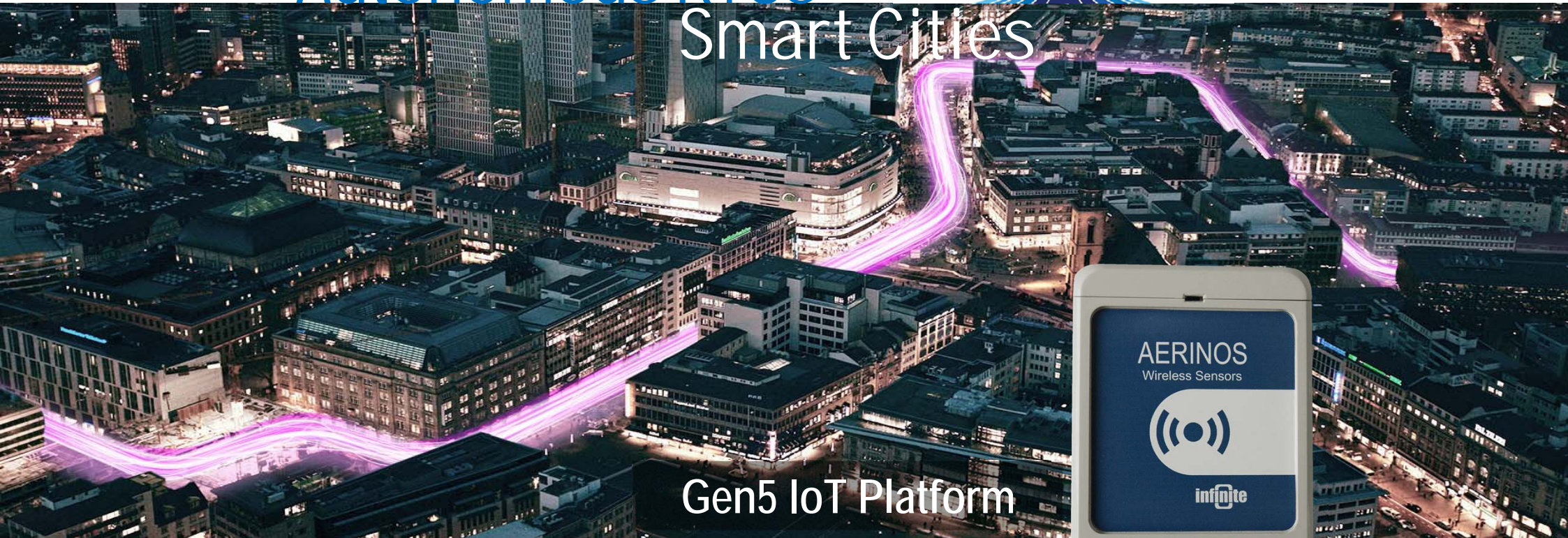


# Autonomous RTUs Smart Cities



Gen5 IoT Platform



## 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 rechargeable power sources for sensor excitation allowing mixed power media applications seamlessly.

