

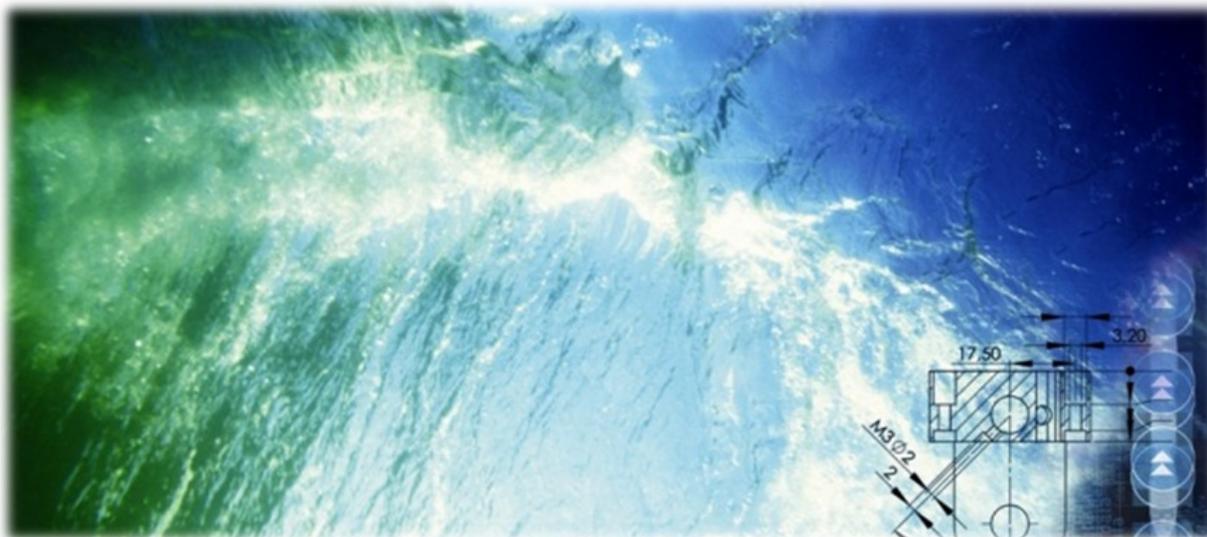
USER MANUAL

## Akvasmart Sensors

Oxygen - Temperature - Current tilt

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A	27.03.14	Second edition, with RDO Sensor	EBL	IL / PÅN
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## 1 Safety

Safety for the users of our equipment is top focus when AKVA group ASA develop new products and product manuals.

We therefor strongly recommend that everyone that use the equipment, all that perform any type of repairs, service or other maintenance to the product, and all that work in areas where the product is installed read this entire manual and at least this safety chapter.

This recommendation is based on both personnel safety as well as a desire to keep the products in order and avoid damages risked if the safety instructions are not followed.

### 1.1 Safety symbols used in the manual

The following symbols are used in this manual:



*Information*



*Important information*



**Show caution, danger of damaging equipment and mild injuries to personnel**

#### 1.1.1 Other symbols used in the manua



See chapter or page for more information or further instructions.

## 1.2 Receiving new equipment



Always check that the delivery is complete according to the service note. If the order is not complete or if any other errors are discovered, contact AKVA group immediately.

AKVA group ASA provides a 1 year warranty covering manufacturer's defects. The warranty is effective upon date of shipment to original recipient.

The following are reasons for a void of warranty:

- Poor treatment of the system due to negligence of preventive recommendations or from improper usage of power sources
- If the sensor units are opened without express **written** consent of an AKVA group employee

## 1.3 Plug caps



Always keep plug-caps safe after installing equipment. We recommend that all plug caps are kept in one, safe place inside the barge so that the caps are easy to locate when taking the equipment out of use for maintenance, repairs and similar tasks. To avoid moisture and salt water sprout in the connections, it is important to replace all plug caps to the EAP or the CSU as well as in cable ends immediately after removing the equipment.

