User manual

Pin-pointing system

protrac®

Table of contents

1 ABOUT THIS MANUAL

1.1 Applicable documents

This user manual applies in conjunction with the user manuals for all devices or systems used for pin-pointing, tracing, or sheath fault location.

1.2 Structure of safety instructions

The safety instructions in this user manual are presented as follows:

Danger symbol 	**SIGNAL WORD**
	Type of danger and its source Possible consequences of violation. ▸ Measure to prevent the danger.

If a dangerous situation could arise at a specific step, the safety instruction is displayed immediately before this dangerous step and is shown as follows:

SIGNAL WORD

Type of danger and its source. Possible consequences of violation.

1. Measure to prevent the danger.

Danger levels

Signal words in the safety instructions specify the danger levels.

DANGER	Will lead to severe injuries or death.
WARNING	May lead to severe injuries or death.
CAUTION	May lead to light to moderate injuries.
NOTICE	May lead to material damage.

Danger symbols

	**Warning about general danger**
	**Warning about electric voltage**
	**Warning about explosive materials**

1.3 View settings

Symbol	Meaning
▸	You are requested to perform an action.
1. 2. ...	Perform the actions in this sequence.
a. b. ...	If an operation consists of several operating steps, specify these with "a, b, c". Perform the operating steps in this sequence.
1 2 ...	Numbering in the legend
▪	List
	Indicates further information on the topic.
	Indicates tools required for the subsequent tasks.
	Indicates spare parts required for the subsequent tasks.

1.4 Note on the screenshots and graphics used

The screenshots and graphics used are intended to illustrate the procedure and may differ from the actual state.

2 FOR YOUR SAFETY

All BAUR devices and systems are manufactured according to the state of the art and are safe to operate. The individual parts and the finished devices are subject to continuous testing by our qualified personnel as part of our quality assurance system. Each device and system is tested before delivery.

However, the operational safety and reliability in practice can be achieved only when all necessary measures have been taken. The responsible body[1] and operator[2] of the device or system are responsible for planning these measures and monitoring their implementation.

Make sure that the responsible body and persons working with the device or system have carefully read through and understood the user manual for the device or system, as well as the user manuals for all associated devices, before starting work.

The responsible body and operator of the device or system are responsible for any injuries or damage resulting from non-compliance with this user manual.

2.1 Intended use

The protrac® pin-pointing system is used for the following:

- Acoustic pin-pointing of cable faults
- Cable fault location using the audio frequency methods
- Pin-pointing of cable sheath faults and faults due to earth contact using the step voltage method
- Tracing

If the system is not used in accordance with this stipulation, safe operation cannot be guaranteed. The user is liable for any damage to persons and property resulting from incorrect operation!

[1] Responsible body is the person or group that is responsible for the safe operation of the device and its maintenance (EN 61010-1, 3.5.12).

[2] Operator is the person who uses the device for its intended purpose (according to the definition of user in compliance with EN 61010-1, 3.5.11).

Proper use also includes

- compliance with all instructions in this user manual, and all other applicable documents,
- compliance with the technical data and connection requirements given on the rating plate and in the user manual and any other applicable documents,
- compliance with the inspection and maintenance instructions for the system and its components.

2.2 Instructions for the operator

protrac® may be operated only by authorised and trained electrical engineers. An electrical engineer is a person who, owing to his professional education (electrical engineering), knowledge, experience and familiarity with the applicable standards and regulations, can assess the tasks assigned to him and detect possible dangers.

The operator must also be familiar with the operation of protrac® and the devices or systems used, as well as with the pin-pointing process.

2.3 Avoiding dangers, taking safety measures

- When erecting the test installations and operating the system, adhere to the latest applicable version of the following regulations and guidelines:
  - Accident prevention and environmental protection regulations applicable for your country
  - Safety instructions and regulations of the country where the system is being used
  - EU/CENELEC countries: EN 50110 Operation of electrical installations

    Other countries: The standards for operating electrical installations applicable in your country
  - Any other relevant national and international standards and guidelines
  - Local safety and accident prevention regulations
  - Employers' liability insurance association regulations (if any)
- Operate the system only in a technical perfect condition.
- Use only accessories and original spare parts recommended by BAUR. The use of spare parts, accessories and special fittings that are not tested and approved by BAUR could adversely affect the safety, function and characteristics of the system.

2.3.1 Dangers when working with electric voltage

When performing measurements with protrac® in combination with a cable fault location system or an HV generator, e.g. a surge voltage generator, a dangerous (and at times very high) voltage is generated and fed into the test object via an HV connection cable and can produce a fatal voltage gradient near the fault location. The responsible body and operator need to pay special attention and must be very careful while working with high voltage.

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burn injuries and electro-ophthalmia due to arcing faults.

- Follow the safety instructions in the user manual for the cable fault location system or HV generator used.
- Before starting work, ensure there is no voltage at the workplace.

2.4 Special personal protective equipment

Personal protective equipment based on the risk assessment for the relevant working conditions is part of the safety concept of BAUR systems.

- Observe the internal operating instructions and the safety instructions applicable in your country.

3 PRODUCT INFORMATION

Information on the technical data as well as standard delivery, accessories and options can be found in Chapter *Data sheet* (on page 122).

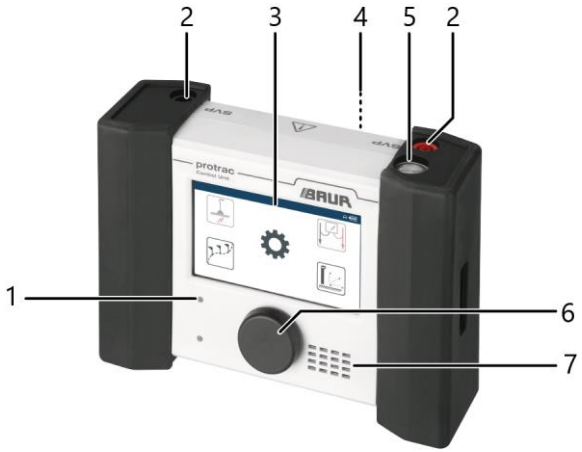
3.1 System overview

The following combinations of protrac® system components are connected with each other wirelessly via Bluetooth®:

- Control unit, acoustic ground probe, and headphones
- Control unit, audio frequency probe, and headphones

No.	Element	Function
1	SVP step voltage probes	Are used to locate cable sheath faults
2	CU control unit	Is used to: ▪ Select the location method ▪ Display the signals from the protrac® system components ▪ Set measurement parameters
3	Bluetooth® headphones	
4	AFP audio frequency probe	Is used for tracing and pin-pointing cable faults and joints using the twist method and the minimum distortion method The twist method and the minimum distortion method are suitable for: ▪ Short-circuits ▪ Low-resistive cable faults ▪ Joints
5	AGP acoustic ground probe	Is used for the acoustic pin-pointing of cable faults and for tracing Acoustic pin-pointing is suitable for: ▪ High-resistive cable faults ▪ Cable and phase breaks

3.2 CU control unit



No.	Element/Function	
1	LED for the operating state indicator Further information: Chapter *Operating state indicator* (on page 16)	
2	Ports for the connection cables of the step voltage probes	
3	Touchscreen	
4	Rechargeable battery compartment and charger socket (back)	
5	On/Off button	
6	Rotary switch	Is used to operate the control unit Further information: Chapter *Operational concept* (on page 26)
7	Loudspeaker	

3.2.1 Operating state indicator

The LED on the control unit indicates the following operating states:

- (flashing):
  - The control unit is in pairing mode.
    Further information: Chapter *Pairing system components* (on page 30)
  - There is a problem with the Bluetooth® connection:
    - The control unit is unable to detect the acoustic ground probe.
    - The control unit is unable to detect the audio frequency probe.
    - The connection to the headphones was interrupted.

    Further information: Chapter *Faults and corrective measures* (on page 108)
- (permanently on):
  - The control unit is switched on and paired with the Bluetooth® devices.
  - The step voltage probes are connected to the control unit.
- (permanently on): The acoustic ground probe is muted (prevention of hearing damage).
- (permanently on): The switching off process is underway.

The control unit is switched off automatically if there is no connection to one of the system components for 5 minutes.

3.2.2 Basic settings

Call up from home screen

- To call up the basic settings, select the ***Settings*** menu on the home screen.

Call up from location method

1. Open the method settings by tapping the button.
2. Select the ***Basic settings*** menu item.
   The basic settings can be opened and changed.
3. To apply changes and return to the user interface for the method, tap the button.

Parameters	Meaning
Power supply	Is used to specify whether the control unit and the acoustic ground probe or the audio frequency probe are supplied with power via rechargeable or non-rechargeable batteries This information is necessary so that the control unit can determine and correctly display the charge status of the rechargeable or non-rechargeable batteries.
Charge status	Displays the charge status of the rechargeable or non-rechargeable batteries of the control unit and the acoustic ground probe or the audio frequency probe
Bluetooth® connections	Displays the devices connected via Bluetooth® - To start a new search for devices, tap on ***Headphones***, ***AFP***, or ***AGP***. - To clear the list of devices connected via Bluetooth®, tap on ***Clear pairing list***. **Note:** The ***Clear pairing list*** function is only available when an acoustic ground probe or an audio frequency probe is connected to the control unit.
Brightness and contrast	Is used to set the brightness and contrast of the touchscreen - ***Standard***: Standard setting - ***High contrast***: Setting for use in a bright working environment

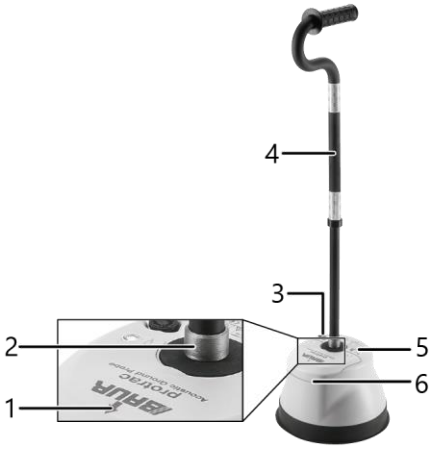
Parameters	Meaning
Sound	Is used to specify whether audio output is via the headphones or the loudspeaker of the control unit
Language and units	Is used to select the language and the units for distance The following units can be selected: ▪ ***ms***: display in milliseconds ▪ ***m***: display in metres ▪ ***ft***: display in feet ▸ To apply the selected language, switch the control unit off and then back on again.
Date and time	Is used to set the date and time displayed on the control unit
About	Displays the software and firmware versions of the system components and the serial number of the control unit
Factory settings	Resets the control unit back to the factory settings

3.3 AGP acoustic ground probe

The acoustic ground probe is used for the acoustic pin-pointing of cable faults and for tracing, and detects acoustic and electromagnetic signals. The acoustic ground probe has a resonantly mounted sensor for the detection of structure-borne noise. Ambient noise is automatically suppressed by adaptive ANS two-level signal processing.

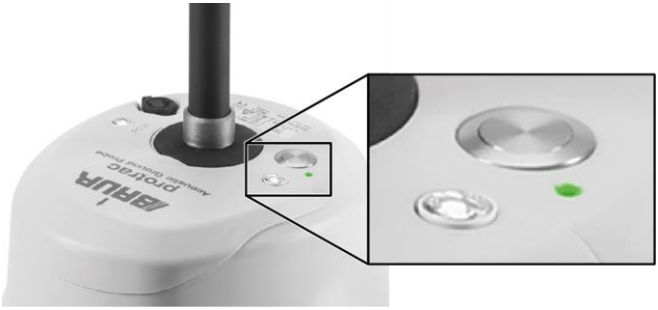
For reliable contact with the ground on solid surfaces, a contact bell is mounted on the underside of the acoustic ground probe. If cable fault pin-pointing with the contact bell is not possible due to undergrowth (grass, weeds, etc.) or the surface (sand, snow, etc.), a contact spike can also be screwed in.

The acoustic ground probe is switched off automatically if there is no Bluetooth® connection to the control unit for 5 minutes.



No.	Element/Function
1	Directional arrow
2	Quick-release fastener Is used to mount and remove the handle
3	Charger socket
4	Height-adjustable handle
5	On/Off button LED for the operating state indicator Further information: Chapter *Operating state indicator* (on page 20)
6	Rechargeable battery compartment

3.3.1 Operating state indicator



The LED on the acoustic ground probe indicates the following operating states:

- (permanently on): The switching on process is underway.
- (flashing): The acoustic ground probe is in pairing mode.

  Further information: Chapter *Pairing system components* (on page 30)
- (flashing): The acoustic ground probe firmware is being updated.
- (permanently on): The acoustic ground probe is switched on and paired with the control unit.
- (permanently on): The acoustic ground probe is muted (prevention of hearing damage).
- (permanently on): The switching off process is underway.

3.4 AFP audio frequency probe

The audio frequency probe is used for pin-pointing cable faults and joints and for tracing. It simultaneously detects the audio frequency signals fed into the cable with three coils arranged on different spatial axes. This means that the coils do not need to be aligned for the respective measurement method. The detected signals are displayed individually for each coil on the control unit and can be shown and hidden according to the measurement method. To distinguish noise signals from the signal that is fed into the cable during location, automatic signal search or defined frequencies can be used for location. The defined frequencies can be selected from a list containing factory calibrated preset and individually configurable frequencies.

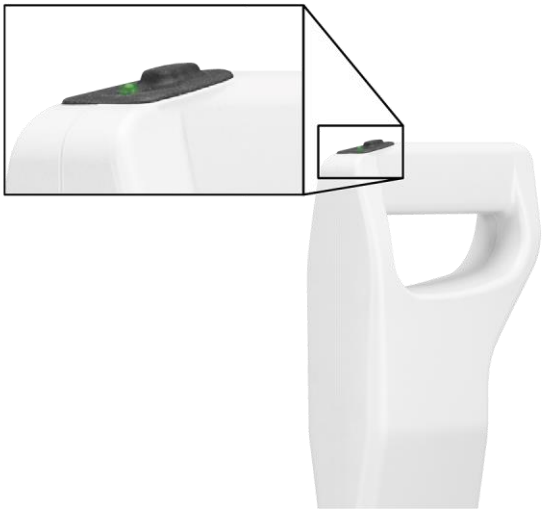
The audio frequency probe can be used to perform cable fault and joint location and tracing with the following methods:

- Maximum method
- Minimum method
- C-Max
- Direct depth measurement
- Current measurement
- 45° depth measurement
- Twist method
- Minimum distortion method

The audio frequency probe is switched off automatically if there is no Bluetooth® connection to the control unit for 5 minutes.

No.	Element
1	LED for the operating state indicator Further information: Chapter *Operating state indicator* (on page 23)
2	On/Off button
3	Rechargeable battery compartment and charger socket (back)

3.4.1 Operating state indicator

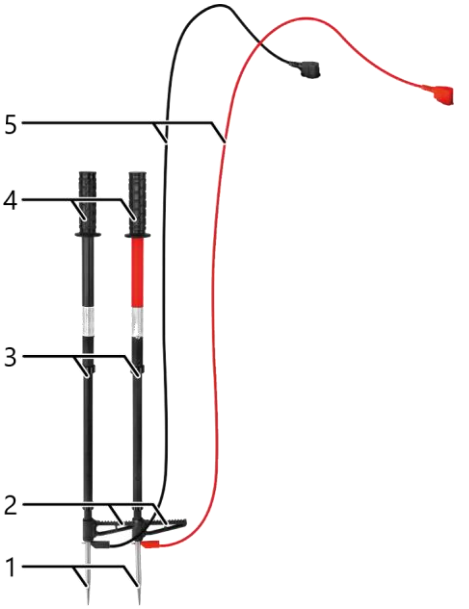


The LED on the audio frequency probe indicates the following operating states:

●	(permanently on):	The switching on process is underway.
◎	(flashing):	The audio frequency probe is in pairing mode. Further information: Chapter *Pairing system components* (on page 30)
◎	(flashing):	The audio frequency probe firmware is being updated.
●	(permanently on):	The audio frequency probe is switched on and paired with the control unit.
●	(flashes once):	Direct depth measurement or current measurement is in progress.
●	(permanently on):	The switching off process is underway.

3.5 SVP step voltage probes

The step voltage probes are used for sheath fault location.



