

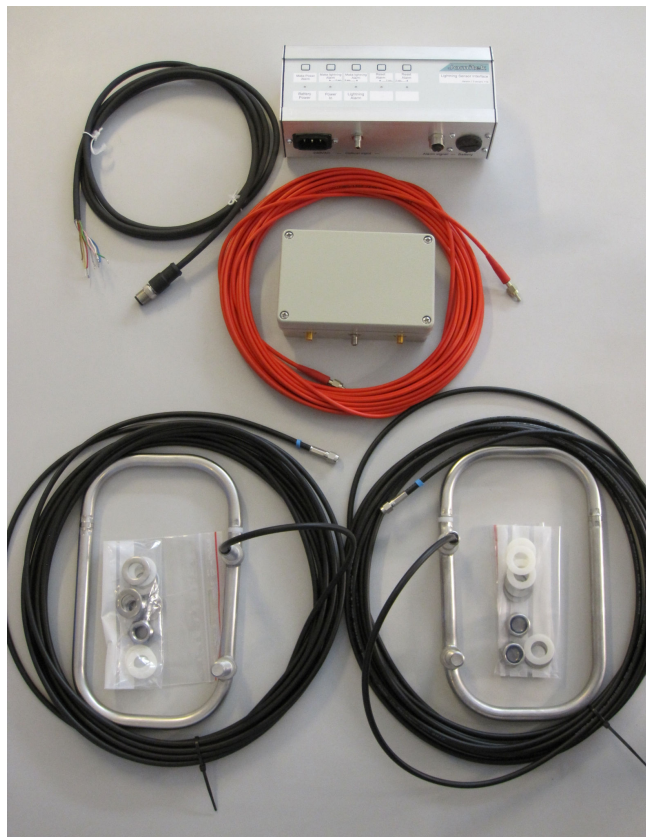
Lightning Sensor Classic

Guide for

Design-in, Installation, Maintenance

Lightning sensor classic

July 6th 2021



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Chapter 1. Design-in

1.1 Design-in guidelines

Design engineers can easily include the lightning sensor to all types of wind turbines.

All strikes that hit's a turbine construction will pass the bottom of the tower. The lower 10-15 meters of the tower is seen as safe installation area (rolling sphere model).

For towers made of concrete material and steel wires, please contact Jomitek for special and free advise.

The 2 antennas has to be placed on opposite sides of the tower. The signal from the two antennas is summarized in the antenna box. Any strike current that passes inside the tower or through the tower wall will be measured by the magnetic field generated. By having the antennas 180 degrees from each other, any strike in nearby turbines will generate a pulse that will have opposite sign in the 2 antennas and thereby become subtracted and will then not be able to generate an alarm. This gives a design rule of thumb:

1. Place the 2 antennas 180 degrees +/- 5 degrees from each other

The magnetic field generated will form circular field lines around the tower and flow through the antennas. It is important that these field lines will not become disturbed so the next rule:

2. Place the antennas at a level where no other iron part will disturb the circle +/- 1 meter in the horizontal plane.

If something big, like a platform structure or a transformer is placed nearby, please ask Jomitek for an evaluation of the actual placement and disturbances.

To make sure that the magnetic field lines will not induce a damaging high voltage between the antenna wires and other metal parts the wires should:

3. Place antenna wires in a horizontal plane +/- 0,5 meters of the antenna level.

As any metallic surrounded hole perpendicular to the current direction will generate a voltage when strike passes a rule that must apply inside the tower as well as outside the tower is:

4. Antenna wires must be kept as close to the tower wall as possible and preferable within 10cm

To make sure that the summation of the antenna signals works well it is preferred that

5. The antenna wires must be approx. the same length for each of the 2 antennas.

As the lightning sensor works on measuring the changing magnetic field :

6. It is free to use permanent magnets for mounting any parts.

And finally remember that

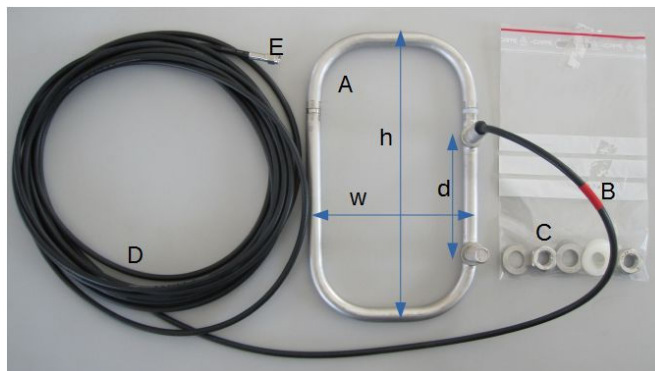
7. Jomitek always offers free design-in assistance

