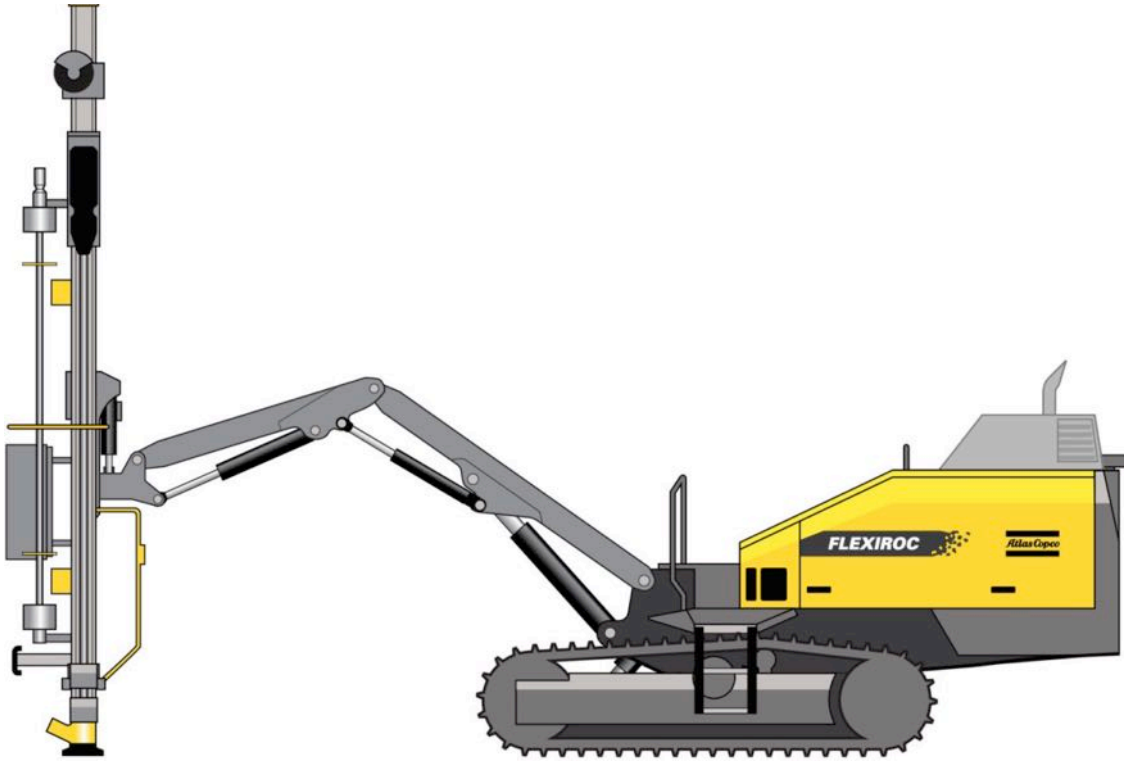
FlexiROC T35 R/T40 R

Operation



Translation of the original instructions

2017-02-13 | No: 3171473547.1 en

Reference

! ***NOTE:*** *Always read the information in the Safety document before starting to use the rig or starting maintenance work.*

Table of Contents

2 General

2.1 Foreword

This instruction manual is part of the complete delivery of the drill rig. It provides information on the design and operation of the drill rig and contains advice and the measures necessary to keep the rig operational. This instruction manual is no replacement for thorough training on the drill rig.

This instruction manual should be read in advance by all persons who are to operate or repair the drill rig or carry out maintenance on it.

See separate instructions for documentation on the rock drill/rotation unit, the diesel engine and certain other components.

For other questions refer to the local Atlas Copco company office. Addresses and telephone numbers are in the Maintenance instructions.

2.2 Application

The drilling equipment is designed mainly for drilling blast holes in e.g. quarries and opencast mines. All other uses are considered inappropriate.

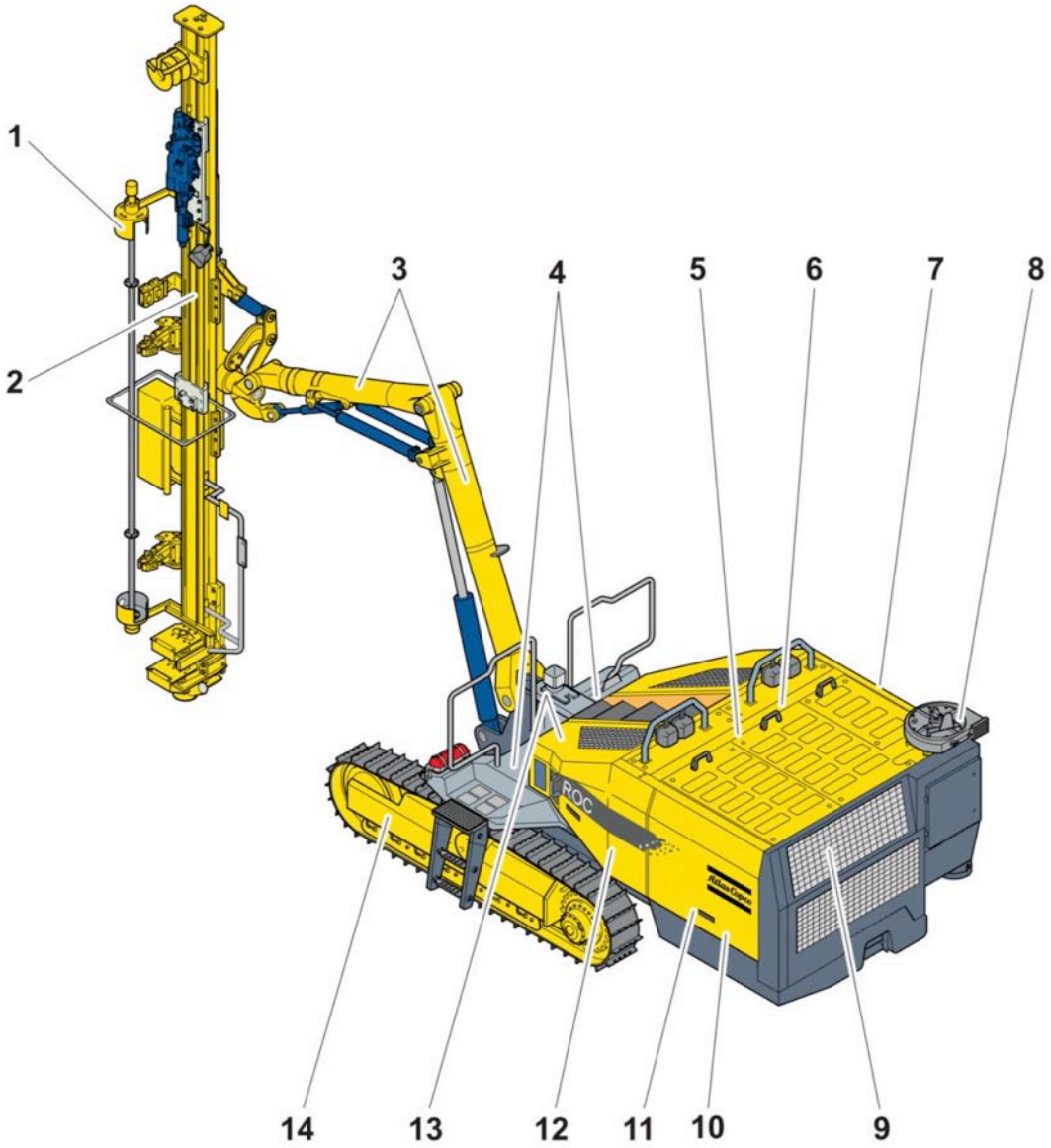
Examples of inappropriate use:

- Lifting and transporting loads and people
- Supporting objects
- Scaling rock

The manufacturer is not liable for damage caused by inappropriate use.

- It is essential the operator has read and comprehends the operator, maintenance and overhauling instruction as well as the maintenance schedules.
- The drilling equipment must only be used, maintained and repaired by personnel well conversant with the equipment and the dangers involved.
- It is essential that personnel observe general and local safety, health and traffic regulations.
- The manufacturer is not liable to damage caused by any arbitrary changes made to the drilling equipment.
- There must be no work in, on or in the vicinity of the machine when there is a risk of lightning.

2.3 Principal components



Principal components

1	Rod handling equipment (RHS)
2	Feeder
3	Boom system
4	Operator platforms
5	Radiator
6	Hydraulic oil cooler
7	Hydraulic oil pumps
8	Dust collector (DCT)
9	Diesel engine
10	Compressor

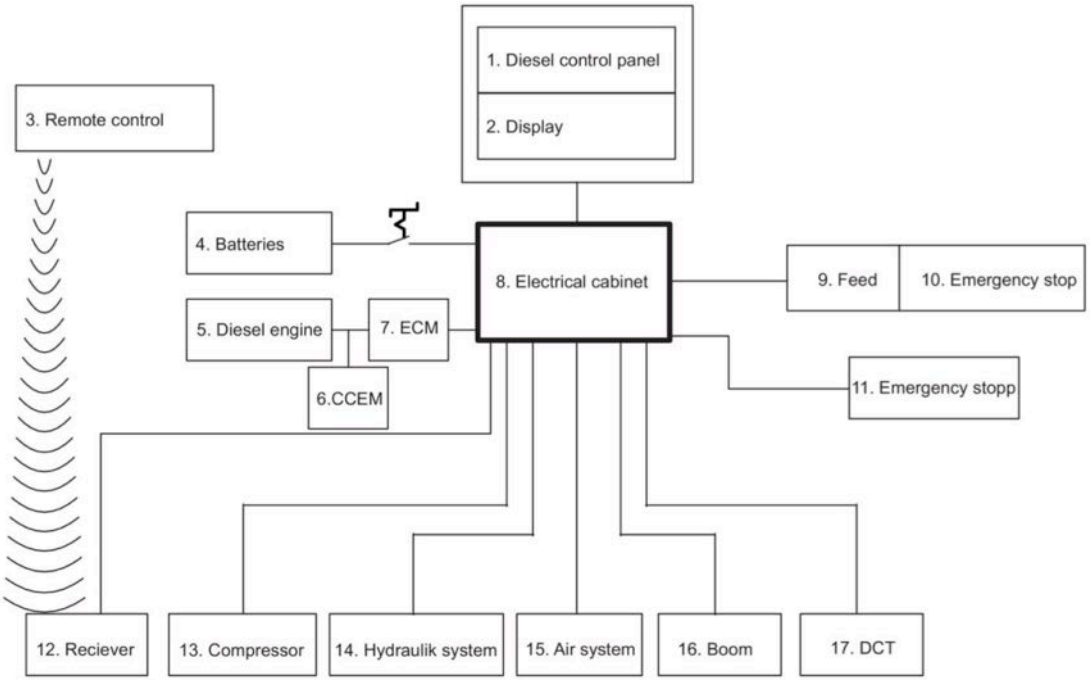
11	Hydraulic oil pumps
12	Electric cabinet
13	Radio receiver
14	Track frames

2.4 General system description

2.4.1 General description of the drill rig

This drill rig is a fully diesel-hydraulic drill rig designed for surface drilling applications such as in quarries and on construction sites.

The drill rig consists of the following main components: (See illustration under General Description)



General Description

1	Control panel for diesel engine
2	Display
3	Remote control box
4	Batteries
5	Diesel engine
6	Engine emissions cleaning unit CCEM
7	Engine electronic control module ECM
8	Electrical cabinet (A1)
9	Feeder

10	Emergency stop cable
11	Emergency stop
12	Receiver
13	Compressor
14	Hydraulic systems
15	Air system
16	Boom
17	Dust collector DCT

2.4.2 Power pack

The hydraulic drill rig is powered by a turbocharged, water-cooled diesel engine which is equipped with an afterburner chamber to reduce emissions.

The diesel engine is equipped with a monitoring system that includes automatic shut-down functions.

The drill rig is driven by two traction motors with gears. The traction motors with gears are mounted in the track frames.

The hydraulic pumps and the compressor are driven by a diesel engine.

2.4.3 Exhaust filtering (Tier 4 Final)

Regeneration is a process that burns the soot from the diesel engine's particle filter, which cleans the exhaust emissions. In most cases regeneration is started completely automatically and without affecting the rig's performance. Regeneration can be run in two different modes depending on the speed of the diesel engine and calculated soot level in the particle filter.

In addition to the particulate filter, this rig is equipped with a system that injects DEF (Diesel Exhaust Fluid) into the machine's exhaust system. By means of a chemical reaction, this fluid dramatically reduces the amount of harmful nitrogen oxides (NOx gases) the rig releases into the atmosphere.

2.4.4 Boom system

The boom system consists of inner/outer boom bodies, boom head, feed holder and associated hydraulic cylinders. The boom system is controlled by directional valves for positioning the feed with the rock drill at different distances and directions.

2.4.5 Dust collector

The hydraulically driven dust collector features automatic cleaning and consists of a filter unit, pre-separator, suction fan and suction hose.

2.4.6 Electrical system

The 24 V electrical system is supplied with current by an alternator and two batteries.

The electrical system comprises starting equipment, work lights, electric controls and safety devices.

The emergency stop buttons/cables are connected in series with the diesel engine cut-out system. As soon as an emergency stop button/cable is activated, the diesel engine will be stopped immediately. Reset the emergency stop buttons before restarting the engine. The engine cannot be started while one of the emergency stops is still activated.

For further details, see separate wiring diagram.

For details of the diesel engine, see separate diesel engine instructions.

2.4.7 Hydraulic system

The principal components of the hydraulic system comprise oil cooler, hydraulic oil tank, valves, hoses and four hydraulic pumps.

The four hydraulic pumps create hydraulic pressure in order to control the different functions. The table below indicates which hydraulic pump controls which function.

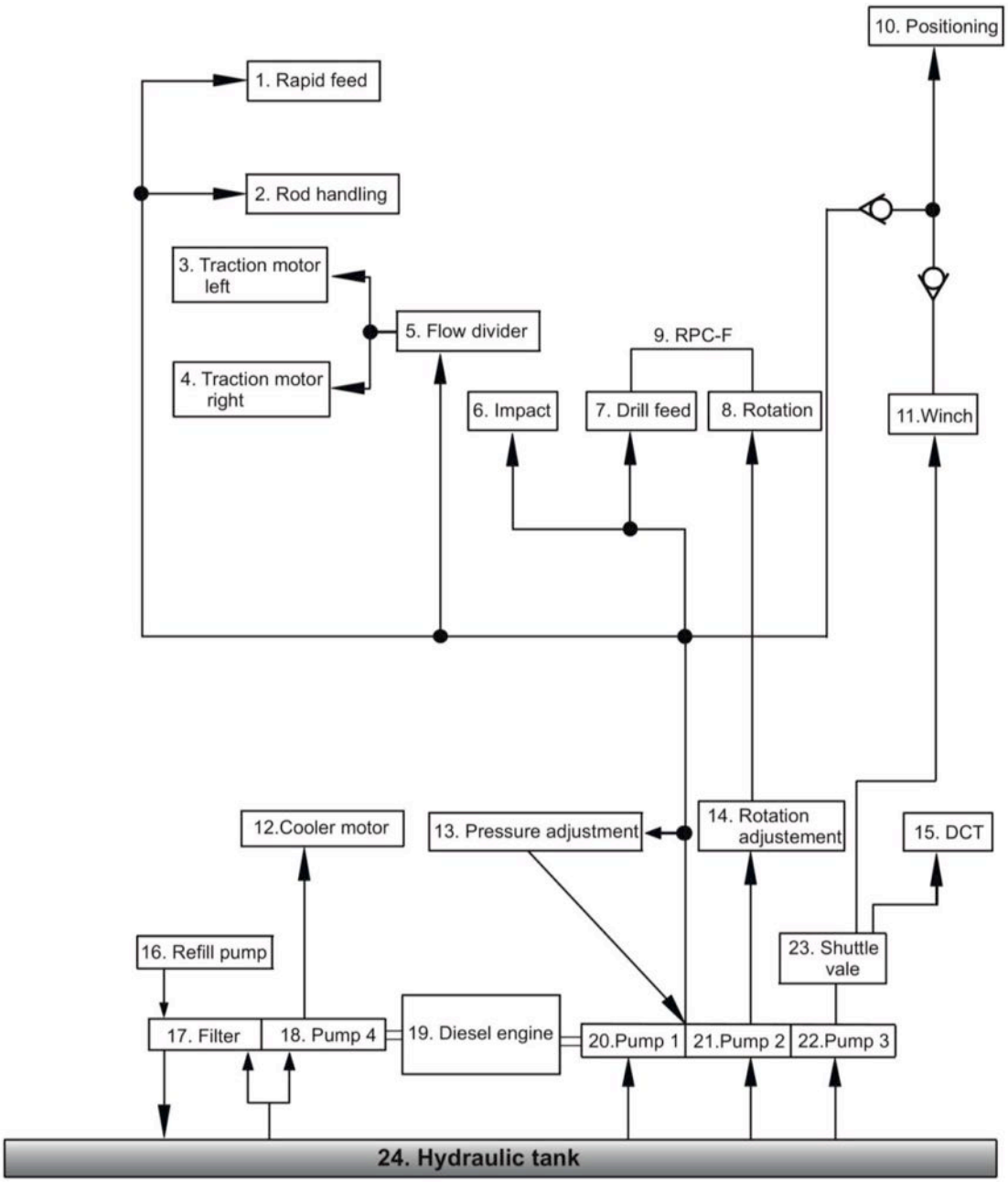
Pump no.	Description
1	Drill feed, rapid feed, percussion, tramming
2	Rotation, preheating
3	Dust collector (DCT), winch, boom positioning
4	Cooler motor

Table 1: Description of hydraulic pump function

The hydraulic oil tank is located on the right-hand side of the drill rig.

The combination cooler is located in the centre of the drill rig.

(For further details, see separate hydraulic system diagram)



1	Rapid feed
2	Rod handling
3	Tramming motor, left
4	Tramming motor, right
5	Flow divider
6	Percussion
7	Drill feed
8	Rotation
9	RPC-F

10	Positioning
11	Winch
12	Cooler motor
13	Pressure adjustment
14	Rotation adjustment
15	Dust collector (DCT)
16	Filler pump
17	Filter
18	Pump 4
19	Diesel engine
20	Pump 1
21	Pump 2
22	Pump 3
23	Reversing valve

2.4.8 Hydraulic pumps

Hydraulic pump 1

Pump 1 is the main pump in the hydraulic system and is of the axial piston type. The pump delivers hydraulic power to the following functions:

- Rock drill percussion
- Rock drill feed
- Boom Positioning
- Tramming

During drilling, hydraulic pump 1 is regulated for the current use of percussion pressure.

Hydraulic pump 2

- Hydraulic pump 2 is directly fitted on the main pump and supplies hydraulic oil to power the rock drill's rotation motor.

Hydraulic pump 3

- Hydraulic pump 3 supplies hydraulic oil to power the dust collector fan motor and to power the winch and boom positioning during tramming.

Hydraulic pump 4

- Hydraulic pump 4 supplies hydraulic oil to the cooler motor and the combined oil cooler. This pump also supplies hydraulic oil to the track oscillation locking mechanism.

Pump no.	CC	Flow (litre/min)	Pressure (bar, max.)
1	71	150	250
2	38	80	170
3	19	40	170
4	19	40	220

Table 2: Hydraulic pump output (2200 rpm)

2.4.9 Air system

The air system consists of the compressor with oil separator, hoses and valves. The compressor is driven directly by the diesel engine.

The compressor element is lubricated by an air-oil mixture. The mixture is separated in the oil separator.

The system supplies air for flushing the drill hole, cleaning the dust collector filter and for the rock drill machine's ECL lubricating system and ECG (option) for oiling the drill steel threads.

Pump configuration, see separate instructions

3 Technical data

3.1 FlexiROC T35 R/T40 R

3.1.1 Weight (Standard equipment Without drill steel)

Description		Data
FlexiROC T35 R	Weight	14,500 kg
FlexiROC T40 R	Weight	14,500 kg

3.1.2 Performance

Description		Data
Diesel engine, CAT C7.1 output at 2200 rpm		168 KW
Temperature range in operation		-25º to +50ºC
Tramming speed, max.		3,1/1,5 km/h
Traction force (low/high gear)		115/81 kN
Ground pressure, average		0,085 N/mm 2
Ground clearance		450 mm
Max. hydraulic pressure		250 bar
Track oscillation		±12º
Noise level	Idling (1500 rpm)	
	Max. engine speed (2200 rpm)	
	Drilling (2000 rpm)	

3.1.3 Tilt angles FlexiROC T35 R / ROC T40 R

! ***NOTE:*** *Stability is specified with respect to CE standards stipulating that rigs must not be operated on inclinations steeper than 20 degrees without the use of a winch.*

NOTE: *ANGLES MUST NOT BE COMBINED!*

Description		Data
Inclination angles for drill rig when drilling:	longitudinally, max. (Downward/ Upward)	20°/20º
	lateral (left/right).	14°/15º

Description		Data
	laterally, (left/right), in extreme positions.	12°/13º
Tilt angles - tramming (in direction):	downward/upward, max. without winch	20°/20º
	laterally, max. (Left/Right)	20°/20º
	downward/upward, with winch	30°

3.1.4 Hydraulic systems

Description	Data
Hydraulic oil cooler for max. ambient temperature	+50ºC

3.1.5 Electrical system

Description		Data
Voltage		24 V
Batteries	Voltage	2 x 12 V/185 Ah
Work lights	Voltage	24 V/70 W
Alternator	Voltage	28V/95 Ah

3.1.6 Air system FlexiROC T35 R

Description		Data
Compressor: C111	Max. air pressure	10.5 bar
	Free air delivery at 10.5 bar	127 l/s
	Working pressure	10.5 bar

3.1.7 Air system FlexiROC T40 R

Description		Data
Compressor: C111	Max. air pressure	10.5 bar
	Free air delivery at 10.5 bar	149 l/s
	Working pressure	10.5 bar

3.1.8 Capacities

Description		Data
Hydraulic oil reservoir	min/max level	185/290 l

Description		Data
Hydraulic systems	total	320 l
Fuel tank		330 l
DEF tank		27 l
Traction gear		3 l
Compressor oil		24 l
Lubricating oil tank		10 l
Diesel engine oil		16 l
Engine cooling system		35 l

3.1.9 Others

Description		Data
Fire extinguisher	A-B-C powder	1 x 6 kg

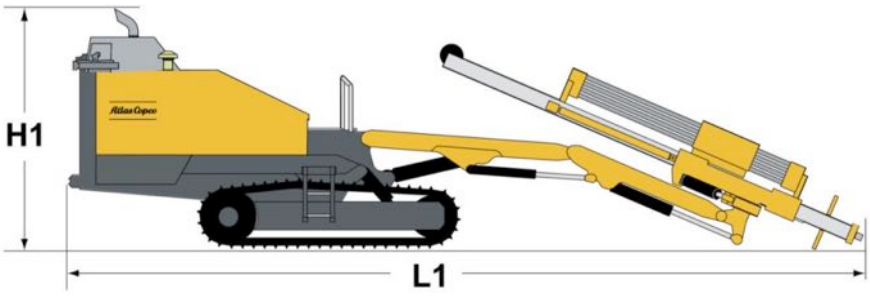
3.2 Dimensions

3.2.1 Dimensions (-01)

Transport dimensions

Length L1	Width	Height H1
11 350 mm	3 200 mm	3 100 mm

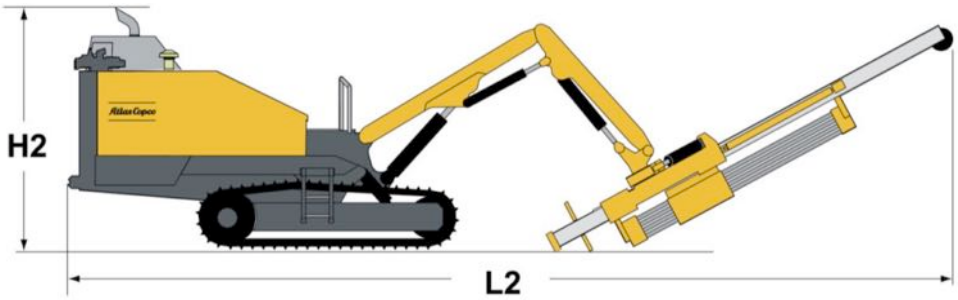
Table 3: Transport position, alternative 1



Transport position, alternative 2

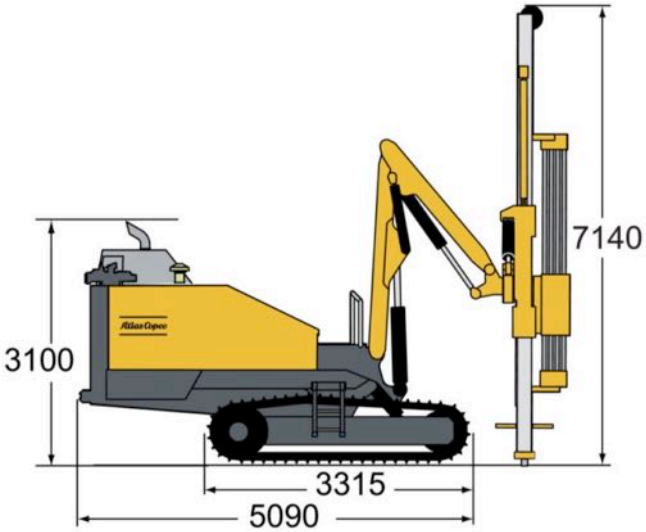
Length L2	Width	Height H2
11 450 mm	3 200 mm	3 500 mm

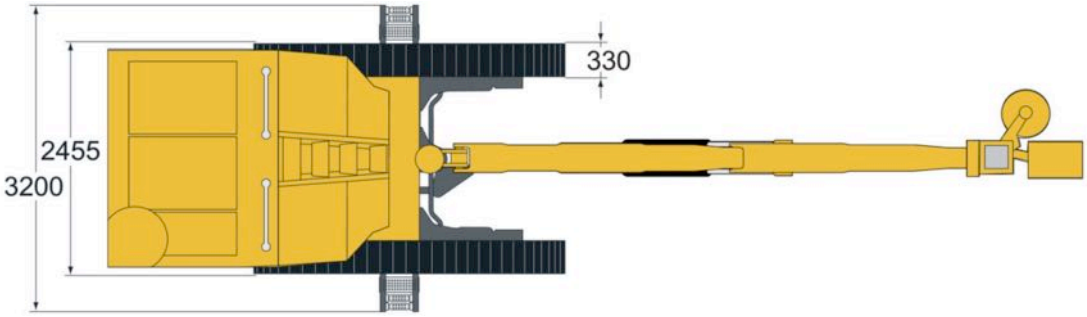
Table 4: Transport position, alternative 2



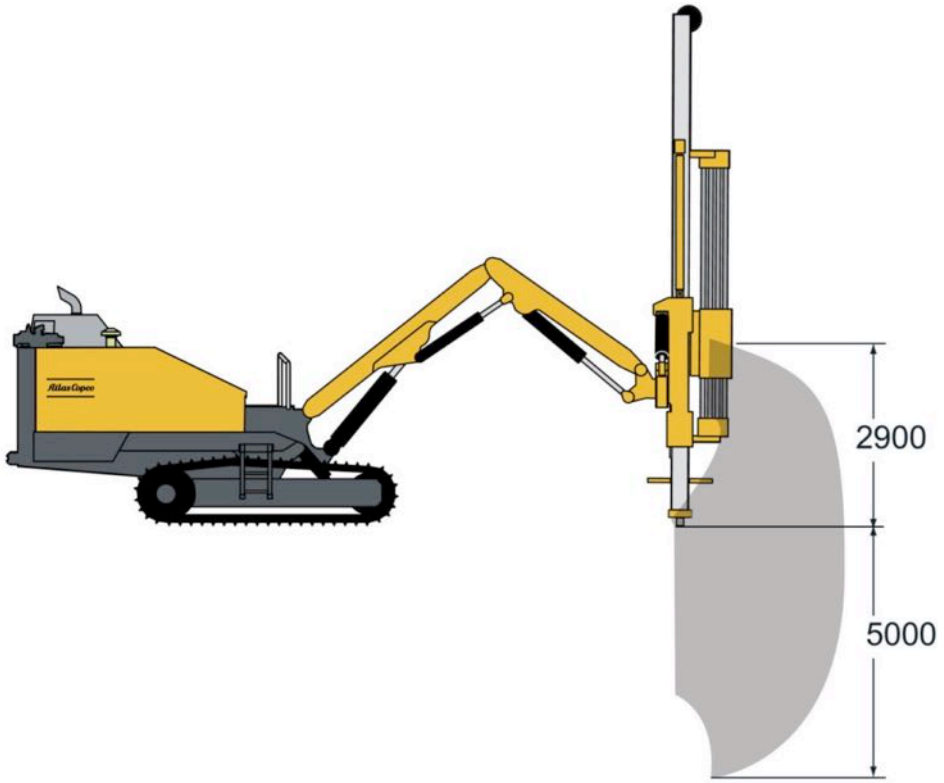
Transport position, alternative 1

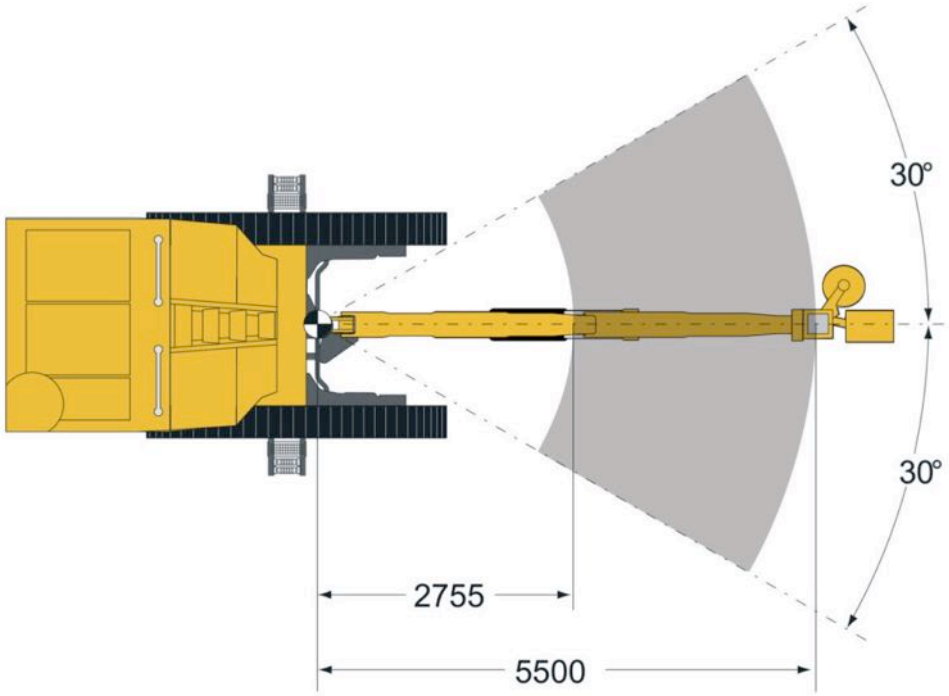
Other dimensions





Coverage area

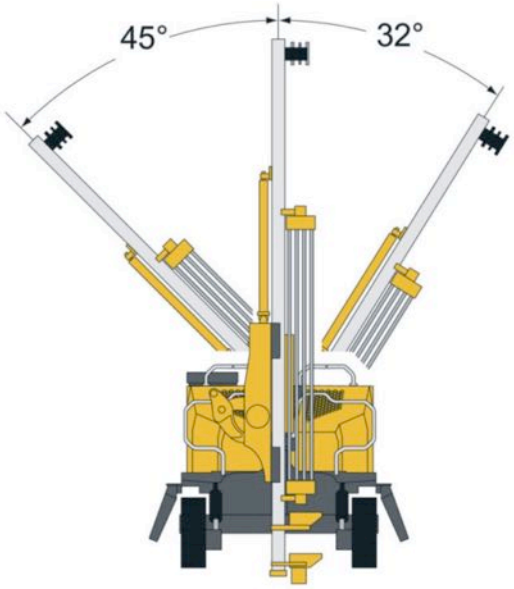




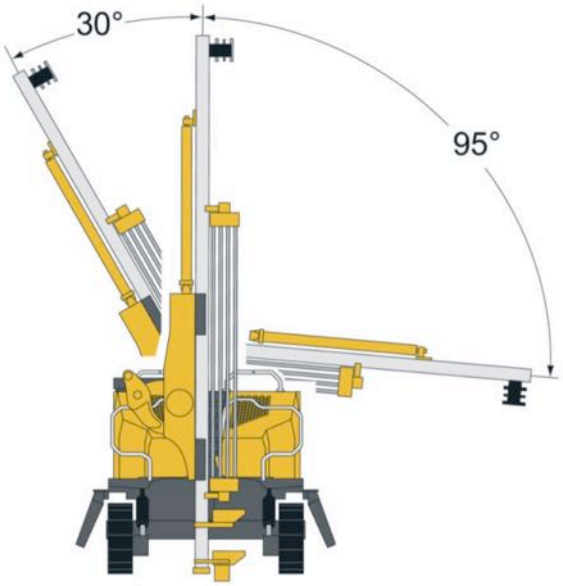
Feeder angles of inclination

Feed inclination angles with swing cylinder connected in various ways.

Normal position in downward-directed drilling



Toe-hole drilling



4 Daily checks

4.1 Foreword

This chapter provides instructions for daily inspection and maintenance to be carried out by the operator before each shift.

Regarding weekly inspections ad other maintenance tasks, see separate instructions "**Maintenance schedules**".

4.2 Extra safety check

4.2.1 Safety

DANGER

Serious injury or death

Danger of moving parts

- Risk of serious personal injury
- Set all levers and switches in neutral position before preparing start-up
- Perform the extra safety check without the engine running

DANGER

Serious injury or death

The side hatches on the drill rig are not dimensioned for extra weight

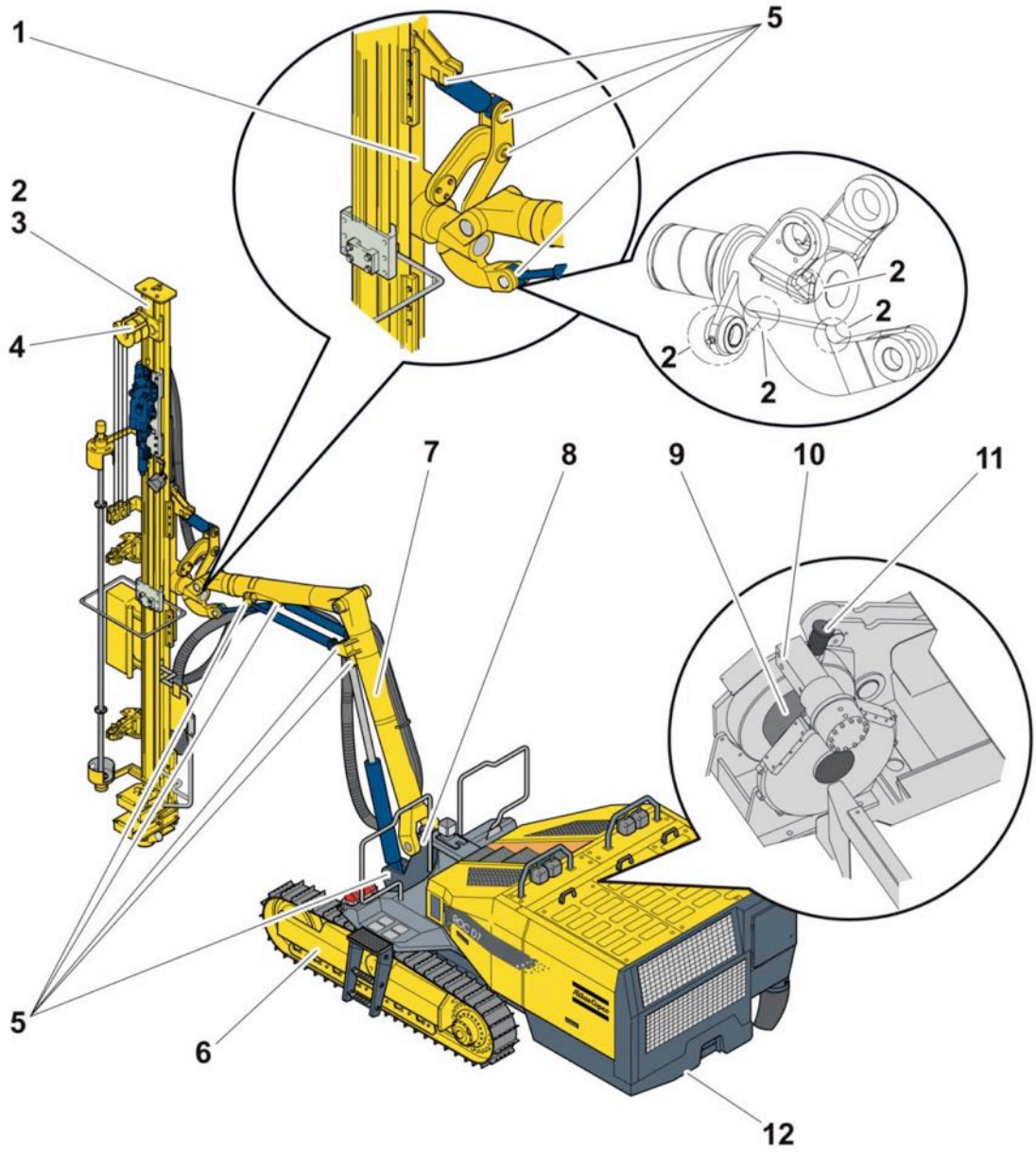
- Risk of serious personal injury
- Standing, sitting or leaning on the side hatches can result in serious injury
- The side hatches must be closed when work is carried out on top of the rig

Before each shift starts an extra and thorough visual safety check should be carried out in order to detect:

- Damage that could give rise to structural weakness or cracks.
- Wear that could have the same consequences.
- Cracks or fractures in materials or welded joints.

