

Cleco[®]
Production Tools

Programming Manual
P2398PM-EN
2022-07

CellCore[™]

S169262

CCBA & CCBP



For additional product information visit our website at www.ClecoTools.com

Copyright © Apex Tool Group, 2022

No part of this document may be reproduced in any way or in any form, in whole or in part, or in a natural or machine-readable language, or transmitted on electronic, mechanical, optical, or other media, without the express permission of the Apex Tool Group.

Disclaimer

Apex Tool Group reserves the right to modify, supplement, or improve this document or the product without prior notice.

Trademark

Cleco Production Tools is a registered trademark of Apex Brands, Inc.

Apex Tool Group

670 Industrial Drive
Lexington, SC 29072
USA

Manufacturer

Apex Tool Group GmbH

Industriestraße 1
73463 Westhausen
Germany

Content

1	About this document	5
2	Product Description	7
2.1	Confirmation button.....	7
2.2	Navigation buttons.....	7
2.3	USB connection	8
3	Menus And Functions	9
3.1	General Functions	9
3.1.1	Switching On The Tool	9
3.1.2	Switching Off Tool.....	9
3.1.3	Selecting a button.....	9
3.1.4	Changing parameters.....	9
3.1.5	Change between FastApps and mPro mode.....	9
3.1.6	Remote start.....	10
3.2	Display.....	10
3.3	Menu structure overview.....	13
3.4	Run screen.....	14
3.4.1	Run screen in the mPro mode	14
3.4.2	Run screen in the FastApps mode.....	15
3.4.3	Selecting the FastApps.....	16
3.4.4	Selecting the Application/Linking group	17
3.4.5	Counterclockwise rotation	17
3.5	Main menu	18
3.6	FastApps menu.....	19
3.6.1	Configuring FastApps.....	20
3.6.2	Selecting the direction of rotation	22
3.6.3	Selecting the tightening strategy	22
3.6.4	Advanced Settings.....	23
3.6.5	Resetting FastApp	24
3.7	Settings.....	25
3.7.1	Setting the date and time.....	26
3.7.2	Adjusting the screen brightness	27
3.7.3	Adjusting the tool light	27
3.7.4	Setting the shut-off properties.....	28
3.7.5	Selecting the torque units.....	29
3.7.6	Setting the PIN.....	30
3.7.7	Locking a menu.....	32
3.7.8	Allowing a Linking group/FastApp selection	33
3.8	Diagnostics.....	33
3.8.1	Speed test.....	34
3.8.2	Angle test.....	35
3.8.3	Torque test.....	36
3.8.4	Calibration value.....	37
3.8.5	Voltage	38
3.8.6	Counters status.....	38
3.8.7	Torque calibration value.....	39
3.9	WLAN communication.....	40

3.9.1	Activating/deactivating WLAN connection.....	41
3.9.2	Installing EAP-TLS certificate	42
3.10	Bluetooth communication.....	43
3.10.1	Activating/deactivating Bluetooth.....	44
3.10.2	Scanning Bluetooth devices	44
3.10.3	Disconnect Bluetooth connection	45
3.11	Utility	46
3.11.1	Displaying the software version.....	47
3.11.2	LiveWire API license.....	48
3.11.3	Saving an archive.....	49
3.11.4	Saving a torque graph.....	51
3.11.5	Loading parameters.....	54
3.11.6	Saving parameters.....	55
3.11.7	Carry Out a Software Update.....	56
3.11.8	Deleting an archive.....	57
3.11.9	Resetting to factory settings	57
4	Tightening sequence	59
5	Troubleshooting	61
5.1	Error messages.....	61
5.2	Tool problems	63
5.3	WLAN data communication problems	64
5.4	Bluetooth data communication problems	65

1 About this document

This document is intended for qualified employees responsible for installation and maintenance (administrators, maintenance technician, service, operator).
It contains information

- for safe and appropriate handling of the product.
- on function.
- for programming the software: S169262-209

The original language of this document is German.

Other documents

P1730PM	Programming Manual – Tightening Sequences
P2280PM	Programming Manual – S168813 mPro400GC(D) & mPro200GC(-AP)
P2372JH	Installation Instruction – S168688 LiveWire Utilities
P2390BA	Instruction Manual – CCBA & CTBP
P2402KA	Quick Installation Guide – CCBA & CTBP Data Transmission
P2403HW	Hardware Description – mPro200GC(-AP)
P2521JH	Installation Instructions – S168709 LiveWire Cert

Symbols in the text

<i>italic</i>	Menu options (e.g., Diagnostics) input fields, check boxes, radio buttons or dropdown menus.
>	Indicates selection of a menu option from a menu, e.g., <i>File > Print</i> .
<...>	Specifies switches, pushbuttons or the keys of an external keyboard, e.g., <F5>.
<i>Courier</i>	Indicates Filenames and paths, e.g., <i>setup.exe</i> .
•	Indicates lists, level 1.
-	Indicates lists, level 2.
a)	Indicates options.
b)	
➤	Indicates results.
1. (...)	Indicates action steps.
2. (...)	
▶	Indicates single action steps.

Other documents

Warning notes are identified by a signal word and a pictogram:

- The signal word describes the severity and probability of the impending danger.
- The pictogram describes the type of danger.

	⚠ Danger A symbol combined with the word Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	⚠ Warning A symbol combined with the word Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	⚠ Caution A symbol combined with the word Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Note A symbol combined with the word Note indicates a potentially harmful situation which, if not avoided, could result in damage to property or the environment.



General instructions include application tips and useful information, but no warnings against hazards.

Structure Of Warnings

	⚠ Caution Type and source of danger. Possible consequences of non-observance. ▶ Measures to avoid danger.
---	--

Abbreviations

Abbreviations	Description
TQ	Torque
NOK	Result is not in order. The result is outside the target value tolerances.
App	Application
AN	Angle

2 Product Description

The cordless tool can be used in two modes of operation:

- In the FastApps mode, the tool works independently without a controller. The Linking groups (FastApps) and settings are parameterized on the tool.
- In the mPro mode, a connection between the tool and the controller is necessary. The linking group and settings are parameterized on the controller and sent to the tool.



Fig. 2-1: Display and tool controls

Item	Description
1	Micro USB-B connection
2	Display
3	Confirmation button
4	Navigation buttons

2.1 Confirmation button

Button	Function
	<ul style="list-style-type: none"> • Open menu. • Confirm settings: The changes are saved.

2.2 Navigation buttons

Use the navigation buttons to navigate to menu items and settings. Some buttons also have additional functions.

Button	Function
	<ul style="list-style-type: none"> • Press to move the selection box up. • Press and hold to go directly to the run screen from all menu levels. • Press to increase a value. • Press and hold to increase a value quickly (jump by one).

Button	Function
	<ul style="list-style-type: none"> • Press to move the selection box to the right. • Press to increase a value. • Press and hold to quickly increase a value (jump by ten).
	<ul style="list-style-type: none"> • Press to move the selection box down. • Press to decrease a value. • Press and hold to quickly decrease a value (jump by one).
	<ul style="list-style-type: none"> • Press to move the selection box to the left. • Press and hold to go to the run screen in the main menu. • Press and hold to jump up one menu level. • Press and hold to exit settings. • Press to decrease a value. • Press and hold to quickly decrease a value (jump by ten).

2.3 USB connection

Connection for a Micro B USB cable to connect the tool to an external device interface.

This is used for the following requirements:

- Saving data and archives
- Installing software updates
- Parameterizing WLAN settings

3 Menus And Functions

3.1 General Functions



All paths are specified starting from the main menu.



- ▶ To go from the runscreen to the main menu, press the key.

3.1.1 Switching On The Tool

- ▶ To switch on the tool, press the start trigger.

3.1.2 Switching Off Tool

There are several ways to switch off the tool.

Option 1:

- ▶ Remove the battery.
 - Tool switches off after 20 seconds.

Option 2:

1. Select > .
2. Press the button.
 - The symbol is displayed on the LCD.
 - After five seconds, the tool switches off.

Option 3:

The tool will switch off if it is not used for a certain time, see *chapter 3.7.4 Setting the shut-off properties, page 28*.

3.1.3 Selecting a button

When talking about pressing a button in this manual, this means the following:

1. Use the arrow buttons to navigate to the desired button (outlined in blue).
2. Press the button.

3.1.4 Changing parameters

1. Press the button.
2. Change the number using the arrow buttons.
3. Confirm with the button.

3.1.5 Change between FastApps and mPro mode

1. Select > .
2. Press the button to switch between modes.

FastApps mode is activated.

mPro mode is activated. A connection to the controller is necessary, see document P2402KA.

3.1.6 Remote start

With the remote start the tool can be started via the controller. To use this function, the software version of the controller must be S168813-1.12 or newer.

Activate the remote start

- To make settings for remote start, select *Navigator > Advanced > Advanced > Extended Tool Settings > Remote control & Error acknowledgment settings*.
- To enable the remote start, Activate the *Enabled* check box.
 - As soon as the remote start is activated, the start button on the tool is locked.
- For *Timeout until SA error [ms]*, define a time in milliseconds until a SA error (tool start error) is displayed.
- For *Time interval between start packages [ms]*, define a time in milliseconds that is between the transmission intervals of the start packets.
- Close the dialog with <OK>.
- To open the *Programmable I/O Mapping*, select *Navigator > Tool Setup > I/O* and confirm the following messages.
- Parameterize the input signals *Motor Start SS*, *Remote Tool Start* and *Remote Tool Reverse*.
 - Motor Start SS* starts the motor of the tool and must always be set to forward the *Remote Tool Start* signal to the tool.
 - Remote Tool Start* allows the tool to be started by an external selection.
 - Remote Tool Reverse* allows the tool to be started by an external selection. The direction of rotation is counterclockwise.

Signals to fasten a tightening via the remote start:

- Always set the *Motor Start SS* signal.
- To start the tightening process, set the *Remote Tool Start* signal.
- To abort the tightening process, remove the *Remote Tool Reverse*.

Signals to loosen a tightening via remote start:

- Always set the *Motor Start SS* signal.
- To start the tightening process, set *Remote Tool Reverse* and the *Remote Tool Start*.
- To abort the tightening process, remove the *Remote Tool Reverse* or *Remote Tool Start*.

3.2

Display

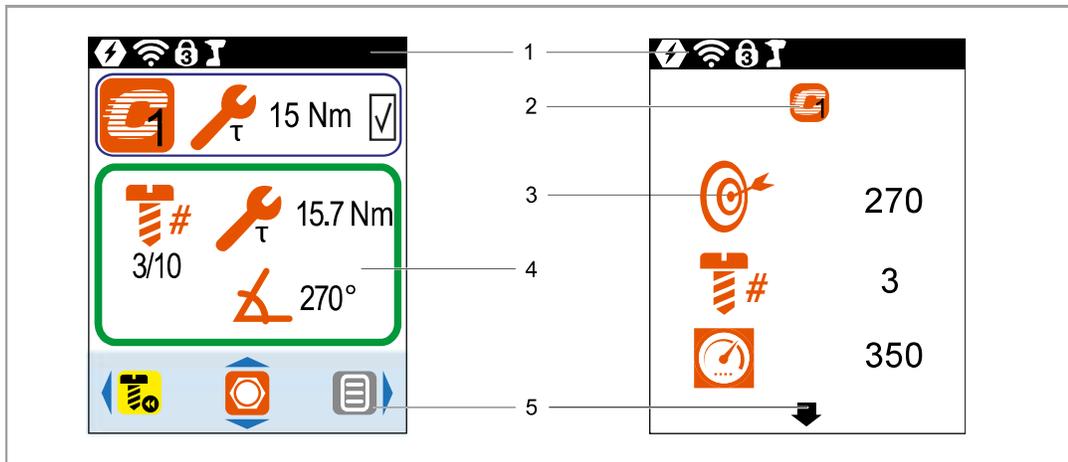
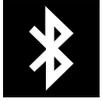


Fig. 3-1: Setup of the menus using the run screen and a submenu as an example

Item	Description
1	Header
2	Symbol of the current menu
3	Submenus and parameters
4	Run screen
5	Footer

Header

The symbols in the header indicate which functions are activated.

Symbol	Description
	Battery is plugged in.
	WLAN connection is available.
	Bluetooth connection is available.
	Displayed in the Diagnostics menu and with warnings.
	PIN is required. The number on the lock indicates the active access level.
	
	
	mPro mode is activated.
	FastApps mode is activated.
	Undervoltage limit is reached, see chapter 3.7.4 <i>Setting the shut-off properties</i> , page 28.



Note

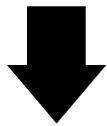
Various modes are selected

When the symbols  and  are displayed, the FastApps mode is selected and, at the same time, the tool is connected to the controller. In this case, the parameters for the FastApps mode are used.

- ▶ Use only one mode.

Footer

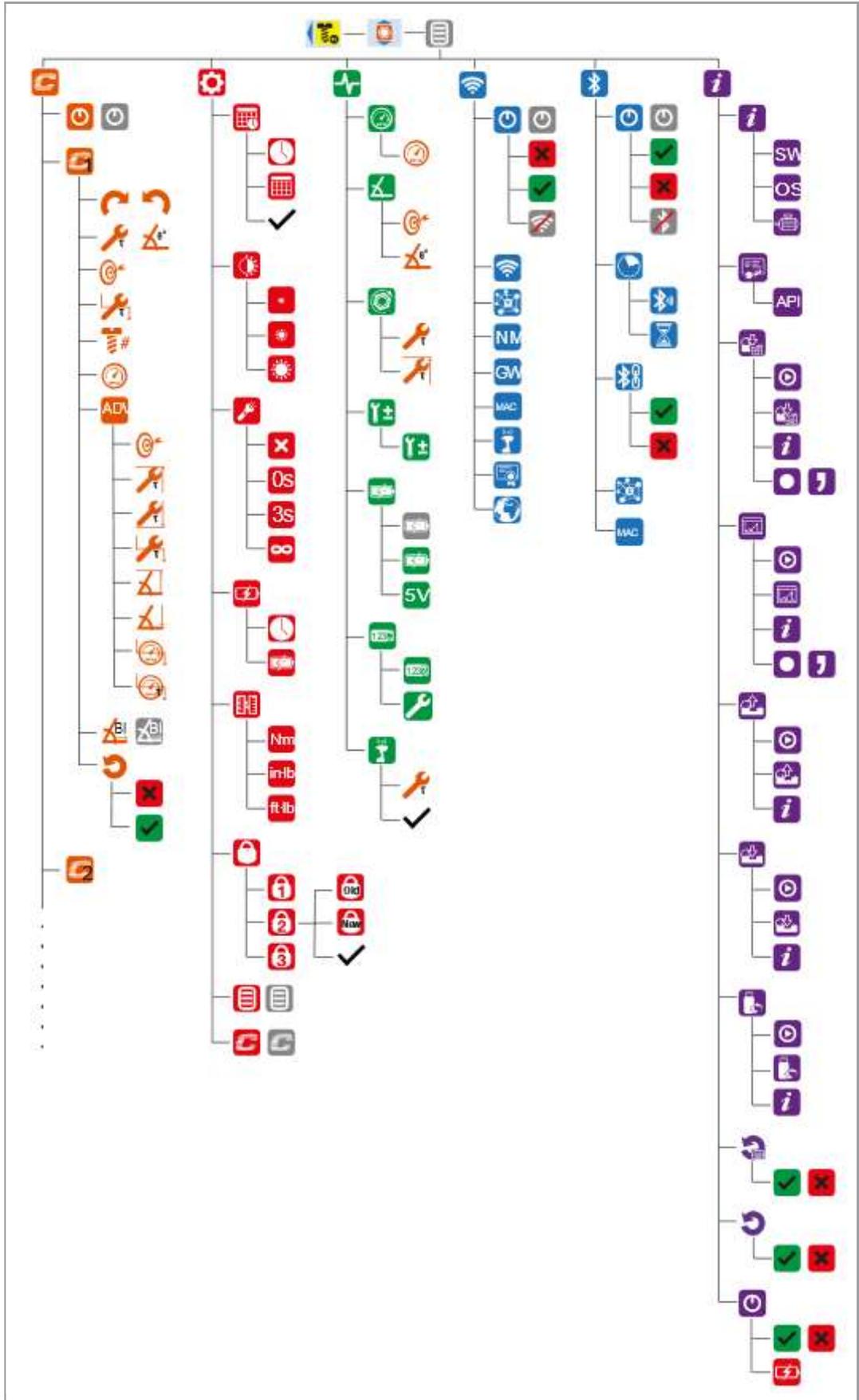
The buttons in the footer are not displayed in every menu.

Symbol	Description
	This button is displayed on the run screen and in counterclockwise rotation. ▶  must be pressed to change between counterclockwise rotation and run screen.
	Select Linking group/FastApps. This button only applies to the run screen. ▶  or  must be pressed to change between the Linking groups/FastApps mode.
	This button is displayed on the run screen and in counterclockwise rotation. ▶  must be pressed to go to the main menu.
	Arrow down indicates that there are other menu items available that are not yet displayed on the LCD. To reach them, press  .

General presentation of the buttons

Button	Description
	Button is in color: Function selectable.
	Button highlighted in gray: Function disabled.
	Button outlined in blue: Function is currently selected with the arrow buttons and can be opened or activated with the  button.
	Button outlined in green: Function is selected and activated.
	Button highlighted in blue: Function is selected and activated.

3.3 Menu structure overview



3.4 Run screen

The run screen displays the rundown data for the tightening sequence. The appearance of the run screen differs depending on whether the mPro mode or the FastApps mode is selected.

For both modes, the following applies:

- Green background: The result of a tightening sequence is OK.
- Green-blue flashing: The overall result for all the tightening positions (batch) is OK.
- Red background: The result of a tightening sequence is NOK.
- Flashing red: The overall result of all the tightening sequences is NOK. This is the case if at least one tightening position is NOK.

3.4.1 Run screen in the mPro mode

The linking group for the tightening sequence is selected in the mPro mode on the controller.



Fig. 3-2: Run screen in the mPro mode without External Application / LG Selection

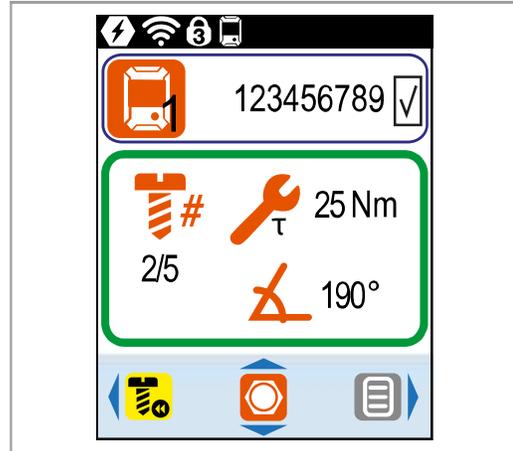


Fig. 3-3: Run screen in the mPro mode with External Application / LG Selection

Display of the Application/Linking group

In mPro mode, the current Application/Linking group is only displayed if the function *Selecting the Application/Linking group* activated. Depending on the setting of the controller, the Application or Linking group is selected.

