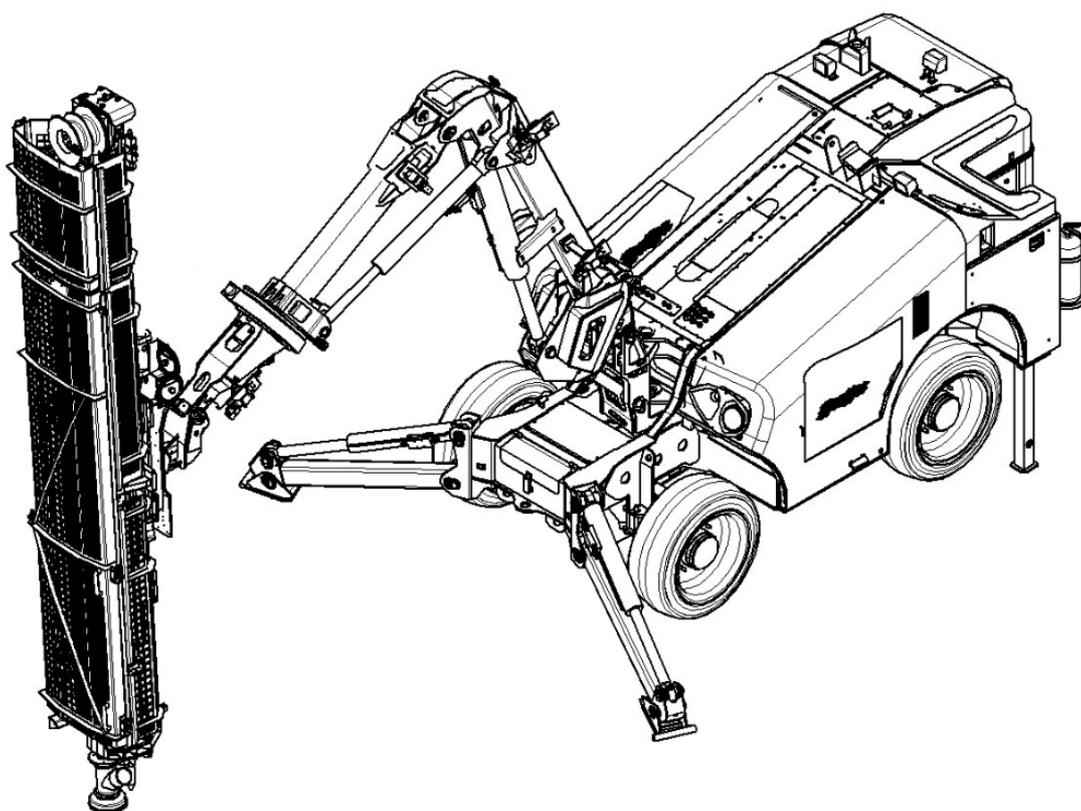


# Epiroc

FlexiROC T20 R

Operator's instructions



## **SAFETY INSTRUCTIONS**

- **Before starting, read all instructions carefully.**
- **Special attention must be paid to information alongside this symbol.**
- **Only use genuine Epiroc parts.**



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**Epiroc Stonetec S.r.l.  
12031 Bagnolo Piemonte (CN), Italy**

# Safety

Reference .....5



## Reference

*Note*

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



**safety**

# Operator's instructions

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# 1. General

## 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.

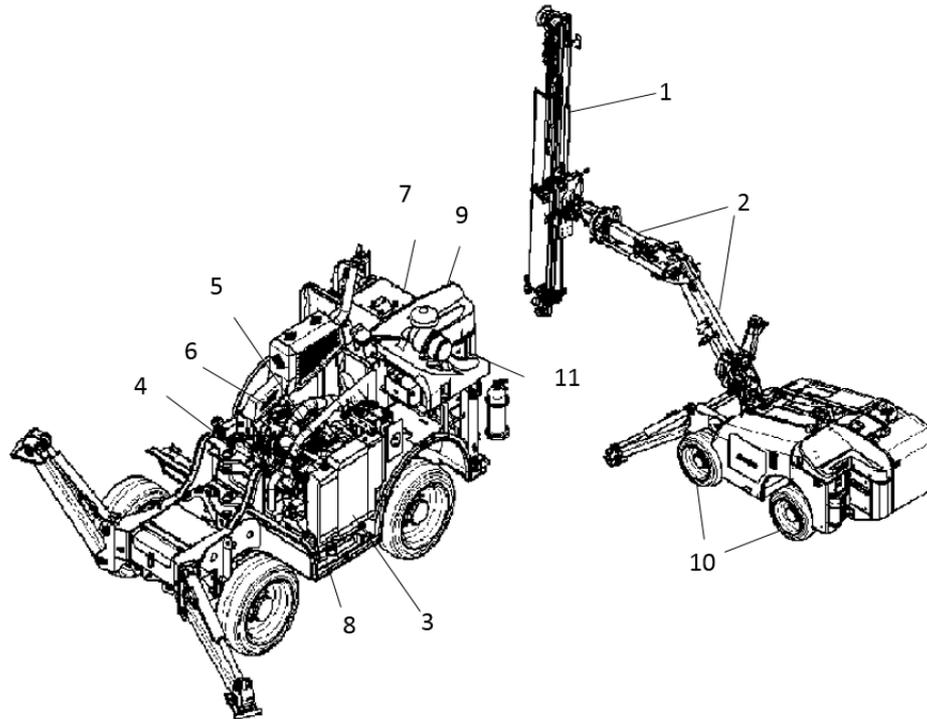
See separate instructions for documentation on the rock drill/rotation unit, the diesel engine and certain other components.

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

# Operator's instructions

## 1. General

# Principal components



*Figure: Principal components*

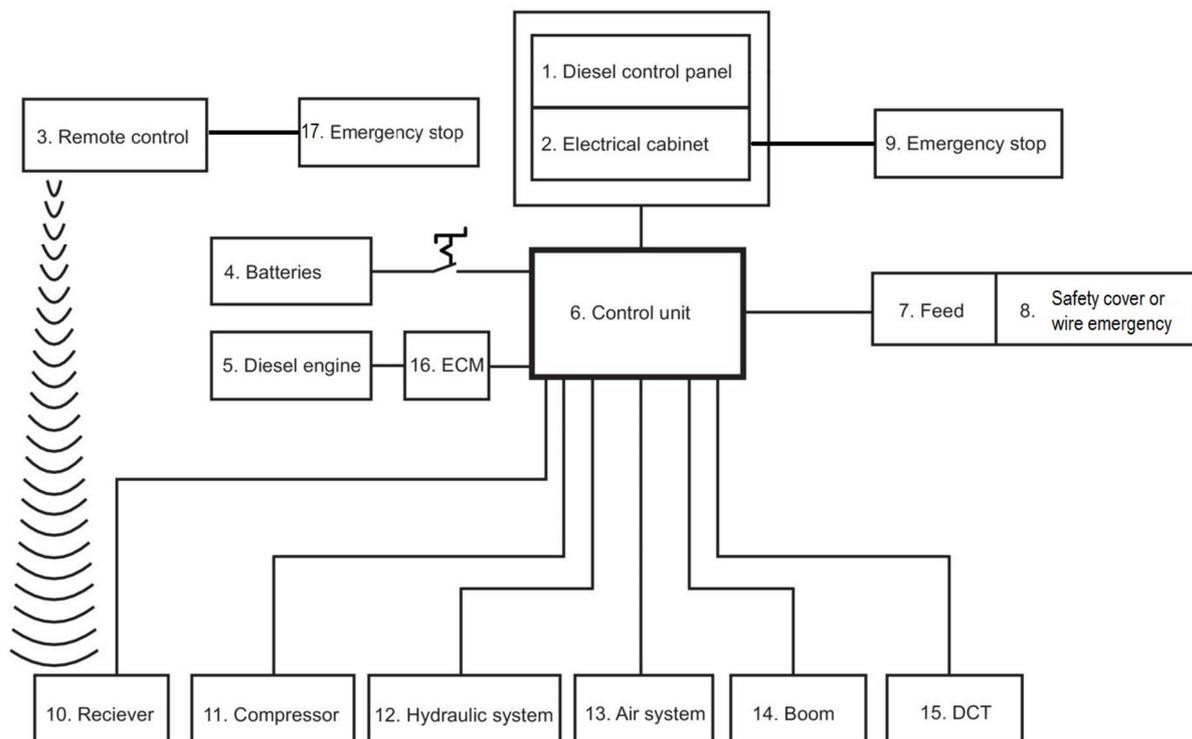
1	Feeder	7	Dust collector (DCT)
2	Boom system	8	Compressor
3	Radiator	9	Radio receiver
4	Hydraulic oil pumps	10	Wheels
5	Diesel engine	11	Electric cabinet
6	Air tank		

# General system description

## 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).



*Figure: General Description*

*Table:*

<b>1. Diesel control panel</b>	<b>10. Receiver</b>
<b>2. Electrical cabinet</b>	11. Compressor
<b>3. Remote control</b>	12. Hydraulic system
<b>4. Batteries</b>	13. Air system
<b>5. Diesel engine</b>	14. Boom
<b>6. Control unit</b>	15. Dust collector
<b>7. Feed</b>	16. Engine electronic board
<b>8. Safety cover or wire emergency</b>	17. Emergency stop
<b>9. Emergency stop</b>	

## **Operator's instructions**

### 1. General

## **Wheeled chassis frame**

The diesel engine, chassis, dust collector, hydraulic system, air system and boom system are mounted on the wagon frame.

The 4 wheels are driven by two steering axles with integrated brake.

The body covers the diesel engine, the compressor, the different lubrication tanks, the valves and the hydraulic hoses. Inspection hatches facilitate access to the different machine components. All the hatches lock in the open position with a pneumatic spring.

The dust collector is mounted at the back of the rig on the right-hand side.

## **Power pack**

This hydraulic drill rig is powered by a turbocharged, water-cooled diesel engine.

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

The drilling carriage is driven by 2 steering axles connected to each other by a universal joint and powered by a hydraulic motor.

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

## **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.

## **Dust collector**

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

## **Electrical system**

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

The electrical system comprises starting equipment, work lighting, 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.

## 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	Winch, tramming, impact, feed drill rotation
2	Boom swing, boom lift, boom extension
3	Steering, lubricating pump, dct, stability jacks, feed swing, feed dump, feed extension, roll over, drill steel support, RAS
4	<i>Oil cooler</i>

*Table: Description of hydraulic pump function*

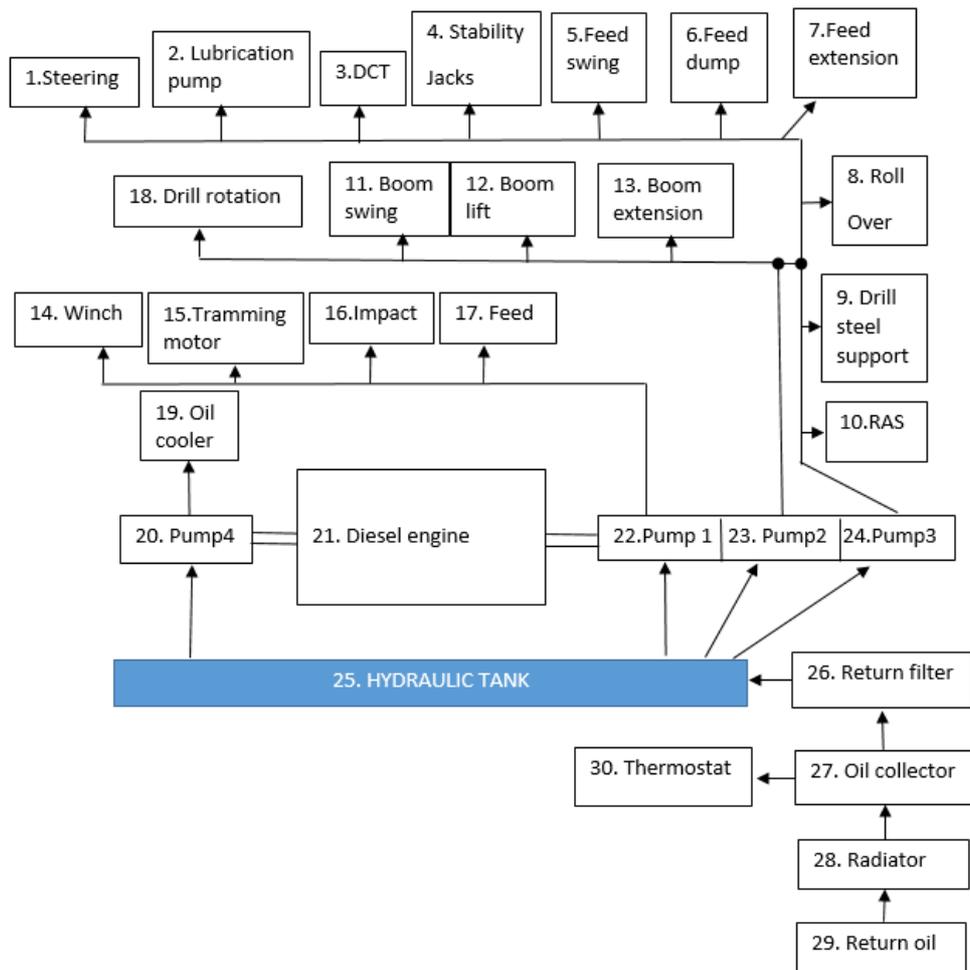
The hydraulic oil tank is located in the centre of the drilling carriage.

The radiator on the right side of the drilling carriage cools the water of the engine, the intercooler and the oil compressor. The radiator on the left side cools the hydraulic oil.

(For more information, see the separate hydraulic system drawing)

# Operator's instructions

## 1. General



<b>1</b>	<b>Steering</b>	<b>16</b>	<b>Impact</b>
<b>2</b>	Lubrication pump	<b>17</b>	Feed
<b>3</b>	DCT	<b>18</b>	Drill rotation
<b>4</b>	Stability Jacks	<b>19</b>	Oil cooler
<b>5</b>	Feed swing	<b>20</b>	Pump 4
<b>6</b>	Feed dump	<b>21</b>	Diesel engine
<b>7</b>	Feed extension	<b>22</b>	Pump 1
<b>8</b>	Roll over	<b>23</b>	Pump 2
<b>9</b>	Drill steel support	<b>24</b>	Pump 3
<b>10</b>	RAS	<b>25</b>	Hydraulic tank
<b>11</b>	Boom Swing	<b>26</b>	Return filter
<b>12</b>	Boom lift	<b>27</b>	Oil collector
<b>13</b>	Boom extension	<b>28</b>	Radiator
<b>14</b>	Winch	<b>29</b>	Return oil
<b>15</b>	Tramming motor	<b>30</b>	Thermostat

## Hydraulic pumps

### Hydraulic pump 1

Main hydraulic system pump 1 is a variable-displacement piston type. The pump supplies hydraulic power to the following functions:

- Winch,
- tramping,
- impact,
- feed drill rotation

### Hydraulic pump 2

Hydraulic pump 2 supplies hydraulic oil to provide power to the boom.

- Boom swing,
- boom lift,
- boom extension

### Hydraulic pump 3

Hydraulic pump 3 supplies hydraulic oil to power the

- Steering,
- lubricating pump,
- dct,
- stability jacks,
- feed swing,
- feed dump,
- feed extension,
- roll over,
- drill steel support,
- RAS

### Hydraulic pump 4

Hydraulic pump 4 supplies hydraulic oil to power the oil cooler motor.

Pump no.	CC	Flow (litre/min)	Pressure (bar, max.)
1	60	139	280
2	30	62	260
3	10	26	260
4	7	26	150

## Air system

The air system consists of the compressor with oil separator, hoses and valves. The compressor is belt-driven from 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 in the bore hole, cleaning of the dust collector filter and the rock drill lubrication system and ECL.

## 2. Technical data

### FlexiROC T20 R

#### Weight (standard equipment without drill steel)

FlexiROC T20 R

Weight 5750 kg

#### Performance

Diesel engine, Cummins QSB3.3	
power output at 2400 rpm/min	82 kW 110 HP
Temperature range in operation	-25° C +40° C
Tramming speed, max.	5 Km/h
Traction force (low/high gear)	59 kN
Ground clearance	220 mm
Max. hydraulic pressure	290 bar
Noise Level	
Max. engine speed (2500 giri/min.)	117 dB (A)
Drilling (2500 giri/min.)	124,5 dB (A)
	128 dB(A) guaranteed

#### Tilt angles

##### Note

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

**ANGLES MUST NOT BE COMBINED!**

Tilt angles for drill rig when drilling:

longitudinally, max. (Downward/Upward)	20°
lateral (left/right).	10°
laterally, (left/right), in extreme positions.	10°

Tilt angles - tramming (in direction):

downward/upward, max. without winch	20°
laterally, max. (Left/Right)	10°
downward/upward, with winch	>20° - < 30°

Max pressure on the ground of stability jacks 0.5MPa

## Operator's instructions

### 2. Technical data

#### Hydraulic systems

Hydraulic oil cooler for max. ambient temperature 40° C

#### Electrical system

Voltage 24V

Batteries

Voltage 2 x 12 V/100 Ah

Front working floodlights

Voltage 2 x 70 W

Rear working floodlights

Voltage 1 x 24V LED

Column working floodlights

Voltage 2 x 24V LED

Generator

Voltage 24 V/55 Ah

#### Air system

Compressor: Gardner Denver E6 Plus

Max. air pressure 12 bar

Free air delivery 50 l/s

#### Capacities

Hydraulic oil reservoir

min/max level 50 / 60 l

Hydraulic systems

total 120 l

Fuel tank

140 l

Compressor oil

9 l

Lubricating oil tank

6 l

Diesel engine oil

8,5 l

Engine cooling system

15 l

#### Miscellaneous

Fire extinguisher

A-B-C powder 1 x 6Kg

Tire pressure 5,2 bar

#### Components weight

Boom 650Kg

Feed 600Kg max

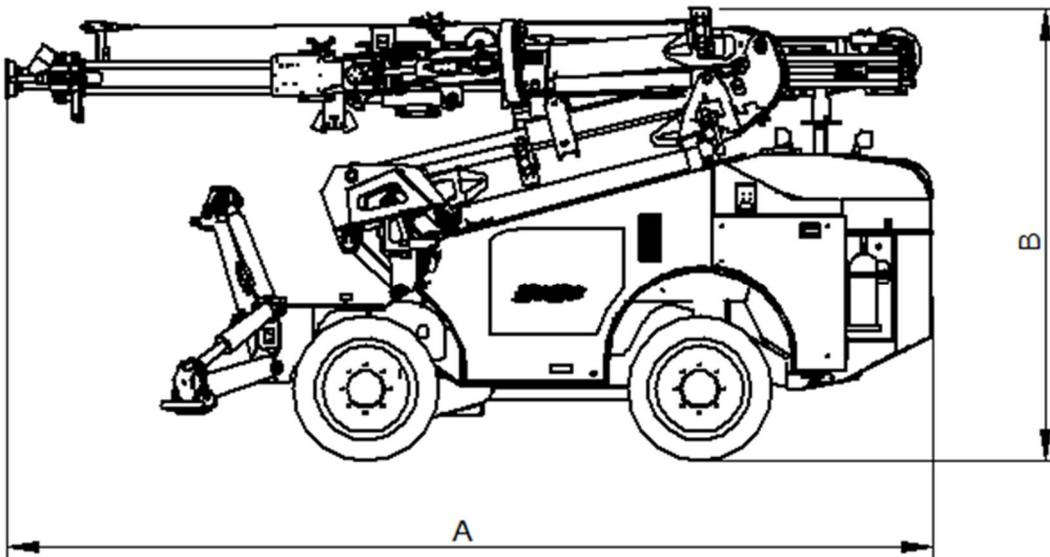
Pomp cover 75 Kg max

# Dimensions

## Dimensions

### Transport dimensions

Feed length	Length A	Height B	Width
8 feet	5300	2580	1900
10 feet	4700	2580	1900
12 feet	4300	2580	1900

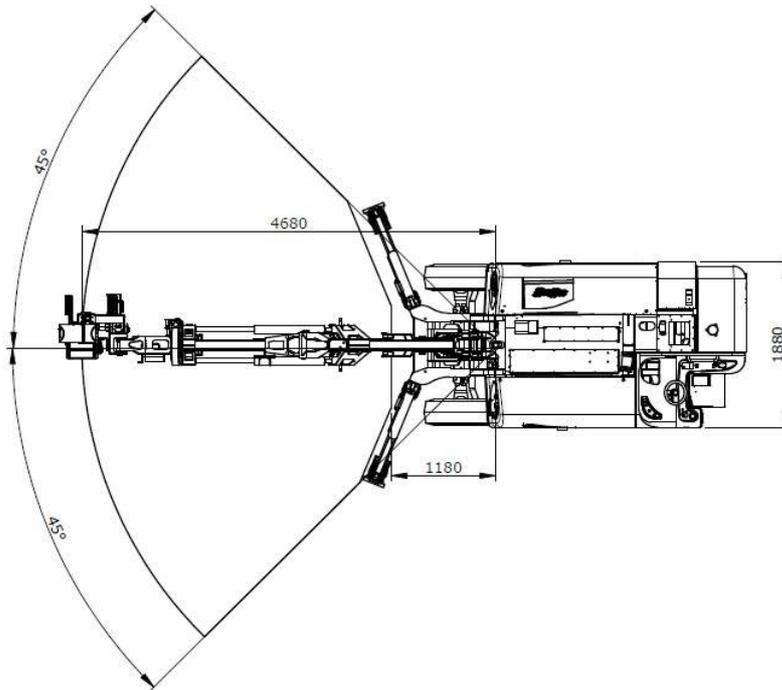


*Figure: Transport dimensions*

# Operator's instructions

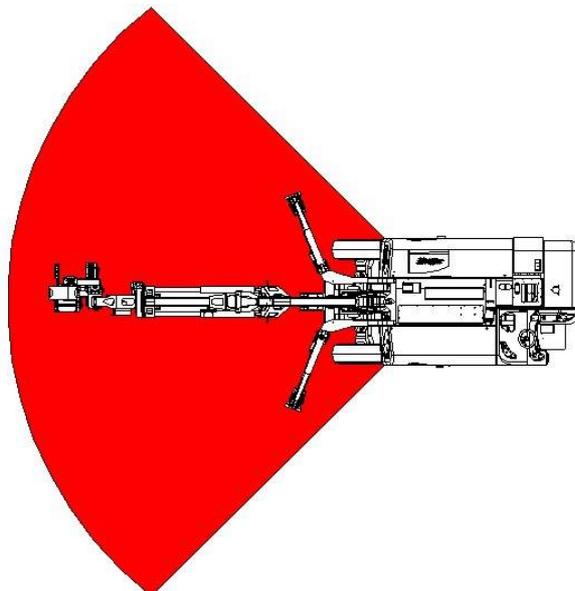
## 2. Technical data

### Coverage area



*Figure: Coverage area*

### Danger zone



*Figure: Danger zone*

## 3. Daily checks

### Foreword

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

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

### Extra safety check

#### Safety

 <b>DANGER</b>
<ul style="list-style-type: none"><li>• <b>Danger of moving parts</b></li><li>• <b>Risk of serious personal injury</b></li><li>• <b>Set all levers and switches in neutral position before preparing start-up</b></li><li>• <b>Perform the extra safety check without the engine running</b></li></ul>

 <b>DANGER</b>
<ul style="list-style-type: none"><li>• <b>The side hatches on the drill rig are not dimensioned for extra weight</b></li><li>• <b>Risk of serious personal injury</b></li><li>• <b>Standing, sitting or leaning on the side hatches can result in serious injury</b></li><li>• <b>The side hatches must be closed when work is carried out on top of the rig</b></li></ul>

## Operator's instructions

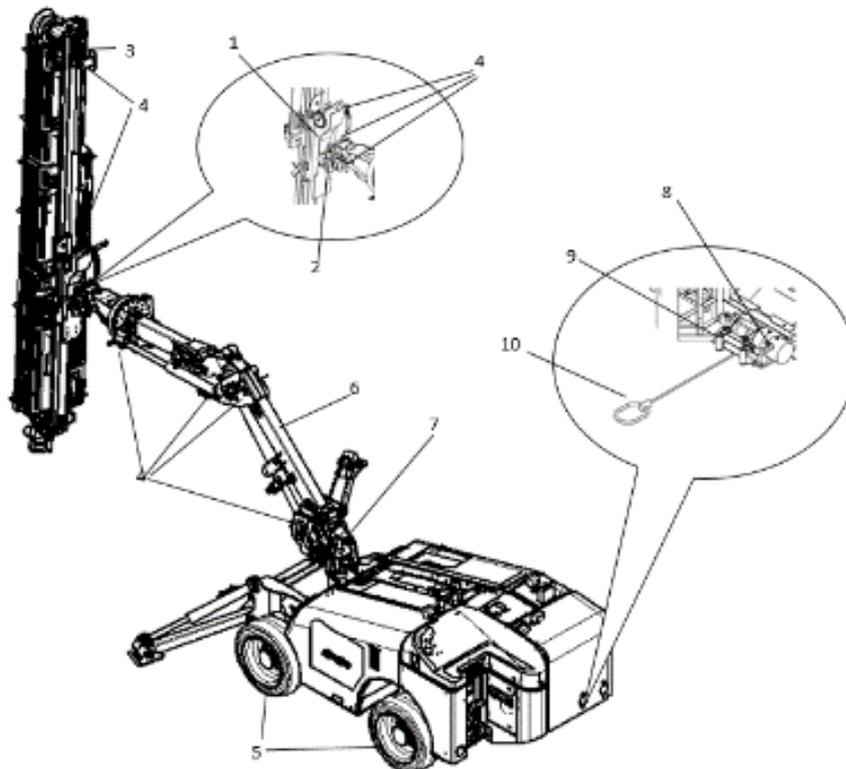
### 3. Daily checks

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).