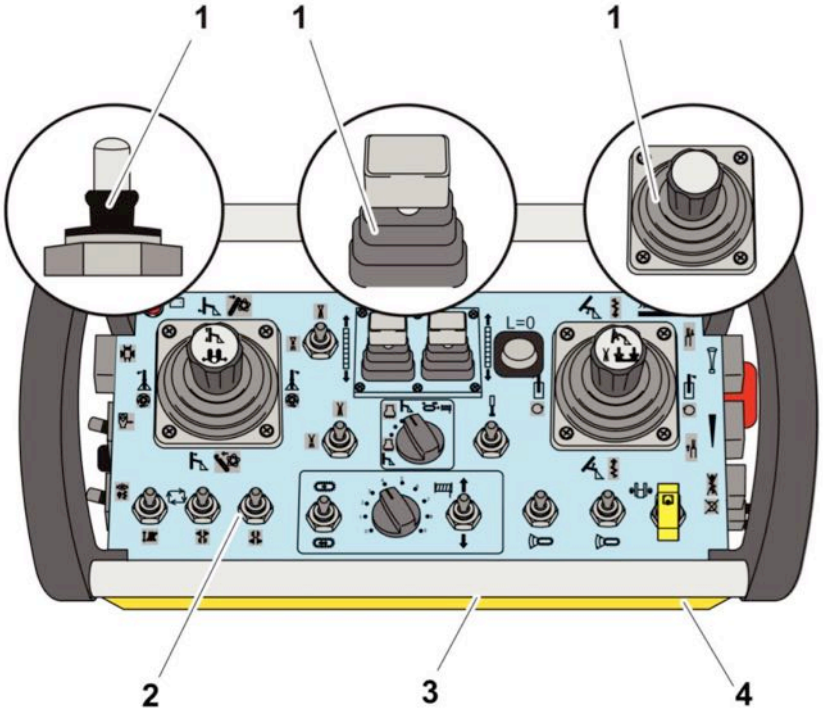
If the drill rig has been subjected to abnormally high stresses, vital load-bearing components may have been damaged. From a safety viewpoint, it is therefore especially important to check the following points (see illustration: Check points).

4.2.2 Checklist



Check points.

1	Feed holder with attachment	7	Boom
2	Boom head	8	Boom support
3	Feed cylinder with attachment	9	Winch wire rope with hook
4	Hose drum with cradle	10	Winch with brackets
5	Cylinder brackets	11	Release/connection mechanism
6	Track frames with attachment	12	Track frames with attachments



Remote control box

1	Rubber bellows on levers and switches	3	The joint between the upper and lower halves of the box must be well tightened.
2	Seals on switches and knobs	4	The box must not be cracked

4.3 Before starting

4.3.1 Safety

WARNING

Serious injury

Danger of moving parts

- Can cause serious personal injury
- Set all levers and switches in NEUTRAL position before start-up preparations
- Carry out the procedures with the engine switched off

WARNING

Serious injury

Dangerous compressed air

- Can cause serious injury
- Release the pressure in the tank before removing the filler plug

4.3.2 Status field symbols

The status field on the engine display shows information to the operator in the form of coloured symbols. The information shown is an indication or a warning. Indications are green while warnings are either yellow or red.

- **Green** - Indication that a specific function is activated, e.g. compressor loaded.
- **Yellow** - Warning to indicate that something is not in its normal state and that the operator must undertake some form of remedy. Machine not in acute danger of malfunction.
- **Red** - Warning, indicates that something is in a critical condition. The engine is switched off when there is significant risk of machine breakdown.

NOTE: *Yellow symbols can become red if the status of the fault worsens.*

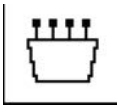
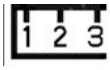
Symbol	Description	Symbol	Description
	**Compressor** Compressor loaded		**Laser status** indicates laser status*
	**Radio system** Radio system active		

Table 5: Green symbols (Information symbols)

NOTE: **) Grey background indicates selection of laser plane. Green background indicates hitting the laser plane.*

Symbol	Description	Symbol	Description
	**Engine service** Indicates time for engine service according to preselected number of hours		**Rock drill service** Indicates time for rock drill service according to preselected number of hours
	**Communication fault** Indicates disrupted communication in the CAN BUS system.		**Length Sensor** Indicates that the length sensor is not calibrated

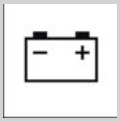
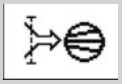
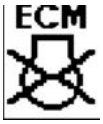
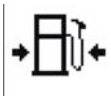
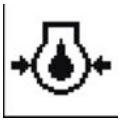
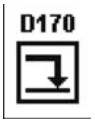
Symbol	Description	Symbol	Description
	**Battery** Indicates that the voltage from the battery is less than 24V		**Compressor air filter** Indicates that the compressor air filter is clogged
	**ECL collection** Indicates that the ECL collection is too low or too high		**ECM** Indicates an ECM error
	**Engine temperature** The engine temperature is becoming too high		**Engine air filter** Indicates that the engine air filter is clogged
	**Engine reduction** Indicates that a fault has arisen and the engine output is limited		**Intake temperature** Indicates that the intake temperature in the engine is too high
	**Fuel level** Indicates low fuel level		**Fuel temperature** Indicates that the engine's fuel temperature is too high
	**Fuel pressure** Indicates that the fuel injection pressure is abnormal		**Engine oil pressure** Indicates that the oil pressure to the engine is becoming too low
	**Engine Sensors** Indicates that an error occurred in the engine sensor, the engine is stopped automatically		**Drill bit** Indicates that replacement is due
	**Length Sensor** B172 Sensor error		**Boom articulation sensor** D170 Sensor error
	**Angle sensors** D171 Sensor error		**Length Sensor** D172 Sensor error

Table 6: Yellow symbols (Warning symbols)

Symbol	Description	Symbol	Description
	**Engine oil pressure** Engine oil pressure is too low. Engine stopped automatically		**Engine temperature** Engine temperature is too high. Engine stopped automatically

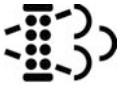
Symbol	Description	Symbol	Description
	**Coolant level** Indicates that the coolant level to the engine is too low. Engine stopped automatically		**Compressor temperature** Indicates that the compressor temperature is too high. Engine stopped automatically
	**Hydraulic oil level** Indicates that the hydraulic oil level is too low. Engine stopped automatically		**Hydraulic Oil Temp** Indicates that the hydraulic oil temperature is too high. Engine stopped automatically
	**High soot content in the particulate filter (DPF)** Shows when the soot content has reached 80%		**High exhaust gas temperature (HEST)** Illuminates when regeneration has started.
	**Automatic regeneration blocked** Used when there is a risk of personal injury or damage to property		

Table 7: Red symbols (Warning symbols that stop the diesel engine)

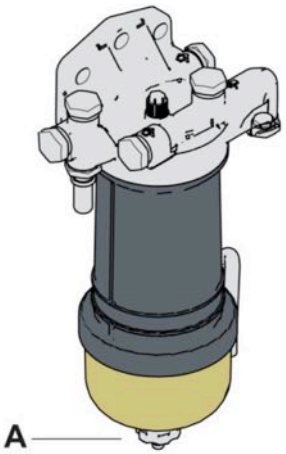
4.3.3 Checks

Check point	Inspection	Instructions
Drill rig.	Visual check	Make sure there are no signs of leaks, damage, breakage or cracks.
Hydraulic oil	Oil level	Check oil level. Top up as necessary.
Lubrication	Oil level	Check oil level. Top up as necessary.
Engine oil	Oil level	Check oil level. Top up as necessary.
Compressor oil	Oil level	Check oil level. Top up as necessary.
Water separator	Fuel prefilter	Drain off the water

Table 8: Checks before starting.

For further instructions, see: Maintenance instructions

4.3.4 Fuel filter



Fuel filter.

Check point	Inspection	Instructions
Water separator	Primary fuel filter	Drain off the water (A).

Table 9: Fuel filter.

4.4 Functionality test after start

4.4.1 Checks

Check point	Inspection	Instructions
Emergency stop	Function	Check that all emergency stops are working (see chapter Safety for location)
Limit position sensor	Function	Make sure the sensors are in working order
Calibration sensors	Function	Make sure the cradle is calibrated correctly
Rock drill	Rock drill hydraulic hoses	Make sure there is no abnormal vibration.
Rock drill	Visual check	Make sure the lubrication is in working order
Engine display	Visual check	Make sure there are no faults indicated
Dust collector (DCT)	Suction ability and filter cleaning	Check filters, suction hose and drill-steel support gasket
Hydraulic Oil Filter	Visual check	Make sure the hydraulic oil filter is not clogged

Check point	Inspection	Instructions
		! ***NOTE:*** *The return oil pressure gauge will show reliable readings once the oil has reached a temperature of at least 40° C (104°F)*
Hydraulic pressure	Visual check	Observe the pressure gauges to make sure no abnormal pressure arises

Table 10: Functionality test.

For further instructions, see: Maintenance instructions

4.5 Function test while drilling

4.5.1 Checks

Check point	Inspection	Instructions
Sensors on the feed beam	Limit position sensor/Calibration sensor	Check the function of the sensors
Rock drill hydraulic hoses	Abnormal vibration	Check the accumulators, for further instructions see "Maintenance instructions for rock drill".
Rock drill	Shank adapter	Make sure that oil trickles out between the front and the adapter.
Display for engine and direction instruments	Display window	Make sure no faults are indicated. If a fault indication is shown, stop the drill rig and rectify the fault
Dust collector (DCT)	Suction ability and filter cleaning	In the event of dust build-up: Check the filter in the filter holder, the suction hose and the drill-steel support gasket.
Drill rig	Complete drill rig	Check for signs of leaks
Hydraulic oil filter/Pressure gauge	Pressure gauge panel	Check for clogging by reading the pressure in the return oil filter with the pressure gauge. If

Check point	Inspection	Instructions
		the needle is in the red zone, the filter **must** be changed. Call for a service technician. Check all the pressure gauges to see that the hydraulic pressure is normal. Call for a service technician if there are any deviations.

Table 11: Checks during drilling

For further instructions, see: Maintenance instructions

4.5.2 Diesel control panel

Check point	Inspection	Instructions
Diesel control panel	Visual check	Check that no fault indicator lamp is on. In the event of a fault indication, stop the rig and rectify the fault.

Table 12: Diesel control panel.

4.5.3 Dust collector (DCT)

Check point	Inspection	Instructions
Dust collector (DCT)	Suction ability and filter cleaning	In case of dust formation: Check the filter in the filter holder and suction hose and also the drill-steel support's drill gasket.

Table 13: Dust collector (DCT).

4.5.4 Drill rig

Check point	Inspection	Instructions
Drill rig	Visual check	Look for any signs of leaks. -Hydraulic systems -Fuel system -Cooling system -Compressor

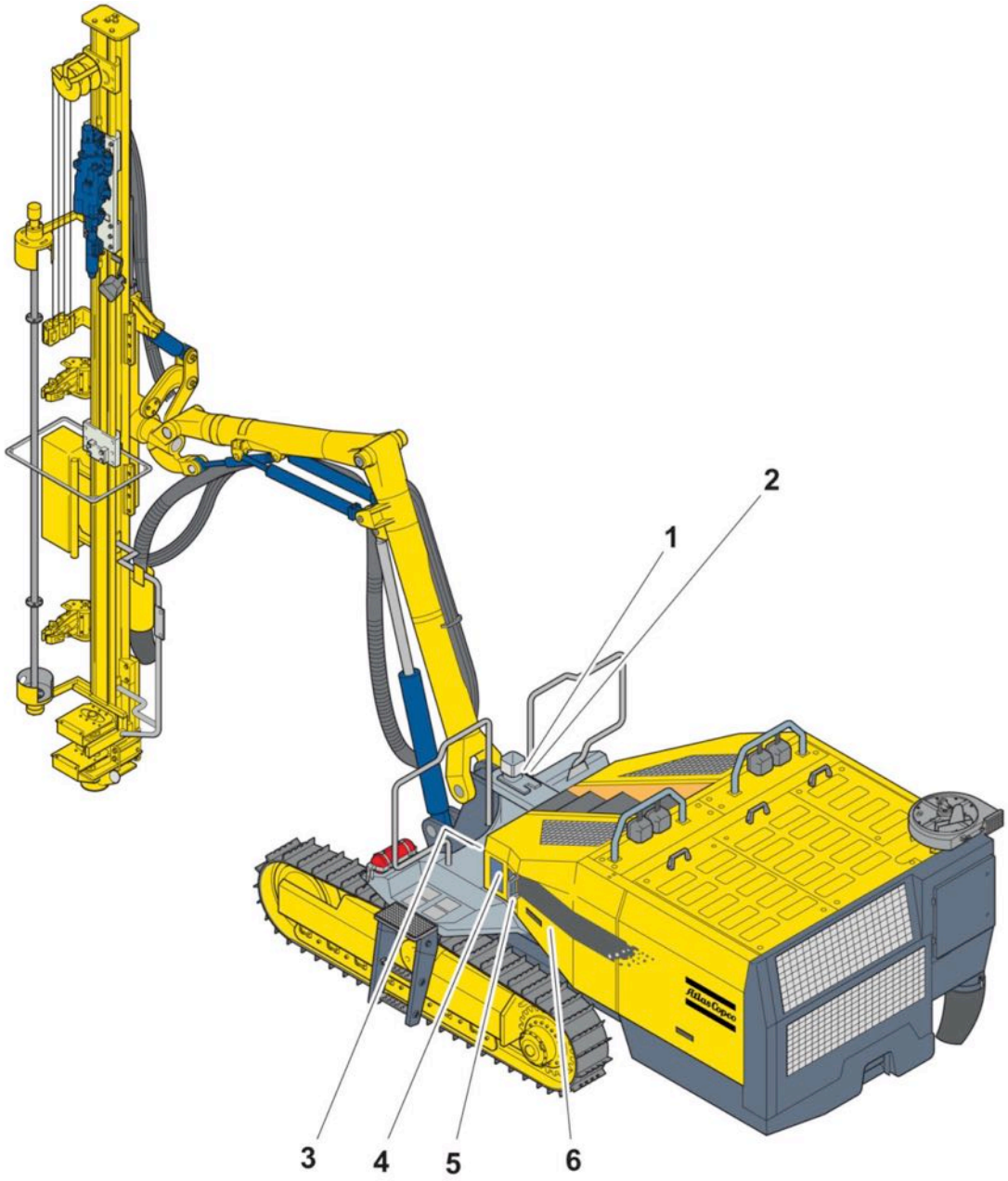
Table 14: Drill rig.

5 Controls

5.1 Controls

5.1.1 General

The equipment for filling up with fuel, hydraulic oil and compressor oil is located close to the appropriate tanks.



General drawing

1	Gradient meter
2	Fire extinguisher

3	Control panel for pressure and pressure gauges
4	Test connections for the hydraulic circuits
5	Display for diesel engine
6	Electric cabinet

5.1.2 Remote control box

WARNING

Serious injury

Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always have an overview of the drill rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when it is not in use
- The remote control box must not be operated from the drill rig when the winch is in use

WARNING

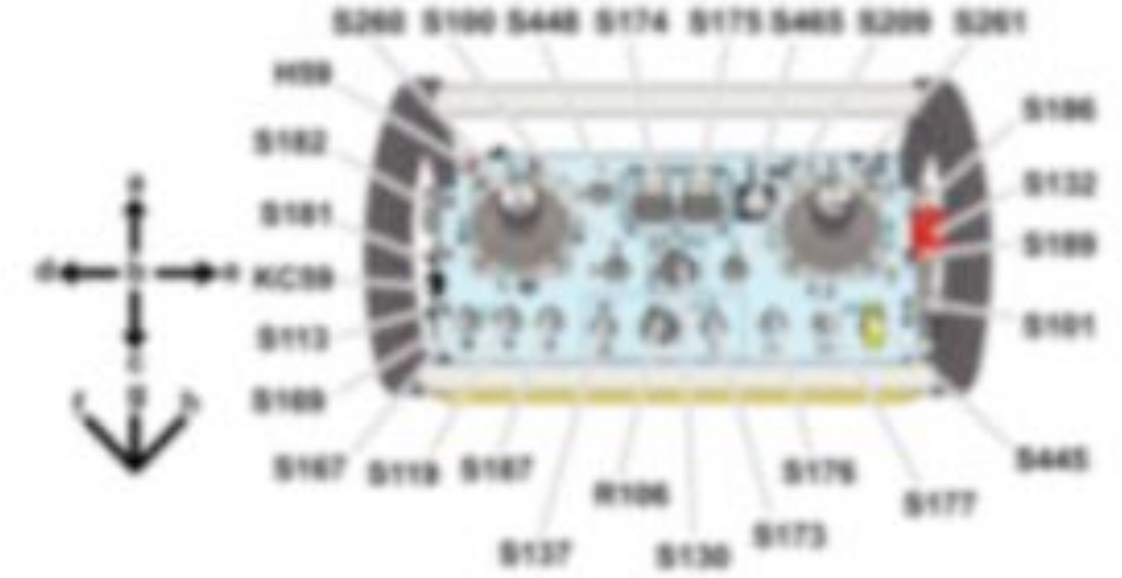
Serious injury

When the remote control box is deactivated then no functions can be controlled

The remote control box is a multi-function box with two levers that change function depending on the mode set on the remote control box.

NOTE: *Pay attention to the mode set on the remote control box!*

Functions



Remote control box.

S100		Circuit breaker **Flushing air**
	a	Default: Full flushing air/ Dust collector active
	b	Default: Reduced flushing air/ Dust collector active
	c	Flushing air deactivated
S101		**Release** button ■ Rotation and feed cease ■ Percussion ceases/ Normal mode ! ***NOTE:*** *If the release button has not been reset, it will not be possible to restart rotation, percussion or feed.*
S113		Switch **Activate limit position sensors**
	a	Sensors deactivated
	c	Sensors activated
S119		Switch **Upper drill-steel support**
	a	Closed ■ The upper drill-steel support opens automatically when the rock drill approaches it ■ Drilling stops automatically ■ The upper drill-steel support closes automatically during retraction
	b	Neutral ■ The upper drill-steel support opens automatically when the rock drill approaches it ■ The shank join is automatically released when drilling ■ The upper drill-steel support closes automatically during retraction

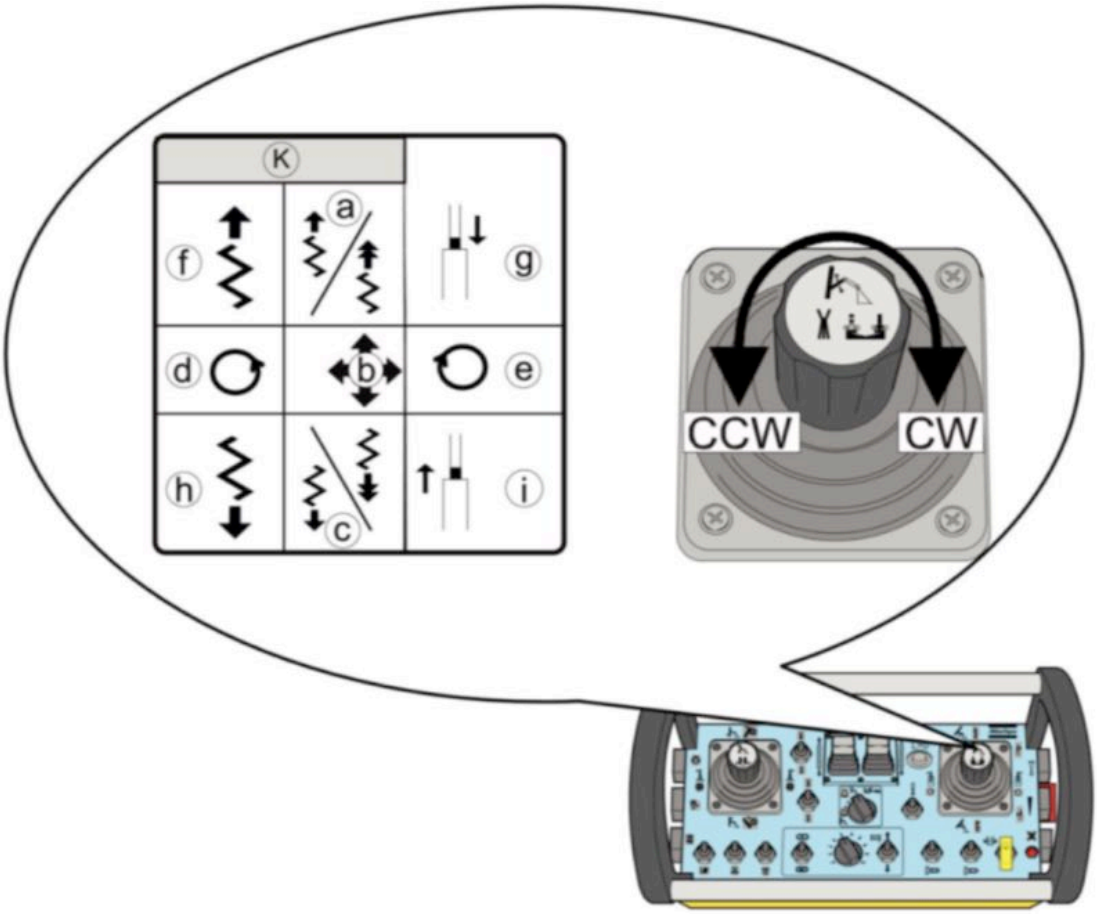
	c	Open ■ Drilling stops automatically
S130		**Mode selector** knob for remote control box
	f	Adjustment mode while drilling
	g	Drilling/Shut-down/Preheating
	h	Positioning/Tramming/Winching
S132		**Drill rig stop** active ! ***NOTE:*** *Works only when radio system is active!*
S137		Switch for **Tramming speed**
	a	Low tramming speed (high traction)
	c	High tramming speed (low traction)
S167		Circuit breaker **suction hood**
	a	Suction hood up (or engine start)
	c	Suction hood down (or engine stop)
S169		Key for activating remote control box Clockwise: Activated Anticlockwise: Deactivated
S173		Circuit breaker **Winching**
	a	Wind in
	b	Neutral
	c	Wind out
S174-S175		Right/Left **tramming lever**
	a	Forward
	b	Neutral
	c	Reverse ! ***NOTE:*** *The speed of the tracks is proportional to the levers, use the levers carefully.*
S176		Switch, left **Track oscillation**
	a	Lower front section
	b	Neutral
	c	Raise the front

S177		Switch, right **Track oscillation**
	a	Lower front section
	b	Neutral
	c	Raise the front
S181		Circuit breaker **Dust collector** (DCT)
	a	Dust collector activated
	c	Dust collector inactivated
S182		**Sleeve grippers** button ■ Sleeve grippers to drill centre ■ Sleep grippers to carousel ! ***NOTE:*** *For the sleeve grippers to work, the rod handling arms must be in the drill centre and the rod handling grippers must be in position "Hard grip".*
S186		**Horn/Reactivation of remote control box** button
S187		Lower **drill-steel support**
	a	Closed
	b	Neutral
	c	Closed
S189		**Engine speed** button ■ Adjustable speed: In this position, the speed can be adjusted using the potentiometer R189 on the diesel panel (1200 to 2200 rpm) ■ Low speed (1500 rpm)
S209		Switch **Jack**
	a	Jack up
	b	Neutral
	c	Jack down
S260		Left **multi-function lever** (rod handling and feeder positioning)
S261		Right **multi-function lever** (drilling and boom positioning)
S445		Switch **Track oscillation lock**
	a	Locked track oscillation
	c	Open track oscillation
S448		Switch **Water mist system**
	a	Reduced water mist
	b	No water mist

c	Max. water mist
S465	Button for **zeroing** hole depth
R106	**Winch traction** potentiometer (when tramming) Clockwise - Increased pressure, more traction Anticlockwise - Reduced pressure, less traction
H59	**Indicator lamp** ■ Flashes green quickly: Indicates that the remote control box is searching for contact ■ Red flash: Indicates low battery level in remote control box ■ Slow green flash: Radio system active ■ Flashing irregularly: Indicates fault on transmitter*
KC59	**Socket** for remote control box cable

Table 15: Functions

5.1.3 Right-hand multifunction lever in drilling position



Sector description - Multi-function lever S261

Sector	Function
a	Drill feed forwards (when percussion active)/ Rapid feed forwards (when percussion inactive)
b	Neutral

Sector	Function
c	Drill feed reverse (when percussion active)/ Rapid feed reverse (when percussion inactive). If low percussion is activated manually, rapid feed reverse can be obtained
d	Drill rotation-Self-holding/air
e	Rotation right
f	Drill feed forwards (self-holding feed percussion (j))/reduced percussion
g	Threading
h	Drill feed reverse
i	Unthreading
j	Self holding for high percussion and feed.

Table 16: Sector description.

> ! ***NOTE:*** *Sequence d - f - j gives automatic collaring. I.e. first drill rotation with flushing air (d), then low drill feed and low percussion (f). When (j) is then reached self-holding and an automatic increase to high percussion and high feed are attained after 5 seconds.*

CCW	Flushing air activated Low percussion and flushing air activated (if lever held longer than 0.5 sec)
CW	High percussion (No holding)

Table 17: Rotation of multi-function lever when no other functions are active

CCW	Deactivates drilling (low percussion, rotation, flushing air and feed)
CW	Activates full drilling (high percussion, rotation, flushing air and high-speed)

Table 18: Rotation of multi-function lever when collaring (active low percussion, rotation, flushing air and low feed)

CCW	Activates collaring (low percussion, rotation, flushing air and low feed)
CW	Deactivates drilling (percussion, rotation, flushing air and feed)

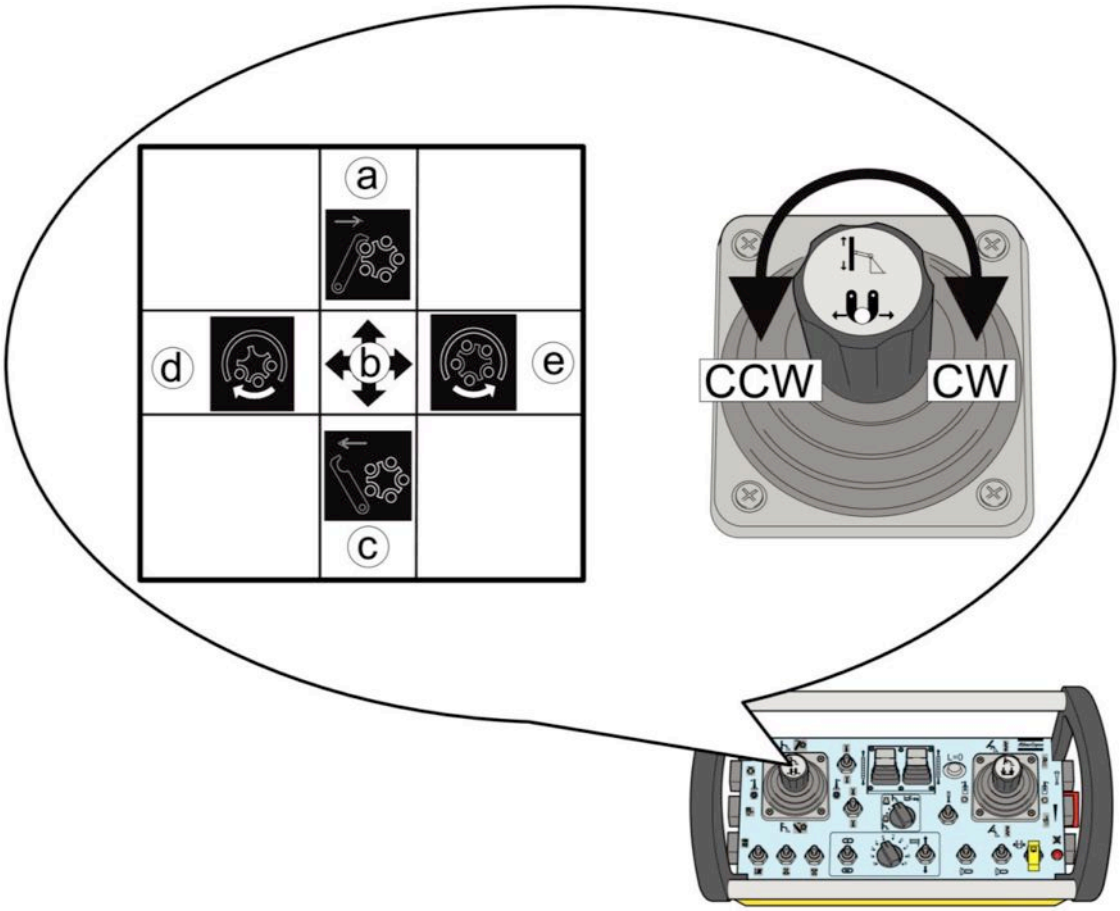
Table 19: Rotation of multi-function lever when full drilling (high percussion active, rotation, flushing air and high feed)

CCW	Activates low percussion

CW	Deactivates flushing air (deactivates rotation after 0.5 sec)

Table 20: Rotation of multi-function lever when rotation and flushing air functions are active.

5.1.4 Left-hand multifunction lever in drilling position



Sector description - Multi-function lever S260

Sector	Function
a	Rod to carousel
b	Neutral
c	Rod to drill centre
d	Carousel rotation (clockwise) + Opens rod grippers
e	Carousel rotation (anticlockwise) + Opens rod grippers

Table 21: Sector description.

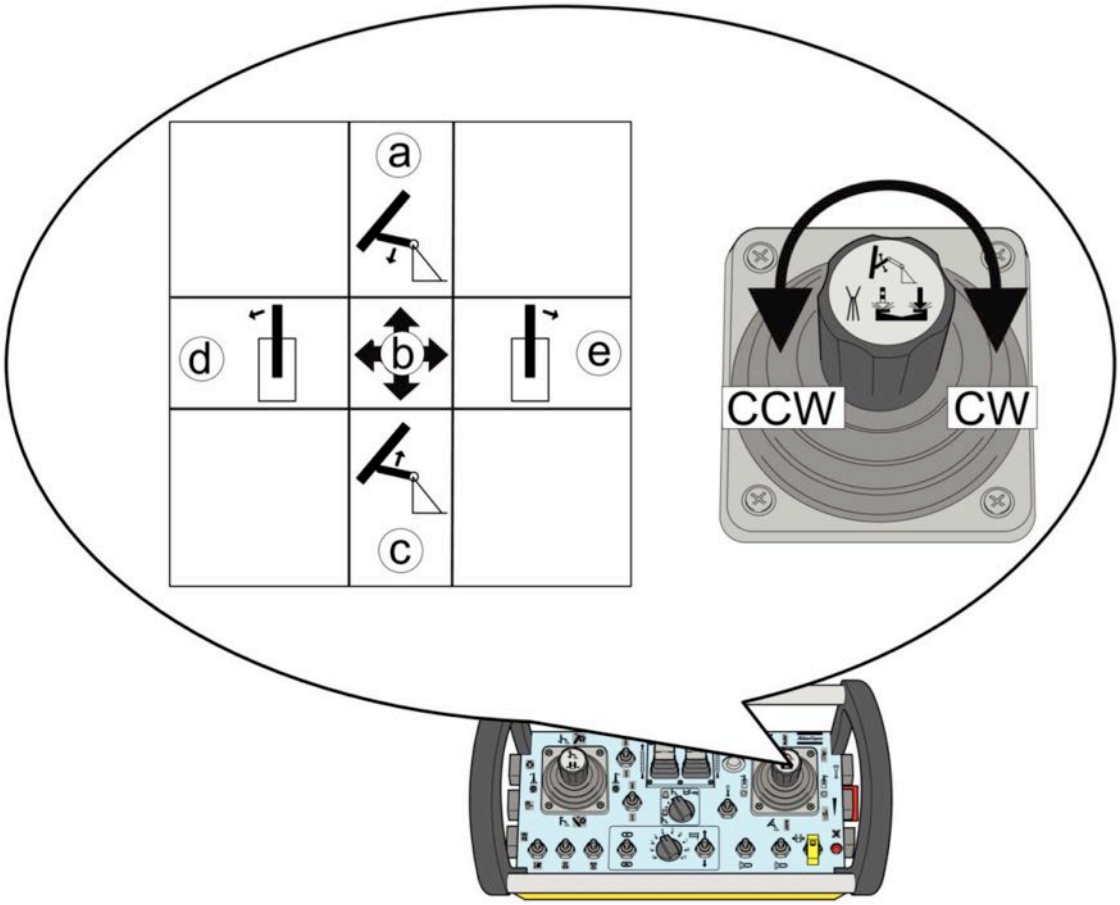
> ! ***NOTE:*** *If sleeve retainer (S182) is activated, it will move first, before the rod to/from the carousel.*

CCW or CWs	Opens rod grippers

Neutral	Closed rod grippers

Table 22: Turning of multi-function lever S261

5.1.5 Right-hand multifunction lever in positioning mode



Sector description - multi-function lever S261

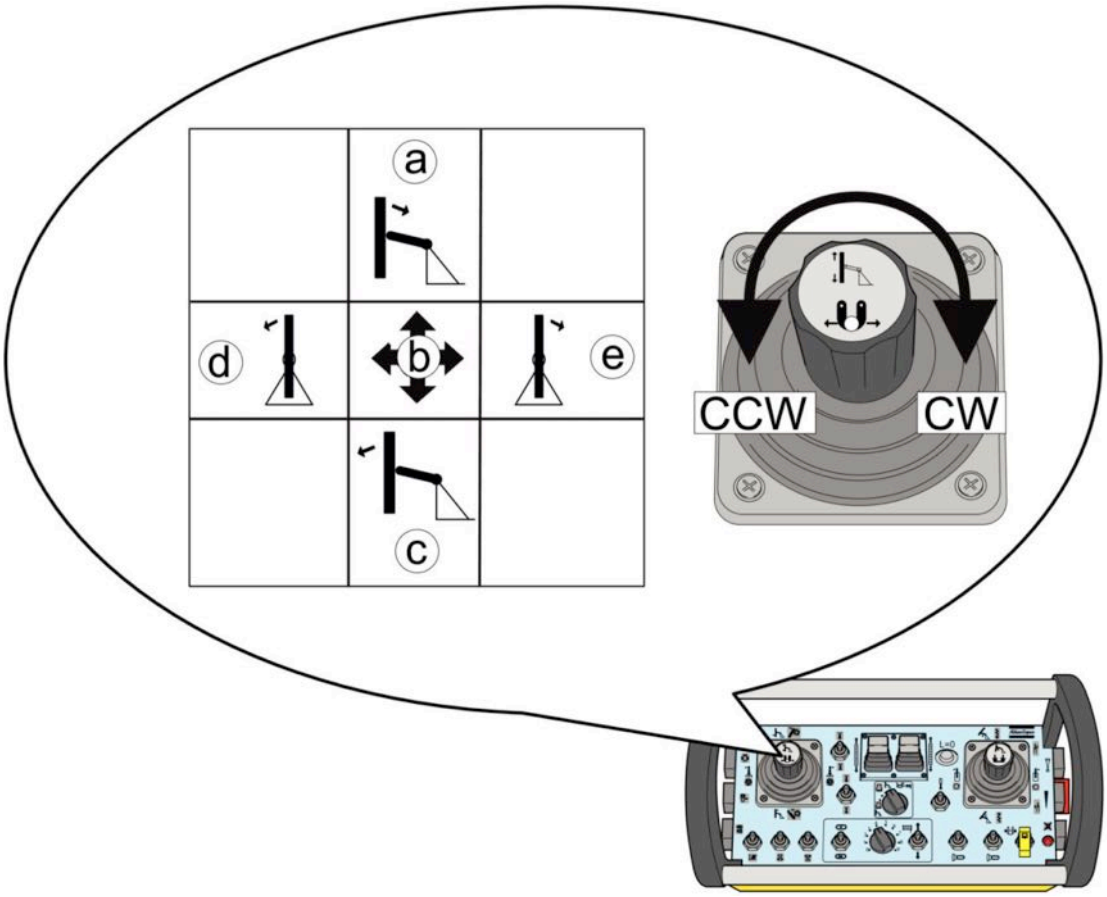
Sector	Function
a	Boom lowering
b	Neutral
c	Boom lift
d	Boom swing (left)
e	Boom swing (right)

Table 23: Sector description.

