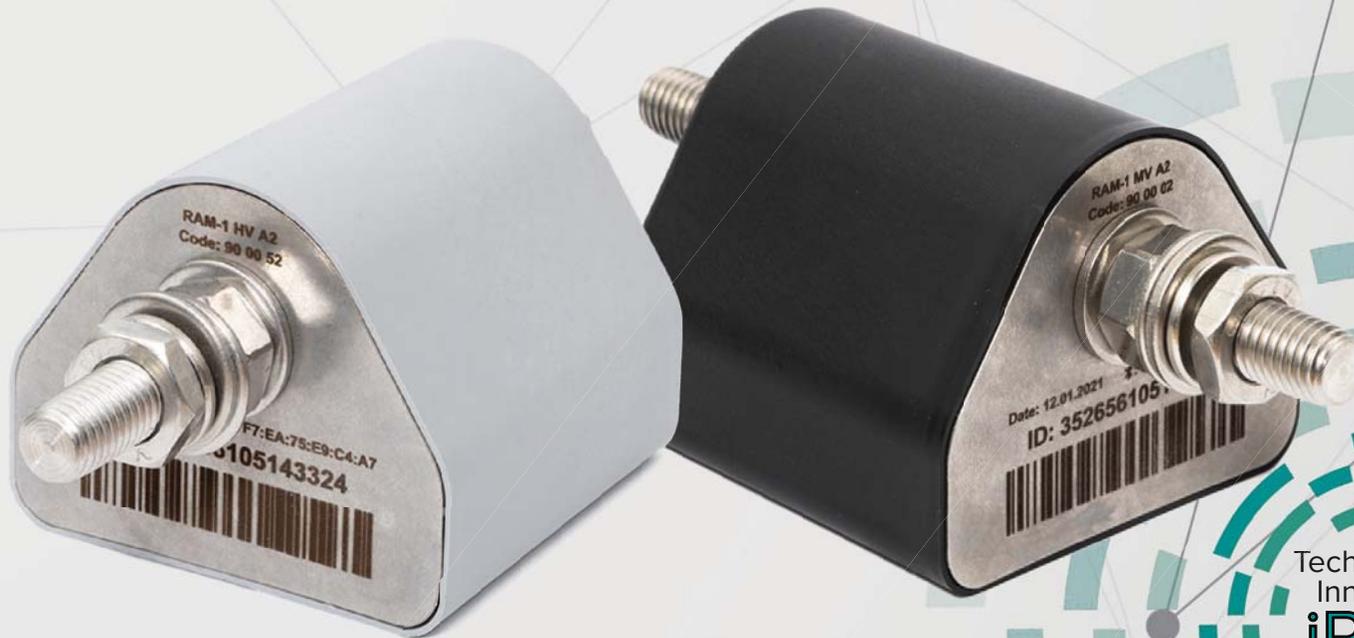


# Smart IoT Device RAM-1

Remote monitoring and advanced analysis of surge arresters and power grids



Technological  
Innovation  
**iRAM**

# RAM-1

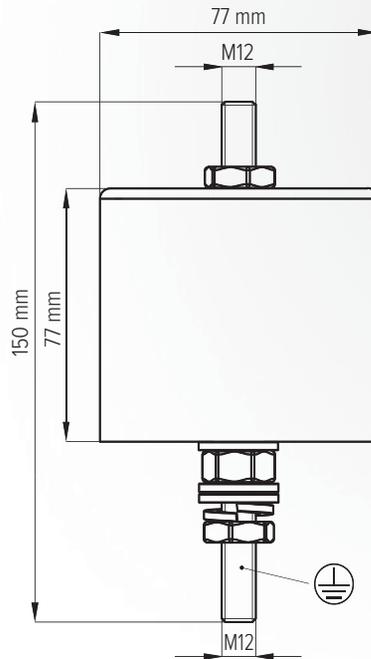
## Smart IoT Device

RAM-1 is an intelligent IoT device specially designed for real time remote monitoring and advanced analysis of surge arresters and power grids. By incorporating the RAM-1 device in to the power grids, they are elevated to a smart level, resulting in enhanced operational processes, improved reliability, and increased stability of electricity transmission and distribution networks.

When connected to a gapless surge arrester with a continuous operating voltage above 1 kV, regardless of the manufacturer, the RAM-1 device will be able to extract the resistive component of the leakage current. This ground breaking method of extracting the resistive component of the leakage current conforms to the IEC 60099-5 standard. Measurement data can be conveniently accessed through a web interface, mobile application, or seamlessly integrated into SCADA system.



