User manual

Time domain reflectometer

IRG 400 portable

Table of contents

1 ABOUT THIS MANUAL

1.1 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**

1.2 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 required cleaning agents.

1.3 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

We, the manufacturer, produce our devices and systems according to the latest technological standards and guarantee a high level of operational safety and reliability. However, responsibility for safe use lies with the responsible body[1] and operator[2]. 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.

This chapter *For your safety* in this user manual is intended to help you implement the required safety measures.

2.1 Intended use

The IRG 400 portable time domain reflectometer is used for fault pre-location on 1- and 3-phase cables. With the time domain reflectometer, measurements are performed according to Time Domain Reflectometry (TDR).

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

- To ensure safe use as intended, follow the instructions in this user manual.

2.2 Operation by qualified personnel

The device may only be operated by qualified personnel. Qualified personnel are individuals who, thanks to their professional electrical engineering training, are able to identify and prevent dangers, and who are qualified to perform the respective tasks.

Before starting work, the responsible body and persons working with the device must have carefully read through and understood the user manual for the device, as well as the user manuals for all associated devices or systems.

[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).

2.3 Avoiding dangers, taking safety measures

- When erecting the test installations and operating IRG 400 portable, adhere to the latest applicable version of the following regulations and guidelines:
  - National accident prevention and environmental protection regulations
  - National safety instructions and regulations
  - EU/CENELEC countries: EN 50191 *Erection and operation of electrical test equipment*

    Other countries: The applicable national standard for the erection and operation of electrical test installations
  - EU/CENELEC countries: EN 50110 *Operation of electrical installations*

    Other countries: The applicable national standard for the operation of electrical installations
  - Any other relevant national and international standards and guidelines
  - Employers' liability insurance association regulations (if any)
  - Internal work safety and accident prevention regulations
- Use the personal protective equipment for protection against electric shock and burning due to possible arcing faults in compliance with the local work safety and accident prevention regulations.

2.3.1 Warning about magnetic fields

A magnetic field is generated during operation of the surge voltage generator. Magnetic fields can be hazardous to health and can, for example, impair the function of pacemakers and other active medical implants. Persons with active medical implants and pregnant women must keep a specific safe distance from running surge voltage generators.

2.3.2 Operation of the product only if it is in a technically safe condition

Safety, function, and availability depend on the proper condition of the device. Upgrades, modifications, or alterations to the device are strictly prohibited.

- Operate the device only in a technically perfect condition.
- In case of damage and malfunction, immediately stop the device, mark it accordingly and have the faults rectified by appropriately qualified and authorised personnel without delay.
- Comply with the inspection and maintenance conditions.
- Never take apart the device. There are no operator-serviceable or -repairable components inside the device.
- Use only accessories and original spare parts recommended by BAUR. The use of spare parts, accessories and special fittings that have not been tested and approved by BAUR could adversely affect the safety, function and characteristics of the device.

2.3.3 No unauthorised modifications to the device

Accessories and spare parts

Upgrades, modifications, or alterations to the device are strictly prohibited.

- Use only accessories and original spare parts recommended by BAUR. The use of spare parts, accessories and special fittings that have not been tested and approved by BAUR could adversely affect the safety, function and characteristics of the device.

Device configuration

The device you receive from BAUR is preconfigured and ready for operation.

Changes to the device configuration may be carried out only after approval from and, if necessary, under the instruction of BAUR After Sales Service. Arbitrary changes to the device configuration can adversely affect the safety, functions, and properties of the device. Faults and problems caused by unauthorised changes to the device configuration are not covered by the warranty.

External software

You may only install software that is required for carrying out measurement tasks and that has been explicitly approved by the authorised person in the company. Only the system administrator is permitted to carry out all software installations.

You are not permitted to install any additional programs without prior approval. This particularly applies for downloaded programs such as computer games, utilities, plug-ins for browsers, etc.

Faults and any changes in system settings due to installed external software are not covered by the warranty.

2.3.4 No operation during condensation

Condensation can form in devices and systems due to temperature fluctuations and high air humidity, which in some components can result in leakage currents, flashovers and short-circuits.

- Always prevent condensation in devices. Temper the device and system before and during the measurements so that no condensation occurs.

2.3.5 No operation in areas with risk of explosion and fire

Measurements in direct contact with water, in environments with explosive gases and in areas with fire risks are not permitted. Possible danger areas include e.g. chemical factories, refineries, paint factories, paint shops, cleaning plants, mills and stores of milled products, tank and loading plants for combustible gases, liquids and solid matter.

2.3.6 Dangers when working with electric voltage

When performing measurements with the IRG 400 portable, voltage of up to 60 V is generated, which is fed into the test object via a connection cable. The IRG 400 portable can also be used to perform measurements on live cables up to max. AC 600 V. The responsible body and operator need to pay special attention and must be very careful when working with electric voltage.

Before commencing work, the responsible body must assess the risks for the specific working conditions. Protective measures are based on the risk assessment and must be followed at the workplace.

Commissioning and operation of the IRG 400 portable is only permitted in compliance with EN 50110 (EU/CENELEC countries) or the relevant standards applicable in your country.

Before starting work: Observe 5 safety rules

1. Disconnect the test object from all phases.
2. Secure the test object against reconnection.
3. Ensure that there is no voltage.
4. Earth all phases of the test object and short-circuit them.

Cover or cordon off adjacent live parts to prevent accidental contact and flashovers.

2.3.7 Working under danger of falling, performing tasks at heights

If performing connection and measurement tasks at workplaces that are more than 1 m above ground, special safety measures must be taken to prevent accidents involving falls.

DANGER

Danger of falling while working at heights

Danger to life, risk of injury due to fall

- Secure workplaces posing risk of falling with safety devices (e.g. railings, platforms, scaffolds, frameworks).
- Use personal safety equipment to protect against falling (e.g. belts)
- Cover or block places where there is danger of falling or stumbling.
- Tasks performed at heights must be supervised by a second person.

2.3.8 Protecting the tablet against malware and other threats from the Internet

No anti-virus or cyber security software is installed on the tablet.

NOTICE

Damage to the tablet due to malware from the Internet

As soon as an Internet connection has been established, the malware (e.g. viruses, trojans) may cause significant damage to the tablet via the Internet.

- Regularly install Windows updates.
- Use a firewall.
- Use anti-virus software and update it regularly.
- Take all other necessary precautions to protect the tablet against viruses and other threats.

2.4 Special personal protective equipment

The personal protective equipment based on the risk assessment for the relevant working conditions is part of the safety concept of the IRG 400 portable.

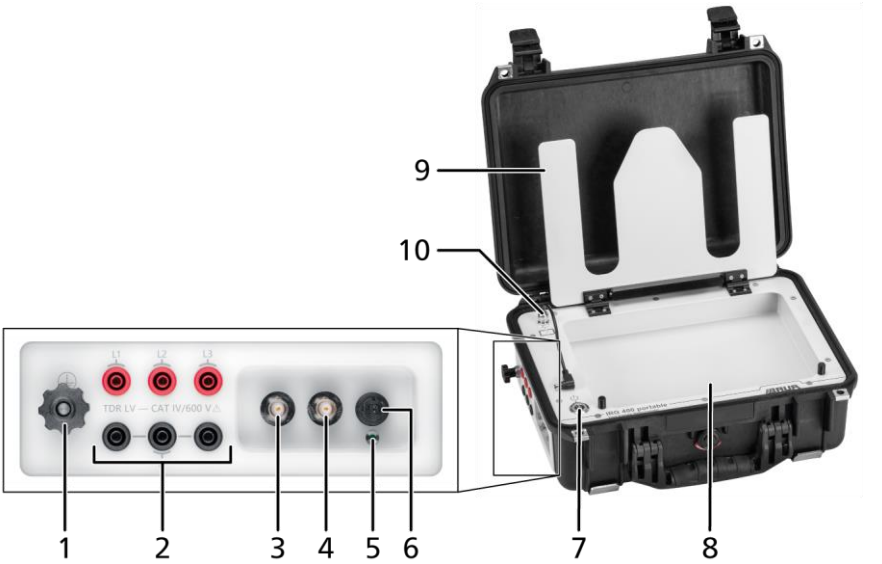
- Observe the national safety regulations and the internal operating instructions.

3 PRODUCT INFORMATION

The IRG 400 portable time domain reflectometer is used for fault pre-location on 1- and 3-phase cables. With the time domain reflectometer, measurements are performed according to Time Domain Reflectometry (TDR).

Information on the technical data as well as standard delivery, accessories and options can be found in Chapter *Data sheet* (on page 67).

