0. CONTENTS

1. SAFETY PRECAUTIONS

Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit or other equipment associated with the system.

Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.

Do not use the device without the cover on.

Aonchip recommends using the original cables and accessories that are supplied with the device.

2. OVERVIEW

Nowadays water is becoming in one of the more appreciated substances in our planet. Climatic changes, growth of the worldwide population and extreme weather make we must to care water as a very important good.
Watersens is a smart irrigation controller able to manage several latch type electrovalves to save water for different types of applications as golf fields, parks, crops, etc

Figure 1. Watersens external appearance

Watersens is provided with LoRaWAN communication so it makes it possible to integrate in any platform based on this technology to change and monitor several parameters linked with the irrigation system.
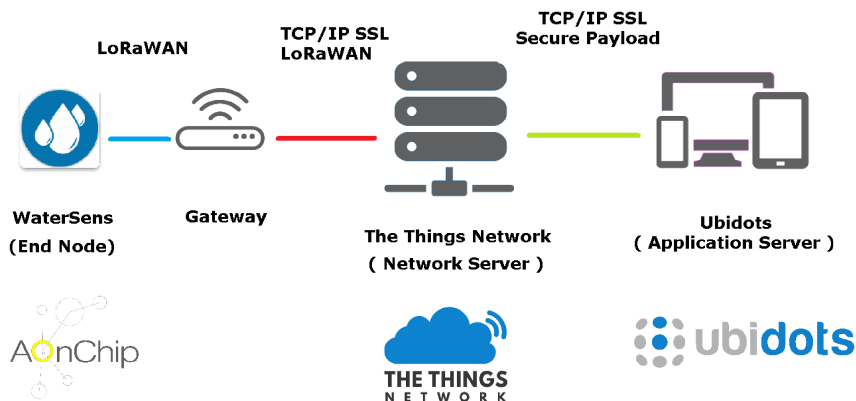

Figure 2. Example of LoRaWAN ecosystem

Watersens is also provided with NFC technology. It means the commissioning process can be carried out in an easy and safe way through any smartphone with NFC technology and using the app Watersens Tool.
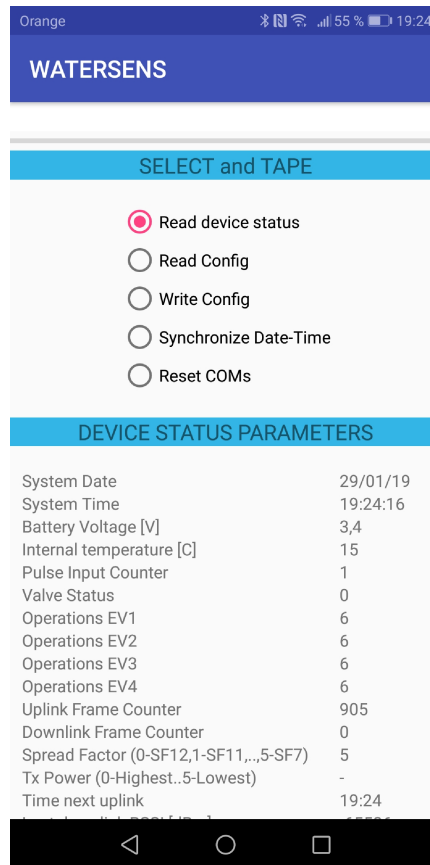
Figure 3. Status and configuration parameters can be obtained using the NFC technology in smartphones and Watersens Tool app