1.2 Drawings and measures:

Antennas:

The antenna consist of following details:

- A. Antenna frame
- B. Colour label Red=left, Green=right
- C. Nut's and washer's
 - 2 nuts
 - 4 steel washers
 - 4 nylon washers
- D. Antenna wire in specified length
- E. Antenna connector, SMA type



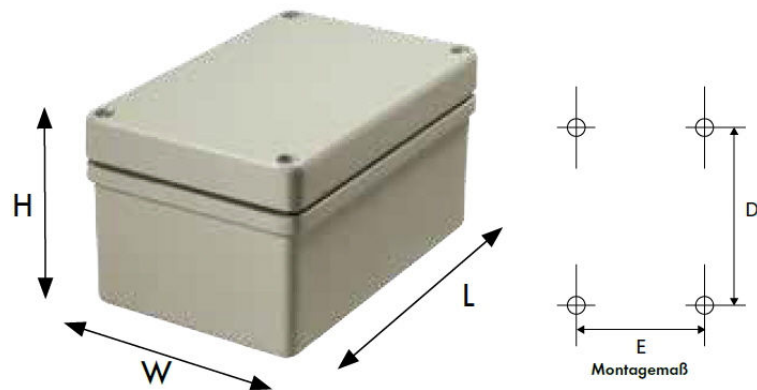
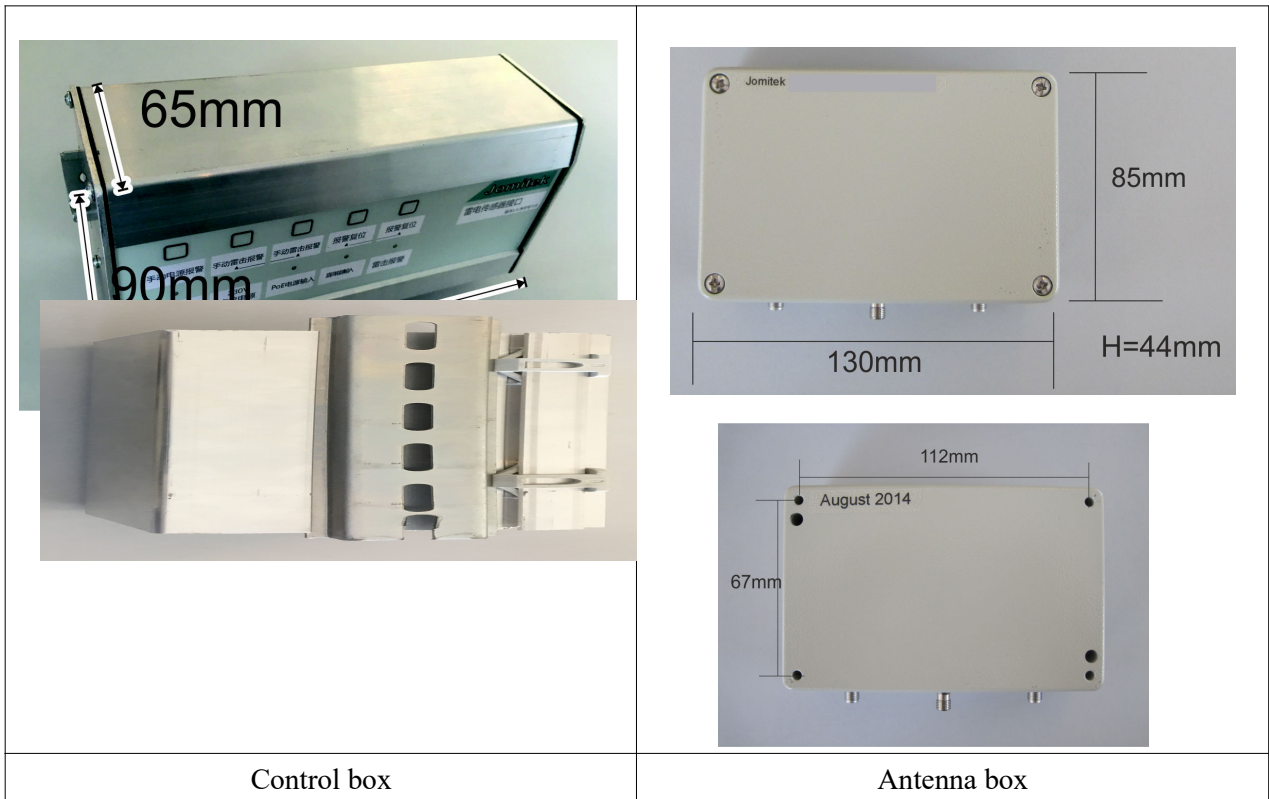
Measures

