

IDSL Installation Guide

v. 1.0

1 Introduction

The objective of this guide is to explain the best sequence of operation for successfully install and put in operation one Inexpensive Device for Sea Level measurements (IDSL). The guide is the result of the installation of at least 5-6 instruments in various conditions. Reading the guide may help to have a better preparation and solve problems before they appear. Nevertheless, a degree of “improvisation” is always necessary because each installation site is different from another and specific solutions are necessary.

The installation foresees that a preliminary survey analysis is carried out in advance in order to identify the right location for the installation which requires a number of points to be fulfilled:

- 1 the location should be easily accessible in case of necessity
- 2 the device must be installed with the sensor that is looking the sea level vertically below the sensor
- 3 the distance between the sensor and any obstacle around must be at least 1 m
- 4 the water depth below the sensor needs to be at least 1.5 m at the minimum tide level
- 5 the location must have a good GPRS connection (3g or 4g)
- 6 the area below the sensor should be kept free all the time
- 7 the installation has to be as close as possible to the open sea water to avoid delay in the hydraulic signal
- 8 Security of the place should be guaranteed as much as possible: an installation in a completely isolated place could result in potential vandalism or robbery

Two basic type of installation can be performed

- With installation of a solar panel (independent installation)
- With external electrical power

Some activities are similar for both cases, some are specific

	Activity	With installation of solar panel	With external electrical power
1	Pole installation	Yes, long pole	Yes, short pole
2a	Solar panel	Yes	No
2b	Position long cable to AC source	No	Yes
3	Arm installation on pole	Yes	Yes
4	SIM card inclusion in Router and configuration	Yes	Yes
5a	Control and battery module installation	Yes	No
5b	AC power adapter installation	No	Yes

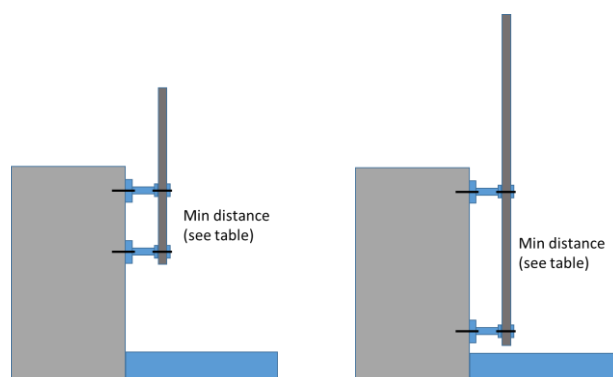
6	Wires connection	Yes	No
7	Wind tension wires	Yes	Yes
8	Switch on and checking	Yes	Yes

2 Pole Installation

The pole installation is the most important because all the devices are then attached to the pole. So it is necessary to select a right solid vertical wall onto which the pole with its mounting supports are fixed. The distance between the two supports should be as large as possible compatibly with the vertical wall characteristics. As high is the distance as low is wind induced oscillation of the pole that is then necessary to counteract with tenso wires.

The following indications should followed, if possible:

Pole length	Min Distance between supports	
1.5 – 2 m	1-1.8 m	Case of AC power available, no solar panel necessary
3.5-4.0 m	1.5-1.8 m	Normal distance for Solar Panel
4.0-5.0 m	2.0-2.5 m	Extended height to rise the Solar Panel



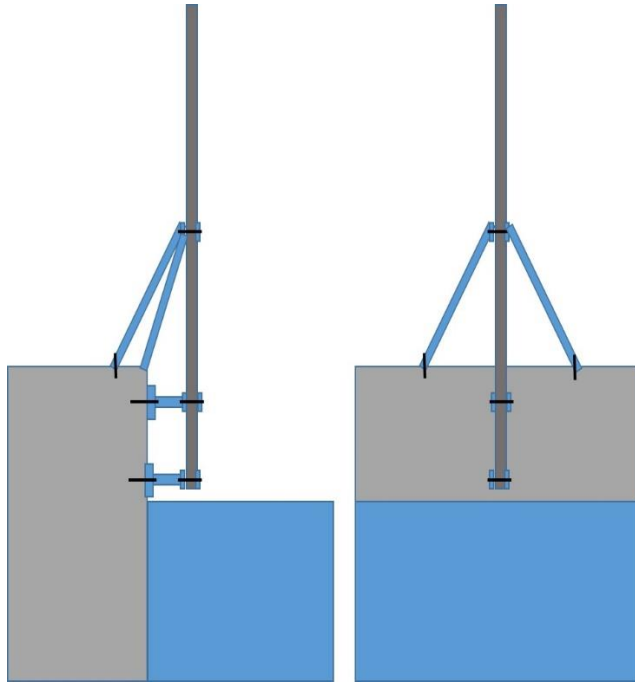
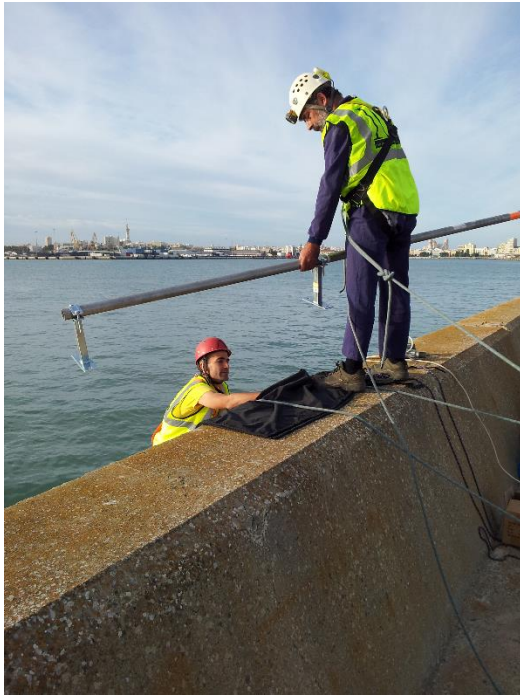
Once identified the right vertical wall that allows the fixing of the supports with their minimum distance, it is usually necessary to involve specialized personnel (Fire Fighters or Mountain specialists) that will work appended outside the vertical wall to drill and fix the supports.

