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A full range of monitoring solutions  
for surge arresters

Answers for energy.

# Highly reliable equipment monitoring with added value

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Growth in worldwide energy demand is putting a greater load on existing networks – sometimes to the limits of their capacity – making reliable, responsible network operation an increasingly difficult challenge. As a result, many network operators are seeking solutions to increase the dependability of their networks. Equipment monitoring is a proven method for recording operating states and remaining service life, providing the operator with important data for asset management. Monitoring information is also valuable for assessing the overall state of the network.

## Efficient monitoring

Surge arresters are highly reliable components in power transmission and distribution systems. When operated in accordance with their specifications, their service life can span as much as 30 years without any maintenance.

Nevertheless, overloads may sometimes occur that can cause arrester failure and even endanger the safety of the network.



Monitors assist in the early detection of relevant changes.

Monitors support security of supply on a whole new level. Siemens offers a complete line of monitoring devices with a variety of innovative functionalities that can be perfectly matched to the customer's requirements, ensuring that impending faults will be detected as early as possible and before the security of supply is compromised.

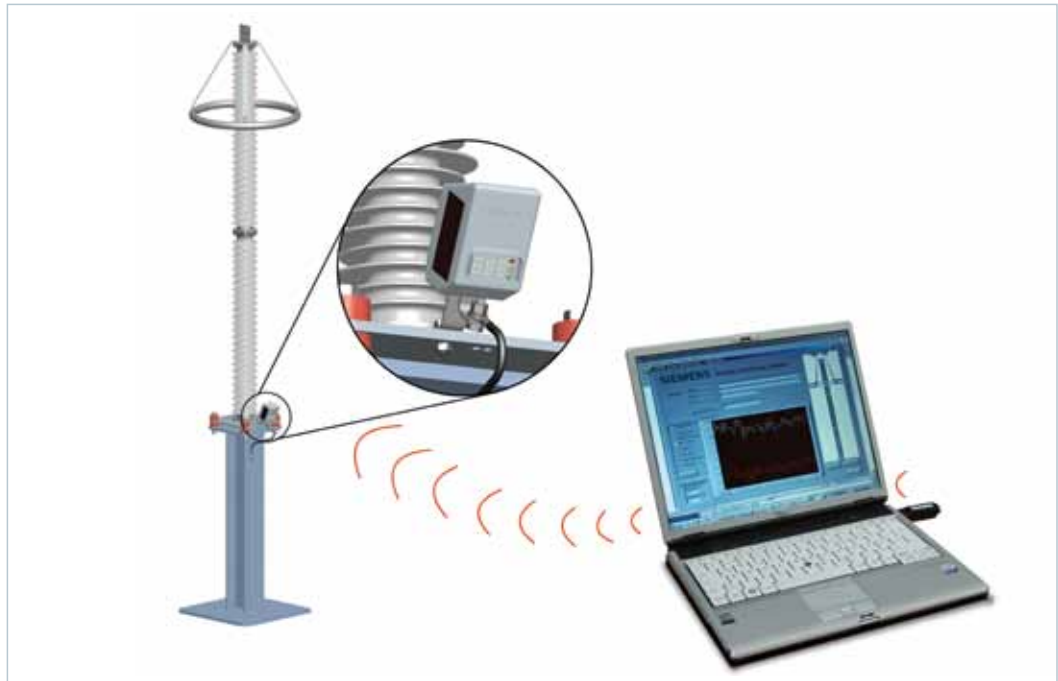
#### **Based on solid experience**

Siemens has over 80 years of experience with surge arresters – a solid foundation on which to build a comprehensive range of monitors that are precisely tailored to today's surge arrester technology. Siemens' line of surge arrester monitors ranges from simple counters and condition indicators to periodic analytic condition monitoring and a future live condition monitoring system. All monitors provide the requisite information on surge arrester responses and the arrester's condition – perfectly matched to the respective voltage level, network situation, and customer requirements.

# ACM – Arrester Condition Monitor

## Advanced version

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The basic functionality of Siemens' ACM basic has been expanded to include new developments and technologies that improve the safety of energy networks even more.

The general functions remain the same. The monitor performs two basic functions. The first is measuring total leakage current and determining the resistive leakage current component by analyzing the leakage current's 3rd harmonic. The second function is registering surge current impulses, as well as detecting and registering the overall number, level, and duration of impulses. This information can then be used to perform a precise analysis of arrester activity.

The ACM advanced solution is additionally equipped with wireless communication for evaluating long-term measurements, counter history, and energy summation. ACM advanced offers, and will continue to offer, the latest in surge arrester monitoring technology.

### Automatic long-term trend registration

The ACM advanced automatically performs a daily leakage current measurement at a user-defined time and stores the data obtained for more than five years. In contrast to simple spot checks, these long-term measurements automatically provide optimal information for trend analysis.

### Logging of surge current history and measurement of energy absorption

In addition to logging a detailed history of surge current impulses, the ACM advanced registers unique information on the energy converted in the surge arrester per impulse.

This provides a clear and detailed picture of the surge arrester's utilization for the duration of its service life.

Even if the total energy absorption throughout the arrester's life cycle has no limit, this information can still make a valuable contribution to asset management.



### **Solar power supply**

Because it is solar powered, the ACM needs no external power supply or batteries, nor is there a galvanic connection between the electronics and the surge arrester's main branch circuit.

### **Ready for IEC 61850**

The ACM advanced already meets the requirements for integration in future IEC 61850 systems without requiring the replacement of hardware on the surge arrester.

