_ INCLINOMETER CASINGS

USER MANUAL

Notes on the use of product

For safe and efficient use of the product, please read carefully the following instructions before starting any operation.

Any use of the product other than the one described in this manual shall be considered the user's full responsibility.
The same applies for any unauthorized modifications.
In addition to the hereby listed standards, the user must comply with the provisions of the current legislation regarding personal safety and health together with all other persons in the workplace.
SISGEO is not responsible for any accident, breakdown or other problems due to lack of knowledge and / or non-compliance with the requirements contained in this manual.
Check that the product has not been damaged during the transport.
Verify that the package includes all items as well as any requested optional accessories; if anything is missing, please promptly contact SISGEO.
The user must strictly follow all the operations described in this manual.
Maintenance or repair of the device is permitted only by authorized operators.
These operators must be physically and intellectually suitable.
For information about instrument or to order spare parts, always specify the product information which can be found on the identification label.
When replacing parts, always use ORIGINAL SPARE PARTS.
The manufacturer reserves the right to make either technical and / or commercial changes without prior notice.
It is our policy to keep manuals continuously updated.

Symbols

Pay particular attention to the following instruction.

Identification

Instruments can be identified

- **From a production lot number (written on the Compliance Certificate)**
- **From a serial number (s/n) engraved indelibly on the instrument**
- **From a label on the instrument**
- **From a label on the cable**

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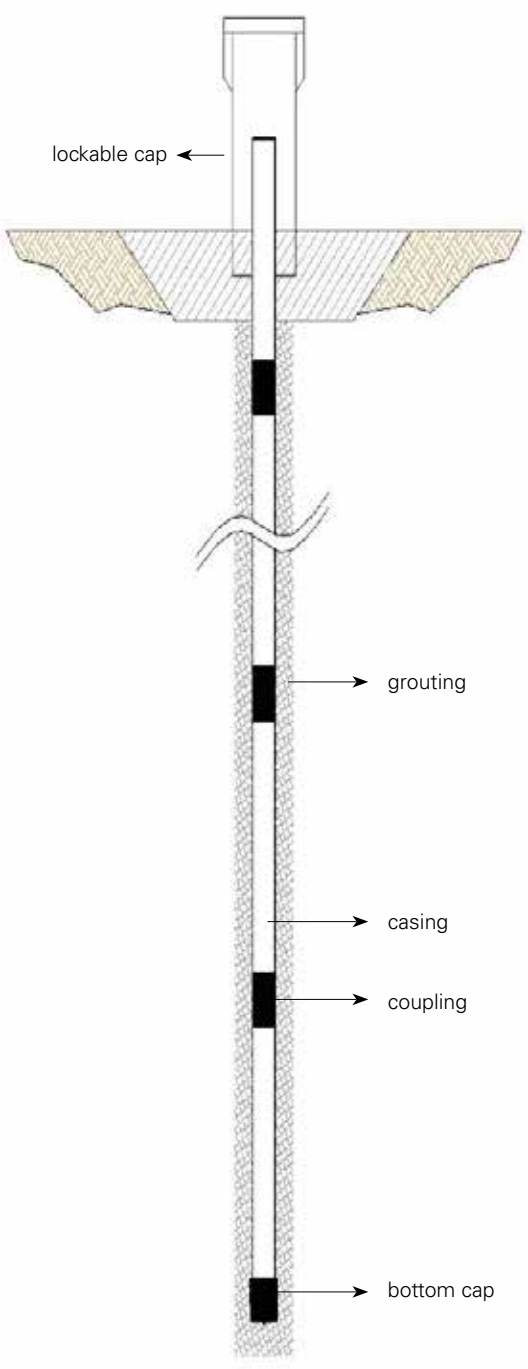
INTRODUZIONE



The inclinometer casing, supplied in 3m bars connected by couplings, is installed in boreholes and anchored to the ground with grouting.

It has 4 orthogonal grooves that direct the instruments within the casing.

The instruments installed within the casing detect the movements and deformations that the ground or the structures transfer to the casing.

They are used also in embankments and within constructions like bulkheads and retaining walls.

When the application expects both horizontal movements and settlements measure, the casing can be supplied with telescopic couplings and magnetic rings.

