

# TrackMan™ Radar Unit

Model: TMAN



## Installation and Operating Manual Revision 1.0

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ISG A/S

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TrackMan™ is a registered trademark by ISG A/S. Other brands and product names are trademarks or registered trademarks of their respective holders.

ISG A/S has filed several patent applications which covers both the construction, operation and processing algorithms of the TrackMan™ system.

**Model TMAN**

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## REGULATORY NOTICE

### FCC compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

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.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TC technician for help.

### Caution

Never try to open or repair the device yourself. Any changes or modifications not expressly approved by ISG A/S could void the user's authority to operate the device.

## **WARNING: RADIATION HAZARD**

### **Radiation Safety Warning.**

This device radiates a low level of microwave electromagnetic radiation from the front window when in use. The radiated power is significantly lower the international safety standards for microwave frequencies. However, the user should maintain a minimum distance of 20 cm from this device during operation.

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## CAUTION: SAFETY INSTRUCTIONS

Use the following safety instructions to ensure your own personal safety and to help protect the TrackMan™ radar unit.

### General

- Do not attempt to service the device yourself. Always follow installation instructions closely.
- Only use cables and accessories approved by ISG A/S together with your TrackMan™ Radar Unit.
- Always connect all cables before turning on power for the TrackMan™ system.
- The AC adaptor may become hot during normal operation of the TrackMan™ system. Use care when handling the adaptor during or immediately after operation.
- When operating the TrackMan™ system outside in direct sunlight, the metallic chassis of the TrackMan™ Radar Unit may become hot. Use care when moving the TrackMan™ Radar Unit in this case.
- If the TrackMan™ system has been used in wet weather, clean all items with a dry cloth after use.
- During use and transportation of the TrackMan™ Radar Unit, avoid bumping into obstacles with the orange plastic front.
- When not using the TrackMan™ Radar Unit, avoid any kind of load at the orange front, since this might damage the radar.

### Power

- Only use the AC adaptor supplied with the TrackMan™ Radar Unit. Use of another adaptor may cause fire or explosion.
- Before you connect the TrackMan™ Radar Unit to an electrical outlet, check the AC adaptor voltage rating to ensure that the required voltage and frequency match the available power source.
- To help prevent electric shock, plug the AC adaptor and device power cables into properly grounded power sources. These power cables may be equipped with 3-prong plugs to provide an earth grounding connection. Do not use adaptor plugs or remove the grounding prong from the power cable plug. If you use a power extension cable, use the appropriate type, 2-prong or 3-prong, to mate the AC adaptor power cable.
- Make sure that the computer and AC adaptor connected to the TrackMan™ Radar Unit are connected to the same power outlet. Failure to comply with this requirement could cause electrical shock and create permanent damage on both the TrackMan™ Radar Unit and the computer.
- Place the AC adaptor in a ventilated and dry area. Do not cover the AC adaptor that will reduce cooling.
- Be sure that nothing rests on your AC adaptors power cable and that the cable is not located where it can be tripped over or stepped on.

ISG A/S accepts no liability for failure to comply with these requirements.

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## WARRANTY COMMENT

The TrackMan™ Radar Unit contains no user serviceable parts inside. In case of defect or malfunctioning TrackMan™ Radar Unit, the unit must be repaired by ISG A/S authorized personal ONLY.

**IMPORTANT** The box is sealed to prevent unauthorized access to the inside of the TrackMan™ Radar Unit. If the sealed is broken any warranty agreement will terminate immediately. Warranty will also terminate immediately if:

- Use of non-approved AC adaptor or incorrect direct applied DC voltage
- Use of non-approved cables between the TrackMan™ Radar Unit and the computer
- If the TrackMan™ Radar Unit is not installed or operated in compliance with this manual.

For full description of the warranty and the scope hereof, reference is made to the warranty agreement between the user and ISG A/S.

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## 1 Introduction

This document provides instructions on how to setup, operate, maintain, and troubleshoot the TrackMan™ system.

This document does not describe the TrackMan™ application software and how to operate it. This is provided in separate document.



