SICE

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# IDSL Installation Guide

v. 2.0 – April 2023

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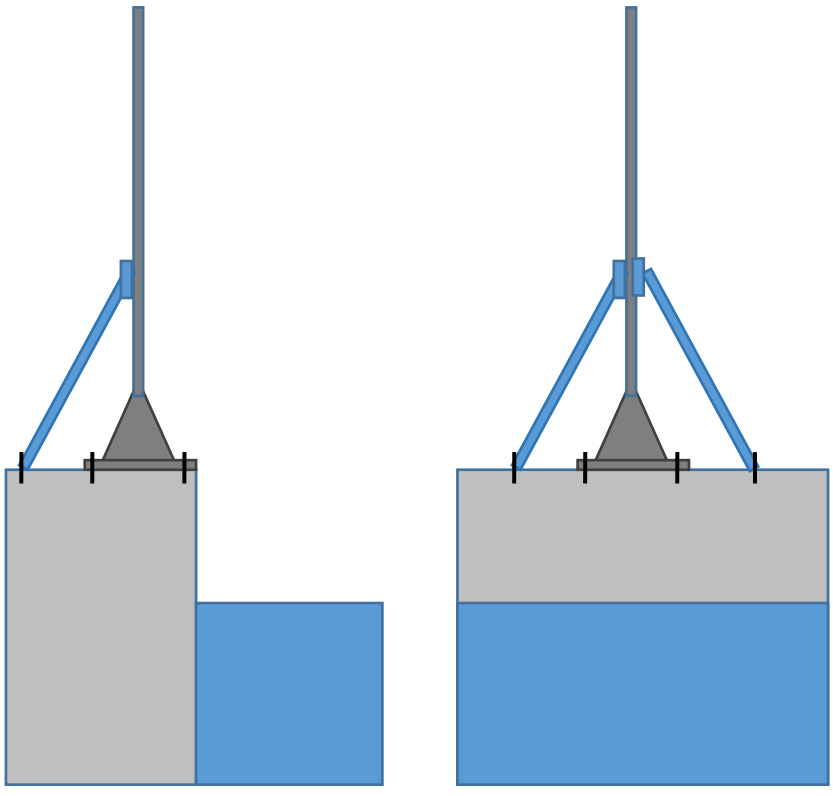
UNESCO Contract EU- 4500484180



# IDSL Installation Guide

v. 2.0 – April 2023

## 1 Introduction

This guide explains the best sequence of operation to install successfully 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 devices in various conditions. Reading the guide may help to have a better preparation and prevent 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 requires that a preliminary survey analysis is carried out to identify the right location for the installation following these requirements:

1. the location should be easily accessible in case of need
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 surrounding obstacle 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 (3/4G)
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; but at the same time should be in a protected area, because string waves may endanger the measurements
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 types 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 |

**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

# 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 or an open flat area for placement of the horizontal platform.

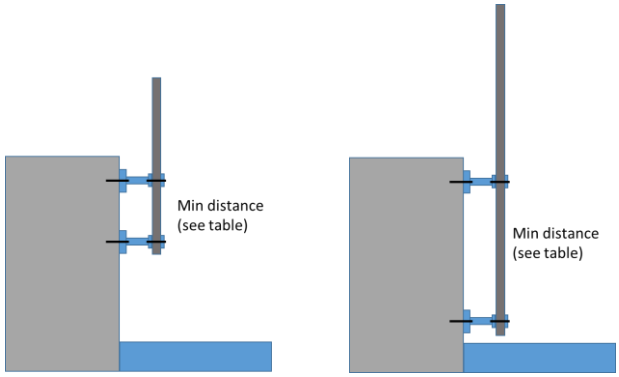
The procedure describes the usage of a Chemical Anchor to fix the elements to a concrete basis. This solution is not best fitted for high latitudes, where mechanical solutions should be adopted (self-tapping screws or screw anchors).

## 2.1 Vertical Installation

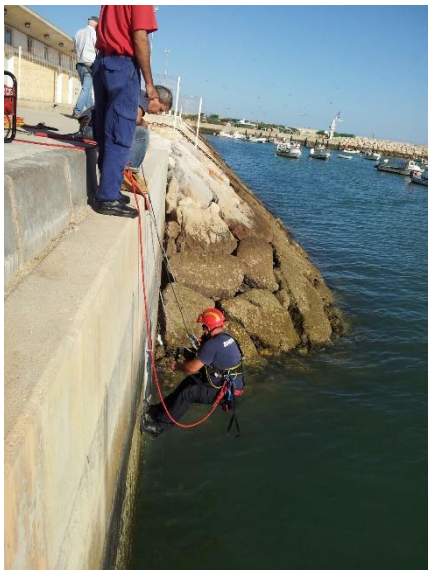
In case the vertical installation is selected, the distance between the two supports should be as large as possible compatibly with the vertical wall characteristics. As high is the distance as low is wind induced oscillation of the pole, that is then necessary to counteract with tensor wires.

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 |



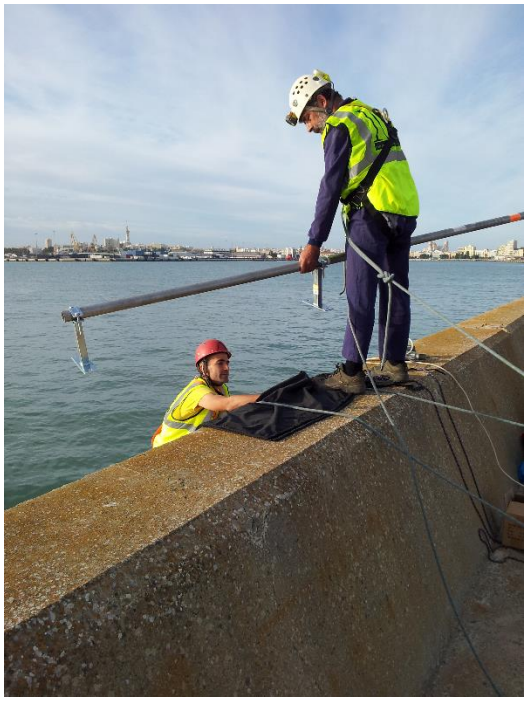

Once identified the right vertical wall that allows the fixing of the supports with their minimum distance, it is usually necessary to involve specialized personnel (Fire Fighters or Mountain specialists) that will work hanging outside the vertical wall to drill and fix the supports.

