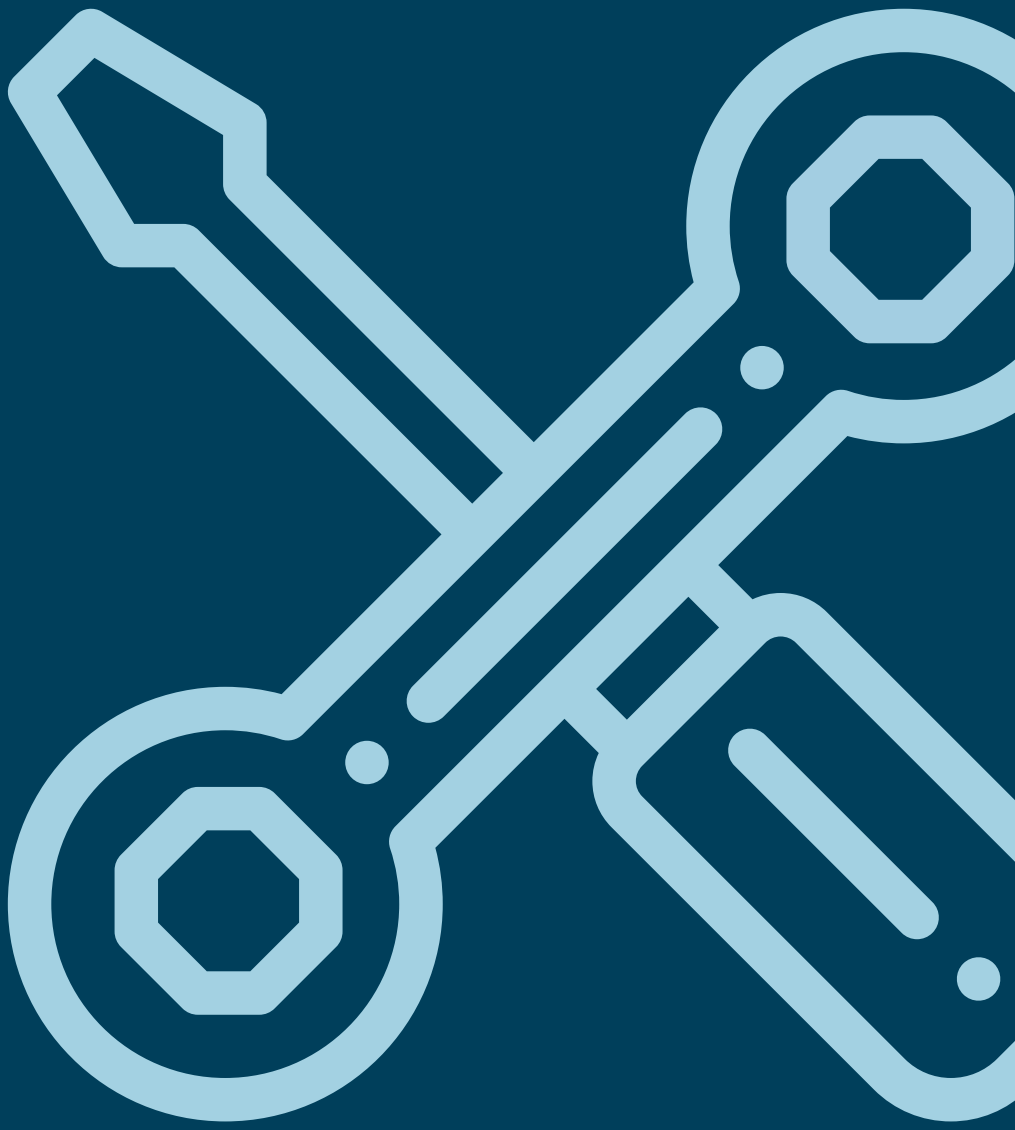


Operation Manual

Bolt-Check 3

R&D Test Systems A/S

Rev. date. 11-12-2024

Contents

1 Document Revision Table

Rev. no.:	Rev. Date:	Change:	Responsible
01	11-12-2024	First edition	JAS

2 Introduction

2.1 Purpose

The purpose of this operating manual is to describe the usability of Bolt-Check and secure safe and correct use of the equipment.

Bolt-Check is used to measure the elongation of fasteners under tension. A bolt traceability system is incorporated alongside Bolt-Check to systematize the measured bolts. This saves time and reduces uncertainty while full traceability is maintained.

2.2 Customer support

R&D Test Systems maintains a customer support, capable of assistance regarding questions not covered in this operation manual. Customer support can be reached via the following:

Customer support
R&D Test Systems A/S Sigma 3 8382 Hinnerup Denmark **Mail:** service@rdas.dk **Phone:** +45 28 51 89 50

2.3 Disclaimer

This manual must be read and understood prior to use. Lack of understanding can lead to inaccurate measurements, damage to the equipment, and/or personal injury.
This manual only covers Bolt-Check 3, which consists of two main components:

- A tablet
- An ultrasonic measurement device

To download additional manuals in relation to Bolt-Check components, browse to:

https://rdtestsystems.com/bolt-check/manuals/

2.4 Warranty

Bolt-Check comes with a one-year limited warranty. The warranty only applies to Bolt-Check units which can be documented to have been bought from R&D Test Systems A/S. Use of the device in ways beyond what is described in this operation manual is not covered. Repairs on software and hardware will be conducted at R&D Test Systems A/S' discretion.

R&D Test Systems A/S will not be held liable for any damage caused by failure, nor interruption of business, loss of profit, etc. R&D Test Systems A/S will not be liable to repair or replace damaged devices, used beyond the scope of this operation manual or that have been subjects to unauthorized repair.

2.5 Scope

Bolt-Check is designed exclusively to conduct length and elongation measurements on fasteners, massive metal rods or similar.

Bolt-Check is not suitable as, e.g.:

- A thickness gauge
- A flaw detector
- An exact length measurement device

Bolt-Check is not suitable for measuring on, e.g.:

- Austenitic steel (Must be verified before using this on such alloys)
- Non-metallic
- Non-solids

For requests on special cases, contact R&D Test Systems A/S using the contact information in "2.2 Customer support".

3 Before you begin

3.1 Safety First!

Before you use your Bolt-Check product, read, and understand the manuals provided with the equipment. Improper operation or maintenance can result in hazardous conditions that can cause severe personal injury or death, or damage to your equipment. Again, read and understand the safety information provided with the equipment before you continue. It is very important that you remain aware of hazards that apply to your equipment.

3.2 Other Documents

In addition to this manual, you have access to additional documents. These documents are highly relevant for the understanding of your product.

- 0001-415-MAN-Bolt-Check BoltTrack Manual
- Dakota Ultrasonics MultiMax Manual
- Panasonic Toughpad FZ-G2 Manual

3.3 Hazard Illustrations

Hazard notices may be embedded in this manual. These notices contain important safety information. Read all hazard notices carefully and follow all directions and recommendations. Three different levels of hazard notices may appear in the manual. Following are explanations of all three levels.

⚠ DANGER

DANGER:

Danger notices indicate the presence of a hazard with a high level of risk which, if ignored, will result in death, severe personal injury, or substantial property damage.

⚠ WARNING

WARNING:

Warning notices indicate the presence of a hazard with a medium level of risk which, if ignored, can result in death, severe personal injury, or substantial property damage.

⚠ CAUTION

CAUTION:

Caution notices indicate the presence of a hazard with a low level of risk which, if ignored, could cause moderate or minor personal injury or equipment damage, or could endanger test integrity.

4 Safety Information

Before you use your Bolt-Check, read, and understand the safety information. Improper operation can result in hazardous conditions that can cause personal injury or damage to your equipment.

4.1 Overview

4.1.1 Intended Use

Bolt-Check is used to measure elongation of fasteners under tension. A bolt traceability system is incorporated alongside Bolt-Check to handle the measured bolts. This saves time and reduces uncertainty while full traceability is maintained.

4.1.2 Foreseeable Misuse

When you prepare to operate the equipment, and during operation, ensure the following. Foreseeable misuse includes, but is not limited to, the following.

- Avoid breaking or cutting the cables on sharp objects.
- Avoid walking on cables as it might damage them.
- Avoid dropping Bolt-Check.
- Do not use Bolt-Check for anything other than what it is intended for, e.g. use of it as a step ladder.
- Do not pull the device by the cables.
- Avoid using Bolt-Check in wet conditions, such as rainy weather.

4.2 Personnel Qualifications

⚠ WARNING

WARNING:

Equipment maintenance, setup, and operation require specialized training.

Installation, maintenance, setup, and operation of the equipment by unqualified personnel can expose them, and others, to hazards that can cause damage to equipment and personal injury or death.

Do not allow unqualified personnel to perform any of the equipment installation, maintenance, setup, or operating procedures. Maintenance, setup, and operating procedures should only be performed by trained personnel.

4.3 Avoid Water

Bolt-Check can withstand water to a certain extent but should under no circumstances be fully submerged in water.

4.4 Energy Isolation

Energy isolation is a prime safety consideration where unexpected energizing, startup, or release of stored energy could occur and cause injury. Before any employee performs service or maintenance on the equipment or a component, the equipment must be isolated from the energy source and rendered inoperative. The customer is responsible for establishing a program of energy control procedures and employee training to ensure that the equipment is isolated from energy sources.

4.5 Site Precautions

⚠ WARNING

WARNING:

The equipment is designed to operate in an environment where precautions have been taken to minimize hazards to personnel and the equipment.

Ignoring hazards and failing to take necessary precautions can result in injury or death to personnel, and damage to equipment.

Do not install or operate the equipment in a hazardous environment.

⚠ WARNING

WARNING:

Hazardous situations or conditions can arise suddenly and without warning.

If immediate action is not taken to remove the hazard or remove personnel from the hazard, serious injury or death can result.

Do not operate the equipment unless you have it in full view.

⚠ WARNING

WARNING:

Working environments that are designed using insufficient or inappropriate ventilation, lighting, heating, and cooling or that use equipment, furniture, or equipment/furniture placements that are non-ergonomic can result in operator fatigue and stress.

Operator fatigue and stress can result in operator errors which can result in injury to personnel or damage to the equipment and/or specimen.

Make sure that ventilation, lighting, heating, cooling, and ergonomic issues are considered in the layout of the operating area to limit operator stress and fatigue.

⚠ WARNING

WARNING:

Service activities (that are outside the bounds of equipment operation) may require specialized tools, fixtures, and expertise.

Attempting to perform these activities can result in personal injury and/or damage to equipment components.

Service activities must be performed or managed by R&D or qualified personnel only. Contact R&D Service & Installation before attempting any service activity.

Official direct contact information for R&D Service and Manufacturing:

Telephone: +45 2851 8950

E-mail: service@rdas.dk

4.6 General Safety Practices

If you have equipment related responsibilities (that is, if you are an operator, service engineer, or maintenance person), you should study this manual carefully before you attempt to perform any procedure.

You need to receive training on this equipment to ensure a thorough knowledge of it and the safety associated with its use. In addition, you should gain an understanding of its functions by studying the other manuals supplied with your equipment.

It is very important that you study the following safety information to ensure that your procedures and the equipment's operating environment do not contribute to or result in a hazardous situation. Remember, you cannot eliminate all the hazards, so you must learn and remain aware of the hazards that apply at all times. Use these safety guidelines to help learn and identify hazards so that you can establish appropriate training and operating procedures and acquire appropriate safety equipment.

Improper operation or maintenance of your equipment can result in hazardous conditions that can cause personal injury, invalid test results, or damage to the equipment. Common sense and a thorough knowledge of the equipment can help to determine an appropriate and safe approach to its operation.

Observe the following safety practices before and during operation.

4.6.1 Safety Practices Before Operating the Equipment

Before you apply power to the equipment, review and complete all of the safety practices.

4.6.2 Read All Manuals

Study the contents of this manual and the other manuals provided with your equipment before attempting to perform any function for the first time. Procedures that seem relatively simple or intuitively obvious may require a complete understanding of the equipment to avoid unsafe or dangerous situations.

4.6.3 Visually Inspection Before Operating the Equipment

Whenever you prepare to apply power to the equipment, R&D recommends that you visually inspect the state of your equipment to make sure that it is not worn out.

4.6.4 Locate and Read Hazard Placards/Labels

Find, read, and follow any hazard placard instructions located in vicinity of the application of the equipment.

4.6.5 Know Facility Safe Procedures

Most facilities have internal procedures and rules regarding safe practices within the facility. Be aware of these safe practices and incorporate them into your operation of the equipment.

4.6.6 Know Controls

Before you operate the equipment for the first time, make a trial run through the operating procedures. Locate all hardware and software controls and know what their functions are and what adjustments they require. If any control function or operating adjustment is not clear, review the applicable information until you understand it thoroughly.

4.6.7 Have First Aid Available

Accidents can happen even when you are careful. Make sure to have first aid available.

4.6.8 Practice Good Housekeeping

Keep the floors in the work area clean. Hydraulic fluid, oil, or water that is spilled on any type of floor can result in a dangerous, slippery surface. Do not leave tools or other items not specific to the operation, lying about on the floor.

4.6.9 Protect Cables

Protect all equipment cables from sharp or abrasive objects that can cause them to fail. Never walk on cables or move heavy objects over them.

4.6.10 Record Changes

If you change any operating procedure, write the change and the date of the change in the appropriate manual.

4.6.11 Provide Adequate Lighting

Ensure that adequate lighting is available to minimize operating errors, equipment damage, and personal injury.

4.6.12 Ensure Correct Cable Connection

If a cable has been disconnected, ensure that you establish the correct relationship during reconnection.

4.7 Safety Practices While Operating the Equipment

4.7.1 Wear Appropriate Personal Protective Equipment (PPE)

Wear appropriate PPE.

- Wear eye protection when you work with anything that could break apart.
- Wear ear protection when you work near electric motors, pumps, or other devices that generate high noise levels.
- Wear appropriate protection (gloves, boots, suits, respirators) whenever you work in proximity to fluids, chemicals, or powders that may irritate or harm the skin, respiratory system, or eyes.
- Wear appropriate protection (gloves, safety shoes, glasses) whenever you work in proximity to sharp edges or objects that could fall onto you.

4.7.2 Do Not Disturb Sensors

Do not bump, wiggle, adjust, disconnect, or otherwise disturb a sensor or its connecting cable when doing a ultrasonic measurement, this will disrupt the signal.

4.7.3 Ensure Secure Cables

Do not change, connect, or disconnect any cable connections when electrical power is applied. If you attempt to change a cable connection while the system is in operation, a spark can occur. In certain environments this could result in severe personal injury, death, or damage to equipment.

4.7.4 Stay Alert

Avoid extended periods of work without adequate rest. In addition, avoid extended periods of repetitious, unvarying, or monotonous work because these conditions can contribute to accidents and hazardous situations. If you are too familiar with the work environment, it is easy to overlook potential hazards that exist in that environment.

5 System Overview

Bolt-Check is used to measure elongation of fasteners under tension. This is done by comparing the current measurement to a reference value of the selected fastener in its untightened stage. A traceability system is incorporated in Bolt-Check, which saves time and reduces uncertainty. Bolt-Check also have a web interface for easy access to your data. Furthermore, it also gives an overview of your sites and projects.

Bolt-Check 3 is protected by a sturdy casing, to protect the components from the environment. The casing comes with integrated handles for improved ergonomics, an integrated magnetic stainless-steel plate for sensors, and a pen holder for the RFID Pen.
The case is designed to stand slightly angled on its own or lay down, if preferred. Furthermore, the back camera of the tablet is made accessible for taking pictures or scanning QR codes.

Bolt-Check 3 has the following interfaces to the supplied accessories.

- Temperature Sensor cable
- Ultrasonic Sensor cable
- RFID Pen
- Charger

Bolt-Check 3 and should under no circumstance be submerged in water or operated in wet conditions. The application temperature of this product is within –10° to 60° Celsius. The device has the following key dimensions.

- *Length: 36.5 cm*
- *Width:* 8.5 cm.
- *Height*: 25.0 cm.
- *Weight*: 3.1 kg.

6 Transportation, Handling, and Storage

The Bolt-Check device should be transported and stored in the provided case. The case has the following key dimensions.

- *Length*: 55.8 cm
- *Width*: 35.5 cm
- *Height:* 22.8 cm
- *Weight*: 8.7 kg (including all equipment)

It is recommended to properly anchor the case during transportation to make sure that it does not fall or bump into someone.

Bolt-Check should be stored in the provided case, in dry conditions, above 0°C. Direct sunlight does not affect the case. The case is IP67 & MIL-SPEC certified, waterproof, and dustproof.
High ambient temperatures will result in high battery temperatures. Avoid charging in these conditions, e.g. in a vehicle with all windows closed and exposed to sunlight.
The battery will not charge if its temperature is outside the allowable range of 0° to 50°.

7 Quick Start

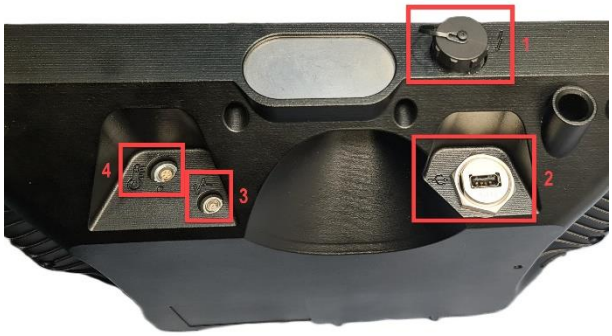
This chapter covers the basics for measurements and is intended as a brush up for trained operators.

7.1 Turn on Device

- Turn on Bolt-Check by pressing the *on button* (1).

7.2 Connect Sensors

- The charging port is on top of the cabinet and is marked with a lightning symbol (1).
- The USB B port is on top of the cabinet and is marked with a USB symbol (2).



- The ultrasonic sensor cable has only one pin in the middle of the termination. The cable can only be plugged into hole (3).
- The temperature sensor cable is larger than the ultrasonic and has of 5 pins in the termination. The cable can only be plugged into (4).

7.3 Synchronize

To measure on an existing project, the project must be synchronized and downloaded.

- To do that, press “Synchronize” and then “Sync down” the project/projects.

7.4 Create a Project

See section “Starting Up a Measurement Project” on page 17.

7.5 Choose Sensor

Sensor sizes are standardized for repeatability. See the table below.

Application	Diameter	MHz
< M16	1/8”	5
M16 – M20	3/8”	2,25
M24 – M48	1/2”	2,25
> M48	3/4"	2,25

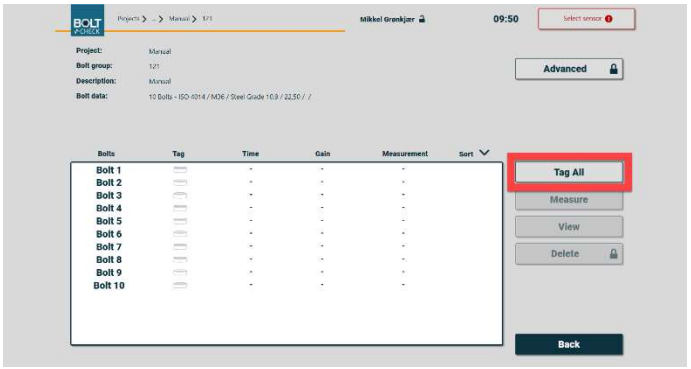
7.6 Scan Sensor

- Use the RFID Pen to read the traceability tag for the sensor and for the bolts.

For more info about scanning and assigning traceability tags, go to: “Preparing Tags, Sensors” on page 21.

- Press “Tag all” and follow the instructions on the screen.

For more info about using Bolt-Check, go to: “Menu and Functions” on page 43.



7.7 Measure Bolts

- Find the sensor that you are going to use to make the measurements.
- Place a small amount of ultrasonic gel on the sensor. Do not use more than what corresponds to the size of a pea.