Height, h	225 mm
Width, w	135 mm
Distance, d	90 mm
Antenna bolts	M12
Length bolts	40 mm
Max diameter of connector	9,5 mm

All materials suitable for harsh off-shore use.

Mounting plates available by special request.

Boxes:



	L	W	H	D	E
Antenna box:	130	85	44	113	52
Control box:	185	90	65		

The antenna box is fixed in one of 2 ways:

1. Use 4 pcs M4 self-tapping bolts in the 4 small holes underneath the box
2. Use 2 pcs M4 bolts mounted from inside the box through the 2 big holes (see picture).



Chapter 2. Installation

2.1. Who may perform the installation?

The Lightning Sensor is advanced electronic equipment. The sensor may therefore only be installed by persons adequately experienced in handling such equipment. In case of need for battery replacement, only such professional persons may open the box.

2.2. Tool requirements.

1. Strong drilling equipment
2. 13mm drill
3. Round file for shaping of the holes
4. 19mm open-ended spanner
5. Lubricant for stainless steel assembly
6. Anti oxidations for protection of the drilled holes
7. Strong aluminium tape or tubes for mounting of the antenna cables
8. Strips for fixing of vertical cables
9. Adhesive or bolts for mounting of the antenna box. The box thickness is approx. 3 mm.
10. Control cable with screening (the connector is included) or it is all included in separate cable kit.

2.3. Content of a complete sensor.

- 2 pcs antennas, including antenna cable
- 1 pcs. antenna box (the small box)
- 1 pcs. optical cable
- 1 pcs. control box (the big box)
- 1 pcs. connector for remote control (or complete cable)
- 1 pcs. IEC cable for AC plug

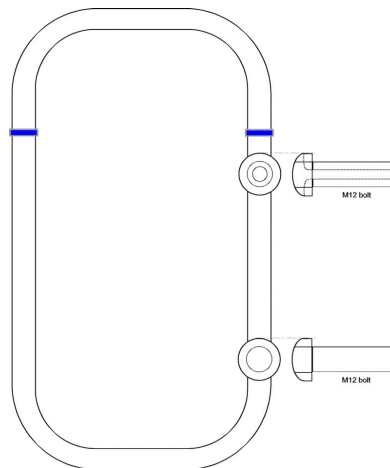
2.4. Installation.

Only professional and trained personal may install the lightning sensor.

Antennas

1. Find suitable places on the tower (outside) for the 2 antennas. The antennas must be mounted opposite each other in the same height above tower button. The exact height of placement is not critical. The most important issue is that the antennas must not be damaged by ladder's or persons. As an example, the antennas could be placed 1-2 meters above entrance door top level. It is very important, that both antennas are mounted having the plastic ring pointing upwards and it is also very important that the antennas are placed exactly diagonally across each other.
- 2.

The antennas must have the plastic rings at the upward end. See the drawing below.



3. Drill 2 holes for each antenna. The 2 holes must be drilled vertically with a centre distance of 90,0mm. The drill size is minimum 12 mm, but due to tolerances of the material and the drilling process a hole size of 13 mm is recommended.
4. Remove the burr at the holes with a round file.
5. Protect the holes against oxidations.
6. If needed, use 2 thin (fishing line) wires out through the holes. Connect the wires to the antenna legs and drag the antennas carefully into position.
7. Remember to use stainless steel lubricant on the bolts and nuts before assembly. If not used there will be a high risk of cold welding of bolt and nut assembly. It is recommended to use a maximum torque of 35NM due to the nylon washers.
8. Mount the antenna cable horizontally along the tower wall. You may use aluminium tape (3M) or tubes.