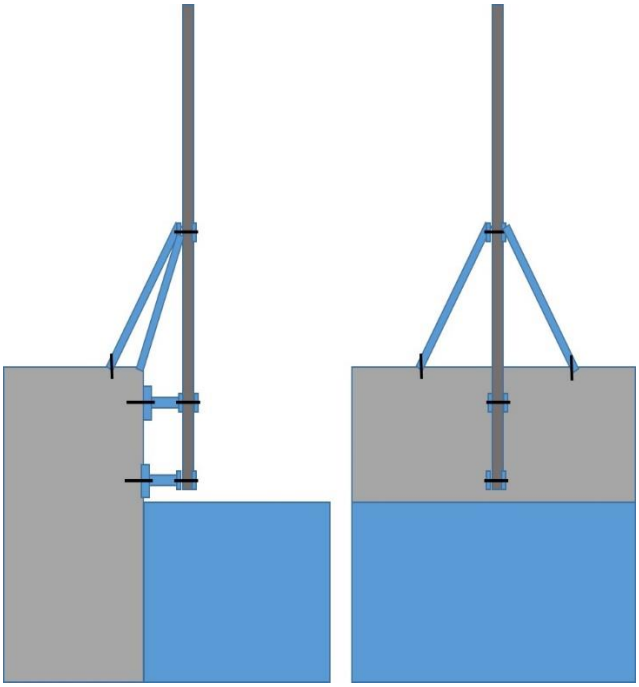


The best practice would be to fix first the upper support, then append the pole with only one support in order to find the right vertical position and then fix the lower support. This procedure however is not practical because once the first two holes are prepared with the chemical paste, the same becomes 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, *for sure it will fall in the sea*!**

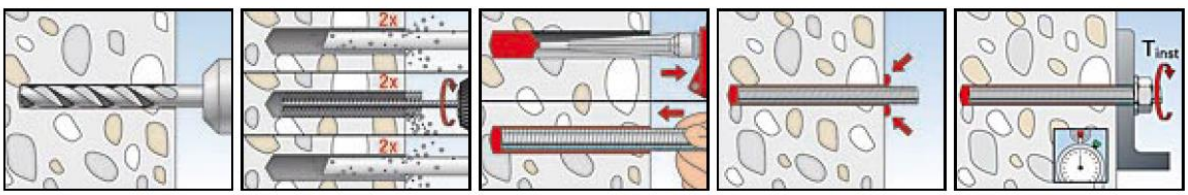


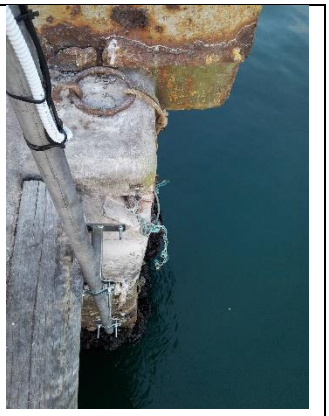


In case the lower support is reached by the water during the day, it is necessary to wait for the low tide to perform the installation. This problem is more present in the Atlantic Ocean locations, where the tide excursion is much larger.

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

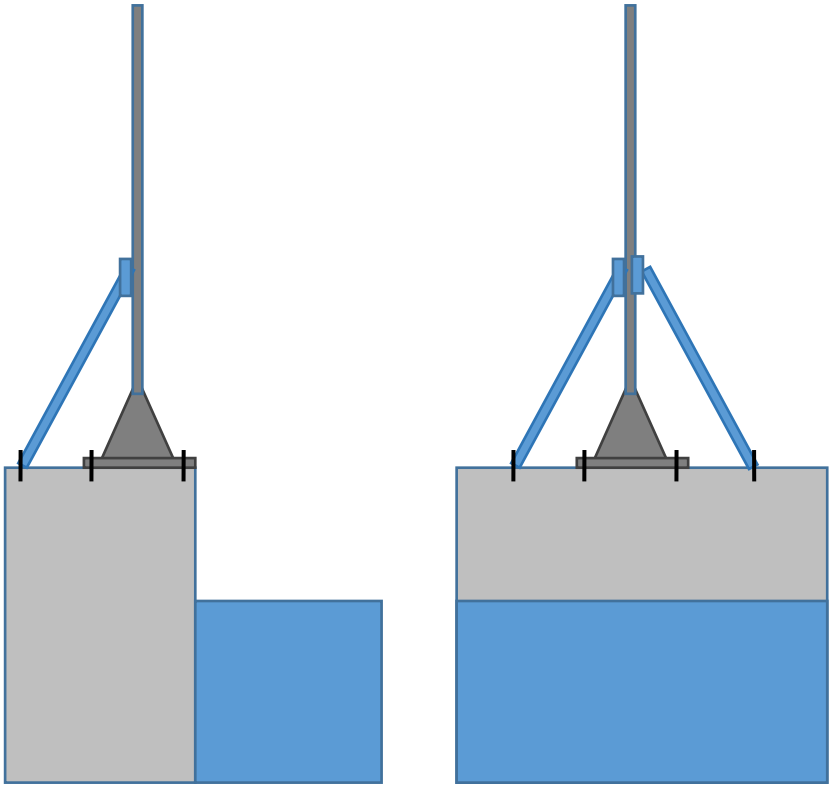
The installation of the two supports should be done using chemical anchors: a special resin inside which a screwable anchor will be positioned. The time for having a perfect blockage depends by the temperature and by the type of material applied, and should be according with the material technical specification. It is essential to install these 4 anchors with the maximum precision and fixing quality because all the installation depends on them**. An e**xample of fixing procedure is shown below.