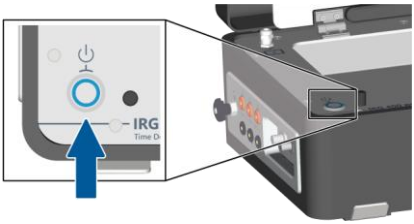
3.1 Full illustration



No.	Element	Function
1	⏚ port	Is used to connect the protective earthing
2	*TDR LV – CAT IV/600 V* ports (*L1 – L3*, *N*)	Are used to connect the IRG 400 portable for measurements according to Time Domain Reflectometry (TDR) TDR measurements via these ports are voltage-proof up to measurement category CAT IV/600 V (with enabled separation filter).
3	*SIM* | *DECAY* port	Is used to connect the IRG 400 portable for non-voltage-proof TDR measurements and for measurements according to the following fault location methods: ▪ SIM/MIM ▪ DC-SIM/MIM ▪ Decay method (Decay) These fault location methods are only possible in combination with additional BAUR products for cable fault location. For further information, please contact your BAUR representative.
4	*ICM* port	Is used to connect the IRG 400 portable for measurements according to the ICM and DC-ICM fault location methods These fault location methods are only possible in combination with additional BAUR products for cable fault location. For further information, please contact your BAUR representative.
5	Operation lamp for the power supply	Illuminated when the device is being supplied with power
6	⎓ *12–24 V* port	Is used to connect the supplied charger for the IRG 400 portable Further information: Chapter *Connecting the device to the mains voltage* (on page 33)
7	ON/OFF key	Is used to switch the device on and off The On/Off button indicates the following operating states as well as the current battery charge status of the device: Further information: Chapter *Operating state indicator* (on page 19)

No.	Element	Function
8	Cable compartment	Is used to store the connection cables and accessories
9	Holder for tablet	
10	 connection cable	Is used for the tablet power supply

3.1.1 Operating state indicator



The On/Off button indicates the following operating states as well as the current battery charge status of the device:

Colour	Description
white	The time domain reflectometer is starting.
Flashing blue	Indicates the battery charge status and that the time domain reflectometer and touch software are not connected During the course of device operation, the LED flashes according to the battery charge status. Flashing sequence: ▪ ▬ ▬ ▬: Battery fully charged ▪ ● ● ● ●. Battery is empty:
Flashing green	Indicates the battery charge status and that the time domain reflectometer is ready for operation and connected to the touch software During the course of device operation, the LED flashes according to the battery charge status. Flashing sequence: See above
yellow	There is an error. Error messages are displayed in the touch software on the tablet.
red	The time domain reflectometer is switching off.

3.2 Tablet

The tablet is used to control and evaluate measurements with the time domain reflectometer using the touch software.

No.	Element	Function
1	Charging port	Is used to charge the tablet with the connection cable of the IRG 400 portable
2	Touchscreen	Is used to operate the touch software
3	ON/OFF key	Is used to switch the tablet on and off **Recommendation:** To prevent battery discharge, switch the tablet off completely if it is not going to be used for some time.

3.3 Power supply

Power can be supplied to the time domain reflectometer via an existing mains supply on site or the integrated lithium-ion battery.

Note: As soon as the device is supplied with mains voltage, the integrated battery is charged. If the tablet is connected to the IRG 400 portable, the tablet battery will also be charged.

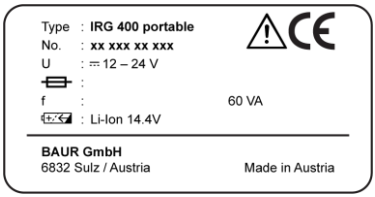
Further information: Chapter *Connecting the device to the mains voltage* (on page 33)

3.4 Connection cables and accessories

The connection cables are located in the cable compartment of the IRG 400 portable as standard.

Figure	Cable	Length	Function
	Protective earthing cable Cross section: 4 mm^2	3 m	Is used to connect the device to the protective earthing
	TDR connection cable	2 m	Is used to connect the device to the test object for voltage-proof TDR measurements Further information: Chapter *Fuses* (on page 57)
	BNC cable with BNC adapter and connection cables, red and black	2.75 m	Is used to connect the device to the test object for 1-phase, non-voltage-proof TDR measurements

3.5 Rating plate



Element	Description
Type	Device designation
No.	Serial number
U	Supply voltage If several supply voltages are possible, these are given consecutively one after another.
⎓	Not applicable here
f	Not applicable here
VA	Max. recorded apparent output
	Integrated rechargeable battery
⚠	General warning sign Indicates that there is a potential risk of danger when using the product and hence the user manual must be observed
CE	CE mark Indicates that the device or system conforms to CE.
BAUR GmbH 6832 Sulz / Austria	Name and address of the manufacturer
Made in Austria	Indicates the country in which the device was manufactured.

4 CHECKS TO PERFORM BEFORE COMMISSIONING

1. Check the device and mechanical connections for damage.
2. Check electrical connections and cables for damage.
   Use only undamaged connection cables.

5 CONNECTING THE DEVICE

5.1 Installing the device

- Comply with the applicable accident prevention regulations and local conditions.
- Select the place of installation for the device in such a way that
  - a stable base is guaranteed,
  - the device and the test object are easy to access for the connections and operation.
  - sufficient safety distances are maintained. You must comply with EN 50110 for the operation of electrical installations (EU/CENELEC countries) or the relevant standards applicable in your country.

5.2 Ensuring there is no voltage at the workplace

Before connecting the test object follow the 5 safety rules:

1. Disconnect the test object from all phases.
2. Secure the test object against reconnection.
3. Ensure that there is no voltage.
4. Earth all phases of the test object and short-circuit them.
5. Cover or cordon off adjacent live parts to prevent accidental contact and flashovers.

Important:

- If the **cable sheath is not earthed**, establish an earth connection to the station earth that is as short as possible – as close as possible to the station earth connection.
- The earth cable should be as short as possible and have a low impedance. Use a

copper earth cable with a cross section of at least 16 mm².

5.3 Preparing the test object terminals

The connection point and the far end represent the two terminals of the test object.

1. Disconnect all equipment that is connected to the test object and is not designed for the stipulated test voltage.
2. Cordon off all metal parts, e.g. lighting masts, at the terminals of the test object or insulate them with insulating safety plates.
3. Earth all metal parts at the terminals to avoid dangerous charging.
4. Follow the cable route and ensure that no work is being carried out underground on gas lines and that there are no other danger points.

5.4 Safety instructions

DANGER

Danger due to electric voltage, flashovers at the connection point, or arcing fault on connection

Electric shock on touching live and active parts and due to residual charges and induction voltages;

Burns, electro-ophthalmia, and hearing damage.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Observe the isolating distances.
- Make sure that the workplace is de-energised.

  Further information: Chapter *Ensuring there is no voltage at the workplace* (on page 23)
- You may touch the parts that were under voltage only if they are visibly earthed and short-circuited.

DANGER

High electric voltage through potential increase

A fault can cause flashovers in the device. In this case, a potential increase of the housing is possible due to high short-circuit currents.

Danger due to the potential increase is reduced when a protective earthing is connected properly.

- Connect the protective earthing carefully. The protective earthing cable should be as short as possible and of low impedance.

Safety instructions for connecting to a live test object

To protect the measurement electronics against damage, the time domain reflectometer may only be connected to a live test object for TDR measurement if:

- the voltage on the test object is max. AC 600 V, and
- the voltage-proof input is enabled.

  Further information: Chapter *Enabling and disabling the CAT IV 600 V separation filter* (on page 45)

DANGER

Working on live parts

Danger to life or risk of injury due to electric shock.

- Only use CAT IV marked BAUR TDR connection cables with fuses.