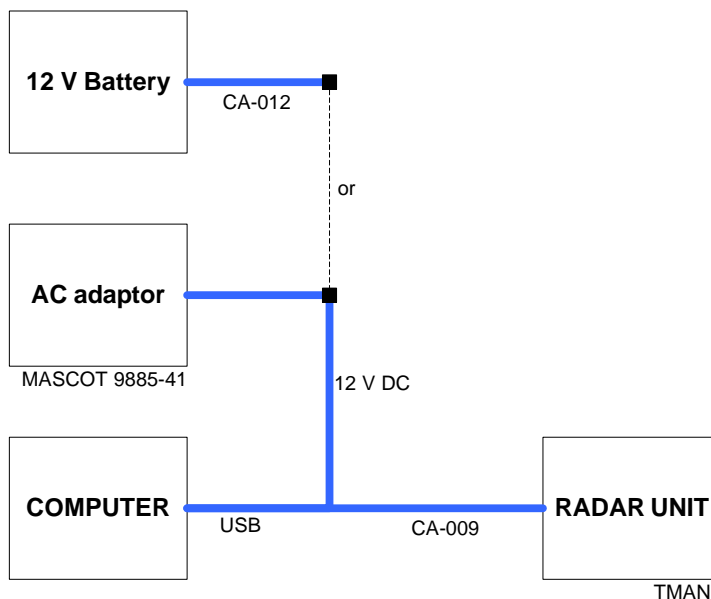
## 2 System description

The TrackMan™ radar system is a standalone measurement system for the detection and measurement of golf club and golf ball movements.

The system consists of:

- a TrackMan™ Radar Unit (RU), model TMAN
- a display unit (DU) – a ruggedized computer
- an interface cable connecting the RU with the DU, CA-009
- an AC adaptor or 12 V battery
- a TrackMan™ Live software

The following diagram depicts the TrackMan™ system:

