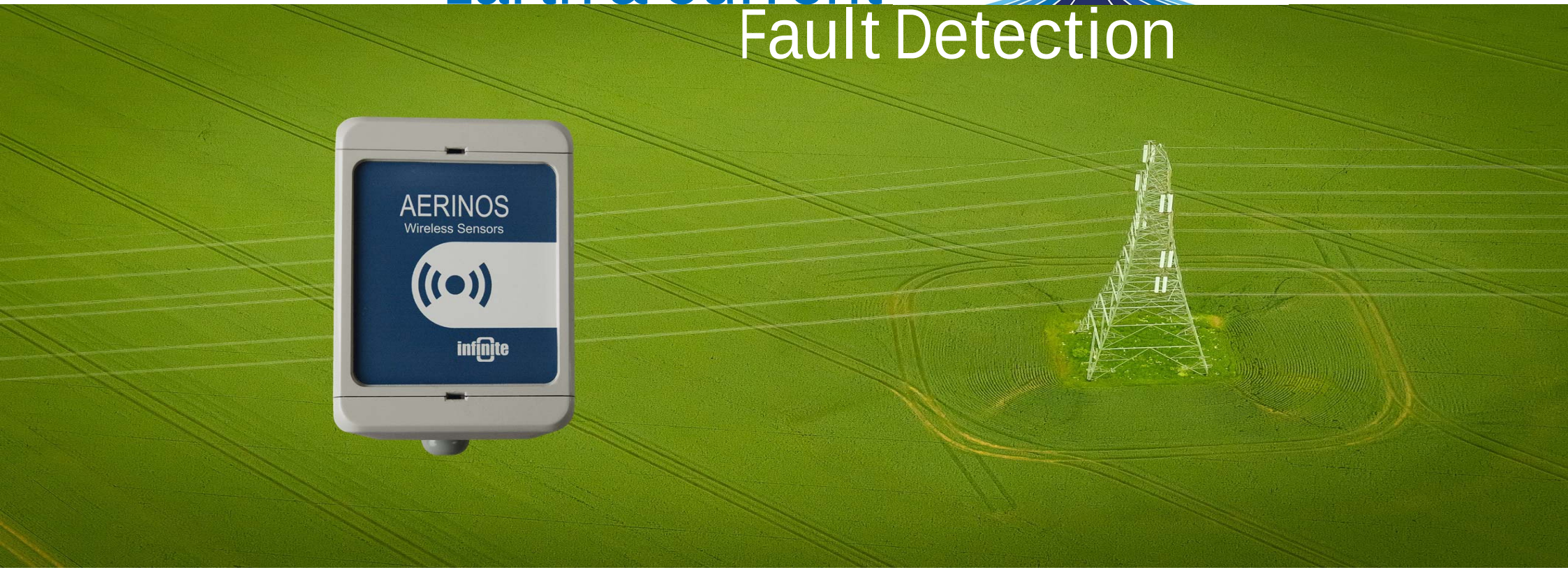
infinite

IoT

Earth & Current Fault Detection



Earth & Current Fault Detection

Cables age and deteriorate due to electrical, mechanical, thermal & environmental reasons.

The result is short circuits and power failures.