CCW	Boom extension in
CW	Boom extension out

Table 24: Turning of multi-function lever S261

5.1.6 Left-hand multifunction lever in positioning mode



Sector description - Multi-function lever S260

Sector	Function
a	Feed tilt (spike forward)
b	Neutral
c	Feed tilt (spike rearward)
d	Feed swing (left)
e	Feed swing (right)

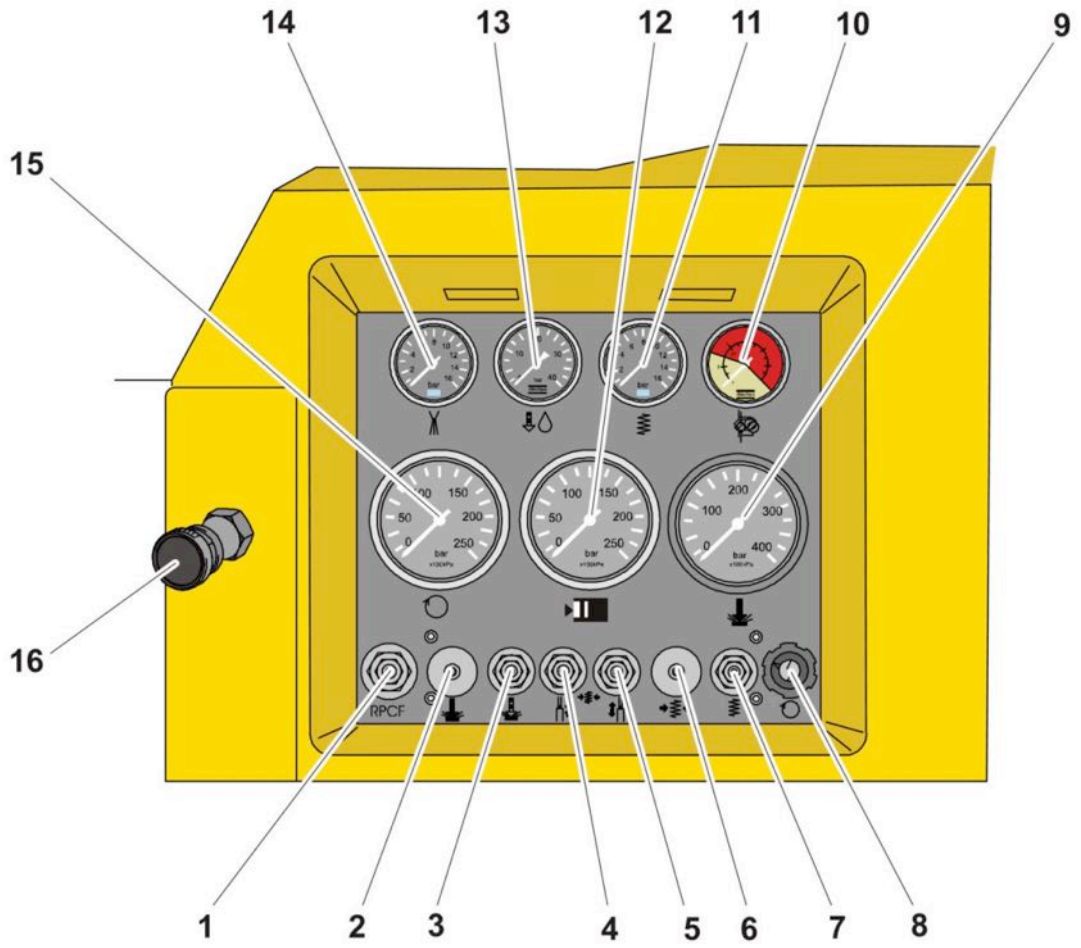
Table 25: Sector description

CCW	Feed extension down
CW	Feed extension up

Table 26: Turning of multi-function lever S260

5.1.7 Pressure adjustments and pressure gauges (COP 1800)

! ***NOTE:*** *The pressure gauges must be checked during drilling.*



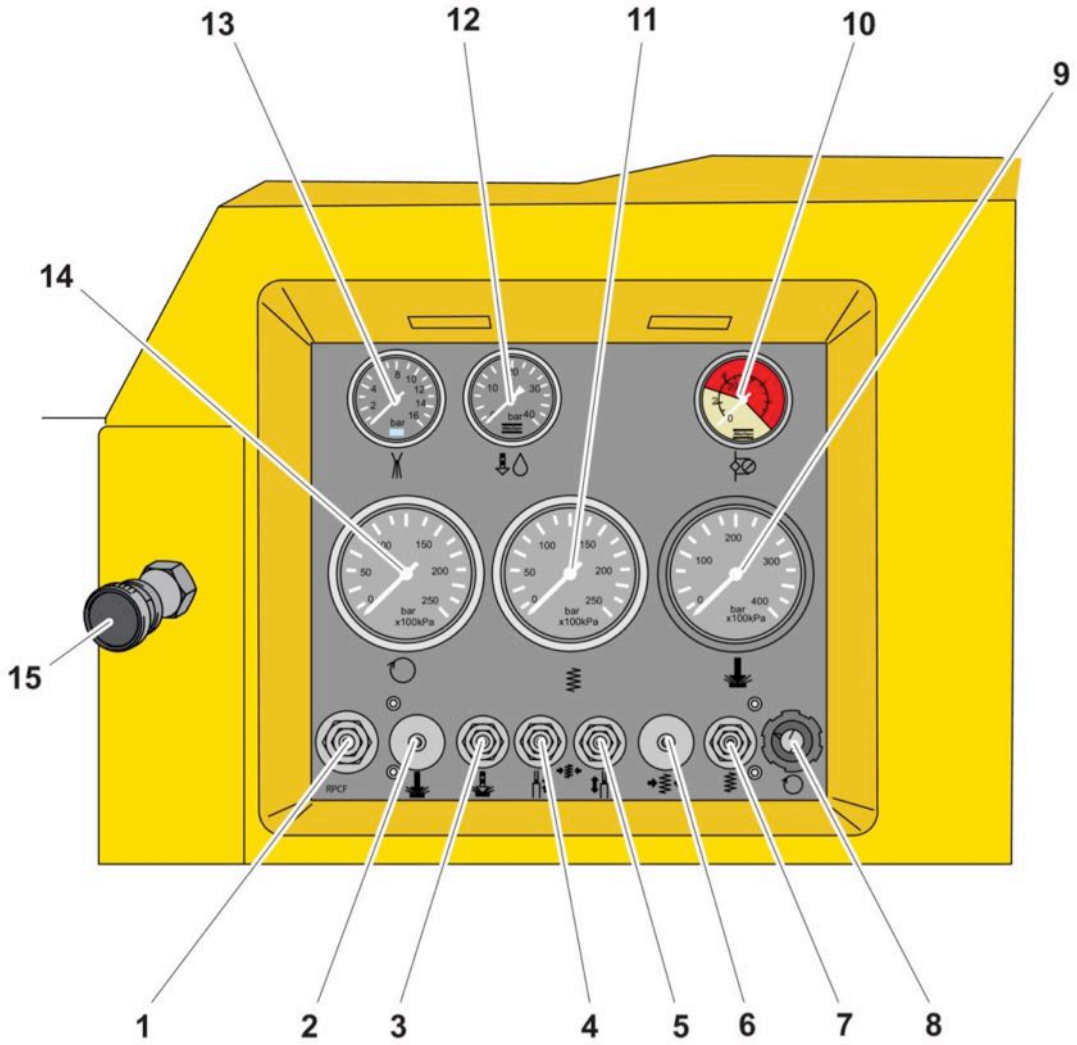
Pressure adjustment and pressure gauges.

1	Adjustment of RPCF
2	Adjusting high percussion pressure
3	Adjusting low percussion pressure
4	Adjusting threading pressure
5	Adjusting unthreading pressure
6	Adjusting high drill feed pressure
7	Adjusting low drill feed pressure
8	Adjusting rotation speed
9	Percussion pressure gauge
10	Return oil pressure gauge
11	Drill feed pressure gauge
12	Damper pressure gauge
13	Lubrication oil pressure gauge
14	Flushing air pressure gauge
15	Rotation pressure gauge

16	Extra air outlet

5.1.8 Pressure adjustments and pressure gauges (COP 1238 series)

> ***NOTE:*** *The pressure gauges must be checked during drilling.*

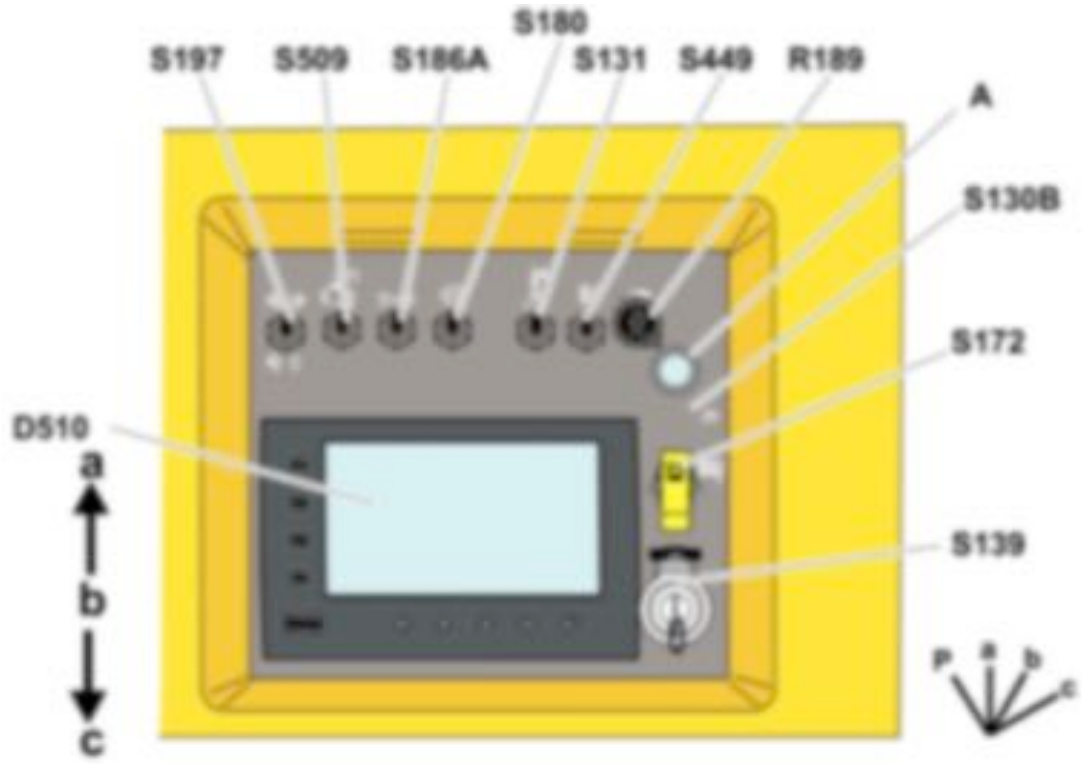


Pressure adjustment and pressure gauges.

1	Adjustment of RPCF
2	Adjusting high percussion pressure
3	Adjusting low percussion pressure
4	Adjusting threading pressure
5	Adjusting unthreading pressure
6	Adjusting high drill feed pressure
7	Adjusting low drill feed pressure
8	Adjusting rotation speed

9	Percussion pressure gauge
10	Return oil pressure gauge
11	Drill feed pressure gauge
12	Lubrication oil pressure gauge
13	Flushing air pressure gauge
14	Rotation pressure gauge
15	Extra air outlet

5.1.9 Control panel for diesel engine and directional instrument



Control panel for diesel engine and directional instrument

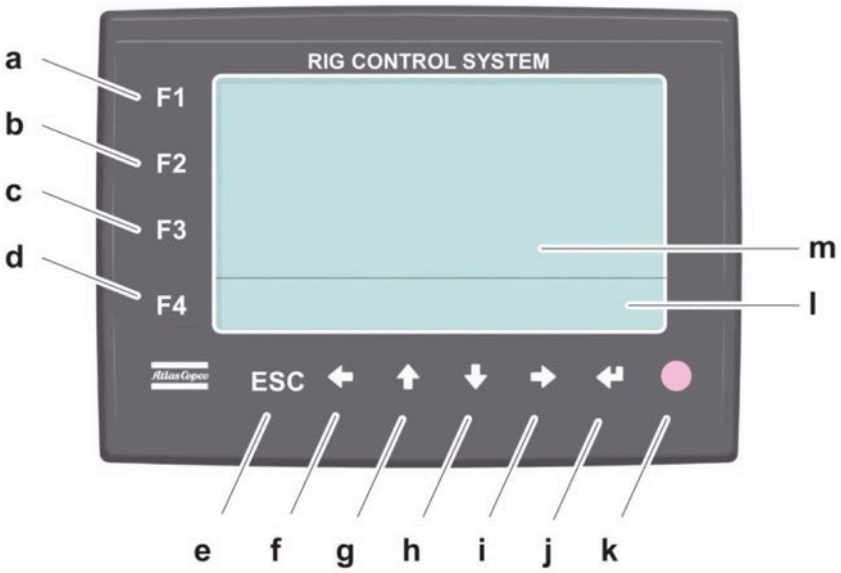
D510		Display for diesel engine and directional instrument
S130B		N/A
S139		Starter key for diesel engine
	a	Off
	b	Ignition
	c	N/A
	P	Override DES
S172		Circuit breaker for activating winch

	a	On
	b	Off
S180		Circuit breaker for compressor loading
	a	Compressor loaded
	c	Compressor unloaded
S186A		Signal Horn
	a	On
	c	Off
R189		Potentiometer for engine speed (active only when "high speed" is activated)
S197		Work lights
	a	Work lights front and rear on
	b	Work lights off
	c	Work lights on
S449		Switch for thread lubrication
	a	On (automatic)
	b	off
	c	Manual
S509		Engine bay lighting
	a	On
	c	Off
A		Reset button

Table 27: Functions

5.1.10 Display for engine and directional instruments

Display for engine and directional instruments



Display for engine and directional instruments.

The diesel engine is controlled by an electronic unit that continually sends information to the engine display. The engine display consists of two fields and nine function buttons (See illustration: Engine display).

> ! ***NOTE:*** *Do not use the drill rig if an error signal is shown on the display. If a warning symbol is displayed, the drill rig must be deactivated and the fault rectified.*

a	**Function button F1:** Provides information on engine speed, engine temperature, hydraulic oil temperature and compressor temperature. To access information on the soot content in the exhaust cleaner press F1 again.
b	**Function button F2:** Gives information on the directional instrument.
c	**Function button F3:** Provides information on drilled length
d	**Function button F4:** GPS compass (additional equipment)
e	**ESC** : Returns to previous presentation.
f - i	**Arrow keys:** For making selections in graphic presentation (Marked in green).
j	**Enter key:** To confirm selection of graphic presentation.
k	**Indicator lamp:** Indicates in connection with graphic presentation for directional instrument
l	**Status field**

m **Primary field**

The push buttons a - c provide direct access to the selected graphic presentation. To select a graphic presentation: select the desired presentation using the arrow keys and confirm by pressing the Enter key.

! ***NOTE:*** *Switching between directional instrument and drilled length (F2 and F3) takes place automatically from the remote control box transmitter. When drilling mode (S130 f) is selected the drilled length is displayed. When positioning mode is selected (S130 h) the directional instrument is displayed.*

Status field symbols

The status field on the engine display shows information to the operator in the form of coloured symbols. The information shown is an indication or a warning. Indications are green while warnings are either yellow or red.

- **Green** - Indication that a specific function is activated, e.g. compressor loaded.
- **Yellow** - Warning to indicate that something is not in its normal state and that the operator must undertake some form of remedy. Machine not in acute danger of malfunction.
- **Red** - Warning, indicates that something is in a critical condition. The engine is switched off when there is significant risk of machine breakdown.

! ***NOTE:*** *Yellow symbols can become red if the status of the fault worsens.*

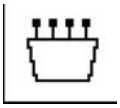
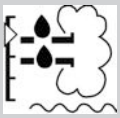
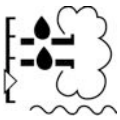
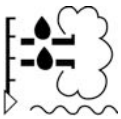
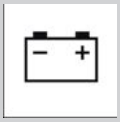
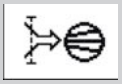
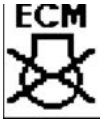
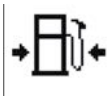
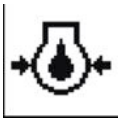
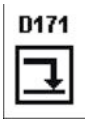
Symbol	Description	Symbol	Description
	**Compressor** Compressor loaded		**Laser status** indicates laser status*
	**Radio system** Radio system active		**DEF level > 80%** Indicates that the DEF (Diesel Exhaust Fluid) level is > 80 %
	**DEF level < 80%** Indicates that the DEF (Diesel Exhaust Fluid) is < 80%		**DEF level < 60%** Indicates that the DEF (Diesel Exhaust Fluid) is < 60%
	**DEF level < 40%** Indicates that the DEF (Diesel Exhaust Fluid) is < 40%		**DEF level < 20%** Indicates that the DEF (Diesel Exhaust Fluid) is < 20%

Table 28: Green symbols (Information symbols)

! ***NOTE:*** **) Grey background indicates selection of laser plane. Green background indicates hitting the laser plane.*

Symbol	Description	Symbol	Description
	**Engine service** Indicates time for engine service according to preselected number of hours		**Rock drill service** Indicates time for rock drill service according to preselected number of hours
	**Communication fault** Indicates disrupted communication in the CAN BUS system.		**Length Sensor** Indicates that the length sensor is not calibrated
	**Battery** Indicates that the voltage from the battery is less than 24V		**Compressor air filter** Indicates that the compressor air filter is clogged
	**ECL collection** Indicates that the ECL collection is too low or too high		**ECM** Indicates an ECM error
	**Engine temperature** The engine temperature is becoming too high		**Engine air filter** Indicates that the engine air filter is clogged
	**Engine reduction** Indicates that a fault has arisen and the engine output is limited		**Intake temperature** Indicates that the intake temperature in the engine is too high
	**Fuel level** Indicates low fuel level		**Fuel temperature** Indicates that the engine's fuel temperature is too high
	**Fuel pressure** Indicates that the fuel injection pressure is abnormal		**Engine oil pressure** Indicates that the oil pressure to the engine is becoming too low
	**Drill bit** Indicates that replacement is due		**Boom articulation sensor** D170 Sensor error
	**Angle sensors** D171 Sensor error		**Length Sensor** D172 Sensor error
	**High exhaust temperature (HEST-)**		**High soot content in the particulate filter (DPF)**

Symbol	Description	Symbol	Description
	Illuminates when regeneration has started.		Is shown when the soot content is > 80%.
	**Automatic regeneration blocked** Used when there is a risk of personal injury or damage to property.		**Self-holding of drilling lever ceases** Illuminates when the soot content reaches 100%. If this occurs, switch off the engine and contact authorised service personnel.

Table 29: Yellow symbols (Warning symbols)

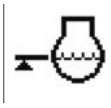
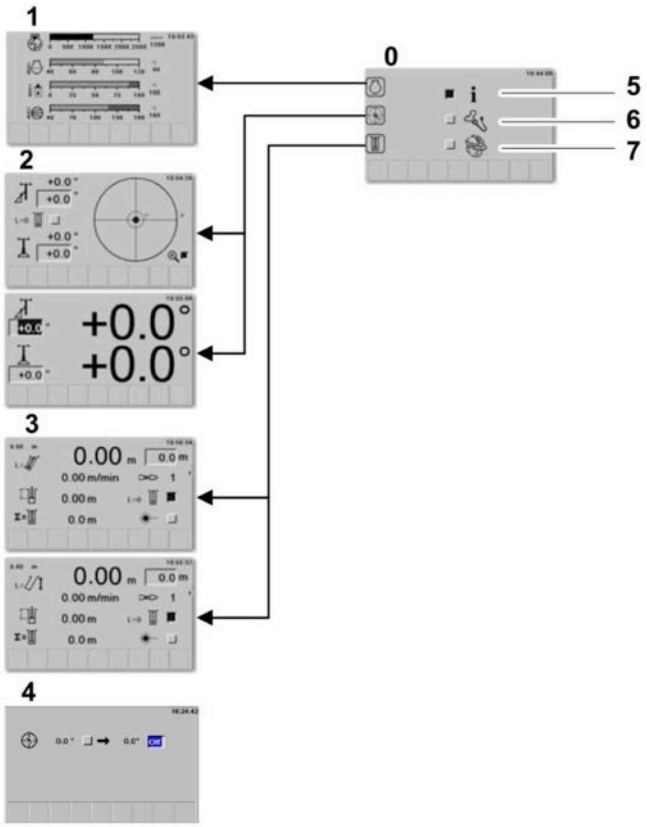
Symbol	Description	Symbol	Description
	**Engine oil pressure** Engine oil pressure is too low. Engine stopped automatically		**Engine temperature** Engine temperature is too high. Engine stopped automatically
	**Coolant level** Indicates that the coolant level to the engine is too low. Engine stopped automatically		**Compressor temperature** Indicates that the compressor temperature is too high. Engine stopped automatically
	**Hydraulic oil level** Indicates that the hydraulic oil level is too low. Engine stopped automatically		**Hydraulic Oil Temp** Indicates that the hydraulic oil temperature is too high. Engine stopped automatically
	**Engine Sensors** Indicates that an error occurred in the engine sensor, the engine is stopped automatically		

Table 30: Red symbols (Warning symbols that stop the diesel engine)

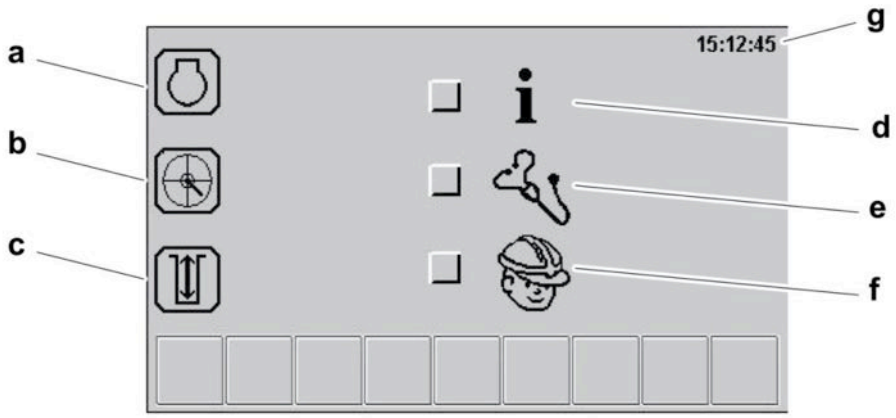
Menus



Main menu and shortcut menus

0	Main menu
1	Engine information
2	Directional instrument
3	Drilled length
4	GPS compass (additional equipment)
5	Statistics
6	System
7	Settings

1 Main menu

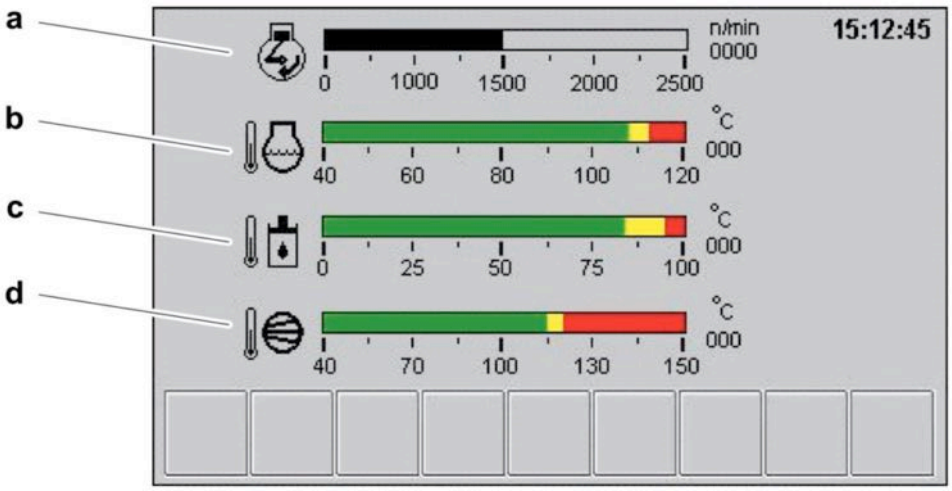


Main menu.

a	Opens graphical presentation for diesel engine
b	Opens graphical presentation for directional instrument
c	Opens graphical presentation for hole length/vertical depth
d	Opens graphical presentation for statistics
e	Opens graphic presentation for system status
f	Opens graphical presentation for settings
g	Clock

1 Engine information / Soot content

Switching between the display of engine information and soot content is performed with function key F1.



Engine information

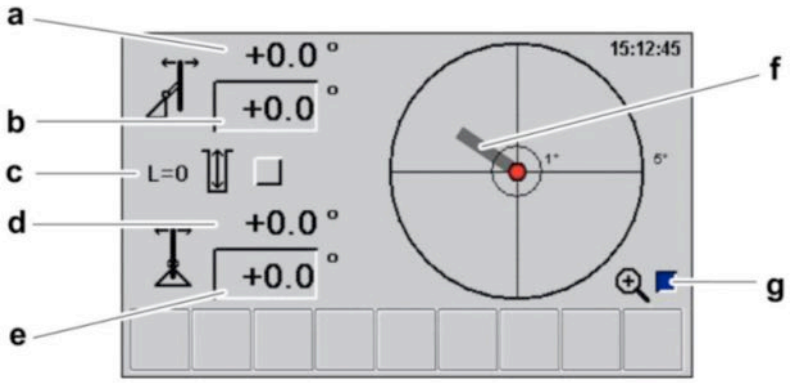
a	Bar graph showing engine speed

b	Bar graph showing engine temperature. The bar changes colour when changing to warning, first yellow warning then red warning.
c	Bar graph showing hydraulic oil temperature. The bar changes colour when changing to warning. First yellow warning then red warning.
d	Bar graph showing compressor temperature. The bar changes colour when changing to warning. First yellow warning then red warning.

3 Directional instrument

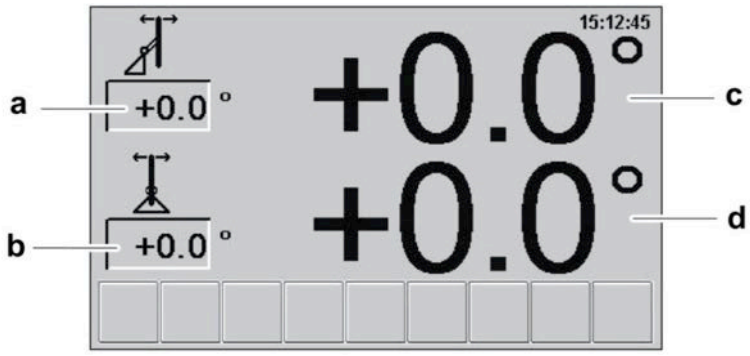
The directional instrument has two display modes, one graphic and one digital. Switch between the modes with function key F2.

The display mode selected with F2 will apply for automatic switching between directional instrument/drilled length from the remote control box.



Directional instrument - graphic display mode.

a	Counter showing actual angle of inclination in relation to required blast direction
b	Shows required inclination angle of the feeder in relation to the blast direction
c	Reset of counter for hole length/vertical depth
d	Counter showing actual lateral angle of the feeder in relation to required blast direction.
e	Shows desired lateral angle of the feeder
f	Shows inclination and lateral angles of the feeder graphically. Follow the direction on the line with the lever to obtain the correct position.
g	Activating Auto Zoom: when the deviating angle is less than 1° the outer circle changes over to indicate 1° instead of 5°.

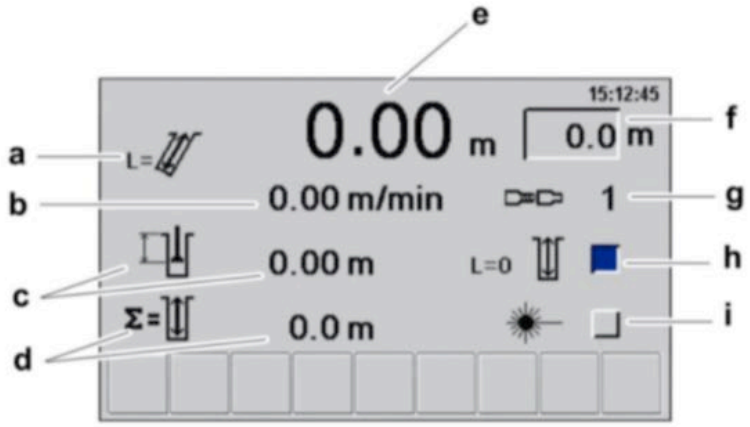


Directional instrument - digital display mode.

a	Shows required inclination angle of the feeder in relation to the blast direction
b	Shows desired lateral angle of the feeder
c	Counter showing actual angle of inclination in relation to required blast direction
d	Counter showing actual lateral angle of the feeder in relation to required blast direction.

4 Drilled length

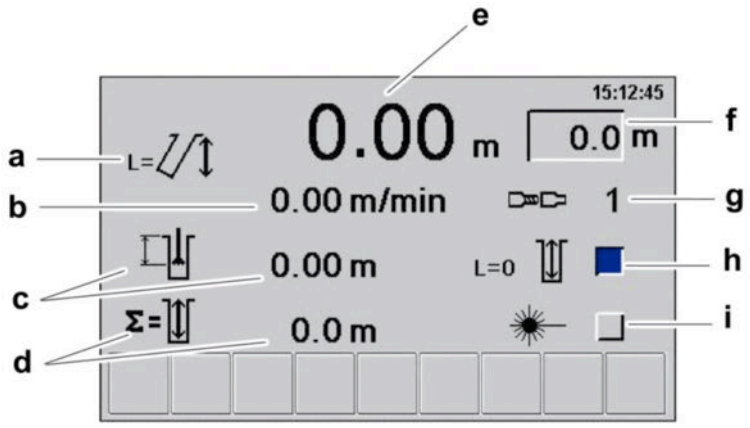
The window has two display modes, one which shows the actual hole length and one which shows the vertical hole depth. Select display mode in menu 7, Settings.



Hole length.

a	The symbol indicates that actual hole length is being displayed
b	Drilling rate (m/min)
c	Shows drill bit position
d	Shows total drilled length (m)
e	Current hole length (m)
f	Desired hole length (m)
g	Number of drill rods
h	Reset of counter for desired hole length

f	Activation of laser receiver (optional equipment). At activation the laser symbol with grey background is shown in the status field and after a hit the background changes to green.

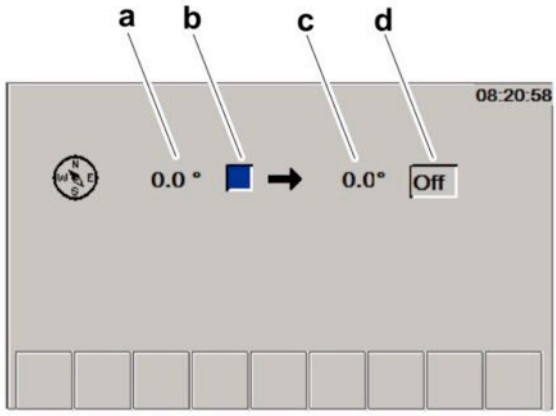


Hole Depth

a	The symbol indicates that vertical hole depth is being displayed
b	Drilling rate (m/min)
c	Shows drill bit position
d	Shows total drilled length (m)
e	Current hole depth (m)
f	Desired hole depth (m)
g	Number of drill rods
h	Reset of counter for desired hole depth
f	Activation of laser receiver (optional equipment). At activation the laser symbol with grey background is shown in the status field and after a hit the background changes to green.

For further instructions, see the chapter "handling drilled length measurement".

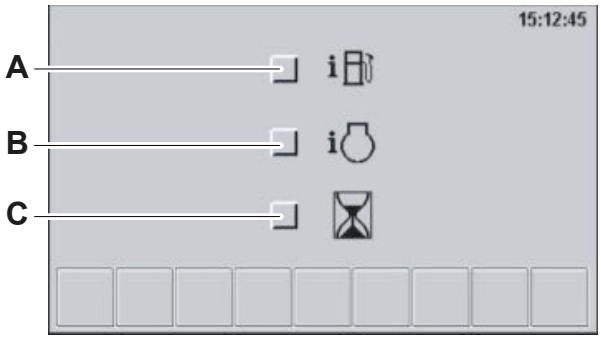
4 GPS compass



GPS compass.

a	Current value
b	Locking the current value for blasting direction
c	Last locked value
d	Activating the GPS compass

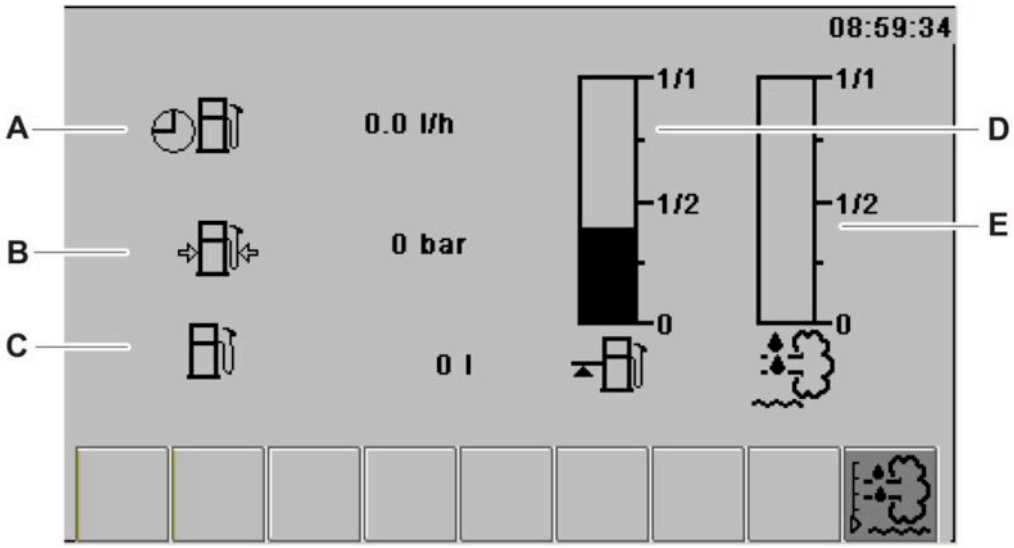
5 Statistics



Statistics menu.

a	Fuel information
b	Engine information
c	Time/consumption

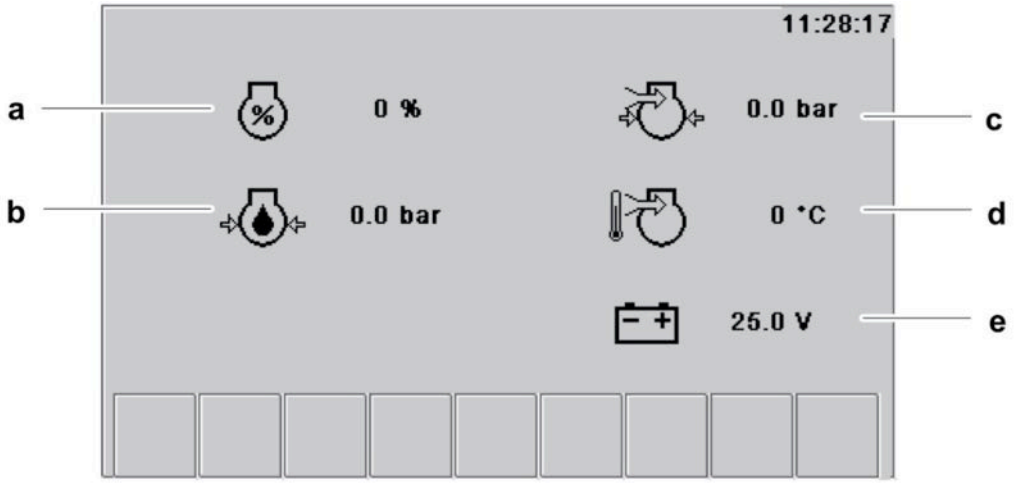
5.1 Fuel information



Fuel information

A	Fuel consumption (litres per hour)
B	Fuel pressure
C	Total fuel consumption
D	Fuel level
E	DEF (Diesel Exhaust Fluid) level

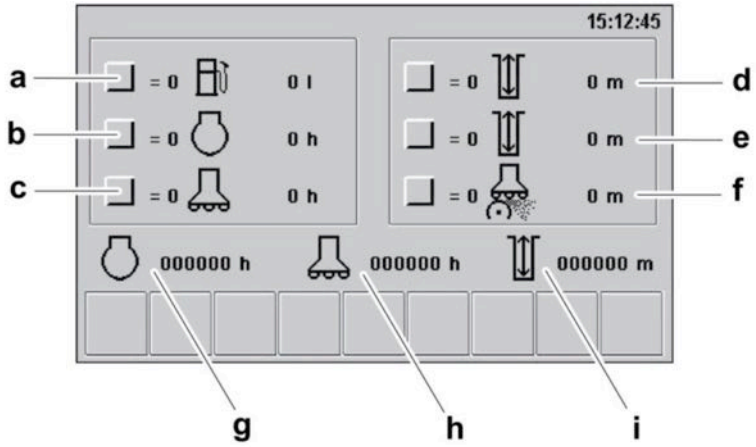
5.2 Engine information



Engine information.

a	Power output
b	Engine oil pressure
c	Charge air pressure
d	Intake manifold temperature
e	Battery voltage

5.3 Time - length - specific charging

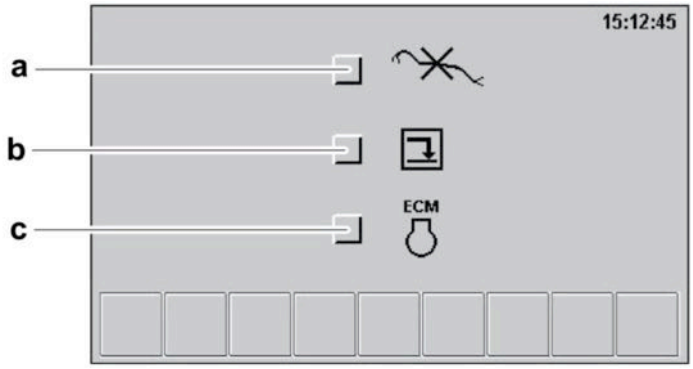


Time - length - specific charging menu.

a	Reset and display of fuel consumption
b	Reset and display of engine hours
c	Reset and display of percussion hours
d	Reset and display of total hole length/hole depth - counter 1
e	Reset and display of total hole length/hole depth - counter 2
f	Reset and display of number of drill-metres after grinding drill bit
g	Indicator for total number of engine hours*
h	Indicator for total number of percussion hours*
i	Counter for total drilled length*

! ***NOTE:*** **Cannot be reset*

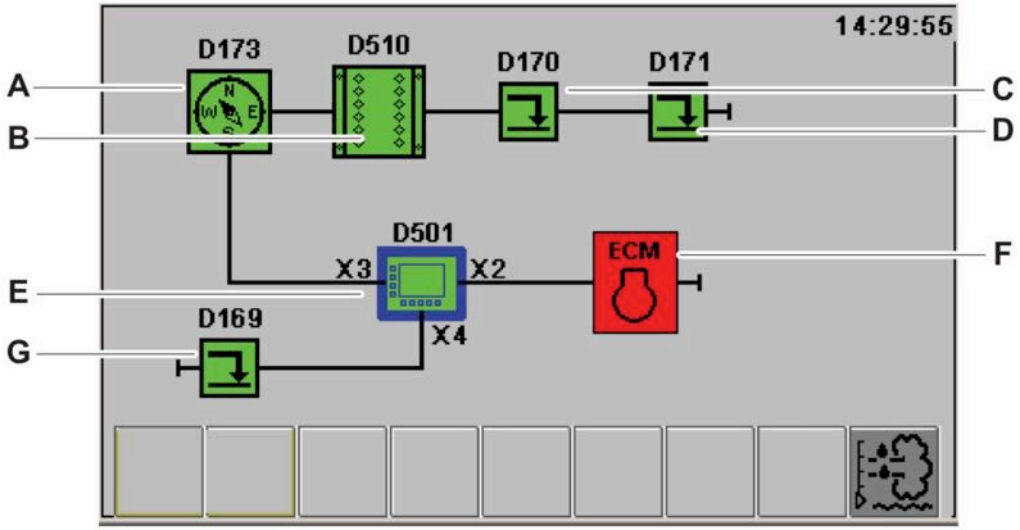
6 System



System menu.