| | | | |
|---|---|---|---|
|  |  |  |  |
| 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 | In this case no need for wind tensors as the distance among the supports is large | In this case part of the pole is underwater during high tide | Sometimes the quality of the wall is not the best one could expect. It may be necessary to reduce the suggested height (Sagres, PT) |

## 2.2 Horizontal installation

This type of installation is much easier because it does not require to fix the supports on the side. Nevertheless, it moves the axis of the pole at least 50-60 cm far from the water; therefore, accordingly the sensor arm should be longer to guarantee the same distance from the wall of the horizontal installation.



# 3 Power source installation

## 3.1 Solar Panel Installation

The solar panel needs to be prepared as it travels dismounted. To mount it correctly follow some easy indications, to avoid mounting and dismounting 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.

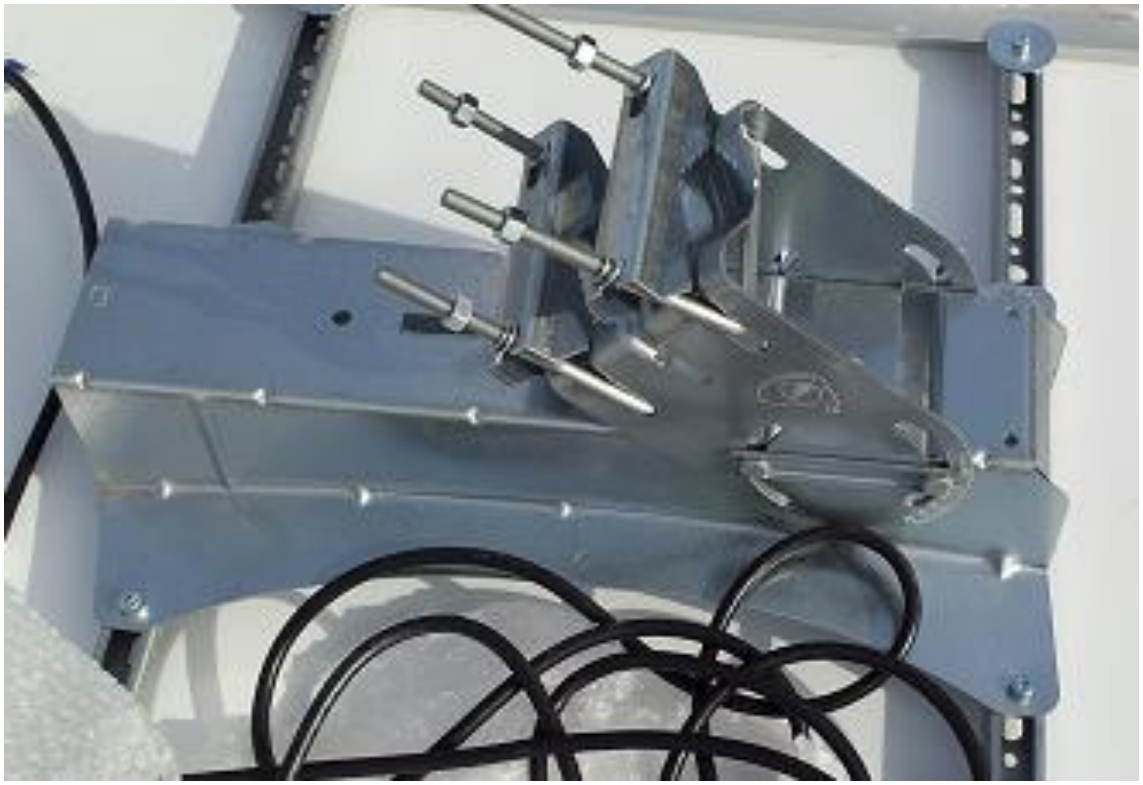
Below is the photographic sequence of the installation.

The sequence of the operations is described below:

| | |
|---|---|
|  | Insert one of the two horizontal bars inside the panel frame, in oblique position |
|  | Rotate the bar to go below the frame at ¼ of the total vertical length of the panel |
|  | 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  |
|  | It is better <u>not</u> to fix completely the bar to have the possibility to a final adjustment |
|  | 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, <u>do not</u> fix the bars strongly |

| | |
|---|---|
|  | 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. |
|  | Please, note the position of the sliding nuts when blocked in the final position, they must be horizontal in respect to the bars to avoid to exit. |

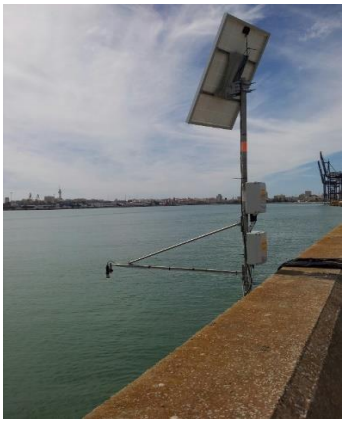
It is necessary to position the bolt correctly along the horizontal bars otherwise it will never stick to it. The final arrangement for the support is the one below. In this position it will allow to freely turn and rotate. The fixing structure is in the bottom part of the panel. The right angle of the 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 avoid 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. To facilitate the mounting of the solar panel it is possible to lower the pole to a more convenient position, fix the solar panel and position it at the correct vertical angle, then rise back the pole to its final position, including the right horizontal inclination (normally toward south).

