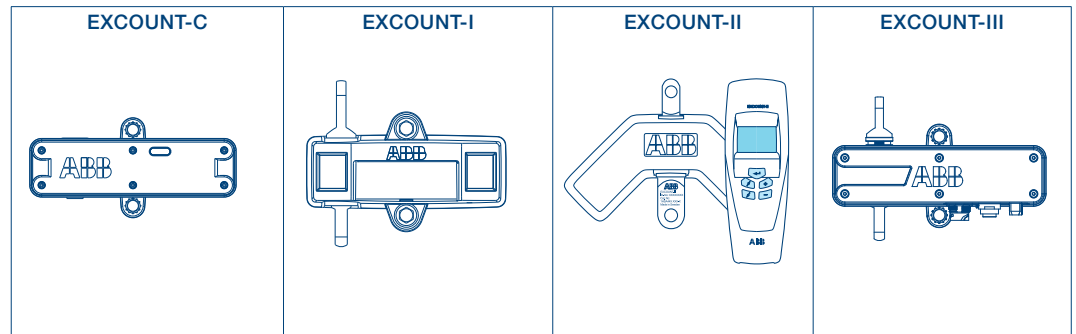


# EXCOUNT

## Surge arrester monitors matched with the surge arresters

With our state-of-the-art product family EXCOUNT, ABB has the full range of counters and monitors to cater for all customer needs – from simple discharge operation count (EXCOUNT-C) through leakage current measurement (EXCOUNT-I), remote wireless monitoring and diagnostics (EXCOUNT-II) to online real-time monitoring, diagnostics and analysis (EXCOUNT-III).



### Surge registration

<b>Number of impulses</b>	Yes	Yes	Yes	Yes
<b>Impulse amplitude classification</b>	-	-	Yes	Yes
<b>Impulse amplitude measurement</b>	-	-	-	Yes (also available without)
<b>Time stamp</b>	-	-	Yes	Yes
<b>Wave steepness</b>	-	-	-	Yes (also available without)
<b>Advanced surge analytics</b>	-	-	-	Yes (also available without)

### Leakage current measurement

<b>Total current</b>	-	Yes (also available without)	Yes	Yes
<b>Resistive leakage current</b>	-	-	Yes (also available without)	Yes
<b>Overvoltage estimation</b>	-	-	-	Yes (also available without)
<b>Online real-time monitoring</b>	-	-	-	Yes

<b>Display</b>	6-digit, electromechanical counter	6-digit, Ch-LCD	Remote reading, PC connectivity	Remotely monitored through network connection
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<b>Power supply</b>	Not applicable	Solar panel	Solar panel and field probe	100-250 Volt, AC (50-60 Hz) or DC, Max. 5 Watt, Max 0.1 A
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# EXCOUNT

## Monitoring the health of surge arresters

**Well-designed and tested, ABB surge arresters are maintenance-free and can reasonably be expected to have a long service life. Nevertheless, considering the type of expensive equipment which an arrester is protecting, together with how costly and devastating an unplanned power outage can be, there are good reasons for “monitoring” the condition of arresters.**

Surge arresters present a high impedance at normal service voltage such that they behave as an insulator for the majority of their life. This is necessary to assure a long life for the arrester itself as well as stability of the electrical network as a whole. A deterioration of an arrester's insulating properties is therefore important to detect early before the situation becomes acute.

In order to truly evaluate the health of an arrester, testing of the kind made as routine during manufacture would need to be performed. However, such testing is not practical to make in the field and removal of the arrester to a HV lab is deemed uneconomic. Instead some kind of in-service diagnostic is required.

### Surge registration

The primary reason for the use of surge counters on modern gapless ZnO arresters is to check if a particular transmission line or phase suffers from an exceptionally high number of overvoltages leading to arrester operation — lightning faults on a line, for example. If this is the case, whilst it validates the need for the arresters, use of some preventative counter-measures may be warranted to limit the number of surges. A sudden increase in the counting rate may also indicate an internal arrester fault, in which case the arrester should be investigated further.

However, simple surge counters tell only part of the story, as they only register the number of surges according to their operating characteristic. The user therefore has no way of telling the magnitude of the surge and if it was significant, nor when it occurred and if it was coincident with a system event.

### Leakage current measurement

Surge counters can be complimented with the facility to measure leakage currents (total and/or resistive), with the intention of monitoring and diagnosing the condition of the arrester and its state of fitness for continued service. However it is important to understand the validity of the information provided.