The best practice would be to fix first the upper support, then append the pole with only one support in order to find the right vertical position and then fix the lower support. This procedure however is not practical because once the first two holes are prepared with the chemical paste, the same becomes quickly solid and thus it is necessary to change to injection plastic pipe that cannot be re-used after 5-10 min.

The normal practice is therefore: to fix the supports onto the pipe at the right distance among them, position the pole towards the wall by sustaining it with a rope, take the right points where the holes will be made using a marker, remove the pole and finally perform the holes.



Be careful always to apply a safety rope to everything that is not fixed. If something falls in the sea is lost. If something falls and has the possibility to fall on the earth or in the sea, it will fall for sure in the sea !



In case the lower support can be part of the day under water, it is necessary to wait the low tide in order to perform the installation. This is more a problem for Atlantic Ocean locations where the tide excursion is much larger.

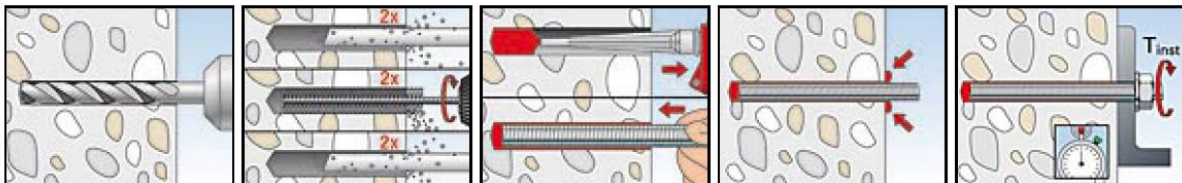
In case the minimum distance is not available, it is necessary to install oblique supports as in the figure, in order to maintain the min distance between the upper and the lower support.





The installation of the two supports should be done using chemical anchors: a special resin inside which a screwable anchor will be positioned. The time for having a perfect blockage depends by the Temperature and by the type of material applied and should be consulted on the material technical specification. It is essential to install these with the maximum precision and fixing quality because all the installation depends on those 4 anchors. Example of fixing procedure is indicated below.

What is a Chemical Anchor?

chemical or resin anchors are generic terms relating to steel studs, bolts and anchorages which are bonded into a substrate, usually masonry and concrete, using a resin based adhesive system. Ideally suited for high load applications, in virtually all cases the resulting bond is stronger than the base material itself. As the system is based on chemical adhesion, no load stress is imparted to the base material as with expansion type anchors and are therefore ideal for close to edge fixing, reduced center and group anchoring and use in concrete of unknown quality or low compressive strength. Although there are many differing variations and delivery systems in the market, all systems operate using the same basic principle with the base resin, requiring the introduction, by mixing, of a second component to begin the chemical curing process, hence the term chemical anchor

<http://www.constructionfixings.com/chemicalanchoring.htm>



			
<p>A pole installed to sustain only the sensor arm. The length is 2 m and the distance between the supports is about 1.8 m</p>	<p>In this case no need for wind tensors as the distance among the supports is large</p>	<p>In this case part of the pole is underwater during high tide</p>	<p>Sometimes the quality of the wall is not the best one could expect. It may be necessary to reduce the suggested height (Sagres, PT)</p>

3 Power source installation

3.1 Solar Panel Installation

The solar panel needs to be prepared as it is provided all dismantled for easier transportation. In order to mount it correctly it is necessary to follow some easy indications, to avoid mounting and dismantling several times. The solar panel supports are composed of two horizontal bars that are fixed to the external frame of the solar panel with 4 hexagonal screws that have a special bolt with a sliding nut.

Below is the photographic sequence of the installation.



The sequence of the operations is described below:



Insert one of the two horizontal bars inside the panel frame, in oblique position

	<p>Rotate the bar to go below the frame at $\frac{1}{4}$ of the total vertical length of the panel</p>
	<p>Insert the bolt with the washer positioning the sliding nut inside the bars. Below a detail of the sliding nut. Be careful to position the nut in the direction of closing otherwise it will not fix</p> 
	<p>It is better not to fix completely the bar to have the possibility to a final adjustment</p>
	<p>Repeat the same procedure with the other bar and keep a distance between the two bars approximately 50% of the length of the panel. Again do not fix the bars strongly</p>
	<p>Position the structure to host the support for the pole between the two bars using similar sliding nuts and bolts. When all is well positioned you can fix firmly all the bolts.</p>



Please note the position of the sliding nuts when blocked in the final position, they must appear horizontally respect to the bars to avoid to exit

It is necessary to position the bolt correctly along the horizontal bars otherwise it will never stick to it. The final arrangement for the support is the one below. In this position it will allow to freely turn and rotate. The fixing structure is in the bottom part of the panel. The right angle of the panel depends on the latitude of installation and is in the order of 30-45 degrees.



