



# SCIENTIFIC LIGHTNING RODS of KEC



**KEC**

The safest and most effective  
Early Streamer Emission (ESE)  
System for Lightning Protection

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## PROTECTION AGAINST DIRECT LIGHTNING STROCKES

For the protection of structures, persons or objects a Lighting Protection System (L.P.S) is needed, which attracts the lightning stroke and leads the lightning currents to earth.

Among the structures which require a LPS are buildings, open areas accessible to the public, structures which are dangerous to the environment due to the possible emission of contaminated substances, historical buildings, etc...

The following systems are currently used for the external protection against lightning:

### SINGE ROD AIR-TERMINATION SYSTEM

**SYSTEM:** The lightning rod is located higher than any other point of the area or structure to be protected, and its objective is to intercept the discharge and to derive the lightning current to earth.



Single rod air-termination system

Capturing lightning rod with mast.  
One or more down-conductors.  
A disconnector on each down-conductor to test the resistivity of the structure.

A protection element against mechanical forces in the final two meter of the down-conductor.  
An earth electrode for each down-conductor.

Equipotential bonding of the earth electrodes and general earth termination system.

### WIREAIR- TERMINATION SYSTEM

The protection is formed by one or more air-wires located above the installation or area to be protected. The conductors are connected to earth through masts on each side. The protected area is the area within the masts or down-conductors.



Wire air-termination system

One or more air-wire conductors.  
A masts on each end of the conductor.

An earth electrode for each down-conductor.

Equipotential bonding of the earth electrodes and general earth termination system.

### MESHAIR-TERMINATION SYSTEM:

The system consists of several capturing points connected with each other through conductors. A network is formed is extended with conductors leading to earth.



Mesh air-termination system

Multiple capturing points.  
A connecting mesh for the capturing points.

For each capturing point one down-conductor.

One earth electrode for each down-conductor.

Equipotential bonding of the earth electrodes and general earth termination system.

## LIGHTNING ROD WITH FEEDING DEVICE KEC

### Advantages of a system with feeding device:

The KEC system releases electrical discharges with opposite polarity to the lightning strokes. This way the system achieves to attract the lightning flash and to raise the strike point to altitude higher than the structure to be protected. The effect is that a large protection area is created than obtained with standard lightning rods.

In the figure it can be seen that the protection area obtained with this system is much larger than that obtained with other protection devices, so that with a single capturing element the protection of buildings and installations with large size can be achieved.

A lightning rod of type KEC is not like a single capturing point of a mesh air-termination system, but rather like all these capturing points which would be needed to protect the area. An important cost saving can be achieved due to the saving of materials such as the number of down-conductors, earth terminations, equipotential bonding, etc.

The system also offers advantages compared to other systems in the protection of open areas as sport fields, etc.

As a consequence the KEC system has several important advantages and a reduced cost compared to other passive capturing systems.

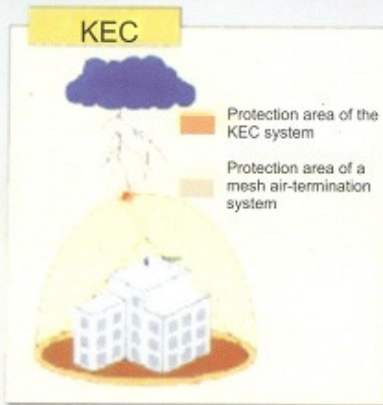
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## AN EFFECTIVE FEEDING DEVICE

### ADVANTAGES

In the instant when a lightning flash goes to earth a discharge on any raised structure is produced. Passive protection systems such as a mesh air-termination system only capture the discharges which the protected structure would receive, due to the lack of capturing system which attracts the lightning stroke.

The feeding device of type KEC releases electrical discharges to the air in order to create a discharge path for the lightning stroke assuring this way an improved efficiency in the capturing of lightning.



