User manual

Handheld Online PD Detector

PD-SGS

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Table of contents

1 GENERAL

1.1 Using this manual

This user manual contains all necessary information that is needed for the commissioning and operation of the described product.

- Read this user manual completely before operating the product for the first time.
- Consider this user manual to be a part of the product and store it in an easily accessible location.
- If this user manual is lost, please contact BAUR GmbH or your nearest BAUR representative (http://www.baur.eu/baur-worldwide).

Applicable documents

If the PD-SGS is delivered together with the optional parabolic reflector and the laser pointer extension kit, this user manual must be applied only with the user manuals of all components comprised.

1.2 Structure of safety instructions

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

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

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

⚠ SIGNAL WORD

Type of danger and its source

Possible consequences of violation.

- Measure to prevent the danger.

Danger levels

Signal words in the safety instructions specify the danger levels.

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

Danger symbols

	**General danger**
	**Risk of electric shock**
	**Risk of falling**

1.3 Symbols used

Symbol	Meaning
▸	You are prompted for an action.
1. 2. ...	Perform the actions in this sequence.
a. b. ...	If an operation consists of several operating steps, specify these with "a, b, c". Perform the operating steps in this sequence.
1 2 ...	Numbering in the legend
▪	List
	Indicates extensive information on the topic in the corresponding user manuals.

1.4 Note on the screenshots and graphics used

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

1.5 Warranty

For warranty claims, please contact BAUR GmbH or your local BAUR representative (http://www.baur.eu/baur-worldwide). Warranty is cancelled in case of misuse.

1.6 After Sales Service

For questions contact BAUR GmbH or your BAUR representative (http://www.baur.eu/baur-worldwide).

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2 FOR YOUR SAFETY

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

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

Before operating the device or system you should read and understand this user manual and the user manuals of all integrated devices.

2.1 Instructions for the user

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

In addition, the user must have:

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

2.2 Intended use

The BAUR handheld online PD detector PD-SGS is used to conduct rapid initial tests for PD activities on live switchgear.

If the device is used without observing this condition, safe operation cannot be guaranteed. The operator or user is liable for any damage to persons and property resulting from incorrect operation.

Proper use also includes

- Compliance with all instructions in this user manual,
- Compliance with the technical data and connection requirements given on the rating plate and in the user manual,
- Compliance with the inspection and maintenance tasks.

[1] Responsible body is the person or group that is responsible for the safe operation of the device and its maintenance (EN 61010, 3.5.12).
[2] Operator is the person who uses the device for its intended purpose (according to the definition of user in compliance with EN 61010, 3.5.11).

2.3 Avoid dangers, take safety measures

When operating the PD-SGS observe the following rules and guidelines:

- Accident prevention and environment protection rules applicable for your country
- Safety instructions and regulations of the country where the PD-SGS is being used (according to the latest version)
- EU/EFTA countries: EN 50110 “Operation of electrical installations”
  Other countries: the standard for operating electrical systems applicable for your country
- If necessary, other national and international standards and guidelines in accordance with the latest applicable version
- Local safety and accident prevention regulations
- Liability insurance association regulations (if any).

Technically secure state of the device

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

- Operate the device only in a technically perfect condition.
- In the case of damage and/or malfunction, immediately stop the device, identify accordingly and have the faults rectified by appropriately qualified and authorised personnel.
- Comply with the inspection and maintenance conditions.
- Use only accessories and original spare parts recommended by BAUR. The use of spare parts, accessories and optional extras that are not tested and approved by BAUR could adversely affect the safety, function and characteristics of the product.
- Never take apart the device. The device does not contain any components that could be serviced or repaired by the user.

Do not operate under damp or humid conditions

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

Maximum danger arises when relatively high air humidity and temperature fluctuations occur consecutively, e.g. which is the case when storing the device in an unheated room or when placed outdoors. Then when the device is exposed to a high ambient temperature, the cold surfaces of the device cool the air in the immediate vicinity, which leads to the formation of condensation, even inside the device.

Therefore, two factors are crucial:

- The higher the relative air humidity, the faster the dew point is reached and water is condensed.
- The higher the temperature difference between the surfaces and the ambient air, the more likely condensation will occur.
- To prevent condensation, always temper the device and system before and during measurements to minimise the risk of condensation.

Working in dangerous environment: working at height

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

DANGER

Danger of falling while working at heights

Danger to life, risk of injury due to fall

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

2.3.1 Dangers when working with high voltage during online measurements

A PD test with the PD-SGS is carried out on a live test object. Personnel need to pay special attention and must be very careful while working with high electric voltage.

During the preparation and while performing the measurement, the user can come close to live parts. Consequently, there is danger of touching the active parts directly or indirectly. Commissioning and operation of the PD-SGS are permitted only in compliance with EN 50110 (EU/EFTA countries) or with standards applicable in your country. Also observe the applicable national and local accident prevention regulations.

