User manual

Cable fault location system

Syscompact 400,
Syscompact 400 portable

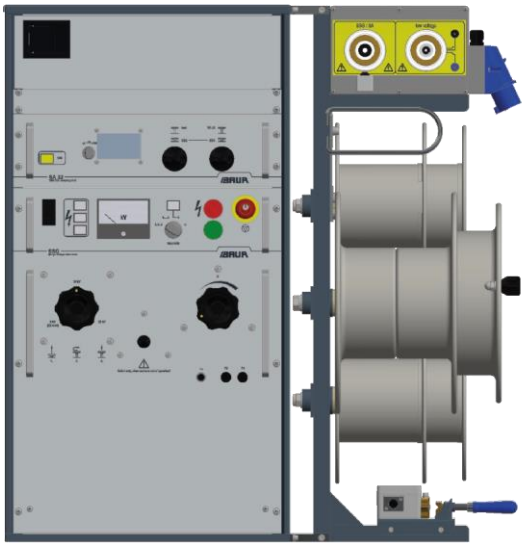


Table of contents

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

	**General danger**
	**Risk of electric shock**
	**Dangerous for persons with pacemakers**

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 tools required for the subsequent tasks.
	Indicates spare parts required for the subsequent tasks.
	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

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 Syscompact 400 / Syscompact 400 portable cable fault location system is used for the pre-location and pin-pointing of high-resistive, low-resistive, and intermittent faults on low- and medium-voltage cables and for cable testing with DC voltage.

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!

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

The product 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.

In addition, the operator must have:

- Knowledge of the technical equipment and operation of the product
- Knowledge of the testing and measurement procedures
- Knowledge of plant engineering (cable types, switchgear, etc.).

[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 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 50191 Erection and operation of electrical test equipment
    Other countries: The standard for erection and operation of electrical test equipment applicable for your country
  - 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)

2.3.1 Forbidden for persons with pacemakers

DANGER

Magnetic and electromagnetic fields in the immediate surroundings of electric equipment

It is dangerous for persons with pacemakers and metal implants to stand in the immediate surroundings of electric equipment.

Magnetic and electromagnetic fields can damage and adversely affect the function of pacemakers and metal implants. This can be dangerous for the health of the concerned persons.

- Persons with pacemakers and metal implants must not stand close to high-voltage systems.

2.3.2 Operation only in a technical secure state

Safety, function and availability depend on the proper condition of the system.

- Operate the system and the integrated devices only in a technical perfect condition.
- In case of damage and malfunction, immediately stop the system, mark it accordingly and have the faults rectified by appropriately qualified and authorised personnel.
- Comply with the inspection and maintenance conditions.
- Use only accessories and original spare parts recommended by BAUR. The use of spare parts, accessories and special facilities that are not tested and approved by BAUR could adversely affect the safety, function and characteristics of the product.

2.3.3 Checking and maintaining the safety devices

The safety devices must be inspected regularly for proper condition and function. The system must not be operated in the case of defects or non-functional safety devices.

The safety devices must not be changed, bridged or switched off.

2.3.4 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.

2.3.5 Dangers when working with high voltage

When performing tests and measurements with the system, dangerous - at times a very high - voltage is generated that is fed to the test object via an HV connection cable.

Personnel need to pay special attention and must be very careful while working with high electric voltage.

Commissioning and operation of the system are permitted only in compliance with the EN 50110 and EN 50191 (EU/CENELEC countries) or with standards applicable in your country.

Observe 5 safety rules

- Comply with the following safety rules before beginning tasks in and on the electrical plant:

1. Disconnect the test object.
2. Secure against re-connection.
3. Verify absence of operating voltage.
4. Earth and short all phases.
5. Provide protection against adjacent live parts.

DANGER

High electrical voltage

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

- Before commencing work, the operator must assess the risks for the specific working conditions. Protective measures are based on the risk assessment and must be followed at the workplace.
- Connect the system as described in this user manual.
- Pay particular attention to ensuring the test object and system are earthed correctly.
- Ensure that adjacent live parts are secured against accidental contact and flashovers with suitable covers (insulation mats, insulating safety plates).
- Cordon off all metal parts in the area of the test object terminals (connection point and far end). Insulate and earth the metal parts to avoid dangerous charges.

The test object may still be live and carry dangerous voltage after a measurement, even after the system or device has been switched off.

- Before removing the safety precautions, discharge, earth and short circuit all live parts.

2.3.6 Danger during the system's surge mode

⚠ WARNING

Potential differences between the system and the ground

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

Potential differences between the system and the ground are possible during surge mode when the system is positioned on the cable route. The greatest potential difference and dangerous contact voltage will occur in the case of a fault due to earth contact in a plastic-insulated low voltage cable without shielding.

Fault is near the system:

Voltage gradient at the fault location. There is risk of electric shock if a person is standing over the fault location and touches the system connected to the station earth.

Fault is far away from the system:

In the event of a cable fault, a voltage difference can occur resulting in a potential increase between the neutral ground and the station earth to which the system is connected. There is risk of electric shock if a person touches the system connected to the station earth.

- Place the system at a distance of several meters to the cable route or cable fault location.
- When positioning over the cable route, do not use measurement methods that use a surge voltage and do not isolate the system.

If it is not possible to avoid the hazard by means of a potential increase, take the following safety measures:

- If operating in surge mode, cordon off the system at a distance of at least 1.5 m.
- During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.

2.3.7 Dangers from road traffic

- As tasks with systems are often carried out in the road traffic area, when assessing the danger also consider this danger area.
- When setting up the system, secure the work place and during testing and measurement tasks, observe the country-specific road traffic regulations, applicable national work safety and accident prevention regulations and local conditions.
- Moreover, dangers for the test personnel and road users must be ruled out. Test personnel must wear high visibility clothing that can be identified clearly by road users.

2.3.8 Guaranteeing immediate measures in an emergency

The device may be operated only if a second person with visual and audio contact to the tester is present and is in the position to detect possible dangers and to act immediately and properly.

2.3.9 Safety locking feature against unauthorised operation

- When leaving the device or the system, press the emergency off button and remove the key.
- Keep the key in a place that is inaccessible for unauthorised persons.

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.

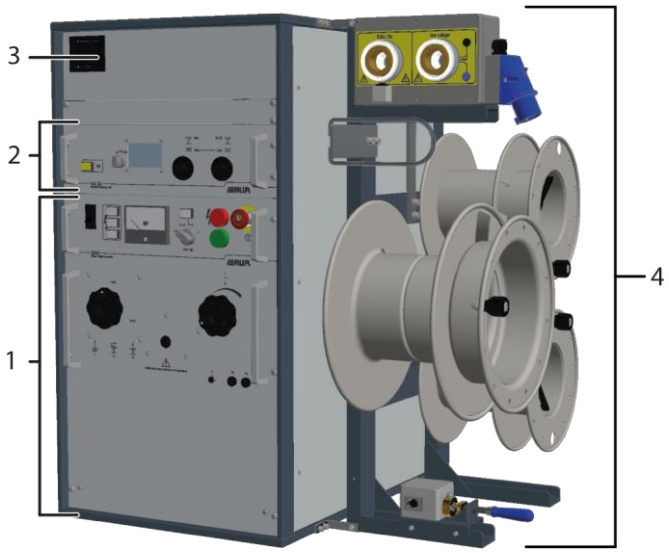
3 PRODUCT INFORMATION

Information on the following subjects is given in the chapter *Data sheet (on page 97):*

- Technical data
- Available methods
- Standard delivery
- Accessories and options

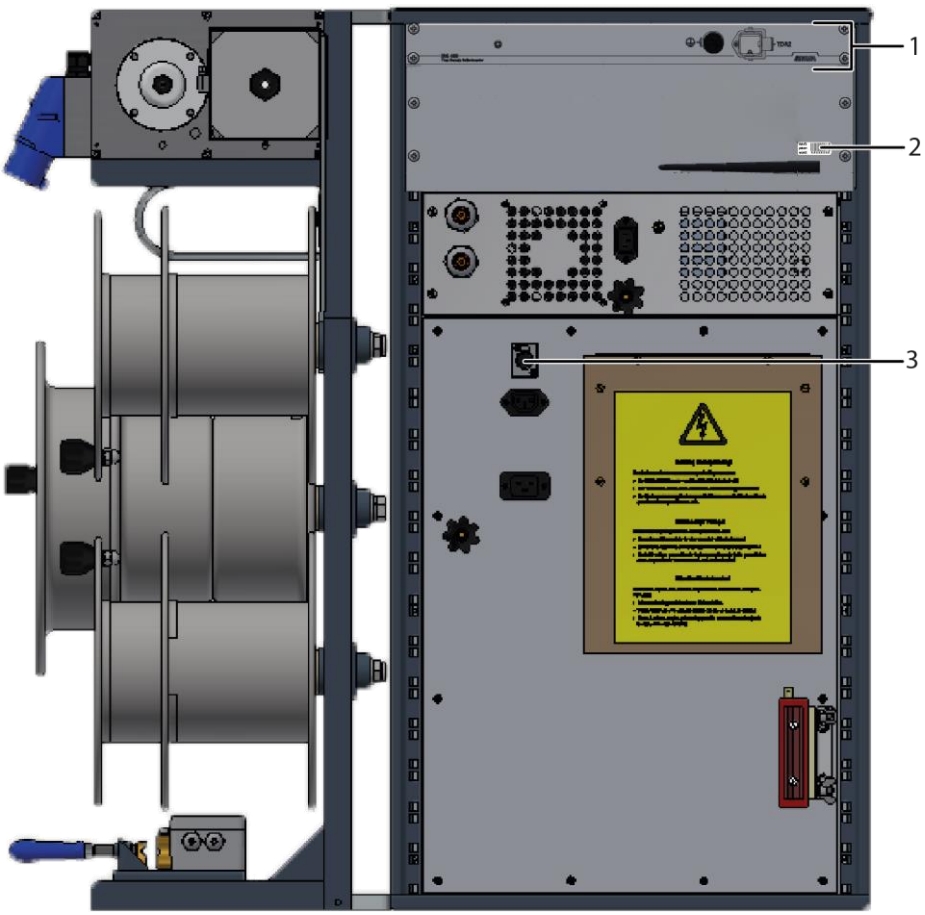
3.1 Front and rear view of the Syscompact 400

Front view



No.	Element	Function
1	SSG surge voltage generator	Is used to generate the surge voltage for fault pre-location and pin-pointing Further information: Chapter *SSG surge voltage generator* (on page 22)
2	SA 32 SIM/MIM coupling unit	Is used to switch between different operating modes and to indicate current flow during cable testing Further information: Chapter *SA 32 SIM/MIM coupling unit* (on page 21)
3	Drawer	Is used to store the tablet or laptop
4	Cable drum rack	Further information: Chapter *KTG M cable drum rack (Syscompact 400 only)* (on page 24)

Rear view

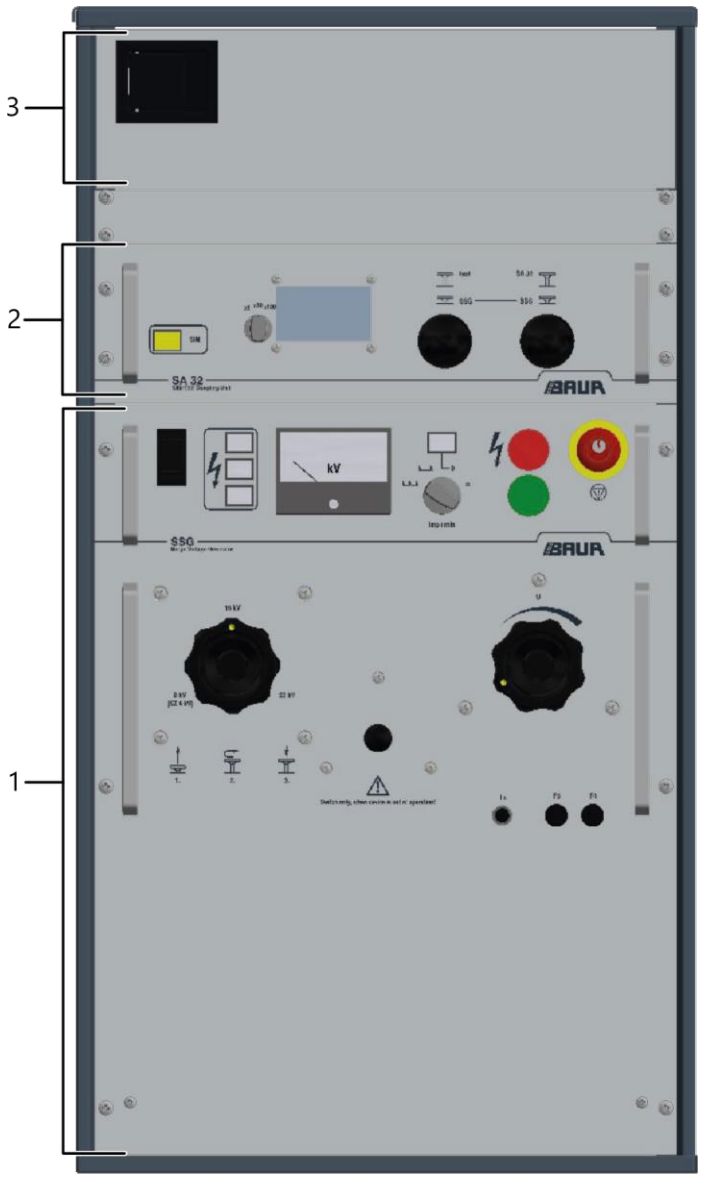


No.	Element	Function
1	IRG 400 time domain reflectometer	Is used to perform and evaluate the cable fault pre-location Further information: Chapter *IRG 400 time domain reflectometer* (on page 20)
2	Sticker	The Wi-Fi password for the system appears below the barcode. Further information: Chapter *Wi-Fi connection does not start automatically* (on page 89)
3	Port for the external emergency off unit	Is used to connect the external emergency off unit If no external emergency off unit is being used, this port must be bridged with a jumper plug.

Note: All other ports on the back of the system are connected by the manufacturer. So as not to impair the system's function, do not alter any of the connections to these ports.