# Characteristics



## The Smart IoT monitoring device RAM-1 offers:

- edge machine learning capabilities,,
- simple and easy installation,
- wireless communication: 4G, 5G, or LoRaWAN,
- on-site reading and configuration function via the RAM-Center app (Bluetooth).

## RAM-1 reports the following parameters:

- the resistive component of leakage current,
- excessive ambient temperature (fire detection),
- inclination/tilt or collapse detection,
- power outage detection (presence of voltage),
- lightning counter and detection of surge manipulations in the power grid,
- surge arrester destruction detection,
- activation of disconnecting device,
- event or fault location (provides navigation to the place of installation).

## Competitive advantages:

- remote monitoring and advanced analysis of surge arrester and transmission and distribution power grids,
- real time measurement of resistive component of leakage current of surge arrester,
- surge counter and temperature sensor,
- detection of collapse or inclination/tilt, micro location, navigation to the place of installation,
- instant notification of critical info, autonomous operating,
- machine learning model capabilities based on collected data,
- Compatibility with all existing and new gapless surge arresters above 1 kV, regardless of the manufacturer.



## Carbon Footprint Reduction and Financial Savings

Almost a quarter of a ton of CO<sub>2</sub> emissions per year can be prevented by installing just one RAM-1 device since it reduces the consumption of fossil fuels!

With the assistance of a company specialising in sustainable development, which strives to find ways to reduce fossil fuel consumption and thereby decrease greenhouse gas and other harmful emissions, we have prepared a carbon emission calculator, which shows carbon emission savings and financial savings by installing the RAM-1 device. The calculator incorporates carbon savings due to power grid losses, cost savings due to power outage prevention, repair cost savings due to power outage intervention, as well as a tree comparison demonstration and CO<sub>2</sub> processing. The calculation is available on our website [www.ram-center.com](http://www.ram-center.com).

Let us emphasize that the calculation does not include the transmission grids and applies only to the distribution networks. The values for transmission grids are at least three times higher. The example below is derived from data for Slovenia, where the power grids are well maintained and the price of electricity is quite affordable. For areas where electrical energy is more expensive or where a price increase is to be expected in the future, cost savings for grid operators would be even more significant.

To put that in to context, a mid-sized utility with roughly 500.000 end consumers has tens of thousands of installed surge arresters and if we assume a rather small percentage of these to be equipped with a smart device RAM-1, most commonly on locations known for overvoltage disruption, and settle for a round number of 1000 RAM-1 devices, we get the following numbers: on an annual basis, 141 tons of CO<sub>2</sub> emission could be saved, which is an equivalent to the amount of CO<sub>2</sub> that 6500 trees can process in the same time period. Furthermore, by reducing power outages and thus ensuring more reliable energy supply, over 1.000.000 € of costs could be saved annually.



## Simple Installation

Installation of the RAM-1 device on surge arresters above 1 kV is very simple and quick. In substations, it can even be done under voltage, with no need to disconnect the electrical network. The only requirement for correct installation is that the RAM-1 device must be installed on the grounding side of the surge arrester and that the grounding of the arrester must be properly routed through the RAM-1 device. If the RAM-1 device is installed incorrectly, it will not function properly, and damage or destruction of the device may occur.