DANGER

Working in the vicinity of adjacent live parts

Danger to life or risk of injury due to electric shock

- Before commencing work, the responsible body or operator must assess the danger for the specific working conditions. Protective measures are based on the risk assessment and must be followed at the workplace.
- Only accredited personnel with appropriate Health and Safety training should use the equipment.
- Do not use the equipment if it is damaged, or its safety is impaired in any way.
- Inspect and test all earthing and signal cables for continuity.
- The user should have read and understood the appropriate equipment manuals.
- Always select the appropriate sensor and sensor connection for the application.
- When taking the measurement, protection must be guaranteed for all plant parts, either
  - through safety devices, insulating cover material
  - or by adhering to the necessary safety distances. Safety distances depend on the voltage level, plant model, personnel qualification and available space. In this regard, comply with EN 50110 or the applicable standards in your country as well as the relevant national and local accident prevention regulations.
- The device has been designed for use only on the earthed, outer surface of metal-clad equipment and the earthed/neutral connections of cables/switchgear.
  Under no circumstances should the sensors be connected to the high-voltage terminals of HV plant under test.
- Do not disturb or interfere with the high-voltage equipment in any way.
- Working in the vicinity of open cables or faulty systems is forbidden. Notify the responsible authorities immediately.
- Never take the safety devices out of operation. It is forbidden to bypass the safety devices.
- Keep the measurement tasks as short as possible.
- Use suitable personal protection equipment to protect against electric hazards.
- To assess the local conditions adequately, provide sufficient lighting at the work place.

Guaranteeing immediate measures in case of danger

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

Access

The test engineers shall only enter the customer's switchyard or substation after they have received permission from an authorised person appointed by the plant owner. If in doubt about any matter the plant owner's high-voltage safety rules should be consulted by the test engineers who will carry out the testing.

Visual inspection of substation

On entry to the test area a visual inspection of the area should be carried out by the test engineers. This should enable the operator to identify any potential hazards in the area and to assess both the type of equipment to be tested and the method of doing so. Only when this visual inspection has been completed can the equipment be set-up for testing.

2.4 Special personal protection equipment

Personal protection equipment based on the risk assessment for the relevant working conditions are part of the PD-SGS safety concept.

- Observe the national safety regulations and your company's working and operating instructions.

Depending on the conditions of the work place, use the following safety equipment:

Protection against electrostatic charging, crushing, slipping and other accidents:	▪ Safety hood
Protection against electrical hazards (arcing fault):	▪ Certified safety clothing ▪ Hard hat with visor ▪ Insulating protective gloves ▪ LV HRC fuse handle with sleeve
Protection against noise:	▪ Ear protection
Protection against dangers from road traffic:	▪ High visibility vest according to EN 471 (Protection class 2) or according to the applicable standards in your country for high visibility clothing for commercial use. **No high visibility vest during tasks with risk of arcs!**
Hand protection:	▪ Safety gloves

3 PRODUCT INFORMATION

3.1 PD-SGS

The BAUR handheld online PD detector PD-SGS is a first level partial discharge (PD) detection device designed for use in distribution voltage substations. It enables network operators to carry out simple routine tests that will identify discharge activity in switchgear and accessories.

The battery-operated portable device has a live display that shows a quantified level of detected PD activity. A colour-coded traffic light system indicates when detected levels exceed the pre-set thresholds.

The PD-SGS has a built-in TEV sensor for capacitive coupling to switchgear and a built-in ultrasonic sensor for detection of surface discharge and tracking. Headphones are also supplied to help the user when working in noisy environment.

The PD-SGS is supplied with a battery-operated function tester PD-FT that should be used to verify the correct operation of the device before use.

The PD-SGS is a non-intrusive test device therefore PD can be identified and located whilst the equipment remains live.

3.2 Partial discharge

Partial discharge (PD) is an electrical discharge that does not completely bridge the space between two conducting electrodes. The discharge may be in a gas filled void in a solid insulating material, in a gas bubble in a liquid insulator or around an electrode in a gas. When partial discharge occurs in a gas, it is usually known as corona.

Partial discharge is generally accepted as the predominant cause of long term degradation and eventual failure of electrical insulation. As a result, its measurement is standard as part of the factory testing of most types of high-voltage equipment. In-service monitoring of equipment for PD gives an advance warning of pending insulation failure. This allows a plant operator to take remedial action during planned outages.

Partial discharge often occurs under normal working conditions, gradually deteriorating the dielectric until it can no longer withstand the electrical stress and fails. By detecting this PD activity while the equipment is in operation, failure can be avoided.

3.2.1 Radiated energy

A PD event will radiate energy in different forms and this energy can be picked up by the PD-SGS in order to detect the source and locate it.