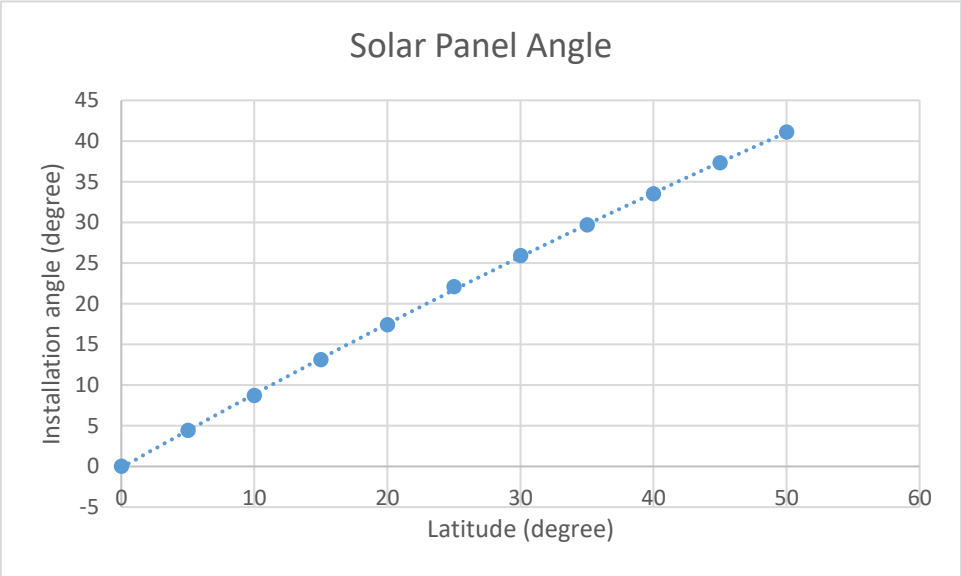
The image below shows the final position of the solar panel.

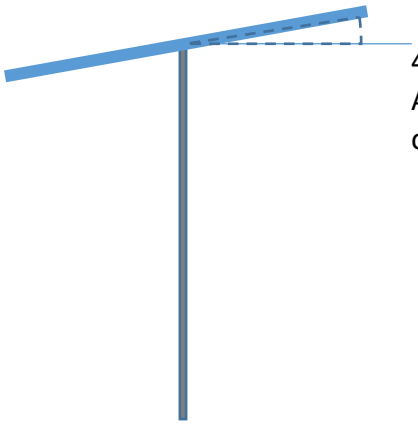


The horizontal angle should be towards south (0). The vertical orientation of the solar panel depends on the latitude of installation. The following table may serve as indication. The orientation can also be computed approximately as follows>