Symbol	Description
	<p>Display of the currently selected Application or Linking group (mPro).</p> <p>Up to 99 Applications/Linking groups can be programmed. The number on the icon indicates which Linking group is selected.</p> <p>To the right of the symbol, up to twelve characters of the name of the Application or Linking group are displayed. If no name has been parameterized, "---" is displayed.</p>
	<p>Display of the currently selected Application or Linking group. The parameters for this Linking group are used for the tightening.</p>

Display of the rundown data

Symbol	Description
	<p>Linking group/Batch display Number of tightening positions for a Linking group.</p> <ul style="list-style-type: none"> If there is only one Linking group, then each result is evaluated. If there is more than one Linking group, the overall result of all the tightening positions is considered. <p>Example: 2/3</p> <ul style="list-style-type: none"> Current tightening position: 2 Total number of tightening positions: 3
	<p>Display of the torque for the current tightening. If an arrow pointing up appears next to the symbol, the result is too high. If an arrow pointing down appears next to the symbol, the result is too low.</p>
	<p>Display of the angle for the current tightening. If an arrow pointing up appears next to the symbol, the result is too high. If an arrow pointing down appears next to the symbol, the result is too low.</p>
	<p>Indicates that the node number or IP address of the tool is assigned twice.</p> <ul style="list-style-type: none"> ► Change the node number or IP address.

3.4.2 Run screen in the FastApps mode

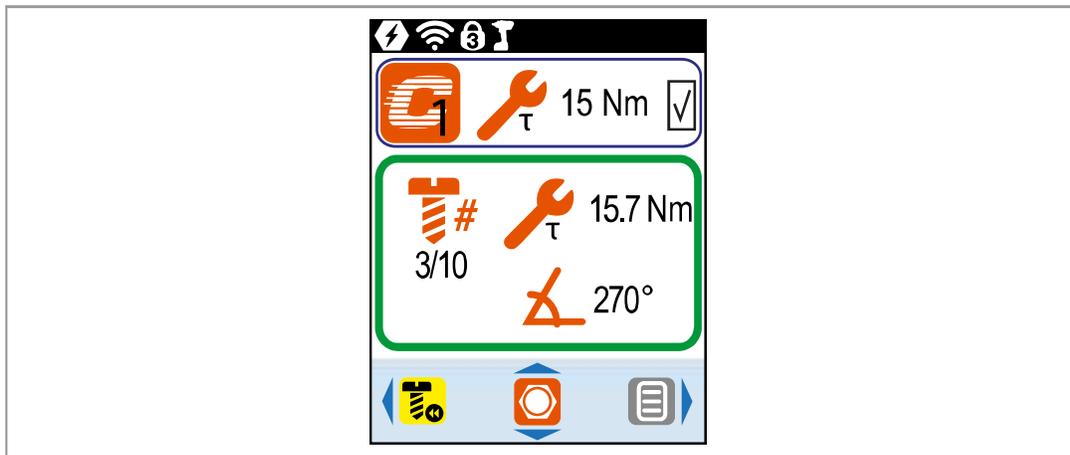


Fig. 3-4: Run screen in FastApps mode

Display of the FastApps

Symbol	Description
	<p>Display of the currently selected FastApp. Up to ten FastApps can be programmed. The number on the button indicates which FastApp is selected.</p>
	<p>Display of the tightening strategy.</p> <ul style="list-style-type: none"> Display of the torque shutoff. The value to the right of the symbol indicates the shut-off torque.

Symbol	Description
	<ul style="list-style-type: none"> Display of the angle shutoff. The value to the right of the symbol indicates the shut-off angle.
	<ul style="list-style-type: none"> Display if the tightening strategy is not programmed.
	Display of the currently selected FastApp. The parameters for this FastApp are used for the tightening.

Display of the rundown data

Symbol	Description
	<p>Batch display Number of tightening positions for a FastApp.</p> <ul style="list-style-type: none"> If there is only one FastApp, then each result is evaluated. If there is more than one FastApp, the overall result of all the tightening positions is considered. <p>Example: 2/3</p> <ul style="list-style-type: none"> Current tightening position: 2 Total number of tightening positions: 3
	<p>Display of the torque for the current tightening. If an arrow pointing up appears next to the symbol, the result is too high. If an arrow pointing down appears next to the symbol, the result is too low.</p>
	<p>Display of the angle for the current tightening. If an arrow pointing up appears next to the symbol, the result is too high. If an arrow pointing down appears next to the symbol, the result is too low.</p>
	<p>Indicates that the node number or IP address of the tool is assigned twice.</p> <ul style="list-style-type: none"> ▶ Change the node number or IP address.

3.4.3 Selecting the FastApps

- ▶ To change between the FastApps, press  or .
- Only Linking groups that have already been parameterized can be selected.
- A new display appears with the following selection options:

Button	Description
	▶ Press the  button to select a new Linking group.
	▶  must be pressed to cancel the process and return to the run screen.

If the FastApp is blocked  (under:  > ) , then the selection options are not available. In this case, a PIN must be entered to switch to another Linking group. A requirement is that a PIN has been defined in the PIN menu ( > ).

3.4.4 Selecting the Application/Linking group

To be able to switch between the Applications/Linking groups in mPro mode, the *External Application / LG Selection* must be activated on the controller.

1. Select *Navigator > Advanced > Tool Group > I/O* on the controller.
2. Activate the checkbox *External Application / LG Selection*.
3. In *Mode* select the *Tool Menu (Cordless Tool)*.
4. To save the settings, press <Navigator>.
5. To change between the Applications/Linking groups on the tool, press  or  .
 - Only Applications/Linking groups that have already been parameterized can be selected.
 - A new display appears with the following selection options:

Button	Description
	▶ Press the  button to select a new Application/Linking group.
	▶  must be pressed to cancel the process and return to the run screen.

The Application/Linking group can also be changed when the tool or control is offline. However, the run-down cannot be done until the connection between tool and control has been re-established.

3.4.5 Counterclockwise rotation

In the *Counterclockwise Rotation* menu, the tool rotates in the opposite direction of rotation as programmed for the FastApp in the controller or in the FastApps menu. During tightening, the display flashes yellow-gray.

The speed for the counterclockwise rotation starts at 20 rpm and increases to 300 rpm.

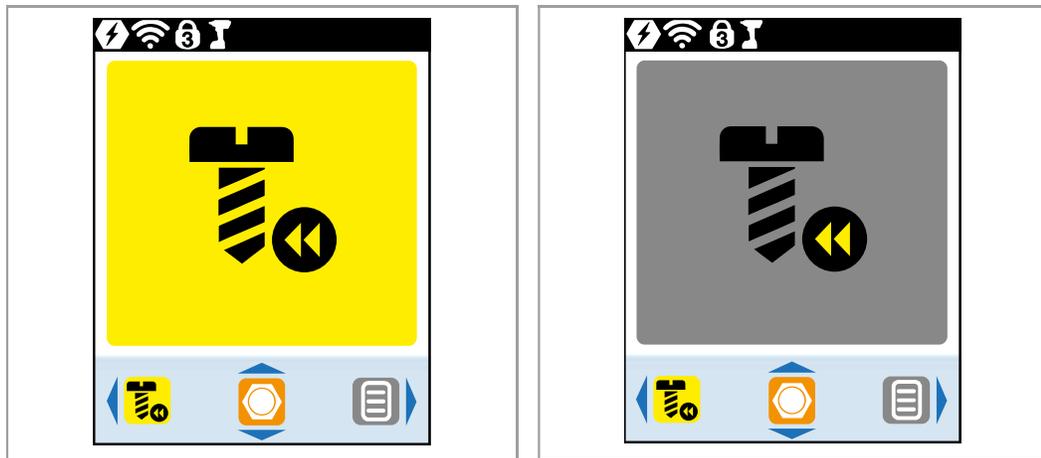


Fig. 3-5: Display during counterclockwise rotation

- ▶ To return to the run screen, press .



Fig. 3-6: Main menu

Button	Description
	FastApps menu
	Settings
	Diagnostics
	WLAN communications
	Bluetooth communication
	Utility

3.6 FastApps menu

The FastApps menu is used to parameterize FastApps. In the mPro mode, the FastApps menu has no function.

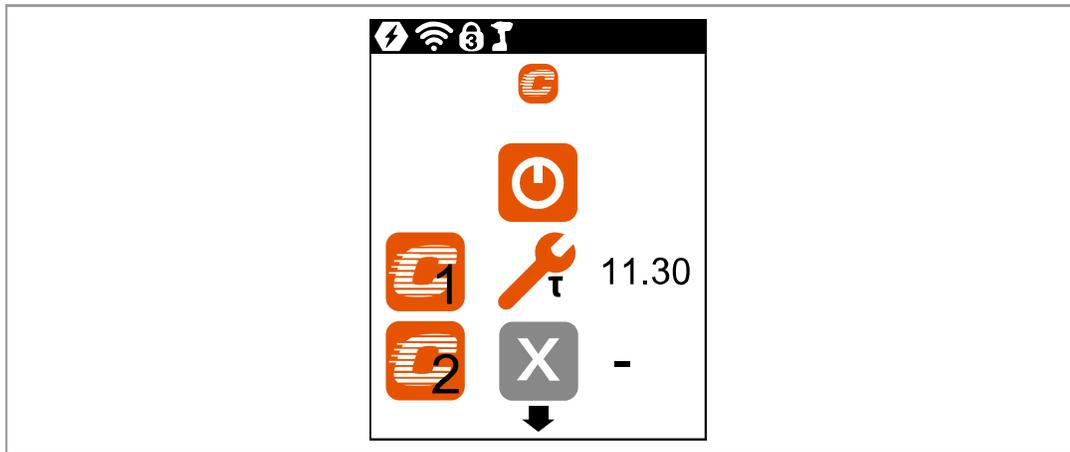


Fig. 3-7: Menu – FastApps menu

Button	Description
	FastApps mode is activated. ➤ mPro mode is disabled.
	FastApps mode is disabled. ➤ mPro mode is active. Only the parameters for the selected mode apply. If the mode is changed, the current settings will not be carried over to the new mode.
	Display of the currently selected FastApp. Up to ten FastApps can be programmed. The number on the button indicates which FastApp is selected.
	FastApp with torque shut-off. The number to the right of the symbol indicates the shut-off torque. The unit corresponds to the selection, see <i>chapter 3.7.5 Selecting the torque units, page 29</i> .
	FastApp with angle shutoff. The number to the right of the symbol indicates the shut-off angle.
	The associated FastApp is not programmed. If the FastApp is not parameterized, it can not be selected on the run screen.

3.6.1 Configuring FastApps

Up to ten FastApps can be programmed. The maximum tightening time is ten seconds.

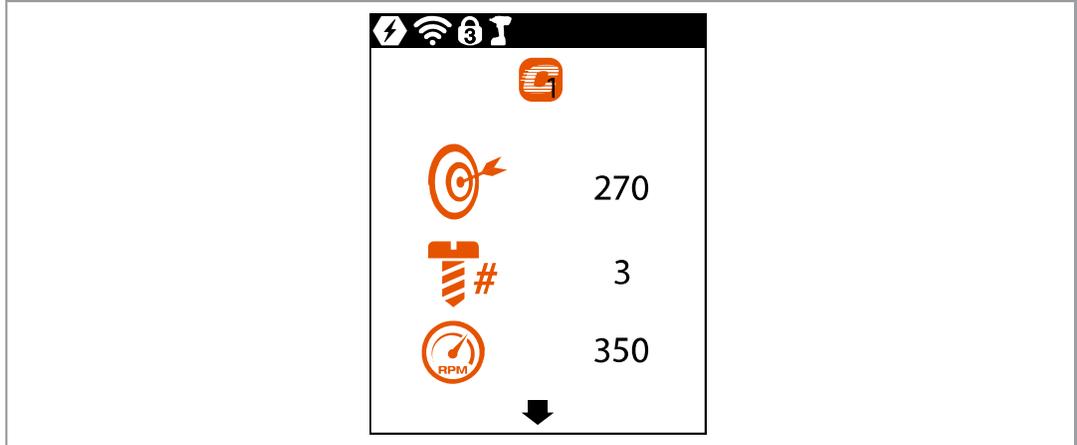


Fig. 3-8: Submenu – Configuring FastApps

Button	Description
	Display of the selected direction of rotation. Depending on the selected direction of rotation, one of the two symbols is displayed.
	Display of the tightening strategy. Depending on the selected shut-off, one of the symbols will be displayed. One torque and one angle shut-off is possible. <ul style="list-style-type: none"> • Display of the torque shutoff
	<ul style="list-style-type: none"> • Display of the angle shutoff.

Button	Description																								
	<ul style="list-style-type: none"> ▶ For a torque shutoff, enter the shut-off torque. ▶ For an angle shutoff, enter the shut-off angle. <p>Once the value has been reached, the tightening process is completed. This setting option is the same as in the menu <i>Advanced Settings</i>.</p> <p>Note</p> <p>If the shut-off value is entered here in the <i>Configuring FastApps</i> menu, then the following values are calculated automatically:</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Shut-off Torque</th> <th>Shut-off Angle</th> </tr> </thead> <tbody> <tr> <td>Minimum Torque</td> <td>-15% of the Shut-off Torque</td> <td>Threshold Torque</td> </tr> <tr> <td>Maximum Torque</td> <td>+15% of the Shut-off Torque</td> <td>Tool capacity</td> </tr> <tr> <td>Minimum Angle</td> <td>0</td> <td>-10 deg of the Shut-off Angle</td> </tr> <tr> <td>Maximum Angel</td> <td>9999</td> <td>+10 deg of the Shut-off Angle</td> </tr> <tr> <td>Threshold Torque</td> <td>50% of the Shut-off Torque</td> <td>Manual input</td> </tr> <tr> <td>Final Speed</td> <td>50</td> <td>50</td> </tr> <tr> <td>Speed Threshold</td> <td>1/4 x of the Shut-off Torque</td> <td>Threshold Torque</td> </tr> </tbody> </table> <p>These values can be changed manually in the  menu, see <i>chapter 3.6.4 Advanced Settings, page 23</i>.</p>	Parameter	Shut-off Torque	Shut-off Angle	Minimum Torque	-15% of the Shut-off Torque	Threshold Torque	Maximum Torque	+15% of the Shut-off Torque	Tool capacity	Minimum Angle	0	-10 deg of the Shut-off Angle	Maximum Angel	9999	+10 deg of the Shut-off Angle	Threshold Torque	50% of the Shut-off Torque	Manual input	Final Speed	50	50	Speed Threshold	1/4 x of the Shut-off Torque	Threshold Torque
Parameter	Shut-off Torque	Shut-off Angle																							
Minimum Torque	-15% of the Shut-off Torque	Threshold Torque																							
Maximum Torque	+15% of the Shut-off Torque	Tool capacity																							
Minimum Angle	0	-10 deg of the Shut-off Angle																							
Maximum Angel	9999	+10 deg of the Shut-off Angle																							
Threshold Torque	50% of the Shut-off Torque	Manual input																							
Final Speed	50	50																							
Speed Threshold	1/4 x of the Shut-off Torque	Threshold Torque																							
	<p>Entering the Threshold Torque.</p> <p>This button is only displayed during angle shutoff. This setting option is the same as in the menu <i>Advanced Settings</i>.</p>																								
	<p>Batch display</p> <p>Enter the number of tightening positions for a FastApp.</p>																								
	<p>Start Speed display.</p> <ul style="list-style-type: none"> ▶ Enter the Start Speed. 																								
	<p>Advanced settings.</p>																								
	<p>Block Angle Detection activated.</p> <p>If block angle detection is enabled, a block angle of 180° is added to torque/angle shutoff. This block angle is used at the start of rundown, to detect if screw is already tighten or thread/screw damaged or crooked screwed-in. The angle counting starts after the block angle.</p> <p>So if within that first 180° the torque exceeds the shutoff-torque (torque shutoff) or maximum torque (angle shutoff), the rundown is aborted and the "BLOC" error is show.</p>																								
	<p>Block Angle Detection disabled.</p>																								

Button	Description
	Reset FastApps.

3.6.2 Selecting the direction of rotation

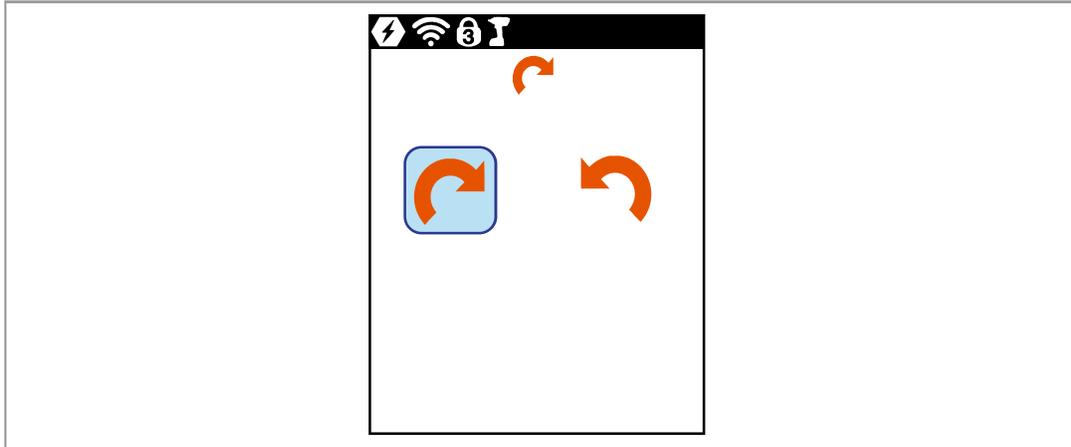


Fig. 3-9: Submenu – Selecting the direction of rotation

Button	Description
	Direction of rotation, right-hand thread.
	Direction of rotation, left-hand thread.

3.6.3 Selecting the tightening strategy

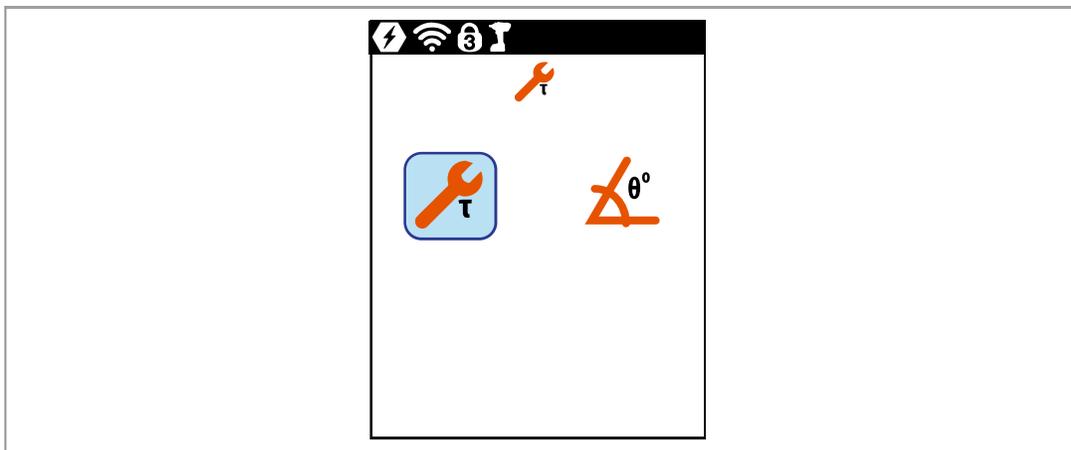


Fig. 3-10: Submenu – Selecting the tightening strategy

Button	Description
	Torque shutoff Sequence 31: Shut-off torque controlled tightening sequence with torque and rotation angle check, see <i>chapter 4 Tightening sequence, page 59</i> .
	Angle shutoff Sequence 51: Shut-off angle controlled tightening sequence with rotation angle and torque check, see <i>chapter 4 Tightening sequence, page 59</i> .