Antenna box

9. The antenna box (the small box) must be mounted exactly in the middle between the 2 antennas, inside the tower, and in approx. the same height. The connectors must point downwards.
10. Connect the antenna cables. The minimum bending radius is 5cm.
11. Connect the optical cable. Be careful not to bend the optical cable too much during installation. The minimum bending radius is 5 cm. Make sure that the cable is fixed so that there is no pull force on the optical connector.

Control box

12. The control box may be placed, where it is most appropriate. All connectors should point downwards.
13. Connect the optical cable and the mains IEC cable. Make sure that the mains IEC connector cannot drop out due to vibrations.
14. Connect the control cable as shown later in this guide.

2.5. Testing.

If test of the complete system is required after final mounting on the turbine, special test equipment is needed. Test equipment is not a part of the lightning sensor itself.

Test may only be performed by trained personnel.

1. An electrical field is applied on one of the antennas.
2. Check that the LED for lightning is lit up and that the relay is activated.
3. Reset the lightning signal from the sensor by pressing the 2 front panel buttons at the same time in approx. 10 sec. until the diode switches off again and the relay deactivates.
4. Repeat the test using reverse polarity on the antenna.
5. Repeat the above tests on the other antenna
6. Repeat the test with the mains supply switched off during the lightning field pulse on the antennas.



2.6 Relays

From factory the output relays are switched on during normal operation (no lightning).

The reason for configuring the relay output to be on during normal operation, meaning no alarms, is to give an alarm automatically if the wire is broken or the connector not attached.

This also implies that if the box is dismantled, the turbine control will see this as an alarm situation. A short circuit at the turbine control input might be needed.

If the battery is not installed or is malfunctioning, the sensor will still work as long as a stable mains supply is attached.

The output relays are powered by the mains supply, so short interruptions in the mains supply might give short interruption of the output relays and thereby give short alarm signals. It is recommended that the turbine control takes care of filtering of such short distortions. Longer interruptions of the mains supply will give an alarm on the power output relay. Very short interruptions might not give alarms on the power alarm relay.




When a strike is detected, the red LED is indicating and the alarm relay will open the contact to signal an alarm.

2.7 Battery maintenance

The expected lifetime of the battery is 10-20 years. The life time will be shortened dramatically during days without mains supply. The battery may be exchanged with a corresponding 3,7V Lithium battery, if the supervision circuit in the sensor signals power failure. Please observe that also errors on the mains supply will give a power failure signal.

The power failure circuit will not give any alarm if the battery is disconnected.

The battery is NOT connected from factory.

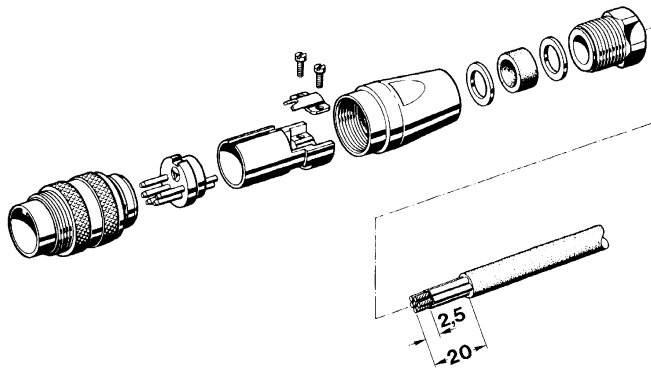
	<p>Battery connector</p>
	<p>Battery connected</p>
	<p>Battery charging</p>

2.8. Connections

The control-cable must be connected to the control box, using the connector delivered. 2 versions are available, the older C091 type or the new M12 type.

C091

(Type C 091 D, IEC130-9, and IP67):



Only screened cable may be used for the control cable.

The connector has to be assembled as follow:

Pin 1 and 2: Power-error relay

Pin 3 and 6: Reset of lightning relay (pin 3 = minus at DC)

Pin 4 and 5: lightning relay

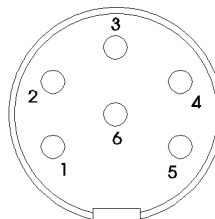
Pin 1. white, pin 2. brown Power failure

Pin 3. green, pin 6. yellow Reset

Pin 4. grey, pin 5. pink Lightning strike

Shield must be connected to the connector housing through the clamp.