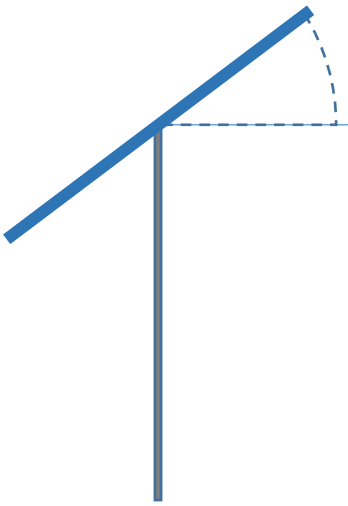
ANGLE=+ 0.9242 * LATITUDE - 0.1517

| 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 |



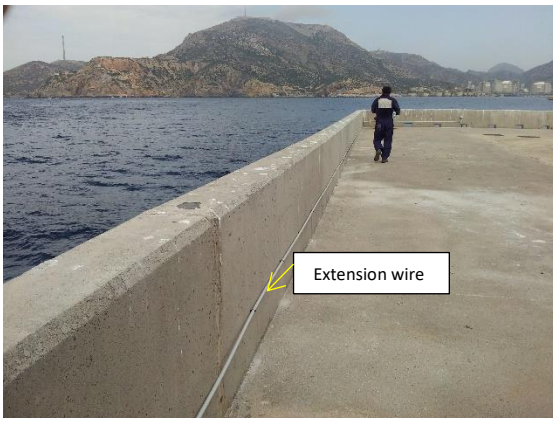
4.4 degrees
At 5 degrees
of latitude

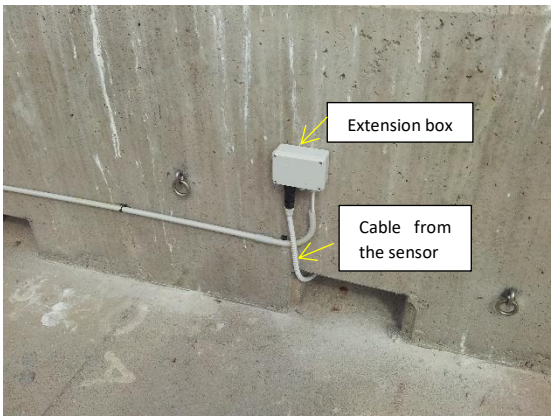


37.3 degrees
At 45
degrees of
latitude

## 3.2 AC power source installation

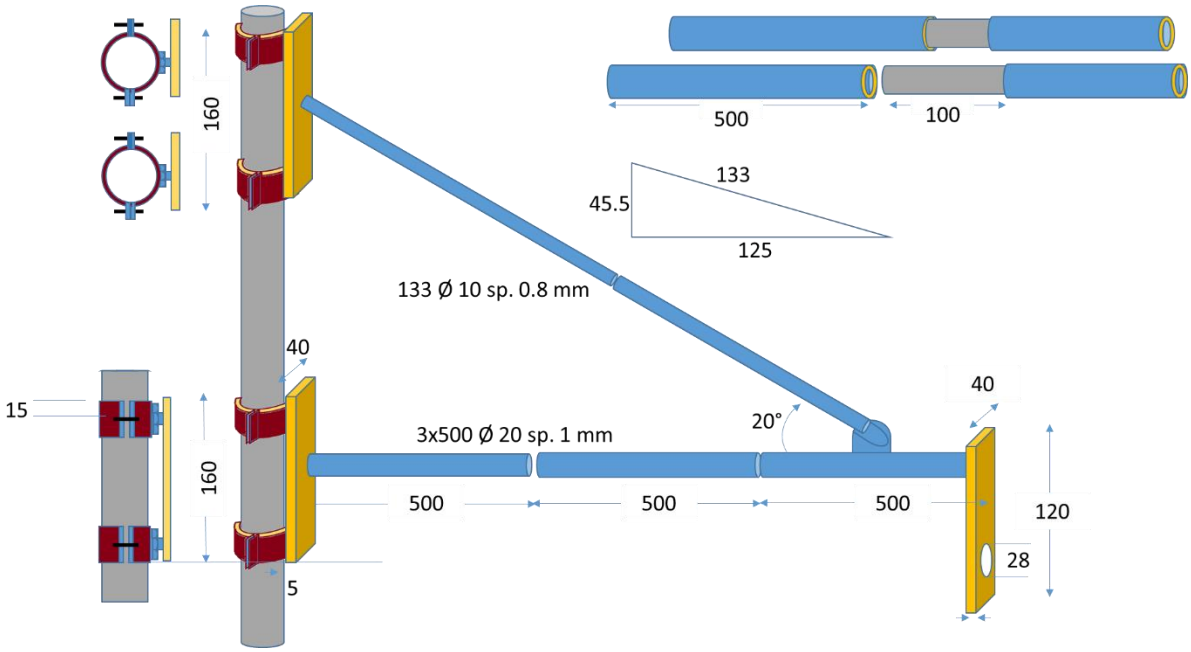
In case a local power source is available, an extension cable is provided (max length 50 m) to decouple the sensor area from the AC power source area. An example is given below for the Cartagena installation in which the AC power source is in a box at about 40 m from the sensor location.


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 to protect it from direct sun exposure.

# 4 Sensor Arm preparation and installation

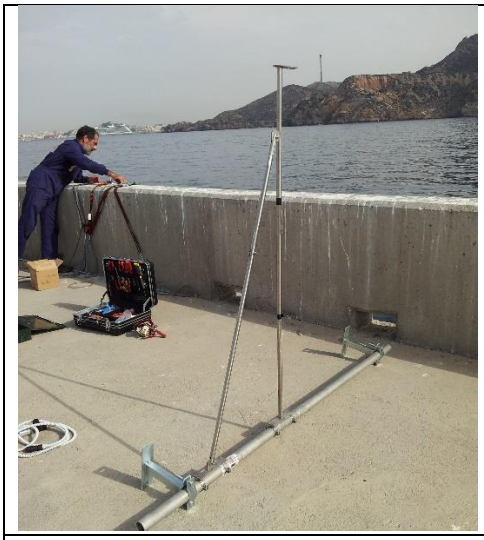
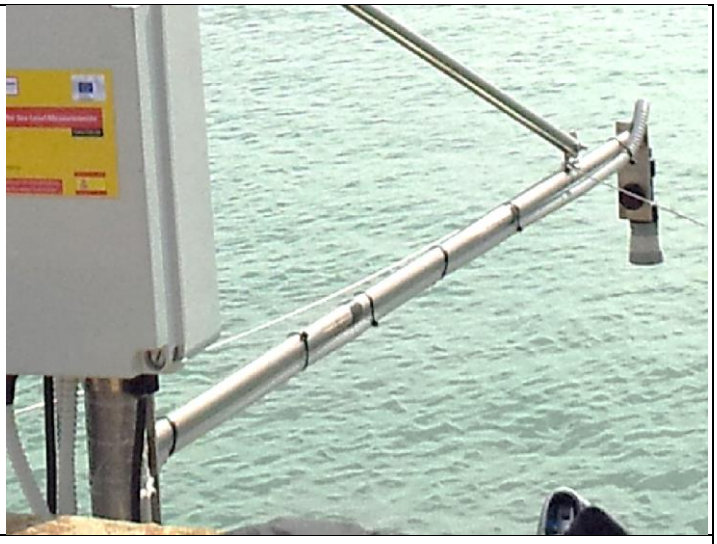



The sensor arm is composed of a number of stainless-steel pieces to form a triangular shape with a final part containing a hole in which the sensor is installed. The horizontal part can be at the bottom or at the top of the triangle depending on the local conditions.

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 part.

| | |
|---|---|
|  |  |
| | |

# 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 done in advance.

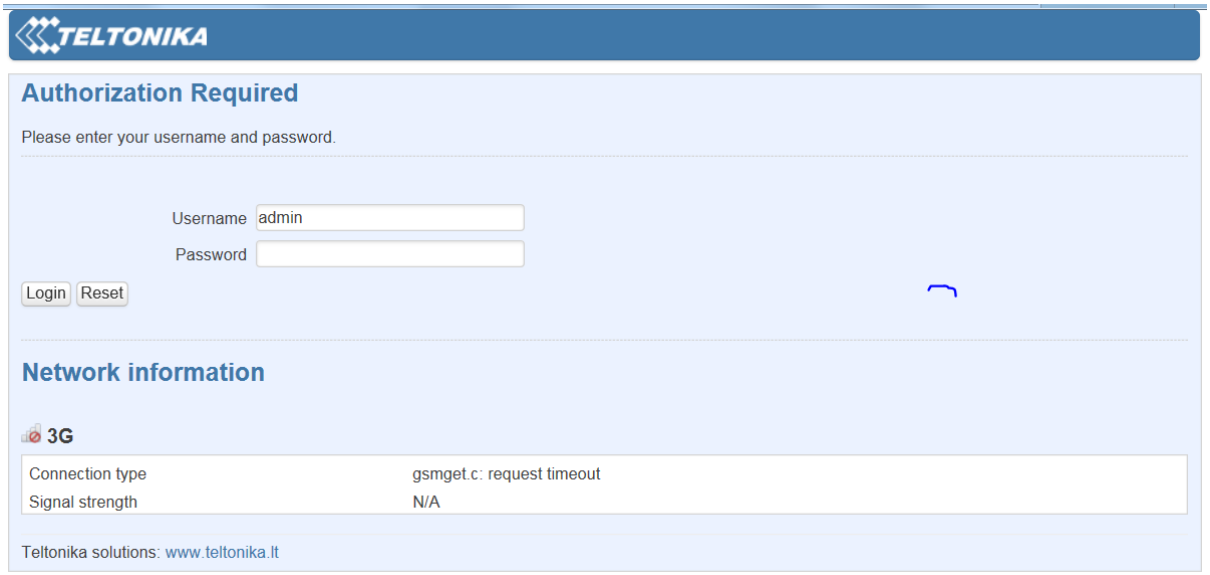
To insert the SIM in the router, remove the router from the control box with a small cross screwdriver (two small screws at the side of the router), and open the router as shown in the figure.