Electromagnetic radiation

PD creates electromagnetic (EM) radiation that dissipates in all directions away from the source. Metal components, for instance the panels around switchgear, will pick up this radiation and small voltages called Transient Earth Voltages (TEVs) are induced on the surface. These very high frequency signals will be picked up by the PD-SGS and indicate that there is a PD source nearby.

Acoustic radiation

Partial discharge also generates acoustic energy across a wide band of frequencies. This acoustic energy can be detected in the ultrasonic range when there is a 'line of sight' between the PD source and the detecting sensor. Sharp points, for instance on air insulated cable terminations, are typical sources of corona that will produce acoustic emission. Cast insulators are prone to surface tracking where electrical stress across the insulator's surface causes discharge, and deteriorates the insulator surface and creates carbon tracks. This can lead to flashover and failure of the equipment.

3.3 Full illustration

1 Transport case
2 Handheld online PD detector PD-SGS
3 PD-SGS power supply / charger
4 Function tester PD-FT
5 Stereo headphones

4 PD-SGS OVERVIEW

4.1 PD-SGS outline

The PD-SGS has a tough ABS enclosure with rubber protective covering around the PD sensors. Both built-in PD sensors are mounted at the front of the device so that they can be easily directed at the inspection point. The PD-SGS is controlled with two membrane switches on the front panel and a trigger button underneath. An OLED type screen is used for function control and providing both text and graphical output information to the user. In addition the PD-SGS has an audio output through both a built-in speaker and pluggable headphones.

The unit is powered by a lithium-ion rechargeable battery giving a life of over 12 hours of use. The software has intelligent power management prolonging battery life.

4.2 PD-SGS Input/Output

The PD-SGS has an input and output as detailed in the tables below:

Front panel	**Type**
Display	▪ OLED display ▪ 6 x PD level LEDs
Control button MODE	Membrane switch
On/Off button	Membrane switch
Side panels	**Type**
Headphone socket	3.5 mm jack
External AE sensor	3.5 mm jack
Handle	**Type**
Trigger button	Push button
Power charge socket	2.1 mm DC power

5 TRANSIENT EARTH VOLTAGE (TEV)

Partial discharge activity inside a metal-clad high-voltage plant induces small voltage impulses called Transient Earth Voltages on the surface of the metal cladding. These TEVs travel around the cladding surface to the outside of the gear where they can be picked up using capacitively coupled transducers.

The TEV signals emerge at the joins between the metal panels and it is at these points that the highest readings are generally detected.

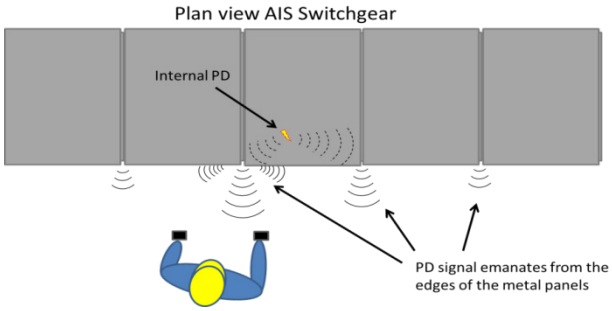


Figure: PD pulse propagation in AIS panels

5.1 Capacitive Coupler sensor

The built-in Capacitive Coupler sensor detects TEVs as they pass over the cladding of the high-voltage plant. The very fast transient signals are detected by the PD-SGS and their magnitude is measured and displayed.

5.2 Specification

Specification	
Sensor	Capacitive
Measurement range	0 – 80 dBmV
Frequency range	20 MHz – 200 MHz
Resolution	1 dB
Accuracy	±1 dB

6 ACOUSTIC EMISSION (AE)

Acoustic emission is ultrasonic energy that is emitted by discharges on electrical insulating surfaces or sometimes called Surface Tracking.

6.1 Surface Tracking

Surface Tracking is the formation of a permanent conducting path across an insulator surface. Usually the conducting path results from degradation of the insulation. Tracking most readily occurs when the insulation is a carbon based compound.

A high-voltage plant is often very difficult to clean, so dirt and contaminants can build up over time. In the presence of moisture, these contaminating layers give rise to leakage current over the insulator surface. This heats the surface and through evaporation causes interruption in the moisture film. Large potential differences are generated over the gaps in the moisture film and small sparks can bridge the gaps. Heat from the sparks causes carbonisation of the insulation and leads to the formation of permanent carbon tracks on the surface. Under such conditions this process will develop over time and eventually lead to flashover and full breakdown of the insulation.

6.2 Acoustic sensor

The ultrasonic acoustic sensor is designed for use on air-insulated terminations where there is a clear sound path between the electrically stressed insulation and the probe. The sensor is extremely sensitive when pointed directly at the discharge source.

The transducer is embedded into the rubber moulded cover at the front of the device so it can be easily directed towards the parts of electrical plant where tracking may occur.