3.2 Front and rear view of the Syscompact 400 portable (basic version)

Front view



No.	Element	Function
1	SSG surge voltage generator	Is used to generate the surge voltage for fault pre-location and pin-pointing Further information: Chapter *SSG surge voltage generator* (on page 22)
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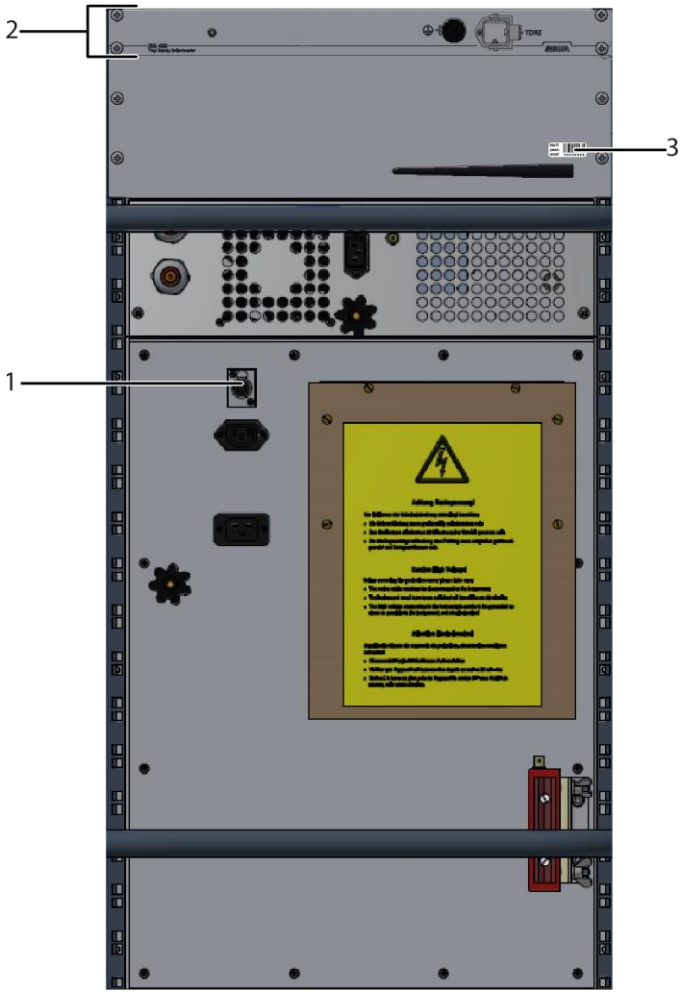
3	Drawer	Is used to store the tablet or laptop

Rear view

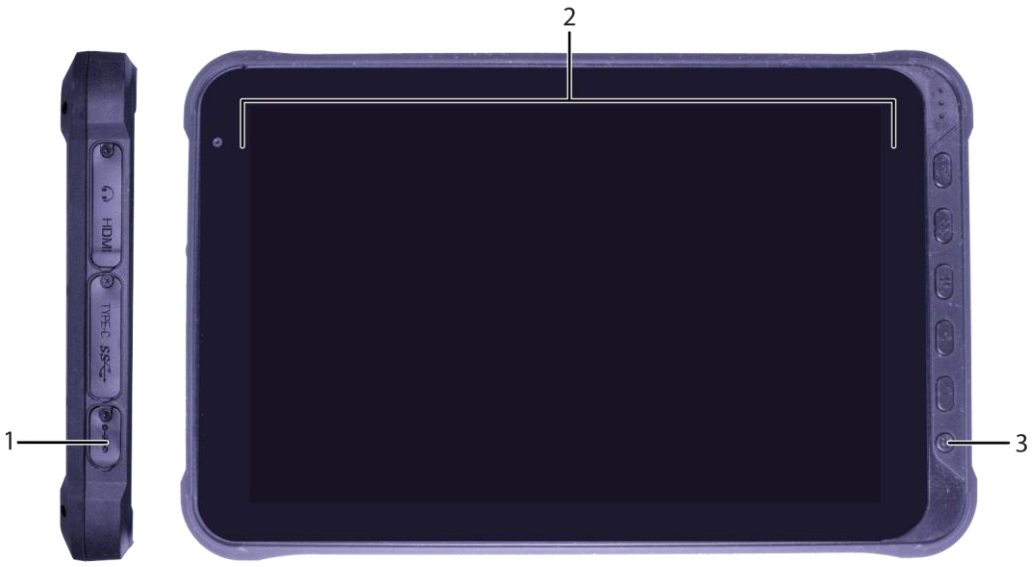


No.	Element	Function
1	Port for the external emergency off unit	Is used to connect the external emergency off unit If no external emergency off unit is being used, this port must be bridged with a jumper plug.
2	IRG 400 time domain reflectometer	Is used to perform and evaluate the cable fault pre-location Further information: Chapter *IRG 400 time domain reflectometer* (on page 20)
3	Sticker	The Wi-Fi password for the system appears below the barcode. Further information: Chapter *Wi-Fi connection does not start automatically* (on page 89)

Note: All other ports on the back of the system are connected by the manufacturer. So as not to impair the system's function, do not alter any of the connections to these ports.

3.3 Tablet

The tablet is used to control and evaluate measurements with the IRG 400 using the touch software.



No.	Element	Function
1	Charging port	Is used to charge the tablet with the built-in system charging cable
2	Touch display	Is used to operate the touch software
3	On/Off switch	Is used to switch the tablet on and off ▪ Press briefly: Standby mode is enabled and disabled ▪ Press and hold down: Tablet is shut down and switched off or tablet is switched on and booted up **Recommendation:** To prevent battery discharge, switch the tablet off completely if it is not going to be used for some time.

3.4 IRG 400 time domain reflectometer

The IRG 400 time domain reflectometer is used to perform measurements and record measurement data for all available pre-location methods in the system on 1-phase and 3-phase cables via the *TDR LV* port.

The IRG 400 is controlled via the BAUR Software on the laptop or the touch software on the tablet.

No.	Element	Function
1	LED	Indicates the operating state of the IRG 400 Further information: Chapter *LED operating state indicator* (on page 20)
2	⏚ port	Is used to connect the protective earthing for the hand cable drum of the TDR connection cable
3	*TDR LV* port	Is used to connect the TDR connection cable

3.4.1 LED operating state indicator

The LED on the time domain reflectometer indicates the following operating states:

- ○ (permanently on): The time domain reflectometer is starting up.
- ◉ (flashing): The IRG 400 is not connected to the BAUR Software or the touch software.

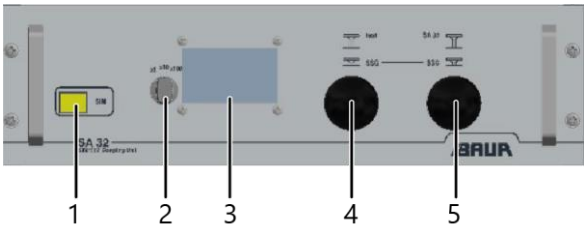
  Further information: Chapter *Wi-Fi connection does not start automatically* (on page 89)
- ◉ (flashing): The IRG 400 is ready for operation and is connected to the BAUR Software or the touch software.
- ● (permanently on): Fault state

  Error messages are displayed in the BAUR Software on the laptop or in the touch software on the tablet.
- ● (permanently on): The time domain reflectometer is switching off.

3.5 SA 32 SIM/MIM coupling unit

The SA 32 SIM/MIM coupling unit is used for the pre-location of high-resistive cable faults using the SIM/MIM method.

The SA 32 SIM/MIM coupling unit also offers the option of performing cable and cable sheath testing if the surge voltage generator is operated in DC mode.

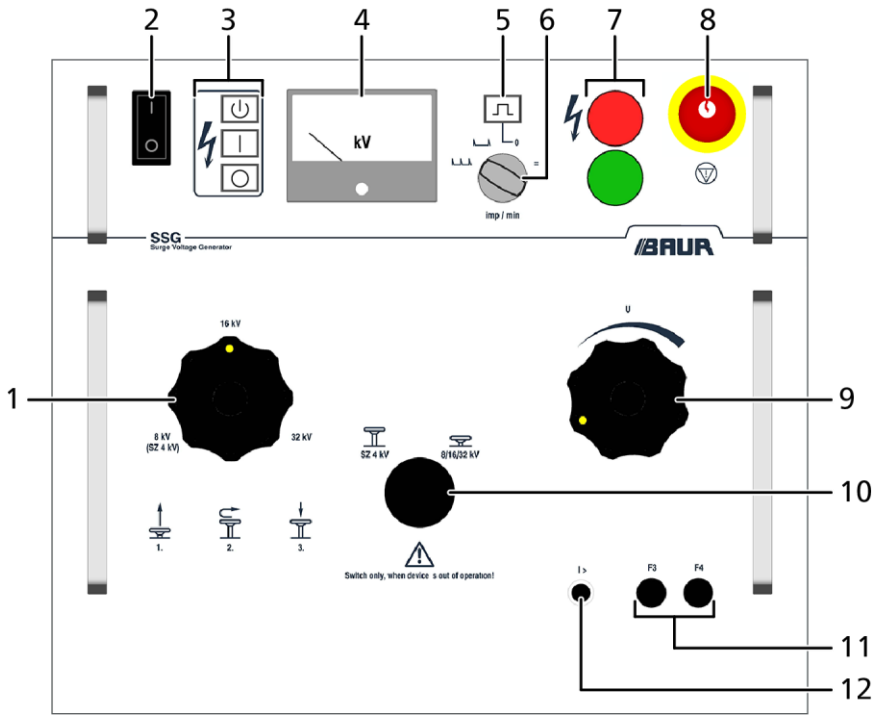


No.	Element	Function
1	*SIM* indicator light	Lights up when a measurement using the SIM/MIM method is underway
2	Selector switch for the sensitivity of the current indicator	Is used to set the sensitivity of the current indicator Positions: *x1*, *x10*, *x100*
3	Current indicator	Shows the actual current during the cable or cable sheath test
4	*test*|*SSG* drawbar	Is used to select between the fault location methods with surge voltage and cable testing with DC voltage ▪ Drawbar pushed in: Is used for fault location methods with surge voltage ▪ Drawbar pulled out: Is used for cable tests with DC voltage. The current indicator is activated.
5	*SA 32*|*SSG* drawbar	▪ Drawbar pushed in: The SIM/MIM coupling unit is deactivated. Surge mode is possible, a measurement cannot be performed according to the SIM/MIM method. ▪ Drawbar pulled out: The SIM/MIM coupling unit is active. A measurement can be performed according to the SIM/MIM method.

Overview of the positions of drawbars for various applications

Application	*test*|*SSG* drawbar	*SA 32*|*SSG* drawbar
Impulse current method (ICM)	pushed in	pushed in
Acoustic pin-pointing	pushed in	pushed in
Secondary-multiple impulse method (SIM/MIM)	pushed in	pulled out
Cable testing with DC voltage	pulled out	pushed in

3.6 SSG surge voltage generator



No.	Element/Function	
1	Selector switch for surge voltage range	
2	On/Off switch	Is used to switch the surge voltage generator on and off
3	⏻ key	Puts the surge voltage generator in the *Ready to switch on* operating state
	| key	Puts the surge voltage generator in the *In operation* operating state
	○ key	Deactivates the high voltage release, activates the internal discharge units and puts the surge voltage generator in the *Ready for operation* operating state
4	Voltage indicator	Indicates the actual value of the surge voltage and the residual voltage after the surge
5	⎍ key	Is used to release a single surge

No.	Element/Function	
6	*imp/min* selector switch	Is used to set the surge sequence or to select the DC voltage: : Rapid surge sequence The number of surges emitted per minute for a rapid surge sequence depends on the surge voltage generator. : Slow surge sequence The number of surges emitted per minute for a slow surge sequence depends on the surge voltage generator. 0: Basic position =: DC voltage operation
7	Indicator lights	Indicate the system operating state: ▪ Green: *Ready for operation* ▪ Red: *Ready to switch on*, *In operation*
8	Emergency off button	Moves the system to the *Ready for operation* operating state. The emergency off button is equipped with a key lock to protect against restart, unauthorised start-up, and unauthorised or unintentional operation. When you press the emergency off button, the following happens: ▪ The surge voltage generator is switched off and discharged. ▪ The I key is no longer illuminated. The green indicator light comes on.
9	U rotary switch	Is used to set the output voltage
10	Drawbar for activating the surge capacitor extension	Is used to activate the optional SZ surge capacitor extension If the surge capacitor extension is activated, additional surge energy is available to the surge voltage generator with a low surge voltage range of 0 – 4 kV. Further information: Chapter *Optional surge capacitor extension of 4 kV* (on page 24)
11	Fuses *F3* + *F4*	Are used to protect the control unit of: ▪ The surge voltage generator ▪ The SIM/MIM coupling unit Further information: Chapter *Fuses* (on page 85)
12	*I* > overcurrent protection switch	Switches the surge voltage generator off in the event of overload The overcurrent protection switch is triggered both thermally and magnetically.

3.7 Optional surge capacitor extension of 4 kV

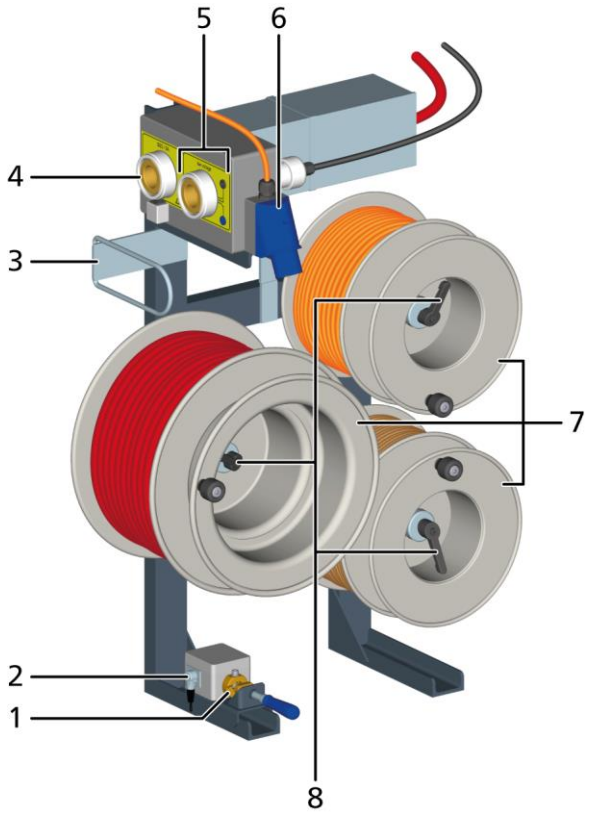
The surge capacitor extension of 4 kV is used together with the surge voltage generator for cable fault location on low-voltage cables. The voltage range 0 - 4 kV and other surge energies are available with the surge capacitor extension of 4 kV.

Further information: Chapter *Data sheet* (on page 97)

3.8 KTG M cable drum rack (Syscompact 400 only)

The KTG cable drum rack is permanently mounted on the system and is used to store, unwind, and wind up the connection cables.

Use the cable drum rack only with the supplied cables or with cables of same specification.



No.	Element	Function
1	Earth terminal	Is used for clamping one of the ferrules of the protective earthing cable for the correct protective earthing of the system
2	⏚ port	Is used to connect an optional external emergency off unit If no external emergency off unit is being used, this port is bridged with a jumper plug.
3	Cable guide loop	Is used for proper guiding of the connection cables
4	*SSG/SA* HV connection	Is used to connect the HV connection cable for measurements with the SSG Further information: Chapter *"SSG/SA" HV connection* (on page 27)

No.	Element	Function
5	*low voltage* LV connection	Is used to connect the HV connection cable for: ▪ TDR measurements ▪ Measurements with external devices of up to 2.5 kV Further information: Chapter *"low voltage" LV connection* (on page 27)
	Additional connections	Are used to connect the IRG 400 time domain reflectometer or an external device of up to max. 2.5 kV
6	Mains connection	Is used to connect the device to the mains voltage Further information: Chapter *Data sheet* (on page 97)
7	Cable drum	Is used to store the connection cables Further information on the connection cables: Chapter *Connection cables for the Syscompact 400* (on page 25)
8	Uncoiling brake for cable drum	Is used to fix the cable drum and to prevent unintentional unwinding of the connection cable

Further information:

- Chapter *Unwinding the cable from the KTG M cable drum* (on page 41)
- Chapter *Winding up the cable on the KTG M cable drum* (on page 82)

3.9 Connection cables

3.9.1 Connection cables for the Syscompact 400

The connection cables are wound onto the cable drums.

Further information: Chapter *KTG M cable drum rack (Syscompact 400 only)* (on page 24)

Cable	Function	Minimum bend radius
HV connection cable with HV plug, nominal voltage (DC) 80 kV	Is used to connect to the test object	100 mm
Mains supply cord, 3 x 4 mm^2, 32 A CEE plug	Is used to connect the system to the mains voltage	75 mm
Protective earthing cable, 16 mm^2	Is used to connect the system to the protective earthing	75 mm

3.9.2 Connection cables for the Syscompact 400 portable

Cable	Function	Minimum bend radius
HV connection cable	Is used to connect to the test object	90 mm
Mains supply cord	Is used to connect the system to the mains voltage	75 mm
Protective earthing cable	Is used to connect the system to the protective earthing	75 mm

3.9.3 Connection cables

Figure	Cable	Length	Function
	IRG connection cable (optional for Syscompact 400)	10 m	Is used to connect the system for 1-phase or 3-phase TDR measurements on de-energised test objects The connection cable has 4 fuses
	TDR connection cable (optional)	25/50 m	Is used to connect the system for 1-phase or 3-phase TDR measurements on de-energised and live test objects within measurement category CAT IV/600 V The connection cable has 4 fuses

Fuses

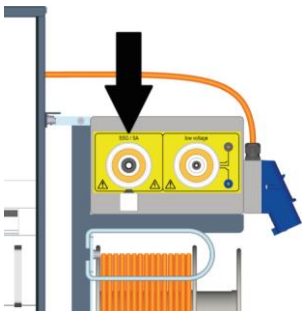
The fuses for the connection cable are located in the fuse holders behind the connection clips.

Further information: Chapter *Fuses* (on page 85)

3.10 "SSG/SA" HV connection

The HV connection is used to connect the HV connection cables for measurements with the surge voltage generator.

The HV connection is equipped with a monitoring contact that prevents the system from being put into the *Ready to switch on* operating state when the HV connection cable is not connected correctly.

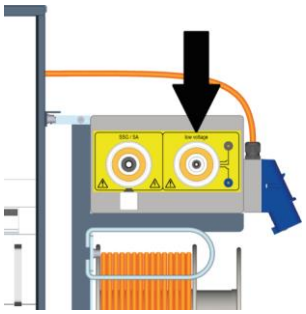


3.11 "low voltage" LV connection

The LV connection is used to connect the HV connection cables for:

- the TDR measurement
- measurements with external devices of up to max. 2.5 kV

The LV connection is equipped with two additional ports that can be used to connect an external device with an output voltage of up to max. 2.5 kV (max. current of 24 A).