3. INSTALLATION
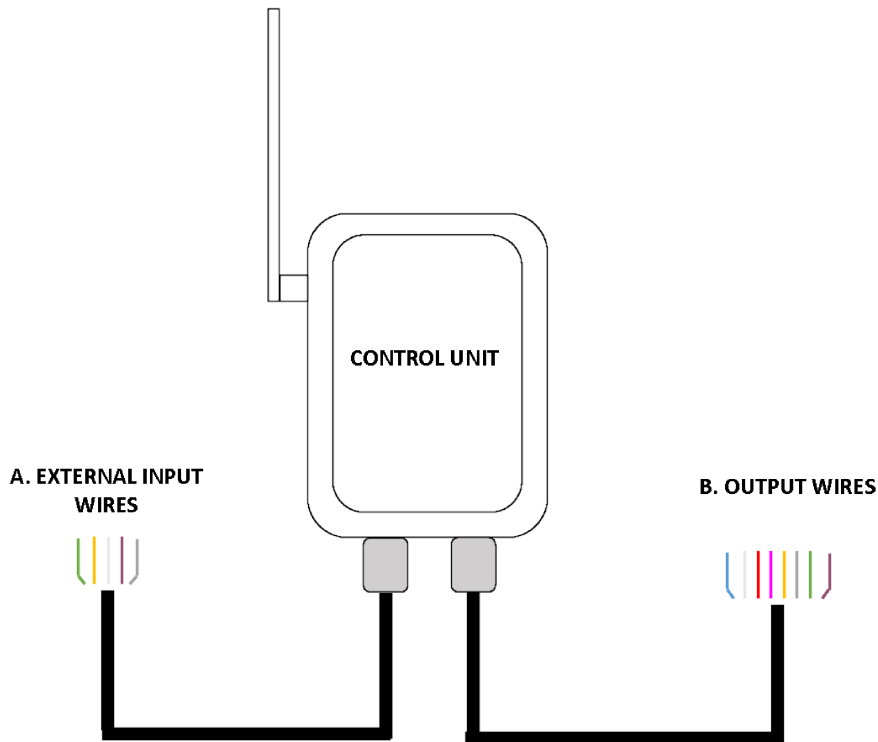
Connections

A. Sensors input wires (only for external input model)

A.1. Grey - External sensors supply (3.3V)
A.2. Brown - External Sensor temperature (analog signal - range 0..3.3V)
A.3. White - External pulse counter sensor (digital signal - 0..3.3V or potential free contact or to connect to open collector / drain output)
A.4. Yellow - External sensor humidity (analog signal - range 0..3.3V)
A.5. Green - Voltage reference GND

B. Electrovalve output wires (for all models)

Watersens is designed to be used with latch electrovalves. These devices require a short excitation pulse to open/close the valve to flow the water. Watersens applies a positive pulse to open the valve and a negative pulse to close it.

B.1. Brown - output electrovalve 1 - voltage A
B.2. Green - output electrovalve 1 - voltage B
B.3. Grey - output electrovalve 2 - voltage A
B.4. Yellow - output electrovalve 2 - voltage B
B.5. Pink - output electrovalve 3 - voltage A
B.6. Red - output electrovalve 3 - voltage B
B.7. White - output electrovalve 4 - voltage A
B.8. Blue - output electrovalve 4 - voltage B

Note:
To activate the electrovalve Watersens applies +9V or +12V (depending on model) in voltage A and 0V in voltage B.
To deactivate the electrovalve the polarity of the output voltage is inverted (0V in voltage A and +9V or +12V in voltage B)
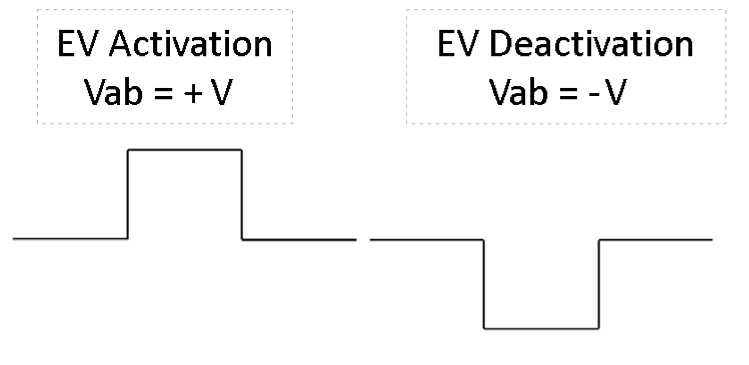
Figure 4.Output pulse waveform for electrovalve excitation

4. COMMISSIONING

First step is configure the equipment to register in the LoRaWAN network and define the irrigation timetable. By default LoRaWAN communication and irrigation parameters are the values used during manufacturing process to guarantee Watersens works correctly for delivering to final customer.

It is possible to modify the default parameters via any smartphone with NFC communication. Tapping the cellular over the front of the housing the values can be read and modified with application Watersens Tool.

NOTE 1

NFC communication is very selective. It means the NFC antennas of the smartphone and the Watersens must be aligned. Please check the position of the NFC antenna in smartphone to find the best match position. The figure below shows the position of the NFC antenna in Watersens.
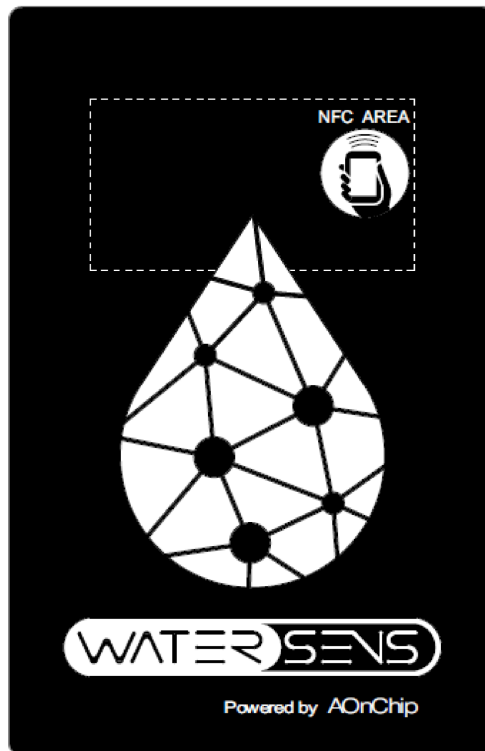
Figure 5. NFC antenna location - white dotted rectangle

