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Client: EDH (South Africa) (Pty) Ltd.
Model #: TB101
Report No: 2003022
Standards: FCC 15.245 & IC RSS-210
Date: April 15, 2003

APPENDIX H: MANUAL

Please see the following pages.



EDH TBox Sensor

Model TB 1.01

Installation and Operating Manual

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General and Safety Notices

Summary

The following notices and general safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of the design, manufacture and intended use of the equipment.

EDH accepts no liability for failure to comply with these requirements.

FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Radiation Safety Warning

This device radiates a low level of microwave electromagnetic radiation periodically when used. The level of radiation is below international safety standards for microwave frequencies. It is however recommended to observe a minimum distance of 1.5 ft (45 cm) directly in front of the Sensor Unit, when operating.

Live Electrical Circuits

Equipment covers must never be removed while equipment is connected to a mains supply. Only qualified service personnel are allowed to make repairs and adjustments. Never perform repairs with the mains power cables connected. To avoid injuries, always disconnect power and discharge circuits before touching them.

Changes or modifications not expressly approved by EDH could void the user's authority to operate the equipment.

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1 PREFACE

This manual provides instructions for the installation, operation and troubleshooting of the EDH TBox Sensor Unit.

2 SYSTEM DESCRIPTION

The TBox Sensor Unit is a standalone measurement sensor for the detection and measurement of moving objects in sports applications.

The unit comprises the following main sub-assemblies and/or printed circuit board assemblies:

- Microwave subassembly, comprising a microstrip microwave antenna array with integrated transmitter and receiver circuits
- DC/Video printed circuit board assembly
- Digital processor printed circuit board assembly
- Mains power supply module
- User interface software (PC based)
- Mains power cable
- Data interface cable

The following diagram depicts the TBox Sensor Unit:

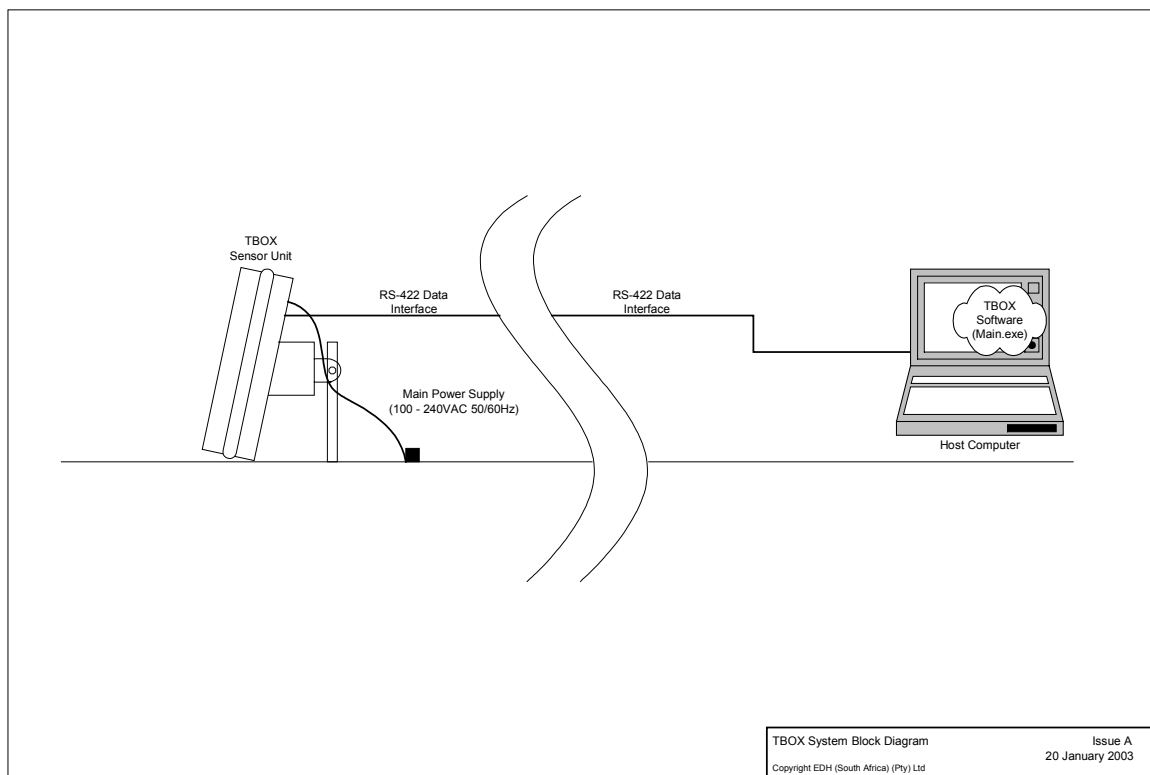


Figure 1 – System Block Diagram



3 INSTALLATION

This section explains how to install, interconnect and set up the system.