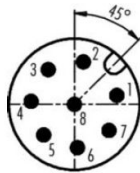
Connector seen from soldering side.



M12

M12 - Version (upgrade from old C091):

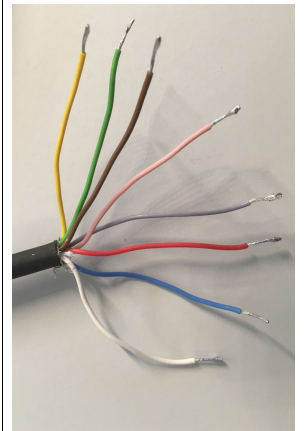
Pin	Description
1	Power Failure
2	Power Failure
3	Alarm Reset -
4	Lightning Alarm
5	Lightning Alarm
6	Alarm Reset +
7	Not used
8	Not used
Shield	Earth



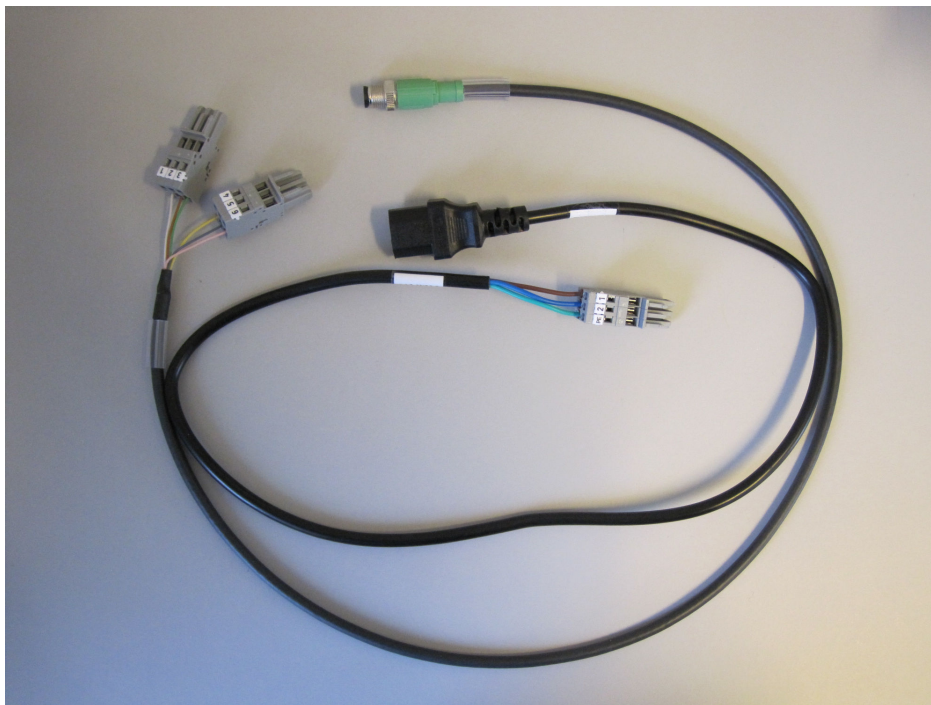
	X	Y
1	2,69	0,57
2	0,57	2,69
3	-1,66	2,20
4	-2,75	0,19
5	-1,94	-1,94
6	0,19	-2,74
7	2,20	-1,65
8	0,00	0,00

- 1 weiß/white
- 2 braun/brown
- 3 grün/green
- 4 gelb/yellow
- 5 grau/grey
- 6 rosa/pink
- 7 blau/blue
- 8 rot/red

Geschirmte Versionen: Schirm auf Gehäuse oder Pin 8
 Shielded versions: shield on housing or pin 8



Jomitek offer ready made cable kits like this:



Recommendations for Control box cables:

Cable specification signal cable:

LIYCY, 3x2x0,25, twisted pair shielded. Outer diameter approx. 7mm.

