

# OTS Control / Coordinator – Radio Control System

## Introduction

The Orienteering Telemetry System (OTS) provides a method of delivering punch data from remote controls wirelessly for safety or commentary purposes.

## Features

- 1) Compatible with both SI and EMIT controls
- 2) Fully waterproof construction
- 3) Multiple controls can be used simultaneously
- 4) Repeaters allow radio coverage in difficult terrain
- 5) Remote units store data in flash to allow retransmission if necessary
- 6) Uses Motorola Handipro radios
- 7) Uses standard AA batteries.



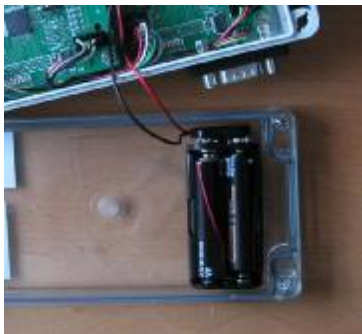
## System Operation

The OTS remote unit receives and stores punch data from the data interfaces. The software adds data protection with a unique serial number and CRC check before transmitting the punch information to the central location through the attached radio.

The receiving unit (coordinator) verifies the CRC and serial number of each data packet received. Integrity is ensured by silently discarding packets where the CRC check fails. If the serial number is out of sequence, the coordinator will transmit a message to the remote unit re-requesting the data which is missing.

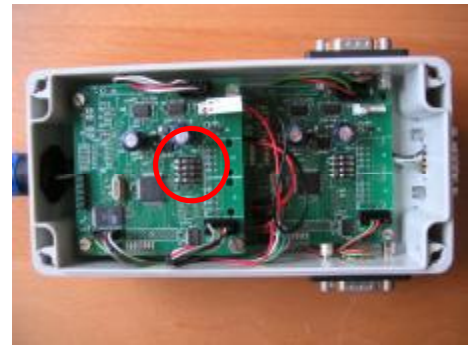
## System setup

- 1) Plan where the radio enabled controls are to be sited. Typically the radio link will transmit for up to 1km but this may be reduced by thick foliage. If a repeater will be needed due to the distance or terrain, see the section below on 'repeaters'
- 2) Fit new batteries to the Handipro radios to be used at both the remote site(s) and the coordinator. Typically a set of Duracell MN1500 batteries will last 24 hours.
- 3) Switch both the radios on, and check that they are both set to the same channel. If there are other users with these radios for voice communication, it is wise to choose a different channel.



- 4) Set the volume level on each radio. Remove any headset and press the 'mon' button on the radio. The white noise should sound 'loud but not distorted'
- 5) Remove the waterproof lids of both the coordinator and the remote unit. Release the 4 screws by turning them 90 degrees. The screws may be turned with either a cross point or straight screwdriver, or even a car key.

- 6) Fit new batteries to the remote unit(s) and coordinator. Typically a set of Duracell MN1500 batteries will last 24 hours.
- 7) Identify the remote unit DIP switches as highlighted in the photo. Note that the set of DIP switches on the lower circuit board are not used.
- 8) Set the DIP switches in the remote unit according to the table below.

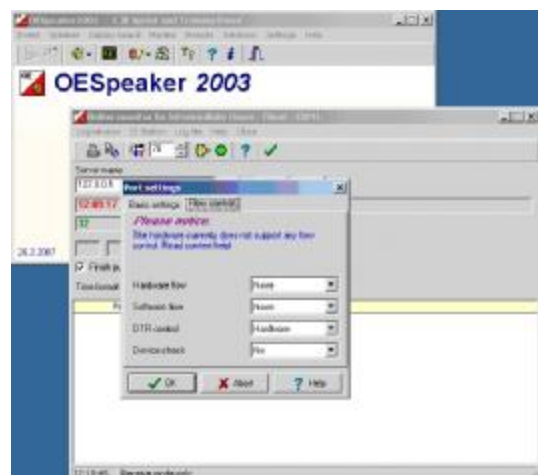


Switch number	1	2	3	4
Sport Ident	Default settings ON (towards middle of circuit board) If using a repeater see section below		ON (towards middle of circuit board)	ON (towards middle of circuit board)
EMIT			ON (towards middle of circuit board)	OFF (towards edge of circuit board)
EMIT Extended Mode			OFF (towards edge of circuit board)	OFF (towards edge of circuit board)