No.	Element/Function	
1	Contact spikes	
2	Foot pegs	Are used to push the contact spikes into the ground
3	Telescopic rods	Are used to adjust the length of the step voltage probes
4	Insulated handles	
5	Connection cables	Are used to connect the contact spikes to the control unit

3.6 Power supply

protrac® is supplied with power from rechargeable or non-rechargeable batteries:

- Rechargeable battery type: NiMH Mignon AA 1.2 V IEC LR6
- Non-rechargeable battery type: Alkaline batteries AA 1.5 V IEC LR6

Further information: Chapter *Charging the batteries* (on page 106)

4 OPERATIONAL CONCEPT

4.1 General icons and buttons

Home screen

	Description
	Opens acoustic pin-pointing Further information: Chapter *Acoustic pin-pointing* (on page 35)
	Opens sheath fault location Further information: Chapter *Sheath fault location* (on page 43)
	Opens tracing Further information: ▪ Chapter *Tracing and depth measurement with the audio frequency probe* (on page 56) ▪ Chapter *Tracing with the acoustic ground probe* (on page 73)
	Opens the audio frequency methods for cable fault location and joint location Further information: Chapter *3D-History Track* (on page 81)
	Opens the basic settings Further information: Chapter *Basic settings* (on page 17)

Header

	Description
AFP / AGP / SVP	Shows that the control unit is connected to the audio frequency probe, the acoustic ground probe, or the step voltage probes If AFP or AGP is flashing, the control unit is in pairing mode.
/	Shows whether audio output is via the headphones or the loudspeaker of the control unit
	Shows the charge status of the rechargeable or non-rechargeable batteries of the control unit

Basic settings or method settings

	Description
	Is used to return to the higher-level menu and to exit the menu By exiting a menu, the relevant settings will not be applied.
/	Are used to navigate the menu
	Is used to open a menu item
	Shows the selected setting
/	Are used to set values

4.2 Using the buttons

There are different types of buttons on the user interfaces for the individual methods.

Toggle buttons

These buttons are used to switch between two states.

Example: Switching audio output on and off

- To switch between the states, tap the button on the touchscreen.

  or

- To switch between the states, select the button with the rotary switch and press the rotary switch.

Selection buttons (operation via touchscreen)

These buttons are used to select an option.

Example: Selecting the frequency

1. Tap the button on the touchscreen.
   All options appear above the selected button.
2. Enable the desired option by tapping it on the touchscreen.

Selection buttons (operation with rotary switch)

These buttons are used to select an option.

Example: Selecting the frequency

1. Select the button with the rotary switch and press the rotary switch.
   All options appear above the selected button.
2. Select the desired option with the rotary switch.
3. Enable the desired option by pressing the rotary switch.

Buttons with scale

These buttons are used to set a parameter. The parameter change is directly applied.

Example: Setting the volume

- Tap the button on the touchscreen and set the desired value for the parameter with the rotary switch.

  or

1. Select the button with the rotary switch and press the rotary switch.
2. Set the desired value for the parameter with the rotary switch.

4.3 Using the loudspeaker of the control unit

If you want to use the loudspeaker of the control unit instead of the headphones:

On the home screen of the control unit

1. Select ⚙ ***Settings*** > ***Sound*** > ***Output*** > ***Loudspeaker***.
   Further information: Chapter *Basic settings* (on page 17)
2. To confirm the selection, exit the menu item by tapping the ← button.

In the method settings

1. Select ⚙ ***Sound*** > ***Output*** > ***Loudspeaker*** (not possible for sheath fault location).
   Further information: Chapter on the method settings for the respective measurement method.
2. To confirm the selection, exit the menu item by tapping the ← button.

5 COMMISSIONING

5.1 Before commissioning

- Observe the safety instructions in chapter *For your safety* (on page 10).

- Follow the user manuals for all devices used.

5.2 Pairing system components

If an acoustic ground probe, an audio frequency probe, or headphones are subsequently integrated into a protrac® system, pairing must be performed. To do this, the devices are paired with the control unit via Bluetooth® the first time they are used. This procedure need only be performed once, after which the connection is established automatically.

5.2.1 Pairing an acoustic ground probe or audio frequency probe

1. Switch on the control unit.
2. Switch on the acoustic ground probe or the audio frequency probe.
3. On the home screen of the control unit select: ***Settings*** > ***Bluetooth® connections*** > ***AGP*** or ***AFP***.
4. Wait until the identification of the system component that is being paired is displayed and then tap this identification.

   The identification contains the last 3 digits of the serial number of the system component that is being paired.

   It can take up to 1 minute for the identification to be displayed. During this time, the LEDs on the control unit and on the acoustic ground probe or the audio frequency probe flash blue.

   If pairing was successful, the ✓ symbol is displayed next to the identification.
5. If the identification is not displayed after 1 minute, restart the pairing process.

6. To confirm the selection, exit the menu item by tapping the ← button.
   If pairing was successful, a tick is displayed next to the identification in the control unit and the AGP or AFP icon appears in the header.
   If the AGP or AFP icon is not displayed:
   a. Check whether the system component that is being paired is still switched on and whether the charge status of the rechargeable or non-rechargeable batteries is sufficient.
   b. Restart the pairing process.

Recommendation: Use the stickers supplied to mark system components that are paired with each other.

5.2.2 Pairing headphones

Note: The procedure will be described for the headphones included in the standard delivery and may vary for other headphones.

▸ Follow the instructions in the user manual for the headphones used.

1. Switch on the control unit.
2. Make sure that the acoustic ground probe or the audio frequency probe is switched on and connected to the control unit.
3. Hold down the On/Off button on the headphones until the LED on the headphones flashes alternately blue and red.
4. On the home screen of the control unit select: ***Settings*** > ***Bluetooth® connections*** > ***Headphones***.
5. Wait until the full identification of the headphones (e.g. ***HD [...]BT***) is displayed and then tap this identification.
   It can take up to 1 minute for the identification to be displayed. During this time, the LED on the control unit flashes blue.
   The selected identification is indicated by ✓.
6. If the identification is not displayed after 1 minute, restart the pairing process for the headphones.

7. To confirm the selection, exit the menu item by tapping the ← button.

   If pairing was successful, the icon appears in the header.

   If the icon is not displayed:

   a. On the home screen of the control unit select: ***Settings*** > ***Sound*** > ***Output*** > ***Headphones***.

   b. Restart the pairing process for the headphones.

Recommendation: Use the stickers supplied to mark system components that are paired with each other.

5.2.3 Pairing the optional 3M Peltor Bluetooth® headphones

▸ Follow the instructions in the user manual for the headphones used.

1. Switch on the control unit.
2. Make sure that the acoustic ground probe or the audio frequency probe is switched on and connected to the control unit.
3. Make sure that Bluetooth® streaming is enabled in setup mode for the headphones.

   This setting only needs to be made once before pairing the headphones for the first time.
4. Press and hold down the ⦿ button on the headphones until the message ***Bluetooth® pairing on*** is played on the headphones.

   The message is repeated until a Bluetooth® connection is successfully established or pairing is cancelled by the headphones.
5. On the home screen of the control unit select: ***Settings*** > ***Bluetooth® connections*** > ***Headphones***.
6. Wait until the full identification of the headphones (e.g. ***Peltor WS5***) is displayed and then tap this identification.

   It can take up to 1 minute for the identification to be displayed. During this time, the LED on the control unit flashes blue.

   The selected identification is indicated by ✓.
7. If the identification is not displayed after 1 minute, restart the pairing process for the headphones.

8. To confirm the selection, exit the menu item by tapping the ← button.

   If pairing was successful, the  icon appears in the header.

   If the  icon is not displayed:

   a. On the home screen of the control unit select: ***Settings*** > ***Sound*** > ***Output*** > ***Headphones***.

   b. Restart the pairing process for the headphones.

   As soon as the headphones are connected to the protrac® system components, the two messages ***Bluetooth® pairing completed*** and ***Connected*** are played on the headphones.

Recommendation: Use the stickers supplied to mark system components that are paired with each other.

5.3 Adding and deleting a frequency

Additional frequencies can be defined or existing frequencies deleted in the method settings for tracing with the audio frequency probe and for the twist and minimum distortion methods.

Adding a frequency

Note: To define frequencies for tracing with the audio frequency probe, the audio frequency probe must be paired with the control unit.

1. Open the method settings by tapping the ⚙ button.
2. Select ***Frequency settings*** > ***Add frequency***.
3. Enter the desired frequency in the input field on the touchscreen.

   Alternatively, you can start the automatic signal search by tapping the ***Find*** button.
4. To add the frequency, tap the + button.

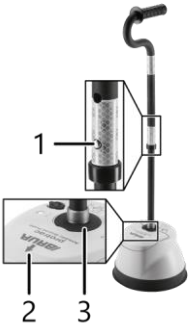
   The added frequency is automatically selected for performance of the method.

Deleting a frequency

Note: The preset standard frequencies provided by BAUR cannot be deleted.

1. Open the method settings by tapping the ⚙ button.
2. Select ***Frequency settings*** > ***Delete frequency***.
   The list of stored frequencies is displayed.
3. In the list, select the frequency you want to delete.
4. Tap the 🗑 button.
   The selected frequency is deleted.

5.4 Mounting and adjusting the handle of the acoustic ground probe



To mount the handle on the acoustic ground probe:

- Place the handle in the quick-release fastener (3) on the acoustic ground probe and turn it clockwise until it engages.

  When the handle is mounted, it is aligned parallel to the directional arrow (2).

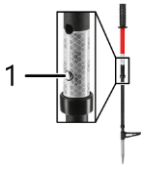
To adjust the height of the handle:

- Press the button (1) in the recess on the handle and set the desired height.

To remove the handle from the acoustic ground probe:

- Turn the handle anti-clockwise and remove it from the acoustic ground probe.

5.5 Adjusting the height of the step voltage probes



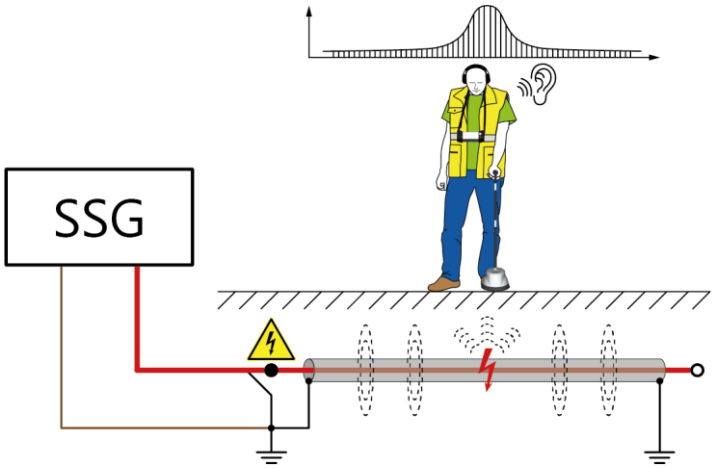
- Press the button (1) in the recess on the handle and set the desired height.

6 ACOUSTIC PIN-POINTING

Acoustic pin-pointing is suitable for:

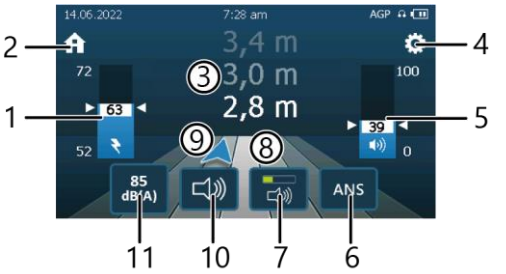
- High-resistive cable faults
- Cable and phase breaks

6.1 About acoustic pin-pointing



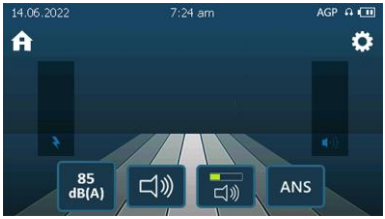
Surge voltage pulses are fed into the faulty phases of the cable, which lead to breakdowns at the fault. The breakdowns result in an acoustic and electromagnetic signal. The different propagation times of the signals are compared: The electromagnetic signal propagates almost at the speed of light and triggers a time measurement in the acoustic ground probe. The acoustic signal, which propagates only at the speed of sound, is detected by the acoustic ground probe after a delay, whereupon the time measurement is stopped. The difference in propagation time between the signals is determined and displayed as a distance from the fault location. The shorter the measured time, the closer is the acoustic ground probe to the fault.

6.2 User interface



No.	Function
1	Shows the strength of the electromagnetic signal (value in the white field) and the scaling of the bar graph (value to the left of the bar graph)
2	Opens the home screen
3	Shows the last measured distances from the fault (latest distance at the bottom)
4	Opens the method settings
5	Shows the strength of the acoustic signal (as a percentage) The bar graph does not display any values when audio output is disabled.
6	Is used to enable and disable the adaptive, two-level ambient noise suppression (ANS) function
7	Is used to set the volume on the headphones or the loudspeaker of the control unit
8	Shows the cable route (middle zone) and neighbouring zones
9	Shows where the acoustic ground probe is located in relation to the cable route and whether the cable fault is located in front of or behind the acoustic ground probe If the cable fault is located less than 0.8 m away from the acoustic ground probe, the directional arrow turns into a large circle that covers all zones.
10	Is used to switch audio output on the headphones or the loudspeaker of the control unit on and off
11	Is used to switch volume limiting to 85 dB(A) on the headphones on and off

Note: If, during acoustic pin-pointing, no signal is sent from the acoustic ground probe to the control unit for 15 seconds, the signal display on the touchscreen of the control unit is automatically reset to the initial state.



6.3 Performing acoustic pin-pointing

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- Take all necessary safety measures.

  Further information: Chapter *For your safety* (on page 10)

- Discharge and earth the test object before touching it.

Required equipment

- Surge voltage generator (e.g. BAUR SSG)
- Acoustic ground probe, control unit, Bluetooth® headphones

Preparing for pin-pointing

A surge voltage generator (standalone device) is used as an example in the description below. The same procedure applies if the surge voltage generator is integrated in a cable fault location system.

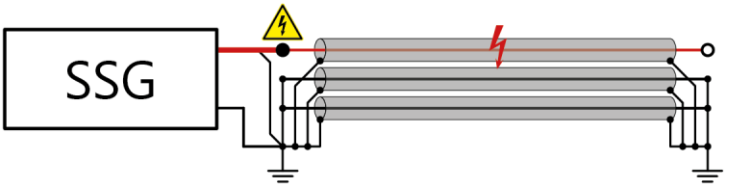
1. Make sure that the cable route is known and marked.

   Further information:

   - Chapter *Tracing and depth measurement with the audio frequency probe* (on page 56)
   - Chapter *Tracing with the acoustic ground probe* (on page 73)

2. Connect the test object properly according to the user manual for the surge voltage generator.

   Example: Connecting the surge voltage generator to a cable with 3 screened phases



3. Switch on the surge voltage generator and select the lowest possible voltage range that is higher than the breakdown voltage of the fault.

   Example: If the breakdown voltage is 6.5 kV, select the 8 kV voltage range.

4. Release the high voltage on the surge voltage generator.
5. Set the maximum permissible output voltage in the selected voltage range and the surge sequence.
6. Make sure that the contact bell is mounted on the underside of the acoustic ground probe.

   If pin-pointing with the contact bell is not possible due to undergrowth (grass, weeds, etc.) or the surface (sand, snow, etc.), also screw in a suitable contact spike.

7. Make sure that the acoustic ground probe is in reliable contact with the ground.

8. Switch on the acoustic ground probe, the headphones, and the control unit.
   The header of the touchscreen shows that the devices are connected.
9. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.
   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Pin-pointing cable faults

1. On the home screen, select the ***Acoustic pin-pointing*** method.
2. If you want to limit the volume of the headphones to 85 dB(A), make sure that the button for 85 dB(A) limiting is in the following state: 85 dB(A).
3. Locate the cable fault. When doing so, note the following:
   - the fault distance displayed,
   - the strength of the electromagnetic signal,
   - your position in relation to the cable route and
   - the acoustic signal.
4. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the ⚙ button.
   Further information: Chapter *Method settings* (on page 42)
5. Move along the cable route towards the fault with the acoustic ground probe.
6. Once you have located the fault, mark the position.
7. Exit the measurement and switch off all the devices and systems used.

▸ Follow the instructions in the user manual for the surge voltage generator used or for the cable fault location system.

6.4 Tips

Evaluation of the acoustic and electromagnetic signals

For acoustic pin-pointing using protrac®, the propagation times of the acoustic and electromagnetic signals are compared (coincidence method). This is helpful, for example, for cables laid in pipes or under concrete: The acoustic signal is often loudest at the end of a pipe or concrete slab, which can be misleading. It is only by comparison with the electromagnetic signal that the distance can be precisely and reliably determined.

Maximum possible surge energy

1. Select the lowest possible voltage range that is higher than the breakdown voltage of the fault.

   Example: If the breakdown voltage is 6.5 kV, select the 8 kV voltage range.
2. Set the maximum permissible output voltage in the selected voltage range and the surge sequence.

This will ensure that the maximum possible surge energy and volume of the breakdown is achieved.

Cable break – connecting the surge voltage generator

- Short all phases with the screen and with the station earth at the far end.

  The signal from the surge voltage generator can then be detected clearly and unambiguously by protrac®.

Changing faults

Faults can disappear temporarily during pin-pointing. This can be due to the fault changing, moisture or the selected output voltage being too low.