3.1 MOUNTING AND ALIGNMENT

The TBox Sensor Unit is intended to be floor mounted, using the mounting bracket and accessories supplied. The Unit should be installed on a hard, level horizontal surface.

The Sensor is fastened to the surface by means of the mounting rod attached to the mounting bracket on the rear of the Sensor Unit.

While the rod must be anchored using an appropriately secure anchor or pivot, the Sensor body must be free-standing on the floor surface, to enable it to be aligned and pointed in the desired direction.

Once the Sensor has been anchored to the mounting rod, it must be roughly pointed in the desired direction, being perpendicular to the front face of the Unit.

If necessary, corrections must be made to the mounting anchor/pivot as well as the body of the Sensor Unit to ensure that it is level relative to the horizontal plane. Where necessary, spacers may be placed under the sensor unit to eliminate uneven floor characteristics. The integral bubble spirit level on the mounting block can be used to verify the installation.

Once the sensor is aligned horizontally, the pointing direction must be finally adjusted, ensuring that the pointing direction is to within ± 2 degrees of the desired direction.

Finally, secure the mounting rod anchor fasteners and mounting bracket bolts.

3.2 DATA CONNECTIONS

The data interface to the host computer is a balanced, asynchronous serial data interface compliant with RS-422 standard specifications.

Identify the data interface connector (9 pin D-style) on the rear panel of the Sensor Unit.

Attach the host computer to the Sensor Unit, using the supplied data interface cable.

3.3 SWITCHING ON

Identify the mains power connector (3 pole Powercon) on the rear panel.

Attach the mains power to the Sensor Unit, using the supplied mains power cable.

Ensure that the mains power supplies connected are correct (AC) and that the voltages are to specification (100-240 Vac, 50/60Hz, 30VA).

Switch on the Sensor Unit.

The system is now ready for use.



4 TBOX SOFTWARE

4.1 DESCRIPTION

The TBox Software is a computer program that provides the user interface to the Sensor Unit.

The TBox Software enables the user to:

- Make/change Sensor settings
- View measured speed and ancillary data

4.2 SOFTWARE INSTALLATION

4.2.1 Host computer requirements

The Host Computer should have the following minimum specifications:

System Processor	Intel Pentium III, 500 MHz or more
Memory	128 Mbytes or more
Display	800 x 600 or 1024 x 768 pixels, color
Hard Disk Drive	4 Gbyte or more
CD ROM Drive	Optional
Flexible Disk Drive	1.44 Mbyte – required
Operating system	Windows 2000, NT 4, Windows 98, or Windows XP
Mouse and keyboard	Required
USB interface port	Optional

4.2.2 Installation of software

The TBox Software is automatically installed on the host PC from either the 1.44 Mbyte flexible Diskette or CD ROM media supplied.

The software is supplied on both 1.44 Mbyte flexible disk and CD formats, and can be installed on the host PC without the rest of the system connected.

- 1) Insert flexible diskette into 1.44 Mbyte diskette drive (alternatively, insert CD into CD drive)
- 2) Run the **setup.exe** application from the selected drive
 - Examples: A:setup.exe (for a diskette in drive A:) or D:setup.exe (for a CD in drive D:)
- 3) Follow the installation instructions
- 4) When the program files are successfully installed, press the "Finish" button.

4.2.3 Operation

Run the application in Windows, by selecting START > PROGRAMS > EDH > main.exe



5 USING THE SYSTEM

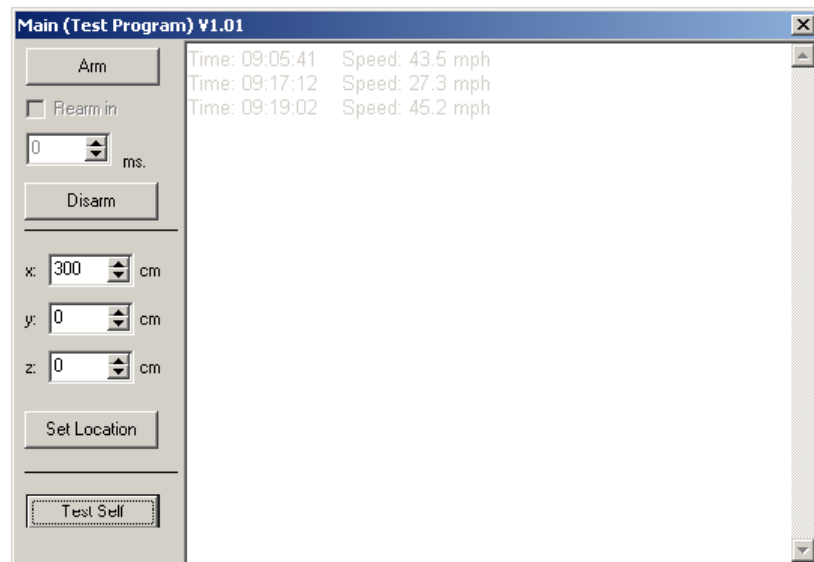
Once the setup steps as described in the previous section have been performed, the user may proceed with measurements.