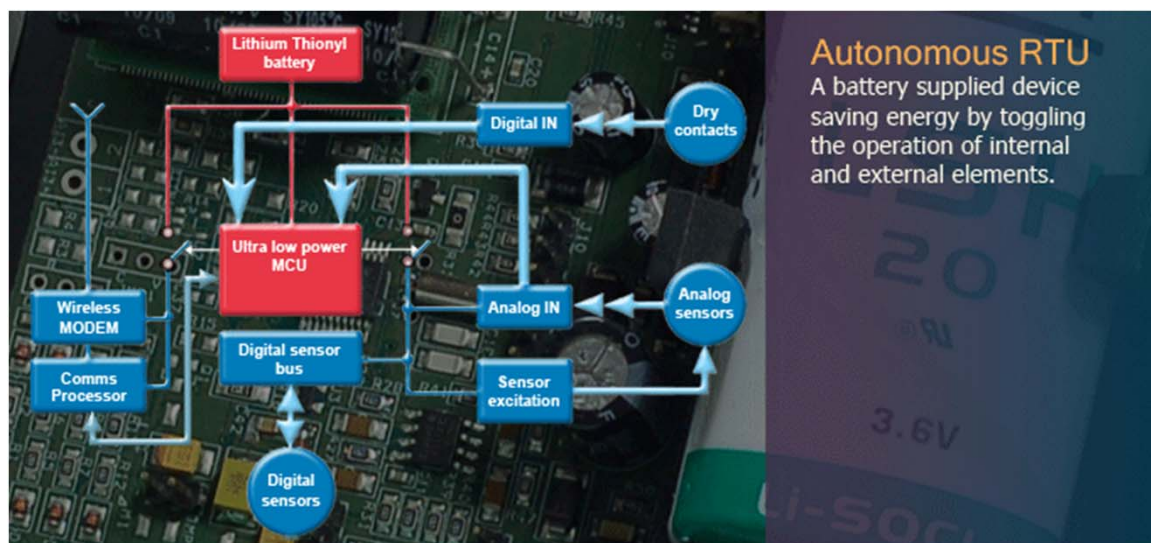


## Internet of Things Networks & Technologies





# Operating principle



## Functions:

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

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.



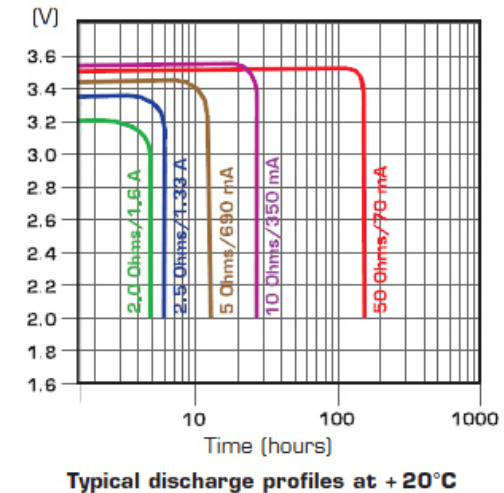
D-size,  
Primary lithium-thionyl chloride battery  
Nominal voltage: 3.6V,  
Capacity: 13.0Ah

# 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





## Water resources management

- Level & flow
- Groundwater monitoring
- Lake and reservoir level monitoring
- Leak detection in distribution pipelines
- Sewer water monitoring
- Water quality monitoring

**Itron**





## 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





## Gas Distribution

- Flow and pressure
- Moisture and leak detection
- LPG level measurement on Gas Storage Tanks

**Itron**







## Cathodic Protection

- Voltage DC
- Voltage AC
- Current
- Transient voltage drop

**Itron**



# Rail & Train Wireless IoT Systems



Continuous monitoring of infrastructure minimizes dangerous conditions and eliminates accidents.

## Rail line mount sensors

- Vibration monitoring of rail lines and slippers
- Temperature, ice, rain monitoring of rail lines

## Alarming

- Embankment collapse alarming
- Structural monitoring of bridges, crossings





## Environmental Monitoring

Air quality measurements

- Ozone, nitrogen dioxide, sulphur dioxide, carbon monoxide

Impact measurements in rivers

- pH, dissolved oxygen, conductivity, turbidity, color

Soil quality and sustainability

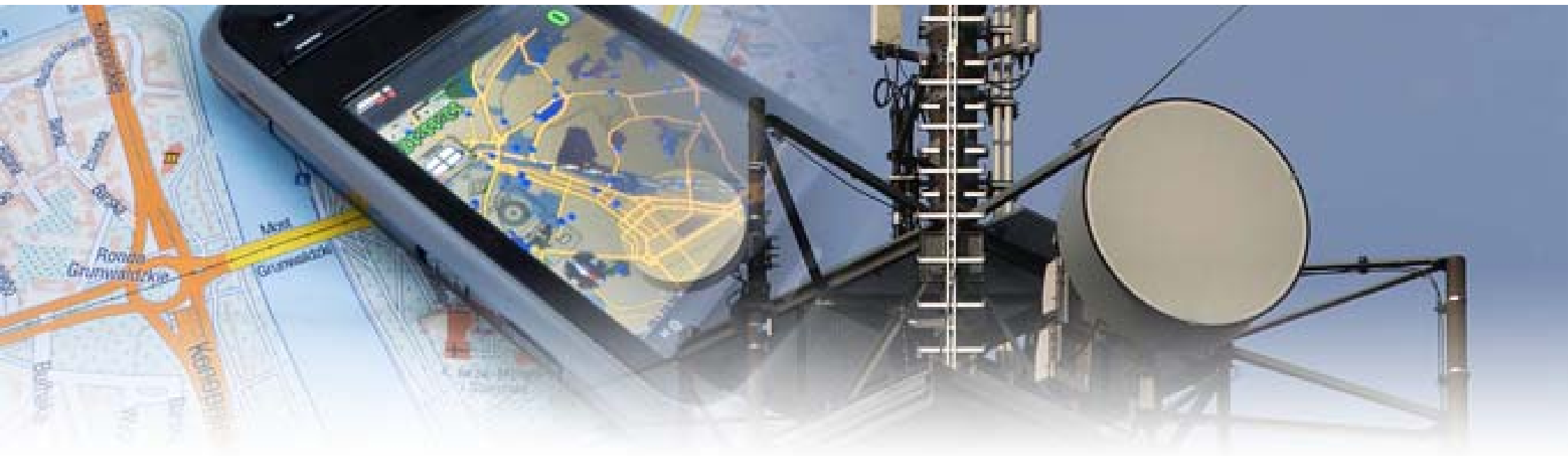
- Soil moisture, electrical conductivity, temperature