- If permitted, increase the output voltage on the surge voltage generator.

  Note, however, that high and long-lasting surge voltages change the fault and can make fault location more difficult.

Pin-pointing in strong wind

Strong wind can affect the sensitivity of the acoustic ground probe.

- To improve the sensitivity of the acoustic ground probe in strong wind (noise level), remove the handle.

  Further information: Chapter *Mounting and adjusting the handle of the acoustic ground probe* (on page 34)

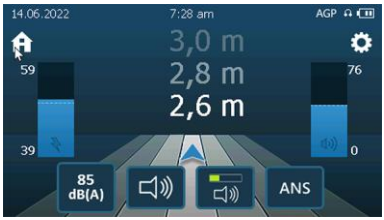
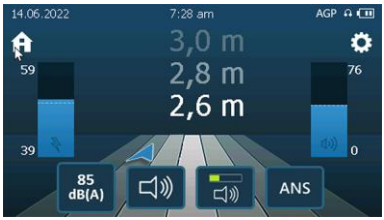
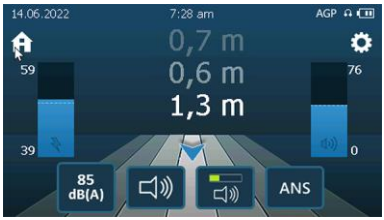
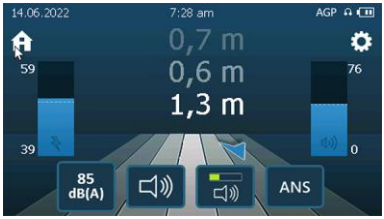
Direction display for acoustic pin-pointing

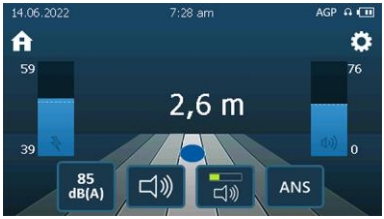
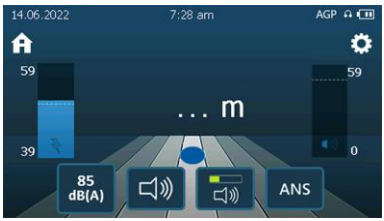
The last three measured distances from the fault are displayed on the touchscreen. The value at the very bottom is the latest distance.

The directional arrow, the stylised cable route (middle zone), and the neighbouring zones show where you are in relation to the cable route.

If only one measurement has been performed or no acoustic signal has been received, your position in relation to the cable route is represented by a dot.

Examples:

Display	Meaning
	You are directly above the cable route and the cable fault is located approx. 2.6 m in front of you.
	You are to the left of the cable route and the cable fault is located approx. 2.6 m in front of you.
	You are directly above the cable route and the cable fault is located approx. 1.3 m behind you.
	You are to the right of the cable route and the cable fault is located approx. 1.3 m behind you.

Display	Meaning
	You are directly above the cable route and approx. 2.6 m from the cable fault. A second measurement must be performed to determine the direction in which the fault is located.
	You are directly above the cable route, but no acoustic signal has been detected. Due to the lack of an acoustic signal, it is not possible to determine the distance from the fault and this is shown as ▪▪▪.

Display of directional arrow

Severe temporary faults can lead to incorrect measurements. Measurements are therefore only evaluated if the acoustic and electromagnetic signals lie within a certain time period.

6.5 Method settings

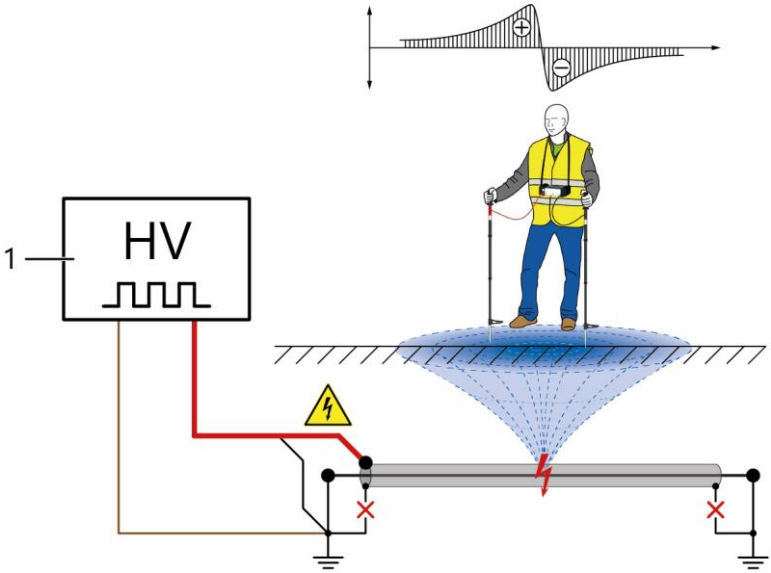
Parameters	Meaning
Sound	Is used to specify whether audio output is via the headphones or the loudspeaker of the control unit
Ambient noise suppression	Is used to activate and deactivate the ambient noise suppression
Basic settings	Opens the basic settings for protrac®

7 SHEATH FAULT LOCATION

Sheath fault location is suitable for:

- Low-resistive cable faults due to earth contact
- Cable sheath faults

7.1 About sheath fault location



1 HV source

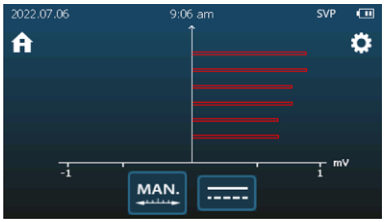
A series of current pulses are fed into the faulty cable. At the fault location, the current pulses discharge into the surrounding ground due to the fault resistance and form a voltage gradient on the surface of the ground. The step voltage that can be measured on the earth surface, rises in the direction of the fault and changes the polarity directly above the fault.

7.1.1 Sheath fault location with pulsed DC voltage

In DC mode (/)

For sheath fault location in DC mode, the DC pulses that enter the ground at the fault location are measured and indicated by a repeat signal on the touchscreen of the control unit. The DC pulses indicated show the direction in which the fault is located. The fewer noise signals present in the ground, the more clearly the DC pulses are indicated. These noise signals can make it hard to detect the DC pulses or can make the step voltage at the surface of the ground appear offset from the fault location.

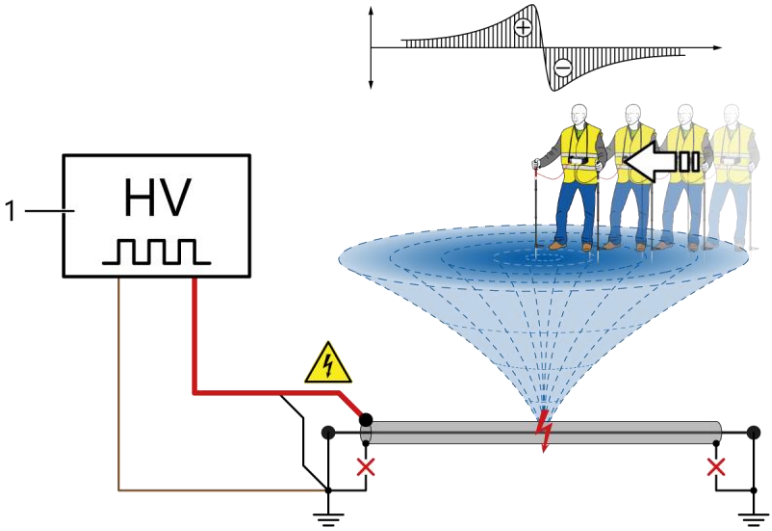
Direction display on the touchscreen:

Cable sheath fault to the left of the operator	Cable sheath fault to the right of the operator
	
Negative DC pulses (deflection to the left)	Positive DC pulses (deflection to the right)
The increasing signal strength at the bottom of the touchscreen shows that you are moving closer to the cable sheath fault.	The decreasing signal strength at the bottom of the touchscreen shows that you are moving away from the cable sheath fault.

Note: The red colour of the pulses on the right corresponds to the red step voltage probe, which should be connected to the right, red port on the control unit and held in the right hand.

In AC mode ( )

For sheath fault location in AC mode, the voltage pulses are capacitively decoupled in the form of a square wave signal using a capacitor. Only the edges of the square wave signal are detected. This results in a signal pair consisting of a rising edge and a falling edge, which are represented with reversed polarity. The polarity of the first half-wave of the detected signal indicates the direction in which the fault is located. All detected DC voltages are blocked by the capacitor, e.g. DC interference voltages.

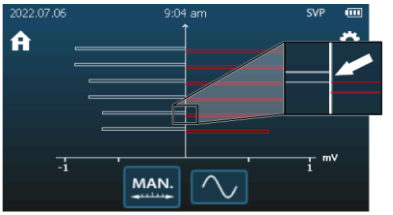


1 HV source

The voltage increases disproportionately in the vicinity of the fault location. The positive and negative voltages cancel each other out directly above the cable sheath fault. This becomes apparent on the touchscreen of the control unit via a very low signal strength that ideally comes close to zero. For more precise location, the distance between the two step voltage probes can be reduced and the voltage display adjusted. The voltage display can be adjusted automatically or manually. Further information: Chapter *Method settings* (on page 55)

To avoid severe voltage changes during fault location and to improve traceability, the distance between two measuring points should be modified in the shortest possible steps using the step voltage probes.

Direction display on the touchscreen:

Cable sheath fault to the left of the operator	**Cable sheath fault to the right of the operator**
	
The first half-wave of the signal has negative polarity.	The first half-wave of the signal has positive polarity.
The decreasing signal strength at the bottom of the touchscreen shows that you are moving away from the cable sheath fault.	The increasing signal strength at the bottom of the touchscreen shows that you are moving closer to the cable sheath fault.

Recommendation: If the approximate position of the cable sheath fault is known, it is best to move just one step voltage probe and keep the other step voltage probe fixed in one spot. This creates a fixed reference point, helping to quickly locate the fault.

Note: The red colour of the pulses on the right corresponds to the red step voltage probe, which should be connected to the right, red port on the control unit and held in the right hand.

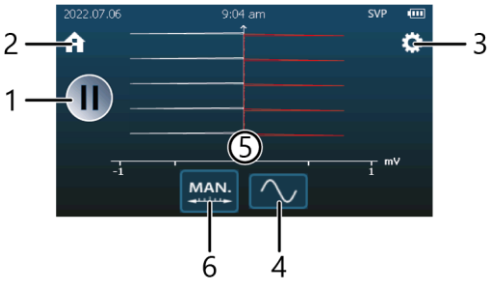
Examples of signal sequences:

Decreasing signal strength	Signal strength is approx. 0
	
There are two reasons why the signal strength may decrease: ▪ In the vicinity of the sheath fault, the voltage initially increases disproportionately, but then decreases rapidly until it is ideally 0 directly above the fault. ▪ After passing the fault location, the voltage initially increases disproportionally again and then decreases again.	The positive and negative voltages cancel each other out directly above the cable sheath fault. This becomes apparent on the touchscreen via very low signal strength that is ideally 0.

7.1.2 Sheath fault location with constant DC voltage

For sheath fault location with a constant DC voltage, only the voltage level is measured and displayed. Trains, trams, large industrial plants, or galvanic elements in the ground generate noise signals which influence the measured voltage. This means that the direction in which the fault is located will no longer be clearly indicated. A constant DC voltage measured in the ground may also originate from elsewhere and therefore cannot always be clearly attributed to a specific cable sheath fault.

7.2 User interface



No.	Function
1	Freezes the display
2	Opens the home screen
3	Opens the method settings
4	Displays the selected signal evaluation: ▪ : only the change to the signal is displayed (capacitive decoupling). ▪ : The input signal is measured and displayed directly. ▪ : The input signal is measured and displayed directly. Zero point adjustment of the signal display is performed automatically. ▸ To change the type of signal evaluation, tap the button.
5	Shows the strength and polarity of the detected signal ▪ In AC mode ( ), the polarity of the first half-wave of the detected signal indicates the direction in which the fault is located. ▪ In DC mode (/), the greater amplitude of the detected signal indicates the direction in which the fault is located.

No.	Function
6	Is used to set whether the voltage display is adjusted automatically (AUTO) or manually (MAN.). ▸ To switch between automatic and manual, tap the button. ▸ To switch between manual and automatic: a) Select the button with the rotary switch. b) Press and hold down the rotary switch until the button changes to automatic. ▸ To set the voltage display manually, switch to manual (MAN.) and turn the rotary switch.

7.3 Performing sheath fault location

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

▸ Take all necessary safety measures.

Further information: Chapter *For your safety* (on page 10)

▸ Discharge and earth the test object before touching it.

Required equipment

- HV generator (e.g. BAUR shirla)
- Step voltage probes, control unit
- To improve the contact between the step voltage probes and the ground for sheath fault location on sealed surfaces (concrete, asphalt): canister of salt water, sponges

Preparing for pin-pointing

An HV generator (standalone device) is used as an example in the description below. The same procedure applies if the HV generator is integrated in a cable fault location system.

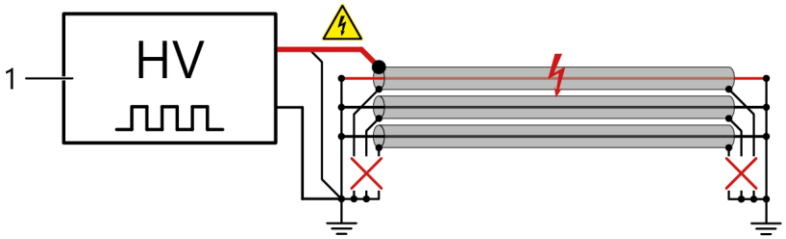
1. Make sure that the cable route is known and marked.

   Further information:

   - Chapter *Tracing and depth measurement with the audio frequency probe* (on page 56)
   - Chapter *Tracing with the acoustic ground probe* (on page 73)

2. Connect the test object properly according to the user manual for the HV generator.

   Example: Connecting the HV source to a cable with 3 screened phases (no earthing strip installed between the near and far end)



1 HV source

3. If there is an earthing strip between the near and far end, earth the screen of the HV connection cable of the HV generator with a separate earth spike.

   The step voltage is discharged at the fault location by the earthing strip, which means that the sheath fault cannot be located at the surface.

4. Switch on the HV generator and set the output voltage.
5. Release the high voltage on the HV generator.
6. If you have already pre-located the fault, go near the pre-located fault location.
7. If necessary, adjust the height of the step voltage probes.

   Further information: Chapter *Adjusting the height of the step voltage probes* (on page 34)

8. Connect the step voltage probes to the control unit.

   To ensure correct signal display in the software, the connection cables must be connected as follows:

   - The red connection cable is connected to the red step voltage probe and to the red *SVP* port on the control unit
   - The black connection cable is connected to the black step voltage probe and to the black *SVP* port on the control unit

9. Make sure that the step voltage probes are in good contact with the ground.

   Sealed surfaces such as concrete or asphalt can have an insulating effect and impede sheath fault location.

   To improve the contact between the step voltage probes and the ground, wet the sponges with salt water and place them on the step voltage probes.

10. Switch on the control unit.

    The header of the touchscreen shows that the step voltage probes are connected.

Locating sheath faults

1. On the home screen, select the ***Sheath fault location*** method.
2. Note the displayed signal deflection.

   If no signal deflection is visible:

   ▸ Insert the step voltage probes into the ground a greater distance apart.

   ▸ Turn 90° and insert the step voltage probes into the ground.

3. Move along the cable route towards the fault with the step voltage probes.

   The voltage increases in the direction of the fault, slowly at first and then sharply in the direct vicinity of the fault. Right above the fault, the polarity of the voltage changes. If the step voltage probes are inserted symmetrically above the fault location, the signal is ideally 0.

4. If you want to adjust the settings for the signal display, call up the method settings by tapping the ⚙ button.

   Further information: Chapter *Method settings* (on page 55)

5. Once you have located the fault, mark the position.
6. Exit the measurement and switch off all the devices and systems used.

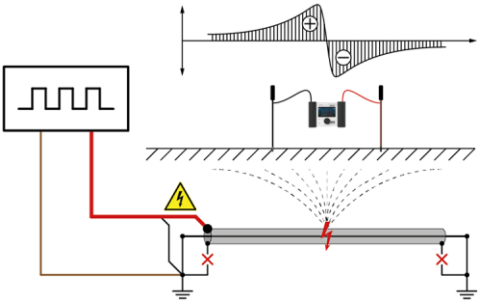
▸ Follow the instructions in the user manual for the HV generator used or for the cable fault location system.