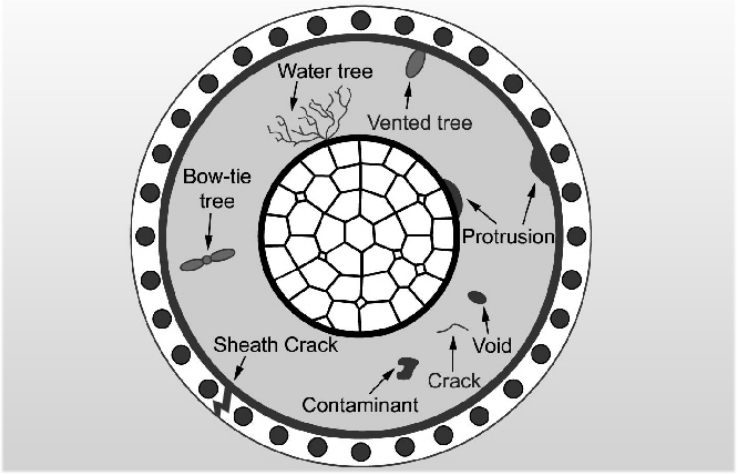
Power Cable Failures

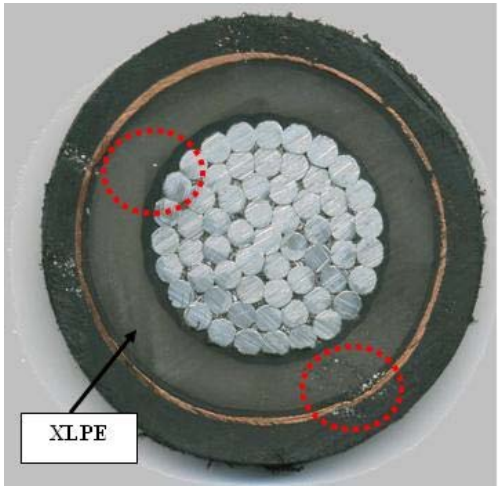
- Power cables mainly fail because of aging and due to thermal, electrical, mechanical & environmental reasons.
- High temperature, Impulses, bending, vibration, fatigue, water, humidity, chemicals are the factors of failure.
- The most often mechanisms are corrosion, cracking, treeing, etc.

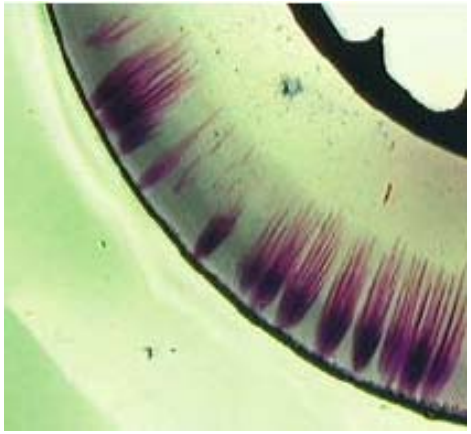
Power Cable Failures

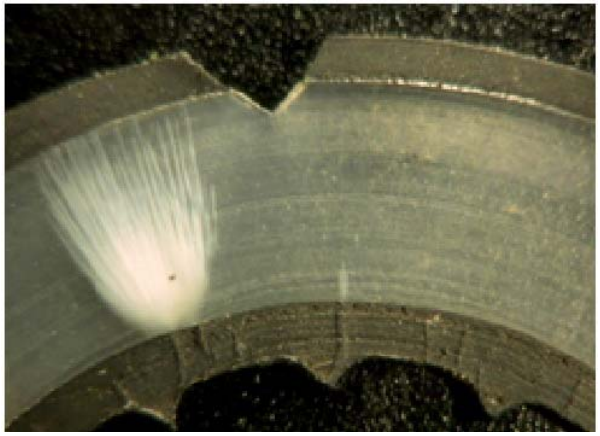
Corrosion
&
Impurities

Treeing









Fault Detection MV/LV substations

Possible Fault Bipoles

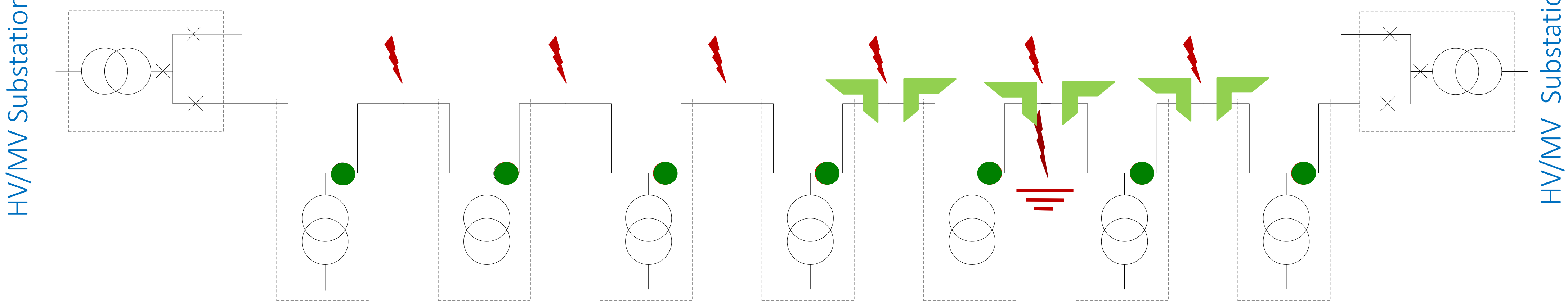
Reroute power in the middle of the line to restore

Short circuits require to identify the location

Power restored

Trial and error with operations

Power to 50% of consumers



Power grid

Earth fault detection and localization in urban power distribution systems.

In combination with earth ground fault detection relays,

- Seamless connection to SCADA via OPC server
- Earth faults can be located in the first minute after occurrence.
- Significant reduction of the CAIDI and SAIDI reliability indicators

Earth Fault Indicators (EFIs) & Current Fault Indicators (CFIs) detect earth & short circuit faults on underground cables

Each EFI unit has a core-balanced sensor which is fixed around the three phases of the cable. Units that detect a current imbalance due to an earth fault will trip and indicate by either bright LED or a mechanical flag.