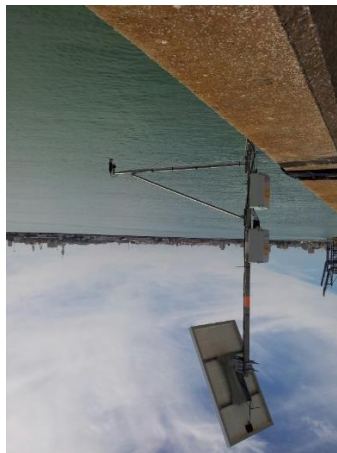


Pay attention to the wire that must not be pulled too much to cause the removal of the contact with the electrical connections of the solar panel.



Once the mounting structure is completed, it is possible to fix the solar panel on the top of the pole. In order to facilitate the mounting of the solar panel it is possible to lower the pole to a more easy position and fix the solar panel and bend it at the correct vertical angle, then rise back the pole to its final position, including the right horizontal inclination (normally toward south).

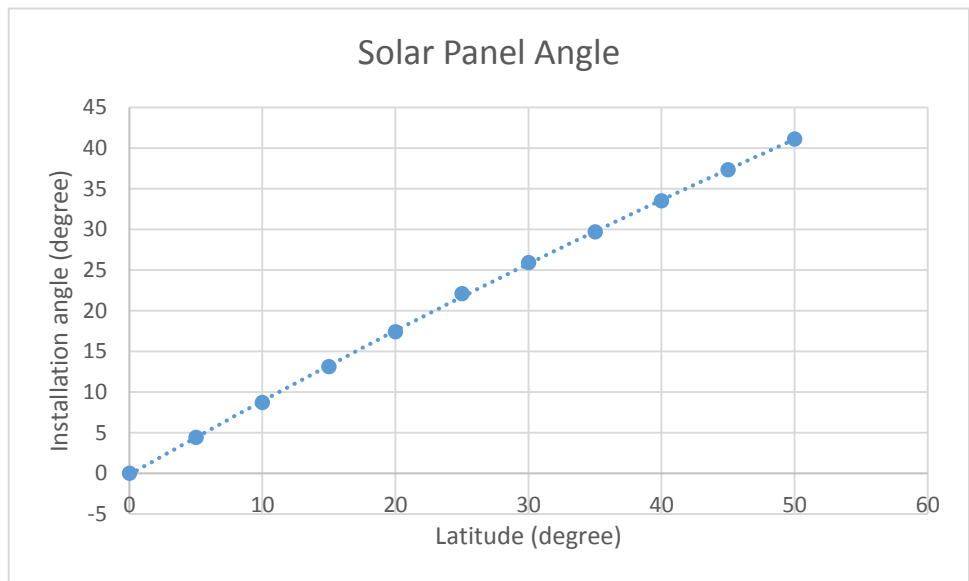
The image below shows the final position of the solar panel.



The horizontal angle should be towards south (0). The vertical orientation of the solar panel depends on the latitude of installation. The following table may serve as indication. The orientation can also be computed approximately as follows

$$\text{ANGLE} = + 0.9242 * \text{LATITUDE} - 0.1517$$

Latitude	Inst. Angle
0	0
5	4.4
10	8.7
15	13.1
20	17.4
25	22.1
30	25.9
35	29.7
40	33.5
45	37.3
50	41.1