A	Opens graphic presentation for CAN BUS communication
B	Opens graphical presentation for sensor information
C	Opens graphical presentation of ECM

6.1 Communication



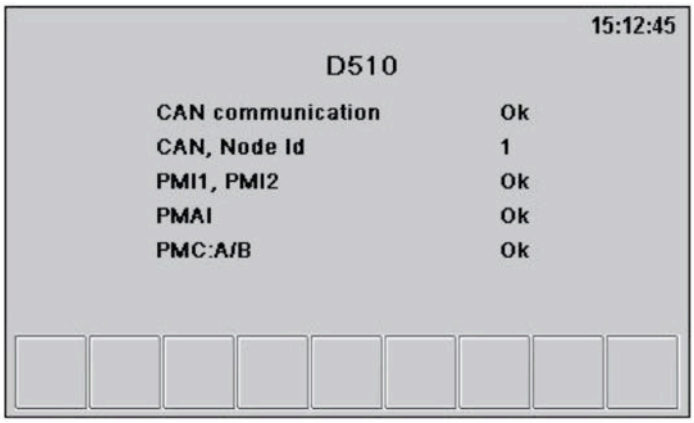
Communication menu.

A	D173 GPS
B	D510 I/O modules
C	D170 Boom axis sensor
D	D171 Angle sensor
E	D501 VGA display and master module
F	ECM Engine Control Module
G	D169 Sight

- Red module: No communication.
- Green module: Communication OK.

6.1.1 Module status

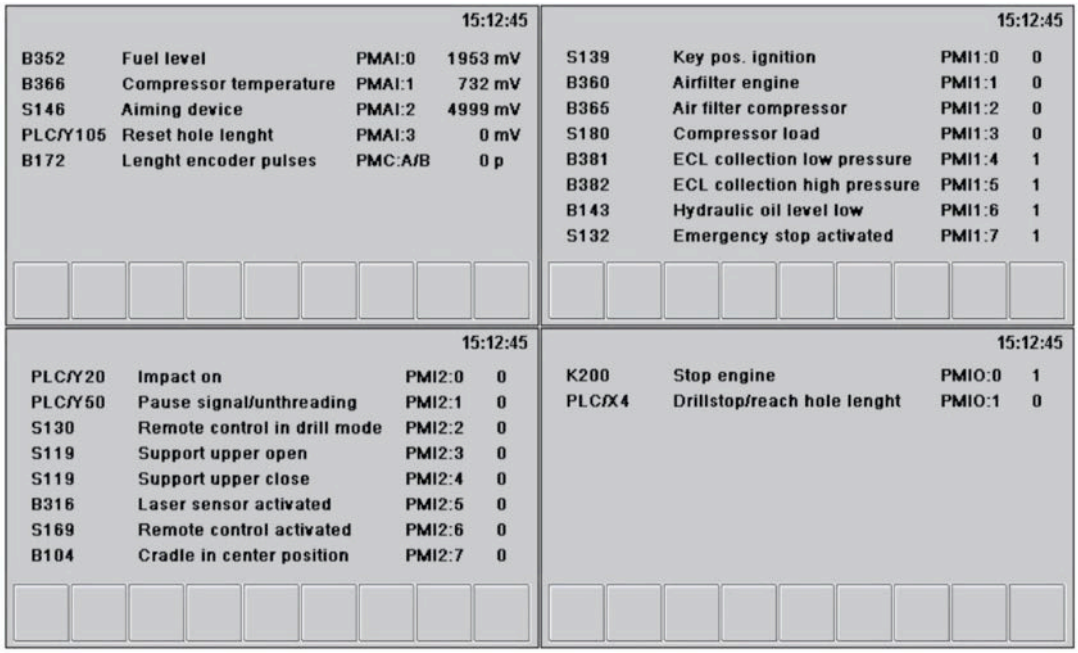
Symbols in the previous menu marked with a blue frame can be activated using Enter. Following which the current status of the modules is shown.



Current status of D510 I/O module

6.2 Sensor information PMAI/PMAI1/PAMI2/PMO

Graphic presentation for list of sensors connected to D510 (I/O module). The list shows position designation, description, connections and current status. Switch between the pages with the function keys, "up" and "down".



Sensor information.

Sensor	Function	Status	Event
B352	Fuel level	0 mV/10000 mV	Empty fuel tank/full fuel tank
B366	Compressor temperature	6000-4000 mV	Compressor oil temperature is ~+20-23°
S146	Aim Device	~1200 mV ~3900 mV	Aim device max right

Sensor	Function	Status	Event
		~8200 mV	Aim device straight ahead Aim device max left
PLC/Y105	Reset hole length	0-10000 mV	When zeroing
B172	Length meter pulses	A/B	When measuring

Table 31: Sensor information

Sensor	Function	Status	Event
S139	Key in ignition position	1	Percussion active
B360	Air filter, engine	0	Filter OK
B365	Air filter, compressor	0	Filter OK
S180	Compressor on	1	Compressor loaded
B381	ECL collection, low pressure	1	Pressure OK
B382	ECL collection, high pressure	1	Pressure OK
B143	Hydraulic oil level low	1	Oil level OK
S132	Emergency Stop Activated	1	Emergency stop not triggered

Table 32: Sensor information

Sensor	Function	Status	Event
PLC/Y20	Percussion ON	1	Percussion ON
PLC/Y50	Pause signal/unthreading	1	Signal from sensor regarding pause
S130	Remote panel in drilling position	1	
S119/A1	Upper drill-steel supports open	1	Drill-steel support is open
S119/A3	Upper drill-steel supports closed	1	Drill-steel support is closed
B316	Laser sensor activated	1	Sensor has received laser signal
A59	Remote panel activated	1	Remote control box active
B104	Cradle in calibration mode	1	Cradle is in calibration position

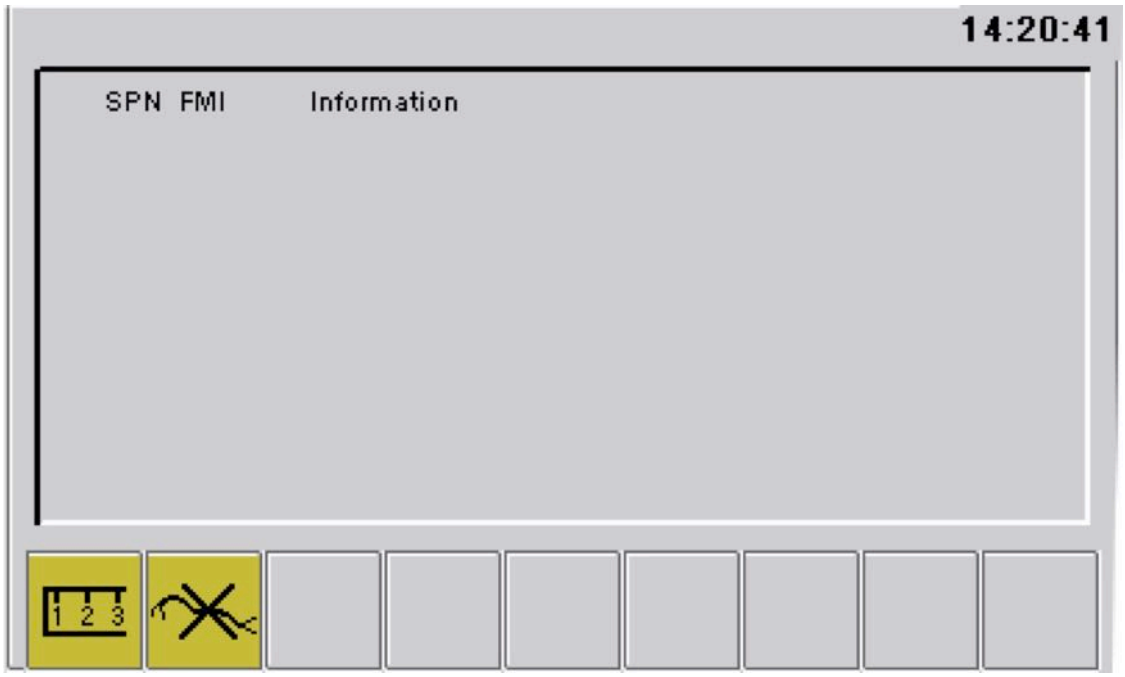
Table 33: Sensor information

Sensor	Function	Status	Event
K200	Stop Engine	0	Engine stopped
PLC/X4	Drill stop/hole length reached	1	Desired hole length obtained

Table 34: Sensor information

> ***NOTE:*** *Any status other than the one given indicates a sensor fault or that something else happened to the function.*

6.3 ECM information

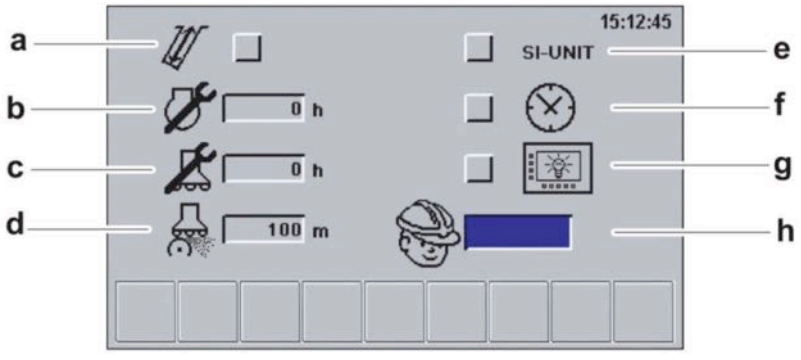


ECM information.

Graphic presentation for list of sensors connected to ECM (Engine Control Module). The list shows position designation, description and whether or not current status is OK.

In the event of a sensor fault the sensor in question and fault type are shown in the menu.

7 Settings



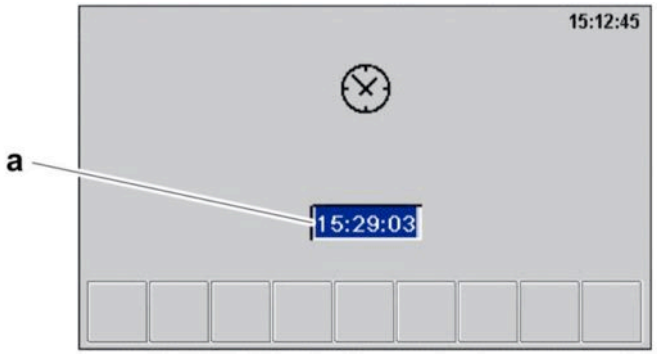
Settings.

Pos.	Function
a	**Selection of drilled length measurement method:** Mark the box using the arrow keys and confirm with Enter. Select hole depth gauge or vertical depth gauge using the arrow keys and confirm with Enter. For further information, see the chapter on "Operating the drilled length instrument".
b	**Service interval, engine hours:** Shows the number of hours left before the engine requires servicing. When the preset number of engine hours has been reached, the "engine service" symbol will be shown in the status bar of the display. When service has been carried out the new setting is added: ■ Use the arrow keys to move to and mark the box. Confirm your selection with Enter. ■ The digits will then be highlighted in blue and show the preset service interval instead of the remaining hours. ■ Use the arrow keys to change the preset service interval and confirm with Enter. ■ The digits will now indicate the remaining number of hours until the engine requires servicing.
c	**Service interval, percussion hours:** Shows the number of hours left before the rock drill requires servicing. When the preset number of engine hours has been reached, the "service rock drill" symbol will be shown in the status field of the display. When service has been carried out, add the new setting ■ Use the arrow keys to move to and mark the box. Confirm your selection with Enter. ■ The digits will then be highlighted in blue and show the preset service interval instead of the remaining hours. ■ Use the arrow keys to change the preset service interval and confirm with Enter. ■ The digits will now indicate the remaining number of hours until the rock drill requires servicing.
d	**Drill bit grinding interval, drilled length:** Displays interval set in number of drill-metres for replacement or grinding of drill bit.

Pos.	Function
	When the preset number of drill-metres has been reached the "Drill bit grinding" symbol will be shown in the display status field. The interval is set in accordance with the steps below. ■ Use the arrow keys to move to and mark the box. Confirm your selection with Enter. ■ Use the arrow keys to display the required value and confirm with Enter. ■ The digits will now display the number since the latest drill bit replacement/grinding. Reset in menu 5.3 "Time - length - specific charging" where the number of drill-metres after grinding is also displayed.
e	**Unit selection:** Select using the arrow keys and confirm with Enter.
f	**Setting the clock:** Select the menu for setting the clock using the arrow keys and confirm with Enter. Set the clock using the arrow keys and confirm with Enter.
g	**Backlight/Contrast** : Select the menu with the arrow keys and confirm with Enter.
h	**Logging in for parameter adjustment:** Select using the arrow keys and confirm with Enter. A flashing cursor will be shown to the left. Enter the password using the arrow keys and confirm with Enter.

Table 35: Functions in the Settings menu.

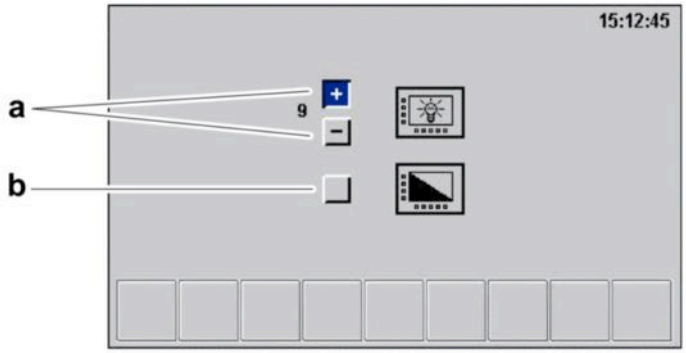
7.1 Setting the clock



Setting the clock.

Pos.	Function
a	Press Enter, adjust with the arrow keys and confirm with Enter.

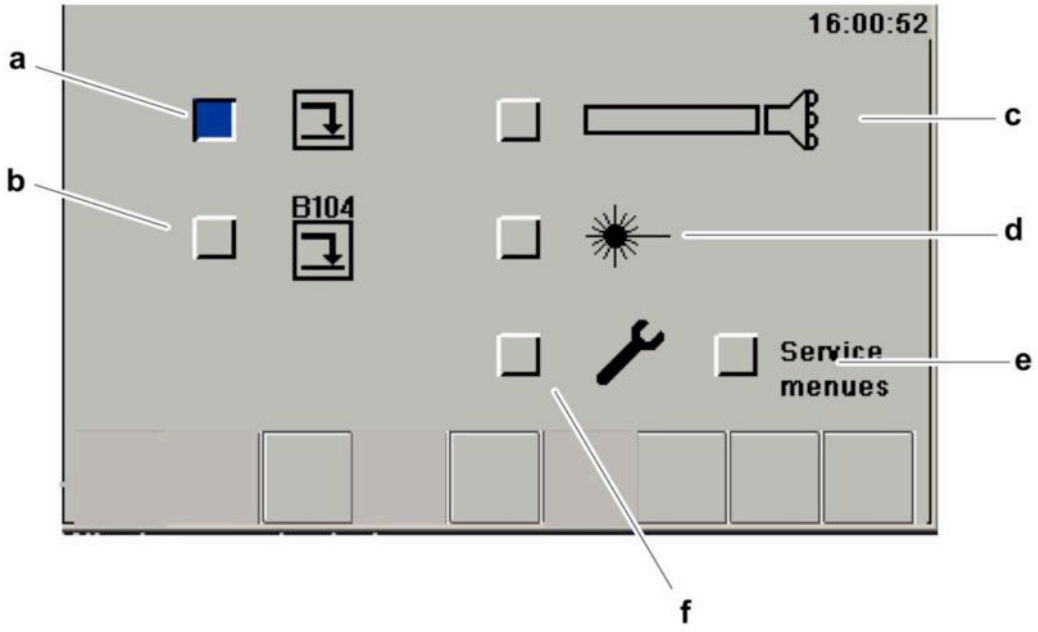
7.2 Display lighting and background colour



Lighting and background colour menu.

Pos.	Function
a	Light adjustment: When the plus button is selected, the background lighting increases when Enter is pressed. When the minus button is selected, the background lighting decreases when Enter is pressed.
b	Background colour: When this button is selected the background colour is switched between white and grey when Enter is pressed.

7.3 Logging in

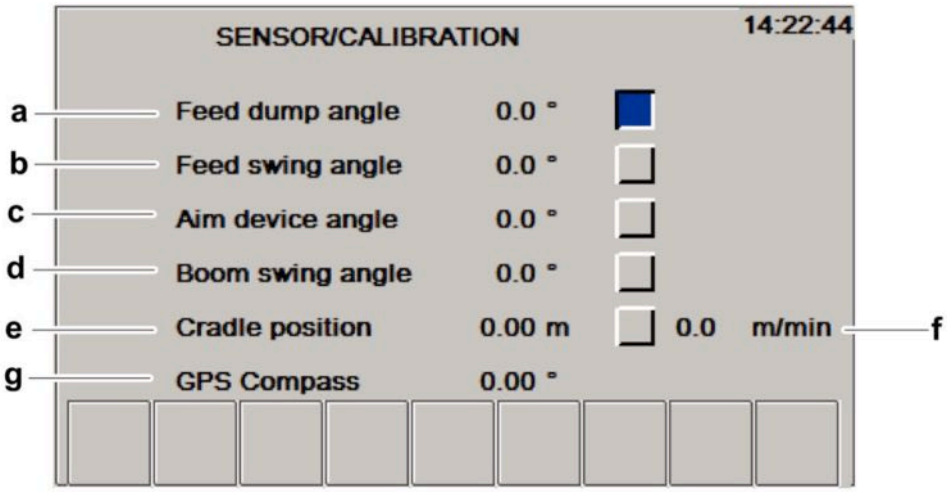


Menu, Logging in.

a	Sensor calibration
b	Length sensor calibration
c	Settings for drill steel
d	Calibration of laser receiver

e	Service menus
f	Setting the service interval and reporting service.

7.3.1 Sensor calibration

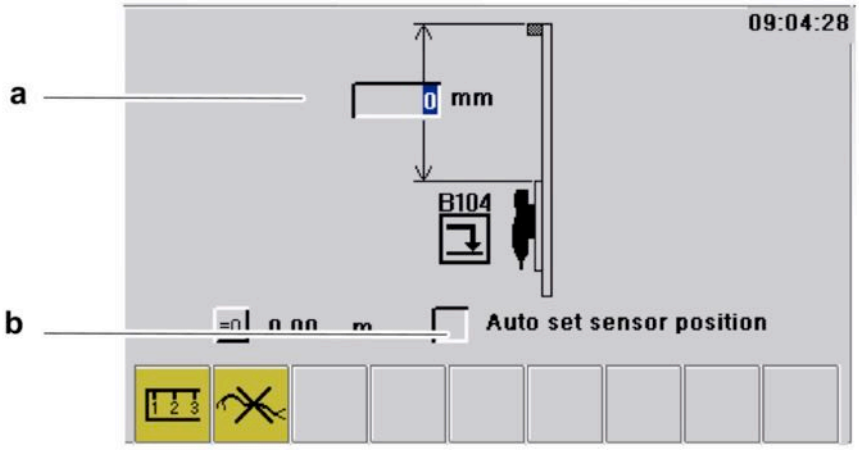


Sensor calibration menu.

a	Feed dump angle
b	Feed swing
c	Aim
d	Boom Swing
e	Cradle position
f	Information on cradle speed
g	GPS compass

Select a setting using the arrow keys and then reset using Enter. See the chapter on "Operating the directional instrument" for further instructions.

7.3.2 Rock drill cradle



Rock drill cradle.

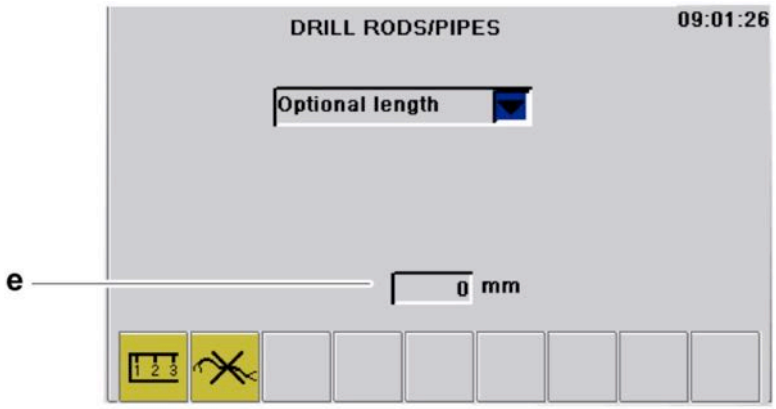
- Calibration of rock drill cradle:

- Run the rock drill cradle all the way up
- Go to menu 7.3.1 "Sensor calibration" and reset "Cradle position"(e).
- Go to the "Sensor information" menu and lower the cradle slowly until sensor B104 gives an indication (0 becomes 1)
- Go back to the "Sensors/calibration" menu and read off the value in "Cradle position"
- Go to the "Rock drill cradle" menu and enter the value that was in "cradle position"

The rock drill cradle is now calibrated.

> ***NOTE:*** *If box (b) is selected then the distance is set automatically after the rock drill has been moved from the top position on the feeder down to the calibration sensor.*

7.3.3 Drill rod



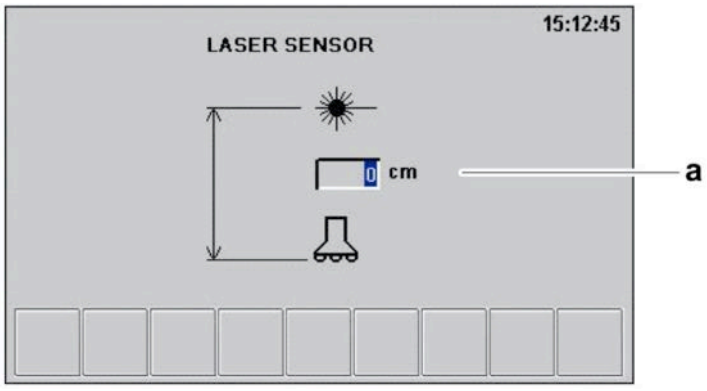
Drill rod.

Select drill rod length using the arrow keys and confirm with Enter.

It is also possible to set the length of the drill steel manually by selecting (e) and then setting a user value.

> ***NOTE:*** *If no selection is made then the hole length measurement will not work.*

7.3.4 Laser sensor

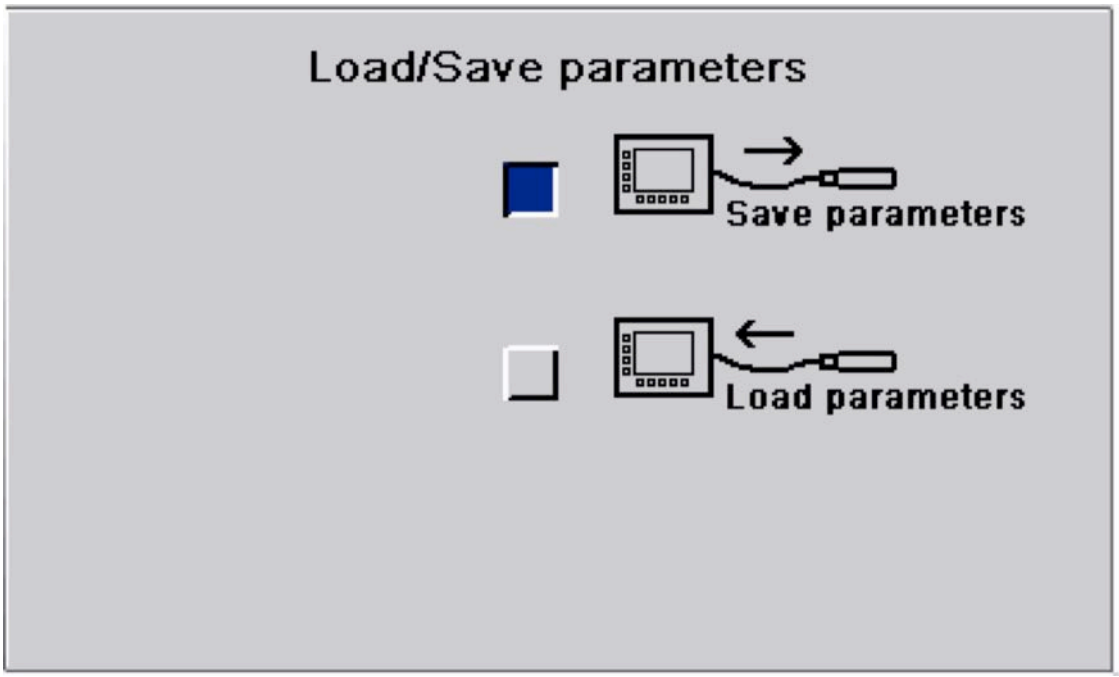


Laser sensor

The distance between the laser sensor and the drill bit should be in the box (a). This value needs to be adjusted in the following cases:

- Changing length of drill steel
- Replacement of laser sensor

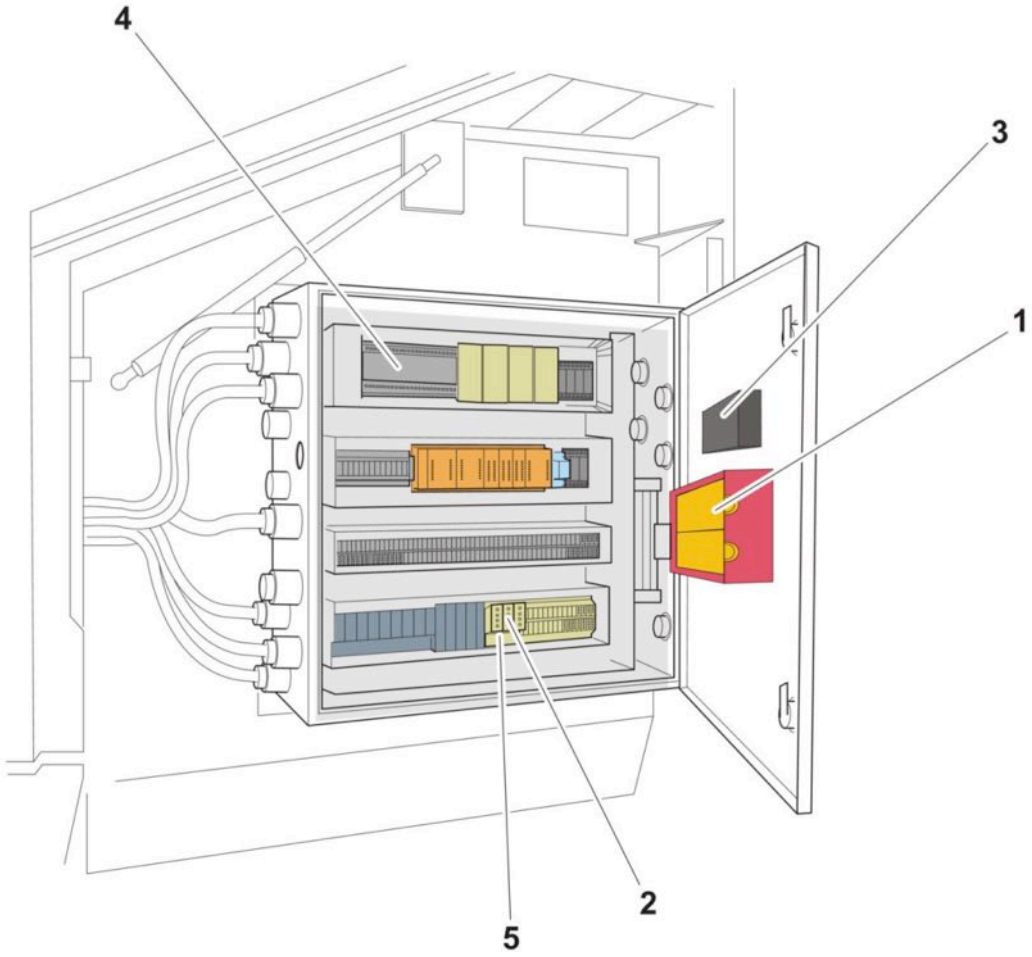
Load/Save parameters



Calibration values for the direction instrument can be saved on a USB card in this menu. The card is connected to the rear of the display.

5.2 Other controls

5.2.1 Electric cabinet



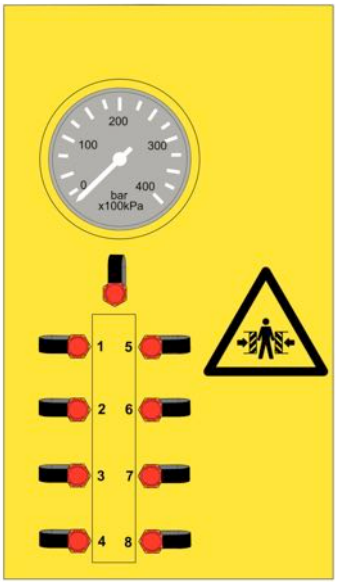
A1 electric cabinet.

1	Battery charger for remote control box batteries.
2	Settings for ECG and ECL
3	Timer diesel heater (optional)
4	PLC
5	Grease brushes (Option) The amount of grease being pumped can be adjusted with the time relay K449. The time period used is set on the upper adjustment knob. It must always be 1-10 seconds. The length of time for which the pump pulses is adjusted on the centre adjustment knob. If the upper knob is at 1-10 seconds and the centre knob is at 3 seconds then the pump operates for 3 seconds every 10th second.

The shape of the pulse is adjusted on the bottom knob. It must always be at B.

> ***NOTE:*** *The entire system can be turned off by stopping the supply of air with the cock by the grease pump.*

5.2.2 Test connections for the hydraulic circuits



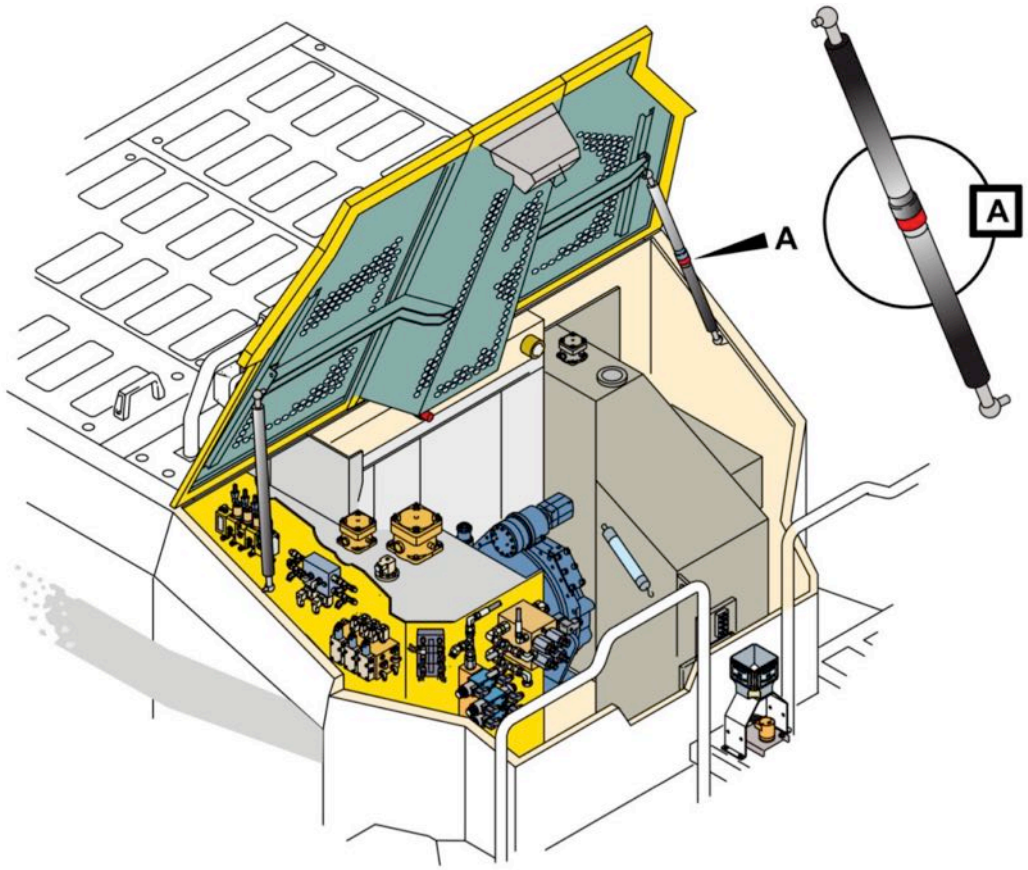
Test instrument for checking the hydraulic circuits.