CFI units have Phase-Phase short-circuit detection using extra CTs connected around individual phase conductors.

EFIs & CFIs help to quickly identify in which section of the network an earth fault is located, once the network has been tripped by the upstream protection.

A connected IoT device can transmit the fault indication to a central SCADA system.

IoT connected MV/LV substations Fault Detection

Restore power to all customers

Fault location identified

HV/MV Substation

HV/MV Substation

SAIFI Improvement

Reduced number of short circuits required to identify the location of the fault.

Reduced stress of network elements (cables & switchgear).

Increased lifetime of switching equipment & cables.

Reduction in infrastructure investments.

SAIDI & CAIDI Improvement

Reduction in the time required to restore power for consumers

Reduction in maintenance crew costs

Earth & Current Fault Detection

sigfox

Itron
Silver Spring NETWORKS

NB-IoT
LTE-M

2G/3G/4G

Design Principles

Autonomous RTUs are flexible devices allowing any modern power source scheme.

They are designed to operate autonomously using single lithium battery cells achieving maximum reliability, and long term solution robustness with operational lifetime >10+ years.

They can work on mains or photovoltaic power with automatic failover to internal lithium battery on power shortage.

They can be used in hybrid power solutions combining lithium battery for telecommunications with rechargable power sources for sensor excitation allowing mixed power media applications seamlessly.

Design Principles

We at Infinite believe It is essential that a monitoring RTU connected to an EFI for MV substations operates autonomously and that it should not be connected to mains power.

An autonomous device is designed to be independent of power source and its main function is when there is no power present and it works on battery.

All high reputation manufacturers of such communication devices (Germany, Irleand, UK), for earth fault indication applications also use the autonomous operation technology.

If LV mains power is required to power the RTUs many problems arise.

Design Principles

In case of mains power and rechargable batteries if there is a power supply failure or a blown fuse the device will work on battery, deplete it and stop to function. In this case when it will be required to function due to an earth fault it will not be available.

A device that works continuously connected to LV mains is risking its functionality and availability. If by design it powers the built in communications modem continuously it is prone to halts and errors. Also it is vulnerable to interference, halts due to high currents, transients, coupling and short circuit currents.

The result is it will not be functional when there will be an earth ground fault.

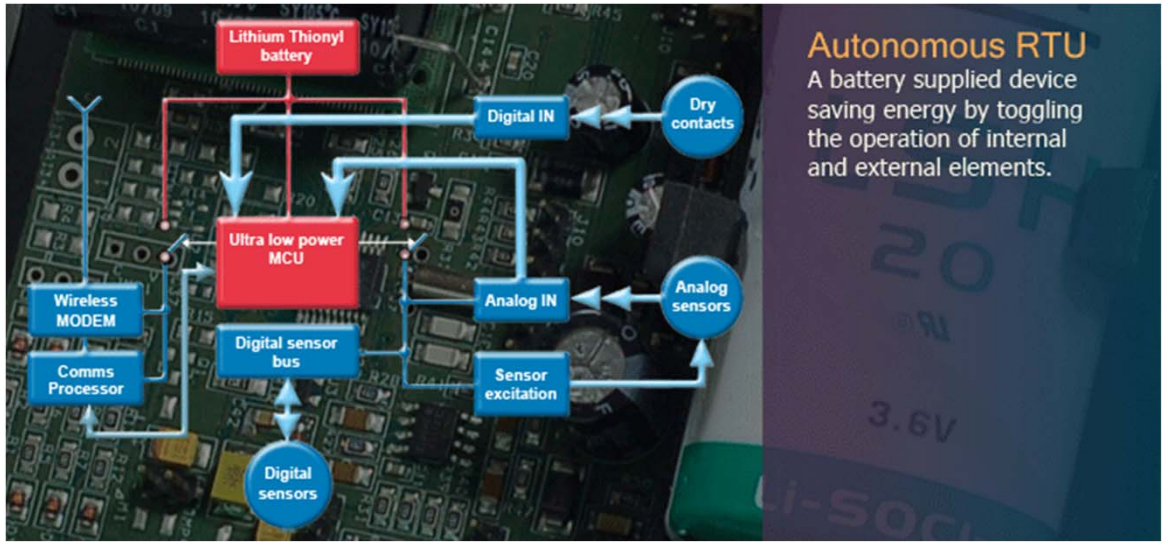
Design Principles

In a high parasitic environment like MV substations, with low mobile network signal the basic principle to assure proper operation and high availability is to operate based on a credible power source such as lithium batteries.