DESCRIPTION

Generally the casing consists in:

1. casing (in 3m bars);
2. couplings;
3. bottom cap;
4. top cap.

We can supply as accessories:

1. Lockable cap;
2. bottom grout valve;
3. injection valve;
4. casing clamps;
5. magnetic rings;
6. pulley and cable stop;

- assembly kit (rivets, drill bits, self-vulcanizing rubber tape, adhesive tape);
- tail sheave and pulley (horizontal installations);
- telescopic couplings;
- embankment magnetic rings.

INSTALLATION

Aluminium inclinometer casing 0S1110054000 - 0S1110075000

1. Fix the bottom cap, with 4 rivets, to the casing that will be installed at the bottom;
2. slip the coupling on the inclinometer casing for 15cm;
3. drill and fix it with 4 rivets;
4. insert the second casing up to the stop;
5. drill and fix it with 4 rivets.

Do not drill near the grooves and be sure that the casings are in contact with each other.

See note page 8

ABS inclinometer casing 0S131006000

1. Fix the bottom cap, with 4 rivets, to the casing that will be placed at the bottom;
2. slip the coupling on the inclinometer casing up to the stop;
3. drill on the points marked on the coupling and fix it with 2 rivets;
4. insert the second casing up to the stop;
5. drill on the marked point and fix it with 2 rivets.

See note page 8

3m section 2.75" ABS casing
0S1411107000

1. Fix the bottom cap with 4 rivets to the casing that will be placed at the bottom;
2. slip the coupling on the inclinometer casing making the references male/female stuck;
3. the coupling is pre-drilled. Drill the casing and fix it with 2 rivets;
4. insert the second casing up to the stop and stuck the references;
5. drill and fix it with 2 rivets.

Make sure that both the "UP" marks and the arrows point in the same direction.

See note page 8

For all the models previously described, every casing/bottom cap and casing/coupling junction, must be sealed.
Place first the self-vulcanizing rubber tape on the rivets and the junction, and then put the adhesive tape as shown in the photos below:

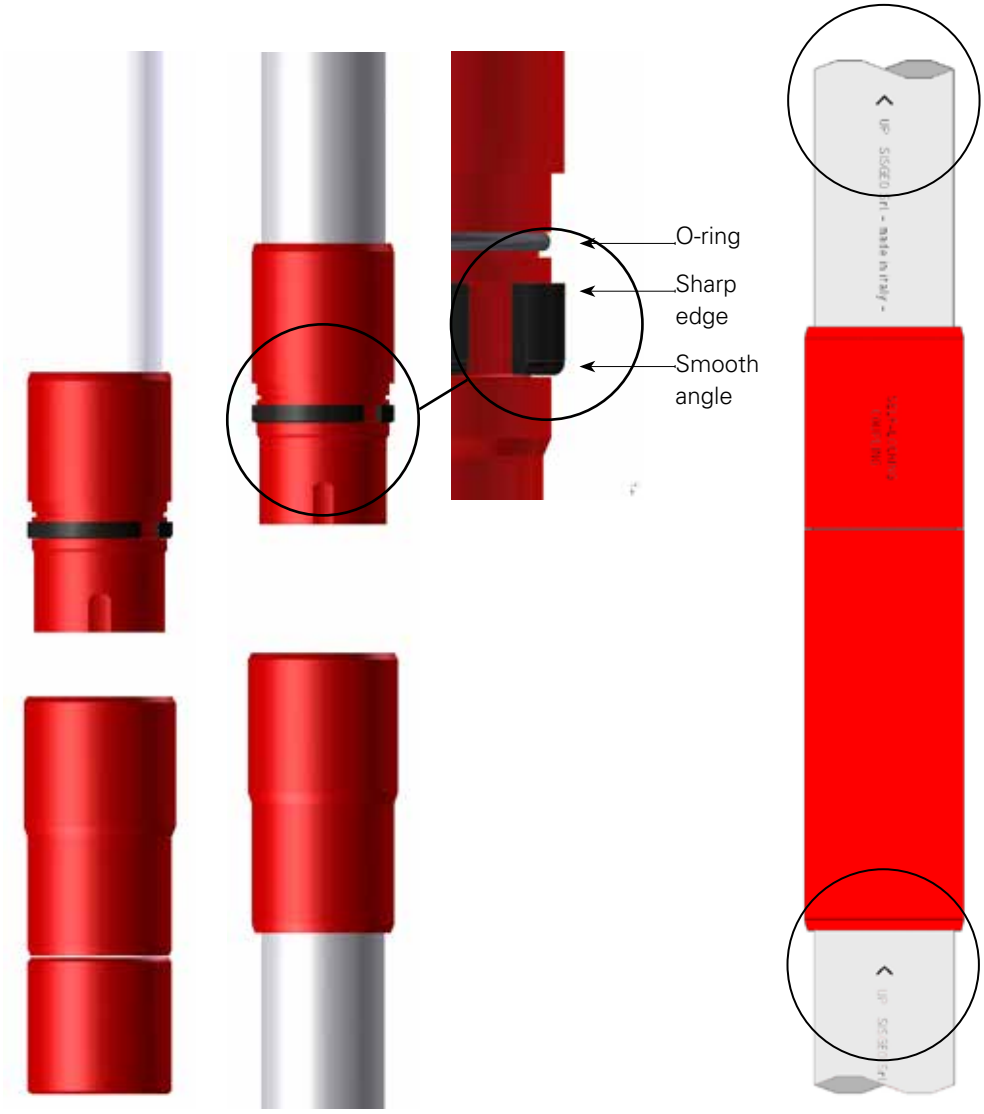
1

2

3

4

3m section 2,75" QJ casing
0S151107000



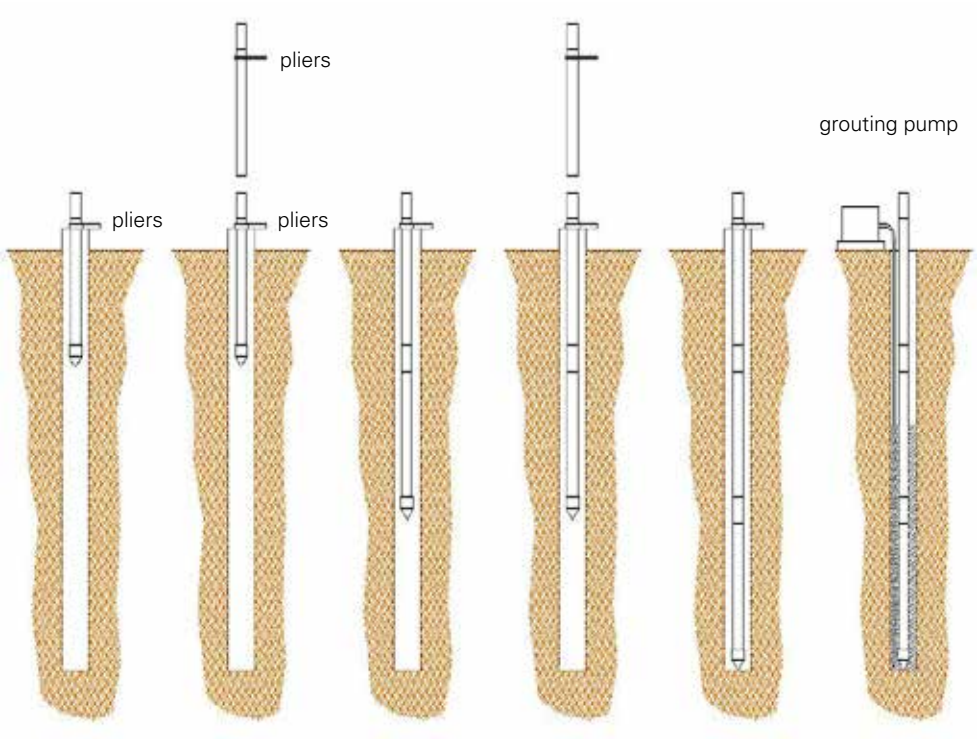
The S151 casing, or Quick Joint, has been developed to make the installation easier and quicker without the necessity to use consumables as rivets, adhesive tapes and glues.
The strong couplings allow their use in earth dams.

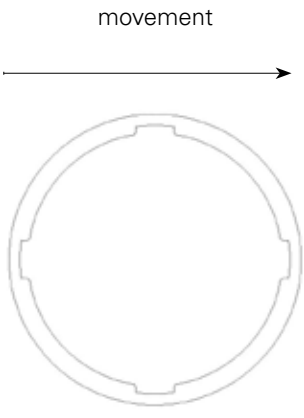
Quick Joint casing is pre-assembled. To join 2 casings you have to:
1. align the reference grooves male/female;
2. connect the 2 casings pushing one towards the other.

