LANGMUIR PROBES FOR THE INTERNATIONAL SPACE STATION

BOIAN KIROV 1, Ditchko Batchvarov 2, Rumiana Krasteva 2, Ani Boneva 2, Rumen Nedkov 3, Stanislav Klimov 4, Valery Grushin 4

1. Solar-Terrestrial Influences Laboratory, Sofia, Bulgaria, email bkirov@space.bas.bg
2. Central Laboratory of Mechatronics and Instrumentation, Sofia, Bulgaria, email dbatchvarov@clmi.bas.bg
3. Space Research Institute, Sofia, Bulgaria, email rnedkov@space.bas.bg
4. Space Research Institute, Moscow, Russian Federation, email sklimov@rssi.ru

Langmuir probe is a well known instrument and has long been used for space-borne measurements of plasma parameters. However, in the case of the International Space Station we encounter some new problems. For the first time we have an object not only with such size, but also so much consuming and therefore energy emitting. It appears that the station body significantly affects all low-energy components in its close (near-surface) vicinity: neutral gases, plasma and magnetic field parameters. On the other hand, the surface floating potential tends to reach the potential of the solar batteries, about -160V, which leads to serious problems. In order to study these interactions, the plasma-wave complex “Obstanovka” (“Environment”) will be operated aboard the International Space Station, consisting of scientific instruments for measuring the wave and plasma parameters in the station’s environment. In this complex, two cylindrical Langmuir probes are included which will measure the electron and ion concentrations, the electron temperature, and the space station potential. The probes will operate in two main modes: “full”, for measuring all parameters with time resolution 1 s, and “fast” for measuring the fluctuations of the plasma concentration, with frequency 200 Hz. The presence of two identical instruments mounted in two different points allows the determination of space variations of N_e, N_i, T_e and U_s in the near surface zone.
In this paper, the Langmuir probes for "Obstanovka” experiment are described, including a more reliable method for the sweep voltage generation, an adaptive algorithm for the probe’s operation, and the possibility for remote upgrading of the instrument by means of wireless communication between the operator (astronaut) inside the station and the instruments mounted on booms outside the station.

International Space Station, Langmuir probe, thermal plasma

Boian Kirov, Solar-Terrestrial Influences Laboratory, Bl.3 Acad.G.Bonchev str., 1113 Sofia, Bulgaria, tel. +359-2-9793432, fax +359-2-8700178, email: bkirov@space.bas.bg