

Autonomous RTUs



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.

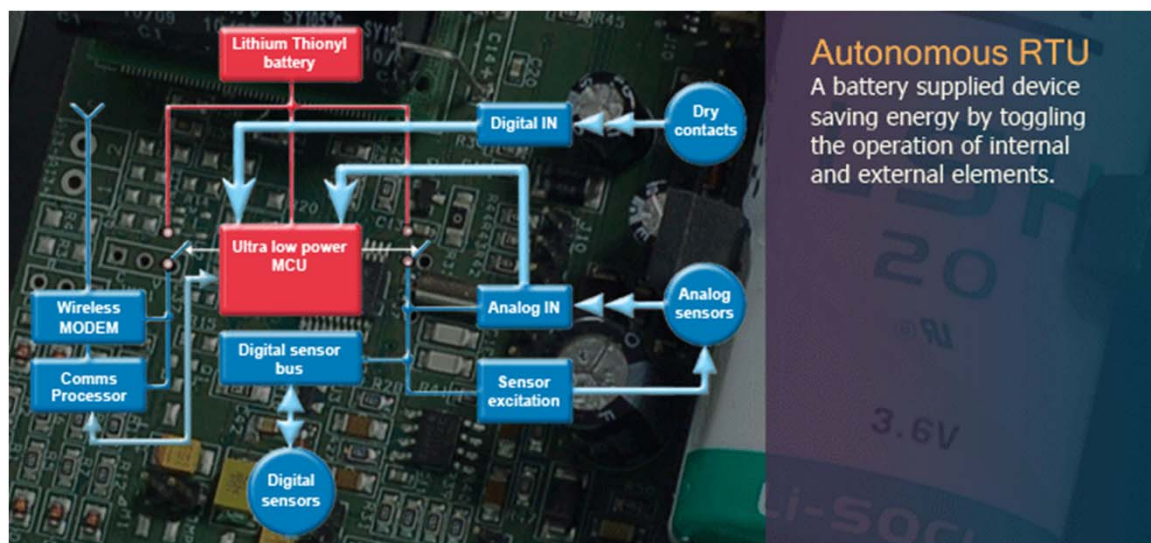
They can be used in hybrid power solutions combining lithium battery for telecommunications with rechargeable power sources for sensor excitation allowing mixed power media applications seamlessly.



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.

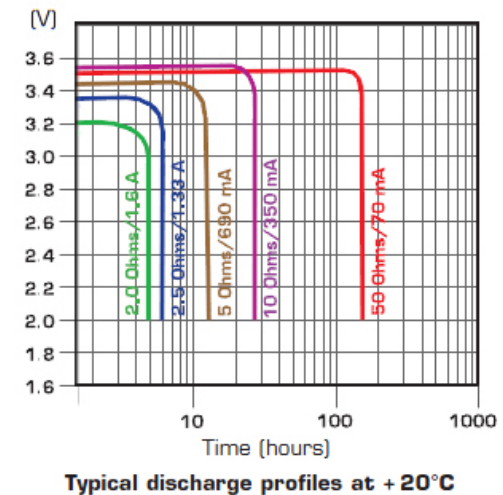


D-size,
Primary lithium-thionyl chloride battery
Nominal voltage: 3.6V,
Capacity: 13.0Ah

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 μ 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





Battery lifetime

BSC-50E RTU/Data logger powered by 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