7.4 Tips

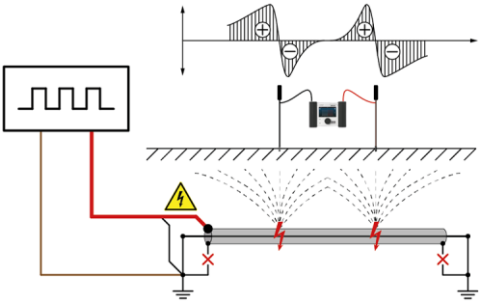
Detecting multiple cable sheath faults

If there are many cable sheath faults in a cable, there is a voltage gradient around each fault. This can result in incorrect measurements: A spot between the actual cable faults similarly shows zero voltage and can be mistaken for a fault.

- To detect this phenomenon, consider the polarity change of the voltage during fault location.



One cable sheath fault



Two cable sheath faults

Pre-locating cable sheath faults more precisely

- To pre-locate the cable sheath faults more precisely, perform a Glaser measuring bridge measurement. Follow the instructions in the user manual for the bridge measuring unit.

Factors influencing signal strength and quality

After the step voltage probes have been placed in the ground, it may take some time before the voltage signals are detected correctly. This can be due to the following:

- the nature of the ground, where the minerals present in the ground react with the stainless steel of the step voltage probes, or
- the way the operator moves, as this can affect the contact between the step voltage probes and the ground.

To minimise their impact on the measurement, it is a good idea to wait for approx. 3 – 5 pulses and observe the stability of the signals displayed.

The pulse sequence or surge sequence can also affect the stability of the measurement. The voltage can change due to capacitive and inductive influences in the cable itself. Together with the galvanic reactions in the ground, this can affect the detected signal. To reduce this effect, it may be helpful to adjust the pulse sequence, the surge sequence, or the height of the current pulses. The surge sequence and pulse height are adjusted on the HV source used.

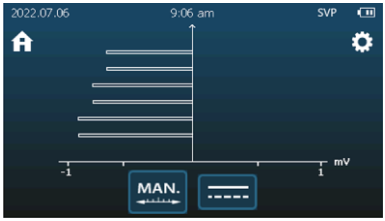
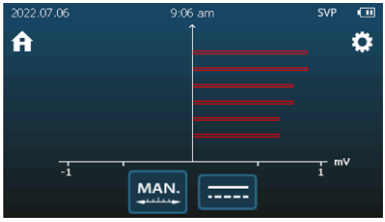
Note: A test measurement can often be used to determine which pulse frequency is the most reliable.

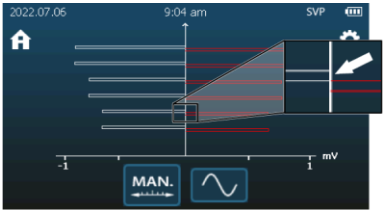
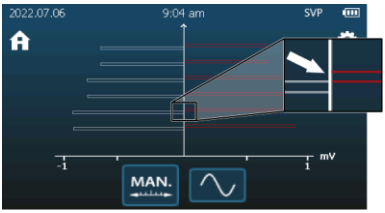
Direction display for sheath fault location

The measured signals are displayed from bottom to top on the time axis (vertical), i.e. the latest measurement is always displayed at the very bottom, with the previous measurements displayed above it.

For sheath fault location, the direction in which the fault is located is displayed.

Examples:

Display	Meaning
Sheath fault location in DC mode (/)	
	**Cable sheath fault to the left of the operator** Negative DC pulses (deflection to the left) The increasing signal strength at the bottom of the touchscreen shows that you are moving closer to the cable sheath fault.
	**Cable sheath fault to the right of the operator** Positive DC pulses (deflection to the right) The decreasing signal strength at the bottom of the touchscreen shows that you are moving away from the cable sheath fault.

Display	Meaning
Sheath fault location in AC mode ( )	
	**Cable sheath fault to the left of the operator** The first half-wave of the signal has negative polarity. The decreasing signal strength at the bottom of the touchscreen shows that you are moving away from the cable sheath fault.
	**Cable sheath fault to the right of the operator** The first half-wave of the signal has positive polarity. The increasing signal strength at the bottom of the touchscreen shows that you are moving closer to the cable sheath fault.

Note: The red colour of the pulses on the right corresponds to the red step voltage probe, which should be connected to the right, red port on the control unit and held in the right hand.

Locating sheath faults precisely by creating a fixed reference point

If the approximate position of the cable sheath fault is known, it is best to move just one step voltage probe and keep the other step voltage probe fixed in one spot. This creates a fixed reference point, helping to quickly locate the fault.

7.5 Method settings

Parameters	Meaning
Signal evaluation	Is used to specify how the detected step voltage will be evaluated ▪ ***AC***: only the change to the signal is displayed (capacitive decoupling). ▪ ***DC***: The input signal is measured and displayed directly. ▪ ***DC + zero point adjustment***: The input signal is measured and displayed directly. Zero point adjustment of the signal display is performed automatically. If the function is activated, protrac® compensates for disruptive external signals and automatically adjusts the zero point of the scale.
Voltage indicator	Is used to set the display range
Mode	Is used to specify whether the scaling of the display range will be adjusted automatically by the software or whether it will be adjusted manually
Display range	Is used to manually adjust the scaling ***Mode*** > ***Manual*** must be enabled.
Measurement range	Is used to define the measurement range ***Standard***: 1 mV to 360 V ***Extended***: 10 µV to 360 V
Basic settings	Opens the basic settings for protrac®

8 TRACING AND DEPTH MEASUREMENT WITH THE AUDIO FREQUENCY PROBE

8.1 About tracing with the audio frequency probe

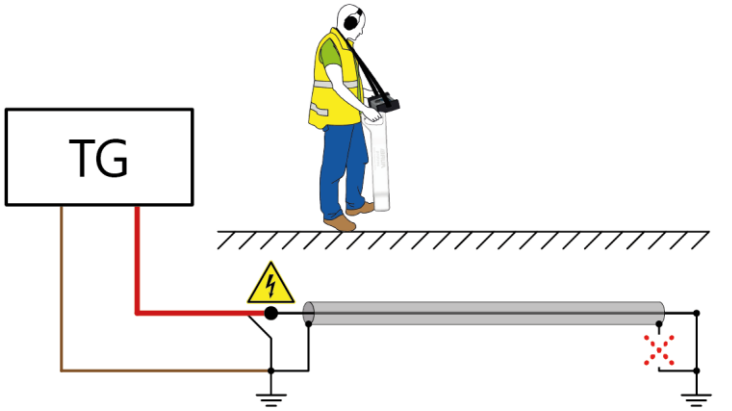
There are two tracing methods - active and passive:

- Active method

An audio frequency signal is generated and fed into the cable to be located using an audio frequency transmitter. This signal generates an electromagnetic field that can be located at the surface of the ground and tracked. This method enables the cable route to be determined.

Recommendation: For clear signal detection, use the active tracing method and disconnect the test object screen from the station earth.

Disconnecting the screen from the station earth prevents return current from flowing back via the screen, and the forward and return currents thus cancel each other out.



⁙ = optional disconnection of the screen for a stronger signal

- Passive method

A live cable generates an electromagnetic field that can be located at the surface of the ground and traced. Interference, e.g. from other cables and pipes, must be taken into account when using this method.

Measurement methods for tracing

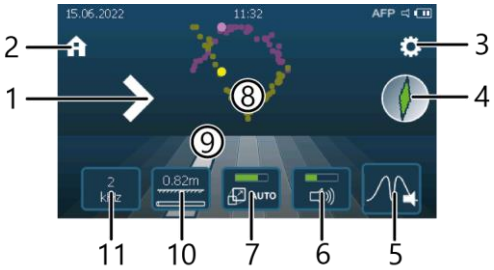
-  ***Minimum method***: The signal displayed on the touchscreen and the acoustic signal reach their minimum level directly above the cable route.
-  ***Maximum method***: The signal displayed on the touchscreen and the acoustic signal reach their maximum level directly above the cable route.
-  ***C-Max:*** Combination of minimum method and maximum method for a more distinct signal amplitude with steep edges. The signal displayed on the touchscreen and the acoustic signal reach their maximum level directly above the cable route.
-  ***45° depth measurement***: To determine the laying depth of the cable route, the audio frequency probe must be offset to the side parallel to the laying direction of the cable route. The signal thus reaches its minimum level at the distance from the cable route that corresponds to the laying depth.

  The mean value calculated by the software based on the signals from the minimum coil and the maximum coil is displayed as a red signal on the touchscreen of the control unit. The signal for the minimum method (yellow signal) can be additionally displayed.
-  Direct current/depth measurement: By briefly pressing the button on the audio frequency probe, the current current strength of the signal or the current laying depth of the cable route can be measured. The measured value is displayed in the button until the next measurement is performed.

The signal display of certain combinations of measurement methods can be simultaneously shown on the control unit. Just one signal is emitted acoustically:

Audio output	**Measurement method**			
				
	x			
		x		
	x	x		
			x	
				x
	x			x

8.2 User interface



No.	Function
1	Shows the direction in which the cable route is located
2	Opens the home screen
3	Opens the method settings
4	Shows the angle at which the audio frequency probe is being guided to the laying direction of the cable route It makes no difference to the display whether the audio frequency probe is being guided directly above the cable route or offset to the side of it.
5	Is used to select the method that will be used to perform tracing ▪ : Minimum method ▪ : Maximum method ▪ : C-Max ▪ : 45° depth measurement Further information: Chapter *About tracing with the audio frequency probe* (on page 56)
6	Is used to set the volume on the headphones or the loudspeaker of the control unit

No.	Function
7	Is used to adjust the display range When ***AUTO*** is selected, adjustment is performed automatically by the software. ▸ To switch between automatic and manual, tap the button. ▸ To switch between manual and automatic: a) Select the button with the rotary switch. b) Press and hold down the rotary switch until the button changes to automatic.
8	Displays the signals from the coils of the audio frequency probe
9	Shows the cable route (middle zone) and neighbouring zones The zone where you are currently located is highlighted in white.
10	Is used for direct depth measurement or current measurement ▪  : Direct depth measurement ▪  : Direct current measurement ▪  : There is signal interference By briefly pressing the button on the audio frequency probe, the current current strength of the signal or the current laying depth of the cable route can be measured. The measured value is displayed in the button until the next measurement is performed.
11	Is used to select a stored frequency for filtering the displayed signals When ***All*** is selected, the signals are displayed in the entire frequency range. Further information: Chapter *Data sheet* (on page 122)

8.3 Performing tracing

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- Take all necessary safety measures.

  Further information: Chapter *For your safety* (on page 10)

- Discharge and earth the test object before touching it.

Required equipment

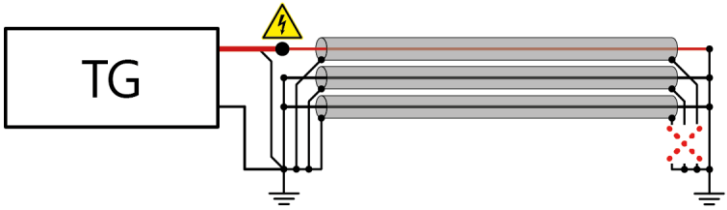
- Audio frequency transmitter (e.g. BAUR TG 20/50)
- Audio frequency probe, control unit, Bluetooth® headphones
- Markers for the route

Preparing for tracing

An audio frequency transmitter (standalone device) is used as an example in the description below. The same procedure applies if the audio frequency transmitter is integrated in a cable fault location system.

1. Connect the test object properly according to the user manual for the audio frequency transmitter.

   Example: Connecting the audio frequency transmitter to a cable with 3 screened phases



⤫ = optional disconnection of the screens for stronger signal

2. Switch on the audio frequency transmitter and make the desired settings.
3. Switch on the audio frequency probe, the headphones, and the control unit.

   The header of the touchscreen shows that the devices are connected.
4. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.

   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Performing tracing

1. On the home screen, select the ***Tracing*** method.
2. If the frequency set on the audio frequency transmitter is already stored in the control unit, select this frequency by tapping the 

button.

   If the frequency set on the audio frequency transmitter has not been stored yet, add the frequency.

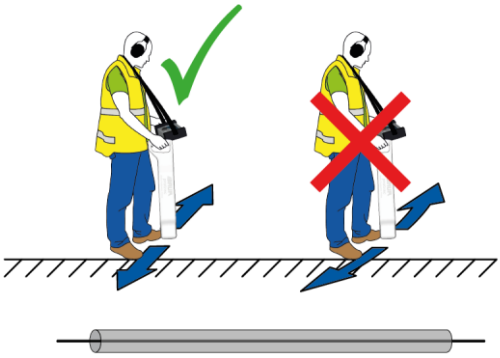
   Further information:

   - Chapter *Using the buttons* (on page 28)
   - Chapter *Adding and deleting a frequency* (on page 33)
3. Select the method that you want to use for tracing. To do this, tap the button for method selection and choose one of the following methods:

   -  : Minimum method
   -  : Maximum method
   -  : C-Max

   Further information: Chapter *About tracing with the audio frequency probe* (on page 56)

4. Locate the cable route by moving the audio frequency probe steadily from left to right over the cable route. Make sure you move in a straight line at a 90° angle to the cable route.



Depending on the location method selected, the displayed signal and the acoustic signal reach their maximum or minimum level directly above the cable route. The directional arrows are visible on both sides of the display.

5. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the button.
   Further information: Chapter *Method settings* (on page 71)
6. Mark the course of the cable route with the markers.
   You can first determine the laying depth of the cable route by selecting direct depth measurement ( ) on the touchscreen of the control unit and then briefly pressing the button on the audio frequency probe.

To determine the precise laying depth of the cable route, perform a 45° depth measurement.

Further information: Chapter *Performing depth measurement* (on page 64)

7. Exit the measurement and switch off all the devices and systems used.

- Follow the instructions in the user manual for the audio frequency transmitter used or for the cable fault location system.

8.4 Performing depth measurement

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- Take all necessary safety measures.

  Further information: Chapter *For your safety* (on page 10)

- Discharge and earth the test object before touching it.

Required equipment

- Audio frequency transmitter (e.g. TG 20/50)
- Audio frequency probe, control unit, Bluetooth® headphones
- Markers

Preparing for depth measurement

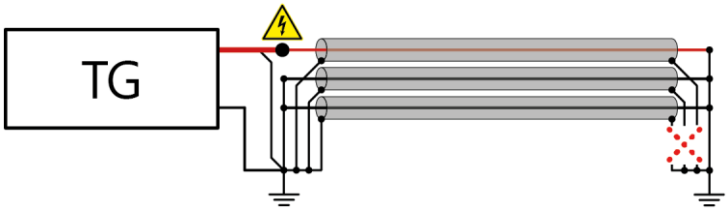
An audio frequency transmitter (standalone device) is used as an example in the description below. The same procedure applies if the audio frequency transmitter is integrated in a cable fault location system.

1. Make sure that the cable route is known and marked.

   Further information: Chapter *Performing tracing* (on page 61)

2. If not yet connected, connect the test object properly according to the user manual for the audio frequency transmitter.

   Example: Connecting the audio frequency transmitter to a cable with 3 screened phases



   ⁘ = optional disconnection of the screens for stronger signal

3. Switch on the audio frequency transmitter and make the desired settings.
4. Switch on the audio frequency probe, the headphones, and the control unit.

   The header of the touchscreen shows that the devices are connected.

5. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.

   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Performing depth measurement

1. On the home screen, select the ***Tracing*** method.
2. If the frequency set on the audio frequency transmitter is already stored in the control unit, select this frequency by tapping the kHz button.

   If the frequency set on the audio frequency transmitter has not been stored yet, add the frequency.

   Further information:

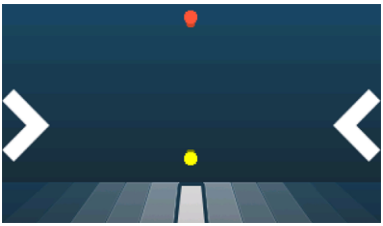
   - Chapter *Using the buttons* (on page 28)
   - Chapter *Adding and deleting a frequency* (on page 33)
3. Set 45° depth measurement and minimum method as the combination of methods:

   a. Tap the button for method selection and select (45° depth measurement).

   b. Tap the button for method selection again and select (minimum method).

   Further information: Chapter *Using the buttons* (on page 28)
4. Place the audio frequency probe on the ground directly above the cable route.

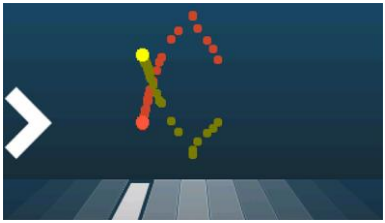
   The yellow signal from the minimum coil (MIN) reaches its minimum level directly above the cable route. The directional arrows are visible on both sides of the display.



5. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the button.

   Further information: Chapter *Method settings* (on page 71)
6. Mark the spot on the ground.

7. Move the audio frequency probe to the side parallel to the cable route until the red signal for 45° depth measurement reaches its minimum level.



