ACTAS

Circuit Breaker Testing

Operating Instructions

ACTAS P260+ / P360+

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Even if a trademark symbol ® or ™ is not given, it does not necessarily follow that a term used in this document is not a brand name.

1 ACTAS P260+ and P360+ switchgear test systems



ACTAS P260+ and P360+ are flexible and compact test systems for testing high- and medium-voltage switchgear devices. They can be operated and controlled by means of the built-in control panel equipped with a high-resolution, resistive 7" touch screen and two function keys. By connecting up directly with a PC or laptop computer, the measurement results saved in the test system can be downloaded and managed with the aid of the user-friendly software. The PC can be linked up via an Ethernet interface (RJ45) or a direct USB connection.

Control outputs are used to cause the device under test to perform a switching operation. The reaction of the device under test is recorded in real time synchronously to signal output and then evaluated by the software running on the test system. The evaluation can also be carried out on a PC.

ACTAS P260+|P360+ have been specially developed for harsh transport and operational conditions. A high level of system integration has made it possible to realize a compact design in a robust, portable hard-top case.

2 About this document

These operating instructions describe how to commission, connect, operate, control and maintain ACTAS P260+|P360+ switchgear test systems.

These operating instructions are intended for:

- Persons who know how to switch on and off, enable, earth and identify electrical circuits and devices/systems in accordance with the applicable safety standards
- Trained operating personnel in electrical installations

2.1 Other applicable documents

A number of other documents apply in conjunction with these operating instructions. The manufacturer is not liable for damages resulting from failure to comply with information contained in any of these documents. All documentation pertaining to the commissioning, configuration of settings, operation and maintenance of ACTAS P260+|P360+ switchgear test systems also applies.

2.2 Validity of the present document

These operating instructions apply only to switchgear test system with the type designation **ACTAS P260+** and **ACTAS P360+**.

The type designation and the serial number of the test system are detailed on the rating plate.

2.3 Warning marks and symbols

⚠ DANGER

Identifies an imminent hazard. Non-observance of the safety information will result in death or extremely serious injuries.

⚠ WARNING

Identifies a possible dangerous situation. Non-observance of the safety information can result in death or extremely serious injuries.

⚠ CAUTION

Identifies a possible dangerous situation. Non-observance of the safety information can result in minor or slight injuries. It may also be used as a warning against property damage.

NOTICE

Identifies a potentially harmful situation.

Non-observance of the safety information can result in damage or destruction of the product and/or of other system components.

NOTE

Identifies information or notes.

2.4 Typographical conventions

Symbol	Explanation
➤	This symbol highlights instructions which require action on the part of the user
1. 2.	Numbered lists are used for actions which must be carried out in the order given
■	This symbol marks the items of a list

3 Basic safety information

⚠ WARNING

The safety information and regulations detailed below must be complied with!
The relevant regulations issued by the appropriate institutions for statutory accident insurance and prevention (professional and trade associations) must be followed.

Non-observance of the safety instructions and regulations, incorrect use of this product or use other than the intended use can can lead to material damage and/or injuries or even death.

3.1 General information

⚠ WARNING

These operating instructions must be read and understood in full before the device is put into operation. They must be kept for future reference and be made available to anyone who uses the device throughout its operational life.

3.2 Qualifications of operating personnel

This product may only be used by qualified personnel in accordance with safety rules and regulations. During use the statutory provisions and safety regulations for the specific application must also be observed.

The term "qualified personnel" refers to persons who are familiar with the set-up, commissioning and operation of the product and who have appropriate qualifications:

- Training or instruction and authorization to switch on and off, isolate, earth and mark accordingly electrical circuits and devices in accordance with safety standards
- Instruction in accordance with the regulations of the appropriate institutions for statutory accident insurance and prevention (professional and trade associations)
- Safety standards in the care and use of appropriate safety equipment

3.3 Intended use

The test system is manufactured in accordance with the state of the art and recognized safety rules.

However, improper use or use other than the intended use can endanger the life and limb of users or third parties and cause damage to the test system or other property.

The manufacturer is not liable for consequential damage arising as a result of use other than the intended use. Any claims under the guarantee are void.

No modifications may be made to the test system other than those which are described in this document or in the other applicable documents.

The test system may only be used for the applications listed below:

- Function test for switchgear devices
- Determination of resistances and operating times in combination with PROMET ohm meters
- Function test of switchgear device components in combination with EPOS motor and coil test systems.

3.4 Safe operation

If there is any reason to suppose that the test system cannot be operated without risk, it must be put out of operation immediately and secured against unintended start-up.
This applies if, for example:

- There is obvious damage to the test device or accessories.
- The test device or accessories do not work properly although the power supply is intact.
- The test device or accessories have been exposed to unfavourable conditions for a significant length of time (e.g. storage at temperature and humidity levels which are beyond the permissible limits without gradual adjustment to the indoor environment).
- The test device or accessories have been exposed to undue transport stresses even if there is no visible external damage.

3.5 Personal protective equipment

The regulations on personal protective equipment laid down by the company operating the test system at the installation location apply. No additional protective equipment is required.

4 Commissioning

Proper transport, specialist storage, set-up and commissioning and careful operation, maintenance and servicing are essential in order for the device to function perfectly and safely.

NOTICE

Check that the delivery is complete and was not damaged during transport. Do not put the device into operation if there is any damage.

4.1 Transport and storage



The following regulations apply for the transport and storage of the tests system:

- Keep upright; avoid strong vibrations and mechanical influences
- Keep the test system dry
- Protect the test system from direct sunlight and heat

4.2 Unpacking

Unpack with care using suitable tools only. Keep the original packaging for future transport.

- Check the packing list to make sure no items are missing
- Perform a visual inspection to check that the product is in perfect condition

4.3 Requirements to be fulfilled by the installation location

- Impermissible environmental conditions may result in damage to the test system and jeopardize safe operation
- Ensure environmental conditions conform to the technical data specified
- Avoid air pollution
- Avoid high levels of air humidity
- When open, the test system offers no protection against moisture penetration. Damp and wetness can damage the test system and cause dangerous short circuits
- When the test system is moved from a cold environment into a warm one, condensation can be a source of danger
- Observe earthing regulations

⚠ WARNING

Risk of explosion

Gases may ignite as a result of sparking which may occur while connecting or operating the test system.

Do not use the test system in environments with explosive gases, vapours or dust.

4.4 ACTAS P260+ and P360+



1. Connection to power supply and on/off switch
2. Earthing socket
3. Relay outputs
4. PIR and main contact inputs
5. Sensor inputs
   Green: +/-10 V / digital
   Blue: +/-10 V / 0...20 mA
6. Auxiliary contact inputs
7. Coil/motor/station voltage measurement input and motor current measurement input via shunt
8. I/O coils control outputs
9. PC interface/storage medium (RJ45; USB A; USB B)
10. PROMET and CSW3 interfaces



1. Connection to power supply and on/off switch
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11. PROMET and CSW3 interfaces

4.5 Touchscreen

Notice

The resistive touch screen reacts to pressure and can therefore also be operated when wearing gloves, for example.

To avoid damage, never use hard or sharp objects to operate the touch screen!



Using the built-in touch screen, it is possible to carry out all the tasks connected with operation and configuration. The measurement results obtained are displayed and an analysis of the results can be carried out directly on the test system itself.

The functions fall into three categories:

Operate

- Test
- Create and edit switchgear
- Create and edit jobs

Administrate

- Configure ACTAS
- Carry out service tasks such as updates etc.

Help & Info

- Info such as user manuals etc.

4.6 Function keys



The function keys ▶**OK** and ■**ESC** are used to start and stop tests.

5 Connect the test system

5.1 Power supply



The device is connected to the power supply by means of a two-pole-and-earth socket-outlet using the power cable provided.

An approved connection cable must be used for the connection to a DC voltage source such as a station battery. The polarity of the conductors is irrelevant.

⚠ WARNING

Incorrect connection to the power supply can cause death or injury from electric shock!

NOTICE

- Operating the test system with an incorrect power supply voltage may damage it and leads to loss of the guarantee.
- The test system may only be operated within the power supply voltage range detailed on the rating plate.
- Check the voltage and frequency of the power supply before connecting the test system to the power supply.

5.2 Earthing

- The test system is earthed via the connection to the power supply or the separate earthing socket.
- Make sure that the connection to the power supply has an earth continuity conductor. The earth connection should never be interrupted, either inside or outside the test system. Never use an extension cord without an earth continuity conductor, for example.
- If, for example, the test system is supplied with electricity from a station battery and no earth continuity conductor is available in the power supply, the test system must be earthed using the separate earthing socket.

⚠ WARNING

- The device must never be operated without adequate earthing.
- Always check the earth connection before start up.

NOTICE

For reasons of safety, it is recommended that the test instrument always be connected to the station earth via the earthing socket.

5.3 Switch on the test system



The test system is switched on at the main switch in the front of the device.

NOTE

After switching on the device and before starting a test, a short warm-up phase should be waited for to ensure safe operation of the integrated voltage sources.

6 Connect the device under test

⚠ WARNING

- The switchgear device to be tested is to be earthed on both sides when the measuring leads are being attached to avoid danger to personnel from capacitively or inductively coupled voltages from neighbouring lines.
- Make sure the test system is switched off before connecting a device under test
- The device under test may only be connected to or disconnected from the test system when it is absolutely certain that no test values are available at the outputs
- For reasons of safety, only measuring leads with plugs which are safe to touch may be used. The measuring leads must be fully insulated. During tests, high voltages which are life-threatening if touched are sometimes present at the output sockets
- Measuring leads, sockets and plugs must be checked for cracks, breaks, or faulty insulation before use. Check the continuity of the measuring leads and replace any which are damaged, also check the insulation of the measurement sockets
- Only use measuring leads which can be firmly fixed to the device under test by means of plug-in contacts, clamps or cable lugs
- Use measuring leads which are as short as possible. Particularly when connecting the operating coils and the measuring loop for the motor current measurement, it is essential to check the correct dimensioning of the conductor cross-sections
- Remove any superfluous measuring leads

⚠ WARNING

- During connection, the drive unit must be put out of operation by interrupting the power supply, for example. In addition, all drive energy must be discharged in the case of drives with an energy storage mechanism (spring, hydraulic or pneumatic)

6.1 PIR and main contacts



Fig.: ACTAS P360+ with four PIR and main contact inputs per pole

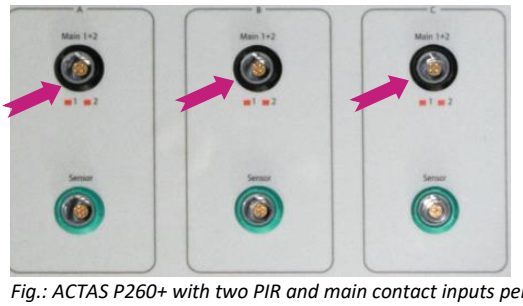


Fig.: ACTAS P260+ with two PIR and main contact inputs per pole

To determine the operating times of the individual interrupter units, the status of the main contacts can be captured for poles A, B and C via four PIR and four main contact inputs (with ACTAS P260+ via two PIR and two main contact inputs).

Using the same inputs it is also possible to carry out a PIR measurement to record the resistance characteristic of the closing and opening resistors.

- R < 5 Ω — Main and resistive contact closed
- 5 Ω < R < 10 kΩ — Resistive contact closed
- R > 10 kΩ — Main and resistive contact open

6.1.1 Connection cables

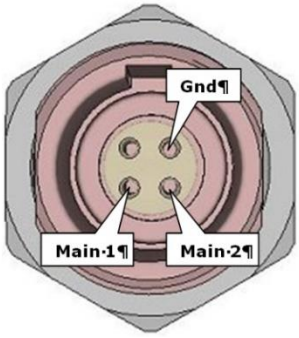


To make the connection, ACTAS connection cables with a black screw connection on the connection plug and labelled with **Main** should be used.

To distinguish the connected poles, the identification is made in red, yellow and blue.

The connection between connection cable and main contact can be made with single-pole measuring leads with crocodile clips.

6.1.2 Assignment connection socket



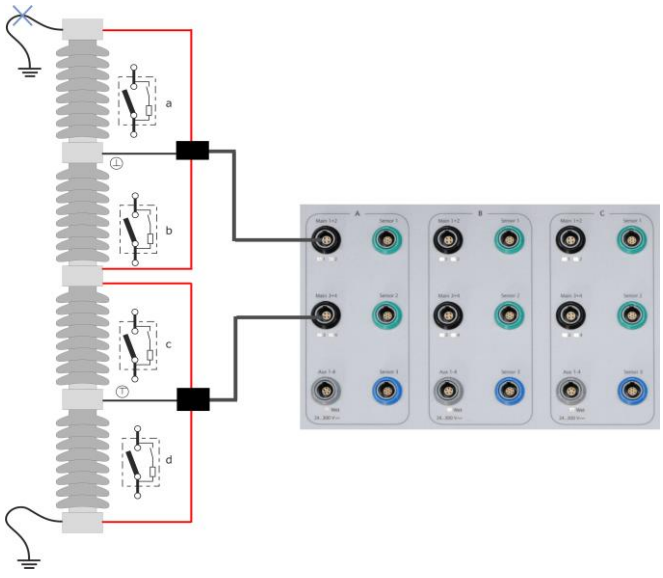
Main

Label socket: ***Black***

PIN	***Signal***	***Wire colour***
1	-	-
2	Main 1/ Main 3	White
3	Main 2 / Main 4	Brown
4	Gnd	SHIELD

6.1.3 Example of how to connect 1 main contact with 4 interrupter units to ACTAS P360+

During the test, earthing must be removed on one side of the breaker pole!



During the test, earthing should be inserted on one side!

NOTE

- During tests the earth conductor must be removed on one side of the switchgear device. Two-pole earthing would lead to the main contact status being permanently evaluated as closed providing the total resistance of the earth loop did not exceed 30 Ω
- In the case of in-plant tests, the earth connection should always remain in place on the side on which there is the greatest danger of capacitively or inductively coupled voltages (e.g. from bus bars running in parallel and currently in operation).

6.2 Auxiliary contacts



Fig.: ACTAS P360+ with twelve auxiliary contact inputs



Fig.: ACTAS P260+ with eight auxiliary contact inputs

The functioning of the auxiliary contacts must be checked as regards operability, operating time and synchronism with the main contact.

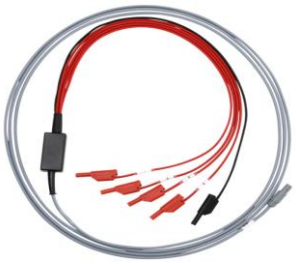
The status of the auxiliary contacts of a switchgear device can be recorded via the auxiliary contact inputs. With ACTAS P360+ it is possible to record 12 auxiliary contacts, with ACTAS P260+ it is possible to record 8 auxiliary contacts.

The test systems feature internal switching for wet auxiliary contacts or voltage provision by ACTAS, see under **Settings for the switchgear device**.

The auxiliary voltage supplied by ACTAS is 24 VDC. The input signal range is between 24 and 300 VDC.

The different functions of the auxiliary contacts (normally closed, normally open or wiper contact elements) are automatically evaluated.

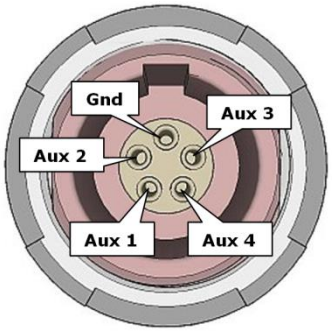
6.2.1 Connection cables



To make the connection, ACTAS connection cables with a grey screw connection on the connection plug and labelled with **Aux** should be used.

To distinguish the connected poles, the identification is made in red, yellow and blue.

6.2.2 Assignment connection socket

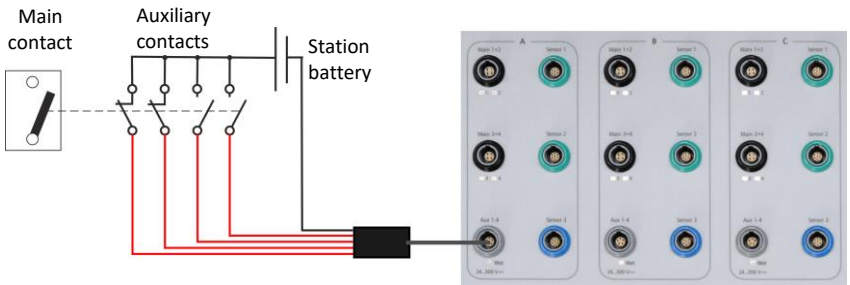


Aux

Label socket: ***Grey***

PIN	*Signal*	*Wire colour*
1	Gnd	
2	Aux 2 / Aux 6	White
3	Aux 1 / Aux 5	Brown
4	Aux 4 / Aux 8	Green
5	Aux 3 / Aux 7	Yellow

6.2.3 Example of how to connect 4 auxiliary contacts to ACTAS P360+



6.3 Travel transducers and sensors

NOTICE

When connecting a travel sensor it is imperative to avoid a long-lasting short-circuit of the reference voltage as this could lead to the destruction of the internal supply. If the sensors or connecting leads in use are not provided by KoCoS or if the connection leads have been self-assembled, it is essential to ensure that the external incremental sensor is provided with the correct supply voltage. Using the wrong signal voltage may result in damage to the sensor or to the test instrument.

NOTE

The interface of the sensors in use must be RS422-compliant. Sensors with 2-track(A/B) and 4-track (AĀ/BB) technology can be used.

6.3.1 Analog 0-10 V DC and incremental



Fig.: ACTAS P360+



Fig.: ACTAS P260+

It is possible to connect analog as well as incremental sensors to the green connections.

10 VDC inputs are available for the analog sensors, appropriate digital inputs are available for the incremental sensors.

A stabilized reference voltage of 10 VDC to supply the travel transducers and sensors is provided.

6.3.1.1 Connection



To make the connection, ACTAS connection cables with a green screw connection on the connection plug should be used.

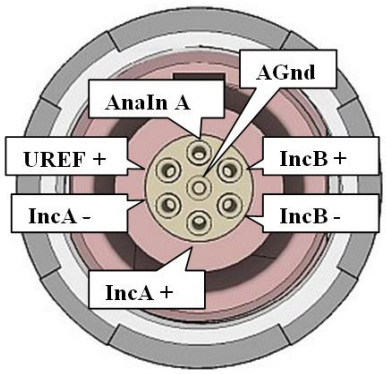


Fig.: Assignment connection socket

Inc / Analog IN

PIN	*Signal*		*Wire color connecting cable*
1	*AnaIn A*	*Analog input +10 V*	*white*
2	*UREF +*	*Reference voltage +10 V*	*brown*
3	*Inc A-*	*Signal input A-*	*green*
4	*Inc A+*	*Signal input A+*	*yellow*
5	*Inc B-*	*Signal input B-*	*grey*
6	*Inc B+*	*Signal input B+*	*pink*
7	*AGnd*	*Supply ground/Signal ground*	*SHIELD*

6.3.2 Analog 0-20 mA and 0-10 V DC



Fig.: ACTAS P360+



Fig.: ACTAS P260+

It is also possible to connect two different types of sensor to the blue connection. For this purpose, a 10 VDC measurement input and a 0…20 mA measurement input are available.

A stabilized reference voltage of 10 VDC to supply the travel transducers and sensors is provided.

6.3.2.1 Connection



To make the connection, ACTAS connection cables with a blue screw connection on the connection plug should be used.

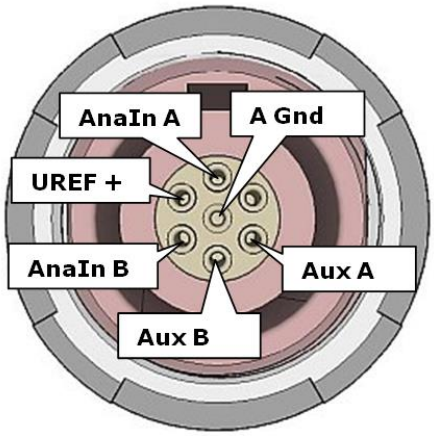


Fig.: Assignment connection socket

Analog IN

PIN	*Signal*		*Wire color connect. cabel*
1	AnaIn A	Analog input +10 V	white
2	UREF +	Reference voltage +10 V	brown
3	AnaIn B	Analog input +10 V (nur P360+)	green
4	Aux B	Analog input +-20 mA	yellow
5	Aux A	Analog input +-20 mA	grey
6		nc	pink
7	A Gnd	Supply ground/Signal ground	SHIELD

6.4 Coil/motor/station voltage and motor current



Fig.: ACTAS P360+ with three voltage measurement inputs

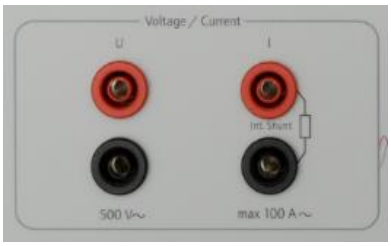


Fig.: ACTAS P260+ with one universal voltage measurement input

ACTAS P360+ also offers the option of recording three voltages during a switchgear test. Two measurement inputs with a measuring range up to max. 300 V and one measurement input with a measuring range of up to max. 500 V are provided for this purpose.

ACTAS P260+ has one universal measurement input with a measuring range of up to max. 500 V.

With P260+ and P360+ the motor current can be measured directly via a shunt which is integrated in the test system. The current measurement has a measuring range of up to 100 A.

⚠ CAUTION

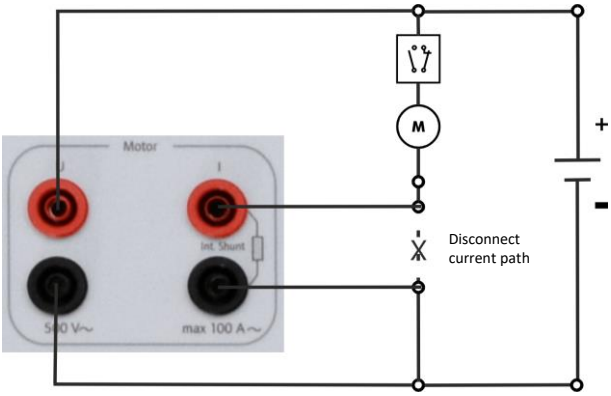
During the current measurement, the 4 mm safety sockets may only be applied with up to 100 A peak for short periods, less than 200 ms. The rated current is 32 A.

6.4.1 Connection cables



During voltage measurements, the connection should be made with ACTAS connection cables labelled with **Voltage**, during current measurements, the connection should be made with cables labelled with **Current**.

6.4.2 Connection example for motor current/voltage measurement on charging motor



The motor voltage can be recorded in parallel with the motor current via the measurement input **U**.

As the test instruments only have one measurement input for the motor current, the motor current test for breakers with a single-pole drive must be carried out pole by pole. This means that for a full test of all three drives, three records must be made. If the motor loaded mechanism is controlled sequentially then the measurement of the motor current of all tensioning motors can be carried out in a single measurement.

6.5 Electronic control outputs

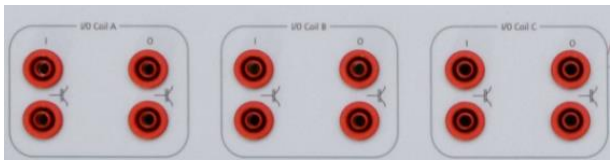


Fig.: ACTAS P360+ with control outputs for three closing- and three opening coils

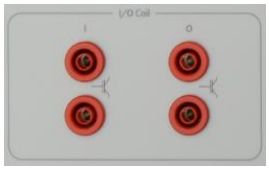


Fig.: ACTAS P260+ with control outputs for one closing and two opening coil

Electronic control outputs (IGBTs) with which d.c. and a.c. voltage coils can be operated are used to operate the switching coils.

The electronic control outputs are able to achieve a much higher degree of accuracy than would be possible with conventional relay outputs. The closing/opening delay of the electronic outputs amounts to just one microsecond.

The coil operating currents are measured using shunts integrated in the test system with a maximum measuring range of 100 A.

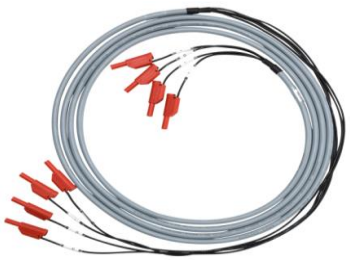
The currents in the closing and opening circuit are galvanically isolated for each phase, but are measured on a common analog input. It is therefore possible to supply closing and opening circuits with electricity from different electrical circuits.

In the case of ACTAS P360+, it is also possible to connect three different coil circuits directly, if the control is not carried out pole by pole, see under **Configure switchgear type/Construction/Coils**

⚠ CAUTION

During the current measurement, the 4 mm safety sockets may only be applied with up to 100 A peak for short periods, less than 200 ms. The rated current is 32 A.

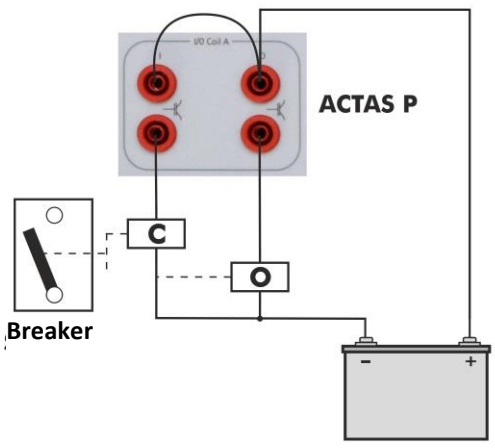
6.5.1 Connection cables



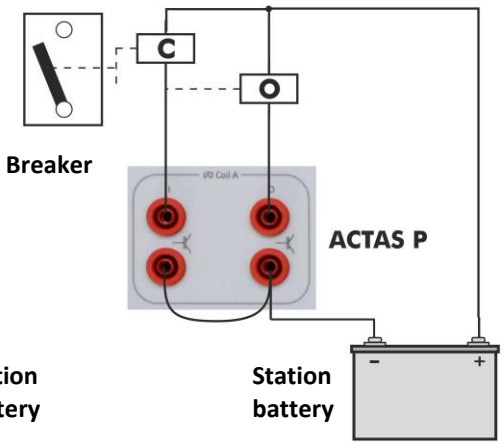
To make the connection, ACTAS connection cables labelled with **I/O Coil** should be used.

6.5.2 Connection example on the plus or ground branch of the operating coil

IGBT output in the positive branch



IGBT output in the negative branch



6.6 Relay outputs

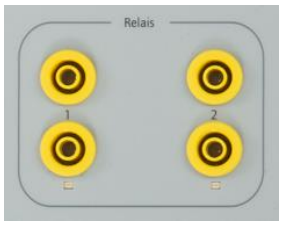


Fig.: ACTAS P360+ with two relais outputs

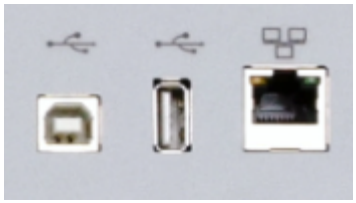


Fig.: ACTAS P260+ with one relais output

The relay outputs are controlled via the software just like the IGBT control outputs. Switch-on and switch-off times can be set which are oriented to the start and end time of the test, see under **Settings for the switching device/Relays**.

7 Connect peripherals

7.1 Interfaces



USB B

The passive USB B interface is used for the communication with a PC.

USB A

The active USB A interface is used for the communication with a storage medium to read in or to issue data.

USB flash drives must be formatted as FAT/FAT32.

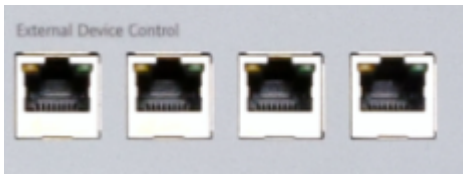
It is also possible to operate a specific printer on this interface.

In addition, a KoCoS-approved wireless adapter can be connected here, see below.

Ethernet

The RJ45 interface serves to connect the test system to a network or PC.

7.1.1 Interfaces for external devices



External Device Control

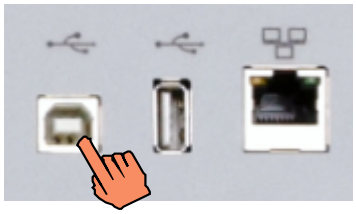
Using RJ45 interfaces it is possible to integrate up to 3 PROMET SE ohm meters, or up to 6 PROMET ohm meters when a CSW 3 connection unit is in use. The measuring devices are controlled by ACTAS. This makes it possible to carry out resistance measurements and to determine operating times simultaneously on three poles with two interrupter units each. When PROMET devices are involved, switchgear tests can be carried out with earthing on both sides.

7.2 Connect test system to PC

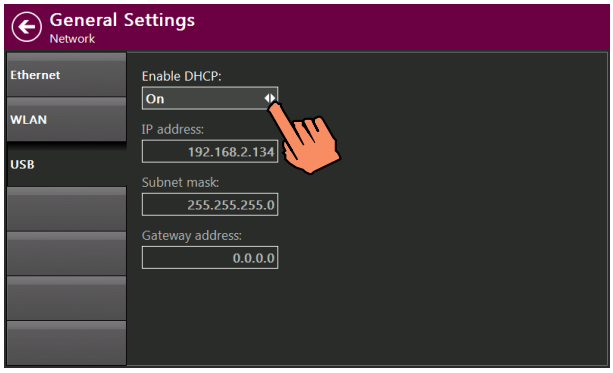
Using the ACTAS testing software, data saved on a test system can be viewed, edited and loaded to an end device, such as a PC, mobile phone or tablet computer, via an Ethernet, a USB or a wireless LAN connection.

Once the remote function has been activated, the test system can also be operated by remote control using the ACTAS testing software or a web browser.

7.2.1 USB



- Connect the USB interface with the PC



- Call up **Configuration > General Settings > Network > USB** on the device display
- Set **Enable DHCP** to **On**

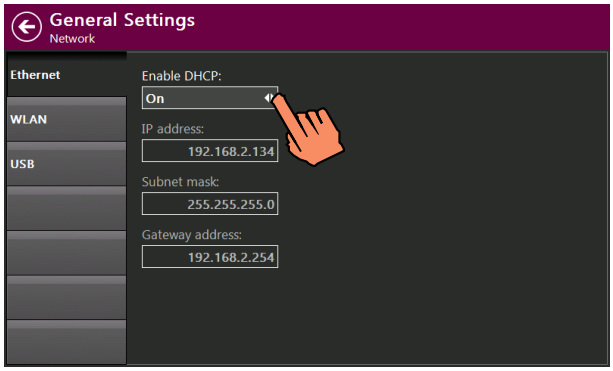
The connection is established and is active when the IP address is displayed on the device display.

- Connect the software with the test system, see the user manual for the ACTAS testing software

7.2.2 Ethernet



- Connect the RJ45 interface with the network



- Call up **Configuration > General Settings > Network > Ethernet** on the device display
- Set **Enable DHCP** to **On**

The connection is established and is active when the IP address is displayed on the device display.

- Connect the software with the test system, see the user manual for the ACTAS testing software

7.2.3 Wireless LAN

Using the wireless LAN module available as an optional extra, a wireless connection can be made between the test system and an end device such as a PC, mobile phone or tablet computer. The connection is made via a web server.



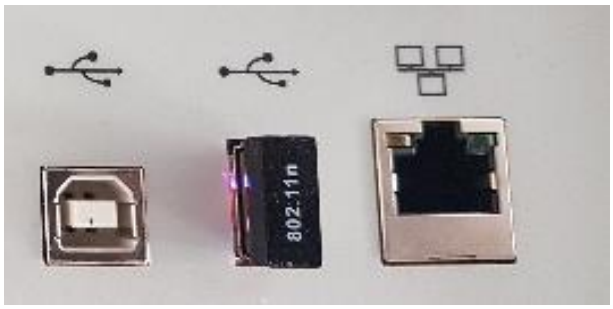
Set up the wireless LAN module

- Insert rechargeable battery in the wireless LAN module
- Write down the SSID and WIFI KEY
- Switch on wireless LAN on the end device and select and connect the SSID of the module
- Enter the WIFI KEY



➤ Press the key of the wireless LAN module

Once the wireless LAN module has been successfully connected to the end device, a green wireless LAN symbol lights up.

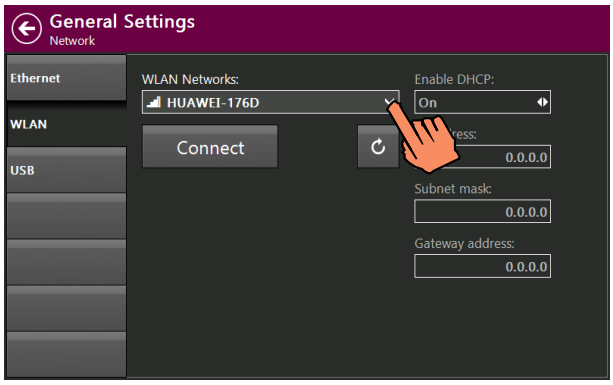


Set up the test system

➤ Insert the wireless adapter into the USB A port

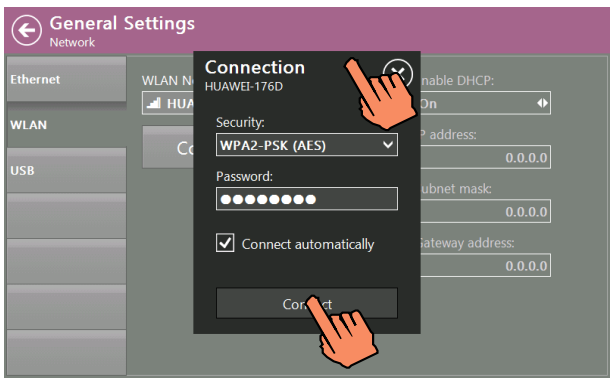
NOTE

To ensure the connection is successful, plug in the WLAN stick only after the WLAN module has been activated.