3.12 Operating states of the system

Out of operation

An operating state in which:

- All power supplies, signal and control electric circuits are switched off and secured against unauthorised restart;
- All safety measures necessary before stepping into the test area have been met.

Ready for operation

An operating state in which:

- All safety measures in the *Out of operation* operating state are in place;
- The power supplies for the signal and control current circuits of the switching devices are switched on;
- The test voltage supply is switched off and secured against accidental start.

Proceed as follows to put the system into the *Ready for operation* operating state:

▸ Press the On/Off switch.

- The system's green indicator light comes on.

After pressing the ○ key or the emergency off button, the system status likewise changes to the *Ready for operation* operating state.

Ready to switch on

An operating state in which:

- All test voltage supplies are switched off;
- All access points to the test area are closed.

▸ To switch the system to the *Ready to switch on* operating state, press the ⏻ key.

- The red indicator light comes on.

In operation

An operating state in which:

- All access points to the test area are closed;
- One or more test voltage supply is switched on.

▸ To switch the system to the *In operation* operating state, press the | key.

- The red indicator light comes on.
- The | key lights up.

3.13 Safety devices and accessories

Safety circuit monitoring for measurements using the *SSG/SA* HV connection

The HV connection is equipped with a monitoring contact that prevents the system from being put into the *Ready to switch on* operating state when the HV connection cable is not connected correctly. If the HV connection cable is not connected securely enough, the power supply to the SIM/MIM coupling unit and the surge voltage generator will be interrupted.

Earthing and discharge unit

The SSG surge voltage generator and the SA 32 SIM/MIM coupling unit have an integrated discharge unit. When the SIM/MIM coupling unit is switched off, if a power failure occurs, or if the monitoring contact is triggered, the HV connection cable and the internal capacitor battery are discharged via the surge voltage generator. The HV connection cable is earthed via the SIM/MIM coupling unit after a delay.

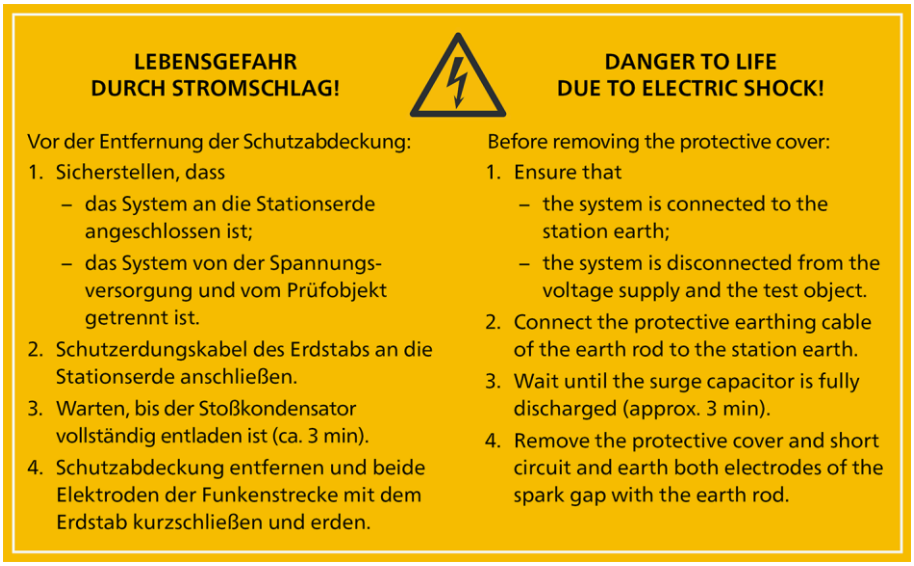
Emergency off button

The emergency off button is located on the front panel of the surge voltage generator and is equipped with key lock for protection against unauthorised or unintentional operation.

- In case of danger, immediately press the emergency off button.
  - The internal capacitor and the test object are discharged.
  - The system status changes to the *Ready for operation* operating state and the green indicator light on the control panel illuminates.
- To operate the system again after pressing the emergency off button, unlock the emergency off button.

3.14 Safety and information signs

Warning sign about high voltage on the SSG surge voltage generator



Symbols on ports and connection cables

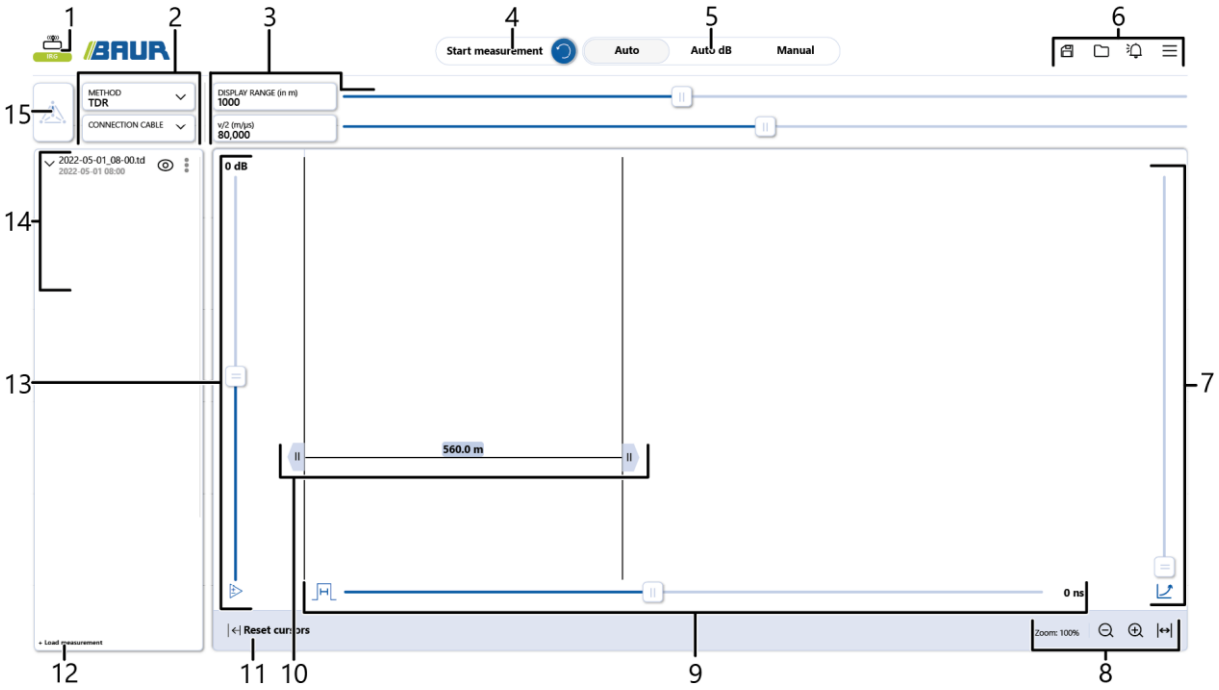
Symbol	Description
	▪ Warns against high electrical voltage and a possible risk of electric shock ▪ Indicates the HV connection cable
	General warning sign Indicates that there is a potential risk of danger when using the product and hence the user manual must be observed
	Indicates the screen of the HV connection cable that is connected to the station earth of the test object as the operational earthing
	Indicates the protective earthing cable

Rating plate

Element	Description
XX XXX XX XXX	Serial number
BAUR GmbH Raiffeisenstrasse 8; 6832 Sulz / Austria Tel.: +43 / 55 22 / 49 41-0 FAX: +43 / 55 22 / 49 41-3 www.baur.eu; e-mail: headoffice@baur.eu	Name and address of the manufacturer

4 OPERATING AND CONFIGURING THE TOUCH SOFTWARE

4.1 User interface of the touch software



No.	Element/Function	
1	Status indicator	Indicates the connection status of the IRG 400 and the touch software ▪ : IRG 400 and touch software are connected ▪ : IRG 400 and touch software are not connected Further information: Chapter *Wi-Fi connection does not start automatically* (on page 89)
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 55) ▪ ***SIM/MIM*** Further information: Chapter *About the SIM/MIM method* (on page 62) ▪ ***ICM*** Further information: Chapter *Über die Methode ICM*
	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 36)

No.	Element/Function	
3	***DISPLAY RANGE (in 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.
4	Operating control for starting and stopping the measurement The operating control can have the following states: ▪ ***Start measurement***: Measurement can be started. ▪ ***In progress***: Measurement is in progress. ▪ ***Active***: Measurement is complete and the IRG 400 and touch software are connected. 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 35)	
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 34)
7	slider	Is used to set the length-dependent gain Further information: Chapter *Length-dependent gain* (on page 33)
8	 button	Is used to zoom in and zoom out the reflection image
	 button	Resets the zoom factor for the reflection image
9	 slider	Is used to set the pulse width of the IRG 400 output signal

No.	Element/Function	
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.td ***2022-05-01 08:00***	Measurement name and time If a measurement has not been saved yet, it will be indicated as ***Unsaved*** .
	button	Shows and hides the reflection image of the measurement in the display range The button can have the following states: ▪ : The reflection image is shown in the display range ▪ : The reflection image is hidden in the display range
	button	Opens a context menu containing options for evaluating the measurement Further information: Chapter on evaluating the fault location method on the tablet.
15	Phase selector	Is used to select the phase on which the measurement is to be performed

4.2 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.

4.3 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 36)
ⓘ ***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 38)
✕ ***Exit application***	Closes the touch software. **Note:** Unsaved measurement data will be lost.

4.4 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.

4.5 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.

4.6 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.

4.7 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.

4.8 Starting and stopping a measurement

Starting a measurement

1. Make sure that the system is switched on and the touch software is connected to the system.

   Further information: Chapter *Switching on the system* (on page 49)
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.

   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.

4.9 Adding a connection cable

1. Make sure that the system is switched on and the touch software is connected to the system.
   Further information: Chapter *Switching on the system* (on page 49)
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 36)
   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 37)

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.

4.9.1 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 system

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

In the touch software

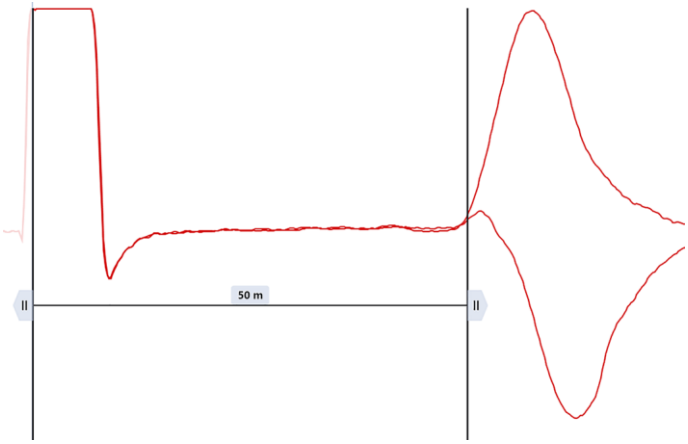
1. In the ***METHOD*** selection list, select the ***TDR*** method.
2. In the ***CONNECTION CABLE*** selection list, select the connection cable that was just created.
3. Start the measurement.
   Further information: Chapter *Starting and stopping a measurement* (on page 35)
   The trace is displayed.
4. Tap the 🖫 button to save the measurement.

On the system

- 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 35)
   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.

4.9.2 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.

4.10 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.

4.11 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* connection on the IRG 400.

4.12 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 56)

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.

4.13 Setting the number of pulses for the SIM/MIM measurement

1. Open the menu by tapping the ☰ button.
2. Tap the ***Settings*** menu item.
3. In the ***Number of SIM/MIM pulses*** input field, enter the desired number of pulses (max. 20) that should be fed into the test object during the SIM/MIM measurement.

5 COMMISSIONING

- Observe the safety instructions in chapter *For your safety* (on page 9).

5.1 Checks to perform before commissioning

1. Operate the system only in a technical perfect condition.
2. Check the system and mechanical connections for damage.
3. Check other devices for damage that are not integrated in the system and that you intend to use.
4. Check electrical connections and connection cables for damage.

   Use only undamaged connection cables.
5. Regularly check that the safety devices and accessories are in good condition and working properly.

   This particularly applies for signal systems, emergency off units, earthing and short-circuit devices and ports.

5.2 Securing the test area

1. Mark out the path for pedestrians.
2. Protect the test lead (connection cable), e.g. with cable bridges or rubber mats. The cables must be protected against damage and there must be no danger of people tripping.
3. If the connection creates a hazard for the testing personnel and pedestrians, mark them.
4. The area around the test assembly (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 test area,
   - 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.
5. If the system is cordoned off from general 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.
6. Mark the test area and terminals clearly. It must be very obvious that a cable test is in progress.
7. Make sure that unauthorised persons cannot access the local mains stations.

5.3 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. In the station, connect all phases of the test object with the station earth and short-circuit it.
5. Ensure that adjacent live parts are secured against accidental contact and flashovers with suitable covers (insulation mats, insulating safety plates).

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 mm**^{2}.

5.4 Preparing the test object terminals

The test object terminals are **the connection point and the far end** of the test object.

1. Disconnect all operating resources that are connected to the test object and are not designed for the stipulated test voltage.
2. Cordon off all metal parts, e.g. lighting masts at the test object terminals or insulate them with insulating safety plates.
3. Earth all metal parts at the terminals to avoid dangerous charging.
4. All cables that are used in danger zones can also carry high voltage potential outwards. Therefore, remove these cables from the danger zone or ensure low-resistive earthing and short-circuit.
5. 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.

5.5 Setting up the system

⚠ WARNING

Potential differences between the system and the ground

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

If a cable fault is located near to the system, there may be potential differences between the system and the ground in surge mode.

- Place the system at a distance of several meters to the cable route or cable fault location.
- If operating in surge mode, cordon off the system at a distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.
- Before starting surge mode, check the cable route for potential dangers.

- Select the installation location for the system in such a way that
  - A stable base is guaranteed and the system cannot tip over,
  - The system is 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.

5.5.1 Placing the system in the road traffic area

When placing the system in the road traffic area:

- Wear a high visibility vest so that road users can recognise you better.
- Position the system as far away from the moving traffic as possible.
- Secure the work place in compliance with the applicable national work safety and accident prevention regulations as well as local conditions.

5.6 Unwinding the cable from the KTG M cable drum

1. Make sure that the cable is not connected anywhere and is placed in the holder on the cable drum, if present. Otherwise you cannot unwind the cable.
2. Release the uncoiling brake on the cable drum you want: To do this, turn the appropriate brake lever anti-clockwise (approx. half a turn, do not turn fully).

3. Unwind the cable to the desired length.
   Guide the cable through the cable guide loop.

4. Attach the uncoiling brake to the cable drum: To do this, turn the brake lever clockwise.

This prevents the cable from unwinding further.

5.7 Safety instructions for connecting the system

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 40)
- You may touch the parts that were under voltage only if they are visibly earthed and short-circuited.

Safety instructions for connecting to a live test object

The system may only be connected to a live test object for TDR measurement and only under certain conditions: The maximum permissible voltage is AC 600 V, and the voltage-proof input must be enabled.

Further information: Chapter *Enabling and disabling the CAT IV 600 V separation filter* (on page 38)

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.