3.6.4 Advanced Settings

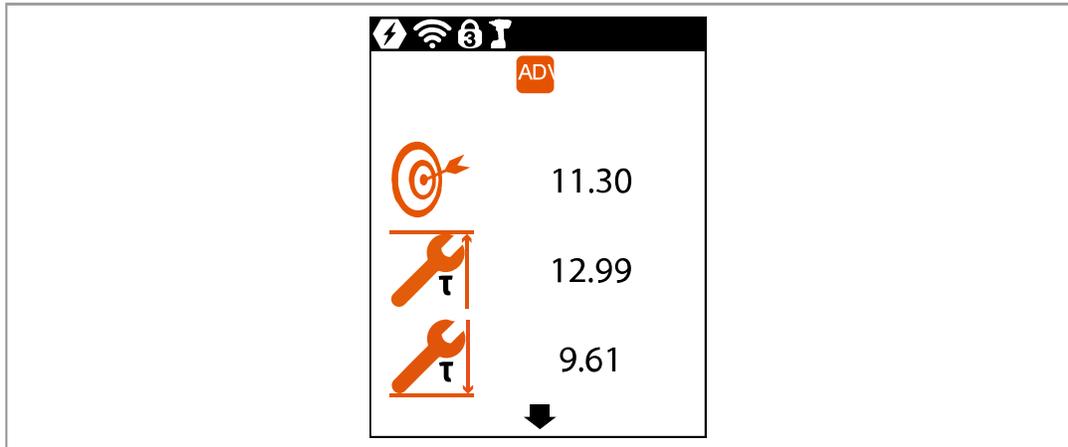


Fig. 3-11: Submenu – Advanced Settings

Button	Description
	<ul style="list-style-type: none"> ▶ For a torque shutoff, enter the Shut-off Torque. ▶ For an angle shutoff, enter the Shut-off Angle. <p>Once the value has been reached, the tightening process is ended. This setting option is the same as in the menu see <i>chapter 3.6.1 Configuring FastApps, page 20</i>.</p> <p>Note If the shut-off value is entered here in the <i>Advanced Settings</i> menu, the minimum and maximum torque, the minimum and maximum angle, as well as the threshold torque, are not calculated automatically.</p>
	<ul style="list-style-type: none"> ▶ Display of the Maximum Torque.
	<ul style="list-style-type: none"> ▶ Display of the Minimum Torque. <p>The Minimum Torque can not be greater than the Shut-off Torque and must be at least as great as the Threshold Torque.</p>
	<ul style="list-style-type: none"> ▶ Enter the Threshold Torque.
	<ul style="list-style-type: none"> ▶ Enter the Maximum Angle.

Button	Description
	▶ Enter the Minimum Angle.
	▶ Enter the Final Speed.
	▶ Enter Speed Threshold. As soon as the Speed Threshold is reached, the speed immediately changes from the start speed to the Final Speed up to the Maximum Torque.

3.6.5 Resetting FastApp

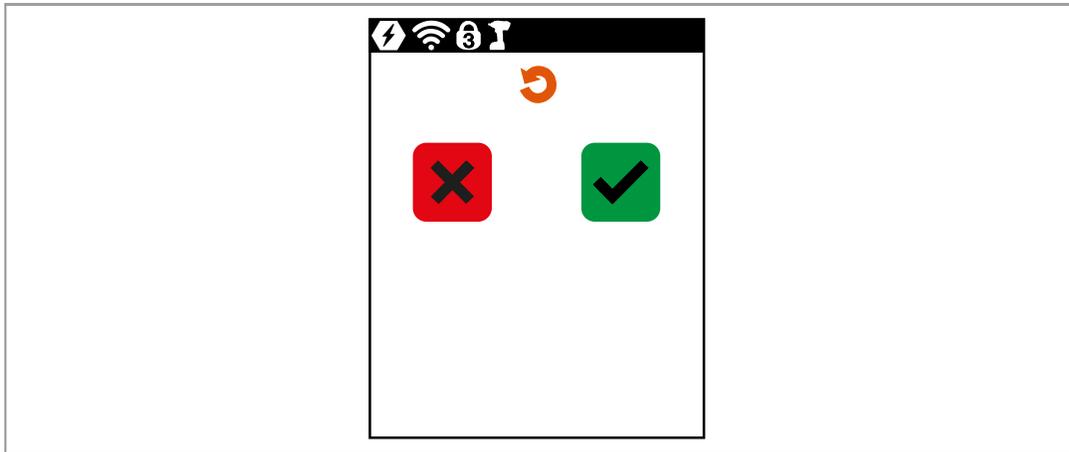


Fig. 3-12: Submenu – Resetting FastApps

Button	Description
	<ul style="list-style-type: none"> ▶ Press to cancel the process. ➤ The settings for the selected FastApp are not reset. ➤ <i>Reset FastApp</i> is exited.
	<ul style="list-style-type: none"> ▶ Press to reset the FastApps menu. ➤ All settings for the selected FastApp are deleted. ➤ The <i>Reset FastApp</i> menu is exited. ➤ Since the FastApp is no longer programmed, the symbol  is displayed in the <i>Configure FastApps</i> menu and this FastApp can no longer be selected on the run screen.

3.7 Settings

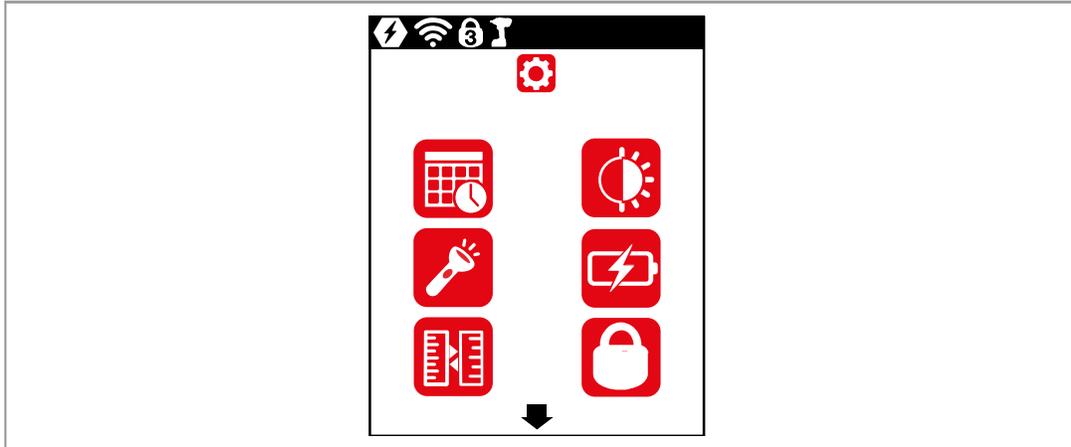


Fig. 3-13: Menu – Settings

Button	Description
	Display and set time and date.
	Adjust screen brightness.
	Adjust tool light.
	Set shut-off properties.
	Select torque units.
	PIN menu
	Lock menu
	Allow Linking group selection.

3.7.1 Setting the date and time

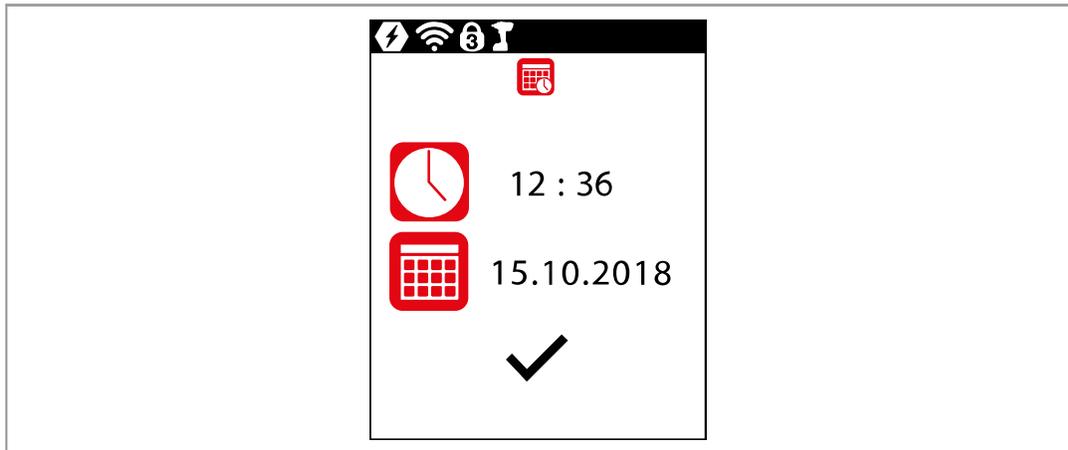


Fig. 3-14: Submenu – Setting the date and time

Button	Description
	Display of the currently selected menu: Set date and time
	Time display Presentation: Hour : Minute
	Display of the date Presentation: Day.Month.Year
	Save time and date.

Change date or time

- Select the date or time and press the  button.
- Enter the hour and minutes or the day, month and year separately.
 - Use the  and  buttons to increase/decrease the numbers.
 - Use the  and  buttons to switch between the input boxes.
- Confirm with the  button.
 - After the changes have been made, the input is checked. If the input is permissible, the input box is highlighted in green and the checkmark turns black. If the input is not permissible, the input box is highlighted in red and must be changed.
- To save the changes, press .
 - After saving, the menu is exited.
 - To exit the menu without saving the changes, press and hold .

3.7.2 Adjusting the screen brightness

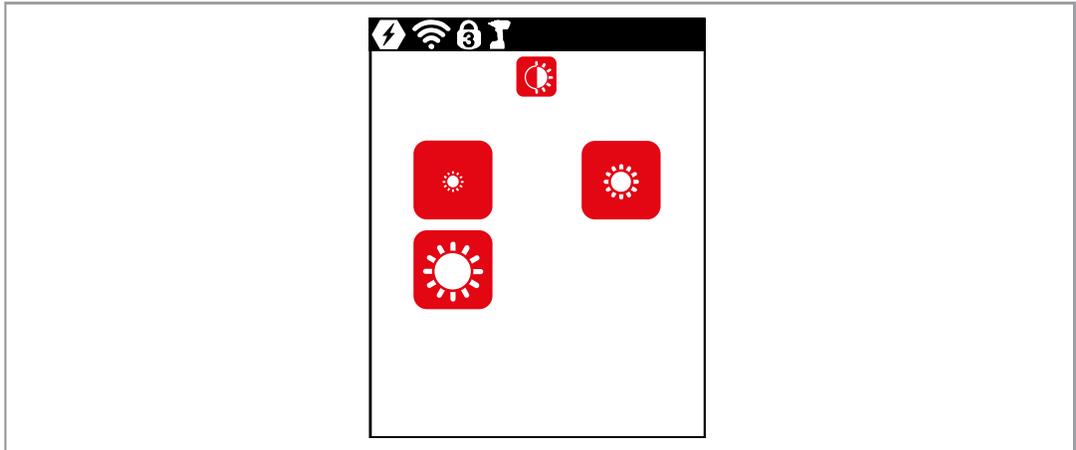


Fig. 3-15: Submenu – Screen brightness

Button	Description
	Brightness Level 1: The LCD is dark and dimly lit.
	Brightness Level 2: The LCD has medium illumination. This is the default setting that is used when none of the buttons are selected (outlined in green).
	Brightness Level 3: The LCD is brightly lit.

3.7.3 Adjusting the tool light

This menu is only available in the FastApps mode. The tool light illuminates the tightening position.

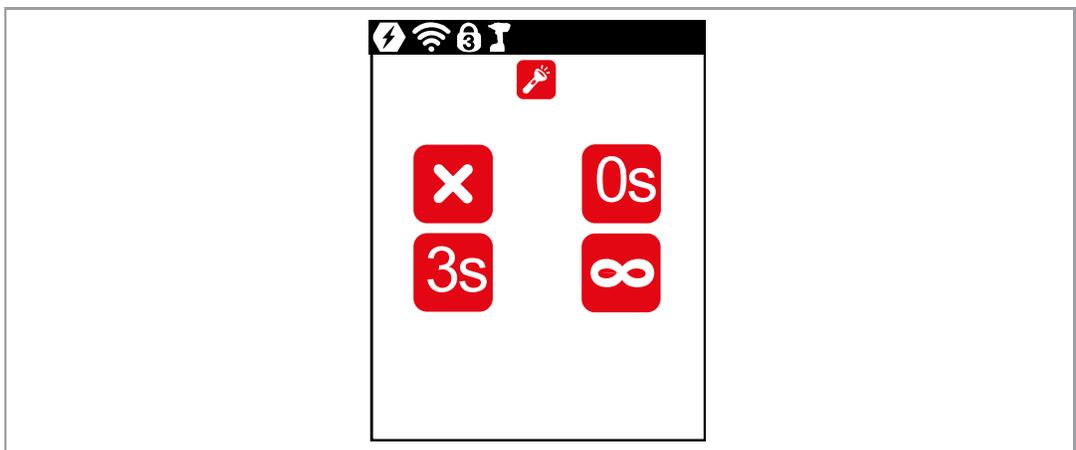


Fig. 3-16: Submenu - Adjusting the tool light

Button	Description
	Tool light disabled. Tool light never goes on.
	Tool light will only go on when the Start switch is pressed halfway. During tightening, it is switched off.
	Tool light is on as long as the Start switch is pressed halfway. If the Start switch is pressed all the way, the tool light will go on for three seconds before it switches off.
	Tool light is on as long as the Start switch is pressed. Tool light is on during the tightening process until the Start switch is released.

3.7.4 Setting the shut-off properties

This menu is only available in the FastApps mode. In the mPro mode, the values can only be changed via the controller.

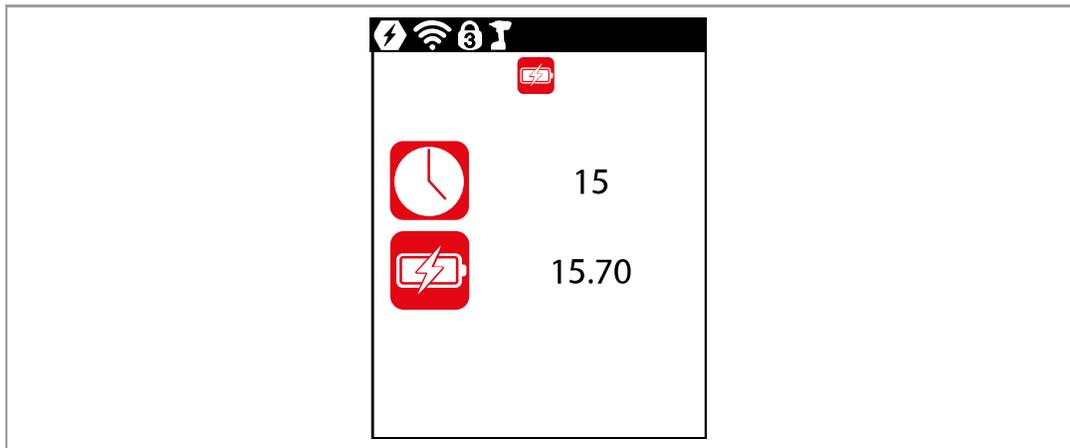


Fig. 3-17: Submenu – Setting the shut-off properties

Button	Description
	Shutoff after idle mode. Enter the time in minutes after which the tool switches off if no button or key has been pressed.
	The undervoltage limit indicates when a battery change is necessary. If the battery voltage falls below the defined value, a gray battery symbol flashes on the display and the same symbol appears in the header.

3.7.5 Selecting the torque units

The torque values on the run screen are displayed in the selected units. The selection is also used for the data export.

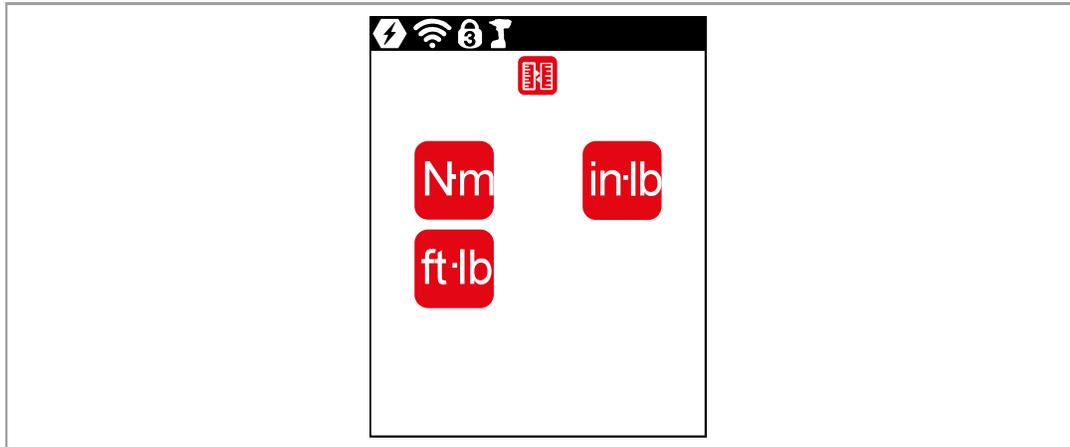


Fig. 3-18: Submenu – Selecting units

Button	Description
	Units Newton-meters
	Units inch-pounds
	Units foot-pounds

3.7.6 Setting the PIN

Up to three PINs for three access levels can be defined. With the access levels, different menus can be available. If a PIN is defined, then the menus can be opened. However, changes can only be made after entering the required PIN.

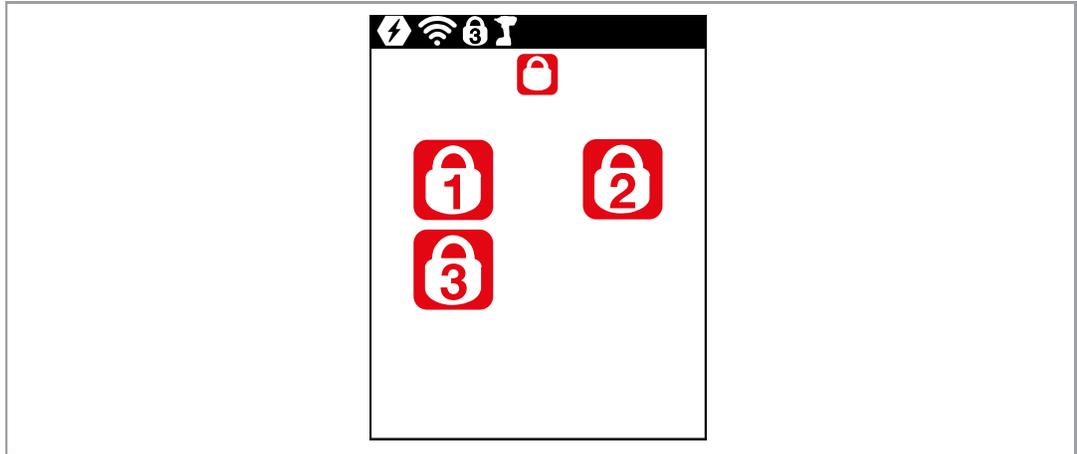


Fig. 3-19: Submenu – PIN menu

Button	Description
	Access Level 1 Valid for the menu:
	Access Level 2 Valid for the menu:
	Access Level 3 Valid for the menu:

If only one PIN is defined, then it applies to all the access levels. PINs for higher access levels also apply to the lower access levels.

	PIN 1	PIN 2	PIN 3
Access Level 1	x	x	x
Access Level 2		x	x
Access Level 3			x

Example:

The following PINs are defined: PIN 1: 1111 PIN 2: 2222 PIN 3: 3333

If asked for PIN 2, both PIN 2 (2222) and PIN 3 (3333) can be entered to access a menu. However, PIN 1 (1111) is invalid.