5.5 Connecting the device for voltage-proof TDR measurements (CAT IV/600 V)

The following TDR measurements can be performed with the IRG 400 portable time domain reflectometer:

- ***TDR***
- ***Step TDR***
- ***TDR continuous***
- ***TDR mean value calculation***

Connection diagram

- Cable with 3 screened phases (on page 27)
- Cable with 1 screened phase (on page 27)
- Cable with 3 unscreened phases (on page 28)

Procedure

1. If it is not possible to safely access the connection point: Make sure that the workplace is de-energised.

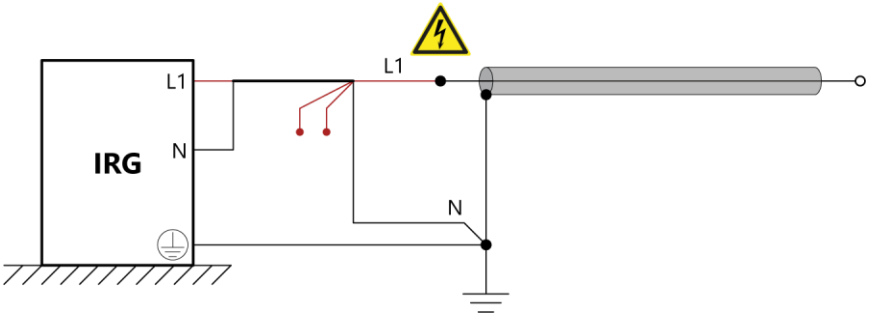
   Further information: Chapter *Ensuring there is no voltage at the workplace* (on page 23)
2. Make sure that the connection point and the far end are prepared for the measurement tasks.

   Further information: Chapter *Preparing the test object terminals* (on page 24)
3. Earth the device: Use the protective earthing cable to connect the ⏚ port of the IRG 400 portable to the station earth.
4. Connect the IRG 400 portable to the test object phase(s) to be tested.
   a. Connect the TDR connection cable to the *TDR LV – CAT IV/600 V* ports of the IRG 400 portable.
   b. Connect the TDR connection cable to the test object phase to be tested. Observe the relevant connection diagram.

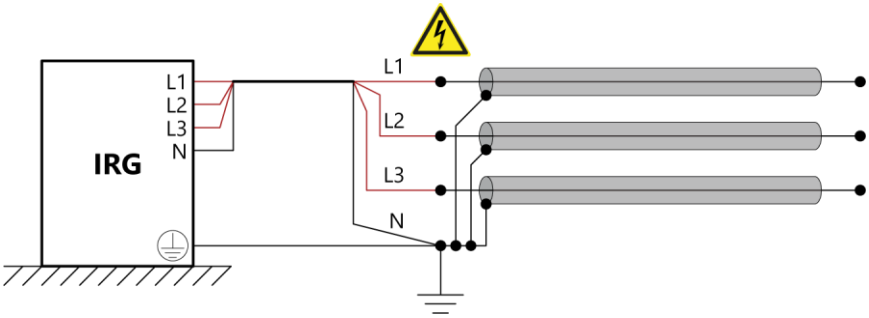
      Observe the labelling of the connection cable (*L1*, *L2*, *L3*, *N*).
5. Remove the earthing and short-circuit connection from the test object: at the connection point and at the far end.
6. If necessary, connect the device to the mains voltage.

Further information: Chapter *Connecting the device to the mains voltage* (on page 33)

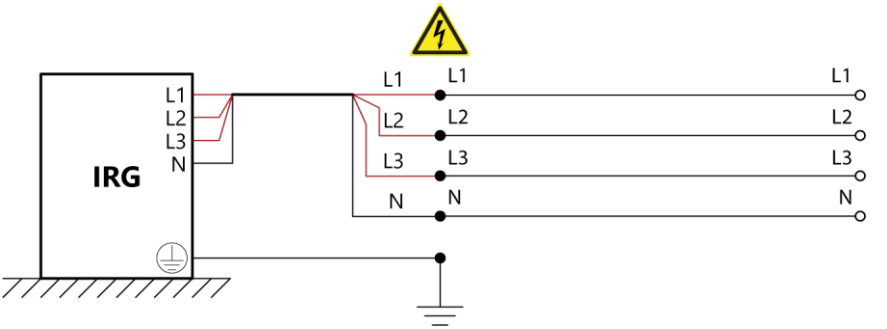
5.5.1 Cable with 1 screened phase



5.5.2 Cable with 3 screened phases



5.5.3 Cable with 3 unscreened phases



5.6 Connecting the device for non-voltage-proof TDR measurements

The following TDR measurements can be performed with the IRG 400 portable time domain reflectometer:

- ***TDR***
- ***Step TDR***
- ***TDR continuous***
- ***TDR mean value calculation***

Connection diagram

- Cable with 3 screened phases (on page 31)
- Cable with 1 screened phase (on page 30)
- Cable with 3 unscreened phases (on page 32)

Procedure

1. Make sure that the workplace is de-energised.

   Further information: Chapter *Ensuring there is no voltage at the workplace* (on page 23)
2. Make sure that the connection point and the far end are prepared for the measurement tasks.

   Further information: Chapter *Preparing the test object terminals* (on page 24)
3. Earth the device: Use the protective earthing cable to connect the ⏚ port of the IRG 400 portable to the station earth.
4. Connect the IRG 400 portable to the test object phase(s) to be tested.

   Measurement via *TDR LV – CAT IV/600 V* ports

   a. Connect the TDR connection cable to the *TDR LV – CAT IV/600 V* ports of the IRG 400 portable.

   b. Connect the TDR connection cable to the test object phase to be tested. Observe the relevant connection diagram.

      Observe the labelling of the connection cable (*L1*, *L2*, *L3*, *N*).

   Measurement via *SIM* | *DECAY* port (only 1-phase measurements possible)

   c. Connect the BNC cable and the short connection cables (red and black, 0.75 m each) to the BNC adapter.

   d. Connect the red and black connection cables to the test object phase to be tested. Observe the relevant connection diagram.

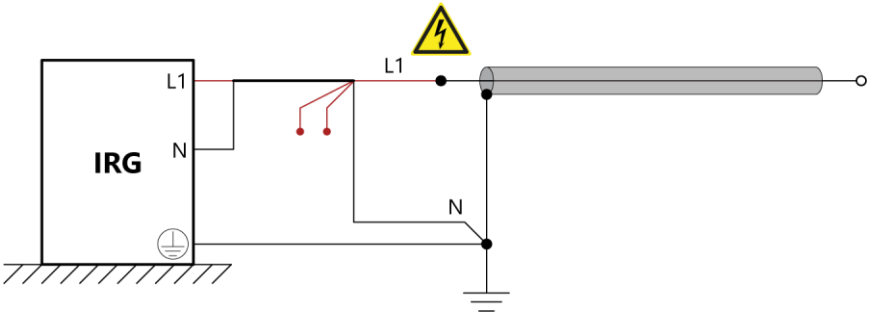
      Observe the labelling of the connection cable (*L1*, *N*).

   e. Connect the BNC cable to the *SIM* | *DECAY* port of the IRG 400 portable.
5. Remove the earthing and short-circuit connection from the phase(s) to be tested: at the connection point and at the far end.
6. Make sure that the unconnected phases are earthed and shorted.
7. If necessary, connect the device to the mains voltage.

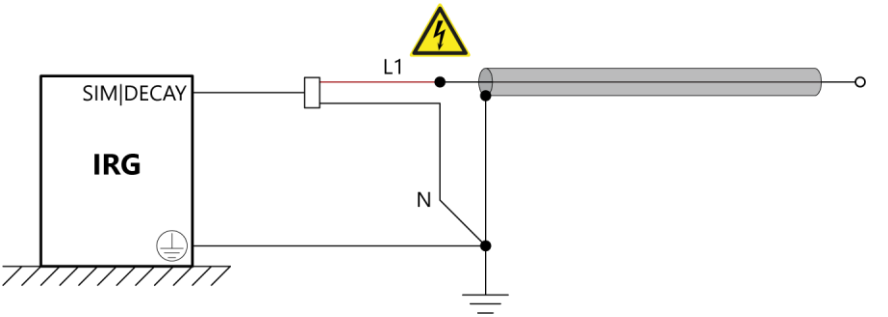
   Further information: Chapter *Connecting the device to the mains voltage* (on page 33)

5.6.1 Cable with 1 screened phase

Measurement via *TDR LV – CAT IV/600 V* ports

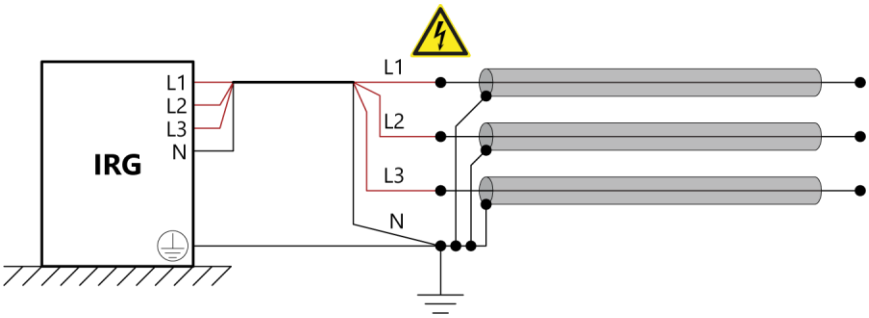


Measurement via *SIM* | *DECAY* port (only 1-phase measurements possible)