Water resources management

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





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

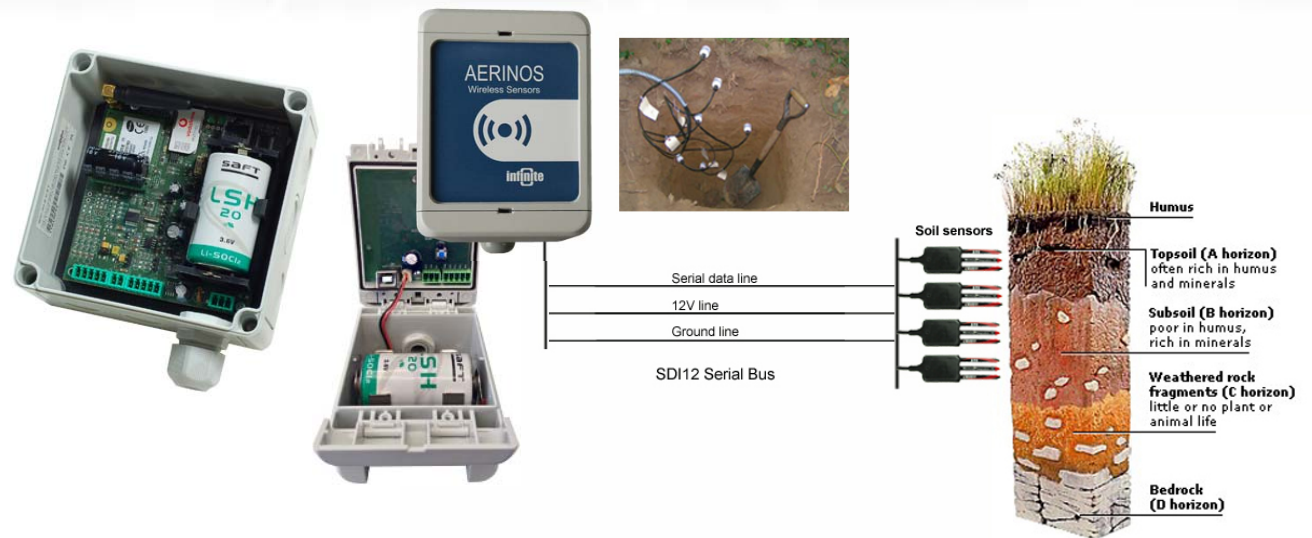




Precision Agriculture

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





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



IoT Autonomous RTUs

Application: Environment



Gas Distribution

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

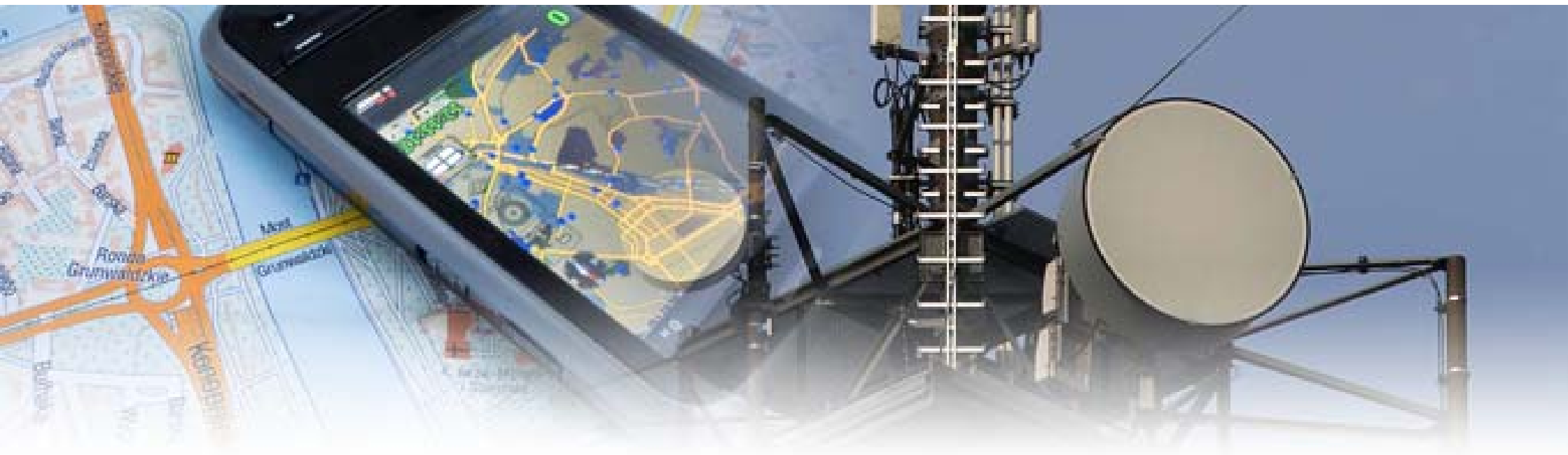




Cathodic Protection

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



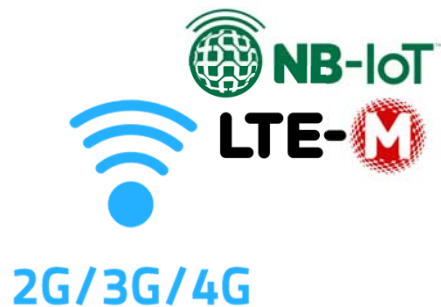


Off-grid general purpose monitoring

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



IoT Autonomous devices



ADU-500, RTU/Data Logger

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size 12VDC mains or photovoltaic power
Consumption :	Continuous 18 μ 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 continous 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

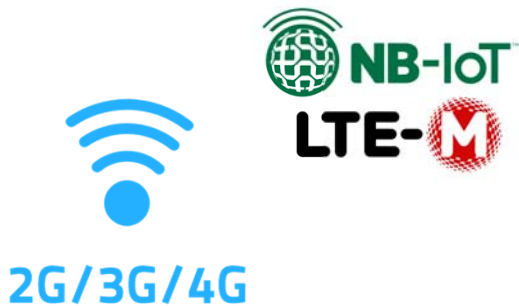
IoT Autonomous devices



BSC-50 E, RTU/Data Logger

Supply current:	Continuous: 40 μ A, Messaging: av. 30mA, 2A peak
Digital inputs:	4, 0-30VDC
Pulse counters:	1, 40Hz, common with DI 4
Analog inputs:	2, 10 bit resolution, 3 gain ranges
Excitation:	7V/140mA or 12VDC/80mA, 5VDC/100mA, 3.5V/200mA
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