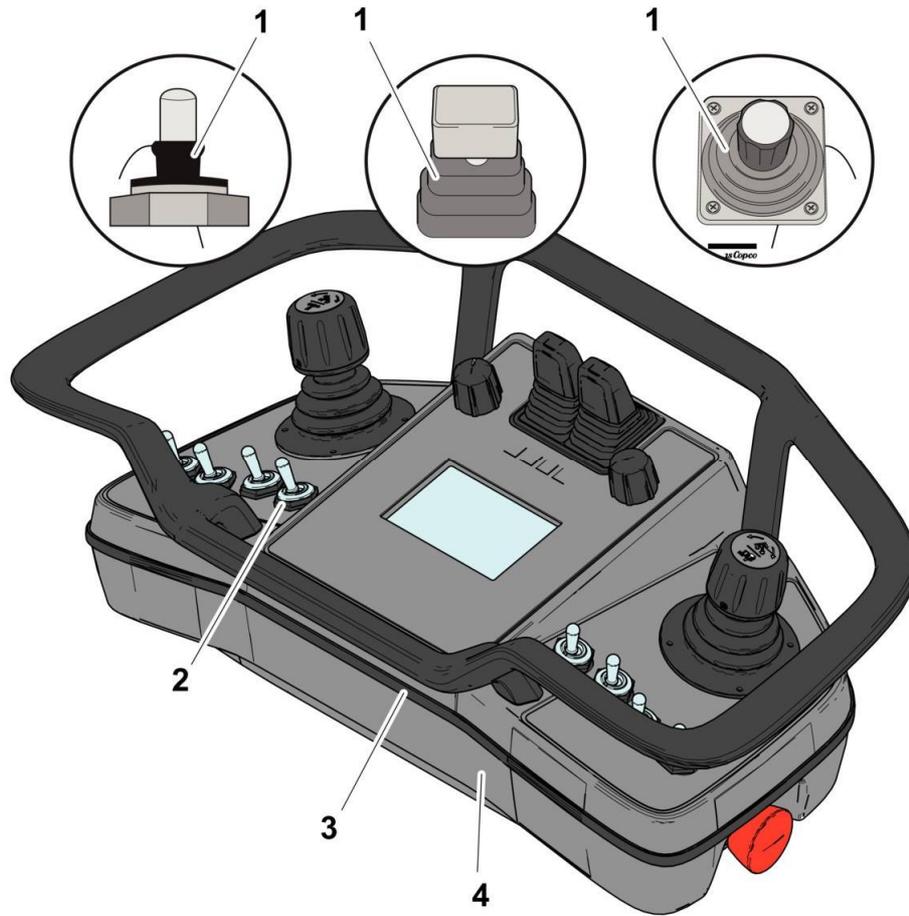
## Check points



*Figure: Check points*

*Table:*

1	Feed holder with attachment	6	Boom
2	Boom head	7	Boom support
3	Feed cylinder	8	Release/engage mechanism
4	Cylinder brackets	9	Winch with brackets
5	Wheels	10	Winch wire rope with hook



*Figure: Remote control box*

*Table: Remote*

1	Rubber bellows on levers and switches	6	The joint between the upper and lower halves of the box must be well tightened
2	Seals on switches and knobs	7	The box must not be cracked

## Operator's instructions

### 3. Daily checks

# Before starting

## Safety

 **WARNING**

- **Danger of moving parts**
- **Can cause serious injuries**
- **Set all levers and switches in NEUTRAL position before start-up preparations**
- **Carry out the procedures with the engine switched off**

 **WARNING**

- **Dangerous compressed air**
- **Can cause serious injury**
- **Release the pressure in the tank before removing the filler plug**

## Checks

*Table: Checks before starting.*

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	Oil level	Check oil level. Top up as necessary.
Motor 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

For further instructions, see: Maintenance instructions

## Functionality test after start

### Checks

*Table: Checks after starting*

Check point	Inspection	Instructions
Emergency stop	Function	Check that all emergency stops are working (see chapter Safety for location)
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
Diesel panel	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
Hydraulic pressure	Visual check	Observe the pressure gauges to make sure no abnormal pressure arises

For further instructions, see: Maintenance instructions

## Operator's instructions

### 3. Daily checks

# Function test while drilling

## Checks

*Table: Checks during drilling*

Check point	Inspection	Instructions
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 shank adapter.
Indicator lamps	Diesel panel	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	Check the filter in the filter holder and suction hose and also the drill-steel support's drill gasket.
Drill rig	Complete drill rig	Check for signs of leaks.
Pressure gauge	Pressure gauge panel	Check all the pressure gauges to see that the hydraulic pressure is normal. Call for a service technician if there are any deviations.

For further instructions, see: Maintenance instructions

# 4.Controls

## Controls

### General

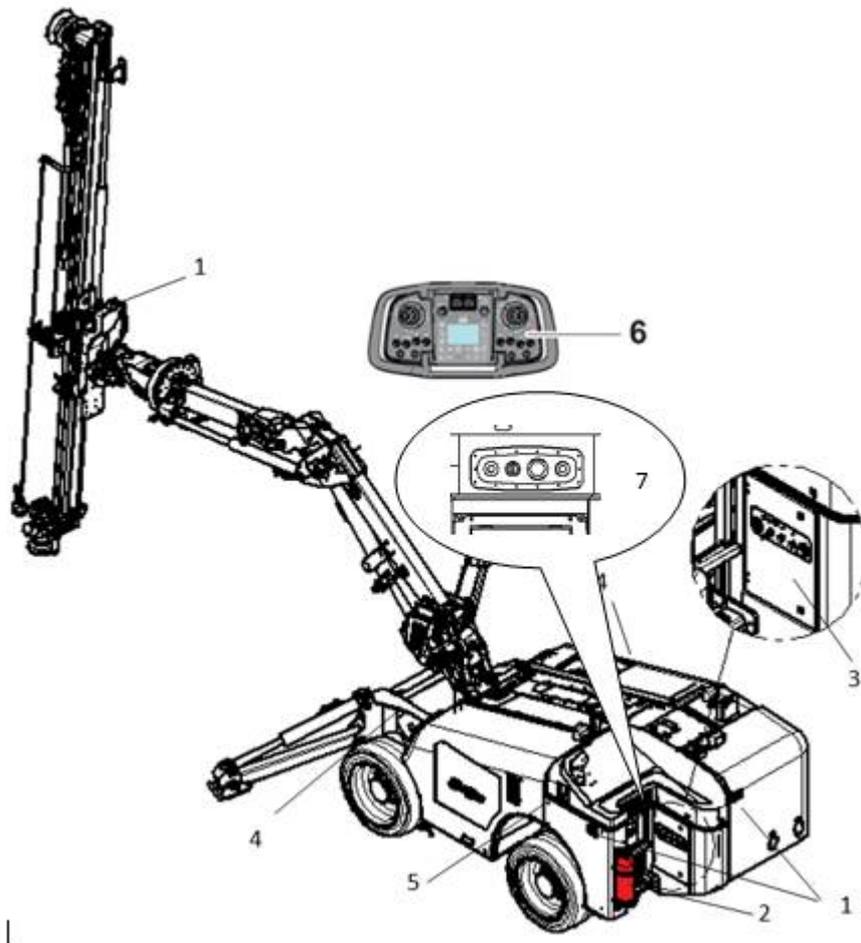


Figure: General drawing

<b>1</b>	<b>Gradient meter</b>
<b>2</b>	Fire extinguisher
<b>3</b>	Electrical panel
<b>4</b>	Pressure gauge panel
<b>5</b>	Operator display
<b>6</b>	Radio remote control
<b>7</b>	Front panel

## Operator's instructions

### 4. Controls

## Remote control box

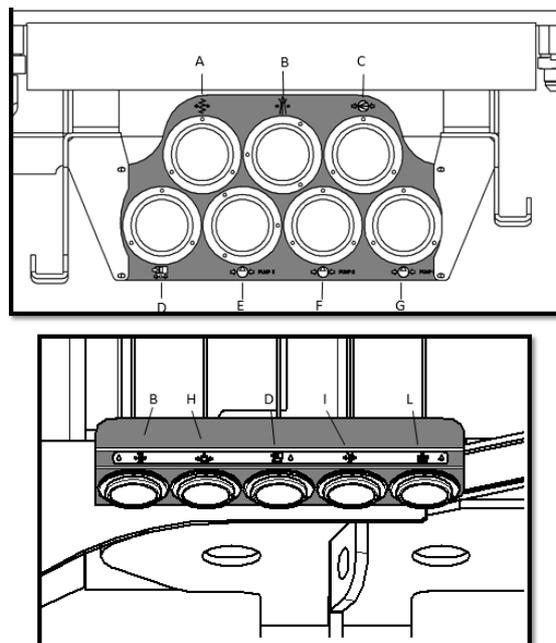
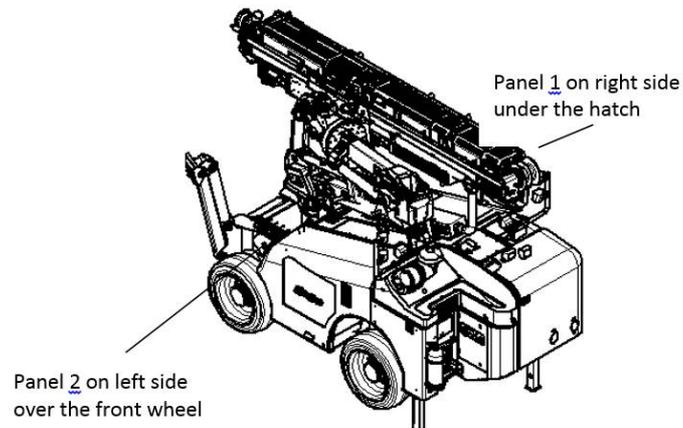
The machine has an on board control called IFM and a remote radio control.

 <b>WARNING</b>	
<ul style="list-style-type: none"><li>• <b>Danger of accidental operation</b></li><li>• <b>May cause serious personal injury and damage to property</b></li><li>• <b>The operator must always have an overview of the drill rig and the remote control box</b></li><li>• <b>Always check that the controls are correctly adjusted before operating</b></li><li>• <b>Always deactivate the remote control box when it is not in use</b></li><li>• <b>Do not activate the remote control from the platform of the drilling carriage when using the winch.</b></li></ul>	

 <b>WARNING</b>	
<ul style="list-style-type: none"><li>• <b>When the remote control box is deactivated then no functions can be controlled</b></li></ul>	

## Pressure gauge panel

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



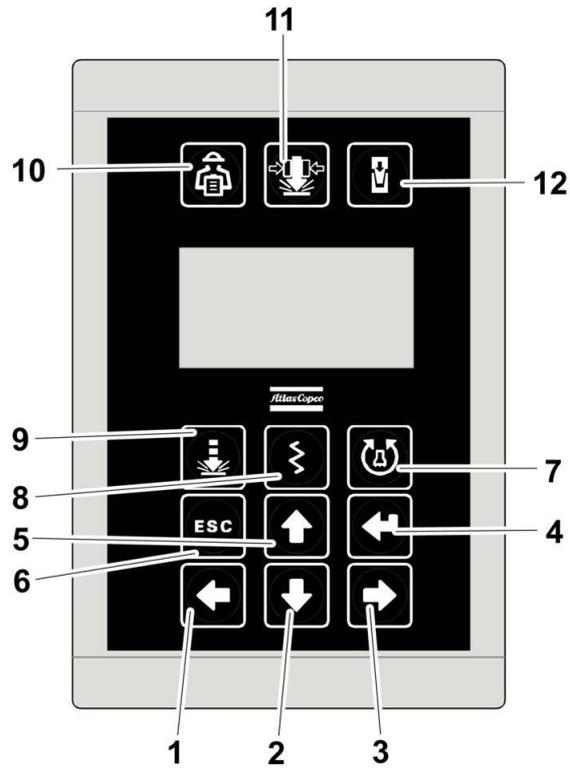
Panel pressure gauge one and two.

<b>A</b>	<b>Feed pressure</b>
<b>B</b>	Flush air lubricating pressure
<b>C</b>	Compressed air pressure
<b>D</b>	Dumper pressure
<b>E</b>	Pump 1 pressure
<b>F</b>	Pump 2 pressure
<b>G</b>	Pump 3 pressure
<b>H</b>	Drilling rotation pressure
<b>I</b>	Flush air pressure
<b>L</b>	Percussion pressure

# Operator's instructions

## 4. Controls

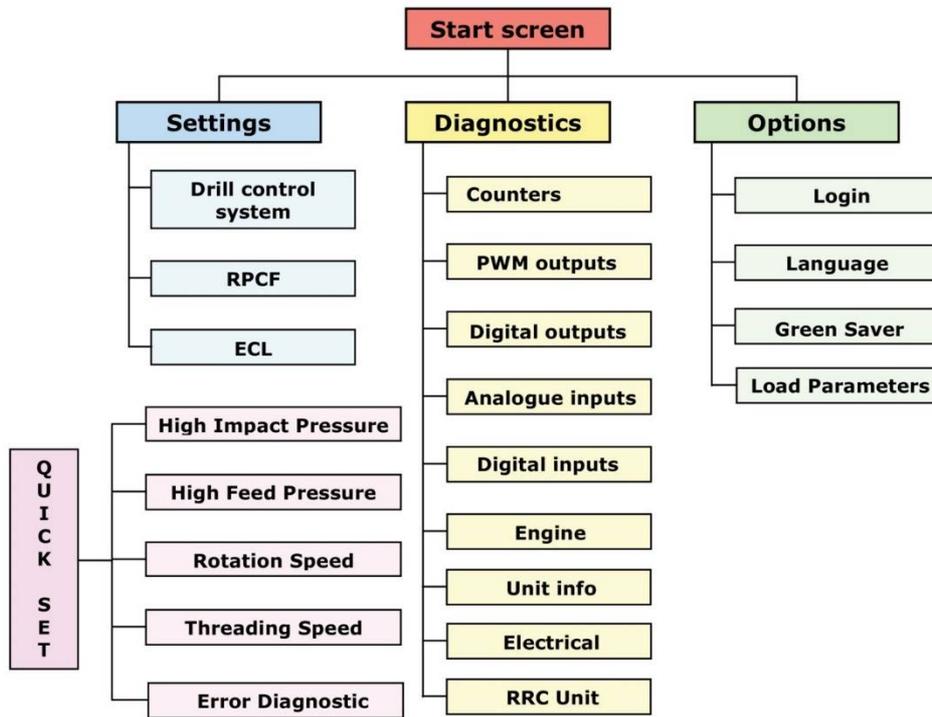
### Operator panel



Operator panel	
1	Left
2	Down
3	Right
4	Enter
5	Up
6	Escape
7	Rotation
8	Feed Pressure
9	Impact pressure
10	Error message
11	N/A
12	N/A

### Top menus

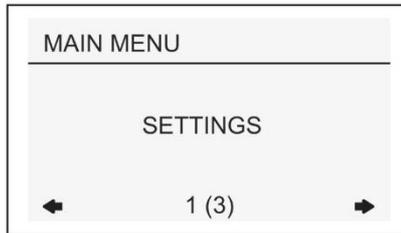
The operator panel provides information on diagnostics and different adjustments and settings.



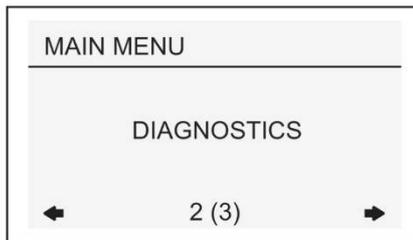
Overview, menus

There are three main menus:

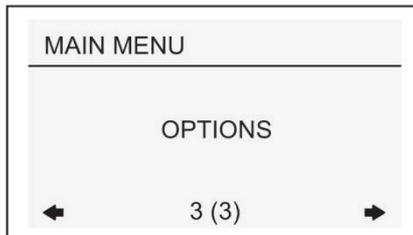
1. Setting



2. Diagnostics



3. Options



These main menus then branch out into submenus.

Select the desired menu using the arrow (button 1 and 3) and confirm with Enter (button 4). The buttons that are selectable under each menu are illuminated and can be selected.

# Operator's instructions

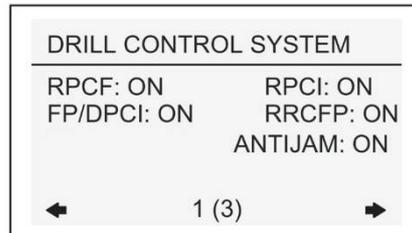
## 4. Controls

### Menu views

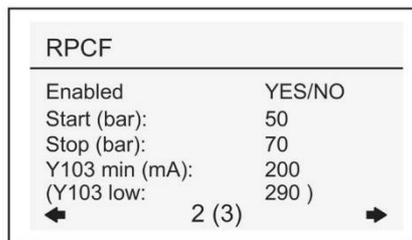
#### Settings submenus

**NOTE:** Settings in the submenus require login level OP.

The setting main menu contains the following submenus:



Under **Drill Control System**, active functions are visible



Under **RPCF (Rotation Pressure Control Feed)**, the following settings can be made:

- Enabled:** If the setting is changed to NO, then the RPCF function is deactivated.
- Start (bar):** The setting for rotation pressure at which the drill feed pressure starts to drop.
- Stop (bar):** The setting for rotation pressure at which the drill feed pressure should be Y103 min. At higher rotation pressure the feed pressure does not drop further.
- Y103 min (mA):** Minimum setting for current for Y103 that activates the valve.
- (Y103 low):** The setting in brackets is collaring-feed pressure. It cannot be adjusted here, but is shown as comparison with the minimum setting for feed pressure.



Under **ECL (Electric Controlled Lubrication)**, the following settings can be made:

- Pulses/minute:** Pulses per minute
- Extended time:** Total time for pump cycle.

## Diagnostics submenus

The **Diagnostics** main menu contains the following submenus:

COUNTERS	
Engine hours:	1230
Impact hours:	405
Minutes:	54
1 (7)	

Under **Counters**, engine and percussion hours can be read, amongst other things

PWM OUTPUTS	
Y100:	0 mA
Desired:	0 mA

Under **PWM Outputs**, desired and actual valve actuation can be read. If a fault is detected in the valve in question then this will be indicated with the text message **ERROR**.

DIGITAL OUTPUTS	
<input checked="" type="checkbox"/>	A30 Diesel filler
<input checked="" type="checkbox"/>	H237 Stop Lamp
<input type="checkbox"/>	H185 Horn
<input type="checkbox"/>	Y210 Compressor load
← 1 (10) →	

**Digital Outputs** gives information about control system activation and digital output.

ANALOGUE INPUTS	
B134 Rotation:	Open
B133 Feed:	Open
← 1 (2) →	

**Analogue Inputs** gives information about control system reading of analogue sensors. If open circuit or short circuit is detected, then this is indicated

DIGITAL INPUTS	
<input type="checkbox"/>	B126 Feed stop uncoupl
<input type="checkbox"/>	B143 Hyd oil level
<input type="checkbox"/>	B342A POMP Guard 1
<input type="checkbox"/>	B342B POMP Guard 2
← 1 (4) →	

Under **Digital Inputs**, digital inputs are located.

## Operator's instructions

### 4. Controls

ENGINE	
Fuel [l/h]:	0.0
Desired:	0
Actuated RPM:	0
Load:	0%
← 1 (4) →	

Under **Engine** there is information about fuel consumption and engine load, amongst other things.

UNIT INFO CPU1	
Status:	OPERATIONAL
SW.ver:	3222 3815 11 2.00
← 1 (4) →	

**Unit Info** gives information about software part number and version. You can also see here whether the CAN modules are working.

### Options submenus

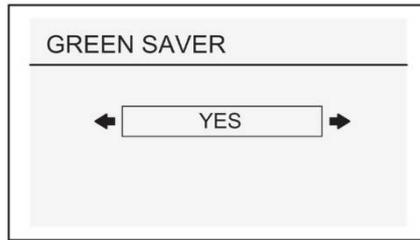
The **Options** main menu contains the following submenus:

OPTIONS	
LOGIN Current level: Operator	
← 1 (4) →	

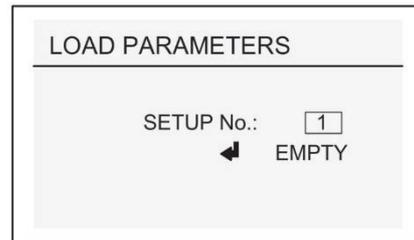
Under **Login** you can make settings to change the level of what can be seen.

LANGUAGE	
← English →	

Under **Language**, language settings can be made.



**Green Saver** is a function whereby the engine speed decreases to idling if no rig function has been used for a certain time. The function is deactivated e.g. during hydraulic heating, when drilling is in progress or when DCT filter cleaning is not finished.



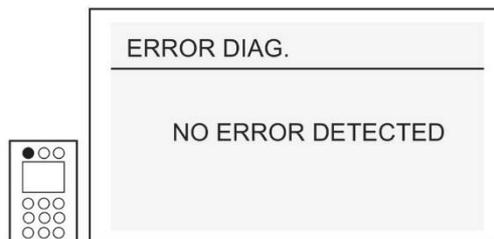
Under **Load Parameters**, drilling parameters can be loaded. They cannot be saved at login level OP, but require a higher login level.

### Shortcuts menus

There are five shortcut menu:

- **Diagnostic** (button 10)
- **Threading Speed** (button 12)
- **Rotation Speed** (button 7).
- **High Feed Pressure** (button 8).
- **High Impact Pressure** (button 9)

**NOTE:** *Shortcut menus can only be changed if the function in question is active*



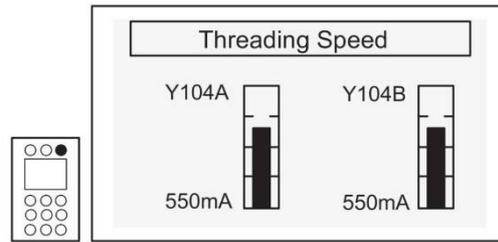
The error message button (10) will flash for all errors indicated on the rig:

**NOTE:** *If there is more than one error message then you can browse through them using Enter (button 4).*

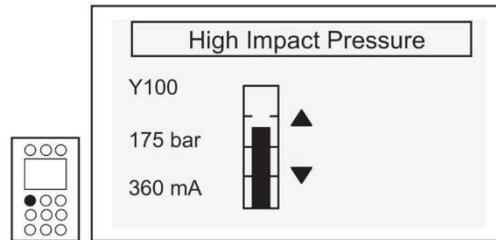
**NOTE:** *To see logged errors that occurred during operation, hold button (10) depressed and browse through the errors using Enter (button 4).*

# Operator's instructions

## 4. Controls

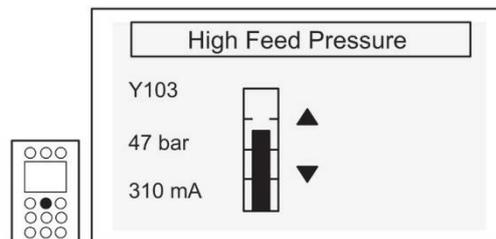


Each setting can only be adjusted when the corresponding function is activated. The setting is made with arrow up and down for all settings in the shortcut menu.