**Itron**



IoT Autonomous RTUs

Application: Environment



## Off-grid general purpose monitoring

- Generator voltage, current
- Diesel fuel tank level
- Backup battery readiness
- Fire, Smoke & water
- Intruder alarming
- Door open and motion detection

**Itron**



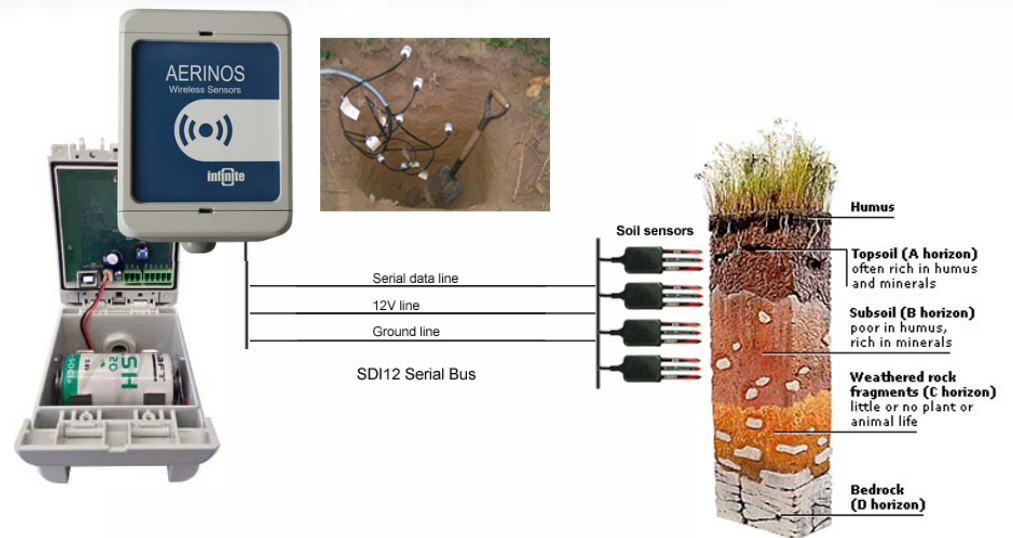




## Precision Agriculture

Agriculture related weather measurements:

- Solar radiation
- Air temperature and relative humidity
- Wind speed and direction
- Rainfall
- Soil temperature and moisture
- All in one weather stations



# IoT Autonomous devices

---

## ADS-410, Itron IoT wireless end nodes

Autonomous IOT unit to connect any sensor for telemetry applications. The unit sends data to the cloud using the Itron Network.

It incorporates the Milli 5 embedded wireless communication module for connection to this network. The unit is battery powered for autonomous operation.

The purpose of the device is to connect multiple sensors from any vendor such as analogue (0-20mA, 0-1V), SDI12, RS485 Modbus, measure and transmit the data over the Itron network.

The ADS-410 can also power the sensors with up to 250mA@12VDC using its 3.6V lithium battery.

All telemetry applications can be realized with the ADS-410.