At continuous operating voltage ( $U_c$ ), a metal-oxide varistor acts as a capacitor, leading to a predominantly capacitive component of current and a significantly smaller resistive part. For a complete surge arrester, the capacitive current is further dependent on stray capacitances, pollution currents on the insulator surface, number of varistor columns in parallel and the actual operating voltage. Meanwhile the small resistive component of the leakage current is temperature and voltage dependant.

Since the capacitive component of the current dominates so greatly, the total leakage current measured on a basic mA-meter will be very sensitive to the installation; making interpretation of the readings difficult. Furthermore, the capacitive current does not change significantly due to deterioration of the voltage-current characteristic of the surge arrester. Consequently, measurement of capacitive current cannot reliably indicate the condition of metal-oxide arresters. Nevertheless, increasing values may be of some use in indicating that cleaning of the insulators is necessary.

# EXCOUNT

## Monitoring the health of surge arresters

Instead, it is generally recognized (IEC 60099-5) that the only reliable indicator for the condition of a gapless arrester that can be assessed during normal service is to measure the resistive component of the leakage current (or estimate it from the 3rd harmonic). The obtained value may then be compared with the maximum allowable resistive current as given by the manufacturer under prevailing service conditions i.e. temperature and applied voltage.



Remote reading with EXCOUNT-II

If a metal-oxide varistor ages or is damaged by impulses etc, the arrester resistive leakage current, and hence power losses, increase permanently. This may result in an increase in temperature, which in turn, increases the leakage current and so on until a so-called thermal runaway occurs. Early detection of a possible harmful increase may prevent a failure and subsequent unplanned shutdown. Hence, to provide true diagnostics, a good monitor must be able to detect the arrester leakage current and isolate and measure the resistive component flowing internally.

### Diagnostic plan

A surge arrester does not contain any moving parts or items that can break. Consequently there is nothing to maintain, adjust, correct or repair, which is why there is normally no need to perform any form of periodical checking or monitoring. In general, a correctly chosen and installed arrester is maintenance free during its entire lifetime. A correctly chosen arrester in this context means that its electrical and mechanical characteristics are matched to actual service conditions.

Nonetheless, since external factors can place stresses on the arrester, potentially leading to its deterioration and ultimate overload, it may be prudent to draw up a schedule for regular checks. Such consideration is all the more important if an unplanned outage is unacceptable for reasons of system stability or economics. The older the arrester, the more regular these checks may need to be, since the statistical risk for overload increases with age.

As a guide, the following strategy is proposed to be made at regular intervals as required and determined by site availability and importance:

- Visual inspection and possible cleaning
- Diagnostics in advance of the designated lightning season and thereafter following periods with bad weather conditions.
- Diagnostics after special fault conditions causing flashover in the network or TOV's of high amplitude and/or long duration.

Because of their nature, old-style gapped arresters should be removed as soon as possible as part of a scheduled replacement program. Their age and inherent design does not warrant detailed evaluation. Early models of gapless arresters may require additional visual checks to look for signs of mechanical or physical deterioration as well as monitoring of the internals. Newly purchased arresters can also benefit from diagnostic monitoring right from first installation since this permits easy trend analysis to detect potential deterioration later on in its service life.

# EXCOUNT

## When safety comes first

EXCOUNT draws upon over 80 years of experience by ABB in the development of arresters and associated accessories. Safety, functionality and longevity are key elements which are given priority in selection and design of components. In stark contrast to many other competing products, EXCOUNT has not neglected short-circuit safety which lies inherent in the design concept.

### The EXCOUNT family is characterized by:

#### Highest personnel safety

- Same safe performance as ABB arresters

#### Negligible residual voltage

- Does not reduce protection margins
- Minimized risk for injury in case of accidental contact during surges

#### Maintenance free

- Sealed components
- Requires no external power supply (except for EXCOUNT-III)

#### Long life

- Moulded components, non-sensitive to humidity or temperature variations

#### Universal application

- All makes and types of gapless surge arresters.
- All weather and temperature conditions.



#### Design

The use of an impulse current transformer with a single-turn primary ensures that the voltage drop across the counter is negligible, even at the highest impulse currents encountered in service. This leads to added personnel safety and no increase in the protection level of the arrester. Since no gaps or series impedance are used, there is no risk of internal arcing and consequent explosive failure in the event of a short-circuit following an arrester failure.

One further common feature with the entire EXCOUNT family is that all internal components are fully encapsulated in polymer. This provides sealing to IP67, which ensures no harmful ingress of dust or moisture as well as providing personal safety through complete protection against contact with the internals.

EXCOUNT is available in different variants, depending on the user's needs: simple, basic or extensive.