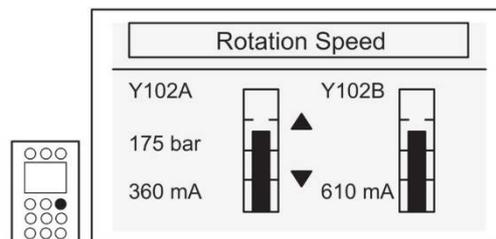
**NOTE:** Only set high percussion pressure when high percussion is used.

A pressure transducer measures the pressure information, and the lower value is the desired PWM current for Y100. Can only be used when the function is used. Adjust desired current with arrow up and down.



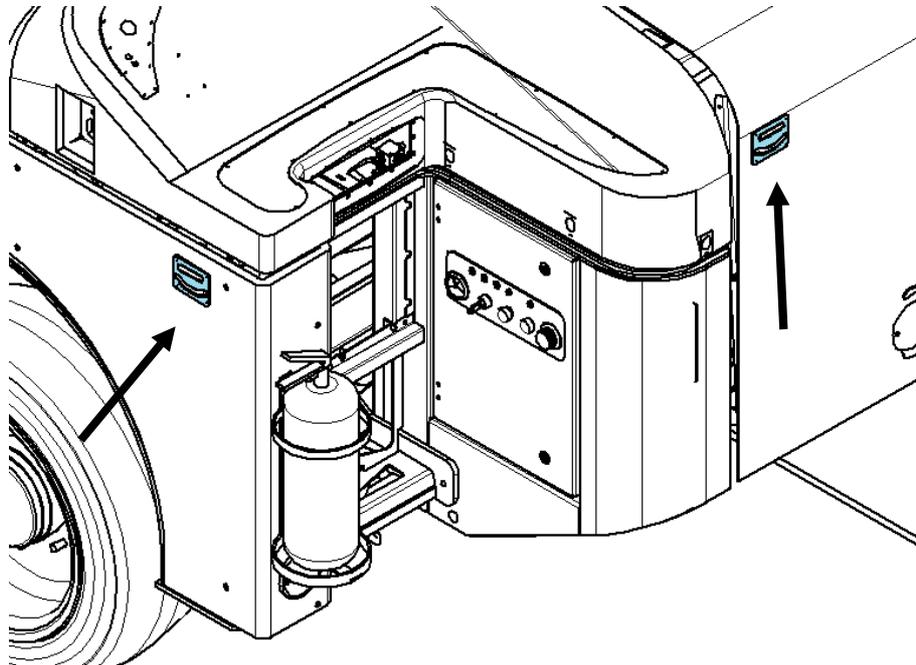
**NOTE:** Only set high feed pressure when high feed is used.

A pressure transducer measures the pressure information, and the lower value is the desired PWM current for Y103. Can only be used when the function is used. Adjust desired current with arrow up and down.



Setting the rotation speed. Pressure is only read during drilling. Adjust desired current with arrow up and down.

### Gradient meter



*Gradient meter*

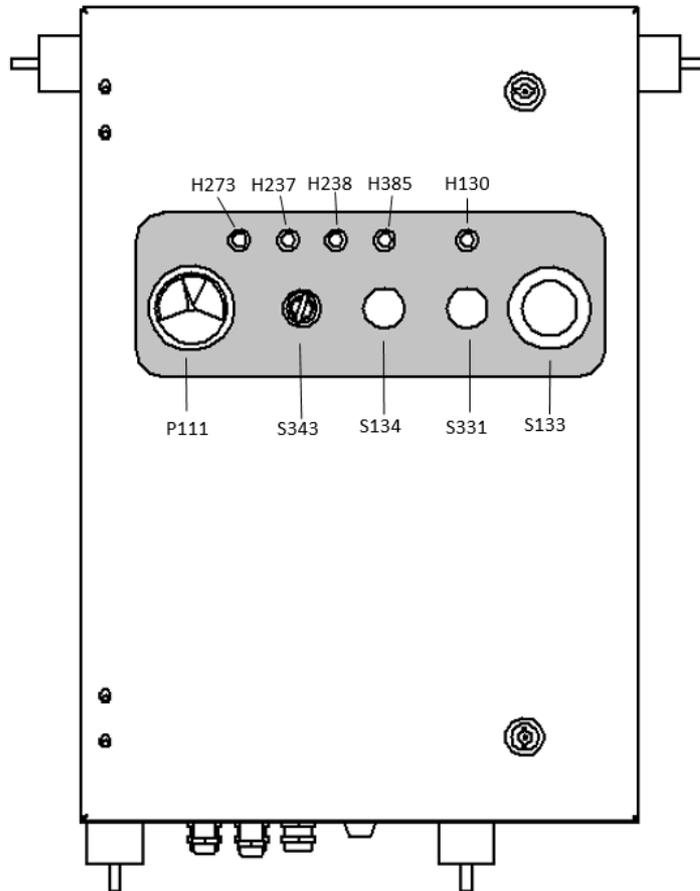
The meter indicates the angles for safe operation of the drill rig. The chassis could tip over outside the specified angle limits.

 <b>CAUTION</b>	
Risk of injury	
<b>The gradient meter shows the chassis frame inclination and not the actual ground inclination</b>	

# Operator's instructions

## 4.Controls

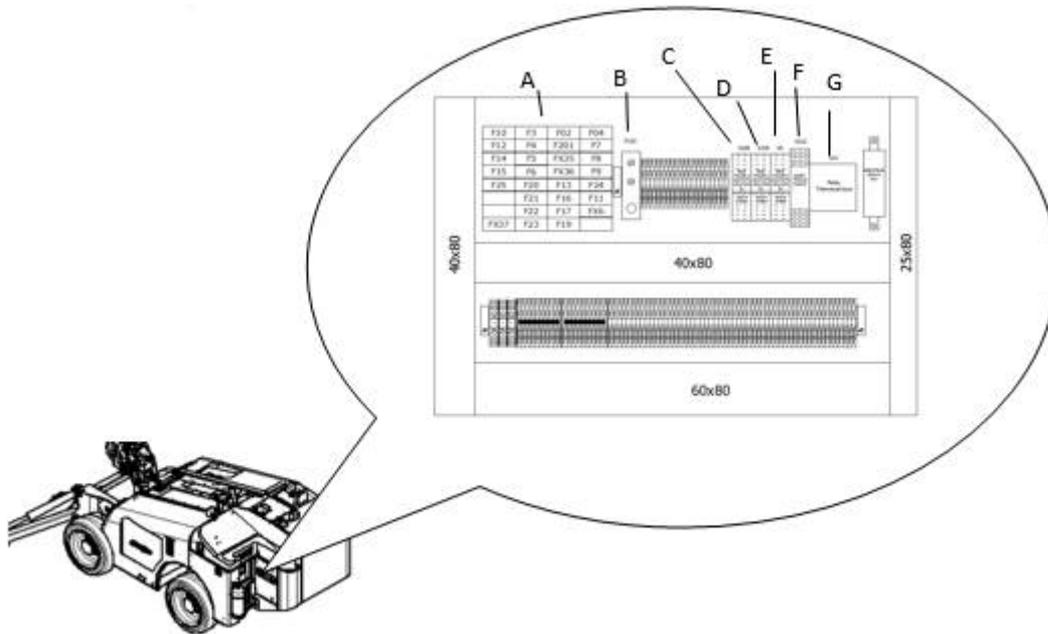
### Control panel for diesel engine



*Control panel for diesel engine*

H273	Indicator lamp for engine "Wait to start"
H237	Indicator lamp for engine "Stop"
H238	Error report, engine "Warning"
H385	Emergency line ok
H130	Radio system ok
P111	Level indication of diesel
S343	Rom mode-Normal mode
S134	Emergency stop reset
S331	Hydraulic oil pre-heating
S133	Emergency button

Electric cabinet



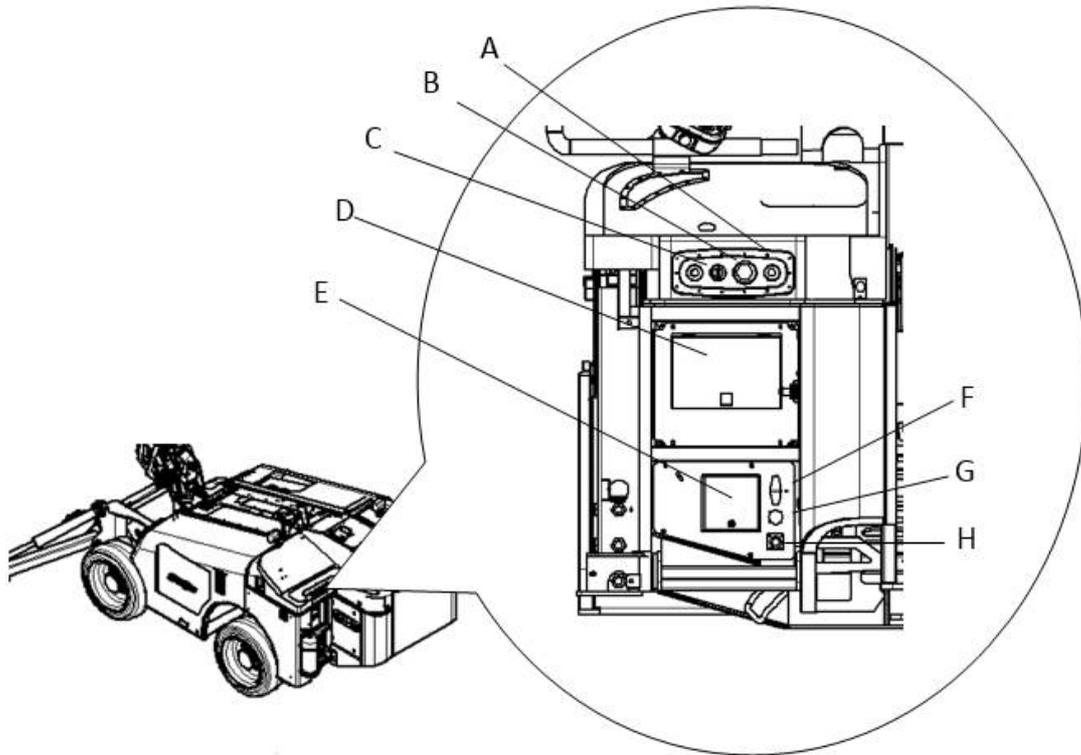
A1 electrical cabinet

A		Fuses
B	P 110	Test
C	K 200	Relay
D	K 330	Relay
E	K 5	Relay
F	K 132	Safety Module
G	K 11	Main relay

Table 17: Components in electrical cabinet

# Operator's instructions

## 4. Controls



*Components in electrical cabinet*

A	S 139	Key
B	S 186	Lights
C	S 486	Steering mode selector
D	A 38	Radio battery charger
E		Webasto display
F	S 300	Battery main switch
G		Engine check
F	WF	Radio transmitter connector

## 5. Radio box

### Safety

 <b>WARNING</b>
<p><b>Serious Injury</b> <b>Danger of accidental operation</b></p> <ul style="list-style-type: none"><li>• May cause serious personal injury and damage to property</li><li>• The operator must always have an overview of the drill rig and the remote control box</li><li>• Always check that the controls are set correctly before operating</li><li>• Always deactivate the remote control box when it is not in use</li><li>• The radio box must not be operated from the drill rig when the winch is being used</li></ul>

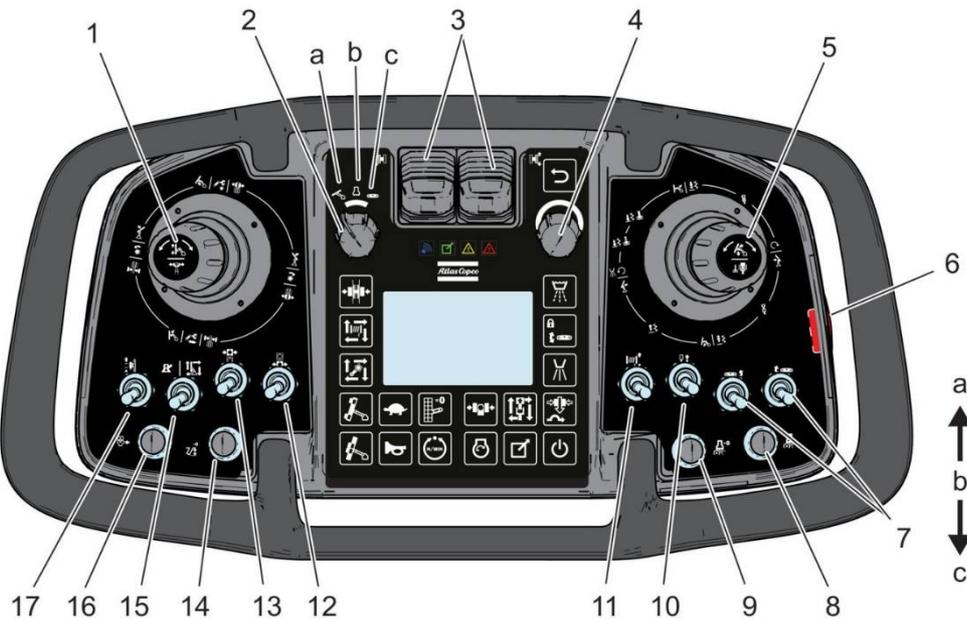
 <b>WARNING</b>
<p><b>Serious Injury</b> <b>Danger of accidental operation</b></p> <ul style="list-style-type: none"><li>• When the radio box is deactivated no functions can be controlled</li></ul>

*NOTE: Pay attention to the position of the radio box!*

# Operator's instructions

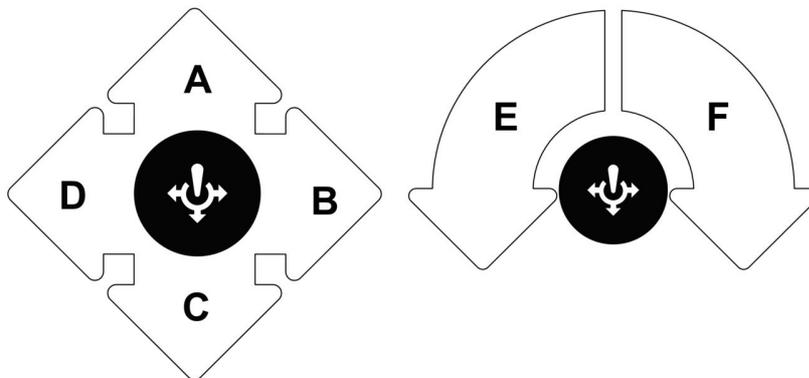
## 4. Controls

### Controls



1	<b>Left hand multifunction lever (Feed positioning)</b>	
2	<b>Switch</b>	
	a	Positioning
	b	Drilling
	c	Tramming/Positioning
3	<b>Tramming levers left and right</b>	
	a	Forward
	b	Neutral
	c	Reverse
4	<b>Multifunction knob.</b> See section Menu views, Navigation	
5	<b>Right hand multifunction lever (Boom and feed positioning)</b>	
6	<b>Machine stop switch</b> Stops the diesel engine (must be reset before restart). The range of the machine stop switch is 60 m.	
7L/R	<b>Jack left/right</b>	
	a	Lower front section
	b	Neutral
	c	Raise front section
8/9	<b>N/A</b>	
10	<b>Hydraulic Jacks</b>	
	a	Up
	c	Down
11	<b>Winch motor</b>	
	a	Wind in
	b	Neutral
	c	Wind out
12	<b>Drill support</b>	
	a	Open
	c	Close
13/14/15	<b>N/A</b>	
16	<b>Dust collector (DCT) On/Off</b>	
17	<b>N/A</b>	

## Left-hand multifunction lever



*Left-hand multifunction lever*

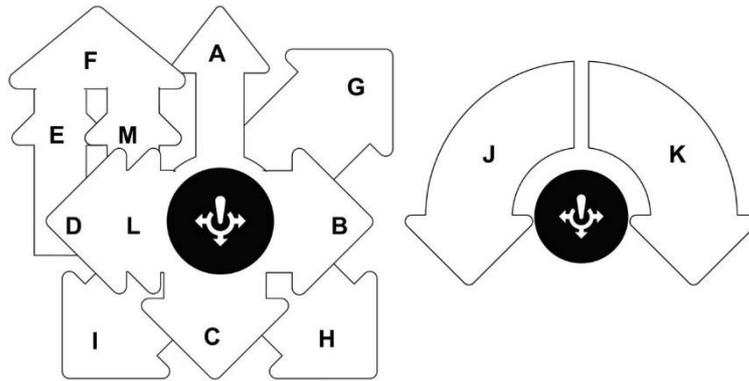
Sector	Activity
<b>A</b>	Feed tilt, front
<b>B</b>	Feed swing (right)
<b>C</b>	Feed tilt, rear
<b>D</b>	Feed swing (left)
<b>E</b>	Feed extension down
<b>F</b>	Feed extension up

*Table 18:* Functions when positioning mode (a) is selected.

## Operator's instructions

### 4. Controls

## Right-hand multifunction lever



Right-hand multifunction lever

Sector	Activity
<b>A</b>	Feed tilt, front
<b>C</b>	Boom lift
<b>B</b>	Boom swing right
<b>D</b>	Boom swing left
<b>J</b>	Boom extension in
<b>k</b>	Boom extension out

Table 19: Functions when positioning mode (a) is selected.

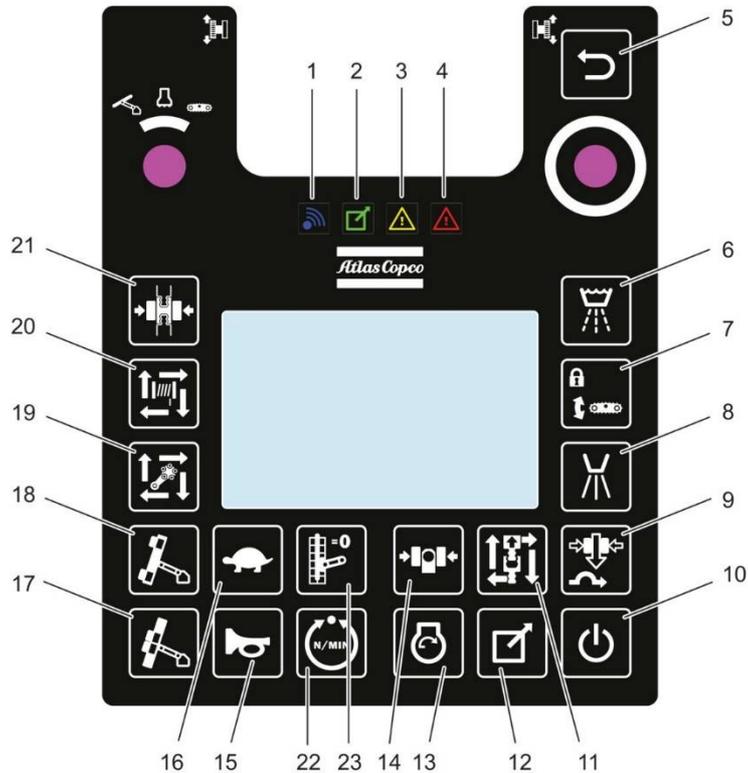
Sector	Activity
<b>A</b>	Rapid feed-forward
<b>C</b>	Rapid feed-backward
<b>B</b>	Rotation (Clockwise)
<b>D</b>	Rotation (Anticlockwise) and Flushing air
<b>G</b>	Threading
<b>H</b>	Unthreading
<b>I</b>	Rotation (Anticlockwise)/Flushing air/Feed-backward
<b>E</b>	Reduced auto-drilling
<b>F</b>	Full auto-drilling/collaring
<b>J</b>	Low percussion / Flushing air self-holding - lever movement < 0.2 sec
<b>K</b>	High percussion / Break loose with deactivated automatic drilling. / Stop flushing air
<b>L</b>	Proportional feed pressure./ Proportional rotation Speed. / Only manual percussion

Table 20: Functions when drilling mode (b) is selected

**NOTE:** Move the lever to sector B to stop drilling/rotation



# Touch buttons



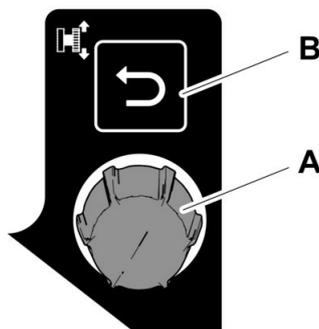
Position	Function	Description
1	Indicates communication Transmitter/Receiver	The symbol flashes during weak communication.
2	Indicates whether the radio box is controlling	The symbol flashes before the remote control box has received the command. The signal lamp illuminates when the radio box has control.
3	Warning	Indication, less serious error. Error cause is read in the IFM display
4	Warning / Stop	Indication, fatal error. The diesel engine is switched off automatically. Error cause is read in the IFM display
5	Escape	Back one step in the menu structure.
6	N/A	
7	Differential Lock on/off	
8	Flushing air ON / OFF	
9	N/A	
10	Radio Box ON / OFF	The button is held depressed until the display is switched on. The levers must be in start position when the radio box is started.
11	N/A	
12	Switch, Radio box/rig	The signal lamp (2) illuminates when the radio box has control.
13	Start/stop button for the diesel engine	
14	N/A	

15	Signal horn	
16	Tramming low / high speed	
17	N/A	
18	N/A	
19	Hydraulic roll-over (option)	The feed swing function changes to hydraulic roll-over if the button is held depressed
20	Winch ON / OFF	
21	N/A	
22	Reset button for protection of moving parts	Activated on each start or after the cover has been opened.

## Menu views

### Navigation

Use the multifunction knob (A) and Escape (B) key to navigate, read or change values in the different menus



Button	Description	Function
<b>A</b>	Multifunction knob	<b>Navigation knob</b> for navigating in and between the menus. <b>Enter key</b> confirms settings made and options selected in the menus. The Enter key also works as reset for time-out. See section Time-out function. <b>Settings knob</b> for setting de- sired values.
<b>B</b>	Escape	Goes back one step in the menu structure. Any changes that have been made in a menu will not be confirmed unless Enter is pressed first.

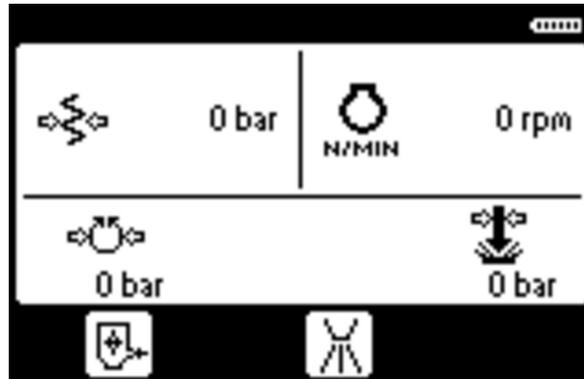
## Operator's instructions

### 4. Controls

#### Menu description

Menus for information/adjusting

The menus show current information or provide the option for setting adjustable values. Winch force and tramming speed are also regulated in the menus.



*Drilling*

This menu shows the current values for drilling.

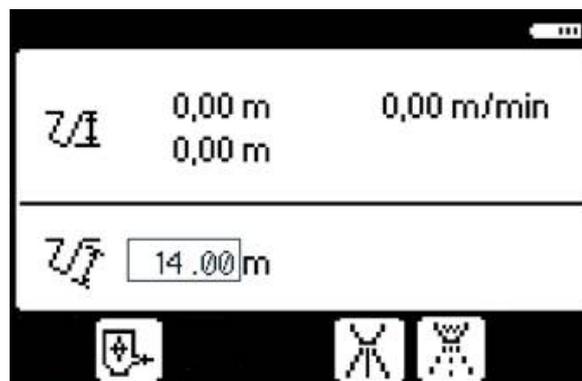
Upper box shows:

- Feed pressure
- Engine RPM

Lower box shows:

- Rotation
- Percussion

Menu for hole depth/hole length

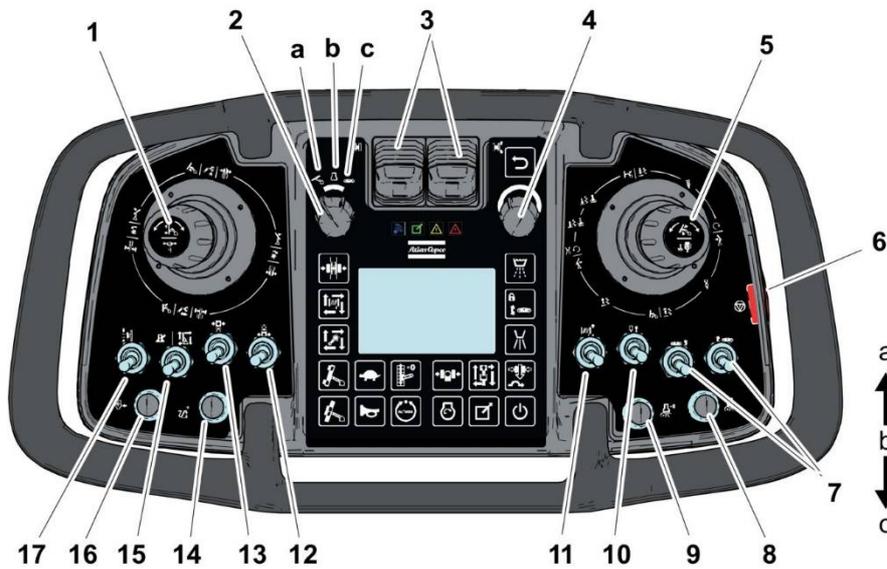


*Boreholes*

The upper box shows current hole length/hole depth, drill bit position and penetration rate.