# IoT Autonomous devices



## 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 18 $\mu$ A
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



## Battery lifetime

ADS-410 RTU/Itron powered by one 3.6V, 13Ah lithium-thionyl battery

Excitation @12V [mA]	Sample/Send rate [S/hour]	Sampling delay [sec]	Battery life [Years]
1	4	1	6.9
1	12	1	4.7
1	30	1	2.7
25	6	1	2.6
25	30	1	1
5	4	1	6.2
5	6	1	5.4
5	30	1	2.1
25	4	5	1.8
50	4	5	1
100	4	5	0.5





**DISTRIBUTECH**<sup>®</sup>  
CONFERENCE & EXHIBITION

USA/New Orleans 2019

#DTECH\Gen 5 SN



Gen 5  
Sensor Node

# Sensors

## Water application SDI12 & Modbus sensors

### Multiparameter Sensors

Temperature, Conductivity, Depth, pH, Dissolved Oxygen, Turbidity, ORP, Blue-Green Algae, Chlorophyll, Ammonium, Nitrate, Chloride



Submersible water level sensors



Ultrasonic water level



Water velocity



Sewer level



# Sensors

## Environmental SDI12 & Modbus sensors



All in one weather stations

Ambient  
Humidity & Temperature



Gas Sensors



# Sensors

---



Wind Speed



Sun Radiation



Wind Direction



# Sensors

---

## Agriculture sensors

Leaf Wetness



Soil Moisture,  
Conductivity,  
Temperature

Soil Moisture



Soil Temperature



# Sensors

## Structural Engineering SDI12 sensors



Crack Propagation



Inclination



Critical  
Structure  
Monitoring

Bridge suspension

# Sensors

## Structural Engineering SDI12 sensors



Inclination

Crack Propagation

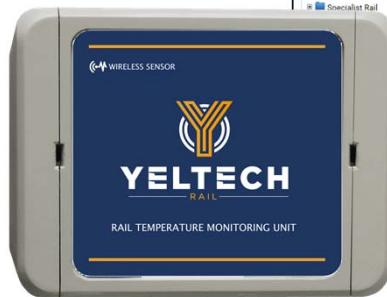
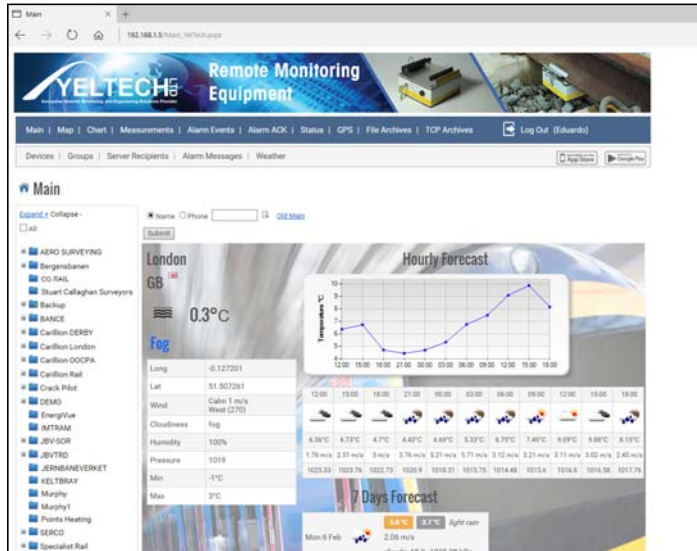
Critical  
Structure  
Monitoring