# Surge counter EXCOUNT-C

EXCOUNT-C is a simple surge counter with all the essentials for easy installation and highest personnel safety. The counter is maintenance free; powered by the surge current and suitable for all weather and temperature conditions.



## Design features

EXCOUNT-C is to be fitted in the earth circuit between the arrester and ground. For simplicity, the EXCOUNT-C does not have a termination point for the earth cable. Instead an opening is provided to draw the entire earth conductor from the arrester completely through and down to ground. In case the conductor is too large to fit through the hole, an optional conductor kit may be ordered separately.

The secondary circuit is connected to a mechanical counting relay and all components are totally sealed in polymer. A viewing window permits easy reading of the six-digit cyclometer-type counter.

## Surge registration

The counting threshold for EXCOUNT-C is adapted for gap-less surge arresters. Only pulses that are considered significant to the arrester capability and life are therefore registered.

## Maintenance free

A robust plastic casing is fitted over the encapsulated internals, which makes EXCOUNT-C non-sensitive to humidity or temperature variations. It can be exposed to all environments regardless of weather and temperature conditions. The current transformer secondary output is sufficient for driving the counter and an external supply source is hence not needed.

# EXCOUNT-C

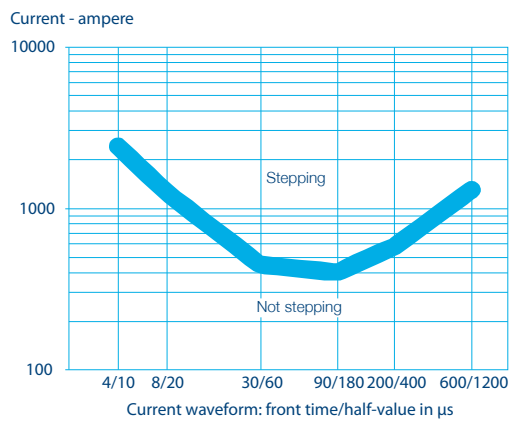
## Technical data

### General

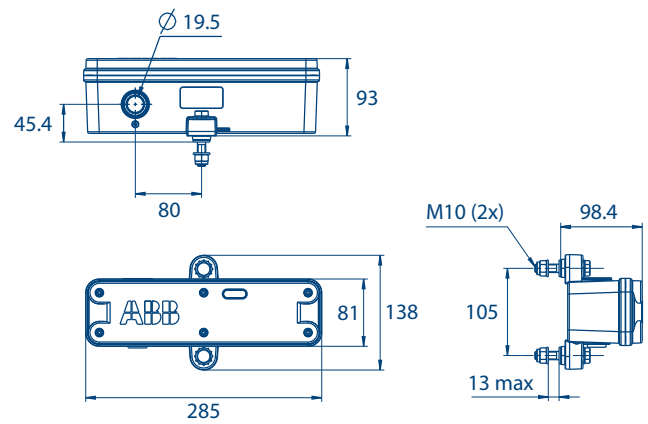
Item number	1HSA448000-A
Climatic conditions	Sealed water-tight design, IP67
Short-circuit capability	65 kA according to IEC 60099-4
Power supply	Impulse current

### Surge registration

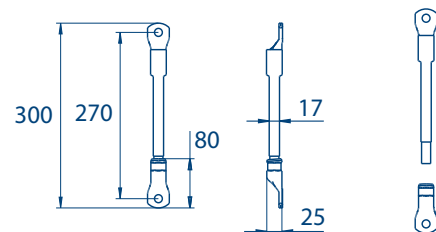
Minimum counting threshold (8/20 $\mu$ s)	1.5 kA
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Stepping criteria



Dimensions



Optional accessory EXCOUNT-C current conductor

Item number: 1HSA448427-A

# Surge counter EXCOUNT-I

## with mA-meter

EXCOUNT-I is a surge counter with basic leakage current measurement function. The counter provides a number of unique features such as short-circuit safety and a well proven electronic display which is easy to read, even in direct sunlight. EXCOUNT-I is specially designed for use with all makes and types of gapless arresters and in diverse environments.



### Design features.

As with all surge counters from ABB, EXCOUNT-I does not negatively affect the residual voltage of the arrester. EXCOUNT-I is housed in a sealed, weather-proof case, suitable for outdoor use and proven to match the short circuit capability of the arresters. EXCOUNT-I has been designed for highest personal safety and has been successfully short circuit tested at 65 kA.

EXCOUNT-I requires no external power supply as it incorporates its own internal power source in the form of a high-efficiency capacitor charged by solar cells.