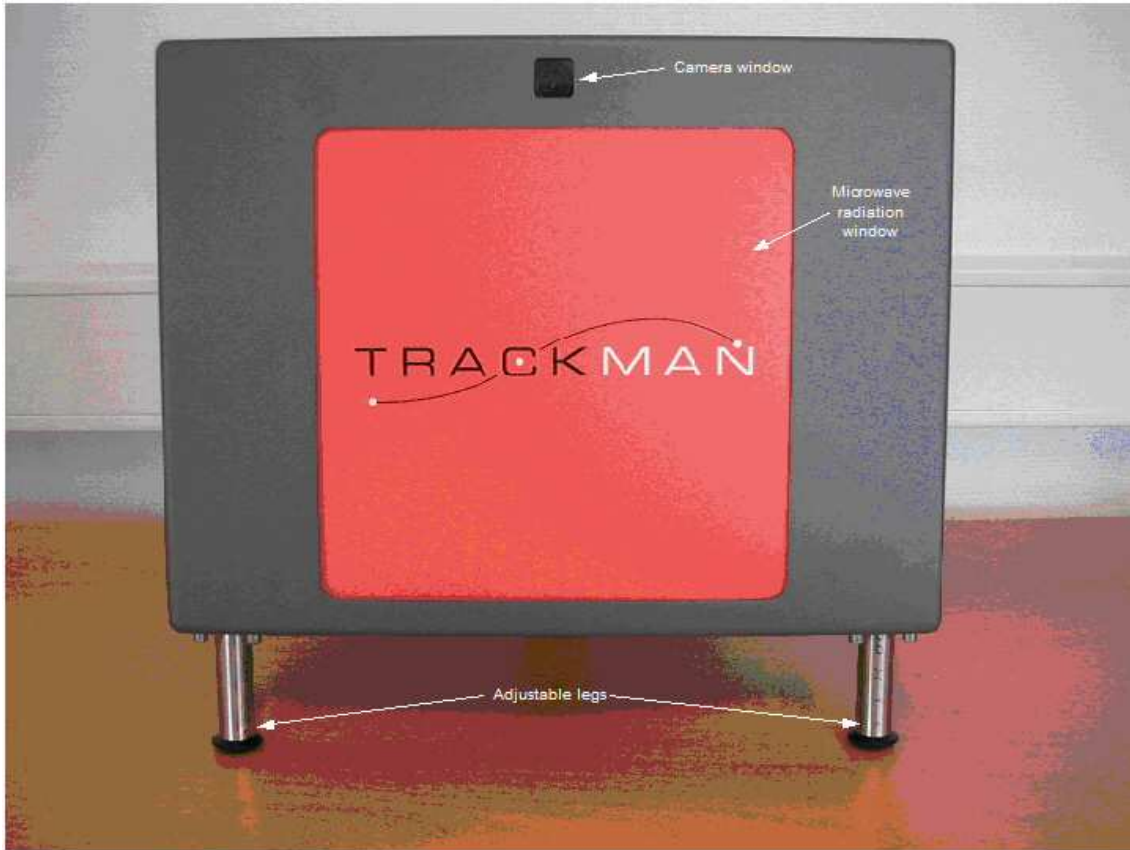


**Figure 1:** TrackMan™ system block diagram

The TrackMan™ Radar Unit can be powered directly from a +12 V battery or from the supplied AC adaptor.

### 2.1 Technical specifications

The TMAN radar unit is a very robust construction, with chassis made in aluminum. The front of the TMAN has an orange plastic window, from where behind the microwave radiation is transmitted and received.



**Figure 2: TrackMan™ radar unit, model TMAN front view**

The TrackMan™ Radar Unit also has a built-in digital camera, which looks out through a window in the front.

**WARNING !**

**Make sure that the orange front and the camera window of the TrackMan™ Radar Unit is handled with care. Avoid any load or bumping into with the front of the TrackMan™ Radar Unit.**

**TrackMan™ Radar Unit , model TMAN**

Operating Frequency	10.500-10.550 GHz, factory fixed
Transmitter power	10 mW
Antenna gain	17 dB
Horizontal beam width	23 degrees
Vertical beam width	19 degrees
Dimensions	Width: 410 mm (16.1") Depth: 125 mm (4.9") Height: 320 mm (12.6")
Mass	~10 kg (22 lbs)
Main power supply	10.5-18 V DC, 25W maximum
Data interface	USB2.0 high speed
Environmental	-5 degC to +45 degC ambient 100% humidity

The TrackMan™ Radar Unit consists of the following sub-assemblies and/or printed circuit board assemblies:

- Microwave transmitter
- Microwave receivers with video amplifiers
- Antennas for transmitting and receiving
- Analog to digital converters
- Adjustable legs with motors
- Servo board
- Digital camera
- Power stabilizing circuit

The TrackMan™ Radar Unit is splash proof and is designed to withstand rain showers. When using the TrackMan™ system in wet weather it might be necessary to dry of water drops at camera window, in order to get proper pictures of the landing field.

The TrackMan™ Radar Unit has two motorized legs for leveling the radar unit.

The connector input, the motor switch and two LED's are covered behind the orange plate of the back of the TrackMan™ Radar Unit.



**Figure 3: TrackMan™ radar unit, model TMAN back side view**

### Display Unit (DU)

The DU must have the following minimum specifications:

- Operating system Microsoft Windows XP SP1 or later, UK version
- USB2.0 high speed port
- CD/DVD drive
- Minimum Pentium 4 2.0 GHz or Pentium M 1.4 GHz
- Minimum 256 MB ram
- Screen resolution 1024x768, 24 bit
- Minimum 50 MB free hard disk space

The TrackMan™ system can be used in conjunction with the TrackMan™ R&D toolbox for post analysis of the raw data files. In this case, it is recommended to have at least 1 GB free hard disk space for data files storage.