8. Mark the spot on the ground.
9. Repeat steps 7 to 8 on the other side of the cable route.
10. Measure the distance of the right and left markings from the marking for the cable route.

    If these distances are equal, their value corresponds to the laying depth of the cable route.

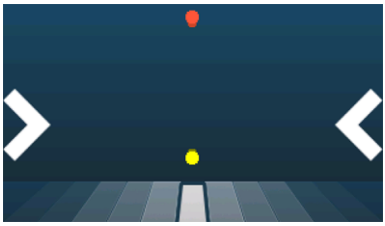
    If these distances differ, the signal field is distorted. In this case, you must perform a reference measurement to precisely determine the position of the cable route.

Performing a reference measurement

1. Raise the audio frequency probe vertically approx. 1 m directly above the marking for the cable route.

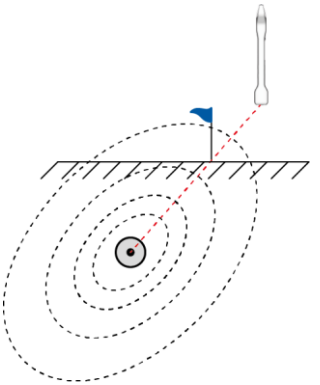
   The signal from the minimum coil (MIN) is no longer at its minimum level.
2. Keeping the audio frequency probe at this height, move it to the side parallel to the cable route.

   The signal from the minimum coil (MIN) reaches its minimum level on one side of the cable route.



3. Draw an imaginary straight line from the bottom end of the audio frequency probe to the marking for the cable route.

   The cable route is located along the continuation of this imaginary line.



4. Exit the measurement and switch off all the devices and systems used.

- Follow the instructions in the user manual for the audio frequency transmitter used or for the cable fault location system.

8.5 Tips

Adjusting the display range

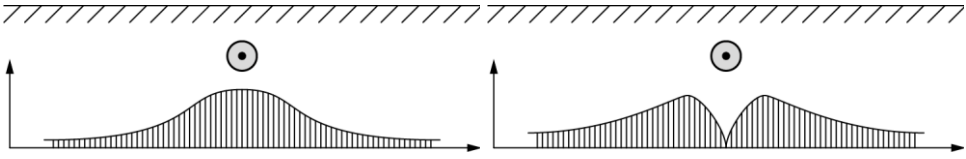
In order to clearly detect signal changes, at the start of tracing you should set the adjustment of the display range to automatic. As soon as the adjustment of the display range has been set, set it back to manual adjustment. This ensures that signal changes are not corrected by the automatic adjustment feature.

Abrupt signal changes during measurement

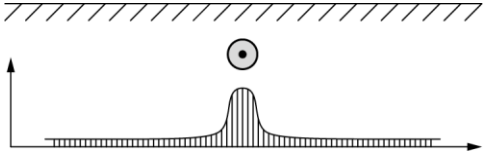
If the signal strength increases or decreases abruptly during measurement, it can be due to the following:

- A change in the laying depth of the cable route
- A joint at which the signal splits in several directions
- A break in the cable or cable screen
- A cable loop
- A fault due to earth contact

Signal sequences



Maximum method Minimum method



C-Max

Direction display for tracing

The bright points for the current signal, the stylised cable route (middle zone), and the neighbouring zones show where you are in relation to the cable route.

The white directional arrows also show the direction in which the cable route is located, e.g. a directional arrow pointing to the right is displayed when you are to the left of the cable route.

Examples:

Display	Meaning
	You are directly above the cable route. This is shown as follows: ▪ Both directional arrows ▪ Position of the bright points for the current signal ▪ Highlighted zone marking
	You are to the left of the cable route. This is shown as follows: ▪ Directional arrow pointing to the right ▪ Position of the bright points for the current signal ▪ Highlighted zone marking
	You are to the right of the cable route. This is shown as follows: ▪ Directional arrow pointing to the left ▪ Position of the bright points for the current signal ▪ Highlighted zone marking

8.6 Method settings

Parameters	Meaning
Sound	
Output	Is used to specify whether audio output is via the headphones or the loudspeaker
Modulation type	Is used to specify how the audio output behaves when the audio frequency probe is moved back and forth ▪ ***Raw data***: The volume and pitch of the signal are output exactly as they are recorded. ▪ ***AM***: The volume of the signal changes. ▪ ***FM***: The pitch of the signal changes.
Modulation frequency	Is used to set the pitch of audio output
Volume	Is used to set the volume of audio output
Frequency settings	
Frequency selection	Is used to select a stored frequency for filtering the displayed signals When ***All*** is selected, the signals are displayed in the entire frequency range. Further information: Chapter *Data sheet* (on page 122)
Add frequency	Is used to add a frequency The frequency can be entered manually or determined with an automatic search. ▸ Further information: Chapter *Adding and deleting a frequency* (on page 33)
Delete frequency	Is used to delete stored frequencies The preset standard frequencies provided by BAUR cannot be deleted.
Frequency filter	Is used to enable and disable the frequency filter

Parameters	Meaning
Method	Is used to specify which method will be used to perform tracing
Maximum method	The signal displayed on the touchscreen and the acoustic signal reach their maximum level directly above the cable route.
Minimum method	The signal displayed on the touchscreen and the acoustic signal reach their minimum level directly above the cable route.
Minimum + maximum method	The signals for the minimum method and the maximum method are displayed simultaneously. In addition, the signal for the minimum method is also emitted acoustically.
C-Max	Combination of minimum method and maximum method Further information: Chapter *About tracing with the audio frequency probe* (on page 56)
45° depth measurement	The mean value calculated by the software based on the signals from the minimum coil (MIN) and the maximum coil (MAX) is displayed.
45° depth measurement* + *Minimum method	The signals for 45° depth measurement and the minimum method are displayed simultaneously. In addition, the signal for 45° depth measurement is also emitted acoustically.
Display duration	Is used to set the length of time that the signals are displayed on the touchscreen
Basic settings	Opens the basic settings for protrac®

9 TRACING WITH THE ACOUSTIC GROUND PROBE

9.1 About tracing with the acoustic ground probe

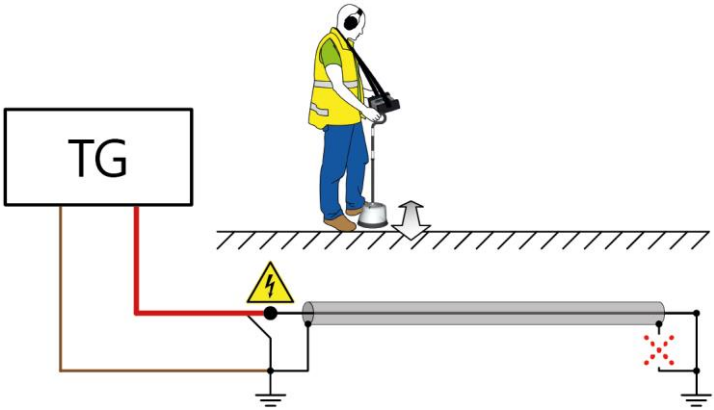
There are two tracing methods - active and passive:

- Active method

An audio frequency signal is generated and fed into the cable to be located using an audio frequency transmitter. This signal generates an electromagnetic field that can be located at the surface of the ground and tracked. This method enables the cable route to be determined.

Recommendation: For clear signal detection, use the active tracing method and disconnect the test object screen from the station earth.

Disconnecting the screen from the station earth prevents return current from flowing back via the screen, and the forward and return currents thus cancel each other out.

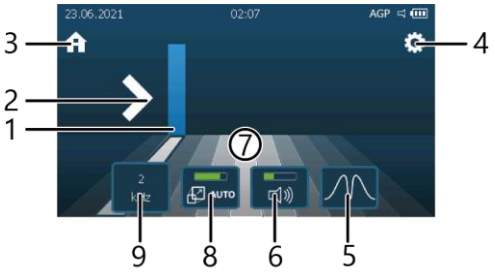


⤫ = optional disconnection of the screen for a stronger signal

- Passive method

A live cable generates an electromagnetic field that can be located at the surface of the ground and traced. Interference, e.g. from other cables and pipes, must be taken into account when using this method.

9.2 User interface



No.	Function
1	Shows the signal strength and where you are in relation to the cable route (middle zone)
2	Shows the direction in which the cable route is located
3	Opens the home screen
4	Opens the method settings
5	Is used to select the method that will be used to perform tracing. ▪ : Maximum method The signal displayed on the touchscreen and the acoustic signal reach their maximum level directly above the cable route. ▪ : Minimum method The signal displayed on the touchscreen and the acoustic signal reach their minimum level directly above the cable route.
6	Is used to set the volume on the headphones or the loudspeaker of the control unit
7	Shows the cable route (middle zone) and neighbouring zones The zone where you are currently located is highlighted in white.

No.	Function
8	Is used to adjust the display range When ***AUTO*** is selected, adjustment is performed automatically by the software. ▸ To switch between automatic and manual, tap the button. ▸ To switch between manual and automatic: a) Select the button with the rotary switch. b) Press and hold down the rotary switch until the button changes to automatic.
9	Is used to select a stored frequency for filtering the displayed signals When ***All*** is selected, the signals are displayed in the entire frequency range. Further information: Chapter *Data sheet* (on page 122)

9.3 Performing tracing

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- ▸ Take all necessary safety measures.
  Further information: Chapter *For your safety* (on page 10)
- ▸ Discharge and earth the test object before touching it.

Required equipment

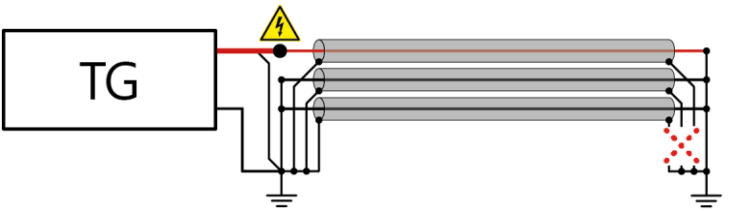
- Audio frequency transmitter (e.g. BAUR TG 20/50)
- Acoustic ground probe, control unit, Bluetooth® headphones
- Markers for the route

Preparing for tracing

An audio frequency transmitter (standalone device) is used as an example in the description below. The same procedure applies if the audio frequency transmitter is integrated in a cable fault location system.

1. Connect the test object properly according to the user manual for the audio frequency transmitter.

   Example: Connecting the audio frequency transmitter to a cable with 3 screened phases



   ⤫ = optional disconnection of the screens for stronger signal
2. Switch on the audio frequency transmitter and make the desired settings.
3. Switch on the acoustic ground probe, the headphones, and the control unit.

   The header of the touchscreen shows that the devices are connected.
4. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.

   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Locate cable route

1. On the home screen, select the ***Tracing*** method.
2. Set the desired method for tracing.

   Further information: Chapter *User interface* (on page 74)
3. Select the frequency that is set on the audio frequency transmitter by tapping the kHz button.

   Further information: Chapter *Using the buttons* (on page 28)
4. Position the acoustic ground probe above the cable route. Make sure that the directional arrow is pointing in the direction of the cable route.

5. Locate the cable route by moving the acoustic ground probe steadily from left to right over the cable route.

   Note your position in relation to the cable route and the acoustic signal.

   -  : (maximum method)

     When the acoustic ground probe is moved towards the cable route, the bar for the signal strength gets higher and, depending on the modulation type, the acoustic signal either becomes louder or higher in pitch.

   -  : (minimum method)

     When the acoustic ground probe is moved towards the cable route, the bar for the signal strength gets lower and, depending on the modulation type, the acoustic signal either becomes quieter or lower in pitch.

6. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the ⚙ button.

   Further information: Chapter *Method settings* (on page 80)

7. Mark the course of the cable route with the markers.
8. Exit the measurement and switch off all the devices and systems used.

- Follow the instructions in the user manual for the audio frequency transmitter used or for the cable fault location system.

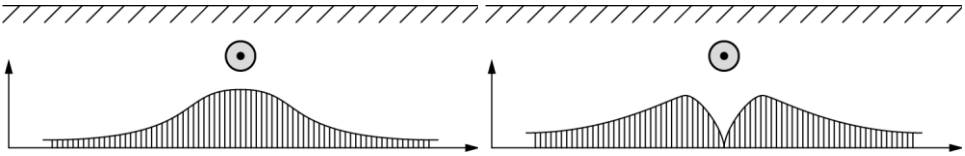
9.4 Tips

Abrupt signal changes during measurement

If the signal strength increases or decreases abruptly during measurement, it can be due to the following:

- A change in the laying depth of the cable route
- A joint at which the signal splits in several directions
- A break in the cable or cable screen
- A cable loop
- A fault due to earth contact

Signal sequences



Maximum method Minimum method

Direction display for tracing

The vertical bar for the signal strength, the stylised cable route (middle zone), and the neighbouring zones show where you are in relation to the cable route.

The white directional arrows also show the direction in which the cable route is located, e.g. a directional arrow pointing to the right is displayed when you are to the left of the cable route.

Examples:

Display	Meaning
	You are directly above the cable route. This is shown as follows: ▪ Both directional arrows ▪ Position of the bar for the signal strength ▪ Highlighted zone marking
	You are to the left of the cable route. This is shown as follows: ▪ Directional arrow pointing to the right ▪ Position of the bar for the signal strength ▪ Highlighted zone marking
	You are to the right of the cable route. This is shown as follows: ▪ Directional arrow pointing to the left ▪ Position of the bar for the signal strength ▪ Highlighted zone marking

9.5 Method settings

Parameters	Meaning
Sound	
Modulation type	Is used to specify how the audio output behaves when the audio frequency probe is moved back and forth ▪ ***AM***: The volume of the signal changes. ▪ ***FM***: The pitch of the signal changes.
Modulation frequency	Is used to set the pitch of audio output
Output	Is used to specify whether audio output is via the headphones or the loudspeaker
Volume	Is used to set the volume of audio output
Frequency selection	Is used to select a stored frequency for filtering the displayed signals When ***All*** is selected, the signals are displayed in the entire frequency range. Further information: Chapter *Data sheet* (on page 122)
Method	Is used to specify which method will be used to perform tracing ▪ ***Minimum method***: The signal displayed on the touchscreen and the acoustic signal reach their minimum level directly above the cable route. ▪ ***Maximum method*** The signal displayed on the touchscreen and the acoustic signal reach their maximum level directly above the cable route.
Basic settings	Opens the basic settings for protrac®

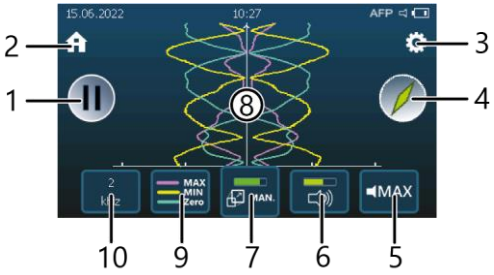
10 3D-History Track

10.1 User interface

This user interface is used to perform the twist method and minimum distortion method.

Further information:

- Chapter *Twist method* (on page 83)
- Chapter *Minimum distortion method* (on page 90)



No.	Function
1	Freezes the display
2	Opens the home screen
3	Opens the method settings
4	When the minimum distortion method is performed, shows whether the audio frequency probe is being guided parallel to the laying direction of the cable route It makes no difference to the display whether the audio frequency probe is being guided directly above the cable route or offset to the side of it. **Note:** This display has no function when the twist method is performed.

No.	Function
5	Is used to select the coil whose signal is to be emitted acoustically To select a signal for audio output, the signal from the coil must be displayed on the touchscreen. If signals from several coils are displayed, only the signal from one coil can be selected.
6	Is used to set the volume on the headphones or the loudspeaker of the control unit
7	Is used to adjust the display range When ***AUTO*** is selected, adjustment is performed automatically by the software. ▸ To switch between automatic and manual, tap the button. ▸ To switch between manual and automatic: a) Select the button with the rotary switch. b) Press and hold down the rotary switch until the button changes to automatic.
8	Displays the signals from the coils of the audio frequency probe
9	Is used to show and hide the signals from the individual coils If all the coils are hidden, the signal from the maximum coil (MAX) is automatically shown again.
10	Is used to select a stored frequency for filtering the displayed signals When ***All*** is selected, the signals are displayed in the entire frequency range. Further information: Chapter *Data sheet* (on page 122)

10.2 Twist method

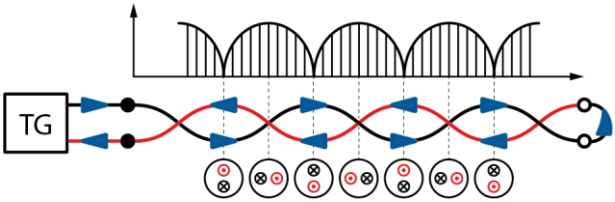
The twist method is suitable for:

- Short-circuits
- Low-resistive cable faults
- Joints

Prerequisites for using the method:

- Cable with twisted, unscreened phases (e.g. lighting or LV cable)
- The phases must not be separately screened.
- The fault resistance is < 10 ohm.