Connect the test instrument to the different outlets (see table below).

1	Hydraulic pump 1: Percussion, Drill feed, Rapid feed, Tramming
2	Hydraulic pump 2: Rotation, Preheating
3	Hydraulic pump 3: Winch and positioning/DCT
4	Hydraulic pump 4: Radiator
5	Hydraulic pump 5: Not used
6	Drill extractor pressure *
7	Pilot pressure
8	Not used

> ***NOTE:*** ** Extra equipment*

5.2.3 Front cover



Front cover

When the front cover is fully opened it is locked in open position. To close the front cover, press button (a) on the gas spring.

6 Operating

6.1 Activating the remote control box

WARNING

Serious injury

Danger of accidental operation

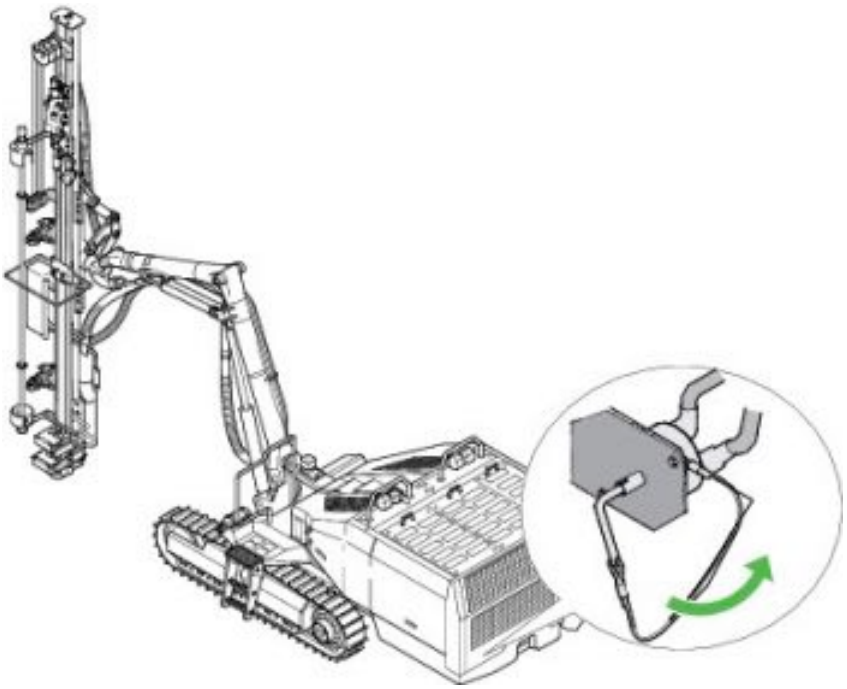
- May cause serious personal injury and damage to property
- The operator must always have an overview of the drill rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the drill rig when the winch is being used

NOTE: *Monitor pressure gauges and display for diesel engine when in operation.*

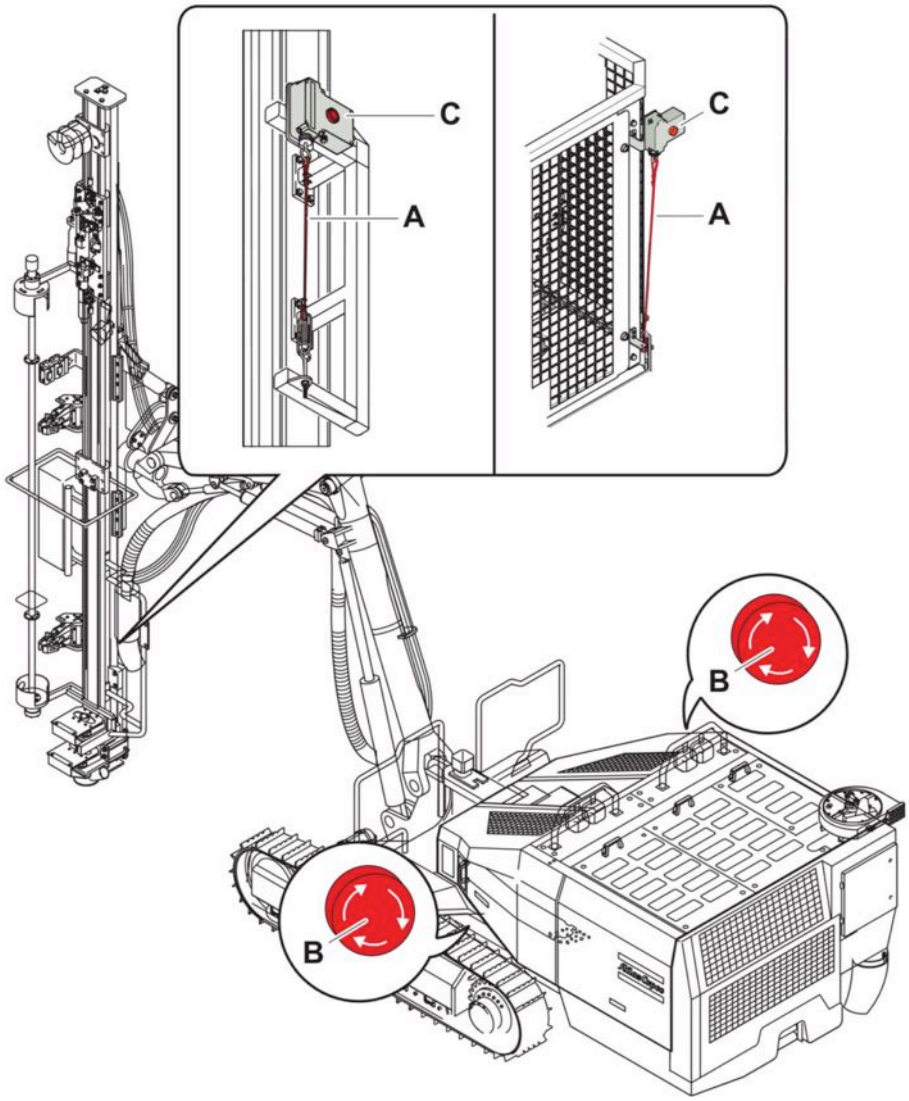
NOTE: *Always have the drill rig and the remote control box under surveillance.*

NOTE: *If the key on the remote control box is turned off once the system has been activated, the diesel engine will stop and deactivate the whole drill rig.*

1. Activate the drill rig's main power contactor (S300).

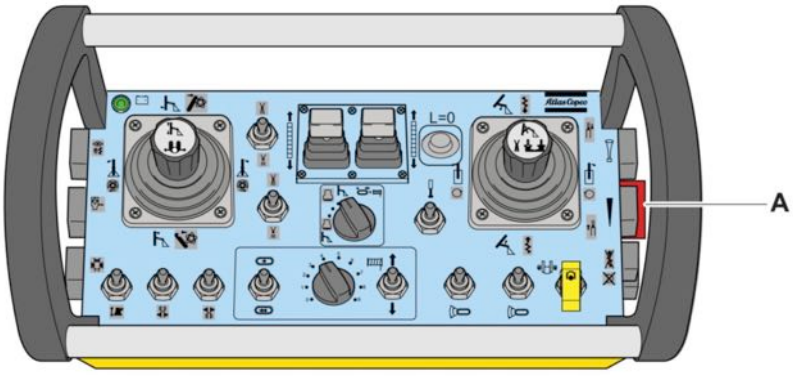


2. Check that no emergency stop is activated. Reset the emergency stops with the reset button (C).

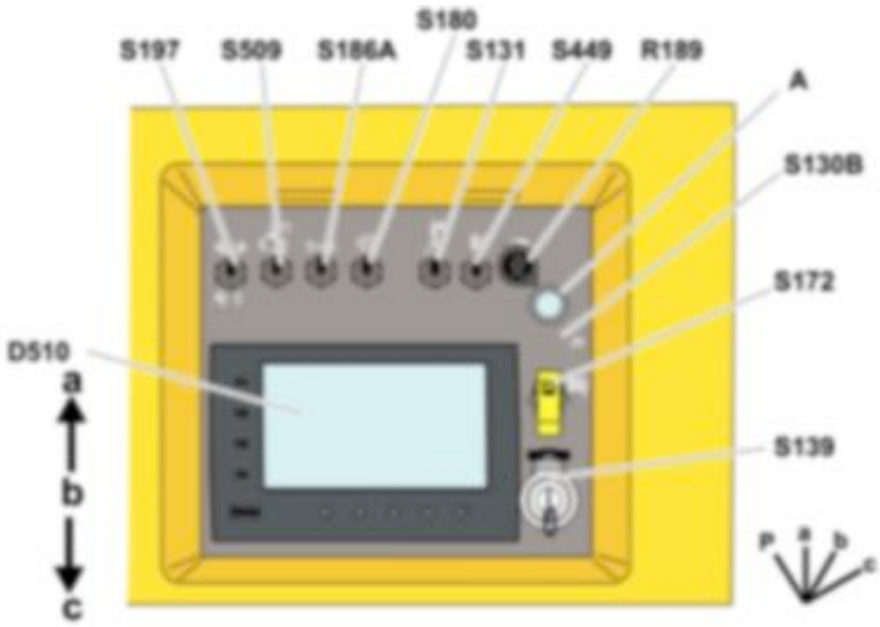


Emergency stop location

3. Reset the emergency stop on the radio box (A).

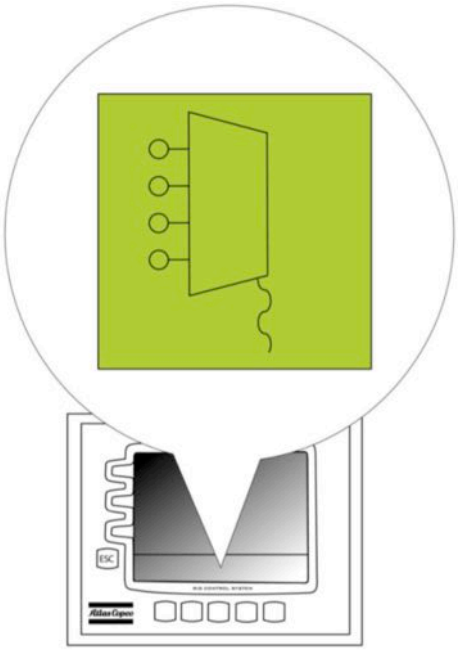


4. Turn the starter key on the diesel panel to the On position, S139 to position (b).



5. Press the reset button (A) on the diesel panel.
6. Activate the radio box with one rapid press of the start button S186 (B). Then press the same button for 2-3 seconds.

➔ A symbol will light up on the diesel engine display once the remote control box has been activated.



7. Unless a control is used on the remote control box within 10 seconds, the box will go into so-called "standby mode". Press button S186 (B) to reactivate the remote control box.

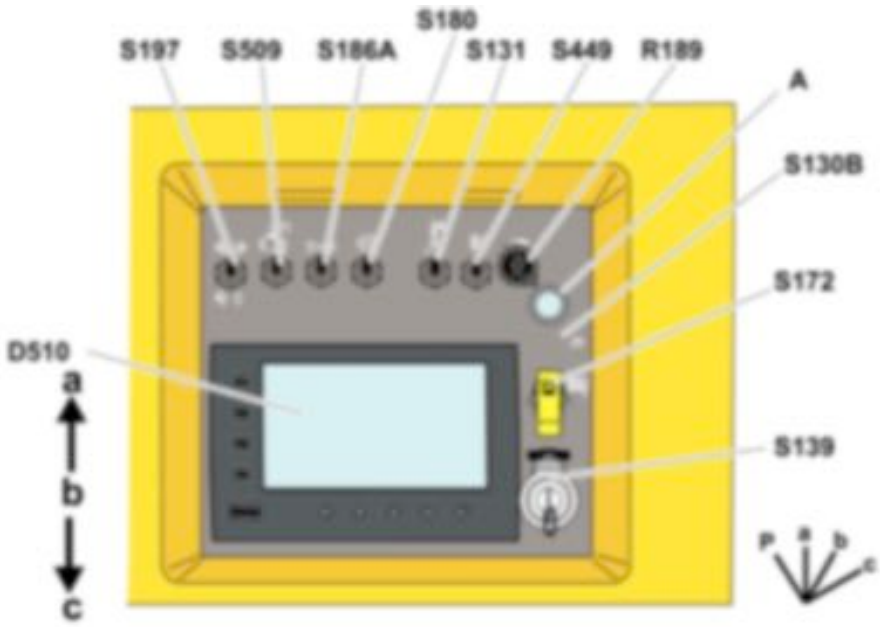
> ! ***NOTE:*** *The 10 seconds timer only works in the "Tramming/Positioning" position*

6.2 Diesel engine starting

> ! ***NOTE:*** *Monitor pressure gauges and display for diesel engine when in operation.*

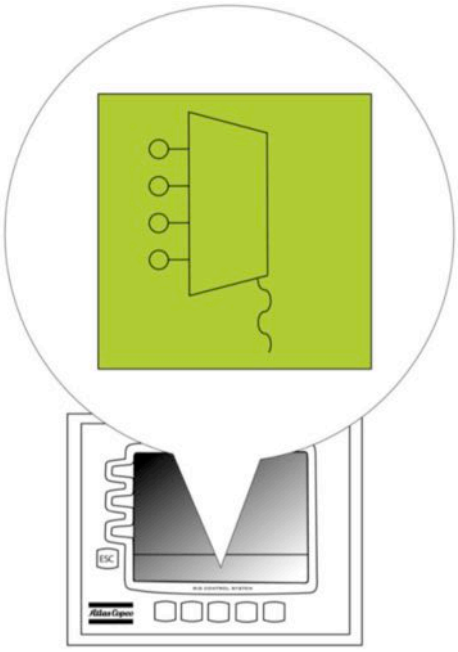
> ! ***NOTE:*** *After an emergency stop, the procedure for obtaining radio contact between the rig and the radio box must be done again.*

1. Make sure the compressor is unloaded. Switch S180, position (c).

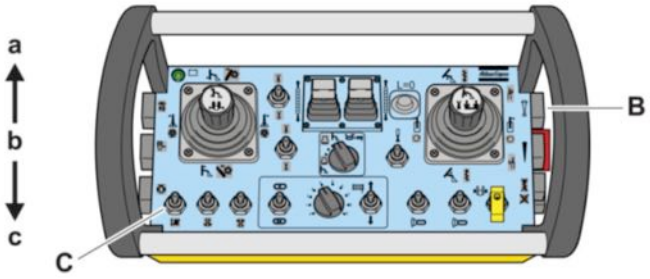


2. Turn the ignition key to ignition (b). Ignition key S139.
3. Reset the emergency stop with the reset button (A) on the diesel panel.
4. Activate the radio box with one rapid press of the start button S186 (B). Then press the same button for 2-3 seconds.

➔ A symbol will light up on the diesel engine display once the remote control box has been activated.



5. Press the start button S186 (B) and then (within 5 seconds) press the button (C) for Suction cup position down (c) and hold for more than one second, then press Suction cup (C) position up (a) until the engine starts.



! ***NOTE:*** *If a fault is indicated on the display for the diesel engine, turn off the engine and see which symbol is on. Rectify the fault.*

6. Check the hydraulic oil temperature (must be preheated to at least 20 °C (68 °F)).

6.3 Regeneration (Tier 4 Final)

⚠ WARNING

Serious injury

Very high exhaust temperatures >600°C

- ▶ May cause serious personal injury and damage to property
- ▶ Always check that the rig is positioned so that fire or other damage cannot occur when regeneration is in progress

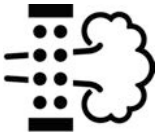
6.3.1 General

Regeneration is a process that burns out the soot from the diesel engine's particulate filter. In normal conditions, regeneration starts automatically and without affecting the rig's performance.

The operator cannot influence the regeneration process. Regeneration is started and stopped without a message being shown on the display.

6.3.2 Warning of high soot content in the particulate filter.

Warning symbol for **high soot level in the particulate filter** is displayed when the soot level reaches 80%.



The warning symbol for **Self-holding of drilling lever ceases** is shown when the soot level is above 100%. If the symbol is shown then the engine must be switched off and authorised service personnel contacted.

6.4 Delayed Engine Shutdown - (DES)

6.4.1 Description

When the engine is switched off, it may continue to run at idling speed for a few minutes. The DES time varies between 1-7 minutes, depending on how hot the injector is.

The purpose of DES is so that the DEF injection system should be able to cool down before the engine stops. This reduces the risk of damage to the DEF injector.

CAUTION

Risk of injury

Always switch off the engine correctly. See section Stopping the diesel engine for further information.

- Do not use the emergency stop to bypass the delayed shutdown period.
- Using the emergency stop system to bypass the delayed shutdown period risks damaging the DEF injector.

Testing the emergency stop system on rigs equipped with DES

The emergency stop system should be tested prior to each shift by activating each respective emergency stop button. If the engine is hot, there is a risk of damaging the DEF injector. In this case, the engine must be restarted immediately after each emergency stop button has been depressed.

Switching off the engine

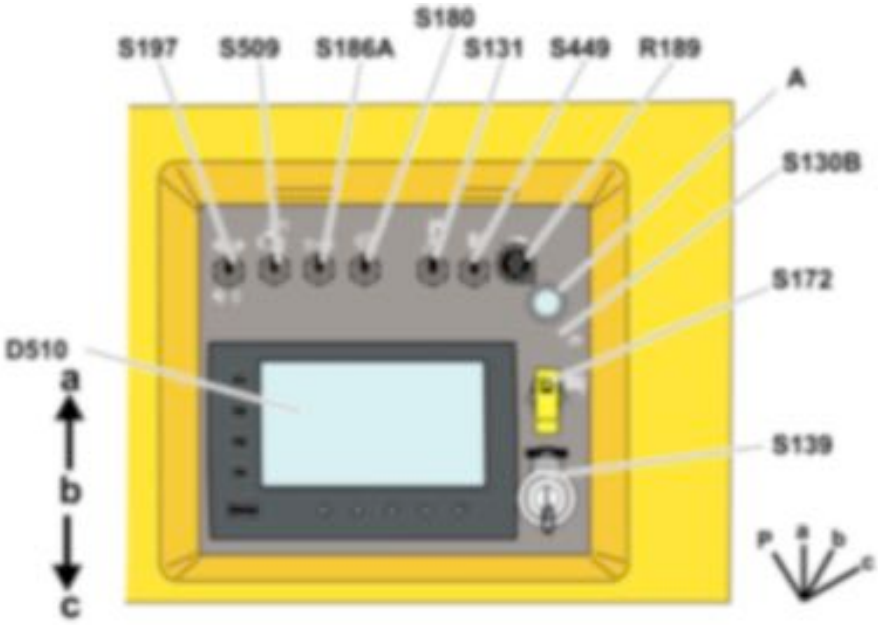
Repeatedly bypassing delayed shutdown (DES) of the engine damages the DEF injector. Each time delayed shutdown is bypassed it is recorded in the event log in the rig's control system.

6.5 Stopping the diesel engine

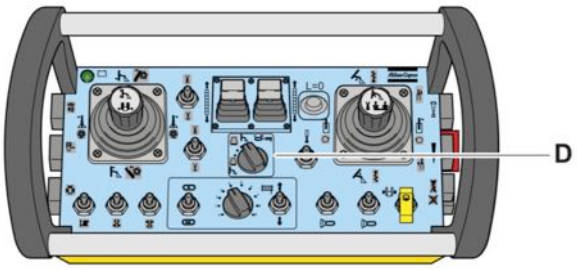
! ***NOTE:*** *If the engine is hot, run it at idling speed for a couple of minutes before switching off.*

1. Unload the compressor. Switch S180A, position (c).

   ! ***NOTE:*** *NOTICE! The engine speed must be lowered to idling before the compressor is discharged.*



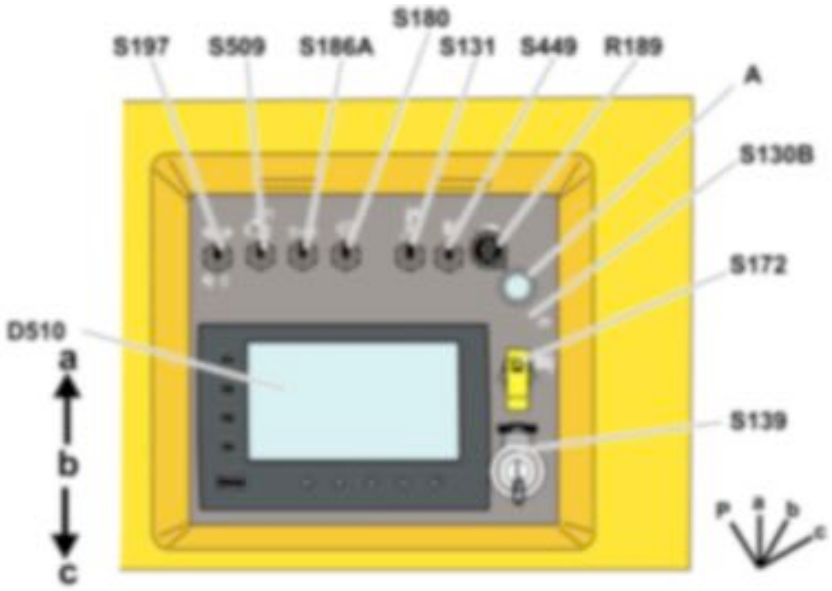
2. Set the position selector S130 (D) on the remote control box to tramming (h).



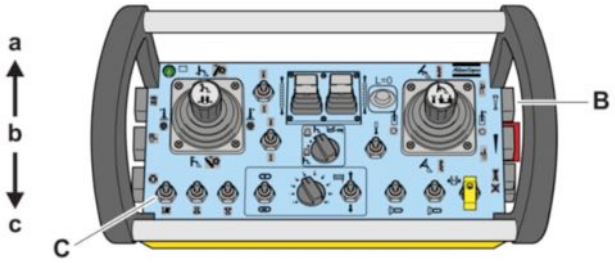
3. To turn off the engine:

   a. Turn the ignition key to OFF. Ignition key S139. The engine may run at idling speed for a few minutes. See the section **Delayed shutdown (DES)** for information. Turn the key to position (P) to bypass DES.

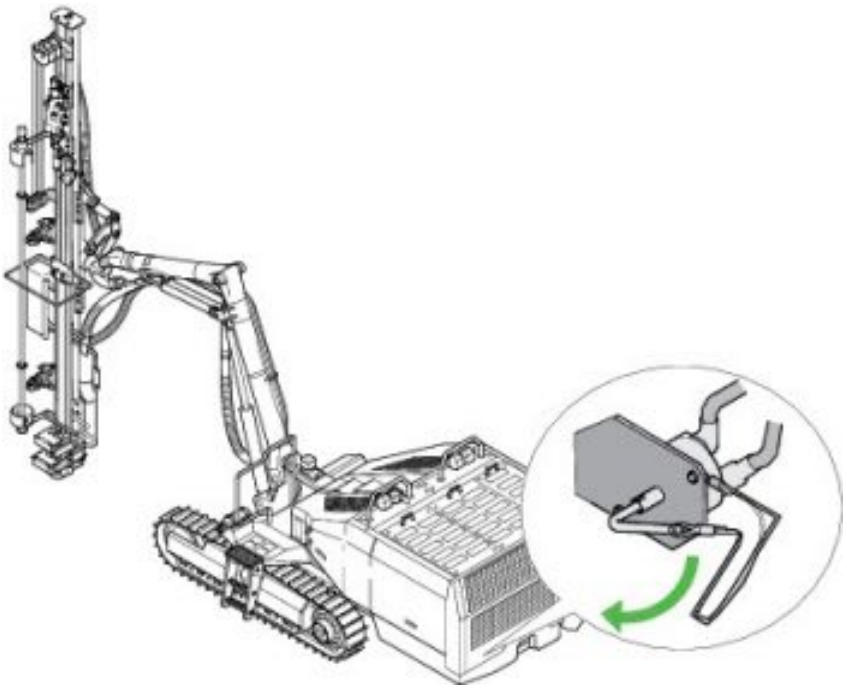
> **NOTE:** *Repeatedly bypassing delayed shutdown (DES) of the engine damages the DEF injector. Each time delayed shutdown is bypassed it is recorded in the event log in the rig's control system.*



b. Press the start button (B) and then (within 5 seconds) press the button for Suction Hood Down (C) position (c) and hold until the engine stops. Turn the ignition key to position (P) to bypass DES.



4. When the engine has stopped, wait 2 minutes before you switch off the battery's main power contactor. The DEF system requires this time to drain all hoses of fluid. The DEF system may be damaged if fluid remains in the hoses after switching off.
5. Deactivate the drill rig's main power contactor (S300).



6.6 Tramming

6.6.1 Tramming

WARNING

Serious injury

Risk of dumping/sliding

- May cause severe personal injury and damage to property
- Always check the prevailing ground conditions where the rig shall be operated
- Keep the track oscillation pedals open during tramming
- Inclination angles for Downward/Upward/Lateral CANNOT be combined with each other
- Do not exceed the inclination angles, See technical data
- Note the gradient meters' values
- Never operate the drill rig from the down side during remote control operation
- Close the cabin door and always use the safety belt
- Always ensure that unauthorised personnel are outside the working area

WARNING

Serious injury

Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always have an overview of the drill rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the drill rig when the winch is being used

WARNING

Serious injury

Danger of high-voltage cables

- May cause serious personal injury and damage to property
- Keep away from high-voltage cables

CAUTION

Risk of injury

Note that worn track shoes reduce the friction with the ground considerably and consequently increase the risk of sliding

WARNING

Serious injury

Risk of falling from the drill rig

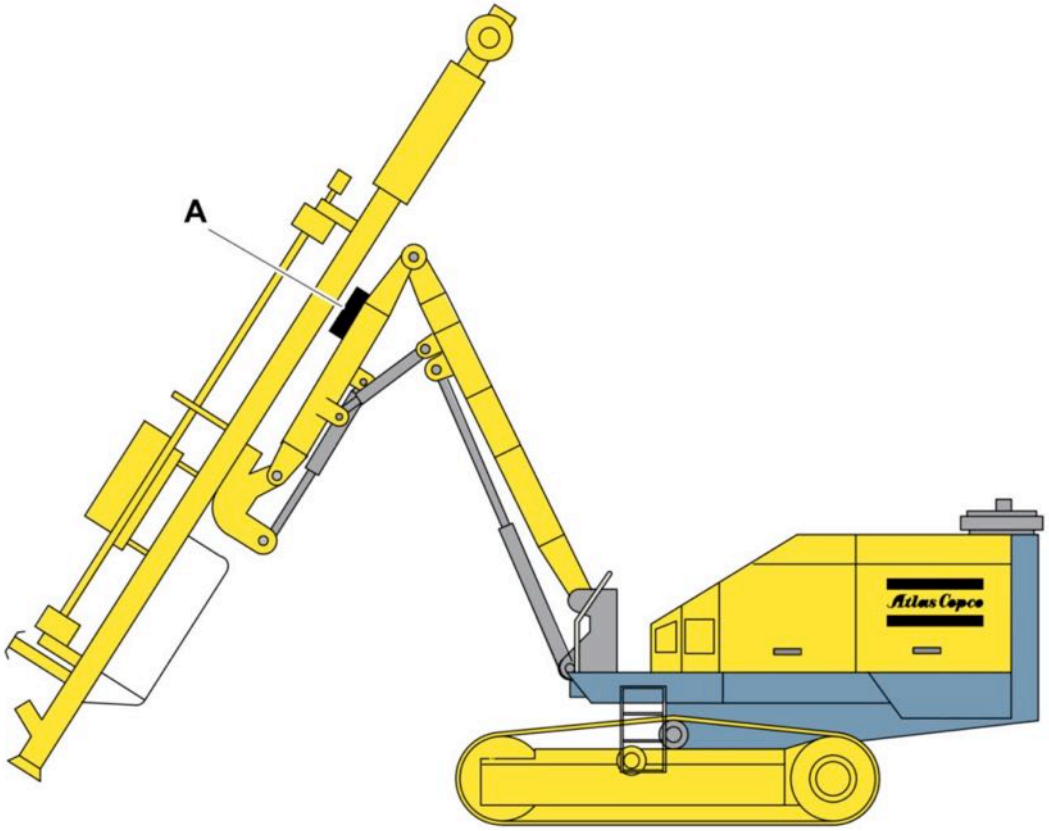
- Always adapt speed in accordance with existing terrain
- If the operator's platform is in use during tramming then it must be up in relation to the inclination used

CAUTION

Risk of injury

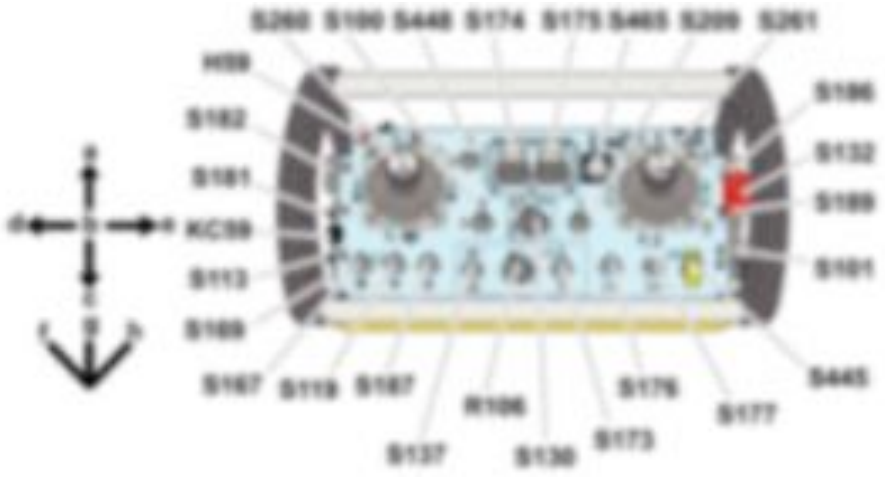
Note that when the jack is lowered, stones or similar may be resting on the jack. When the jack is subsequently raised, then the stones MAY damage the oil pan on the diesel engine and the suction hoses to the hydraulic pumps

> ! ***NOTE:*** *The gradient meter shows the chassis frame inclination and not the actual ground inclination.*



Tramming

1. Put the remote control box into tramming and positioning mode. Knob S130, position (h).
2. Position the feeder against the feed support (A). Multi-function levers S261 and S280.
3. Raise the hydraulic jack. Switch S209, position (a).
4. Open the tract oscillation lock. Switch S445, position (c).



Remote control box.

5. Choose tramming speed depending on the terrain. Switch S137, position (a) or (b).

> ***NOTE:*** *Low tramming speed gives the highest traction and vice versa.*

6. Operate the levers to move the drill rig in the desired direction. Levers S174 and S175.

> ***NOTE:*** *If one crawler track is operated while the other is stationary the tracks are subjected to unnecessary stresses. This should therefore be avoided.*

> ***NOTE:*** *A horn and a beacon indicate that the drill rig is reversing.*

7. Use the switches for track oscillation to keep the drill rig as level as possible. Switches S176 and S177.
8. Use the boom system to optimise the stability of the rig (See chapter: General principles of tramming).

6.7 Checking after tramming

All emergency stop wires and all emergency stops must be checked after tramming.

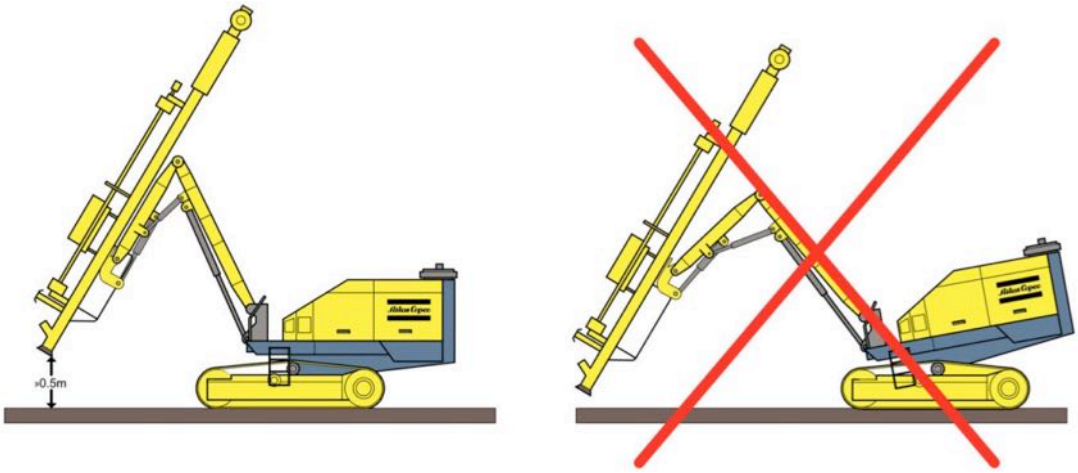
6.8 Tramming - General principles

6.8.1 Tramming, general

Direct the boom system straight ahead, contract the boom and position the feeder against the outer boom **before** opening the track oscillation lock.

While tramming, the track oscillation lock must be open so that the caterpillar tracks can move freely whenever there is a change in terrain. Use track oscillation to keep the chassis frame as horizontal as possible.

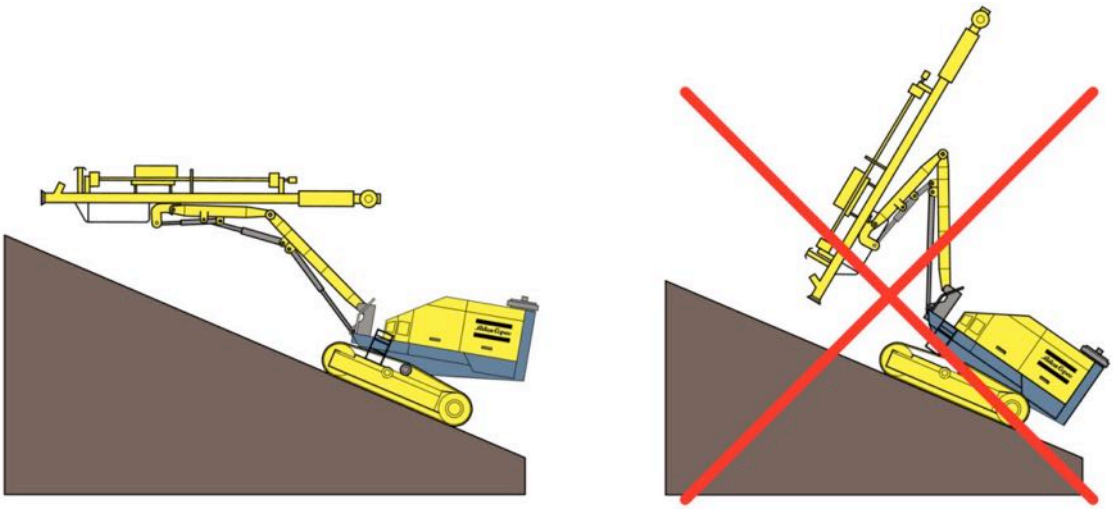
Adapt the speed to the terrain. Always check the terrain where the drill rig will be manoeuvred.



Left: Correct position for general tramming. Right: Wrong position.

6.8.2 Tramming, uphill

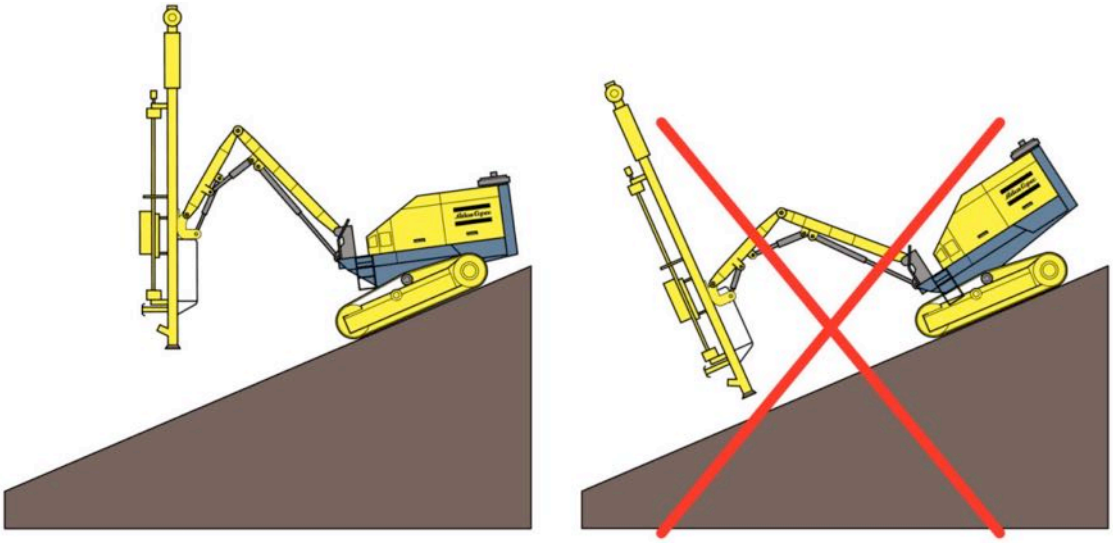
Extend the boom system and use it as a counterweight when tramming uphill.