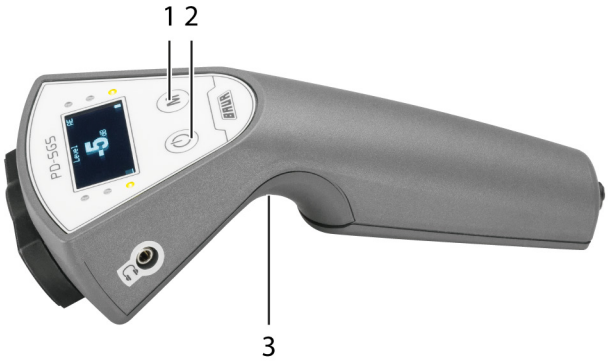
6.3 Specification

Specification	
Measurement range	-6 to +70 dBµV
Resolution	1 dB
Accuracy	±1 dB
Convertor sensitivity	-65 dB (0 dB = 1 V/µbar$_{rms}$ sound pressure level)
Convertor average frequency	40 kHz ± 1 kHz

7 OPERATIONAL CONTROL

7.1 Control buttons

The PD-SGS is controlled by three buttons on the device as shown below:



1	MODE button
2	On/Off button
3	TRIGGER button

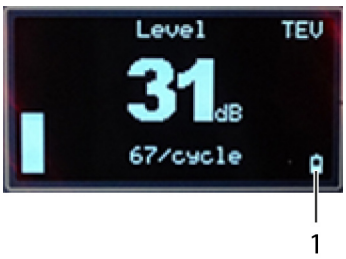
7.2 On/Off button

The On/Off button is used to turn the PD-SGS on and off.

Note that the On/Off button should be pressed and held down for two seconds before the power is switched.

7.3 Battery level indication

The remaining charge in the battery is indicated by the small icon in the bottom right-hand side of the display screen.



1 Battery level indication

7.4 MODE button

The *MODE* button is used to toggle the device between ***TEV*** mode and ***AE*** mode. The *MODE* button should be pressed briefly in order to switch between the two modes.

7.4.1 TEV mode

In ***TEV*** mode, the device measures and displays the magnitude of TEV signals detected. The measured value is shown in dBmV such that 0 dB = 1 mV. The relationship between detected signal magnitude in dB and mV is shown in the table below:

mV	dB
1	0
2	6
5	14
10	20
20	26
35	31
50	34
100	40
1 000	60
10 000	80

7.4.2 TEV noise detection

In ***TEV*** mode, the PD-SGS can identify HF signals that are from a noise source and are not PD. When noise is detected, the display will alternate between the dB level recorded and the indication ***Noise*** as shown in the figure below:

The noise detection algorithm is only applied to signals with a magnitude greater than 20 dB as noise signals below this level are relatively common.

It should be noted that when high noise is detected, it can mask genuine PD. It is advisable to use more sophisticated PD detection devices that can detect PD even in the presence of high noise.

7.4.3 AE mode

In ***AE*** mode, the device measures and displays the magnitude of ultrasonic acoustic signals detected. The measured value is shown in dBµV such that 0 dB = 1 µV. The relationship between detected signal magnitude in dB and µV is shown in the table below:

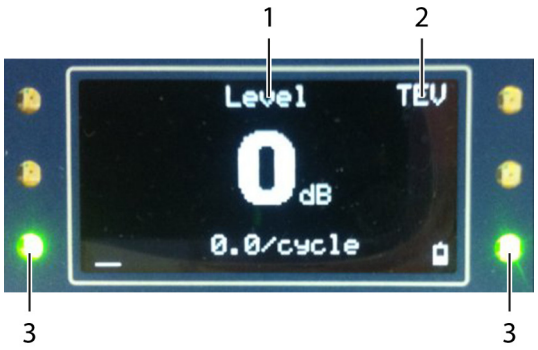
µV	dB
0.5	-6
1	0
2	6
5	14
10	20
20	26
35	31
50	34
100	40
1 000	60
3 100	70

7.5 Display

When the device is in either ***TEV*** mode or ***AE*** mode, the display can be toggled between ***Level*** and ***Trend*** display by using the *TRIGGER* button.

7.5.1 Level display

This is the default display for both ***TEV*** and ***AE*** mode and shows the real-time signal levels measured in dB as a single number, see example below:



1 Display mode
2 Sensor mode TEV / AE
3 LEDs indicate severity

In ***TEV*** mode, the count is also shown. The count is the average number of pulses detected in a single power cycle and reflects the intensity of the detected activity.

Coloured LEDs (3) on either side of the display indicate whether the activity detected is low, medium or high. In ***TEV*** mode, the green and amber LEDs illuminated indicate medium activity.

Thresholds are set according to the levels shown in the tables below.