# Sensors

## Rail line temperature monitoring





# Sensors

## Power Grid & Industrial



Earth Ground Fault alarming



Substations & Transformers



Multifunctional RTUs, PLCs



Current Transformers

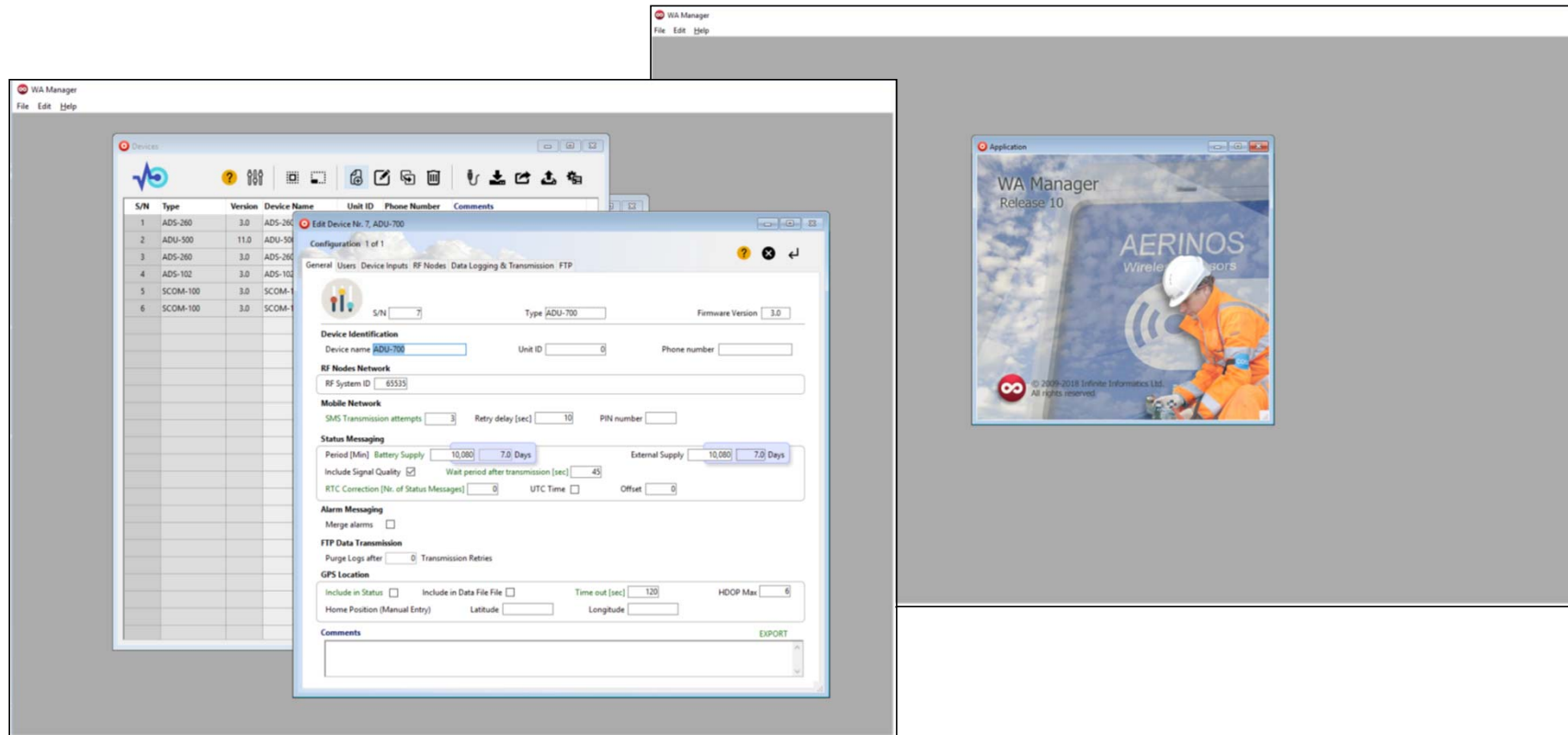


4-20mA, 0-20mA, 0-10V, 0-1V sensors



Fault passage indicators

# WA Manager – Windows software to configure devices

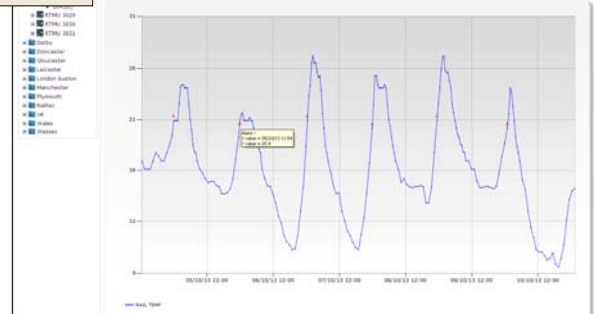


# WaT - Web aided Telemetry

## Cloud telemetry platform with GIS information

The screenshot displays the main dashboard of the WaT web interface. At the top, there is a navigation menu with options like 'Map', 'Chart', 'Measurements', 'Alarms', 'Status', 'SMS Archive', 'Error Log', and 'Log Out'. Below the menu, there are sections for 'Main' and 'Device 3F'. The 'Main' section contains a table of devices with columns for 'Group', 'ID', 'Status', 'Last Status', 'Signal (%)', 'Status', 'Logging', 'A/I', 'Alarm', and 'IC'. The 'Alarm' section contains a table with columns for 'Ch. A/I', 'Ch. ID', 'Ch. Desc', 'Msg. Date', 'Msg. Desc', 'Comments', 'Value', 'Group', 'Device', and 'ID'. The interface also features a sidebar with a tree view of device groups.