3.2 AC power source installation

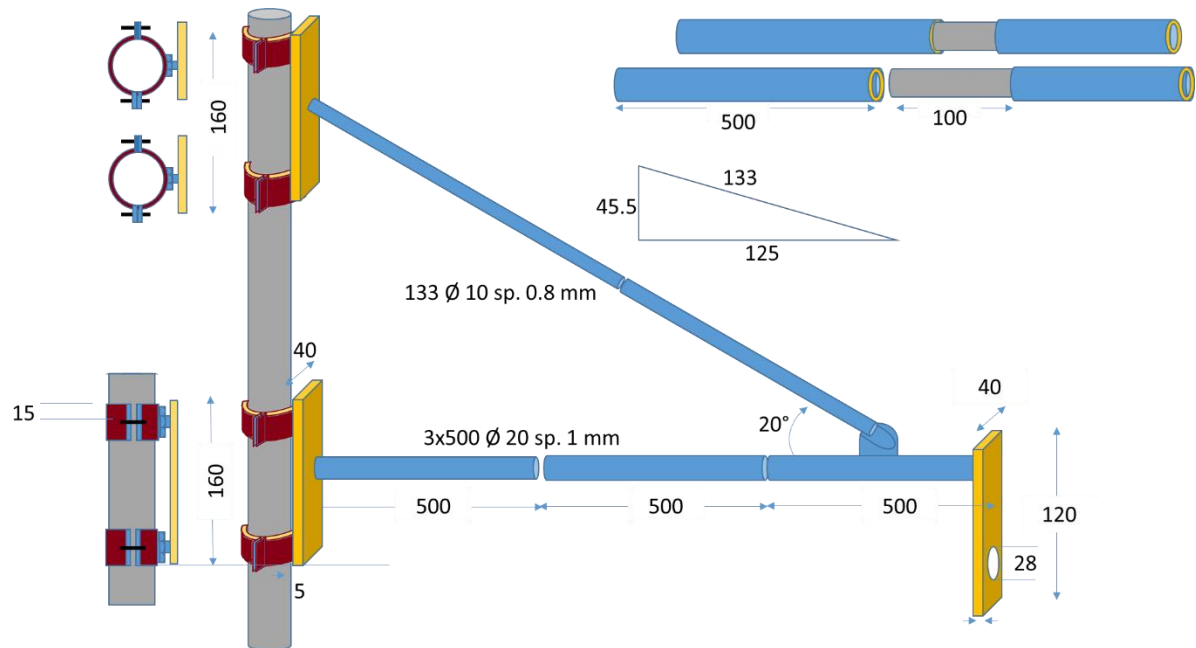
In case a local power source is available, an extension cable is provided (max length 50 m) in order to decouple the sensor area from the AC power source area. An example is given below for the Cartagena installation in which the AC power source was located in a box at about 40 m from the sensor location.





JRC provides the extension cable; this cable is planned to resist to outside conditions. It is however better to consider the installation of a plastic tube that can contain the cable and protect from sun insulation.

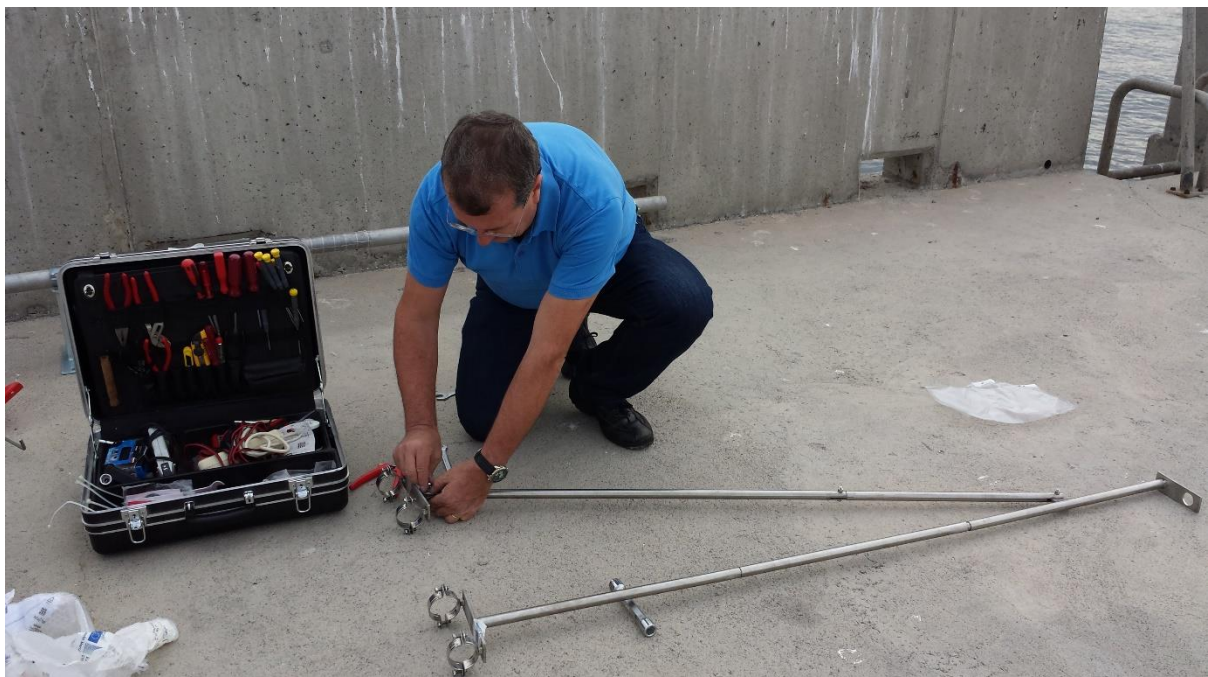
4 Sensor Arm preparation and installation



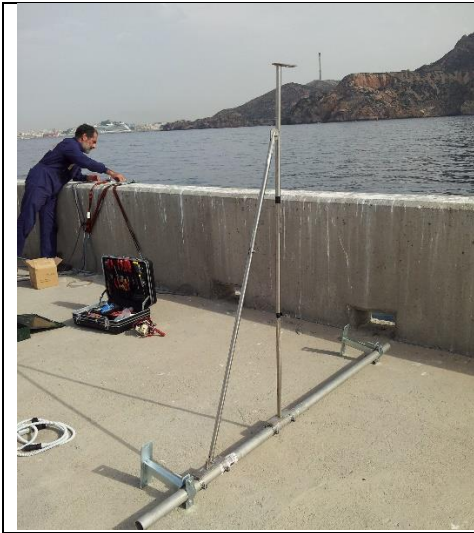
The sensor arm is composed of a number of stainless steel pieces to form a triangular shape with a final part containing a hole in which the sensor is installed. The horizontal part can be at the bottom or at the top of the triangle depending on the local conditions.