Color code according to DIN 47100,

Operating temperature: -30 - +80 degree C

Flame retardant to IEC60332-1

Testing voltage 1200V

Peak operating voltage 300V

Cable specification 230V cable:

Rated voltage 300/500V

H05VV-F 3x0,75

Color coding: brown(Phase), blue(Neutral), yellow/green(Earth)

Operating temperature: -30 - +60 degree C

Free wire ends: 2-3 cm.

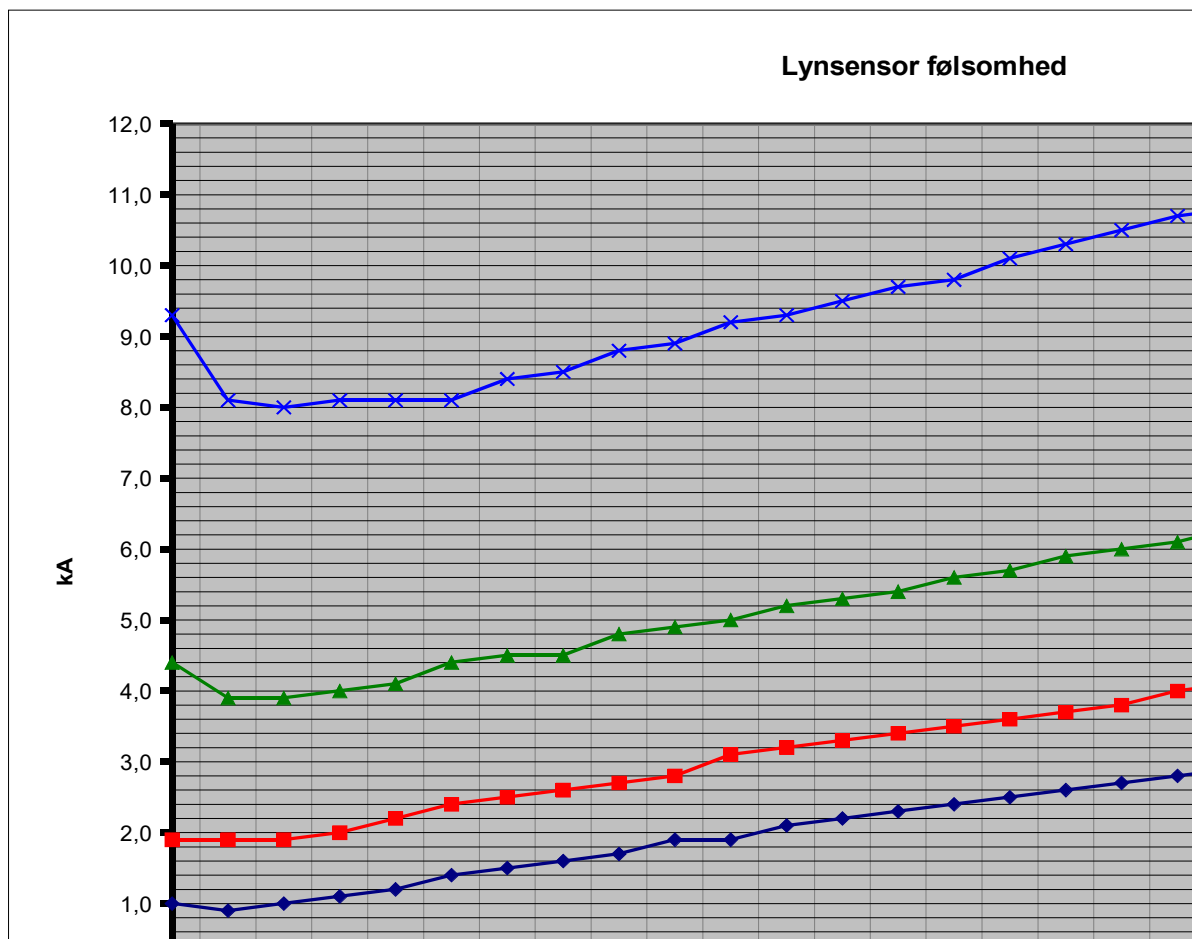
2.9 Antenna sensitivity

The lightning sensor sensitivity may be adjusted into 4 different levels. The factory setting is for level 1, i.e. maximum sensitivity.

