Electronic Services

Mark Ross

Senior Technical Specialist

Mark joined the School of Physics and Astronomy as a trainee technician after leaving school in 1990. He completed a part-time HNC in Computer Aided Engineering and went on to achieve an HND in Electrical and Electronic Engineering. In 2008 Mark graduated with an MPhil degree from the University of St Andrews following part-time study with the OPO group here in Physics and Astronomy. The type of work undertaken within Electronic Services has evolved greatly over the years.

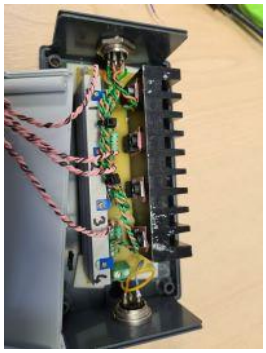
A main part of Mark's current role is to design and develop a wide array of bespoke electrical and electronic instrumentation. This includes very low power to high power electronic and electrical system, involving a lot of analogue and digital electrical knowledge, analogue skills include passive circuits and networks, transistor knowledge (bipolar and mosfet technologies), and all sorts of operational amplifier-based circuits etc. Digital skills include the usage of most logic families. Experience of micro controller platforms such as the PIC series. Coupled with these, skills have been gained with the powerful 32-bit ESP platform. A lot of work has also been carried out with many Arduino boards.

Such design work requires reading of up-to-date literature and keeping in touch with new technologies. This type of design work usually starts with ideas and research before laying down the design onto schematic and pcb software. The design is then manufactured and tested and usually housed is some type of instrument enclosure which will have hardware and interfaces to control the circuit. The instrument is then thoroughly tested before being handed over. In cases where the instrument has a microcontroller embedded in it, firmware code must be written which involves the C programming language.

In addition, a repair service is offered whereby a vast array of faulty instruments are all initially diagnosed and usually repaired. This requires a broad knowledge of electronic and electrical hardware which include fault finding methods coupled with other skills.

Some examples of recent work undertaken

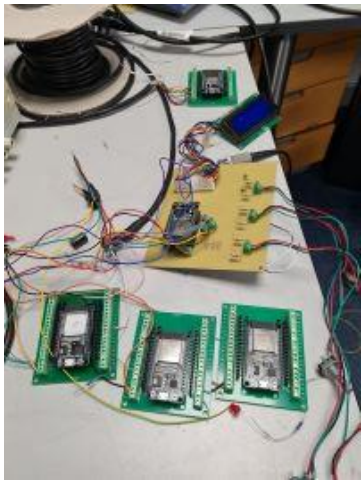
On the right is a current source which was designed and constructed. The current source had four channels, and each channel delivered current from 10mA to 800mA to an oled load, it had accuracy of up to one thousandth of a milliamp.



Pictured on the left here is a 10 channel, high bandwidth transimpedance amplifier with high current output to drive oleds.

This system to the left is a remote-controlled shutter driver for the heavy shutter for the Gregory telescope. Currents of greater than 50A had to be delivered to the high-powered motor for the shutter to open/close. There were two microcontroller platforms used to control the system.

To the right is a 3-channel stepper motor driver system. It uses five powerful ESP32 platforms. The first device decodes the three optical encoders which are used to set the motor speed. The device the sends data through fifteen metres of cable to the second device. The second device is coded as a transceiver which decodes the incoming signals and transmits the three channels of data wirelessly via a local area network to the three devices which are coded as receivers. This data is then sent to the stepper motors via a stepper motor controller.



On the left here is a re-designed high powered piezo motor driver for driving six piezo actuators in a particular sequence. The actuators require a fast rising edge so specific generated signals were required.

Chris Booth

Senior Technical Specialist

Chris has been a member of the team since 2002. He graduated with a BEng (Hons) in Electrical & Electronic Engineering from the University of Aberdeen, and then had a few years as an electronic design engineer with a couple of different companies before joining Physics & Astronomy.

The main purpose of the role is to provide a wide range of electronic support to the school. This includes the design and manufacture of bespoke electronic equipment for research and teaching; fault finding and repair (where possible) of existing equipment, both bespoke and bought-in; provide electronics advice and support; and electrical safety advice and testing.

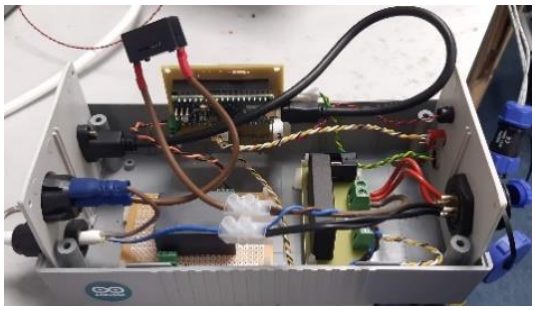
The role is carried out using accumulated knowledge and experience of analogue, digital and power electronics. This knowledge is continuously being updated using training resources and exploring new technologies and techniques.

Many designs have incorporated a microcontroller or Arduino, with the software created in-house. The printed circuit boards are designed and manufactured in-house using a PCB milling machine. The equipment is assembled in Electronics, with all soldering and wiring done there, and mechanical support from the workshop.

Some examples of recent work undertaken

Below photographs show a Laser Diode Controller. Built for an experiment in the Honours Lab, this device pulses a laser diode at 50 Hz in phase with mains. Additional controls allow the user to alter the pulse width and phase.

Pictured below, is a Light Sheet Heater. This device controls the temperature of a water bath to keep samples viable.



Pictured below here: Laser Interlock. All laser labs in the school are equipped with the laser interlock safety system. Lasers have a built-in interlock connection which is controlled by this unit. If the lab door is opened without either the keycode entered or the bypass switch pressed, laser emission is halted.

Napier Dome Control (below):

This system controls the rotation and opening/closing of the domes at the Napier building of the observatory.