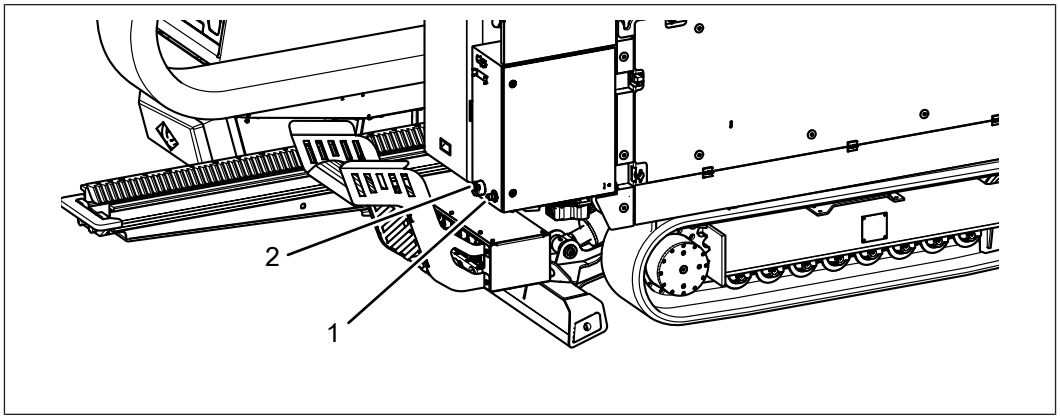


Fig. 6-80 Electrical control cabinet

Tab. 6-46 Operating elements, connections and indicators on the electrical control cabinet

Item	Operating element/indicator, connection	Function
1	Emergency stop button	switches the machine off in an emergency
2	Socket, 13-pin	Connection for external mixing system

6.2.10 Footstep

To fold out the footstep, please proceed as follows:

1. Unlock the spring latch (1).
2. Swivel the footsteps outwards by 90°.
   ⇨ The spring latch automatically engages in the 2nd position (2).
3. Fold the upper step upwards.
   ⇨ The spring latch (3) automatically engages in the retainer (4).

To fold in the footstep, please proceed as follows:

1. Unlock the spring latch (3).
2. Fold the upper step downwards.
3. Unlock the spring latch (1).
4. Swivel the footsteps inwards by 90°.
   ⇨ The spring latch automatically engages in the 1st position.

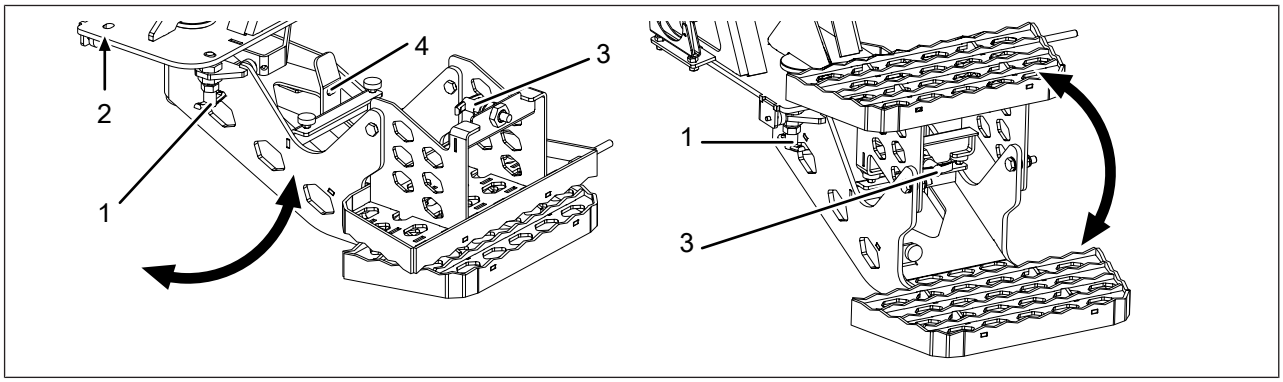


Fig. 6-81 Folding the footstep out and in

6.2.11 Emergency operation system with emergency hydraulic system and emergency mode

The emergency operation system consists of:

– emergency hydraulic system
– electrical emergency mode

Inside the switch cabinet there is a switch for activating the electrical emergency mode. This switch can be used for completing the drilling operation in case of a sensor system failure.

6.2.11.1 Emergency hydraulic system

NOTICE

Machine damage caused by collision of unmonitored movable parts!

If the bore rig is operated via the emergency hydraulic system, all functions can be carried out manually directly on the valves, even functions that could cause a damage! The individual functions are not monitored by the control unit. No locks are activated.

- Only trained service personnel may operate the emergency hydraulic system.
- Please contact the TRACTO-TECHNIK customer service before switching on and using the emergency hydraulic system.

⇨ TRACTO-TECHNIK does not assume liability for damage resulting from improper operation.

NOTICE

Regeneration of exhaust gas after-treatment inoperative at a standstill!

Due to the missing regeneration of the exhaust gas after-treatment at a standstill, the engine may be damaged.

- Make sure that the potentiometer used for emergency operation for the engine speed is at the left stop during normal operation. Otherwise, regeneration of the exhaust gas after-treatment cannot be activated during standstill.

Only trained service personnel may operate the emergency hydraulic system. Herein, this procedure is not described into further detail.

6.2.11.2 Emergency mode

Operating the emergency mode

The emergency mode allows the bore rig to be traversed and the bore to be completed in case of a sensor system failure.

NOTICE

Regeneration of exhaust gas after-treatment inoperative at a standstill!

Due to the missing regeneration of the exhaust gas after-treatment at a standstill, the engine may be damaged.

- Make sure that the potentiometer used for emergency operation for the engine speed is at the left stop during normal operation. Otherwise, regeneration of the exhaust gas after-treatment cannot be activated during standstill.

NOTICE

Machine damage caused by collision of unmonitored movable parts!

When the bore rig is operated in electrical emergency mode, all electrically controlled functions can be executed. However, the individual functions will not be monitored by the control unit. No locks are activated.
If the sensor system is switched off, incorrect handling may lead to damages to the machine.

- Please contact the TRACTO-TECHNIK customer service before switching off the sensor system.

⇨ The operator is responsible for any damage due to improper handling.

Enabling the emergency mode

To activate the emergency mode, please proceed as follows:

1. Set the desired engine speed at the potentiometer behind the tailgate.
   The potentiometer is only functional when the engine control is disturbed.
2. Open the "Settings -> Bore parameters" menu.
3. Actuate the "Emergency mode" toggle switch (1).

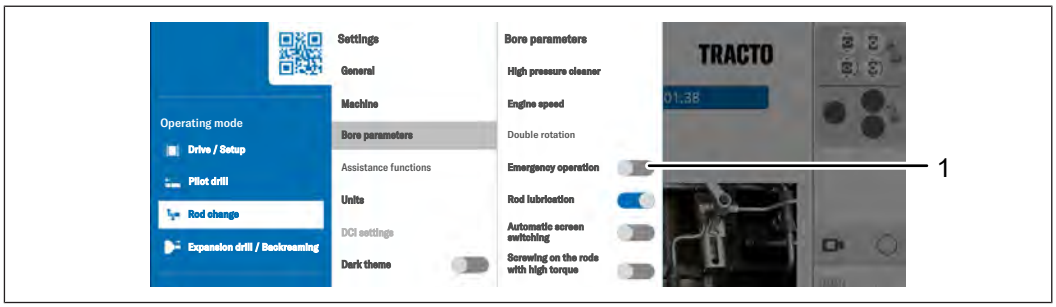


Fig. 6-82 Switching on the emergency mode on the operating terminal

⇨ The screen of the operating terminal is displayed with a red frame. The "Emergency operation" symbol ( ) appears in the status line.



Fig. 6-83 Emergency mode enabled on the operating terminal

Info!
Should the monitor of the operating terminal not work, you can enable the joysticks and buttons on the operating terminal and in the cab at the operating terminal for the emergency mode inside the electrical control cabinet to execute different functions.

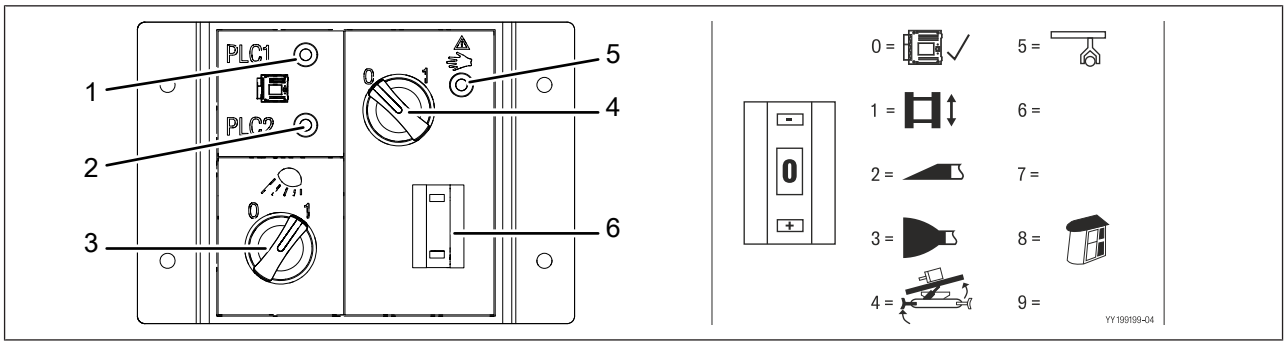


Fig. 6-84 Operating panel for the emergency mode inside the electrical control cabinet

Tab. 6-47 Operating panel for the emergency mode inside the electrical control cabinet

Item	Operating element/indicator	Meaning/function
1	"PLC1" LED (green)	flashes when the control unit is switched on – in every operating status
2	"PLC2" LED (green)	flashes when the control unit is switched on; glows in the event of a control unit error
3	"Control cabinet lighting" rotary switch	0: Control cabinet lighting off 1: control cabinet lighting on With its magnetic stand, the light can be flexibly positioned and pointed.

Item	Operating element/indicator	Meaning/function
4	"Emergency mode" rotary switch	0: emergency mode switched off 1: emergency mode switched on
5	"Emergency mode" LED (red)	lights up when the emergency mode is switched on
6	"Operating mode" selector switch	Select the operating mode for the emergency mode with the +/- buttons. Depending on the position of the "Emergency mode" rotary switch and the selected emergency operating mode, the machine functions assigned to the two joysticks change (see below). Execute the functions using the joysticks on the operator seat.

Switch combinations

If you have activated emergency mode using the rotary switch, set the "Drive mode/ bore mode" rotary switch on the left joystick panel to the corresponding operating mode and select the desired emergency mode using the selector switch. Depending on the selected emergency mode, the machine functions assigned to the two joysticks change.
The following combinations of "Emergency mode" rotary switch and "Operating mode" selector switch are possible:

Tab. 6-48 Combinations rotary switch emergency mode — operating mode

"Emergency mode" rotary switch	"Operating mode" selector switch	Operating mode	Operating mode
0	0	Normal operation	
1	0	Electrical emergency mode (sensors are bypassed; joystick assignment as shown in the screen menu)	
1	1	Drive	drive mode
1	2	Pilot drill	drilling operation / bore mode
1	3	Expansion drill / Backreaming	drilling operation / bore mode
1	4	Setup	drive mode
1	5	Rod change	drilling operation / bore mode
1	6	None (no machine function operation)	drive mode
1	7	None (no machine function operation)	
1	8	Cab functions	
1	9	None (no machine function operation)	

In the following, the assignments of the operating elements on the joystick/operating terminal for the diverse operating modes are listed.

Drive emergency mode



Fig. 6-85 Joystick assignment emergency mode — "Drive" mode

Tab. 6-49 Joystick assignment emergency mode — "Drive" mode

Item	Operating element	Function
1	Right setting wheel	serves to set the engine speed
2	Outer push button on the right	none
3	Right joystick	forward: advances the right track back: reverses the right track to the left: lowers the rear rig boom inclination to the right: lifts the rear rig boom inclination
4	Front right push button	switches the speed level for the tracks between slow and fast
5	Left setting wheel	none
6	Outer push button on the left	none
7	Left joystick	forward: advances the left track back: reverses the left track to the left: lowers the front rig boom inclination to the right: lifts the front rig boom inclination
8	Front left push button	none

Pilot drill emergency mode

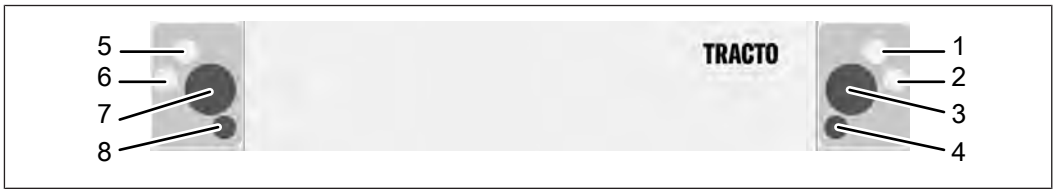


Fig. 6-86 Joystick assignment emergency mode — "Pilot drill" mode

Tab. 6-50 Joystick assignment emergency mode — "Pilot drill" mode

Item	Operating element	Function
1	Right setting wheel	serves to set the thrust force serves to set the engine speed
2	Outer push button on the right	switches rapid motion for the thrust rig on or off Switches the anchor plate pump on or off
3	Right joystick	forward: advances the thrust rig back: reverses the thrust rig 1× to the left: selection thrust menu 1× to the right: selection engine speed menu
4	Front right push button	Switches the length compensation lock on or off Switches the high pressure cleaner on or off
5	Left setting wheel	serves to set the drilling fluid flow rate speed
6	Outer push button on the left	switches the drilling fluid pump on or off switches internal rotation on or off
7	Left joystick	forward: starts clockwise rotation back: starts counter-clockwise rotation 1× to the left: selection bentonite pump menu 1× to the right: selection rotation menu
8	Front left push button	switches the rotation level between slow and fast

Expansion drill / Backreaming emergency mode

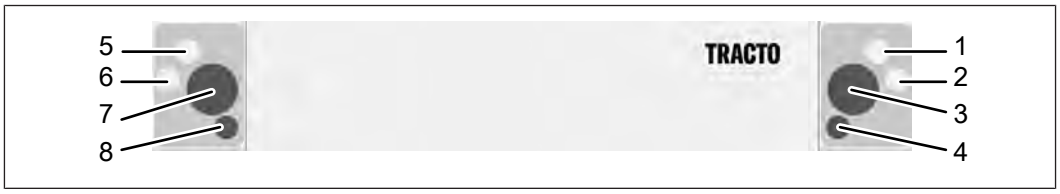


Fig. 6-87 Joystick assignment emergency mode — "Expansion drill / Backreaming" mode

Tab. 6-51 Joystick assignment emergency mode — "Expansion drill / Backreaming" mode

Item	Operating element	Function
1	Right setting wheel	serves to set the thrust force serves to set the engine speed
2	Outer push button on the right	switches rapid motion for the thrust rig on or off Switches the anchor plate pump on or off
3	Right joystick	forward: advances the thrust rig back: reverses the thrust rig 1× to the left: selection thrust menu 1× to the right: selection engine speed menu
4	Front right push button	Switches the length compensation lock on or off Switches the high pressure cleaner on or off
5	Left setting wheel	serves to set the drilling fluid flow rate speed
6	Outer push button on the left	switches the drilling fluid pump on or off switches internal rotation on or off
7	Left joystick	forward: starts clockwise rotation back: starts counter-clockwise rotation 1× to the left: selection bentonite pump menu 1× to the right: selection rotation menu
8	Front left push button	switches the rotation level between slow and fast

Setup emergency mode

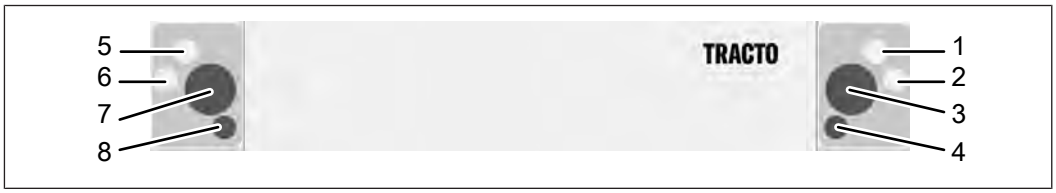


Fig. 6-88 Joystick assignment emergency mode — "Setup" mode

Tab. 6-52 Joystick assignment emergency mode — "Setup" mode

Item	Operating element	Function
1	Right setting wheel	none
2	Outer push button on the right	selection right anchor boring rig
3	Right joystick	forward: lifts the selected anchor boring rig back: lowers the selected anchor boring rig to the left: lowers the rear stabiliser to the right: lifts the rear stabiliser
4	Front right push button	selection left anchor boring rig
5	Left setting wheel	none
6	Outer push button on the left	lowers the anchor plate
7	Left joystick	Forward: drills the selected drill into the ground Back: drills the selected drill out of the ground to the left: lowers the front stabiliser to the right: lifts the front stabiliser
8	Front left push button	lifts the anchor plate

Rod change emergency mode

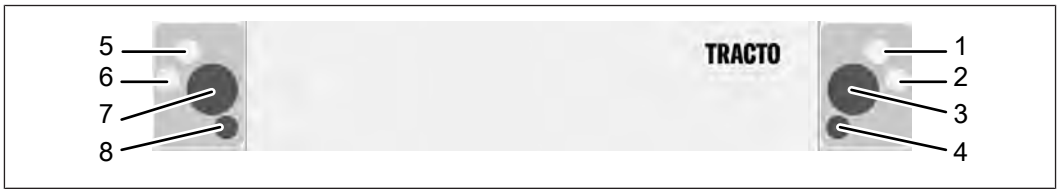


Fig. 6-89 Joystick assignment emergency mode — "Rod change" mode

Tab. 6-53 Joystick assignment emergency mode — "Rod change" mode

Item	Operating element	Function
1	Right setting wheel	serves to set the thrust force
2	Outer push button on the right	opens the rod gripper
3	Right joystick	forward: advances the thrust rig back: reverses the thrust rig to the left: moves the gripper arm of the rod changing system toward the bore axis to the right: moves the gripper arm of the rod changing system toward the rod box
4	Front right push button	opens the clamping tongs/break-away clamp
5	Left setting wheel	left stop = selection of the clamping tongs right stop = selection of the break-away clamp
6	Outer push button on the left	closes the rod gripper
7	Left joystick	forward: starts clockwise rotation back: starts counter-clockwise rotation to the left: lowers the gripper arm of the rod changing system to the right: lifts the gripper arm of the rod changing system
8	Front left push button	closes the clamping tongs/break-away clamp

Commodities emergency mode

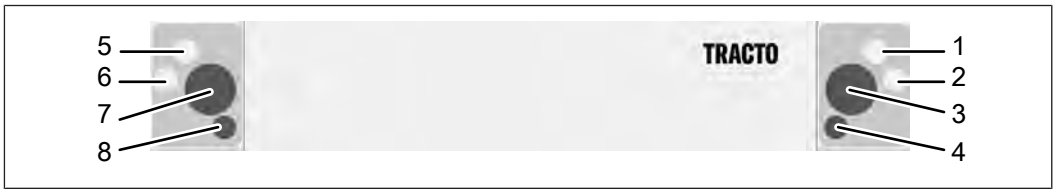


Fig. 6-90 Joystick assignment emergency mode — "Commodities" mode

Tab. 6-54 Joystick assignment emergency mode — "Commodities" mode

Item	Operating element	Function
1	Right setting wheel	none
2	Outer push button on the right	switches the working lights on and off
3	Right joystick	To the left: swings out the cab To the right: swings in the cab
4	Front right push button	switches the rotating light on and off
5	Left setting wheel	none
6	Outer push button on the left	switches the headlights on and off
7	Left joystick	To the left: opens the bonnet To the right: closes the bonnet
8	Front left push button	switches the interior lighting on and off

Terminating the emergency mode

1. To terminate the emergency mode, set the potentiometer for the engine speed behind the tailgate back to the left stop.
2. Turn the "Emergency mode" switch back to the "0" position (zero)
   ⇨ The red "Emergency mode" LED goes out.
3. Reset the operating mode to normal operation (= 0) using the +/- buttons.

6.3 Checks prior to start-up

⚠ WARNING



Risk of injury if personal protective equipment is not worn!

- Always wear your personal protective equipment, including ear protection and a work vest in fluorescent colours.
- During drilling, wear the comprehensive protective equipment included in the scope of delivery of the electric shock warning device.

Before starting the machine, ensure the following:

- The drill rods do not have any cracks and all sealing O-rings are available.
- The drilling fluid has been mixed and the drilling fluid mixing system is ready for operation.
- The engine is ready for operation (sufficient amount of fuel, coolant, engine oil, hydraulic oil, DEF).
- All hoses are properly connected, fit tightly, are installed safely (hose bridges) and do not touch any hot parts.
- All electric cables are properly connected and safely installed without touching any hot parts.
- The bonnet is closed.
- All communication means (radio or hand signals) have been settled between the operator on site and the operator of the machine.
- The operating personnel wears their personal protective equipment (foot protection, hand protection, head protection, ear protection, protective clothing).
- All safety regulations have been observed.
- The electric shock protection device has been tested and is ready for operation.
- The detection system has been tested and is ready for operation
- The transport locks for the rods are removed from the rod box and fastened in their parking position.
- Sufficient and clearly evident warning has been given that unauthorized access to the site, the drilling fluid mixing system and the machine is prohibited.

6.4 Start

Conditions

- The machine is standing in starting position at the entrance pit and is anchored to the ground.
- The personnel has already been instructed and has completely read and understood these instructions, especially the "Safety" chapter.
- Suitable accessories are ready for use.
- Means of communication between entrance pit and target pit are ready for use.

Info!
When moving a joystick axis or actuating a joystick button while the ignition is being switched on, the actuated component will be disabled.
If, for example, the left joystick is pushed forward while the ignition is being switched on, the left track chain (in drive mode) or the rotation (in bore mode) cannot be controlled.

- To rectify the fault, switch off the ignition.
- Always set the ignition lock to the centre position when you switch off the ignition. This prevents the battery from being deeply discharged.
- Only switch the ignition back on when it is sure that, in doing so, no operating element is actuated.

1. Switch on the mixing system (see mixing system instructions).
2. Make sure that neither a joystick nor a joystick button was actuated.
3. Start the engine (chapter 5.3.6, page 84).
4. Make sure that the warning indicator of the soot particle filter is not illuminated. Otherwise start the combustion process for soot particles as described in chapter 6.10, page 248.

NOTICE

Engine performance can deteriorate with prolonged idling!

- Only allow the engine to run at idle for a short time. If the idle time is too long, this may lead to a poor engine performance.

6.5 Connecting the first drill rod to the sub-saver

NOTICE

Oils and greases hazardous to the environment!



Danger of environmental pollution!

- Do not let oils and greases penetrate into the soil, waters or the sewage system.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.

1. Switch the "Drive mode/bore mode" rotary switch over to bore mode on the left joystick panel.
2. Always grease the drill rod threads!
   Avoid excessive grease on the drill rods. Prevent oils and greases from penetrating into the soil, water or sewage system.
3. Access the "Rod change — Pilot drill" screen.



4. If setting via the setting wheel is enabled at "Settings -> Bore parameters -> Engine speed", set the engine speed using the right setting wheel on the operating terminal to 1,400 rpm.



5. You can switch on the camera image of the rear camera on the sub-saver tapping the icon or the checkbox on the right action panel.
   If no camera has been selected, the rear camera is automatically switched on when the carriage is moved backward over the centre of the rig.



6. Completely reverse the thrust rig to the stop position by pulling the right joystick backwards.
   If applicable, follow the procedure on the screen.



7. Position the gripper arm above the rod box by briefly pushing the right joystick outwards.



Info!
The bore rig will automatically determine the bay in the rod box from which the rod is to be taken.



