The Technical Details of E-Punching

Do you need to know this?

No. If you have read the Basics and Race Day pages there is very little on this page that will help you during an event.

However, if you would like to get involved with running the EP system, are technically minded or just plain inquisitive, you may find the information below interesting from the perspective of having a more in-depth knowledge of how e-punching works.

The Finger Stick

The finger stick (aka SI-Card, Chip or Dibber) is a passive RFID (Radio Frequency Identification) device carried by a runner during orienteering (or similar) events. The antenna is built into the plastic casing and the device is powered through very close proximity to a control or download station.

CAOC's original stock was the SI-5 model, which was discontinued in 2009. The replacement model is the SI-8, which has a black tip. These are both basic models and other models available in the open market have features such as recording more controls and personal information. The specification of the SI-8 is:

- Maximum number of control records carried = 33. Three of these records are dedicated to the Clear, Start & Finish times and are not available for field control times. Thus the maximum number of controls is 30. The SI-5 also records the Check time.
- Data exchange time = 115ms. This is the time it takes for the control and the stick to complete the data transfer. When the control detects the presence of a finger stick it records the serial number of the stick in its own memory along with the current time. The control then transmits it's station number and the current time to the stick. The resulting beep and flashing light confirm that the transfer has been completed. However, see below for the control standby time factor. The SI-5 has an exchange time of 330ms, which is it's single disadvantage when compared to the SI-8.

The Control Station

Each station can be configured to function in any role (Clear, Check, Start, Finish or Field) through the use of the Sport Software application SI-Config. This application also provides the ability to interrogate the control's battery level (to estimate remaining battery life) and internal memory (where finger stick serial numbers are stored along with the times written to the sticks.)

The control station connects with the finger stick through inductive coupling. The station is constantly transmitting an extremely short range signal, but it does so in 2 modes: Standby and Active.

In Standby mode a control is drawing a minimal current (approximately 2µA) and is really just waiting to sense the presence of a finger stick. Once a finger stick is inserted into the control to "punch" it, the control activates and transmits the current time to the stick. The control also records the serial number of the stick being punched, and the time that was written to the stick.

The control then stays in Active mode for a pre-determined length of time waiting for another stick to arrive. During this time the control is drawing around 2mA of current. The CAOC controls are set to stay active for 15 minutes before going back to Standby mode. This is based on the assumption that runners will arrive during the 15 minute window and keep the control active, which will avoid the power surge that occurs during activation.

So, although the finger sticks have specific response times (330ms for an SI-5 and 115ms for an SI-8) there is also the factor of what mode the control is in when it is punched, as a control in Standby mode will also need time to activate.

The battery in the control is a 5V lithium battery (1/2 AA-size, 1Ah) with an estimated working life of 4 – 5 years. The SI-Config application can be used to display the current voltage in the battery, and it's remaining capacity. These readings are taken at the beginning and end of the CAOC season to estimate when controls will need new batteries.

While the battery is rated at 5V the real readings should fall between 2.9V and 3.7V. As lithium batteries lose their voltage rapidly at the end of their life, a reading close to 3V is an indication that it is time to plan on getting the battery changed.

At the Finish

The finish area has 2 components: the software and power management.

Providing a runner has read the information contained in the articles on the **Basics of E-Punching** and **Race Day Instructions**, the finish area could (in theory) be left unmanned with runners responsible for downloading their data and collecting their splits printout.

That is obviously not practical, as there are many questions and problems that can arise during an event, so the club requires that the laptop is staffed by a volunteer at all times. This may seem like a daunting responsibility, but the event software is actually fairly simple to use, and has features that allow the database to be accessed and the event information to be manipulated in almost any way. As with any new software, however, it takes time and practice to learn how to do this safely and correctly. Guides for the different versions of the software are provided to assist users of the laptop and more help can be obtained from the club's e-punch coordinator.

From a power management perspective, the equipment at the finish area requires constant supervision. The laptop can run for almost 2 hours on it's own battery, which is sufficient to get the event started, but as soon as the first finisher arrives the download station and printer will need to be switched on.

The download station's power comes from the laptop through a USB connection. It has an internal battery, but this is only for backup purposes as it has an internal memory that is storing control data from the SI-sticks. Without an external power source the laptop battery is not sufficient to keep the download station powered for the duration of an event.

The printer has a 96W peak power rating (120Vah at 0.8A) and can only run from an external power supply.

To supply enough power to run the equipment from 9:00 am until about 3:00 pm (the normal duration of a CAOC event) a pre-charged battery pack is used. Experience has shown this to be a reasonable solution providing laptop and battery pack are both fully charged before the event. In the event of there not being enough capacity in the battery pack there is a 12V car adaptor, inverter and 100' extension cable. This assumes that the EP table will be close enough to the parking lot for the connections to be made.