Advice for Event Advisers and Controllers – How to control Emit

This paper is intended to equip a Controller with sufficient information to be able to check that the organiser is using the Emit system effectively.

Technical information about Emit Equipment is available at http://www.emit.no

Successful application of electronic punching is a function of the electronic punching system itself, the computer software that may be used, the reliability of the computing systems and the knowledge and skill of the team involved in handling all aspects of the electronic punching and computing systems. This typically includes entry secretaries, planners, organisers and the results computing team.

A Controller should be satisfied that all of these groups have communicated adequately and have a sufficient understanding of the systems they are using.

Principles of operation
Emit control units and control cards are both battery powered. A "punch" is registered by placing the card near to or on a control unit. In doing so, the control card transmits its code to the card and it is stored in the card memory along with the time of the punch.

Cards are downloaded onto a reader after the finish to verify the punch sequence and provide time data which may be either printed directly or passed to a computer system.

Start units and control units come pre-programmed and so are not interchangeable. They require no programming or set-up.

The Emit Controls
There are two main types of Emit control used for Foot Orienteering

1. Standard version 2 contact controls; most now have lights on them.
2. Touch-free (TFP) short-range wireless controls (up to 1 metre radius).

(There are additionally "Eline" controls which allow a competitor to record a punch at much longer ranges. The control units are quite large boxes. The range depends on the antenna used. Eline controls are sometimes used at the start or finish.)j

Standard version 2 contact controls
Controls are all pre-allocated a number between 31 and 249 (except for 66, 68, 86, 89, 98 & 99 which are not used). The number, which is shown on the bottom of the control along with the date of production, is set at manufacture and cannot change. Controls are always on. They are guaranteed for a minimum of 5 years and can last up to 10 years. When the battery in the control is reaching the end of its life it will register an additional control code (99) that will show up on competitors' ecards when they download.

Control 249 is often used as the Finish control, although any control number can be used as a finish; the software just assumes the last control punched was the finish. Joker controls are also available which can be re-programmed to any number between 31 & 249 by using a special ecard. This allows the planner/controller, or anyone else patrolling the competition area, to just carry blank controls, which can then be changed to any number as a replacement. These also have the back-up punch in a unique position.

Controls should have the open end of the control unit facing towards the control feature, or away from the optimum approach route if on an open feature such as a depression or clearing. This allows the competitor to hold the ecard in the palm of their hand and punch with the end of the card facing back towards them.

Controls can be fixed to any type of stake, trestle, and fence pole. They have a hole at either end to allow permanent fixing. If using a pole this should ideally be aluminium, plastic or wood. If ordinary metal is used then a wood block 1 cm thick is recommended under the control, otherwise the control life span can be reduced by 10-15%.

Controls can also have a small light (LED) on them, which will flash to confirm a registration has occurred. Lights are optional for version 2 controls.

The controls have a back-up pin on them so that when an ecard is correctly placed into the control, the water resistant back-up card will receive a pin mark. These are uniquely placed and can therefore be used to verify which specific controls have been visited.

Touch-Free (TFP) Emit Controls
The TFP controls are within a plastic plate the same size as a panel on a conventional control kite, which can be fixed to a conventional control for hanging, or hung/stood on their own. These touch-free controls work with the emiTags which will register up to about 80 cm away. The emiTag must be within the field of the control for about 0.1 seconds so when a competitor is moving at speed, the emiTag will need to be closer than 80 cm in order to record a punch. Obviously with these controls there is no automatic back-up pin-punch. To provide a back-up punch system, a conventional pin punch can be hung from the

kite. The TFP controls store the details of the punches in their memory and can be downloaded to a computer.

The TFP controls have a life of approx 1500 hours after which they have to be completely replaced. The controls have an on-off switch. The default is that controls will switch to power save mode after 2 hours inactivity, but any card in the vicinity will switch them back to normal mode. In power save mode, the emiTag will be a little slower to respond. The controls should be switched off after the event. When the main unit runs out of battery, a backup unit with a separate battery takes over. It is not quite as fast and has a shorter range. There is a flashing light on the unit which notifies the organiser that the main unit has expired.

Note that it is vital that all TFP controls are turned off before transportation and storage. This not only conserves the life of the battery but, even more importantly, prevents any emiTags which might be in range from continuously registering a punch and draining the emiTag battery.