- 9) Set the switches in the coordinator according to the table below:

Switch number	1	2	3	4
Sport Ident	Reserved for testing (see appendix) Must be ON (towards middle of circuit board) For normal operation		ON (towards middle of circuit board)	ON (towards middle of circuit board)
EMIT			ON (towards middle of circuit board)	OFF (towards edge of circuit board)
EMIT Extended Mode			OFF (towards edge of circuit board)	OFF (towards edge of circuit board)

- 10) Refit the lids taking care that the screws are pushed down and rotated 90 degrees to maintain the waterproof seal.
- 11) With the leads provided, connect the radios to the remote unit(s) and coordinator.
- 12) When programming the controls with ensure that 'Autosend' is enabled
- 13) Connect the controls to the remote unit.
- 14) Connect the coordinator unit to the serial port of the PC that will be running the safety or commentary software using a standard 9 way d-type serial lead.
- 15) Your commentary software must set the DTR line on the serial port for correct operation of the coordinator unit. The screenshot below shows how this can be done in OE Speaker.
- 16) The system is now ready for testing or deployment. If testing, ensure that the radios are at least 1m apart and switch on the coordinator. Verify that the green light is flashing



- 17) Switch on the remote unit and verify that the green light is flashing
- 18) The system is operational.

## Repeaters

The OTS system allows for a repeater to be used to extend the range of the system, or to give coverage over a hill, or in a valley.

The instructions below describe how to configure the system for use with a repeater station.

- 1) Identify the unit that is to be used as the repeater. Remote units labeled '31' or '32' can be used. Units with any other identification number cannot be used as repeaters.
- 2) Remove the waterproof lids of the remote unit(s) that is to send data through the repeater. Release the 4 screws by turning them 90 degrees. The screws may be turned with either a cross point or straight screwdriver, or even a car key.
- 3) Identify the Configuration DIP switches as described in the setup section of this document and ensure that the DIP switches numbered 3 and 4 are set correctly.
- 4) Set DIP switches 1 and 2 as shown in the table below.

Switch number	1	2
No Repeater (Default)	Default settings ON (towards middle of circuit board)	Default settings ON (towards middle of circuit board)
Repeater is labeled '31'	ON (towards middle of circuit board)	OFF (towards edge of circuit board)
Repeater is labeled '32'	OFF (towards edge of circuit board)	ON (towards middle of circuit board)

## Radio Interfaces

The radio interface is a standard 3.5mm and 2.5mm plug pair. The OTS protocol is encoded using frequency shift keying (FSK) modulation, the baud rate is 1200bps. This modulation makes it suitable for connection to numerous different communications channels. This allows the optimum radio to be chosen based upon, the range required, the number of other nodes in the network etc. Normally the OTS hardware uses low cost 500mW radios, however for mountain marathons 5W licensed radios have been used.



## Data Interfaces

The data interface is a waterproof RS232 9pin D connector. The content of the data is not relevant to the OTS system; however the system does interpret the packet format (STX / ETX) so as to only regenerate complete packets at the coordinator.

## Events

The OTS hardware is used at all major orienteering events in the UK

- **British Schools Orienteering Championships**
- **Junior European Championships**
- **JK Festival of Orienteering**
- **British Orienteering championships**

OTS has also been used to provide safety race information at the following mountain races:

- **3 Peaks Mountain Marathon**
- **Caledonian Challenge**

## Available Configurations

The following versions of the hardware are available:

- OTS-Control1 (1 x RS-232 Male Data Interface, Radio Interface)
- OTS-Control3 (3 x RS-232 Male Data Interfaces, Radio Interface)
- OTS-Coordinator (Radio Interface, 1 x RS-232 Female Data Interface)

## Compatible Software

The OTS hardware is fully compatible with the following orienteering commentary software packages:

- **OESpeaker / OSSpeaker** software package from Sport Software
- **OCOMM** software package from Michael Napier

## Customisation

The OTS hardware can quickly be customised by GPProjects to different packet formats.

## Extra Coordinator DIP switch settings

Note, the settings below are for test modes only, and the default values should normally be used.

Switch	1	2
Default	ON (towards middle of circuit board) For normal operation	ON (towards middle of circuit board) For normal operation
On next startup, assume packet sequence number is the first of the event	ON (towards middle of circuit board)	OFF (towards edge of circuit board)