Info!
To ensure an even wear of the drill rods, please start in turn with the outer and the inner bay.



8. Open the drill rod grippers and lower the gripper arm.
   To do so, press the push button on the far right (>>Open gripper<<) and briefly push the left joystick outwards.



9. Close the rod grippers and move the gripper arm upwards.
   To do so, press the front left push button (>>Close gripper<<) and briefly push the left joystick inwards.
   The gripper arm automatically moves to the upper end position.



10. Position the gripper arm with the drill rod above the bore axis by briefly pressing the right joystick inwards.



11. Move down the gripper arm. To do so, briefly push the left joystick outwards.



Info!
The gripper arm is automatically pushed to the front.



12. Open the rod grippers and move the gripper arm upwards.
    To do so, press the push button on the far right (>>Open gripper<<) and push the left joystick inwards.



13. Position the gripper arm above the rod box by briefly pushing the right joystick outwards.

NOTICE

Possible damage to the threads due to too fast rotation or too high thrust speed!

- When screwing the sub-saver to the rods and the rods to each other, proceed slowly and with low thrust to avoid damaging the threads.



14. Switch on clockwise rotation (outer rod/drill rod) by pushing the left joystick forward and holding it.
    The inner rod automatically rotates along with the outer rod (if the front clamp is closed).
    Simultaneously push the right joystick forward to advance the thrust rig until the sub-saver and the drill rod have been screwed together.
    If applicable, follow the procedure on the screen.



15. You can switch on the camera image of the front camera on the clamp tapping the icon or the checkbox on the left action panel.
    If no camera has been selected and there is a front camera installed, this camera is switched on as soon as the carriage is moved forward over the centre of the rig.



16. Push the right joystick forward to slowly advance the thrust rig until the front end of the drill rod rests inside the clamp.
    If applicable, follow the procedure on the screen.

6.6 Pilot drill

⚠ DANGER

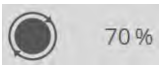
Rotating drill rod!

Contact with the rotating drill rod can lead to injuries or death!

- Only screw the rock drilling unit to the drill rod by hand (or with a suitable tool) using a suitable lifting device.
- Only start drilling operation if there is nobody in the range of rotating parts.
- Only personnel required to operate the machine are allowed near the machine.
- Keep out of the danger area.
- Keep away from rotating parts.

Info!
In manual mode, rapid motion is activated for the thrust. To move the feed in rapid motion, fully deflect the joystick.

1. Attach a suitable drilling tool to the rock drilling unit.
2. Switch the "Drive mode/bore mode" rotary switch over to bore mode on the left joystick panel.
3. Access the "Pilot drill" screen.



4. Set the speed for the rotation of the inner rod to 100 % to achieve the maximum rotation speed.
   To do so, tap the icon or the percentage value on the left action panel and set the value using the slider.



5. Set the sensitivity for the rotation of the outer rod to 100 %.
   To do so, tap the icon or the percentage value on the left action panel and set the value using the slider.



6. Push the right joystick forward to advance the thrust rig until the drill rod protrudes from the front of the clamping tongs.
7. Screw the rock drilling unit onto the first drill rod manually or with a suitable tool using a suitable lifting device.

NOTICE

Potential damage to the drill rod if the rock drilling unit is insufficiently secured!

- Ensure that the threaded shoulder of the drill rod and the rock drilling unit are adjacent to each other.



8. Push the right joystick forward to advance the thrust rig until the drill head reaches the ground.



9. Set the drilling fluid flow rate using the left setting wheel to a low value.



10. Push the front left push button to switch on the drilling fluid pump.
11. Check whether drilling fluid exits from all nozzles of the drill head.



12. Push the front left push button to switch the drilling fluid back off.



13. Push the left joystick forward to rotate the drill rod exactly to the "6 o'clock position".
    During the process, observe the drill rod.



14. Use the left setting wheel to set a low drilling fluid flow rate and push the front left push button to switch on the drilling fluid pump.



15. Push the right joystick forward to advance the thrust rig until the drill head has entered the ground approx. 30–40 cm.
16. Leave the drilling fluid switched on.



17. Switch on clockwise rotation by pushing the left joystick forward and holding it in this position.
    At the same time, push the right joystick forward to drive the thrust rig forward until the drill rod has completely entered the ground, or until the thrust rig has advanced to the front stopper.



Info!
This way the rod connection lies exactly between both clamps.



18. Push the front left push button to switch the drilling fluid back off.



19. Pull the right joystick back to reverse the thrust rig by approx. 5 cm to enable length compensation of the sub-saver.



Info!
Now you can locate the drill head (see instructions provided by the manufacturer of the detection system).

20. Access the "Rod change — Pilot drill" screen.



21. You can switch on the camera image of the front camera on the clamp tapping the icon or the checkbox on the left action panel.
    If no camera has been selected and there is a front camera installed, this camera is switched on as soon as the carriage is moved forward over the centre of the rig.



22. Tap the icon on the left action panel to close the clamping tongs.

Info!
As soon as the clamp is closed, the valve for drilling fluid pressure relief will open automatically.



23. Pull back the left joystick to completely unscrew the drill rod from the thrust rig or sub-saver in counter-clockwise direction.



24. Completely reverse the thrust rig to the stop position by pulling the right joystick backwards.
If applicable, follow the procedure on the screen.

6.6.1 Adding further drill rods

Info!
The bore rig will automatically determine the bay in the rod box from which the rod is to be taken.



1. Open the drill rod grippers and lower the gripper arm.
To do so, press the push button on the far right (>>Open gripper<<) and briefly push the left joystick outwards.



2. Close the rod grippers and move the gripper arm upwards.
To do so, press the front left push button (>>Close gripper<<) and briefly push the left joystick inwards.
The gripper arm automatically moves to the upper end position.



3. Position the gripper arm with the drill rod above the bore axis by briefly pressing the right joystick inwards.



4. Move down the gripper arm. To do so, briefly push the left joystick outwards.



5. Open the rod grippers and move the gripper arm upwards.
To do so, press the push button on the far right (>>Open gripper<<) and push the left joystick inwards.



6. Position the gripper arm above the rod box by briefly pushing the right joystick outwards.

NOTICE

Possible damage to the threads due to too fast rotation or too high thrust speed!

- When screwing the sub-saver to the rods and the rods to each other, proceed slowly and with low thrust to avoid damaging the threads.



7. Switch on clockwise rotation (outer rod/drill rod) by pushing the left joystick forward and holding it.
   The inner rod automatically rotates along with the outer rod (if the front clamp is closed).
   Simultaneously push the right joystick forward to advance the thrust rig until the sub-saver and the drill rod have been screwed together.
   If applicable, follow the procedure on the screen.



8. Keep pushing both joysticks forward until the two drill rods are screwed together.
   Always screw on the rods with maximum torque.



9. Tap the icon on the right action panel to open the clamping tongs.

Straight bores



Info!
Only carry out the following working steps in case of straight bores!

10. Access the "Pilot drill" screen.



11. Set the drilling fluid flow rate using the left setting wheel to a low value.



12. Push the front left push button to switch on the drilling fluid pump.
13. Wait until the pressure on the scale on the screen has built up.



Info!
To fill the rods faster, push the push button again.



14. If necessary, adjust the drilling fluid flow rate using the setting wheel on the left joystick.



15. Switch on clockwise rotation by pushing the left joystick forward and holding it in this position.



16. Push the right joystick forward to advance the thrust rig.

Correcting the drilling direction



17. Push the left joystick gently forward to switch on clockwise rotation until the desired position is reached.
    Check the position using the detection system.
18. Afterwards, switch off the rotation by bringing the left joystick into centre position.



19. Set the drilling fluid flow rate using the left setting wheel to a low value.



20. Push the front left push button to switch on the drilling fluid pump.



21. If necessary, adjust the drilling fluid flow rate using the setting wheel on the left joystick.



22. Push the right joystick forward to advance the thrust rig.



23. Push the front left push button to switch the drilling fluid back off.
24. Stop the thrust of the thrust rig by letting go of the right joystick.
25. Locate the drill head (see instructions provided by the manufacturer of the detection system) and compare its position with the destined bore path (height and side position).
    In case of any deviations, carry out the required corrections again!

Continuing drilling operation



26. Push the front left push button to switch on the drilling fluid pump.



27. Set the drilling fluid flow rate using the left setting wheel to a low value.
28. Wait until the pressure on the scale on the screen has built up.



29. Switch on clockwise rotation by pushing the left joystick forward and holding it in this position.



30. Push the right joystick forward to advance the thrust rig and to drive the drill rod further into the ground.



31. If necessary, switch on the mud pump to pump out the bore mud. To do so, tap the icon or the checkbox on the right action panel.

Repeat this process until the pilot bore is completed.

6.6.2 Auto-bore during pilot bore

Info!
With the front right push button you can automatically
- conduct a single drilling process or
- continuously remove drill rods and conduct drilling processes until the rod box is empty or you manually stop the process.

Requirements
- The rod crane is not positioned above the bore axis.
- The thrust rig is positioned at the front stopper in front of the clamp.
- A rod has been screwed to the sub-saver.

1. Access the "Pilot drill" screen.
2. Disable the "Clock mode" and "Carving mode" buttons.



Fig. 6-91 Disabling "Clock mode" and "Carving mode"

⚠ DANGER

Risk of injury due to machine movements during auto-bore!

- Sit down on the operator seat to keep out of the machine's movement range.
- Remain seated until all working steps of the auto-bore have been completed.
- Make sure that nobody is standing in the machine's movement range.

1 x

3. Push the front right push button once to automatically remove a new drill rod and conduct a drilling process.
   ⇨ A new drill rod is removed and the drilling process conducted automatically.
   ⇨ The process stops when the thrust rig is positioned at the front stopper in front of the clamp.

Fully automatic mode
2 x

4. Push the front right push button twice in quick succession (within 1 s) to switch on the fully automatic mode during pilot bore.
   ⇨ A new drill rod is removed, the drilling process is conducted automatically and then another drill rod is removed.
   ⇨ This process is repeated automatically (depending on the type of rod).

You can interrupt automatic drilling if you push the front right push button again or if you leave the operator seat.

6.6.3 Automatic rod exchange

Requirement – The thrust rig is positioned at the front stopper in front of the clamp.

⚠ DANGER **Risk of injury due to machine movements during auto-bore!**

- Sit down on the operator seat to keep out of the machine's movement range.
- Remain seated until all working steps of the auto-bore have been completed.
- Make sure that nobody is standing in the machine's movement range.

1. Access the "Rod change — Pilot drill" screen.



2. Tap the "Rod bay selection" icon to select a bay from which the rod shall be removed.



3. Briefly push the front right push button once to switch on automatic rod change.
   - ⇨ The sub-saver is loosened.
   - ⇨ The thrust rig is reversed.
   - ⇨ The next drill rod comes to be screwed in place.

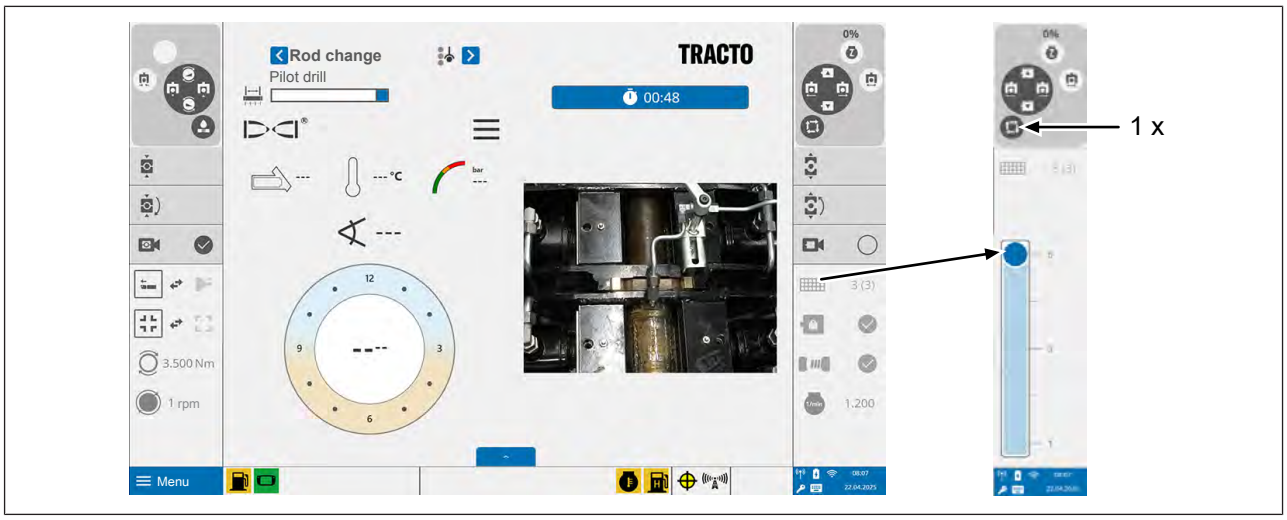


Fig. 6-92 Enabling automatic rod exchange pilot drill



To interrupt automatic rod exchange, push the front right push button again or leave the operator seat.

6.7 Inserting rods into the rod box and removing rods

If a larger rod quantity is required, single drill rods may be added.
Please find the weights of the individual drill rods in the technical data.

⚠ WARNING



Risk of injury if personal protective equipment is not worn!

- Always wear your personal protective equipment, including ear protection and a work vest in fluorescent colours.
- During drilling, wear the comprehensive protective equipment included in the scope of delivery of the electric shock warning device.

6.7.1 Inserting rods into the rod box

Requirements

- The outer bay of the rod box is empty.
- At least one of the other bays of the rod box is not filled completely.
- The grippers are positioned above the outer rod bay.
- The grippers of the gripper arm are empty.

1. Switch the "Drive mode/bore mode" rotary switch over to bore mode on the left joystick panel.
2. Access the "Pilot drill" screen.



3. Tap the "Rod bay selection" icon to select a bay into which the rod shall be inserted.
4. Fold the lower protection cover (1, shown in transparent fashion) of the rod box upwards as follows:
   - ⇨ Draw the spring hooks (2) downwards and turn them outwards.
   - ⇨ Fold up the protection cover.
   - ⇨ Attach the spring hooks into the slots (3) to secure the protection cover from folding down.

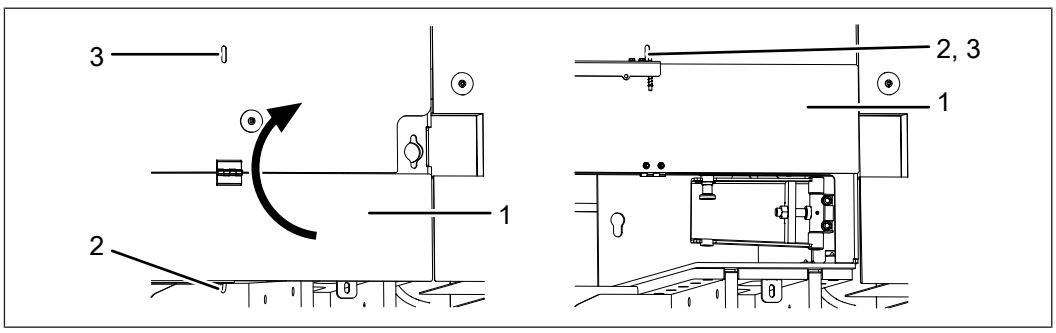


Fig. 6-93 Folding up the lower protection cover of the rod box

5. Unlock the bolt (1) of the rod stopper (2) and fold out the rod stopper.

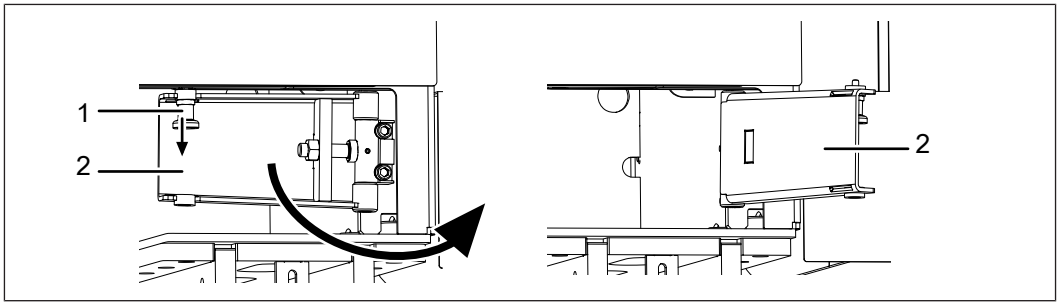


Fig. 6-94 Folding out the rod stopper

6. Turn the >>Load/unload<< rotary switch (1) to the left to give clearance for loading rods.

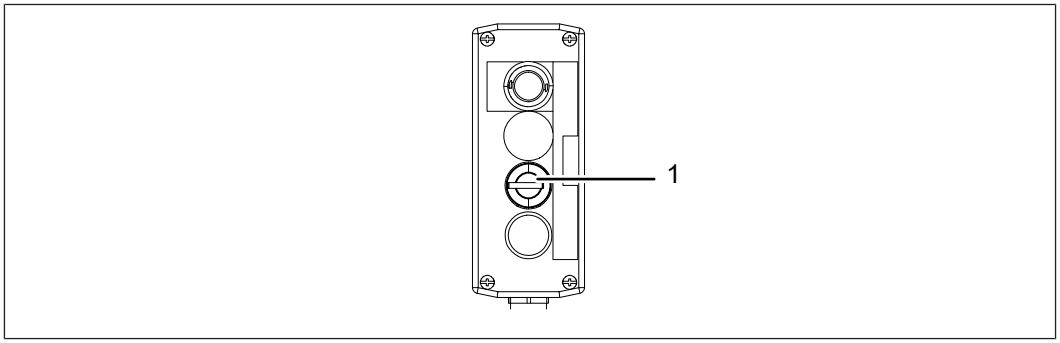


Fig. 6-95 >>Load/unload<< rotary switch

7. Pull out the two rod retainers (1).
8. Attach the rod retainers into the support axis (3) in the position for inserting (2) rods.

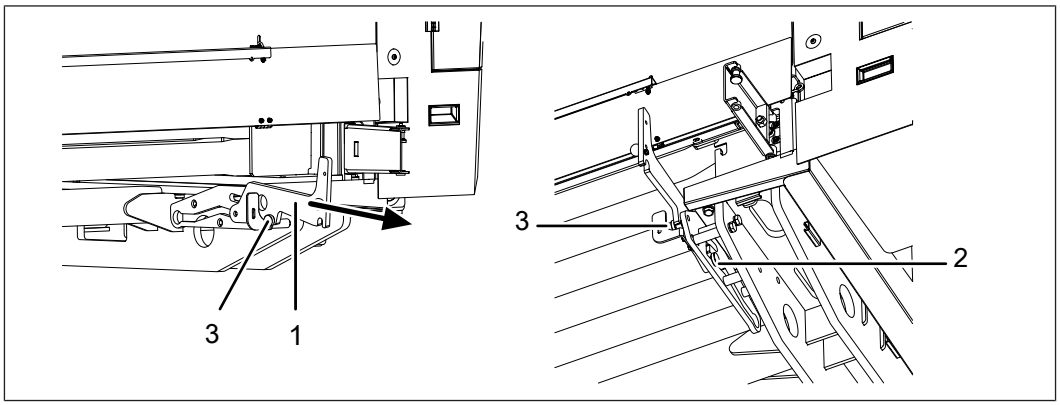


Fig. 6-96 Rod retainer in position for inserting drill rods

9. Place a drill rod on the two rod retainers so that it can be fed to the outer bay of the drill rod box.
   ⇨ Grip the drill rod outside its centre so that it is slightly tilted with an inclination matching the rig boom inclination.

10. Press the push button (1) so that the gripper arm takes the rod out of the outer bay and places it into the selected bay of the rod box.

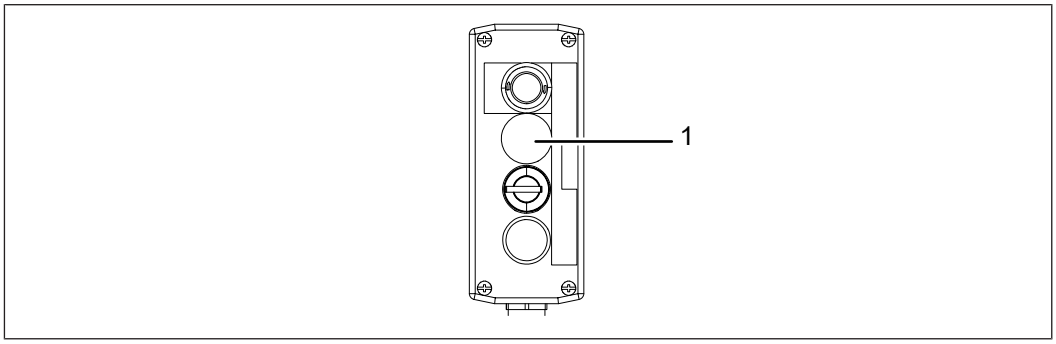


Fig. 6-97 >>Load/unload rod<< push button

Info!
A warning signal is emitted when actuating the push button.

11. Repeat the working steps of point 9 and 10 until the desired number of rods has been reached. If the selected drill rod bay is full, another drill rod bay will be selected automatically.
12. Push the two rod retainers under the rod box again.
13. Fold in the rod stopper again and lock it by means of the bolt.
14. Fold the lower protective cover of the rod box back down.
15. Attach the spring hooks into the lower mounting holes again.
16. Turn the >>Load/unload<< rotary switch (1) to the centre to cancel clearance for loading/unloading rods.

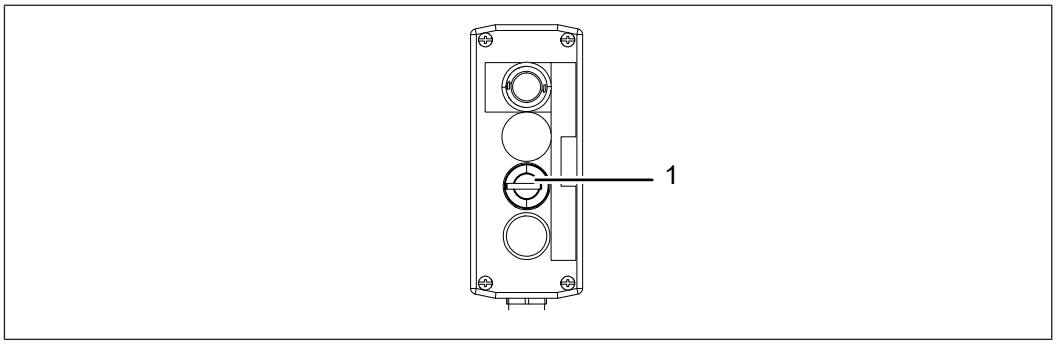


Fig. 6-98 >>Load/unload<< rotary switch

Continue with the pilot bore.

6.7.2 Removing rods from the rod box

If, during the pilot bore, you notice that a rod is defective or worn, remove it from the rod box.
The weight of the single rods can be gathered from the technical data.

Prerequisites

– The outer bay of the rod box is empty.
– The thrust rig is reversed.

1. Access the "Expansion drill / Backreaming" screen.



2. Tap the "Rod bay selection" icon to select a bay from which the rod shall be removed.
3. Turn the >>Load/unload<< rotary switch (1) to the right to give clearance for unloading rods.