Start Units
Start units look similar to standard control units but perform the function of clearing the memory of an emit card and starting the clock. The card clock is set to zero when the unit is placed on the start unit and starts timing as the card is lifted from the unit.

Reading unit
The 250 reading unit looks like a standard control unit except that it has no pin and it has a cable attached for connection to a computer. It is used for downloading the card data to a computer after the finish.

Mini Time Recorder Unit
Mini Time Recorder (MTR) units are small boxes, much larger than normal units. When a card is placed on top of the MTR unit, the MTR unit will read and store the card data. MTR-3 units store about 1000 cards and MTR-4 units store about 2000 cards. MTR units can be used just before the start to record who started, and the information can be downloaded to a computer. MTR units can be used at the finish to download the data into a computer, or directly to a mini-printer.

Traditional Emit Cards
There are now three types of "traditional" ecard in use:

- Version 2 cards (with no display)
- Version 3 cards (with a display)
- Version 4 cards (with no display)

Version 3 ecards have a small LCD display. The display shows three scrolling bars to indicate a successful "punch". Additional information, including control code and running time, can be viewed.

Version 4 ecards are identical to version 2 cards except that they use more modern components.

All three types of card take a water-resistant (back-up) card that will receive a pin mark from the conventional controls when an ecard is correctly placed into the control.
Placing the card squarely in the control will causes the light to flash and will also mark the back-up card.

Each card is uniquely identified, with either a 5 or 6-digit number.
Pressing the red button on a version 3 card at any time before starting a race will show the card number and then the software version.

The ecards hold up to 48 control codes and times in memory. These remain until reset by a start unit at the next event.

Ecards are guaranteed to last for 5 years and are expected to last for about 10 years. With version 3 cards nearing the end of their life, the display will dim when placed on a start unit.

emiTags
emiTags are used for "touch-free" punching with the touch-free control units. They have no display, but instead there is a light which flashes for 10 seconds when a punch has been recorded. The emiTag can store up to 500 punches. The battery is estimated to last for 5 years. A Velcro band is used to strap the emiTag to the hand or wrist.

The battery status of emiTags should always be checked before use. The voltage should be at least 2.9 volts. The voltage can be measured by using the emiTagCheck application with the ECU1 chip reader. The ECU1 is the size of a USB stick and plugs directly into an available USB port on a PC, or via a USB extension cable (max. 3 m).

The start process for traditional emit cards
Competitors place their ecard on the start unit. This clears the ecard memory and takes less than one second. On version 3 ecards, a display of zeros indicates that this process is complete. The ecard clock starts as the ecard is lifted off the start unit.

On events with pre-allocated start times where punching starts are not required, competitors need not punch on the start line. (However, they must punch a start unit before the start line in order to clear the card and start the clock). The start time is based on the allocated start, and not a start punch. In this case it is important to ensure that the computer clocks on the download system are synchronised to race time, to get accurate and consistent timing.

Punching at controls with traditional emit cards
The competitor places the ecard on the control unit to punch. The control unit has asymmetrical raised lugs to ensure correct placement of the ecard. This ensures that a back-up punch can be registered in the correct location while the electronic punch is registered.

When punching, the Version 3 ecard briefly displays the number of the control that has been punched, then the split from the last control for a few seconds, and finally reverts to the count of controls and total run time. Where a control has had to be substituted with one with a different number, the ecard may show a control code different from the physical number displayed on the control. The physical number will show the correct control code, and competitors should always rely on the physical number displayed.

It is the competitors' responsibility to ensure the card is fully inserted into the control. It is possible for a competitor to record a punch by just touching the end of the ecard (away from the elastic) against the vertical edge of the bulge on the control unit. Some competitors seek to save time by doing this, and they can check the lights or the Version 3 display to see that the punch has been successful. If they elect not to fully insert their card, they will not get a pin prick in their back-up card and they obviously cannot dispute any subsequent electronic disqualification.

Decisions to be made in advance

Punching start or timed start. A punching start is more flexible but is not suitable for high-level events. If the start times have been input into the software, then the results programmes can use it. It is possible to use a timed start for most, but allow those who need flexibility (e.g. officials, split starters etc) to use a punching start.

Punching finish or timed finish. A punching finish is the only practical solution for large numbers of competitors.

Back-up
Ecards incorporate an intrinsic back-up capability; ensure the event provides back-up cards for competitors' ecards at Enquiries/Registration and at the Start.