Entering a PIN

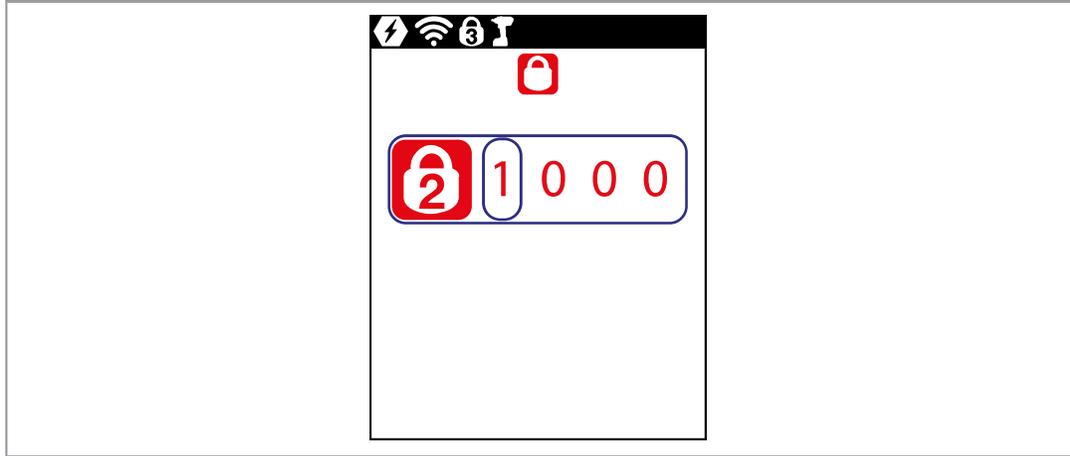


Fig. 3-20: Submenu – Entering a PIN

If a PIN is activated, a lock symbol appears in the header and on the respective menu. The number on the lock symbol in the header **1** indicates the current access level. If a PIN for a higher access level is required to open a menu, then a lock symbol is also displayed on the respective menu. To open these menus, a PIN must be entered.

Enter a PIN (a PIN consists of four numbers)

1. Enter four numbers. The number on the lock indicates which PIN must be entered.
 - Use the and buttons to increase/decrease the numbers between 0 and 9.
 - Use the and buttons to switch between the four input boxes.
2. Confirm the PIN with the button.
 - The PIN is highlighted in green: PIN is correct
 - The PIN is highlighted in red: PIN is incorrect

After unlocking, the tool will lock again if no action is taken for two minutes or if a switch is made to the run screen.

Changing a PIN

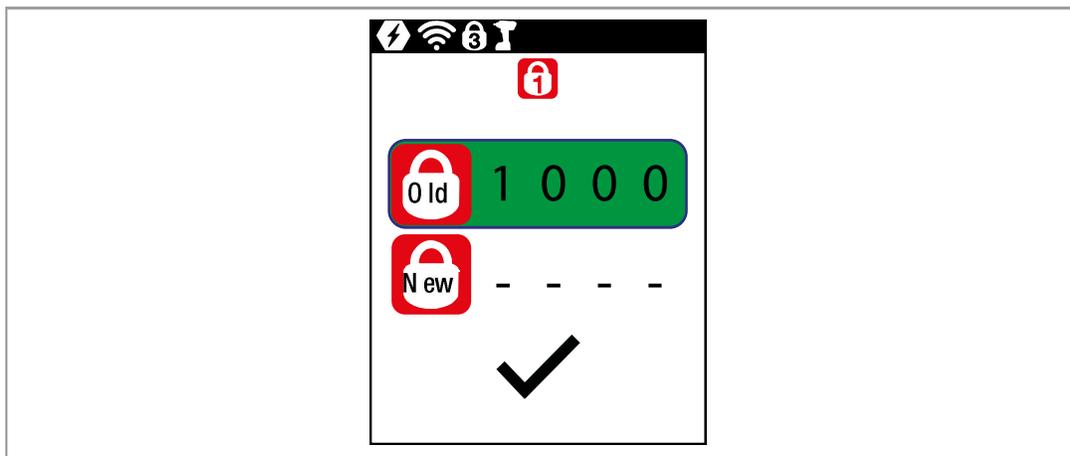


Fig. 3-21: Submenu – Changing a PIN

Button	Description
	Entering an old PIN.
	Entering a new PIN.
	<p>Saving a PIN.</p> <p>After a PIN is entered, the background color of the input box and the checkmark changes:</p> <ul style="list-style-type: none"> • Red: The input of the old PIN is incorrect. The change can not be saved. • Green: The input is permissible. The change can be saved.

Change a PIN

1. Navigate to *Changing a PIN*  >  and select one of the three access levels   
2. Press the  button to activate the input box. The numbers are entered individually.
3. For , enter the old PIN. If no PIN was previously defined, enter 0000.
4. For , enter the new PIN. The PIN must not be 0000.
5. save the PIN, press .
 - The new PIN is activated and the menu is exited.

Deactivating a PIN

- ▶ For , enter 0000 to deactivate a PIN.

3.7.7

Locking a menu

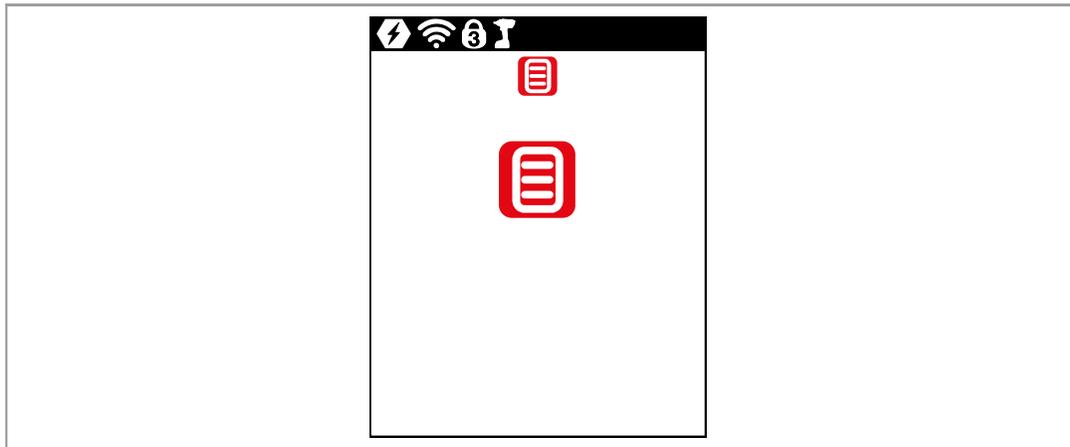


Fig. 3-22: Submenu – Locking a menu

Button	Description
	Lock activated. To open the main menu from the run screen, a PIN must be entered. Unlocking is possible with each access level. The requirement is that a PIN has already been defined.
	PIN lock disabled. All menus can be opened without entering a PIN.

3.7.8 Allowing a Linking group/FastApp selection

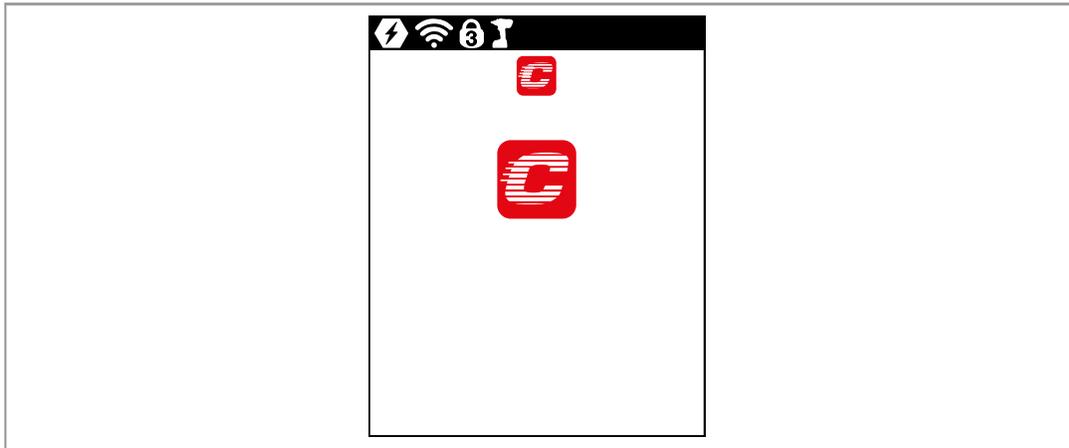


Fig. 3-23: Submenu – Allowing a Linking group/FastApp selection

Button	Description
	Lock activated. Requirement: A PIN must be activated. To switch to another Linking group/FastApp from the run screen, a PIN must be entered. The functionality of the Start switch is not restricted.
	Lock disabled. Switching between all the parameterized Linking groups/FastApps can be carried out in the run screen. There is no need to enter a PIN.

3.8 Diagnostics

	⚠ Caution
	<p>Winding hazard The rotation of the output can cause severe finger injuries.</p> <ul style="list-style-type: none"> ▶ Never reach into the rotating parts of the tool. ▶ Make sure that the rotation of the tool does not pose any danger. ▶ Do not perform diagnostic tests on the workpiece. Perform the test with a freely rotating tool.

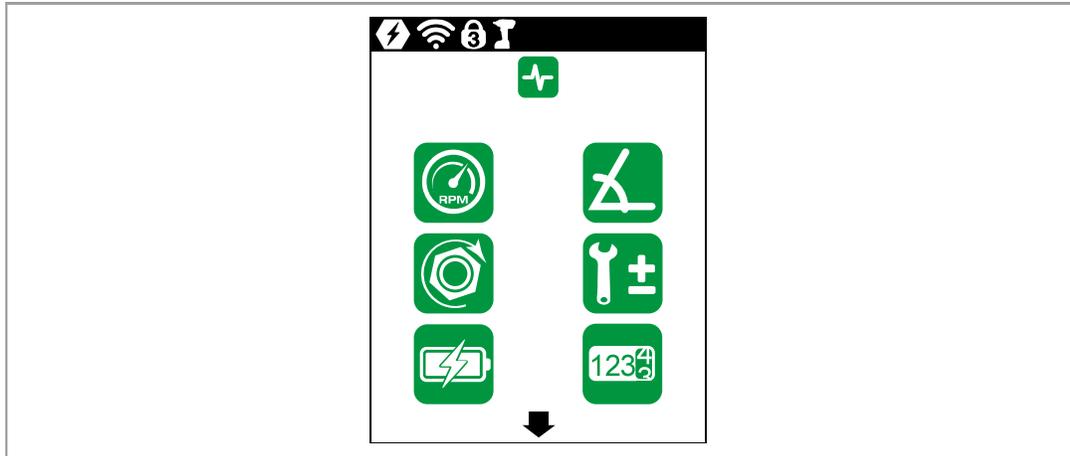


Fig. 3-24: Menu – Diagnostics

Button	Description
	Speed test
	Angle test
	Torque test
	Calibration value
	Voltage
	Counters status
	Tool constant

3.8.1 Speed test

This test function enables an evaluation of the speed.

The speed measurement is based on the angle information from the motor. If the start button is released, the tool stops. As a safety function, the torque is monitored by the tool transducer. If it exceeds 15% of its calibrated value, the speed measurement is terminated.

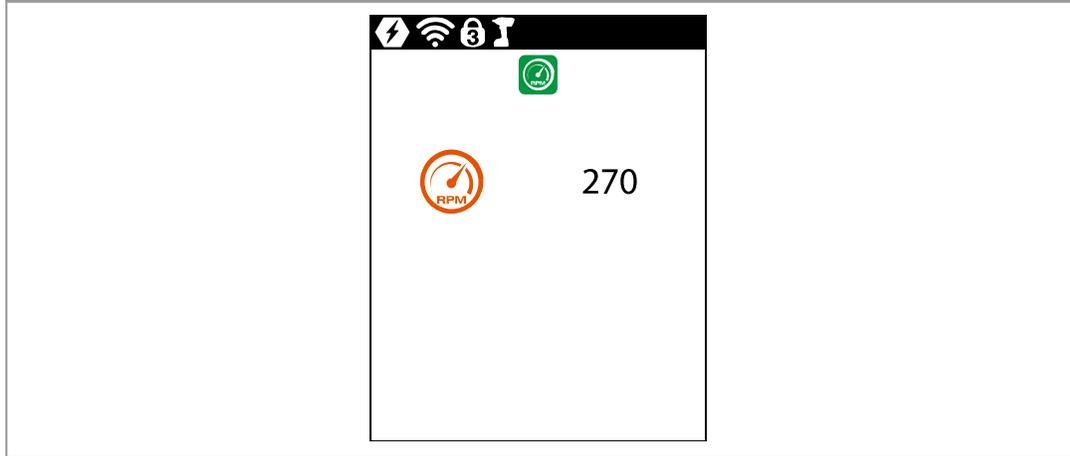


Fig. 3-25: Submenu – Speed test

Symbol	Description
	<ul style="list-style-type: none"> ▶ Keep the Start switch pressed. ➤ The tool runs at maximum speed. ➤ The current speed is displayed.

3.8.2 Angle test

This test function allows an evaluation of the angle measurement.

By using the Start button, the tool starts with 25% of the maximum speed. The speed is limited to a maximum of 60 rpm. After one revolution at the output (target angle 360°), the tool is stopped. During a fixed dwell time of 200 ms, any possible angular pulses are still detected. The total result is shown as the Actual Angle.

If the test run is not aborted by a monitoring criterion and the total result is greater than or equal to 360°, then it is evaluated as OK and displayed. Monitoring criteria are the torque and a monitoring time.

If the torque exceeds 15% of the calibration value (even during the dwell time), or if the monitoring time lasts four seconds, then the test run is aborted with an Tq> or TMAX evaluation. However, you must check for yourself whether the output has rotated by the displayed value (e.g., make a mark).



Make sure that the output shaft has rotated by the indicated number of revolutions (e.g., by marking its position). If the rotation made by the output shaft does not match the displayed value, either an incorrect angle factor has been set or the angle sensor is defective.

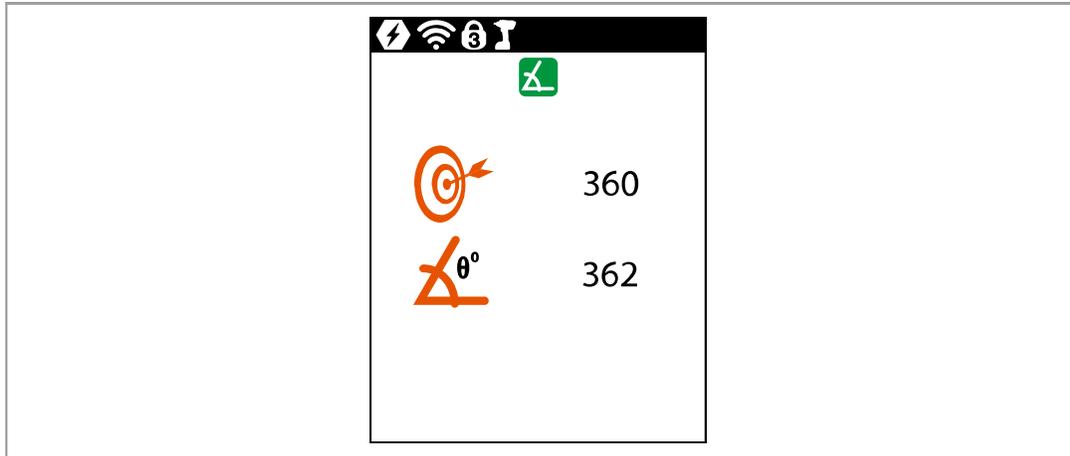


Fig. 3-26: Submenu – Angle test

- To start the tests, keep the start trigger pressed.

Symbol	Description
	Display of the shut-off angle of 360°.
	Display of the angle. The displayed angle should be close to 360°.

3.8.3

Torque test

With the torque test, the functionality of the measuring sensor can be checked, and the torque measurement can be evaluated.

At the beginning of the test, the torque is 0 Nm. Throughout the entire test, the torque is measured and displayed.

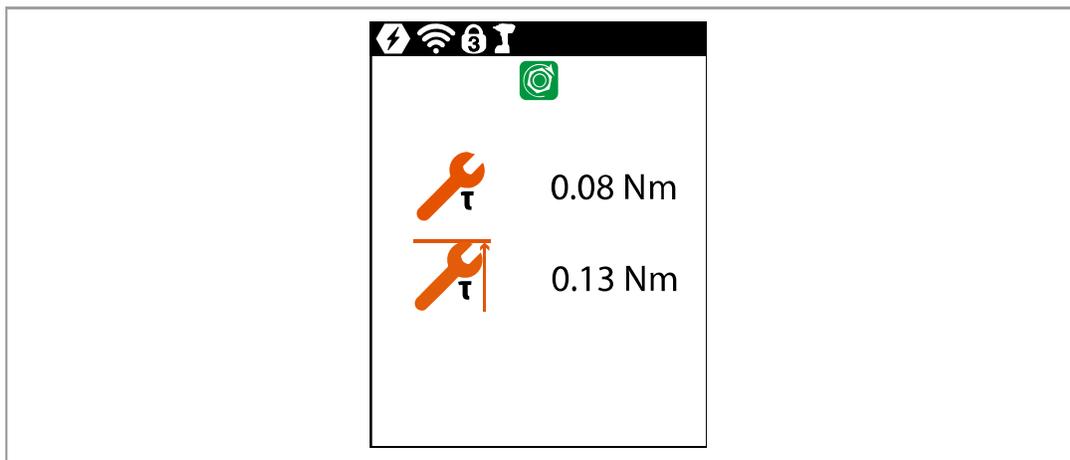


Fig. 3-27: Submenu – Torque test

- To start the tests, keep the start trigger pressed.

Symbol	Description
	Display of the current torque.
	Display of the maximum torque.

3.8.4 Calibration value

This test function allows an evaluation of the calibration voltage.