TEV mode:

LOW	< 20 dB
MEDIUM	20 – 29 dB
HIGH	> 29 dB

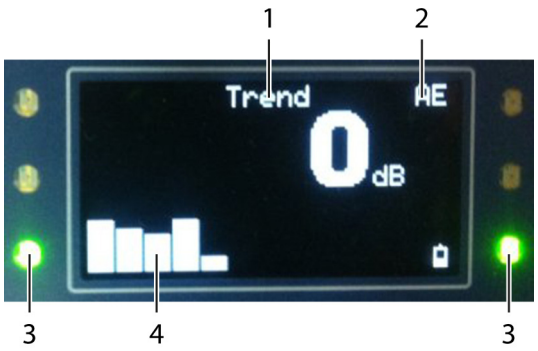
AE mode:

LOW	< 6 dB
HIGH	> 6 dB

Further information: Appendix *The relationship between PD and criticality* (on page 43).

7.5.2 Trend display

In both ***TEV*** and ***AE*** mode, pressing the *TRIGGER* button, switches the display to ***Trend***. This display shows the activity over a 5 second period. A horizontally scrolling bar chart shows the variation in the activity with each of the 5 bars representing the maximum signal detected in a single second.



1	Display mode
2	Sensor mode TEV / AE
3	LEDs indicate severity
4	Trend chart bar

The current level recorded is still shown in dB.

When the *TRIGGER* button is pressed again the display will show the largest signal detected in the previous 5 seconds and the LEDs (3) will flash with the appropriate colour for that level as shown below:

The LEDs flash according to the highest level detected during the previous 5 seconds.

By pressing the *TRIGGER* button a third time, the display will return to ***Level*** display.

Pressing and holding *TRIGGER* whilst in Level mode will switch to ***Trend*** mode, and continuously sample until *TRIGGER* is released. Once released, sampling ceases and the maximum reading over the past 5 seconds is displayed. Pressing and releasing *TRIGGER* again reverts back to the ***Level*** mode.

7.5.3 Setting the volume

The volume of the sound for the built-in speaker and the headphones can be adjusted. To change the volume, hold down the *MODE* button for about 2 seconds and the speaker icon will appear on the screen.

By pressing and holding the *TRIGGER* button, the desired volume can be selected as the volume cycles through the different ranges.

Release the *TRIGGER* button when the required volume is highlighted.

Once the correct volume is selected, pressing the *MODE* button again will return the unit to the ***AE***/***TEV*** display.

If no adjustments are made for 5 seconds, the unit will automatically return to the ***AE***/***TEV*** display.

8 CHARGING THE DEVICE

- Charge the device only with the supplied charger.
- Do not charge the device near high-voltage systems.

Note: During the charging process, the PD-SGS cannot be activated.

9 CHECKING THE PD-SGS FUNCTION

Before carrying out any test work with the PD-SGS it should be tested to check if it is operating correctly.

9.1 Function tester PD-FT

The function tester PD-FT is a small battery operated test device for checking the correct performance of the PD-SGS. When the yellow button is pressed it generates both TEV signal and AE signal.

The PD-FT is battery operated. When the battery level is low, the *Power* LED will flash. The PD-SGS charger can be used to recharge the battery. Whilst charging, the LED will be bright and when fully charged the LED will return to normal intensity.

9.2 Checking the TEV function

- Hold the PD-FT up against the sensor head of the PD-SGS and press the yellow button as shown in the figure above.

  The bottom surface of the PD-FT should be held directly against the sensor head.

The PD-SGS should record a value of greater than 30 dB to confirm correct operation.

9.3 Checking the AE function

- Hold the PD-FT up against the sensor head of the PD-SGS and press the yellow button as shown in the figure above.

  The AE sensor end of the PD-FT should be held up against the sensor head using the two rubber extensions to regulate the distance between the PD-FT and the PD-SGS as shown in the figure above.

The PD-SGS should record a value of greater than 30 dB to confirm correct operation.

10 SURVEYING SWITCHGEAR PANELS FOR PD – TEV

	**⚠ DANGER**
	Working in the vicinity of adjacent live parts Danger to life or risk of injury due to electric shock ▸ Always maintain safety distances between the device, the operator and any high-voltage components.

Checking the TEV activity levels

1. Switch the PD-SGS to ***TEV*** mode and ***Level*** display.
2. Starting at one end of the switchboard, check each panel for activity:
   a. Place the sensor in the centre of the panel and record the dB level shown on the PD-SGS screen.
      The sensor head should be held directly against the panel.
   b. If a single switchgear unit has more than one metal panel, then the test should be carried out on each of them individually.
3. Record the results for future reference and comparison.
   An example of a form for doing this is shown in Appendix A.