## 1.4 Disinfecting the equipment



If equipment, cables, suspensions and other things that belong to this equipment is going to be moved from one site to another, it is decreeded by law to disinfect everything to prohibit contamination. We recommend rinsing everything with fresh water after disinfection, because the disinfecting medium may be corrosive to the equipment.

### 1.5 Cable



Make sure that the sensor cables are never twirled! Coil them according to instructions in chapter 7. Make sure that the cable is in order, without any tears or damages, when it is connected to power. The cable must not be used if it has any bends, tears or breaks.

To make sure that there is no tension to the cable when the sensor is in the water, and to avoid lifting the sensor by its cable, always use lifting ropes, one for each sensor. Instructions for these ropes are found in chapter 5.2.



### 1.6 Bad weather



Always make sure that all of the ropes and all of the equipment are ok after bad weather and storms. These may cause the ropes and cables to twirl, the equipment may to loosen, it may even cause damages to the equipment. Therefore, it is important to check that everything is in order after stormy weather. If anything is out of order or damaged, contact AKVA immediately.

## 2 Introduction



**This user manual is part of the equipment delivered with AKVAsmart sensors. Preserve the manual for as long as the equipment is being used, and make sure that all changes done to the equipment are being noted in this manual.**

Thank you for choosing AKVA group ASA as supplier for your sensor. Do not hesitate contacting us if you need more information regarding installation, use or maintenance for your product.

With four main brands, AKVA group ASA is a world leading supplier of technical aquaculture equipment. Since 1980 we have developed and produced fish farming equipment, both for cages at sea and for land based hatcheries. AKVA represents an industrial standard, which is presumed to be the key to the future. Research, project management, fast deliveries and customer follow-up have been our focus to ensure that we contribute to a positive development within the aquaculture industry. Our goal is to deliver the best possible and most cost efficient equipment in order to keep preserving sustainable farming.

We have a wide variety of products, for example: plastic and steel cages, high pressure washers, net washers, boats, feed barges, feeding systems, cameras, sensor systems, under water lighting, software for fish farming and recycling systems.

We practice continuous product development to improve the equipment's safety, functions, manner of operation and working reliability. This User Manual enables the operator to run and maintain the Akvasmart Sensors in a safe and economically way.

All of our equipment is pre-installed, tested and delivered from our own production department or from authorized collaborating companies.

Our production staff consists of people with great expertise and enthusiasm to produce the best possible products for you. Having our own production site gives you excellent service in case something should go wrong, or if you are in need of any assistance. We hold most of the parts for your equipment in stock, and our service staff is available on the telephone or on location in order to assist you if necessary.



**This entire manual and especially the safety chapter must be read and understood before commencing any work on the equipment.**

Prior to operating, repairing, performing maintenance or any other operations related to the sensor, we recommend that the personnel attend proper training by AKVA group ASA.

This manual must be read and maintenance must be performed as described to ensure reliable operation. The Operating manual will give answers to most of the day to day question and operating procedures.

## 2.1 Contact information

### **AKVA group ASA - Bryne (Head Office)**

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PO. Box 271  
4340 Bryne  
Norway  
tel. +47 - 51 77 85 00  
fax. +47 - 51 77 85 01

Support Hardware and AKVAconnect  
tel. + 47 - 51 77 85 03  
[supportakvasmart@akvagroup.com](mailto:supportakvasmart@akvagroup.com)

Support Fishtalk  
tel. +47 - 73 84 28 20  
[supportfishtalk@akvagroup.com](mailto:supportfishtalk@akvagroup.com)

### 3 Sensors

Controlling environmental data as temperature, oxygen level and current speed are important inputs when feeding fish. In the Akvasmart CCS Feed System, all these factors can be set to automatically control or adjust the feeding amount and its speed. All environmental data will be logged and can be used in further analyses either in AkvaControl or in Fishtalk.

Accurate real time measurements are shown and logged in the control program and AkvaControl will calculate expected daily feed amount based on feeding tables and invited sensor data.