NOTE 2

After manufacturing process Watersens is programmed in a deep sleep special mode. To wake up the Watersens from this mode only it is possible applying a NFC field (e.g. reading status or configuration via smartphone with Watersens Tool application). If this action is not performed Watersens will remain without activity.

4.1. Setting communication parameters

Understanding Watersens LoRaWAN profile class

Watersens can be integrated in a LoRaWAN network as a class A device. It means the device implements a bi-directional communication profile in which the data sent by server only can be received by the node after performing an uplink transmission. Is in this moment when the node opens two short downlink receive windows as it is shown in the figure below.
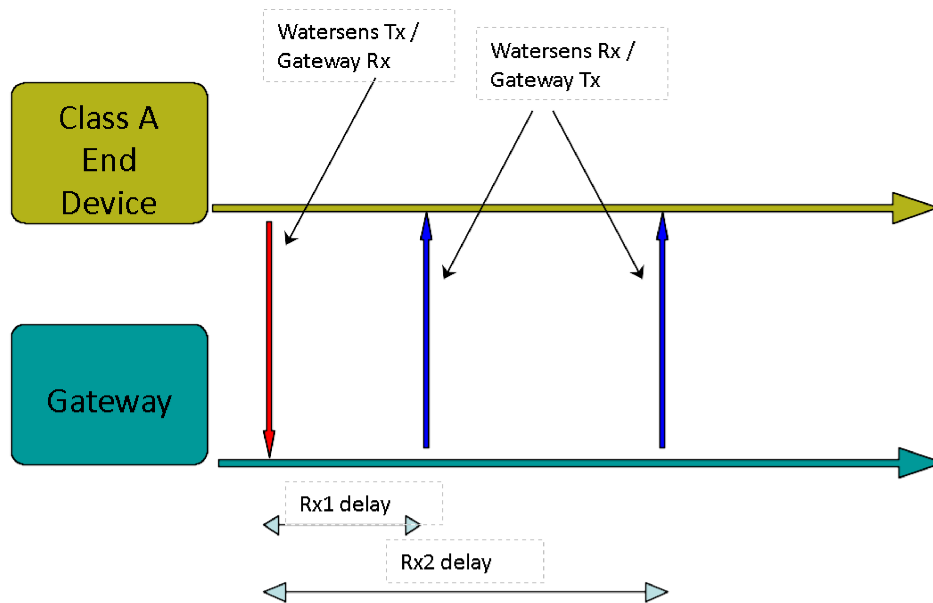
Figure 6. Uplink & Downlink diagram for a class A end device

This communication profile is the best option to preserve the life battery as it is the profile which the quantity of node transmissions are minimal.

Time to update status

Each 15 minutes Watersens checks if an irrigation operation must be performed. In case of any change, the new output status is transmitted to the gateway.

On other hand it is possible to force an interval transmission according to the time defined in time to update status parameter. The value can be from 0 to 100:

- 0 - minimum update time. Each 3 minutes a transmission is done. This value is recommended only to verify the communication or to accelerate the datarate adjustment in case of datarate adjustment by the network.
- 1...96 - number of 15 minutes lapses between forced transmissions carried out by Watersens (1: 15 minutes, 2: 30 minutes, ...)
- 100 - Watersens transmission only in case of output status change

Activation method

Watersens can be configured in 2 different methods depending on user preferences (security, band occupancy time, etc)

- **OTAA** (Over The Air Activation Method). Watersens receive a device address and an authorization token from which to derive sessions keys in combination with AppKey parameter after sending a JOIN request to the server. This method provide high level of security.
- **ABP** (Activation By Personalization). Sessions keys and device network address are predefined. Watersens doesn't send a JOIN request to server but the security level is lower than OTAA method.

Application EUI (AppEUI)

This parameter is used in OTAA method. It identifies the application during JOIN request. The length is 8 bytes.

Application KEY (AppKey)

This parameter is used in OTAA method. It encrypts data during the JOIN request. The length is 16 bytes.

