

Lightning observation station at the Rzeszow University of Technology, Poland

Abstract: A short description of a lightning observation station which is arranged for investigation of natural lightning at the Rzeszow University of Technology, Poland is presented in the paper. The system is based on electric and magnetic field antennas and fast video camera.

Streszczenie: W artykule przedstawiono krótki opis stacji rejestracji wyładowań piorunowych, która aktualnie jest budowana na Politechnice Rzeszowskiej. Głównymi elementami systemu są anteny do pomiaru pola elektrycznego i magnetycznego oraz szybka kamera wideo (*Stacja obserwacji wyładowań atmosferycznych na Politechnice Rzeszowskiej*).

Keywords: Lightning, lightning electric and magnetic field, fast video camera

Słowa kluczowe: Wyładowania atmosferyczne, piorunowe pole elektryczne i magnetyczne, szybka kamera wideo

Introduction

The development of investigations of different aspects of lightning phenomena is impressive within last few decades. The knowledge on many of these aspects is significantly richer now [1]. However, there is necessity to conduct further investigations concerning the lightning physics and mechanisms as well as the lightning protection [2].

The results of lightning investigations conducted in Rzeszow University of Technology (RUT), Poland, in cooperation with lightning group from University of Florida [3-5] became an impulse to build The Lightning Test Center in south east part of Poland. Recently, a new lightning observation station is developed in Rzeszow as well.

A new lightning observation station

Natural lightning will be investigated at the Rzeszow University of Technology (RUT), Poland based on lightning electric (Fig. 1) and magnetic (Fig. 2) field measurements and fast video recordings (Fig. 3) of lightning flashes [6].

A magnetic field change is already measured by the LINET antenna installed at the RUT in 2006 [7]. Therefore, fairly good location of measured and recorded lightning discharges will be possible using a data from the lightning location system operated in Europe.

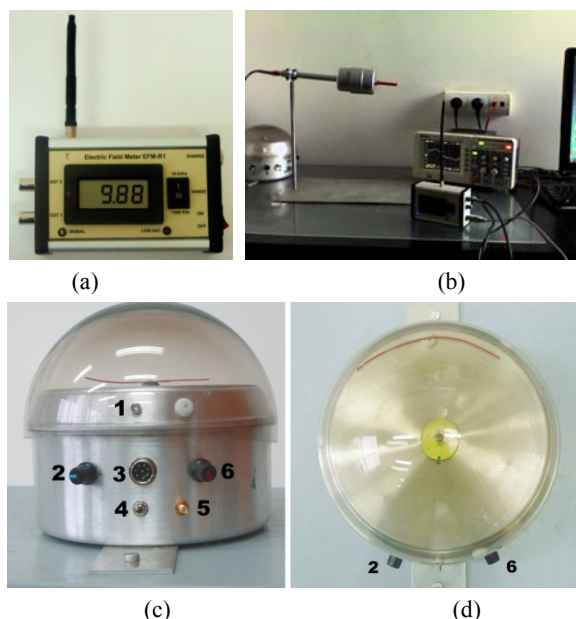


Fig. 1. Antennas for electric field measurements during thunderstorm conditions; (a) The electric field meter EFM-R1 (receiver) for monitoring of electric field slow change (DC–10Hz frequency range); (b) sensor and receiver of the field meter EFM-R1 during laboratory tests; (c) A side and (d) top view of a fast antenna for electric field measurements in 20Hz–3 MHz frequency range: (1) trigger indicator, (2) sensitivity adjuster, (3) 8-pin socket, (4) power switch, (5) HF calibration socket, (6) threshold controller insensitivity. Both antennas were constructed at the Warsaw University of Technology, Poland.



Fig. 2. The first LINET antenna installed in Poland in 2006 [7] working as a reference point of the lightning location system will be used for measurements of lightning magnetic field component. This year, new antennas shown in Fig. 1 and the FVC Photron SA5 shown in Fig. 3 will be mounted at the same roof together with the LINET sensor.

The measuring system will be supported by fast video recordings of lightning flashes using a digital camera Photron SA5. This camera will be triggered together with the E-field fast antenna during recordings.