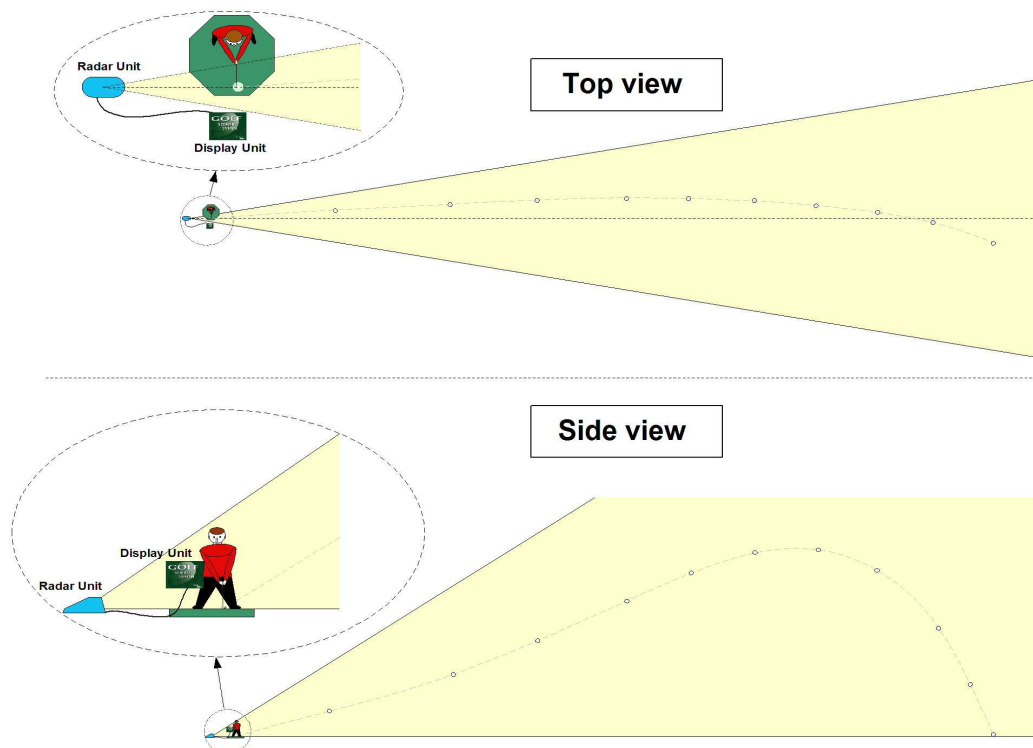
The DU for the TrackMan™ is normally delivered by ISG A/S. During operation of the TrackMan™ system, the computer must ONLY run the TrackMan™ application, since this will require the full processing power of the computer. If other programs are running simultaneously with the TrackMan™ application, the operation of the system might be impossible.

### 3 Setting up the system

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

#### 3.1 General comments

The system requires a free line-of-sight to the ball throughout the complete flight of the ball in order to be able to deliver measurement data.



**Figure 4: Recommended placement of the TrackMan™ Radar Unit.**

The TrackMan™ Radar Unit should be placed roughly 2-3m directly behind the desired tee-off position. The system requires a free line-of-sight to the ball throughout the complete flight. Avoid standing in front of the radar in such a way, that if you hook the ball, you will be blocking the radar beam.

Avoid as much as possible large objects, especially metallic object, close to the radar inside the beam of the radar. Metallic objects in the beam of the radar will have a negative effect on the measurement accuracy.

In some situations, like measuring ball flights from a mechanical golfer, it is impossible to avoid metallic objects in the beam. In this case the accuracy can be increased by adding intentionally reflectors or by using microwave absorbing materials to avoid the main reflectors to enter the radar. Please consult ISG support team for guidelines on how to do this.

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NOTE! Some types of fluorescent light tubes emit significant electromagnetic noise. Placement of the TrackMan™ Radar Unit nearby such types of light tubes will have a negative influence on the tracking capability of the TrackMan™ system.