Device Address (DevAddr)

This parameter is used in ABP method. It is the address in the Lora Network. The length is 4 bytes

Device EUI (DevEUI)

This parameter is used in ABP and OTAA method. The value cannot be modified (predefined in factory) and it is used to identify the device in Lora Network (it's unique for each device). The length is 8 bytes

Application Session Key (AppSKey)

This parameter is obtained automatically in OTAA mode, but must be defined by user in ABP mode. The Application Session Key encrypts data during transmission and other applications which can access to the network cannot see the content of messages. The length is 16 bytes.

Network Session Key (NwkSKey)

This parameter is obtained automatically in OTAA mode, but must be defined by user in ABP mode. The Network Session Key encrypts data during transmission and other networks cannot see the content of messages. The length is 16 bytes.

Adaptive Rate

Data rate can be adapted automatically by the network (AUTO) or can be adjusted in a fix value by the user (OFF).

Data Rate

This parameter is the speed at data which is transferred. It can be adjusted by user if adaptive rate is configured as OFF.
Depending on the region (EU868, US915 or AS923) the data rate takes different values.

EU868 and AS923 regions

DataRate	Configuration	Indicative physical bit rate [bit/s]
0	SF12 / 125kHz	250
1	SF11 / 125kHz	440

2	SF10 / 125kHz	980
3	SF9 / 125kHz	1760
4	SF8 / 125kHz	3125
5	SF7/125kHz	5470
6	SF7 / 250kHz	11000

US915 region

DataRate	Configuration	Indicative physical bit rate [bit/s]
0	SF10 / 125kHz	250
1	SF9 / 125kHz	440
2	SF8 / 125kHz	980
3	SF7 / 125kHz	1760
4	SF8 / 500kHz	3125
5:7	RFU	
8	SF12 / 500kHz	980
9	SF11 / 500kHz	1760
10	SF10 / 500kHz	3900
11	SF9 / 500kHz	7000
12	SF8/500kHz	12500
13	SF7 / 500kHz	21900

Tx Power
This parameter refers to EIRP (Equivalent Isotropically Radiated Power). The output power can be adjusted according to tables below depending on the region (EU868, US915 or US923).

EU868 and AS923 regions

TXPower	Configuration (EIRP)
0	Max EIRP
1	Max EIRP - 2dB
2	Max EIRP - 4dB
3	Max EIRP - 6dB
4	Max EIRP - 8dB
5	Max EIRP - 10dB
6	Max EIRP - 12dB
7	Max EIRP - 14dB

(*) By default Max EIRP is +16 dBm

US915 region

TXPower	Configuration (conducted power)
0	Max ERP
1	Max ERP - 2dB
2	Max ERP - 4dB
3	Max ERP - 6dB
4	Max ERP - 8dB
5	Max ERP - 10dB
6	Max ERP - 12dB
7	Max ERP - 14dB
8	Max ERP - 16dB
9	Max ERP - 16dB
10	Max ERP - 10dB

(*) By default Max ERP is +20 dBm

Tx Port
Watersens port for data transmission. Values from 1 to 223

Rx Port
Watersens port for data reception. Values from 1 to 223

4.2. Irrigation parameters settings

Setting the pulse duration
The pulse duration is defined in ms. The default value is 20ms and it can be modified at 200ms as maximum.

Must be considered that higher is the pulse duration higher will be the power consumption.

Valve output enable
If it is necessary and to preserve the battery life, it is possible to enable and disable the activation of the outputs. Each output can work in independent way.

Timetable irrigation identifier
To reduce the datalength of the communications between endnode and server it is necessary to assign a identification number to the timetable (from 0 to 65535). This parameter will be sent instead of the complete irrigation plan.

Setting the timetable
The timetable is defined along the day (24h) and it is divided in 15 minutes slots. This is the minimum time to carry out an irrigation operation. The number of operations is unlimited.

4.3. Checking the setup and establishing first communication

Once the equipment has been installed and the configuration parameters has been programmed according to user requirements, Watersens is ready to send and to receive data from server.

In most cases the coverage of the network is unknown and it depends on distance and relative height between node and gateway, the size and the quantity of obstacles in line transmission (as buildings), climatic conditions, etc. To ensure the success of data transmissions is recommended to initialize the Watersens communications at minimum data rate and maximum transmission power using the mobile application option «Reset COMs». On other hand configuring «Time to update status» at value 0 also is recommended to increase the quantity of transmissions performed by the equipment (each 3 minutes).

If adaptive data rate is configured as auto (network controls the data rate of the Watersens) after several communications, server and node will adapt the data rate to the value which the occupation of the band and the power transmission of the node will be lowest. In this case and if it is not necessary, user can modify the «Time to update status» to lower value to save energy from battery.

Finally to proceed the irrigation task properly, is necessary to configure date and time. These settings can be adjusted through Lora commands as can be chapter «Data frame format».