### **PC communication via USB stick and software**

The USB wireless module (3EX5 085) and the Service Tool can be used to set up a connection between an ACM and a PC. The two devices then function as both transmitter and receiver. The Service Tool software makes it possible to display, analyze, and evaluate the measured and calculated data on a PC. It can also be used to modify and store certain customer-specific parameters and to perform software updates, enhancing both convenience and flexibility.

### **Easy upgrade**

If the basic version is already in use on a surge arrester, it is possible to upgrade to the advanced version using a USB wireless module, free software, and a specific access license, without having to modify the arrester. It then has access to the entire range of functions of this powerful system.

# ACM – Arrester Condition Monitor

## Basic version

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Even more options compared to an indicator are possible using arrester condition monitoring for which Siemens offers innovative technology with many new functions.

### Basic functions as a solid foundation

The Siemens devices for basic arrester condition monitoring (ACM) provide a wide range of standard functions, including total leakage current measurement and display, surge current impulse metering and display, 3rd harmonic analysis of leakage current with compensation for network-dependent harmonics, temperature correction, and condition indication by means of LEDs in the colors of traffic lights.

From the first day of operation, the monitor works in the background to measure leakage current and compile a comprehensive counter history.\*

Future viability is guaranteed through the simple option of upgrading to the advanced system, which requires no changing of the arrester sensor; it can even be used as a sensor in future ISCM (integrated station condition monitoring) systems.

Thanks to its solar power supply, the monitor requires no external power supply or batteries, and no galvanic connection is established between the electronics and the arrester's main current path. The entire device is encased in silicone with no hollow spaces, making it impossible for moisture to penetrate.

\* Access only with advanced monitoring

# Surge counters

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## Surge counters

The 3EX5 030 surge counter is a traditional monitor for surge arresters. It is integrated into the arrester ground connection and counts the surge arrester responses that have occurred.

### Surge counter with leakage current meter

The 3EX5 050 surge counter with leakage current meter also offers monitoring of arrester leakage current.

In addition to the functions described here, both surge counters can also be equipped with a passive auxiliary contact for remote metering (3EX5 030-1, 3EX5 050-1).

## Technical data for 3EX5 030

Response sensitivity:

- 8/20  $\mu$ s discharge current: 200 A
- Resolution: 5 impulses per second
- 4/10  $\mu$ s high-current impulse: 100 kA

## Technical data for 3EX5 050

Response sensitivity:

- 8/20  $\mu$ s discharge current: 200 A
- Resolution: 5 impulses per second
- 4/10  $\mu$ s high-current impulse: 100 kA

Leakage current measurement:

- Indicated by mA meter as peak value /  $\sqrt{2}$
- Measuring range up to 30 mA (normal) or 50 mA (special model: 3EX5 050-2)
- Bilinear scale

# Sensor and display

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< 200 m

## Sensor and display

The 3EX5 060 sensor is a surge arrester monitor that is integrated into the arrester ground wire. It counts the surge arrester responses that occur and continuously measures leakage current.

The 3EX5 062 display visualizes the surge arrester responses detected by the sensor and the leakage current at a convenient location. The display can be installed at a distance of up to 200 meters.

The display unit also provides a connection for measuring the leakage current locally – for example, using an oscilloscope (measuring lead available as accessory).

## Technical data for 3EX5 060/062

Response sensitivity:

- 4/10  $\mu$ s, 8/20  $\mu$ s discharge current: 1000 A
- 30/60  $\mu$ s discharge current: 200 A
- Rectangular-wave discharge current: 100 A

Leakage current measurement:

- mA meter measuring range up to 20 mA
- Logarithmic scale



# Control spark gap and LCM 500

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## Control spark gap

The control spark gap is a monitor for surge arresters that is integrated into the arrester's ground wire. It counts the surge arrester responses that have occurred and allows an estimation of the current flowing through the surge arrester based on characteristic burn marks.

## Live condition monitoring with LCM 500

The LCM 500 is a portable measuring system for metal-oxide surge arresters that measures the 3rd harmonic component of the leakage current without interrupting operation. The data obtained can provide valuable information on the condition of the arrester.

The specific correction information for Siemens' arresters is contained in the software.

# Overview

ACM advanced



ACM basic



Surge counter



Surge counter with leakage current indication



<b>Concept</b>	Electronic	Electronic	Electromechanic	Electromechanic
<b>Measured variables</b>	Analyzes surge current impulses (time stamp, peak value, pulse width, energy content) Total leakage current 3rd harmonic of leakage current with temperature correction and harmonic compensation (3 LEDs) Arrester energy absorption	Number of surge current impulses Total leakage current 3rd harmonic of leakage current with temperature correction and harmonic compensation (3 LEDs)	Number of surge current impulses	Number of surge current impulses Total leakage current (including DC)
<b>Power supply</b>	Solar	Solar	None	None
<b>Remote indication</b>	Wireless	No	Special model AC: wired via aux. contact	Special model AC: wired via aux. contact
<b>Installation</b>	Integrated into ground wire	Integrated into ground wire	Integrated into ground wire	Integrated into ground wire
<b>Order no.</b>	3EX5 080-1 3EX5 085 (USB wireless module)	3EX5 080-0	3EX5 030 3EX5 030-1	3EX5 050 3EX5 050-1 3EX5 050-2

Sensor and display



Control spark gap



LCM 500



Electromechanic	Spark gap	Electronic
Number of surge current impulses Total leakage current	Number of surge current impulses	Total leakage current 3rd harmonic of leakage current
None	None	Battery / mains
Wired	Special model: via optical fiber*	Special model
Sensor integrated into ground wire / display wired	Integrated into ground wire	Portable / clamp-on ammeter
3EX5 060 3EX5 062	3EX6 040 3EX6 020*	LCM 500

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