Left: Correct position for tramming uphill. Right: Wrong position.

6.8.3 Tramming, downhill

Retract the boom system maximally towards the drill rig.



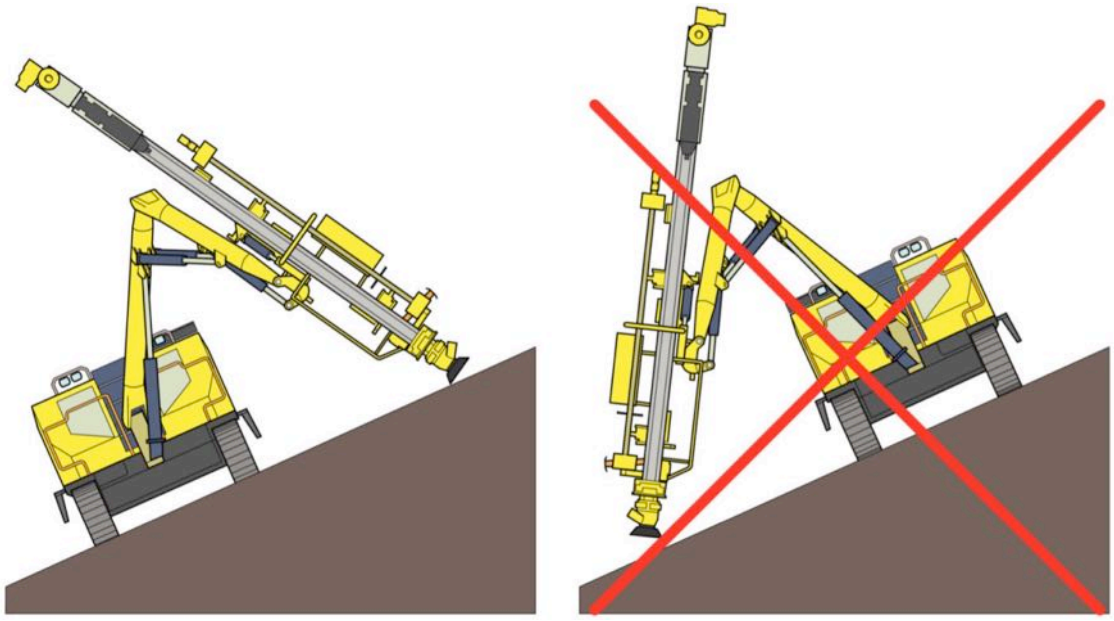
Left: Correct position for tramming downhill. Right: Wrong position.

6.8.4 Tramming on transverse inclines

Use the boom system as a counterweight when traversing inclines.

NOTICE! The risk of slipping is greatest when tramming on a transverse incline.

NOTICE! Always observe ground conditions.



Left: Correct position for traversing inclines. Right: Wrong position.

6.9 Using the winch when tramming

WARNING

Serious injury

Risk from dumping and moving parts

- May cause serious personal injury and damage to property
- Ensure that unauthorised personnel are outside of the working area
- Never use the winch with less than three turns remaining on the winch drum

WARNING

Serious injury

Risk from dumping and cable failure

- May cause serious personal injury and damage to property
- The anchorage point must be firm and secure (pay attention to local regulations)
- The safety hook must not be able to slide or detach from its attachment point
- A damaged cable or hook must not be used
- Check that the winch locking mechanism is fully engaged in the drum before use, following the attachment of the cable eye on the anchorage point

WARNING

Serious injury

Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always have an overview of the drill rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the drill rig when the winch is being used

6.9.1 General

The winch can be used as an additional safety feature, either to provide extra thrust when tramming up or down a slippery slope, or as an extra brake when tramming down an incline.

NOTE: *The winch should not be used for any other purpose.*

NOTE: *The winch can only be operated from the remote control box.*

NOTE: *The remote control box must not be operated from the drill rig when the winch is being used.*

6.9.2 Tramming up inclines

WARNING

Serious injury

Risk of dumping

- May cause severe personal injury and damage to property
- Hold track oscillation pedals open during tramming
- The angles for Downward/Upward/Lateral CANNOT be combined with each other
- Do not exceed the inclination angles, See technical data
- Note the gradient meters' values
- Never operate the drill rig from the down side

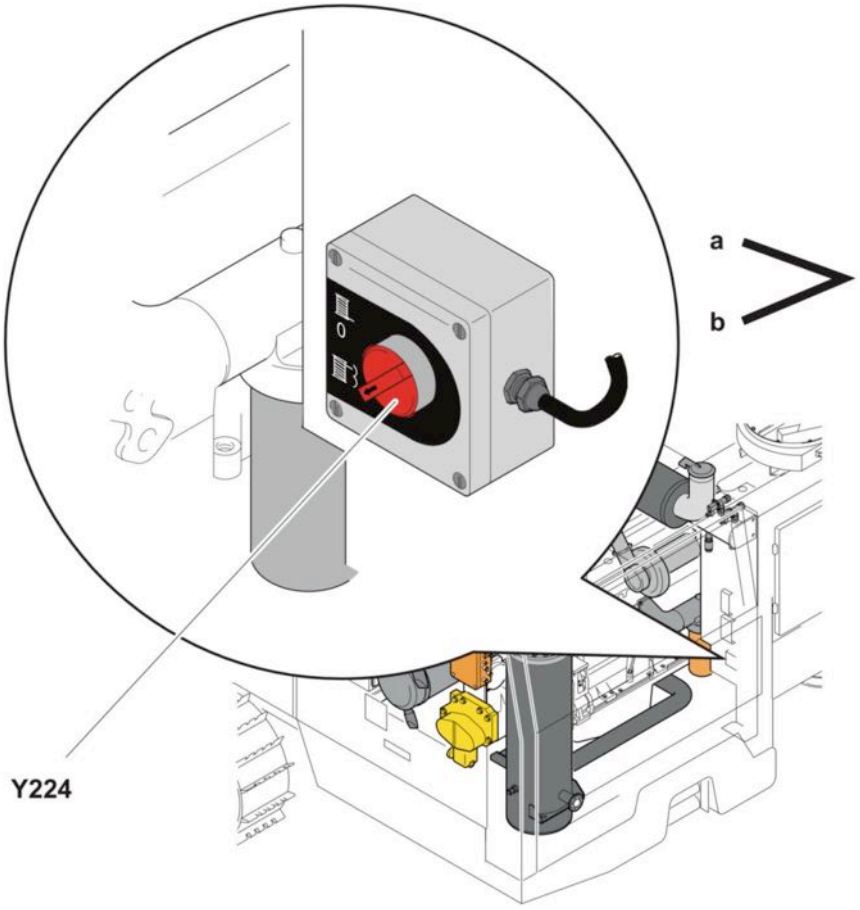
WARNING

Serious injury

Risk of dumping

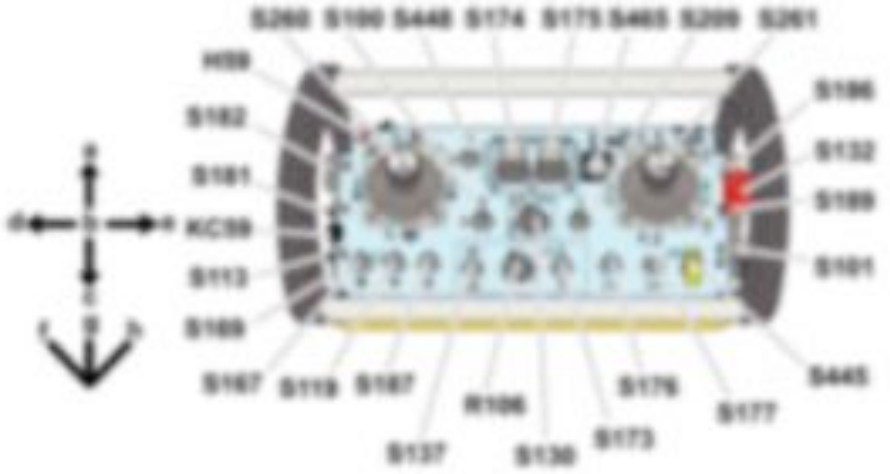
- May cause severe personal injury and damage to property
- Keep the winch cable continuously taught

1. Activate the remote control box (see chapter: Activating the remote control box).
2. Make sure the remote-control box is in tramming mode. Knob S130, position (h).
3. Check that the track oscillation lock is deactivated. Switch S445, position (a).



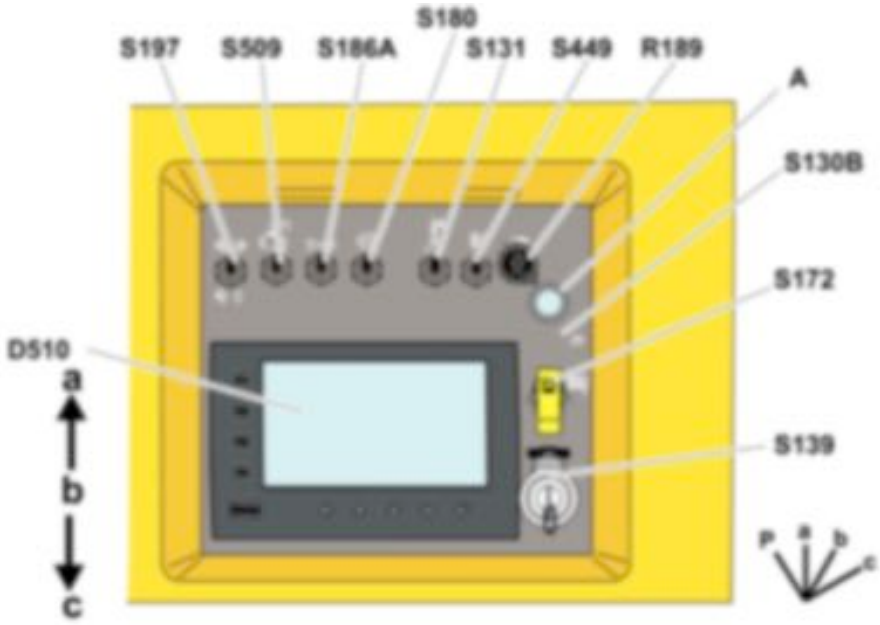
Switch Y224.

4. Release the winch drum in order to pull out the wire. Switch Y224, position (b).
5. Pull out the wire and fasten the eye to the anchor point.
6. Lock the winch drum. Switch Y224, position (a).



Remote control box.

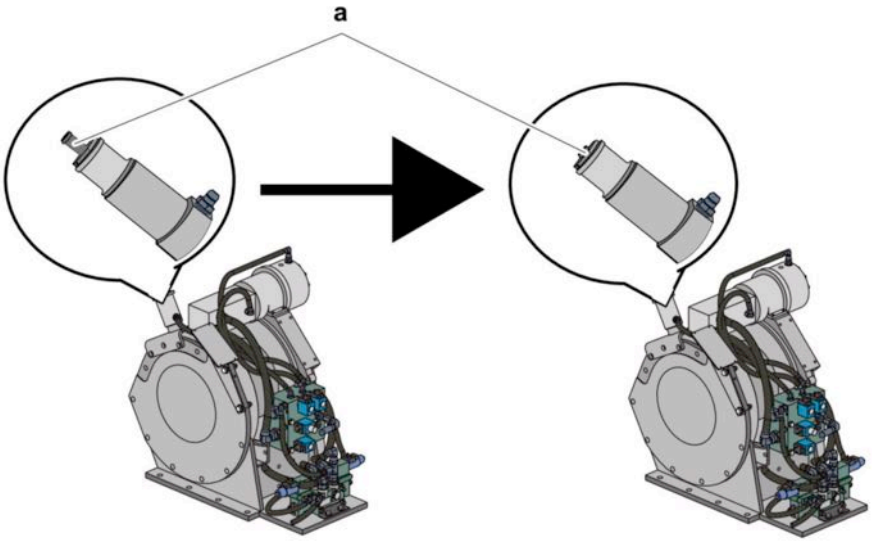
7. Set the winch potentiometer to desired pressure by turning it. Potentiometer R106.



Control panel for diesel engine.

8. Activate the winch circuit. Switch S172, position (a).
9. Activate wind-in manually to ensure the lock mechanism is fully engaged in the drum before putting strain on the winch. Switch 173, position (a).

   NOTE: Do not commence tramming without ensuring that the winch locking mechanism (a) is fully engaged.



Left: The winch lock mechanism is completely disengaged. Right: The winch lock mechanism is fully engaged.

10. Reverse up the incline using the tramming levers. Make sure that the wire is kept taut constantly.

6.9.3 Tramming down inclines

1. Check that the track oscillation lock is deactivated. Switch S445, position (a).
2. Fasten the eyelet to the anchorage point.
3. Set the traction of the winch to max. pressure by turning the potentiometer clockwise. Potentiometer R106.
4. Activate the winch circuit. Switch S172, position (a).
5. Reduce the winch cable pressure gradually until the drill rig can be driven smoothly down the incline with a suitable counterbalance from the winch. Make sure that the cable remains taut constantly.

! ***NOTE:*** *The winch will work (inwards) simultaneously while the tramming levers are activated*

7 Before drilling

7.1 Safety

WARNING

Serious injury

May cause severe personal injury

- Ensure that unauthorised personnel are not within the working area
- Do not approach the area surrounding rod/pipe gripper or carousel
- Always use lifting assistance when loading and unloading the carousel
- Do not approach the area surrounding rod/pipe when the drill-steel support is closed during loading
- Two persons are required to load and unload the carousel
- Follow the instructions carefully

7.2 Loading the rod carousel

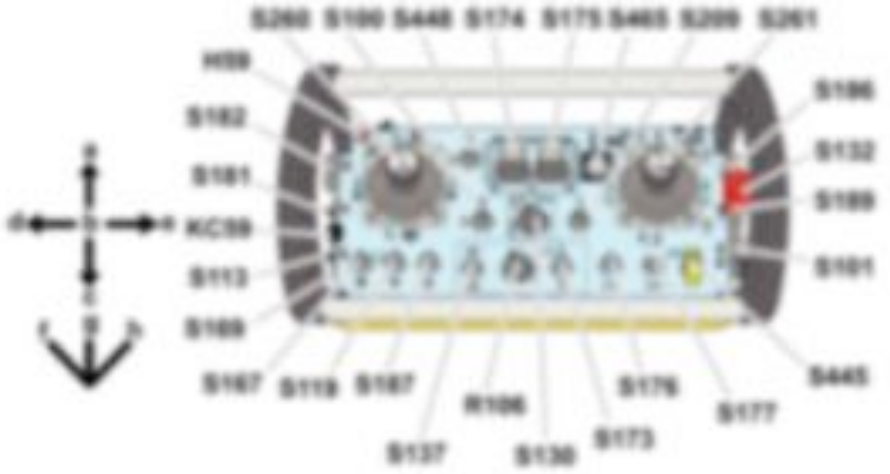
WARNING

Serious injury

Danger of accidental operation

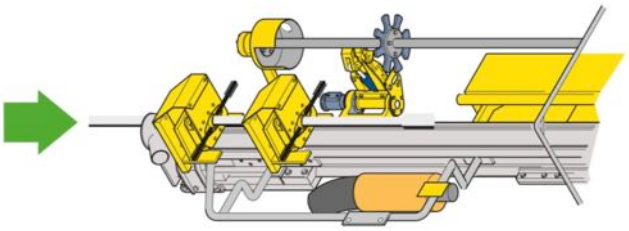
- May cause serious personal injury and damage to property
- The operator must always have an overview of the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the drill rig when the winch is being used

1. Put the control box in positioning mode. Knob S130, position (f).



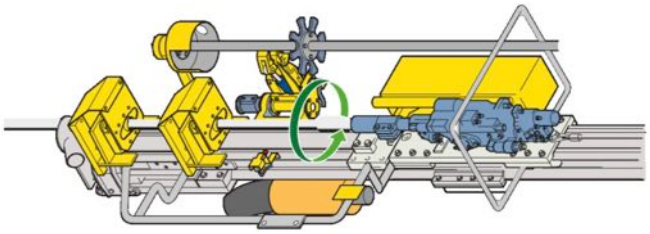
Remote control box.

2. Position the feed beam horizontally. Right and left multifunction levers.
3. Put the remote-control box in drilling mode. Knob S130, position (b).
4. Move the rod handling arms into the carousel. Left-hand multifunction lever, position (a).
5. Rotate the rod carousel anticlockwise to its end position. Left-hand multifunction lever, position (e).
6. Activate the rapid feed stop to contain the correct stops with the rock drill. Switch S113, position (c).
7. Run the rock drill down to its lowest position. Right-hand multifunction lever, position (a).
8. Open the upper and lower drill-steel supports. Switches S187 and S119, position (c).
9. Insert the first drill steel through the drill-steel supports (use suitable lifting equipment to lift the drill steel) and then close them. Switches S187 and S119, position (a).



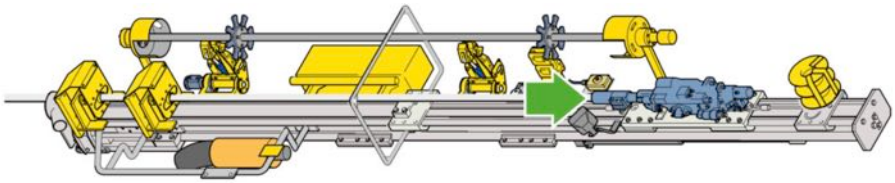
Close the drill-steel support to hold the drill rod.

10. Screw the adapter fully into the drill steel sleeve. Right-hand multifunction lever, position (g).



Screw the drill steel onto the adapter.

11. Run the rock drill up with the drill rod until it stops at the automatic stop in the drill steel. Right-hand multifunction lever, position (c).



When switch S113 is activated, the cradle will be stopped automatically in the right position for inserting the drill rod into the carousel.

12. Activate loose grip by moving the multifunction lever S260 to neural position. Run the rock drill up until it stops at the automatic stop for inserting the rod in the carousel.
13. Open the rod handling grippers and move out the rod handling arms. Turn the left-hand multifunction lever anticlockwise while pulling it back.
14. Activate hard grip with the rod grippers by leaving the left-hand multifunction lever pulled back and turning it to neutral.
15. Unthread the drill road from the adapter. Right multi-function lever, down to the right.
16. Run up the rock drill when the drill rod has been unscrewed. Right-hand multifunction lever, position (c).
17. Move the drill rod into the carousel. Left multi-function lever, Up (position a).
18. Repeat the procedure until the required number of drill rods are in the carousel.

7.3 Setting up for drilling

WARNING

Serious injury

Risk of dumping

- May cause severe personal injury and damage to property
- Keep the track oscillation cylinders locked
- Do not lower the hydraulic jack too much, the rear sections of the track frames must stand firmly against the ground
- The angles for Downward/Upward/Lateral, specified in Technical data, must NOT be combined
- Do not exceed the angles of inclination, see Technical data
- Note the gradient meters' values
- Never operate the drill rig from the downhill side
- Ensure that unauthorised personnel are not within the working area

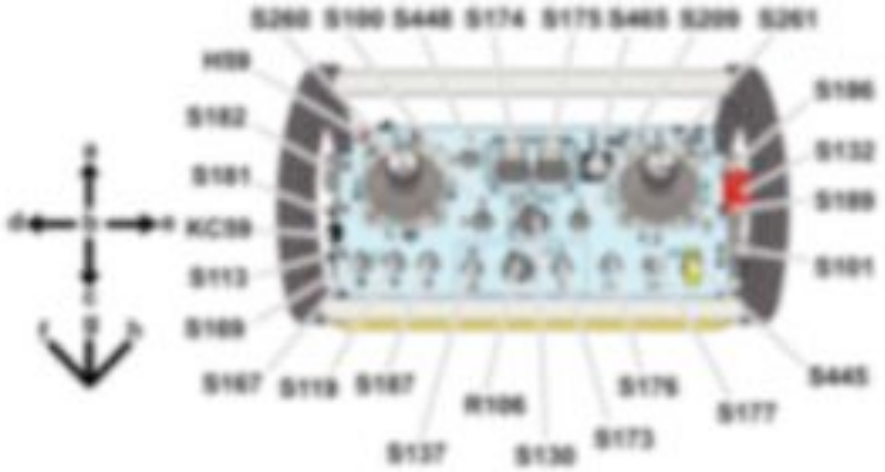
CAUTION

Risk of injury

Risk of feed beam bending

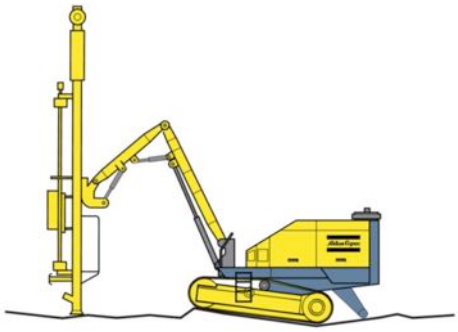
- To avoid overloading the feeder, do no use the cylinder alone for lowering the boom, or the cylinder for feed extension individually to place the feeder against the ground
- Do not raise the front section of the track frame from the ground

1. Put the remote control box in tramming and positioning mode. Knob S103, position (h).



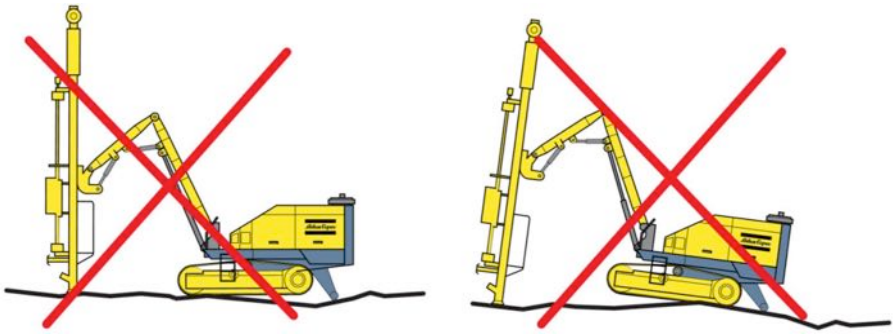
Remote control box.

2. Make sure track oscillation is open. Switch S445, position (c).
3. Set up the drill rig horizontally using track oscillation. Switches S176 and S177.



Correct set up for drilling.

4. Lock track oscillation once it is in the desired position. Switch S445, position (a).
5. Lower the jack so it is firmly on the ground without lifting the drill rig. Switch S209, position (c).



Incorrect set up.

6. Position the feed beam to desired inclination and place the spike firmly against the ground without lifting the drill rig. Right and left-hand multifunction lever.

> ! ***NOTE:*** *Do not lift the drill rig with the feeder!*

7.4 Setup for drilling - General principles

7.4.1 Setting-up in general, summary

Set up the drill rig as close to the horizontal as possible with track oscillation in **open position** .

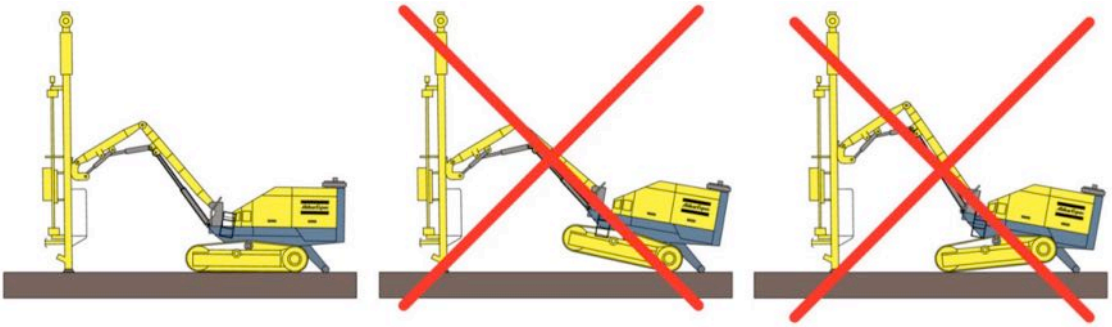
Lower the jack steadily against the ground without lifting the track frames from the ground.

Secure the track oscillation lock and then start positioning the boom and feeder.

Set the feeder jack steadily against the ground without lifting the track frames from the ground.

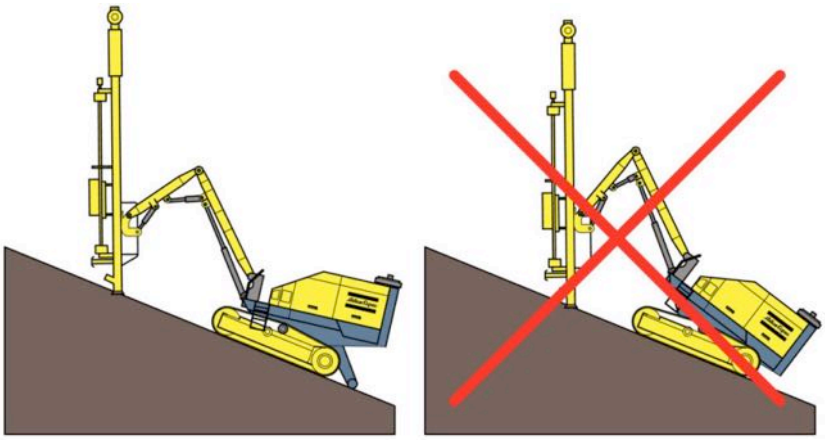
> ! ***NOTE:*** *Position the boom and feeder with smooth movements.*

> ! ***NOTE:*** *Never unlock the track oscillation lock while the drill rig is set up for drilling*



General setup.

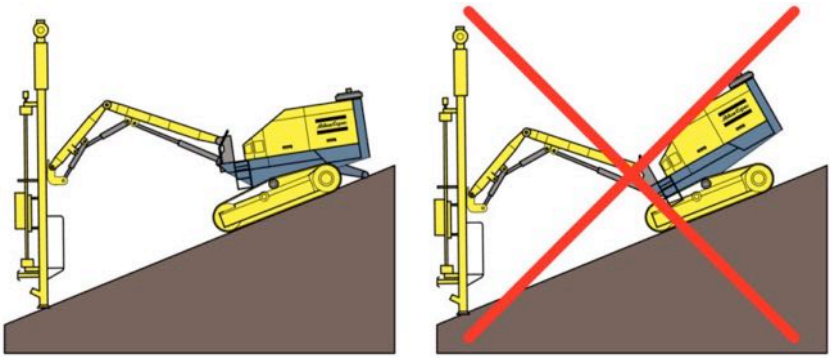
7.4.2 Downhill setup



Left: Correct position for drilling uphill. Right: Wrong position.

7.4.3 Downhill setup

Set up the drill rig as close to the horizontal as possible.



Left: Correct position for drilling downhill. Right: Wrong position for drilling downhill.

7.4.4 Setup - Transverse incline

NOTICE! The risk of slipping is greatest when set-up on a transverse incline.

NOTICE! Always observe ground conditions.

NOTICE! Always be very careful when setting up on a transverse incline, always use smooth movements during setup.

8 Drilling

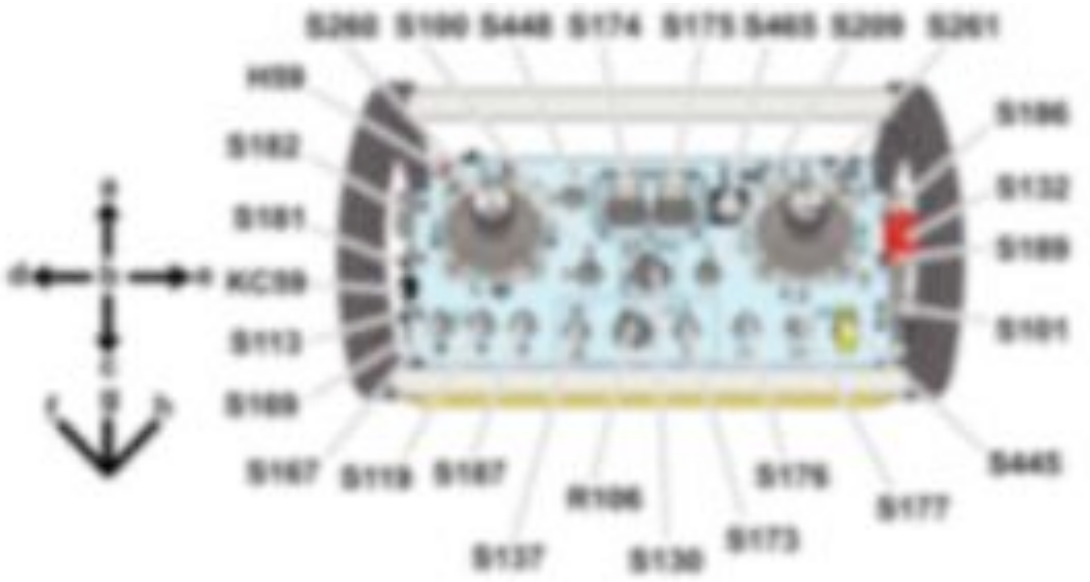
8.1 Start of drilling

WARNING

Serious injury

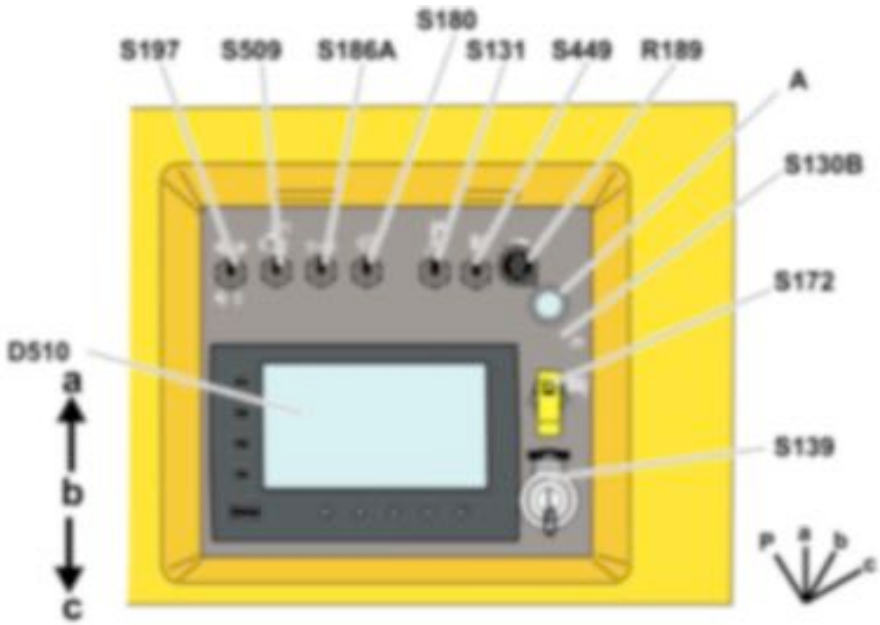
Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always control of the rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the rig when the winch is being used



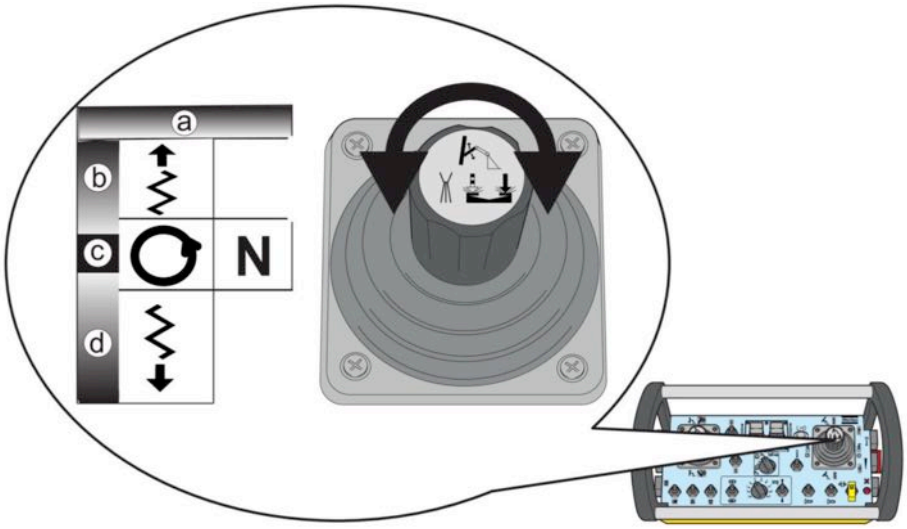
Remote control box.

1. Put the remote control box in DRILLING mode. Knob S130, position (g).
2. Check that the track oscillation cylinders are locked. Switch S445, position (a).
3. Check that the dust collector is activated. When flushing air is activated later, the dust collector suction will start. Switch S181, position (a).
4. Load the compressor. Switch S180 on the diesel panel, position (a).



Diesel panel

5. Check that the switch for flushing air is in position for REDUCED/FULL FLUSHING AIR. Flushing air starts at the same time as percussion is started. Switch S100, position (a).
6. Close the drill-steel supports. Switches S119 and S187, position (a).
7. Lower the rock drill until the drill bit is pressing lightly against the ground. Right multi-function lever, position (c).
8. Set the hole length to zero, button S465 (option).
9. Lower the suction hood to the ground. Switch S167, position (c).
10. Start rotation. Right multi-function lever to the left (sector c).



Sector description, right multi-function lever.

11. Start drill feed. Right-hand multi-function lever forward through sector (b).
12. Low percussion is activated through turning right-hand multifunction lever (anticlockwise):

> ***NOTE:*** *Use the drill lever intermittently through sector (b) until solid rock is reached.*
>
> ***NOTE:*** *Collaring with feed too high will make the drill bit veer off in the wrong direction and result in a deviating hole and bent drill string.*

13. Drilling can be suspended by moving the right multi-function lever through sector (b) to the end position. The lever can be released back to neutral once the holding circuit has started.

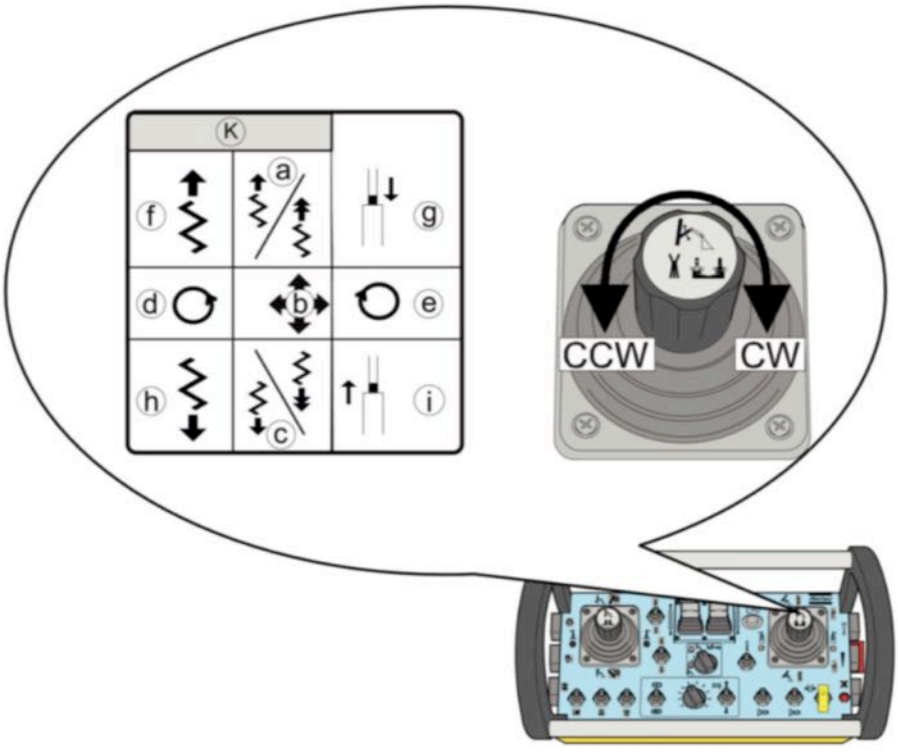
> ***NOTE:*** *To check that crushed rock is properly flushed out of the hole, raise the suction hood from time to time.*

14. Turn the drill lever (clockwise) to activate high percussion pressure.
15. The upper drill-steel support opens automatically just before the rotation chuck reaches it.
16. To cease drilling:
    a. In **low percussion** turn the right-hand multifunction lever **anticlockwise** .
    b. In **high percussion** turn the right-hand multifunction lever **clockwise** .

8.1.1 Manual drill feed

Self-holding circuit for percussion is activated.

1. Move the right multi-function lever to sector (j).



Right-hand multifunction lever.