5.8 Connecting the system to the test object

Connection diagrams

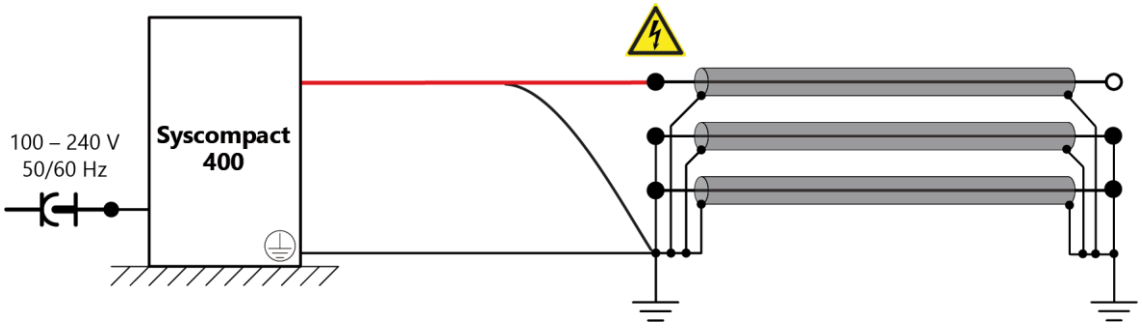
- *Screened cable with 3 phases* (on page 44)
- *Cable with 1 screened phase* (on page 44)
- *Unscreened cable with 3 phases* (on page 44)

Procedure

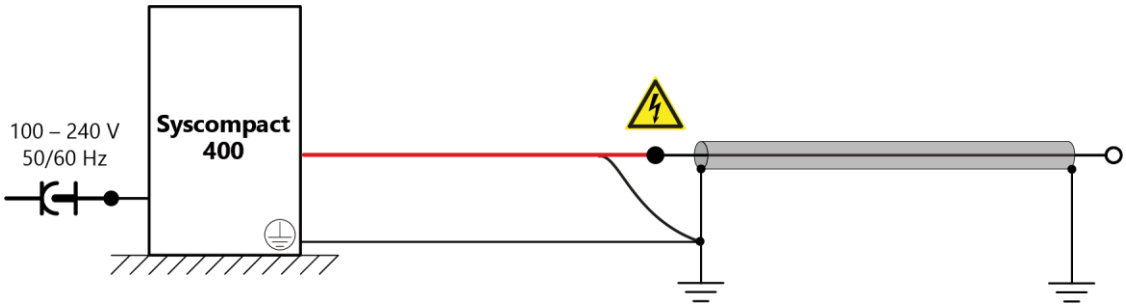
1. Make sure that the workplace is de-energised.
   Further information: Chapter *Ensuring there is no voltage at the workplace* (on page 40)
2. Make sure that the connection point and the far end are prepared for the measurement tasks.
   Further information: Chapter *Preparing the test object terminals* (on page 40)
3. Connect the protective earthing cable to the system and the station earth – as close as possible to the station earth connection.
   Procedure at the cable drum rack:
   a. Unroll the protective earthing cable to the required length so that the protective earthing cable is as short as possible and there are no loops.
   b. Connect the protective earthing cable to the station earth – as close as possible to the station earth connection.
   c. Clamp one of the ferrules of the protective earthing cable to the earth terminal on the cable drum rack.
4. Connect the protective earthing cable of the discharge and earth rod to the station earth.
5. The screen of the HV connection cable is used for operational earthing. Connect the screen of the HV connection cable to the station earth. Select the location for connecting the screen to the station earth as follows:
   - as close as possible to the location where the test object screen is connected to the station earth and
   - as close as possible to the location where the unconnected phases are connected to the station earth.

6. Connect the HV connection cable to the test object according to the respective connection diagram.
7. Connect the HV connection cable to the system.
   - *low voltage* LV connection: For TDR measurements performed via the HV connection cable
   - *SSG/SA* HV connection: For measurements performed with the surge voltage generator
8. Remove the earthing and short-circuit connection from the phase to be tested: at the connection point and at the far end.
9. Make sure that the phases that are not being tested are earthed and short-circuited.

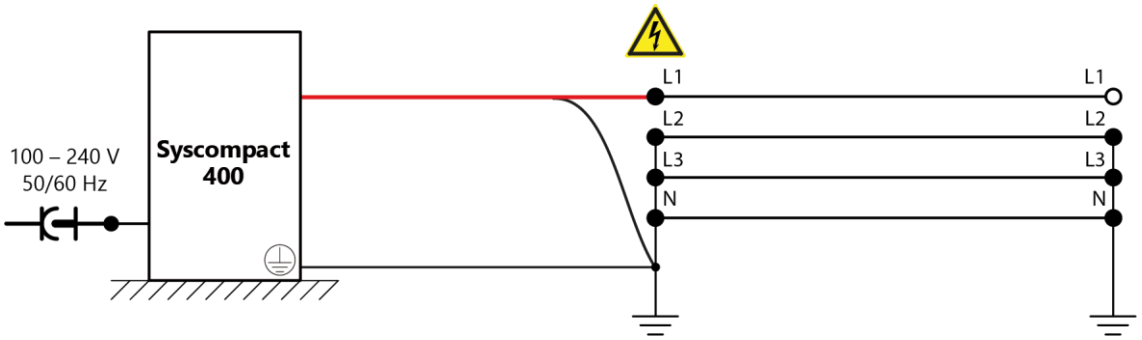
5.8.1 Screened cable with 3 phases



5.8.2 Cable with 1 screened phase



5.8.3 Unscreened cable with 3 phases



5.9 Connecting the connection cable to the test object

Connection diagrams

- *Cable with 3 screened phases* (on page 46)
- *Screened cable with 1 phase* (on page 47)
- *Unscreened cable with 3 phases* (on page 48)

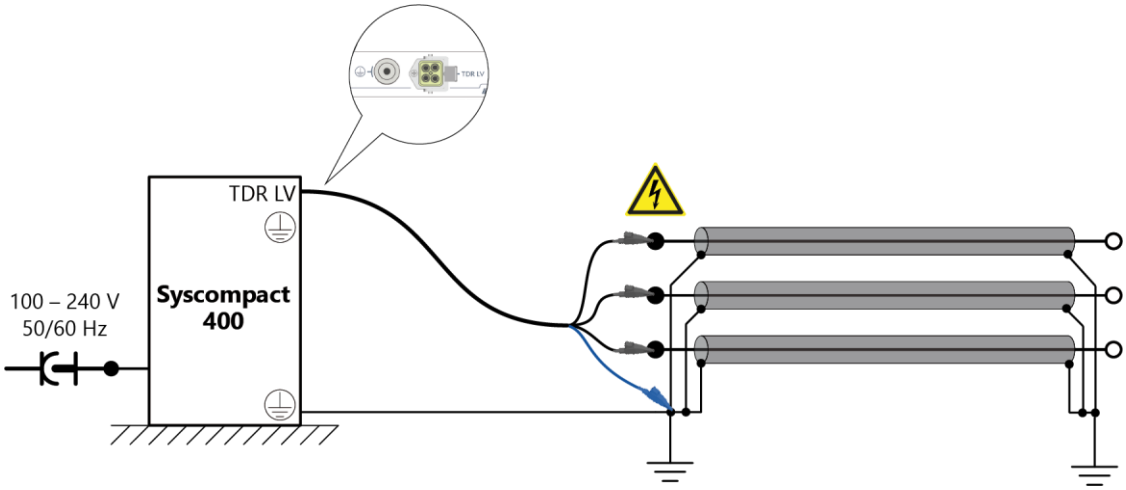
Procedure

1. Make sure that the workplace is de-energised.
   Further information: Chapter *Ensuring there is no voltage at the workplace* (on page 40)
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 40)
3. Connect the protective earthing cable to the system and the station earth – as close as possible to the station earth connection.
   Procedure at the cable drum rack:
   a. Unroll the protective earthing cable to the required length so that the protective earthing cable is as short as possible and there are no loops.
   b. Connect the protective earthing cable to the station earth – as close as possible to the station earth connection.
   c. Clamp one of the ferrules of the protective earthing cable to the earth terminal on the cable drum rack.
4. Connect the protective earthing cable of the discharge and earth rod to the station earth.
5. Connect the TDR connection cable to the test object according to the respective connection diagram.
6. Remove the earthing and short-circuit connection from the phase to be tested: at the connection point and at the far end.
7. Make sure that the phases that are not being tested are earthed and short-circuited.

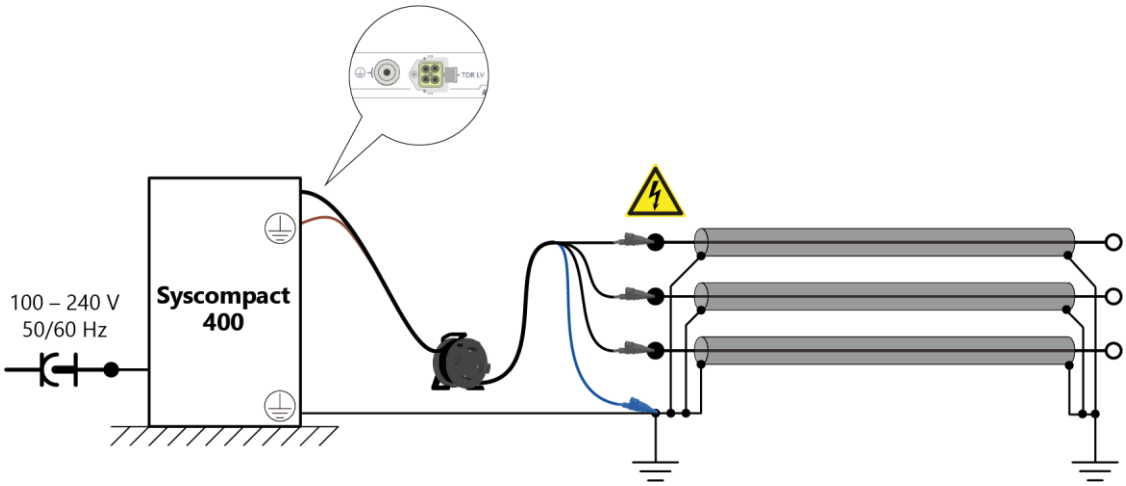
NOTICE
Damage to the system due to improper use
▸ Disconnect the TDR connection cable before applying high voltage methods.

5.9.1 Cable with 3 screened phases

IRG connection cable

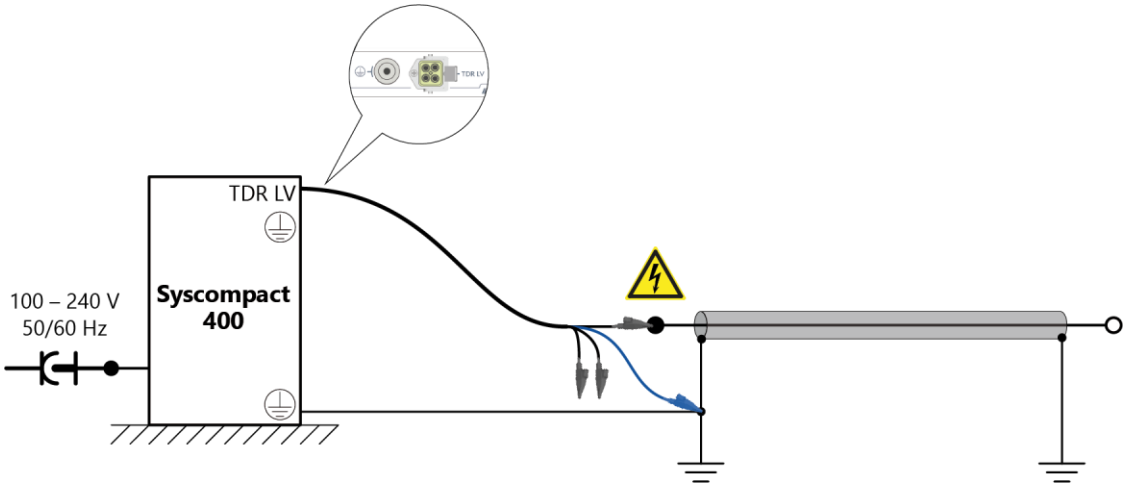


TDR connection cable

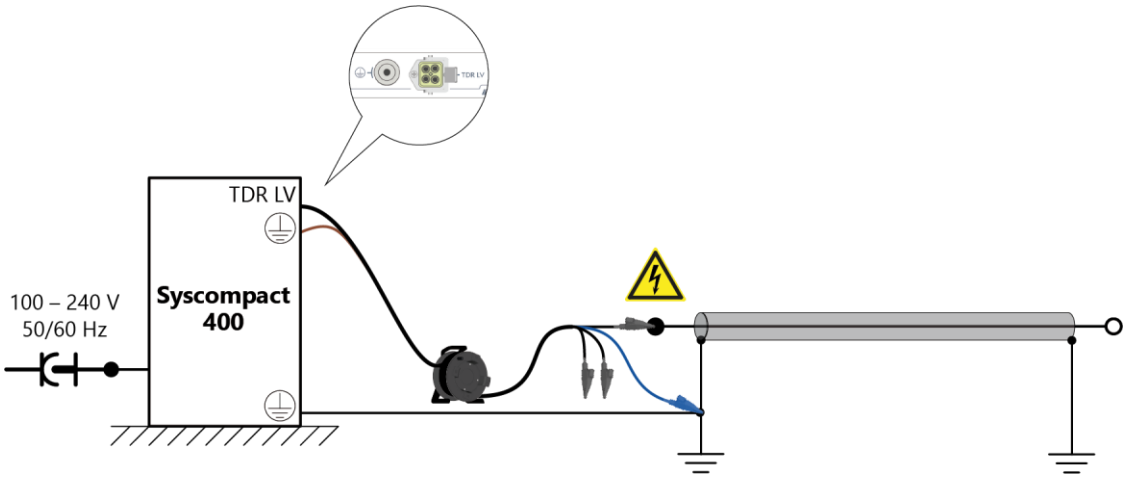


5.9.2 Screened cable with 1 phase

IRG connection cable

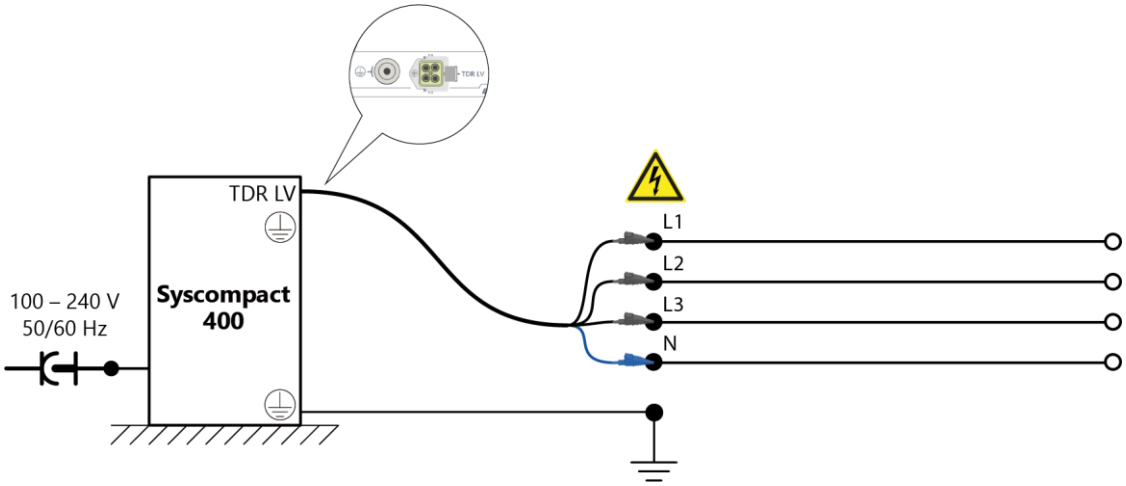


TDR connection cable

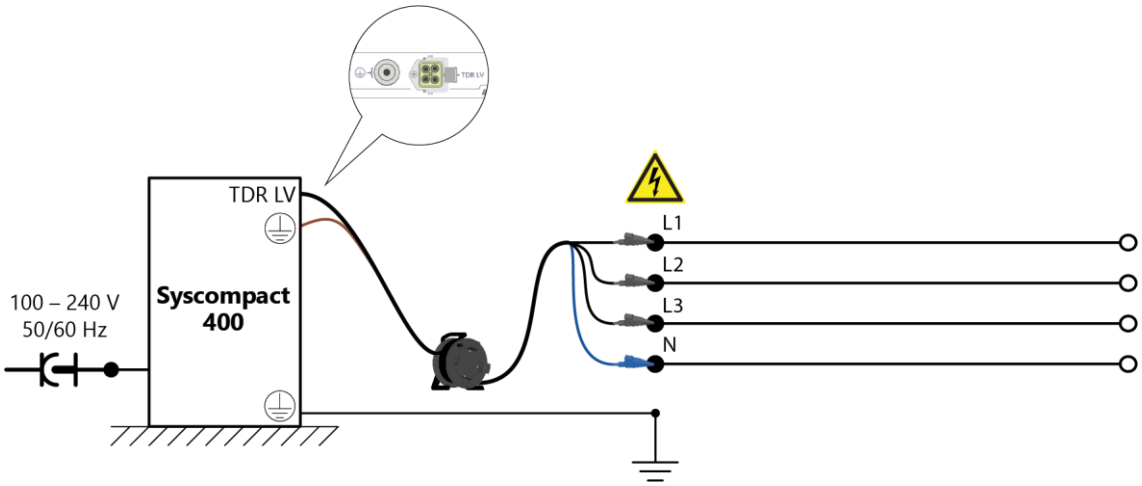


5.9.3 Unscreened cable with 3 phases

IRG connection cable



TDR connection cable



5.10 Connecting the system to the supply voltage

1. Make sure that the mains voltage matches the specifications in the data sheet.
   Further information: Chapter *Data sheet* (on page 97)
2. Connect the system to the mains voltage via the mains supply cord. If necessary, use an approved country-specific adapter with safety contact.
   Note that the mains supply earth is not isolated from the station earth.
   NOTICE! If the voltage is too low, the system will not work properly; if it is too high, it may damage the device.

