



Autonomous RTUs  
IoT for Water Telemetry



## Water resources management

- River level & flow gauging
- Groundwater monitoring
- Lake and reservoir level monitoring
- Leak detection in distribution pipelines
- Water quality monitoring



# Design Principles

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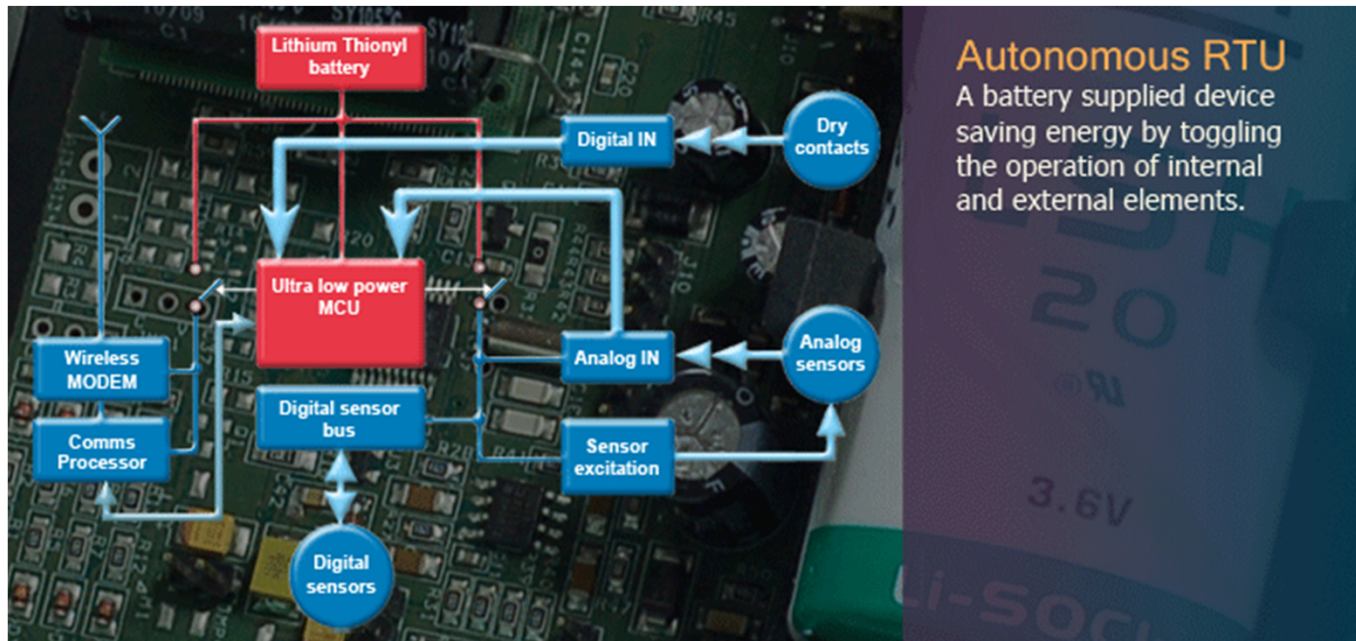
Autonomous RTUs are flexible devices allowing any modern power source scheme.

They are designed to operate autonomously using single lithium battery cells achieving maximum reliability, and long term solution robustness with operational lifetime >20 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.