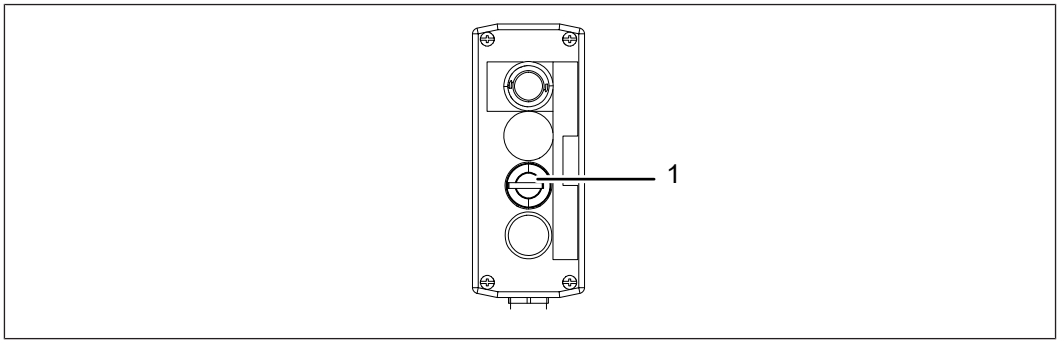


Fig. 6-99 >>Load/unload<< rotary switch

4. Fold the lower protection cover (1, shown in transparent fashion) of the rod box upwards as follows:
   ⇨ Draw the spring hooks (2) downwards and turn them outwards.
   ⇨ Fold up the protection cover.
   ⇨ Attach the spring hooks into the slots (3) to secure the protection cover from folding down.

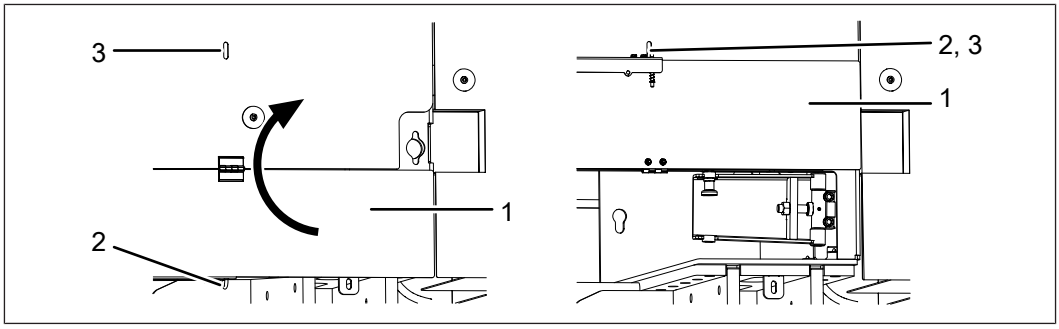


Fig. 6-100 Folding up the lower protection cover of the rod box

5. Unlock the bolt (1) of the rod stopper (2) and fold out the rod stopper.

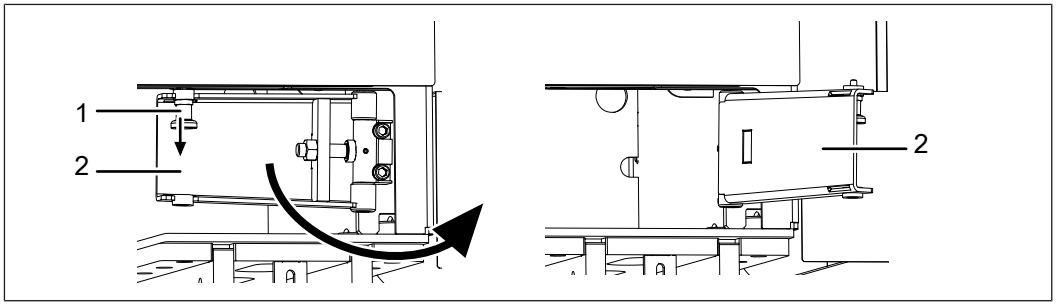


Fig. 6-101 Folding out the rod stopper

6. Pull out the two rod retainers (1).
7. Attach the rod retainers into the support axis (3) in the position for removing (2) rods.

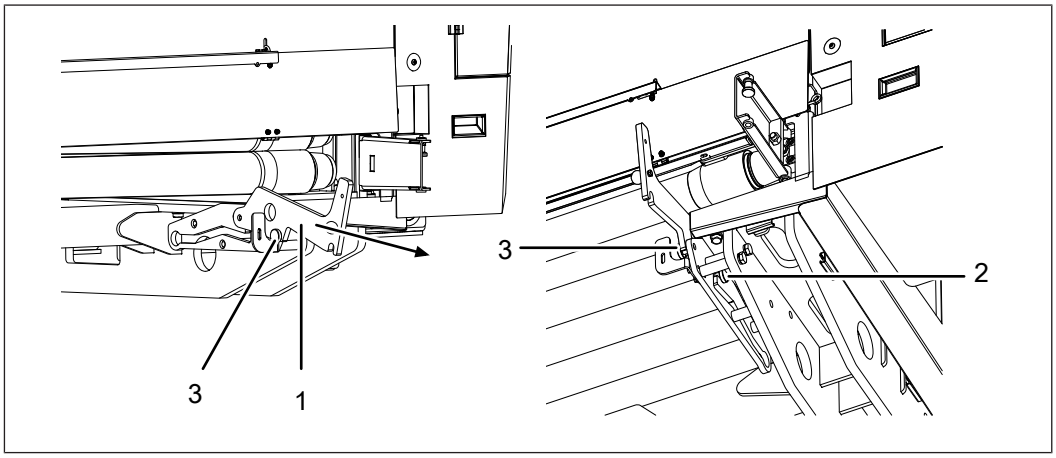


Fig. 6-102 Rod retainer in position for removing drill rods

⚠ WARNING

Drill rods rolling out!

When placing the rod into the rod bay via the rod gripper and when rolling the rod out onto the rod retainers, there is a risk of crushing your hands and fingers.

- Keep your hands away from the rod bay and the rod retainers.
- Wait until the rod has rolled onto the retainers.

8. Press the push button (1) so that the gripper arm takes the rod out of the selected bay and places it into the outer bay of the rod box.
   ⇨ The drill rod will then roll onto the rod retainers.

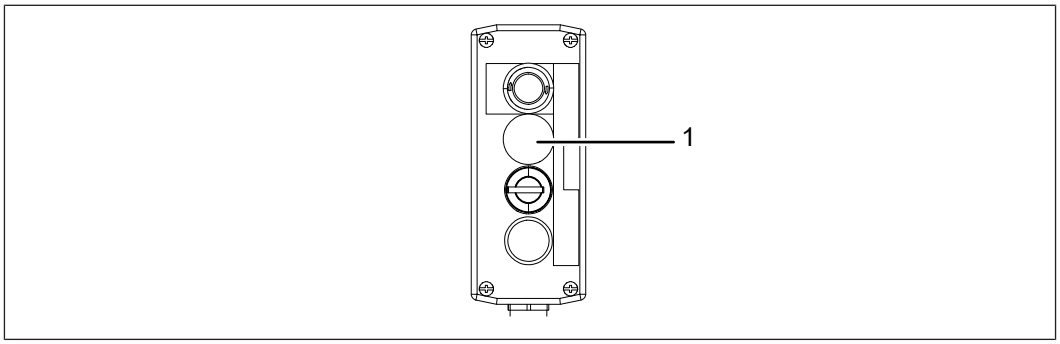


Fig. 6-103 >>Load/unload rod<< push button

Info!
A warning signal is emitted when actuating the push button.

9. Take the drill rod out of the two drill rod retainers.
10. Repeat the working steps in point 8 and 9 until all required rods have been taken out.
11. Push the two rod retainers under the rod box again.
12. Fold in the rod stopper again and lock it by means of the bolt.
13. Fold the lower protective cover of the rod box back down.
14. Attach the spring hooks into the lower mounting holes again.
15. Turn the >>Load/unload<< rotary switch (1) to the centre to cancel clearance for loading/unloading rods.

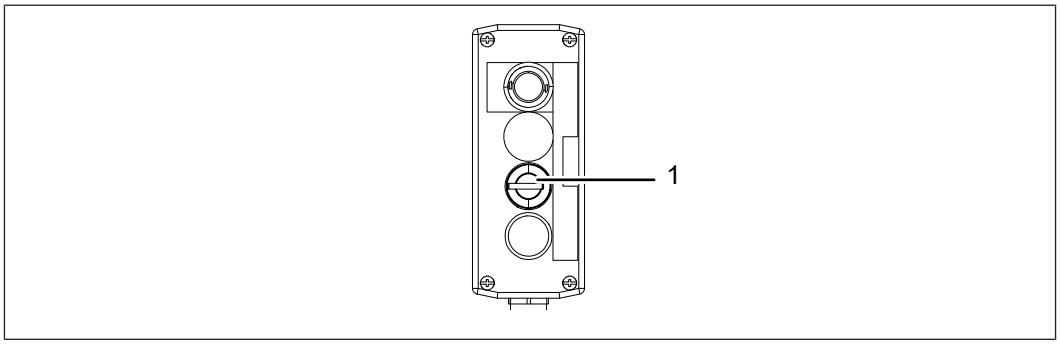


Fig. 6-104 >>Load/unload<< rotary switch

Continue with the pilot bore.

6.8 Additional box

In case the number of drill rods in the rod box is not sufficient for the planned drilling operation, you can attach an optionally available additional box to the outside of the rod box.

In case the number of drill rods in the rod box is not sufficient for the planned drilling operation, you can attach an additional box to the outside of the rod box. This additional box can take a maximum of 4 drill rods.

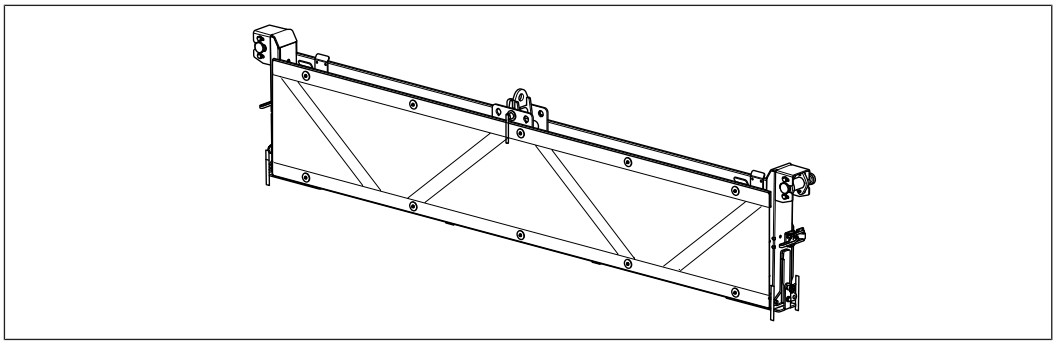


Fig. 6-105 Additional box for drill rods

6.8.1 Attaching and removing the additional box

⚠ DANGER

Suspended loads!



Danger due to falling loads!

- Keep out of any suspended components.
- Keep third persons away from the danger area.
- Always adhere to the maximum permissible bearing load of the lifting gear used.

⚠ CAUTION

Crush hazard between additional box and rod box



There is a hand crush hazard when you hook in the additional box.

- Wear a hand protection when you hook in the additional box.



Info!

For hooking in and unhooking the additional box, use the loading crane.
Observe the specifications regarding the max. permissible weight and operating distance of the loading crane provided in the technical data (chapter 3.6, page 54).

Requirement

– The anchor plate has been lowered to the ground.

Proceed as follows to hook in the additional box:

1. Use the loading crane to hook the additional box into the holders (1) to the left and right of the outer rod bay.

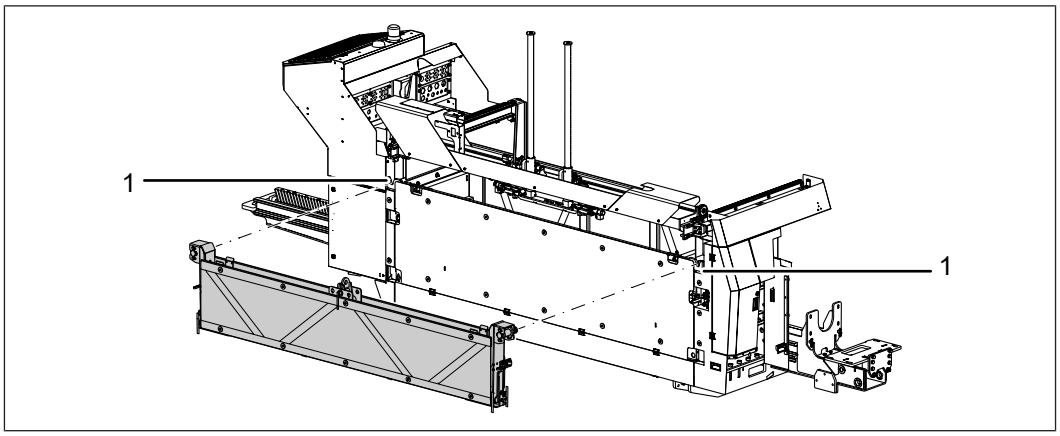


Fig. 6-106 Hooking in the additional box

2. Secure the additional box with the two toggle clamps (1).

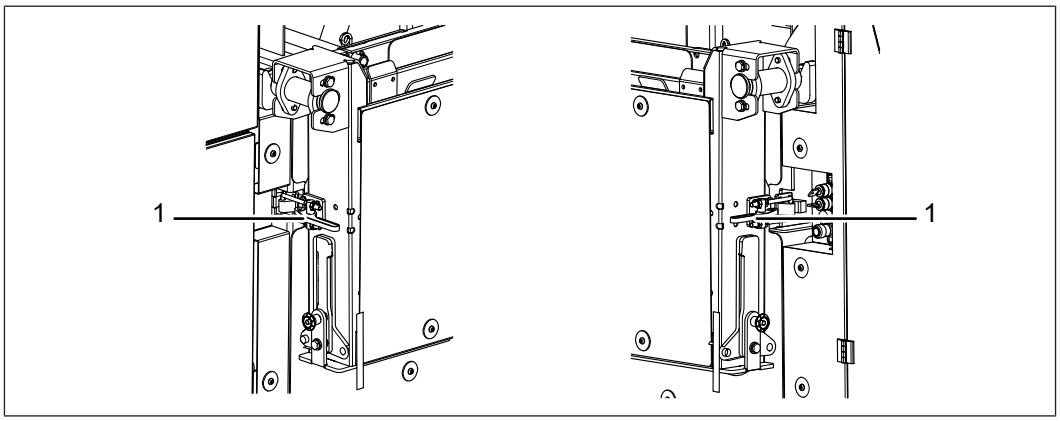


Fig. 6-107 Additional box attached and secured

3. Fit the bentonite drain hose at the bottom of the front side of the additional box.
4. Lock the attached drain plate (1) with the bolt (2).

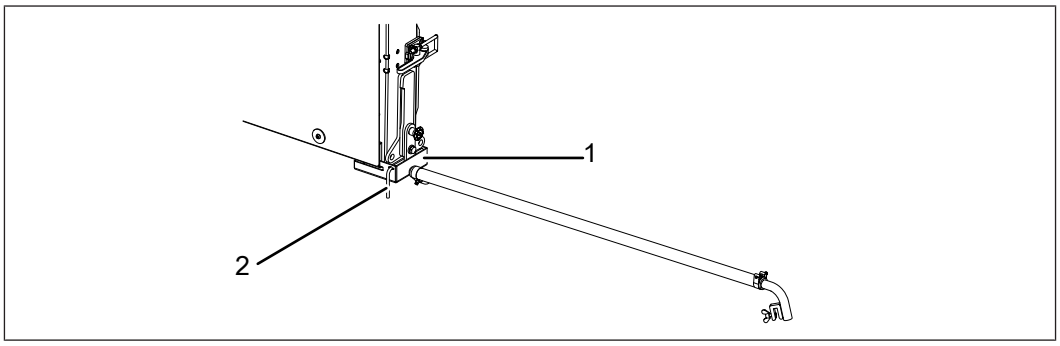


Fig. 6-108 Mounting the bentonite drain hose

5. Fasten the hose end by means of the wing nut (1) at the edge of the anchor plate (2) so that the draining bentonite can run into the anchor plate and be siphoned by the mud pump.

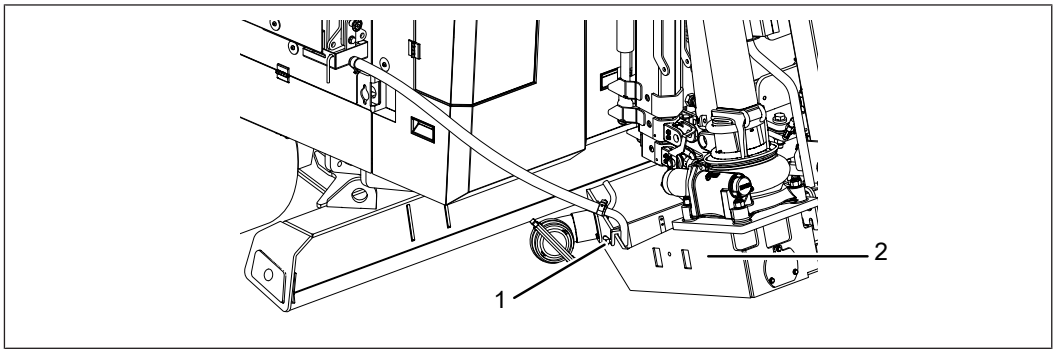


Fig. 6-109 Bentonite drain hose at the anchor plate

6. Loosen the lifting bolt (1) and remove the lifting eye of the additional box (2). Put the lifting bolt and lifting eye safely aside.

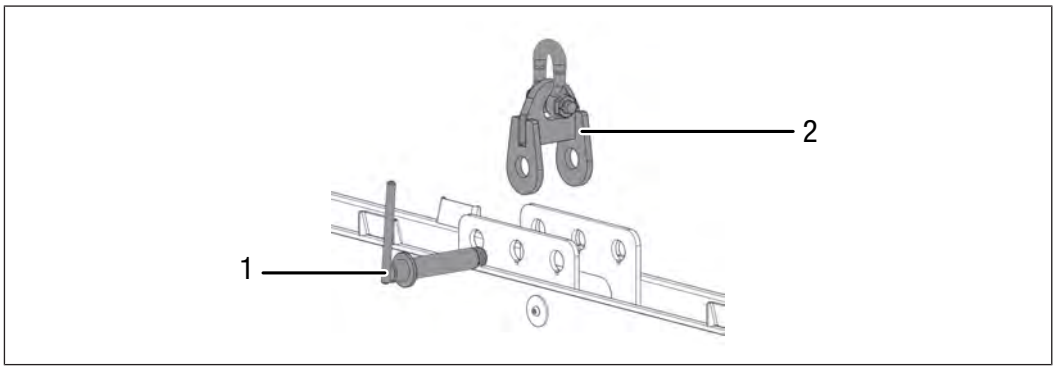


Fig. 6-110 Removing the attachment point of the additional box

7. Pull out the locking pins (3) and fold out the front (1) and rear (2) profile extension for the gantry crane.
8. Lock the folded-out profile extensions with the plug bolt (3) from beneath.

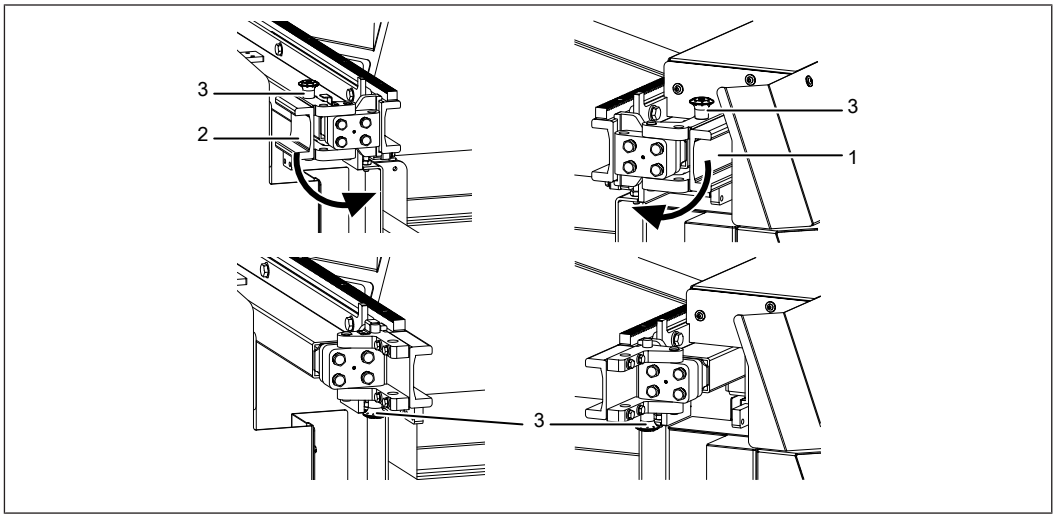


Fig. 6-111 Folding out the profile extensions for the gantry crane

9. Move the magazine crane stopper (1) from the combined roller profile to the profile extension at the front and at the rear (see Fig. 6-105).
10. If necessary, adjust the inner stop screws (2) at the front and rear of the magazine so that the gantry crane can take the rod out of the additional box and put it back in.
11. Secure the stop screws with the counter nut.

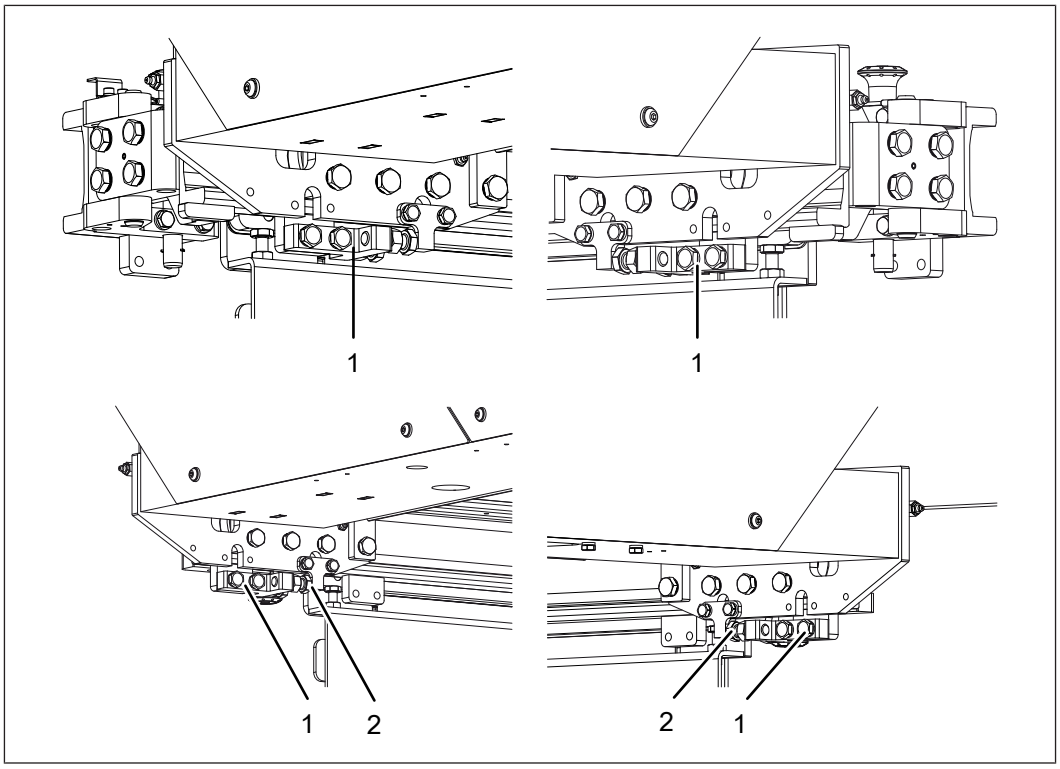


Fig. 6-112 Loosening the outer stoppers of the gantry crane without additional box (top) and with additional box (bottom)

Info!
Refit the two outer stops when you no longer need the additional box and have removed it.

6.8.2 Placing down the additional box

When not used, place down the additional box on a level horizontal surface:

1. Unlock the plug bolts (1) at the bottom on the front sides of the additional box.
2. Fold out the support feet (2) on both sides of the additional box - one support foot each to each side.
3. Lock the folded out support feet again using the plug bolts.