- Begin by placing the edge of the sensor on the surface.
- Place the sensor on the bolt by tilting it. Doing so will squeeze away any air trapped inside the gel.
- Rotate the ultrasonic sensor clockwise and counterclockwise until excess gel is squeezed out of the contact surface and the friction feels higher.
- For more info about traceability tags and sensors, go to: “Preparing Tags, Sensors” on page 21.
- Now adjust the “Delay/Width and gain” for the optimal picture.
- Press “Capture” when the optimal picture is achieved.

For more info about optimal picture, look at: “Measuring Elongation on page 39”.

8 Operation

8.1 Starting Up Bolt-Check

This chapter covers the equipment included with Bolt-Check 3 and how to prepare it.

8.1.1 Contents

The Bolt-Check device comes in a robust case with:

- Bolt-Check 3
- Ultrasonic sensor(s)
- Traceability tags
- RFID pen
- Calibration rod
- Calibration fluid
- Ultrasonic gel
- Temperature sensor
- Charger and cables
- Centring pads
- Rigged Case

Bolt-Check 3	UT-Sensor(s)	Magnetic tags	RFID pen
			
Ultrasonic gel	**Temperature sensor**	**Sensor cable**	**Rigged case**
			
Calibration rod	**Centring pads**	**Charger and cable**	**Calibration fluid**
			

Bolt-Check 3 consists of two different devices: a tablet, and an ultrasonic device. Both devices are built into the same case.

Tablet: Panasonic FZ-G2	Ultrasonic device: Dakota Ultrasonics MultiMax
	

8.1.2 Preparing for Measurements

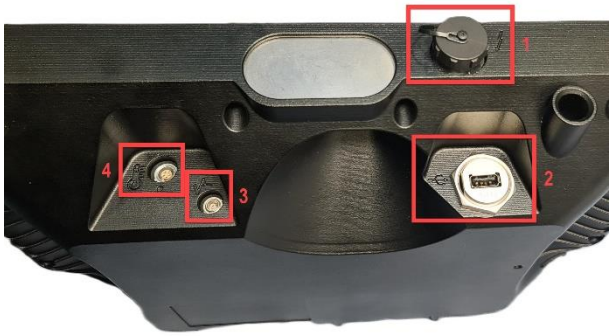
Before starting a measurement, control that the following are connected to the device.

- Ultrasonic sensor
- Temperature sensor
- RFID pen

Ultrasonic sensor	Temperature sensor	RFID pen
		

- Turn on Bolt-Check by pressing the “on button”. (1)
- The tablet has a touch screen and can be operated by either a clean dry finger or with a touch pen.

- The charging port is on top of the cabinet and is marked with a lightning symbol, as show on. (1)
- The USB B port is on top of the cabinet and is marked with a USB symbol, as shown on (2)



- The ultrasonic sensor cable is a small cable with one pin in the middle of the termination. It can only be plugged into hole (3).
- The temperature sensor cable is larger than the ultrasonic sensor cable. It has 5 pins in the termination and can only be plugged into (4).

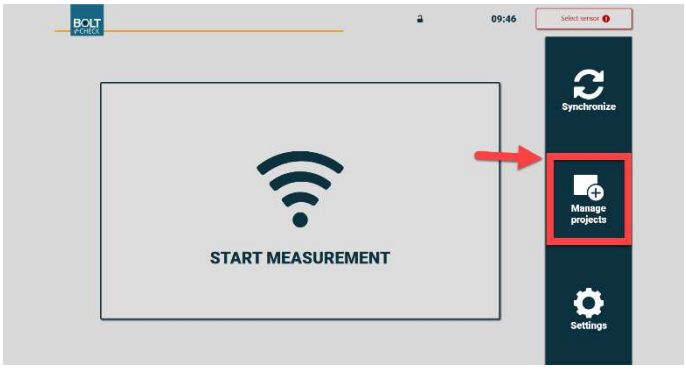
8.2 Starting Up a Measurement Project

This chapter covers how to set up a measurement project via the Bolt-Check program.

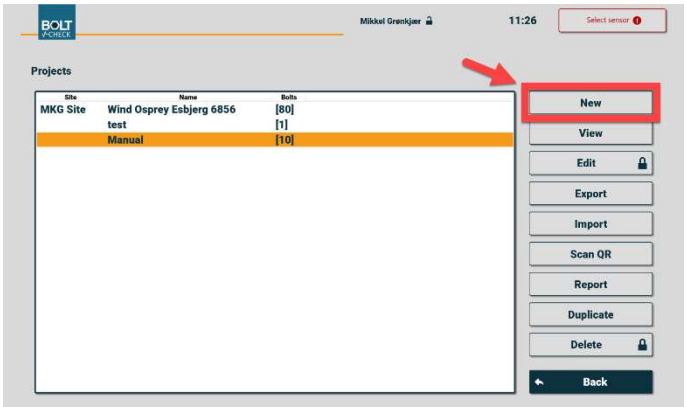
The easiest way to set up a measurement project is on a computer where the Bolt-Check program is installed, but it is also possible to do it on the device.

If a project is already created and stored online in BoltTrack, synchronization must be conducted. For more information see “Synchronization” on page 43.

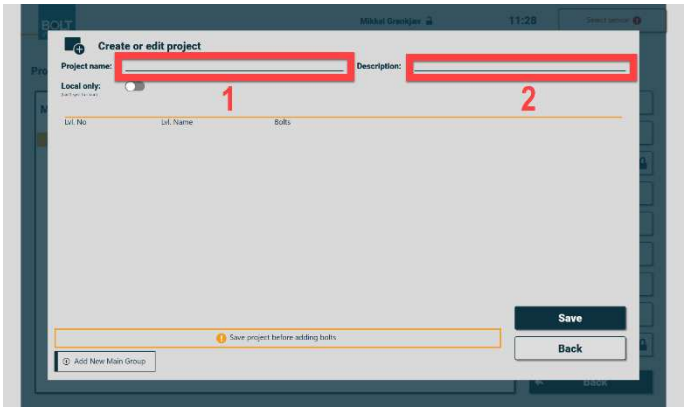
- Press “Manage projects”.



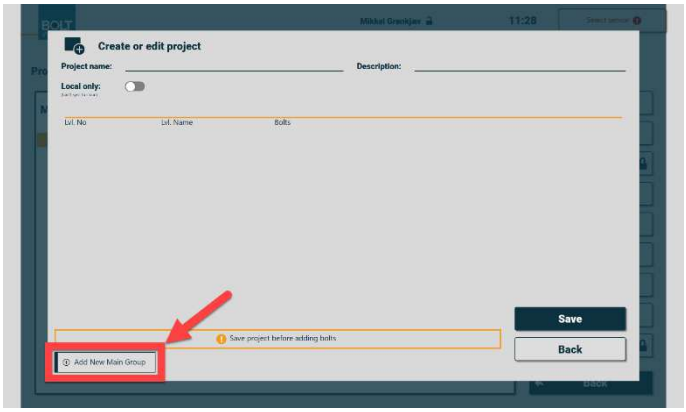
- Select “New”.



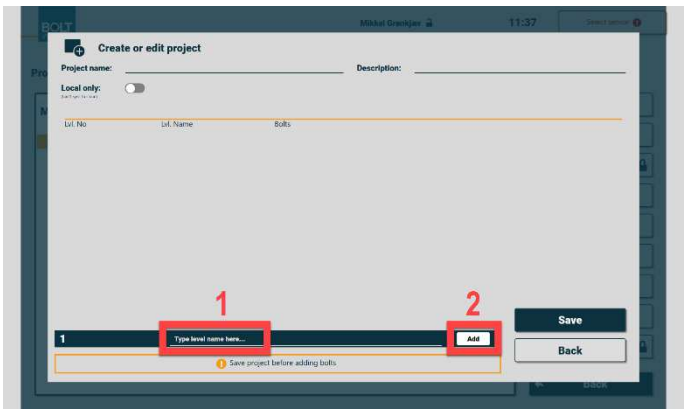
- Enter project name. (1)
- Enter a description (optional). (2)
- Press “Save”.



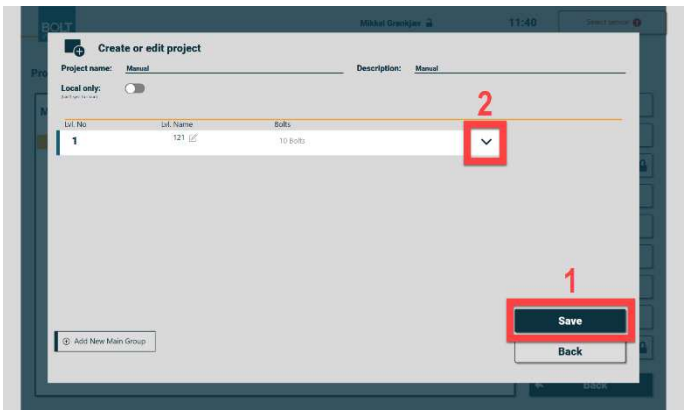
- Press “Add New Main Group”.



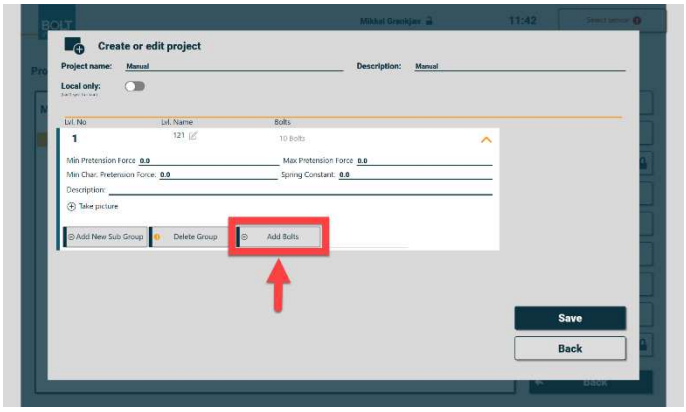
- Type the name of the group. (1)
- Press ”Add”. (2)
- An info is shown that the project must be saved before bolts can be added.



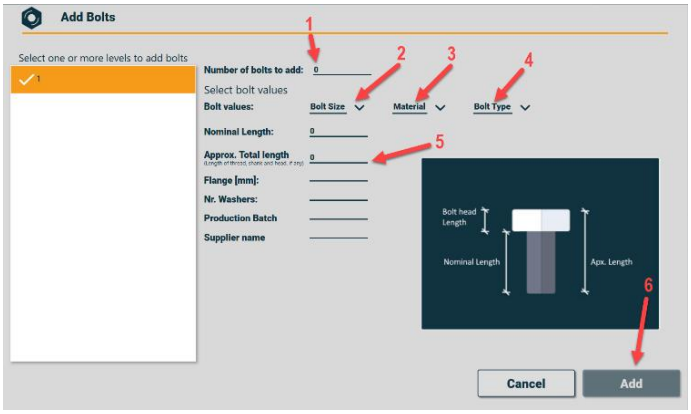
- Press “Save”. (1)
- Expand the level. (2)
- Now it is possible to add bolts or add subgroups.



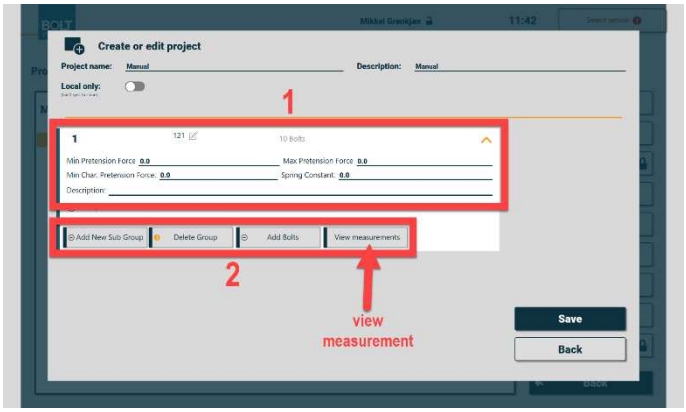
- Press “Add Bolts”.



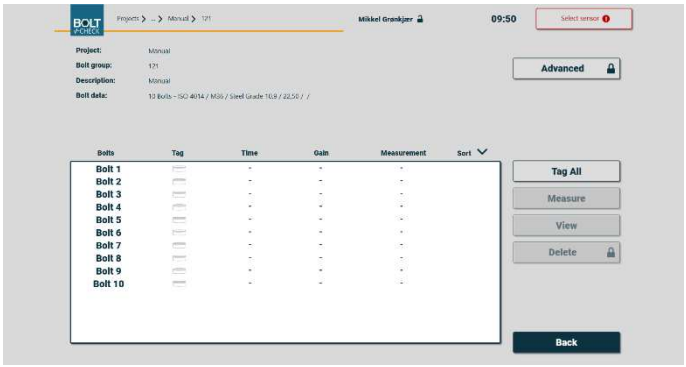
- Enter number of bolts. (1)
- Select bolt size in the drop-down menu. (2)
- Select bolt material in the drop-down menu. (3)
- Select bolt type in the drop-down menu. (4)
- Enter total length of the bolt / fastener, incl. bolt head, if present. (5)
- Enter the clamping length. The distance between the bolt head and the nut. (Optional)
- Enter the number of mounted washers, if they are not already measured as a part of the clamping length. (Optional)
- Enter the batch of the production. (Optional)
- Enter the name of the supplier. (Optional)
- Press “Add”. (6)
- Now a bolt group has been created.



- Optional fields to fill: (1)
  - Min Pretension Force
  - Max Pretension Force
  - Min Char. Pretension Force
  - Spring constant
  - Description
- There are multiple options to press: (2)
  - Add a new Subgroup
  - Delete Group
  - Add Bolts
  - View measurements
- Press “View measurements” as shown on the picture.



- Now the project is ready to have traceability tags assigned.

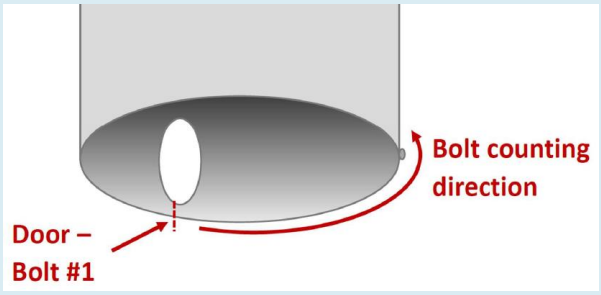
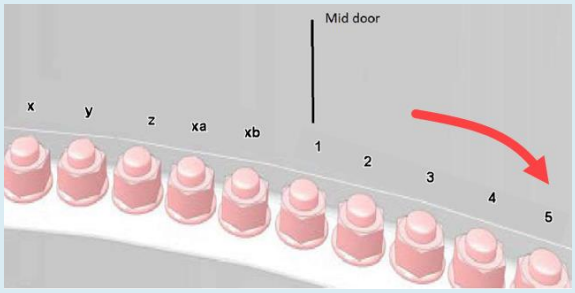


8.3 Preparing Tags, Sensors, and Bolts

This chapter covers how to prepare, assign, and place tags, sensors, and bolts.

8.3.1 Placing Traceability Tags

Before assigning traceability tags it should be considered where, when, and in which order this is desired. An example can be seen in the following two figures of a numbering system from a wind turbine.

Door-Bolt	Mid-Door
	

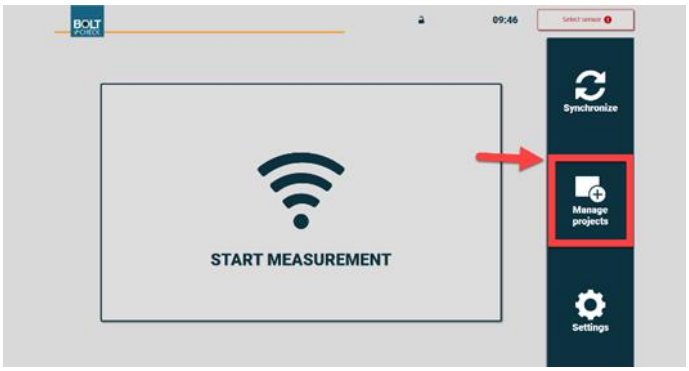
The tags can be placed on mounted bolts or on bolts not yet mounted. If bolts are already mounted the tags can favourably be placed and scanned in order from 1 to N, following the numbering order already used on site or a newly specified order.

The magnetically mounted tags can be attached with additional glue (*e.g. Sikaflex 521 UV or similar non-brittle adhesive).*

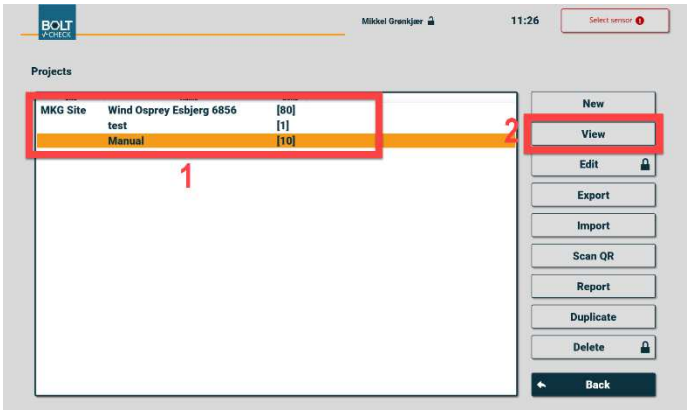
Example of mounted tags


8.3.2 Assigning Traceability Tags

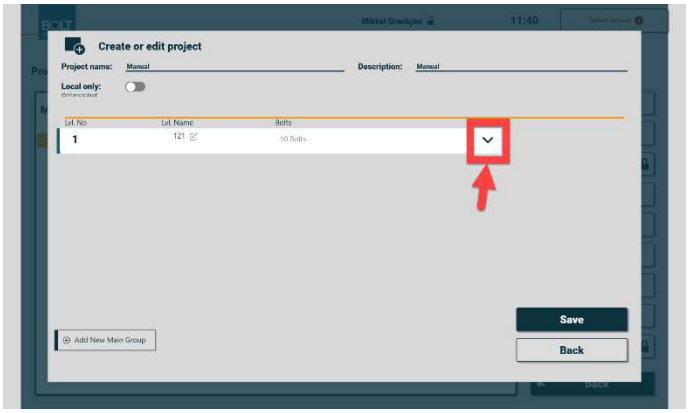
- Press “Manage projects”.



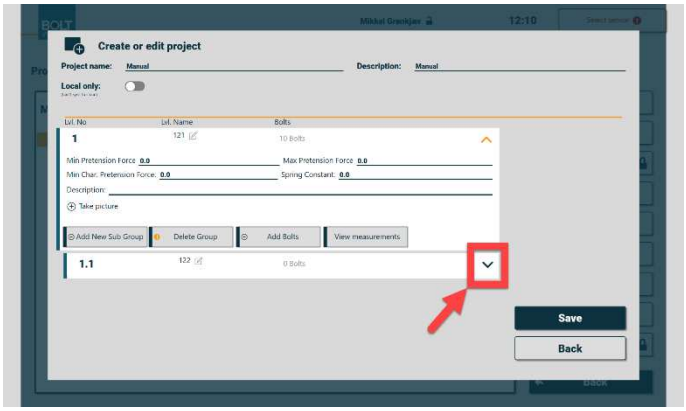
- Choose the desired project to measure. (1)
- Press “View”. (2)



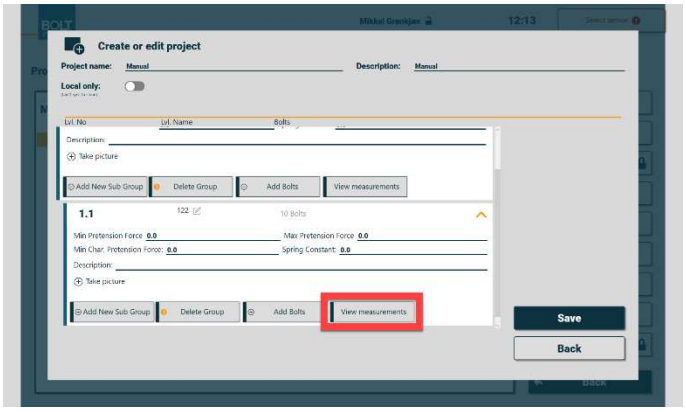
- Press the arrow, so the dropdown will appear.