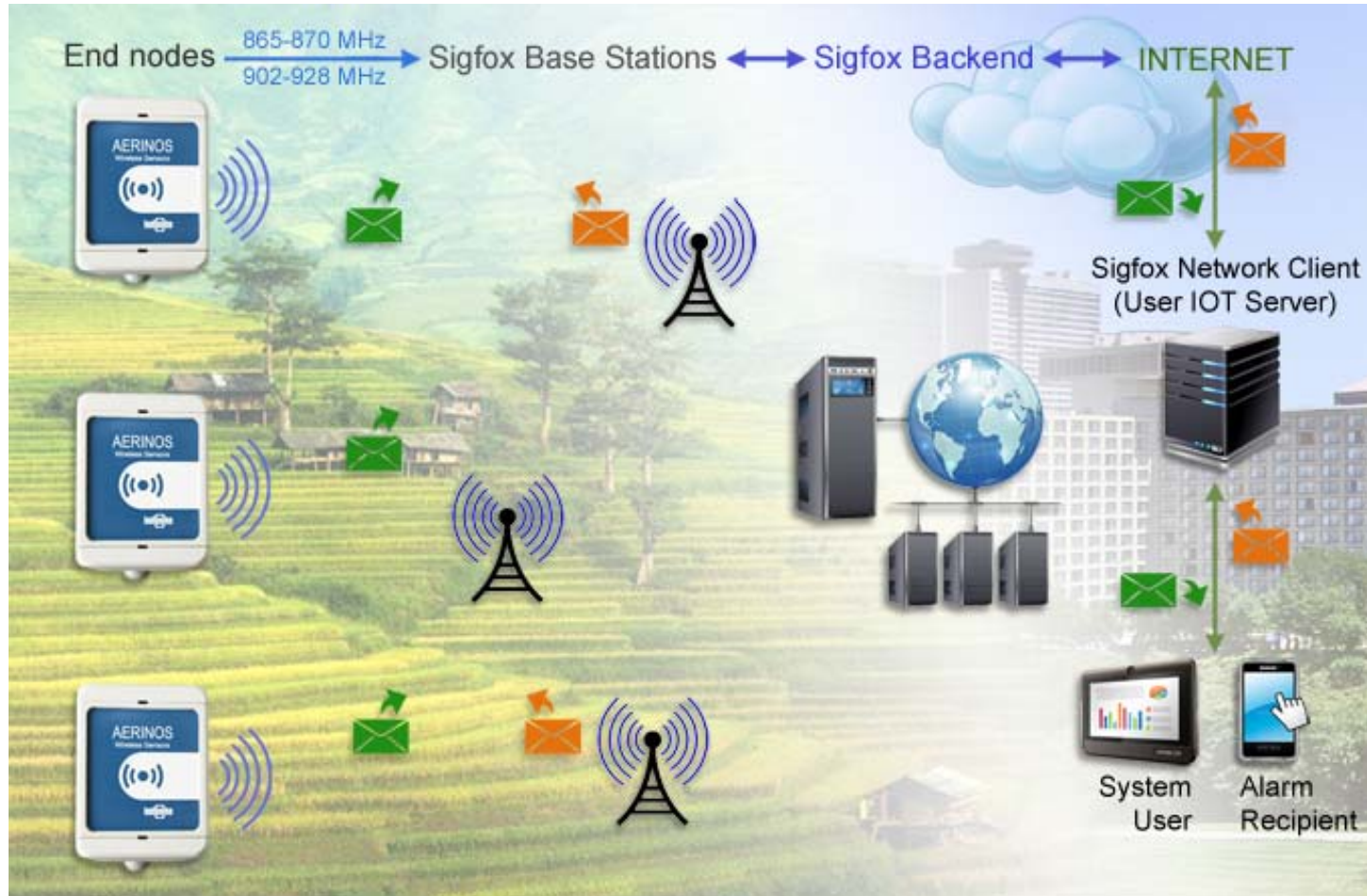
IoT Autonomous devices



BSC-50D, GSM Alarming RTU

Power supply:	3.6V, 13 Ah Lithium Thionyl battery, D-size 5VDC mains or photovoltaic power
Consumption :	Continuous 18 μ 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

SIGFOX



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 18 μ 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:	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



ADS-27x, 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 μ 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°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

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 μ 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 $^{\circ}$...+65 $^{\circ}$ C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x