The complete system of fast video recordings consists of the following components:

- Color fast video camera Photron SA5 with 32 GB memory (2.98 s record duration at 7500 fps and at resolution 1024x1000),
- Dual-channel data acquisition card Photron -Interface type PCI 3525 with drivers for Matlab and Labview,
- Data acquisition card Mi2 Spectrum 3131 with drivers for Matlab and Labview,
- Module to signals transmission at a distance of 60 m for data acquisition card,

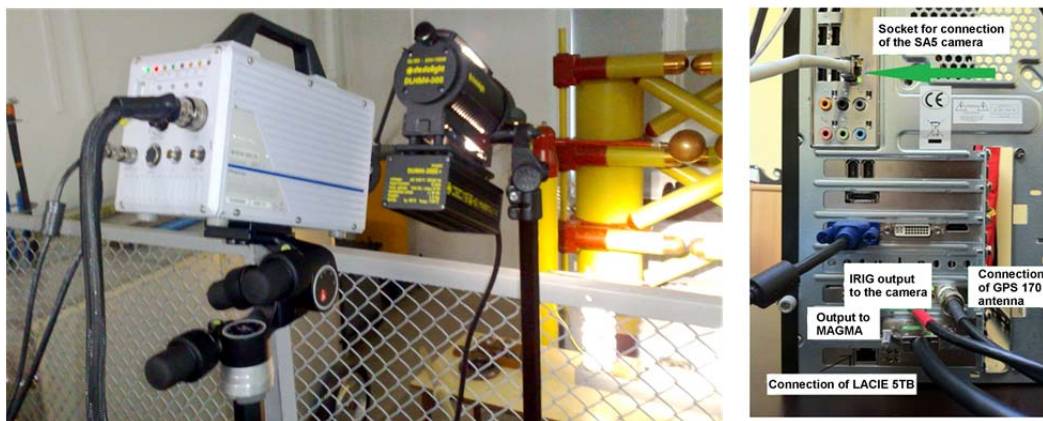
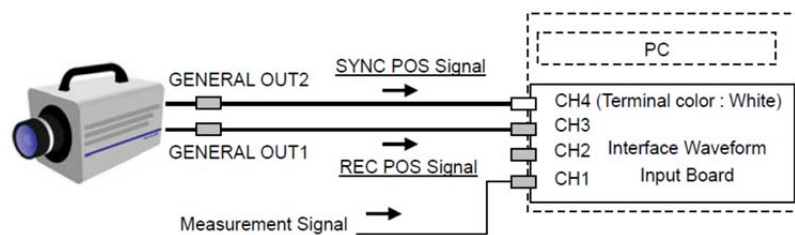


Figure 3. Connections between Photron SA5 general outputs and data acquisition card installed in the box for 4 PCI expansion cards with interface to a PC and an additional interface for connecting to a laptop card (upper panel), and general view of FVC Photron SA5 working in HV Laboratory at the RUT during preliminary tests together with the back of the PC which integrates the entire measuring and recording system (bottom panel).

- Meinberg IRIG system type 170 with a GPS external antenna,
- 60 m extension cable to connect the Photron camera IRIG-B input with the card detection time installed in PC,
- MAGMA PCI Box for 4 PCI expansion cards with interface to a PC and an additional interface for connecting to a laptop card (Express Card EC34),
- Additional memory LACIE 5Big Backup Server with a capacity of 5 TB,
- The PC which integrates the entire system.

In Fig. 3 it is shown connections between the FVC Photron SA5 general outputs and data acquisition card installed in the external box dedicated for 4 PCI expansion cards with interface to a PC and an additional interface for connecting to a laptop card. Below, in the same figure a general view of fast video camera tested in HV laboratory at the RUT, Poland is shown together with the PC back which integrates the entire measuring and recording system (bottom panel in Fig.3).

In the initial phase of the project will be carried out analysis of lightning registration systems working worldwide. This will avoid common mistakes, and also create the possibility to further optimize such system. Further, the collective database will allow for analysis of lightning parameters based on long-term registrations.

Conclusion

The lightning research group at the RUT started its experimental investigations of efficiency of lightning protection systems of small structures in 2007 in cooperation with the International Center for Lightning Research and Testing (ICLRT) at Camp Blanding, Florida. After experimental investigations carried out in 2007 and 2008 in Poland the new site for lightning research was arranged close to the Rzeszow. As a complementary of lightning protection experiments a new lightning observation

station is built at the roof of Electrical Engineering Building of the Rzeszow University of Technology. We plan to start regular work of the station in the summer season in 2012.

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