The system can be wireless and signals are transferred between the cage edge (via CSU or EAP) and the base unit. Therefore, cables are only necessary from the cage edge and down to the sensors. Each cage may be adjusted individually, and the entire system is connected to the Akvasmart CCS Feeding System. The entire system is an aid for the feeding operators, so that they, with correct use of this system and AKVA's specifications, can optimize the feeding and thereby exploit full potential from the feed. This gives best possible growth and the lowest feed factor.

***Correct feeding is turnkey for  
achieving good fish breeding results***

***Excellent environmental conditions are  
a smart investment,  
that will improve the bottom line***

### 3.1 Current sensor

Two types of the current sensors:

- one measuring currents from 0-50cm/sec
- one larger sensor measuring currents from 0-100cm/sec



Current sensor, type	0-50 cm/sec	0-100 cm/sec
<b>Accuracy</b>	+/- 1 cm/sec	+/- 2 cm/sec
<b>Measurement range</b>	0-50 cm/sec (0-1 knots)	0-100 cm/sec (0- knots)
<b>Measuring principle</b>	Electronic tilt sensor	Electronic tilt sensor
<b>Materials</b>	Acrylic/POM/Aluminum	Acrylic/POM/Aluminum
<b>Power consumption</b>	75mA	75mA
<b>Cable</b>	30m polyurethane cable	30m polyurethane cable
<b>Plug</b>	Amphenol (water proof, potted plug)	Amphenol (water proof, potted plug)
<b>Max. depth range</b>	30m*	30m*
<b>Size - L x W x H</b>	165x165x200mm	165x165x200mm
<b>Weight</b>	5kg - 12kg**	5,3kg - 12,3kg**

\*Limited by cable length \*\* Including stainless steel stabiliser weight and cable

The Akvasmart Current sensor is one of several tools developed for the fish farming industry to optimize feeding and thereby cost benefits.

The current sensor is directly connected to the Akvasmart CCS Feeding System, and signals participate in regulating the feeding rate and amount. The sensor also contribute in preventing feed from being carried out from the cage before the fish gets the chance to eat it.

Sensors are placed strategically, and maximum current speed for feed termination as well as which cages are controlled by the specific sensor, is programmed. When the current exceeds this given limit, the feeding stops automatically in the specified cages, and starts again when current is back below the limit.

When the sensor is affected by currents, the angle changes like a pendulum. The angle is electronically measured and is converted to cm/sec (feeding limit is given in cm/sec).

The current sensor has no moveable parts. This gives it longevity and a minimum of maintenance.



A centre weight must be attached to the current sensor. See instructions in chapter 5.1 for more information.

### 3.2 Oxygen sensors



	<b>RDO Oxygen Sensor</b>
<b>Accuracy:</b>	+/- 0.1mg/L 0-8mg/L +/- 0.2mg/L 8-20mg/L +/- 10% 20-50mg/L
<b>Operating temp.range</b>	0-50°C (32-122 °F)
<b>Measurement range</b>	0-50 mg/L
<b>Measuring principle</b>	Optical luminescent
<b>Materials</b>	Polyethylene
<b>Power consumption</b>	50mA at 12 VDC
<b>Cable</b>	10m or 50m
<b>Plug</b>	Amphenol (water proof)
<b>Max depth rating</b>	210m (689') limited by cable
<b>Size - L x Ø</b>	203mm x 47mm
<b>Weight</b>	0,9kg with 10m cable

Oxygen sensors are one of several tools developed for the fish farming industry to optimize feeding and thereby the fish farms cost benefits. Oxygen is an important factor for growth and fish welfare. With this sensor connected to the feeding system, feed amount may be stopped when the waters oxygen level is too low. The RDO oxygen sensor is a robust and reliable membrane free sensor whose measurements are based on optical readings. This reduces the need for calibrations, gives high accuracy degree and can be used for long periods without loss of measurement accuracy.

Simple, regularly cleaning is all the only maintenance needed for this device. AKVA group's optical oxygen sensors have short response time and maintains stable, even in dynamically changing conditions.