It should be noted that lead acid rechargable batteries require chargers, conditioning and do not last more than 2 years.

Compact design and unmanned operation is essential for high volumes of systems on the field.

Operating principle



An ultra low power MCU is in continuous operation with two main tasks:

- Performing measurement, data recording and detecting an alarm condition.
- Controlling power of internal and external functional elements in order to extend battery lifetime. The principle is to power functional sections, according to user defined time schedules.

Autonomous RTUs utilize an ultra low power dual processor architecture in order to combine low power consumption with advanced processing and communication characteristics.

Functions:

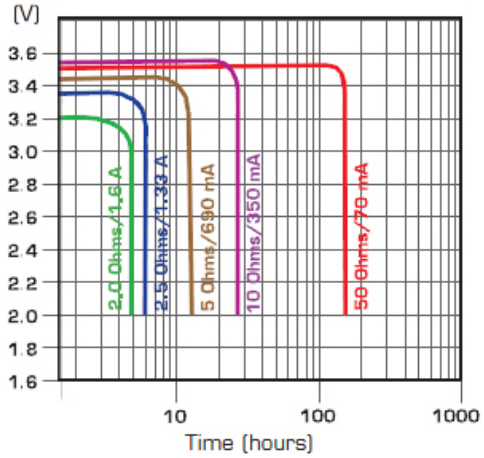
- Measurement
- Transducer excitation
- Data recording
- Data & alarm transmission

D-size,
Primary lithium-thionyl chloride battery
Nominal voltage: 3.6V,
Capacity: 13.0Ah

System comparison

Subject	Solar powered	Autonomous
Daily energy consumption	2 mAh (An average 2 mA current draw is assumed).	0.03 mAh (2 mA during sampling, 40 µA in idle state, sampling period at 1 minute).
Maintenance free operation	2-3 years. The rechargeable cell's capacity diminishes over time. Current delivery is reduced due to increase in internal resistance over time.	Up to 15 years. The Lithium Thionyl battery features undiminished voltage level and current delivery during almost 98% of its lifetime.
System power supply	Complex, costly.	Simple, low cost.
Ambient temperature	Frost protection for the solar cell is required at lower temperatures. Solar cell efficiency is lowered and rechargeable battery life is shortened at temperatures over 40°C.	Infinite's autonomous devices operate at temperatures between −20°C and +65°C.
Weather conditions	Smooth operation depends on sufficient sunlight.	Weather independent.
Overall system size	Massive, provoking vandalism.	Minimum sized, compact, unnoticeable.
Minimum sampling period	Down to a few seconds, according to the availability of the renewable energy source.	1 minute (5...15 minutes, typ) for preserving a reasonable battery lifetime.

Lithium Thionyl Battery



Typical discharge profiles at + 20°C

Battery lifetime

BSC-50D RTU/Data logger powered using one 3.6V, 13Ah lithium-thionyl battery

Excitation @3.3V [mA]	Sampling rate [S/hour]	Sampling delay [sec]	Sending rate [hours]	Battery life [Years]
1	4	1	2	4.3
1	60	1	2	4.2
25	4	1	2	4.0
25	60	1	2	2
25	60	1	4	2.3
25	60	1	8	2.5
5	4	1	24	10.4
25	4	1	24	9.0
25	4	5	24	5.4
50	4	5	24	3.6
100	4	5	24	2.1

IoT Autonomous devices

NB-IoT
LTE-M

2G/3G/4G

BSC-50D, GSM Alarming RTU

Power supply:	3.6V, 13 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	4 x Digital inputs, 0-30VDC
	1 x Analog input, 0-1VDC, 12 bit resolution
	2 x Digital counter, 1 KHz
Transducer excitation	12V/200mA, 5V/200mA
Wireless modem:	Sierra Wireless 2G, 3G, 4G, NBIoT, LTE-Cat M1
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

IoT Autonomous devices

ADS-26x, Sigfox IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	IN1, configurable as:
	Digital input, 0-30VDC
	Analog input, 0-1VDC, 12 bit resolution
	Digital counter, 1 KHz
SDI-12 Bus:	8 Channels, up to 3 sensor support.
RS-485, MODBUS:	8 Channels, up to 3 sensor support, ASCII/RTU.
Transducer excitation	12V/250mA, 5V/200mA
Wireless modem:	Radiocrafts Sigfox RC1,2,4
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