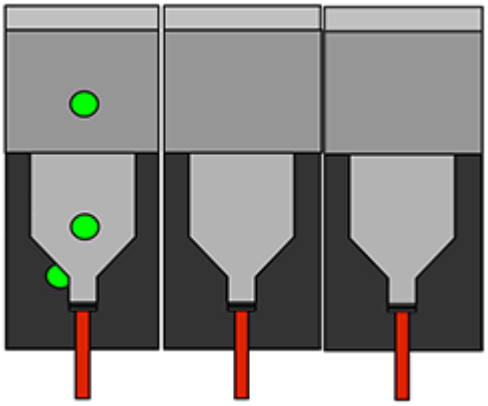
Verifying whether detected activity is noise or PD

Substations are very often electrically noisy environments and this noise can be picked up by the PD-SGS. Noise levels often reach or exceed 15 dB, in some harsh industrial environments levels can be as high as 30 or even 40 dB. A simple check can be carried out to help identify whether the activity detected is coming from the switchgear or is noise from surrounding plant.

1. Measure the highest level of activity on the switchgear panel.
2. Measure background noise in the substation by placing the PD-SGS sensor up against a metallic object that is not electrically coupled to the switchgear under test. This will give a background reference level.
3. If the activity level measured on the switchgear is more than 6 dB higher on the switchgear than it is on the reference object then there is a high likelihood that the activity is discharge coming from within the switchgear. Further investigative tests should be carried out using more sophisticated PD test equipment such as the BAUR online PD spot tester liona or the offline diagnostics system PD Portable.

10.1 Examples for checking TEV activity levels

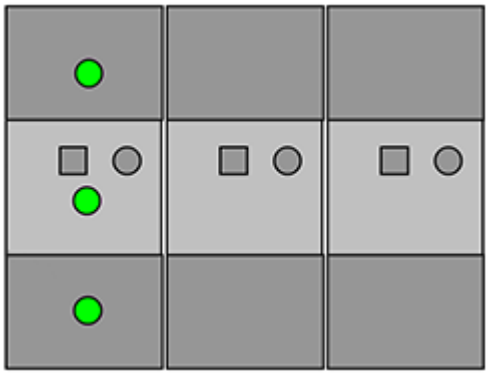
Example 1 – PD-SGS placement on component switchgear



- Test for activity in all 3 positions.

Where the switchgear has exposed components such as the bus bar chamber, current transformer or voltage transformer chamber, circuit breaker and cable box, then each part should be tested for activity as shown in the figure above.

Example 2 – PD-SGS placement on fully enclosed switchgear



- Test for activity in all 3 positions.

Where the switchgear has exposed components such as the bus bar chamber, current transformer or voltage transformer chamber, circuit breaker and cable box, then each part should be tested for activity as shown in the figure above.

11 SURVEYING SWITCHGEAR PANELS FOR PD – AE

	DANGER
	Working in the vicinity of adjacent live parts Danger to life or risk of injury due to electric shock ▸ Always maintain safety distances between the device, the operator and any high-voltage components.