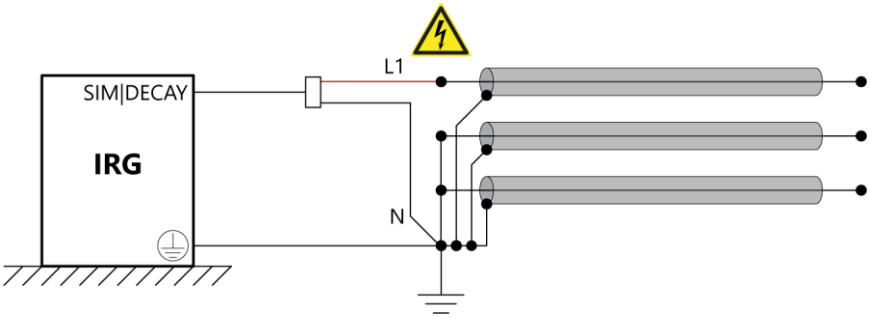


5.6.2 Cable with 3 screened phases

Measurement via *TDR LV – CAT IV/600 V* ports

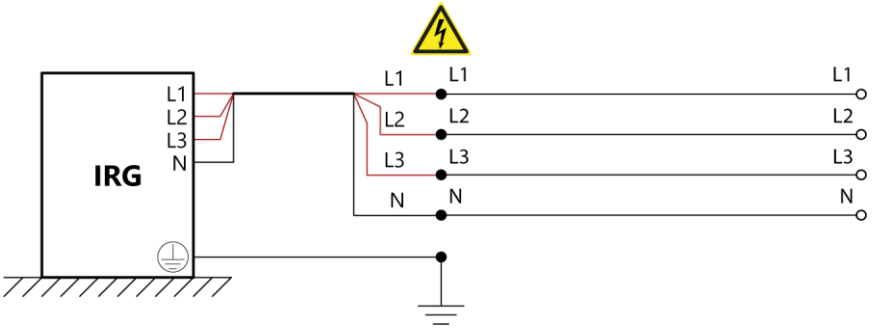


Measurement via *SIM | DECAY* port (only 1-phase measurements possible)

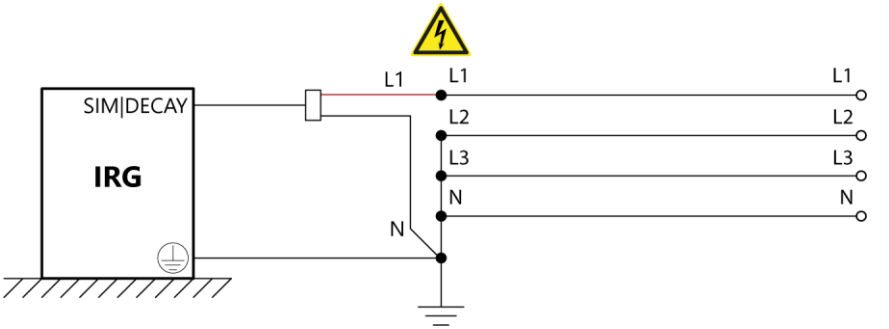


5.6.3 Cable with 3 unscreened phases

Measurement via *TDR LV – CAT IV/600 V* ports



Measurement via *SIM | DECAY* port (only 1-phase measurements possible)



5.7 Connecting the device to the mains voltage

Note: The integrated battery is charged while the time domain reflectometer is connected to the mains voltage. If the tablet is connected to the time domain reflectometer, the tablet battery will also be charged. The devices do not need to be switched on.

1. Make sure that the mains voltage matches the specifications on the rating plate of the IRG 400 portable charger.
2. Connect the charger to the ⎓ *12–24 V* port of the IRG 400 portable and to the mains voltage.

   The IRG 400 portable can be operated while it is connected to the mains voltage with the charger.

5.8 Securing the test area

1. Mark out the path for pedestrians.
2. Secure the connection cables, e.g. with cable bridges or rubber mats. The connection cables must be protected against damage and there must be no danger of people tripping.
3. If the connection of the device obstructs test personnel and pedestrians, these obstructions must be clearly marked.
4. Check that no-one is located in the vicinity of the test assembly (test area).
5. The test area must be demarcated from workplaces and traffic in such a way that

   - *except for the tester, no other person can remain in the test area,*
   - *except for the tester, no other person can access the prohibition zone,*
   - *persons standing outside the boundary cannot reach the operating elements of the test installations located inside the boundary.* (EN 50191)

   The minimum height of individual boundaries must be 1 m or correspond to the local safety regulations and standards.
6. If the device is cordoned off from generally accessible areas only with ropes, chains or bars, the entire test assembly must be monitored during the test in compliance with EN 50191. If the test assembly includes several local test areas, security guards must be appointed for each test area. But it is important that the testing personnel and the security guards understand each other well.
7. Make sure that unauthorised persons cannot access the device and test area.
8. Mark the test area and terminals clearly. It should be immediately apparent that cable testing or measurement tasks are being performed on the cable system.

9. Make sure that unauthorised persons cannot access the connection point and the far end of the test object.
10. Make sure that the workplace is de-energised, and that the connection point and the far end of the test object are prepared for the measurement tasks.

    Further information:

    - Chapter *Ensuring there is no voltage at the workplace* (on page 23)

6 SWITCHING ON THE DEVICES

- Chapter *Preparing the test object terminals* (on page 24)

On the time domain reflectometer

1. Make sure that the device is connected properly.

   Further information: Chapter *Connecting the device* (on page 23)
2. Switch on the device via the On/Off button.

   The On/Off button lights up or flashes according to the current operating state and, once the device has started, it indicates the battery charge status of the device. Further information: Chapter *Operating state indicator* (on page 19)

On the tablet

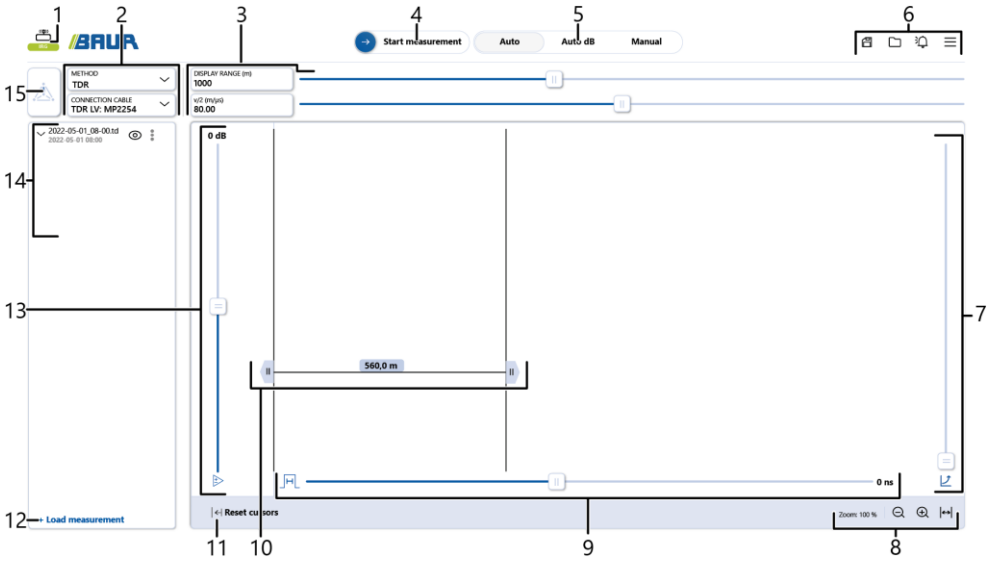
- Switch on the tablet.

  The tablet automatically establishes the Wi-Fi connection to the time domain reflectometer. If the connection is not established automatically, you can connect the tablet manually. Further information: Chapter *Wi-Fi connection does not start automatically* (on page 60)

  The touch software that is installed on the tablet starts automatically. If the touch software is connected to the time domain reflectometer, the  icon appears in the status display. The On/Off button on the time domain reflectometer flashes green.