2. The holding circuit has now ceased and the feed can be controlled manually in sectors (f) and (a).
3. To continue with self-holding, move the multi-function lever back to sector (j).

8.1.2 Boom/feed adjustment while drilling

⚠ CAUTION

Risk of injury

The equipment can be damaged

- The drill rig can only be interrupted in drilling mode or with emergency stop

If the boom/feeder for any reason must be readjusted while drilling, this can be done by resetting the remote control box. Switch S130, position (a). The multi-function levers will then go to positioning mode and drilling can continue.

! ***NOTE:*** *Drilling can only be terminated by resetting the remote control box to drilling position or activating the emergency stop.*

! ***NOTE:*** *After 5 seconds, the positioning functions will be deactivated and only percussion stop will work. To continue drilling, reset the mode switch to drilling position.*

8.2 Checks during drilling

Monitor the drilling and pay particular attention to the points below. If anything is abnormal, stop drilling and rectify the problem or ask service personnel to investigate the cause.

Abnormal impact hose vibration.	Check the pressure in the rock drill accumulators.
Check that the shank adapter is sufficiently lubricated.	Lubricating oil/air should leak out from the shank adapter. Lubricating oil pressure should be between 2 and 10 bar on the ECL pressure gauge.
Abnormal leakage from the rock drill.	
Note that the shank adapter has a "float position", i.e. it is pressed out about 4-6 mm from the subframe.	
If damper pressure is lower than 35 bar or higher than 120 bar, percussion will stop automatically (**For drill rig COP 1800/2150/2550/4050 series**)	Stop drilling immediately and ask service personnel to investigate. If the rig is equipped with ECL collection, the ECL collection lamps on the display should be checked.

Table 36: Rock drill:

If water emerges from the drill hole	Switch off DCT to protect the filters

Table 37: The borehole:

8.3 Break loose

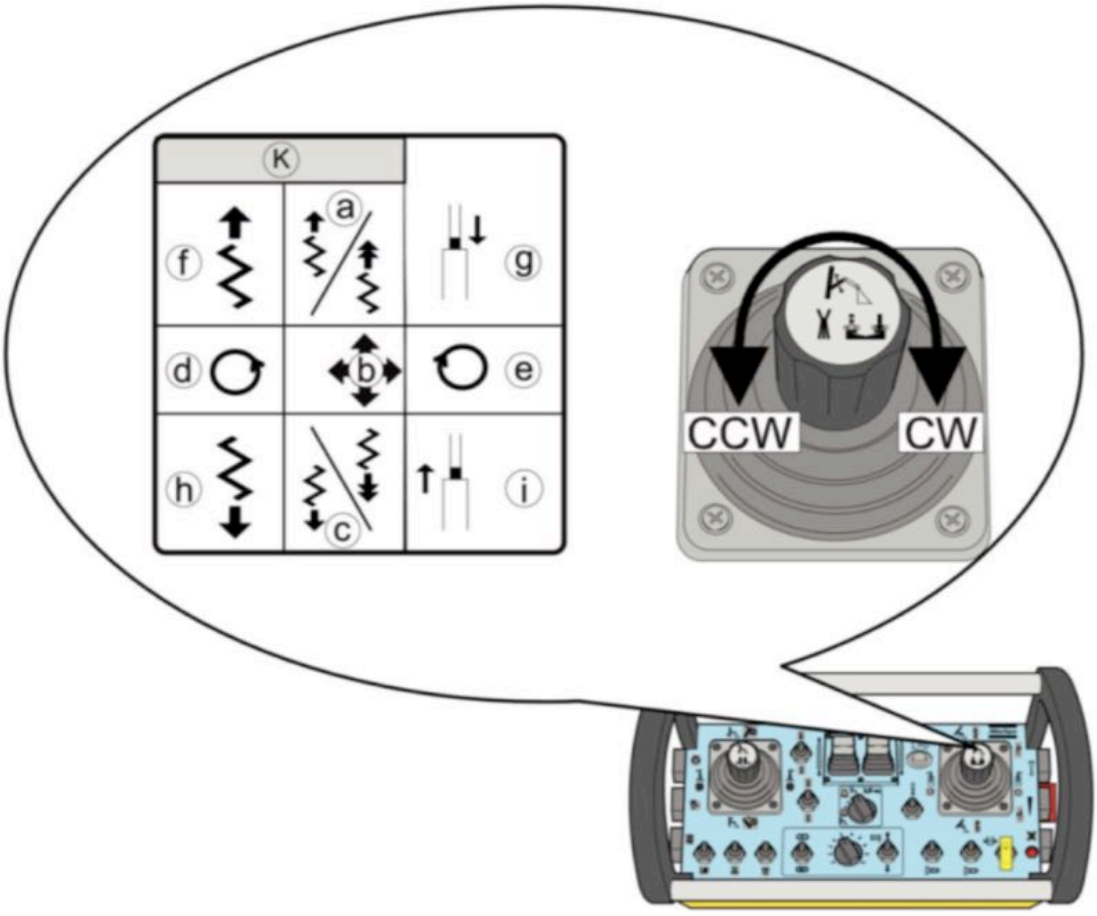
WARNING

Serious injury

Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always control of the rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the rig when the winch is being used

8.3.1 Manual loosening

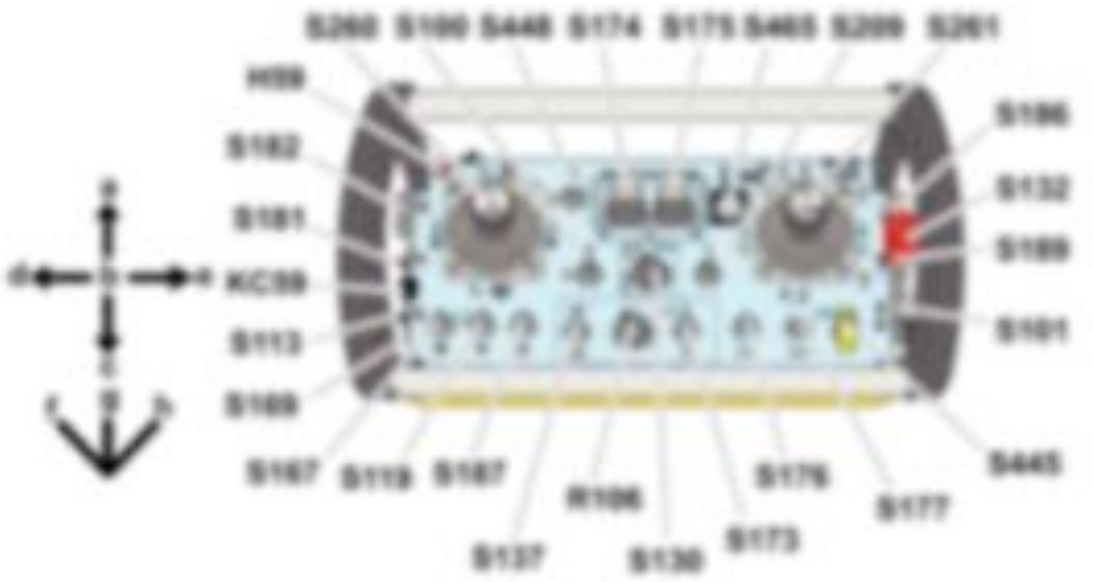


Right-hand multi-function lever S261.

1. Deactivate self-holding for feed and rotation. Button S101 on the remote control box.
2. Feed can now be controlled manually using the right-hand multi-function lever in sectors (f) and (h).

3. Leave percussion active until all the drill rod couplings/couplings are loose.
4. Then deactivate percussion by pressing button S101 once.

> **NOTE:** *Remember that the rotation stop button S101 is a "toggle switch", rotation will not start unless the button is reset! For information see chapter: Controls*



> **NOTE:** *High percussion is better when releasing.*

8.3.2 Automatic break loose

Put the upper drill-steel support in neutral

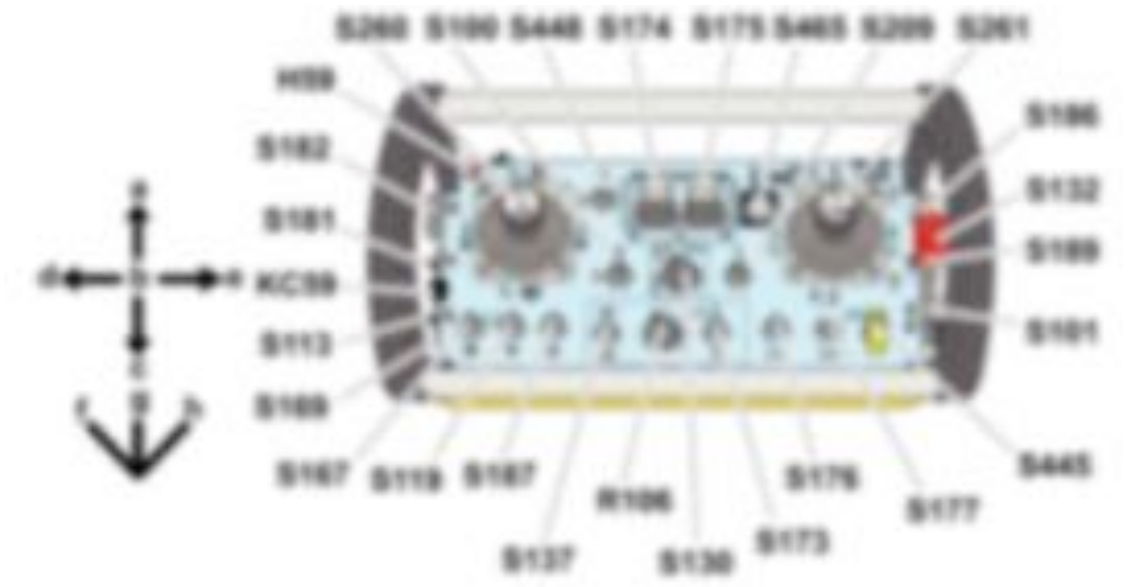
8.4 Rod adding

WARNING

Serious injury

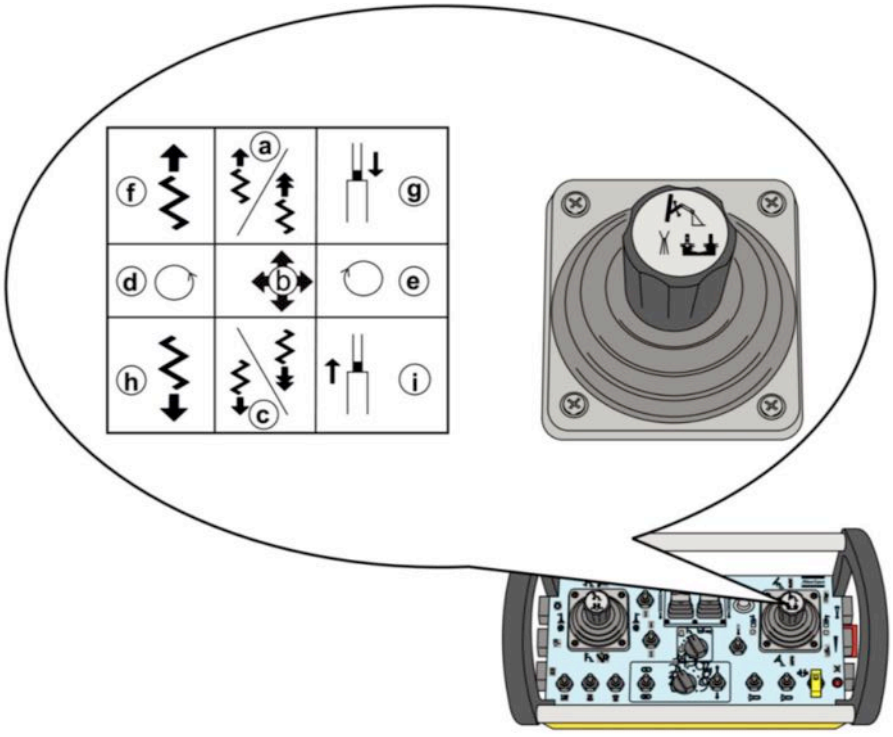
Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always control of the rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the rig when the winch is being used



Remote control box.

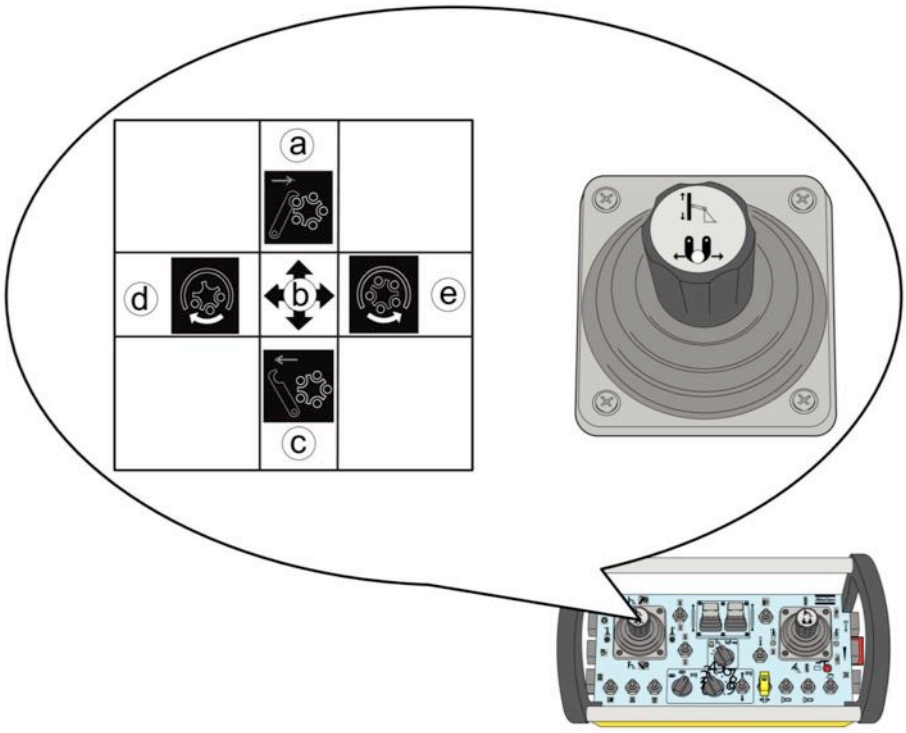
1. Make sure that the upper drill-steel support (for locking the sleeve) is closed. (See section on controls, upper drill-steel support switch.)
2. Make sure that the rapid feed stop's rod handling positions are deactivated in order to allow the rock drill to stop above the rod carousel. Switch S113, position (c).
3. Unscrew the shank adapter completely from the drill sleeve. Right-hand multi-function lever, position (i).



Sector description - Right multi-function lever.

4. Rapid feed in reverse until the rock drill stops in its uppermost position above the rod carousel. Right-hand multi-function lever sector (c).
5. Move the drill rod from the carousel to the drill centre by moving the left multi-function lever to sector (c).

If there is not a drill steel in the rod grippers, the carousel must first be rotated so that there is a rod in position. Left multi-function lever, sector (d) or (e).



Sector description - Left multi-function lever.

6. Move the right multi-function lever to sector (g) (threading) until both joints are tight.
7. Open the rod grippers and return the rod handling arms to the carousel by turning the left-hand multifunction lever and moving it forwards.
8. Rotate the carousel by moving the left multi-function lever to the right.

! ***NOTE:*** *The rod grippers open automatically when rotating the carousel.*

8.5 Unthreading and extracting

WARNING

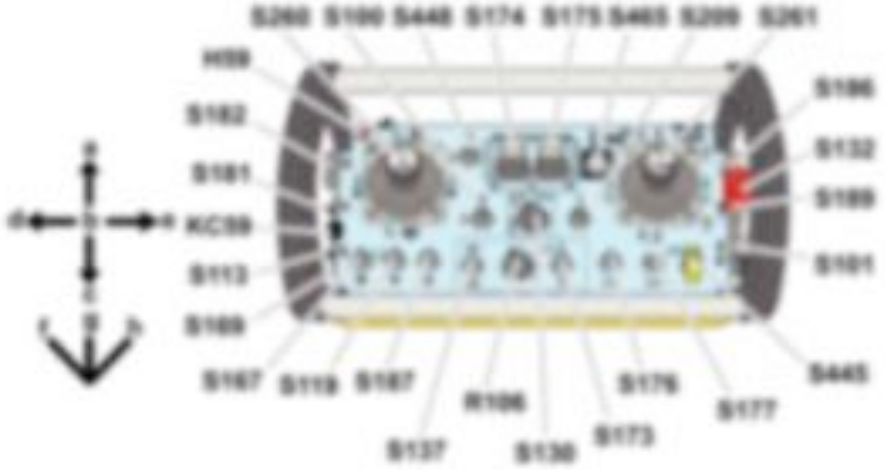
Serious injury

Danger of accidental operation

- May cause serious personal injury and damage to property
- The operator must always control of the rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when not in use
- The remote control box must not be operated from the rig when the winch is being used

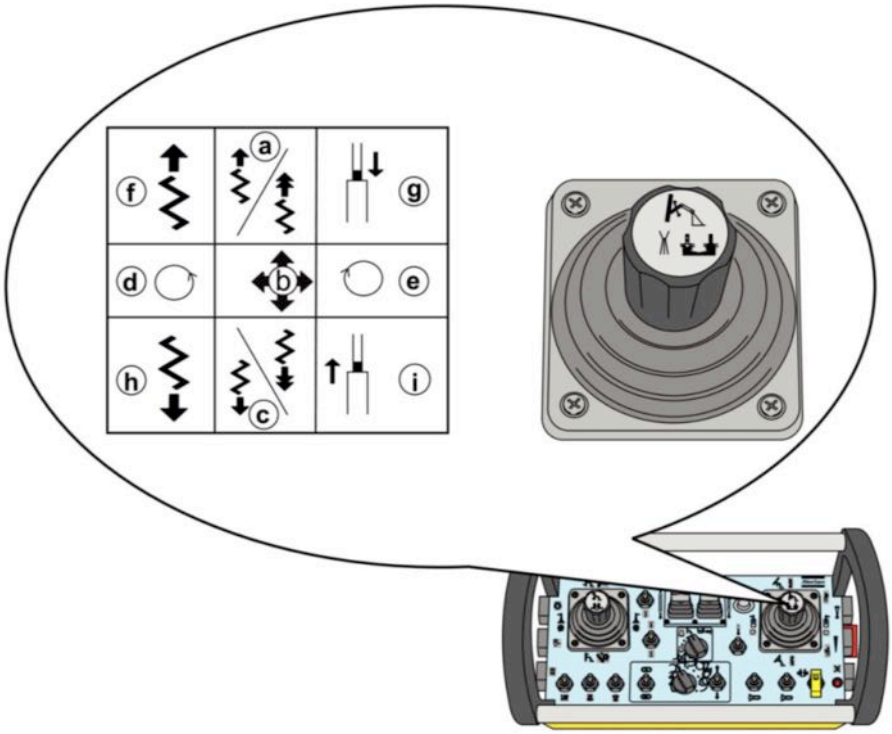
> **NOTE:** *The rod grippers are opened automatically when the carousel rotates. Applies only to FR T30 R -01 with RHS.*

1. Make sure the shank joints are broken loose.
2. Activate the rapid feed stops. Switch S113, position (a).



Remote control box.

3. Open both drill-steel supports. Switches S119 and S187, position (c).
4. Extract the drill string until the rock drill stops automatically with the sleeve in the upper drill-steel support. Right multi-function lever, sector (c).
5. Close the upper drill-steel support. Switch S119 to position (a).
6. Open the rod handling grippers by turning the left multi-function lever in any direction.
7. Open the rod handling arms by pulling back the left multi-function lever.
8. Close the grippers to hard grip by leaving the multi-function lever pulled back and turning the lever to neutral.
9. Move the right-hand multi-function lever to threading position, sector (g), in order to tighten the joint between the shank adapter and the sleeve.



Sector description, right multi-function lever.

10. Return the left-hand multi-function lever to neutral position (loose grip).
11. Activate unthreading by moving the right multi-function lever to sector (i) (break loose rod joints).
12. Pull back on the right-hand multi-function lever (rock drill stops at limit switch).
13. Pull back on the left-hand multi-function lever (hard grip).
14. Unthread the shank adapter from the drill rod by moving the left multi-function lever to sector (i).
15. Insert the drill rod into the carousel by moving forward the right multi-function lever.
16. Rotate the carousel by moving the left multi-function lever to the left.

8.6 Changing drill bit

WARNING

Serious injury

Moving parts

- Risk of personal injury, clothing can be trapped
- Stop rock drill rotation when changing bits

NOTE: *Never start percussion with the drill bit free without any resistance.*

1. Operate the feeder until the spike is approx. 10 cm from the rock.

2. Make sure that the rotation lever is in neutral.
3. Move the drill bit forward until it is pressed against the rock.
4. Switch on high percussion pressure for several seconds.
5. Switch off percussion pressure when the drill bit has loosened. If the percussion pressure is engaged for too long then the drill steel can detach from the shank adapter.
6. Unscrew the old drill bit by hand and replace with a new one.

8.7 Action in case of drilling problems

8.7.1 Drilling problems

If the following trouble occurs during drilling:

- Hot coupling sleeves (loose coupling sleeves).
- Difficulties in uncoupling the coupling sleeves.
- Hole deflections

8.7.2 High coupling sleeve temperature

! ***NOTE:*** *The coupling sleeve temperature should not exceed 120ºC (248ºF)*

1. Excessive coupling sleeve temperature is indicated by:
   a. Measuring with a thermometer
   b. Oil dripping from the rock drill vaporises on the coupling sleeve
   c. The coupling sleeve changes colour
2. Depending on the layers of the rock, temperature can vary even within a small area. High coupling sleeve temperature is usually due to a poor relationship between drill feed pressure, percussion pressure and rotation pressure. The following solutions are recommended to reduce coupling sleeve temperature.
   a. Check the condition of the drill bit; an overdrilled bit gives less torque in the coupling sleeve.

      Grind the drill bit.
   b. Change to a drill bit with ballistic buttons.
   c. If the rock is too hard for ballistic bits, then...

      reduce rotation speed as much as possible without causing the drill string to rotate jerkily

      Check the drill feed pressure and set it to the recommended value.

      Reduce percussion pressure to below the basic setting (5-10 bar). A reasonable reduction in penetration rate must be accepted.
   d. Check and/or adjust damper pressure so that the shank adapter is in "float position".

8.7.3 Difficulties in loosening the coupling sleeve

The best method of loosening the coupling sleeve is to "drill" the last few centimetres without feed pressure and rotation, leaving percussion active for a few seconds to break loose the coupling sleeve.

- Make sure the RPC-F system is set correctly. An RPC-F system that is set too high causes excessive torque in the coupling sleeve.

8.7.4 Hole deflection

1. Try to drill with as low a drill feed pressure as possible.
2. Check the condition of the drill bit.
3. Use TAC pipes, drop centre bits.
4. Only use flushing air and rotation during overload.
5. Drill the first drill steel with reduced drilling for at least half of the drill steel in order to minimise hole deflection at the start of the hole.

9 Angle instruments

9.1 General

Depending on the equipment level chosen, the drill rig can be equipped with one of the following alternatives:

- Angle instrument with aim device (standard equipment).
- Laser plane instrument (option).
- GPS compass (option).

In all of these cases the system consists of a number of sensors. The sensors are connected to the I/O unit and the LCD display through CAN BUS communication. The system is presented on and operated from the LCD display.

These instructions cover the complete instrument with all available options. If the drill rig has fewer pieces of equipment, only the relevant sections need to be studied.

9.1.1 Angle instrument with sight

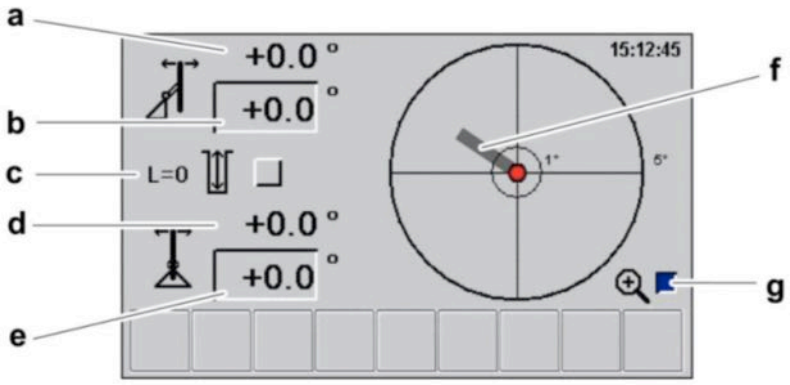
This drill rig is equipped with an electronic angle indication system consisting of an angle sensor on the boom and feeder, aim device and graphic presentation on an LCD display. The aim device makes it possible to drill parallel holes by selecting a reference point before the first hole is drilled. This reference point is then maintained throughout the entire round or as long as the bearing is the same. By turning the aim device back to the same reference point the entire time regardless of how the drill rig travels, the instrument calculates how the feed inclination must be changed to maintain the same bearing. The angle sensor on the boom mounting allows the instrument to compensate for the turning of the boom the same way as when the aim device is turned.

Menus

The angle instrument is accessed by pressing button F2 in the left-hand edge of the display. These three buttons always provide direct access to the respective functions, i.e. you do not need to use the ESC key to go back to the main menu to select them.

Main menu

Four numbers are shown on the angle instrument display which show the required and actual inclination laterally and longitudinally respectively, as well as a graphic image of the deviation from required inclination.



Directional instrument - graphic display mode

Spike forward = +°
Spike back = -°

Table 38: Feed movement - Tilt (feeder forward and reverse)

Spike left = +°
Spike right = -°

Table 39: Feed movement - Swing (feeder right and left)

> ! ***NOTE:*** *The display shows Tilt movement forwards = +° and back = -°. To show: drill bearing from drill rig with + angles. Drill bearing in under the drill rig with - angles.*

a	**Actual inclination front/back:** Shows the actual inclination of the feeder. When the feeder is positioned perfectly, the desired value and the actual value are the same.
b	**Desired inclination front/back:** Set the desired inclination in relation to the reference point (sight). Mark the field by moving with the arrow keys until the field is blue and then press Enter to get a flashing cursor under the digits. Set the desired hole inclination using the arrow keys and press Enter to confirm.
c	**Actual inclination left/right:** Shows the actual inclination of the feeder. When the feeder is positioned perfectly, the desired value and the actual value are the same.
d	**Desired inclination left/right:** Set the desired inclination in relation to the reference point (sight). Mark the field by moving with the arrow keys until the field is blue and then press Enter to get a flashing cursor under the digits. Set the desired hole inclination using the arrow keys and press Enter to confirm.

e	**Reset:** Resetting the drilled length instrument. Before the start of each hole, the drill bit should be positioned against the ground. Use the arrow keys to mark the button by the symbol and press Enter. The button will then become blue. Current drilled length should show 0. The display will continue to show the angle instrument menu. This reset is also available in the drilled length instrument's menu.
f	**Graphic:** The graphic shows deviation from the desired inclination via a red line drawn in the direction of the deviation. The feeder spike must be positioned in the opposite direction of the line to reduce the deviation. When the feeder is set with the desired amount of inclination, only a red dot is shown in the centre of the graphic. ! ***NOTE:*** *If the total deviation of the lateral inclination and the forwards/backwards inclination exceeds 3º, the lamp on the side of the display window will light red.*
g	**Activating Auto Zoom:** When the deviating angle is less than 1º, the outer circle changes over to indicate 1º instead of 5º.

Table 40: Directional instrument - graphic display mode

! ***NOTE:*** *Remember that the desired angle values should always be specified in relation to the setting of the sight. If the sight is not to be used, it should be set straight ahead and the desired values adjusted to 0.*

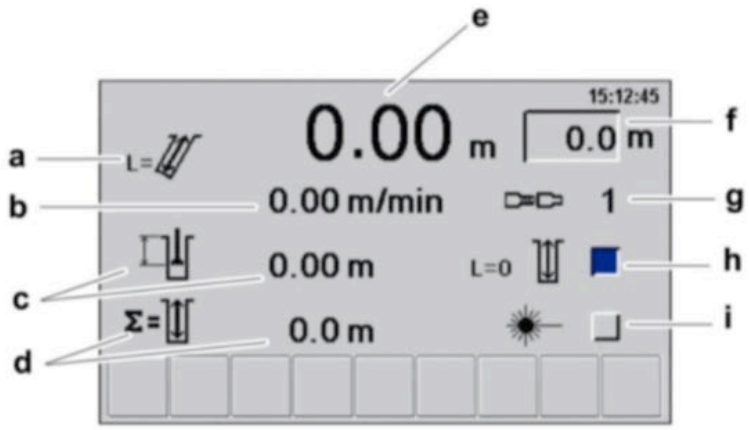
9.1.2 Laser plane instrument (option)

As a supplement to the drilled length instrument, a laser plane can be used as the reference level instead of the local ground level using a laser beam and a receiver on the drill rig.

This requires that the distance between the drill bit and the laser receiver be entered when the instrument is installed (see the section "Calibration"). Once the laser receiver on the rock drill cradle has passed the laser plane, the indicated drilled length is related to the laser plane instead of ground level. The indicated drilled length will then "jump" up to the pre-programmed value and continue measurement from there. The laser beam must be positioned in such a way that nothing comes between the laser beam and the laser receiver on the drill rig.

Menus

The laser plane function is activated in the drilled length menu. Function indication is down in the status field of the display.



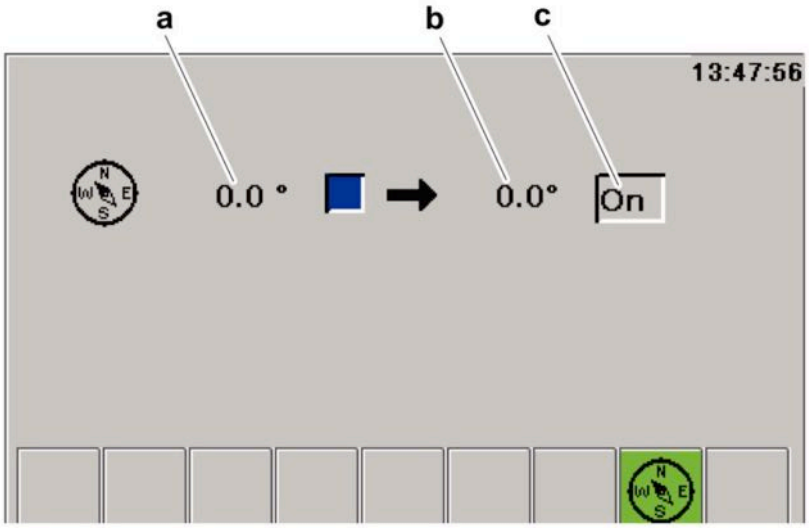
Drilled length

i	**Activation of the laser plane function:** Mark the field by moving with the arrow keys until the button is blue and then press Enter to confirm. **Laser plane function indication:** The indicator is lit in the status field of the display when the function is active. Once the laser receiver has registered the laser plane, the indicator will change colour from grey to green and the drilled length value will then be calculated from the laser plane level.

9.1.3 GPS compass (option)

When the drill rig is equipped with an electronic angle indication system, which consists of angle sensor on the boom and feeder, aim device, GPS compass and graphic presentation on an LCD display, the aim device is set making it possible to drill parallel holes by selecting a reference point before the first hole is drilled. This reference point is then maintained throughout the entire round or as long as the bearing is the same. The bearing is then kept to the same reference point automatically, regardless of how the drill rig travels, without the need for changing the aim device. The instrument calculates how feeder inclination must be changed to maintain the same bearing.

The direct selection menu F4 contains the settings for the GPS compass.



a	Shows the aim device's compass direction
b	Shows the compass direction selected for locking
c	Shows whether the function is off or on

Table 41: Menu F4

- Turn the aim device to the required compass direction.
- Access menu F4 and confirm value (a) with Enter. The selected value is then moved to b.
- Activate or deactivate the GPS compass by selecting the right-hand box (c) with Enter, and select On or Off using the arrow keys. Confirm with Enter.

Symbol		Explanation
	Green info/ Yellow warning	Green = GPS compass active. Yellow = problem with e.g. GPS reception.

Table 42: Symbols

> ***NOTE:*** *After starting up the rig's electrical system it may take several minutes before the symbol becomes green. This is because the antennas have to establish contact with the satellites.*

If the symbol does not become green then this may be due to several causes, e.g.:

- No satellites available
- The antennas are covered by snow
- Open circuit in cable between the antennas and the electronic unit

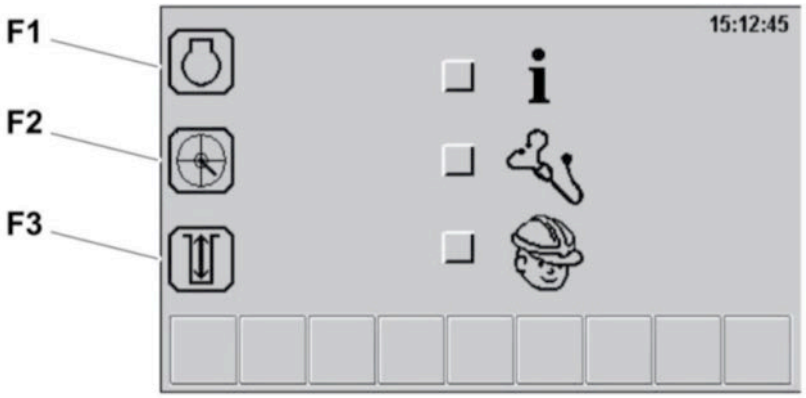
If the symbol remains green, deactivate the GPS compass in the F4 menu and use the aim device in the traditional way.

9.1.4 Drilled length instrument

In order to control drilling length and penetration rate, the system is equipped with a drilled length sensor. This is mounted on the rock drill cradle and is connected to the display together with other components in the system. The drilled length instrument can be configured to show either the actual drilled length, hole length measurement or the vertical depth, vertical depth measurement. In the latter case, the instrument takes into account the hole inclination, and the value that is displayed is therefore less than the actual drilled length.

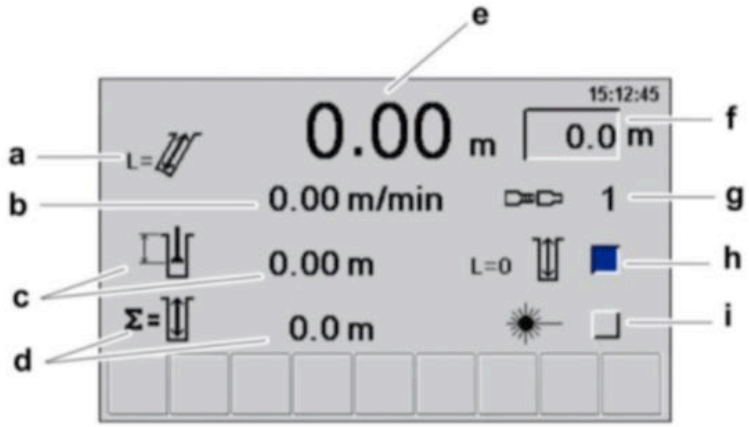
Menus

The drilled length instrument is accessed by pressing button F3 in the left-hand edge of the display. This provides direct access to the drilled length instrument menu.

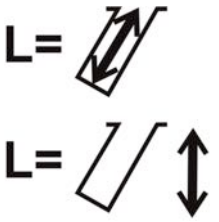


Main menu

The depth instrument has the following functions:



Drilled length



a	Indication of selected measurement method The method of measurement is selected in the "Settings" menu. Use the arrow keys to mark the button by the symbol. Press Enter to toggle between the two alternatives. Use the ESC key to leave the menu when the desired symbol is shown.
b	**Speed Penetration rate:** Shows the penetration rate while drilling is in progress.
c	**Bit position:** Shows the current position of the drill bit.
d	**Accumulated drilled length:** Shows the total drilled length since the memory was last reset in the statistics menu.
e	**Current drilled length:** Shows the drilled length of the hole in progress after the counter has been reset in accordance with (g).
f	**Desired drilled length when using automatic drill stop:** Set the desired inclination in relation to the reference point (sight). Mark the field by moving with the arrow keys until the field is blue and then press Enter to get a flashing cursor under the digits. Set the desired drilled length using the arrow keys and press Enter to confirm. After the counter has been reset, drilling will be stopped automatically once the desired value has been reached.

