14 Electronics Workshop

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In the reporting period a lot of repair and maintenance work was done for the different research groups at the institute. Almost all components of an ESR spectrometer had to be fixed. Triggered by a damaged power supply the whole electronic chain was finally affected and several devices had to be replaced. In this particular case it was very difficult to find suppliers for some older components. Despite of this we developed and built different components used in the laboratories at the physics institute, for other institutes of the university and for experiments at outside labs where members from our institute do there research work. For the demonstration experiments in the lecturer halls again different devices and experimental setups were improved and supplemented in collaboration with L. Pauli and J. Seiler, who are responsible for the preparation of the experiments. Different seminars and courses were attended to keep track of the latest developments. The main focus was on the application of micro controllers and the lead-free soldering process. In the future all assemblies will be produced with lead-free components and lead-free alloys used for the soldering so we acquainted ourselves with this technology. The electronic workshop maintains also a small supply store with the most necessary items, which we upgrade and adapt continuously. In this period we renewed and unified the cable stock. We supplemented also the electronic equipment in the laboratory with a modern spectrum analyzer. It is an extremely lightweight and compact spectrum analyzer that is ideal for a large number of applications in development, service and production. Despite its compact size, it offers a wealth of functions. The instrument features a tracking generator up to 3 GHz and can demodulate signals with a bandwidth of 20 MHz. The main functions of the spectrum analyzer are directly accessible by fixed-assignment function keys, with additional functions accessed using softkeys and tables. This shortens the learning curve for new users as well as for users who operate the instrument only rarely. The spectrum analyzer is ideal for fast, easy measurements during production.

In collaboration with members of the institute of physiology (Research group Prof. N.G. Greef) we developed and built the control electronics for an optical shutter (Fig. 14.1) which is used in a fluorescence microscope with laser illumination. To investigate the operation of ion channels they detect the fluorescence light of a fluorophore, a component of a molecule which causes a molecule to be fluorescent with a CCD camera. These fluorophores suffer damages from the intense illumination. To minimise the exposure time the shutter interrupts the laser beam synchronized to the camera control and hence maximises the lifetime of the fluorophore. Ion channels are membrane proteins, found in virtually all cells, that are of crucial physiological importance.

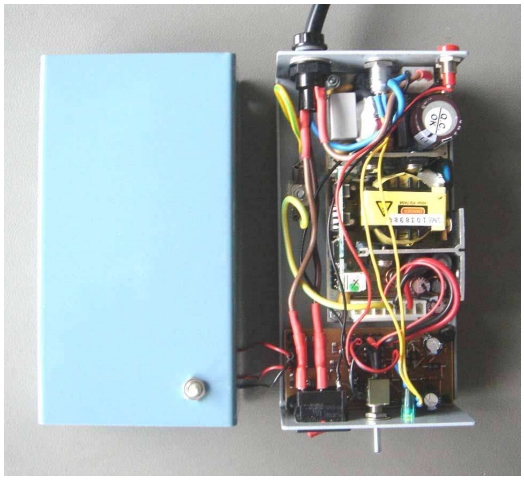

Figure 14.1: Shutter control electronics for the fluorescence microscope.

We also supported a group of high school students from the Kantonsschule Wettingen in performing their "Maturitätsarbeit", which is required as a part of the exam they have to pass. With the help of Kurt Bösiger, Peter Robmann and Stefan Steiner they constructed, built and programmed a robot which can make drawings on a standard blackboard used in class

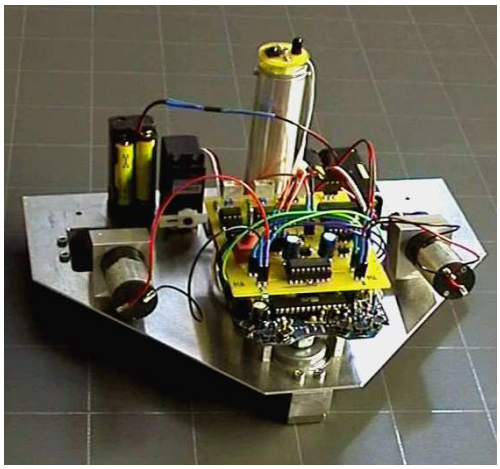

Figure 14.2:
The "Ghostwriter" on the blackboard.

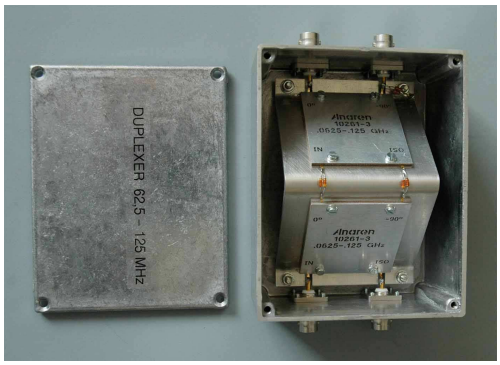

Figure 14.3: Duplexer built for the SCOPES NMR-spectrometers.

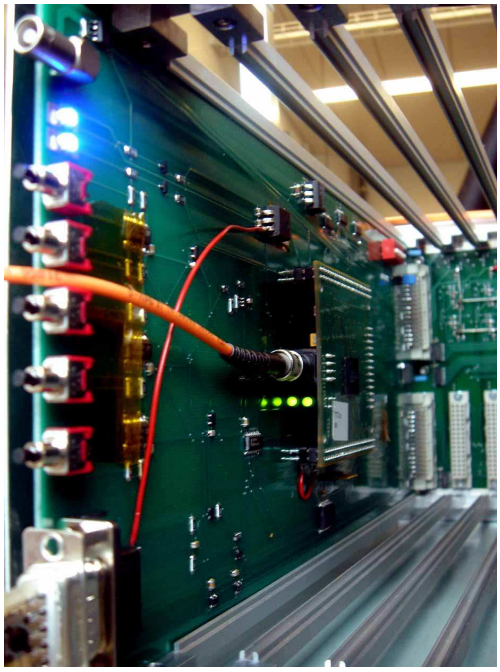

Figure 14.4: Controller card simulator.

rooms. To start with the project a tiny mobile robot developed for educational purposes by DLR, the german aerospace centre was used and adapted to the corresponding needs. The device is very flexible and completely programmable in C. Except for the printed circuit boards only standard parts are utilized and freeware tools can be used for programming. Therefore it is exceptionally suitable as an introduction into processor-controlled electronics, for projects in schools and universities. Special tools, which are freeware for private users, have been used for all electronic development phases and software design, proving that robots can be designed without expensive tools or machines. The robot is equipped with a RISC-processor and an IR-Interface for programming and remote controlling by a PC (Fig. 14.2).

A selection of projects for the different groups is listed below:

- **Physics of Biological Systems (Group Fink, Sec. 12)**
  A high voltage heating power supply transformer was modified and improved. The maximum voltage rating was increased from 3.5 kV to 4.5 kV.

- **Superconductivity and Magnetism (Group Keller, Sec. 9)**
  Several spectrometers, like the already mentioned ESR spectrometer, had to be repaired. Additional devices for the SCOPES NMR spectrometer were designed and built (Fig.14.3).

- **Particle Physics at DESY/HERA (H1) (Group Straumann and Truöl, Sec. 5)**
  The workshop was again involved in the repair and maintenance of the CIP readout electronics for the H1 experiment at DESY in Hamburg.

- **High-precision CP-violation Physics at LHCb (Group Straumann, Sec. 7)**
  Several new layouts of printed circuit boards were made and existing ones were adapted. A control card simulator board with a built on micro-controller was developed and built. (Fig. 14.4).