The electronic display is of Cholesteric Liquid Crystal Display type. This ensures highest readability, even in direct sunlight. The display is Bi-stable, which means that power is only required during refresh of the display.

### Surge registration

EXCOUNT-I registers the surge each time the arrester has discharged a current over 10 A. The accumulated number of surges is continuously shown on the electronic display.

### Leakage current measurement

ABB's unique design ensures that total leakage current through the arrester can be measured without risking personnel safety.

The measurement is initiated by triggering a light sensitive diode using a standard laser pointer. This will initiate EXCOUNT-I to start measuring the total leakage current for several cycles and shortly thereafter display the average value (in mA). The counter will then automatically return to its normal state and display number of impulses. Thus, the measurement can be made at a discreet distance without coming into direct contact with the equipment.

### Maintenance free

EXCOUNT-I is a maintenance free product in outdoor applications. The display and solar panels might however need to be wiped off before measurement in extremely polluted conditions.

# EXCOUNT-I

## Technical data

### General

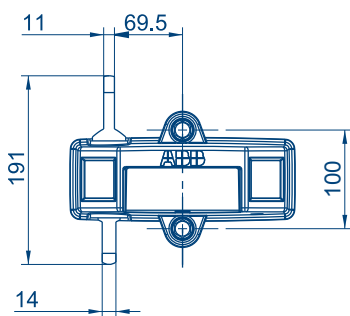
<b>Climatic conditions</b>	Sealed water-tight design, IP67
<b>Short-circuit capability</b>	65 kA according to IEC 60099-4
<b>Power supply</b>	Built-in solar cells (battery alternative for indoor use)

### Surge registration

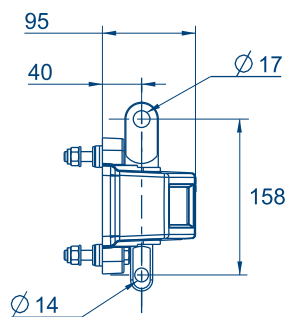
<b>Minimum counting threshold (8/20 <math>\mu</math>s)</b>	10 A
<b>Surge counting memory capacity</b>	999999 registrations (wrap-around)
<b>Time resolution</b>	< 0.5 s

### Leakage current measurement

<b>Measuring range of total leakage current</b>	0.1 - 50 mA <sub>peak</sub>
<b>Measuring frequency range</b>	48 - 62 Hz
<b>Laser pointer wavelength</b>	630 nm



Dimensions

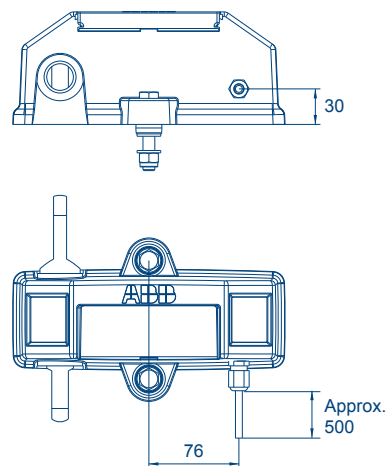


### EXCOUNT-I versions

EXCOUNT-I can be supplied with an output connection (auxiliary contact) for interfacing to external signalling equipment. Versions with only surge counting function are also available.

Model	Surge counting	Leakage current measurement	Auxiliary contact	Laser pointer included
1HSA440000-C	Yes	-	-	-
1HSA440000-E	Yes	-	Yes	-
1HSA440000-J	Yes	Yes	-	Yes
1HSA440000-L	Yes	Yes	Yes	Yes

The auxiliary pulse contact is suitable for use with AC or DC voltage (max. 250V, 1A). An auxiliary relay of suitable type must be connected separately to the EXCOUNT-I auxiliary contact (not included as standard).



Auxiliary contact brought out via dual-core (2 x 1 mm) cable  
1HSA440000-E and 1HSA440000-L



# Surge arrester monitor EXCOUNT-II

## Remote wireless monitoring and diagnostics

EXCOUNT-II is our remote wireless monitoring and diagnostics product combining outstanding looks with the most extensive and powerful features. Included are a variety of surge counting features together with all the essential leakage current measurement functions. EXCOUNT-II enables users to keep track of overvoltages in the network as well as providing state-of-the-art on-line condition monitoring of arresters.



### Design features

EXCOUNT-II is a unique monitoring system, which can be used as an aid to assess the health of the entire substation by monitoring surges transmitted in and out of the network. Each surge arrester is fitted with a sensor, which detects the total number of discharges, the surge amplitude, date and time of occurrence, as well as the leakage current through the arrester. The measurements can be remotely read when convenient with the aid of a hand-held transceiver (and optional external antenna).