# 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.

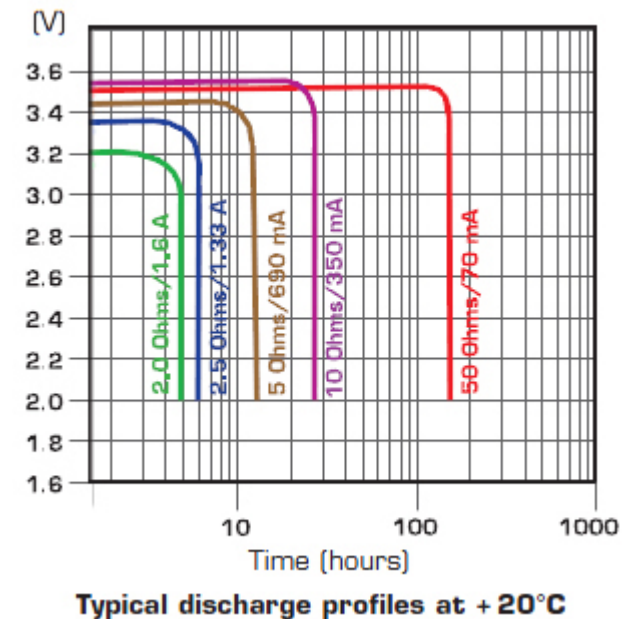


D-size, Primary lithium-thionyl chloride battery, Nominal voltage: 3.6V, Capacity: 13.0Ah

# 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 $\mu$ A 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





## Internet of Things Networks & Technologies



## ADU-500 Autonomous RTU

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The ADU-500 is an ultra low power, wireless RTU with data logging and alarming capabilities.

The battery powered RTU supports acquisition from multiple sensors and it incorporates three digital inputs, two analog inputs, two pulse counter inputs, SDI-12 bus, RS485 Modbus and multiple excitation options for powering measuring transducers.

The ADU-500 uses an internal cellular modem to automatically send data and alarms.

A D-size Lithium Thionyl battery can provide autonomous operation for over 10 years.

# IoT Autonomous devices

## ADU-500, RTU/Data Logger



2G/3G/4G



Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size 12VDC mains or photovoltaic power
Consumption :	Continuous 18 $\mu$ A
SDI12:	up to 16 SDI-12 sensors with up to 48 channels
RS485:	up to 10 Modbus ASCII/RTU up to 10 channels
Digital inputs:	3, 0-30VDC
Pulse counters:	2, 2KHz, common with DI 2&3
Analog inputs:	2, 12 bit resolution, differential, 1-200 programmable gain
Transducer Excitation:	12VDC/400mA, or 9V/500mA or 5VDC/200mA, 3.3V/1A
Battery monitoring:	built in battery gauge continuous consumption monitoring
Wireless modem:	Sierra Wireless HL series 2G, 3G or 4G
Messages:	Alarm, Status, Data
Temperature:	-40°...+65°C, operating
Dimensions:	130 x 130 x 75 mm
Housing:	IP66, IP68 Nema 4x



# ADU/BSC IP68



**IP68**

5Pin 0.3mm<sup>2</sup>



# IoT Autonomous devices



## BSC-50D, GSM Alarming RTU

Power supply:	3.6V, 13 Ah Lithium Thionyl battery, D-size 5VDC mains or photovoltaic power
Consumption :	Continuous 18 $\mu$ A
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, NBloT, 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

# ADS-260 SIGFOX

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The ADS-260 is an ultra low power, wireless smart end node for the Sigfox network.