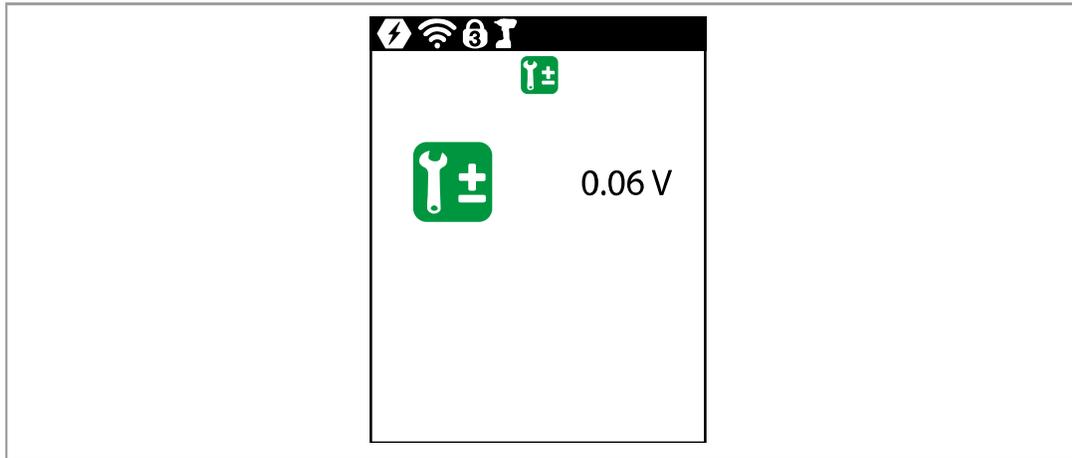


Fig. 3-28: Submenu – Calibration value

Symbol	Description
	<p>Display of the neutral position value for the measuring sensor.</p> <p>The displayed value should be at 0 V. The tolerance limits are ± 0.2 V.</p>

3.8.5

Voltage

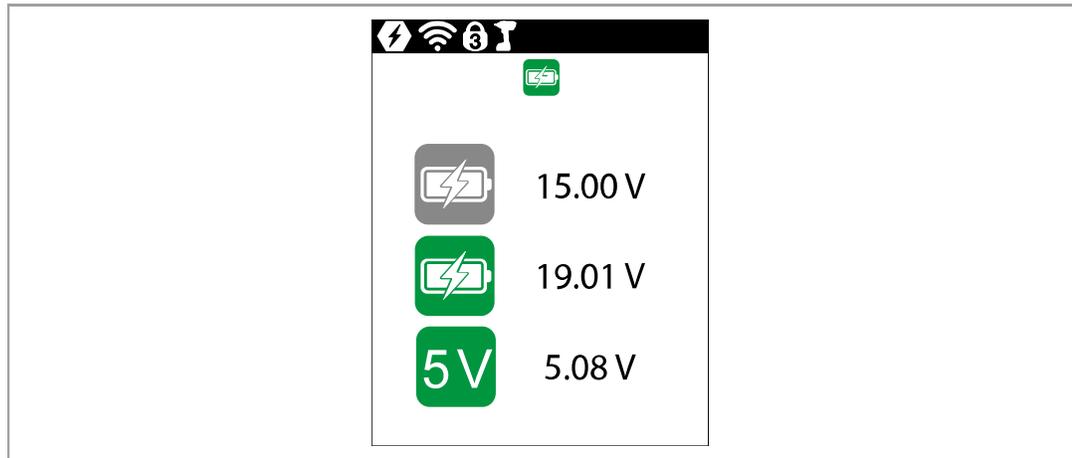


Fig. 3-29: Submenu – Voltage

Symbol	Description
	<p>Display of the undervoltage limit.</p> <p>This limit can be set in the menu <i>Setting the shut-off properties</i>.</p>
	<p>Display of the current battery voltage.</p> <p>For high operational capability, this voltage is continuously monitored during the tightening process. If the voltage drops below the undervoltage, a warning is issued on the tool, see <i>chapter 3.7.4 Setting the shut-off properties, page 28</i>.</p>
	<p>Display of the logic voltage of 5 V.</p> <p>A voltage for components that are not needed for the core functions of the tool. The tolerance limits are $\pm 5\%$.</p>

3.8.6

Counters status

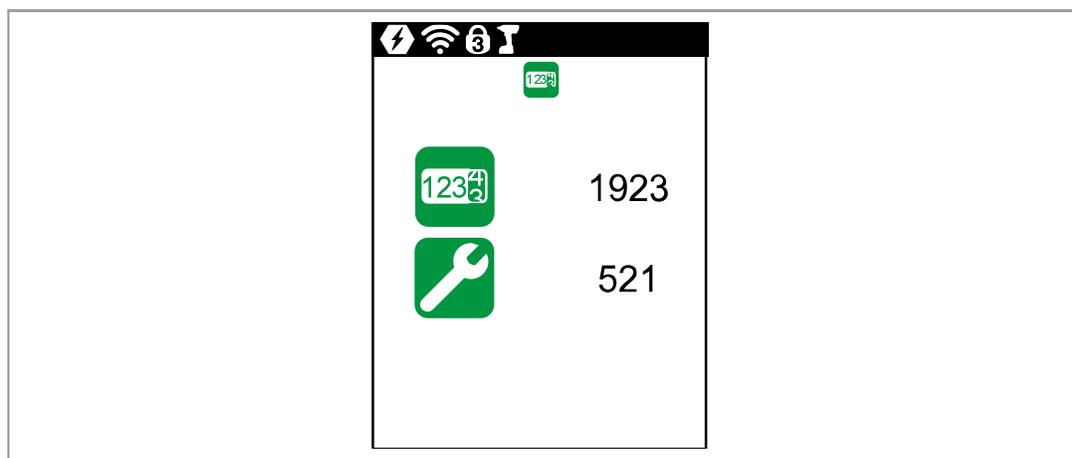


Fig. 3-30: Submenu – Number of tightenings

Symbol	Description
	Display of the number of all previous tightenings.
	Display of the number of all tightenings since the last service.

3.8.7 Torque calibration value

In Torque calibration value, the torque calibration value of the tool can be adjusted. This may be necessary if the torque of the tool changes due to wear.

This menu is only available in the FastApps mode. In the mPro mode, the menu is hidden.

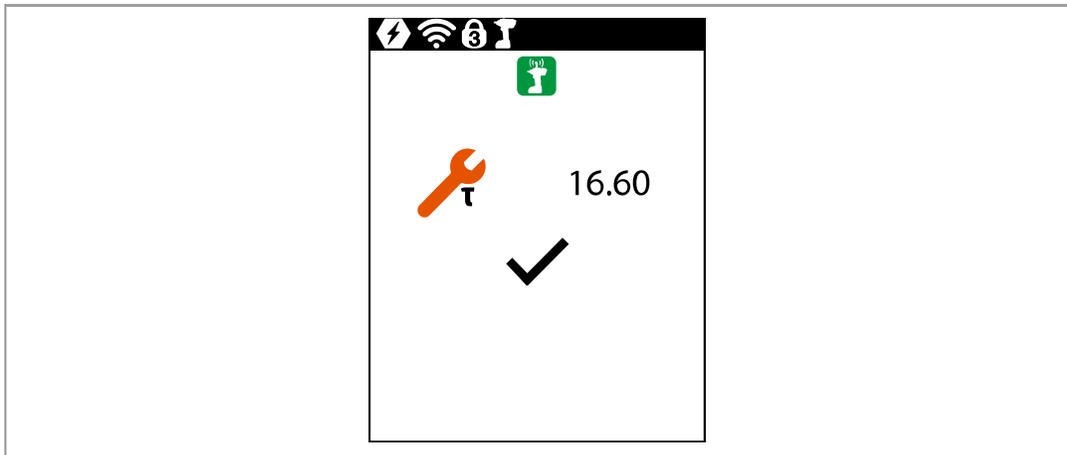


Fig. 3-31: Submenu – Torque calibration value

Button	Description
	Display of the torque calibration value. The tool constant can be changed by $\pm 20\%$.
	To prevent unintentional changes to the tool constant, every change must be confirmed. ▶ Press to confirm a torque calibration value change.

Change the torque calibration value

- To activate the input box, select .
- Increase/decrease the torque calibration value with the  and  or  and  buttons.
- To confirm the change, press .
 - The checkmark is highlighted in green.
 - The tool constant is saved.
 - The *Torque calibration* menu is exited.

To not save a torque calibration value change, exit the menu with the  button.

3.9 WLAN communication

In this menu, information about the WLAN connection is to be found. To configure WLAN settings, use the *Cordless RF Configuration* software. See document *P2372JH*.

If the tool is programmed so that WLAN settings are assigned via DHCP, this will appear to the right near the "-" symbol as long as no connection could be established.

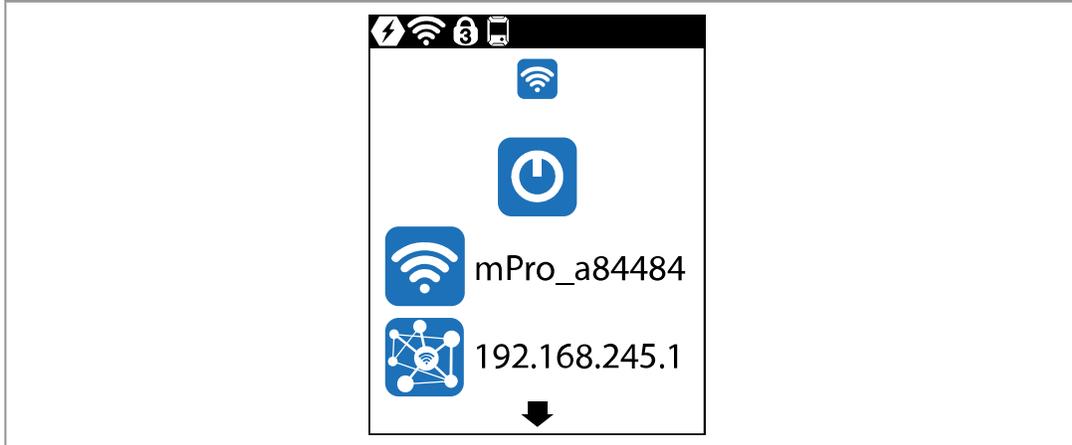


Fig. 3-32: Menu – Communications

Button	Description
	WLAN connection is activated.
	WLAN connection is deactivated. ➤ All WLAN settings are hidden.
	SSID display.
	IP address display. If the IP address is assigned twice, the symbol is displayed in the run screen.. ▶ Then change the IP address.
	Network mask display.
	Gateway display.
	MAC address display.

Button	Description
	Signal strength in [dBm] display.
	EAP-TLS certificate display. The symbol is only displayed if EAP-TLS encryption is enabled.
	Region display.

3.9.1 Activating/deactivating WLAN connection

This menu is displayed when the WLAN connection is to be activated or deactivated.

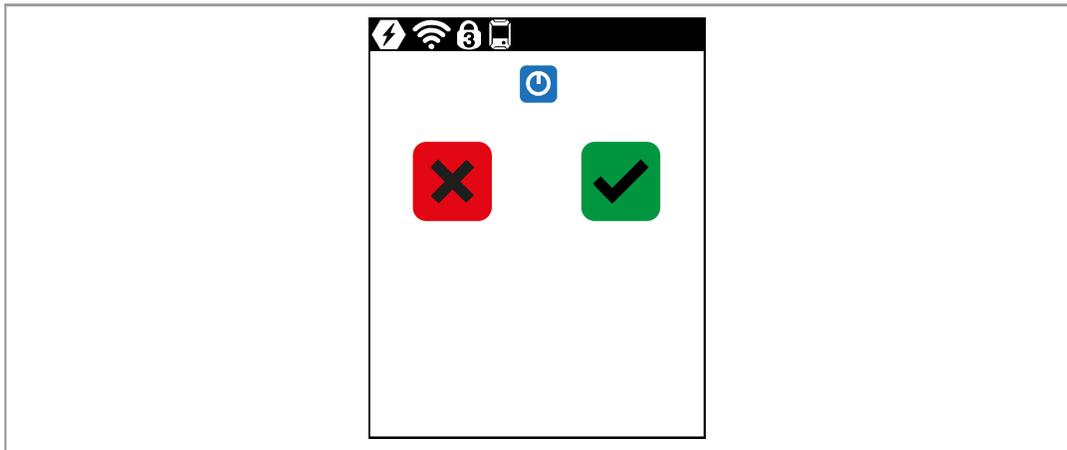


Fig. 3-33: Submenu – Activating/deactivating WLAN connection

Button	Description
	<ul style="list-style-type: none"> ▶ Press to cancel the process. ➤ The WLAN connection is not activated/deactivated. ➤ The <i>Activating/deactivating WLAN connection</i> menu is exited.
	<ul style="list-style-type: none"> ▶ Press to activate/deactivate the WLAN connection. ➤ The WLAN connection is activated/deactivated. ➤ The <i>Activating/deactivating WLAN connection</i> menu is exited.
	A simultaneous WLAN and Bluetooth connection is not possible. As soon as the WLAN connection is activated, the tool disconnects the Bluetooth connection.

3.9.2 Installing EAP-TLS certificate

The EAP-TLS certificate is used for WLAN encryption.



Setting up the EAP-TLS certificate on the tool

- Installing an EAP-TLS certificate on the tool. There are two ways to do this:
 - Installation via software update on the tool:
Using the *LiveWire Cert* software to create a *.tma file from the EAP-TLS certificate and perform a software update, see [chapter 3.11.7 Carry Out a Software Update, page 56](#).
 - Installation via external software:
Install the EAP-TLS certificate to the tool via a *.tma file. Use the *LiveWire Cert* software for this, see document [P2521JH](#).
- Parameterize EAP-TLS encryption on the tool. Use the *Cordless RF Configuration* software for this, see [P2372JH](#). Configure the following WLAN settings and transfer them to the tool with <Apply>:

Parameter	Description
SSID	Enter the SSID of the WLAN network name.
Encryption	Select an 802.1x EAP-TLS encryption.
Username	Enter the username and password of the WLAN infrastructure. If not required, enter any username and password. The entry has no effect on the WLAN settings. The WLAN settings cannot be transferred to the tool if these input fields are empty.
Password	
Confirm password	

As soon as the EAP-TLS encryption is parameterized, the symbol  is displayed. The date until the EAP-TLS certificate file is valid, is displayed next to the symbol. The background color of the date indicates its status:

Color	Display	Description
White	Date	The certificate is valid. A WLAN connection to the network is possible.
White	„-“	The date of the certificate is invalid, e.g. 31.02.2020.
Yellow	Date	The expiration date has passed and the certificate is no longer valid. A WLAN connection to the network is not possible.
Red	„-“	802.1x EAP-TLS encryption has been configured via the <i>Cordless RF Configuration</i> software, but no certificate has been installed yet.

An EAP-TLS certificate file cannot be uninstalled or transferred to another tool. The EAP-TLS certificate file can only be deleted if the tool is reset to the factory settings.

To use a newer certificate file, install it on the tool. The tool always uses the certificate file with the newest date.

3.10 Bluetooth communication

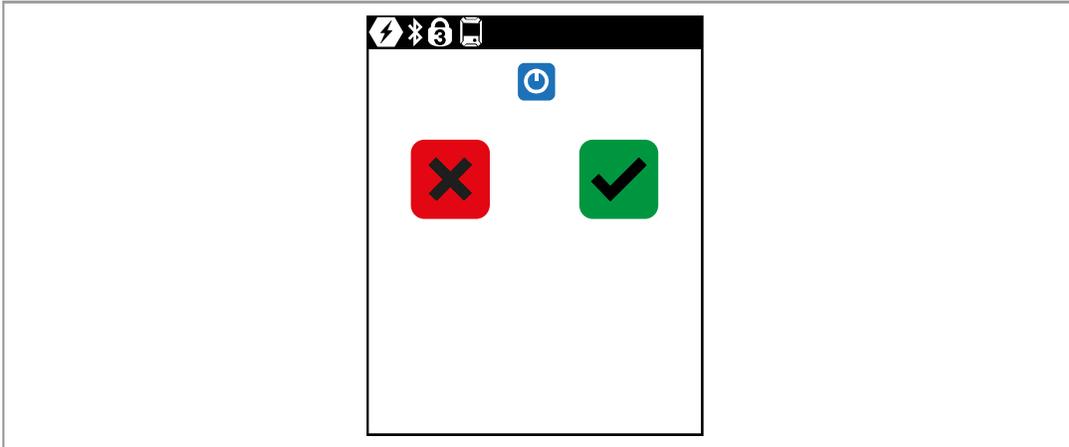


Fig. 3-34: Menu – Bluetooth communication

Button	Description
	Bluetooth is activated. <ul style="list-style-type: none"> ➤ All buttons of the Bluetooth menu turn blue.
	Bluetooth is deactivated. <ul style="list-style-type: none"> ➤ All Bluetooth settings are greyed out. ➤ " - " is displayed right next to the symbols.
	Scanning Bluetooth devices and establishing a Bluetooth connection.
	Display active Bluetooth connection and disconnect Bluetooth connection. <ul style="list-style-type: none"> ➤ The MAC address or the name of the controller is displayed with which the tool is connected via Bluetooth.
	Select the node number. <ul style="list-style-type: none"> • The IP address ranges from 192.168.245.101 to 192.168.245.107 and depends on the node number. Example: Tool 3 has the IP address 192.168.245.103. • Ensure that each node number is assigned only once. <p>Up to seven node numbers can be assigned:</p> <ol style="list-style-type: none"> 1. Press the button to activate the input field. 2. Use the arrow keys to increase/decrease the node number. 3. Confirm with the button. <ul style="list-style-type: none"> ➤ If the node number is assigned twice, the field is highlighted in yellow and the symbol is displayed in the run screen. In this case, change the node number.
	MAC address display of the Bluetooth module.

3.10.1 Activating/deactivating Bluetooth

This menu is displayed when Bluetooth is to be activated or deactivated.

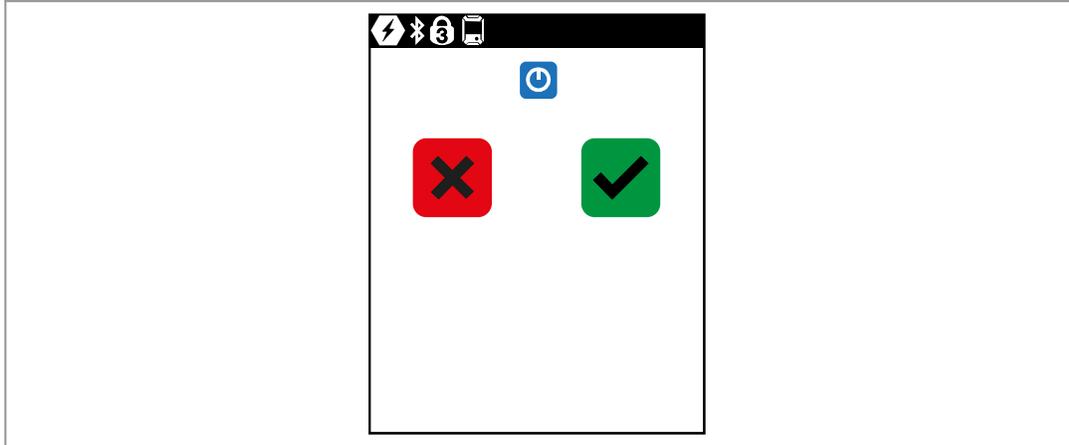


Fig. 3-35: Submenu – Activating/deactivating Bluetooth

Button	Description
	<ul style="list-style-type: none"> ▶ Press to cancel the process. ➤ The Bluetooth connection is not activated/deactivated. ➤ The <i>Activating/deactivating Bluetooth</i> menu is exited.
	<ul style="list-style-type: none"> ▶ Press to activate/deactivate the Bluetooth connection. ➤ The Bluetooth connection is activated/deactivated. ➤ The <i>Activating/deactivating Bluetooth</i> menu is exited.
	<p>A simultaneous WLAN and Bluetooth connection is not possible. As soon as the Bluetooth connection is activated, the tool disconnects the WLAN connection.</p>

3.10.2 Scanning Bluetooth devices

The scan will continue as long as the menu is open.