The screenshot shows the 'Map' view of the WaT web interface. It features a satellite map of a railway station area. A pop-up window for 'RTMU TAUNTON (59)' is visible, showing details such as 'Last Status: 13/10/2013 4:15:38 PM, 74.2%', 'Last Log: 17/10/2013 7:57:00 PM, 82.5-4-IC', and 'Last Alarm: 17/10/2013 8:45:05 PM, RAIL\_TSW\_L1\_LOW\_ALARM, 23.3'. The interface includes a navigation menu and a sidebar with a tree view of device groups.



# WaT - Web aided Telemetry

Cloud telemetry platform with GIS information

The screenshot displays the WaT web interface. The top navigation bar includes links for Main, Map, Chart, Measurements, Alarm Events, Alarm ACK, Status, GPS, File Archives, and TCP Archives. Below this, there are tabs for Devices, Groups, Server Recipients, Alarm Messages, and Weather. The main content area is split into two panels. The left panel, titled 'Devices', shows a table with columns for #, Status, Alarm, Group, Device ID, Device Name, Phone Number, Type, Latitude, Longitude, Zoom Level, and Show. The right panel, titled 'Map', shows a satellite map of a coastal town with numerous green location markers. The map interface includes a search bar, a date selector (14/02/2017), and zoom controls.

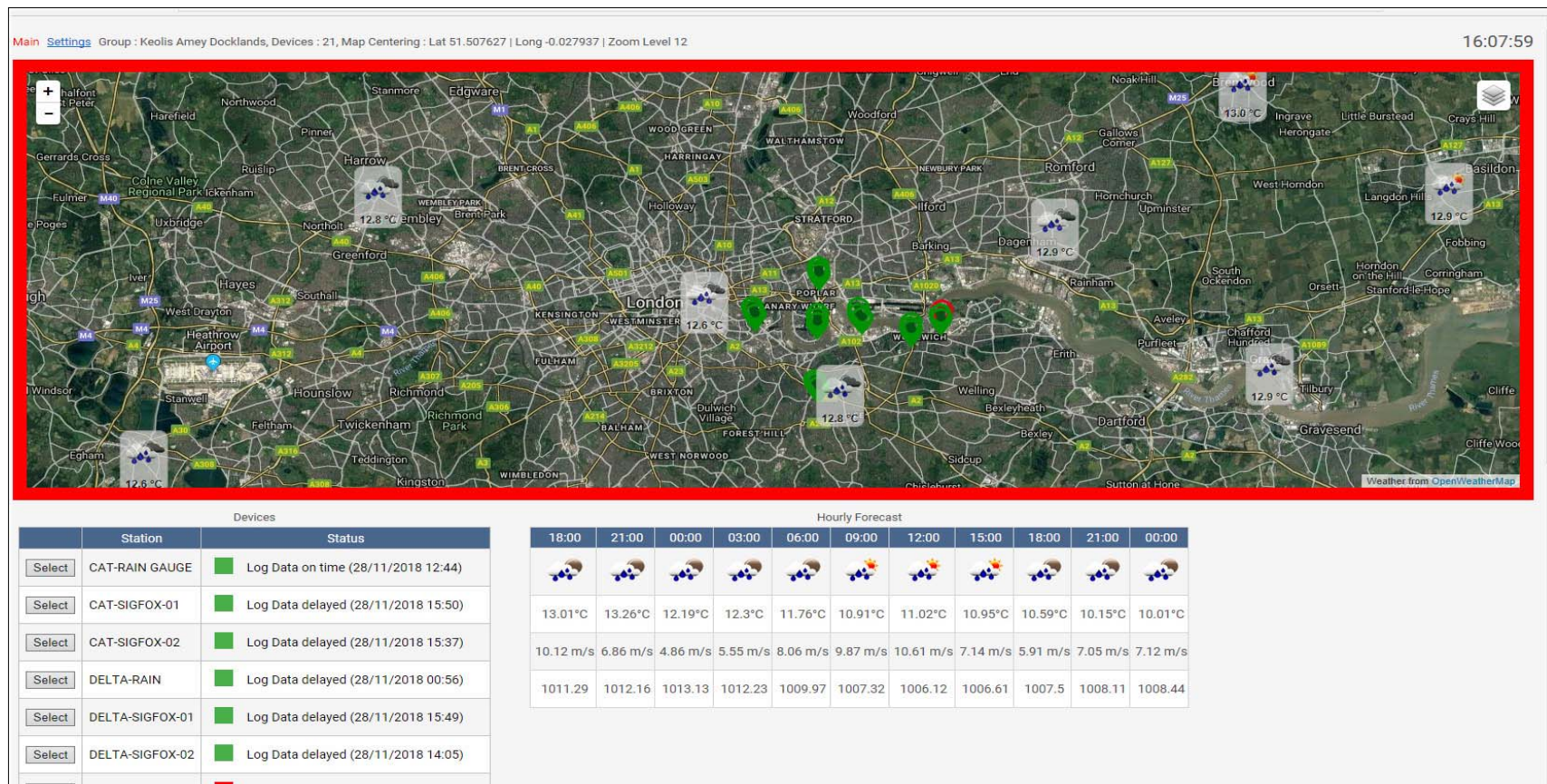
#	Status	Alarm	Group	Device ID	Device Name	Phone Number	Type	Latitude	Longitude	Zoom Level	Show
23/III	Active	22/I	309	B-267	+30698555376	BSC-50-E	40.613761	22.960675	12	Yes	
25/III	Active	22/I	310	B-49	+30698555378	BSC-50-E	40.611438	22.959543	12	Yes	
25/X	Active	23/I	311	B-10	+306979440747	BSC-50-E	40.614305	22.957654	12	Yes	
26/IX	Active	23/III	313	166	+306975850674	BSC-50-E	40.643439	22.946430	12	Yes	
27/IV	Active	23/III	312	N-37	+306975850668	BSC-50-E	40.640908	22.952879	12	Yes	
28/III	Active	24/I	315	O-3	+306979440909	BSC-50-E	40.641245	22.960855	12	Yes	
29/III	Active	24/I	314	N-537	+306975850441	BSC-50-E	40.642286	22.951364	12	Yes	
30/III	Active	25/III	321	702	+30698555349	BSC-50-E	40.634777	22.936283	12	Yes	
31/I	Active	25/VIII	320	B-214	+306979440449	BSC-50-E	40.610653	22.952909	12	Yes	
36/I	Active	25/X	319	PE-81	+306972307079	BSC-50-E	40.501590	22.923310	12	Yes	
22/I	Active	26/IX	318	Z-83	+30698555379	BSC-50-E	40.663834	22.933113	12	Yes	
23/I	Active	27/IV	317	K-577	+30698555337	BSC-50-E	40.581534	22.949494	12	Yes	
24/I	Active	27/IV	322	K-739	+30698555336	BSC-50-E	40.586705	22.953391	12	Yes	
270/XI	Active	270/XI	326	111	+306975850658	BSC-50-E	40.636033	22.947371	12	Yes	
31/III	Active	270/XI	325	130	+306975850666	BSC-50-E	40.634069	22.952770	12	Yes	
31/III	Active	28/III	323	20X	+30698555377	BSC-50-E	40.634371	22.939710	12	Yes	
31/III	Active	28/III	324	581	+30698555372	BSC-50-E	40.637809	22.936708	12	Yes	
32/III	Active	29/III	332	5	+30698555354	BSC-50-E	40.633250	22.940097	12	Yes	