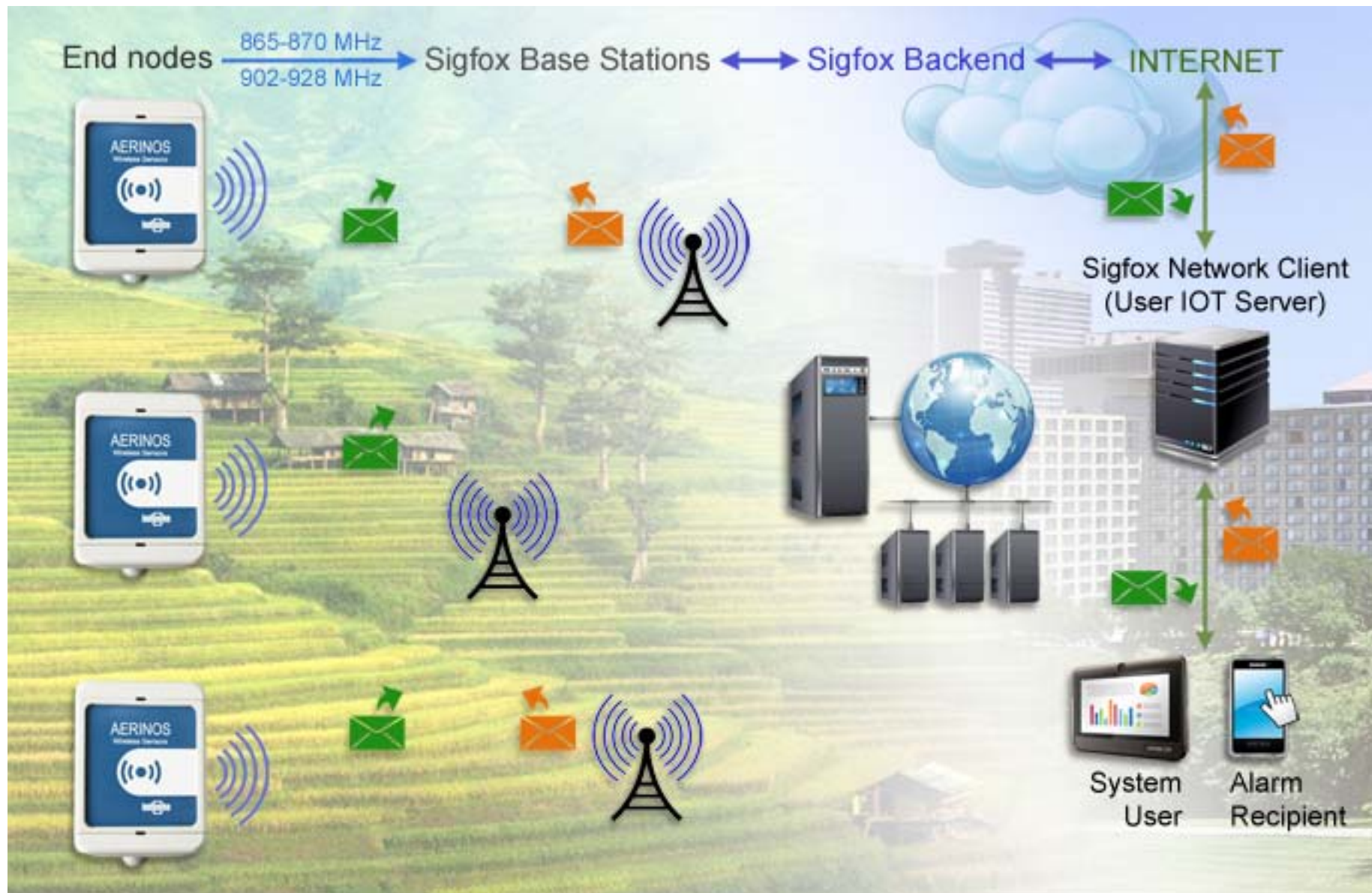
It is available for the SIGFOX network for Europe, USA, Latin America, Australia and New Zealand, RC1, RC2, RC4.

The battery powered RTU supports acquisition from multiple sensors and it incorporates one digital/analogue/pulse input, SDI-12 bus with up to 3 sensors supported, an RS485 Modbus bus with up to 3 sensors supported and multiple excitation options for powering measuring transducers.

A D-size Lithium Thionyl battery can provide autonomous operation for over 10 years.



# ADS-260 SIGFOX



# IoT Autonomous devices

## ADS-260, Sigfox 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:	Sigfox RCZ1, RCZ2, RCZ4
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20 $^{\circ}$ ...+65 $^{\circ}$ C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

# ADS-270 LoRaWan

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The ADS-270 is an ultra low power, wireless smart end node for the LoRaWan network.

It is available for Europe, USA, Latin America, Asia, Australia and New Zealand, with frequencies 433, 868 and 915 MHz.

The battery powered RTU supports acquisition from multiple sensors and it incorporates one digital/analogue/pulse input, SDI-12 bus with up to 3 sensors supported, an RS485 Modbus bus with up to 3 sensors supported and multiple excitation options for powering measuring transducers.

A D-size Lithium Thionyl battery can provide autonomous operation for over 10 years.



# IoT Autonomous devices

## ADS-270, LoraWan 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:	Microchip LoraWan 433/868/915
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20 $^{\circ}$ ...+65 $^{\circ}$ C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x



## ADS-410 Itron

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The ADS-410 is an ultra low power, wireless smart end node for the Itron network.