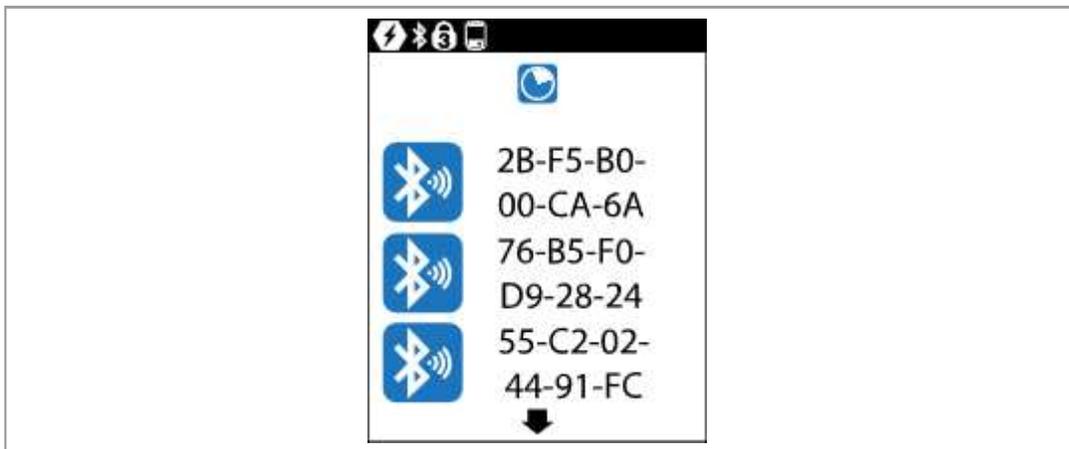


Fig. 3-36: Submenu – Scanning Bluetooth devices

Symbol	Description
	<p>List of all devices detected during scanning.</p> <ul style="list-style-type: none"> All devices with which a Bluetooth connection is possible are displayed. The tool can only connect to a controller of the mPro200GC-AP series. Each device is displayed with an icon and the MAC address or name of the device. The controller to which the tool is already connected is highlighted in green in the list. <p>To establish a Bluetooth connection, select a controller and confirm with the  button, see document P2402KA for details.</p> <ul style="list-style-type: none"> Yellow background: Connection establishment is ongoing. Green background: Bluetooth connection has been established. Red background: Bluetooth connection failed.
	<p>Waiting time until a device is found during the scanning process.</p>

3.10.3 Disconnect Bluetooth connection

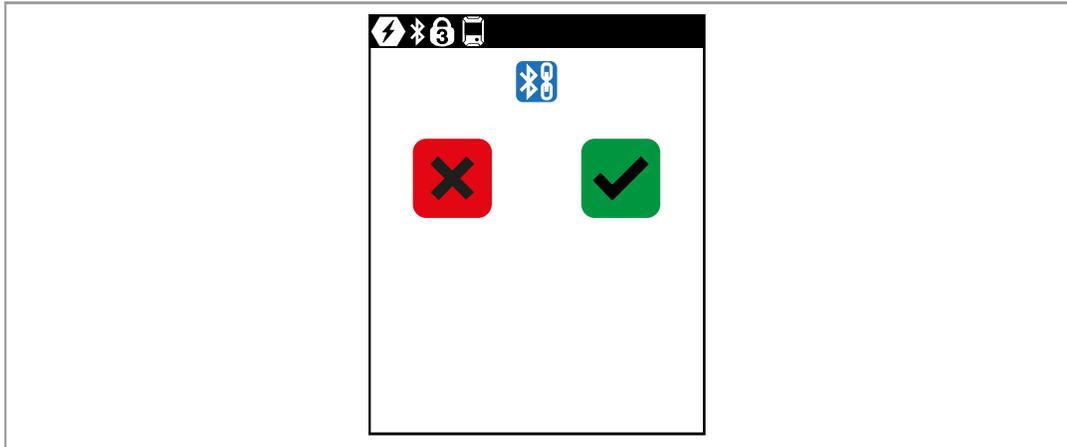


Fig. 3-37: Submenu – Disconnect Bluetooth connection

Button	Description
	<ul style="list-style-type: none"> Press to cancel the process. The Bluetooth connection to the device is not interrupted. The <i>Disconnect Bluetooth connection</i> menu is exited.
	<ul style="list-style-type: none"> Press to disconnect the Bluetooth connection. The Bluetooth connection to the device is interrupted. The <i>Disconnect Bluetooth connection</i> menu is exited.

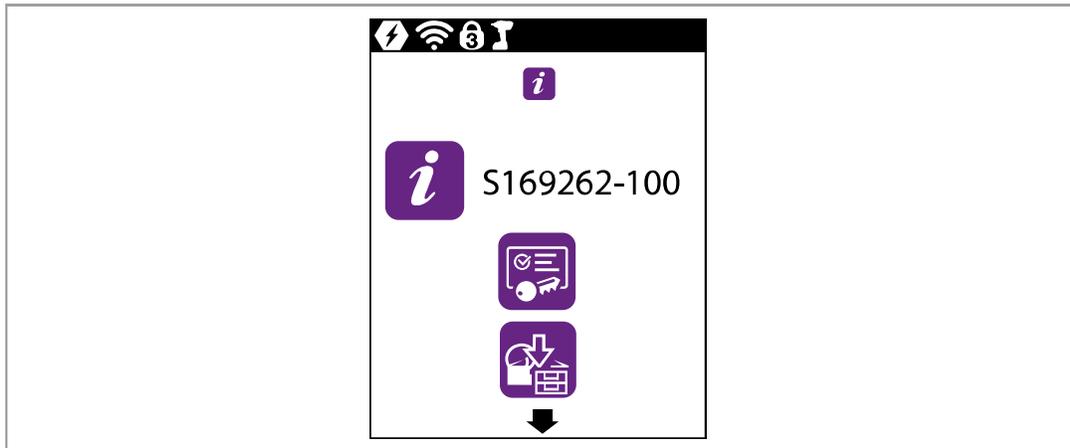


Fig. 3-38: Menu – Utility

Button	Description
	Display of the software versions.
	Save archive.
	Save torque graph.
	Load parameters.
	Save parameters.
	Software update.
	Delete archive.
	Reset to factory settings.

Button	Description
	Switch off tool.

3.11.1 Displaying the software version

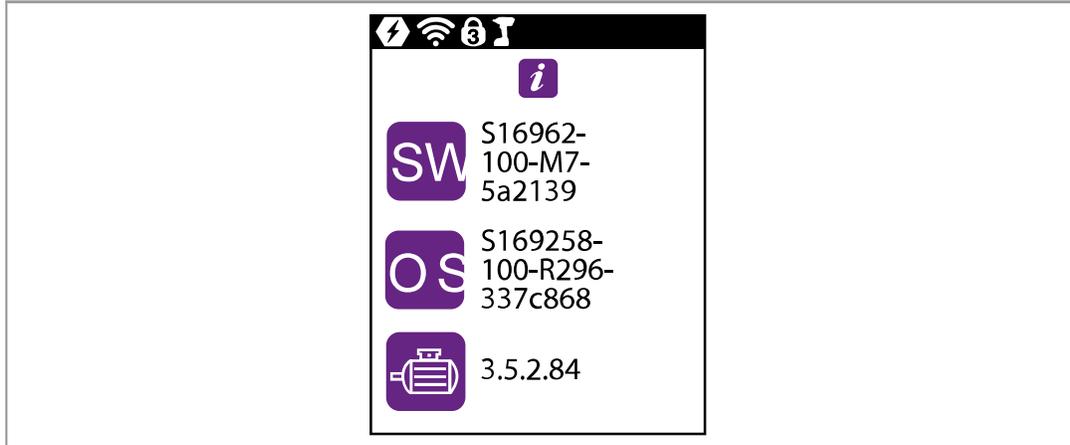


Fig. 3-39: Submenu – Displaying the software version

Symbol	Description
	Display of the software version for the measuring board.
	Display of the software version for the operating system.
	Display of the software version for the servo.

3.11.2 LiveWire API license

With the LiveWire API license the tool can be programmed and operated via software S168684 (optionally available). A controller is not required for this.

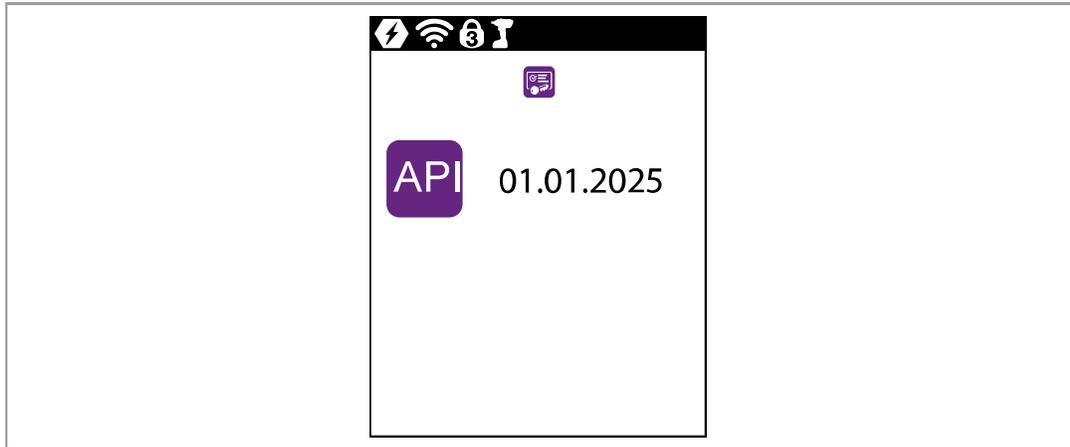


Fig. 3-40: Submenu – Show LiveWire API license

Symbol	Description		
	In the license menu all available licenses are displayed with an expiration date. The background color of the date indicates the status:		
	Color	Display	Description
	White	Date	The license is invalid.
	White	„-“	The date of the license is invalid, e.g. 31.02.2020.
	White	31.12.9999	This date is displayed if there is no expiration date.
Yellow	Date	The expiration date has passed and the license is no longer valid.	

Installing LiveWire API license

The LiveWire API license is an *.xml file that is installed on the tool like a software update.

1. Save the LiveWire API license on a USB stick and perform a software update, see *chapter 3.11.7 Carry Out a Software Update, page 56*.
2. After installation, restart the tool.

Uninstalling the LiveWire API license

A LiveWire API license cannot be uninstalled or transferred to another tool. The LiveWire API license can only be deleted if the tool is reset to factory settings.

To use a newer license, install it on the tool. The tool always uses the license with the newest date.

3.11.3 Saving an archive

This menu is only available in the FastApps mode. In the mPro mode, no archive data are recorded on the tool.

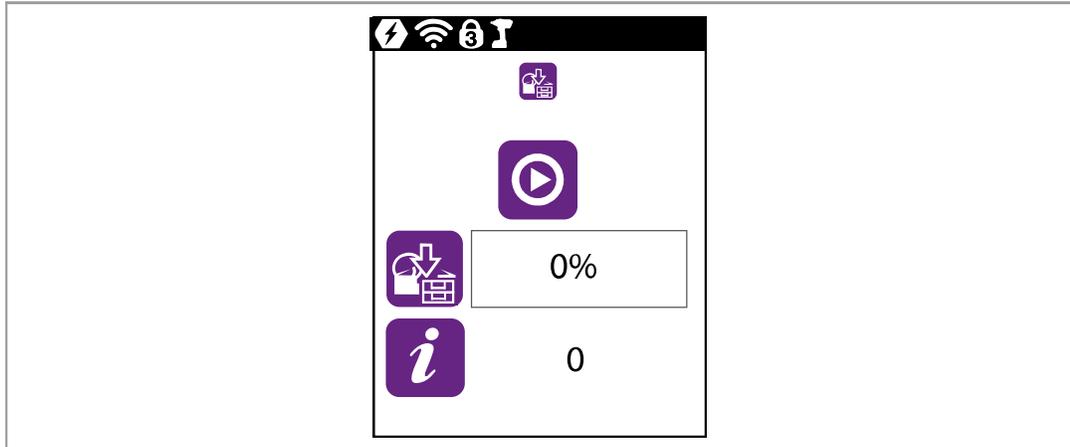


Fig. 3-41: Submenu – Saving an archive

Button	Description
	Start the saving process.
	Display of the saving progress. The status bar indicates what percentage of the archive is already saved.
	Display of the status of the saved archive. After saving, the status bar is red or green: <ul style="list-style-type: none"> Green: The saving process has been successfully completed. There is an "OK" in the status line. Red: An error occurred during the saving process, see <i>chapter Error messages, software updates and data storage, page 62</i>.
	Displays how the decimal place of the torque is indicated.

Save the archive

1. Connect the USB stick with the tool via the Micro B USB cable.
2. Select > .
3. must be pressed to start the saving process.
 - The progress bar and status bar indicate when the archive is saved.
 - A *.csv file is generated.

A *.csv file contains a table with the following columns:

Column	Description
Record No.	Sequential number of archive entries/results

Column	Description
Date	Date
Time	Time
App	Number of the FastApp
Step	Number of the linking/batch display
Tq	Torque
TqMin	Minimum Torque
TqMax	Maximum Torque
PTq	Peak torque
Angle	Angle
AngleMin	Minimum angle
AngleMax	Maximum angle
Evaluation	Evaluation of the result. Either OK or NOK is entered.
Stage	Fastening stage
Reason	Shut-off cause, <i>see chapter 5.1 Error messages, page 61.</i>
GraphicID	Number of the graphic entry.

Select separator

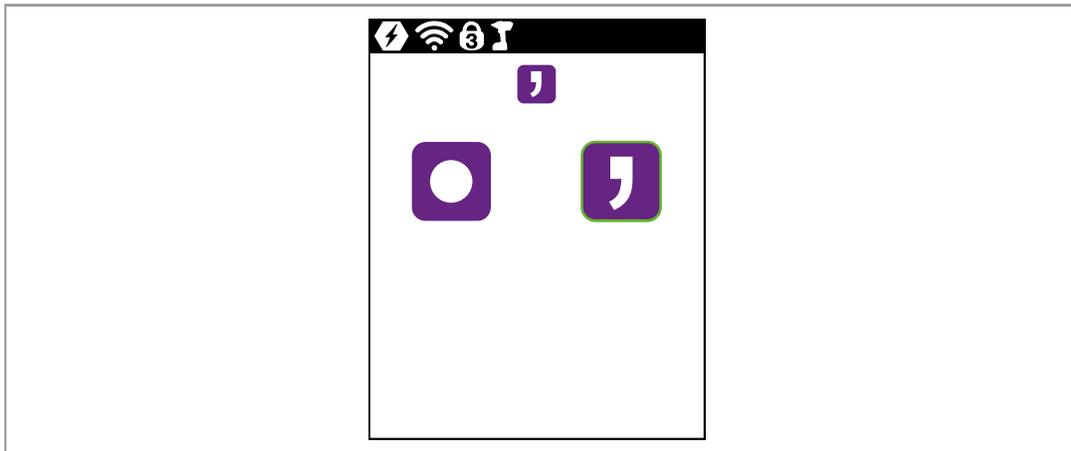


Fig. 3-42: Submenu – Select separator

Button	Description
	For torque, the decimal place is separated with a point.
	For torque, the decimal place is separated with a comma.

3.11.4 Saving a torque graph

This menu is only available in the FastApps mode. In the mPro mode, no torque graph is recorded on the tool.

The torque graph shows how the torque increases over the course of a tightening.

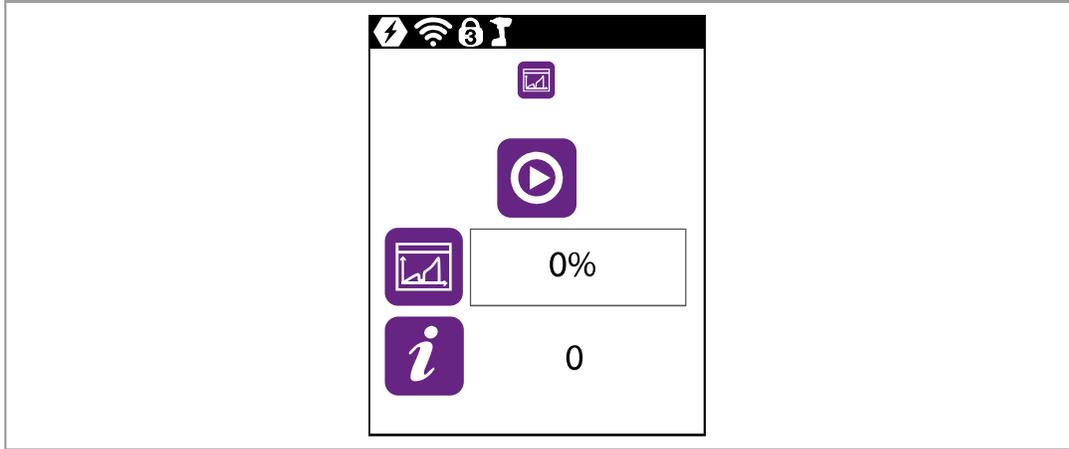


Fig. 3-43: Submenu – Saving a torque graph

Button	Description
	Start the saving process.
	Display of the saving progress. The status bar indicates what percentage of the torque graphs are already saved.
	Display of the status of the saved torque graphs. After saving, the status bar is red or green: <ul style="list-style-type: none"> Green: The saving process has been successfully completed. There is an "OK" in the status line. Red: An error occurred during the saving process, see chapter Error messages, software updates and data storage, page 62.
	Displays how the decimal place of the torque is indicated.

Save torque graph

1. Connect the USB stick with the tool via the Micro B USB cable.
2. Select > .
3. must be pressed to start the saving process.
 - The progressbar and status bar indicate when the archive is saved.
 - A folder is created that contains a *.csv and *.svg file. The name of the folder shows the date and time when the export was performed: *graphic_year_month_day_hour_minute_second*

csv file

In the *.csv file, the angle, time, torque and speed are entered for each data point. The name of the *.csv file contains the date and time when the result was recorded. The ID in the file name corresponds to the *GraphicID* column from the table of the archive, see *chapter 3.11.3 Saving an archive, page 49*. In this way, each graphic can be assigned to a measurement result from the archive:

graphic_ID_year_month_day_hour_minute_second.csv

The *.csv file contains a table with the following columns:

Column	Description
Type	Tool type with which the tightening was done
Serial	Serial number of the tool
Date	Date of export: Day.Month.Year
Time	Time of export: Hour:Minute:Second
Application	Number of the FastApp
GraphicID	Number of the graphic entry. The number is identical to the <i>GraphicID</i> for the archive.
Size	Number of graphic points
Torque low [Nm]	Minimum Torque
Torque high [Nm]	Maximum Torque
Torque [Nm]	Shut-Off Torque
Angle low [deg]	Minimum Angle
Angle high [deg]	Maximum Angle
Angle [deg]	Shut-Off Angle
Target	Switch-Off value, depending on the selected tightening strategy the unit is [Nm] or [deg].
Shutoff reason	Shut-Off reason
Angle [deg]	Angle
Time [ms]	Time
Torque 1 [Nm]	Torque
Torque 2 [Nm]	Torque (redundancy)
Current [A]	Current
Speed [RPM]	Speed

svg file

In the *.svg file, the data points of the *.csv file are displayed graphically. The name of the *.svg file contains the date and time when the result was recorded. The ID in the file name corresponds to the *GraphicID* column from the table of the archive, see *chapter 3.11.3 Saving an archive, page 49*. In this way, each graphic can be assigned to a measurement result from the archive:

graphic_ID_year_month_day_hour_minute_second.svg

The scaling of the axes depends on the measured values. The graphic recording ends when the switch-off values have been reached.