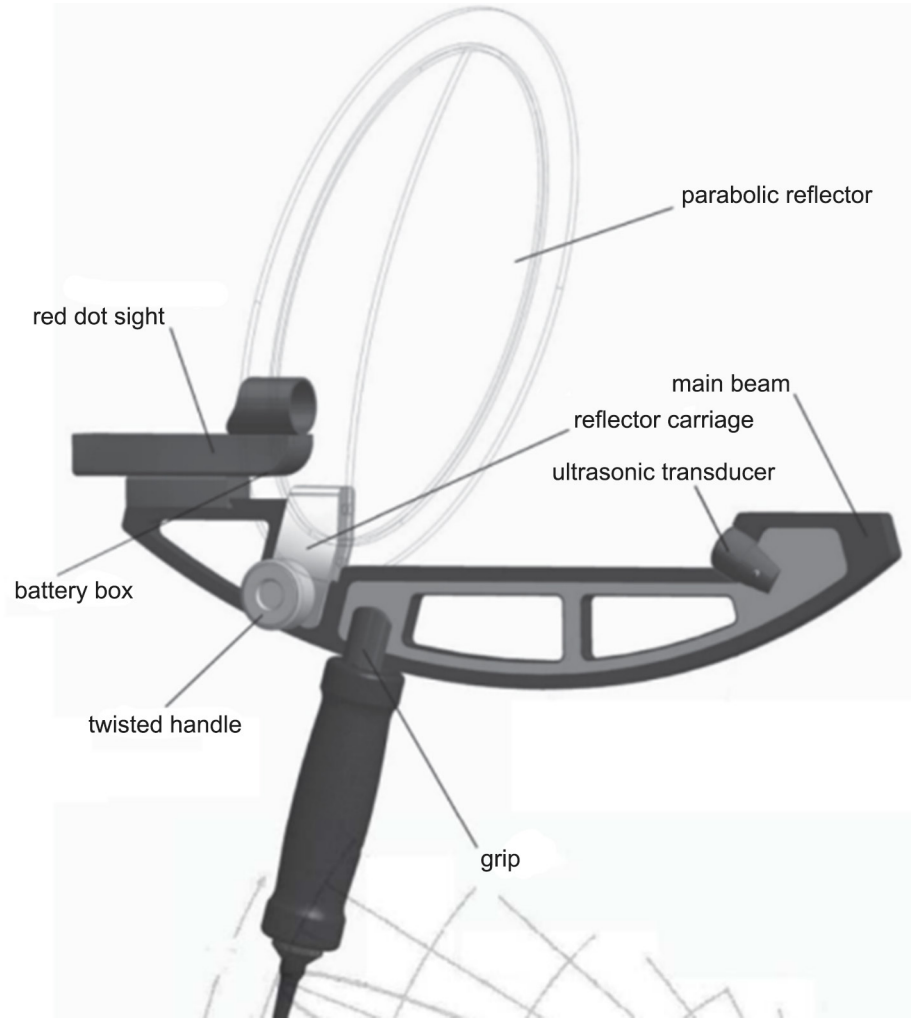
Checking the AE activity levels

1. Switch the PD-SGS to ***AE*** mode and ***Level*** display.
2. Starting at one end of the switchboard check each panel for activity:
   a. Point the sensor towards any exposed HV points like cable terminations or exposed insulators around HV points, for instance resin bushings or spouts on a withdrawable breaker. This may mean aiming the sensor though gaps in the metal cladding or through ventilation grills.
   b. If activity is found, move the transducer around until the highest level is detected and record the dB level shown on the PD-SGS screen.
3. Record the results for future reference and comparison.
   An example of a form for doing this is shown in Appendix A.

12 PARABOLIC REFLECTOR (OPTIONAL)

The parabolic reflector is an ultrasonic sensor for use when detecting partial discharge activity on exposed insulating surfaces. The reflector increases the sensitivity of the sensor allowing detection to be effective at up to 25 m. It is commonly used in outdoor switchyards to detect surface discharge on string and post insulators, sealing ends and other exposed equipment.

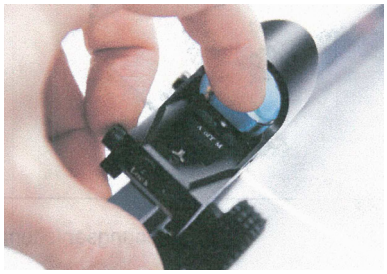
12.1 Assembling and commissioning



1. Remove the protective plastic film from the reflector completely.
2. Put the reflector carriage on the main beam and turn the handle hand-tight.
   While assembling and disassembling, touch only the reflector carriage in order to avoid damage.

3. Connect the parabolic reflector cable to the PD-SGS.

4. Turn on the red dot sight and choose one of the predefined light intensities for your specific lighting conditions.



Switch positions:

- A (AUTO) – brightness adjusts to surroundings
- Off – turns off the red dot sight
- M (MANUAL) – one brightness mode; not adjustable

Note: Turn off the red dot sight after use to extend the battery life.

12.2 Using the parabolic reflector

With the parabolic reflector connected to the PD-SGS, the reflector should be pointed at the HV equipment being inspected.

Look through the view finder with both eyes open and line up the red dot visible through the view finder with the centre of the inspection area.

The PD-SGS device should be operated in ***AE*** mode and it will register a dB reading on the user display. It will also generate an audible output according to the level of activity detected.

Further information: user manual of the parabolic reflector

It is recommended that when using the parabolic reflector out of doors, the headphones are worn in order to minimise interference from outside noise sources.

Owing to the nature of acoustic PD detection and natural variations caused by environmental conditions, it is recommended that PD levels identified are appraised according to their relative values when compared with other similar plant and not in absolute terms.

12.3 Maintenance and Servicing

- If necessary clean the equipment with a damp cloth. Do not use solvents as this may damage the surface.
- After use, the equipment should be disassembled and stowed in the carrying case.
- Replace low batteries immediately with a new cell of the type CR2032 / 3 V.
  The battery box is situated on the side of the red dot sight.

Further information: user manual of the red dot sight

12.4 Calibration

The parabolic reflector is supplied fully calibrated.

12.5 Laser pointer extension kit (optional)

Assembly on the parabolic reflector and commissioning

1. Put the laser pointer in the laser pointer carrier, so that the On/Off button is horizontally in line with the rotary know on the side of the laser pointer carrier.
2. Replace the red dot sight with the laser pointer carrier.
3. Tighten the locking screw on the side of the carrier.
4. Switch-on the laser pointer by turning the rotary knob.

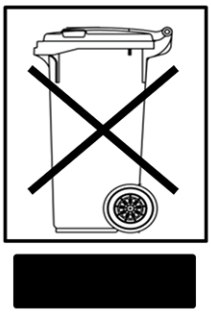
Further information:

- user manual of the laser pointer
- user manual of the laser pointer carrier

13 DISPOSING OF THE DEVICE

BAUR devices do not belong in the domestic waste!