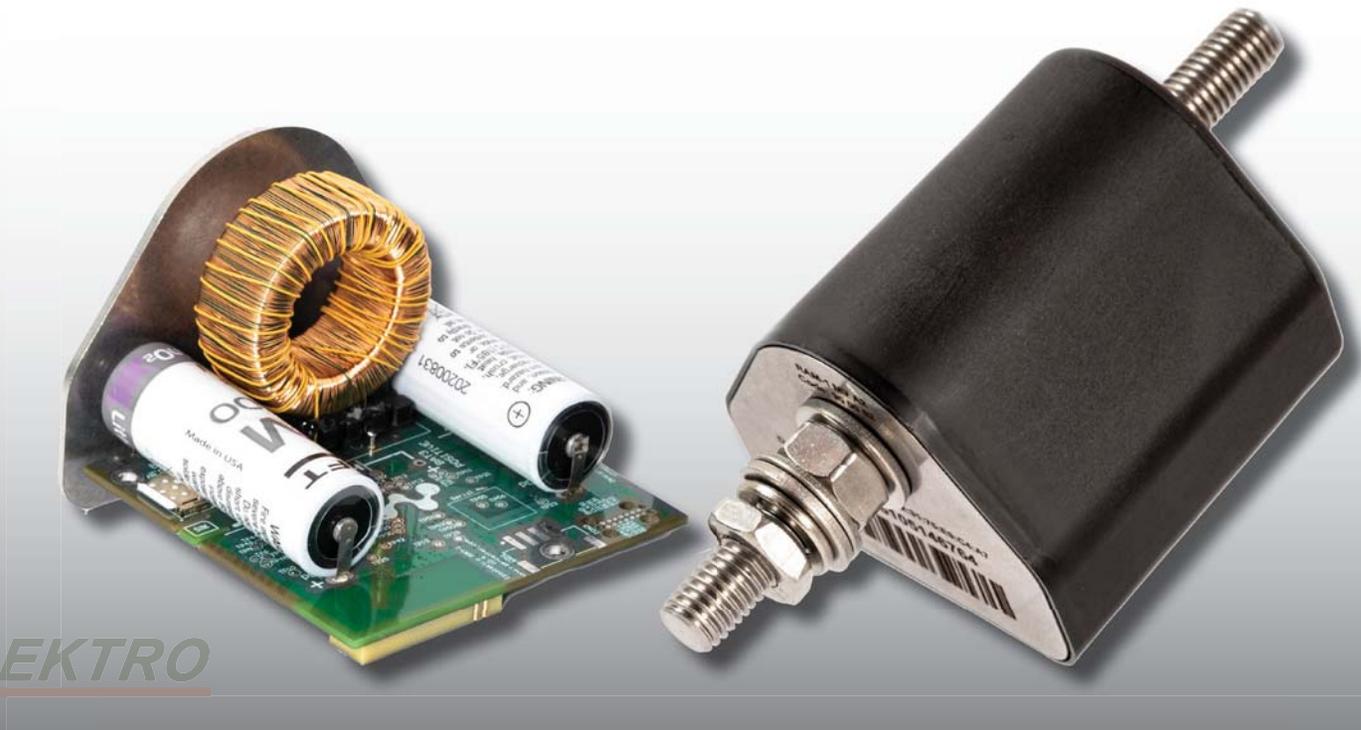
However, if you want to use the RAM-1 as a tilt/inclination/temperature indicator without installing it on a surge arrester, the installation is even simpler. Just mount the RAM-1 in the upper third of the pole/tower/structure you wish to monitor. It does not need a power supply or grounding to work.



## Development with Sustainability in Mind

For Izoelektro, sustainability represents meeting the consumers electricity demands without compromising the ability of future generations to meet their own demands. We are accomplishing this by reorganizing our product portfolio with a trend to responsible consumption and production, offering high quality working conditions and generally making our products better to assure more reliable electrical system operation, thus bringing the most out of our natural resources.

The battery of the smart IoT device RAM-1 is intended for 20 years\* of operation, which is very uncommon nowadays in the field of electronic devices. Only top-quality components were chosen to assemble the device including the market leading Saft batteries, which are certified to withstand temperatures as low as -40 °C.





## Tracks, Analyses & Reports Immediately

- Excessive ambient temperature (fire indication)
- Inclination/tilt or collapse of pole/tower
- Power outage (the presence of voltage)
- Lightning counter and detection of other surge manipulations in network
- Destruction of arrester
- Activation of disconnecting device
- Location of event or fault (provides navigation to the location)

## Monitoring of Installation Points

### Warnings:

- Collapse or tilt of pole/tower
- Temperature of surroundings (indication of wildfire)
- Power outage (presence of voltage)
- Location of event or fault
- Navigation to location

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## Changing the Game

RAM-1 will definitely change the game in the electricity sector. The smart IoT device RAM-1 is intended for remote monitoring and advanced analysis of surge arresters and power grids. Monitoring the operation of power grids in general will be automatic, remote, without the need for people in the field and regular control. RAM-1 allows grid operators to remotely monitor the status of their grids and get instant real-time information about faults.

## Predictive maintenance

Maintenance planning. With the automatic monitoring of the condition of the surge arrester enabled by RAM-1, grid operators can predict exactly when equipment replacements is needed and how much and which equipment will need to be replaced without physical inspections. Grid operators can further reduce their costs by using our device. Certain equipment that operators would replace preventively – as they are doing now – could remain in the grid.