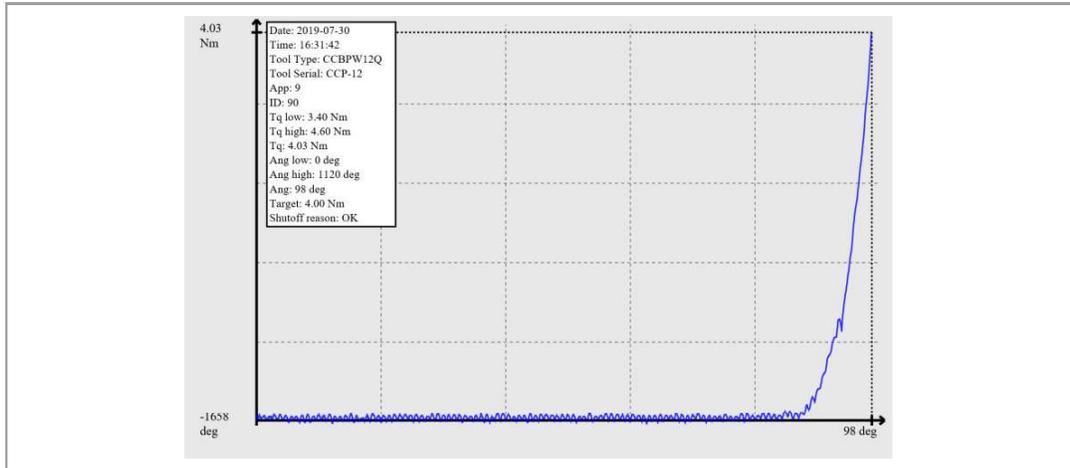


Fig. 3-44: Graphics export – Torque graph

The *.svg file contains the following values:

Column	Description
Tool Type	Tool type with which the tightening was done
Tool Serial	Serial number of the tool
Date	Date of export: Day.Month.Year
Time	Time of export: Hour:Minute:Second
App	Number of the FastApp
ID	Number of the graphic entry. The number is identical to the <i>GraphicID</i> for the archive.
Tq low [Nm]	Minimum Torque
Tq high [Nm]	Maximum Torque
Tq [Nm]	Shut-Off Torque
Ang low [deg]	Minimum Angle
Ang high [deg]	Maximum Angle
Ang [deg]	Shut-Off Angle
Target	Switch-Off value, depending on the selected tightening strategy the unit is <i>Nm</i> or <i>deg</i> .
Shutoff reason	Shut-Off reason

Select separator

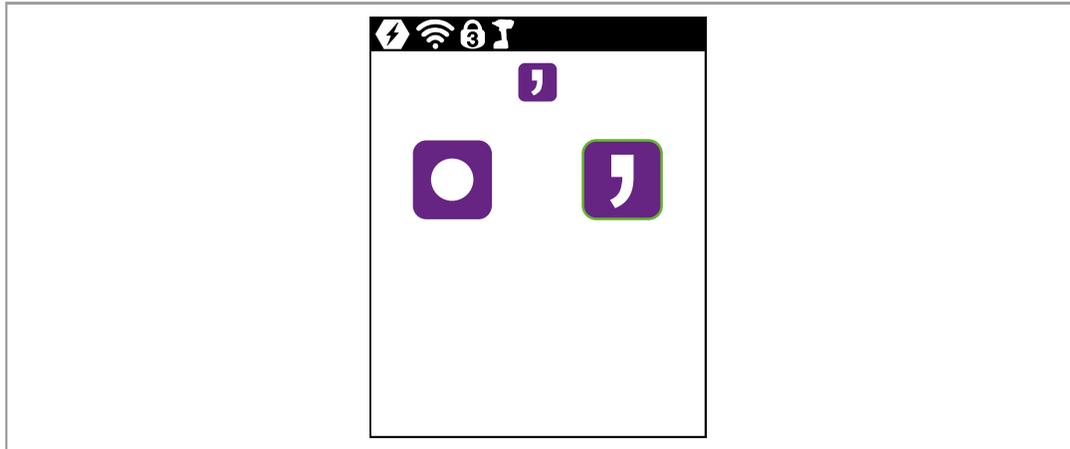


Fig. 3-45: Submenu – Select separator

Button	Description
	For torque, the decimal place is separated with a point.
	For torque, the decimal place is separated with a comma.

3.11.5 Loading parameters

All data except the archive data are loaded on the tool.

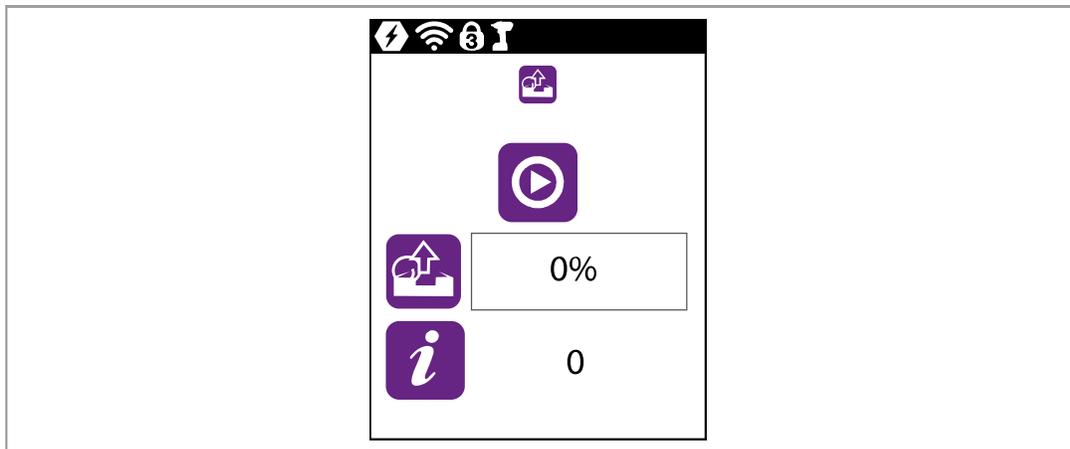


Fig. 3-46: Submenu – Loading parameters

Button	Description
	Start the loading process.

Button	Description
	Display of the saving progress. The status bar indicates what percentage of the parameters are already loaded.
	Display of the status of the loaded parameters. After loading, the status bar is red or green: <ul style="list-style-type: none"> Green: The loading process has been successfully completed. There is an "OK" in the status line. Red: An error occurred during the loading process, <i>see chapter Error messages, software updates and data storage, page 62.</i>

Load the parameters

1. Save a `parameters_(DatumUhrzeit).zip` file to a USB stick. The USB stick may only contain one file with the extension `*.zip`.
2. Connect the USB stick with the tool via the Micro B USB cable.
3. Select  > .
4.  must be pressed to start the loading process.
 - The progress bar and status bar indicate when the data are loaded.

3.11.6 Saving parameters

Data about parameters, messages, information and settings are saved. Archive data are not saved.

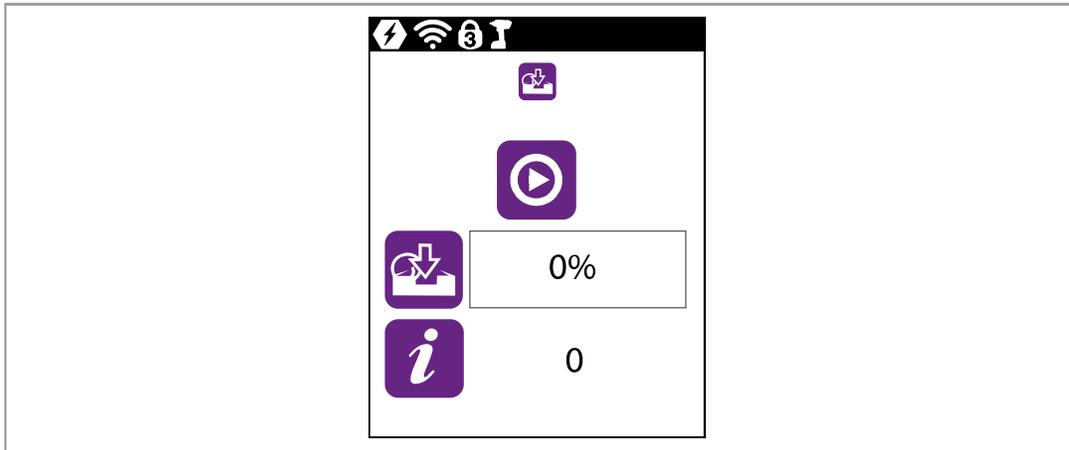


Fig. 3-47: Submenu – Saving parameters

Button	Description
	Start the saving process.
	Display of the saving progress. The status bar indicates what percentage of the archive is already saved.
	Display of the status of the saved parameters. After saving, the status bar is red or green: <ul style="list-style-type: none"> Green: The saving process has been successfully completed. There is an "OK" in the status line. Red: An error occurred during the saving process, <i>see chapter Error messages, software updates and data storage, page 62.</i>

Save parameter

1. Connect the USB stick with the tool via the Micro B USB cable.
2. Select  > .
3.  must be pressed to start the saving process.
 - The progress and status bar indicate when the parameters are saved.
 - A password-protected file is generated: `parameters_(DateTime).zip`

3.11.7 Carry Out a Software Update

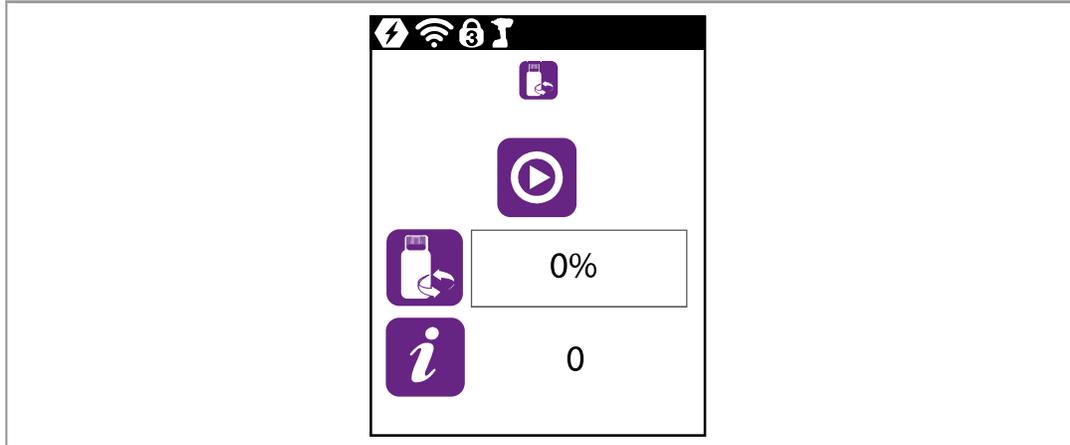


Fig. 3-48: Submenu – Software update

Button	Description
	Start the software update.
	Display of the software update progress. The progress bar indicates what percentage of the software is already reached.
	Display of the software update status. After the software update, the status bar is red or green: <ul style="list-style-type: none"> • Green: The software update was successfully completed. There is an "OK" in the status line. • Red: An error occurred during the software update, see <i>chapter 5 Troubleshooting, page 61</i>.

There are two options for carrying out a software update.

Option 1:

1. Download the software update from the website <http://software.apextoolgroup.com/>.
2. Save the *.tma file to a USB stick. The USB stick may only contain one file with a *.tma extension.
3. Connect the USB stick with the tool via the Micro B USB cable.
4. Select  > .
5.  must be pressed to start the software update.
 - The progress bar and status bar indicate when the software update has been completed.
 - After the software update has been completed, the tool restarts.

Option 2:

Carry out the software update using the *Cordless RF Configuration* software. See document P2372JH.

3.11.8 Deleting an archive

This menu is only available in FastApps mode. No archive data is recorded on the tool in mPro mode.

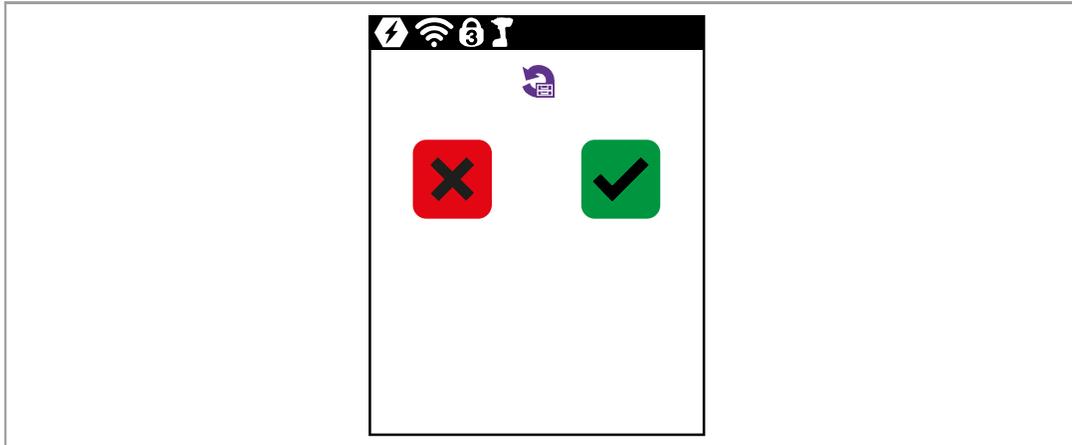


Fig. 3-49: Submenu – Deleting an archive

Button	Description
	<ul style="list-style-type: none"> ▶ Press to cancel the process. ➤ The tightening results and the torque graphs are not deleted. ➤ The <i>Reset archive</i> menu is exited.
	<ul style="list-style-type: none"> ▶ Press to delete the archive. ➤ All tightening results and torque graphs are deleted. ➤ The <i>Reset archive</i> menu is exited.

3.11.9 Resetting to factory settings

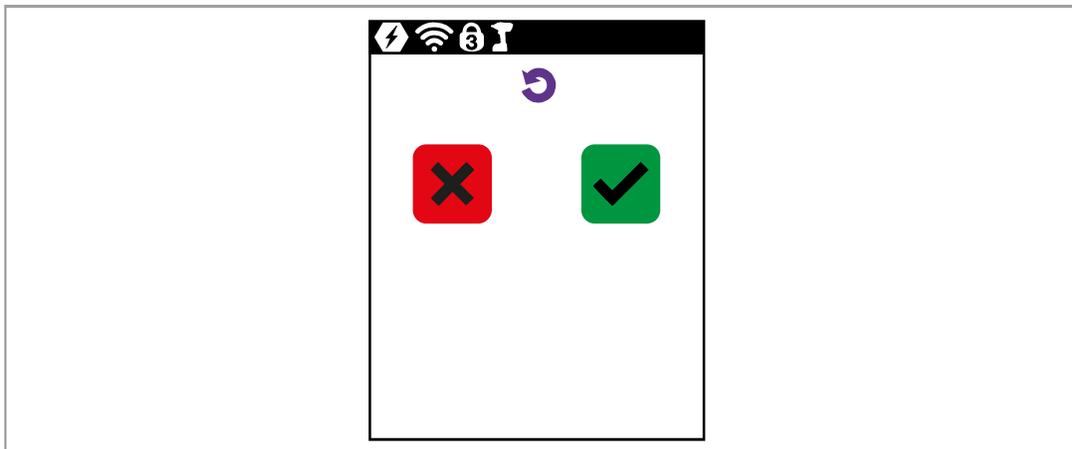


Fig. 3-50: Submenu – Resetting to factory settings

Button	Description
	<ul style="list-style-type: none"> ▶ Press to cancel the process. ➤ The tightening results and the torque graphs are not deleted. ➤ The <i>Resetting to factory settings</i> menu is exited.

Button	Description
	<ul style="list-style-type: none">▶ Press to reset the tool to factory settings.➤ All the settings of the tool and the archive are deleted.➤ The <i>Resetting to factory settings</i> menu is exited.

4 Tightening sequence

In the FastApps mode, there is a choice between two tightening sequences:

- **Torque shutoff: Sequence 31 torque controlled, extended monitoring**

Shut-off torque-controlled tightening sequence with torque and angle check.

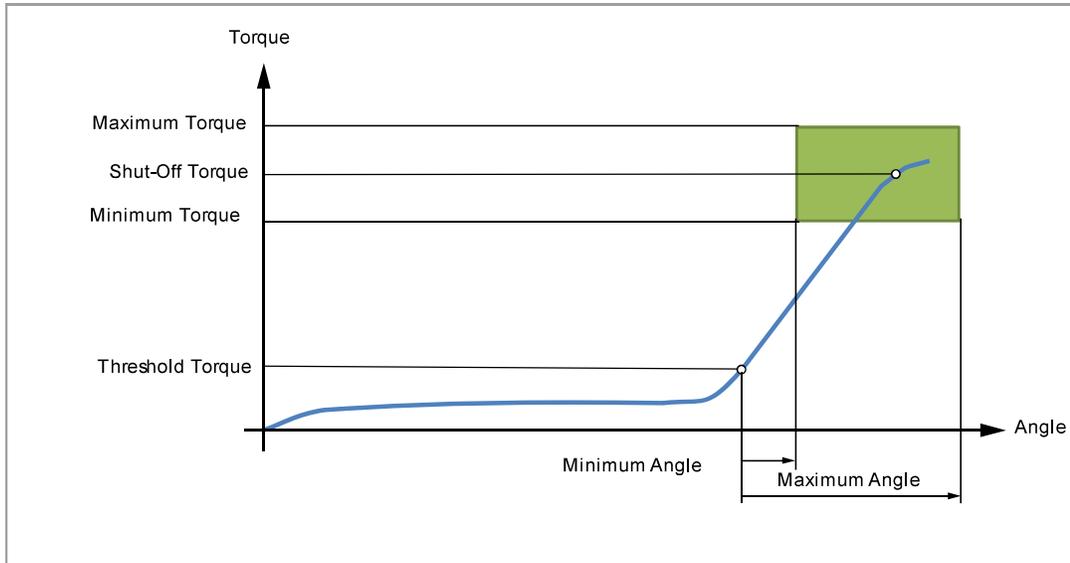


Fig. 4-1: Representation of torque shutoff

- **Angle shutoff: Sequence 51 angle-controlled, extended monitoring**

Shut-off angle-controlled tightening sequence with angle and torque check.

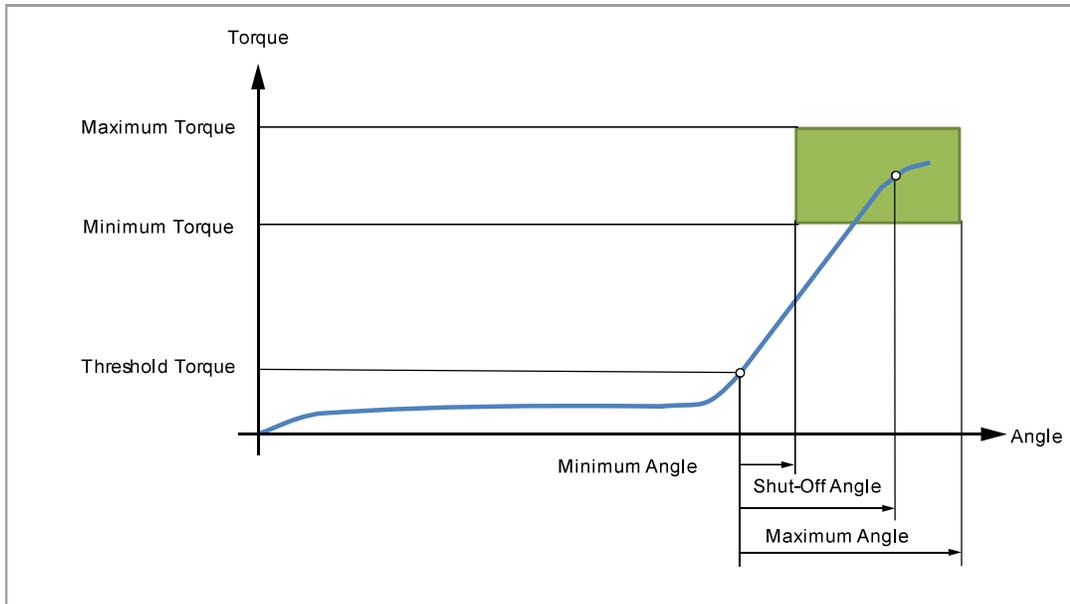


Fig. 4-2: Representation of angle shut-off

The following description applies to both tightening sequences.