It is available for Europe and USA, with frequencies 868 and 915 MHz. The Itron network is an very secure network which is usually owned by utilities and municipal authorities.

The battery powered RTU supports acquisition from multiple sensors and it incorporates one digital/analogue/pulse input, SDI-12 bus with up to 3 sensors supported, an RS485 Modbus bus with up to 3 sensors supported and multiple excitation options for powering measuring transducers.

A D-size Lithium Thionyl battery can provide autonomous operation for over 10 years.





# 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

# Sensors

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## Water Level Ultrasonic



## PH



## Water Quality

# Sensors

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Surcharge Velocity sensor



Correlation Sensor



Water Quality

# Sensors

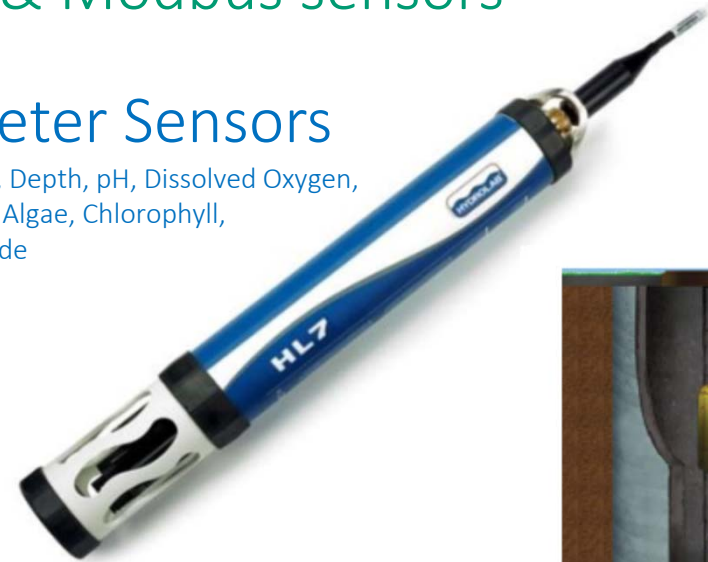
## Water application SDI12 & Modbus sensors

### Multiparameter Sensors

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



Submersible water level sensors



Water velocity

Sewer level



# Sensors

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Ambient  
Humidity & Temperature



Valve

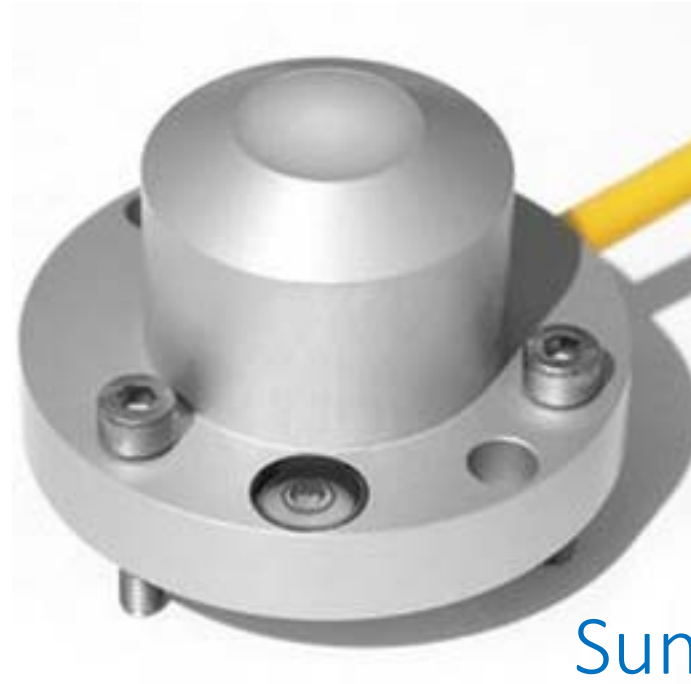


# Sensors

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Wind Speed



Sun Radiation



Wind Direction

Gas Sensors



# Configuration Software

## New WAManager configuration tool

The screenshot displays the WAManager configuration tool interface. On the left, a 'Devices' window shows a table of device information:

S/N	Type	Version	Device Name	Unit ID	Phone Number	Comments
1	ADS-260	3.0	ADS-260			
2	ADU-500	11.0	ADU-500			
3	ADS-260	3.0	ADS-260			
4	ADS-102	3.0	ADS-102			
5	SCOM-100	3.0	SCOM-100			
6	SCOM-100	3.0	SCOM-100			

The main configuration window, titled 'Edit Device Nr. 7, ADU-700', shows the following settings:

- General:** S/N: 7, Type: ADU-700, Firmware Version: 3.0
- Device Identification:** Device name: ADU-700, Unit ID: 0, Phone number: [empty]
- RF Nodes Network:** RF System ID: 65535
- Mobile Network:** SMS Transmission attempts: 3, Retry delay [sec]: 10, PIN number: [empty]
- Status Messaging:** Period [Min]: 10,080, Battery Supply: 7.0 Days, External Supply: 10,080, 7.0 Days. Includes Signal Quality: . Wait period after transmission [sec]: 45. RTC Correction [Nr. of Status Messages]: 0, UTC Time: , Offset: 0.
- Alarm Messaging:** Merge alarms:
- FTP Data Transmission:** Purge Logs after: 0, Transmission Retries: [empty]
- GPS Location:** Include in Status: , Include in Data File File: , Time out [sec]: 120, HDOP Max: 6. Home Position (Manual Entry): Latitude: [empty], Longitude: [empty]
- Comments:** [empty text area]

On the right, an application splash screen for 'WA Manager Release 10' is shown, featuring the AERINOS logo and a worker in an orange safety suit. Copyright information: © 2009-2018 Infinite Informatics Ltd. All rights reserved.

# WaT - Web aided Telemetry

## Cloud telemetry platform with GIS information

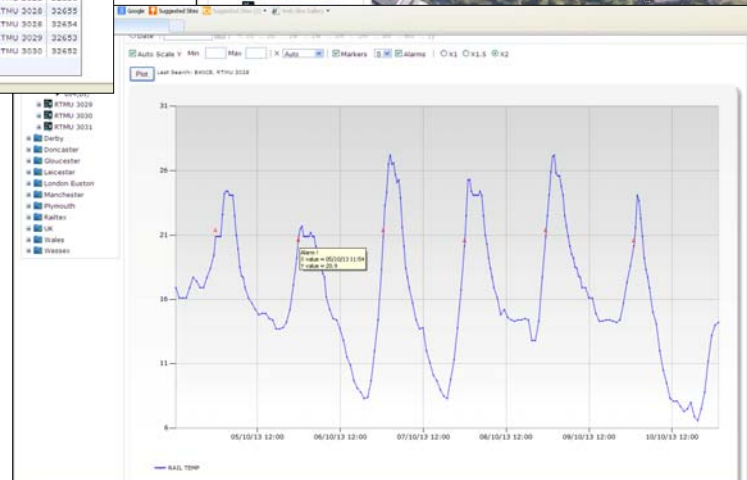
The screenshot shows the main dashboard of the WaT web interface. At the top, there is a navigation bar with links for 'Main', 'Map', 'Chart', 'Measurements', 'Alarms', 'Status', 'SMS Archive', 'Error Log', and 'Log Out (Eduardo)'. Below the navigation bar, there is a 'Main' section with a 'Clear All' button and a 'Device: 22' dropdown. A table lists various devices with columns for Group, ID, Device, Last Status, Signal %, Status, Logging, AT I, Alarm, and RC. Below the table, there is an 'Alarm List' section with columns for Ch. ID, Ch. ID1, Ch. ID2, Sin. Date, SMS Date, Comments, Value, Group, Device, and ID.