- Resetting with the touch button resets all values (bit on the stone then push button 14 on the RRC)
- Enter desired hole depth in the lower box, with the button 4.

Activation of hole depth/hole length setting



1. In drilling mode turn the multifunction knob (4) then double click it. Turn the knob to select between hole depth or hole length.
2. Click the multifunction knob once more to activate the length setting. Turn the knob to set the correct length.
3. Click one last time on the multifunction knob to save the value.

**Note:** make sure to follow step by step the sequence on how to change the rod or the deep recorder will not identify the second one

Menu tramming speed, winch power and feed pressure



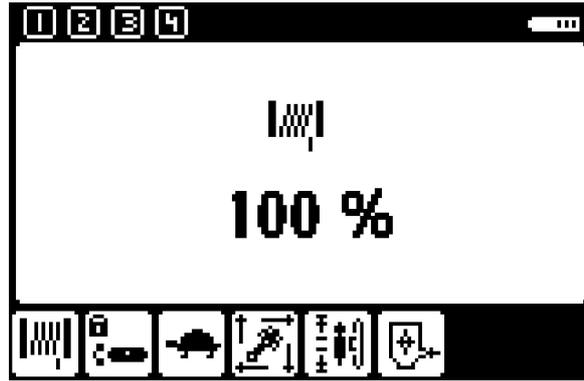
*Tramming speed*

Tramming speed

The menu for tramming speed adjustment appears when the switch is in the Tramming position, with tramming levers activated. Adjust tramming speed using the multifunction knob.

## Operator's instructions

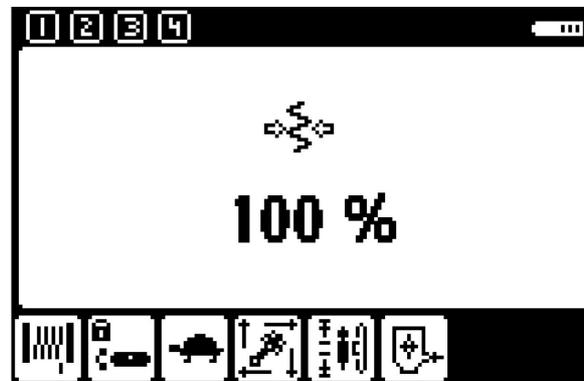
### 4. Controls



*Winch force*

Winch force

The menu for winch force adjustment appears when the switch is in the Trimming position, with the touch button for Winch activated. Adjust winch force using the multifunction knob.



*Feed pressure*

Feed pressure

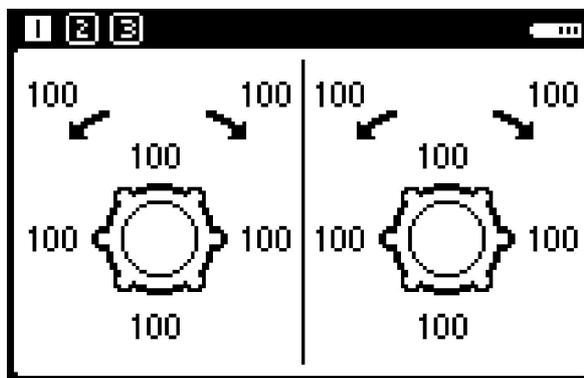
When feed forward is activated, feed pressure can be adjusted using the multifunction knob. The screen is visible during the change. The functionality must have been activated earlier in Settings (RRCFP).

### Menus for testing

The menus for testing are shown below.

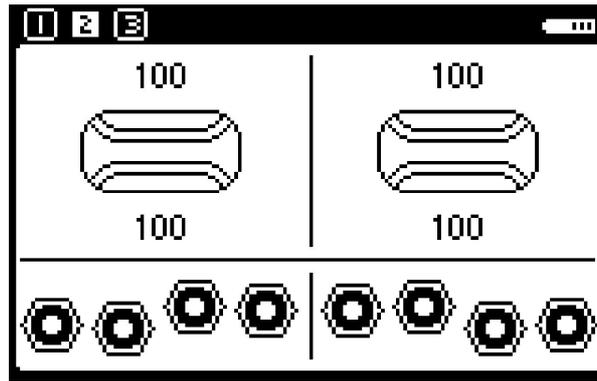
n The menus for testing are accessed by holding the Watermist button  and the On button  depressed when the radio box is started.

n Navigate between the test menus using the switch.



*Testing the levers*

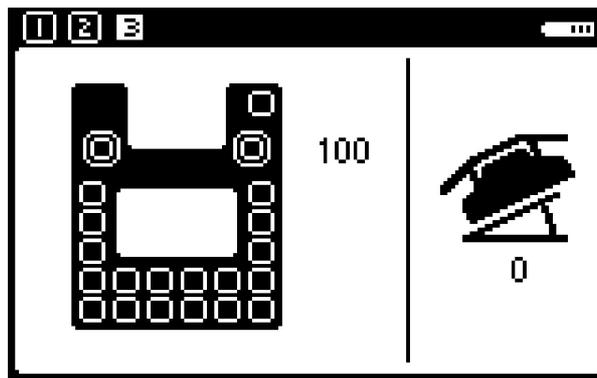
Each lever movement is shown with the interval 0 - 100.



*Testing the trammig levers*

Each lever movement is shown with the interval 0 - 100. Testing the circuit breakers

- Testing the circuit breakers
- The white indication in the centre of the symbol moves up/down when testing circuit breakers, and indicates correct function.



*Testing the touch panel, multifunction knob and tilt sensor*

- Touch buttons in the menu illuminate during testing, and indicate correct function.
- The multifunction knob is shown with positive and negative values.
- The tilt sensor detects the position of the radio box.
  - Permitted inclination is shown with 0.
  - Unpermitted inclination is shown with 1.

## Operator's instructions

### 4. Controls

#### Error messages

Error messages are shown below.



*Start-up screen*

If the radio box is working then the following screen should be shown on the radio box during start-up. The figure 0 (A) gives an indication that there is no error message and the box should work normally. If 0 has changed to another figure then Epiroc's service organization must be informed for troubleshooting.



*Lever fault*

- The message is shown during engagement if the levers are not in start position.
  - Release the levers for the message to disappear.
- The message is shown in the event of a lever fault. Communication is disconnected.
  - Restart the box in test mode and check the levers.



*Low battery*

- The message is shown in the event of low battery level.
  - Replace the battery.



*Communication fault*

- The message is shown when radio communication is interrupted.
  - Approach the rig for automatic reconnection.

**NOTE:** *The blue signal lamp on the box flashes when communication is weak.*



*Button fault*

## Operator's instructions

### 4. Controls

- The message is shown if the wrong button/button combination is held depressed when the box is started.
  - Restart the radio box.
- The message is shown in the event of a fault in the button.
  - Go to test mode to check the buttons.



*Inclination error*

- The message is shown in the event of unpermitted inclination of the radio box. The box loses control and shuts down the current function.
  - Set the radio box correctly. The message disappears and control of the radio box is restored.



*Internal fault*

- The message is shown in the event of a fault in the radio box.
  - If the error message remains after restart, contact the Epiroc service organisation.
- The message is also shown if the switch (touch button 12) has to be depressed to take control with the radio box.

## Function

### Time-out function

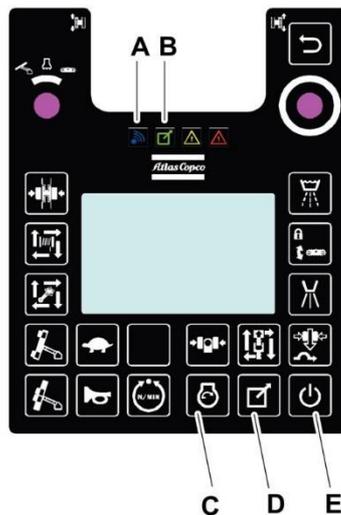
The radio box has a time-out function. When the box has not been activated for 10 seconds the levers are inactive. Reset with the horn button, Enter key or by changing mode with the switch.

### Start-up

The switch on the radio box must be in the Trimming/positioning position in order to enable start-up of the radio box.

1. Start the radio box by holding button (E) depressed until text is visible on the display.

**NOTE:** The levers must be in start position when the radio box is started.



2. Transfer control to the radio box by pressing button (D).

**NOTE:** The screen is shown and the signal lamp (B) flashes before the radio box has taken control. The signal lamp (B) illuminates when the radio box has taken control.

3. Start the engine by pressing button (C). The signal lamp (B) should illuminate.

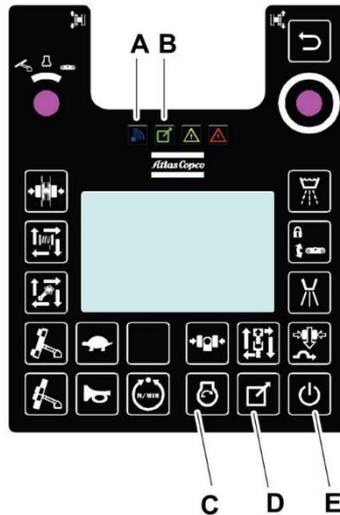
## Operator's instructions

### 4. Controls

#### Stops

The system is switched off as follows.

1. Switch off the diesel engine with button (C).



2. Switch off the radio box with button (E)
3. Switch off the CAN system with the key.

#### Drilling

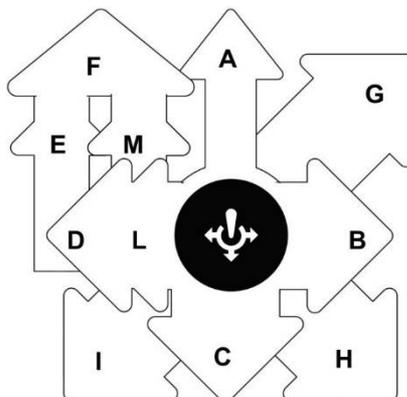
For information about drilling, see the operator's instructions.

#### Stop drilling/rotation

The following functions for stopping drilling/rotation are unique to the radio box.

#### Stop drilling/rotation function

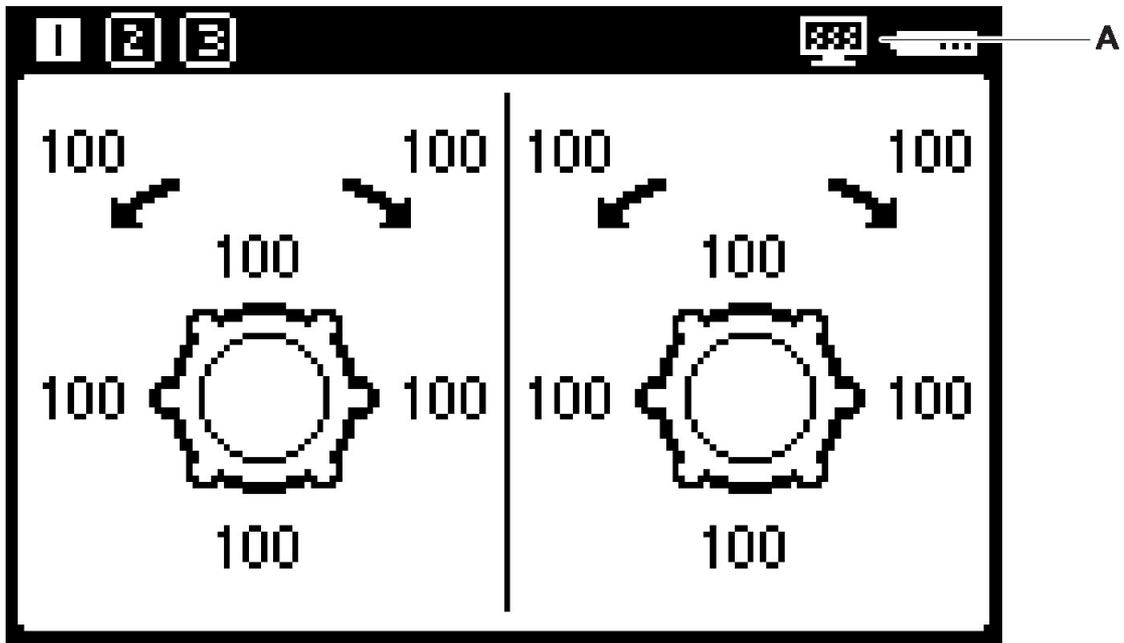
Move the right-hand multifunction lever to sector (B) to stop drilling/rotation.



#### Stop drilling/rotation function in adjustment mode

In the event of repositioning during ongoing drilling (adjustment) the levers are inactive after 5 seconds, except the stop drilling/rotation function. It operates after 5 seconds.

Display heater

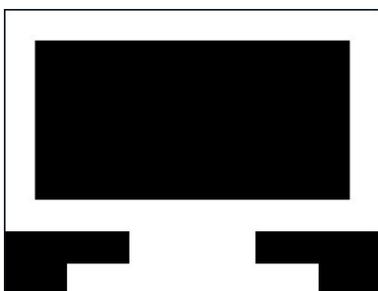


*Display heater in operation*

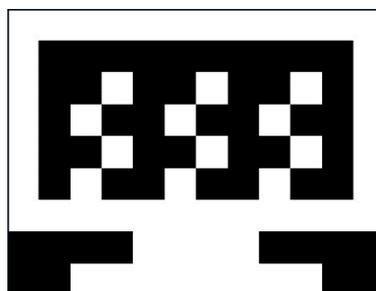
If the temperature falls below approximately  $-9\text{ }^{\circ}\text{C}$ , the display heater is switched on automatically. The symbol (A) is shown in the display. The heater is also switched off automatically around approximately  $0\text{ }^{\circ}\text{C}$ .

If the battery starts to become discharged and the battery warning is shown, the heater is switched off despite the temperature needing the heater. This is to avoid affecting the use of the radio box. The battery time will decrease when the heater is running. How much depends on how cold the temperature is and how long the heater is running.

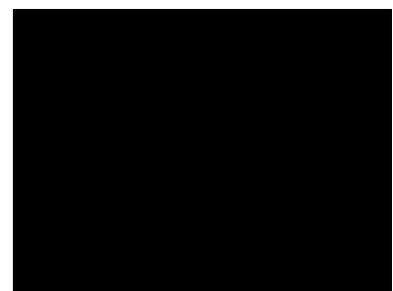
If the radio box has a heater, the symbols for OFF/ON appear as follows:



*Display heater off*



*Display heater on*



*No display heater*

## Operator's instructions

### 4. Controls

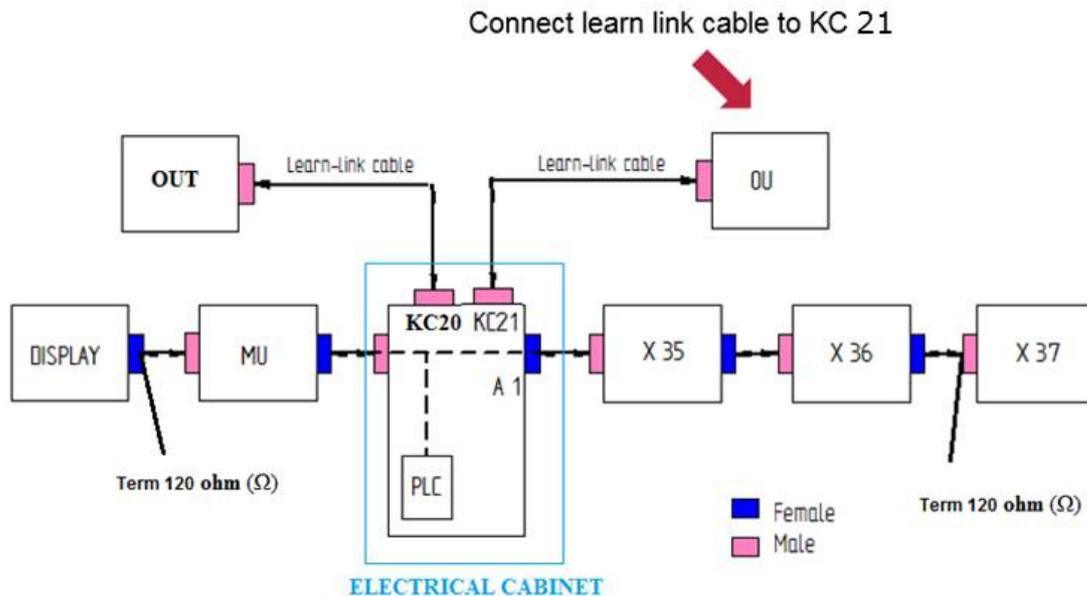
#### Replacing the box

Use the **learn link** routine for replacing the radio box.

**Learn link** connects transmitter (radio box) with receiver (rig). After the procedure, the rig addresses to the new radio box.

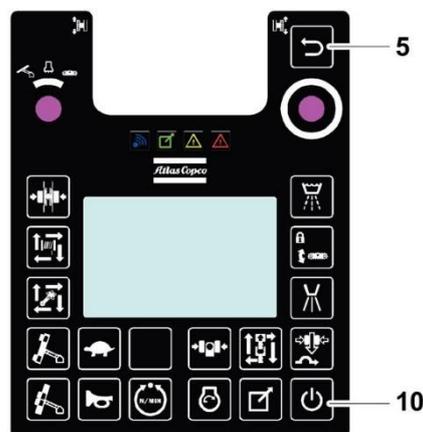
#### Learn-link

1. Switch off the rig with the main power contactor (S300) and switch off the radio box.

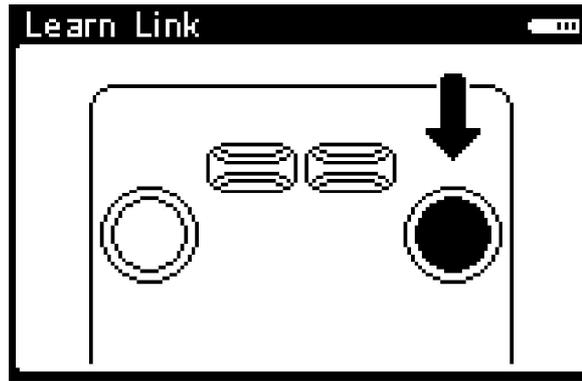


Connect in accordance with the figure below. Connect the radio box via Learn-link cable (9106 9715 24) to KC21 on the A1-cabinet.

2. Activate the main power contactor (S300) to the ON position (I).
3. Start the radio box in **learn-link** mode by depressing buttons (5) and (10) simultaneously until the "Start learn-link" image is shown on the display.



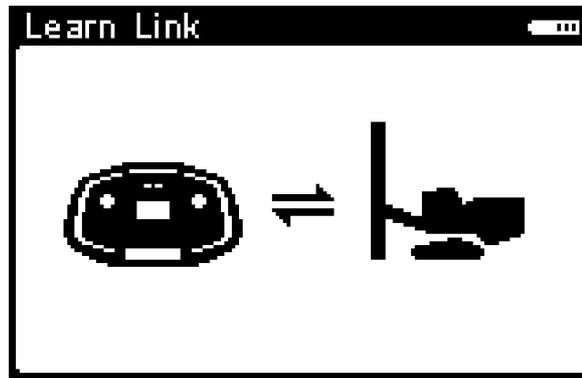
Start the radio box in learn-link mode



*Start learn link*

4. Press Enter to start **learn link**.

Now the transfer of data starts. The transfer is complete when the following image is shown on the display:



*Transfer complete*

6. Switch off the radio box with the emergency stop.
7. Switch off the rig's control system.
8. Reset the rig by disconnecting the Learn-link cable and the rig is ready to be restarted.

## 6. Operating

### Activating the remote control box

**WARNING**

**Serious injury**  
**Danger of accidental operation**

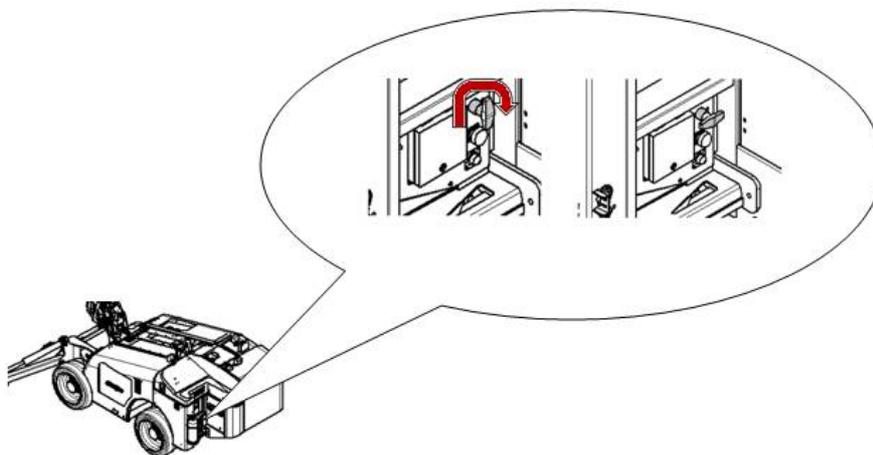
- **May cause serious personal injury and damage to property**
- **The operator must always have an overview of the drill rig and the remote control box**
- **Always check that the controls are correctly adjusted before operating**
- **Always deactivate the remote control box when not in use**

*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.*

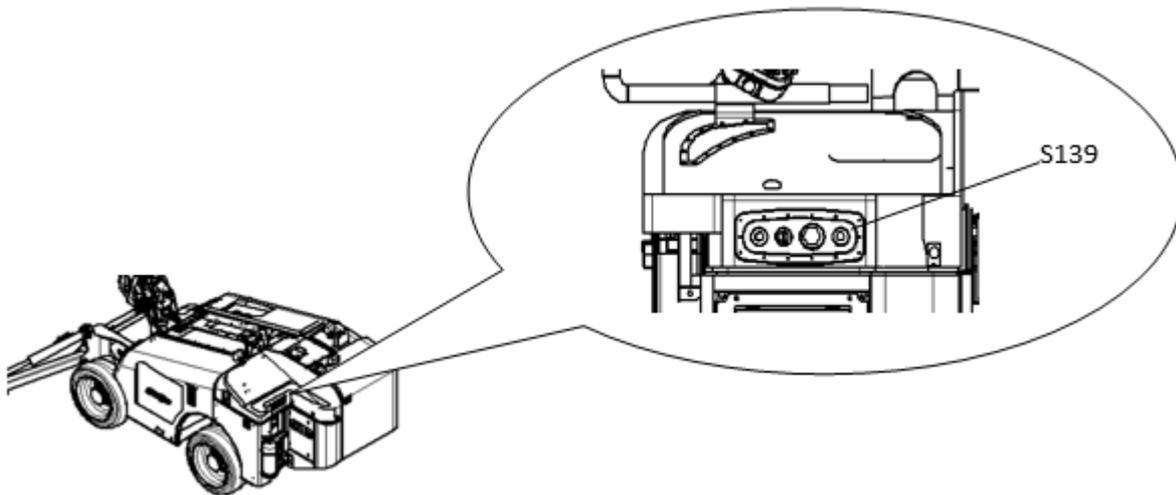
*NOTE: If the remote control box is turned off once the system has been activated, the diesel engine will stop and deactivate the whole drill rig.*