For the speed, select a second speed parameter *Final Speed*. The behavior at the Final Speed is different in FastApps and mPro mode:

- **FastApps mode:** If the *Final Speed* is programmed, the speed immediately changes from the start speed to the final speed up to the maximum torque.
- **mPro mode:** If the *Final Speed* is programmed, the speed is reduced from the starting speed to the final speed starting from the threshold torque to the maximum torque.

The final speed must be lower than the standard speed.

The angle counting starts when the *Threshold Torque* is reached.

After switching off via the *Shut-Off Torque/Shut-Off Angle*, the torque that develops or the associated angle is compared with the *Minimum/Maximum Torque* and the *Minimum/Maximum Angle* and evaluated OK/NOK accordingly.

The following parameters can be programmed in the particular FastApp configuration, see *chapter 3.6 FastApps menu, page 19*.

Parameter	Description	Range of values	Abbrev.
Speed	Speed selection: In the range of the maximum speed specified in the tool constants, with validity at the beginning of the sequence up to the threshold torque (mPro mode)/Speed threshold (FastApps mode). Begin: With tool start End: <ul style="list-style-type: none"> • Threshold Torque (mPro mode) • Speed threshold (FastApps mode). 	± Maximum speed	n (rpm)
Speed Threshold (rpm) ¹	Speed when the maximum torque is reached. Must be less than the starting <i>Speed</i> sein. FastApps-Modus As soon as the speed threshold is reached, the speed is reduced from the starting speed to the final speed at the maximum torque. With increasing torque, the speed drops. Begin: From the Speed Threshold Torque Ende: Shut-Off Torque Pro mode In mPro mode, the parameterization of the controller is valid.	± Maximum speed	n2
Maximum Angle	Upper limit of attained angle.	0 ... 9 999	AngMax (deg)
Maximum Torque	Upper limit of attained torque.	0 ... 1,2 x MD capacity	TqMax
Minimum Angle	Lower limit of attained angle.	0 ... 9 999	AngMin (deg)
Minimum Torque	Lower limit of attained torque.	0 ... TQ Shut-Off Torque	TqMin
Threshold Torque	Beginning of angle counting.	0 ... TQ capacity	TqTh
Shut-Off Torque	Valid monitoring torque during the tightening process. If the monitoring torque is exceeded, the drive stops immediately.	0 ... TQ capacity	TqP
Shut-Off Angle		0 ... 9 999	AP (deg)

¹ The maximum torque is not normally reached. The torque shutoff value is less than the maximum torque. Therefore, it is not completely regulated to the final speed.

5 Troubleshooting

5.1 Error messages

Error messages for shut-off cause

Error message	Description
?S?	Abort due to other errors
Ang<	Angle too small
Ang>	Angle too large
Abbr	Abort by the controller
ANF1	Transducer 1 absent
AW<	Too few graphic values recorded for an evaluation
BLOC	Tightened on block
Erg?	Measuring board provides no result
FC<	Clamping force too low
FC>	Clamping force too great
FLT	Servo warnings
FMK	Measuring board error
FPEF	Error in Snug Point Detection
FRC<	Residual clamping force too low
FRC>	Residual clamping force too great
FSMW	Not enough rundown data
GD<	Gradient too small
GD>	Gradient too large
GEB?	Encoder error torque/angle
IP	Error output section, excessive current
IRED	Current/TQ redundant
JUM	Error due to the socket slipping off
KAL1	Calibration error, Transducer 1
COMM	Host<-->TM communication error
LEF	Bearing fault
M1<	Torque M1, threshold not reached
M1>	Torque M1 exceeded
M2<	Torque M2, threshold not reached
M2>	Torque M2 exceeded
MBO>	Torque has exceeded top evaluation torque
MBU<	Torque has fallen below bottom evaluation torque
MDSI	Safety torque exceeded
TQUE	Torque too high
TQUN	Torque too low
ME>	Press-in torque too high
MDTE>	Maximum distribution torque exceeded
NECK	Socket or nutrunner break
NOT	End due to emergency stop

Error message	Description
OFF1	Offset error, Transducer 1
P1M>	Torque in Phase 1 too high
P2M<	Torque in Phase 2 too low
P2M>	Torque in Phase 2 too high
P2UU	To much under- and overstep in Phase 2
P3M<	Phase 3: Torque too low
P3M>	Phase 3: Torque too high
P4M<	Phase 4: Torque too low
P4M>	Phase 4: Torque too high
PAR	Wrong parameter
PS?	Wrong parameter set
RAM	Memory error, measuring board
SA	Canceled by removal of the start signal
SeBB	No ready signal for servo
SS>	Max. number of cycles for stick-slip exceeded
SST>	Max. number of cycles for stick-slip exceeded
TDS	Shutoff by depth sensor
TMAX	Canceled by exceeding the max. time
TMS<	Angle redundancy by time below min Value
TMS>	Angle redundancy by time exceeded
TQ<	Torque too low
TQ>	Torque too high
WG1D	Error in Angle Encoder 1
WIG<	Total angle too small
WIG>	Total angle too large
ZRF	Gear defective

Error messages, software updates and data storage

Error message	Description	Measure
E1	Export script not available.	<ul style="list-style-type: none"> ▶ Try to export the script two to three times. ▶ If the error message continues to occur, perform a software update.
E2	Error during export.	<ul style="list-style-type: none"> ▶ Connect USB stick. ▶ Check USB stick for errors.
E3	Error while writing the archive.	<ul style="list-style-type: none"> ▶ Check USB stick for errors.
E10	Software update script not available.	<ul style="list-style-type: none"> ▶ Try two to three times to perform the software update ▶ If the error message continues to occur, contact a <i>Sales & Service Center</i>, see reverse
E50	Crash during software update.	
E99	Timeout on startup expired.	<ul style="list-style-type: none"> ▶ Connect USB stick.
E110	No compatible update packages found.	<ul style="list-style-type: none"> ▶ Make sure there is the right *.tma file selected.
E121	License is invalid.	<ul style="list-style-type: none"> ▶ Download the license again and install it on the tool. The *.xml file must not be modified.

Error message	Description	Measure
E123	License does not match the serial number of the tool. Each license is valid only for one serial number.	▶ Use a valid license for the tool.
E200	Several *.tma files available.	▶ Make sure that there is only one *.tma file on the USB stick.
E210	No compatible update packages found.	▶ Make sure there is a *.tma file on the USB stick.
E230	Certificate file is invalid or defective.	▶ Download the EAP-TLS certificate file again and install it on the tool.
E240	Password for certificate file is invalid.	▶ Enter correct password.

5.2 Tool problems

Problem	Possible causes	Measure
Tool does not start.	No speed (RPM) programmed.	▶ Check Linking group. In the mPro mode, select <i>Navigator</i> > <i>Standard</i> or <i>Navigator</i> > <i>Basic</i> . ▶ Check FastApps. In the FastApps mode:  >  .
	Controller is waiting for tool enablement.	▶ Enable the input <i>Tool Enable</i> or, if not required, deactivate <i>Tool Enable</i> .
	Fast-Apps mode disabled.	▶ Enable FastApps mode:  >  >  .
	Self-identification data are not recognized after tool change.	Accept Tool Settings again: 1. <i>Navigator</i> > <i>Tool Setup</i> . 2. Select the line with the tool. 3. Select <i>Tool Settings</i> > <i>Accept</i> .
Tool not recognized	Software incorrect.	▶ Check controller and measuring card software.
	FastApps mode is enabled.	▶ Disable FastApps mode to connect to the controller.
	Tool defective.	▶ Change tool.
Tool doesn't start with counterclockwise rotation activated.	With counterclockwise rotation, parameter for speed is set to 0 ¹ /min.	Parameterize Speed left rotation ▶ Select on the controller <i>Navigator</i> > <i>Standard</i> > <i>Tool Groups</i> > <i>Settings For Speed Left Rotation</i> .
Work light disabled.	Disabled by parameter setting.	▶ Parameterize the tool light on the controller screen: <i>Navigator</i> > <i>Advanced</i> > <i>Tool Group</i> > <i>Extended Tool Settings</i> . ▶ To activate the work light:  > 
Tool shuts off prematurely.	Operator releases start trigger before the controller stops the tool.	▶ Make sure that the operator keeps the start trigger pressed throughout the entire sequence.
	The fastening time exceeds the standard time of 10 seconds.	▶ Increase the fastening time.
	Tool exceeds the angle setpoint.	▶ Check the fastening sequence to ensure that the torque shutoff value and/or angle setpoint are correct. Adjust as necessary. ▶ Check whether the fastening joint has changed significantly.

Problem	Possible causes	Measure
Control menu on tool is not enabled or only partially enabled.	Disabled by parameter setting.	▶ To enable the control menu:  > 
No-load speed not reached.	Battery voltage is too low.	▶ Use a fully charged battery.
Expected number of run-downs is not achieved with one charge of the battery.	Battery is not fully charged.	▶ Use fully charged battery.
	The warning threshold for undervoltage is not set to the minimum value.	▶ Reduce the Undervoltage (V) on the control screen: <i>Navigator</i> > <i>Tool Setup</i> > <i>Tool Settings</i> > <i>Others</i> > <i>Low Level [V]</i> . ▶ To set the warning threshold:  > 
	High torque is needed during a fastening sequence, e.g., for coated fasteners.	If a high torque is needed for a longer period of time, e.g., for several turns, the number of run-downs that can be achieved with one battery charge will be significantly reduced.
	Battery has too many charging cycles.	After 800 charging cycles, the capacity is reduced to approx. 60%.
Software does not boot.	Error in the main software.	▶ Use recovery SD card. Contact the <i>Sales & Service Center</i> , see reverse.
Barcode is not read.	Barcode is damaged.	▶ Use another barcode.
	Wrong barcode type is used.	▶ Use another barcode.
	Wrong barcode type is programmed.	▶ Unlock the barcode type used.

5.3 WLAN data communication problems

WLAN data communication problems between controller and access point

Problem	Possible cause	Measure
No communication between the controller/service PC and access point. Applies only to WLAN infrastructure customers.	IP address and subnet mask are not in the same range.	Without network administration, it is necessary for the IP address and subnet mask for the mPro200GC and the base station to be in the same range. 1. Use the same subnet mask for both. 2. For the IP address, use the same first three numbers, e.g., - IP address for the controller: 192.168.1.xxx - IP address for the base station: 92.168.1.xxx - Subnet mask: 255.255.255.0

WLAN data communication problems between tool and access point

Problem	Possible cause	Measure
The tool can not connect with the access point. Indicator: Signal strength at tool is always "-". The tool does not appear in the list of connected clients.	Tool not yet parameterized with the correct WLAN settings.	▶ Parameterize WLAN settings in the controller and with the <i>Cordless RF Configuration</i> PC software. See Document P2402KA.
	WLAN settings are different for the tool and the access point.	▶ Use the <i>Cordless RF Configuration</i> PC software to check whether the WLAN settings for the tool match the settings of the access point (SSID, encryption, network key).
	Encryption settings are not selected correctly. Password is entered incorrectly.	

Problem	Possible cause	Measure
	Incorrect WLAN channel	<p>Select another channel.</p> <ol style="list-style-type: none"> 1. Select the channel on the controller: <i>Utility > Cordless Tools</i>. 2. Select the channel with the <i>Cordless RF Configuration</i> PC software. The same channel must be set as on the controller.

WLAN data communication problems between controller and tool

Problem	Possible cause	Measure
No WLAN data communication between the controller and tool.	The IP address of the tool is not correctly entered in the controller.	<ol style="list-style-type: none"> 1. Check on the control screen: <i>Navigator > Tool Setup</i>, whether the IP address of the tool has been entered in the box <i>Type</i>. 2. Otherwise, mark the line and <Edit>. <p>IP address of tool –see Tool in submenu <i>WLAN communication</i>.</p>
	Tool is already assigned to another controller.	<ul style="list-style-type: none"> ▶ Check the WLAN settings and make sure that the WLAN settings for the controllers are different. <p>Applies only to WLAN infrastructure customers:</p> <ul style="list-style-type: none"> ▶ Check whether another controller already has a connection to this tool. In other words, another controller is using the same IP address.
IP address cannot be pinged.	IP address already exists in the network. In this case, the tool will not establish a connection.	<ul style="list-style-type: none"> ▶ Check the physical connection (RSSI values):  >  ▶ Check the assigned IP address.
Occasional interruptions in WLAN data communication.	Distance between the access point and the tool is too great.	<ol style="list-style-type: none"> 1. Check signal strength at tool in the submenu <i>Signal Strength</i>:  >  2. If necessary, reduce the distance between the access point and the tool.
	Excessive data traffic on WLAN network.	<p>Reduce data traffic on WLAN network.</p> <ol style="list-style-type: none"> 1. On the Basic control screen, increase the Trigger: <i>Navigator > Basic Application Builder > Trigger Torque</i>. 2. Disable the torque graph data transmission on <i>Navigator > Advanced > Controller > General > Trace Recording</i>. For this, select the entry <i>Record</i> in the column <i>Off</i>.

5.4 Bluetooth data communication problems

Bluetooth data communication problems between controller and tool

Problem	Possible cause	Measure
The tool can not connect with the controller.	Controller is not visible.	<ul style="list-style-type: none"> ▶ Make sure that the Bluetooth function is activated on the controller.
	The controller is not displayed in the <i>Scanning Bluetooth devices</i> menu.	<ul style="list-style-type: none"> ▶ Make sure that the Bluetooth function is activated on the controller. ▶ Check that the controller is visible with another tool.

Problem	Possible cause	Measure
	Establishing a Bluetooth connection fails.	<ul style="list-style-type: none"> ▶ Note that the tool can only connect to an mPro200GC series controller. ▶ Retry to establish a Bluetooth connection. ▶ Restart the tool and try to establish the Bluetooth connection again. ▶ Restart the controller and try to establish the Bluetooth connection again.
	The node number is assigned twice.	<ul style="list-style-type: none"> ▶ Make sure that each node number is assigned only once. Note that only seven nodes are possible.
	The wrong IP address is used for the tool on the controller.	<ul style="list-style-type: none"> ▶ Make sure that the tool has been installed on the controller with the correct IP address.

Index

A

Advanced settings 23
 AN 6
 Angle
 maximum 23
 minimum 24
 angle shutoff 20
 Angle shutoff 23, 59
 Angle test 35
 App 6
 Application select 14
 Archive
 delete 57
 save 49

B

Batch 21
 Batch display 15
 Block Angle Detection 21
 Bluetooth
 activate 44
 connect 43
 deactivate 44
 disconnect 45
 scan 44

C

Calibration value 37
 Change mode 9
 Confirmation button 7
 Counterclockwise rotation 17
 Counters status 38
 csv file 52

D

Date 26
 Diagnostics 33
 Direction of rotation 20, 22

E

EAP-TLS certificate 42
 EAP-TLS certificate 41
 Error message
 data storage 62
 Shut-off cause 61
 software update 62

F

Factory settings 57
 FastApps
 configure 20
 lock 33
 menu 19
 reset 24
 select 16

FastApps mode 7, 9, 19
 Final Speed 24

G

Gateway 40

I

IP address 40
 twice 40

L

License 48
 Linking group 33
 select 14

M

MAC address 40
 MAC adresse 43
 Menu lock 32
 mPro mode 7, 9, 19

N

Navigation buttons 7
 Network mask 40
 Node number 43
 NOK 6

P

Parameter
 change 9
 load 54
 save 55
 PIN 30
 change 31
 deactivate 32
 enter 31

R

Remote start 10
 reset 57
 Result 14
 Run screen 14

S

Save
 archive 49
 Parmameter 55
 Torquegraph 51
 Screen brightness 27
 Selecting button 9
 Settings 25
 Shut-off properties 28
 Signal strength 41
 Software update 56
 Software version 47

Speed
 Final Speed 24
 Speed Threshold 24
Speed test 34
SSID 40
Start Speed 21
svg file 52
Switch off 47
Switching off 9
Switching on 9

T

Threshold Torque 21, 23
Tightening sequence 59
Tightening strategy 15, 22
Time 26
Tool light 27
Torque
 maximum 23
 minimum 23
 unit 29

Torque calibration value 39
Torque graph 51
torque shutoff 20
Torque shutoff 23, 59
Torque test 36
TQ 6
TQ calibration value 39

U

Undervoltage limit 38
USB connection 8
Utility 46

V

Voltage 38

W

WLAN connection
 activate 41
 deactivate 41

POWER TOOLS SALES & SERVICE CENTERS

Please note that all locations may not service all products.

Contact the nearest Cleco® Sales & Service Center for the appropriate facility to handle your service requirements.



Sales Center



Service Center

NORTH AMERICA | SOUTH AMERICA

DETROIT, MICHIGAN

Apex Tool Group
2630 Superior Court
Auburn Hills, MI 48236
Phone: +1 (248) 393-5644
Fax: +1 (248) 391-6295

LEXINGTON,

SOUTH CAROLINA
Apex Tool Group
670 Industrial Drive
Lexington, SC 29072
Phone: +1 (800) 845-5629
Phone: +1 (919) 387-0099
Fax: +1 (803) 358-7681

MEXICO

Apex Tool Group
Vialidad El Pueblito #103
Parque Industrial Querétaro
Querétaro, QRO 76220
Mexico
Phone: +52 (442) 211 3800
Fax: +52 (800) 685 5560

EUROPE | MIDDLE EAST | AFRICA

ENGLAND

Apex Tool Group UK
C/O Spline Gauges
Piccadilly, Tamworth
Staffordshire B78 2ER
United Kingdom
Phone: +44 1827 872771
Fax: +44 1827 874128

FRANCE

Apex Tool Group SAS
25 Avenue Maurice Chevalier - ZI
77330 Ozoir-La-Ferrière
France
Phone: +33 1 64 43 22 00
Fax: +33 1 64 43 17 17

GERMANY

Apex Tool Group GmbH
Industriestraße 1
73463 Westhausen
Germany
Phone: +49 (0) 73 63 81 0
Fax: +49 (0) 73 63 81 222

HUNGARY

Apex Tool Group
Hungária Kft.
Platánfa u. 2
9027 Győr Hungary
Phone: +36 96 66 1383
Fax: +36 96 66 1135

ASIA PACIFIC

AUSTRALIA

Apex Tool Group
519 Nurigong Street, Albury
NSW 2640
Australia
Phone: +61 2 6058 0300

CHINA

Apex Power Tool Trading
(Shanghai) Co., Ltd.
2nd Floor, Area C
177 Bi Bo Road
Pu Dong New Area, Shanghai
China 201203 P.R.C.
Phone: +86 21 60880320
Fax: +86 21 60880298

INDIA

Apex Power Tool Trading
Private Limited
Gala No. 1, Plot No. 5
S. No. 234, 235 & 245
Indialand Global
Industrial Park
Taluka-Mulsi, Phase I
Hinjawadi, Pune 411057
Maharashtra, India
Phone: +91 02066761111

JAPAN

Apex Tool Group Japan
Korin-Kaikan 5F,
3-6-23 Shibakoen, Minato-Ku,
Tokyo 105-0011, JAPAN
Phone: +81-3-6450-1840
Fax: +81-3-6450-1841

KOREA

Apex Tool Group Korea
#1503, Hibrand Living Bldg.,
215 Yangjae-dong,
Seocho-gu, Seoul 137-924,
Korea
Phone: +82-2-2155-0250
Fax: +82-2-2155-0252

Cleco[®]
Production Tools

Apex Tool Group, LLC
Phone: +1 (800) 845-5629
Phone: +1 (919) 387-0099
Fax: +1 (803) 358-7681
www.ClecoTools.com
www.ClecoTools.de