5.11 Switching on the system

1. Make sure that the system is properly positioned and connected to the test object and the supply voltage.
2. Press the On/Off switch on the system control panel.

   - The system status changes to the *Ready for operation* operating state.
   - The green indicator light and the ⏻ key light up.
3. Switch on the tablet.
   - If the touch software is connected to the system, the icon appears in the status display.
   - The status LED on the IRG 400 time domain reflectometer flashes green.

6 DETERMINING THE BREAKDOWN VOLTAGE

6.1 About determining the breakdown voltage

To select a suitable fault location procedure, it is necessary to check whether the cable can be charged and to determine the breakdown voltage. For this, a DC voltage is applied to each phase for a brief period.

The determined breakdown voltage is used to set the optimum voltage for the fault location.

6.2 Determine breakdown voltage

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.
- If operating in surge mode, cordon off the system at distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.

NOTICE

Erosion on short-circuit contacts inside the device caused by switching the operating mode under voltage

- Only switch the SSG surge voltage generator to DC voltage operation when it is in a de-energised state (Position: ⎓).

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system.
   Further information: Chapter *Switching on the system* (on page 49)

On the SIM/MIM coupling unit

1. Push the *SA 32*|*SSG* drawbar in (position: *SSG*).
2. Set the sensitivity selector switch of the current indicator to the desired position.
   Recommendation: Position *x100* (highest step)
3. Pull out the *test*|*SSG* drawbar until it reaches the stop (position: *test*).

On the surge voltage generator

1. Set the selector switch for voltage ranges to the lowest possible voltage range required.
2. Turn the U rotary switch to the left.
3. Set the *imp/min* selector switch to the = position (dc voltage).
4. Release the high voltage: To do this, press the ⏻ key.
   The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.
5. Switch on the high voltage: To do this, press the | key.
   The system status changes to the *In operation* operating state. The red indicator light and the | key light up.
6. Using the U rotary switch, increase the output voltage. When doing this, take into account the maximum permissible voltage for the cable.

On the SIM/MIM coupling unit

- Observe the current indicator during the measurement.

On the surge voltage generator

- As soon as the current indicator deflects to the SA 32: read off the value displayed on the SSG voltage indicator. This is the breakdown voltage.
  If no breakdown was achieved, increase the voltage (if permitted) and repeat the measurement.

6.3 End measurement or connect other phase

On the surge voltage generator

1. Turn the U rotary switch all the way to the left.
2. Press the O key.
   The system changes to the safe *Ready for operation* operating state.
3. To protect the system against restarting, press the emergency off button and remove the safety key.

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 system.
2. If you wish to connect another phase, connect the required phase to the system.
   Further information: Chapter *Connecting the system to the test object* (on page 43)

7 CABLE TESTING

7.1 About cable testing

During the cable testing, a voltage is applied between phase and screen for a specific period to test the insulation. The test is considered successful if no breakdown occurs.

The test duration and the voltage are defined by applicable standards based on the insulating material.

Note: The DC voltage is not suitable for cable testing of mixed, XLPE and PE insulated cables. On one hand, substantial faults are not detected with this testing technology. On the other hand, high DC voltage test levels can damage the dielectric.

7.2 Performing the cable test

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.
- If operating in surge mode, cordon off the system at distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system.
   Further information: Chapter *Switching on the system* (on page 49)

On the SIM/MIM coupling unit

1. Make sure that the drawbars are in the following positions:
   - *test*|*SSG*: pulled out
   - *SA 32*|*SSG*: pushed in
2. Set the sensitivity selector switch of the current indicator to the desired position.
   Recommendation: Position *x100* (highest step)

On the surge voltage generator

1. Set the selector switch for voltage ranges to the desired voltage range.
2. Turn the rotary switch all the way to the left.
3. Set the *imp/min* selector switch to the position (dc voltage).
4. Release the high voltage: To do this, press the key.

   The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.
5. Switch on the high voltage: To do this, press the key.

   The system status changes to the *In operation* operating state. The red indicator light and the key light up.

   The cable test starts.
6. Using the rotary switch, increase the output voltage while observing the current and voltage indicators. If the actual current is too high (> 250 mA), the target voltage cannot be reached. In this case, a fault is present which can be pre-located using the SIM/MIM method.

   The cable test is considered successful if the target voltage has been reached and no breakdown has occurred within the preset time.
7. If a breakdown occurs, end the cable test.

   Note: After a breakdown, the surge voltage generator automatically switches to burn mode.

7.3 End measurement or connect other phase

On the surge voltage generator

1. Press the key.

   The system changes to the safe *Ready for operation* operating state.
2. To protect the system against restarting, press the emergency off button and remove the safety key.

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 system.
2. If you wish to connect another phase, connect the required phase to the system.

   Further information: Chapter *Connecting the system to the test object* (on page 43)

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 is not suitable for locating high-resistive cable faults, as they produce very minor or no impedance changes at the fault. Methods involving surge voltage, such as SIM/MIM or ICM, are suitable for these types of faults.

Further information:

- Chapter *SIM/MIM: Secondary-Multiple Impulse Method* (on page 62)
- Chapter *ICM: Impulse current method* (on page 69)

8.1.1 TDR measurement modes

With the IRG 400 time domain reflectometer, TDR measurement can be performed in different modes.

Measurement modes on the laptop

Further information is given in the user manual for the BAUR Software.

- To open the user manual, press the F1 key in the open BAUR Software.

Measurement modes on the tablet

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. Based on the duration of the reflections and the velocity of propagation (v/2), the IRG 400 calculates the distance to the open end or the fault location. Cursors are automatically set in the reflection image. Further information: Chapter *Operating and configuring the touch software* (on page 31) 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 31) 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.

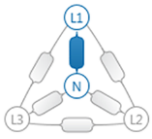
8.2 Performing a TDR measurement on the laptop

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system and start the BAUR Software on the laptop.
   Further information: Chapter *Switching on the system* (on page 49)

In the BAUR Software

CABLE FAULT LOCATION > ***Pre-location*** > ***TDR***

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



2. If you want to change the settings for the measurement, click on the icon.

   The first measurement must be performed in automatic measurement mode. From the second measurement onwards, you can change the settings. Further information: User manual for the BAUR Software (press the *F1* key)
3. Click the ***Start measurement*** button.
4. In the ***Measurement*** dialog, click the ***Start measurement*** button.

   The measurement is performed. The traces are displayed. Cursors are set automatically at the measured cable end and at the cable fault if applicable.

   When the measurement is complete, it finishes automatically. You can also end the measurement early by cancelling it.

   To close the ***Measurement*** dialog, click the ***Close*** button.

Next steps

- Evaluating the reflection image: *Evaluating the TDR reflection image on the laptop* (on page 58)
- 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 61)

8.3 Evaluating the TDR reflection image on the laptop

The reflections can be divided into two groups:

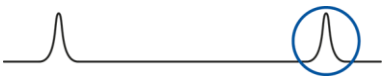
- Normal reflections

  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:



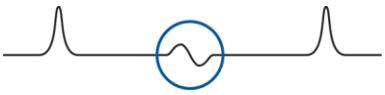
Open cable end

The reflection is a positively increasing pulse. There is no pulse from the far end.

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

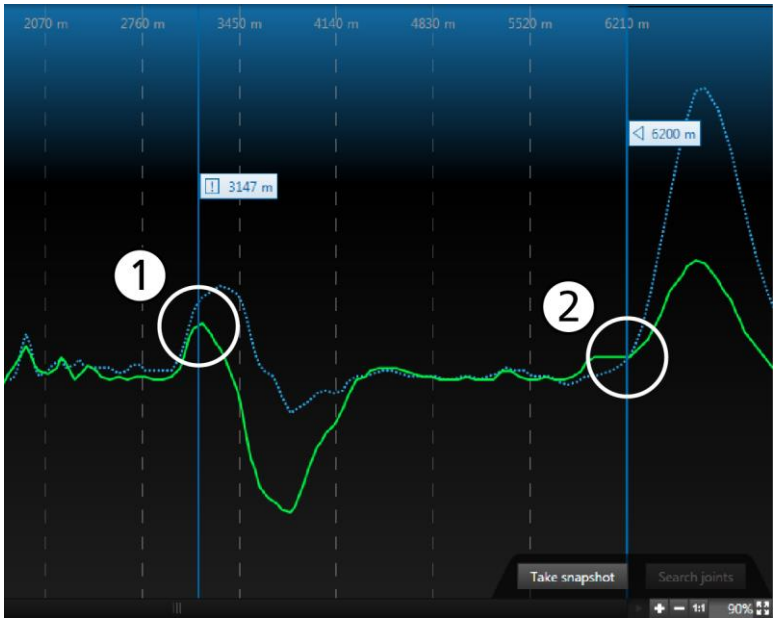
Short-circuit or low-resistive fault

The reflection is a negatively decreasing pulse. There is no pulse from the far end.



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.



1	Fault position (negative reflection)
2	Cable end (positive reflection)

1. If possible, compare the traces of a healthy and a faulty phase.
   The differences in the traces clearly indicate possible fault positions.
2. Double-click to set a cursor at the position where the two traces separate.
   If you are unable to compare traces of two phases, set the cursor at the position where the trace points downwards.
3. If required, adjust the position of the fault cursor. To do so, click on the flag of the fault cursor and hold down the mouse button to move the cursor to the desired position.
4. To confirm the fault position, right-click on the cursor flag and select the ***Confirm as fault position*** context menu item.
5. In the extended context menu, select the phase where the fault occurred.
   The fault position is displayed in the reflection image and in the cable image. A tolerance range is displayed around the pre-located fault position and the fault can be located within this range.
6. If you want to create a cable fault location report, select the ***Report*** tab.
   Further information: User manual for the BAUR Software (press the *F1* key)

8.4 Performing a TDR measurement on the tablet

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system and start the touch software on the tablet.
   Further information: Chapter *Switching on the system* (on page 49)

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 56)
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 36)
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.

   Further information: Chapter *Starting and stopping a measurement* (on page 35)

   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 33)

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

   Further information: Chapter *Starting and stopping a measurement* (on page 35)

Next steps

- Evaluating the reflection image: *Evaluating the TDR reflection image on the tablet* (on page 60)
- 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 61)

8.5 Evaluating the TDR reflection image on the tablet

The reflections can be divided into two groups:

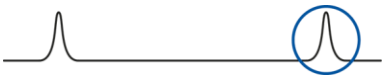
- Normal reflections

  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:



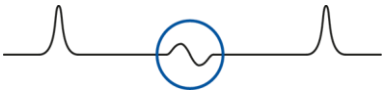
Open cable end

The reflection is a positively increasing pulse. There is no pulse from the far end.

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. There is no pulse from the far end.



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 a TDR measurement on the tablet* (on page 59)
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.

8.6 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 system.
2. If you wish to connect another phase, connect the required phase to the system.
   Further information: Chapter *Connecting the system to the test object* (on page 43)

9 SIM/MIM: Secondary-Multiple Impulse Method

9.1 About the SIM/MIM method

The secondary-multiple impulse method (SIM/MIM) is the most well-established and precise pre-location method and in most cases, performs fast fault pre-location. It is used for pre-locating high-resistive faults.

The SIM/MIM method is based on the electric arc surge method. With this method, first a reflection image is recorded without a fault or with a high-resistive fault. As high-resistive faults result in very minor or no impedance changes at the fault position, no fault is visible on this reflection image. Therefore, it is also called "healthy trace". Then, a high-voltage surge pulse is fed into the faulty phase, which ignites an electric arc at the fault location and temporarily converts the fault location into a low-resistive connection. Reflection measurements are automatically taken at the precise moment of ignition. Up to 20 TDR pulses are fed into the phase and are reflected negatively at the temporarily low-resistive fault location. The reflection image is displayed on screen without and with an electric arc. By comparing the reflection images, the fault position is clearly visible from the way the healthy trace and faulty trace differ. The fault distance is calculated from the duration of the pulse and the velocity of propagation (v/2).

The breakdown time can be delayed, or the duration of the breakdown can be shorter due to the varying properties of the cable fault. With automatic reflection measurements over a time interval, the fault state before, during, and after the ignition of the fault location is displayed. The fault is thus apparent at every moment of the ignition.

9.2 Performing a SIM/MIM measurement on the laptop

⚠ WARNING

Potential differences between the system and the ground

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

If a cable fault is located near to the system, there may be potential differences between the system and the ground in surge mode.

- Place the system at a distance of several meters to the cable route or cable fault location.
- If operating in surge mode, cordon off the system at a distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.
- Before starting surge mode, check the cable route for potential dangers.

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)

2. Switch on the system and start the BAUR Software on the laptop.
   Further information: Chapter *Switching on the system* (on page 49)

On the SIM/MIM coupling unit

- Make sure that the drawbars are in the following positions:
  - *test*|*SSG*: pushed in
  - *SA 32*|*SSG*: pulled out

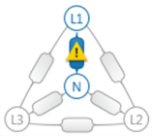
On the surge voltage generator

1. Set the selector switch for voltage ranges to the desired voltage range.
2. Rotate the rotary switch all the way to the left.
3. Release the high voltage: To do this, press the key.
4. The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.
5. Switch on the high voltage: To do this, press the key.
   The system status changes to the *In operation* operating state. The red indicator light and the key light up.
6. Set the *imp/min* selector switch to the 0 position (single surge).

In the BAUR Software

CABLE FAULT LOCATION > ***Pre-location*** > ***SIM/MIM***

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



2. If you want to change the settings for the measurement, click on the icon.
   The first measurement must be performed in automatic measurement mode. From the second measurement onwards, you can change the settings. Further information: User manual for the BAUR Software (press the *F1* key)
3. Click the ***Start measurement*** button.
4. In the ***Measurement*** dialog, click the ***Start measurement*** button.
   The measurement is performed. The healthy trace is displayed. The ***Waiting for breakdown*** message is displayed.

On the surge voltage generator

1. Using the rotary switch, set the surge voltage so that it is 20 – 30% higher than the determined breakdown voltage.
   Further information: Chapter *Determining the breakdown voltage* (on page 50)
   The capacitors in the surge voltage generator are charged up; you can read off the actual voltage on the voltage indicator.
2. When the desired target voltage has been reached, turn the rotary switch all the way to the left.
   The capacitors are charged and ready to emit the voltage.

3. Release a single surge: To do this, press the key.

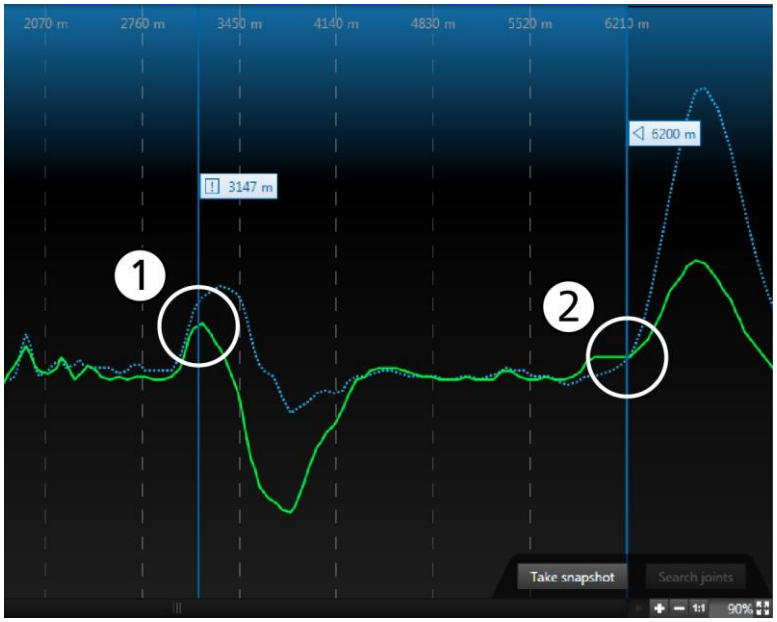
   The time domain reflectometer automatically performs further measurements. The traces are displayed in the BAUR Software. Cursors are set automatically at the measured cable end and at the cable fault if applicable.
4. In the ***Measurement*** dialog in the BAUR Software, click on the ***Disable*** button first, then the ***Close*** button.