IoT Autonomous devices

Itron

Silver Spring NETWORKS

Available Q4 2019

ADS-410, Itron IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	IN1, configurable as:
	Digital input, 0-30VDC
	Analog input, 0-1VDC, 12 bit resolution
	Digital counter, 1 KHz
SDI-12 Bus:	8 Channels, up to 3 sensor support.
RS-485, MODBUS:	8 Channels, up to 3 sensor support, ASCII/RTU.
Transducer excitation	12V/250mA, 5V/200mA
Wireless modem:	Milli 5 Itron Silver Spring networks
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

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USA/New Orleans 2019

#DTECH\Gen 5 SN

Itron
Silver Spring®
NETWORKS

Gen 5
Sensor Node

Itron

Silver Spring NETWORKS

Gen5
Sensor node

The Gen5 Network is the fabric connecting critical infrastructure devices with value-added applications. Itron has successfully architected the Gen5 Network to balance the stringent and competing demands of ubiquitous coverage, high performance, and cost efficiency.

Gen5 Sensor node is a battery powered end node for the Gen5 Network. The device supports serial communications with digital sensors. Communication capabilities include the popular SDI-12 and MODBUS protocols. Additional digital and analog inputs and an internal battery gauge are included. It provides two excitation options for external sensors. The unit uses the Milli 5 module for the connectivity to the Gen5 Network.

Features

- Periodical capture and data transmission of actual recordings to the utility for advanced analysis and applications.
- Alarm messages and periodical Health messages for verifying unit availability.
- Continuous battery gauging with respective data transfer.
- Scaling parameters and alarm limits are user definable.
- Remote configuration of the operation parameters.

Applications

- Environmental monitoring
- Smart grid
- Weather monitoring
- Gas distribution
- Water resources management
- Smart Farming

Technical Specifications

Internal supply	3.6V Lithium Thionyl battery
External supply	5V ±2%
Supply current	Idle: 10µA max. Sampling: 2.7 mA Transmit: 48mA
Data memory	I2C EEPROM
Digital inputs	1, 0-30V, dry contact
Analog input	0-1V, 12bit
Counters	1, 2kHz
SDI-12	Up to 16 channels
MODBUS	RS-485, 8 channels
Sensor Excitation	12VDC, 250mA 5VDC, 200mA
Battery Gauge	0.17mAh resolution
Communication	GEN5, Milli5 module
Antenna	SMA Jack
Serial interface	USB, 115 kBit/s
Temperature	-40°...65°C, operating
Dimensions	124 x 79.5 x 70 mm
Protection	IP66/67

Itron

Itron is a global technology company. We build solutions that help utilities measure, manage and analyze energy and water. Our broad product portfolio includes electricity, gas, water and thermal energy measurement and control technology; communications systems; software; and professional services. With thousands of employees supporting nearly 8,000 utilities in more than 100 countries, Itron empowers utilities to responsibly and effi ciently manage energy and water resources. Join us in creating a more resourceful world;

Start here: www.itron.com

CORPORATE HEADQUARTERS

2111 N Molter Road
Liberty Lake, WA 99019
USA

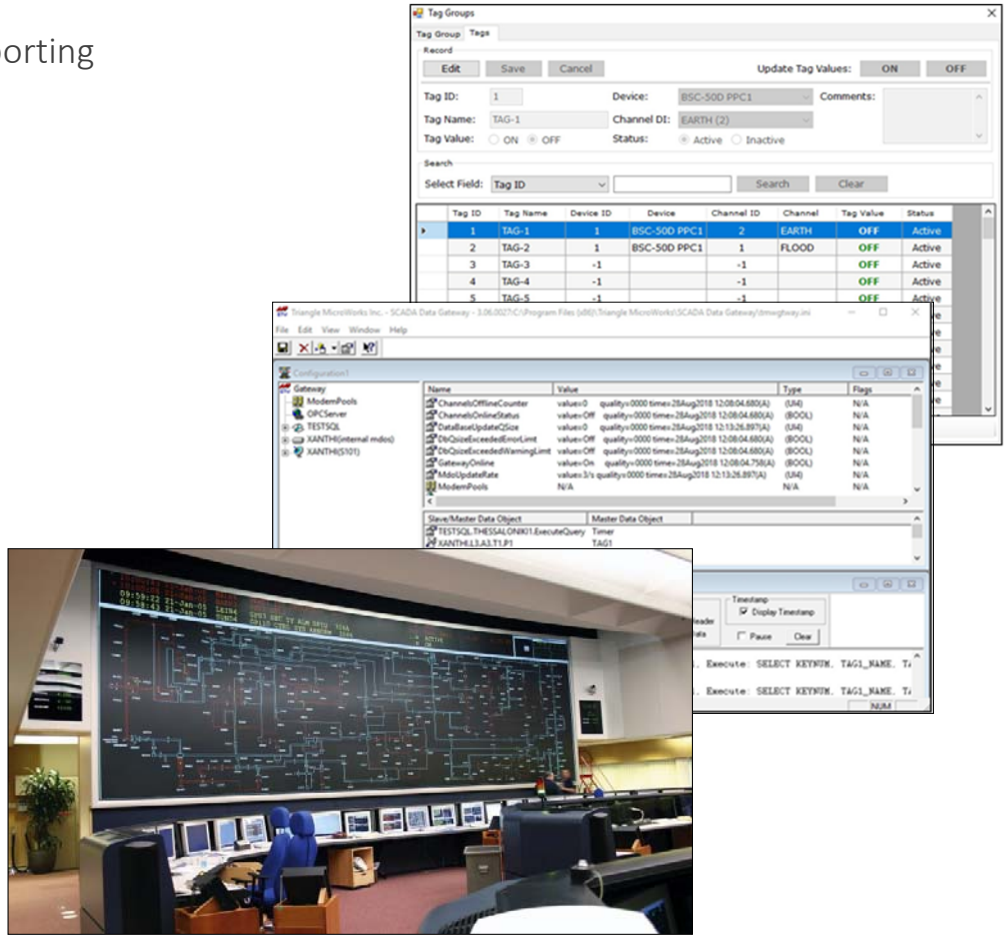
Phone: 1.800.635.5461
Fax: 1.509.891.3355