1. Activate the drill rig's main power contactor. Switch (S300) in position (1a).



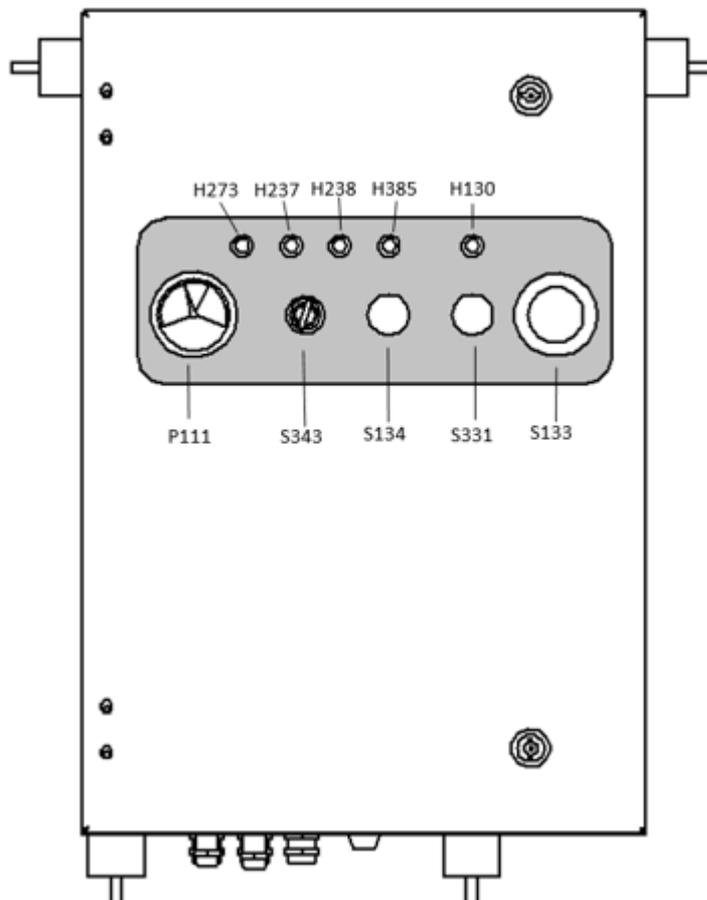
Main power contactor S300

2. Turn the ignition lock S139 on the diesel panel to position (I).



*Control panel for diesel engine*

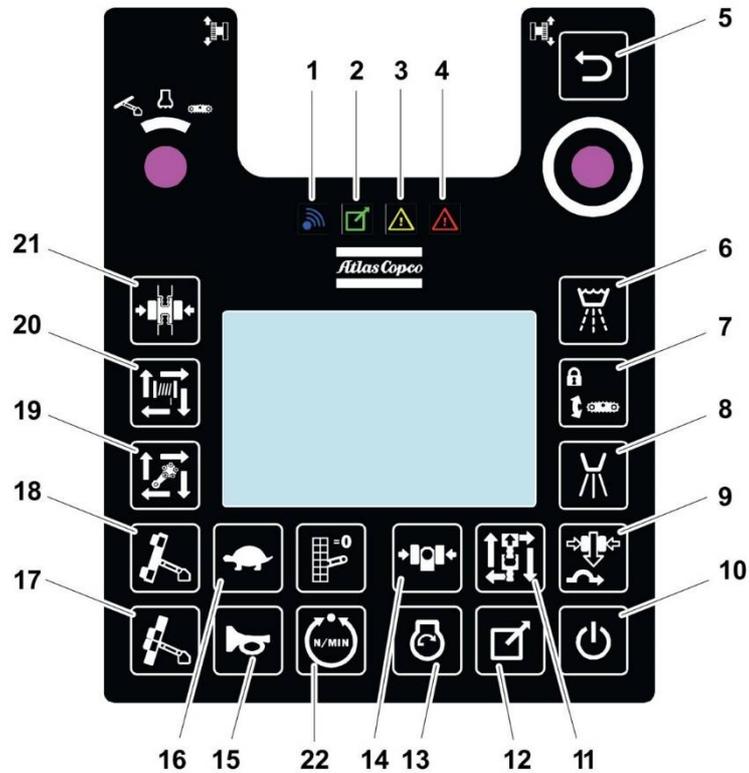
3. The emergency stop is always activated when the drill rig has been switched off. Reset the emergency stop cable with reset button (S134).



## Operator's instructions

### 5. Operating

4. Activate the circuit breaker on the remote control box by holding touch button (10) depressed for several seconds. The display and all indicator lamps illuminate for a short time. Indicator lamp (1) maintains its constant glow and indicator lamp (2) starts to flash.



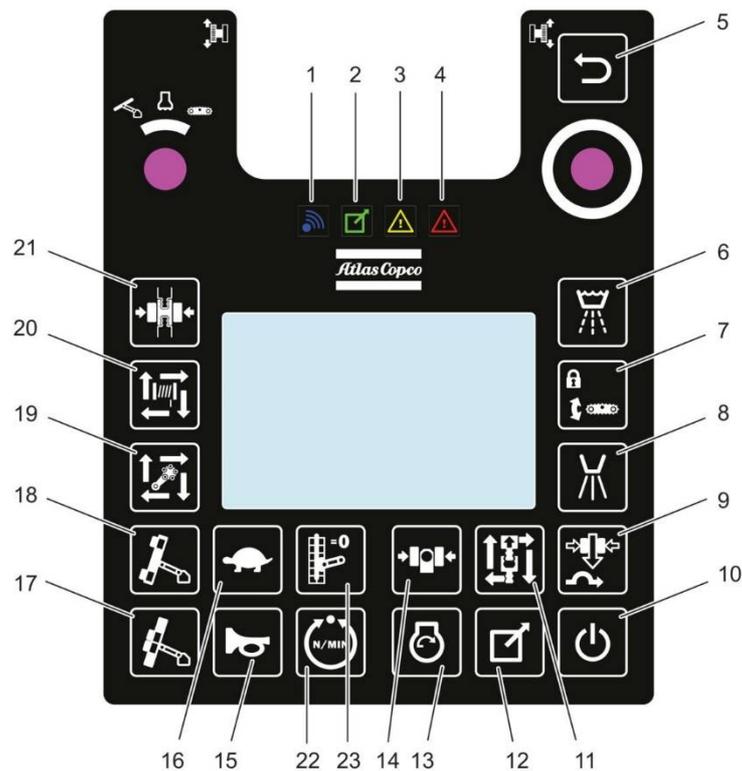
*Touch buttons*

5. Press touch button (12). Indicator lamp (2) stops flashing and has a constant glow, and the box is activated.

## Diesel engine starting

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

1. Check that the ignition switch S139 (ignition key) is in position (I). Wait until diesel engine preheating is finished and indicator lamp H273 has extinguished.
2. Start the engine with touch button (13).



Touch buttons

**NOTE:** NOTICE! If the engine does not start, stop the starting procedure after 5 seconds.

**NOTE:** If a fault is indicated by the indicator lamps on the radio box or the diesel panel for the diesel engine: switch off the engine and check to see which symbol(s) is/are illuminated and then rectify the fault.

When the engine is warm, with the knob 4 in tramming mode and pushing the button S331 on the electrical box you will activate the automatic pre-heating until the hydraulic oil will reach 35°C. You can deactivate it by turning the knob in positioning or drilling mode.

## Operator's instructions

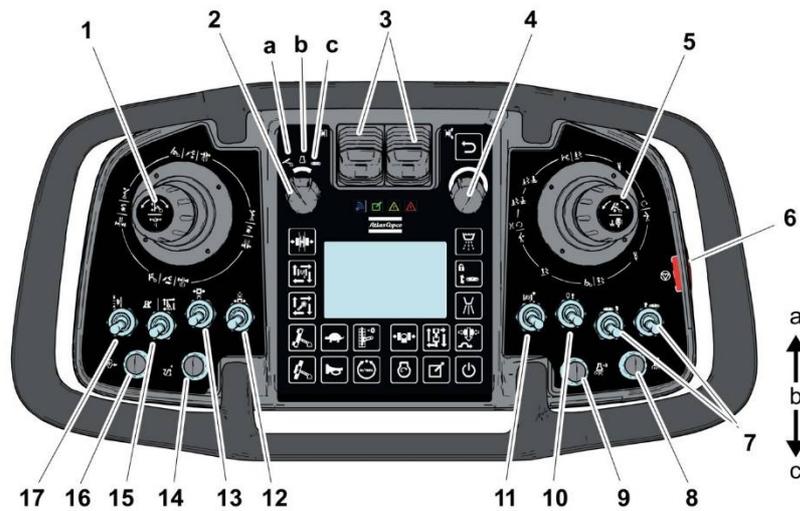
### 5. Operating

# Stopping the diesel engine

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

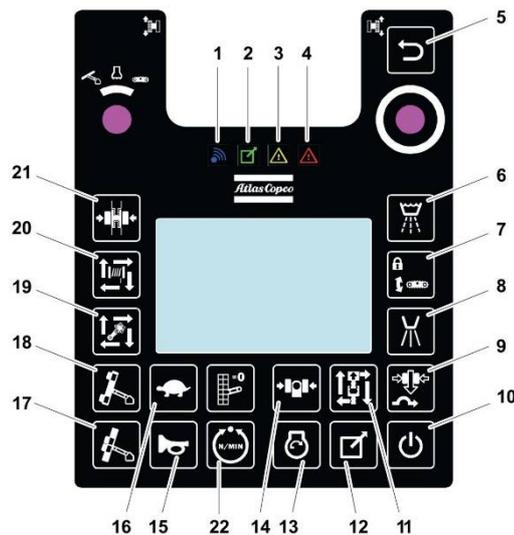
1. Switch over the remote control box to tramming mode. Switch (2), position c.

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

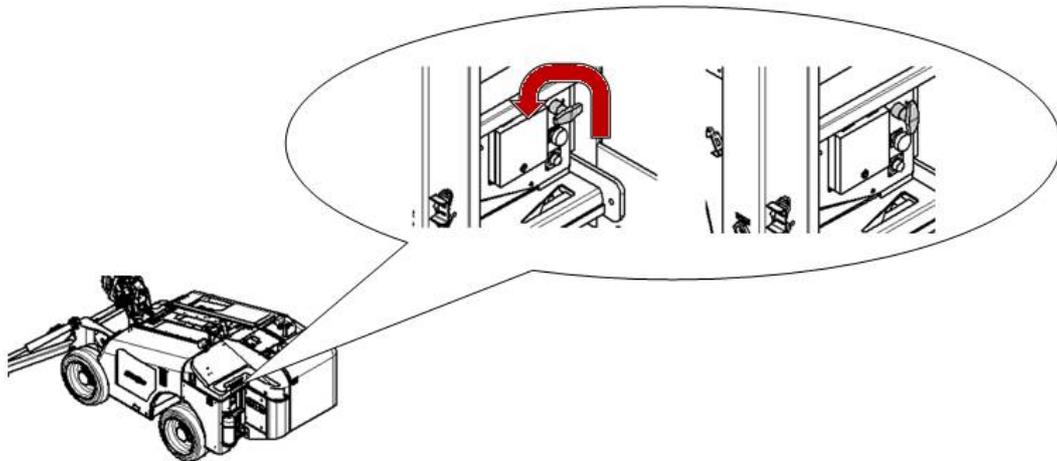


Remote control box

2. Stop the diesel engine by depressing touch button (12) or (13).



3. Switch off the box by pressing and holding touch button (10).
4. Deactivate the drill rig's main power contactor. Switch S300 in position (1b).



*Drill rig main power contactor*

## Feed Rotation

### General

Feed rotation can be carried out both manually and hydraulically. Hydraulic feed rotation is an option

### Upward and horizontal drilling

Upward and horizontal drilling requires higher feed force in order to compensate for the weight of the rock drill and drill cradle. The drill feed pressure needs to be increased by approx. 30-40 bar during upward drilling.

**NOTE:** Exercise caution regarding the drill rig's stability. Note that the rig's stability is affected by forces from boom movements and/or forces from the boom feed. See chapter Technical Data.

## **Operator's instructions**

### 5. Operating

#### **Maintenance for drilling upwards**

The following maintenance is added for drilling upwards:

- Grease nipples at sprocket wheels require daily filling with grease. See Maintenance schedules.
- Slide rails require daily cleaning. See Maintenance schedules.

## Hydraulic feed rotation

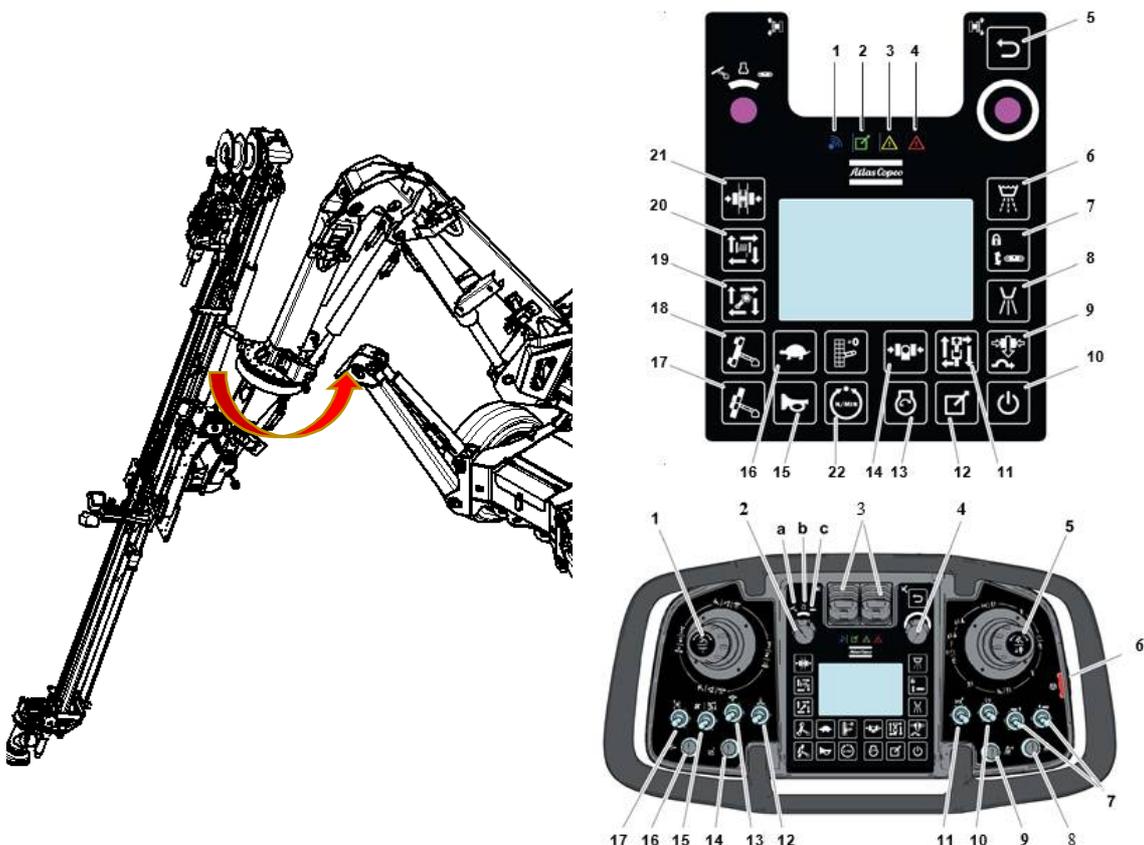
### Safety

 <b>CAUTION</b>
<p><b>Risk of injury</b>  <b>Moving parts</b></p> <ul style="list-style-type: none"> <li>• <b>Risk of personal injury</b></li> <li>• <b>The feeder must be in horizontal position during rotation.</b></li> <li>• <b>Deactivate the remote control box during rotation in order to avoid the risk of accidental operation.</b></li> </ul>

### Operation

*NOTE: Pay attention to how the hoses move during rotation in order to prevent them from being trapped or damaged in some other way.*

1. Position the feeder so that it is in such a position that the hydraulic feed rotation can rotate freely without damaging the feeder or other parts, see figure.



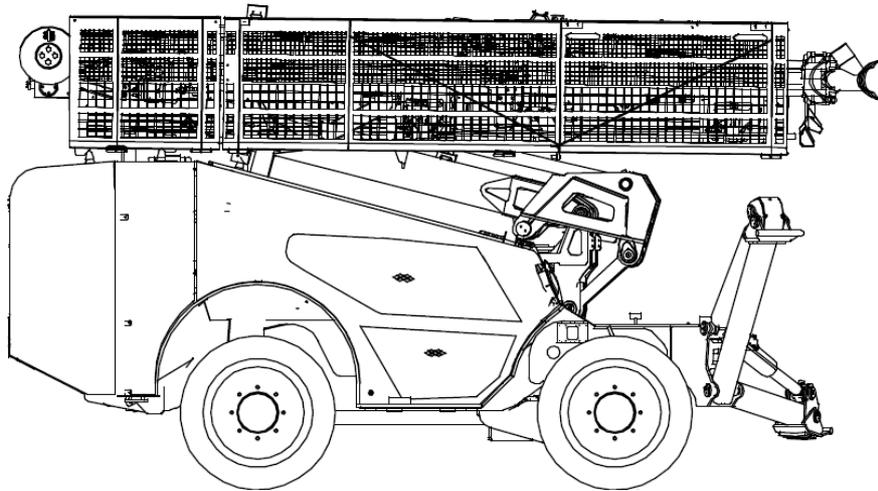
2. Press and hold touch button (19) and, at the same time, move the left-hand multifunction lever (1) to the left or right for the desired position, see illustration.

# Tramming

## Operation

 <b>WARNING</b>
<p><b>Serious injury</b></p> <p><b>Danger of accidental operation</b></p> <ul style="list-style-type: none"><li>• <b>May cause serious personal injury and damage to property</b></li><li>• <b>Always check the prevailing ground conditions where the rig shall be operated</b></li><li>• <b>Inclination angles for Downward/Upward/Lateral CANNOT be combined with each other</b></li><li>• <b>Do not exceed the inclination angles, See technical data</b></li><li>• <b>Note the gradient meters' values</b></li><li>• <b>Never operate the drill rig from the down side during remote control operation</b></li><li>• <b>Always ensure that unauthorized personnel are outside the working area</b></li><li>• <b>The operator must always have an overview of the drill rig and the remote control box</b></li><li>• <b>Always check that the controls are correctly adjusted before operating</b></li><li>• <b>Always deactivate the remote control box when it is not in use.</b></li><li>• <b>May cause serious personal injury and damage to property</b></li><li>• <b>Keep away from high-voltage cables</b></li><li>• <b>Feeder and boom must be in transport position before the jacks are raised.</b></li><li>• <b>For slope higher than 5° must use turtle</b></li></ul>

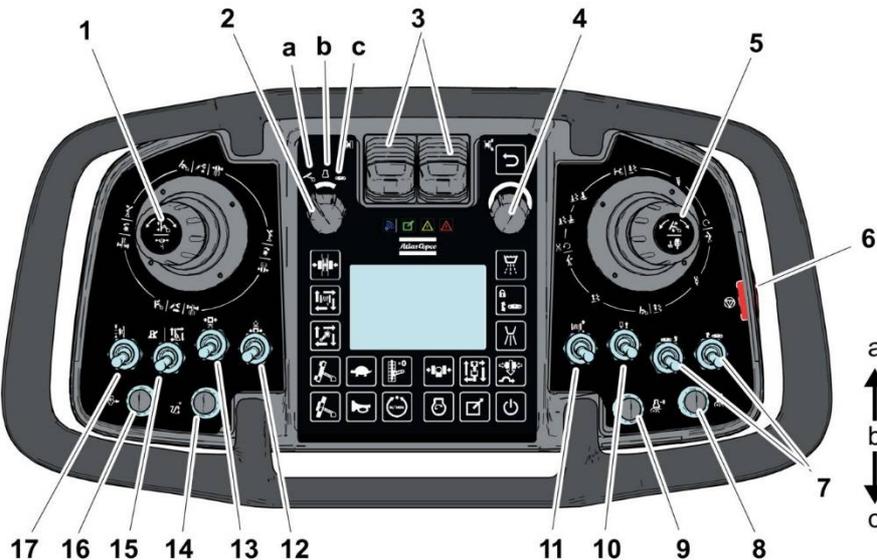
 <b>CAUTION</b>
<p><b>Risk of injury</b></p> <ul style="list-style-type: none"><li>• <b>Note that worn tires reduce friction with the ground considerably and consequently increase the risk of sliding</b></li></ul>



Position for trammung (trammung position)

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

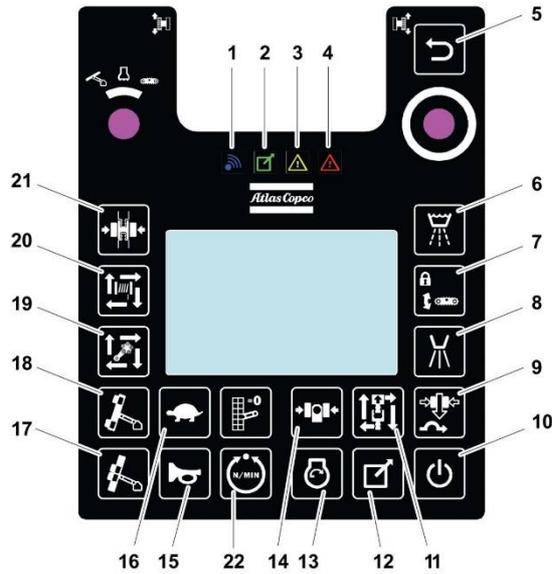
1. Set the remote control box in trammung and positioning mode. Switch (2), position (c).
2. Position the feeder to trammung position. Multifunction levers (1) and (5).
3. Raise the hydraulic jacks. Switch (10) in position (a) for the rear jacks, and switch (7) in position (c) for the front jacks.



4. Select trammung speed depending on terrain characteristics, touch button (16). Turn the multifunction knob (4) for fine adjustment of trammung speed. The display shows the current speed as % of a maximum speed of 100%, in case you can activate the differential lock, touch button (7).

## Operator's instructions

### 5. Operating



Touch buttons

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

5. Operate the tramming levers (3) to move the drill rig in the desired direction.

**NOTE:** If one wheel pair is operated while the other is stationary then the tyres are subjected to unnecessary stresses. This should therefore be avoided.

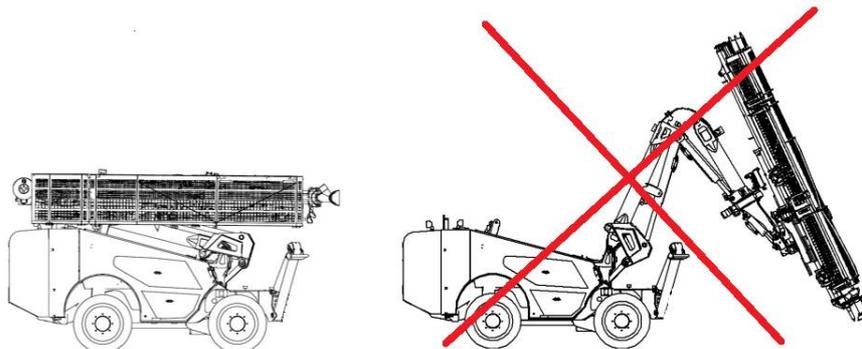
## Checking after tramming

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

## Tramming - General principles

### Tramming, general

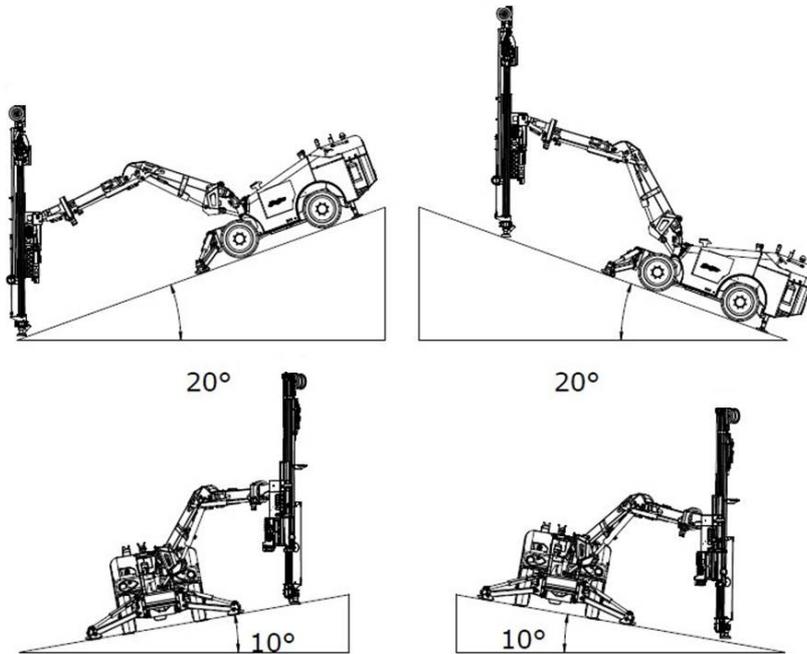
Position the boom and feed beam to transport position. Always check the terrain where the drill rig shall be operated. Adapt speed according to terrain.