The horizontal arm can be 1.5 or 1 m long as the central section of the horizontal and the inclined structures can be removed. The use of a shorter arm can be dictated by local conditions (need to reduce the length) but the longer arm is preferable.

The various pieces must be connected by using 6 mm screws with bolts of 10 mm, provided in the package.



Once the installation of the arm is performed, it can be fixed to the pole using the screws. At this point it is possible to include the sensor and fix the sensor cable using 3 or 4 cable ties (or tie-wraps) along the horizontal pipe.



5 SIM Card inclusion in the router and Configuration

Generally the SIM card is available only at the installation place. If instead the SIM is provided before the installation this step can be skipped.



In order to insert the SIM in the router it is necessary to remove the router from the control box with a small cross screwdriver (two small screws at the side of the router), and open the router as indicated in the figure.

The SIM has to be inserted respecting the form as indicated in the figure.

Then close the router and reinstall inside the control box.

The configuration of the router must be done switching on the device and connecting with a computer using the built-in WIFI connection. Searching the WIFI network

you should find a Teltonika_IDSL-xx to which you need to connect. Ask JRC for the password of the WIFI.

Once you have connected with the WIFI network, open a browser and type the address of the router: <http://192.168.1.1>

A screenshot of the Teltonika web interface. The top header is blue with the Teltonika logo. Below it, a section titled "Authorization Required" asks for a username and password. The username field is pre-filled with "admin". There are "Login" and "Reset" buttons. Below this is a "Network information" section showing a 3G connection type and signal strength. At the bottom, there is a link to Teltonika solutions: www.teltonika.lt.

Login in the initial page indicating username admin and the password that will be given by JRC.

Then select Network > 3G as indicated below

The screenshot shows the Teltonika web interface. The top navigation bar includes 'Status', 'Network', 'Services', 'System', and 'Logout'. The 'System' section is active, displaying 'System information'. A dropdown menu is open under 'Network', showing options: 3G, WAN, LAN, Wireless, Backup WAN, Firewall, Static Routes, Diagnostics, and Site Survey. The 'System information' table lists various system details, and the 'Memory' section shows usage statistics.

System information	
System	
Router Name	
Router Model	
Firmware Version	01.556
Kernel Version	
Local Time	22 2014
Uptime	
Load Average	

Memory	
Total Available	13100 kB / 29912 kB (43%)
Free	1424 kB / 29912 kB (4%)
Cached	8672 kB / 29912 kB (28%)
Buffered	3004 kB / 29912 kB (10%)

Teltonika solutions: www.teltonika.it

Change the APN according to the GSM provider (in the image below web.omnitel.it) and the PIN number of your SIM card, if any. The Dialing Number in general should be left blank or *99# and the authentication mode as none. If your phone card provider require authentication, indicate CHAP or PAP from the drop down menu and a user/password fields will appear. For the service mode leave 3g preferred.

The screenshot shows the '3G Configuration' page in the Teltonika web interface. It includes fields for APN, PIN number, Dialing number, 3G authentication method, and Service mode. A 'Show 3G info at login page' checkbox is also present. A 'Save' button is located at the bottom right.

Here you can configure your 3G settings.

3G Configuration

APN:

PIN number:

Dialing number:

3G authentication method:

Service mode:

Show 3G info at login page: ☒

Save

Teltonika solutions: www.teltonika.it

Once you completed this step save by pushing the button and you should be able to navigate in internet if the provider allows it.

In order to verify if you can navigate in internet or not, connect your PC with the raspberry using an SSH connection (ex. using Putty or MobaXTerm programs) and connecting with parameters:

192.168.1.1xx

Where xx depends on the device, so IDSL-04 would be 192.168.1.104

Username is **pi** and password is: **raspberry**

Once connected, to verify it can go in internet, give the command

wget www.google.com

if it can go in internet it will start downloading the google home page.

6 Control and battery module installation

6.1 Control Module Installation

After having inserted the SIM and verified that it can go in internet, you can proceed by fixing the control module on the pole. Take into account that in case of extended flooding of this location, it is very difficult that the module will survive if immersed in water. Therefore you should install in a high position on the pole.

The installation is quite simple, it is sufficient to unscrew the 4 screws behind the panel and fix firmly the collars on the pole. Leave enough space below the control panel to allow the cables insertion.

6.2 Battery Module installation

The battery module should be installed below the control module because, being much heavier it is better not to have too much weight at higher levels.