Remote reading provides increased personnel safety compared with conventional counters. With a communication distance of up to 60 m (120 m with external antenna), the person does not necessarily have to even be inside the substation perimeter, so saving the need to arrange entry permits or have electrically trained personnel perform the work.

The measured data can then be transferred to a computer for statistical analysis. Included with EXCOUNT-II is specially designed software which facilitates download of the measured data from the transceiver and permits analysis and reporting of the collected information.

### Surge registration

EXCOUNT-II does more than just count surges. It also registers the date and time as well as amplitude of the surge each time the arrester has discharged a current over 10 A. Time and amplitude measurement gives the user better information about overvoltages in the network and the operation of the arrester.

### Leakage current measurement and condition monitoring

EXCOUNT-II gives the user the possibility to measure both the total leakage current as well as the resistive component of the current through the arrester. Measurement of the resistive current gives a good indication of the arrester's condition and fitness for continued service. The measurement method employed is based on third-harmonic analysis which is considered the most reliable measuring method for condition monitoring according to IEC 60099-5.

### Safe and secure

The sensor is housed in a sealed, weather-proof case, suitable for outdoor use and proven to match the short-circuit capability of the arrester to which it is connected. The sensor requires no external power supply as it incorporates its own internal power source in the form of a high-efficiency capacitor automatically charged by solar cells and electric field probe.

# EXCOUNT-II

## Technical data

### General

<b>Climatic conditions</b>	Sealed water-tight design, IP67
<b>Short-circuit capability</b>	65 kA according to IEC 60099-4
<b>Power supply</b>	Built-in solar cells and field probe (battery alternative for indoor use)

### Surge registration

<b>Minimum counting threshold (8/20 <math>\mu</math>s)</b>	10 A
<b>Amplitude classification (8/20 <math>\mu</math>s)</b>	10 - 99 A 100 - 999 A 1000 - 4999 A 5000 - 9999 A > 10000 A
<b>Time stamp</b>	Yes
<b>Time resolution</b>	< 0.5 s
<b>Memory capacity</b>	1000 registrations (wrap-around)

### Leakage current measurement

<b>Measuring range of total leakage current</b>	0.2 - 12 mA <sub>peak</sub>
<b>Measuring range of resistive leakage current (peak level)</b>	10 - 2000 $\mu$ A
<b>Measuring frequency range</b>	48 - 62 Hz

### EXCOUNT-II versions

EXCOUNT-II are available for two different frequencies depending on national regulations. Contact ABB for guidance.

### Sensor

Model	Frequency
1HSA441 000-A	for 868.35 MHz
1HSA441 000-C	for 916.50 MHz

### Sensors for inverted mounting

Model	Frequency
1HSA441 000-D	for 868.35 MHz
1HSA441 000-E	for 916.50 MHz

### Transceiver model 1

Application: Measuring total leakage current and surge data

Model	Frequency
1HSA442 000-C	for 868.35 MHz
1HSA442 000-E	for 916.50 MHz

### Transceiver model 2

Application: Measuring total leakage current, resistive leakage current and surge data.

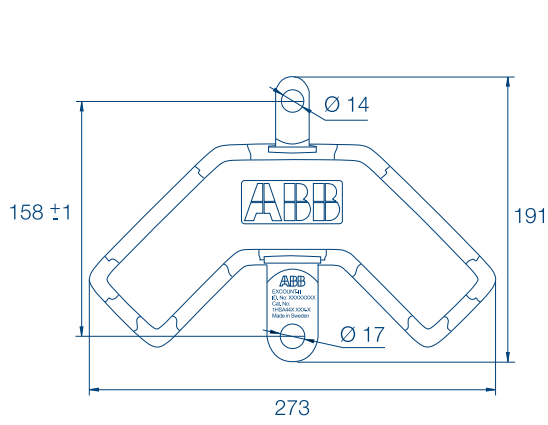
Model	Frequency
1HSA442 000-A	for 868.35 MHz
1HSA442 000-D	for 916.50 MHz

### External antenna

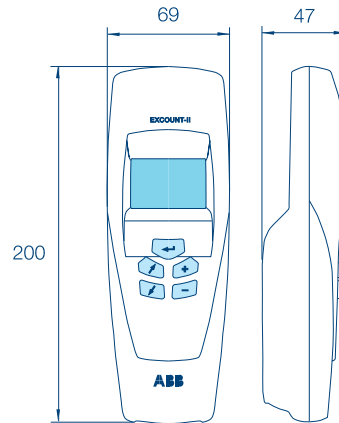
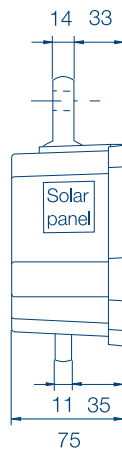
Model	Frequency
1HSA446 000-A	for 868.35 MHz
1HSA446 000-B	for 916.50 MHz