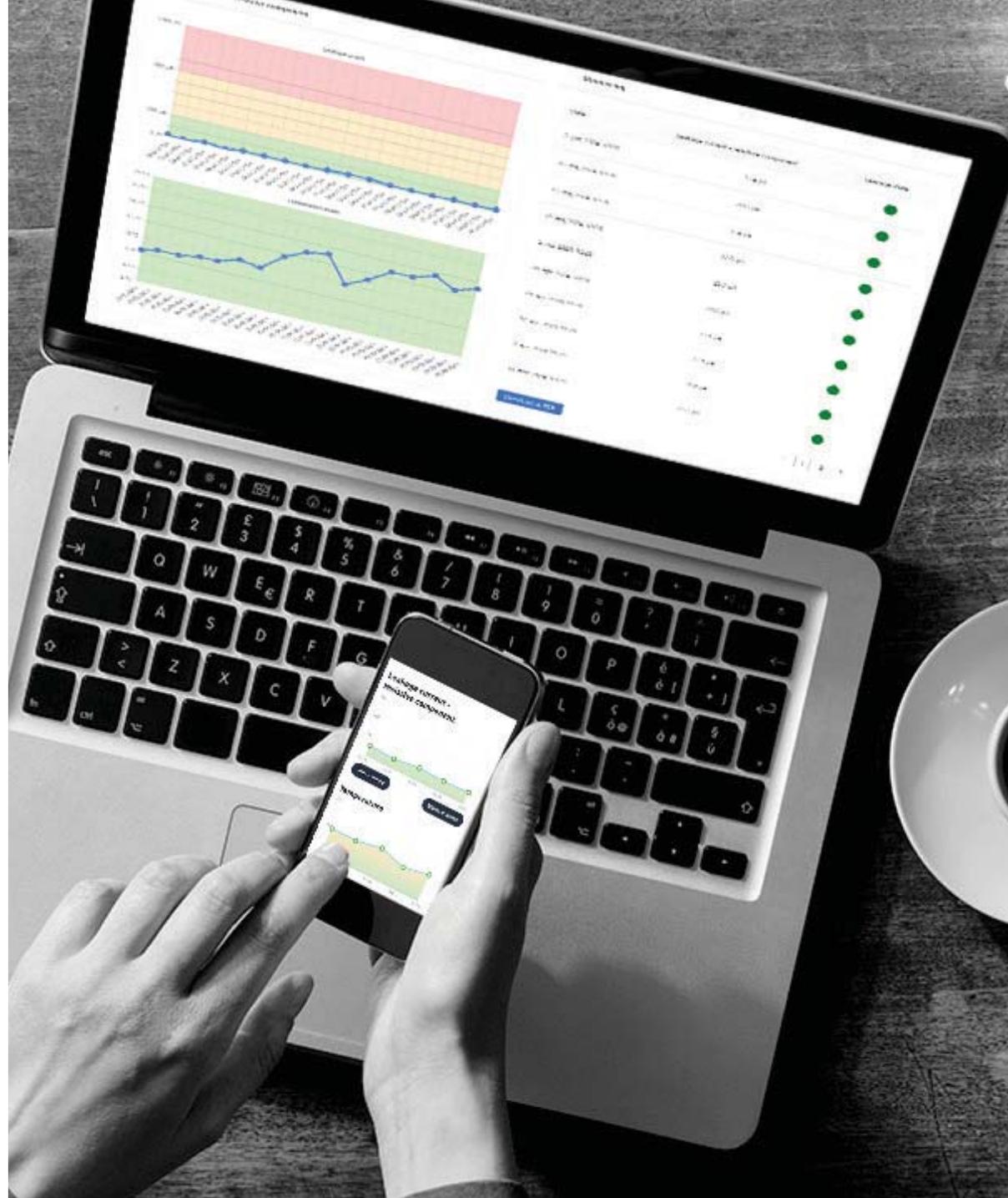


Tap to download firmware



Last Monitoring	2 Jun 2024 at 10:28
Installed firmware version	v1.0.2
Device ID	352656103609742
Communication mode	Mobile
Temperature	18°C ●
Device deviation	0,1° ●
Surge counter	1 ▾

## Leakage current - resistive component



# RAM-Center application

The authorized RAM-Center app by Izoelektro provides a comprehensive overview of installed RAM-1 devices, allowing for effective monitoring of surge arresters within power grids. RAM-Center presents in-depth graphical monitoring of measurements, an extensive log of previous measurements, and instant push notifications for alerts (such as fire, sudden tilt, damage or failure of the surge arrester) as well as predefined events (such as surpassing the leakage current threshold). The app also provides GPS coordinates for installed RAM-1 devices and allows direct navigation to the installation location where the event/alert occurred.