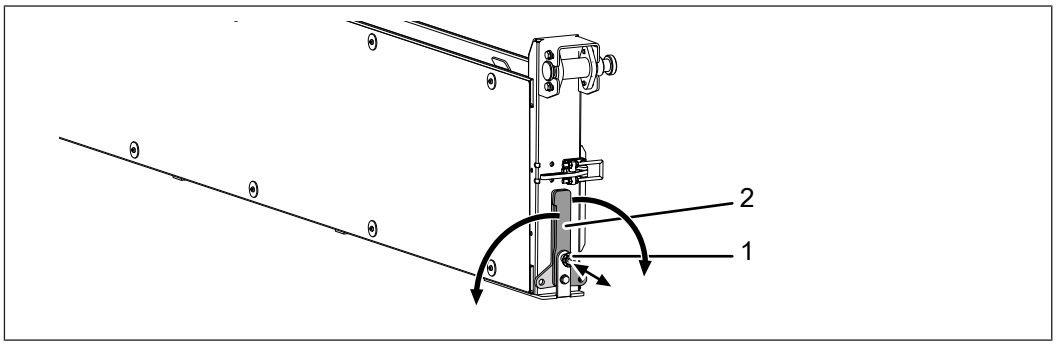


Fig. 6-113 Folding out the support feet

4. Carefully place down the additional box.
5. Detach the lifting device of the loading crane from the additional box.

6.9 Expansion/pull-in mode

Once the target pit is reached, the diameter of the created pilot bore may have to be enlarged to match the diameter of the product pipe to be installed. A change of tools is required for this purpose.

⚠ WARNING



Risk of injury if personal protective equipment is not worn!

- Always wear your personal protective equipment, including ear protection and a work vest in fluorescent colours.
- During drilling, wear the comprehensive protective equipment included in the scope of delivery of the electric shock warning device.

⚠ DANGER

Rotating drill rod!

Contact with the rotating drill rod can lead to injuries or death!

- Only screw the expander head to the drill rod by hand (or with a suitable tool and using a suitable lifting device).
- Only start expansion / pull-in mode if there is nobody in the range of rotating parts.
- Only personnel required to operate the machine are allowed near the machine.
- Keep out of the danger area.
- Keep away from rotating parts.

6.9.1 Tool change for expanding

Info!
Since the selection of expander components depends very much on the application, please contact the TRACTO-TECHNIK customer service.

⚠ DANGER

Pre-tensioned drill rod!

The drill rod can be pre-tensioned, twist all of a sudden and cause injuries!

- Before loosening the rock drilling unit, relieve the pretension of the drill rod by pushing the thrust rig back and forth.

1. Move the thrust rig back and forth by pushing the right joystick forward and pulling it backward.
2. Stop the engine by briefly pressing either the start/stop button (1) on the left joystick panel or the start/stop button (2) on the operating terminal.
3. Switch off the ignition by briefly pressing the "Gear wheels" push button (3) on the remote control key.

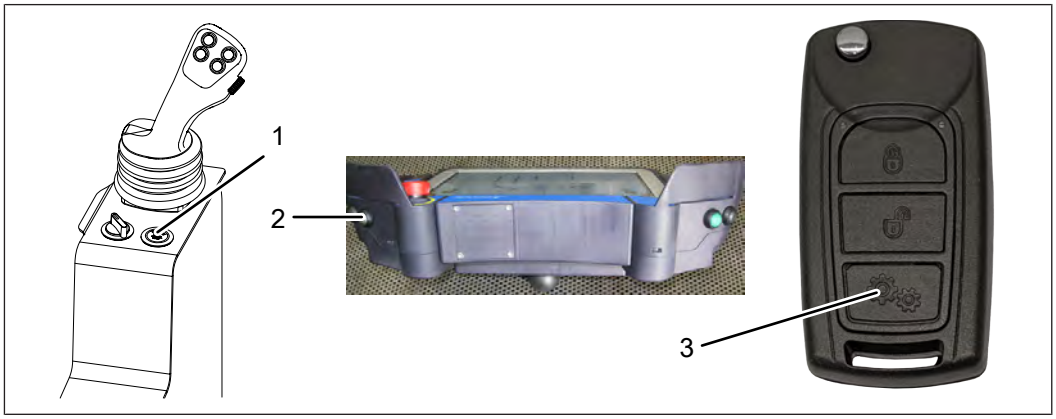


Fig. 6-114 Stopping the engine

Info!
Always operate the machine with the wireless pit remote control when working in the target pit (chapter 5.3.8, page 88 and chapter 6.2.5, page 198).

Operator in the target pit

4. Detach the rock drilling unit from the rod string.
5. Screw the prepared expander head onto the drill rod. Prevent dirt from reaching the screwed connections or drill rods.

6.9.2 Connecting the product pipe to the expander head

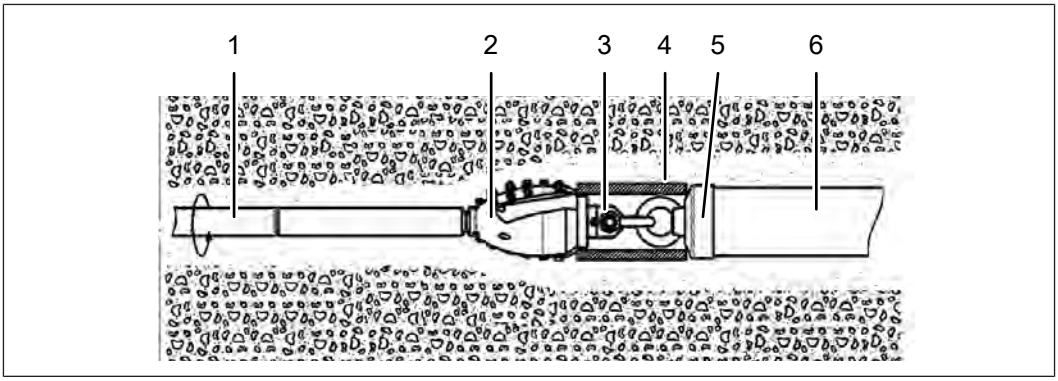


Fig. 6-115 Example set-up of drill rod with expander head and product pipe

1	Drill rods	4	Protective sleeve (PE pipe section, optional)
2	Expander head (backreamer)	5	Pipe puller
3	Swivel	6	Product pipe / line to be installed

1. Do not carry out this step unless you are using a PE pipe:
   Screw a suitable pipe puller firmly into the product pipe to be installed.
2. In the swivel area insert a PE pipe section as protective sleeve (recommended for larger pipe diameters). It prevents the bore hole from collapsing and thus the braking effect during pipe installation.
3. Connect the pulling lug of the swivel with the ring nut of the pipe puller using an appropriate shackle.
4. After completion of the work in the target pit, switch off both the machine and the wireless pit remote control by turning the key counter-clockwise.
5. Inform the operator at the machine that the machine can now again be started and operated from the operator seat.

Info!
If a protective sleeve is used, ensure that it is provided with an opening so you can access the connection point.

6.9.3 Expanding and installing the product pipe

1. Mount the rod wiper (precise version depends on the model).

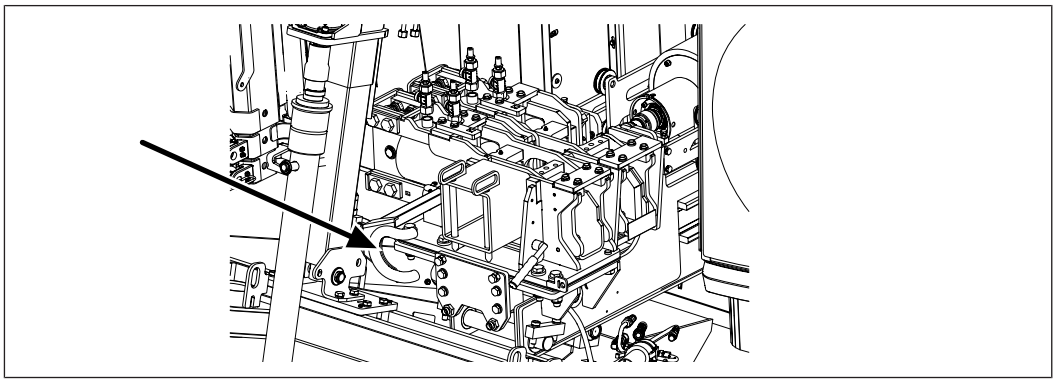


Fig. 6-116 Rod wiper

2. Start the engine (chapter 5.3.6, page 84).
3. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.
4. Open the "Drive / Setup" screen on the operating terminal.



5. If setting via the setting wheel is enabled at "Settings -> Bore parameters -> Engine speed", set the engine speed using the right setting wheel on the operating terminal to 1,400 rpm.
6. Switch the "Drive mode/bore mode" rotary switch over to bore mode on the left joystick panel.
7. Access the "Expansion drill / Backreaming" screen.



8. Set the drilling fluid flow rate using the left setting wheel to a low value.



9. Push the front left push button to switch on the drilling fluid pump.
10. Check whether drilling fluid exits from all nozzles of the backreamer.



11. Push the front left push button to switch the drilling fluid back off.



12. Reverse the thrust rig until the expander head abuts on the ground.
To do so, pull the right joystick backward.



13. Use the left setting wheel to set a high drilling fluid flow rate and push the front left push button to switch on the drilling fluid pump.



14. Push the front left push button again.
    ⇨ This way the rod string is filled quickly.



15. Use the left setting wheel to adjust the drilling fluid flow rate.
16. Check the pressure at the indicator on the operating terminal.
    The pressure should be between 20 bar and 40 bar.



17. The expander diameter and the hardness of the ground are decisive for the rotation speed.
    If setting via the setting wheel is enabled at "Settings -> Bore parameters -> Engine speed", increase the engine speed to the maximum speed (approx. 2,200 rpm) at the right setting wheel.



18. Tap the icon or the % value on the left action panel to increase the sensitivity of the joystick and change the value moving the slider.
19. Access the "Rod change — Expansion drill / Backreaming" screen.



20. You can switch on the camera image of the front camera on the clamp tapping the icon or the checkbox on the left action panel.
    If no camera has been selected and there is a front camera installed, this camera is switched on as soon as the carriage is moved forward over the centre of the rig.



21. Switch on clockwise rotation by pushing the left joystick forward and holding it in this position.



22. Reverse the thrust rig until the first screw connection point of the drill rods is positioned precisely between the two clamping tongs.
    To do so, pull the right joystick backward.
    At the same time make sure that the rotation does not get caught and that the cuttings or rather drilling debris is mixed homogeneously when it is fed back.
    If applicable, follow the procedure on the screen.



Info!
In expansion operation, the thrust is automatically stopped in the rod-break-away position. The drilling mud on the drill rod is removed by the rod wiper during pull-in.



23. Push the front left push button to switch the drilling fluid back off.

⚠ DANGER

Crush hazard at the clamp!



Your hands may be crushed when the clamping tongs close.

- Keep away from the clamp and break-away device and keep other persons away.



24. Tap the icon on the left action panel to close the clamping tongs.



Info!
As soon as the clamp is closed, the valve for drilling fluid pressure relief will open automatically.



25. Tap the icon on the left action panel and hold it until the pivoting cylinder is extended to close the break-away clamp.



26. Tap the icon on the right action panel and hold it until the pivoting cylinder is retracted to open the break-away clamp.



27. Switch on counter-clockwise rotation until the first drill rods have been unscrewed at the front inside the clamping tongs. To do so, pull the left joystick backward.
At the same time, reverse the thrust rig by approx. 2 cm by pulling the right joystick backward.

⚠ DANGER

Crush hazard at the break-away clamp!



Your hands may be crushed when the break-away clamp closes.

- Keep away from the clamp and break-away device and keep other persons away.



28. Tap the icon on the left action panel to close the break-away clamp.



29. Pull the left joystick back to detach the sub-saver from the drill rod in a counter-clockwise rotation. Turn the sub-saver 1.5 rotations.
Then let go of the left joystick to stop counter-clockwise rotation.



30. Tap the icon on the right action panel to open the break-away clamp.



31. Reverse the thrust rig until the front part of the rod only rests in the rod support tray.
To do so, pull the right joystick backward.
If applicable, follow the procedure on the screen.



32. Position the gripper arm above the bore axis. To do so, briefly push the right joystick to the left.



33. Open the drill rod grippers and lower the gripper arm.
To do so, press the push button on the far right (>>Open gripper<<) and briefly push the left joystick outwards.



34. Close the rod grippers. To do so, push the push button on the far left (>>Close gripper<<).



35. In order to completely loosen the screw connection between drill rod and sub-saver, switch on counter-clockwise rotation by pulling the left joystick.



36. Completely reverse the thrust rig to the stop position by pulling the right joystick backwards.

Info!
The rod(s) can only be lifted out of the bore axis when the rod grippers are closed and the thrust rig is completely reversed.

37. Move the gripper arm upwards. To do so, briefly push the left joystick inwards.

38. Position the gripper arm above the rod box by briefly pushing the right joystick outwards.

Info!
The bore rig will automatically determine the bay of the rod box into which the drill rod has to be inserted.

39. Move down the gripper arm. To do so, briefly push the left joystick outwards.

40. Open the drill rod gripper. To do so, push the push button on the far right (>>Open gripper<<).

41. Move the gripper arm upwards. To do so, briefly push the left joystick inwards.

42. Advance the thrust rig to the next drill rod. To do so, push the right joystick forward.

43. As soon as the thread of the sub-saver is positioned below the rod lubrication, switch on the rod lubrication. To do so, push the front left push button.

44. Tap the icon on the right action panel to open the clamping tongs.

45. Proceed with the installation of the drill rods as described from point 12 until the rod box is full or the expansion complete.

6.9.4 Fully automatic mode for expansion drill/backreaming

Requirements

- The rod crane is not positioned above the bore axis.
- The screw connection between drill rod and sub-saver is situated precisely between the two clamping tongs.

Automatic rod cleaning

In the "Settings -> Bore parameters -> High pressure cleaner" menu, you can adjust the switch-on distance (1) of the rod cleaner during automatic pipe installation.

With the slider (2) below, you can set the switch-on duration of the rod cleaner.

In the present example, the rod cleaner would be switched on every 1 m for a duration of 5 s during automatic pipe installation or expansion. Setting either of the two values to zero deactivates automatic rod cleaning.



If automatic rod cleaning is disabled, you can manually enable it — also during automatic pipe installation — in the checkbox on the right action panel.

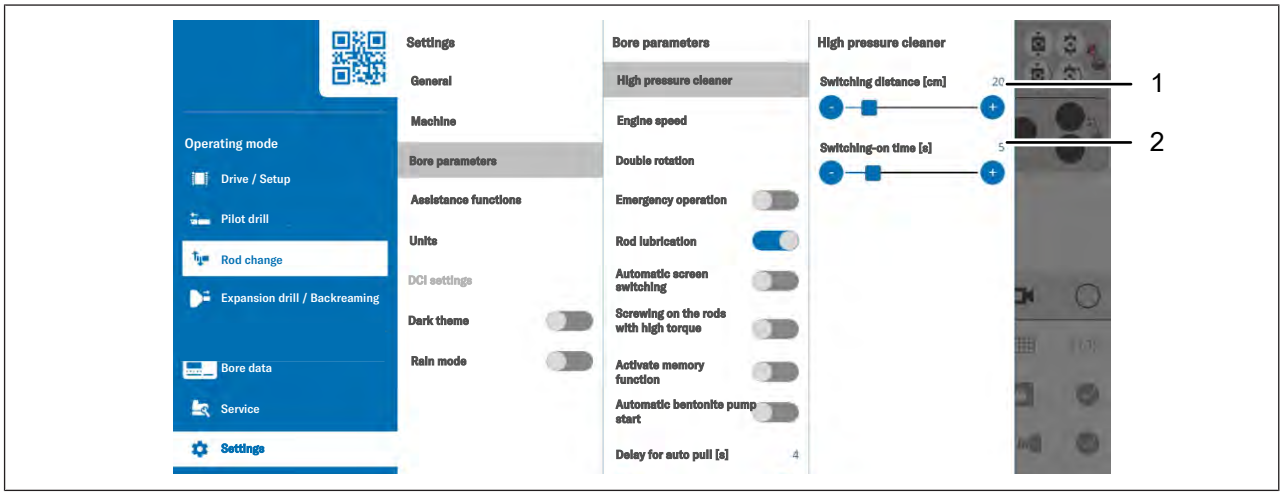


Fig. 6-117 "Settings -> Bore parameters -> High pressure cleaner" menu

⚠ DANGER

Risk of injury due to machine movements during auto-bore!

- Sit down on the operator seat to keep out of the machine's movement range.
- Remain seated until all working steps of the auto-bore have been completed.
- Make sure that nobody is standing in the machine's movement range.

1. Access the "Expansion drill / Backreaming" screen.



2. Tap the icon or the % value on the left action panel to set the sensitivity of the rotation and change the value moving the slider.



3. Tap the icon or the % value on the right action panel to set the traction speed and change the value moving the slider.



4. Push the front right push button twice in quick succession (within 1.5 s) to switch on the fully automatic mode for expansion drill/backreaming.

   ⇨ Expansion and rod exchange will be carried out automatically until all drill rods have been pulled in.

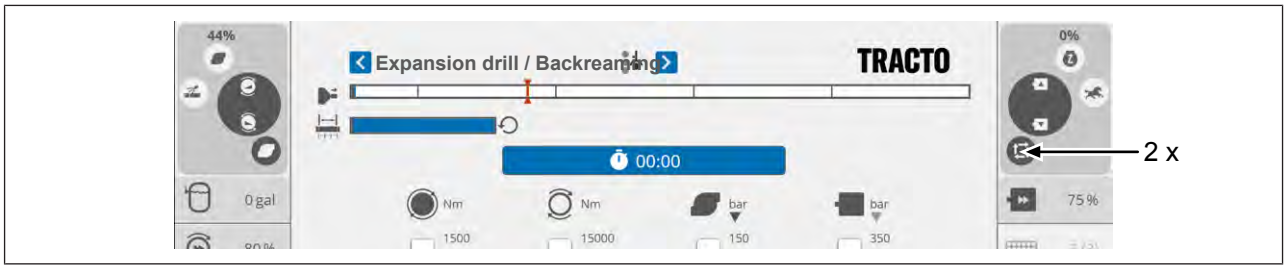


Fig. 6-118 Starting fully automatic mode for expansion drill/backreaming



To interrupt the fully automatic mode for expansion / pipe installation, push the front right push button again or leave the operator seat.

6.10 Cleaning of the exhaust gas system

Soot particles are usually combusted automatically as soon as a certain amount of soot particles has accumulated inside the soot particle filter (1) and the exhaust gas temperature is sufficiently high.

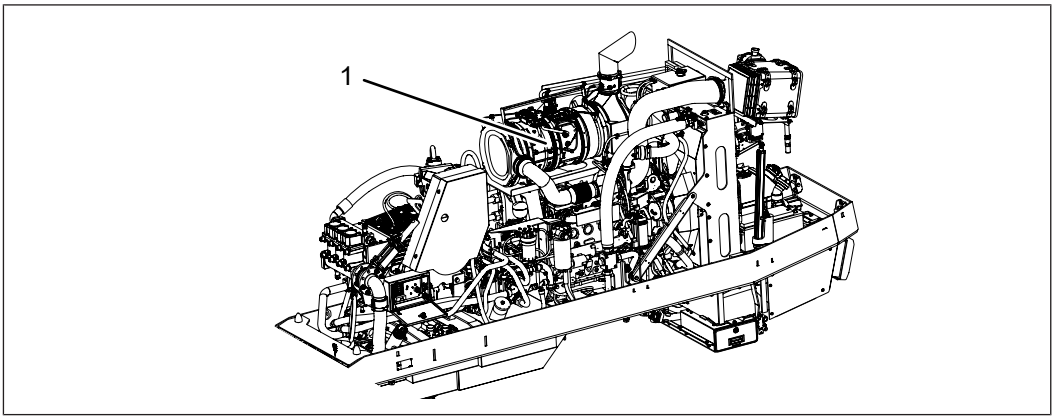


Fig. 6-119 Soot particle filter

Explanation of warning messages

The status indicators for the diesel engine and the cleaning of the exhaust gas system are displayed in the lower section of the screen on the operating terminal.

The icons of the cleaning of the exhaust gas system function as follows:

Tab. 6-55 Icon functions for cleaning the exhaust gas system

Symbol	Meaning	Remedy
 illuminated	**"Cleaning of exhaust gas system disabled" icon** — Is illuminated when the cleaning of the exhaust gas system (regeneration) is disabled in the "Settings -> Machine -> Regeneration" menu and active cleaning is prevented.	Only disable the cleaning of the exhaust gas system if high exhaust gas temperatures are hazardous. With disabling, stationary cleaning processes are required more often.
 illuminated	**Icon for increased exhaust gas temperature (HEST)** — Is illuminated in case of an excessively high exhaust gas temperature during the cleaning of the exhaust gas system (regeneration).	Make sure that the exhaust pipe outlet is not directed at combustible or ignitable surfaces.
 illuminated	**"Cleaning of exhaust gas system" icon** — Is illuminated when the exhaust gas system cannot complete an automatic cleaning process.	Make sure that the cleaning of the exhaust gas system (regeneration) is not disabled and continue to work until you can carry out a stationary cleaning of the exhaust gas system (regeneration) in parking position.
 flashing	**Flashing "Cleaning of exhaust gas system" icon** — Flashes when the stationary cleaning of the exhaust gas system has been triggered in the "Settings -> Machine -> Regeneration" menu. The icon continues to flash until the stationary cleaning process has been completed.	As soon as the icon has gone out, you can resume work as usual.

Symbol	Meaning	Remedy
 flashing	**"Cleaning of exhaust gas system" icon plus "Engine warning" icon** — If the exhaust gas system is not cleaned within an appropriate time frame after the "Cleaning of exhaust gas system" icon has lit up, the "Engine warning" icon is illuminated in addition and the engine power is reduced significantly.	Park the bore rig in a safe location and start cleaning the exhaust gas system in the "Settings -> Machine -> Regeneration" menu. Once the cleaning process has been completed, the normal engine power will be restored.
 flashing	**"Cleaning of exhaust gas system" icon plus "Engine stop" icon** — If the exhaust gas system is not cleaned within an appropriate time frame after the icons "Cleaning of exhaust gas system" plus "Engine warning" have lit up, the "Engine stop" icon is illuminated.	Interrupt the operation of the bore rig and stop the engine. Have the soot particle filter repaired by the TRACTO-TECHNIK customer service.

⚠ DANGER

Fire hazard due to inflammable materials near the exhaust pipe!



Inflammable materials near the exhaust pipe can ignite during cleaning of the exhaust gas system!

- Make sure that there are no inflammable particles in the ambient air (e.g. particles from a grain warehouse).

⇨ Otherwise, disable the combustion process by pressing the "Cleaning of exhaust gas system" switch.

NOTICE

Regeneration of exhaust gas after-treatment inoperative at a standstill!

Due to the missing regeneration of the exhaust gas after-treatment at a standstill, the engine may be damaged.

- Make sure that the potentiometer used for emergency operation for the engine speed is at the left stop during normal operation. Otherwise, regeneration of the exhaust gas after-treatment cannot be activated during standstill.

Starting the combustion process manually

1. Manually start the combustion of the soot particles as soon as the "Cleaning of exhaust gas system" icon is illuminated in the status line of the operating terminal.
2. Access the "Settings -> Machine" menu and tap "Exhaust system cleaning" (1).