6.3 AC power adapter installation

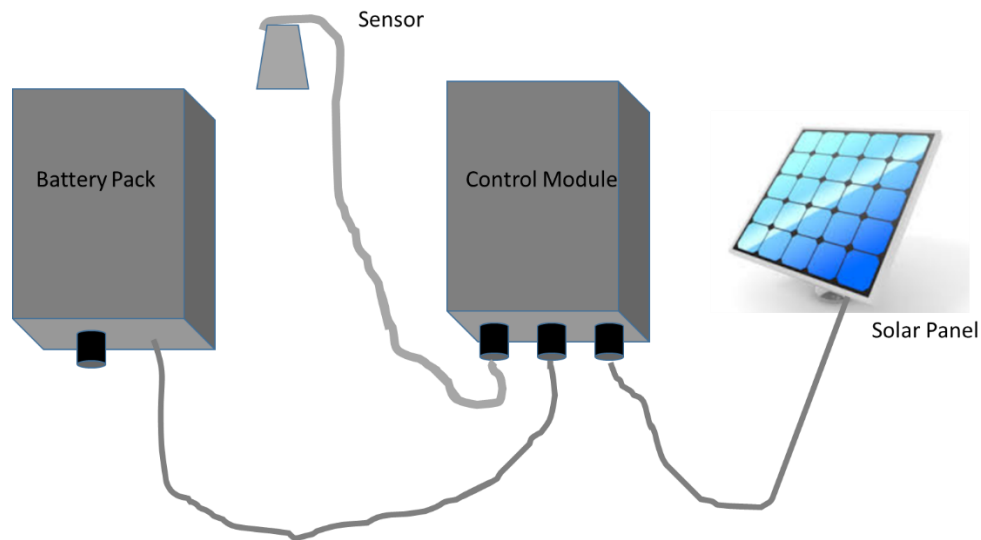
If there is AC power available (and not solar panel), the AC adapter will be positioned somewhere close to the control module.



7 Wires connection

At this point, the wires connection can take place following the schemes below.

The solar panel should be connected with the right connector of the control module, the sensor with the left connector and the battery pack with the central connector.



Please make sure not to connect wrongly the 3 connectors as it may damage the sensor.

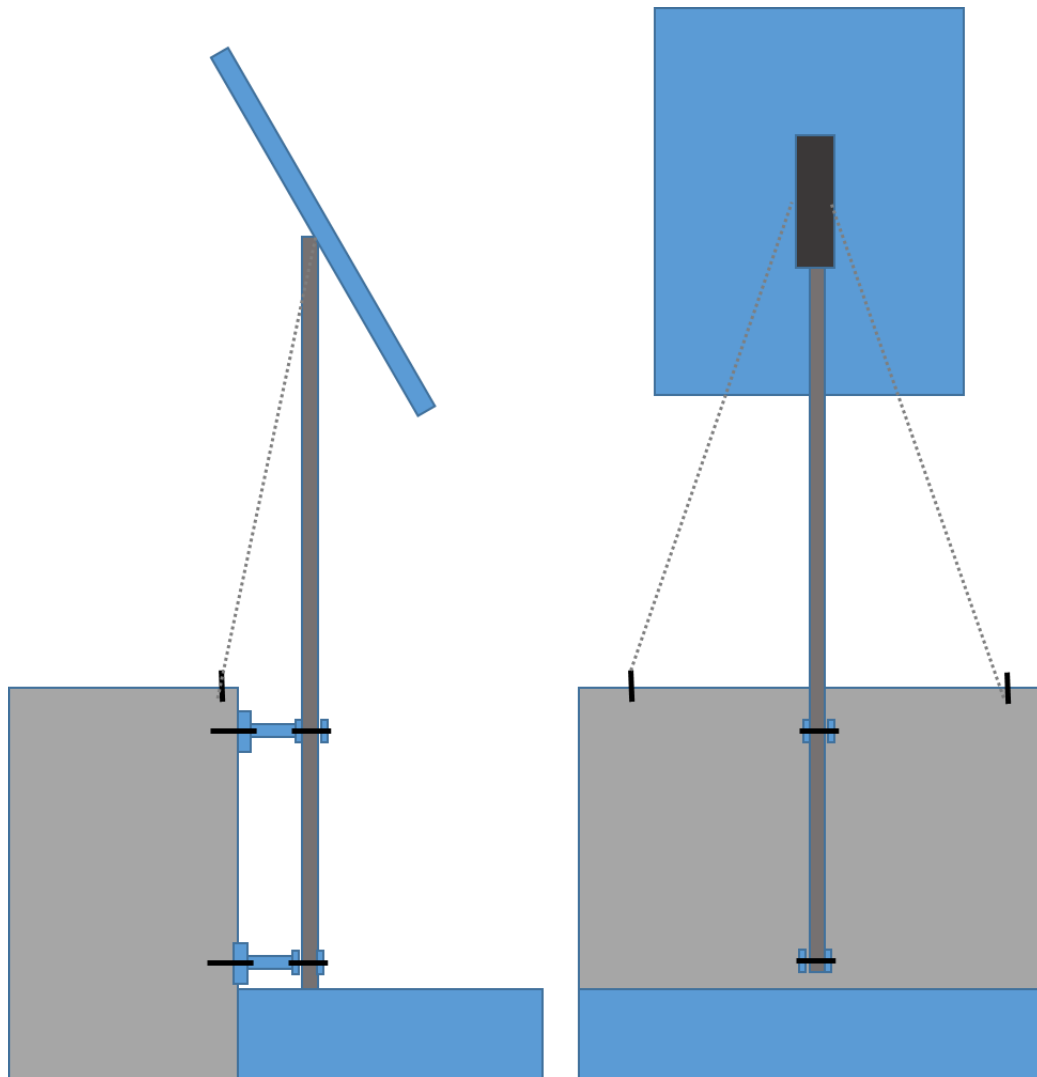
An additional free plus is present on the battery pack that could allow the connection of an additional battery pack or for measuring the battery voltage from outside, without opening the boxes.