➤ Select the wireless LAN module on the device display under **Configuration > General Settings > Network > WLAN**

➤ Tap **Connect**

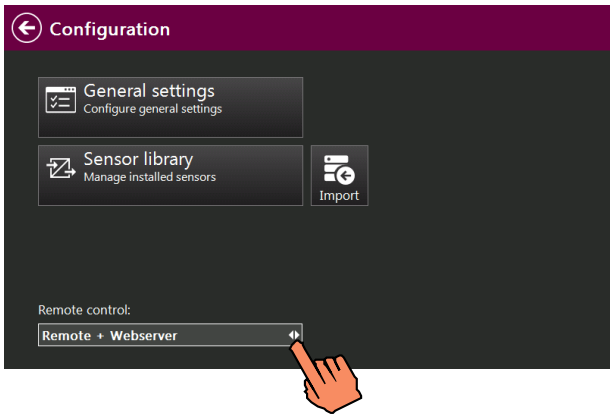


➤ Under **Security** select **WPA2-PSK (AES)** and enter the password (WIFI KEY)

➤ Tap **Connect**

➤ Connect the software with the test system, see the user manual for the ACTAS testing software

7.3 Activate remote control



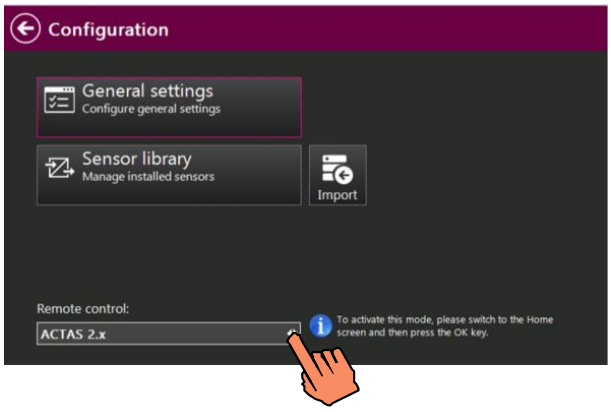
The test system can be operated by remote control with an end device such as a PC, mobile phone or tablet computer.

Set the mode for remote control

Remote
The test system can be operated with a PC with ACTAS P or ACTAS Expert software. For more information, see the manual for the ACTAS software.

Web server
The test system can be operated via a web server. To do so, the IP address of the test system must be entered in the browser with the suffix **/remote.html**. The IP address is displayed under **General Settings/Network**.

7.3.1 Remote control with the ACTAS 2.x software

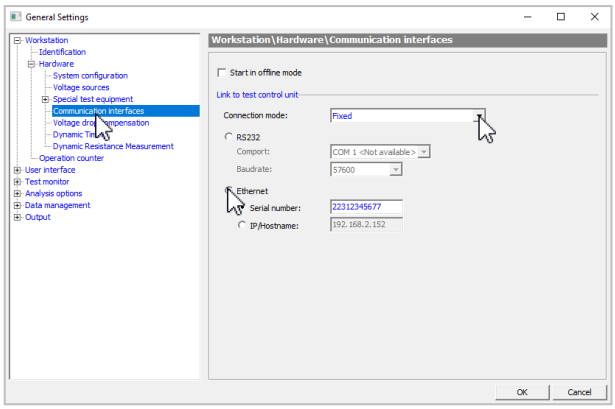


The test system can be operated with a PC with ACTAS 2.x software. This makes it possible to carry out tests created in ACTAS 2.x using an ACTAS P test system and to evaluate the results in ACTAS 2.x.

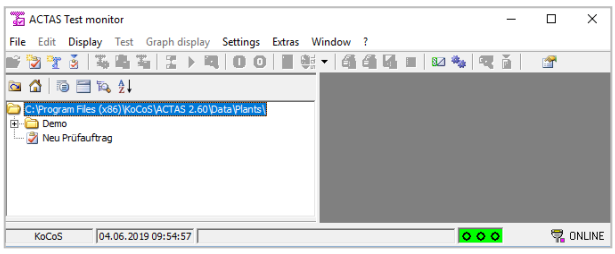
- Select ACTAS 2.x

NOTE

To activate the mode, return to the start screen and press the **OK** key. To end the mode, press the **ESC** key.



- In the ACTAS 2.x software, go to **Settings/General Settings/Workstation/Hardware/Communication Interfaces**
- Set the **Connection mode** to **Fixed**
- Click **Ethernet**
- Enter the the serial number or the IP address of the device
- Confirm settings with **OK**

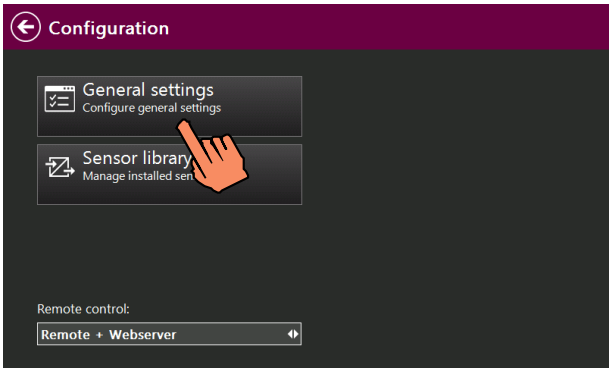


The display for the connection status changes to **ONLINE**.

8 General settings



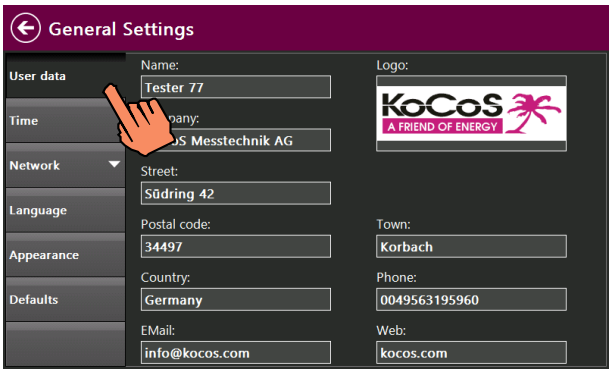
The general settings and the sensor library can be found in the **Administrate** function group, under **Configuration**



Under **General Settings**, settings can be made for user data, time, network, language and appearance as well as for defaults.

When a user exits the general settings, a message is shown asking whether or not the change is to be saved. Some changes also require the system to be restarted. If so, a message is displayed to this effect.

8.1 User data

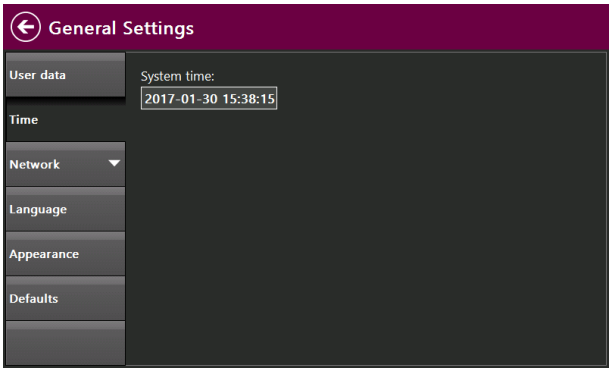


➤ Enter user data

Additionally, a graphic can be read in under **Logo** using a USB flash drive.

The user data entered here appears in test reports.

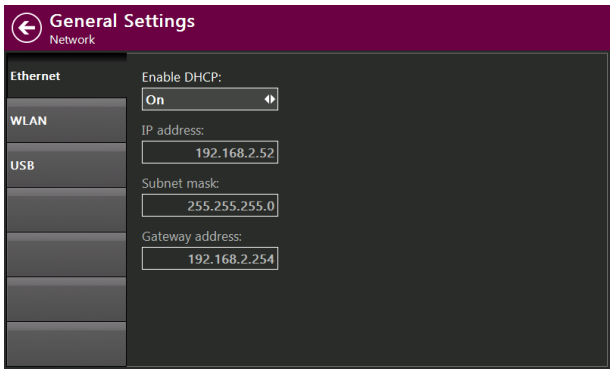
8.2 Time



➤ Set the system time

The system time appears in test reports.

8.3 Network

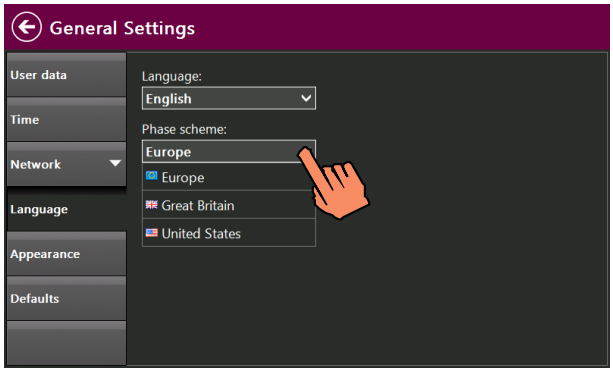


- Enter network settings

In order to be able to connect the test system in a network or with a computer, the appropriate settings must be made here.

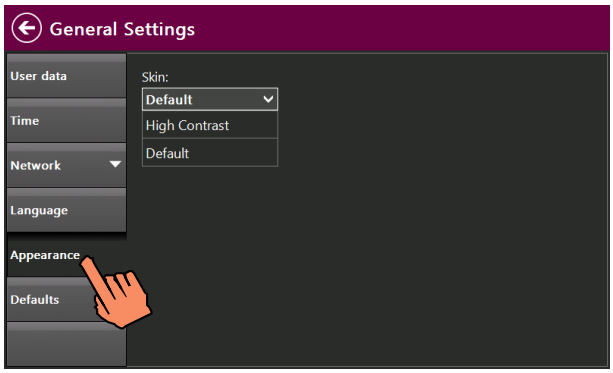
It is possible to obtain an IP address automatically via DHCP. The **DHCP** function must be enabled for this purpose.

8.4 Language and phase scheme



- Select a language
- Select a phase scheme for the signal colours in the recordings and in the test report

8.5 Appearance

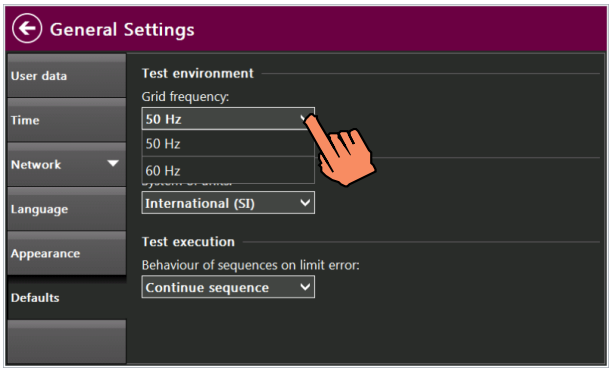


- Select a setting for the touch screen display

8.6 Defaults

The default settings apply to all switching devices or tests. However, it is possible to change the default settings for each switching device individually, see **Settings for the switching device/General settings**.

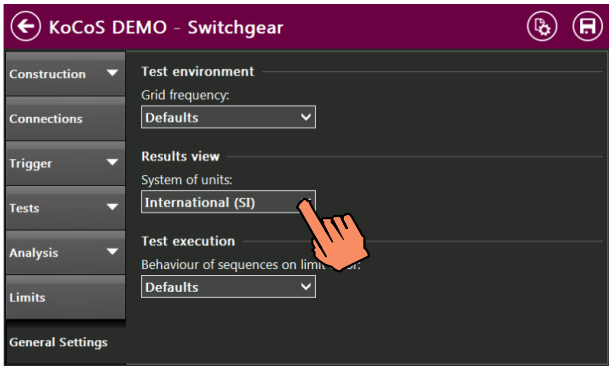
8.6.1 Grid frequency



➤ Set mains frequency as reference variable for the test environment

Changing the setting will only affect new tests.

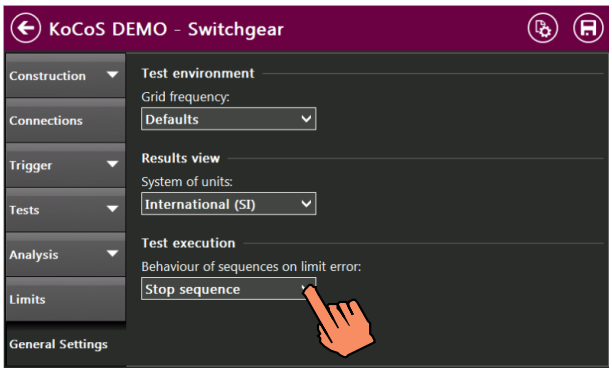
8.6.2 Result view



➤ Set unit system for evaluation

The default setting offers the possibility to use imperial units (ft, inch, ft/s etc.) for the evaluation in addition to the international system of units (SI).

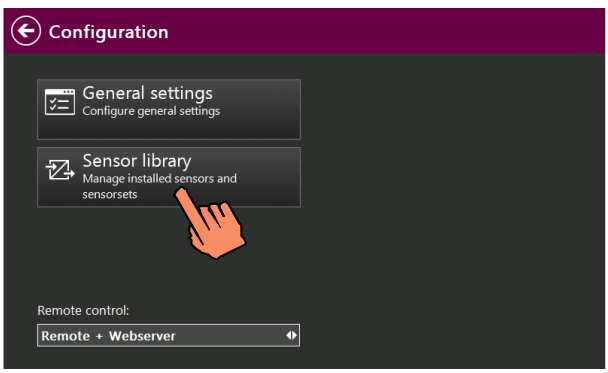
8.6.3 Test execution



➤ Set behavior in case of limit value violation

For the limit values created in the PC software, it is possible to preset whether the test sequence should be stopped or continued in the event of a limit value violation, see also under **Limit values**.

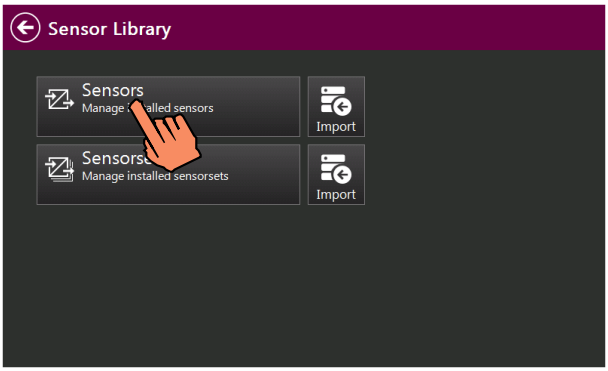
8.7 Sensor library



Sensors ans sensor sets with the required parameters can be created in the sensor library or imported from a USB data carrier using the Import function.
When parameterising switching devices, it is then possible to insert sensors or sensor sets directly from the library.

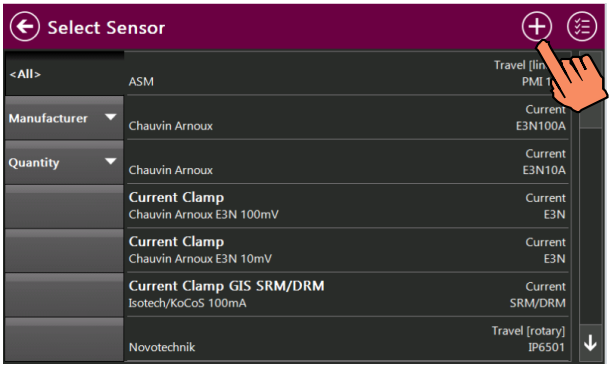
➤ Tap the sensor library to open it

8.7.1 Sensors

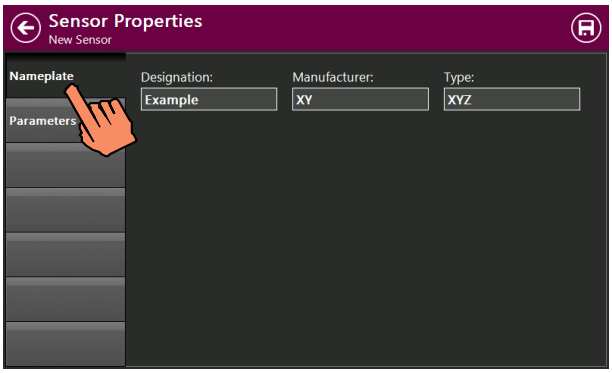


➤ Tap **Sensors**

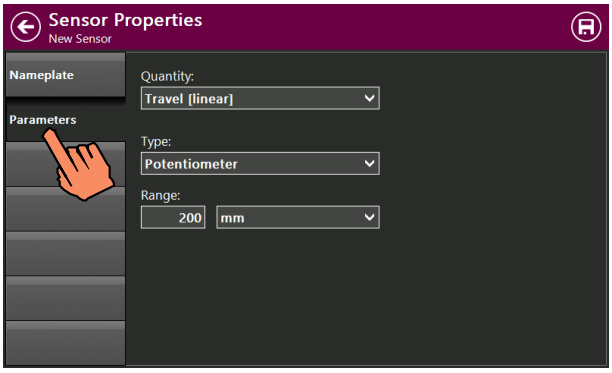
The sensor database is opened, sensor types can be edited and managed.



➤ Select a sensor or add a new sensor



➤ Fill in the sensor nameplate

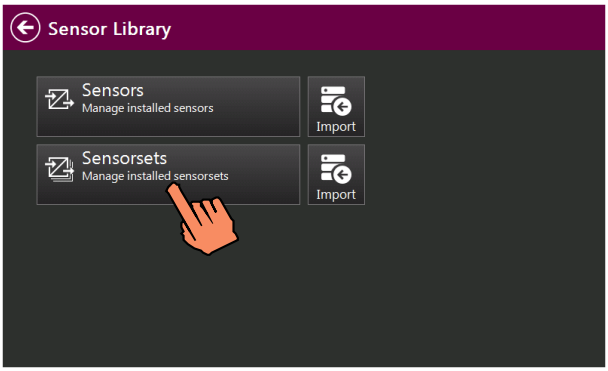


➤ Select measurement quantity and define parameters

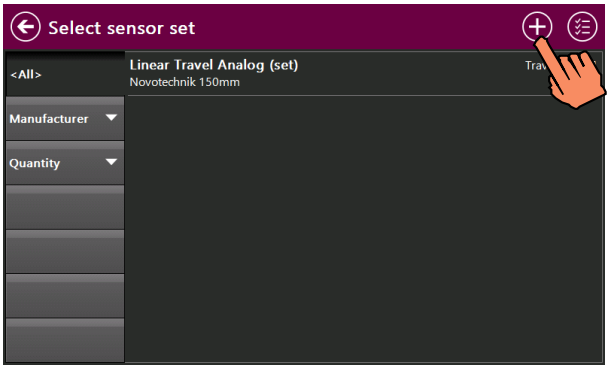
For measuring transducers such as current clamps, the transducer ratio can be entered directly, e.g. 1 A / 3 mA.

➤ Save entry

8.7.2 Sensor sets for analog linear transducers

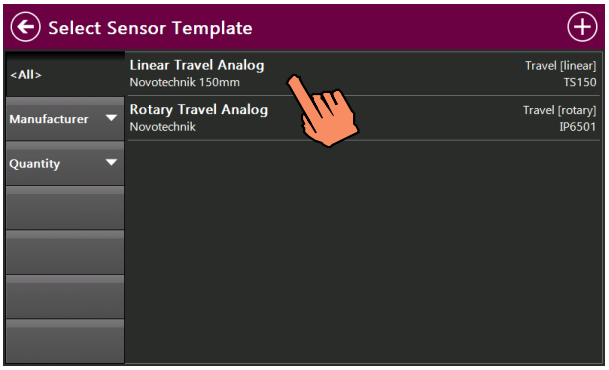


➤ Tap on **Sensorsets**
The sensor database is opened.



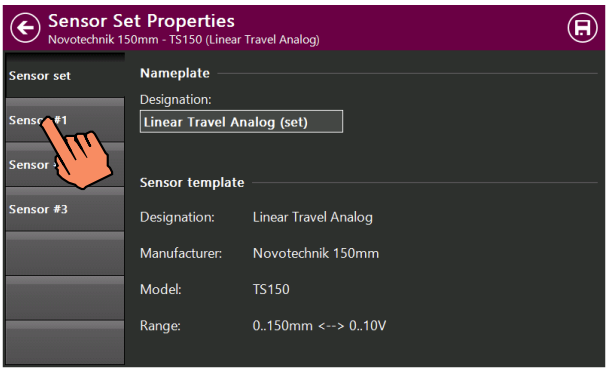
All sensor sets stored in the sensor library are displayed.

➤ Tap ⊕ to create a new sensor set



The applied analog displacement sensors are displayed.

➤ Select an existing sensor to create a sensor set of this sensor type

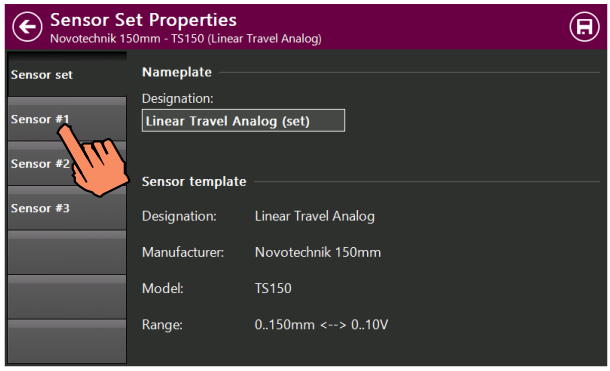


A sensor set with three sensors of the selected sensor type is created.

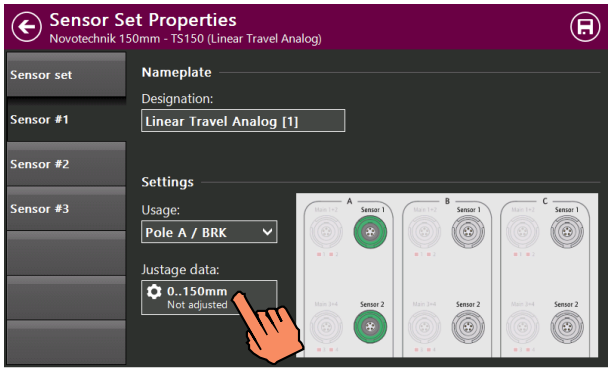
By tapping on the sensors 1-3, the respective sensors can be assigned to the switch poles and adjusted.

8.7.3 Adjust sensor

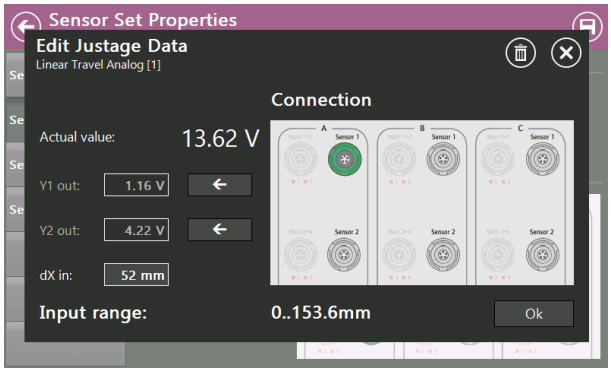
The individual sensors of a set can be adjusted to exclude deviations due to different measuring accuracies.



- Tap the sensor



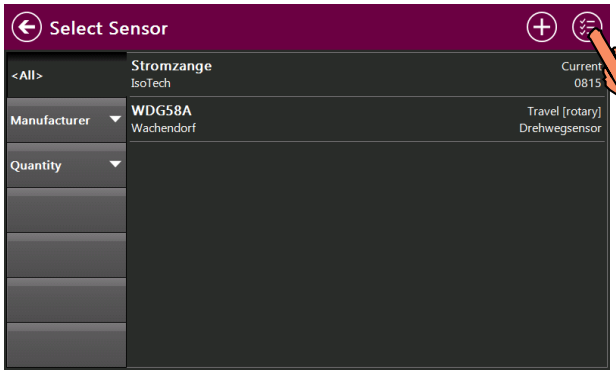
- Tap in the **Adjustment data** field



- Connect sensor
- Move the sensor to a defined position, for example by approaching a gauge block, and use ← to define the first adjustment point
- Move a defined distance and use ← to define the second adjustment point.
- Enter the length of the defined path in the **dX in** field

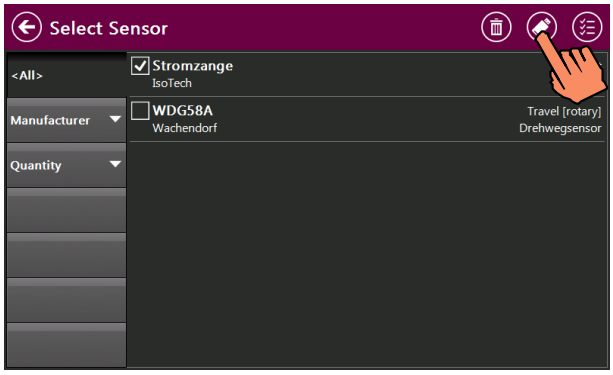
The actual input range of the sensor is automatically calculated, displayed and stored for correction during measurements with the sensor in question.

8.7.4 Export sensor data



To use sensor data, sensors and sensor sets e.g. on another test system, it can be exported to a USB storage medium.

- Tap the button for selection view



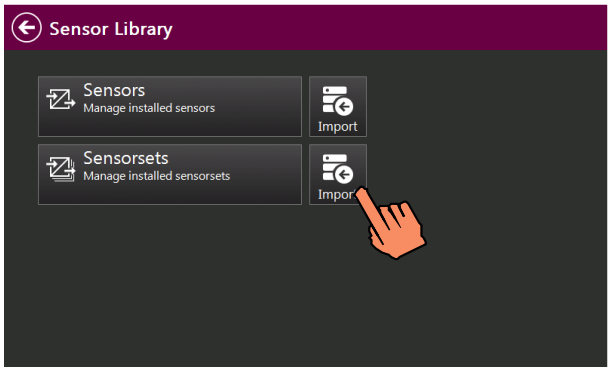
- Select sensors or sensor sets to be exported
- Tap the button for export

8.7.5 Import sensor data



The **Import** function can be used to import exported sensor data, sensors and sensor sets from a USB storage medium to the sensor library.

- Tap **Configuration**



- Tap the **Import** button next to the **Sensor library** and follow the instructions

9 Settings for the switchgear device

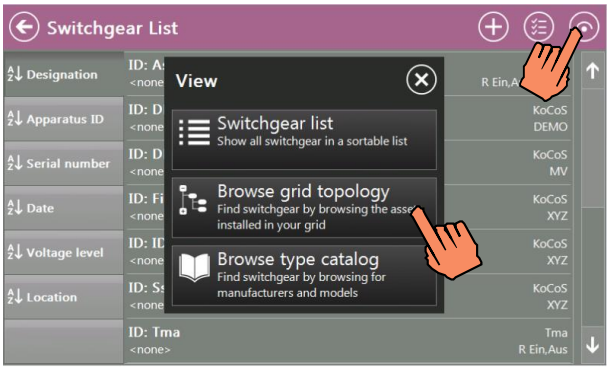


The switchgear assets and type catalogue can be found in the **Operate** function group, under **Switchgear**.

9.1 Assets

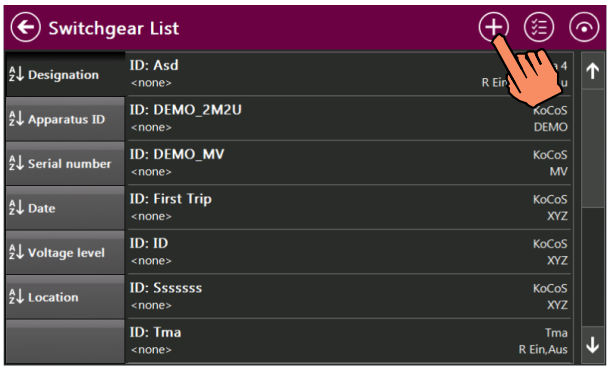


All the switchgear devices on which measurements have already been carried out are listed under **Assets**. The switchgear devices listed can be sorted according to various different criteria.



The listed switchgear can be sorted according to various criteria.

- Tap 
- Select search criterion for the display

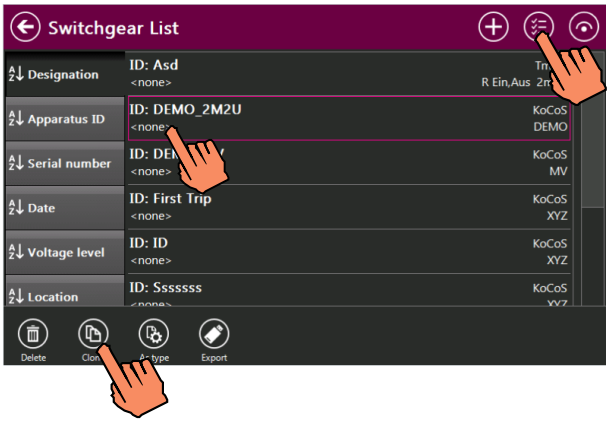


If switchgear types have already been created in the type catalogue, new switchgear can be created from them.

- Tap 

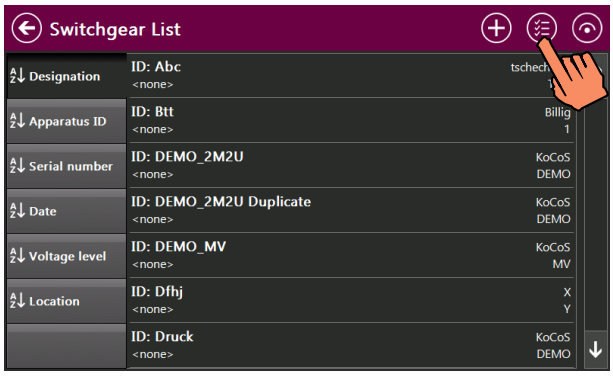
The type catalogue is called up.

- Select switchgear type
- Fill in the switchgear rating plate and save the switchgear



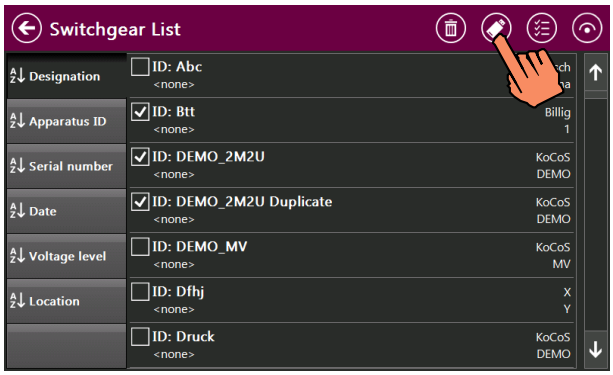
Tapping and holding on a switching device displays functions for deleting, copying, saving and exporting.

9.1.1 Export switchgear devices



To use switchgear devices or switchgear types e.g. on another test system, they can be exported to a USB storage medium.

➤ Tap the button for selection view



➤ Select switchgear devices to be exported

➤ Tap the button for export

If test jobs are saved in the selected switchgear device, a query appears asking whether these should also be exported.

The export is carried out with the switchgear name and the abbreviation **brk** for switchgear devices and the abbreviation **job** for test jobs.

NOTE

Alternatively, the function for exporting can be called up directly in the switchgear list by tapping and holding a switchgear device.

9.1.2 Import switchgear data



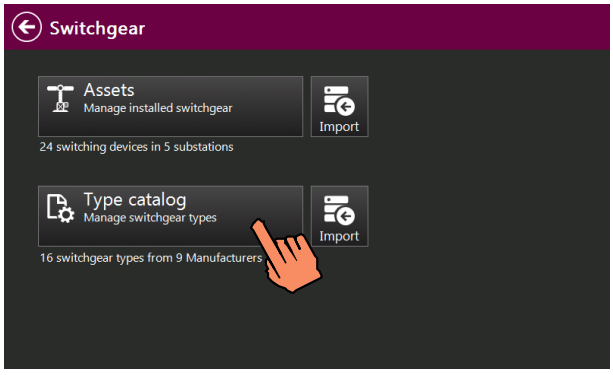
The **Import** function can be used to import exported switchgear data from a USB storage medium.

- Tap **Switchgear**

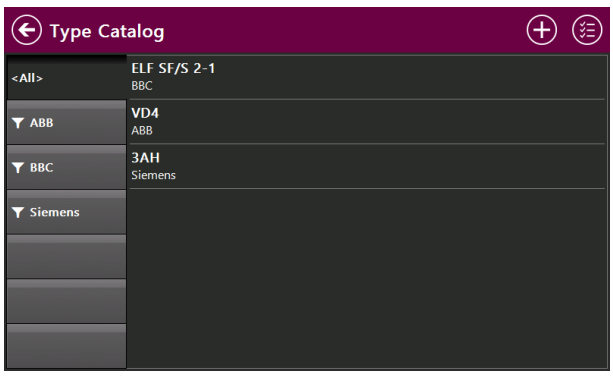


- Tap the **Import** button
- Select the desired switchgear devices and tap **Start**

9.2 Type catalogue



The switchgear types and templates can be managed and created in the type catalogue. The switchgear types listed can be sorted according to various different criteria.



Switchgear types can be added, deleted or saved on a storage medium.

9.2.1 Create new switchgear type



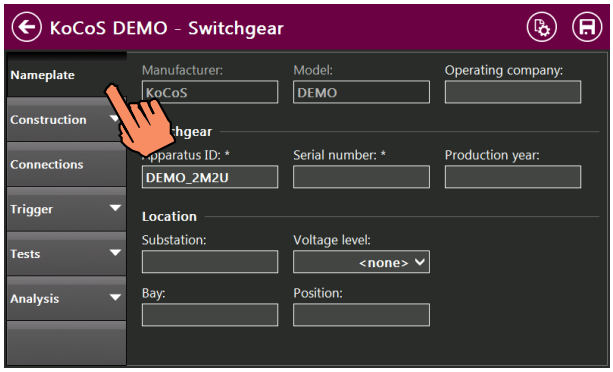
➤ Use the **+** button to add a new switchgear device in the type catalogue

9.3 Configure switchgear devices

NOTE

All settings can also be changed in the **Test** function group at any time, even during the course of a test.