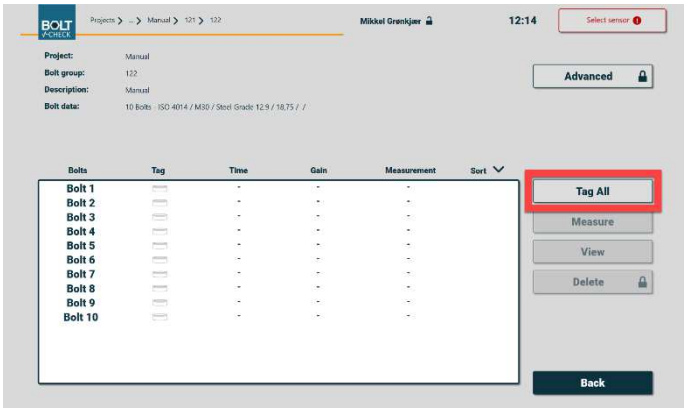
- Press the arrow until the desired level is reached.



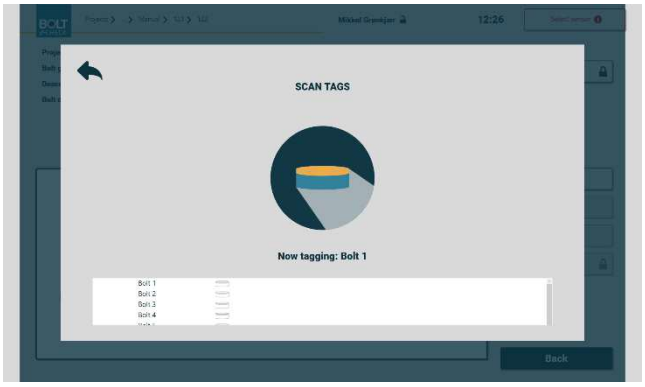
- Press “View measurements”.



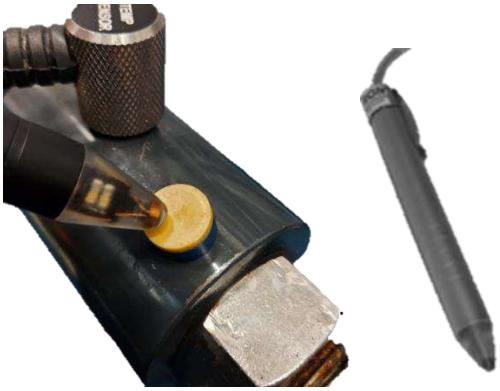
- Press “Tag all”.



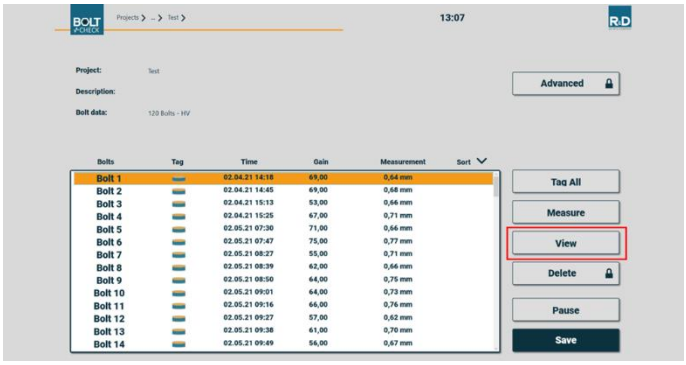
- A “Scan tags” page will appear.



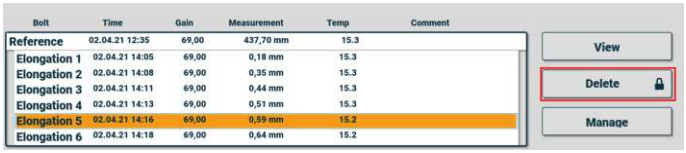
- Place the tip of the RFID pen on top of the traceability tag (yellow side). When the traceability tag is scanned, a high-pitch sound is played as confirmation.
- Simultaneously, the upper tag is marked in the list on the screen and moved to the bottom.
- When all bolts are tagged, the project is ready for measurements.



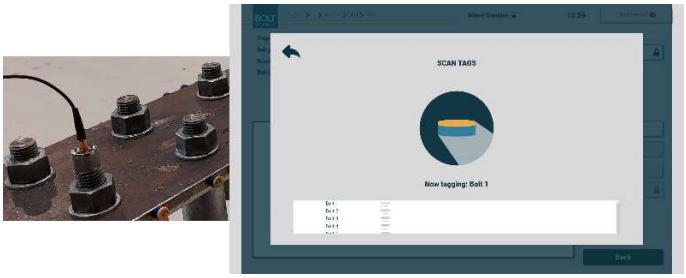
- All reference measurements and elongation measurements are listed. Press “View” to see the selected.



- If an elongation measurement is to be deleted, simply highlight the elongation, and click “Delete”. This will only delete the elongation measurement and not the bolt itself.
- Go to “Menu and Functions” on page 43 for more information about “Delete”.



- When measuring bolts in a group they should all be measured from the same end (either the head or threaded rod end) to get the best and most consistent measurements.
- If all bolts in the group cannot be accessed from the same site (e.g. like in the picture). The measurement menu can be reached by pressing the arrow as shown on the picture.



8.3.3 Choosing Correct Sensor

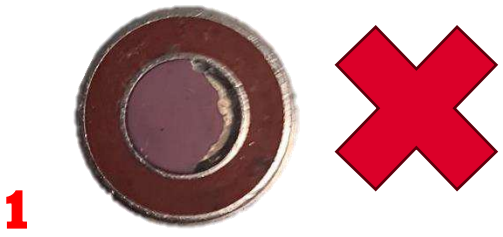
The size of sensor is standardized for repeatability. Sensor sizes are handled by the program as well, meaning that measurements with a wrong sensor size is not possible.

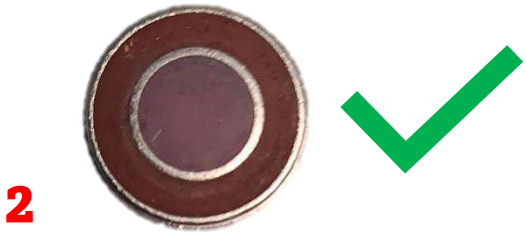
Application	Diameter	MHz
< M16	1/8”	5
M16 – M20	3/8”	2,25
M24 – M48	1/2”	2,25
> M48	3/4"	2,25

For purchasing of additional sensors and calibration rods for operational calibration, contact the Bolt-Check team using the contact information in “Customer support” on page 4.

8.3.4 Preparing Sensor and Bolts

- Make a visual inspection of the sensor, ensuring the measuring surface has no cracks, and does not have any areas where the surface is damaged.
- Clean the sensor surface using a clean cloth.
- Use the following as a guide when performing the inspection.
  - Picture (1) illustrates a heavy worn sensor with a crack. This cannot be used.
  - Picture (2) illustrates a slightly worn sensor without any cracks and all intact. This sensor can be used.
- Check the sensor cable for cracks and verify that all connections are tight.
- Remove any loose particles on the bolt surface, using a wire brush or similar.
- Remove any kind of additional surface protection from the bolt surface, such as Tectyl or Non Nafta, using an appropriate cleaning agent.
- If installing new hot dip galvanized bolts, it can be beneficial to lightly sand the bolt surface, using a fine grinding paper or gently use a grinder to remove the small galvanizing peaks at the surface.
- Make a visual assessment of the measuring surface of the bolt, to decide if additional preparation of the bolt is needed. The placement of the sensor on different types of measuring surfaces is given in the table below.





Example	Description	Suitable for sensor surface	Suitable for reflection surface
	**Type** Forged head. **Batch info** In the centre of the head, negative texture. **Texture** The bolt head is a bit rough, but by selecting the right UT sensor, it is possible to conduct a measurement. The batch info diameter must not exceed 0,75 x Crystal diameter. **Note:** If the batch info is laying below the flat part of the bolt head, this will not have significant influence on the measurement on the bolt, if the UT sensor is placed at the bolt end.	(✓) Sensor surface	✓ Reflection surface
	**Type** Forged head. **Batch info** No info in the middle of the bolt head. **Texture** The bolt head is a bit rough. The surface is suitable as reflection surface. The surface can be used as sensor surface, by selecting largest possible sensor, without interfering with the stamped letters on the bolt head. **Note:** If the surface is grinded or milled to reduce the roughness it can improve the results (especially the repositioning of the sensor by subsequent measurements).	✓ Sensor surface	✓ Reflection surface

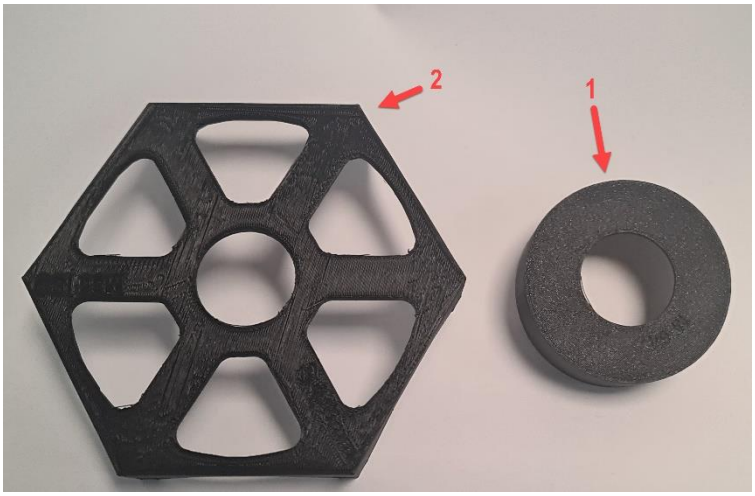
Example	Description	Suitable for sensor surface	Suitable for reflection surface
	**Type** Forged head. **Batch info** In the centre of the head, raised characters on in the measuring area. **Texture** The bolt head is okay, but the presence of the raised characters close to the middle of the bolt head, makes it difficult to position the UT sensor accurately enough.	✗ Sensor surface	✓ Reflection surface
	**Type** Bolt or stud end. **Batch info** Plain without any info or marks. **Texture** The bolt head is acceptable, and the threaded rod is a good surface to measure on. **Note:** The best area to place the UT sensor.	✓ Sensor surface	✓ Reflection surface

Example	Description	Suitable for sensor surface	Suitable for reflection surface
	**Type** Stud end. **Batch info** Plain with marks for batch info. **Texture** The ends are normally sawed and are thus smooth and perpendicular to the bolt. **Note:** Typically, this information is printed as negative holes. This rarely cause problems for positioning the UT sensor. This is a good area to place the UT sensor.	✓ Sensor surface	✓ Reflection surface
	**Type** Bolt or stud end, non-planar, typically hollow. **Batch info** No info. **Texture** This is the worst surface to perform measurement on. Due to the shape of the end, it is possible to vary the results significantly. Even as a reflection surface, if measuring on the bolt head, the readings will be subject to increased uncertainty. **Note:** Surfaces like this are mostly seen for bolt sizes up to M36 as they are often cold forged	✗ Sensor surface	✗ Reflection surface
	**Type** Bolt end after milling. **Batch info** No info. **Texture** The bolt end shown above can be milled to make it suitable for measurements. **Note:** Milling procedure can be sent on request After milling the surface is very suitable both as sensor surface as well as reflection surface.	✓ Sensor surface	✓ Reflection surface

8.3.5 Centering Pads

The positioning, or centering, pads are designed to ensure that the measuring position on bolts, is repeatable. These pads can be purchased at R&D to fit any size of stud or bolt.

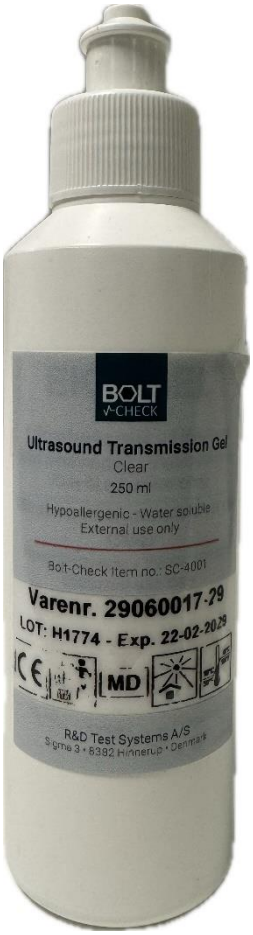
- Centering pad to fit stud, on picture (1).
- Centering pad to fit hex, on picture (2)



8.3.6 Placing Sensor

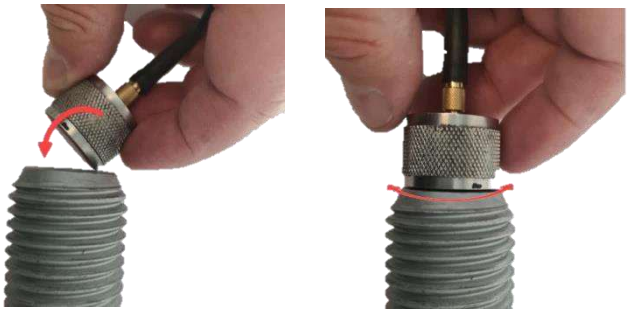
The ultrasonic sensor must have a contact surface with a thin layer of gel to function properly. This removes air between sensor and material, thus improving the transmission of ultrasound.
Special attention is required when handling the sensor and cable. Handling sensor on cable may cause excessive wear and eventually make the cable to break as it is fragile.

- Find the ultrasonic gel and the sensor.

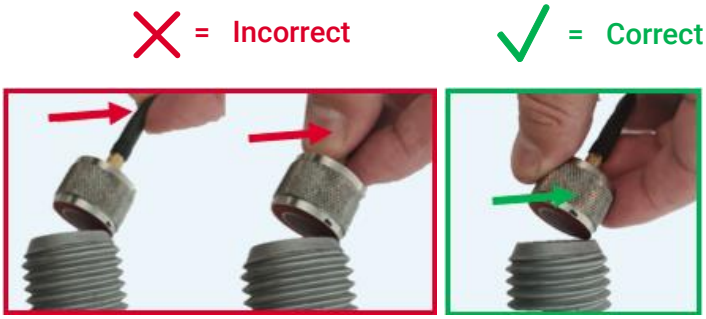


- Apply a small amount of ultrasonic gel to the sensor. The amount should be the size of a pea.

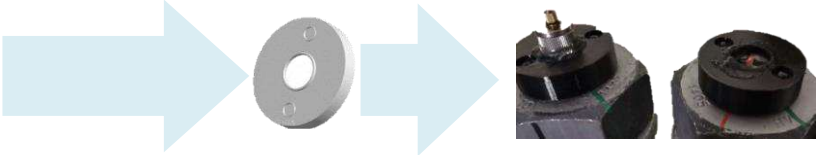
- Place the edge of the sensor on the surface.
- Place the sensor on the bolt by tilting it. Doing so will squeeze away any air trapped inside the ultrasonic gel.
- Rotate the ultrasonic sensor clockwise and counterclockwise until excess ultrasonic gel is squeezed out of the contact surface and the friction feels higher.
- If the sensor can tilt or does not seem to have a stable contact to the measuring surface, then try to clean the surface and sensor followed by a repositioning.
- If the issue is caused by a dent or similar on the surface of the fastener this must be removed.



- The ultrasonic sensor must be held on the textured metal surface, and not on the connection cable to avoid cable damage.
- Measurements should be conducted several times on each fastener to ensure proper placement.
- A method is to reposition the sensor three times and memorize the numbers. If the readings are within ±0,02 mm, the measurement is assumed to be correct.



- Use of a centering pad is recommended to ensure correct re-positioning of sensor.



8.3.7 Placing Temperature Sensor

The temperature sensor is sensitive to external temperature sources, such as warm fingers and storage in pockets. Therefore, the temperature sensor must be handled with special attention as this could affect the measurement. Show special attention in cold conditions with strong sunlight, and similar situations, as this may cause certain areas to be warmer than other.

- Handle sensor on the wire only.
- Keep sensor within 40 cm of the measured fastener.

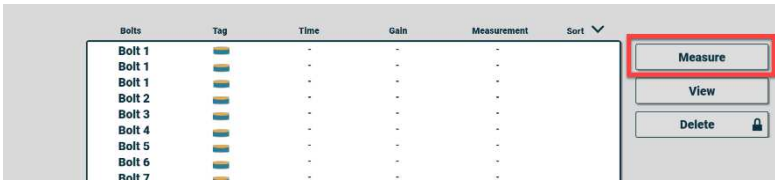
- Mount sensor on fastener or flange.

8.4 Creating Reference Data

This chapter covers the process of measuring reference data, using a project already set up.

For information on how to adjust the picture, read “Measurement Specifications” on page 59

- Press “Measure” at the bolt group. A scanning menu will now appear.



- Use the RFID pen to read the traceability tag and measure the bolt.
- This will be the reference measurement and will be the zero point for this bolt afterwards.

- The ultrasonic reflection is displayed.
- For the first measurement it might be necessary to press “Autoset” to tune in on the correct image.
- On the remaining bolts this “Autoset” should only be used if the image needs adjusting, due to a different batch of bolts, etc. (1)

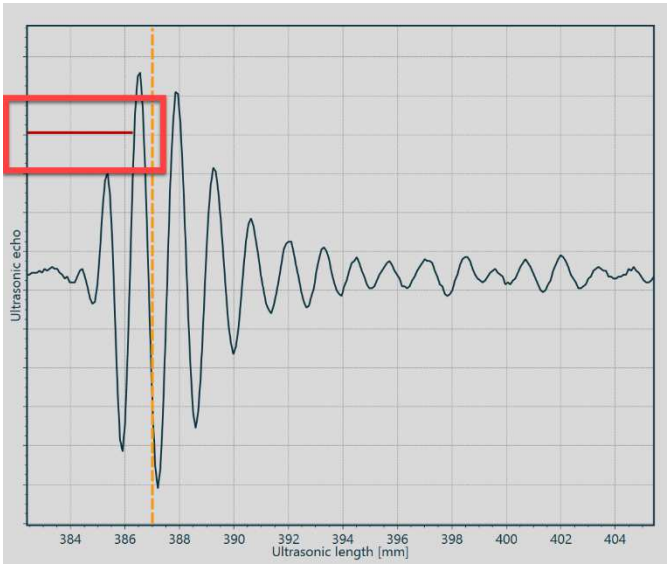
- When the reading on the screen looks satisfying press “Capture”.
- A good image is shown on the picture.
- The ultrasonic length is displayed as showed on the picture.
- This is the reference, and it displays the calculated length.

8.4.1 Measured Wave

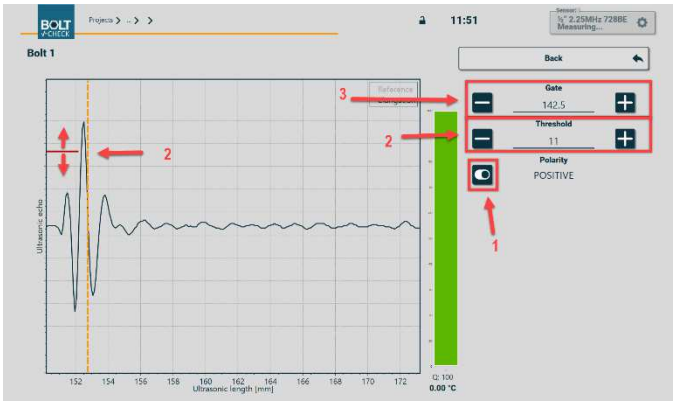
This chapter covers how and where to read the measured wave correctly.

- The red horizontal line displays the point of measurement.
- The wave measured can be with positive (+) or negative (-) polarity.
- The polarity defines if it is a positive or negative wave that the measurement is performed on. The polarity cannot be changed after a reference measurement is made. *
- The reference length will vary a bit depending on the polarity, but as the polarity is fixed afterwards, it will not have any influence on the elongation measurements.