7 OPERATING AND CONFIGURING THE TOUCH SOFTWARE

7.1 User interface of the touch software



No.	Element/Function	
1	Status indicator	Indicates the connection status of the time domain reflectometer and the touch software ▪ : connected ▪ : not connected Further information: Chapter *Wi-Fi connection does not start automatically* (on page 60)

No.	Element/Function	
2	***METHOD*** selection list	Is used to select the measurement method ▪ ***TDR***, ***Step TDR***, ***TDR continuous***, ***TDR mean value calculation*** Further information: Chapter *About the TDR method* (on page 46) ▪ ***SIM/MIM**** ▪ ***ICM**** ▪ ***Decay**** * These fault location methods are only possible in combination with additional BAUR products for cable fault location. For further information, please contact your BAUR representative.
	CONNECTION CABLE selection list	Is used to select the connection cable being used The supplied connection cables have already been created in the touch software. You can add further connection cables. Further information: Chapter *Adding a connection cable* (on page 42)
3	***DISPLAY RANGE (m)*** input field	Is used to enter the display range You can also adjust the value using the slider to the right of the input field.
	v/2 (m/µs) input field	Is used to enter the velocity (v/2) at which a pulse is propagated in the cable You can also adjust the value using the slider to the right of the input field.

No.	Element/Function	
4	Operating control for starting and stopping the measurement ▪ ***Start measurement***: Measurement can be started. ▪ ***In progress***: Measurement is in progress. ▪ ***Active***: The measurement is complete. As soon as a parameter is modified in the touch software, a new measurement is automatically triggered. You can trigger a new measurement manually by tapping the  icon. Further information: Chapter *Starting and stopping a measurement* (on page 42)	
5	Button for selecting the display settings ▪ ***Auto***: The height and width of the reflection image are automatically scaled for optimum display in the display range. ▪ ***Auto dB***: The height of the reflection image is automatically scaled for optimum display in the display range. ▪ ***Manual***: The reflection image is displayed in the display range based on manually set parameters (gain, pulse width).	
6	 button	Is used to save the measurement.
	 button	Opens the dialog to load saved measurements
	 button	Opens the notifications
	 button	Opens the menu Further information: Chapter *Menu* (on page 39)
7	 slider	Is used to set the length-dependent gain Further information: Chapter *Length-dependent gain* (on page 39)
8	 and  buttons	Zoom out und zoom in the reflection image
	 button	Resets the zoom factor for the reflection image

No.	Element/Function	
9	slider	Is used to set the pulse width of the time domain reflectometer output signal
10	cursor	Indicates the zero point of the reflection image When a connection cable is selected, the cursor is automatically placed at the start of the phase. After measurement, you can move the cursor to any position in the reflection image.
	cursor	Indicates the position where the end of the phase, a cable fault, or a joint was detected automatically After measurement, you can move the cursor to any position in the reflection image.
	The distance between the two cursors is indicated on the line connecting them.	
11	operating control	***Automatic cursors active*** display: The cursors are automatically set by the touch software
		Reset cursors button: Resets the cursors to the position automatically set by the touch software
12	***+ Load measurement*** button	Opens the dialog to load saved measurements
13	slider	Is used to set the gain The current gain value is displayed above the slider.
14	List containing the current measurement and saved measurements	
	button	Opens the measurement details
	2022-05-01_08-00.tdr	Measurement name and time
	2022-05-01 08:00	If a measurement has not been saved yet, it will be indicated as ***Unsaved*** .

No.	Element/Function	
14	button	Shows and hides the reflection image of the measurement in the display range ▪ : shown ▪ : hidden
	button	Opens a context menu containing options for evaluating the measurement Further information: Chapter *Evaluating TDR reflection images* (on page 50)
15	Phase selector	Is used to select the phase on which the measurement is to be performed

7.2 Length-dependent gain

Due to the damping losses in the phase, events that are far away (such as faults) reflect a smaller pulse than those that are close by. Length-dependent gain compensates for this effect by converting damping into signal gain.

You can adjust this signal gain using the slider. This means that events at the far end of the phase are represented to an equal extent as events at the near end.

7.3 Menu

▸ Open the menu by tapping the button.

Header

Element	Function
button	Closes the menu
X.X.X.X	Version number of the touch software

Menu bar

Menu item	Function
Settings	Opens the general and method-specific settings
Connection cables	Is used to manage the connection cables created in the touch software Further information: Chapter *Adding a connection cable* (on page 42)
Tips and tricks	Opens the user support
Notifications	Opens the notifications
Options	Is used to manage the available and activated options Further information: Chapter *Activating options* (on page 45)
Exit application	Closes the touch software. **Note:** Unsaved measurement data will be lost.

7.4 Setting the design mode

1. Open the menu by tapping the ☰ button.
2. Tap the ⚙ ***Settings*** menu item.
3. You can use the ***Theme*** button to switch between the following design modes:
   - ***Light mode***: Brightness and colours setting for the touch software when working in a well-lit location.
   - ***Dark mode***: Brightness and colours setting for the touch software when working in a poorly lit or dark location.

7.5 Enabling and disabling simulation mode

In simulation mode, reflection images are displayed which were defined for the individual measurement methods.

1. Open the menu by tapping the ☰ button.
2. Tap the ⚙ ***Settings*** menu item.
3. You can use the ***Simulation mode*** button to enable and disable simulation mode.
   - ***Simulation***: Simulation mode is enabled.
   - ***Real measurement***: Simulation mode is disabled.

7.6 Setting the language

1. Open the menu by tapping the ☰ button.
2. Tap the ⚙ ***Settings*** menu item.
3. In the ***Language*** selection list, select the desired language.

   The language is changed straight away; the touch software does not need to be restarted.

7.7 Setting the colour of the traces

1. Open the menu by tapping the ☰ button.
2. Tap the ⚙ ***Settings*** menu item.
3. In the ***Colour selection*** selection list, you can set the colour for the trace of each phase separately.

7.8 Starting and stopping a measurement

Starting a measurement

1. Make sure that the time domain reflectometer and tablet are switched on and the touch software is connected to the time domain reflectometer.

   Further information: Chapter *Switching on the devices* (on page 34)

2. To start the measurement, drag the operating control for starting and stopping the measurement to the right.

   Depending on the measurement method, the operating control is in ***Active*** or ***In progress*** status.

   As soon as a parameter is modified in the touch software, a new measurement is automatically triggered.

3. You can trigger a new measurement manually by tapping the icon.

Stopping a measurement

- Drag the operating control for starting and stopping the measurement to the left.

7.9 Adding a connection cable

1. Make sure that the time domain reflectometer and tablet are switched on and the touch software is connected to the time domain reflectometer.

   Further information: Chapter *Switching on the devices* (on page 34)

2. Open the menu by tapping the button.
3. Tap the ***Connection cables*** menu item.
4. Tap the ***+ Add connection cable*** button.
5. In the ***Name*** input field, enter the name you want to appear in the connection cable selection list.
6. Select the port for the connection cable from the ***Port*** selection list.
7. Enter the connection cable data. There are two ways to do this:

   If the length of the connection cable and the velocity of propagation (v/2) in the connection cable are not known: *Determining cable data through measurement* (on page 43)

   If the length of the connection cable and the velocity of propagation (v/2) in the connection cable are known: *Entering cable data manually* (on page 44)

Recommendation: To ensure that cable fault location is as accurate as possible, determine the cable data by performing a measurement. This procedure takes into account deviations in the velocity of propagation inside the connection cable, which can be caused by plugs or terminals, for example.

7.9.1 Determining cable data through measurement

In the touch software

1. In the ***Length (m)*** input field, enter the value ***0***.
2. Tap the ***OK*** button.
   The connection cable is created.
3. In the header, tap the ✕ button.
   The menu is closed.

On the time domain reflectometer

- Connect the connection cable to the chosen port and leave the unconnected cable end open.

In the touch software

1. In the ***METHOD*** selection list, select the ***TDR*** method.
2. In the ***CONNECTION CABLE*** selection list, select the connection cable that was just created.
3. Start the measurement.
   Further information: Chapter *Starting and stopping a measurement* (on page 42)
   The trace is displayed.
4. Tap the 🖫 button to save the measurement.

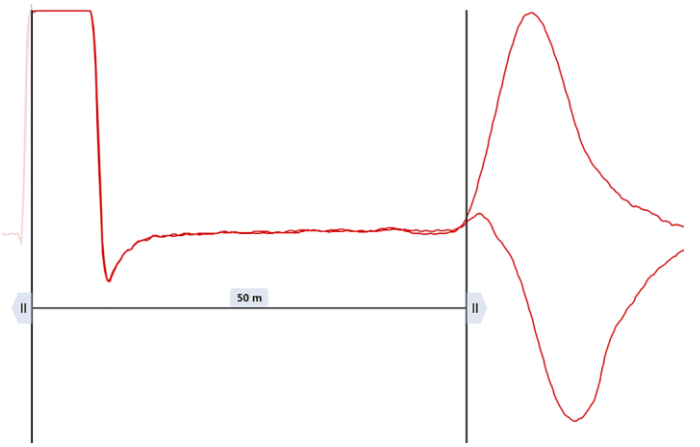
On the time domain reflectometer

- Short-circuit the unconnected end of the connection cable.