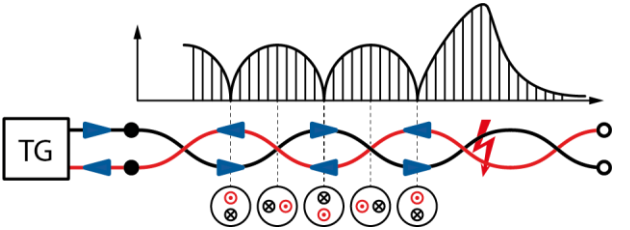
10.2.1 About the twist method



An audio frequency signal with a high current strength is fed in between two faulty phases (cable fault location) or two healthy phases (joint location) of a cable with twisted, unscreened phases (e.g. lighting or LV cable). Despite the current flowing in opposite directions, the resulting electromagnetic fields can be measured at the surface of the ground. The amplitude of the field and the twisting of the cable results in a twisted field. When walking at a quick pace along the cable route with the audio frequency probe, an increasing and decreasing signal can be heard, which is generated by the twisted field.

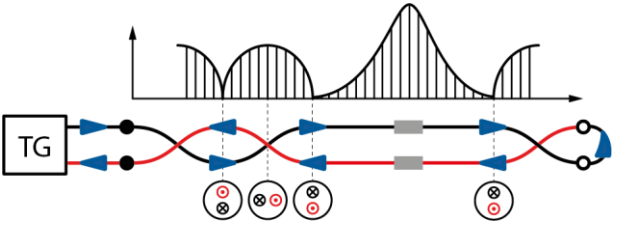
Depending on the application, the following signal sequences occur:

Cable fault location



If there is a fault between two phases, the audio frequency transmitter is connected to both faulty phases. The audio frequency signal that is fed in, flows through the first faulty phase up to the fault, through the short-circuit to the fault in the second faulty phase and back again to the audio frequency transmitter. A twisted field is measured up to the fault. The signal strength increases at the fault location and decreases to a minimum after the fault location.

Joint location



For joint location, the audio frequency transmitter is connected to two phases at one cable end. These two phases are short-circuited at the other cable end. The audio frequency signal that is fed in flows through the first phase to the short-circuit at the far cable end and via the second phase back to the audio frequency transmitter. A twisted field is measured up to the joint. The signal strength increases briefly directly above the joint. The audio frequency probe measures the twisted field again after the joint.

10.2.2 Performing cable fault location using the twist method

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- Take all necessary safety measures.

  Further information: Chapter *For your safety* (on page 10)

- Discharge and earth the test object before touching it.

Required equipment

- Audio frequency transmitter (e.g. BAUR TG)
- Audio frequency probe, control unit, Bluetooth® headphones

Preparing for pin-pointing

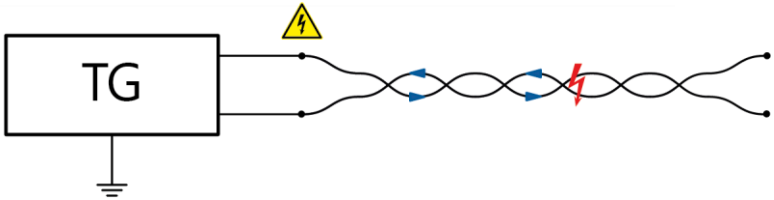
An audio frequency transmitter (standalone device) is used as an example in the description below. The same procedure applies if the audio frequency transmitter is integrated in a cable fault location system.

1. Make sure that the cable route is known and marked.

   Further information: Chapter *Tracing and depth measurement with the audio frequency probe* (on page 56)

2. Connect the test object properly according to the user manual for the audio frequency transmitter.

   Example: Connecting the audio frequency transmitter to a cable with twisted, unscreened phases (e.g. belted cable)



3. Set the desired frequency on the audio frequency transmitter.
4. Switch on the audio frequency probe, the headphones, and the control unit.

   The header of the touchscreen shows that the devices are connected.
5. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.

   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Pin-pointing cable faults

1. On the home screen of the control unit select the ***3D-History Track*** method.
2. If the frequency set on the audio frequency transmitter is already stored in the control unit, select this frequency by tapping the kHz button.

   If the frequency set on the audio frequency transmitter has not been stored yet, add the frequency.

   Further information:

   - Chapter *Using the buttons* (on page 28)
   - Chapter *Adding and deleting a frequency* (on page 33)
3. Hold the audio frequency probe above the cable route so that it is aligned parallel to the route.
4. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the button.

   Further information: Chapter *Method settings* (on page 94)
5. Move along the cable route towards the fault with the audio frequency probe.

   The typical signal sequence of the twisted field is displayed on the touchscreen of the control unit.
6. Once you have located the fault, mark the position.
7. Exit the measurement and switch off all the devices and systems used.

- Follow the instructions in the user manual for the audio frequency transmitter used or for the cable fault location system.

10.2.3 Performing joint location using the twist method

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- Take all necessary safety measures.

  Further information: Chapter *For your safety* (on page 10)

- Discharge and earth the test object before touching it.

Required equipment

- Audio frequency transmitter (e.g. BAUR TG)
- Audio frequency probe, control unit, Bluetooth® headphones

Preparing for joint location

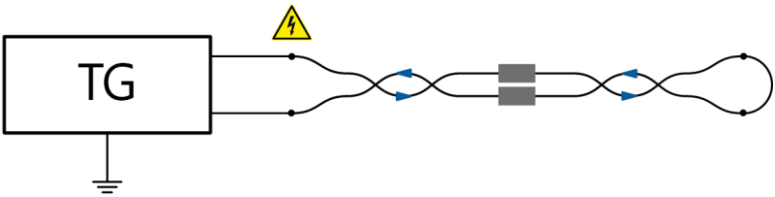
An audio frequency transmitter (standalone device) is used as an example in the description below. The same procedure applies if the audio frequency transmitter is integrated in a cable fault location system.

1. Make sure that the cable route is known and marked.

   Further information:

   - Chapter *Tracing and depth measurement with the audio frequency probe* (on page 56)
   - Chapter *Tracing with the acoustic ground probe* (on page 73)
2. Connect the test object properly according to the user manual for the audio frequency transmitter.

Example: Connecting the audio frequency transmitter to a cable with twisted, unscreened phases (e.g. belted cable)



3. Set the desired frequency on the audio frequency transmitter.
4. Switch on the audio frequency probe, the headphones, and the control unit.
   The header of the touchscreen shows that the devices are connected.
5. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.
   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Locating joints

1. On the home screen of the control unit select the ***3D-History Track*** method.
2. If the frequency set on the audio frequency transmitter is already stored in the control unit, select this frequency by tapping the kHz button.
   If the frequency set on the audio frequency transmitter has not been stored yet, add the frequency.
   Further information:
   - Chapter *Using the buttons* (on page 28)
   - Chapter *Adding and deleting a frequency* (on page 33)
3. Hold the audio frequency probe above the cable route so that it is aligned parallel to the route.
4. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the button.
   Further information: Chapter *Method settings* (on page 94)
5. Move along the cable route towards the far end.
   The typical signal sequence of the twisted field is displayed on the touchscreen of the control unit.

6. If you have located a joint, mark the spot and continue with the location towards the far end.
7. Exit the measurement and switch off all the devices and systems used.

- Follow the instructions in the user manual for the audio frequency transmitter used or for the cable fault location system.

10.2.4 Tips

If the twist field signal can no longer be received during the location, it can be due to two reasons.

Unknown branches in the cable route

There could be unknown branches in a cable route. These can present a big problem when locating cable faults, as it is suddenly no longer possible to measure the twist field signal.

1. Go back to the point where the twist field signal could be measured the last time.
2. To find the twist field signal again, search in a circle around the point where the twist field signal could be measured the last time.

In branched cable systems, the twisted field always runs in the direction of the cable fault. The healthy branches emit a continuously low sound.

Changing the laying depth of the cable

Sometimes the laying depth of the cable changes suddenly for a short while. If the laying depth increases, the twist field signal can be lost temporarily.

- Continue following the cable route.

The signal can be measured again along the cable route. If a twist field signal is measured, the cable fault is located in the direction you are walking.

10.3 Minimum distortion method

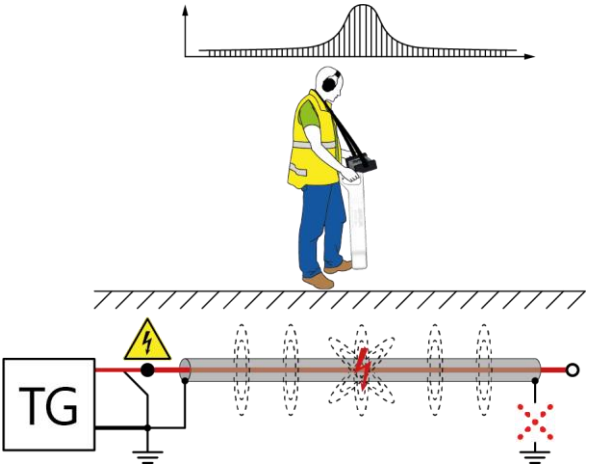
The minimum distortion method is suitable for:

- Short-circuits
- Low-resistive cable faults
- Joints

Prerequisites for using the method:

- Screened phase
- The fault resistance is < 10 ohm.

10.3.1 About the minimum distortion method



⁒ = optional disconnection of the screen for a stronger signal

The audio frequency transmitter is connected to the faulty phase and to the earthed cable screen that must be present along the entire length of the cable. To locate the fault, the audio frequency probe is guided parallel to the cable route. The magnetic field generated by the audio frequency transmitter does not induce any current in the minimum coil of the audio frequency probe, and no signal or a very low minimum signal is displayed. In the area near a fault or a joint, the magnetic field is disturbed, the signal increases and then decreases again to the minimum.

For successful pin-pointing with the minimum distortion method, it is important to pre-locate the cable fault as precisely as possible with the time domain reflectometry (TDR). This reduces possible misinterpretations during location, as the magnetic field can be disturbed by various factors, e.g. parallel running or crossing phases or iron parts located in the ground.

Recommendation: For clear signal detection, use the active tracing method and disconnect the test object screen from the station earth.

Disconnecting the screen from the station earth prevents return current from flowing back via the screen, and the forward and return currents thus cancel each other out.

10.3.2 Performing the minimum distortion method

DANGER

Dangerous electric voltage

Danger to life or risk of injury due to electric shock. Risk of burns and electro-ophthalmia due to arcing faults.

- Take all necessary safety measures.

  Further information: Chapter *For your safety* (on page 10)

- Discharge and earth the test object before touching it.

Required equipment

- Audio frequency transmitter (e.g. BAUR TG)
- Audio frequency probe, control unit, Bluetooth® headphones

Preparing for pin-pointing

An audio frequency transmitter (standalone device) is used as an example in the description below. The same procedure applies if the audio frequency transmitter is integrated in a cable fault location system.

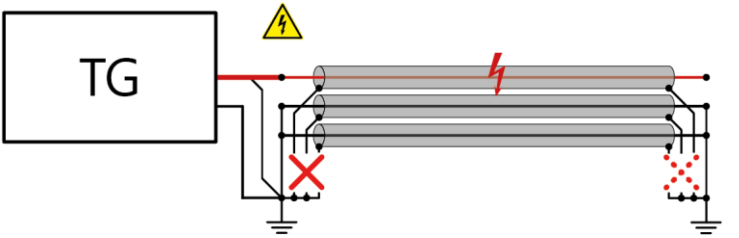
1. Make sure that the cable route is known and marked.

   Further information:

   - Chapter *Tracing and depth measurement with the audio frequency probe* (on page 56)
   - Chapter *Tracing with the acoustic ground probe* (on page 73)

2. Connect the test object properly according to the user manual for the audio frequency transmitter.

   Example: Audio frequency transmitter connected to faulty phase and cable screen



   ⤫ = optional disconnection of the screens for stronger signal

3. Switch the audio frequency transmitter on.
4. Set the desired frequency on the audio frequency transmitter.
5. Switch on the audio frequency probe, the headphones, and the control unit.

   The header of the touchscreen shows that the devices are connected.

6. If you want to use the loudspeaker of the control unit instead of the headphones, enable the loudspeaker in the settings for audio output.

   Further information: Chapter *Using the loudspeaker of the control unit* (on page 29)

Pin-pointing cable faults

1. On the home screen of the control unit select the ***3D-History Track*** method.
2. If the frequency set on the audio frequency transmitter is already stored in the control unit, select this frequency by tapping the kHz button.

   If the frequency set on the audio frequency transmitter has not been stored yet, add the frequency.

   Further information:

   - Chapter *Using the buttons* (on page 28)
   - Chapter *Adding and deleting a frequency* (on page 33)
3. Hold the audio frequency probe above the cable route so that it is aligned parallel to the route.

   The signal from the minimum coil (MIN) comes close to zero.
4. If you want to adjust the settings for the signal display and audio output, open the method settings by tapping the button.

   Further information: Chapter *Method settings* (on page 94)
5. Move along the cable route towards the fault with the audio frequency probe.
6. Once you have located the fault, mark the position.
7. Exit the measurement and switch off all the devices and systems used.

- Follow the instructions in the user manual for the audio frequency transmitter used or for the cable fault location system.

10.4 Method settings

Parameters	Meaning
Sound	
Output	Is used to specify whether audio output is via the headphones or the loudspeaker
Modulation type	Is used to specify how the audio output behaves when the audio frequency probe is moved back and forth ▪ ***Raw data***: The volume and pitch of the signal are output exactly as they are recorded. ▪ ***AM***: The volume of the signal changes. ▪ ***FM***: The pitch of the signal changes.
Modulation frequency	Is used to set the pitch of audio output
Volume	Is used to set the volume of audio output
Frequency settings	
Frequency selection	Is used to select a stored frequency for filtering the displayed signals When ***All*** is selected, the signals are displayed in the entire frequency range. Further information: Chapter *Data sheet* (on page 122)
Add frequency	Is used to add a frequency The frequency can be entered manually or determined with an automatic search. Further information: Chapter *Adding and deleting a frequency* (on page 33)
Delete frequency	Is used to delete stored frequencies The preset standard frequencies provided by BAUR cannot be deleted. Further information: Chapter *Adding and deleting a frequency* (on page 33)
Frequency filter	Is used to enable and disable the frequency filter

Parameters	Meaning
Coil for audio output	Is used to select the coil for audio output ▪ ***Minimum coil (MIN)*** ▪ ***Maximum coil (MAX)*** ▪ ***Parallel coil (Zero)***
Display duration	Is used to set display duration of the signals on the touchscreen
Basic settings	Opens the basic settings for protrac®

11 UPDATING THE SOFTWARE AND FIRMWARE

11.1 Updating the control unit software

Required equipment

- Empty USB drive (*FAT32* file system)
- PC or laptop
- Current software as ZIP file

  You can download the ZIP file from the BAUR website: https://www.baur.eu

  The ZIP file contains all the files you need to update the control unit software and the firmware of the acoustic ground probe.
- protrac® tool (included in the standard delivery)
- USB adapter cable (included in the standard delivery)

Procedure

The update process including automatic restart of the control unit takes approximately 2 – 3 minutes.

1. Make sure that the rechargeable or non-rechargeable batteries are fully charged, and stay with the device throughout the entire update process.
2. Download the ZIP file containing the current software.
3. Connect the USB drive to the PC or laptop.
4. Unzip the ZIP file to the USB drive.

   Important: The software on the control unit can only be updated using the USB drive.
5. Open the battery compartment of the control unit carefully. Make sure that the rechargeable or non-rechargeable batteries do not fall out.
6. Connect the USB adapter cable to the mini USB port in the battery compartment.
7. Switch on the control unit and wait until the home screen is displayed.
8. Connect the USB drive to the USB adapter cable.

   The update process starts automatically, after which the control unit is automatically restarted. This process can take 2–3 minutes.
9. Remove the USB drive and the USB adapter cable and close the battery compartment.

11.2 Updating the firmware of the acoustic ground probe

The update process involves the following steps:

1. Establish a Bluetooth® connection

   Further information: Chapter *Pairing the laptop/PC with the acoustic ground probe* (on page 97)
2. Determine the COM port number of the AGP acoustic ground probe

   Further information: Chapter *Determine the COM port number of the acoustic ground probe* (on page 99)
3. Update the firmware on the acoustic ground probe

   Further information: Chapter *Updating the firmware of the acoustic ground probe* (on page 100)

Note: Administrator rights are **not** required to perform the update.