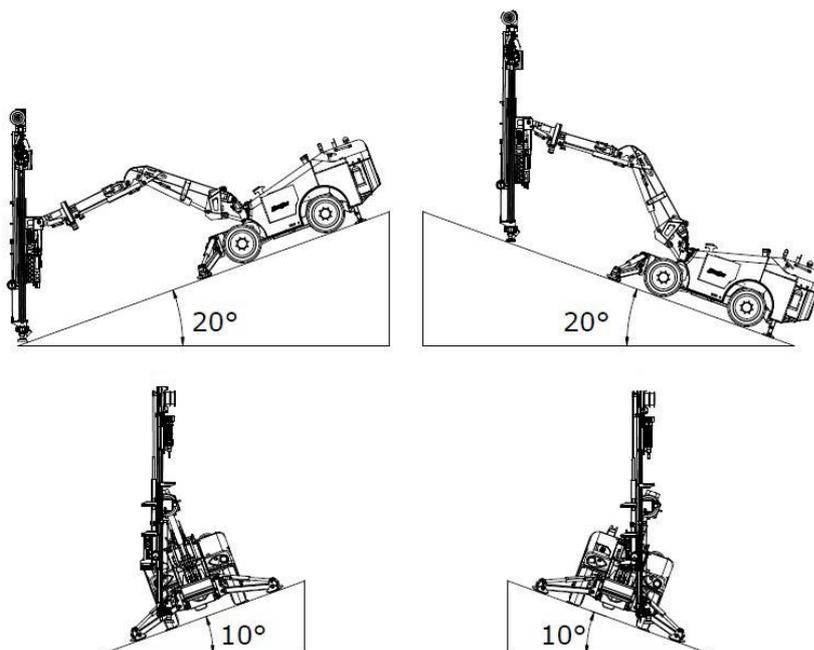
Left: Correct position for general tramming. Right: Wrong position.

# Maximum permitted inclination angles during setting-up for drilling

Setting-up for drilling with the feeder in vertical position and centered between the wheels



Setting-up for drilling with the feeder in vertical position and swung max to left



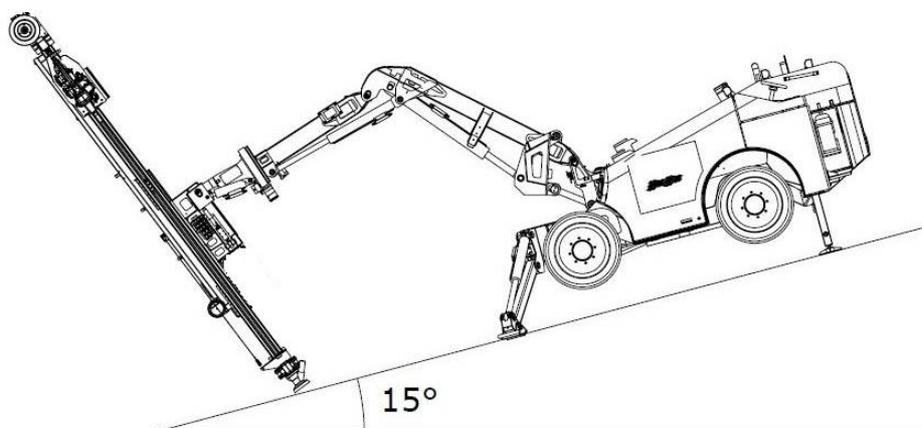
## Operator's instructions

### 5. Operating

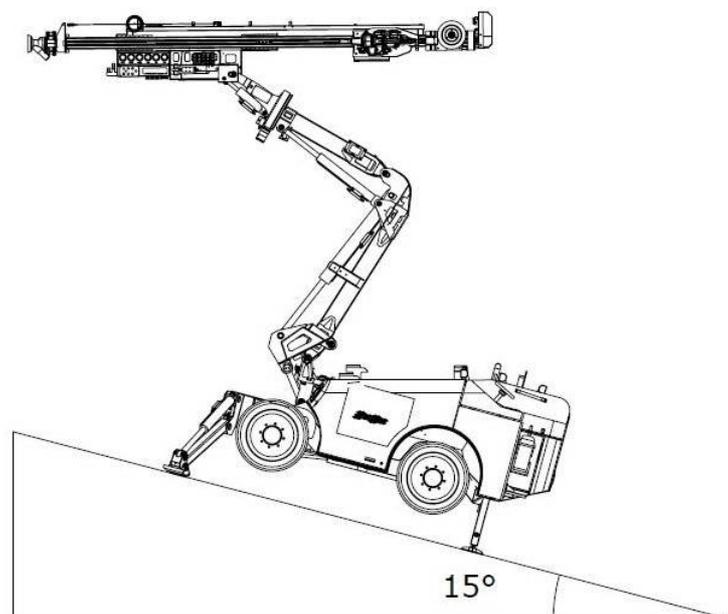
#### Setting-up for drilling with the feeder in vertical position and swung max to right

*NOTE: The rig is symmetrical so the same angles apply as in the chapter "Setting-up for drilling with the feeder in vertical position and swung max to left".*

#### Setting-up for drilling with the feeder top in extreme position forwards, the feeder laterally vertical and centred between the wheels



#### Setting-up for drilling with the feeder top in extreme position rearwards, the feeder laterally vertical and centered between the wheels



## 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 unauthorized personnel are outside of the working area
- Never use the winch with less than three turns remaining on the winch drum
- 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. See the section, Wire ropes, in the maintenance instructions.
- 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
- 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

## Operator's instructions

### 5. Operating

## General

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

Remember that the max. pull force is of 3600Kg.

Gear ratio	Rope diameter [MM]	Layer	Load Capacity [KG]
1/5,3	10	1	3.600
		2	3.055
		3	2.653
		4	2.344
		5	2.100

Oil supply [LT/MIN]	Drum speed [RPM]	Wrapping speed [MT/MIN]				
		1	2	3	4	5
40	28,1	9,9	11,6	13,4	15,2	16,9
50	35,1	12,3	14,5	16,8	19,0	21,2
60	42,1	14,8	17,5	20,1	22,7	25,4
Minimum rope breaking load EN 14492-1 [KG]		7.200				

## Action before winching

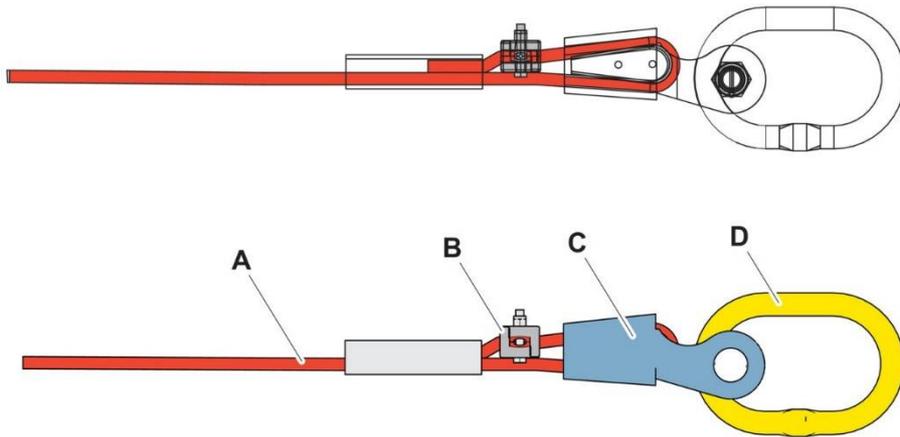
- The cable and eye must always be inspected before use.
- The rig must be switched off during anchoring or adjustment of the cable.
- A damaged cable must always be replaced.

## Checking the attachment of the winch cable

It is of the utmost importance that the cable is correctly fitted in the winch eye. It must be checked:

- before each use
- when replacing the cable
- when first attaching the cable after shortening

## Correct assembly



*Correct assembly*

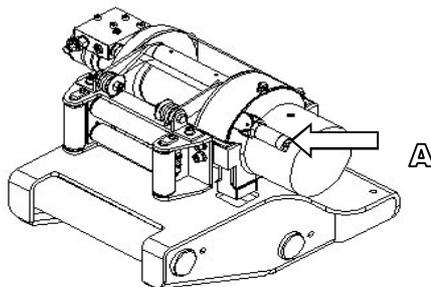
A	Cable
B	Rope lock
C	Connector sleeve with wedge plug
D	Hook

1. The cable must run in line with the eye on the connector sleeve.
2. The rope lock must only lock the end cable.
3. The free end must be at least 6-9 x the diameter of the cable in order to ensure that the whole section of the cable that is either lashed-in or annealed and tapered is outside the connector sleeve.

## Tramming uphill

 <b>WARNING</b>
<p><b>Serious injury</b></p> <ul style="list-style-type: none"><li>• Risk from dumping and moving parts</li><li>• May cause serious personal injury and damage to property</li><li>• The angles for Downward/Upward/Lateral <b>CANNOT</b> be combined with each other</li><li>• Do not exceed the inclination angles, See technical data</li><li>• Note the gradient meters' values</li><li>• Never operate the drill rig from the down side</li><li>• Keep the winch cable continuously taugt</li></ul>

1. Activate the remote control box (see chapter: Activating the remote control box).
2. Check that the remote control box is in tramming mode. Switch (2), position c.
3. Disengage the winch drum with the disengagement mechanism (A) to enable the cable to be pulled out.

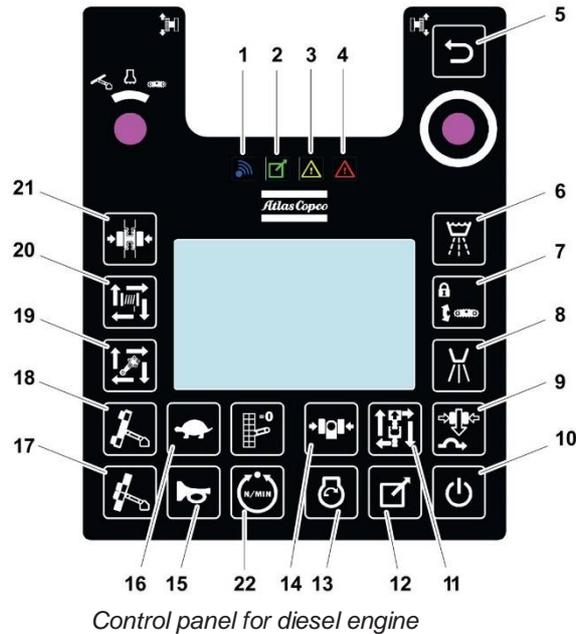


*Disengagement mechanism, winch*

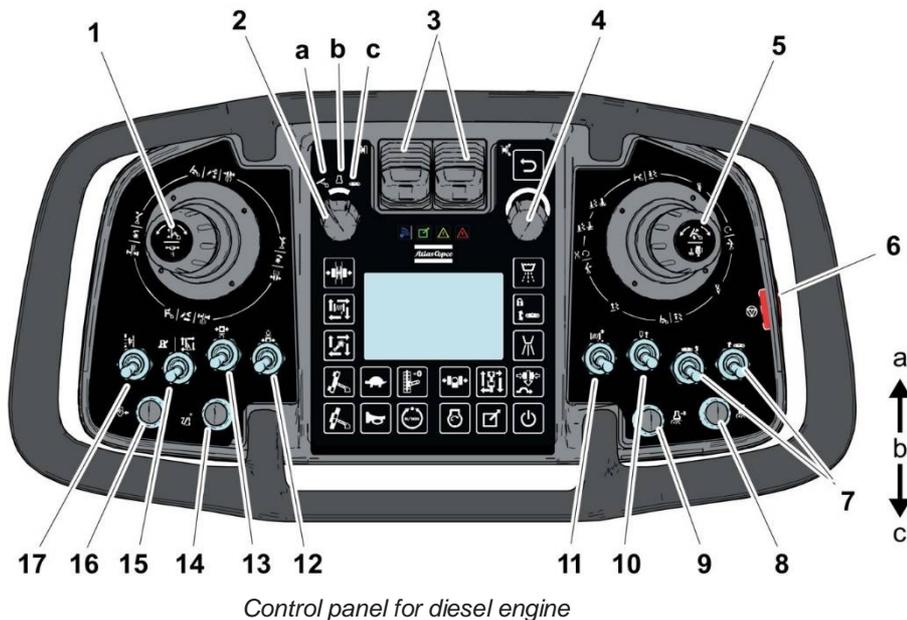
## Operator's instructions

### 5. Operating

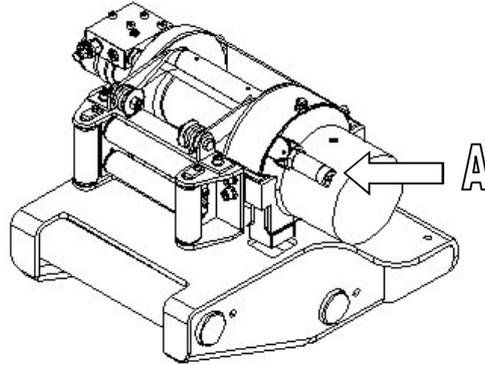
4. Pull out the wire and fasten the eye to the anchor point.
5. Lock the winch drum with the disengagement mechanism (A).
6. Set the winch potentiometer to the desired pressure, touch button (20). Turn the multi-function knob (4) to change the winch pressure. The display shows the current pressure as % of a maximum pressure of 100%. Depress the multifunction knob (4) at the same time as turning it to change trammig speed.



7. Activate the winch circuit. Touch button (20).
8. Activate wind-in manually to ensure the lock mechanism is fully engaged in the drum before loading the winch. Switch (11).



**NOTE:** Do not commence tramping without ensuring that the winch locking mechanism is fully engaged (A).



*The winch locking mechanism is fully engaged (A).*

9. Reverse up the incline using the tramping levers. Make sure that the wire is kept taut constantly.

## **Tramping downhill**

10. Fasten the eyelet to the anchorage point.
11. Set the winch thrust using the multifunction knob (4). Turn it clockwise to reach maximum pressure 100%.
12. 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 tramping levers are activated

## 7. Before drilling

### Safety

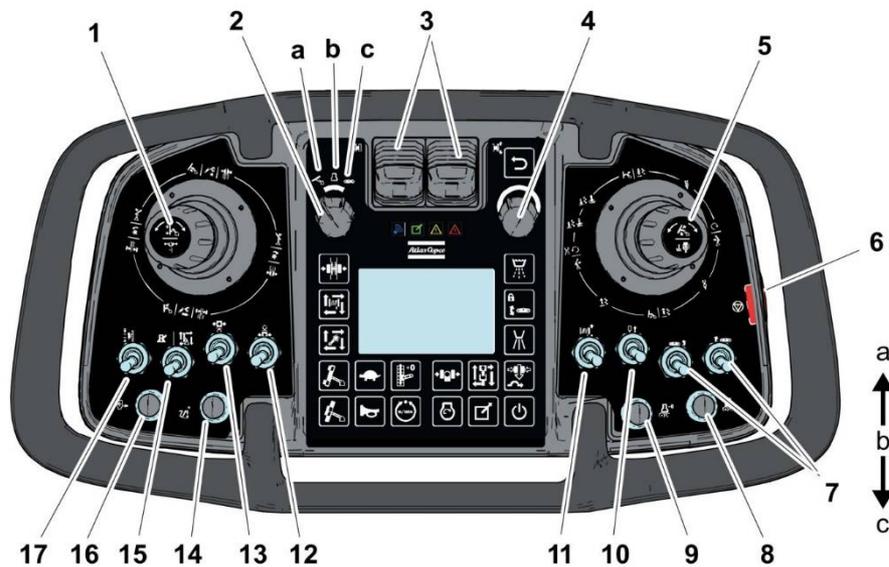
 <b>WARNING</b>	
<ul style="list-style-type: none"><li>• May cause severe personal injury</li><li>• Ensure that unauthorised personnel are not within the working area</li><li>• Follow the instructions carefully</li></ul>	

### Setting up for drilling

 <b>WARNING</b>	
<ul style="list-style-type: none"><li>• Risk of tipping</li><li>• May cause severe personal injury and damage to property</li><li>• The angles for Downward/Upward/Lateral, specified in Technical data, must NOT be combined</li><li>• Do not exceed the tilt angles, see Technical data</li><li>• Note the gradient meters' values</li><li>• Never operate the drill rig from the downhill side</li><li>• Ensure that unauthorised personnel are not within the working area</li></ul>	

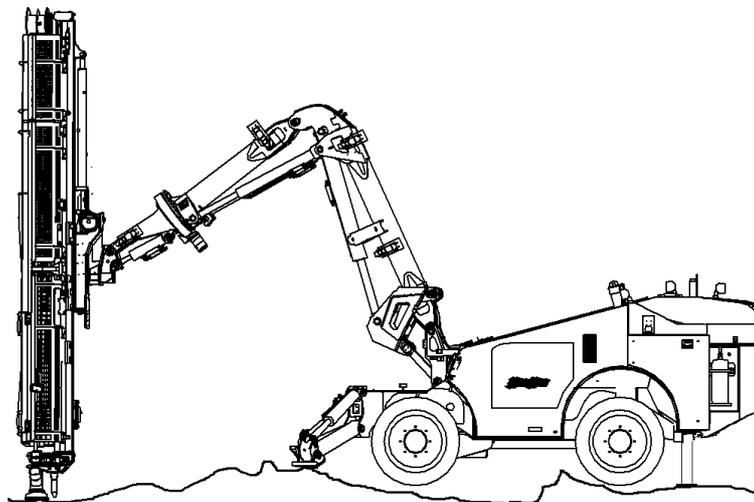
 <b>CAUTION</b>	
<ul style="list-style-type: none"><li>• Risk of feed beam bending</li><li>• To avoid overloading the feeder, do not use the cylinder alone for lowering the boom, or the cylinder for feed extension individually to place the feeder against the ground</li></ul>	

1. Set the remote control box in tramming and positioning mode. Switch (2), position (c).



Remote control box

2. Set up the rig horizontally using the jacks. Switch (10) in position (c) and switch (7) in position (a).



Correct set up for drilling

3. Set the remote control box in drilling mode. Switch (2), position (b).
4. Position the feed beam and boom to the desired position. Set the feed 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!

## Operator's instructions

### 6. Before drilling

# Setup for drilling - General principles

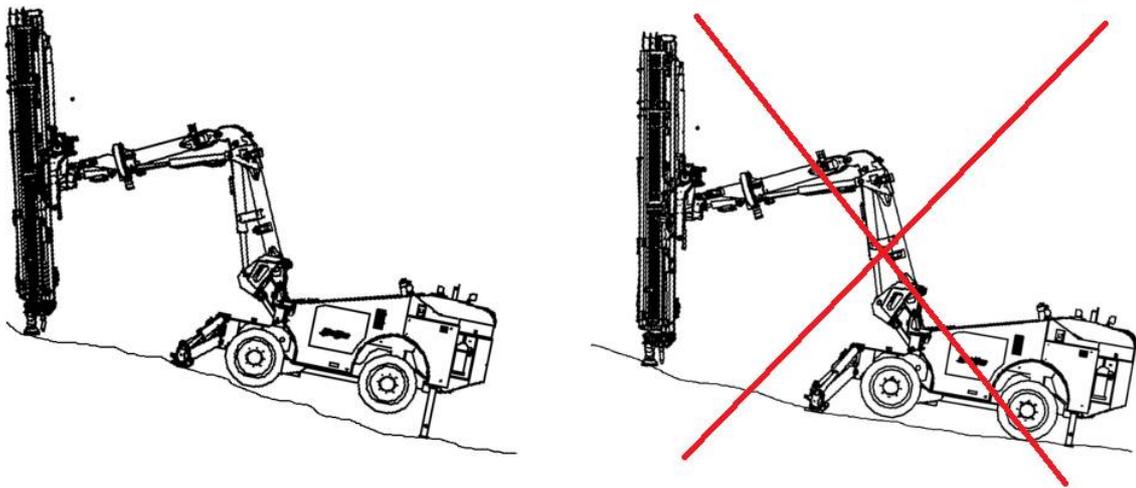
## General setup

Align the rig as horizontally as possible using the jacks.

Place the feed spike firmly against the ground without lifting the frame off the ground.

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

## Uphill setup

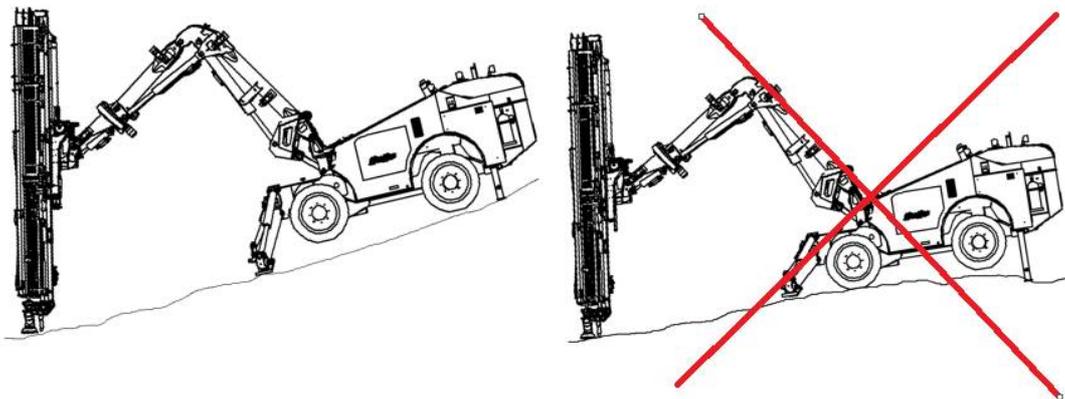


*Left: Correct position for drilling uphill. Right: Wrong position.*

## Downhill setup

*NOTE: Notice! If the inclination is  $>10^\circ$  then the winch should be used!*

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



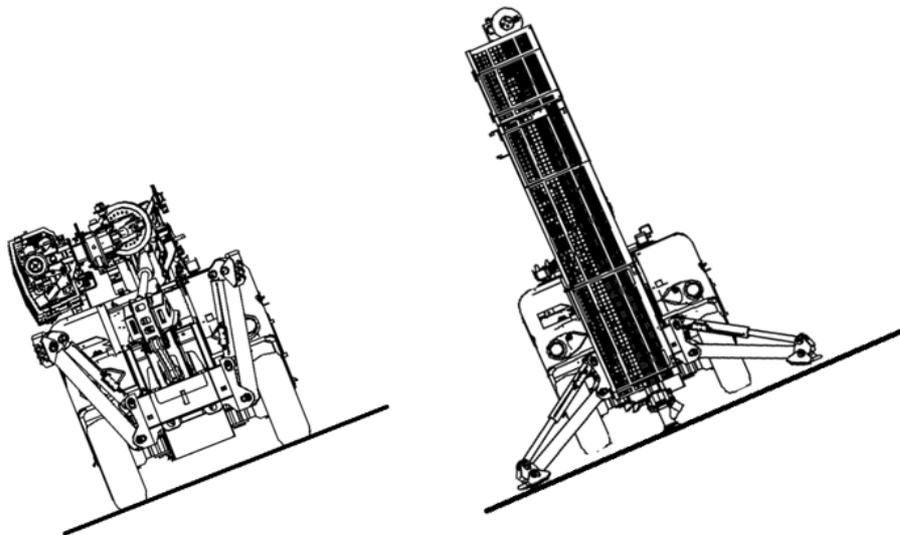
*Left: Correct position for drilling downhill Right: Wrong position.*

## **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 slope; always use smooth movements during setup.



*Correct position for setting-up in transverse incline*

## 8. Drilling

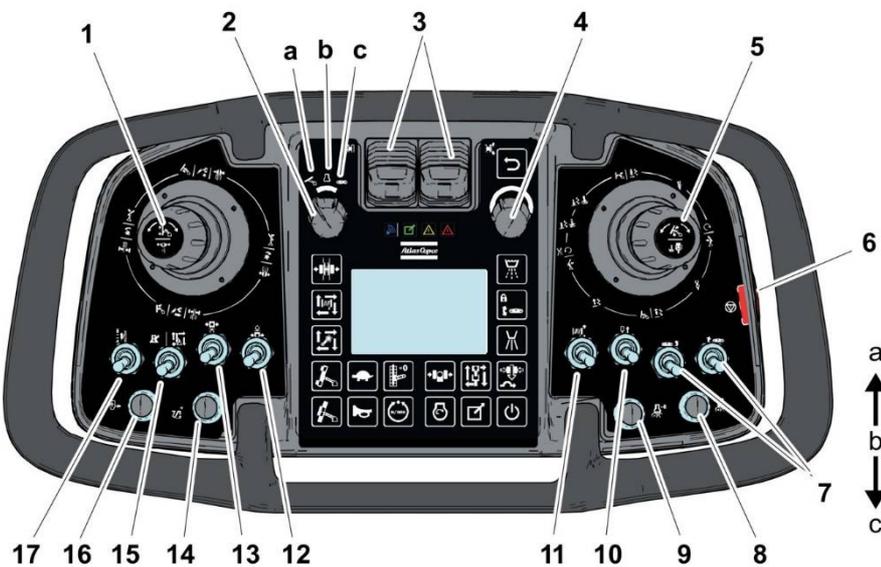
⚠

### WARNING

- **Danger of accidental operation**
- **May cause serious personal injury and damage to property**
- **The operator must always have an overview 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 it is not in use**

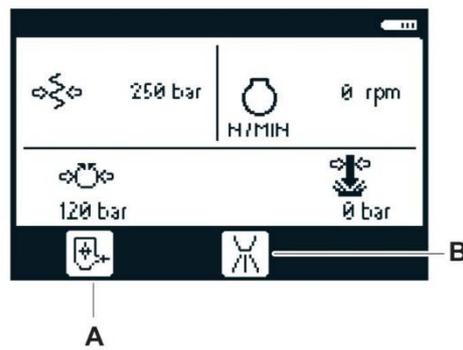
### Start of manual drilling

1. Set the remote control box in drilling mode, switch (2), position b.



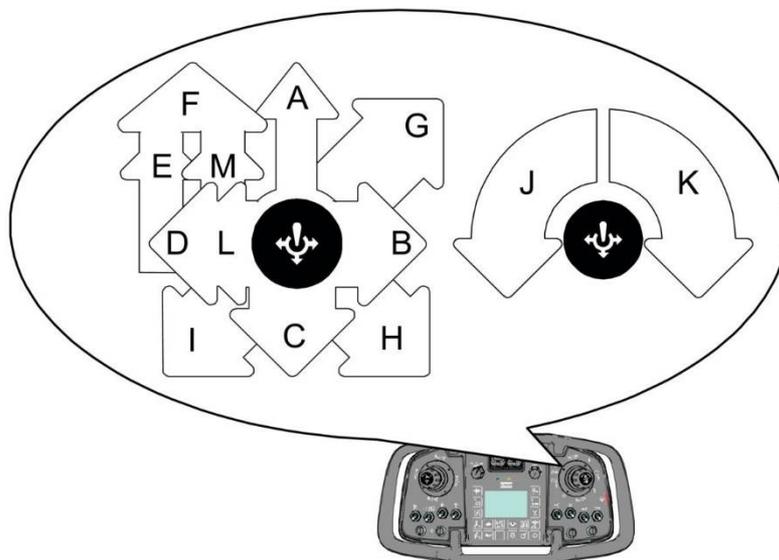
*Remote control box*

2. Check that the dust collector and flushing air are activated. When the dust collector is active, the symbol for the dust collector is shown in the display on the radio box (A).