NOT RADIOACTIVE

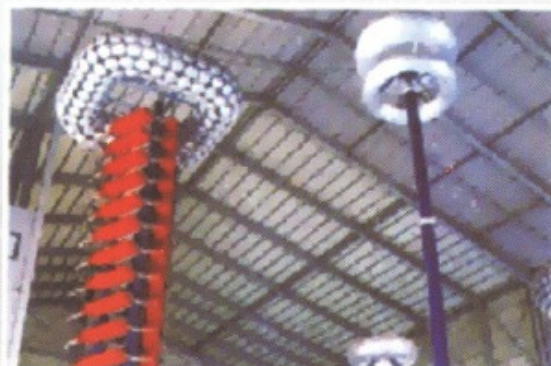
### WORKING PRINCIPLE

By means of the feeding devices, the system emits a high voltage signal with a certain frequency and amplitude. Its efficiency is obtained by creating an up-going path up to the down-going path of the lightning stroke. This way a striking point on an attitude higher than the protected structure is created which increases the radius of the protected area if compared with a standard lightning rod.

### ENERGY AUTONOMY

The feeding device does not need any auxiliary power supply such as other lightning capturing systems. The KEC obtains the energy for the generation of the high voltage signal from the electro-magnetic field which is automatically created during thunderstorms (between 10 to 20KV/m).

The values determined in the test correspond to average values. These values are evaluated in the standards NF C 17 - 102 or in UNE21 186 according to the random nature of lightning.



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## CALCULATION & SELECTION OF KEC MODEL

The radius of protection is calculated as following standard (NF C 17-102 and UME 21186)

$$R_p = \sqrt{2Dh - h^2 + \Delta L (2D + \Delta L)}$$

R<sub>p</sub>: protection radius.

h: height from referred protection plan to KEC (5m ≤ h ≤ 60m)

D: a parameter that takes the different values depending on the protection level:

D=20m for Level I ( for area with very high risk of lightning)

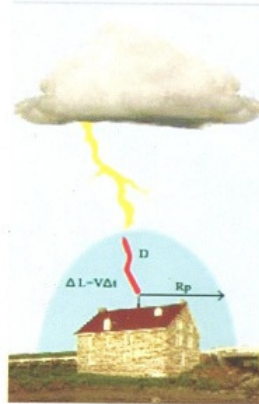
D= 45m for Level II ( for area with high risk of lightning)

D=60m for Level III ( for area with normal risk of lightning)

ΔL: virtual height of upward leader achieved upon the conductor.

ΔL= Vx Δt where V is the streamer velocity of propagation (~1m/μs).

Δt: average gain in time of upward leader emission and taken from KERI test report.



Height from structure to KEC (m)	Level I (Maximum Security) D = 20				Level II (High Security) D = 45				Level III (Standard Security) D = 60			
	K0	K1	K2	K3	K0	K1	K2	K3	K0	K1	K2	K3
2	10	17	24	32	15	23	30	40	17	26	33	44
3	15	25	35	48	22	34	45	59	26	39	50	65
4	21	34	48	64	30	46	60	78	34	52	67	87
5	28	46	64	86	38	61	81	105	43	69	90	115
8	27	47	65	86	40	63	83	106	45	71	92	116
10	28	47	65	87	42	64	84	106	46	73	93	117
15	29	48	65	87	46	67	86	108	53	76	96	119
20	30	48	66	87	49	69	87	109	57	79	98	121
25	30	48	66	87	50	70	88	110	59	81	100	122
30	30	48	66	87	51	72	89	111	61	83	101	123
35	30	48	66	87	52	73	90	112	63	85	103	125
40	30	48	66	87	53	73	91	112	65	86	104	125
45	30	48	66	87	55	73	91	112	68	87	105	126
50	30	48	66	87	55	73	91	112	69	88	105	127
60	30	48	66	87	55	73	91	112	70	88	105	128

If the protected structure is higher 2m and under 5m, the protection radius is followed the selection table.

If the protected structure is higher 5m and under 60m, the protection radius is calculated in compliance with above NF C 17-102 and Δt (μs) of laboratory test result.

TEST REPORT KERI



EARTH VOLTAGE EQUALIZER		LIGHTNING COUNTER	
Model	MH-VE	Model	K-500
Discharge voltage	1120V	Minimum metering current	300A
Max discharge current (I/20 μs)	120kA	Maximum metering current	100kA
Insulation resistance	> 500MΩ	Metering range	0 - 9999
Response time	< 25nS	Operation temperature	-20 → + 60°C
Operation temperature	-40 → + 85°C	Material	ABS & Aluminium
Dimension (WxHxD)	163mmx80mmx70mm	Dimension (WxHxD)	106mmx81mmx61mm
Terminal type	GV50SQ	Weight	825g
Connection	Earth to Earth	Color	Black

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