### **3.2 Step-by-step setup**

In order for the system to function properly, it has to be set up in the correct way, and in the correct order:

1. Place the TrackMan™ Radar Unit and DU where you want them roughly to be. Turn on the DU
2. Pull out the two legs of the TrackMan™ Radar Unit until you hear a click. This indicates that the legs are safely fastened in their sockets. If the legs are at different lengths, don't be alarmed. This is merely a result from the last time the unit was operated.
3. Tip out the orange leg on the back of the TrackMan™ Radar Unit about 120 deg until it snaps in place. Now the leg should be locked in place.
4. Align the front of the TrackMan™ Radar Unit roughly in the desired ball flight direction.
5. Connect the TrackMan™ Radar Unit to the DU's USB port and connect the AC adaptor as well.
6. Turn on the power to the TrackMan™ Radar Unit. Make sure that the power LED on the TrackMan™ Radar Unit is green.
7. Engage the motor switch in the back of the TrackMan™ Radar Unit to initiate the leveling mechanism. You should now hear a low motor sound, indicating that leveling is taking place. When level LED is green and the motors are quiet, correct leveling has taken place.
8. Turn off the motor switch, in order to avoid unintentional movement of the radar during measurement.
9. Start the TrackMan™ application software

The final horizontal alignment happens from within the TrackMan™ application software.

Depending on type of computer being used, it might be required to place the computer on a table to make sure moisture does not enter the computer. Please check with the guidelines for the computer.

If it is raining, make sure that the computer and the AC adaptor is placed under cover. To avoid malfunction, make sure that the computer is kept clean and dry.

### **3.3 Leveling**

When the switch is on, the internal servo will insure that the TrackMan™ Radar Unit is leveled. The legs operate at a speed of approximately ¼ mm a second. If the system is very far from leveled, it might take some time to level the TrackMan™ Radar Unit.

The legs can also be manually adjusted, just turn the legs with your hands. The manual adjustment of the legs can even take place when the motors are turned on.

If the TrackMan™ Radar Unit is placed on a extremely unlevelled ground, the legs might get fully extended or compressed. This might cause the legs to get out of grip with the motor axis. This is not harmful in anyway to the mechanics of the TrackMan™ Radar Unit. In this case simply make a few turns of the leg with your hands while pushing/pulling slightly in the leg to get a grip.

If the motors in the TrackMan™ Radar Unit are moving while the TrackMan™ system is measuring, distortion in the recorded signal might occur. To avoid this, switch off the motors while measuring.

It should be avoided to place the TrackMan™ Radar Unit on a non-solid ground, like wooden terrace or similar. If it is done anyway, make sure to switch of the motors while measuring, since the TrackMan™ Radar Unit might get into mechanical oscillating vibration which will have a negative influence on the recorded signals.

At any time the motors can be turned on in order to verify that the radar is still leveled.

## 4 End of use

When terminating a session with the TrackMan™ system, please follow these steps:

1. Exit the TrackMan™ application software
2. Turn off the motor switch of the TrackMan™ Radar Unit
3. Turn of the power to the TrackMan™ Radar Unit
4. Disconnect the cables to the TrackMan™ Radar Unit, by pulling the connector out.
5. Push the two motorized legs into the box by giving the TrackMan™ Radar Unit a small knock on the top. Push the legs in as far as you can.
6. The backside leg is pulled out and up. Be careful not to get a finger caught when it snaps into place. Now the TrackMan™ Radar Unit is ready for stow.

Make sure that the TrackMan™ Radar Unit and DU are wiped dry, and that any mud and dirt is removed. The system will not be damaged by water, mud or dirt, but to extend the appearance and life time of the TrackMan™ Radar Unit it is advisable.



## 5 Troubleshooting

<b>Problem</b>	<b>The TrackMan™ Radar Unit does not seem to level correctly</b>
Step 1	Is the cable connected to both the TrackMan™ Radar Unit and the power supply?
Step 2	Make sure the AC adaptor for the radar is turned ON?
Step 3	Is the motor switch ON and does the green light appear in the switch (might be a weak light)?
Step 4	Has the motors reached its end stops? If yes re-position the radar at a more leveled place.