In the touch software

1. Tap the ***Manual*** button.
2. Start the measurement.
   Further information: Chapter *Starting and stopping a measurement* (on page 42)
   The trace for the saved measurement with open cable end and the trace for the short-circuited measurement that was just performed are displayed.

3. Set the cursor at the left end of the trace.
4. Set the cursor at the point where the two traces diverge.
   Example for the traces of a connection cable approximately 50 m in length:



   Note: The connection cable length displayed is calculated by the touch software based on the measured signal propagation time and the velocity of propagation (v/2). If the displayed length differs from the actual length of the connection cable, this may be because the velocity of propagation set in the touch software does not match the velocity of propagation inside the connection cable.
5. Open the menu by tapping the button.
6. Tap the ***Connection cables*** menu item.
7. Tap the button to the right of the connection cable that was just measured.
8. Tap the ***Apply*** button.
   The connection cable length appears in the ***Length (m)*** input field.
9. Tap the ***OK*** button.
   The connection cable is created.

7.9.2 Entering cable data manually

1. In the ***Length (m)*** input field, enter the length of the connection cable.
2. In the ***v/2 (m/µs)*** input field, enter the velocity of propagation of the pulse inside the connection cable.
3. Tap the ***OK*** button.

The connection cable is created.

7.10 Activating options

Certain functions are only available if the corresponding option is activated. You require an option code to activate an option. For further information on this, contact your BAUR representative.

1. Open the menu by tapping the ☰ button.
2. Tap the ***Options*** menu item.
3. The option code is based on the hardware identifier that is displayed in this dialog. Quote the displayed hardware identifier to your BAUR representative.

   You will receive an option code for each option that is to be activated.
4. Enter the option code in the ***Option code*** input field and tap the ***Activate*** button.

   The option is displayed as activated.

7.11 Enabling and disabling the CAT IV 600 V separation filter

The separation filter is required for measurements on live test objects within measurement category CAT IV/600 V. The separation filter must be disabled for measurements on de-energised test objects.

1. Open the menu by tapping the ☰ button.
2. Tap the ***Settings*** menu item.

   You can use the ***Voltage-proof input (TDR LV)*** button to enable and disable the CAT IV 600 V separation filter for the *TDR LV – CAT IV/600 V* connection on the IRG 400 portable.

7.12 Configuring mean value calculation

You can specify the number of individual pulses that are used to calculate the mean value for the display of traces for TDR measurement mode ***Step TDR***.

Further information: Chapter *TDR measurement modes* (on page 48)

1. Open the menu by tapping the ☰ button.
2. Tap the ***Settings*** menu item.
3. In the ***No. of measurements for mean value (Step TDR)*** input field, enter the desired number (max. 100) of individual pulses that the touch software should use to calculate the mean value.

8 TDR: Time Domain Reflectometry

8.1 About the TDR method

Areas of application

- To detect the cable length and to test the velocity of propagation
- To check if all phases are equal in length and if there is a cable break
- To detect joints and other impedance changes
- To compare healthy and faulty phases

Measurement principle

A transmitting pulse is fed into the cable. When the transmitting pulse reaches a position with impedance change (cable ends, faults or joints), a part of the pulse energy is reflected to the time domain reflectometer. These reflections are recorded and presented in a graph.

The amplitude of a reflection is determined by the extent of the impedance change, which is defined by the reflection factor *r*:

$$r = \frac{Z_2 - Z_1}{Z_2 + Z_1}$$

r	Reflection factor
Z_1	Cable impedance up to impedance change
Z_2	Impedance of a change in the cable route (e.g. fault or joint)

If the impedance of a change Z_2 is greater than the cable impedance Z_1, the reflection factor is positive. In the reflection image, the open cable end is displayed by a positive reflection.

If the impedance of a change Z_2 is less than the cable impedance Z_1, the reflection factor is negative. In the reflection image, a short-circuit or a low-resistive fault is displayed by a negative reflection:

To determine the fault distance, the time gap between the transmitting pulse and the reflecting pulse is measured. The fault distance is calculated with the following formula.

$$l = t \times \frac{v}{2}$$

l	Fault distance
t	Time gap between the transmitting pulse and the reflecting pulse
v/2	Velocity of propagation

This formula shows that it is necessary to specify a correct velocity of propagation for precise determination of the fault distance. If the velocity of propagation is not known, it can be calculated with the cable length.

Note: Time Domain Reflectometry not is suitable for locating high-resistive cable faults, as they produce very minor or no impedance changes at the fault position.

8.1.1 TDR measurement modes

With the time domain reflectometer, TDR measurement can be performed in different modes.

Measurement mode	Meaning
TDR	A pulse is fed into the phase that is to be tested. This pulse passes through the phase and is partly reflected at fault locations and joints and then fully reflected at the open end. The distance to the open end or the fault location is calculated based on the duration of the reflections and the velocity of propagation (v/2). Cursors are automatically set in the reflection image. Further information: Chapter *Operating and configuring the touch software* (on page 35) This mode is suitable for determining the cable length and for the pre-location of low-resistive cable faults.
Step TDR	A pulse with an abrupt rising edge is fed into the phase that is to be tested. The rising edge of this pulse is partly reflected at fault locations and joints and is then fully reflected at the open end. Due to the width of the pulse, this happens before the falling edge of the pulse reaches the fault locations, joints, and the open end. As a result, a very clear faulty trace is produced in the vicinity. Cursors are automatically set in the reflection image. Further information: Chapter *Operating and configuring the touch software* (on page 35) This mode is suitable for detecting joints or illegal branching (electricity theft) in the vicinity.
TDR continuous	Pulses are permanently fed into the phase that is to be tested. These pulses pass through the phase and are partly reflected at fault locations and joints and then fully reflected at the open end. This mode is suitable for observing changes in the faulty trace over any period of time.
TDR mean value calculation	Pulses are permanently fed into the phase that is to be tested. These pulses pass through the phase and are partly reflected at fault locations and joints and then fully reflected at the open end. The mean value of the reflections is generated during the first 10 reflections and is displayed as a trace. From the 11th reflection onwards, the exponentially smoothed average of the mean value of all previous reflections and of the currently measured reflection is generated and displayed as a trace. This mode is suitable for reducing high signal noise in the reflection image.

8.2 Performing the TDR measurement

1. Secure the test area and connect the test object properly.

   Further information: Chapter *Connecting the device* (on page 23)

2. Switch on the time domain reflectometer and tablet and start the touch software on the tablet.

   Further information: Chapter *Switching on the devices* (on page 34)

In the touch software

1. In the phase selector, select the phase on which you want to perform the measurement.

   Note: Simultaneous measurement on three phases can only be performed in TDR measurement modes ***TDR*** or ***Step TDR*** via the ***TDR LV*** connection.

2. In the ***METHOD*** selection list, select one of the TDR measurement modes.

   Further information: Chapter *TDR measurement modes* (on page 48)

3. In the ***CONNECTION CABLE*** selection list, select a connection cable.

   The supplied connection cables have already been created in the touch software. You can add further connection cables.

   Further information: Chapter *Adding a connection cable* (on page 42)

4. If necessary, set the display range.

   If ***Auto*** is selected, the display range is set automatically so that the reflection image shows the entire length of the phase in the display range.

5. If necessary, enter the velocity of propagation of the pulse in the ***v/2 (m/µs)*** input field.

6. Start the measurement by dragging the operating control for starting and stopping the measurement to the right.

   The measurement is performed. The traces are displayed. The cursors are set automatically.

   You can save the measurement by tapping the button.

7. If necessary, set the input signal gain and the length-dependent gain.

   Further information: Chapter *Length-dependent gain* (on page 39)

   As soon as a parameter is modified in the touch software, a new measurement is automatically triggered.

8. Stop the measurement by dragging the operating control for starting and stopping the measurement to the left.

Next steps

- Evaluating the reflection image: *Performing the TDR measurement* (on page 49)
- If you do not wish to perform further measurements or if you want to connect another phase: *End measurement or connect other phase* (on page 51)

8.3 Evaluating TDR reflection images

The reflections can be divided into two groups:

- Normal reflections

  Even healthy phases can show reflections. These reflections are caused by inhomogeneities such as bends, connection points, meeting points of cable sections with different insulations or joints.