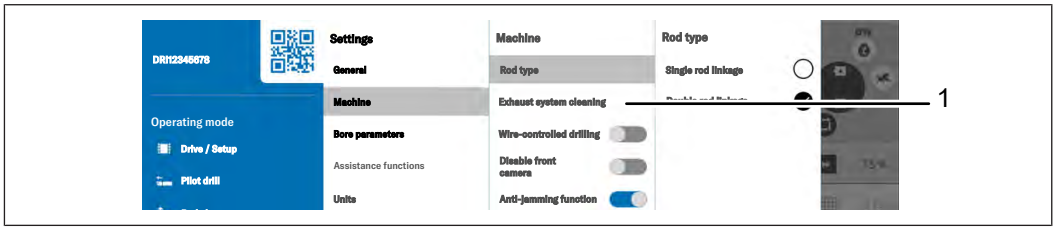


Fig. 6-120 Starting the cleaning of the exhaust gas system manually

⇨ The "Exhaust system cleaning" pop-up window opens.

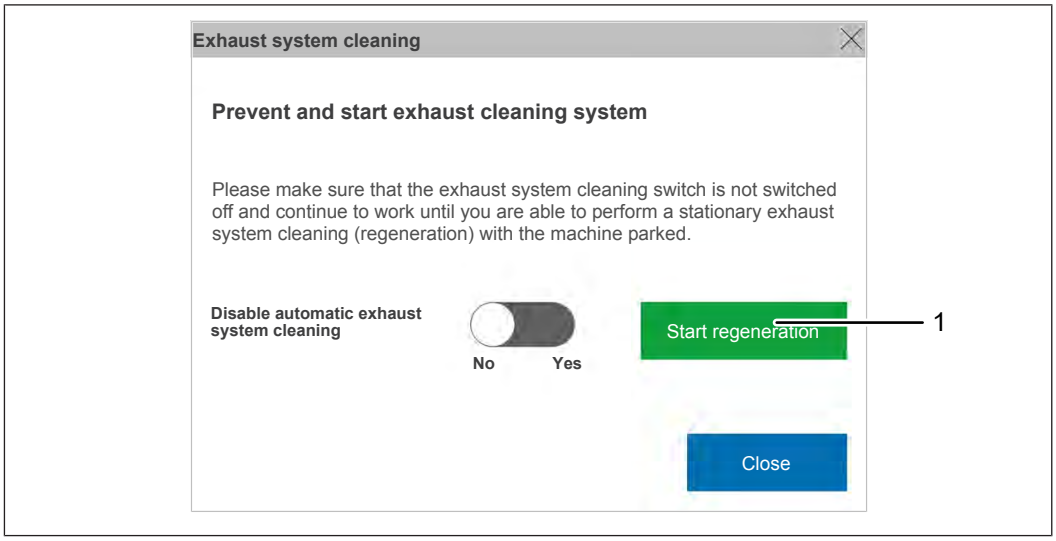


Fig. 6-121 Starting the stationary cleaning of the exhaust gas system

3. Tap the "Start regeneration" button (1).



⇨ The "Cleaning of exhaust gas system" icon in the status line continues to flash until the stationary cleaning process has been completed.

⇨ The engine speed is automatically increased during cleaning.

⇨ When the "Cleaning of exhaust gas system" icon goes out, the combustion process has been completed. Additionally, the engine speed will decrease.

6.11 Switching off the engine and locking the machine

Switching off the engine

1. Stop the engine by briefly pressing either the start/stop button (1) on the left joystick panel or the start/stop button (2) on the operating terminal.
2. Switch off the ignition by briefly pressing the "Gear wheels" push button (3) on the remote control key.

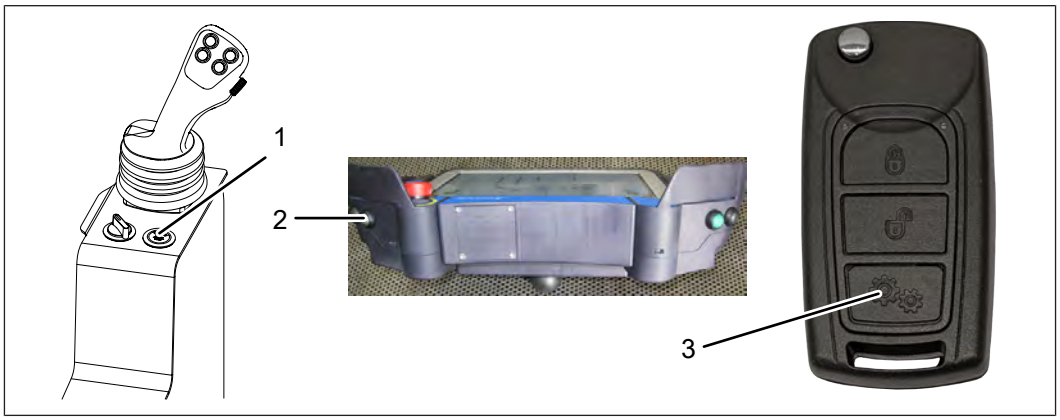


Fig. 6-122 Stopping the engine

Locking the machine

1. If you have been working from inside the cab, remove the operating terminal from the holder inside the cab and leave the cab.
2. Close the cab door from outside.
3. Fold up the footstep.
4. Briefly press the "Lock" push button (1) on the remote control key to lock the machine.



Fig. 6-123 Locking the machine

Requirements

- The accessories have been disconnected from the machine.
- All drill rods are inside the rod box.
- The loading crane is folded in.

For disassembly and de-installation, loosen the anchoring device and lift the anchor plate.

Carry out the following steps for disassembly and de-installation:

- loosen the anchoring device
- lift the anchor plate
- drive the rod crane to the parking position
- rise the stabilisers
- horizontally align the rig boom
- close the cab door
- fold up the footstep

Loosening the anchoring device

⚠ DANGER

Rotating drill anchor!
In case your clothing comes into contact with the drill anchor, there is a risk that you will be pulled in.



- Wear tight-fitting clothing.

1. Switch the "Drive mode/bore mode" rotary switch over to drive mode on the left joystick panel.
2. Open the "Drive / Setup" screen on the operating terminal.
3. Select the anchor boring rig with the checkbox (1) in the right action panel.
4. Move up the anchor boring rig with the rotating drill pulling down both joysticks (2, 3).
5. When the drill has been moved up, disable the anchor boring rig to access the "Drive / Setup" screen in "Drive" mode.



Fig. 7-1 Loosening the anchoring

6. Turn the >>Switch-over operation<< rotary switch on the right joystick panel to "operating terminal".
7. Remove the operating terminal from the holder and leave the cab.
8. Close the cab door.
9. Fold the upper footstep downwards and swing the whole footstep underneath the cab.

⚠ CAUTION

Impact hazard! Swivelling cab!

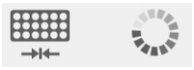
- When swivelling the cab make sure that no other person is put at risk.

10. When the cab has been swung out, tap on the cab (1) symbol in the "Drive / Setup" screen on the operating terminal.
    ⇨ The symbol is shown in blue.
11. Press the push button at the front left (2, arrow pointing inwards).
    ⇨ A warning message is displayed.
12. Make sure that nobody is put at risk by swinging out the cab and confirm the warning message with "OK" (3).
13. Press and hold the front left push button (2) again.
    ⇨ The cab moves until you release the push button or until the end position is reached.
    Once the end position is reached, the push button disappears.



Fig. 7-2 Swinging the cab in

Rod crane, stabilisers, rig boom



1. Press the >>Approach transport position<< (1) push button on the "Drive / Setup" screen of the operating terminal.
2. Press the push button at the front right (2, automatic button).
   - ⇨ The thrust rig and the rod crane move to the transport position.
   - ⇨ During travel into the transport position, the checkbox next to the >>Approach transport position<< button rotates.
   - ⇨ As soon as the transport position has been reached, the checkmark appears in the checkbox (3).
3. Lift the front and rear stabiliser by tapping the corresponding stabiliser (4, 5) on the operating terminal and moving it upwards with the outer left push button (6, arrow pointing upwards).
4. Select the respective tilt cylinder (8, 9) and tap the push buttons (6, 7) to horizontally adjust the rig boom.

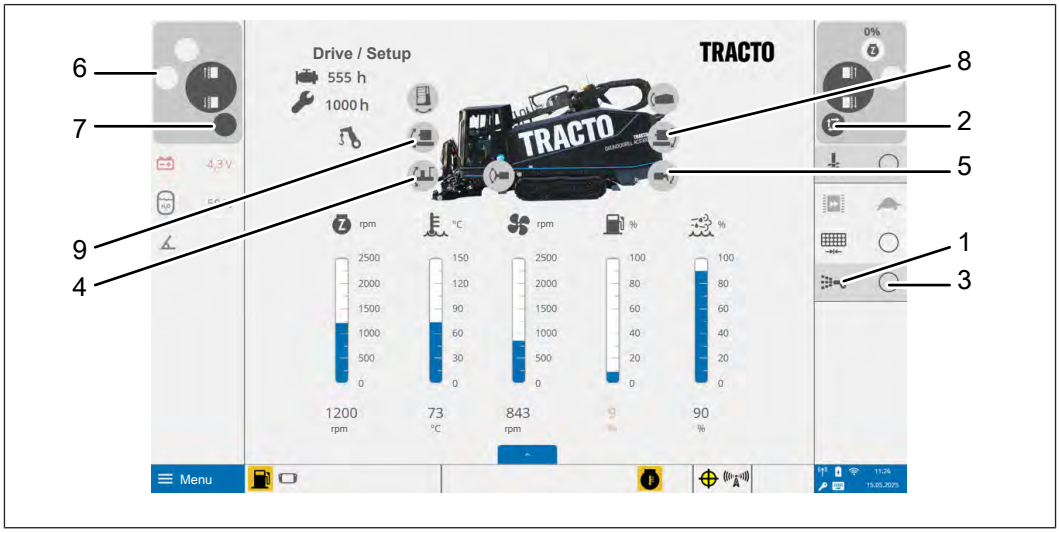


Fig. 7-3 Approaching the transport position

Drive the machine to the intended location (chapter 5.3.10, page 92) or switch off the engine (chapter 6.11, page 251).

8.1 Indication of errors and faults

All warning and error messages are displayed as pop-up windows on the screen of the operating terminal.

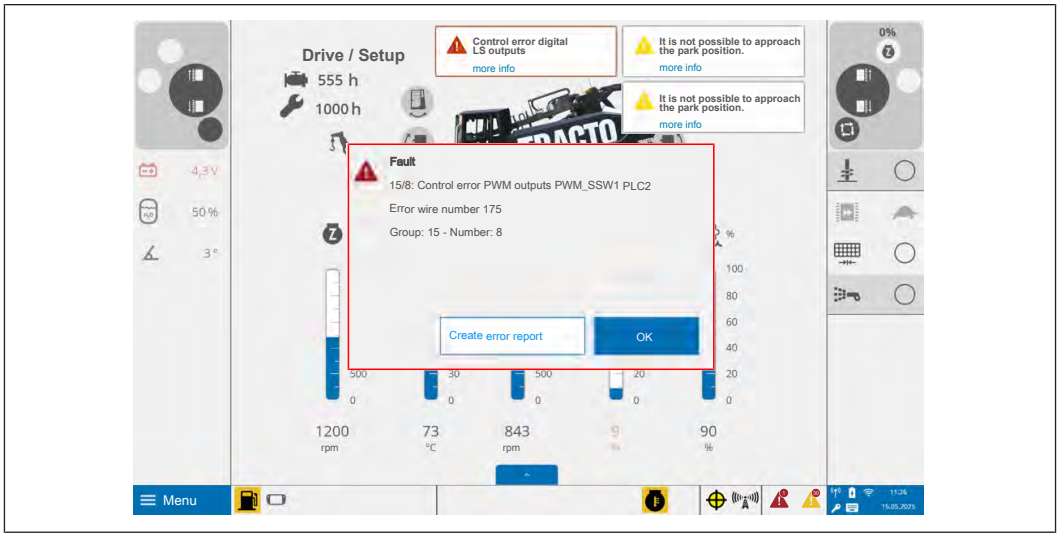


Fig. 8-1 Warning and error messages as pop-up windows (exemplary illustration)

In the status line of the screen, a yellow or red warning triangle indicating the respective number of warnings or errors is displayed.

Tap the warning triangles in the status line to display the list of warnings/errors. Tap the respective message in the screen.

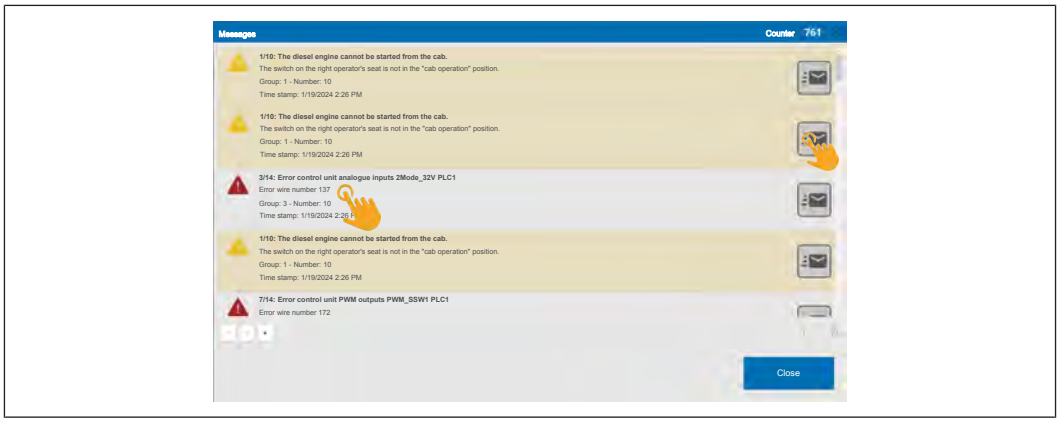


Fig. 8-2 List of warnings (exemplary illustration)

On that list, tap a warning/error to mark the message as "read".

Acknowledged error messages are hidden. Nonetheless, this does not mean that the fault is no longer present! After a restart of the machine, the error message is displayed again.

Correct the fault according to Tab. 8-2 and acknowledge the error message or contact the TRACTO-TECHNIK customer service for support.

Customer service

Tab. 8-1 TRACTO-TECHNIK customer service:

Germany: **TRACTO-TECHNIK GmbH & Co. KG** Tel.: +49 2723 808-0 www.tracto.com E-mail: info@tracto.com		
USA / Canada: **TT Technologies Inc.** Tel.: +1 630-851-8200 www.tttechnologies.com E-mail: info@tttechnologies.com	Switzerland: **TRACTO-TECHNIK Schweiz AG** Tel.: +41 79 820 3897 www.tracto-technik.ch E-mail: info@tracto-technik.ch	UK: **T.T. UK LTD** Tel.: +44 1234 342 566 www.tracto-technik.com.uk E-mail: info@tracto-technik.com.uk
France: **Tracto-Techniques S.a.r.l.** Tel.: +33 160 42 49 40 www.tracto-technik.fr E-Mail: info@tracto-technik.fr	Africa: **TRACTO-TECHNIK Afrique S.a.r.l.** Tel.: +212 5 37 40 13 63 / 64 www.tracto-technik.ma E-mail: info@tracto-technik.ma	Pacific Rim: **TRACTO-TECHNIK Australia Pty Ltd.** Tel: +61 7 3420 5455 www.tracto-technik.com.au E-mail: info@tracto-technik.com.au

Error report

You can create an error report and send it to the TRACTO-TECHNIK customer service. In the list of errors/warnings, tap the envelope icon next to the respective error to indicate the error report. Alternatively, tap the "Create error report" field in the error message.
The option is only available with an active LTE connection.

Enter the name of the operator in the mandatory field (1). In addition to the information summarised by the system, you can enter your own error description (2). To send the error report, tap the "Create error report" field (3).

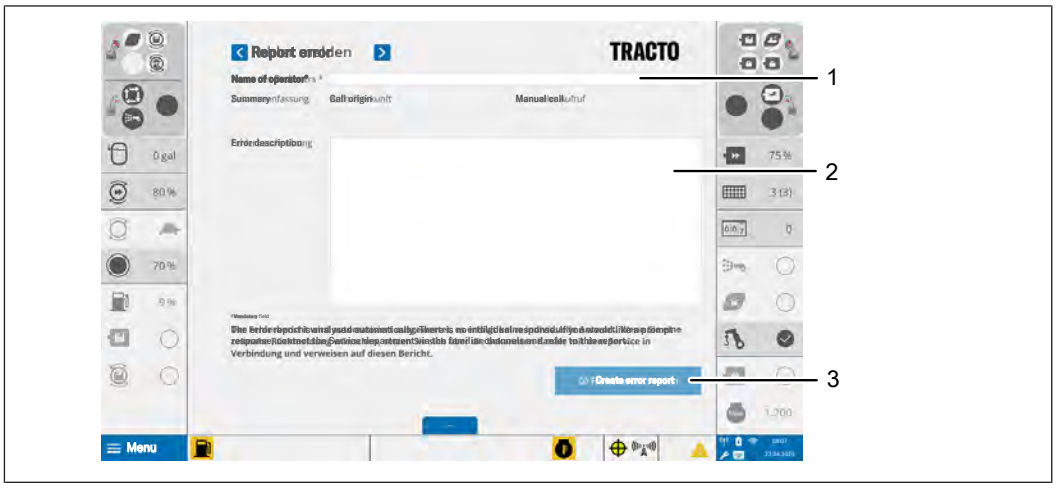


Fig. 8-3 Error report

The error report is analysed automatically. There is no individual response. If you wish for prompt feedback, please contact the TRACTO-TECHNIK customer service via the usual means and refer to this report.

8.2 Other faults and malfunctions

The following faults which are not indicated on the operating terminal can occur on the machine:

Tab. 8-2 Other faults and troubleshooting

Error	Cause	Rectification
Total failure of the hydraulic system	Defective hydraulic line, hose or connection in the system leading up to the hydraulic pump	Find the defective part in the system (also check the connections) and repair or replace it as needed
	Defective hydraulic pump	Have the hydraulic pump replaced
	Faulty electrical supply	Check the electrical supply and, if necessary, contact the TRACTO-TECHNIK customer service
Decreasing or insufficient hydraulic pressure in the entire drilling system	Excessive hydraulic oil temperature, defective fan	Check the fan at the hydraulic oil cooler
	Insufficient engine speed (depending on the system) of the drive unit	Check and if necessary adjust the engine speed (upon consultation with the TRACTO-TECHNIK customer service)
Leakage on hydraulic lines, hoses or connections	Threading subsidence or loosening of connections due to constant vibrations during machine operation	Re-tighten the leaking connections with adequate tools
	Worn or defective sealing rings (O-rings)	Check the sealing rings and replace them if required
Total failure of the electric system	Cable crushed	Repair cable or replace if damage is great
	Defective fuse in the electrical control cabinet	Replace fuses.
Leakage at the drilling fluid rotary feed-through	Sealing of rotary joint defective	Contact the TRACTO-TECHNIK customer service
The sub-saver is not screwed firmly to the drill rod.	Worn threading.	Check the sub-saver and replace it if necessary.
Failure of individual auxiliary functions	Electric limit switch of the respective function defective	Swap the electric cable plug of the defective function with one in working order and try to narrow down and localize the fault via the control unit (upon consultation with the TRACTO-TECHNIK customer service).
	Defective electrical switches or operating levers	Check the switches by means of a measuring device (upon consultation with the TRACTO-TECHNIK customer service).

Error	Cause	Rectification
Vigorous lashing of the drilling fluid supply line, no pressure or low drilling fluid pressure at the drill rods	Drilling fluid mixture or drilling fluid of too high viscosity	Work with more water contents or check feed pressure of transfer pump (approx. 2 bar).
	Incorrect position or closing behaviour of the ball valves at the drilling fluid mixing system	Check the position and functioning of the ball valves (see instructions for the mixing system).
	Contamination due to gravel or wear on the suction / pressure valves of the feed pump	Gravel stuck to the valves' sealing surfaces can sometimes be removed by controlled blows of a rubber mallet onto the blind caps of the feed pump housing. Otherwise, disassemble the pump and remove the foreign objects manually. Replace defective valves. To do so, the pump has to be disassembled first.
	Worn seals of the feed pump	Check the seals and replace them if necessary.
	Hydraulic motor of the feed pump defective or insufficient hydraulic oil supply	Check the pressure at the measuring connection and, if necessary, contact the TRACTO-TECHNIK customer service.
	Icing inside the drilling fluid mixing system	Carefully defrost by use of a hot air blower or gas burner (see also chapter 9.20, page 291).
Failure of the control unit	Malfunctioning control system	Contact the TRACTO-TECHNIK customer service
Failure of the transmitter or receiver during drilling	Empty transmitter batteries or defective transmitter (check via receiver indication)	See instructions provided by the manufacturer of the detection system.
	Above- or underground electromagnetic or metal-related interferences.	Pull the rock drilling unit back to the point where the measuring data was still correct. If necessary, exchange the probe for a more powerful one
	Empty receiver batteries (check via the receiver indication)	Replace batteries.
Ignition/engine cannot be switched on or off with the remote control key	Battery of the remote control key discharged	Replace battery
Cab cannot be unlocked/ locked with the remote control key		
Ignition/diesel engine cannot be started	Initialisation error of the safety control unit in the drive	Check whether the LED for PLC2 is glowing switch off ignition for 5 seconds and switch on again
Bonnet cannot be opened		Contact the TRACTO-TECHNIK customer service

9.1 Safety instructions for maintenance and troubleshooting

⚠ DANGER

All maintenance, repair and troubleshooting activities involve an increased risk of accident!

- Only perform maintenance, repair and troubleshooting activities when the machine is shut down.
- Switch off the engine before starting maintenance, repair or troubleshooting activities.
  Safely store the remote control key so that the engine is not switched on unexpectedly.
- Interrupt the power supply by switching off the main power switch.

  ⇨The hydraulic lines are immediately depressurized.

⚠ WARNING

Risk of injury due to coolant spurting out during maintenance work on the air conditioning system!

Pressurized coolant can injure you when it spurts out.

- Have work on the air conditioning system carried out only by a specialist company or specially trained personnel.

NOTICE



Oils and greases hazardous to the environment!

Danger of environmental pollution!

- Do not let oils and greases penetrate into the soil, waters or the sewage system.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.

NOTICE

Environmental damage caused by coolant!



Coolant leaking out during maintenance work of the air conditioning system can pollute the environment.

- Collect any leaking coolant.
- Observe the safety precautions and regulations in the technical and toxicological data sheet from the coolant manufacturer.

– Carefully read all safety information contained in this manual before starting any maintenance work.
– Maintenance work must only be carried out by appropriately authorised personnel.
– By yourself, only perform the maintenance and adjustment works specified in this manual. For additional works contact the customer service of TRACTO-TECHNIK.
– If necessary, secure a large area around the maintenance zone.
– Clean the machine, in particular the connections and screw fittings, to remove oil, fuel and maintenance products before starting maintenance and repair work.
– Once the maintenance, repair and troubleshooting work is completed, reattach all safety devices and check them for proper functioning.
– Retighten any screw connections that have been loosened for maintenance, repair and troubleshooting activities.
– After completion of maintenance, remove the tools and repair materials from the operating site.

9.2 Safety instructions for work on the hydraulic system

Observe the following when working on the hydraulics and when handling hydraulic oil:

⚠ CAUTION



Contact with hydraulic oil!

Hydraulic oil is a chemical product which, in the case of skin contact over a longer time, may cause skin irritations or allergic reactions. In the case of eye contact, hydraulic oil may damage your eyes.

- When performing maintenance work on the hydraulics, wear protective goggles and gloves.
- Observe the safety precautions and regulations in the technical and toxicological data sheet from the hydraulic oil producer!

⚠ DANGER

Hydraulic oil spurting out!
Residual pressure between cylinder and check valve when the rig boom is inclined or the clamping mechanism closed, as well as at the stabilisers!