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



14 TECHNICAL DATA

General information		
Battery type		Lithium-ion rechargeable battery 2.2 Ah; DC 3.75 V
Battery life		Approx. 12 h
Main charger		
	Nominal voltage	AC 90 – 264 V (50/60 Hz)
	Output voltage	DC 5 V / 3.0 A
	Charging time	Approx. 2 h
Ambient temperature (operation)		-5 °C to +55 °C
Humidity		≤ 90%, Non condensing
Degree of protection		IP 54
Dimensions (W x H x D)		Approx. 90 x 190 x 65 mm
Weight		Approx. 300 g
Safety and EMC		CE-compliant in accordance with Low Voltage Directive (2014/35/EU) and EMC Directive (2014/30/EU)
TEV measurement		
Sensor		Capacitive
Measurement range		0 – 80 dBmV
Frequency range		20 MHz – 200 MHz
Resolution		1 dB
Accuracy		±1 dB

Ultrasound measurement	
Measurement range	-6 to +70 dBµV
Resolution	1 dB
Accuracy	±1 dB
Convertor sensitivity	-65 dB (0 dB = 1 V/µbar$_{rms}$ sound pressure level)
Convertor average frequency	40 kHz ± 1 kHz
Hardware	
Housing	Plastic injection-moulded housing
Operating controls	2 keys (membrane keyboard) 1 trigger button
Connections	Power supply Headphones External acoustic sensor
Display	High-resolution OLED display with strong contrast, 6 display LEDs (PD level)

15 DELIVERY INCLUDES AND OPTIONS

Standard delivery includes	Options
▪ BAUR handheld online PD detector PD-SGS ▪ Function tester PD-FT ▪ Transport case ▪ Stereo headphones ▪ Main charger incl. country-specific adapter (UK, Europe, Australia); DC 5 V / 3.0 A ▪ Charger cable incl. USB plug ▪ Micro car charger; DC 5 V / 2.1 A ▪ User manual	▪ Parabolic reflector incl. carrying bag ▪ Laser pointer extension kit

16 DECLARATION OF CONFORMITY

We,

BAUR GmbH
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www.baur.eu

declare, under our sole responsibility, that the product

BAUR Handheld Online PD Detector PD-SGS,

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

- Low voltage Directive 2014/35/EU
  EN 61010-1:2010
- EMC Directive 2014/30/EU
  EN 55011:2009 + A1:2010
  EN 61000-3-2:2014
  EN 61000-4-2:2009
  EN 61000-4-4:2012
  EN 61000-4-5:2014
  EN 61000-4-11:2004

Signed: Torsten Berth, Technical Director
Dr. Eberhard Paulus, Director QM/QS

Sulz, 30.11.2015

17 APPENDIX

APPENDIX A

Example Test Sheet

Substation Name		Test Engineer	
Location		Test Date	
Panel No.	Panel Section	TEV Level (dB)	Acoustic Level (dB)
1	Top		
	Middle		
	Bottom		
2	Top		
	Middle		
	Bottom		
3	Top		
	Middle		
	Bottom		
4	Top		
	Middle		
	Bottom		
5	Top		
	Middle		
	Bottom		
6	Top		
	Middle		
	Bottom		
7	Top		
	Middle		
	Bottom		

APPENDIX B

The relationship between PD and criticality

Criticality

The criticality of a high-voltage asset (e.g. a cable circuit or switchgear panel) is a measure of how likely it is to fail. The criticality is therefore very important for the asset manager in order to know when and where to carry out maintenance and repair work.

Partial discharge

The criticality of an asset has many different contributing factors and partial discharge is an important part. Discharge activity will cause small but very localised damage to the insulation. Over time this damage can develop to the point where it causes full breakdown. Partial discharge is a good indication of weak insulation and an increased probability of failure. Both the magnitude and repetition rate are important in determining the influence of the PD and the following tables are based upon the average total discharge activity per power cycle.

The tables below are guides to PD activity levels and the associated severity.

TEV mode:

ASSET	LOW	MEDIUM	HIGH
SWITCHGEAR			
MV switchgear	< 20 dB	20 – 29 dB	> 29 dB

AE mode:

ASSET	LOW	HIGH
SWITCHGEAR		
MV switchgear	< 6 dB	> 6 dB

Note: In XLPE cables the insulation does not withstand any PD for very long so the figures quoted are for PD in the cable accessories.

Recommendations for the appropriate actions for these severities are given in the table below:

LOW	No further action required
MEDIUM	Test again within 3 months
HIGH	Locate PD and repair

It should be noted that the lead time to failure after on-set of PD can be between a few days and many months.

18 INDEX

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