The SIM must be inserted respecting the form as shown in the figure.

Then close the router and reinstall it inside the control box.

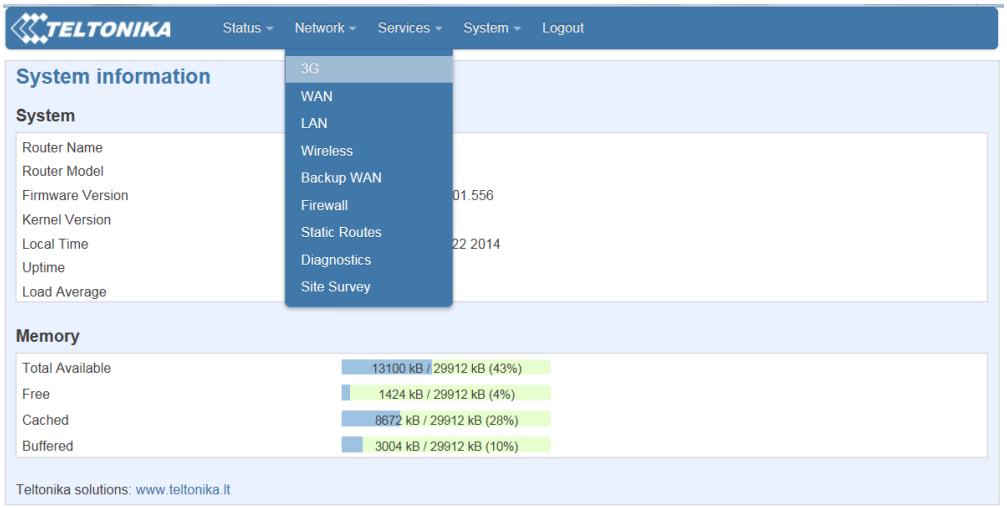
The configuration of the router must be done switching on the device and connecting with a computer using the built-in WIFI connection. Searching the WIFI network you should find a Teltonika_IDSL-xx to which you need to connect. Ask JRC for the password of the WIFI.

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

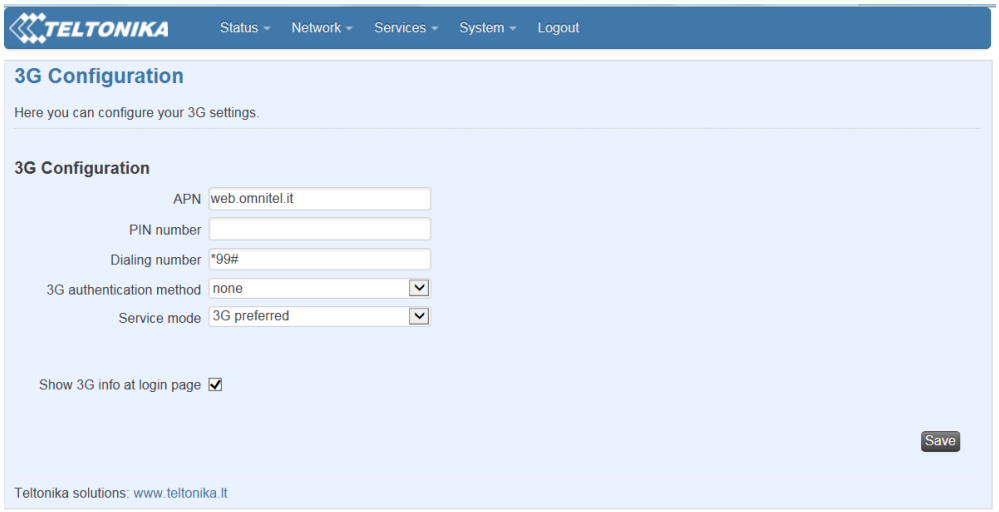



Login in the initial page indicating username admin and the password that will be given by JRC.

Then select Network > 3G as indicated below




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, if available in your area.




Once you completed this step, save by pushing the Save 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:

192.168.1.101

Username is **pi** and the password is provided by the JRC.