MsG – Multiprotocol Scada Gateway

The MSG is a modern SCADA communication gateway, supporting multiple protocols,

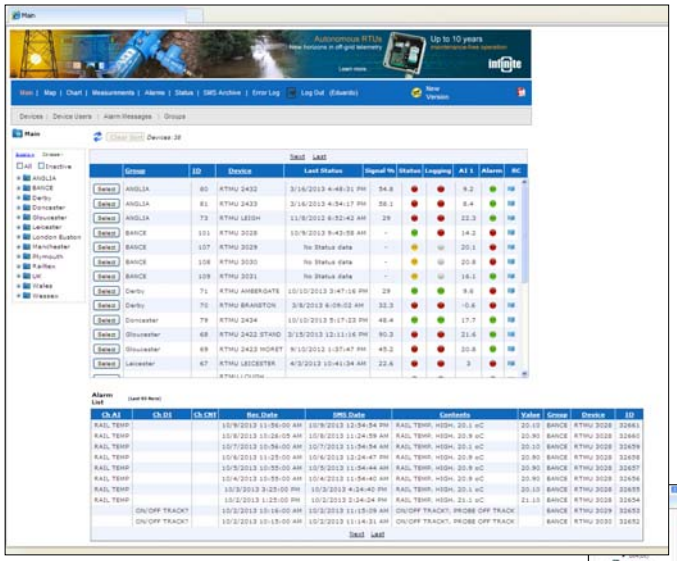
- DNP3 Secure Authentication v5 (SAv5)
- IEC 60870-5-101, 102,103
- IEC 60870-5-104
- IEC 60870-5 Secure Authentication for -101 and -104
- OPC Data Access
- OPC XML Data Access
- OPC Alarms & Events
- IEC 61850
- IEC 60870-6
- Modbus

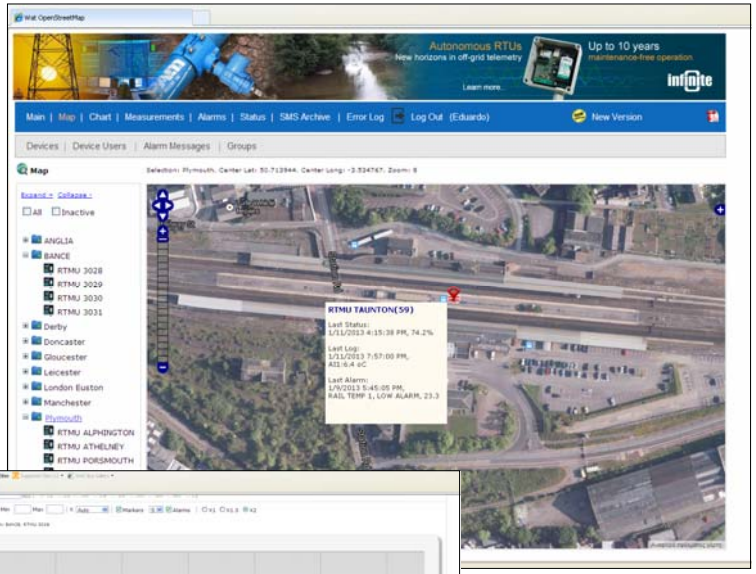
MS SQL server database backend for
Historical data storage and management.