Menu screen radio box

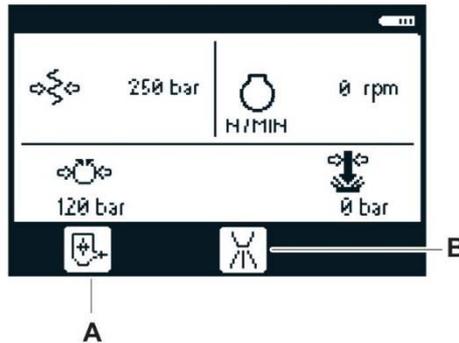
3. Close the drill-steel support. Switch (12).
4. Lower the rock drill until the drill bit is pressing lightly against the ground. Right multi- function lever (5), position (c).
5. Start rotation/flushing air. Right-hand multifunction lever to left (sector d). (1 second for self-holding). Check that flushing air is activated. The symbol for flushing air is then shown in the display on the radio box (B). If no symbol is visible in the display, press button (16).



Sector description, right-hand multifunction lever

## Operator's instructions

### 7. Drilling



Menu screen Radio box

6. Start drill feed. Right-hand multifunction lever forwards through sectors a and f.
7. Low percussion is activated through turning right-hand multifunction lever (anticlockwise):  
*NOTE: Use the drill lever intermittently through sectors a and f 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.*
8. Drilling can be suspended by moving the right-hand multifunction lever through sectors a and f to the end position. The lever can be released back to neutral once the self-holding circuit has started. After a few seconds the percussion switches from automatic to high.
9. Turn the drill lever (clockwise) to activate high percussion pressure.
10. Turn the right-hand multifunction lever to the right to stop all drilling functions (rotation, feed, percussion and flushing air).
11. To stop drilling but maintain flushing air:
  - a. In **Low impact** turn the right-hand multifunction lever **clockwise**.
  - b. In **high impact** turn the right-hand multifunction lever **clockwise**

## Feeder adjustment during drilling



The feeder can be readjusted as necessary by operating the left-hand multifunction lever (1).

## Checks during drilling

Monitor drilling performance and pay particular attention to the points below:

Should anything out of the ordinary occur, stop drilling and clear up the trouble or ask service personnel to investigate.

### 1. Rock drill :

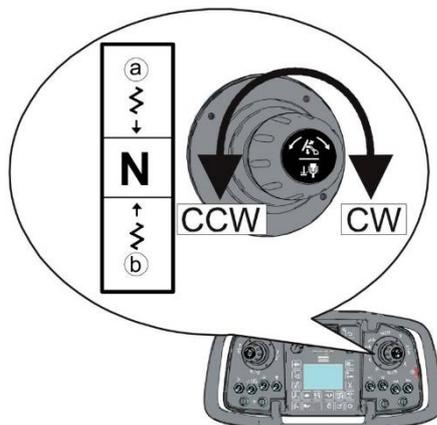
- Abnormal percussion hose vibration.
  - Check the pressure in the rock drill accumulators.
- Check that the shank adapter is sufficiently lubricated.
  - Lubricating oil/air should leak out at the shank adapter.
- Abnormal leakage from the rock drill.
- Note that the shank adapter has a "float position", i.e. it is pressed out about 4-6 mm from the sub frame.

## Break loose

**WARNING**

- **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 it is not in use**

## Break loose (applies to extension drilling)



*Sector description, right-hand multifunction lever*

## Operator's instructions

### 7. Drilling

1. Stop drilling by turning the right-hand multifunction lever (5) clockwise/anticlockwise, or move the right-hand multifunction lever to the right, sector (b), for total shut off.
2. Turn the right-hand multifunction lever clockwise to activate high percussion. Release the lever when the joint is loose.

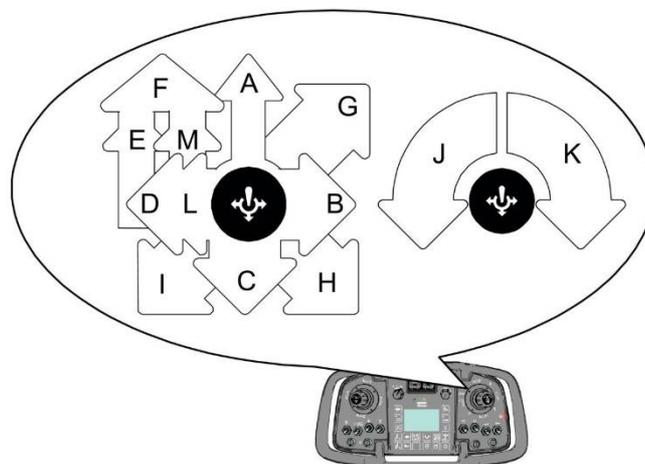
**NOTE:** Release/rattling pressure is used during break loose. The break loose pressure is retrieved from the operator panel.

## Rod adding

**WARNING**

- **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 it is not in use**
- **The rock drill must never be moving when adding rods.**

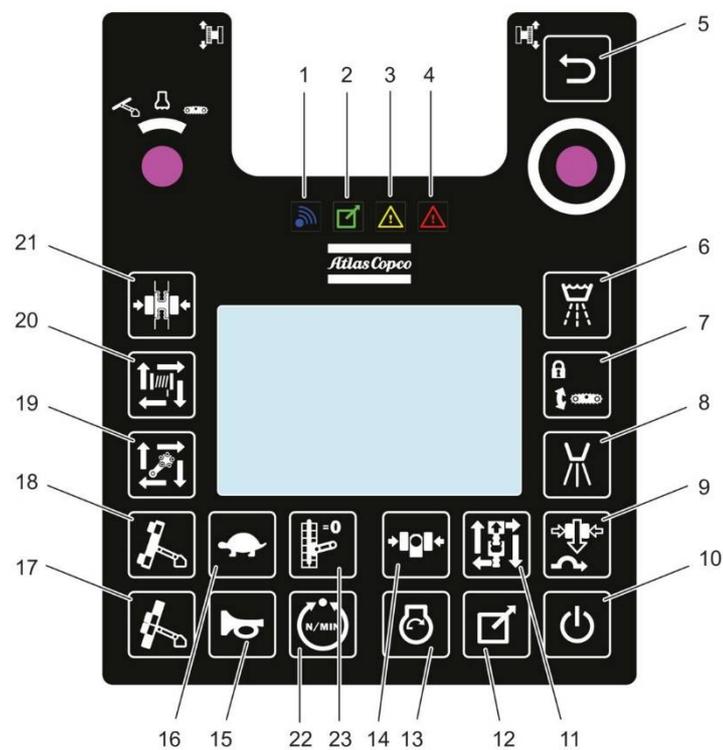
1. Lock the coupling sleeve, close the drill-steel support and keep it close.
2. Disconnect the rock drill by setting the right-hand multifunction lever to the unthreading position (H).



3. Set the lever for drill feed in neutral position.
4. Move the rock drill up by pulling the right-hand multifunction lever backward (C).
5. Open the guard and position the drill steel in drill center.
6. Move the rock drill's tool shank down towards the drill steel.

**NOTE:** When the guard is open, only reduced feed can be obtained.

7. Close the guard for moving parts and press the reset button on the radio box (23).



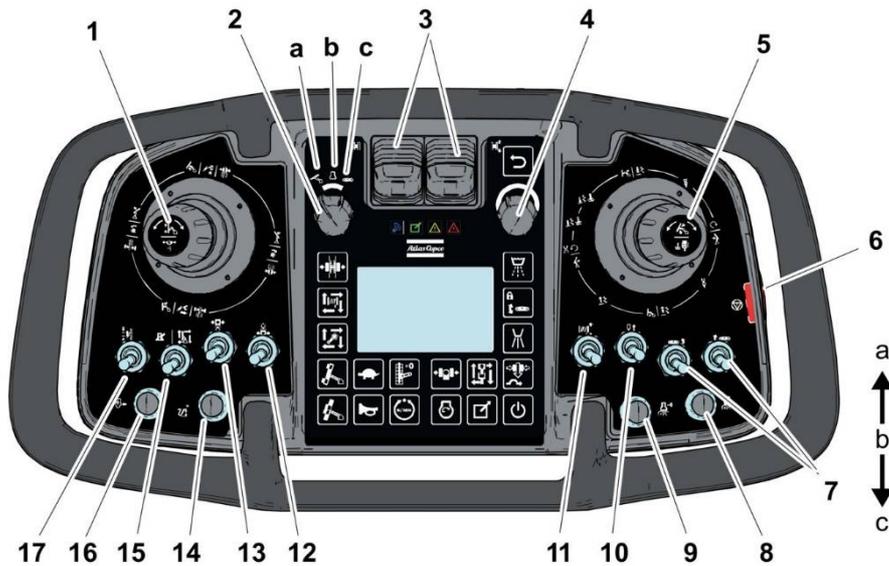
8. Thread together the rock drill's tool shank with the drill steel.

# Threading

**WARNING**

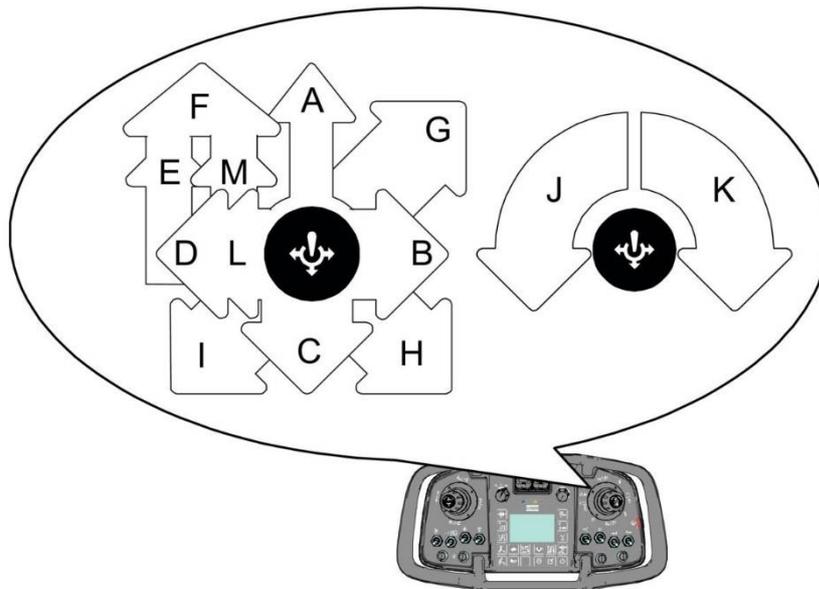
- Danger of accidental operation
- May cause serious personal injury and damage to property
- The operator must always control of the rig and the remote control box
- Always check that the controls are correctly adjusted before operating
- Always deactivate the remote control box when it is not in use

1. Make sure the shank joints are broken loose.



Remote control box

2. Open the drill-steel support. Switch (12) position (c).
3. Pull up the drill string up until the sleeve reaches the drill-steel support. Right-hand multifunction lever (5), sector (c).
4. Close the drill-steel support. Switch 12 to position (a).
5. Activate unthreading by moving the right-hand multifunction lever to sector (g).



Sector description - Right-hand multifunction lever

6. Unthread the shank adapter from the drill rod.

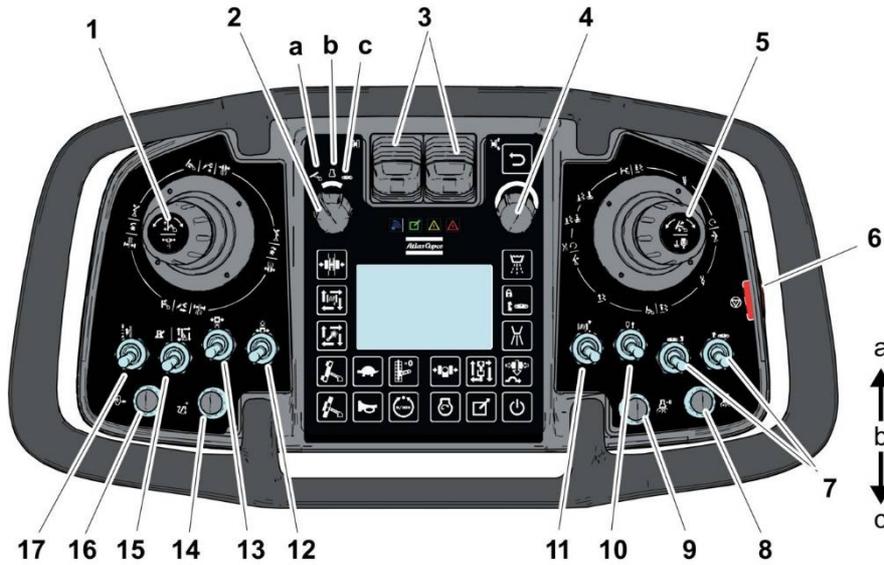
## Unthreading and extracting

 <b>WARNING</b>	
<ul style="list-style-type: none"><li>• <b>Danger of accidental operation</b></li><li>• <b>May cause serious personal injury and damage to property</b></li><li>• <b>The operator must always control of the rig and the remote control box</b></li><li>• <b>Always check that the controls are correctly adjusted before operating</b></li><li>• <b>Always deactivate the remote control box when it is not in use</b></li></ul>	

1. Make sure the shank joints are broken loose.

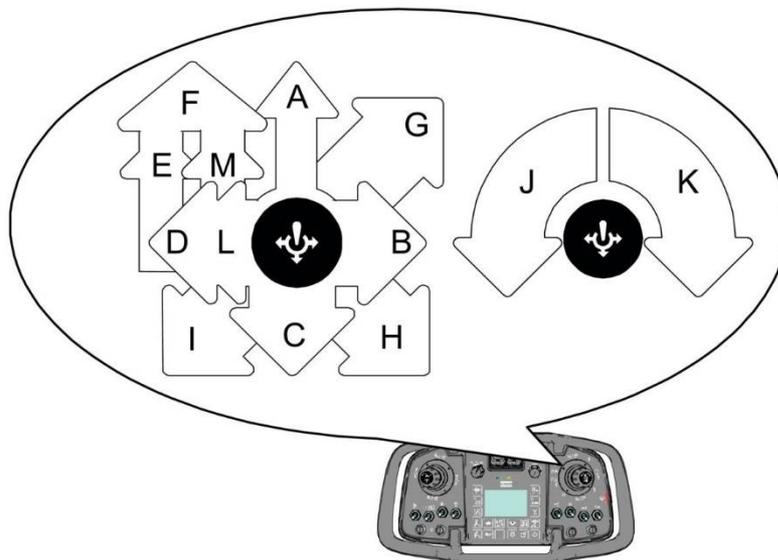
# Operator's instructions

## 7. Drilling



Remote control box

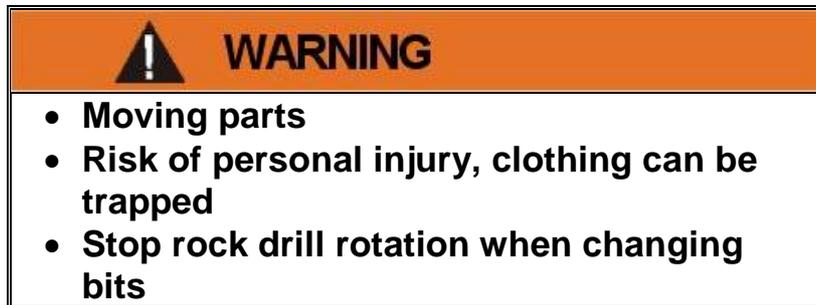
2. Open the drill-steel support. Switch (12) position (c).
3. Pull up the drill string up until the sleeve reaches the drill-steel support. Right-hand multifunction lever (5), sector (c).
4. Close the drill-steel support. Switch 12 to position (a).
5. Activate unthreading by moving the right-hand multifunction lever to sector (h).



Sector description - Right-hand multifunction lever

6. Unthread the shank adapter from the drill rod.

## Changing drill bit



*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. Turn the right-hand multifunction lever (5) to the right to activate break loose.
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.

## Action in case of drilling problems

### Drilling problems

If the following trouble occurs during drilling:

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

## Operator's instructions

### 7. Drilling

## High coupling sleeve temperature

*NOTE: The coupling sleeve temperature should not exceed 120°C (248°F)*

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 over drilled 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.

## Difficulties in loosening the coupling sleeve

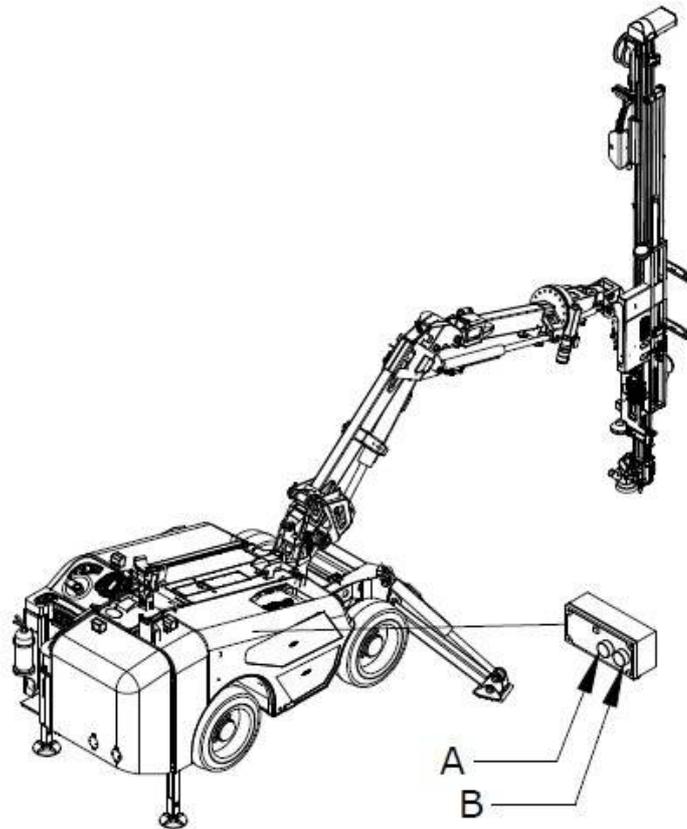
The best method of loosening the coupling sleeve is to "drill" the last few centimetres without feed pressure and rotation, leaving percussion active for a few seconds to break loose the coupling sleeve.

## Hole deflection

1. Try to drill with as low a drill feed pressure as possible
2. Check the condition of the drill bit
3. 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.

## 8. Options

### Electric filler pump



*Figure: Electric filler pump*

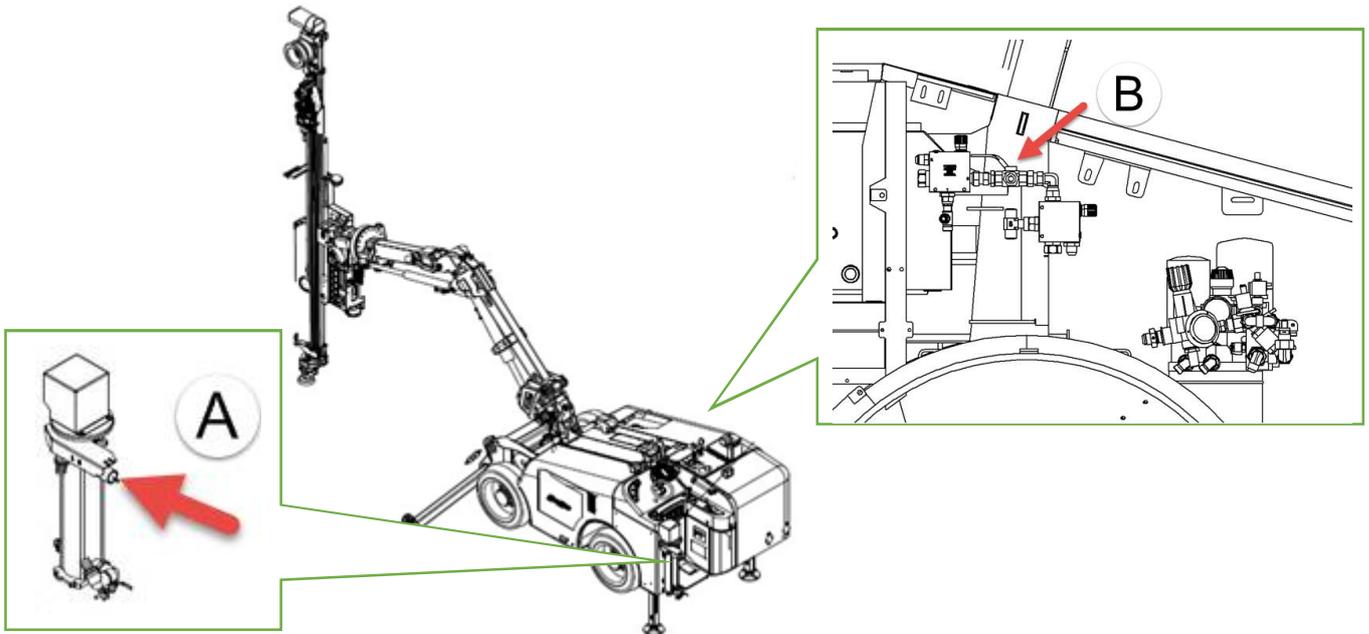
The pump is used to fill fuel.