Next steps

- Evaluating the reflection image: *Evaluating the SIM/MIM reflection image on the laptop* (on page 64)
- 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 67)

9.3 Evaluating the SIM/MIM reflection image on the laptop

The healthy trace and the first trace of the ignited fault are displayed in the reflection image. The fault cursor is set automatically after the measurement.



1	Fault position (negative reflection)
2	Cable end (positive reflection)

1. Compare both traces. A negative reflection is visible at the fault position. The two traces split at this point.

   To display other traces, in the list of completed measurements, enable the checkbox of the respective trace.
2. If required, adjust the position of the fault cursor. To do so, click on the flag of the fault cursor and hold down the mouse button to move the cursor to the desired position.
3. To confirm the fault position, right-click on the cursor flag and select the ***Confirm as fault position*** context menu item.
4. In the extended context menu, select the phase where the fault occurred.

   The fault position is displayed in the reflection image and in the cable image. A tolerance range is displayed around the pre-located fault position and the fault can be located within this range.

5. If you want to create a cable fault location report, select the ***Report*** tab.
   Further information: User manual for the BAUR Software (press the *F1* key)

9.4 Performing a SIM/MIM measurement on the tablet

⚠ WARNING

Potential differences between the system and the ground

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

If a cable fault is located near to the system, there may be potential differences between the system and the ground in surge mode.

- Place the system at a distance of several meters to the cable route or cable fault location.
- If operating in surge mode, cordon off the system at a distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.
- Before starting surge mode, check the cable route for potential dangers.

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system and start the touch software on the tablet.
   Further information: Chapter *Switching on the system* (on page 49)

On the SIM/MIM coupling unit

- Make sure that the drawbars are in the following positions:
  - *test*|*SSG*: pushed in
  - *SA 32*|*SSG*: pulled out

On the surge voltage generator

1. Set the selector switch for voltage ranges to the desired voltage range.
2. Rotate the U rotary switch all the way to the left.
3. Release the high voltage: To do this, press the ⏻ key.
   The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.
4. Switch on the high voltage: To do this, press the | key.
   The system status changes to the *In operation* operating state. The red indicator light and the | key light up.
5. Set the *imp/min* selector switch to the 0 position (single surge).

In the touch software

1. In the phase selector, select the phase on which you want to perform the measurement.
2. In the ***METHOD*** selection list, select the ***SIM/MIM*** method.
3. In the ***CONNECTION CABLE*** selection list, select the desired 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 36)
4. If necessary, set the display range.

   If ***Auto*** is selected, the display range is set automatically so that the healthy trace shows the entire length of the phase to be tested 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.

   Further information: Chapter *Starting and stopping a measurement* (on page 35)

   The healthy trace is recorded.

On the surge voltage generator

1. Using the rotary switch, set the surge voltage so that it is 20 – 30% higher than the determined breakdown voltage.

   Further information: Chapter *Determining the breakdown voltage* (on page 50)

   The capacitors in the surge voltage generator are charged up; you can read off the actual voltage on the voltage indicator.
2. When the desired target voltage has been reached, turn the rotary switch all the way to the left.

   The capacitors are charged and ready to emit the voltage.
3. Release a single surge: To do this, press the key.

   The IRG 400 automatically performs further measurements. The reflection image is displayed in the touch software. The cursors are set automatically.

In the touch software

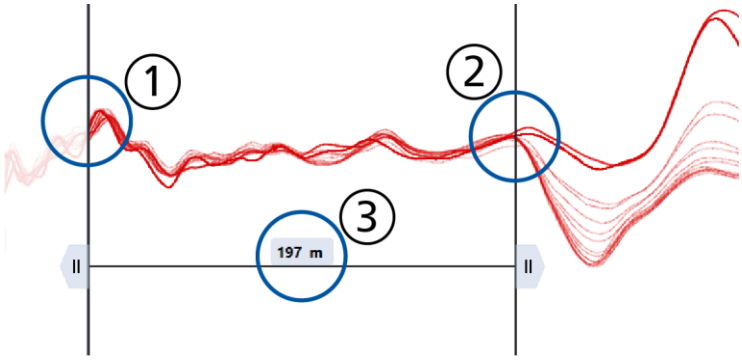
1. Stop the measurement.

   Further information: Chapter *Starting and stopping a measurement* (on page 35)
2. You can save the measurement by tapping the button.

Next steps

- Evaluating the reflection image: *Evaluating the SIM/MIM reflection image on the tablet* (on page 67)
- 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 67)

9.5 Evaluating the SIM/MIM reflection image on the tablet



1	Connection point
2	Fault position (negative reflection)
3	Distance between connection point and fault position

In the touch software

1. Select a SIM/MIM measurement from the list of saved measurements or perform a SIM/MIM measurement.
   Further information: Chapter *Performing a SIM/MIM measurement on the tablet* (on page 65)
2. Tap the ⌄ button for the measurement.
   All traces for the measurement are listed under the measurement.
   You can show and hide the individual traces by tapping the corresponding trace in the list of saved measurements.
3. Select the trace with clearest negative deflection.
4. You can move the cursor to determine the precise distance to the fault location.
5. If you wish to edit the traces, tap the ⋮ button.
   The following options are available:
   - ***Assign colour***: You can change the colour of the traces in the display range.
   - ***Load parameters***: Loads the parameter settings with which the measurement was last saved.
   - ***Move***: You can move the traces in the display range.
   - ***Align with position***: You can align all traces at a point in the display range with the same position.
   - ***Save***: Saves the changes that were made.
   - ***Close***: Closes the measurement.

9.6 End measurement or connect other phase

On the surge voltage generator

1. Press the ○ key.
   The system changes to the safe *Ready for operation* operating state.
2. To protect the system against restarting, press the emergency off button and remove the safety key.

On the SIM/MIM coupling unit

- Push the *SA 32*|*SSG* drawbar in (position: *SSG*).

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 system.
2. If you wish to connect another phase, connect the required phase to the system.
   Further information: Chapter *Connecting the system to the test object* (on page 43)

10 ICM: IMPULSE CURRENT METHOD

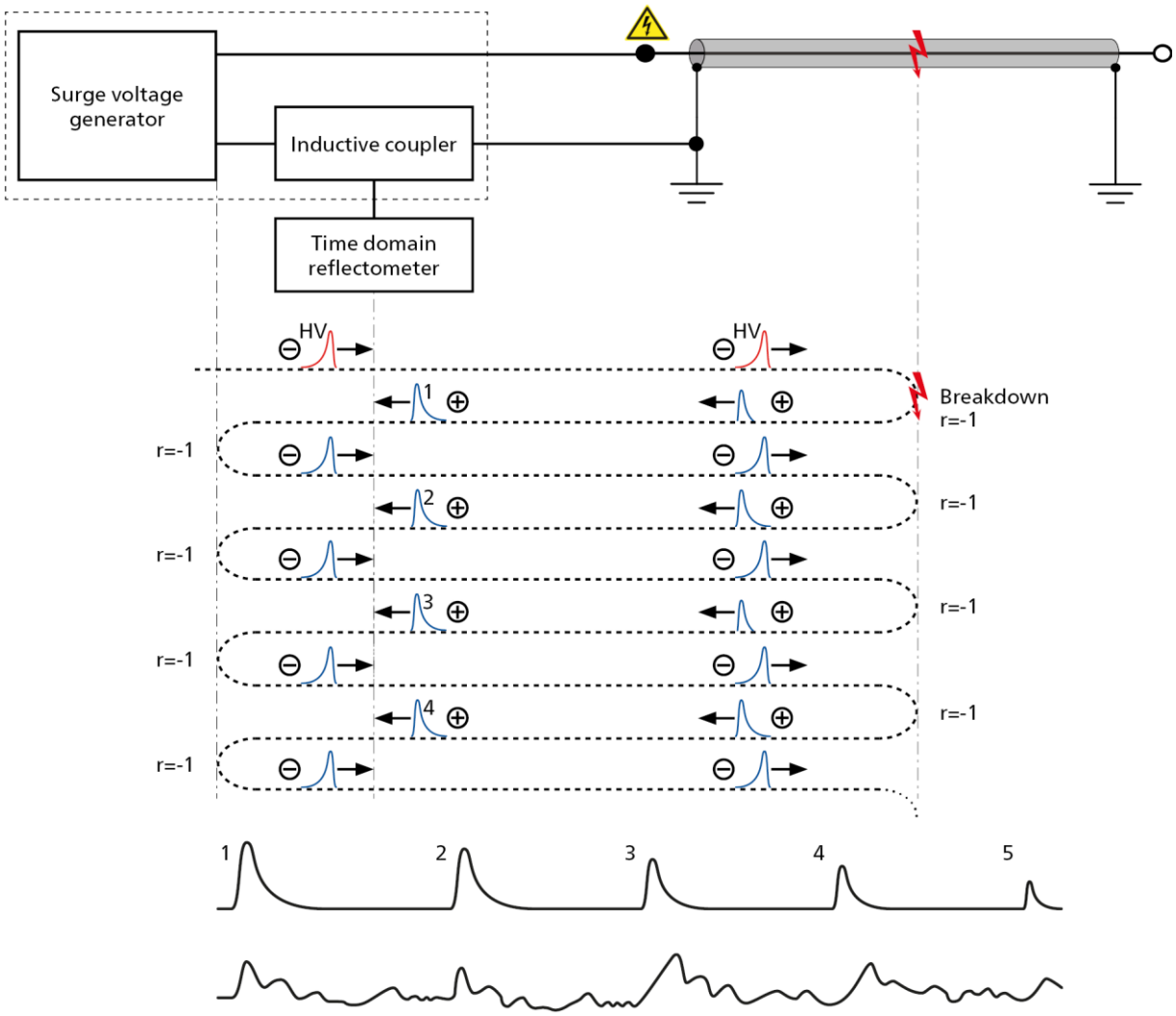
10.1 About the ICM method

The impulse current method (ICM) is suitable for pre-location of the following cable faults:

- high-resistive faults
- wet faults
- faults in long cables
- faults that cannot be located with the Time Domain Reflectometry due to high pulse damping

A breakdown is generated at the fault through a HV surge pulse. The breakdown produces a travelling wave that is reflected between the connection point of the surge voltage generator and the fault location with alternating polarity. The current ratio of this transient wave is evaluated via the inductive coupler, and the time interval between the periodically recurring reflections is measured. The distance of the fault position from the connection point is calculated from the measured time and the velocity of propagation in the cable.

Main circuit diagram



HV surge pulse of the surge voltage generator that is fed into the test object and that generates a breakdown at the fault.

This breakdown produces a transient wave that spreads to the test object.

Transient wave that is reflected from the fault to the connection point of the surge voltage generator.

As the continuous electric arc produced by the breakdown is low-resistive, the polarity of the transient wave is reversed each time.

Transient wave that is reflected from the connection point of the surge voltage generator.

As the connection point is low-resistive, the polarity of the transient wave is reversed each time.

1, 2, 3 ... Reflection period number

r Reflection factor

10.2 Performing an ICM measurement on the laptop

⚠ WARNING

Potential differences between the system and the ground

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

If a cable fault is located near to the system, there may be potential differences between the system and the ground in surge mode.

- Place the system at a distance of several meters to the cable route or cable fault location.
- If operating in surge mode, cordon off the system at a distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.
- Before starting surge mode, check the cable route for potential dangers.

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system and start the BAUR Software on the laptop.
   Further information: Chapter *Switching on the system* (on page 49)

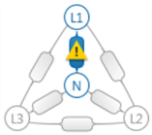
On the SIM/MIM coupling unit

- Make sure that the drawbars are in the following positions:
  - *test*|*SSG*: pushed in
  - *SA 32*|*SSG*: pushed in

In the BAUR Software

CABLE FAULT LOCATION > ***Pre-location*** > ***ICM***

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



2. If you want to change the settings for the measurement, click on the ⚙ icon.
   The first measurement must be performed in automatic measurement mode. From the second measurement onwards, you can change the settings. Further information: User manual for the BAUR Software (press the *F1* key)
3. Click the ***Start measurement*** button.
   The displayed settings are taken from the voltage assistant (***Tools*** > ***Voltage assistant***). You require administrator rights to change these settings.
   Further information: User manual for the BAUR Software (press the *F1* key)

4. If required, change the display range in relation to the cable length.

   In the first reflection period, the measurement results are distorted due to the ignition lag. Generally, the second or third reflection period is suitable for the evaluation. To ensure that many reflection periods can be presented for a better evaluation, enter at least 300% to 500%. The display range will show the three-fold or five-fold cable length.
5. In the ***Measurement*** dialog, click the ***Start measurement*** button.

   The measurement is performed.

   Several breakdowns are required for the transient image to be displayed correctly.

On the surge voltage generator

1. Set the selector switch for voltage ranges to the desired voltage range.
2. Release the high voltage: To do this, press the ⏻ key.

   The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.
3. Switch on the high voltage: To do this, press the | key.

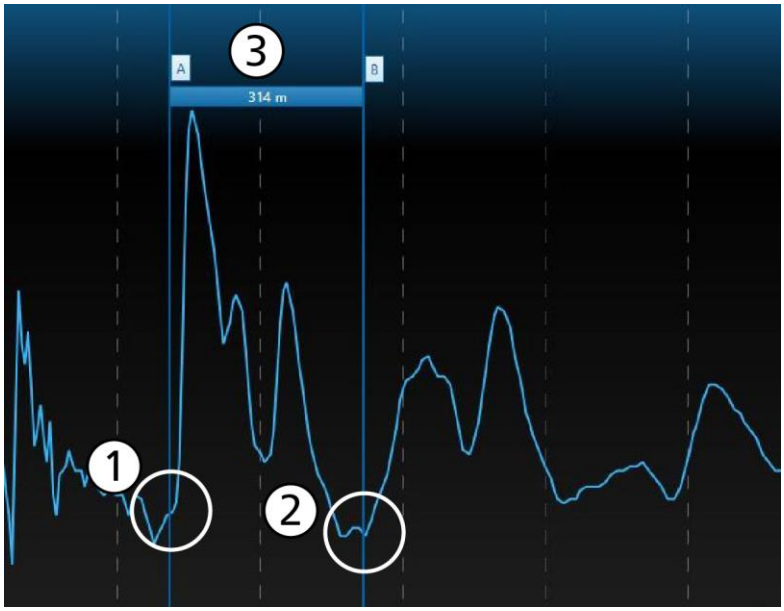
   The system status changes to the *In operation* operating state. The red indicator light and the | key light up.
4. Set the *imp/min* selector switch to the ⩩ (fast surge sequence) or ⎍ (slow surge sequence) position.

   Recommendation: Set the fast surge sequence first. If no breakdown occurs with this setting, set the slow surge sequence.
5. Increase the surge voltage with the U rotary switch until you hear a breakdown.
6. Observe the transient image in the BAUR Software. If the measurement results are not clear, increase the voltage (if permitted) and repeat the measurement.

Next steps

- Evaluating the transient image: Chapter *Evaluating the ICM transient image on the laptop* (on page 73)
- 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 76)

10.3 Evaluating the ICM transient image on the laptop



1. You can insert a horizontal auxiliary guide line to precisely position the cursors used for calculating the fault distance. To do this, right-click in the transient image and select the ***Add horizontal line*** context menu item.
2. To move the line, click on the line and hold down the mouse button to drag it to the desired position.
3. Double-click in the transient image at the beginning of a reflection period.

   A cursor is added (1).

   Note: Do not use the first reflection period for the evaluation, as it is distorted by the ignition lag.
4. Double-click in the transient image at the end of this reflection period.

   A second cursor is added (2).
5. If required, adjust the position of the cursor. To do this, click on the cursor flag and hold down the mouse button to move the cursor to the desired position.
6. Right-click on the cursor flag of the first cursor and select the ***Select reference cursor*** context menu item.
7. In the list, select the reference cursor that you set at the end of the reflection period.

   A bar (3) with the fault distance is displayed between the two cursors.

   The fault distance is produced from the distance between the two cursors minus the test lead length.
8. To confirm the fault distance as the fault position, right-click on the blue bar and select the ***Confirm as fault position*** context menu item.

   The fault position is displayed in the cable image. A tolerance range is displayed around the pre-located fault position and the fault can be located within this range. The faulty phase is also indicated by a fault symbol.
9. If you want to create a cable fault location report, select the ***Report*** tab.

   Further information: User manual for the BAUR Software (press the *F1* key)

10.4 Performing an ICM measurement on the tablet

⚠ WARNING

Potential differences between the system and the ground

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

If a cable fault is located near to the system, there may be potential differences between the system and the ground in surge mode.