The Controller should be satisfied that the team have adequate plans in place for dealing with unwanted events. In particular, no system involving electronics is totally fault-proof so, at high-level events, adequate backup measures should be in place to separately record start and finish times. Where start times are pre-allocated this may be as simple as ticking runners' names on a start list. Finish times can be secured by recording the finish with a video or web camera providing that the camera's clock has been synchronised to race time.

Mount control units on stakes or place on the ground. For major events, proper stakes should normally be used, and the numbering and kite should be consistent with IOF rules, but for events where access is difficult (e.g. high fells) it can be acceptable to just hang a flag on a cane and put the box on the ground underneath. Boxes on the ground should be tethered and within 1 metre of the flag.

Computers

Consider whether the event requires computer-based entries and results. The ideal approach depends on the scale of the event, and smaller training events can be run without computers.

Procedures

Final Details

Where Final details are provided the following statement should be included: "It is the competitor's responsibility to check that their emit card has been correctly activated at the start and a correct punch obtained at each control including a backup pin prick on the yellow backup card. There will only be reinstatement for a missing electronic record of visiting a control if there is visible evidence of punching on the backup card."

The computer team should check the Final Details before they are published.

Checking the controls

The Planner/Forest Team MUST check that ALL controls are giving the correct electronic code before they are placed in the forest. This confirms they are working and that they have been labelled correctly in the factory. A version 3 card is the simplest way of checking control codes. It is also helpful if those placing control units punch them using a Version 3 ecard to confirm the control code.

Spare units

The planner should have a few control units available in case any are unofficially removed from the correct site. It is possible that a control cannot be replaced with the same control number as the lost control and so a different number is used. In this case, the control should be clearly labelled with the correct number. The results software can allow the alternate control code to be accepted as a correct punch.

Hour change

Emit control units are not affected by changes of daylight saving time.

The Start

Spare ecards and paper backup cards should be available at the start, especially if the start is a long way from assembly. Competitors who have a Version 3 ecard

that fails to start at the check or start, for example because it has reached the end of its life of 5-10 years, may be provided with a substitute. If ecards are substituted, a record of the exchange needs to be kept to maintain the integrity of the safety procedures.

An MTR unit can be used in the start block to record those who start. This is particularly useful for events with pre-entries. If the MTR unit has been programmed as a Start unit (an "MTR Zero"), the technique also starts the competitor's ecard. This can be used to verify correct functioning of the ecard and provide a back-up start time for competitors who fail to start their ecard properly on the start line. The ecard clock will be restarted when lifted off a start unit. Once the Start is closed, the MTR unit can be downloaded and the starters compared with the finishers as a safety check.

The MTR unit should be cleared before use if it is to be used to capture starters' details for safety reasons. At the same time, it is helpful to synchronise the MTR unit's clock to race time but this is purely a matter of convenience and will not impact on its operation if it is not carried out.

If a punching start is used, great care must be taken to ensure that all competitors punch the start unit – beginners may not realise that they have to do that.

Late starters
If competitors are supposed to start at their given start time, then a clear policy must be decided for late starters.
IOF Rule 22.9 states: *Competitors who are late for their start time through their own fault shall be permitted to start. The organiser will determine at which time they may start, considering the possible influence on other competitors. They shall be timed as if they had started at their original start time.*
The competitor should be sent off as soon as possible; if they are only a few minutes late at the pre-start, it may be they can be advanced to the right line and can start at their right time. (In the rush, the official must not forget to use the MTR unit to clear and start the competitor's ecard.) If a competitor has definitely missed their time, they should be set off as soon as possible – not kept waiting for a free slot. That may mean setting them off on the half minute. A competitor hanging around is a drain on organisational resources (and is getting cold). Normally, if the lateness is their own fault, then the competitor's time is from when they should have started. If the lateness is the fault of the organiser (e.g. the minibus taking competitors to the start got lost) then the competitor's start time should be adjusted. The late start official should generally not try to arbitrate but should record the actual start time so that the competitor can complain to the organiser if he/she feels that the actual start time should be used.

Touch-Free punching considerations

- It is important to check that the control placements are suitable for Touch-Free punching. For example there should be no chance to punch from the wrong side of an uncrossable fence.

- Sometimes an e-line (long-distance) control unit is used as the start/clear unit. In such cases, there must be no chance that the competitor might come back near it during the race.