# EXCOUNT-II

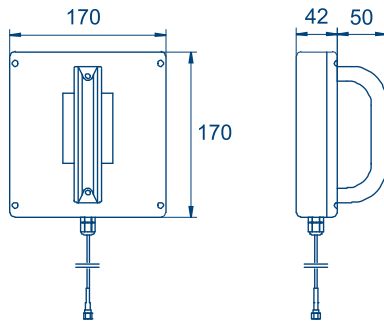
## Dimensions



Sensor



Transceiver



External antenna

# Online surge arrester monitor EXCOUNT-III

## Remote real-time monitoring, diagnostics and analysis

ABB introduces the next generation of monitoring equipment for surge arresters: EXCOUNT-III, utilizing unique features previously unseen on the market.

Given that much of the other station equipment is already being condition and activity monitored, there has been a clear desire to include arresters as well. Not only does EXCOUNT-III monitor the arrester itself, it can also give an estimate of overvoltage occurring at nearby apparatus within the arrester's protection zone - providing valuable information about whether the protection against potentially damaging surges is sufficient or not. In this way, EXCOUNT-III provides the user with remote real-time monitoring of arresters as well as useful input to the insulation co-ordination of the station as a whole.

With market pressure on utilities to obtain near 100% power availability, taking all actions to avoid even a rare unplanned outage is considered worthwhile. As users push their systems harder accordingly, it can be expected to see stresses from system events leading to the arresters also being called upon to act more often than they perhaps did in the past. Monitoring how they handle those stresses - as well as what the consequences of those events are on the system itself - may be included as part of the user's strategy for improving the overall availability. EXCOUNT-III has been developed with this strategy in mind.

### Design features

For each surge arrester it is fitted on, the advanced version (EXCOUNT-IIIA) registers the total number of discharges, the surge amplitude and wave-steepness, the date and time of occurrence, the total leakage current as well as the resistive leakage current through the arrester by third-harmonic analysis (method B2 according to IEC 60099-5). Using high speed sampling and sweep time, complete surge current impulses at the arrester's connection point are recorded and available for analysis.

The standard version (EXCOUNT-IIIM) is available for users who do not desire to analyze the overvoltages in detail. With this, discharges are only categorized by their amplitude along with a date and time stamp of occurrence. Other generic features are the same between the versions.

A web browser interface via an optical fibre connection permits online interrogation and data analysis from each unit individually and is also used for configuration setup. The introduction of smart grid and the communication protocol IEC 61850 has made users more focused on integration with



existing SCADA systems. EXCOUNT-III supports this protocol and communicates remotely via the fibre optic cable to permit the user to add signals into an existing data collection system.

### Surge registration

In addition to surge counting, a special feature of the advanced version is the registration of the surge amplitude and wave-steepness. This can be used to define the residual voltage across the arrester for the actual surge, which in turn can be used to better estimate overvoltages in the station for a more detailed evaluation of insulation co-ordination than has been possible in the past.

This added-value feature will help users to verify if they have adequate protection or if they need to reconsider their choice of arrester or even increase the number of arresters in the station. Furthermore, there is particular interest to correlate front time and overvoltage levels with pre-existing transformer monitoring equipment as a means to support total system condition monitoring diagnostics.

# Online surge arrester monitor EXCOUNT-III

## Remote real-time monitoring, diagnostics and analysis

### **Leakage current measurement and condition monitoring**

EXCOUNT-III gives the user the possibility to measure both the total leakage current as well as the resistive component of the current through the arrester. The measurement of the resistive current especially gives a good indication of the arrester's condition and fitness for continued service. With the aid of the SCADA system, these measurements can readily be used to co-ordinate maintenance work and possible replacement in order to assist with minimizing unnecessary and costly unplanned outages.

### **Safe and secure**

EXCOUNT-III remote retrieval of data via the optical fibre cable eliminates the need for substation visits solely to monitor arrester condition, while also enabling the highest possible personnel safety standard by not having to approach an ener-

gized arrester to perform online diagnostic measurements. All components are housed in a sealed, weather-proof case, suitable for outdoor use. The base unit is mounted on the support structure and interconnected similar to a traditional counter, while the separate field probe is fixed at the bottom of the arrester. An external power connection from the station auxiliary supply (100 - 250 V, AC or DC) as well as a fibre optic cable connection are additionally to be provided by the user.