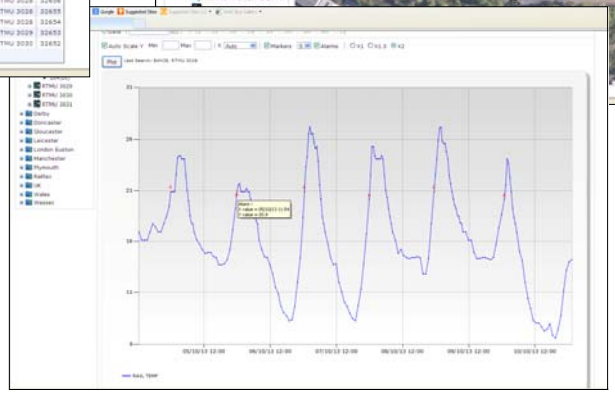


WaT - Web aided Telemetry

Cloud telemetry platform with GIS information







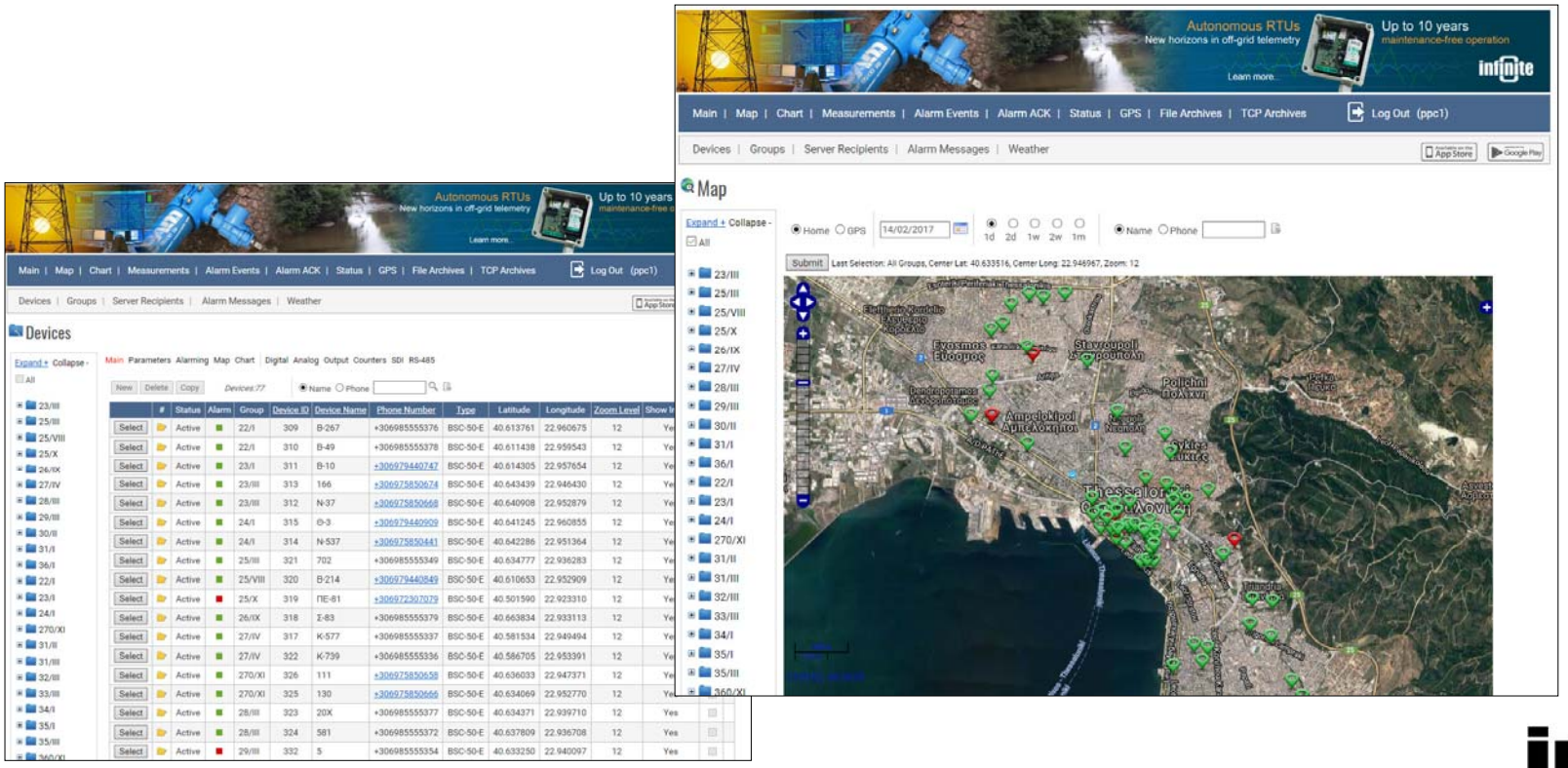
ANDROID APP ON Google play

Download on the App Store

infinite

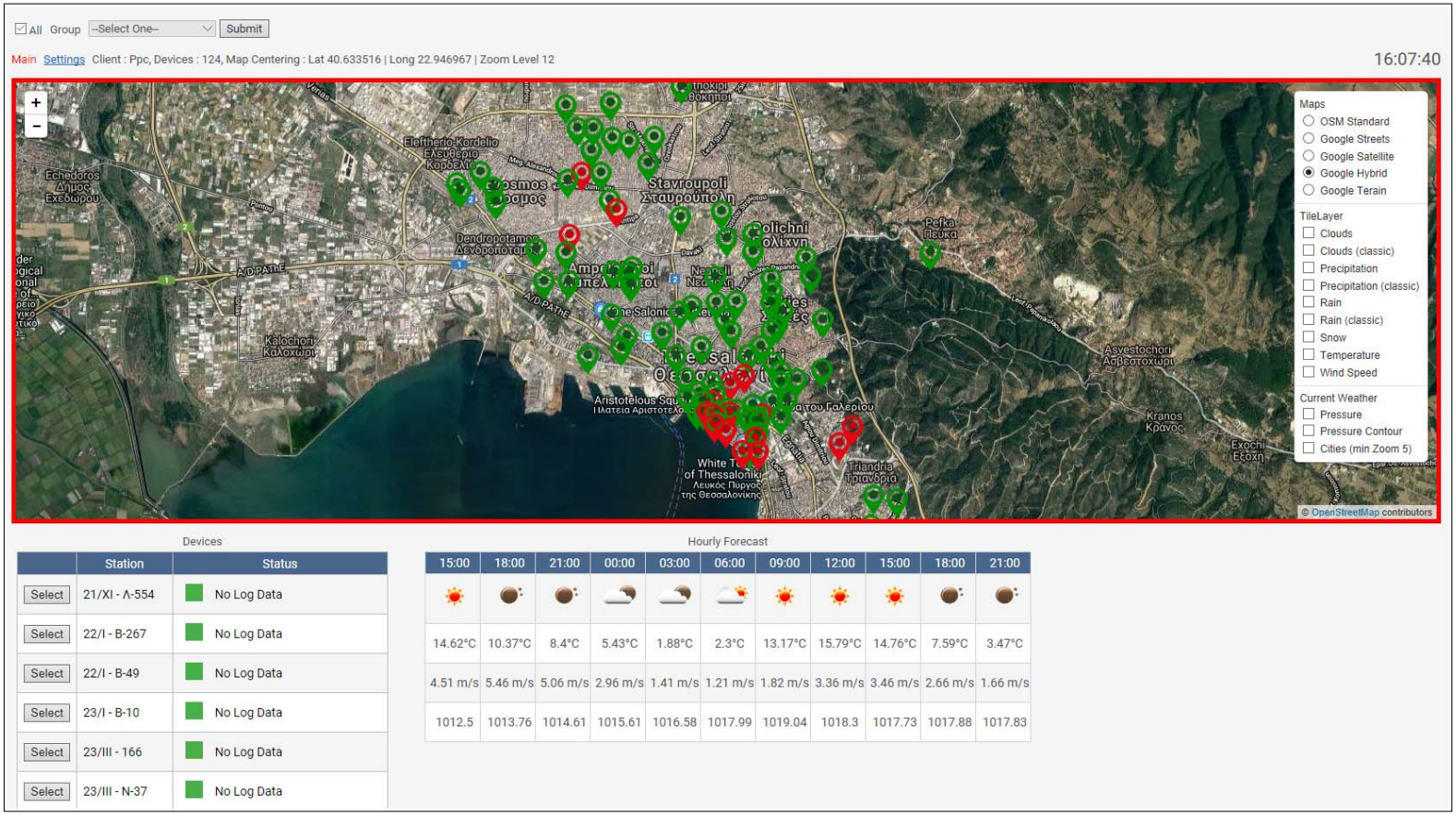
WaT - Web aided Telemetry

Cloud telemetry platform with GIS information



WaTEye - Web aided Telemetry Eye dashboard

Online dashboard with live weather and telemetry data



Internet of Things Networks & Technologies

2G/3G/4G

NB-IoT

LTE-M

sigfox

LoRa™

Itron

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Case Study City of Xanthi Greece

https://www.youtube.com/watch?v=0-muFxwbtnQ