First, ensure that the TBox Sensor Unit is switched on, and connected to the Host PC.

Run the host computer software application

main.exe. The user screen will display the required controls and settings, as well as the log of speed measurements.

The primary functions available to the user are:



View/set the sensor location

The location of the sensor relative to the measured event can be set, in three dimensions (x,y,z). Negative values may be selected. The notation for location settings is as follows:

- x : positive distance along the pointing direction of the Sensor
- y : offset perpendicular to the pointing line of the sensor.
+ for Right offsets and – for Left offsets
- z : vertical offset between the object and the Sensor Unit
+ for Sensor lower than object, - otherwise

Self test

Selecting this function will perform a self test of the TBox Sensor Unit, providing a Go/NoGo indication of the basic functional operation of the Unit.

Arm/Disarm sensor

The sensor can be manually armed by clicking on the **Arm** button. This will cause the sensor unit to transmit a microwave signal and anticipate a trigger event (such as rapid object movement). When the Sensor detects a suitable moving object, it will process the measured signals to produce a speed value for the detected object. The speed data will be sent to the TBox Software for display.

The unit can also be set to automatically re-arm after the **re-arm delay** (in milliseconds).

Once armed, the sensor can be disarmed by selecting the **Disarm** button.



Speed log display

Each speed measurement received from the TBox Sensor will be displayed on the log screen, with the time at which it was measured.



6 MAINTENANCE AND TROUBLESHOOTING

6.1 INTRODUCTION

The Sensor Unit and its associated software is supplied on the strict condition that all rights relating to trademarks, copyright, patents and designs are reserved by EDH and may not be reproduced or used in any manner not authorized in writing by EDH.

6.2 MAINTAINING THE SENSOR

The TBox Sensor system is a highly reliable electronic system that requires low maintenance.

6.2.1 Routine maintenance

Routine maintenance is limited to the following:

- Keep dry and clean at all times
- Cleaning periodically using a damp cloth with, if required, a light household detergent and water to remove visible soiling
- Inspect the Unit enclosure as well as cable connections periodically for visible signs of damage or wear

These tasks should be performed by the operator/end user three-monthly (or more regularly where high levels of dust or mechanical effects (vibration, handling, etc) are present).

6.2.2 Corrective maintenance

The Sensor Unit is only factory repairable. Faulty units must be swapped with replacement units.

6.2.3 General maintenance actions

6.2.3.1 Storage

When not in use, store the equipment in its transport packaging.

6.2.3.2 Connectors

Ensure that the connectors are clean and dry at all times. Exposed connectors should always be protected from dust, moisture, insects and other contaminants.

6.2.3.3 Power supply

Please observe the voltage levels on any external supply, BEFORE applying the power to the system.

6.2.3.4 Data connector

The data interface connector is a 10 pin ITT Cannon connector fitted to its rear panel.

This connector should be kept dry and free from contamination.

If used continuously for prolonged periods, the cable may be attached and the connector covered with a self-vulcanizing sealing tape.



6.3 TROUBLESHOOTING

Symptom	Sensor Unit does not power up
Step 1	Check external supply connections and presence of mains supply to Sensor Unit
Step 2	Remove Sensor Unit and return for repair

Symptom	No Communication between PC and Sensor Unit
Step 1	Check communications cable connection between PC and Sensor
Step 2	Check selection of correct COM" port on TBox Software
Step 3	Restart the PC and the TBox Software
Step 4	Exit the TBox Software program and restart the computer
Step 5	Remove Sensor Unit and return for repair

Symptom	No measurements obtained on live objects
Step 1	Ensure Sensor Unit has mains power supply and is switched on
Step 2	Inspect the Sensor Unit to ensure that its mechanical mounting and alignment is correct
Step 3	Review all settings in the TBox Software, ensuring that the settings and selections are sensible
Step 4	Inspect data interface connection
Step 5	Remove Sensor Unit and return for repair

Symptom	Results appear incorrect
Step 1	Run the Self Test command from the TBox Software
Step 2	Carefully review all settings in the TBox Software, ensuring that the settings are sensible. Refer to recorded settings used when setting up initially.
Step 3	Change settings in the TBox Software and re-measure objects

6.4 CABLE INSPECTIONS

6.4.1 Data interface cable

Do continuity test between the connectors of the cable roll.

Test for short circuit between all pins on each of the connectors of the cable.



7 SPECIFICATIONS

Operating Frequency	10.525.GHz
Transmitter power	10 mW
Antenna gain	17 dB
Horizontal beamwidth	10 degrees
Vertical beamwidth	20 degrees
Dimensions	Width 13.8" (350 mm) Height 10.6" (270 mm) Thickness 3.9" (100 mm)
Mass	< 4.4 lb (2 kg)
Mains power supply	100 – 240 Vac, 50/60 Hz, 1.2A max
Data interface	RS-422 asynchronous serial



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