Smart solutions for remote monitoring

1.1 Smart IoT Device RAM-1: Overview

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.

1.1.1 Prioritizing Sustainability in Development

Izoelektro places great importance on sustainability, striving to fulfil the electricity needs of consumers while safeguarding the ability of future generations to meet their own requirements. Our approach involves restructuring our product portfolio to emphasize responsible consumption and production. By enhancing the quality of working conditions and overall product performance, we ensure a more dependable electrical system operation, thus maximizing the utilization of our natural resources.

The battery incorporated into the smart IoT device RAM-1 is designed to operate for an exceptional 20 year lifespan, a rarity in today's electronic device industry. Meticulous selection of top-tier components, including the renowned Saft batteries that are certified to endure temperatures as low as -40 °C, further enhances the device's reliability and longevity.

1.1.2 Predictive Maintenance

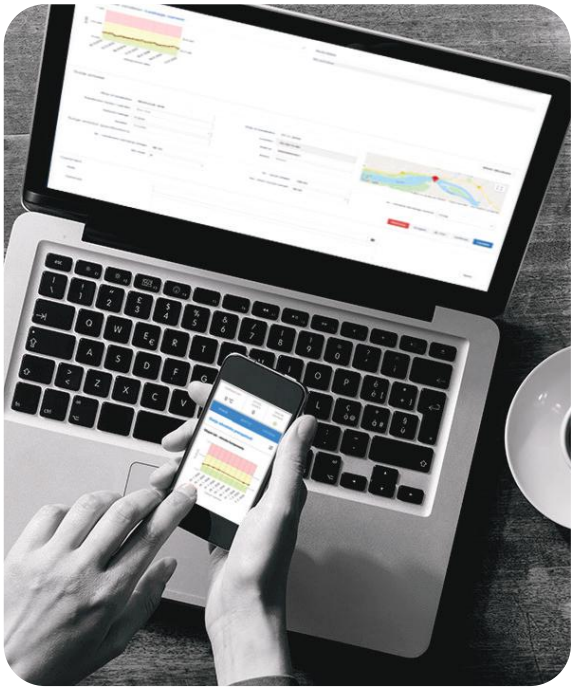
Predictive maintenance is made possible through the automatic monitoring of the power grid's state of health using RAM-1. This technology empowers grid operators to accurately forecast the timing and extent of equipment replacements, eliminating the need for physical inspections.

By utilizing our device, grid operators can effectively minimize costs. In some cases, equipment that would traditionally be replaced during preventive maintenance can now remain in operation within the grid.

1.2 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 offers GPS coordinates for installed RAM-1 devices and facilitates direct navigation to the place of installation.



Tracked Parameters

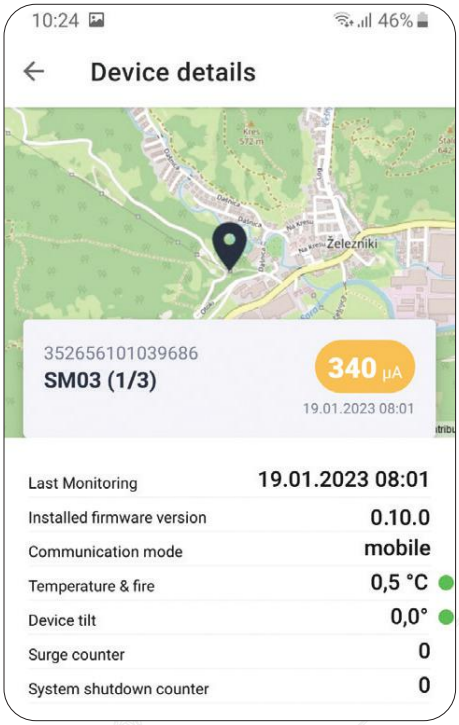
- The resistive component of leakage current
- Instantaneous faults
- Surge count
- Temperature
- Inclination
- Location

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)



1.3 RAM-1 Characteristics

The RAM-1 Smart IoT device provides:

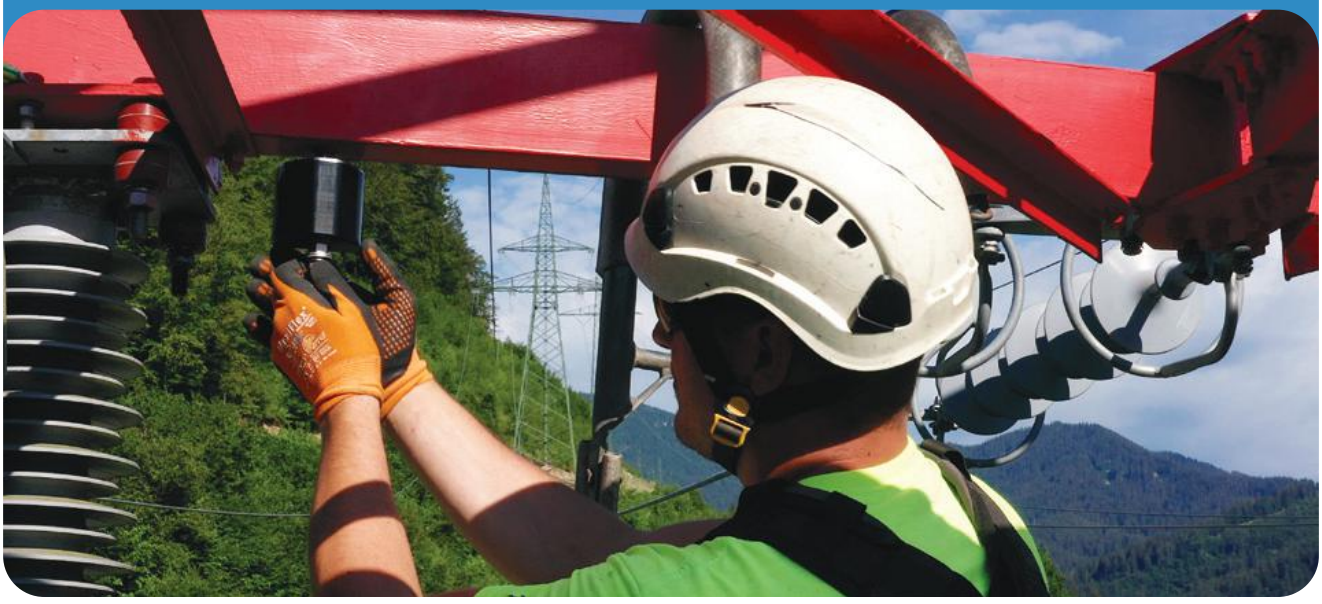
- advanced machine learning capabilities,
- simple and easy installation,
- wireless communication: 4G, 5G, or LoRaWAN,
- on-site reading and configuration function via the RAM-Center app (Bluetooth).

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

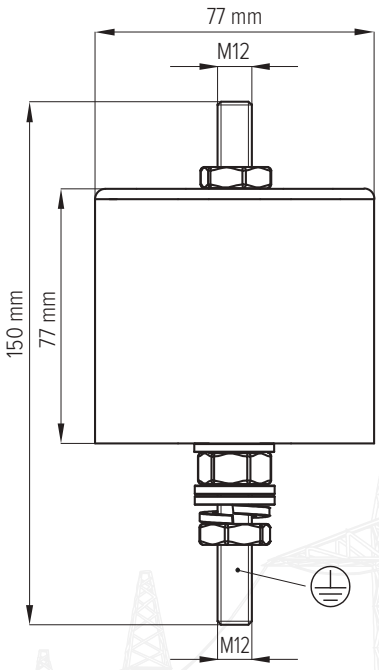
- Remote monitoring and advanced analysis of surge arresters and transmission and distribution power grids
- Real time measurement of resistive component of leakage current of surge arrester
- Surge counter, temperature sensor
- Detection of collapse or inclination/tilt, micro location, navigation to the place of installation
- Instant notifications of critical information, autonomous operation
- Machine learning capabilities based on collected data
- Compatibility with all existing and new gapless surge arresters above 1 kV, regardless of the manufacturer



1.4 RAM-1 Technical Data

Name	Description
Intended use	remote monitoring and advanced analysis of gapless surge arresters (regardless of the manufacturer) with a continuous operating voltage above 1 kV and power grids
Basic measurement	resistive component of leakage current <0.03...3 mA (± 10%)
Standard for basic measurement	IEC 60099-5
Other measurements	failure, wildfire, live line indicator, surge counter, device temperature, ambient temperature, inclination/tilt, location
Temperature range	from -40 °C up to +85 °C
Ingress protection IP	IP 67
Tested according to standards	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)
Frequency	from 48 Hz up to 62 Hz
User interface	web and mobile application (Android, iOS)
Measurement cycle	1 hour
Communication cycle	in real time: all significant faults (fire, destruction of the arrester, exceeding the recommended values) once a day – UDP package; for other measurements (with default settings) once every seven days – MQTT package; for other measurements (with default settings)
Communication	4G/5G (LTE-M/NB-IoT with PSM) or LoRaWAN; bluetooth (for on-site device configuratio and reading of measurements)
Battery autonomy	20 years*
Housing material	PA6 GF30 (UV UL 94 V-0), stainless steel A2 or A4
Connection material	stainless steel A2 or A4
Installation	on grounding side of surge arrester or in the top third of the pole/tower
Mass	0,580 kg

RAM-1 (black housing)
for medium voltage
< 110 kV



RAM-1 (light grey housing)
for high voltage
≥ 110 kV

1.5 Ordering the RAM-1 Device

Basic device versions

RAM-1 MV A2
RAM-1 HV A2

Possible device modifications - optional

A4 steel protection
External LoRaWAN antenna
AC/DC power supply
AC/DC power supply and external LoRaWAN antenna
RAM-1 with a SIM card provided by the customer

Monthly usage fee

covers: MFF2 eSIM card monthly subscription, all costs of mobile communications, AWS cloud services, unlimited use of the RAM-Center platform (web, Android, iOS), firmware and software maintenance and upgrades (functionality upgrades, upgrades of solutions obtained on the basis of machine learning) and monthly reports.

Warranty 20 years*

for battery (*using the device's default factory settings and with a stable mobile network that has the Power Saving Mode service enabled).
Built-in electronic components are covered by the electronic component manufacturer's warranty.

Explanation of the Name

RAM-1	Smart IoT device for remote monitoring and advanced analysis of surge arresters and power grids
A2 or A4	Quality of steel material
MV	black housing; for medium voltage use < 110 kV
4G/5G	Wireless communication
LoRaWAN	Wireless communication with External LoRaWAN antenna