Ensure that on the male coupling there is the O-ring and the anti-release ring as shown in the picture.
Make sure that both the "UP" marks and the arrows point in the same direction.
Once assembled, they can not be dismantled.

VERTICAL INSTALLATION IN DRILLINGS

The installation can be outlined as follows:





To perform a correct installation:

- line up a couple of grooves with the expected movement direction;
- embed, in the stable substrate, for a few meters, the casing final part;
- we suggest to speed up the installation, to assemble 2 or more inclinometer casings before lowering them in the hole.

Tools needed:

- portable drill
- riveter and rivets
- self-vulcanizing rubber tape
- adhesive tape
- depth probe
- casing clamps
- jig saw
- ballast, eventually (i.e. iron rings)

The hole useful diameter changes according to the casing maximum external diameter and to the hollow space between casing/ground grouting mode.
The grouting can be performed from inside the casing using a bottom valve (optional) or with a flexible tube fixed outside the inclinometer casing.
The bottom valve shall be installed in place of the bottom cap following the same instructions.

Once the grouting ends, remove the injection valve assembled at the end of the injection tubes, pulling carefully upwards.
Clean the tube pumping clean water.
The grouting mixture shall recreate the texture of the ground where the casing is installed.
Approximately these are the proportions of the mixture:

Material	Ratio	Hard and medium soil		Ratio	Soft soil
Cement	1	50 kg		1	50 kg
Water	2,5	125 kg		6,5	325 kg
Bentonite	0,3	15 kg		0,4	20 kg

The right way to mix the materials is:

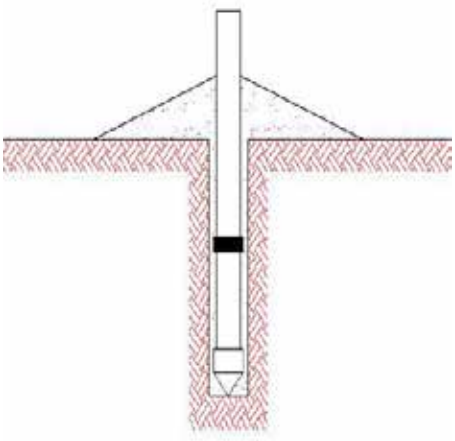
1. mix the water and cement
2. add and mix the bentonite

the results have to be similar to an heavy cream.
Choose the injection tube diameter according to the mixture texture.
It can be useful to drill the injection tube in several points towards the bottom if it should stop up during the installation.

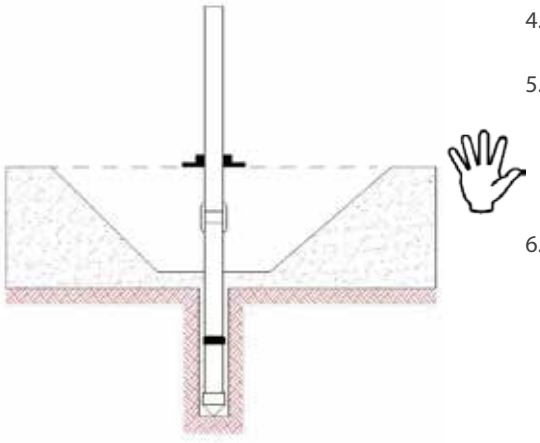
We recommend:

- if you are using coating, pull them out vertically. Do not twist them;
- to avoid that the buoyancy lifts the inclinometer casing, add water inside or fix a ballast outside to weigh it down;
- in case of buoyancy, do not push the casing head to avoid deformations;
- at the end of the injection, clean the tube pumping clean water.