9.3.1 Nameplate

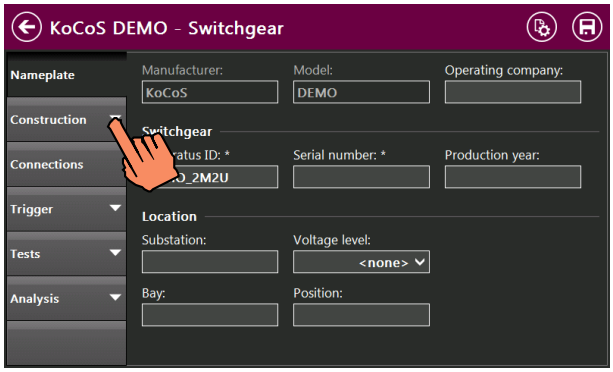


➤ Enter data for identifying the switching device

The information in the **Manufacturer** and **Model** fields is taken from the switchgear type that was used as a template.

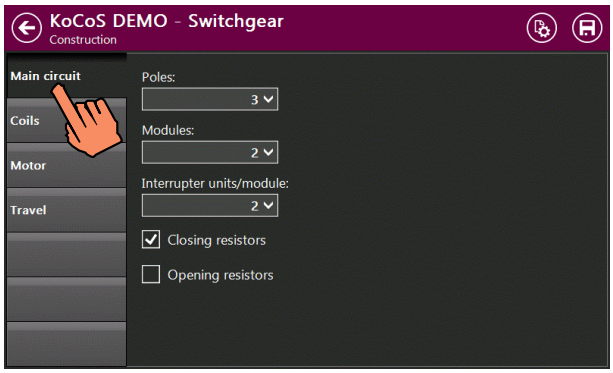
When specifying the voltage level, you can create any voltage levels yourself using the **Add** entry.

9.3.2 Construction



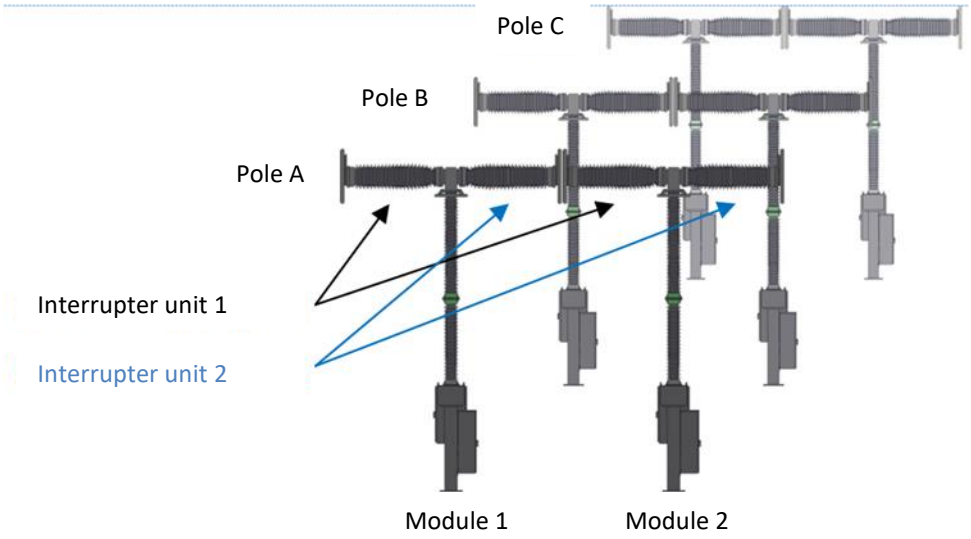
The main circuit, coils, drives and travel for the device under test are defined under **Construction**.

9.3.2.1 Main circuit

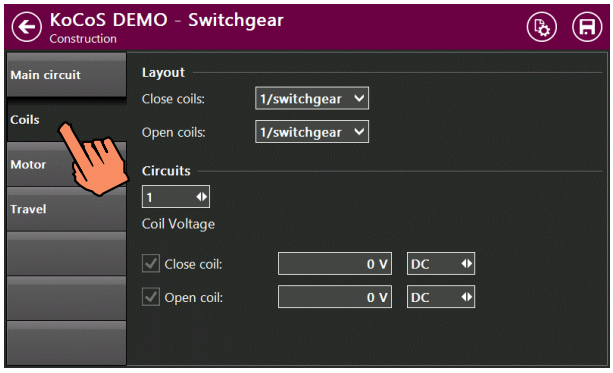


- Select the number of poles
- Select the number of modules (example: a double T breaker has two modules, see below)
- Select the number of interrupter units per module
- Activate the check box if there are closing or opening resistors

9.3.2.2 Nomenclature in the main circuit



9.3.2.3 Coils



- Select the number of closing and opening coils

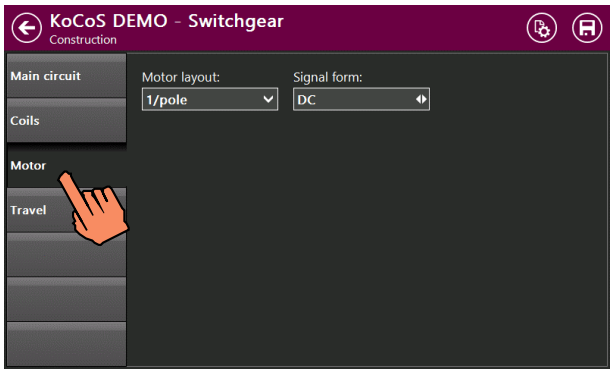
ACTAS supports separate testing of the redundant closing and opening coils (coil circuits) which many switchgear have.

- Enter the number of coil circuits (max. 3)
- Select voltage for coil circuits
- Select signal form, can be switched between AC and DC

NOTE

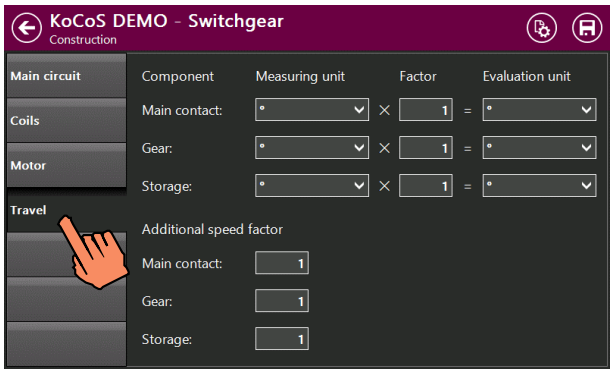
For tests with several coil circuits with ACTAS P260+ and for single pole control with ACTAS P360+, the coil circuits to be controlled must be selected manually by reconnecting the test cables accordingly. With ACTAS P360+, up to 3 closing and opening circuits can be connected at the same time with simultaneous control of the breaker poles.

9.3.2.4 Motor



- Select motor layout
- Select signal form, can be switched between AC and DC

9.3.2.5 Travel



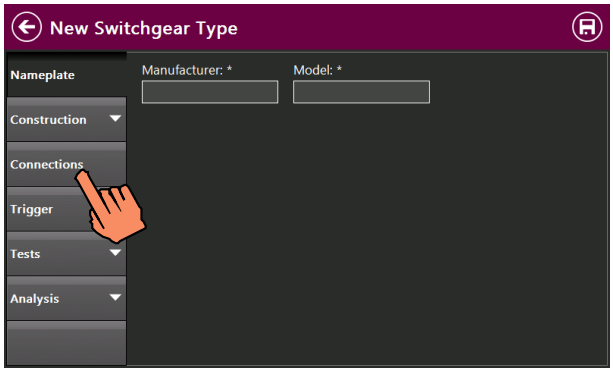
For travel, an automatic conversion of the measuring units for the acquisition and evaluation can be saved with an appropriate **factor**.

It is possible, for example, to measure the rotary movement of a drive in **°** and to display it as travel of the driven contact in **mm**.

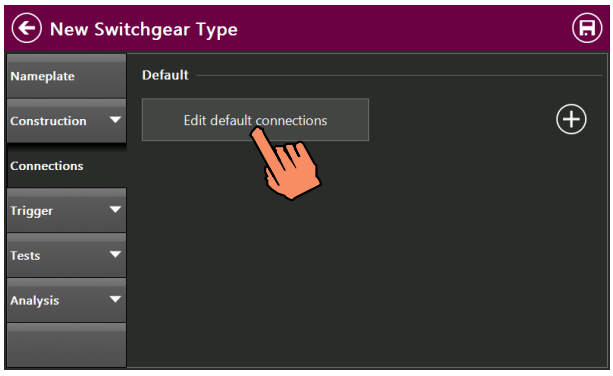
Additional speed factor

When recording speeds, a factor can be specified, for example, to adjust gear ratios or deflections.

9.3.3 Connections



Under **Connections**, the test mode is set for the main contacts and the components to be connected, such as auxiliary contacts, sensors, coils and drives, are configured.



- Tap the **Edit default connections** button

NOTE

Using the **+** button, individual connection configurations can be saved for the **Timing**, **Drive**, **Contact resistance** and **Pre-insertion resistance** test functions. For more information, see under **Connection configurations for test functions**.

9.3.3.1 Main contacts

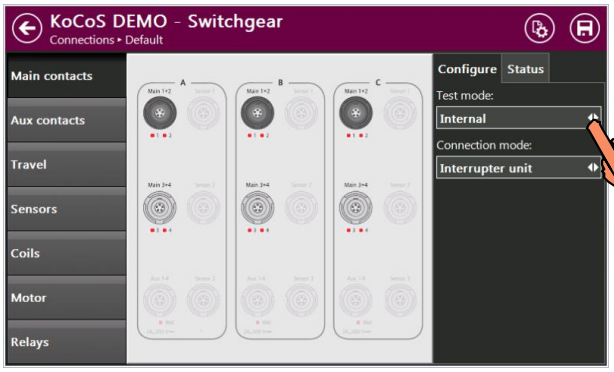


Fig.: ACTAS P360+

➤ Select test mode, see below

- Internal
- PROMET
- First Trip
- VDS

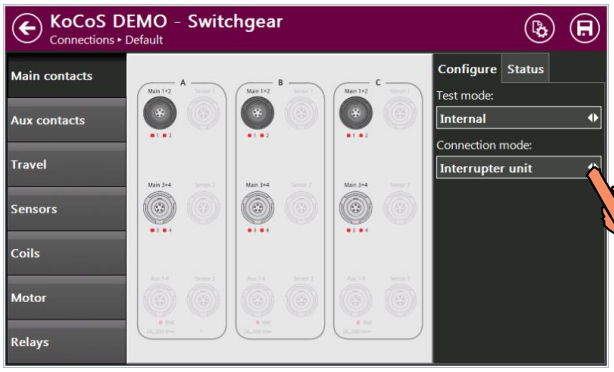


Fig.: ACTAS P360+

➤ Select connection mode

Only those connection modes defined under **Construction/Main circuit** are displayed here.

- **Pole**
  The measurement is made across the entire pole, i.e. all interrupter units of the pole are included.
- **Module**
  The measurement is made across the entire module, i.e. all interrupter units of the module are included.
- **Interrupter unit**
  The measurement is made on each individual interrupter unit.

9.3.3.2 Internal test mode

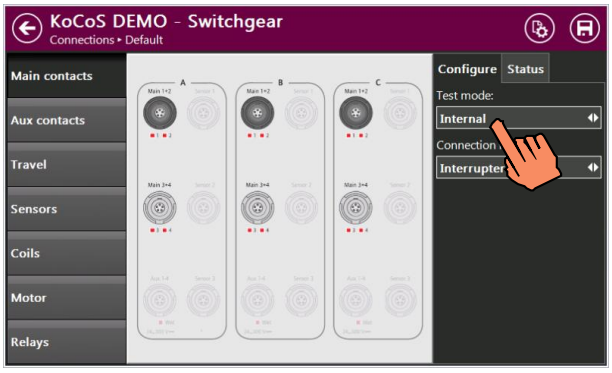


Fig.: ACTAS P360+

➤ Select the **Internal** test mode if a test is to be carried out without additional components

The connections for the main contacts are displayed.

9.3.3.3 Status display for internal test mode

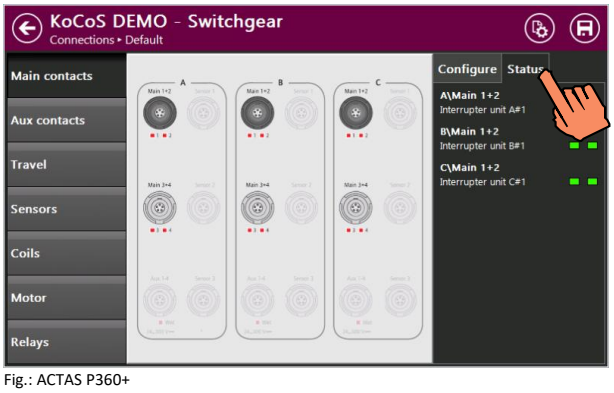


Fig.: ACTAS P360+

The status of the main and resistive contacts is shown on the status display in the **Internal** test mode.

9.3.3.4 PROMET test mode

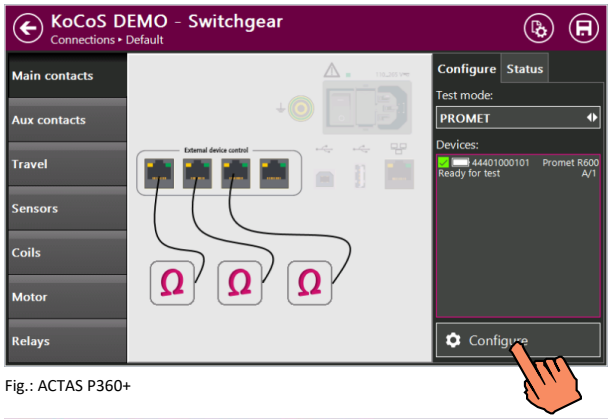
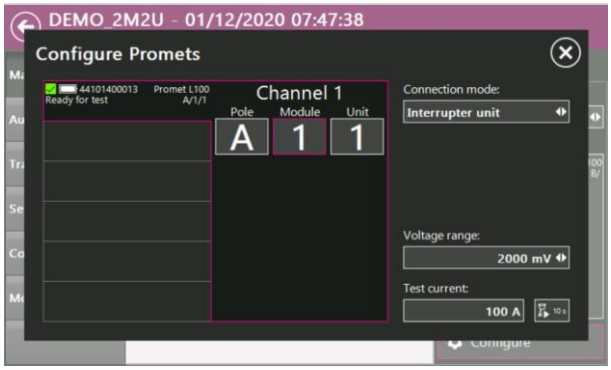


Fig.: ACTAS P360+

- Select the **PROMET** test mode, if a contact resistance measurement or a measurement on a breaker which is earthed on both sides is to be carried out

PROMET devices connected with ACTAS are displayed under **Devices**.

- Tap **Configure**



- Set connection type, voltage range and test current, see under **Test/Contact resistance test function**

If current transformers are installed, they should be saturated before the test begins. For Promet L100 and R300/R600 a time span can be set to output the test current before the test begins.

- Set the lead time for test current

NOTE

With PROMET L100 the lead time is limited to 10 s due to the maximum output time. The total test duration should not exceed 12 s.

9.3.3.5 PROMET test mode for testing GIS installations with earthing on both sides

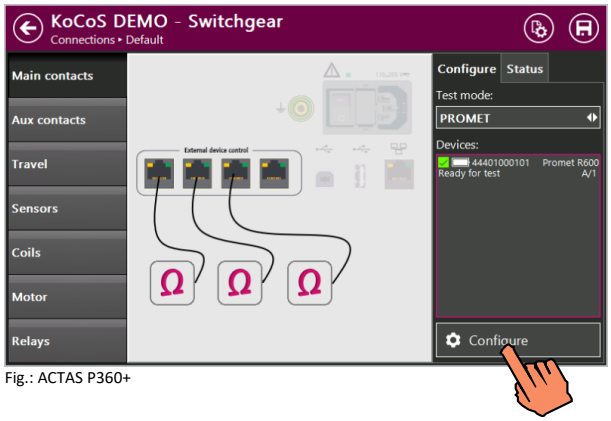
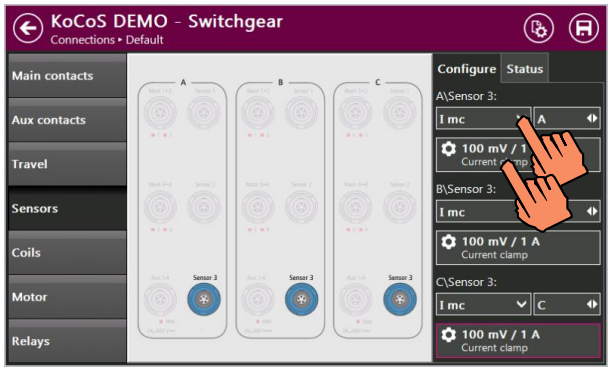


Fig.: ACTAS P360+

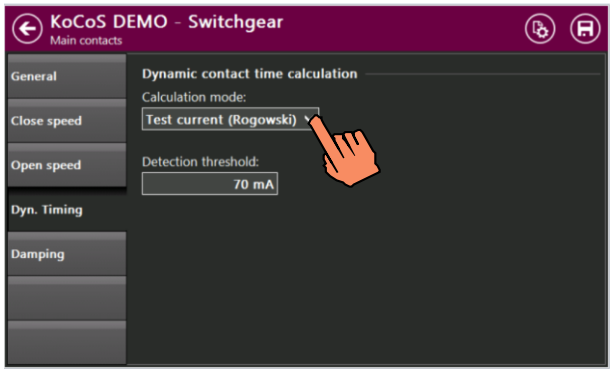
- Select **PROMET** test mode
- Tip on **Configure**
- Set the test current and voltage range



- Switch to Connections/Sensors
- Set sensors for measuring I mc (main contact) at poles A/B/C
- Tip on ⚙ and configure current clamp with the corresponding transformation ratio

NOTE

The offset adjustment for the current clamps is carried out automatically before every test



- Switch to **Analysis/Main contact/Dynamic Timing**
- Set **Test current (Rogowski)** as calculation mode

NOTE

If the switching evaluation of operating times fails, the detection threshold must be determined using a cursor and adjusted here as required.

9.3.3.6 First Trip test mode

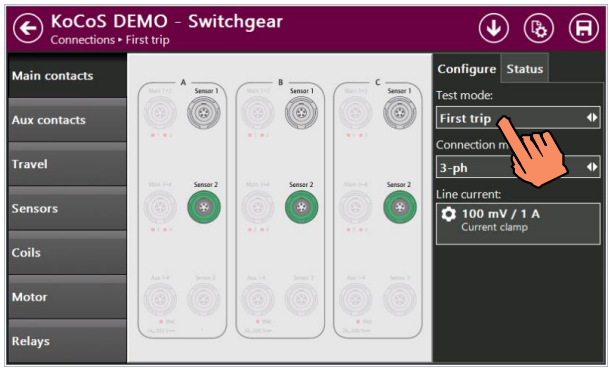


Fig.: ACTAS P360+

In **First Trip** mode, the operating times and the coil currents are measured via external sensors at the inputs "Sensor 2", see under **Test/Special tests/First Trip**.

- Select **First Trip** test mode
- Set the connection mode to three phase or per pole

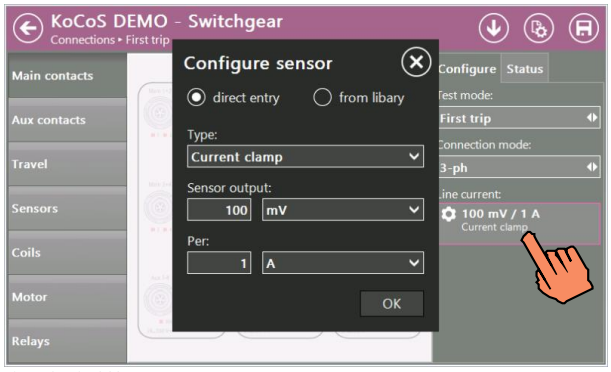


Fig.: ACTAS P360+

- Configure the used sensor, see under **Connections/Sensors**

9.3.3.7 VDS test mode

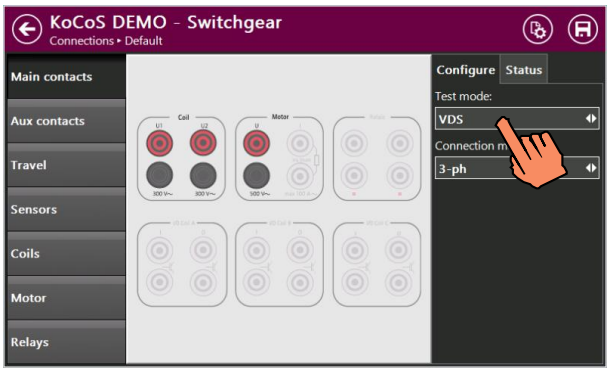


Fig.: ACTAS P360+

In **VDS** mode, the operating times and the coil currents are measured directly at the capacitive measurement points of a VDS system, see under **Test/Special tests/VDS**.

- Select **VDS** test mode
- Set the connection mode to three phase or per pole

9.3.3.8 Auxiliary contacts

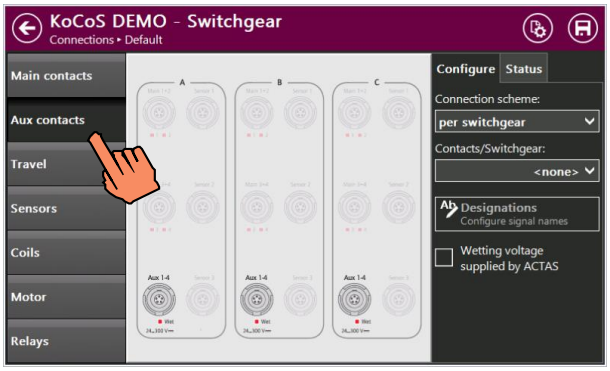


Fig.: ACTAS P360+

- Select a connection scheme
- Select contacts per switchgear
- Define signal name
- Define whether voltage for auxiliary contacts is provided by ACTAS or whether the auxiliary contacts are wet

9.3.3.9 Travel

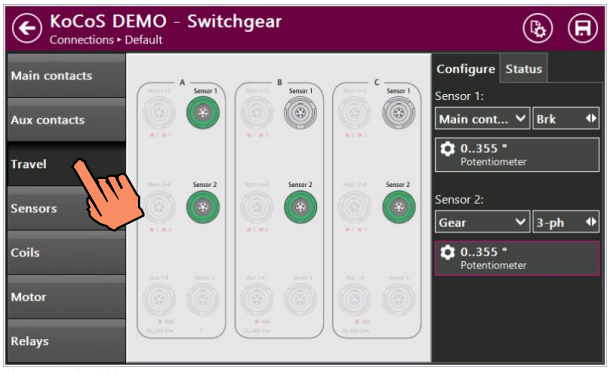


Fig.: ACTAS P360+

- Define whether the measurement is carried out on the **contact**, the **gear** or the **storage**
- Define whether the measurement is carried out on the switchgear device, on module 1 or 2 or in three phases

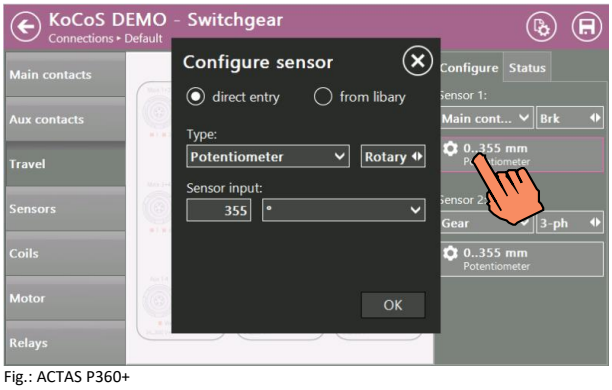


Fig.: ACTAS P360+

- Tap the display and configure the travel sensor

The data can be entered directly or can be included from the sensor library.

For the travel sensors, an automatic conversion of the measuring units for the acquisition and evaluation can be saved, e.g. from ° to mm, see the section of these operating instructions titled **Configure switchgear devices/Construction**.

The current values of the travel sensors are displayed under **Status**.

9.3.3.10 Sensors

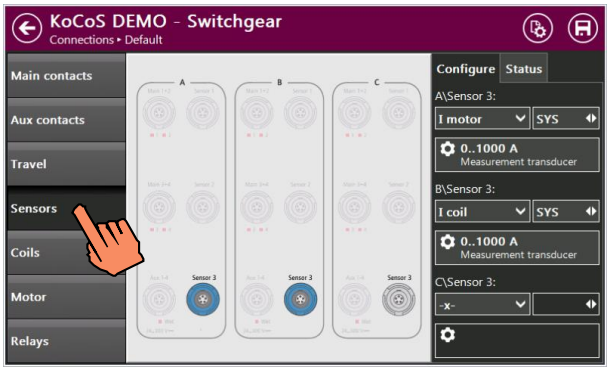
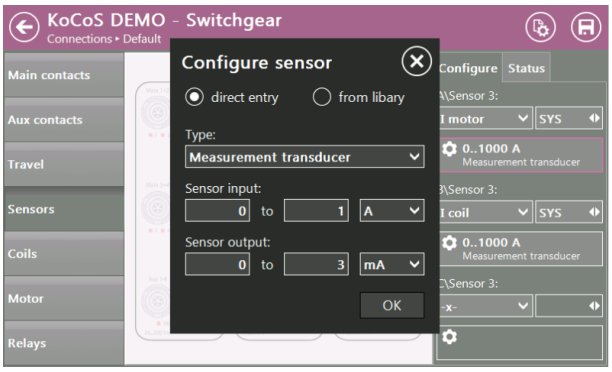


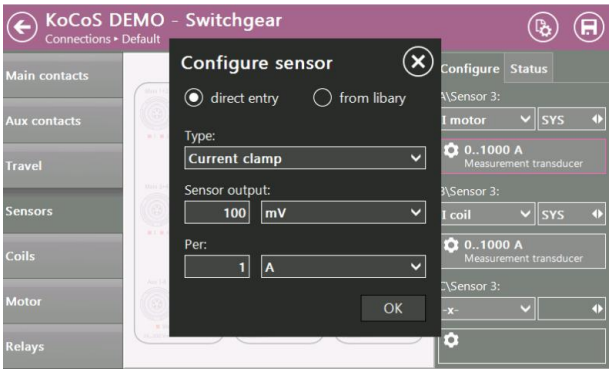
Fig.: ACTAS P360+

- Define measurement function for sensors
- Set measurement according to the switch design
- Tap on ⚙ and configure the sensors

The data can be entered directly or can be included from the sensor library.



For measuring transducers, the transducer ratio can be entered directly, e.g. 1 A = 3 mA here.



With current clamps, the transmission ratio is entered as a factor from output to input, here e.g. 100 mV per 1 A

9.3.3.11 Coils

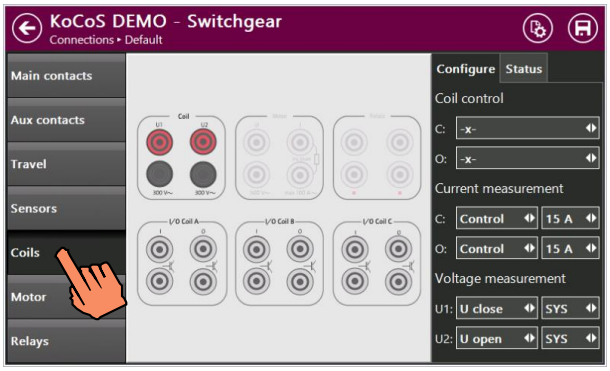


Fig.: ACTAS P360+

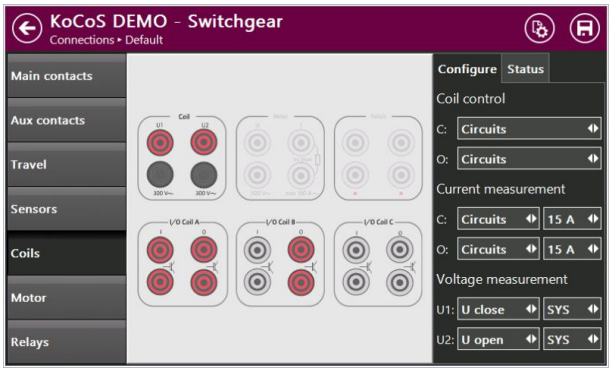
- Define the connections for coil control and select the measuring ranges for the coil operating currents (Maximum coil current 100 A peak)

NOTE

Only those coils defined under **Construction/Coils** can be assigned.

- Define the current measurement
- Define the voltage measurement

With ACTAS P360+, the closing and opening coil can be measured via the measurement inputs U1 and U2. With ACTAS P260+, measurement of both coils is possible by connecting them in parallel to the universal voltage input.



Direct control and measurement via coil circuits

With ACTAS P360+, up to three closing and opening circuits can be connected at the same time with simultaneous control of all breaker poles.

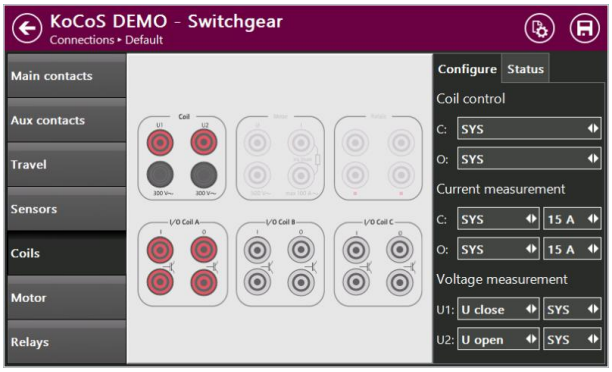
- Connect circuit 1 to pole A
- Connect circuit 2 to pole B
- Connect circuit 3 to pole C

In the example, one closing and two opening circuits are connected which are controlled and measured in accordance with the configuration.

NOTE

If the coil current is measured via current clamps (instantaneous release), it is possible to measure the corresponding control currents in parallel via the control outputs.

9.3.3.13 Evaluate coil resistance



- Define coil control
- Define the voltage measurement

The coil resistance is automatically evaluated and displayed in the numerical result display.

NOTE

If no voltage measurement is activated, the nominal value entered under **Construction/Coils** is automatically used to calculate the coil resistance.

9.3.3.14 Motor

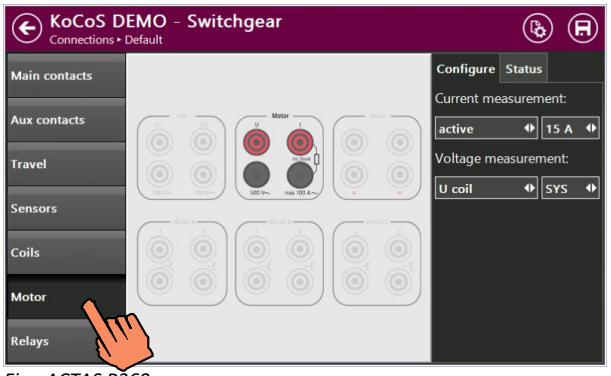


Fig.: ACTAS P360+

- Activate/deactivate motor current measurement and select measuring range (Maximum motor current 100 A peak)
- Activate/deactivate motor voltage measurement and select measuring range

NOTICE

During the current measurement, the 4 mm safety sockets may only be applied with up to 100 A for short periods, less than 200 ms. The rated current is 32 A.

NOTE

The activation of the current measurement is blocked if a current measurement was already selected under **Connections/Sensors** during sensor configuration

9.3.3.15 Relais

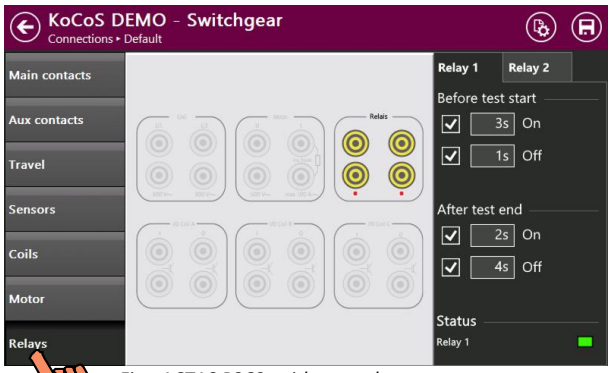


Fig.: ACTAS P360+with two relay outputs

The switch-on and switch-off times of the relays are based on the start and end times of the test.

- Define state before start of test
- Define state after end of test

Using the check boxes, the relay output can be switched on before the test start and switched off after the test end, for example.

9.3.3.16 Connection configurations for test functions

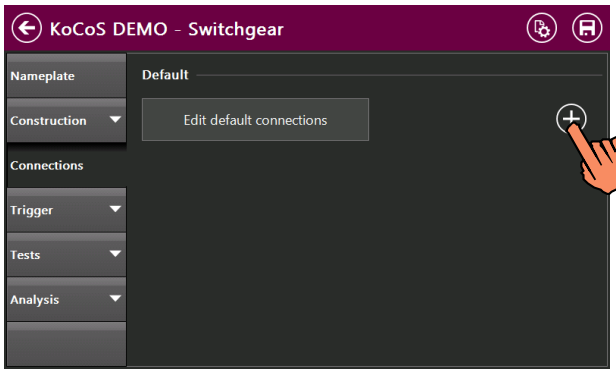


Fig.: ACTAS P360+

Individual connection configurations can be created for the **Timing**, **Drive** and **Contact resistance** test functions; these configurations are used automatically during tests.

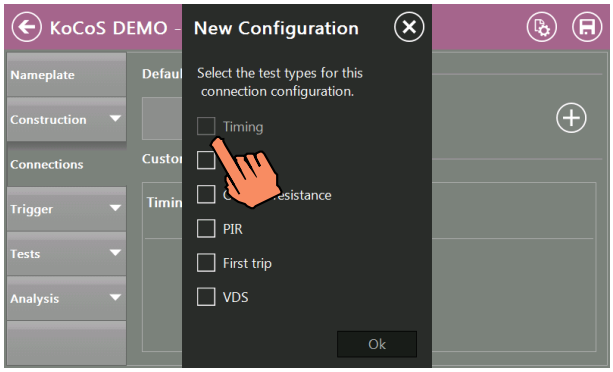
This means that the individual test functions can be carried out directly without having the adjust the default settings manually.