The measurement principle is to send a blue modulated light through a foil and measure the reflected red light. The signal is then linearised and temperature compensated. This principle makes this sensor working in stationary water, no currents are necessary for correct oxygen measurements. Optical sensors react quickly to changes and stay stable even in dynamically changing conditions. The RDO Oxygen sensor stores all logged measurement information in the replaceable cap tip for one year at a time.

The tip holds a calibrated cap covering the sensor. This is fresh produce, and has an expiration date. After this expiration date (up to 12 months after installation), a new user code must be ordered and installed. Note the date for when the sensor is installed, and make sure to order a new code before the old one expires. **AKVA part no. for the code: 1000855**

### 3.3 Temperature sensor



<b>Resolution</b>	+/- 0,1 °C
<b>Accuracy</b>	+/- 0,5 °C
<b>Measurement range</b>	0-50 °C
<b>Housing materials</b>	Machined bronze
<b>Cable</b>	30m (100'), urethane cable
<b>Depth rating</b>	30m (100'), limited by cable
<b>Size - L x Ø</b>	80mm x 50mm (3.15" x 2")
<b>Weight</b>	3,5kg (7.7lbs) with cable
<b>Connection plug</b>	Amphenol waterproof plug (potted with epoxy)

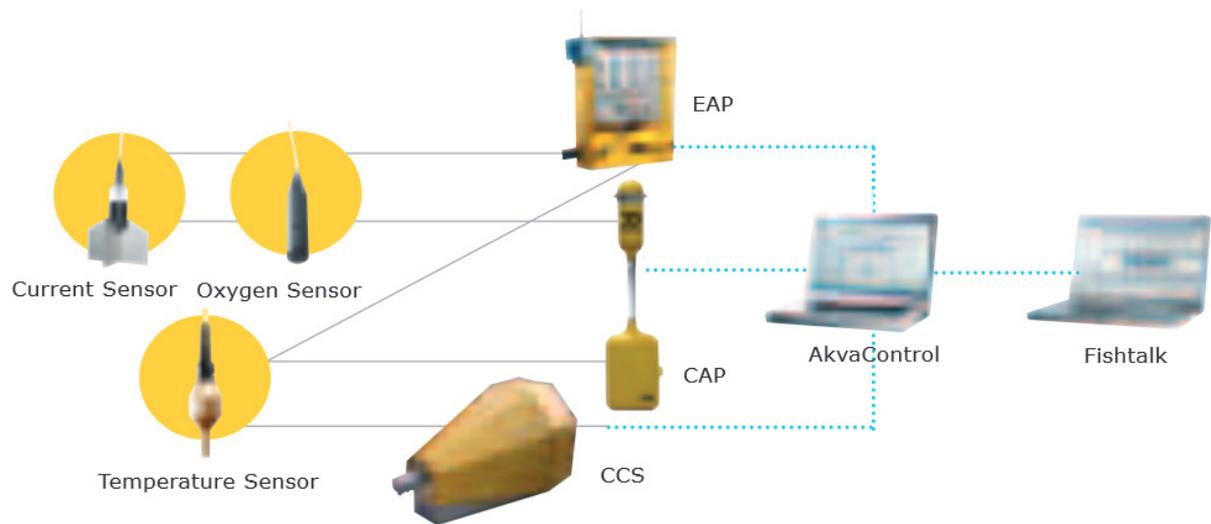
The Akvasmart temperature sensor is the foundation for all feeding regimes and growth tables. It is a robust and reliable sensor made to measure temperatures at different depths. The real time measurements are continuously shown on the surveillance computer screen and are logged in Akvacontrol.

With temperature measurements and integrated feed and growth tables, Akvacontrol calculate expected daily feed. This is a good estimate for setting up the feeding.

Sensor may be connected to the wireless system via CSU to an environment station (EAP) or directly to the selector in the feeding system.

Akvasmart temperature sensors are produced in bronze, which prevents sprout and gives minimal maintenance, and also gives quick response to temperature changes.

## 4 Flow diagram for sensors



*The temperature sensor can also be connected directly to a CCS Feeding system.*

## 5 Installation and suspension

### 5.1 Current sensor

Before the current sensor is placed in the water, the weight needs to be attached about 100cm from the cable coupling. Use the Unbraco keys and make sure that it is properly attached.