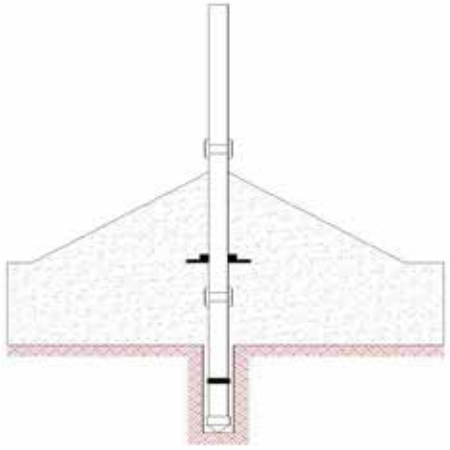
EMBANKMENT INSTALLATION (example)
In case of inclino-settlement, the first bar to be inserted in the borehole is a 1.5m casing section with magnetic reference point (datum point) pre-assembled from SISGEO.



1. Insert the lower part of the casing with the reference point (datum point) in the borehole for at least 2m. starting from the ground level;
2. grout the cavity with a concrete mixture or fill in with coarse sand;
3. support the remaining casing for at least 50cm. with the embankment material;

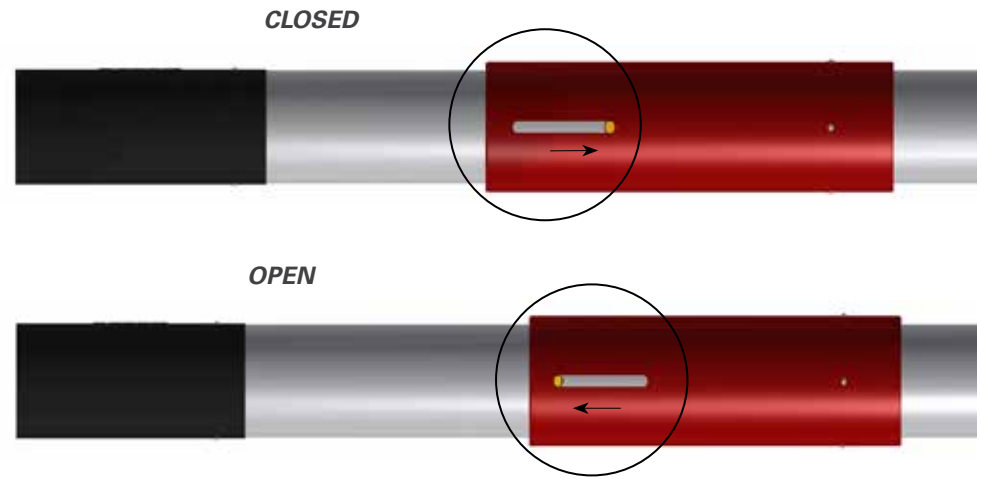


4. proceed with the construction of the embankment;
5. when necessary, assemble the casing with the telescopic couplings. Attention! be sure to assemble the coupling in "open" position (see next page);
6. fill in the cavity with the embankment material;



7. compact it;
8. install the magnetic ring at the required height;
9. cover it with embankment material and compact it;
10. support the casing upper part with the embankment material;
11. end the installation assembling the cover cap or the protection well.

TELESCOPIC COUPLING INSTALLATION

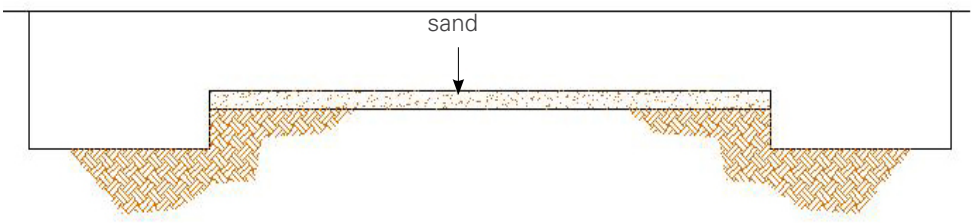


To keep the coupling in position "open" it can be useful to use adhesive tape.

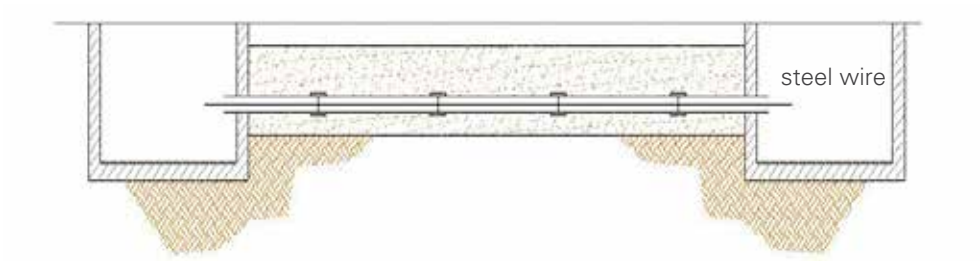
INSTALLATION EXAMPLES

HORIZONTAL INSTALLATION

The inclinometer casing, in horizontal installations, shall be placed on the building foundation plane within a suitable trench.