## Tracked Parameters:

- The resistive component of leakage current
- Instantaneous faults
- Surge count
- Temperature
- Inclination
- Location

## Features:

- Surveillance of surge arrester's health
- Navigation to the place of installation
- Adding photos and specifications of the place of installation

## Status and administration:

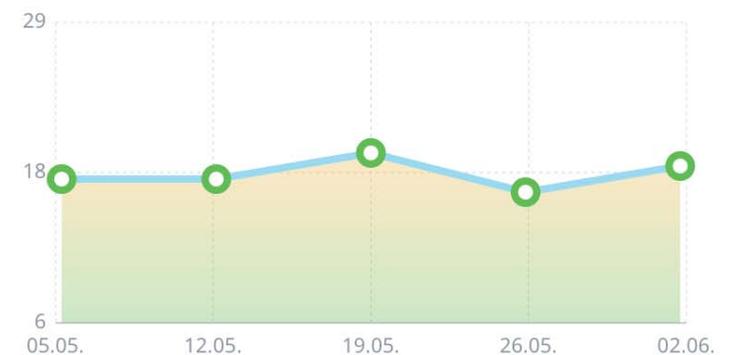
- Get real time information about installed surge arresters
- Receive instant push notifications when the surge arrester leakage current threshold is exceeded or when alerts such as fire, malfunction, sudden tilt, etc. occur
- Take control of the settings for the RAM-1 device
- Wirelessly update the RAM-1 firmware to incorporate new features (FOTA)

Temperature	18°C ●
Device deviation	0,1° ●
Surge counter	1 ^
13.02.2024 13:27	Surge

## Leakage current - resistive component



## Temperature





## Technical Data

<b>Use</b>	remote monitoring and advanced analysis of gapless surge arresters (regardless of the manufacturer) with a continuous operating voltage above 1 kV and power grids
<b>Basic measurement</b>	resistive component of leakage current <0.03 ... 3 mA (± 10%)
<b>Standard for basic measurement</b>	IEC 60099-5
<b>Other measurements</b>	failure, wildfire, voltage, surge counter, temperature, inclination/tilt, location
<b>Temperature range</b>	from -40 °C up to +85 °C
<b>Ingress protection IP</b>	IP 67
<b>Tested according to standards</b>	EN 60529:1991 + A1:2000 + A2:2013 IEC/EN 62368-1:2014+A11:2017 EN 303 446-1 (EN 55032, EN 55024, EN 301 489-1/-3/-17/-19/52)
<b>Frequency</b>	from 48 Hz up to 62 Hz
<b>User interface</b>	web and mobile application (Android, iOS)
<b>Measuring cycle</b>	1 hour
<b>Communication cycle</b>	in real time: all significant faults (fire, destruction of the arrester, exceeding the recommended measurements) once a day – UDP package; for other measurements (with default settings) once every seven days – MQTT package; for other measurements (with default settings)
<b>Communication</b>	4G/5G (LTE-M/NB-IoT with PSM) or LoRaWAN; bluetooth (for on-site device configuration and reading of measurements)
<b>Battery autonomy</b>	20 years; *using the device's default factory settings and with a stable mobile network that has the Power Saving Mode service enabled
<b>Housing material</b>	PA6 GF30 (UV UL 94 V-0), stainless steel A2 or A4
<b>Connection / material</b>	stainless steel A2 or A4
<b>Installation</b>	on grounding side of surge arrester or in the top third of the pole/tower
<b>Weight</b>	0,580 kg



## Technological Innovation iRAM

In 2023, we started the development of the iRAM project. iRAM will enable the production of smart surge arresters with an integrated signal circuit. The measuring device and the communication part will be integrated as a module in the core of medium and high voltage surge arresters. The signal will be received by the RAM-1, which it will forward to the SCADA systems or to a mobile/web application. The iRAM intelligent surge arresters will be the first of their kind in the world. We expect the development of iRAM to be completed in 2025, when we plan to offer the first smart surge arresters to the global market.





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**iRAM**

**Final Goal of the Project**

We are developing a new product – an intelligent system for remote monitoring of surge arresters and data analysis.

**The system consists of three key components:**

- An intelligent arrester that upgrades the standard arrester with a data collection and communication module
- A gateway device for data collection from the intelligent arresters and analysis on edge
- A cloud platform for performing complex analyses based on the microlocation of the arrester (predictive maintenance, determination of arrester condition, control of environmental parameters and mass data analysis for detailed insight into the operation of the power grids)

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