### 5.2 Oxygen sensor

Before installing the oxygen sensor, write down the date of installation, so that new code for the cap is ready for use when the old one expires.

### 5.3 All sensors



All sensor cables have to be attached to ropes before launched in the water to avoid stretch and tension to the cable when raising them out from the water. Fasten the lifting ropes to the cable as close to the sensor as possible, using a rolling hitch.

Mark the lifting ropes with knots, pieces of tape or other water proof markers for every or every other meter to manually indicate the sensors depths. This can also be marked on the cable, however **NOT** with knots!

When all these preparations are executed, launch the sensors in desired depth in- or outside of the cages or by the barge.

## 6 Power supply

The sensors are connected to either CSU or EAP for transfer of power and signals.



The sensor cables have their own plug caps attached to the cable ends. Make sure that these connections never break, in order to have full control of the caps whereabouts.

If the connections should be loosened from the cable and the cable-input in CSU and EAP has to be taken care of by the site personnel, so that they can be replaced when the sensors are taken away from the cage area.



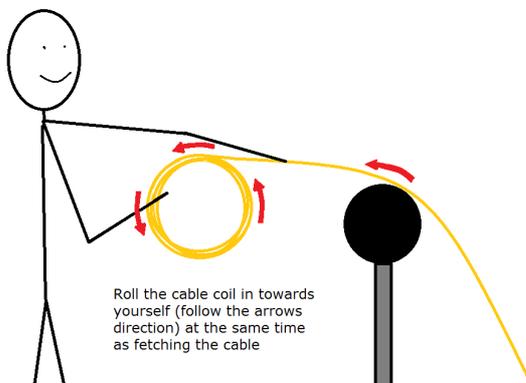
We recommend collecting all loose plug caps together in a safe place in the barge.

## 7 Handling the cable

When the sensor cables are coiled, it is important not to twirl them. These cables do not tolerate any twirling.



**Do not coil a sensor cable up like a rope, but follow these instructions:**



- 1 Make a loop and fasten the loop with strips or something similar
- 2 Roll the coil around this loop
- 3 If twines appear, the entire coil must be rotated. This way you avoid twirling to the cable, and this also leads to prolonged operating time for the cable
- 4 If you end up with excessive cable after launching the sensor in the water, fasten the coil with tape or strips and hang it to the cage edge and out of the walking path around the cage.



Make sure that the attaching lifting ropes are long enough to avoid stretching the cables when suspending them.

## 8 Maintenance

The sensors are maintenance free, but we recommend checking and wiping them off regularly in order to achieve correct measurements. When the temperatures are high and in brighter seasons, cleaning off sprout will be necessary more often. Clean the sensor with a moist cloth or a soft brush, to avoid scrapes in the sensors materials.

We recommend taking the sensors out of the water once a month to check both the sensor and the cable thoroughly for external damages.

### 8.1 Daily inspection

- control the ropes and suspensions that are attached to the sensor for tearings and wearings
- control that the cable hangs free and is not exposed to gnawing
- check all equipment and suspensions during and after periods of bad weather



*Add these daily routines into a daily maintenance form along with other daily maintenance routines.*

### 8.2 Weekly inspection and maintenance

- weekly cleaning of the sensors during bright and warm seasons (sprout-season)
- shells, barnacle and similar has to be removed in order to maintain correct measurements
- control suspensions and lifting ropes
- oxygen sensor: clean the sensor measurement window very gently with a soft, moist cloth or a soft brush

### 8.3 Monthly inspection and maintenance

- Control and check all suspensions and ropes thoroughly
- Control cable thoroughly. If any wear and tear is discovered, find the cause for this and hang the cable in a way that avoids further tearings. If there is any risk of breakage, contact AKVA for a cable change
- Control the sensors cable strain relief
- In case of corrosion detection, contact AKVA immediately!