Pressurized hydraulic oil can injure you when spurting out.

- Never tighten pressurized screw fittings.
- Depressurize the hydraulic system before starting maintenance, servicing and repair work by switching off the machine!



- When carrying out maintenance work on the hydraulics, fire, open light and smoking are prohibited.
- Work on the hydraulic system may only be performed by persons with special skills and experience in the field of hydraulics.

Hydraulic hose lines

Observe the following when handling hydraulic hose lines:

- Hydraulic hose lines must not be extended.
- Make sure that the connections are correct.
- Comply with the minimum bending radius for hydraulic hose lines as specified by the manufacturer.
- Regularly check all lines, hoses and screw fittings for leakages and visible damage. Rectify the damage immediately.
- Replace defective hydraulic hose lines.
- Exchange hydraulic hoses after expiry of their period of use even if there are no visible safety-related deficiencies on the hose line.
- The maximum period of use of the hydraulic hose lines is 6 years, including a storage duration of 2 years maximum. Notwithstanding this, the period of use can be determined in accordance with available test results, particularly taking into account the operating conditions. Please note the manufacturer's label on the hydraulic hose lines (date of manufacture: quarter and year or month and year).

NOTICE

Environmental damage due to hydraulic oil!



Leaking hydraulic oil will pollute the environment.

- Make sure that the damage is quickly remedied. Hydraulic oil entering the soil requires immediate large-scale excavation of the contaminated ground.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.
- Observe the safety precautions and regulations in the technical and toxicological data sheet from the hydraulic oil producer!

9.3 Safety instructions for work on the electrical system

⚠ DANGER

Danger due to electrical power!



Risk of injury due to electric shock upon contact with live parts.

- Switch off the machine before starting work on the electric system.
- Before carrying out any repair works on the electrical system, disconnect the ground cable from the battery of the drive unit or actuate the main power switch.
- Only allow skilled electricians or instructed persons working under the supervision of a skilled electrician to carry out work on the electrical system in accordance with the electrical engineering rules and regulations.

– Have the machine's electrical equipment checked by trained, skilled electricians regularly.
– Eliminate defects such as loose connections or scorched cables immediately.
– In the event of a short circuit, there is a sparking and fire hazard.
– Only use original fuses with the required current rating and tripping characteristic. When you replace a fuse, first search for the cause of the fault and remedy the fault before replacing the fuse.
– For work on live parts, use insulated tools only.
Work with another person who can switch off the machine via the main power switch in the event of an emergency.
– The battery voltage of the electrical system is 24 V.
– Do not disconnect any cables between the battery, regulator and alternator (e.g. by disconnecting the battery) while the diesel engine is running.
– Keep the battery clean and free from corrosion.
– Dispose of used batteries according to regulations.
– Switch off the main power switch when carrying out repairs (e.g. welding work) and when the machine is not operated for more than 2 days.

9.4 Checks by qualified persons

Have the whole machine checked by an authorised person at regular intervals.

Qualified persons are considered to be those persons that due to their technical training and professional expertise have sufficient knowledge about bore rigs. Furthermore, they must be familiar with the relevant national occupational safety and accident prevention regulations, directives and the generally accepted codes of practice, so that they are able to assess the condition of bore rigs with regard to safe operation.

The timeframes for the inspection must be defined by the machine operating company.

For further information please contact the TRACTO-TECHNIK customer service.

9.5 Maintenance intervals

The abbreviations in the table below have the following meaning:

the abbreviation:	means that the maintenance task has to be performed at the following intervals:
o.h.	after ... operating hours

The time specifications are based on an 8-hour working day. If the given number of operating hours is exceeded during the corresponding period (e.g. shift work), reduce the interval accordingly.

Info!
Annual maintenance activities are to be carried out by TRACTO-TECHNIK service personnel.

Tab. 9-1 Maintenance intervals

Maintenance activity	Maintenance interval [oh]								Further information
	50	500	1000	2000	4000	4500	5000	6500	
Safety devices									
Functional check of the emergency stop buttons	weekly								prior to start-up, chapter 9.8.3, page 273
Functional check of the electric shock protection device	x	x	x	x	x	x	x	x	prior to start-up, chapter 9.8.2, page 273
Visual inspection of the electric shock protection device	weekly								prior to start-up, chapter 9.8.1, page 273
Entire machine									
Performance of a general functional check*)	x	x	x	x	x	x	x	x	See check list regarding the inspection schedule
Performance of a visual inspection*)	x	x	x	x	x	x	x	x	chapter 9.9, page 274
Applying a sticker for the next maintenance	x	x	x	x	x	x	x	x	

Maintenance activity	Maintenance interval [oh]								Further information
	50	500	1000	2000	4000	4500	5000	6500	
Checking the screw connections for tight fit*)	x	x	x	x	x	x	x	x	once after 20 operating hours chapter 9.9, page 274
Lubrication of the machine	x	x	x	x	x	x	x	x	See check list regarding the inspection schedule and chapter 9.7, page 271
Cleaning	After every operation								chapter 10, page 295
Check of toothed racks and pinions of the thrust for damage*)	x	x	x	x	x	x	x	x	See check list regarding the inspection schedule
Checking hydraulic and electric lines for leak tightness and tight fit	daily								
Checking the rotational drive for functioning and leakages	daily								annual check by TRACTO-TECHNIK service technicians
Gear oil pump rotational drive Cleaning the magnet in the suction line	initially after 50 operating hours, then every 500 operating hours								
Checking the screw connections on the thrust motors for tight fit	initially after 50 operating hours, then every 500 operating hours								
Changing the battery of the remote control key	annually								chapter 9.11, page 279
Changing the gear oil for the thrust gear		x	x	x	x	x	x	x	
Checking the oil level of the thrust brake			x	x	x		x		every 1000 o. h.
Checking the modem connection	x	x	x	x	x	x	x	x	
Changing the fresh air filter for the cab heater			x	x	x		x	x	every 1000 o. h.
High-pressure filter crane carriage magazine		x							
Checking the screw connections of the tracks' guide rollers and drive wheels for tight fit	x	x	x	x	x	x	x	x	
Checking the track chain tension and re-tension if necessary*)	x	x	x	x	x	x	x	x	chapter 9.18, page 284
Check of the alignment of the drill rod magazine (bay position, bore axis, transport position)	x	x	x	x	x	x	x	x	
Hydraulic system									
Changing the hydraulic oil			x	x	x		x		
Changing the vent filter of the hydraulic tank*)			x	x	x		x		

Maintenance activity	Maintenance interval [oh]								Further information
	50	500	1000	2000	4000	4500	5000	6500	
Change of the hydraulic return-flow suction filter		x	x	x	x	x	x	x	
Cleaning and, if required, change of the hydraulic line filter auxiliary functions		x	x	x	x	x	x	x	
Checking the valve blocks for tightness and the levers for proper functioning	annually								
Checking the function and tightness of the hydraulic cylinders	annually								
Checking the hydraulic oil filter (return-flow suction filter) via the error messages on the display	daily								
Diesel engine (see instructions provided by the engine manufacturer)									
Checking the fuel supply	daily								Inspections before and during machine start-up
Checking the filling level of the DEF tank	daily								
Checking the engine oil filling level	x	x	x	x	x	x	x	x	See check list regarding the inspection schedule
Changing the engine oil and filter of the diesel engine	every 500 o. h.								
Changing the diesel prefilter and diesel main filter			x	x	x		x		
Changing the air filter			x	x	x		x		
Checking the combined cooler for dirt and cleaning it, if necessary	x	x	x	x	x	x	x	x	
Checking the combined cooler pressure cap			x	x	x		x		
Checking the coolant and charge air hoses for damage and tightness	x	x	x	x	x	x	x	x	
Checking the coolant level and antifreeze (-36 °C)	x	x	x	x	x	x	x	x	
Changing the coolant (-36 °C)				x	x				
Checking the battery poles for corrosion	x	x	x	x	x	x	x	x	
Checking the V-ribbed belt, tensioner and strap discs			x	x	x		x		
Adjusting the valves							x		
Changing the drive belts, fans				x	x				
Cleaning the diesel engine				x	x				every 2000 o. h.
Checking the diesel particle filter								x	

Maintenance activity	Maintenance interval [oh]								Further information
	50	500	1000	2000	4000	4500	5000	6500	
Replacing the filling filter for DEF tank				x	x				every 2000 o. h.
Changing the filter for DEF tank				x	x				every 2000 o. h.
Changing the filter for the DEF dosing unit					x				every 4000 o. h.
Checking the Bowex coupling and replace it, if necessary							x		
Drilling fluid pump									
Checking the connections for tight fit*)	annually								
Check of the toothed belt tension and wear	x	x	x	x	x	x	x	x	
Functional check of the pump	every 6 months								
Visual inspection of the pump for leakages	daily								
Checking the plunger of the feed pump for grooves or excessive drilling fluid leakage and meanwhile emptying the collection container	daily								

*) according to maintenance and inspection programme

9.6 Designations and number of filters on the machine

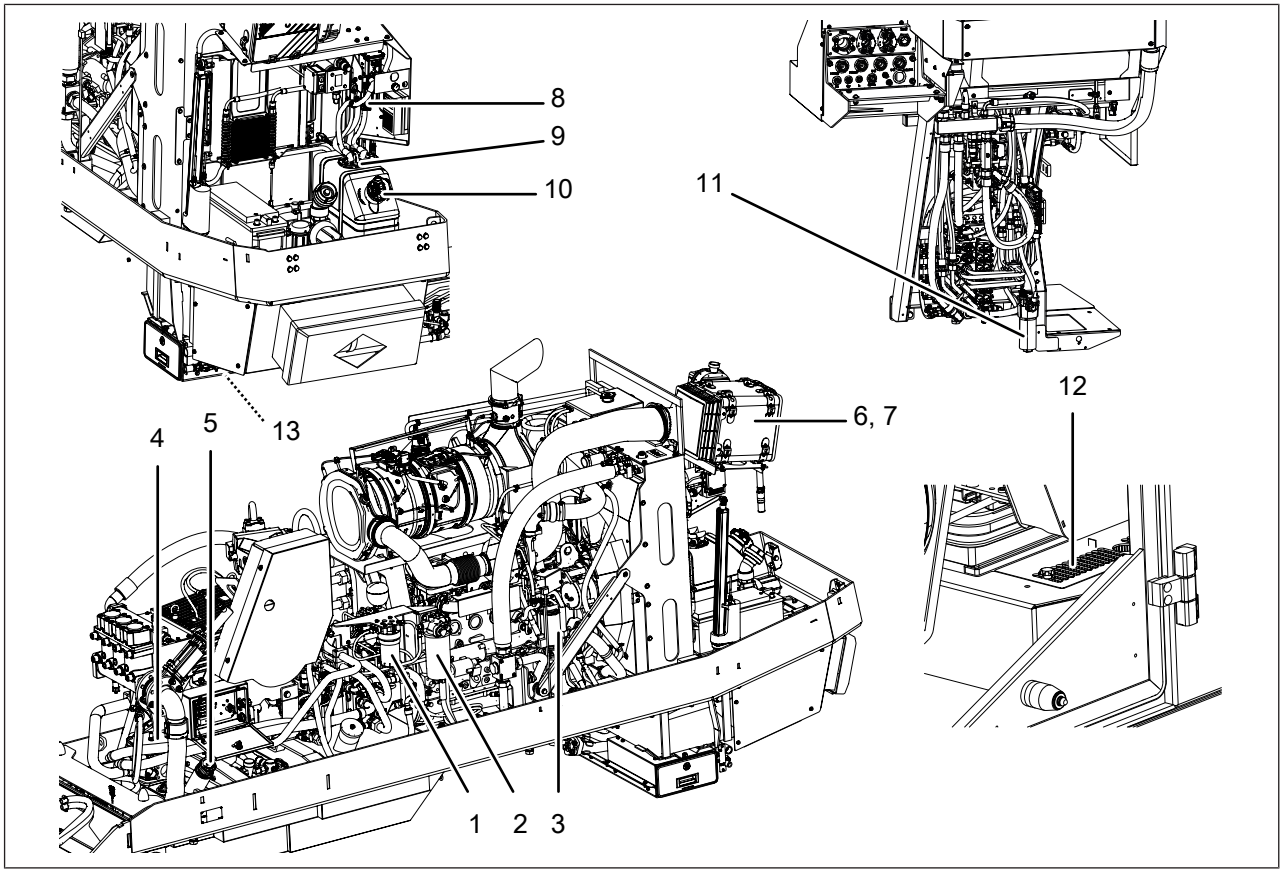


Fig. 9-1 Filters on the machine

Tab. 9-2 Filter designations and quantity

Item	Filter designation	Quantity
1	Diesel filter Stage V engine	1
2	Diesel pre-filter Stage V engine	1
3	Engine oil filter	1
4	Hydraulic reverse motion suction filter	1
5	Hydraulic tank vent filter	1
6	Cummins Stage V engine, airfilter, primary element	1
7	Cummins Stage V engine, airfilter, secondary element	1
8	Cummins Stage V engine, filter for DEF dosing unit	1
9	Cummins Stage V engine, DEF tank filter	1
10	Cummins Stage V engine, filling filter for DEF tank	1
11	High-pressure filter crane carriage magazine	1
12	Fresh air filter cab heating	1
13	Fresh water filter	1

9.7 Lubrication intervals and check of operating supplies

The abbreviations in the table below have the following meaning:

the abbreviation:	means that the maintenance task has to be performed at the following intervals:
o.h.	after ... operating hours

The time specifications are based on an 8-hour working day. If the given number of operating hours is exceeded during the corresponding period (e.g. shift work), reduce the interval accordingly.

Info!
Annual maintenance activities are to be carried out by TRACTO-TECHNIK service personnel.

Tab. 9-3 Lubrication intervals and check of operating supplies

Activity	Intervals [OH]								Further information
	50	500	1000	2000	4000	4500	5000	6000	
Drill rod									
Lubricating the threading	daily								chapter 9.12, page 280
Swivel									
Lubricating the swivel	daily								chapter 9.19, page 285
Pipe puller									
Lubricating the threading	daily								chapter 9.19, page 285
Drill head									
Lubricating the drill head	annually								chapter 9.19, page 285
Entire machine									
Checking the coolant level and the amount of antifreeze of the diesel engine	every 6 months								chapter 9.10, page 275
Lubricating the rod crane guidance	daily								chapter 9.19.1, page 286
Lubricating the crawler tracks' stabiliser cylinders	weekly								chapter 9.19.1, page 286
Lubricating the clamping mechanism	weekly								
Lubricating the tilt cylinders	monthly								
Lubricating the bearing of the rotational drive	before each application and 2–3 times daily during drilling as well as during the annual inspection								chapter 9.19.1, page 286
Greasing the rollers of the thrust rig	before every application, after every cleaning process and during the annual inspection								
Thrust gear Changing gear oil		X	X	X	X	X	X	X	

Activity	Intervals [OH]								Further information
	50	500	1000	2000	4000	4500	5000	6000	
Changing the gear oil of the track-mounted undercarriage*)			X	X	X		X		
Check hydraulic oil level	daily								Inspections before and during machine start-up
Change of the hydraulic oil			X	X	X		X		
Pump for high-pressure cleaner									
Changing the gear oil*)	X	X	X	X	X	X	X	X	
Drilling fluid pump									
Changing the gear oil*)	X	X	X	X	X	X	X	X	
Check and, if required, change of the bushings and valves or piston seals	daily								see manufacturer's instructions

*) according to maintenance and inspection programme
**) if available

9.8 Maintaining the safety devices

9.8.1 Visual inspection of the electric shock protection device

1. Check the grounding cables for intact insulation, plugs and connections.
   ⇨ Replace defective grounding cables with new ones.
2. Check the step grid and grounding mats for intactness.
   ⇨ Replace the defective step grid or the defective grounding mat with a new one.
3. Check the grounding stake for intactness.
   ⇨ Replace the defective grounding stake with a new one.

9.8.2 Functional check of the electric shock protection device

Check the electric shock warning device as described in chapter 5.5.1, page 100.

9.8.3 Functional check of the emergency stop buttons

1. Start the engine (chapter 5.3.1, page 78).
2. Press one of the emergency stop buttons.
   ⇨ The engine must switch off.
3. Try to restart the engine.
   ⇨ It must be impossible to start the engine. The actuated emergency stop button is fully functional.
   ⇨ Keep the machine shut down if the emergency stop button is not functioning properly.
   ⇨ Have the fault rectified by a skilled electrician.
4. If the emergency stop button is fully functional, turn it clockwise to unlock it.
5. Repeat the functional check with all remaining emergency stop buttons on the machine and on the operating terminal.

9.8.4 Checking the safety signs and labels

Check the safety signs and labels at the machine for completeness and legibility.

Renew illegible safety signs and labels.

9.9 Maintaining the machine

Visual inspection

Visually inspect the entire machine for intactness.

Keep the machine shut down if cracks or wear are visible. In this event return the machine to TRACTO-TECHNIK for maintenance.

Screw connections

Check the screw connections on the machine for tight fit.

Retighten any loosened screw connections before starting to operate the machine.

Welded connections

Visually check the welded connections on the machine for their perfect condition.

Keep the machine shut down if cracks or wear are visible. In this event return the machine to TRACTO-TECHNIK for maintenance.

9.10 Maintaining the diesel engine

⚠ DANGER

Explosion hazard due to mixed fuel!



Do not mix petrol or diesel with alcohol or petrol containing ethanol ("gasohol").

NOTICE

Risk of damage to the fuel pump and the injection system.

- Make sure that the diesel fuel is free from water and dirt.

Info!
The diesel engine complies with the requirements of the Stage V exhaust emission standard.

– US EPA and EU legislation stipulate the usage of ULSD fuel.
– Only use diesel fuel ultra-low in sulphur (ULSD) with a max. sulphur content of 15 ppm.

NOTICE

Potential damage due to incorrect engine oil.

- Only use low-ash engine oil.

NOTICE

Use diesel exhaust fluid (e.g. AdBlue®) with API certification [American Petroleum Institute] according to DIN 70700, ISO 22241-1 and AUS-32.

This ensures the necessary purity and concentration of urea.

Info!
If you have any questions on the use of the correct diesel fuel, please contact the TRACTO-TECHNIK customer service.

9.10.1 Instructions on daily maintenance

Check the diesel engine
- for a sufficient level of all lubricants and liquids
- for leakages
- for loose or damaged parts
- for changes in the system behaviour
- for an unusual fuel smell
- for an unusual smell coming from electrical components (e.g. charred cables)
- for unusual noises

Carry out the checks daily in order to identify further necessary maintenance activities in time and thus to ensure optimum performance of the mechanical and electrical components of the diesel engine.

The following occurrences, types of damage, errors and faults require further maintenance activities:
- low lubricant pressure
- low supply voltage
- sudden change of engine power
- erratic or irregular reaction when actuating an operating element
- lighting up / permanent illumination of the warning lamps and indicators
- unusual cooling water or oil temperature
- unusual operating noise
- excessive development of smoke/exhaust gases
- excessive consumption of coolant, lubricants or fuel
- leakages in the area of the coolant, lubricants or fuel
- loose or damaged parts
- worn out or damaged drive belts
- worn out or damaged electrical components

Contact your TRACTO-TECHNIK customer service!

9.10.2 Engine operation at temperatures < 0 °C

NOTICE

At ambient temperatures of < 0 °C, use diesel fuel with a cetane number of at least 45.
At ambient temperatures of > 0 °C, use diesel fuel with a cetane number of at least 42.

Using diesel fuels with another cetane number may cause start-up difficulties, instability and excessive development of white smoke. In order to obtain a satisfactory operational behaviour even at low ambient temperatures, only use diesel fuel in accordance with the recommended cetane number.

Antifreeze

Use antifreeze complying with the requirements under ASTM 4985 (specification GNM6038M) or ASTM D6210. Reduce the maintenance intervals when using antifreeze with a low silicate content (e.g. according to ASTM D4985 (specification GNM6038M)).

Fill the cooling system with an equal quantity of high-quality water (low in calcium, magnesium, chloride and sulphate) and antifreeze. The details can be found in the table below.

Tab. 9-4 Water quality for mixing antifreeze

Substance	Quantity
Calcium and magnesium	max. 170 ppm as $CaCO_3$ + $MgCO_3$
Chloride	40 ppm as Cl
Sulphate	100 ppm as SO_4

Info!
If you have any questions on the use of the correct antifreeze, please contact the TRACTO-TECHNIK customer service.

9.10.3 Greasing oils

Only use high-quality and highly resistant SAE 10W-40 greasing oils complying at least with the CES 20081 standard (Cummins Engineering Standard) and the API classification CJ-4.

Tab. 9-5 Greasing oils – classification

Cummins Engineering Standard classification (CES)	American Petroleum Institute classification (API)	Comment
CES 20081	CJ-4/SL	Minimum required oil classification

Info!
Use a funnel with an angled tube or similar when topping up engine oil.

NOTICE

Potential engine damage due to incorrect greasing oil.

Greasing oils complying with the API classification CJ-4 do not necessarily meet the CES 20081 standard.

- Always make sure that the used greasing oil also meets the CES 20081 standard. Further details regarding the use of greasing oils in Cummins engines can be found in the latest version of the "Cummins Engine Oil Recommendations, Bulletin 3810340".

Info!
If you have any questions on the use of the correct greasing oil, please contact the TRACTO-TECHNIK customer service.

9.11 Changing the battery of the remote control key

Info!
Change the battery once a year, preferably before the start of the winter months, to ensure unrestricted functioning of the remote control key.

⚠ WARNING

Explosion hazard!

If the battery is replaced with the wrong type of battery, there is a risk of explosion.

- Use a branded type CR2032 battery.

1. Fold out the key blade.
2. Press against the inner edge of the cover (arrow) to open the cover (1) of the battery compartment on the bottom of the key.



Fig. 9-2 Opening the remote control key

3. Remove the battery (1) with a suited tool such as a small screwdriver.

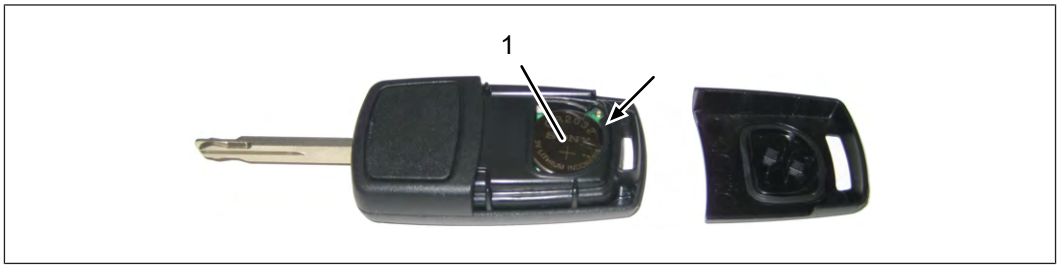


Fig. 9-3 Removing the battery

4. Insert the new battery (1) into the battery compartment (2) with the positive pole pointing up.
5. Press the cover (3) back on to the battery compartment.



Fig. 9-4 Inserting the battery

9.12 Maintaining the drill rods

1. Visually inspect the drill rods for intactness.
2. Perform a magnetic particle test on the drill rods at least once a year.
   ⇨ The drill rods must be free from cracks, deep notches, visible wear and distortions. The threads, too, must be free from wear.
   ⇨ In one or more of these cases, replace the respective drill rod(s) by a new one / new ones.
3. Check the outer diameters of the threaded connectors of the drill rods and the inner connectors for wear at least once a year.
   ⇨ Replace the drill rod(s) affected by (a) new one(s) if the rod diameter falls below the permissible wear limits. Information regarding the wear limits can be found in the data sheet for the drill rod. If you have any questions, please contact the TRACTO-TECHNIK customer service.
4. Clean the threading of the drill rods if required and apply a sufficient amount of approved thread lubricant (chapter 9.19, page 285).