- Place the system at a distance of several meters to the cable route or cable fault location.
- If operating in surge mode, cordon off the system at a distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.
- Before starting surge mode, check the cable route for potential dangers.

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system and start the touch software on the tablet.
   Further information: Chapter *Switching on the system* (on page 49)

On the SIM/MIM coupling unit

- Make sure that the drawbars are in the following positions:
  - *test*|*SSG*: pushed in
  - *SA 32*|*SSG*: pushed in

In the touch software

1. In the phase selector, select the phase on which you want to perform the measurement.
2. In the ***METHOD*** selection list, select the ***ICM*** method.
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 36)
4. If necessary, set the display range.
   If ***Auto*** is selected, the display range is set automatically so that the transient image shows 10x the length of the phase to be tested 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.
   Further information: Chapter *Starting and stopping a measurement* (on page 35)

On the surge voltage generator

1. Set the selector switch for voltage ranges to the desired voltage range.
2. Release the high voltage: To do this, press the ⏻ key.
   The system status changes to the *Ready to switch on* operating state.
   Switch on the high voltage: To do this, press the | key.
3. Set the *imp/min* selector switch to the ⩍ (fast surge sequence) or ⎍ (slow surge sequence) position.
   Recommendation: Set the fast surge sequence first. If no breakdown occurs with this setting, set the slow surge sequence.
4. Increase the surge voltage with the ⍦ rotary switch until you hear a breakdown.

In the touch software

The ICM measurement is performed.

1. Several breakdowns are required for the transient image to be displayed correctly. When the transient image stops changing, turn the ⍦ rotary switch on the surge voltage generator all the way to the left.
2. Stop the measurement.
   Further information: Chapter *Starting and stopping a measurement* (on page 35)
   You can save the measurement by tapping the 🖫 button.

Next steps

- Evaluate the ICM transient image: *Evaluating the ICM transient image on the tablet* (on page 75)
- 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 76)

10.5 Evaluating the ICM transient image on the tablet

In the touch software

1. Select an ICM measurement from the list of saved measurements or perform an ICM measurement.
   Further information: Chapter *Performing an ICM measurement on the tablet* (on page 74)
2. Tap the ⋮ button.
   The following options are available:
   - ***Assign colour***: You can change the colour of the transient image in the display range.
   - ***Load parameters***: Loads the parameter settings with which the measurement was last saved.
   - ***Move***: You can move the transient image in the display range.
   - ***Save***: Saves the changes that were made.
   - ***Close***: Closes the measurement.

10.6 End measurement or connect other phase

On the surge voltage generator

1. Press the ○ key.
   The system changes to the safe *Ready for operation* operating state.
2. To protect the system against restarting, press the emergency off button and remove the safety key.

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 system.
2. If you wish to connect another phase, connect the required phase to the system.
   Further information: Chapter *Connecting the system to the test object* (on page 43)

11 ACOUSTIC PIN-POINTING

11.1 About acoustic pin-pointing

Acoustic pin-pointing is suitable for pin-pointing high-resistive cable faults and cable and phase breaks in buried cables and cable systems. The prerequisite for applying this method is that a breakdown must take place at the fault.

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 magnetic signal. During acoustic pin-pointing, a pin-pointing system (such as the BAUR protrac®) is used to look for the location where the breakdown noise is loudest. The breakdown noise can be best heard directly over the fault.

11.2 Performing acoustic pin-pointing

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.
- If operating in surge mode, cordon off the system at distance of at least 1.5 m.

  During surge mode, only the operator may stand inside the barrier in order to operate the system. All other persons must stand outside the barrier.

1. Secure the test area and connect the test object properly.
   Further information: Chapter *Commissioning* (on page 39)
2. Switch on the system.
   Further information: Chapter *Switching on the system* (on page 49)

On the SIM/MIM coupling unit

- Make sure that the drawbars are in the following positions:
  - *test*|*SSG*: pushed in
  - *SA 32*|*SSG*: pushed in

On the surge voltage generator

1. Set the selector switch for voltage ranges to the desired voltage range.
2. Release the high voltage: To do this, press the ⏻ key.
   The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.
3. Switch on the high voltage: To do this, press the | key.
   The system status changes to the *In operation* operating state. The red indicator light and the | key light up.
4. Set the *imp/min* selector switch to the ⊔ (slow surge sequence) or ⊔⊔ (fast surge sequence) position.
5. Increase the surge voltage with the ⊔ rotary switch until you hear a breakdown.
6. Locate the cable fault with a pin-pointing system (such as the BAUR protrac®).

11.3 Finishing acoustic pin-pointing or connecting another phase

On the surge voltage generator

1. Press the ○ key.
   The system changes to the safe *Ready for operation* operating state.
2. To protect the system against restarting, press the emergency off button and remove the safety key.

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 system.
2. If you wish to connect another phase, connect the required phase to the system.
   Further information: Chapter *Connecting the system to the test object* (on page 43)

12 PUTTING THE TEST INSTALLATIONS OUT OF OPERATION

12.1 Safety instructions for decommissioning

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.

12.2 Discharging and earthing the test object

DANGER

Dangerous voltage in test object.

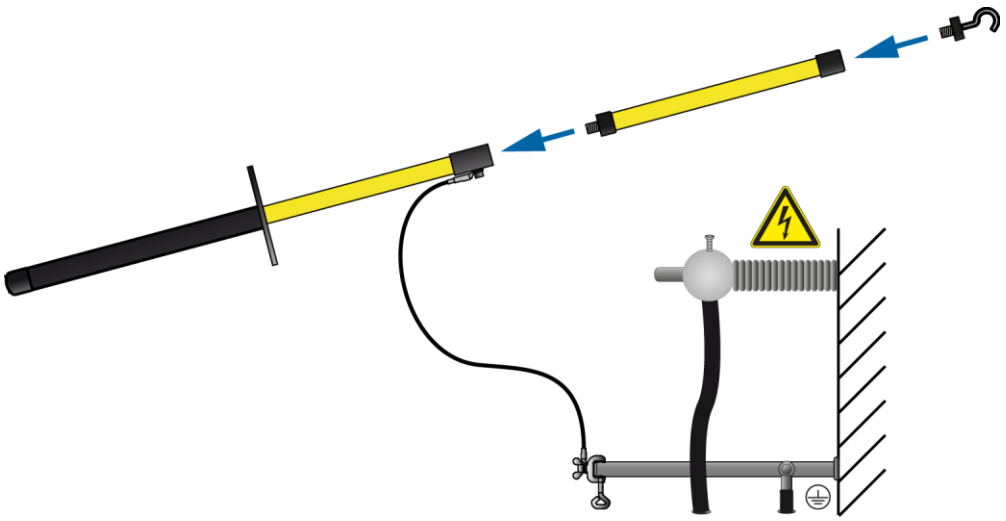
Danger of electric shock or risk of injury

- **Before touching, discharge, earth and short-circuit:** The test object 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.
- Connect the discharge and earth rod correctly to the station earth.
- Only use the discharge and earth rod if its surface is clean and dry.
- Hold the discharge and earth rod only at the handles!
- Observe the minimum discharge period in accordance with the capacitance of the test object.

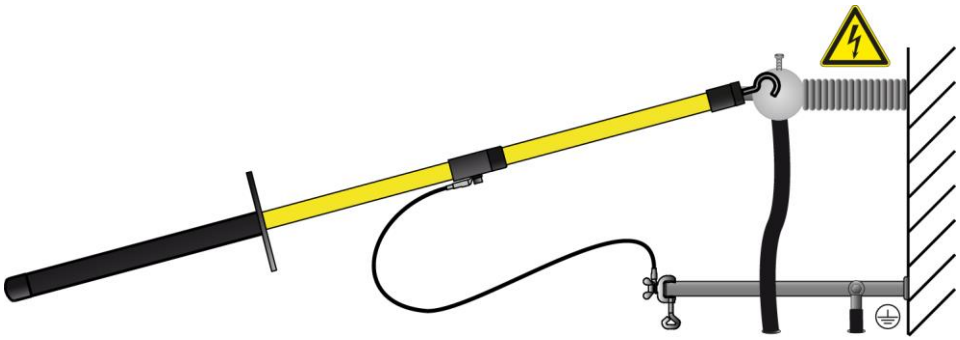
12.2.1 Discharging

	DANGER
	Dangerous voltage in test object Danger to life or risk of injury due to electric shock or electric arcs. ▸ Use suitable personal protective equipment against electric shocks and arcing faults. ▸ Keep a distance of at least 50 cm from the protective earthing cable of the discharge and earth rod.

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



3. Use the black handle to hold the discharge and earth rod and make contact with the test object by touching it with the tip of the discharge and earth rod.

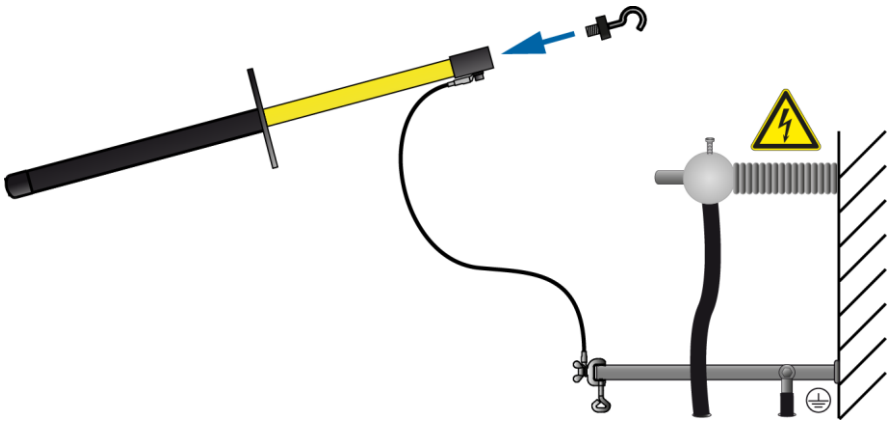


4. Observe the minimum discharge period in accordance with the capacitance of the test object.

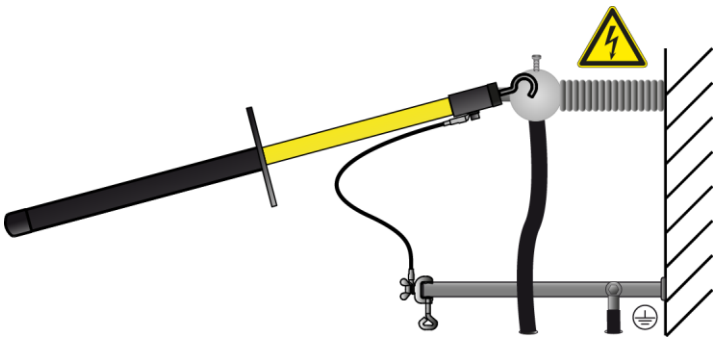
12.2.2 Earthing

	DANGER
	Dangerous voltage in test object Danger to life or risk of injury due to electric shock or electric arcs. ▸ Use suitable personal protective equipment against electric shocks and arcing faults. ▸ Keep a distance of at least 50 cm from the protective earthing cable of the discharge and earth rod.

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



3. Contact the test object with the tip of the earth rod.



4. Immediately after earthing, connect the earthing and short-circuit equipment to the test object.

12.3 Taking the system out of operation

NOTICE
Damage to devices due to improper use. ▸ Do not switch off the system under load. ▸ Before switching off the system, bring it to 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 79)
2. Switch off the system via the On/Off switch.
3. To disconnect the system completely from the supply voltage, pull out the mains plug.
4. Press the emergency off button and remove the safety key.
5. Disconnect the connection cables in the reverse order.
   Important: Finally, disconnect the earth cable last.
6. Clean the connection cables.
7. Secure the connection cables onto the holder or clear them away.
8. If necessary, remove the cordoning.
9. 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.
10. Remove the barriers and marking of the test area.

12.4 Winding up the cable on the KTG M cable drum

1. Make sure that the system has been properly taken out of operation.
   Further information: Chapter *Taking the system out of operation* (on page 82)
2. Disconnect the cable and lay it in a straight loop. Make sure that the connection is near the cable drum so that it does not drag when the cable is wound up.
3. Check the cable for cracks, damage, and dirt.
4. If the cable is dirty, clean it with a lint-free cloth.
5. Remove the cable from the cable guide loop.
6. Release the uncoiling brake on the cable drum you want: To do this, turn the appropriate brake lever anti-clockwise (approx. half a turn, do not turn fully).

7. Wind up the cable.
8. Make sure that the cable is distributed evenly on the cable drum.
9. Once the cable has been wound up, engage the uncoiling brake on the cable drum: To do this, turn the brake lever clockwise.

This prevents the cable from unwinding unintentionally.

10. Insert the plugs of the cable into the corresponding holder on the cable drum rack.

13 MAINTENANCE AND CARE

13.1 Safety instructions for maintenance work

⚠ WARNING

Unauthorised opening of the system

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

- Never take the system apart. There are no operator-serviceable or -repairable components inside the device.
- Maintenance and repair work must only be carried out by personnel trained and authorised by BAUR.

1. Switch off the system before starting any maintenance tasks.
2. To disconnect the system completely from the supply voltage, pull out the mains plug.

13.2 Maintenance schedule

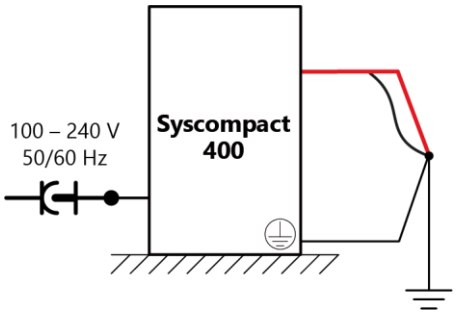
Interval	Task
After each use	▸ Check and clean the connection cables and the connection accessories. Further information: Chapter *Checking and cleaning the connection cables and accessories* (on page 87)
Monthly	▸ Check the condition of all connection cables. Further information: Chapter *Checking and cleaning the connection cables and accessories* (on page 87)
Every 12 months (with frequent use, every 6 months or as required)	▸ Check the discharge resistor of the discharge unit. Further information: Chapter *Testing the discharge unit* (on page 86)
Every 12 months (with frequent use, every 6 months or as required)	▸ Check the ignition voltage of the spark gap. Further information: Chapter *Checking the ignition voltage of the spark gap* (on page 85)
As required depending on the conditions of use	▸ Clean the system components. Further information: Chapter *Cleaning system components* (on page 88)

13.3 Fuses

	Dimensions (ø x length)	Time/current characteristic	Rated current	Rated breaking capacity	Rated voltage
SSG (F4)	5 x 20 mm	Time lag (T)	3.15 A	1.5 kA (H)	250 V
SSG (F3)	5 x 20 mm	Time lag (T)	3.15 A	1.5 kA (H)	250 V
TDR/IRG connection cable (4x)	6.3 x 32 mm	Quick-acting (F)	1 A	50 kA (H)	600 V

13.4 Checking the ignition voltage of the spark gap

- Check the ignition voltage of the spark gap every 12 months or as required. The ignition voltage must be between 500 V and 1000 V.



At the station earth

1. Connect the system to the station earth.
2. Connect the HV connection cable and the screen of the HV connection cable to the station earth.

On the SIM/MIM coupling unit

- Make sure that the drawbars are in the following positions:
  - *test*|*SSG*: pushed in
  - *SA 32*|*SSG*: pushed in

On the surge voltage generator

1. Use the selector switch to set the *0 – 8 kV* surge voltage range on the surge voltage generator.
2. Release the high voltage: To do this, press the ⏻ key.
   The system status changes to the *Ready to switch on* operating state. The red indicator light comes on.

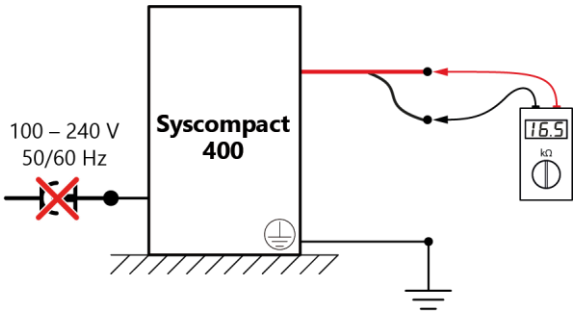
3. Switch on the high voltage: To do this, press the | key.
   The system status changes to the *In operation* operating state. The red indicator light and the | key light up.
4. Set the *imp/min* selector switch to the 0 position (single surge).
5. Use the rotary switch to set the surge voltage to 4 kV.
6. Press the ⎍ key and check the voltage indication when doing so.
   A single surge is triggered. As long as the surge voltage is > 1 kV, the voltage should collapse with a single surge.
7. Reduce the surge voltage step by step and release a single surge each time.
   As long as the surge voltage is > 1 kV, the voltage should collapse with a single surge. When the voltage is less than 1 kV, the voltage should no longer collapse. In this case, the ignition voltage is within the permissible range.
8. If the voltage continues to collapse, even under 1 kV, contact your nearest BAUR representative.
9. To stop testing the ignition voltage, deactivate the high voltage release: To do this, press the ○ key.