For a turbine having a radius of 2,2 meter at the antennas, the sensitivities are:

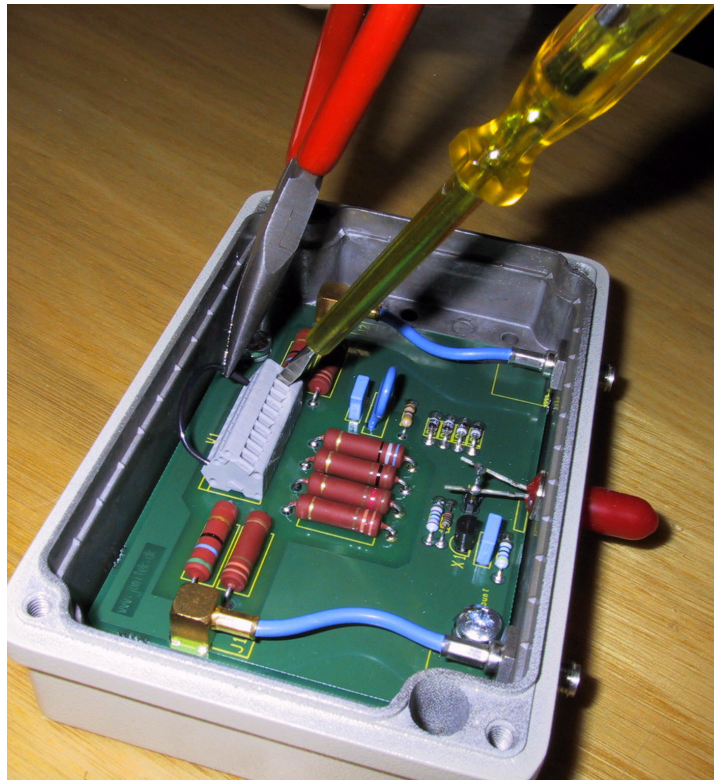
- Level 1.: 1kA
- Level 2.: 2kA
- Level 3.: 4kA
- Level 4.: 8kA

The sensitivity is dependant of the rise time of the lightning current. See the graph below:



Lightning sensor sensitivity.
Vertically; Lightning current in kA.
Horizontally; Rise time of lightning current in microseconds.

The sensitivity may be adjusted by placing small wire jumpers into the cage clamp inside the antenna box.



Jumper settings:

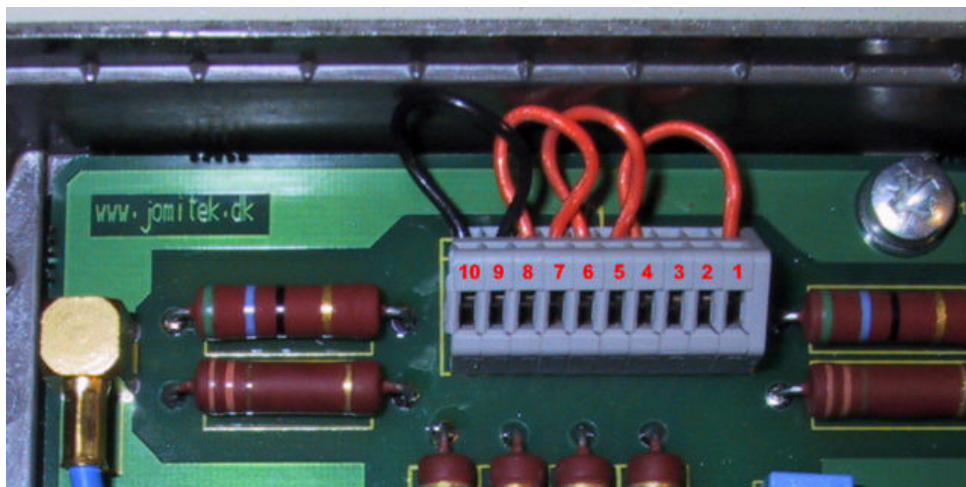
Numbering from right to left 1 to 10

Level 1 (1kA): 10-1

Level 2 (2kA): 10-3, 2-1

Level 3 (4kA): 10-7, 6-5, 4-1

Level 4 (8kA): 10-9, 8-7, 6-5, 4-1



Chapter 3.

3.1 Maintenance

It is recommended that the battery is exchange minimum every 10 years.

The battery is NOT connected from factory.

It strongly recommended to test the installed system one time per year using the system mentioned in chapter 2.5.