8 Wind tension wires

The installation of the wind tension wire is necessary when the panel exposes the pole to wind. In some cases, when the distance between the pole support is very high or there is no solar panel, there is not a strong need for these wires, however it can be judged on a case-by-case basis.

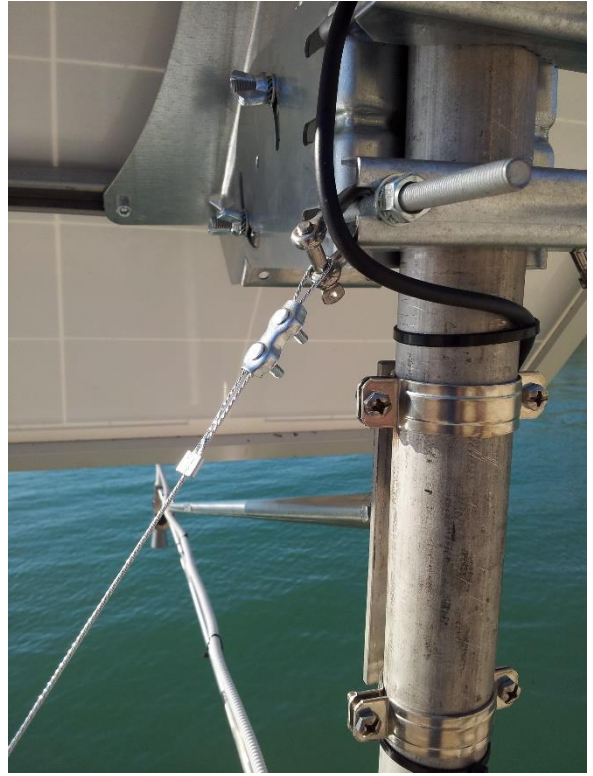
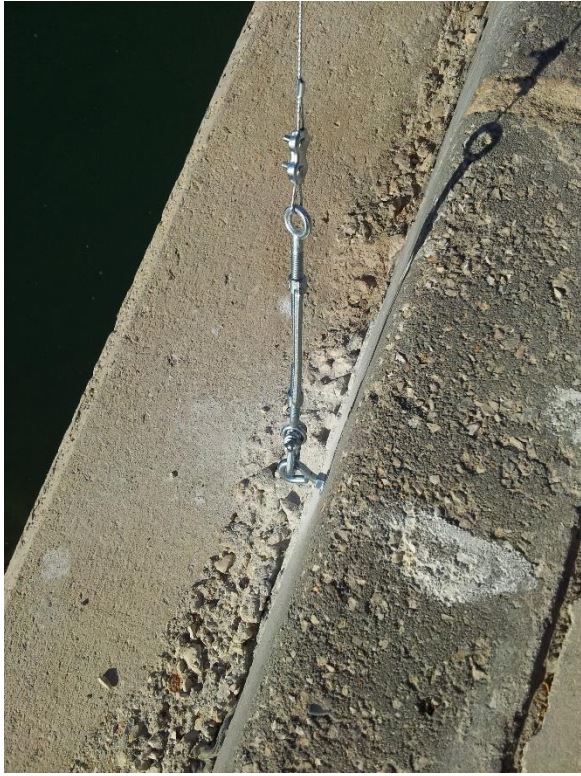
When wires are needed, there can be wires for the pole and wires for the arm. The wires are strong stainless steel wires of about 1 mm diameter that are used by fixing a ring on the ground and connecting them with the solar panel structure close to the pole. Tensors are used in order to have the right tension to the pole.

A suggested method for connecting the wires is indicated below.



The figures below indicate the details of the connection of the wires at the bottom, with the tensor, and at the top, with the solar panel. In order to fix the wires we used nautical shackles.

The two wires should not be exactly on the same plane of the pole. If they are slightly off-center, as indicated in the image above, there is also a horizontal component that helps to keep in place the pole with low oscillations.



9 Switch on and checking

When all is fixed, it is possible to switch on the device with the special key provided. After some minutes (2-5 min), if the device is working correctly you will see the data flowing to the JRC web site

http://webcritech.jrc.ec.europa.eu/tad_server

if the device is not listed, try to add the keyword
&test=true

http://webcritech.jrc.ec.europa.eu/tad_server&test=true

as in some cases the devices are kept in test mode. The listing of device should include your device and indicate the latency in data transmission.