# WaTEye - Web aided Telemetry Eye dashboard

Online dashboard with live weather and telemetry data



# 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.

The screenshot displays the 'Tag Groups' configuration window. It includes a 'Record' section with 'Update Tag Values' set to 'ON'. Below this is a table of tag configurations:

Tag ID	Tag Name	Device ID	Device	Channel ID	Channel	Tag Value	Status
1	TAG-1	1	BSC-500 PPC1	2	EARTH	OFF	Active
2	TAG-2	1	BSC-500 PPC1	1	FLOOD	OFF	Active
3	TAG-3	-1		-1		OFF	Active
4	TAG-4	-1		-1		OFF	Active
5	TAG-5	-1		-1		OFF	Active

Below the table is a 'Configuration' window showing a list of parameters with their values and types. A 'Slave/Master Data Object' window is also visible, showing a query: 'Execute: SELECT KEYWIM, TAG1\_NAME, T...'





## Case Study City of Xanthi Greece

---

<https://www.youtube.com/watch?v=0-muFxbtnQ>

Featuring Infinite's BSC-50D RTU for earth fault alarming, SCOM-100 wireless controllers for remote control, MSG – Multiprotocol SCADA Gateway offering connectivity to Siemens & EFASEC SCADA systems using the IEC-6870-5-104 protocol.

# Clients & OEM