If a connection configuration has been created for a specific test function, this connection configuration is automatically used during tests. If no configuration has ben created, the settings under **Default connections** apply.

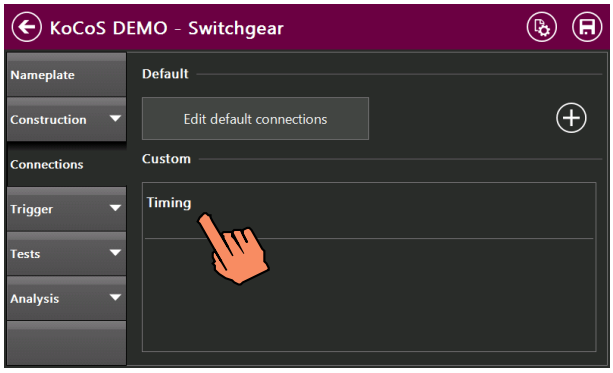
Create a new configuration:

- Tap the **+** button

To delete, tap and hold the configuration to be deleted.

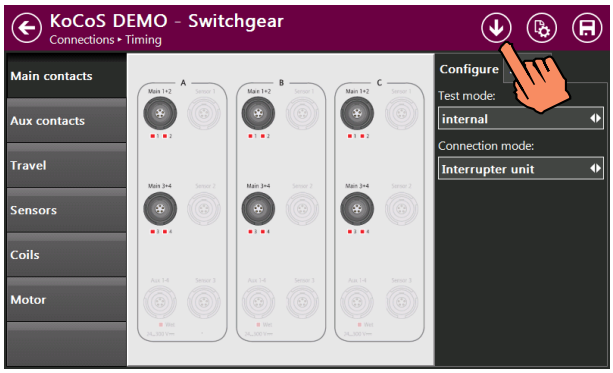


- Select a test function and confirm with **OK**



A connection configuration is created with the current settings for the default connections.

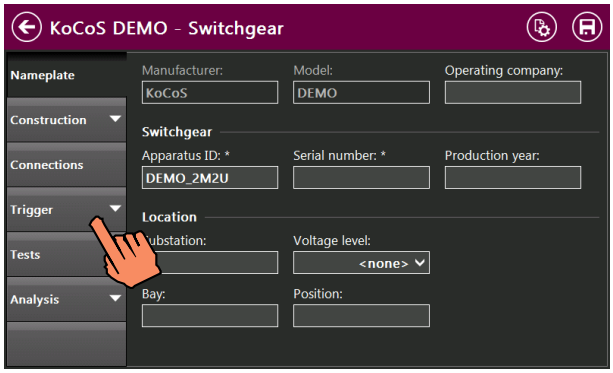
- Tap the connection configuration



- Configure the connection

Using the arrow key, it is possible, e.g. after changing the default connections, to bequeath their current configuration to the test-function-specific configuration.

9.3.4 Trigger

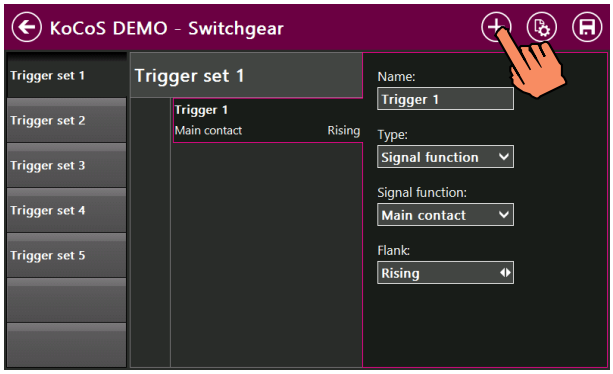


Recordings can be carried out manually by tapping the start button or automatically by external triggers, which can be configured here. The configured triggers can then be defined as start criterion for the relevant recording under **Tests**.

By configuring a trigger, in the case of a switchgear device which is to be triggered manually, for example, the test can be started in advance and the switchgear device can then be triggered manually while recording is started automatically using a trigger.

NOTE

It is not possible to use triggers for tests with ACTAS and PROMET!

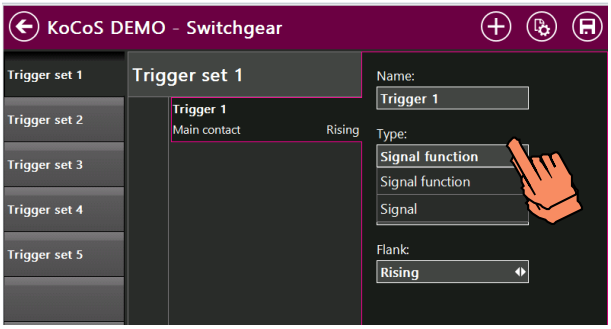


Different signal functions und signals can be configured in up to five trigger sets. If several signals are configured in a trigger set, the first incoming signal acts as a trigger.

- Select a trigger set
- Enter a name for the trigger set
- Use the **+** key to add a trigger to the trigger set

NOTE

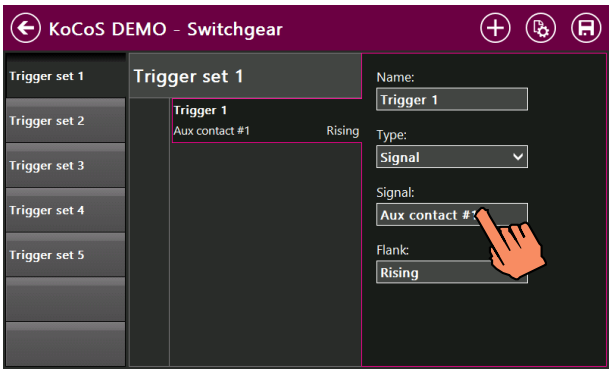
If several triggers are created in one trigger set, they are ORed to each other.



➤ Define the trigger type

Signal function:

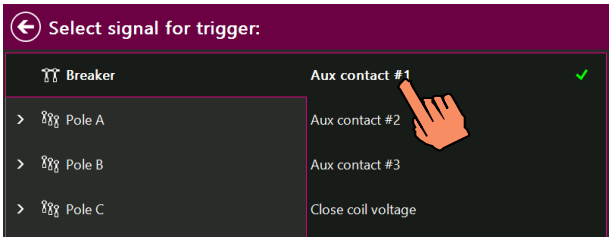
The trigger applies to the function, not to a single signal. If, for example, the **Auxiliary contact** signal function is selected, the first incoming auxiliary contact signal acts as a trigger, regardless of which auxiliary contact it comes from.



Signal:

The trigger applies to a specific signal.

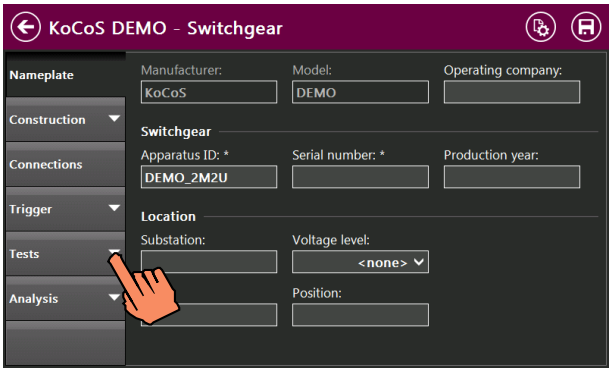
➤ Tap the **Signal** selection box



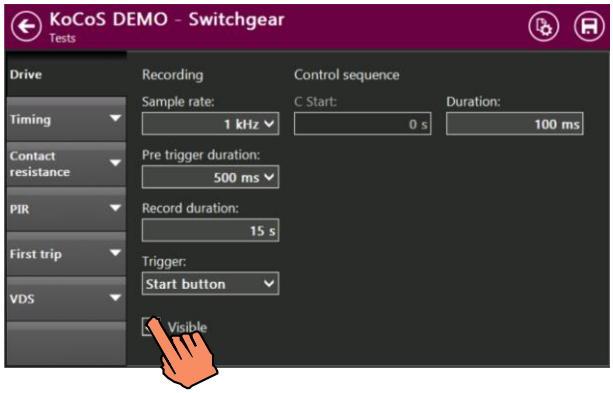
The signals browser is called up. All signals defined under **Connections** are offered.

➤ Select signal

9.3.5 Tests

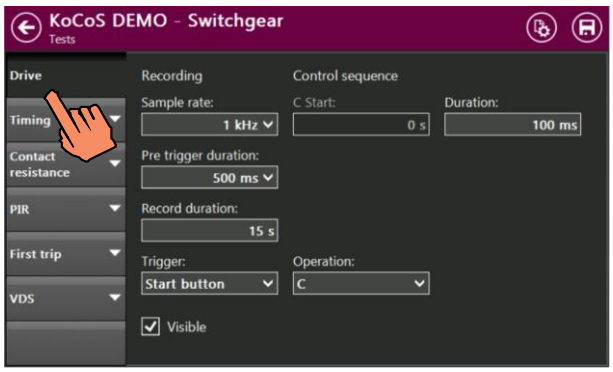


The control sequences and the recordings desired are configured under **Tests**.



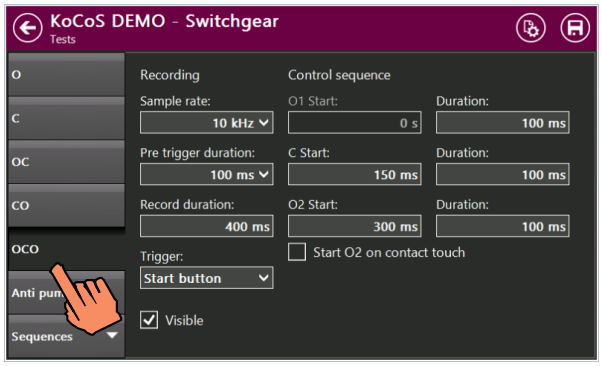
Use the check box **Visible** to set whether the control sequence should be displayed or hidden in the test monitor. In this way, switch specific test plans can be easily created.

9.3.5.1 Drive



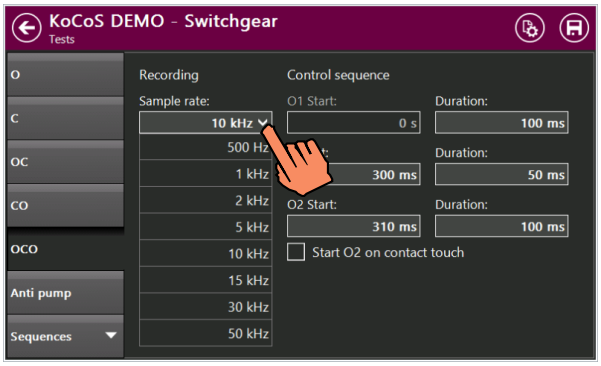
- ➢ Enter the parameters for the control sequence
- ➢ Select operation: Motor run after close or open sequence
- ➢ Enter parameters for recording, see under **Timing**

9.3.5.2 Timing



- ➢ Select a switching operation for the test

O	Opening operation
C	Closing operation
OC	Successful automatic reclosing
CO	Unsuccessful closing operation, e.g. closing operation on a short-circuit
OCO	Automatic reclosing with unsuccessful reclosing

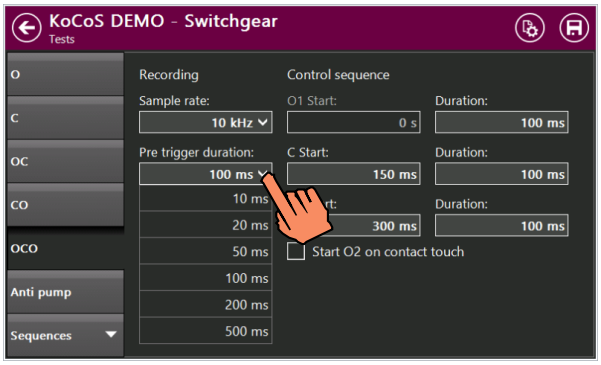


➤ Set the sampling rate

The product of the sample rate in hertz and the recording duration in seconds gives the number of measurement values per channel.

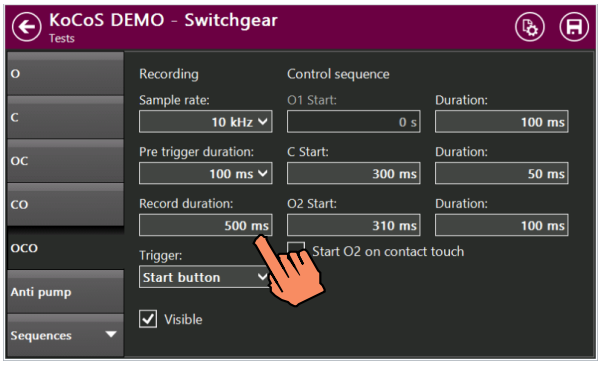
For example, a value of 1 kHz = 1000 Hz means that 1000 measurement values are recorded per second, or 1 measurement value per millisecond.

As the number of sample values increases so do the transmission time and storage space requirements. For this reason it is not sensible to select values for recording duration and sample rate which are higher than is necessary for the assessment of the measured signal characteristics.



➤ Set pre trigger duration

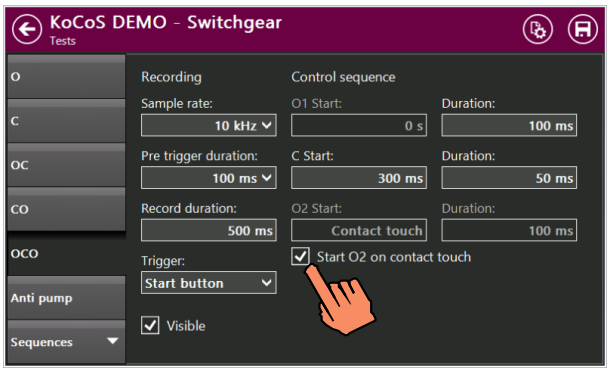
Under **Pre trigger duration** it is defined how long before the beginning of the switching operation signal recording should be started.



➤ Set recording duration

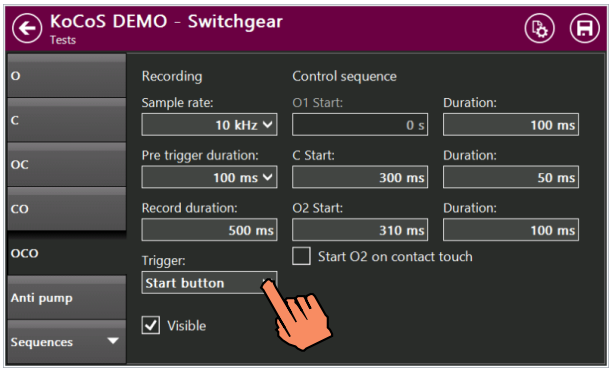
Because storage space requirements increase as the duration increases, the recording should not be unnecessarily long.

However, it should be sufficiently longer than the total duration of the control sequences so that all results can be fully recorded.



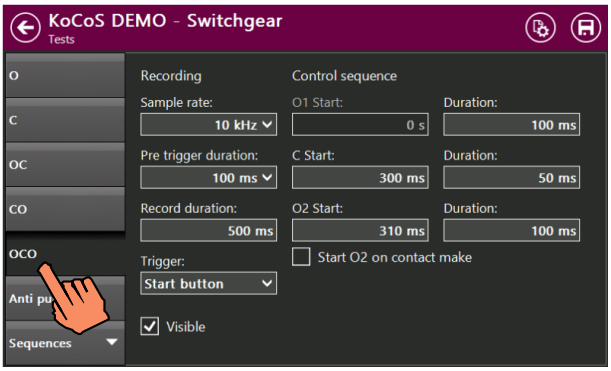
Start recording on contact touch

In case of CO and OCO switching operations, recording for disconnection can be done automatically at contact closure of the previous connection.



➢ Set triggers

Recordings can be carried out manually by tapping the start button or automatically via external triggers which can be configured under **Trigger**, see above.



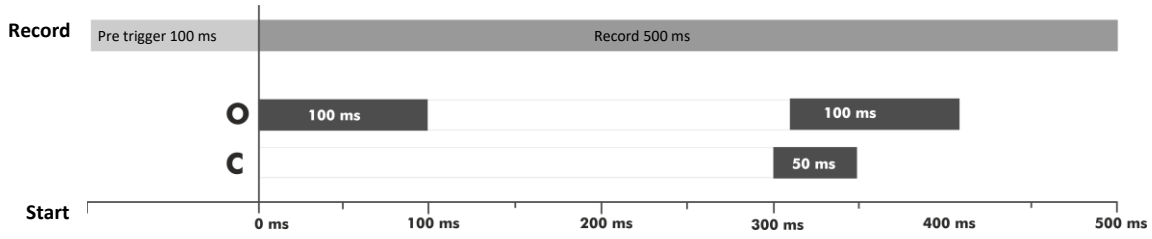
➢ Set the control sequences

The start time of the first controlling is set at 0 ms.

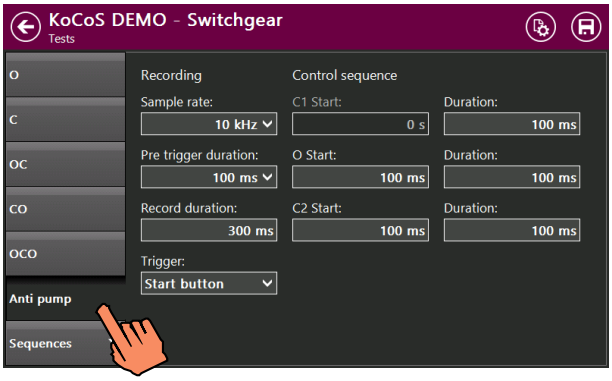
Further start times are given as absolute values.

Example operating sequence OCO, automatic reclosing with unsuccessful reclosing

- The operating sequence starts with the opening operation at 0 ms, controlling takes 100 ms
- The reclosing is carried out at 300 ms, controlling takes 50 ms
- At 310 ms, i.e. while controlling of the reclosing is still going on, the second opening operation is carried out



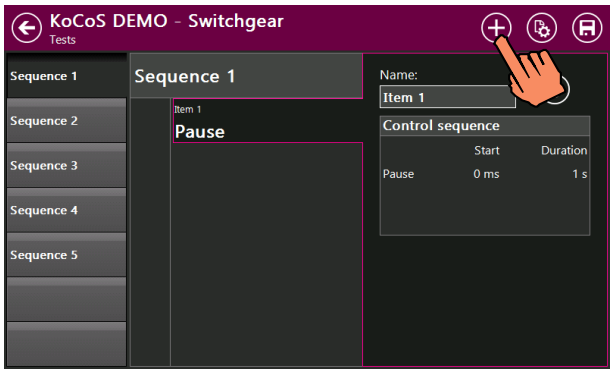
9.3.5.3 Anti pump



A COC operation is used to test anti pump. The switching operations are counted for evaluation. For the result display, a limit value can be set in the testing software so that an error is displayed if more than one C switching operations is carried out.

➢ Define the parameters for the recording and the control sequence as described under **Timing**

9.3.5.4 Sequences

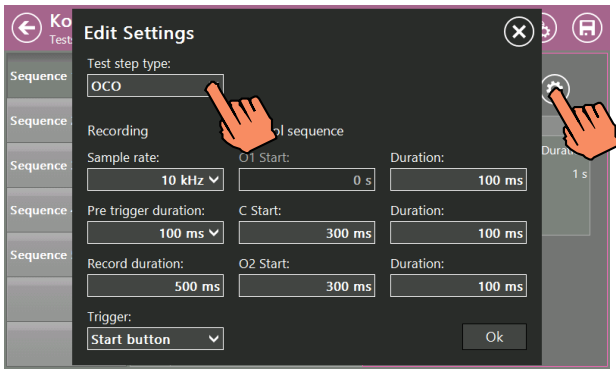


Various switching operations and pauses can be arranged one after another and saved in sequences. These sequences can be called up during testing so that they run automatically.

- Use the **+** button to add a switching operation to the sequence

The newly added switching operation is initially defined as a pause.

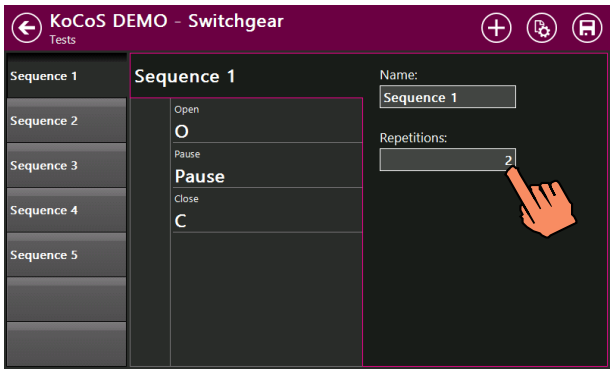
- Enter a name for the switching operation
- Tap the control sequence



- Edit the control sequence as described above

NOTE

In the result monitor, the switching commands are displayed graphically in the detailed information on the coil current.

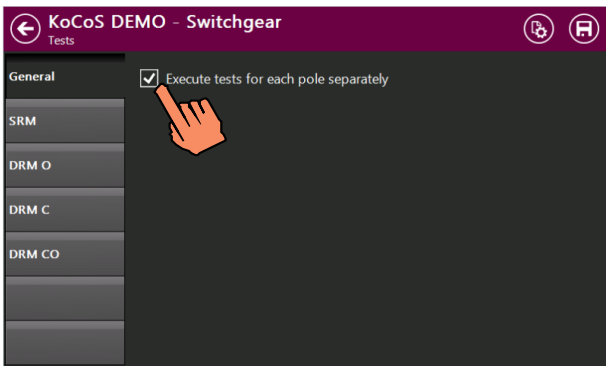


- Set repetitions

If the sequence is to be output several times in succession, up to 50 automatic repetitions can be set.

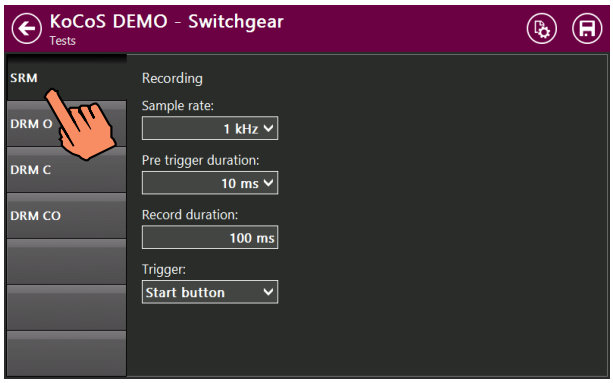
If a pause is required between each repetition, it can be added at the end of the sequence.

9.3.5.5 Contact resistance



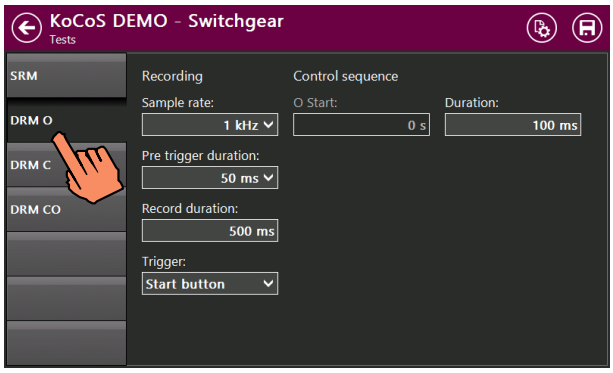
If the **Execute tests for each pole separately** check box is selected, the tests are offered individually for poles **A**, **B**, and **C** respectively, see under **Testing/ SRM and DRM Testing of GIS switchgear**.

9.3.5.6 Contact resistance SRM



➤ Define the parameters for the recording as described under **Timing**

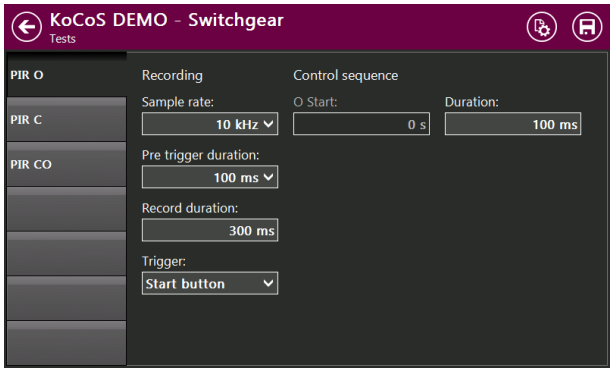
9.3.5.7 Contact resistance DRM



➤ Define the parameters for the recording and the control sequence as described under **Timing**

The dynamic determination of the contact resistance can be carried out for an O, a C or a CO operation.

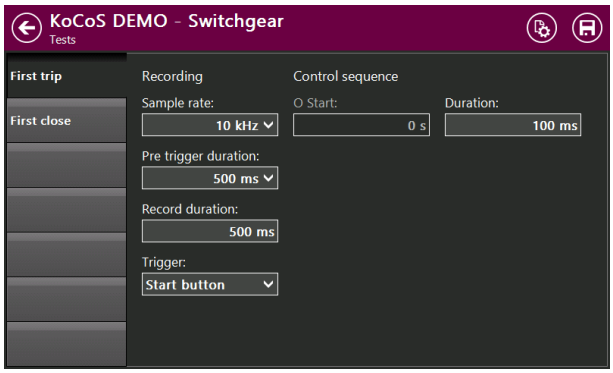
9.3.5.8 Closing/Opening resistance PIR



The determination of the pre-insertion resistance can be carried out for an O, a C or a CO operation.

➤ Define the parameters for the recording and the control sequence as described under **Timing**

9.3.5.9 First trip



➢ Define the parameters for the recording as described under **Timing**

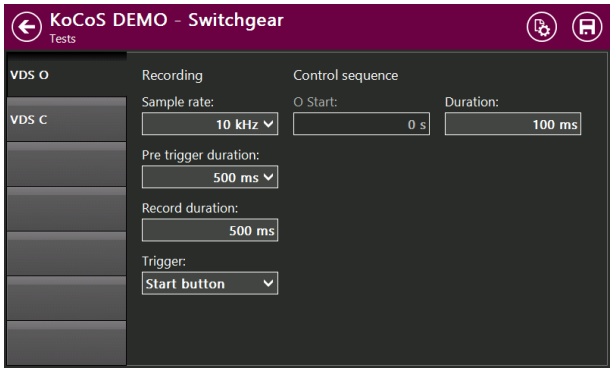
NOTE

In order to obtain an optimum test result, the basic settings of 500 ms for the duration of the pre-trigger and the recording duration should not be undershot.

➢ Select trigger

For first trip tests, a trigger set with the type **Signal** must be created on both **Close coil current** and **Open coil current**, see **Tests/Special Tests/First Trip**.

9.3.5.10 VDS



➢ Define the parameters for the recording as described under **Timing**

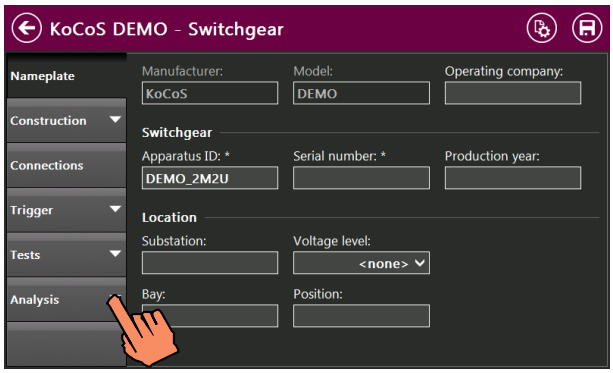
NOTE

In order to obtain an optimum test result, the basic settings of 500 ms for the duration of the pre-trigger and the recording duration should not be undershot.

➢ Select trigger

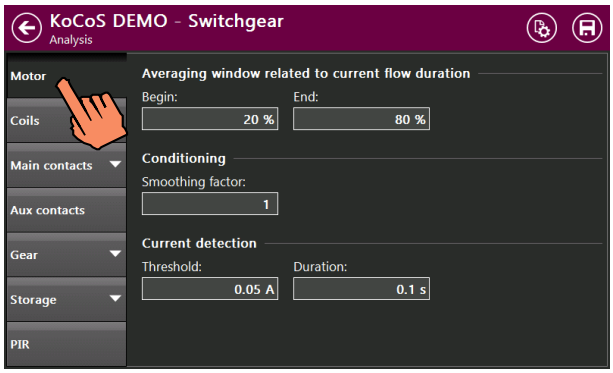
For VDS tests, a trigger set with the type **Signal** must be created on both **Close coil current** and **Open coil current**, see **Tests/Special Tests/VDS**.

9.3.6 Analysis



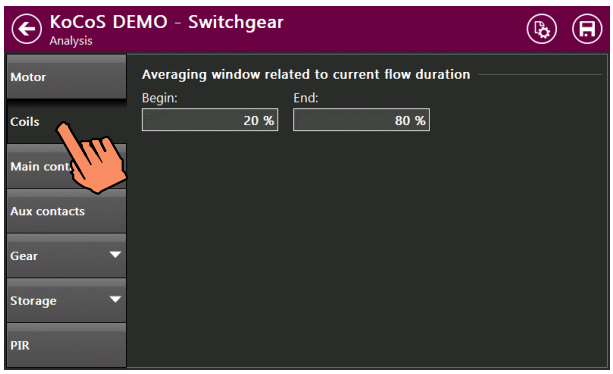
The parameters and reference methods for the evaluation of the recordings are defined under **Analysis**.

9.3.6.1 Motor



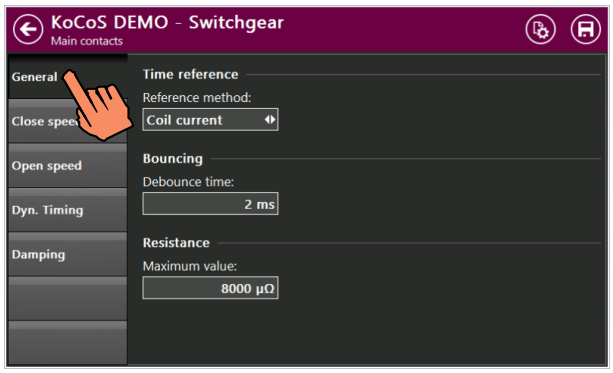
- Enter the beginning and the end value for the calculation of the mean value relative to the current flow duration of the motor current
- Enter the smoothing factor as filter function for smoothing the motor current signal
- Enter threshold and duration for the detection of the motor current signal

9.3.6.2 Coils



- Enter the beginning and the end value for the calculation of the mean value relative to the current flow duration of the coil current

9.3.6.3 Main contacts/General



Time reference

Various different methods can be selected for the time reference, for example:

Command time or **Coil current**

- Select the method for the time reference

Bouncing

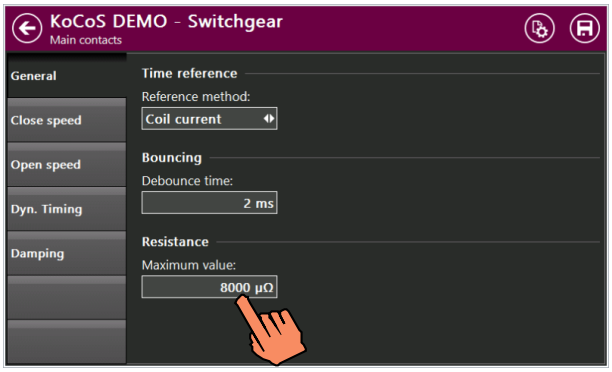
In addition, a debounce time of 0 to 500 ms can be entered. For those bounces which occur within the given duration, the edge change is not taken into consideration.

These edge changes remain visible in the **Raw data** results display.

- Enter debounce time

NOTE

The edge on which the evaluation should take place during debouncing can be set under **Analysis/Advanced**.



Resistance

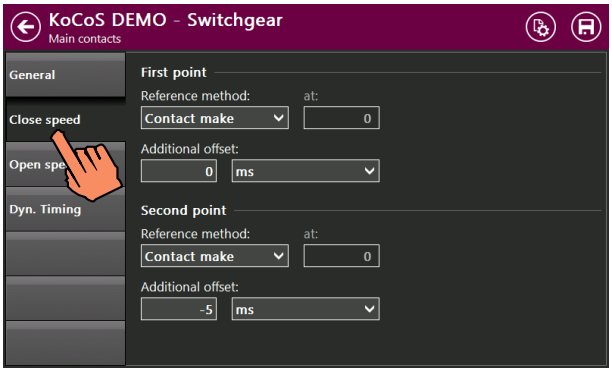
A maximum value can be defined for the evaluation of the main contact resistance in order to keep the display as compact as possible.

- Enter the maximum value for the resistance

Note

By entering a maximum value, the evaluation is limited to the area below it, even if events have still been recorded above it.

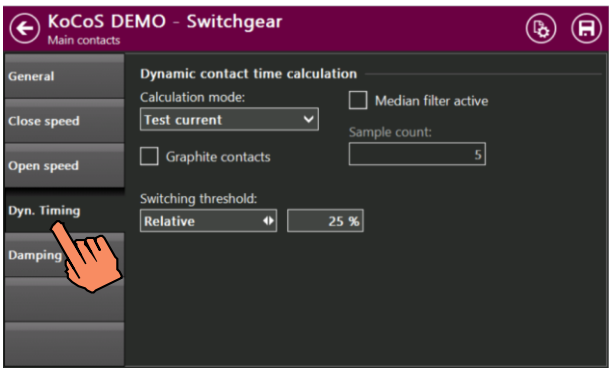
9.3.6.4 Main contacts/Close speed and Open speed



- Define the start and end point for the calculation of the close and open speed

Various reference methods can be selected, such as at contact make or contact break or the absolute or relative stroke, for example.