DISTRIBUTECH[®]
CONFERENCE & EXHIBITION

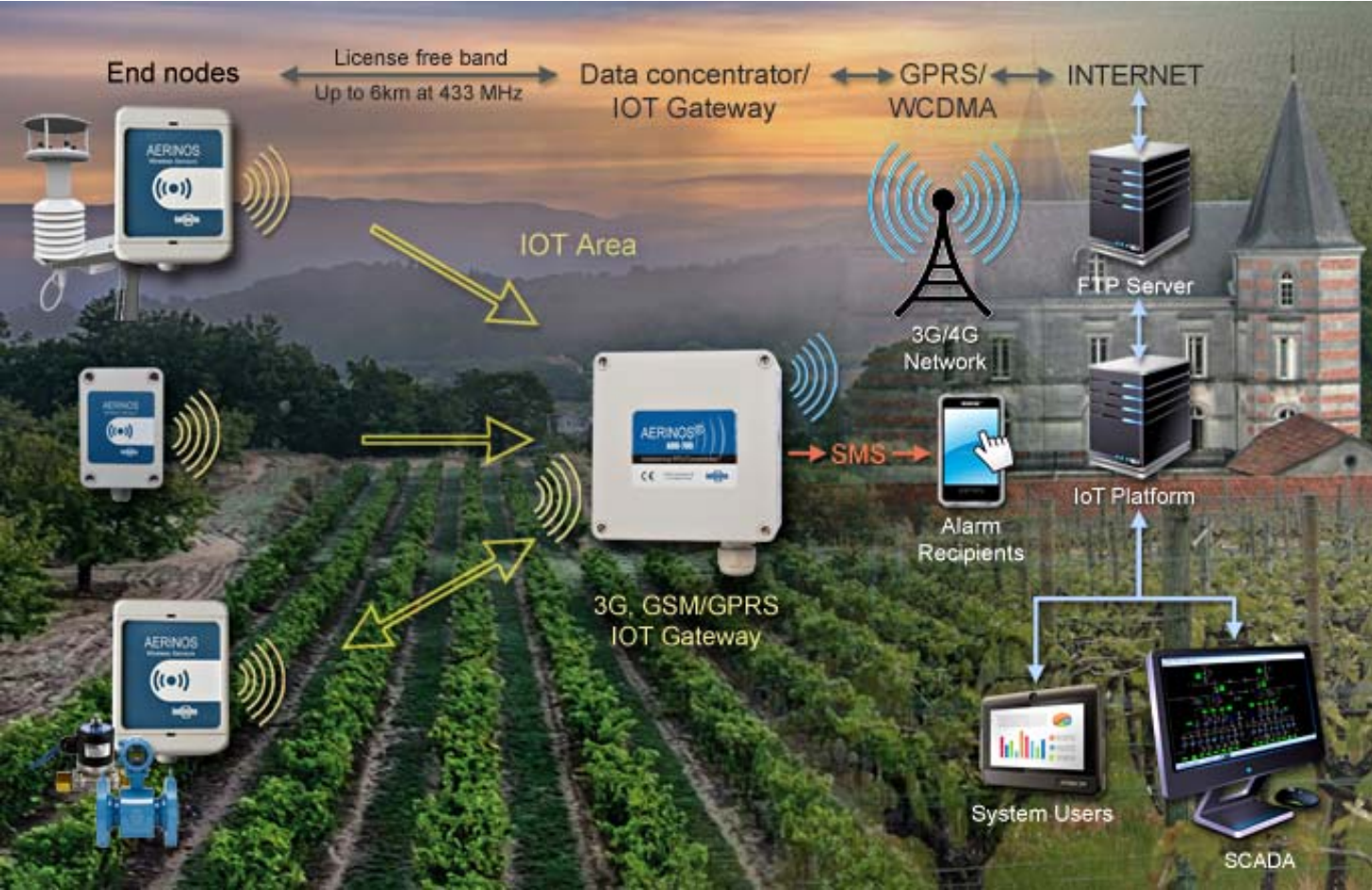
USA/New Orleans 2019

#DTECH\Gen 5 SN



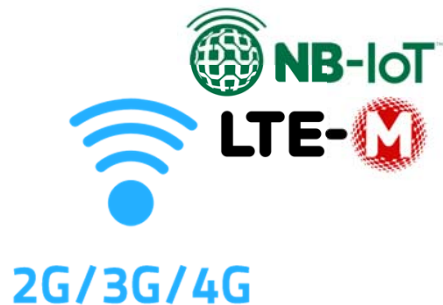
Gen 5
Sensor Node

ADU-700 Profisens



IoT Autonomous devices

ADU-700, Wireless Gateway RTU/Data Logger



Power supply: 3.6V, 13-18 Ah Lithium Thionyl battery, D-size
12VDC mains or photovoltaic power

Consumption : Continuous 18 μ A
RS485: For future use
Digital inputs: 3, 0-30VDC

Wireless RF: Radiocrafts 433.05-433.79 4+Km line of sight
Wireless modem: Sierra Wireless HL series 3G or 4G
Messages: Alarm, Status, Data

Temperature: -40°...+65°C, operating
Dimensions: 130 x 130 x 75 mm
Housing: IP66, IP68 Nema 4x