Group	ID	Device	Last Status	Signal %	Status	Logging	AT I	Alarm	RC
ANGLIA	80	RTMU 2432	3/14/2013 4:48:31 PM	54.8	●	●	9.3	●	●
ANGLIA	81	RTMU 2433	3/16/2013 4:54:17 PM	50.1	●	●	8.4	●	●
ANGLIA	73	RTMU LEIGH	11/8/2012 6:52:42 AM	29	●	●	23.3	●	●
BANCE	101	RTMU 3028	10/9/2013 9:43:58 AM	-	●	●	14.2	●	●
BANCE	107	RTMU 3029	No Status data	-	●	●	20.1	●	●
BANCE	108	RTMU 3030	No Status data	-	●	●	20.0	●	●
BANCE	109	RTMU 3031	No Status data	-	●	●	16.1	●	●
Derby	71	RTMU AMBERGATE	10/10/2013 3:47:16 PM	29	●	●	9.6	●	●
Derby	70	RTMU BRANSTON	3/8/2013 6:09:02 AM	32.3	●	●	-5.6	●	●
Doncaster	79	RTMU 2434	10/10/2013 5:17:23 PM	48.4	●	●	17.7	●	●
Gloucester	68	RTMU 2422 STAND	3/13/2013 12:11:16 PM	90.3	●	●	21.6	●	●
Gloucester	69	RTMU 2423 HDREY	9/10/2012 1:37:47 PM	45.2	●	●	2.8	●	●
Leicester	67	RTMU LEICESTER	4/3/2013 10:41:34 AM	22.6	●	●	2.8	●	●

Ch. ID1	Ch. ID2	Ch. ID3	Sin. Date	SMS Date	Comments	Value	Group	Device	ID
RAIL TEMP			10/9/2013 11:56:00 AM	10/9/2013 12:54:54 PM	RAIL TEMP, HIGH, 20.1 cC	20.10	BANCE	RTMU 3029	32651
RAIL TEMP			10/8/2013 10:26:03 AM	10/8/2013 11:24:39 AM	RAIL TEMP, HIGH, 20.9 cC	20.10	BANCE	RTMU 3028	32650
RAIL TEMP			10/7/2013 10:56:00 AM	10/7/2013 11:54:54 AM	RAIL TEMP, HIGH, 20.1 cC	20.10	BANCE	RTMU 3028	32659
RAIL TEMP			10/6/2013 11:25:00 AM	10/6/2013 12:24:47 PM	RAIL TEMP, HIGH, 20.9 cC	20.90	BANCE	RTMU 3028	32658
RAIL TEMP			10/5/2013 10:55:00 AM	10/5/2013 11:54:44 AM	RAIL TEMP, HIGH, 20.9 cC	20.90	BANCE	RTMU 3028	32697
RAIL TEMP			10/4/2013 10:55:00 AM	10/4/2013 11:54:40 AM	RAIL TEMP, HIGH, 20.9 cC	20.90	BANCE	RTMU 3028	32656
RAIL TEMP			10/2/2013 9:28:00 PM	10/2/2013 4:24:40 AM	RAIL TEMP, HIGH, 20.1 cC	20.10	BANCE	RTMU 3028	32655
RAIL TEMP			10/2/2013 1:29:00 PM	10/2/2013 2:24:04 PM	RAIL TEMP, HIGH, 21.1 cC	21.10	BANCE	RTMU 3028	32454
ON/OFF TRACK?			10/2/2013 10:16:00 AM	10/2/2013 11:15:09 AM	ON/OFF TRACK?, PROBE OFF TRACK		BANCE	RTMU 3029	32653
ON/OFF TRACK?			10/2/2013 10:16:00 AM	10/2/2013 11:14:31 AM	ON/OFF TRACK?, PROBE OFF TRACK		BANCE	RTMU 3030	32652

