

# NINETEENTH-CENTURY SELF-RECORDING PHOTOGRAPHIC METEOROLOGICAL INSTRUMENTS AT THE OBSERVATORY INFANTE D. LUIZ, LISBON

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## INTRODUCTION

In the second half of the nineteenth century the *Infante D. Luiz* Observatory of Lisbon belonged to an international network of scientific institutions that worked in meteorological and magnetic studies. This internationalization of the science of meteorology led the Observatory to acquire photographic self-recording instruments like electrographs, baropscycographs and magnetographs. These instruments were calibrated at the Kew Observatory as there were privileged scientific relations between the Lisbon Observatory scientists Fradesso da Silveira and Brito Capello and the director of the Kew Observatory Balfour Stewart. Further important cooperation was also established with William Thomson (Lord Kelvin) and Mascart, among others.



Observatory Building founded in 1863

## ELECTROGRAPH

William Thomson (Lord Kelvin) invented the quadrant electrometer in 1853. This instrument used the electrical force generated between charged electrodes. A butterfly-shaped electrode with two quadrants of a circular disk is supported by a torsion fiber inside a stationary circular box composed of four quadrants, with opposite pairs of which are electrically connected. The rotation of the suspended electrode depends on the potentials applied to the various electrodes. A beam of light reflected from a mirror attached to the fiber is shown on a scale and is deflected as the fiber is rotated.



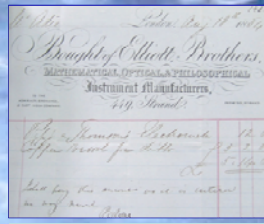
Thomson's quadrant electrometer (MCUL00331)

## KELVIN'S LETTER



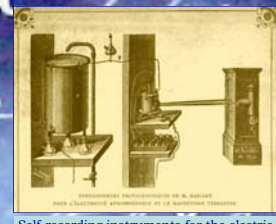
William Thomson's letter to Brito Capello: 22/12/1864 (Folder correspondence - 1864, IGIDL)

In 1864 Brito Capello from Observatory Infante D. Luiz and William Thomson exchanged correspondence. In his letter, Lord Kelvin explains to Capello how he used the electrometer in order to get results with more accuracy for the studies of atmospheric electricity and how he made photographic recording.



Electrometer receipt from the maker Patrick Adie (Folder correspondence - 1864, doc. n. 148, IGIDL)

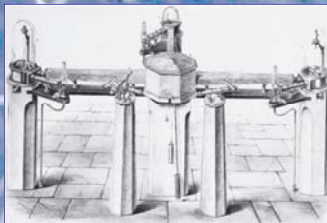
Although the experiments with the quadrant electrometer had started in 1864, the measurements of the electric potential, with photographic record, had only been initiated in 1877.



Self-recording instruments for the electric potential, adapted from Mascart (Ph. Pellin Catalogue, n.d.)

## MAGNETOGRAPH

Self-recording magnetographs had been in operation at the Kew observatory since 1858. The instruments were made by Adie, of London. In the Observatory Infante D. Luiz under the direction of Fradesso da Silveira, and with the principal observer Brito Capello, the magnetographs (made also by Adie) were in regular operation by the beginning of July, 1863. Shortly afterwards Capello forwarded copies of some of the Lisbon magnetic curves to Stewart, superintendent of the Kew observatory. The comparison of the corresponding curves shows similar and interesting results and led to a communication to the Royal Society of London by Capello and Stewart (Proceedings, vol. 13, p. 111-120).



Adie Magnetograph (CASELLA, n.d.)

This is a photo-recording instrument made by Patrick Adie of London, used in Kew Observatory and in the Observatory Infante D. Luiz in Lisbon. The three magnetographs (declination, bifilar and balance) were placed in the vault room in the first floor.



Magnetograph pieces (MCUL00386) and Octagonal box with PHOTOGRAPHIC devices of the magnetographs (MCUL00354)

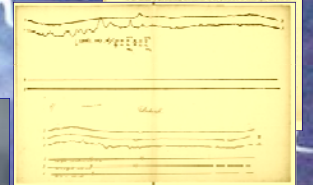
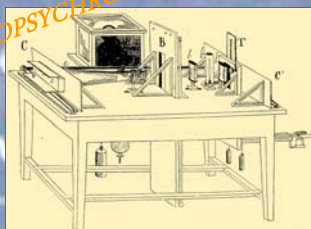


Photo-lithographic Impressions of traces produced simultaneously by the magnetographs at Kew and Lisbon (Kew and Lisbon Observatories, 1864)

## BAROPSYCHROGRAPH



The Baropscychrograph of the Observatory Infante D. Luiz (Silveira, 1864)

Instrument made by Jules Salleron for photographic recording of the barometric and psychrometric variations.

« M. Salleron, à l'occasion de la présentation récente faire par M. Babinet d'un baromètre construit par M. Morin, rappelle un enregistreur météorologique qu'il a lui-même construit, et qui, depuis quatre ans, fonctionne à l'Observatoire du Dépôt de la Marine. Cet appareil donne, avec la hauteur barométrique, la température atmosphérique, la direction et la vitesse du vent et la quantité de pluie tombée. » (Comp. R. Heb. Sc., T. 59, p. 916).

## FINAL NOTES

- The use of photographic devices for meteorological and magnetic studies has been crucial for its development.
- The international scientific cooperation that was carried by Capello led to a significative production of scientific publications at that time.

## ACKNOWLEDGMENTS

- Instituto Geofísico Infante D. Luis, Portugal (IGIDL)
- Museu de Ciência da Universidade de Lisboa, Portugal (MCUL)

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