Once connected, to verify it can access Internet, give the command

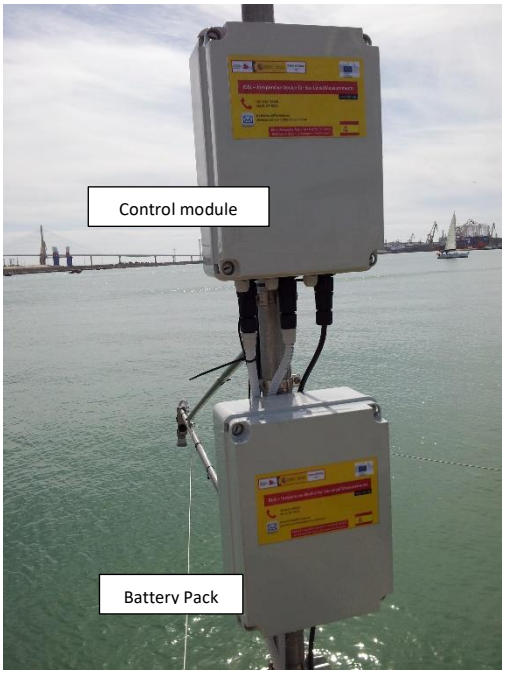
wget www.google.com

if it can access 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 access 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 it in a high position on the pole.




The installation is quite simple> it is sufficient to un-screw 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.

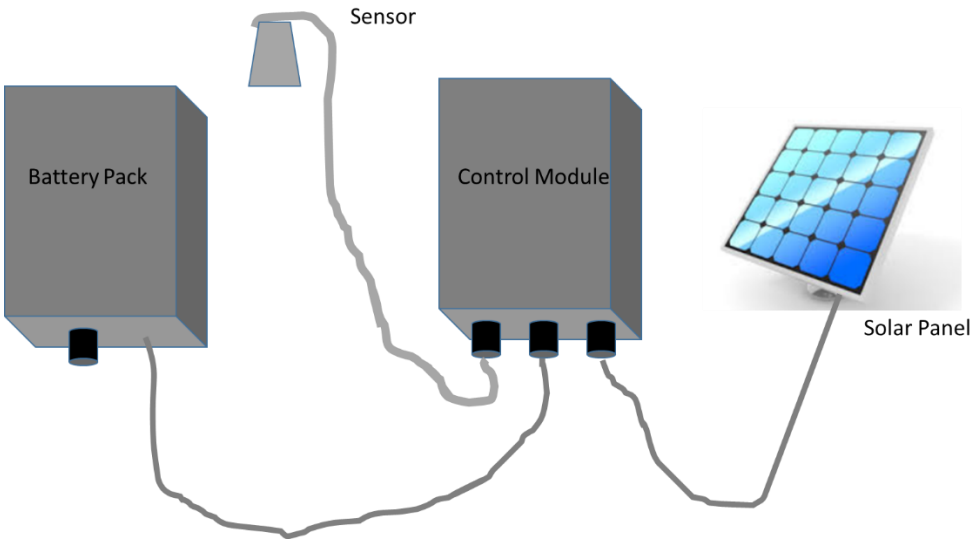
## 6.3 AC power adapter installation

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 must connect with the right connector of the control module, the sensor with the left connector and the battery pack with the connector in the middle.




Beware, wrong connections may damage the sensor.

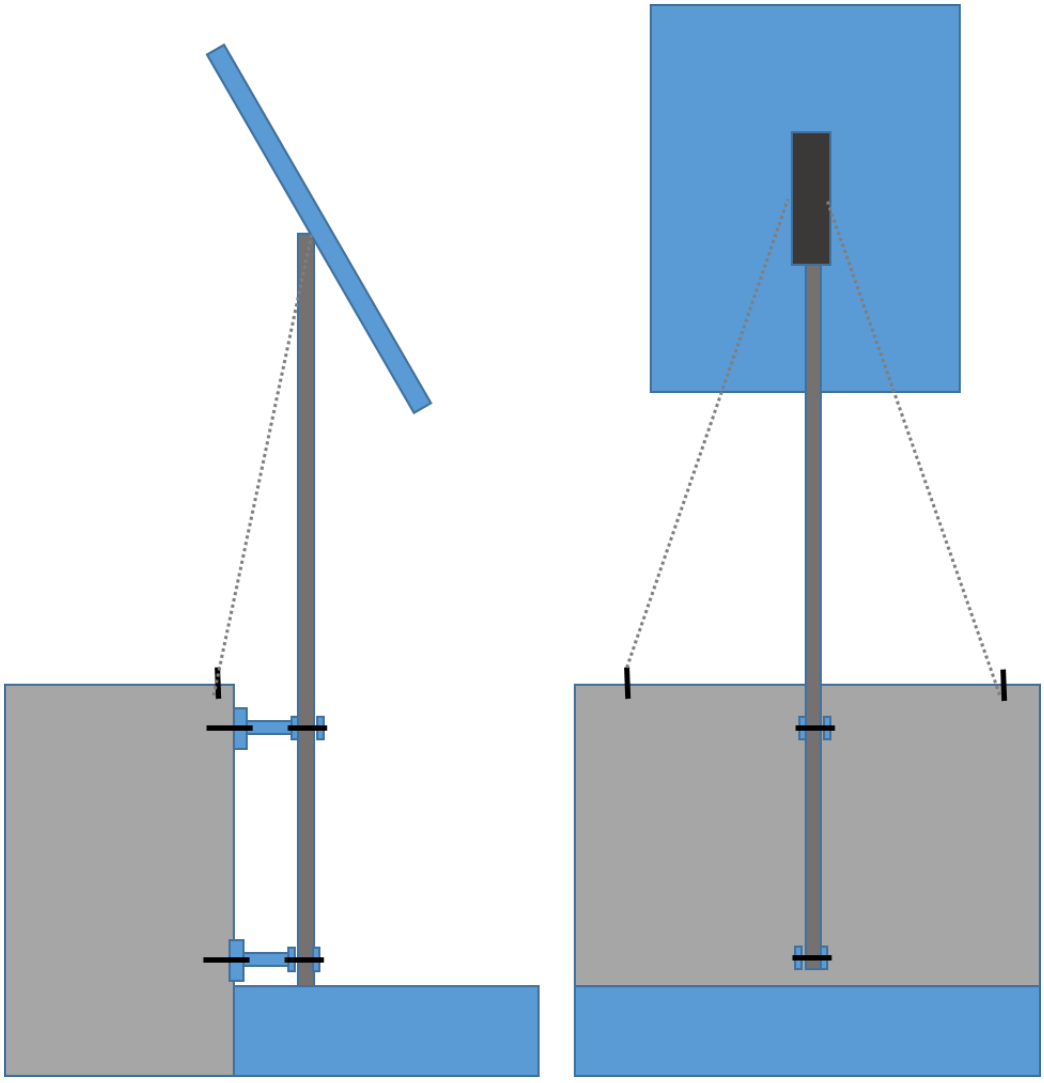
An additional connector is present on the battery pack to allow the cascade of additional battery packs or to measure the battery voltage from outside, without opening the boxes.