9.3.6.5 Main contacts/Dynamic Timing

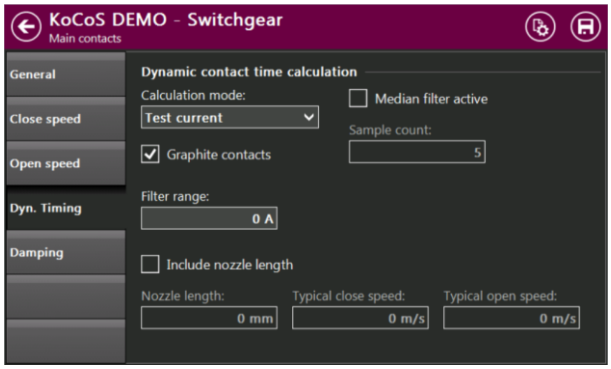


Dynamic determination of operating times

The dynamic determination of operating times (DYNAMIC Timing) allows tests to be carried out with earthing on both sides for a sound diagnosis of the interrupter units throughout the whole switching operation. Measurement results are displayed numerically and in curve form.

Test current calculation method

- Select the **Test current** calculation method for tests with earthing on both sides
- Adjust **Switching threshold** according to switch characteristics
- Activate the **Median filter** function if disturbing influences on the measured signals are to be filtered out
- Use the number of interpolation points (Sample count) to define the width of the median filter

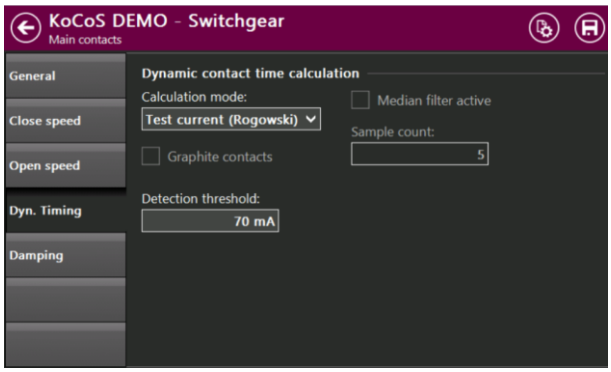


Graphite contacts

- Activate the **Graphite contacts** check box if the switchgear is equipped with graphite contacts
- Activate the **Include nozzle length** function if travel measurements cannot be carried out on the switchgear device

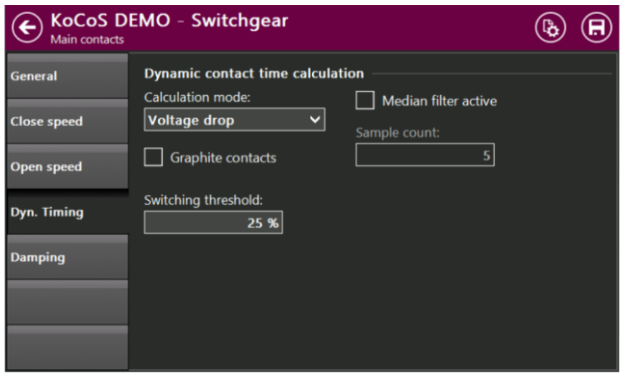
Then ACTAS calculates an idealized travel-time curve by entering the typical close or open speed.

- Enter the nozzle length and typical CLOSE/OPEN speed



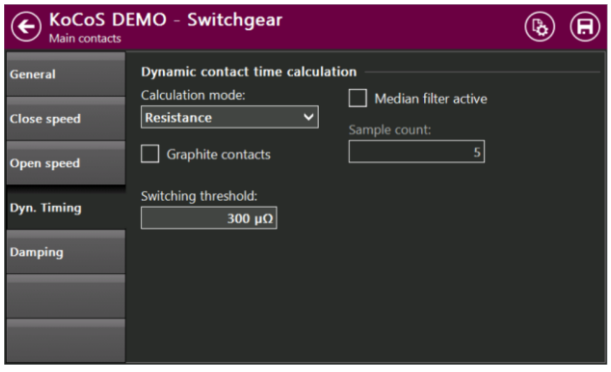
Test current (Rogowski) calculation method

- Select the **Test current (Rogowski)** calculation method for the switching time test of GIS switchgear earthed on both sides
- Adjust **Detection threshold** according to switch characteristics
- If required, activate the check box **Graphite contacts**, see above



Voltage drop calculation method

- Select the **Voltage drop** calculation method for testing switchgear devices with different contact materials such as graphite
- Adjust **Switching threshold** according to switch characteristics
- Activate the **Median filter** function if disturbing influences on the measured signals are to be filtered out
- Use the number of interpolation points (**Sample count**) to define the width of the median filter and the voltage range
- If required, activate the check box **Graphite contacts**, see above



Resistance calculation method

- Select the **Resistance** calculation method for tests with earthing on both sides
- Adjust **Switching threshold** according to switch characteristics
- Activate the **Median filter** function if disturbing influences on the measured signals are to be filtered out
- Use the number of interpolation points (Sample count) to define the width of the median filter
- If required, activate the check box **Graphite contacts**, see above

9.3.6.6 Main contacts/Damping behaviour

Circuit breakers are often equipped with an integrated damper which brakes the movement of the main contact before the final position is reached in order to prevent premature wear and tear to the mechanical components. For opening operations in particular this changes the travel-time curves recorded during tests.

The following parameters describe damper behaviour:

- **Start of damping**

This values refers to the distance of the main contact from the final OFF position at which the speed begins to slow down as a result of the action of the damper.

- **Damping duration**

This values refers to the length of time by which the arrival of the main contact in the final OFF position is delayed by the action of the damper.

- **Damping saddle height**

The height of the damping saddle corresponds approximately to the strength of the damper. The damping saddle is determined at the point at which the speed of the main contact has fallen to a value close to 0 before having reached the final OFF position.

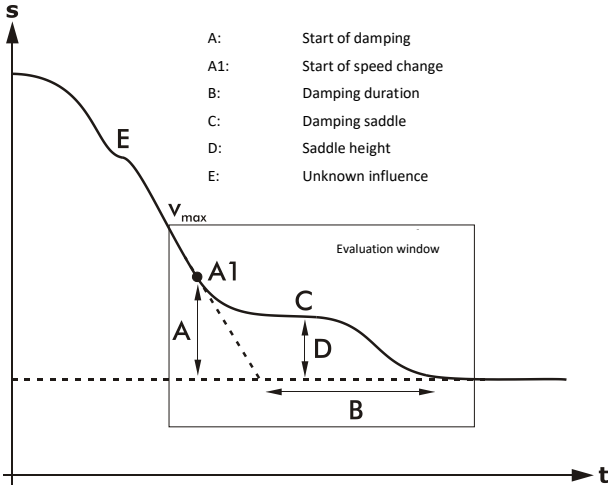
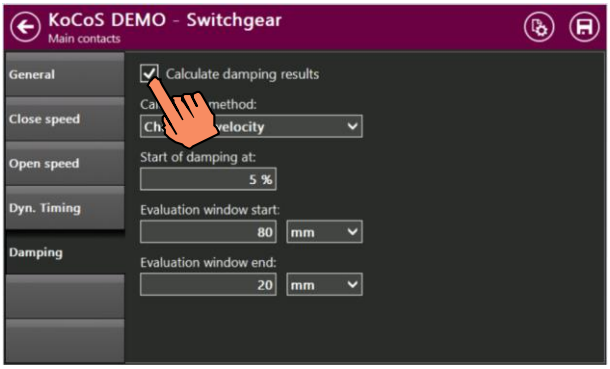


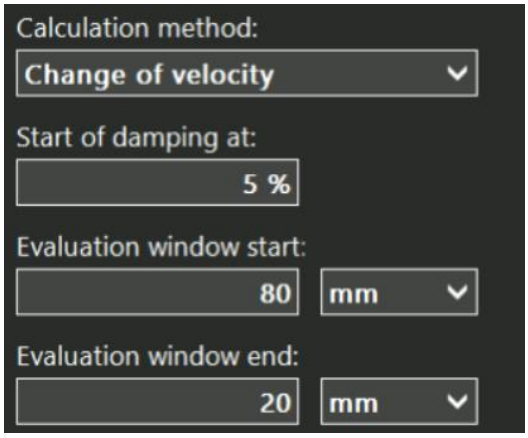
Fig.: Typical curve characteristic of an opening operation for a switchgear device with a damper

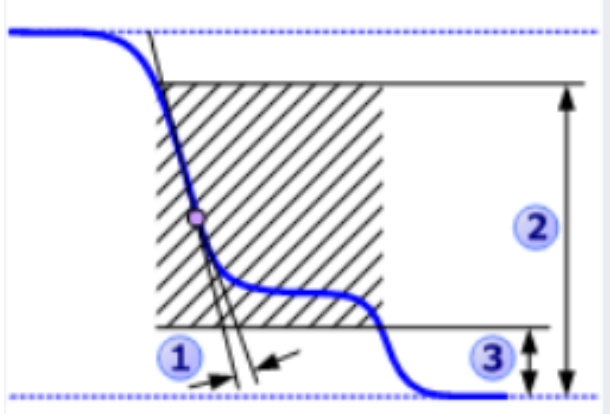
The characteristic parameters of the damper action can be determined by the evaluation algorithms saved in **ACTAS**, various quantities being determined by means of various algorithms.

As velocity deviations which are not directly connected with the dampers (point E) can also occur during undamped moving contact travel, an evaluation window must be defined. The effect of dampers on contact velocity is only examined within this window.



- ➤ Activate damping calculation
- ➤ Determine the method for calculating the damping behaviour



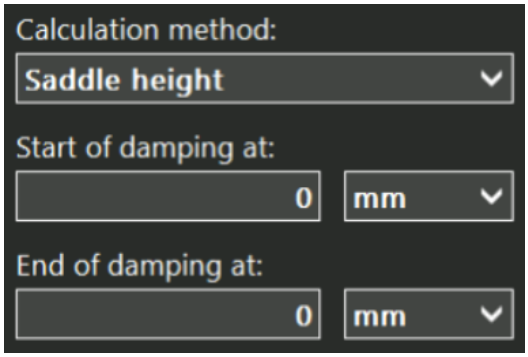


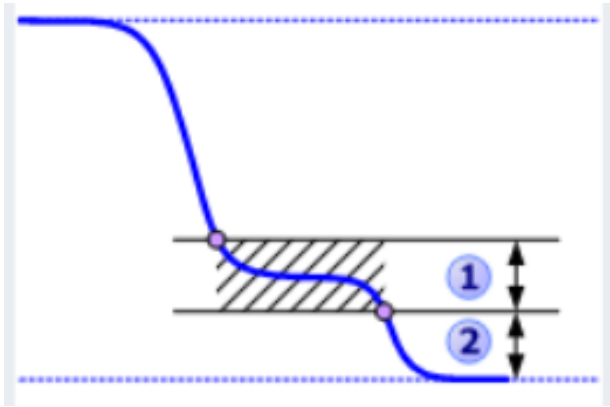
Change of velocity method

Saddle height and damping duration are determined by entering the beginning of damping, start and end of the evaluation window.

The percentage deviation of the main contact velocity from the maximum main contact velocity at which **ACTAS** is to assume that damping has begun to take effect is entered under **Start of damping at (1)**.

Use the **Evaluation window start (2)**and **Evaluation window end (3)** boxes to enter the range of the main contact position in relation to the final position to which evaluation of damping parameters is to be limited.

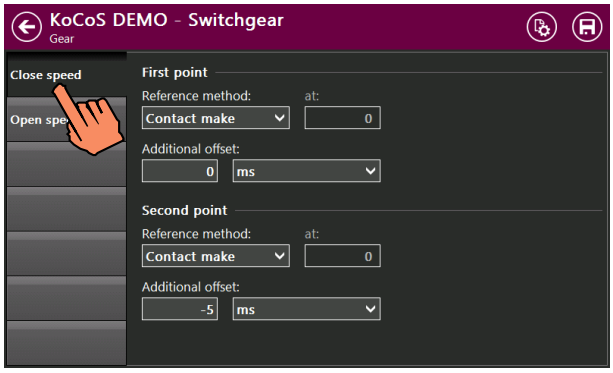




Saddle height method

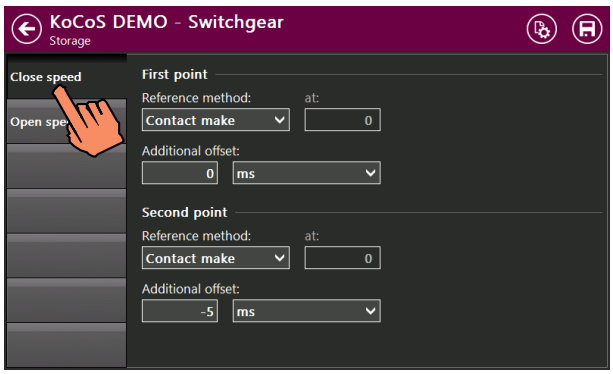
Saddle height and damping duration are determined by entering the travel points **Start of damping** (1) and **End of damping** (2).

9.3.7 Gear / Close speed and Open speed



➤ Define the start and end point for the calculation of the close and open speed with measurements at the gear

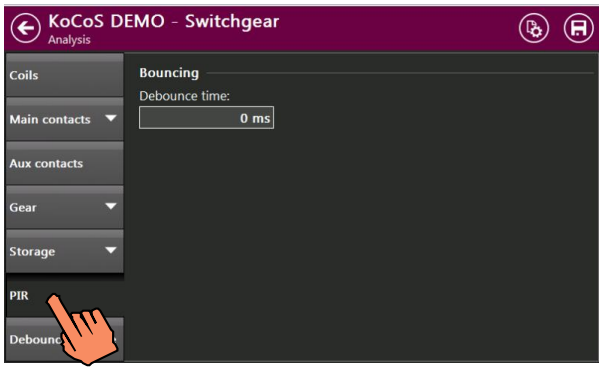
9.3.8 Storage / Close speed and Open speed



➤ Define the start and end point for the calculation of the close and open speed with measurements at the storage

9.3.9 PIR

9.3.9.1 Bouncing



➤ Enter debounce time, see under **Main contact**

The PIR value is calculated automatically within an evaluation window:

Evaluation window for PIR Close:

Start: Last fall below 1 kOhm

End: Last fall below 5 Ohm

Evaluation window for PIR Open:

Start: First exceeding of 5 kOhm

End: First exceeding of 1 kOhm

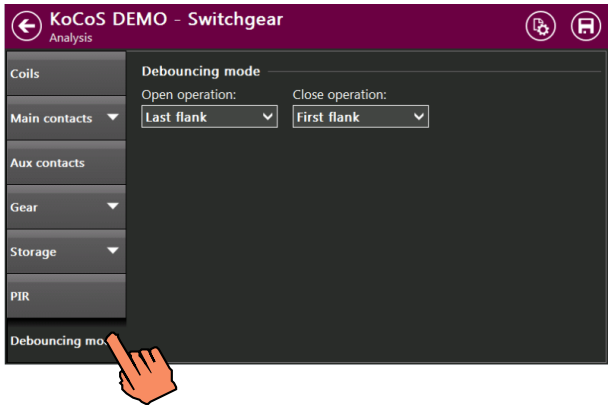
Value determination:

The values are determined by calculating the mean resistance over all sample points in the evaluation window. Each sampling point whose value meets all of the following three criteria is included in the mean value calculation:

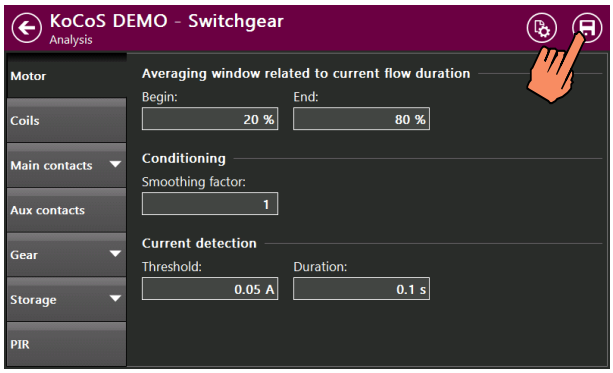
1. Value is above 5 Ohm
2. Value does not deviate by more than 5 Ohm in comparison to the previous and subsequent sampling point (only values that are almost on one level are included).
3. Value is greater than half of the previously calculated mean value (strong outliers in relation to the previous mean value are rejected).

Between Close and Open, the resistance value must be below 5 Ohm for at least 5 ms in order for the previous operation to be considered completed.

9.3.10 Debouncing mode



- Select the edge on which the evaluation is to be carried out during debouncing



Configuration is now complete.

- Save changes in a new switchgear type

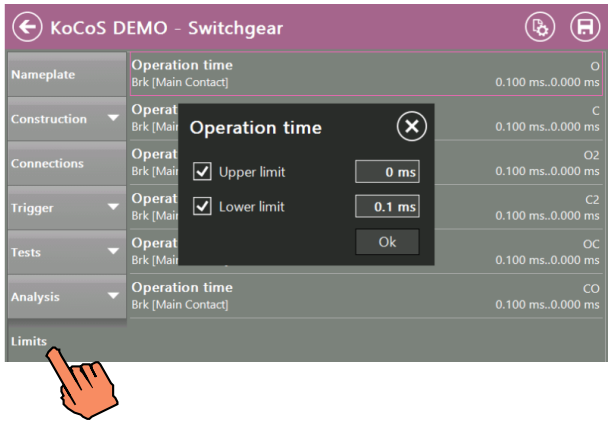
or

- Save changes in the existing switchgear device

9.3.11 Limits

NOTE

Limits is only displayed if limits have been set for evaluation in the ACTAS test software.



If limit values have been defined for evaluation in the ACTAS test software, the upper and lower limits can be activated or deactivated independently of each other and the values can be changed. Deleting and adding limit values is only possible in the PC software.

NOTE

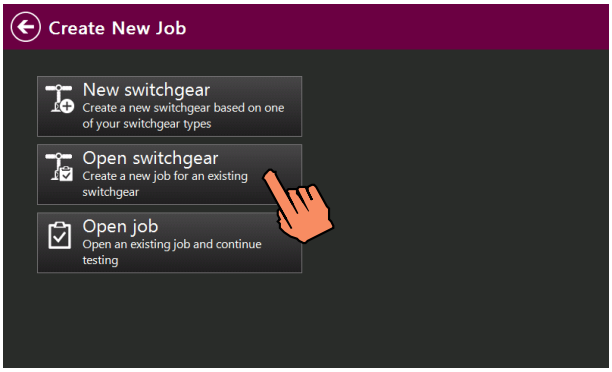
Under **Configuration/General settings/Defaults**, you can set whether the test sequence should be stopped or continued in the event of a limit value violation.

10 Test



All the functions for carrying out a switchgear test can be found in the **Operate** function group under **Test**.

10.1 Select a switchgear device



A switchgear device must be selected at the beginning of every test.

New switchgear

A new switchgear device can be created on the basis of a switchgear type, for more information see the section of these operating instructions titled **Settings for the switchgear device**.

Open switchgear

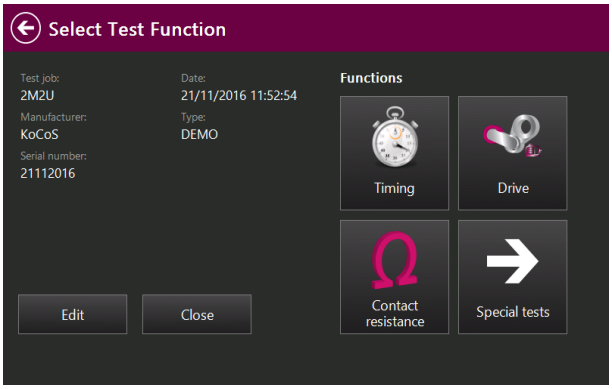
A switchgear device can be called up from the database as the basis for a new test job.

Open job

It is also possible to open an existing test and to complete it, if required.

- ➤ Select a switchgear device or an existing test

10.2 Select test function



Once a switchgear device has been selected, the **Select Test Function** window is called up.

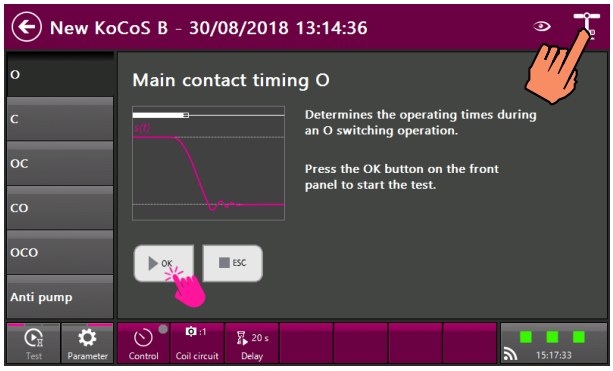
Timing measurements, drive tests as well as static and dynamic resistance measurements are saved as functions.

Further application-specific tests can be found under **Special tests**

Test jobs can be edited or the test jobs which is still open can be completed.

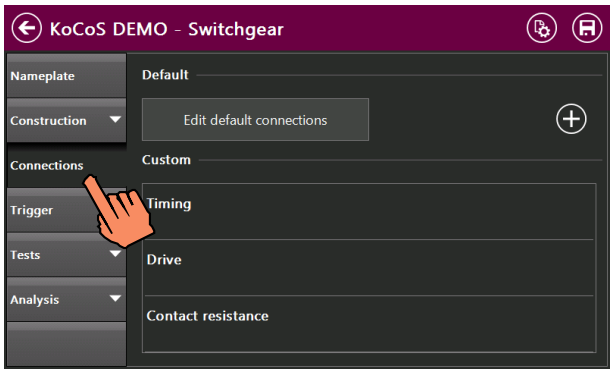
If a test job is not completed, this test job is automatically called up until it is completed.

10.2.1 Edit test parameters later on



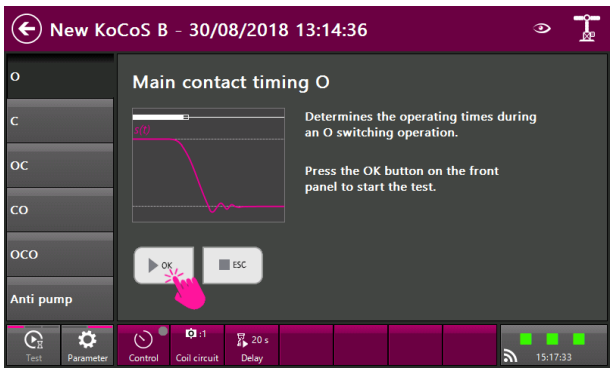
In any test function, test parameters can be edited without having to quit the test job:

- ➤ Tap the breaker icon in the top right-hand corner



The switchgear parameters are called up, any changes, e.g. to the connections, can be made directly.

10.3 Timing test function



In the **Timing** test function, the operating times for main contacts and auxiliary contacts can be tested with various switching operations.

In addition, the coil current is recorded as an analog trace and signals from sensors and travel sensors are recorded.

10.3.1 Prepare the test



Connect the test system and the device under test and carry out all settings as described above

Select switching operation on the left-hand side of the screen

Keep the mouse button pressed and swipe to scroll through the list.

Put the switchgear device into test position

Switch manually

In order to move the contacts to the required test position, a switching operation can be triggered manually via the status display.

Status display green: Breaker open

Status display red: Breaker closed

- Tap the status display
- Press the ▶**OK** key on the front panel to trigger a switching operation



Start the test

- Press the ▶**OK** key on the test system to start the test



Start the test with time delay

- Call up **Parameter** function bar
- Call up the **Delay** function and set the delay

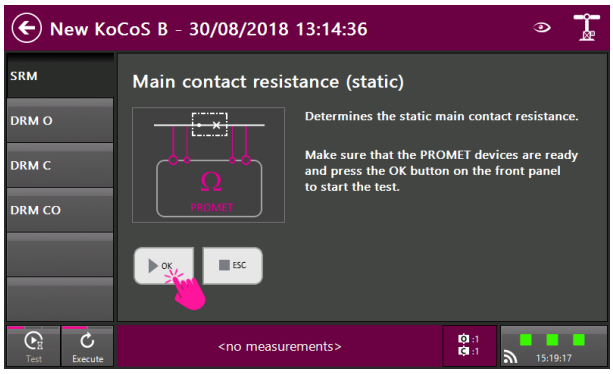
After pressing the ▶**OK** key, the configured time is counted down and the test is then started automatically. During the time delay, the test can be cancelled at any time with the ■**ESC** key.

The setting is saved globally for the test system and applies, even after a restart, to each test until it is changed by the user.

Within sequences, the time delay is only applied before the first test step.

If external triggers are set, the time delay runs first, then the trigger is waited for.

10.3.2 Contact resistance test function



Used in combination with PROMET ohm meters, both the static and the dynamic contact resistance can be determined simultaneously on three poles with two interrupter units each.

CAUTION

To avoid inductive / capacitive coupling which can cause damage to the measuring device, PROMET may only be connected to closed, earthed breakers!

10.3.2.1 Connect PROMET SE

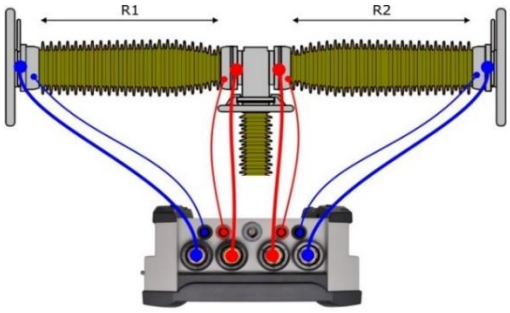


Fig.: PROMET SE connected to two interrupter units

Example: PROMET SE on two interrupter units

- Earth the breaker and set it to closed switching state
- Use the carrying strap to hang PROMET SE up on the main contact chamber
- Connect PROMET SE to the interrupter units (4-wire method)
- Use patch cables to connect PROMET SE to the **External Device Control** interfaces on the ACTAS P260+/360

If more than six interrupter units are to be measured at the same time, the PROMET SE devices needed are to be connected to the fourth interface via the CSW3 connection unit.



Fig.: Cable set CS 203



Fig.: Cable set CS 100-DRM

CAUTION

The patch cables between the ACTAS P260+/P360+ and PROMET SE and, if present, the CSW3 connection unit, must be connected immediately one after the other in order to prevent high voltages from being coupled in via the cable, which can cause damage to the meter.

Cable sets

Cable set CS 203:
high-current leads 2 x 3 m / 25 mm² for
for DRM measurements with a current of up to 180 A

Cable set CS 100-DRM:
high-current leads 1 x 5 m / 10 mm², 1 x 1 m / 10 mm² for measurements in the DRM I mode with a constant current of just over 100 A

CAUTION

When connecting the PROMET SE to the breaker, pay attention to the following:

- Only use the KoCoS CS 100-DRM cable set for carrying out current controlled contact resistance measurements
- Always use high-current connection clamps (with short cable and plug) together with the high-current leads (extension cables)
- Using the high-current connection clamps without the high-current leads (extension cables) or using the wrong cable set may cause damage to the device!

10.3.2.2 Set PROMET SE

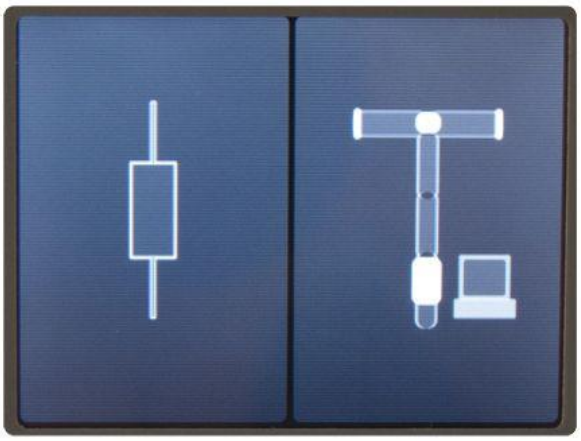
The contact resistance measurement with PROMET SE can be carried out with voltage or current control.

Voltage controlled mode (DRM-U):

In the DRM-U mode, the current of the PROMET SE adjusts to the contact resistance value while the breaker is closed. This means that the capacitor voltage adjusts in such a way that a configured test current of e.g. 150 A flows at the resistance of the measuring lead and contact. If an arc contact greater than 3 mΩ is added during the dynamic test, the current is reduced by the various resistances. In voltage-controlled operation, PROMET SE with the CS 203 cable set (3 meters, 25 mm²) can be adjusted to test currents from 5 to 180 A.

Current controlled mode (DRM-I):

In the DRM-I mode, the current is controlled to a constant 108 A. This means that the current remains constant regardless of the load, resulting in stable current curves. In this mode, however, it is necessary to use a special cable set (CS 100-DRM: 5 meters, 10 mm² + 1 meter, 10 mm²) in order to make this control work, to minimize power loss in PROMET SE and not to destroy the device. Important: The CS 203 cable set cannot be used in this mode!



- Use the **ESC** function key to switch to the selection of the measuring mode
- Select the measurement mode with PROMET and ACTAS



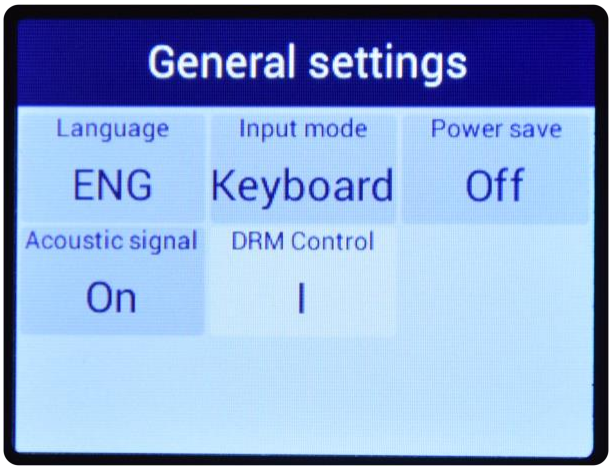
Stand-alone measurement with PROMET.



Measuring mode for the static (SRM) and dynamic (DRM) resistance measurement with PROMET and ACTAS, voltage controlled.

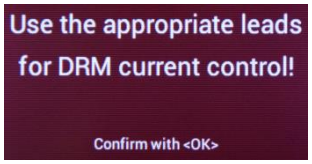


Measuring mode for the static (SRM) and dynamic (DRM) resistance measurement with PROMET and ACTAS, current controlled.



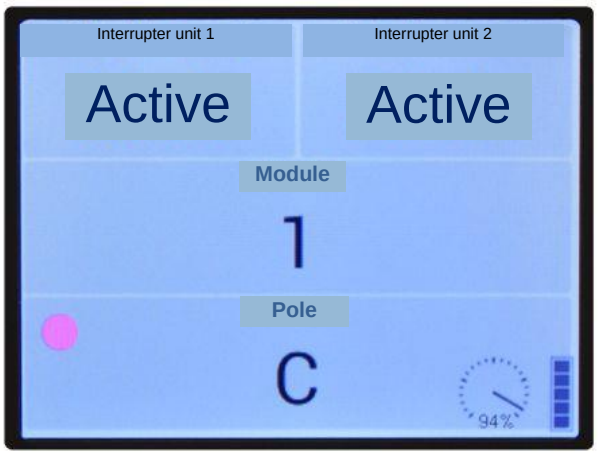
DRM Control

- Under **Settings/General/DRM Control**, set whether the measurement is to be carried out with current or voltage control.
- Set the **Power save** mode to **Off**



CAUTION

Current controlled DRM measurements may only be carried out with the KoCoS CS 100-DRM cable set!



- Make the settings for interrupter unit, module and pole. For more information, see the section of these operating instructions titled **Nomenclature in the main circuit**
- Use the **OK** key to switch to the stand-by mode

The display is switched off, PROMET SE is now ready for the measurement with ACTAS.

NOTE

If the resistance measuring device is connected to ACTAS, the setting can also be made directly on the test system, see **Configuring PROMET via ACTAS**

10.3.2.3 Connect PROMET L100

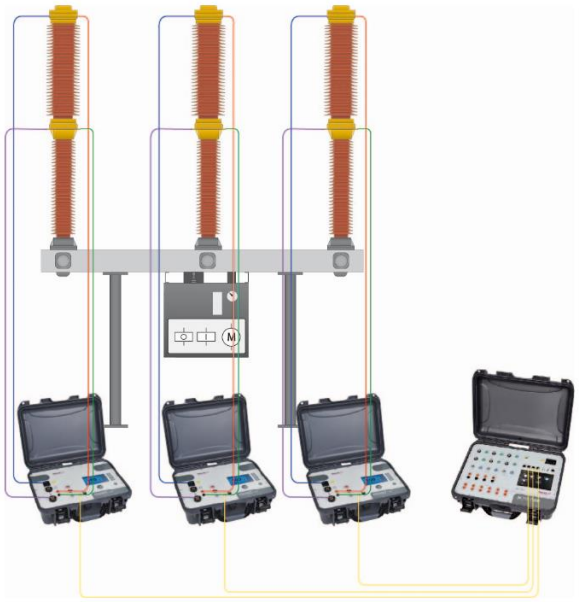


Fig.: Three PROMET R600 connected to three interrupter units

Only one interrupter unit at a time can be measured with a PROMET L100.

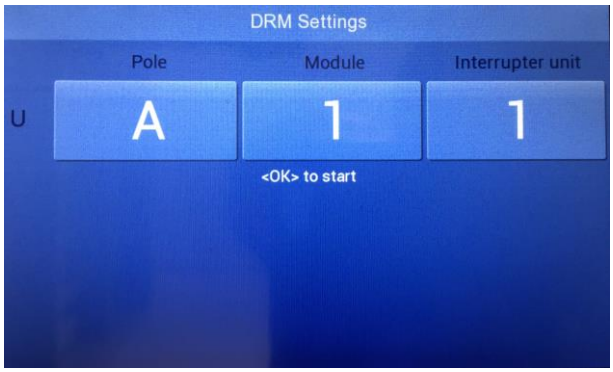
- Earth the breaker and set it to closed switching state
- Connect PROMET L100 to the interrupter unit (4-wire method)

The connection should be made using the standard cable set provided and/or the corresponding extension sets.

- Use patch cables to connect PROMET L100 to the **External Device Control** interfaces on the ACTAS P260+/360

If more than three interrupter units are to be measured at the same time, the PROMET L100 devices needed are to be connected to the fourth interface of ACTAS via the CSW3 connection unit.