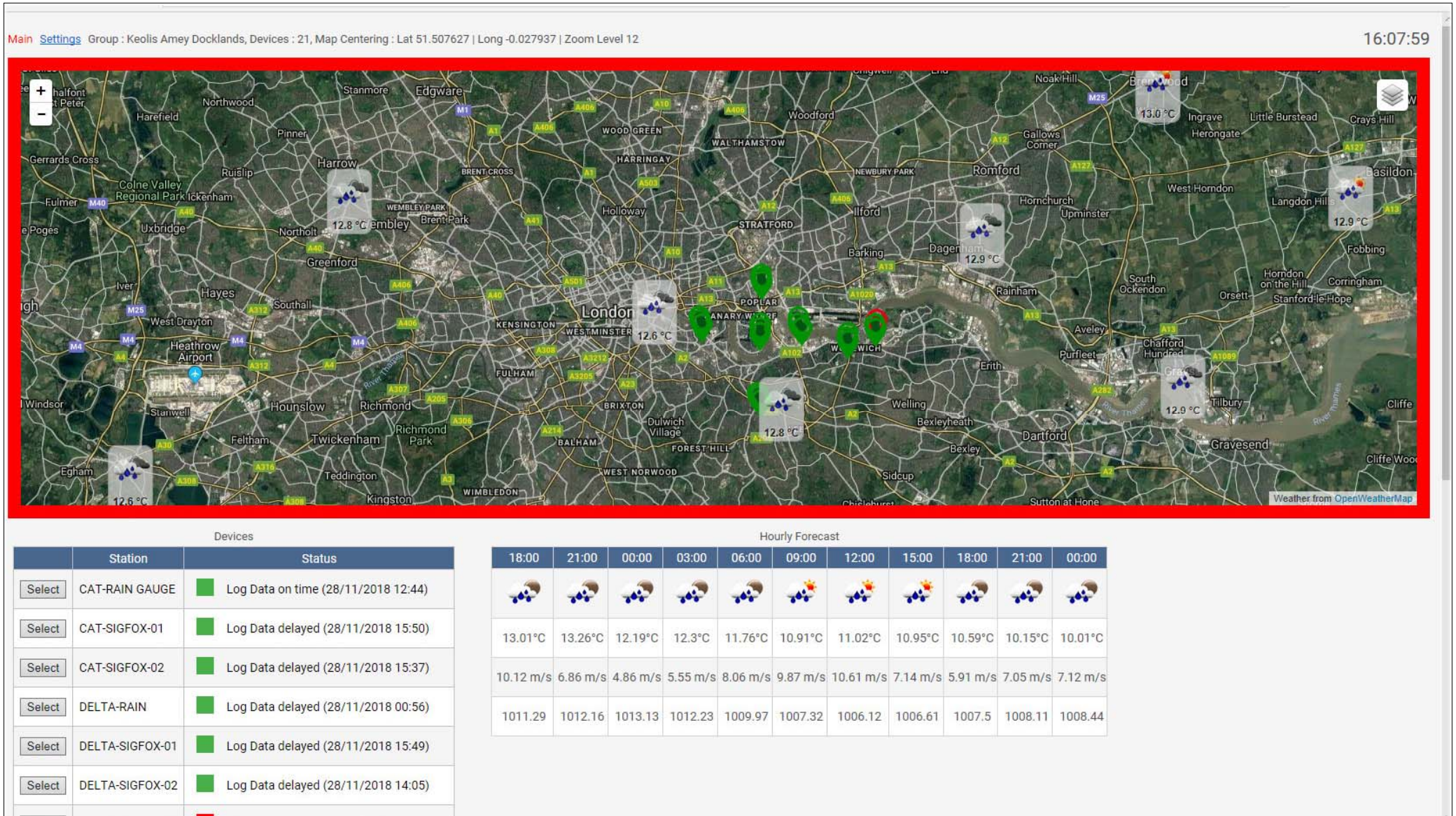
The screenshot shows the 'Map' view of the WaT web interface. It features an aerial view of a railway station area with several RTMU locations marked. A pop-up window for 'RTMU TAUNTON (S9)' is visible, showing its last status, last log, and last alarm. The interface includes a search bar, a list of locations, and a legend for 'All' and 'Inactive' devices.

RTMU TAUNTON (S9)  
Last Status: 1/11/2013 4:15:38 PM, 74.2%  
Last Log: 1/11/2013 7:57:00 PM, AT1:6.4 cC  
Last Alarm: 1/9/2013 8:48:05 PM, RAIL TEMP 1, LOW ALARM, 23.3