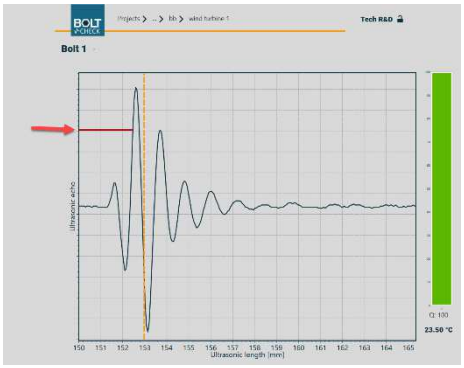
*NB: All calibrations on the devices are made using positive (+) polarity.

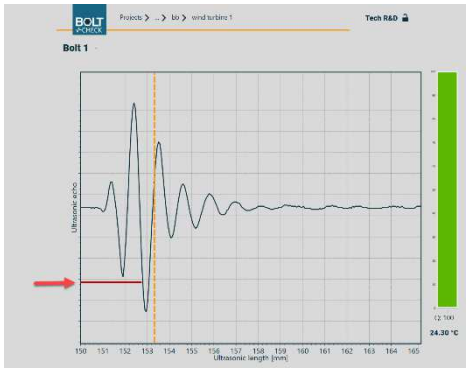


- Under “Advanced”, there is three options to choose from:
  - Gate
  - Threshold
  - Polarity
- To change the polarity, press the button as shown on the picture. The name/polarity will change accordingly. (1)
- It is recommended to change the polarity to “Positive”.
- “Threshold” will change how high or low the wave is measured; the wave will move up or down as shown by the two arrows on the picture. (2)
- Changing “Gate” will change where the measuring line (red line) starts from. In this case the line starts measuring from 142.5 instead of from 0. Meaning it will not measure any noise from 0 to 142.5 (3)

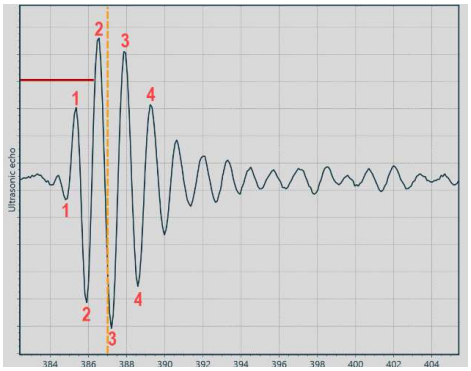


- Illustration of measurement on positive and negative settings on the same image on the two pictures.
  - Top picture is measured on the positive side.
  - Bottom picture is measured on the negative side.





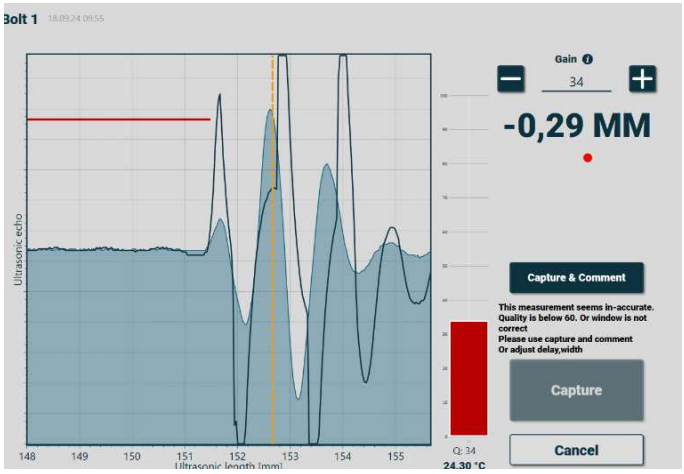
- The first four waves are numbered on both the positive and negative side.
- The fasteners should be measured on the second wave since this is often the easiest to repeat, even after an elongation where the ultrasonic image can change a bit.



8.4.2 Error from Wrong Wave Measurement

A typical error during elongation measurement is to accidentally measure on another wave than the reference measurement was performed on.

- Measuring on same wave results in a correct measurement. In this case a 0 measurement.
- Measuring on an earlier/later wave (1 wave) results in an error on approx. ±0,3mm.
- To compensate for this wrong measurement, identify correct wave and adjust gain until correct/reference wave is measured on.



8.4.3 Stress Factor

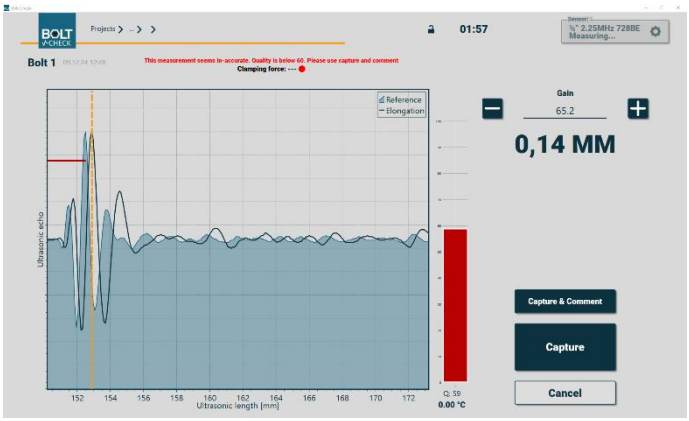
This chapter covers the stress factor and its visual impact during measurements.

The ultrasonic image on the graph does not show the actual elongation. The ultrasonic measurements have a “stress factor” which is a material constant. This is due to a change in the speed of sound through a material which is stretched.

Stress factor is a constant corresponding to the difference between raw ultrasonic elongation and physical elongation. It is defined as $\frac{Physical\ elongation\ [mm]}{Ultrasonic\ elongation\ [mm]}$ and is a unitless constant.
The stress factor is material specific, and relatively stable between different steel batches.
For Bolt-Check measurements a stress factor for steel is used on 0,274.

The visual impact of the stress factor is a difference between the displayed elongation on the image, and the displayed elongation in digits. This means that for each 1 mm on the ultrasonic image scale, this only represents 0,274 mm elongation.
During reference measurements it must therefore be considered when choosing the width of the image. If an elongation on 1 mm is expected, the ultrasonic image will then need 3,65 mm free space. Width must therefore be adjusted, so that the image has space enough from reference image and through all future measurements.

- On elongation images the shadow represents the reference measurement, and the line represents the actual reading.
- Data treatment of stress factor impact is handled automatically by Bolt-Check.
- The operator should only focus on reading at the right wave peak and adjust the height of the curve to get the best result possible.



Stress factors can be calculated on batch level, but this is normally not recommended. For further information on stress factor calibration see Ref. [2] in section 17 on page 86.

8.5 Measuring Elongation

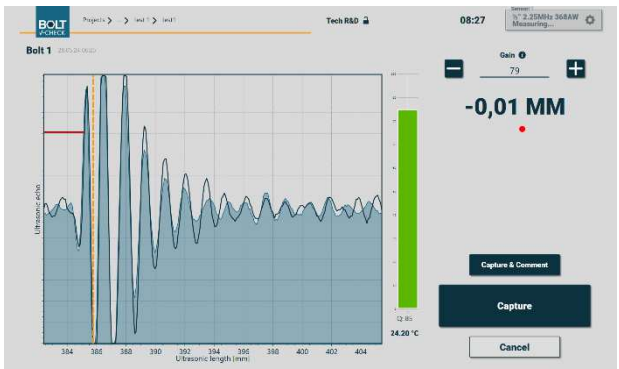
This chapter covers elongation measurements, which are always performed after reference measurements.

Bolt-Check is used to obtain an ultrasonic reflection image. The reference measurement is measured on the bolt before any tightening is conducted. Afterwards when the tightening is done, the elongation measurement is performed to measure the elongation of the bolt.
Measurements can be performed after tightening procedure or during tightening procedure if measurement surface is available during tightening.

When measuring an elongation, the procedure is the same as when measuring a reference.

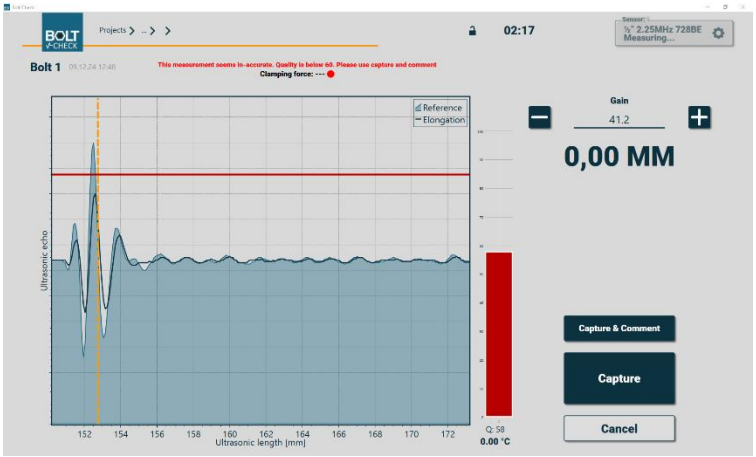
- Press “START MEASUREMENT” on the main screen to be directed to the bolt group.
- Press “Measure” at the bolt group.
- Scan traceability tag.

- The display appears with a blue shadow curve which is the reference curve.
- When placing the ultrasonic sensor on the bolt, a dark blue line appears. This line displays the current ultrasonic image.



- The quality indicator helps repositioning the sensor to find an ultrasonic image close to the reference. (1)
- The temperature will affect the elongation if the temperature sensor is not the same temperature as the bolt. Therefore, let the temperature settle before capturing a measurement. (2)
- Elongation is in [mm]. (3)
- Adjusting the gain might improve the value of the quality indicator. (4)
- If the quality indicator has a low value, or some observations are made on-site. It is possible to assign comments to the individual measurement by pressing “Capture & Comment”. (5)
- Pressing “Capture” captures the measurement. Afterwards the program returns to the scanning menu. (6)

- If the quality are lower than 60, it is not possible to press “Capture”. Several scenarios may cause this:
  - The measurement is conducted on the wrong wave. In this case “Gain” should be adjusted to find the optimal reflection.
  - The contact surface needs gel or cleaning.
  - The cable is not connected properly to the ultrasonic sensor.
  - The measurement is conducted on the wrong bolt. In this case, press “Cancel” and scan the correct traceability tag instead.
  - Unidentified reason for low quality. In this case the button “Capture & Comment” should be used.



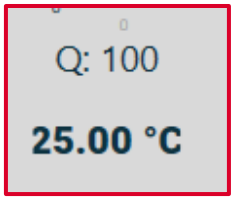
8.5.1 Quality Indicator

When performing measurements, a quality indicator is shown on the right side of the screen as colour scaled bar. This reflects the quality of the measurement and therefore, a high quality indicates a reliable measurement.

The quality indicator has two functions:

- When performing **reference measurements**, it shows if the signal is sufficient. It does not show if the image is sufficient regarding measured wave, delay, width, or gain. That is for the operator to decide.
- When performing **elongation measurements**, it shows the similarity of the elongation image compared to the reference. This is to verify that the same ultrasonic wave is measured.

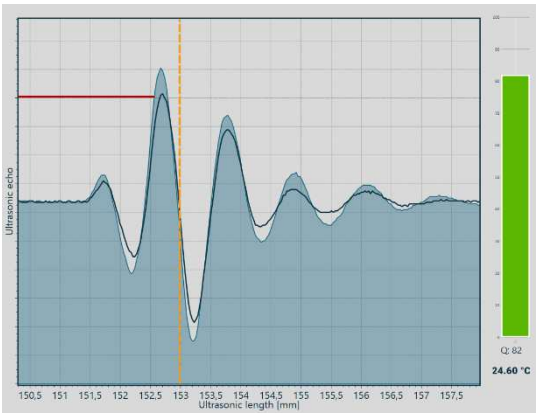
- The quality is displayed both in the height and colour of the bar, and numerically below the bar.
- Positioning of sensor and "Gain" will impact the quality indicator.

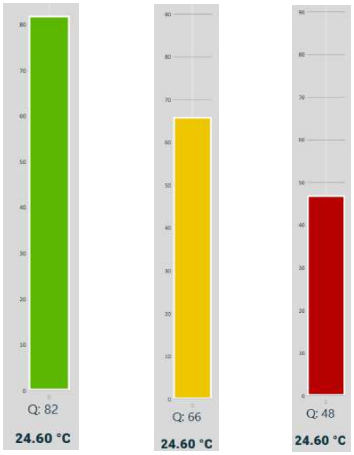


- Increases of the quality indicator are obtained primarily by a changed height of the curves. Normally the readings are made at the second wave. The heights of the first three curves are the most important to adjust.
- Elongation measurements should, as a rule, have the same wave height on the measured wave as the reference to ensure good quality indication.
- If a wrong wave is measured, the image must be adjusted with the "Gain" option.

- When performing elongation measurements, it is recommended to always try and change the gain up or down if the quality indicator is below 90, to see if it increases.
- Good quality measurements increase credibility and reduce doubt in unexpected results.
- There are three different colours for the quality indicator:
  - Green
  - Yellow
  - Red
- The colours indicate how much the current elongation measurement, resembles the reference measurement.

This doesn't mean that the measurement is wrong, only that the picture of waves has changed.





9 Menu and Functions

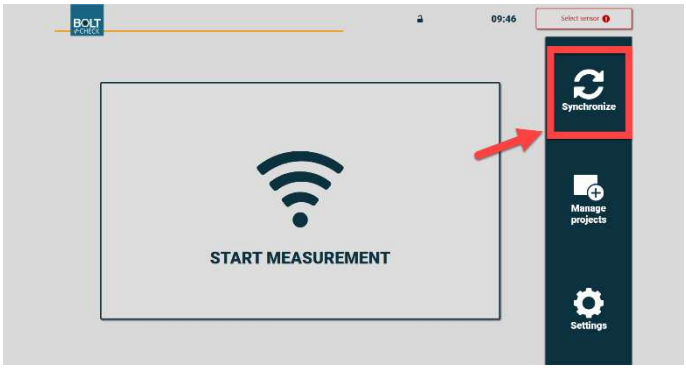
This chapter covers different menu topics and navigation in the Bolt-Check program.

9.1 Synchronization

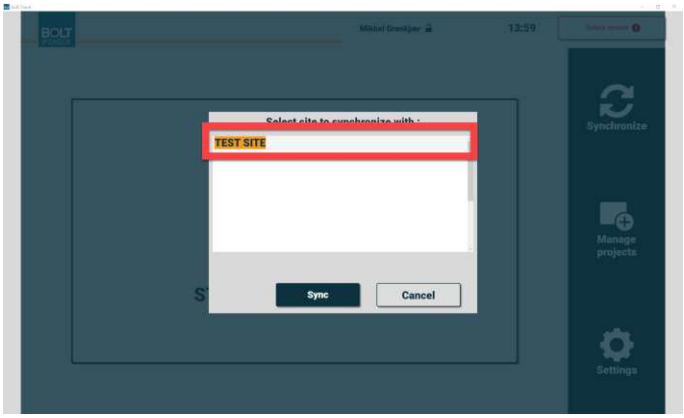
This chapter cover synchronization between Bolt-Check device and database.

- Press “Login”.
- Enter the login received from Bolt-Check team or admin consisting of an e-mail and a password.

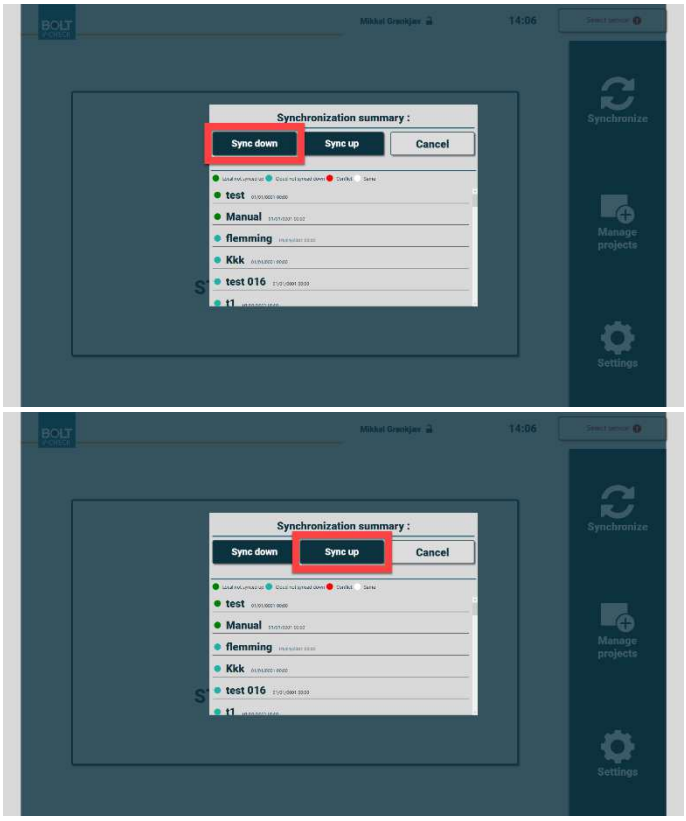
- To measure an existing project, which is stored online in BoltTrack, the project must be synchronized.
- Press “Synchronize”.



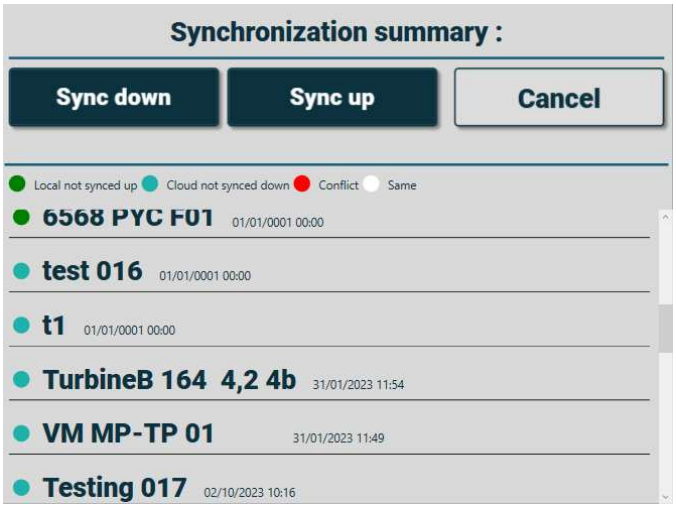
- Press and highlight which site to synchronize.



- To update the device with data from database, use “Sync Down”.
- It is now possible to continue measurements on a project from BoltTrack.
- To update the database with data from device, use “Sync Up”.
- The database is now updated with newest data from device.



- “Local not synced up” (green) means that the project is only updated locally the Bolt-Check and not online in the database.
- “Cloud not synced down” (blue) means the project is not synced down from the database, any changes made in the database will not be visible before it has been synced down.
- “Conflict” (red). If any conflict is detected, it will appear in red e.g. If the internet went out while synchronizing.
- “Same” (white). If the project appears white, it means that the database and device are aligned.



9.2 Manage Projects

This chapter covers all options under "Manage projects" found on the start screen.

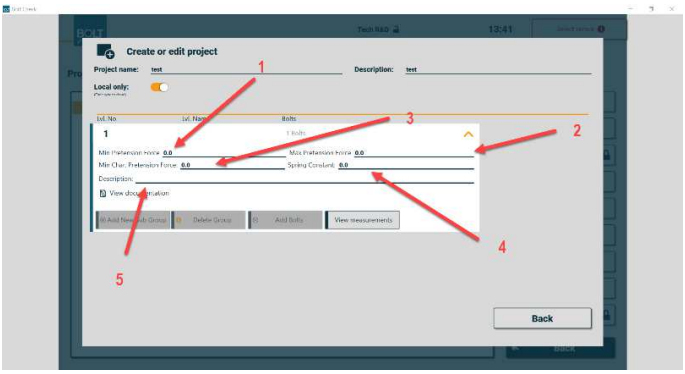
9.2.1 New

Go to "Starting Up a Measurement Project" on page 17 for full introduction on how to start a new project.