10.3.2.4 Set PROMET L100



- On the PROMET, use the **ESC** function key to switch to **Settings**.
- Go to **DRM Mode**
- Assignment of the voltage measurement channels to the poles, modules and interrupter units to be measured

For the static measurement shown above at three poles with one module and one interrupter unit each, the setting shown on the left is required.

- Confirm the settings with the **OK** function key

PROMET switches to **Remote control** mode, the measurement can be carried out via ACTAS, see under **Setting ACTAS**.

NOTE

If the resistance measuring device is connected to ACTAS, the setting can also be made directly on the test system, see **Configuring PROMET via ACTAS**

10.3.2.5 Connect PROMET R300/600, static measurement

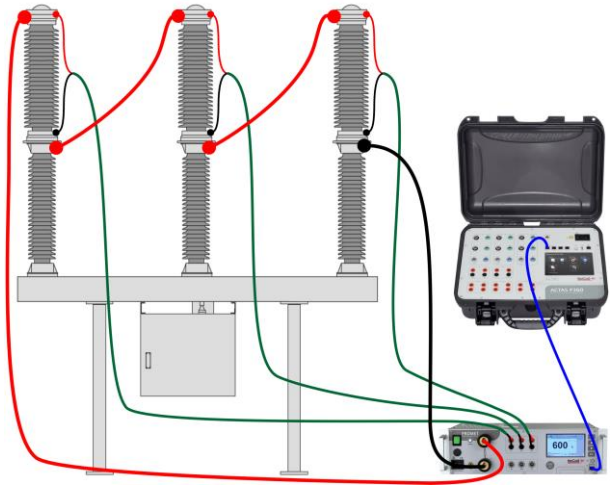


Fig.: PROMET R600 connected to three interrupter units

During a static contact resistance measurement, up to three interrupter units can be measured simultaneously with one PROMET 300/600 by connecting the current output via all three interrupter units in series. All three voltage inputs U1, U2 and U3 are used for measurement.

- Earth the breaker and set it to closed switching state
- Connect PROMET R300/600 to the interrupter units (4-wire method)

The connection should be made using the standard cable set provided and/or the corresponding extension sets.

- Use patch cables to connect PROMET R300/600 to the **External Device Control** interfaces on the ACTAS P260+/360

10.3.2.6 Connect PROMET R300/600, dynamic measurement

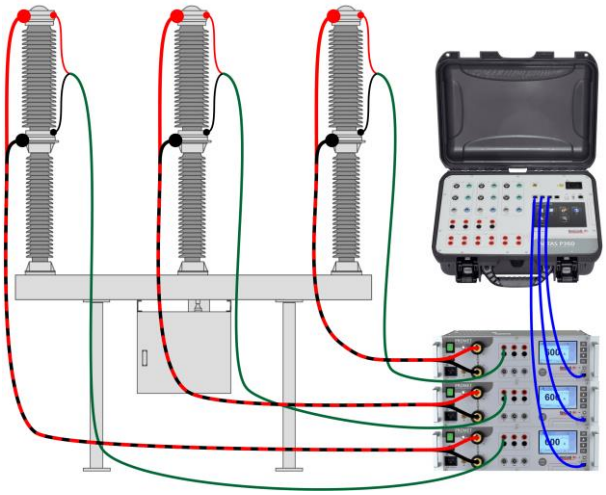


Fig.: Three PROMET R600 connected to three interrupter units

During the dynamic contact resistance measurement, one interrupter unit each can be measured with one PROMET 300/600.

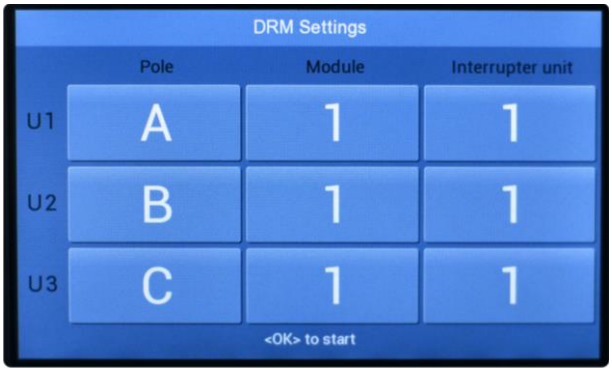
- Earth the breaker and set it to closed switching state
- Connect PROMET R300/600 to the interrupter units (4-wire method)

The connection should be made using the standard cable set provided and/or the corresponding extension sets.

- Use patch cables to connect PROMET R300/600 to the **External Device Control** interfaces on the ACTAS P260+/360

If more than three interrupter units are to be measured at the same time, the PROMET R300/600 devices needed are to be connected to the fourth interface of ACTAS via the CSW3 connection unit.

10.3.2.7 Set PROMET R300/600



- On the PROMET, use the **ESC** function key to switch to **Settings**.
- Go to **DRM mode**
- Assignment of the voltage measurement channels to the poles, modules and interrupter units to be measured

For the static measurement shown above at three poles with one module and one interrupter unit each, the setting shown on the left is required.

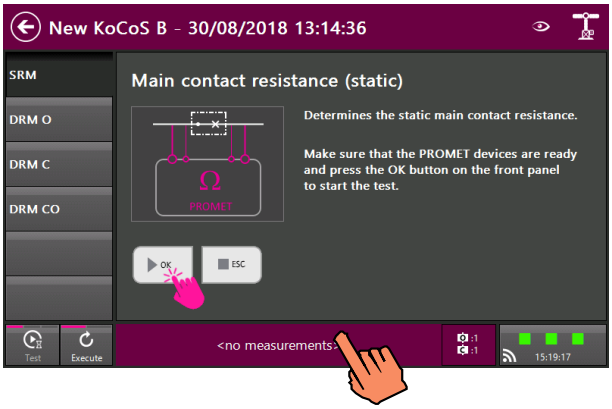
- Confirm the settings with the **OK** function key

PROMET switches to **Remote control** mode, the measurement can be carried out via ACTAS, see under **Setting ACTAS**.

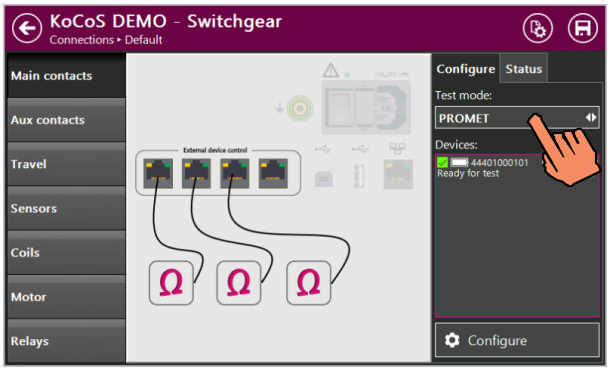
NOTE

If the resistance measuring device is connected to ACTAS, the setting can also be made directly on the test system, see **Configuring PROMET via ACTAS**

10.3.2.8 Set ACTAS



- Tap the status bar to call up the connection parameters for main contacts



- Set **PROMET** test mode

PROMET devices connected with ACTAS are displayed under **Devices**.

- Put the switchgear device into **CLOSE** test position
- Set the test current

NOTE

When measuring with PROMET SE, always set the following test currents:

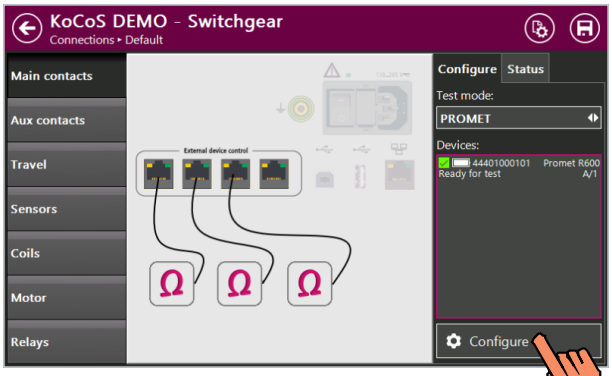
Measuring mode voltage controlled:	5-180 A
Measuring mode current controlled:	108 A

- Set expected voltage measuring range
- Wait until all PROMET devices have finished adjusting and the **Ready for test** status is displayed

NOTE

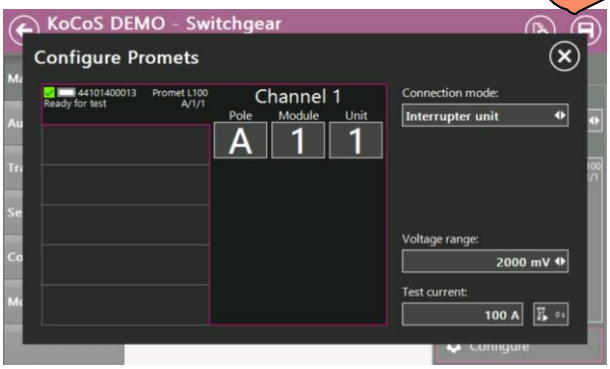
For the resistance measurement it is important to ensure that the smallest possible voltage measuring range is set in order to achieve the highest possible degree of accuracy.
In addition, one side of the earthing is to be removed during the measurement.

10.3.2.9 Configure PROMET via ACTAS



PROMET devices connected to ACTAS can be configured directly via the test system.

- Tap **Configure**



The assignment of the voltage measurement channels to the poles, modules and interrupter units to be measured, as set in PROMET, is displayed.

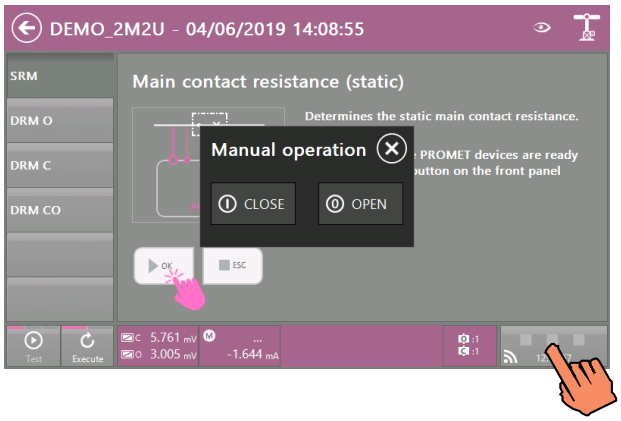
By clicking on the **Pol/Module/Unit** fields, the assignment to which breaker unit the PROMET is connected can be changed from ACTAS.

The settings for voltage range and test current are also possible from here.

NOTE

If, for example, several modules have been specified for a switchgear under **Construction**, an entry must be made here for **Module** to make it clear which module is being measured.

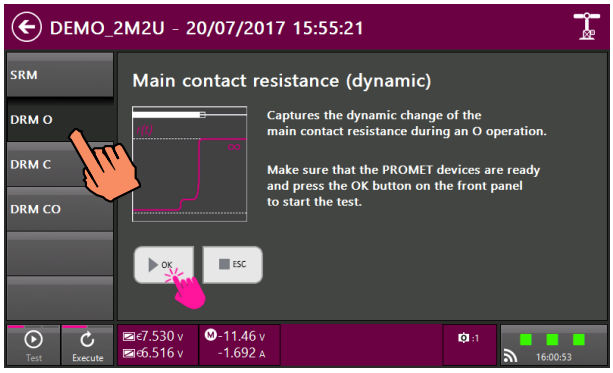
10.3.2.10 Interrupter units status display



- Tap the display

The **Manual operation** window is called up.

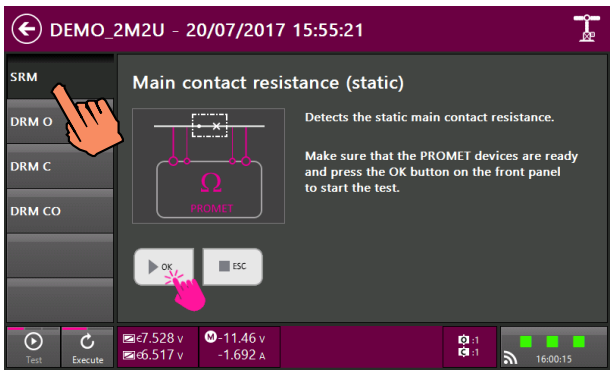
10.3.2.11 Dynamic resistance measurement DRM



A dynamic contact resistance measurement determines the resistance characteristic during a CLOSE/OPEN switching operation. The measurement gives an indication of the length and state of the arcing contacts of high-voltage breakers, for example.

- Select DRM
- Move the contacts to be measured to the **OPEN** position by tapping the status display
- Press the **OK** key on the test system to start the test

10.3.2.12 Static resistance measurement SRM

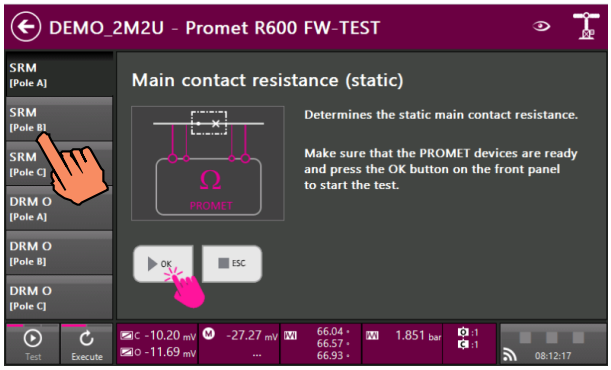


Problems, such as high transfer resistance resulting from poor connections, can be identified by measuring static contact resistance.

During a static contact resistance measurement, the resistance is determined when the contacts are closed.

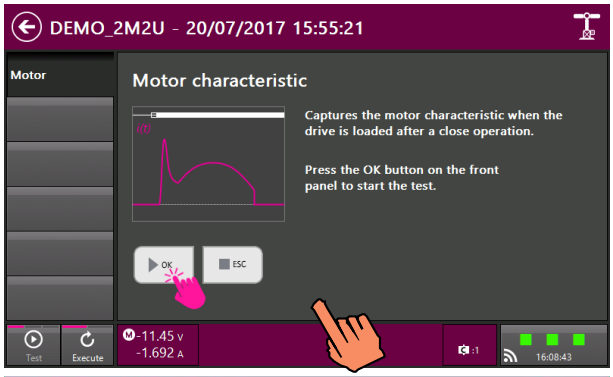
- Select SRM
- Move the contacts to be measured to the **CLOSE** position by tapping the status display
- Press the **OK** key on the test system to start the test

10.3.2.13 Resistance measurement on individual poles



In order to perform resistance measurements for poles **A**, **B** and **C** separately, the check box **Execute tests for each pole separately** must be activated in the settings for the switching device under **Tests/Contact resistance**.

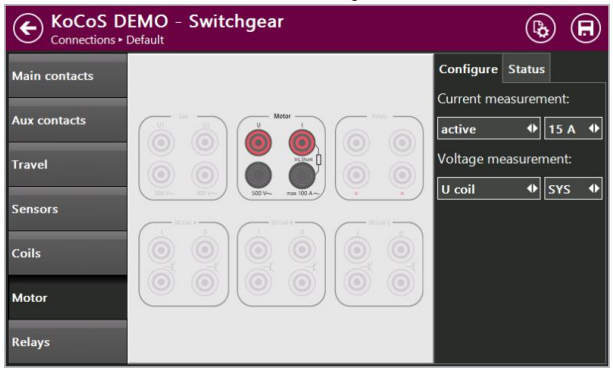
10.3.3 Drive test function



ACTAS offers the option of measuring and evaluating the operating current and the operating voltage of the drive motors.

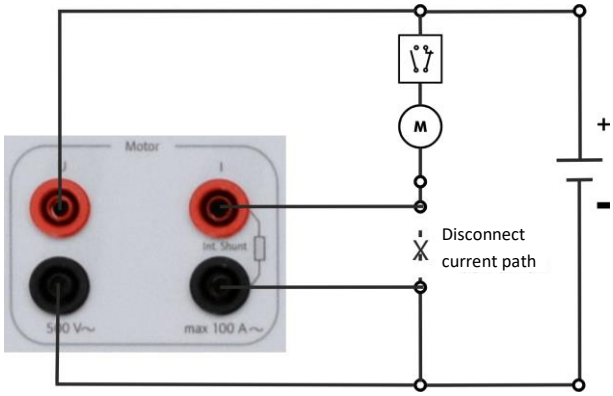
Set ACTAS

- ➤ Tap the status bar to call up the connection parameters for motors



- ➤ Activate/deactivate motor current measurement and select measuring range
- ➤ Activate/deactivate motor voltage measurement

Fig.: ACTAS P360+



Connect source and ACTAS

- ➤ Connect the power source to the device under test and configure the settings in accordance with the operating instructions
- ➤ Connect current measurement to ACTAS

The motor current can be measured directly via a shunt which is integrated in the device. The current measurement has a measuring range of up to 100 A.

In order to measure the operating current, the electricity supply to the motor must go via this shunt.

- ➤ If activated, connect voltage measurement to ACTAS

⚠ CAUTION

During the current measurement, the 4 mm safety sockets may only be applied with up to 100 A peak for short periods, less than 200 ms. The rated current is 32 A.

The measuring leads used should be as short as possible. Particularly when connecting the operating coils and the measuring loop for the motor current measurement, check the correct dimensioning of the conductor cross-sections.

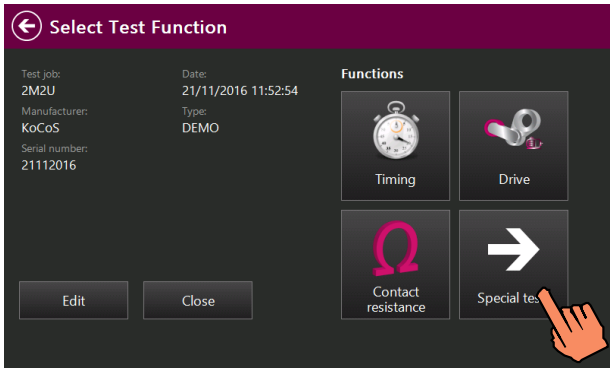
NOTE

For a breaker with single-pole drive, the motor current test must be carried out pole by pole. This means that for a full test of all three drives, three recordings must be made.



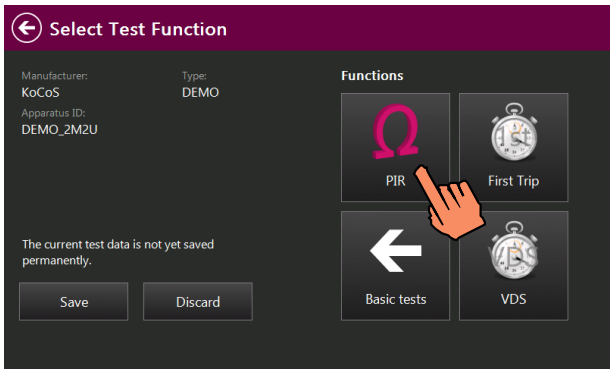
- Press the **OK** key on the test system to start the test
-

10.4 Special tests



Various application-specific tests can be carried out under **Special tests**.

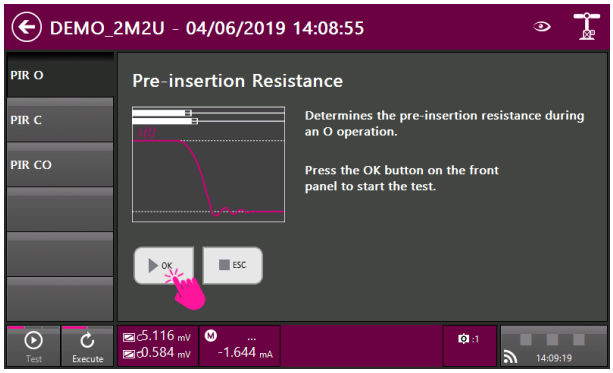
10.4.1 Closing/Opening resistance PIR



In the **PIR** test function, the operating times for main contacts and auxiliary contacts can be tested with various switching operation.

NOTE

The **PIR** test function can only be called up if the **Closing resistors** and/or **Opening resistors** check box is activated under **Construction/Main circuit**.



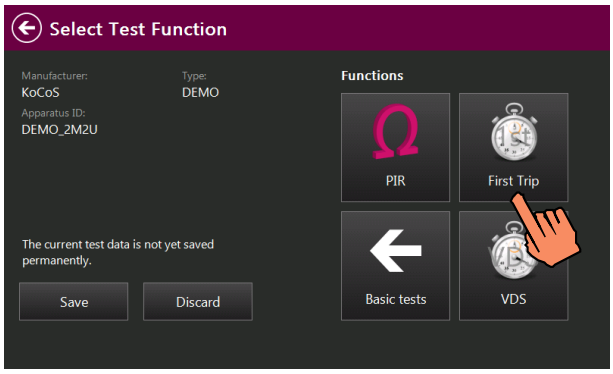
In the **PIR** test function, the operating times for main contacts and auxiliary contacts can be tested with various switching operation.

In addition, the coil current is recorded as an analog trace and signals from sensors and travel sensors are recorded.

NOTE

The main contact wires for breaker unit 1 and 2 must not be plugged together. If only one PIR is used, connect only one wire

10.4.2 First Trip



In the **First Trip** mode, the operating times and coil currents are measured via external sensors. The switchgear device can remain in operation, provided that the secondary quantities can be accessed safely. The test is triggered by external triggers.

10.4.2.1 Connection

WARNING

During the first trip test, the switchgear is not disconnected, provided that the measured quantities can be accessed safely at all times. Comply with safety rules!

Using ACTAS, first trip measurements can be performed on three phases. For connection to secondary current transformers, up to nine external analog sensors, such as non-contact DC or AC clamps, can be connected to the test system simultaneously and recorded. Up to three direct voltage measurement channels are available for voltage transformers. Which connections are to be used on the ACTAS is indicated when the connections are configured, see above.

- Connect the sensors to the secondary side of the current transformers and to the release coils and connect them to ACTAS according to the configuration

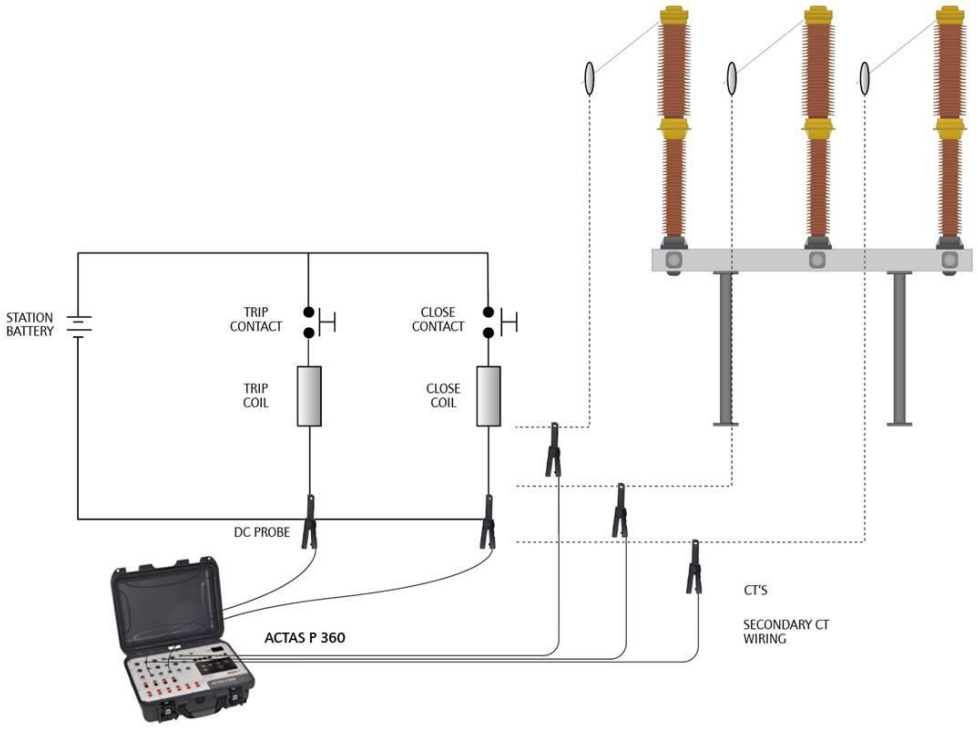
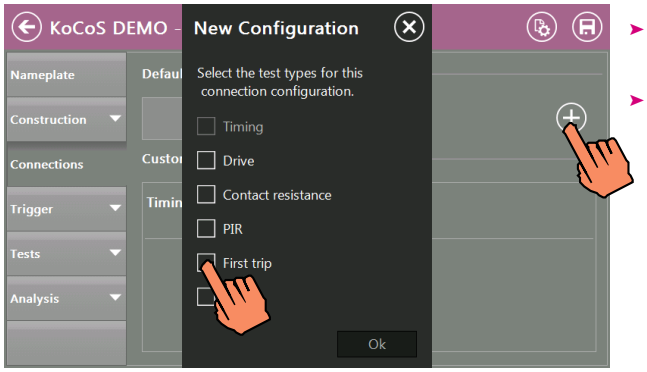
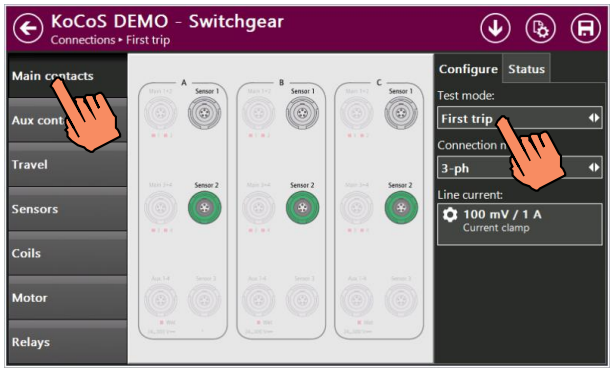


Fig.: Connection diagram for first trip tests with ACTAS P360+

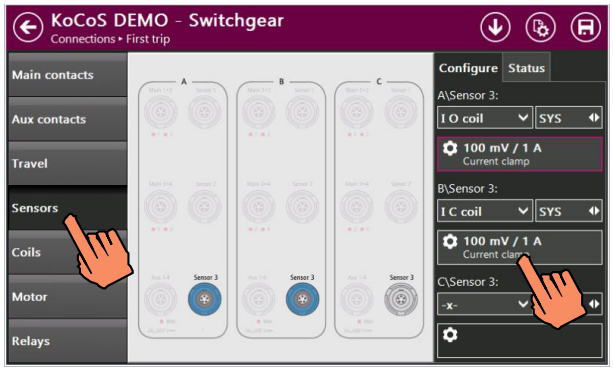
10.4.2.2 Configuration



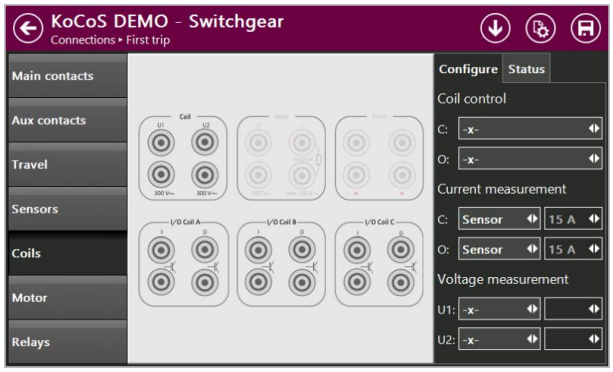
- Create an own **First Trip** connection configuration under **Connections**
- Click **First Trip** connection configuration to open it



- Select the First Trip test mode under Connections/Main contacts
- Set the connection mode to three phase or per pole
- Configure the used sensor

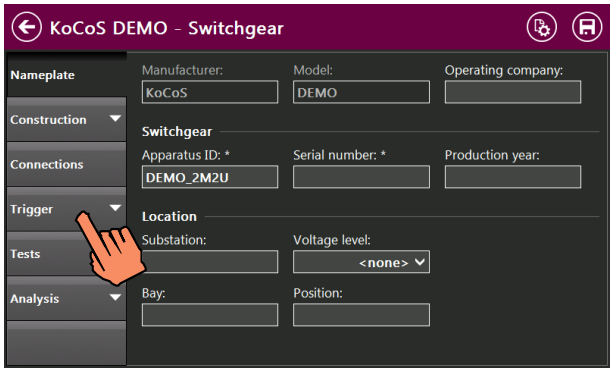


- Set the sensors for measuring the coil currents under **Connections/Sensors**

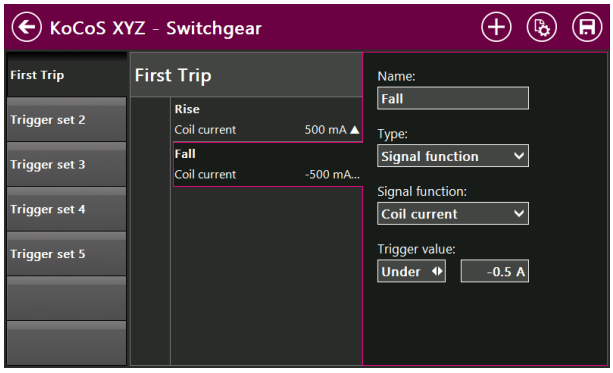


Settings under **Connections/Coils** are not required. An active coil control does not take place because external triggers are used.

Under **Current measurement**, the already configured acquisition via sensors is displayed.



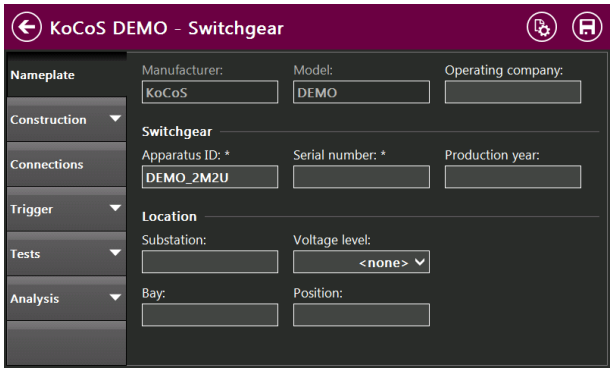
- Switch to **Trigger**



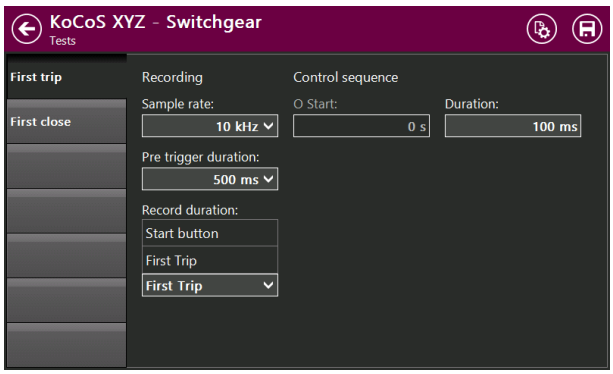
➤ Apply a **Signal function/Coil current** trigger set with an **Over** trigger with positive trigger value and an **Under** trigger with negative trigger value

NOTE

If several triggers are created in one trigger set, they are ORed to each other.



➤ Switch to **Tests/First Trip**



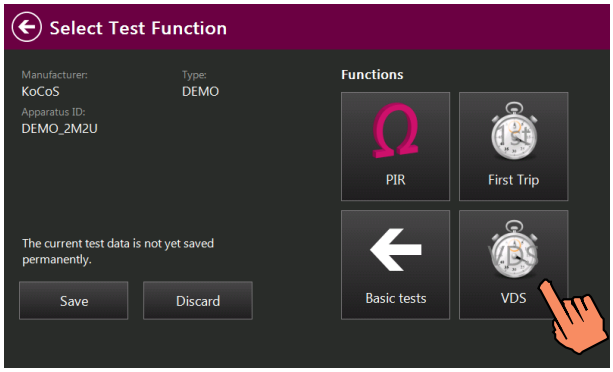
➤ Defining parameters for the recording

NOTE

In order to obtain an optimum test result, the basic settings of 500 ms for the duration of the pre-trigger and the recording duration should not be undershot.

➤ Select trigger, see above

10.4.3 VDS (ACTAS P360+ only)



In **VDS** mode, the operating times and the coil currents are measured directly at the capacitive measurement points of a VDS system. The switchgear device can remain in operation, provided that the secondary quantities can be accessed safely. The test is triggered by external triggers.

10.4.3.1 Connection

WARNING

During the VDS test, the switchgear does not have to be disconnected, provided that the measured quantities can be accessed safely at all times. Comply with safety rules!

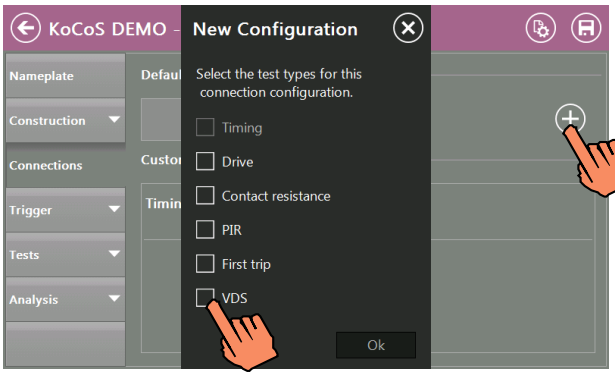


Using ACTAS P360+, the VDS measurement can be carried out on three phases at the ACTAS voltage inputs U1/U2/U. Which connections are to be used in detail, is indicated when the connections are configured, see above.

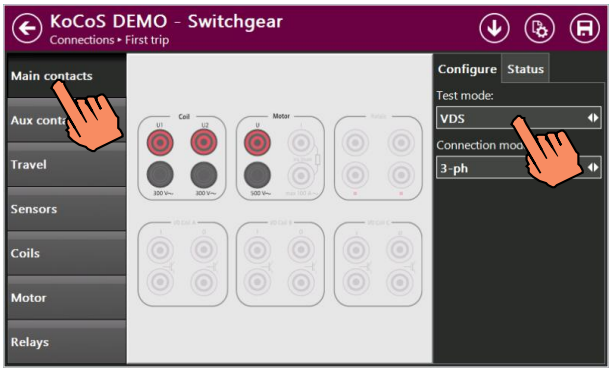


To make the connection, ACTAS connection cables labelled with **Voltage** can be used.