- Reflections caused by faults

  A faulty phase shows normal reflections as well as reflections caused by faults. Due to the damping losses in the cable, a fault that is far away reflects a smaller pulse than a fault that is close by.

  To differentiate normal reflections from reflections caused by faults, it is always recommended comparing the traces of a faulty and a healthy phase.

Typical traces

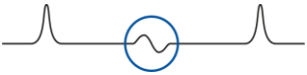
Open cable end

The reflection is a positively increasing pulse.

If the positive reflection is displayed before the actual cable end, there could be a cable break or the cable length could be incorrect.

Short-circuit or low-resistive fault

The reflection is a negatively decreasing pulse.



Changes in cable type, joints (impedance changes)

The amplitude of the reflecting pulse depends on the extent of the impedance change. The joints generate s-shaped reflections.

In the touch software

1. Select a TDR measurement from the list of saved measurements or perform a TDR measurement.
   Further information: Chapter *Performing the TDR measurement* (on page 49)
2. Tap the ⋮ button.
   The following options are available:
   - ***Assign colour***: You can change the colour of the trace in the display range.
   - ***Load parameters***: Loads the parameter settings with which the measurement was last saved.
   - ***Move***: You can move the trace in the display range.
   - ***Save***: Saves the changes that were made.
   - ***Close***: Closes the measurement.

8.4 End measurement or connect other phase

On the test object

⚠ DANGER

Dangerous voltage at test object and other live plant parts.

Danger to life or risk of injury due to electric shock.

- Before touching the test object, discharge, earth and short it: at the connection point and at the far end.
- You may touch the plant parts that were under voltage only if they are visibly earthed and short-circuited.

1. Disconnect the phase that is connected to the time domain reflectometer.
2. If you wish to connect another phase, connect the required phase to the time domain reflectometer.Further information: Chapter *Connecting the device* (on page 23)

9 CREATING A REPORT

You can save and load the measurements performed with the touch software on the tablet; however, it is not possible to create a report directly. If you wish to create a report based on the measurements performed with the touch software, you will need the BAUR Software for this.

- For information on the system requirements and the BAUR Software, please contact your BAUR representative.

10 ENDING A MEASUREMENT

DANGER

Dangerous voltage in test object.

Danger to life or risk of injury due to electric shock.

- **Before touching, discharge, earth and short-circuit:** The test object at the connection point and at the far end.
- You may touch the parts that were under voltage only if they are visibly earthed and short-circuited.
- Disconnect the earth connections as the last connection of the test assembly.
- Never disconnect the earth connections as long as power and other periphery connections are still connected.

10.1 Taking devices and the test area out of operation

NOTICE
Damage to devices due to improper use. ▸ Do not switch off the used devices under load. ▸ Before switching off the used devices, put them in the *Ready for operation* operating state.

1. Make sure that the test object is discharged, earthed, and short-circuited.
   Further information: Chapter *Discharging and earthing the test object* (on page 54)
2. Exit the touch software by tapping the ✕ ***Exit application*** menu item under ⚙ ***Settings***.
3. Shut down and switch off the tablet.
4. Switch off the time domain reflectometer via the On/Off button and disconnect it completely from the mains voltage.
   The On/Off button lights up red while the time domain reflectometer is switching off.
5. Take all other devices used for measurement out of operation.
6. Press the emergency off button on the used devices and remove the safety key.
7. Disconnect the connection cables in the reverse order.
   Important: Finally, disconnect the earth cable last.
8. Clean the connection cables.
9. Put away the connection cables.
10. If necessary, remove the cordoning.
11. Remove the earthing and the short-circuit on the test object only if no subsequent work is required and if the test object is to be put back into operation by the responsible individuals.
12. Remove the barriers and marking of the test area.

11 DISCHARGING AND EARTHING THE TEST OBJECT

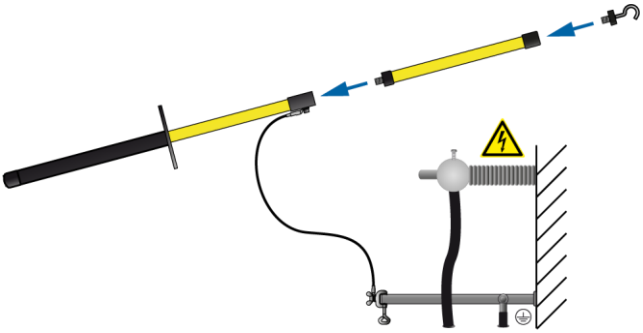
After a measurement is finished, dangerous voltage may still be present on the test object, which can lead to life-threatening injuries caused by electric shock or an arcing fault.

- Before touching the test object, discharge, earth and short it: at the connection point and at the far end.
- You may touch the plant parts that were under voltage only if they are visibly earthed and short-circuited.
- Use suitable personal protective equipment against electric shocks and arcing faults.

Procedure with the BAUR discharge and earth rod

The procedure with the BAUR earth rod is the same.

1. If not yet connected, connect the protective earthing cable of the discharge and earth rod to the station earth.
2. Assemble the discharge and earth rod: Screw the hook onto the discharge part and the discharge part onto the handle.

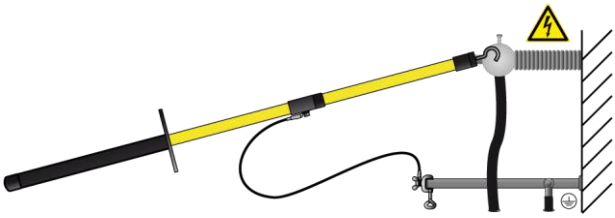


3. Only use the discharge and earth rod if its surface is clean and dry. If necessary, clean and dry the surface of the discharge and earth rod.
4. Only ever use the black handle to hold the discharge or earth rod and make contact with the test object by touching it with the hook of the discharge and earth rod.

   Important:

   - Keep a distance of at least 50 cm from the protective earthing cable of the discharge and earth rod.

- Observe the minimum discharge period in accordance with the capacitance of the test object.



12 MAINTENANCE AND CARE

NOTICE

Damage to device due to improper handling

The user is liable for damages caused due to improper maintenance or care.

- Never take apart the device. This can lead to device damages. Inside the device there are no components that could be serviced or repaired by the user.
- Maintenance tasks must be carried out only by personnel trained and authorised by BAUR

12.1 Maintenance intervals

Component	Interval	Maintenance work
General maintenance tasks	Before each use	Check the devices and connection cables for physical damage
	After each use	Clean the devices and connection cables and check for physical damage
IRG 400 portable	Every 3 months and as required	Charging the rechargeable battery
	As required by BAUR After Sales Service	Replace the battery
Tablet	Every 3 months and as required	Charging the rechargeable battery
	As required	▪ Clean the display ▪ Replace the battery Further information: User manual for the tablet
TDR connection cable	As required	Replace fuses

12.2 Fuses

	Dimensions (ø x length)	Time/current characteristic	Rated current	Rated breaking capacity	Rated voltage
TDR connection cable, 4 pcs	6.3 x 32 mm	Quick-acting (F)	1 A	50 kA (H)	600 V

12.3 Checking and cleaning the connection cables and their accessories

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 device, clean all the connection cables used and their accessories.

   Dirty or corroded contacts can affect the measurement and are often the cause for device damage.
2. Check the connection cables for damage.

   Cracks, breaks or other damage in the connection cable can damage the cable.

Regular inspection

- Before and after each time you use the device, check the condition of all the connection cables. Check them for cracks, damage, and dirt.
- Regularly check all connection accessories for damage and dirt.

12.4 Cleaning the device

NOTICE

Damage to the device may be caused by using the wrong cleaning agents

- Do not use any abrasive, corrosive cleaning agents or strong solvents.
- Ensure material compatibility.
- Do not clean the product with acetone or thinner.
- Never clean electrical devices with water.

Required equipment

- Mild detergent
- Lint-free cleaning cloth

Procedure

1. Switch off the device and disconnect it from the mains voltage.
   Further information: Chapter *Taking devices and the test area out of operation* (on page 53)
2. Make sure that all live parts in the immediate vicinity are covered.
3. Clean the device surfaces with mild detergent and a lint-free cloth.
   NOTICE! Device damage due to leaking fluids.
4. Do not allow liquids to leak into the devices.

12.5 Charging the time domain reflectometer battery

Deep discharge can cause irreversible damage to the time domain reflectometer battery. To prevent deep discharge of the battery, fully charge the battery every 3 months.