9.2.2 View

- When the project is selected press "View".
- Thereafter press the "arrow" to get the menu opened.
- "Min Pre-tension Force" is set after the specific joint. (1)
- "Max Pretension Force" is also set after the specific joint. (2)
- "Min Char. Pretension Force". (3)
  $\mu - Kn.\sigma$
  μ: Mean of sample
  Kn: Coefficient from table
  σ: Sample standard deviation
- "Spring Constant" is an individual force dependency for each joint that is calculated and set here. (4)
- "Description" can be written here for personal use. (5)

*Information can only be viewed here. To make changes the project must be opened by using the edit button.



Characteristic Pretension

μ - $k_n \cdot \sigma$

where:
μ : mean of sample
k_n : coefficient from Table 13-1
σ : sample standard deviation
n : number of measurements in sample

n	3	4	5	6	8	10	20	30	∞
k_n	3.37	2.63	2.33	2.18	2.00	1.92	1.76	1.73	1.64

Table 13-1: Value for the k_n for the 5% characteristic value, based on EN 1990:2002+A1:2005 (E).

For values of n not available in Table 13-1, the following approach can be used for obtaining k_n depending on n value of interest:

- for 3 < n < 30 ,

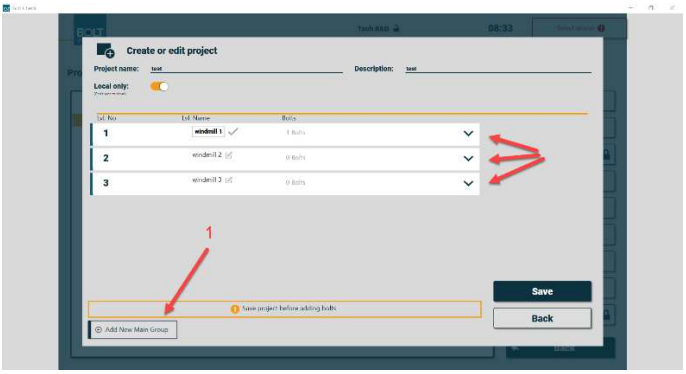
$$k_n = \frac{(n_2 - n)}{(n_2 - n_1)} \cdot k_{n1} + \frac{(n - n_1)}{(n_2 - n_1)} \cdot k_{n2}$$

Corresponding to a linear interpolation using the following values from Table 13-1:
n_2 : n value closest to and immediately higher than n
n_1 : n value closest to and immediately lower than n
k_{n2} : k_n value correspondent to n_2
k_{n1} : k_n value correspondent to n_1

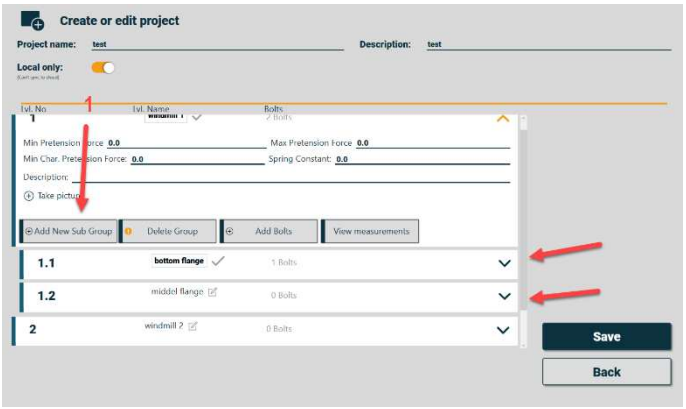
- for n > 30 , $k_n = k_{30}$.

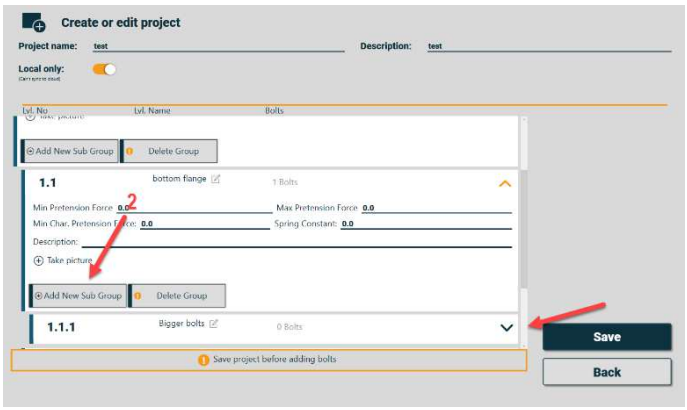
9.2.3 Edit

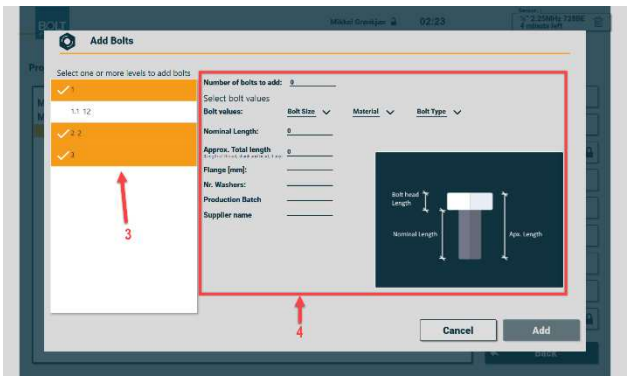
- Under edit, as shown in “View on page 45”, there are options for every group and subgroup.
- “Add New Main Group” is used to design a structure of the project. (1)



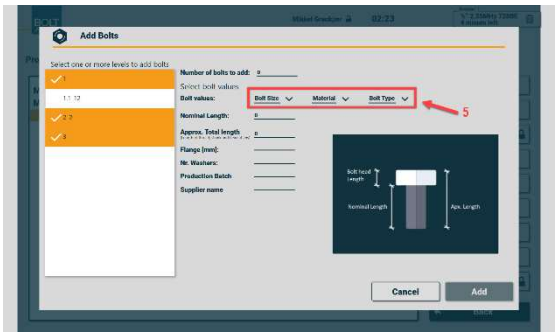
- “Add New Subgroup” is used to set up subgroups to a main group.
- As shown in the picture it is possible to have a flange assembly or several under the specific wind turbine. (1)
- There is also an option to add more subgroups e.g. if there are different bolt types.
- Press “Add New Subgroup” under the desired group, press “Save” and open it again. This will make it available to insert min/max pretension etc. (2)
- To “Add Bolts” every main group and subgroup needs to be saved.
- Press “Add Bolts”
- A window will open, from here select every main and subgroup with the same bolts to add them all at once. If it is all different bolts skip this and only select the needed group. (3)
- Insert every relevant information such as (4)
  - Number of bolts
  - Bolt size
  - Material
  - Bolt type
  - Nominal length
  - Flange
  - Washers
  - Production batch
  - Supplier name

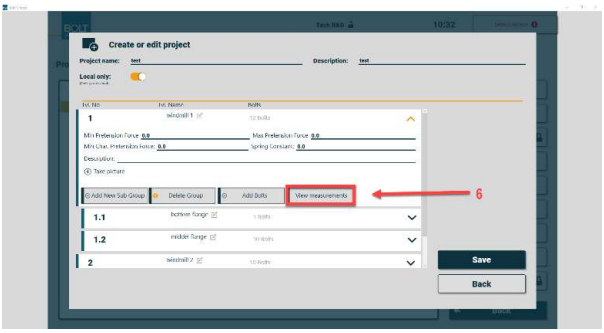


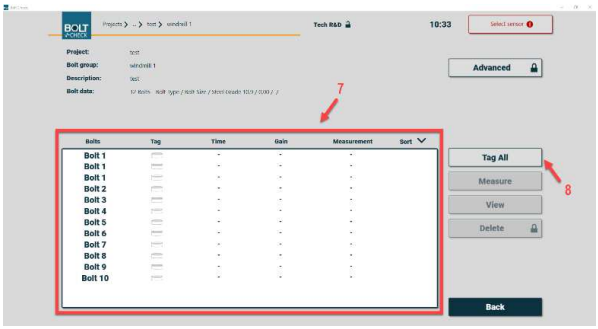




- Bolt properties regarding size, material and type can be chosen from a drop-down menu. Simply click the arrow. (5)
- When all required and relevant information is entered, press “Add”. Bolts are now added to the selected groups.
- Press “View Measurement” to view bolts in the specific group. This needs to be done with every main and subgroup. (6)
- Additional information on a flange is shown. This includes: (7)
  - Tag
  - Time
  - Gain
  - Measurement
- Another option from here is to “Tag All”. An explanation can be found under the chapter “Assigning Traceability Tags” on page 22. (8)



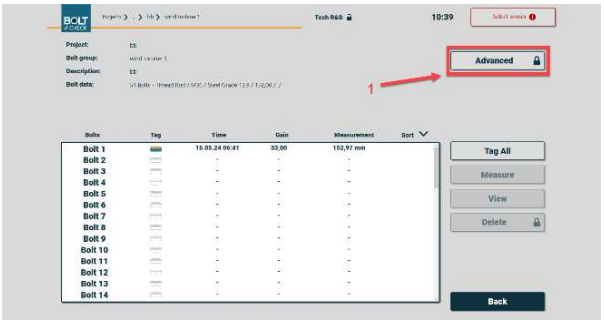


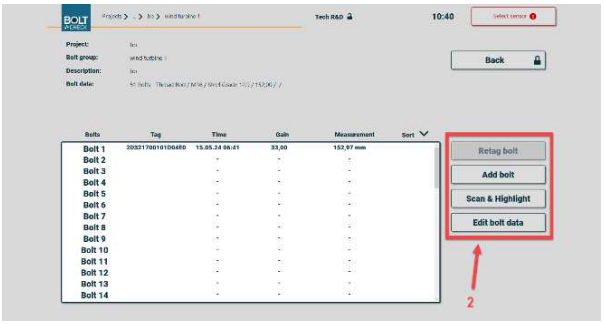


9.2.4 Advanced

Under “Advanced” there is a sub-menu, from here additional options occur: “Retag bolt”, “Add bolt”, “Scan & Highlight” and “Edit bolt data”. (1)

- The traceability tags change from icons to the actual traceability numbers.
- Press “Retag bolt” if a tag is lost for a known bolt. This will initiate a process to scan a new tag to be associated with the selected bolt.
- Press “Add bolt” if more bolts are needed in the group. Follow the instructions on screen.
- Press “Scan & Highlight” to verify tag association. The associated bolt with the scanned tag will be highlighted on screen.
- Press “Edit bolt data” if any edits need to be done to e.g. Bolt Size/Material/Bolt Type/Nominal length/Approx. Total length/Flange/Nr. Washers/Production Batch/Supplier name.





9.2.5 Export

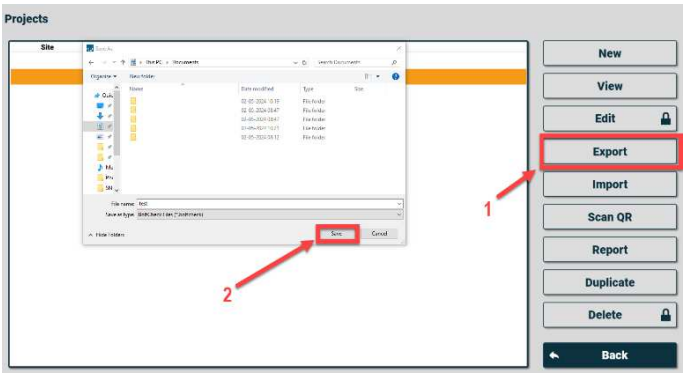
By exporting the selected project, it can be saved to a desired location.

This file can only be opened by Bolt-check software.

For importing it see “Importing Data” on page 70.

- Press “Export” and a window will pop up to choose where to export the file to. (1)
- Press “Save” after navigating to desired location. (2)

*More in-depth version can be found under “Exporting Data” on page 68.

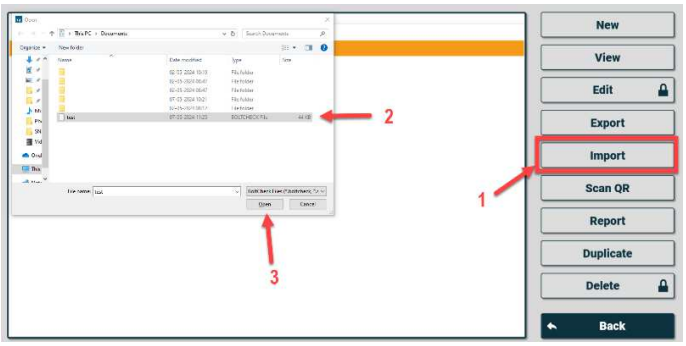


9.2.6 Import

By importing a Bolt-Check file, it is possible to open a project on another Bolt-Check device or PC.

- Press “Import” to import the new file to the Bolt-Check software. (1)
- Select the Bolt-Check file to be imported by highlighting it. (2)
- Press “Open” and the project will be available under “Manage projects”. (3)

*More in-depth version can be found here “Importing Data” on page 70.

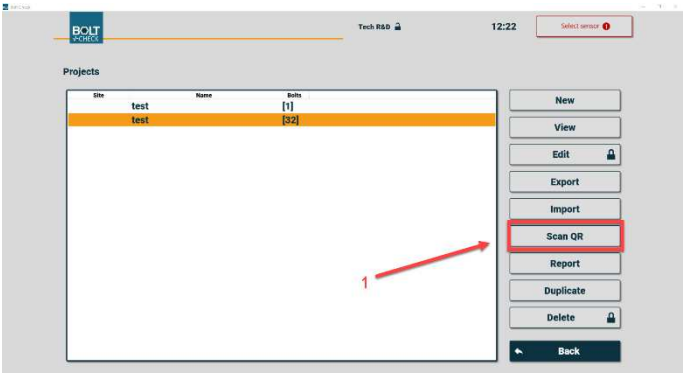


9.2.7 Scan QR

"Scan QR" makes it possible to scan QR codes, designed to include all relevant flange and bolt data.

This makes it easier to navigate if there is a lot of projects on the Bolt-Check device.

- Press "Scan QR" and the camera will activate.
- Point the camera at the QR code and the project will open. (1)



Format for QR codes is:
{ "metadata": [1, "*Location ID*", "*Rotor size*", "*Power rating*", "*Mark*", "*Bolt_group_path*", "NOT USED", *Number_of_Bolts*, *Number_of_Tags*, "Bolt_M_Size", "*Bolt_Material_Grade*", "*Bolt_Type*", Nom_Bolt_Length*_mm, Bolt_kN_min_pretension, Bolt_kN_max_pretension, Bolt_kN_min_characteristic_pretension, Bolt_liniar_relationship_kN_mm]*
}

Example:
{ "metadata": [1, "ABC53", "164", "4,2", "4b", "Tower/Section1", "NOT USED", 50, 32, "M56", "10.9", "HV", 220, 200, 300, 190, 309]
}

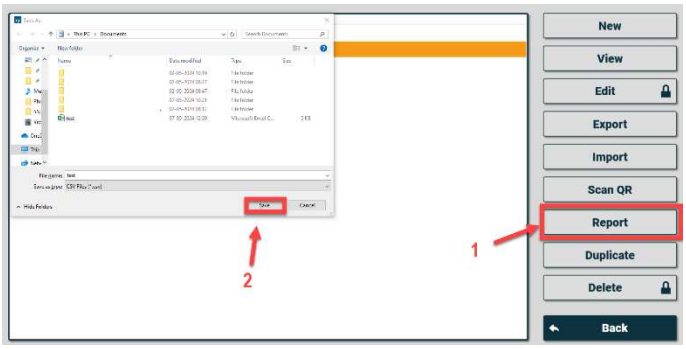
This is rewritten into a QR code, and looks like this:

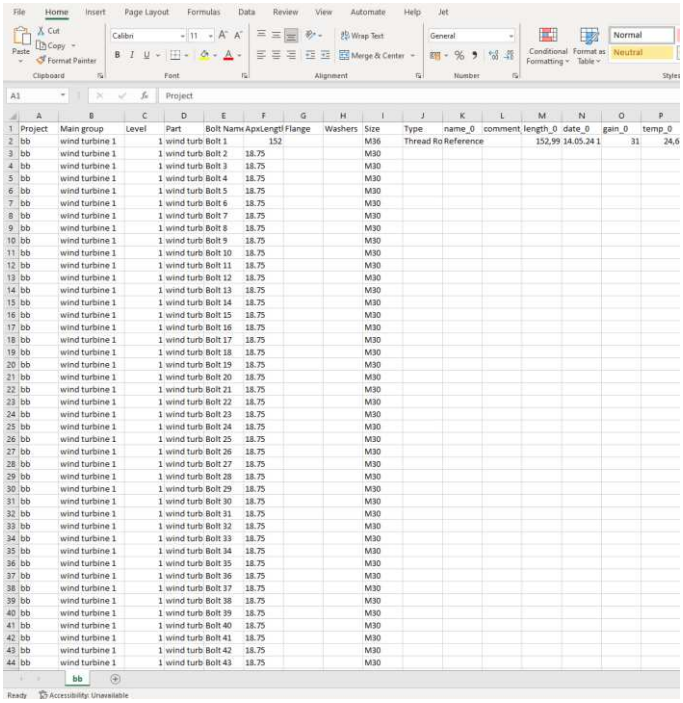
9.2.8 Report

"Report" extracts data from the selected project, this file is saved as a .csv file which can be used for further data treatment.

- Press "Report". (1)
- Select a desired location to store the file and press "Save". (2)
- When opened with Excel the information is displayed, so that every bolt has its own line with all information on the same row. Displayed information is:
  - Project
  - Main group
  - Level/Subgroup
  - Part
  - Bolt name
  - AptLenght
  - Flange
  - Washers
  - Size
  - Type
  - Ref measurement
  - Measurement 1
  - Measurement 2

*Ref, measurement 1 and 2 are not on the picture because they were not conducted.



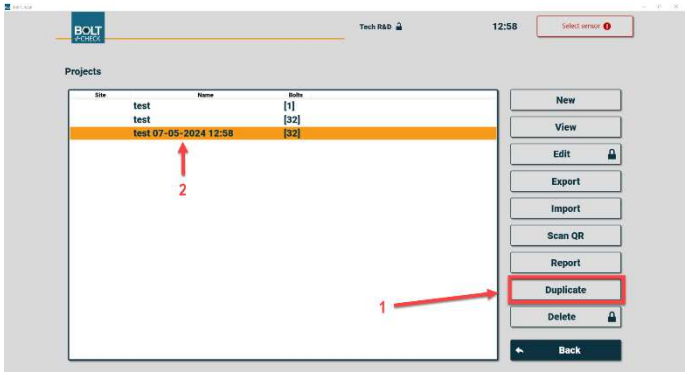


9.2.9 Duplicate

"Duplicate" is used for duplicating a project to save time.

It takes time to set up a site with locations and flanges. Therefore, it is possible to use an existing project to create a duplicate.
It is only the structure which is copied. Any results or association to tags are not a part of the duplicate project.

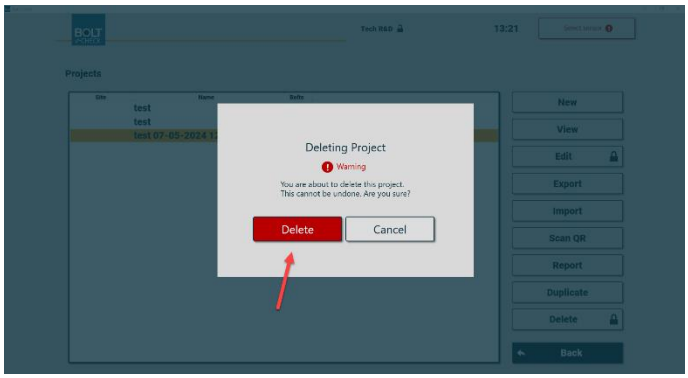
- Select the project by highlighting it.
- Press "Duplicate". (1)
- Another project will appear with date and time it was duplicated. (2)



9.2.10 Delete

"Delete" will delete any highlighted project; the system comes with a warning before deleting.