Required equipment

- Laptop/PC with Bluetooth® function activated
- Current firmware and update software for the acoustic ground probe as a ZIP file

  You can download the ZIP file from the BAUR website: https://www.baur.eu

  The ZIP file contains all the files you need to update the control unit software and the firmware of the acoustic ground probe.

11.2.1 Pairing the laptop/PC with the acoustic ground probe

Procedure for Windows 7

1. Switch on the acoustic ground probe.
2. On the laptop/PC, open the dialog ***Devices and Printers***: Control Panel > ***Hardware and Sound*** > ***Devices and Printers***
3. Click on ***Add a Device***.

   The AGP acoustic ground probe is displayed as a multimedia device.

   Note: It can take a while before the acoustic ground probe appears in the list of devices.
4. Select the acoustic ground probe and click ***Next***.

   If several acoustic ground probes are displayed, select the one with the desired serial number and click ***Next***.

Note: The identification for the acoustic ground probe contains the last 3 digits of the serial number of the acoustic ground probe.

The acoustic ground probe is configured and shown as having been successfully added.

5. Click on ***Close***.
6. Determine the COM port number of the acoustic ground probe.

   Further information: Chapter *Determine the COM port number of the acoustic ground probe* (on page 99)

Procedure for Windows 10

1. Switch on the acoustic ground probe.
2. On the laptop/PC, open the ***Manage Bluetooth devices*** dialog. To do this, double-click the  symbol in the taskbar, for example.

   A list of available Bluetooth® devices is displayed.

   For further information on the Bluetooth® settings, use the operating system's help function.

   Note: It can take a while before the acoustic ground probe appears in the list of devices. Wait until the acoustic ground probe is displayed and its status is ***Ready to pair***.
3. Select the acoustic ground probe and click ***Pair***.

   If several acoustic ground probes are displayed, select the one with the desired serial number and click ***Pair***.

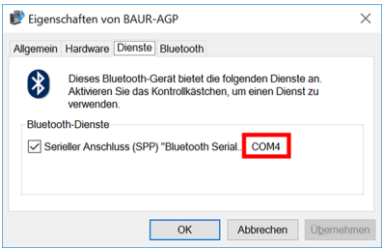
   The Bluetooth® connection between the laptop/PC and the acoustic ground probe is established. The acoustic ground probe is displayed as ***Paired***.
4. Determine the COM port number of the acoustic ground probe.

   Further information: Chapter *Determine the COM port number of the acoustic ground probe* (on page 99)

11.2.2 Determine the COM port number of the acoustic ground probe

1. On the laptop/PC, open the dialog ***Devices and Printers***: Control Panel > ***Hardware and Sound*** > ***Devices and Printers***

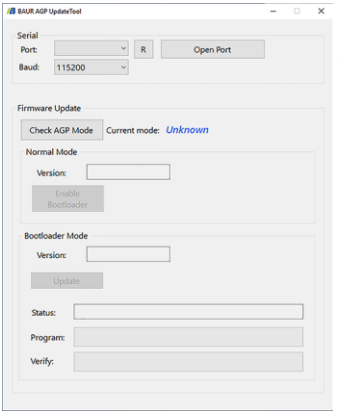
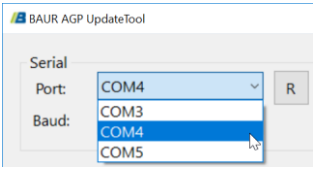
   A list of available devices is displayed. The AGP acoustic ground probe is displayed as a multimedia device.
2. Right-click on the acoustic ground probe and select the ***Properties*** context menu item.
3. Select the ***Services*** tab and note or write down the COM port number.

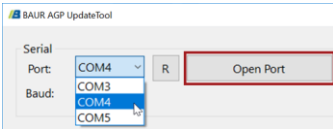


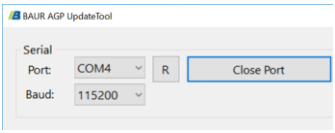
4. Continue with the firmware update.

   Further information: Chapter *Updating the firmware of the acoustic ground probe* (on page 100)

11.2.3 Updating the firmware of the acoustic ground probe

1.		If you have not yet unzipped the file: Unzip the ZIP file to the USB drive. The files needed during the update process are located in the root directory of the USB drive: • *BAUR_AGP_UpdateTool_vxxx.exe* • *BAUR_AGP_Vxxx.ldr*
2.		Switch on the acoustic ground probe.
3.		Start the acoustic ground probe update software. To do this, double-click on the *BAUR_AGP_UpdateTool_vxxx.exe* file.
4.		In the ***Port*** selection list, select the COM port number that has been determined. If the COM port number is not displayed in the selection list, click on the ***R*** button. The list is refreshed and the COM port number of your acoustic ground probe is displayed.

5. 

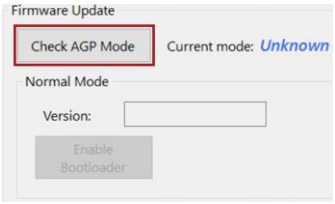


Click the ***Open Port*** button.

The text on the button changes to ***Close Port***.

Note: If the text does not change, the Bluetooth® connection may have been interrupted. Pair the PC or laptop with the acoustic ground probe again.

Further information: Chapter *Pairing the laptop/PC with the acoustic ground probe* (on page 97)

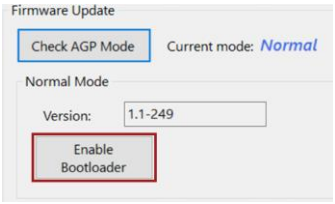
6. 

In the ***Firmware Update*** section, click on the ***Check AGP Mode*** button.

The current operating state of the acoustic ground probe is determined. At this point in the update process the acoustic ground probe is in the *Normal* operating state.

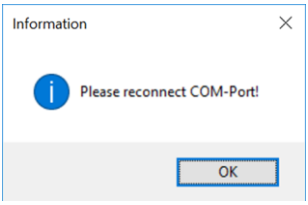
The current version of the firmware on the acoustic ground probe is displayed in the ***Normal Mode*** section. The ***Enable Bootloader*** button is active.

- If the current version of the firmware on the acoustic ground probe is not displayed, restart the laptop/PC and start the update process again.

7. 

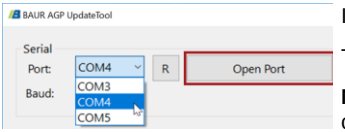
Click the ***Enable Bootloader*** button.

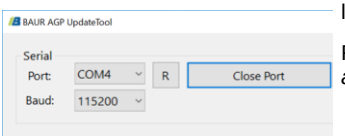
The acoustic ground probe switches to the *Bootloader* operating state. The operating state indicator LED flashes blue/green. The acoustic ground probe remains in this operating state until the firmware update is complete.

8. 

The message ***Please reconnect COM-Port!*** appears.

Confirm the message with ***OK***.

9. 

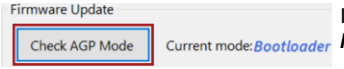


In the ***Serial*** section, click on the ***Open Port*** button.

The text on the button changes to ***Close Port***.

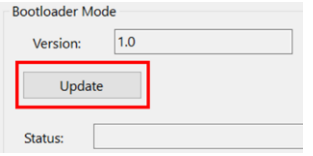
Note: If the text does not change, the Bluetooth® connection may have been interrupted. Pair the PC or laptop with the acoustic ground probe again.

Further information: Chapter *Pairing the laptop/PC with the acoustic ground probe* (on page 97)

10. 

In the ***Firmware Update*** section, click on the ***Check AGP Mode*** button.

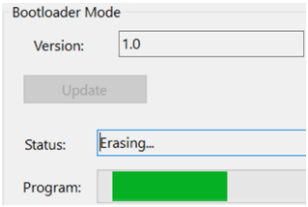
The current operating state of the acoustic ground probe is determined. At this point in the update process the acoustic ground probe is in the *Bootloader* operating state. The operating state indicator LED flashes blue/green. The acoustic ground probe remains in this operating state until the firmware update is complete.

11. 

In the ***Bootloader Mode*** section, click on the ***Update*** button.

The ***Update*** dialog opens.

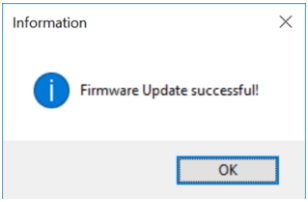
12. If the *BAUR_AGP_Vxxx.ldr* file has not been detected automatically, select it in the ***Open*** dialog.

13. 

The firmware is automatically updated. The text in the progress bar changes from ***Erasing...*** to ***Programming...*** and finally to ***Verifying...***.

This process can take several minutes.

When the update process is complete, a message appears stating that the update was successful.

14. 

Confirm the message with ***OK***.

The updated firmware of the acoustic ground probe is immediately active; the acoustic ground probe does not need to be restarted.

The operating state indicator LED flashes blue.

Notes:

- If there are any other protrac® Bluetooth® devices nearby, these may interfere with the update process. If an error message appears during the update, make sure that no other active Bluetooth® signal is present and start the update process again.
- If the error message ***Erase fail*** appears, restart the laptop/PC and start the update process again.

12 MAINTENANCE AND CARE

12.1 Cleaning the devices

NOTICE
Device damage due to wrong cleaning agents ▸ Do not use any abrasive, corrosive cleaning agents or strong solvents. ▸ Never clean electrical devices with water.

- If required, clean the device surfaces with mild detergent and a lint-free cloth.
  NOTICE! Device damage due to leaking fluids.
  Do not allow liquids to leak into the devices.

12.2 Checking and cleaning connection cables

NOTICE
Damage to cable due to aggressive cleaning agents ▸ Do not use any abrasive, corrosive cleaning agents or strong solvents. ▸ Ensure material compatibility. ▸ Do not clean the connection cables with acetone or thinner.

Required equipment

- Mild cleaning agents or petroleum ether
- Lint-free cleaning cloth

Checking and cleaning after each use

1. Each time after using the system, clean all the connection cables used.
2. Check the connection cables for damage, e.g. cracks, breaks, or other types of damage.

12.3 Charging the batteries

⚠ CAUTION

Danger of explosion or fire due to charging non-rechargeable batteries

Risk of injury, damage to device.

- Never charge non-rechargeable batteries.

NOTICE

Damage to the rechargeable batteries due to the ambient temperature being too low or too high

- When charging the rechargeable batteries, comply with the ambient temperature specified in the technical data for the rechargeable batteries (0 to +45°C for the supplied rechargeable batteries).

1. Make sure that the device is switched off.
2. Ensure that rechargeable batteries are inserted in the device.
3. Connect the supplied charger to the charger socket.
   The charge status is displayed on the charger.

12.4 Replacing the batteries

Required equipment

- 8 x each for the control unit or 6 x for the acoustic ground probe and the audio frequency probe:
  - NiMH Mignon AA 1.2 V IEC LR6 or
  - Alkaline batteries AA 1.5 V IEC LR6
- protrac® tool (included in the standard delivery)

Procedure

1. Make sure that the device is switched off.
2. Open the battery compartment and replace the rechargeable or non-rechargeable batteries.

   NOTICE! Wrong polarity of rechargeable or non-rechargeable batteries can destroy the electronics.
3. While inserting batteries, pay attention to the polarity of the rechargeable or non-rechargeable batteries.
4. Close the battery compartment.
5. On the control unit, specify whether the device is supplied with power from rechargeable or non-rechargeable batteries.

   Further information: Chapter *Basic settings* (on page 17)

12.5 Replacing the BIOS battery

Required equipment

- CR 1225 coin cell, 3 V
- protrac® tool (included in the standard delivery)

Procedure

1. Make sure that the control unit is switched off.
2. Open the battery compartment and replace the coin cell.
3. Close the battery compartment.
4. Switch on the control unit and set the date and time.

   Further information: Chapter *Basic settings* (on page 17)

13 FAULTS AND CORRECTIVE MEASURES

Fault	Possible cause	Corrective measure
Connection problem between the control unit and the acoustic ground probe or the audio frequency probe Symptoms: ▪ Control unit LED is flashing blue, but the control unit is not detecting the system component ▪ AGP/AFP icon is flashing in the header on the touchscreen of the control unit ▪ Information: ***No AGP connected*** (under ***Settings*** > ***Bluetooth® connections*** > ***AGP Firmware version***)	The acoustic ground probe or the audio frequency probe is not switched on.	▸ Switch on the acoustic ground probe or the audio frequency probe.
	The rechargeable or non-rechargeable batteries of the acoustic ground probe or the audio frequency probe are too weak.	▸ Charge or replace the rechargeable batteries, or replace the non-rechargeable batteries. Further information: ▪ Chapter *Charging the batteries* (on page 106) ▪ Chapter *Replacing the batteries* (on page 107)
	The current version of the firmware is not installed on the acoustic ground probe or the audio frequency probe.	▸ Update the firmware on the acoustic ground probe or the audio frequency probe. Further information: Chapter *Updating the software and firmware* (on page 96)
	The acoustic ground probe or the audio frequency probe is switched on, but the identification for a different acoustic ground probe or audio frequency probe is stored in the control unit.	▸ Pair the acoustic ground probe or the audio frequency probe with the control unit. Further information: Chapter *Pairing system components* (on page 30)

Fault	Possible cause	Corrective measure
Connection problem with the Bluetooth® headphones Symptom:  icon is flashing in the header on the touchscreen of the control unit	▪ The rechargeable or non-rechargeable battery of the headphones is too weak. ▪ The headphones are not paired with the control unit.	▸ Check the charge status of the non-rechargeable or rechargeable battery. ▸ Charge the rechargeable batteries or replace the rechargeable batteries (if possible) or the non-rechargeable batteries. ▸ Clear the pairing list and pair all the system components with the control unit again. Further information: ▪ Chapter *Basic settings* (on page 17) ▪ Chapter *Pairing system components* (on page 30)

14 TRANSPORTATION AND STORAGE

14.1 Transportation

NOTICE

Damage to device due to incorrect transportation

- When transporting the system components, always use the transport cases or vehicle holder provided for this purpose.
- Comply with the ambient conditions specified in the technical data for this system.

  Further information: Chapter *Data sheet* (on page 122)
- Protect all system components against damage, vibrations, dampness, and moisture during transportation.

14.2 Storage

NOTICE

Damage to device due to improper storage

- Store the system components in the transport cases provided for this purpose with the lids closed.
- During storage, comply with the ambient conditions specified in the technical data for the pin-pointing system.

  Further information: Chapter *Data sheet* (on page 122)
- Protect all system components against dampness and moisture during storage.

NOTICE

Damage to the rechargeable or non-rechargeable batteries due to improper storage

- If you are not going to use the control unit, the acoustic ground probe, or the audio frequency probe for an extended period, remove the batteries from the battery compartment.
- To prevent deep discharging of the rechargeable batteries, fully charge the rechargeable batteries of the control unit, the acoustic ground probe, and the audio frequency probe approximately every 2 months.

15 Warranty and After Sales

Warranty

For warranty claims, please contact BAUR GmbH or your local BAUR representative. Warranty is cancelled in case of misuse. Wear parts are excluded from the warranty.

After Sales

For questions contact BAUR GmbH or your BAUR representative.

BAUR GmbH

Raiffeisenstraße 8
6832 Sulz / Austria
service@baur.eu
https://www.baur.eu

16 DISPOSAL

The final decommissioning and disposal of the system must be carried out only in compliance with country-specific laws, regulations and standards.

System components do not belong in the domestic waste.

- Dispose of electrical system components in accordance with the applicable national regulations.
- Dispose of the various system components in an environmentally friendly manner and in accordance with the applicable national regulations.

17 QUESTIONS AND ANSWERS

Why won't the acoustic ground probe, the audio frequency probe, or the control unit switch on?

The rechargeable or non-rechargeable batteries may be too weak.

- Rechargeable batteries: Replace the batteries or charge the batteries using the supplied charger.
- Batteries: replace the batteries.

Further information:

- Chapter *Charging the batteries* (on page 106)
- Chapter *Replacing the batteries* (on page 107)

How do I know if the rechargeable or non-rechargeable batteries of the acoustic ground probe or the audio frequency probe are getting too weak?

If the rechargeable or non-rechargeable batteries of the acoustic ground probe or the audio frequency probe are getting too weak, a message is displayed on the touchscreen of the control unit:

- Acoustic ground probe: ***The charge status of the rechargeable/non-rechargeable batteries of the AGP is low.***
- Audio frequency probe: ***The charge status of the rechargeable/non-rechargeable batteries of the AFP is low.***

How do I see that a device is connected to the control unit?

As soon as a device is connected, this will be displayed in the header, e.g. AGP: Acoustic ground probe and headphones are connected to the control unit.

Possible reasons for the device not being displayed:

- The device is not switched on.
  - ▸ Switch the device on.
- The device has not yet been paired with the control unit.
  - ▸ Pair the device with the control unit.
    Further information: Chapter *Pairing system components* (on page 30)
- There is a Bluetooth® connection problem.
  - ▸ Re-establish the Bluetooth® connection.
    Further information: Chapter *Basic settings* (on page 17)

Why are the date and time suddenly wrong?