Dig a trench 50/100cm deep and at least 40cm wide at the bottom.
Build a dip at each end to ease the work of the operators during the measurement execution. Lay a bed of fine sand (10 cm. thick) at the bottom and compact it.



Position the casing so that 2 grooves are perpendicular to the ground (keep it for the whole length).

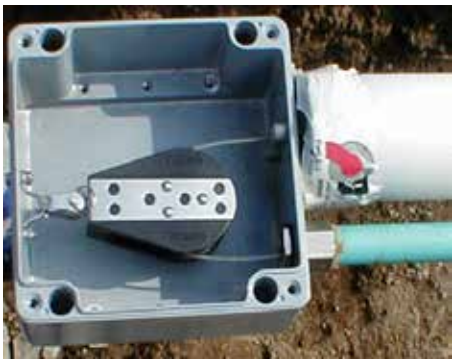
Assemble the inclinometer casing as described in the previous chapters, working next to or directly in the trench.

Notes:

- remember to insert a Ø2mm steel wire in the casing during the assembly, in order to drag the probe during the measurements;
- cover the casing with 15cm sand layers. Compact them by hand or with a vibrator.
- end the filling of the trench with a layer of coarse sand or gravel. Compact it with a roller or vibrator.

In earth dams we recommend to build some bentonite cap to avoid water infiltration along the casing, using bentonite rings on the whole trench section.

When one of the casing's end is not accessible, is necessary to install a pulley and the ½" tube.
The following photos show some installations:

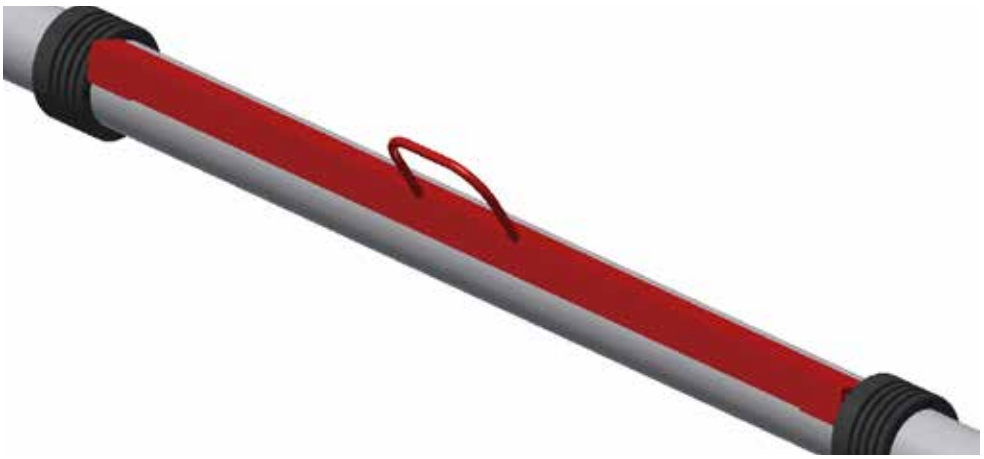


CONSTRUCTIONS INSTALLATION

In case of installation in piles or diaphragms, please proceed as described in the previous chapters.
Fix the casing to the rebars in order to avoid any damage during the junction of the rebars sections.
The casing shall be fixed to the rods with a iron tie in order to avoid movement or damage during the grouting.

MAGNETIC RINGS

The magnetic rings, when used for measures with the probe 0REX451, shall be placed at a distance of 937.5mm with their mounting jig.



The three screws that block the ring on the casing, shall not be screwed tightly.
Their purpose is to avoid the ring movement during the installation.
Be careful to point all the rings in the same direction.

BOTTOM ANCHOR DEX

The bottom anchor for Dex probes shall be fixed to the deeper casing using the supplied cap and as described at page 7.