# WaTeye - Dashboard

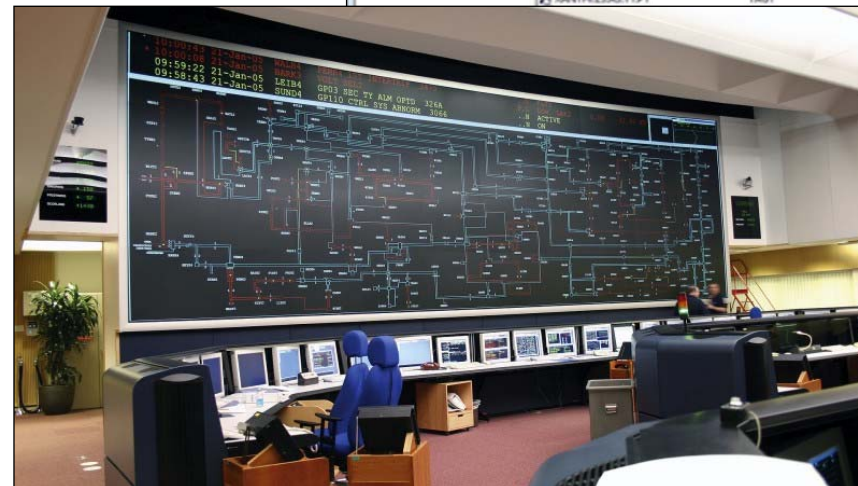
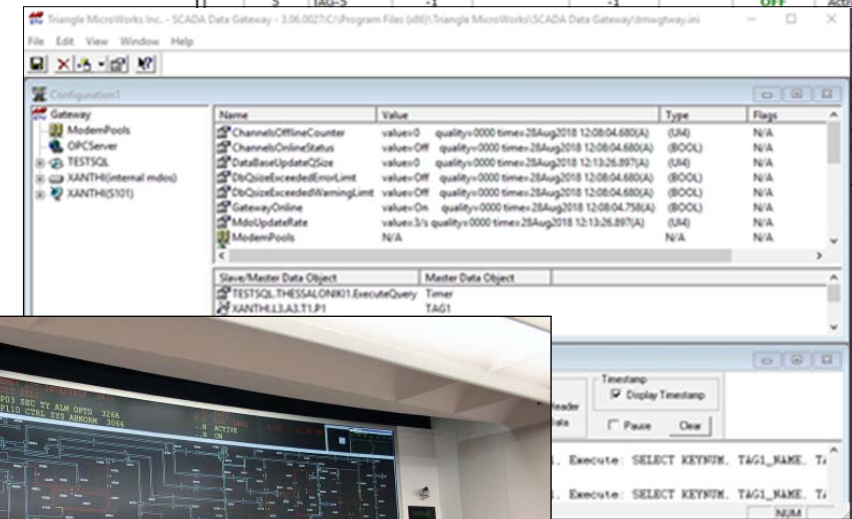
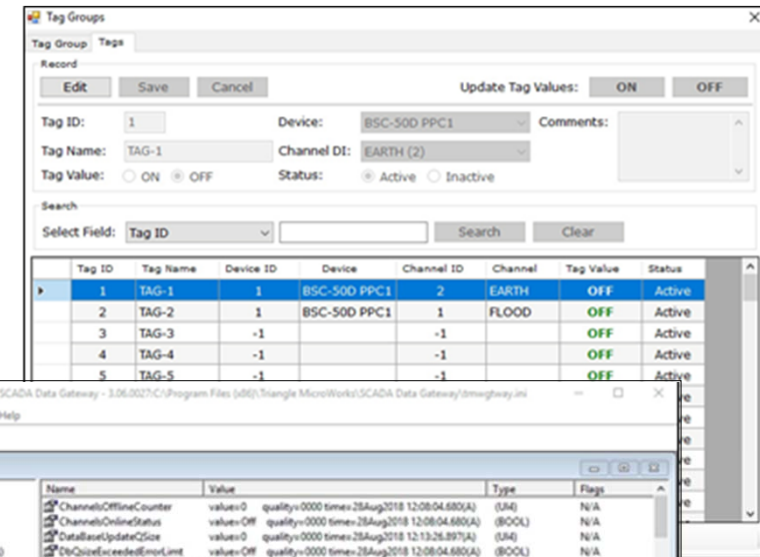


# MSG – Multiprotocol Scada Gateway

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.



## 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

# Clients & OEM