1. Make sure that the hose and the filter are clean.
2. Connect the attached hose to the fuel source.
3. Press **START** on the control panel (B).

The top-off electro pump stops automatically when the fuel tank of the drilling carriage is full, or press **STOP** (A) to interrupt dispensing.

# Water flush / Water mist

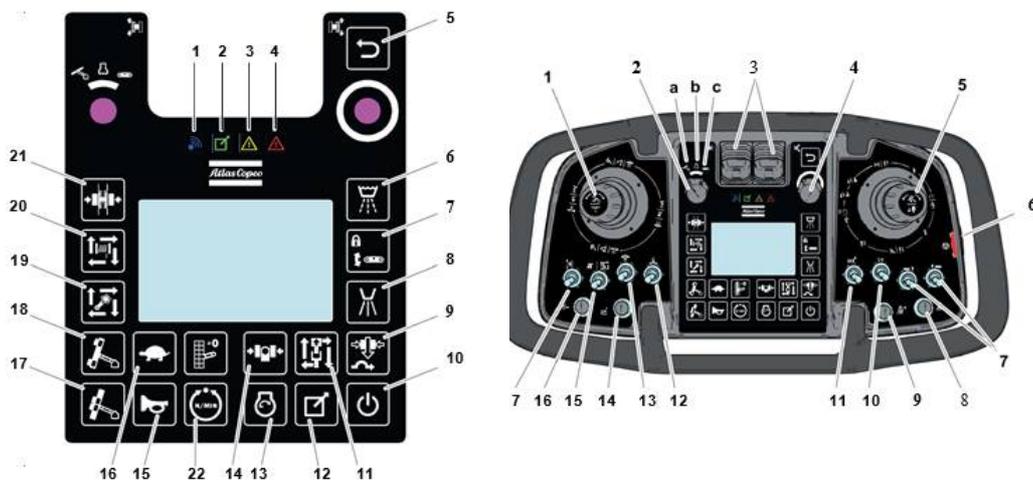
## Water flushing



Water flush pump

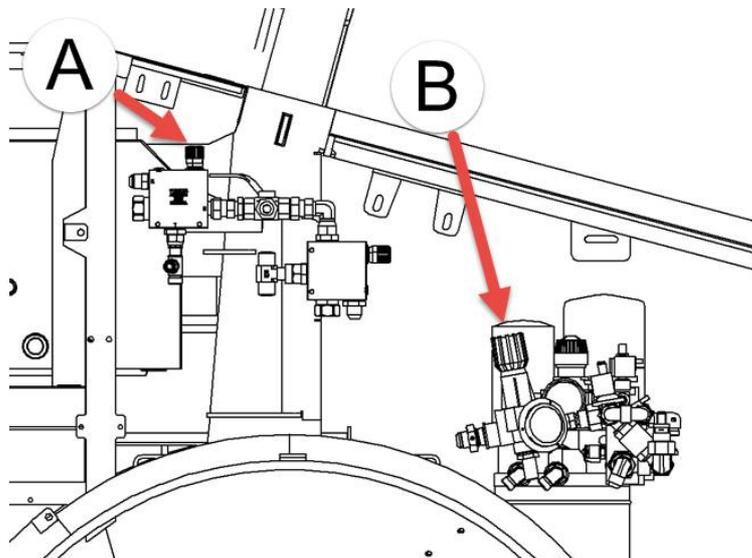
The pump is used to perform a water flushing.

1. Connect the input hose to the fitting A.
2. Turn the valve B in order to activate the water pump

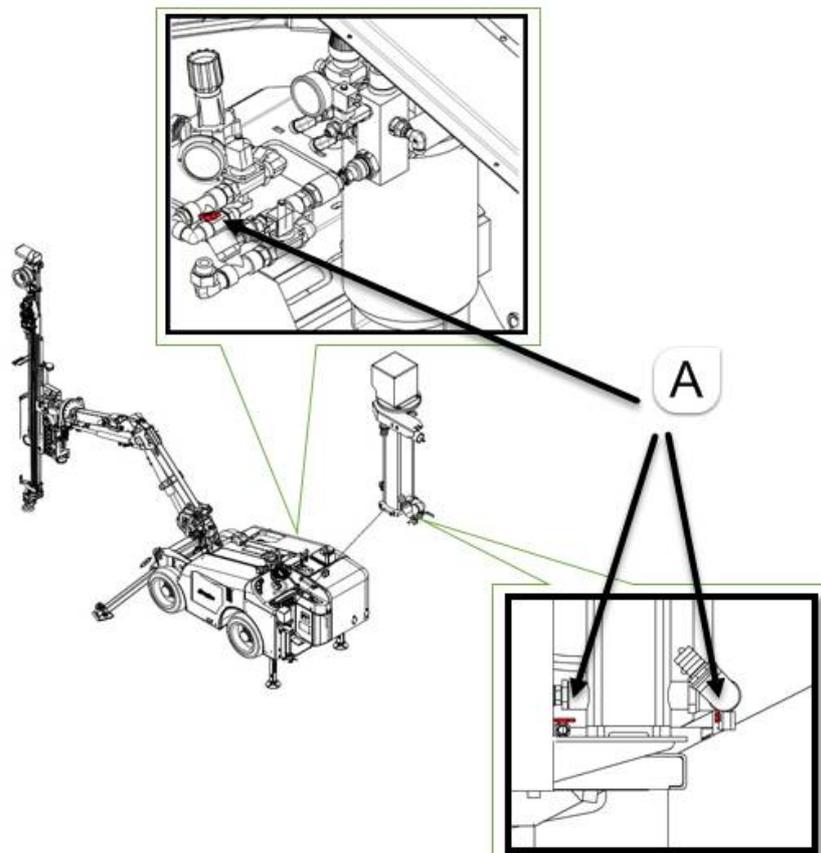


3. Make sure that the DCT is activate from the Radio box (button 16).
4. Activate the water flushing button no 6 on the touch panel and switch of the air (button no 8 on the touch panel).

**NOTE:** you can adjust the water flow from the regulator A show in the picture and the water pressure from the regulator B.



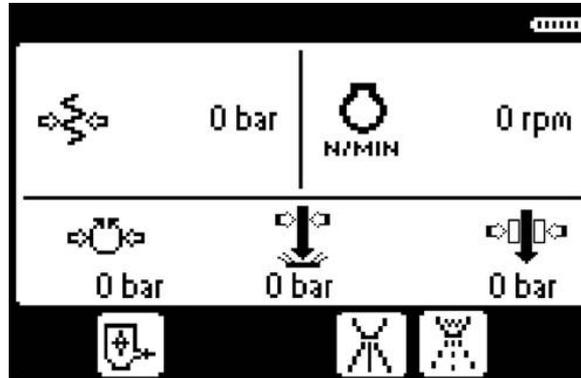
**NOTE:** In case of cold temperature, it is recommended to drain the water system by opening all the valves A in the picture below and activating flushing with air.



**NOTE:** In case the water pressure is connected in input, A it is already too high and you don't need the pump, you can switch off it from the button 16 on the radio box.

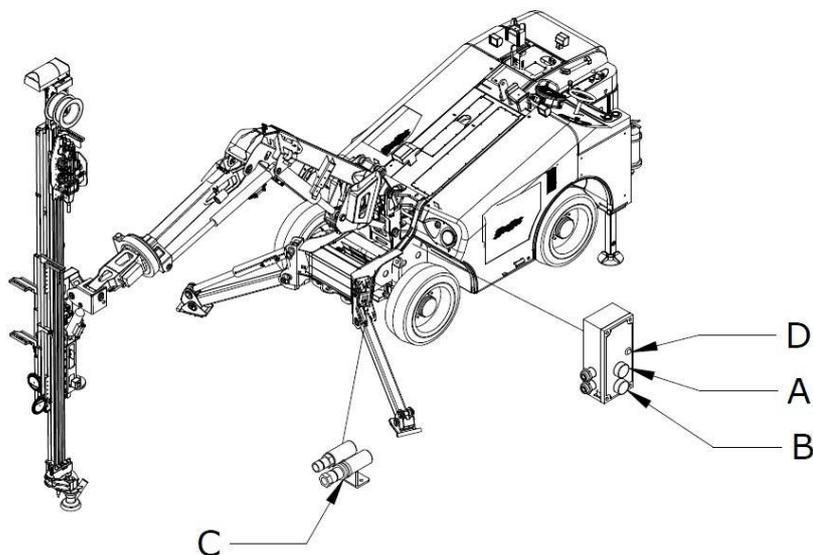
## Water mist

Follow the same procedure for the water flushing and activating in the same time the air flushing, button no 8 on the touch panel, you can activate water mist.



*Water mist*

## Auxiliary hydraulic fittings



*Figure: Auxiliary hydraulic fittings*

The auxiliary hydraulic fittings provide hydraulic power to the machine's auxiliary applications (hydraulic sharpener, etc.)

1. Connect the equipment's output and return to the quick connectors (C).
2. Press button B from the control panel to power the auxiliary application.
3. To interrupt hydraulic power to the application, press button A.

 <b>WARNING</b>
<ul style="list-style-type: none"> <li>• <b>Before disconnecting the auxiliary application from the machine, make sure the auxiliary system is not powered (indicator light D off)</b></li> </ul>

 <b>CAUTION</b>
<ul style="list-style-type: none"> <li>• <b>Protect your eyes from contact with hydraulic oil.</b></li> <li>• <b>Wear protective goggles.</b></li> </ul>

# Operator's instructions

## 8. Options

### RAS

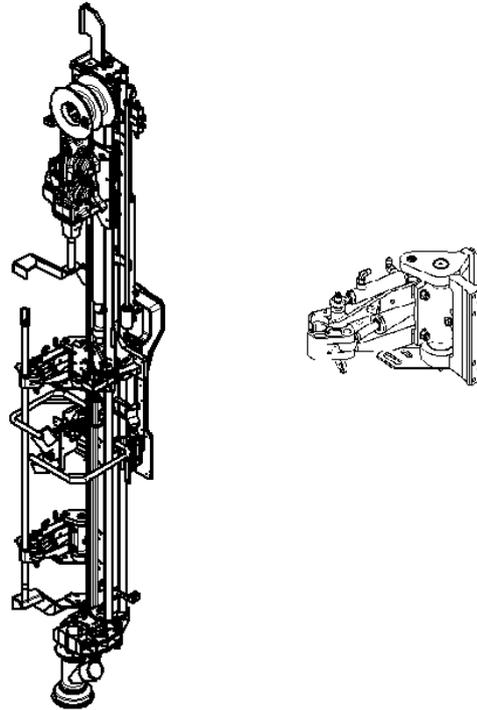
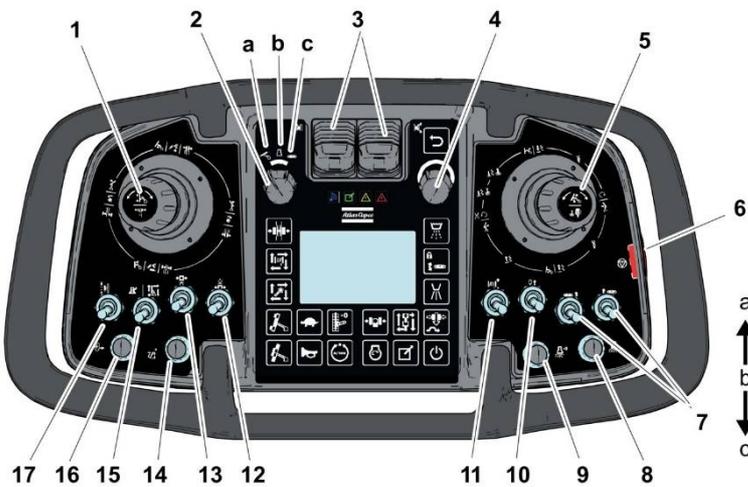


Figure: RAS

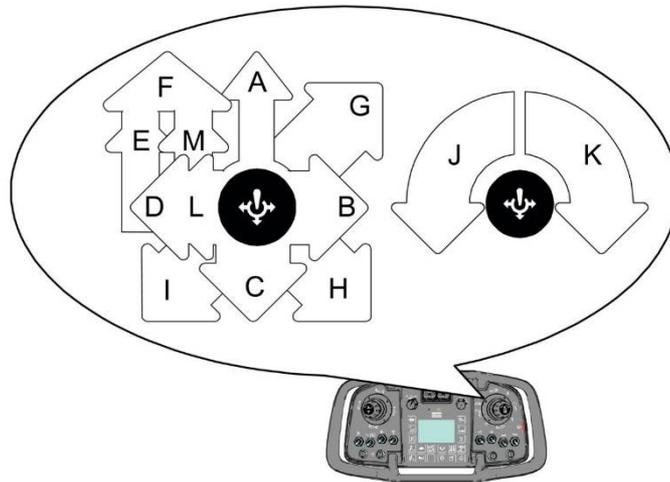
 <b>WARNING</b>	
<b>Serious injury</b> <b>Crushing hazard</b>	
<ul style="list-style-type: none"><li>• Danger of rotating parts</li><li>• Do not stay in the vicinity of the rod grippers</li></ul>	

### Rod adding with RAS



Remote control box

1. Lock the coupling sleeve; close the drill-steel support, and keep it close
2. Move the right-hand multifunction lever (5) into threading position (H) in order to dis- connect the rock drill from the drill steel.



3. Move the right-hand multifunction lever (5) into position (C) in order to move the rock drill back.
4. Left-hand multifunction lever (1) in position (C) in order to move the drill steel into drill centre.
5. Left-hand multifunction lever (1) to sector (C) in order to obtain hard grip.
6. Right-hand multifunction lever (5) to sector (G) in order to thread the drill steel into the rock drill.
7. Left-hand multifunction lever (1) to neutral position in order to obtain loose grip.
8. Right-hand multifunction lever (5) to sector (G) (threading) until both joints are tightened.
9. Right-hand multifunction lever (5) to sector (E) in order to open the claws.
10. Left-hand multifunction lever (1) to sector (A) in order to move back the rod handling arms.
11. Open the drill supports with circuit breakers (12) and (13).

## Operator's instructions

### 8. Options

## Unthreading and extracting with RAS

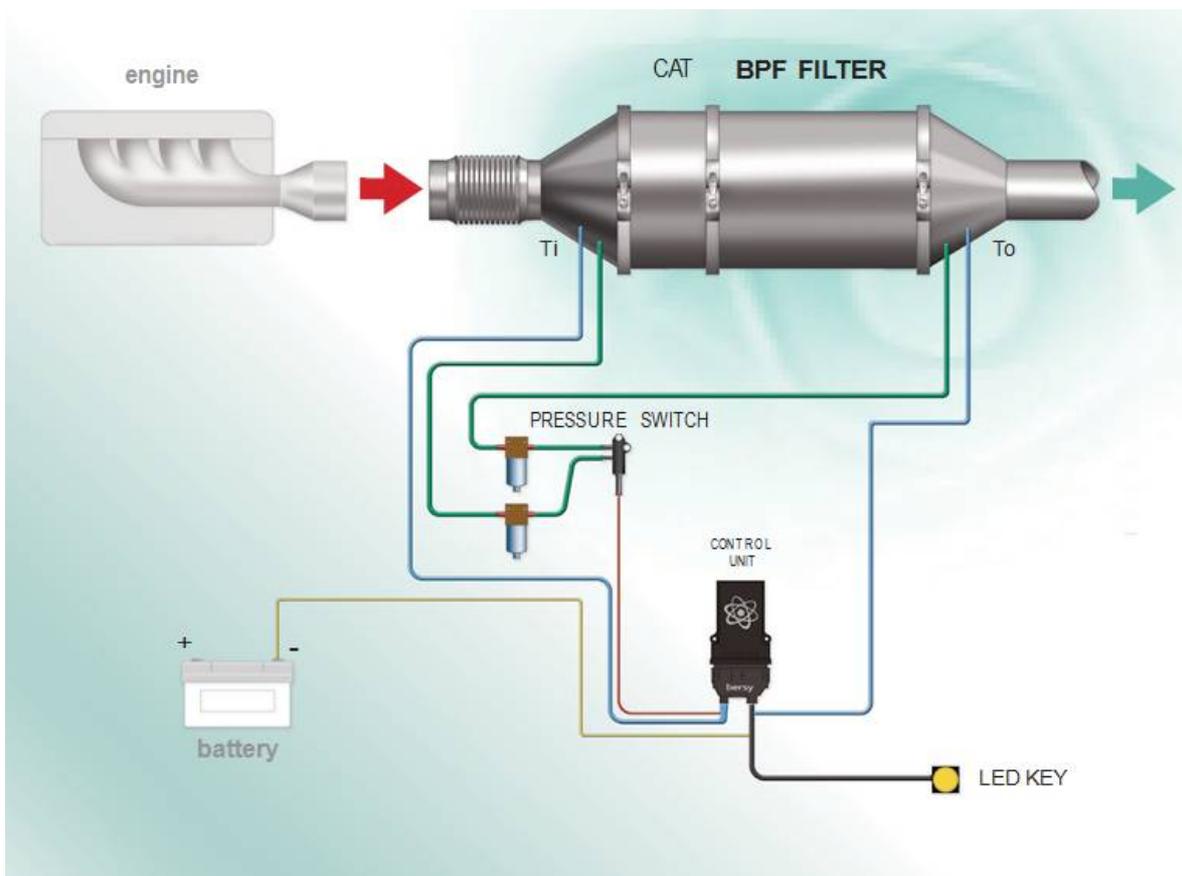
Knock loose the joints before extraction:

1. Open the drill-steel support fully by moving the drill-steel support selector to opening position.
2. Pull up the drill string until the sleeve is in the drill-steel support by holding the rapid feed selector in UP position.
3. Swing the rod handling arms to drill centre by moving the rod handling lever to the arm to centre position.
4. Grip the drill steel by moving the lever for rod handling to closing position.
5. Tighten the joint between the shank adapter and the upper rod slightly by holding the rotation/feed lever at drill rotation position for a few brief intervals.
6. Close the drill-steel support by moving the drill-steel support selector to closing position.
7. Apply loose grip by moving the lever for the rod handling arms to NEUTRAL position and the rod gripper lever to loose grip position.
8. Unscrew the drill steel fully from the sleeve in the drill-steel support by holding the rotation/feed lever in reverse rotation position.
9. Raise the rock drill about 10cm by holding the rapid feed lever in UP position.
10. Apply hard grip by moving the rod gripper lever to CLOSED.
11. Unscrew the shank adapter from the upper coupling sleeve by holding the rotation lever in reverse rotation position.
12. Unscrew the shank adapter fully from the drill steel. Hold the rotation lever in reverse rotation position. Move the lever back to NEUTRAL once the shank adapter has been unthreaded.
13. Move the drill rod away from drill centre by moving the lever for the rod handling arms to the from drill centre position.
14. Lower the rock drill by holding the rapid feed lever in the DOWN position and then thread the shank adapter into the coupling sleeve that is fastened in the drill-steel support by holding the rotation lever in drill rotation position.

## Filter with Pre-Cat

The filter with Pre-Cat system is constructed using silicon carbide (SiC) filters with oxidation catalysts, positioned in front to guarantee the reduction of the unburned hydrocarbon (HC) and carbon monoxide (CO) emissions.

This combination allows the nitrogen dioxide (NO<sub>2</sub>) level to be raised which, unlike oxygen (O<sub>2</sub>), allows combustion of the particulate at compatible temperatures with those of the exhaust gases.



The silicon carbide particulate filter does not require frequent maintenance. Cleaning is required and consists of cooking the filter and pulsing air through it to remove ash.

This cleaning is normally carried out every 1200 operating hours, or whenever the electronic control unit indicates, cleaning is required.

The oxidation catalyst must be cleaned every 3000 hours of use by washing in warm water and a neutral detergent.

The system can be applied to all diesel engines, without limitations in terms of engine age.

**The operation of the filter is only guaranteed with the use of diesel that meets the EN590 legislation.**

## Operator's instructions

### 8. Options

## Use and maintenance

The installation of a BPF R620 system does not change the use and the maintenance of the engine.

The maintenance intervals indicated by the vehicle/engine manufacturer for the other systems do not change and must be strictly respected.

For the functioning of the BPF R620 systems is mandatory to take care of the indications of the status LED. The following indications must be strictly observed:

### System status

The status LED shows with its signaling the status of the system when the engine is running. The indications of the LED and their meanings are showed in the following:

**FIXED GREEN:** normal operation.

**FIXED RED:** high pressure alarm.

**BLINKING RED:** low pressure alarm.

**BLINKING RED/GREEN:** high pressure alarm and low pressure alarm acknowledged.

**DOUBLE BLINKING RED:** pressure warning

**TRIPLE BLINKING RED:** warning inlet temperature, warning outlet temperature, warning additional temperature, warning additive pump, warning aided regeneration device (glow plugs), warning plausibility checks, warning additional pressure (if no other signal is active).

**QUADRUPLE BLINKING RED:** closed additional relay.

**QUINTUPLE BLINKING RED:** ALARM MEMORY full.

**DOUBLE BLINKING RED / DOUBLE BLINKING GREEN:** low additive level.

**TRIPLE BLINKING RED / TRIPLE BLINKING GREEN:** maintenance interval achieved.

**BLINKING GREEN:** manual ignition of the aided regeneration device (glow plugs) in progress.

The high pressure alarm and low pressure alarm must be acknowledged from the operator by pressing the pushbutton. After the acknowledgement, the signaling of the LED changes (it becomes **BLINKING RED/GREEN**).

If a high pressure alarm or low pressure alarm is acknowledged, it will end at the engine shut down or at the BYBOX power off.

If a high pressure alarm or low pressure alarm is not acknowledged, it will remain active and signaled by the LED even after the engine shut down and restart, or after the power off and on of the BYBOX.



In case of TRIPLE BLINKING RED, it is necessary to connect to BYBOX by means of the dedicated software, to determinate which is the cause of the signalling (call the AC Service ).

## **Scheduled maintenance**

A necessary condition for the BPF R620 system to work is to systematically follow the maintenance plan specified by the vehicle/engine manufacturer.

It is necessary to guarantee that:

The smoke opacity of the exhaust gases measured upstream of the filter is lower than 1.7 K [m-1]

The lube-oil consumption is lower than 0.25% of the fuel consumption.

The temperature of the exhaust gases at the inlet of the muffler must be kept above 350°C for at least 15% of the engine running time if BPF systems are used.

The temperature of the exhaust gases at the outlet of the muffler must be kept above 200°C for at least 50% for BPF R620 systems.

### **Note**

For achieving the functioning temperature profiles described above to favour/allow on board regeneration of the particulate filter, it is suggested, when possible during the normal use of the engine, to:

For circulating applications, bring the engine to full running load (at full power/driving under load on a straight stretch of road at a constant speed, observing the speed limit, or on a section of road going uphill).

For auxiliary engines, earth movement vehicles, or stationary applications, increase the power demand from the hydraulics system or the other connected devices, to achieve full load on the engine.

In any case, this loading of the engine must be carried out for no more than 15 minutes.

## Operator's instructions

### 8. Options

The operations to be performed specifically for the BPF R620 system are the following:

This operation must be done by AC Service

- Verify backpressure upstream of the filter at least every 6 months
- Verify the smoke opacity of the exhaust gases upstream the filter at least every 6 months
- Check/clean/drain the “Pressure sensor protection” gas filter at least every 6 months
- Cleaning/replacing the particulate filter: annually (and in any case whenever alerted by the status LED)
  - Flushing with air in the opposite side of exhaust flow for 30 minute at 7 bar.
  - Heat the filter in a hoven at 650 °C for 4 hours
  - Flushing with air in the opposite side of exhaust flow for 30 minute at 7 bar.
- Checking and if necessary replacing the additive filter (downstream of the delivery pump): at least every 6 months
- Replace the particulate filter (if fitted with a catalytic coating): every 10000 hours.
- Replace the oxidation catalyst (if present): every 10000 hours.

In addition, should there be an engine problem or damage (such as a broken turbo compressor, fuel-pump or injectors) which would generate a large amount of soot in a short time period, it will be necessary to contact the AC Service for:

- Carrying out a diagnosis of the BPF R620 system
- Inspecting the condition of the particulate filtering cartridge and of the oxidation catalyst (if present)
- If required, cleaning and replacing the particulate filtering cartridge and/or the oxidation catalyst (if present)

The checks/repairs/replacements described above must be carried out in compliance with the proper technical regulations, taking the necessary safety precautions, and preferably they should be performed at specialized workshops.