9.13 Maintaining the pipe puller

Visually inspect the pipe puller. Check whether the clamping segments spread out during screwing.

The O-rings (2) must be available and undamaged.

The ring nut (1) must be undamaged and show no signs of corrosion.

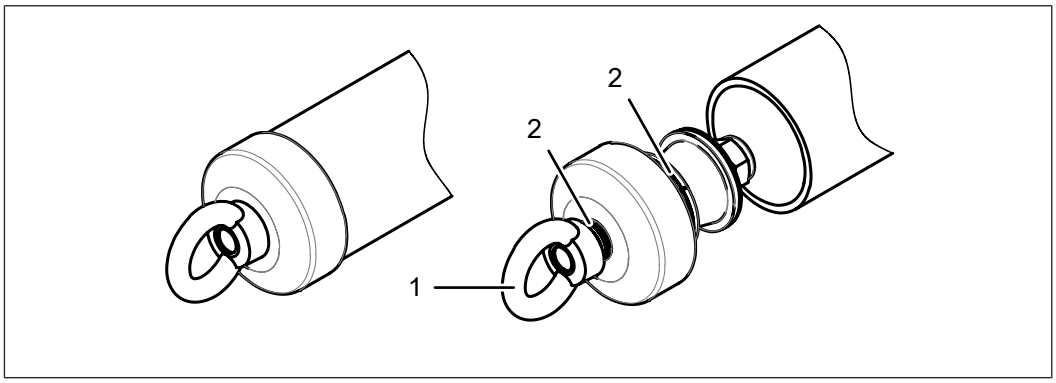


Fig. 9-5 Pipe puller

9.14 Maintaining the swivel

Visual inspection Check the swivel for damage and loose parts before every application. In case of visible damage to the lug (1) or loose screws, replace the affected components. Damages on the lug include corrosion, cracks or an ovally deformed mounting hole.

Lubrication Lubricate the swivel via the greasing nipple (2) directly after every application so that any dirt that might have entered is immediately pressed out again. If the lug can be rotated freely without any resistance before lubrication, the seal is defective. Replace the defective seal. Press grease into the greasing nipple until clean grease exits (see arrow).

Functional check Turn the lug by hand. It must be possible to turn the lug with an even force. If the lug gets jammed or makes noise when it is turned, do not use the swivel any longer. The lug may have an axial clearance of max. 0.5 mm and a radial clearance of max. 0.3 mm.

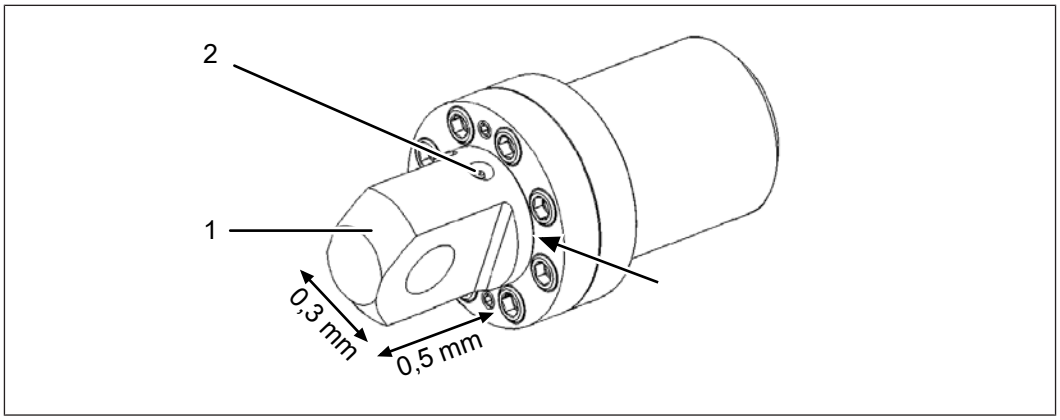


Fig. 9-6 Swivel

9.15 Maintaining the expander head

Check the entire expander head for intactness.

Furthermore, check the following at the expander head:
- the drilling fluid nozzles for intactness
- the permeability of the drilling fluid nozzles
- the threaded connection including the O-ring

Remove any burrs, thrown-up material and chippings.

9.16 Maintaining the roller chisel

Check the following at the roller chisel:
- the thread for intactness
- the permeability of the nozzles
- the bits for intactness
- the clearance of the roller chisel

Remove any burrs, thrown-up material and chippings. Check that all bits are soldered.

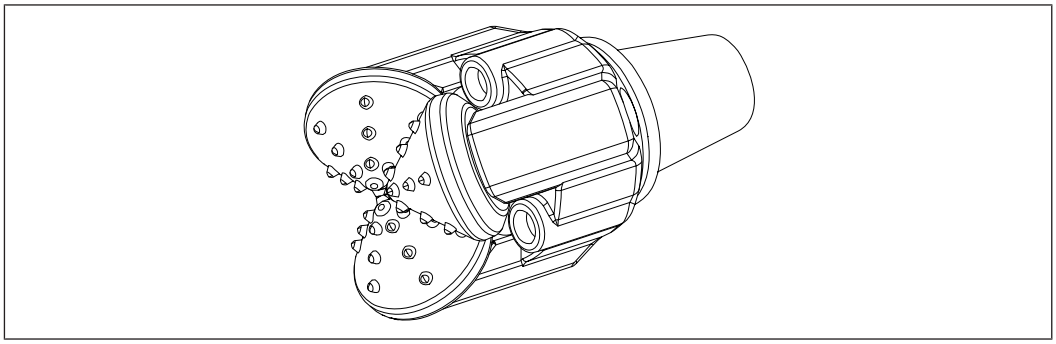


Fig. 9-7 Roller chisel for rock drilling

9.17 Maintaining the transmitter housing, transmitter and receiver

Visually inspect the transmitter housing, including the slots (2), the transmitter (1) and the receiver. Watch out for any damages and wear, fissures or abrasion.

Make sure that the threading, the bore holes and lock pins (3) of the transmitter housing are undamaged.

Carry out a functional check of transmitter and receiver according to the detection system manufacturer's instructions.

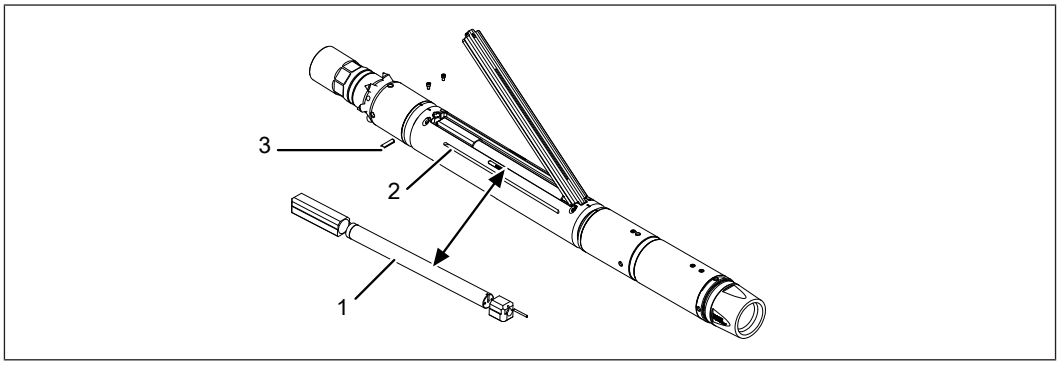


Fig. 9-8 Rock drilling unit with integrated transmitter housing and transmitter

Information regarding the structure of the rock drilling unit into which the transmitter housing is integrated can be found starting from chapter 5.8, page 106.

Check the batteries and the battery compartment as follows:

- To detach the battery cover, hold the transmitter to the metal housing into which the battery cover is screwed.
- Make sure that the threading of battery cover is free of dirt and rust.
- Check the O-ring of the battery cover for dirt and intactness to prevent the infiltration of humidity.
- Only use copper grease to lubricate the threading at the battery cover. When using another type of grease, the earthing contact of the batteries could be interrupted.
- Make sure that the spring of the battery cover is sufficiently pretensioned.
- Make sure that the battery's positive pole is intact.
- Check the transmitter function before every drilling task.
- Place the provided spring between the batteries to prevent any discharge due to vibrations.

9.18 Retensioning the track chain

Info!
Also observe the operating manual from the manufacturer of the track-mounted undercarriage.

1. Use the stabiliser and the rig inclination to lift the track chains to a degree that the track chain is freely suspended.
2. Remove the cover.
3. Attach the grease gun to the nipple (1).
4. Press in as much grease until the track chain is tensioned properly.
   ⇨ The sag (3) between the lower rollers and the track chain must be between 10 mm and 15 mm.

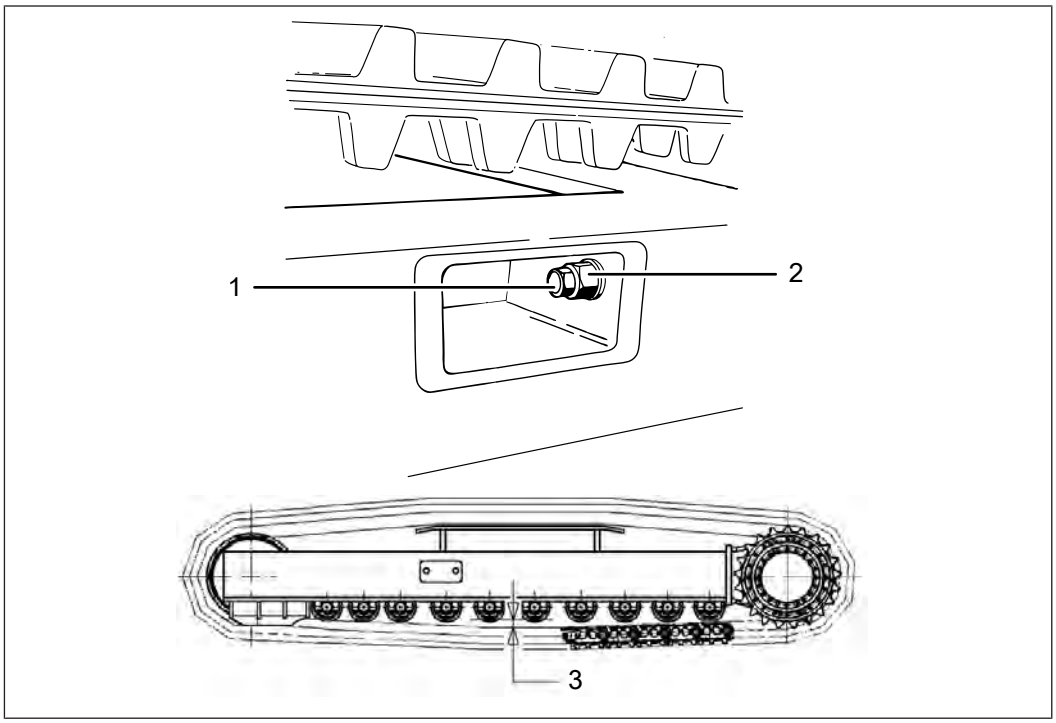


Fig. 9-9 Retensioning the track chain

5. If it is necessary to relieve the track chain (for example because too much grease has been pressed in), loosen the screw (2) on the grease nipple (1). Let the grease drain off until the chain has reached the necessary tension, then tighten the screw again.

9.19 Lubrication

NOTICE



Oils and greases hazardous to the environment!

Danger of environmental pollution!

- Do not let oils and greases penetrate into the soil, waters or the sewage system.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.

Note to the following instructions for lubricating the machine:

– Thorough lubrication of the machine is required to ensure failure-free operation and avoids costly repairs. This is particularly true for the proper lubrication of all bearings.
– Lubrication is carried out via the central lubrication pump.
– Carry out manual lubrication and all tasks necessary for lubrication when the machine is not running.
– Lubricate the bearings daily or within the given time schedules using the recommended lubricants.
– The recommended lubricants can be found in the lubricant table.
This recommendation does not exclude the use of third-party lubricants with the same characteristics.

Info!
Only use grease of the same type.

9.19.1 Lubrication points on the machine

The following lubrication points are located on the machine:

Central lubrication pump

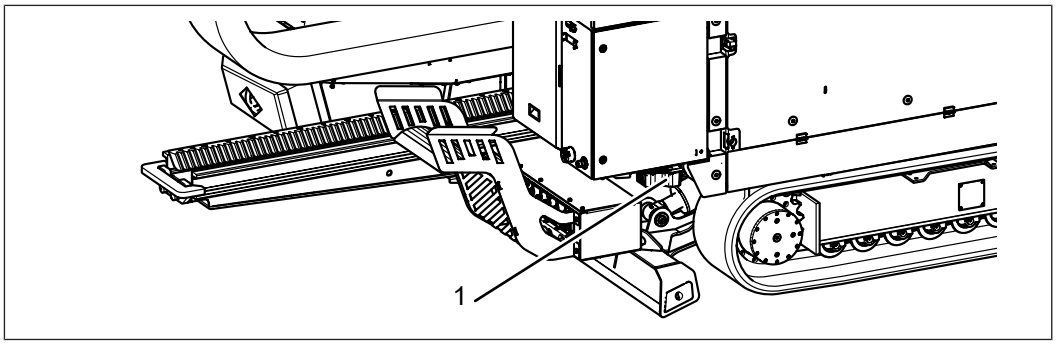


Fig. 9-10 Central lubrication pump

Tab. 9-6 Central lubrication pump

Item	Component	Number of lubrication points	Lubrication interval
1	Central lubrication pump	1	Check filling level on a daily basis and refill if necessary

Chassis, stabilisers, tilt cylinders

The lubricating bar for the chassis, the stabilisers and tilt cylinders is located at the rear, below the drive frame:

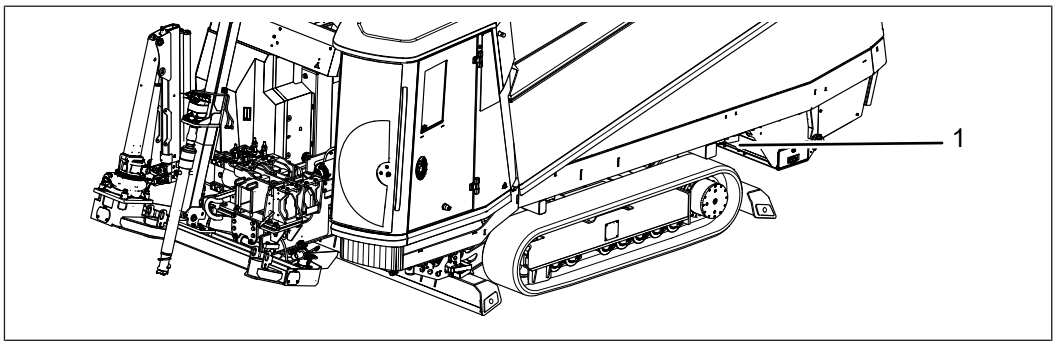


Fig. 9-11 Position of the lubricating bar for the chassis

Tab. 9-7 Lubricating bar for the chassis

Item	Component	Number of lubrication points	Lubrication interval
1	Lubricating bar for the chassis	8	weekly

Gantry crane

The lubricating bars for the gantry crane are located at the rear on the gantry crane:

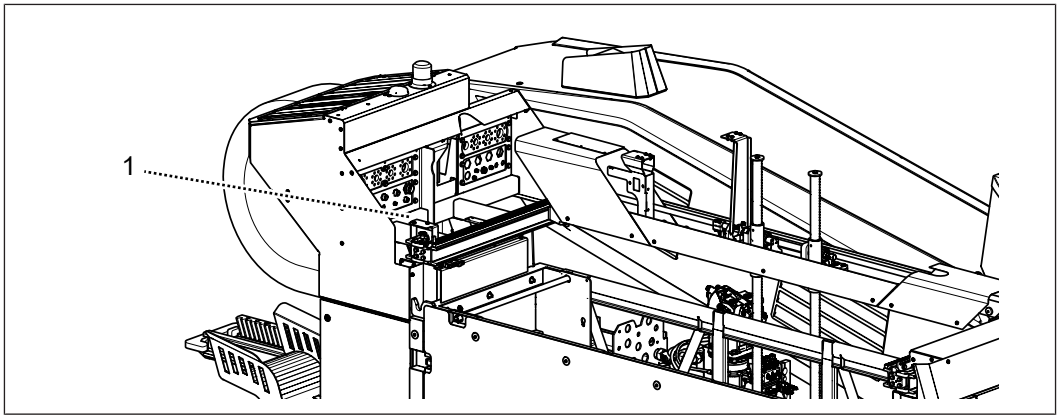


Fig. 9-12 Position of the lubricating bar for the gantry crane

Tab. 9-8 Lubricating bar for the gantry crane

Item	Component	Number of lubrication points	Lubrication interval
1	Lubricating bar for the gantry crane	4	daily

Clamping

The lubricating bars for the clamping are located at the front on the rod box, behind the protection cover:

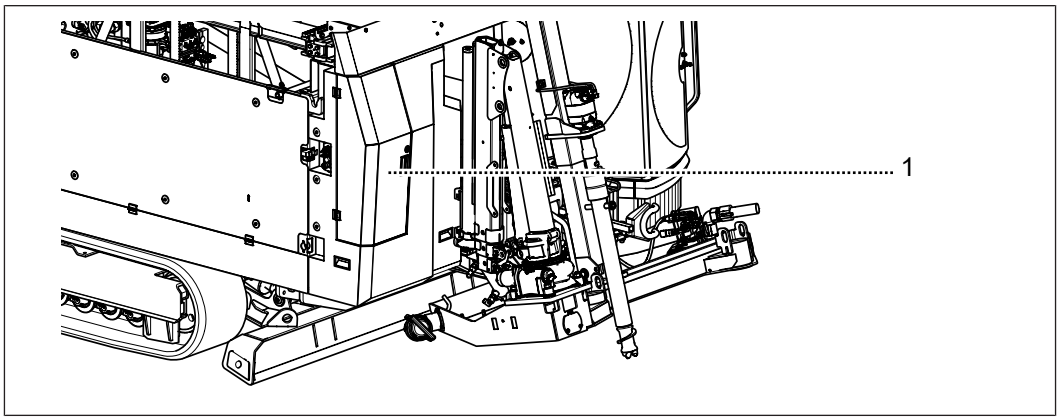


Fig. 9-13 Position of the lubricating bar for the clamping

Tab. 9-9 Lubricating bar for the clamping

Item	Component	Number of lubrication points	Lubrication interval
1	Lubricating bar for the clamping	4	weekly

Thrust rig

The lubricating bars for the thrust rig and the rotational drives are located on the thrust rig:

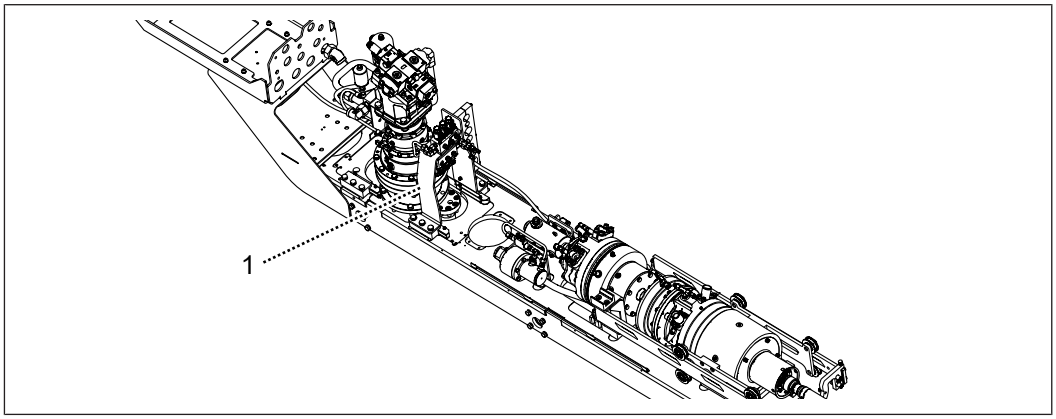


Fig. 9-14 Position of the lubricating bar for the thrust rigs

Tab. 9-10 Lubricating bar for the thrust rig

Item	Component	Number of lubrication points	Lubrication interval
1	Lubricating bar for the thrust rig	1	daily

Loading crane

There are six individual lubrication points on the loading crane:

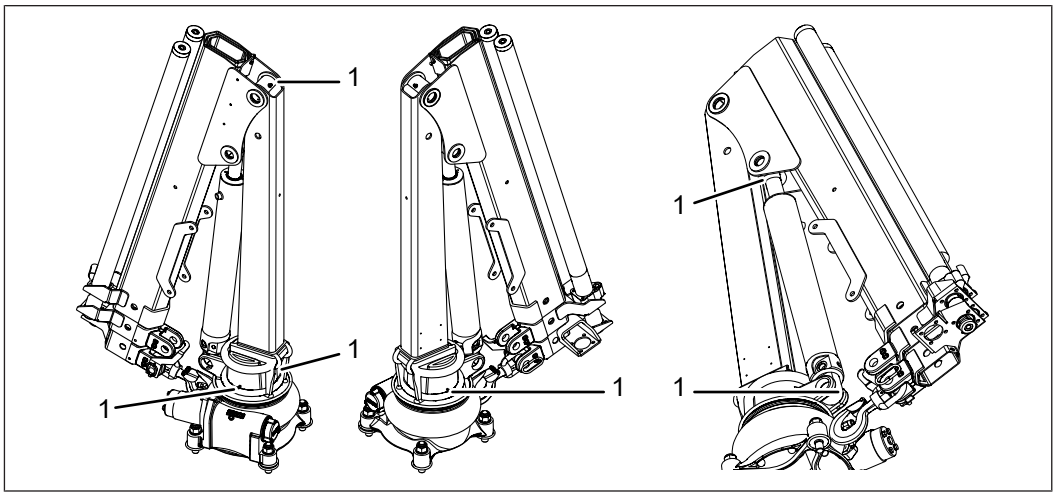


Fig. 9-15 Lubrication points on the loading crane

Tab. 9-11 Lubricating bar for the thrust rig

Item	Component	Number of lubrication points	Lubrication interval
1	Lubrication point on the loading crane	6	daily

9.19.2 Lubricant and greasing oil tables

Tab. 9-12 Lubricant and greasing oil table

Component	Filling quantity	Designation
Crawler tracks per gearbox	1.8 l	EP 85W-90
Hydraulic tank bore rig	151 l	Ultraplant BIO 46[1] Ultramax HVLP 68 [1] Ultramax HVLP 46 [1]
Diesel engine engine oil Cummins Stage V	17 l	SAE 10W/40[2]
Drilling fluid pump P80	9 l	EP 85W-90
Thrust gear	6.5 l	EP 85W-90
Thrust brake	0.29 l	ATF55
Rotation brake[3]	0.04 l	ATF55
Speck pump high-pressure cleaner	0.28 l	EP 85W-90
Air conditioning compressor-lubricating oil	150 ml	Refrigerator oil RENISO PAG100
Central lubrication system	2.5 l	Multi-purpose grease, lithium-based, NLGI 2, EP2
Lubricating bars	as needed	Multi-purpose grease, lithium-based, NLGI 2, EP2
[1] Optional hydraulic oil grade [2] Only use engine oil of API class CJ-4/SL or higher or CES-20081! [3] if available		

Lubricants for accessories

Tab. 9-13 Lubricants for accessories

Component	Lubricant
Drill head retainer	Multi-purpose grease, lithium-based, NLGI 2, EP2
Lubricating the swivel	Multi-purpose grease, lithium-based, NLGI 2, EP2
Lubricating the threading of the pipe puller	Multi-purpose grease, lithium-based, NLGI 2, EP2
Greasing nipple rig boom	Multi-purpose grease, lithium-based, NLGI 2, EP2
Drill rod threading	Multi-purpose grease, lithium-based, NLGI 1

9.19.3 Adjusting the grease quantity of the rod lubrication

Info!
The exact quantity for rod lubrication can be adjusted via a setting screw.