<b>Problem</b>	<b>The TrackMan™ application software is not able to communicate with the Radar Unit.</b>
Step 1	Is the cable connected to both the TrackMan™ Radar Unit and the power supply and is the power supply to the radar turned on?
Step 2	Have you inserted the TrackMan™ Radar Unit in the assigned USB2.0 port on the computer? Note: the drivers for the TrackMan™ Radar Unit is dedicated to the USB port where the radar was connected during installation.
Step 3	Is there a USB hub between the computer USB port and the TrackMan™ Radar Unit. If yes, remove it.
Step 4	Try to unplug the USB cable at the computer, wait a couple of seconds, and re-insert it again.
Step 5	Consult the TrackMan™ application software diagnostic tools for more help

<b>Problem</b>	<b>The camera pictures from the TrackMan™ radar Unit seems over exposed</b>
Step 1	Try position/orient the radar so the light intensity at the front of the radar is similar to the light intensity on the target field.
Step 2	Try to increase the light intensity at the camera window by using a flash light or other high intensity light source while taking the pictures.

<b>Problem</b>	<b>No triggering occurs when a golf ball is launched</b>
Step 1	Make sure that the power to the TrackMan™ Radar Unit is turned on and the radar is properly leveled. Make sure that the golf ball is being launched from the indicated area shown in the TrackMan™ application software.
Step 2	Consult the TrackMan™ application software diagnostic tools for more help

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<b>Problem</b>	<b>The measurement data seems incorrect.</b>
Step 1	Make sure that the golf ball is being launched from the indicated area shown in the TrackMan™ application software.
Step 2	Make sure that the TrackMan™ is properly leveled and aligned at the desired target direction.
Step 3	Make sure that the altitude of the golf ball being launched is within 5 cm of the surface that the TrackMan™ Radar Unit rests on.
Step 4	Remove any solid objects in front of the TrackMan™ Radar Unit. Especially large metallic objects like golf clubs, golf bags or other instruments can influence the data quality.
Step 5	Consult the TrackMan™ application software diagnostic tools for more help

## 6 Transportation, storage and maintenance

When unpacking the TrackMan™ Radar Unit from the original shipping box, remember to store the box for future use. The original shipping box must be used in case of return of unit for service or repair.

### 6.1 Transportation

The construction of the TrackMan™ Radar Unit is in general very robust. However, the plastic plate in the front of the radar is a bit more sensitive. During transportation the TrackMan™ Radar Unit should be protected from direct shocks and bumps on the front window.

The TrackMan™ Radar Unit is designed to fit into a carrier-on luggage for the airlines. It is recommended to enclose the TrackMan™ Radar Unit with foam or other shock absorbing materials when packed in a box or bag.

If the TrackMan™ Radar Unit is send by cargo, which is not recommended, allow for at least 50 mm of space from the metallic chassis of the TrackMan™ Radar Unit to the shipping box sides, by using heavy duty shock damping materials.

### 6.2 Maintenance

The TrackMan™ Radar Unit has been constructed in robust materials with minimum maintenance for years of outdoor usage.

The TrackMan™ Radar Unit contains only highly reliable electronic and mechanical systems that require no user maintenance.

When the two legs of the TrackMan™ Radar Unit are extended there can be some water, mud, or dirt on them after use. To remove this, use a soft cloth to wipe it of. There are two O-rings that make sure that no dirt, water or mud gets inside the TrackMan™ Radar Unit. If the legs are cleaned very thoroughly, a small amount of grease has to be added on the legs in front of the O-rings.

The front of the TrackMan™ Radar Unit can be wiped with a soft damp cloth. Make sure that the front plate is not damaged. In the case that the front plate is damaged DO NOT try to open the TrackMan™ Radar Unit, nor try to change the front plate.

#### **WARNING!**

**Security screws are mounted on the back of the TrackMan™ Radar Unit. If the seal is broken the warranty agreement will terminate immediately.**

The camera window has to be cleaned once in a while. Use regular window cleaning detergent. Be careful not to scratch the window glass.

The connector on the TrackMan™ Radar Unit as well as the connectors on the cables should be cleaned for dirt. Use compressed air and mild detergents to clean the connectors.

### **6.3 Storage**

When not in use the TrackMan™ Radar Unit should for maximum lifetime be stowed at room temperature in a low humidity room.