# EXCOUNT-III

## Technical data

### General

Climatic conditions	Sealed water-tight design, IP67
Power supply	100-250 Volt, AC (50-60 Hz) or DC

### Surge registration

Minimum counting threshold (8/20 µs)	Adjustable 100 -1000 A	
	EXCOUNT-IIIM	EXCOUNT-IIIA
Amplitude classification/ measurement (8/20 µs)	The surge amplitude is classified as follows: 100-999 A 1000- 4999 A 5000 – 9999 A >10 000 A	The surge amplitude is classified as follows: 100-999 A 1000- 4999 A 5000 – 9999 A >10 000 A Additionally, EXCOUNT-IIIA provides the measured surge amplitude between 100-20 000 A. EXCOUNT-IIIA register amplitude, wave-steepness and calculates estimated overvoltage at connection point.
Time stamp	Yes	
Time resolution	1 s	
Memory capacity	30 years of data	

### Leakage current measurement

Measuring range of total leakage current	0.2 - 12 mA <sub>peak</sub>
Measuring range of resistive leakage current (peak level)	10 - 2000 µA
Measuring frequency range	48 - 62 Hz

### Communication

Optical fibre connection	Yes
Protocol	IEC 61850, Ed. 2. TCP/IP with web server in the device

### EXCOUNT-III versions

EXCOUNT-III is available in two versions, EXCOUNT-IIIM and EXCOUNT-IIIA.

#### EXCOUNT-IIIM

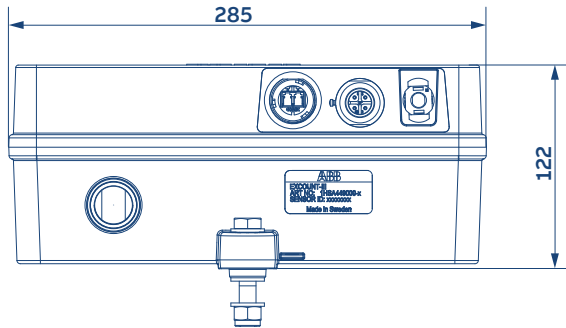
Version	EXCOUNT-IIIM
Model	1HSA449000-C
Surge counting	Yes
Time stamp	Yes
Impulse amplitude classification	Yes
Impulse amplitude measurement	-
Leakage current measurement	Yes
Resistive leakage current measurement	Yes
Online real-time monitoring	Yes
Wave steepness	-
Advanced surge analytics	-
Overvoltage estimation	-

#### EXCOUNT-IIIA

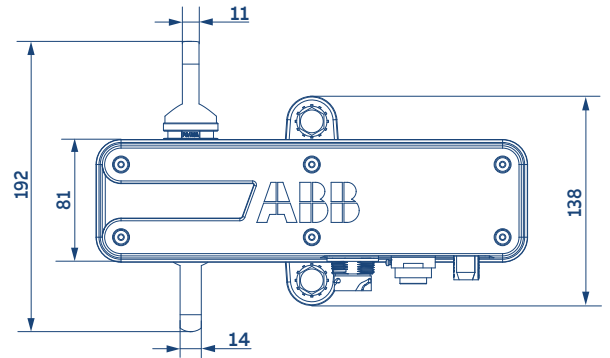
Version	EXCOUNT-IIIA
Model	1HSA449000-A
Surge counting	Yes
Time stamp	Yes
Impulse amplitude classification	Yes
Impulse amplitude measurement	Yes
Leakage current measurement	Yes
Resistive leakage current measurement	Yes
Online real-time monitoring	Yes
Wave steepness	Yes
Advanced surge analytics	Yes
Overvoltage estimation	Yes