5. OPERATION

Watersens is a smart electrovalve controller which is powered by batteries. To preserve the battery life, it is very important to reduce the power consumption when equipment is not carrying out any task, therefor the Watersens enters in deep sleep mode.

Watersens exits from deep sleep mode if internal alarm wakes up the equipment or if it is detected a NFC signal.

5.1. Internal alarm wakeup

Watersens wakes up each 15 minutes matching with quarter hour (XX:00, XX:15, XX:30 and XX:45) with a random time deviation from 0s to +10s. This random time is performed by the control unit to avoid possible collisions for uplinks from different Watersens units.

After waking up Watersens carries out several tasks:
- Measures battery voltage
- Measures internal temperature
- Performs an irrigation operation if it is scheduled according to timetable for each electrovalve and updates valve cycles counters
- Reads external inputs (depending on the model)
- If it is scheduled sends device status and receive data from server
- Check if it is the end of the day (00:00h) to update in EEPROM counters (electrovalve operations, frame counters, etc),

All these tasks takes 30 seconds

5.2. NFC signal detection

When a NFC field is detected, Watersens wakes up and checks if it is received any command from mobile application. Commands available are:
- Read status parameters
- Read memory configuration (communication and irrigation parameters)
- Write memory configuration (communication and irrigation parameters)
- Time and date synchronization
- Initialize communications

When the NFC field disappears Watersens enters again in deep sleep mode.

6. DATA FRAME FORMATS

6.1. UPLINK 00 (NODE → SERVER – Device Status).

byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11
tf	**te**	**mv**	**ee**	**em**	**es**	**hh**	**mm**	**ss**	**ti_hi**	**ti_lo**

tf. Type of uplink frame (00 - Watersens status)

te. Temperature in ºC (data type 8 bits signed)

mv. microcontroller voltage supply in volts x10 (data type 8 bits). Examples:
- Voltage OK (>2.9V) - **te** = 33 means 3.3V
- Low battery (<2.9V) - **te** = 28 means 2.8V

ee. Electrovalve enable. Parameter which contains the flags to know if valves are enabled (variable type mask). Examples:
> 0x01 – EV1 enabled
> 0x02 – EV2 enabled
> 0x04 – EV3 enabled
> 0x08 – EV4 enabled
> 0x0F - All enabled

em. Electrovalve control mode. Parameter which contains the flags to know if valves are controlled in manual way or they work according to irrigation schedule (variable type mask). Examples:
> 0x01 – EV1 in manual mode
> 0x02 – EV2 in manual mode
> 0x04 – EV3 in manual mode
> 0x08 – EV4 in manual mode
> 0x0F - All in manual mode
> 0x00 - All valves in auto mode

es. Electrovalve status. Parameter which contains the flags to know the status of the valves (variable type mask). Examples:
> 0x01 - EV1 ON.
> 0x02 - EV2 ON.
> 0x04 - EV3 ON.
> 0x08 - EV4 ON.
> 0x0F - All ON
> 0x00 - All OFF

hh. Hour in time format in 24H

mm. Minutes

ss. Seconds

ti_hi-ti_lo. Timetable identification. To avoid long transmissions sending the irrigation timetable of all valves, user can assign a code during setup process to identify the irrigation programmed in Watersens. This code will be included in the status uplink frame to know what is the current irrigation schedule.
> Example - ti_hi = 01
> ti_lo = 05
> table_identifier = 1*256 + 5 = 261

6.2. UPLINK 01 (NODE → SERVER – Irrigation programming)

After receiving from server the command requesting the irrigation schedule for a valve, Watersens will perform in 3 minutes an uplink with this info. The format of the payload is described below

byte 1	byte 2
tf	**er**

byte 3	byte 4	byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14
rr1	**rr2**	**rr3**	**rr4**	**rr5**	**rr6**	**rr7**	**rr8**	**rr9**	**rr10**	**rr11**	**rr12**

tf. Type of uplink frame (01 - irrigation schedule info)

er. Electrovalve schedule requested. This parameter contains the identifier number of valve of which irrigation schedule info is required

rr1..rr12 Timetable in bytes.
    Each bit is a slot of 15 minutes.
    Each byte is a slot of 2 hours.

Timetable examples

Irrigation from 00:15 to 00:30 and from 21:00 to 21:45

byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14	byte 15	byte 16
0x02	0x00	0x00	0x30	0x00	0x00	0x00	0x00	0x00	0x00	0x70	0x00

Irrigation from 07:00 to 07:30 and from 20:30 to 21:00

byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14	byte 15	byte 16
0x00	0x00	0x00	0x30	0x00	0x00	0x00	0x00	0x00	0x00	0x0C	0x00

 (*) REMARKS

· Take into account the length of this uplink frame in some regions in combination with low data rate (DR) are not allowed. Example, in US915 for DR0 the maximum payload length is 11. It is necessary a higher DR to allow Watersens send this uplink frame successfully.