- If a "run-though" finish is used, competitors must not be allowed back near the finish line afterwards as they may record a second finish punch which might be taken as their actual finish.

- The competitor will glance at the emiTag when they are near the control to see that the emiTag is flashing; that confirms they have punched successfully. Therefore, there must be no possibility that the emiTag is actually still flashing from a previous control. That previous control may be one that the competitor deliberately punched, or one that the competitor inadvertently punched by passing near it. Therefore, **if emiTags with a flash time of 10 seconds are being used, the minimum separation of controls must be 50 metres** because a runner moving at 3.5 min/km covers 48 metres in 10 seconds.

The finish
The finish banner should be placed in line with the finish unit and a control flag **must** be placed on each stake to make the finish units visible to a fast-finishing runner.

In the case of a major relay, a single finish unit should be placed just beyond the finish line, and the results of close finishes (at least for the podium places) should be determined by judges. The exit from the finish line to the finish punch should be narrow enough to ensure that finish officials can maintain the finish order from the finish line to the finish control. For close finishes, the judge's decision will be final, and so that may mean a little editing of the finish times is required to get the order right.

Competitors should be encouraged to go directly to download.

Timing
For a high-level event with a timed start, it is important that the timing for each competitor's run is based on the event clocks (i.e. the start clock and the finish computer's clock), rather than the individual clocks inside each card. Therefore, the running time for a competitor must be calculated by subtracting the competitor's known start time from the download time and then further

subtracting the time from finish to download. The Emit etiming software will handle this automatically once configured for this start mode.

Note that the time from finish to download can only be based on the potentially slightly inaccurate clock inside the card. Therefore, in a high-level event where correct one-second timing must be guaranteed, it is recommended that there is only a short distance from the finish to download which will mean that any inaccuracies are insignificant. It would not be sensible to have a half-hour walk from finish to download!

Results
The exact procedure for dealing with incorrect punching will be dependent on the results software being used, if any. Typically the computer software will indicate controls missing or visited in the wrong order. At small events, where no computer is in use, the ecard will be downloaded onto an MTR box, and this will print a set of splits for the competitor. A second set must be printed and retained for the results. In this case, the splits need to be inspected to ensure that all the controls are present in the correct order. The competitor's ecard number and time is also on the print.

If using a computer at download running Emit's etiming software, there is a screen which displays a picture of the back-up card and highlights any errors. This helps to resolve disqualifications. If not using a computer then it is recommended that any disputed card is compared to any other card that has been passed as correct.

Computer software is available to provide course back-up punch patterns or you can keep the back-up card from the first correct runner on each course, provided they have a full set of back-up punches.

If a competitor has a **missing punch**, check the back-up card for evidence that the control was visited. If a pin punch has registered in the position of the "missing" control, the competitor can be credited with visiting the control. If no pin punch is found in the position of the missing control, the competitor should be disqualified.

Note that other evidence of being at the control is not acceptable, because the competitor must **both visit the control and punch properly**. The relevant rule states:
20.5: *A competitor with a control punch missing or unidentifiable shall not be placed unless it can be established with certainty that the punch missing or unidentifiable is not the competitor's fault…..*If there is a problem with a control (misplaced or stolen) to such an extent that no acceptable result can be produced for the competition, then the course should normally be declared void. It is tempting to try to 'correct' the problem by removing the splits either side of the relevant control, but this means that competitors are not being measured over the planned course and introduces distortions such as unfairly benefiting runners who lost time on the

subsequent control. IOF rule 24.15 says *The results must be based on competitors' times for the whole course. It is forbidden to eliminate sections of the course on the basis of split times unless the section has been specified in advance (e.g. a short section containing a busy road crossing).*

Identifying missing runners
For small events, results should be transferred onto the entry sheet as downloaded, to ensure that all runners have completed. For an event taking entries only on-the day and where the entries are typed into a computer system, you may be able to assume that all entrants will start and anyone not finished is still out on the course. However, for pre-entry events, or if Auto-download software is used, an MTR unit should be used in the pre-start and downloaded into the results software which may be able to identify starters who have yet to download.

Results publication
On the afternoon/evening after the event, the split times may be uploaded to:
- WinSplits
- Route Gadget (if available and permitted by the artistic copyright holder)
- SplitsBrowser

Splits comparisons are very interesting in the few hours and days after the event, but interest declines rapidly with time.

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Changes since the last version – January 2014

• Advice on minimum control unit separation for Touch-Free controls

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