The BIOS battery in the control unit may be too weak.

- ▸ Replace the BIOS battery.
  Further information: Chapter *Replacing the BIOS battery* (on page 107)

How long does it take for the control unit to be switched off automatically if it is not being used?

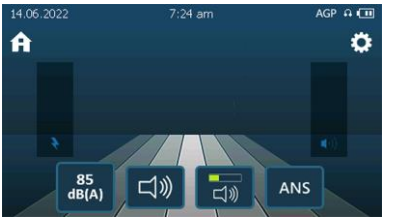
The control unit is switched off automatically if there is no connection to one of the system components for 5 minutes.

Will the acoustic ground probe or the audio frequency probe be switched off automatically when it is not connected to the control unit?

The acoustic ground probe or the audio frequency probe is switched off automatically if there is no Bluetooth® connection to the control unit for 5 minutes.

Why is there suddenly nothing displayed during acoustic pin-pointing?

If, during acoustic pin-pointing, no signal is sent from the acoustic ground probe to the control unit for 15 seconds, the signal display on the touchscreen of the control unit is automatically reset to the initial state.

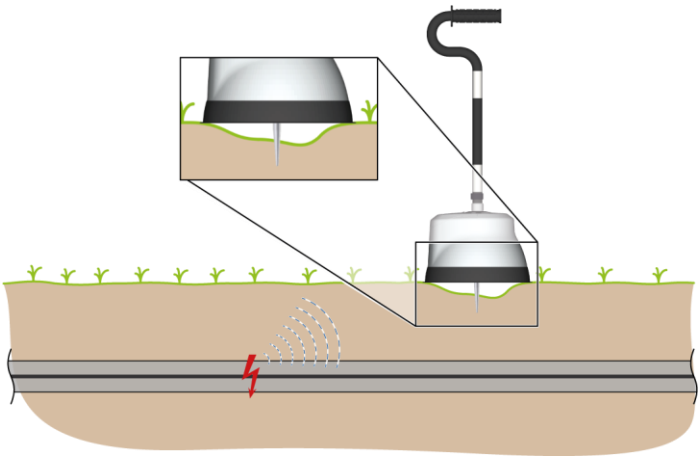


Why don't I get a good signal or any signal at all when I want to locate a cable fault on an overgrown area?

For acoustic pin-pointing, the acoustic ground probe always needs to be in reliable contact with the surface. On overgrown areas (grass, weeds, etc.) or loose surfaces (sand, snow, etc.), this can be ensured by the following measures:

- Place the acoustic ground probe so that the rubber foot on the underside is completely flush with the surface.
- Mount a suitable contact spike on the underside of the acoustic ground probe.

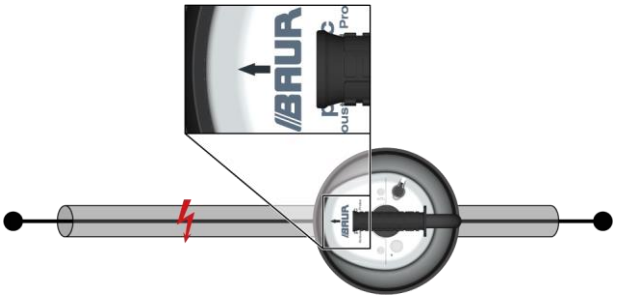
  Further information on available contact spikes: Chapter *Data sheet* (on page 122)



How must the acoustic ground probe be positioned above the cable route?

The acoustic ground probe must be positioned parallel to the cable route so that protrac®:

- can correctly determine and show the distance from the cable fault, and
- can correctly show where you are in relation to the cable route.



Examples:

- If the acoustic ground probe is positioned at a 90° angle to the cable route, the detected signal is 0.
- If the acoustic ground probe is positioned at a 45° angle to the cable route, the detected signal is 70% of the max. signal strength.

I have increased the volume on the headphones, but the audio signal is still very quiet. Why might this be?

The max. volume on the headphones may be limited to 85 dB(A) (only possible for acoustic pin-pointing).

- ▸ To disable volume limiting, tap the 85 dB(A) button.

18 INDEX

protrac®

BAUR pin-pointing system

The figure is illustrative.

Fast and precise cable fault pin-pointing

- Multifunctional all-in-one solution for fast pin-pointing of cable faults, joints, and cable routes
- Precise 3D user guidance to the fault
- Excellent acoustic quality and range

The protrac® pin-pointing system is used for the precise pin-pointing of cable faults and cable sheath faults. It provides methods for both tracing and joint location in one system, making it ideal for universal use.

Thanks to the use of the latest technologies, locating the exact fault position with the protrac® is extremely fast and precise. The innovative two-level signal processing concept permits a high degree of sensitivity and accuracy, and maximum suppression of ambient noise.

The processed measurement data is sent directly to the headphones and the control unit via Bluetooth®. This provides greater convenience and freedom of movement.

The measurement parameters are set automatically depending upon the environmental conditions. As a result, and thanks to the intuitive operation of the capacitive touchscreen, working with the protrac® is extremely simple.

NEW:
AFP audio frequency probe – location of cable routes, cable faults, and joints

Functions

- Pin-pointing of cable faults
  - Acoustically and magnetically
  - Step voltage method
  - Audio frequency methods
- Joint location
- Tracing

Advantages

Unique operating convenience

- All system components, except for the step voltage probes, are connected with each other wirelessly via Bluetooth®.
- Operation possible via touchscreen or rotary switch
- Power supply by rechargeable or non-rechargeable batteries
- Can also be used without headphones thanks to the loudspeaker integrated into the control unit

Precise 3D user guidance

- Tracing with the audio frequency probe:
  - Precise depth and position measurement
  - Direction display of the cable route and Deviation Alert
- 3D-History Track: Precise left/right guidance and fault direction display in the 3D view
- Real-time calculation and display of the fault distance incl. the previous measured values
- Excellent acoustic quality and range
- Adaptive two-stage ambient noise suppression (ANS)
- Clear distinction between the breakdown noise of the fault and the surge noises of the cable fault location system

protrac®
Fast and precise cable fault pin-pointing

CU control unit

With the 3D view, the control unit provides clear and intuitive navigation to the fault and along the cable route. For optimum user support for all location methods, the current measured values and the last measured fault distances or the signal sequence are displayed over a period of time that can be defined.

- Convenient and intuitive operation using touchscreen or rotary switch
- Acoustic pin-pointing: Precise 3D operator guidance to the fault by left/right navigation and fault direction display
- Compass function when using the audio frequency probe for faster detection of changes in the cable route direction
- Can also be used without headphones thanks to the integrated loudspeaker
- Work safety assured by limiting the volume in the headphones to 85 dB(A) in accordance with EC directive 2003/10/EC, ISO 1999:1990 and OSHA 1910.95(c)(1)

AGP acoustic ground probe

- Powerful piezoelectric sensor with a high long-term measuring stability, designed for long-term use in harsh environments
- Automatic adaptive ambient noise suppression thanks to ANS two-level signal processing concept
- Noise signals are adaptively suppressed using statistical methods and by intelligent linking to the available signal information.
- Clear distinction between the cable fault noise in the ground and the direct surge noises of the cable fault location system
- Direct transmission of signal data to the headphones and to the control unit via Bluetooth® (range of up to 40 m)
- Simplified tracing function
- Ambient noise inhibiting design
- Contact bell for reliable contact with the ground on hard surfaces
- Different length contact spikes for better contact with the ground on loose surfaces
- Designed to be physically stable during use in strong wind and on steep gradients

Figures are illustrative

protrac®

Tracing, cable fault location, and joint location with audio frequency

AFP audio frequency probe

The audio frequency probe is used in conjunction with the control unit and an audio frequency transmitter to locate cable routes, cable faults, and joints.

The core element of the new audio frequency probe is the 3D space coil, whose three coils are arranged in the x, y, and z axes. This means that the signals from all three coils can be simultaneously displayed on the control unit and compared in real time.

- Visualisation of tracing data on the control unit
- Easy to operate, as the audio frequency probe does not need to be aligned for the respective measurement method
- Extension of protrac® to create an all-in-one system with a wide range of application options
- 3D-History Track: Location of short-circuit faults and joints with twist method or minimum distortion method
- Tracing:
  - Combination of maximum and minimum signal: C-Max
  - Direct live readout of cable depth
- Flexible frequency selection for every situation:
  - Pre-set frequencies (50/60 Hz mains frequency, BAUR standard frequencies)
  - Freely programmable frequencies within the overall frequency range of the audio frequency probe
  - Maximum user support thanks to the frequency search function
  - The entire frequency range of the audio frequency probe can be displayed (unfiltered or filtered)

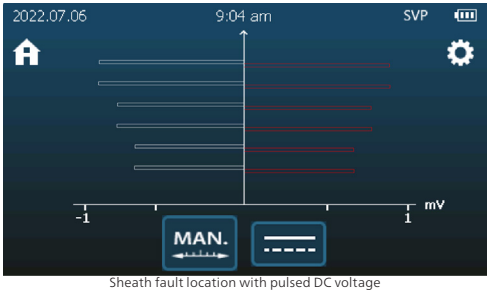
Figures are illustrative

protrac®
Sheath fault location with step voltage

SVP step voltage probes

The step voltage probes are used in conjunction with the control unit and an HV source to locate cable sheath faults.

- Sheath fault location with DC and AC voltage
- User assistance through automatic ranging
- Automatic noise compensation in DC mode for faster fault location



Sheath fault location with pulsed DC voltage

Other system components

Figures are illustrative

Technical data

CU control unit	
Intuitive user interface in multiple languages	
Loudspeaker	3 W
Display	transmissive colour TFT
Display size	4.3", 480 x 272 pixels
Brightness	800 cd/m²
Touchscreen	capacitive, operable with gloves
Power supply	
Rechargeable battery mode	8 x NiMH Mignon AA 1.2 V IEC LR6
Non-rechargeable battery mode	8 x alkaline batteries AA 1.5 V IEC LR6
Rechargeable or non-rechargeable battery life	approx. 6 h*
Charging time	approx. 3.5 h
Degree of protection	IP54
Dimensions (W x H x D)	205 x 143 x 69 mm
Weight	Approx. 1.1 kg

AFP audio frequency probe	
Methods	▪ Maximum method ▪ Minimum method ▪ C-Max ▪ Direct depth measurement ▪ 45° depth measurement ▪ Twist method ▪ Minimum distortion method
Data transmission	Bluetooth®
Frequency range	16 Hz – 15 kHz (40 Hz – 10 kHz for depth measurement)
Accuracy	1% at 1 m
Dynamic range	10 mA – 10 kA @ 50 Hz 20 µA – 20 A @ 10 kHz
Power supply	
Rechargeable battery mode	6 x NiMH Mignon AA 1.2 V IEC LR6
Non-rechargeable battery mode	6 x alkaline batteries AA 1.5 V IEC LR6
Rechargeable or non-rechargeable battery life	Approx. 14 h*
Charging time	approx. 3.5 h
Degree of protection	IP54
Dimensions (W x H x D)	115 x 705 x 90 mm
Weight	Approx. 1.8 kg

AGP acoustic ground probe	
Data transmission	Bluetooth®
Range	40 m
Power supply	
Rechargeable battery mode	6 x NiMH Mignon AA 1.2 V IEC LR6
Non-rechargeable battery mode	6 x alkaline batteries AA 1.5 V IEC LR6
Rechargeable or non-rechargeable battery life	approx. 16 h*
Charging time	approx. 3.5 h
Degree of protection	IP65
Dimensions	Ø 225 x 146 mm
Weight	approx. 2.6 kg (without handle) approx. 3.2 kg (with handle)

Acoustic and electromagnetic pin-pointing	
Filter	ANS (Adaptive Noise Suppression)
Acoustic gain	Automatic/manual, 0 – 34 dB
Electromagnetic gain	Automatic/manual, 0 – 50 dB
Propagation time measurement range	0 – 100 ms (approx. 50 m @ v = 500 m/s)
Resolution	21 µs (approx. 0.1 m @ v = 500 m/s)
Acoustic bandwidth	1 Hz – 2 kHz
Distance indicator	in milliseconds, metres or feet with historic measured values
Left/right indication	yes

Sheath fault location	
Measurement range	1 µV – 220 V
Noise suppression	50/60 Hz, 16 2/3 Hz, DC
Zero point adjustment	automatic
SVP step voltage probes	
Length	extendable, approx. 580 mm – 1,100 mm
Weight per probe	Approx. 0.9 kg

General	
Charger for rechargeable batteries	
Power supply	100 – 240 V, 50/60 Hz
Output voltage	DC 5 – 14.4 V, 1 A ±100 mA
Safety/work safety	Volume limiting to 85 dB(A)
Ambient temperature (operational)	-20°C to +55°C
Storage temperature	-20°C to +65°C
Rel. humidity	Non-condensing
Safety and EMC	CE-compliant in accordance with Low Voltage Directive (2014/35/EU), EMC Directive (2014/30/EU), EN 60068-2-ff Environmental testing

* Operating period depends upon environmental conditions.

Standard delivery

	"Tracing" set	"Pin-pointing" set	"Acoustics" set	"Step voltage" set	"Audio frequency" set
CU control unit incl. – Carrying strap – 8 x rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6 – protrac® tool – Charger incl. country-specific adapter – USB cable 2.0 for software updates	✓	✓	✓	✓	✓
AGP acoustic ground probe incl. – Contact bell, Ø 79 mm – Tripod – Telescopic handle – Contact spikes: 50, 100, 150 mm – 6 x rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6 – Charger incl. country-specific adapter	–	✓	✓	–	–
SVP step voltage probes incl. – SVP step voltage probe, red – SVP step voltage probe, black – Connection cables, red and black, 1.5 m each	–	✓	–	✓	–
AFP audio frequency probe incl. – 6 x rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6 – Charger incl. country-specific adapter	✓	–	–	–	✓
Bluetooth® headphones with USB charging cable and charger incl. country-specific adapter	✓	✓	✓	–	✓
TG 20/50 audio frequency transmitter incl. – Carrying strap, adjustable – Mains supply cord, 2.5 m – Earth cable, 3 m, with earth terminal – Connection cables, red and black, touch-proof, 2 m each, with connection clips – Connection clip, black – Connection clip, red – Earth spike – Connection cable, 25 m, on hand reel – TG 20/50 user manual	✓	–	–	–	–
protrac® user manual	✓	✓	✓	✓	✓
Transport case	✓	✓	✓	✓	✓

✓ Included in standard delivery
–: Not available

Options

	"Tracing" set	"Pin-pointing" set	"Acoustics" set	"Step voltage" set	"Audio frequency" set
Contact spike for AGP, 300 mm	–	Option	Option	–	–
Contact bell for AGP, Ø 109 mm	–	Option	Option	–	–
Connection cable, 10 m	–	Option	–	Option	–
Connection cable, 25 m, on hand reel	–	Option	–	Option	–
Headphones, 3M Peltor Bluetooth® (without volume limiting)	Option	Option	Option	–	Option
Rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6 incl. transport box (quantity depends on the set)	Option	Option	Option	Option	Option
RA 10 loop antenna	Option	–	–	–	–
AZ 10/D 70 clip-on current transformer, with connection cable	Option	–	–	–	–
AZ 10/D 80 clip-on current transformer, with connection cable	Option	–	–	–	–
AZ 10/D 125 clip-on current transformer, with connection cable	Option	–	–	–	–
Battery connection cables, red and black, 5 m each	Option	–	–	–	–

Extension kits

"Control unit" extension kit:

- CU control unit
- Carrying strap
- 8 x rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6
- Charger incl. country-specific adapter
- protrac® tool
- USB cable 2.0 for software updates

"Audio frequency transmitter" extension kit:

- TG 20/50 audio frequency transmitter
- Carrying strap, adjustable
- Mains supply cord, 2.5 m
- Earth cable, 3 m, with earth terminal
- Connection cables, red and black, touch-proof, 2 m each, with connection clips
- TG 20/50 user manual

"Acoustics" extension kit:

- AGP acoustic ground probe
- Contact bell, Ø 79 mm
- Tripod
- Telescopic handle
- Contact spikes for AGP: 50, 100, 150 mm
- 6 x rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6
- Charger incl. country-specific adapter

"Audio frequency" extension kit:

- AFP audio frequency probe
- 6 x rechargeable batteries, NiMH Mignon AA 1.2 V IEC LR6
- Charger incl. country-specific adapter

"Step voltage" extension kit:

- SVP step voltage probe, red
- SVP step voltage probe, black
- Connection cables, red and black, 1.5 m each

–: Not available
Option: Optional

Would you like to discover more about this product?
If so, contact us: www.baur.eu > BAUR worldwide

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