6.3. DOWNLINK 01 (SERVER → NODE – Irrigation programming)

byte 1	byte 2	byte 3	byte 4
tf	**ti_hi**	**ti_lo**	**ev**

byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14	byte 15	byte 16
rr1	**rr2**	**rr3**	**rr4**	**rr5**	**rr6**	**rr7**	**rr8**	**rr9**	**rr10**	**rr11**	**rr12**

tf. Type of downlink frame (01 - Update irrigation schedule)

ti_hi-ti_lo. Timetable identification. To avoid long transmissions sending the irrigation timetable of all valves, user can assign a code to identify the irrigation programmed. This code will be included in the status uplink frame to know what is the current irrigation schedule

> Example - User defines identifier code 3 for the irrigation
> > ti_hi = 00
> > ti_lo = 03
> > table_identifier = 0*256 + 3 = 3

ev. Electrovalve to be updated. This parameter contains the flags to indicate the valves which will be programmed with schedule defined in rr1-rr12 bytes. Examples:
> 0x01 – EV1.
> 0x02 – EV2.
> 0x04 – EV3.
> 0x08 – EV4.
> 0x0F – All valves programmed with the schedule

rr1..rr12 Timetable in bytes.
> Each bit is a slot of 15 minutes.
> Each byte is a slot of 2 hours.

Timetable examples

Irrigation from 00:15 to 00:30 and from 21:00 to 21:45

byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14	byte 15	byte 16
0x02	0x00	0x00	0x30	0x00	0x00	0x00	0x00	0x00	0x00	0x70	0x00

Irrigation from 07:00 to 07:30 and from 20:30 to 21:00

byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14	byte 15	byte 16
0x00	0x00	0x00	0x30	0x00	0x00	0x00	0x00	0x00	0x00	0x0C	0x00

(*) REMARKS

· After receiving the new schedule, it will be will be applied 3 minutes later and Watersens will perform an uplink type 00 (device status) to notify the change.

· Take into account the length of this downlink frame in some regions in combination with low data rate (DR) are not allowed. Example, in US915 for DR0 the maximum payload length is 11. It is necessary a higher DR to send this downlink frame successfully.

6.4. DOWNLINK 02 (SERVER → NODE – Mode control and status for valves)

byte 1	byte 2	byte 3
tf	**em**	**es**

tf. Type of uplink frame (01 - mode control and status for electrovalve outputs)

em. Electrovalve control mode. Parameter which contains the flags to program valves in manual mode or in auto mode according to irrigation schedule (variable type mask). Examples:

> 0x01 – EV1
> 0x02 – EV2 enabled
> 0x04 – EV3 enabled
> 0x08 – EV4 enabled
> 0x0F - All enabled

es. Electrovalve status. Parameter which contains the flags to know the status of the valves (variable type mask). Examples:

> 0x01 - EV1 ON.
> 0x02 - EV2 ON.
> 0x04 - EV3 ON.
> 0x08 - EV4 ON.
> 0x0F - All ON
> 0x00 - All OFF

 (*) REMARKS

· After receiving the command, it will be will be applied 3 minutes later and Watersens will perform an uplink type 00 (device status) to notify the change.

6.5. UPLINK 03 (NODE → SERVER – Confirmation of uplink period)

After receiving from server the command programming the time slot between uplinks, Watersens will perform in 3 minutes an uplink to confirm the new setup. The format of the payload is described below

byte 1	byte 2
tf	**up**

tf. Type of frame (03 - Confirmation uplink time period)

up. Value configured. Possible values:
- 0 - 3 minutes between uplinks (commissioning purpose)
- 1..96 - multiple of 15 minutes time slots between uplinks
- 100 - uplinks only performed when outputs status have changed. Transmission not forced

Example - confirmation of 3 minutes between uplinks

tf = 03 / **up** = 00 - Payload: **03 00**

6.6. DOWNLINK 03 (SERVER → NODE – Configure Uplink period)

byte 1	byte 2
tf	**up**

tf. Type of frame (03 - Configure uplink time period)

up. Parameter to configure the slot time between uplinks. Values:
- 0 - 3 minutes between uplinks (commissioning purpose)
- 1..96 - multiple of 15 minutes time slots between uplinks
- 100 - uplinks only performed when outputs status have changed. Transmission not forced

Example - configure 30 minutes as slot time between uplinks

time = 2 * 15 = 30 minutes

up = 02

6.7. DOWNLINK 04 (SERVER → NODE – Time and date update)

byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7	byte 8
tf	**hh**	**mm**	**ss**	**ww**	**dd**	**rr**	**yy**

tf. Type of frame (04 - Uplink configuration for time and date)

hh. Hours (Time in format in 24H)