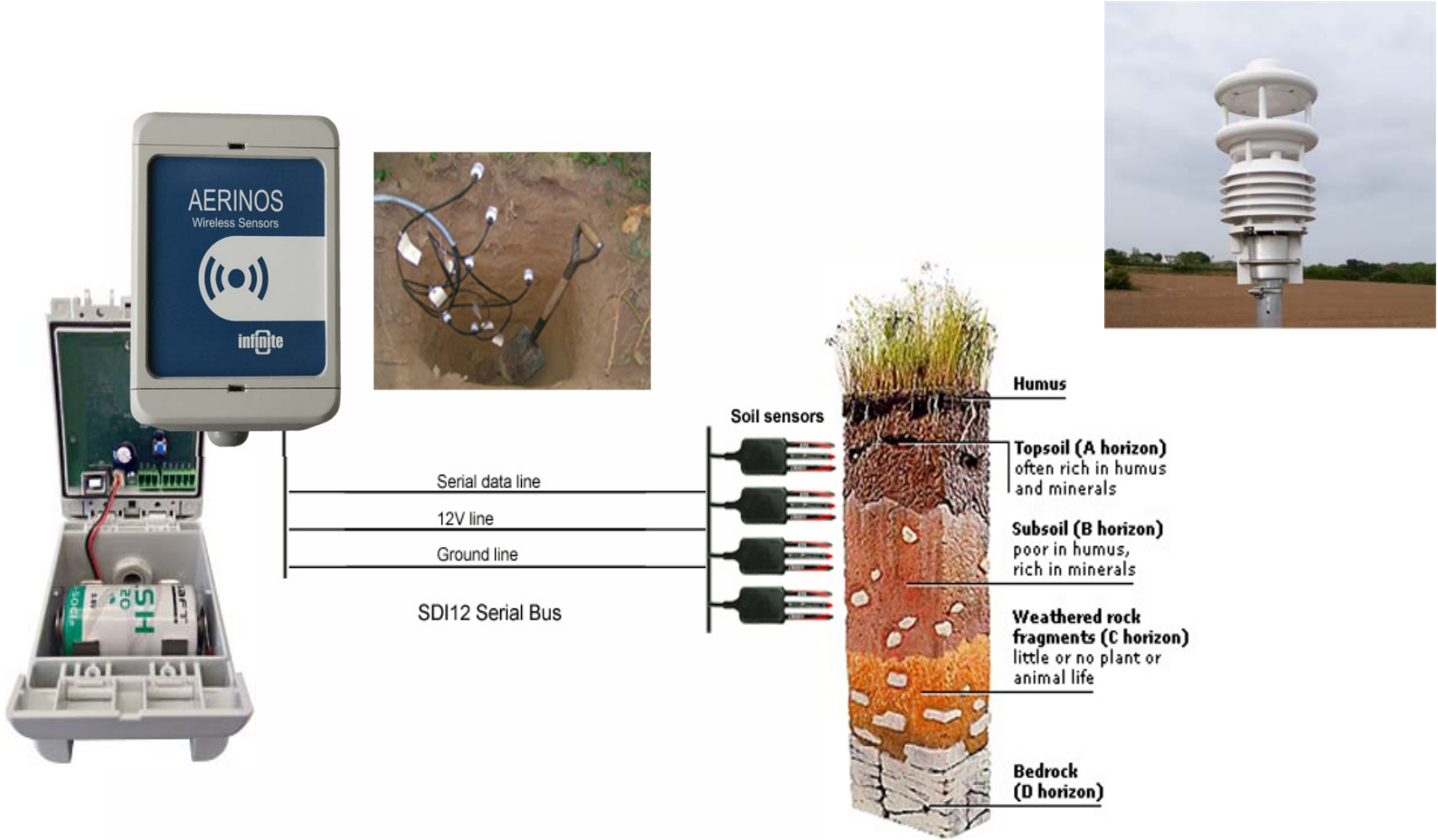
IoT Autonomous devices

ADS-200, IoT wireless end nodes



Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size 5VDC mains or photovoltaic power
Consumption :	Continuous 18 μ 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 tranceiver:	Radiocrafts 433.05-433.79 Mhz
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-200



IoT Autonomous devices



ADS-210, IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size 5VDC mains or photovoltaic power
Consumption :	Continuous 18 μ A
Discrete inputs:	1 Digital input, 0-30VDC 1 Digital counter, 1 KHz 1 Analog input, 0-1VDC, 12 bit resolution
Outputs :	1 Valve Channels
Transducer excitation	12V/250mA, 5V/200mA
Wireless tranceiver:	Radiocrafts 433.05-433.79 Mhz
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-102, IoT wireless end nodes



Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size 5VDC mains or photovoltaic power
Consumption :	Continuous 18 μ A
Discrete inputs:	1 Digital input, 0-30VDC 1 Digital counter, 1 KHz 2 Analog input, 0-1VDC, 12 bit resolution
Transducer excitation	3.6V/120mA
Wireless RF :	Radiocrafts 433.05-433.79 Mhz
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

Power Grid & Industrial



Underground Earth Ground fault detector



Current Transformers



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



Multifunctional RTUs



Fault passage indicators

Sensors

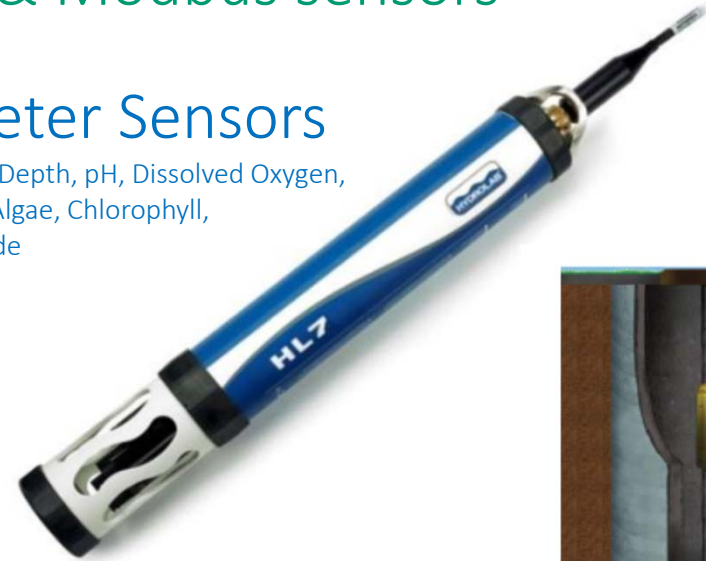
Water application SDI12 & Modbus sensors