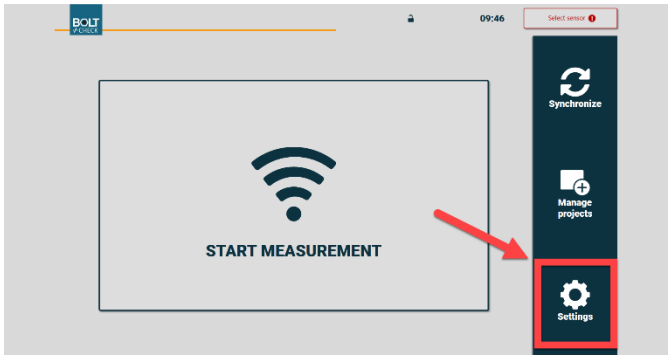
As shown on warning pop-up, deleting a project cannot be undone, unless the project has been exported or synchronized already.



9.3 Settings

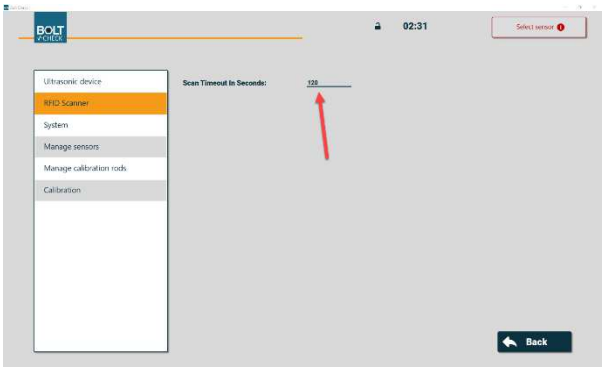
This chapter covers all options under settings.

- The “Setting” button is located at the start screen on Bolt-Check.
- From there navigation is possible to manage:
  - Measurement Device
  - RFID Scanner
  - System
  - Sensors
  - Calibration rods



9.3.1 RFID Pen

- The timeout for the RFID pen can be adjusted.

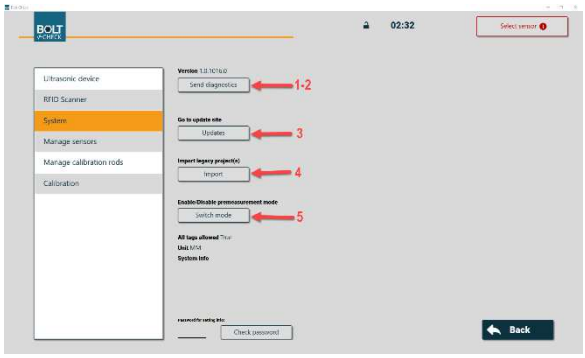


9.3.2 System

The system tap contains information and some action buttons.

- Send diagnostics if something is wrong with the Bolt-Check program. This will then be available to R&D as an error report. (1)
- System software version is shown here. (2)
- The program can be updated to newest version. Use “Updates” to be directed to the website from where software can be downloaded. (3)
- “Switch mode” is used to go into pre-measurement mode, this is enabled/disabled by pressing on the button. (4)

*Premeasurement mode is made for bolt manufacturers.

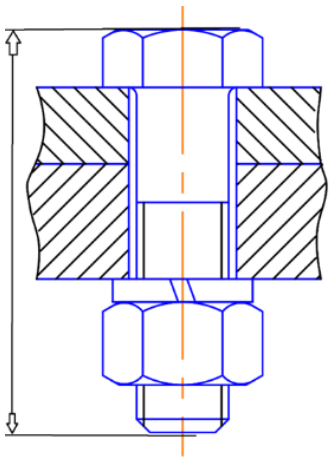


9.3.3 Manage Sensors

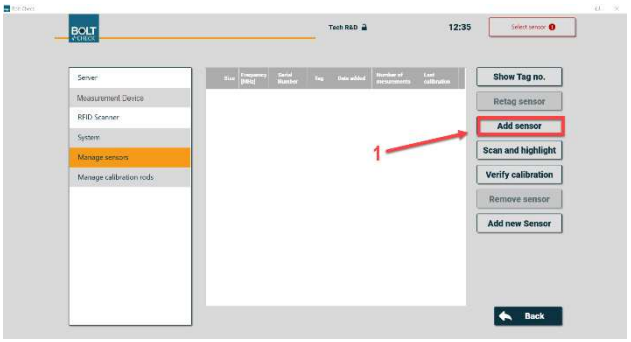
When receiving the equipment, it will have a basis calibration from R&D, based on R&D master calibration rods.
If separate rods are delivered along with Bolt-Check, the calibration will be based on these rods.
This calibration is based on the actual setup of the device at delivery.

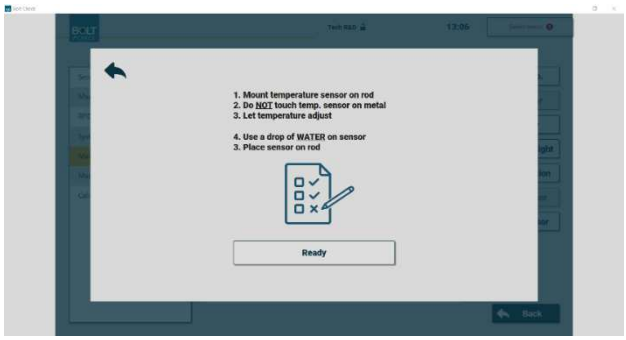
To ensure repeatability of the measurements the Bolt-Check setup must be calibrated in the following situations.

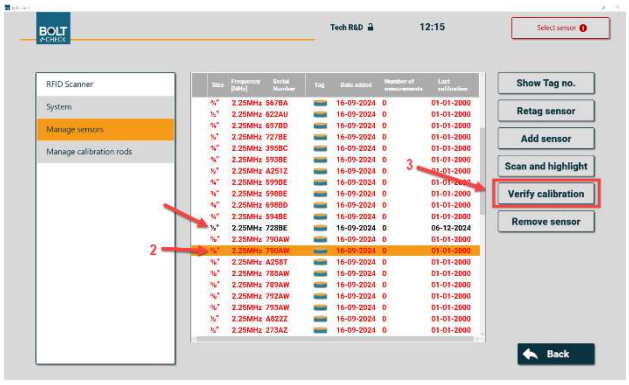
- Initial calibration of the setup using delivered ultrasonic sensor.
- If replacing an ultrasonic sensor.
- If replacing a signal cable.
- On a regular basis, max 31 days, controlled by the Bolt-Check software.



- When receiving a new Bolt-Check device or a new sensor it must be added in the Bolt-Check program.
- A tag is present on each individual sensor.
- Press on “Add sensor” (1) and scan the tag.
- Sensor name and details will appear on the new sensor, and the text will be red. This means that a calibration is required. (2)
- Press “Verify Calibration” and scan the tag on the sensor. (3) The calibration wizard will guide the user through the calibration process.
- Scan the tag on the sensor and afterwards on the calibration rod.
- A checklist appears, guiding the user to prepare sensor and rod for calibration.







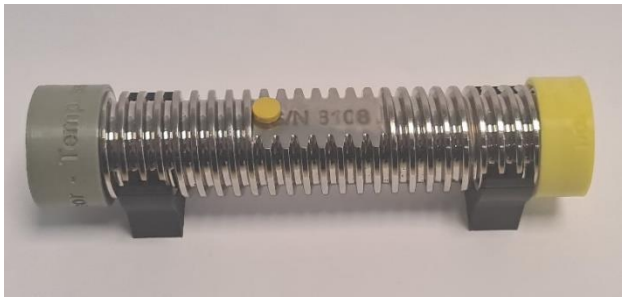
1. Mount temperature sensor on rod.
   - The grey pad on rod is for temperature sensor, and no other sensors will fit.

2. Do not touch temperature sensor or metal.
   - Heat from fingers affect the temperature reading.

3. Let temperature adjust.
   - Observe the temperature over a few minutes, and perform calibration when temperature is stable.

4. Use a droplet of calibration fluid on sensor.
   - It is very important to use calibration fluid
   - Ultrasonic gel is *not allowed*. It increases uncertainty during calibration.

5. Place ultrasonic sensor on rod.
   - Prepare the calibration rod with a centring pad corresponding to the sensor size.
   - Place the sensor.
   - Now “ready” can be pushed and calibration is initiated.

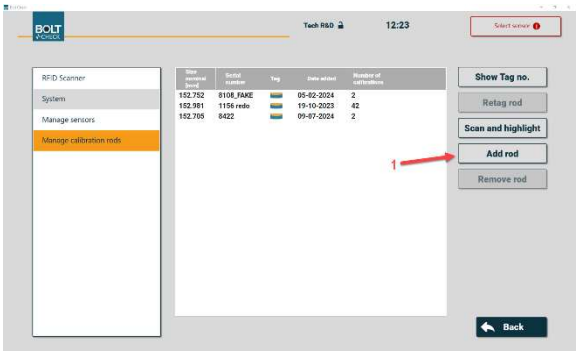


- Reposition the sensor a few times to find a stable measurement.
- If the elongation is less than ± 0,005 mm press “Verify calibration”.
- If the elongation length is above ± 0.005 mm press “Adjust calibration” and the device will automatically calibrate. (6) While one button is active, the other is inactive.
- Wait for the calibration to execute and the calibration is complete.

9.3.4 Manage Calibration Rods

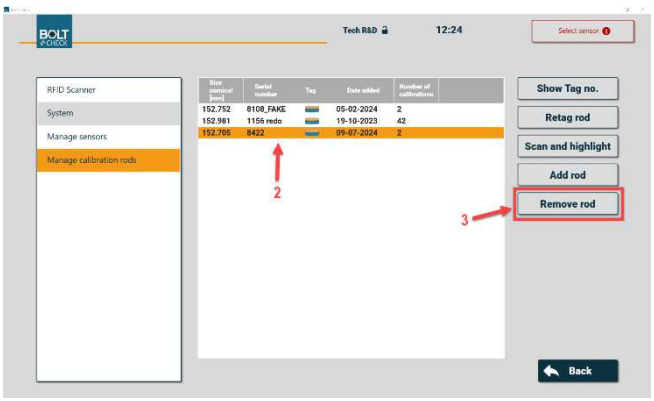
When receiving a Bolt-Check device, a calibration rod is assigned to the equipment. Independently of the measurement task, the rod is always used to as a calibration reference for future measurements.

- Press “Add rod” and scan the tag on the rod. (1)
- Now the rod is ready to go.
- The rod must be added to the program before any calibration of sensors can take place.

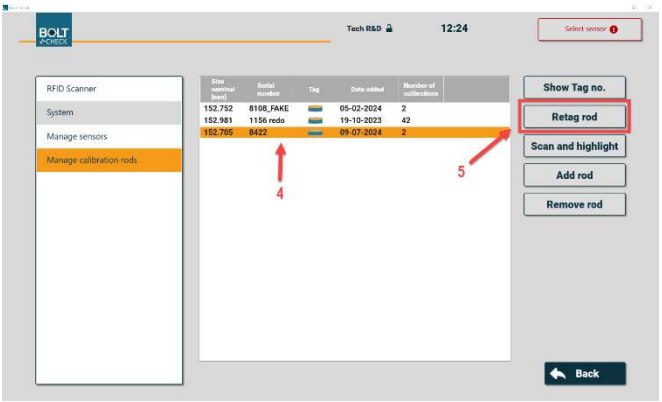


- If the rod is lost and not possible to use again it can be removed from the list.
- Press and highlight the rod to be removed. (2)
- Press “Remove rod” to make a window appear where the reason for removal can be chosen from a list (3). Three options appear:
  - Broken
  - Missing
  - Other

After choosing a reason, the rod will be removed from the list.



- If a tag from the rod is lost, but the rod is still in good condition, the tag can be replaced on site for a temporary repair.
- Press on the rod line to highlight it. (4)
- Press “Retag rod”. (5)
- A window will open, requesting a scan of the new tag.
- Scan the new tag for the calibration rod. (6)
- Place the new temporary traceability tag on the rod.
- Contact Bolt-Check to request a repair for a more permanent solution.



10 Measurement Specifications

Multiple settings and factors can be adjusted in the Bolt-Check software. These are presented in the following sections.

10.1 Overview

There are three basic adjustments and three advanced that can be used during reference measurements.

10.1.1 Basic Adjustments

Delay defines the starting point for the ultrasonic image.
Width defines the width of the visible image on the screen.
Gain controls the power of the input signal and thereby also the resulting return signal, hence it controls the height of the ultrasonic waves.
Example: a bolt is 500 mm in loose condition. Delay should be approximately 497 mm, and width should be approximately 15 mm. Thereby the image is within the visible field.

10.1.2 Advanced Adjustments

Polarity defines the side of the "0-line" in the centre of the ultrasonic image on which the measurements are performed. Measurements can be conducted on both positive and negative polarity, but only during reference measurements.
Threshold defines the height from the "o-line" for which the measurements are performed. A higher threshold means that the ultrasonic waves must be higher in order to be registered as a measurement.
Gate defines the starting point from which the device looks for waves to be measured.
Example: If a bolt is 500 mm, the gate should be a bit earlier than this value, perhaps 480 mm.

10.2 Adjusting Delay

Adjusting the delay changes the offset of the image. The ideal position for the reference measure point on a loose bolt is approximately 2 mm from the screen width, from the left. This is controlled in the software, so no reference measurement can be conducted closer to the edges of the ultrasonic image.

Moves the field of view to the left

Moves the field of view to the right

Example

A bolt having a reference length of 472 mm and a clamping length of 400 mm.

Expected elongation is 1.5 mm. Minimum visible measuring distance after the reference is 1.5 mm x 4 = 6 mm.

If this bolt is to be **loosened**, this reference image would be unusable since there is no space in the image for the reading to move left.
If this bolt is to be **tightened**, this reference image is suitable.

If the measured bolt is to be **loosened** when measuring the reference, it is recommended to move the reading point to a position where the expected elongation (when loosening, the elongation will be negative) in [mm] **multiplied by 4** can easily be within the field of view to the left. See picture.

10.3 Adjusting Width

Adjusting width changes how much of the image there is available for the measurement to move. In some cases, it may be necessary to have a high width, e.g. if it is expected to perform a long stretch.
If the measured bolt is to be tightened, then there must be enough space, so that the expected elongation in [mm] **multiplied by 4** can easily be within the field of view to the right.

*Note that the expected elongation must be multiplied by 4 to have the approximate ultrasonic elongation. This should be considered when deciding the width.

Example

In the pictures below the same waves are seen with two different widths.

The first has a width of 7.7 mm.

The second picture has a width of 15.3 mm.

10.4 Adjusting Gain

Gain describes the strength of the ultrasonic sound and thereby also the ultrasonic reflection, which is shown as the height of the waves. It is comparable to the volume on a loudspeaker system.
This might have to be adjusted between measurements of the individual bolts, and when performing elongation measurements.

When capturing the reference length of a bolt, all settings except gain are locked and cannot be adjusted further during elongation measurements.

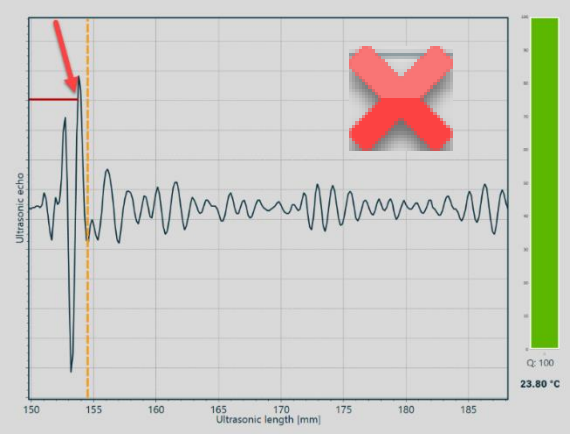
Gain is always possible to adjust. In the picture below a reference value is already captured and therefore only gain can be adjusted.

The next three images show different measurement curves with different gain.

Example

Gain 38

Here the measurement is conducted on the third wave, which is wrong. Therefore, the measurement needs more gain to increase the reflection so that the second wave gets large enough to be measured on.



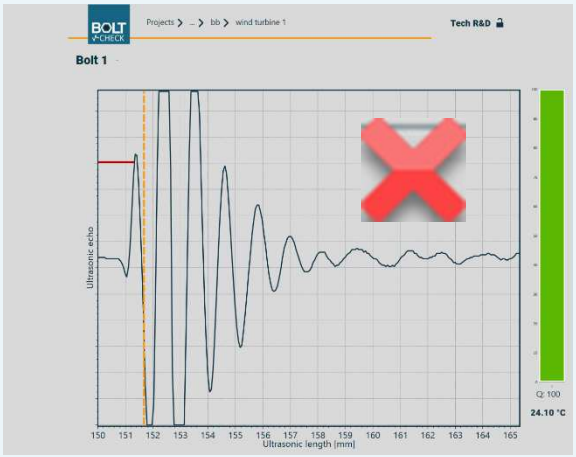
Gain 39

Here the measurement is conducted on the second wave, which is correct. The only issue is that the measurement is conducted on the tip of the wave which can be difficult to repeat. Therefore, the measurement needs more gain to increase the second wave reflection. It is recommended to increase the gain, so most of the height of the display is used.

Gain 42

Now the second wave is measured at a stable point.

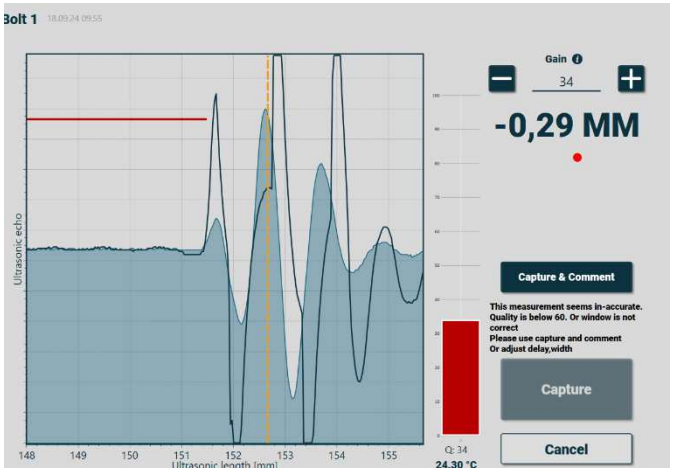
Applying too much gain will also result in unsuitable measurements. In this case the first wave is measured instead of the second. The peaks are now outside the display, which should be avoided.



10.5 Error from Wrong Wave Measurement

A typical error during elongation measurement is to accidentally measure on another wave than the reference measurement was performed on.

- Measuring on same wave results in a correct measurement. In this case a 0 measurement.
- Measuring on an earlier/later wave (1 wave) results in an error of approx. ±0,3mm.
- To compensate for this wrong measurement, identify correct wave and adjust gain until correct/reference wave is measured on.



10.6 Gate

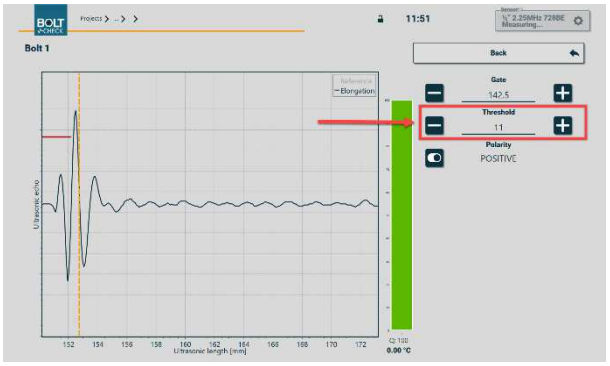
Gate is used to search for a good echo at the right length, instead of searching the entire length of the stud/bolt. Gate can be adjusted if the echo catches some noise.

To adjust gate press “+” or “–“ depending on what is needed.