    Example
            11:00 AM - **hh** = 11
            11:00 PM - **hh** = 23

mm. Minutes

ss. Seconds

ww. Day of the week
        01 – Monday
        02 - Tuesday
        …
        07 –Sunday

dd. Day of the month (1..31)

rr. Month of the year
        01 – January
        02 – February
        …
        12 –December

yy. Two last dates of the year

    Example
            2018 - **yy** = 18

(*) REMARKS

· After receiving the command, the new date and time will be applied immediately and 3 minutes later Watersens will perform an uplink type 00 (device status) to notify the change.

6.8. UPLINK 05 (NODE → SERVER – LoRaWAN Network status)

After receiving from server the command requesting the network status seen from the device side, Watersens will perform in 3 minutes an uplink with this info. The format of the payload is described below

byte 1	byte 2	byte 3	byte 4	byte 5
tf	**ri**	**sn**	**dr**	**tp**

tf. Type of uplink frame (05 - network status uplink)

ri. RSSI of the last link received by Watersens in dBm data (data type 8 bits signed)

sn. SNR of the last link received in dB data (data type 8 bits signed)

dr. Data rate adjusted in Watersens (for more detail according to the region see data rate table in setting communication parameters)

tp. Tx Power adjusted in Watersens (for more detail according to the region see data rate table in setting communication parameters)

6.9. DOWNLINK 05 (SERVER → NODE – Next data requested for uplink)

By default Watersens performs uplinks with the status parameters of the device. If it is needed another type of info, it could be requested with the downlink specified below

byte 1	byte 2	byte 3
tf	**nu**	**ev**

tf. Type of frame (06 - Next data requested for uplink)

nu. Data Type for next uplink:

- 00 - Watersens parameters status
- 01 - Irrigation schedule schedule of the electrovalve specified in **ev** byte
- 03 - Uplink period
- 05 - LoRaWAN Network status

ev. Electrovalve requested (only necessary to request irrigation schedule)

Examples

· To know the network status, send to Watersens the downlink payload

(**tf** = 06 / **nu** = 05 / **ev** not required) - **06 05**

· To know the irrigation schedule of electrovalve connected to output 2, send to Watersens the downlink payload

(**tf** = 06 / **nu** = 01 / **ev** = 02) - **06 01 02**

(*) REMARKS

· After sending the requested data (different from device status), the Watersens will send again the device status

7. TROUBLESHOOTING

Problem	Cause → Solution
Device doesn't work	· Low battery or defective batteries → Replace batteries · Wrong battery replacement → Ensure battery polarity · Watersens in deep sleep mode → Tap the Watersens with a smartphone with NFC interface enabled. The device should detect the NFC signal and it should to enter in running mode
Electrovalves don't work according to timetable	· Wrong irrigation parameters configured → Review timetable, ensure valve outputs are enabled and check time and date. Verify electrovalve activation time is correct. · Wrong solenoid connection → Check the output valve signals are properly connected to open/close electrovalve
Watersens cannot be commissioned by app	· NFC is not enabled in smart phone → Enable NFC communication through settings · Access code has not been entered before any read/write operation → Enter access code and check mobile can read status and configuration parameters
Watersens cannot send uplink frames	· Wrong communication parameters configured → Review all RF parameters and apply correct settings. · Data rate and transmission powers are not correct → Configure Data Rate parameter as AUTO and apply a reset in communication module via Watersens Tool. This action will initialize communication settings in maximum power transmission and lowest data rate to ensure maximum network coverage

8. MAINTENANCE AND TECHNICAL SERVICE

If the device is going to be switched off for a long time it is recommended to configure the LoRaWAN Parameter Time to update status as 100 (only transmission when a change occurs in vale outputs) and to program the irrigation timetable without any operation. In this way the current consumption is minimum and battery life is preserved.

In case of battery replacement, replace them by batteries with same features (voltage, capacity, maximum output current, etc)

8.1.   Battery replacement procedure

1. Disconnect Watersens from external sensors and electrovalves

2. Remove screws from housing

3. Remove housing from the cover. Be careful with internal antenna cable and wire connectors

4. Remove old batteries from holders and put new batteries

5. Make all connections and ensure all well done.

6. Ensure the O-ring is placed correctly to avoid humidity inside the housing in wet environments.

7. Fit the housing and the cover and screw them

8. Date and time were lost. Configure time and date through downlink frame type 2 (time and date setup) or via NFC with Watersens app (select synchronize date-time)

9. TECHNICAL FEATURES

Power supply	
Type	2x Type C battery
Voltage	3.6V
Maximum pulse current	2500mA
Capacity	2x 6000mAh
Life expected	10 years (*)