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

Water application SDI12 & Modbus sensors

PH



Ultrasonic water 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

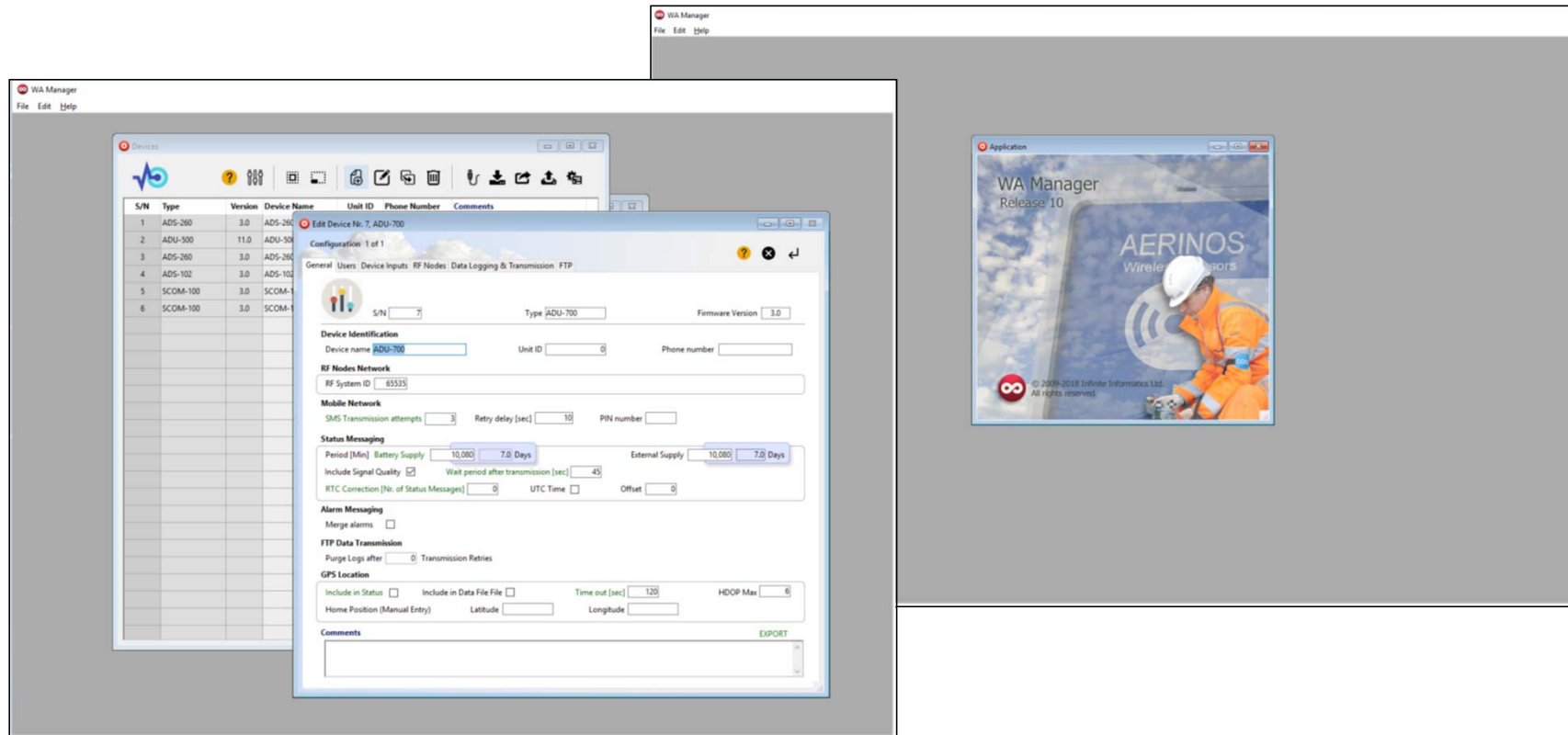


Critical
Structure
Monitoring



Bridge suspension

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's a navigation bar with options like 'Map', 'Chart', 'Measurements', 'Alarms', 'Status', 'SMS Archive', 'Error Log', and 'Log Out'. Below this, a sidebar lists various locations such as ANGLIA, Derby, Doncaster, Gloucester, Leicester, London Euston, Manchester, Plymouth, Stoke, and Wakes. The main area features a table of devices with columns for Group, ID, Status, Last Status, Signal (%), Status, Logging, A/I, Alarm, and IC. Below the device table is an 'Alarm' section with a table listing alarm details like ID, Ch, Al, Ch, St, Rec. Date, SMS Date, Contents, Value, Group, Device, and ID.