1. Unlock the quantity setting unit by loosening the counter nut (1).
2. Adjust the screw (2) for the quantity setting:
   - ⇨ Turn the screw into the quantity setting unit to reduce the grease quantity.
   - ⇨ Turn the screw out to increase the grease quantity.
   - ⇨ An indication for an ideal grease quantity is the grease being shortly before exiting when screwing together the drills. However, it must not ooze out.
3. Retighten the counter nut.

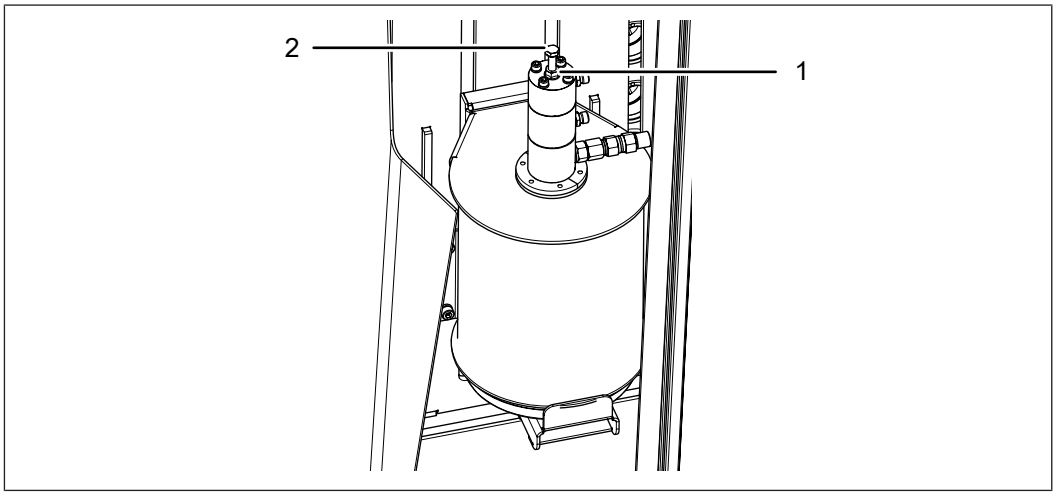


Fig. 9-16 Setting the drill rod greasing quantity

9.20 Frost protection measures

NOTICE

Engine damage due to non-approved antifreeze!

- Only use approved antifreeze for the diesel engine!
- Use ethanediol for the drilling fluid pump or the high-pressure cleaner.

Info!
Make sure that a drill rod is situated in the bore axis and rinse the bore rig with clean water before protecting the machine against frost!

Window cleaning unit

Fill an antifreeze agent suitable for de-icing car windows into the tank of the window cleaning unit (no ethanediol!). This will save you the trouble of manual ice scraping and prevents the window from freezing over again.

Engine cooling circuit

Check the antifreeze content in the cooling circuit of the diesel engine (see the engine manufacturer's instructions).

Water tank and high-pressure cleaner

Please proceed as follows to protect the water tank and the high-pressure cleaner against frost:

1. Empty the fresh water tank by opening the ball valve (1) at the drain (2) of the water tank.
2. When the tank is completely drained, close the ball valve.
3. Open the vent cap (3) and fill the water tank with approx. 3 litres of antifreeze.

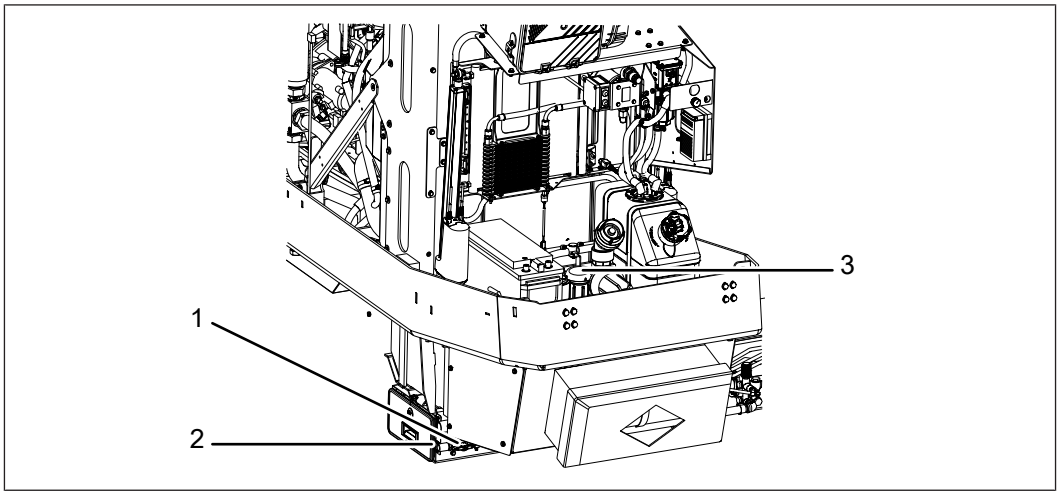


Fig. 9-17 Filling the fresh water tank with antifreeze

4. Operate the bore rig at idle speed.
5. Start to operate the high-pressure cleaner by means of the checkbox on the right action panel in the "Pilot drill" screen until the antifreeze exits through the rod cleaning nozzle or the cleaning gun.

Drilling fluid pump

Please proceed as follows to protect the drilling fluid pump against frost and relief its pressure:

Info!
The antifreeze for the drilling fluid pump is sucked from a can.

1. Open the ball valve (2) for the lower suction on the drilling fluid pump.
2. Close the ball valve (1) at the gate valve of the drilling fluid pump.
3. Take the transparent tube (3) and insert it into the opening of the antifreeze can.

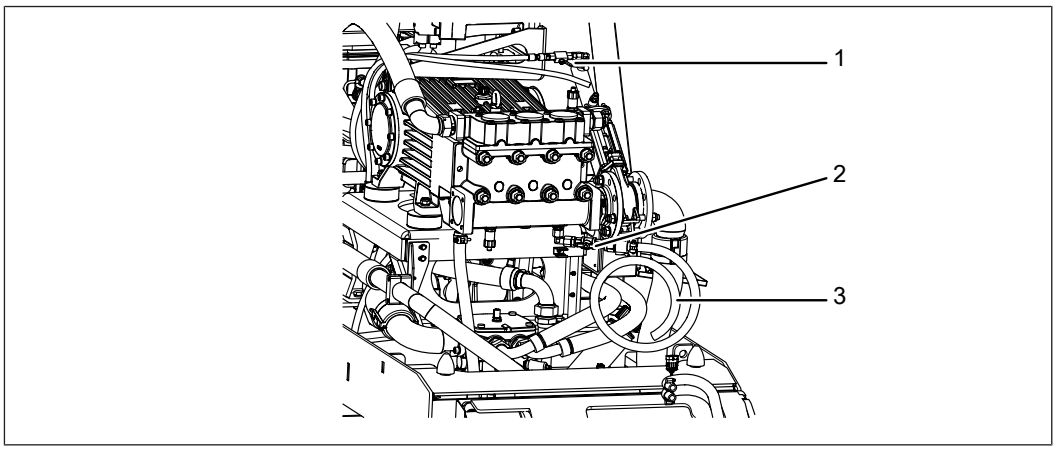


Fig. 9-18 Stop cocks drilling fluid pump

4. Operate the bore rig at idle speed.
5. Access the "Pilot drill" screen.



6. Set the drilling fluid flow rate using the left setting wheel to a low value.



7. Push the front left push button to switch on the drilling fluid pump.
8. Let the drilling fluid pump run until antifreeze exits at the pump's pressure relief and from the sub-saver.
9. Switch off the machine.

10. Immediately after switch-off, close the ball valve (2) for the lower suction on the drilling fluid pump.
11. Remove the transparent tube from the can and stow it safely.
12. Open the ball valve (1) at the gate valve of the drilling fluid pump.

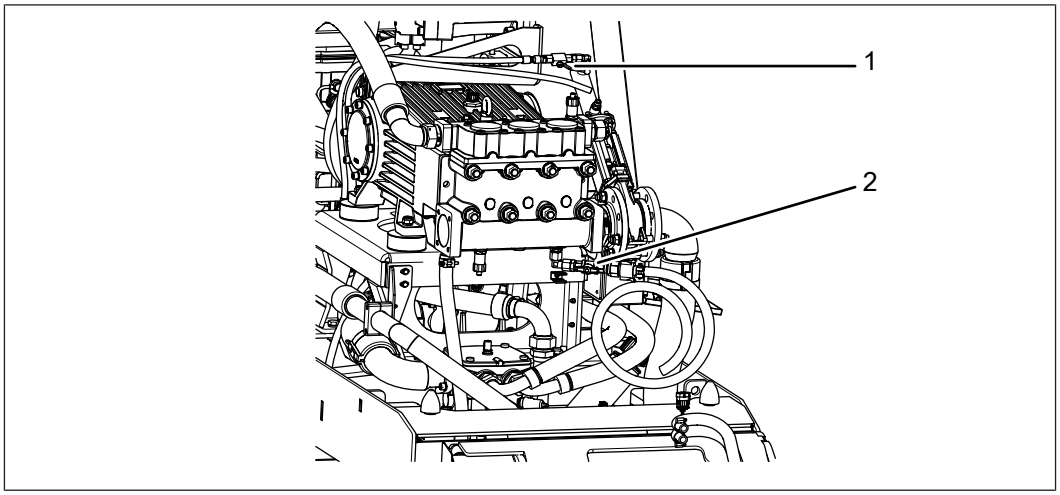


Fig. 9-19 Stop cocks drilling fluid pump

13. If necessary, tilt the rig boom so that excess antifreeze can run off.
14. Collect the excess antifreeze in a suitable container. Depending on the degree of soiling, it can be used again.

Clean the machine after every application.

Requirement

The machine is switched off and the system depressurized.

Cleaning the machine

Clean the operating elements inside the cab with a cloth, never use a high-pressure cleaner.

Clean the operating elements on the panel with a cloth, never use a high-pressure cleaner.

Close all protective caps and doors of the machine!

Connect the high-pressure cleaner as described in chapter 5.10, page 109.
- Clean the machine with the high-pressure cleaner.
- Clean the drill rods and the tools with the high-pressure cleaner.

Cleaning the operating terminal

If there are any water drops or another type of stains on the surface of the LCD display, immediately wipe them off. Otherwise, stains may remain.

NOTICE

The use of cleaning solvent, thinner or cleaning alcohol as well as the penetration of liquids damages the operating terminal!

The use of cleaning solvent, thinner or cleaning alcohol when cleaning the surface of the operating terminal can attack the surface and cause staining.
Penetrating liquids can result in malfunctioning and damage.
- Do not use commercial household cleaners or cosmetics since those may contain substances which attack the surface.
- Never spray water or cleaning agents directly on the surface.

To clean the touch-sensitive screen, use the soft cloth supplied with the operating terminal.

To clean other parts than the screen, wipe the surfaces with a soft, dry cloth (e.g. gauze). If you use cleaning agents, dip a soft cloth into water diluted with cleaning agent and wring out thoroughly.

Cleaning the remote control key

Clean the remote control key with a soft, clean, dry and lint-free cloth. For removing heavier soiling, you can lightly dampen the cloth with lukewarm water.
Only use solvent-free cleaning agents. The use of cleaning agents containing solvents can attack the plastic housing and the labelling.

Requirements

- The boom and the stabilisers are raised.
- The machine is switched off.
- The hydraulic system is depressurized.

11.1 Storage conditions

Store the machine and the accessories under the following storage conditions:

- dry
- under roof
- storage temperature in accordance with the outside temperature

11.2 Storing hydraulic hoses

For the storage of hydraulic hoses and hose lines observe the following:

- Store the hoses in a cool, dry place with low dust levels by wrapping them in plastic packaging material.
- Avoid direct sunlight or UV irradiation.
- Shield nearby heat sources.
- Avoid storage temperatures below -10 °C for elastomers.
  The most favourable storage conditions are temperatures between +15 °C and +25 °C as well as a relative humidity below 65 %.
- Make sure that no ozone-generating lighting fixtures, e.g. fluorescent light sources, mercury vapour lamps, or electrical appliances with sparking are used in the immediate vicinity of the storage location.
- Store hose lines away from substances which could cause damage, e.g. acids, caustic solutions or solvents.
- Store hose lines free of tension and in a horizontal position.
- When storing in loops, observe the minimum bending radius.
- Observe the maximum storage time of 2 years for hose lines and 4 years for hydraulic hoses. Dispose of the hoses when this limit is exceeded.

11.3 Storing lubricants

Lubricants such as oils and grease should be stored in clean, closed containers so that dust and humidity cannot penetrate the storage area. Store the containers in a dry and cool place.

Prevent oils and greases from penetrating into the soil, water or sewage system.

12.1 Disposal of auxiliary material

NOTICE



Oils and greases hazardous to the environment!

Danger of environmental pollution due to oils or greases.

- Do not let oils and greases penetrate into the soil, waters or the sewage system.
- Dispose of used oil, oily cloths and empty hydraulic containers in an environmentally responsible way and according to the respective laws of your country, e.g. at collection points.

Information on the quantity and type of auxiliary materials used can be found in the technical data and in the safety data sheets.

12.2 Disposal of the machine

Prior to disassembly, shut down the machine and drain the diesel fuel and the hydraulic oil from the machine. Observe the applicable country-specific disposal regulations.

For disposal, dismantle the machine and separate the components into the individual material groups:

- plastics
- non-ferrous metals (e.g. copper scrap)
- electronic scrap
- steel



The batteries of the operating terminal must not be disposed of as domestic waste. At the end of its life, dispose of the battery at an appropriate collection point only.

Dispose of the materials in accordance with your country-specific laws.

13.1 Checklist for construction site planning

Determine the date for the execution of the machine, intermediate and installation manholes / target pit whilst considering the aspects mentioned below.

Tab. 13-1 Checklist for construction site planning

		Comments
On-site conditions	Accessibility of the operating site	
	Ground conditions	
	Geological survey of the ground required	
	Obstacles in the intended bore path (foundations, pipes)	
	Plans of adjacent lines	
	Area for the installation of the product pipe	
	Determining the starting position in accordance with the technical parameters	
	Determining the location and excavation method for the working pits in accordance with the technical parameters	
	Determining the installation site for the drilling fluid system	Hoses and electrical cables must be long enough to reach the bore rig. It must be possible to re-fill the drilling fluid mixing system at the installation site.
	Minimum safety distance	
	Height difference between entry and exit point	
	Overlap minimum maximum	
Technical parameters	Length of the bore path	
	Clarifying the compliance with the min. permissible bending radius of the drill rods under on-site conditions	
	Determining the product pipe with regard to length, diameter and flexibility	
	Ordering the product pipe	
	Finding a water connection for the drilling fluid mixing system	
	Providing an additional lifting device if necessary	
	Planning transportation to the site	
	Determining the date for construction	

		Comments
Legal framework conditions	Local regulations (working hours, manhole arrangement, residential requirements), traffic regulations	
	Environmental requirements in the event of damage	
	Clarifying liability in case of work accidents	
	Clarifying liability in case of work deficiencies	
	Clarifying liability in case of environmental damage	
	Clarifying responsibilities for the disposal of potential residual water in manholes	
Official permits	Obtaining the required permits (traffic, Waterways and Shipping Office, excavation permit)	
Personnel	Assigning a site manager	
	Determining assistant workers	

13.2 Maintenance programme



The maintenance intervals are covered in this operating manual.
Non-compliance with the maintenance intervals invalidates any warranty claim!

The following form is used to document maintenance activities on the machine.

1. Perform the maintenance activities according to the table in chapter 9.5, page 266.
2. Fill in the date and operating hours of the inspection/repair performed.
3. Fill in the date or the operating hours of the next scheduled inspection.
4. Fill in the number of the company/department/representative in the "Plant" column:
   1 = Company headquarters Lennestadt
   2 = Customer centre Lennestadt
   3 = Assembly & Logistics
   4 = Customer centre Bakum
   5 = Customer centre Altbach
   6 = Customer centre Viernheim
   7 = Customer centre Golzow
   8 = Customer centre Erkrath
   9 = Customer centre Lützen
   10 = Customer centre Hamburg
   11 = Representative Bavaria
   12 = Maintenance/inspection/repair by the customer
5. Fill in your name and sign.

Tab. 13-2 Maintenance programme

Inspection/repair performed					Next inspection on/at	
Inspection date	Repair date	Operating hours	performed by (name/signature)	Plant	Date	Operating hours

13.3 Declaration according to EC Machinery Directive 2006/42/EC (reproduction of content)

DECLARATION OF CONFORMITY
TRANSLATION OF THE ORIGINAL
ACCORDING TO EC MACHINERY DIRECTIVE 2006/42/EC, ANNEX II, 1, A AND EC DIRECTIVE 2000/14/EC

WE HEREBY DECLARE THAT THE MACHINE

Product description:	HDD bore rig
Type:	GRUNDODRILL ACS300
Machine number:	DRI....
Year of manufacture:	20..
complies with the following relevant provisions:	
Directive 2006/42/EC	as of 17/05/2006
Directive 2000/14/EC	as of 08/05/2000
	Guaranteed sound power level L_{WA}: 105 dB

APPLIED HARMONISED STANDARDS:

EN ISO 12100:2011	EN ISO 14120:2016	EN ISO 13857:2020
EN 16228-1:2022	EN 16228-3:2022	EN ISO 4413:2011
EN 60204-1:2019	EN ISO 13849-1:2016	EN ISO 13849-2:2013

Manufacturer:	TRACTO-TECHNIK Paul-Schmidt-Str. 2 57368 Lennestadt
Authorised representative for the compilation of the technical documents:	Dipl.-Ing. Rouwen Homringhaus

Lennestadt, ...

_____

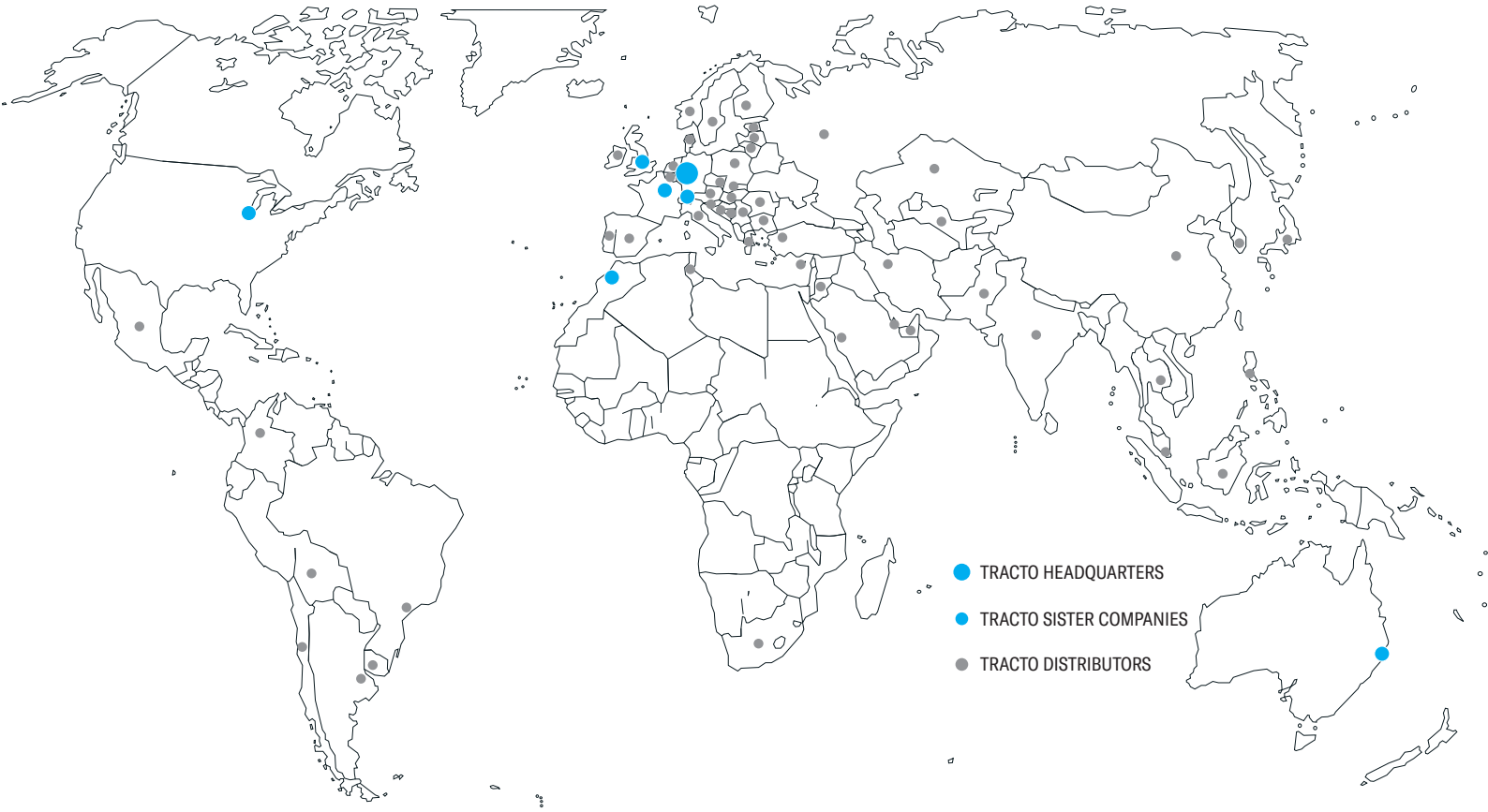
Dipl.-Ing. Meinolf Rameil, CTO

Please note: The declaration of conformity loses its validity if an alteration is made that has not previously been agreed on with the manufacturer.

TRACTO-TECHNIK GMBH & CO. KG HEADQUARTERS

PAUL-SCHMIDT-STRASSE 2
57368 LENNESTADT, GERMANY
T +49 2723 808-0
F +49 2723 808-180
INFO@TRACTO.COM

TRACTO.COM



SWITZERLAND
TRACTO-TECHNIK SCHWEIZ AG
INDUSTRIESTRASSE 4
8360 ESCHLIKON TG, SCHWEIZ
T +41 79 8203897
CH@TRACTO.COM
TRACTO.COM/CH-FR

UNITED KINGDOM
TRACTO-TECHNIK UK LTD
10 WINDSOR ROAD
BEDFORD MK 42 9SU
T +44 1234 342566
F +44 1234 352184
INFO@TRACTO-TECHNIK.CO.UK
TRACTO.COM/UK

FRANCE
TRACTO-TECHNIK FRANCE S.A.R.L.
1/3 RUE DE LA PRAIRIE
F-77700 BAILLY ROMAINVILLIERS
T +33 1 60 42 49 40
F +33 1 60 42 49 43
INFO@TRACTO-TECHNIK.FR
TRACTO.COM/FR

USA
TT TECHNOLOGIES INC.
2020 EAST NEW YORK STREET
AURORA, IL. 60502
T +1 630 851 8200
F +1 630 851 8299
INFO@TTTECHNOLOGIES.COM
TTTECHNOLOGIES.COM

AUSTRALIA
TRACTO-TECHNIK AUSTRALIA PTY LTD.
10 ALICIAJAY CIRCUIT
LUSCOMBE, QLD 4207
T +61 7 3420 5455
AU@TRACTO.COM
TRACTO.COM/AU

MOROCCO
TRACTO-TECHNIK AFRIQUE S.A.R.L.
ROUTE DE TAMESNA 4022
POSTE 2044, 12220 TAMESNA
T +212 5 37 40 13 63 / 64
F +212 5 37 40 13 65
INFO@TRACTO-TECHNIK.MA
TRACTO.COM/MA

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ADVANCED TRENCHLESS TECHNOLOGY