Legal notice

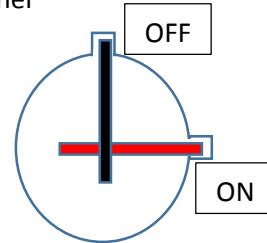
TAD SERVER										
Institute for Protection and Security of the Citizens - JRC Ispra Site										
European Commission > Webcritech > TAD Server										
Home	Devices List	Sensor Monitor	Links	About	Login					
Tide gauge list										
Id	Name	Sensor	Lat.	Lon.	Description	Location	Provider	Last value	Last Date	Latency
59	FCUL-IGCAS		38.69	-9.42	Cascais	Portugal(Lisboa)	FCUL	2.600	11 Oct 2015 10:46:33	23 Sec
60	FCUL-IGLAG		37.10	-8.67	Lagos	Portugal(Lisboa)	FCUL	2.558	11 Oct 2015 10:46:33	23 Sec
64	IDSL-01	RAD	43.88	8.02	Imperia	Italy(Liguria)	JRC	0.063	11 Oct 2015 10:46:53	3 Sec
77	IDSL-04	RAD	37.01	-8.93	Sagres	Portugal(Algarve)	JRC	0.493	11 Oct 2015 10:46:41	15 Sec
78	IDSL-05	RAD	37.08	-8.26	Albufeira	Portugal(Algarve)	JRC	0.629	11 Oct 2015 10:46:53	3 Sec
79	IDSL-06	RAD	36.54	-6.28	Cadiz	Spain(Andalucia)	JRC	2.165	11 Oct 2015 10:46:52	4 Sec
80	IDSL-07	RAD	37.57	-0.98	Cartagena	Spain(Murcia)	JRC	2.169	11 Oct 2015 07:00:21	3 Hours
50	IPMA-IGCAS		38.69	-9.42	Cascais	Portugal(Lisboa)	IPMA	0.480	11 Oct 2015 10:47:05	-8 Sec
52	IPMA-IGLAG		37.10	-8.67	Lagos	Portugal(Algarve)	IPMA	0.578	11 Oct 2015 10:47:05	-8 Sec
56	IPMA-IHFUL		32.64	-16.91	Funchal	Portugal(Madeira)	IPMA	2.156	11 Oct 2015 10:43:52	3 Min
54	IPMA-IHLEX		41.19	-8.70	Leixões	Portugal(Porto)	IPMA	2.415	11 Oct 2015 10:43:52	3 Min
53	IPMA-IHPEN		39.95	-8.89	Peniche	Portugal(Oeste Subregion)	IPMA	2.530	11 Oct 2015 10:43:51	3 Min
57	IPMA-IHSIN		37.95	-8.89	Sines	Portugal(Alentejo)	IPMA	2.692	11 Oct 2015 10:46:30	27 Sec
55	IPMA-IHMA		36.85	-15.15	Matosinhos	Portugal(Madeira)	IPMA	2.254	11 Oct 2015 10:43:33	3 Min

If still the device is not listed you should check again if the device is able to go in internet (see chapter 5).

9.1 How to switch off and on the Control Panel



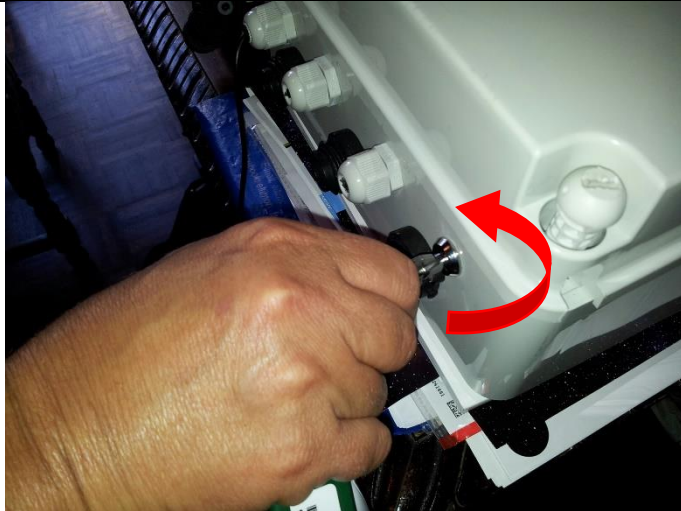
Identify the key switch on the right side of the bottom of the control panel



Note the small tooth on the switch key



Insert the key in horizontal position (respect to the box length)



Rotate the key anti-clockwise and put the key vertically (respect to the box length)



Return the key in the horizontal position and extract it

10 Lessons Learnt from the Installations

In this chapter we try to indicate the lessons learnt from the installations performed so far that can be useful for new installation. As every installation is a new case, this chapter will evolve all the times.

1. (WHO IS INSTALLING) Use a rope to keep material and tools and avoid falling under water: anything on the sea must be secured (included the persons)
2. (LOCAL SUPPORT PERSONNEL) Bring all the appropriate tools and in particular
 - a. Driller with the series of Drill Bits, including the large ones for the chemical anchors
 - b. Chemical anchors glue
 - c. Allen key for the solar panels
 - d. Mechanical keys and at least numbers 7, 10, 13, 17
 - e. Angle grinder for cutting pieces
 - f. Electrical power source, either with wire or autonomous
 - g. Cutter
 - h. Several cable ties of various dimensions
 - i. Hammer
 - j. Pliers
3. Ensure that the support unit onsite has the right equipment for descending on the vertical wall
4. (JRC Personnel) Be sure to have replacement parts for:
 - a. All screws, bolts, sliding nuts
 - b. Router, Raspberry, power regulator or alternatively, if possible, one complete control box