Group	ID	Status	Last Status	Signal (%)	Status	Logging	A/I	Alarm	IC
ANGLIA	80	RTMU 2432	31/10/2013 4:46:31 PM	94.0	●	●	●	●	●
Derby	81	RTMU 2433	31/10/2013 4:34:17 PM	88.1	●	●	●	●	●
Doncaster	79	RTMU 3028	11/9/2013 8:52:42 AM	29	●	●	●	●	●
Gloucester	101	RTMU 3029	10/9/2013 9:43:08 AM	-	●	●	●	●	●
Leicester	107	RTMU 3029	No Status data	-	●	●	●	●	●
London Euston	108	RTMU 3030	No Status data	-	●	●	●	●	●
Manchester	109	RTMU 3031	No Status data	-	●	●	●	●	●
Plymouth	71	RTMU AMBERDATE	10/10/2013 3:47:16 PM	29	●	●	●	●	●
Stoke	70	RTMU BRABSTON	3/8/2013 9:08:02 AM	33.3	●	●	●	●	●
Wakes	79	RTMU 2424	10/10/2013 9:17:22 PM	46.4	●	●	●	●	●
Doncaster	68	RTMU 2422 STYHO	21/8/2013 12:11:16 PM	80.2	●	●	●	●	●
Gloucester	69	RTMU 2423 10471	8/10/2013 1:07:47 PM	49.3	●	●	●	●	●
Leicester	67	RTMU LEICESTER	4/3/2013 10:41:04 AM	22.6	●	●	●	●	●

ID	Ch	Al	Ch	St	Rec. Date	SMS Date	Contents	Value	Group	Device	ID
RAIL_TEMP					10/9/2013 11:04:00 AM	10/9/2013 12:34:04 PM	RAIL_TEMP, HIGH, 20.1 uC	20.10	BANCE	RTMU 3028	32641
RAIL_TEMP					10/9/2013 11:04:05 AM	10/9/2013 11:24:59 AM	RAIL_TEMP, HIGH, 20.9 uC	20.90	BANCE	RTMU 3028	32640
RAIL_TEMP					10/7/2013 10:34:00 AM	10/7/2013 10:34:04 AM	RAIL_TEMP, HIGH, 20.1 uC	20.10	BANCE	RTMU 3028	32639
RAIL_TEMP					10/6/2013 11:29:00 AM	10/6/2013 10:24:47 PM	RAIL_TEMP, HIGH, 20.9 uC	20.90	BANCE	RTMU 3028	32638
RAIL_TEMP					10/5/2013 10:35:00 AM	10/5/2013 11:34:44 AM	RAIL_TEMP, HIGH, 20.9 uC	20.90	BANCE	RTMU 3028	32637
RAIL_TEMP					10/4/2013 10:19:00 AM	10/4/2013 11:34:44 AM	RAIL_TEMP, HIGH, 20.9 uC	20.90	BANCE	RTMU 3028	32636
RAIL_TEMP					10/3/2013 9:25:00 PM	10/3/2013 9:24:42 PM	RAIL_TEMP, HIGH, 20.1 uC	20.10	BANCE	RTMU 3028	32635
RAIL_TEMP					10/2/2013 11:28:00 PM	10/2/2013 11:24:24 PM	RAIL_TEMP, HIGH, 21.1 uC	21.10	BANCE	RTMU 3028	32634
ON/OFF TRACK?					10/2/2013 10:14:00 AM	10/2/2013 11:15:09 AM	ON/OFF TRACK?, WINDS OFF TRACK		BANCE	RTMU 3029	32633
ON/OFF TRACK?					10/2/2013 10:15:00 AM	10/2/2013 11:14:51 AM	ON/OFF TRACK?, WINDS OFF TRACK		BANCE	RTMU 3029	32632

This screenshot shows the map view of the WaT web interface. It features an aerial map of a railway station area with several RTMU locations marked. A pop-up window for 'RTMU TAUNTON (59)' provides details: Last Status: 13/10/2013 4:15:38 PM, 74.2%; Last Log: 17/10/2013 7:57:00 PM, 82.5 uC; Last Alarm: 17/10/2013 8:45:05 PM, RAIL_TEMP_1, LOW ALARM, 23.3. Below the map, there is a line chart showing temperature data over time, with a legend for various RTMU locations.



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 links for Devices, Groups, Server Recipients, Alarm Messages, and Weather. The main content area is divided into two sections: a table of devices and a map view.

Devices Table:

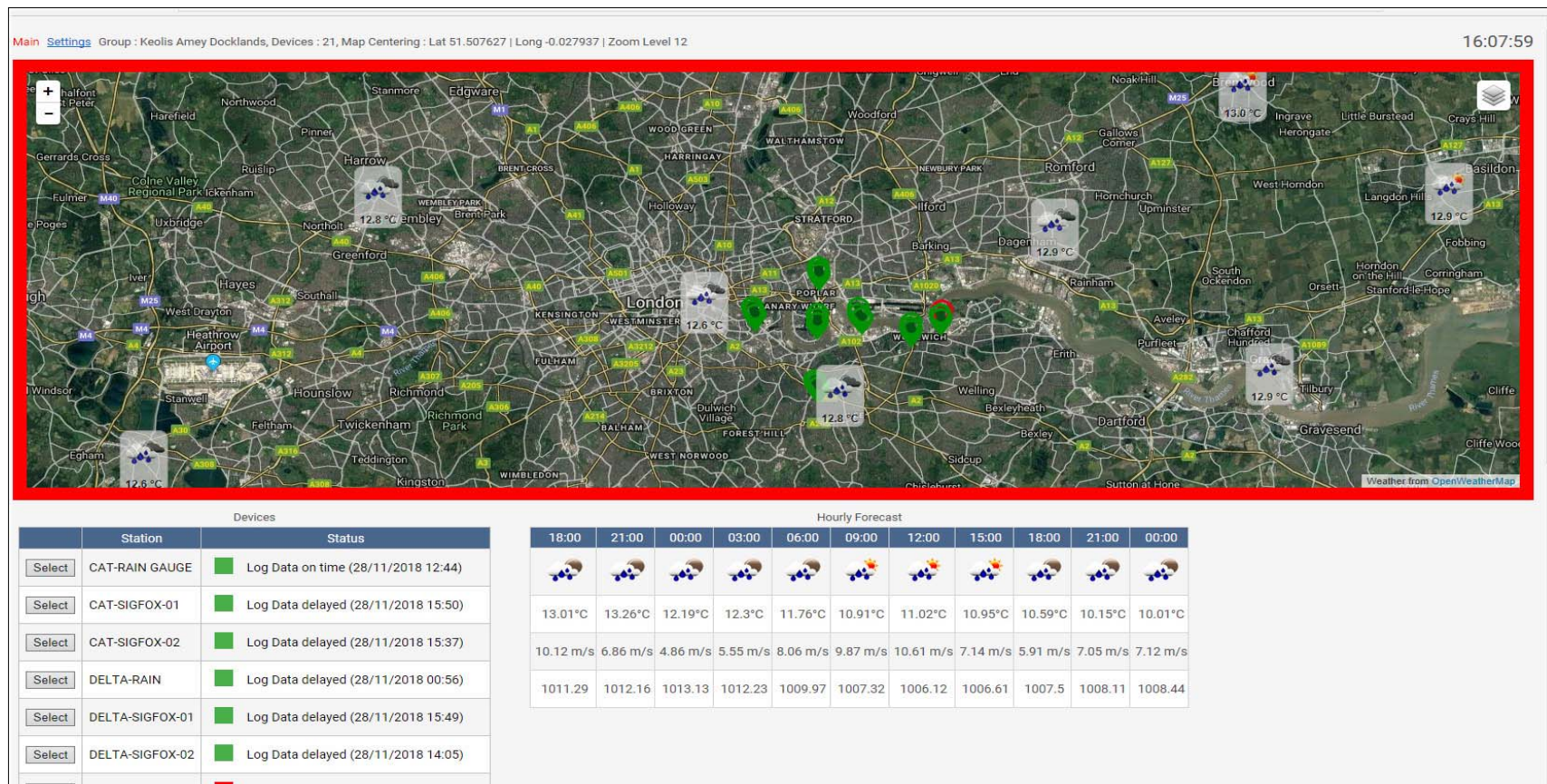
#	Status	Alarm	Group	Device ID	Device Name	Phone Number	Type	Latitude	Longitude	Zoom Level	Show
23/III	Active	22/I	309	B-267	+30698555376	BSC-50-E	40.613761	22.960675	12	Yes	
25/III	Active	22/I	310	B-49	+30698555378	BSC-50-E	40.611438	22.959543	12	Yes	
25/X	Active	23/I	311	B-10	+306979440747	BSC-50-E	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	0-3	+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	

Map View: The map shows a geographical area with numerous green location markers. The interface includes a search bar, a date selector (14/02/2017), and zoom controls. The map is titled "Map" and shows a detailed view of a coastal town area.



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 image displays the MSG software interface, which is used for configuring and managing SCADA tags. The main window shows a list of tags with columns for Tag ID, Tag Name, Device ID, Device, Channel ID, Channel, Tag Value, and Status. The tags are listed as follows:

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 tag list, there is a configuration window showing a tree view of the gateway configuration. The tree view includes the following items:

- Gateway
- ModemPools
- OPCServer
- TESTSQL
- XANTH(internal mdm)
- XANTH(S101)

The configuration window also shows a list of parameters with their values and types. The parameters are:

Name	Value	Type	Flags
ChannelsOfflineCounter	value=0 quality=0000 times=28Aug2018 12:08:04.880(A)	(SM)	N/A
ChannelsOnlineStatus	value=OFF quality=0000 times=28Aug2018 12:08:04.880(A)	(BOOL)	N/A
ChannelsOfflineSize	value=0 quality=0000 times=28Aug2018 12:13:26.897(A)	(SM)	N/A
ChnQueueExceededEventLimit	value=OFF quality=0000 times=28Aug2018 12:08:04.880(A)	(BOOL)	N/A
ChnQueueExceededWarningLimit	value=OFF quality=0000 times=28Aug2018 12:08:04.880(A)	(BOOL)	N/A
GatewayOnline	value=On quality=0000 times=28Aug2018 12:08:04.750(A)	(BOOL)	N/A
ModemUpdateRate	value=3/s quality=0000 times=28Aug2018 12:13:26.897(A)	(SM)	N/A
ModemPools	N/A		N/A

The interface also shows a SQL query window with the following query:

```
Execute: SELECT KEYWIM, TAG1_NAME, T...
```

The image also includes a photograph of a control room with a large wall-mounted display showing a complex SCADA system diagram. The control room is equipped with multiple workstations and monitors, and a person is visible sitting at one of the workstations.