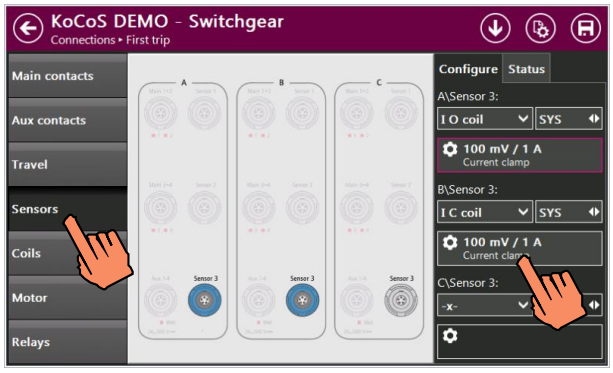
10.4.3.2 Configuration



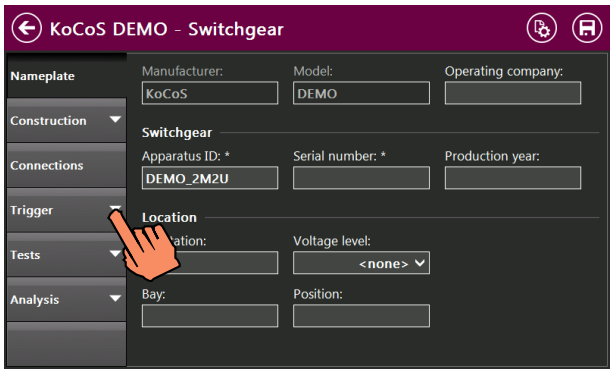
- Create an own **VDS** connection configuration under **Connections**
- Click **VDS** connection configuration to open it



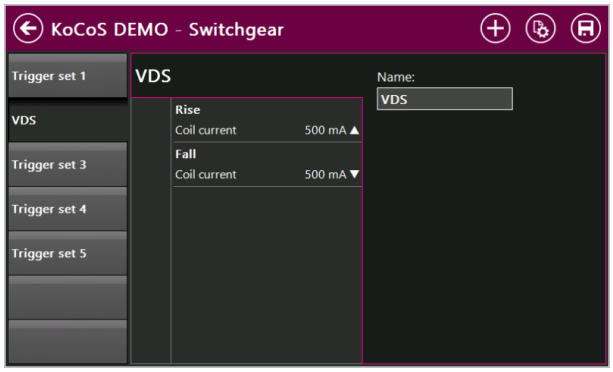
- Select the **VDS** test mode under **Connections/Main contacts**
- Set the connection mode to three phase or per pole



- Set the sensors for measuring the coil currents under **Connections/Sensors**



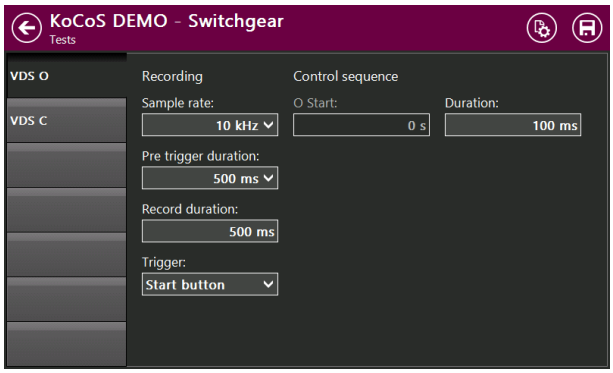
- Switch to **Trigger**



- Apply a **Signal function/Coil current** trigger set with an **Over** trigger with positive trigger value and an **Under** trigger with negative trigger value

NOTE

If several triggers are created in one trigger set, they are ORed to each other.



- Switch to **Tests/VDS**
- Defining parameters for the recording

NOTE

In order to obtain an optimum test result, the basic settings of 500 ms for the duration of the pre-trigger and the recording duration should not be undershot.

- Select trigger, see above

10.4.4 Operating times test of GIS switchgears with earthing on both sides



If at least one insulated earthing switch is available, the measurement of the operating times can be carried out on a GIS switchgear with earthing on both sides.

The measurement is carried out similar to a conventional operating time test. Three Rogowski coils and at least one PROMET Ohm meter are also used.

The voltage drop is not relevant for this test method and does not need to be connected or configured.

10.4.4.1 Connection



Fig.: Rogowski coil on the insulated earthing switch of a GIS switchgear

All connections except those of the main contacts are made in the same way as for the conventional timing test, see the sections **Connect the device under test** and **Test**.

3 Rogowski coils and at least one PROMET Ohm meter are required to measure the main contact operating times.

The Rogowski coils are connected to the insulated earthing switch per pole:

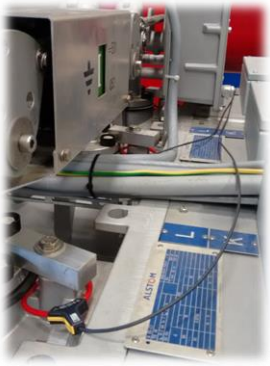


Fig.: Rogowski coil on insulated earthing switch



Fig.: PROMET SE on a GIS switchgear

Note

At least 1 insulated earthing switch must be available. When connecting the Rogowski coils, pay attention to the correct current flow direction!

The red PROMET power cables are also attached to the insulated earthing switch, the black power cables are attached to the other side of the interrupter unit on the GIS switchgear, or, failing this, depending on the design of the switchgear alternatively to the housing.

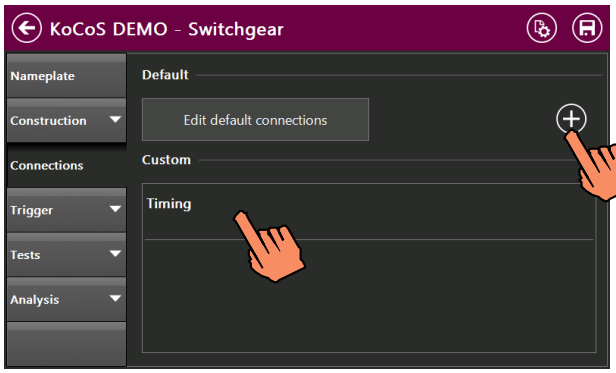
GIS switchgear, 3 interrupters, one switching tube:

To obtain an optimal test result, 3 PROMET SE or 3 PROMET L100 should be connected in parallel to the GIS switchgear. When using the PROMET R600 only one device is required, depending on the switchgear. The voltage drop channels are not required for the measurement.

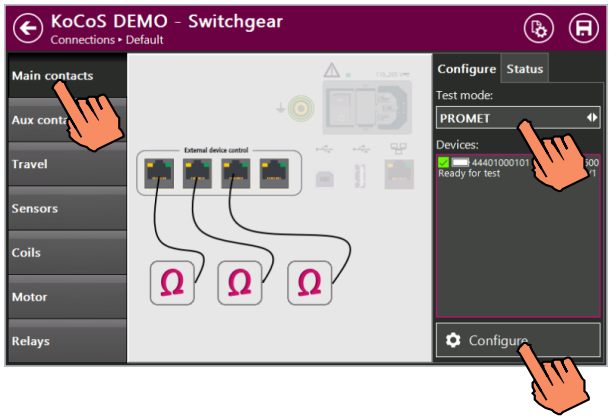
GIS switchgear, 3 interrupters, one switching tube each:

To obtain an optimum test result, one PROMET device should be connected for each switching tube. The voltage drop channels are not required for the measurement.

10.4.4.2 Configuration



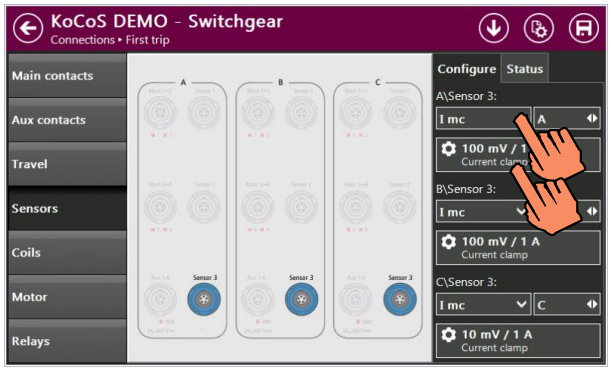
- Under **Connections/Custom**, open the **Timing** configuration or, if not already available, create and open them, see the section **Connection configurations for test functions**



- Under **Main contacts**, select test mode **PROMET**
- Tap **Configure**
- Set the test current

Guide values for test current:

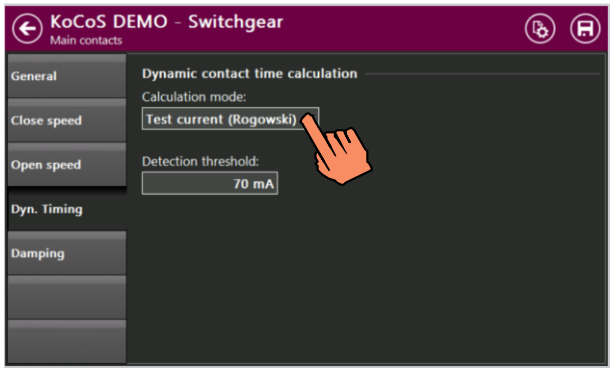
- PROMET SE and L100 min.100 A
- PROMET R300/R600 depending on switchgear min 300 A



- Switch to Connections/Sensors
- Set sensors for measuring I mc (main contact) at poles A/B/C
- In the box ⚙, configure a Current clamp with the corresponding transformation ratio

NOTE

The offset adjustment for the current clamps is carried out automatically before every test



- Switch to Analysis/Main contact/Dynamic Timing
- Set Test current (Rogowski) as calculation mode

NOTE

If the evaluation of operating times fails, the detection threshold must be determined using a cursor and adjusted here as required.

10.4.5 SRM and DRM test of GIS switchgears with earthing on both sides



If at least one insulated earthing switch is available, the measurement of both the static and dynamic contact resistance can be carried out on a GIS switchgear with earthing on both sides. The measurement is carried out similar to a conventional SRM/DRM test.

However, to determine the resistance across the contact gap, AC/DC current clamps are used to record the current flow through the interrupter unit. The voltage drop is also measured.

10.4.5.1 Connection



Fig.: Current clamp on the insulated earthing switch of a GIS switchgear

All connections are made in the same way as for a conventional SRM/DRM test, see the sections **Connect the device under test** and **Test**.

For the current measurement, AC/DC current clamps are connected to the insulated earthing switch per pole.

Note

At least 1 insulated earthing switch must be available. When connecting the current clamps, pay attention to the correct current flow direction!



Fig.: Current clamps, PROMET and voltage drop cable on a GIS switchgear

The red PROMET power cables are also attached to the insulated earthing switch, the black power cables are attached to the other side of the interrupter unit on the GIS switchgear or, failing this, depending on the design of the switchgear alternatively to the housing.

The voltage drop cables must also be connected together with the current cables in the respective colour. Depending on the switch construction, the measured voltage drop can influence the result of the resistance measurement and the exact resistance of the interrupter unit is not necessarily determined. However, it is important to measure always at the same place.

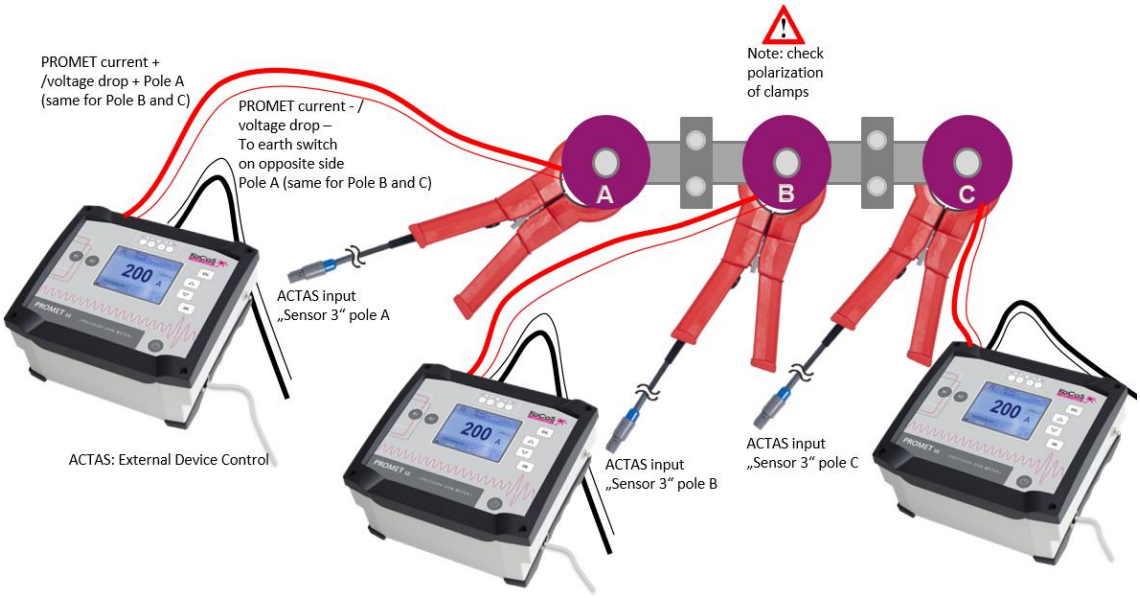
GIS switchgear, 3 interrupters, one switching tube:

To obtain an optimal test result, 3 PROMET SE or 3 PROMET L100 should be connected in parallel to the GIS switchgear. When using the PROMET R600, only one device is required, depending on the plant.

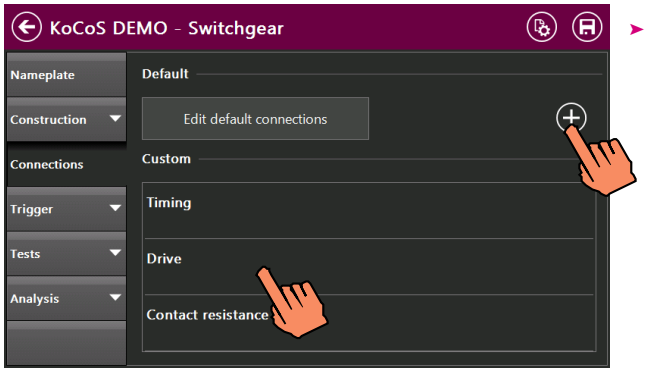
GIS switchgear, 3 interrupters, one switching tube each:

To obtain an optimum test result, one PROMET device should be connected per switching tube.

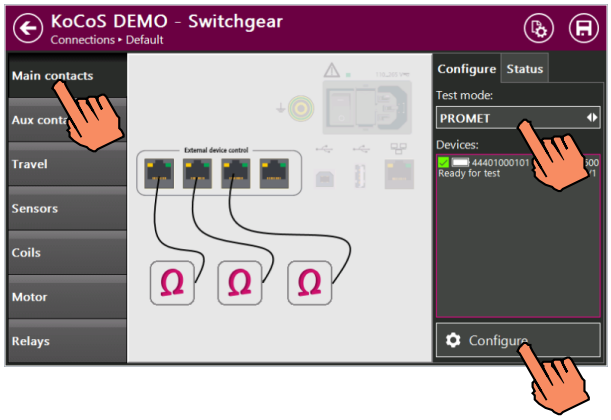
Connection scheme for measurement on three poles simultaneously



10.4.5.2 Configuration



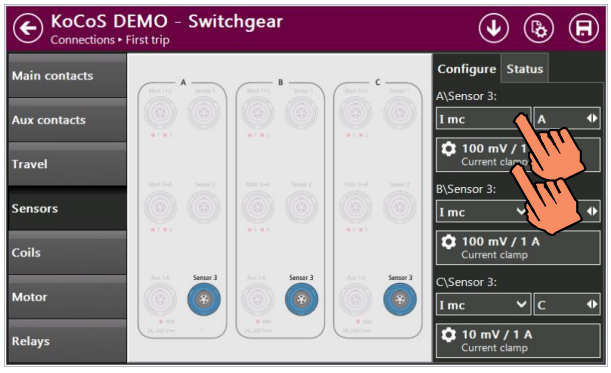
- Under **Connections/Custom,** open the **Contact resistance** configuration or, if not already available, create and open it, see the section **Connection configurations for test Functions**



- Under Main contacts, select **PROMET** test mode
- Tap **Configure**
- Set the test current

Guide values for test current:

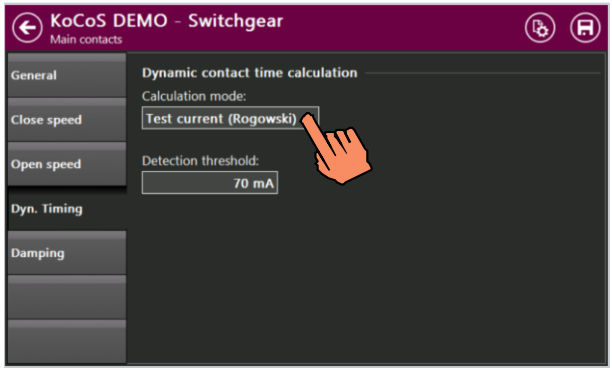
- PROMET SE and L100 min. 100 A
- PROMET R300/R600 depending on switchgear min. 300 A



- Switch to **Connections/Sensors**
- Set sensors for measuring **I mc** (main contact) at poles **A/B/C**
- In the box , configure a **Current clamp** each with the corresponding transformation ratio.

NOTE

The offset adjustment for the current clamps is carried out automatically before every test



- Switch to **Analysis/Main contact/Dynamic Timing**
- Set Test current (Rogowski) as calculation method

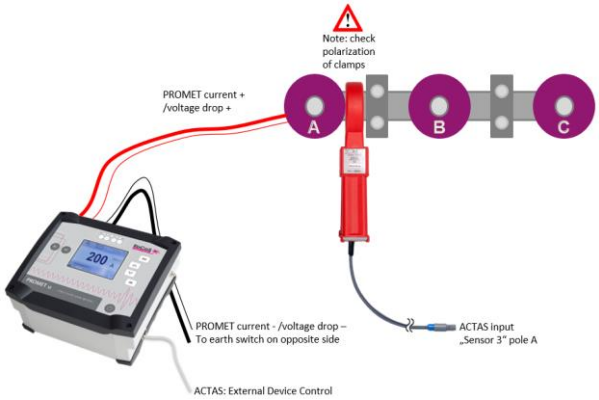
NOTE

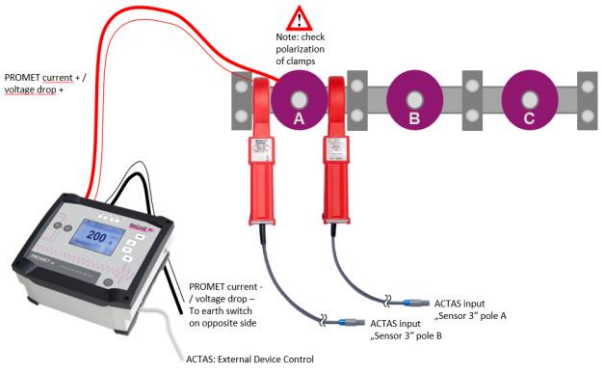
The **Test Current (Rogowski)** setting can also be selected here. As soon as a current clamp is mapped as **I mc** this measured current is used to evaluate the resistance.

10.4.6 Testing on individual poles of GIS switchgear under grounding on both sides

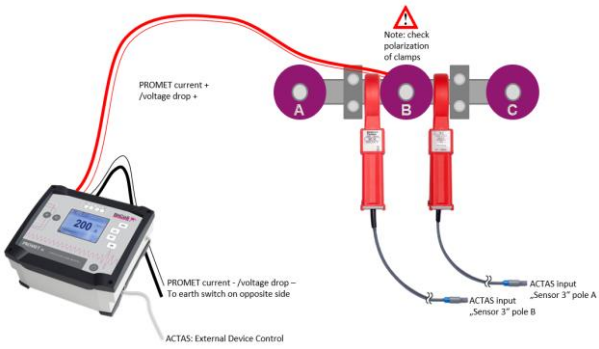
In addition to the resistance measurement on three poles simultaneously, the measurement can also be carried out on individual poles one after the other with only one resistance measuring device.

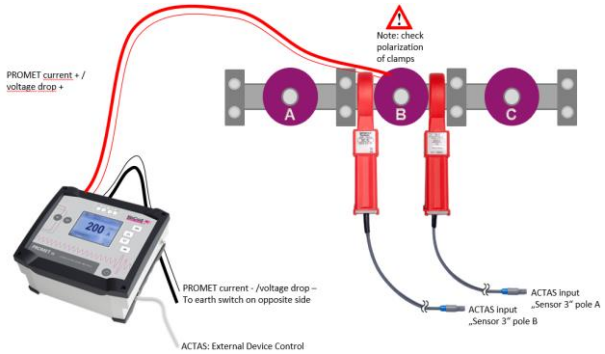
10.4.6.1 Connection scheme for measurement on pole A



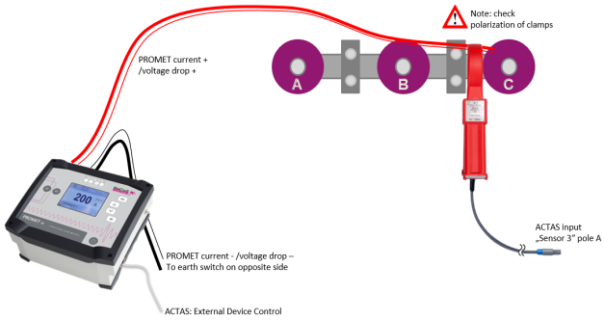


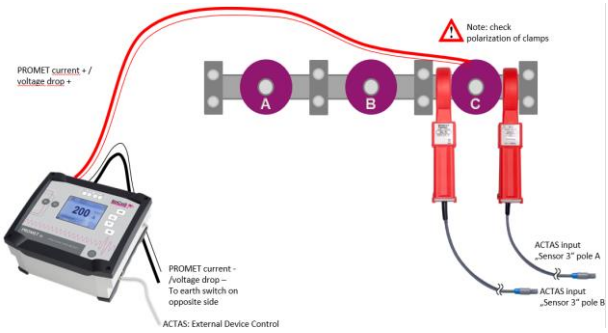
10.4.6.2 Connection scheme for measurement on pole B



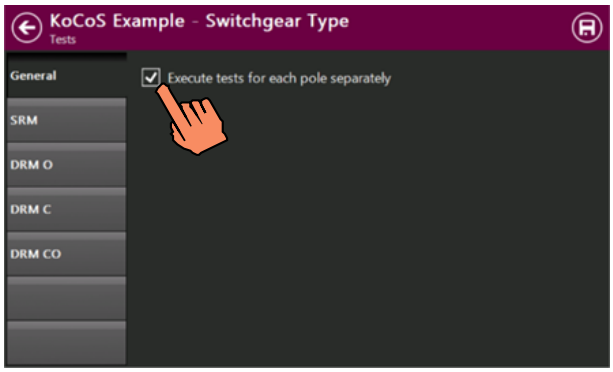


10.4.6.3 Connection scheme for measurement on pole C

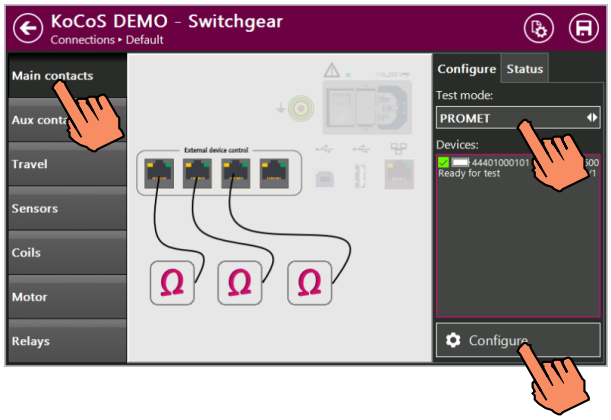




10.4.6.4 Configuration



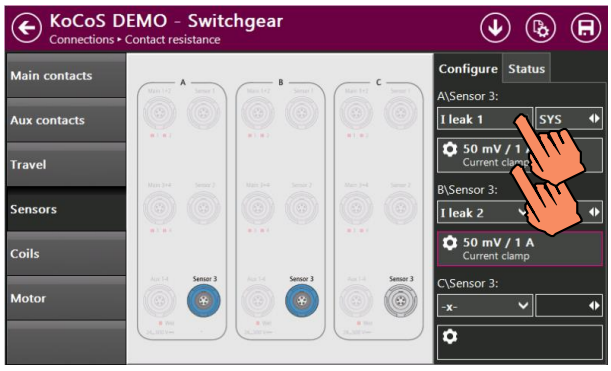
- In the settings for the switching device under **Tests/Contact resistance**, activate the **Execute test for each pole separately** check box.



- Under **Main contacts**, select **PROMET** test mode
- Tap **Configure**
- Set the test current

Guide values for test current:

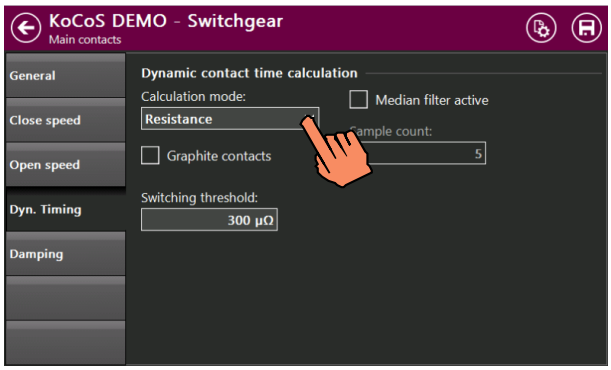
- PROMET SE and L100 min.100 A
- PROMET R300/R600 depending on switchgear min 300 A



- Switch to **Connections/Sensors**
- Set the sensors for measuring the leakage current **I leak 1** and, if a second current clamp is used, **I leak 2**
- Tip on ⚙ and configure current clamp with the corresponding transformation ratio

NOTE

ACTAS automatically calculates the current across the switch from the PROMET current and the two leakage currents.



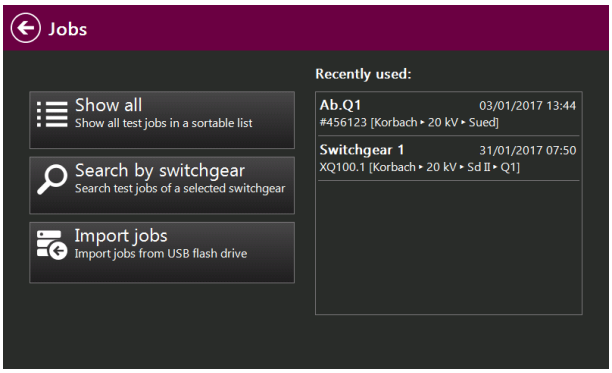
- Switch to **Analysis/Main contact/Dynamic Timing**
- Set **Resistance** as calculation mode

11 Analyse tests



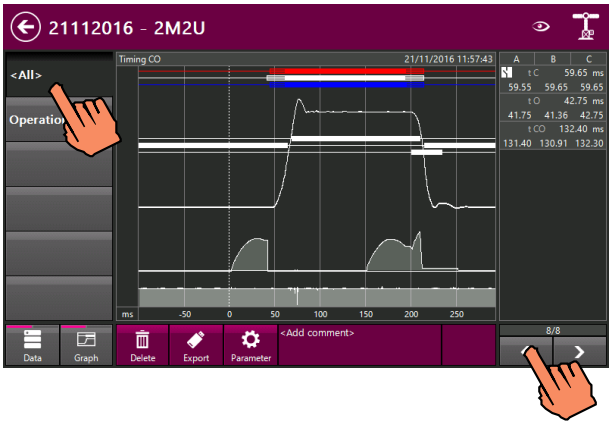
Completed test jobs which are saved in the test system can be opened and analysed.

11.1 Select test jobs



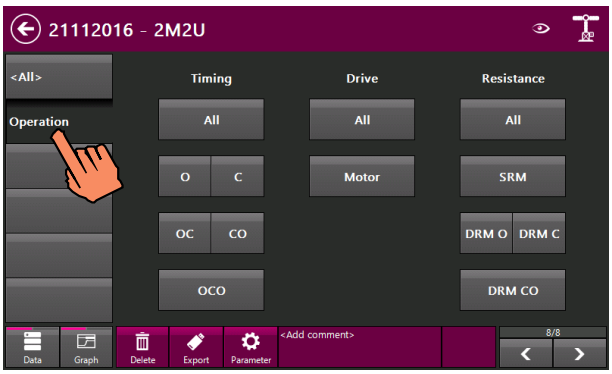
The jobs saved in the test system can be displayed in a sortable list. It is also possible to search for the test jobs of a specific switchgear device. Recently completed jobs are displayed directly under **Recently used** and can be opened with a single tap.

- ➤ Select test job



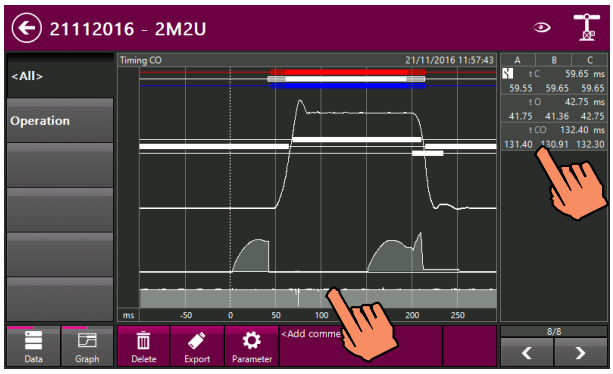
The results are displayed in the analysis monitor.

Under **All**, all the tests of the selected test job which have been carried out can be viewed. Using the arrow keys it is easy to browse through all the tests.



Under **Operation**, individual tests can be selected for opening.

11.2 Analysis monitor



Graphical result display

The graphical result display includes all recorded analog and binary signal characteristics.

Numerical result display

The numerical result display provides an overview of the result values.

11.2.1 Detailed views

By tapping in the result displays, various detailed views can be activated.

11.2.1.1 Graphical display



- Tap a characteristic

Detailed information is displayed.

In the example the defined start and end points for calculating the maximum value are displayed, see also under **Signal metrics**.

- Tap and hold a characteristic

Only the selected characteristic is displayed.

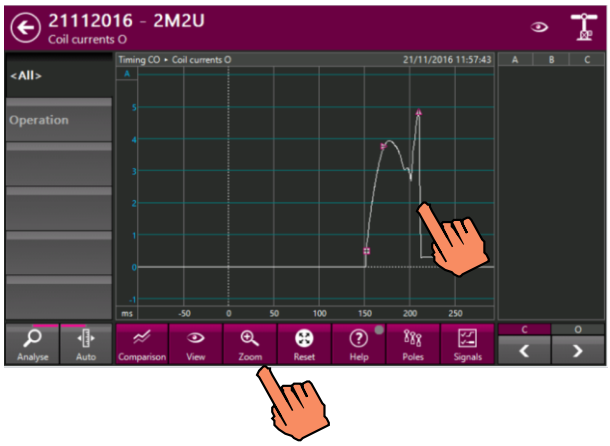
- Tap again and hold the characteristic

The selected characteristic is scaled for the maximum display size.

- Tap ←

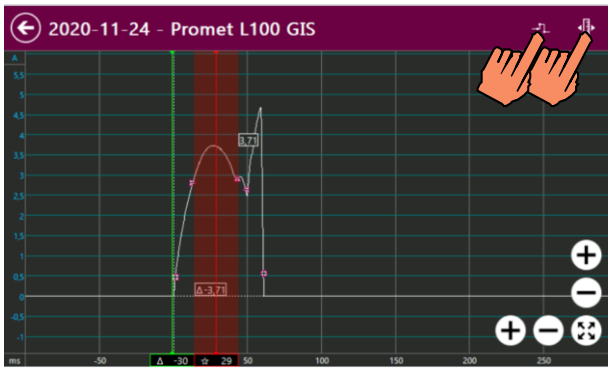
The view is reset.

11.2.1.2 Signal metrics



The metric points mark the start, end and maximum values of an evaluation and form the basis of the calculated values. They can be shown and hidden and can be moved manually.
Metric points can be set manually at the cursor and thus moved. If a point is moved, the associated metric changes accordingly. In addition, all results that depend on it are recalculated with the then current metric. In future recalculations the manually changed metric will only be overwritten on demand.

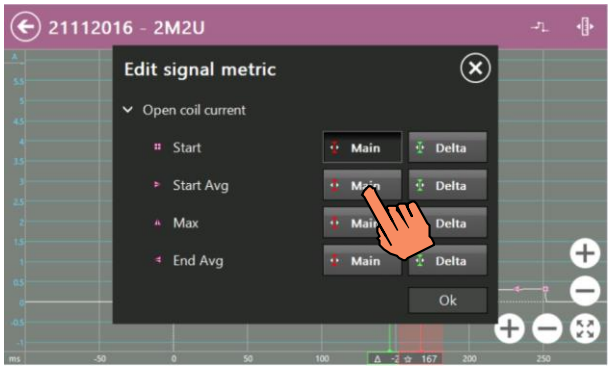
- Tap the signal so that the metric points are displayed
- Tap the **Zoom** button



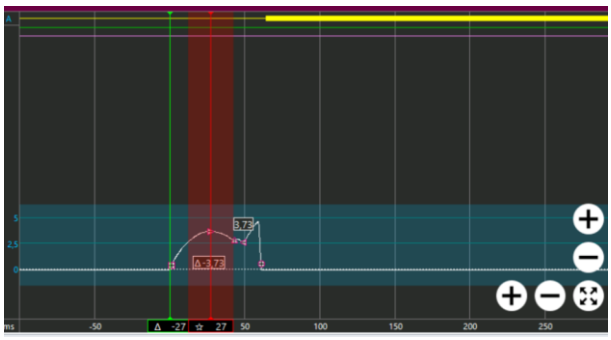
- Insert and position cursor

The icon for the signal metric is displayed.