10.7 Threshold

Threshold is used to change the measurement point “Red horizontal line” on the vertical axis.

To adjust threshold press “+” or “–“ depending on if it is too high or low.



10.8 Polarity

Polarity can be set to positive or negative by pressing the button, the name will change depending on which polarity is chosen.

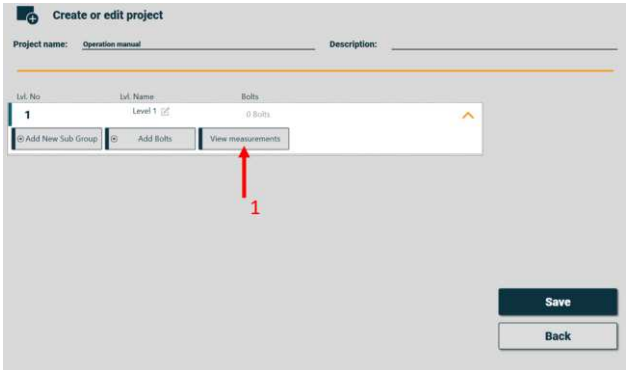
Polarity is often correctly decided by using the “Autoset” function but can also be manually changed.

The most suitable polarity is dependent on each type of fastener.

11 Pre-measurement Method

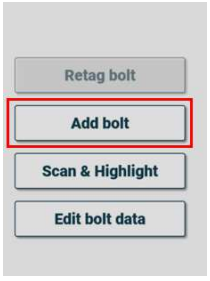
In the scenario where bolts are already pre-measured by a Bolt-Check certified bolt manufacturer, the approach for adding bolts is different. Bolts must be synchronized to the Bolt-Check device before these steps are conducted. This is done by pressing “Synchronize” from the main screen. See “Synchronization” on page 43.

- Press “Edit” measurements. (1)
- Now the project opens, and there are no bolts added.

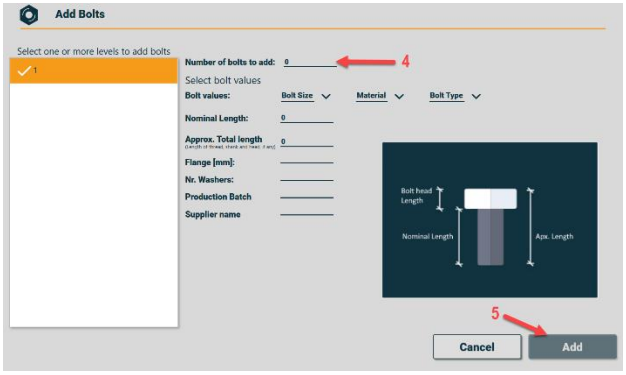


- Click “Advanced”. (2)

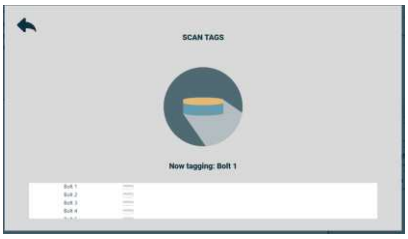
- Select “Add bolt”. (3)
- Now a window appears like this one, when adding bolts manually.



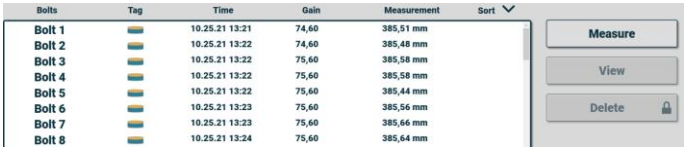
- Select the number of bolts to be imported. **No other data** may be entered. (4)
- Press “Add”. (5)



- The system automatically enters tagging mode.
- Scan each tag in the order intended.
- The tag should be located inside the bolt. It is visible as a small yellow dot.
- If the ultrasonic gel was not properly removed during previous measurement, the yellow dot may appear white.



- After scanning all traceability tags, and all bolts have an assigned tag, the reference measurements for the individual bolts are also a part of the project.
- Elongation measurements can now be conducted.



12 Data Processing

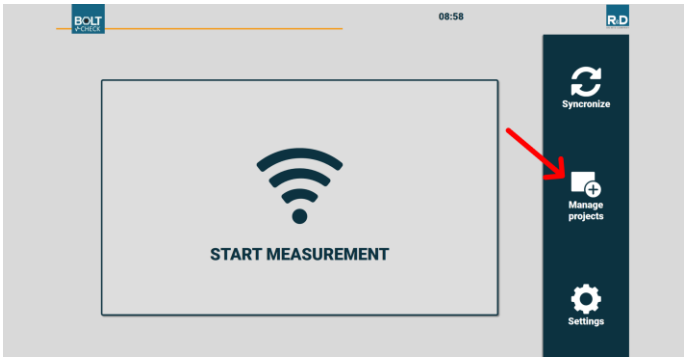
When a measurement has been finalized, the data can be “Reported” as a numeric value comma-separated file (“csv” file) or exported as a Bolt-Check data file, which also contains ultrasonic information for future measurements.

12.1 Exporting and Importing Data

It is possible to import and export the measurements as a Bolt-Check file.
This makes it possible to switch devices or send the datafiles to another location if synchronization is not an option.

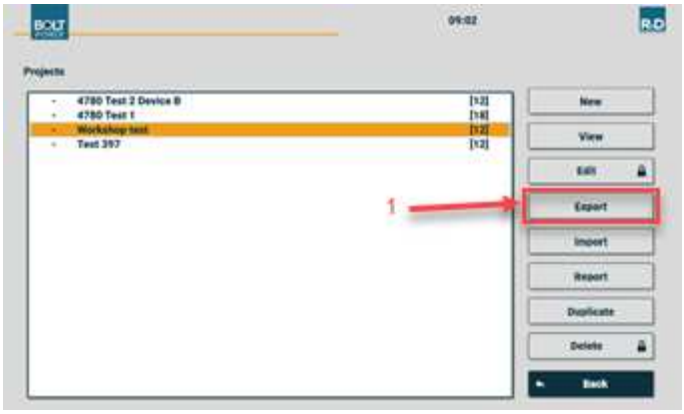
12.1.1 Exporting Data

- Press “Manage projects”.

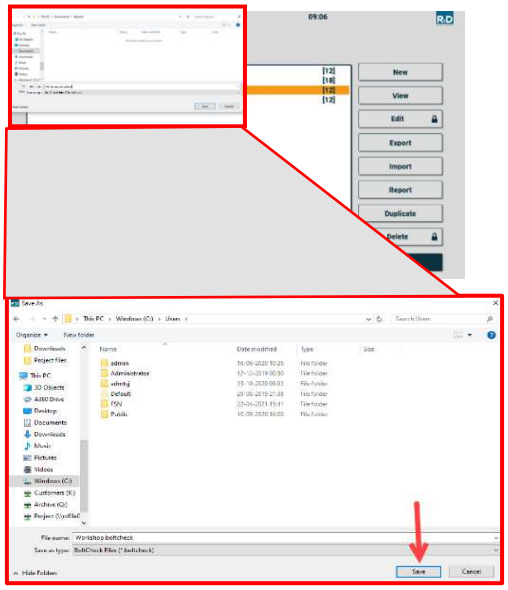


- Select the project from which data is to be exported. This is done by pressing the project and highlighting it.

- Press “Export”. (1)

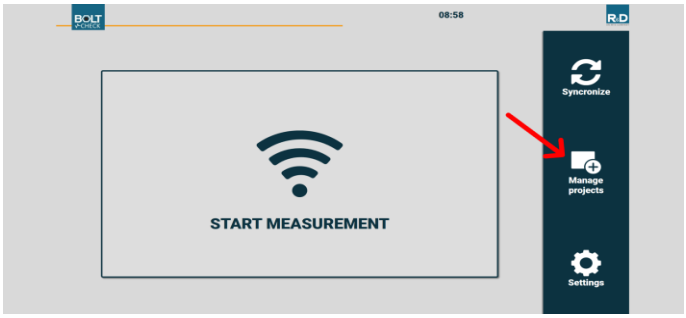


- Navigate to the preferred location and write a name for the project.
- Press “Save”.

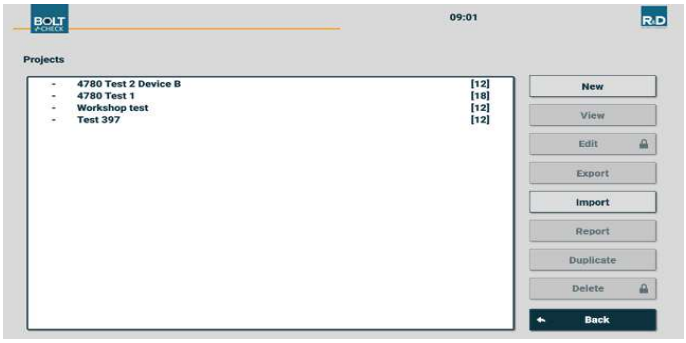


12.1.2 Importing Data

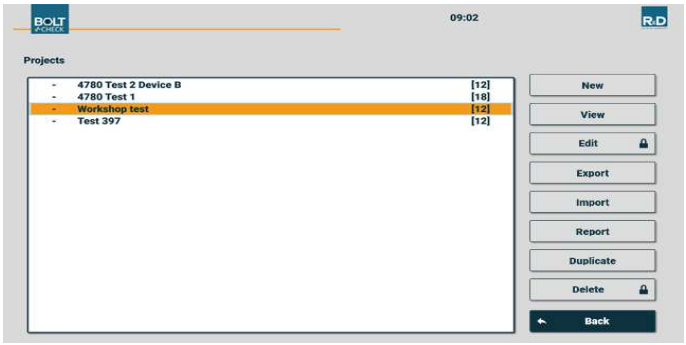
- Press “Manage projects”.



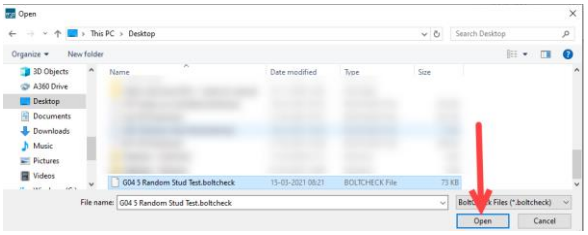
- Select the project from which data is to be imported. This is done by pressing the project and highlighting it.



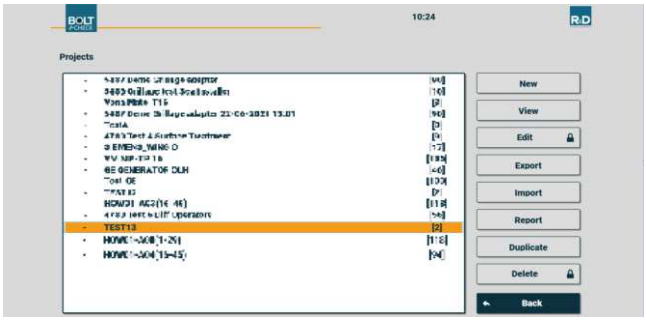
- Press “Import”.



- Select the files to import and press “Open”.

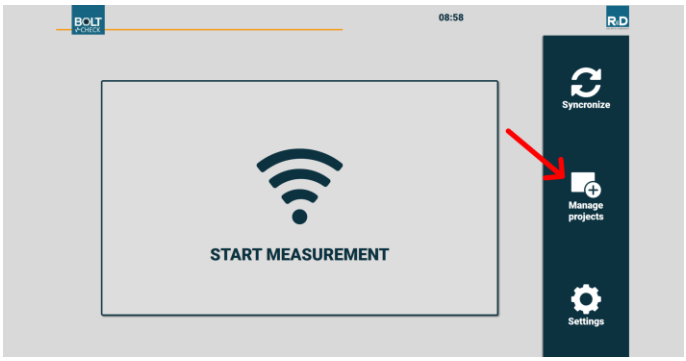


- The new project is now imported to the Bolt-Check device and can be found under “Manage projects”.



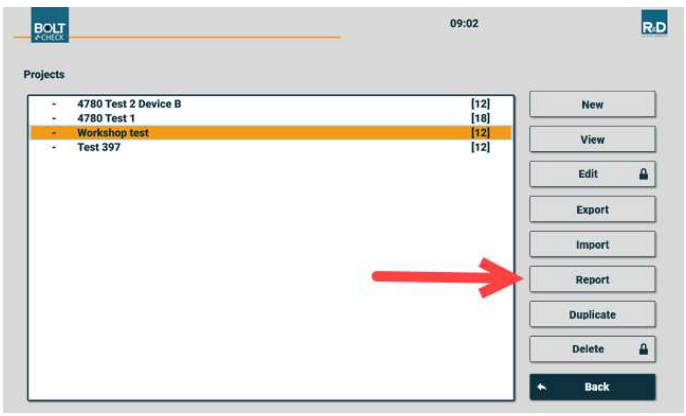
12.2 Report Data as CSV-file

- To extract data as a CSV-file, go to the Bolt-Check program main screen and press “Manage projects”.
- The manage projects page will appear.

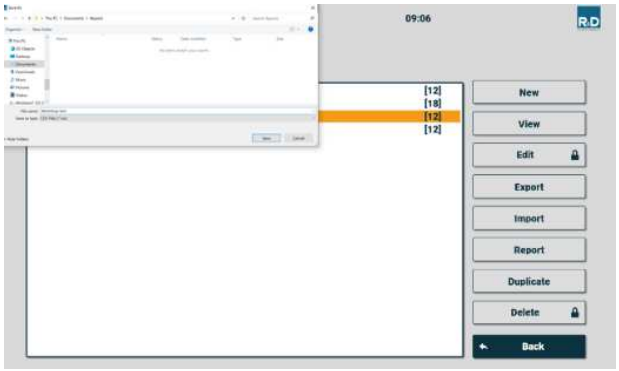


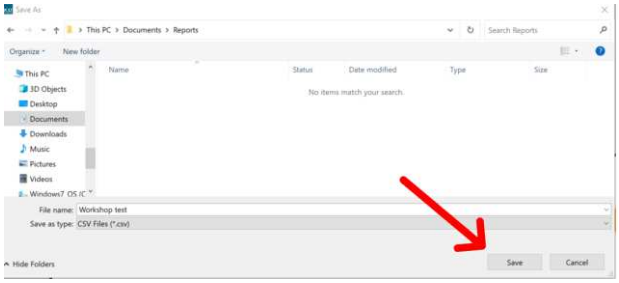
- Select the project from which data is to be extracted. This is done by pressing the project and highlighting it.
- In this example it is “Workshop test”.

- Press “Report”.
- A box pops up where the path for the stored file is to be specified.

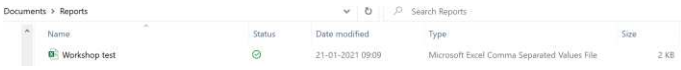


- Navigate to the preferred location and write a name for the project.
- Press “Save”.





- The file is stored as a Microsoft Excel Comma Separated Value File (.csv file)

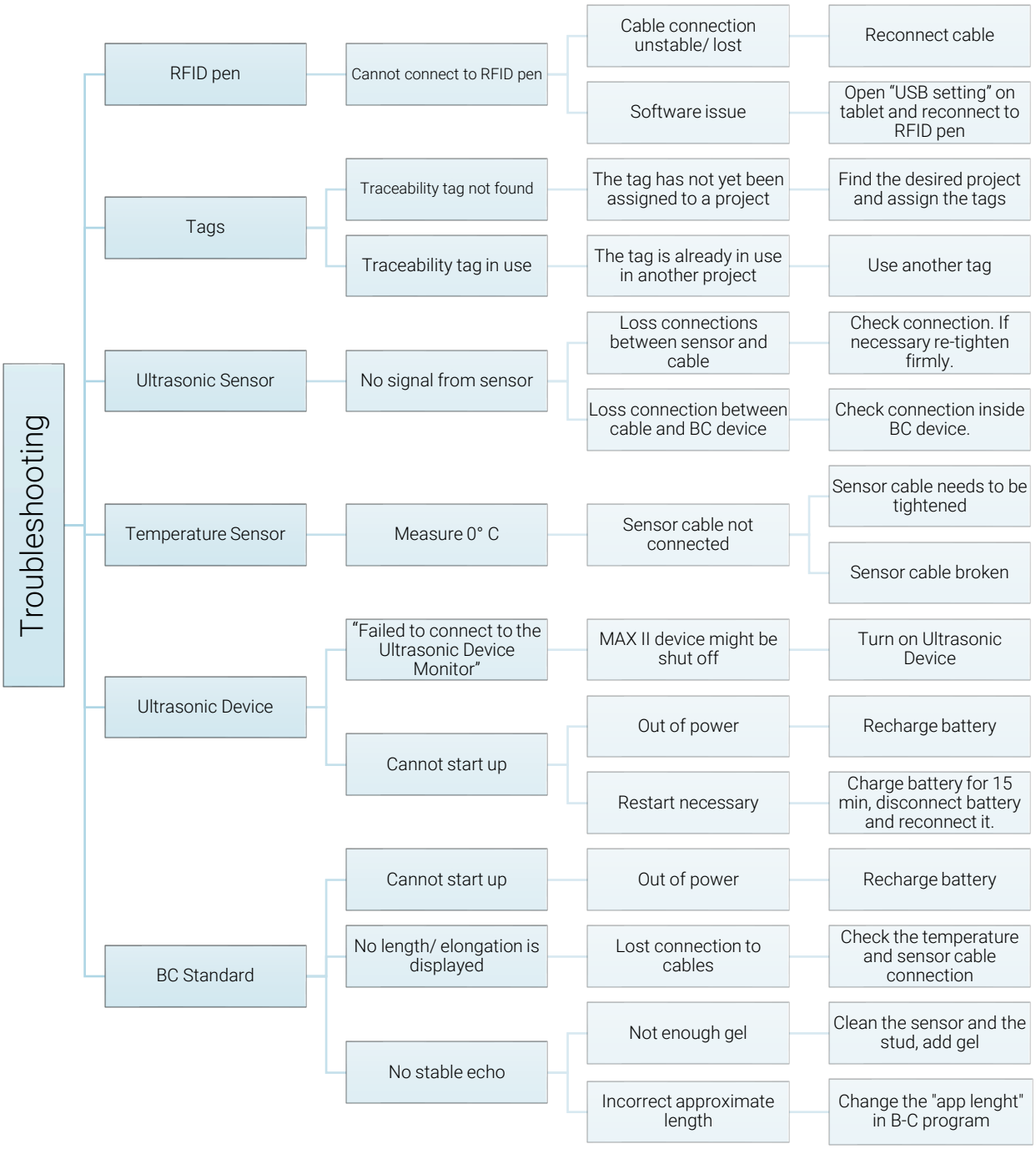


13 Troubleshooting

The purpose of this chapter is to give the operator of the Bolt-Check device a guide to handle some of the issues that can occur when performing ultrasonic measurements.
The foreseen issues are summarized in the list below and elaborated on the following pages.

- Table of troubleshooting
- Bolt-Check device cannot start up
- Ultrasonic device cannot start up
- No signal from sensor
- Traceability tag not found
- Traceability tag in use
- RFID Pen not found
- No connection to ultrasonic device

13.1 Table of Troubleshooting



13.2 Suggested Solutions

Bolt-Check device cannot start up

Bolt-Check cannot start up => Connect to charger

Ultrasonic device cannot start up

Bolt-Check program cannot connect to MultiMax => Update firmware

1. *Go to Bolt-Check website and download the newest firmware for MultiMax*
2. *Go to Program files on disk drive and find "MultiUI" or where the firmware is located*
3. *Now delete the old file and insert the new one.*

No signal from sensor

Control connection in both ends.

1. *First check the connection between sensor cable and sensor. It should be tight.*
2. *If loose, tighten firmly with two fingers.*
3. *Check connection between sensor cable and Ultrasonic Device.*
4. *Check if cable is damaged, in case of damaged a new cable should be bought.*

Traceability tag not found

If a traceability tag is scanned but not recognized, it is because it has not yet been assigned to a project.