# EXCOUNT-III

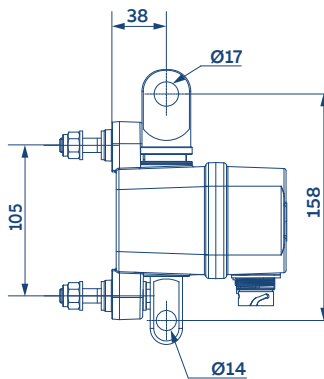
## Dimensions



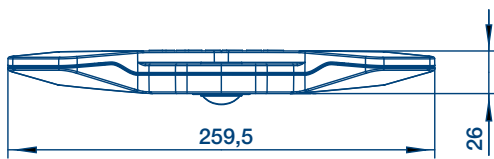
EXCOUNT-IIIIM/IIIA



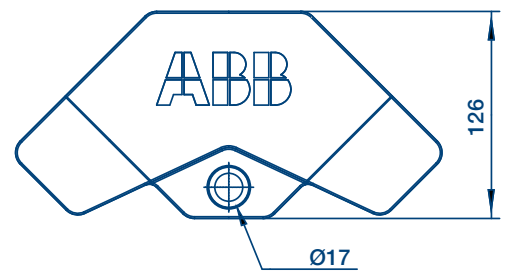
EXCOUNT-IIIIM/IIIA



EXCOUNT-IIIIM/IIIA



Field probe



Field probe

# Purchase order

Project		Handled by, e-mail or fax		Tender reference no (if any)	
Buyer			Date (yyyy-mm-dd)	Buyer reference	
End user				End user reference (if any)	
Shipping terms	Destination			Means of transport	
Freight forwarder (if FCA or FOB)				Payment terms	
Goods marking <input type="checkbox"/> No <input type="checkbox"/> Yes		Delivery address			
Inspection of routine tests	Routine test standard	Documentation language	Rating plate language	Currency	

## Items

Quantity	Arrester type designation				
Color (porcelain)	Line terminal		Earth terminal		Insulating base
Delivery date (EXW) yyyy-mm-dd			Unit price (if known)		Total price (if known)

Quantity	Arrester type designation				
Color (porcelain)	Line terminal		Earth terminal		Insulating base
Delivery date (EXW) yyyy-mm-dd			Unit price (if known)		Total price (if known)

Quantity	Arrester type designation				
Color (porcelain)	Line terminal		Earth terminal		Insulating base
Delivery date (EXW) yyyy-mm-dd			Unit price (if known)		Total price (if known)

Quantity	Arrester type designation				
Color (porcelain)	Line terminal		Earth terminal		Insulating base
Delivery date (EXW) yyyy-mm-dd			Unit price (if known)		Total price (if known)

It is recommended that the following form is used when ordering EXLIM/PEXLIM/TEXLIM surge arresters and accessories. Send to fax: +46 (0)240 179 83 or mail to [ordersa.swg@se.abb.com](mailto:ordersa.swg@se.abb.com).



# Installations with ABB surge arresters



PEXLIM surge arresters protecting a 420 kV power transformer in Norway



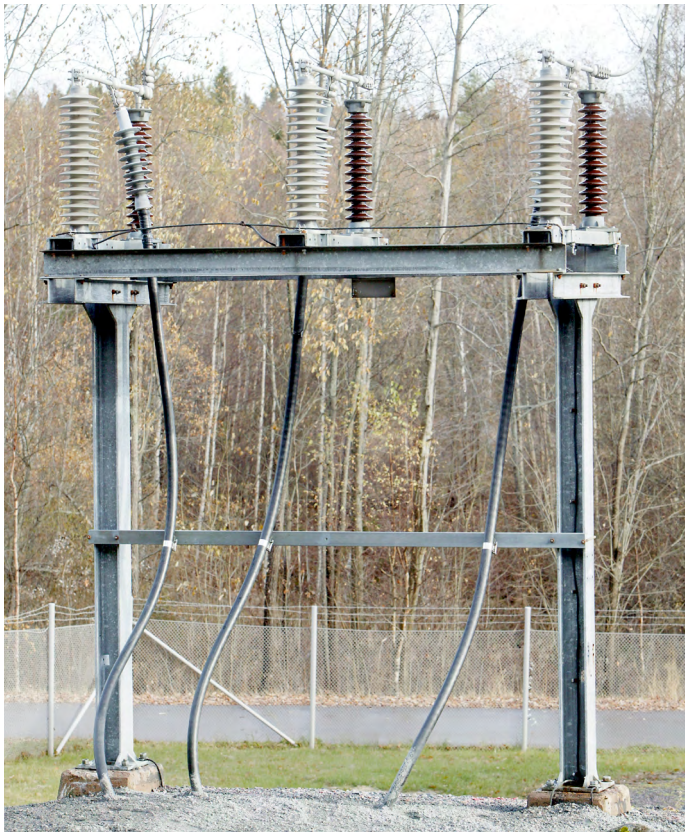
PEXLIM surge arresters protecting a 420 kV power transformer in Sweden



TEXLIM surge arresters connected to the line entrance



PEXLIM surge arresters connected to the 420 kV the secondary winding on a step-up transformer in a nuclear power plant



PEXLIM surge arresters protecting a cable entrance



EXLIM surge arresters protecting a 420 kV power transformer



# Contact us

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