   DANGER

   Dangerous voltage on the test object and other live machine parts. Danger to life, risk of injury from high electric voltage.
10. Before touching test object, discharge, earth and short-circuit the same: 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.

13.5 Testing the discharge unit

- Check the discharge unit works correctly every 12 months or as required. The discharge resistor of the discharge unit must have a resistance of 16.5 kOhm (±15%).



1. Make sure that the resistance measurement is performed before putting the system into operation.
   Residual charges in the surge capacitors and the thermal heating of the resistors affect the resistance measurement.
2. Switch off the system and disconnect it from the supply voltage.
3. Earth the system properly.
4. Connect the ohmmeter to the HV connection cable and the screen of the HV connection cable.

5. Measure the resistance between the HV connection cable and the screen.
   The resistance must be 16.5 kOhm (±15%).
6. If the measured resistance deviates from 16.5 kOhm by more than 15%, contact your nearest BAUR representative.

13.6 Checking and cleaning the connection cables and accessories

DANGER

Dangerous voltage in system components and adjoining live plant parts

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

- You may touch the live parts and connection accessories that were under voltage only if they are discharged and earthed.
- Cover the live plant parts properly.

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.

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

Checking and cleaning after each use

1. Each time after using the system, clean the connection cables.
2. Check the connection cables for damage.
   Cracks, breaks or other damage in the connection cable can damage the cable.
3. If dirty, clean the connection accessories with a lint-free cloth.
   Dirty or corroded contacts can affect the measurement and are often the cause for device damage.

Regular inspection

- Every four weeks, check the condition of all connection cables. To do this, unwind the connection cables and examine them for cracks, damage and any dirt.
- Regularly check all connection accessories for damage and dirt.

13.7 Cleaning system components

DANGER

Residual voltage in connection fittings and in the live system components

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

- You may touch the connection fittings that were under voltage only after they have been discharged and earthed.

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.

1. Cover any live parts in the immediate vicinity.
2. Switch off the system and disconnect it from the supply voltage.
   Further information: Chapter *Safety instructions for maintenance work* (on page 84)
3. If required, clean the device surfaces with mild detergent and a lint-free cloth.
   NOTICE! Damage to the device due to leaking fluids.
4. Do not allow liquids to leak into the devices.

14 FAULTS AND CORRECTIVE MEASURES

14.1 Wi-Fi connection does not start automatically

- If the laptop or tablet does not establish the Wi-Fi connection automatically, you can establish this connection manually via the Windows settings.
  - Network name: *Syscompact400_xxxxx*

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

    Further information: Chapter *Safety and information signs* (on page 29)
  - Password: unique to each system

    You will find the password below the barcode on a sticker. The sticker is located on the back of the system above the antenna.

15 STORAGE

- Store the system so that it always remains in an upright position.
- During storage, comply with the ambient conditions specified in the technical data of the product.

  Further information: Chapter *Data sheet* (on page 97)
- Protect the system and components from moisture.
- Protect the system against unauthorised access.

16 TRANSPORTATION

16.1 Packaging

1. Keep the original packaging because it provides the best protection for the system during transportation.
2. If you would like to dispose of the packaging, ensure you comply with the applicable national regulations when doing so.

16.2 Ensure the following when transporting

NOTICE
Damage to the device caused by improper transportation and incorrect storage ▸ Always transport the device as intended. ▸ Comply with the ambient conditions specified in the technical data for this system.

- ▸ Protect all system components against the following during transportation:
  - ▪ Damage,
  - ▪ Vibrations,
  - ▪ Dampness and humidity.
- ▸ Transport and store the system so that it always remains in an upright position.
  Otherwise the system may become damaged.
- ▸
- ▸ When transporting the system, secure the uncoiling brake to the cable drum.

16.3 Transporting the Syscompact 400 portable manually

	⚠ **CAUTION**
	Risk of injury from the system tipping over If the system is transported incorrectly at an angle, on steep slopes or over obstacles, the system may tip over. ▸ Transport the system carefully. Max. inclined position in direction of transport ≤ 15%

- ▸ Ensure that the system always remains in an upright position during transportation.
- ▸ To transport the system manually, tilt the transport trolley into the transport position and

pull it along by the carry handle.

- Do not place any objects on the system.
- If it is necessary to lift or carry the system, use two people or a suitable lifting or transportation device.

16.4 Transporting the system in vehicles

1. Transport the system so that it always remains in an upright position.
2. Secure the system to prevent it from sliding or tipping over.

16.5 Shipping the system

1. Ship the system in the original packaging.
2. Pack the system so that it always remains in an upright position.

17 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

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

18 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.

19 INDEX

Syscompact 400

BAUR cable fault location system

The figure is illustrative.

NEW:
Can be controlled via tablet with the intuitive BAUR BUI-F app

Functions

- Pre-location
  - TDR: Time Domain Reflectometry
  - Step TDR
  - SIM/MIM: Secondary/multiple impulse method with surge voltage or in DC mode
  - ICM: Impulse current method
  - Decay method (option)
- Pin-pointing*
  - Acoustic pin-pointing
  - Step voltage method for pin-pointing cable sheath faults
- DC voltage testing up to 32 kV

Features

- Surge energy up to 1.100 J (optionally up to 2.050 J)
- Intuitive user interface in multiple languages
- Control of measurement via
  - Tablet with BAUR BUI-F app or
  - Laptop with BAUR Software 4
- Length-dependent gain for better display of remote events with the BAUR BUI-F app
- Greater convenience, as the TDR measurement can be controlled via Wi-Fi
- Integrated CAT IV/600 V separation filter for TDR measurements on live cables
- Compact system, suitable for installation in a small van

Compact and multifunctional

- Easy to operate
- Maximum safety during application
- High-performance surge voltage generator
- Proven fault pre-location methods

The compact cable fault location system, Syscompact 400, is used for the pre-location and pin-pointing of faults on power cables.

The system can be equipped with a range of surge voltage generators, which feature an automatic surge mode. The new IRG 400 time domain reflectometer can be controlled via a tablet or laptop. With the simple menu navigation and integrated location methods, cable fault location with the Syscompact 400 is fast and precise.

The IRG 400 can be operated remotely, thanks to the wireless connection of the control unit via Wi-Fi. This makes for easy and convenient performance and evaluation of the TDR measurement.

Thanks to its compact design, the Syscompact 400 is easy to transport and is also suitable for installation in any small van with a payload of 300 – 500 kg.

***with the BAUR protrac® pin-pointing system**

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Technical data

IRG 400 time domain reflectometer		
Measurement methods		▪ TDR Time Domain Reflectometry
	Option	3-phase measurement
		▪ Step TDR
	Option	3-phase measurement
		▪ SIM/MIM secondary/multiple impulse method
		▪ ICM impulse current method
	Option	▪ Decay method
Pulse voltage		60 V
Pulse width		30 ns – 10 µs
Voltage-proof up to		400 V, 50/60 Hz
Measurement category		CAT IV/600 V (Up to CAT IV/600 V in combination with the optional TDR connection cable)
Output impedance		30 ohm – 2 kOhm
Input signal gain		Dynamic range 101 dB (-63 to +38 dB)
Display range		10 m – 1000 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 system		▪ via tablet with BAUR BUI-F app ▪ via laptop with BAUR Software 4

Surge voltage generator		
Surge voltage ranges		0 – 8 kV, 0 – 16 kV, 0 – 32 kV
Surge energy	SSG 1100	1.100 J
	Option SSG 1500	1.580 J
	Option SSG 2100	2.050 J
Surge sequence		10 or 20 pulses/min, single surge
	Option SSG 1500	20 or 30 pulses/min, single surge
DC voltage		0 – 32 kV
Max. output current (burn)		DC 560 mA (0 – 8 kV)
Option SSG 1500/SSG 2100		DC 850 mA (0 – 8 kV)

Surge capacitor extension		SZ 1000	SZ 1600
Surge voltage range		0 – 4 kV	0 – 4 kV
Surge energy	SSG 1100	880 J	1.480 J
	Option SSG 1500	980 J	1.580 J
	Option SSG 2100	1.110 J	1.710 J

System	
Power supply	220 – 230 V, 50/60 Hz
Options	▪ 110 – 120 V, 50/60 Hz (with external auto transformer) ▪ 240 V, 50/60 Hz (with conversion kit for mains supply)
Ambient temperature (operational)	-10 to +50°C
Storage temperature	-20 to +60°C
Dimensions (W x H x D)	Approx. 935 x 970 x 775 mm (incl. KTG M3 cable drum rack)
Weight	From 195 kg (depending upon equipment)
Degree of protection	IP22
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

Control of the IRG 400 via tablet or laptop
(The figure is illustrative)

Standard delivery

- BAUR Syscompact 400 cable fault location system
  - IRG 400 time domain reflectometer
  - SA 32 SIM/MIM coupling unit
  - SSG 1100 surge voltage generator
  - SK 1D inductive coupler for ICM
  - 19″ rack, height 21 RU (933.45 mm), depth 700 mm, for Syscompact 400
  - 19″ drawer for tablet or laptop
  - KTG M3 cable drum rack with HV connection cable, mains supply cord and earth cable, each 25 m
  - CS 2 HV coaxial connection socket, 40 kV
- Tablet with BAUR BUI-F app

  or

  Laptop with BAUR Software 4
- GR 40 earth rod
- User manual

Optional software functions for BAUR Software 4

- Mapping (available countries on request)
- GIS interface

Accessories and options

- Conversion kit for 240 V mains supply for SSG 1100
- Conversion kit for 240 V mains supply for SSG 1500 / SSG 2100
- External auto transformer 110/230 V, 1.5 kVA, for SSG 1100
- External auto transformer 110/230 V, 3.0 kVA, for SSG 1500 / SSG 2100
- Surge voltage generator SSG 1500 instead of SSG 1100
- Surge voltage generator SSG 2100 instead of SSG 1100
- SZ 1000 surge capacitor extension
- SZ 1600 surge capacitor extension
- KTG M3 cable drum rack with HV connection cable, mains supply cord and earth cable, each 50 m
- protrac® pin-pointing system, "Acoustics" set
- GDR 40-250 discharge and earth rod
- Trolley for Syscompact 400
- Steel frame with wheels and guide rods for Syscompact 400
- Steel pallet for Syscompact 400
- TDR connection cable, CAT IV/600 V, 3-phase, 25 m, on hand cable drum
- TDR connection cable, CAT IV/600 V, 3-phase, 50 m, on hand cable drum

Syscompact 400 portable

BAUR cable fault location system

The figure is illustrative.

Portable system for pre-location and pin-pointing

- Fast and reliable
- Maximum safety during application
- High-performance surge voltage generator
- Proven fault pre-location methods

The portable cable fault location system, Syscompact 400 portable, is used for the pre-location and pin-pointing of faults on power cables. It is ideal for mobile use, without the need for permanent installation in a vehicle.

The system can be equipped with a range of surge voltage generators, which feature an automatic surge mode. The new IRG 400 time domain reflectometer can be controlled via a tablet or laptop. With the simple menu navigation and integrated location methods, cable fault location with the Syscompact 400 is fast and precise.

The IRG 400 can be operated remotely, thanks to the wireless connection of the control unit via Wi-Fi. This makes for easy and convenient performance and evaluation of the TDR measurement.

NEW:
Can be controlled via tablet with the intuitive BAUR BUI-F app

Functions

- Pre-location
  - TDR: Time Domain Reflectometry
  - Step TDR
  - SIM/MIM: Secondary/multiple impulse method with surge voltage or in DC mode
  - ICM: Impulse current method
  - Decay method (option)
- Pin-pointing*
  - Acoustic pin-pointing
  - Step voltage method for pin-pointing cable sheath faults
- DC voltage testing up to 32 kV

Features

- Surge energy up to 1,100 J (optionally up to 2,050 J)
- Intuitive user interface in multiple languages
- Control of measurement via
  - Tablet with BAUR BUI-F app or
  - Laptop with BAUR Software 4
- Length-dependent gain for better display of remote events with the BAUR BUI-F app
- Greater convenience, as the TDR measurement can be controlled via Wi-Fi
- Integrated CAT IV/600 V separation filter for TDR measurements on live cables
- No special vehicle required for transportation

***with the BAUR protrac® pin-pointing system**

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Technical data

IRG 400 time domain reflectometer	
Measurement methods	▪ TDR Time Domain Reflectometry 1- and 3-phase measurement ▪ Step TDR 1- and 3-phase measurement ▪ SIM/MIM secondary/multiple impulse method ▪ ICM impulse current method
Option	▪ Decay method
Pulse voltage	60 V
Pulse width	30 ns – 10 µs
Voltage-proof up to	400 V, 50/60 Hz
Measurement category	CAT IV/600 V (Up to CAT IV/600 V in combination with the optional TDR connection cable)
Output impedance	30 ohm – 2 kOhm
Input signal gain	Dynamic range 101 dB (-63 to +38 dB)
Display range	10 m – 1000 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 system	▪ via tablet with BAUR BUI-F app ▪ via laptop with BAUR Software 4

Surge voltage generator	
Surge voltage ranges	0 – 8 kV, 0 – 16 kV, 0 – 32 kV
Surge energy	1,100 J
Option SSG 1500	1,540 J
Option SSG 2100	2,050 J
Surge sequence	10 or 20 pulses/min, single surge
Option SSG 1500	20 or 30 pulses/min, single surge
DC voltage	0 – 32 kV
Max. output current (burn)	DC 560 mA (0 – 8 kV)
Option SSG 1500/SSG 2100	DC 850 mA (0 – 8 kV)

System	
Power supply	220 – 230 V, 50/60 Hz
Options	▪ 110 – 120 V, 50/60 Hz (with external auto transformer) ▪ 240 V, 50/60 Hz (with conversion kit for mains supply)
Ambient temperature (operational)	-10°C to +50°C
Storage temperature	-20°C to +60°C
Dimensions (W x H x D)	
with carrying handles (basic version)	Approx. 745 x 815 x 750 mm
with heavy duty wheels	Approx. 775 x 1 185 x 935 mm
Weight	From 140 kg (depending upon equipment)
Degree of protection	IP22
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

Control of the IRG 400 via tablet or laptop
(The figure is illustrative)

Standard delivery

- BAUR Syscompact 400 cable fault location system incl.
  - IRG 400 time domain reflectometer
  - SA 32 SIM/MIM coupling unit
  - SSG 1100 surge voltage generator
  - SK 1D inductive coupler for ICM
  - 19″ rack for Syscompact 400, height 21 RU (933.45 mm), depth 700 mm, incl. heavy duty wheels and handle
  - 19″ drawer for tablet or laptop
  - HV connection cable, 10 m
  - Earth cable, 10 m, with earth terminal
  - Mains supply cord, 10 m
- Tablet with BAUR BUI-F app

  or

  Laptop with BAUR Software 4
- IRG connection cable, 3-phase, 10 m
- GR 40 earth rod
- User manual

Optional software functions for BAUR Software 4

- Mapping (available countries on request)
- GIS interface

Accessories and options

- Conversion kit for 240 V mains supply for SSG 1100
- Conversion kit for 240 V mains supply for SSG 1500 / SSG 2100
- External auto transformer 110/230 V, 1.5 kVA, for SSG 1100
- External auto transformer 110/230 V, 3.0 kVA, for SSG 1500 / SSG 2100
- External auto transformer 127/230 V, 3.0 kVA, for SSG 1500 / SSG 2100
- Surge voltage generator SSG 1500 instead of SSG 1100
- Surge voltage generator SSG 2100 instead of SSG 1100
- protrac® pin-pointing system, "Acoustics" set
- GDR 40-250 discharge and earth rod
- HV connection cable, 25 m, with HV coaxial connection socket
- HV connection cable, 50 m, with HV coaxial connection socket
- TDR connection cable, CAT IV/600 V, 3-phase, 25 m, on hand cable drum
- TDR connection cable, CAT IV/600 V, 3-phase, 50 m, on hand cable drum

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