Duration of the charging process: approx. 4 h

Procedure

- Connect the time domain reflectometer to the mains voltage.

  The integrated battery is charged while the time domain reflectometer is connected to the mains voltage. If the tablet is connected to the time domain reflectometer, the tablet battery will also be charged. The devices do not need to be switched on.

  Further information: Chapter *Connecting the device to the mains voltage* (on page 33)

12.6 Charging the tablet battery

Deep discharge can cause irreversible damage to the tablet battery. To prevent deep discharge of the battery, fully charge the battery every 3 months.

1. Connect the tablet to the time domain reflectometer via the  connection cable.
2. Connect the time domain reflectometer to the mains voltage.

   The integrated battery is charged while the time domain reflectometer is connected to the mains voltage. If the tablet is connected to the time domain reflectometer, the tablet battery will also be charged. The devices do not need to be switched on.

   Further information: Chapter *Connecting the device to the mains voltage* (on page 33)

13 FAULTS AND CORRECTIVE MEASURES

NOTICE

Damage to device due to improper handling

The user is liable for damages caused due to repairs.

- Never take apart the device. This can lead to device damages. Inside the device there are no components that could be serviced or repaired by the user.
- Repairs must be carried out only by personnel trained and authorised by BAUR.

1. In the event of damage and malfunction, stop the device immediately.
2. Mark the faulty device accordingly.
3. Have the faults rectified by appropriately qualified personnel authorised by BAUR.

13.1 Wi-Fi connection does not start automatically

If the tablet does not establish the Wi-Fi connection automatically, you can establish this connection manually via the Windows settings.

- Network name: *IRG400P_xxxxx*

  xxxxx represents the last five characters of the device serial number. The serial number can be found on the rating plate of the device.

  Further information: Chapter *Rating plate* (on page 22)

- Password: unique for every device

  You will find the password below the barcode on a sticker. The sticker is located on the inside of the case lid.

14 TRANSPORTATION AND STORAGE

NOTICE

Damage to device due to incorrect transportation and improper storage

- Protect the device and its components against strong vibrations, moisture, and unauthorised access.
- Comply with the ambient conditions specified in the technical data.

  Further information: Chapter *Data sheet* (on page 67)

NOTICE

Damage to the rechargeable batteries due to improper storage

The rechargeable batteries used for the time domain reflectometer and the tablet are protected against deep discharge and overcharge. However, during longer periods of storage, the rechargeable battery may still discharge itself, e.g. due to weak leakage currents.

To prevent the rechargeable batteries from discharging themselves, they must be charged fully every 3 months.

Important: The rechargeable batteries must always be fully charged before storage.

Further information:

- Chapter *Charging the time domain reflectometer battery* (on page 59)
- Chapter *Charging the tablet battery* (on page 59)

15 Warranty and After Sales Service

Warranty

For warranty claims, please contact BAUR GmbH or your local BAUR representative. Improper use will render the warranty null and void. Wear parts are excluded from the warranty.

After Sales Service

If you have any queries, please contact BAUR After Sales Service or your BAUR representative.

BAUR GmbH

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

16 Disposal

Electrical devices do not belong in domestic waste.

- Dispose of the device in an environmentally friendly manner and in accordance with the applicable national regulations.

17 DECLARATION OF CONFORMITY

We

BAUR GmbH
Raiffeisenstr. 8
6832 Sulz
Austria

declare, under our sole responsibility, that the product

Time domain reflectometer

IRG 400 portable

to which this declaration refers, conforms to the following standards or standard documents:

- Low Voltage Directive 2014/35/EC
  EN 61010-1:2010
- EMC Directive 2014/30/EU
  EN 55011:2009 + A1:2010
  EN 61000-3-2:2014
  EN 61000-4-2:2009
  EN 61000-4-4:2012
  EN 61000-4-5:2014
  EN 61000-4-11:2004
- Environmental testing
  EN 60068-2-ff

Signed: Dr. Markus Baur, CEO

Sulz, 10/07/2023

18 INDEX

IRG 400 portable

BAUR time domain reflectometer

The figure is illustrative.

Reliable and fast cable fault location

- Precise pre-location with high-performance technology
- Light, compact and portable
- Maximum safety for operators
- Can be installed in cable fault location systems

The IRG 400 portable time domain reflectometer is used for fault pre-location on 1- and 3-phase cables. The integrated separation filter allows TDR measurements to be performed on live cables up to measurement category CAT IV/600 V.

Thanks to the intuitive operational concept, cable faults can be located more rapidly and easily with the IRG 400 portable. Using the IRG 400 portable and the BAUR BUI-F application, TDR fingerprints of cables can be created that allow comparisons against existing reference measurements. Changes in the cable can therefore be detected immediately. The recorded measurement results can be exported via the tablet's USB interface and imported into the BAUR Software 4 for further processing, e.g. reporting.

The measuring device and tablet are connected via Wi-Fi. Therefore the measurement can be controlled and traced safely and conveniently using the tablet outside of the danger zone.

Functions

- TDR: time domain reflectometry (1- and 3-phase)
- Step TDR for the pre-location of cable faults and joints in the vicinity (1- and 3-phase)
- In combination with BAUR surge voltage generators
  - SIM/MIM: secondary/multiple impulse method
    Up to 20 reflection measurements per HV pulse
  - DC-SIM/MIM: secondary/multiple impulse method used in DC mode
  - ICM: impulse current method
  - DC-ICM: impulse current method used in DC mode
- In combination with BAUR HV generators with DC voltage
  - Decay method (option)

Features

- Intuitive user interface in multiple languages
- Measurement controlled via a tablet using the BAUR BUI-F application
- Length-dependent gain for better display of remote events
- Greater convenience, as measurements can be controlled via Wi-Fi
- Integrated separation filter (can be enabled/disabled) for TDR measurements on live cables with measurement category CAT IV/600 V
- Everything needed for the measurement in one handy case – time domain reflectometer, tablet, accessories
- Suitable for use in the field and weather-proof (splash water and dust protection)
- Operation via rechargeable battery or mains voltage

Technical data

IRG 400 portable	
Pulse voltage	60 V
Pulse width	30 ns – 10 µs
Number of SIM/MIM pulses	1 – 20 pulses, adjustable
Voltage-proof up to	400 V, 50/60 Hz
Measurement category	CAT IV/600 V (with enabled separation filter)
Input signal gain	Dynamic range 101 dB (-63 to +38 dB)
Measurement range	10 m – 250 km
Accuracy	0.1% (relating to the measurement result)
Data rate	400 MHz
Resolution	0.1 m (at v/2 = 80 m/µs)
Velocity of propagation (v/2)	20 – 150 m/µs, adjustable
Control of measurements	BAUR BUI-F application, installed on a tablet
Power supply	
Mains voltage (via charger)	100 – 240 V, 50/60 Hz
Rechargeable battery	Lithium-ion battery, 14.4 V, 2,900 mAh, 39.2 Wh
Battery life	Approx. 6 h
Battery charging time	Approx. 4 h
Dimensions	Approx. 371 x 259 x 152 mm
Weight	▪ IRG 400 portable (acc. to standard delivery): approx. 7.7 kg ▪ Tablet: approx. 1.1 kg
Degree of protection	IP54
Ambient temperature (operational)	-20°C to +55°C
Storage temperature	-20°C to +65°C
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
BAUR Software 4 for office PC (office installation)	Used to evaluate test and measurement logs

SCORPION industrial tablet	
Display size	10.1"
Operating system	Windows 10
Degree of protection	▪ IP65 ▪ MIL-STD-810G
Rechargeable battery	Lithium-ion battery, 7.6 V, 5,000 mAh, 38 Wh
Charging the battery	via the IRG 400 portable (USB-C)

Standard delivery

IRG 400 portable time domain reflectometer:

- IRG 400 portable time domain reflectometer
- SCORPION industrial tablet, incl.:
  - Windows operating system
  - BAUR BUI-F application
- 3-phase TDR connection cable, 2 m, with connection clips and fuses
- BNC cable, 2 m, incl.:
  - BNC adapter, 2 x connection Ø 4 mm
  - Connection cables, red and black, 0.75 m each, with fuses
- Earth cable, 3 m, with earth terminal
- Charger incl. country-specific mains supply cord
- User manual

Information on individual functions and the required accessories can be obtained from your BAUR representative.

Accessories and options

BAUR Software 4 for office PC (office installation)

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

Data sheet: BAUR GmbH · 826-143-5 · 04.2024 · Subject to modifications

BAUR GmbH

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Touch software: V1.0