### 8.4 Recommended maintenance plan

Parameter	Daily	Weekly	Monthly	Comments
Check ropes for tearings	X			
Check that the cable hangs freely	X			
Clean sensor		X		
Remove shells, barnacle etc.		X		
Check lifting ropes thoroughly		X		Place ropes somewhere else if gnawing occurs, change rope if necessary
Control the power cable			X	Place cable somewhere else if gnawing occurs. Change power cable if necessary
Control lifting rope			X	
Control sensors for corrosion			X	Contact AKVA in case of corrosion

## 8.5 Maintenance plans

### 8.5.1 Instructions



ALWAYS make copies of the maintenance forms!



Use one form per sensor.

Fill in:

- week number in the daily maintenance forms
- name of the month in the weekly forms
- correct year in the monthly maintenance forms

This is important in order to maintain regularly maintenance.

After each task is performed, sign with your initials in the correct box.

Make copies of the next two pages and keep these copies in a maintenance binder. It may be smart to mark the last copy with a note that says "This is the last copy, make more before using this" in order to always have access to at least one copy.

**8.5.2 Daily maintenance for \_\_\_\_\_ sensor** (fill in correct type)



*Make copies of this form before filling **anything** in.  
Use one form per sensor.*

<b>Week_____</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>
Check ropes for tearings							
Check that the cable hangs freely							

<b>Week_____</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>
Check ropes for tearings							
Check that the cable hangs freely							

<b>Week_____</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>
Check ropes for tearings							
Check that the cable hangs freely							

<b>Week_____</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>
Check ropes for tearings							
Check that the cable hangs freely							

<b>Week_____</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>
Check ropes for tearings							
Check that the cable hangs freely							

<b>Week_____</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>
Check ropes for tearings							
Check that the cable hangs freely							

**8.5.3 Weekly maintenance for \_\_\_\_\_ sensor** (fill in correct type)



*Make copies of this form before filling **anything** in.  
Use one form per sensor.*

Month_____	Week__	Week__	Week__	Week__
Clean sensor, remove sprout, shells and similar				
Check lifting ropes thoroughly				

Month_____	Week__	Week__	Week__	Week__
Clean sensor, remove sprout, shells and similar				
Check lifting ropes thoroughly				

Month_____	Week__	Week__	Week__	Week__
Clean sensor, remove sprout, shells and similar				
Check lifting ropes thoroughly				

Month_____	Week__	Week__	Week__	Week__
Clean sensor, remove sprout, shells and similar				
Check lifting ropes thoroughly				

Month_____	Week__	Week__	Week__	Week__
Clean sensor, remove sprout, shells and similar				
Check lifting ropes thoroughly				

**8.5.4 Monthly maintenance for \_\_\_\_\_ sensor (fill in correct type)**



*Make copies of this form before filling **anything** in.  
Use one form per sensor.*

Year_____	Jan	Feb	Mar	Apr	May	Jun
Check power cable thoroughly						
Change lifting ropes if necessary						
Control sensor for corrosion						

Year_____	July	Aug	Sept	Oct	Nov	Dec
Check power cable thoroughly						
Change lifting ropes if necessary						
Control sensor for corrosion						

Year_____	Jan	Feb	Mar	Apr	May	Jun
Check power cable thoroughly						
Change lifting ropes if necessary						
Control sensor for corrosion						

Year_____	July	Aug	Sept	Oct	Nov	Dec
Check power cable thoroughly						
Change lifting ropes if necessary						
Control sensor for corrosion						

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## Appendix B - Deviation form



*Make copies of this form before filling **anything** in.  
Use one form per sensor.*

<b>Deviation control nr.:</b>	
-------------------------------	--

Unit:	Producer:	Prod.no.:	Purchase year:

<b>Deviation description:</b>
-------------------------------

--

<b>Follow up proposition:</b>
-------------------------------

--

<b>Date and signature, declarer:</b>
--------------------------------------

--

<b>Follow up directed:</b>
----------------------------

--

<b>Status:</b>
----------------

--

<b>New action for deviation no.:</b>
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--

<b>Date and signature, follow up:</b>
---------------------------------------

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