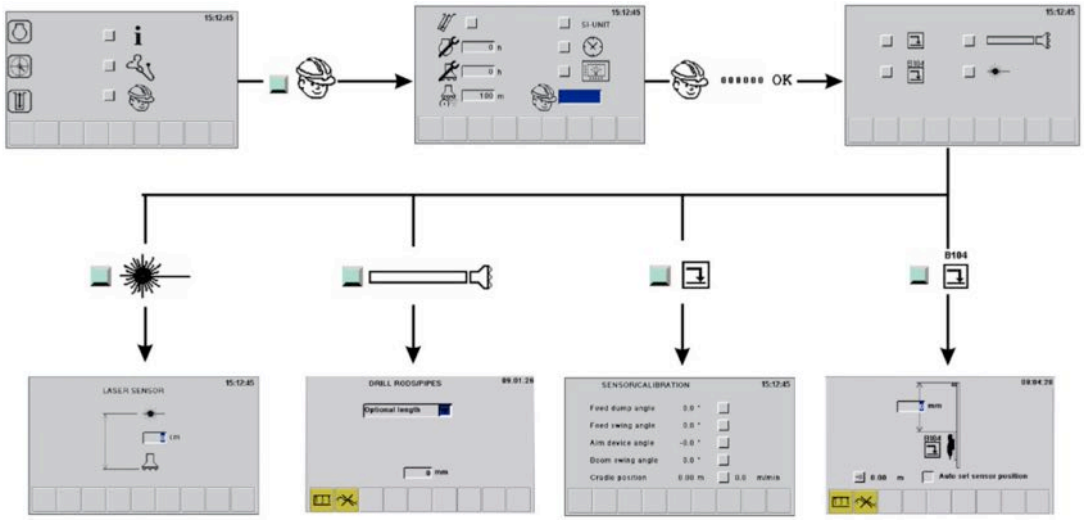
g	Number of drill rods.
h	**Reset of drilled length counter:** Before the start of each hole, the drill bit should be positioned against the ground. Use the arrow keys to mark the button next to the symbol and press Enter. The button will then become blue. Current drilled length (b) should show 0. This reset is also available in the angle instrument menu.
i	**Activation of the laser plane function:** See the chapter Options.

Table 43: Drilled length

9.1.5 Settings

When the system is installed or a sensor is replaced, the system must be calibrated and configured. This is done by logging in with a password in the "Settings" menu.

1. Press the ESC key until the basic menu of the display is shown.
2. Use the arrow keys to select the button by the symbol for the "Settings" menu and press Enter to confirm. The display will then show the "Settings" menu.
3. Use the arrow keys to mark the numerical field for logging in and press Enter to obtain a flashing cursor in the field.
4. Use the arrow keys to enter the password (6 characters). When an authorised password has been entered, "OK" will be displayed by the digits. Confirm with Enter to access the "Logging in" menu.



Menu tree for basic settings

Basic settings

The following settings are not normally required when calibrating the angle measuring instrument. If, on the other hand, any of the following has taken place, the basic settings must be redone.

- The display unit has been replaced.
- A drill steel of another type than was originally supplied with the drill rig is being used.

1. Log in to the "Logging in" menu following the instructions above.
2. Use the arrow keys to highlight the button by the "drill steel" symbol. Confirm with Enter to access the "drill steel" menu.

3. The current setting is shown in the field at the bottom left. If this differs from the equipment to be used, it must be changed. Use the arrow keys to mark the correct type of equipment and confirm with Enter. The new setting will then be shown in the field to the bottom left.
4. Go back to the "Logging in" menu by pressing ESC once.
5. Use the arrow keys to highlight the button by the "laser sensor" symbol. Confirm with Enter to access the "laser sensor" menu.
6. Press Enter to obtain a flashing cursor under the digits in the blue field.
7. Measure the exact length between the front of the drill bit and the laser receiver on the rock drill cradle and use the arrow keys to enter that value in the numerical field if it differs from the given value. Press Enter to confirm.
8. Leave the menu using ESC.

Calibration of the angle and drilled length system

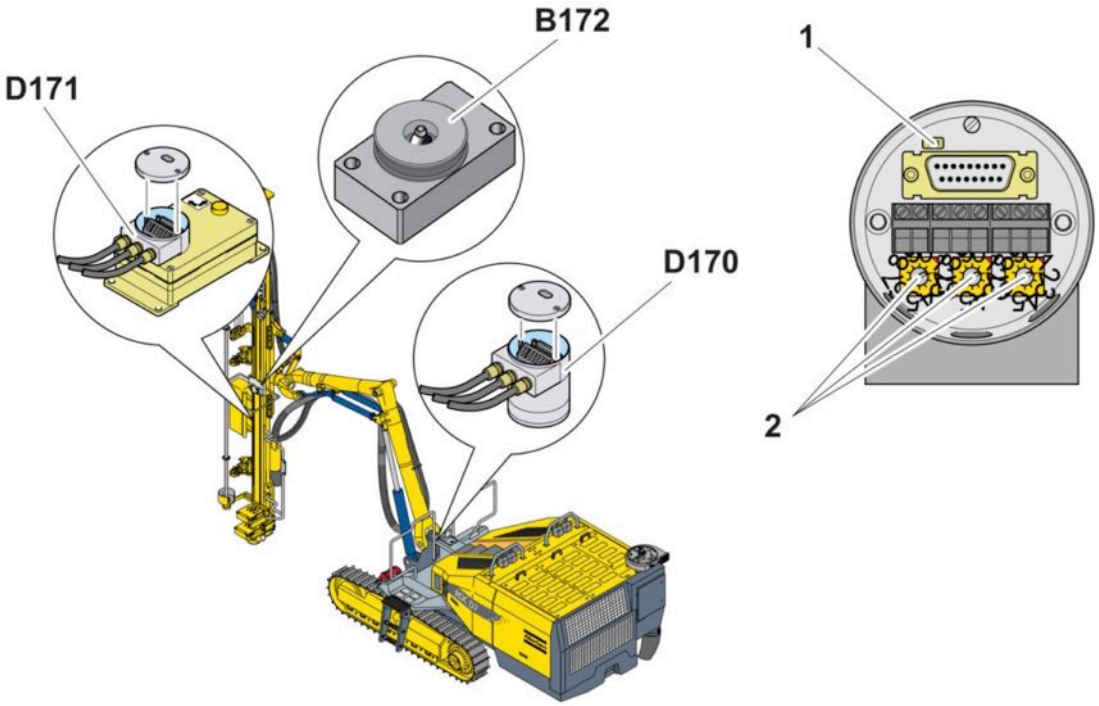
The following instructions should be followed if one of the following has occurred.

- Retrofitting of a system or individual sensor.
- Sensor replacement.
- The system indicates faulty angle values.

Replacement of sensors

If a sensor is replaced or retrofitted, it must be calibrated before the system can be calibrated.

Sensors

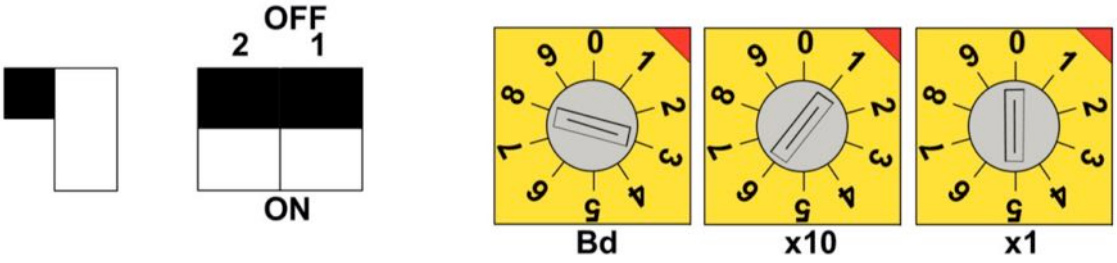


Sensors

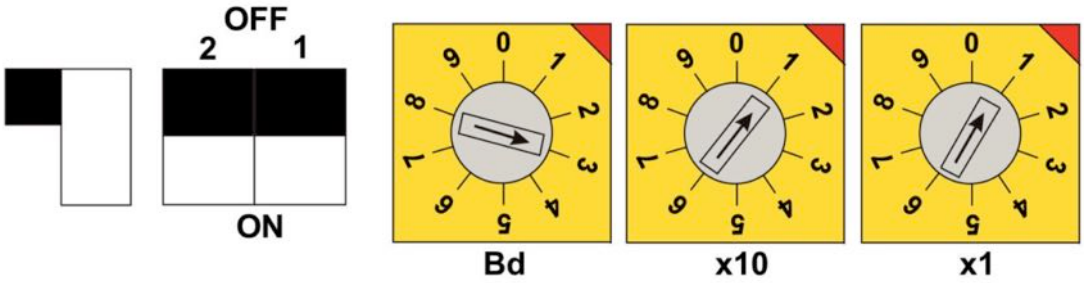
D170	Boom articulation sensor

D171	Inclination sensor
B172	Length Sensor
1	Switch
2	Adjusting screws

Carefully open the cover and set the DIP switches as illustrated below. The illustration is also found on the inside of the A1 cabinet door.



DIP switch settings for D170.



DIP switch settings for D171.

Aim device S146

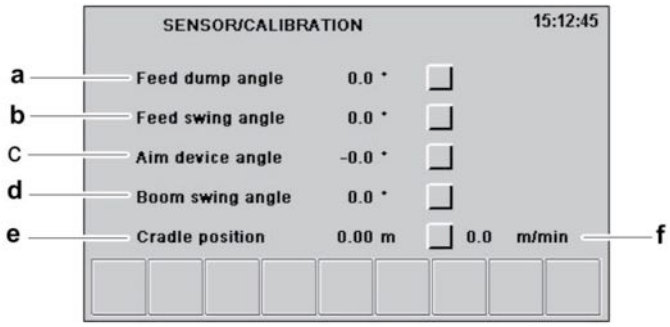
The aim device unit S146 does not require calibration as it is an analogue sensor and not a part of the CAN-BUS system.

9.1.6 Calibration

- Set the boom so that it is aimed straight ahead, parallel to the boom bracket.
- Set the aim device so that it is aimed straight ahead, i.e. at a 90° angle and parallel to the boom.
- Use a level to adjust the feed beam to a vertical position both front/back and left/right
- Run the rock drill cradle to the mechanical stop at the top of the feeder.

Once this is done, the system can be calibrated from the "Sensor/Calibration" menu.

1. Log in to the "Logging in" menu following the instructions under the Settings heading.
2. Use the arrow keys to mark the button by the "sensor calibration" symbol. Confirm with Enter to access the "Sensor/Calibration" menu.
3. A list of the sensors in the angle and drilled length system is displayed in the sensor calibration menu ("SENSOR/CALIBRATION"). When boom, aim device, feeder and rock drill cradle are in their respective zero positions in accordance with the conditions above then the digit values in the menu shall also be 0.



Sensor calibration menu.

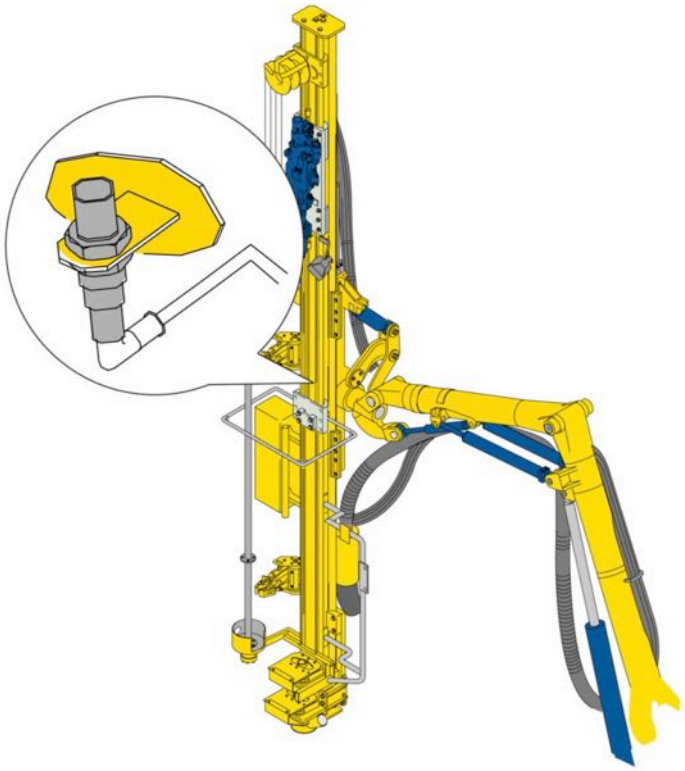
a	Feeder tipping angle
b	Feed swing
c	Aim
d	Boom Swing
e	Cradle position
e	Information on cradle speed

4. If any value is not 0, it must be reset for the instrument to function correctly.
5. Use the arrow keys to mark one button at a time and press Enter to reset the value.
6. Once all values are 0, leave the menu using ESC.

Calibration of the length sensor

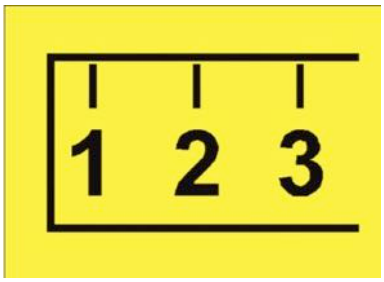
The length sensor must be recalibrated as follows each time the CAN-BUS is restarted.

1. Run the rock drill to its uppermost position.
2. Run the rock drill down **slowly** past the calibration sensor.



Calibration sensor.

3. The symbol for "Calibrate length sensor" in the status bar of the display will be extinguished once the length sensor is calibrated.



Warning symbol "Length sensor not calibrated".

9.1.7 Operation

1. Move the rig to the drill site and set it up in the desired position.
2. Select a reference point and turn the sight so that the arrow points towards the reference point. The reference point should be as far away as possible (at least 2 km) if it does not lie in direct line with the row of holes in order to minimise angle error. If the reference point lies in line with the row of holes, it can be as close as 10 m from the last hole of the row without any angle errors arising.
3. Set the desired hole inclination front/back or left/right.
4. Position the feed beam so that the red line in the graphic is reduced to a red dot in the centre. Once this has occurred, the desired angle value is the same as the actual value.
5. Press the feeder spike against the ground by using the feed extension.

6. Set the desired hole length / vertical depth in the drilled length instrument's menu if automatic drill stop is to be used.
7. Position the drill bit against the ground and reset the drilled length instrument either directly in the angle instrument's menu or by first selecting the drilled length instrument's menu and then resetting it. This reset must be also be done if the laser plane function is to be used.
8. Drill until the preset depth has been reached and drilling stops automatically or drill until the desired drilled length is shown in the drilled length menu and switch off drilling manually.
9. Extract the drill string and move the drill rig to the next hole or, if the whole is close by, turn the boom to the next hole.
10. If the drill rig is moved, the sight should be turned until it is aligned with the reference point. The instrument will then take the new drill rig position into consideration to make the next hole parallel to the previous one. If additional holes can be drilled without changing the setup, the sight does not have to be adjusted.
11. Repeat steps 4-10.

10 Options

10.1 Thread lubrication

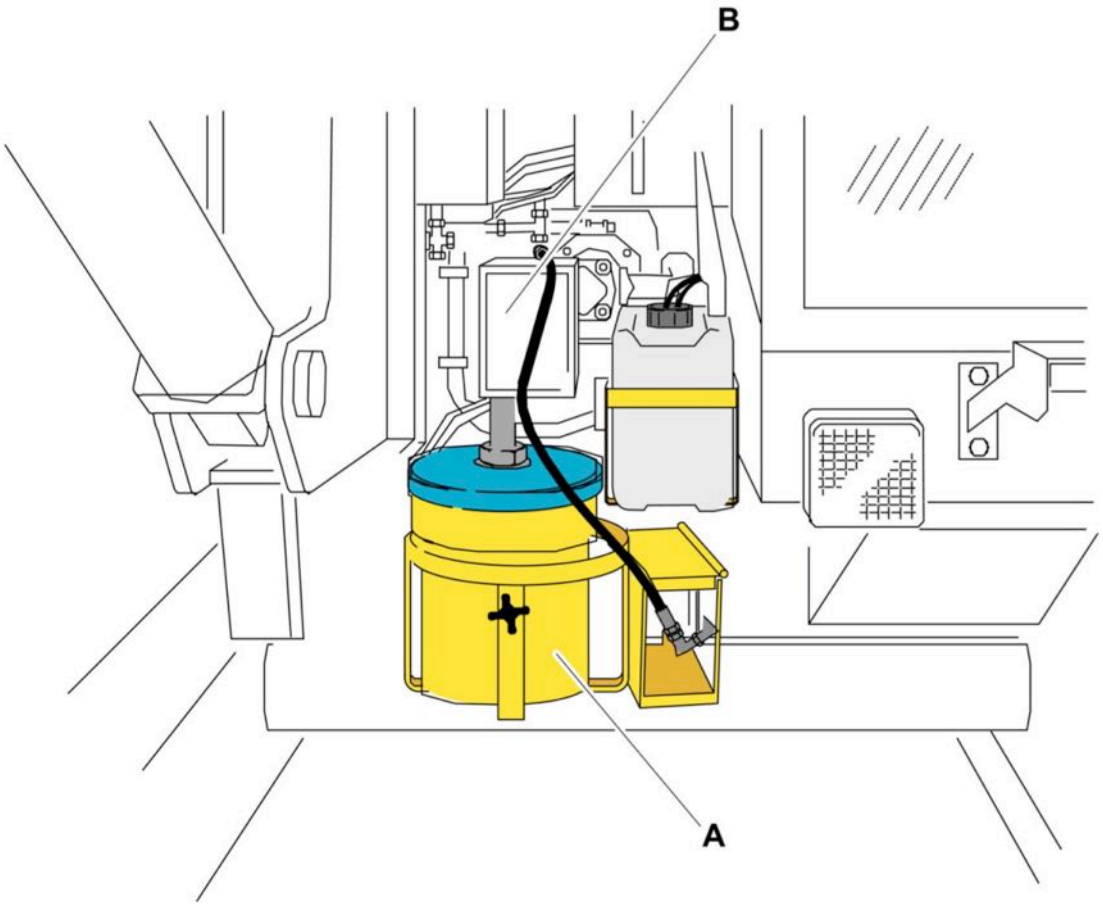
10.1.1 Thread lubrication with brushes

Function

Drill steel threads are lubricated using two brushes (C) mounted on the RHS carousel lower bracket.

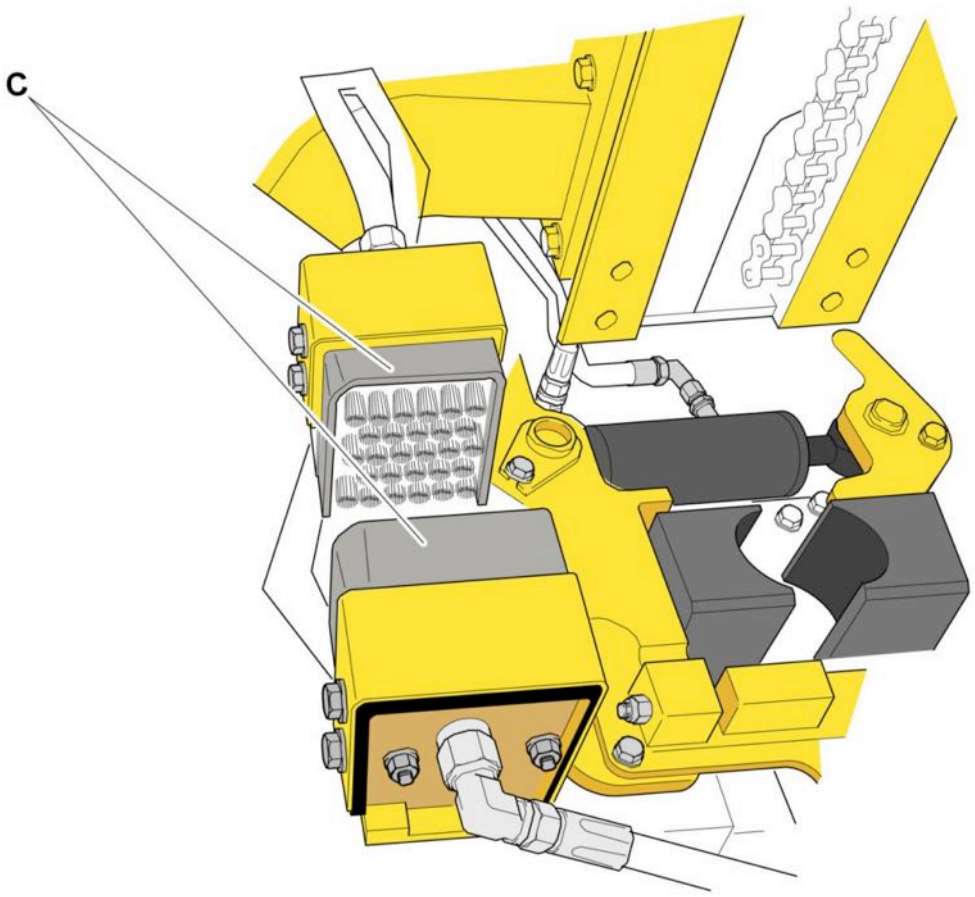
Grease comes from a pump (B) placed in a grease container (A) at the front of the chassis frame. The pump is driven by compressed air from the drill rig compressor.

The pump can be activated manually or automatically.



Thread lubrication system.

A	Grease tank.
B	Pump.



Brushes for thread lubrication.

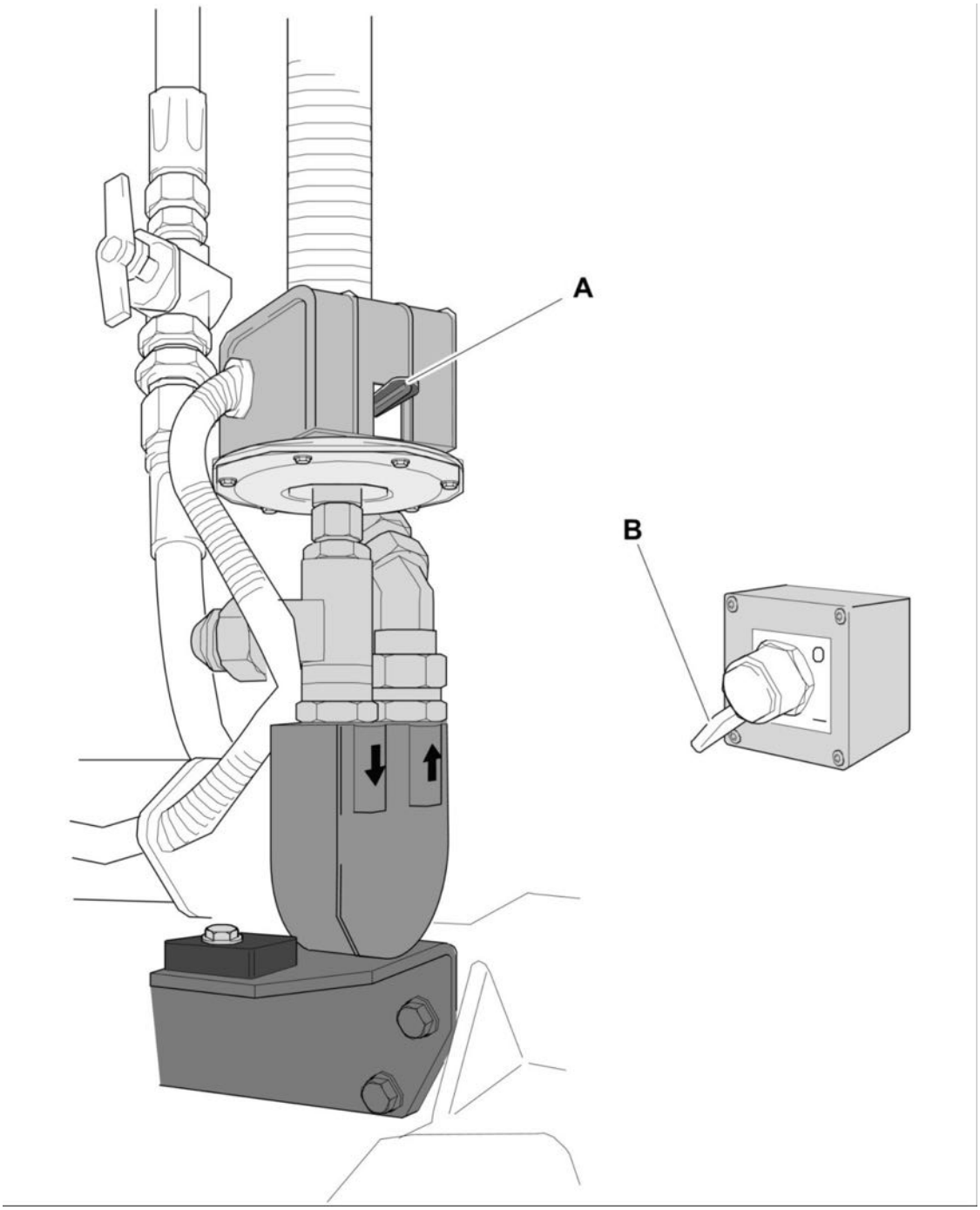
Operation

Lubrication is regulated with a switch that is described in the chapter, Controls.

- During normal use, the system will operate automatically. The grease pump will then operate when the rod handling lever is in position to move a rod to the drill centre. This means that each time a rod is moved out from the carousel, a certain amount of grease will be pumped to the brushes that the rod threads subsequently pass.
- If it is necessary to pump more grease to the brushes, the system can be operated manually. The grease pump will then be active as long as the circuit breaker for greasing is held in MANUAL position.
- If thread lubrication is not desired, the system can be switched off.

10.2 Electric filler pump

10.2.1 Electric pump for filling fuel



Electric filler pump

The pump is used to fill fuel.

1. Make sure that the hose and the filter are clean.
2. Connect the attached hose to the fuel source.
3. Move switch (B) to position 1.
4. Activate switch (A) to start filling.

The electric filler pump will stop automatically when the drill rig fuel tank is full. It will also stop if the source of fuel runs out.

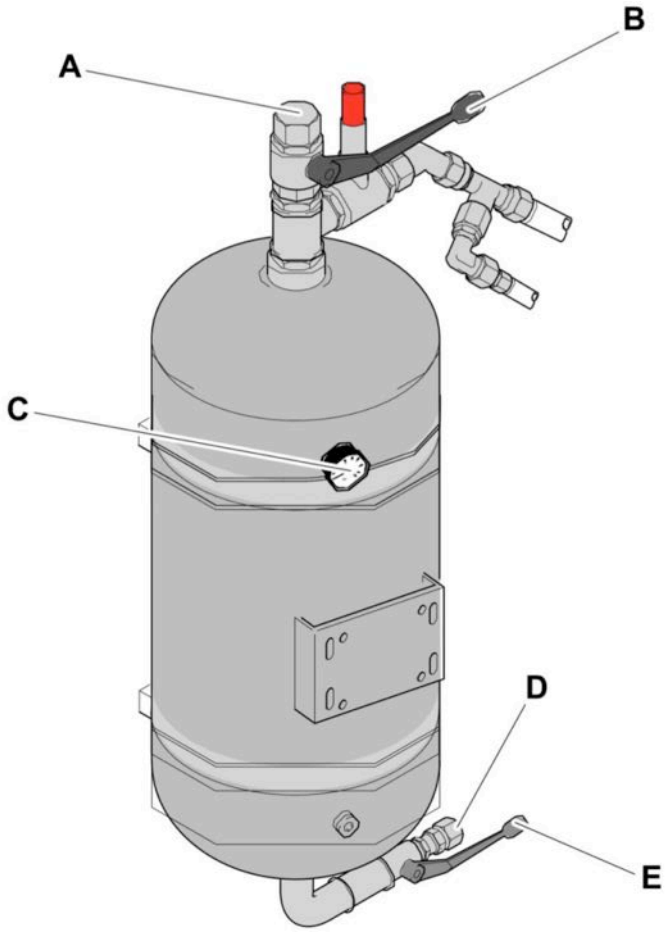
10.3 Water mist system

10.3.1 General

The water mist system is a pressurised system that is pressurised from the drill rig's air system.

- The water mist system comprises:
  - Tank
  - Safety valve
  - Strainer
  - Two cocks
  - Two valves
  - Non-return valve (to prevent water flowing back to the compressor).

Pressure tank



Pressure tank.

A	Cover.
B	Filler cock.
C	Pressure gauge.

D	Drain outlet.
E	Drain cock.

The system is filled with pure water via (A) the pressure tank cap.

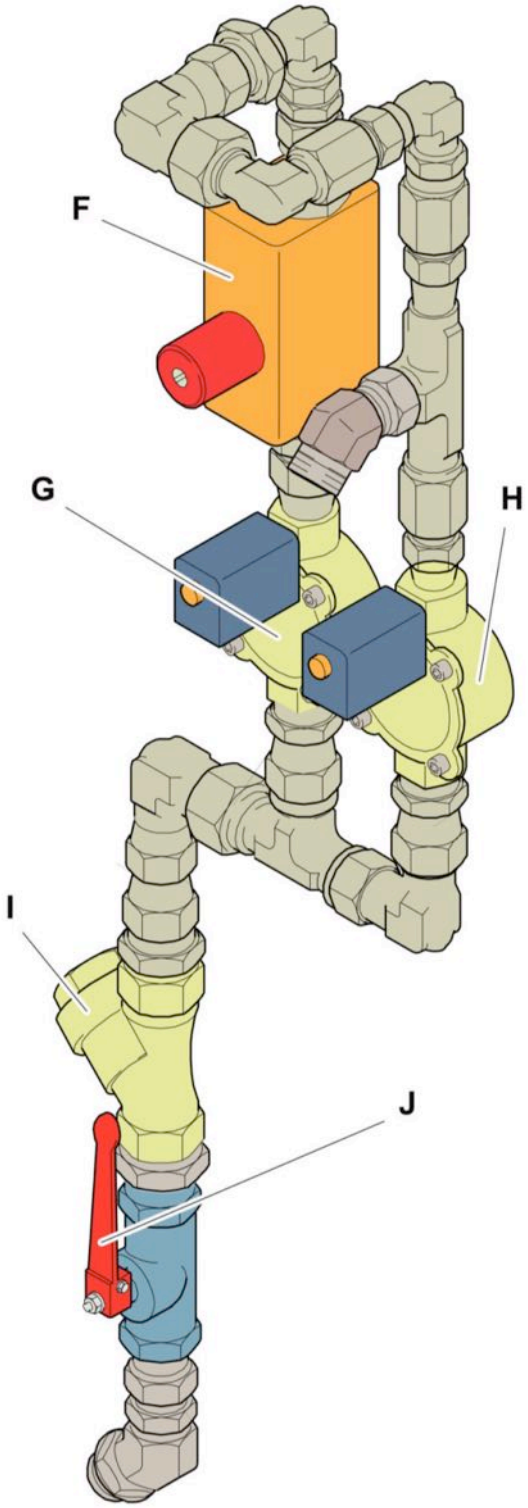
The system pressure can be read on (C) the tank pressure gauge.

The system is drained from water through the cock (E).

The system can be completely closed using a cock located on the pressure tank or air cross.

Functions and settings

- The water mist system switch has three positions:
  - Up - Fully open valves (Valve G).
  - Neutral - Only the preset valve circuit is open (valve H).
  - Down - OFF.



Water mist system.

F	Fine adjustment of water mist
G	Valve.
H	Valve.
I	Strainer
J	Cock for adjusting the water mist system.

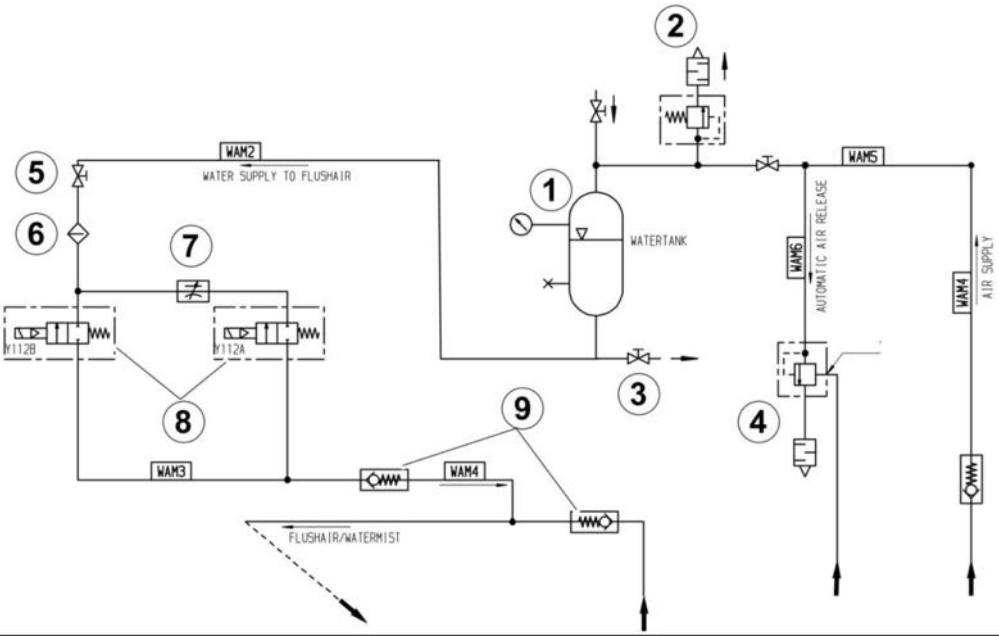
When the circuit breaker for the water mist system is in position (a) (valves fully open), the quantity of water is controlled solely by the cock (J) on the water mist system. The cock should normally be set so that water mist emerges from the drill bit.

With the circuit breaker for the water mist system in position (b) (only preset valve circuit open), the water mist can be finely adjusted further using valve (F) on the water mist system. This enables two different water mixtures to be obtained.

The system is depressurised via a blowdown valve when the drill rig compressor is deactivated.

10.3.2 Water mist system 225 litres

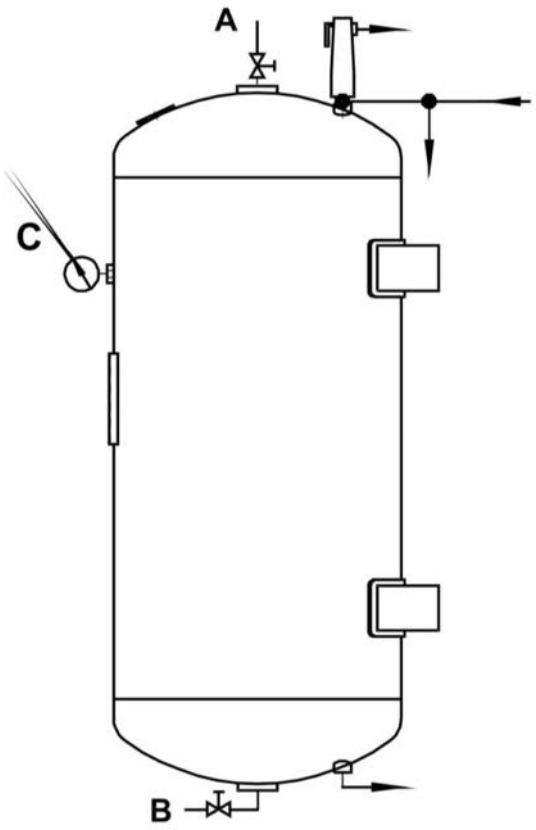
The 225 litre water mist system is pressurised. The water is forced into the air circuit when the water tank is pressurised by the compressor.



Water mist system

1	Tank
2	Safety valve
3	Foot valve
4	Blow-down valve
5	Shut off valve
6	Filter
7	Needle valve
8	Solenoid valves
9	Check valves

Operation



Pressure tank and drill panel

- The water tank must be filled with pure water and possibly dust binding additive through the filler valve on top of the tank (A).
- The tank can be drained through the valve on the bottom of the tank (B).
- The water supply from the tank can be turned off during maintenance work on the system using the valve (5).
- Normally, a small amount of water is used to dampen the drill dust and bind it into larger particles for dust binding or to build up the wall of the hole. In this case the system must be in AUTO position.
- If it is necessary to add a large amount of water, e.g. if a mud pocket is hit, the system can be set to MANUAL.
- If there is no need to add any water, the system can be turned off completely.

To avoid clogging suction hoses and filters, the DCT should be turned off if the dust is moist or if water is washing up out of a hole.

When the compressor discharges or the engine is turned off, the air pressure in the tank will automatically evacuate through the blow-down valve (4).

If there is a risk of freezing, the tank should be emptied and the system flushed with anti-freeze before leaving the rig overnight or for the weekend.

The filter (6) should be regularly dismantled and cleaned.

Setting

WARNING

Serious injury

Never carry out maintenance work while the drill rig is in operation

- Make sure that the hydraulic, water and air systems are depressurised and that the electrical system is without current before starting any work

The system has two possible settings:

- Basic setting with shut-off valve (5). To set the amount of water when the system is run in MANUAL, the shut-off valve can be closed slightly.
- Setting water mist. In AUTO, the amount of water can be set with the needle valve (7).

Note that there is a certain delay after activating the water mist before the water emerges from the drill bit.

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