# 8 Wind tension wires

The installation of the wind tension wires is needed in case of strong winds. 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.

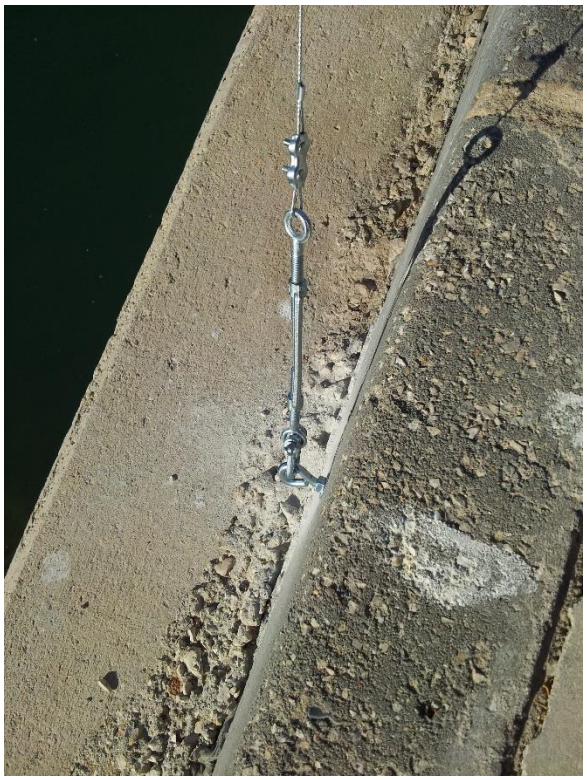
When wires are needed, there can be wires for the pole and wires for the arm. The wires are strong stainless-steel wires of about 1 mm diameter, that are used by fixing a ring on the ground and connecting them with the solar panel structure close to the pole. Tensors are used to have the right tension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

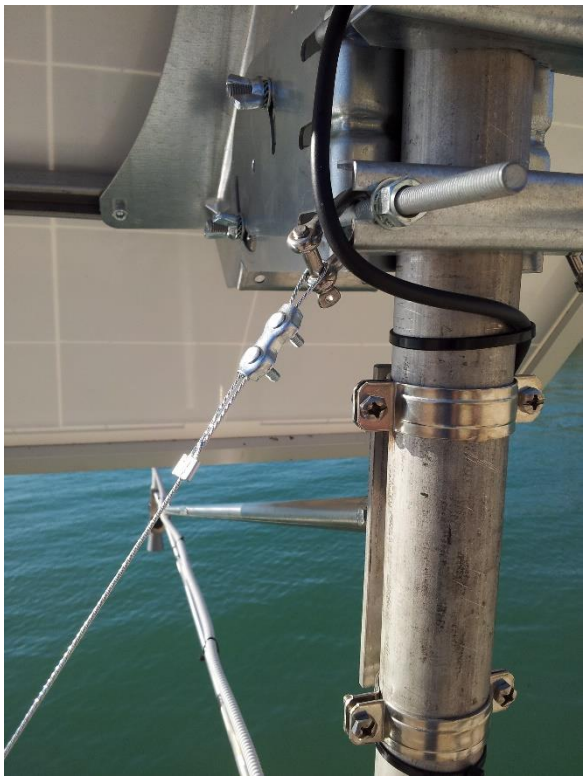
A suggested method for connecting the wires is indicated below.



The figures below show the details of the connection of the wires at the bottom, with the tensor, and at the top, with the solar panel. To fix the wires we used nautical shackles, needed to prevent the corrosion from the sea water.

The two wires should not be exactly on the same plane of the pole. If they are slightly off-center, as shown 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 using the special key provided, in case of the lock switch model. The button switch model automatically turns on, when a power surge is connected (internal battery, external battery, or AC adapter). After some minutes (2-5 min), if the device is working correctly, you will see the data flowing to the JRC web site. Check it accessing this web page:

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

since in some cases the devices are kept in test mode. The listing of device should include your device and show 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 |

If still the device is not listed, you should check again if the device is able to access Internet (see chapter 5).

# 10 Lessons Learnt from the Installations

In this chapter you will find 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 in time.

1. (WHO IS INSTALLING) Use a rope to keep material and tools and avoid falling in water: anything on the sea must be secured (included the people).

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 in case of vertical installation.

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

**IDSL Installation sequence**

1. Preparing the holes for the supports of the pole either horizontally or vertically
2. Define the location of the bases of the tripod
3. Drilling the holes for the supports and the tripod bases
4. Position the supports with the chemical glue
5. Position the tripod bases with the chemical glue
6. Wait the necessary time for fixing the glue
7. Fix the pole, possibly lowering it as much as possible
8. Fix the solar panel
9. Fix the sensor arm after having fixed the sensor at the end of it
10. Rise the pole at the right height and rotate to orient the solar panel towards south
11. Rotate the arm to extend straight on the sea
12. Fix the tripod
13. Install the control box and the battery(ies)
14. Fix the tension wires
15. Switch on the control box
16. Check transmission of sea level on webcritech.jrc.ec.europa.eu