1. *First go to the desired project and assign the tags.*

Traceability tag in use

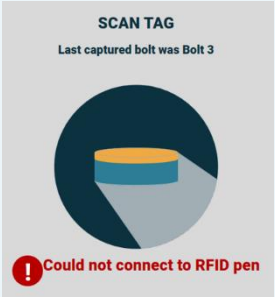
If a traceability tag is not accepted, because it is already in use in another project.

1. *Find the other project or use a new tag.*

RFID Pen not found

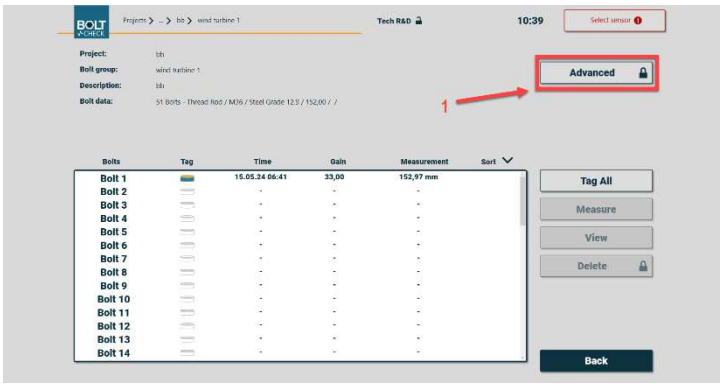
If a traceability tag is to be scanned and the following error occurs:

1. *Ensure correct USB connection.*
2. *Make sure the current firmware for RFID Pen is located on the tablet.*

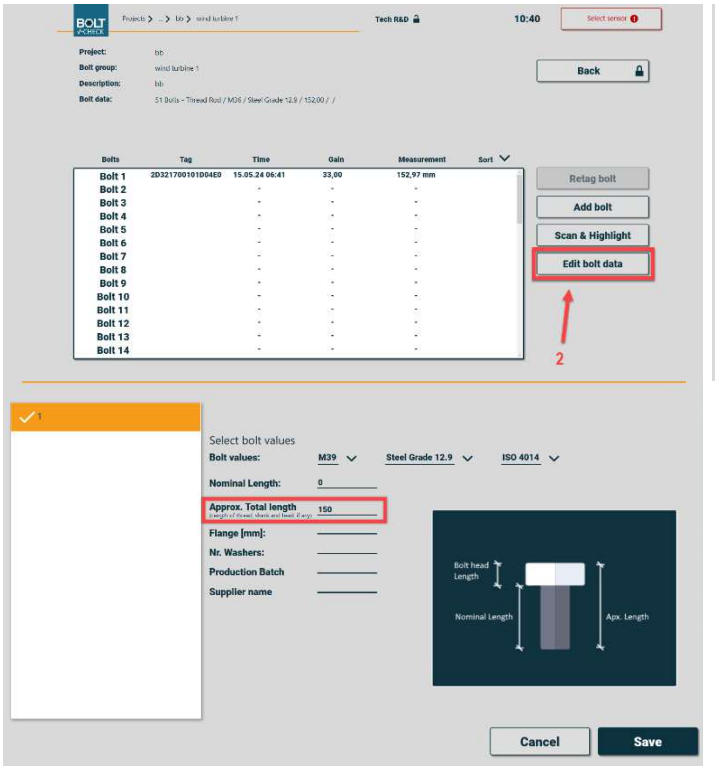


13.3 Wrong Approximate Length

- If the approximate length value is wrong, navigate to group overview. Press “Advanced”. (1)



- Press “Edit bolt data” and select the right “Approx. Total length” (2)



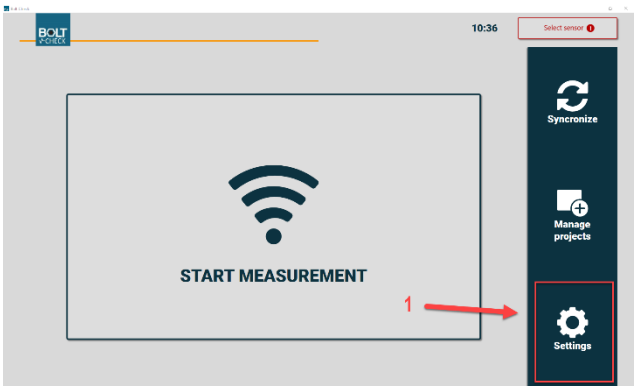
14 Software

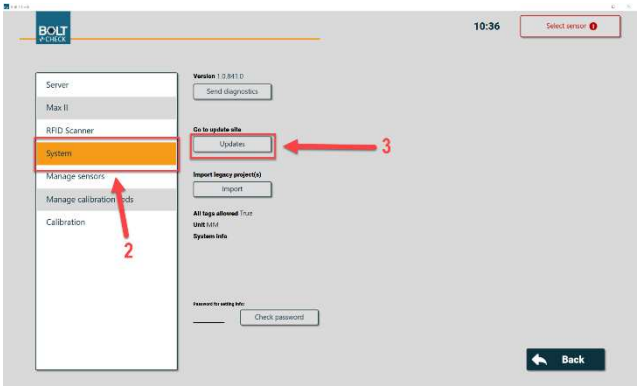
This chapter covers the software administration.

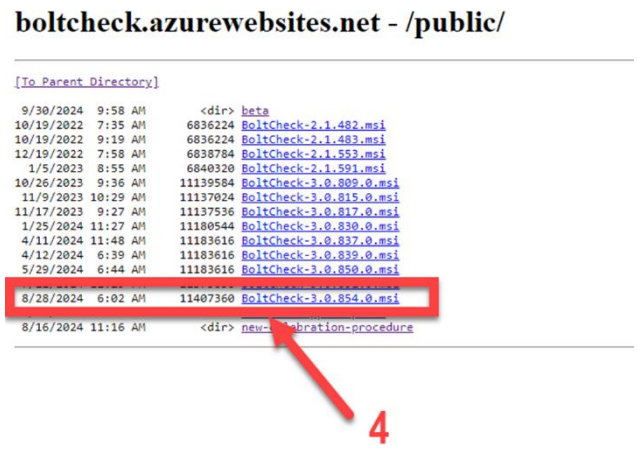
14.1 Updating Software

- Bolt-Check software update files can be downloaded from the settings menu.
- Go to the starting screen on Bolt-Check device.
- Follow directions on the picture, press on “Settings” as shown. (1)
- Go to “System”. (2)
- Press on “Updates” this will open an internet browser, so control internet connection before opening. (3)
- Now, find the newest Bolt-Check file, either look at the dates for their upload or look for the numbers at the end of their name. In this case “BoltCheck-3.0-854.0.msi” is the newest version (4)

Install the new software on your Bolt-Check.







14.2 Download and Install Bolt-Check Software

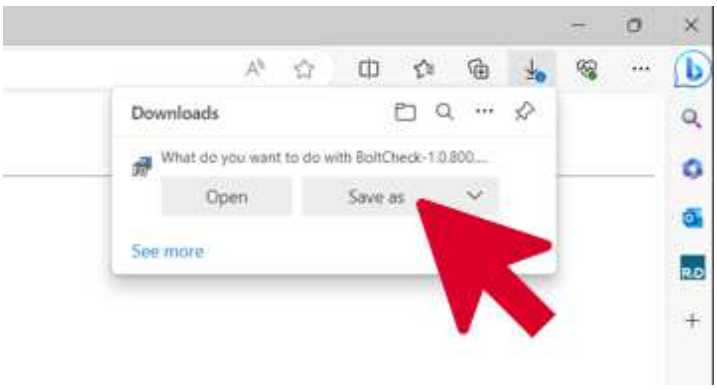
To download the software, click on the link below.

Installation link
boltcheck.azurewebsites.net - /public/beta/

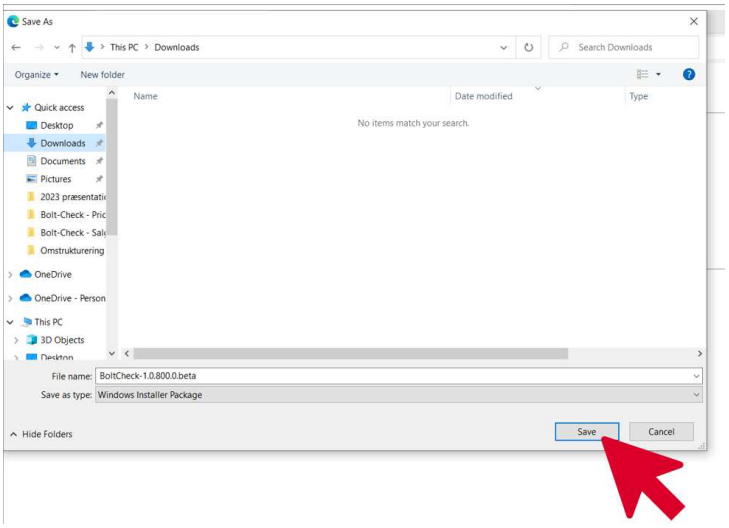
Follow the steps.

- Press on the newest link.
- Open the downloads.

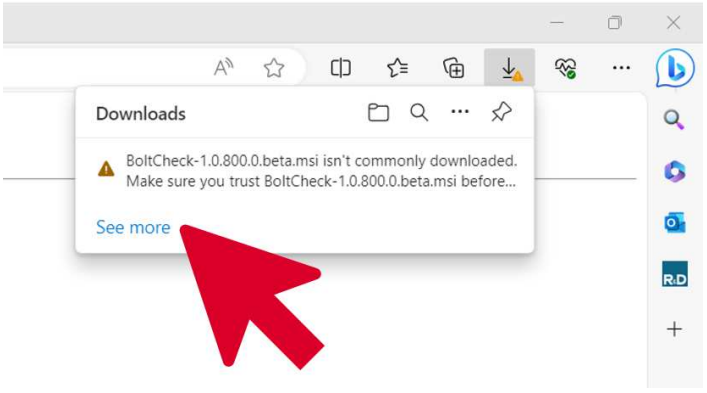
- Press “Save as”.



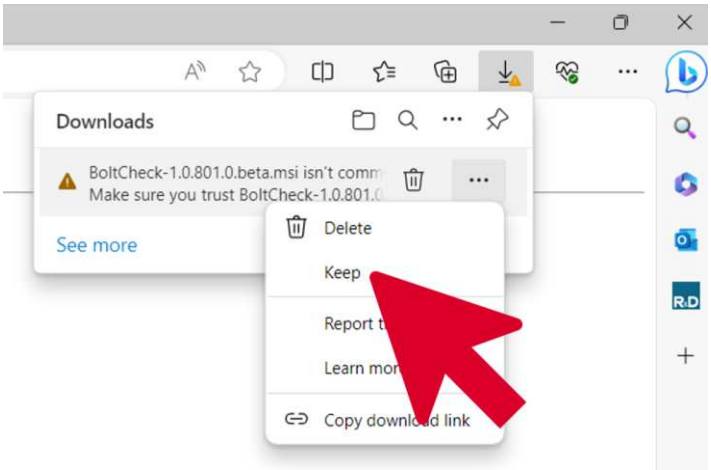
- Choose the file location for the program.



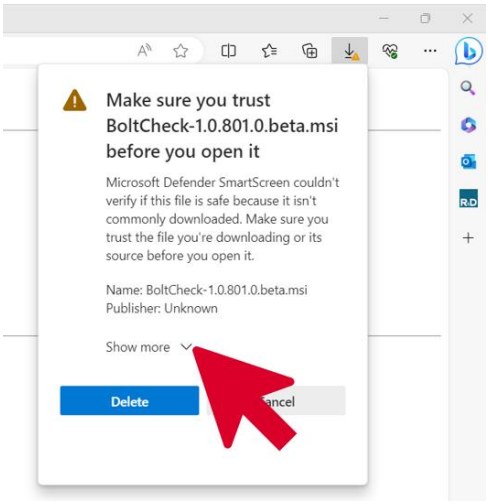
- A pop-up warning will appear in the downloads.
- Press “See more”.



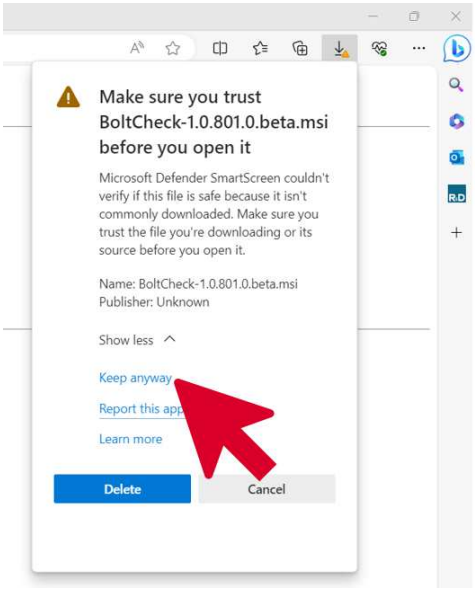
- Place your cursor on the warning and click on the three dots.
- A drop-down menu will appear.
- Choose “Keep”.



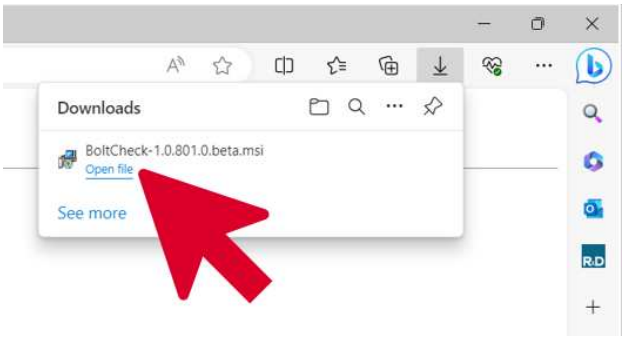
- A Microsoft Defender warning will appear.
- Press “See more”.



- Press “Keep anyway”.

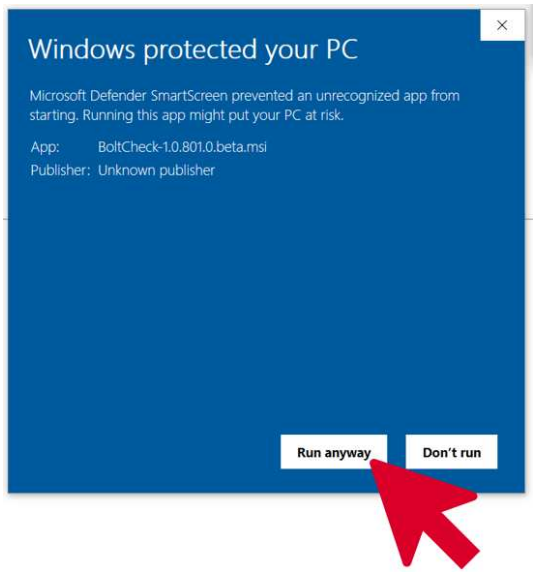


- Press “Open file”.

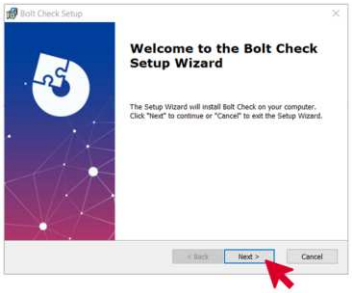


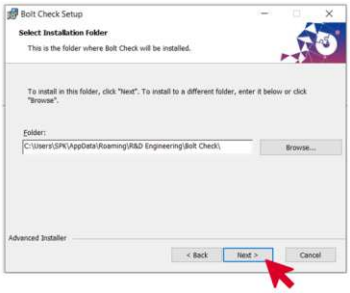
- Microsoft Defender will once again warn you.
- Press “See more”.

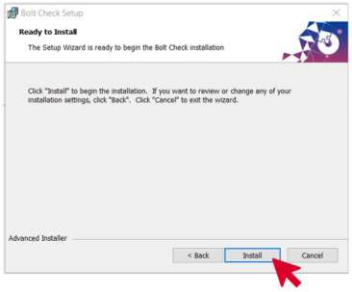
- Press “Run anyway”.

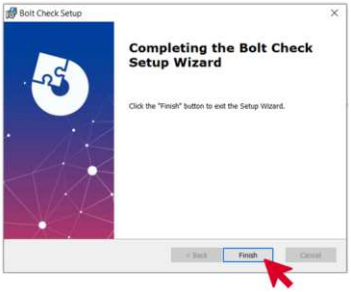


- A set-up window will appear.
- Press “Next >”.
- Select installation folder and click “Next >”.
- Press “Install”.
- Complete the installation by clicking “Finish”.



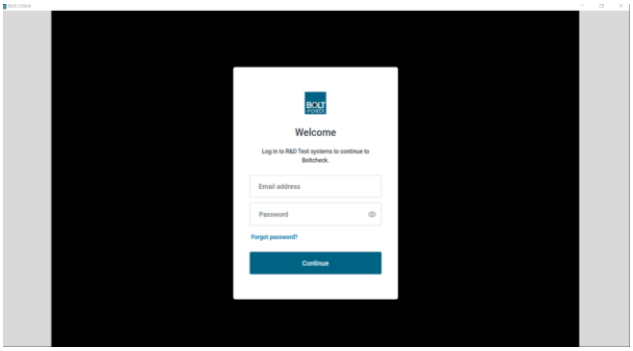






- Go to your desktop.
- Open “Bolt-Check” by clicking on the Bolt-Check shortcut.

- Enter the login you have received from Bolt-Check consisting of an e-mail and a password. This can be provided by your admin.



- The homepage of the Bolt-Check software will appear.
- You have now successfully installed the Bolt-Check Software and are now able to start a project.

15 Service and Maintenance

The maintenance shall be carried out by qualified technical maintenance personnel.

⚠ WARNING	WARNING: Attempting to perform system maintenance can expose personnel to electrical hazards. Do not attempt to perform any maintenance procedure unless you have read and fully understand the information provided in the “Safety Information”.

Official direct contact information for R&D Service and Installation:
Phone: +45 2851 8950
Mail: service@rdas.dk

15.1 Inspection

R&D recommends inspecting the product before using it. Pay attention to damages, missing or loose fasteners, dirt, and worn-out cables. Make sure to get all identified defects repaired. Contact R&D for support.

15.2 Cleaning

R&D recommends keeping the product clean. Use a damp cloth to remove dirt from the exterior of the Bolt-Check device and associated equipment.

15.3 System Calibration

Once a year a system calibration must be performed. It is recommended that this is included in a service agreement with R&D. The calibration will be conducted by R&D. Book a system calibration by contacting R&D and then deliver the entire product with associated equipment to R&D before the agreed calibration date.

R&D Test Systems A/S
Sigma 3
8382 Hinnerup
Denmark
Mail: service@rdas.dk
Phone: +45 2851 8950

16 Dismantling, Disabling, and Scrapping

The decommissioning, including dismantling, disabling, and scrapping, shall be carried out by qualified technical personnel.

⚠ WARNING

WARNING:
Attempting to perform decommissioning can expose personnel to electrical hazards.
Do not attempt to perform any decommissioning procedure unless you have read and fully understand the information provided in the “Safety Information”.

Energy Control

Make sure to disconnect the charging cable from the Bolt-Check device and turn it off before opening it up.

Risk Reduction and PPE

Following PPE must be equipped before decommissioning is performed. This reduces the risk of electrocution, cuts from sharp edges, and impact from dropping the equipment.

- Electrically insulated gloves.
- Safety shoes.

Sequence for Decommissioning

The sequence or chronology for decommissioning the Bolt-Check device consists of following overall steps.

1. Equip PPE, as described above.
2. Open the device and disconnect all the electronic components with the necessary precautions.
3. Disconnect and disassemble all other components
4. Sort everything in their respective waste group and dispose of or recycle accordingly to local legislation.
    - Electrical
    - Plastic
    - Metal
    - Other waste

17 References

Ref. [1] 0001-415-MAN-Bolt-Check BoltTrack Manual rev. 01

Ref. [2] Dakota_MultiMax_Manual

Ref. [3] TOUGHBOOK G2 Reference Manual