- Tap on the icon for the signal metric

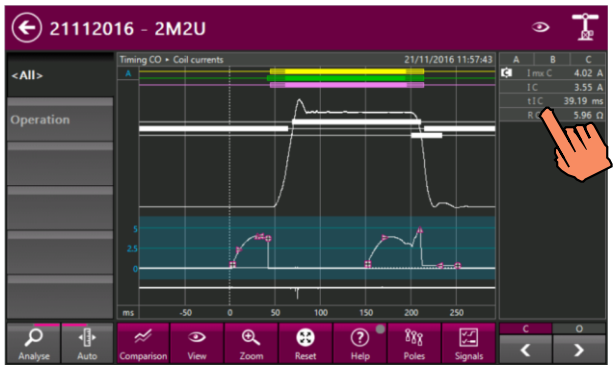


- Select metric point and place it at the position of the main or auxiliary cursor
- Confirm with **OK**

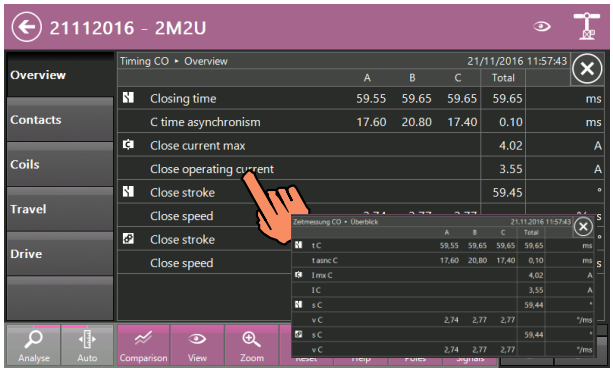


The metric points are placed at the assigned cursors and can be moved as desired.

11.2.1.3 Numerical display



➤ Tap the numerical display

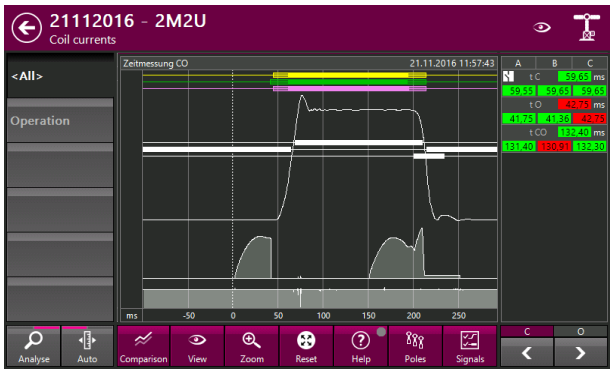


The results are displayed in detail.

➤ Tap the nomenclatures

The nomenclatures are displayed in short form.

11.2.2 Limit value display for results

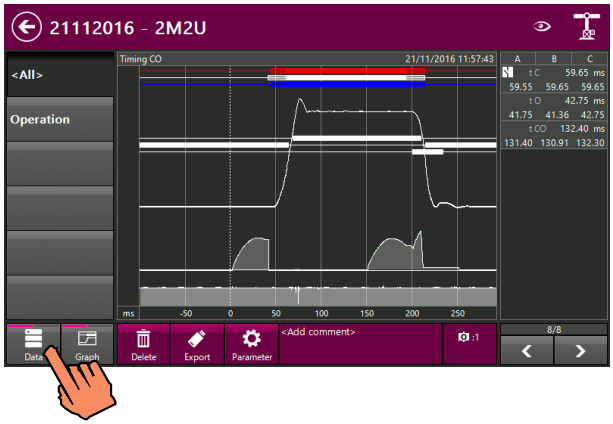


In the ACTAS test software limit values for the results can be defined.

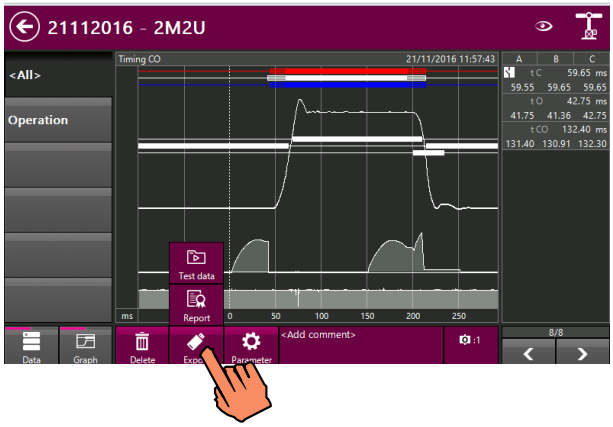
During analysing, the results are highlighted in green and red, depending on whether the limit values have been exceeded or not.

The actual values can be edited directly on the test system, see the section under **Change parameters for evaluation**.

11.2.3 Delete and export recordings

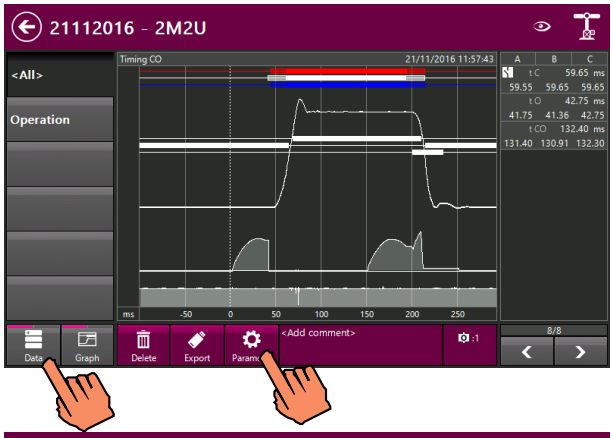


Recordings can be evaluated, deleted or exported in the function bar under **Data**.



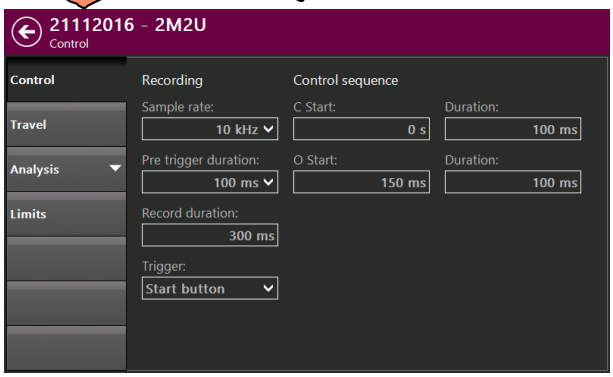
Under **Export**, test data or test reports can be saved on a USB flash drive.

11.2.4 Change parameters for evaluation



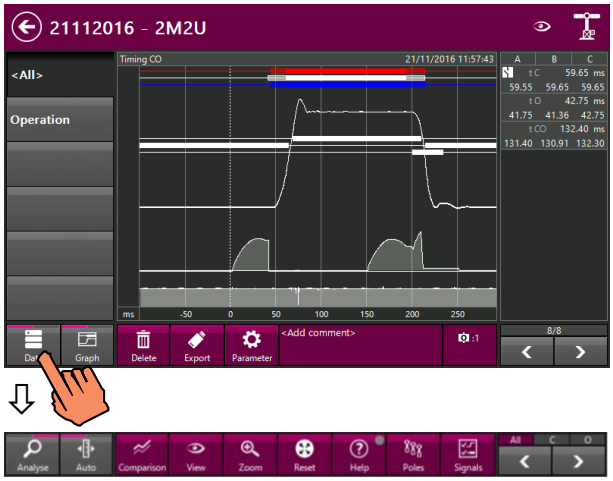
The settings for calculating the results such as close-open speed, coil current and motor current can be edited later on. For more information, see the sections of these operating instructions titled **Configure switchgear device/Analysis**.

- ➤ Switch function bar to **Data**
- ➤ Tap **Parameter**



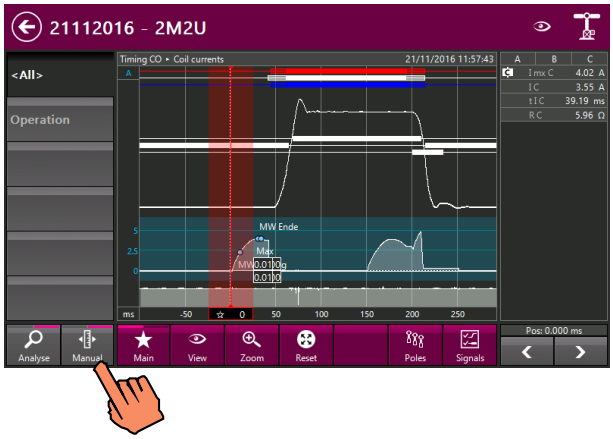
If values are edited here, the results are recalculated.

11.2.5 Analysis functions



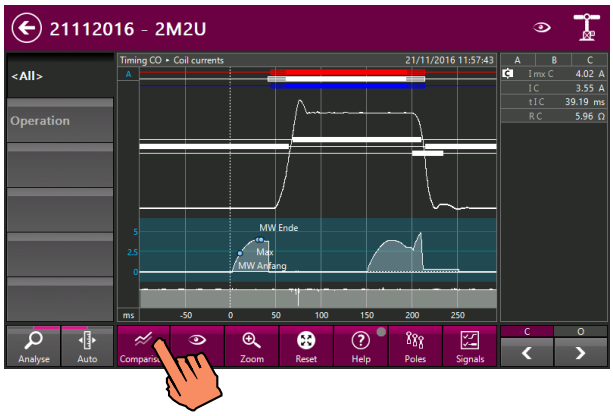
Tap the graphical result display or the **Data** button to switch the function bar to **Analyse**. Functions and views for evaluating tests are provided here.

11.2.5.1 Auto/Manual



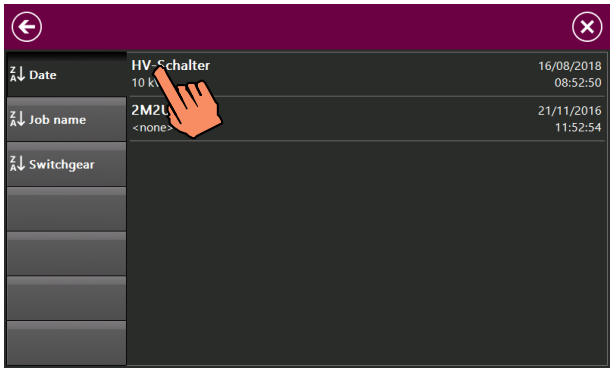
By changing from **Auto** mode into **Manual** mode, the results can be evaluated with a cursor. A main and a delta cursor are provided for this purpose.

11.2.5.2 Comparison



For the purpose of comparison, two test results can be displayed one above the other.

➤ Tap **Comparison**



A list of all test jobs created with switchgear devices of the same type as the one currently open is displayed.

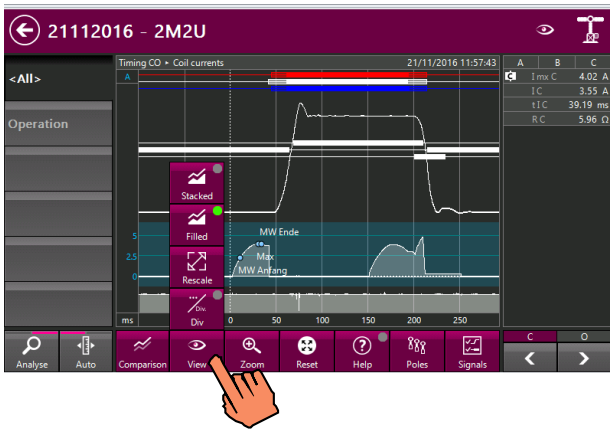
- Select test job
- Use ⊖ to exit the selection

The oldest test step of the same switching operation as currently opened is displayed as a shadow.

When a comparison is selected, the status bar above the graphic shows which test is currently used as a comparison. To do so, the status display switches between the two tests.

- To deactivate the comparison, exit the selection with ⊗

11.2.5.3 View

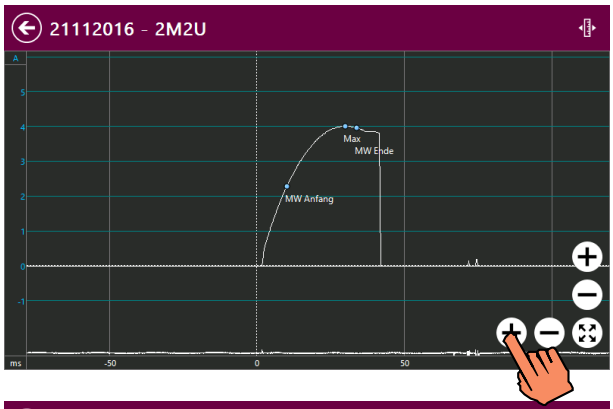


For the sake of clarity, the **View** button can be used to fill signal characteristics or display them in a stack for multi-pole records.

For the purposes of direct comparison of the various tests, the graphical view is automatically scaled to the maximum value of all tests with the **Rescale** function.

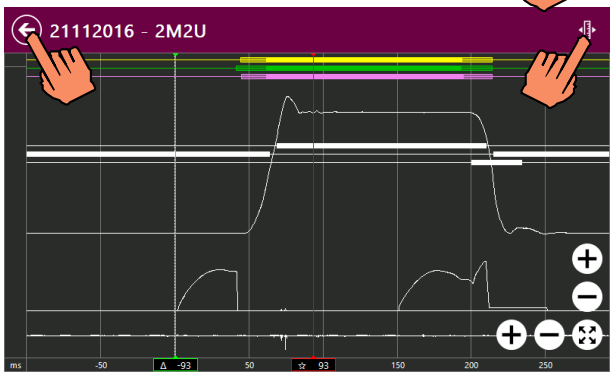
With the button **Div** a scale division is displayed, with **CMD** the command times for coils are displayed in the detailed band.

11.2.5.4 Zoom



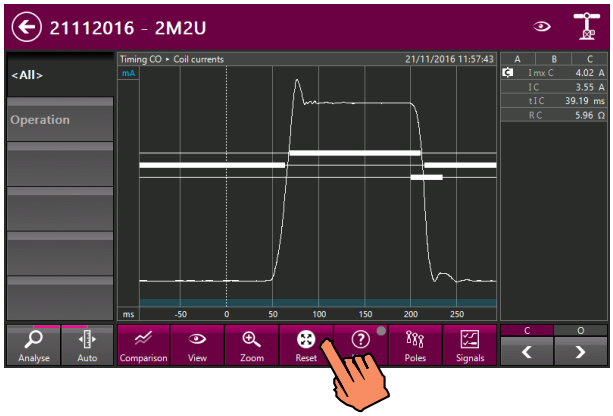
In the **Zoom** window, the view can be enlarged and reduced along the x and y axis with the **+** and **-** buttons.

In addition, the graphic can be grabbed and moved to any position.



A main and a delta cursor can be displayed for evaluation.

- Exit the zoom area with ←

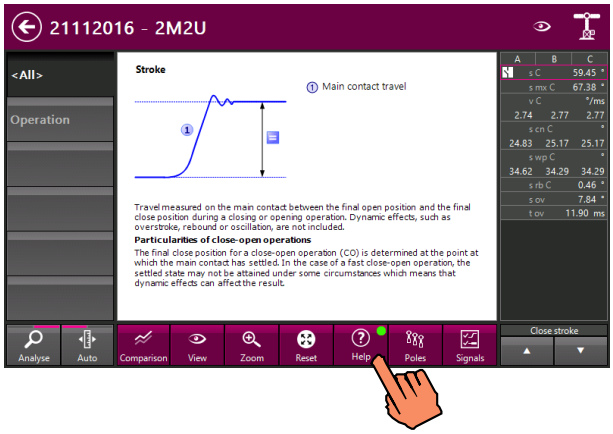


➤ Use **Reset** to go back to the original view

NOTE

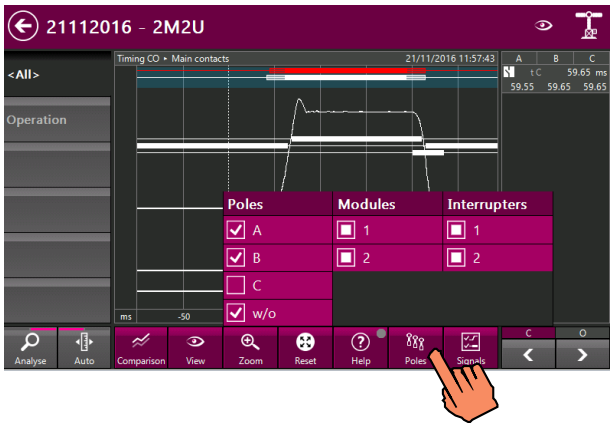
If the view is not reset, it is also displayed in the test report as enlarged or reduced.

11.2.5.5 Help



The results displayed and the evaluation of results are explained in the result help.

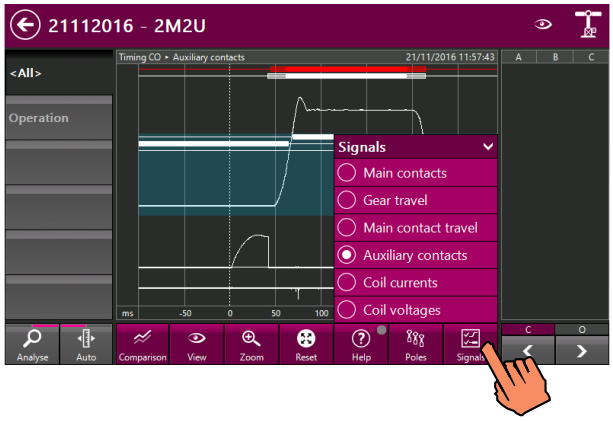
11.2.5.6 Poles



Using the **Poles** button, the signal characteristics for poles, modules and interrupt units can be shown or hidden. In the detailed view, the individual recordings can be displayed separately and in a clearly structured form.

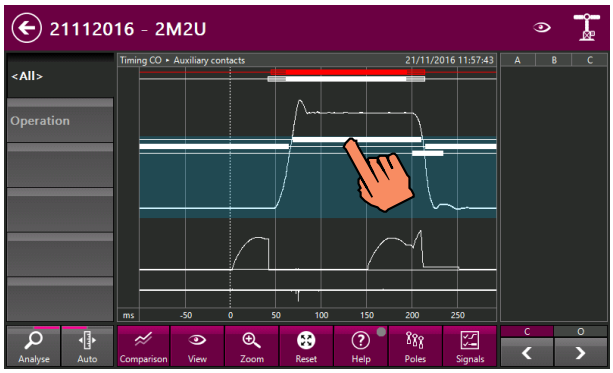
If individual poles, modules or interrupters are deactivated, the areas to be displayed incompletely are indicated by a ☐ in the selection.

11.2.5.7 Signals

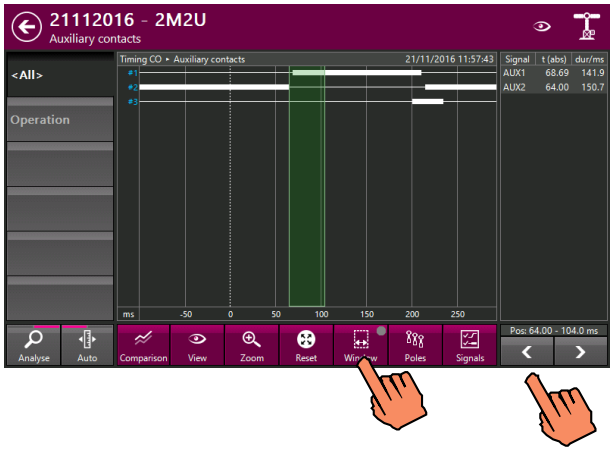


The **Signals** button can be used to select individual signal characteristics. The signal band is highlighted in the overall view. Only the selected signal is displayed in the detailed view.

11.2.5.8 Evaluation auxiliary contacts



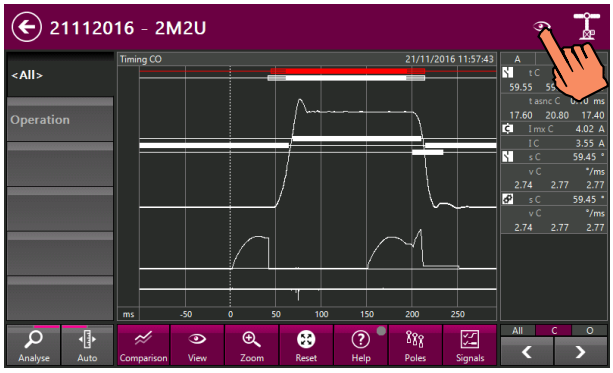
➤ Activate detailed view by tapping and holding the binary signals of the auxiliary contacts



In the detailed view an evaluation band is displayed, which automatically jumps from binary change to binary change by moving it with the arrow keys.
In the numerical display all time values within the band are displayed.

After activating the **Window** button, the width of the evaluation band can be set with the arrow buttons.

11.2.6 Save views



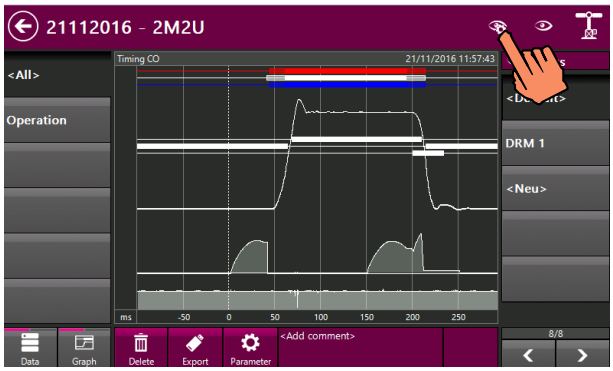
In addition to the settings via the menu bar buttons, views can be set and saved via the **View** function. Saved views can then be applied to any recordings.

➤ Call up recording

➤ Tap the button for views

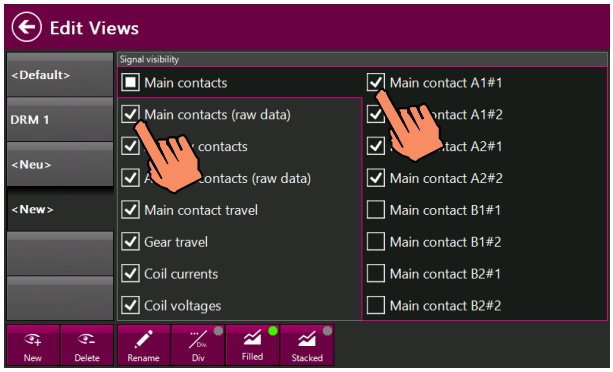
NOTE

The function of the button is only active in the test monitor after the test has been completed and in the analysis monitor when the test job is open.



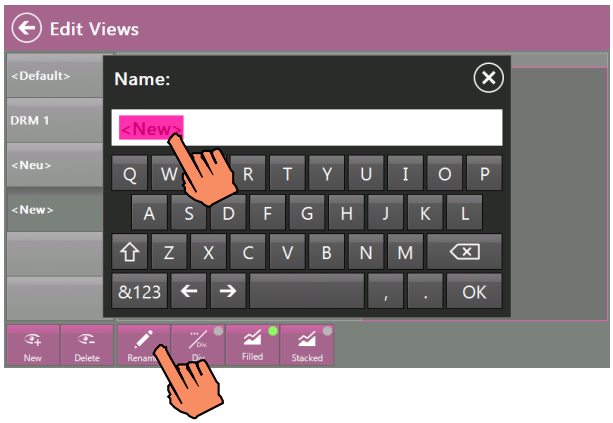
Views which have already been saved and the button for editing views are displayed.

➤ Tap the button to edit views



A selection list for the signals to be shown in the view is displayed.

- Select signal
- Select the poles/modules for which the signal is to be displayed (A1#1 = pole A, module 1, interrupter 1)



- Enter a name for the created view

11.2.7 Display of main and resistive contacts



Because the binary signals for main and resistive contacts superimpose each other in the standard view, the states are displayed differently:



All main contacts of a pole are closed.



Some, but not all, main contacts or resistive contacts of a pole are closed



At least one resistive contact is closed

12 Service

12.1 Software update

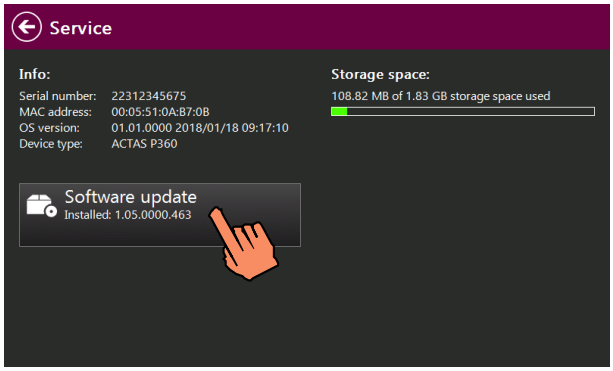
A software update can be carried out via USB interface directly on the device or via the PC software.

12.1.1 Update via USB interface



A software update can be carried out via USB flash drive (FAT/FAT32):

- Tap Service



- Tap Software update
- Insert USB flash drive with update (spz file, e.g. DeviceController.Actas P360+-1.05.0000.407.spz)

Software is displayed

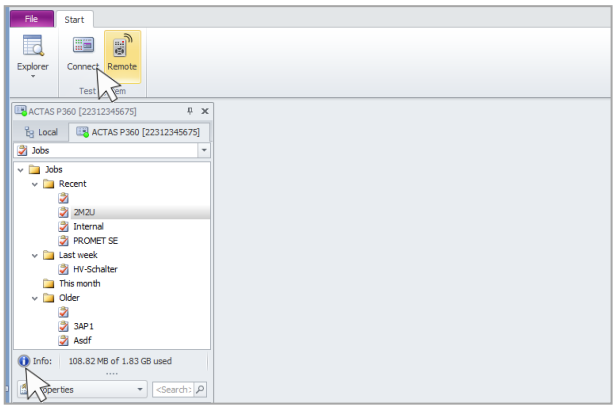
- Tap the desired update

The software update is carried out automatically.

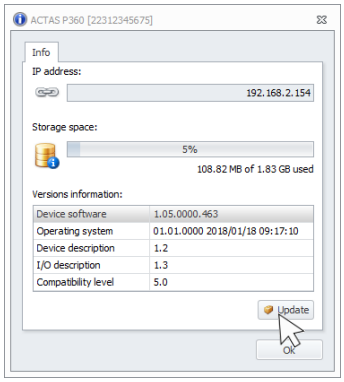
- Remove the USB flash drive

The new software is activated.

12.1.2 Update via PC software



- Connect the PC software to the device
- Click **Info**



- Click **Update**
- Tap **Service** and then **Software Update** on the test system
- Click **Update** again
- Select the update and click **Open**
- Follow the instructions on the test system and in the software

13 Maintenance

⚠ WARNING

Before carrying out any maintenance work, the unit must be switched off and the mains connection disconnected!

13.1 Cleaning

Clean the device only with a soft linen cloth, which may be slightly moistened with isopropyl alcohol in case of heavy soiling.

⚠ WARNING

Do not apply cleaning agent directly to the device. Do not use a spray cleaner.

Make sure that no moisture gets inside the device.

NOTICE

Do not use organic or strong chemical solvents for cleaning the device.

13.2 Repairs

⚠ WARNING

Repairs may only be carried out by authorized personnel after consultation with KoCoS Messtechnik AG and only using original spare parts.

13.3 Calibration

Regular calibration is necessary in order to ensure the validity of the results obtained with KoCoS test and measuring systems.

During calibration, the systematic deviation of the values output by a device from a traceable standard which serves as a reference is determined and documented. A traceable standard has its own calibration, which can be traced back to a national standard via a chain of other higher-ranking standards. Calibration does not involve any intervention in respect of the device, it remains unchanged. Calibrations are carried out under defined reference conditions. The deviations detected during calibration are documented in a calibration certificate.

13.3.1 Calibration confirmation

This device has been tested and calibrated in accordance with the published technical data.

Calibration has been carried out using measuring devices which are compared and set in accordance with certified measurement standards at regular and suitable intervals.

13.3.2 Handling of calibration intervals

According to the applicable guidelines, the user is always responsible for regular calibration and for the definition of calibration intervals. As the manufacturer, KoCoS cannot define calibration intervals for devices, because changes in accuracy depend, among other things, on the individual requirements of the user, the frequency of use and the degree of stress on the devices.

Based on experience, KoCoS recommends an initial calibration interval of 2 years. The value is a recommendation for calibration after the first period of use. Based on the detected deviations, the user then determines the following intervals himself and corrects them continuously in accordance with further experience.

NOTICE

The accuracy of a calibration is determined by the accuracy of the measuring devices used, the environmental conditions and the methods used. If suitable measuring devices, environmental conditions and methods are not available, the calibration should be carried out by the manufacturer.

13.3.3 Adjustment

If the deviations detected during calibration are outside the tolerance limits, the device should be adjusted.

During adjustment, the device is adjusted in such a way that the systematic deviations from the standard are minimized and lie within the specified tolerance limits. This involves setting the output values of the device to the known value of the standard under defined reference conditions.

NOTICE

During adjustment, an intervention takes place that has a lasting effect on the device. Because this change can influence the accuracy, function and safety of the adjusted device, adjustments may only be carried out by the manufacturer or by organizations and persons accredited by the manufacturer.

14 Guarantee conditions

KoCoS Messtechnik AG guarantees that this product will function correctly for two years from the date of the invoice. During this period defective devices are repaired free of charge; alternatively, defective devices, or certain components of such devices, are replaced.

If a defect occurs, the device can be sent in for repair after consultation with the service department of KoCoS Messtechnik AG. For devices which have been repaired, the guarantee is still valid for the rest of the remaining guarantee period and for at least 90 days after the repair for those parts affected by the repair.

This guarantee does not cover:

- Defects resulting from unauthorized modifications or attempts to make repairs carried out by persons not authorized to do so.
- Defects arising from improper use, e.g. through overvoltage
- Mechanical damage caused by external influences
- Fuses and other materials subject to wear

No guarantee is undertaken for the suitability of the device for a specific application.

KoCoS Messtechnik AG is not liable for indirect, direct, especial or consequential damage stemming from the use of this product.

15 Technical data

Control outputs	Electronic switching outputs (IGBT) for single or three-phase control of the closing and opening coils. All operating sequences can be configured and output in increments of 1 ms.			
	IGBTs for controlling the release coils	Voltage	300 VAC/DC	
		Current	100 A peak	Intrinsically safe via short-circuit and overload protection
		Time resolution	0.1 ms	
		Accuracy	±0.033 ms	
	Relayoutputs for control	**Relayoutputs**	250 VAC /8 A 35 VDC / 8 A	bei 300 VDC/0,15 A
	Power supply to external sensors	Reference voltage for analog sensors	10 VDC	
		Supply voltage for incremental sensors	10 VDC	
Measurement inputs	**General**	Recording duration	Max. 13.33 min at 500 Hz, Max. 8 s at 50 kHz	
		Time resolution	0.033 ms	
		Time accuracy	±0.005 ms	
		A/D-conversion	16 bit	
		Accuracy	0.05% of range	
	Analog inputs	Oversampling	200 kHz per measurement channel	
		Sampling rates	500 Hz...30 kHz, adjustable	
		Measuring range close/open coil current	15/100 A, internally switchable	
		Coil/station voltage	300 V AC/DC, internally switchable	
		Motor voltage	500 V AC/DC, internally switchable	
		Motor current	100 A peak	
		Measuring range motor current	15/100 A AC/DC, internally switchable	
		Sensor inputs	±20 mA (Imp. 200 Ohm/0.25 W) ±10 VDC	
		Protection	P260+: 1 x galvanic isolation 2.5 kV, all the inputs are isolated against earth P360+: 3 x galvanic isolation 2.5 kV, all the inputs are isolated against earth	
	Binary inputs	Sampling rate	50 kHz	
			Activation range 24…300 VDC	
		Auxiliary contacts	Wet/dry switching	
	Incremental inputs for digital travel transducers	Supply voltage	10 VDC	
		Limit frequency	200 kHz	

Complete system	Operation, system control, data storage and evaluation by means of the built-in control panel equipped with a high-resolution, resistive 7" touch screen and two function keys as well as via a standard external Windows PC or by remote control via tablet or smartphone			
	User interface	ACTAS system software for the parameterization, execution and evaluation of switchgear tests under Windows 7/8.1/10		
	Power supply	Rated voltage 110...265 VAC/DC		
	Measurement connections	On the front panel via 4 mm safety sockets and via push-pull sockets		
	PC interfaces	1 x RJ45 Ethernet 1 x USB A/B each		
	KoCoS interfaces	4 x control of external devices (PROMET and voltage sources)		
	Environment	Operating temperature Storage temperature Relative humidity Protection	-10…50°C -30…70°C 5…95% non-condensing IP65 (closed)	
	CE conformity	EN 61010-1: 2011 Safety requirements for electrical equipment for measurement, control, and laboratory use EN 61326-1: 2013 Electrical equipment for measurement, control and laboratory use - EMC requirements		

			ACTAS P260+	ACTAS P360+
Product specifications				
	Control outputs	Closing coils	1	3
		Opening coils	1	3
		Relayoutputs	1	2
	Analog measurement inputs	Coil current	1 x 2 (I/O)+ 1 x O	3 x 2 (I/O)
		Coil/station voltage	1	2
		Motor current via shunt	1	1
		Motor voltage	-	1
		Sensor (+/-10 V/digital)	3	6
		Sensor (+/-10 V/0…20 mA)	1	3
		Main and PIR contacts	3 x 2	6 x 2
	Binary measurement inputs	Auxiliary contacts	2 x 4	3 x 4
	Reference voltage for external sensors		1 x 10 VDC / 200 mA	3 x 10 VDC / 200 mA
	Connections additional equipment	PC	1	1
		Ohm meter	3	3
		CSW 3	1	1
		Digital voltage source	1	1
	Housing	Hard-top case		
		Dimensions (W x H x D) mm	425 x 340 x 170	475 x 375 x 180
		Weight	5.3 kg	6.9 kg