(*) Conditions:
- 2 irrigation operations per day
- 1 latch electrovalve connected (9V - 2W coil activation)
- Data Rate 0 (SF12) TxPower 0
- No external sensors connected

Environmental features	
Operating temperature	-10ºC...+50ºC
Storage temperature	-20ºC...+60ºC
Air humidity	15...+90 %rH non-condensing

Mechanical features	
Dimensions (WHD)	110x150x40mm (without antenna)
Weight	320g
IP class	IP67
Housing material	ABS UL94 V-0

LoRaWAN communication	
LoRaWAN Specification	v1.0.2 (with Regional Parameters v1.0.2rB)
End device type	Class A
Frequency	EU863-870MHz ISM Band US902-928MHz ISM Band AS923MHz ISM Band
Maximum transmit power (dBm)	EU863-870MHz +14dBm US902-928MHz + 20dBm AS923MHz +16dBm
Sensitivity (dBm)	-136dBm
Antenna	1/2 Wave Whip SMA connector

NFC communication	
Frequency	13.56MHz
Interface	Passive NFC
Memory access	Read - allowed Write - res tinged with password

Internal sensor	
Housing temperature	Range: -20ºC...+60ºC Resolution: 0.5ºC

Inputs	
External temperature	Analog signal Range [0...3.3V] Protected against ESD
External humidity	Analog signal Range [0...3.3V] Protected against ESD
External water pulse counter	Digital signal Range [0...3.3V] or free potential contact Maximum frequency 1kHz Protected against ESD
Power supply	External sensors can be powered by Watersens. Voltage - 3.3V Maximum current consumption- 0,25 A Sensors will be powered only during measurement task

Outputs	
Number of electrovalves available	4
Output pulse activation voltage (Vab)	+9V or +12V (depending model)
Output pulse deactivation voltage (Vab)	-9V or -12V (depending model)
Protection	Protection against ESD and voltages peaks originated by solenoid switching
Maximum output current	1.2 A
Pulse duration	20ms...200ms
Maximum wire length recommended	2m

10. PRODUCT REGULATIONS

Watersens is a product in conformity with the following directives

RED Directive (2014/53/EU)		
EMC	Emissions EN 301 489-3 V2.1.	Radiated Emissions EN 55032
	Immunity EN 301 489-3 V2.1.	Electrostatic discharges EN61000-4-2 Radiated immunity EN61000-4-3
Radiospectrum efficiency	Short Range Devices operating on 25MHz to 1000MHz EN 300 220-2 V3.1.1	Radiated spurious
	Short Range Devices operating on 9kHz to 30MHz EN 300 330 V2.1.1	Radiated spurious (<30MHz) Permitted range of operating frequencies Operating frequency ranges Modulation bandwidth Transmitter H-filed requirements
RoHS Directive (2011/65/EU)		
	Evaluation EN50581	

11. TRADEMARKS

All referenced brands, product names, services names and trademarks are the property of their respective owners.

12. GUARANTEE

Aonchip guarantees its products against any manufacturing defect for two years after the delivery of the units.

Aonchip will repair or replace any defective factory product returned during the guarantee period.

Pay attention

• No returns will be accepted and no unit will be repaired or replaced if it is not attached a report indicating the defect detected or the reason for the return.

•The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. "Improper usage" is defined as any operating or storage condition not allowed in the national electrical code or that overcomes the limits indicated in the technical and environmental features of this manual.

• Aonchip accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or "improper usage" of the unit. Consequently, this guarantee does not apply to failures as: - Excessive temperatures; - Improper installation and/or lack of maintenance; - Buyer repairs or modifications without the manufacturer's authorization.

13. DOCUMENT HISTORY

Rev.	Date	Changes
A	30-Oct-2018	Preliminary version
B	05-Feb-2019	· Pictures updated · Modification in uplink frame type 01 according to new functionality
C	05-Mar-2019	· Contact information updated
D	04-Jun-2019	· Product pictures updated · Features updated with AS923 ISM Band
E	27-Sept-2019	· Added new uplink and donwlink frames according to new functionality

14. CONTACT INFORMATION

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For sales please send an email to: info@aonchip.com
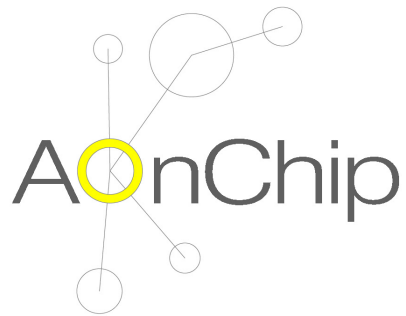
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